HEIDENHAIN

Data Interfaces of HEIDENHAIN Devices

Service Manual

May 2000

Foreword

Changes/further development
We are constantly working on technical improvements of our products. For this reason, details described in this manual may slightly differ from your model. In this case please order a revised serivce manual from us.

Duplication
This service manual is provided subject to the condition that no part of it shall be duplicated in any form without our prior consent.

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Contents Service Manual
Data Interfaces of HEIDENHAIN Devices

Table of Contents

1 General information on the data interfaces

Depending on the type of equipment (controls, counters) one or several of the data interfaces stated below are available:

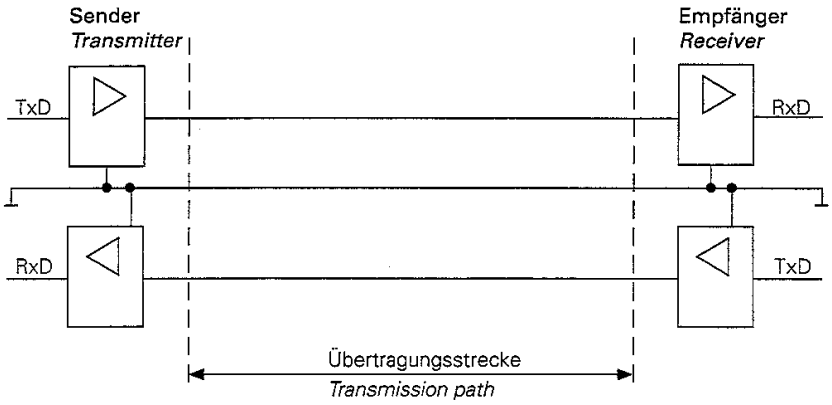
1.1 V.24/RS-232-C interface

The name of the RS-232-C serial interface is derived from the American EIA standard for data transfer rates up to 19200 bps. Data transfer is asynchronous with one start bit before and one or two stop bits after each character.
The interface is designed for transmission paths of up to 30 m.
RS-232-C was slightly modified and introduced in Europe as V.24 interface. The German standard is DIN 66020.

1.1.1 Hardware

Two V.24/RS-232-C interfaces are physically connected by a non-symmetrical line, i.e. the central ground connection between transmitter and receiver is used as return line.

Principle of the physical connection:



1.1.2 Signal levels

With the V.24/RS-232-C interface two different signal lines and the corresponding levels must be differentiated.

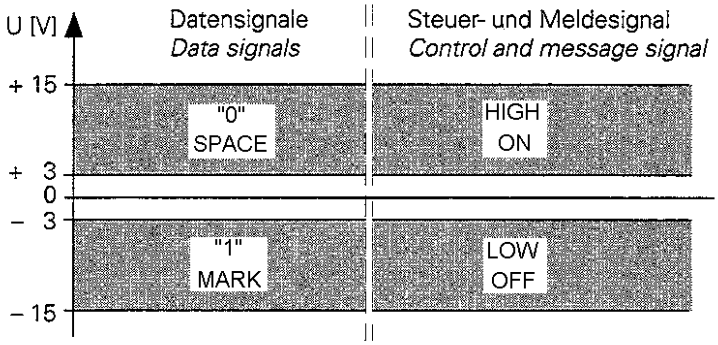
Data lines:

The data signals are defined as logical "1" (MARK) in the range from –3 to –15V and as logical "0" (SPACE) between +3 and +15V

Control and message lines:

These signals are defined as "ON" (high) in the range from +3 to +15V and as "OFF" (low) between –3 and –15V.

The voltage range from –3 to +3V of all signals is not defined as logic level and therefore cannot be evaluated.



1.1.3 HEIDENHAIN data transfer software

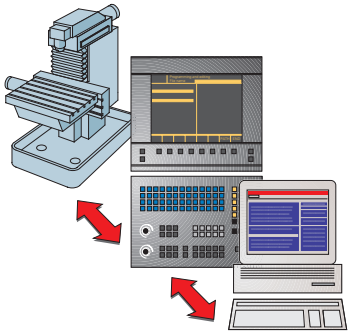
For the data transfer between PC and control (or ND or VRZ) HEIDENHAIN offers the following transmission programs. For testing purposes a shareware version is available:

TNCremo for the operating systems:

MS-DOS
Windows 3.1
Windows for workgroups 3.11
Windows 95

TNCremoNT for the operating systems:

Windows 95
Windows 98
Windows NT



Functions of TNCremo

- Data transfer in LSV2, FE or ME protocol
- PC as file server
- Creation of TNC screen dumps (storage of TNC screen contents on the PC)
- Download of the control log
- Remote control of TNC from the PC
- Data backup of the control hard disk (TNC 426, TNC 430)
- Text editor
- Blockwise transfer of long programs
- File management of control on the PC
- Modem operation

Functions of TNCremoNT

- Data transfer in LSV2, FE or ME protocol
- PC as file server
- Download of the control log
- Text editor
- Blockwise transfer of long programs
- File management of control on the PC
- TNC 426, TNC 430: creation of palette tables, editing and testing
- Dialog language selectable (German, English, Italian, Spanish)

Not all controls are featured with every function. Which function is available on which control, please see section "Operating modes".

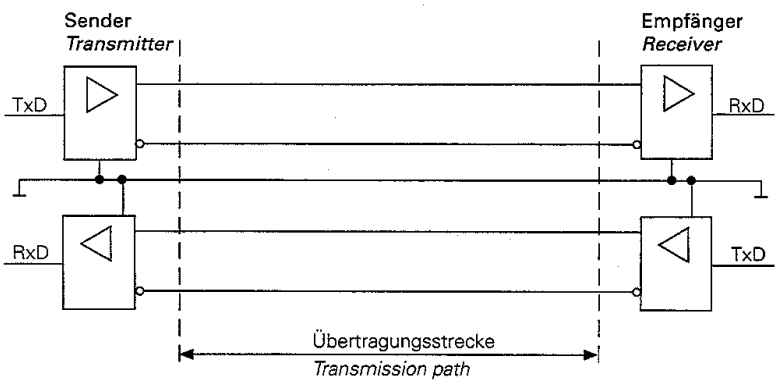
1.2 V.11/RS-422 interface

The interface V.11/RS-422 has been developed, since V.24/RS-232-C only offers limited functions. This model is standardized, too, but it operates symmetrically.
The V.11/RS-422 interface is suitable for data transfer rates up to 10 Mbits/sec.
At a rate of 38400 baud, the maximum cable length is 1 km.

1.2.1 Hardware

The standard V.11/RS-422 operates with differential voltages. This technology offers the advantage that interferences act uniformly and in the same way on both signal lines of the transmission path. Since only the differential voltages of both signal lines are evaluated in the receiver, these interferences can be neglected. This technology allows for much longer lines and - due to the consequences of interferences being of less influence - for a considerably higher data transfer rate.

Principle of the physical connection:

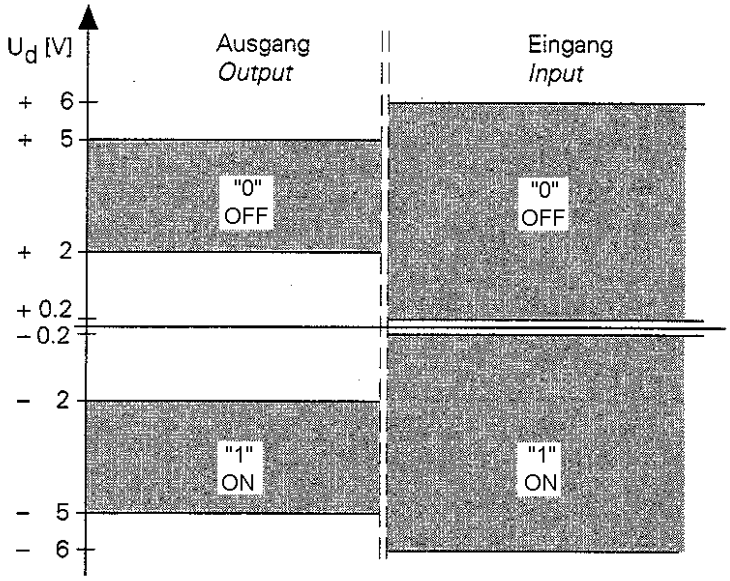


1.2.2 Signal levels

With the V.11/RS-422 interface the signals are transferred in both directions in the form of a differential voltage.
A positive differential voltage corresponds to a logical "0" (OFF), a negative one to a logical "1" (ON).
Differential voltages are output between

U_{dmin} = 2V and U_{dmax} = 5V; the control recognizes the differential voltages between

U_{dmin} = 0.2V and U_{dmax} = 6V as logically defined levels.



1.2.3 HEIDENHAIN data transfer software

See section 1.1.3

1.3 Ethernet

Most of the local networks are based on Ethernet technology. It was designed in 1982 by DIGITAL EQUIPMENT, INTEL and XEROX. The Ethernet can operate at a data transfer rate of up to 100 Mbits/sec (fast Ethernet); the hardware versions most frequently used operate at 10 Mbits/sec, e.g. 10BASE2 (thin Ethernet, Cheapernet), 10BASE5 (thick Ethernet, yellow cable) or 10BASET (twisted pair). They differentiate in price, installation and network topology, but not in the access to the medium.
The data transfer rate highly depends on the work-load of the network.
Realistic values: NC program up to 200 kBits/sec,
ASCII file up to 1Mbit/sec

1.3.1 Hardware

As soon as you have installed the Ethernet card, the 10BASE2 connector (BN) and the 10BASET connector (twisted pair) are available. Only one connector can be used at a time. The connectors are metallically isolated from the control electronics.

Connection and wiring diagrams: please see **section 6.2**
Connector layout: **section 2.2**.

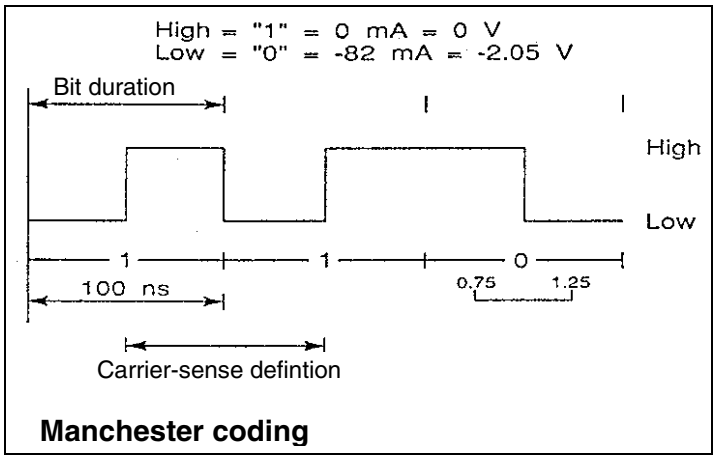
X26 Ethernet interface, BNC connection (coaxial cable 10Base2)
The 10BASE2 connection is also known as **Thin Ethernet** or **CheapterNet**.
Connect the TNC to your network via the BNC-T connector. The maximum cable length is 185 m (coaxial cable). The network topology is a linear bus. The unconnected ends of the bus must be equipped with terminating resistors.

X25 Ethernet interface, RJ45 connection (10BaseT)
The twisted-pair cable of the 10BASET connector may be either shielded or non-shielded.
Maximum cable length: non-shielded: 100 m
shielded: 400 m

The network topology is a star connection. The center of the star is a hub enabling a connection to the other clients.

1.3.2 Signal structure

Ethernet frames are transferred in **Manchester code** which is a so-called self-clocking code. The synchronization or the transfer of a transmit clock pulse is executed such that each bit is transmitted invertedly in the first half of the transfer period, i.e. the bit rate is half the baud rate. A data rate of 10 Mbits/sec results in a bit duration of 100 ns. Carrier detect (activity on the cable) is indicated by the presence of signal edges. If the signal level does not change in a bit duration interval between 0.75 and 1.75 after the last transition, no carrier is detected. (see figure below).



Manchester coding

The network settings of the TNC are described in the TECHNICAL MANUAL and in section 6 (Ethernet) of this service manual.

1.3.3 Connecting the TNC to data networks

The HEIDENHAIN control models TNC 426/TNC 430 can be equipped with an Ethernet data interface (option[1)]): Via this data interface the TNC 426/TNC 430 can be connected in data networks as client.

The TNC transfers data in TCP/IP protocol (transmission control protocol / Internet protocol) and with the aid of the NFS, version 2 (network file system). TCP/IP and NFS have above all been implemented in UNIX systems.
Therefore, in most cases TNCs can be operated in a UNIX network environment without additional software.

PC network environments with Microsoft operating systems also use TCP/IP, but not NFS. For this reason, additional software is usually required for operation in PC networks. HEIDENHAIN recommends the following network software:

Operating systems	Network software
WIN 95 WIN 98 WIN NT	CIMCO NFS Available at HEIDENHAIN (Id.No. 339737-xx)

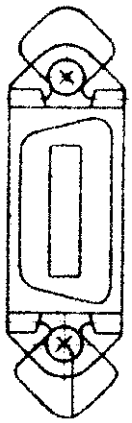
Note:
In principle also other NFS servers can be used.
However, due to the great variety of software manufacturers HEIDENHAIN is not in a position to provide technical support when adapting other NFS servers.

1) The control models that can be operated with the Ethernet card are listed in **section 2.**
The network settings of the TNC are described in the TECHNICAL MANUAL and in **section 6** (Ethernet) of this service manual.

2 Connectors and pin layouts

2.1 Connectors and pin layouts of TNC 125, 131, 135, 145, 150, 151/155

V.24/RS-232-C data interface,14.pin, Amphenol
Flange socket with female insert



PIN No.	Assignment	Designation
1	GND	Chassis ground
2	n.c.	
3	n.c.	
4	n.c.	
5	RTS	Request to Send
6	DSR	Data Set Ready
7	n.c.	
8	n.c.	
9	n.c.	
10	n.c.	
11	DTR	Data Terminal Ready
12	TxD	Transmit Data
13	CTS	Clear to Send
14	RxD	Receive Data
Chassis	External shield	

2.2 Connectors and pin layouts as of TNC 122

V.24/RS-232-C data interface, 25-pin, D-SUB
Flange socket with female insert

PIN No.	Assignment	Designation
1	Shield	Chassis Ground
2	RxD	Receive Data
3	TxD	Transmit Data
4	CTS	Clear to Send
5	RTS	Request to Send
6	DTR	Data Terminal Ready
7	GND (0V *2)	Signal Ground
8 to 19	not assigned	
20	DSR	Data Set Ready
21 to 25	not assigned	
Chassis	external shield = chassis	

Control model	V.24/RS-232-C connector			
	X21	X25	X6	X26
TNC 122	x			
TNC 246			x	
TNC 2500/B/C		x		
TNC 306		x		
TNC 335		x		
TNC 351/355				x
TNC 360		x		
TNC 406	x			
TNC 407	x			
TNC 410	x			
TNC 415/B	x			
TNC 425	x			
TNC 426	x			
TNC 430	x			
CNC 232B			x	
CNC 234.xxx		x		
CNC 332				x

V.24/RS-232-C data interface, 9-pin, D-SUB
Flange socket with female insert

PIN No.	Assignment	Designation
1	Shield	Chassis Ground
2	TxD	Transmit Data
3	RxD	Receive Data
4	DSR	Data Set Ready
5	GND	Signal Ground
6	DTR	Data Terminal Ready
7	CTS	Clear to Send
8	RTS	Request to Send
9	not assigned	
Chassis	External shield = chassis	

Control model	V.24/RS-232-C connector			
	X21			
TNC 124	x			
TNC 310	x			
TNC 370	x			

V.11/RS-422 data interface, 15-pin, D-SUB
Flange socket with female insert

PIN No.	Assignment	Designation
1	Shield	Chassis Ground
2	RxD	Receive Data
3	CTS	Clear to Send
4	TxD	Transmit Data
5	RTS	Request to Send
6	DSR	Data Set Ready
7	DTR	Data Terminal Ready
8	GND	Signal Ground
9	RxD	Receive Data
10	CTS	Clear to Send
11	TxD	Transmit Data
12	RTS	Request to Send
13	DSR	Data Set Ready
14	DTR	Data Terminal Ready
15	do not assign	

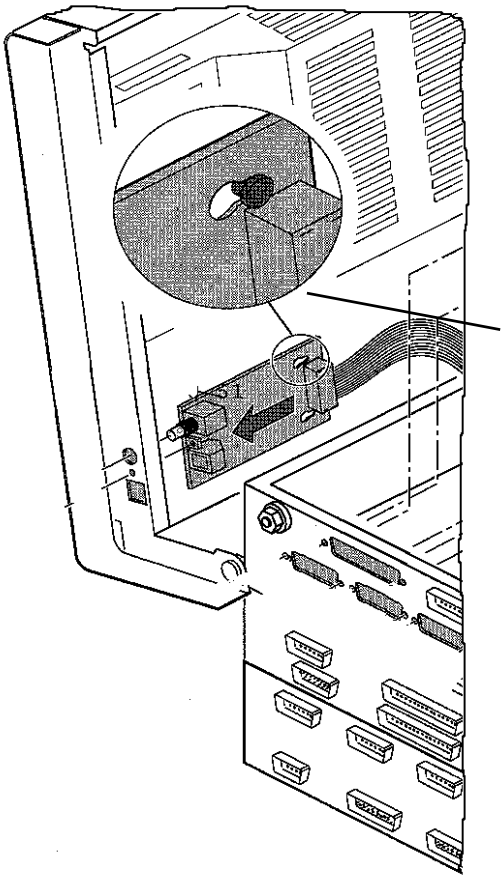
Control model	V.11/RS-422 connector			
	X22			
TNC 406	x			
TNC 407	x			
TNC 415/B	x			
TNC 425	x			
TNC 426	x			
TNC 430	x			

X25 Ethernet interface, RJ45 connector 10BaseT
Maximum cable length:
non-shielded: 100 m
shielded: 400 m

RJ45 connector (female) 8-pin	Assignment
1	TX+
2	TX–
3	REC+
4	not assigned
5	not assigned
6	REC–
7	not assigned
8	not assigned

X26 Ethernet interface, BNC connector 10Base2 (coaxial cable)
Maximum cable length: 180 m

BNC connector (female)	Assignment
Internal conductor (core)	Data (RXI, TXD)
Shield	GND



ETHERNET BOARD (option)
Id.No. 293 890-51

Control model	Ethernet connector (option)	
	X25	X26
TNC 426.B	x	x
TNC 430.A	x	x
TNC 426M/430M	x	x

2.3 Connectors and pin layouts of ND 2xx and PT 8xx

V.24/RS-232-C data interface, 25-pin, D-SUB
Flange socket with female insert

PIN No.	Assignment	Designation
1	Shield	Chassis Ground
2	TxD	Transmit Data
3	RxD	Receive Data
4	RTS	Request to Send
5	CTS	Clear to Send
6	DSR	Data Set Ready
7	GND	Signal Ground
8 to 19	not assigned	
20	DTR	Data Terminal Ready
21 to 25	not assigned	
Chassis	Ext. shield = chassis	

Position display	V.24/RS-232-C connector			
	X31			
ND XXX	x			
PT 8XX	x			

3 Wiring diagrams of the data interfaces

3.1 Overview V.24/RS-232-C

Control model	Connection of peripheral unit, 25-pin				Connection of peripheral unit, 9-pin			
	Wiring diagram for connection				Wiring diagram for connection			
	direct		via adapter and JH cable		direct		via adapter and JH cable	
	HW	SW	HW	SW	HW	SW	HW	SW
TNC 122	11	12	2	1	10	10	3	4
TNC 124	-	-	14	14	-	-	15	15
TNC 125	13	13	7	8	9	9	5	6
TNC 131	13	13	7	8	9	9	5	6
TNC 135	13	13	7	8	9	9	5	6
TNC 145	13	13	7	8	9	9	5	6
TNC 150	13	13	7	8	9	9	5	6
TNC 151/155	13	13	7	8	9	9	5	6
TNC 246	11	12	2	1	10	10	3	4
TNC 2500/B/C	11	12	2	1	10	10	3	4
TNC 306	11	12	2	1	10	10	3	4
TNC 310	-	-	14	14	-	-	15	15
TNC 335	11	12	2	1	10	10	3	4
TNC 351/355	11	12	2	1	10	10	3	4
TNC 360	11	12	2	1	10	10	3	4
TNC 370	-	-	14	14	10	10	15	15
TNC 406	11	12	2	1	10	10	3	4
TNC 407	11	12	2	1	10	10	3	4
TNC 410	11	12	2	1	10	10	3	4
TNC 415/B	11	12	2	1	10	10	3	4
TNC 425	11	12	2	1	10	10	3	4
TNC 426	11	12	2	1	10	10	3	4
TNC 430	11	12	2	1	10	10	3	4
CNC 232B	11	12	2	1	10	10	3	4
CNC 234.xxx	11	12	2	1	10	10	3	4
CNC 332	11	12	2	1	10	10	3	4
ND XXX	16	17	-	-	-	-	-	
PT 8XX	16	17	-	-	-	-	-	-

1 - xx: number of the wiring diagram on the following pages

HW: wiring diagram for data transfer with hardware handshake
SW: wiring diagram for data transfer with software handshake

3.2 Overview V.11/RS-422

Control model	Wiring diagram
TNC 406	18
TNC 407	18
TNC 415/B	18
TNC 425	18
TNC 426	18
TNC 430	18

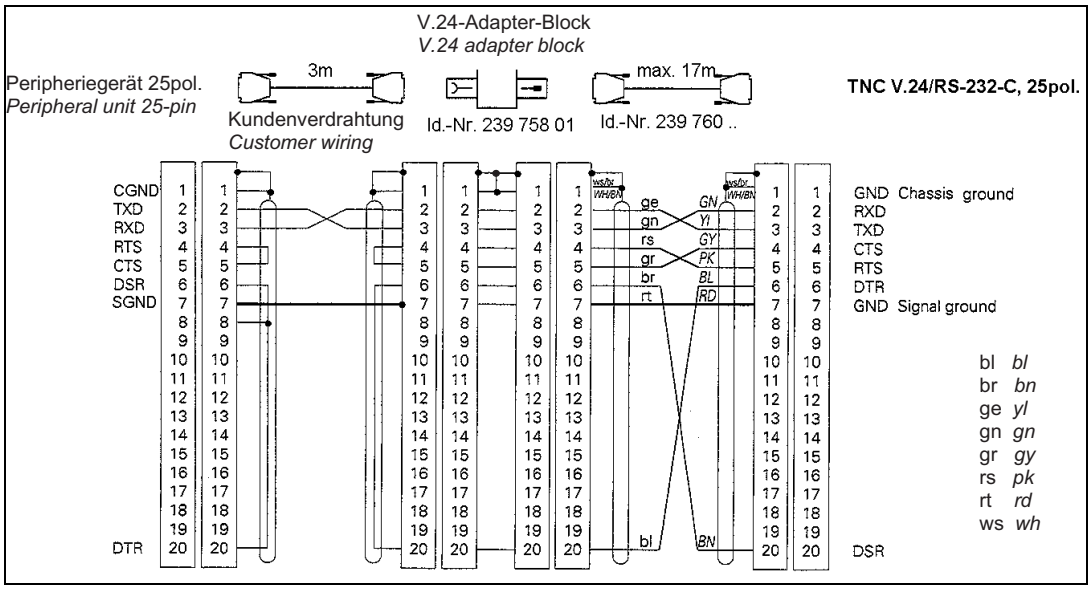
3.3 Overview Ethernet

Control model	Wiring diagram
TNC 426.B	section 6.2
TNC 430.A	section 6.2
TNC 426M/430M	section 6.2

1 - xx: number of the wiring diagram on the following pages

3.4 Diagrams V.24/RS-232-C

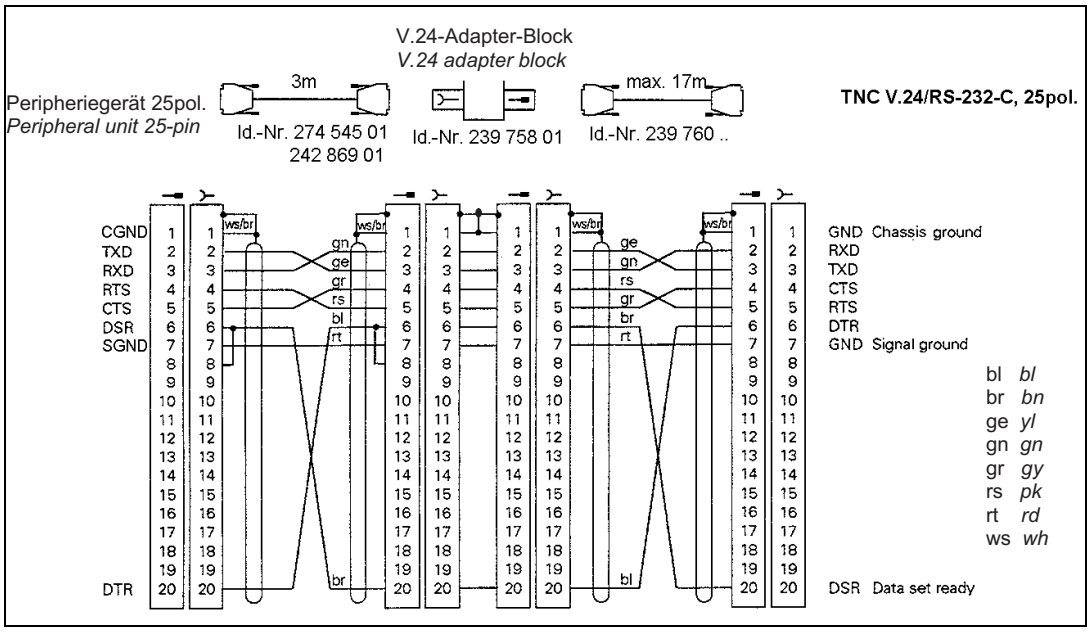
Diagram no.1
V.24/RS-232-C with adapter block for software handshake, TNC 25-pin / peripheral unit 25-pin



With this wiring type only transfer stop with DC3 (software handshake) is possible!

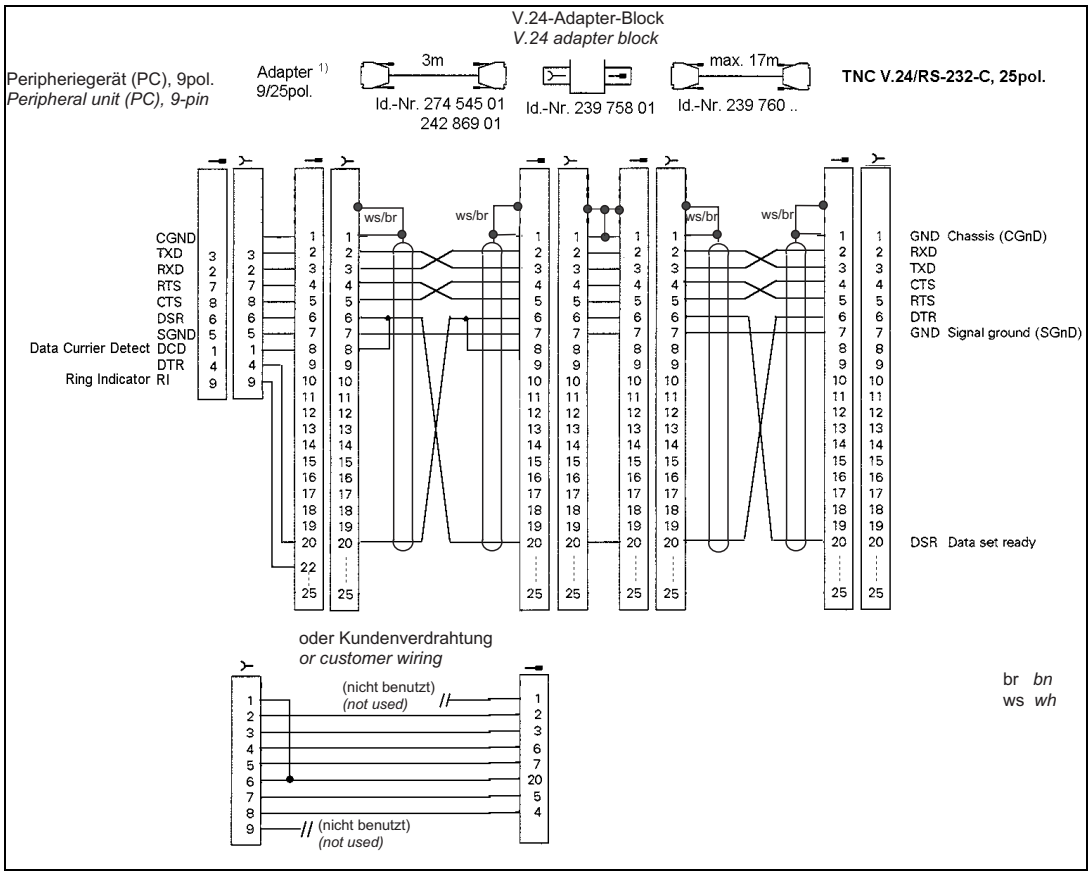
The pin layouts of the RS-232-C-/V.24 data interface are different at the logic unit and at the V.24 adapter block.

Diagram no.2
V.24/RS-232-C with adapter block for hardware handshake, TNC 25-pin / peripheral unit 25-pin



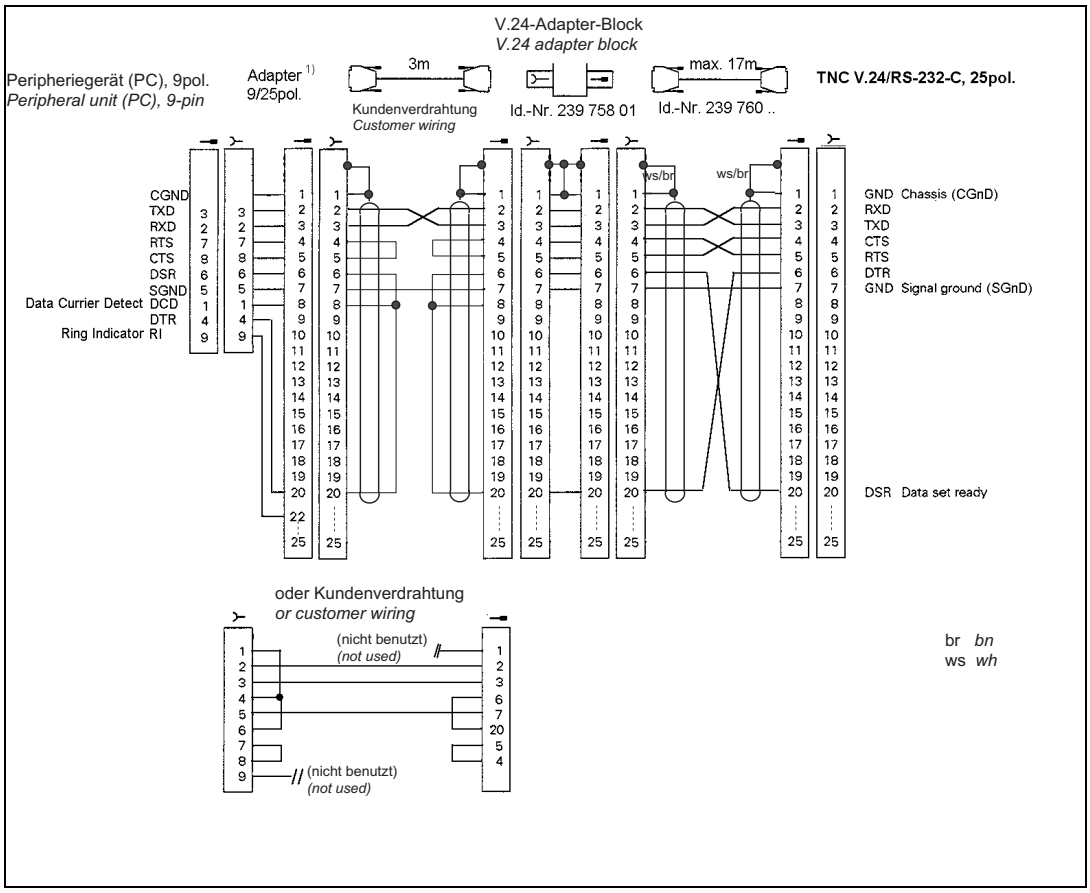
If the pin layout of your peripheral unit differs from the above, the HEIDENHAIN connecting cable cannot be used.

Diagram no.3
V.24/RS-232-C with adapter block for hardware handshake, TNC 25-pin / peripheral unit 9-pin



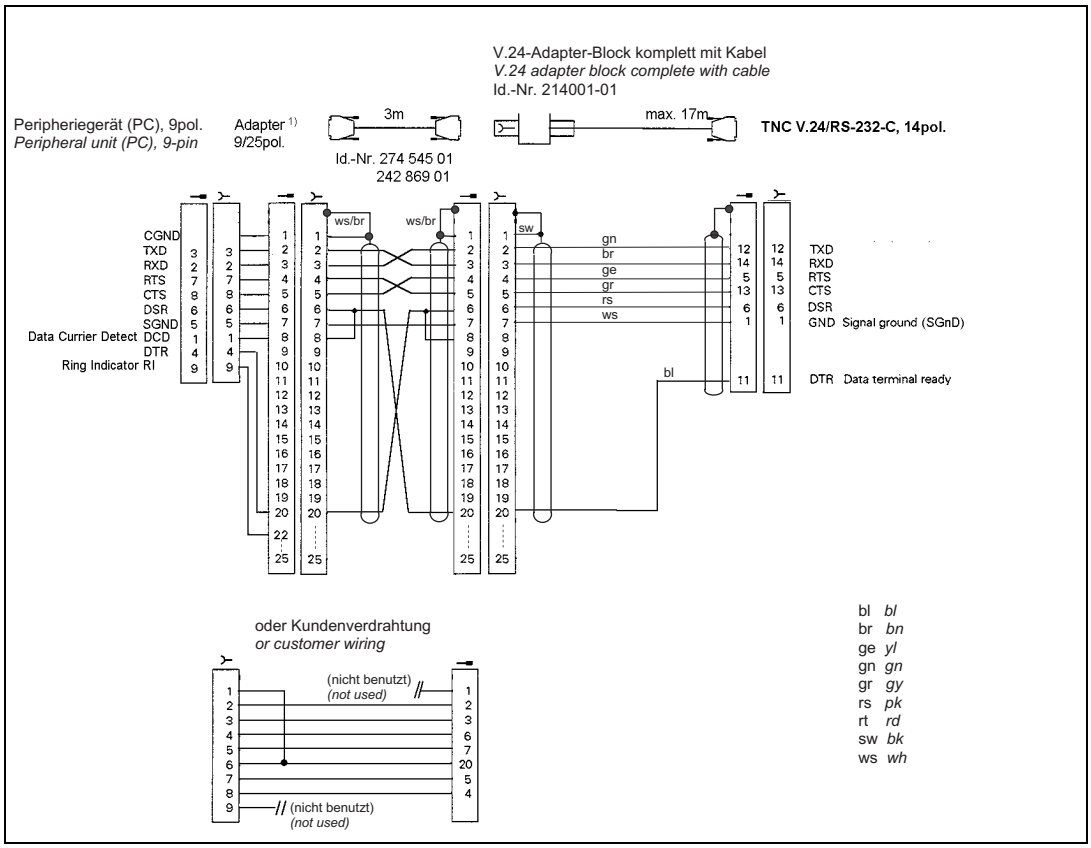
1) Customer wiring or prefabricated part

Diagram no.4
V.24/RS-232-C with adapter block for software handshake, TNC 25-pin / peripheral unit 9-pin



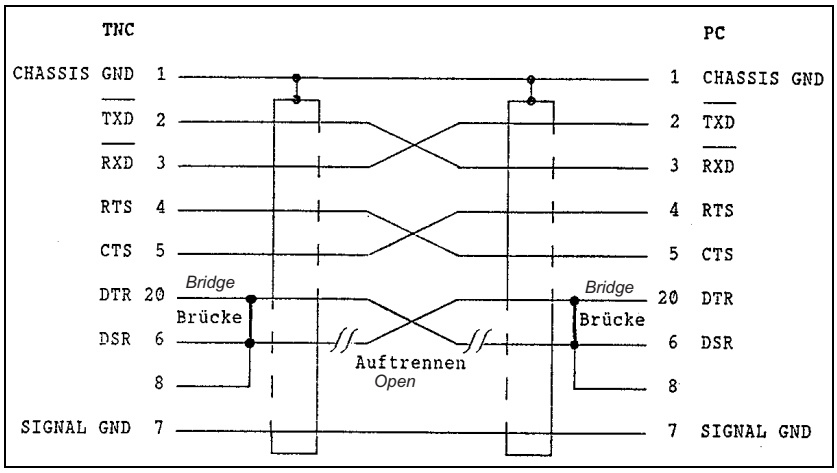
1) Customer wiring or prefabricated part

Diagram no.5
V.24/RS-232-C with adapter block for hardware handshake, TNC 14-pin / peripheral unit 9-pin



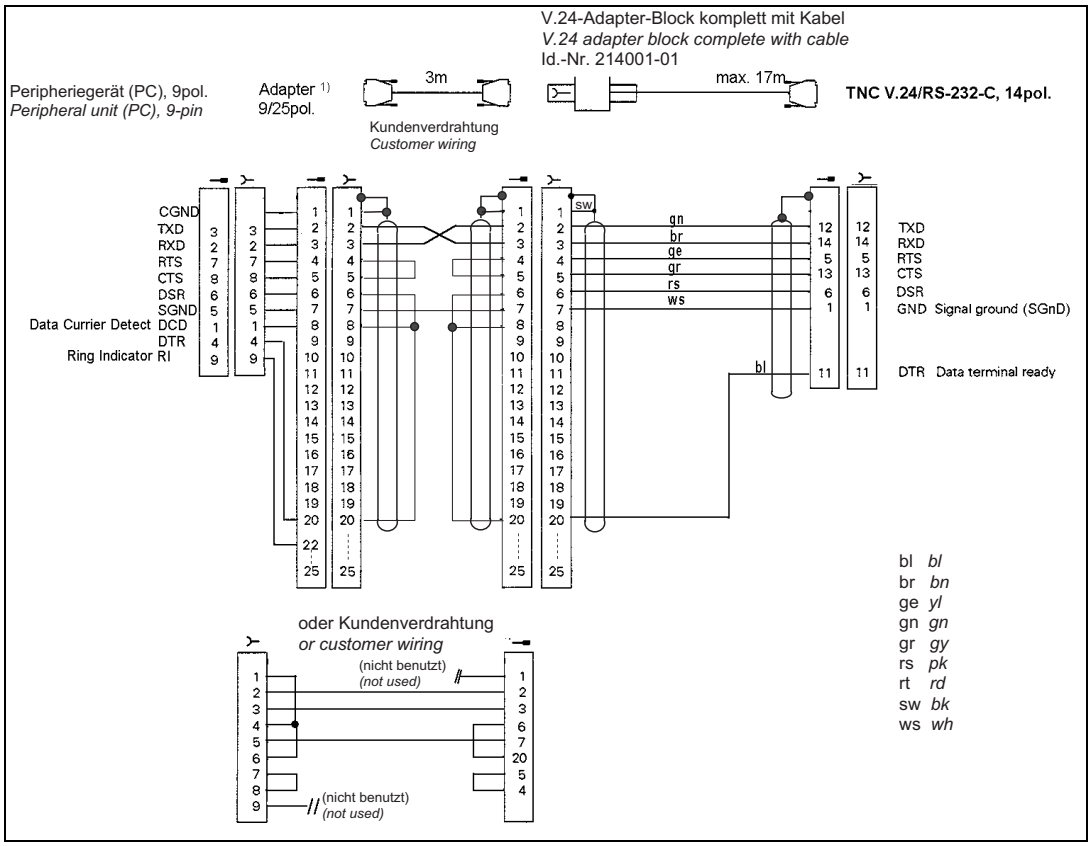
1) Customer wiring or prefabricated part

CAUTION! TNC 145 to TNC 155



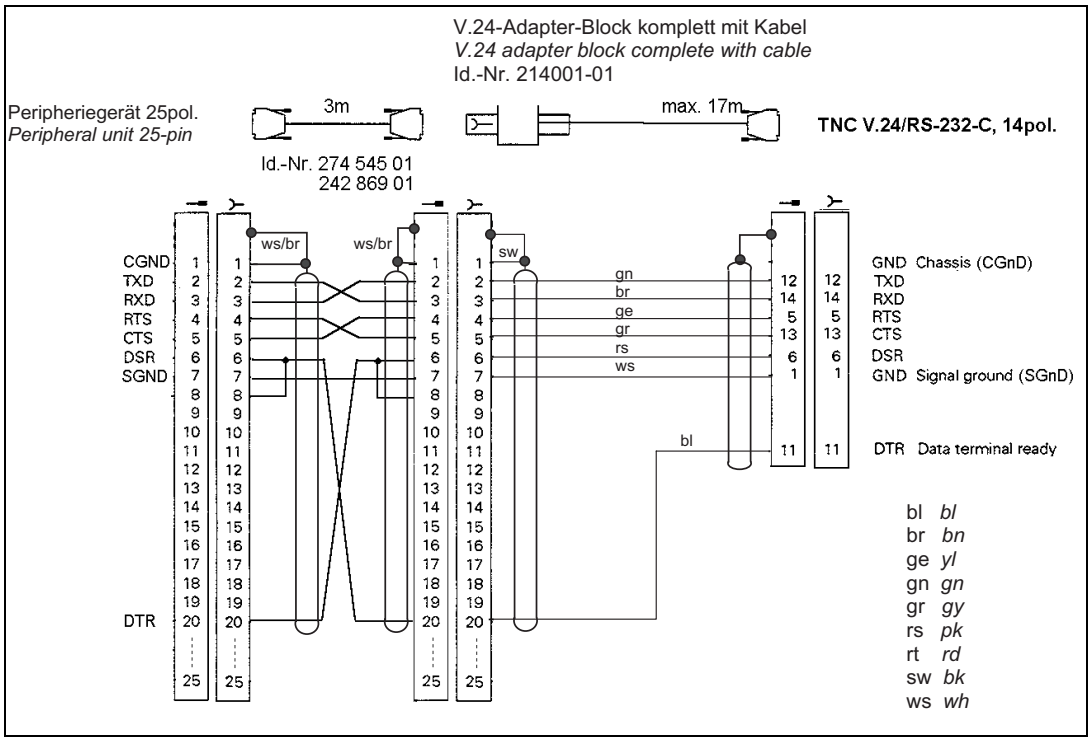
This modification applies for hardware handshake with TNC 145 to TNC 155. In these control models, the RTS pin is not connected but tied high internally.
The following modification is required for hardware handshaking:
Cut the line on both sides between "DSR" and "DTR" and short-circuit "DSR" with "DTR" (PC: pin6 with pin20).
Without this modification, data transfer using hardware handshaking is not only stopped but aborted immediately (like "power off").
Do not use this configuration for TNC 355 with new hardware.

Diagram no.6
V.24/RS-232-C with adapter block for software handshake, TNC 14-pin / peripheral unit 9-pin

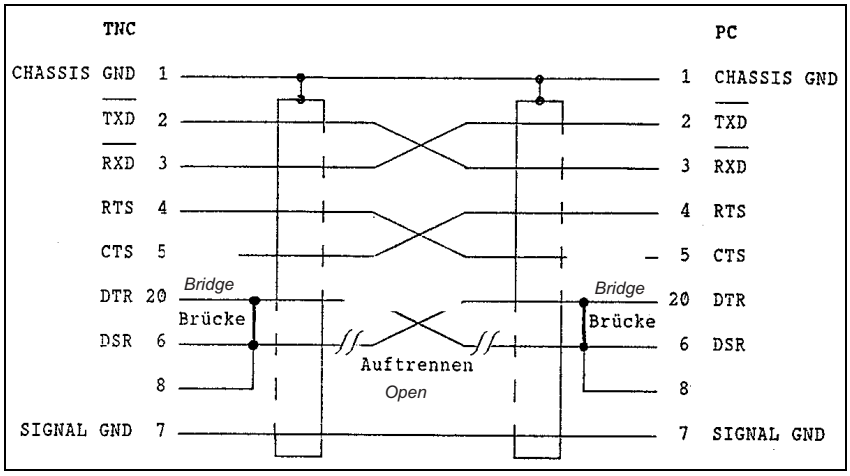


[1] Customer wiring or prefabricated part

Diagram no.7
V.24/RS-232-C with adapter block for hardware handshake, TNC 14-pin / peripheral unit 25-pin



CAUTION! with TNC 145 to TNC 155



This modification applies for hardware handshake with TNC 145 to TNC 155. In these control models, the RTS pin is not connected but tied high internally.
The following modification is required for hardware handshaking:
Cut the line on both sides between "DSR" and "DTR" and short-circuit "DSR" with "DTR" (PC: pin6 with pin20).
Without this modification, data transfer using hardware handshaking is not only stopped but aborted immediately (like "power off").
Do not use this configuration for TNC 355 with new hardware.

Diagram no.8
V.24/RS-232-C with adapter block for software handshake, TNC 14-pin / peripheral unit 25-pin

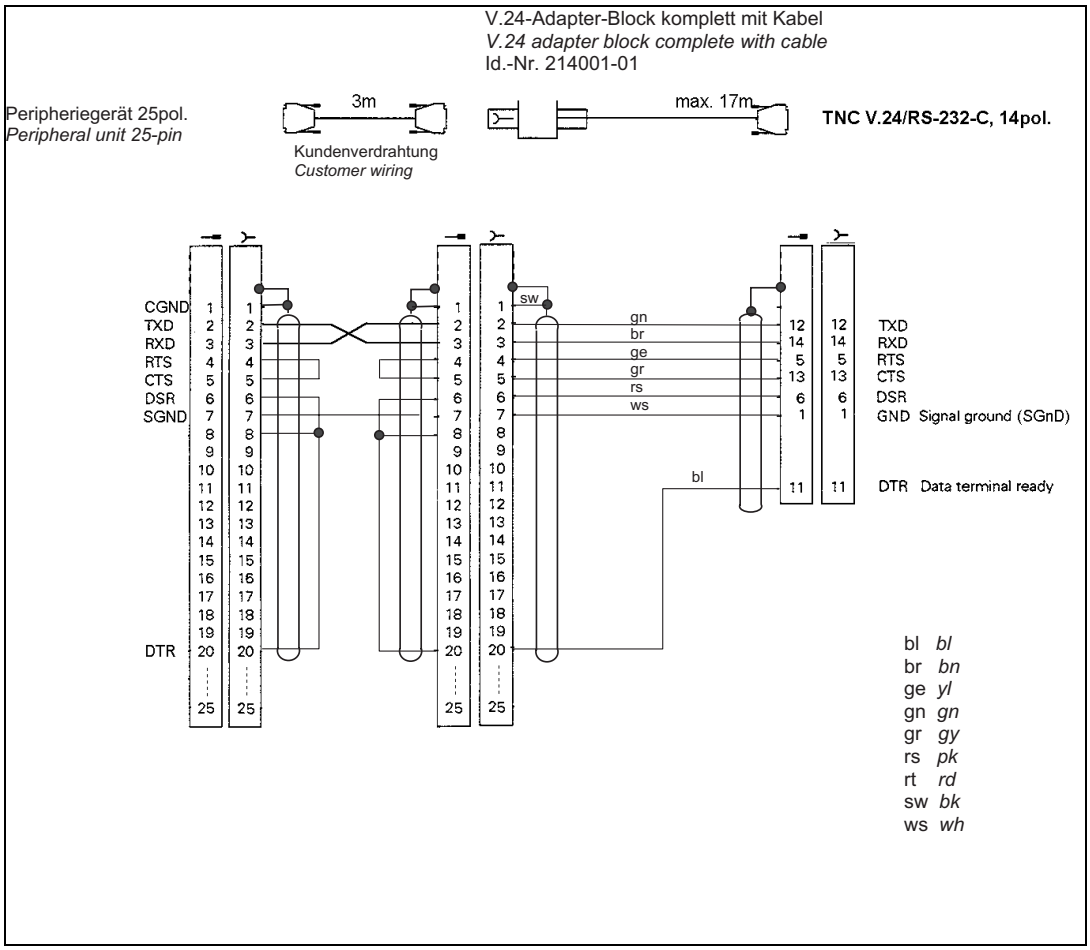


Diagram no.9
V.24/RS-232-C direct connection, TNC 14-pin / peripheral unit 9-pin

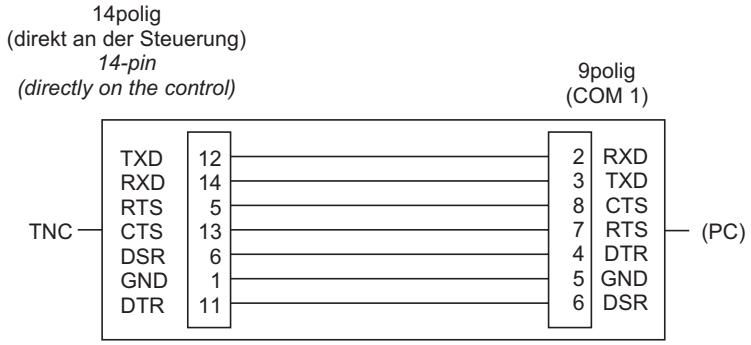


Diagram no.10
V.24/RS-232-C direct connection, TNC 25-pin / peripheral unit 9-pin

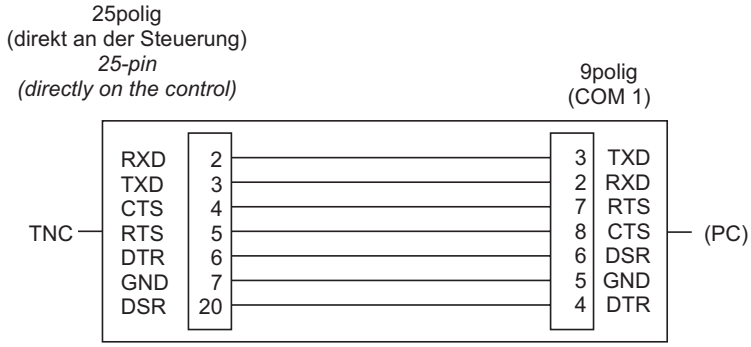


Diagram no.11
V.24/RS-232-C direct connection for hardware handshake,
TNC 25-pin/peripheral unit 25-pin (1:1)

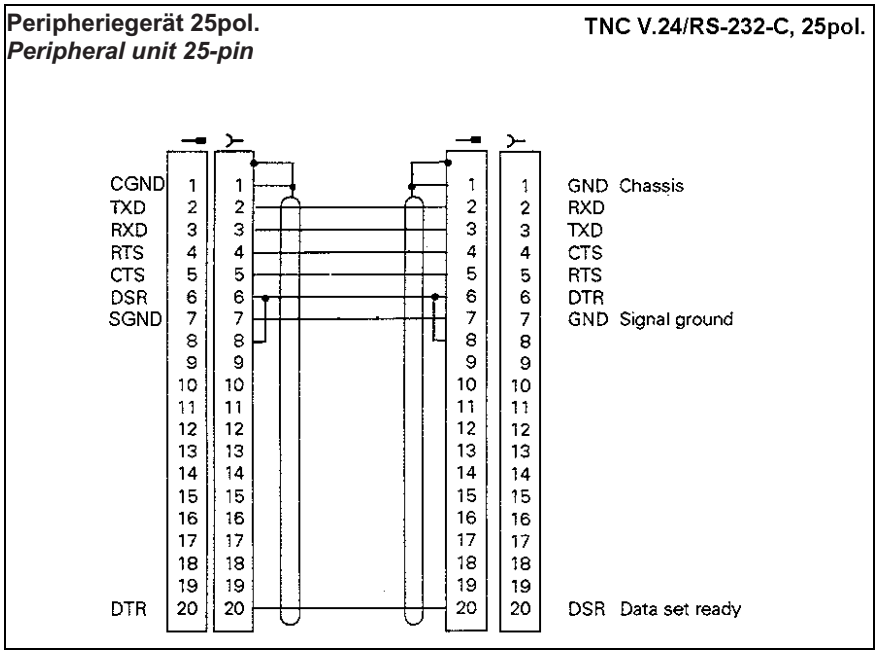


Diagram no.12
V.24/RS-232-C direct connection for software handshake,
TNC 25-pin / peripheral unit 25-pin (1:1)

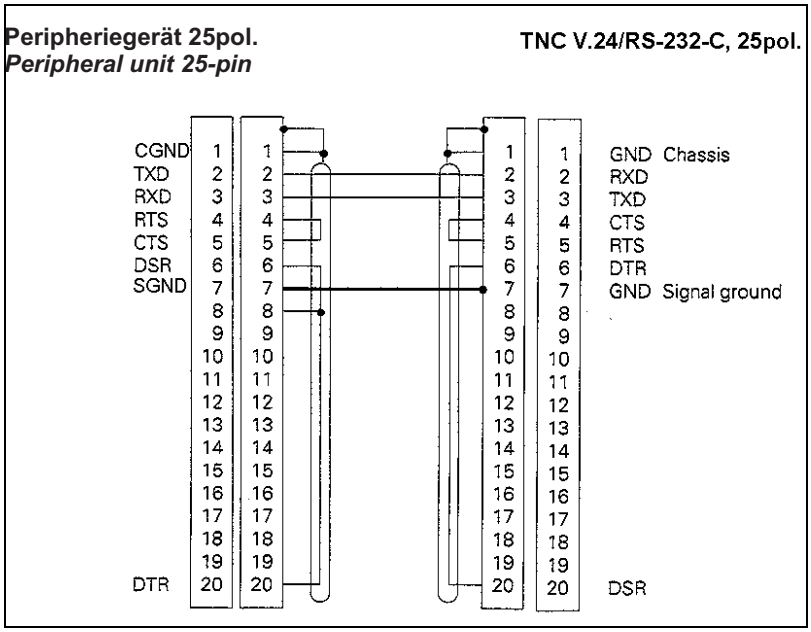


Diagram no.13
V.24/RS-232-C direct connection, TNC 14-pin / peripheral unit 25-pin

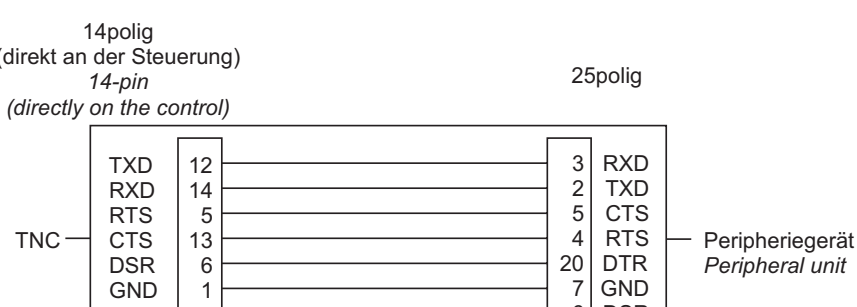
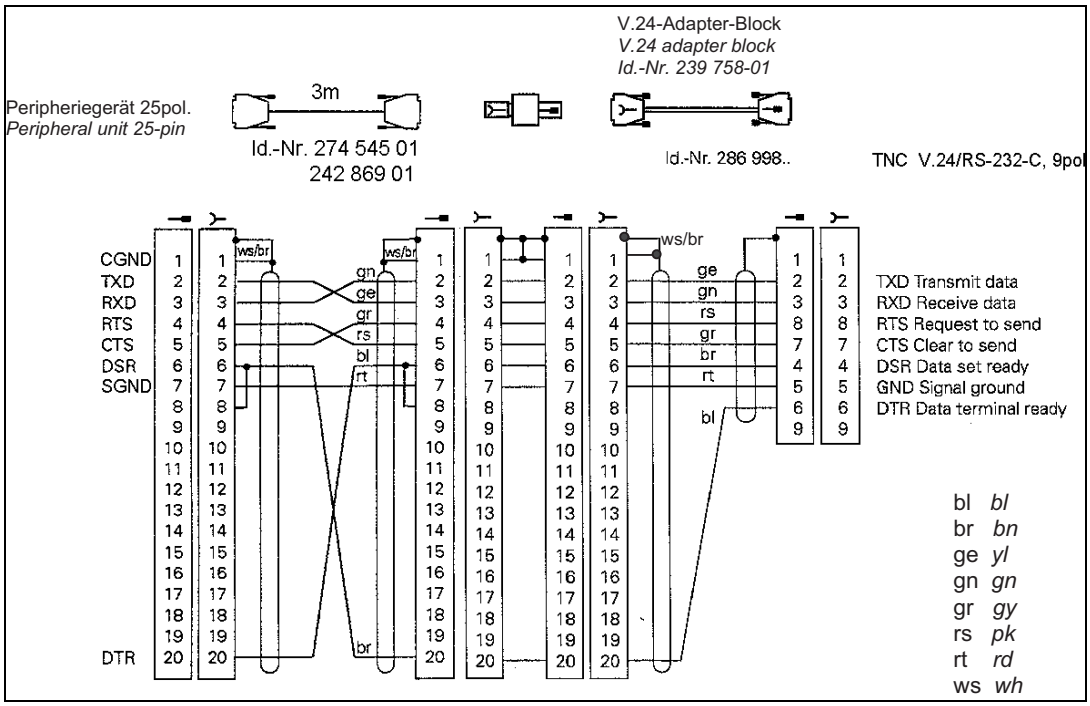
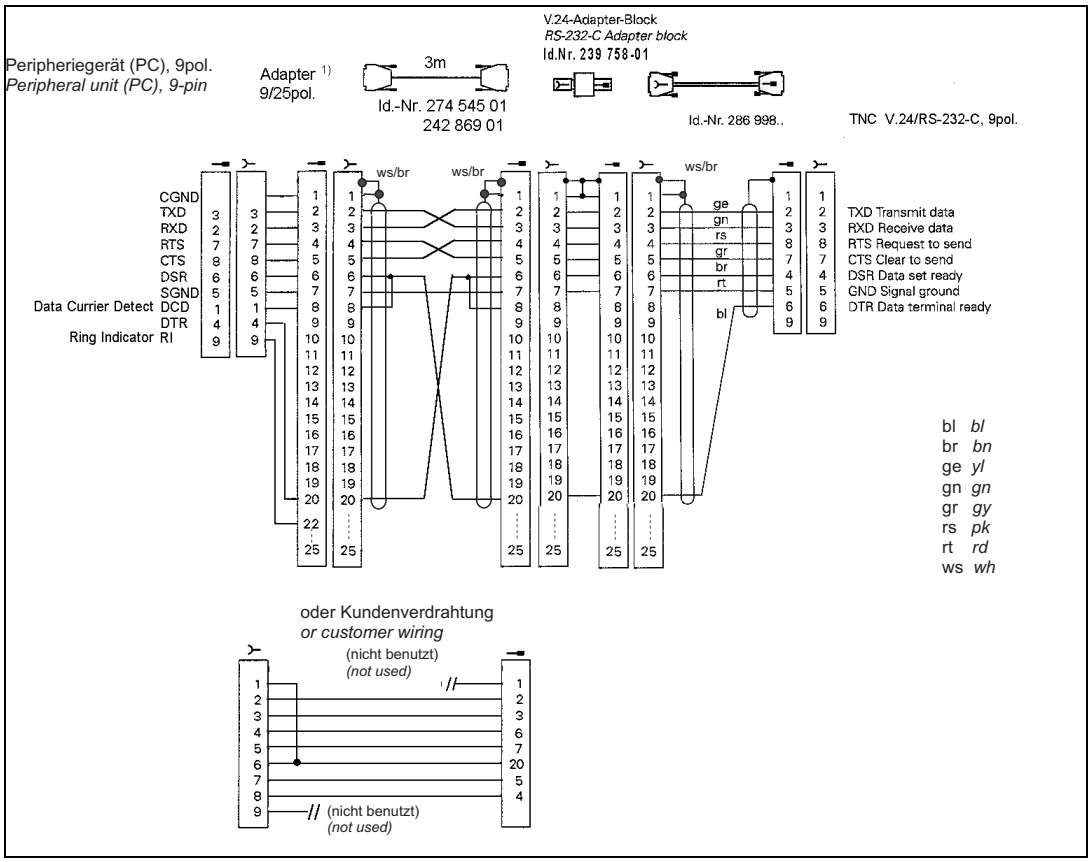


Diagram no.14
V.24/RS-232-C with adapter block for hardware handshake, TNC 9-pin / peripheral unit 25-pin



If the pin layout of your peripheral unit differs from the above, the HEIDENHAIN connecting cable cannot be used.

Diagram no.15
V.24/RS-232-C with adapter block for hardware handshake, TNC 9-pin / peripheral unit 9-pin



1) Customer wiring or prefabricated part

Diagram no.16
V.24/RS-232-C direct connection for hardware handshake, ND/PT 25-pin / peripheral unit 25-pin

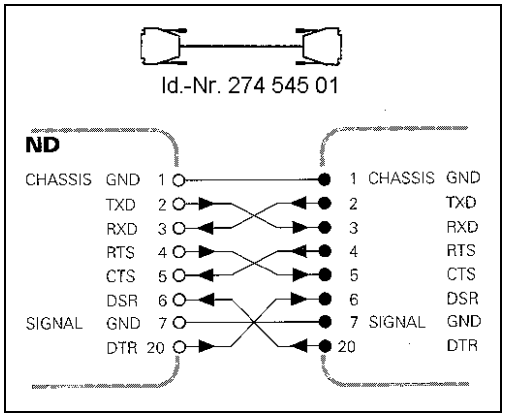
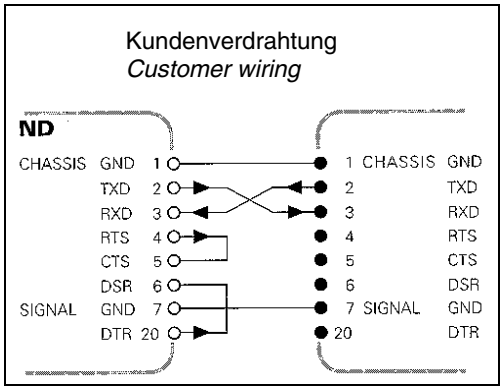
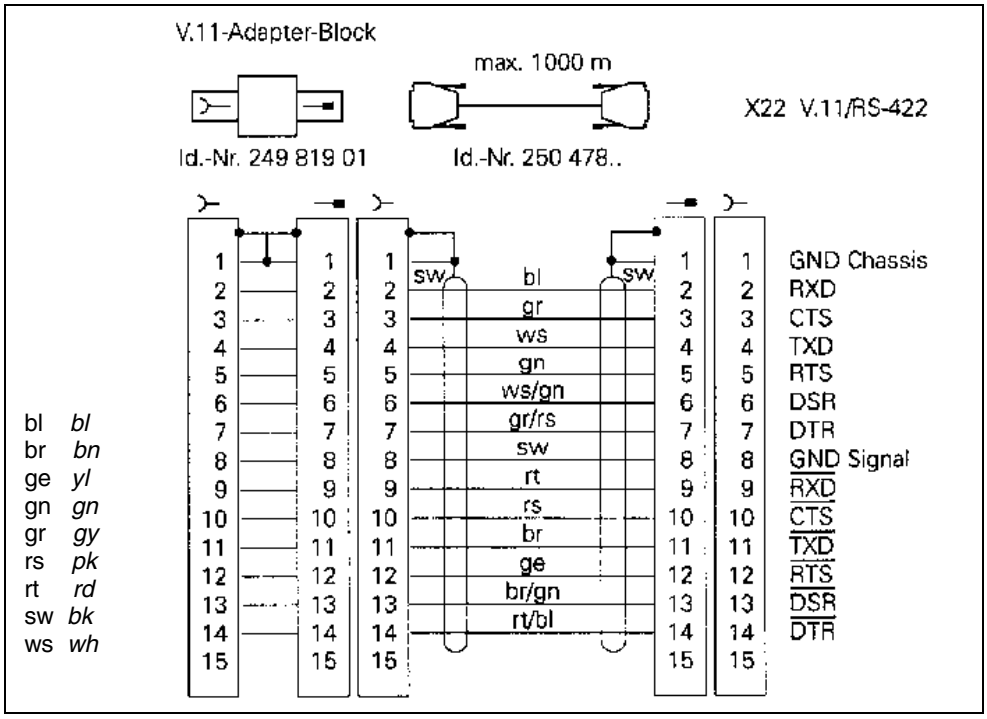


Diagram no.17
V.24/RS-232-C direct connection for softw. handshake, ND/PT 25-pin / peripheral unit 25-pin



3.5 Diagram V.11/RS-422

Diagram no.18
V.11/RS-422 data interface



The pin layout of the RS-422-/V.11 data interface **is the same** at the logic unit X22 and at the V.11 adapter block.

4 Operating modes of the data interfaces

4.1 Operating modes on TNC 125, 131, 135, 145, 150, 151/155

One or several operating modes may be available, depending on the control model.

Control model	Operating mode			
	ME	FE	EXT	Remark
TNC 125	x			
TNC 131	x	x		
TNC 135	x	x		
TNC 145	x			
TNC 150	x			
TNC 151/155 B/Q	x	x	x	Selection via MOD
TNC 151/155 A/P	x	x	x	Selection via machine parameter

ME - For connection of the HEIDENHAIN magnetic tape unit ME 101/102 or other peripheral units. Data format (7 data bits, 1 stop bit, even parity) and baud rate (2400) are adapted to the ME.

FE - For connection of the HEIDENHAIN floppy disk unit FE 401 or other peripheral units. Data transfer is executed with a special protocol (blockwise transfer) to back up data. Data format (7 data bits, 1 stop bit, even parity), baud rate (9600) and transfer protocol are adapted to the FE.

EXT - For adaptation of data transfer in standard data format and for blockwise transfer to peripheral units. The interface for data transfer is adapted via machine parameters; any baud rate can be selected.

4.2 Operating modes on TNC 122 to TNC 430 and ND 2XX / PT 8XX

One or several operating modes may be available, depending on the unit.

Control model	Operating mode							
	ME	FE	EXT	LSV2	Screen dump	Host operation	DNC	Log
TNC 122	x	x	x					
TNC 124	x	x	x					
TNC 246	x	x	x					
TNC 2500/B/C	x	x	x		x			
TNC 306	x	x	x		x			
TNC 310					x			x
TNC 335	x	x	x		x			
TNC 351/355	x	x	x					
TNC 360	x	x	x		x			
TNC 370	x	x	x		x			
TNC 406 [2]	x	x	x	x	x	x		x
TNC 407	x			x	x		x [3]	x
TNC 410					x			x
TNC 415/B	x			x	x		x [3]	x
TNC 425	x			x	x		x [3]	x
TNC 426.A/.B				x [4]	x			x
TNC 430.A				x [4]	x			x
CNC 232B [1]	x	x	x		x			
CNC 234.xxx [1]	x	x	x		x			
CNC 332	x	x	x					
ND 2XX	x							
PT 8XX	x	x						

1) The data transfer rate must be set to 9600 baud.
2) "Change directory" not possible.
3) The machine must support the LSV2/DNC mode.
4) File server (LSV2) as from software versions 280 462 05, 280 470 01, 280 472 01..

For internal settings please refer to the User's Manuals and Technical Manuals of the controls or display units.

FE 1: For connection of the HEIDENHAIN floppy disk unit FE 401 B (or floppy disk unit FE 401, as from software 230 626 03) or other peripheral units.

Data format and protocol are adapted to FE 401/B!

Protocol:	Blockwise transfer
Data format:	7 data bits, 1 stop bit, even parity
Baud rate:	110 - 115 200 Baud (depending on the hardware of the HEIDENHAIN unit)
Interface parameter:	fixed
Transfer stop:	software handshake with DC3

FE 2: For connection of the HEIDENHAIN floppy disk unit FE 401 or other peripheral units.

Data format and protocol are adapted to FE 401/B!

Protocol:	Blockwise transfer
Data format:	7 data bits, 1 stop bit, even parity
Baud rate:	110 - 115 200 Baud (depending on the hardware of the HEIDENHAIN unit)
Interface parameter:	fixed
Transfer stop:	software handshake with DC3

EXT: For adaptation of data transfer in standard data format and for blockwise transfer to external peripheral units.

Protocol:	Standard or blockwise transfer Adaptation via machine parameter MP 5000 and following
Data format:	Adaptation via machine parameter MP 5000 and following
Baud rate:	110 - 115 200 Baud (depending on the hardware of the HEIDENHAIN unit)
Interface parameter:	Adaptation via machine parameter MP 5000 and following
Transfer stop:	Software handshake with DC3 or hardware handshake with RTS; selectable in machine parameter MP5000 and following

LSV-2: With the appropriate software (TNCremo V 3.0) various functions can be executed in the LSV-2 protocol, e.g. file management, remote control and TNC diagnosis from a PC.

Protocol:	Bi-directional transfer according to DIN 66019
Data format:	8 data bits, 1 stop bit, no parity
Baud rate:	110 - 115 200 Baud (depending on the hardware of the HEIDENHAIN unit)
Interface parameter:	fixed
Transfer stop:	Software handshake via protocol

5 Machine parameters for the data interfaces

5.1 MPs for TNC 125, 131, 135, 145, 150, 151/155, 351/355

5.1.1 Overview

Function	TNC							
	125	**131**	**135**	**145**	**145C**	**150**	**151/155**	**351/355**
General information								
Data format	-	-	-	-	-	-	MP 222 Bit 0	MP 222 Bit 0
ASCII characters for beginning and end of program	-	-	-	-	MP 76	MP 71	MP 71	MP 71
Decimal point or comma	-	-	-	-	MP 70	MP 92	-	-
Blockwise transfer								
Operating mode of RS-232-C	-	-	-	-	-	-	MP 223	MP 223
ASCII characters for data input and data output	-	-	-	-	-	-	MP 218 MP 219	MP 218 MP 219
Command block Start/End	-	-	-	-	-	-	MP 220	MP 220
Pos./neg. acknowledge	-	-	-	-	-	-	MP 221	MP 221
Data transfer finished	-	-	-	-	-	-	MP 224	MP 224
Printer adaptation								
Output of control characters at the beginning of each graphics	-	-	-	-	-	-	MP 226 MP 227 MP 228 MP 229	MP 226 MP 227 MP 228 MP 229
Output of control characters at the beginning of each graphic line	-	-	-	-	-	-	MP 230 MP 231 MP 232 MP 233	MP 230 MP 231 MP 232 MP 233
Character parity	-	-	-	-	-	-	MP 222 Bit 4-7	MP 222 Bit 4-7
Transfer stop	-	-	-	-	-	-	MP 222 Bit 2-3	MP 222 Bit 2-3

5.1.2 Description of the machine parameters

Machine parameters - general information

Data format

As of **TNC 151 B/Q** the data format can be set in machine parameter MP 222.

MP 222 (5020)	Bit 0	:	0	≙	7 data bits (ASCII code, bit 8 = parity)
			1	≙	8 data bits (ASCII code, bit 8 = 0, bit 9 = parity)
	Bit 1		0	≙	no BCC check
			1	≙	BCC check
	Bit 2		1	≙	transfer stop by hardware handshaking
	Bit 3		1	≙	transfer stop by software handshaking
	Bit 4		0	≙	even character parity
			1	≙	odd character parity
	Bit 5		1	≙	character parity desired
	Bit 7, 6		00	≙	1 1/2 stop bits
			01	≙	2 stop bits
			10	≙	1 stop bit
			11	≙	1 stop bit

Example:
For "blockwise transfer" with the HEIDENHAIN data transfer software in the "EXT" mode the data format must be as follows:
7 data bits, 1 stop bit, even parity, software handshake

7	6	5	4	3	2	1	0	Bit
1	0	1	0	1	0	0	0	binary
↓		↓		↓				
128	+	32	+	8				= **168** decimal

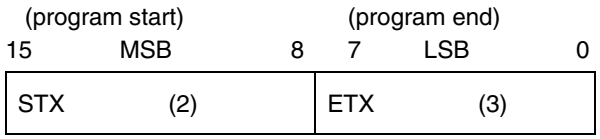
In the "FE/ME" mode the data format in MP 222 is not active; in this case the format is always set to 7 data bits, 1 stop bit, even parity and software handshake.

Program end and program start

The control characters for "program end" and "program start" are defined in MP 71 (5010.0).

MP 71 (5010.0) LSB: Bit 0 - 7 = character for program end
MSB: Bit 8 - 15 = character for program start

For this example the standard values "ETX" and "STX" are used, i.e. MP 71 : 515



2 * 256 + 3 = **515**

For serial data transfer only the character for program end is transmitted (in our example "MP 71 : 3" would be sufficient for "EXT").

Both characters, for program start and program end, are only transmitted with blockwise transfer (in our example it would be "MP 71 : 515" for "STX" and "ETX").

To select the characters for program start and program end via MP 71, the RS-232-C must be set to "ETX" mode.
In the "FE" and "ME" modes the control characters "STX" and "ETX are automatically set, i.e. MP 71 must be 515.
In old control models (TNC 150; TNC 151 A/P; TNC 155 A/P) the machine parameter MP 71 is always active.

Machine parameters of TNC 145 C and TNC 150

MP 70: Decimal point or comma ON = decimal point
OFF = decimal comma

If numerical values in programs are to be output with decimal points, the parameter 70 must be programmed ON; if output with decimal comma is required, this parameter must be programmed OFF.

MP 71: Character for end of program 1-126

MP 76: By means of the parameter 71 (TNC 150) or 76 (TNC 145C) an additional ASCII character for "Program End" can be selected for remote programming. The input depends on the significance of the character and is derived from the pattern on the punched tape (without parity bit).

MP 92: Decimal point or comma 0 = decimal comma
1 = decimal point

If numerical values in programs are to be output with decimal points, the parameter 70 must be programmed ON; if output with decimal comma is required, this parameter must be programmed OFF.

Operating mode of the data interface

The operating mode of the data interface is defined in the machine parameter MP 223 (5030).

MP 223 (5030) 0 = Blockwise transfer inactive
1 = Blockwise transfer active

Machine parameters for blockwise transfer

With BLOCKWISE TRANSFER in the operating mode "PROGRAM RUN", machine programs - in general created on a remote computer-aided workstation - of any desired length can be down-loaded and machined via the serial data interface.
Blocks already machined are deleted from the memory and the next program blocks are requested from the external memory.
With BLOCKWISE TRANSFER the data flow is not stopped by RTS or DC3, but only by the control characters ACK (acknowledge = positive) and NAK (not acknowledge = negative).
Each transferred block is checked by means of a BCC (block check character): the received data are checked for block parity. If both values are the same, positive acknowledge is transmitted; if they are not the same, negative acknowledge is transmitted.
This block is repeated up to three times. If the result is a negative acknowledge in each case, data transfer is aborted and an error message displayed.

Parameter No.	Bit	Function	Entry values for
71 or 5010.0	0 ... 7 8 ... 15	ETX or any ASCII character; character for **End of Program** STX or any ASCII character; character for **Start Program**	ETX and STX: 515
218 or 5010.1	0 ... 7 8 ... 15	H or any ASCII character; transmitted in the a command block for data input before the program number. E or any ASCII character; transmitted in the a command block for data input after the program number.	H and E: 17736
219 or 5010.2	0 ... 7 8 ... 15	H or any ASCII character; transmitted in the a command block for data output before the program number. A or any ASCII character; transmitted in the a command block for data output after the program number.	H and A: 16712
220 or 5010.3	0 ... 7 8 ... 15	ETB or substitute character (decimal code 1 - 47); transferred at the end of the command block. SOH or substitute character (decimal code 1 - 47); transferred at the beginning of the program block.	ETB or SOH: 279
221 or 5010.4	0 ... 7 8 ... 15	ACK or substitute character (decimal code 1 - 47); positive acknowledge, transferred if the data block was been correctly received. NAK or substitute character (decimal code 1 - 47); negative acknowledge, transferred if the data block was not correctly received.	ACK or NAK: 5382
224 or 5010.5	0 ... 7	EOT or substitute character (decimal code 1 - 47); transferred at the end of data transfer.	EOT: 4

For MP 218 (5010.1) and MP 219 (5010.2)
H = HEIDENHAIN plain language
D = DIN-ISO programs
M = Machine parameter list
P = PLC program
S = Multipoint error compensation list
X99999967 = For all programs stored in the ME mode.

Calculation of machine parameters

Examples for MP 218 (5010.1) - MP 221 (5010.4) and MP 224 (5010.5)

	15 MSB 8	7 LSB 0
MP 218 (5010.1):	E (69)	H (72)

69 x 256 + 72 = **17736**

MP 218 (5010.1) = 17736

LSB must match the data transfer program
("Change identifier" in FDE program)

X	(88)	- User parameters (general) ME mode
H	(72)	- Programs in HEIDENHAIN plain language
D	(68)	- DIN/ISO programs
P	(80)	- PLC programs
M	(77)	- Machine parameters
S	(83)	- Multipoint error compensation list

MSB must match the data transfer program
("E" is prescribed in the FDE/TNC program).

	15 MSB 8	7 LSB 0
MP 219 (5010.2):	A (65)	H (72)

65 x 256 + 72 = **16712**

MP 219 (5010.2) = 16712

LSB can be selected as in the above example, but must be the same for both machine parameter and identifier.

"A" is prescribed in the FDE/TNC program for MSB.

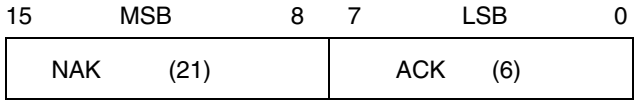
	15 MSB 8	7 LSB 0
MP 220 (5010.3):	SOH (1)	ETB (23)

1 x 256 + 23 = **279**

MP 220 (5010.3) = 279

SOH and ETB are prescribed for the FDE/TNC program. Otherwise a substitute character can be selected which must match the data transfer software.

MP 221 (5010.4):

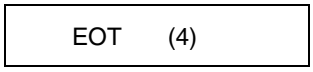


21 x 256 + 6 = **<u>5382</u>**

MP 221 (5010.4) = 5382

ACK/NAK is defined for the FDE/TNC program, otherwise a matching substitute character can be selected in the data transfer software.

MP 224 (5010.5):



4 = **<u>4</u>**

MP 224 (5010.5) = 4

Prescribed for FDE/TNC program; otherwise selectable as above.

For our example the following values must be entered in the machine parameter list:

MP	71	(5010.0)	=	515	(STX, ETX)
MP	218	(5010.1)	=	17736	(E, H)
MP	219	(5010.2)	=	16712	(A, H)
MP	220	(5010.3)	=	279	(SOH, ETB)
MP	221	(5010.4)	=	5382	(NAK, ACK)
MP	222	(5020)	=	168	(7 data bits, 1 stop bit, even parity, xon/xoff)
MP	223	(5030)	=	1	(blockwise transfer active)
MP	224	(5010.5)	=	4	(EOT)

Printer adaptation

General information for graphic output

Important: Your printer manual is absolutely required!

Proceeding:
Via the DIP switches the printer must be configured such that it matches the configuration of the control.

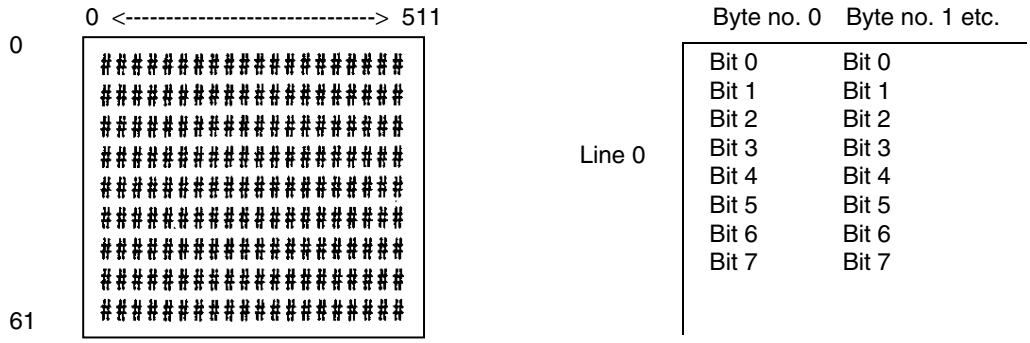
Control settings:

1. At the control the **RS-232-C interface** must be set to **"EXT"** (the interface can be selected by pressing MOD; pressing ENT changes the setting).
2. The **baud rate** must also be selected via MOD and a value entered.
   (Observe the setting of the DIP switches at the printer.)
3. Data format: 8 data bits, 1 stop bit, even parity, software handshaking; the data format is set in **MP 222 (MP 5020): 169**.
4. The control character for the end of program is "EXT"; it is set in machine parameter **MP 71 (MP 5010.0): 3**.
5. Blockwise transfer must be deactivated in **MP 223 (MP 5030) :** 0.
6. Values must be entered for the machine parameters **MP 226 (MP 5110.0)** to **MP 233 (MP 5120.3)**.
   The calculation of the machine parameters is explained on the following pages.

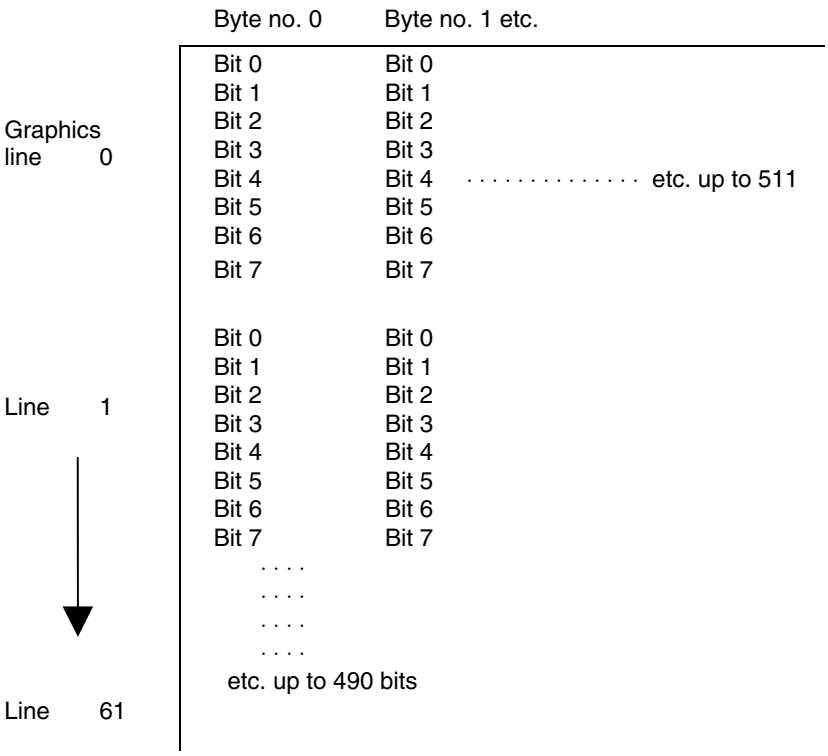
   The printer manual is required to define the escape sequences. The values determined must be entered in the machine parameter list.

Machine parameter calculation for graphic output

In the graphics mode the screen of TNC 155/355 consists of 512 + 490 picture elements. For graphics data output, the data are output line-by-line in 8-bit format via the serial interface. A line consists of 8 pixels and 512 bytes per line.



represents one byte on the screen



The parameters are subdivided into two blocks:

The first parameter block (MP 226 (5110.0) to MP 229 (5110.3)) is transmitted once before each block.
It initializes the printer and sets the general printer parameters for graphic output, e.g. line spacing, carriage return, line feed and possibly form feed to reach the beginning of the printer paper.

The line feed must be specified such that the graphic lines are printed without blank lines in between. For this reason, the line spacing should be set to 72/216".

The second parameter block (MP 230 (5120.0) to MP 233 (5120.3)) is output before each graphic line to perform a carriage return and a line feed at the printer and to set it to the graphics mode.

The control outputs 512 data bytes per line, i.e. 512 bytes must be displayed as graphics on paper before the printer automatically switches from the graphics mode to the ASCII mode.

The commands for the printer are displayed in ESCAPE sequences which may vary from printer to printer. The EPSON command block for printers is a quasi-standard supported by most printer manufacturers. Therefore, we refer to these EPSON ESCAPE SEQUENCES.

The following escape sequences and ASCII characters must be transmitted to the printer for initialization:

The machine parameters MP 226 (5110.0) to MP 233 (5120.3) are noted as 16-bit values and output as decimal values. The input value may be between 0 and 65535. These machine parameters are subdivided into bytes.

The most significant byte from MP 226 (5110.0) and MP 230 (5120.0) defines the number of bytes the control outputs via RS-232-C.

The entry values 0 to 7 are advisable, since up to 7 bytes can be transferred. The next bytes are output individually in ascending order.

Example:

The escape sequences stated below are not generally valid; they must be defined individually for each printer (with the help of the printer manual).

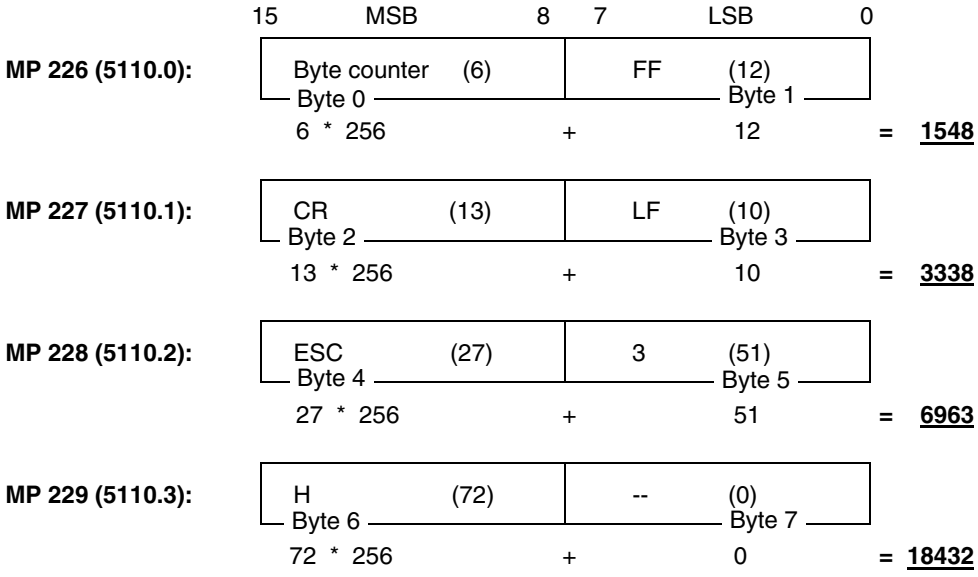
Machine parameter block 1 MP 226 (5110.0) to MP 229 (5110.3)

Output of control characters at the beginning of each graphics

Required:	Character	ASCII code	Result
1. Form feed	FF	12 DEC.	Form Feed
2. Carriage return	CR	13 DEC.	Carriage Return
3. Line feed	LF	10 DEC.	Line Feed
4. Line spacing	ESC	27 DEC.	Escape
5. set to	3	51 DEC.	3 in ASCII code
6. 72/216"	H	72 DEC.	H in ASCII code

Byte counter → **6** FF CR LF ESC 3 H

Result:



Entry values:
MP 226 (5110.0) : 1548
MP 227 (5110.1) : 3338
MP 228 (5110.2) : 6963
MP 229 (5110.3) : 18432

Machine parameter block 2 MP 230 (5120.0) to MP 233 (5120.3)

Output of control characters at the beginning of each graphic line

Required:	Character	ASCII code	Result
1. Carriage Return	CR	13 DEC.	Carriage Return
2. Line Feed	LF	10 DEC.	Line Feed
3. Graphics mode with 8	ESC	27 DEC.	Escape
4. needles	*	42 DEC.	Asterisk
5. 72 dpi and	5 DEC.	5 DEC.	Decimal 5
6. 512 data bytes	0 DEC.	0 DEC.	Decimal 0
7. per line	2 DEC.	2 DEC.	Decimal 2

Byte counter → 7 CR LF ESC * 5 0 2

Result:

15 MSB 8 7 LSB 0

MP 230 (5120.0): Byte counter (7) | CR (13)
Byte 0 | Byte 1
7 * 256 + 13 = **1805**

MP 231 (5120.1): LF (10) | ESC (27)
Byte 2 | Byte 3
10 * 256 + 27 = **2587**

MP 232 (5120.2): * (42) | 5 DEC. (5)
Byte 4 | Byte 5
42 * 256 + 5 = **10757**

MP 233 (5120.3): 0 DEC. (0) | 2 DEC. (2)
Byte 6 | Byte 7
0 * 256 + 2 = **2**

Entry values
MP 230 (5120.0) : 1805
MP 231 (5120.1) : 2587
MP 232 (5120.2) : 10757
MP 233 (5120.3) : 2

5.2 MPs for TNC 122/124

5.2.1 Overview

Function	TNC		
	122	124	
Data transfer rate	-	5040	

5.2.2 Description of the machine parameters

Machine parameters

The following list contains the machine parameters for all software versions.
Since however, several machine parameters are not valid for certain controls or have been introduced or eliminated with a certain software version, there are columns with symbols for differentiation belonging to the parameter number.

Explanation of the symbols

♦ = The parameter applies for **all** software versions of this controls.

04 = The parameter has been **introduced** with a certain software version (e.g. with version 04).

I04 = The parameter was **eliminated** from a certain software version on (e.g. version 04) or **replaced** by a new parameter.

- = The parameter is not active with this software (control).

Explanation of the columns

TNC 124 = TNC 124 with NC software 246 16* --

Function	MP No. Bit	TNC 124				Input
Data transfer rate	5040	♦				300 600 1200 2400 4800 9600 19200 38400

5.3 MPs for TNC 232/246

5.3.1 Overview

Function	TNC					
	232	246				
Control character for "Blockwise Transfer“ Character for beginning and end of program; the character for program end also applies for "standard data interface"	5010.0	5010.0				
ASCII character for data input	5010.1	5010.1				
ASCII character for data output	5010.2	5010.2				
ASCII character for beginning and end of command block	5010.3	5010.3				
ASCII character for pos. and neg. acknowledge	5010.4	5010.4				
ASCII character for "data transfer finished"	5010.5	5010.5				
Data format and transfer stop for the data interface	5020	5020				
Transfer mode for EXT	5030	5030				

5.3.2 Description of the machine parameters

Function	MP No.	Bit	TNC 246 B	CNC 232 B			Input
Control character for "Blockwise Transfer“ Character for beginning and end of program; the character for program end also applies for "standard data interface"“	5010.0*		◆	◆			0 ... 65 535
ASCII character for data input ASCII character for data output	5010.1* 5010.2*		◆ ◆	◆ ◆			0 ... 65 535
ASCII character for beginning and end of command block	5010.3*		◆	◆			0 ... 65 535
ASCII character for pos. and neg. acknowledge	5010.4*		◆	◆			0 ... 65 535
ASCII character "Data transfer finished"	5010.5*		◆	◆			0 ... 65 535
Data format and transmission stop for the data interface RS-232-C/V.24 7 or 8 data bits Block check character Transmission stop by RTS Transmission stop by DC3 Character parity even or odd Character parity desired	5020*	0 1 2 3 4 5 6/7	◆	◆			0 .. 255 + 0 → 7 data bits (ASCII code 8th bit = parity) + 1 → 8 data bits (ASCII code 8th bit = 0 and 9th bit = parity) + 0 → any BCC + 2 → BCC not control character + 0 → not active + 4 → active + 0 → not active + 8 → active + 0 → not active + 16 → active + 0 → even + 32 → odd 7 | 6 0 | 0 1 ½ stop bits 0 | 1 2 stop bits 1 | 0 1 stop bit 1 | 1 1 stop bit Bit 6: + 64 Bit 7: + 128
Operating mode of the data interface RS-232-C/V.24	5030*		◆	◆			0 → "Standard data transfer“ 1 → "Transfer blockwise“

* accessible via code number 123

5.4 MPs for TNC 306/335/360/2500/CNC 234/TNC 370

5.4.1 Overview

Function	TNC						
	234	306	335	360	2500	370	
Control character for end of text (ETX)	-	5010	-	-	-	-	
1. control character for end of text (ETX) 2. control character for start of text (STX)	5010.0	-	5010.0	5010.0	5010.0	5010.0	
1. ASCII character for file type for data input 2. ASCII character for input code (E)	5010.1	-	5010.1	5010.1	5010.1	5010.1	
1. ASCII character for file type for data output 2. ASCII character for output code (A)	5010.2	-	5010.2	5010.2	5010.2	5010.2	
1. control character for end of command block (ETB) 2. control character for start of command block (SOH)	5010.3	-	5010.3	5010.3	5010.3	5010.3	
1. control character for pos. acknowledge (ACK) 2. control character for neg. acknowledge (NAK)	5010.4	-	5010.4	5010.4	5010.4	5010.4	
Control character for end of data transfer (EOT)	5010.5	5011	5010.5	5010.5	5010.5	5010.5	
Transfer mode for EXT	5030	-	5030	5030	5030	5030	
Data transfer rate for PLC coupling	-	-	5040	5040	-	-	
Graphic printout	-	-	-	-	-	-	
Graphic printout	-	-	-	-	-	-	
Block check number sequence with data transfer from interface	-	5990	-	-	-	-	
Data format and transmission stop for the data interface RS-232-C/EXT	5020	-	5020	5020	5020	5020	

5.4.2 Description of the machine parameters

Function	MP No.	Bit	TNC 2500	TNC 360	*NC 306	CNC 234	Input
Control character for end of text (ETX)	5010		-	-	04	-	0 ... 255
1. control character f. end of text (ETX) 2. control character f. start of text (STX)	5010.0*		◆	◆	-	◆	0 ... 32382
1. ASCII character for file type for data input 2. ASCII character for input code (E)	5010.1*		◆	◆	-	◆	0 ... 32382
1. ASCII character for file type for data output 2. ASCII character for output code (A)	5010.2*		◆	◆	-	◆	0 ... 32382
1. control character for end of command block (ETB) 2. control character for start of command block (SOH)	5010.3*		◆	◆	-	◆	0 ... 32382
1. control character for positive acknowledge (ACK) 2. control character for negative acknowledge (NAK)	5010.4*		◆	◆	-	◆	0 ... 32382
Control character for end of data transfer (EOT)	5010.5*		◆	◆	-	◆	0 ... 32282
Control character for end of data transfer (EOT)	5011		-	-	04	-	0 ... 32382
Data format and transmission stop for the RS-232-C/EXT data interface	5020*		◆	◆	◆	◆	0 ... 255
7 or 8 data bits		0					+ 0 = 7 data bits, bit 8 = parity + 1 = 8 data bits, bit 8 = 0 and bit 9 = parity
Block check character		1					+ 0 = any BCC + 2 = BCC not control character
Transmission stop by RTS		2					+ 0 = not active + 4 = active
Transmission stop by DC3		3					+ 0 = not active + 8 = active
Character parity even/odd		4					+ 0 = even + 16 = odd
Character parity on/off		5					+ 0 = off + 32 = on
Number of stop bits		6/7					+ 64 => bit 6 = 1 + 128 => bit 7 = 1 6/7 | 0/1 = 1 1/2 stop bits 1/0 = 2 stop bits 0/1 = 1 stop bit 1/1 = 1 stop bit
Activation of RTS signal		8	11	16	-	08	+ 0 = RTS signal always active + 256 = RTS signal is set active when data transfer is activated and set inactive at the end of data transfer.
Control sends EOT after having received ETX		9	11	17	-	-	+ 0 = EOT is transmitted + 512 = EOT is not transmitted

* accessible via code number 123

Function	MP No.	Bit	TNC 2500	TNC 360	*NC 306	CNC 234	Input	
Transfer mode for EXT	5030*		◆	◆	-	◆	0 =	"Standard data interface"
							1 =	"Blockwise transfer"
Data transfer rate for PLC coupling	5040		-	03	-	-	0 =	110 [Bd]
			-	03	-	-	1 =	150
			-	03	-	-	2 =	300
			-	03	-	-	3 =	600
			-	03	-	-	4 =	1200
			-	03	-	-	5 =	2400
			-	03	-	-	6 =	4800
			-	03	-	-	7 =	9600
			-	03	-	-	8 =	19200
			-	06	-	-	9 =	38400
Graphic printout	5110.0		I04	-	-	-	0 =	without function
	5110.1							
	5110.2							
	5110.3							
Graphic printout	5120.0		I04	-	-	-	0 =	without function
	5120.1							
	5120.2							
	5120.3							
Block check number sequence with data transfer from interface	5990		-	-	◆	-	0 =	NC PGM with block numbers
							1 =	NC PGM without block numbers

* accessible via code number 123

1) Example for the calculation of these machine parameters:
(decimal code 1st character)+ (256 x decimal code 2nd character) = input value
3 (ETX) + 256 x (STX) = 515

5.5 MPs for TNC 310/410

5.5.1 Overview

Function	TNC						
	310	**410**					
Data format and transmission stop							
for the operating mode **EXT1**	5020.0	5020.0					
for the operating mode **EXT2**	5020.1	5020.1					
for the operating mode **EXT3 (PLC)**	5020.2	5020.2					
Transfer mode for							
EXT1	5030.0	5030.0					
EXT2	5030.1	5030.1					
EXT3 (PLC)	5030.2	5030.2					
Data transfer rate for PLC coupling (EXT3)	5040	5040					

5.5.2 Description of the machine parameters

Function	MP No.	Bit	A	B	C	D	Input
Data format and transmission stop							
for the operating mode **EXT1**	5020.0		◆				0 ... 255
for the operating mode **EXT2**	5020.1		◆				
for the operating mode **EXT3**	5020.2		◆				
7 or 8 data bits		0					+ 0 = 7 data bits, bit 8 = parity + 1 = 8 data bits, bit 8 = 0 and bit 9 = parity
Block check character		1					+ 0 = any BCC + 2 = BCC not control character
Transmission stop by RTS		2					+ 0 = inactive + 4 = active
Transmission stop by DC3		3					+ 0 = inactive + 8 = active
Character parity even / odd		4					+ 0 = even 6 = odd
Character parity on / off		5					+ 0 = off + 32 = on
Number of stop bits		6 7					+ 64 → bit 6 = 1 +128 → bit 7 = 1 bit 6 bit 7 0 1 = 1½ stop bits 1 0 = 2 stop bits 0 1 = 1 stop bit 1 1 = 1 stop bit
Activation of RTS signal		8					+ 0 = RTS signal always active + 256 = RTS signal is set active when data transfer is activated and set inactive at the end of data transfer.
Control sends EOT after having received ETX		9					+ 0 = EOT is transmitted + 512 = EOT is not transmitted
Transfer mode for							
EXT1	5030.0		◆				0 = "Standard data transfer" 1 = "Blockwise transfer"
EXT2	5030.1		◆				
EXT3	5030.2		◆				
Data transfer rate for PLC coupling (EXT3)	5040		◆				0 ... 9 0 = 110 Bd 5 = 2400 Bd 10 = 57600 Bd 1 = 150 Bd 6 = 4800 Bd 11 = 115200 Bd 2 = 300 Bd 7 = 9600 Bd 3 = 600 Bd 8 = 19200 Bd 4 = 1200 Bd 9 = 38400 Bd

5.6 MPs for TNC 406/407/415/425

5.6.1 Overview

Function	TNC					
	406	407	415	425		
Inhibiting a data interface	5000	5000	5000	5000		
Data format and transmission stop						
for the operating mode **EXT1**	5020.0	5020.0	5020.0	5020.0		
for the operating mode **EXT2**	5020.1	5020.1	5020.1	5020.1		
for the operating mode **EXT3** (PLC)	5020.2	5020.2	5020.2	5020.2		
Transfer mode for						
EXT1	5030.0	5030.0	5030.0	5030.0		
EXT2	5030.1	5030.1	5030.1	5030.1		
EXT3 (PLC)	5030.2	5030.2	5030.2	5030.2		
Data transfer rate for PLC coupling (EXT3)	5040	5040	5040	5040		
Control characters for "Blockwise transfer"						
ASCII character for start of program						
EXT1 (STX)	5200.0	5200.0	5200.0	5200.0		
EXT2	5200.1	5200.1	5200.1	5200.1		
EXT3 (PLC)	5200.2	5200.2	5200.2	5200.2		
ASCII character for end of program						
for EXT1 (ETX)	5201.0	5201.0	5201.0	5201.0		
for EXT2	5201.1	5201.1	5201.1	5201.1		
for PLC	5201.2	5201.2	5201.2	5201.2		
ASCII character for file type for data input						
for EXT1	5202.0	5202.0	5202.0	5202.0		
for EXT2	5202.1	5202.1	5202.1	5202.1		
for PLC	5202.2	5202.2	5202.2	5202.2		
ASCII character for input code						
for EXT1 (E)	5203.0	5203.0	5203.0	5203.0		
for EXT2	5203.1	5203.1	5203.1	5203.1		
for PLC	5203.2	5203.2	5203.2	5203.2		
ASCII character for file type for data output						
for EXT1	5204.0	5204.0	5204.0	5204.0		
for EXT2	5204.1	5204.1	5204.1	5204.1		
for EXT3 (PLC)	5204.2	5204.2	5204.2	5204.2		
ASCII character for output code						
for EXT1 (A)	5205.0	5205.0	5205.0	5205.0		
for EXT2	5205.1	5205.1	5205.1	5205.1		
for EXT3 (PLC)	5205.2	5205.2	5205.2	5205.2		
ASCII character for start of command block						
for EXT1 (SOH)	5206.0	5206.0	5206.0	5206.0		
for EXT2	5206.1	5206.1	5206.1	5206.1		
for EXT3 (PLC)	5206.2	5206.2	5206.2	5206.2		
ASCII character for end of command block						
for EXT1 (ETB)	5207.0	5207.0	5207.0	5207.0		
for EXT2	5207.1	5207.1	5207.1	5207.1		
for EXT3 (PLC)	5207.2	5207.2	5207.2	5207.2		
ASCII character for positive acknowledge						
for EXT1 (ACK)	5208.0	5208.0	5208.0	5208.0		
for EXT2	5208.1	5208.1	5208.1	5208.1		
for EXT3 (PLC)	5208.2	5208.2	5208.2	5208.2		
ASCII character for negative acknowledge						
EXT1 (NAK)	5209.0	5209.0	5209.0	5209.0		
EXT2	5209.1	5209.1	5209.1	5209.1		
EXT3 (PLC)	5209.2	5209.2	5209.2	5209.2		
ASCII character for end of transmission						
EXT1 (EOT)	5210.0	5210.0	5210.0	5210.0		
EXT2	5210.1	5210.1	5210.1	5210.1		
EXT3 (PLC)	5210.2	5210.2	5210.2	5210.2		

5.6.2 Description of the machine parameters of TNC 406/407/415

Machine parameters

The following list contains the machine parameters for all software versions.
Since however, several machine parameters are not valid for certain controls or have been introduced or eliminated with a certain software version, there are columns with symbols for differentiation belonging to the parameter number.

Explanation of the symbols:

◆ = The parameter or the entry value applies for all software versions of this control.

04 = The parameter has been introduced with a certain software version (e.g. with version 04).

I04 = The parameter is inactive.
- = The parameter does not exist on this control.

Explanation of the columns:

A = TNC 407 with NC-software 243 07* -- (without digitizing function)
B = TNC 415 with NC-software 243 05* -- and 259 91* -- (without digitizing function)
C = TNC 407 with NC-software 243 02* -- (with digitizing function)
D = TNC 415 with NC-software 259 96* -- and 259 97* -- (with digitizing function)
E = TNC 407 with NC-software 243 03* -- (software equivalent to TNC 415B/425)
F = TNC 407 with NC-software 280 58* -- (special software)

Function	MP No.	Bit	A	B	C	D	E	F	Input
Inhibiting a data interface	5000	07	09	◆	◆	◆	◆		0 = no interface inhibited 1 = RS-232 inhibited 2 = RS-422 inhibited
Control characters for "Blockwise transfer" Character for program end and start; the character for program end is also valid for the "standard data interface "	5010.0*	I05	I08	-	-	-	-		0 ... 32 382
ASCII character for data input	5010.1*	I05	I08	-	-	-	-		0 ... 32 382
ASCII character for data output	5010.2*	I05	I08	-	-	-	-		0 ... 32 382
ASCII character for start and end of command block	5010.3*	I05	I08	-	-	-	-		0 ... 32 382
ASCII character for pos. and neg. acknowledge	5010.4*	I05	I08	-	-	-	-		0 ... 32 382
ASCII character "data transfer finished"	5010.5*	I05	I08	-	-	-	-		0 ... 32 382
Data format and transmission stop for the operating mode **EXT** for the operating mode **EXT1** for the operating mode **EXT2** for the operating mode **EXT3** (PLC)	 5020.0* 5020.1* 5020.2*	 I05 05 05 -	 I08 08 08 -	 - ◆ ◆ ◆	 - ◆ ◆ ◆	 - ◆ ◆ ◆	 - ◆ ◆ ◆		 0 ... 255
7 or 8 data bits		0							+ 0 = 7 data bits, bit 8 = parity + 1 = 8 data bits, bit 8 = 0 and bit 9 = parity
Block check character		1							+ 0 = any BCC + 2 = BCC not control character
Transmission stop by RTS		2							+ 0 = inactive + 4 = active
Transmission stop by DC3		3							+ 0 = inactive + 8 = active
Character parity even / odd		4							+ 0 = even + 16 = odd
Character parity on / off		5							+ 0 = off + 32 = on
Number of stop bits		6 7							+ 64 → bit 6 = 1 +128 → bit 7 = 1 bit 6 bit 7 0 1 = 1½ stop bits 1 0 = 2 stop bits 0 1 = 1 stop bit 1 1 = 1 stop bit
Transfer mode for EXT EXT1 EXT2 EXT3 (PLC)	 5030 5030.0* 5030.1* 5030.2*	 I05 05 05 -		 I08 08 08 -	 - ◆ ◆ ◆	 - ◆ ◆ ◆	 - ◆ ◆ ◆	 - ◆ ◆ ◆	 0 = "Standard data transfer" 1 = "Blockwise transfer"

* accessible via code number 123

Function	MP No.	Bit	A	B	C	D	E	F	Input
Data transfer rate for PLC coupling (EXT3)	5040		-	-	◆	◆	◆	◆	0 ... 9 0 = 110 Bd 5 = 2400 Bd 1 = 150 Bd 6 = 4800 Bd 2 = 300 Bd 7 = 9600 Bd 3 = 600 Bd 8 = 19200 Bd 4 =1200 Bd 9 = 38400 Bd
Control characters for "Blockwise transfer"									
ASCII character for start of program									0 ... 127
EXT 1 (STX)	5200.0*		05	08	◆	◆	◆	◆	
EXT 2	5200.1*		05	08	◆	◆	◆	◆	
EXT3 (PLC)	5200.2*		-	-	◆	◆	◆	◆	
ASCII character for end of program									0 ... 127
for EXT1 (ETX)	5201.0*		05	08	◆	◆	◆	◆	
for EXT2	5201.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5201.2*		-	-	◆	◆	◆	◆	
ASCII character for file type for data input									0 ... 127
for EXT1	5202.0*		05	08	◆	◆	◆	◆	
for EXT2	5202.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5202.2*		-	-	◆	◆	◆	◆	
ASCII character for input code									0 ... 127
for EXT1 (E)	5203.0*		05	08	◆	◆	◆	◆	
for EXT2	5203.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5203.2*		-	-	◆	◆	◆	◆	
ASCII character for file type for data output									0 ... 127
for EXT1	5204.0*		05	08	◆	◆	◆	◆	
for EXT2	5204.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5204.2*		-	-	◆	◆	◆	◆	
ASCII character for output code									0 ... 127
for EXT1 (A)	5205.0*		05	08	◆	◆	◆	◆	
for EXT2	5205.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5205.2*		-	-	◆	◆	◆	◆	
ASCII character for start of command block									0 ... 127
for EXT1 (SOH)	5206.0*		05	08	◆	◆	◆	◆	
for EXT2	5206.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5206.2*		-	-	◆	◆	◆	◆	
ASCII character for end of command block									0 ... 127
for EXT1 (ETB)	5207.0*		05	08	◆	◆	◆	◆	
for EXT2	5207.1*		05	08	◆	◆	◆	◆	
for EXT3 (PLC)	5207.2*		-	-	◆	◆	◆	◆	
ASCII character for positive acknowledge	5208.0*		05	08	◆	◆	◆	◆	0 ... 127
for EXT1 (ACK)	5208.1*		05	08	◆	◆	◆	◆	
for EXT2	5208.2*		-	-	◆	◆	◆	◆	
for EXT3 (PLC)									
ASCII character for negative acknowledge	5209.0*		05	08	◆	◆	◆	◆	0 ... 127
EXT1 (NAK)	5209.1*		05	08	◆	◆	◆	◆	
EXT2	5209.2*		-	-	◆	◆	◆	◆	
EXT3 (PLC)									
ASCII character for end of transmission									0 ... 127
EXT1 (EOT)	5210.0*		05	08	◆	◆	◆	◆	
EXT2	5210.1*		05	08	◆	◆	◆		
EXT3 (PLC)	5210.2*		-	-	◆	◆	◆	◆	

* accessible via code number 123

5.6.3 Description of the machine parameters of TNC 415B/425

Machine parameters

The following list contains the machine parameters for all software versions.
Since however, several machine parameters are not valid for certain controls or have been introduced or eliminated with a certain software version, there are columns with symbols for differentiation belonging to the parameter number.

Explanation of the symbols:

◆ = The parameter applies for all software versions of this control.

04 = The parameter has been introduced with a certain software version (e.g. with version 04).

I04 = The parameter is inactive.
- = The parameter does not exist on this control.

Explanation of the columns:

A = TNC 415/B/F/BR/FR and TNC 425/E with NC-software 259 93* -- and 259 94* --
B = TNC 415/B/F/BR/FR and TNC 425/E with NC-software 280 54* -- and 280 56* -- (special software)
C = for future use

Function	MP No.	Bit	A	B	Input
Inhibiting a data interface	5000		◆	◆	0 = no interface inhibited 1 = RS-232 inhibited 2 = RS-422 inhibited
Data format and transmission stop for the operating mode **EXT1** for the operating mode **EXT2** for the operating mode **EXT3** (PLC)	 5020.0* 5020.1* 5020.2*		 ◆ ◆ ◆	 ◆ ◆ ◆	 0 ... 255
7 or 8 data bits		0			+ 0 = 7 data bits, bit 8 = parity + 1 = 8 data bits, bit 8 = 0 and bit 9 = parity
Block check character		1			+ 0 = any BCC + 2 = BCC not control character
Transmission stop by RTS		2			+ 0 = inactive + 4 = active
Transmission stop by DC3		3			+ 0 = inactive + 8 = active
Character parity even / odd		4			+ 0 = even + 16 = odd
Character parity on / off		5			+ 0 = off + 32 = on
Number of stop bits		6 7			+ 64 → bit 6 = 1 +128 → bit 7 = 1 bit 6 bit 7 0 1 = 1½ stop bits 1 0 = 2 stop bits 0 1 = 1 stop bit 1 1 = 1 stop bit
Transfer mode for EXT1 EXT2 EXT3 (PLC)	 5030.0* 5030.1* 5030.2*		 ◆ ◆ ◆	 ◆ ◆ ◆	 0 = "Standard data transfer" 1 = "Blockwise transfer"
Data transfer rate for PLC coupling (EXT3)	5040		◆	◆	0 ... 9 0 = 110 Bd 5 = 2400 Bd 10 = 57600 Bd 1 = 150 Bd 6 = 4800 Bd 11 = 115200 Bd 2 = 300 Bd 7 = 9600 Bd 3 = 600 Bd 8 = 19200 Bd 4 = 1200 Bd 9 = 38400 Bd
Control character for "Blockwise transfer" **ASCII character for start of program** EXT 1 (STX) EXT 2 EXT 3 (PLC)	 5200.0* 5200.1* 5200.2*		 ◆ ◆ ◆	 ◆ ◆ ◆	 0 ... 127
ASCII character for end of program for EXT1 (ETX) for EXT2 for PLC	 5201.0* 5201.1* 5201.2*		 ◆ ◆ ◆	 ◆ ◆ ◆	0 ... 127
ASCII character for file type for data input for EXT1 for EXT2 for PLC	 5202.0* 5202.1* 5202.2*		 ◆ ◆ ◆	 ◆ ◆ ◆	0 ... 127

Function	MP No.	Bit	A	B	Input
ASCII character for input code					0 ... 127
for EXT1 (E)	5203.0*		◆	◆	
for EXT2	5203.1*		◆	◆	
for PLC	5203.2*		◆	◆	
ASCII character for file type for data output					
for EXT1					0 ... 127
for EXT2	5204.0*		◆	◆	
for EXT3 (PLC)	5204.1*		◆	◆	
	5204.2*		◆	◆	
ASCII character for output code					0 ... 127
for EXT1 (A)	5205.0*		◆	◆	
for EXT2	5205.1*		◆	◆	
for EXT3 (PLC)	5205.2*		◆	◆	
ASCII character for start of command block					0 ... 127
for EXT1 (SOH)	5206.0*		◆	◆	
for EXT2	5206.1*		◆	◆	
for EXT3 (PLC)	5206.2*		◆	◆	
ASCII character for end of command block					0 ... 127
for EXT1 (ETB)	5207.0*		◆	◆	
for EXT2	5207.1*		◆	◆	
for EXT3 (PLC)	5207.2*		◆	◆	
ASCII character for positive acknowledge					0 ... 127
for EXT1 (ACK)	5208.0*		◆	◆	
for EXT2	5208.1*		◆	◆	
for EXT3 (PLC)	5208.2*		◆	◆	
ASCII character for negative acknowledge					0 ... 127
EXT1 (NAK)	5209.0*		◆	◆	
EXT2	5209.1*		◆	◆	
EXT3 (PLC)	5209.2*		◆	◆	
ASCII character for end of transmission					0 ... 127
EXT1 (EOT)	5210.0*		◆	◆	
EXT2	5210.1*		◆	◆	
EXT3 (PLC)	5210.2*		◆	◆	

* accessible via code number 123

5.7 MPs for TNC 426/430

5.7.1 Overview

Function	TNC						
	426	**430**					
Inhibiting a data interface	5000	5000					
Data format and transmission stop for the operating mode **EXT1** for the operating mode **EXT2** for the operating mode **EXT3** (PLC)	 5020.0 5020.1 5020.2	 5020.0 5020.1 5020.2					
Transfer mode for EXT1 EXT2 EXT3 (PLC)	 5030.0 5030.1 5030.2	 5030.0 5030.1 5030.2					
Data transfer rate for PLC coupling (EXT3)	5040	5040					

5.7.2 Description of the machine parameters

Function	MP No.	Bit	A	B	C	D	Input
Inhibiting a data interface	5000		◆				0 = no interface inhibited 1 = RS-232 inhibited 2 = RS-422 inhibited
Data format and transmission stop for the operating mode **EXT1** for the operating mode **EXT2** for the operating mode **EXT3** (PLC)	 5020.0* 5020.1* 5020.2*		 ◆ ◆ ◆				 0 ... 255
7 or 8 data bits		0					+ 0 = 7 data bits, bit 8 = parity + 1 = 8 data bits, bit 8 = 0 and bit 9 = parity
Block check character		1					+ 0 = any BCC + 2 = BCC not control character
Transmission stop by RTS		2					+ 0 = inactive + 4 = active
Transmission stop by DC3		3					+ 0 = inactive + 8 = active
Character parity even / odd		4					+ 0 = even + 16 = odd
Character parity on / off		5					+ 0 = off + 32 = on
Number of stop bits		6 7					+ 64 → bit 6 = 1 **+128** → bit 7 = 1 bit 6 bit 7 0 1 = 1½ stop bits 1 0 = 2 stop bits 0 1 = 1 stop bit 1 1 = 1 stop bit
Transfer mode for EXT1 EXT2 EXT3 (PLC)	 5030.0* 5030.1* 5030.2*		 ◆ ◆ ◆				 0 = "Standard data transfer" 1 = "Blockwise transfer"
Data transfer rate for PLC coupling (EXT3)	5040		◆				0 ... 9 0 = 110 Bd 5 = 2400 Bd 10 = 57600 Bd 1 = 150 Bd 6 = 4800 Bd 11 = 15200 Bd 2 = 300 Bd 7 = 9600 Bd 3 = 600 Bd 8 = 19200 Bd 4 = 1200 Bd 9 = 38400 Bd

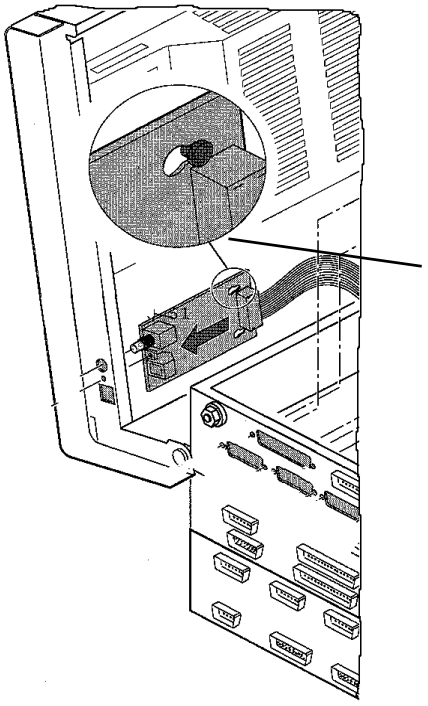
* accessible via code number 123

6 Ethernet card in TNC controls (option)

6.1 Installing the Ethernet Card

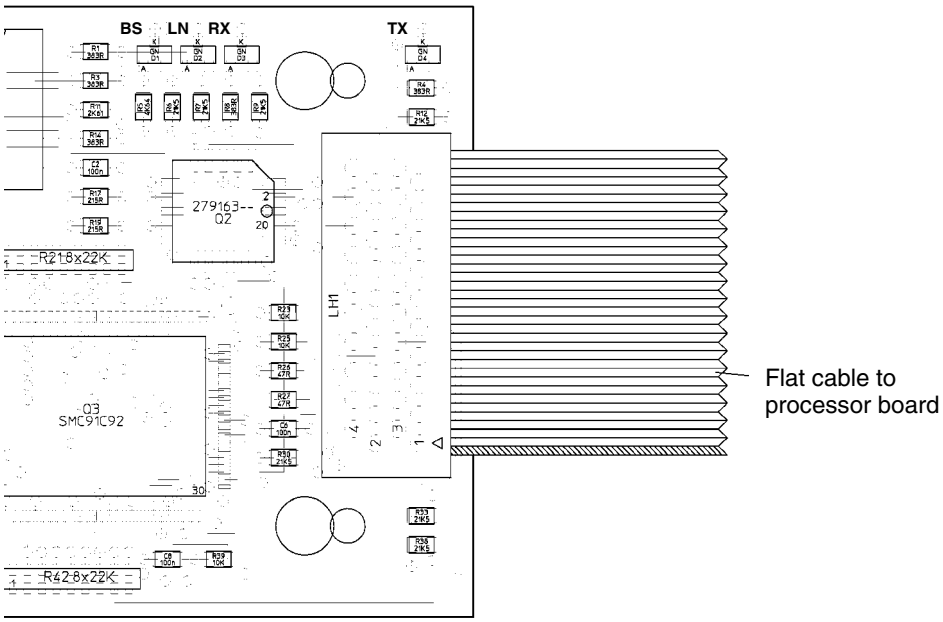
Danger to internal components!
When handling components that can be damaged by electrostatic discharge (ESD), observe the safety recommendations in EN 100 015. Only use antistatic packaging material. Be sure that the work station and the technician are properly grounded during installation.

The assembly may only be installed by especially trained staff.



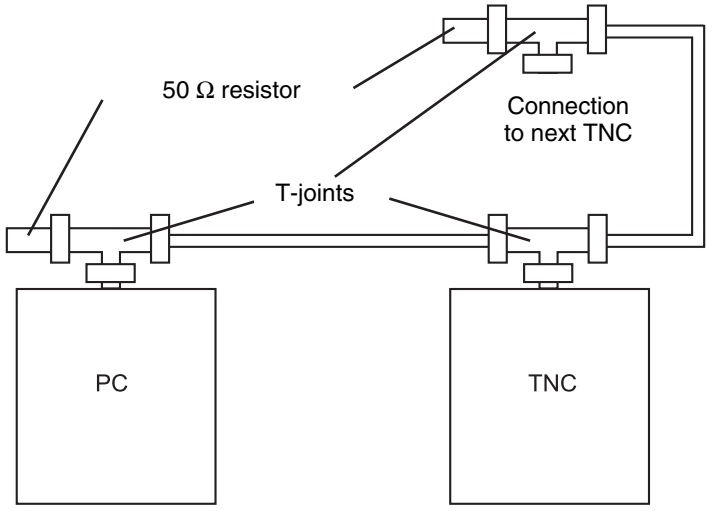
Function of the green LEDs on the ETHERNET board:

BS (D1), **B**us **S**elect: Access to the Ethernet controller by the CPU of the TNC. This LED **must** blink when the control is started!
LN (D2), **Lin**k: Link signal received from server.
RX (D3), **R**eceived: Data are received.
TX (D4), **T**ransmitted: Data are transmitted.

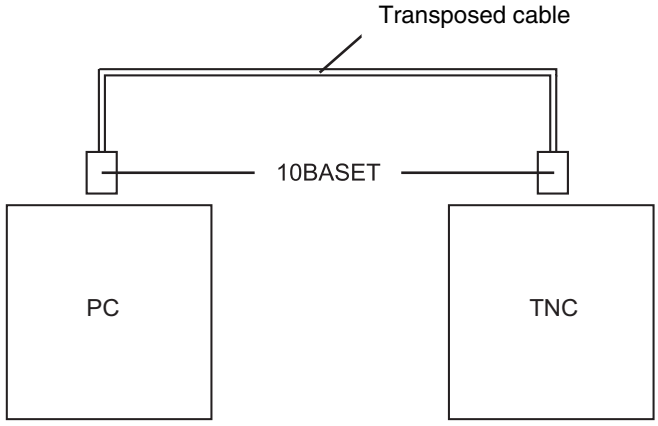


6.2 Connecting the Ethernet hardware

X26, 10Base2 The maximum cable length is 185 m.
If longer cables are required, an additional amplifier must be used.
The minimum distance between two T-joints is 0.5 m; up to 30 T-joints may be used.
Cable ends not in use must be terminated by 50Ω resistors.



X25, 10BaseT A transposed cable must be used to realize a direct connection from PC to TNC via 10BaseT.

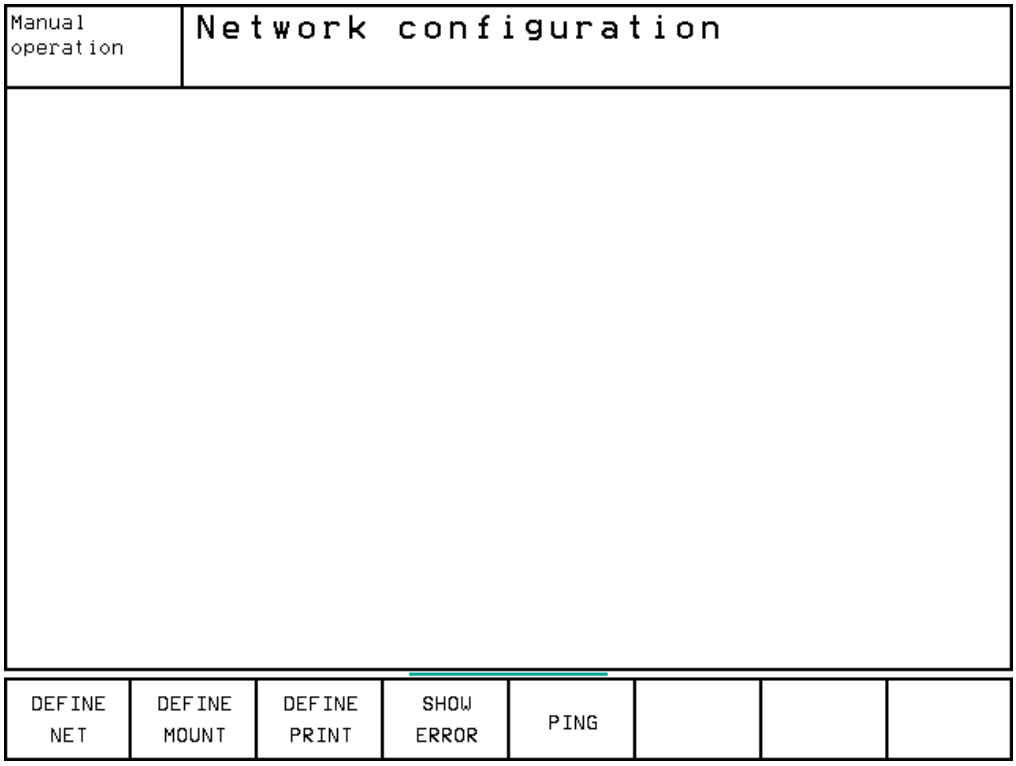


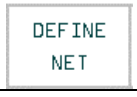
The pin layouts of 10Base2 and 10BaseT connections please see from **section 2.2.**

6.3 Ethernet configuration in the TNC

6.3.1 Settings in DEFINE NET

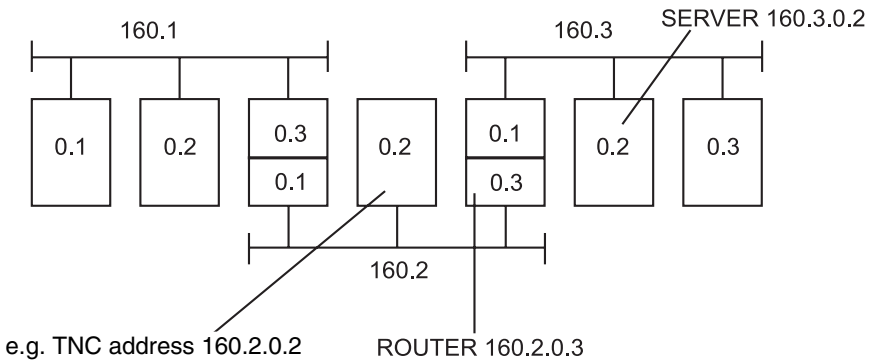
Press key	Function
	TNC in operating mode PROGRAMMING/EDITING
	Prepare TNC for input of code number
	Enter code number, confirm with ENT



	Call menu DEFINE NET

The following settings can be made in DEFINE NET:

ADDRESS:[1)] Information on the address of your TNC in the network (Internet).
MASK:[1)] SUBNET MASK to "save" addresses in the network.
ROUTER:[1)] ROUTER addresses only have to be specified, if a branch into another network level is required to the SERVER.
PROT:[1)] Here the format for data transfer is specified (RFC in most cases).
HW: Hardware configuration of the connection: 10BaseT (twisted pair)
10Base2 (COAX)
HOST:[1)] Only valid for the NC software versions 280 472 and 280 473!
Here the name is entered under which the control registers itself at the server.

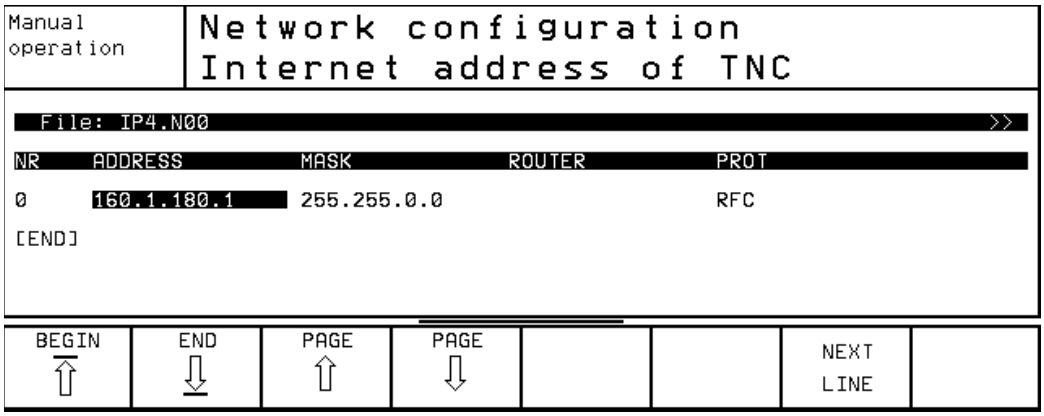


The boxes represent for example TNCs or personal computers. Please observe that a TNC can never be a ROUTER, since it does not feature the second connector for feeding signals through.

[1)] This information will be provided by your network administrator!

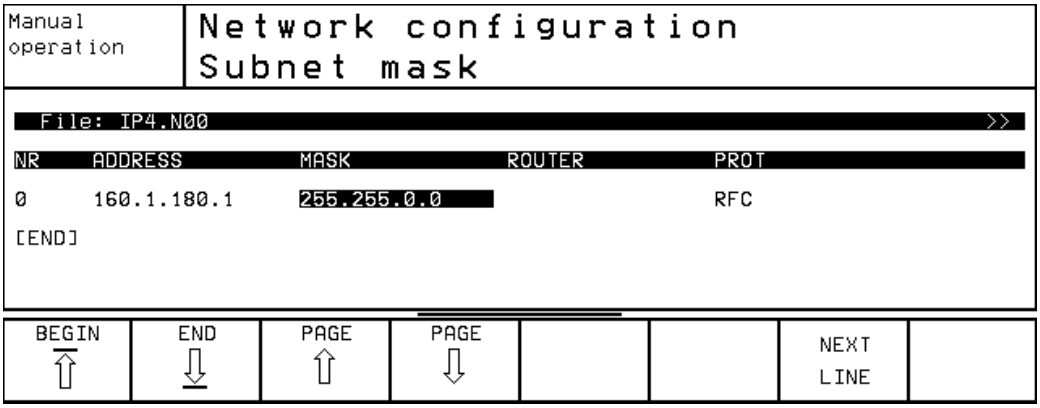
On the following pages please find an **example** of the settings listed above.

ADDRESS:[1] Information on the address of your TNC in the network (Internet).



→	Switch to next column.

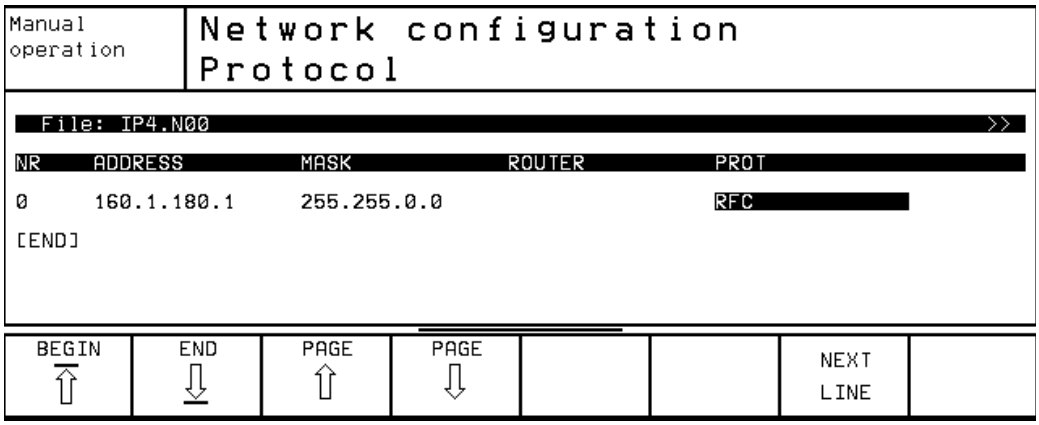
MASK:[1] SUBNET MASK to "save" addresses in the network.



→ →	

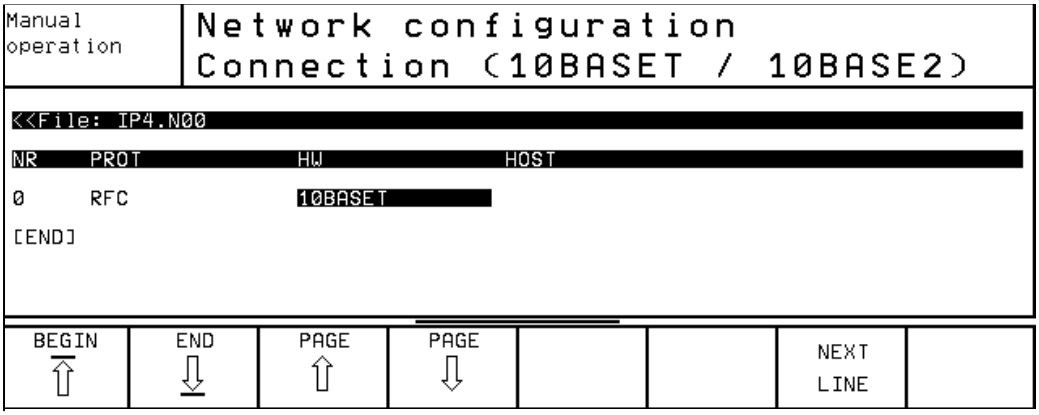
[1] This information will be provided by your network administrator

PROT:[1] Here the data transfer protocol is specified (RFC in most cases).



→	Switch to next column.

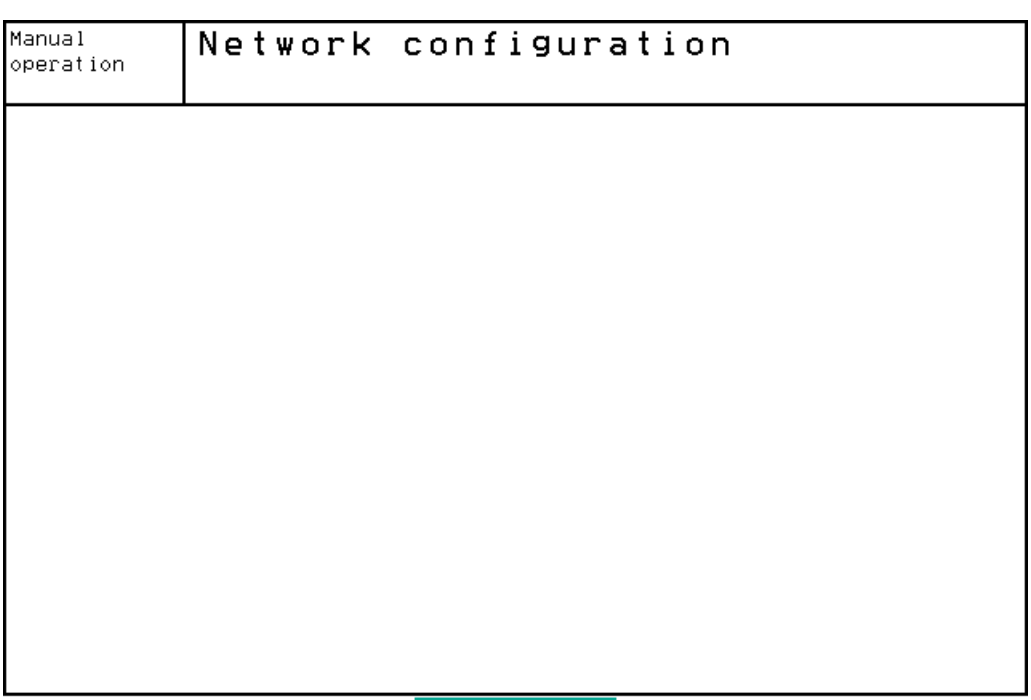
HW: Hardware configuration of the connection: 10BaseT (twisted pair)
10Base2 (COAX)



END	Exit menu.

[1] This information will be provided by your network administrator

6.3.2 Settings in DEFINE MOUNT



DEFINE MOUNT	Call menu DEFINE MOUNT.

The following settings can be made in DEFINE MOUNT:

ADDRESS:[1] Address (Internet) of the server.

RS:[2] Packet size for data input.

WS:[2] Packet size for data output.

TIMEOUT:[1] After the defined period a remote-procedure call not responded by the NFS server is repeated. 0 = 700 (standard).

HM: 1=YES/ 0=NO: During the hardmount a remote-procedure call is repeated until an answer is received from the NFS server. The advantage is that if the server crashed and was restarted, operation can be continued without any problem. Soft-mount (0) should only be used, if the server is only available at times.

DEVICENAME: This name (TNC device name) is displayed in the TNC program manager for the network mounted.

PATH: Directory path of the NFS server to be mounted.
e.g.: world / home / test (input depends on the server software)

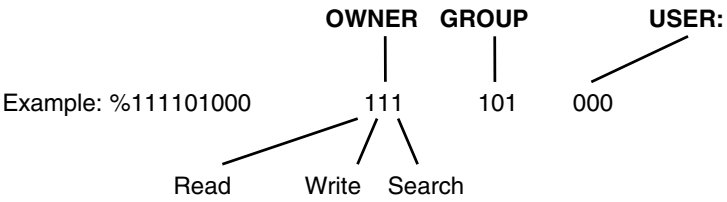
DOMAIN: With this name the TNC registers at the server.
When using NC software 280 472 or 473 this information is not required.

UID:[1] USER ID: identifies the **user**.

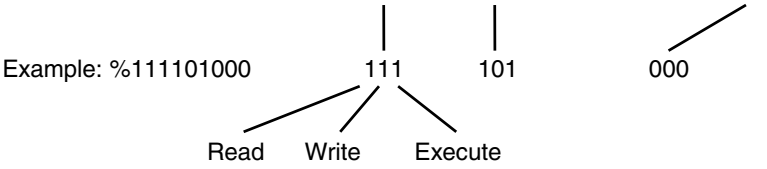
GID:[1] GROUP ID: figure to identify the **group**.

DCM Directory-create mode to define access rights to the directory for OWNER, GROUP and other USERS.

PROT This information can only be entered in the NC software versions 280 472 and 473.
The data transfer protocol is specified here, e.g.: UDP



FCM **F**ile**C**reate**M**ode: definition of the access rights to **files** for **OWNER; GROUP;** and **other USERs:**



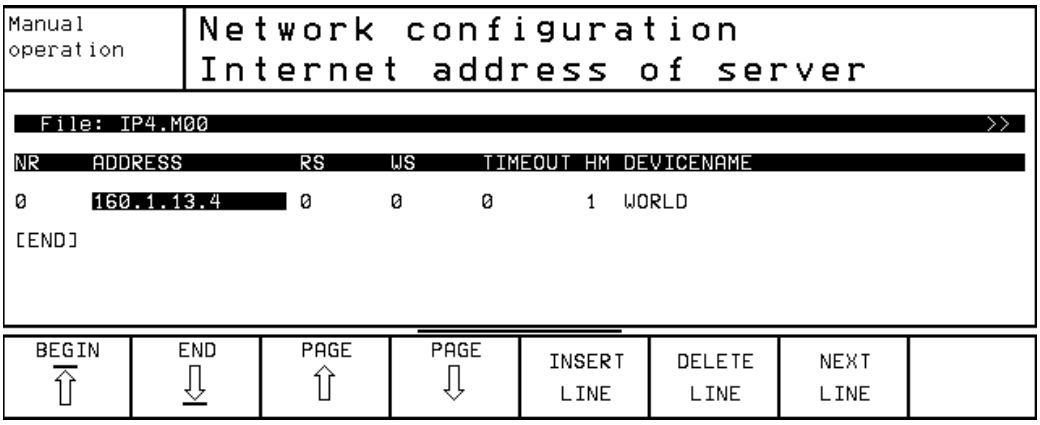
AM Definition whether **AUTOMOUNT** is possible.

[1] This information will be provided by your network administrator

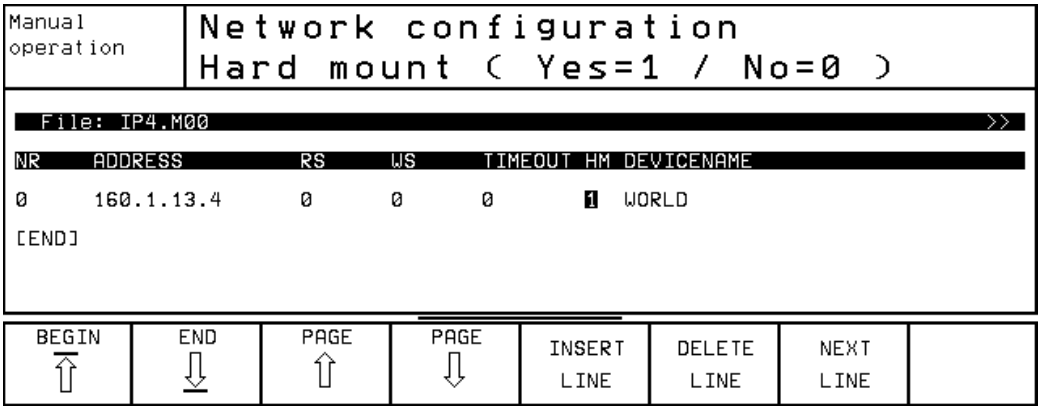
2) If the entry value is zero (standard) the optimum transfer size determined by the NFS server is used. Other entry values should only be used in the case of problems regarding the data transfer rate. Entry range: 512 - 4096 bytes.

On the following pages please find an **example** of the settings listed above.

ADDRESS:[1] Address (Internet) of the server.



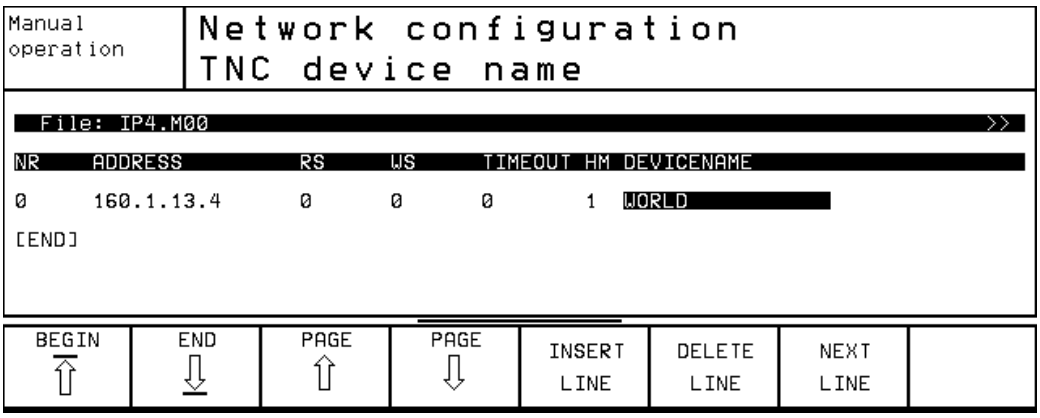
HM: 1=YES / 0=NO



Switch to next column.

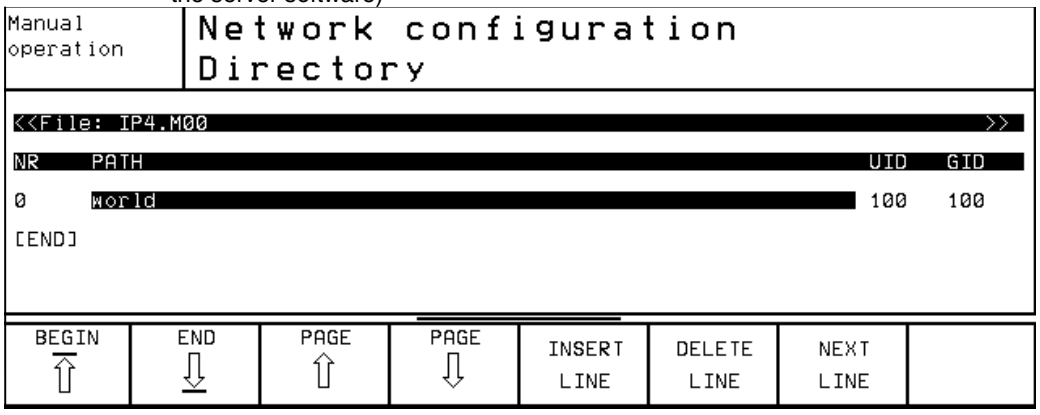
[1] This information will be provided by your network administrator

DEVICENAME: This name is displayed in the TNC program manager for the network mounted.



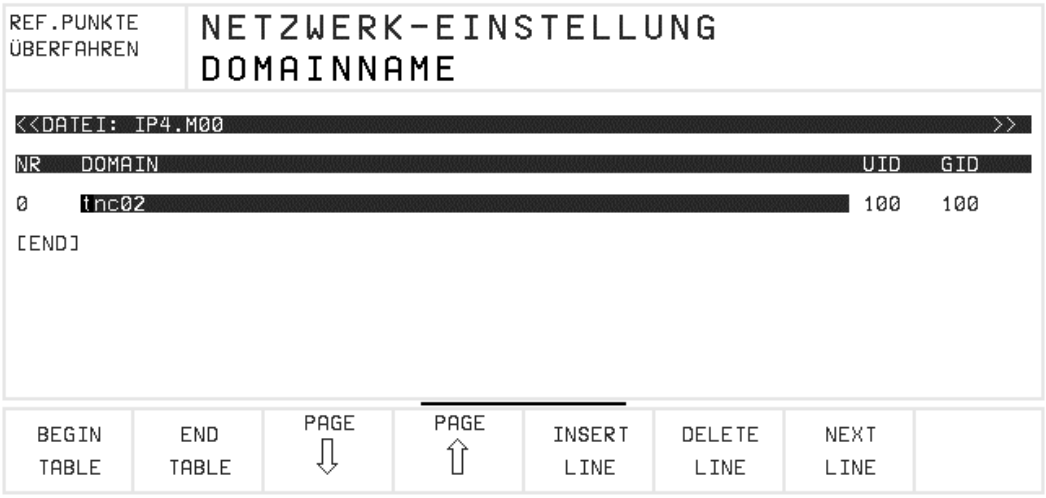
→	Switch to next column.

PATH: Definition of the directory path, e.g. world / home / test (input depends on the server software)



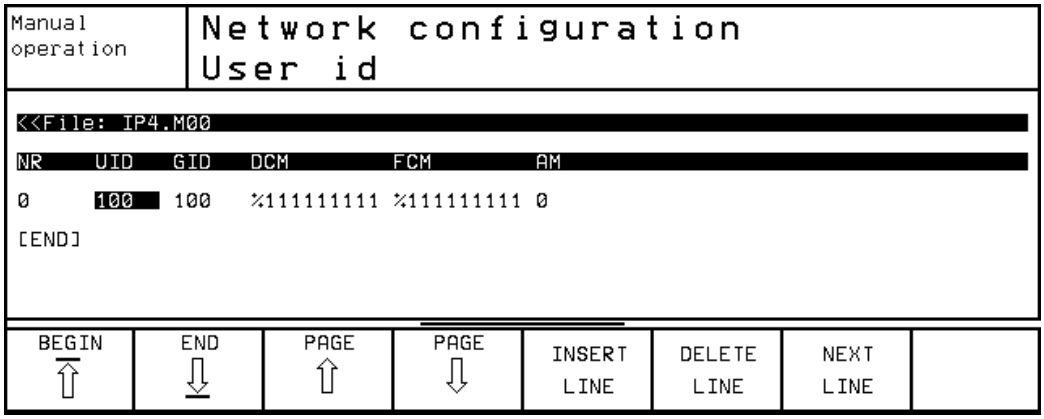
→	Switch to next column.

DOMAIN: With this name the TNC registers at the server.
When using NC software 280 472 or 473 this information is not required.



→	Switch to next column.

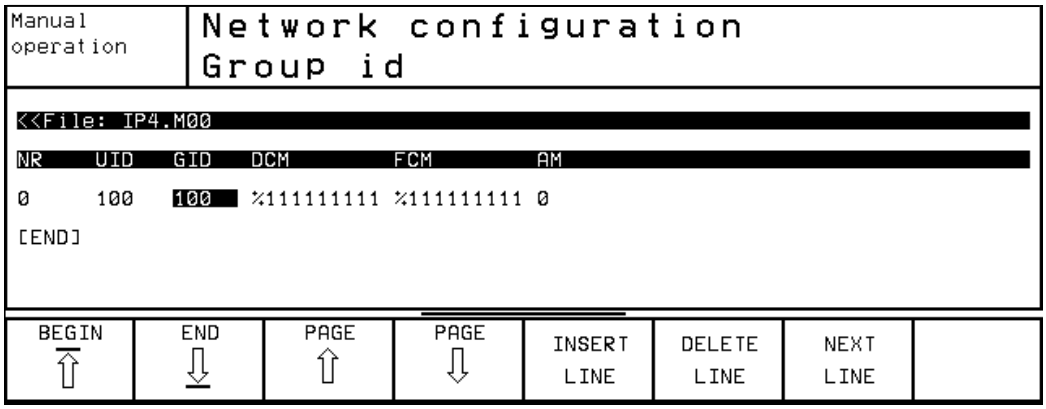
UID:[1] USER ID: identifies the **user**.



→	Switch to next column.

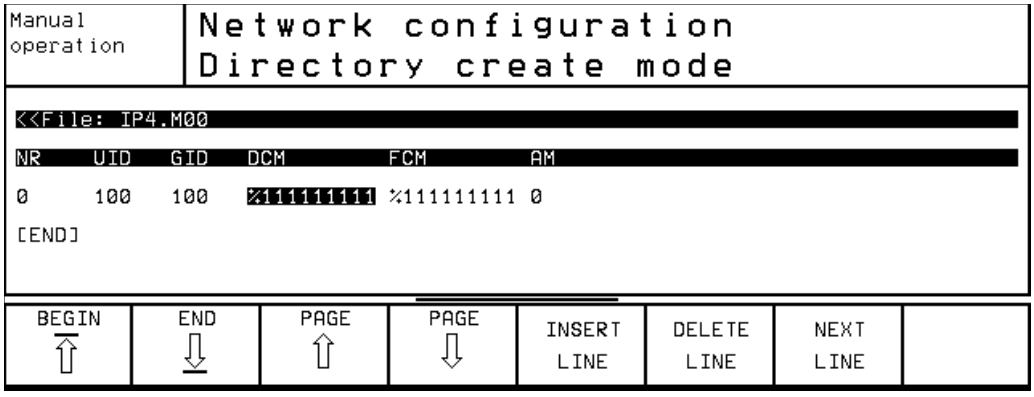
[1] This information will be provided by your network administrator

GID:[1] GROUP ID: figure to identify the **group**.



→	Switch to next column.

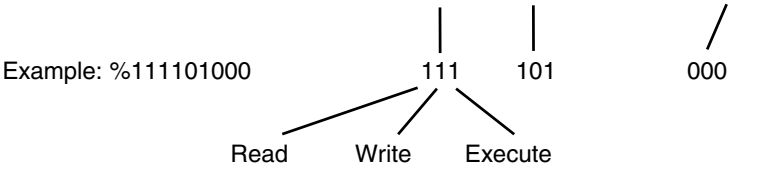
DCM: Directory Create Mode; definition of the access rights to the directory for OWNER, GROUP and other USERS.



→	Switch to next column.

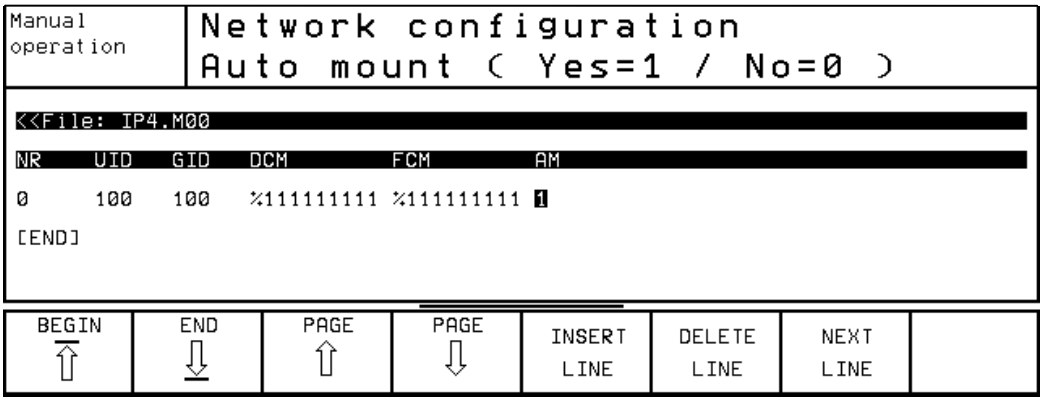
[1] This information will be provided by your network administrator

FCM: **F**ile **C**reate **M**ode; definition of the access rights to **files** for **OWNER**; **GROUP**; other **USERS**



→	Switch to next column.

AM: Definition whether **AUTOMOUNT** is possible.



END END	Exit menu.

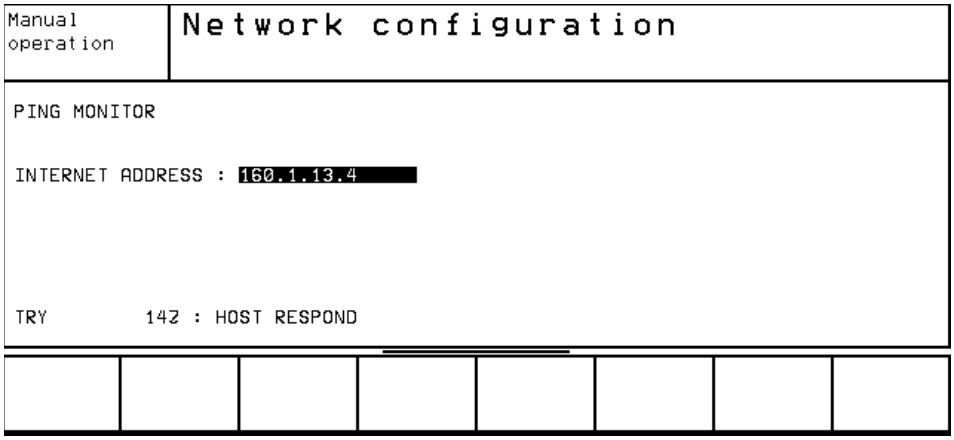
After having configured the interface, the control must be switched off and on to activate the data in the control.

6.4 Checking the connection to the server

Press key	Function
	TNC in operating mode PROGRAMMING/EDITING
	Prepare TNC for input of code number
	Enter code number (for NC software 280 472: NET123)
	and confirm input
	Press soft key (not with NC 280 472)
	Press soft key

As `INTERNET ADDRESS` enter the address stored in DEFINE MOUNT ADDRESS.

	Enter address
	Confirm input



The TNC now transmits a cyclic signal (ping) to the server and waits for confirmation. The number of attempts and the status of the confirmation is displayed in the line `TRY xx : yy`.

xx: Number of attempts

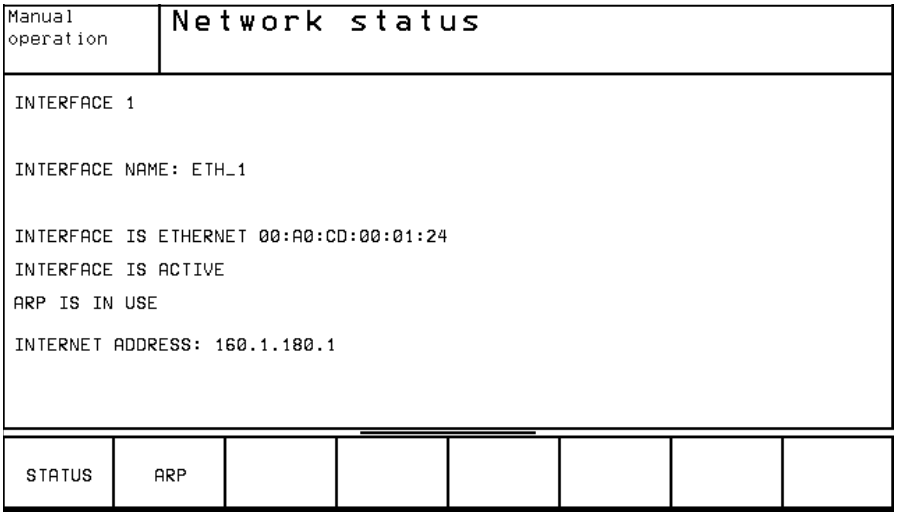
yy: Status: `TIMEOUT` ⇨ no connection
`HOST RESPOND` ⇨ properly connected

	Exit menu

6.5 Finding the hardware address of the Ethernet card

Press key	Function
	TNC in operating mode PROGRAMMIING/EDITING
MOD	Prepare TNC for input of code number
N E T M O N I	Enter code number
ENT	and confirm input
INTERFACE	Press soft key
INTERFACE 1	Press soft key

The hardware address of the Ethernet card is now displayed on the screen:
`INTERFACE IS ETHERNET XX:XX:XX:XX:XX:XX.`

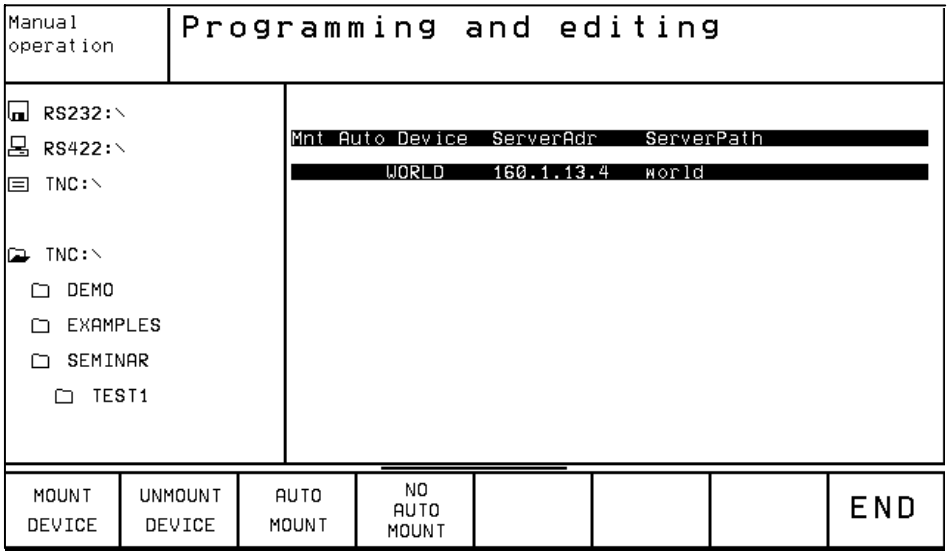


END END END	Exit menu

6.6 Working with the Ethernet interface

6.6.1 Establishing the network connection (mounting)

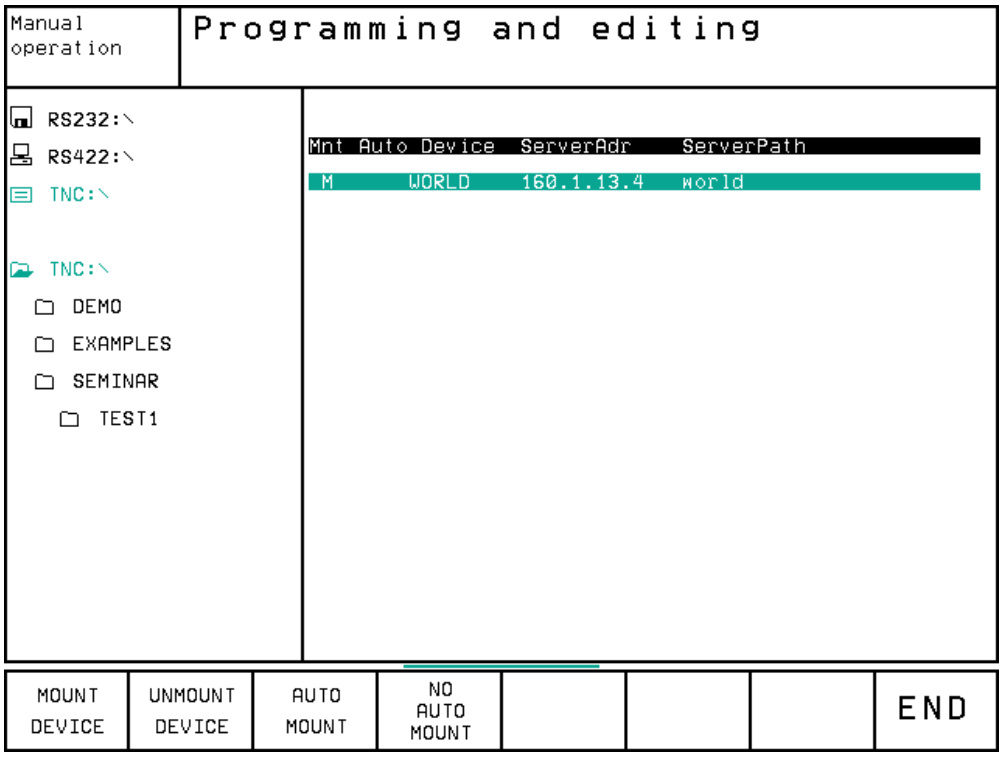
Press key	Function
	TNC in operating mode PROGRAMMIING/EDITING
	Call program management
	Switch soft-key row
	Press soft key NET



The network line must now be connected to the Ethernet card.

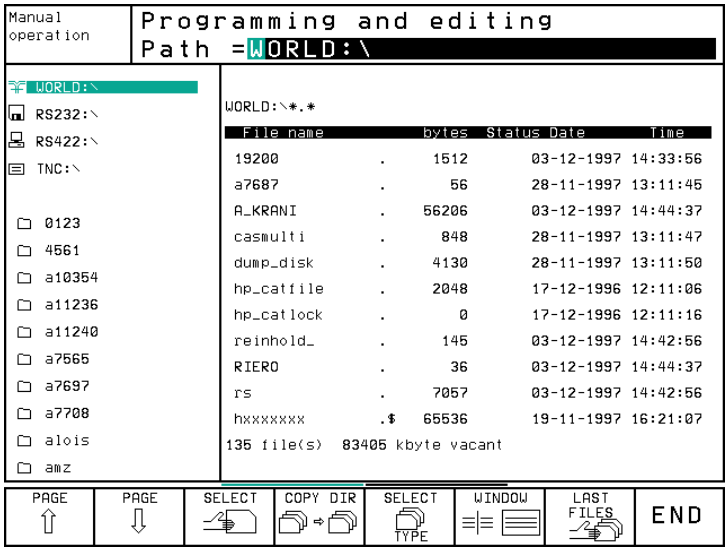
	MOUNT DEVICE	Establish connection

The letter `M` below `Mnt` shows that the device has been mounted.



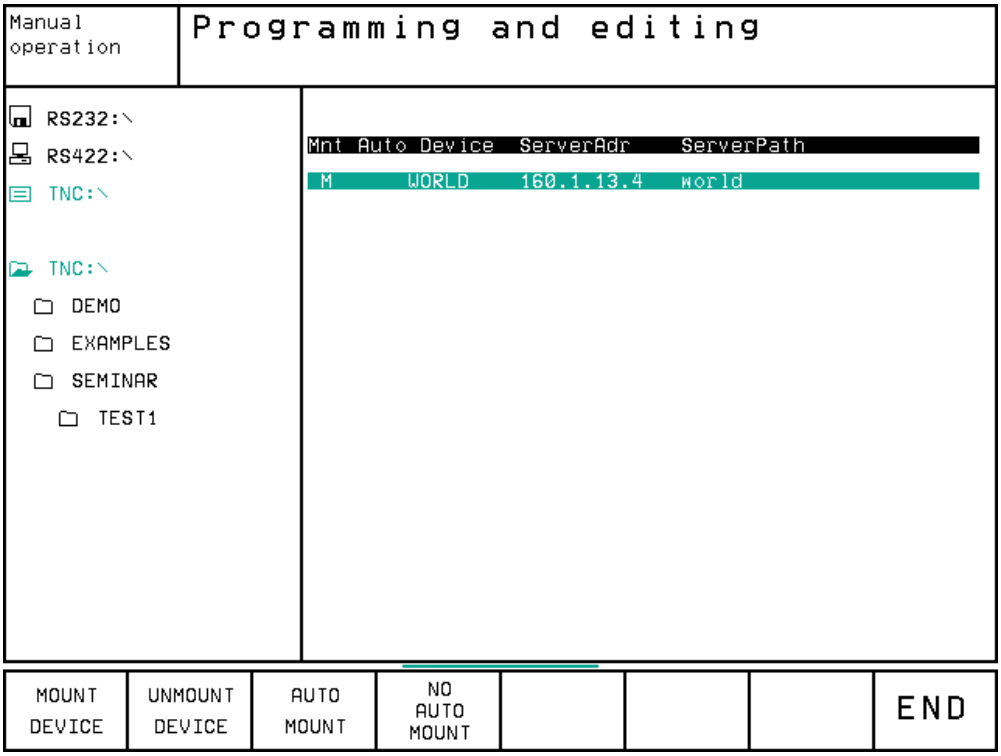
On the left half of the screen the drive mounted is displayed now (here WORLD:\ )

Press key	Function
END	Press soft key to exit the submenu
← ↑ ...	Press arrow keys to select the network drive
ENT	The directory ([READ DIR]) is loaded



6.6.2 Unmounting a network connection

Press key	Function
	TNC in operating mode PROGRAMMING/EDITING
	Call program management
	Switch soft-key row
	Press soft key NET



The network line must now be disconnected from the Ethernet card.

	Disconnect
	Press soft key to exit the submenu

7 Error messages and their causes

7.1 Error messages related to the RS-232C and RS-422 interface

7.1.1 Error messages at the TNC in the ME mode

WRONG OPERATING MOPE

No operating mode or wrong operating mode set on the external data medium.

PROGRAM DATA ERRONEOUS

Wrong program data have been detected during data transfer. The control attempted three times to read the data from the magnetic tape before interrupting the process.

DATA MEDIUM MISSING

No cassette has been inserted into the drive.

DATA MEDIUM EMPTY

No programs are stored on the data medium (cassette).

DATA MEDIUM WRITE-PROTECTED

The write-enable plug in the cassette is missing.

PROGRAM INCOMPLETE

Data transfer was interrupted before the program was transferred completely.

EXT. INPUT/OUTPUT NOT READY

The DSR-signal is missing at the TNC.
- ME not connected.
- Defective or wrong transfer cable.
- Wrong interface assignment.

ME: TAPE END

The cassette is full. To continue data transfer, turn over or exchange the cassette.

7.1.2 Error messages at the ME

In the ME the electronics is tested, and the external operating conditions are checked. If an error is detected, the lamps of the operating mode display start blinking. In the following table the error types are listed:

○ LED off ✸ LED blinks

Indicator lamps	Error message
○○○✸ ○○○○	Faulty data during transfer
○○✸○ ○○○○	No cassette inserted
○○✸✸ ○○○○	Write-enable plug in cassette missing
○✸○○ ○○○○	Wrong operating mode selected
○✸○✸ ○○○○	Data of magnetic tape faulty
○✸✸○ ○○○○	Magnetic tape empty
✸○○○ ○○○○	Errors in ME electronics
✸○○✸ ○○○○	
✸○✸○ ○○○○	
✸○✸✸ ○○○○	
✸✸○○ ○○○○	
✸✸○✸ ○○○○	
✸✸✸✸ ○○○○	End of tape
○✸✸✸ ○○○○	Peripheral unit not connected
✸✸✸○ ○○○○	Data transfer between TNC and ME or peripheral unit interrupted by DEL □

Pressing STOP clears the error messages.

7.1.3 Error messages at the FE in the ME mode

In the ME mode errors are displayed by the indicator lamps (LEDs) of the control buttons blinking.

○ LED off ● LED on ✸ LED blinks

Indicator lamps	Error message
○○○● ○✸○○	Disk missing or error in the ME electronics
○○○✸ ○✸○○	Disk cannot be formatted, as it is currently being used
✸○○● ✸○○○	Disk missing or not formatted
✸○○✸ ✸○○○	Disk cannot be copied, as a read/write process is active
●○✸● ○○○○	External device not ready or not connected
✸○●● ○○○○	Disk missing or not formatted
✸○○● ○○●○	Disk missing or not formatted or no program available
✸○●✸ ○○○○	Program cannot be output, as data transfer via TNC interface in process
✸○○✸ ○○●○	Program cannot be output, as data transfer via PRT interface in process
○○✸● ●○○○	External device not ready or not connected
○○●● ✸○○○	Disk missing or not formatted
○○○● ✸○●○	Disk missing or not formatted
○○●✸ ✸○○○	Program cannot be output, as data transfer via TNC interface in process
○○○✸ ✸○●○	Program cannot be output, as data transfer via PRT interface in process
○●○● ○○✸○	External device not ready or not connected
○✸○● ○○●○	Disk missing or error in the ME electronics
○✸○✸ ○○●○	Table of contents cannot be output, as data transfer via PRT interface in process
○○○✸ ○○●○	No interface coupling possible, as data transfer via TNC interface in process
○○●✸ ○○○○	No interface coupling possible, as data transfer via PRT interface in process
○○✸● ○○○○	External device not ready or not connected

Pressing STOP clears the error messages.

7.1.4 Error messages at the TNC in the FE mode

In this operating mode, the floppy disk unit outputs errors in the following format:

(SOH) ERR: (SP) (SP) (SP) [XXX] (ETB) (BCC)
XXX = error number

The following errors may be displayed:

Input/output errors

ERR: 001 = Wrong command code
ERR: 002 = Illegal program name
ERR: 003 = Faulty data transfer
ERR: 004 = Program incomplete
ERR: 005 = Receiving buffer overflow
ERR: 006 = Function currently disabled
ERR: 007 = Data-buffer overflow

Errors during program write or read

ERR: 010 = Program not on disk
ERR: 011 = Program erase-protected
ERR: 012 = Program is being written to
ERR: 013 = Program directory is full
ERR: 014 = Disk is full
ERR: 015 = Text not found
ERR: 016 = Program name already exists
ERR: 017 = Disk access active
ERR: 018 = Program currently being read

Disk / drive / controller errors

ERR: 100 = Disk not initialized
ERR: 101 = Sector number too large 1)
ERR: 102 = Drive not ready 2)
ERR: 103 = Disk is write-protected
ERR: 104 = Faulty data on disk 1)
ERR: 105 = Sector cannot be found1)
ERR: 106 = Check sum incorrect 1)
ERR: 107 = Disk controller defective 3)
ERR: 108 = DMA error 3)
ERR: 109 = Disk exchanged during program loading

1) These error messages indicate that the disk is defective; in most cases, they can only be eliminated by reformatting the disk.

2) If this error message comes up while the disk is inserted, the drive is probably defective.

3) Hardware defect

7.1.5 Error messages on data transfer

TRANSFERRED VALUE INCORRECT X

X =
- A Faulty character frame
- B Character overflow
- C Faulty character frame or character overflow
- D Parity error
- E Faulty character frame or parity error
- F Character overflow or parity error
- G Faulty character frame or character overflow or parity error
- H Receiving-buffer overflow
- K Incorrect ESC sequence (only in ME mode)
- L Incorrect ESC sequence (only in ME mode)

DATA TRANSFER ERRONEOUS X

X =
- A Faulty character frame
- D Parity error
- M Control has received the character for "negative acknowledge" (NAK) more than 3 times
- N Control has sent the character for "negative acknowledge" (NAK) more than 3 times
- P Timeout ACK/NAK

BAUD RATE NOT POSSIBLE

If both data interfaces (RS 232 / RS 422) are active simultaneously, the baud rates of both interfaces must be the same.

INTERFACE ALREADY ASSIGNED

A data interface cannot be used for two operating modes simultaneously. (e.g. DNC mode and programming at the same time is not possible with one data interface):

EXT. INPUT/OUTPUT NOT READY

- DSR signal missing at the TNC
- Defective or wrong transfer cable
- Wrong interface assignment

PROGRAM INCOMPLETE

Data transfer was aborted before the program was completely loaded.

7.2 Ethernet error messages

Error messages or warnings output during mounting of a device are stored in plain language in an ERROR file.
If the control is switched off and on, the contents of this file are **erased**.
Entries in this file can be viewed by entering the code number **"NET123"** and pressing the soft key **"SHOW ERROR"**.

Structure of an error message

The first information is the program part that has detected the error; it is followed by a colon. Next there may be the name of the device to be mounted in <> brackets. The software differentiates between errors **(E)** and warnings**(W)**. If an error has occurred, it is not possible to activate the network or to mount the device. In the case of a warning the network was activated or the device mounted, but non-permissible entry values were corrected.

Errors recognized by the link layer:

"LL: (W) CONNECTION "error string" UNKNOWN USING DEFAULT 10BASE2"

An unknown name was entered for the connection.
10BASE2 (thin Ethernet) is used.

"LL: (E) PROTOCOL "error string" UNKNOWN"

An unknown name was entered for the protocol.

Errors recognized by the network layer:

"IP4: (E) INTERFACE NOT PRESENT"

No Ethernet interface card was detected.

"IP4: (E) INTERNET ADDRESS NOT VALID"

The internet address of the control is not valid, e.g. D-class or E-class address, loop-back address or broadcast address.

"IP4: (E) SUBNET MASK NOT VALID"

The subnet mask does not match the internet address, or only 1 bit specified for the subnet ID or the host ID.

"IP4: (E) SUBNET MASK OR HOST ID NOT VALID"

Input of the internet address or the subnet mask faulty, or all bits of the host ID are 0 or 1.

"IP4: (E) SUBNET MASK OR SUBNET ID NOT VALID"

All bits of the subnet ID are 0 or 1.

"IP4: (E) DEFAULT ROUTER ADDRESS NOT VALID"

The internet address specified for the default router is not valid, e.g. D-class or E-class address, loop-back address or broadcast address.

"IP4: (E) CAN NOT USE DEFAULT ROUTER"

The net ID and subnet ID of the default router is not identical to that of the control.

"IP4: (E) I AM NOT A ROUTER"

The internet address of the default router is identical to that of the control.

Errors recognized by the mount system call:

"MOUNT: <device name> (E) DEVICE NAME NOT VALID"

The device name is too long or contains non-permissible characters.

"MOUNT: <device name> (E) DEVICE NAME ALREADY ASSIGNED"

A device with this name already exists.

"MOUNT: <device name> (E) DEVICE TABLE OVERFLOW"

The device table is full; the device cannot be mounted any more.

Errors and warnings generated by the driver of the network file system, version 2:

"NFS2: <device name> (W) READ SIZE SMALLER THEN x SET TO x"

The read size selected is too small; it is set to the smallest permissible value.

"NFS2: <device name> (W) READ SIZE LARGER THEN x SET TO x"

The read size selected is too large; it is set to the highest permissible value.

"NFS2: <device name> (W) WRITE SIZE SMALLER THEN x SET TO x"

The write size selected is too small; it is set to the smallest permissible value.

"NFS2: <device name> (W) WRITE SIZE LARGER THEN x SET TO x"

The write size selected is too large; it is set to the highest permissible value.

"NFS2: <device name> (E) MOUNT PATH TOO LONG"

The specified mount path is too long; the device cannot be mounted.

"NFS2: <device name> (E) NOT ENOUGH MEMORY"

The memory available for the driver is insufficient to provide the management data for the device.

"NFS2: <device name> (E) HOST NAME TO LONG"

The specified host name is too long; the device cannot be mounted.

"NFS2: <device name> (E) CAN NOT OPEN PORT"

A port required for mounting cannot be opened.

"NFS2: <device name> (E) ERROR FROM PORT MAPPER"

The data received from the port mapper are not plausible or no data were received.

"NFS2: <device name> (E) ERROR FROM MOUNT SERVER"

The data received from the mount server are not plausible or no data were received.

"NFS2: <device name> (E) CANT GET ROOT DIRECTORY"

The mount server does not permit the mounting of the specified directory.

"NFS2: <device name> (E) UID OR GID 0 NOT ALLOWED"

User ID 0 and group ID 0 are not permitted; they may exclusively by used by the super user or the system administrator.

8 Tables

8.1 7-bit ASCII code

Character	Decimal	Octal	Hexadecimal
NUL	000	000	00
SOH	001	001	01
STX	002	002	02
ETX	003	003	03
EOT	004	004	04
ENQ	005	005	05
ACK	006	006	06
BEL	007	007	07
BS	008	010	08
HT	009	011	09
LF	010	012	0A
VT	011	013	0B
FF	012	014	0C
CR	013	015	0D
SO	014	016	0E
SI	015	017	0F
DLE	016	020	10
DC1 (X-ON)	017	021	11
DC2	018	022	12
DC3 (X-OFF)	019	023	13
DC4	020	024	14
NAK	021	025	15
SYN	022	026	16
ETB	023	027	17
CAN	024	030	18
EM	025	031	19
SUB	026	032	1A
ESC	027	033	1B
FS	028	034	1C
GS	029	035	1D
RS	030	036	1E
US	031	037	1F

Character	Decimal	Octal	Hexadecimal
SP	032	040	20
!	033	041	21
"	034	042	22
#	035	043	23
$	036	044	24
%	037	045	25
&	038	046	26
´	039	047	27
(	040	050	28
)	041	051	29
*	042	052	2A
+	043	053	2B
,	044	054	2C
-	045	055	2D
.	046	056	2E
/	047	057	2F
0	048	060	30
1	049	061	31
2	050	062	32
3	051	063	33
4	052	064	34
5	053	065	35
6	054	066	36
7	055	067	37
8	056	070	38
9	057	071	39
:	058	072	3A
;	059	073	3B
<	060	074	3C
=	061	075	3D
>	062	076	3E
?	063	077	3F
@	064	100	40
A	065	101	41
B	066	102	42
C	067	103	43

Character	Decimal	Octal	Hexadecimal
D	068	104	44
E	069	105	45
F	070	106	46
G	071	107	47
H	072	110	48
I	073	111	49
J	074	112	4A
K	075	113	4B
L	076	114	4C
M	077	115	4D
N	078	116	4E
O	079	117	4F
P	080	120	50
Q	081	121	51
R	082	122	52
S	083	123	53
T	084	124	54
U	085	125	55
V	086	126	56
W	087	127	57
X	088	130	58
Y	089	131	59
Z	090	132	5A
[	091	133	5B
\	092	134	5C
]	093	135	5D
^	094	136	5E
–	095	137	5F
`	096	140	60
a	097	141	61
b	098	142	62
c	099	143	63
d	100	144	64
e	101	145	65
f	102	146	66
g	103	147	67

Character	Decimal	Octal	Hexadecimal
h	104	150	68
i	105	151	69
j	106	152	6A
k	107	153	6B
l	108	154	6C
m	109	155	6D
n	110	156	6E
o	111	157	6F
p	112	160	70
q	113	161	71
r	114	162	72
s	115	163	73
t	116	164	74
u	117	165	75
v	118	166	76
w	119	167	77
x	120	170	78
y	121	171	79
z	122	172	7A
{	123	173	7B
¦	124	174	7C
}	125	175	7D
~	126	176	7E
DEL	127	177	7F

8.2 Powers of 2

n	2^n
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1 024
11	2 048
12	4 096
13	8 192
14	16 384
15	32 768
16	65 536
17	131 072
18	262 144
19	524 288
20	1 048 576