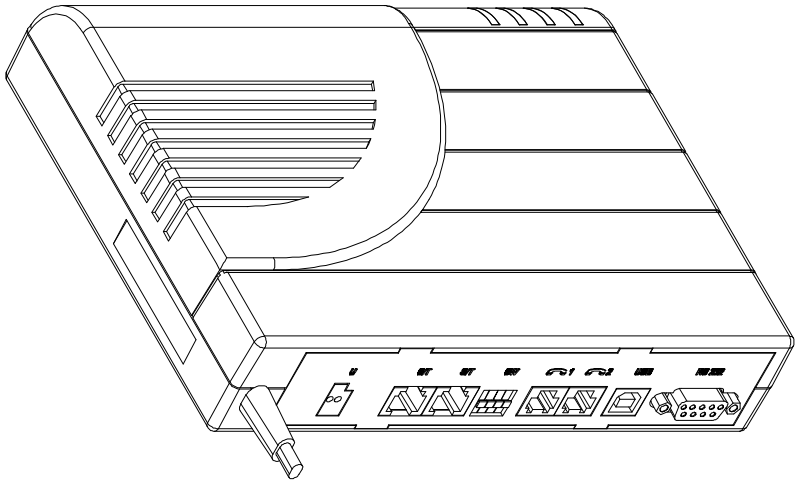
NT1+Multi



Intelligent Network Terminator

User manual

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The present manual is designed for help of installation of NT1+Multi. It explains the mounting of device and the setup of necessary driver and configuration tools. Additional information for DTMF programming and AT commands contains more information then possible in the local network or your NT1+Multi version. For more detailed information about the implemented services and features in your ISDN network please contact your network operator or your internet service provider (ISP).
It can be possible that described features are not implemented in your network or your NT1+Multi version.

Table of contents

1 Introduction

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

NT1+ Multi Hardware
Software version V1.364 or higher

1.1 The NT1+MULTI in use

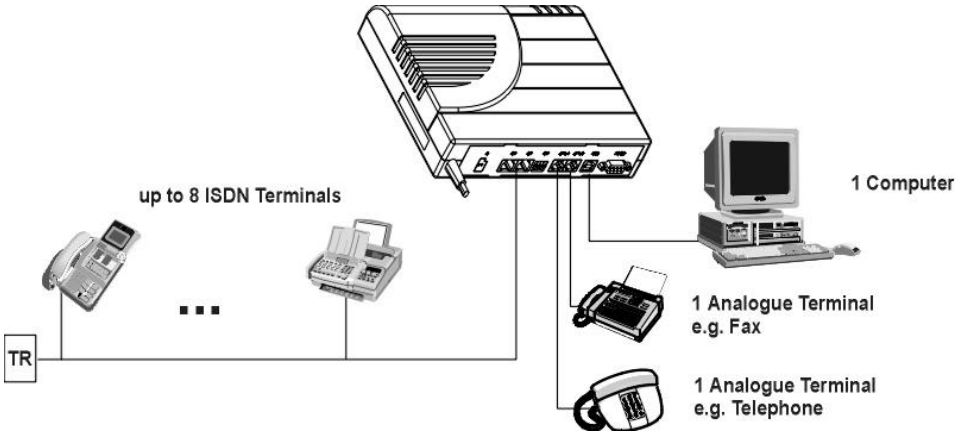
The user of the ELCON NT1+MULTI can dispose of different interface types designed for connection of a variety of terminals. These are:
1. the S/T interface
2. both a/b interfaces
3. the data interface V.24 (RS232)
4. the data interface USB (Version 1.1)

The S/T interface offers connection of digital ISDN terminals via two RJ45 connectors. Apart from this, you can establish an S bus, thus linking up to eight digital ISDN terminals with the NT1+MULTI, whereby four of these terminals can be powered at the same time from the NT1+MULTI via S bus.

With help of the RJ 11 plug connector, one analogue terminal can be directly connected to each of both a/b interfaces. If you have at your disposal analogue terminals, for example telephones, fax devices, modems or answering machines, you can connect them directly to the analogue interfaces at the NT1+MULTI. Your existing analogue devices are now able to provide you with a wide range of ISDN services.

The data interface V.24 (RS232) or USB allows direct connection of personal computers via their COM or USB interface. The data interface V.24 and USB integrated in the device NT1+MULTI allow you problem-free connection of your PC at one data port, of which you simply have to link the network termination to a free COM interface or a free USB port. Using the delivered software you can open the door to a variety of application fields, for example internet, e-mail or computer-based fax transmission.

The Figure below shows some application fields of the NT1+MULTI.



1.2 System prerequisites for installation of the NT1+MULTI

To offer usage of the whole range of services provided by the NT1+MULTI, the following conditions should be fulfilled:

For local power supply, an appropriate 110 VAC or 230 VAC mains connection is required.
For connection to the ISDN, you need an ISDN subscriber line (U) with line code 2B1Q and transfer protocol Euro ISDN DSS 1, which will be provided by your telecommunications network operator.

Using the data interface V.24 or USB requires below given additional conditions:

IBM-compatible computer running at a clock frequency of > 75 MHz
Operating memory 16 Mbytes
Free hard-disc memory 50 Mbytes
CD-ROM disc drive
Operating system Windows `95 or Windows `98
Free serial interface (COM- Port) with interface module UART 16550 (Data transfer rate > 115 kbps; better > 230 kbps) **or** free USB interface (USB Version 1.1) for a connection between NT1+MULTI and PC

2 Mounting

2.1 Scope of delivery

NT1+MULTI – ISDN network terminating unit with two analogue interfaces,
one data interface V.24 (RS232) and one data interface USB
Mounting accessories (dowels, screws, drilling template)
Mounting and operating instruction
CD ROM with installation software Windows 95/98 and Windows 2000/NT and drivers
V.24 standard modem cable SUBD 9-pole (1:1)
USB standard cable

2.2 Selection of mounting site / Fastening the device NT1+MULTI

The NT1+MULTI is designed for wall mounting. Select an appropriate mounting spot for the device near to the U-subscriber line from your network operator. Further, the device has to be installed near the 110/230 V mains socket, since the power plug represents the link to the supply mains. The power plug should always be easily accessible.

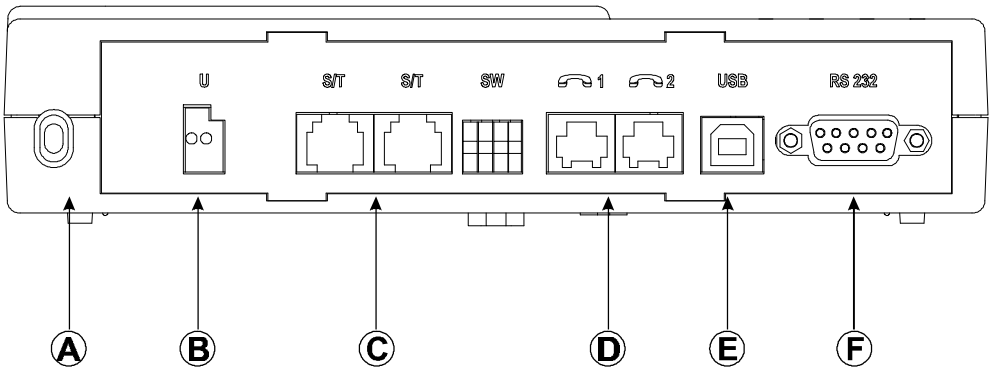
Please make sure that there are no other concealed supply lines (e.g. power, water, gas, telecommunication supply lines) and that the device is not exposed to direct insulation. Apart from this, the device shall be protected from moisture.

2.3 Mounting the NT1+Multi

The NT1+Multi is designed for use as desktop device and to be wall mounted.
For mounting at wall use the attached drilling template. Place it vertical at the wall and mark the drilling holes. For a proper installation use a water level. Now drill two holes with a diameter of 6 mm. Fix the dowels (S6) in the holes. You find them together with the screw in the accessories of the NT1+Multi.
Screw the the screws in the dowels. The head of the screw should have a distance to the wall of around 5 mm.
Now you can hang up the NT1+Multi at these screws and continue with cabeling.

2.4 Connection facilities

Below figure shows the connecting sockets of the NT1+MULTI with the corresponding designation.



A) Power supply
The NT1+Multi is equipped with internal power supply. To connect the NT1+Multi to the power network, plug the Euro flat connector into the power supply socket. Thanks to the wide-range power supply, the NT1+Multi can be used either at 110V or 220V.

B) U interface
The ISDN line supplied from the network operator shall be connected to the clamp connectors. The wire shall remain unstripped for 5 mm and be pressed into the clamps. In order to remove the cable, press onto the orange clamps and pull out the cable.

C) S interface
The S/T interface is the interface for customer premises. It offers direct connection for two digital ISDN terminals via RJ45 connectors. Apart from this, you can establish an S bus, thus linking up to eight digital ISDN terminals with the NT1+MULTI, whereby four of these terminals can be powered at the same time from the NT1+MULTI via S bus.

When establishing the S bus, keep in mind to terminate the bus by termination resistors (see 2.8 Configuration of DIP - switches). For establishing the S bus in Y-configuration, both ends of the bus shall be terminated by termination resistors.

For more details on installation of ISDN bus and ISDN equipment, please contact your network provider or see installation instructions item 2.7. enclosed.
The pin assignment of the RJ45 connectors is described in *Appendix A2*

D) Analogue interfaces
With help of RJ 11 plug connector, one analogue terminal can be directly connected to each of both a/b interfaces. The length of such a hard-wired line shall not exceed 250 m. It allows you to use ISDN services with analogue terminal equipment without additional terminal adapters.
The pin assignment of the RJ 11 connectors is described in *Appendix A4*.

E) Data interfaces (USB)
The data interface USB (E) allows direct connection of personal computers via their USB interface. A USB cable serves for establishing a data transmission line and is linked at one side with a free USB interface at the computer, and at the other – with the NT1+MULTI.

F) Data interface (V.24 / RS 232)
The data interface V.24 (RS232) (F) allows direct connection of personal computers via their COM interface. A 9-pole SUB D-cable serves for establishing a data transmission line and is linked at one side with a free COM interface at the computer, and at the other **–** with the NT1+MULTI. A „1 to 1“ modem cable is recommended to be used as cable for data transmission. The cable shall be fixed to the devices by appropriate screws and protected from tensile loads.

2.5 Cable coupling

Connect the ISDN cable of your network operator to the U interface at your NT1+MULTI.
Now connect your analogue terminals. For connection you can plug-in the RJ11-plugs into the determined jacks (a/b1 and a/b2).
Your ISDN terminals can be connected to the corresponding jacks (S/T) by means of the RJ45-plugs. Alternatively, you can establish an S bus, to which the terminals can be linked.
Now plug-in your mains plug in a 110 VAC power supply socket. Your NT1+MULTI with all terminals connected is now ready for operation, offering the manufacturer’s default settings.
You can connect your PC with the NT1+MULTI as described above.

2.6 Procedure for demounting the NT1+MULTI

For demounting the NT1+MULTI first disconnect all cables, beginning with the power supply cord. Now the device can be taken from the wall.

2.7 S- Bus configuration

For indoor installation of ISDN S0- bus different types of bus systems can be used. For connecting one terminal equipment like PBX a point to point installation is to install. If it is necessary to connect more TE (ISDN phone, Fax, etc.) a point to multi point installation is to use.

2.7.1 Generell

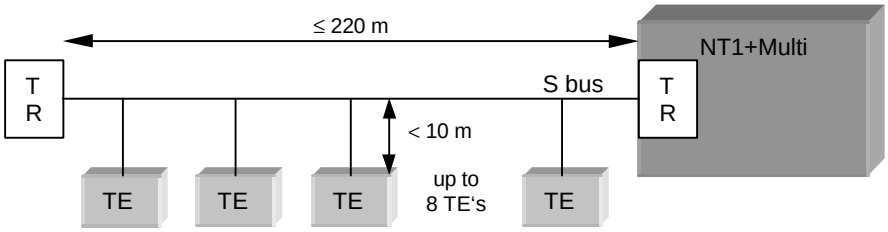
One feature of an installation of ISDN is the possibility to connect up to 8 different ISDN Terminals. All of theses terminals are connected parallel at a so call S0 bus. This allows you to install ISDN Fax, ISDN PC card and of course ISDN telephones

at one S0 port. All of the mentioned terminals can be used independenly of each other, depending on a free B channel.
The S0 bus allows to feed power for up to 4 terminals from the NT1+Multi in normal operation mode. If you want to use more devices they need a local power supply.
In case that the NT1+Multi is not powered locally one terminal can be a emergency terminal which is feed by the NT1+Multi. Prerequisite this terminal is set as emergency terminal and S0 interface is chosen for emergancy mode. Please refer therefore to the User manual of your equipment.
The bus system therefore is called short passive bus. It is a point to multi point connection. It can be also installed in Y- configuration then the internal termination resistors must be switched of.

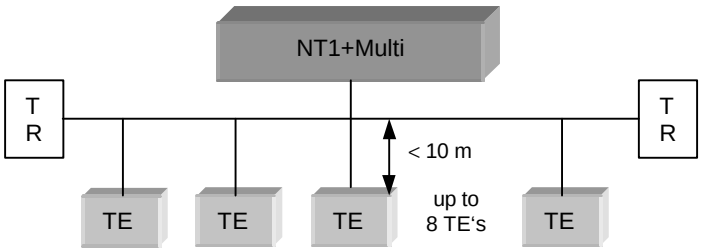
In case that your bus is longer than 500 m an extended bus should be switched in the NT1+Multi.
For installation of small PABX (mini switches) a point to point installation should be chosen.

In the following graphics are displayed some samples of configuring a S0 bus system.

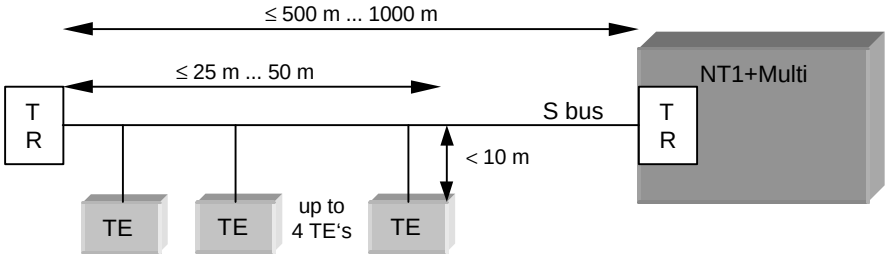
2.7.1.1 Short passive bus:



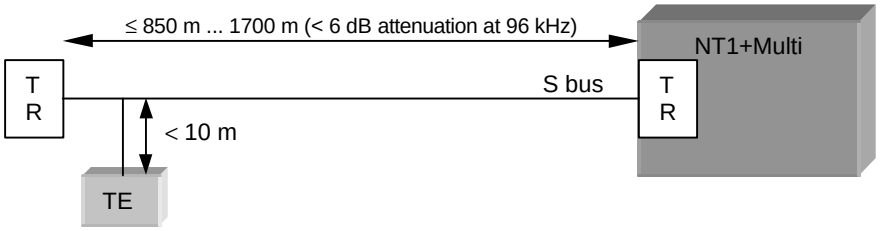
2.7.1.2 Y- configuration



2.7.1.3 Extended passive bus:

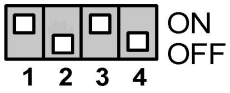
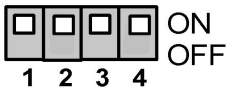
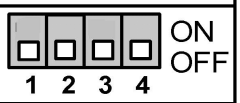


2.7.1.4 Point to point configuration:



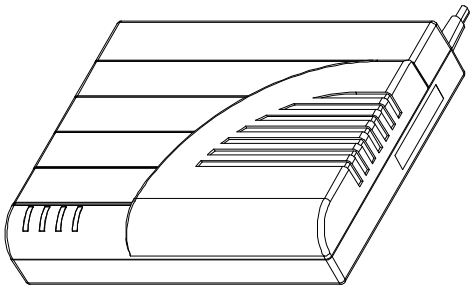
2.8 Configuration of DIP switches

For a correct termination of S – bus the NT1+Multi is equipped with internal termination resistors. Depending on the installed bus system, the correct resistance can be set with DIP- switches. The switches are located in the connection area between S – interface and analogue ports.

100 Ohm	
50 Ohm	
termination resistor switched off	

2.9 Display elements (LED's)

The NT1+Multi is equipped with four LED's for signalling you the state of the NT1+Multi.
The LED's have following meaning:



U ON U- interface is active
Flashing Activation of U- interface
OFF U- interface is not connected
or U- interface is in Idle state
~ ON local power supply is connected
OFF no local power supply is available
The NT1+Multi operates in emergency mode
B1,B2 ON B- channel is busy by a/b port or data interface
Flashing The NT1+Multi performs a Reset

3 Analogue interfaces

The NT1+Multi 2G supports two analogue subscriber interfaces a/b1 and a/b2. Both ports are of identical functionality and can be used independently of each other. Using an analogue telephone capable of DTMF dialling, you can modify the configuration of the relevant analogue interface as described below.

Please note that the usage of some services require that your telephone is equipped with a so-called R-Flash-key.
Any settings you implement at an a/b port will take effect only at that very port!

Wrong settings or invalid commands are quit with a busy tone.
Accepted settings are confirmed by signalling with an acknowledgement signal.

The analogue interfaces are able to offer ISDN services also to these a/b ports. That makes it possible that for instance the number of the calling party can be displayed. Prerequisite your network operator supports this service.

The Supplementary Services for analogue interfaces are implemented according customer requirements. Therefore it is possible that the programming sequences in your device deviate from the one described below. Please refer to the user manual for the used DTMF sequences or contact your network operator.
Also the electrical parameter for these ports are implemented according national requirements and national standards.

The following services can be available with each analogue port.
Many of the functions are invoked with a sequence beginning with pressing a key with flash functionality, typically the "R" key. Please change the setting of the used telephone to flash functionality; the earth key is not supported.
Some of the functions will be acknowledged by **tones** created inside the NT1+:
successful programming: a continuous tone (without time limit),
not successful programming: a quickly interrupted tone (without time limit).

Note: Most of the settings can also be achieved by using AT commands via the V.24 port. Please refer to chapter 6.5 for details.

- **Caller ID (CLIP)**

With incoming calls the calling number can be displayed if the connected analogue phone is supporting this feature, also called **CLIP** on analogue line. This feature has to be enabled and setup to the correct mode.

Deactivate:	dial "***107*0#**"	
Activate:	dial "***107*1#**"	in ONHOOK mode **(default)**
	dial "***107*2#**"	in OFFHOOK mode
	dial "***107*3#**"	in ONHOOK and OFFHOOK mode

Setup caller id protocol:

Dial	"***108*0#**"	for ETS 300 659 V.23 FSK **(default)**
Dial	"***108*1#**"	for ETS 300 659 DTMF
Dial	"***108*2#**"	for Bellcore Bell202

(see AT commands AT**ACLIENA and AT**ACLITPYE).

- **MSN (Multiple Subscriber Number)**

Your ISDN connection may offer to have more than one telephone number. These numbers (MSN) can be programmed for each port.
If no MSN's are programmed, all incoming calls will be accepted.
With an outgoing call the first programmed MSN (if available) will be used for displaying.

Set	1st MSN	dial: *100*<NR>#
	2nd MSN	dial: *101*<NR>#
	3rd MSN	dial: *102*<NR>#
Clear	1st MSN	dial: #100#
	2nd MSN	dial: #101#
	3rd MSN	dial: #102#

Different ringing tones
The ringing cadence can be configured depending on the called MSN.
The following table describes the available ringing cadences:

Dial	"*111*<nr>#"	for 1st MSN **(default nr=1)**
Dial	"*112*<nr>#"	for 2nd MSN **(default nr=2)**
Dial	"*113*<nr>#"	for 3rd MSN **(default nr=3)**

Ringing cadences:

			ON	OFF	ON	OFF (ms)
No.:	0	=	Ringing disabled			
	1	=	1000	4000		
	2	=	400	200	400	4000
	3	=	600	200	200	4000
	4	=	200	600	200	4000
	5	=	200	400	400	4000
	6	=	200	200	600	4000

- **Outgoing call**

The analogue device (i.e. a telephone, modem or fax machine) can use the dial method with DTMF tones or pulse dialing. The method is determined automatically by the NT1+Multi.

- **Incoming call**

With the default setting any incoming call causes both telephones to ring. You can program different numbers (multiple subscriber numbers = msn) for each analogue port, so only the selected (called) telephone will ring (see above and AT commands "AT**ab/1.amsn1" or "AT**ab/2.amsn1").

- **Terminal type**

This terminal profile determines the service that will be used with an outgoing call and compatibility checking for incoming calls.

Set:	*106*0#	(inactive, outgoing calls only)
	*106*1#	(audio, no outgoing HLC, incoming: accept all call)
	*106*2#	(Telephony, **default**)
	*106*3#	(FAX).

- **Call waiting (CW)**:

While having established a voice connection an incoming call will be announced by a special tone (see note) in the telephone. This second incoming call can be accepted in two ways:

1. going on hook will disconnect the first connection; the second call will cause the telephone to ring like a normal incoming call. (The phone must be on hook for a minimum time of 1 second).
or 2. **"R", "2"** : this will cause the first connection to go into hold, the second will automatically be accepted.
or 3. **"R", "1"** : this will clear the first connection, the second will automatically be accepted.
or 4. **"R", "0"** : this will clear the incoming (call waiting) call.

Call waiting can be
enabled by dialing ***43#**
disabled by dialing **#43# (default)**

(see also AT command **AT**AB/1.ACW** or **AT**AB/2.ACW**)

Note: The generated tones have the following format:
call waiting with B channel:
200ms tone, 150ms pause, 200ms tone.
This type of call waiting can be additionally picked up by the other telephone.
call waiting without B channel:
500ms tone, 200ms pause, 500ms tone.
This type of call waiting cannot be picked up by the other telephone.

- **Inquiry, shuttle, transfer**:

While having established a connection, you can make an inquiry to a third party. The first connection will go into hold.
- Establish the first connection (or accept an incoming call)
- Go into hold state by pressing the "R" key (Flash key)
- Set-up a second connection by dialing a number (external or internal connection)

From this second connection you can go on in the following ways:
1. **"R", "2"** : Shuttle back to the first connection, the active connection will go into hold. The next pressing of "R","2" will shuttle to the second connection and so on.
2. **"R", "1"** : shuttle back to the first connection and clear the active connection.
2a. One internal connection: Transfer the first connected party to the second connected party by going on hook
2b. Public switch: Disconnect active connection by going on hook. The other connection will cause ringing.

- **Three party conference (3PTY)**:

While having established a connection and having a second connection in hold state, you can invoke a three party conference. Both connections will get active at the same time.

"R", "3" : activate three party conference.

"R", "2" : deactivate three party conference, one connection will go into hold state, the other one stays active.

Note: a three party conference cannot be used together with internal connections, so only one POTS port may be part of the conference.

- **Busy on busy**:

When the NT1+Multi is configured for both POTS ports with the same MSN both telephones will ring by an incoming call. If one POTS port is busy it can be selected whether the other telephone shall ring or the caller will get a busy line indication.

Activate: go off hook free telephone will **not** ring, the caller gets busy **(default)**
dial **"*115#"**
go on hook
Deactivate: go off hook default: free telephone will ring
dial **"#115#"**
go on hook
(see also AT command **AT**AB/1.AEXCL** or **AT**AB/2.AEXCL**)

- **Call Pickup**:

An external incoming call for only one of the POTS ports (selected e.g. by different MSNs, while ringing or while call waiting), can be picked up by the other POTS port by entering after off hook the keys **"*82#"**.

- **Call completion to busy subscriber (CCBS):**

If you get a busy line after making an outgoing call, you can activate the "call completion to busy subscriber". Your telephone will ring when the called party is no longer busy.

Activate: go off hook
dial number
dialled number is busy
dial **"R","*37#"**
go on hook
Deactivate: go off hook
dial **"#37#"**
go on hook
Interrogate: go off hook
dial **"*#37#"**
go on hook

Note: The telephone switch will clear an activated „Call completion to busy subscriber“ automatically, the time for clearing is dependent of the telephone network provider.

- **Malicious Call Identification (MCID):**

The telephone number of a malicious caller can be registered in the public switching system. This functionality can be activated using the following scenario. Please note that the usage of malicious call identification has to be enabled by your telephone provider.

While the connection is established or was just disconnected by calling user press:

"R", "*39#" the connection will be registered at your telephone provider.

- **Call Bumping**

This function clears a speech channel in case of data transmission using channel trunking if you wish to call to another subscriber.

Call Bumping can only set with the following DTMF sequences:

*301*0#	Call Bumping OFF
*301*1#	Call Bumping for incoming calls
*301*2#	Call Bumping for outgoing calls
*301*3#	Call bumping for incoming and outgoing calls

- **Call forwarding**

Three types of call forwarding are supported by the NT1+Multi:

1. **Call forwarding unconditional** (CFU): incoming calls will be forwarded immediately to the programmed telephone number.

Activate: go off hook;
dial "***21* <number>** # "; for all MSNs used on the ISDN access **or**
dial "***21* <own number>* <number>** #"; for an MSN specified individually by the user
go on hook
Deactivate for all MSNs:
go off hook ; dial **"#21#"** ; go on hook
Deactivate for all individual MSN:
go off hook ; dial **"#21*<own number>#"** ; go on hook

(see also AT command **AT**AB/1.AACFU** or **AT**AB/1.ADCFU**)

2. **Call forwarding busy** (CFB): incoming calls will be forwarded to the programmed telephone number, if the analogue port is busy.

Activate: go off hook;
dial "***67* <number>** # "; for all MSNs used on the ISDN access **or**
dial "***67* <own number>* <number>** #"; for an MSN specified individually by the user
go on hook
Deactivate for all MSNs:
go off hook ; dial **"#67#"** ; go on hook
Deactivate for all individual MSN:
go off hook ; dial **"#67*<own number>#"** ; go on hook

(see also AT command **AT**AB/1.AACFB** or **AT**AB/1.ADCFB**)

3. **Call forwarding no reply** (CFNR): incoming calls will be forwarded to the programmed telephone number, if the device connected to the analogue port does not accept the incoming call within 30 seconds (maybe national dependent).
Activate: go off hook;
dial "***61* <number>** # "; for all MSNs used on the ISDN access **or**
dial "***61* <own number>* <number>** #"; for an MSN specified individually by the user
go on hook
Deactivate for all MSNs:
go off hook ; dial **"#61#"** ; go on hook
Deactivate for all individual MSN:
go off hook ; dial **"#61*<own number>#"** ; go on hook

(see also AT command **AT**AB/1.AACFNR** or **AT**AB/1.ADCFNR**)

If call-forwarding programming was successful, a continuous tone will be given after programming, if not successful a quickly interrupted tone will be given. Activating call forwarding can take some seconds, so the acknowledge tone may be delayed.

Note: The setting of call forwarding will not be stored inside the NT1+Multi and cannot be readout.

- **Call number restriction (CLIR) per call:**

Before making an outgoing call you have the choice to deactivate or activate the presentation of your call number at the called side. This has to be setup up prior to the outgoing call:

Deactivate: go off hook; **(default)**
dial **"*31*"**
dial the wished number without going on hook again.
Activate: go off hook;
dial **"*31#"**
dial the wished number without going on hook again.

Note: Within some ISDN networks this service has to be enabled by your telephone provider.

- **Call number restriction (CLIR) permanent:**

You can deactivate the presentation of your call number at the called side for all outgoing calls. This has to be setup up by:

Activate: go off hook;
dial **"*31*#"**
go on hook
Deactivate: go off hook; **(default)**
dial **"#31*#"**;
go on hook
(see also AT command **AT**AB/1.ACLIR** or **AT**AB/2.ACLIR**)

Note: Within some ISDN networks this service has to be enabled by your telephone provider.

- **Hotline call**

The hotline call feature allows the user to program a phone number which will be called automatically after going OFFHOOK and a programmable delay time.
If the user starts normal dialing during the delay time the timer is stopped and the standard procedures for outgoing calls are performed.

Program number:	dial "***53*<number>**#"	
Activate hotline call:	dial "***53**#"	
Deactivate hotline call:	dial "**#53**#"	
Program delay time:	dial "**#117*<delay>**#"	delay in sec, default=5

- **Incoming call management**

By programming this parameter the user can determine the behaviour of NT1+Multi in case of an incoming voice call which is decided to be compatible for *both* analogue ports.

The user can decide to program the following alternatives:

Broadcast **(default)**	dial "***300*0**#"	Call offered to both analogue ports
Distributed	dial "***300*1**#"	Alternating offered to port 1 and 2
Port 1 preferred	dial "***300*2**#"	Offered to Port 1 if Port1 is able to accept, otherwise offered to Port 2
Port 2 preferred	dial "***300*3**#"	Offered to Port 2 if Port 2 is able to accept, otherwise offered to Port 1

- **Closed User Group (CUG)**

An ISDN access can be member of a Closed User Group. When the user wants to make a call there are two choices:

1. The user can request a connection with a CUG index (assigned by the network) before dialing the called party number.
2. The user can request a connection without a CUG index before dialing the called party number.

Call with index: dial **"01<number>#"**
Call without index: dial **"01#"**

4 Installation of drivers

4.1 Windows 9x/ME/2000 Driver Installation – V.24

This chapter describes the installation of the NT1+Multi for the operating system Windows 9x/ME/2000 for the V.24 port (COM-port).

The following components will be installed:

Modem driver into the modem list

4.1.1 Preparation (Windows9x/ME/2000)

Please check the following requirements before installing the software for Windows9x/ME/2000:

PC-System with connected MT1+Multi.
Access to a CDROM drive and hard disk
Installed Microsoft Windows 9x/ME/2000 operation system
Windows 9x CD-ROM (Installation disks) (typically not required for ME/2000)
Installation Software -NT1+Multi/Win9x/WinNT4.0/Win2000

4.1.2 Installation (Windows9x/ME/2000)

When the NT1+Multi is connected and power up while booting your PC with Windows9x/ME/2000, the Plug and Play feature of the NT1+Multi will get active, so Windows9x/ME/2000 will request an installation disk.

You can add new Modem drivers for the NT1+Multi manually. Please go to
START -> SETTINGS -> CONTROL PANEL -> MODEMS
Activate the button "Don’t detect my modem, I will select it from a list".
Please choose via the DISKETTE button the path to the NT1+Multi installation disk and open the file "mdmstint.inf".
You can select the following NT1+Multi modems:
“NT1+Multi PPP (PnP)"
“NT1+Multi Internet PPP"
“NT1+Multi Internet ML-PPP"

Please note, that every modem has to be installed separately.

Select the used COM port and finish to end the installation procedure.

At the end of the installation you will get information about the installed software and modem types.

4.2 Windows NT 4.0 Software Installation – V.24

This chapter describes the installation, configuration and usage of the NT1+Multi for the operating system Windows NT 4.0 for the V.24 port (COM-port).

The following components will be installed:

Modem driver into the modem list

4.2.1 Preparation (WindowsNT4.0)

Please check the following requirements before installing the software for WindowsNT4.0:

PC-System with connected NT1+Multi.
Access to a CDROM drive and hard disk
Installed Microsoft Windows NT operation system
Windows NT4.0 CD-ROM (Installation disks)
Installation disk Software-NT1+/Win9x/WinNT4.0/Win2000

4.2.2 Installation (WindowsNT4.0)

You have to add new Modem drivers for the NT1+Multi manually. Please go to START -> SETTINGS -> CONTROL PANEL -> MODEMS
Select ADD and activate the button "Don’t detect my modem, I will select it from a list".
Please choose via the DISKETTE button the path to the NT1+Multi installation disk and open the file "mdmstint.inf".
You can select the following NT1+Multi modems:

“NT1+Multi PPP (PnP)"
“NT1+Multi Internet PPP"
“NT1+Multi Internet ML-PPP"

Please note, that every modem has to be installed separately.

Select the used COM port and finish to end the installation procedure.

4.3 Windows 98 Driver Installation – USB

This chapter describes the installation of the NT1+Multi for the operating system Windows 98 when connected via USB.
The following components will be installed:

NDIS WAN Miniport driver
CAPI driver
ELCON ISDN Utilities program group

4.3.1 Preparation (Windows98)

Please check the following requirements before installing the software for Windows 98:

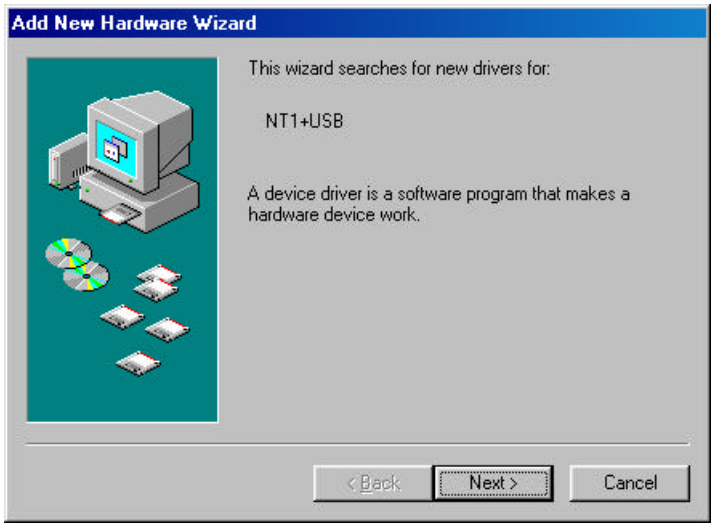
PC-System with connected NT1+Multi.
Access to a CDROM drive and hard disk
Installed Microsoft Windows 98 operation system
Windows 98 CD-ROM (Installation disks)
Installation disk Software-NT1+/Win9x/WinNT4.0/Win2000

Make sure the NT1+Multi installation CD is inserted before connecting the hardware for the first time. Also, keep the Windows 98 installation CD handy, as it will be needed during installation.

Note: If you have installed any device driver or applications for an ISDN Adapter on your system, uninstall the device drivers or ISDN applications as per the manufacturer's instructions, to prevent failure of the new installation.

4.3.2 Installation (Windows98)

After connecting the NT1+Multi to a USB port, the hardware recognition facility of Windows 98 will recognise the presence of a new hardware component and start the Hardware Wizard.

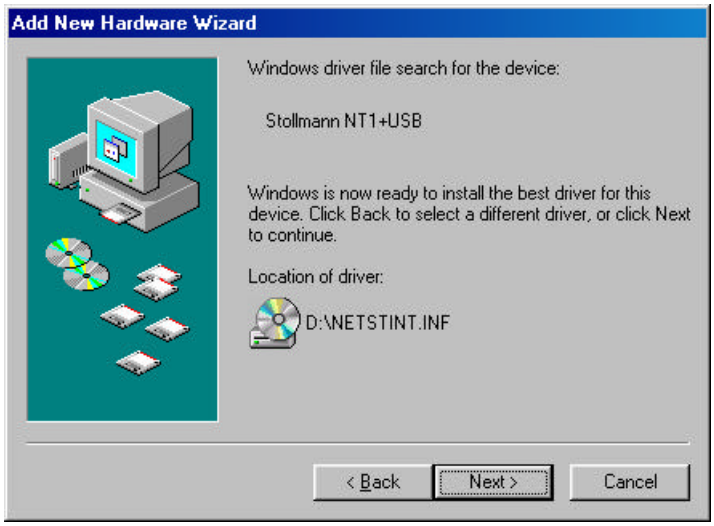


Click Next.

Accept the default setting to have the computer search for the device driver, and click Next.

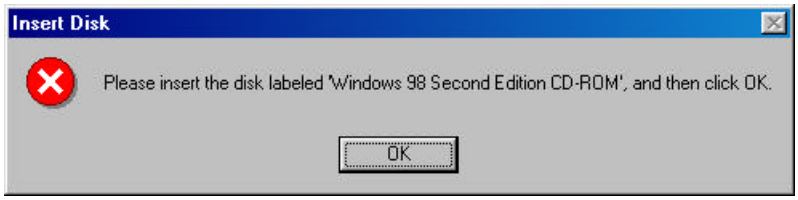
Enter the pathname of your CD-ROM drive as the location of the driver database. Make sure the NT1+Multi installation CD is inserted. Then click Next.

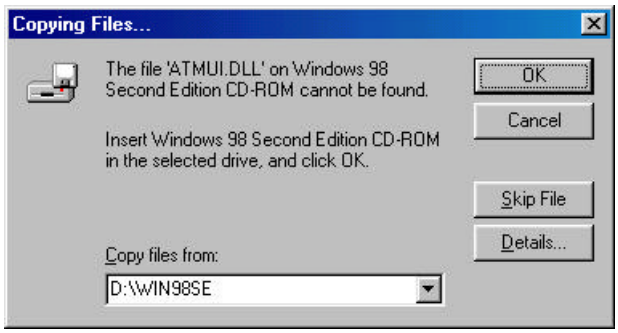
Confirm the location of the driver database by clicking Next again.



The Hardware Wizard will now start updating the driver database, copying the NT1+Multi driver to your hard disk. This process will take a bit of time; watch the progress indicator on your screen.

The last installation step requires that the Windows 98 installations CD be inserted. Wait for your CD-ROM drive to recognize the new CD. Enter or select the correct source path, and click OK.





This concludes the installation process.

Click Finish to continue.

The Computer has to be restarted for the new installation to take effect.
Click Yes to confirm.

After the system has been restarted, your NT1+Multi is ready to use. The installation program will have installed the following components on your system:

NDIS WAN Miniport driver
CAPI driver
ELCON ISDN Utilities program group

4.4 Windows ME Driver Installation – USB

This chapter describes the installation of the NT1+Multi for the operating system Windows ME when connected via USB.

The following components will be installed:

NDIS WAN Miniport driver
CAPI driver
ELCON ISDN Utilities program group

4.4.1 Preparation (WindowsME)

Please check the following requirements before installing the software for Windows ME:

PC-System with connected NT1+Multi.
Access to a CDROM drive and hard disk
Installed Microsoft Windows ME operation system
Windows ME CD-ROM (Installation disks)
Installation Software -NT1+/Win9x/WinNT4.0/Win2000

Make sure the NT1+Multi installation CD is inserted before connecting the hardware for the first time. Also, keep the Windows ME installation CD handy, as it will be needed during installation.
If the PC is connected to a network (LAN), it is recommended to disconnect the network cable temporarily. This keeps Windows ME from loading the entire device driver database and speeds up the installation process.

Note: If you have installed any device driver or applications for an ISDN Adapter on your system, uninstall the device drivers or ISDN applications as per the manufacturer's instructions, to prevent failure of the new installation.

4.4.2 Installation (WindowsME)

After connecting the NT1+Multi to a USB port, the hardware recognition facility of Windows Me will recognise the presence of a new hardware component and automatically start the Found New Hardware Wizard.

Click Next.

The Hardware Wizard will now start updating the driver database, copying the NT1+Multi driver to your hard disk. This process will take a bit of time; watch the progress indicator on your screen.

Click Finish to continue.

The Computer has to be restarted for the new installation to take effect.

Click Yes to confirm.

After the system has been restarted, your NT1+Multi is ready to use. The installation program will have installed the following components on your system:

NDIS WAN Miniport driver
CAPI driver
ELCON ISDN Utilities program group

4.5 Windows 2000 Driver Installation – USB

This chapter describes the installation of the NT1+Multi for the operating system Windows 2000 when connected via USB.
The following components will be installed:

NDIS WAN Miniport driver
CAPI driver
ELCON ISDN Utilities program group

4.5.1 Preparation (Windows2000)

Please check the following requirements before installing the software for Windows 2000:

PC-System with connected NT1+Multi.
Access to a CDROM drive and hard disk
Installed Microsoft Windows 2000 operation system
Windows 2000 CD-ROM (Installation disks)
Installation software-NT1+/Win9x/WinNT4.0/Win2000

Make sure the NT1+Multi installation CD is inserted before connecting the hardware for the first time.

Note: If you have installed any device driver or applications for an ISDN Adapter on your system, uninstall the device drivers or ISDN applications as per the manufacturer's instructions, to prevent failure of the new installation.

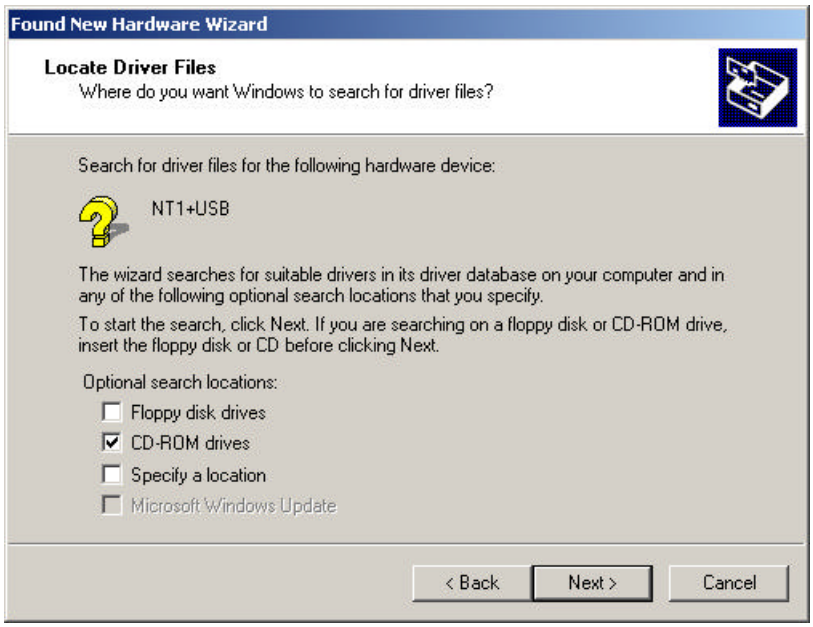
4.5.2 Installation (Windows2000)

After connecting the NT1+Multi to a USB port, the hardware recognition facility of Windows 2000 will recognise the presence of a new hardware component and automatically start the Found New Hardware Wizard.

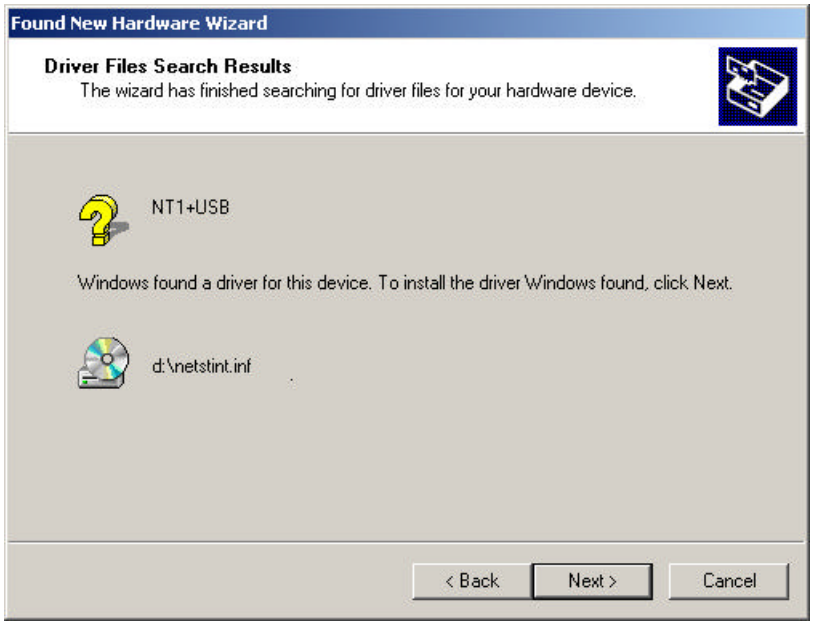
Click Next.

Accept the default setting to have the computer search for a suitable driver for your device, and click Next.

Check CD-ROM drives as an optional search location for suitable drivers. Make sure the NT1+Multi installation CD is inserted in the CD-ROM drive. Then click Next.

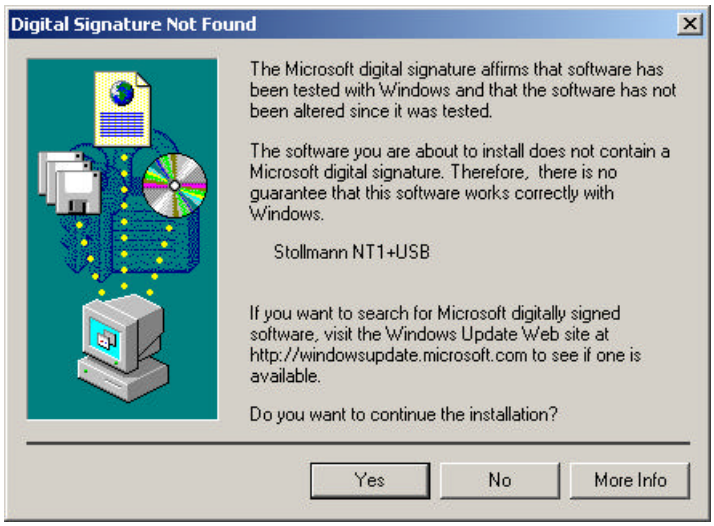


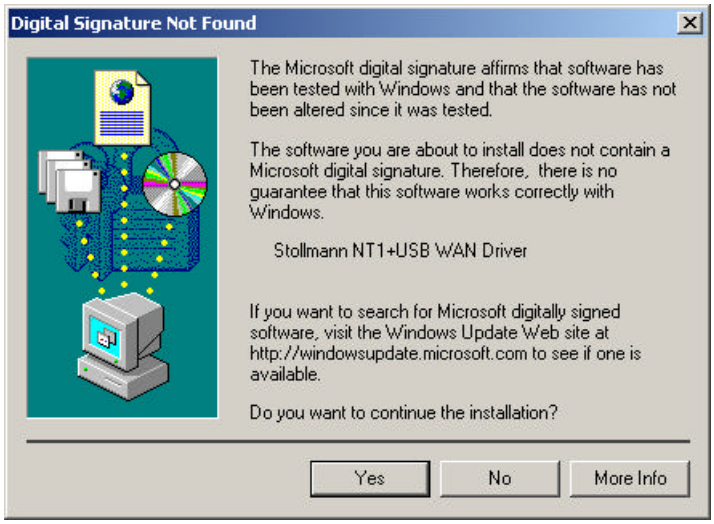
Confirm the location found for the driver database by clicking Next again.



The Hardware Wizard will now start updating the driver database, copying the NT1+Multi driver to your hard disk. This process will take a bit of time; watch the progress indicator for the various installation steps on your screen.

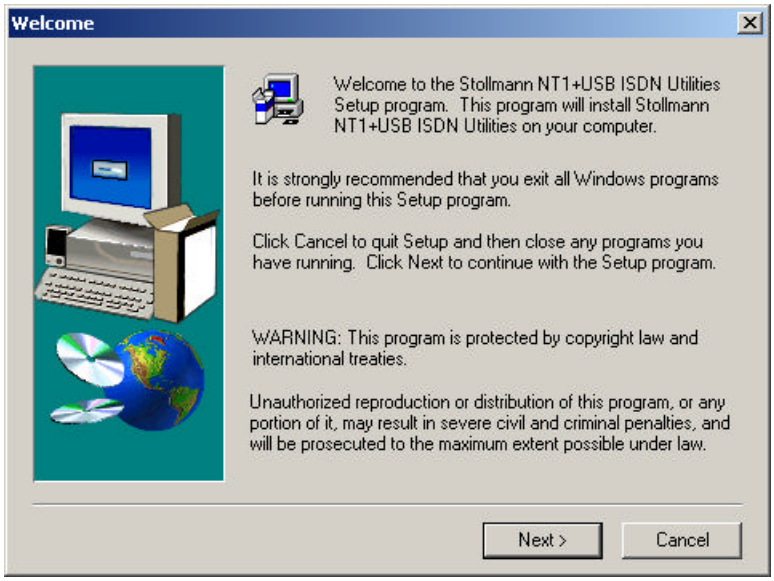
As the installation progresses, you will see two questions concerning a digital signature that was not found. Simply continue the installation by clicking Yes.



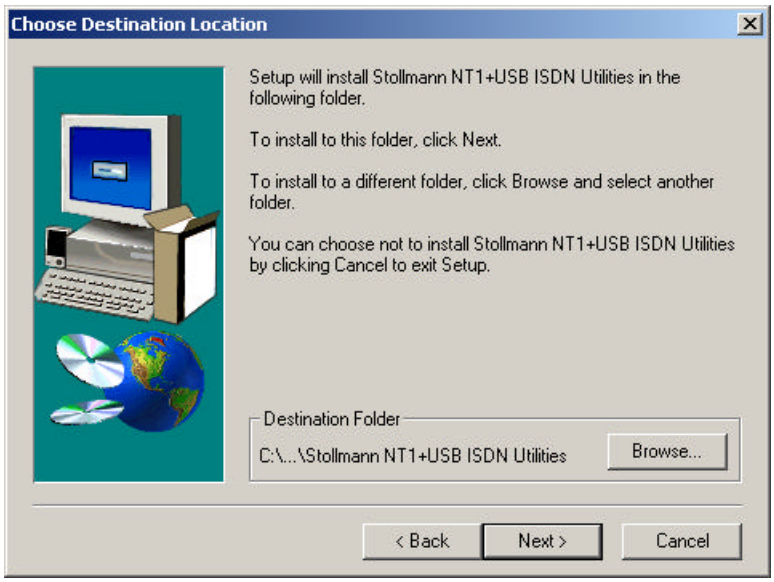


Once the driver installation is completed, the installation of the ELCON ISDN Utilities is started automatically. The following dialog box will ask for the language for this installation. Select your language (e.g. U.S. English) and click ´OK´.

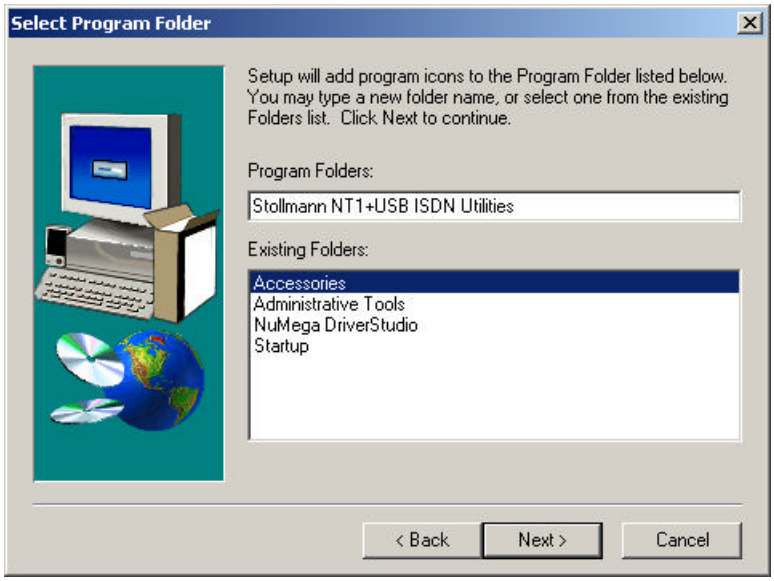
Click Next.



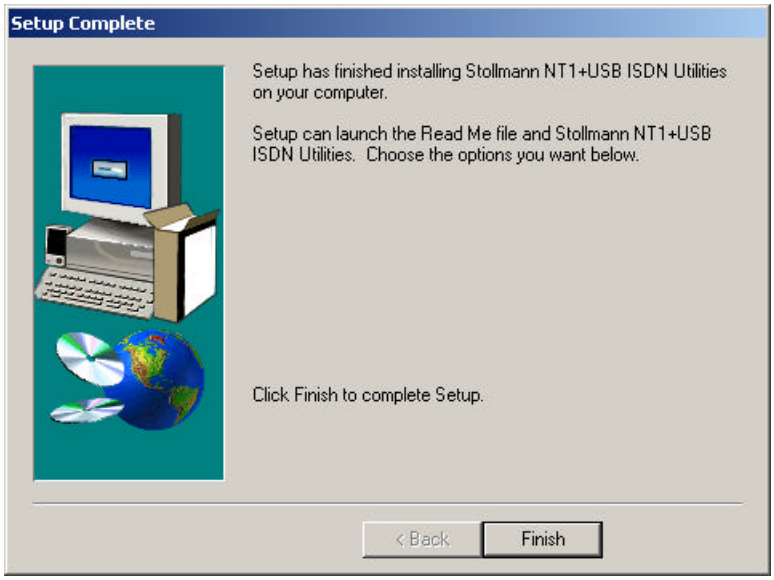
Enter or select a destination folder for the ELCON ISDN Utilities. Click Next.



Select the program folder where the ELCON ISDN Utilities icons are to be installed. To install the ELCON ISDN Utilities icons in a new program folder, enter the name for the new folder instead. Click Next.



This concludes the installation of the ELCON ISDN Utilities. Click Finish.



This concludes the installation of the ISDN driver software.

Click Finish to continue.

The installation program will have installed the following components on your system:

NDIS WAN Miniport driver
CAPI driver
ELCON ISDN Utilities program group

5 Using the NT1+Multi with Application Software

To use the NT1+Multi with different application software and access points you have to look for the following items:
Usually you need a contract with the service provider. They can help you to get an appropriate application program to run on a PC.
The service provider will also supply you with the ISDN access number to call (has to be entered in the application program).
The NT1+ 's parameter must fit the characteristics of the access point which be recommended in the next chapters.

5.1 Configuration for Internet

To access the Internet via ISDN you have to have a contract with an Internet service provider (ISP) who runs an ISDN access. To configure the NT1+Multi you need the following information from the ISP:

ISDN access number (to be entered at the PC program)
Layer two protocol, usually the protocol PPP by selecting Modem NT1+Multi Internet PPP.
Access protocol (to be entered at the PC system software or Internet software)

5.1.1 Internet Access

There are two ways to access the Internet via ISDN:
by synchronous PPP or Multilink PPP
by B channel protocol X.75
It depends on the access facilities of your Internet service provider (ISP) or Point-of-presence (POP) which one you may use.

For setting up internet access please follow the steps in the Dial- Up adapter of Windows operating systems. For V.24 connection use as modem type the correct modem protocol of your internet service provider.
For USB connection use “ISDN line 1” as modem. For Multi Link connection set in the folder Multilink as second device “ISDN line 2”.

Please get more information from your Internet provider if necessary.

5.2 Remote LAN Access

To access a LAN remotely via ISDN you have to choose the appropriate protocol that is used by the ISDN router on the LAN.

6 Configuring the NT1+Multi

6.1 Introduction

The ELCON NT1+Multi has been designed for the ISDN basic connection. In addition to that, the device offers two analogue interfaces for the connection of common terminating units and one V.24 interface and one USB- interface for direct computer connection. The analogue interfaces provide numerous ISDN services, thus substantially extending the service range offered by analogue phones.

The settings of the NT1+Multi for the V.24 interface and the ISDN interface are called configuration. The NT1+Multi is delivered with a set of pre-set values. In the following section it will be shown how, by using the configuration commands, you can examine the configuration of the NT1+Multi and if necessary change it. The values can be stored in non volatile memory; this means they'll remain unchanged even if the power supply is disconnected.

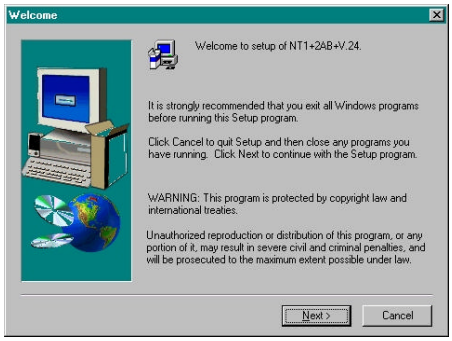
You can configure the NT1+Multi in the following ways:
by using the AT command set entered by the locally connected PC.
by using NT1+ Multi configuration commands entered by the locally connected PC.
by using NT1Multi configurator tool
by using DTMF sequences

To make configuration of the NT1+Multi more comfortable, a software is enclosed to the ELCON NT1+Multi that simplifies execution of the configuration settings required.
The CD-ROM supplied with each device contains:
Modem driver for V.24 and USB
NT1+Multi configurator

6.1.1 Hardware requirements

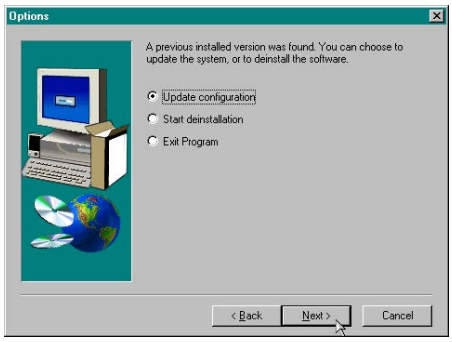
Pentium 100 PC
8MB RAM
8MB HardDisc Space
Serial Interface
Windows 9x

6.2 Installation at V.24 interface



The NT1+Multi is Plug-and-Play-compatible. Connect your PC via enclosed serial cable to the NT1+Multi and start the computer anew. The connected hardware will be automatically identified. Now follow the instructions displayed on your screen. Insert the disc in drive A:\ and select the desired driver.

Note: To install further drivers later on, choose from the menu »System control« the item „Modem“ and „Add driver“. After this, determine the path for your disc and select the new modem driver.

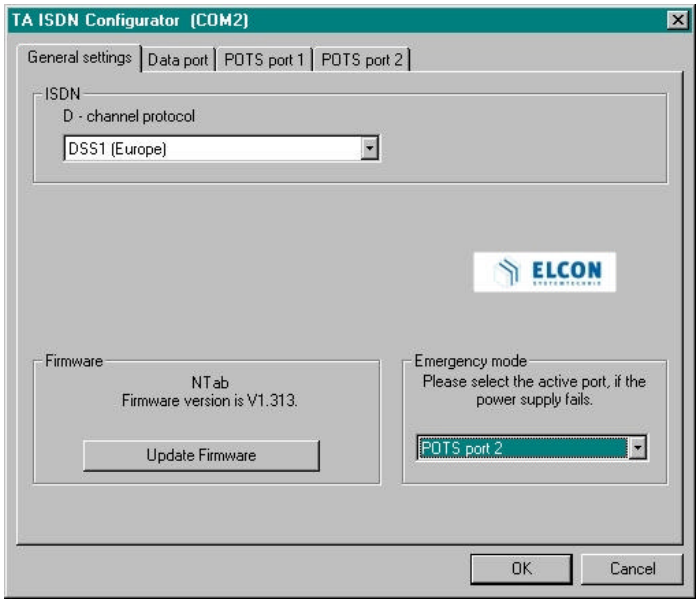


To install or deinstall the driver manually, insert the disc in your drive and start »Setupta.exe«. If an installation has already been performed, you are asked whether the existing programme should be updated or the software should be deleted.

6.3 Configuration start

Select from the start menu the item »NT1+Multi« and there the subitem »Configurator«. The programme is started and reads in the current settings from the NT1+Multi.

6.4 Configuration menu



6.4.1 General settings

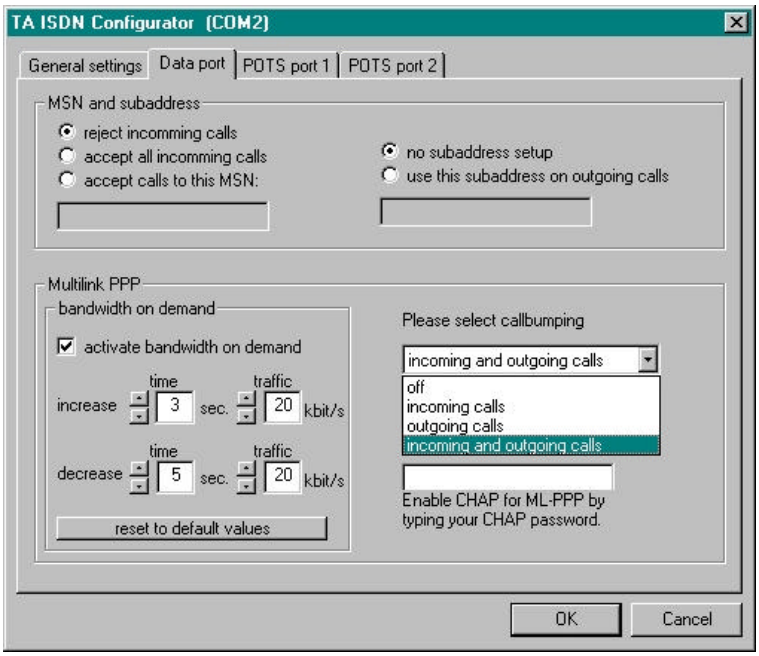
Within this menu, the following settings are performed:
Selection of D-channel protocol via Pull-Down menu
Standard setting is DSS1, which is used world wide; in case of eventual deviations ask your network operator.

Determination of emergency units for S/T, a/b1, a/b2, a/b1 or a/b2 (dynamic),
This allows to determine the emergency device in case of local power breakdown. If the selection of the analogue interfaces is performed dynamically, the telephones on both a/b ports will ring one after another, but only one connection is possible.

Firmware update
This button enables to read a new firmware in the NT+. Starting from the directory, the path and the new file are selected and then the upload is started.

Indication of firmware version number

6.4.2 Data port



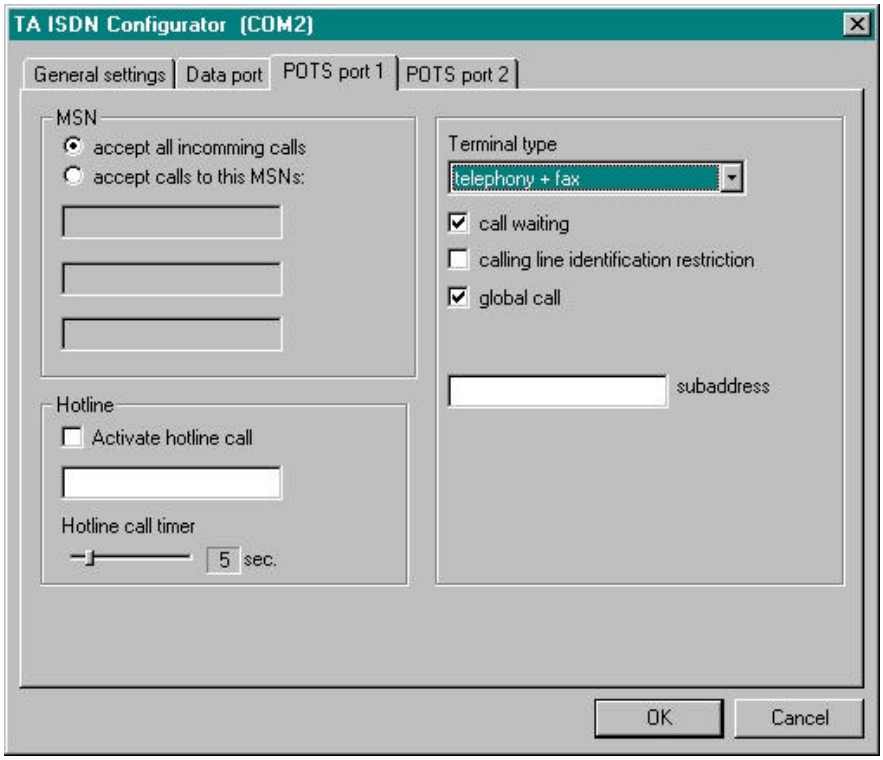
Entering the MSN and the subaddress for the data interafce
Acceptance allowance or refusal of incoming calls

Activation of the function „Bandwidth On Demand“
Setting of time and data transfer volume from the moment of enabling the second B-channel
Setting of time and data transfer volume from the moment of disabling the second B-channel.

Activation of the function „Call Bumping“
This means: Release of a B-channel during existing Multilink – connection for either incoming or outgoing calls, respectively for both incoming and outgoing calls

Entering the password for MS CHAP.

6.4.3 Analogue port



Note: These settings apply to both analogue ports

Entering the MSN of that port
Up to three call numbers can be assigned to each analogue interface. All incoming calls on the set MSN will be accepted on that port.

Selection of device type via Pull - Down menu.
It is possible to determine the terminal type, e.g. facsimile or / and telephony

Activation of supplementary services
– Call Waiting (to signal a second incoming call during an existing call)
– Calling Line Identification Restriction
- Global Call

Entering of the subaddress

6.4.4 Writing the data for the NT1+Multi

Confirm your changes made by entering »Ok«. All changes will be sent to the device and saved there. You will be informed about the successful completion of the configuration.

6.4.5 Firmware update

The configurator programme makes it possible to update the NT1+Multi firmware to a higher level.

For this, start the NT1+Multi configurator. Select from the menu »General settings«, the item »Update Firmware«.

The new firmware file will be chosen through a certain menu and sent to the NT+. If the update is completed successfully, a respective confirmation message will be displayed on your screen.

6.5 Configuration of USB-port

Remarks: The function Call Bumping at the USB port can be set only by DTMF commands. Therefore see item 3 (Analogue interfaces).

Select from the start menu the item »NT1+Multi« and there the subitem »Configurator«. The programme is started and reads in the current settings from the NT1+Multi

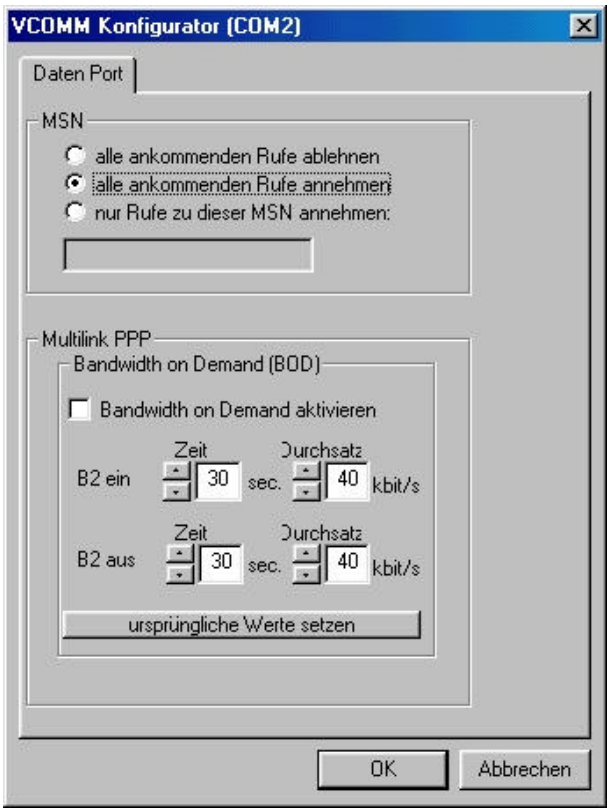
After reading the actual setup it will be display in the menu “VCOMM configurator”. This menu allows you to set parameters for the virtual COM port which has been installed by the driver setup.
Following parameters can be set:
Accept call:

- reject all calls
- accept all calls
- accept call for the entered MSN only

Settings for Bandwidth Management

- Activation of Bandwidth On Demand
- Time and data rate for activation of second B channel

- Time and data rate for deactivation of second B channel
- Set to default parameters



After changing the parameters press “OK” button. The new configuration will be stored.

6.6 AT command set (V.24 port)

Depending on firmware version of your NT1+Multi some AT- and configurator commands can not be applied.

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

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

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

Connect the NT1+Multi to ISDN interface
Connect the PC's com-port to the DTE interface of the NT1+Multi.
Connect the power supply to the mains socket.
Start a terminal emulation on your PC, please verify that the baudrate setting of the terminal emulation fits those of the NT1+Multi.
Set up the parameter of the NT1Multi from the terminal emulation and save the parameter using the AT command set.
Example:
To change the used B channel protocol to X.75 please enter the following commands:
ATB10<↵> (set protocol to X.75)
AT&W<↵> (save the new configuration)
Leave your terminal emulation and start your application program.

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

The parameter settings of the NT1+Multi obtained when using the AT commands can be permanently stored (AT&W) and are not lost by resetting or by leaving the AT command mode.

To enter the AT command mode during an active data connection you must use the following sequence ("Escape sequence"):
at least 1 sec pause **<+><+><+>** 1 sec pause
The time gap between all three plus signs may not exceed 1 sec.
The escape sequence is transmitted transparent to the remote device.

Supported commands:

A/ Repeat last command line

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

A Accept incoming call

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

ATA[//<*UUS1data*>]

UUS1data transmitted data with UUS1 signalling

B B channel protocol

Transmission protocol for data communication in the B channel.

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

ATB4 : HDLC transparent (octets are packed into HDLC frames)
ATB5 : Byte transparent (raw B channel data)
ATB10 : X.75-NL (i.e. for BBS access)
ATB31 : Multilink PPP (ML-PPP)

%B Set local baudrate

Sets the local baudrate of the NT1+Multi to the desired value (fix value) or to auto detection. When auto detection is set, the NT1+ will recognize the desired baudrate with every newly entered AT command by the terminal equipment (PC). With all other settings the PC must use the same baudrate.
Must be the last command in an AT command line.

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

Note: If autobauding is selected (default) and after powering on the NT1+Multi no AT command is entered, a response from the NT1+Multi (i.e. RING) will be sent with the baudrate 115200 bit/s.

CONF Enter Configurator mode

Enters directly into the Configurator mode, the configuration prompt "#" will be displayed. Leave the Configurator mode with the command "quit".

ATCONF

&C DCD control

Selects the behavior of the DCD control line from the NT1+Multi.
AT&C NT1+ control line DCD is always ON
AT&C1 DCD ON indicates ISDN connection is established and synchronized (default)

#C Received bearer service

Shows the bearer service that is received with an incoming call in hexadecimal coding *hbhb*.
The value for *hbhb* (word) is the CIP value as defined in the CAPI 2.0 specification.
AT#C

#C1=*hbhb* Select bearer service outgoing

Selects the bearer service that will be sent with an outgoing call
The value for *hbhb* (word) is the CIP value as defined in the CAPI 2.0 specification (default 0000).
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 00000004).
Example: AT#C2=00030012 : Accept analogue incoming calls
AT#C2=00000001 : Accept all incoming calls.
Note: Before issuing an outgoing call the command AT#C1 has to be set.
To use the predefined services please setup factory defaults (AT&F).

D Initiate outgoing call

Dials the number (D for Dial). The dial modifier "W", ">", "T", ";", "@" can be freely inserted in the dial string; they have no influence on the dial procedure of the NT1+Multi.
Must be the last command in AT command line.
Any character input while the NT1+Multi is dialling will cancel the dialling procedure.

ATD<*CALLEDnumber*>[*/*<*subaddr*>][*//*<*UUS1data*>]
[,*X*[P*xxx*-][R][N<nuipwd>][G<cug>]<*X25number*>][*D*<*userdata*>]]

CALLEDnumber: ISDN call number for a dialed B channel connection or X.25 number for X.31 D channel
subaddr dialed subaddress
UUS1data transmitted data with UUS1 signaling
P : use packet size *xxx* for X.25 connection

R : request the facility reverse charging
G : access to X.25 closed user group
O : Outgoing call from X.25 closed user group
N : use NUI and password with call setup
allowed chars: a-z, A-Z, 0-9.
(overrides setting of nui configuration command)
X25number: dialed X.25 call number (X.25 B channel only)
D : separator for user data: "D" or ",": user data without protocol ID
"P": user data with protocol ID (“01000000“)

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

Note1:To setup the own subaddress see configuration command **sub**.

&D DTR control

Selects the behavior of the NT1+Multi, when the DTE control line DTR changes from ON to OFF.
AT&D DTE control line DTR setting is ignored
AT&D2 DTE control line DTR is evaluated: dropping the DTR line by the DTE will disconnect an existing ISDN connection (default).
An incoming call will accepted only with DTR active.

E Local echo

Selects the local echo in command mode.
ATE No local echo
ATE1 Local echo on in command phase (default)

&F Load factory defaults

Factory default will be loaded, ISDN protocol setting and msn's will not be overwritten. (for storing in non volatile memory please use the command AT&W).
AT&F setup all parameter concerning data port
AT&F1 setup all parameter including ISDN protocols, msn settings and passwords.

H Disconnect

Disconnects existing ISDN data connection, after issuing the Escape sequence (see page 31).
ATH[//<*UUS1data*>]
UUS1data transmitted data with UUS1 signaling

I Display version information

Displays different information about version number and settings:

ATI Returns the "Modem"-type; name of the terminal adapter ('NT1+Multi')
ATI1 Returns internal checksum (“64“)
ATI2 Returns “OK“
ATI3 Returns version string: "TA5.xy.z0"
ATI4 Returns manufacturers name
ATI5 Returns ISDN selected protocol: "0 - DSS1"
ATI6 Returns copyright string: "(c) Copyright ELCON Systemtechnik GmbH"
ATI7 Returns “OK“
ATI8 Returns “ERROR”
ATI9 Returns plug and play ID string
ATI77 Returns Bootloader version string
ATI99 Returns software creation date

&K Flowcontrol

Selects the flow control behavior of the NT1+Multi while in data communication phase.

AT&K No local flow control between the DTE and NT1+ is used
AT&K3 Local flow control is set to hardware handshake RTS/CTS (default)
AT&K4 Local flow control is set to software handshake XON/XOFF

#M Received CLID

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

AT#M

O Return to online state

If the NT1+Multi is in command mode after issuing an escape sequence out of an existing connection, ATO brings the NT1+ back to data phase.
Must be the last command in AT command line.

ATO

#O Received CLIP

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

AT#O

Q Suppress results

With this command result codes or messages can be suppressed.

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

&R CTS control

Selects the behavior of the CTS control line from the NT1+Multi.

AT&R NT1+ control line CTS is following all changes of RTS
AT&R1 CTS is always ON (default)

#R Handle incoming calls

Selects the behavior of the NT1+Multi when an incoming call is received.
When set, all incoming calls are ignored independent of all other settings.

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

S Display and set internal S register

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

&S DSR control

Selects the behavior of the DSR control line from the NT1+Multi.

AT&S NT1+ control line DSR is always ON (default)
AT&S1 DSR ON indicates ISDN connection is established and synchronized

V Result format

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

&V Display configuration

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

W Extended result codes

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

&W Store active configuration

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

Z Load stored settings

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

&Z Store call-number

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

AT&Z*x*=*nn*	set entry number *x* to dialing number *nn*
AT&Z*x*=-	erases entry number *x*.
AT&Z*x*	shows entries number *x*.
AT&Z	show all entries.

Note: Refer to TA+Configurator command *catab* for more information.
See command ATDS for using.

#Z Define own msn

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

AT#Z=*nn*	set msn to *nn*
AT#Z	shows currently set msn number.

The msn is automatically stored to non volatile ram (without issuing command AT&W).

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

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

****PRTY** Parity asynchronous chars

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

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

6.6.1 ISDN specific AT commands

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

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

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

AT**BSIZE=*x*

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

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

Defines the LLC value for outgoing calls in hexadecimal format. In some situation a specific LLC value is required to pass detailed information about the used B channel protocol to the called party. This can be done by setting the LLC to a fix value.
An empty parameter has to be entered by "-" (default: LLC is empty).

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

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

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

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

ATDTE=0** Calling side reacts as DTE,
called side reacts as DCE (default, X.75 standard)
AT**DTE=1 NT1+ reacts as DTE (own adr = 01)
AT**DTE=3 NT1+ reacts as DCE (own adr = 03)

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

****EMERGENCY** Set emergency mode

Selects in case of emergency power supply (mains fault) which device will be still working.

ATEMERGENCY=0** Emergency on S bus
AT**EMERGENCY=1 Emergency on POTS port 1
AT**EMERGENCY=2 Emergency on POTS port 2
AT**EMERGENCY=3 Emergency on POTS port 1 and 2

****ISDN** Select D channel protocol

Selects ISDN D channel protocol to the ISDN line. The protocol must fit the protocol running on the ISDN line otherwise a connection cannot be set up.
Note: after changing and storing the ISDN protocol the NT1+Multi has to be reset by powering it off and on (alternately you can use the command AT&W**RESET).

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

****G711LAW** Set coding for voice connections

Selects the coding for voice type connections.
ATG711LAW=0** automatic through D channel protocol
AT**G711LAW=1 coding fix to a-law
AT**G711LAW=2 coding fix to µ-law

Note: changing the isdn protocol sets up the g711law to a predefined default:
isdn = 0,8 : coding = a-law
isdn = 5,6,7 : coding = µ-law
AT&F does not change the setting of g711law.

****K** Set Layer 2 windowsize

Sets windowsize *x* layer 2 protocol B channel: *x* = 1 ..7, default: **7**
AT**K=*x*
The default value is dependent of the selected B channel protocol.

****PTP** Set ISDN interface type

ATPTP=0** select multipoint mode (to connect ISDN terminals, default)
AT**PTP=1 select point to point mode (to connect ISDN switching systems)

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

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

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

Executes one configuration command.
AT**<*cmd*>

6.6.2 AT command S register set

S0 0: No automatic call acceptance, acceptance of an incoming call is controlled by the data terminal (command ATA after RING)
1: Immediate call acceptance by the terminal adapter (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 TA+Configuration command “ringtimer“ (default = 5 sec.)

S1 Ring Counter (read only)
S2 Escape Character (default = 43h)
S3 Carriage Return Character (default = 0Dh)
S4 Line Feed Character (default = 0Ah)
S5 Backspace Character (default = 1Ah)
S7 Wait time for Carrier (sec) (default = 30 sec)
S9 Enable PNP functionality for Windows95 (default=1, enabled)
S16 Last occurred CAPI/ISDN error cause
S90 Last incoming ISDN calling number (CLIP)
S91 **0**: default
1: all unknown AT commands will be answered with OK.
2: Windows 2000 compatibility: some AT commands will be answered with OK (see list below), unknown AT commands will be answered with OK.

Windows2000 AT command set change:
ATBxxx All commands ATBxxx will respond OK without any functionality behind it. The B-channel protocol settings can be set with AT**PROT.
AT\Nxxx All commands AT\Nxxx will respond OK without any functionality behind it. The B-channel protocol settings can be set with AT**PROT.

6.6.3 AT result codes

Result codes (numerical and verbose):

Code	Text	Meaning
0	OK	Command completed
1	CONNECT <*rn*>	Connection established (*rn* = call number of remote site)
2	RING <*rn*>	Indicates an incoming call (SETUP received)
3	NO CARRIER <*xx*>	No synchronization (*xx* = ISDN error cause)
4	ERROR	Illegal command or error that can not be indicated otherwise
6	NO DIALTONE <*xx*>	No access to ISDN network (*xx* = ISDN error)
7	BUSY <*xx*>	Number engaged (*xx* = ISDN error cause)
8	NO ANSWER <*xx*>	No connection; called number can not be reached (*xx* = ISDN error cause)
9	RINGING <*rn*>	Outgoing call is ringing at called site
19	CONNECT 64000 <*rn*>	Connection, line speed 64 kbps

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

In AT command mode, call number display (does not belong to the AT command standard) can be turned on by issuing the command ATV2 or ATV3. If turned on, the call number of the caller is shown with the Connect- or Ring-message (in pointed brackets), depending on the signaling in D-channel.

If the NT1+Multi is used at the public network then the call number of the remote site (including area code) is displayed.

Example: CONNECT 64000 <040890880>

Error cause display:
<*xx*> = ISDN release (error) cause, hexadecimal
Example: NO CARRIER <#34F0>

In AT command mode, error cause display (does not belong to the AT command standard) can be turned on by issuing the command ATV2 or ATV3. 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 57). All other causes are CAPI error causes (see page 59).

6.6.4 Analogue port AT commands

****AB/1.ACLIENA** Enable Call number identification (CLIP)
****AB/2.ACLIENA** Enable Call number identification (CLIP)

Enables the call number identification for the analogue port.
AT**AB/1.ACLIENA=0 Disable call number presentation
ATAB/1.ACLIENA=1** Enable CLI only when on hook (default)
AT**AB/1.ACLIENA=2 Enable CLI only when off hook (not supported yet)
AT**AB/1.ACLIENA=3 Enable CLI when on hook or off hook (not supported yet)

Note: When call number presentation on hook is activated the ringing sequence is different.

****AB/1.ACW** Call waiting analogue port A

Handles Call Waiting for analogue port A. When enabled, an incoming call during connection situation is signaled by two short internal tones.
AT**AB/1.ACW=0 Disable Call Waiting for analogue port A
ATAB/1.ACW=1** Enable Call Waiting for analogue port A (default)
AT**AB/1.ACW Shows setting or Call Waiting for analogue port A.

****AB/2.ACW** Call waiting analogue port B

Handles Call Waiting for analogue port B. When enabled, an incoming call during connection situation is signaled by two short internal tones.

AT**AB/2.ACW=0	Disable Call Waiting for analogue port B
ATAB/2.ACW=1**	Enable Call Waiting for analogue port B (default)
AT**AB/2.ACW	Shows setting or Call Waiting for analogue port B.

****AB/1.AACFU** Call forwarding unconditional

Sets the telephone number for call forwarding unconditional on analogue port A. Every call to this analogue port will be forwarded to the programmed number without ringing of the connected telephone.

ATAB/1.AACFU= -**	Disable call forwarding for analogue port A (default)
AT**AB/1.AACFU=*n*	Enable call forwarding for analogue port A to number *n*

****AB/2.AACFU** Call forwarding unconditional

Sets the telephone number for call forwarding unconditional on analogue port B. Every call to this analogue port will be forwarded to the programmed number without ringing of the connected telephone.

ATAB/2.AACFU= -**	Disable call forwarding for analogue port B (default)
AT**AB/2.AACFU=*n*	Enable call forwarding for analogue port B to number *n*

****AB/1.AACFB** Call forwarding busy

Sets the telephone number for call forwarding busy on analogue port A. Every call to this analogue port will be forwarded to the programmed number if the port is occupied (off hook).

ATAB/1.AACFB= -**	Disable call forwarding for analogue port A (default)
AT**AB/1.AACFB=*n*	Enable call forwarding for analogue port A to number *n*

****AB/2.AACFB** Call forwarding busy

Sets the telephone number for call forwarding busy on analogue port B. Every call to this analogue port will be forwarded to the programmed number if the port is occupied (off hook).

ATAB/2.AACFB= -**	Disable call forwarding for analogue port B (default)
AT**AB/2.AACFB=*n*	Enable call forwarding for analogue port B to number *n*

****AB/1.AACFNR** Call forwarding no reply

Sets the telephone number for call forwarding no reply on analogue port A. Every call to this analogue port will be forwarded to the programmed number, if the call will not be accepted within 30 seconds.

ATAB/1.AACFNR= -** Disable call forwarding for analogue port A (default)

AT**AB/1.AACFNR=*n* Enable call forwarding for analogue port A to number *n*

****AB/2.AACFNR** Call forwarding no reply

Sets the telephone number for call forwarding no reply on analogue port B. Every call to this analogue port will be forwarded to the programmed number, if the call will not be accepted within 30 seconds.

ATAB/2.AACFNR= -** Disable call forwarding for analogue port B (default)

AT**AB/2.AACFNR=*n* Enable call forwarding for analogue port B to number *n*

****AB/1.ACLIR** Call number restriction (CLIR) permanent
****AB/2.ACLIR**

You can deactivate the presentation of your call number at the called side for all outgoing calls. This has to be setup up by:

AT**AB/1.ACLIR=1 Activate call number restriction

ATAB/1.ACLIR=0** Deactivate call number restriction (default)

****AB/1.ACOFWD** Stimulus codes forwarding
****AB/2.ACOFWD**

Setup the coding form for activation functionality inside the switch, that is done in a stimulus way.
If the first key pressed after going offhook is one of the keys "*" or "#", the actual connection setup will be aborted. Further inputs will be stored locally until a pause of key inputs of 4 seconds occurs or the key "#" is entered. Hereafter all collected key entries will be sent as functional request to the public switch, as far as no locally defined programming sequence is recognized.
Usually these functional codes are transmitted as “Keypad“ (KYP) elements. Some switches need these codes to be transmitted as element "Called Party Number" (CdPN), this mode has to be selected by a configuration command.

AT **AB/1.ACOFWD=0 Set coding forwarding to calling number (CdPN)

AT **AB/1.ACOFWD=1 Set coding forwarding to keypad transmission (default)

AT**AB/1.ACOFWD Show coding for forwarding

****AB/1.AEXCL** Exclusive ringing

When the NT1+Multi is configured for both POTS ports with the same MSN both telephones will ring with an incoming call. If one POTS port is busy it can be selected wether the other telephone shall ring.

ATAB/1.AEXCL=0**	free telephone will ring
AT**AB/1.AEXCL=1	free telephone will **not** ring
AT**AB/1.AEXCL	Show setting exclusive ringing for analogue port A

****AB/2.AEXCL** Exclusive ringing

When the NT1+Multi is configured for both POTS ports with the same MSN both telephones will ring with an incoming call. If one POTS port is busy it can be selected wether the other telephone shall ring.

ATAB/2.AEXCL=0**	free telephone will ring
AT**AB/2.AEXCL=1	free telephone will **not** ring
AT**AB/2.AEXCL	Show setting exclusive ringing for analogue port B

****AB/1.AMSN1** Set 1st msn analogue port A

Set 1st msn (multiple subscriber number) for the analogue port A.
If no msn is specified or one msn is set to **"*"** all incoming calls will be accepted.

**AB/1.AMSN1=*n*	Set msn to *n*, *n* = string of digits (max length = 20)
****AB/1.AMSN1=-**	Clear msn setting, all incoming calls will be accepted, no outgoing msn (default)
**AB/1.AMSN1	Shows 1st msn (multiple subscriber number) for analogue port A.

The msn is automatically stored to non volatile ram.

With all 3 msn's empty all incoming calls are accepted.
Once msn is activated, it will be sent with an outgoing call. An incoming call is accepted, if the received called party number is compatible to the entered msn. An incoming call without a called party number is always accepted.

****AB/2.AMSN1** Set 1st msn analogue port B

Sets 1st msn (multiple subscriber number) for the analogue port B

**AB/1.AMSN2=*n*	Set msn to *n*, *nn* = string of digits
****AB/1.AMSN2=-**	Clear msn setting, all incoming calls will be accepted, no outgoing msn (default)
**AB/1.AMSN2	Shows 1st msn (multiple subscriber number) for analogue port B.

The msn is automatically stored to non volatile ram.

With all 3 msn's empty all incoming calls are accepted.

Once msn is activated, it will be sent with an outgoing call. An incoming call is accepted, if the received called party number is compatible to the entered msn. An incoming call without a called party number is always accepted.

****AB/1.AMSN2** Set 2nd msn analogue port A

Sets 2nd msn (multiple subscriber number) for the analogue port A,
see command **ab/1.amsn2.

****AB/2.AMSN2** Set 2nd msn analogue port B

Sets 2nd msn (multiple subscriber number) for the analogue port B
see command **ab/2.amsn2.

****AB/1.AMSN3** Set 3rd msn analogue port A

Sets 3rd msn (multiple subscriber number) for the analogue port A
see command **ab/1.amsn3.

****AB/2.AMSN3** Set 3rd msn analogue port B

Sets 3rd msn (multiple subscriber number) for the analogue port B
see command **ab/2.amsn3.

****AB/1.ANO** Set internal number for analogue port A

Sets the local internal number for analogue port A (max. 3 digits incl. * and #).
ATAB/1.ANO=**** (default)
Note: Any number beginning with the local internal number cannot be used to make an external connection.

****AB/2.ANO** Set internal number for analogue port B

Sets the local internal number for analogue port B (max. 3 digits incl. * and #).
ATAB/1.ANO=**** (default)
Note: Any number beginning with the local internal number cannot be used to make an external connection.

****AB/1.ATFLOW** Flash detection time low
****AB/1.ATFHIGH** Flash detection time high

The minimum and maximum times to recognize the flash (R-) key can be programmed.
****AB/1.TFLOW**=<time> set flash detection time low to time (in 10 ms).
default: 9 (=90 ms)
****AB/1.TFHIGH**=<time> set flash detection time high to time (in 10 ms).
default: 31 (=310 ms)

Settings for ab/2.tflow and ab/2.tfhigh are respectively.

Note1: Make sure, that the min-value is always lower then max-value.
Note2: If the min-value is lower than 90 ms pulse dialing is not usable.
Note3: If the programmed max time is greater than 500 ms the detection time for on hook will be automatically increased to maximum time + 10ms.

****AB/1.ATTYPE**	Sets terminal profile for analogue port A
AT**AB/1.ATTYPE=0...3	Set terminal type: 0: inactive, outgoing calls only **1**: Audio 3.1 kHz, no outgoing HLC (default) incoming: accept all calls 2: Telephony 3: FAX
AT**AB/1.ATTYPE	Show terminal type

Note: Changing attype uses the following settings for an outgoing call:
attype = 0 => bc=9090A3; hlc=-; llc=-
attype = 1 => bc=9090A3; hlc=-; llc=-
attype = 2 => bc=8090A3; hlc=9181; llc=-
attype = 3 => bc=9090A3; hlc=9184; llc=-

****AB/2.ATTYPE**	Sets terminal profil for analogue port B
AT**AB/2.ATTYPE=0...3	Set terminal type: 0: inactive, outgoing calls only **1**: Audio 3.1 kHz, no outgoing HLC (default) incoming: accept all calls 2: Telephony 3: FAX
AT**AB/2.ATTYPE	Show terminal type

ab/1.abc	Bearer Capability port A
ab/2.abc	Bearer Capability port B

Changes the BC (bearer capability) value to the string *hb*.
If BC is empty, BC will derive from selected terminal type *attype*.
(default: attype=1 => abc=9090A3 : Audio 3.1 kHz)
Should not be changed.

ab/0.abc=<hb>	(Default: empty)
ab/0.abc=-	Clear BC
ab/0.abc	Show BC

Sometimes alternatively the value 8090A3 (ISDN speech) is used.

Both BC values are accepted with incoming calls, the selected value is used for outgoing calls (see note 2).

ab/1.ahlc High layer Compatibility port A
ab/2.ahlc High layer Compatibility port B

Changes the HLC (high layer compatibility) value to the string *hb* for an outgoing call.
If HLC is empty, HLC will derive from selected terminal type *attype*.
(default: attype=1 => ahlc=8083 : Telephony)
Should not be changed.

ab/0.ahlc=<HLC> (Default: empty)
ab/0.ahlc=- Clear HLC
ab/0.ahlc Show HLC

Sometimes the values 9181 (Telephony) or 9184 (Fax group 2/3) are used.
All values of hlc (including an empty hlc) are accepted with an incoming call.

ab/1.allc Low layer Compatibility port A
ab/2.allc Low layer Compatibility port B

Changes the LLC (low layer compatibility) value to the string *hb* for an outgoing call.
If LLC is empty, LLC will derive from selected terminal type *attype*.
(default: attype=1 => allc=empty)
Should not be changed.

ab/0.allc=<LLC> (Default: empty)
ab/0.allc=- Clear LLC
ab/0.allc Show LLC

All values of llc (including an empty llc) are accepted with an incoming call (see note 2).

6.6.5 Subaddressing

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

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

The functionality Subaddressing can be used with the dialing procedures AT-command set, PAD X.3 and automatic call.

Examples:

ATD*isdnnumber*[*/subaddr*]

isdnnumber	Dialing called party number
subaddr	Called subaddress

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

rn	Calling party number
subaddr	Calling party subaddress

The own subaddress (calling subbaddress) can be setup using the configuration command **sub**.

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

6.6.6 Using Multilink PPP

To enable Multilink PPP handling within the NT1+Multi please enable protocol ML-PPP: **ATB31** rsp. **prot = 31**.

ML-PPP may be used with two different authentication protocols during the link establishment phase:
PAP (password authentication protocol, RFC 1334),
CHAP (challenge handshake authentication protocol, RFC 1994) with variants MD5 according to RFC 1321,
Microsoft Chap according to RFC 2433.

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

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

6.6.7 Restrictions on Windows95

The CHAP protocol requires that the local side (PC or NT1+) responds with the proper, encrypted password when ever requested by the remote host. Since Windows95 does not respond on repeated requests CHAP can be used on the second link only if the NT1+Multi knows the password. It must be stored in the NT1+'s NVRAM:

Enter "**at**chappwd=<password>**" to input your password in the NT1+Multi.

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 NT1+.

If the password *chappwd* is not stored on the NT1+Multi (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.

6.6.8 Call Bumping

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

To enable Call Bumping proceed as follows:
Activate call waiting on the S bus. It has to be activated in the ISDN switch and is a feature of the ISDN line you ordered.
Open the "properties" of the dial-up link you are using for ML-PPP and "additional settings". Input "**at**cmlp=1**" as an additional parameter.

If there is an incoming call during a ML-PPP session the NT1+ will drop one B-channel and an ISDN telephone attached to the S bus will be ringing to accept the call.
The setting of cmlp is not affected by command AT&F.

6.6.9 Bandwidth on demand ("BOD")

Enabling this feature will cause the NT1+Multi 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 for data transfer used.
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.

6.6.10 Software update

The NT1+Multi uses a Flash-EPROM to store the software. This software can be updated from a local connected PC via the COM port.

Please fulfill the following steps to update the NT1+Multi:

Get a new software release for the NT1+ from your supplier and copy it to your PC.
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“.
Wait for end of erasing the Flash-EPROM and the prompt to start your X-MODEM transfer.
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.
After completion you will get the information whether the software update ended successfully or erroneous.
Give the NT1+Multi about 20 seconds to activate the new software.
Due to new functionality the last stored configuration setting may be lost, please check before using. To set factory default values please use the command "at&f1".

6.7 Diagnostic and error messages

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

6.7.1 Error messages from AT command set

When the extended result messages are selected using the command ATV2 ISDN error codes are displayed in addition to the standard AT result messages.
ISDN error causes from the ISDN network are always coded as *34xxH*, whereas the last two digits *xx* represent the ISDN cause in hexadecimal coding. The meaning can be taken from the following tables ISDN causes (see page 57).

6.7.2 Table of ISDN causes and their explanation (DSS1)

Cause Decimal / Hexadecimal	Meaning	Translation to AT result codes
1 / 0x81	Unallocated (unassigned) number	3
2 / 0x82	No route to transit network	3
3 / 0x83	No route to destination	3
6 / 0x86	Channel unacceptable	6
7 / 0x87	Call awarded and being delivered in an established channel	6
16 / 0x90	Normal clearing	3
17 / 0x91	User busy	7
18 / 0x92	No user responding	8
19 / 0x93	No answer from user (user alerted)	8
20 / 0x94	No answer from user (device off)	8
21 / 0x95	Call rejected	8
22 / 0x96	Number changed	3
26 / 0x9A	Non selected user clearing	3
27 / 0x9B	Destination out of order	8
28 / 0x9C	invalid number format	3
29 / 0x9D	Facility rejected	3
30 / 0x9E	Response to STATUS ENQUIRY	3
31 / 0x9F	Normal disconnect, unspecified	3
34 / 0xA2	No circuit/channel available	7
38 / 0xA6	ISDN network out of order	6
41 / 0xA9	Temporarily failure	6
43 / 0xAB	Access information discarded	6
44 / 0xAC	Requested circuit/channel not available	6
46 / 0xAE	Precedence call blocked	6
47 / 0xAF	Resource unavailable, unspecified	6
49 / 0xB1	Quality of service unavailable	3
50 / 0xB2	Requested facility not subscribed	3
53 / 0xB5	Outgoing calls barred within CUG	3
55 / 0xB7	Incoming calls barred within CUG	3
57 / 0xB9	Bearer capability not authorized	3
58 / 0xBA	Bearer capability not presently available	3
63 / 0xBF	Service or option not available, unspecified	3
65 / 0xC1	Bearer capability not implemented	3
66 / 0xC2	Channel type not implemented	3
69 / 0xC5	Requested facility not implemented	3
70 / 0xC6	Only restricted digital information bearer capability is available	3

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

6.7.3 CAPI causes and their explanation

Coding of the CAPI cause in hexadecimal form.

0000	No error
0001	NCPI ignored
0002	Flags ignored
0003	Alert already sent
1001	Too many applications
1002	Logical block size too small
1003	Buffer exceeds 64k
1004	Message buffer size too small
1005	Too many logical connections
1006	Reserved1
1007	Message could not be accepted
1008	Register OS Resource Error
100a	External Equipment not supported
100b	External Equipment only
1101	Bad application ID
1102	Illegal cmd or message length
1103	Message queue full
1104	Message queue empty
1105	Message lost
1106	Unknown notification
1107	Message not accepted
1108	OS Resource Error
1109	CAPI not installed
2001	Bad State
2002	Illegal Identifier
2003	Out of PLCI
2004	Out of NCCI
2005	Out of LISTEN
2006	Out of Fax Resources
2007	Illegal Message Parameters
3001	B1 protocol not supported
3002	B2 protocol not supported
3003	B3 protocol not supported
3004	B1 protocol param not supported
3005	B2 protocol param not supported
3006	B3 protocol param not supported
3007	B Prot combination not supported
3008	NCPI not supported
3009	Unknown CIP value

300a	Flags not supported
300b	Facility not supported
300c	Data length not supported
300d	Reset procedure not supported
3301	Layer1 protocol error
3302	Layer2 protocol error, i.e. DTE address not correct, TEI not correct
3303	Layer3 protocol error
3304	Another application got the call
3311	Fax remote station is not fax
3312	Fax training failed
3313	Fax disconnect before transfer
3314	Fax disconnect remote abort
3315	Fax disconnect remote procedure
3316	Fax disconnect local transmitter underrun
3317	Fax disconnect local receiver overflow
3318	Fax disconnect local abort
3319	Fax illegal transmit data

34xx Error cause from the ISDN line, xx represents the ISDN cause (see page 57)

7 Appendix

A1: Technical data:

One V.24 channel:	
functional:	V.24
electrical:	V.28
mechanical:	9 pin DSUB connector (female)
Transmission speeds:	
DTE:	1200 – 230400 bit/s (asynchronous)
B channel:	2 x 64000 bit/s (synchronous)
Character representation:	8Bit no Parity, 1 stop bit
7Bit even/odd Parity, 1 stop bit	
Character synchronization:	asynchronous
Operating mode:	half duplex or full duplex
USB interface	Type 2 USB socket
Analogue ports:	POTS with DTMF detection electrical parameter according national
requirements	
ISDN interface:	2 wire U interface 2B1Q coding
Physical dimensions:	appr. 155 x 221 x 57 mm (DxWxH)

A2: Pinout of the ISDN S-bus connector

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

Pin	Signal (S_0)
1	Not connected
2	Not connected
3	Tx+ (Transmit +)
4	Rx+ (Receive +)
5	Rx- (Receive -)
6	Tx- (Transmit -)
7	Not connected
8	Not connected

A3: Pinout of the ISDN U interface connector

Pinout of the 6 pin ISDN U-interface connector (RJ11)

Pin	Signal (U)
1	Not connected
2	Not connected
3	U1
4	U2
5	Not connected
6	Not connected

A4: Pinout of the analogue connector

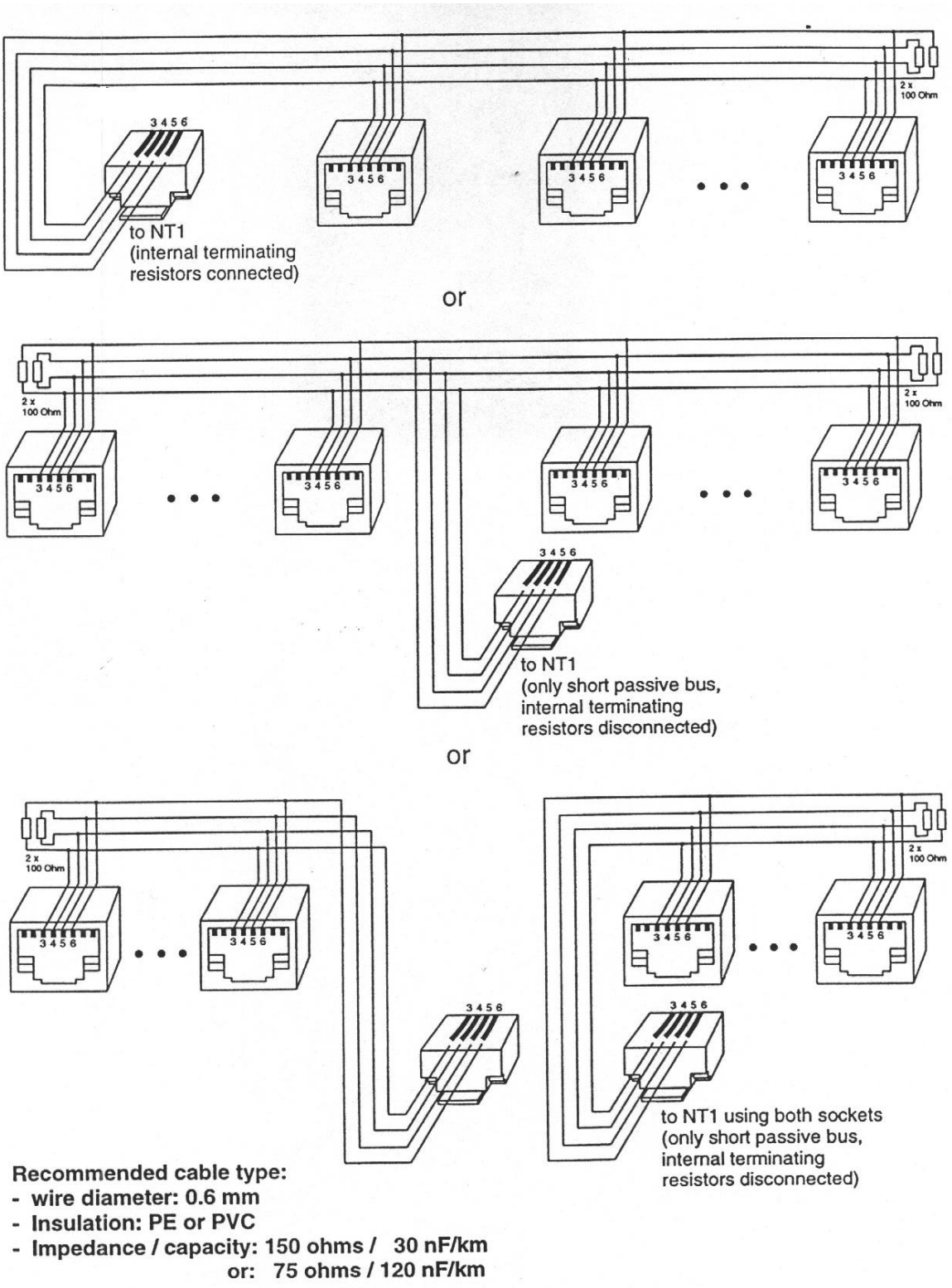
Pinout of the 4 pin analogue interface connector (RJ14)

Pin	Signal (a/b)
1	Not connected
2	B line (RING)
3	A line (TIP)
4	Not connected

A5: Pinout of the V.24/V.28 interface NT1+Multi (DSUB 9)

Pin	V.24/V.28			I/O	TEXT
	ITU	DIN	EIA		
1	109	M5	DCD	O	Data carrier detect
2	104	D2	R D	O	Receive data
3	103	D1	T D	I	Transmit data
4	108/1 108/2	S1.1 S1.2	DTR	I	Data terminal ready
5	102	E2	GND	---	Signal ground
6	107	M1	DSR	O	Data set ready
7	105	S2	RTS	I	Request to send
8	106	M2	CTS	O	Clear to send
9	125	M3	RI	O	Ring indicator

A6: S bus configuration



Recommended cable type:
- **wire diameter: 0.6 mm**
- **Insulation: PE or PVC**
- **Impedance / capacity: 150 ohms / 30 nF/km**
  or: 75 ohms / 120 nF/km

8 Glossary

1TR6	Older German national ISDN protocol (PTT)
3PTY	Third Party connection, conference call with three parties
A party	partner who makes the connection (active)
B party	partner, who is on the receiving end of connection (passive)
B Channel	basic channel of an ISDN-basic rate port. A public access (basic rate) has 2 B-channels.
BBS	Bulletin Board Service ("Mailbox")
BC	bearer capability. D Channel element to select a specific service.
BOD	Bandwidth on demand
BRI	Basic Rate Interface; ISDN-connection for 2 B-channels via 4 wires, bus operation possible, bus operation radius ca. 150m, in point-to-point operation ca. 950m
CCBS	Call completion to busy subscriber
CCITT	Consultative Committee on International Telephone and Telegraph, international standards committee
CFB	Call Forwarding Busy
CFNR	Call Forwarding No Reply
CFU	Call Forwarding Unconditional
CHAP	Challenge Handshake Authentication Protocol, RFC 1994
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
Configuration	Adapting to the standard requested by a work modus
CTS	Clear To Send, status line from TA to DTE
CW	Call Waiting

CUG	Closed User Group
Default	preset value, is regarded as standard value, when no other value is set or input
DCD	Data Carrier Detect, status line from TA to DTE
DCE	DataCircuit-Terminating Equipment
DKZE	Based on 1TR6 national (extended) D-channel protocol for private branch exchange (PBX), same as the DKZN1-protocol
DKZN1	Based on 1TR6 national (extended) D-channel protocol for private branch exchange (PBX), same as the DKZE-protocol
DSR	Data Set Ready, status line from TA to DTE
DTE	Data Terminal Equipment: Data terminal, i.e. PC with Terminal Emulation
DTMF	Dual Tone Multi Frequency; also known as tone dialing
DTR	Data Terminal Ready, status line from DTE to TA
DSS1	D channel protocol for Europe. Also known as EURO-ISDN.
EIA	Electronic Industries Association
ETSI	synonym for ISDN protocol (defined by ETSI group) for European ISDN interfaces, specification dependent on national characteristics.
HLC	high layer compatibility. D channel element to select specific services
Hotline	connection establishment is initiated through an interface control circuit or automatically
ISDN	Integrated Services Digital Network (Service integrating digital telecommunication network)
ISP	Internet service provider
Jumper	short plug
LAN	Local Area Network

LLC	low layer compatibility. D channel element to select specific services
MCID	Malicious Call Identification
MLPPP	Multilink Point to Point Protocol, Protocol used for Internet Access to combine more than one B channel.
MSN	multiple subscriber number. Part of the call number to directly address different devices on an ISDN interface
PABX	Private Automatic Branch Exchange;
PAP	Password Authentication Protocol, RFC 1334
POTS	Plain Old Telephone System, interface analogue telephones
PPP	Point to Point Protocol, Protocol used for Internet Access in combination with TCP/IP
remote	distant, that is the device on the other end - as opposite to local
RAS	Remote Access Service
RI	Ring Indication, status line from TA to DTE
RJ45	Connector for max. 8 wires ("Western plug"), international standard (here: ISO 8807)
RTS	Request To Send, status line from DTE to TA
S0	ISDN-connection for 2 B-channels via 4 wires, bus operation possible, bus operation radius ca. 150m, in point-to-point operation ca. 950m
SUB	Subaddress. Optional additional information to the call number, that can be sent with an outgoing call.
TA	Terminal-Adaptor
U0	Physical ISDN connection for 2 B channels over 2 wires, point to point operation
UUS	Transparent user to user information, transmitted via D channel with setup message (UUS1) or during connection (UUS3)
V.24	Interface description of the CCITT for serial data transmission between a DTE and a DCE.

Same as the EIA standard RC-232-C. An example for a V.24 DTE is the COM-Interface of a PC.

WAN	Wide Area Network