



TA+HIX

ISDN Terminal Adapter Module

User Manual

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1 Introduction

This documentation is valid for the product:

- TA+HIX Hardware version 1.0
 Software version V1.xxx or later

1.1 Product description

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

- The TA+HIX connects devices with a serial communication 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 in B channel.
 - by using the transmission method X.75 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
- The connected device can drive the TA+HIX by using
 - asynchronous PAD (X.3) commands
 - asynchronous AT commands
- The TA+HIX connects devices with an analogue interface to the ISDN. It gives access to other voice devices i.e. telephones connected to ISDN or PSTN.

To work with TA+HIX 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+HIX

1.2 License

The TA+HIX has the following license number for the connection to the PSTN:

CE-0682 X for Europe (EC), Switzerland, Norway.

TA+HIX is conform to the European safety requirements IEC 60 950. Connect the TA+HIX only to the BRA-interfaces with SELV (**S**afety **E**xtra **L**ow **V**oltage) related to EN60950.

The TA+HIX is conform to the European rules of EMC. EN50081-1, here EN55022 Class B, for electromagnetic field emission and EN50082-1 for emission of electromagnetic interference.

2 Installation

2.1 Interfaces

The TA+HIX has to be accessed via 3 interface connectors:

- P1: Communication interface to control the TA+HIX and power supply
- P2: Interface to the ISDN Network
- A1: Interface to connect analogue devices

A detailed description of the interfaces is given in the appendix.

3 Using the TA+HIX

For the general mechanisms to use the TA+HIX please refer to the user manual for the TA+POX.

The following chapters will describe the differences to the TA+POX.

3.1 AT commands related to product "TA+HIT"

AT**VMSN= <msn value>	Define own msn
------------------------------	----------------

Defines the msn *nn* (multiple subscriber number) for incoming calls "msni" and outgoing calls "msno" for the data port.
(compare: manual TA+POX/TA+HUX/TA+SOC)

If the number is set to "" (default), all incoming calls are acceptable.
Both values "msni" and "msno" will be displayed by command AT&V.

ATVMSN=*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**VMSN needs two saving procedures. It will save the value "msni" and "msno" separately. This parameter will not saved automatically.

ATS70= <0/1>	enable codec port for ATB40 only
---------------------	----------------------------------

This parameter enables or disables the CODEC on the TA+HIX hardware and changes the structure of the serial data output (":\$" or ":1").
Depending of the value in ATS70 the incoming call will message an IOM call (:\$RING1xDxxxOxxxB0x) or a CODEC call (:1RING1xDxxxOxxxB0x).

ATS70=0 incoming call will be displayed as IOM calls (default).

Example: :\$RING11D211O222B01

ATS70=1 incoming call will be displayed as CODEC calls
and enable the CODEC.

Example: :1RING11D211O222B01

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.

3.2 AT command set to control audio connections

The following section describes the enhancements for driving the audio (CODEC) port via AT commands.

All other commands and behaviour, making data connection and maintaining the module, is identical to the documentation of TA+POX and can be referenced at the corresponding user manual.

To use the TA+HIX for audio connections the B-channel protocol must set to ATB40 (extern IOM) to use the CODEC interface.

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

Every CODEC controlling AT command is preceded by a ":" and the port number (always "1").

Example: "AT:1 CR D1234" ; Establish a connection.

Resultmessages from CODEC commands are preceded by ":1"

Example: ":1 CONNECT..." ; Connection established

Every CODEC based 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".

All connection based commands have to use the call reference.

Supported commands:

AT:1 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".

The Call-Reference is valid from the indication of an incoming call or the status change of an connect request til the given release command.

Example: "AT:1 A I1" Accept an incoming call for port 1

AT:1 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:1CR) without complete destination address.

"I" selects Call-Reference, 1..9

"D" sets destination address (the dialing number).

<rn> ISDN number, string of digits, 1..22.

Example: "AT:1 CC I1 D2"

Continue for an existing outgoing call for port 1 to send the destination address "2" to the network.

AT:1 CR [D<rn.>] [O<rn.>] *Connect Request to the network*

Initiate an outgoing call.

“D” sets destination address (the dialing number).

“O” sets origination address (own msn), optional.

<rn> ISDN number, string of digits, 1..22.

The TA module initiates an outgoing call request and reports the call reference.

Result message:

":1I<Call-Reference >"

Example: Command: "AT:1CR D234 O567"
 Result: ":1I1"

Initiate 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.

Note: The used B channel is reported via message "INFO" (option).

AT:1 CH I<Call-Reference> *Call Hold*

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

Example: "AT:1 CH I1"

Initiate a call hold for the existing connection 1 for Port 1

AT:1 CA I<Call-Reference> *Call Retrieve*

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

Example: "AT:1 CA I1"

Initiate retrieve for the existing connection 1 for Port 1

AT:1 C3PTY I<Call-Reference> **IH**<Call-Reference(HeldCall)>
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:1 C3PTY I1 IH2"
Initiate 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 **lxx** 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:1 #C I<Call-Reference> *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.

Example: Command "AT:1#C I1"
Result "0010" ; Received bearer service

AT:1 DISC I <Call-Reference> [C<hb>] *Disconnect*

Disconnects existing ISDN connection within the given cause value *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:1 DISC I1"

Disconnect an existing connection with normal call clearing.

Example: "AT:1 DISC I1 C11"

Disconnect an incoming call with the cause 0x11 (User busy).

AT:1 RA I<Call-Reference> *Send alert message*

Send an Alert message to the network for the call that is addressed by *Call-Reference*.

Example:

AT:1 RA11 Initiate an alert request for an existing incoming call for port 1.

3.2.1 AT result messages

All messages sent from the codec port of the TA+HIX are preceded by an ":1". There are no spaces between the different parameters of the messages.

:1 CONNECT I<Call-Reference> D<rn..> O<rn..> B<hb>
Connection established

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.

<rn> ISDN number, string of digits, 1..22.

Example: ":1CONNECTI1D234O567B01"

Indicates a connection for Port 1 with destination address 234 and origination address 567 and using B channel 1.

:1 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+POX manual CAPI-causes).

Example: ":1DISCI1C3491"

Outgoing call is cleared with the ISDN cause 0x91 (User busy).

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

Information initiated 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.

:1 RING I<Call-Reference> D<rn..> O<rn..> B<hb> *incoming call*

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.

<rn> ISDN number, string of digits, 1..22.

Example: ":1RINGI1D234O567B01"

Indicates an incoming 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).

:1 CRA I<Call-Reference> *call request accepted*

Indicates that the call request is accepted.

Example: ":1CRAI1"

:1 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: ":1RINGINGI1"

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

3.2.2 Call control examples

3.2.2.1 Outgoing data call and disconnect

AT application		TA+HIX module	Remarks
"ATB10"	→		Select b-channel protocol
	←	"OK"	OK
"ATD123"	→		Initiate outgoing call to 123
			Destination is ringing, accept call with "ATA"
	←	"CONNECT 64000"	Connection established
"+++"	→		Change into local command mode
	←	"OK"	OK
"ATH"	→		Disconnect call
	←	"OK"	OK

3.2.2.2 Outgoing voice call and disconnect

AT application	TA+HIX module	Remarks
"ATB40"	→	Select ext. IOM connection
	←	"OK"
"AT:1CRD123"	→	Initiate outgoing call to 123
	←	":1CRAI1B01"
	←	":1RINGING1"
		Destination accept call
	←	":1CONNECTI1D123O234B01"
		Connection established
"AT:1DISC1"	→	Disconnect call
	←	":1OK"
	←	":1RELI1C"
		Call released

3.2.2.3 Accepted incoming voice call

AT application	TA+HIX module	Remarks
"AT#C2=00000001"	→	Select bearer service incoming, accept all incoming calls
"RING"	←	Incoming call to TA+HIX, destination is dialling
"AT#C"	→	Check received bearer service, select for voice or data calls
	← "0004"	0001 : Speech 0002 : Data 0004 : 3,1 kHz Audio 0010 : Telephony
"ATB40"	→	Select ext. IOM connection
	← "OK"	OK
"AT:1RAI1"	→	Send alert message
	← ":1RINGI1D300O310B01"	Ringling
	← ":1OK"	
"AT:1AI1"	→	Accept incoming call
	← ":1CONNECTI1D123O234B01"	Connection established
		Destination disconnect, i.e. go onhook
	← ":1RELI1C3490"	Call released, normal clearing

3.2.2.4 Call hold handling

<u>AT application</u>	<u>TA+HIX module</u>	<u>Remarks</u>
"ATB40"	→	Select ext. IOM connection
	←	"OK"
"AT:1CRD123"	→	Initiate outgoing call to 123
	←	":1CRAI1B01"
	←	":1RINGINGI1"
		Destination accept call
	←	":1CONNECTI1D123O234B01"
		Connection established
"AT:1CHI1"	→	Put activ connection in hold
	←	":1HOLDI1"
"AT:1CAI1"	→	Retreive the hold connection
	←	":1OK"
"AT:1DISCI1"	→	Disconnect call
	←	":1OK"
	←	":1RELI1C"
		Call released

3.3 B channel connections without codec (option)

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.

All other commands and behaviour, making data connection and maintaining the module, is identical to the documentation of TA+POX and can be referenced at the corresponding user manual.

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 controls a B channel connection without switching an on board device to the B channel is preceded by a ":" and a dummy port number (always "\$").

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

Resultmessages to the commands are preceded 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".

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 supported commands are described in the chapter 3.2, the differences are as follows:

- instead of :1 the parameter :\$ has to be set.
- instead of the codec the B channels will be switched transparently to the external devices via the IOM bus.
- additional messages defined, see below.

3.3.1 Additional messages without codec (option)

:\$ INFO I<Call-Reference> B<hb> *information to existing call reference*

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

“B” shows B channel used (hexadecimal coded byte):

00 = no B channel occupied.

01 = B channel 1 occupied.

02 = B channel 2 occupied.

Example: ":\$INFO I1B01"

3.4 Using TA+HIX in point to point mode

For using the TA+HIX at an ISDN access configured in point to point mode, the following settings have to be used.

AT**PTP=1 Select point to point mode. After setting and storing (AT&W) the TA+HIX has to be reset.

3.4.1 Incoming call

An incoming call will be signaled via a RING message. Additionally later received dialed numbers will be signaled via the message INFO (overlap receiving). When the called number is complete the application has to send a request alert message, this will cause that the caller gets the ringing tone.

":1RINGI1D224422O888B01" Incoming call received to ISDN access 224422
":1INFO I1D9" Next received dialed number "9".
AT:1 RA1 Initiate an alert request.

3.4.2 Outgoing call

An outgoing call has to be initiated by the command "AT:1CRxxx". There is no difference to the handling at a multipoint to point access. Overlap sending is done using the commands

AT:1CRDxxx send first connect request and
AT:1 CC I1 D2 send next to be dialled numbers.

3.5 Using TA+HIX with DTMF detection

This commands enables the DTMF recognizing mechanism for DTMF signals on the B channel from the ISDN line.

The DTMF recognition is only valid if B channel protocol is set to transparent (ATB5) and the presentation of received data is disabled (AT**RCVDATA=0).

Detected and valid received DTMF signals are presented via the V.24 interface using the following syntax inside the V.24 data stream.

RCVDATA	Disable receiving B channel data
----------------	----------------------------------

This command disables the presentation of B channel data received from the ISDN line via the V.24 interface.

AT**RCVDATA=0 disable receive data from the ISDN line

ATRCVDATA=1** enable receive data from the ISDN line

RCVDTMF	Enable interpretation of DTMF signals
----------------	---------------------------------------

(only valid for ATB5)

ATRCVDTMF=0** disable DTMF recognition

AT**RCVDTMF=1 enable DTMF recognition

The received DTMF tones are presented in the following way:

<DLE> 1 key "1" pressed by the connected phone

<DLE> 2 key "2" pressed by the connected phone

<DLE> * key "*" pressed by the connected phone

<DLE> # key "#" pressed by the connected phone

<DLE> is presented as hex value 0x10.

3.6 Support for Telim Protocol 10 baud

The Telim Protocol Support can be activated using protocol setting ATB80. Using this setting the ISDN connection will be set up by signaling the service voice for connection to analog lines.

After connection established the transmission and reception of FSK frequencies is used to transport data in the following way:

RTS line off: no FSK frequency is transmitted

RTS line on, TxD line idle: FSK frequency 980 Hz transmitted

RTS line on, TxD line mark: FSK frequency 1180 Hz transmitted

CTS line off: no valid FSK frequency is received / detected, RxD line is idle

CTS line on, RxD line idle: FSK frequency 1650 Hz received

CTS line on, RxD line mark: FSK frequency 1850 Hz received

The correct transmission and detection of FSK frequencies is limited to about 10 baud on RxD and TxD lines.

Frequencies are according to ITU recommendation V.21.

The ISDN connection can be released by dropping the DTR line.

4 Appendix

A1: Technical data TA+HIX

One serial channel for data communication and connection control:

functional:	V.24
electrical:	TTL
mechanical:	dual pin rows

one audio interface for voice:

input:	typical 750 mV _{pp}
output:	typical 750 mV _{pp} , R _L > 2000 Ohm

Data 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:

BRA-interface according to ITU I.430

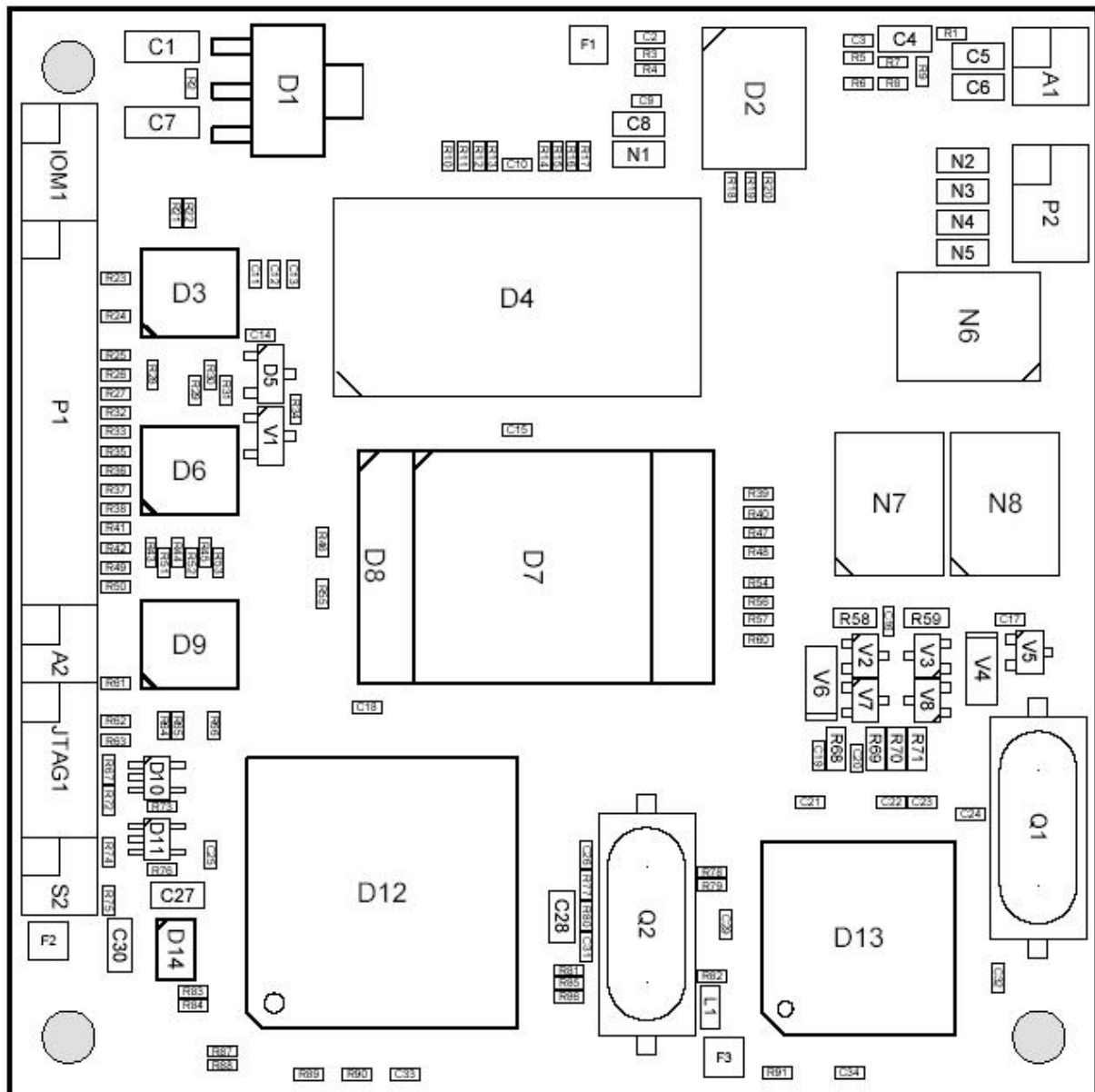
Power supply:

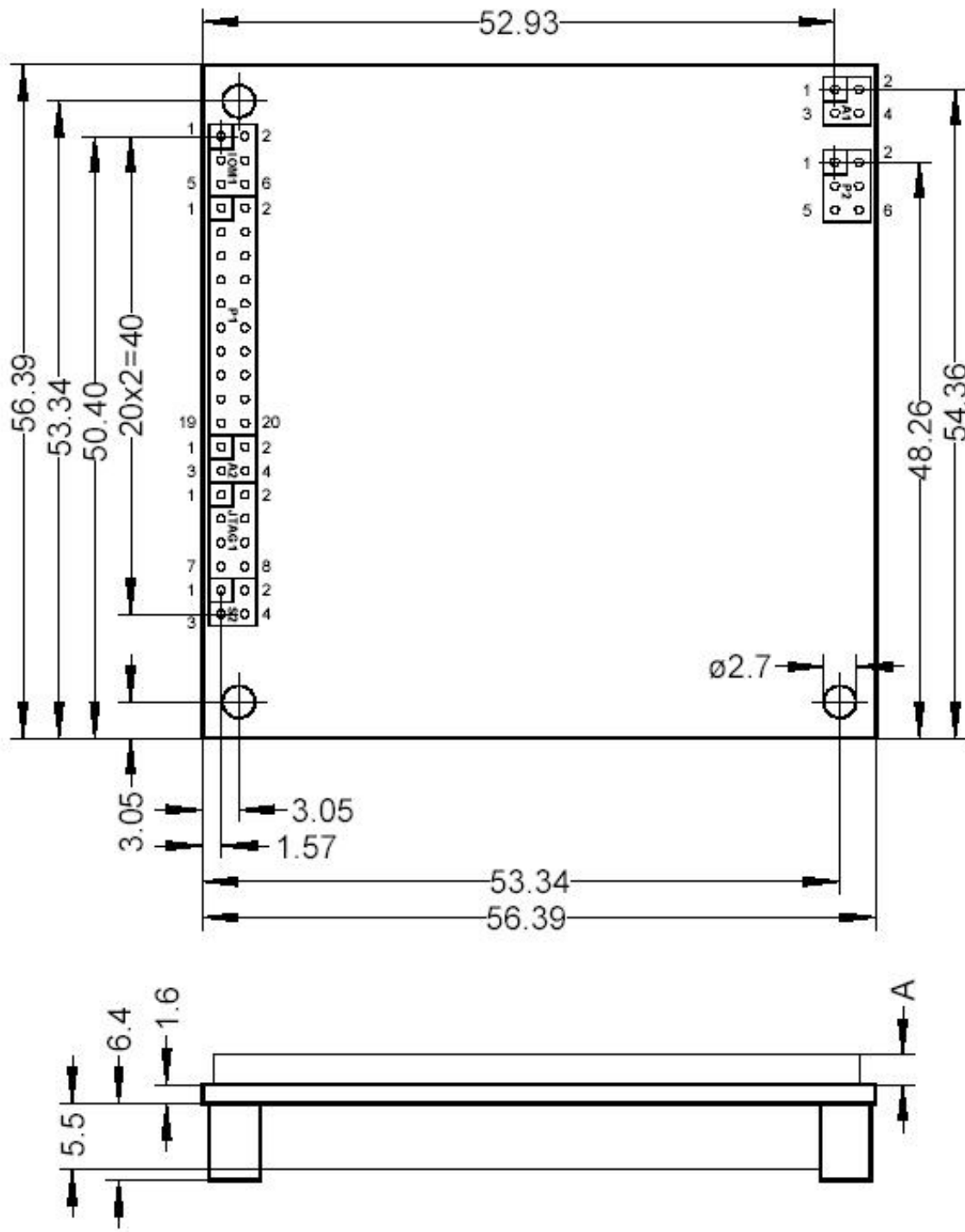
+5V \pm 5%, nominal: app. 60 mA, (max 110 mA)
idle: app. 25 mA.

Physical dimensions:

plug on module: 56 x 56 x 12 (8) mm (WxDxH)

A2: Mechanical dimensions of the module TA+HIX





	A
without Modem	< 1mm
with Modem	< 2.5 mm

A3: TA+HIX Serial Interface Connector P1

P1-Pin	Signal	Direction from TA+HIX	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+HIX	NC or READ
8	RTS	I		
9	ID1	O	10k Pull up on TA+HIX	NC or READ
10	CTS	O		
11	RESET	I	RESET active low OC	NC
12	DTR	I		
13	L3	O		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	NC, reserved
19	UA2	O	User Output 2	NC, reserved
20	UE2	I	User Input 2	NC, reserved

A4: TA+HIX 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

A5: TA+HIX interface Connector IOM1

IOM1-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

A6: TA+HIX audio interface Connector A1

A1-Pin	Signal
1	NF OUT
2	GND OUT
3	NF IN
4	GND IN

A7: TA+HIX audio interface Connector A2

A2-Pin	Signal
1	GND OUT
2	NF OUT
3	NF IN
4	GND IN

A8: TA+HIX interface Connector JTAG1 (option)

JTAG1-Pin	Signal	TA usage
1	TDI	Serial data in
2	TDO	Serial data out
3	TMS	TAP mode select
4	RES	Target System reset
5	TCK	Clock
6	GND	Signal Ground
7	TRST	TAP reset
8	VCC	3,3 V

A9: TA+HIX serial interface Connector S2

S2-Pin	Signal	Direction
1	NC	
2	TXD	I
3	GND	
4	RXD	O

A10: Pinout of the ISDN connector

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

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