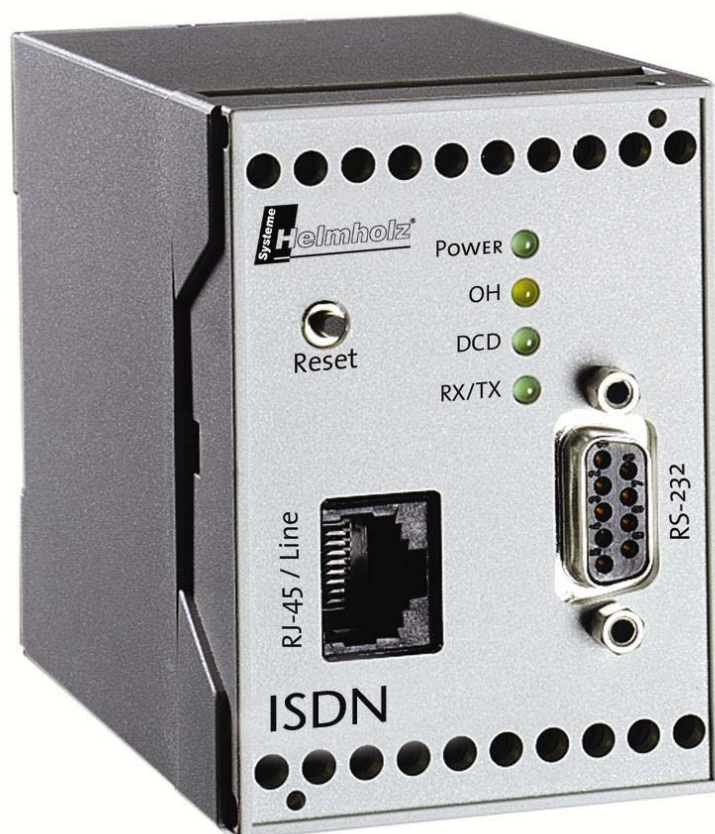


# Modem

## ISDN TA 4.0

### Operating Manual

Version: 2.02 / 01.04



Order number: 700-751-HSM02



# Content

<b>0</b>	<b>SCOPE OF DELIVERY</b>	<b>1</b>
<b>1</b>	<b>GENERAL</b>	<b>1</b>
<b>2</b>	<b>TECHNICAL DATA</b>	<b>2</b>
2.1	GENERAL	2
2.1.1	Features	2
2.1.2	Mechanical Features	2
2.2	INTERFACES AND INDICATORS	3
2.2.1	Terminal Layout	3
2.2.2	Display Elements	4
2.2.3	Power Supply	4
2.2.4	Serial Interface	4
2.2.5	S <sub>0</sub> Interface	5
2.2.6	Reset	5
2.2.7	Digital Inputs And Outputs	6
2.3	TRANSMISSION STANDARDS AND PROTOCOLS	6
2.4	APPROVALS	6
<b>3</b>	<b>INITIAL OPERATION</b>	<b>7</b>
3.1	INSTALLATION OVERVIEW	7
3.2	INSTALLATION STEPS	7
<b>4</b>	<b>INTERFACE TYPES</b>	<b>9</b>
4.1	BASIC RATE INTERFACE	9
4.2	PRIMARY RATE INTERFACE	10
4.3	INTERFACE CONFIGURATION OF THE BASIC RATE INTERFACE	11
4.3.1	Multipoint Connection (PTM, Point-To-Multipoint)	11
4.3.2	ISPBX Connection (PTP, Point-To-Point)	12
<b>5</b>	<b>CONFIGURATION</b>	<b>13</b>
5.1	LOCAL CONFIGURATION	13

5.1.1	Configuring With AT Commands	13
5.1.2	Configuration With The TA Configurator	14
5.1.3	Configuration With X3.PAD	15
5.2	REMOTE CONFIGURATION VIA CONFIGURATOR	17
5.2.1	Remote Access Control	17
5.2.2	TA+ Configurator Commands	18
6	FUNCTIONS	22
6.1	AUTOMATIC CALL	22
6.2	SECURITY CALLBACK	23
6.2.1	Principle Structure	23
6.2.2	Functionality	23
6.2.3	Configuration	24
6.3	ALARM FUNCTIONS	25
6.3.1	Alarm Input	25
6.3.2	Switch Output	28
6.3.3	AT Commands For The Alarm Functions	29
6.4	ISDN ACCESS CONTROL	29
6.5	DATA FLOW CONTROL	30
6.5.1	Hardware Handshake (RTS/CTS)	30
6.5.2	Software Handshake (XON/XOFF)	30
6.6	SOFTWARE UPDATE	31
6.7	IDLE CONNECTION CONTROL	32
7	COMMAND OVERVIEW	33
7.1	OVERVIEW ABOUT THE MOST IMPORTANT AT COMMANDS	33
7.2	ISDN SPECIFIC AT COMMANDS	39
7.3	S REGISTER	40
8	CONFIGURATION SOFTWARE HSCOMM	41
8.1	SYSTEM REQUIREMENTS	41
8.2	INSTALLATION OF THE CONFIGURATION SOFTWARE	41
8.3	PROGRAM DESCRIPTION	41
8.3.1	Menu Commands	42

<b>9</b>	<b>ISDN INFORMATION</b>	<b>43</b>
<b>9.1</b>	<b>ABBREVIATIONS FOR ISDN SERVICE FEATURES</b>	<b>43</b>
<b>9.2</b>	<b>PROTOCOLS AND CHANNELS</b>	<b>43</b>
9.2.1	D channel	43
9.2.2	B Channel	43
<b>9.3</b>	<b>FREQUENT ISDN ERROR MESSAGES</b>	<b>45</b>
<b>9.4</b>	<b>EXTENDED ERROR MESSAGES FOR ISDN</b>	<b>47</b>



## 0 Scope Of Delivery

Please check the scope of delivery before initial operation:

- HELMHOLZ ISDN TA 4.0
- 9-pin serial cable for connection between PC and HELMHOLZ ISDN TA 4.0 (RS232 cable)
- S0 cable for connecting with the ISDN jack
- CD with configuration software HSComm, manuals and driver.

In case the content is not complete, please refer to your supplier.

Please check the device for shipping damage. Please refer to your supplier if damage exists.

Please keep the packaging material for dispatch or storage.

## 1 General

The HELMHOLZ ISDN TA brings some considerable advantages and soon you will not be able to exclude it from your company any longer. The DIN rail installation in the switch cabinet is very easy, just the same as the connection and the start-up.

It provides you possibilities like

- Establishment of an ISDN data connection
- Automatic call
- Security Callback
- Data flow control
- Idle connection control (DTC)
- Flash update of the firmware
- *New:* 4 status LEDs
- *New:* 2 alarm inputs with alarm message via SMS or for establishing an alarm data connection
- *New:* 2 switch outputs – relay SPDT (single pole double throw)
- Local or remote configuration

## 2 Technical Data

### 2.1 General

#### 2.1.1 Features

- Mounting on DIN rail DIN EN 500 22
- Data, fax and SMS services
- Power supply via screw terminal 10..60 V DC, 5% ripple  
50..80 V DC, 5% ripple  
optionally 5VDC
- Level on V.24 interface according to V.28
- Protected V.24/V.28 interface with 9-pin SUB-D jack (screwed)
- S<sub>0</sub> interface: Screw terminal or telephone socket (RJ 45)
- Reset via button or via screw terminal
- Watchdog
- Line requirements: S<sub>0</sub>/I.430
- Flash EPROM
- Alarm functions
- Idle connection control (DTC)
- Remote control with password
- Security Callback
- SMS dispatch

#### 2.1.2 Mechanical Features

Weight	250 g
Dimensions (max.)	w x d x h = 55 x 110 x 75
Temperature range	0°C ..55°C
Protective class	Housing IP 40/ Terminals IP 20
Humidity	0 - 95% non-condensing

**Note:** The HELMHOLZ ISDN TA may not be used in wet surroundings.



2.2 Interfaces and Indicators



Front view







2.2.1 Terminal Layout

Housing top

<input type="checkbox"/>	1	GND
<input type="checkbox"/>	2	50 ... 80 VDC
<input type="checkbox"/>	3	10 ... 60 VDC
<input type="checkbox"/>	4	GND
<input type="checkbox"/>	5	GND
<input type="checkbox"/>	6	RESET
<input type="checkbox"/>	7	GND
<input type="checkbox"/>	8	INPUT 1
<input type="checkbox"/>	9	INPUT 2
<input type="checkbox"/>	10	GND

	Terminal	Description
1	GND	Ground
2	50..80VDC	Power supply 50V - 80V DC
3	10..60VDC	Power supply 10V -60V DC
4	GND	Ground
5	GND	Ground
6	Reset	Reset input
7	GND	Ground
8	Input 1	Alarm input 1
9	Input 2	Alarm input 2
10	GND	Ground

Housing bottom

<input type="checkbox"/>	11	OUT 1-NC 			
<input type="checkbox"/>	12	OUT 1 			
<input type="checkbox"/>	13	OUT 1-NO 			
<input type="checkbox"/>	14	OUT 2-NC 			
<input type="checkbox"/>	15	OUT 2 			
<input type="checkbox"/>	16	OUT 2-NO 			
<input type="checkbox"/>	17	LB1	STA	RX+	
<input type="checkbox"/>	18	LB	SRA	RX-	
<input type="checkbox"/>	19	LA	SRB	TX+	
<input type="checkbox"/>	20	LA1	STB	TX-	

	Terminal	Description
11	OUT1 NC	Output 1 – normally closed
12	OUT1 COM	Output 1
13	OUT1 NO	Output 1 – normally open
14	OUT2 NC	Output 2 – normally closed
15	OUT2 COM	Output 2
16	OUT2 NO	Output 2 – normally open
17	STA	Transmit A (a2) RJ45 pin 3
18	SRA	Receive A (a1) RJ45 pin 4
19	SRB	Receive B (b1) RJ45 pin 5
20	STB	Transmit B (b2) RJ45 pin 6

## 2.2.2 Display Elements

Name	Color	off	on
Power	green	no power supply	power on
OH (off hook)	yellow	offline	connected to phone line (online)
DCD (Data Carrier Detect)	green	no connection established	connection established (carrier detected)
RX/TX (Receive / Transmit)	green	no data exchange	data is exchanged via the ISDN TA

## 2.2.3 Power Supply

Power supply with single voltage:

10..60 V DC

50..80 V DC

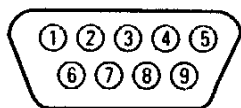
Power consumption: approx. 0,5 W (for connection)

Current consumption:

Supply voltage	Current (standby)	Current (connection)
10 VDC	60 mA	63 mA
24 VDC	28 mA	30 mA

## 2.2.4 Serial Interface

Signals of the 9 pin D-Sub plug



9-pole D-Sub Plug

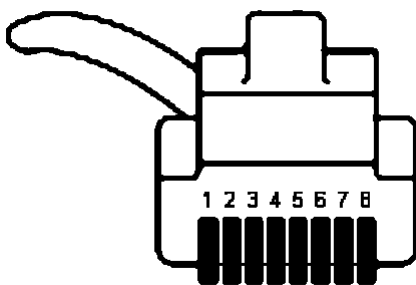
Description of the signals of 9 pin D-Sub connector of the DCE:

9-pin D-Sub DCE pin no.	Description	Function	CCITT V-24	EIA RS232	DIN 66020	I/O DCE to DTE
1	DCD	Data Carrier Detect	109	CF	M5	O
2	RXD	Receive Data	104	BB	D2	O
3	TXD	Transmit Data	103	BA	D1	I
4	DTR	Data Terminal Ready	108	CD	S1	I
5	GND	Ground	102	AB	E2	

DCE pin no.			V-24	RS232	66020	to DTE
6	DSR	Data set ready	107	CC	M1	O
7	RTS	Request to send	105	CA	S2	I
8	CTS	Clear to send	106	CB	M2	O
9	RI	Ring Indication	125	CE	M3	O

RS232 interface speed : V.24/V.28 up to 230.400 bps

### 2.2.5 S<sub>0</sub> Interface



8 pin Western plug (front view)

Signals of the 8 pin Western plug and the RJ 45 socket

Pin	Signal (S <sub>0</sub> )
1	not connected
2	not connected
3	STA (Transmit A)
4	SRA (Receive A)
5	SRB (Receive B)
6	STB (Transmit B)
7	not connected
8	not connected

### 2.2.6 Reset

- Via screw terminal: A reset is possible using the **Reset** screw terminal by an external device.
- Via Reset key To trigger a reset, the reset button must be pushed for at least 3s, or a low potential must be connected to the terminal for at least 3 s.

## 2.2.7 Digital Inputs And Outputs

### 2.2.7.1 Alarm Input:

LOW 0 .. 1 V

HIGH 4 .. 12 V

Supply current from LOW to internal +5V: typ. 0.5 mA

### 2.2.7.2 Switch Output:

Galvanic insulated relay SPDT (single pole double throw) switch

max. switch voltage: 30 V (DC) / 42 V (AC)

max. current load: 1 A (DC) / 0.5 A (AC)

## 2.3 Transmission Standards And Protocols

- B channel: V.110, X75,, X25/X31, HDLC (transparent)
- D channel: DSS1, X.31
- dial-up procedure: Hayes dial-up (AT command set), V25bis async. Hotline 108 DTR, X.3 (PAD)
- Transmission in D channel with 9.600 bps (X.31-D)
- Transmission in B channel with 64.000 bps (X.31-B)

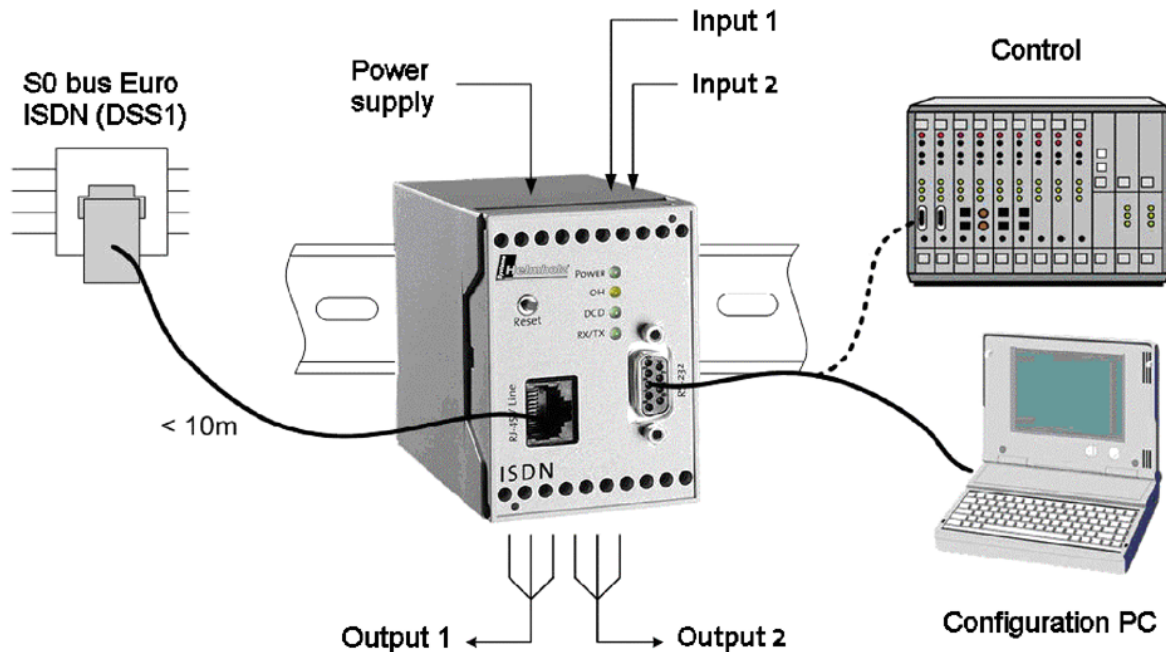
## 2.4 Approvals

The HELMHOLZ ISDN TA bears the CE mark of conformity. This mark is a declaration that the HELMHOLZ ISDN TA corresponds to the currently valid versions of the following EC Directives.

- CTR 3 (Europe)
- CE
- Approval number D801034L

## 3 Initial Operation

### 3.1 Installation Overview



### 3.2 Installation Steps

1. *Mounting on DIN rail:*  
simply clip on
2. *Connecting the power supply:*
  - a) Connecting the ground connection GND
  - b) Connecting the power supply 10..60 VDC, 50..80 VDC or 5 VDC  
**Please follow specifications on the housing top (power supply- the values stated are maximum values)!**
  - c) Connecting the power supply  
The power LED lights up on successful installation.
3. *Connecting to S<sub>0</sub> bus:*
  - a) Plug the delivered ISDN S0 cable into the RJ 45 socket at the housing front or alternatively
  - b) connect via screw terminal on the housing bottom according to description 6STB, 5SRB, 4SRA, 3STA, NC
  - c) AND to a TAE-socket or directly to the NT

Please disconnect the connection to the phone line immediately in case of incorrect or irregular behavior of the HELMHOLZ ISDN TA. Please refer to your service partner in such cases. In order to preserve your guarantee, **please do not open or perform any operation on the HELMHOLZ ISDN TA.**

4. *Connecting PC/terminal*

Plug the enclosed RS 232 interface cable into the housing front and connect to PC/terminal.

5. *Checking successful installation:*

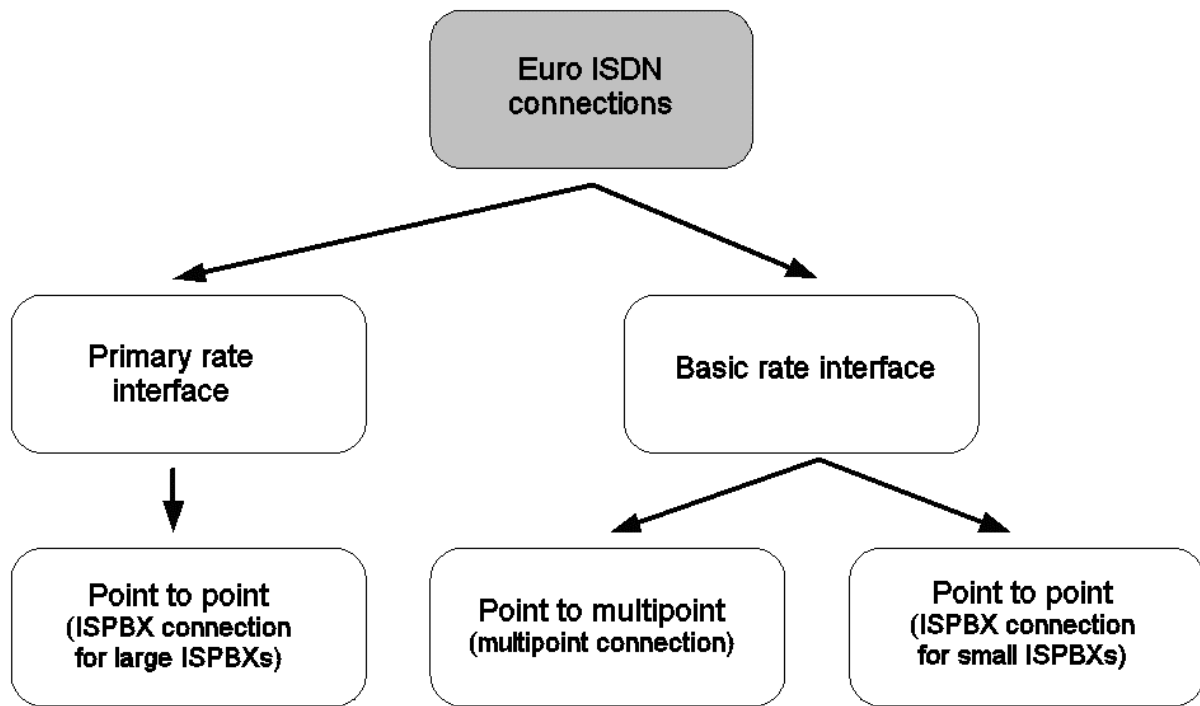
This short test takes place via your terminal program (HyperTerminal). Enter the command **AT** and press Enter. If **OK** appears on your screen the HELMHOLZ ISDN TA has been installed successfully.

6. *Perform a connection set-up:*

- Dial by **ATD** one of the following numbers (for PABXs, which require a "0" for connection set-up, replace **ATD** by **ATX3D**):
  - HDLC protocol (**ATB3**): 010190/1929 (enter **ATD0101901929**)
  - X.75 protocol (**ATB10**): 040/89088291 (enter **ATD04089088291**)
- Off-Hook LED lights up
- ISDN TA dials
- After max. 1 minute, the message **CONNECT** appears.

## 4 Interface Types

Several interface types are available for Euro ISDN.

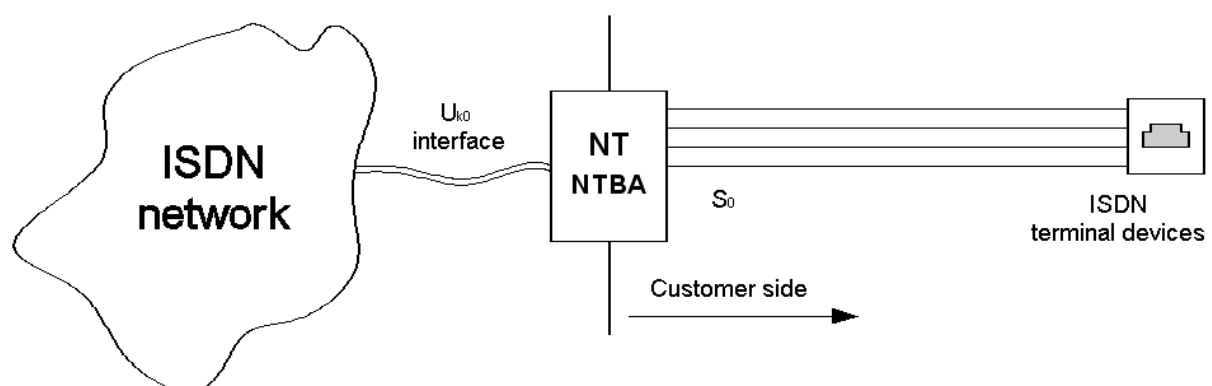


ISDN TAs can only establish data connections to the following remote terminals:

- ISDN TA
- GSM data adapter, e.g. HELMHOLZ GSM

A data connection to a purely analog modem is not possible.

### 4.1 Basic Rate Interface

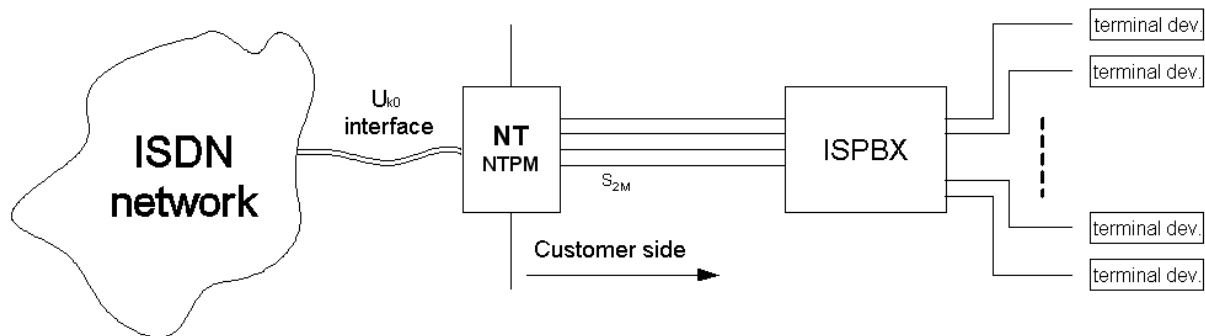


The basic rate interface is provided via a usual two-wire line with the switching center. The interconnection point between switching center and the customer is the network termination (NT). This is also referred to as NTBA / NT. A four-wire line, the S<sub>0</sub> bus, connects the terminal devices to the NT.

The S0 bus consists of a transmitting and a receiver circuit. The data stream of 144kbit/s in the transmitting and receiver circuit divides into 2 utilizable channels (B channel, in each case 64 kbit/s) and 1 signaling channel (D channel, 16kbit/s).

## 4.2 Primary Rate Interface

The primary rate interface is intended for the supply of larger ISDN ISPBXs (integrated services private branch exchanges), which have a large requirement of transmission channels.



The **primary rate interface**, abbreviated PMxA or PRI, has 30 utilizable channels as PBX connection.

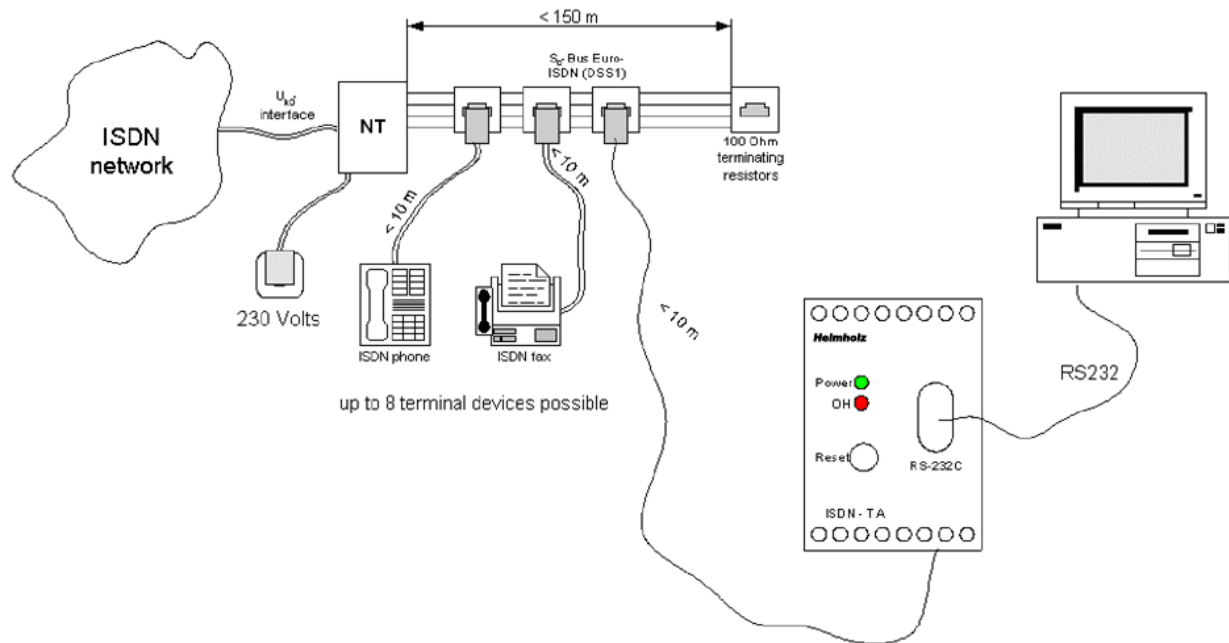
The connection is made by two conventional two-wire lines and a primary multiplex network termination (PMx NT). A ISPBX is connected to this NT using the so-called S2M port. The data transmission rate at the primary multiplex port (30 utilizable channels + 1 data channel) is 2 Mbit/s.

Each utilizable channel (B channel) uses a transmission speed of 64 kbit/s. Additionally to the utilizable channels a so-called data channel (D channel, see D channel) exists, which is used for the signaling information. Moreover additional synchronization information is transmitted.



## 4.3 Interface Configuration Of The Basic Rate Interface

### 4.3.1 Multipoint Connection (PTM, Point-To-Multipoint)



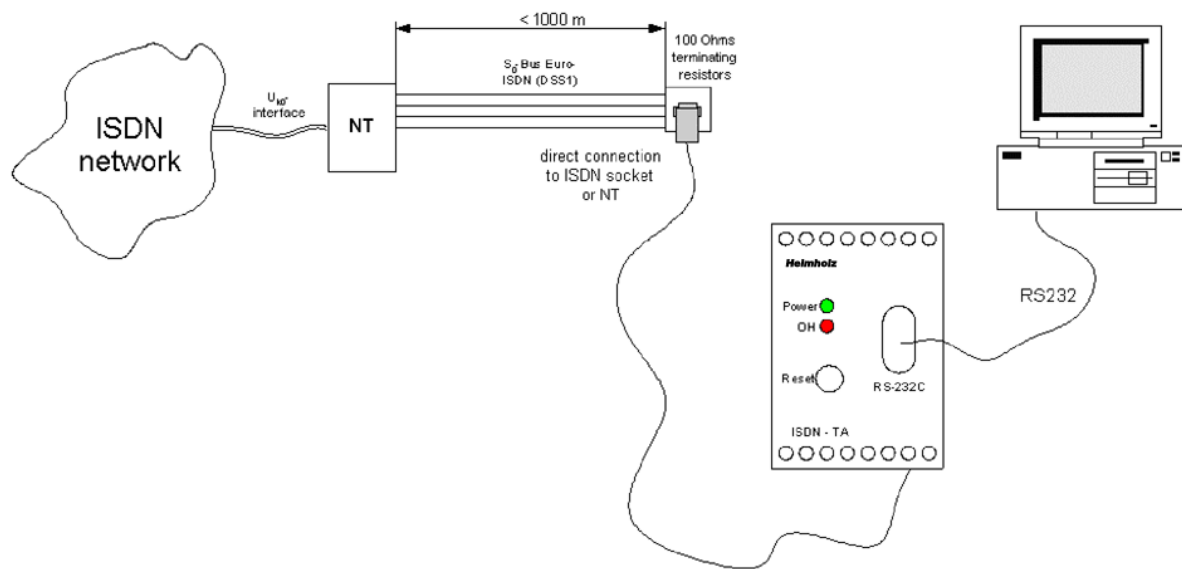
For a multipoint connection, max. 8 ISDN terminal devices can be connected at the  $S_0$  bus, two of which are usable at the same time. Each of the attached terminal devices can get its own call number (MSN) assigned.

In this case the HELMHOLZ ISDN TA must be programmed to multipoint connection and the MSN must be configured.

#### Programming HELMHOLZ ISDN TA

<b>AT**PTP=0</b>	Multipoint connection (default)
<b>AT#z=MSN</b>	(MSN = assigned call number, multiple subscriber number)
<b>AT&amp;W</b>	Storing the setting

### 4.3.2 ISPBX Connection (PTP, Point-To-Point)



Only one terminal device can be operated at the ISPBX connection on principle.  
The HELMHOLZ ISDN TA has to be programmed to point to point in this case.

#### Programming:

**AT\*\*PTP=1** (Setting the ISPBX connection)  
**AT&W** (Storing the setting)

## 5 Configuration

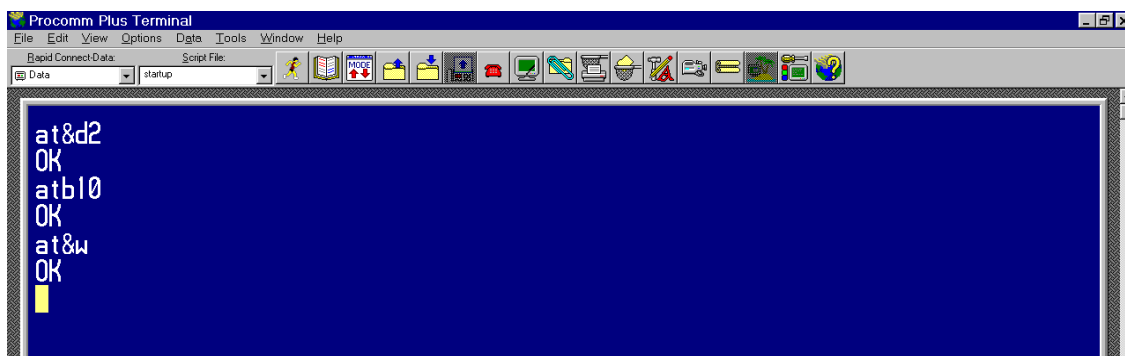
The settings of the HELMHOLZ ISDN TA for the serial interface and the  $S_0$  interface are called configuration. The HELMHOLZ ISDN TA is delivered with a set of pre-set values. In the following section you will see how to check and, if necessary, change the configuration of the HELMHOLZ ISDN TA using the configuration commands. The values can be stored in the non-volatile memory and are kept even after disconnecting the power supply.

You can configure the HELMHOLZ ISDN TA locally or from remote in the following way:

- by entering the AT commands via the terminal program at a directly connected PC (locally).
- by entering the TA configurator commands via the terminal program at a directly connected PC (locally).
- by entering the TA configurator commands via the terminal program at a PC connected via the ISDN network. (remote configuration).
- by entering the PAD (X.3) commands via the terminal program at a directly connected PC (locally).

### 5.1 Local Configuration

#### 5.1.1 Configuring With AT Commands



To execute a TA+ configuration command out of the AT command mode you have to enter the command **at\*\*[cmd]**.

##### 5.1.1.1 Syntax Of The Standard AT Commands

The AT standard is a line-oriented command language. Each command consists of three elements: Prefix, main part, and ending character.

The **prefix** consists of the letters **AT**, except the **A/** command.

The **main part** is made up of individual characters as described in this chapter. It consists of a name and, if applicable, of associated values. In case an associated value is optional, it is indicated by square brackets ([...]).

The **standard ending character** is **<CR>** (=0X0D).

Commands may be combined to one command line. Spaces between the individual main parts are ignored.

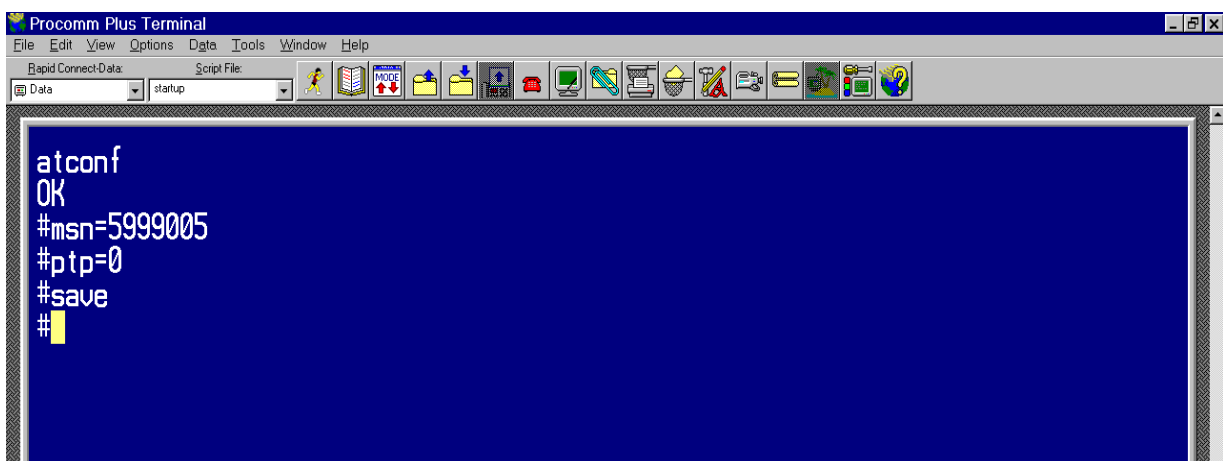
The commands are acknowledged with **OK** or **ERROR**.

### 5.1.1.2 Result Codes For Normal Data Communication

Response	Code	Type	Description
OK	0	final	command executed, no error
CONNECT	1	intermediate report	connection established, when parameter setting X=0
CONNECT [<text>]		intermediate report	connection established, when parameter setting X>0 <text>: e.g. 'cnx 6400'. The data transmission rate is 64.00 Bit/s then.
RING	2	unsolicited	ring signal detected
NO CARRIER	3	final	connection not established or terminated
ERROR	4	final	invalid command or command line too long
NO DIAL TONE	5	final	no dial tone, connection set-up not successful, wrong operation mode
BUSY	6	final	remote terminal busy
NO ANSWER	7	final	connection set-up time-out

### 5.1.2 Configuration With The TA Configurator

The TA configurator can be started by entering a special command via the command interface (PAD: "CONF" or **AT**: "**ATCONF**").



### 5.1.3 Configuration With X3.PAD

To execute a TA+ configuration command out of the X.3 - PAD command mode you have to enter the command **exec cmd**.

Use the command **conf** to start the TA+ configurator.

You can leave the TA+ configuration program with the command **quit**.

**Note:** After changing a value marked with (#1), you have to enter the commands **save** and **go** additionally. This is necessary to save and activate the new parameter.

#### 5.1.3.1 X.3 Command Set

If you connect a serial interface to the X.31 service, you can use the integrated PAD of the HELMHOLZ ISDN TA. You can use for example the command **stat** to display the status of the connection.

Use the configuration command **cmds = 1** to set the PAD mode.

The following PAD-Commands according to X.28/X.29 are supported:

- *(dot)* Displays PAD identification

**[Pxxx-][R ][N<nuipwd> ][G<cug> ]X25number[l<ISDNnumber>][D<userdata>]**

Establishes an X.25 connection

**P** use packet size *xxx* for X.25 connection

**R** request the facility reverse charging (only for X.25)

**G** access to a closed X.25 user group

**O** outgoing call from a closed X.25 user group

**N** use NUI and password in call packet, allowed characters: a-z, A-Z, 0-9. (overrides setting of nui configuration command)

**X25number** dialed X.25 call number

**ISDNnumber** ISDN call number for a dialed B channel connection

**D** separator for user data: **D**, **P** or **,**

**clr** terminate an X.25 connection

**stat** displays the PAD connection status

**set** sets the PAD profile to profile 0

**set x:n** sets the PAD profile parameter *x* to value *n*

**prof x** configures to the PAD profile *x*, *x* = 0..7, 90, 91

**prof?** displays the configured PAD profile parameters

**par [x][,x]** displays all configured PAD profile parameters or the PAD parameter *x* **par** without parameter displays all settings

**ver** displays the version number

*Note:* PAD parameter can be stored using the command **exec save**.

### 5.1.3.2 X.3 Parameter Of The Integrated PAD

Using the PAD command **set x:n** you can change the parameter according to ITU specification X.3.

After changing one or more X.3 parameter you can store the change non-volatile by entering **exec save**.

The stored parameter can be reloaded with the command **exec load**.

After an X.25 connection is cleared, the PAD parameter will be reset to the last active profile (or default).

#### International parameters 1 through 12

1	Enable (disable) switch to command mode
2	Echo
3	Data forwarding characters
4	Timer for data forwarding
5	Control of additional devices
6	Display PAD messages
7	Handling the BREAK signal
8	Display received data (ON/OFF)
9	Fill characters following a carriage return (<CR>)
10	Screen line control
11	Local baud rate (read only)
12	Local flow control (read only)

#### Extended parameters 13 through 21

13	Automatic line feed
14	Line feed fill characters
15	Control input buffer editing
16	Character-delete character
17	Delete line
18	Repeat line - line-display character
19	Handling delete characters
20	Echo filter
21	Parity handling (read only)

## National parameters 118 – 126

118	Character-delete character
119	Delete line
120	Repeat line - line-display character
123	Parity handling
126	Generating a line feed

## 5.2 Remote Configuration Via Configurator

The HELMHOLZ ISDN TA to be configured is referred to as "remote TA" here.

The configuring HELMHOLZ ISDN TA is referred to as "local TA" here.

Please make sure that the remote TA is connected to the ISDN line and powered up.

- Start a terminal emulation program
- Configure at the local TA the B channel protocol X.75 and block size 2048 (**ATB10**).
- Set up an ISDN connection to the remote TA using the command **ATD?<isdnnnum>?e?<Return>**. The extension **e** at the end of the call number establishes an internal control connection to the remote TA.

The called TA responds with a password query. Please enter the correct password (default: no password, press Return only).

Now you can remote-configure the remote TA using the TA configurator commands (see chapter TA+ Configurator Commands).

- Configure the parameter for the remote TA from your terminal program and store them (if wanted).

**Note:** The active set of parameters can be displayed with the command **show<RETURN>**.

- Terminate the ISDN connection by leaving the configurator program using the command **quit**. Before, you should execute a RESET command that the remote TA will be reset, and terminate the connection to the local TA.
- Exit the terminal program. After the next reset the changes in the remote TA will be active.

### 5.2.1 Remote Access Control

Using the following commands you can setup a list, which allows only dedicated callers the access to the remote configuration of the HELMHOLZ ISDN TA.

If this list is empty (default) or one entry is set to star (\*), any incoming call is allowed.

Every incoming call that does not fit to one of the entries of racctab will be rejected with the explanation "call rejected".

racctabx nn/ss	set entry number x to ISDNnumber nn and subaddress ss
----------------	---

racctabx-	clear entry number x
racctabx *	allow all incoming calls to be accepted
racctabx	display entry number x
racctab	display all entries

Maximum number of entries = 3

Maximum length of ISDN number = 20 digits

Maximum length of subaddress = 20 digits

The ISDN number can contain wildcards:

\* : represents one or more digits

? : represents exactly one digit

#### Examples:

racctab1 1234567890	accepts only specified number
racctab2 *456*	accepts all numbers with 456 somewhere in the middle
racctab3 ? 2345678 ??	accepts all number with 2345678 in the middle preceeded by one digit and followed by two digits.
racctab2 *1234/987	accepts all numbers that end with 1234 and have the subaddress 987
racctab3 *	accepts all incoming calls without subaddress
racctab3-	clears entry no. 3

### 5.2.2 TA+ Configurator Commands

The TA+ configuration commands have to be entered correctly and completely, including all blanks.

Capital/small letter use is not important.

Examples for using the commands:

**[?]<command>[=parameter]**

Set the ISDN B channel protocol to X.75:

**prot=10**

Display the selected ISDN protocol:

**prot**

Display all selectable ISDN protocols:

**?prot**



Command	Description
<b>atsx, atopt, atrej</b>	AT command parameter set
<b>bc</b>	bearer capability
<b>br</b>	baudrate asynchronous
<b>brn</b>	line baudrate asynchronous V.110
<b>bsize</b>	frame length
<b>catab</b>	show table catab
<b>cato</b>	call timeout to abort
<b>capa</b>	call pause
<b>catry</b>	calls retry
<b>ccts</b>	CTS control
<b>cdcd</b>	DCD control
<b>cdsr</b>	DSR control
<b>cdtr</b>	DTR control
<b>cha</b>	charging information
<b>chatol</b>	charging information total
<b>chappwd</b>	set password for PPP chap authorization
<b>cmds</b>	command set (#1)
<b>cmlp</b>	multilink PPP control
<b>defa</b>	default settings
<b>dbits</b>	asynchronous data bits
<b>dte</b>	B channel link address
<b>flc</b>	flow control
<b>fwload</b>	load new firmware
<b>fwstart</b>	start new firmware
<b>idle</b>	idle data timeout
<b>isdn</b>	ISDN D channel protocol (#1)
<b>k</b>	window size
<b>lcgr</b>	logical group number X.25
<b>llc</b>	low layer compatibility

Command	Description
<b>load</b>	Load stored parameter setting
<b>msn</b>	Multiple Subscriber Number
<b>nui</b>	nui and password
<b>prot</b>	B channel protocol
<b>prty</b>	asynchronous parity
<b>ptp</b>	ISDN interface type
<b>quit, exit, go</b>	activate parameter changes
<b>reset</b>	reset TA+HUT
<b>ringtimer</b>	delay of RING messages
<b>rmmsg</b>	RMON/RMOFF message for remote
<b>rmsn</b>	Multiple Subscriber Number for remote
<b>rpwd</b>	password
<b>save</b>	store parameter changes
<b>show</b>	show parameters
<b>showall</b>	show all parameters
<b>spid1, spid2</b>	set spid
<b>start</b>	startup timer
<b>sub</b>	Subaddress
<b>s0led</b>	automatic ISDN (S0) activation
<b>tdi</b>	timer delay incoming call
<b>tei</b>	TEI value
<b>txfwd</b>	timer for data forwarding
<b>t320</b>	timer delay ISDN disconnect
<b>xnr</b>	own X.25 address
<b>xtab</b>	show table xtab
<b>x3lrr</b>	enable rerouting for X.31 D channel
<b>pxxx</b>	X3 parameter set
<b>w</b>	B channel window size L3

Command	Description
<cmd>?	more information for one command
??	help

## 6 Functions

### 6.1 Automatic Call

Automatic call establishment is available in two modes:

- Initiation of an automatic call if DTR is on and
- automatic connection establishment irrespective of any status line.

To enable an automatic call, the TA+ configuration parameter **cmds** has to be set to 6, 7 or 8 (see table below). With setting this parameter, the baud rate will be set automatically to 9.600 bit/s (br=4).

An established connection will be indicated by a status line. (See also configuration commands **cdcd** and **cdtr** in the table).

If a connection cannot be established successfully, an automatic redialing will be initiated. The number of attempts as well as the pause duration until the next attempt are defined using the commands **capa n** and **catry n**.

The dialed numbers are taken from the table **catab**.

All entries of the table **catab** are used one after the other.

<b>cmds 6</b>	Automatic connection establishment if DTR is on.
<b>cmds 7</b>	Automatic connection establishment if the TA receives any data byte (auto-bauding is not supported, set br not equal to 0).
<b>cmds 8</b>	Automatic connection establishment irrespective of any status line.
<b>cato n</b>	Termination of an unsuccessful call after n seconds. n={3..255}, default: 15 seconds.
<b>capa n</b>	Call pause for n seconds before next call attempt. <i>n = 0: no call attempt.</i> n={0..255}, default: 3 seconds.
<b>catry n</b>	Automatic call: max. number of attempts for every number entry in catab. n={1..255}; default: 1
<b>catabx nn/ss</b>	Sets entry number x to ISDNnumber nn and subaddress ss
<b>catabx -</b>	Deletes entry number x
<b>catabx</b>	Displays entry number x
<b>catab</b>	Displays all entries

Maximum number of entries = 3; x = 1..3

Maximum length of ISDN number = 20 digits

Maximum length of subaddress = 20 digits

#### Configuration with AT-Interface:

Atxx[command]

or with TA+ configurator

**ATCONF**

#capa\_20

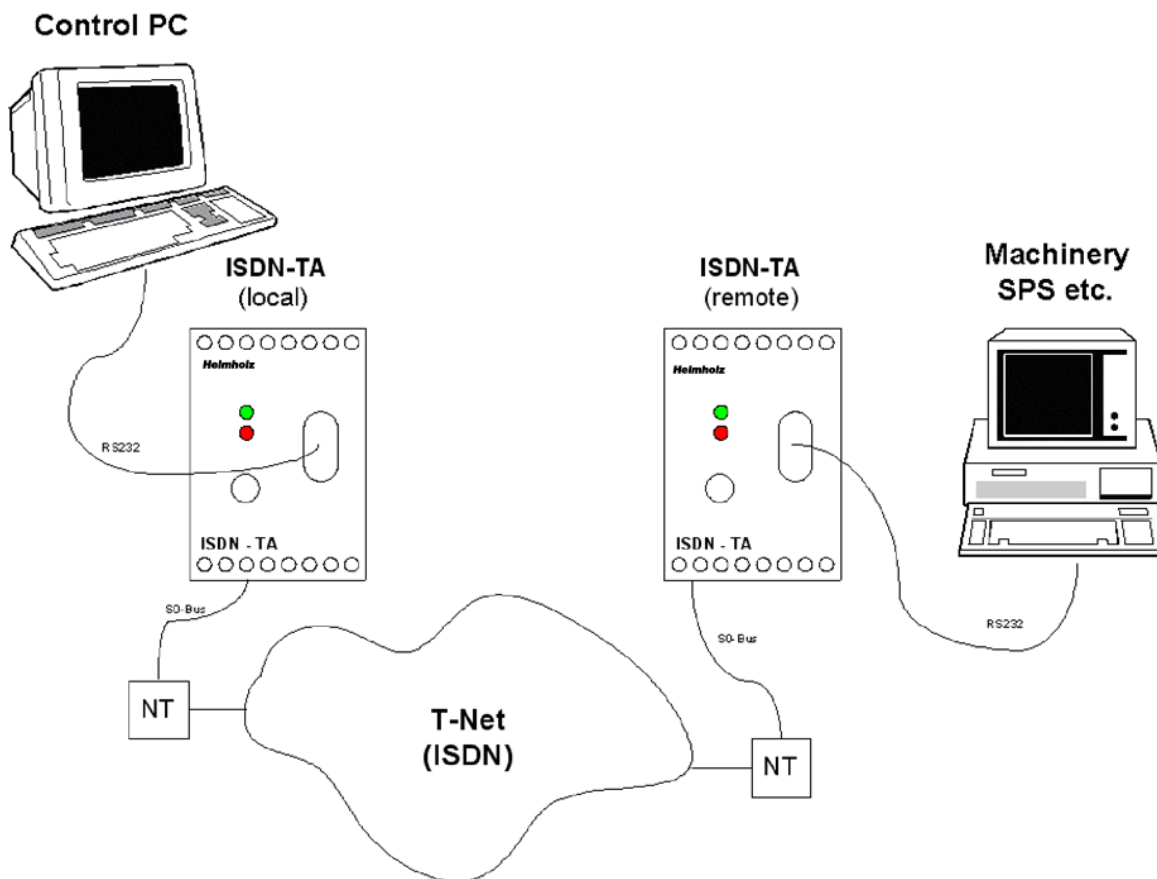
**Note:** The configuration command **idle** can be used for an automatic disconnection after a predefined time without data transmission.

Please take care that parameter **rstim** is greater than 10, to enable the entry in the TA configurator commands after a reset (default=40, 4 seconds).

## 6.2 Security Callback

With the Security Callback function, the called HELMHOLZ ISDN TA is able to make an automatic call to a predefined number.

### 6.2.1 Principle Structure



### 6.2.2 Functionality

The local HELMHOLZ ISDN-TA tries to establish a data link to the remote ISDN TA. The remote ISDN TA compares the call number of the incoming call (of the local TA) with the entered call numbers in its "Access Table" (acctab). If the call number matches, the num-

ber, which is in the entry of the callback number (casnr), is called back after the expiry of the callback time (capa). Otherwise the call is rejected.

The function "security callback" is activated by the parameter **cmds2=40** and is deactivated by **cmds2=0**.

ONLY 1 callback attempt is possible.

### 6.2.3 Configuration

Before configuring the function "**Security Callback**" the user-defined standard settings have to be configured. See for this chapter "Initial Operation Of The ISDN TA".

#### 6.2.3.1 Local ISDN TA

- Setting the MSN (own call number)  
**at\*\*msn=xxx**                      xxx stands for the call number
- Setting the baud rate  
**at%bx**                              x stands for the selection of the respective baud rate, see chapter: Overview about the most important basic commands
- Storing the settings  
**at&w**

#### 6.2.3.2 Remote ISDN TA

- Setting the MSN (own call number)  
**at\*\*msn=xxx**                      xxx stands for the call number
- Setting the interface type  
**at\*\*ptp=x**                              x=0 Multipoint connection  
   x=1 ISPBX connection
- Setting the baud rate  
**at%bx**                              x stands for the selection of the respective baud rate, see chapter: Overview about the most important basic commands
- Activating the security callback function:  
**at\*\*cmds2=40**
- Entering the call number of the local ISDN TA:  
**at\*\*acctab1=xxx**                      xxx stands for the call number
- Enter the callback number (local ISDN TA):  
**at\*\*casnr=xxxx**
- Setting the callback time  
**at\*\*capa=xx**                              xx in seconds
- Storing the settings  
**at&w**

## 6.3 Alarm Functions

The HELMHOLZ ISDN TA has two alarm inputs and two control outputs.

In case of an alarm an SMS message can be sent (alarm SMS) or a connection to any subscriber can be made (alarm data connection).

The switch outputs are galvanic insulated SPDT (single pole double throw switches, which can be switched locally as well as remote).

### 6.3.1 Alarm Input

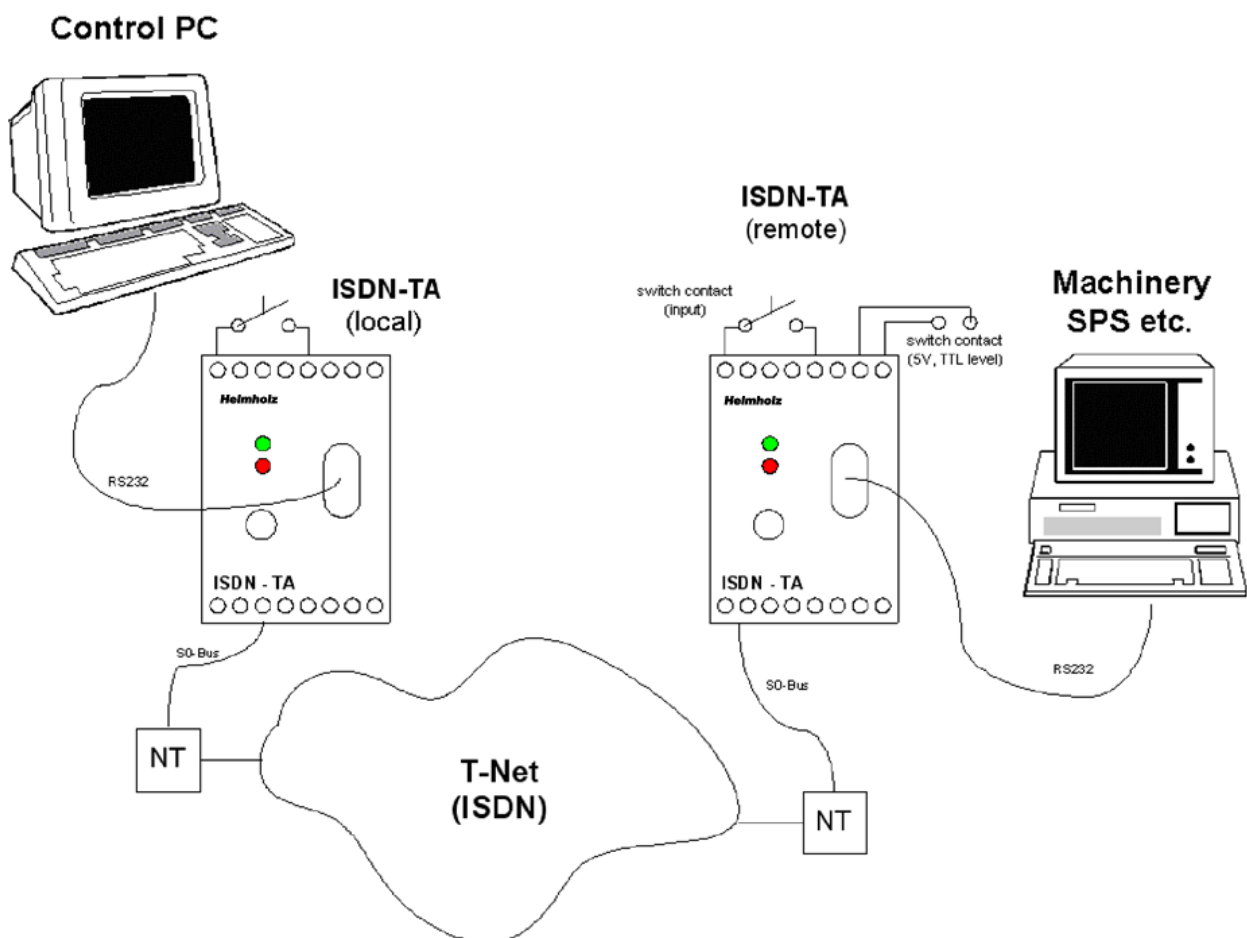
Both alarm inputs can send two SMS messages to two different mobile phone numbers within a GSM network. The alarm texts consist of a common collective message (120 characters) and an individual text (40 characters).

A data connection can be established alternatively in case of an alarm. Data connections and alarm messages via data connections are sent to the same phone number for both alarm inputs.

Note: The protocol X.75 (not HDLC) is required as default for all alarm connections.

#### 6.3.1.1 Alarm Data Connection

##### Principle Structure



## Functionality

After the activation of the alarm input (at least 300ms), the local ISDN TA tries to set up a data connection to the remote ISDN-TA. The number of the remote TA has to be configured in the number memory of the local TA. If no number is stored there, the activity will be terminated.

In case an error occurs, the alarm call is repeated for three times with a dialing pause of 10 seconds. A new alarm can be started by reactivating the alarm input.

After the connection is established, the configured alarm text is sent automatically. The connection remains established until the alarm input is deactivated or the ceased time in the parameter "idle" expired.

## Configuration of the local ISDN TA

- Setting the MSN (own call number)  
**at\*\*msn=xxx**                      xxx stands for the call number
- Setting the baud rate  
**at%bx**                                x stands for the selection of the respective baud rate, see chapter: Overview about the most important basic commands
- Setting the target number (remote TA)  
**at&z1=XXX**
- Setting the alarm text  
**at\*v**                                    common text for both alarms (collective message)  
**at\*v1**                                   individual text for alarm 1  
**at\*v2**                                   individual text for alarm 2  
**-> NEW ALARMTEXT:**            Enter the new text: max. 160 characters for collective message if the individual texts are empty, otherwise 120 characters for collective message and 40 characters for each individual text.
- Setting the alarm function (optional)  
**at\*y2**                                   Connection will be terminated by deactivating the alarm input (only for alarm input 1)
- Storing the settings  
**at&w**

## Configuration of the remote ISDN TA

- Setting the MSN (own call number)  
**at\*\*msn=xx**                        xxx stands for the call number
- Setting the baud rate  
**at%bx**                                x stands for the selection of the respective baud rate, see chapter: Overview about the most important basic commands
- Automatic call acceptance  
**ats0=1**                                Call acceptance after first ring

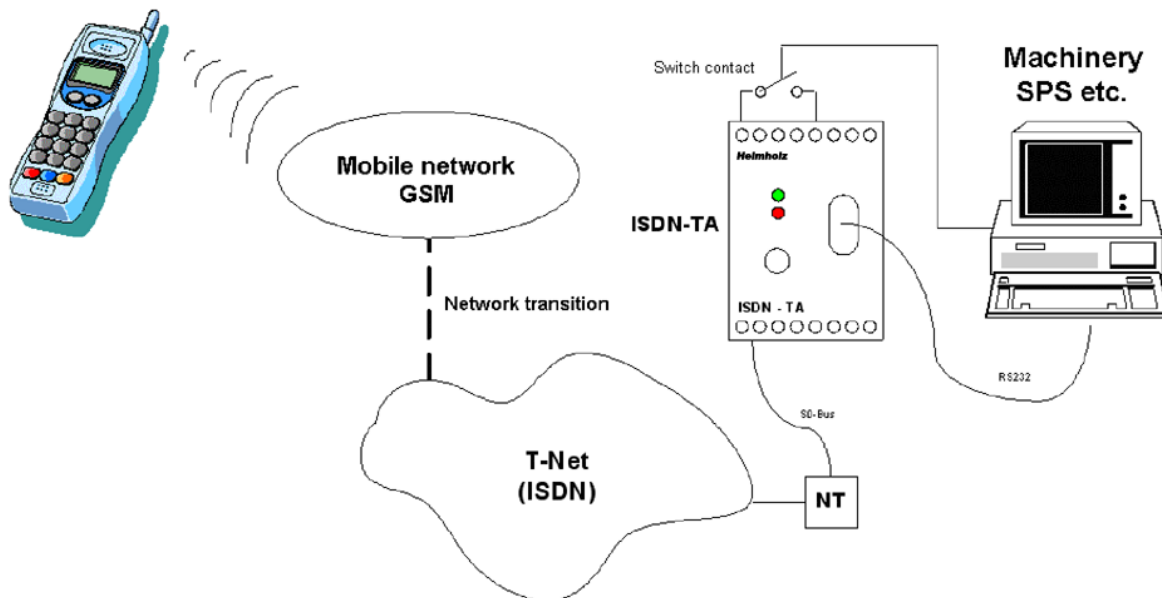


- Storing the settings  
`at&w`

### 6.3.1.2 Alarm SMS

#### Principle Structure

#### Principle Structure



#### Functionality

The SMS dispatch is either started automatically by activating the alarm input or manually by entering the command `at*x`.

The ISDN TA tries to send a predefined SMS message to a GSM mobile phone after activation of the alarm input (at least 300ms to GND).

The following networks support the acceptance of SMS messages from the fixed network: T-D1, D2 Vodafone, E-PLUS. Both SMS recipients have to belong to the network of the same GSM provider.

In case an error occurs, the SMS dispatch is repeated for three times with a dialing pause of 10 seconds. A new SMS dispatch can be started by reactivating the alarm input.

The maximum length of the SMS message is 160 characters. The alarm texts consist of a common collective message (120 characters) and an individual text (40 characters per alarm). They are configured using the command `atv`.

#### Configuration of the ISDN TA

- Setting the network dependent parameters for recipients in the T-D1 network:
 

<code>at*m1</code>	network selection T-D1
<code>at&amp;z1=01712521002</code>	Service center number of T-D1
<code>at&amp;z3=49171xxx</code>	Target number of the mobile phone (the number starts with the country code without "+")

- Setting the network dependent parameters for recipients in the Vodafone D2 network:
  - at\*m2** network selection Vodafone D2
  - at&z1=01722278000** Service center number of Vodafone D2
  - at&z3=0172xxx** Target number of the mobile phone (without country code)
- Setting the network dependent parameters for recipients in the E-Plus network:
  - at\*m3** network selection E-Plus
  - at&z1=01771167** Service center number of E-Plus
  - at&z3=49177xxx** Target number of the mobile phone (the number starts with the country code without "+")
- Setting the MSN (own call number)
  - at\*\*msn=xxx** xxx stands for the call number
- Setting the baud rate
  - at%bx** x stands for the selection of the respective baud rate, see chapter: Overview about the most important basic commands
- Setting the SMS text
  - at\*v** common text for both alarms (collective message)
  - at\*v1** individual text for alarm 1
  - at\*v2** individual text for alarm 2
  - > NEW ALARMTEXT:** Enter the new text: max. 160 characters for collective message if the individual texts are empty, otherwise 120 characters for collective message and 40 characters for each individual text.
- Storing the settings
  - at&w**
- SMS dispatch by activating the alarm input or manually from the terminal program
  - at\*x0** activation alarm 1
  - at\*x1** activation alarm 2

### 6.3.2 Switch Output

The switch outputs OUT1 and OUT2 can be configured via AT commands (locally **AT\*Y**, remote **ATS14**, **ATS15**) or via TA+ configurator commands.

Action	Output OUT1	Output OUT2
Connect output to normally closed contact	<b>AT*Y0,0</b> <b>ATS14=0</b>	<b>AT*Y1,0</b> <b>ATS15=0</b>
Connect output to normally open contact	<b>AT*Y0,1</b> <b>ATS14=1</b>	<b>AT*Y1,1</b> <b>ATS15=1</b>
Output following DCD	<b>AT*Y0,2</b> <b>ATS14=2</b>	-

The state of the registers S14 and S15 can be stored with the command **AT&W** or the TA+ configuration command **save**.

### 6.3.3 AT Commands For The Alarm Functions

Command	Description
<b>AT*Y</b> <b>ATS14</b> <b>ATS15</b>	Setting the switch outputs
<b>AT*V</b>	Definition of the alarm texts
<b>AT*M</b>	Transport protocol for the alarm messages
<b>AT*X</b>	Alarm triggering
<b>AT&amp;Z</b>	Call numbers recipient and service center number for SMS

## 6.4 ISDN Access Control

Using these commands you can set up a list, which allows only dedicated callers to access the HELMHOLZ ISDN TA.

If this list is empty (default) or one entry is set to star (\*), any incoming call is allowed.

The received caller number is compared with every entry of the list, beginning with the last digit until the entry matches. Every incoming call that does not fit to one of the entries of acctab will be ignored.

<b>acctabx nn/ss</b>	sets entry number x to ISDN number nn and subaddress ss
<b>acctabx-</b>	deletes entry number x
<b>acctabx *</b>	allows all incoming calls to be accepted
<b>acctabx</b>	displays entry number x
<b>acctab</b>	displays all entries

Maximum number of entries = 5; x = 1..5

Maximum length of ISDN number = 20 digits

Maximum length of address = 20 digits

The ISDN number nn can contain wildcards:

\* : represents one or more digits

? : represents exactly one digit

**Note:** If a subaddress is set, the received calling subaddress must be identical to the subaddress that is set.

**Examples:**

<b>acctab1 1234567890</b>	accepts only specified number
<b>acctab2 *456*</b>	accepts all numbers with 456 somewhere in the middle
<b>acctab3 ? 2345678 ??</b>	accepts all numbers with 2345678 in the middle preceeded by one digit and followed by two digits.
<b>acctab2 *1234/987</b>	accepts all numbers that end with 1234 and have the subaddress 987
<b>acctab3 *</b>	accepts all incoming calls without subaddress
<b>acctab3-</b>	deletes entry no. 3

**Note:** If you are not sure, which format the incoming call has, use the command **ATV2** to display the format of the calling number in the RING message. This number can be taken over into the acctab list.

## 6.5 Data Flow Control

There are two possibilities of flow control between PC and HELMHOLZ ISDN TA.

### 6.5.1 Hardware Handshake (RTS/CTS)

The two control lines RTS and CTS of the serial interface are used to control the data flow here. As soon as the buffer of the HELMHOLZ ISDN TA is full, the HELMHOLZ ISDN TA resets the CTS line to indicate that no more data can be accepted from the PC.

If the internal data buffer of the HELMHOLZ ISDN TA is processed, it sets the CTS line back to ON, thereby informing the PC, that it is again ready to receive data.

The control line RTS is used by the PC. A set RTS line (state ON) indicates the HELMHOLZ ISDN TA that it can request data from the PC.

The hardware controlled data flow control is set in the HELMHOLZ ISDN TA with the commands **AT&K** and **AT&R**.

It depends on the respective software, which runs on the PC, whether the RTS/CTS lines are served.

### 6.5.2 Software Handshake (XON/XOFF)

Both ASCII control characters XON (CHR(19)) and XOFF (CHR(17)) are used to control the data flow.

If the input buffer of the HELMHOLZ ISDN TA has exceeded a predetermined XOFF fill level, the HELMHOLZ ISDN TA inserts an XOFF character into the data stream to the PC. This character causes the PC to stop sending further data.

Once the HELMHOLZ ISDN TA has processed the input buffer so far that it falls below a predetermined XON fill level, the HELMHOLZ ISDN TA includes the XON character in the data stream. This character causes the PC to start sending data again to the HELMHOLZ ISDN TA. In a similar manner, the PC can control the data flow from the HELMHOLZ ISDN TA to the PC.

The XON/XOFF procedure is only possible, if the XON or XOFF characters are not present in the data to be transmitted, so as a rule only for ASCII texts. When transmitting pro-

grams, or in BTX operation, or e.g. using XMODEM transmission protocol, any XON or XOFF characters appearing randomly would disturb the operation.

It depends of the setting of the HELMHOLZ ISDN TAs with the command **AT&K**, whether the HELMHOLZ ISDN TA supports the XON/XOFF data flow control procedure.

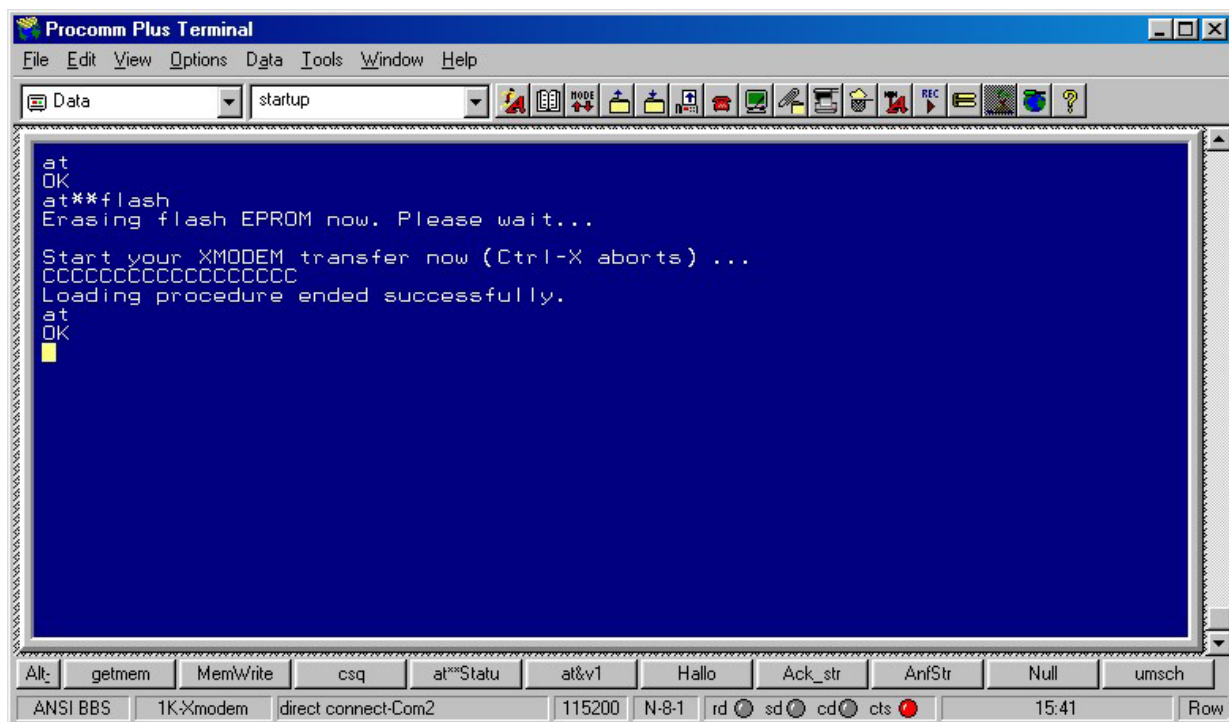
It depends on the respective software, which runs on the PC, whether the XON/XOFF data flow control is supported.

#### AT commands to control the serial data transmission

Command	Description
<b>AT&amp;K</b>	select data flow control between PC and HELMHOLZ ISDN TA
<b>AT&amp;R</b>	RTS/CTS behavior

## 6.6 Software Update

The HELMHOLZ ISDN TA uses a Flash-EPROM for software updates to store the operational software. This software can be updated from a local PC via the COM port. Please follow the following steps to update the HELMHOLZ ISDN TA:



- Get the latest software release for the HELMHOLZ ISDN TA from your supplier.
- Start a terminal emulation on your PC with the capability to run an X-MODEM file transfer (i.e. HyperTerminal).
- Set the baudrate to 115.200 baud, choose the parameter 8N1 and hardware flow control (handshake).
- Enter the command **AT** – the response is **OK**
- Enter the command **AT\*\*FLASH**

- Wait for the end of the Flash-EPROM erasing process (response: **Erasing ...**) and the prompt to start your X-MODEM transfer.
- Start the 1kX-MODEM file transfer (send file or upload) by selecting the **Transfer / Send File** menu item in your terminal emulation (e.g. Hyper Terminal). Select the new software and press the Send button.
- After the file has been transmitted, you receive a message whether the software has been transferred successfully.
- The HELMHOLZ ISDN TA executes a reset and activates the new firmware.

**Note:** If the firmware has not been installed correctly, both LEDs **Offhook** and **DCD** remain on after the reset. To load a new firmware correctly, you have to enter again the command **at\*\*flash** and load the new firmware, using the XMODEM protocol as described above. For this, you have to set the baud rate to 115.200 baud.

Command	Description
<b>AT**FLASH</b>	load the software

## 6.7 Idle Connection Control

Idle connection control (Date Transmit Control DTC) is a function integrated in the firmware for monitoring the data transmission in online operation.

This function prevents the HELMHOLZ ISDN TA for remaining online for an unlimited duration during a X.25 connection, although no more data is transmitted anymore.

The function is only valid for the X.31 B channel.

Any byte sent to the terminal or received by the terminal resets the timer completely again and it starts to run again.

The connection setup takes place if no more data is sent or received and the set time has expired completely.

AT command for idle connection control:

Command	Description
<b>idle 0</b>	deactivate
<b>idle xx</b>	xx seconds to the termination of the connection (xx: 1..255)

## 7 Command Overview

### 7.1 Overview About The Most Important AT Commands

Default values are printed **bold**.

Command	Description
<b>A/</b>	<u>Repeat last command</u> This command repeats the commands of the last entered command line.
<b>ATA</b>	<u>Accept incoming call</u> Using this command you can accept an incoming call, if automatic call acceptance is disabled (register S0 = 0). An incoming call is displayed by the message " <b>RING</b> " or the code "2". This command must be the last command in an AT command line. <b>ATA[//&lt;UUS1data&gt;]</b> <UUS1data> data transmitted with UUS1 signaling
<b>ATB</b>	<u>B channel protocol</u> Transmission protocol for data communication in the B channel. ATB0 V.110 asynchronous (i.e. for BBS access) ATB1 V.110 synchronous ATB3 HDLC async to sync conversion (PPP asynchronous, single link PPP) (e.g. for Internet / dial-up network access) for internet / RAS network access) ATB4 HDLC transparent (octets are packed into HDLC frames) ATB5 Byte transparent (B channel data) <b>ATB10</b> X.75-NL (e.g. for BBS access) ATB20 X.31 B channel (X.25 B channel, option) ATB21 X.31 D channel (option)
<b>AT%B</b>	<u>Set local baud rate</u> Sets the local baud rate of the HELMHOLZ ISDN TA to the desired value (fix value) or to auto detection. When auto detection is set, the HELMHOLZ ISDN-TA will recognize the required baud rate with every newly entered AT command by the terminal software (PC). With all other settings the PC must use the same baud rate. Must be the last command in an AT command line. <b>AT%B0</b> Automatic baud rate detection enabled (autobauding) AT%B1 Local baud rate 1.200 bit/s AT%B2 Local baud rate 2.400 bit/s AT%B3 Local baud rate 4.800 bit/s AT%B4 Local baud rate 9.600 bit/s AT%B5 Local baud rate 19.200 bit/s AT%B6 Local baud rate 38.400 bit/s AT%B7 Local baud rate 57.600 bit/s AT%B8 Local baud rate 115.200 bit/s AT%B9 Local baud rate 230.400 bit/s  <b>Note:</b> If autobauding is selected (default) and after powering on the HELMHOLZ ISDN TA no AT command is entered, a response from HELMHOLZ ISDN TA (e.g. RING) will be sent with the baud rate

	115.200 bit/s.
<b>ATCONF</b>	<u>Starting the HELMHOLZ USDN TA+ configurator</u> Calls directly the ISNYS ISDN TA+ configurator. The “#” prompt of the configurator is displayed. The HELMHOLZ ISDN TA+ configurator is left with the command “quit”.
<b>AT&amp;C</b>	<u>DCD control</u> Selects the behavior of the DCD control line from the HELMHOLZ ISDN TA. <b>AT&amp;C</b> HELMHOLZ ISDN TA control line DCD is always ON <b>AT&amp;C1</b> DCD ON indicates ISDN connection is established and synchronized
<b>AT#C</b>	<u>Received bearer service</u> Displays the bearer service that is received with an incoming call in hexadecimal coding <i>hbhb</i> . The value for <i>hbhb</i> (word) is the CIP value as defined in the CAPI 2.0 specification.
<b>AT#C1=<i>hbhb</i></b>	<u>Select bearer service outgoing</u> Selects the bearer service that will be sent with an outgoing call. The value for <i>hbhb</i> (word) is the CIP value as defined in the CAPI 2.0 specification. (Default 0000).
<b>AT#C2=<i>hbhbhbhb</i></b>	<u>Select bearer service incoming</u> Selects the bearer services that can be accepted with an incoming call. The definition of <i>hbhbhbhb</i> (double word) is the CIP mask as defined in the CAPI 2.0 specification. (Default 00000004). <b>Example:</b> AT#C2=00000001: accept all incoming calls. <b>Note:</b> Before setting up a connection, the command AT#C1 has to be set. To use the predefined services please setup factory defaults with AT&F.
<b>ATD</b>	<u>Connection set-up</u> Dials the given number (D for Dial). The dial modifiers “W”, “>”, “T”, “;”, “@” can be freely inserted into the dial string. They have no influence on the dial procedure of the HELMHOLZ ISDN TA. Must be the last command in AT command line. Entering any character while the HELMHOLZ ISDN TA is dialing will cancel the dialing procedure.  <b>ATD&lt;CALLEDnumber&gt;[/&lt;subaddr&gt;][//&lt;UUS1data&gt;]  [&lt;X[Pxxx-]&gt;][R ][N&lt;nuipwd&gt; ][G&lt;cug&gt;  ]&lt;X25number&gt;][D&lt;userdata&gt;]]</b>  <b>CALLEDnumber:</b> ISDN call number for a selected B channel connection or X.25 number for X.31 D channel <b>subaddr</b> dialed sub address <b>UUS1data</b> transmitted data with UUS1 signaling <b>P:</b> packet size xxx for X.25 connection <b>R:</b> request the facility reverse charging (only for X.25) <b>G:</b> access to closed X.25 user group <b>O:</b> outgoing call from closed X.25 user group <b>N:</b> use NUI and password with call setup allowed characters: a-z, A-Z, 0-9, (overrides setting of NUI configuration command AT&N)



	<p>mand)</p> <p><b>X25number:</b> dialed X.25 call number (X.25 B channel only)</p> <p><b>D:</b> separator for user data: "D" or ";": user data without protocol ID</p> <p>"P": user data with protocol ID ("01000000")</p> <p>ATDL dial the last dialed number</p> <p>ATDS=<i>n</i> dial number <i>n</i> from stored telephone number list (<i>n</i> = 1..3) (see command AT&amp;Z to store numbers)</p> <p>ATD&lt;<b>CALLEDnumber</b>&gt;eCall to remote access of HELMHOLZ ISDN TA (see note).</p> <p><b>Note1:</b> To setup an own sub address see configuration command <b>sub</b>.</p> <p><b>Note2:</b> Adding an "e" to <b>CALLEDnumber</b> indicates that a connection to the internal remote access of an HELMHOLZ ISDN TA shall be performed. The protocol X.75 (ATB10) has to be used for this.</p>
<b>AT&amp;D</b>	<p><u>DTR control</u></p> <p>Selects the behavior of the HELMHOLZ ISDN TA, when the DTE control line DTR changes from ON to OFF.</p> <p>AT&amp;D state of the DTR line is ignored</p> <p><b>AT&amp;D2</b> state of the control line DTR is evaluated: dropping signal on the DTR line will disconnect an existing ISDN connection (default).</p> <p>An incoming call will only be accepted with active DTR.</p>
<b>ATE</b>	<p><u>Local echo</u></p> <p>Selects the local echo in command mode.</p> <p>ATE no local echo</p> <p><b>ATE1</b> local echo on in command phase (default)</p>
<b>AT&amp;F</b>	<p><u>Load factory defaults</u></p> <p>Factory defaults will be loaded, ISDN protocol settings and MSNs will not be overwritten. (for storing in non-volatile memory please use the command AT&amp;W).</p> <p>AT&amp;F setup all parameter concerning data port</p> <p>AT&amp;F1 setup all parameter including ISDN protocols, MSN settings and passwords</p>
<b>ATH</b>	<p><u>Disconnect</u></p> <p>Disconnects existing ISDN data connection after issuing the Escape sequence.</p> <p>ATH[//&lt;<b>UUS1data</b>&gt;]</p> <p><b>UUS1data</b> transmitted data with UUS1 signaling</p>
<b>ATI</b>	<p><u>Display version information</u></p> <p>Displays different information about version number and settings:</p> <p>ATI1 Returns internal checksum ("64")</p> <p>ATI2 Returns "OK"</p> <p>ATI3 Returns version string: "TA5.xy.z0"</p> <p>ATI5 Returns selected ISDN protocol: "0 - DSS1"</p> <p>ATI7 Returns "OK"</p> <p>ATI8 Returns "ERROR"</p> <p>ATI9 Returns plug and play ID string</p> <p>ATI77 Returns Boot loader version string</p> <p>ATI99 Returns software creation date</p>

<b>AT*I</b>	<u>Querying the alarm inputs</u> Response: <Input1>, <Input2> Values:        0        Input activated (LOW) 1        Input open (HIGH) This command can also be executed remote. The input state is also stored in the registers S17 and S18 (read only).
<b>AT&amp;K</b>	<u>Data Flow Control</u> Selects the data flow control behavior of the HELMHOLZ ISDN TA while in data communication phase. AT&K                No local data flow control between the DTE and HELMHOLZ ISDN TA is used <b>AT&amp;K3</b> Local data flow control is set to hardware handshake RTS/CTS AT&K4                Local data flow control is set to software handshake XON/XOFF
<b>AT#M</b>	<u>Received CLID</u> Displays the call line identification (CLID) that is received with an incoming call – this is the number of the called party addressed on the local S0 bus (selected MSN).
<b>AT*M</b>	<u>Transport protocol for the alarm messages</u> AT*M0                via data connection to the B channel protocol set with ATB AT*M1                as SMS to T-D1 network (protocol TAP with X.75) AT*M2                as SMS to Vodafone D2 network (protocol UCP with X.75) AT*M3                as SMS to E-Plus network (protocol TAP) The SMS gateways of the GSM network providers are entered with AT&Z1
<b>ATN</b>	<u>Set transmission baud rate V.110</u> Sets the transmission baud rate of the HELMHOLZ ISDN TA to the desired value. (Only valid for V.110 asynchronous B channel protocol). <b>ATN0</b> transmission baud rate automatically set (equal to local baud rate or less) ATN1                transmission baud rate    1.200 bit/s ATN2                transmission baud rate    2.400 bit/s ATN3                transmission baud rate    4.800 bit/s ATN4                transmission baud rate    9.600 bit/s ATN5                transmission baud rate 19.200 bit/s
<b>ATO</b>	<u>Return to online mode</u> If the HELMHOLZ ISDN TA is in command mode after entering an escape sequence out of an existing connection, ATO returns the HELMHOLZ ISDN TA back to data mode. Must be the last command in an AT command line.
<b>AT#O</b>	<u>Received CLIP</u> Displays the calling line identification (CLIP) that is received with an incoming call – number of the calling party.
<b>ATQ</b>	<u>Suppress results</u> With this command result codes or messages can be suppressed. <b>ATQ</b> returns status codes after command input (default) ATQ1                no result codes are returned
<b>AT&amp;R</b>	<u>CTS Control</u>

	<p>Selects the behavior of the CTS control line from the HELMHOLZ ISDN TA.</p> <p><b>AT&amp;R</b> HELMHOLZ ISDN TA control line CTS is following all changes of RTS</p> <p><b>AT&amp;R1</b> CTS is always ON</p>
<b>AT#R</b>	<p><u>Handle incoming calls</u></p> <p>Selects the behavior of the HELMHOLZ ISDN TA when an incoming call is received.</p> <p>When <b>AT#R1</b> is set, all incoming calls are ignored independent of all other settings.</p> <p><b>AT#R</b> enables automatic reject of all incoming calls</p> <p><b>AT#R1</b> enables automatic reject of all incoming calls</p>
<b>ATS</b>	<p><u>Display and set internal S register</u></p> <p><b>ATSnn?</b> displays the actual value (decimal) of selected register <i>nn</i></p> <p><b>ATSnn=xx</b> sets selected register <i>nn</i> to the decimal value <i>xx</i>.</p> <p>Overview about the S registers see chap. 7.3</p>
<b>AT&amp;S</b>	<p><u>DSR control</u></p> <p>Selects the behavior of the DSR control line from the HELMHOLZ ISDN TA.</p> <p><b>AT&amp;S</b> HELMHOLZ ISDN TA control line DSR is always ON</p> <p><b>AT&amp;S1</b> DSR ON indicates ISDN connection is established and synchronized</p>
<b>ATV</b>	<p><u>Result format</u></p> <p><b>ATV</b> result is presented as numbers (followed by &lt;.&gt;)</p> <p><b>ATV1</b> result is presented as text</p>
<b>AT&amp;V</b>	<p><u>Display current configuration</u></p> <p><b>AT&amp;V</b> displays the actual configuration of AT command setting including stored ISDN numbers</p> <p><b>AT&amp;V1</b> displays the actual configuration of extended AT command setting</p>
<b>AT*V</b>	<p><u>Alarm texts</u></p> <p><b>AT*V&lt;n&gt;?</b> querying the alarm texts</p> <p><b>AT*V&lt;n&gt;</b> entering the alarm text after prompt <b>NEW ALARMTEXT:</b></p> <p><b>&lt;n&gt;</b></p> <ul style="list-style-type: none"> <li>0 collective message (160 characters without individual messages, 12 characters with individual messages)</li> <li>1 individual messages for alarm 1</li> <li>2 individual messages for alarm 2</li> </ul> <p>The index n=0 may be left out.</p>
<b>ATW</b>	<p><u>Extended result codes</u></p> <p><b>ATW</b> result is presented with extended result codes</p> <p><b>ATW1</b> result is presented with extended result codes</p> <p>RING and CONNECT include the ISDN address, all others include the error reasons. Message RINGING will be displayed.</p>
<b>AT&amp;W</b>	<p><u>Store active configuration</u></p> <p>The active configuration will be stored in non-volatile memory.</p>
<b>ATX</b>	<p><u>Reduce result messages</u></p> <p>Reduces the number of result messages after trying to set up a connection</p> <p><b>ATX0</b> "CONNECT" only (without line speed)</p> <p><b>ATX1</b> "CONNECT" with line speed, "BUSY", "NO DIALTONE" are not used</p>

	<p>ATX2 "CONNECT" with line speed, "BUSY" is not used</p> <p>ATX3 "CONNECT" with line speed, "NO DIALTONE" is not used</p> <p><b>ATX4</b> "CONNECT" with line speed, all messages are used.</p>
<b>AT*X</b>	<p><u>Alarm triggering</u></p> <p>AT*X1 alarm 1 is triggered</p> <p>AT*X2 alarm 2 is triggered</p>
<b>AT*Y</b>	<p><u>Setting the switch outputs</u></p> <p><b>AT*Y</b>&lt;port&gt;,&lt;status&gt;</p> <p>&lt;port&gt;           0    Output OUT1</p> <p>                  1    Output OUT2</p> <p>&lt;status&gt;        0    normally closed</p> <p>                  1    normally open</p> <p>                  2    follows DCD (only for OUT1)</p>
<b>ATZ</b>	<p><u>Load stored settings</u></p> <p>The active configuration will be replaced by the stored configuration. Must be the last command in an AT command line.</p>
<b>AT&amp;Z</b>	<p><u>Store call number</u></p> <p>AT&amp;ZX=nn       stores the call number nn as entry number x into the telephone list (x = 1..3).</p> <p>AT&amp;ZX=-        deletes entry number x</p> <p>AT&amp;ZX           displays entry number x</p> <p>AT&amp;Z            displays all entries</p> <p>Note:           see configurator command <i>catab</i> for further information</p> <p><i>Fixed assignment for alarm functions</i></p> <p>AT&amp;ZX=nn       x=1   target number for data connection</p> <p>                  x=2   service center number for SMS dispatch (gateway)</p> <p>                  x=3   mobile phone number SMS recipient for alarm 2</p> <p>                  x=3   mobile phone number SMS recipient for alarm 1</p>
<b>AT#Z</b>	<p><u>Define own MSN</u></p> <p>Defines the MSN <i>nn</i> (multiple subscriber number) for the data port. If the number is set to "*" (default), all incoming calls are acceptable. The MSN can be displayed by the command AT#H or AT&amp;V.</p> <p>AT#Z=<i>nn</i>       sets MSN to <i>nn</i></p> <p>AT#Z            displays currently set MSN</p> <p>The MSN is automatically stored to non-volatile memory (without issuing command AT&amp;W).</p> <p><b>Note:</b>        If 1TR6 D channel protocol is selected, only one, or the last digit is valid.</p>
<b>AT**DBITS</b>	<p><u>Number of data bits <i>x</i> on DTE interface (7,8)</u></p> <p>Number of data bits <i>x</i> for asynchronous characters (7,default: 8)</p> <p>AT**DBITS=<i>x</i></p>
<b>AT**PRTY</b>	<p><u>Parity of asynchronous characters</u></p> <p>AT**PRTY=<i>x</i>   Selects the parity for asynchronous characters:</p> <p>                  <i>x</i>=0   no parity</p> <p>                  <i>x</i>=1   odd parity</p> <p>                  <i>x</i>=2   even parity</p>

## 7.2 ISDN specific AT commands

Only one command is allowed per line, default values are printed **bold**.

Command	Description
<b>AT**BSIZE</b>	<u>Set B channel block size</u> Defines the maximum length x of a data block transmitted or received in B channel (default: BSIZE = 2048). AT**BSIZE=x The value will be changed by setting the B channel protocol (ATBx).
<b>AT**LLC</b>	<u>Set low layer compatibility (LLC)</u> Defines the LLC value for outgoing calls in hexadecimal format. In some situation a specific LLC value is required to pass detailed information about the used B channel protocol to the called party. This can be done by setting the LLC to a fix value. <b>AT**LLC=-</b> Deleting of LLC-value (default: LLC is empty). AT**LLC=8890 Entering a new LLC value: The value will be changed by setting the B channel protocol (ATBx).
<b>AT**DTE</b>	<u>Set B channel Layer 2 address</u> Selects the Layer 2 link addresses. Only valid for protocols that are HDLC based (X.75, LAPB). <b>AT**DTE=0</b> Calling side reacts as DTE, called side reacts as DCE (default, X.75 standard) AT**DTE=1 TA reacts as DTE (own address = 01) AT**DTE=3 TA reacts as DCE (own address = 03) The value will be changed by setting the B channel protocol (ATBx).
<b>AT**K</b>	<u>Set Layer 2 window size</u> Sets window size x layer 2 protocol B channel:         x = 1 ..7, default: <b>7</b> AT**K=x The default value is dependent of the selected B channel protocol.
<b>AT**PTP</b>	<u>Set ISDN interface type</u> <b>AT**PTP=0</b> select point to multipoint mode (to connect ISDN terminals, default) AT**PTP=1 select point to point mode (to connect ISDN switching systems)
<b>AT**RPWD</b>	<u>Password for remote configuration</u> Sets password for remote configuration to mmm (1..32 chars) Default: no password. AT**RPWD=mmm
<b>AT**SPID</b>	<u>Set SPID (optional)</u> For ISDN lines in the U.S. you have to set the SPID. You get it from your ISDN provider. AT**SPID1=xxxx Set SPID 1 AT**SPID2=xxxx Set SPID 2
<b>AT**&lt;cmd&gt;</b>	<u>Execute configuration command</u> Executes a configuration command.

## 7.3 S Register

The HELMHOLZ ISDN TA has status register which control the operation.

S register can be read and written using the **ATS** command. Certain S registers can **only** be read, while others can only be set within a limited range of values.

Register	Description
<b>S0</b>	<p>0: no automatic call acceptance, acceptance of an incoming call is controlled by the data terminal (command <b>ATA</b> after RING)</p> <p><b>1:</b> immediate call acceptance by the HELMHOLZ ISDN TA (default)</p> <p>2..n: call acceptance by the HELMHOLZ ISDN TA after <i>n</i> "RING" messages</p> <p><b>Note:</b> The time between 2 ring messages can be set with the command "ringtimer" (default = 5 s.)</p>
<b>S1</b>	Ring tone counter (read only)
<b>S2</b>	Escape character (default = 43h)
<b>S3</b>	Return character (default = 0Dh)
<b>S4</b>	Line feed character (default = 0Ah)
<b>S5</b>	Backspace character (default = 1Ah)
<b>S7</b>	Waiting time for carrier signal in seconds (default = 30)
<b>S9</b>	Set PNP functionality for Windows95 (default=1, enabled)
<b>S14</b>	<p>Status switch output OUT1</p> <p><b>0</b> <b>normally closed</b></p> <p>1 normally open</p> <p>2 follows DCD</p>
<b>S15*</b>	<p>Status switch output OUT2</p> <p><b>0</b> <b>normally closed</b></p> <p>1 normally open</p>
<b>S16</b>	Last CAPI/ISDN error
<b>S17</b>	<p>Status alarm input 1 (read only)</p> <p>0 activated (connected to GND)</p> <p>1 open</p>
<b>S18</b>	<p>Status alarm input 2 (read only)</p> <p>0 activated (connected to GND)</p> <p>1 open</p>
<b>S90</b>	Last incoming ISDN call number (CLIP)
<b>S91</b>	<p><b>0:</b> Default</p> <p><b>1:</b> All unknown AT commands are answered with OK</p> <p><b>2:</b> Windows 2000 compatibility: Some AT commands (see list below) are answered with OK, unknown commands are answered with OK.</p>

## 8 Configuration Software HSComm

The configuration program HSComm is available to ease the configuration of the HELMHOLZ ISDN TA.

### 8.1 System Requirements

- Windows 95 or newer
- Display with a resolution of 800 x 600 pixels or more
- CD-ROM-drive or network connection
- serial interface (9 pin connector/9 pin socket)

### 8.2 Installation Of The Configuration Software

You can start HSComm ISDN via CD: Hutschiene DIN-rail ISDN\Hscomm ISDN.exe

### 8.3 Program Description

Using the configuration software HSComm, the most important settings and configurations can be made comfortably and simply without knowledge of the AT commands.

**HS COMM ISDN**

File Serial Interface Terminal Configure Error Device Language SP5 Help Info

**Alarm and safety functions**

**Password**

Change password

**Alarm output**

☒ Default setting low  
☐ Default setting high  
☐ Set to DCD at alarm

**other**

☒ Result messages for connect  
☐ auto answer  
 Rings to auto answer: 0

**Action at alarm**

☒ Alarm input active  
 Characters for dial prefix:

standing connection  
 terminate connection

☒ Call telephone number: 49170 123456789  
☐ Call telephone number: 0172  
☐ SMS to D1 - mobile: 49177  
☐ SMS to D2 - mobile:  
☐ SMS to E - mobile:

Alarm text/SMS: (max 159 characters) 89 characters remaining

alarm from Helmholtz ISDN - location main pump station  
Market Street No. 5

**Access protection**

☐ Access protection:  
☐ Callback:  
 Callback time for security callback: 00 seconds

**Handshake**

☒ no Handshake  
☐ RTS/CTS  
☐ XON/XOFF  
☐ RTS/CTS + XON/XOFF

**DTR options**

☒ No DTR control  
☐ Hang up  
☐ Command mode  
☐ Reset

**Protocol**

☐ V110 asynchron  
☐ HDLC transparent  
☐ Byte transparent  
☐ V.120 async  
☒ X.75-SLP  
☐ X.25 B  
☐ Async HDLC  
☐ X.31 D  
☐ External

MSN:

COM1 19200 8N1 TX

**Helmholtz**  
compatible with you

Read settings

Reset modem

Send default settings

Send

The following data can be modified among other settings using the interface:

- Changing the password for remote control and security callback
- Default setting of the switch output (low, high, high during alarm sending)
- Entering the alarm text
- Activation of the alarm input
- Network selection to which the SMS is to be sent
- Entering the phone number to which the message is to be transmitted
- Access control
- Type of handshake function
- Type of DTR behavior
- Selecting the protocol
- Echo (on/off)
- Short answers (on/off)

Attention: Only by pushing the button **Send**, the settings are transmitted to the HELMHOLZ ISDN TA.

### 8.3.1 Menu Commands

The following settings can be made with the menu commands:

Command	Description
File/new datafile	Creates an empty parameter data record. Serves for setting of a defined initial state.
File/load datafile	Loads a stored parameter data record.
File/save datafile	Stores the actual parameter data record.
File/save datafile as	Stores the actual parameter data record under a new file-name.
File/send data	Loads an ASCII file into the HELMHOLZ ISDN TA.
File/Exit program	Terminates the program HSComm.
Interface	Calls the dialog window for setting the interface parameters.
Terminal	Calls up the terminal window.
Configure	Calls up the configuration window.
Device/ Reset device	Resets the connected HELMHOLZ ISDN TA.
Info	Displays an information window with information about the manufacturer and the program.



## 9 ISDN Information

### 9.1 Abbreviations For ISDN Service Features

Abbreviation	Description
AOCD	Advice of charge during the call
AOCE	Advice of charge at the end of the call
CCBS	Completion of calls to busy subscribers
CFB	Call forwarding busy
CFNR	Call forwarding no reply
CFU	Call forwarding unconditional
CLI (CLIP)	Call line identification presentation
CLIR	Call line identification restriction
COLP	Connected line identification presentation
COLR	Connected line identification restriction
CW	Call waiting

### 9.2 Protocols And Channels

#### 9.2.1 D channel

The D channel (data channel) transfers control information, like call numbers, units, services, etc. within the ISDN.

The D channel is a signaling channel.

The transmission of control and management information before, during, and after the connection takes place here.

The transmission speed at the basic rate interface is 16 kbit/s, and for the primary rate interface it is 64 kbit/s. The available D channel is used for the signaling information of all existing B channels.

The D channel protocol is a fixed standard, which transmits control and management information of the connections.

The D channel protocol is referred to as DSS1 in Euro ISDN. It is an adaptive HDLC protocol.

#### 9.2.2 B Channel

Each basic rate interface (multipoint and ISPBX connection) has 2 B channels available.

The information transmission in the B channel takes place unsecured in ISDN. Security procedures have to be used for flawless transmission therefore.

## **X.25**

X.25 is a protocol for data transmission in packet switched networks like Datex-P of the German Telekom.

## **X.31**

X.31 is an international manufacturer-independent ITU standard for the connection of ISDN systems to X.25 networks. Packet oriented terminal devices are supported by ISDN using X.31.

## **X.75 Protocol**

The X.75 protocol is also known as X.75SLP (=Single Line Protocol). X.75 is the standard protocol for data transmission in packet switched networks in ISDN with a transmission rate of 64 kbit/s.

It has the same use like V.42 for modem connections in principle. It extends the payload data from higher layers to obtain information about failure control. The X-75 layer of the remote party checks all data using this information and requests the data again if it detects that they have been falsified during transmission.

There are three more parameters which can be set for the X.75 protocol.

- The data block size on layer 2 (data length, frame size, block size)
- The maximum number of blocks to be sent (window size)
- The module mode

## **HDLC transparent (layer 1b protocol)**

The HDLC protocol is a control protocol for the data transmission for point-to-point or point-to-multipoint connections and is usually used (automatically) in connections with X.75 for data protection.

HDLC uses no control characters and is code-independent. To transmit data within HDLC, the connection will be established first, then the data transmission takes place, and then the connection will be terminated again. Failures are detected by using so called frames and windows during transmission and the transmission will be repeated if necessary.

If a failure correction is not necessarily required (e.g. for voice services) or protocols of higher layers take over the failure correction (e.g. a transmission mode like Z-HELMHOLZ ISDN TA), the failure correction does not have to be performed on layer 2 again.

## **V.110 (layer 1b protocol)**

V.110 is the description for a standard for transmitting data between an analog connection and an ISDN connection (data rate 1.200 to 38.400 bit/s, asynchronous) or between two ISDN connections (data rate 56 or 64 kbit/s).

The task of V.110 is (in asynchronous mode) to depict an asynchronous data stream between 300 and 38.400 bps at the 64.000 bps ISDN data stream. Since always 64.000 bps go over the line, the protocol inserts fill bits into the data stream to level out differences to 64.000 bps. The fill bits are extracted and thrown away at the remote terminal then. The connection represents itself for the layers above level 1 as if only 38.400 bps would go over the line really. V.110 slows down the ISDN speed to 300 bps theoretically. Practically this goes down to 9.600 bps.

In contrast to X.75, for which problems might occur with the access parameters, there are fixed standards for V.110.

The bit rate (300 to 38.400 bps) has to be the same for both communication partners.

### **V.120 Protocol**

V.120 is the standard for asynchronous data transmission with 57.600 bit/s in ISDN.

V.120 can be compared with X.75 concerning the tasks. HDLC is also used for failure detection for V.120.

### **PPP Protocol**

The PPP protocol (point to point protocol) is a standard method for the transmission of multi-protocol-datagrams.

An important protocol feature of PPP is the failure correction:

Failures, which occurred during the transmission, are detected automatically here. But this failure correction results some more overhead. This is at least 8 bytes of additional overhead per packet. But this will be compensated if either the line quality is poor or one of the two computers is under heavy load.

Another feature of PPP is the LCP (Link Configuration Protocol):

This adjusts the connection settings. Among other things, the IP addresses are exchanged—even assigned if necessary (dynamic address assignment). The configuration of such an interface is much easier using the LCP.

## **9.3 Frequent ISDN Error Messages**

In case of a failing connection the exact failure reason is recorded in the protocol memory of the ISDN TA. The most frequent error messages are described here; a complete list of the error messages follows below (see chap. 9.4).

### **Layer 1 protocol error**

No physical connection to the ISDN network exists. Check the cable connection between ISDN adapter and ISDN connection. Do you use a correct cable? Has the connection socket been installed correctly? Is the ISDN network termination activated correctly? Are there any other devices at the ISDN connection, which might be defective or block the S0 bus?

### **Layer2 protocol error, e.g. DTE address invalid, TEI invalid**

No connection to the ISDN network could be established. A wrong ISDN protocol could be the reason. Is the ISDN protocol set to "1TR6" (German ISDN) , while your ISDN connection is a standard "DSS1" (Euro ISDN), or the other way round?

### **Unallocated (unassigned) number**

"This number is not assigned". The remote terminal could not be contacted since the called number is not assigned to a participant. However, the phone number has a valid format. Please refer to your phone company or the provider of your ISPBX for the up-to-date phone number.

**Normal clearing**

"Regular end of the connection". One of the parties of this connection has terminated the connection. The connection has not been interrupted by the ISDN network.

**User busy**

"Busy". The remote terminal cannot accept another call right now since all channels are busy.

**No user responding**

The remote terminal does not respond within the preset period to your connection request. No terminal device is connected at the remote side. Please contact the operator of your remote terminal.

**No answer from user (user alerted)**

The remote terminal has acknowledged the incoming call within the set period, but no connection has been established. If the remote device is a phone, it has rung, but the call has not been accepted. Please call again after a while.

**Call rejected**

The device contacted under the phone number has rejected the call, although it is not busy and could accept the call. Example: If the ISDN-Option "call waiting" is activated at the remote terminal, a phone at the remote terminal could accept your call even if it is busy. This error message occurs if your incoming call has been rejected by the participant of the remote terminal.

**Number changed**

The phone number of the remote terminal has changed. Please ask your phone company for the up-to-date phone number.

**Destination out of order**

The terminal device at the called number could not be contacted since the interface to this terminal device did not work. Possible reasons: The terminal device at the remote side is not connected or not turned on or does not work correctly. Please contact the operator of the remote terminal to clarify the reason.

**Invalid number format**

The remote terminal could not be contacted since the called number has no valid format or is incomplete.

**No circuit/channel available**

No B channel is available for a call at the moment. The ISDN TA triggers a locking release upon this and makes a B channel available.

**ISDN network out of order**

Problems in the ISDN network. Wait some time and try again to call.

**Temporarily failure**

Temporary problems in the ISDN network. You can immediately try to call again.

### Incompatible destination

The terminal device of the remote side is not compatible with the calling terminal device. The call cannot be accepted therefore. This failure occurs e.g. if the remote terminal device is a regular phone.

## 9.4 Extended Error Messages For ISDN

Reason (hexadecimal)	Description	AT response	X.25 re- sponse
0000	No error		
0001	NCPI ignored		
0002	Flags ignored		
0003	Alert already sent		
1001	Too much CAPI applications		
1002	Logic block size too small		
1003	Buffer bigger than 64k		
1004	Buffer of the message too small		
1005	Too much logical connections		
1006	Reserved 1		
1007	Message has not been accepted		
1008	Register: OS resources failure		
100a	External equipment not supported		
100b	Only external equipment		
1101	Wrong application ID		
1102	Invalid command or message length		
1103	Message queue full		
1104	Message queue empty		
1105	Message has been lost		
1106	Unknown message		
1107	Message not accepted		
1108	OS resources failure		
1109	CAPI not installed		
2001	Wrong state		

Reason (hexadecimal)	Description	AT response	X.25 re- sponse
2002	Invalid identifier		
2003	No PLCI free anymore		
2004	No NCCI free anymore		
2005	No LISTEN free anymore		
2006	No fax resource existing anymore		
2007	Invalid message parameter		
3001	B1 protocol not supported		
3002	B2 protocol not supported		
3003	B3 protocol not supported		
3004	B1 protocol parameter not supported		
3005	B2 protocol parameter not supported		
3006	B3 protocol parameter not supported		
3007	B channel protocol combination not supported		
3008	NCPI not supported		
3009	Unknown CIP value		
300a	Flags not supported		
300b	Facility not supported		
300c	Data length not supported		
300d	Reset procedure not supported		
3301	Layer 1 protocol error		
3302	Layer2 protocol error, e.g. DTE address invalid, TEI invalid		
3303	Layer 3 protocol error		
3304	Another application has accepted the call		
3311	Fax remote station is no fax		
3312	Fax training terminated with error		
3313	Fax connection termination before data transmission		
3314	Fax connection termination remote termination		

Reason (hexadecimal)	Description	AT response	X.25 re- sponse
3315	Fax connection termination remote procedure		
3316	Fax connection termination "local transmitter underrun"		
3317	Fax connection termination "local receiver overflow"		
3318	Fax connection termination "local abort"		
3319	Fax invalid send data		
3481	Unallocated (unassigned) number	3	13, 78
3482	No route to transit network	3	0D, 78
3483	No route to destination	3	0D, 78
3486	Channel unacceptable	6	05, 78
3487	Call awarded and being delivered in an established channel	6	05, 78
3490	Normal clearing	3	00, 78
3491	User busy	7	01, 78
3492	No user responding	8	09, 78
3493	No answer from user (user alerted)	8	09, 78
3494	No answer from user (device off)	8	09, 78
3495	Call rejected	8	21, 78
3496	Number changed	3	0D, 78
349A	Non selected user clearing	3	00, 78
349B	Destination out of order	8	09, 78
349C	invalid number format	3	13, 78
349D	Facility rejected	3	13, 78
349E	Response to STATUS ENQUIRY	3	13, 78
349F	Normal disconnect, unspecified	3	00, 78
34A2	No circuit/channel available	7	01, 78
34A6	ISDN network out of order	6	05, 78
34A9	Temporarily failure	6	05, 78

Reason (hexadecimal)	Description	AT response	X.25 response
34AB	Access information discarded	6	05, 78
34AC	Requested circuit/channel not available	6	05, 78
34AE	Precedence call blocked	6	05, 78
34AF	Resource unavailable, unspecified	6	05, 78
34B1	Quality of service unavailable	3	13, 78
34B2	Requested facility not subscribed	3	13, 78
34B5	Outgoing calls barred within CUG	3	13, 78
34B7	Incoming calls barred within CUG	3	13, 78
34B9	Bearer capability not authorized	3	13, 78
34BA	Bearer capability not presently available	3	13, 78
34BF	Service or option not available, unspecified	3	13, 78
34C1	Bearer capability not implemented	3	13, 78
34C2	Channel type not implemented	3	13, 78
34C5	Requested facility not implemented	3	13, 78
34C6	Only restricted digital information bearer capability is available	3	13, 78
34CF	Service or option not implemented, unspecified	3	13, 78
34D1	Invalid call reference value	3	21, 78
34D2	Identified channel does not exist	3	21, 78
34D3	A suspended call exists, but this call identity does not	3	21, 78
34D4	Call identity in use	3	21, 78
34D5	No call suspended	3	21, 78
34D6	Call having the requested call identity has been cleared		21, 78
34D7	User not member of CUG	3	21, 78
34D8	Incompatible destination	3	21, 78
34DA	Non-existent CUG	3	21, 78
34DB	Invalid transit network selection	3	21, 78
34DF	Invalid message, unspecified	3	21, 78



Reason (hexadecimal)	Description	AT response	X.25 re- sponse
34E0	Mandatory information element missing	3	21, 78
34E1	Message type non-existent or not implemented	3	21, 78
34E2	Message not compatible with call state or message type non-existent or not implemented	3	21, 78
34E3	Information element /parameter non-existent or not implemented	3	21, 78
34E4	Invalid information element contents	3	21, 78
34E5	Message not compatible with call state	3	21, 78
34E6	Recovery on timer expiry	3	21, 78
34E7	Parameter non-existent or not implemented, passed on	3	21, 78
34EF	Protocol error, unspecified	6	05, 78
34FF	Network interworking error, unspecified	6	05, 78