Highspeed TA Pro

Highspeed TA Pos

ISDN - Terminal Adapter

User Guide and Technical Documentation

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Contents

1 Notice

Every effort has been taken to ensure the accuracy of the information contained in this User Guide. The equipment manufacturer reserves the right to change the product specification without notice and in the

event this user guide may not relate totally to your product it describes. In this event please refer to any addenda sheets that have been included with this manual.

1.1 Special Note

This User Guide describes the complete implementation of the Highspeed TA Pro Terminal Adapter with all its hardware and software options. If you are using a version of the product that doesnot support all of those features, for example, the analogue telephone port, X.31 PAD or the X.21-interface, then references to those functions are not directly relevent.

The Highspeed-TA POS doesnot support the optional analogue telephone line interface, the X.21-interface or synchronous operation. Asynchronous datacommunications is limited to 38,400 bps.

1.2 Introduction

The **Highspeed TA Pro** Terminal Adapter is a multifunctional device for connection to the *ISDN* digital telephone network.

The **Highspeed TA Pro** supports the following features;

- data transmission on the B -channel with speed buffering
- packet oriented data transmisson (X.25 Packet switching) on the supervisory or D-Channel
- connection to „normal" standard telephone equipment

The **Highspeed TA Pro** provides the same functions over an ISDN circuit as a modem does over an analogue telephone line. There are many advantages of ISDN over analogue transmission, for example, immediate connection, high speed and error free data transmission, greater range of performance options.

The **Highspeed TA Pro** allows any device with a standard V.24 (RS232) port to connect via an S_0-Bus to a basic rate (V.110) ISDN service, eg. E-DSS1 or DeutscheTelekom 1TR6.

The **Highspeed TA Pro** supports a number of different communications protocols:

V.110 - the data and serial interface control signals are transmitted over the ISDN B-Channel. V.110 offers error detection without error correction.

V.120 offers asynchronous datarates of upto 38.4kbps and synchronous data transmission at 64kbps. V.120 offers both error detection and error correction over the ISDN B-channel.

The **X.75** and **X.75/T.70NL** protocols allow you to use the **Highspeed TA Pro** to access Packet Switched Data services for example, Datex J, Transpac or Prestel.

X.31 - for Packet Switched communications X.25 / DATEX P. X.31 communications takes place on the D-Channel at datarates of upto 9600bps and upto 38,400bps on the B-Channel.

The **Highspeed TA Pro** can be configured using the **AT Command Set** or **V.25bis** (optional) **commands** and a **PAD** for asynchronous connection to the Packet Switched Network and HotlineCalls.

The **a/b-Interface** permits a standard analogue telphone to be connected to the **Highspeed TA Pro**. One important difference between calls to a TA via the a/b switch is the availability of different call options (MSN/EAZ) and Bearer Capability Indicators. Both DTMF (touchtone) and the loop disconnect (pulse) dialling techniques are supported.

Configuration in the Command Mode can be made using a dumb terminal or PC running a terminal emulation Program, by the DIP-switches accessible from the rear panel, or remotely over ISDN.

1.3 About this Handbook

This User Guide contains all the necessary information about the Highspeed TA Pro and how to connect it to the ISDN. It has been written as a comprehensive guide for both experienced and inexperienced users of ISDN communications devices and for this reason, where necessary, it provides detailed background information about communications over the ISDN to assist those users who are new to configuring a terminal adapter.

If you are already familiar with using the industry standard AT-Command set to configure an analogue modem then you will have no difficulty in setting up the Highspeed TA Pro but we recommend you read chapters titled, *Overview/Controls and Indicators* and *Configuration and Operation*", before using the Highspeed TA Pro for the first time.

In addition to AT Commands the Highspeed TA Pro can be set up using other optional command Protocols, refer to the chapter "*Configuration and Operation*".

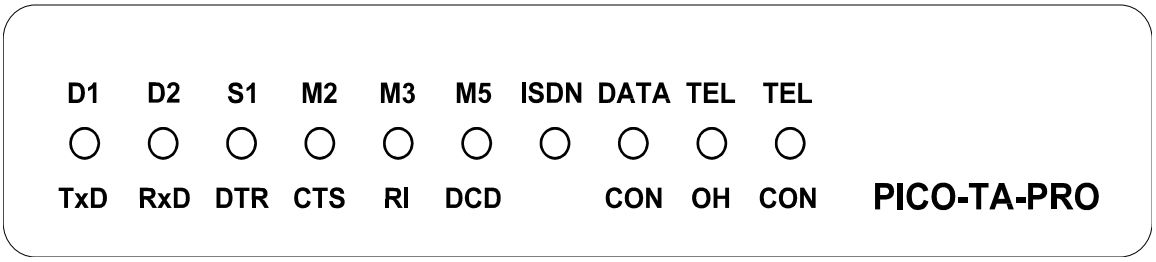
2 Overview

2.1 Description

2.2 Controls and Indicators

All connections to the Highspeed TA Pro and the ON/OFF switch are located on the back panel of the device. The front panel only contains the *LED* status indicators.

Front Panel:



The functionality/description of the 10 LED indicators can be divided into 3 groups:

a) From the left, the 6 red LED's show the status of the V.24 interface control signals;

D1 / TxD	[input]	cct 103 *transmit data*: On = binary 1, flickers in sync with Tx datastream
D2 / RxD	[output]	cct 104 *receive data*: On = binary 1, flickers in sync with Rx datastream.
S1 / DTR	[input]	cct 108 *data terminal ready*: On when DTR is active from host DTE. The TA's response to this signal is Programmable. A positive transition of DTR will trigger a *hotline call.*
M2 / CTS	[output]	cct 105 *clear to send*: On when the TA is ready to send data.
M3 / RI	[output]	*Ringing indicator*: Indicates an incoming data call
M5 / DCD	[output]	Data Carrier Detect: ON when there is an ISDN-(Data)connection between two TA's.

b) The next 2 (yellow) LED's are ISDN status indicators.

ISDN / S0	ON when the TA is physically connected to the ISDN network and the TA is in sync with the digital signalling stream (*Layer-1 active*). When the TA is not connected to the ISDN network socket the LED flashes.
Data / CON	ON when the Highspeed TA Pro has established a data connection on the public network via the supervisoryor D-channel.

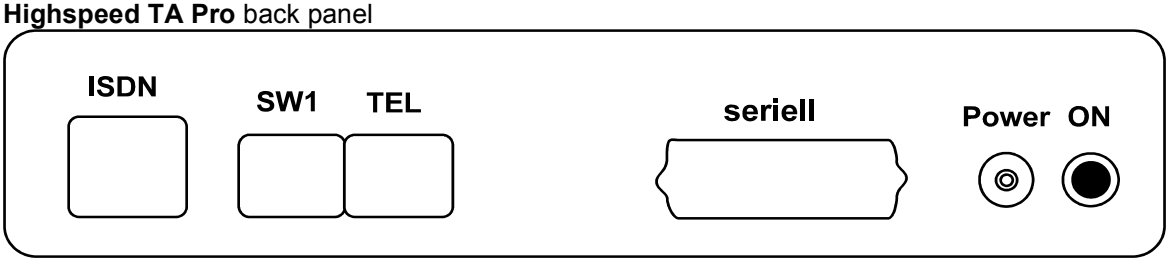
c) The 2 red (or yellow) LED's on the right show the status of the analogue telephone interface.

☎ / OH	ON when the telephone handset is off-hook. When the telephone is on-hook this indicator lights, in sync with the ringing signal, to show an incoming voice call. cf Calling Indicator.

☎ / CON ON when the telephone is connected to the ISDN network. When a call is being set up this LED lights when the "ringback" is detected from the remote, called, TA.

Note: In other hardware variants, e.g the Highspeed TA POS the front panel indicator LED's are different. The four righthand LED's indicate; ISDN, DATA, TEL,TEL and three on the lefthand side; L1, L2 & ON. The ON LED shows the device is powered and ready and the L1 and L2 LED's show the status of the ISDN.

Highspeed TA Pro back panel



from left to right:

ISDN ISDN connector - RJ45.

SW1 5-way switchbank (*DIP-switches*). (Highspeed-TA Pro only)

☎ Analogue phone connector - RJ12. (Highspeed-TA Pro only)

seriell V.24/RS232C serial port (DB25M). (seriell {D} = serial)

Power Power input jack.

ON On/Off switch - Highspeed-TA Pro only.

Note: The Highspeed-TA POS does not have the analogue phone connector or the switchbank SW1.

3 Configuration and Operation

3.1 Initial Operation

The shipping carton should contain the following items;

- Highspeed TA Pro
- Wallcube Power Supply
- ISDN network cable

in addition you will need;

- an analogue Telephone.
- a terminal or PC with serial cable

When you install the Highspeed TA Pro for the first time:

1) **Check that all the switches of SW1 (rear panel) are OFF (up). In this mode the Highspeed TA Pro can only be configured with an async terminal.**

2) Connect the power supply output cable to the **Highspeed TA Pro** and a 230Vac power outlet.

3) Power up the **Highspeed TA Pro** (TA) by pressing the rear panel ON/OFF button. On power up the Highspeed TA Pro performs a selftest and after about one second the yellow front panel LED, "ISDN/S0" should start to flash followed by the the red CTS LED. This shows that the TA is ready but it doesnot recognise the S0-Bus.

4) Using the cable supplied connect the TA to the ISDN network termination. The ISDN/S0 LED will now stop flashing and be ON permanently showing that the TA is connected to the S0-Bus and is ready.

If the ISDN/S0 LED doesnot come on and continues to flash, unplug the network cable, wait a second, and reconnect it. The TA automatically tries to synchronise with the ISDN (Layer-1) signalling and if the ISDN/S0 LED still doesnot come on then there is a problem with the ISDN service.

NOTE: On some ISDN/S0-Bus exchanges (especially on the public network) after about 20 secs the ISDN/S0 LED will start to flash again. **This is not an error** the exchange has deactivated the S0-Bus (Layer-1) because an inactivity timer has timed-out. This function is usually configurable in the VST - "Layer-1 activity timer".

5) To connect the telephone handset to the **Highspeed TA Pro** "Tel" socket on the rear panel.

5a) When you lift the telephone handset the front panel LED (☎/OH will light to show that the telephone is active and loop current is flowing. The (☎/CON LED will come on and you will hear dialtone to indicate that the network is active. You can now dial a

call normally using either DTMF or pulse dialling, the **Highspeed TA Pro** recognises either but DTMF is preferred.

5b) When calling another telephone that is connected to the same ISDN bus (with DSS1 this is possible irrespective of how the MSN is set) the (☎/OH LED will light in sync with the ringing signal and the other telephone will ring. Pick up the handset and talk normally.

6) To use the Highspeed TA Pro for normal data transmission, from either a PC or dumb terminal, connect the terminal's COM port to the TA using a standard V.24/RS232 serial cable and Proceed as follows;

6a) Run the PC's terminal emulation Program and configure the communications parameters for, **9600 bps, 8 bits, no parity (8N1)**.

6b) Quickly cycle the power to theTA and after a short delay the TA will output the start up screen to the PC.

CPV Highspeed TA Pro

nvram valid

Terminal Adapter V.110 DSS1
AT command interpreter

6c) Type "**AT"** followed by **<CR>** carraige return. The TA responds with **"OK"**.

6d) To set up a test transmission to another TA/ISDN user configure the TA as follows(Protocol V.110 or X.75);

6d1) Set the terminal Program comms datarate to 19200 bps or 38400bps and type AT<CR>, in order for the **Highspeed TA Pro** to adjust itself to the terminal datarate. This is especially important if you are using V.110 Protocol.

6d2) Select the required ISDN Protocol in the TA (X.75 {default} = "AT\N2" and V.110 = "AT\N1") and originate the call using the "ATD" command followed by the required number and <CR>. After a very short delay the TA will output the connect message;

CARRIER nnnnn
PROTOCOL yyyyy
CONNECT nnnnn <isdn-called number>

To disconnect type the Escape command, "+++" and after a short delay the TA will output "OK" and then type "ATH" foolowed by <CR> to disconnect.

The Highspeed TA Pro is now correctly configured and ready for normal ISDN operation. If the installation Process has not been successful refer to the chapter titled, "Troubleshooting".

3.2 Configuration

NOTE: Always remember to save all changes you make to the standard (default) settings of the **Highspeed TA Pro.** If not, they will be lost when the TA is powered off and the TA will power up loading the default parameters. (cf the AT Command AT&W).

The default parameters are;

- ISDN-Protocol DSS1
- AT Command Interpreter enabled on power up

analogue telephone interface (a/b):

- no MSN is programmed for outgoing and incoming calls
- *Voice/Telephony* enabled for incoming and outgoing calls|.

V.24/RS232 serial port

- datarate and format 9600 bps, 8 bits, no parity, 1 stopbit.
- *autobps* enabled
- no MSN Programmed for incoming and outgoing calls
- *DATA* mode enabled for incoming and outgoing calls
- autoanswer enabled for AT and PAD.
- Service-Call allowed
- AT Command Interpreter enabled with X.75 Protocol.

You use AT commands via the AT Command Interpreter to configure the Telephone Interface. Refer to the chapter titled, "A*nalogue Telephone Interface (a/b)*".

You use the AT Commands to configure the TA serial port and datacommunications parameters, refer to the chapter titled, "*V.24 Serial Interface".*

3.2.1 The Configuration Module

NOTE: It is not normally necessary to make changes to the Configuration Module. In the most part all changes to the TA's parameterisation should be made using the Command Interpreter (AT, PAD).

The Configuration Module contains the Highspeed TA Pro default operating parameters, for example, which Interpreter is loaded by default and the standard operating parameters.

On power up the TA's controller performs a selftest function and reports, "nvram valid". Immediately following the selftest the user has 1 second to the type <CR> to load the last stored datarate and data format parameters (9600bps, 8N1) and load the Configuration Module. The TA responds with the Prompt character "#".

The different functions of the TA are controlled in their own individual, and independent, software modules. Each module has its individual shortform name or title (cf for the Configuration Module, at for the AT Command Interpreter, ab for the analogue telephone module, pad for the DATEX-P-Mode and so on) and module specific parameter settings. You can display each parameter which is displayed showing the, shortform name followed by a dot "." followed by the parameter value. To change a parameter value type a space character or "=" followed by the new value. Numeric values will be interpretted as decimal numbers and hexadecimal values must be preceeded with an "x".

Online help is available by simply typing "*help"* followed by the module acronym, eg "*help cf*". Type "*go"* to return to the main application.

```
# help cf
cf.cpv: cpv special command
cf.service: service special command
cf.help: show parameter set names or command list
cf.appl: set default application
0 - Terminal Adapter
1 - PAD (X.31 or X.25)
cf.timer: application start timer (50 ms ticks)
cf.save: save parameter
cf.clear: clear parameter
cf.load: load parameter
cf.go: application start
cf.reset: reset
#
# cf
cf.appl: 0 - Terminal Adapter
cf.timer: 20 (0x14)
#
```

The "cf.appl: n " parameter shows the basic operating mode, e.g

appl 0	AT Commands selected on power up,
appl 1	PAD Command Interpreter selected on power up.
appl 2	TA starts up in X.25 synchronous mode with the V.24 serial port running at 9600 bps. This mode sets up the TA to operate in DATEX-P10-Mode (optional). Not a primary command protocol.
appl 3	V.25bis Command Interpreter selected on power up (in development, available mid '97).

To reset and save settings;

clear	reset and load factory default values
save	save set values in non-volatile memory

NOTE: Never set a parameter to an invalid value outside of the range described in this User Guide.

3.2.2 Back Panel Switches

SW1 is a 5 way bank of DIP-Switches (Highspeed TA Pro only) that are located behind a small plastic cover on the rear panel adjacent to the RJ45 S0 ISDN connector. A switch is OFF when it is UP and ON when it is DOWN.

NOTE: For normal operation all switches must be OFF.

The switches set the following functions:

Switch 1: OFF (up): V.24-inteface signalling
ON (down): X.21-interface signalling (use special cable)

Switch 2: not used

Switch 3: not used

Switch 4: OFF: Normal operation
ON: X.25 synchronous operation (P10H) (optional)

Switch 5: OFF: Normal operation
ON: Ignore stored user configuration on power up and load factory default setting (9600bps asynchronous).

4 Interfaces and Protocols

This chapter describes the Highspeed TA Pro communications interfaces and supported protocols.

4.1 V.24 Serial Interface

NOTE: This chapter explains the logical function of the V.24 serial port, for an explanation of the physical aspect of the V.24 serial port refer to the section titled, *"Technical Specification"*.

The V.24 serial port is the communications interface between the DTE and the DCE, ie. the host PC or terminal. All control and data signals between the DTE and the TA pass across this interface.

Upon power up, following selftest the TA loads the prestored Configuration Module User interface, AT, PAD, V25 etc. In this configuration the TA has loaded the AT Command Interpreter. After a short delay the AT Command Interpreter outputs the opening message.

CPV Highspeed TA Pro

Terminal Adapter DSS1
AT command interpreter

If the displayed message is garbled or corrupted check the PC (or terminal) is correctly configured for 9600bps, 8 bits, no parity and 1 stop bit (96008N1). For more information refer to *autobauding* and *Saving the Configuration* in the next chapter.

4.2 X.21 Serial Interface

NOTE: The X21 interface is supplied as an option and is not available in all configurations of the HighspeedTA Pro

To enable the X.21 interface set SW1 switch 1 ON and use a special 25 way to 15 way X.21 interface cable to connect the TA to the host X.21 port. The X.21 interface is a balanced interface with 2 lines for each signal, whereas V.24 has all signals referenced to a common ground line. The V.24 interface is recommended for datarates up to a maximum of 20kbps over a distance of 15m. X.21 permits transmission of higher data rates over longer cable distances

4.3 AT Command Set

4.3.1 Introduction

The AT Command Set is an industry standard software command language, originally developed by Hayes Corporation in the US for configuring and controlling analogue modems.

The standard AT Commands that originally were used to control a modem's basic functions and have been developed further to control the extended functions and features that have been introduced and, in

some cases, are special to one manufacturer's device and are hence no longer "standard", these commands are known as "Extended Commands" . The AT Command Set was developed to control an analogue modem and its interpretation in the context of controlling the functions of the Highspeed TA Pro for ISDN communications must be seen as an extended command set that is special to the Highspeed TA Pro.

By default the Highspeed TA Pro is configured to operate over the ISDN using the E- DSS1 Protocol. The user or application interface must be set for 9600bps, 8bits, no parity and 1 stop bit (8N1). A*utobauding* can be enabled to *allow the Highspeed TA Pro to automatically adapt to, or track, the host port speed in the normal range of, 1200, 2400, 4800, 9600, 19200 and 38400bps.*

In General

All commands must be prefixed with „AT" and terminated with *carriage return, <CR>*. One exception to this is „A/ - *Repeat Last Command"*. Commands can be concatinated (in a string) between an, "AT" and <CR>, and can be in either upper or lower case. Commands are alpha-numeric characters and the special characters„+","&","%","$","/"and "\". A command comprises a letter, with or without a preceeding special character, followed by a number. In a command string the individual commands can be separated with a "space character" to make it easy to read in the Command Mode and editing errors can be corrected using *backspace <BS>.*

The Command Interpreter executes, or actions, the command upon receipt of the <*CR*> and responds with „OK" or „ERROR".

If the TA "*autobauding*" feature is enabled the Highspeed TA Pro uses the "A" of the "AT" prefix to determine the host port speed, or datarate. If"*autobauding*" is used always ensure that the application software sends, at least, one "AT" to ensure that the TA is locked onto the host datarate. This is especially important if the host application is running in unattended answer mode.

The AT Command Interpreter exists in one of two states or modes:

Command Mode

In the Command Mode the TA is off line and ready to accept commands either to configure the device or to originate or answer a call. As the TA establishes a connection, the AT Command Interpreter changes state to the,

Data Mode (On line)

In this state the TA's serial interface is connected to the serial interface of the remote TA. All data characters are transmitted to the remote device over the ISDN. It is possible to switch from the "Data Mode" to the "Command Mode" (Command On-Line Mode) without losing the connection by using the "*Escape Sequence"* by typing the characters, "+++", after a short period of inactivity on the data lines. After a short delay the TA responds with, *"OK",* and you can enter commands or interrogate the configuration whilst the TA is still connected to the remote TA. You return to the Data Mode by typing the command, *"ATO"*, and the TA reestablishes the connection and reports the connect message. Alternatively you can disconnect from the ISDN

connection using the *"ATH"* command. The "+" or plus character is standard for this operation but it is Programmable should this character sequence conflict with the user data.

4.3.2 Command Overview

The following section explains the AT Commands that are implemented in the Highspeed TA Pro in detail including the „S-Register", store for each command parameter. Each „S-Register", has a number (cf name) and is a dedicated 8-bit wide, memory location which is used to store a number in the range, 0 to 255. Some „S-Registers" are Programmable and others are "read-only" and are bit-oriented to store the numeric value of an AT command. Unless you are very experienced at Programming a communications device using AT commands, and to avoid mis-programming the TA, it is recommended that you use AT commands rather than attempt to write directly to the corresponding „S-Register", When using the AT Command Interpreter to configure the Highspeed TA Pro whose configuration is unknown, always recall Factory Default settings to initialise the device into a known working state. If, after Programming the „S-Registers", the TA fails to function correctly, reintialise the device using the *"&F c*ommand.

Like a standard analogue modem the Highspeed TA Pro has 2 user Programmable *configuration Profiles,* Profile 0 and Profile 1, which are stored in non-volatile memory and can be recalled using the *"ATZn"* command. On power up the TA loads *Profile 0*.

Each command is followed by a numeric parameter and if the numeric parameter is omitted the Command Interpreter accepts it as a null or "0". For example, "ATH" is the same as, "ATH0".

4.3.3 Command Description

The TA responds to a valid command with "OK", to show that it has been executed, if the command is not recognised the Command Interpreter will respond with, "ERROR". Sometimes the Command Interpreter will acknowledge the command even if it has no functional significance and has been accepted only for compatibility with other devices.

CMD
Range
Meaning
S-Reg.

A

answer incoming call

A/

repeat last command

%B

ISDN bit rate
S37

&C

0,1,2
DCD interface functionality
S21

D

nnnn
dial command - number nnnn

$D

0,1
automatic DTR-dial (hotline call)
S31

&D

0...3
DTR operation
S21

\D

0...3
DSR interface handling
S52

E

0,1
Command echo
S14

&NOTE:

recall factory defaults

\NOTE:

View called number

%G

0,1
Network side bit rate handling

S37

H

0
Disconnect (*onhook*)

I

0..4
Identity

+I

<text>
Program ISDN identifier

&K

not used, for compatibility

\J

not used, for compatibility

%L

Change bit rate
S28

&M

async/sync

\N

0...11
Set communications Protocol (V.110,X.75)
S36

$P

Switch to PAD

O

online;return to data mode

Q

0,1
Quiet response mode
S14

&Q

0..1
autobauding
S52

\Q

0..4
Handshake

S
...
Program/read S-Registers

V

0,1
Verbose or numeric responses
S14

&V

0,1
View configuration Profiles/S-Register

$V

Switch to V.25bis Comand Mode

W

0..3
Extended connect messages
S14

&W

0,1

Save configuration to Profile n

X

0...4
Call Progress monitoring
S22

+X

<text>
Write <Text> to the Configuration Module

Z

0,1
Load Profile n

&Z

not used, for compatibility

In the following section the factory default parameters are shown in **bold** with a □ .

NOTE:

ATA Answer incoming call. Only used on its own.

A/ Repeat last command. This command is not prefixed with „AT" or followed by <CR>.

AT&C0 DCD is always ON
AT&C1 DCD is ON when the TA is synchronised with another TA.

ATDnnnn Dial number nnn

The characters, ´T´, ´P´and ´;´ are accepted for compatibility only and have no meaning.

AT$D1 DTR-Dial ON; DTR going true causes the TA to dial the number stored in the DTR NUMBER Variable. If no number has been programmed this command has no effect.

AT&D0 ignore DTR - DTR forced ON internally
AT&D1 -not used-
AT&D2 DTR - DTR going from ON to OFF will cause the TA to disconnect from line
AT&D3 -not used-

AT\D0 DSR is always ON

AT\D1 DSR follows the V.110 transmission channel

ATE0 Echo OFF
ATE1 Echo ON

&NOTE:

&**NOTE:** Recall Factory Default settings
NOTE: Use the &**NOTE:** to reinitialise the TA to factory default settings. The configuration will only be loaded into the Active Profile (RAM) and must be saved to non-volatile memory using the &W command, if required.

AT%G0 Autobaud enabled (net rate ≠ user rate)
AT%G1 -not used-

ATH0
On hook; disconnect from line

ATI0 Show Product ID
ATI1 Show ROM-checksum
ATI2 Show ROM-check result
ATI3 Show firmware version
ATI4 Show Product names
ATI5 Read Country Code (Germany = 006)
ATI6 Show hardware version. Result is independent of product and software version
ATI7 Show (firmware) module list
ATI8 Read serial number (not for all versions)
ATI9 List configured firmware modules (service aid)

```
ati0
Terminal Adapter V.110 DSS1
OK
ati1
00
OK
ati2
OK
ati3
V1.00.a 220496
OK
ati5
006
OK
ati7
AB AT PAD DEBUG
OK
```

AT+IMSNIN[=nnnn]
The MSNIN command sets, or modifies, the calling party number from which the device will only accept calls. When an MSN is set the device will compare the incoming calling party number (*DAD)* before connecting. If they are different the call will be ignored. If the MSNIN and calling party number are of a different length the device will only compare the last eight digits. An MSN can be up to eight digits long.

NOTE: Take care to only set an MSN that corresponds to the numbering plan agreed with the telecommunications service provider, otherwise no call will be answered.

AT+ISERVICEIN[=n]

The SERVICEIN command sets the accepted Bearer Capability of incoming call. Only calls with the same Bearer capability will be answered. Permitted values for n are:

0 Voice/Telephone
1 Data Service (Default)
2 Data with additional information (*LLC*)
3 All services are allowed (for test purposes)

AT+IMSNOUT[=nnnn]

The MSNOUT command is used to set the outgoing Calling Party ID *(OAD)*. This is the number that is sent by the ISDN exchange when it routes the call. If the MSNOUT is different to the MSN that are permitted by the ISDN exchange it is ignored and the exchange routes the call to the first MSN that is set for the called S0-Bus.

AT+ISERVICEOUT[=n]

The SERVICEOUT parameter set the outgoing call service class. Permitted values are:

0 Voice/Telephone
1 Data Service (Default)
2 Data Service with additional information (*LLC*)

AT+IDTRNUMBER[=nnnn]

The DTRNUMBER command is used to programme the calling number (Subscriber Number) to be autodialled under DTR control.

The above commands should not be used in a command string.

&M Synchronous/Asynchronous Operation

AT&M0 asynchronous operation
AT&M1 synchronous operation
AT&M2 synchronous operation(as &M1)
AT&M3 "autosync" operation

In synchronous mode the TA presents the *receive* and *transmitted clock* signals to the serial interface and the transmission data rate is set in S-Register S93. In synchronous mode the *autobauding* (Q0) function is **not** used and call set up is initiated using the DTR-Dial ($D1) function.

„autosync" means that the TA functions asynchronously in the Command Mode (Normal operation) and switches to synchronous operation when online in the Data Mode.

Example:

Set 9600 bps, synchronous, DTR-Dial: AT &M1 &D1 S93=8 &W
Set 64000 bps , synchronous: AT &M1 S93=20 &W

NOTE: In order to prevent the the TA from being set to use an unsupported asynchronous datarate (e.g. 64000 bps), the &M command must preceed the S93=xx command.

\N Communications Protocol

AT\N0 -not used-
AT\N1 V.110 Direct Mode operation, port speed = line speed, i.e. no autobps or speed buffering
AT\N2 X.75
AT\N3 -not used-
AT\N4 V.120 (available mid '97)
AT\N5 ISO 8208 X.25 packet switching in the B-channel
AT\N9 X.75/DxJ (special variant of X.75 for Datex-J operation or T-Online-Service to 01910 numbers in Germany {cf Minitel France, Teletext UK}. Note the maximum block size is limited to 128 bytes.

O On line

ATO On line

Used to reconnect from Command on-line Mode to Data Mode following ESCAPE-Sequence break. ATH will trigger a disconnect.

Closes the AT Command Interpreter and loads the PAD Command Module.

ATQ0 Terminal Adapter responses/messages ON
ATQ1 Terminal Adapter responses/messages OFF

AT&Q0 Autobaud ON
AT&Q1 Autobaud OFF

With *autobaud* enabled the TA automatically adapts to the host port data rate. The TA does this on detecting the „A" at the start of the command string and to ensure the TA and host are running at the same interface string always ensure that the Application sends at least one „AT<CR>" and the TA responds with "OK".

AT\Q0 Flow control disabled
AT\Q1 XON/XOFF (software) flow control
AT\Q2 Hardware flow control (RTS/CTS)
√ **AT\Q3 Hardware flow control (RTS/CTS)**

AT\Q4 Hardware (RTS/CTS) and software XON/XOFF flow control

The \Qn command controls which method of flow control is used between the Terminal Adapter and the DTE. Hardware flow control is achieved by controlling the RTS and CTS lines on the serial interface. Software flow control is achieved by sending, XON/XOFFcharacters inband with the serial datastream. Care must be taken when selecting XON/XOFF flow control with binary data because the control characters could be present in the data stream.

NOTE: When using V.110 protocol local flow control has no effect and all signals present on the interface and data characters are sent to and processed by the remote DTE.

ATSnn=xxx Write value xxx to S -Register nn
ATSnn? Read setting of S-Register nn

ATV0 TA outputs numeric responses as a 3-digit decimal number with leading zeroes followed by <CR>.

ATV1 TA outputs responses as words (verbose form) followed by <CR><LF>.

&V View active configuration

AT&V0 Read all S-Registers
AT&V1 Read active command Profile.

```
at&v
 s000=0   s001=0   s002=43  s003=13  s004=10  s005=8   s012=50  s014=138
 s021=176 s022=64  s027=0   s028=4   s030=0   s031=0   s036=17  s037=3
 s051=0   s052=8   s087=16  s093=16  s153=4   s154=0   s155=0   s158=0
 s159=0   s160=0   s171=0   s173=0   s190=0   s193=0
OK
at&v1
 %B3    &C1    $D0    &D2    \D0    E1    %G0
 \J0    %L1    &M0    \N1    Q0    \Q0    &S1
  V1    X4    \X0
OK
```

$V Switch to V.25bis Command Set

This command closes the AT-Command Interpreter and loads the V.25bis-Command Set. Software option. Not implemented at this time (mid '97).

ATW0 Display "CONNECT" message only
ATW1 Display "CARRIER nnn", "PROTOCOL xxx" and "CONNECT nnn"
ATW2 Display Calling Party ID (number<nn>) with RING <nn> and CONNECT <nn>
ATW3 Output "RING <nn>", "CARRIER nnn", "PROTOCOL xxx" and "CONNECT nnn<nnn>" (W1 and W2 combined).

AT&W0 Save Active Configuration (S-Registers) in Profile 0
AT&W1 Save Active Configuration (S-Registers) in Profile 1

Command &W is used to save the current "active" configuration (*configuration Profile*) in non-volatile memory. The Highspeed TA Pro has two user configurable profiles, Profile 0 and Profile

1, which can be used to store different working configurations. Profile 0 is recalled when the AT-Command Interpreter is loaded (corresponds to &Z0).

When reinitialising the TA with command &F remember to save the factory default settings to non-volatile memory with the AT&W0&W1 commands.

NOTE: The command &W writes the setting to non-volatile memory. When working in a different command module (eg. a/b-Interface parameters) be sure to save the settings you make.

ATX0	TA outputs shortform connect message ("CONNECT", without serial port speed indication)
ATX1	TA outputs long connect message (CONNECT nnn = Port speed); ref.. ATW and ATQ.
ATX2	as X1
ATX3	as X1
ATX4	as X1

Command X is provided for compatibility with modem-based application programs and has no effect on the operation of the **Highspeed TA Pro**.

AT+X<text>

The AT+X command is used to quit the Configuration Module (see Chapter *Software Description)*. In base models of the **Highspeed TA Pro** (without a/b, PAD, V.25 or other command modules) this command is used only for Service and Test purposes. For a detailed explanation of the command refer to the chapter titled, "*Configuration Module"*.

ATZ0	Load Profile 0
ATZ1	Load Profile1

On power-up the TA loads parameters from Profile 0 (= ATZ0).

4.3.4 S-Registers

The following table of S-Register definitions provides an overview of their function and each S-Register is explained in detail later in this chapter. Unlike programming an analogue modem the TA should only be configured via the command module and no attempt should be made to program the S-Registers directly. Some S-Registers are currently undefined and are reserved for future developments of the Highspeed TA Pro.

In the column with heading XX the S-Registers marked with an asterix „*" can be changed to a new value and saved using the &W command. Those marked as „RO" are read-only and no attempt should be made to write to them.

In the column with heading „range." gives the permitted range of values which can be set for that S-Register and the column headed „def." contains the factory default value (also set by &F).

The coloumn headed 7..0 shows the bit-map for that S-Register corresponding to individual commands.

XX
S
range
def.
meaning
7
6
5
4
3
2
1
0

S0

0-20
0
auto answer ring counter

S1

„Ring" counter

S2

'+'
ESCAPE character

S3

x0D
Carriage Return character <CR>

S4

x0A
Linefeed character <LF>

S5

x08
Backspace character <BS>

S12

0-255
50
ESCAPE guard time (n*20 ms)

S14

xBA
AT command interpreter
OA
-

W
W
V
Q
E
-

S21

x70
V.24
&S
&C
&C
&D
&D
&R
-
-

S22

x40
messages
-
X
X
X
-
-
-
-

S27

x00
sync./async.
-
-
-
-
-
-
&M
&M

S28

x04
V.110
-
-
-
-
%L
%L
-
-

S30

0-255
0
inactivity timer

S31

x00
DTR
-
-
$D
-
-
-

-
-

S36

x01
mode
-
-
-
-
\N
\N
\N
\N

S37

x11
isdn bit rate
\J
%G
-
%B
%B
%B
%B
%B

S51

x03
flow control
-
-
-
-
\Q
\Q
\Q
\Q

S52

x00
V.24

\D
\D

RO
S87

network speed

S93

user interface speed

S171

x04
(X.75 setting) i.V.

S173

x00
serial interface data format

Only those S-Registers that can be modified by the user are explained in greater detail. The bit-mapped registers bit values are shown in the table above and are not explained in detail.

From the AT-Command Interpreter an S-Register value can be read using the command, „ATSnn?", where "nn" is the S-Register number. An S-Register value can be modified using the, „ATSnn=xx" command where "xx" is the new value.

NOTE: S-Register values are programmed and read as decimal numbers.

S0 Autoanswer ring counter

When S0 = 0 auto answer is disabled

When S0 is set to a non-zero value (=n) the TA will answer after "n" rings.

Default is S0 =1.

The TA controller counts the incoming rings and increments the S1 register. At the same time the TA outputs the „RING nnn" message on the RxD line and activates the front panel RI indicator LED in sync with the incoming ringing signal.

S2 Escape Character

The S2 register contains the "Escape" character.

By default the value is decimal 43 = ASCII '+'.

The S3 register contains the <*CR*> *carriage return* character which must terminate each command string.

Default = 13.

S4 Line Feed Character

The S4 register contains the <LF> line feed character.

Default = 10.

The S5 register contains the <*BS*>*, backspace* character.

Default = 8.

The S12 register together with S2 contains that value of the guard time, or pause, that must preceed and follow the ESCAPE Sequence in order for the TA to switch from the Data Mode to the Command Mode.

The Guard Time is the period of inactivity on both the TxD line before the TA activates the ESCAPE Sequence. By default this value is set to 1 second.

The shortform description for is, <Pause> + + + <Pause>.

The default value is 50 (x20mS) which equals a 1 second pause. Permitted range is 0 to 255.

S30 Inactivity Timer

The S30 register sets the number of seconds of inactivity that must elapse before the TA automatically terminates a connection. The TA monitors the serial interface data lines and if there is no data traffic for the time period set by S30 (= n secs) the TA will automatically terminate the connection. S30=0 disables this function.

NOTE: The S30 register is not implemented in the Highspeed TA Pro at this time

S87 Network Data Rate (ISDN)

The S87 register indicates the current, or previous, network connection speed. The S87 register is read-only.

4	1200 bps
5	2400 bps
6	4800 bps
8	9600 bps
11	19200 bps
16	38400 bps
20	64000 bps

The S93 register value indicates the host computer port speed setting. The user can set and store this value using the &W command.

When *autobauding* is enabled the TA automatically tracks and adapts automatically to the host port speed.

The user can set the TA to run at a constant port speed by setting S93 to a value shown below and saving it to non-volatile memory. For example, setting „ATS93=16 &W0" sets the TA to run at a port speed of 38400bps. S93 can be set to one of the following values;

2	(300 bps) not implemented
3	(600 bps) not implemented

4 1200 bps
5 2400 bps
6 4800 bps
8 9600 bps
11 19200 bps
16 38400 bps
17 (48000 bps) -not supported-
18 (56000 bps) -not supported-
19 57600 bps - only with special hardware option
20 (64000 bps) - only with special hardware option
21 76800 bps - only with special hardware option
22 115200 bps - only with special hardware option
23 230400 bps - only with special hardware option

NOTE: When using V.110 protocol, asynchronous data transmission can only use values, 4, 5, 6, 8, 11 and 16. The network signalling rate must be greater than the host PC datarate.

The S173 register contains the asynchronous data format setting, ie. no. of data bits, parity and no. of stop bits. Default setting is S173=0; 8bits, no parity and 1 stop bit (8N1).

To change the data format you must set S173 as shown in the table below.

decimal	bit	7 6 5 4 3 2 1 0	Meaning	
0		x x x x 0 0 0 x		no parity
2		x x x x 0 0 1 x		mark parity (=1)
4		x x x x 0 1 0 x		even parity
6		x x x x 0 1 1 x		odd parity
8		x x x x 1 0 0 x		space parity (=0)
0		x x x 0 x x x x	1	stop bit
16		x x x 1 x x x x	2	stop bit
0		00 x x x x x x		8 bit per character
64		01 x x x x x x		7 bit per character

Remember to set S173 register with the corresponding decimal number for the required async data format. eg. to set 7E1 - ATS173=68

4.3.5 Responses and Error Messages

4.3.5.1 Text or Verbose Responses

When ATV1 is set (default) the TA outputs its responses in verbose form or as a text message.

BUSY
Remote device is incompatible for one of the following reasons;
- wrong number
- incompatible service indicator
- busy

CARRIER nnnn The TA has established a connection with a remote TA. "nnnn" is the network data rate. With V.110 Direct operation this number always equals the host PC data rate.

CONNECT nnnn <callnr>
An ISDN connection is established with a compatible remote device.
For reasons of compatibility with modem applications the CONNECT message always follows the CARRIER message.
When ATW2 is set, the TA reports the line speed followed by the ISDN-call number (in brackets).

ERROR
TA cannot execute the command.
Possible reasons:
- unrecognised command
- invalid command parameter

NO CARRIER
The TA cannot establish an ISDN-connection.
Possible reasons:
- remote has disconnected
- incompatible Protocol (V.110)
- V.110: incompatible host port data rates at each end
- local TA has disconnected

OK
Normal response to an „AT" command string

RING nnnn
Incoming ring (calling indication) where "nnnn" is the calling party's number.

4.3.5.2 Numeric Responses

Note: ATV0 selects numeric responses

Value
Text Meaning

000
OK

001

CONNECT

002
RING

003
NO CARRIER

004
ERROR

005
CONNECT 1200

006
NO DIALTONE

007
BUSY

008
NO ANSWER

009
CONNECT 0600

010
CONNECT 2400

011
CONNECT 4800

012
CONNECT 9600

016
CONNECT 19200

017
CONNECT 38400

018
CONNECT 57600

019
CONNECT 76800

020
CONNECT 115200

021
CONNECT 230400

046
CARRIER 1200

047
CARRIER 2400

048
CARRIER 4800

050
CARRIER 9600

053
CARRIER 19200

054
CARRIER 38400

056
CARRIER 64000

057
CARRIER 128000

080
PROTOCOL V.110

081
PROTOCOL X.75

082
PROTOCOL X.75/DXJ

083
PROTOCOL V.120

084
PROTOCOL X.31/D

085
PROTOCOL X.31/B

086
PROTOCOL X.25/B

087
PROTOCOL ISO-8208

4.4 PAD Commands

4.4.1 PAD - Introduction

The *PAD* (Packet Assembler Disassembler) allows asynchronous DTE's to communicate using a "packet oriented" protocol via the X.25 Packet Switched Network (DATEX-P). The operation of the PAD conforms to the International ITU/CCITT standards, X.3, X.28 and X.29, and is not „manufacturer specific" as compared to the AT-Commands described in the previous chapter.

The PAD *Parameters* are defined in an international standard (international 22) and the S-Registers are defined as part of the standard AT Command set. The parameter set build a *Profile* and the Highspeed TA Pro is has several different preset command Profiles which can be loaded by the user. The CCITT Standard defines 2 international profiles, „90" and „91", which are referred to as, "*standard* and *transparent"* Profiles. The Highspeed TA Pro has 8 additional prestored Profiles of which Profile-0 (Null) can be modified by the user.

The configuration of the PAD is controlled by standard commands and in addition the Highspeed TA Pro supports some special commands to control additional ISDN functions.

The PAD conforms to the following CCITT-Standards:

X.3 describes the standard parameters, (*Parameter* 1..22), supported by the PAD;

X.28 describes local interface control signals, see *Commands*;

X.29 describes the remote interface control signalling (DCE), eg.remote PAD (only partially implemented in the Highspeed TA Pro).

4.4.2 PAD Access to X.25

The Highspeed TA Pro can be configured in a number of different ways to access the Packet Switched Network using either the ISDN D-Channel or B-Channel signalling.

D-Channel This type of access is known as ***X.31 in the D-Channel*** (16Kbps supervisory channel) and is the most commonly used method of X.25 access via ISDN. In Germany it is known as, "DATEX-P-Access", in France, "Transpac" and "PSS" in the UK. The user subscribes to a permanent ISDN service and is then billed, by the service provider, according to the number of transmitted data packets. Transmission datarate is limited to 9600 bits/sec and to send data via the packet switched network the user only has to call one number to service provider and establish a connection. This is similar to X.400 Frame Relay service.

B-Channel Using the B-Channel allows access to the full 64.000 bit/sec channel bandwidth and thus allows data transmission at higher datarates,compared to D-Channel signalling; for example, upto 38K4bps async and 64Kbps sync. Signalling in the B-Channel is not billed by the number of transmitted data packets but as a function of the connect time, like a normal telephone call.

To enable X.31 communications you must decide how the PAD will be configured:

Case1: The network service provider provides a permanent dedicated X.25 gateway which doesnot require a special ISDN number for access to the

ISDN exchange (*packet handler*) - this is known as signalling in the D-Channel.

This case is known as ***X.31 in the B-Channel (PH)*** and is a seldom used access method by standard network service operators.

Case 2: In this case you access the X.25 network (private X.25-Packet Switched Service Provider) by making a normal ISDN call to an X.25 Server (*packet handler*). ***X.25 in the B-Channel***.

Case 3: In this case there are 2 TA's set up for X.25 packet switched communications (PAD) bundled onto one ISDN line. In this case the communications is known as, ***X.25 in the B-Channel (DTE-DTE), ISO 8208***. In the true sense this is not packet switched communications because it takes place end to end between two DTE's and is not routed via an X.25 Service Provider. The ISDN connection is set up popint to point and is billed by the call duration.

In each case incoming and outgoing data traffic via ISDN is possible depending upon the conditions agreed with your service provider.

4.4.3 PAD Configuration

As there are different methods of access to Packet Switched Network available to the user and it is important that the PAD is correctly configured for the chosen method of datatransmission. By default the Highspeed TA Pro is configured for *X.31 in the D-Channel*.

The PAD can be configured, either

- in the Configuration Module directly after power up (at the *´#´* Prompt),
- in the PAD itself (in response the the command word *config*), or,
- from a different Module (e.g in AT mode following the exit command *AT+x*)

When parameterising the PAD itself, the PAD must be restarted in order to load the new configuration. If you are configuring the PAD for your normal way of working and always remember to save the new configuration to non-volatile memory.

PAD program Parameters

pad.padmode	selected programming mode
pad.packethandler	X.25-server ISDN number (only used with *X.25 in the B-Channel (DCE)*)
pad.msnout	Terminal Adapter ISDN "Caller ID" (originator address), optional, not essential; used with *X.25 in the B-Channel* and *X.25 in the B-Channel (DTE-DTE), ISO-8208.*

pad.msnin sets the incoming Caller ID that will be answered by the TA. Do not set if theTA is to answer all calls. If a number is set then the TA will only answer an incoming call from another TA with the same MSN (*see pad.msnout).* Used with *X.25 in the B-Channel* and *X.25 in the B-Channel (DTE-DTE), ISO-8208.*

pad.tei For *X.31 D-Channel* access the network service provider allocates a TEI-number (terminal endpoint identifier) which is required for connection to an S0-bus. By default the TEI-number is "1" -. The TEI will only change when there are more than one X.31-devices connected to the same S0-bus.

pad.incoming Enables auto answer. By default is set to "1" = "yes".

pad.dataformat Sets the synchronous data format. By default it is set to "0" = 8N1 (8 bits, no parity, 1 stop bit). The *dataformat* setting corresponds to the S173 Register setting in the AT-Command Interpreter.

decimal	bit	7 6 5 4 3 2 1 0	Meaning
0		x x x x 0 0 0 x	no parity
2		x x x x 0 0 1 x	mark parity (=1)
4		x x x x 0 1 0 x	even parity
6		x x x x 0 1 1 x	odd parity
8		x x x x 1 0 0 x	space parity (=0)
0		x x x 0 x x x x	1 stop bit
16		x x x 1 x x x x	2 stop bits
0		00 x x x x x x	8 bits per character
64		01 x x x x x x	7 bits per character

Remember to program this parameter with a 3 digit decimal number in the same way as programming an S Register value in the AT-Command Interpreter.

help pad & *pad* View PAD configuration

```
#help pad
pad.msnin: incoming MSN/EAZ (msnin=nnnn or empty)
pad.msnout: outgoing MSN/EAZ
pad.packethandler: isdn address of packet handler
pad.TEI: X.31 TEI value (normally 1)
pad.padmode: pad mode:
    0: X.31 D-channel
    1: X.31 B-channel {ISDN packethandler via bearer capability}
    2: X.25 (DCE) {nedds packethandler ISDN address!}
    3: X.25 (DTE-DTE), ISO-8208
pad.incoming: incoming: 0: disabled; 1: enabled
```

```
pad.Profile: default Profile (0..7,90,91)
#pad
pad.msnin: <>
pad.msnout: <>
pad.packethandler: <>
pad.TEI: 1 (0x1)
pad.padmode: X.31 D-channel
pad.incoming: disabled
pad.Profile: 0 is active
#
```

The actual PAD configuration can be displayed as shown in the table above by typing, "help pad", after the # prompt character in the Configuration Module. To set a PAD parameter directly use the command "config" followed by a space followed by the parameter value to be set.
eg. "config mnsin=1234" sets the incoming MSN value to 1234. Cf. "AT+X" command in the AT Command Interpreter.

4.4.4 Initial Connection

This section describes a typical call set up using *X.31 in the D-Channel*.

Default parameters:

padmode 0	X.31 in the D-Channel
tei 1	
Profile 0	Default Profile (Parameter set) for standard asynchronous serial interface - 9600bps, 8-bits, no parity, 1 stop bit.

On power up the TA outputs an Opening Message and performs a selftest. After about 1 second you can load the PAD from the Configuration Module by typing <CR>. If the TA powers up in the *AT Command Interpreter* use the "AT$P <CR>" to switch to the PAD.

When the PAD is invoked the TA outputs an "*" as the prompt character.

To test the X.31_Functions set up a call to your local X.25-Echo-Server:

**ISDN tel. No.* <CR>

When the connection to the Server is established, the server sends a "Greetings Message" and all packets sent to the server are echoed back. Note that in the standard PAD configuration a packet is sent upon receipt of <CR. This can be modified by changing Parameters 3 and 4.

To disconnect from the Server switch back to the Command Mode (Parameter 1) by typing Control-P. The PAD responds with the Prompt character. To hang up the connection type,

*clr<CR>

Note: In the above command the asterix character "*" is the PAD prompt and is not part of the command.

4.4.5 Commands (X.3, X28)

You can view the PAD commands by typing, "*help com".* In addition to the Standard X.28 commands the PAD supports the following: *config, at, pad, v25.* These commands allow you to switch between the different Command Interpreters. PAD commands are "case sensitive" and hence enter the commands as shown and do not mix upper and lower case characters.

The PAD supports the following commands;

```
*help
help      : this message
help com  : show pad commands
help par  : show pad parameter
help Prof : show all pad Profiles
*help com
 nnnn     : establish a logical connection
 CALL nnnn : establish a logical connection
 CLR      : clear a virtual connection
 CONFIG   : config commands (config help pad)
 HELP     : display help information
 ProF x   : load Profile x
 PAR?     : show actual parameter
 SAVE     : save actual params to Profile 0
 SET x:y  : set parameter x to value y
 SET? x:y : set and read
 AT       : switch to AT command module
 PAD      : restart PAD
 V25      : switch to V.25 module
 X21      : switch to X.21 module
 .        : show pad module signon string
*
```

. (point)		Show PAD-Identifier string
nnnn	or	
call *nnnn*		Establish an X.25 Connection. nnnn is usually the X.25 Service Provider's number (Datex-P-Call Number in Germany). In cases 2 and 3 (see above) is an ISDN Call Number. See end of this section for more information.
clr		Clear down the current X.25-connection (hang up)
help		Online-Help
Prof *n*		Load PAD-Profile *n*. *n* can be a value, 0..7, 90 or 91. Profile-0 is the working Profile and loading *Prof n* loads the preset configuration "n" into Profile-0. Individual parameters can be changed using the *set* command.

NOTE: Profile-0 runs from RAM and in order to make any parameter changes permanent be sure to save the Profile to non-volatile memory using the *save* command. The changes will then be loaded on power up.

par?	Show actual parameter.
save	Save current working Profile to Profile-0.
set *x:y*	Change value of Parameter *x* to *y.* Parameter strings are permitted, punctuate the x:y values with a comma.
set? x:y	Same as *set,* but show the new values as they are set.
stat	Show current PAD-Connect Status.

In addtion to the standard X.28 commands the PAD also supports the following special commands:

at	Change to the AT-Command Interpreter.
pad	Restart (load) the PAD. Should be used after making parameter changes.
config *text string*	Overwrite the Text String (Command) in the Configuration Module.
v25	Change to V.25bis-Command Interpreter (optional).

A Call Number can be suffixed with a qualifier:

- reverse charges (called party is billed for the call)
- closed user group
- user data

The call qualifier is sent as *call packet* during the X.25-Connection call set up phase. The command syntax is according to X.28 and P20 (Variants A and B):

[R][G(xy)-]nnnnnn[,user-data]

or

[R,][C(xy)]nnnnnn[Duser-data]

or

[R,][G(xy)]nnnnnn[Puser-data]

The parameter in square brackets [] can be omitted.

R	reverse charges, folowed by a ´,´ or ´ ´
G(xy)	closed user group xy (2 digits, preceded with a ´G´or ´C´)
nnnnnn	ISDN- or X.25 Call Number (15-digits max)
,user-data	user data (max. 12 characters, preceded with a ´,´ ´D´ or ´P´)

4.4.6 Parameter (X.3)

The supported PAD commands and their permitted parameter range can be viewed using the *help par* command. The allowed values shown as, " x..y" mean any value in the specified range whereas x,y means either, or, the values listed. The value range shown as, "x+y etc" are bit-mapped.

The table below show an overview of the Parameter range which is followed by a detailed description of each Parameter in turn.

*help par

par	name	allowed values
1	escape	0,1,32..126
2	echo	0,1
3	forward	0..127
4	idle	0..255
5	device	0,1
6	signals	0+1+4+8
7	break	0..31
8	discard	0,1

```
  9  CRpad        0..255
 10  folding      0
 11  speed        (read-only)
 12  flow         0,1
 13  LFinsert     0..7
 14  LFpad        0..255
 15  Edit         0,1
 16  Cdelete      1..127
 17  Ldelete      1..127
 18  Ldisplay     1..127
 19  Esignals     0..2
 20  Mask         0..255
 21  parity       0..3
 22  page         0..255
121  121          0
122  122          0
123  123          0
*
```

Parameter
Range
Meaning

1

0,1,32..126

0
1

32..126
Switch to Command Mode
Defines which User command will switch from the Data Mode:

switching not allowed
↑P (Control-P, DLE, 0x10)
Character to initiate switch to Command Mode. Decimal ASCII value

2

0,1

0

1
Command Echo

Echo Off
Echo On

3

0+1+2+4+8
+16+32+64

0
1
2
4
8
16
32

64

Data Forwarding Character
The parameter defines the Packet Forwarding Character that flags the beginning and end of each data Packet

none
all alpha-numeric characters 0 - 9, a - z
Carriage return (<CR>)
ESC, BEL, ENQ, ACK
DEL, CAN, DC2
EXT, EOT
HT, LF, VT, FF
Any special control character

4

0..255

0

1..255
Packet Idle Timer
This parameter controls the time delay that the pad will allow to elapse without data input before closing the Packet. (idle timer)

No delay timer
Continue after delay n * 50 ms

5

0,1

0

1
Transmit Flowcontrol (input)
Enables software flow control (XON/XOFF) between host terminal and TA .

XON/XOFF flowcontrol is disabled
XON/XOFF flowcontrol is enabled

6

0+1+4+8

0
1
4

8
PAD Responses and Messages
controls PAD responses and messages

no PAD Messages
PAD Messages enabled. If value 8 is not set PAD outputs normal X.28 english text messages, otherwise it outputs P20 (German: DATEX-P ...) messages.

PAD outputs an "*" prompt in the Command mode.
PAD outputs Datex-P responses and messages (Rec. P20)

7

0+1+2+4+8

0
1
2
4

8
BREAK-Signal Handling
Defines how the TA handles a Break-Signal from the terminal

ignore Break
send an *interrupt* packet
Reset
end an *indication of break* message
switch to Command Mode

8

0,1

0

1
PAD output control
This parameter controls whether the PAD outputs the received Packet forwarding character
normal output
received forwarding characters are not output

9
0..255
Carriage return followed by NUL
This parameter controls the NUL (0x00) character count to follow each CR to the host (DTE)

10

0

0
Automatic line break control

disabled

11
read-only
Output data transmission speed

- not implemented -

12

0,1

0

1
Receiver Flowcontrol (Output)
Enables XON/XOFF flow control between TA and host terminal

XON/XOFF-flow control disabled
XON/XOFF-flow control enabled

NOTE: when XON/XOFF is disabled, RTS/CTS Hardware handshake is enabled
13

0+1+2+4

0
1
2

4
Line feed control
Controls whether or not and how a LF character is sent after a carriage return character (<CR>)

no LF
LF follows <CR> with output messages
LF follows <CR> with input commands
LF follows <CR> in command echo mode

14
0..255
NUL character following line feed counter
Sets the number of NUL (0x00) characters that follow each LF that is output to the host (DTE)

15

0,1

0

1
Input correction
This parameter controls whether or not input characters are corrected in the input buffer (in data mode)

no correction
correction enabled

16
0..127
Delete character
Sets the control character that can be used to delete an input character in a command string (eg Backspace)

17
0..127
Delete line character
Sets the control character that will erase a complete input string

18
0
Repeat input string

- not implemented -

19

0,1,2

0
1

2
Character deletion
Controls how the PAD deletes characters as they are output to the DTE

no character deletion
output from ´\´
output from BS,SPACE,BS (delete all characters to the left of the cursor and position cursor one space left

20

0+1+2+4+8
+15+32+64
+128

0
1
2
4
8
16
32
64

128
Echo-Filter
Controls the characters which are echoed back in command echo mode

no Echo-Filter (all characters echoed)
CR not echoed
LF not echoed
VT, HT. FF not echoed
BEL, BS not echoed
ESC, ENQ not echoed
ACK, NAK, STX, SOH, EOT, ETB, ETX not echoed
Parameters 16,17,18 not echoed
Special small SPACE character not echoed

21

0..3

0,1

2,3
Parity Checking
Defines whether or not the TA checks parity

no parity check
check parity

22
0
Page output control

- not implemented -

121
0
- not implemented -

122

0
- not implemented -

123
0
- not implemented -

4.4.7 Preset Profiles

The Highspeed TA Pro is programmed with 10 preset profiles - 0..7, 90 and 91. Profiles 90 and 91 are the Standard and Transparent Profile as defined in CCITT Rec. X.31(now known as ITU Rec). Profiles 1 to 7 are special preset profiles as defined in the Deutsche Telekom Datex-P user Guide. Profile 0 is the factory default setting and is the default Profile for standard Terminal applications.

*help Prof

Profile	0	1	2	3	4	5	6	7	90	91
par 1	1	1	1	0	1	1	0	1	1	0
par 2	1	0	0	0	0	0	0	1	1	0
par 3	2	126	2	0	2	2	0	2	126	0
par 4	20	0	0	20	0	0	4	0	0	20
par 5	1	1	0	0	0	0	0	0	1	0
par 6	1	9	9	1	9	1	0	9	1	0
par 7	2	2	2	8	2	2	0	2	2	2
par 8	0	0	0	0	0	0	0	0	0	0
par 9	0	0	2	0	2	2	0	2	0	0
par 10	0	0	0	0	0	0	0	0	0	0
par 11	0	0	0	0	0	0	0	0	0	0
par 12	1	1	0	0	0	1	0	0	1	0
par 13	0	0	4	0	0	5	0	4	0	0
par 14	0	0	0	0	0	0	0	0	0	0
par 15	0	0	0	0	0	1	0	0	0	0
par 16	8	127	127	8	127	127	127	127	127	127
par 17	24	24	24	24	24	24	24	24	24	24
par 18	18	18	18	18	18	18	18	18	18	18
par 19	1	2	2	2	2	2	2	2	1	1
par 20	0	0	0	0	0	0	0	0	0	0
par 21	0	0	3	0	0	3	3	3	0	0
par 22	0	0	0	0	0	0	0	0	0	0
par 121	0	0	0	0	0	0	0	0	0	0
par 122	0	0	0	0	0	0	0	0	0	0
par 123	0	0	0	0	0	0	0	0	0	0

*

4.4.8 PAD Responses

Parameter 6 controls whether the PAD outputs English text messages as defined in ITU recommendation X.28 or German text messages according to P20 (DATEX-P ...).

In the PAD Configuration Module you can set the PAD to output text messages using the command "*config pad.verbose 1*".

Refer to chapter titled, "Troubleshooting" section X.25 for further information.

4.5 X.25 Synchronous Interface

NOTE: Synchronous operation is not supported as a standard feature in the Highspeed TA Pro and requires a special hardware interface.

4.5.1 X.25-synchronous - Introduction

TheTerminal Adapter can support synchronous Datex-P10-Basic Rate operation (9600 bps) in the D-Channel (X.31). The TA can be used in this mode with any X.25 device with either a standard V.24/V.28 serial port or X.21 (optional) interface.

In PAD/X.31 mode it is possible to set a TEI-Value (terminal input identifier) when there are multiple X.31-devices on the same network. Check with your network service provider the permitted maximum number of virtual point to point connections (SVC´s) that can be established at one time. Generally a maximum of two are allowed.

In this mode the front panel DATA/CON indicator LED has a special function. See below.

4.5.2 X.25-Synchronous Operation

To enable X.25-synchronous operation the TA must be configured as described below and note that in this mode it is not possible to switch between AT and PAD.

Configuration is done in two stages:

1. X.25-synchronous (relay) mode must be set as the default application. Set the command "*appl 2*" and save it using the "*save"* command. If you are not in the PAD but in the AT Command Interpreter switch to the PAD using the "*at+x*" command, or PAD "*config".*

   Cycle the power to the TA wait two seconds approx whilst the TA performs its self test, type CR and the TA will respond with the PAD prompt "#".

2. Use the command "*relay*" to check X.25-synchronous mode is loaded. It is important that the value of *relay.tei*. is set to 1.

Check using the command *"save*" the set values are correct. Switch the TA off.

The X.25-synchronous mode configuration is now completed.

Configuration parameters.

relay.tei To access *X.31 in the D-Channel* the network service operator will allocate a TEI-value (terminal endpoint identifier) and the TEI-value allows the Terminal Adapter to be connected to the S0-Bus. The standard value for the TEI is "1" and the TA has this value set by default. A different TEI value is only needed when more than one X.31 device is connected to the same S0-Bus.

4.5.3 X.25-Synchronous Operation

When the TA is properly configured and powered up, following the self test, the TA loads the application *"relay"* (X.25 synchronous connection via X.31 in the D-Channel). If you have an async terminal connected (set for 9600 8N1) you can monitor the output data which is presented as a hexadecimal value 0x7e.

In synchronous mode the **D2/RxD** indicator LED will be ON constantly.

When connected to another synchronous X.25-device the **D1/TxD** LED will be on constantly and the Layer-1 on the serial interface is active.

An explanation of Layer-1 and Layer-2:

Layer-1 describes the physical layer or connection which carries synchronous bit stream in both directions (0x7e on the serial line).
Layer-2 describes the logical connection between two devices (DCE and DTE). Layer-2 is active when the DTE-side (as a rule viewed from the originate end) has sent a data packet ("SABM") and the DCE-side has responded with a special data packet ("UA").

In X.25-synchronous mode Layer-2 in the X.31/D-Channel is established first followed by Layer-2 on the synchronous interface of the DCE/DTE which can be controlled by the user or at regular intervals (eg 1 minute).

The **DATA/CON** LED shows the Layer-2 state on the serial interface and the D-Channel connection:

DATA/CON LED OFF**:**

Layer-2 is not active on neither the serial interface nor X.31/D-Channel.

DATA/CON flashes slowly with a long pause (0,5 sec to 1,5 sec.):

Layer-2 is established on the serial line and the TA is trying to establish Layer-2 on the X.31/D-Channel. This happens when,

- the ISDN-S0 line is not connected
- the ISDN exchange does not support X.31/D-Channel
- the ISDN exchange does not recognise the set TEI-value

DATA/CON flashes slowly with short pause (1,5 sec to 0,5 sec.):

Layer-2 signalling on the network is correctly established - the network connection to the S0-Bus is good and the terminal equipment is connected to the TA.

DATA/CON ON **permanently**:

Normal X.25-synchronous operation is established in D-Channel (X.31/D-Channel). Layer-2 is active at both ends of the link. As long as the remote terminal device is ready the TA will try to maintain the connection state even when the network is establishing the Layer-2 state. The DATA/CON LED will still be ON.

4.6 V.25bis-Command Set

NOTE: This module will only be available as an option and at the time of writing the option is still in development.

4.7 Analogue Telephone Interface (a/b switch)

NOTE: This chapter describes the „logical" performance or functionality of the A/B switch analogue interface, the „physical" description (pin-out) can be found in the section titled, *Technical Data.*

The a/b switch allows a standard analogue telephone or similar device with a 2 wire analogue line interface (modem or Group 3 fax) to be connected to the S0-Bus via the terminal adapter. The a/b switch can support either a modern electronic telephone with electronic ringer circuit and DTMF dialling or the older electromechnical type with loop disconnect (pulse) dialling. The a/b connection for the analogue attachment uses a Western Electric type RJ12 connector and if the analogue attachment is not equipped with the appropriate RJ11/12 connector you will need a cable converter to connect the telephone to the **Highspeed TA Pro**.

By default the a/b switch is set for *Speech/Telephony* Bearer Capability for both outgoing and incoming calls to enable Group 2/3 Fax operation and an incoming call's MSN will not be tested to allow unrestricted operation.

The a/b-switch is configured via the serial interface using a dumb terminal or PC, either from the Configuration Module directly on power up (see 3.2.1), or from the AT-Command Interpreter using the Command „at+x" (This command must be the final command in a string).

NOTE: Take care not to mix upper and lower case characters because they each have their own special meaning

The available a/bswitch commands and parameters are listed below. All commands are terminated with <CR> and the characters shown in square brackets „[...]" are the parameter value, it is not necessary to enter the square brackets with the command.

a/b Switch Commands

help ab List all a/b switch command parameters

ab<CR> Lists the a/b-Interface parameters settings. This command has no functional relevance as far as the a/b switch settings are concerned but it is a very useful command when troubleshooting problems related to a/b switch operation.

ab.msnin[=nnnn] This command sets the MSN (*multiple subscriber number*) [=nnnn] for incoming calls. Only incoming calls with the same MSN value will be answered and if the incoming MSN is longer than the set MSN the TA compares the last few digits.

If no value is entered after the „=" sign the set MSN value is deleted.
After setting the commands the call number to be dialled will be shown in arrow brackets „<nnn>".
An MSN-number can comprise upto 8 characters max.

ab.msnout[=nnn]

This command sets the Calling Party ID number (*oad*) which is sent with the out going call information and is transmitted by the network to the called party with the ringing information. If the outgoing MSN does not correspond to one that is set for the called subscriber S0-Bus the call is ignored and the first MSN on the Bus is selected.

ab.clir[=n]

Withhold Calling Party ID for the called party (*calling line identification restriction*):
O: CP.ID is sent with call (allowed)
1: CP.ID is withheld (restricted)

ab.servicein[=n]

Sets the accepted Bearer Capability for incoming calls.
n =
0 Voice/Telephony
1 Group 2/3 Fax
2 Voice/Telephony and Group 2/3 Fax
3 All services enabled (inv. Data calls: for test purpoes only)

NOTE: For *Group 2/3 Fax* use the sending fax must be connected to the ISDN and set for the same Bearer capability. Fax calls form the analogue network are accepted when the TA is set for Voice/Telephony.

ab.serviceout[=n]

Sets the outgoing Bearer Capability for the a/b-Interface.
n =
0 Voice/Telephony
1 Group 2/3 Fax

```
# help ab
ab.msnin: incoming MSN/EAZ (msnin=nnnn or empty)
ab.msnout: outgoing MSN/EAZ
ab.clir: calling line: (0:presentation allowed,1:presentation restricted)
ab.servicein: service/bc of incoming a/b call (0:TEL; 1:FAX; 2:TEL+FAX; 3:all)
ab.serviceout: service/bc of outgoing a/b call (0:TEL; 1:FAX)
ab.show: show internals of a/b module
# ab
ab.msnin: <>
ab.msnout: <>
ab.clir: presentation allowed
ab.servicein: 0:TEL
ab.serviceout: 0:TEL
# ab.msnout=1234
<1234>
```

```
# ab.msnin=5678
<5678>
# ab
ab.msnin: <5678>
ab.msnout: <1234>
ab.clir: presentation allowed
ab.servicein: 0:TEL
ab.serviceout: 0:TEL
#
```

4.8 ISDN-Interface

NOTE: This chapter describes the „logical" characteristics of the serial interface. The „physical " description (pin-out) can be found in the chapter titled "*Technical Data".*

The ISDN-connection to an S0-Bus conforms to ITU Rec. I.430.

The S0-Interface provides the user with 3 digital channels:

one **D-Channel**	The D-Channel runs at an operating speed of 16000bps and is referred to as the "Supervisory channel" and it carries the call set up and clear down information that is exchanged between the TA and the ISDN exchange (Central Office). The D-Channel is also used for packet switched datacommunications known as X.31 (PAD/X.31) communicating at 9600bps.
two **B-Channels**	The B-Channel is the user channel and runs at a datarate of 64,000bps. The B-Channel is used to transmit digitised voice (from a/b-telephone) and data from the Terminal Adapter according to V.110 protocol. Packet switched data can also be transmitted in the B-Channel providing the TA is configured for packet switched operation (X.31 PAD).

Which B-Channel is used during an ISDN connection is signalled from the ISDN exchange to the TA in the Supervisory channel (D-Channel) signalling as the connection is established.

The call set up and cleardown signalling between the ISDN exchange and the TA takes palce in accordance with a fixed protocol called DSS-1 or Euro-ISDN (ETS 300-102). The Highspeed TA Pro also supports the old German national standard for D-Channel signalling, 1TR6, which can be selected by the user if required.

NOTE: Packet switched data transmission in the D-Channel (X.31) is only supported by DSS-1 signalling protocol and not 1TR6.

5 Causes and Error Messages

5.1 ISDN Error Codes

5.1.1 DSS-1 Protocol Error Codes

Cause (hex)	**Meaning**
0x81	Unknown number

0x83
X.25 Network access is not available

0x86
D-Channel is not available

0x90
Normal call set up

0x91
Subscriber number is busy

0x92
No response from called device

0x93
No Answer (call set up time-out)

0x95
Incoming call from remote subscriber denied

0x9A
A different device has taken the call

0x9B
called machine is not available

0x9D
Network facility denied

0x9F
normal cleardown

0xA2
No free B-Channel

0xA6

0xA9
Incident on ISDN-network

0xAA

0xAF
Network congested

0xB2
Network facility not accessible

0xB9
Invalid bearer capability

0xBA
Bearer Capability not available

0xBF
Service / Option not available

0xC1
Service (bearer capability)not implemented

0xC6

56 kbit-Channel only available (restricted digital channel only)

0xCF
Service / Option not implemented

0xD8
incompatible remote device

0xE0..EF
Protocol failure

0xFF
Error at network interface

5.2 Internal Software Error Codes

5.3 X.25 Cleardown Error Codes

X.25 Release or Cleardown Packets

Value (hex)
Value (dec)
Acronym
Meaning

0x00
0
DTE/CONF
Cleardown by remote device

0x01
1
OCC
Remote/called party is busy

0x03
3
INV
Invalid netfork facility request

0x05
5
NC
temporary network disturbance

0x09
9
DER
Out of service/disrupted

0x0B
11
NA
access not available

0x0D
13
NP
unobtainable

0x11
17
RPE
remote timeout error

0x13
19
ERR
local timeout error

0x19
25
RNA
reverse charging not allowed

0x21
33
ID
incompatible remote device

0x29
41
FNA
single packet accepatnce not possible

5.4 DATEX-P Network Responses

Value (hex)	Meaning
00	No extra Information available
01	Invalid P (S)
02	Invalid P (R)
10	Invalid Packet type
11..1D	Invalid Packet type in r1 State
20	Packet not allowed
21	Unidentified Packet No. #
22	Call on other B-Channel
23	Invalid Packet type on Virtual connection
24	Packet "retry request" not allowed
26	Packet too short
27	Packet too long
28	Invalid default ID
29	Restart in the logical channel doesnot equal "0"
2A	Packet incompatible with network facility
2B	Illegal brak confirmation
2C	Illegal break packet
30	Idle timer running
	idle timer running to:

31 - send Packet "Incoming call"
32 - send Packet "Cleardown character"
33 - send Packet "Reset character"
34 - send Packet "Restart character"
40 Call set up Problem
41 Network performance code not allowed
42 Network performance parameter not allowed
43 Invalid Rufnummer des gerufenen Anschlusses
44 Invalid Rufnummer des rufenden Anschlusses
45 Invalid Leistungsmerkmalslänge >127
46 Incoming call denied
47 No free B-Channel available
48 Call collision
49 X.25: doppelte Leistungsanforderung
X.75: fehlende Transit DNIC
4A Fehlerhafte Adresslänge
4B Leistungsmerkmal vorhanden
4C Erwartetes Leistungsmerkmal fehlt
4D Ungültiges CCITT-spezifisches DEE-Leistungsmerkmal
4E Maximale Anzahl von Rufumleitungen überschritten
51 Fehlerhafte Codierung des Grandes
52 Unvollständiges Oktett vorhanden
53 Fehlerhaftes Q-Bit
54 NUI Problem
61 DNIC unobtainable
62 Unbekannte Transit DNIC
64 Falsche Nutzung des Leistungsmerkmals
65 Fehlerhafte Länge des Netzmerkmals
66 Länge des Netzmerkmals ungleich Null
67 M-Bit error
71 Problem with remote network
72 International network problem
73 Übermittlungsabschnitt außer Operation

74 International line is busy
75 Fehler im Transitnetz
76 Fehler im Zielnetz - unerlaubtes Netzmerkmal gefanden
78 Vorübergehendes LeitwegeProblem
79 Unbekannt gerufene DNIC
7A Wait
80 Fehlerhaftes Q-Bit or keine Operationsmittel available
81 Einzelpacket nicht vereinbart or vorübergehend außer Operation
82 Feld des Grandes ungleich 00 or gesperrt durch Netzbetreiber Datex-P
83 Unverträgliche Packetlänge
84 Fehlerhaftes M-Bit
85 Rückweisen der Verbindungsanforderung or NUI-Rufe nicht mehr erlaubt
86 FVV-Anschlußbeschreibung fehlerhaft
87 Auslösung durch Netzbetreiber Datex-P
88 DNIC unobtainable
89 Übernahme des Verbindungsentgeltes nicht vereinbart
8A Fehlende Vereinbarung
8B Fehlende Rufnummer des rufenden Anschlusses
8C Fehlerhafte Rufnummer des rufenden Anschlusses
8D Übermittlungsabschnitt unterbrochen
8E Übermittlungsabschnitt außer Operation
8F Zeitüberwachung für den Zustand P1 ("Unbelegt") abgelaufen
90 Fehlerhafte Codierung des Grandes
91 Fehlerhafter Direktruf
92 Unvollständiges Oktett vorhanden
93 Leistungsmerkmal vorhanden
94 Falsche Nutzung des Leistungsmerkmals

95	Fehlerhafte Adresse im Packet "Rufannahme"
96	Unerlaubtes Unterbrechungspacket im Subnetz
97	Unerlaubte Unterbrechungsbestätigung im Subnetz
98	Nur Einzelpacket mit Beschränkung der Antwortgabe erlaubt
99	Unverträgliche FVV
9A	Fehlerhafte Absprache der Fenstergröße
9B	Fehlende Felder
9C	Fehlerhafte Adresslänge
9D	Fehlerhafte Länge der Leistungsmerkmale
9E	Unvollständiges Feld
9F	Unverträgliche Durchsatzklassen
A0	Sammelrufnummer außer Operation
A1	Sammelrufnummer nicht erreichbar
A2	Sammelrufnummer vorübergehend außer Operation
A3	Fehlerhafte Adresse
A4	Fehlerhafte Subadresse
A5	Fehlerhaftes Netzmerkmalformat
A6	Länge des Netzmerkmals ungleich Null
A7	Keine Benutzerdaten vorhanden
A8	Fehlendes Kennzeichen für nationales Leistungsmerkmal
A9	Zugang zu Benutzern des gleichen Servicees gesperrt
AA	Rufnummer vorübergehend nicht erreichbar
AB	Benutzerkennung erforderlich in den Packeten "Verbindungsanforderung" and "Rufannahme"
AC	Gerufener Anschluß hat das Leistungsmerkmal "Einzelpacket" nicht vereinbart
AD	Netzinterne Ladeanforderung empfangen
AE	Netzkomponenten-Fehler
AF	Netzausfall einer virtuellen Verbindung
B0	Netzinterne Restartanforderung empfangen
B1	Fehlerhafte Rufnummer des gerufenen Anschlusses im Packet "Rufannahme"
B2	Unbekanntes Netzmerkmal
B5..B6	X.32 Wählzugang nicht available
B7	Reserved

C0..C1	X.25 Wählzugang: Servicedatenfehler
C2	X.25 Wählzugang: Benutzerdaten fehlerhaft
C3	X.25 Wählzugang: Prozedurfehler
C4..C5	X.25/X.32 Wählzugang: Modemfehler
C8	X.25 Wählzugang: erfolgreicher Verbindungsaufbau
C9	X.25 Wählzugang: z.Zt. im Wählvorgang
FF	System failure

6 Troubleshooting

First Step:

NOTE: If, you are experiencing problems, the first step is to **reinitialise the Highspeed TA Pro by recalling the Factory Default settings.** Proceed as follows;

- Reset the Highspeed TA Pro by turning it off and on again.
- Connect a dumb terminal or a PC running a terminal emulation program to the serial interface. Set the communications parameters for **9600 bps, 8 bits, no parity** (9600, N81).
- Power up the Highspeed TA Pro, after two seconds approx. type <CR> (Return) and the TA responds with the „#" prompt character.

- Type the command "clear" followed <CR>. The TA replies with „clearing .... done".

- All stored parameters will be deleted. Cycle the power to the Terminal Adapter and the device is now running with the factory default settings.

6.1 Common Problems

No LED's are lit

Check the TA switched on and the power supply is correctly connected to the TA and plugged into the wall outlet. If this is the case the "ISDN" LED should be on or flashing. If this is not the case check the power supply is working correctly.

No responses appear on the local terminal screen.

Check the serial cable is correctly connected and has the right pin configuration. Do you need a normal serial cable or Null Modem cable?

TA responses are garbaged!

The terminal and TA are set to operate at different speeds. Type either 'A' or 'a' to get the TA to adapt to the terminal operating speed. If the TA responses to the screen are still garbaged check TA has autobaud enabled.

6.2 Problems with AT Commands

TA responds with "BUSY" to all call attempts.

Check the TA is correctly connected to the ISDN socket, the ISDN LED should be ON. If the ISDN connection is correct then check the following;

a) Are you calling the correct number? Are you dialling through a PBX? If yes have you prefixed the number with the correct network access digit (usually 9 or 0).

b) Are you trying to access a function that is not supported by the ISDN exchange or the called device is not programmed to accept your call. Repeat the call one more time and if that fails test the connection using a voice telephone.

TA responds to all calls with NO CARRIER

If you are trying to set up a connection in the B-Channel, as indicated by the DATA/CON LED - a NO CARRIER response after 10 seconds (V.110) or 30 seconds (X.75) means that the Highspeed TA Pro is not synchronised with the remote TA or the remote TA has disconnected. Possible reasons are;

a) The TA's are operating at different speeds. This is the most common fault condition V. 110 Protocol. Check the operating speed of the remote TA and set your terminal to the same speed.

b) The remote TA is not using the same Protocol (V.110 or X.75). The remote device is a telephone.

6.3 Problems with the Analogue Telephone Interface

No network tones can be heard on the telephone

Check that the „ISDN"LED is ON. If not there is no connection to the (see below).

If the ISDN LED is ON then lift the telephone receiver and check that the ☎/OH LED comes ON, this indictaes that loop current is flowing to the telephone. If the ☎/OH LED is not ON check the cable connection between the telephone and the TA. The telephone may need a special cable of plug adapter to connect to the a/b-socket (RJ11/12).

If the connection is OK then the ☎/CON LED should come on when the telephone is taken off-hook unless there is no available B-Channel for the telephone to use. In this case there are 3 possible reasons for the problem:

a) The ISDN network is not using DSS-1 protocol in the supervisory or D-Channel signalling (Euro-ISDN).

b) The a/b-Interface is not supported by the network or the Bearer Capability for a/b switch use has not been set. Set the TA for *Voice/Telephony Bearer capability*.

c) The telephone handset is defective (very unlikely).

If the ☎/CON LED is ON but yet there is no dialtone present from the network, check that you have not already dialled a digit(s). Dial the call anyway to see if you can establish a connection.

The telephone doesnot ring, no incoming calls

An incoming call is indicated by the ☎/OH LED flashing in sync with the incoming ringing signal, providing the TA is set to accept the call. If this is the case then the telephone's ringer may be switched off or the ringer is defective.

If ☎/OH LED still does not flash when there is an incoming call there are several possible reasons why this may be the case:

a) The TA is set for an incompatible Bearer Capability, set *voice/Telephony*.

b) You have set an incompatible MSN for incoming calls and the TA hence doesnot accept the call. Switch the MSN off (see section *analoge Interface*).

c) Both B-Channel on this S0-Bus are already in use and the **Highspeed TA Pro** ignores the incoming call.

6.4 PAD/X.31 Problems

It is not possible to set up a call to the Echo-Server

Check the *padmode* parameter is set to 0 (X.31 im D-Channel). Telecom's X.31 Echo-Server is temporarily unobtainable. Check you are calling the right number with the correct prefix. For Germany the prefix is "0262".

Check the ISDN service supports X.31 in the D-Channel.

I cannot cleardown from an establish connection

The default configuration for this type of operation uses Profile, and to terminate a connection in this mode type "CONTROL-P" followed by "*clr"* <*CR*>.

If you have set a different Profile it is possible that the TA will not respond to this command and the connection will have to be cleared from the remote end. In this case either, disconnect the serial port cable so that the TA loses DTR, or power down the TA to terminate the connection.

I have problems sending large files

The optimum oerformance of the PAD is only achieved using asynchronous datarates of upto 9600bps. It is possible to work using higher ports speeds but the system performance (data throughput) is limited because of restrictions on data block size, and with large file sizes a 128byte block size is not optimum (parameter 1,2,3).

If you need to send large data volumes, set Parameter 3 = 0 (Null) to enable maximum block sizes.

It is not possible to establish a connection to an ISDN number

Check the front panel ISDN connection indicators are ON, if not the ISDN number may be incorrect or you are trying to set up a connection with an incompatible device. If the LED's are ON the network has routed the call and both terminal devices trying to establish an X.25 connection in the B-Channel. If the call attempt fails check the Cause or Error message returned by the TA or network, or alternatively wait for the special data is the *call packet* from the remote terminal device.

7 Technical Specification

7.1 Overview

Serial Interface (DTE)

Data rate	1200 - 230.400 bit/sec asynchronous. (8N1), automatic bps rate recognition (option: 1200 -38,400 only) 64.000 bit/sec. (synchronous)
electrical / mechanical	V.24 / V.28 (25-way DSub) X.21 / V.11 (15-way DSub via adapter cable)
Protocol	Extended AT Commands Direct (hotline) call (DTR-Dial) PAD for X.31 (Option) V.25bis (Option)

X.25 synchronous (P10H) (Option)

ISDN Interface

electrical / mechanical S0 complies with I.430 (dc feed is not necessary)
8-way RJ-45 connector (4 pins used)

Protocols; D-Channel LAPD
X.31 (access to X.25-Packet Switched network via D-channel)
Euro-ISDN (ETS 300 102)
1 TR6 (old Deutsche Telekon national ISDN standard) (Option)

B-Channel X.75
V.110 / ECMA 102
V.120
X.31 (Access to X.25-Packet Switched Network via B-channel)
X.25
X.25 DTE-DTE (ISO 8208)
transparent (HDLC)

Telephone Interface

mechanical a/b for standard analogue telephones
6-way RJ-12 connector (2 pins used)

electrical

Impedance:	600 □ or 810 □ complex
Coding:	G.711 A-Law or optional m-Law
Ringing signal:	35V..42VRMS ac 50Hz + 20V..55V dc
Loop current:	max. 24mA +/- 20%
Schaltschwelle:	5mA..15mA dc

Call Set up Methods Loop disconnect/pulse dialling
DTMF or touchtone dialling
Services (telephony / FAX / none) Programmable
separate Programmable MSN / EAZ numbers

Additional data

Indicators	10 LED's (6 x DTE, 2 X ISDN, 2 x a/b)
case	Tabletop (205 x 40 x 175 mm)
Power supply	Wallcube, 230V / 9V 50/60Hz, 7 Watt
Configuration	DIP-Switch and non-volatile memory
Sicherheitsnormen	CE; EN60950, Class I
Approval Number	B 127220 H

7.2 Serial Interface Configuration

The Highspeed TA Pro serial port is configured on a DB25M connector, which can be configured as either a, V.24 (RS232), or X.21 interface.

The X.21 interface uses those pins of the DB25 connector that are unused in the V.24 configuration. When the Highspeed TA Pro serial port is configured as an X.21 port you will need to use a special (25 way to 15 way) adapter cable to connect the TA to the host DTE. All modern PC's (PC-AT onwards) have a 9 pin serial port connector and for comparison purposes the table below also includes reference to the 9 pin serial port pin/function configuration.

Pin **V.24 / V.28** **X.21**	**9way** **25way** **EIA** **CCITT** **DIN** **CCITT** **Signal** **to/from TA**	
-	1	PG 101 E1 Protective/frame Ground
3 2 TD 103 D1 Transmit Data to TA	2	3
2 3 RD 104 D2 Receive Data from TA	7	4
7 4 RTS 105 S2 Request To Send to TA	8	5
8 5 CTS 106 M2		

Clear To Send
from TA

6
6
DSR
107
M1

Data Set Ready
from TA

5
7
SG
102
E2

Signal Ground

1
8
DCD
109
M5

Carrier Detect
from TA

9

T(A)
X.21: Transmit Data
to TA

10

T(B)
X.21: Transmit Data
to TA

11

C(A)
X.21: Control
to TA

12

C(B)
X.21: Control
to TA

13

R(A)
X.21 Receive Data
from TA

14

R(B)
X.21 Receive Data
from TA

18

S(A)
X.21: Data Clock
from TA

19

S(B)
X.21: Data Clock
from TA

4
20
DTR
108
S1

Data Terminal Ready
to TA

21

I(A)
X.21: Indication
from TA

9
22
RI
125
M3

Ringing Indicator
from TA

23

I(B)
X.21: Indication
from TA

15
TC
114
T2

Transmitted Clock
from TA

17
RC
115
T4

ReceivedClock
from TA

The serial port is hardware configured for either V.24 or X.21 by setting DIP-Switch 1 on TA rear panel;

SW1 OFF (up) >>> V.24
SW1 ON (down) >>> X.21

NOTE: To avoid the risk of causing electrical damage take care to ensure the serial port is correctly configured for your particular application.

7.3 Analogue a/b Interface Pin-out

The a/b Interface uses a 6-pin RJ12 connector:

RJ12 Pin
Signal

1

2

3
b-wire

4
a-wire

5

6
Frame Ground or Earth

RJ12 Connector pin layout

2 4 6 Viewed from component side
o o o

o o o

1 3 5 Viewed from underside

7.4 ISDN S0 Interface Pin-out

The S0-Interface uses an 8-pin RJ45 connector as defined in ISO 8877 TE

RJ45 Pin Signal
1
2
3 Transmit +
4 Receive +
5 Receive -
6 Transmit -
7
8

RJ45 connector pin layout

```
 2  4  6  8
 o  o  o  o

o  o  o  o
1  3  5  7
```

viewed from underside

8 Appendix

8.1 AT-Command Set examples

8.2 PAD / X.31 examples

To set up an X.31 in the D-Channel connection to the to Telekom (Deutsche Telekom) X.25 Echo-Server. On power up set the PAD for X.31 in the D-Channel working and then start the PAD and call the Telekom Echo-Server. Then enter "echo" and "test" after a one second delay switch back to the Command Mode with Cntrl-P and type, "clr" to terminate the connection.

```
CPV Highspeed TA Pro

nvram valid

#
# appl
0 - Terminal Adapter
# appl 1
1 - PAD (X.31 or X.25)
# help pad
pad.msnin: incoming MSN/EAZ (msnin=nnnn or empty)
pad.msnout: outgoing MSN/EAZ
pad.packethandler: isdn address of packet handler
pad.TEI: X.31 TEI value (normally 1)
pad.padmode: pad mode: 0: X.31 D-channel
        1: X.31 B-channel {ISDN packethandler via bearer capability}
        2: X.25 (DCE) {nedds packethandler ISDN address!}
        3: X.25 (DTE-DTE), ISO-8208
pad.incoming: incoming: 0: disabled; 1: enabled
pad.Profile: default Profile (0..7,90,91)
# pad.padmode 0
X.31 D-channel
# go

PAD X.31/X.25 (Pulsar)
*par?

par   1:1    2:1    3:126  4:20   5:1    6:1    7:2    8:0
      9:0   10:0   11:0   12:1   13:0   14:0   15:0   16:127
     17:24  18:18  19:1   20:0   21:0   22:0  121:0  122:0
    123:0
*026245400029002
calling <026245400029002>[PH:<>]
```

```
 Deutsche Bandespost TELEKOM ECHO at the Hamburg-Node echoechotesttest
*clr
CLR 00/00
*
```

8.3 Example V.25

Glossary/Acronyms

1TR6	Deutsche Telekom national ISDN Protocol (obsolete)
ASCII	American Standard Code for Information Interchange
AT	"Attention" prefix for modem commands (ref Hayes)
B-Channel	ISDN user channel(64.000 bit/sec.)
BZT	Bandesamt für Zulassungen in der Telekommunikation
CAPI	Common ISDN Application Interface; software interface between the application layer and the ISDN terminal adapter hardware
CCITT	Comité Consultatif International Télégraphique et Téléphonique; now known as the ITU
CLIP	Calling line identifier
CLIR	Calling line identification restriction
CUG	closed user group
D-Channel	ISDN supervisory or control channel (16.000 bits/sec.)
DAD	Destination address
DCE	Data communications equipment; DÜE
DIN	Deutsches Institut für Normung e.V.
DSS1	Digital subscriber signalling 1; Euro-ISDN-Protocol
DTE	data terminating equipment
EAZ	Endgeräteausdialziffer, DDI suffix cf MSN DSS-1(1TR6 Protocol)
ECMA	European Computer Manufacturers Association

EMC	Electromagnetic Compatibility
ETS	ETSI Norme or standard; eg. ETS 300-102 = DSS1 Layer-3
ETSI	European Telecommunications Standards Institute
HDLC	high-level data link control
I.430	Basic rate ISDN Layer-1 Protocol
ISDN	Integrated Services Digital Network
ISO	International Standardization Organization
ITU	International Telecommunications Union: formally known as the CCITT. Sector T (ITU-T) is responsible for the V-Series (data transmission) and I- and Q-Series (ISDN) Recommendations.
LAN	Local Area Network
LAPB	Link Access Procedure Balanced; Layer-2 Protocol
LAPD	Link Access Procedure On D-Channel; Layer-2 Protocol
LED	Light Emitting Diode
MSN	Multi Subscriber Number; DSS1 Protocol
NT	Network Termination. Service Provider's S0-Bus interface termination at the subscriber's premises.
OAD	Origination Address
PABX	Private Automatic Branch Exchange
PAD	Packet Assember and Disassembler
PH	Packet Handler
PSPDN	Packet Switched Public Data Network; eg. Datex-P (Germany)
RJ45	ISDN connector type (Western Electric - US)
S0	Basis rate ISDN termination(bus), comprising 1 x D-Channel and 2 x B-Channels
S2M	Primary multiplexer connection
SAPI	Service Access Point Identifier
SPV	*Semipermanente Verbindung* (virtual private connection). Specific to 1TR6 Protocol
SUB	Sub-address
T.70NL	X.75-Packet; must be set at each end of a connection
TEI	Terminal Endpoint Identifier

V.24/V.28	Serial interface definition and electrical signalling standard
V.120	ISDN B-channel HDLC-Framing Protocol for asynchronous and synchronous data packets.
V.110	Rate adaption Protocol for Asynchronous DTE's connected to the ISDN 64kbit/sec B-Channel
VSt	Abbreviation for the German word, "Vermittlungsstelle". English "ISDN Exchange" or Central Office
Watchdog	Automatic (timer control) hardware reset mechanism to restart a system in the event of a software failure (lock up).
X.75	Protocol for secure data transmission using HDLC-signalling techniques
X.25	Packet Switched Network
X.21	High speed balanced serial interface

Register