AT Commands
Interface Guide
6620-3200

IDW-90

ISDN
Terminaladapter

www.westermo.com

1. Introduction

The Westermo IDW-90 is an industrialised ISDN Terminal adapter. This Terminal adapter has been developed with high speed industrial data communications in mind and has some features you would not expect to find on normal adapters.

The unit is DIN rail mounted and has both an RS-232/V.24 and RS-485 interfaces with 2 or 4 wire connections.

Terminal data rates of up to 115.2 kbit/s can be handled with a 128 kbit/s ISDN

B-channel bit rate

The IDW-90 has been designed to meet the European ISDN standard DSS1.
All standard ISDN transport protocols are supported including HDLC transparent, X75, PPP and ML-PPP.

V.110 asynchronous is supported with flow control at data rates up to 19.2 kbit/s.
A watchdog facility continually monitors the power supply and internal hardware as well as the operational software. In the event of a problem the modem automatically resets. This feature has been included to make the unit more suitable for use in unmanned locations.

The IDW-90 is available in an LV version

The nominal input voltage is 12–48 VDC ±10%.

The IDW-90 has 1 Digital opto-coupled input that can be used to trigger services specified in a list of service entries. The IDW-90 also has a relay output with change over contact. The relay output can be controlled from a remote Westermo modem (PSTN, GSM and ISDN).

The IDW-90 features DIP-switch configuration and can be programmed using AT-commands or a Configurator which allows local and remote configuration and CAPI 2.0 compatibility. It also has an internal analogue V.34 modem enabling connections from ISDN to analogue modem end locations.

The IDW-90 documentation includes extensive information on the command set, S registers, DIP-switches and error codes. Please call your local Westermo office if you need further technical information.

1.1 LED Indicators

LED	Function	Description
L1	ISDN Line status	LED normally showing the status of the ISDN S_0 interface. L_1 together with L_2 is also used to indicate error conditions in the IDW-90 and the connection to the ISDN S_0 interface.
L2	ISDN Data connection	LED Normally showing the state of the data connection
ANL	Analogue line	OFF = No analogue connection established BLINK = Analogue call in progress ON = Analogue line established
TD	Transmit Data	LED showing data from the DTE, the LED will blink when data received
RD	Receive Data	LED showing data transmitted to the DTE, the LED will blink when data transmitted
RTS	Request to Send	LED showing the status of the handshake line RTS from DTE, LED is ON when DTE requests to send data
DCD	Data Carrier Detect	LED showing the status of the handshake line DCD from IDW-90, The behaviour of the DCD-line is programmable, see configuration command cdcd
DTR	Data Terminal Ready	LED showing the status of the handshake line DTR

L1	L2	Status
ON	5 blink/s	Start up phase
ON	OFF	S_0 connection OK
ON	1 short blink/s	Call setup in progress
ON	1 long blink/s	Waiting for B channel synchronization
ON	ON	Data connection is established
OFF	OFF	No power or Hardware error
0.5 sec ON 0.5 sec OFF	OFF	Faulty or no S_0 connection
OFF	2 blink/s	IDW-90 internal RAM error
OFF	0.5 sec ON 0.5 sec OFF	IDW-90 internal ROM error

2. DIP-Switch Setup

The IDW-90 DIP-switches will be read at Power on and override the current database setting.

If an AT-command or Configurator command given after Power on is addressing the same parameter as a DIP-switch setting, the command will in turn override the DIP-switch setting.

To store the current DIP-switch setting use the configurator command **save** or **AT&W**.

3. Factory settings

Throughout this manual the default factory settings of parameters are shown with **bold** typeface and labelled (**default**) where applicable.

4. AT-command set

All parameters can be changed by using an extended AT command set described in this chapter.
Check to see whether the factory setting will fit your environment.
The factory setting is described (highlighted) in the parameter list shown below.
If you want a different configuration from the factory default setting, take the following steps:

- Connect the IDW-90 to ISDN interface.
- Connect the PC's COM port to the DTE interface of the IDW-90.
- Connect the power supply to the mains socket.
- Start a terminal emulation on your PC, and verify that the baudrate setting of the terminal emulation fits that of the IDW-90.
- Set up the parameters of the IDW-90 from the terminal emulation and save the parameters using the AT command set.

Example:

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

AT**prot=10<*CR*> (set protocol to X.75)
AT&W<*CR*> (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 AT!,-where the prefix-AT! is used to identify commands to the analogue modem. Commands are terminated with <*CR*>. Corrections in a command line are done with <*BACKSPACE*>. A command line has a maximum of 240 characters. The command line is automatically cancelled by longer input. Blanks are ignored, capital/small letters are not significant.

The parameter settings of the IDW-90 obtained when using the-AT commands can be permanently stored (AT&W) and are not lost by resetting or by leaving the-AT command mode.

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

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

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

Note: If B channel protocol PPPasync (AT**prot=3) 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.

AT-command	Description
A/	Repeat last command line
A	Accept incoming call
##An	Only analogue outgoing call
B	B channel protocol (no function use IDW-90+Configurator command PROT)
%B	Set local baudrate
CONF	Enter IDW-90+Configurator
&C	DCD control
#C	Received bearer service
#C1=hbhb	Select bearer service outgoing
#C2=hbhbhbhb	Select bearer service incoming
!%C	Enable/Disable Data Compression
D	Initiate outgoing call
&D	DTR control
!+DS	Data Compression
E	Local echo 1
!%E	Enable/Disable Line Quality Monitor and Auto Retrain or Fallback/Fall Forward
!+ES	Error Control
&F	Load factory defaults ISDN
!&F	Load factory defaults analogue option
H	Disconnect
#H	Display msn
I	Display version information
!I	Display version information for analogue modem.
&K	Flow control
!K	MNP Extended Services
!%L	Report Line Signal Level
#M	Received CLID
!+MS	Modulation Selection
N	Set line baudrate V.110 (no function use IDW-90+Configurator command BRN)

AT-command	Description
!\N	Operating Mode
O	Return to online state
#O	Received CLIP
Q	Suppress result
!%Q	Report Line Signal Quality
&R	CTS control
#R	Handle incoming calls
S	Display and set internal S register
&S	DSR control
V	Result format
&V	Display configuration
!&V1	Display Last Connection Statistics
W	Enhance result messages
&W	Store active configuration
!&W	Store active configuration for analogue modem
X	Reduce result messages
Z	Load stored settings
&Z	Store call number
#Z	Define own msn
**<*cmd*>	Execute configuration command
!#UD	Last Call Status Report

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.

A/ – Repeat last command line

This command repeats the commands of the last entered command line.
Note: No prefix AT is required.

A/

##An – Only analogue outgoing call

Forces the IDW-90 to make analogue calls even if no control character ('#' or '!') is used in the dial string.
This also implies that no digital outgoing call can be made when AT##A1 is set. Digital incoming calls can still be received.

AT##A0:	configures the adapter to be able to make both analogue and digital outgoing calls. (**default**)
AT##A1:	configures the adapter only to make analogue outgoing calls.

A – Accept incoming call

Using this command you can accept an incoming call, if automatic call acceptance is not set (Register S_0 = 0). An incoming call is displayed by the message "RING" or the code "2".
Must be the last command in an AT command line.
ATA

B – B channel protocol

This command will respond with OK without any functionality after it. The B-channel protocol settings can be set with AT**prot.

%B – Set local baudrate

Sets the local baudrate of the IDW-90 to the desired value (fixed value) or to auto-detection. When autodetection is set, the IDW-90 will recognize the desired baudrate with every newly entered AT command by the terminal equipment (PC). With all other settings the PC must use the same baudrate.
Must be the last command in an AT command line.

AT%B0	Automatic local baudrate detection enabled (autobauding, **default**)
AT%B1	Local baudrate set to 1 200 bit/s
AT%B2	Local baudrate set to 2 400 bit/s
AT%B3	Local baudrate set to 4 800 bit/s
AT%B4	Local baudrate set to 9 600 bit/s
AT%B5	Local baudrate set to 19 200 bit/s
AT%B6	Local baudrate set to 38 400 bit/s
AT%B7	Local baudrate set to 57 600 bit/s
AT%B8	Local baudrate set to 115 200 bit/s
AT%B9	Local baudrate set to 230400 bit/s

Note: Autobauding (AT%B0) is available for AT command set only.
If autobauding is selected and no AT-command has been sensed before an incoming call baudrate 9600 will be used.

CONF – Enter IDW-90+Configurator

Enters directly into the IDW-90+Configurator, the configuration prompt "#" will be displayed. Leave the IDW-90+Configurator with the command "quit".

ATCONF

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

#C – Received bearer service

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

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

AT#C

#C1=hbhb – Select bearer service outgoing

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

The value for hbhb (word) is the CIP value as defined in the CAPI 2.0 specification (**default** 0002).

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

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

#C2=hbhbhbhb – Select bearer service incoming

Selects the bearer services that can be accepted with an incoming call.

The definition of hbhbhbhb (double word) is the CIP mask as defined in the CAPI 2.0 specification

(**default** 00010016).

Example: AT#C2=00010016: 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)**.

!%C – Enable/Disable Data Compression

Enables or disables data compression negotiation for connection to PSTN.

The modem can only perform data compression on an error corrected link.

The parameter value, if valid, is written to S41 bits 0 and 1.

AT!%C<*value*>

0	Disables data compression. Resets S46 bit 1.
1	Enables MNP 5 data compression negotiation. Resets S46 bit 1.
2	Enables V.42 bis data compression. Sets S46 bit 1.
3	Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1. (**default**)

&C – DCD control

Selects the behaviour of the DCD control line from the IDW-90.

AT&C0	IDW-90 control line DCD is always ON
AT&C1	DCD ON indicates ISDN or PSTN connection is established and synchronized (**default**)
AT&C2	DCD follows DTR
AT&C3	DCD indicates link level established (X.31-D only)

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 IDW-90. Must be the last command in AT command line.
Any character input while the IDW-90 is dialling will cancel the dialling procedure exept when dabort=0.

ATD<*CALLEDnumber*>[/<*subaddr*>]
[,X[Pxxx-][R][N<*nuipwd*>][G<*cug*>]<*X25number*>]]

CALLEDnumber:	ISDN call number for a dialled B channel connection or X.25 number for X.31 D channel
Subaddr	dialled sub address
P:	use packet size xxx for X.25 connection (value from 64 – 2048)
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:	dialled X.25 call number (X.25 B channel only)
ATDL	Dial the last dialled number
ATDS=n	Dial number n from stored telephone number list (n = 1..3) (See command AT&Z to store numbers)

AT!D<*PSTNnumber*>
ATD#<*PSTNnumber*>
ATDT#<*PSTNnumber*>

PSTNnumber:	Call number for a dialled connection to an analogue PSTN number over ISDN using the internal analogue modem
AT!DL	Dial the last dialled number
AT!DS=n	Dial number n from stored telephone number list (n = 1..3) (See command AT&Z to store numbers) and catab n

Notes: – To setup the own sub address see configuration command sub.

ATD<*CALLEDnumber*>**e**

Adding an "**e**" to CALLEDnumber indicates that a connection to the internal remote access of an IDW-90 shall be performed, the protocol X.75 (ATB10) has to be used. Remote configuration can also be accessed through sending the remote access escape sequence ´++++'. See section 5.5

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

ATD12345678XP64,R,O02,Nnuivalue,4000123456<*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

&D – DTR control

Selects the behaviour of the IDW-90, when the DTE control line DTR changes from ON to OFF.

AT&D DTE control line DTR setting is ignored

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

AT&D4 DTR is evaluated: Incoming calls will be accepted independent of DTR status; DTR drop disconnects an active connection

For nearer information see also chapter 4.3 Serial status lines.

!+DS – Data Compression

This extended-format compound parameter controls the V.42bis data compression function if provided in the modem. It accepts four numeric sub parameters:

AT!+DS=[<*direction*>[,<*compr_neg*>[,<*max_dict*>[,<*max_string*>]]]]

<*direction*> Specifies the desired direction(s) of operation of the data compression function; from the DTE point of view.
- 0 Negotiated; no compression (V.42bis P0=0).
- **3** both directions, accept any direction (V.42bis P0=11) (**default**)

<*compr_neg*> Specifies whether or not the modem should continue to operate if the desired result is not obtained.
- 0 Do not disconnect if V.42bis is not negotiated by the remote modem as specified in <*direction*>

<*max_dict*> Specifies the maximum number of dictionary entries (2 048 entries) which should be negotiated (may be used by the DTE to limit the codeword size transmitted, based on its knowledge of the nature of the data to be transmitted).

<*max_string*> Specifies the maximum string length (32 bytes) to be negotiated (V.42bis P2).

Reporting Current or Selected Values

Command: AT!+DS?
Response: +DS: <*direction*>,<*compr_neg*>,<*max_dict*>,<*max_string*>
Example: +DS: 3,0,2048,32 for the defaults and 2048 entry max dictionary

Reporting Supported Range of Parameter Values

Command: AT!+DS=?
Response: +DS: (<*direction*>range),(<*compr_neg*>range), (<*max_dict*>range),(<*max_string*>range)
Example: +DS: (0,3),(0),(2048),(32)

E – Local echo

Selects the local echo in command mode.

ATE0 No local echo
ATE1 Local echo on in command phase (**default**)

!%E – Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback/Fall Forward

Controls whether or not the modem will automatically monitor the line quality and request a retrain (%E1) or fall back when line quality is insufficient or fall forward when line quality is sufficient (%E2). The parameter value, if valid, is written to S41 bits 2 and 6. If enabled, the modem attempts to retrain for a maximum of 30 seconds.

AT!%E0	Disable line quality monitor and auto-retrain.
AT!%E1	Enable line quality monitor and auto-retrain.
AT!%E2	Enable line quality monitor and fallback/fall forward. (**default**)

Fallback/Fall Forward. When %E2 is active, the modem monitors the line quality (EQM). When line quality is insufficient, the modem will initiate a rate renegotiation to a lower speed within the V.34/V.32 bis/V.32 modulation speeds. The modem will keep falling back within the current modulation if necessary until the speed reaches 2 400 bit/s (V.34) or 4 800 bit/s (V.32). Below this rate, the modem will only do retrains if EQM thresholds are exceeded. If the EQM is sufficient for at least one minute, the modem will initiate a rate renegotiation to a higher speed within the current modulation speeds. The rate renegotiations will be done without a retrain if a V.32 bis connection is established. Speeds attempted during fallback/fall forward are those shown to be available in the rate sequences exchanged during the initial connection. Fallback/fall forward is available in error correction and normal modes, but not in direct mode.

!+ES – Error Control

This command specifies the initial requested mode of operation when the modem is operating as the originator, optionally specifies the acceptable fallback mode of operation when the modem is operating as the originator, and optionally specifies the acceptable fallback mode of operation when the modem is operating as the answerer. It accepts three numeric sub parameters:

AT!+ES=[<*orig_rqst*>[,<*orig_fbk*>[,<*ans_fbk*>]]]

<*orig_rqst*>	Decimal number which specifies the initial requested mode of operation when the modem is operating as the originator. The options are:
0	Not supported.
1	Initiate call with Normal Mode (also referred to as Buffered Mode) only.
2	Initiate V.42 without Detection Phase. If V.8 is in use, disable V.42 Detection Phase.
3	Initiate V.42 with Detection Phase. (**default**)
4	Initiate MNP.
6	Not supported.
7	Initiate Frame Tunnelling Mode when connection is complete, and Data Mode is entered.

<*orig_fbk*>	Decimal number which specifies the acceptable fallback mode of operation when the modem is operating as the originator.
0	LAPM, MNP, or Normal Mode error control optional. (**default**)
1	Not supported.
2	LAPM or MNP error control required; disconnect if error control is not established.
3	LAPM error control required; disconnect if error control is not established.
4	MNP error control required; disconnect if error control is not established.
<*ans_fbk*>	Decimal number which specifies the acceptable fallback mode of operation when the modem is operating as the answerer or specifies V.80 Synchronous Access Mode.
0	Not supported.
1	Error control disabled, use Normal Mode.
2	LAPM, MNP, or Normal Mode error control optional. (**default**)
3	LAPM, MNP, or Direct Mode error control optional.
4	LAPM or MNP error control required; disconnect if error control is not established.
5	LAPM error control required; disconnect if error control is not established.
6	MNP error control required; disconnect if error control is not established.
8	Not supported.
9	Not supported.

Example:

AT! +ES=3	Enable V.42 with Detection Phase originator. Disable V.80 Synchronous Access Mode originator.
AT!+ES=,,2	Allow LAPM, MNP, or Normal Mode connection answerer. Disable V.80 Synchronous Access Mode answerer.
AT!+ES=3,,2	Enable V.42 with Detection Phase originator, allow LAPM, MNP, or Normal Mode connection answer. Disable Synchronous Access Mode originator and answerer.

Reporting Current or Selected Values

Command:	AT!+ES?
Response:	+ES: <*orig_rqst*>,<*orig_fbk*>,<*ans_fbk*>
Example:	+ES: 3, 0, 2 For **default** settings.

Reporting Supported Range of Parameter Values

Command:	AT!+ES=?
Response:	+ES: (<*orig_rqst*> range),(<*orig_fbk*>range),(<*ans_fbk*>range)
Example:	+ES: (0-4, 6, 7), (0-4), (0-6, 8, 9)

&F – Load factory defaults

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

AT&F0	Setup all parameters concerning data port
AT&F1	Setup all parameters including ISDN protocol and msn settings.

!&F – Load factory defaults

Factory **default** will be loaded for the analogue option
(for storing in non volatile memory please use the command AT!&W).

AT!&F	The analogue modem loads the factory **default** configuration (profile)

H – Disconnect

Disconnects existing ISDN data connection, after issuing the Escape sequence (+++).
To enter the ATH command during an active data connection you must use the following sequence "*<1 sec pause>* <+><+><+> *<1 sec pause>*" to reach the online command mode.
The time gap between all three plus signs may not exceed 1 sec.
The escape sequence is transmitted transparently 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:

ATI0	Returns the "Modem"-type; name of the terminal adapter ("IDW-90")
ATI1	Returns internal checksum ("??")
ATI2	Returns "OK"
ATI3	Returns version string: "410045vv" vv = version number.
ATI4	Returns manufacturers name: "Westermo Teleindustri AB"
ATI5	Returns ISDN selected D-Channel protocol: "0 – DSS1"
ATI6	Returns copyright string: "(c) Copyright Westermo Teleindustri AB"
ATI7	Returns the status of the IDW-90 configuration switches. 1 1 1 1 "00000000.00000000.00000000.00000000" SW1 SW2 SW3 SW4 '0' = switch OFF and '1' = switch ON.
ATI9	Returns plug and play ID string
ATI99	Returns software version creation date

!I – Display version information for analogue modem

Displays various information about version number and settings for the analogue modem:

AT!I0	Reports product code,
AT!I1	Reports the least significant byte of the stored checksum in decimal (see firmware release notes). Reports 255 if the prestored checksum value is FFh.
AT!I2	Reports "OK".
AT!I3	Reports identification codes in the form RevisionName-Modulation where: RevisionName =Product family, CX06833. Modulation = V34 or V32
Example:	CX068330-V34
AT!I4	Reports OEM Manufacturer string e.g.: Westermo IDW-90
AT!I5	Reports Country Code parameter, e.g., 42.
AT!I6	Reports modem data pump model and internal code revision
AT!I7	Reports OK.

&K – Flow control

Selects the flow control behaviour of the IDW-90 while in data communication phase.

AT&K0	No local flow control between the DTE and IDW-90 is used
AT&K3	Local flow control is set to hardware handshake RTS/CTS (**default**)
AT&K4	Local flow control is set to software handshake XON/XOFF

!-K – MNP Extended Services

Enables or disables conversion of a V.42 LAPM connection to an MNP 10 connection. The parameter value, if valid, is written to S40 bits 0 and 1.

AT!-K0	Disables V.42 LAPM to MNP 10 conversion. (**default**)
AT!-K1	Enables V.42 LAPM to MNP 10 conversion.
AT!-K2	Enables V.42 LAPM to MNP 10 conversion; inhibits MNP Extended Services initiation during V.42 LAPM answer mode detection phase.

!%L – Report Line Signal Level

Returns a value which indicates the received signal level. The value returned is a direct indication of the receive level at the MDP, For example, 009 = –9 dBm, 043 = –43 dBm, and so on. This command is only valid in online command mode.

#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

! +MS – Modulation Selection

This command parameter controls the manner of operation of the modulation capabilities in the modem. It accepts six sub parameters:
AT!+MS=[<*carrier*>[,<*automode*>[,<*min_tx_rate*>[,<*max_tx_rate*>[,<*min_rx_rate*>[,<*max_rx_rate*>]]]]]]
Where: Possible <*carrier*>, <*min_tx_rate*>, <*max_tx_rate*>, <*min_rx_rate*>, and <*max_rx_rate*> values are listed below.

!+MS Command Supported Rates

Modulation	<*carrier*>	Possible (<*min_rx_rate*>, <*max_rx_rate*>, (<*min_tx_rate*>) and <*max_tx_rate*>) Rates (bit/s)
Bell 103	B103	300
Bell 212	B212	1 200 Rx/75 Tx or 75 Rx/1 200 Tx
V.21	V21	300
V.22	V22	1 200
V.22 bis	V22B	2 400 or 1 200
V.23	V23C	1 200
V.32	V32	9 600 or 4 800
V.32 bis	V32B	14 400, 12 000, 9 600, 7 200 or 4 800
V.34	V34	33 600, 31 200, 28 800, 26 400, 24 000, 21 600, 19 200, 16 800, 14 400, 12 000, 9 000, 7 200, 4 800 or 2 400

Defined Values

<*carrier*> — A string which specifies the preferred modem carrier to use in originating or answering a connection. <*carrier*> values are strings of up to eight characters, consisting only of numeric digits and upper case letters.
<*carrier*> values for ITU standard modulations take the form: *<letter><1-4 digits><other letters as needed>*.

<*automode*> — A numeric value which enables or disables automatic modulation negotiation (e.g., ITU-T V.32 bis Annex A or V.8).
0 = Automode disabled.
1 = Automode enabled. (**default**)

<*min_rx_rate*> and <*max_rx_rate*> — Numeric values which specify the lowest (<*min_rx_rate*>) and highest rate at which the modem may establish a receive connection. May be used to condition distinct limits for the receive direction as distinct from the transmit direction. Values for this sub parameter are decimal encoded, in units of bit/s. The possible values for each modulation are listed in Table 1.
Actual values will be limited to possible values corresponding to the entered <*carrier*> and fall-back <*carrier*> as determined during operation. (**default** = lowest (<*min_rx_rate*>) and highest (<*max_rx_rate*>) rate supported by the selected carrier.

<*min_tx_rate*> and <*max_tx_rate*> Numeric values which specify the lowest (<*min_tx_rate*>) and highest (<*max_tx_rate*>) rate at which the modem may establish a transmit connection. Non-zero values for this subparameter are decimal encoded, in units of bit/s. The possible values for each modulation are listed in Table 1.
Actual values will be limited to possible values corresponding to the entered <*carrier*> and fall-back <*carrier*> as determined during operation. (**default** = lowest (<*min_tx_rate*>) and highest (<*max_tx_rate*>) rate supported by the selected carrier.)

Reporting Current or Selected Values

Command: !+MS?
Response: +MS: <*carrier*>, <*automode*>, <*min_tx_rate*>, <*max_tx_rate*>, <*min_rx_rate*>, <*max_rx_rate*>

Note:- The current active settings are reported under control of the !+MR parameter.

Example: !+MS=V90, 1, 300, 33 600, 300, 33 600 This example uses **default** values, allowing maximum system flexibility to determine optimal receive and transmit rates during operation.

Reporting Supported Range of Parameter Values

Command: !+MS=?
Response: +MS: (<*carrier*> range), (<*automode*> range), (<*min_tx_rate*> range), (<*max_tx_rate*> range), (<*min_rx_rate*> range), (<*max_rx_rate*> range)
Example: +MS: (B103, B212, V21, V22, V22B, V23C, V32, V32B, V34), (0,1), (300-33 600), (300-33 600)

N – Set line baudrate V.110

This command will respond with OK without any functionality after it. V.110 baudrates can be set with AT**BRN.

!\N – Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection.

AT!\N0	Selects normal speed buffered mode (disables error-correction mode).
AT!\N1	Same as !\N0
AT!\N2	Selects reliable (error-correction) mode. The modem will first attempt a LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up. (Forces !&Q5, S36=4, and S48=7.)
AT!\N3	Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode. (Forces S36=7, and S48=7, (**default**)
AT!\N4	Selects LAPM error-correction mode. Failure to make an LAPM error-correction connection results in the modem hanging up. (Forces S48=0.) **Note:** The !-K1 command can override the !\N4 command.
AT!\N5	Selects MNP error-correction mode. Failure to make an MNP error-correction connection results in the modem hanging up. (Forces S36=4, and S48=128.)

O – Return to online state

If the IDW-90 is in command mode after issuing an escape sequence out of an existing connection, ATO brings the IDW-90 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 result

Suppresses result codes.

ATQ0	Return status – codes after command input (**default**)
ATQ1	No result codes are returned

!%Q – Report Line Signal Quality

Reports the line signal quality. Returns the higher order byte of the EQM value.
Based on the EQM value, retrain or fallback/fall forward may be initiated if enabled by !%E1 or !%E2.
Only valid in online command mode.

&R – CTS control

Selects the behaviour of the CTS control line from the IDW-90.

AT&R0	IDW-90 control line CTS is following all changes of RTS
AT&R1	CTS is always ON (**default**)
AT&R2	CTS follows DTR

For nearer information see also chapter 4.3 Serial status lines

S – Display and set internal S register

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

&S – DSR control

Selects the behaviour of the DSR control line from the IDW-90.

AT&S	TA control line DSR is always ON (**default**)
AT&S1	DSR ON indicates ISDN connection is established and synchronized
AT&S5	DSR ON indicates an active ISDN call procedure (off hook)

For further information see also chapter 4.3 Serial status lines

V – Result format

ATV0	Result is presented as numbers (followed by <*CR*>)
ATV1	Result is presented as text (**default**)
ATV2	Result is presented as text RING and CONNECT including ISDN address, all others include error causes

&V – Display configuration

AT&V0	Displays the actual configuration of AT command setting including stored ISDN numbers
AT&V1	Displays the actual configuration of IDW-90+Configurator command setting.

!&V1 – Display Last Connection Statistics

Displays the last connection statistics in the following format (shown with typical results):

```
TERMINATION REASON      LOCAL REQUEST
LAST TX rate....    26400 BIT/S
HIGHEST TX rate.    26400 BIT/S
LAST RX rate....    33600 BIT/S
HIGHEST RX rate.    33600 BIT/S
PROTOCOL .......    LAPM
COMPRESSION ....    V42Bis
Line QUALITY ...    038
Rx LEVEL .......    015
Highest Rx State    67
Highest TX State    67
EQM Sum ........    00B4
Min Distance ....   0000
RBS Pattern.....    00
Rate Drop.......    00
Digital Loss....    2000
Local Rtrn Count    00
Remote Rtrn Count       00
Flex 9481814347C4
```

RBS Pattern: Shows which bits are being robbed in the least significant 6 bytes, e.g., 03 indicates 2 robbed bits in bit positions 0 and 1.

Digital Loss: Shows if a pad was encountered and if so, what was the digital loss. 2000 means 0dB.

W – Enhance result messages

ATW0 Shows result code (RING, CONNECT) without additional info (**default**)

ATW1 Result is presented with extended result codes
RING and CONNECT including ISDN address, all others include error causes.
Message RINGING will be displayed with an outgoing call.

&W – Store active configuration

The active configuration will be stored in non volatile memory.

AT&W0
AT!&W

!&W – Store active configuration

The active configuration for the analogue modem will be stored in non volatile memory.
AT!&W

X – Reduce result messages

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

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

Z – Load stored settings

The active configuration will be replaced by the stored configuration.
Must be the last command in an AT command line.

ATZ

This command will also cause a soft reset of the analogue modem with a recall of stored configuration profile.

&Z – Store call-number

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

AT&Zx=nn	set entry number x to dialling number nn
AT&Zx	shows entries number x.
AT&Z	show all entries.

#Z – Define own msn

Defines the msn nn for the data port.
If the number is set to "*" (**default**), all incoming calls are acceptable.
The msn can be displayed by command AT#H or AT&V1.

AT#Z=nn

The msn is automatically stored to non volatile RAM.

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

Executes one configuration command, for definition of commands
see IDW-90+Configurator commands section.

AT**<*cmd*>

Table 1 S-registers

Register	Function	Range	Units	Saved	Default	Note
S0	Rings to Auto-Answer	0–255	rings	*	1	
S1	Ring Counter	0–255	rings		0	
S2	Escape Character ASCII	0–255	ASCII	*	43 (02Bh)	
S3	Carriage Return Character	0–127	ASCII	*	13 (0Dh)	
S4	Line Feed Character	0–127	ASCII	*	10 (0Ah)	
S5	Backspace Character	0–128	ASCII	*	8	
S6	Dial delay	0–255	ASCII	*		
S7	Wait Time for Carrier, Silence, or Dial Tone	0-60	s	*	50	
S9	Enable PNP functionality for Windows	0–1	ASCII		1	
S10	Lost Carrier To Hang Up Delay	1–255	0.1 s	*	14	PSTN
S16	Last occurred CAPI/ISDN error cause	–	–			
S30	Disconnect inactivity timer See *idle	0-255	10s	*	0	
S36	LAPM Failure Control	–	–	*	7	PSTN
S40	General Bit-Mapped Options Status	–	–	*	104 (68h)	PSTN
S41	General Bit-Mapped Options Status	–	–	*	195 (C3h)	PSTN
S46	Data Compression Control	–	–	*	138	PSTN
S48	V.42 Negotiation Control	–	–	*	7	PSTN
S86	Analogue Call Failure Indication	0–26	–		21	PSTN
S90	Last incoming ISDN calling number (CLIP)	–	–			
S91	PSTN Transmit Attenuation Level	0–15	dBm	*	13	PSTN
S93	Unknown AT command handling	0,1	ASCII	*	0	
S210	V.34 Symbol Rate	0–255	–		13 (0Dh)	PSTN

* Register value may be stored in the user profiles with the &W command.

S0 – Number of Rings to Auto-Answer

S0 sets the number of the rings required before the modem automatically answers a call. Setting this parameter to zero disables auto-answer mode.

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 (**default**)

2..n Call acceptance through the terminal adapter after n "RING " messages.

Note: The time between two ring messages can be configured using the IDW-90-configuration command "ringtimer "(**default** =5 sec.)

S1 – Ring Counter

Ring Counter (read only), S1 is incremented each time the modem detects a ring signal.

S2 – Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The **default** value 43 corresponds to an ASCII '+'..

S3 – Carriage Return Character

S3 sets the command line and result code terminator character. **Default**: 13 Carriage Return

S4 – Line Feed Character

S4 sets the character recognised as a line feed. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used. **Default**: 10 Line Feed.

S5 – Backspace Character

S5 sets the character recognised as a backspace. The terminal adapter will not recognise the Backspace character if it is set to a value that is greater than 128 ASCII. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.
Default: 8 (Backspace)

S6 – Dial delay

This S-register defines how many seconds the unit will delay a call attempt.
The timer starts counting after the ATD command has been sent to the adapter.

S7 – Wait time for Carrier

S7 sets the time the terminal adapter will wait for synchronization and also the time the analogue modem will wait for carrier. **Default**: 50 sec

S9 – Enable PNP functionality for Windows

S9 enables and disables the Windows Plug and Play identification of the terminal adapter. (**default** = 1, enabled)

S10 – Lost Carrier To Hang Up Delay (analogue)

S10 sets the length of time, in tenths of a second, that the analogue modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.
The actual interval the modem waits before disconnecting is the value in register S10 minus 0.6s.
Therefore, the S10 value must be greater than 0.6s or else the modem disconnects before it recognises the carrier.
Range: 1 – 255 tenths of a second
Default: 14 (1.4 seconds)

S16 – Last ocurred CAPI/ISDN error cause

See Table 6 ISDN causes and their explanation (DSS1) 84 and Table 8 CAPI causes and their explanation.91

S30 – Disconnect Inactivity Timer

S30 sets the length of time, in tens of seconds, that the modem will stay online before disconnecting when no data is sent or received. In error-correction mode, any data transmitted or received will reset the timer. In other modes, any data transmitted will reset the timer.
Range: 0–255 tens of seconds (0–2 550 seconds) See configuration command "**idle**".

S36 – LAPM Failure Control (analogue)

Bits 0 – 2 This value indicates what should happen upon a LAPM failure. These fallback options are initiated immediately upon connection if S48=128.If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

0 Modem disconnects.
1 Modem stays on-line and a Direct mode connection is established.
2 Reserved.
3 Modem stays on-line and a Normal mode connection is established.
4 An MNP connection is attempted and if it fails, the modem disconnects.
5 An MNP connection is attempted and if it fails, a Direct mode connection is established.
6 Reserved.
7 An MNP connection is attempted and if it fails, a Normal mode connection is established.(**default**)

S40 – General Bit Mapped Options Status (analogue)

S40 indicates the status of command options.

Default: 0 (00h) (00000000b)

Bits 0 – 1 MNP Extended Services (-Kn)

- **0** Disable extended services (-K0) (**default**)
- 1 Enable extended services (-K1)
- 2 Enable extended services (-K2)

Bits 2 – 7 Reserved.

S41 – General Bit Mapped Options Status (analogue)

S41 indicates the status of command options.

Default: 195 (C3h) (1100011b)

Bits 0 – 1 Compression selection (%Cn)

- 0 Disabled (%C0)
- 1 MNP 5 (%C1)
- 2 V.42 bis (%C2)
- **3** MNP 5 and V.42 bis (%C3) (**default**)

Bits 2, 6 Auto retrain and fallback/fall forward (%En)

- 0 0 Retrain and fallback/fall forward disabled (%E0)
- 0 1 Retrain enabled (%E1)
- **1 0** Fallback/fall forward enabled (%E2) (**default**)

Bits 3 – 5, 7 Reserved.

S46 – Data Compression Control (analogue)

S46 controls selection of compression. The following actions are executed for the given values:

S46	
136	Execute error correction protocol with no compression.
138	Execute error correction protocol with compression. (**default**)

S48 –V.42 Negotiation Control (analogue)

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if so desired.

S48	
0	Disable negotiation; bypass the detection and negotiation phases; and proceed with LAPM.
7	Enable negotiation. (**default**)
128	Disable negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S36. Can be used to force MNP.

S86 – Call Failure Reason Code (analogue)

When the internal analogue modem issues a NO CARRIER result code, a value is written to S86 Register to help determine the reason for the failed connection. S86 records the first event that contributes to a NO CARRIER message. The S86 register is only updated when the NO CARRIER is sent as result from a broken connection to an analogue subscriber. The code definitions are:

S86	
0	Normal hangup,no error occurred.
1	Reserved.
2	Reserved.
3	Call Waiting caused disconnect.
4	Physical carrier loss.
5	No error correction at the other end.
6	No response to feature negotiation.
7	This modem is async only; the other modem is sync only.
8	No framing technique in common.
9	No protocol in common.
10	Bad response to feature negotiation.
11	No sync information from the remote modem.
12	Normal hang-up initiated by the remote modem.
13	Retransmission limit reached.
14	Protocol violation occurred.
15	Lost DTR.
16	Received GSTN clear down.
17	Inactivity timeout.
18	Speed not supported.
19	Long space disconnect.
20	Key abort disconnect.
21	Clears previous disconnect reason.
22	No connection established.
23	Disconnect after three retrains.
24	Call Waiting tone detected.
25	Extension pickup detected.
26	Remote hang-up detected.

S90 – Last incoming ISDN calling number (CLIP)

S90 displays the ISDN line identification of the last incoming call.

S91 – PSTN Transmit Attenuation Level (analogue)

S91 sets the transmit attenuation level from 0 to 15 dBm for the PSTN mode, resulting in a transmit level from 0 to – 15 dBm.
Default: 13.

S93 – Unknown AT command handling

Controls the response to unknown AT-commands

0	Undefined AT commands will be responded to with ERROR (**default**)
1	Undefined AT commands will be responded to with OK

S210 – V.34 Symbol Rates (analogue)

The bits in this parameter control V.34 symbols rates and enables/disables V.34 asymmetric rates. This parameter is used for diagnostic purposes only.

Bits 0 – 2

Selects the range of allowed V.34 symbol rates.

Bit			Symbol Rates (baud)
2	1	0	
0	0	0	2 400 only
0	0	1	2 400 only (no 2 734)
0	1	0	2 400, 2 800
0	1	1	2 400, 2 800, 3 000
1	0	0	2 400, 2 800, 3 000, 3 200
1	0	1	2 400, 2 800, 3 000, 3 200, 3 429 (**default**)

Bit 3

Enable/disable V.34 asymmetric rates.

0 = Disable asymmetric rates

1 = Enable asymmetric rates (**default**)

Bits 4 – 7 Reserved.

Default: 13.

Table 1 S-registers

Short Form	Long Form	Description	Note
0	OK	A command line has been executed	
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) or if the the call was to an analogue destination. Replaces BUSY and NO DIALTONE. Dependent on ATXn setting. Also sent when the modem auto-disconnects due to loss of carrier.	
4	ERROR	Illegal command or error that can not be indicated otherwise e.g. 1. The command line contains a syntax error. 2. The modem cannot execute a command contained in the command line, i.e., the command does not exist or is not supported. see register S93 3. A command parameter within the command line is outside the permitted range.	
5	CONNECT 1 200 <*rn*>	A connection with a line speed of 1200 bit/s has been established. (V110 or analogue connection)	
6	NO DIALTONE <*xx*>	No access to ISDN network (xx = ISDN error)	
7	BUSY<*xx*>	Number engaged (xx = ISDN error cause)	

Table 2 cont.

Short Form	Long Form	Description	Note
8	NO ANSWER<*xx*>	No connection; called number can not be reached (xx = ISDN error cause) or if the the call was to an analogue destination. The modem is attempting to originate a call if a continuous ringing signal is detected on the line until the expiration of the timer S7.	
9	CONNECT 600 <*rn*>	Connection, line speed 600 bit/s.	1
11	CONNECT 4 800 <*rn*>	Connection, line speed 4 800 bit/s. (V.110 or analogue connection)	
12	CONNECT 9 600 <*rn*>	Connection, line speed 9 600 bit/s. (V.110 or analogue connection)	
13	CONNECT 7 200 <*rn*>	Connection, line speed 7 200 bit/s.	1
14	CONNECT 12 000 <*rn*>	Connection, line speed 12 000 bit/s.	1
15	CONNECT 14 400 <*rn*>	Connection, line speed 14 400 bit/s.	1
16	CONNECT 19 200 <*rn*>	Connection, line speed 19 200 bit/s. (V.110 or analogue connection)	1
19	CONNECT 64 000 <*rn*>	Connection, line speed 64 000 bit/s.	
59	CONNECT 16 800 <*rn*>	Connection, line speed 16 800 bit/s	1
61	CONNECT 21 600 <*rn*>	Connection, line speed 21 600 bit/s	1
62	CONNECT 24 000 <*rn*>	Connection, line speed 24 000 bit/s	1
63	CONNECT 26 400 <*rn*>	Connection, line speed 26 400 bit/s	1
64	CONNECT 28 800 <*rn*>	Connection, line speed 28 800 bit/s	1
84	CONNECT 33 600 <*rn*>	Connection, line speed 33 600 bit/s	1
91	CONNECT 31 200 <*rn*>	Connection, line speed 31 200 bit/s	1

Note 1. Analogue modem result code.

4.1 Call number display

In AT command mode, call number display (does not belong to the AT command standard) 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 signalling in D-channel.
If the IDW-90 is used with 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>***

4.2 Error cause display

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 84). All other causes are CAPI error causes (see page 91).

4.3 Serial status lines

The behaviour of the output serial status lines DSR, CTS, DCD, RI and the input serial status lines DTR, RTS can be configured with AT and configurator commands

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 IDW-90 firmware. With regard of this behave the maximum input level change must be lower than 1kHz.

The RS-232 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).

Table 3 Serial status line control

Status line	Description	no connect	dial/disc.	connect
CTS	0: CTS follows RTS	=RTS/flc.*	=RTS/flc.*	=RTS/flc.**
	1: CTS always ON	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 this data to the destination side. A delay of (configured "txfwd" time + 10ms) between sending the last data byte and dopping 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 this 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 IDW-90 (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 characters 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 becomes 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 becomes active during an incoming call request.
If the incoming call will be accepted or the call request ended the RI control circuit goes off.

4.4 ISDN access control

Using these commands you can setup a table, to allow only dedicated callers to get a connection to the IDW-90.
If this list is empty (**default**) or one entry is set to star (*), any incoming call is allowed. Every incoming call that does not fit to one of the entries of acctab will be ignored. The received calling party number is compared to every entry starting at the last digit and is stopped when the shorter number is completely compared.

acctabx nn/ss	set entry number x to ISDN number nn and subaddress ss
acctabx -	clear entry number x
acctabx *	allow all incoming calls to be accepted
acctabx	show entry number x
acctab	show all entries

Maximum number of entries = 5; x = 1..5
Maximum length of ISDN number = 20 digits
Maximum length of subaddress = 20 digits
The ISDN number nn can contain wildcards:

* : represents one or more digits
? : represents exactly one digit

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

Examples:

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

Note: If you are not sure in which format the calling number will be presented with an incoming call, please use the command ATW1 to see the the format of the calling number in the RING message. This number can be entered into the acctab.

4.5 Sub addressing

With outgoing and incoming calls the transmission of subaddresses can be performed using the ISDN supplementary service SUB. The subaddress is transmitted transparently from the calling party to the called party before the B channel connection is fully established.
Please note, that this ISDN service typically has to be enabled by the ISDN service provider and may be charged additionally.

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

The functionality Subaddressing can be used with the dialling procedures AT-command set, and automatic call.

Examples:

ATDisdnnumber[/subaddr]

isdnnumber	Dialling called party number
subaddr	Called subaddress

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

rn	Calling party number
subaddr	Calling party subaddress

The calling subbaddress can be set up using the configuration commands **subi** and **subo**.

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

4.6 Automatic call establishment "Hotline" call

Automatic call establishment can be activated in three ways:

1. Initiated by an activation of the DTR control line (**cmds= 6**).
2. Initiated by activity of the Data line from DTE (**cmds=7**), autobauding is disabled in this mode.
3. Initiated at power on reset, "always on" (**cmds=8**).

Autobauding is not supported when cmds is set to 6,7 or 8. Please select a baudrate with DIP-switches or AT command. If autobauding is selected DTE baudrate will be set to 9600 bit/s (br=4).
The status line DCD/DTR can be used to indicate a successful connection, (see command **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 dialled numbers are taken from the table **catab**, all numbers from the call table catab will be taken one after each other. The parameter **cato** sets the timeout for establishing the call, **capa** the pause between call attempt and **catry** the number of retries.
The call can be disconnected through deactivating DTR see **cdtr** parameter, or through using the inactivity timer **idle**.
To return to the AT- or Configurator command set the DIP-switches can be used SW3:5-SW3:7.

4.7 Transparent I/O

4.7.1 Digital Input

The digital input gives the following functionality:

1. Establishing a data connection to a predefined target number.

When the input is switched (pulsed), the modem will establish a data connection to the stored predefined number. After a time, specified in the modem, without data exchange, the connection shall be released (inactivity timer).

2. Sending a SMS Message to a predefined targetnumber.

When the input is switched (pulsed), the modem will establish a connection to an SMS service centre defined by a predefined number. The SMS Messages can handle at least 160 characters. TAP and UCP protocols is supported.

3. Sending a Text Message to a predefined targetnumber.

When the input is triggered, the modem establishes a connection to the stored telephone number and send out a short text message.

4. Switch the remote digital output.

When the input is triggered, the modem establishes a connection to the stored number of a remote unit and sends out a command, that switches (pulses) the remote output according to a predefined sequence.

5. Execute AT-Command string

Execute a pre-programmable AT command string stored in the table of entries. This can for example be used for switching DTE communication parameters for online an offline mode by using two entries

6. Transparent I/O

When the input is triggered, the modem establishes a connection to the stored number of a remote unit and sends out a command. After a connection is established, the I/O is bi-directional

4.8 Digital Output

The digital output gives the following functionality:

1. Change over contact (SPDP).
2. Remote controlled.
   - Transparent I/O transfer
   - Static set ON/OFF
   - Pulsed via string pattern "101.."
3. Follow DCD or DTR.

1. Output Contact

The output shall have the possibility to switch if an incoming call is detected. This will be detected via an incoming ring signal. It will be controlled via an AT-Command or a S-register.

2. Remote controlled

The output can be programmed to follow a remote modem data input. A remote unit can also set/reset the output as well as transferring a sequence of set- and resets of the output.

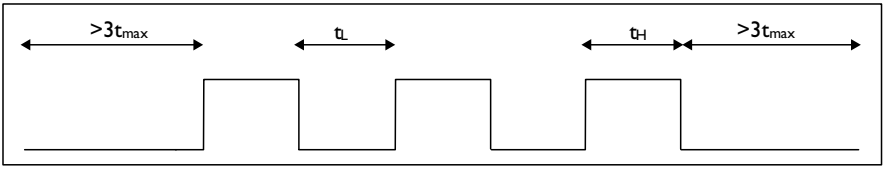
3. Follow DCD/Network

The output can be programmable to follow the local DCD or DTR signal.

To accept any operation on the output from remote modems the "Remote IO Enable" DIP switch must be set "ON"

5. Input Pulsing

For the pulsing of an input, some timings must be kept. The parameters t_{min} and t_{max} are programmable from 10 to 2550 s. When determining the number of pulses there must be more than $3t_{max}$ separating the pulse sequences. If a pulse is in active state for more than $3t_{max}$ counting is restarted. When the input has been in its inactive state for more than $3t_{max}$ after, x valid pulses, the number of pulses counted is accumulated.



$t_{min} < t_L < t_{max}$

$t_{min} < t_H < t_{max}$

5.1 Using Multilink PPP

To enable Multilink PPP handling within the IDW-90 please enable the B channel protocol ML-PPP: **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
  1. MD5 according to RFC 1321
  2. 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..

5.1.1 Restrictions on Windows95

The CHAP protocol requires that the local side (PC or TA) responds with the proper, encrypted password when 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.

5.2 Bandwidth on demand ("BOD")

Enabling this feature will cause the IDW-90 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.

5.3 IDW-90+Configurator command set

The settings of the IDW-90 for the serial interface and the S0 interface are called configuration. The IDW-90 is delivered with a set of pre-set values. The following section shows how the configuration commands allow viewing and alteration of the of the IDW-90 configuration. The values can be stored in non volatile memory, such that they will remain unchanged even if the power supply is disconnected.

The IDW-90 can be configured in the following ways:

- by using IDW-90+ Configurator commands entered by a locally connected PC.
- by using IDW-90+ Configurator commands entered via the ISDN access (remote configuration).
- by using the AT command set entered by a locally connected PC.
- By setting DIP-switches.

The configurator can be entered in the following ways:

- remotely via ISDN by using the ATD<*CALLEDnumber*>e command
- remotely from any modem by using the remote access escape sequence '++++' and log on to the remote access configurator
- by using a special command from the asynchronous DTE command interface (AT: "ATCONF").

5.4 Configuring the IDW-90 with AT commands

To execute one IDW-90+configuration command cmd from the AT command mode, issue the command: "**at**cmd**" .
To call up the IDW-90+configurator please use the command "**atconf**".
Now leave the IDW-90+configurator by the command "**quit**".
Note: After altering one of the profile values **you have** to give the additional commands ***save*** and ***go***. This is necessary to save and activate these new parameters.

5.5 Configuration using the IDW-90+Configurator commands (remote)

There are two methods to remotely configure an IDW-90. Both methods are described here for backward compatibility and compatibility with other Westermo modem products. Method 1 has the advantage that its transparent on the remote site and can even be performed when the remote IDW-90 is connected on the other B-channel.
Method 2 has the advantage that configuration can be made from any ISDN terminal adapter or modem supporting analogue modulation (PSTN or GSM).

5.5.1 Method 1

The IDW-90 to be configured is referred here as "remote IDW-90".
The IDW-90 to configure is referred as "local IDW-90".
Please make sure that the remote IDW-90 is connected to the ISDN line and powered up.

- Connect the local IDW-90 to ISDN interface
- Connect the PC's COM port to the DTE interface of the local IDW-90.
- Connect the power supply to the mains socket.
- Start a terminal emulation program (i.e. Windows-Terminal)
- Configure the local IDW-90 with the B channel protocol X.75 and blocksize 2048.
- Set up an ISDN connection to the remote IDW-90 to be configured by using the command: ATD<*ISDN-No*>e<*CR*>. The extension "e" at the end of the calling number gives a connection to the internal remote access of the remote IDW-90. The called IDW-90 configurator acknowledges by requesting the remote password. Enter the correct password (**default**: no password, just return). Now work with the configurator by using the IDW-90+Configurator commands.
- Configure the parameter for the remote IDW-90 from your terminal program and store them (if required).

  Example:
  To change the used B channel protocol to X.75 enter the following commands:
  prot 10<*CR*> (set protocol to X.75 – blocksize 2048)
  save<*CR*> (save the new configuration)
  Hint: The active set of parameters can be displayed on screen by the configurator with the command "**show<*CR*>**".
  If necessary the remote IDW-90 can be reset using the command "**reset<*CR*>**".
- Hang up the ISDN connection by leaving the configurator using the command **quit**. Leave your terminal program. After the next reset the changes will be active.

Now the configured remote IDW-90 with the new set of parameters can be used.

5.5.2 Method 2

The IDW-90 to be configured is referred here as "remote IDW-90".
The modem used to configure is referred as "local modem".
Make sure that the remote IDW-90 is connected to the ISDN line and powered up.

- Connect the local modem to its media (ISDN, PSTN or GSM)
- Connect the PC's COM port to the DTE interface of the local modem.
- Connect the power supply to the mains socket.
- Start a terminal emulation program (i.e. Windows-Terminal)
- Configure the local modem protocol
- 1. If local connection is ISDN, configure with the B channel protocol X.75 and blocksize 2048.
- 2. If local connection uses some analogue modem no special configuration needs to be done at remote IDW-90.
- Set up an ISDN connection to the remote IDW-90 to be configured by using the normal dial command: ATD<*ISDN-No*><*CR*>. When connected send the remote escape sequence <++++>. The called IDW-90 configurator acknowledges by requesting the remote password. enter the correct password (**default**: no password, just return). Now work with the configurator by using the IDW-90+Configurator commands.
- Configure the parameter for the remote IDW-90 from your terminal program and store them.
- Example:

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

prot 10<*CR*> (set protocol to X.75 – blocksize 2048)
save<*CR*> (save the new configuration)

Hint: The active set of parameters can be displayed on screen by the configurator with the command "**show<*CR*>**".
If necessary the remote IDW-90 can be reset using the command "**reset<*CR*>**".

- Hang up the ISDN connection by leaving the configurator using the command **quit.** Leave your terminal program. After the next reset the changes will be active.

Now the configured remote IDW-90 with the new set of parameters can be used.

5.6 Remote access control

By using the following commands a table can be set up which allows 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 match one of the entries of racctab will be rejected with the ISDN cause "call rejected".

racctabx	nn/ss	set entry number x to ISDN number nn and sub address ss
racctabx	-	clear entry number x
racctabx	*	Allow all incoming calls to be accepted
racctabx		Show entry number x
racctab		Show all entries

Maximum number of entries = 5
Maximum length of ISDN number = 20 digits
Maximum length of sub address = 20 digits
The ISDN number can contain wildcards:

*: represents one or more digits
?: represents exactly one digit

Example:

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

5.7 List of IDW-90+Configurator commands

The IDW-90+Configuration 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 values in **bold** 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

Some major IDW-90+ commands are shown here as a preview:

show	show the normally used parameter
showall	show all changeable parameters
quit	leave IDW-90+Configurator
help	show all available commands
defa	setup default parameter set
defa 1	setup factory default parameter set
save	store parameter (non volatile)

<*cmd*>? – More information for one command

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

Table 4 List of Configurator commands

Configurator Command	Description
acctab	Isdn access control
atsx, atopt, atrej	AT command parameter set
autoreset	TA reset option
bc	Bearer capability
bod	Bandwidth On Demand enable
bodiv	BOD increase value
bodit	BOD increase timer
boddv	BOD decrease value
boddt	BOD decrease timer
br	Baudrate asynchronous
brn	Line baudrate asynchronous V.110
bsize	Frame length
catab	Automatic call table
cato	Call timeout to abort
capa	Call pause
catry	Calls retry
ccts	CTS control
cdcd	DCD control

Configurator Command	Description
cdsr	DSR control
cdtr	DTR control
chappwd	Set password for PPP chap authorisation
cipm	Cip value mask
cipo	Cip value outgoing
cmds	Command set (note 1, page 85)
dabort	Dial abort
dbits	Asynchronous databits
defa	Default settings
dhtc	Highest 2-way channel (X.25 D channel)
dltc	Lowest 2-way channel (X.25 D channel)
dte	B channel link address
flc	Flow control
ftei	Tei value point to point, fixed tei
fwload	Load new firmware
fwstart	Start new firmware
htc	highest 2-way channel (X.25 B channel)
hlc	Higher layer compability
help	
idle	Idle data timeout
iinit	ISDN initialisation after power ON
isdn	ISDN D channel protocol
k	Windowsize
lcgr	Logical group number X.25
llc	Low layer compatibility
load	Load stored parameter setting
loadsw	load DIP-switches parameter setting
msni	Multiple Subscriber Number for incoming calls
msno	Multiple Subscriber Number for outgoing calls
nui	Nui and password
prot	B channel protocol
prty	Asynchronous parity
ptp	ISDN interface type
pvc	X.25 connections permanent virtual circuits usage
quit, exit	Activate parameter changes
racctab	Access table setup for remote access
reset	Reset IDW-90
ridle	Idle data timeout for remote connection
ringtimer	Delay of RING messages
rmsg	Message for remote access
rmsn	Multiple Subscriber Number for remote

Configurator Command	Description
rstmsg	Startup message
rsttim	Startup timer
rsub	Subaddress for remote access
save	Store parameter changes
sbits	Number of stopbits.
sertrc	Serial link trace
show	Show parameters
showall	Show all parameters
status	Status of serial line and ISDN
subi	Sub address for incoming calls
subo	Sub address for outgoing calls
swstatus	TA-DIP Switches status
tdi	Timer delay incoming call
tei	TEI value
trcnnn	commands for internal trace
txfwd	Timer for data forwarding
t320	Timer delay ISDN disconnect
v110llc	Usage of LLC for V.110 connections
v110flc	Usage of V.110 flowcontrol
*wcb	Callback security
*wcbpwd	Callback/secure access password
*wcbtab	Secure callback table
*wiod	General IO delete entry
*wiol	General IO list
*wiot	General IO test
* wrap	Remote access password
w	B channel windowsize L3
xnr	Own X.25 address

acctab – isdn access control

Using these commands a table can be set up which allows only dedicated callers to get a connection to the TA.

acctab**x nn/ss**	set entry number **x** to ISDN number **nn** and subaddress **ss**
acctab**x -**	clear entry number **x**
acctab**x ***	Allow all incoming calls to be accepted
acctab**x**	show entry number **x**
acctab	Show all entries

Note: for a detailed description see section "ISDN access control" on page 39

atsx, atopt, atrej – AT command parameter set

AT command set only:

Handle AT specific settings.

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

ats0	show setting of S0-Register
ats0=1	set Register S0 to 1
atopt	show option register (bit-values):
	bit 0 : 01 => ATV1
	bit 1 : 02 => ATW1
	bit 2 : 04 => ATQ1
	bit 3 : 08 => ATE1
	bit 4 : 10 => ATS9=0
atrej	show reject register => setting of AT#R (0,1)

autoreset – TA reset option

The autoreset command has a default value of 0, but if the value is 1 then the unit will reset every time a disconnect occurs.

If the value is more that 1 and less that 255 the unit resets periodically by the number of minutes specified by this command.

Example: autoreset=**0** (**default**)

autoreset=1

autoreset=20

bc – Bearer capability

Bearer capability for outgoing data calls.

bc = 0000 (**default**)

bod – Bandwidth On Demand enable

0 disable BOD (**default**)

1 enable BOD

bodiv – BOD increase value

bodiv=<*incrValue*> Sets the bit-rate in kbit/s at which a second B channel is connected (**default**=40).

bodit – BOD increase timer

bodit=<*incrTime*> Sets the time in seconds the bit-rate has to exceed the increase value before the second B-channel is connected (**default**=30)

boddv – BOD decrease value

boddv=<*decrValue*> Sets the bit-rate in kbit/s at which the second B channel is disconnected (**default**=40).

boddt – BOD decrease timer

boddt=<*incrTime*> Sets the time in seconds the bit-rate has to be below the increase value before the second B-channel is disconnected (**default**=30)

br – Baudrate asynchronous

Selection of the asynchronous baudrate for the DTE interface

0: Autobauding, (automatic local bit rate adaption) (**default**)
1: 1 200 bit/s
2: 2 400 bit/s
3: 4 800 bit/s
4: 9 600 bit/s
5: 19 200 bit/s
6: 38 400 bit/s
7: 57 600 bit/s
8: 115 200 bit/s

Note: Autobauding (br = 0) is available for AT command set only.

brn – Line baudrate asynchronous V.110

Selection of the asynchronous baudrate for V.110 line (B channel)

0: Line baudrate equals local baudrate (**default**)
1: 1 200 bit/s
2: 2 400 bit/s
3: 4 800 bit/s
4: 9 600 bit/s
5: 19 200 bit/s
6: 38 400 bit/s

bsize – Frame length

Maximum length of a data frame (**default** 2048)
Note! changing the B-channel protocol will affect the bsize parameter.
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 – Automatic call table

With this command the priority table of automatic DTR and TxD calling number is set-up.
The IDW-90 will call the numbers defined in order from catab1 to catab3 until a connection is established. The character # is used as prefix to signal that the call shall use an analogue connection.

catabx	nn	set entry number x to receiver number nn.
catabx	-	clear entry number x
catabx		show entry number x
catab		show all entries

Maximum number of entries = 3
Maximum length of number = 20 digits.

In example below entry 1 tells IDW-90 to make a call using the analogue modem, while entry 2 and 3 making ISDN –ISDN connections.

Example:

```
catab1 #00461661200
catab2 004616480250
catab3 0123987652
```

cato – Call timeout to abort

Time to abort a call if not successfully connected after n seconds.
n = 3..255, (**default** 15 s).

capa – Call pause

Automatic call: set a call pause for n seconds before next call attempt.
n = 0 .. 255, n=0 no call retry, (**default** 3s).

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: CTS always ON (**default**)
2: CTS follows DTR
See also 4.3 Serial status lines

cdcd – DCD control

DCD control
0: DCD always ON
1: DCD indicates a connection (**default**)
2: DCD follows DTR
3: DCD indicates link level established (X.31-D only)
See also 4.3 Serial status lines

cdsr – DSR control

DSR control

0: DSR always ON (**default**)
1: DSR indicates a connection
2: DSR follows DTR

See also 4.3 Serial status lines

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 is evaluated:
Incoming calls will be accepted independent of DTR
status; DTR drop disconnects an active connection

See also 4.3 Serial status lines

chappwd – Set password for PPP chap authorisation

(only required for WINDOWS 95)

Enable ML-PPP CHAP authorisation 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 unauthorised persons.

cipm – cip value mask

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** 00010016h).

Example: cipm=00010016: Accept analogue incoming calls
cipm=00000001: Accept all incoming calls.

See also AT command AT#C1.

cipo – cip value 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** 0002h).

Example: An outgoing call as a voice call: cipo =0004.

See also AT command AT#C2.

cmds – Command set (note 1, page 85)

Command set for connection control

0: AT command set (**default**)
6: Automatic dialling when DTR is set
7: Automatic dialling when TxD is received by the IDW-90
8: Automatic dialling always connect
10: IDW-90+Configurator
12: Incoming calls only (no active connections)

dabort – Dial abort

Dialling will normally be aborted by characters coming from the DTE, by setting parameter dabort =0 characters received during the dial procedure will be ignored.

0: Dialling will not be aborted by incoming characters.
1: Characters from DTE aborts dial during the connection process (**default**).

dbits – Asynchronous databits

Number of data bits asynchronous chars (**default:** 8) 7, 8

defa – Default settings

Sets up factory default parameter setting.

defa 0: setup all parameters concerning data port
defa 1: setup all parameters 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

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

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).

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

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

flc – Flow control

Flow control to DTE

0: No flow control
3: Hardware flow control RTS/CTS (**default**)
4: Software flow control XON/XOFF
5 : Hardware flow control RTS/CTS in data mode and command mode

For further information see also chapter 4.3 Serial status lines

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 become active after sending "save" command and a reset of the TA.

fwload – load new firmware

This commands loads new firmware into the TA without starting the new firmware.
For transferring the firmware file XMODEM1K protocol is used.
The firmware will be stored into the upper unused part of the flash memory.
While uploading the following checks will be performed:

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

fwstart – start new firmware

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 with 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.

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

hlc – Higher layer compability

Higher layer compatibility for outgoing call.
(see Note 2 page 81)

help

Displays help texts for all commands

idle – Idle data timeout

Timer to disconnect the ISDN B channel connection after inactivity.

0: inactive (**default**)
1..n: delay time to disconnect , n=1 to 255. (10..2550 s).

iinit – ISDN initialisation after power ON

Defines the behavior of the TA after Reset. If set to 1 the ISDN interface will automatically be activated after Power ON. As a result, the LED L1 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 LED L1 will stay blinking until 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

Selects ISDN D channel protocol

- **0**: DSS1 (Euro-ISDN) (**default**)
- 12: leased line with usage of just B channel B1.
- 13: leased line with usage of just B channel B2.

k – Windowsize

Layer-2 protocol: windowsize (**default:***7*). k = {1..7}
Value will be automatically changed with changing B channel protocol.

lcgr – Logical group number X.25

Logical group number for X.25 packet layer protocol.
lcgr = {0..255}, **default:** 0

llc – Low layer compatibility

Low layer compatibility for outgoing calls (Hex bytes)
(see note 2 and 3, page 81)

load – Load stored parameter setting

All parameters stored in non volatile RAM will be loaded.

loadsw – load DIP-switches parameter setting

Parameters entered via the DIP-switches will be loaded and active in the same manner as at power up.

msni – Multiple Subscriber Number for incoming calls

Own MSN (Multiple Subscriber Number) for incoming calls.

msni *	global msn, all incoming calls will be accepted. (**default**)
msni nn	set "msni" to nn = string of digits (max length = 22)
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. (**default**)
msno nn	set "msno" to nn = string of digits (max length = 22)
msno	show current setting of "msno".

nui – Nui and password

Setup nui and password sent with an outgoing X.25 call packet.
nui and password has to be entered as ASCII characters.
(X.25 B channel and X.31 D channel only).

prot – B channel protocol

Transmission protocol for data transfer

-0:	V.110 asynchronous	(Mainly for access to GSM network)
-3:	HDLC async to sync	(Async PPP to sync PPP, conversion single link i.e. for Internet / PPP dial-up network access)
-4:	HDLC transparent	(octets are packed into HDLC frames)
-5:	Byte transparent	(raw B channel data)
10:	X.75- SLP	(For file and data transfer i.e. for BBS access, (**default**)
13:	V.120	For file and data transfer i.e.AOL/CompuServe access
20:	X.31 B channel	(X.25 B channel, access to X.25 packet switched network over B-channel)
21:	X.31 D channel	(X.25 D channel, access to X25 packet switched network over D-channel
31:	ML-PPP	(ML-PPP, Async to sync PPP conversion in Multilink PPP mode, for internet access)

prty – Asynchronous parity

Parity of asynchronous character (**default**: no parity)

0: No parity.
1: Even parity.
2: Odd parity

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)

pvc – X.25 connections permanent virtual circuits usage

Enable usage of permanent virtual connections instead of switched logical connections. X.25 channel number 0 will be used.

pvc = 1: enable (**default** 0)

quit, exit – Activate parameter changes

Activates the actual parameter settings and leave the 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 IDW-90.

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 page 47

reset – Reset IDW-90

Resets the whole functionality of the IDW-90 by forcing a hardware reset.

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**)

ringtimer – Delay of RING messages

Delaytime between two RING messages, if S_0 register is set not equal to 1, value in 100 ms. **Default** 50 (5 seconds).

rmsg – Message for remote access

Controls whether a message for establishment or??disconnect message on the remote port, If display enabled "rmon" for established and "rmoff" for disconnected remote configuration access is sent out on the remote local port. ??????????

0: display no messages (**default**)
1: display messages

rmsn – Multiple Subscriber Number for remote

MSN (Multiple Subscriber Number) for remote configuration

*: no specific MSN, all incoming calls accepted

rmsn *	global msn, all incoming remote calls will be accepted. (**default**)
rmsn nn	set "rmsn" to nn = string of digits (max length = 22)
rmsn -	no acceptance of incoming remote calls
rmsn	show current setting of "rmsn".

rstmsg – Startup message

Startup message:
"+++ Press <*CR*>, <*CR*>, <*ESC*>, <*ESC*> to enter IDW-90+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 sent after power on. (**default**)
1: active, startup message will be sent 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)

rsub – Subaddress for remote access

SUB (sub address) for remote configuration

*: no specific SUB, all incoming calls accepted (**default**).

rsub *	global SUB, all incoming remote calls will be accepted, (**default**).
rsub nn	set "rsub" to nn = string of digits (max length = 22)
rsub -	no acceptance of incoming remote calls
rsub	show current setting of "rsub".

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 IDW-90.

save – Store parameter changes

Stores the actual set of parameters in non volatile memory.

sbits – Number of stopbits.

Sets the number of stopbits 1 or 2, (**1 default**).

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, 1, 2, **3**
(**Default** 3, enable serial data and status lines).

show – Show parameters

Displays the actual set of parameters, see &V1.

showall – Show all parameters

Displays all the accessable parameters

status – Status of serial line and ISDN

Returns the status of the serial line and ISDN channels.
Example: current status information IDW-90

Current status information IDW-90
serial line: DTR:on, RTS:on, DSR:on, CTS:on, DCD:off, RI:off
ISDN: L1:down
Dch: Prot:DSS1 State:disconnected, CdPN:, CgPN:, prev error: 0
Bch: Prot:X.75 SLP State:disconnected, CdPN:, CgPN:

subi – sub address for incoming calls

Own SUB (sub address) for incoming calls.

subi *	global subi, all incoming calls will be accepted, (**default**).
subi nn	set "subi" to nn = string of digits (max length = 22).
subi -	no acceptance of incoming calls.
subi	show current setting of "subi".

subo – sub address for outgoing calls

Own SUB (sub address) for outgoing calls.

subo nn	set "subo" to nn = string of digits (max length = 22).
subo -	no use of "SUB" value for outgoing calls, (**default**).
subo	show current setting of "subo".

swstatus – TA-DIP Switches status

Returns the status of the TA-Configuration switches.
This command has the same function and result as ATI7 command.

See ATI7 command for presented result.

tdi – Timer delay incoming call

Delay time between receiving ISDN incoming data call and signalling via RING or CONNECT message.

0: no delay (**default**)
1..n: delay time in 50 ms ticks. VAD är MAX n

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**)

trcnnn – commands for internal trace

The usage of the commands for internal trace are described in chapter 9.

txfwd – Timer for data forwarding

If no character is entered within the defined period, the received data will be transmitted to the ISDN using the selected transmission protocol. (comparable to the functionality of X.29 parameter 2, data forwarding timer)

0:	minimum delay time (appr. 10 ms)
1..n:	delay time in 50 ms ticks. (**default: 1**)

Note: Valid for AT command set and X.25 B channel or X.25 D channel only.

t320 – Timer delay ISDN disconnect

Delay time between the clear message of the last X.25 connection and an automatic ISDN disconnect. Only valid for X.25 B channel.

0: immediate ISDN disconnect (**default**)
1..n: delay time in seconds (1..254).
255: immediate ISDN disconnect

Note: The released X.25 connection will be signalled due to the selected mode (via response "NO CARRIER", CLR xxx or DCD goes inactive). The unreleased ISDN connection is not signalled, also the released ISDN connection has no signal.

v110llc – Usage of LLC for V.110 connections

If set the LLC parameter will be used for incoming and outgoing V.110 connections.

0: LLC is ignored and not created
1: Ougoing 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

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

***wbrk – break and data packing**

0: Break and data packing disabled. Break detected on the DTE side ignored. (**default**)
1-255: Break and data packing enabled . When a break is detected on the local DTE side the modem will send a break to the remote side. The length of the break is set in increments of 10ms according to this parameter (10 – 2550 ms). The parameter set the break length at the local modem.

When the "Break and data packing" is enabled data are packaged in frames before being transferred between the modems. Packing of data in frames enables the possibility to transfer break signals over the line independent of line protocol but will lower the transferee rate slightly. With that in mind the "Break and data packing" shall only be used when break handling over the line is necessary.
Note! Modem in both ends must have the *wbrk enabled but doesn't need to have the same parameter value.

***wcb – callback security**

The callback functionality makes the established link more secure. After an incoming call the adapter will make a callback to either a preconfigured number or to the incoming number. The callback can be protected by a password. The unit can also be configured for a secure access without callback.
If the password is enabled, the calling part will be prompted for the password directly after connection. When the password is entered correctly, the adapter will disconnect the current link and make a callback after a preconfigured number of seconds (configurator command: **capa** [**default** 3]).
If the unit is configured as "secure access", it will allow data only after the password is correctly entered.
After 3 retries of entering wrong password or after 60 seconds, the link will be disconnected and the callback/secure access aborted.
The number to callback must be entered in the ***wcbtab number table** (***wcbtab1, *wcbtab 2 or *wcbtab 3**).
The passwords is stored in: ***wcbpwd1, *wcbpwd2** or ***wcbpwd3**.
When making a callback to a number stored in *wcbtab, the password in *wcbpwd1 is connected to the number in *wcbtab1 (and *wcbpwd2 to *wcbtab2 and *wcbpwd3 to *wcbtab3)
A callback to an analogue modem can be done with ID90-V90 and by storing an '#' before the number in catab. (see also the catab command in this manual)
For an even more secure connection the ***wcb** can be combined with the **acctab** command.

Callback control:

0: callback disabled (**default**)
1: callback enabled, No password needed, callback number only in position1 in *wcbtab (wcbtab1)
2: callback enabled, No password needed, callback to incoming number
3: access security enabled, Password in one or more positions in wcbpwdx (x= 1, 2 or 3). If a correct password is detected the connection is opened without any callback
4: callback enabled, Password in one or more positions in *wcbpwdx (x= 1, 2 or 3), callback to number in wcbtab, (*wcbpwd1 corresponds to *wcbtab1...)
5: callback enabled, Password in one or more positions in *wcbpwdx (x= 1, 2 or 3), callback to incoming number
6: callback enabled, Password in one or more positions in *wcbpwdx (x= 1, 2 or 3), callback to number that is entered after password check is OK.

see also the following commands: *wcbtab, *wcbpwd, capa, acctab

***wcbpwd – callback/secure access password**

This command is used to store the password used in the callback and the secure access functionality.
Three different passwords can be stored.

Example:
*wcbpwd1=qwerty
*wcbpwd2=asdfgh
*wcbpwd3=zxcvbnm
*wcbpwd3=- Delete the password

The password may contain any writeable character.
The maximum number of characters is 20.
see also the following commands: *wcbtab, *wcb, capa

***wcbtab – Secure callback table**

This command is used to store the numbers used in the callback and the secure access functionality.
Three different numbers can be stored.
The character # is used as prefix to signal that the call will use an analogue connection

wcbtabx	nn	set entry number x to receiver number nn.
wcbtabx	-	clear entry number x
wcbtabx		show entry number x
wcbtab		show all entries

Maximum number of entries = 3
Maximum length of number = 20 digits.

In the example below, entry 1 tells IDW-90 to make a call using the analogue modem, while entry 2 and 3 are for making ISDN –ISDN connections.

Example:
wcbtab1 #00461661200
wcbtab2 004616480130
wcbtab3 0123987652

see also the following commands: *wcbpwd, *wcb, capa

***wdpp – data packing parameters**

Syntax: *wdpp=<*timeout*>, <*package length*>
*wiod=?

<*timeout*> This timeout gives the time triggering a package transfer. The timeout specifies in units of 10ms the maximum time between characters not triggering a package transfer. Legal values 1 to 9 (10 to 90 ms), **default** 10 ms.

<*package length*> This value specifies the maximum number of characters in each package. An elapsed timeout overrides the length value and forces a package transfer. Legal values ranging from 1 to 255 characters. (**default** 255)

Examples: Set timeout = 30ms and package length = 128 characters
*wdpp=3,128

OK
Request current setting
*wdpp?
*wiod: 3,128

OK

Request the format string
*wdpp=?
*wdpp: (1-9),(1-255)

OK

Result Codes: OK

ERROR Otherwise

***wiod – General IO delete entry**

This command deletes one or more IO entries in the list.

Syntax: *wiod=<*index*>[,<*stop_index*>]
*wiod=?
<*index*> Index of first entry to delete
[,<*start,stop*>] Last entry to delete

Examples: Delete entry 2
*wiod=2

OK

Delete entries 3,4,5,6,7
*wiod=3,7

OK

Request the format string
*wiod=?
*wiod: (1-10)[,(1-10)]

OK

Result Codes: OK

ERROR Otherwise

*wiol – General IO list

This command is used to program the list of IO entries with parameters and data. The list can contain up to 10 entries

Syntax:

Set up a service entry:
*WIOL=<*entry*>, <*service*>, <*flag*>, <*timeout*>, <*priority*>, <*data1*>, <*data2*>, <*data3*>, <*data4*>, <*data5*>, <*data6*>

Request the format string:
*WIOL=?
*WIOL : (1-10), (0-7),(0-3), (0-255), (0-1), (0-20 char), (0-160 char), (0-20 char), (0-2), (0-8 char), (0-20 char)

List all table entries. Listing will pause every 3rd entry and wait for any key hit to continue. ESC will terminate.

*WIOL?

List entry 3.
*WIOL=3?

<*entry*> IO entry number, up to 10 entries can be defined.

<*service*> IO entry service

0=NONE	No service defined for this entry
1=DIAL	Makes a connection to the number defined in <*data1*>.
2=SMS	<*data1*> Destination number of the SMS <*data2*> SMS-message <*data3*> SMS service provider number <*data4*> SMS protocol type (0=NONE, 1=UCP, 2=TAP) <*data5*> Password if required by provider.
3=TEXT	Make a connection to number defined in <*data1*> and transfer text defined in <*data2*>.
4=EMAIL	Reserved for future use, service not implemented.
5=OUT	Make a connection to the number defined in <*data1*> and set/pulse the remote output according to pattern defined in string defined in <*data2*>. The connection is terminated after the pattern is transferred.
6=CMD	AT command specified by <*data1*> is executed when the entry is triggered.
7=TRANS	Makes a connection to number defined by <*data1*>, IO is transferred transparently between the two units. The transparent mode must be ended by a timeout.

<flag> Defines whether the establishment of service shall be retried, the time between retries is controlled by register S7.

0=NO	No retry, tries once to perform requested action
1=RETRY	Retry infinitely to establish service according to current table entry.
2=RETRY_3	Do 1 try and max 3 retries.
3=NEXT_OK	If current service ends with OK the service specified by next table entry will be triggered. If fail to perform/establish the current entry service the unit will return to idle.
4=NEXT_ERR	The unit will execute service specified by next table entry if fail to perform/establish current service. If service according to current table entry terminates normally the unit will return to idle and wait for any new event trigger.

<timeout> Timeout is used in Dial and Transparent IO. The timeout is designed as an inactivity timer and will be retriggered for each Data / IO transfer. The timeout is the only normal way to terminate Dial and Transparent IO, see **Table 5** for reference of state after termination by timeout.
Setting a timeout for any other service than transparent IO will not cause any failure but will not have any function.

<timeout>	**Function of *<timeout>***
= 0	The service will not be terminated
= 1 – 255	The timeout is specified in units of 10s. Valid values 1 – 255 *10 s (10s – 2550s)

<priority> Priority of the service specified.

<priority>	**Function of *<priority>***
= 0	An existing connection will not be terminated. Retries will be made according to setting of *<flag>*, time between retries is set by register S7.
= 1	The current connection will be terminated before the connection specified by service is established.

<*data1*> The interpretation of this field depends on the service specified for the entry. The field accepts 0 – 20 characters.

Service	Function of <*data1*>	
DIAL	Number to connect to.	
SMS	Phone number of SMS receiver.	
TEXT	Phone number of TEXT receiver, if left empty the TEXT is sent out on the local DTE connection.	
EMAIL	Reserved.	
OUT	Phone number of the modem where the output shall be set. If <*data1*>, is empty the transfer will be to the local digital output.	
CMD	AT command string to be executed when the entry is triggered, can be used to modify the trigger condition.	
TRANS	Phone number of the modem to which the transparent IO should occur. For dependencies of other parameters and line type. See **Table 5**.	
	<*data1*> =number	Makes a connection to the number defined and start Transparent IO transfer between the two units.
	<*data1*>=empty	Transparent IO transfer will use an existing data connection.

<*data2*> Interpretation of field <*data2*> is also service dependent the size is 0 – 160 characters.

Service	Parameter <*data2*>
DIAL	Not used
SMS	The SMS message
TEXT	Text message
EMAIL	E-mail message
OUT	A sequence of "101.." to be transferred to the addressed output
CMD	Not used
TRANS	Not used

<*data3*> Field <*data3*> is only used for SMS and EMAIL service.

Service	Parameter <*data3*>
SMS	SMS provider number.
EMAIL	Reserved for ISP number

<*data4*> Field <*data4*> is only used for SMS and EMAIL service.

Service	Parameter <*data4*>
SMS	SMS protocol 0 = No protocol, 1= UDP, 2 = TAP
EMAIL	Reserved for mail protocol

<*data5*> Field <*data5*> is only used for SMS and EMAIL service.

Service	Parameter <*data5*>
SMS	Password for access to SMS provider
EMAIL	Reserved for password to mail server

<*data6*> Field <*data6*> is only used for EMAIL service.

Service	Parameter <*data6*>
EMAIL	Reserved for username to mail server

Table 5 Dial and Transparent IO connection types

Connected	Data 1	prio	Line Type	
No	Empty	No	LL	Illegal.
No	Empty	Yes	LL	Illegal.
No	Number	No	LL	Illegal.
No	Number	Yes	LL	Illegal.
Yes	Empty	No	LL	Normal Transparent IO over leased line. See **Note 1**
Yes	Empty	Yes	LL	Normal Transparent IO over leased line. See **Note 1**
Yes	Number	No	LL	Normal Transparent IO over leased line, number discard. See **Note 1**
Yes	Number	Yes	LL	Normal Transparent IO over leased line, number discard. See **Note 1**
No	Empty	No	CS	Error, try to establish service failed.
No	Empty	Yes	CS	Error.
No line	Number	No	CS	Normal Transparent IO over Circuit switched.
No line	Number	Yes	CS	Normal Transparent IO over Circuit switched.
Yes	Empty	No	CS	Use current connection for I/O transfer. The Empty data 1 will override priority. See **Note 1**
Yes	Empty	Yes	CS	Use current connection for I/O transfer. See **Note 1**
Yes	Number	No	CS	Due to that line is busy and no priority set the modem will retry connection according to <*flag*>.
Yes	Number	Yes	CS	Disconnect and dial Number.

LL = Leased line PSTN or ISDN

CS = Circuit switched PSTN, ISDN or GSM

Note 1 The existing data connection will be paused during transparent IO transfer. The modem will use the flow control specified by flow control command. If no flow control set DTE data will be discarded during the Transparent IO transfer. When the transparent IO transfer is terminated by timeout the connection will revert to data-mode and activate CTS / sending XON.

Example 1: Define entry #1 for SMS service with 3 retries, priority, receiver of SMS 016480251, message “Hello Westermo”, provider 00491712521002, TAP protocol, password PG1

*WIOL =1,2,2,0,1,0164251,Hello Westermo,00491712521002,2,PG1

OK

Example 2: Define entry #4 for Transparent IO service with retry for ever, priority, timeout 400s, remote modem number 016480250

*WIOL =4,7,1,40,1,016480250

OK

Exampel 3: List the entry table:
*WIOL?

1_Service= SMS
1_Flag= RETRY_3
1_Timeout=0
1_Priority=YES
1_Data1=016480251
1_Data2= Hello Westermo
1_Data3=00491712521002
1_Data4=TAP
1_Data5=PG1
1_Data6=
2_Service= DIAL
2_Flag=RETRY
2_Timeout=0
2_Priority=NO
2_Data1=12345
2_Data2=
2_Data3=
2_Data4=
2_Data5=
2_Data6=
.
.
10_Data5=
10_Data6=

OK

List entry 4
*WIOL=4?

4_Service=TRANS
4_Flag=RETRY
4_Timeout=040
4_Priority=YE
4_Data1=016428250
4_Data2=
4_Data3=
4_Data4=
4_Data5=
4_Data6=

Exampel 4: Read the format string.
*WIOL=?
*WIOL : (1-10), (0-7), (0-3), (0-255), (0-1), (0-20 char), (0-160 char), (0-20 char), (0-2), (0-8 char), (0-20 char)
*WIOL=<*entry*>, <*service*>, <*flag*>, <*timeout*>, <*priority*>, <*data1*>, <*data2*>, <*data3*>, <*data4*>, <*data5*>, <*data6*>

Request the format string:
*WIOL=?
*WIOL : (1-10), (0-7), (0-3), (0-255), (0-1), (0-20 char), (0-160 char), (0-20 char), (0-2), (0-8 char), (0-20 char)

OK

Result Codes: OK
ERROR Otherwise

*wiop – General IO parameters

This command set the IO parameters.

Syntax: *wiop=<*tmin*>, <*tmax*>, <*type*>, <*trig*>, <*norm*>
*wiop=?
*wiop?

<*tmin*> Min trig pulse time in 10 ms increments [1-255].
This parameter sets the minimum time the pulse must be active.
A pulse shorter than this time will be skipped.

<*tmax*> Max trig pulse time in 10 ms increments [1-255]
Sets the maximum active width of a pulse, if pulse is longer the pulse will be skipped.
The number of pulses will be calculated when the time between pulses is longer than 3 times tmin.

<*type*> Trig source and type

0=NO	Trigger not used
1=LEVEL	Trigger source is the Digital input Level or edge sensitive trigger
2=PULSE	Pulsed trigger used
3=DCD	Trigger internally coupled to reflect the DCD signal
4=DTR	Trigger internally coupled to reflect the DTR signal

<*trig*> Trigger level

0=NO	Trigger not used
1=HIGH	Defines that a High level triggers the service
2=LOW	Defines that a Low level triggers the service
3=POS	A positive edge triggers the service.
4=NEG	A negative edge triggers the service.

<*norm*> Normal inactivated state of the output as well as the source controlling the output.

0=NO	Output not used
1=IO operation	Controlled by remote IO Transparent or Out
2	Reserved
3=DCD	Output will be controlled by DCD. An active DCD will activate the output.
4=DTR	Output will be controlled by DTR. An active DTR will activate the output.

Examples: Set input min pulse width to 500ms max pulse width to 1s, triggered on high level and output to follow DCD

*wiop=50,100,1,1,3

OK

Change input type to be pulse triggered
*wiop=,,2,,

OK

*wiop?
*wiop :TMIN=50,TMAX= 100,TYPE=2,TRIG=1, NORM=3

OK

Result Codes: OK
ERROR Otherwise:

***wiot – General IO test**

This command executes the specified entry as if it was triggered by the normal trigger condition.

Syntax: *wiot =<*entry_num*>[,<IO_state>]
*wiot =?

<*entry_num*>	IO entry index number (0 – 10) 1 – 10 selects the entry at the corresponding index in the table. Selecting entry_num =0 selects the local output, the state of the output is selected with parameter IO_state
[,<*IO_state* >]	The state to set the local output (0 or 1) when entry_num is set to 0.

Examples: *wiot =2 Trigger and execute entry 2 in the table

OK

*wiot =?
*wiot: (0-10)[,(1-1)]

OK

Result Codes: OK
ERROR Otherwise

*** wrap – Remote access password**

This command sets the remote access password.

Syntax:	wrap =<*password*>	Set the password
	wrap =?	Request formatstring
	wrap?	Show current value
	***wrap** -	no remote password is set
<*password*>	Remote access password (6-20 char:s) setting password to – will delete the previous password.	
Examples:	*wrap=QwErTy	
	OK	
	*wrap=? *wrap : (6-20 char)	
	OK	
Result Codes:	OK	
	ERROR	Otherwise

w – B channel windowsize L3

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

xnr – Own X.25 address

Setup an origination X.25 address.
Only necessary, if not supported from the network (X.31B channel only)

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

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

?? – help

Displays help texts for all commands

Notes:

(Note 1) After issuing one of these parameters, execute the "save" command to store the configuration in non volatile memory. To activate and use the new setting you have to run the "reset" command.

(Note 2) Command syntax for setting hlc, llc and bc
An empty parameter has to be entered by "-".
Example: Deleting of LLC-value: LLC -<*cr*>
Entering a new LLC: LLC 8890<*cr*>

(Note 3) Different modes for V.110 baudrate adaption

- 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 baud rate will be created by br rsp. the recognized local baud rate.

- 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 baud rate for V.110 baud rate.
LLC received: accept incoming call, use in B channel the baud rate derived from the LLC as V.110 baud rate.
The usage of the LLC is controlled by the IDW-90+Configurator command dial.v110llc.

6. Software update

The IDW-90 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 or via a remote configuration connection. Carry out the following steps to update the **IDW-90**:

- 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 IDW-90 will send the message "Erasing flash EPROM now. Please wait...".
- After erasing of the Flash-EPROM the TA sends out the request for 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 information on 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 IDW-90 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 boot loader supports only AT**cmd with fixed baudrate of 115.200 Baud.

7. Diagnostic and error messages

For the diagnosis of erroneous situations the following functionality is supported.
Check first the behaviour of LED displays, if an ISDN connection can not be established.
Refer to list of LED displays.

7.1 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 84). All other causes are CAPI error causes (see page 91).

Error cause display:

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

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

7.2 ISDN causes and their explanation (DSS1)

Table 6 ISDN causes and their explanation (DSS1)

ISDN Cause Code		Explanation	Translation to AT result code	Translation to X.25 cause + diagnostic
Number	Hex			
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	Subscriber absent (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 (incomplete number)	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	Temporary 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

Table 6 cont.

ISDN Cause Code		Explanation	Translation to AT result code	Translation to X.25 cause + diagnostic
Number	Hex			
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	3	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	3	21, 78
99	0xE3	Information element parameter non-existent or not	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

7.3 X.25 diagnostic codes

Table 7 X.25 diagnostic codes

No. hex	Restart-ind.	Clear-ind.	Reset-ind.	Diag-nostics	Meaning
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

Table 7 cont.

No. hex	Restart-ind.	Clear-ind.	Reset-ind.	Diag-nostics	Meaning
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 CCITT-speciffied 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	–	Non aligned octet
53	–	–	X	–	Inconsisstent Q bit setting
54	–	X	–	–	NUI problem
61	–	X	–	–	DNIC not accessable
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
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-field not equal 00 (hex.) or
82	–	X	X	–	Closed by service provider, e.g. DATEX-P
83	–	X	PVC	–	Incompatible paket length
84	–	–	X	–	Erroneous M-Bit
85	–	X	–	–	Rejection of the connection request or
85	–	X	–	–	NUI-call no longer granted
86	–	–	X	–	PVC-Access description erroneous

Table 7 cont.

No. hex	Restart-ind.	Clear-ind.	Reset-ind.	Diag-nostics	Meaning
87	–	X	PVC	–	Clear by service provider, e.g. DATEX-P
88	–	X	–	–	DNIC not accessable
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	–	Uncomplete 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 adress 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 accessable
A2	–	X	–	–	Group call number temprarily 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 accessable
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”

Table 7 cont.

No. hex	Restart-ind.	Clear-ind.	Reset-ind.	Diag-nostics	Meaning
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 stations in the packet »Call-Accepted«
B2	–	X	–	–	Unknown network facility
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: dialling 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 shown 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).

7.3.1 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	Temporary network disturbance
09	Remote station ready (virtual connections only)
0F	Network ready (virtual connections only)
11	Incompatible destination

7.3.2 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

7.3.3 X.25 causes in Restart packet

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

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

8. CAPI causes and their explanation

Table 8 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

Table 8 CAPI causes and their explanation

Coding of the CAPI cause in hexadecimal form	
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	Layer 1 protocol error
3302	Layer 2 protocol error, i.e. DTE address not correct, TEI not correct
3303	Layer 3 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 table 4)

9. Diagnostic using the internal Trace

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

trcmsk – set tracemask

trcmsk par Setup the mask to select the type of data to be written into the tracebuffer.
Default: D channel Layer 1 and 3, DTE interfacelines, 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 00 00 00 00 80**):
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** (**default**)
	enable C/I codes and states	77
dl2	D channel LAPD frames disabled	**00** (**default**)
	enable HDLC frames	03
dl3	D channel layer 3 messages disabled	**00** (**default**)
	enable layer 3 messages	72
sl1	serial line trace disabled	**00** (**default**)
	enable serial trace	05
app	No call logging	00
	enable call logging	**80** (**default**)

Examples:

trcmsk 0000007700720500	D channel layer-1 and layer-3, serial data and status lines
trcmsk 0003000000720500	D channel layer-3, B-channel layer-2, serial data and status lines
trcmsk 0000030000720500	D channel layer-3, B-channel layer-3, serial data and status lines

trcdln – length of trace entry

trcdln xx — set trace buffer entries to a maximum length of xx. (**default**: 256).

trcon – start trace write

trcon — set trace to active regarding tracemask.

trcoff – stop trace write

trcoff — set trace to OFF independent of tracemask.

trcclr – clear trace buffer

trcclr — clear actual tracebuffer 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><Data bytes>

Entry number	Sequence number of entry
Timestamp	in units of 10 ms
TypeAndSource	Source of traceentry: bit0–7 : type from tracemask bit8–14 : source of traceentry: 0500 : D channel layer 1 (dl1) 0600 : D channel layer 2 (dl2) 0700 : D channel layer 3 (dl3) 0900 : Serial line (sl1) 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:

0511/8511:	D channel layer 1 status
0xF1	Inactive not used
0xF2	Sensing not used
0xF3	Deactivate
0xF4	Awaiting Signal
0xF5	Identifying Input
0xF6	Synchronized
0xF7	Activated
0xF8	Lost Framing
0512:	D channel layer 1 C/I code (NT to TE)
0x00	Deactivation Request from F7/F8
0x01	Reset acknowledge
0x02	Test mode acknowledge
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 AKNOWLEDGE
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 IDW-90 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 signalled 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

9.1 Call logging

Within the trace module functionality the logging of ISDN connection attempts – successful or not – can be selected (**default**).
The buffer is built as a wrap around buffer, if full, the oldest entries will be deleted. The maximum number of entries is about 80.

Every entry is formatted in the following way:
EntryNo, dw(timestamp), int(TypeandSource), int(Length), Date, Time, int(Appl), int(Service), Duration, int(State), Cause, ChargingInfo, ISDN-No.

For detailed information about the Disconnect cause refer to the chapter on ISDN causes.

The following commands can be used:

trcmsk 0000000000000080
Enable call logging

trcread
Readout all available logging data

trcclr
Clear logging data

Examples: Reset
00000 0000000002 FFFF
Outgoing Call, normal clearing:
00001 0000013349 8A80 002F 98/06/16 14:48 80 02 00:00:01 00 349F 0000 291
Outgoing Call busy:
00002 0000020676 8A80 002F 98/06/16 14:49 80 02 00:00:04 FF 3491 0000 500
Incoming Call, normal clearing:
00003 0000020875 0A80 002F 98/06/16 14:59 80 02 00:00:06 03 349F 0000 270

10. Diagnostic using analogue chipset status report

For sophisticated diagnostic and debugging of analogue connections the following command is available.

!#UD – Last Call Status Report

!#UD is an action command requesting reporting of logged operation events. It does not take parameters and must be the last command in the command line.
The modem logs aspects of their operation for each call, and saves these results until cleared by one of the following events:

1. Power off
2. Hard reset
3. Soft reset = ATZ or AT&F
4. AT!D or ATD# command issued
5. Automatic answer (e.g., set register !S0>0 and ring detected)

10.1 Data Call State Model

For purposes of this command, there are four data call states, and associated status issues:

- Call Setup
  - Calling DCE: get dial tone, generate dial digits, detect call progress signals.
  - Answering DCE: detect ringing, detect CallerID, etc.
- Negotiation
  - V.25 calling tone/answer tone exchanges.
  - V.8 or V.8bis call function negotiations.
  - V-series modem carrier detection and training.
  - Modem-to-modem protocols (e.g., V.42, V.42bis).
- Data Transfer
  - Bit-error rates, for each direction.
  - Rate renegotiation.
  - Retraining.
- Call Termination
  - protocol disconnect signals.
  - carrier disconnect signals.
  - loss of carrier.
  - excessive error rates.

Command Syntax

In response to this command, the modem will report one or more lines of information text as defined below. Information text format conforms to V.250; each line is preceded by a *<CR><LF>* pair, and terminated by *<CR><LF>*. (CR and LF characters may be changed by writing new values to the contents of registers S3 and S4, respectively.) The modem may generate a single line or multiple lines, followed by a standard OK final result code. For example, if call setup failed, only that result is useful. Each information text line is formatted as follows, including one or more key=value pairs:

Command	AT!#UD
Response	DIAG *<token key=value [[key=value] [key=value]] ...>*

Defined Values

DIAG	5 hexadecimal characters (44h, 49h, 41h, 47h, 20h)
<	Left angle bracket (less than sign) (3Ch)
token	Unique 32-bit hexadecimal string 2A4D3263(32h, 4h1, 34h, 44h, 33h, 32h, 36h, 33h)
space	space character (20h)
Key	One- or two-digit hexadecimal number (see Key in Table 8)
=	Equal sign (3Dh)
Value	Any string as defined below (Table 8 as appropriate)
>	Right angle bracket (greater than sign) (3Eh)

Unless otherwise noted, all values are hexadecimal numbers. Any numeric values from tables in ITU V.58 are converted to hexadecimal. Multi-digit values are reported MSD first. Leading 0's may be deleted. See examples in Table 17.

callCleared codes from 3.6.4/V.58-1994

callCleared: indicates that the DCE has gone on hook and that the previously existing network connection has been cleared. These values are hex, converted from decimal in V.58. callCleared codes are described in Table 16.

Table 9 AT!#UD Last Call Status Report Format

Key	Value(s)	Definition
0	2 digits	Diagnostic Command Specification revision number, digit.digit
1	Table 9	Call Setup Result code
2	Table 10	Multi-media mode
3	Table 11	DTE-DCE interface mode
4	String	V.8 CM octet string, same format as V.250, in quotes
5	String	V.8 JM octet string, same format as V.250, in quotes
10	0–2F	Received signal power level, in –dBm (0-43)
11	0–1F	Transmit signal power level, in –dBm (e.g., 0–17)
12	0–64	Estimated noise level, in –dBm (e.g., 10–90)
17	0–FFF	Round Trip delay, in units of ms
18	Table 12	V.34 INFO bit map
20	Table 13	Transmit Carrier Negotiation Result
21	Table 13	Receive Carrier Negotiation Result
22	0–1F40	Transmit Carrier symbol rate (0–8 000) in symbol/s
23	0–1F40	Receive Carrier symbol rate (0–8 000) in symbol/s
24	0–FA0	Transmit Carrier frequency (0–4 000) in Hz
25	0–FA0	Receive Carrier frequency (0–4 000) in Hz
26	0–FA00	Initial transmit carrier data rate (0–64 000) in bit/s
27	0–FA00	Initial receive carrier data rate (0–64 000) in bit/s
30	0–FF	Temporary carrier loss event count
31	0–FF	Carrier Rate re-negotiation event count
32	0–FF	Carrier Retrains requested
33	0–FF	Carrier Retrain requests granted
34	0–FA00	Final transmit carrier data rate in bit/s
35	0–FA00	Final receive carrier data rate in bit/s
40	Table 14	Protocol Negotiation Result
41	0–400	Error control frame size in bytes
42	0–FF	Error control link timeouts in transmission
43	0–FF	Error control link NAKs received
44	Table 15	Compression Negotiation Result
50	0–2	Transmit flow control: 0 = off; 1 = DC1/DC3; 2 = V.24 ckt 106/133
51	0–2	Receive flow control: 0 = off; 1 = DC1/DC3; 2 = V.24 ckt 106/133
52	0–FFFFFFFF	Transmit characters sent from DTE
53	0–FFFFFFFF	Received characters sent to DTE
54	0–FFFF	Transmit characters lost (data overrun errors from DTE)
55	0–FFFF	Received characters lost (data overrun errors to DTE)
56	0–FFFFFFFF	Transmit I- Frame count, if error control protocol running
57	0–FFFFFFFF	Received I-Frame count, if error control protocol running
58	0–FFFF	Transmit I-Frame error count, if error control protocol running
59	0–FFFF	Received I- Frame error count, if error control protocol running
60	Table 16	Termination Cause
61	0–FF	Call Waiting event count

Table 10 Call Setup Result Codes

Code	Definition
0	No previous call (modem log has been cleared since any previous calls)
1	No dial tone detected
2	Reorder signal detected, network busy
3	Busy signal detected
4	No recognized signal detected (e.g., no signal, or nothing recognizable)
5	Voice detected * if this is a voice modem (e.g., V.253) operating in voice mode (e.g., +FCLASS=8.0)
7	Data Answering signal detected (e.g., V.25 ANS, V.8 ANSam)
8	Data Calling signal detected (e.g., V.25 CT, V.8 CI)
9	Fax Answering signal detected (e.g., T.30 CED, DIS)
A	Fax Calling signal detected (e.g., T.30 CNG)
B	V.8bis signal detected

Table 11 Multimedia Modes

Code	Definition
0	Data Only
1	Fax Only
2	Voice
3	VoiceView(tm)
4	ASVD, V.61
8	DSVD, V.70
9	Video-telephony, H.324
A	Other V.80 call

Table 12 Multimedia Modes

Code	Definition
0	Async data
1	V.80 transparent synchronous mode
2	V.80 framed synchronous mode

Table 13 V.34 INFO bit report

Bits	Source bits	Definition
31–30	INFO0 bit 20; 0	
20–29	INFOc bits 79–88	
16–19	INFOc bits 26–29 or 35–38 or 44–47 or 53–56 or 62–65 or 71–74	Pre-emphasis field, selected by the symbol rate chosen
12–15	INFOa bits 26–29	
10–11	MP bit 50; 0	
0–9	INFOa bits 40–49	

Table 14 gstnModulationSchemeActive from 3.7.2/V.58

Value	Description
0	V.17 (G3 Fax call)
1	V.21
2	V.22
3	V.22bis
4	V.23 Constant Carrier (1200/75)
8	V.27ter (G3 Fax call)
9	V.29 HD (G3 Fax call)
A	V.32
B	V.32bis
C	V.34
E	V.90
81	K56flex
84	Bell 212A
85	Bell 103

Table 15 errorControl Active from 3.5.2/V.58

Value	Description
0	Disable/none
1	V.42 LAPM
2	V.42 Alternative protocol (MNP™)
80	MNP10™

Table 16 compressionActive from 3.2.2/V.58

Value	Description
0	None
1	V.42bis
80	MNP5™

Table 17 callCleared codes from 3.6.4/V.58-1994

Value	Description	Notes
0	CauseUnidentified	Call setup issues
1	No Previous call	Not in V.58
2	Call is still in progress	Not in V.58
3	Call Waiting signal detected	Not in V.58, only if modem can detect it
4	Delayed	Same as value 2A, CallAttemptsLimitExceeded
19	InactivityTimerExpired	
1F	cct108isOffInhibitsDial	DTR low
20	cct108turnedOff	DTR drop
29	BlacklistedNumber	
2A	CallAttemptsLimitExceeded	Same as "Delayed", see ETS 300 001
2B	ExtensionPhoneOffHook	If extension detection supported
2C	CallSetupFailTimerExpired	e.g., S7 timeout
2D	IncomingCallDetected	If incoming call while sending dial command.
2E	LoopCurrentInterrupted	
2F	NoDialTone	
31	ReorderTone	Fast busy
33	EngagedTone	Busy
34	LongSpaceDisconnect	And if modem program to abort on long space
3C	CarrierLost	Signal Converter
3D	TrainingFailed	
3E	NoModulationinCommon	
3F	RetrainFailed	
40	RetrainAttemptCountExceeded	
41	GstnCleardownReceived	
42	FaxDetected	If this was not a fax call attempt
46	InTestMode	Test
50	AnyKeyAbort	Call Control
51	DteHangupCommand	If ATH was used to terminate the previous call.
52	DteResetCommand	If ATZ was used to terminate the previous call.
5A	FrameReject	Error Control
5B	NoErrorControlEstablished	Error control was required
5C	ProtocolViolation	
5D	n400exceeded	LAPM retransmission Count Timer
5E	NegotiationFailed	
5F	DisconnectFrameReceived	
60	SabmeFrameReceived	
64	LossOfSynchronization	Data Compression

11. Example Modem Response and Usage

Table 18 Completed Data Call, with some errors and rate retrain during the call

Modem Response line Description	Description
DIAG <*2A4D3263 0=09*>	This is version 0.9
DIAG <*2A4D3263 1=06 2=0 3=0*>	Data Answer signal detected; Data only; Character async
DIAG <*2A4D3263 5="C14513902A" 6="A145"*>	V.8 Call Menu indicates: V.8 Joint Menu selects:
DIAG <*2A4D3263 10=1F 11=0C 12=52*>	Receive level = -31 dBm; transmit level = –12 dBm; noise level = -82 dBm
DIAG <2A4D3263 14=03 15=05 16=10>	Far end echo delay in milliseconds; Far end echo loss in dB; Near end echo loss = 16 dB
DIAG <*2A4D3263 20=C 22=780 24=0C80 26=79E0*>	Transmitter: V.34 training completed; V.34 carrier frequency = 1920; V.34 symbol rate = 3 200; initial transmit rate is 31 200 bit/s
DIAG <*2A4D3263 30=00 31=03 32=01 33=01*>	No carrier loss events, 3 carrier rate renegotiations attempted; 1 carrier retrain requested; 1 carrier retrain granted
DIAG <*2A4D3263 40=1 41=100*>	LAPM negotiation completed; frame size = 256
DIAG <*2A4D3263 42=0 43=0*>	No error control timeout or link NAKs
DIAG <*2A4D3263 44=1 45=400*>	V.42bis data compression used; dictionary size = 1024
DIAG <*2A4D3263 50=2 51=2*>	Hardware transmit and receive flow control
DIAG <*2A4D3263 52=343CC 54=0*>	213964 DTE characters transmitted, w/o underrun
DIAG <*2A4D3263 53=7230E6 55=47*>	7483622 DTE characters received, 71 characters lost due to receive data overrun
DIAG <*2A4D3263 56=29D 58=0001*>	597 (decimal) frames transmitted, with 1 frame error
DIAG <*2A4D3263 58=2A4B 59=0004*>	10827 (decimal) frames received, with 4 frame errors
DIAG <*2A4D3263 60=51*>	Local PC initiated hangup

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