



Tixi ISDN TA Manual

Tixi Super Modem ISDN AT (SD03)
Tixi Message Modem AT ISDN (ED20)
Tixi Message Modem AT ISDN & Fax (EF20)

Tixi Alarm Modem ISDN (JD20)
Tixi Alarm Modem ISDN&Fax (JF20)

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1 Introduction

The Tixi ISDN TA is an ISDN terminal adapter that is built-in your Tixi device. It enables you to fully use ISDN features together with your Tixi device which gives you several advantages, as faster connection establishing and better transfer ratio.

For Tixi operation, the Tixi Server will control the ISDN card. But you might want to use the adapter even with external applications, maybe for surfing the www or some home banking activities. This manual provides the information you need to operate the Tixi ISDN TA properly even by other software than Tixi.

1.1 About this ISDN TA

At this stage, a word of explanation regarding synchronous and asynchronous data transmission. In the synchronous mode, additional synchronisation signals are required, to synchronize the transmission and reception signals. In the asynchronous mode synchronisation is by means of “start-bits” and “stop-bits” which mark the beginning and end of each data word.

The modem can dial by itself and also react automatically to incoming calls. The information it needs in order to dial a telephone number, together with the various configuration commands, are provided by the respective data terminal equipment via the same serial interface which is used to send the data. In this mode, the system operates with the so-called “AT” command set.

1.2 What is ISDN ?

This chapter will help you to understand the special capabilities of the ISDN network.

ISDN is an abbreviation for **I**ntegrated **S**ervices **D**igital **N**etwork.

This already gives you an information about the main features: ISDN is a digital network with several interated services.

Because of the digital network, ISDN is faster and has a better line quality as an analogue PSTN line.

With ISDN you will get two independend lines, depending on the contract with your telephony provider. You will get 3 phone numbers (MSN: multiple subsriber number) which you can assign to different devices or services.

The most advantage of ISDN are the different services which are:

VOICE
FAX
DATA

An example will help you to understand this feature:

You have three phone numbers with your ISDN line: 2001, 2002, 2003

You have a faxmachine, a telephone and a Tixi-Mail Box ISDN.

You assign the number 2001 to your telephone, the 2002 to your faxmachine and also the 2002 to your Tixi-Mail Box.

The telephone will answer all incoming calls on number 2001.

The Tixi-Mail Box ISDN will only answer incoming calls with the service "DATA" on number 2002, all incoming calls with service "FAX" will be answered by the faxmachine even if it's configured on the same number.

2 General Description

This is an overview of general product features:

- The Tixi ISDN TA gives access to other devices connected to the ISDN network.
- B-channel protocols:
 - V.110, X.75, HDLC (sync PPP), ML-PPP
- Transmission with 64000 bps (single line)
- Transmission with 128000 bps (channel bundling)
- Asynchronous communication between modem and computer
- AT-command set
- Number storage for 3 telephone numbers
- Automatic baudrate-adaption up to 230.400 bps
- Caller Line Identity Presentation (CLIP)
- Flash rom
- Plug&Play Installation for Windows 9x / ME / Windows 2000
- On/Off switch

To work with Tixi ISDN TA you need

- an ISDN Basic Rate Interface (BRI) (replacing an analogue telephone line). The basic rate access can be ordered by your local telephone company or PTT.
- a PC with a terminal emulation to configure the Tixi ISDN TA

The Tixi ISDN TA has the certificate of conformity for the connection to the PSTN according to TBR3 with TBR3A1:

CE-0682 for Europe (EC)

Tixi ISDN TA is compliant to the European safety requirements IEC 60 950. Please use the shipped power supply only or an original replacement from Tixi.Com GmbH.

The Tixi ISDN TA is compliant to the European rules of EMC EN50081-1, here Product Standard EN55014/EN55022 class B and FCC part 15 class B, for electromagnetic field emission and EN50082-1 for emission of electromagnetic interference.

3 Installation

3.1 Hardware Installation for all operating systems

- Connect the serial cable to a COM port of your PC and to the appropriate jack of the Tixi ISDN Modem.
- Use the telephone cable to connect the RJ45 jack of your Tixi ISDN Modem to the telephone wall outlet.
- Connect the Tixi ISDNModem to the power supply using the AC adapter. Switch Tixi on.

3.2 Installation of the Modem Drivers within Windows 9x /ME /2000

Within Windows 9x/ME/2000, the modem will be detected automatically after restarting the PC.

When asked by Windows 9x/ME/2000, please insert the Tixi CD and choose your CD-ROM. Please read the instructions on installing the software in the Tixi Handbook.

3.3 Installation of the Modem Drivers within Windows NT4.0

Click on **Start > Settings > Controlpanel > Modems**. A dialog window for modem installation opens. Click on **Select Modem (no automatic detection)** and then on **Next**. In the next dialog window, click on **Have Disk**. Then insert the Tixi-Mail CDROM and enter the appropriate driveletter (eg D:\).

A list shows the modem drivers contained on the CDROM. From this list, choose your Tixi device and click on **Next**. In the next dialog window specify the COM port where your Tixi device is attached to, eg COM2, and click on **Next**. The modem is going to be configured now. Then click **Finish** in order to end the installation.

You have to repeat this step for each B-channel protocol device driver.

Read the instruction in the Tixi Handbook for installing the TA ISDN Configurator.

3.4 Configuration

By use of the *TA ISDN Configurator* the configuration parameters of the Tixi ISDN TA will be set. If you don't know the correct parameter, please contact the provider of your ISDN basic rate interface (telephone company).

Please make sure that the Tixi device is connected to the serial interface as well as to the power supply.

After setting the following parameters you can shutdown the Configurator. The Tixi ISDN TA is now ready to be used with Modem applications (i.e. Microsoft Dial-Up Networking).

- **D channel protocol**

The ISDN D channel protocol is the most important characteristic of your ISDN basic rate interface. Different countries will support different D channel protocols. Euro-ISDN (*DSS1*) will be used nearly all over Europe. Tixi may support several of these protocols.

- **MSN**

This selects the telephone number of the data port that will be used for incoming and outgoing calls. The complete telephone number (without area code) will be supplied by the ISDN provider.

- **Call bumping**

These parameter configure the behavior when multilink PPP is used. Please refer to chapter 8.3

3.5 Configuration for Internet

To access the Internet via ISDN you have to have a contract with an Internet service provider (ISP) who runs an ISDN access. To configure the Tixi ISDN TA you need the following information from the ISP:

- ISDN access number (to be entered at the PC program)
- Layer 2 protocol, usually the protocol-type PPP by selecting Modem syncPPP (HDLC).
- Access protocol (to be entered at the PC system software or Internet software)

To configure the Internet access software on the PC it may be necessary that you need some additional information like TCP/IP address, user name, password etc. Please refer to the software manual and ask your Internet Service Provider about details of your access data.

4 Guidelines for Using AT Commands

The ISDN TA is programmed with AT commands from the data terminal equipment (computer, PC or terminal) and thus also receives instructions to cover automatic dialling. The communications or fax software will carry out most of these operations for you, so that in general circumstances you do not need to have a detailed understanding of the commands which are described below.

The ISDN TA must be in command mode before it can accept commands. In this condition, all the characters sent from the computer are interpreted as commands and, where appropriate, confirmed by a modem message on the screen. When a connection is set up to a remote modem, the modem will switch to data mode and transfer all the characters it receives to the other party.

The ISDN TA can be switched from an existing connection, back into the command mode, by using the Esc Sequence (+++), without breaking off the connection to the remote modem. In this status, any commands which are entered will not be transferred to the remote modem.

The ISDN TA is activated by AT commands, the subsequent value of which will modify the form of the command. ISDN TA messages provide information on the form of the commands.

In the Hayes Command Set, commands are entered by the character sequence AT (at) and can also be entered as a list of commands with or without spaces between the individual commands. The "Backspace" key is used for deleting. Commands can be entered in uppercase or lowercase. In the command mode, the modem automatically recognizes data frames and data speed.

- AT commands can be transferred to the modem at the following data speeds: 230400, 115200, 57600, 38400, 19200, 9600, 4800, 2400, and 1200 bps

4.1 Examples of Command Syntax:

```
ATX3<CR>
```

```
ATQ0<CR>
```

```
ATD12345<CR>
```

Individual commands ending with the <CR> Enter key, can be entered in a different manner with the same effect, by inserting as many spaces as you need, to make the command easier to visualise

```
ATX3Q0D12345<CR> or:
```

```
AT X3 Q0 D12345<CR>
```

4.2 Standard Commands

ATA	Answer mode: Modem monitors telephone line
A/	Repeat last command line; entered without "AT"
ATB	Switching between B-channel protocols
ATD	Enter automatic dialling
ATE	Controlling of echo modem commands on screen
ATH	Break off an existing connection
ATI	Information on Modem product code
ATN	Select Data Rate Handshake
ATO	Return to Online-mode after entering Esc sequence
ATQ	Controlling modem messages
ATS	Read and modify modem register(s)
ATV	Modem message format (verbal or numeric)
ATW	Directing speed messages
ATX	Modem function during dialling; modem messages
ATZ	Modem Reset and Load one of the stored modem profiles
+++	Escape Sequence to return temporarily to Command mode
AT&C	Controlling M5 (DCD) Signal at the serial interface
AT&D	DTR Option
AT&F	Load the factory setting
AT&K	Flow Check
AT&R	Controlling M2 (CTS) and S2 (RTS) Signal at the serial interface
AT&S	Controlling M1 (DSR) Signal at the serial interface
AT&V	Displaying current configuration
AT&W	Storing Modem settings
AT&Z	Storing telephone numbers

5 AT command set

All parameter can be changed by using an extended AT command set described in this chapter.

Please check if the factory setting will fit with your environment. The factory setting is printed in boldface in the parameter list shown in chapter "AT command set" (see below).

If you want another configuration as set in the factory default setting, please do the following steps:

- Connect the Tixi ISDN TA to ISDN interface
- Connect the PCs com-port to the DTE interface of the Tixi ISDN TA.
- Connect the power supply to the mains socket.
- Start a terminal emulation on your PC, please verify that the baudrate setting of the terminal emulation fits those of the Tixi ISDN TA.
- Set up the parameter of the Tixi ISDN TA from the terminal emulation and save the parameter using the AT command set.

Example:

To change the used B channel protocol to X.75 please enter the following commands:

ATB10<↵> (set protocol to X.75)

AT&W<↵> (save the new configuration)

- Leave your terminal emulation and start your application program.

With the exception of the command **A/** (Repeat command) all commands begin with the prefix **AT** and are terminated with <CR>. Corrections in a command line are done with <BACKSPACE>. A command line has a maximum of 80 characters. The command line is automatically cancelled by longer input. Blanks are ignored, capital/small letters are not significant.

The parameter settings of the Tixi ISDN TA obtained when using the AT commands can be permanently stored (AT&W) and are not lost by resetting or by leaving the AT command mode.

To enter the AT command mode during an active data connection you must use the following sequence ("Escape sequence"):

at least 1 sec pause **<+><+><+>** 1 sec pause

The time gap between all three plus signs may not exceed 1 sec.

The escape sequence is transmitted transparent to the remote device.

5.1 Supported commands:

A/ Repeat last command line

This command repeats the commands of the last entered command line.

Note: No prefix **AT** is required.

A/

A Accept incoming call

Using this command you can accept an incoming call, if automatic call acceptance is not set (Register S0 = 0). An incoming call is displayed by the message "RING" or the code "2".

Must be the last command in an AT command line.

ATA[//<UUS1data>]

UUS1data transmitted data with UUS1 signalling

B B channel protocol

Transmission protocol for data communication in the B channel.

ATB0: V.110 (option)

ATB3: HDLC async to sync conversion (PPP asynchronous, single link PPP, default) (i.e. for Internet / dial-up network access)

ATB4: HDLC transparent (octets are packed into HDLC frames)

ATB5: Byte transparent (raw B channel data)

ATB10: X.75-NL (i.e. for BBS access)

ATB22: T.70-NL-CEPT (for T-Online (videotext) access)

ATB23: T.90-NL

ATB31: Multilink PPP (ML-PPP)

%B Set local baudrate

Sets the local baudrate of the TA to the desired value (fix value) or to autodetection. When autodetection is set, the TA will recognize the desired baudrate with every newly entered AT command by the terminal equipment (PC). With all other settings the PC must use the same baudrate.

Must be the last command in an AT command line.

AT%B0	Automatic local baudrate detection enabled (autobauding, default)
AT%B1	Local baudrate set to 1200 bit/s
AT%B2	Local baudrate set to 2400 bit/s
AT%B3	Local baudrate set to 4800 bit/s
AT%B4	Local baudrate set to 9600 bit/s
AT%B5	Local baudrate set to 19200 bit/s
AT%B6	Local baudrate set to 38400 bit/s
AT%B7	Local baudrate set to 57600 bit/s
AT%B8	Local baudrate set to 115200 bit/s
AT%B9	Local baudrate set to 230400 bit/s

&C DCD control

Selects the behavior of the DCD control line from the Tixi ISDN TA.

AT&C	Tixi ISDN TA control line DCD and Line-LED is always ON.
AT&C1	DCD ON indicates ISDN connection is established and synchronized (default)

#C Received bearer service

Shows the bearer service that is received with an incoming call in hexadecimal coding *hbhb*.

The value for *hbhb* (word) is the CIP value as defined in the CAPI 2.0 specification.

AT#C

#C1=hbhb Select bearer service outgoing

Selects the bearer service that will be sent with an outgoing call

The value for *hbhb* (word) is the CIP value as defined in the CAPI 2.0 specification.

Example: an outgoing call as a voice call: AT#C1=0004.

#C2=hbhbhbhb Select bearer service incoming

Selects the bearer services that can be accepted with an incoming call. The definition of *hbhbhbhb* (double word) is the CIP mask as defined in the CAPI 2.0 specification.

Example: AT#C2=00030012 : Accept analogue incoming calls

AT#C2=00000001 : Accept all incoming calls.

Note: Before issuing an outgoing call the command AT#C1 has to be set.
To use the predefined services please setup factory defaults (AT&F).

D Initiate outgoing call

Dials the number (D for Dial). The dial modifier "W", ">", "T", ";", "@" can be freely inserted in the dial string; they have no influence on the dial procedure of the Tixi ISDN TA.

Must be the last command in AT command line.

Any character input while the TA is dialing will cancel the dialing procedure.

ATD<CALLEDnumber>[/<subaddr>][!/<UUS1data>]

CALLEDnumber: ISDN call number for a dialled B channel connection

subaddr dialled subaddress

UUS1data transmitted data with UUS1 signalling

ATDL Dial the last dialed number

ATDS=*n* Dial number *n* from stored telephone number list (*n* = 1..3)
(See command AT&Z to store numbers)

Note: - To setup the own subaddress see command AT**SUB.

&D DTR control

Selects the behavior of the Tixi ISDN TA, when the DTE control line DTR changes from ON to OFF.

AT&D DTE control line DTR setting is ignored

AT&D2 DTE control line DTR is evaluated: dropping the DTR line by the DTE will disconnect an existing ISDN connection (default).
An incoming call will accepted only with DTR active.

E Local echo

Selects the local echo in command mode.

ATE No local echo

ATE1 Local echo on in command phase (default)

&F Load factory defaults

Factory default will be loaded, ISDN protocol setting and MSN's will not be overwritten. (for storing in non volatile memory please use the command AT&W).

AT&F set-up all parameter concerning data port and B-channel

AT&F1 set-up all parameter including MSN

H Disconnect

Disconnects existing ISDN data connection, after issuing the Escape sequence (see page 10).

ATH[//<UUS1data>
UUS1data transmitted data with UUS1 signalling

#H Display MSN

Shows own MSN (multiple subscriber number) for the data port.
default: MSN = "*" (no MSN).

The MSN can be set by command AT#Z.

AT#H

I Display version information

Displays different information about version number and settings:

AT10 ID-String for modem code
AT11 Version numbers for firmware
AT12 implemented software features
AT13 present hardware
AT14 Product code
AT15 settings of hardware
AT16 Country settings
AT17 Manufacturer
AT18 original filename for main program
AT19 PnP string
AT110 Error

&K Flowcontrol

Selects the flow control behavior of the Tixi ISDN TA while in data communication phase.

AT&K No local flow control between the DTE and Tixi ISDN TA is used
AT&K3 Local flow control is set to hardware handshake RTS/CTS (default)
AT&K4 Local flow control is set to software handshake XON/XOFF

#M Received CLID

Shows the called line identification (CLID) that is received with an incoming call – this is the number of the called party addressed on the local S-bus (selected MSN).

AT#M

N Set line baudrate V.110

Selects the line baudrate of the TA to the desired value (only valid for B channel protocol V.110 asynchronous).

- ATN1 Line baudrate set to 1200 bit/s (option)
 - ATN2 Line baudrate set to 2400 bit/s
 - ATN3 Line baudrate set to 4800 bit/s
 - ATN4 Line baudrate set to 9600 bit/s
 - ATN5** Line baudrate set to 19200 bit/s
-

O Return to online state

If the Tixi ISDN TA is in command mode after issuing an escape sequence out of an existing connection, ATO brings the Tixi ISDN TA back to data phase. Must be the last command in AT command line.

ATO

#O Received CLIP

Shows the calling line identification (CLIP) that is received with an incoming call – number of the calling party.

AT#O

Q Suppress results

With this command result codes or messages can be suppressed.

- ATQ** Returns status - codes after command input (default)
 - ATQ1 No result codes are returned
-

&R CTS control

Selects the behavior of the CTS control line from the Tixi ISDN TA.

- AT&R Tixi ISDN TA control line CTS is following all changes of RTS
 - AT&R1** CTS is always ON (default)
-

#R Handle incoming calls

Selects the behavior of the Tixi ISDN TA when an incoming call is received.

- AT#R** Disable automatic reject of all incoming calls (default)
- AT#R1 Enable automatic reject of all incoming calls

S Display and set internal S register

ATS*nn*? Show actual values (decimal) of selected register *nn*
ATS*nn*=*xx* Set selected register *nn* to the decimal value *xx*.

&S DSR control

Selects the behavior of the DSR control line from the Tixi ISDN TA.

AT&S Tixi ISDN TA control line DSR is always ON (default)
AT&S1 DSR ON indicates ISDN connection is established and synchronized

V Result format

ATV Result is presented as numbers (followed by <␣>)
ATV1 Result is presented as text (default)
ATV2 Results is presented as enhanced text including error causes

&V Display configuration

AT&V Displays the actual configuration of AT command setting
AT&V1 Displays the actual configuration of extended AT command setting including stored ISDN numbers

W Enhance result message

ATW Shows result code (RING, CONNECT) without additional info (default)
ATW1 Shows result code (RING, CONNECT) with address

&W Store active configuration

The active configuration will be stored in non volatile memory.
AT&W

X Reduce result messages

Reduces the number of result messages after trying to set up a connection

ATX0 "CONNECT" only
ATX1 "CONNECT" with line speed, "BUSY", "NO DIALTONE" not used
ATX2 "CONNECT" with line speed, "BUSY" not used
ATX3 "CONNECT" with line speed, "NO DIALTONE" not used
ATX4 "CONNECT" with line speed, all messages used (default).

Z Load stored settings

The active configuration will be resetted to the stored configuration.
Must be the last command in an AT command line.

ATZ

&Z Store call-number

Stores dialing number *nn* as entry number *x* into the telephone list (*x* = 1..3).

AT&Z*x=nn* set entry number *x* to dialling number *nn*

AT&Z*x* shows entries number *x*.

AT&Z show all entries.

#Z Define own MSN

Defines the MSN *nn* for the data port.

If the number is set to "" (default), all incoming calls are acceptable.

The MSN can be displayed by command AT#H or AT&V1.

AT#Z=*nn*

The MSN is automatically stored to non volatile ram.

****DBITS** Number of data bits for asynchronous chars (7,8)

Number of data bits *x* for asynchronous character (7,default: 8)

AT**DBITS=*x*

****PRTY** Set parity for asynchronous chars

Selects the parity for asynchronous characters.

0: no parity; 1: even parity; 2: odd parity

AT**PRTY=0 No parity (default)

AT**PRTY=1 Even parity

AT**PRTY=2 Odd parity

+TBAUD Set the baudrate

This command sets the baudrate for communication between the modem and the DTE. Possible values are: AUTO, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400. Default is AUTO, which means autobauding. When being used along with other commands in a single line, this one must be the last command in that line. Bringing this setting back to it's default value requires a hardware reset.

+TFORMAT Set the data format

This command sets the baudrate for communication between the modem and the DTE.

AT+TFORMAT=<databits>,<parity>,<stopbits>

Where possible values are:

 <databits> 5, 6, 7, 8

 <parity> N, E, O, X (X means automatic)

 <stopbits> 1, 2

The default is 8X1. If Parity is set to X, these formats are supported: 7E1, 7O1, 7N2, 8N1, 8E1, 8O1

When being used along with other commands in a single line, this one must be the last command in that line. Bringing this setting back to it's default value requires a hardware reset.

+TERASE Load factory defaults

This command restarts the modem and loads its factory defaults.

+TREBOOT Restart the modem

This command restarts the modem without clearing its memory.

ISDN specific AT commands

Setting up special ISDN parameter:

(only one command is allowed per AT command)

****BSIZE** Set B channel blocksize

Defines the maximum length *x* of a data block transmitted or received in B channel (default: BSIZE = 2048).

AT**BSIZE=*x*

Note:

The value will be changed by setting the B channel protocol (ATBx).

****LLC** Set low layer compatibility (LLC)

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. An empty parameter has to be entered by "-" (default: LLC is empty).

Example: Deleting of LLC-value: AT**LLC=-<↵>
 Entering a new LLC: AT**LLC=8890<↵>

Note: The value will be changed by setting the B channel protocol (ATBx).

****ISDN** Select D channel protocol

Selects ISDN D channel protocol to the ISDN line. The protocol must fit the protocol running on the ISDN line otherwise a connection cannot be set up.

Note: after changing and storing the ISDN protocol the TA has to be resetted by powering it off and on.

ATISDN=0** Select DSS1 (Euro-ISDN) (default)
ATISDN** Show selected ISDN protocol
AT?ISDN** Show available ISDN protocols

****K** Set Layer 2 window size

Sets window size *x* layer 2 protocol B channel: *x* = 2 ..7, default: 7

AT**k=*x*

The default value is dependent of the selected B channel protocol.

****SUB** Set ISDN subaddress

Sets ISDN subaddress for the device: x=*,0..9, default *

AT**SUB=* accept all calls for the configured MSN.

AT**SUB=x accept only calls with this subaddress.

This feature has to be enabled by your ISDN provider.

6 AT result codes

Result codes (numerical and verbose):

Code	Text	Meaning
0	OK	Command completed
1	CONNECT <rn>	Connection established (rn = call number of remote site)
2	RING <rn>	Indicates an incoming call (SETUP received)
3	NO CARRIER <xx>	No synchronization (xx = ISDN error cause)
4	ERROR	Illegal command or error that can not be indicated otherwise
5	CONNECT 1200 <rn>	Connection, line speed 1.2 kbps (V.110)
6	NO DIALTONE <xx>	No access to ISDN network (xx = ISDN error)
7	BUSY <xx>	Number engaged (xx = ISDN error cause)
8	NO ANSWER <xx>	No connection; called number can not be reached (xx = ISDN error cause)
10	CONNECT 2400 <rn>	Connection, line speed 2.4 kbps (V.110)
11	CONNECT 4800 <rn>	Connection, line speed 4.8 kbps (V.110)
12	CONNECT 9600 <rn>	Connection, line speed 9.6 kbps (V.110)
16	CONNECT 19200 <rn>	Connection, line speed 19.2 kbps (V.110)
19	CONNECT 64000 <rn>	Connection, line speed 64 kbps

7 S Registers

- S0** **0:** No automatic call acceptance, acceptance of an incoming call is controlled by the data terminal (command ATA after RING) (default)
1: Immediate call acceptance by the terminal adapter.
2..n: Call acceptance through the terminal adapter after *n* "RING" messages. Valid values: 0..255. Storage in non-volatile memory: AT&W
- S1** Ring Counter (read only). Valid values: 0..255
- S2** Escape Character (default = 43h). Valid values: 0..255, ASCII Characters. Storage in non-volatile memory: AT&W
- S3** Carriage Return Character (default = 0Dh). Valid values: 0..255, ASCII Characters. Storage in non-volatile memory not possible
- S4** Line Feed Character (default = 0Ah). Valid values: 0..255, ASCII Characters. Storage in non-volatile memory: AT&W

- S5** Backspace Character (default = 08h). Valid values: 0..255, ASCII Characters. Storage in non-volatile memory: AT&W
- S7** Wait time for Carrier (sec) (default = 30 sec). Valid values: 0..255
- S16** Last occurred CAPI/ISDN error cause (read only).
- S90** Last incoming ISDN calling number (read only).
- S91** **0**: default
1: all unknown AT commands will be answered with OK.

8 ISDN Services

8.1 User to User Signalling UUS1

With outgoing and incoming calls the transmission of User-to-User-Data (UUS1-data) can be performed using the ISDN supplementary service UUS1. The UUS1-data are transmitted transparently from the calling party to the called party before the B channel connection is fully established.

Please note, that this ISDN service typically has to be enabled by the ISDN service provider and may be charged additionally.

See the command ATD in AT command set:

Example: **ATDisdnnumber[//<UUS1-data>]**

“//”: separator for UUS1-data

The UUS1-data have a maximum length of 128 Bytes and will be interpreted as ASCII characters. (the ISDN service provider may limit the length).

Incoming UUS1-data are presented as enhancement to the RING and CONNECT message.

```
AT:  RING [<rn>] [//<UUS1-data>]
      CONNECT [<rn>] [//<UUS1-data>]
```

Note: The presentation of UUS1-data has to be enabled by command ATW1.

The data are presented as ASCII characters.

An incoming call can be accepted (S0 register set to 0) by an ATA or rejected by an ATH combined with the transmission of UUS1-data (AT only):

```
ATA [//<UUS1-data>]
ATH [//<UUS1-data>]
```

Examples:

```
ATD1234567890//userdata#010203*ende
RING //userdata
RING //#01020304
```

8.2 Subaddressing

With outgoing and incoming calls the transmission of subaddresses can be performed using the ISDN supplementary service SUB. The subaddress is transmitted transparently from the calling party to the called party before the B channel connection is fully established.

Please note, that this ISDN service typically has to be enabled by the ISDN service provider and may be charged additionally.

The subaddress is separated by an “/” from the called number.

Examples:

```
ATDisdnnumber[/subaddr]
      isdnumber           Dialling called party number
      subaddr             Called subaddress
```

```
RING [<rn>[/subaddr]]
CONNECT [<rn>[/subaddr]]

      rn                   Calling party number
      subaddr               Calling party subaddress
```

The own subaddress (calling subaddress) can be set-up using the command **AT**sub**.

Note: The subaddress can be entered additionally into all tables that contain ISDN numbers for dialling or checking an ISDN address.

8.3 Using Multilink PPP

To enable Multilink PPP handling within the TA please enable the B channel protocol ML-PPP: atb31 rsp. prot = 31.

8.3.1 Call Bumping

A ML-PPP connection uses both B-channels of the S0 bus. To accept an incoming call (i.e. for telephony) during a ML-PPP session one B-channel has to be released. This is called Call Bumping.

To enable Call Bumping proceed as follows:

- Activate call waiting on the S0 bus. It has to be activated in the ISDN switch and is a feature of the ISDN line you ordered.
- Open the “properties” of the dial-up link you are using for ML-PPP and “additional settings”. Input “at**cmlp=1” as an additional parameter.

If there is an incoming call during a ML-PPP session the TA will drop one B-channel and an ISDN telephone attached to the S0-bus will be ringing to accept the call.

9 Diagnostic and error messages

For the diagnostic of erroneous situations the following functionality is supported.

9.1 Error messages from AT command set

When the extended result messages are selected using the command `ATV2` ISDN error codes are displayed in addition to the standard AT result messages.

ISDN error causes from the ISDN network are always coded as `34xxH`, where as the last two digits `xx` represent the ISDN cause in hexadecimal coding. The meaning can be taken from the following tables ISDN causes.

9.2 Table of ISDN causes and their explanation (DSS1)

Cause Decimal / Hexadecimal	Meaning
1 / 0x81	Unassigned number
3 / 0x83	No route to destination
6 / 0x86	Channel unacceptable
16 / 0x90	Normal clearing
17 / 0x91	User busy
18 / 0x92	No user responding (i. e. DTR not ON)
19 / 0x93	
21 / 0x95	Call rejected
22 / 0x96	Number changed
26 / 0x9A	Non selected user clearing
27 / 0x9B	Destination out of service
28 / 0x9C	invalid number format
29 / 0x9D	Facility rejected
31 / 0x9F	Normal disconnect, unspecified
34 / 0xA2	No B channel available
38 / 0xA6	ISDN network out of order
41 / 0xA9	Temporarily failure of the ISDN network
42 / 0xAA	ISDN network congestion
47 / 0xAF	ISDN network congestion
50 / 0xB2	Requested facility not subscribed
57 / 0xB9	Bearer capability not authorized
58 / 0xBA	Bearer capability not available
63 / 0xBF	Service/option not available
65 / 0xC1	Bearer capability not implemented
70 / 0xC6	Only restricted digital bearer capability (BC) available
79 / 0xCF	Service/option not implemented
87 / 0xD7	User not member of CUG

Cause Decimal / Hexadecimal	Meaning
88 / 0xD8	Incompatible destination
111 / 0xEF	Protocol error, unspecified
127 / 0xFF	Network interworking error, unspecified

10 Appendix

A1: Technical data:

One V.24 channel:

functional: V.24
 electrical: V.28

Transmission speeds:

DTE: 1200 – 230400 bit/s (asynchronous)
 B channel: 2 x 64000 bit/s (synchronous)

Character representation:

8Bit no Parity, 1 stop bit
 7Bit even/odd Parity, 1 stop bit

Character synchronization: asynchronous

Operating mode:

half duplex or full duplex

ISDN interface:

S₀-interface according to CCITT I.430 (1TR3)