SIEMENS

SINAUT ST7
Analog Telephone Modem MD3

SINAUT – Telecontrol with SIMATIC S7

SIEMENS

SINAUT ST7

Analog Telephone Modem
MD3

(Hardware Version ³ 4)

Operating Instructions

Edition 07/2002

SINAUT® Documentation

It is possible that there are operable functions in the device that are
not described in this documentation. However, no claims can be made
for these functions for new delivery or in cases of servicing.

We have checked the contents of this manual for agreement with the
hardware and software described. Deviations, however, cannot be
entirely precluded. The information in this manual is reviewed regularly
and any necessary corrections included in subsequent editions.
Suggestions for improvement are welcome.

Technical data subject to change.

Siemens-Aktiengesellschaft.

Preface

Notes

This documentation uses the following conventions for pointing out information of special importance:

Note

This symbol draws your attention to information on the product, handling the product, or to a particular part of the documentation.

! **Important**

This symbol draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Notes of Warning

The following notes are used in the documentation for various levels of warning:

Danger

This symbol indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.

Warning

This symbol indicates that death, severe personal injury or substantial property damage **can** result if proper precautions are not taken.

Caution

This symbol indicates that minor personal injury or property damage **can** result if proper precautions are not taken.

Contents

To
Siemens AG

I&S OCW TI

D-76181 Karlsruhe, Germany

	Suggestions **Corrections**

Correspondence to:

SINAUT ST7
Analog Telephone Modem MD3
Operating Instructions

Sender	Order no.: 6NH7811-0AA32
Name:	Edition: 07/2002

Address of your company/office

Street: _____

ZIP: _____ City: _____

Tel: _____ / _____

Fax: _____ / _____

E-mail: _____

If you notice typographical errors in this document please use this form to inform us. We would also be grateful for your suggestions and criticisms.

Suggestions and/or corrections

Overview

1

1.1 Areas of Application

The MD3 modem (see Fig. 1-1) is a dialing modem for transmitting data via the analog telephone network. It can also be used as a modem for duplex point-to-point data transmission via a 2-wire dedicated line.

It was developed as a component of the SINAUT ST7 station control system but can also be used as a normal dialing or dedicated line modem independent from this system. Due to its design and its electrical properties the MD3 is suited for use in industrial applications.

Fig. 1-1   SINAUT MD3 Modem

Note

These operating instructions apply exclusively to the MD3 modem with hardware version $\geq$ 4. In the following documentation the MD3 modem with hardware version $\geq$ 4 is referred to as **MD3** or simply the **MD3 modem**. When referring to the MD3 modem with hardware version < 4, the specific designation **MD3 (HW version < 4)** or **MD3 modem (HW version < 4)** will be used.

1.2 Main Features

The MD3 modem has the following features:

- SIMATIC S7-300 construction design (see Fig. 1-1)

- Can be mounted on a S7-300 mounting rail or a 35 mm standard rail (using the optional adapter 6NH7760-0AA)

- DC 24V power supply connection, power consumption 200 mA

- RS232 port (9-pin sub-D plug) and RS485 port (9-pin sub-D socket)

- Potential insulation between power supply and RS232/RS485 interface

- Modem can be controlled by AT or V.25bis commands

- Available standard transmission modes:
  - V.22   1200   bps, duplex
  - V.22bis   2400   bps, duplex
  - V.32bis   4800   bps, duplex
  - V.32bis   9600   bps, duplex
  - V.32bis   14400   bps, duplex
  - V.34bis   19200   bps, duplex
  - V.34bis   33600   bps, duplex

- Other transmission modes:
  - V.32bis   7200   bps, duplex
  - V.32bis   12000   bps, duplex
  - V.34bis   16800   bps, duplex
  - V.34bis   21600   bps, duplex
  - V.34bis   24000   bps, duplex
  - V.34bis   26400   bps, duplex
  - V.34bis   28800   bps, duplex
  - V.34bis   31200   bps, duplex

- V.42 and MNP4 error correction

- V.42bis and MNP5 data compression

- In dedicated line mode the MD3 provides on a 2-wire dedicate line a duplex transmission channel which can be used for a point-to-point connection between two data terminals (DTE).

- Certified for use in   (see section 1.7)
  - Europe
  - USA
  - Canada

Note

SINAUT ST7 is suitable for use in Class 1, Division 2, Groups A, B, C, D or non-hazardous locations only.

1.3 Compatibility to SINAUT ST1 Modems

In certain operating modes the MD3 modem is compatible to the dialing modems that are used for SINAUT ST1. This compatibility is ensured in two ways:

1. You can build a new SINAUT ST1 station into an existing network and use the MD3 modem to exchange data with an existing ST1 dialing modem at the partner.

2. You can use the MD3 modem as a replacement for a defective ST1 dialing modem.

The following table provides a compatibility matrix of the MD3 modem in connection with the dialing modems used in the SINAUT ST1 system.

Table 1-1   Compatibility matrix of the MD3 modem and SINAUT ST1 dialing modems

Operating Mode of the MD3	SINAUT ST1 Dialing Modem	
	MD125	**MDM2425B DX**
1200 bps dx V.22	x	-
2400 bps dx V.22bis	x	x

1.4 Compatibility to MD3 Modem (HW version < 4)

In certain operating modes the MD3 modem is compatible to the MD3 modem (HW version < 4). The compatibility ensures that you can replace a defective MD3 modem (HW version <4) with a newer MD3 modem.

The following table provides a compatibility matrix of the MD3 modem in connection the MD3 modem (HW version < 4).
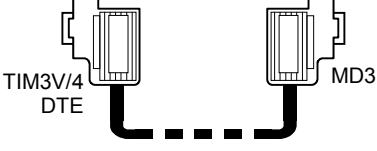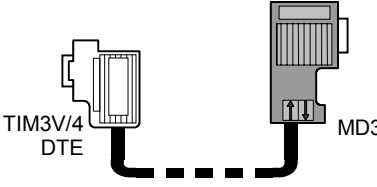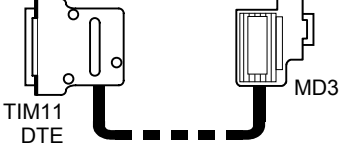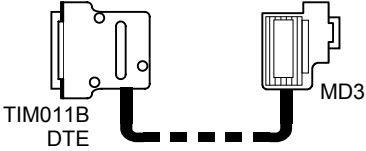
Table 1-2   Compatibility matrix of the MD3 modem and the MD3 (HW version < 4)

Operating Mode of the MD3	MD3 (HW version < 4)
1200 bps dx V.22	x
2400 bps dx V.22bis	x
4800 bps dx V.32bis	x
9600 bps dx V.32bis	x
14400 bps dx V.32bis	x
19200 bps dx V.34bis	-
33600 bps dx V.34bis	-

1.5   Standard Cables

The following standard cables are available for the RS232 and RS485 interfaces.

Table 1-3   Standard cables for the RS232 and RS485 interface

Order No.	Description	Diagram
6NH7701-4AL	Cable for connecting the MD3 modem (RS232) with a TIM3V/TIM4 (RS232) or an other terminal (DTE) with an identically configured 9-pin RS232 interface. Cable length 1.5 m	
6NH7701-4DL	Cable for connecting the MD3 modem (RS485) with a TIM3V/TIM4 (RS485) or an other terminal (DTE) with an identically configured 9-pin RS485 interface. Cable length 1.5 m	
6NH1701-7AN	Cable for connecting the MD3 modem (RS232) with a TIM11 (RS232) or an other terminal (DTE) with an identically configured 25-pin RS232 interface (socket) and slide lock. Cable length 2.5 m	
6NH1701-7BK	Cable for connecting the MD3 modem (RS232) with a TIM011B (RS232) or an other terminal (DTE) with an identically configured 25-pin RS232 interface (socket) and screw lock. Cable length 1.0 m	

Tables 2-6 to 2-9 in Chapter 2, *Mounting and Installation*, show the configuration of the cables listed above.

1.6   Dedicated Line Operation

On a 2-wire dedicated line the MD3 provides a duplex transmission channel which can be used for a point-to-point connection between two data terminal devices (DTE).

To configure a point-to-point connection, note that the two MD3 modems being used for the connection must be set differently. To simplify matters, the differently set modems will be referred to as "Modem A" and "Modem B" in the following. In this scenario "Modem A" (originate) is the active modem which attempts to establish a connection to the other party via the dedicated line. "Modem B" (answer) is the passive, responding modem in this process of establishing a connection.

During the connecting process the modems try to get synchronized to each other. After this has been executed a duplex connection for data transmission is available.
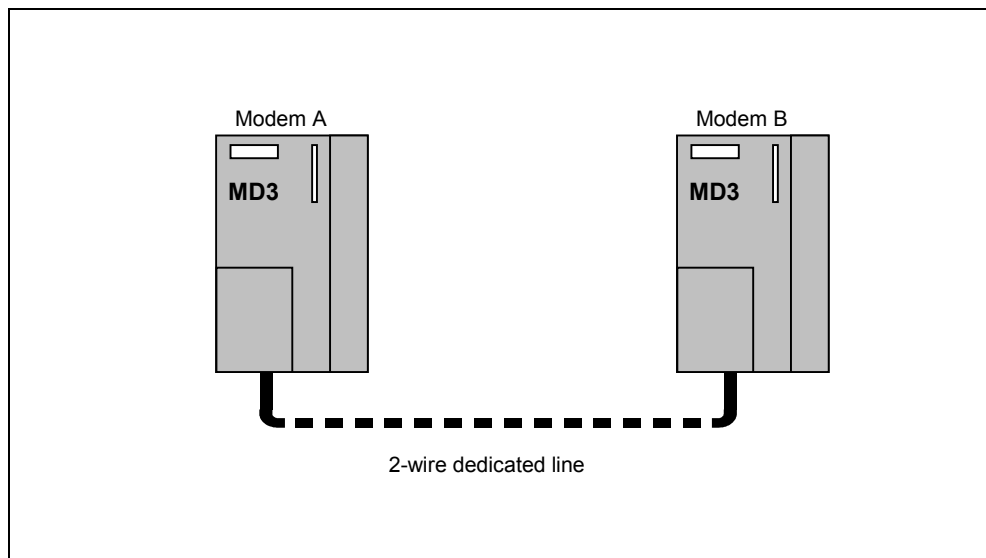
Fig. 1-2   Point-to-point connection between two MD3 Modems
          via a 2-wire dedicated line

How both dedicated line modems can be set to "Modem A" or to "Modem B" can be found in Chapter 2.1.7 *Settings for the DIL Switches Accessible from above*, section *Default Settings for Dedicated Line Mode*.

1.7 Certification and CE Labeling

⚠

Warning

Exposure to some chemicals may degrade the sealing properties of materials used in the following devices on the module MD3:
Relay K1   type DIL-CL-1A81-9-13M from MEDRE electronic AG
Relay K2   type KV-5 from Anritsu Corp. or
                type NA-5W-K or FBR12ND05 from Fujitsu Takamisawa Ltd.

Recommendation:

The devices named above shall be inspected periodically for any degradation of properties and replaced if degradation is found. Signs of physical degradation could be e.g. crazing, swelling or deformation.

1.7.1 Certification for Europe

Certification Provisions

The MD3 is intended for connection to the analog public telecommunication network. In Germany the device is connected with the standard TAE6 cable with N coding provided with the device. The telephone line is passed through and enables down-line connection of a certified telephone.

It should be pointed out that if a handset device is off the hook when the modem hangs up, there can still be a connection which is subject to charge.

The device fulfills the requirements of the "Allgemeine Anschalteerlaubnis" (AAE, "General Connection Permit"). Anyone may connect and operate it using the standard plug device (TAE, "Telekommunikations-Anschalte-Einrichtungen").

Certification for Europe

In accordance with the Council ruling, 98/482/EC, this device is certified for connection as an individual terminal device in the public telephone network throughout Europe. Due to the differences existing between the public telephone networks in various countries, this certification is not necessarily a guarantee for successful operation of the device at all network connection points.

Network Compatibility

This product conforms to national as well as the European standard, TBR21, in accordance with the European Telecommunications Standard Institute (ETSI) Guide EC 201121 (R&TTE Directive). This products therefore operates without error in the PSTN network of all EU countries and any other country that supports the TBR21 standard.

1.7.2   Certification for the USA

EXHIBIT J (FCC PART 68 REQUIREMENTS)

This equipment complies with Part 68 of the FCC Rules. On the soldering side of this equipment is a label that contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your telephone company.

This equipment uses **RJ12** plugs.

An FCC compliant telephone cord and modular plug are provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is part 68 compliant. See installation instructions for details.

The REN is useful to determine the quantity of devices you may connect to your telephone line and still have all those devices ring when your telephone number is called. In most, but not all areas, the sum at the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should contact your local telephone company to determine the maximum REN for your calling area.

If your telephone equipment causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact

SIEMENS Energy & Automation, Inc.
Factory Service Center
3000 Bill Garland Road
Johnson City, Tennessee 37605

Tel: (423) 461-3000

for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

1.7.3   Certification for Canada

INDUSTRY CANADA (IC) NOTICE

The Industry Canada (IC) label identifies certifies equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations,

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by a user to this equipment, or equipment malfunctions, may give telephone communications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection, that the electrical ground connections of the power utility, telephone lines an international metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

⚠ **Caution**

Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority or electrician, as appropriate.

Note

The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

   REN: 0,9

Repair Service Center:

   SIEMENS Energy & Automation, Inc.
   Factory Service Center
   3000 Bill Garland Road
   USA, Johnson City, Tennessee 37605

   Tel. +1 (423) 461-3000

1.7.4 Notes about CE Labeling

Product Description

Product Description	Order No.	EMC
MD3	6NH7810-0AA30	**

EC Guidelines EMC 89/336/EEC

The product described above complies with the requirements of the EC Directive 89/336/EEC "Electromagnetic Compatibility" and the Harmonized European Standards (EN) published in this connection.

EC Guidelines TCE 1999/5/EEC

The product described above complies with the requirements of the EC Directive 1999/5/EC "Directive of the European Parliament and Council Governing Radio and Telecommunication Terminal Equipment and the Mutual Recognition of their Conformity".

In accordance with the EC directive described above, the EC conformity declarations are kept available at the following address:

Siemens Aktiengesellschaft
Industrial Solutions & Services
I&S IS 6 E D
P.O. Box 3249
D-91050 Erlangen
Germany

Operating Areas

The product fulfills the following requirements:

Operating environment	Requirement	
	Interference emission	**Interference immunity**
Equipment in non-protected environment	-	EN 60870-2-1 : 1996
Industry	* EN 55022 (A) : 1998	-
Residential	** EN 55022 (B) : 1998	-

Observe Installation Guidelines

The product complies with the requirements when the product information and the installation guidelines described in the product documentation are observed during installation and operation.

Mounting and Installation

2

2.1 Design of the MD3 Modem

Introduction

This section provides a description of the design of the MD3 modem with its connections, display elements and switches.

2.1.1 Front View of an MD3 with Closed Front Doors
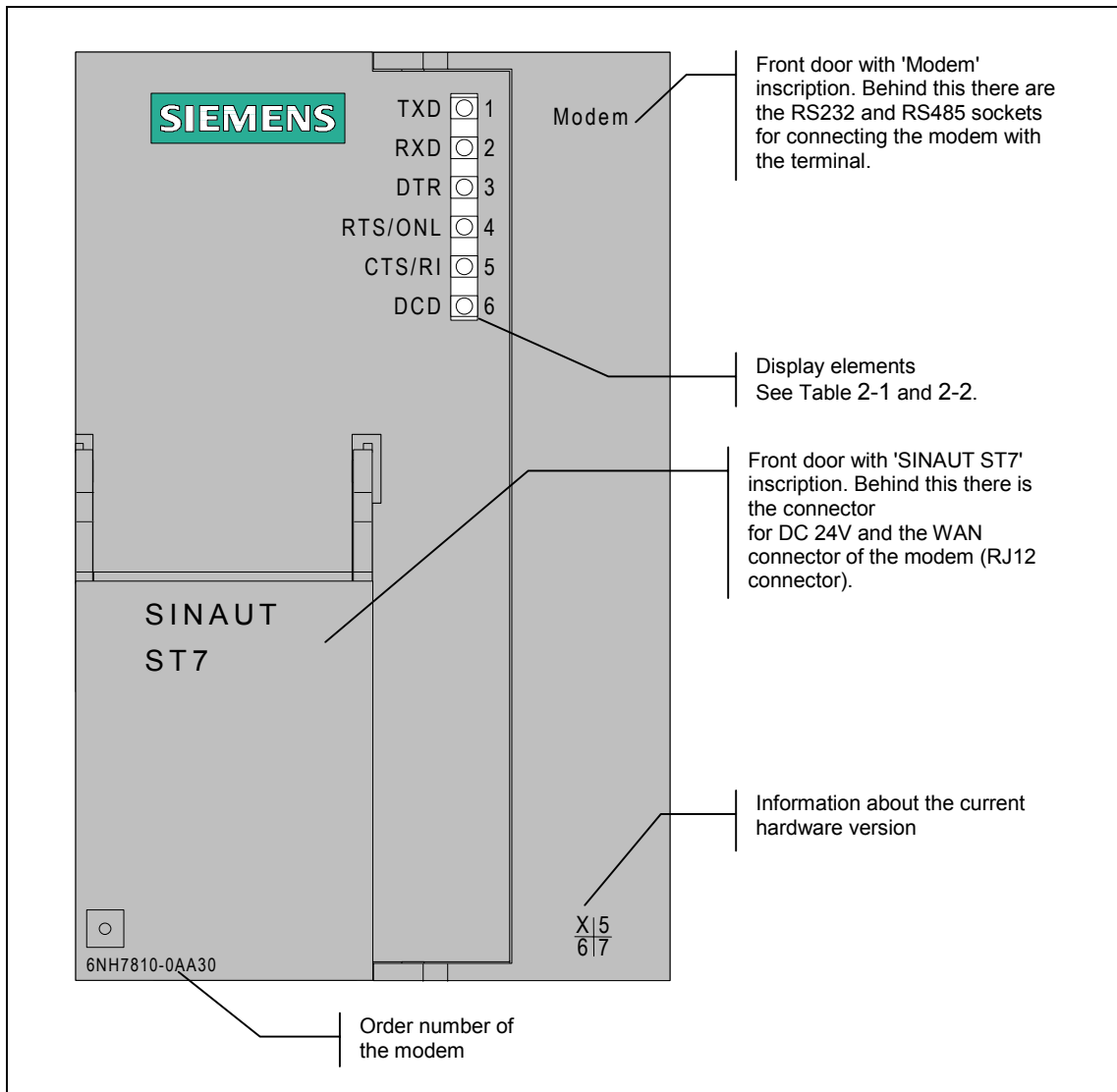
Fig. 2-1   Front view of the MD3 modem with closed front doors

2.1.2   LED Display of the MD3

The following table is a summary of the meaning and the activity of the six LEDs on the front of the modem in the dial-up mode.

Table 2-1   Meaning and activity of the six LEDs on the MD3 front in dial-up mode

LED no.	Inscription	Description
1	TXD	Transmit Data The LED blinks in rhythm with the data flow that is sent to the modem by the terminal via the RS232 or RS485 interface.
2	RXD	Receive Data The LED blinks in rhythm with the data flow that is sent from the modem to the terminal via the RS232 or RS485 interface. The data flow is indicated in the data phase as well as the command phase.
3	DTR	Data Terminal Ready Outgoing call: The LED lights up when the terminal requests a connection to be established and goes out as soon as the terminal wants to disconnect the established connection. If connection is not made, is ended by the other side or disrupted by interference, the terminal recalls the DTR signal as soon as it receives an appropriate message from the modem. Incoming call The LED lights up when the terminal wants to accept an incoming call. The LED goes out under the same circumstances as for an outgoing call.
4	RTS / ONL	Modem online (ONL), "receiver off the hook" Outgoing call: The LED lights up as soon as the modem receives the dialing command from the terminal and begins to establish the connection. The LED goes out when the connection is ended (by its own terminal or by the other side) or when interference disrupts the connection. Incoming call The LED lights up when the terminal signals with DTR that it wants to accept an incoming call. The LED goes out under the same circumstances as for an outgoing call.
5	CTS / RI	Incoming call (RI) The LED lights up with an incoming call.
6	DCD	The LED has two functions: 1. Operation status It indicates the operation status of the modem. The LED lights up after the power is switched on if the operating voltage is correct. The LED remains off if the modem is not operational. 2. Connection established During normal operation of the modem, the LED goes out as soon as the two participating modems have synchronized their connection (reported to terminal with CONNECT). The LED lights up again when the connection has ended or is disrupted by interference.

The RTS and CTS inscriptions are irrelevant for the MD3.

The following table is a summary of the meaning and the activity of the six LEDs on the front of the modem in the dedicated line mode.

Table 2-2   Meaning and activity of the six LEDs on the MD3 front in dedicated line mode

LED no.	Inscription	Description
1	TXD	Transmit Data The LED blinks in rhythm with the data flow that is sent to the modem by the terminal via the RS232 or RS485 interface.
2	RXD	Receive Data The LED blinks in rhythm with the data flow that is sent from the modem to the terminal via the RS232 or RS485 interface.
3	DTR	Data Terminal Ready This LED indicates the signal state of the DTR channel of the data terminal. Due to the factory setting of the MD3, the signal state of the DTR channel in the dedicated line mode has no effect on the modem.
4	RTS / ONL	Modem online (ONL) The modem attempts to establish a connection to the partner modem after power ON, i.e., the two modems attempt to synchronize themselves. As soon as they are synchronized the ONL LED continues to light but the DCD LED goes out (see below). If there is no synchronization within 60 seconds, the ONL LED goes out briefly and then lights up again to indicate that the modems are attempting to synchronize once again.
5	CTS / RI	-
6	DCD	The LED has two functions: 1. Operation status It indicates the operation status of the modem. The LED lights up after the power is switched on if the operating voltage is correct. The LED remains off if the modem is not operational. 2. Connection established The LED goes out as soon as the participating modems have synchronized their connection (see also ONL). The LED lights up again when the connection has been disrupted by interference.

The RTS, CTS and RI inscriptions are irrelevant for the MD3.

2.1.3 Front View of an MD3 with Removed Front Doors

The following illustration shows a front view of the MD3 modem with the doors removed so that the connectors inside are visible.
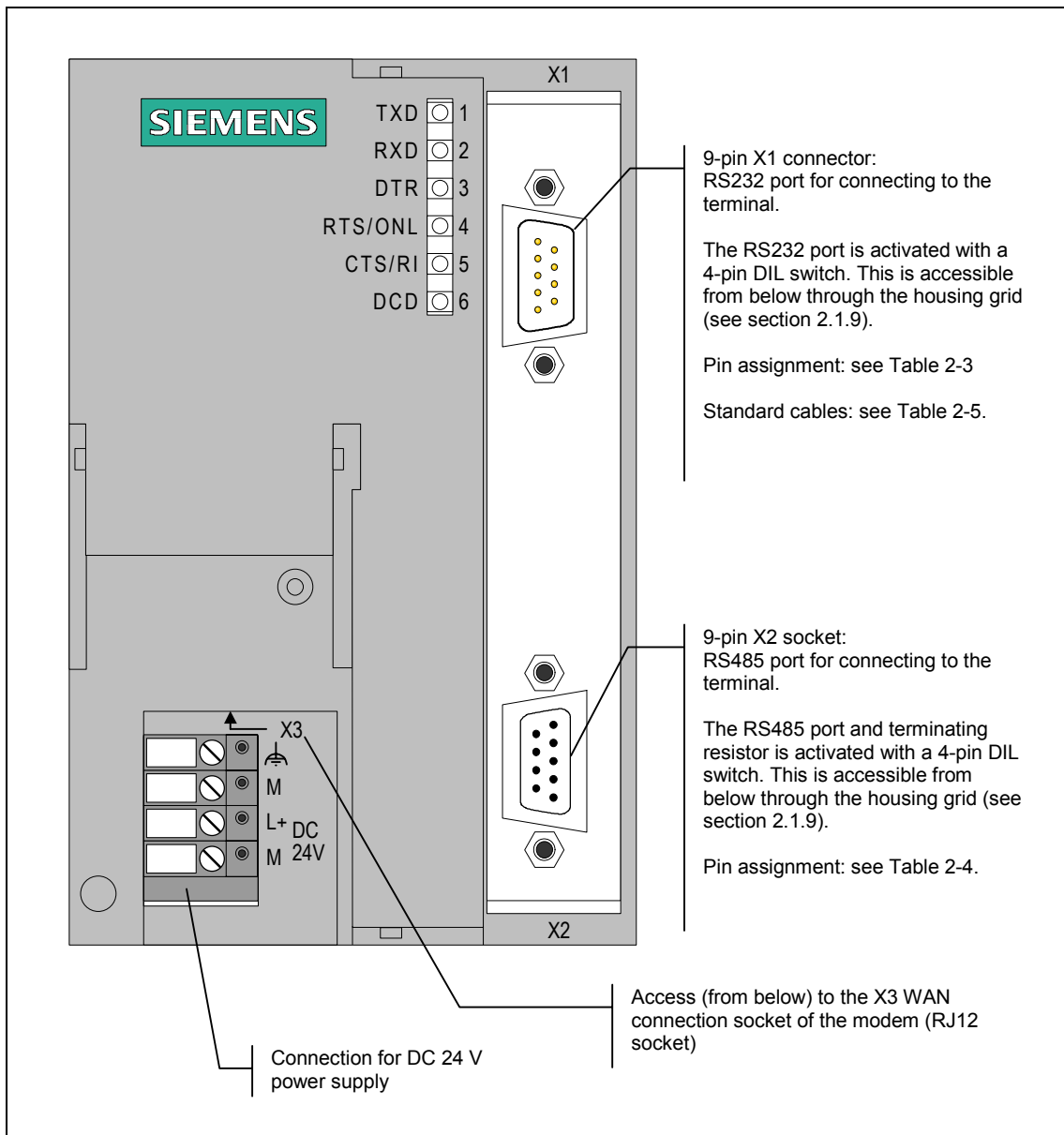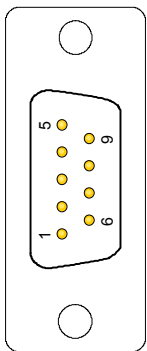
Fig. 2-2   Front view of the MD3 modem with removed front doors

2.1.4   Pin Assignments for the RS232 and RS485 Ports

The X1 connector is a 9-pin Sub-D miniature socket (male). The following table lists the pin assignments. Used as an RS232 interface the pin assignment corresponds to a standard PC port.

The RS232 port is activated with the 4-pin DIL switch which can be accessed from below through the housing grid. The corresponding settings on the DIL switch are described in section 2.1.9.
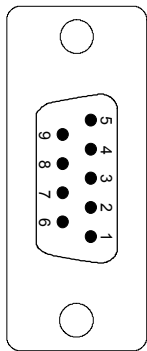
Table 2-3   Pin assignments on X1 RS232 socket

Diagram	Pin no.	Signal name	Signal direction	Comments
	1	DCD	Output	
	2	RXD	Output	
	3	TXD	Input	
	4	DTR	Input	
	5	GND		
	6	DSR	Output	
	7	RTS	Input	
	8	CTS	Output	
	9	RI / T	Output	

The RS485 port is a 9-pin Sub-D miniature socket (female). The following table lists the pin assignments.

The RS485 port and terminating resistor can be activated with a 4-pin DIL switch which can be accessed from below through the housing grid. The corresponding settings on the DIL switch are described in section 2.1.9.

Table 2-4   Pin assignments on the X2 RS485 socket

Diagram	Pin no.	Signal name	Signal direction	Comments
	1			
	2			
	3	Data B	bi-directional	
	4			
	5	M5	-	0 V for bus termination in the plug *)
	6	P5	-	5 V for bus termination in the plug *)
	7			
	8	Data A	bi-directional	
	9			
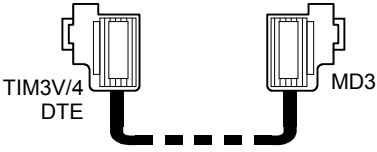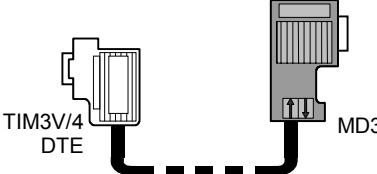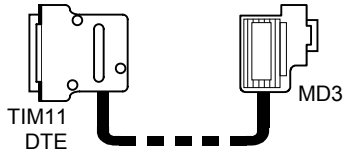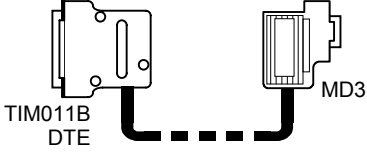
*)   It is not recommended to activate the terminating resistor for the RS485 bus in the plug. Use the bus terminating resistor in the modem instead. This can be activated with the 4-pin DIL switch which can be accessed from below. See section 2.1.9.

2.1.5   Standard Cables for the RS232 and RS485 Ports

The X1 9-pin RS232 connector or the X2 9-pin RS485 socket is used to connect a terminal with an appropriate interface, for example, a PC or a TIM transmission module of the SINAUT ST1 or ST7 system.

The following standard cables are available for the X1 socket.

Table 2-5   Standard cables for the RS232 and RS485 interface

Order no.	Description	Diagram
6NH7701-4AL	Cable for connecting the MD3 modem (RS232) with a TIM3V/TIM4 (RS232) or an other terminal (DTE) with an identically configured 9-pin RS232 interface. Cable length 1.5 m	
6NH7701-4DL	Cable for connecting the MD3 modem (RS485) with a TIM3V/TIM4 (RS485) or an other terminal (DTE) with an identically configured 9-pin RS485 interface. Cable length 1.5 m	
6NH1701-7AN	Cable for connecting the MD3 modem (RS232) with a TIM11 (RS232) or an other terminal (DTE) with an identically configured 25-pin RS232 interface (socket) and slide lock. Cable length 2.5 m	
6NH1701-7BK	Cable for connecting the MD3 modem (RS232) with a TIM011B (RS232) or an other terminal (DTE) with an identically configured 25-pin RS232 interface (socket) and screw lock. Cable length 1.0 m	

The following tables show how the cables mentioned above are configured.

Table 2-6   Configuration of standard cable 6NH7701-4AL
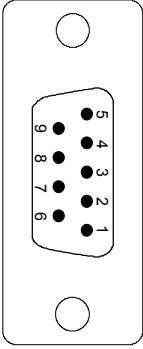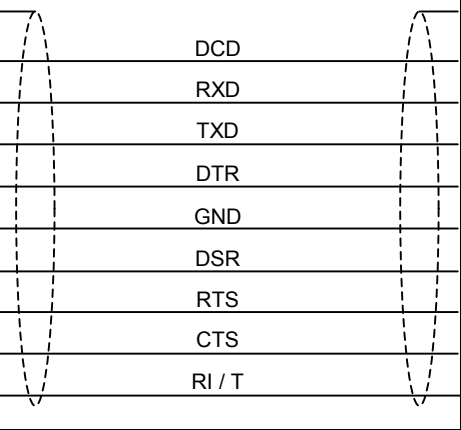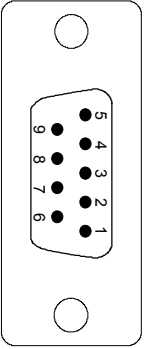
DTE/TIM3V/TIM4 (RS232)	Pin no.	Connection	Pin no.	MD3 Modem (RS232)
Sub-D socket 9-pin	Housing shell		Housing shell	Sub-D socket 9-pin
	1	DCD	1	
	2	RXD	2	
	3	TXD	3	
	4	DTR	4	
	5	GND	5	
	6	DSR	6	
	7	RTS	7	
	8	CTS	8	
	9	RI / T	9	

Table 2-7   Configuration of standard cable 6NH7701-4DL
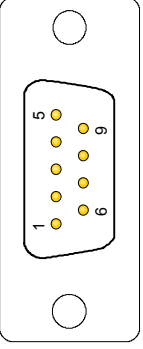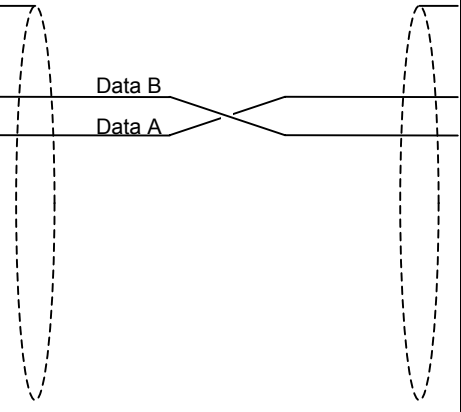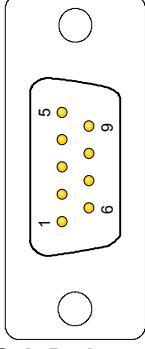
DTE/TIM3V/4TIM (RS485)	Pin no.	Connection	Pin no.	MD3 Modem (RS485)
Sub-D plug 9-pin	Housing shell		Housing shell	Sub-D plug 9-pin
	1			
	2	Data B	A1 (8)	
	3	Data A	B1 (3)	
	4			
	5			
	6			
	7			
	8			
	9			

Table 2-8   Configuration of Standard Cable 6NH1701-7AN
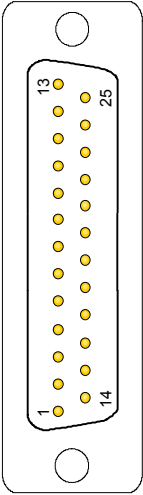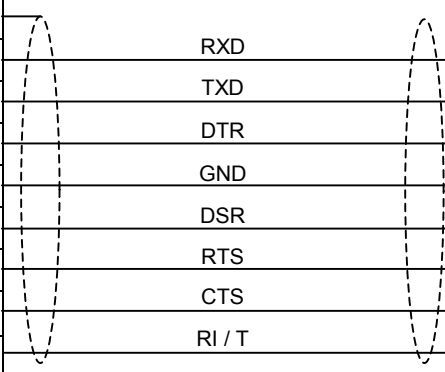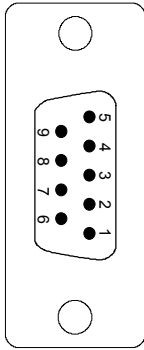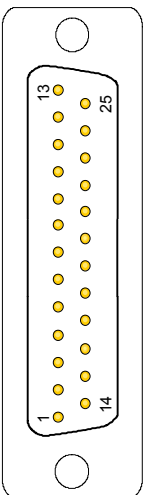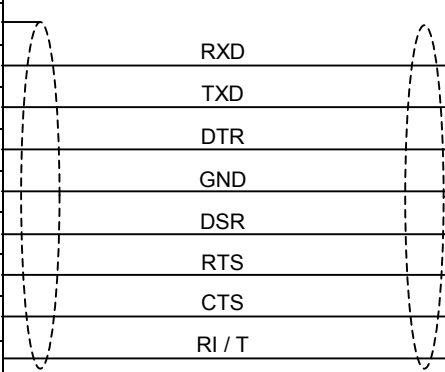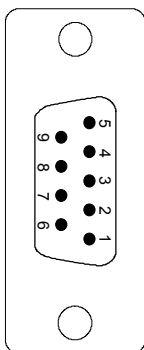
DTE/TIM11 (RS232)	Pin no.	Connection	Pin no.	MD3 Modem (RS232)
	1		1	
	3	RXD	2	
	2	TXD	3	
	18	DTR	4	
	7	GND	5	
	6	DSR	6	
	4	RTS	7	
	8	CTS	8	
	22	RI / T	9	
Sub-D Plug 25-pin				**Sub-D socket 9-pin**

Table 2-9   Configuration of Standard Cable 6NH1701-7BK

DTE/TIM011B (RS232)	Pin no.	Connection	Pin no.	MD3 Modem (RS232)
	1		1	
	3	RXD	2	
	2	TXD	3	
	20	DTR	4	
	7	GND	5	
	6	DSR	6	
	4	RTS	7	
	5	CTS	8	
	22	RI / T	9	
Sub-D Plug 25-pin				**Sub-D socket 9-pin**

2.1.6 View of the MD3 Modem from Above

The following illustration is the MD3 modem viewed from above. It shows the positions of the DIL switches, SW1 (4-pin) and SW2 (10-pin), accessible from above.

10-pin DIL switch SW2 for setting the desired operating mode, dial-up network or dedicated line
Settings: see section 2.1.7.

4-pin DIL switch SW1 for setting clock pulse filter and for switching off the loop power section in dedicated line mode.
Settings: see section 2.1.7.

Front door with 'Modem' inscription
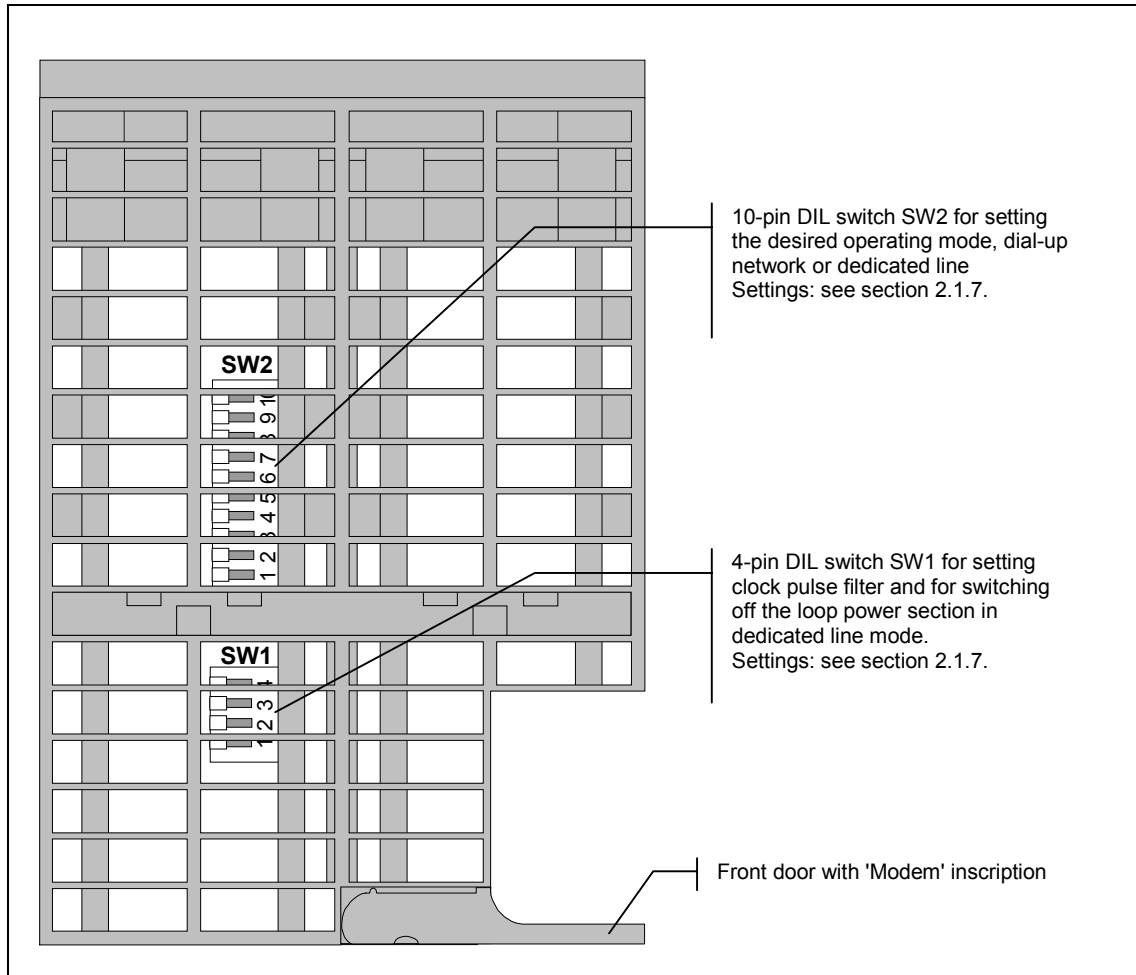
Fig. 2-3   View of the MD3 modem from above

2.1.7 Settings for the DIL Switches Accessible from Above

The MD3 modem features a 4-pin and a 10-pin DIL switch (see Fig. 2-3). The 10-pin DIL switch, SW2, is located directly on top of the housing grid. The 4-pin DIL switch, SW1, can also be reach through the housing grid on top but is located deeper in the interior and may therefore be somewhat difficult to locate. To set this SW2 switch you will need a long, thin tool, for example, a small screw driver or toothpick.

The DIL switches have the following functions:

- 4-pin DIL switch, SW1
  - Clock pulse filter
    at 12 kHz or at 16 kHz
  - Power loop section ON or OFF

- 10-pin DIL switch, SW2
  - Setting for one of 16 standard profiles
  - Data format 11-bit or 10-bit
  - Tone dialing or pulse dialing
  - Modem type A (originate) or B (answer) for dedicated line mode
  - Reset function
  - Loudspeaker ON or OFF
  - Line adjustment with 600 Ohm (fixed) or with Zr (frequency dependent)

The following illustration is a summary of the settings possible.

Standard profile for dial-up network		1	2	3	4
0	AT mode	*OFF*	OFF	OFF	OFF
1	V.25bis, 1200 bps V.22	*OFF*	ON	OFF	OFF
2	V.25bis, 2400 bps V.22bis	*OFF*	OFF	ON	OFF
3	V.25bis, 4800 bps V.32bis	*OFF*	ON	ON	OFF
4	V.25bis, 9600 bps V.32bis	*OFF*	OFF	OFF	ON
5	V.25bis, 19200 bps V.34bis	*OFF*	ON	OFF	ON
6	V.25bis, 33600 bps V.34bis	*OFF*	OFF	ON	ON
7	AT mode, adjustable	*OFF*	ON	ON	ON

Standard profile for dedicated line		1	2	3	4
8	300 bps (direct)	*ON*	OFF	OFF	OFF
9	1200 bps (direct)	*ON*	ON	OFF	OFF
10	2400 bps (direct)	*ON*	OFF	ON	OFF
11	9600 bps (direct)	*ON*	ON	ON	OFF
12	19200 bps (direct)	*ON*	OFF	OFF	ON
13	19200 bps (buffered)	*ON*	ON	OFF	ON
14	33600 bps (buffered)	*ON*	OFF	ON	ON
15	AT mode, adjustable	*ON*	ON	ON	ON

Fig. 2-4   Various settings on the DIL switches accessible from above
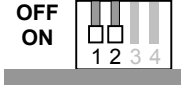
Note

Always set reserved DIL switches to the OFF position.
See also the factory DIL switch settings in Fig. 2-7.

Setting the Clock Pulse Filter

- The clock pulse filter can be set to
  - 12 kHz or
  - 16 kHz

Table 2-10   Settings for the clock pulse filter

Clock pulse filter	Setting on DIL switch
16 kHz (e.g. for Germany, Switzerland)	SW1
12 kHz (e.g. for Austria)	SW1

Setting the Power Loop Section

The power loop section must be activated for dedicated line mode. The power loop is switched off for dedicated line operation.

Table 2-11   Settings for the power loop section

Power loop section	Setting on DIL switch
switched off (default for dedicated line mode)	SW1
switched on (default for dial-up mode)	SW1

Default Settings for Dial-up Mode

Default settings need to be made for the dial-up mode. These settings are for the data format, the dialing procedure and line adjustment. The default settings are made on the DIL switches SW2.1, SW2.5, SW2.6 and SW2.9.

The procedure is as follows:
Switch off the power supply and make the desired settings using the four switches mentioned above. At power ON the modem reads the selected default settings.

Table 2-12   Default settings for the dial-up mode

Meaning	Setting on DIL switch	
Data format 11-bit (8E1)	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
Data format 10-bit (8N1)	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
Tone dialing	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
Pulse dialing	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
Line adjustment 600 Ohm [1]	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
Line adjustment Zr [1]	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10

1) The factory setting for the line adjustment is Zr because the MD3 is usually connected to a digital telephone exchange. If an older analog telephone exchange is used transmission problems may occur making it necessary to set the line adjustment to 600 Ohm.

Setting a Standard Dialing Profile

Besides the default setting for the dial-up mode, switches SW2.2, SW2.3 and SW2.4 can be used to select one of the 8 standard dialing profiles. Standard dialing profiles 0 to 6 are factory settings that enable the MD3 modem to be put into operation without any programming by a terminal program if one of these profiles fits the intended application. Standard dialing profile 7 can be freely configured by the user which then requires programming through a terminal program before the MD3 can be put into operation (for details see section 2.4 *User-Configurable Profiles*).

The procedure is as follows:
Switch off the power supply and make the desired profile setting using the four switches SW2.1 to SW2.4. At power ON the modem then reads the selected standard dialing profile.

The following table lists the properties of the individual dialing profiles and to set them using the switches mentioned above.

Table 2-13   Standard dialing profile settings

Profile no.	Meaning	Setting on DIL switch	
0	AT mode	SW2	
1	V.25bis 1200 bps duplex, V.22	SW2	
2	V.25bis 2400 bps duplex, V.22bis	SW2	
3	V.25bis 4800 bps duplex, V.32bis	SW2	
4	V.25bis 9600 bps duplex, V.32bis	SW2	
5	V.25bis 19200 bps duplex, V.34bis	SW2	
6	V.25bis 33600 bps duplex, V.34bis	SW2	
7	AT mode adjustable	SW2	
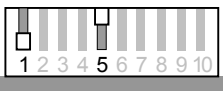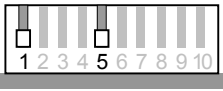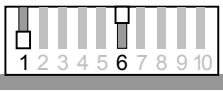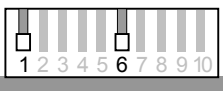
Default Settings for Dedicated Line Mode

Default settings need to be made for the dedicated line mode. These settings are for the data format, the type of modem and line adjustment. The default settings are made on the DIL switches SW2.1, SW2.5, SW2.6 and SW2.9.

The procedure is as follows:
Switch off the power supply and make the desired settings using the four switches mentioned above. At power ON the modem reads the selected default settings.

Table 2-14   Default settings for dedicated line mode

Meaning	Setting on DIL switch	
Data format 11-bit (8E1)	SW2	
Data format 10-bit (8N1)	SW2	
Modem A (originate) [2]	SW2	
Modem B (answer) [2]	SW2	
Line adjustment 600 Ohm [1]	SW2	
Line adjustment Zr [1]	SW2	

1) The factory setting for the line adjustment is Zr because the MD3 then usually will be optimally adapted to the dedicated line and the used frequencies. A switch over to 600 ohm will normally be unnecessary. Important is, however, that both MD3 modems connected to each other via the dedicated line are set to the same line adjustment.

2) For details see next page

!   **Important**

An other important default basic setting for dedicated line mode is the switch-off of the power loop section. Refer to *Setting the Power Loop Section* on page 2-12.

Modem A and Modem B for Dedicated Line Operation

To configure a point-to-point connection, note that the two MD3 modems being used for the connection must be set differently. To simplify matters, the differently set modems are referred to as Modem A and Modem B. In this scenario Modem A (originate) is the active modem which attempts to establish a connection to the other party via the dedicated line. Modem B (answer) is the passive, responding modem in this process of establishing a connection.

During the connecting process the modems try to get synchronized to each other. After this has been executed a duplex connection for data transmission is available.
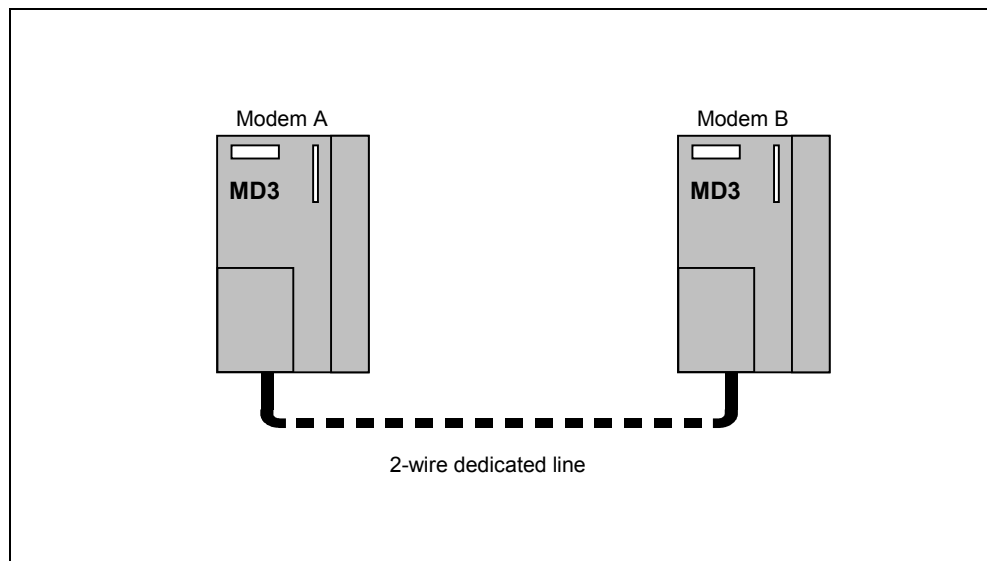
Fig. 2-5   Point-to-point connection between two MD3 Modems
            via a 2-wire dedicated line

Setting a Standard Dedicated Line Profile
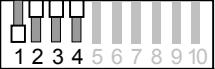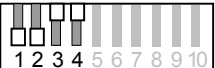
Besides the default setting for the dedicated line mode, switches SW2.2, SW2.3 and SW2.4 can be used to select one of the 8 standard dedicated line profiles. Standard dedicated line profiles 8 to 14 are factory settings that enable the MD3 modem to be put into operation without any programming by a terminal program if one of these profiles fits the intended application. Standard dedicated line profile 15 can be freely configured by the user which then always requires programming through a terminal program before the MD3 can be put into operation (for details see section 2.4 *User-Configurable Profiles*).

The procedure is as follows:
Switch off the power supply and make the desired profile setting using the four switches SW2.1 to SW2.4. At power ON the modem reads the selected standard dedicated line profile.

The following table lists the properties of the individual dedicated line profiles and how to set them using the switches mentioned above.

Table 2-15   Standard dedicated line profile settings

Profile no.	Meaning	Setting on DIL switch	
8	300 bps (direct) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
9	1200 bps (direct) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
10	2400 bps (direct) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
11	9600 bps (direct) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
12	19200 bps (direct) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
13	19200 bps (buffered) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
14	33600 bps (buffered) (only suitable for RS232 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10
15	AT mode Adjustable (also suitable for RS485 interface)	SW2	OFF / ON 1 2 3 4 5 6 7 8 9 10

!   **Important**
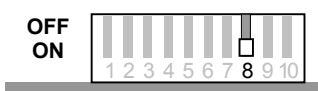
The selection of the standard dedicated line profile not only depends on the desired transmission speed but also on which interface should be used, the RS232 or the RS485 interface.

Standard dedicated line profiles 8 to 14 are only suitable for use with the RS232 interface. For the RS485 interface the freely configurable standard dedicated line profile 15 must be selected and configured (for more information see section 2.4 *User-Configurable Profiles*). However, if required profile 15 can also be used with the RS232 interface.

Loudspeaker ON or OFF

The MD3 modem is equipped with a loudspeaker. The loudspeaker enables you to hear all the signal tones during the connection phase and during data transmission. The loudspeaker can also be switched on for testing purposes or for continuous operation.

Table 2-16   Loudspeaker settings

Loudspeaker	Setting on DIL switch	
switched off	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
switched on	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10

Modem Reset

The factory settings can be reloaded when the configuration of the modem is unclear. Resetting the modem loads the factory settings for all 16 standard profiles.

Procedure:

1. Power supply OFF.

2. Set switch SW2.7 to ON.

3. Switch the power supply ON, wait at least 10 seconds until the DCD LED lights up.

4. Power supply OFF, set switch SW2.7 to OFF.

5. Select default setting and standard profile, power supply ON.

SW2   OFF ON   1 2 3 4 5 6 7 8 9 10
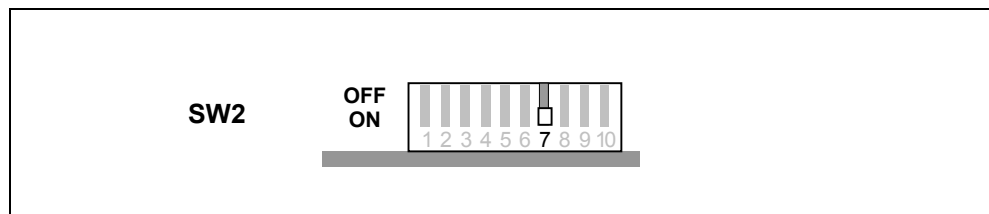
Fig. 2-6   Setting the DIL switch for modem reset

Factory Default Settings for DIL Switches SW1 and SW2

The factory default settings for the modem are as follows:

- Clock pulse filter 16 kHz

- Power loop section ON

- Standard profile 0: AT mode

- Data format 11-bit (8E1)

- Tone dialing

- Loudspeaker OFF

- Line adjustment Zr

With the factory default settings the switches appear as shown in the following illustration.
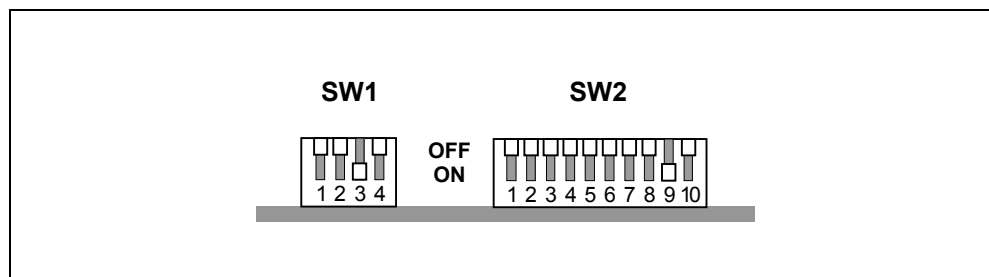
Fig. 2-7   Factory settings for DIL switches SW1 and SW2

2.1.8 View of the MD3 Modem from Below

The following illustration shows the MD3 modem from below with the X3 RJ12 Western socket and the DIL switch for activating the RS232 or RS485 interface.

Front door with 'Modem' inscription

X3 RJ12 socket:
WAN connection for the MD3 modem.
The appropriate standard cable is supplied with the MD3
(see section 2.1.11).

The 4-pin DIL switch is used to activate either the RS232 or RS485 interface. The terminating resistor for the line is also switched on here for the RS485 mode.
See also section 2.1.9.

RS232 port active (default setting)

RS485 port active and terminating resistor active

Fig. 2-8   View of the MD3 modem from below

2.1.9 Settings for the DIL Switches Accessible from Below

Another 4-pin DIL switch can be accessed from the bottom of the modem housing (see Fig. 2-8). The DIL switch is used to activate either the RS232 or RS485 interface. The terminating resistor for the line is also switched on here for the RS485 mode. The following illustration shows a summary of the settings possible, Fig. 2-8 lists the default settings.

RS485 active — no RS485 terminator

RS232 active — RS485 terminator active
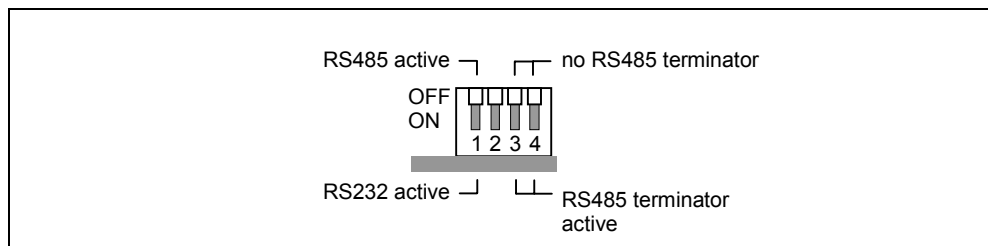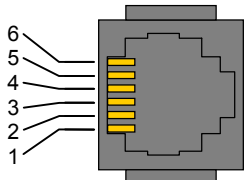
Fig. 2-9   Various settings on the 4-pin DIL switch accessible from below

2.1.10   Pin Assignments on the RJ12 Socket

Pin Assignments on the X3 RJ12 Socket for the MD3 Modem

The X3 connector on the MD3 modem is a 6-pin RJ12 Western socket. The following table lists the pin assignments.

Table 2-17   Pin assignments on the X3 RJ12 socket for the MD3 modem
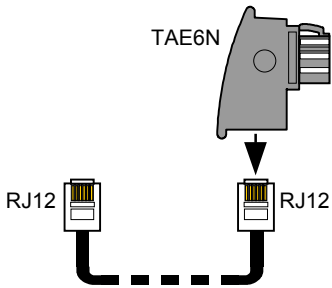
Diagram	Pin no.	Signal name	Signal direction	Comments
	1	G		Ground
	2	a2	bi-directional	Outgoing core pair (together with b2)
	3	b1	bi-directional	Incoming core pair
	4	a1		
	5	b2	bi-directional	Outgoing core pair (together with a2)
	6	C		Clock pulse

2.1.11   Standard Cable for the RJ12 Port

A 6NH7700-3BR60 cable is delivered with each MD3 modem. It enables the modem to be connected to a TAE6 telephone socket for dial-up mode or to an LTOP overvoltage protection module for dedicated line mode.

A replacement connection cable can be ordered by specifying the part number listed below.

Table 2-18   Standard cable for the RJ12 port of the MD3 modem

Order no.	Description	Diagram
6NH7700-3BR60	Cable with 2 x RJ12 Western plugs and a clip-on TAE6N plug for connecting an MD3 modem (RJ12) to a telephone outlet (TAE6N) or to an LTOP overvoltage protection module (RJ12) for dedicated line mode. Cable length 6 m	
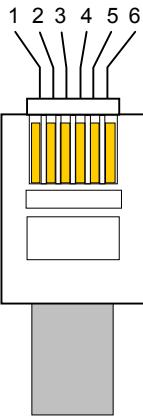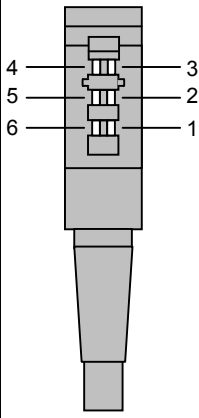
!   Important

Cable 6NH7700-3BR60 has a ferrite on one of its two ends to protect against EMC interference. The ferrit should usually not be removed. Make sure that the cable end with the ferrit is connected with its RJ12 Western plug at the modem end.

For the cable described on the previous page the following table shows the signal assignments at the modem end's RJ12 Western plug and the clippable TAE6N plug. For more details about these signals refer to Table 2-17.

Table 2-19   Signal assignments on the RJ12 Western and TAE6 plugs

RJ12 Western Plug		Signal name	TAE6 Plug	
Diagram	**Pin no.**	**Signal name**	**Pin no.**	**Diagram**
	4	a1	1	
	3	b1	2	
	6	C	3	
	1	G	4	
	5	b2	5	
	2	a2	6	

Standard Cable for the Dial-up Mode

For the dial-up mode cable 6NH7700-3BR60 is used to connect the MD3 modem to a TAE6 telephone outlet. For this the TAE6N plug is clipped onto one of the RJ12 Western plugs of the cable.

Note

When the MD3 modem is used outside of Germany, a telephone plug adapter specific to the country can be clipped onto the RJ12 Western plug. Some countries already use RJ12 sockets in their telephone outlets which means that the 6NH7700-3BR60 cable can be connected directly without the need for an adapter.

Standard Cable for the Dedicated Line Mode

For the dedicated line mode cable 6NH7700-3BR60 is used to connect the MD3 modem to an LTOP overvoltage protection module. For this purpose the cable does not need the TAE6N plug.
The actual connection to the dedicated line is made through screw terminals on the LTOP overvoltage protection module.

Note

When inserting the cable in the X3 RJ12 socket of the modem, it is best to hold it directly below the RJ12 plug. The insertion is then considerably easier than when holding the cable by the RJ12 plug. Make sure that the RJ12 plug clearly clicks when it is inserted!

2.2 Connecting the MD3 with a DTE and a Telephone Outlet

Connecting the MD3 with a DTE (e.g. TIM) and TAE6 Socket in Dial-up Mode

The following diagram provides an overview of how to connect an MD3 modem in dial-up mode to a DTE (e.g. a TIM via RS232) and to a telephone outlet (TAE6N socket) using the specified standard cables. A telephone may be connected parallel to the modem on the same telephone socket (TAE6F socket).
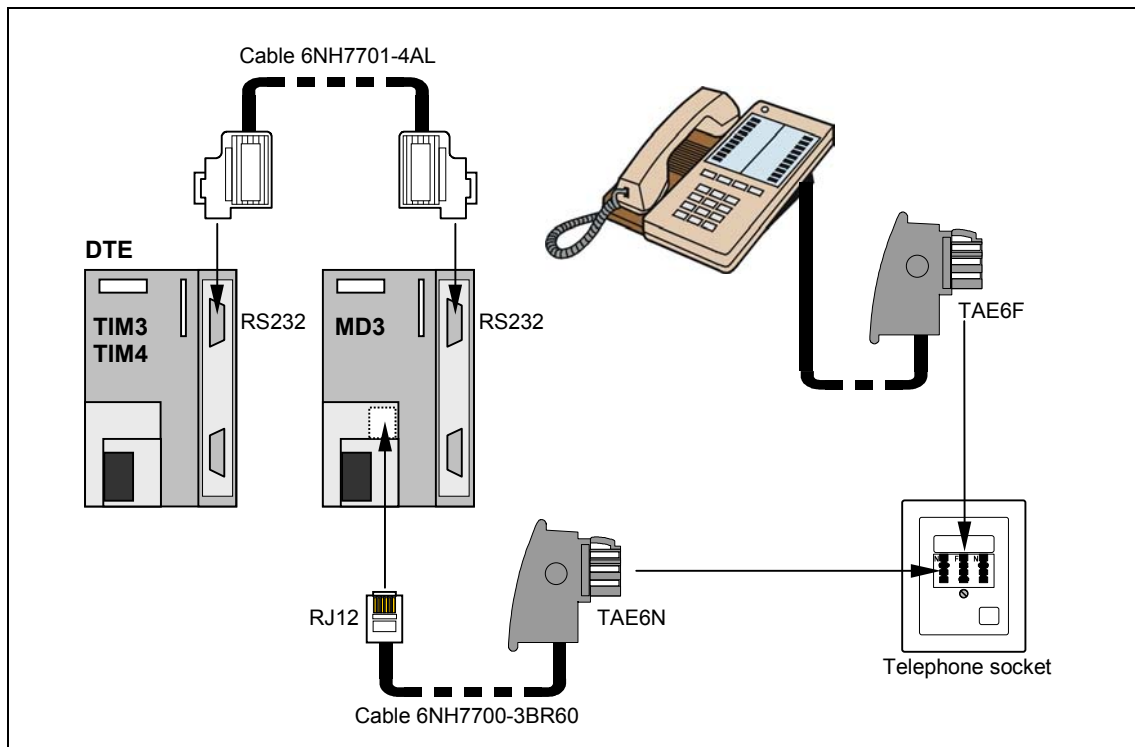
Fig. 2-10   Connecting the MD3 with a DTE (e.g. TIM) and telephone outlet

Connecting an MD3 and a Telephone in Parallel to a TAE6 Outlet

The following illustration shows how to connect an MD3 and a telephone in parallel to a TAE6 outlet. The diagram shows the standard wiring of the TAE6 socket of the German Telekom with a connection for one telephone (TAE6F) and a connection for a modem or a fax machine (TAE6N).
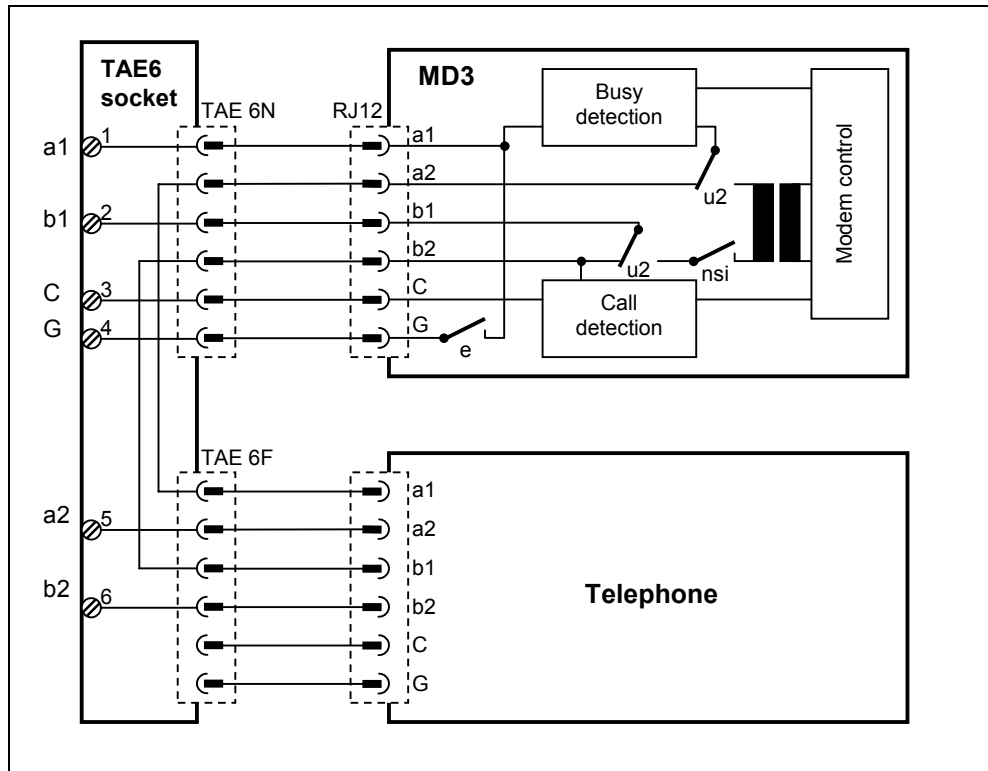
Fig. 2-11   Parallel connection of an MD3 and telephone to a TAE6 outlet

2.3   Connecting an MD3 to DTE, LTOP and Dedicated Line

Introduction

The following diagrams show various possibilities for connecting the MD3 modem in dedicated line mode to a DTE (e.g. TIM) or other MD3 modems (via RS485) as well as via an LTOP to the dedicated line.

For detailed information about connecting, switching and configuring LTOPs, refer to section 2.5 *LTOP Line Transformer with Overvoltage Protection*.

Connecting an MD3 with DTE (e.g. TIM) via the RS232 interface

Through the RS232 interface only one MD3 modem can be connected to a data terminal equipment DTE (e.g. TIM). This results in the following configuration:

Cable 6NH7701-4AL

Important:
The RS232 signals RTS and CTS of the MD3 have no function.
On a TIM this could be regarded by setting the RTS/CTS delay time to 1 ms.
See also ST7 Manual, section 5.4.5.

DTE

TIM3V TIM4 RS232   **MD3** RS232

Requirements for dedicated line operation via RS232:

1. RS232 port must be activated (see section 2.1.9)

2. Basic settings for dedicated line operation have been made (see page 2-15)

3. One of the dedicated line profiles 8 to 14 for RS232 has been selected (see page 2-17)

Cable 6NH7700-3BR60

LTOP1 overvoltage protection 6NH9821-0BC11   LTOP1

2-wire dedicated line

Fig. 2-12   Connection of an MD3 with a DTE (e.g. TIM) via RS232, 2-wire terminal point

Please pay attention to the notes in the above picture to ensure a trouble-free commissioning.

Connecting Several MD3 with a DTE (e.g. TIM) via the RS485 Interface

Through the RS485 interface several MD3 modems can be connected to a data terminal equipment DTE (e.g. TIM). This type of connection is needed when several dedicated lines come together on one DTE, in other words, when the connection involves a star-shaped network. The following diagram shows an example of such a configuration using standard components.

To be regarded by the DTE:

1. Operation mode: half duplex
2. Pause time between data reception and sending data must be observed (see Table 2-20), e.g. for a TIM via RTS/CTS delay time

Requirements for dedicated line operation via RS485 (for all MD3s):

4. RS485 port must be activated (see section 2.1.9)
5. Basic settings for dedicated line operation have been made (see page 2-15)
6. Profile 15 has been selected and is configured for dedicated line operation via RS485 (see section 2.4)

Fig. 2-13   Connecting several MD3s with a DTE (e.g. TIM) via RS485, star-shaped junction of several dedicated lines

The standard 6NH7701-4DL cable is used for connecting the DTE to the first MD3. There is no prefabricated cable for the connection to the next modems. However, one can be built using standard components from the SIMATIC S7 product catalog. The same components can be used as those for making an MPI connection. 6XV1830-0AH10 is recommended for the cable, and 6ES7972-0BA12-0XA0 for the plug. The RS485 terminating resistor for the line can be switched on this plug if required.

> **!** **Important**
>
> Do not forget to activate the terminating resistor for the RS485 bus with the slide-switch on the last plug (see Fig. 2-13)!

The table on the next page shows how several MD3s are to be connected in parallel using the various cable sections.

RS485 Operation of the MD3

When connecting several MD3s in parallel through the RS485 interface, several factors should be taken into consideration when setting the modem.

1) The MD3 modem should be set to profile 15 using the 10-pin DIL switch (see Fig. 2-3).

2) Please make sure that this freely configurable profile 15 is set to a profile that is suitable for the RS485 mode. A PC and a terminal program are required for that. Information about this can be found below in Chapter 2.4 and Table 2-26.

3) The RS485 interface must also be activated with the 4-pin DIL switch accessible from below (see Fig. 2-8).

4) As data exchange via RS485 is only possible in a halfduplex mode the operation mode of the connected DTE must be set to halfduplex.

5) After the MD3 has received data and has passed them to the DTE the MD3 needs a pause of several ms until it is able to send data. The DTE must observe this time delay, i.e. after data has been received sending data is only allowed after expiration of the pause time. The length of the pause depends on the transmission speed that is run on the dedicated line (see following table).

Tabelle 2-20   Pause time between data reception and sending data for RS485

Speed on dedicated line	Required pause time	Speed on dedicated line	Required pause time
300 bps	100 ms	14400 bps	10 ms
1200 bps	100 ms	19200 bps	10 ms
2400 bps	50 ms	26400 bps	10 ms
9600 bps	25 ms	33600 bps	10 ms

If the DTE connected to the MD3 modem is a TIM from the SINAUT catalog, this pause time can be considered by the TIM by setting an appropriate RTS/CTS delay time. This and other notes concerning the RS485 mode with a TIM can be found in the SINAUT ST7 Manual, section 5.4.5.

Table 2-21   Configuration of standard cable 6NH7701-4DL from the DTE (e.g. TIM) to first MD3 modem

DTE (TIM3V/4) (RS485)	Pin no.	Connection	Pin no.	Modem MD3 (RS485)
	Housing shell		Housing shell	
	1			
	2	Data B	A1 (8)	
	3	Data A	B1 (3)	
	4	Data A	a2	
	5	Data B	b2	
	6			
	7			
Sub-D socket 9-pin	8			**Sub-D plug 9-pin**
	9			
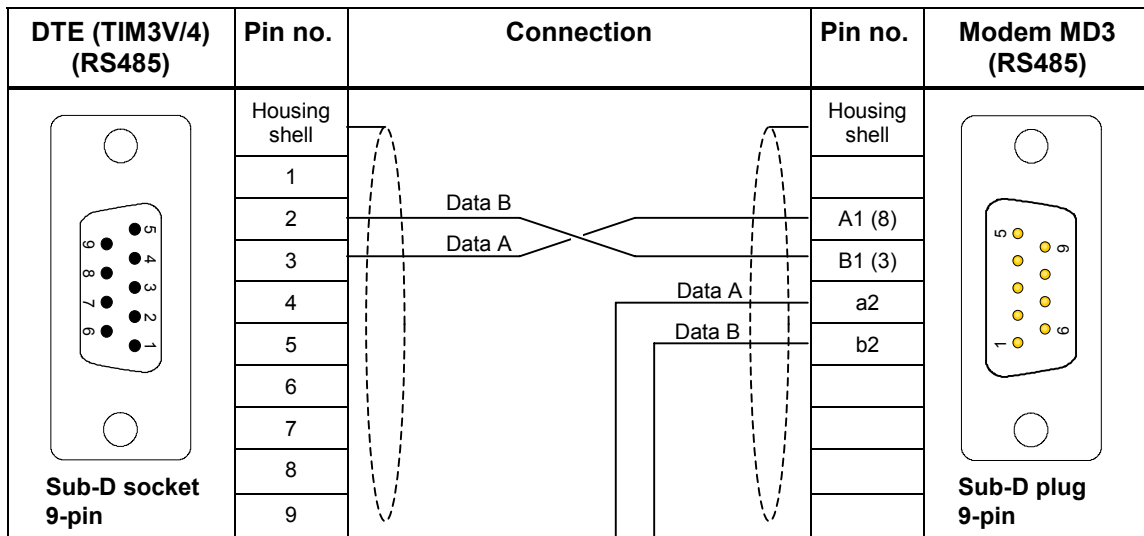
Table 2-22   Connection to the second MD3 modem

		Connection		Pin no.	Modem MD3 (RS485)
				Housing shell	
		Data A		A1 (8)	
		Data B		B1 (3)	
				a2	
				b2	
					Sub-D plug 9-pin
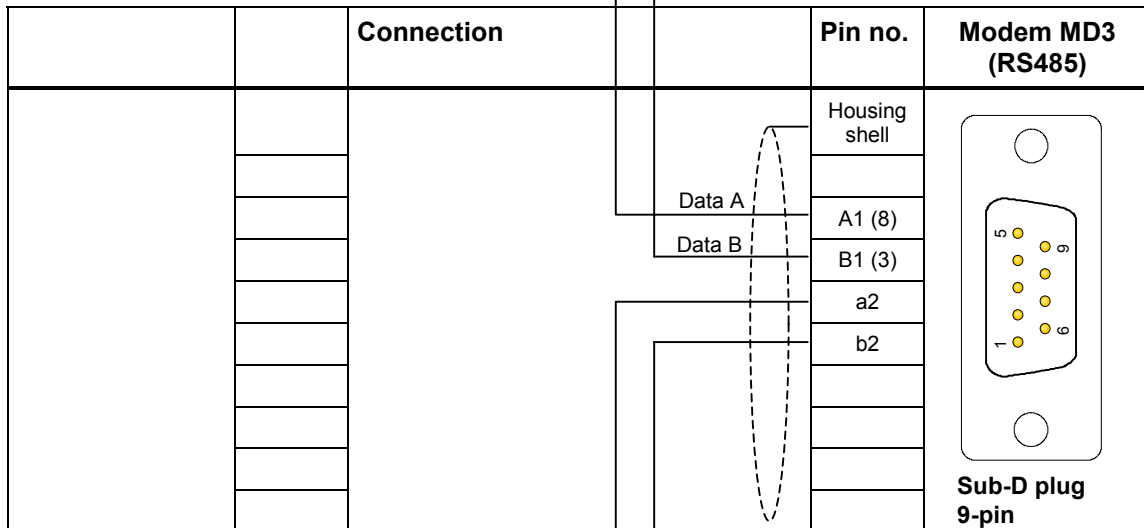
Table 2-23   Connection to the third MD3 modem, etc.

		Connection		Pin no.	Modem MD3 (RS485)
				Housing shell	
		Data A		A1 (8)	
		Data B		B1 (3)	
				a2	
				b2	
					Sub-D plug 9-pin
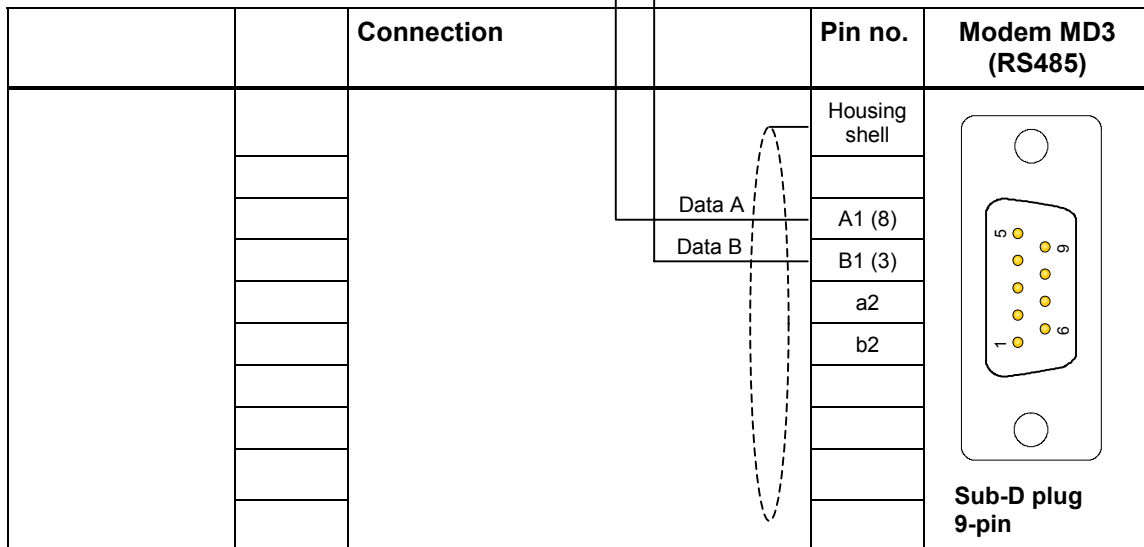
Signal Loss Values of the MD3 Modem in Dedicated Line Mode

Table 2-24   Signal loss values of the MD3 modem in dedicated line mode

Transmission speed (bps)	Loss per km (dB)	Loss per LTOP (dB)
At line termination with Z = Zr		
300 to 33600	1.0	0.4

The values listed in Table 2-24 are approximate values for a telecommunication line type 2 x 2 x 0.8 J-Y(St)Y (non-coil-loaded).

Maximum Range of the MD3 Modem in Dedicated Line Mode

Table 2-25   Maximum range of the MD3 modem in dedicated line mode

Transmission speed (bps)	Maximum range (km)			
	Send level –15 dB		Send level -10 dB	
	with LTOP	without LTOP	with LTOP	without LTOP
At line termination with Z = Zr				
300	29	30	34	35
1200 to 19200	23	24	28	29
33600	14	15	19	20

The values listed in Table 2-25 are approximate values for a telecommunication line type 2 x 2 x 0.8 J-Y(St)Y (non-coil-loaded).

A level reserve of 4 dB was included in the calculation of the maximum range. This is to compensate for deviations in cable properties that experience has shown to occur in actual operation, and thus always ensure that sufficient signal level is available for undisturbed data transmission.

2.4 User-Configurable Profiles

Introduction

In addition to the 7 standard profiles for dial-up mode and and those for dedicated line mode (profile 8 to 14), the MD3 modem also provides a freely configurable profile for each mode. Profile 7 is a freely configurable profile intended for the dial-up mode, profile 15 is for dedicated line mode.

Either profile can be configured on a PC using AT commands (see Chapter 6 *AT Commands*). The PC and modem must be connected to each other with a cable to do this (see Fig. 2-14). The cable connects to the COM1 or COM2 port on the PC and the RS232 interface on the modem.

The AT command are entered with a terminal program. Hyper Terminal from WINDOWS 95/98/NT can be used for this purpose.

Connection between the PC and Modem

To send the AT commands a connection between the PC and modem is made with the SINAUT ST7 standard cable 6NH7701-4AL. If the standard cable is not available, use any cable with two 9-pin Sub-D sockets and the following pin assignments.
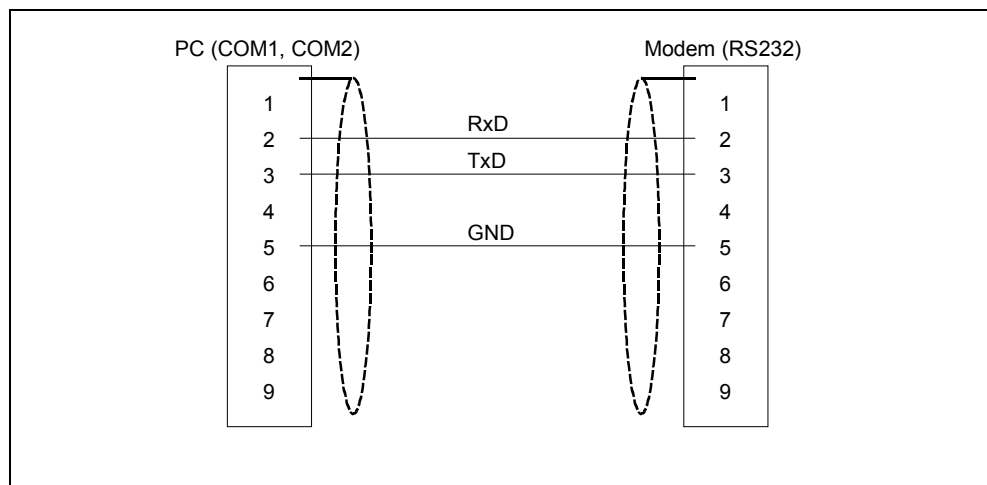
Fig. 2-14   Basic wiring diagram of a PC modem cable

User-Configured Profile 7 for Dial-up Mode

When none of the standard profiles 0 to 6 are suitable for the intended application, the user can configure profile 7 and save it in the non-volatile memory.
The factory settings for profiles 7 and 0 are identical.
All of the AT commands described in Chapter 6 can be used to configure profile 7.

Carry out the following steps to configure profile 7:

1) Switch the modem power supply OFF.

2) Set the standard <u>Profile 7</u> on the modem (on DIL switch SW2).

3) Connect the modem to the PC using the RS232 interface (cable: see previous page).

4) Switch the modem power supply ON.

5) Send the desired AT commands to the MD3 using the terminal program.

6) Save the profile in the non-volatile memory.

    Input: **AT &W7** ↵
    Modem: **OK**

Note

If a modem reset is carried out using DIL switch SW2.7, profile 7 is returned to its factory settings. Profile 7 has then to be configured again.

User-Configured Profile 15 for Dedicated Line Mode

The freely configurable standard profile 15 is mainly intended for dedicated line mode in which the RS485 interface of the MD3 is used. Of course, profile 15 can also be configured to operate with the RS232 interface. This may be useful, for example, when the user wishes to use a transmission speed other than those provided by standard profiles 8 to 14.

All of the AT commands described in Chapter 6 can be used to configure profile 15.

The tables on the following page summarize the AT strings for configuring profile 15 for dedicated line mode using the RS232 and RS485 interfaces.

Table 2-26   Profile 15 – Configuration for RS485 interface

Profile description	AT string
300 bps (buffered)	**AT\N0F1&D0%E0\Q0&C2&L1&W15**
1200 bps (buffered)	**AT\N0F2&D0%E0\Q0&C2&L1&W15**
2400 bps (buffered)	**AT\N0F3&D0%E0\Q0&C2&L1&W15**
4800 bps (buffered)	**AT\N0F8&D0%E0\Q0&C2&L1&W15**
7200 bps (buffered)	**AT\N0F9&D0%E0\Q0&C2&L1&W15**
9600 bps (buffered)	**AT\N0F10&D0%E0\Q0&C2&L1&W15**
12000 bps (buffered)	**AT\N0F11&D0%E0\Q0&C2&L1&W15**
144000 bps (buffered)	**AT\N0F12&D0%E0\Q0&C2&L1&W15**
16800 bps (buffered)	**AT\N0F13&D0%E0\Q0&C2&L1&W15**
19200 bps (buffered)	**AT\N0F14&D0%E0\Q0&C2&L1&W15**
21600 bps (buffered)	**AT\N0F15&D0%E0\Q0&C2&L1&W15**
24000 bps (buffered)	**AT\N0F16&D0%E0\Q0&C2&L1&W15**
26400 bps (buffered)	**AT\N0F17&D0%E0\Q0&C2&L1&W15**
28800 bps (buffered)	**AT\N0F18&D0%E0\Q0&C2&L1&W15**
31200 bps (buffered)	**AT\N0F19&D0%E0\Q0&C2&L1&W15**
33600 bps (buffered)	**AT\N0F20&D0%E0\Q0&C2&L1&W15**

Table 2-27   Profile 15 – Configuration for RS232 interface

Profile description	AT string
300 bps (direct)	**AT\N1F1&D0%E0\Q0&L1&W15** (standard profile 8)
1200 bps (direct)	**AT\N1F2&D0%E0\Q0&L1&W15** (standard profile 9)
2400 bps (direct)	**AT\N1F3&D0%E0\Q0&L1&W15** (standard profile 10)
4800 bps (direct)	**AT\N1F8&D0%E0\Q0&L1&W15**
7200 bps (direct)	**AT\N1F9&D0%E0\Q0&L1&W15**
9600 bps (direct)	**AT\N1F10&D0%E0\Q0&L1&W15** (standard profile 11)
12000 bps (buffered)	**AT\N0F11&D0%E0\Q0&L1&W15**
14400 bps (buffered)	**AT\N0F12&D0%E0\Q0&L1&W15**
16800 bps (buffered)	**AT\N0F13&D0%E0\Q0&L1&W15**
19200 bps (buffered)	**AT\N0F14&D0%E0\Q0&L1&W15** (standard profile 13)
21600 bps (buffered)	**AT\N0F15&D0%E0\Q0&L1&W15**
24000 bps (buffered)	**AT\N0F16&D0%E0\Q0&L1&W15**
26400 bps (buffered)	**AT\N0F17&D0%E0\Q0&L1&W15**
28800 bps (buffered)	**AT\N0F18&D0%E0\Q0&L1&W15**
31200 bps (buffered)	**AT\N0F19&D0%E0\Q0&L1&W15**
33600 bps (buffered)	**AT\N0F20&D0%E0\Q0&L1&W15** (standard profile 14)

Carry out the following steps to configure profile 15:

1) Switch the modem power supply OFF.

2) Set the standard Profile 15 on the modem (on DIL switch SW2).

3) Connect the modem to the PC using the RS232 interface (cable: see previous page).

4) Switch the modem power supply ON.

5) Send the desired AT strings as listed in Tables 2-26 and 2-27 to the MD3 using the terminal program.

!

Important

If you wish to send further AT commands to the modem in adition to the strings contained in Tables 2-26 and 2-27, you should insert them before the AT sequence **&L1&W15**. The reason for this is that the modem changes to online mode after receiving the AT command **&L1** and therefore can no longer send any AT commands to the MD3. In this situation reset the modem using DIL switch SW2.7 and then configure it once again.

Note

If a modem reset is carried out using DIL switch SW2.7, profile 15 is returned to its factory settings. Profile 15 has then to be configured again.

2.5   LTOP Line Transformer with Overvoltage Protection

Introduction

Dedicated lines are highly susceptible to the coupling-in and carry-over of external potentials. Coupling-in of external potentials may be inductive or capacitive, e.g. as the result of lightning. Direct galvanic coupling is also possible as a result of insulation faults.

The LTOP (Line Transformer with Overvoltage Protection) limits interference voltage and overvoltage to a non-critical level. The floating transformer provides electrical isolation in addition, thus preventing potential carry-over onto other sections of the line.

> **Note**
>
> the LTOP line transformer with overvoltage protection is only designed for connection to dedicated lines. For dial-up network applications other voltage protection modules must be used which are suitable for dial-up networks. Here we refer to third-party suppliers like Phoenix or Dehn (both Germany) who offer TAE6 and RJ12 telephone sockets with integrated overvoltage protection.

2.5.1 Design

Protective Mechanism

The protective mechanism consists of a combination of components whose functions supplement one another (see Figs. 2-15 and 2-16):

- Overvoltage suppressors filled with inert gas as coarse protection (G1, G2)
- Inductors which limit rises in current (L1, L2)
- Metal oxide varistor as fine protection (voltage-dependent resistance; R1)
- Transformer for electric decoupling (T1)
- Suppressor diode to limit the secondary voltage of the transformer (V1)
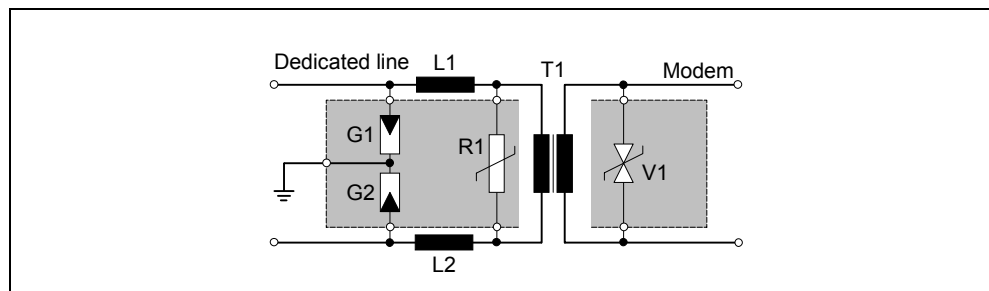
Fig. 2-15   Circuit diagram of an LTOP unit
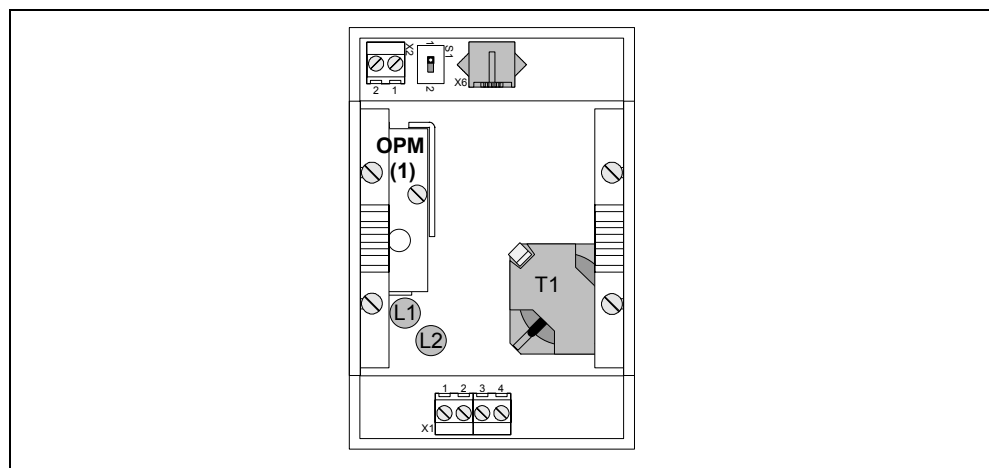
Fig. 2-16   Location of circuit elements in an LTOP1 (viewed from above)

Note

The protective elements in the OPM (Overvoltage Protection Module) undergo high stress during discharge processes and progressively deteriorate. Therefore it is recommended to replace the OPMs every one year. To be on the safe side within regions with frequent thunderstorms this period should be reduced to about 6 months.

LTOP Models

In one housing either one LTOP unit is accommodated (= LTOP1) or two LTOP units (= LTOP2). Only the LTOP1 version should be used together with the MD3 modem. The following figure shows the design of this LTOP version with its connectors and adjustment switches.

View from above	Schematic diagram
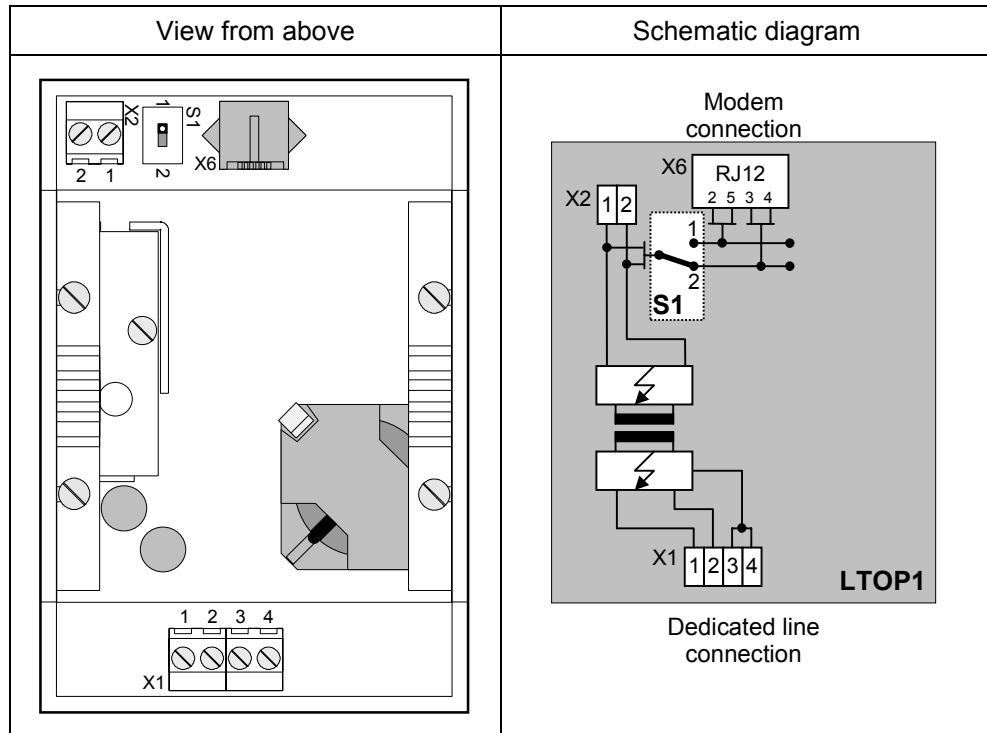
Fig. 2-17   LTOP1

Legend:

X1   Dedicated line connection (screw terminals 1, 2)
         Ground connection (screw terminals 3, 4)
X2   2-wire modem connection through screw terminal
X6   2-wire modem connection via RJ12 Western connector; for direct connection of the MD3 modem using the standard cable 6NH7700-3BR60 (RJ12 – RJ12) which is supplied with this modem.
S1   Adjustment switch

2.5.2 Connecting the MD3 Modem

The following illustration shows the connection of the MD3 modem in dedicated line mode. The connection to LTOP1 is made via the standard cable 6NH7700-3BR60 supplied with the modem. This cable has RJ12 Western plugs at both ends.

> **!** **Important**
>
> Please ensure that the switch S1 is set correctly in position 2 as shown in the illustration!

Connection at a 2-wire Terminal Point
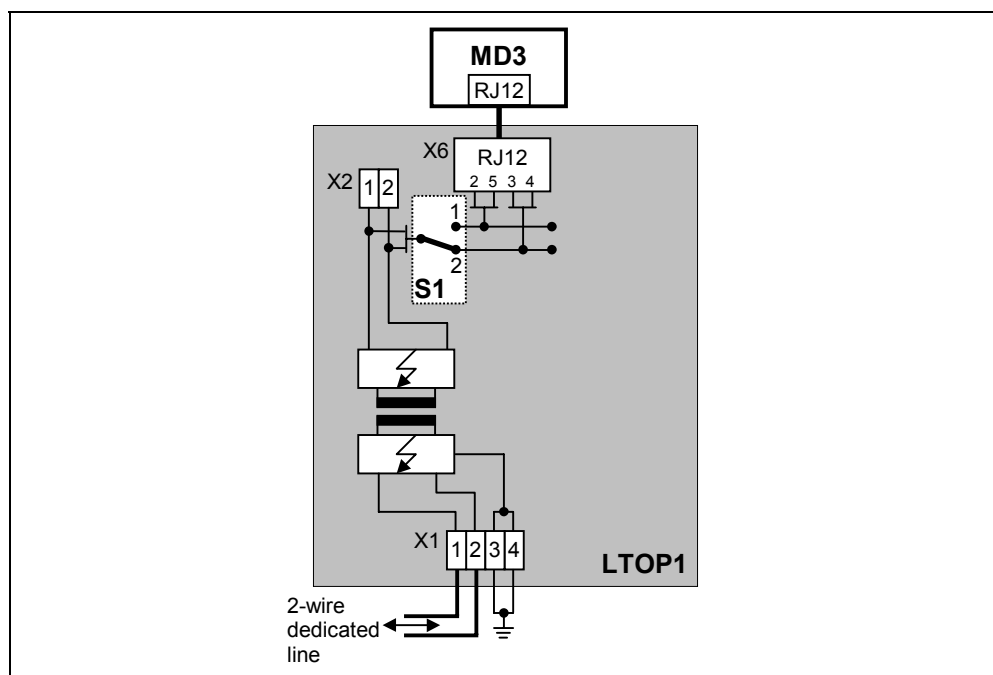
Fig. 2-18   Connection of the MD3 to an LTOP1 at a 2-wire terminal point

2.6 Mounting the MD3 Modem

Introduction

The MD3 modem can be mounted on a SIMATIC S7-300 mounting rail or on a standard 35 mm mounting rail using a 6NH7760-0AA adapter (must be ordered separately).

You have the possibility to mount and operate the modem horizontally or vertically.

> **!**
>
> **Important**
>
> Before the MD3 modem is mounted on the S7-300 or standard mounting rail, all of the DIL switches on the MD3 modem should be set to the positions required for operation. These switches are usually not easy to access when mounted.

2.6.1 Mounting on an S7-300 Mounting Rail

> **!**
>
> **Important**
>
> If the MD3 modem is mounted together with other S7-300 modules, please note the fact that this modem does <u>not</u> have an S7-300 backplane bus. For this reason an S7-300 SM, FM or CP module that communicates with the S7-CPU via this backplane bus may not be placed to the right of the modem!

Procedural Steps for Installation

To mount the modem on a S7-300 mounting rail, carry out the steps listed below:

1. Switch off the power supply to which the modem is to be connected.

2. Hang the modem on the mounting rail and swing it down.

3. Screw the modem tight.

4. Connect the modem to the power supply (see also section 2.6.4).

5. Insert the supplied cable for the modem into the X3 RJ12 socket. This is located above the power supply screw terminal on the modem (see Fig. 2-2 and Fig. 2-8). The release clip of the RJ12 Western plug must be on the right side when inserted.

> **Note**
>
> When inserting the cable it is best to hold it directly below the RJ12 plug. The insertion is then considerably easier than when holding the cable by the RJ12 plug. Make sure that the RJ12 plug clearly clicks when it is inserted!

6. To connect the modem to a terminal (a TIM, for example), insert the 9-pin sub-D plug of the modem cable (see 2.1.5 *Standard Cables*) into the X1 socket (RS232 port) of the modem and screw it tight. Connection to the optional RS485 X2 port is carried out in the same way. For this port, however, a standard cable is not available.

> **Note**
>
> Standard cable 6NH7701-4AL for connecting the modem with a TIM3 or TIM4 module is inserted 'upside down', in other words, the cable leads upward. The cable is also inserted from above on the TIM3/TIM4.

7. If other modems are to mounted into the rack, follow the procedures described above for each one.

8. When all of the modems are mounted the power supply can be switched on. The modem starts up and shows the availability of the supply voltage by switching on the DCD LED. On its other LEDs the modem will first show activity when the terminal addresses it.

2.6.2 Mounting on a Standard 35 mm Mounting Rail

Mounting the modem on a standard 35 mm mounting rail requires the optional 6NH7760-0AA adapter (see illustration below).
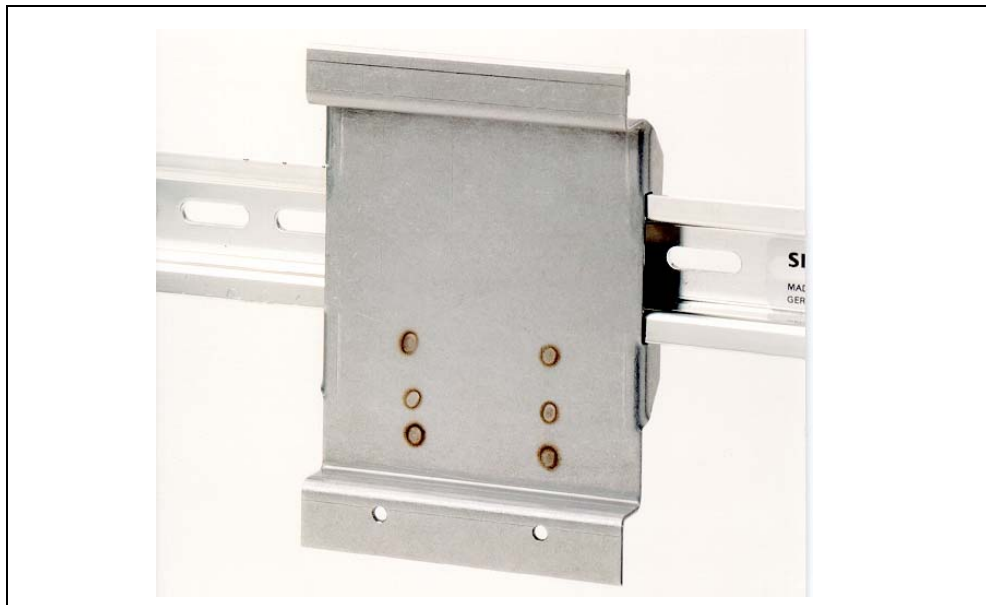
Fig. 2-19   Adapter for mounting on a standard 35 mm mounting rail

Hang the modem on the adapter, similar to the way it is mounted on an S7-300 rail. Screw the modem tight on the adapter. Now the modem is ready for mounting on the standard rail and can clipped into place.

The remaining steps for mounting are similar to those described in section 2.6.1 *Mounting on an S7-300 Mounting Rail*.

2.6.3 Horizontal and Vertical Mounting
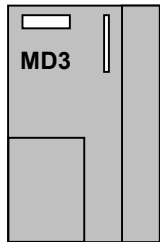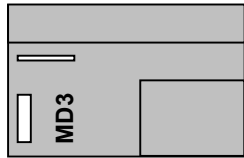
Horizontal and Vertical Assembly

You have the possibility to mount and operate the MD3 modem horizontally or vertically.

Permissible Ambient Temperature

The MD3 modem does not deviate from the temperature range specified for other S7-300 components:

Table 2-28   Permissible ambient temperature for the MD3 modem

Installation Position	Permissible Ambient Temperature
Horizontal	0 to 60 °C
Vertical	0 to 40 °C

Assembly Dimensions of the MD3 Modem

Table 2-29   Assembly dimensions of the MD3 modem

Module	Module width	Module height	Max. depth req.
Modem module MD3	80 mm	125 mm	120 mm or 180 mm with open front plate

2.6.4 Connecting to the Power Supply

⚠️ **Warning**

Connecting the modem module to live current can cause damage to it. Only connect the modem to the power supply when it is not under current.

⚠️ **Warning**

The power for the device (DC 24 V) must be generated as safe, electrically isolated low voltage. This means that the power must be SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) in conformity with DIN VDE 0100 Part 410 (IEC 60364-4-41).

Cabling

For wiring the power supply use flexible cables with a cross section of 0.25...0.75 mm^2. An additional core sleeve is necessary if you are wiring more than one cable per connection.

Wiring

To wire the power supply module to an MD3 modem, carry out the following steps:

1. Open the front door of the power supply and the MD3 modem.

2. Connect the power supply cables to the MD3 modem: M and L+

3. Close the front doors.

❗ **Important**

To avoid ground loops you should not connect the shielding of the modem.

Connection Diagram

Use the following diagram for connecting one or more modems. Other SINAUT ST7 modems or a SINAUT ST7-TIM may also be mounted in place of an MD3 modem. The same connection scheme applies for these modules.
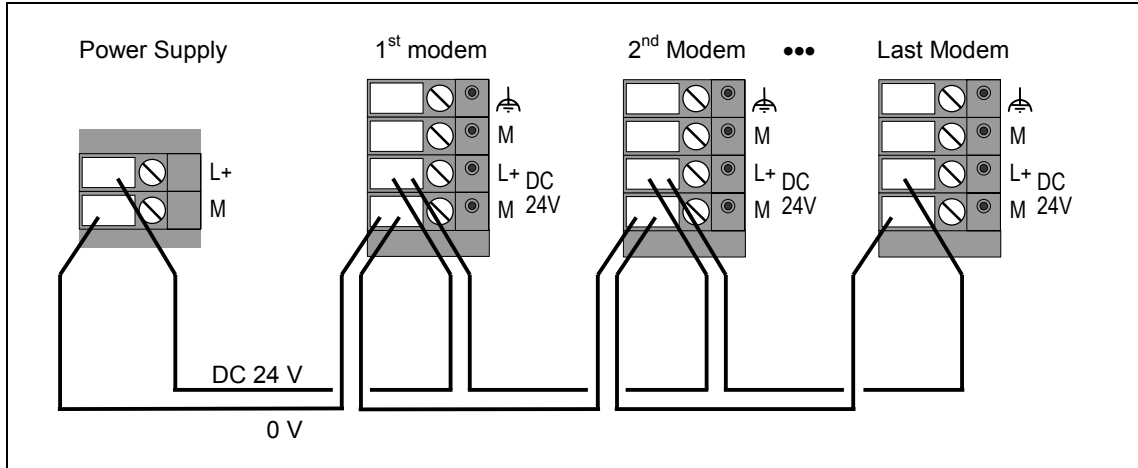
Fig. 2-20   Connecting to the power supply

Instructions for Operation with SINAUT ST1

3

3.1 Compatibility to SINAUT ST1 Modems

Introduction

In certain dial-up operating modes the MD3 modem is compatible to the dialing modems that are used for SINAUT ST1. This compatibility is ensured in two ways:

1. You can build a new SINAUT ST1 station into an existing network and use the MD3 modem to exchange data with a ST1 dialing modem at the partner.

2. You can use the MD3 modem as a replacement for a defective ST1 dialing modem.

> **Note**
>
> A new SINAUT ST1 station might also be a SINAUT ST7 device with an MD3 operating as an ST1 station.

For most applications it is possible to use the MD3 modem for SINAUT ST1 without further programming of the modem by a terminal program. One of the available standard profiles and the default setting are simply selected on the DIL switch of the modem.

In the following you will find detailed information about connecting the MD3 to a SINAUT ST1 device.

Compatibility Matrix

The following table provides a compatibility matrix of the MD3 modem in connection with the dialing modems used in the SINAUT ST1 system.

Table 3-1   Compatibility matrix of the MD3 modem and SINAUT ST1 modems

Operating Mode of the MD3	SINAUT ST1 Dialing Modem	
	MD125	**MDM2425B DX**
1200 bps dx V.22	x	-
2400 bps dx V.22bis	x	x

> **!**
>
> **Important**
>
> The MD3 modem does not have a compatible mode for the V.23 (1200 bps hx) protocol used by SINAUT ST1 applications. Select an operating mode from those listed in Table 3-1.

3.2   Compatibility to MD3 Modem (HW version < 4)

Introduction

In certain dial-up operating modes the MD3 modem is compatible to older MD3 modems (HW version < 4) which are also used as dial-up modems in SINAUT ST1. This compatibility is ensured in two ways:

1. You can install a new SINAUT ST1 station in an existing network and use the MD3 modem to exchange data with an older MD3 (HW version < 4) at the partner.

2. You can use the MD3 modem as a replacement for a defective MD3 (HW version < 4).

Note

A new SINAUT ST1 station might also be a SINAUT ST7 device with an MD3 operating as an ST1 station.

For most applications it is possible to use the MD3 modem for SINAUT ST1 without further programming of the modem by a terminal program. One of the available standard profiles and the default setting are simply selected on the DIL switch of the modem.

In the following you will find detailed information about connecting the MD3 to a SINAUT ST1 device.

Compatibility Matrix

The following table provides a compatibility matrix of the MD3 modem in connection with the MD3 modem (HW version < 4) used in the SINAUT ST1 system.

Table 3-2   Compatibility matrix of the MD3 modem and the MD3 (HW version < 4)

Operating Mode of the MD3	MD3 (HW version < 4)
1200 bps dx V.22	x
2400 bps dx V.22bis	x
4800 bps dx V.32bis	x
9600 bps dx V.32bis	x

!   **Important**
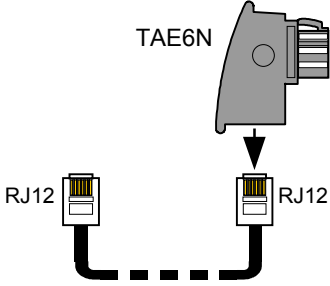
The MD3 modem does not have a compatible mode for the V.23 (1200 bps hx) protocol used by SINAUT ST1 applications. Select an operating mode from those listed in Table 3-2.

3.3 Connecting the MD3 to a TIM11 and TIM011B

Standard Cable

Cable 6NH7700-3BR60 is delivered with the MD3 modem (see following table). This enables the MD3 modem to be connected to a TAE6 telephone socket (German standard).

Table 3-3   Standard cable for the RJ12 port of the MD3 modem

Order no.	Description	Diagram
6NH7700-3BR60	Cable with 2 x RJ12 Western plugs and a clip-on TAE6N plug for connecting an MD3 modem (RJ12) to a telephone outlet (TAE6N) or to an LTOP overvoltage protection module (RJ12) for dedicated line mode. Cable length 6 m	
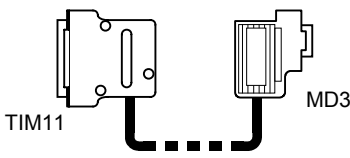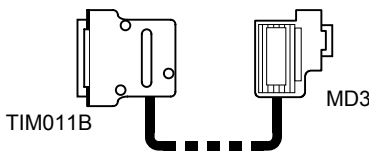
!   **Important**

Only use cable 6NH7700-3BR60 that is supplied with the MD3 for connecting the modem to the TAE6 socket. The cable for modem MD125 appears identical but is wired differently and therefore will not function properly!

There are two standard cables for connecting the MD3 to the SINAUT ST1 modules TIM11 and TIM011B (see following table). These are not included with the MD3; both must be ordered separately.

Table 3-4   Standard cables for SINAUT ST1 modules TIM11 and TIM011B

Order no.	Description	Diagram
6NH1701-7AN	Cable for connecting the MD3 modem (RS232) with a TIM11 (RS232) or another terminal with an identically configured 25-pin RS232 interface (socket) and slide lock. Cable length 2.5 m	
6NH1701-7BK	Cable for connecting the MD3 modem (RS232) with a TIM011B (RS232) or another terminal with an identically configured 25-pin RS232 interface (socket) and screw lock. Cable length 1.0 m	

The section *'Standard Cables for the RS232 and RS485 Port'* in Chapter 2 provides a description of these cable's configuration.

3.3.1 Default Settings of the Modem

Before setting the dialing profile on the DIL switch, it is important to specify the default setting of the modem, i.e., the data format, the dialing method and the line adjustment. The MD3 is usually operated with 11-bit data format, tone dialing and Zr line adjustment in SINAUT ST1. These are the factory settings. If these setting are not suitable for the application you are using, the default setting can be changed on the DIL switches SW2.1, SW2.5, SW2.6 and SW2.9.

Table 3-5   Various default settings for dial-up mode in the SINAUT ST1 system

Meaning	Setting on DIL switch
Data format 11-bit (8E1)	SW2 OFF / ON
Data format 10-bit (8N1)	SW2 OFF / ON
Tone dialing	SW2 OFF / ON
Pulse dialing	SW2 OFF / ON
Line adjustment 600 Ohm [1]	SW2 OFF / ON
Line adjustment Zr [1]	SW2 OFF / ON

[1] The factory setting for the line adjustment is Zr because the MD3 is usually connected to a digital telephone exchange. If an older analog telephone exchange is used transmission problems may occur making it necessary to set the line adjustment to 600 Ohm.

3.3.2 Controlling the Modem with V.25bis Commands

In most cases you will probably want to operate the MD3 using the V.25bis mode which is normal for SINAUT ST1. The following provides a description of the necessary configuration and settings for this mode. The following requirements must also be fulfilled:

- TIM11   version $\geq$ 12
- TIM011B version $\geq$ 5

If you wish to control the MD3 using the AT command set, refer to the notes in section 3.3.3.

Required Configuration for V.25bis

If the MD3 modem is to be connected to a TIM11 or TIM011B, one of the following standard profiles must be selected on the DIL switch of the modem. It is also necessary to enter the listed parameters for the TIM module in the SINAUT ST1 startup program.

Table 3-6   Required configuration for modem and TIM (modem control with V.25bis commands)
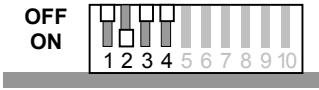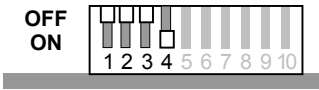
Operating Mode of the MD3	Standard Profile on the MD3	Basic Parameters for TIM11 or TIM011B							
		MTYP	BAUD	DUPL	SINT	SZEI	UZEI [1]	WAHL [2]	FORM [2]
V.25bis, 1200 bps dx (V.22)	1	1	1200	1	0	0	0	0	0,0
V.25bis, 2400 bps dx (V.22bis)	2	1	2400	1	0	0	0	0	0,0
V.25bis, 9600 bps dx (V.32bis)	4	1	9600	1	0	0	0	0	0,0

1) Answer delay for incoming calls is only available for the MD3 when used together with a TIM11 version $\geq$ 15 or a TIM011B $\geq$ version 8. Answer delay does not function with older versions. The parameter UZEI therefore needs to be set to 0 for these TIMs.

2) The WAHL and FORM parameters are only available with the newest version 7.0 of the TD1 software.

Setting the Required V.25bis Profile on the DIL Switch of the MD3

The selection of one of the V.25bis profiles (1, 2 or 4) which can be used for SINAUT ST1 is made on the 10-pin DIL switch SW2 that can be accessed from above through the grid (see also Chapter 2, section 2.1.7). The following table shows how to set the switches for profiles 1, 2 and 4.

Table 3-7   Settings for V.25bis profiles 1, 2 and 4

Profile no.	Profile description	Setting on DIL switch	
1	V.25bis, 1200 bps, dx (V.22)	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
2	V.25bis, 2400 bps, dx (V.22bis)	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10
4	V.25bis, 9600 bps, dx (V.32bis)	SW2	OFF ON 1 2 3 4 5 6 7 8 9 10

3.3.3 Controlling the Modem with AT Commands

The MD3 modem connected to a TIM11 or TIM011B can be controled with AT commands instead of V.25bis. For SINAUT ST1 this is possible if the following requirements are fulfilled:

- Software package SINAUT TD1, version 7.0
- TIM11   version $\geq$ 12
- TIM011B version $\geq$ 5

Required Configuration for AT Commands

Standard profile 0 needs to be set on the DIL switch SW2 of the modem if the MD3 is to be connected to a TIM11 or TIM011B. It is also necessary to enter the listed parameters for the TIM module in the SINAUT ST1 startup program.

Table 3-8   Required configuration for modem and TIM (modem control with AT commands)

Operating Mode of the MD3	Standard Profile on the MD3	Basic Parameters for TIM11 or TIM011B							
		MTYP	BAUD	DUPL	SINT	SZEI	UZEI [1]	WAHL	FORM
AT mode	0	1	[2]	1	0	0	0	1	0,0 or 1,0

[1]   Answer delay for incoming calls is only available for the MD3 when used together with a TIM11 version $\geq$ 15 or a TIM011B $\geq$ version 8. Answer delay does not function with older versions. The parameter UZEI therefore needs to be set to 0 for these TIMs.

[2]   The following baud rates can be selected: 1200, 2400, 4800, 9600.

Along with these basic parameters for the TIM module, the TIM also needs information about how the MD3 modem should be preset during startup. An initialization string is required for this. FB99, SREGP, is used in the SINAUT startup program for configuring this initialization string. The call for this FB must directly follow the FB for the TIM basic parameters.

If you are editing an existing SINAUT program that has already been setup for the use of AT commands, an FB99 will normally be available there (see following note). If an initialization string was configured for a previously used MD125, this configuration must be changed because most of the default settings are different for the MD3.

Note

The FB99 was not necessarily required for an MD125. In many cases the default initialization string that is stored on the TIM could be used. The FB99 will then be missing in the SINAUT startup program. For the connection of the MD3 the program has to be extended then by that function block.

A different initialization string is required for each of the operating modes used by the modem. The following table lists the details of these variations. It also includes the corresponding parameters for FB99.
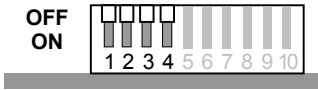
Table 3-9   Initialization strings for the MD3 using AT commands for modem control

Modem Operating Mode	Initialization String	Parameters for FB99, SREGP
V.22 (1200 bps, dx)	AT\N1F2	``` : JU FB99
NAME : SREGP:
SSNR : KF+..
AT1   : KH4154   (AT)
AT2   : KH5C4E   (\N)
AT3   : KH3146   (1F)
AT4   : KH320D   (2Cr)
AT5   : KH0AFF   (Lf + end code FF)
AT6   : KH0000
:
AT20 : KH0000```
V.22bis (2400 bps, dx) or **V.32bis** (4800/9600 bps, dx)	AT\N1F0	``` : JU FB99
NAME : SREGP:
SSNR : KF+..
AT1   : KH4154   (AT)
AT2   : KH5C4E   (\N)
AT3   : KH3146   (1F)
AT4   : KH300D   (0Cr)
AT5   : KH0AFF   (Lf + end code FF)
AT6   : KH0000
:
AT20 : KH0000```

Setting the Required AT Standard Profile on the MD3 DIL Switch

Set standard profile 0 to control the modem using AT commands. See the following table. The setting is made on the 10-pin DIL switch SW2 that can be accessed from above through the grid (see also Chapter 2, section 2.1.7).

Table 3-10   Setting standard profile 0

Profile no.	Profile description	Setting on DIL switch	
0	AT mode (factory default)	SW2	OFF / ON — 1 2 3 4 OFF, 5 6 7 8 9 10

3.3.4 Avoiding Problems When Exchanging Modems

Note the following points when using the MD3 to replace a defective SINAUT ST1 dialing modem:

- Set the required default setting and the correct standard profile on DIL switch SW2 before operating the modem. In most cases one of the three V.25bis profiles will be needed (profiles 1, 2 or 4). However, the factory setting for the modem is profile 0, i.e., AT mode.

- Use the cable supplied with the MD3 for connecting the modem to the TAE6 socket. The cable for modem MD125 appears identical but is wired differently and therefore will not function properly!

- For the operating mode V.22bis (2400 bps, dx) one of the basic parameters of the TIM must be changed:
  for the MD125, which knows this operating mode, MTYP=5 was the correct parameter,
  for the MD3 you will need to change this to MTYP=1!

- Ensure that the TIMs to which you wish to connect the MD3 modems have the following versions:
  TIM11   version $\geq$ 12
  TIM011B   version $\geq$ 5

- If you have operated to date with an answering delay (to be able to use a telephone parallel to the modem), this will only work with the MD3 if the TIM has the latest firmware version installed:
  TIM11 beginning with version 15
  TIM011B beginning with version 8
  If the TIM has an earlier version you must first update the TIM firmware to be able to use answer delay.

- If the MD125 modem being replaced was controlled with AT commands instead of the usual V.25bis commands, the initialization string (configured with FB99, SREGP) in the startup program must be changed. The initialization strings for MD125 and MD3 differ considerably. The required initialization strings can be found in Table 3-9.

- When the modem being replaced has been operating with V.23 (1200 bps hx), you need to select another operating mode. The MD3 modem is not compatible with this operating mode.
  All of the modems and TIMs connected to the same dial-up network must be set to the same operating mode. For the TIMs this means that the basic parameters of the SINAUT startup program in the ST1 CPUs need to be adjusted. Details about the basic parameters for each operating mode are available in section 3.3.
  If older ST1 modems are used such as LGM1200-H1, MDB1200-01 or similar models which can only operate V.23 (1200 bps hx) mode, they must be replaced by the MD3.

Controlling the MD3

4

6NH7811-0AA32

Introduction

This chapter provides basic information about controlling the MD3 modem. Two command languages are available:

- Extended Hayes® AT command set

- V.25bis command set

While V.25bis only provides a basic range of commands for dialing and controlling connections, the AT command set enables full control of the modem. The MD3 modem however uses a special extension of the V.25bis syntax that allows almost all AT commands to be passed through V.25bis! For more information about this topic refer to Chapter *V.25bis Operation*.

4.1 Using AT Commands

All commands to Hayes compatible modems must begin with the sequence **AT** and end with ↵ (RETURN). (**A/** and **a/** are exceptions as will be explained later!)

AT stands for *Attention*. Through the use of this character string the modem can automatically detect the bit rate and data format of the connected terminal. The "A" is used to detect the data transmission speed and the "T" the data format.

4.2 Permissible Data Formats and Speeds

The following is a list of permissible data formats over the serial interface of the MD3 modem:

Number of data bits	Parity	Number of stop bits
7 or 8	Even	1 or 2
7	Odd	1 or 2
7	Mark	1 or 2
7	Space	1 or 2
7 or 8	None	1 or 2

All of the above formats can be used with the following speeds:

1200, 2400, 4800, 7200, 9600, 12000, 14400, 19200, 38400, 57600, 115200 bps

If you unintentionally use an invalid format or an non-allowed speed it will be rejected or you will receive an **ERROR** as a response.

4.3   Command Syntax

As already mentioned, each command line must begin with **AT** and end with ↵. The characters can be written either capitalized (AT...) or small (at...). Several commands can be entered in sequence in a command line and spaces can be used to make the line easier to read. You can correct a mistaken entry at any time by using the backspace key (←) before entering the command with a return (↵). However, once **AT** has been entered it can no longer be deleted! If necessary, the ASCII codes for ↵ and ← can be changed.

> **Note**
>
> The commands **AT Z** and **AT &W** require a certain time to take effect and should therefore be entered at the end of the command line! In general, however, it is best not to use these commands in combination with other commands.

4.4   Maximum Length of the Command Buffer

The maximum allowed length of a command line is limited to 40 characters in correspondence to the size of the command buffer! This limit does not include the characters **AT**, ↵ and the line feed (LF). If more than 40 characters are entered the modem signals an **ERROR.**

4.5   Command Parameters

If no parameter is entered for a selection command the value is automatically assumed to be zero.

Example: **AT X** corresponds to **AT X0**

4.6   Command Mode and Data Mode

Modems use two different operating modes:

- Command mode
- Data mode

In the command mode the modem interprets the characters coming from the PC as control signals. These are not passed on to the opposite party!

In the data mode, on the other hand, the modem is ready for data exchange with the opposite party. All of the characters arriving from the PC are passed on without hindrance and without evaluation. This direct forwarding makes sense since the data being transmitted is not necessarily normal text and therefore may contain character strings that could be mistakenly interpreted as control commands. This is referred to as transparent data transmission. Of course, there is a way to change from the data mode back into the command mode: the ESCAPE sequence.

ESCAPE ● Changing from the Data Mode to the Command Mode

Carry out the following standard procedure to change from the data mode back into the command mode:

1 second pause · +++ · 1 second pause

(No transmission 1 second long <u>from</u> the terminal (PC) <u>to</u> the modem, three plus signs, 1 second pause as before).

The MD3 then reports with **OK**.

> **!** **Important**
>
> Please note that changing to the command mode does not cancel the connection to the opposite party! Connection charges will still continue. Another command is necessary to end the connection.

The procedure for exiting the data mode can be changed within certain limits, although standard method should be sufficient for practically every situation. For one, the pause time can be changed. This parameter is stored in register S12 and applies to the pause time before and after the character string. In addition, another character can be substituted for the plus character. The ASCII character code in register S2 must be correspondingly changed (see Chapter 9, *S Registers*).

In addition to the escape sequence, many programs also support cancellation of a connection and return to the command mode at the same time by turning off the DTR signal on the serial RS232 interface. The AT command **&Dn** is used to have the MD3 react this way.

4.7 Note about the V.25bis Modem Control Protocol

Due to the limited range of functions as compared to the AT command set, a few special notes need to be made about operation with the V.25bis protocol implemented in the MD3. Especially lacking is the automatic detection of the port speed and format.

The registers **S43**, **S44** and **S45** enable direct access to the internal modem variables which – normally set by an AT command – can also be used here to directly set the configuration of the V.25bis operating parameters. In addition, the contents of the registers can be saved in the modem profiles. A few V.25bis standard profiles are available for selection per DIL switch as well.

4.8   Notes about RS485 Mode

The modem can be switched to RS485 with the command **AT&C2**. In this mode the DCD signal is active during the time the modem transmits characters. There is no command line echo.

RS485 only functions in the buffered mode (\N0)! 8-N-1 or 8-E-1 are allowed as character formats in the data phase (online) whereby the configuration is set with DIL switch SW2.5 (see Chapter 2.1.7).

With 8-E-1 the parity check throws out all incorrect characters regardless of the data direction.

Since no message and control signals are used in the RS485 mode, the DTR monitoring and the handshake (data flow control) should be switched off:

AT &D0 \Q0 ↵.

4.9 Modem Responses

Commands to the modem generally result in a response. In addition to **OK** and **ERROR** as mentioned above, there are a number of other messages that are described in tables 4-1 and 4-2 below.

Basically you can select between an English normal text message (long form) and a number code (short form). The form of the response depends on the setting in the modem (see **Vn** and **\Vn** in the Chapter 6 *AT Commands*).

Messages in number code primarily serve to enable further processing in automatic computer programs.

Table 4-1   Standard Messages

Short form	Long form	Meaning / Notes
0	OK	Command completely executed
119	CONNECT	Connection established to opposite party
2	RING	Incoming call (ringing) detected
3	NO CARRIER	No carrier frequency can be detected or the carrier frequency has gone out in the meantime.
4	ERROR	Error Message caused by: • Non-allowed entry in the command line or • More than 40 characters in the command line or • Internal memory error
6	NO DIAL TONE	No dial tone • The **W** command was contained in the dialing command but a dial tone was not detected within the time specified in register S7. • While using the extended response codes **X2** or **X4** no dial tone was detected within 5 seconds after the "receiver was off the hook".
7	BUSY	Telephone line is occupied! (This response only occurs when the extended response code **X3** or **X4** is enabled!)
8	NO ANSWER	Call not accepted or the opposite modem does not answer the call
112	DELAYED	Selected telephone number is temporarily disabled.
113	BLACKLISTED	Selected telephone number is disabled.

Table 4-2   CONNECT Messages

Short form	Long form	Speed [bps]	Error correction protocol	Compression method
1	CONNECT 300	300		
5	CONNECT 1200	1200		
10	CONNECT 2400	2400		
11	CONNECT 4800	4800		
12	CONNECT 7200	7200		
13	CONNECT 9600	9600		
14	CONNECT 12000	12000		
15	CONNECT 14400	14400		
16	CONNECT 16800	16800		
17	CONNECT 19200	19200		
18	CONNECT 21600	21600		
19	CONNECT 24000	24000		
20	CONNECT 26400	26400		
21	CONNECT 28800	28800		
22	CONNECT 31200	31200		
23	CONNECT 33600	33600		
24	CONNECT 300/MNP	300	MNP4	
25	CONNECT 1200/MNP	1200	MNP4	
26	CONNECT 2400/MNP	2400	MNP4	
27	CONNECT 4800/MNP	4800	MNP4	
28	CONNECT 7200/MNP	7200	MNP4	
29	CONNECT 9600/MNP	9600	MNP4	
30	CONNECT 12000/MNP	12000	MNP4	
31	CONNECT 14400/MNP	14400	MNP4	
32	CONNECT 16800/MNP	16800	MNP4	
33	CONNECT 19200 /MNP	19200	MNP4	
34	CONNECT 21600/MNP	21600	MNP4	
35	CONNECT 24000/MNP	24000	MNP4	
36	CONNECT 26400/MNP	26400	MNP4	
37	CONNECT 28800/MNP	28800	MNP4	
38	CONNECT 31200 /MNP	31200	MNP4	
39	CONNECT 33600/MNP	33600	MNP4	
40	CONNECT 300/MNP COMPRESSED	300	MNP4	MNP5
41	CONNECT 1200/MNP COMPRESSED	1200	MNP4	MNP5
42	CONNECT 2400/MNP COMPRESSED	2400	MNP4	MNP5
43	CONNECT 4800/MNP COMPRESSED	4800	MNP4	MNP5
44	CONNECT 7200/MNP COMPRESSED	7200	MNP4	MNP5

(Table continued: see next page)

Short form	Long form	Speed [bps]	Error correction protocol	Compression method
45	CONNECT 9600/MNP COMPRESSED	9600	MNP4	MNP5
46	CONNECT 12000/MNP COMPRESSED	12000	MNP4	MNP5
47	CONNECT 14400/MNP COMPRESSED	14400	MNP4	MNP5
48	CONNECT 16800/MNP COMPRESSED	16800	MNP4	MNP5
49	CONNECT 19200 /MNP COMPRESSED	19200	MNP4	MNP5
50	CONNECT 21600/MNP COMPRESSED	21600	MNP4	MNP5
51	CONNECT 24000/MNP COMPRESSED	24000	MNP4	MNP5
52	CONNECT 26400/MNP COMPRESSED	26400	MNP4	MNP5
53	CONNECT 28800/MNP COMPRESSED	28800	MNP4	MNP5
54	CONNECT 31200 /MNP COMPRESSED	31200	MNP4	MNP5
55	CONNECT 33600/MNP COMPRESSED	33600	MNP4	MNP5
56	CONNECT 300/V42	300	V.42	
57	CONNECT 1200/V42	1200	V.42	
58	CONNECT 2400/V42	2400	V.42	
59	CONNECT 4800/V42	4800	V.42	
60	CONNECT 7200/V42	7200	V.42	
61	CONNECT 9600/V42	9600	V.42	
62	CONNECT 12000/V42	12000	V.42	
63	CONNECT 14400/V42	14400	V.42	
64	CONNECT 16800/V42	16800	V.42	
65	CONNECT 19200 /V42	19200	V.42	
68	CONNECT 21600/V42	21600	V.42	
71	CONNECT 24000/V42	24000	V.42	
72	CONNECT 26400/V42	26400	V.42	
73	CONNECT 28800/V42	28800	V.42	
74	CONNECT 31200 /V42	31200	V.42	
75	CONNECT 33600/V42	33600	V.42	
76	CONNECT 300/V42BIS	300	V.42	V.42bis
78	CONNECT 1200/V42BIS	1200	V.42	V.42bis
79	CONNECT 2400/V42BIS	2400	V.42	V.42bis
82	CONNECT 4800/V42BIS	4800	V.42	V.42bis
83	CONNECT 7200/V42BIS	7200	V.42	V.42bis
84	CONNECT 9600/V42BIS	9600	V.42	V.42bis
85	CONNECT 12000/V42BIS	12000	V.42	V.42bis
86	CONNECT 14400/V42BIS	14400	V.42	V.42bis

(Table continued: see next page)

Short form	Long form	Speed [bps]	Error correction protocol	Compression method
87	CONNECT 16800/V42BIS	16800	V.42	V.42bis
88	CONNECT 19200 /V42BIS	19200	V.42	V.42bis
89	CONNECT 21600/V42BIS	21600	V.42	V.42bis
90	CONNECT 24000/V42BIS	24000	V.42	V.42bis
91	CONNECT 26400/V42BIS	26400	V.42	V.42bis
92	CONNECT 28800/V42BIS	28800	V.42	V.42bis
93	CONNECT 31200 /V42BIS	31200	V.42	V.42bis
94	CONNECT 33600/V42BIS	33600	V.42	V.42bis
95	CONNECT 38400	38400		
96	CONNECT 57600	57600		
97	CONNECT 115200	115200		
98	CONNECT 38400/MNP	38400	MNP4	
99	CONNECT 57600/MNP	57600	MNP4	
100	CONNECT 115200/MNP	115200	MNP4	
101	CONNECT 38400/MNP COMPRESSED	38400	MNP4	MNP5
102	CONNECT 57600/MNP COMPRESSED	57600	MNP4	MNP5
103	CONNECT 115200/MNP COMPRESSED	115200	MNP4	MNP5
104	CONNECT 38400/V42	38400	V.42	
105	CONNECT 57600/V42	57600	V.42	
106	CONNECT 115200/V42	115200	V.42	
107	CONNECT 38400/V42BIS	38400	V.42	V.42bis
108	CONNECT 57600/V42BIS	57600	V.42	V.42bis
109	CONNECT 115200/V42BIS	115200	V.42	V.42bis

Error Correction, Data Compression, Flow Control

5

Introduction

The MNP (**M**icrocom **N**etworking **P**rotocol), V.42 and V.42bis protocols are methods for achieving connections that are free of error and with data compression. These protocols work fully automatically in the background for the user. They pack the data of the terminal in packets and assign checksums to them. If an error is detected during transmission from one modem to the other, the packet can be requested again until it has been correctly transmitted. The terminals are unaffected by these operations although the transmission time for individual characters may take longer. One reason for this is that packets, not single characters, are being sent. Another reason is that any necessary resending can lead to time delays.

Error correction is necessary if data compression is used. Without it, the loss of a single character would mean that all of the following characters cannot be correctly extracted. Another advantage of transmission with error correction is that the data is transported synchroneously which means there is no need for the start and stop bits between the modems. From the 10 bits between the terminal and the modem, 8 bits are used between the modems, in other words the transmission speed is increased even without compression by a factor of 10/8.

! **Important**

Both connected parties must be set for the respective protocol being used!

! **Important**

The above mentioned error correction and data compression methods may not be used in connection with SINAUT ST1 and SINAUT ST7 station control systems!

The use of the protocols mentioned requires the additional use of data flow control to enable the control of the data flow between the terminal (PC) and modem.

The following sections contain detailed information about the protocols as well as the data flow control methods available.

The AT commands for setting the correction and compression methods as well as the data flow control are described in Chapter 6.

5.1 MNP - Microcom Networking Protocol

The MNP protocol, developed by the American company Microcom, is used today by many modem manufacturers and is considered somewhat of a standard for error-free and compressed data transmission. The MNP protocol is not actually a single process, but rather several stapled processes or "classes". Until now 10 classes have been developed, whereby classes 2 to 5 represent the standard for MNP modems. The MD3 modem with MNP5 also covers classes 2 to 4 (class 1 is considered outdated and is no longer used, classes 2 and 3 are only used for backward compatibility).

In class 4 (MNP4) the error correction method is defined while in class 5 (MNP5) very fast (due to a mathematical technique) hardware data compression is used.

The maximum achievable compression factor is 2, in other words, with a 9600 bps connection the data transfer rate can be theoretically doubled to 19200 bps.

The MNP protocol is also capable of automatically adjusting to the current quality of the transmission line. A poor connection means a lower transfer rate while a good connection allows a correspondingly higher transfer rate.

5.2 V.42 Error Correction

V.42 is the most common standardized error correction protocol from the ITU (previously CCITT). It operates more effectively than MNP4 and is backwards compatible to it. This means that V.42 modems can work together with MNP4 error correction.

Note

The term "error correction" should actually be called "error check" because transmission errors are not automatically corrected by these methods. What happens in fact, is that when the receiving modem detects a transmission error, it requests the sending modem to send the data block again until it has been correct received.

5.3 V.42bis Data Compression

The V.42bis protocol is a standardized data compression method from the ITU. It is – at least theoretically – double as effective as MNP5. 2400-bps modems using V.42bis can obtain a data transfer rate of up to 9600 bps.

Another great advantage in comparison with MNP5 is the automatic detection of pre-compressed files. File transfers often involve files that have already been externally compressed. In such situations MNP5 still attempts to compress the data (which of course is useless but still costs time) and the transmission speed is therefore even reduced slightly. V.42bis recognizes compressed files and automatically switches the compression off during transmission. This way no time is lost.

! **Important**

V.42bis is <u>not</u> compatible with MNP5!

V.42bis is based on "*dictionaries*" in which often used character strings are stored in tables. The transmission contains references to table entries then in the place of these character strings.

5.4 Operating Modes

The MD3 offers four different operating modes for error correction and data compression:

- DIRECT
- NORMAL
- RELIABLE
- AUTORELIABLE

These four operating modes are described in the following.

5.4.1 DIRECT Operating Mode

A DIRECT connection corresponds to a normal modem connection. The transmission rate is identical with the speed of the connected terminal (PC) and also has to match the data rate of the modem connection.

For example, if you are running a PC communication program with 9600 bps, the data connection is established with 9600 bps too (CONNECT 9600). The data throughput is also 9600 bps. By the same token, if your PC is set to 9600 bps and the modem at the other end answers with only 2400 bps, the modem switches down to 2400 bps. Your communication program must then also be capable of reducing the speed of the PC to 2400 bps (switch the communication program to "autobaud" otherwise erroneous characters appear on the screen).

5.4.2 NORMAL Operating Mode

This operating mode features automatic buffering and speed adjustment in the modem. The speed between the modem and terminal (PC) need not match the transmission rate of the modem connection. The maximum data throughput however is never higher than the transmission speed between the modems.

Assume, for example, that your PC is operating with 9600 bps while the transmission rate between the modems lies at 2400 bps. As long as the speed of the data input does not cause an overflow to the internal send buffer of the modem, automatic adjustment occurs between the (modem) input speed (9600 bps from the PC) and the output speed (2400 bps from the transmission line). The data throughput however remains limited to 2400 bps.

To prevent an overflow of the modem memory, the modem can instruct the PC to stop transmission if necessary until data can be accepted once again. See section 5.5 *Data Flow Control*.

Error correction and data compression are switched off in the NORMAL mode.

5.4.3 RELIABLE Operating Mode

RELIABLE means just that. The transmission speeds between a modem and a PC or a modem and an opposite modem may also differ in a RELIABLE connection as automatic buffering takes place in the modem. However, an error correction method is switched on in addition. Data compression can be optionally added.

It is not possible to establish a connection to another party running without error correction.

data flow control is also required for this operating mode. See section 5.5 *Data Flow Control*.

5.4.4 AUTORELIABLE Operating Mode

The AUTORELIABLE mode corresponds to the RELIABLE mode for the most part but also allows connections to other parties without error correction. It first attempts to establish the connection with error correction. If this is not possible the connection falls back to the NORMAL mode.

Note

It is practically always possible to establish a connection of some kind in the AUTORELIABLE mode. For this reason it is the preferred mode. If a connection with error correction is absolutely necessary, however, the RELIABLE mode should be selected.

5.5 Data Flow Control

As mentioned above, the MD3 allows differing speeds between the terminal and modem or between a modem and an opposite party. When the line quality is poor speeds may be reduced or data jams may occur, requiring many data blocks to be resent and ultimately may cause a data overflow in the internal buffer. This may result in the loss of data.

To prevent such overflows, there is additional negotiation between the modem and terminal (PC). In the other direction the terminal can also signal the modem whether or not it is currently ready to accept data. This communication is called a "handshake" or data flow control.

Besides bi-directional data flow control, there is also uni-directional control. The latter only uses control in the "modem to terminal" direction. One example of uni-directional data flow control is fax operation.

> **Note**
>
> Always use data flow control when possible!

!

> **Important**
>
> To ensure correct operation it is important that both the terminal and the MD3 are set to the same data flow control method!

5.5.1 Hardware Data Flow Control (RTS/CTS)

Hardware data flow control is the preferable method. This requires the use of the signals *RTS* (Request to Send) and *CTS* (Clear to Send) of the RS232 interface.

When the modem buffer is full the modem sets the CTS signal to the OFF status. As soon as data can once again be accepted, the signal changes back to the ON status. Via the CTS signal the modem is therefore capable of controlling the data flow coming from the terminal (PC).

The RTS signal is used for the opposite direction. The terminal sets the RTS signal to the OFF status to tell the modem not to send any more data to it and changes back to the ON status as soon as data can be accepted once again from the modem.

5.5.2   Software Data Flow Control (XON/XOFF)

Software data flow control does not require any additional signals. Instead, special characters are added to the flow of data. XOFF (ASCII: 19) stops the data flow and XON (ASCII: 17) starts it once again. In this way a connection between modem and terminal only requires three control signals.

!
Important

If the MD3 is connected to the terminal via the RS485 interface, only software data flow control is possible, i.e. with XON and XOFF!

AT Commands

<div style="text-align: right; font-size: 3em; font-weight: bold;">6</div>

Introduction

This chapter describes the standard AT commands and their effects. The commands especially reserved for **MNP/V.42/V.42bis operation** are described in section 6.2 MNP/V.42/V.42bis Commands.

In the place of the variable "n", a selected value needs to be entered as explained by the respective description. Several "nnn" represent a sequence of characters.

6.1 General AT Commands

AT   **Attention**

A command to the modem must always begin with **AT**. These two characters are used to measure the transmission format and speed between the PC and modem. At the same time the string prepares the modem for the series of commands that will soon follow. Note that a command line can have a maximum of 40 characters! This limit does not include the characters **AT**, ↵ and the line feed (LF).

Enter the character string **AT** ↵ once the modem is switched on. This allows the modem to adjust itself to the transfer format and transmission speed of your PC and immediately enables stable communication. Otherwise the modem starts operation with the default speed stored in its non-volatile memory.

Example:
Input: **AT** ↵
Modem: **OK**

A/   **Repeat Previous Command Line**

or

a/

The command causes the previous command line to be repeated. It must be entered without the **AT** prefix and closing ↵ and may not be combined with other commands. The **A**/ command is especially useful for redialling. It is the only exception to the rule that every command must begin with the prefix **AT** and close with ↵.

A   **Answer**

This command causes the modem to "pick up the receiver" and to immediately begin sending the answer signal (manual answer mode). If a connection is not established within the time specified in register S7, the modem hangs up and reports: **"NO CARRIER"**. You can also cancel ongoing answering by sending a character of any kind to the modem. The possibility to cancel the answering, however, lasts only until a connection has been established. When the connection is established ("DCD" LED is lit), the modem goes immediately into the data mode.

Example:
Input: **AT A** ↵
Modem: The modem "picks up the receiver" and sends an answer signal (answer mode)

Bn   BELL or CCITT Transmission Standards

This command selects between the transmission standards BELL (typical in the USA) and CCITT (typical in Europe). The default setting loaded by the modem when started is taken from the contents of the non-volatile memory. The choice between the BELL and CCITT standards applies only to 1200 bps operation (see also the **F** command)! In contrast to the F command, the B command essentially limits the highest speed and allows the lowest speed for the various types of modulation.

B0 — 300..33600bps   Standard according to CCITT (default)
B1 — 300..33600bps   Standard according to BELL
B2 — 300..33600bps   Standard according to CCITT (autoselect)
B3 — 1200bps   only V.23
B4 — 300bps   V.21
B5 — 1200 bps   V.22
B6 — 1200..2400 bps   V.22bis
B7 — 4800bps   V.32bis
B8 — 4800..9600bps   V.32
B9 — 4800..14400bps   V.32bis
B10 — 2400..16800bps   V.22bis, V.32bis, V.34
B11 — 2400..19200bps   V.22bis, V.32bis, V.34
B12 — 2400..21600bps   V.22bis, V.32bis, V.34
B13 — 2400..24000bps   V.22bis, V.32bis, V.34
B14 — 2400..26400bps   V.22bis, V.32bis, V.34
B15 — 2400..28800bps   V.22bis, V.32bis, V.34
B16 — 2400..31200bps   V.22bis, V.32bis, V.34bis
B17 — 2400..33600bps   V.22bis, V.32bis, V.34bis

Example:
Input: **AT B0 A** ↵
Modem: The modem switches to the CCITT standard and sends the answer tone (answer mode).

Input: **AT B1 A** ↵
Modem: The modem uses the BELL standard at a transmission speed of 1200 bps. At 2400 bps the CCITT V.22bis standard is used.

Dnnn   Dialing

Along with the actual data connection, the dialing of a telephone number represents one of the central tasks of a modem. For this reason the Hayes "AT" command set provides convenient commands for all aspects of dialing. You can select either pulse or tone dialing (tone is also referred to as multiple frequency or MF).

A **D** is always prefixed to the beginning of a dialing command. The desired telephone number follows, when necessary supplemented by control characters, which all together form the dialing command. The modem processes the parts of a dialing command sequentially. In other words, it reads and executes each command in the dialing command string one after the other. For example, if a pause character is placed within the telephone number, the pause will occur at exactly this position. For more exact details read the following descriptions.

The digits "0" to "9" are permitted for pulse dialing and for tone dialing the characters "A", "B", "C", "D", "#" (number sign) and "*" (asterisk) are allowed in addition. The following control characters are also defined.

P — Pulse

The digits following will be dialed with pulse dialing.

T — Tone

The digits following as well as "A", "B", "C", "D", "#" and "*" will be dialed with tone dialing.

, — Comma

The modem pauses during dialing. The default pause duration is 2 seconds although this can be varied in register **S8**.

@ — Ampersand

The modem waits at the position of this character for a line rest of at least 5 seconds before continuing dialing. If a "line rest" is not detected within the time specified in register **S7** (30 seconds by default), dialing is canceled.

S=n Stored

A dialing sequence previously stored in the non-volatile memory is called up and executed. **n** may be between 0 and 19 (see also the **&Zn=x** command).

! — Flash

The modem hangs up for 60 ms and then "picks up the receiver" again. This function is of no practical use in the German telephone network.

W — Wait

This command tells the modem to wait for the "dial tone" at the position of this character before continuing to dial. If the "dial tone" is not detected within the time specified in register **S7** (30 seconds by default), dialing is canceled.

; — Semicolon

This command may only be used as the last character in a dial command! This instructs the modem to stay in the command mode rather than to go into the data mode after a connection has been successfully established.

A "-" (hyphen) and "(" or ")" (parenthesis) can be inserted in the dial command to improve the readability.

Example:

Input: **AT DP 0041, 056 1234567** ↵
Modem: **OK**
The modem dials with pulse dialing:
the country code (0041), 2 seconds pause, the area code (056) and finally the telephone number (1234567).

You can find more detailed information in Chapter 8 *Detailed Dialing Instructions*.

En   Echo ON/OFF

This command determines whether the modem should send characters received from the PC back to the PC when the modem is in the command mode (=Echo).

E0 — Echo - OFF (default)
E1 — Echo - ON

Example:
Input: **AT E1** ↵
Modem: Characters are sent back to the PC.

Fn   Transmission Speed CCITT

This command is used to select the transmission protocol and the maximum speed. (See also the **B** command)!

F0 —	300..33600bps	Automode, V.21, V.22bis, V32bis, V.34
F1 —	Reserved	
F2 —	1200bps	V.22
F3 —	2400bps	V.22bis
F4 —	Reserved	
F5 —	Reserved	
F6 —	Reserved	
F7 —	Reserved	
F8 —	4800bps	V.32bis
F9 —	7200bps	V.32bis
F10 —	9600bps	V.32bis
F11 —	12000bps	V.32bis
F12 —	14400bps	V.32bis
F13 —	16800bps	V.34bis
F14 —	19200bps	V.34bis
F15 —	21600bps	V.34bis
F16 —	24000bps	V.34bis
F17 —	26400bps	V.34bis
F18 —	28800bps	V.34bis
F19 —	31200bps	V.34bis
F20 —	33600bps	V.34bis

Hn   Hook (pick up the receiver and hang up)

This command enables you to answer an incoming call manually and to end an existing connection. The ATH1 command only opens the line. It can be followed by either a dial command, ATDnn, or an answer command, ATA. In any case the connection establishment time is running in register S7 and therefore the modem will hang up when no connection is established within this time period.

H0 — End the connection (hang up the receiver)
H1 — Open the connection (pick up the receiver)

In   Identification / Check

The modem responds to this command with various messages for purposes of identification and checks.

I0 — Indicates modem type "33600".
I1 — The EPROM checksum is calculated and reported.
         The modem description, modem standard and version number is also displayed.
I2 — A test of the modem memory is carried out. If no error occurs, **OK** is reported, otherwise **ERROR** is reported.
I3 — The internal version number of the MNP/V.42/V.42bis system is returned.
I4 — The modem description, modem standard and version number as well as the manufacturer and type of modem chip are displayed.
I11 — Displays the hardware version of the board
I21 — Displays the date when the firmware was compiled.
I68 — Shows the results of the self-test.
I90 — Displays the country setting.

Example:
Input: **AT I90** ↵
Modem: **Current   Country: 6 Europe**
          Default   Country: 6 Europe

Ln   Volume

This command sets the volume of the built-in loudspeaker to one of three levels.

L0 — Low
L1 — Low (default)
L2 — Medium
L3 — High

Mn   Loudspeaker Control

This command determines when the loudspeaker is to be turned on.

M0 — Loudspeaker is always OFF
M1 — Loudspeaker is ON from the beginning of dialing until CONNECT (default).
M2 — Loudspeaker is always ON
M3 — Loudspeaker is ON after dialing until CONNECT.

Note

The loudspeaker can be switched on and off with DIL switch SW2.8 (see Chapter 2.1.7).

O   Online

This command enables you to change from the command mode back to the data mode during an <u>ongoing</u> modem connection. For example, if you wish to change a modem parameter during a data connection, you first change from the data to the command mode using the ESCAPE sequence. As mentioned above, this does not end the modem connection! You can then enter the desired control commands to the modem. Finally, you change back to the data mode using **O** and continue the data transmission.

<u>Example</u>: (In this example ~ stands for: 1 second pause)

Input: **AT DP 0041, 056 1234567** ↵ (dial)
Modem: Dials the other party and establishes a connection.
            CONNECT 1200   (connection established; data mode)

Input: **~ +++ ~**   (ESCAPE: data → command mode)
Modem: **OK**

Input: **AT %R** ↵   (command: show signal level)
Modem: **020**   (Modem detects a signal level of -20 dBm)
            OK

Input: **AT O** ↵   (switch: command → data mode)
Modem: **CONNECT 1200**   (connection in data mode)
            The data transmission can be continued.

P   Pulse Dialing

This command sets the modem to pulse dialing. This setting is only active in the currently selected standard dialing profile and can be changed with the ATT command or a parameter in the ATD command.

Qn   Quiet (no modem messages)

You can use this command to determine whether the modem messages such as **OK** or **ERROR**, for example, should be displayed. This command, however, only relates to the messages described under section 4.9 *Modem Responses*.

Q0— Modem displays responses. (default)
Q1— Modem displays no responses.

<u>Example</u>:
Input: **AT Q0** ↵
Modem: **OK**
Input: **AT Q1** ↵
Modem: (no response)

> **Note**
>
> Turning off the modem response messages does not mean that the commands are no longer executed! The messages of the modem are only suppressed!

Sr?   Read S-Register Indicated by r

This command is used to read a modem register, whereby **r** specifies the desired register. The returned display is always in the form of a three-digit decimal number. You can find a detailed description about the meaning of the individual registers in Chapter 9 *S-Registers*.

Example:
Input: **AT S0? ↵**
Modem: **003**
         OK
         The modem answers an incoming call after the third ring.

> **Note**
>
> The Sr? command can be supplemented by another letter to determine the output format of the requested register content.
>
> **Sr?B** — Displays the register content in binary format.
>
> **Sr?H** — Displays the register content in hexadecimal format.

Sr=n   Write to S-Register Indicated by r

This command is used to write the value **n** in register **r**. Please note that some registers are "BIT Mapped Registers", the values of which must be converted from the binary to the decimal system. Some registers are "read-only", in other words, the modem will report an **ERROR** when you attempt to write to them.

Example:
Input: **AT S0=2 ↵**
Modem: **OK**
         The modem now answers an incoming call after the second ring.

> **Note**
>
> The write command should be used very carefully as its misuse may lead to chaos in the modem control. Please use this command only after you are sure exactly what its effect will be!

Sr.b?   Read Bit from S-Register Indicated by r

This command returns the value of an individual bit in the S-register specified by **r** as a three-digit decimal number. The value may be 0 or 1. The number of bit **b** can have the value 0 - 7, whereby 7 is the most significant bit.

Example:
Input: **AT S21.2?** ↵
Modem: **001**
          OK

Sr.b=   Write Bit to S-Register Indicated by r

This command sets the value of an individual bit in the S-register specified by **r**. The value may be 0 or 1. The number of bit **b** can have the value 0 - 7, whereby 7 is the most significant bit.

Example:
Input: **AT S80.6=1** ↵
Modem: **OK**

T   Tone Dialing

This command sets the modem to tone dialing. This setting is only active in the currently selected standard dialing profile and can be changed with the ATP command or a parameter in the ATD command.

Vn   Form of the Modem Response Messages

This command is used to determine the form of the modem responses, either in English text or as decimal code. See also Chapter 4.9.

V0 — Code messages
V1 — Text messages (default)

> **Note**
>
> Text responses are closed with a carriage return and line feed (CR/LF). Decimal responses have only a carriage return (CR)!

Xn   Result Code (extended modem messages)

This command is mainly used to control the type of monitoring during establishment of the connection and the responses in this context.

The command affects:

- type of CONNECT message
- detection of the dial tone
- detection of the busy signal

The CONNECT message consists of either the word "CONNECT" only or the message form specified by **\V** which contains the transmission speed and possibly the error correction protocol.

It may be necessary in private branch exchanges (PBX systems) to begin dialing without a dial tone present.

If for some reason a busy signal is inadvertently detected, for example, because of a spoken message, the detection of the busy signal can be switched off with the **X** command.

X0	X1	X2	X3	X4	
	x	x	x	x	CONNECT according to \V
		x		x	Dial tone detection on
		x	x		Busy signal detection on

Example:

Input: **ATX3** ↵
Modem: **OK**
            Extended CONNECT and busy signal detection are on.

Note

As very different frequencies are used for the "dial tone" and "busy signal," it may be difficult to correctly detect these signals in certain circumstances!

PBX Systems: PBX systems often require the use of an "external access number" before the actual telephone number. Only the internal dial tone is present before this number is entered. When **X2** or **X4** is used, this internal dial tone is usually not recognized as the normal dial tone and therefore the modem will not begin dialing the number (including the external access number); shortly thereafter it cancels the attempt and the **NO DIALTONE** message appears. Changing to **X1** or **X3** may help in this case!

Z   RESET

Entering a **Z** command resets the modem's internal register to the settings in the EEPROM. The conclusion of the RESET is confirmed by the modem with the message: **OK**. Commands following a **Z** command in the same line are ignored. The profile loaded by the reset can be determined by a parameter or the DIL switches. If a number follows the ATZ command this number determines the profile. Otherwise the DIL switches are read and select the profile (see the information about the DIL switches in Chapter 2 *Mounting and Installation*).

Example:
Input: **AT Z ↵**
Modem: **OK**
          The modem is reset to the profile set on the DIL switches.

%D   Display Restricted Telephone Numbers

The modem shows an OK. This command is implemented to make it compatible with previous models.

%En   Automatic Retrain

This command enables the modem to trigger a new synchronization when it determines that the transmission quality is too poor. This feature is only available with V.22bis, V.32bis and V.34bis.

%E0 — Auto retrain OFF
%E1 — Auto retrain ON (default)

%Ln   Set Send Level

The send level for the telephone connection can set within certain limits depending on the country (see Register **S91**). The value is given in -dBm.

Example:
Input: **AT %L11 ↵**
Modem: **OK**
          Sets the modem to a send level of -11dBm.

%Pn   Auto Power-up Call

When the "Auto Power-up Call" is activated the modem dials the number saved by the **&Z0=** command when the power supply is switched on.

%P0 — Auto power-up call OFF (default)
%P1 — Auto power-up call ON

%Q   Quality of the Reception Signal

This command offers the possibility to display the reception quality online in the command phase when using the modulation modes V.22bis, V.32bis and V.34bis. A three-digit decimal number from 0 - 127 is returned. 0 corresponds to a perfect signal. 127 corresponds to loss of synchronization.

%R   Reception Level

This command offers the possibility to display the reception level in -dBm online in the command phase.

&An   Special Functions

This command has the following functions:

&A0 — switch to Hayes/AT command set

&A1 — switch to V.25bis

&Cn   Data Carrier Detect (DCD)

This command enables you to control the response of the DCD output. The DCD output is used to signal the connected terminal (PC) that the data carrier signal has been detected.

&C0 — The DCD output is always ON regardless whether a carrier has been detected or not.

&C1 — The DCD output corresponds to the status of the data carrier.
ON status means: data carrier detected! (default)

&C2 — Switch to RS485. The DCD output is now used to control the RS485 mode.

> **Note**
>
> If the MD3 is operated via its RS485 interface, the following has to be taken into account:
>
> After the MD3 has received data and has passed them to the DTE the MD3 needs a pause of 5 ms until it can be switched to the send function. For sending the DTE must consider this time delay.
>
> If the DTE connected to the MD3 modem is a TIM from the SINAUT catalog, this note is not relevant.

&Dn   Data Terminal Ready (DTR)

Using the DTR signal the modem can determine if the connected terminal is ready for operation. At the same time DTR can also be used for various control tasks (for example with RS485). The "**DTR**" LED reflects the current status. The DTR signal criteria are the two signal flanks:
ON to OFF: signals a change from the ON status to the OFF status.
OFF to ON: signals a change from the OFF status to the ON status.

&D0 — The modem ignores the operating status of the terminal (= DTR signal). The LED "**DTR**" is always on.

&D1 — The modem goes to the command mode as soon as it detects an ON to OFF flank from the DTR signal. The "**DTR**" LED reflects the current signal status.

&D2 — The modem "hangs up the receiver", goes to the command mode and switches Auto Answer off when an ON to OFF flank is detected. Auto Answer can be activated by an ON status from the DTR signal. The "**DTR**" LED reflects the current signal status. (default)

&D3 — When an ON to OFF flank is detected the modem is reinitialized, that is, the configuration is reset to the setting in the non-volatile memory.

&D4 — Same as **&D2** but a rising DTR flank causes the telephone number saved with **&Z0=** to be called.

> **Note**
>
> In the ONLINE status the changes of the DTR signal are only detected when they last longer than the time specified in register **S25**!

&En   Automatic Speed Adjustment

Using V.32bis and V.34bis the modem can adjust the transmission speed to the quality of the line. This means that the speed can be increased and decreased by the modem. A new CONNECT message therefore does not occur, which can lead to problems in the direct mode. With all the buffered methods, i.e., Normal, MNP or V.42 connections, the user will not notice any of the speed adjustments.

&E0 — Automatic speed adjustment OFF (default)
&E1 — Automatic speed adjustment ON

&Fn   **Factory Settings**

With this command the modem configures itself to the factory settings saved in the EPROM. There are 16 factory settings.

&F   **—** Factory setting as configured on the DIL switch
&F0..15 — Profile 0 ..15

> **Note**
>
> The factory settings are not saved in non-volatile memory at this time! To do this the command **&Wn** must be entered.

&Gn   **Guard Tone**

This command switches the "guard tone", an additional signal tone.

&G0— Guard tone OFF (default).
&G1— Guard tone 550 Hz.
&G2— Guard tone 1800 Hz.

&Ln   **Switch over from dial-up to dedicated line mode**

This command enables you to switch the modem to the dial-up or dedicated line mode.

&L0 — Dial-up mode.
&L1 — Dedicated line mode.

&Rn   **Clear-To-Send (CTS) Behavior**

This command enables you to control the response of the CTS signal.

&R0— CTS signal follows DTR or indicates readiness to send. This setting is used with V.25bis.
&R1— The CTS is always ON or follows the \Q setting in data mode (default).

&Sn   **Data Set Ready (DSR)**

This command enables you to control the response of the DSR signal.

&S0 — DSR signal always ON.
&S1 — Response of DSR signal corresponds to CCITT V.22bis/V.22 recommendations. (default)

&Vn Display Configuration

This displays an overview of the current configuration, a profile saved in the memory banks (see AT&W) and the telephone number memory (the first 4 numbers) When a number follows the AT&V command the loaded configuration of the profile indicated by that number is displayed. Otherwise DIL switches SW2.1 to SW2.4 determine the profile.

&V — Display configuration of DIL switch SW2.1 to SW2.4
&V0..15 — Display profiles 0..15

&Wn Write Configuration (save the current settings)

The **&W** command enables you to save "configuration profiles" in the non-volatile memory (EEPROM) of the MD3. These settings are loaded when the unit is switched on (based on the DIL switch settings) or after the command **ATZ** is entered.
When a number follows the AT&W command it determines the area where the values are saved in the non-volatile memory. Otherwise DIL switches SW2.1 to SW2.4 determine the area.

&W — Save the profile in the area determined by the DIL switch.
&W0..15 — Save the profile in the area 0..15.

Example:
Input: **AT &W1** ↵
Modem: **OK**
Input: **ATZ** ↵
Modem: **OK**

The current modem configuration is saved in the profile area "1" of the non-volatile memory and then a RESET is carried out whereby the profile specified by the DIL switches is reloaded.

&Zn=xxx Telephone Number Memory for Quick Dialing

This command enables you save in the non-volatile memory up to twenty often-used telephone numbers (**n** = 0..19), including the control characters for dialing, which can then later be selected by the short string **AT DS=n** ↵. **xxx** represents the dialing sequence (telephone number + control character) to insert.

Example:
Input: **AT &Z0=P 0221 1234567** ↵
Modem: **OK**

The telephone number, including the instruction for using pulse dialing, is saved in quick dialing memory "0". This information (telephone number) will not be lost when the modem is switched off. To dial a saved telephone number enter:

Input: **AT DS=0** ↵
Modem: **ATDP02211234567**
    Dials the telephone number 0221/1234567 using pulse dialing.

> **Note**
>
> The maximum length for an entry in the quick dialing memory is 30 characters (not including spaces). Longer dialing strings are cut off after the 30th character!

&Z?   Display All Quick Dialing Numbers

Lists all the telephone numbers saved in the quick dialing memories 0 ... 19.

&Zn?   Display Quick Dialing Number Specified by n

Shows the telephone number saved in quick dialing memory **n**
(**n** = 0 ... 19).

*B   Display Permanently Resricted Telephone Numbers

The modem shows an OK. This command is implemented to make it compatible with previous models.

*D   Display Temporarily Restricted Telephone Numbers

The modem shows an OK. This command is implemented to make it compatible with previous models.

\F   Display All Quick Dialing Numbers

Similar to **&Z?,** this displays all telephone numbers saved in quick dialing memories 0 ... 19.

6.2 MNP/V.42/V.42bis Commands

\Nn Selection of the Connection Mode

This command is used to set the connection mode as described in Chapter 5 *Error Correction, Data Compression, Flow Control* .

\N0 — NORMAL Mode
In this mode the transmission speeds between a modem and a PC or a modem and an opposite modem may differ. Automatic buffering and speed adjustment is carried out internally in the modem. A successful connection is reported by the modem and the transmission speed is indicated with the message **CONNECT xxxx** (**xxxx** = bit rate). It is practically always possible to establish a connection to a modem in the NORMAL mode. Error correction and data compression (MNP operation) are switched off.

\N1 — DIRECT Mode
Error correction and data compression are not used here either. Internal automatic buffering and speed adjustment in the modem are switched off. The transmission speeds between modem and PC or modem and opposite modem must be identical. A successful connection is also reported in the DIRECT mode with the message **CONNECT xxxx** (**xxxx** = bit rate).

> **Note**
>
> If the opposite party answers with another speed as the calling side (for example, you call at 2400 bps but the opposite party answers at 1200 bps), the modem sets the speed of the RS232 interface accordingly (in this case it switches to 1200 bps). Many communication programs cannot follow this automatic adjustment which results in the display of erroneous characters! Then it is best that you select the NORMAL Mode.

\N2 — RELIABLE Mode
An MNP connection is established immediately. The opposite party must also be equipped with MNP. A successful connection is reported with **CONNECT xxxx** (**xxxx** = bit rate) or with **CONNECT xxxx/MNP** if \V1 has been set.

> **Important**
>
> If the opposite party is not an MNP capable modem, a connection will not be possible!

\N3 — AUTORELIABLE Mode
You may often establish connections to another party without knowing in advance whether or not the modem is MNP capable. The AUTORELIABLE mode was developed just for such situations. The modem first checks if the other party is sending characters according to the MNP definition and attempts to establish an MNP connection within the first 3 seconds. If the attempt fails the modem automatically switches to the NORMAL mode.

\N4 — Same as **\N2** but only V.42 or V.42bis connections are permitted. MNP is not permitted and will result in cancellation.

\N5 — Same as **\N2** but MNP and V.42 or V.42bis are permitted.

\N6 — Same as **\N3** however the modem first attempts to make a connection with V.42 or V.42bis. If no successful connection can be established it then switches to MNP operation.

%Cn   Data Compression

This command is used to switch the data compression ON and OFF.
To be able to establish an actual data compressing connection both sides must have this feature activated.

%C0 — Data compression switch off (MNP4 or V.42)
%C1 — Data compression enabled (MNP5 or V.42bis)

6.3 Other Commands for MNP Operation

The commands described in this section, \Bn, \Kn, \Tn and \Vn, can also be used for V.42.

\An Maximum MNP Block Size

Using the MNP transfer protocol, characters are sent bundled in blocks. This command enables you to set the size of the data blocks.

\A0 — Max. block size 64 bytes
\A1 — Max. block size 128 bytes
\A2 — Max. block size 192 bytes
\A3 — Max. block size 256 bytes (default)

> **Note**
>
> A small block size should be specified for poor-quality telephone connections!

\Bn Send "Break" Signal

n specifies the length of the "Break" signal in 100 millisecond increments and may be between 1 and 9. In an MNP connection the "Break" time is a constant 300 milliseconds. A "Break" signal can only be sent in the command mode!

Example:
Input: **~ +++ ~**   ("~" Δ 1 sec. pause = ESCAPE)
Modem: **OK**
Input: **AT \B5 ↵**   (send 500 ms "Break")
Modem: **OK**
Input: **AT O ↵**   (switch back to data mode)

\Kn   Evaluate "Break" Signal

This command is used to select the type if evaluation used for the "Break" signal. **n** may be between 0 and 5. The default setting is 5. The following table provides more detailed information:

	"Break" from the PC during an ongoing connection in the NORMAL or MNP mode	"Break" from the PC during an ongoing connection in the DIRECT mode	"Break" from the opposite party during an ongoing connection in the NORMAL mode	\Bn command from the PC issued during an ongoing connection in the NORMAL or MNP mode
\K0	Change to command mode; do not send BREAK to the opposite party	Send BREAK immediately then change to command mode	Empty character buffer immediately and send BREAK to the PC	Empty character buffer immediately and send BREAK to the opposite party
\K1	Empty character buffer immediately and send BREAK to the opposite party	Send BREAK immediately to the opposite party		
\K2	Same as \K0	Same as \K0	Send BREAK immediately to the PC	Send BREAK immediately to the opposite party
\K3	Send BREAK immediately to the opposite party	Same as \K1		
\K4	Same as \K0	Same as \K0	Send BREAK during the data transmission to the PC	Send BREAK during the data transmission to the opposite party
\K5	Send BREAK during the data transmission to the opposite party	Same as \K1		

\Ln   "Block Link" / "Stream Link"

"Block Link" and "Stream Link" are designations for two different transmission methods and safety schemes for establishing connections in MNP operation.

\L0 — "Stream Link" (default)
\L1 — "Block Link"

\Tn   Timeout ("Inactive" Time Limit)

n may be between 0 and 90 and specifies the time in increments of 10s after which a connection is automatically disconnected if no more data traffic occurs within the specified time period. Entering zero deactivates the function. It is not available in the DIRECT mode. The default is "0".

\Vn   Extended Connection Response Messages

This command can be used to extend the CONNECT messages of the modem (either in English text or in numerical form) by the used protocol (MNP/V.42). It also enables the separate output of the type of modulation and the Rx and Tx transmission speeds when there is an asymmetric bit rate (only V.34bis).
The following table lists the possibilities.
"DCE"   = modem
"DTE"   = local terminal, for example a PC
"Bit rate"   = one of the possible DCE or DTE speeds
"Protocol" = the error correction method used

\V0 — Standard CONNECT message with DCE bit rate
   Format: "CONNECT bit rate"
   Example: CONNECT 33600

\V1 — Extended CONNECT message with DCE bit rate and protocol
   Format: "CONNECT bit rate" or
              "CONNECT bit rate / protocol"
   Example: CONNECT 33600/MNP

\V2 — Standard CONNECT message with DTE bit rate
   Format: "CONNECT bit rate"
   Example: CONNECT 115200

\V3 — Extended CONNECT message with DTE bit rate and protocol
   Format: "CONNECT bit rate" or
              "CONNECT bit rate / protocol"
   Example: CONNECT 115200/MNP

\V4 — Standard CONNECT message with DCE bit rate
   Format: "CONNECT Tx bit rate / Rx bit rate"
   Example: CONNECT 33600/33600

\V5 — Extended CONNECT message with DCE bit rate and protocol
   Format: "CONNECT Tx bit rate / Rx bit rate" or
              "CONNECT Tx bit rate / Rx bit rate / protocol"
   Example: CONNECT 115200/115200/MNP

\V6 — corresponds to **\V2**
\V7 — corresponds to **\V3**

\V8 — Extended CONNECT message with DCE bit rate and modulation
   Format: "CONNECT bit rate / modulation"
   Example: CONNECT 33600/V34

\V9 — Extended CONNECT message with DCE bit rate, protocol and modulation
   Format: "CONNECT bit rate / modulation" or
              "CONNECT bit rate / protocol / modulation"
   Example: CONNECT 33600/MNP/V34

\V10— Extended CONNECT message with DTE bit rate and modulation
Format: "CONNECT bit rate / modulation"
Example: CONNECT 115200/V34

\V11— Extended CONNECT message with DTE bit rate, protocol and modulation
Format: "CONNECT bit rate / modulation" or
"CONNECT bit rate / protocol / modulation"
Example: CONNECT 115200/MNP/V34

\V12— Extended CONNECT message with DCE bit rate and modulation
Format: "CONNECT Tx bit rate / Rx bit rate / modulation"
Example: CONNECT 33600/33600/V34

\V13— Extended CONNECT message with DCE bit rate, protocol
and modulation
Format: "CONNECT Tx bit rate / Rx bit rate / modulation" or
"CONNECT Tx bit rate / Rx bit rate / protocol / modulation"
Example: CONNECT 33600/33600/MNP/V34

\V14— corresponds to **\V10**
\V15— corresponds to **\V11**

The DCE bit rates may be:
300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 16800, 19200
21600, 24000, 26400, 28800, 31200 and 33600

The DTE bit rates may be:
300, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 19200, 38400, 57600 and
115200

Note

Normally the "extended CONNECT messages" should be activated to provide exact information about the type of connection. However, CONNECT messages are often evaluated by the communication programs and there may be circumstances in which a communication program being used cannot evaluate the extended CONNECT messages.

6.4 Speed Adjustment and Data Flow Control

\Qn Data Flow Control of the RS232/RS485 Interface

There are often differing transmission speeds between the modem and PC or between the modem and opposite modem. The data is therefore buffered in modem. The task of the data flow control is to prevent an overflow in the internal modem buffer. This is accomplished by instructing the PC to hold the transmission of data when the modem's buffer is full until the modem is ready to accept more characters. There are several methods for controlling this:

\Q0 — Data flow control OFF
If your PC or communication program does not have data flow control features, the control must be switched off using this command. The transmission of characters between the modem and the PC should then be less than or the same as the speed of the transmission line to the opposite party.

\Q1 — XON/XOFF data flow control
Using this type of data flow control, certain characters, namely XON (= Control Q) and XOFF (= Control S) are inserted to control the data flow. In NORMAL or (AUTO) RELIABLE operation, this is used to control the data flow not only between the modem and PC but also between two modems in certain circumstances. In this case both parties must have XON/XOFF control activated. In the opposite direction the PC can report to the modem that it presently cannot process any more characters.

> **Note**
>
> This type of data flow control is suitable for both RS232 and RS485 interfaces!

\Q2 — Unidirectional CTS data flow control
With this method the modem uses the CTS signal (Clear to Send) of the RS232 interface for controlling the data flow. By switching the CTS signal off the modem informs the terminal to stop sending data. This is referred to as unidirectional because the control only occurs in the direction "terminal sending data to modem".

> **Note**
>
> This type of data flow control is only suitable for the RS232 interface!

\Q3 — **RTS/CTS data flow control**
The CTS signal is used to control the data flow from the PC to the modem (see **\Q2**), and in the other direction the RTS signal (Request to Send) is used to control the flow from the modem to the PC.

> **Note**
>
> This type of data flow control is only suitable for the RS232 interface!

\Q4 — **Unidirectional XON/XOFF data flow control**
In this mode the modem sends XON/XOFF characters to the connected PC. XON/XOFF characters arriving from the PC are ignored.

> **Note**
>
> This type of data flow control is suitable for both RS232 and RS485 interfaces!

\Xn XON/XOFF forwarding

This command determines whether the modem should forward or filter out the XON/XOFF control characters. If "forwarding" is activated, XON/XOFF characters from your PC are sent to the opposite party, and, in the other direction, XON/XOFF characters from the opposite party are passed to your PC.

\X0 — XON/XOFF control characters are evaluated by the modem but not forwarded. (default)

\X1 — XON/XOFF control characters are evaluated by the modem and forwarded.

6.5 Firmware Upload

*P Firmware Upload

The AT*P command causes the firmware to be uploaded to the flash memory of the modem. To do this you need to use a terminal program such as Hyperterminal in Windows 95/98/NT. When the firmware upload is started the modem expects an upload using the *X modem* or *X modem 1K* transmission protocol and the current DTE bit rate set in the terminal program. The procedure takes approximately one minute at 115.2 kbps.

The steps involved in a firmware upload are described in the following:

1) Connect the modem via its RS232 interface to the PC (see Fig. 2-19)
2) Switch the modem power supply ON.
3) Set the bit rate and data format in the terminal program, for example, to 115200 bps, 8 data bits, no parity, 1 stopbit.
4) Start the firmware upload:

Input:	**AT** ↵	(modem detects the bit rate and data format)
Modem:	**OK**	
Input:	**AT*P** ↵	
Modem:	**Initial program loader Version 2.01 from 8.11.00**	
	Flash ID: C257	
	Flash by Macronix, Flash type: 29F200B	
	please start x modem upload	

5) The modem is now ready to receive the new firmware. Start the upload with the *Send file* function of your terminal program by selecting the firmware file and specifying the *X modem* or *X modem 1k* transmission protocol.
   When the upload is completed the modem reports:

   Modem: **Programming finished and OK**

6) Switch the modem power supply OFF.
7) Carry out a RESET of the modem using DIL switch SW2.7.
8) Switch the modem power supply ON.
   The modem now operates with the new firmware.

V.25bis Operation

7

Introduction

In addition to the Hayes® or AT command set, the MD3 modem can also be controlled using V.25bis. V.25bis is a command set defined by CCITT/ITU for modem control and signaling via the RS232 interface. Commands are only accepted in the offline mode.

As V.25bis only covers a small selection from the wide range of Hayes commands, its practical application is limited. However, the **CNL** command has been implement in the MD3 as a device-specific enhancement. This enables you to use almost all of the AT commands even in V.25bis.

> **Note**
>
> If the MD3 is connected to the terminal (PC) via the RS485 interface, it cannot be controlled with V.25bis!

!
> **Important**
>
> V.25bis is not capable of automatic speed or data format detection (autobaud)! It therefore uses:
>
> - the last speed and data format valid on switching back from AT to V.25bis
>
> or
>
> - the default speed and format upon power-up

7.1 Switching from V.25bis ↔ AT Command Set

AT command set → V.25bis command set

In the AT command mode enter the following command to switch to the V.25bis mode:

AT&A1 &W Z ↵

The modem reports **VAL** (valid) and is now in the V.25bis command mode. Commands smaller than 3 or greater than 60 characters are recognized as errors and canceled with **INV** (invalid). The commands described in 7.2 are now active.

V.25bis command set → AT command set

In the V.25bis mode enter the following command to switch back to the AT mode:

CNL&A0 &W Z ↵

Any commands you now enter will be interpreted as AT commands and the modem will respond accordingly.

7.2   V.25bis Commands

The following is a list of the V.25bis commands implemented in the MD3.

CIC   **Connect Incoming Call**

The modem goes online and answers an incoming call in the answer mode. Any previous **DIC** is canceled at this time. Without an incoming call the modem responds with an **INV** message.

CNL   **Local Configuration**

This command enables AT commands to be processed with V.25bis. Complete command lines can be entered.

Example: **CNLS0=2**
            this corresponds to **AT S0=2**

CRIn   **Call Request With Number And Identification**

The modem reacts just like with the **CRN** command.
Following the **CRI** command there is the dial command with up to 40 characters which may contain the characters 0-9, #, *, T, P, =, &, :, ;. The semicolon serves as a separator between the telephone number and the identification (= the telephone number of the calling modem).

Example: **CRI 026448995;368765**
            dials 02644 / 8995

CRNn   **Call Request with Number**

The modem connects to the line, begins the dialing sequence and establishes a connection.
Following the **CRN** command there is the dial command with up to 40 characters which may contain the characters 0-9, #, *, T, P, =, &, :, ;.

Example: **CRN 026448996**

CRSn   **Call Request with Memory Address**

The modem connects to the line and executes the saved dialing string (**n** = quick dialing memory 0 to 19) and establishes the connection.

Example: **CRS0**
            this selects the telephone number saved in quick dialing memory 0

DIC **Disregard Incoming Call**

The modem rejects an incoming call. The command can be canceled with **CIC**.

PRNn;m Program Number

This command is used to store dialing strings in one of the 20 quick dialing memory slots numbered 0 to 19.

The following are included in the command:
n Memory slot 0 to 19
; Separator between the memory slot number and the dialing string
m Dialing string. The same numbers and characters are allowed as for **CRI** and **CRN** with up to 40 characters in length.

Example: **PRN14;0W022123456**

RLD **List Request Of Delayed Telephone Numbers**

There is no longer a list of delayed telephone numbers.
The MD3 answers with VAL.

RLF **List Request Of Forbidden Telephone Numbers**

There is no longer a list of forbidden telephone numbers.
The MD3 answers with VAL.

RLNn **List Request Of Stored Telephone Numbers**

The modem displays the dialing string from the memory slot **n** in the quick dialing memory (0 to 19). If **n** is not specified, the modem displays the complete list. It first shows the number of the memory slot and then, separated by a semicolon, the stored number.

<u>Example</u>
Input: **RLN ↵**
Modem: **0;T019834**
  1;026448996
  etc.
  VAL

7.3 V.25bis Response Messages

VAL **Valid**

A command was accepted and successfully executed.

INV **Invalid**

The command entered contains an error and cannot be executed.

CNX **Connect**

A connection was established. The connection speed is also displayed.
The CNX message can be changed like the CONNECT message by
setting X and \V.
The default setting for V.25bis is X3 \V1, in other words the DCE bit rate
and possibly the protocol are shown.

Example: **CNX9600** or **CNX9600/V42BIS**

CFIxx **Call Failure Indication**

An attempt to call has not resulted in a connection. In addition, the cause
is indicated by the parameter **xx**:

CFIAB No dial tone or canceled by the DTE (terminal).
CFIET Busy signal detected.
CFIFC The number to dial is blacklisted and therefore blocked;
cannot dial.
CFINT No answer tone.
CFIRT Opposite party does not answer.

INC **Incoming Call**

An incoming call is detected.

DLC **Delayed Call**

A call does not lead to a connection and the number has been listed as
DELAYED. Due to a dialing restriction this number cannot be dialed at
this time. The time remaining before the number can be dialed again is
also shown.

Detailed Dialing Instructions

8

Introduction

Along with the actual data transmission, establishing a connection between two modems is one of the most important tasks in modem control. For this reason this chapter provides special details about dialing.

8.1   Command Combinations for Dialing

The **D** command precedes each dialing string, which may consist of the numbers **0** to **9** (and also the characters **A, B, C, D, *** (asterisk) and **#** (number sign) when tone dialing is used) to form the dialing command. A range of other characters are also available for controling dialing and make it more convenient.

S —— **Stored:**
S=n causes a telephone number previously saved with the command **&Zn** to be dialed.

Example:
Input: **AT &Z2=P 0123 987654** ↵
Modem :   **OK**

Input: **AT DS=2** ↵
Modem :   **AT DP 0123 987654**

(Dials the telephone number 0123/987654 using pulse dialing.)

T —— **Tone:**
Must be inserted in front of the telephone number in the dial command and instructs the modem to dial the following numbers and special characters (A, B, C, D, *, #) using tone dialing.

P —— **Pulse:**
Must also be placed in front of the telephone number and instructs the modem to dial the following numbers using pulse dialing.

; —— **Semicolon:**
This instructs the modem to stay in the command mode rather than to go into the data mode after a connection has been successfully established.

, —— **Comma:**
Dialing pause. A default pause of 2 seconds is made at the position of a comma in the dial command. The pause time is specified by the content of register **S8**. Several commas can be inserted in a dial command and a sequence of commas can be used to cause longer pauses.

! —— **Flash:**
The modem hangs up for 60 ms (see **S29**) and then "picks up the receiver" again. This command may somtimes be practical for call forwarding in telephone extension systems.

@ ── Ampersand:
This character causes the modem to wait for a 5 second pause in activity on the telephone line. If this pause is not detected within the time specified in register **S7** (30 seconds by default), dialing is canceled.

W ── Wait:
The modem waits for the "dial tone" before continuing dialing. If a "dial tone" is not detected within the time specified in register **S7** (30 seconds by default), dialing is canceled.

Example:
Input: **AT DT 0 W 01234 987654** ↵
Modem: Dials "0", waits for the "dial tone", dials the
area code (01234) and the telephone number (987654).

8.2 Dialing a Telephone Number

The following are examples of typical dialing commands:

Input: **AT DP 0123 98765** ↵

As you see, this "normal" dial command contains nothing special besides the **P** for pulse dialing. The space between the area code "0123" and the telephone number "98765" is ignored. It is only inserted to make the telephone number easier to read.

Input: **AT DP 001, 808 123456,,** ↵

This is an example of dialing a telephone number in the USA (from Germany). First the modem dials "001", the country code for the USA. The comma causes the modem to pause for 2 seconds. The area code "808" in the USA is dialed. Finally the telephone number "123456" is dialed. The closing commas cause a delay in the start time for detecting the data carrier. The wait time saved in register **S7** (30 seconds by default) normally begins at the end of the dial command. However, for international connections it usually take a few seconds longer to establish a line to the other party. The commas are inserted here to prevent this time from being taken from the wait time specified by register **S7** . This delays the beginning of the wait time by 4 seconds.

8.3 Dialing through a Telephone Extension System

In telephone extension systems you are usually required to dial an access number for an external line. The numbers "0" or "9" are used most often for this. At the same time and especially in large telephone extension systems, there are often comparably few external lines available for the many internal extension users. It is therefore very possible that an attempt to get an external line will fail. The **W** command can then be used to avoid dialing into a "busy line".

Input: **AT DP 0 W 01234 987654** ↵

After the external access number is dialed, "0" in this example, the modem waits for the "dial tone". If a "dial tone" is not detected within the 30 seconds, dialing is canceled.

> **Note**
>
> The detection of the internal "dial tone" may be difficult and lead to problems within telephone extension systems due to deviating tones! Especially when it appears that the modem is not dialing at all, the cause is usually the configuration of the command **Xn**. You should therefore use **X1** or **X3**, in other words, select dialing without detecting a "dial tone!

8.4 Dialing and Remaining in the Command Mode

After dialing a telephone number the modem normally automatically switches to the data mode. This can be prevented by inserting a **;** (semicolon) at the end of the dial command. The modem will then remain in the command mode after dialing. One application for this is when the modem is used as an automatic telephone dialer. In this case a data connection is not wanted.

Example:
Input: **AT DP 01234 987654 ;** ↵
Modem: **OK**

> **Note**
>
> After the telephone number has been dialed the "receiver" of the modem remains "off the hook"! The command **AT H0** ↵ must be additionally entered for it to hang up.

8.5   Repeat Dialing

The command interpreter of the modem always keeps the most recent command in its memory. This feature can be used for repeat dialing, for example.

Example

Input:	**AT DP 01234 987654 ↵**
Modem:	**BUSY**
	(opposite party is occupied)
Input:	**A/**
	(repeat dialing)
Modem:	**CONNECT**
	(connection established)

Note

Note that the A/ is entered without the prefix AT and the closing ↵!

8.6   Canceling Dialing

Dialing can be canceled at any time by sending any character to the modem before a data connection has been established. The modem then hangs up the "receiver" and, if it was still in the process of dialing, reports: **OK**. If the modem has finished dialing the telephone number and is waiting for a data carrier from the opposite party, it reports: **NO CARRIER**.

S-Registers

9

Introduction

The MD3 features numerous registers which are referred to as S-registers. They are used to store modem settings. Some of the registers are temporary and are lost when the modem is switched off; others can be permanently saved in the EEPROM. AT commands can be used to read out and write to S-registers. The descriptions of the AT commands contain explicit information about the syntax for accessing the S-registers.

9.1 List of S-Registers

Register	#	Function
S0	ew	Number of rings for auto-answer
S1		Ring signal counter
S2	ew	ASCII: ESCAPE character [+]
S3	w	ASCII: Carriage Return [↵]
S4	w	ASCII: Line Feed [↓]
S5	w	ASCII: Backspace [←]
S6	ew	Wait time for "dial tone" [sec.]
S7	ew	Wait time for data carrier [sec.]
S8	ew	Pause at comma in the dial command [sec.]
S9	ew	Min. detect time for data carrier [1/10 sec.]
S10	ew	max. carrier down time [1/10 sec.]
S11	ew	Tone dialing: Length of dialing tone [millseconds]
S12	ew	Wait time before and after ESCAPE character [1/50 sec.]
S13		RESERVED
S14	e	Modem control register (bit mapped)
S15		RESERVED
S16		RESERVED
S17		RESERVED
S18	ew	RESERVED
S19	w	RESERVED
S20	w	RESERVED
S21	e	Modem control register (bit mapped)
S22	e	Modem control register (bit mapped)
S23	e	Modem control register (bit mapped)
S24	ew	RESERVED
S25	w	DTR delay
S26	w	RESERVED
S27	e	Modem control register (bit mapped)
S28	e	Modem control register (bit mapped)
S29	w	Flash time
S30	w	Inactivity timer
S31	e	RESERVED
S32	w	XON character
S33	w	XOFF character
S34		RESERVED
S35		RESERVED

Register	#	Function
S36	ew	LAPM fallback scheme
S37	ew	Modem control register (bit mapped)
S38	w	Hangup time
S39	e	Data flow control modem / terminal (handshake)
S40	e	Modem control register (bit mapped)
S41	e	Modem control register (bit mapped)
S43	ew	Data format in command phase and possibly data phase
S44	ew	Port speed
S45	ew	Data format in the data phase
S46	ew	Data compression
S48	ew	V.42 Negotiation Control
S82	w	RESERVED
S86		Most recent reason for hangup
S91	ew	Send level in dialing operation
S92	ew	Send level FAX
S93	w	Special function
S95	ew	\V value
S99	e	RESERVED

\# e = can be saved in EEPROM
\# w = writable

9.2 Descriptions of the S-Registers

Register 0 —— Rings until answering

Default value: 1
Value range: 0 - 5
Meaning: Register **S0** is used to set the desired number of ring signals until the modem should automatically answer an incoming call (= auto-answer). When **S0** is "0" calls are not automatically answered. A value greater than "0" determines the number of ring signals until the "receiver is picked up". For example, a value of "3" means the modem answers the call after the third ring.

Register 1 —— Ring signal counter

Default value: 0
Value range: 0 - 255
Meaning: This register is used to count the number of ring signals for an incoming call. Every ring signal increments the contents of the register by one. Register **S1** only functions when register **S0** is set to a value greater than "0". When register **S0** and register **S1** match, the incoming call is answered. If a call is broken off before reaching the value specified in **S0** , the contents of **S1** are automatically deleted 8 seconds later.

Register 2 —— Definition: ESCAPE character

Default value: 43   (ASCII: +)
Value range: 0 - 127
Meaning: This register is used to specify the ESCAPE character which is required for switching between the data and command modes. Alternatively, with the commands **&D1**, **&D2** or **&D3** an ON-to-OFF edge in the DTR signal can be used to change to the command mode.

> **Note**
>
> Entries greater than 127 are not allowed and switch the function off! It is then no longer possible to exit the data mode!

Register 3 —— Definition: RETURN character

Default value: 13   (ASCII: ↵)
Value range: 0 - 127
Meaning: The character defined here is used to close a command line. At the same time it appears at the beginning and the end of a modem response message. This only applies to asynchronous operation.

> **Note**
>
> Entries greater than 127 are not allowed and switch the function off! The default value should not be changed!

Register 4 —— Definition: Line feed

Default value: 10   (ASCII: ↓)
Value range: 0 - 127
Meaning: This character is inserted after the RETURN character (register 3) and only applies to asynchronous operation.

> **Note**
>
> Entries greater than 127 are not allowed and switch the function off! The default value should not be changed!

Register 5 —— Definition: Backspace

Default value: 8   (ASCII: ← [Backspace])
Value range: 0 - 32 or 127
Meaning: This register specifies the character for deleting data in the command line.

> **Note**
>
> The **AT** at the beginning of a command line cannot be deleted! The default value should not be changed!

Register 6 —— Wait time for dial tone

Default value: 3
Value range: 3 – 6   [seconds]
Meaning: After "picking up the receiver" the modem waits for the time specified here before beginning to dial. The minimum wait time is 3 seconds and cannot be reduced by entering a smaller value. If the result codes **X2** or **X4** (see Chapter AT Commands, Result Codes **Xn**) are set, these commands are given higher priority and overwrite the selected register value.

Register 7 —— Wait time for data carrier of the opposite party

Default value: 60
Value range: 0 - 60   [seconds]
Meaning: After completing the dialing the modem waits for the data carrier of the opposite party for a period of time specified in this register. If a data carrier is not detected within this time, the modem reports **NO CARRIER** and hangs up.

Register 8 —— Pause in the dial command : "," (comma)

Default value: 2
Value range: 1 - 255   [seconds]
Meaning: This register specifies the time that the modem should wait when a comma (,) is placed within the dial command.

Register 9 —— Time: Stable data carrier detected

Default value: 6
Value range: 1 - 255   [1/10 seconds]
Meaning: The data carrier of the opposite party must be detected as stable for the time period specified here before the modem switches the DCD signal to ON.

Register 10 — Time: max. allowed carrier down time

Default value: 100
Value range: 1 - 255   [1/10 seconds]
Meaning: Due to poor telephone connections short interruptions may occur in the detection of the data carrier of the opposite party. This time period specifies the maximum length of such an interruption before the modem breaks the connection.

> **Note**
>
> If the value in register **S10** is set smaller than the value in register **S9**, the connection will be broken off any time the data carrier is "not detected"!

Register 11 — Duration of tones for tone dialing

Default value: 95
Value range: 50 - 255 [1/100 seconds]
Meaning: Tone dialing uses 90 ms regardless of the value in the
S-register because this value is critical for certification and the
functioning of tone dialing.

Register 12 — Wait time before and after ESCAPE character

Default value: 50
Value range: 0 – 255   [1/50 seconds]
Meaning: This register determines the pause before and after the ESCAPE
characters. The pauses between the three ESCAPE characters
must also be less than the time specified here.

> **Note**
>
> If this register is set to zero, there is no pause before and after
> the ESCAPE character. The three ESCAPE characters must then
> be entered in immediate sequence!

Register 13 — RESERVED

Register 14 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning	
0		-	
1	0	**E0**	Echo in the command line OFF
	1	**E1**	Echo in the command line ON
2	0	**Q0**	Modem response messages OFF
	1	**Q1**	Modem response messages ON
3	0	**V0**	Modem response messages as numbers
	1	**V1**	Modem response messages as text
4		-	
5	0	**DT**	Tone dialing
	1	**DP**	Pulse dialing
6		-	
7	0		Answer Mode
	1		Originate Mode

Register 15 — RESERVED
     ⋮   ⋮
     ⋮   ⋮
Register 20 — RESERVED

Register 21 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning
0		**&D4** DTR dialing
1		-
2	0	**&R0** Wait for CTS
	1	**&R1** Ignore CTS
3-4	0	**&D0** DTR always ON
	1	**&D1** At negative DTR edge: Change to command mode:
	2	**&D2** At negative DTR edge: Break connection and change to command mode At positive DTR edge: Activate auto-answer
	3	**&D3** At negative DTR edge: Reinitialize modem
5	0	**&C0** DCD always ON
	1	**&C1** DCD ON when data carrier is detected
6	0	**&S0** DSR always ON
	1	**&S1** DSR corresponds to V.22/V.22bis recommendation
7		-

Register 22 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning
0-1		**ATL** Loudspeaker volume
2-3		**ATM** Loudspeaker control
4-6	0	**X0** No extended CONNECT, no detection of dial tone and busy signal
	4	**X1** Extended CONNECT, no detection of dial tone and busy signal
	5	**X2** Extended CONNECT, detection of dial tone, no detection of busy signal
	6	**X3** Extended CONNECT, detection of busy signal, no detection of dial tone
	7	**X4** Extended CONNECT, detection of dial tone and busy signal
7		-

Register 23 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning
0-5		-
6-7	0	**&G0** Guard tone OFF
	1	**&G1** Guard tone 550 Hz
	2	**&G2** Guard tone 1800 Hz

Register 24 — RESERVED

Register 25 — Delay of the DTR Signal

Default value: 5
Value range: 0 – 255   [1/10 seconds]
Meaning: A shorter change in the status of the DTR signal than that specified
                here is ignored.

Register 26 — RESERVED

Register 27 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning
0-1	0	**\N0 ... \N6** Content depends on the \Nn command used
	1	
	2	
	3	
2	0	**&L0** Dial-up line operation
	1	**&L1** Dedicated line operation
3	0	**\N0 ... \N6** Content depends on the \Nn command used
	1	
4-5		-
6	0	**B** CCITT Standard
	1	**B** Bell Standard
7		-

Register 28 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning
0	0	**&C0, &C1** see S-Register 21, Bit 5
	1	**&C2** RS485 operation; DCD is active as the modem is sending characters
1		-
2	0	**F0 ... F6, F8 ... F20**
	1	**F7** V.23 1200 bps half-duplex
3		-
4		-
5		-
6		-
7		-

Register 29 — Duration of the Flash Key

Default value: 20
Value range: 20   [1/100 seconds]
Meaning: Duration of the flash signal.

Register 30 — Inactivity Timer

Default value: 0
Value range: 0 - 255   [10 seconds]
Meaning: If no data is exchanged with the modem for the period of time
                specified here, it hangs up. The value "0" switches the function off.

Register 31 — RESERVED

Register 32 — XON

Default value: 17
Value range: 0 - 127
Meaning: Contains the decimal value for the "XON" character.

Register 33 — XOFF

Default value: 19
Value range: 0 - 127
Meaning: Contains the decimal value for the "XOFF" character.

Register 34 — RESERVED

Register 35 — RESERVED

Register 36 — LAPM fallback scheme

Default value: 7
Value range: 0 - 7
Meaning: This register determines how the modem reacts in regard to the error correction protocol when a connection is being negotiated. If no LAPM is desired or cannot be established, register **S36** tells the modem how to continue. Possible alternatives are MNP, buffered connection, direct mode and hanging up. Direct and buffered mode cannot be selected at the same time.

> **Note**
>
> The **AT\Nn** command overwrites register **S36**.

Bit	Meaning
0	Direct mode connection
1	Buffered mode instead of direct mode
2	MNP connection
3	-
4	-
5	-
6	-
7	-

Possible values for S36 are:
S36=0:   Modem hangs up
S36=1:   Direct mode connection
S36=3:   Buffered connection
S36=4:   Attempt a MNP connection or modem hangs up
S36=5:   Attempt a MNP connection or direct mode
S36=7:   Attempt a MNP connection or buffered

Register 37 — Modem control register (bit mapped)

Bit	Value	AT Command / Meaning
0-5		
6	0	Cancellation by pressing key during establishment of connection
	1	No cancellation by pressing key (default)
7	0	Smart mode (default)
	1	Dumb mode

Register 38 — Timer: Limit hangup time

Default value: 20
Value range: 0 - 255 [seconds]
Meaning: When the modem should hang up (e.g. by the ATH command or DTR transition edge 1 → 0), the error correction protocol attempts to send to the other party the data in the buffer which was received from the DTE. This procedure can be limited by a time set in S38. When S38=255 the time does not operate, i.e. all data are transmitted regardless of how long it takes.

Register 39 — Data flow control modem / terminal

Default value: 0000 0011b

Bit	Value	AT Command / Meaning
0-3	0	**\Q0** Data flow control OFF
	3	**\Q3** Data flow control bidirectional via CTS and RTS
	4	**\Q1** Data flow control bidirectional via XON/XOFF
	11	**\Q2** Data flow control unidirectional via CTS
	12	**\Q4** Data flow control unidirectional via XON/XOFF
4		RESERVED
5	0	Xon/Xoff disabled
	1	Xon/Xoff enabled
6		-
7		-

Register 40 — Modem control register (bit mapped)

Default value: 0110 1000b

Bit	Value	AT Command / Meaning
0-1		RESERVED
2		RESERVED
3-5	0	**\K0** Break signal evaluation
	1	**\K1** Break signal evaluation
	2	**\K2** Break signal evaluation
	3	**\K3** Break signal evaluation
	4	**\K4** Break signal evaluation
	5	**\K5** Break signal evaluation
6-7	0	**\A0** Max. MNP block size 64 bytes
	1	**\A1** Max. MNP block size 128 bytes
	2	**\A2** Max. MNP block size 192 bytes
	3	**\A3** Max. MNP block size 256 bytes

Register 41 — Modem control register (bit mapped)

Default value: 1000 0100b

Bit	Value	AT Command / Meaning
0-1	0	**%C0** Data compression OFF (MNP4 or V.42)
	3	**%C1** Data compression ON (MNP5 or V.42bis)
2	0	**%E0** Automatic retrain OFF
	1	**%E1** Automatic retrain ON
3		-
4		-
5		-
6	0	**&E0** DCE speed remains constant
	1	**&E1** DCE speed is automatically adjusted to the line quality
7	0	Fallback until V.22 disabled
	1	Fallback until V.22 enabled

Register 43 — Data format in command phase and possibly data phase

Bit	Value	AT Command / Meaning
0-1	0	Word length 5 Bit
	1	Word length 6 Bit
	2	Word length 7 Bit
	3	Word length 8 Bit
2	0	1 Stop bit
	1	2 Stop bits
3	0	No parity
	1	Enable parity
4	0	Odd parity
	1	Even parity
5	0	Do not insert fixed parity bit
	1	Insert fixed parity bit. Value located in bit 7
6	0	Reserved
7	0	Value of fixed parity bit = 0
	1	Value of fixed parity bit = 1

Note

S45.1 determines whether this data format is also used in the data phase.

Register 44 — Port Speed

Default value: depends on profile
Value range: 0 - 31
Meaning: The current port speed is entered in this register: Each AT detects
                 the bit rate and enters it in this register. However, it can also be
                 specified in a command line and then remains in effect until the
                 next change of the bit rate.

S44=2:   300 bps
S44=3:   600 bps
S44=4:   1200 bps
S44=5:   2400 bps
S44=6:   4800 bps
S44=7:   9600 bps
S44=8:   19200 bps
S44=9:   38400 bps
S44=10:   110 bps
S44=11:   135 bps
S44=12:   3600 bps
S44=13:   7200 bps
S44=14:   12000 bps
S44=15:   14400 bps
S44=17:   57600 bps
S44=18:   115200 bps
S44=21:   16800 bps
S44=22:   21600 bps
S44=23:   24000 bps
S44=24:   26400 bps
S44=25:   28800 bps
S44=26:   20800 bps
S44=27:   31200 bps
S44=28:   41600 bps
S44=29:   51200 bps
S44=30:   62400 bps
S44=31:   230400 bps

Register 45 — Data format in the data phase

Bit	Value	AT Command / Meaning
0	0	Word length 10 Bit (with RS485 operation: fixed 8N1)
	1	Word length 11 Bit (with RS485 operation: fixed 8E1)
1	0	S43 determines the format in the data phase
	1	S45.0 determines the format in the data phase
2-7		-

Note

The data format is determined by DIL switches SW2.1 to SW2.4.
However, these are only loaded by a reset or power ON.

Register 46 — Data compression

Default value: 136
Value range: 136, 138
Meaning: The AT%Cn command is displayed in bits 0 and 1 of register S41
                  as well as in this register.
                  S46=136 for AT%C0, S46=138 for AT%C1.

Register 48 — V.42 Negotiation Control

Default value: 7
Value range: 0, 7, 128
Meaning: Behavior during the negotiating phase of establishing a protocol.
                  V.42 allows for modems to exchange specific character strings
                  (ADP/ODP) in order to determine if both parties desire LAPM as an
                  error correction protocol. If it is already guaranteed that both
                  parties desire LAPM, this phase can be skipped. In addition, it
                  allows MNP to be used as an alternative protocol. This register is
                  overwritten by the command **AT\N**.

                  Possible values are:
                  S48 = 0:   LAPM without detection phase
                  S48 = 7:   Detection phase according to V.42 (ADP/ODP)
                  S48 = 128: No detection phase according to V.42; behavior
                              according to **S36**

Register 82 — RESERVED

Register 86 — Most recent reason for hangup

Default value: 21
Value range: 0 - 21
Meaning: The most recent reason for hangup is entered in this register.
                  Possible entries are:
                  S86=0:   Normal hangup
                  S86=3:   Wait for answer
                  S86=4:   Carrier loss
                  S86=5:   No error correction possible
                  S86=6:   Negotiation failed
                  S86=7:   This modem operates asynchronous,
                            the remote modem synchronous
                  S86=8:   No common block form
                  S86=9:   No common error correction
                  S86=10:   Unacceptable answer during negotiation
                  S86=11:   Remote modem does not switch to synchronous
                  S86=12:   Remote modem beginning correct hangup
                  S86=13:   Max. block retries reached
                  S86=14:   Hangup due to DTR
                  S86=15:   Too many retrains while DTR is inactive
                  S86=16:   Cleardown received
                  S86=17:   Inactivity timer expired
                  S86=18:   No common transmission speed
                  S86=19:   Hangup due to break received
                  S86=20:   Cancellation by key
                  S86=21:   No hangup yet, default value

Register 91 — Send level in dialing operation

Default value: 10
Value range: 10 – 15
Meaning: Send level in –dBm

Register 92 — Send level in fax operation

Default value: 10
Value range: 10 - 15
Meaning: Send level in –dBm

Register 93 — Special functions

Bit	Value	AT Command / Meaning
0-1		
2	0	**%P0**
	1	**%P1** Power-up dialing
3	0	AT command set
	1	V.25bis command set
4-7		-

Register 95 — \V value

Default value: 1
Value range: 0 - 15
Meaning: Form of the CONNECT message. Corresponds to the AT\V command.

Bit	Value	AT Command / Meaning
0	0	No protocol display
	1	Display of protocol
1	0	Display of DCE bit rate
	1	Display of DTE bit rate
2	0	Display of DCE or DTE bit rate depending on bit 1
	1	Display of first Tx and then Rx bit rate for DCE bit rate
3	0	No modulation display
	1	Display of modulation
4-7		-

Register 99 — RESERVED

9.3   Direct Changes to the Registers

The contents of the registers can be changed using the AT command:

AT Sn=x ↵

whereby "**n**" stands for the register and "**x**" for the desired input value. "**x**" may be between 0 and 255. Some registers, however, allow only a limited range of values. Non-allowed entries either lead to an error message or the entry is automatically changed to the nearest allowed value. The allowed value range for each register is provided in the respective descriptions.

Example
Input: **AT S0 = 2** ↵
Modem :   **OK**
                 Auto-answer is activated. The modem now answers incoming calls after the second ring.

Some S-registers work with bytes, others with bits. To simplify working with bit-oriented registers another input method was created.

Write :   **ATS45.3=1** ↵
                 Bit 3 in register **S45** is set to "1".

9.4   Reading the Registers

Just as registers can be directly changed, they can also be read directly. The command for this is:

AT Sn? ↵

Here too "**n**" stands for the register, a number between 0 and 255.

Example:
Input: **AT S0?** ↵
Modem :   **002**
                 OK
                 Auto-answer after second ring.

Problem Report
SINAUT ST1 / ST7 / ST7*cc*

K _ _ _ _ (Servicenumber given by I&S OCW TI Hotline)

E _ _ _ _ (Servicenumber given by I&S IS6 ECS)

To	From	Entry remark
SIEMENS AG I&S OCW TI Attn. Ms. Ksiondz Siemensallee 84 76181 Karlsruhe Germany		
Tel. +49 (0)721 / 595 - 5204 Fax. +49 (0)721 / 595 - 5244 E-mail: **Hotline.ST@khe.siemens.de**	Tel. Fax. E-mail:	Response: .... Done: ....

When hardware is clearly at fault, please send the device to:

**Siemens AG, I&S IS6-ECS, Retourenstelle, Attn. Ms. Stenzel,
Frauenauracher Str. 98, 91056 Erlangen, Germany**

		for information	for processing
Forwarded on			
☐ to Karlsruhe I&S OCW TI, Mr./Ms.:	....	☐	☐
☐ to Erlangen I&S IS6 ECS, Mr./Ms.:	....	☐	☐

1. Keyword : ....

2. Project : ....

3. Contact at Siemens AG (Sales):

Name: .... Dept.: .... City: ....

4. Contact at customer

Company: .... Dept.: ....

Name: .... Tel.: .... Fax: ....

Street: .... ZIP: .... City: ....

E-mail: ....

5. Brief description of plant (for example: Dial-up network with 10 stations)

....

....

6. Description of problem:

Occurs :   ☐ always   ☐ sporadically   ☐ reproducible

The error has occured since: .... observed by: ....

Problem already discussed with: .... on:...............................

7. Attachments:

☐ Network configuration .... ☐ Archived project .... ☐ other attachments

Dept., City, Date   Processed by

To be completed by the person who processes the problem report:
Keyword 1: ....
Keyword 2: ....

Attachment to Problem Report:

1. Keyword :

2. Project :

---

8. Description of problem: (Description, what are the expected / observed results, error log, messages, . . .)

If the problem described relates to several stations / components, please list each of the components affected

....

....

....

....

....

....

....

....

....

....

....

....

9. Information about versions: (TIM software version available in STEP7 dialog: 'Module Information', 'General' tab)

ST1 / ST7 Components:

SW Components	Version	SW Components	Version
☐ Configuration Tool		☐ Routing Server	
☐ TD7 Library		☐ Diagnostics Server	
☐ Firmware		☐ Time-of-day Server	
☐ RMOS for TIM ST7		☐ SDB Server	
☐ Installation		☐ WAN Dial-up Driver	
☐		☐ WAN Dedicated Line Driver	

HW Components	Order Number	Version
☐ TIM	6NH7 800-	
☐ Modem	6NH7 810-	
☐ CPU		

ST7*cc* Components:

SW Components	Version	SW Components	Version
☐ ST7 Server		☐	
☐ ST7*cc* Config		☐	
☐ ST7 Channel DLL		☐	
☐ Softnet S7		☐	
☐ S7 542		☐	
☐ WinCC		☐	

Modem MD3 • 6NH7811-0AA32   © Siemens AG 2002 All Rights Reserved