TA+HIX, TA+HUX, TA+POX, TA+SOC

User manual

ISDN Terminal Adapter

Version r01
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1 Introduction

We are very pleased to see that you have bought a Stollmann product and would like to express our appreciation.
This documentation is valid for the products:

- TA+HIX
- TA+HUX
- TA+POX
- TA+SOC hardware version 2
- Software versions V7.000 or later

Please refer to the appendixes about differences between the products.

1.1 Product description

The TA+POX is an ISDN terminal adapter with the following functions. You can see it as a digital replacement for an analogue modem.

- The TA+POX connects devices with a serial port to the ISDN. It gives access to other devices connected to the ISDN network.
- Data can be transmitted either over the D- or B-channel with the following rates:
  - by using the transmission method V.110 or V.120 in B channel.
  - by using the transmission method X.75, PPP or HDLC in B channel.
  - call a host connected to the X.25-network (X.25 in B or D channel).
  - call a host connected to an ISDN-X.31 subscriber line
- Data can be transmitted either over the D- or B-channel with the following rates:
  - Transmission via D-channel with 9600 bps (X.31-D)
  - Transmission via B-channel with 64000 bps (X.31-B)
- The connected device can drive the TA+POX by using
  - asynchronous PAD (X.3) commands
  - asynchronous AT commands
  - automatic call

To work with TA+POX 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 TA+POX

1.2 Service

By using the call number +49 40 89088-291 you can connect up to an asynchronous support server, which uses the B channel protocol **X.75** (please use command ATB10 to set up the correct B channel protocol).
By using the call number +49 40 89088-293 you can connect up to an asynchronous support server, which uses the B channel protocol **X.25** (please use command ATB20 to set up the correct B channel protocol).

To LOGIN please use
name: guest
password: guest.

X.31 connection:
The German Telecom offers a test access point for X.25 (echo generator) with the following X.121 number (Datex-P): 40400049912

> **HINT:** For access to the German DATEX-P network from an X.31-D basic rate interface in Germany you have to use the dialing prefix 0262 preceding the X.25 calling number (i.e. call 0262 40 4000 49912).

After the connection is established the echo generator will echo all received text string in X.25 packets.

1.3 License

The following license numbers for the connection to the ISDN are given by
CE for Europe (EC), Switzerland, Norway:

TA+POX and TA+HUX are conform to the European safety requirements IEC 60 950. Please use only the delivered power supply or an original replacement from Stollmann. Connect the TA+POX only to the S bus interfaces (indoor) with SELV (**S**afety **E**xtra **L**ow **V**oltage) related to EN60950.

The TA+POX and TA+HUX are conform to the European rules of EMC. EN50081-1, here EN55022 Class B, for electromagnetic field emission and EN50082-1 for immunity against electromagnetic interference.

2 Installation

2.1 Contents

This packet contains the following items:

- ISDN Terminal adapter TA+POX in desktop box
- Mains plug power supply adapter (only TA+POX)
- ISDN interface cable (only TA+POX)
- DTE interface serial cable (only TA+POX)
- This user manual

2.2 Installation procedure

- Connect the serial port (DTE) of the TA+POX to the serial port (COM port) of the PC by using the supported DTE interface serial cable. Please make sure that the COM-port of the PC is not used for other purposes or by other communication programs.
- Connect the ISDN port of the TA+POX to the basic rate interface (BRI) of the ISDN using the delivered ISDN cable.
- Connect the power supply with the TA+POX and plug it into mains.

Please reference to page 5 for selecting the correct plug for interfacing.
Now the power-up sequence described in chapter 2.3 should appear.

The TA+POX is now ready for use, please refer to the next chapter for the configuration to use the PC together with the TA+POX.

2.3 Displays and control elements TA+POX

For interfacing the module TA+HUX and TA+SOC please refer to the appendix.

2.3.1 TA+POX front view

You can control the status of the **TA+POX** via 8 LEDs at the front side.

The 4 LEDs at the right show the status of the serial interface to the PC:

T :	shows activity of transmitted data from the terminal (DTE to TA)
R:	shows activity of receiving data from the ISDN line (TA to DTE)
DTR :	shows the status of DTR line, i.e. the terminal is trying to connect via the **TA+POX**
DCD :	represents the status of the DCD line (V.24); shows normally an active data connection

The 4 LEDs at the left show the status of the ISDN interface:

B1 : show the usage of the first B-channel
B2 : show the usage of the second B-channel
If one or both LED's are ON, the B channel is occupied due to an incoming or outgoing connection.
L1 : show the activation status of the ISDN interface
L2 : show the connection state in coded form

The following list describes the view for an error free power on sequence.

	Status	L1	L2	B1	B2	
1.	Bootloader start up, wait	⊗	⊗	⊗	⊗	(0,5 s)
2.	Firmware start up, wait	⊗	Θ	O	O	(2 sec.)
3.	ready for operation, ISDN ok	⊗	O	O	O	
4.	ISDN data connection on B1 channel	⊗	⊗	⊗	O	

LED Legend: ⊗ On
Θ Continuously blinking
O Off

A complete list you can find in the appendix "LED displays"

2.3.2 TA+POX back view

At the back of the TA+POX you will find the connectors for the following interfaces:

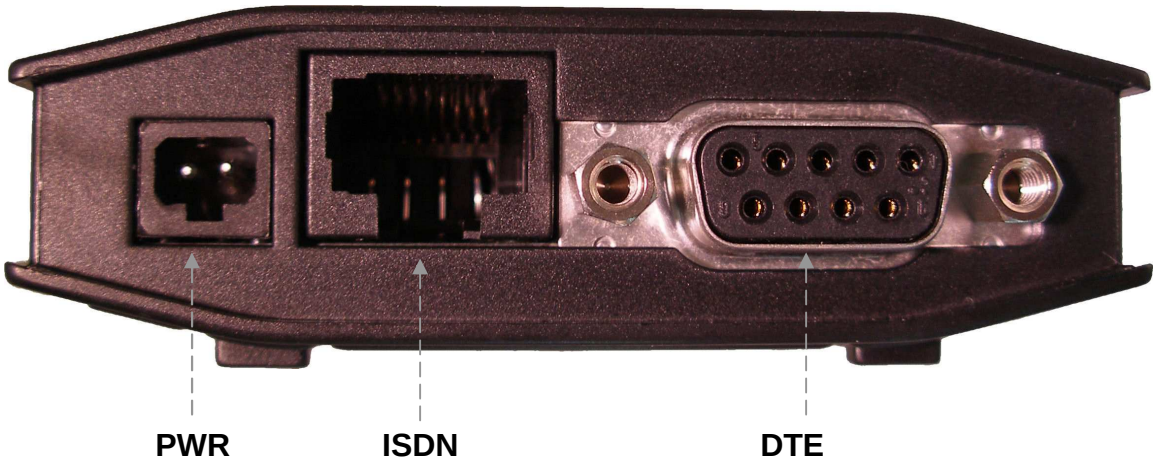

Fig. 2: Back view of the desktop model TA+POX

PWR: external power supply (5V DC)
ISDN: ISDN interface
DTE: V.24 interface for DTE, i.e. a PC

3 Using the TA+POX, TA+HUX, TA+SOC

You can select different operation modes for the TA+POX. These operating modes are used to setup ISDN connections and to configure the TA+POX.

Supported operating modes:
- X.3 asynchronous mode to connect asynchronous devices that drive a PAD X.3 interface
- asynchronous mode for devices that need the AT command set
- Automatic dialing deriving from DTR or TxD or always connected

You can configure the TA+POX in the following ways:
- by using the X.3 command set entered by the locally connected PC.
- by using the AT command set entered by the locally connected PC.
- by using TA+ configuration commands entered by the locally connected PC.
- by using TA+ configuration commands entered via the ISDN line (remote configuration).

3.1 X.3 command set - integrated PAD

If you connect an asynchronous DTE to the X.31-service, you can use the integrated PAD of the TA+POX. You can use for example the command *stat* to see the status of the connection.
To setup PAD mode please use the configuration command “cmds = 1“.

The following PAD-Commands regarding the specifications X.28/X.29 are supported:

- *(dot)* Displays PAD identification

[P*xxx*-][R][N<nuipwd>][G<cug>]*X25number*[I<*ISDNnumber*>][*D*<*userdata*>]
Establishes an X.25 connection
P : select X.25 packet size *xxx* for X.25 connection
R : request the facility reverse charging
G : access to X.25 closed user group
O : Outgoing call from X.25 closed user group
N : use NUI and password with call setup, allowed chars: a-z, A-Z, 0-9.
(overrides setting of nui configuration command)
X25number : dialed X.25 call number
ISDNnumber : ISDN call number for a dialed B channel connection
D : separator for user data: "D", "P" or ","

clr Clears an X.25 connection

stat Showing the PAD connection status

set Set the PAD Profile to Profile 0

set *x*:*n* Set the PAD Profile parameter *x* to value *n*
Note: PAD parameter can be stored using the command “exec save“.

prof *x* Configures to the PAD Profile *x*, *x* = 0..7, 90, 91
Note: PAD parameter can be stored using the command “exec save“.

prof? Displays the configured PAD Profile values

par [*x*][,*x*] Displays all configured PAD Profile values or the PAD parameter *x*
“par“ without parameter displays all parameter.

ver Displays the version number

exec <*cmd*> Executes one TA+configuration command, for definition of commands see page 66.

Example: **exec msni=12345**
set specific msn value for incoming calls

3.1.1 X.3 Parameter of the integrated PAD

Using the PAD command "set *x:n*" you can change the parameter according to ITU specification X.3.
After changing one or more X.3 parameter you can store the change non volatile by issuing "exec save". The stored parameter can be reloaded with the command "exec load".
After an X.25 connection is cleared the PAD parameter will be reset to the last active profile (or default).

International Parameters 1 through 12

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1 Enable (disable) switch to command mode

Defines whether the terminal user may switch from data to command mode (e.g. to change a X.3 parameter), and - if he may - which key(s) must be pressed to make the switch.

Valid Parameter Values:

0 Switch to command mode disabled.

1 Switch to command mode enabled
switch by pressing the key combination **<CTRL>+P** (hexadecimal 10, decimal 16)

n Switch to command mode enabled
switch by entering the ASCII character, that corresponds to the parameter value ***n*** (decimal integer value in the range between 32 and 126).

---

2 Echo

Determines whether a character will be echoed to the terminal data transfer mode.

Valid Parameter Values:

0 No echo

1 Echo

3 Data Forwarding Characters

This parameter defines a control character to be used as the Data Forwarding Character. This character can be used to force the transmission of the collected data to the other end, even when the defined packet size has not yet been reached.

Valid Parameter Values:

0 Only send full packets, thus no Data Forwarding Character

Regardless of the value set in parameter 3, the data packet will always be forwarded under any of the following conditions:

- when the input buffer holds a full data packet (128 bytes) and parameter 15 is set to 0 (zero)
- when the input buffer is full (512 Bytes) and parameter 15 is set to 1 ; in this case, one data packet will be sent and the remaining data will be shifted forward in the input buffer
- after the first character of a PAD command is entered
- following the entry of the BREAK signal (command INTD) - also see parameter 7
- after the timeout of the timer set with parameter 4

4 Timer for Data Forwarding

Defines the timeout interval, following which the collected data will be sent as a data packet even if the defined packet size was still not reached.
The timer is reset each time a data packet is sent, even if it was sent as the result of the Data Forwarding Character (see parameter 3).

Valid Parameter Values:

0 No timeout, thus no time interval

1 Immediate transfer, thus each character is immediately transferred as a data packet.

n ***n*** time interval in units of 50 msec. (1/20 of a second) and the value must be an integer in the range from 2 to 255.
Example: ***n*** = 40 => time out interval of 2.0 seconds

A data transfer timeout is only permitted, when parameter 15 is set to 0 (zero).

5 Control of additional devices

! not implemented, all values ignored !

6 Displaying PAD Messages

Defines, whether the PAD messages should be displayed. PAD messages are service signals, that the PAD generates in response to PAD commands.

Valid Parameter Values:

0 No display of PAD messages
1 Display of X.28-PAD-Messages (ITU) without PAD-Prompt.
5 Display of X.28-PAD-Messages (ITU) with PAD-Prompt.
9 Display of DATEX-P PAD-Messages without PAD-Prompt.
13 Display of DATEX-P PAD-Messages with PAD-Prompt.

17 Display of extended PAD-Messages without PAD-Prompt.
21 Display of extended PAD-Messages with PAD-Prompt.
To add one of the following features, add the described value to one of the previous selected:
+32 Suppress X.25 address and ISDN no. when connected
+64 Display CAPI error cause.

7 Handling the BREAK Signal

Defines, how the PAD should react, when it receives a BREAK signal from the terminal of the other communications partner (command INTD).

Valid Parameter Values:

0 No reaction
1 Send Interrupt packet
2 Send Reset packet
5 Send Interrupt and break packet
8 Change to command mode (can be useful when parameter 1 is set to 0 (zero).
21 Discard local data and send Interrupt and break packet

8 Display Received Data ON/OFF

Defines, whether received data should be displayed on the screen.

Valid Parameter Values:

0 Display all received data.

1 Don't display the received data.

9 Fill Characters Following a Carriage Return (<CR>)

Defines, how many fill characters (<NULL>) the PAD should insert into the character string following a <CR> (carriage return).

Valid Parameter Values:

0 No fill characters <NULL>

n Number of fill characters <NULL> following a <CR>.
n is an integer in the range from 1 to 255.

Note: This parameter is ignored for output to the screen, since the fill characters serve no useful function on a screen display (left over from the days of the teletype).

10 Screen Line Width

not supported

11 Local baudrate (Read only)

Displays actual used **baudrate** on asynchronous line.

1: 1200 bit/s
2: 2400 bit/s
3: 4800 bit/s
4: 9600 bit/s
5: 19200 bit/s
6: 38400 bit/s
7: 57600 bit/s
8: 115200 bit/s
9: 230400 bit/s

12 Local flow control (Read only)

Handles and displays used flow control on asynchronous line.

0: no flow control
3: flow control RTS / CTS
4: flow control XON / XOFF

Extended Parameters 13 through 24

14 Line Feed Fill Characters

Defines, whether fill characters <NULL> should be sent following a line feed <LF> .

Valid Parameter Values:

0 No fill characters <NULL> after a <LF>

n Following a <LF> on the screen, append *n* fill characters <NULL>. *n* is an integer in the range from 1 to 255.

15 Control Input Buffer Editing

Defines, whether characters in the input buffer may be edited.

Valid Parameter Values:

0 No editing; the values of the parameters 16, 17, 18, and 19 will be ignored.

1 Editing enabled and the editing features set by the parameters 16, 17, 18, and 19 may be used; in this case, it is not possible to do a preemptive transmission of a data packet using the Data Forwarding Character (see parameter 4).

16 Delete Character

Defines the Character-Delete character, thus the ASCII value of the character that when entered will delete the previously entered character. Only possible, when parameter 15 is set to 1 (PAD has editor capability).

Valid Parameter Values:

n ***n*** is an integer in the range from 1 to 255 and gives the ASCII value (decimal) of the desired Character-Delete character.
default = 8 (=> < BACKSPACE> key)

17 Delete Line

Defines the Line-Delete character, thus the ASCII value of the character, with which you can delete the previous line. Only possible, if parameter 15 is set to 1 (PAD has editor capability).

Valid Parameter Values:

n ***n*** is an integer in the range from 1 to 255 and gives the ASCII value (decimal) of the desired Line-Delete character.
default = 127 (=> <Delete> key)

18 Repeat Line

Defines the Line-Display character, thus the ASCII value of the character, with which you can cause the characters that were entered on the previous line to be repeated on the current line. Only possible, if parameter 15 is set to 1 (PAD has editor capability).

Valid Parameter Values:

n ***n*** is an integer in the range from 1 to 255 and gives the ASCII value (decimal) of the desired Line-Display character. default = 0

19 Handling Delete Characters

Defines, what should be sent to the screen when a Character-Delete or a Line-Delete character is received.

Valid Parameter Values:

0 Nothing

2 Send a <BS><Space><BS>, so that the last character displayed is deleted.

19 Echo Filter

If parameter 2 is set to 1 (= character echo during data transfer), this parameter can be used to determine which characters, entered from the keyboard, will not be echoed to the screen.

Valid Parameter Values:

0 No echo filter, thus echo all characters
1 No echo for <CR>
2 No echo for <LF>
4 No echo for <VT>, <HT>, <FF>
8 No echo for <BEL>, <BS>
16 No echo for <ESC>, <ENQ>
32 No echo for <ACK>, <NAK>, <STX>, <SOH>, <EOT>, <ETB>, <ETX>
64 No echo for editing characters, those set with the parameters 118, 119, and 120
128 No echo for <DEL> or any other ASCII control character not listed above

Note: This parameter is interpreted bit wise, thus any combination of the above listed values can be combined to form a sum of the desired values

21 Parity handling (Read only)

Handles and displays used parity on asynchronous line.

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

National Parameters 118 – 126

118 Character-Delete Character

See parameter 16.

119 Delete Line

See parameter 17.

120 Repeat Line - Line-Display Character

See parameter 18.

123 Parity handling

See parameter 21.

126 Generating a Line Feed

See parameter 13.

Note: The following parameter values are not implemented:
5, 10, 22, 121, 122, 125

Note: The following parameters are read only, can be changed using configuration commands:
11, 12, 21

Table of the X.29 standard profiles

Parameter	Prof 0	Prof 1	Prof 2	Prof 3	Prof 4	Prof 5	Prof 6	Prof 7	Prof90	Prof91
1	0	0	1	0	1	1	0	1	1	0
2	0	0	0	0	0	0	0	1	1	0
3	0	0	2	0	2	2	0	2	126	0
4	5	1	0	20	0	0	4	0	0	20
(5)	-	-	-	-	-	-	-	-	-	-
6	69	0	9	0	9	9	0	9	1	0
7	8	0	21	2	21	2	0	21	2	2
8	0	0	0	0	0	0	0	0	0	0
9	0	0	2	0	2	2	0	2	0	0
10	0	0	0	0	0	0	0	0	0	0
(11)	-	-	-	-	-	-	-	-	-	-
(12)	3	-	-	-	-	-	-	-	-	-
13	0	0	4	0	0	5	0	4	0	0
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	1	1	0	0	0	0
16	0	0	127	127	127	127	127	127	127	127
17	0	0	24	24	24	24	24	24	24	24
18	0	0	18	18	18	18	18	18	18	18
19	0	2	2	2	2	2	2	2	1	1
20	0	0	0	0	0	0	0	0	0	0
21	0	0	1	0	0	1	1	1	0	0
22	0	0	0	0	0	0	0	0	0	0

Note: Parameter in Brackets are not implemented or not setup by command prof*xx*.

3.2 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 described (highlighted) 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 TA+POX to ISDN interface
- Connect the PC's com-port to the DTE interface of the TA+POX.
- 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 TA+POX.
- Set up the parameter of the TA+POX 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 <↵>. Corrections in a command line are done with <BACKSPACE>. A command line has a maximum of 80 characters (up to 140 characters using “UUS1”. The command line is automatically cancelled by longer input. Blanks are ignored, capital/small letters are not significant.

The parameter settings of the TA+POX 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"):

1. <delay time according to S12 register>
2. **<+><+><+>**
3. <delay time according to S12 register>

The time gap between all three plus signs may not exceed 1 sec.
The escape sequence is transmitted transparent to the remote device.

Note: If B channel protocol PPPasync (ATB3) is selected, the escape sequence has to be included in an asynchronous HDLC frame. The coding of the complete asynchronous sequence is: 7E 2B 2B 2B 1B B4 7E.

The timeout after sending the "escape sequence" <+><+><+> will increase in terms of the configuration parameter "txfwd". The default value of "txfwd" is set to "0" (“0” = 4 character timeout).
If "txfwd=100" (equals 1 second), the timeout of receiving the "OK" message will be around 2 seconds.

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“.
The time interval to display the incoming call (“RING” or “2”) can be configured with the S-register S80. The default value is set to “S80=50” which is equivalent to 5 seconds.
The serial status line "RI" will toggle during the active "RING" state uniformly distributed according the half time of register S80.

This command must be the last command in an AT command line.

ATA

B B channel protocol

Transmission protocol for data communication in the B channel.

ATB0 : V.110 asynchronous
ATB3 : HDLC async to sync conversion (PPP asynchronous)
ATB4 : HDLC transparent (octets are packed into HDLC frames)
ATB5 : Byte transparent voice connection (raw B channel data)
ATB6 : Byte transparent data connection (raw B channel data)
ATB10 : X.75 SLP
ATB13 : V.120 async
ATB20 : X.31 B channel (X.25 B channel)
ATB21 : X.31 D channel
ATB22 : T.70NL
ATB23 : T.90NL
ATB31 : MLPPP (Option)
ATB33 : X.75 B-channel bundling (Option)
For this type of protocol both B-channel on the ISDN interface need to be free. Otherwise the connection will fail - no automatic detection.
ATB40 : B channel transp. switched to IOM-2 (audio connection)
ATB43 : B channel transp. switched to IOM-2 (data connection)
ATB45 : B channel transp. switched to IOM-2 (data and audio connection)

%B Set local baudrate

Sets the local baudrate of the TA to the desired value (fix value) or to auto detection. When auto detection 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, (default) autobauding exclude serial speed of 300bps, 600bps,10400bps)
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

AT%B20	Local baudrate set to 300 bit/s (no autobauding detection)
AT%B21	Local baudrate set to 600 bit/s (no autobauding detection)
AT%B26	Local baudrate set to 10400 bit/s (no autobauding detection)

Note: If autobauding (AT%B0) is selected (default) after switching on the TA+POX, and no local AT command is entered, the incoming call message (i.e. RING) will be sent with 115200 bit/s.

The automatic local baudrate detection “autobauding” will also support the local data format detection for 10 bit character format (7,E,1 / 7,O,1 / 8,N,1).

CONF Enter TA+Configurator

Enters directly into the TA+Configurator, the configuration prompt "#" will be displayed. Leave the TA+Configurator with the command "quit" (or “exit” or “go”).

ATCONF

Note: During the change between the command sets from "AT command set" to "configuration command set" the serial status line DSR gets inactive.

&C DCD control

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

AT&C	TA control line DCD is always ON
AT&C1	DCD ON indicates ISDN connection is established and synchronized (default)
AT&C2	TA control line DCD follows DTR

For nearer information see also chapter 3.3.

#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, also to be found via Stollmann URL http:\\www.stollmann.de.

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 (default 0000).

Example: an outgoing call as a voice call: AT#C1=0004.
Example: an outgoing call as a data call: AT#C1=0002.

#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 (default 00000004).

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 TA+POX/TA+HUX. Must be the last command in AT command line.
Any character input while the TA is dialing will cancel the dialing procedure.

1. ATD<*CALLEDnumber*>[X[Pxxx(,|-)][R,][N<*nuipwd*>,][G<*cug*>,]
[H<own X.25 number>,] <*X25number*> [D<*userdata*>]]<cr>

CALLEDnumber: ISDN call number for a dialed B channel connection or X.25 number for X.31 D channel

X : starting X.25 parameter section
P : use packet size *xxx* for X.25 connection (value from 64 - 2048)
The separator after "Pxxx" will allow [-] or [,]
R : request the facility reverse charging
G : access to X.25 closed user group
O : Outgoing call from X.25 closed user group
N : use NUI and password with call setup
allowed chars: a-z, A-Z, 0-9.
H : set own X.25 number for outgoing calls, (max. length = 15 digits)
(overwrites setting of "XNR" configuration command in chapter 4.4.)

NOTE: For X.31-D channel calls the configured own X.25 address will be
compared with the real X.25 address of the local X.25 access point.
In case of different X.25 numbers the X.25 packet handler will use its own configured X.25 number.

X25number: dialed X.25 call number, (X.25 B channel only),
(max. length=15 digits)

D : separator for user data:
"**D**" : user data without protocol ID, data length max. 16 char.
"**P**": user data with protocol ID ("01000000"), data length max. 12 char.

ATD<*CALLEDnumber*>**e**
Make a call for remote management (see note).
Adding an "**e**" to ***CALLEDnumber*** indicates that a connection to the internal remote access of a TA shall be performed, the protocol X.75 (ATB10) has to be setup before use.

2. ATDS=nnnn <cr>
Dial out of the stored phone number table.

Example: AT&Z1=1234567<cr>
ATDS=1<cr>

Enter AT&Z1=1234567 to store the number, and ATDS=1 to dial it. To dial the second phone number in the list, you would enter AT&Z2 to store it, and ATDS =2 to dial it.

Examples for X.25 and X.31 calls:

ATD12345678<cr>
- X.31: dial X.25 number 12345678
- X.25-B: dial ISDN call to 12345678
without a specific X.25 number

ATD12345678X4000123456<cr>
X.31: ISDN number 12345678 will be ignored if X.25 number is set
dial X.25 number 4000123456
X.25-B: dial ISDN call to 12345678
with X.25 number 4000123456

ATD12345678X4000123456Ddatadata<cr>
X.31: ISDN number 12345678 will be ignored if X.25 number is set
dial X.25 number 4000123456
and X.25 user data “datadata”.
X.25-B: dial ISDN call to 12345678
with X.25 number 4000123456
and X.25 user data “datadata”.

ATD12345678XP64,R,O02,Nnuivalue,4000123456Pdatadata<cr>
X.25-B: dial ISDN call to 12345678
with packet size 64 byte
with active reverse charging
with outgoing call from closed user group "CUG" 02
with NUI selection string "nuivalue"
with X.25 number 4000123456
and X.25 user data “datadata” include "protocol-ID".

&D DTR control

Selects the behavior of the 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.
AT&D4 DTE control line DTR is evaluated: dropping the DTR line by the DTE will disconnect an existing ISDN connection.
An incoming call will accepted with DTR off.

For nearer information see also chapter 3.3.

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 settings, passwords and msn's will not be overwritten. (for storing in non volatile memory please use the command AT&W).

AT&F setup all parameter concerning data port.

AT&F1 setup all parameter including ISDN protocols, msn settings and passwords.

H Disconnect

Disconnects existing ISDN data connection, after issuing the escape sequence (see page 17).

ATH

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

1. <delay time according to S12 register>
2. **<+><+><+>**
3. <delay time according to S12 register>

The time gap between all three plus signs may not exceed 1 sec.
The escape sequence is transmitted transparent to the remote device.

The timeout after sending the "escape sequence" <+><+><+> will increase if the configuration parameter "txfwd" will rise. The default value of "txfwd" is set to "0".

I Display version information

Displays different information about version number and settings:

ATI Returns the "Modem"-type; name of the terminal adapter (“TA+POX“)
ATI1 Returns internal checksum (“0“)
ATI2 Returns “OK“
ATI3 Returns version string: "V7.xyz"
ATI4 Returns manufacturers name: "Stollmann E+V GmbH"
ATI5 Returns ISDN selected protocol: "0 - DSS1"
ATI6 Returns copyright string: "(c) Copyright Stollmann GmbH"
ATI7 Returns “OK“
ATI8 Returns “ERROR”
ATI9 Returns plug and play ID string
ATI77 Returns Bootloader version string
ATI99 Returns software creation date

&K Flow control

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

AT&K No local flow control between the DTE and TA is used
AT&K3 Local flow control is set to hardware handshake RTS/CTS
AT&K5 Hardware flowcontrol RTS/CTS in data mode and command mode

For nearer information see also chapter 3.3.

#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).

ATN0 Line baudrate automatic set (equals to local baudrate or less)
ATN1 Line baudrate set to 1200 bit/s
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 TA+POX is in command mode after issuing an escape sequence out of an existing connection, ATO brings the TA+POX 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 TA.

AT&R	TA control line CTS is following all changes of RTS
AT&R1	CTS is ON and handle serial flow control RTS/CTS (default)
AT&R2	TA control line CTS is following all changes of DTR

For nearer information see also chapter 3.3.

S Display and set internal S register

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

For nearer information see also chapter 3.2.1 “AT command S register set”

&S DSR control

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

AT&S	TA control line DSR is always ON (default)
AT&S1	DSR ON indicates ISDN connection is established and synchronized
AT&S2	TA control line DSR is following all changes of DTR
AT&S3	TA control line DSR is following all changes of DCD
AT&S5	DSR ON indicates an active ISDN call procedure (off hook)

For nearer information see also chapter 3.3.

V Result format

ATV	Result is presented as numbers (followed by <↵>)
ATV1	Result is presented as text (default)

&V Display configuration

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

W Extended result codes

ATW 1. Result is presented without extended result codes
ATW1 2. Result is presented with extended result codes
3. RING and CONNECT including ISDN address,
4. RING and CONNECT including X.25 userdata (available for X.25 protocol only, prot=20, 21)
5. disconnect message include error causes.

ATW4 1. Result is presented with extended result codes
2. RING and CONNECT including ISDN address,
3. disconnect message include error causes,
4. and the current date and time in addition to the CONNECT message

See also 3.2.3. “AT result codes”

&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 (without line speed)
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 reset to the stored configuration.
Must be the last command in an AT command line.

ATZ

&Z<x>=<nnn> storing phone numbers

The TA+POX can store up to three of the most frequently called numbers (**AT&Z1, AT&Z2, AT&Z3**).

AT&Z**x**=***nn*** set entry number ***x*** to ISDNnumber ***nn*** (max. length=20 digits)
AT&Zx shows the value of entry **x**
AT&Zx=<cr> clears the value of entry **x**

Example: AT&Z1=1234567<cr>
ATDS=1<cr>

Enter AT&Z1=1234567 to store the number, and ATDS=1 to dial it. To dial the second phone number in the list, you would enter AT&Z2 to store it, and ATDS =2 to dial it.

#Z Define own msn *(compatibility to older firmware)*

Defines the msn *nn* (multiple subscriber number) for the data port.
If the number is set to “*“ (default), all incoming calls are acceptable.
The msn can be displayed by command AT&V.

AT#Z=*nn* set parameter "msni" and "msno" to *nn*
max. length = 20 digits

Note: If 1TR6 D channel protocol is selected, only one or the last digit is valid.
This parameter is not saved automatically.

AT#Z needs two saving procedures. It will save the value “msni” and “msno” separately.

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

Number of data bits for asynchronous character (7,default: **8**)
AT**DBITS=(7,8)

AT**DBITS=7
If the configuration parameter “DBITS” is set to 7 data bits the parity bit has to be activated (PRTY=1 or PRTY=2). The count of stop bits (SBITS) can be “1” or “2”.

Note: To use other data formats than 10 bit (8N1, 7E1, 7O1) the local serial speed (**BR) has to bet to a fixed speed.

The automatic local baudrate detection “autobauding” will also support the local data format detection for 10 bit character format (7,E,1 / 7,O,1 / 8,N,1).

****PRTY** Set parity of asynchronous characters

Selects the parity for asynchronous characters.
0: no parity; 1: even parity; 2: odd parity

ATPRTY=0**	No parity (default)
AT**PRTY=1	Odd parity
AT**PRTY=2	Even parity

Note: To use other data formats than 10 bit (8N1, 7E1, 7O1) the local serial speed (**BR) has to bet to a fixed speed.

The automatic local baudrate detection “autobauding” will also support the local data format detection for 10 bit character format (7,E,1 / 7,O,1 / 8,N,1).

3.2.1 ISDN specific AT commands

Setting up special ISDN parameter:
(only one command is allowed per AT command)

****BSIZE** Set B channel block size

Defines the maximum length *x* of a data block transmitted or received in B channel. This parameter value depends of the configured B-channel protocol.

- prot=10 BSIZE = 2048
- prot=20 BSIZE = 128
- prot=21 BSIZE = 128

AT**BSIZE=*x*

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

****DTE** Set B channel Layer 2 address

Selects the Layer 2 link addresses. Only valid for X.25-B protocol.

AT**DTE=0 calling side reacts as DTE,
called side reacts as DCE (default, X.75 standard)
ATDTE=1** TA reacts as DTE (own cmd.-adr. = 01)
AT**DTE=3 TA reacts as DCE (own cmd.-adr. = 03)

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 reset by powering it off and on (alternately you can use the command AT&W**RESET).

ATISDN=0**	Select DSS1 (Euro-ISDN) (default)	
AT**ISDN=1	Select 1TR6 (Germany national)	(Option)
AT**ISDN=2	Select DSS1 NT mode (Euro-ISDN)	(Option)
AT**ISDN=5	Select Bellcore National ISDN-1/2 (USA)	(Option)
AT**ISDN=6	Select NTT INS-NET (Japan)	(Option)
AT**ISDN=7	Select AT&T 5ESS (USA)	(Option)
AT**ISDN=8	Select VN-4 (France)	(Option)
AT**ISDN	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* = 1 ..7, default: **7**
AT**k=*x*
The default value is dependent of the selected B channel protocol.

****RPWD** Password remote configuration

Sets password for remote configuration to *nn* (1..32 chars)
AT**RPWD=*nn*
Default: empty, just press return key.

****SPID1, SPID2** Set SPID (Option)

For ISDN lines in the U.S. you have to set the SPID. You get it from your ISDN provider.
AT**SPID1=xxx Set SPID 1
AT**SPID2=xxx Set SPID 2

****<*cmd*>** Execute configuration command

Executes one configuration command, for definition of commands see page 66.
AT**<*cmd*>

3.2.2 AT command S register set

The available S-Parameters are listed below and can be stored to the user profile by entering the “AT&W” command.
The modem selects an S-Parameter, performs an S-Parameter read or write function, or reports the value of an S-Parameter.

ATSn=v Set S-Parameter n to the value v.
ATSn? Reports the value of S-Parameter n

If the number “n” is outside of the range of the available S-Parameter or the value “v” is outside the range permitted for the given S-Parameter, the mode will return the ERROR message.
Some S-Parameters are read only.

S0 Number of Rings to Auto-Answer

S0 set the number of the rings required before the TA automatically answers a call. Setting this parameter to “0” disables auto-answer mode.

S0
- **0**: No automatic call acceptance, acceptance of an incoming call is controlled by the data terminal (command ATA after RING)
- 1**:** Immediate call acceptance by the terminal adapter
- *2..n*: Call acceptance through the terminal adapter after *n* "RING" messages.

The serial status line "RI" will toggle during the active "RING" state uniformly distributed according the half time of register S80.

Note: The time interval to display the incoming call (“RING” or “2”) can be configured with the S-register S80.

S1 Ring Counter

S1 is incremented each time the TA signals the RING message to the serial interface. This parameter is read only.

Note: If parameter S0 is set to “0” the ring counter is disabled.

S2 Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The default value “43” corresponds to the ASCII “+”.

S3 Carriage Return Character

S3 set the decimal value of the ASCII character for the command line and result code terminator character.
The default value “13” corresponds to “Carriage Return”.

S4 Line Feed Character

S4 set the decimal value of the ASCII character recognized as a line feed. The Line Feed control character is output after the Carriage Return character if verbose result code is used.
The default value “10” corresponds to “Line Feed”.

S5 Backspace Character

S5 set the decimal value of the ASCII character recognized as a backspace. This character can be used to edit a command line.
The default value “08” corresponds to “Backspace”.

S7 Wait time for Carrier

S7 set the length of time, in seconds, the TA will wait for carrier before hanging up. The timer is started when the dial command line was closed by the Carriage Return character and stopped when the data channel protocol (ATBn) was synchronized.
The default value is set to “30” seconds.

S9 WINDOWS PnP functionality

S9 controls the functionality to react to the WINDOWS specific “Plug and Play” feature.

ATS9=0 disable PNP feature (default)
ATS9=1 enable PNP feature

Note: See also internal configuration command "PNP"

S12 Escape Sequence delay time

S12 controls the delay time (in 10ms steps) before and after the Escape Character configured in the parameter ATS2 to switch from the online data mode to the online command mode.
The default value is set to “100” which equals 1 second.

Example for the default escape sequence:
<delay time **1 sec.**> <escape sequence **+++**> <delay time **1 sec.**>

S16 Last occurred CAPI/ISDN cause

S16 reports the last occurred internal CAPI cause or ISDN error cause.
This parameter is read only is will not be saved in the stored configuration profile.

ATS16? Reports the last occurred CAPI/ISDN error cause

S20 Command Line timeout

S20 controls the timeout for the current command line if no Carriage Return character (ATS3, end of line character) was sent.
The timer is started after each received command line character from the serial interface. When no Carriage Return character (i.e. 0x0D) was received after the timer expired, the complete command line parameter list is erased.
The default value is set to “30” seconds.
This timer is available in the command mode only.

S30 Suppress sending the Escape Sequence [+++]

S30 controls the behaviour of transmitting the Escape Sequence Character (ATS2) as a data stream to the destination side.

ATS30=0 Escape characters will not be sent
ATS30=1 Escape characters will be sent (default)

S31 B-channel loop (for analysis only) (option)

S31 activate a loop of the B-channel for incoming calls during the active connection. The used B-channel for the loop is given from the public switch within the incoming call message (DSS1: SETUP, I-element: Channel Identification 0x18).

ATS31=0 ISDN B-channel loop deactivated (default)
ATS31=1 ISDN B-channel loop activated
The value of ATS31 register is saved into the internal configuration parameter "**bchloop**".

Note: The configured B-channel protocol must be set to ATB5 (Byte transparent). To accept different call types (data calls and speech calls) you can configure this behavior with parameter "AT#C2".
Note: Please also check the delay within the ISDN B-channel loop which can configure with parameter "**bch1delay**".

ATS70=<0/1> IOM2 port command prefix (for ATB40, 43,45 only)

This parameter manage the command prefix for the IOM2 interface (TA+HUX, TA+SOC) or codec port (TA+HIX) on the TA+ hardware of the serial data output ("**:$"** or "**:1**").
Depending of the value in ATS70 the incoming call will message:

- an IOM2 interface call (:$RINGIxDxxxOxxxB0x)
- or a CODEC interface call (:1RINGIxDxxxOxxxB0x) *(TA+HIX only).*

ATS70=0 incoming call will be displayed as IOM2 calls (default).
Example: :$RINGI1D211O222B01
ATS70=1 incoming call will be displayed as CODEC calls and enable the CODEC.
Example: :1RINGI1D211O222B01

When the command interface receive an ext. IOM command "**AT:$xxx**" or an CODEC command "**AT:1xxx**" the value for the data structure will be changed in this S-register will be changed automatically.

ATS71=<0/1> Codec port command behaviour (for TA+HIX only)

This parameter manage the response of voice commands according to the older product, called TA+HIT.

ATS71=0	voice connections are controlled as described in the current manual of TA+HIX (default).
ATS71=1	voice connections are controlled as described in the manual of TA+HIT.

S80 RING message interval time

S80 controls the time interval in 100ms steps to display the incoming call message "RING" or "2".
The default value is set to "50" which equals 5 seconds.

S91 special command response behaviour
WINDOWS 2000 / WINDOWS XP compatibility

S91 controls the responses of entered configuration commands.

ATS91=0	normal response behavior (default)
ATS91=1	all unknown AT commands will be answered with OK.
ATS91=2	Windows 2000 compatibility: some AT commands will be answered with OK (see list below), unknown AT commands will be answered with OK.

Windows2000 AT command set change:

ATNxxx	all commands ATNxxx will respond OK without any functionality behind it. V.110 baudrates can be set with AT**BRN.
ATBxxx	All commands ATBxxx will respond OK without any functionality behind it. The B-channel protocol settings can be set with AT**PROT.
AT\Nxxx	All commands AT\Nxxx will respond OK without any functionality behind it. The B-channel protocol settings can be set with AT**PROT.

3.2.3 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)
17	CONNECT 38400 <*rn*>	Connection, line speed 38.4 kbps (V.110)
19	CONNECT 64000 <*rn*>	Connection, line speed 64 kbps

Call number display:
<*rn*> = call number of remote site

In AT command mode, call number display (does not belong to the standard AT command set) can be turned on by issuing the command **ATW1**. If turned on, the call number of the caller is shown with the CONNECT or RING message (in pointed brackets), depending on the signaling in the D channel.

If the TA is used at the public network then the call number of the remote site (including area code) is displayed.

Example:

TxD	RxD
ATW1	
	OK
	RING **<040890880>**
ATA	
	CONNECT 64000 **<040890880>**

Error cause display:
<*xx*> = ISDN release (error) cause, hexadecimal

Example:	Tx data	Rx data
	ATW1	
		OK
	ATD12345	
		NO CARRIER **<34A2>**

In AT command mode, error cause display (does not belong to the AT command standard) can be turned on by issuing the command **ATW1**. The shown error causes use the coding defined by the CAPI definition. ISDN error causes from the ISDN network are always coded as 34xxH, where xx represents the hexadecimal version of the ISDN error cause (see page 91). All other causes are CAPI error causes (see page 99).

Note: If autobauding is selected and after powering on the TA no AT command is entered, a response from the TA (i.e. RING) will be sent with the baudrate 115200 bit/s.

Date and time display:
In AT command mode, the current date and time (does not belong to the AT command standard) can be turned on by issuing the command **ATW4**. The current date and time value is given as part of the connection message from the public switch. The value is available in the verbose result code only (ATV1).

Example:	Tx data	Rx data
	ATW4	
		OK
	ATD12345	
		CONNECT·64000·<12345>**·[13.05.06,·16:30]**

X.25 userdata display:

In the AT command mode, the received X.25 userdata of the X.25 CALL REQUEST PACKET can be displayed for an incoming call in the **CONNECT** message when the configured B-channel is set to X.25-B channel or X.25-D channel (prot=20, 21)
And the extended result code is set to **ATW1**.

For X.25-D channel (prot=21) the received X.25 userdata will be displayed in the **RING** message as well.

The display of the received X.25 userdata is set in brackets "**<>**" include a delimiter "**D**" followed by the number sign "**#**" in hex coded form:

Example:

<D#**0100000074657374**>
01000000 protocol identifier (national use)
74657374 X.25 userdata „test"

Example for X.25-B channel
(include protocol ID and X.25 userdata "test"):

Tx data	Rx data
ATW1	
	OK
RING	ATA
	CONNECT·64000· <D#0100000074657374>

Example for X.25-D channel
(without protocol ID but include X.25 userdata "12345"):

Tx data	Rx data
ATW1	
	OK
RING <D#3132333435>	ATA
CONNECT·64000· <D# D#3132333435>	

3.3 Serial status lines

The behave of the output serial status lines DSR, CTS, DCD, RI and the input serial status lines DTR, RTS can be configured as described in chapter 3.1 and 4.1 to 4.3.

After power on all serial status lines from the TA will be inactive.
The serial status line DSR can be configured to signal the activation of the current command set (cdsr=0). When changing the command set (cmds) the DSR line goes off during this change phase.
The serial input status lines DTR and RTS will be controlled of an interrupt in the TA firmware. With regard of this behave the maximum input level change must be lower than 100Hz (10ms steps).

The V.24 control circuits will be described for the three different states:

no connect phase: The TA has no ISDN connection.
The serial data (commands and responses) will be used to configure the TA (command mode).

dial phase: **and** **disconnect phase:** The TA has started to establish an ISDN connection and is waiting for the synchronization.
The TA disconnects the existing connection (B-channel and D-channel connection).

connect phase: ISDN data connection is established (D-channel and B-channel connected).
Serial data will be sent or received according to the configured B-channel protocol (data mode).

Status line	Description	no connect	dial/disc.	connect
CTS	0 : CTS follows RTS	=RTS/flc.*	=RTS/flc.*	=RTS/flc.**
	1 : HW FLC	ON/flc.*	ON/flc.*	ON/flc.**
	2 : CTS follows DTR	=DTR/flc.*	=DTR/flc.*	=DTR/flc.**
DCD	0 : DCD always ON	ON	ON	ON
	1 : DCD indicates a connection	OFF	OFF	ON
	2 : DCD follows DTR	=DTR	=DTR	=DTR
DSR	0 : DSR always ON	ON	ON	ON
	1 : DSR indicates a connection	OFF	OFF	ON
	2 : DSR follows DTR	=DTR	=DTR	=DTR
	3 : DSR follows DCD	=DCD	=DCD	=DCD
	5 : DSR Off Hook (connection establishment started)	OFF	ON	ON

flc.* CTS signals the serial flow control from TA (DCE) to the DTE in the command mode and data mode (flc=5).

flc.** CTS signals the serial flow control from TA (DCE) to the DTE in the flow control modes 3 or 5 (flc=3 or flc=5).

DTR: Data terminal ready

The serial status line DTR is used to control the ISDN connection.

0: *No control*

Outgoing calls: The DTR level will be ignored to establish a connection.
Incoming calls: Incoming calls will be accepted independent of DTR status.
Disconnection: DTR drop does not disconnect an active connection.

2: *DTR line will be considered*

Outgoing calls: The DTR level will be considered.
DTR off in the command mode refuses the call procedure with ERROR.
Incoming calls: Incoming calls will be accepted only when DTR is ON.
The incoming call request can be refused with changing DTR to off.
Disconnection: DTR drop disconnects an active connection or a call during the dial phase.
If DTR will be dropped immediately after sending serial data there is no guarantee to transmit these data to the destination side.
A delay of (configured "txfwd" time + 10ms) between sending the last data byte and dropping the DTR line would send out the last data stream.

4: *DTR ignore and DTR drop disconnects*

Outgoing calls: The DTR level will be ignored to establish a connection.
Incoming calls: Incoming calls will be accepted independent of DTR status.
Disconnection: DTR drop disconnects an active connection.
If DTR will be dropped immediately after sending serial data there is no guarantee to transmit these data to the destination side.
A delay of (configured "txfwd" time + 10ms) between sending the last data byte and dropping the DTR line would send out the last data stream.

RTS: Request to send (flow control)
This serial status line is used for the flow control between the DTE device and the TA (DCE).
0: No flowcontrol
3: Hardware flowcontrol RTS/CTS in the data mode
5: Hardware flowcontrol RTS/CTS in data mode and command mode

- If the DTE activates the flow control (RTS=off) the TA needs up to 3 character to stop the serial data stream to the DTE.

- If the connection will be cleared during an active flow control (RTS=off) the received data will be sent to the DTE device when RTS gets active. The reported result code will also be sent with RTS on.
  The control lines to indicate the active connection (DCD) and the "off hook" state (DSR) will be changed without recognizing the current flow control state.

CTS: Clear to send (flow control)
This serial status line is used for the flow control between the TA (DCE) and the DTE device.
0: No flowcontrol
3: Hardware flowcontrol RTS/CTS in the data mode
5: Hardware flowcontrol RTS/CTS in data mode and command mode

- If the TA activates the flow control (CTS=off) the TA will buffer up to 256 bytes from the DTE device.
- If the connection will be cleared with DTR=off during an active flow control CTS=off) the current connection will be cleared after a short timeout. The received serial data from the DTE during the connection will be erased after clearing the connection.
  The control lines to indicate the active connection (DCD) and the "off hook" state (DSR) will be changed without recognizing the current flow control state.

RI: Ring indicator
The serial status line RI gets active during an incoming call request.
If the incoming call will be accepted or the call request ended the RI control circuit gets off.

3.4 Automatic call establishment

Automatic call establishment is available in the following modes:

- An automatic call will be initiated when the control line DTR is on
- An automatic call will be initiated when serial transmit data (character) received into the terminal adapter
- Automatic connection establishment independent of any status line.

To enable automatic call you have to set TA+configuration parameter cmds to 6, 7 rsp. 8 (see below). With changing this parameter the baudrate has be set to a fixed value ('br' not equal to '0').
An established connection will be indicated by a status line. See also configurations commands **cdcd** and **cdtr**.
If a connection cannot be established successfully an automatic retry will be started. The duration of trying to establish the connection and the pause for next retry can be configured.
The dialed number is taken from the parameter **catab**.

cmds 6 Automatic connection establishment when DTR is ON.
Note: "cmds=6" and cdtr=4" can be used on different sides to accept incoming calls if DTR level is set to OFF.

cmds 7 Automatic connection establishment when the TA receives any data byte.

cmds 8 Automatic connection establishment independent of any status line.

Note: (autobauding is not supported, set *br* not equal to 0)

cato *n* call abort of a not successful call after *n* seconds. *n*={3..255}, default: **15** seconds.
capa *n* call pause for *n* seconds before next call attempt. *n* = 0 : immediate call retry. *n*={0..255}, default: **3** seconds.
catab1 ***nn*** set ISDN number ***nn***
catab1 - clear entry
catab1 show entry

Maximum length of ISDN number = 20 digits

Hint: The configuration command „idle" can be used, to automatically disconnect after a predefined time without data transmission.
Note: Please take care that parameter rsttim is greater than 10 and rstmsg =1, to enable the entry into the TA+Configurator after reset (default=40, 4 sec.)

3.5 X.25 D channel rerouting

If the protocol **X.25 D channel** (prot = 21) is selected an automatic establishment of a B channel connection can be selected, if the X.25 call using the X.31-D channel is not successful.
The B channel connection will be started if

- no successful X.25 connection is established within of a timeout set by command "cato" in seconds
- an error is reported from X.31 D channel line.

The rerouting will be activated by setting the configuration command "x31rr=1" (from PAD enter please "exec x31rr=1").
The ISDN number used for establishment of the B channel connection will be taken from the table *xtab* dependent of the entry found in the table.
If the X.25 address meets no entry, the rerouting will not be used.

Example:

1. To enable rerouting for all X25 addresses:
   ```
   x31rr  1
   xtab1  *i04089928392
   ```
2. To enable rerouting for the x25 address 45400012345 and 45400012389:
   ```
   x31rr 1
   xtab1  45400012345i04089928392
   xtab2  45400012389i04089928392
          or
   xtab1  454000123*i04089928392
          or
   xtab1  454000123??i04089928392
   ```


3.6 Using Multilink PPP (option)

To enable Multilink PPP handling within the TA please enable protocol ML-PPP: **ATB31** rsp. **prot = 31**.

ML-PPP may be used with two different authentication protocols during the link establishment phase:

- PAP (password authentication protocol, RFC 1334),
- CHAP (challenge handshake authentication protocol, RFC 1994) with variants
  - MD5 according to RFC 1321,
  - Microsoft Chap according to RFC 2433.

The simpler PAP transmits the user password as clear text over the line, whereas CHAP uses encryption. Which protocol is actually used depends on

- the local PC: if the dialup network configuration requests password encryption only CHAP will be used,
- the remote host configuration: it may (e.g.) allow both PAP and CHAP, CHAP only etc..

3.6.1 Restrictions on Windows95

The CHAP protocol requires that the local side (PC or TA) responds with the proper, encrypted password when ever requested by the remote host. Since Windows95 does not respond on repeated requests CHAP can be used on the second link only if the TA knows the password. It must be stored in the TA's NVRAM:

- Enter "**at**chappwd=<password>**" to input your password in the TA.
  Warning: The input echo is shown in clear text, it should be hidden from unauthorized persons. Nevertheless, commands as "**AT&V1**" display the password as a sequence of asterisks ("*").
- Enter "**AT&W**" to store the setting in the TA.

If the password *chappwd* is not stored on the TA (or is wrong) and remote and/or local dialup network configuration require password encryption, the second link will be physically established for a short time, and will then be disconnected. As a consequence the Multilink option is disabled for the current connection.

3.6.2 Bandwidth on demand ("BOD")

Enabling this feature will cause the TA+POX to use the Multilink PPP protocol to enhance the ISDN throughput using the second B channel automatically:

- if the throughput of the internet connection is higher than a definable value a second B channel connection will be established automatically and used for data transfer.
- if the throughput of the internet connection is lower than a definable value the second B channel connection will be disconnected automatically.

atbod=0**	disable BOD (default)
atbod=1**	enable BOD
atbodiv=<incrValue>**	Throughput level to add 2nd B channel connection (in kbit/s) (default=40)
atbodit=<incrTime>**	duration that bodiv has been reached to add 2nd b channel (in secs) (default=30)
atboddv=<decrValue>**	Throughput level to release 2nd B channel connection (in kbit/s) (default=40)
atboddt=<decrTime>**	duration that boddv has been reached to release 2nd b channel (in secs) (default=30)

Note: call bumping ("cmlp") has higher priority than bandwidth on demand.

3.7 ext. IOM-2 interface (option)

The following chapter will describe the ext. IOM-2 interface of the TA+HUX and TA+SOC module. This option is not available in the external product TA+POX.

The call control commands describe within this document support the following supplementary services for ISDN connections:

- CLIP
- MSN
- Overlap dialling
- Call waiting
- Call hold
- Call retrieve
- 3 party conference

3.7.1 ext. IOM-2 interface command set

The following section describes the enhancements for driving B channel connections without switching the B channel to an on board device (Codec). The B channel data have to be interfaced through the IOM interface.

To select the IOM2 interface of the TA+HUX or TA+SOC module you have to select the correct B-channel protocol.

ATB40	external IOM2 audio connections (speech, S01 used, see command CR…)
ATB43	external IOM2 data connections (speech, S02 used, see command CR…)
ATB45	external IOM2 audio / data connections (Service user defined)

Every command is always answered by the ISDN-module; a following command may only be entered after a response has been received.

Every AT command that controlles a B channel connection without switching an on board device to the B channel is preceeded by a ":" and a dummy port number (always "**$**").

Example: "AT:$ CR D1234" ; Establish a connection.

Result messages to the commands are preceeded by ":$"

Example: ":$CONNECT..." ;Connection established

Every B channel connection is identified by a call reference "Call-Reference".
The call reference is created and reported by the ISDN module:

- incoming call: as parameter to the "RING" message
- outgoing call: as result to the "CR" command.

The call reference has to be released by the application:

- with the command "DISC" or "REL".

All commands based on the same connection have to use the same call reference. More than one call reference can be active at a time.
The B channel information is reported from the TA within the parameter *Bxx*.

The ATS7 register (Wait time for Carrier) is not supported for IOM-2 interface connections.

The supported commands are described as followed:

Supported commands:

ATS80 Set pause between RING messages

ATS*80*?	Show actual values (decimal) of selected register *nn*
ATS*80*=xxx	Set pause between displayed RING messages: 0: RING message not repeated, D channel message ALERT not sent automatically 1..255: pause to repeated RING messages in 100ms steps. D channel message ALERT sent automatically. Default: 50 = 5 seconds. Note: overlap receiving not possible.
ATS*80*?	Show current values (decimal) of register S80.

AT:$ A I<*Call-Reference*> *Accept incoming call*

Using this command you can accept an incoming call, if automatic call acceptance is not set (Register "ATS0" = 0). An incoming call is indicated by the result message "RING" include the callreference value and the selected B-channel. See also the chapter " AT result messages" in this document.

The Call-Reference is valid from the indication of an incomig call or the status change of an connect request til the given release command.
Example: "AT:$ A I1"
Accept an incoming call for port 1

AT:$ CC I<*Call-Reference*> **D<*rn*..>**
Send destination address to the network

Continue to send the destination address to the network (overlap dialling) after initiating an outgoing call (i.e. command AT:$CR) without complete destination address.

"I" selects Call-Reference, 1..9
“D” sets destination address (the dialing number).
“K” sets Keypad information, (option – currently not implemented)
<*rn*> ISDN number, string of digits, 1..22.

Example: "AT:$ CC I1 D12345"
Continue for an existing ougoing call for port 1 to send the destination address "12345" to the network.

AT:$ CR [D<*rn*..>] [O<*rn*..>] *Connect Request to the network*
AT:$ CR [D<*rn*..>] [O<*rn*..>] [S<nn>] *(ATB45 only)*

Initiate an outgoing call.
“D” sets destination address (the dialing number).
“O” sets origination address (own msn), optional.
“S” sets the service indicator (available values: 01, 02, 04, 16)
01: speech
02: unrestricted digital information
04: 3,1kHz audio
16: telephony
<*rn*> ISDN number, string of digits, 1..22.
The TA module initiates an outgoing call request and reports the call reference.
With protocol set to B40 the service indicator 01 speech will be used.

Result message:
":$CRAI<*Call-Reference* >B<selected B-channel>"

B-channel selection: first B-channel "B01"
second B-channel "B02"
Example 1: Command: "AT:$CR D234 O567"
Result: ":$CRAI1B01
Intiate an outgoing call for port 1 with destination address 234 and origination address 567 (own msn), the call can be referenced using the call reference 1. The used B channel is reported in the result message.

Example 2: Command: "AT:$CR D234 O567 S02" (ATB45 only)
Result: ":$CRAI1B01
Intiate an outgoing data call for port 1 with destination address 234 and origination address 567 (own msn), the call can be referenced using the call reference 1.
The used B channel is reported in the result message.

AT:$ CH I<*Call-Reference*> *Call Hold* *(option)*

Hold the call which is addressed by *Call-Reference*.

Example: "AT:$ CH I1"
Intiate a call hold for the existing connection 1 for Port 1

AT:$ CA I<*Call-Reference*> *Call Retrieve* *(option)*

Retrieve the call which is addressed by *Call-Reference*

Example: "AT:$ CA I1"
Intiate retrieve for the existing connection 1 for Port 1

AT:$ C3PTY I<*Call-Reference*> **IH**<*Call-Reference(HeldCall)*> *(option)*
Pass into three party service

Pass into three party which is addressed by the call reference's
Note: The further on used B channel is that one from the active connection.

Example: "AT:$ C3PTY I1 IH2"
Intiate a 3 party conference.

To release a three party conference please enter the same command again, then the previous state will be entered: Call on call reference **Ixx** will be active, call on the call reference **IHxx** will be in hold.

If one of the other two party of the three party conference is going on hook, the previous state for the staying connection will be entered. Example: if the previous active connection releases the connection within the three party conference, the three party conference will be closed and the staying connection will be in hold state.

AT:$ DISC I<*Call-Reference*> [C<"34"*hb*>] *Disconnect*

Disconnects existing ISDN connection within the given cause value "34"*hb* (hexadecimal coded byte).
The causevalue *hb* is defined according to Q931/ETS 300 102-1.
It is also possible to send an disconnect without an cause value (normal call clearing).
The *Call-Reference* is released by this command and is no longer valid.

Example: "AT:$ DISC I1"
Disconnect an existing connection with normal call clearing.

Example: "AT:$ DISC I1 C3495"
Disconnect an incoming call with the cause 0x95 (call rejected).

AT:$ RA I<*Call-Reference*> *Send alert message*

Send an Alert message to the network for the call that is addressed by *Call-Reference.*
This command is only requred when the terminal adpter does not automatically send the ALERT message to the ISDN public switch. To suppress sending the ALERT message you have to modify the value "ATS80=0" (default ATS80=50, RING message timer in 100ms steps)
The ALERT message has to be sent within 8 seconds after receiving the inconing call message ":$RING… ".

Example:
AT:$ RAI1
Initiate an alert request for an existing incoming call for port 1.

Note: After sending this " AT:$ RAI1" command no additional RING message will be sent from the ISDN TA to the serial interface.

AT:$ REL I<*Call-Reference*>

Disconnects existing ISDN connection with the cause value "3490" (normal call clearing) to the public switch.

The *Call-Reference* is released by this command and is no longer valid.

Example: "AT:$ REL I1"
Disconnect an existing connection with normal call clearing.

AT:$ TS I<*Call-Identifier*> ***B***<*Channel*>***T***<*Timeslot*> *Select IOM-2 Timeslot*

Selects a Timeslot for the B-Channel

Example: " AT:$TS I1 *B2 T2* "
Select IOM-Timslot 2 for B-channel 2 for call 1

3.7.2 AT result messages

All messages sent from the IOM2 interface of the TA+HUX are preceeded by an ":$".
There are no spaces between the different parameters of the messages.

:$ CONNECT I<*Call-Reference*> **D<*rn*..> O<*rn*..> B<*hb*>** *Connection established*
:$ CONNECT I<*Call-Reference*> **D<*rn*..> O<*rn*..> B<*hb*> S<nn>** *(ATB45 only)*

Indicates that the connection with the remote side is established using *Call-Reference*.

"D" shows destination address (the dialled number).
"O" shows origination address (the dialling number).
"B" shows B channel used (hexadecimal coded byte):
01 = B channel 1 occupied.
02 = B channel 2 occupied.
"S" sets the service indicator (available values: 01, 02, 04, 16)
01: speech
02: unrestricted digital information
04: 3,1kHz audio
16: telephony
<*rn*> ISDN number, string of digits, 1..22.

Example 1: ":$I1CONNECTI1D234O567B01"
Indicates a connection for Port 1 with destination address 234 and origination address 567 and using B channel 1.
Example 2: ":$I1CONNECTI1D234O567B01S01" (ATB45 only)
Indicates a speech connection for Port 1 with destination address 234 and origination address 567 and using B channel 1.

:$ CRA I<*Call-Reference*> **B<*hb*>** *outgoing call accepted*

This CRA response to an outgoing call initiated by a :$ CR … that the call will be processed (SETUP ACK or CALL PROCEEDING from the ISDN line).
The ongoing connection can be referenced by the Call Reference. Tones on the ISDN B channel are available.
"B" shows B channel used (hexadecimal coded byte):
01 = B channel 1 occupied.
02 = B channel 2 occupied.

Example 1: ":$I1B01"

:$ DISC I<*Call-Reference*> C<*hbhb*> *disconnect received*

Indicates that a call has been disconnected.
The cause is indicated with causevalue *hb* (hexadecimal coded word).
The causevalue hb is defined according to CAPI 2.0 (see also TA+POC manual CAPI-causes).

Example: ":$DISCI1C3491"
Outgoing call is cleared with the ISDN cause 0x91 (User busy).

NOTE: In case of the "$DISC" message available inband information in the selected B-channel will be sent to the IOM-2 interface.

:$ ERROR *Syntax error in AT:$ command*

There was a syntax error or not known AT command issued.

:$ INFO I<*Call-Reference*> **D<*rn*..>** *information to existing call reference*

Information initated by a status change for an existing call reference with:

"D" shows destination address (the dialled number).

Example: ":1INFO I1D9"
next dialled number "9" received.

:$ REL I<*Call-Reference*> C<*hbhb*> *disconnect received*

Indicates that a call has been disconnected.
The cause is indicated with causevalue *hb* (hexadecimal coded word).
The causevalue hb is defined according to CAPI 2.0 (see also TA+POX manual CAPI-causes).

Example: ":$RELI1C3491"
Outgoing call is cleared with the ISDN cause 0x91 (User busy).

NOTE: In case of the "$REL" message no inband B-channel information is available and the selected B-channel for the last call is free.

:$ RING I<*Call-Reference*> **D<*rn*..> O<*rn*..> B<*hb*>** *incoming call*
:$ RING I<*Call-Reference*> **D<*rn*..> O<*rn*..> B<*hb*> S<nn>** (ATB45 only)

Indicates an incoming call, a SETUP is received.
"D" shows destination address (the dialled number, = dialled msn).
"O" shows origination address (the dialling number).
"B" shows B channel used (hexadecimal coded byte):
00 = no B channel occupied (if call waiting and both B channels occupied).
01 = B channel 1 occupied.
02 = B channel 2 occupied.
"S" sets the service indicator (available values: 01, 02, 04, 16)
01: speech
02: unrestricted digital information
04: 3,1kHz audio
16: telephony

<*rn*> ISDN number, string of digits, 1..22.
With protocol set to B40 all speech based calls will be signalled (S=01, 04 and 16, CIP value = 00030012).

Example 1: ":$RINGI1D234O567B01"
Indicates an incoming call for port 1 with destination address 234 and origination address 567 and using B channel 1.

Example 2: ":$RINGI1D234O567B01S01"
Indicates an incoming speech call for port 1 with destination address 234 and origination address 567 and using B channel 1.

Note: This message is repeated (like in AT modems).
The repetition time is configured in parameter "ATS80" (time in 100ms steps).
The default value is set to "50" which is 5 seconds.

:$ RINGING I<*Call-Reference*> *called party is ringing*

Indicates that the call request is accepted at the called party and a ringing is issued.

Example: ":$RINGINGI1"

Note: This message is not repeated (like in AT modems).

3.7.3 IOM-2 connection control examples

3.7.3.1 Accepted incoming call

AT application		TA+HUX module	Remarks
	←	":$RINGI1D234O567B01"	Incoming call (call reference is valid)
"AT:$ AI1"	→		Accept the call
	←	":$CONNECTI1D234O567B01"	Connection established
"AT:$ DISC I1 C3400" →			Disconnect, normal clearing, release call reference
	←	":$OK"	Disconnected
	←	":$RELI1C"	used B-channel is free

3.7.3.2 Rejected incoming call

AT application		TA+HIT module	Remarks
	←	":$RINGI1D234O567B01"	Incoming call (call reference is valid)
"AT:$ DISCI1C3491" →			Disconnect, cause: user busy, release call reference
	←	":$OK"	Disconnected
	←	":$RELI1C"	used B-channel is free

NOTE: If the disconnect command “AT:$DISCIxC3491” will not receive the requested respone ":$RELIxC3490" within about 1 second the additional "AT:$RELIx" command is required to clear the current used ISDN B-channel immediately.

3.7.3.3 Successful outgoing call and disconnect

AT application		TA+HIT module	Remarks
"AT:$CR D234 O567"			Initiatate outgoing call to "234"
	←	":$CRAI1B01"	Request accepted, use call reference 1, B-channel B01.
	←	":$RINGINGI1"	Destination is ringing
	←	":$CONNECTI1D234O567B01"	Connection established
	←	":$DISCI1C3490"	Connection released, normal clearing
"AT:$ REL I1"	→		Disconnect, release call reference
	←	":$OK"	OK

NOTE: In case of receiving ":$RELI1C3490" in case of ":$DISCI1C32490" no additional "AT:$ REL I1" command is required.

3.8 ISDN leased line (option)

With a special firmware generation the TA+POX (TA+HUX, TA+SOC) supports the connectivity of an ISDN leased line (type 64S, or 64S2).

To use the TA+POX on an ISDN leased line you have to configure the firmware especially.
This chapter includes the special settings for the leased line configuration only.
The following parameter must be set

****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 reset by powering it off and on (alternately you can use the command AT&W**RESET).

AT**ISDN=12	Select LL 64SB1 (leased line 64S, B-channel 1)
AT**ISDN=13	Select LL 64SB2 (leased line 64S, B-channel 2)
AT**ISDN=14	Select LL 64S2 (leased line 64S2, B-channel 1)
AT**ISDN	Show selected ISDN protocol
AT**?ISDN	Show available ISDN protocols

In the leased line mode the adapter can handle the B-channel protocol “ATB4” (HDLC transparent) only.

B B channel protocol

Transmission protocol for data communication in the B channel.

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

3.8.1 ISDN connection example

To establish a data connection the adapter will start the outgoing call as usual independent of the configured command set “cmds” of the TA+POX. The called party number is not specified for the outgoing call.

Note: The call request (outgoing call) must be done on both ends of the ISDN leased line with the TA+POX.

3.8.1.1 ISDN connection with AT command set

1. Start the outgoing call
   ”ATD1<cr>”

2. When the TA+POX will detect the ISDN line (activation of layer 1) the adapter will result the connection message and control lines.
   “CONNECT 64000”
   and serial status line “DCD” => ON

3. To disconnect the logical link you can use the available mechanism to clear the connection.
   Send the escape sequence “+++” delay of 1 second “ATH<cr>”
   or drop the serial status line DTR = OFF.

Note: There is currently no connection control between both devices from end to end. If one device will be removed from the leased line the other device is still connected.

3.8.1.2 ISDN connection with “automatic call establishment”

Automatic call establishment is available in the following modes:
- An automatic call will be initiated when the control line DTR is on
- An automatic call will be initiated when serial transmit data (character) received into the terminal adapter
- Automatic connection establishment independent of any status line.

To enable automatic call you have to set TA+configuration parameter cmds to 6, 7 rsp. 8 (see below). With changing this parameter the baudrate has be set to a fixed value (‘br’ not equal to ‘0’).
An established connection will be indicated by a status line. See also configurations commands **cdcd** and **cdtr**.
If a connection cannot be established successfully an automatic retry will be started. The duration of trying to establish the connection and the pause for next retry can be configured.

The dialed number is taken from the parameter **catab1**.

cmds 6	Automatic connection establishment when DTR is ON.
cmds 7	Automatic connection establishment when the TA receives any data byte.
cmds 8	Automatic connection establishment independent of any status line.

Note: (autobauding is not supported, set *br* not equal to 0)

cato *n*	call abort of a not successful call after *n* seconds. *n*={3..255}, default: **15** seconds.
capa *n*	call pause for *n* seconds before next call attempt. n = 0 : immediate call retry. *n*={0..255}, default: **3** seconds.

catab1 ***nn***	set ISDN number ***nn***
catab1 -	clear entry
catab1	show entry

Maximum length of ISDN number = 20 digits

Hint: The configuration command „idle“ can be used, to automatically disconnect after a predefined time without data transmission.
Note: Please take care that parameter rsttim is greater than 10 and rstmsg =1, to enable the entry into the TA+Configurator after reset (default=40, 4 sec.)

4 TA+Configurator command set

The settings of the TA+POX for the serial interface and the S bus interface are called configuration. The TA+POX is delivered with a set of pre-set values. In the following section it will be shown how, by using the configuration commands, you can examine the configuration of the TA+POX and if necessary change it. The values can be stored in non volatile memory; this means they'll remain unchanged even if the power supply is disconnected.
You can configure the TA+POX in the following ways:

- by using TA+ configuration commands entered by a locally connected PC.
- by using TA+ configuration commands entered via the ISDN access (remote configuration).
- by using the PAD (X.3) command set entered by a locally connected PC.
- by using the AT command set entered by a locally connected PC.

The TA+Configurator can be entered in the following ways:

- remote via ISDN (see page 64).
- by using a special command from the asynchronous dialup command interface (PAD: “CONF” or AT: “ATCONF”).
- or escape sequence in power up phase if enabled (rsttim>10, rstmsg=1).

4.1 Configuring the TA+POX with AT commands

To execute one TA+configuration command *cmd* out of the AT command mode you have to issue the command: "**at*****cmd***" .
To call up the TA+Configurator please use the command "**atconf"**.
You can leave the TA+Configurator by the command “quit” (or „exit“ or „go“).

Note: After altering one of the profile values marked by *(#1)* you **have to** give the additional commands *save* and *go*. This is necessary to save and activate these new parameters.

4.2 Configuring the TA+POX with X.3 PAD

To execute one TA+configuration command *cmd* out of the X.3 - PAD command mode you have to issue the command: "**exec *cmd***" .
To call up the TA+Configurator please use the command "**conf**".
You can leave the TA+Configurator by the command "quit".

Note: After altering one of the profile values marked by *(#1)* you **have to** give the additional commands *save* and *go*. This is necessary to save and activate these new parameters.

4.3 Configuring the TA+POX after power on

For this entry you have to set the configuration parameter "**rstmsg=1**".

- Connect the TA+POX to ISDN interface
- Connect the PC's com-port to the DTE interface of the TA+POX.
- Start a terminal emulation program (i.e. Hyper-Terminal) with the following settings: 9600 Baud, 8 databits, No Parity **(8N1**)
- Connect the TA+POX to the mains by the mains plug adaptor
- Wait until LED 2 starts blinking (after about 5 sec, see config cmd “start“) and the message to enter the config-sequence is displayed:
  "**+++ Press <CR>,<CR>,<ESC>,<ESC> to enter TA+Configurator +++**"
- Type in quickly the sequence <RET> <RET> <ESC> <ESC>, to call up the TA+Configurator.
- The TA+Configurator acknowledges by giving a welcome string and a “#“ as the prompt character. Now you can work with the TA+Configurator by using the configuration commands (see page 66).
- Setup the parameter for the TA+POX from your terminal program and store them.
  Example:
  To change the used B channel protocol to X.75 please enter the following commands:
  prot 10<↵> (set protocol to X.75)
  save<↵> (save the new configuration)
  quit<↵> (leave the TA+Configurator and activate the new value settings)
  Hint: The active set of parameters can be displayed on screen by the TA+Configurator with the command **"show**<↵>**"**.
- Leave the terminal program and start your application.

Now you can use the TA+POX with the new set of parameters by running the needed PC program.

4.4 Remote Configuration using the TA+Configurator commands

The TA+POX to be configured is referred here as “*remote* TA+POX”.
The TA+POX to configure is referred as “*local* TA+POX”.
Please make sure that the *remote* TA+POX to be configured at the other end is connected to the ISDN line and powered up.

- Connect the *local* TA+POX to ISDN interface
- Connect the PC's com-port to the DTE interface of the *local* TA+POX.
- Connect the power supply to the mains socket.
- Start a terminal emulation program (i.e. Windows-Terminal)
- Configure the *local* TA+POX with the B channel protocol X.75 and blocksize 2048 (ATB10).
- Set up an ISDN connection to the *remote* TA+POX to be configured by using the command: ATD<*ISDN-No*>e<↵>. The extension "e" at the end of the calling number gives a connection to the internal remote access of the *remote* TA+POX.
  The called TA+POX TA+Configurator acknowledges by requesting the remote password. Please enter the correct password (default: no password, just return). Now you can work with the TA+Configurator by using the TA+Configurator commands (see page 61).
- Configure the parameter for the *remote* TA+POX from your terminal program and store them (if wanted). (see page 66).
  Example:
  To change the used B channel protocol to X.75 please enter the following commands:
  prot 10<↵> (set protocol to X.75 - blocksize 2048)
  save<↵> (save the new configuration)
  Hint: The active set of parameters can be displayed on screen by the TA+Configurator with the command **"show**<↵>**"**.
  If necessary the *remote* TA+POX can be reset using the command **"reset**<↵>**"**.
- Hang up the ISDN connection by leaving the TA+Configurator using the command **quit**.
  Leave your terminal program. After the next reset the changes will be active.

Now the configured *remote* TA+POX with the new set of parameters can be used by running the needed PC program.

4.4.1 Remote access control

Using the following commands you can setup a table, to allow only dedicated callers to get a connection to the remote management facilities inside the TA.
If this list is empty (default) or one entry with a star (*) is set, any incoming call is allowed.
Every incoming call that does not fit to one of the entries of acctab will be rejected with the ISDN cause „call rejected“.

racctab***x*** ***nn*** set entry number ***x*** to ISDN number ***nn***
racctab***x*** - clear entry number ***x***
racctab***x*** ***** Allow all incoming calls to be accepted
racctab***x*** Show entry number ***x***
racctab Show all entries

Maximum number of entries = 5
Maximum length of ISDN number = 20 digits
The ISDN number can contain wildcards:
* : represents one or more digits
? : represents exactly one digits

Example:

```
racctab1  1234567890     ; accept the only specified number
racctab2  *456*          ; accept all number with 456 somewhere in the
                           middle
racctab3  ?2345678??     ; accept all number with 2345678 in the middle
                           preceded by one digit and followed by two digits.
racctab3  *              ; accept all incoming calls
racctab3  -              ; clear entry no. 3
```

4.5 List of TA+Configurator commands

The TA+Configurator commands typed in must have the correct syntax and be complete, including all blanks. Capital/small letter use is not important. The entry is not case sensitive.
The bolded values are factory defaults. The usage is:

[?]<command>[=parameter]

Example to **set** the ISDN B channel protocol to X.75:

prot=10

Example to **show** the selected ISDN protocol:

prot

Example to **show all** selectable ISDN protocols:

?prot

To get an overview about the commands of your TA some major commands here as a preview:

show	show the usually used parameter
showall	show all changeable parameter
quit	leave TA+Configurator
help	show all available commands
defa	setup default parameter set
defa 1	setup factory default parameter set
save	store parameter non volatile

---

at.s*x*, at.opt, at.rcs S-Register, AT command parameter set

Handle AT command set specific settings.

Show and change AT S registers by entering the new value.

AT.Sn=v	set Register Sn to value v
AT.Sn?	show current value of S-Register Sn

The complete list of S-Register is described in chapter 3.2.2.
“AT command S register set”.

at.opt show option register (bit-values):

- bit 0 : 01 => ATE1
- bit 1 : 02 => ATQ1
- bit 2 : 04 => ATV1
- bit 5 : 32 => ATW1

at.rcs equals setting of Hayes "ATX" command

bch1delay ISDN B-channel loop delay (ATS31=1 needed)

This parameter set the data loop delay in the ISDN B-channel when S-register S31=1 which activates the B-channel loop for incoming calls. The used B-channel for the loop is given from the public switch within the incoming call message (DSS1: SETUP, I-element: Channel Identification 0x18).

bch1delay ISDN B-channel data loop delay (in 64 byte steps)
bch1delay = {256 … 3968}, default: 256 Byte

The delay time in the B-channel can be controlled by changing the buffer size of the internal memory in 64 byte steps (equals 8ms steps).
The minimum buffer size can be set to 256 byte.
The maximum value is 3968 byte.
The step size is 64 byte which equals 8ms.

Example: t = 200 ms (delay time) (must be divisible by eight)
bch1delay = (delay time) in ms / 8ms x 64 Byte = 1600 byte

This table list a selection of typical parameter. (64 bytes / 8ms)

bch1delay (byte)	256	512	1024	1600	2048	2560	2880	3200	3968
B-channel delay in ms	32	64	128	200	256	320	360	400	496

bchloop ISDN B-channel loop

This parameter indicates the data loop in the ISDN B-channel which can be set with S-register ATS31=1.
The ISDN B-channel loop must be set with ATS31 register and will automatically saved to the configuration parameter **bchloop**.

bchloop ISDN B-channel loop
0 : B-channel loop disabled (ATS31=0)
1 : B-channel loop enabled (ATS31=1)

bchloop ? return the configured ISDN B-channel loop
which is set with ATS31=[0,1].

br **baudrate asynchronous**

Selection of the asynchronous baudrate for the DTE interface
- **0**: Autobauding, (automatic local bit rate adoption) (default)
- 1: 1200 bit/s
- 2: 2400 bit/s
- 3: 4800 bit/s
- 4: 9600 bit/s
- 5: 19200 bit/s
- 6: 38400 bit/s
- 7: 57600 bit/s
- 8: 115200 bit/s
- 9: 230400 bit/s
- 20: 300 bit/s
- 21: 600 bit/s
- 26: 10400 bit/s

Note: Autobauding (br = 0) is available for AT command set only. If set and cmds is changed to PAD, br will be set to 4 (9600 bit/s).

brn **line baudrate asynchronous V.110**

Selection of the asynchronous baudrate for V.110 line (B channel)
- **0**: Line baudrate equals local baudrate
- 1: 1200 bit/s
- 2: 2400 bit/s
- 3: 4800 bit/s
- 4: 9600 bit/s
- 5: 19200 bit/s

(See in addition note 3)

bsize **frame length**

Maximum length of a data frame. This setting is valid for both received and transmitted data frames.

prot=X.25-B	128
prot=X.31-D	128
prot=X.75	2048
values:	32 .. 2048

catab<x> **show call table entry**

Show setting of the parameter **catab<x>** for automatic dialing.
The call table **catab** includes 3 entries (catab1, catab2, catab3).

catab**x *nn***	set entry number ***x*** to ISDNnumber ***nn*** (max. length=20 digits)
catab1 -	clear entry
catab1	show entry

cato **call timeout to abort**

Time to abort a call if not successful connected after *n* seconds.
n = {3..255}, default: **15** seconds.

capa **call pause**

Automatic call: set a call pause for *n* seconds before next call attempt.
n = 0 : immediate call retry. *n*={0..255}, default: **3** seconds.

catry **calls retry**

Automatic call: max. no of tries of every number entry in catab.
n = 1 .. 255 :, default: **1**

ccts **CTS control**

CTS control
0 : CTS follows RTS
1 : HW FLC / hardware flow control RTS/CTS (default)
2 : CTS follows DTR
For nearer information see also chapter 3.3.

cdcd **DCD control**

DCD control
- 0 : DCD always ON
- **1** : DCD indicates a connection (default)
- 2 : DCD follows DTR

For nearer information see also chapter 3.3.

cdsr **DSR control**

DSR control
- **0** : DSR always ON
- 1 : DSR indicates a connection
- 2 : DSR follows DTR
- 3 : DSR follows DCD
- 5 : DSR Off Hook (default)

For nearer information see also chapter 3.3.

cdtr **DTR control**

Usage of DTR to control ISDN connection
- 0 : No control:
  Incoming calls will be accepted independent of DTR status;
  DTR drop does not disconnect an active connection.
- **2** : DTR off disconnects (default)
  Incoming calls will be accepted only when DTR is ON;
  DTR drop disconnects an active connection.
- 4 : DTR ignore and DTR drop disconnects
  Incoming calls will be accepted independent of DTR status;
  DTR drop disconnects an active connection.

For nearer information see also chapter 3.3.

chappwd **set password for PPP chap authorization**
(only required for WINDOWS 95)

Enable ML-PPP CHAP authorization by setting the password corresponding to the user name used for the PPP connection. If the server does not handle CHAP an automatic fallback to PAP is performed.

chappwd=<password> set password for CHAP

Note: Since the password is shown in plain text it may be disclosed by unauthorized persons.

cmds **command set** ***(note 1)***

Command set for connection control
- **0**: AT command set (default)
- 1: PAD X.3 command set
- 6: Automatic dialing when DTR is set
- 7: Automatic dialing when TxD is received by the TA
- 8: Automatic dialing always connect
- 10: Configurator (internal configuration command set)
- 12: incoming calls only (no active connections)

Note: For details see the appropriate chapters.
After changing *cmds* via remote management the TA has to be reset using the command "reset".

cnr<x> **storing phone numbers**

The TA+POX can store up to three of the most frequently called numbers (**AT&Z1, AT&Z2, AT&Z3**). These parameter can also be set from the internal configurator.

cnr**x**=***nn*** set entry number ***x*** to ISDNnumber ***nn*** (max. length=20 digits)
cnr**x** shows the value of entry **x**
cnr**x**=- clears the value of entry **x**

See also parameter AT&Z<x>=<nnn>.

dbits **asynchronous databits**

Number of data bits asynchronous chars (default: 8) 7,**8**
Note: To use other data formats than 10 bit (= (N1, 7E1, 7O1) you have to set br to fixed speed.

defa **default settings**

Sets up factory default parameter setting.
defa 0: setup all parameter concerning data port
defa 1: setup all parameter including ISDN protocol and msn settings.

dhtc **highest 2-way channel (X.25 D channel)**

Highest switched virtual logical channel for incoming and outgoing X.25 connections.
dhtc = {1...4095}, default: **1**

The value range for this LCN (logical channel number) can be set from 1 to 16 (LCN: bit 1 to bit 4). LCN values from 17 to 256 (LCN: bit 5 to 8) are currently not supported. These LCN values will fail within the outgoing call with the result code "NO DIALTONE".
Explanation of X.25 channel number structure:

Logical channel group number	Logical channel number	
LCGN (4 bit length, bit 9 to 12)	LCN (8 bit length, bit 1 to 8)	
X X X X	0 0 0 0	X X X X

Example:
LCGN=0 and LCN=1 "dhtc" value = "0x001" = 1
LCGN=0 and LCN=5 "dhtc" value = "0x005" = 5
LCGN=2 and LCN=10 "dhtc" value = "0x20A" = 522
LCGN=4 and LCN=1 "dhtc" value = "0x401" = 1025
LCGN=15 and LCN=1 "dhtc" value = "0xF01" = 3841

dltc **lowest 2-way channel (X.25 D channel)**

Lowest switched virtual logical channel for incoming and outgoing X.25 connections.
dltc = {1...4095}, default: **1**
The value range for this LCN (logical channel number) can be set from 1 to 16 (LCN: bit 1 to bit 4). LCN values from 17 to 256 (LCN: bit 5 to 8) are currently not supported. These LCN values will fail within the outgoing call with the result code "NO DIALTONE".

Explanation of X.25 channel number structure:

Logical channel group number	Logical channel number	
LCGN (4 bit length, bit 9 to 12)	LCN (8 bit length, bit 1 to 8)	
X X X X	0 0 0 0	X X X X

Example:
LCGN=0 and LCN=1 "dltc" value = "0x001" = 1
LCGN=0 and LCN=5 "dltc" value = "0x005" = 5
LCGN=2 and LCN=10 "dltc" value = "0x20A" = 522
LCGN=4 and LCN=1 "dltc" value = "0x401" = 1025
LCGN=15 and LCN=1 "dltc" value = "0xF01" = 3841

dte **B channel link address**

Selects the Layer 2 link addresses for ISDN B channel. Only valid for protocols that are HDLC based (X.75, LAPB, X.25-B).

0 Calling side reacts as DTE,
called side reacts as DCE
(default for several protocols, prot=10, 13, 22, 23)
1 TA reacts as DTE (own adr = 01)
(default for X.25 protocol, prot=20, 21)
3 TA reacts as DCE (own adr = 03)

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

flc **flowcontrol**

Flowcontrol to DTE
0 : No flowcontrol
3 : Hardware flowcontrol RTS/CTS in the data mode
5 : Hardware flowcontrol RTS/CTS in data mode and command mode
For nearer information see also chapter 3.2.

ftei **tei value point to point, fixed tei**

Reserved functionality, Point to Point mode only:
Value of the terminal equipment identifier for fixed tei connections. This value is set to 0 per default and should not be changed.

0..63	tei value as defined will be used (default: **0**)
127	automatic tei procedure will be used

Note: changing the type of ISDN access by setting the parameter "ptp" will automatically change the parameter "ftei".
These values get active after sending "save" command and a reset of the TA.

fwload **load new firmware** **(8Mbit Flash memory required)** **(option)**

This commands loads new firmware into the TA without starting.
The firmware will be stored into the upper not used part of the flash memory. While uploading the following checks will be performed:

- File transfer protocol is XMODEM1K
- An overall firmware checksum is used.
- The firmware type written in the module header of the firmware must be compatible to the hardware- and allowed firmware type (stored inside the Bootloader).

NOTE: If the flash memory size is only 4Mbit this command is not supported.

fwstart **start new firmware** **(8Mbit Flash memory required)** **(option)**

This command starts new firmware previously stored within the TA.
The firmware stored in the upper part of the flash memory will be loaded into the executable part of the FlashProm and started, if the following conditions are met:

- the overall firmware checksum must be correct.
- The firmware type written in the module header of the firmware must be compatible to the hardware- and allowed firmware type (stored inside the Bootloader).

Starting includes a hardware reset of the TA.
Note: If new functionality has been added, your last stored configuration may be lost.
If the flash memory size is only 4Mbit this command is not supported.

htc **highest 2-way channel (X.25 B channel)**

Highest switched virtual logical channel for incoming and outgoing X.25 connections.
htc = {1...4095}, default: **1**

The value range for this LCN (logical channel number) can be set from 1 to 16 (LCN: bit 1 to bit 4). LCN values from 17 to 256 (LCN: bit 5 to 8) are currently not supported. These LCN values will fail within the outgoing call with the result code "NO DIALTONE".

Explanation of X.25 channel number structure:

Logical channel group number	Logical channel number	
LCGN (4 bit length, bit 9 to 12)	LCN (8 bit length, bit 1 to 8)	
X X X X	0 0 0 0	X X X X

Example:

LCGN=0 and LCN=1	"htc" value = "0x001" = 1
LCGN=0 and LCN=5	"htc" value = "0x005" = 5
LCGN=2 and LCN=10	"htc" value = "0x20A" = 522
LCGN=4 and LCN=1	"htc" value = "0x401" = 1025
LCGN=15 and LCN=1	"htc" value = "0xF01" = 3841

idle **Idle data timeout**

Timer to disconnect the ISDN B channel connection after inactivity (sec).
0: inactive (default)
1..*n***:** delay time to disconnect in seconds (1..255).

iinit **ISDN initialisation after power ON**

Defines the behavior of the TA after Reset. If set to 1 the ISDN interface will automatically activated after Power ON. As a result, the LED1 will show the correct state regarding the ISDN line.
If set to 0, the TA stays passive to the ISDN line after power On, the LED1 will stay blinking till the first successful communication through the ISDN line takes place.

iinit 0 :	no activation after Power On
iinit 1 :	Automatic activation after Power On
iinit 2 :	Automatic activation every time the S-Bus is deactivated
iinit 3 :	Automatic Tei-Request after Power On
iinit 4 :	Automatic Tei-Request and LAPD link setup after Power On
iinit 5 :	Automatic Tei-Request and LAPD link setup and RESTART after Power On (ISDN point to point mode, all connections will be cleared)
iinit 6 :	Automatic Tei-Request and LAPD link setup permanently

isdn **ISDN D channel protocol** ***(note 1)***

Selects ISDN D channel protocol

0: DSS1 (Euro-ISDN)	
1: 1TR6 (Germany national)	(option)
2: DSS1 NT mode (Euro-ISDN)	(option)
5: National ISDN-1/2 (USA)	(option)
6: NTT INS-NET (Japan)	(option)
7: AT&T 5ESS (USA)	(option)
8: VN4 (France)	(option)
12: leased line with usage of just B channel B1	(option)
13: leased line with usage of just B channel B2	(option)
14: leased line with usage of both B channels.	(option)

k **windowsize**

Layer-2 protocol: windowsize (default:**7**). k = {1..7}
Value will be automatically changed with changing B channel protocol *prot*.
The default value for "prot=21" (X.31 D channel) is set to k=3".

load Load stored parameter setting

All parameters stored in non volatile ram will be loaded.

ltc lowest 2-way channel (X.25 B channel)

Lowest switched virtual logical channel for incoming and outgoing X.25 connections.

ltc = {1...4095}, default: **1**

The value range for this LCN (logical channel number) can be set from 1 to 16 (LCN: bit 1 to bit 4). LCN values from 17 to 256 (LCN: bit 5 to 8) are currently not supported. These LCN values will fail within the outgoing call with the result code "NO DIALTONE".

Explanation of X.25 channel number structure:

Logical channel group number	Logical channel number	
LCGN (4 bit length, bit 9 to 12)	LCN (8 bit length, bit 1 to 8)	
X X X X	0 0 0 0	X X X X

Example:

LCGN=0 and LCN=1	"ltc" value = "0x001" = 1
LCGN=0 and LCN=5	"ltc" value = "0x005" = 5
LCGN=2 and LCN=10	"ltc" value = "0x20A" = 522
LCGN=4 and LCN=1	"ltc" value = "0x401" = 1025
LCGN=15 and LCN=1	"ltc" value = "0xF01" = 3841

msni Multiple Subscriber Number for incoming calls

Own MSN (Multiple Subscriber Number) for incoming calls.

msni *	global msn, all incoming calls will be accepted.
msni *nn*	set "msni" to *nn* = string of digits (max length = 20)
msni -	no acceptance of incoming calls
msni	show current setting of "msni".

msno Multiple Subscriber Number for outgoing calls

Own MSN (Multiple Subscriber Number) for outgoing calls.

msno -	no "msn" value will be used for outgoing calls.
msno *nn*	set "msno" to *nn* = string of digits (max length = 20)
msno	show current setting of "msno".

p*xxx* **X3 parameter set**

PAD X.3 command set only:
show setting of one X3 parameter.
Change X3 parameter by entering the new value.
p001 show setting of X3 parameter 0
p001=1 set X3 parameter 0 to 1
Note: See chapter 3.1.1 for supported pad parameter.

pnp **plug and play ID**

Select the plug and play functionality for WINDOWS operating systems.
0 : disable plug and play ID
1 : enable plug and play ID

prot **B channel protocol**

Transmission protocol for data transfer
0 : V.110 asynchronous
3 : HDLC async to sync conversion (PPP asynchronous)
4 : HDLC transparent (octets are packed into HDLC frames)
5 : Byte transparent voice connection (raw B channel data)
6 : Byte transparent data connection (raw B channel data)
10 : X.75 SLP
13 : V.120 async
20 : X.31 B channel (X.25 B channel)
21 : X.31 D channel
22 : T.70NL
23 : T.90NL
31 : MLPPP (Option)
33 : X.75 B-channel bundling (Option)
For this type of protocol both B-channel on the ISDN interface need to be free. Otherwise the connection will fail - no automatic detection.
40 : B channel transparently switched to IOM-2 (audio connection)
43 : B channel transparently switched to IOM-2 (data connection)
45 : B channel transparently switched to IOM-2 (data and audio connection)

prty **asynchronous parity**

Parity of asynchronous character (default: no parity)
0 : No parity; 1 : Odd parity; 2 : Even parity

Note: To use other data formats than 10 bit (8N1, 7E1, 7O1) you have to set the parameter of the serial bps-rate "br" to a fixed speed ("br" unequal "0").

ptp **ISDN interface type**

Select type of ISDN interface:
0 : select multipoint mode (to connect ISDN terminals, default)
1 : select point to point mode (to connect ISDN switching systems)

quit, exit, go **activate parameter changes**

Activates the actual parameter settings and leave the TA+Configurator (without storing the parameter in non volatile memory).

racctab **Access table setup for remote access**

Using these commands you can setup a table, to allow only dedicated callers for remote management to get a connection to the TA.

racctab***x*** ***nn*** set entry number ***x*** to ISDN number ***nn***
racctab***x*** - clear entry number ***x***
racctab***x*** ***** Allow all incoming calls to be accepted
racctab***x*** show entry number ***x***
racctab Show all entries

Note: for a detailed description see chapter 4.4.1.

reset **reset TA+POX**

Resets the whole functionality of the **TA+POX** by a forced hardware reset (like Power off / on). Refer also to parameter rsttim.

Note: If you reset a TA from remote management the "resetted" TA will loose it's connection to the ISDN network. Due to timeouts of the ISDN network it can take up to 30 seconds till the local TA will notify the released connection.

ridle **idle data timeout for remote connection**

Timer to disconnect the remote connection after inactivity (sec).

0: inactive
1..*n***:** delay time to disconnect in seconds (1..255).
60: 60 seconds (default)

rmua, rmua1, rmua2, rmua3 **Output pin behavior**

Definition of the behavior of the output pins UA, UA1, UA2 and UA3.
The behavior can be configured by using one of the following setting to the value of the list below.
The output level can be inverted by adding 128 to the desired value (defines the output pin to low active).

0 :	output pin always OFF	
1 :	output pin always ON	
2:	ISDN activation	blinking 0.5 sec OFF, 0.5 sec ON (deactivated), ON (activated)
3:	ISDN activation	OFF (deactivated), ON (activated)
10:	OFF HOOK	B1 channel occupied
11:	OFF HOOK	B2 channel occupied
12:	OFF HOOK	B1 or B2 channel occupied
29 :	data connection	B1 or B2 channel connected and synchronized
30 .		connection establishment in coded form • dial procedure = slow flashing • synchronization procedure = quick flashing
31 .		B1 channel connected and synchronized
32 :		B2 channel connected and synchronized
22 :	customer define	DATA_CHCONNECT_EXT
40 :	customer define	ALARM_OUTPUT
41 :	customer define	INC_EXT_CALL
43 :		equals L1 of TA+POC (L1 without refresh, only refresh output with active call)

Default values:			
	rmua	131	(TA+HUX)
	rmua1	30	(TA+HUX)
	rmua2	140	(TA+HUX)
	rmua3	-	

NOTE: incoming remote connection to the TA will also be signaled with the B-channel LED's (B1 of B2).

rmsn **Multiple Subscriber Number for remote**

MSN (Multiple Subscriber Number) for remote configuration
*****: no specific MSN, all incoming calls accepted (default).

rmsn *	global msn, all incoming remote calls will be accepted.
rmsn *nn*	set "rmsn" to *nn* = string of digits (max length = 20)
rmsn -	no acceptance of incoming remote calls
rmsn	show current setting of "rmsn".

NOTE: The remote connection needs to get an incoming call with a special LLC value "88 90 21 58 00 BB" which is automatically set in the additional "e" of the dial command from the connecting Stollmann ISDN TA.

rpwd **password**

Password for remote configuration (character input), max length 32 character.
To disable password please enter: “rpwd –“ (default).

rpwd -	no remote password is set
rpwd *nn*	set "rpwd" to *nn* = string of digits (max length = 32)
rpwd	show current setting of "rpwd".

rstmsg **startup message**

Startup message:
"+++ *Press <CR>,<CR>,<ESC>,<ESC> to enter TA+configurator* +++"
after start up can be displayed with a fixed speed of 9600 bps, 8 data bits, no parity, 1 stop bit.

0: inactive, no startup message will be send after power on. (default)
1: active, startup message will be send after power on

rsttim **startup timer**

Startup delay timer after reset. Within this period the configuration can be entered after reset.

1 .. 255 :	reset phase in 100 milliseconds, default: **40** (4 seconds)

save **store parameter changes**

Stores the actual set of parameters in non volatile memory

sbits **number of stopbits**

Number of stopbits of asynchronous character
1 : One stopbit (default); 2 : two stopbit
Note: To use other data formats than 10 bit (= (N1, 7E1, 7O1) you have to set br to fixed speed.

sertrc **serial link trace**

Controls the part of serial output to the trace module.
bit 0 : enable serial data to the trace log
bit 1 : enable serial status lines to the trace log

available values:		
	0	disable serial output to the trace log
	1	enable serial data to the trace log
	2	enable serial status lines to the trace log
	3	enable serial data and status lines, default

shidle **Short hold: Idle data timeout** **(option)**

Short hold mode is activated if the parameter is set to a value unequal 0. Timer to disconnect the ISDN B channel connection after inactivity (sec).
0: inactive
1...*n***:** delay time to disconnect in seconds (1...255), default: **60** seconds

shto **Short hold: Call timeout to abort** **(option)**

Time to abort a call if not successful connected after *n* seconds
n=3…255, default: **15** seconds

shpa **Short hold: Call pause** **(option)**

Set a call pause for *n* seconds before next call attempt.
0: immediate call retry
1...*n*: call pause in seconds (1...255), default: **3** seconds

shtry **Short hold: Maximum number of connection attempts (opt.)**

This parameter defines the maximum number of connection attempts until the connection to the application is disconnected. If the number of not successful connection attempts is greater than the value of the parameter “shtry” the connection to the application will be disconnected. The disconnect message includes the cause of the last connection attempt. In case the disconnect is caused by elapsing of the timer “shto” the cause “No User Responding” is indicated to the application.
n!=0, default: **2**

show **show parameters**

Displays the actual set of parameters

showall **show all parameters**

Displays the all accessible parameters

spid1, spid2 **set spid** **(option)**

For ISDN lines in the U.S. you have to set the SPID. You get it from your ISDN provider.
spid1=xxx Set SPID 1
spid2=xxx Set SPID 2

status **Global status of TA**

The overall status of the TA will be displayed.

Example:
Current status information TA+POX
serial line: DTR:on, RTS:on, DSR:on, CTS:on, DCD:on, RI:off
ISDN: L1:up
Dch: Prot:DSS1, State:connected, CdPN:291, CgPN:509, prev error: 0
Bch: Prot:X.75 SLP, State:connected, CdPN:291, CgPN:509

tei **TEI value**

X.31 D channel only:
Terminal equipment identifier. This value must be identical to the tei of your basic rate access, will be defined by your ISDN supplier.
tei=**1** (default)

trc*nnn* **commands for internal trace**

The usage of the commands for internal trace are described in chapter 5.6.

txfwd **timer for data forwarding**

If no additional character to the already entered characters is entered within the defined period, the already received serial data will be transmitted to the ISDN using the selected transmission protocol.
(comparable to the functionality of X.29 parameter 4, data forwarding timer)
0 : minimum delay time (app. 10 ms)
1..n: delay time in 10 ms ticks, default: **0** (10 ms)
Note: Valid for AT command set and X.75, X.25 B channel or X.25 D channel only.

ver **show version string**

Displays detailed information about the software version and TA type.

verb **show version string of bootloader**

Displays detailed information about the bootloader version.

v110llc **Usage of LLC for V.110 connections**

Set LLC parameter for incoming and outgoing V.110 connections.

0: LLC is ignored and not created.

1: outgoing call: an LLC is sent deriving from the settings of the TA
incoming call: the received LLC is used to setup the parameters for the V.110 connection (default).

v110flc **Usage of V.110 flowcontrol**

Controls the ISDN flowcontrol for V.110 connections.

0: V.110 flowcontrol via xbits will be ignored (default).

1: V.110 flowcontrol via xbits enabled.

w **B channel windowsize L3**

B channel layer 3 protocol: windowsize (default:**2**). w = {1..7}
Value will be automatically changed with changing B channel protocol *prot*.

xnr **own X.25 address**

Setup an origination X.25 address.

xnr *nn*	set "xnr" to *nn* = string of digits (max length = 15)
xnr -	erase the current value of “xnr” value
xnr	show current setting of "xnr".

Only necessary, if not supported from the network (X.31 B channel only)

xtab<n> **X.25 translation table**

xtab***x*** <***xadr***>**i**<***nn***> set entry number ***x*** to ISDNnumber ***nn*** and X.25 address ***xadr.***

xadr**:** To find an entry, the x25addr is compared against all entries of *xadr*. The *xadr* can contain wildcards:

***** : represents one or more digits

? : represents exactly one digit

nn : ISDN number

The ISDNnumber *nn* can contain following wildcards:

xtab***x*** - clear entry number ***x***

xtab***x*** show entry number ***x***

xtab Show all entries

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

Maximum length of ISDN number = 20 digits

Note:

The table is valid for X.25 in B channel and X.31D rerouting only.

Examples:

xtab1 45400029003i04089928392

<cmd>? **more information for one command**

Displays the allowed values for one selected command <*cmd*>

?? **help**

Displays help texts for all commands

Notes:

(Note1) After issuing one of these parameter you should execute the "save" command to store the configuration in non volatile memory. To activate and use the new setting you have to run the "go" (or "reset") command.

(Note2) Command syntax for setting hlc, llc and bc
An empty parameter has to be entered by "-".
Example: Deleting of LLC-value: LLC -<↵>
Entering a new LLC: LLC 8890<↵>

(Note3) **Different modes for V.110 baudrate adoption**

- Outgoing call:

brn # 0 : ISDN message SETUP will be created with or without LLC(brn) depending on the setting of *dial.v110llc*;
The B channel (V.110 baudrate) will use the baudrate set by *brn* (independent of *br* or recognized local baudrate)

brn = 0 : "adaptive": same mechanism as *brn* # 0; the V.110 baudrate will be created by *br* rsp. the recognized local baudrate.

- Incoming call:

brn # 0 : no LLC received: accept incoming call, use in B channel *brn* for V.110 baudrate.
LLC received compliant to *brn*: accept incoming call
LLC received not equal to *brn*: Reject incoming call: DISCONNECT (cause = incompatible destination).

brn = 0 : "adaptive":
no LLC received: accept incoming call, use in B channel *br* rsp. the recognized local baudrate for V.110 baudrate.
LLC received: accept incoming call, use in B channel the baudrate derived from the LLC as V.110 baudrate.

The usage of the LLC is controlled by the TA+Configurator command *dial.v110llc*.

4.6 Software update

The **TA+POX** uses a Flash-EPROM for software updates to store the operational software. This software can be updated from a local connected PC via the COM port. Please fulfill the following steps to update the **TA+POX**:

- Start a terminal emulation on your PC with the capability to run an X-MODEM file transfer (i.e. HyperTerminal).
- Enter the AT command "AT**FLASH" to start the update procedure. The TA+POX will send the message "*Erasing flash EPROM now. Please wait...*".
- After erasing of the Flash-EPROM the TA send out the request of the download procedure with the 1kX-MODEM protocol:
  "*Start your XMODEM transfer now (Ctrl-X aborts) ...*"
- Start the 1kX-MODEM file transfer (send file or upload) by selecting the Transfer / Send File menu point in your terminal emulation and select the new software. The internal timeout of each X-Modem block is set to 10 seconds.
- After completion you will get the information whether the software update ended successfully or erroneous.
  - Positive result: - "*Loading procedure ended successfully*".
  - Negative reason: - "*Checksum error.*" (for example)
  Negative result: - "*Flash EPROM software is probably not executable*".
- The loaded new firmware will automatically start after a software reset.
- (Give the TA about 15 seconds to activate the new software.)
- Due to new functionality the last stored configuration setting may be lost, please check before using.

Note:

Due to an error it may be that no firmware is active within the TA. This will be indicated by flashing of the LEDs (Bootloader active). To store a new firmware correctly you have to enter the command "AT**FLASH" again and load a firmware using the XMODEM protocol as described above. This bootloader supports only AT**cmd with a fixed baudrate of 115.200 Baud.

5 Diagnostic and error messages

For the diagnostic of erroneous situations the following functionality is supported.
Please check first the behavior of LED displays, if an ISDN connection can not be established. Refer to list of LED displays on page 107.

5.1 Error messages from AT command set

In AT command mode, error cause display (does not belong to the AT command standard) can be turned on by issuing the command **ATW1**. The shown error causes use the coding defined by the CAPI definition. ISDN error causes from the ISDN network are always coded as 34xxH, where xx represents the hexadecimal version of the ISDN error cause (see page 91). All other causes are CAPI error causes (see page 99).

Error cause display:
<*xx*> = ISDN release (error) cause, hexadecimal

Example:

Tx data	Rx data
ATW1	
	OK
ATD12345	
	NO CARRIER <**34A2**>

5.2 Error messages of the integrated PAD

For the diagnostic of erroneous situations - e.g. no X.25-connection possible - the following error indicators are supported.
If an error occurs during the establishment of an X.25-connection, a reason for the failure of the connection establishment or the release of an established connection will be indicated in accordance to the configured indication type.

See parameter 6: Indication according to ITU, Datex-P, with English extension.

The following error indicators are supported:

- Error codes during establishment of an X.25-connection:
  Indication as part of the Connection-Release-Message.
  E.g.: "CLR OCC diag" or
  "CLR DER 0 <*zzzz*H>"
  or "Datex-P: connection released"
  or "connection released, reason *xx* diag *yy* [<zzzzH>]".
  xx shows the hexadecimal coding of the X.25 release cause and
  yy shows the hexadecimal coding of the diagnostic.
  zzzz shows the hexadecimal coding of the CAPI cause.

5.3 Table of ISDN causes and their explanation (DSS1)

Cause Decimal / Hexadecimal	Meaning	Translation to AT result codes	Translation to X.25 cause + diagnostic
1 / 0x81	Unallocated (unassigned) number	3	13, 78
2 / 0x82	No route to transit network	3	0D, 78
3 / 0x83	No route to destination	3	0D, 78
6 / 0x86	Channel unacceptable	6	05, 78
7 / 0x87	Call awarded and being delivered in an established channel	6	05, 78
16 / 0x90	Normal clearing	3	00, 78
17 / 0x91	User busy	7	01, 78
18 / 0x92	No user responding	8	09, 78
19 / 0x93	No answer from user (user alerted)	8	09, 78
20 / 0x94	No answer from user (device off)	8	09, 78
21 / 0x95	Call rejected	8	21, 78
22 / 0x96	Number changed	3	0D, 78
26 / 0x9A	Non selected user clearing	3	00, 78
27 / 0x9B	Destination out of order	8	09, 78
28 / 0x9C	invalid number format	3	13, 78
29 / 0x9D	Facility rejected	3	13, 78
30 / 0x9E	Response to STATUS ENQUIRY	3	13, 78
31 / 0x9F	Normal disconnect, unspecified	3	00, 78
34 / 0xA2	No circuit/channel available	7	01, 78
38 / 0xA6	ISDN network out of order	6	05, 78
41 / 0xA9	Temporarily failure	6	05, 78
42 / 0xAA	switching equipment congestion	6	05, 78
43 / 0xAB	Access information discarded	6	05, 78
44 / 0xAC	Requested circuit/channel not available	6	05, 78
46 / 0xAE	Precedence call blocked	6	05, 78
47 / 0xAF	Resource unavailable, unspecified	6	05, 78
49 / 0xB1	Quality of service unavailable	3	13, 78
50 / 0xB2	Requested facility not subscribed	3	13, 78
53 / 0xB5	Outgoing calls barred within CUG	3	13, 78
55 / 0xB7	Incoming calls barred within CUG	3	13, 78
57 / 0xB9	Bearer capability not authorized	3	13, 78
58 / 0xBA	Bearer capability not presently available	3	13, 78
63 / 0xBF	Service or option not available, unspecified	3	13, 78
65 / 0xC1	Bearer capability not implemented	3	13, 78

Cause Decimal / Hexadecimal	Meaning	Translation to AT result codes	Translation to X.25 cause + diagnostic
66 / 0xC2	Channel type not implemented	3	13, 78
69 / 0xC5	Requested facility not implemented	3	13, 78
70 / 0xC6	Only restricted digital information bearer capability is available	3	13, 78
79 / 0xCF	Service or option not implemented, unspecified	3	13, 78
81 / 0xD1	Invalid call reference value	3	21, 78
82 / 0xD2	Identified channel does not exist	3	21, 78
83 / 0xD3	A suspended call exists, but this call identity does not	3	21, 78
84 / 0xD4	Call identity in use	3	21, 78
85 / 0xD5	No call suspended	3	21, 78
86 / 0xD6	Call having the requested call identity has been cleared		21, 78
87 / 0xD7	User not member of CUG	3	21, 78
88 / 0xD8	Incompatible destination	3	21, 78
90 / 0xDA	Non-existent CUG	3	21, 78
91 / 0xDB	Invalid transit network selection	3	21, 78
95 / 0xDF	Invalid message, unspecified	3	21, 78
96 / 0xE0	Mandatory information element missing	3	21, 78
97 / 0xE1	Message type non-existent or not implemented	3	21, 78
98 / 0xE2	Message not compatible with call state or message type non-existent or not implemented	3	21, 78
99 / 0xE3	Information element /parameter non-existent or not implemented	3	21, 78
100 / 0xE4	Invalid information element contents	3	21, 78
101 / 0xE5	Message not compatible with call state	3	21, 78
102 / 0xE6	Recovery on timer expiry	3	21, 78
103 / 0xE7	Parameter non-existent or not implemented, passed on	3	21, 78
111 / 0xEF	Protocol error, unspecified	6	05, 78
127 / 0xFF	Network interworking error, unspecified	6	05, 78

5.4 X.25 causes and their explanation

5.4.1 X.25 causes in Clear packet

Coding of the field "cause" in packet "Indicate-Cause".

00	DTE/CONF	Triggered by the remote DTE/DCE
01	OCC	Remote DCE busy, dialed number busy/engaged
03	INV	Facility requested not valid/supported
05	NC	Temporary disturbance in network
09	DER	Remote DTE doesn't answer/out of operation
0B	NA	Access not available
0D	NP	No access with this dial number
11	RPE	Remote procedural error, sequence error
13	ERR	Local procedural error, sequence error
19	RNA	Reverse charging not accepted
21	ID	Remote DTE/DCE incompatible
29	FNA	Incompatible connection request; receipt of single packet not agreed upon

5.4.2 X.25 diagnostic codes

No. hex	Restartind. Clearind.		Resetind.	Clearind.	Meaning Diagnostic
00	X	X	X	-	No additional information
01	-	-	X	-	Invalid P (S)
02	-	-	X	-	Invalid P (R)
10	-	-	-	X	Packet type invalid
11	X	-	PVC	X	Packet type invalid for state r1
12	X	-	PVC	X	Packet type invalid for state r2
13	-	-	-	-	Packet type invalid for state r3
14	-	X	-	-	Packet type invalid for state p1
15	-	X	-	-	Packet type invalid for state p2
16	-	X	-	-	Packet type invalid for state p3
17	-	X	-	-	Packet type invalid for state p4
18	-	X	-	-	Packet type invalid for state p5
19	-	X	-	-	Packet type invalid for state p6
1A	-	X	-	-	Packet type invalid for state p7
1B	-	-	X	-	Packet type invalid for state d1
1C	-	-	X	-	Packet type invalid for state d2
1D	-	-	-	-	Packet type invalid for state d3
20	-	-	-	-	Packet not allowed
21	-	X	PVC	-	Unidentifiable packet
22	-	X	-	-	Call on one-way logical channel
23	-	-	PVC	-	Packet type invalid for state at PVC
24	-	X	-	X	Packet on unassigned logical channel
25	-	-	X	-	Reject not subscribed to
26	X	X	X	-	Packet too short
27	X	X	X	-	Packet too long
28	-	X	-	X	Invalid general format identifier
29	-	X	X	X	Restart or registration packet »0«
2A	-	X	-	-	Packet type not compatible with facility
2B	-	-	X	-	Unauthorized interrupt conformation
2C	-	-	X	-	Unauthorized interrupt
2C	-	-	X	-	Unauthorized reject
30	-	-	-	-	Time expired:
31	-	X	-	-	- for incoming call
32	-	-	-	X	- For clear indication
33	-	X	PVC	-	- For reset indication
34	X	-	-	X	- For restart indication
35	X	-	-	X	- For call deflection
40	-	X	-	-	Call set-up, call clearing or registration problem

41	-	X	-	-	Facility/registration code not allowed
42	-	X	-	-	Facility parameter not allowed
43	-	X	-	-	Invalid called DTE address
44	-	X	-	X	Invalid calling DTE address
45	-	X	-	-	Invalid facility/registration length
46	-	X	-	-	Incoming call barred
47	-	X	-	-	No logical channel available
48	-	X	-	-	Call collision
49	-	X	-	-	X.25: repeated facility request X-75: missing transit DNIC
4A	-	X	-	-	Non zero address length
4B	-	X	-	-	Non zero facility length
4C	-	X	-	-	Facility not provided when expected
4D	-	X	-	-	Invalid ITU-specified DTE-facility
4E	-	X	-	-	max. number of call redirections or call deflections exceeded
51	X	X	X	-	Improper cause code from DTE
52	-	X	X	-	Not aligned octet
53	-	-	X	-	Inconsistent Q bit setting
54	-	X	-	-	NUI problem
61	-	X	-	-	DNIC not accessible
62	-	X	-	-	Unknown transition DNIC
64	-	X.75	-	-	Wrong use of facility
65	-	X	-	-	Erroneous length of Net-Indicator
66	-	X	-	-	Length of Net-Indicator not equal zero
67	-	-	X	-	Erroneous M-Bit
71	-	X	X	-	Problem concerning remote net
72	-	X	X	-	International net problem
73	-	X	PVC	-	Transmission section out of operation
74	-	X	PVC	-	International line engaged
75	-	X	PVC	-	Error in the transit net
76	-	X	-	-	Error in the destination net - invalid facility found
77	-	X	-	-	International routing problem
78	-	X	-	-	Temporary routing problem
79	-	X	-	-	Unknown called DNIC
7A	-	X	X	-	Service
80	-	-	X	-	Erroneous Q-Bit or
80	-	X	X	-	No operation means available
81	-	X	-	-	Single packet not agreed upon or
81	-	X	X	-	Temporarily out of operation
82	X	X	X	-	Cause-flied not equal 00 (hex.) or
82	-	X	X	-	Closed by service provider, e.g. DATEX-P
83	-	X	PVC	-	Incompatible packet length
84	-	-	X	-	Erroneous M-Bit

85	-	X	-	-	Rejection of the connection request or
85	-	X	-	-	NUI-call no more granted
86	-	-	X	-	PVC-Access description erroneous
87	-	X	PVC	-	Clear by service provider, e.g. DATEX-P
88	-	X	-	-	DNIC not accessible
89	-	X	-	-	Reverse charging not agreed upon
8A	-	X	-	-	Missing agreement
8B	-	X	-	-	Missing number of calling station
8C	-	X	-	-	Erroneous number of calling station
8D	-	X	PVC	-	Transmission section interrupted
8E	-	X	PVC	-	Transmission section out of operation
8F	-	X	PVC	-	Time expired DATEX-P state P1
90	X	-	-	-	Erroneous coding of cause
91	-	X	-	-	Erroneous direct call
92	-	X	X	-	Uncompleted octet found
93	-	X.75	-	-	Facility valid
94	-	X.75	-	-	Erroneous use of facility
95	-	X.75	-	-	Erroneous address in packet »Call-Accepted«
96	-	-	X	-	Invalid interrupt packet in subnet
97	-	-	X	-	Invalid interrupt acknowledge in subnet
98	-	X	-	-	Only single packet with limitation of response entry permitted
99	-	-	PVC	-	Incompatible PVC
9A	-	X	-	-	Erroneous agreement of window size
9B	-	X	-	-	Missing fields
9C	-	X	-	-	Erroneous address length
9D	-	X	-	-	Erroneous length of facilities
9E	-	X	-	-	Incomplete field
9F	-	X	-	-	Incompatible transmission rate class
A0	-	X	-	-	Group call number out of order
A1	-	X	-	-	Group call number not accessible
A2	-	X	-	-	Group call number temporarily out of order
A3	-	X	-	-	Erroneous address
A4	-	X	-	-	Erroneous sub address
A5	-	X	-	-	Erroneous format of net facility
A6	-	X	-	-	Length of net facility not equal 0
A7	-	X	-	-	No user data
A8	-	X	-	-	Missing indicator for national facility
A9	-	X	-	-	Access to users of the same service blocked
AA	-	X	-	-	Number temporarily not accessible
AB	-	X	-	-	User recognition required in the packets »Connection-Request« and »Call-Accepted«
AC	-	X	-	-	Called subscriber has not agreed upon the facility "Single Packet"

AD	-	X	-	-	Network internal Load-Request received *)
AE	-	X	-	-	Network component error *)
AF	-	X	-	-	Network failure of a virtual connection *)
B0	-	X	-	-	Network internal restart request received *)
B1	-	X	-	-	Erroneous number of called station in the packet »Call-Accepted«
B2	-	X	-	-	Unknown network faculty
B5	-	X	-	-	X.32 dial access not available
B6	-	X	-	-	X.32 dial access not available
B7	-	-	X	-	Reserved
C0	-	X	-	-	X.25 dial access: Service data error
C1	-	X	-	-	X.25 dial access: Service data error
C2	-	X	-	-	X.25 dial access: User data erroneous
C3	-	X	-	-	X.25 dial access: Procedural error
C4	-	X	-	-	X.25 / X.32 dial access: Modem error
C5	-	X	-	-	X.25 / X.32 dial access: Modem error
C8	-	X	-	-	X.25 dial access: successful connection establishment
C9	-	X	-	-	X.25 dial access: dialing procedure running now
FF	X	X	X	X	System error

Notes:

X The diagnostic indication will be used by the above shown packet.

\- The diagnostic indication will not be used by the above showed packet.

PVC The above showed packet will use this diagnostic indication only with PVC (Permanent Virtual Call).

X.75 The diagnostic indication will be used with international connections.

***)** Only valid for special network components (concentrator).

5.4.3 X.25 causes in Restart packet

Coding of the field "Reason for Restart" in the packet "Indicate-Restart".

01	Local sequence error
03	Temporarily disturbance in the network
07	Network ready

5.4.4 X.25 causes in Reset packet

00	Triggered by DTE
01	Out of operation (virtual connections only)
03	Remote sequence error
05	Local sequence error
07	Temporarily network disturbance
09	Remote station ready (virtual connections only)
0F	Network ready (virtual connections only)
11	Incompatible destination

5.5 CAPI causes and their explanation

Coding of the CAPI cause in hexadecimal form.

0000	No error
0001	NCPI ignored
0002	Flags ignored
0003	Alert already sent
1001	Too many applications
1002	Logical block size too small
1003	Buffer exceeds 64k
1004	Message buffer size too small
1005	Too many logical connections
1006	Reserved1
1007	Message could not be accepted
1008	Register OS Resource Error
100a	External Equipment not supported
100b	External Equipment only
1101	Bad application ID
1102	Illegal cmd or message length
1103	Message queue full
1104	Message queue empty
1105	Message lost
1106	Unknown notification
1107	Message not accepted
1108	OS Resource Error
1109	CAPI not installed
2001	Bad State
2002	Illegal Identifier
2003	Out of PLCI
2004	Out of NCCI
2005	Out of LISTEN
2006	Out of Fax Resources
2007	Illegal Message Parameters

3001	B1 protocol not supported
3002	B2 protocol not supported
3003	B3 protocol not supported
3004	B1 protocol param not supported
3005	B2 protocol param not supported
3006	B3 protocol param not supported
3007	B Prot combination not supported
3008	NCPI not supported
3009	Unknown CIP value
300a	Flags not supported
300b	Facility not supported
300c	Data length not supported
300d	Reset procedure not supported

3301	Layer1 protocol error
3302	Layer2 protocol error, i.e. DTE address not correct, TEI not correct
3303	Layer3 protocol error
3304	Another application got the call
3311	Fax remote station is not fax
3312	Fax training failed
3313	Fax disconnect before transfer
3314	Fax disconnect remote abort
3315	Fax disconnect remote procedure
3316	Fax disconnect local transmitter underrun
3317	Fax disconnect local receiver overflow
3318	Fax disconnect local abort
3319	Fax illegal transmit data

34xx Error cause from the ISDN line, xx represents the ISDN cause (see page 91)

5.6 Diagnostic using the internal Trace

For more sophisticated debugging an internal trace functionality is implemented. This logging mechanism allows to write activities of the ISDN and the serial interface into a wrap around buffer. The type of entries can be selected by a trace mask.

trcmsk **set trace mask**

trcmsk *par* Setup the mask to select the type of data to be written into the trace buffer.
Default: D channel Layer 1 and 3, DTE interface lines, DTE-Data in connection-setup and clearing-phase.
The parameter *par* has to be setup in the following way, all bytes have to be entered (default 00 00 00 77 00 72 05 02):

par := bl1 bl2 bl3 dl1 dl2 dl3 sl1 app

bl1	reserved	**00**
bl2	B channel frames (layer 2) disabled	**00** (default)
	enable HDLC frames	03
bl3	B channel packets (layer 3) disabled	**00** (default)
	enable X.25 packets	03
dl1	D channel layer 1 status disabled	00
	enable C/I codes and sttes	**77** (default)
dl2	D channel LAPD frames disabled	**00** (default)
	enable HDLC frames	03
dl3	D channel layer 3 messages disabled	00
	enable layer 3 messages	**72** (default)
sl1	serial line trace disabled	00
	enable serial trace	**05** (default)

examples:

trcmsk 00000077007205	D channel layer-1 and layer-3, serial data and status lines
trcmsk 00030000007205	D channel layer-3, B-channel layer-2, serial data and status lines
trcmsk 00000300007205	D channel layer-3, B-channel layer-3, serial data and status lines

trcclr **clear trace buffer**

trcclr clear actual trace buffer contents

trcread **read trace buffer**

trcread Output of the complete trace buffer in hexadecimal chars (ASCII, max. line length 72 chars).

Every entry of the trace buffer is output using the following format:
Entry number – Timestamp – Type – Length – Databytes

Entry number	Sequence number of entry
Timestamp	in units of 10 ms
TypeAndSource	Source of trace entry: bit0-7: type from trace mask bit8-14: source of trace entry: 0200 : B channel layer 2 (bl2) 0500 : D channel layer 1 (dl1) 0600 : D channel layer 2 (dl2) 0700 : D channel layer 3 (dl3) 0900 : Serial status line / serial data bit15: 0xxx : incoming event (from ISDN line) 8xxx : outgoing event (to ISDN line) “FFFF“ : Reset for firmware
Length	Length of following data bytes
Databytes	Data bytes; continued lines are indicated by an “>“.

Coding of trace data bytes dependent of *TypeAndSource*:
The high order bit shows always the direction of the data:
0xxx = received data into the TA (from ISDN or serial)
8xxx = transmitted data by the TA (to ISDN or serial)

0511/8511: D channel layer 1 status
- 0xF1 Inactive not used
- 0xF2 Sensing not used
- 0x F3 Deactivate
- 0x F4 Awaiting Signal
- 0x F5 Indentifying Input
- 0x F6 Synchronized
- 0x F7 Activated
- 0x F8 Lost Framing

0512: D channel layer 1 C/I code (NT to TE)
- 0x00 Deactivation Request from F7/F8
- 0x01 Reset acknowlegde
- 0x02 Test mode acknowlegde
- 0x03 Slip detected
- 0x04 Signal received
- 0x05 Deactivation Request from F6
- 0x07 Power up
- 0x08 Activation request
- 0x0A Activation request loop
- 0x0B Illegal code violation
- 0x0C Activation indication priority 8
- 0x0D Activation indication priority 10
- 0x0E Activation indication loop
- 0x0F Deactivation confirmation

8512: D channel layer 1 C/I code (TE to NT)
- 0x00 Timing
- 0x01 Reset
- 0x02 Test mode SSP
- 0x03 Test mode SCP
- 0x08 Activation request priority 8
- 0x09 Activation request priority 10
- 0x0A Activation request loop
- 0x0F Deactivation indication

0712/8712: D channel messages, coding refers to Q.931 and ETS 300102-1.
Coding of Message Type within D channel layer 3 message – 4th data byte in trace output:

Message code (Hex)	Message name
01	ALERTING
02	CALL PROCEEDING
03	PROGRESS
05	SETUP
07	CONNECT
0D	SETUP ACKNOWLEDGE
0F	CONNECT KNOWLEDGE
20	USER INFORMATION
21	SUSPEND REJECT
22	RESUME REJECT
25	SUSPEND
26	RESUME
2D	SUSPEND ACKNOWLEDGE
2E	RESUME ACKNOWLEDGE
45	DISCONNECT
46	RESTART
4D	RELEASE
4E	RESTART ACKNOWLEDGE
5A	RELEASE COMPLETE
60	SEGMENT
75	STATUS ENQUIRY
79	CONGESTION CONTROL
7B	INFORMATION
7D	STATUS
7E	NOTIFY

0602/8602: D channel LAP-D frames, coding refers to Q.921

0904/8904: Serial line received / transmitted data by the TA+ in command phase (i.e. AT commands and responses).

0901: Serial status lines

X	X	CTS	RTS	DCD	RI	DSR	DTR
-	-	0/1	0/1	0/1	0/1	0/1	0/1

The count of the received value is hexadecimal coded (0x NN).
An active level (ON) of the serial status line is signaled with logical level “1”.

Example:

X	**X**	**CTS**	**RTS**	**DCD**	**RI**	**DSR**	**DTR**	**Hex coded result**
-	-	0/1	0/1	0/1	0/1	0/1	0/1	0xNN
-	-	ON	ON	OFF	OFF	ON	ON	0x33
-	-	ON	ON	ON	OFF	ON	ON	0x3B
-	-	ON	ON	OFF	OFF	ON	ON	0x33
		ON	OFF	OFF	OFF	ON	OFF	0x22

6 Appendix

A1: Technical data TA+POX, TA+HUX, TA+SOC

TA+POX serial interface:

functional:	V.24
electrical:	V.28
mechanical:	9 pin DSUB connector (female)

TA+HUX serial interface:

functional:	V.24
electrical:	TTL
mechanical:	double pin rows P1

TA+SOC serial interface:

functional:	V.24
electrical:	TTL
mechanical:	single pin rows X4

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:	S bus interface according to ITU I.430
TA+POX mechanical:	build in RJ45 plug
TA+HUX mechanical:	double pin rows P2
TA+SOC mechanical:	single pin rows X3

Physical dimensions:

TA+POX:	desktop casing: 71 x 22 x 123 mm (WxHxD)
TA+HUX:	plug on module: 56 x 56 x 12 (8) mm (WxHxD)
TA+SOC:	plug on module: 64,5 x 26,5 x 14 mm (WxHxD)

Power supply:

TA+POX:	external power supply 5V DC.
TA+HUX:	5V DC / 3,3V DC +/- 5%, via double pin row P2
TA+SOC:	3,3V DC +/- 5%, via single pin row X5

A2: LED displays TA+POX

Active states:

L1	L2	Status	
⊗	⊗	Power-On-Phase ; Wait (0,5 s)	
⊗	Θ	Firmware start up, wait (2 sec.)	
Θ (1x1s)	O	ISDN not ok	; Check ISDN interface/ -connector
⊗	O	Active phase	; ISDN ok, no ISDN connection established
⊗	∅	Call active	; ISDN Connection will be established
⊗	⊕	Synch active	; Waiting for B channel synchronization
⊗	⊗	Connected	; Data connection is established

B1, B2	Status B channels	
O	B channel offline	;
⊗	B channel online	; ISDN connection established

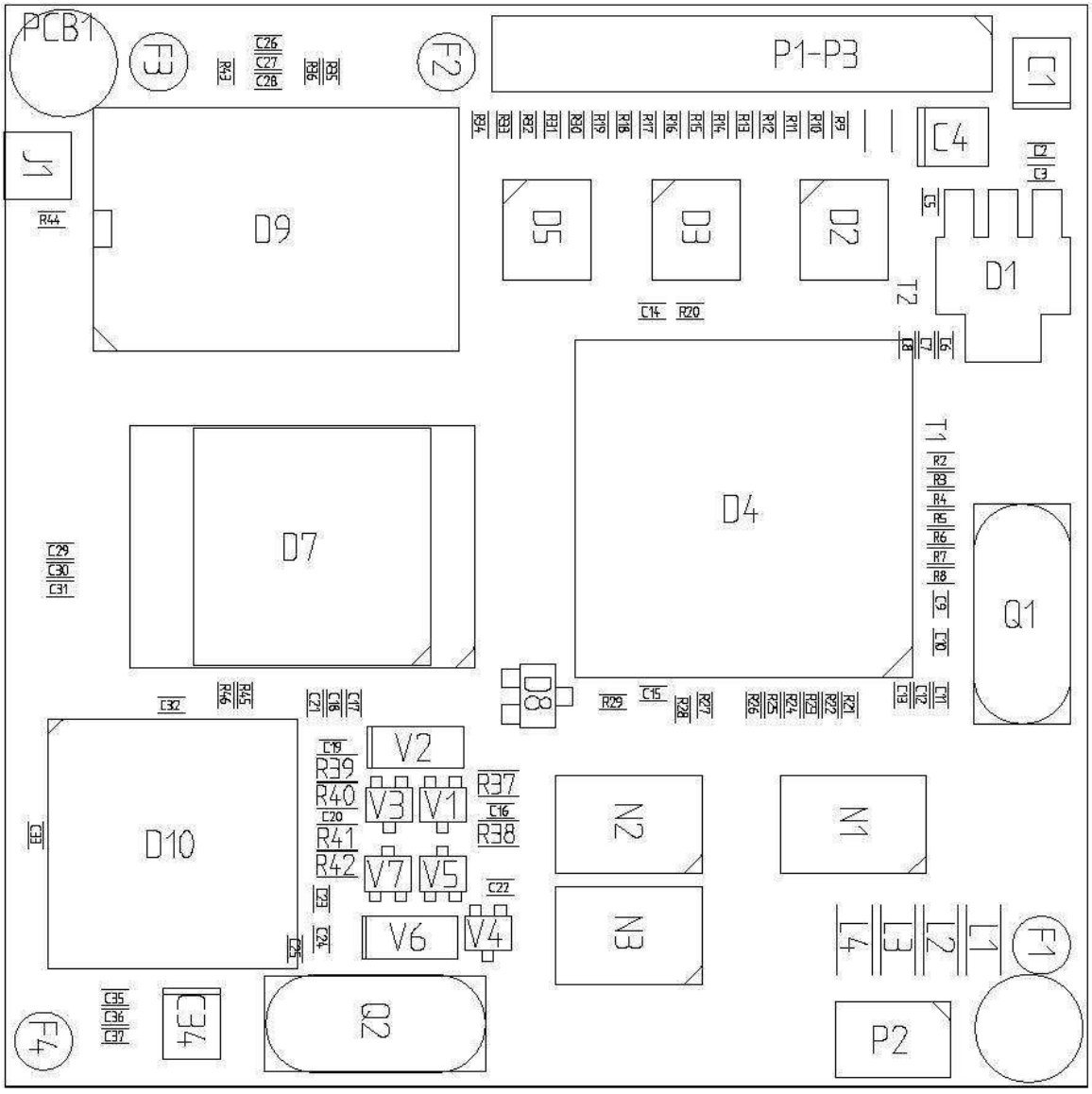
Error states:

L1	L2	Status	
O	O	TA+POX not ok	; Hardware error, TA+POX repair necessary
Θ	O	ISDN not ok	; Check ISDN interface/ -connector
O	Θ (nx1s)	TA+POX not ok	; Hardware error, TA+POX repair necessary
Θ	Θ	B1, B2 flashing: Bootloader active, no operational firmware programmed. Use command at**flash to download firmware with 115200 Bd,N81 (see page 88).	

LED Legend:

⊗	On		
∅	occ	short on, long off	Cycle 1 sec
⊕	fl	long on, short off	Cycle 1 sec
Θ	(***n***x***m***s)	continuous blinking: ***n*** times every ***m*** seconds	
O	Off		

A3: TA+HUX V1 Mechanical dimensions of the module V1



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A4: TA+HUX V1 Serial Interface Connector P1

P1-Pin	Signal	Direction from TA	TA usage	External interfacing
1	GND	I	0V-Power	0V Power supply
2	VCC	I	+5V-Power	+5V Power supply
3	GND		GND	GND
4	TXD~	I		
5	GND		GND	GND
6	RXD~	O		
7	ID2	O	GND on TA+HUX	NC or READ
8	RTS~	I		
9	ID1	O	10k Pull up on TA+HUX	NC or READ
10	CTS~	O		
11	RESET~	I	RESET active low (OC)	NC
12	DTR~	I		
13	L3	O	(internal 10k Pull up)	NC or status info
14	DCD~	O		
15	RI~	O		
16	DSR~	O		
17	UA	O	User Output 1	NC or status info
18	UE~	I	User Input 1	10k Pull up
19	UA2	O	User Output 2	NC or status info
20	UE2	I	User Input 2	NC, reserved

Outputs:

- UA: default: similar to L1 of TA+POX (ON : ISDN activated, else OFF)
- L3: default: equals L3+L4 of TA+POX: one or both B channel occupied: B channel(s) connected, but may be not synchronized.
- UA2: reserved

Inputs:

- UE: reserved
- UE2: reserved

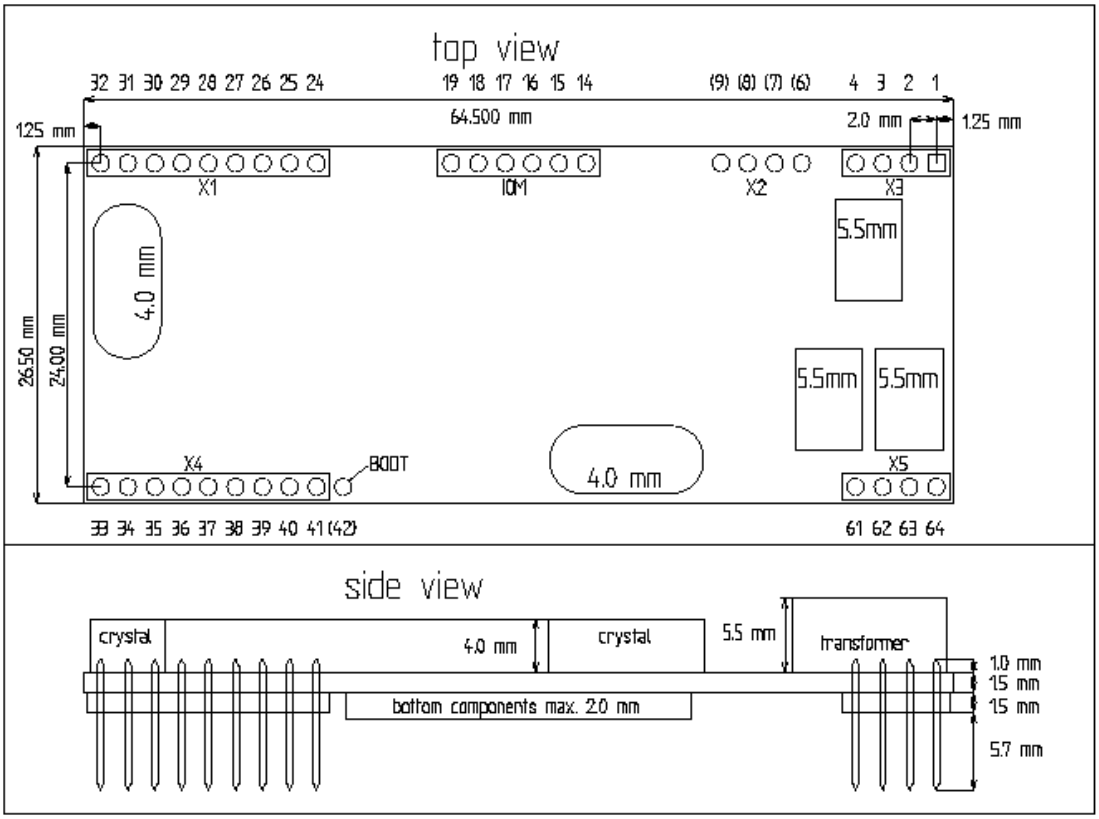
A5: TA+HUX V1 ISDN interface connector P2

P2-Pin	Signal	Direction	RJ-45-Pin
1	RX-	I	5
2	TX-	O	6
3	RX+	I	4
4	TX+	O	3
5	RX (BRA-power supply)	O	NC
6	TX (BRA-power supply)	O	NC

A6: TA+HUX V1 IOM Interface connector P3

P3-Pin	Signal	Direction from TA	TA usage
1	DD	O	IOM Data downstream
2	DU	I	IOM Data upstream
3	FSC	O	IOM frame sync
4	DCL	O	IOM double bit clock
5	SDS	O	IOM B channel strobe
6	BCL	O	IOM bit clock

A7: TA+SOC V2 Mechanical dimensions of the module



A8: TA+SOC V2 connector X1 to X6

Pin	Con	Signal	Dir.	active	TA+SOC usage
1	X3	TX+	O		ISDN Transmit +, RJ45 jack Pin 3
2	X3	TX-	O		ISDN Transmit -, RJ45 jack Pin 6
3	X3	RX+	I		ISDN Receive +, RJ45 jack Pin 4
4	X3	RX-	I		ISDN Receive -, RJ45 jack Pin 5
14	IOM	BCL	O *		IOM Bit clock, LT-S-Mode: Input
15	IOM	DU	I *		IOM data upstream, LT-S-Mode: Output
16	IOM	DD	O *		IOM data downstream, LT-S-Mode: Input
17	IOM	FSC	O *		IOM Frame sync, LT-S-Mode: Input
18	IOM	DCL	O		IOM Double bit clock
19	IOM	SDS	O		IOM channel strobe
24	X1	RESET~	I	L	Reset, may be left open
25	X1	nc			
26	X1	GND			GND (Signal)
27	X1	UA	O	H	To connect to LED1
28	X1	L3	O	H	To connect to LED2
29	X1	nc			
30	X1	UA2	O	H	General purpose Output
31	X1	UE	I	H	General purpose Input
32	X1	UE1	I	H	General purpose Input
33	X4	RTS~	I	L	Request to Send
34	X4	RXD	O	H	Receive Data
35	X4	TXD	I	H	Transmit Data
36	X4	RI~	O	L	Ring Indicator
37	X4	DSR~	O	L	Data Set Ready
38	X4	CTS~	O	L	Clear to Send
39	X4	DCD~	O	L	Data Carrier Detect
40	X4	DTR~	I	L	Data Terminal Ready
41	X4	GND			GND (Signal)
61	X5	VCC	I		+3.3V (Power Supply)
62	X5	nc			
63	X5	GND			GND (Supply)
64	X5	nc			

nc = not connected, do not connect to any signal.

A9: TA+POX Pinout of the ISDN connector

Pinout of the 8 pin ISDN S-interface connector (RJ45) (ITU I.430/ISO 8877)

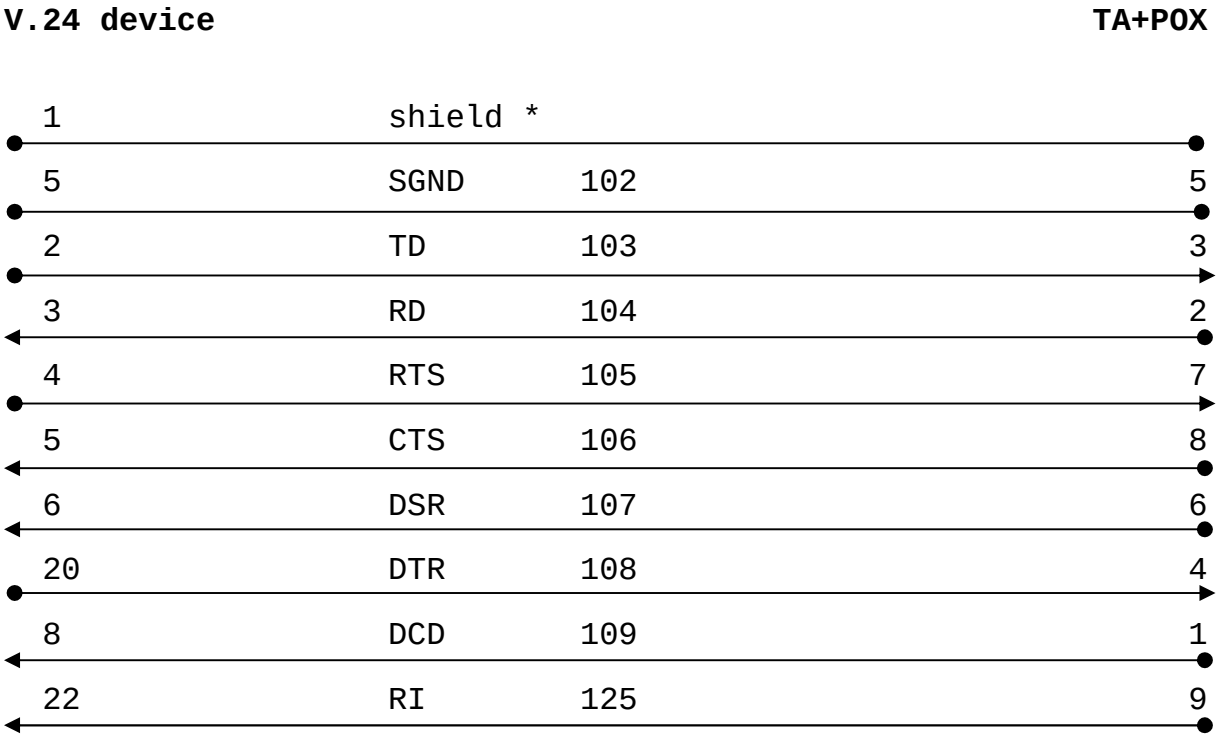
Pin	Signal (S bus)
1	Not connected
2	Not connected
3	Tx+ (Transmit +)
4	Rx+ (Receive +)
5	Rx- (Receive -)
6	Tx- (Transmit -)
7	Not connected
8	Not connected

A10: TA+POX Pinout of the V.24/V.28 interface (DSUB 9)

DSUB-Pin	Signal ITU	Signal DIN	Signal EIA	Direction	Comment
1	109	M5	DCD	O	Data Carrier Detect
2	104	D2	RxD	O	Receive Data
3	103	D1	TxD	I	Transmit Data
4	108/1 108/2	S1.1 S1.2	DTR	I	Data Terminal Ready
5	102	E2	GND	--	Signal Ground
6	107	M1	DSR	O	Data Set Ready
7	105	S2	RTS	I	Request To Send
8	106	M2	CTS	O	Clear To Send
9	125	M3	RI	O	Ring Indicator

A11: TA+POX Cable layout for connection of terminals with 25 pin connectors (male or female)

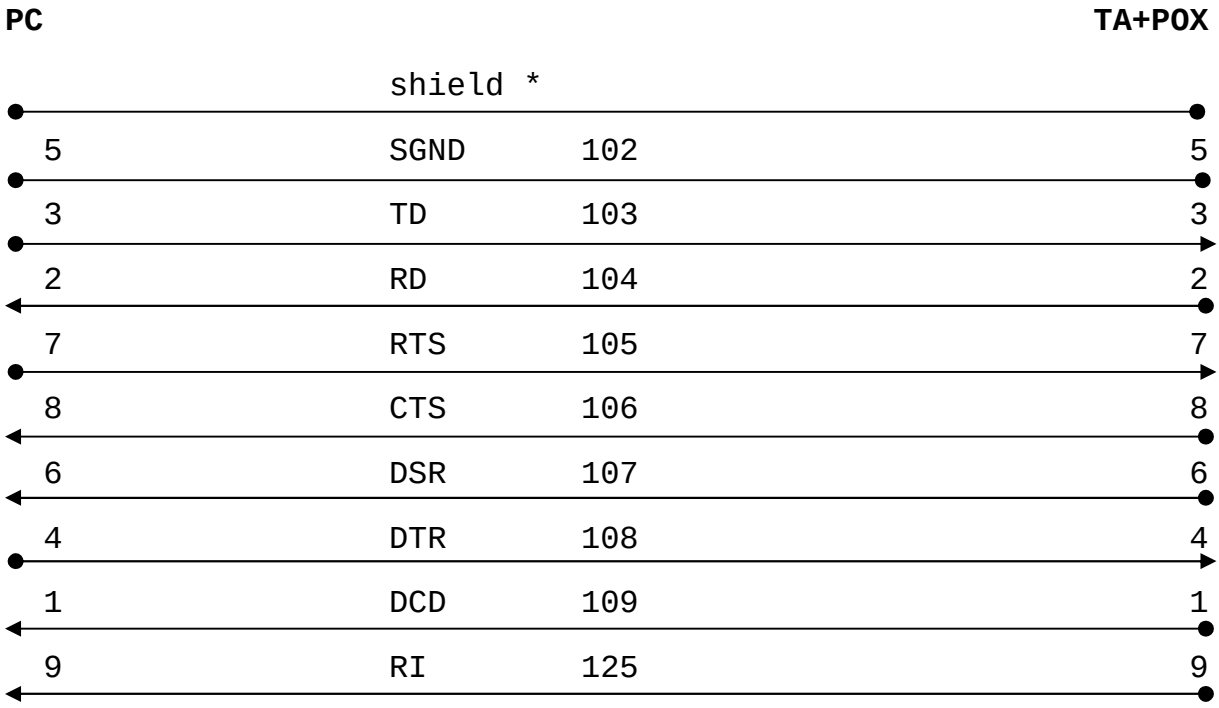
Only the cable with a male plug at the terminal side is shown. The pin configuration for the female plug is the same.



25 pin jack 9 pin jack

Attention: allowed cable length < 15m.
for transmission speeds > 19.200 bit/s < 2m.
* necessary if cable length > 2m

A12: TA+POX Cable layout to connect a PC with 9 pin male plug through a serial COM-port



Attention: allowed cable length < 15m.
for transmission speeds > 19.200 bit/s < 2m.
* necessary if cable length > 2m