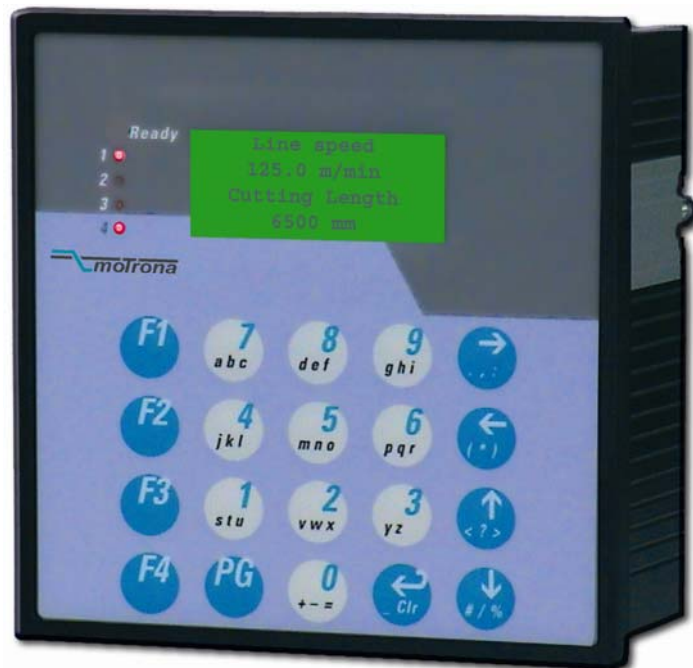


CE
TX 721

**Operator Terminal with CAN Bus Interface
for LENZE Series 9300 Drives**



Operating Instructions

- Back-light LCD display 4 lines x 16 characters
- 64 pages for free editing of texts and variables
- Supplementary I/O ports and programmable key functions
- PC operator software for easy setup
- CAN, RS 232 and RS 485 communication (Master or Slave)
- 1 M Byte Flash - Eprom-Memory
- 18...30 VDC supply, standard housing 144 x 144 x 65 mm

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1. Introduction

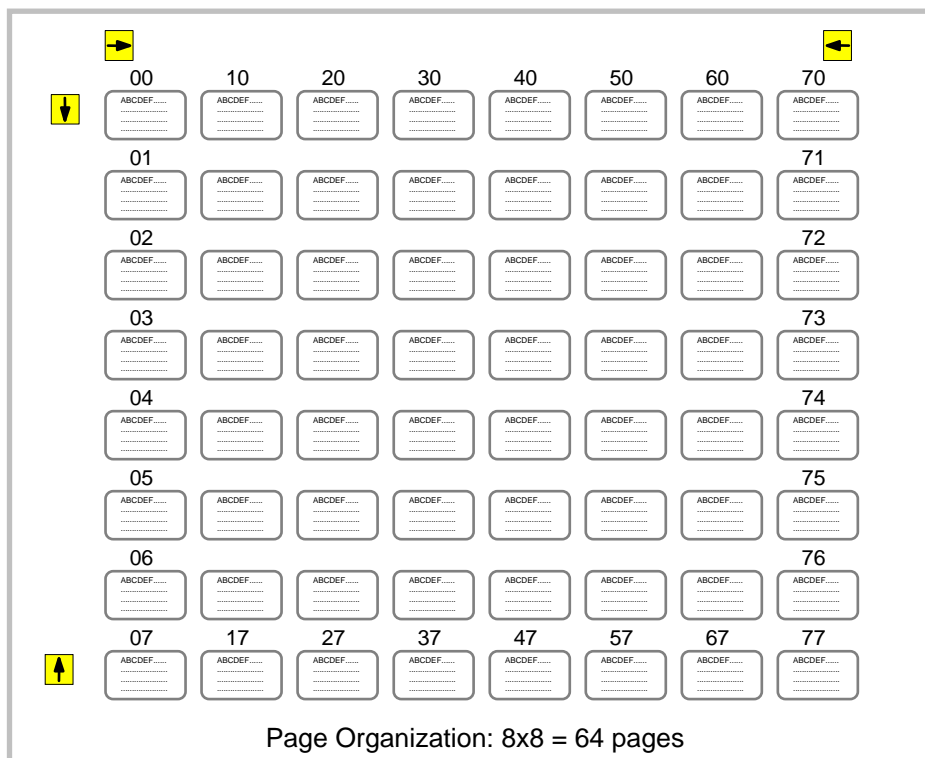
The TX721 unit has been designed as a low cost operator terminal, with special regard to drive applications. For users of controllers or drives with CAN interface, it provides an easy means for operation and communication, at a reasonable price. The CAN open protocol used is especially suited to operate with LENZE Series 9300 drives. Also, the terminal can communicate by RS232 and RS485 interface, using the LECOM A/B protocol. The terminal provides mixed service and can communicate via CAN and serial at time.

2. Basic Configuration

The unit provides a LCD display with back light and 4 lines at 16 characters each. Any kind of texts, register values or variables can be displayed. It is possible to access all connected target units and to read out or change settings. 8 digital inputs and 8 digital outputs are available for general control purpose and 8 keys can be programmed to execute special commands. The TX721 can operate as a "**Bus Master**" and does not need any support from a PLC or IPC.

Subsequently, the expressions "page" or "window" will be used when we talk about one set of $4 \times 16 = 64$ characters on the screen.

There are totally 64 programmable pages available which can be accessed by the arrow keys    and . The pages are arranged in a matrix with 8 rows (0-7) and 8 columns (0-7).



For editing of texts and specification of variables, delivery includes a PC operator software (supplied on disc). It is possible to edit, upload, download and save all information of the 64 pages, which the unit itself stores in a Flash memory. For repeating applications, setup files can be stored and then downloaded to any number of TX721 units, making the setup of the units very easy.

The PC must meet the following minimum standard to operate successfully with the TX721 operator software:

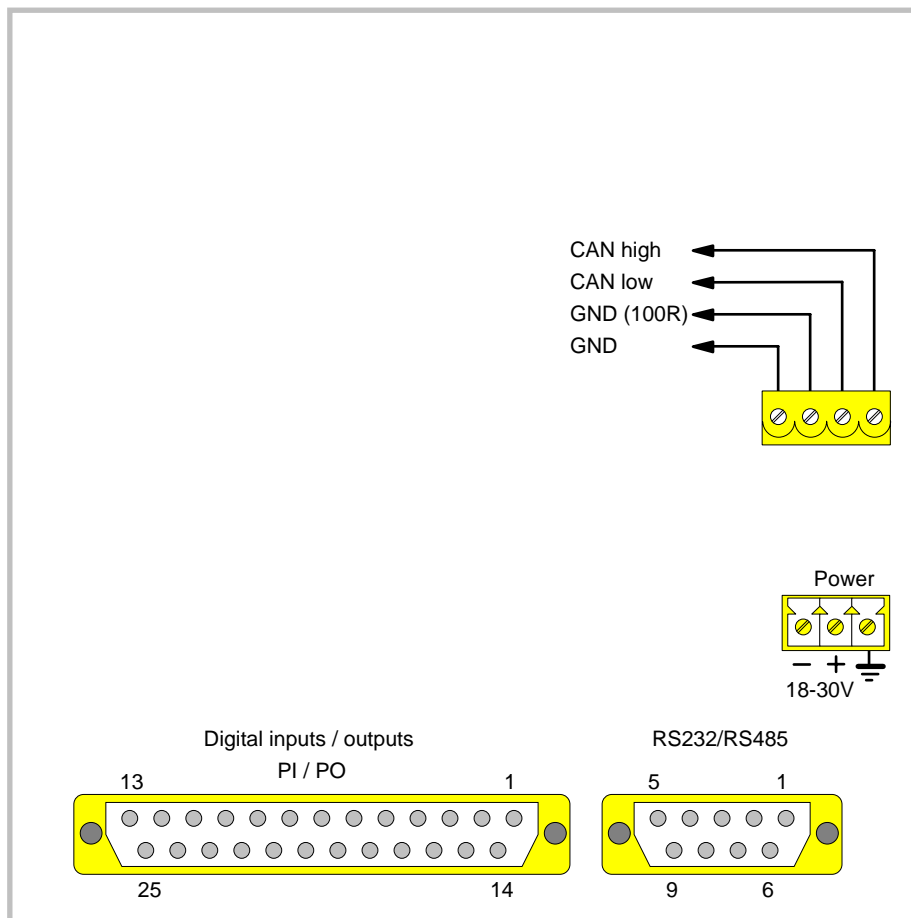
Processor	: 386, 486 oder Pentium
Minimum RAM	: 8 MByte
Minimum HD	: 20 MByte
Operating System	: Windows 3.X or Windows 95

The operator software should also work fine under Windows NT, however actual experience is too low to guarantee trouble-free NT operation.

3. Hardware

The unit possesses plug-in screw terminals on the rear for connection of power supply and the CAN communication line. A Sub-D-9 connector connects the serial RS 232 and RS 485 interface. Another 25-pin Sub-D-connector accesses the 8 digital input and 8 digital output lines.

Both Sub-D-connectors are of female type, so the cable must use male connectors



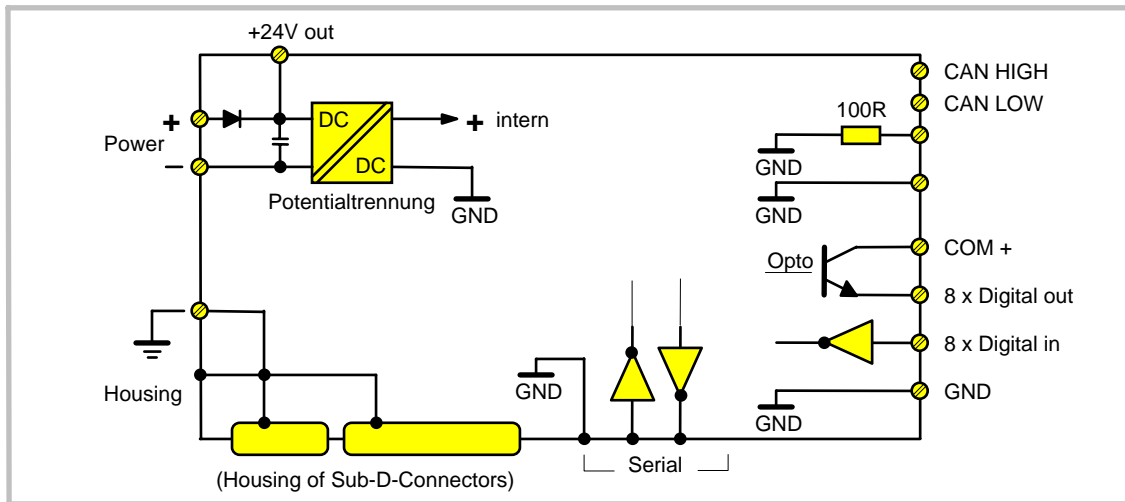
Connection panel on the TX721 backside

3.1 Power-Supply

The unit operates with an unbalanced supply voltage in a range of 18 30 VDC (approx. 100 mA). The supply terminals are electrically protected against wrong polarity misconnection. Since the unit uses only switching voltage regulation inside, there is practically no internal heating up.

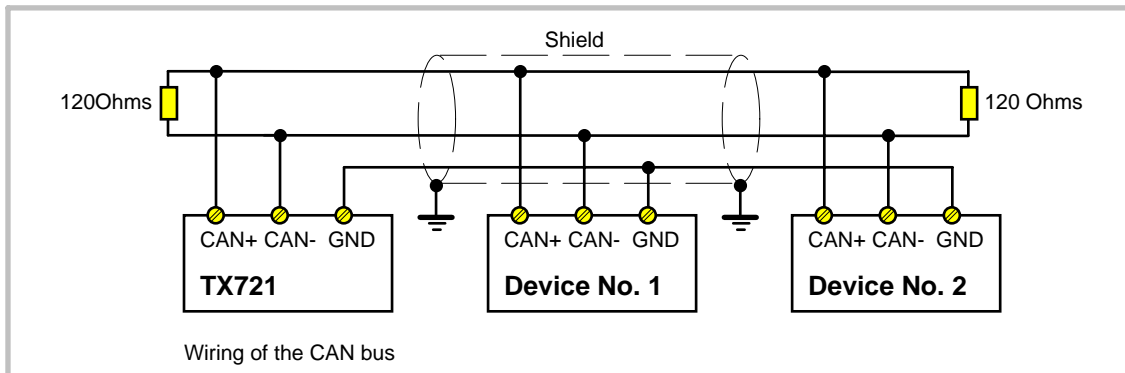
The terminal marked \perp is connected to the metal housings only and does not earth any of the internal potentials.

The subsequent diagram explains the potential conditions with respect to the internal potential separation.



3.2 CAN interface connection

The CAN bus potential is separated from the power supply, but uses the same ground as the serial RS 232/RS 485 ports and the digital inputs.



The following cable types are recommended, depending on the total length:

Total Length < 300m	
Cable type	LIYCY 2 x 2 x 0,5 mm ² (twisted and screened)
Resistance	≤ 40 Ω /km
Capacity	≤ 130 nF/km
Length	≤ 300 m
Total Length > 300m	
Cable type	CYPIMF 2 x 2 x 0,5 mm ² (twisted and screened)
Resistance	≤ 40 Ω /km
Capacity	≤ 60 nF/km
Length	≤ 1000 m

Please use the leads like shown:

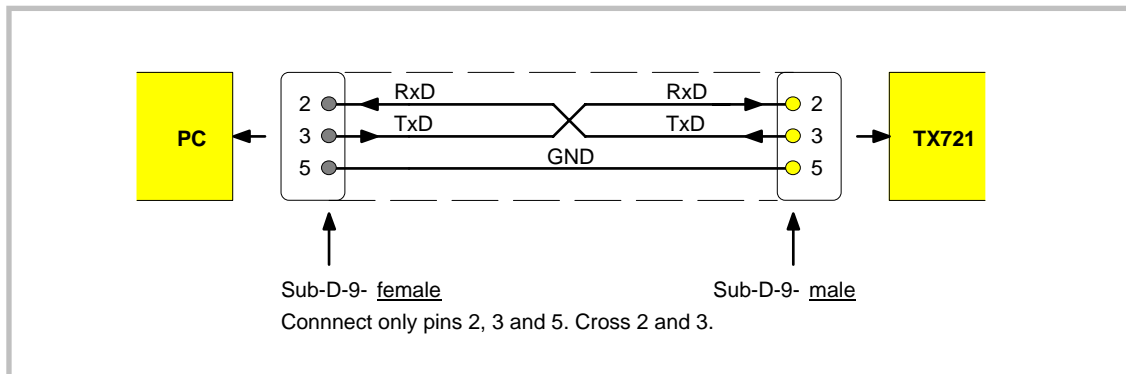
Pair 1 (white/brown)	CAN-Low and CAN-High
Pair 2 (green/yellow)	GND

CAN-Specification	
Standard	DIN ISO 11898
Protocol	CANopen (CAL based communication profile DS 301)
Baud rate (KBit/s)	25, 50, 125, 250, 500, 1000 (adjustable)

Maximum Cable Length					
Baud rate (KBit/s)	50	125	250	500	1000
Cable length (m)	1000	550	250	120	25

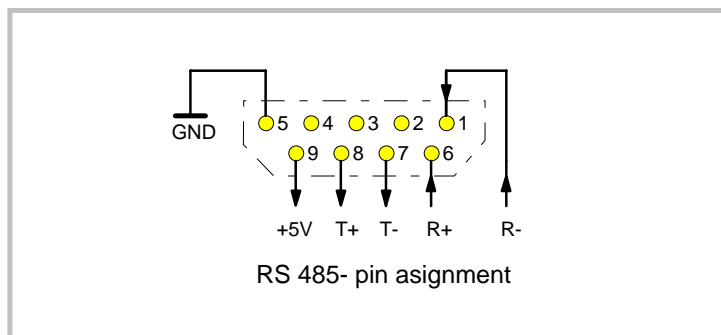
3.3 The RS 232 serial interface

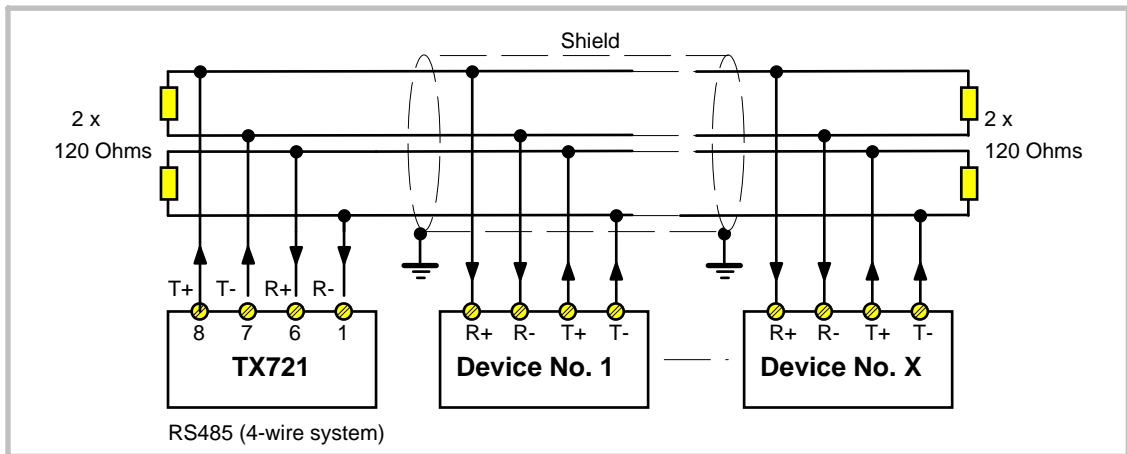
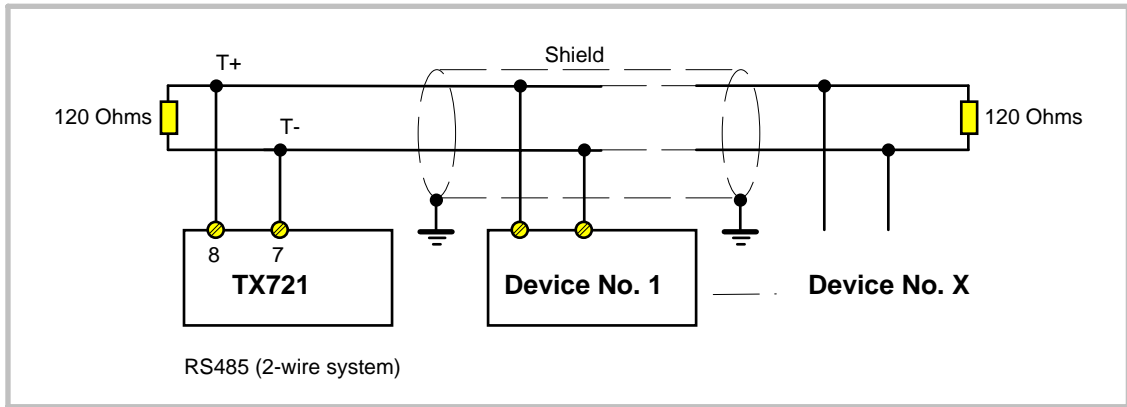
This serial link, in general, will be used to set up the TX721 operator terminal by a PC. However, with cable length up to 15 meters, it is legal to use the interface for online communication with a target unit also. RS 232 uses pins 2 (RxD), 3 (TxD) and 5 (GND) of the 9-position Sub-D-connector. For use with a PC, lines 2 and 3 must be crossed like shown.



3.4 The RS485 serial interface

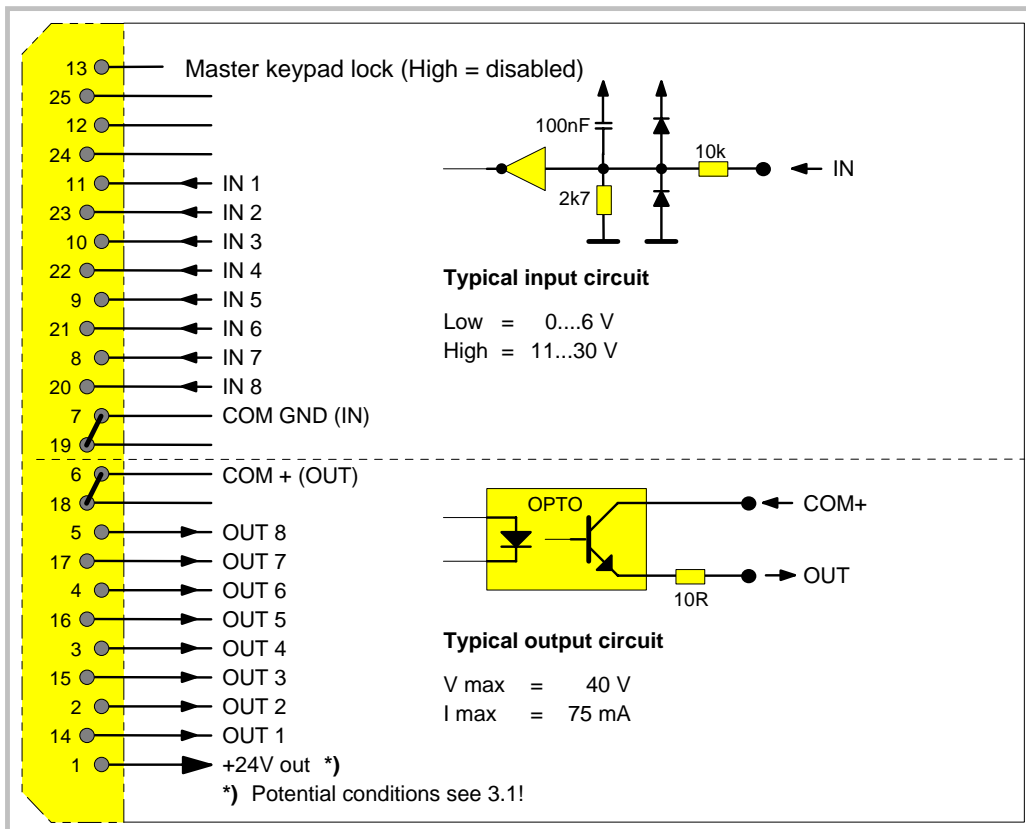
Up to 32 target units can be served by this interface. It is possible to set the terminal for 2-wire or 4-wire communication. The RS 485 lines use pins 1, 6, 7 and 8 of the Sub-D-9 serial connector.





3.5 Digital Inputs and Outputs

Inputs and Outputs are accessible by the rear 25pin Sub-D-Connector.



4. **General Setup by Keypad**

Prior to use, some basic settings must be made to fix up the desired communication mode. These settings do not refer to communication with the PC while programming the unit. PC setup uses fixed communication parameters stored in the unit. The settings are important for later communication with a participant unit and specify transmission format and communication speed.

General setup can be made by Keypad or by PC. This section describes the procedure when using the keypad, and section 7. describes setup by PC.

TX721 is able to communicate via CAN and via serial interface at the same time. Where you use only CAN participants, the serial settings are unimportant. Where you use only RS 485 target units, the CAN settings are unimportant.

To start setup procedure, keep **F4 down and press **Prg** (while **F4** is kept)**

Use key **↵** to change settings. Use the arrow keys to scroll the settings (for viewing only). Leave the setup procedure by pressing **Prg** . Default settings use bold print subsequently.



Ready
1
2
3
4

ser. Baud Rate
0
PRG=end ENT=edit

- 0 = 9600
- 1 = 4800
- 2 = 2400
- 3 = 1200
- 4 = 600
- 5 = 19200

Ready
1
2
3
4

ser. Data Form
0
PRG=end ENT=edit

- | | |
|--------------|--------------|
| 0 = 7 even 1 | 6 = 8 even 1 |
| 1 = 7 even 2 | 7 = 8 add 1 |
| 2 = 7 add 1 | 8 = 8 no 1 |
| 3 = 7 add 2 | 9 = 8 no 2 |
| 4 = 7 no 1 | |
| 5 = 7 no 2 | |

Ready
1
2
3
4

ser. Mode
0
PRG=end ENT=edit

- 0 = RS232
- 1 = RS485 -4 wire
- 2 = RS485 -2 wire

Ready
1
2
3
4

Can Baud Rate
1
PRG=end ENT=edit

- 0 = 1.000 k
- 1 = 500 k
- 2 = 250 k
- 3 = 150 k
- 4 = 50 k
- 5 = 20 k

Ready
1
2
3
4

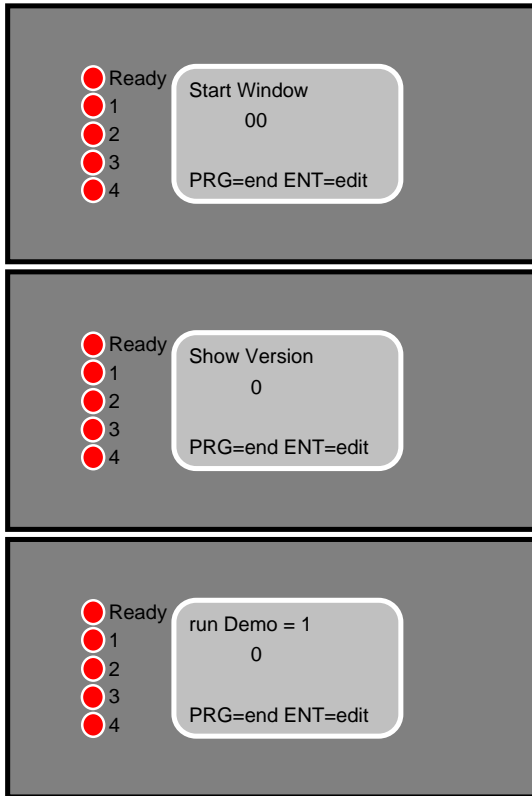
Password

PRG=end ENT=edit

0000 - 9999

Default 6078





Number of the start page, i.e. the window which should appear after power up.

0: No display of the version number after power up.

1: After power up, for 3 seconds the version number appears before we see the start window.

0: Normal operation. Unit searches for variables on the bus and an error message appears when the target unit does not respond.

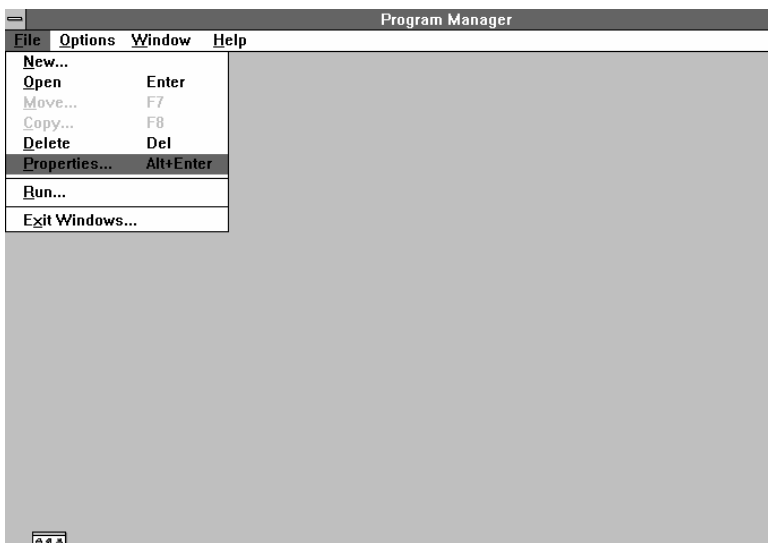
1: For demonstration only. Suited for trials when no target units are connected.

With the 5th setting in this sequence, you can define your own pass word (Default value = 6078). For later operation you can specify individually **for each variable or parameter**, if the operator should have free access or if he must use the pass word.

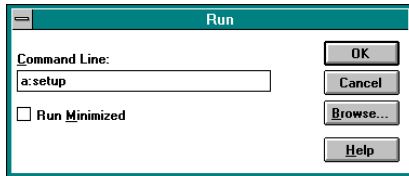
5. Installation of the TX721 PC Software

The minimum requirements for the PC have been shown in section 1. Before you start the installation, please close all other programs first.

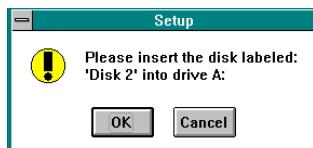
- 5.1 Start Windows and select "Run". With Windows 95 you can click this function directly and with Windows 3.x you find it in the Program manager



- 5.2** Insert disc No. 1 to the disc drive.
Type "**a: setup**" to the command line and click OK
(If applicable, use other drive than "a").



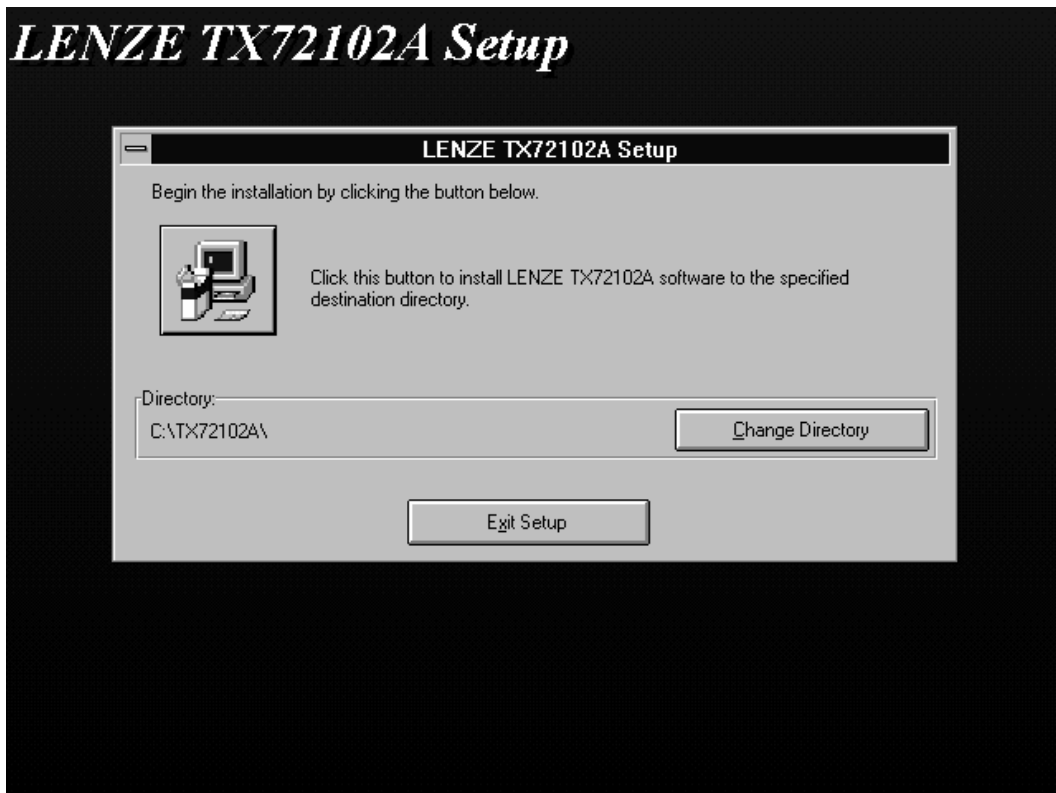
- 5.3** The setup procedure starts now. After a short time you will find a request to insert disc No. 2.
After this, click OK.



- 5.4 When you find this screen, just click OK.



- 5.5 Click the square button showing the screen when you like to accept the directory shown on screen. Where you like to install the software in another directory, Click "Change directory" and enter your instructions.



- 5.6 Upon request by the screen, insert disc No. 3 and click OK. This terminates the installation procedure. Where you use Windows 3.11, your Windows screen will subsequently offer you an icon labeled "motrona TX721". With Windows 95, you can find the software label in the field of programs.

6. Basic Functions of the PC Software

The operator software allows full editing of texts and definition of variables and registers. As long as you do not try to read from or to write to the Flash Eprom of a terminal, it is not necessary to have a TX721 unit connected to the PC when using the setup software.

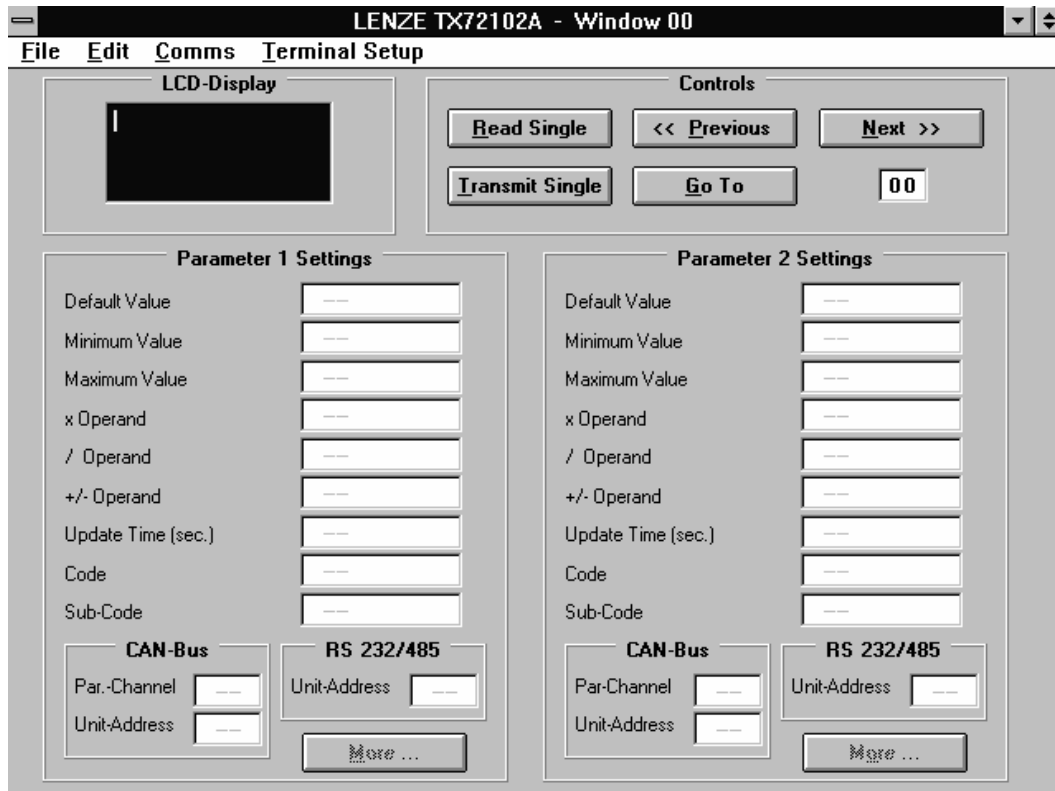
Important: For any serial communication with the terminal, it is important to read **“Serial Setup”** on the LCD display (Press **Prg** and then **"0"** on the terminal keyboard).

For connection between TX721 and your PC see section 3.3.

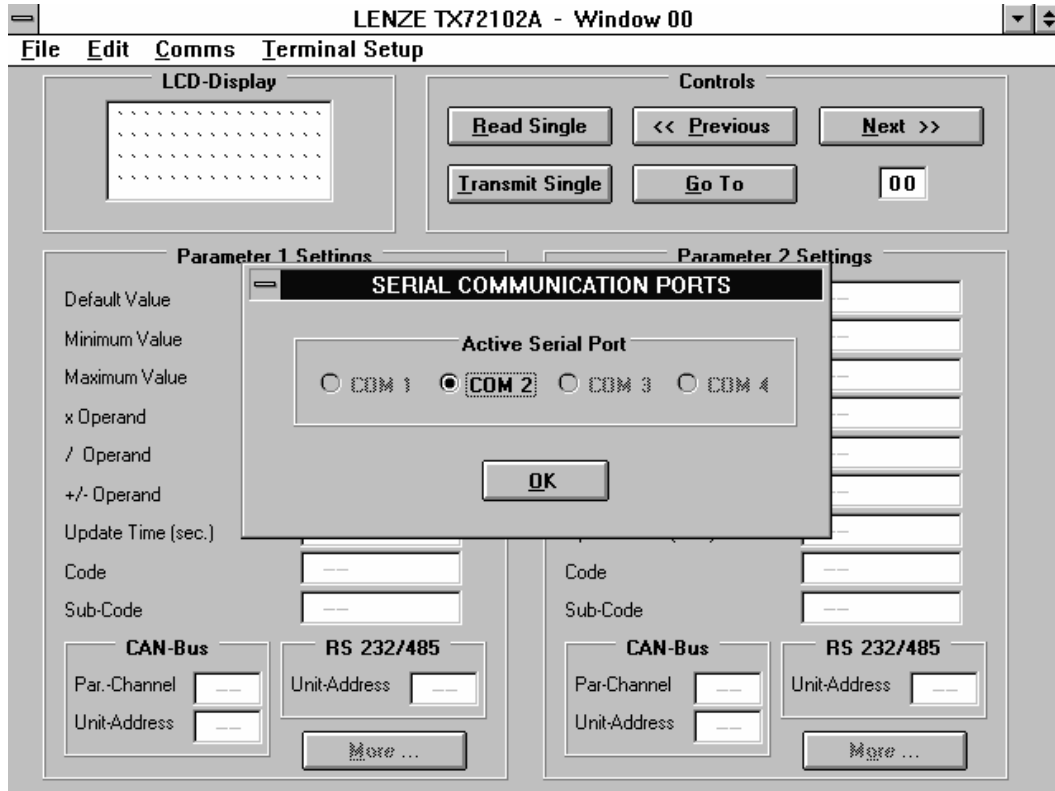
Where you have already stored an existing file, you can directly load it down to the terminal (Menu “File“). This also loads down all basic settings and definitions to the Flash Eprom and the unit is fully set up after the download.

It is also possible to load up all settings from an existing unit and copy the file down to other units.

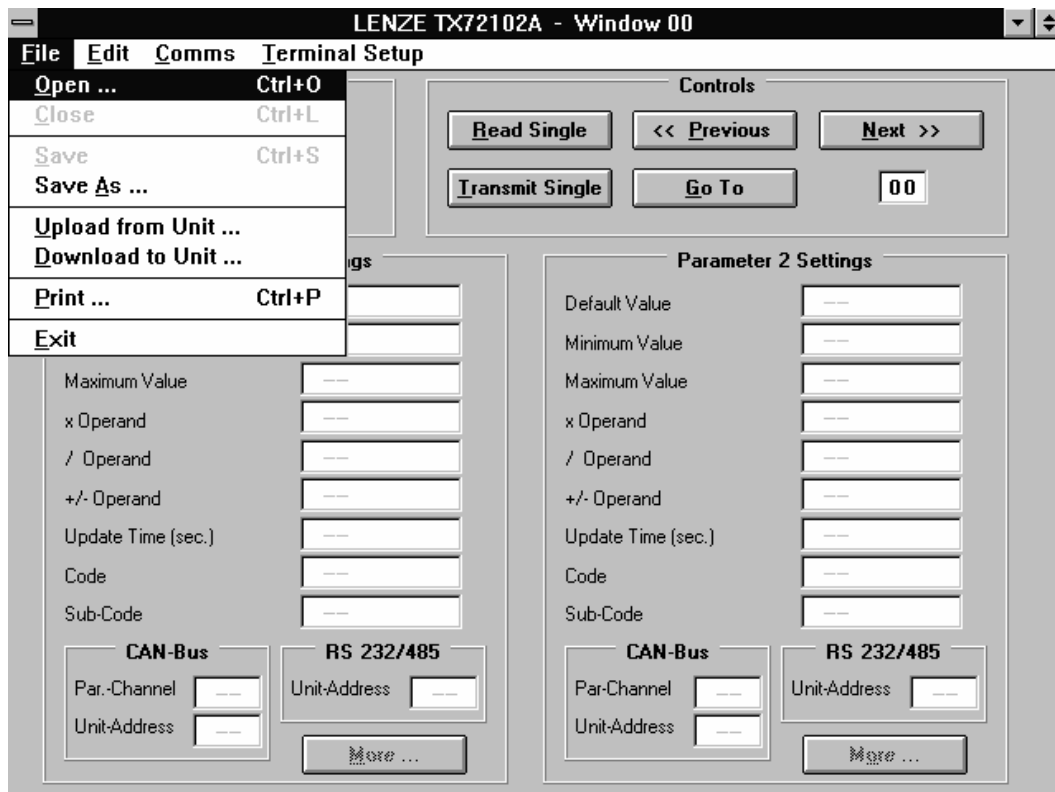
- 6.1 When running the TX721 setup software, you will find the following screen:



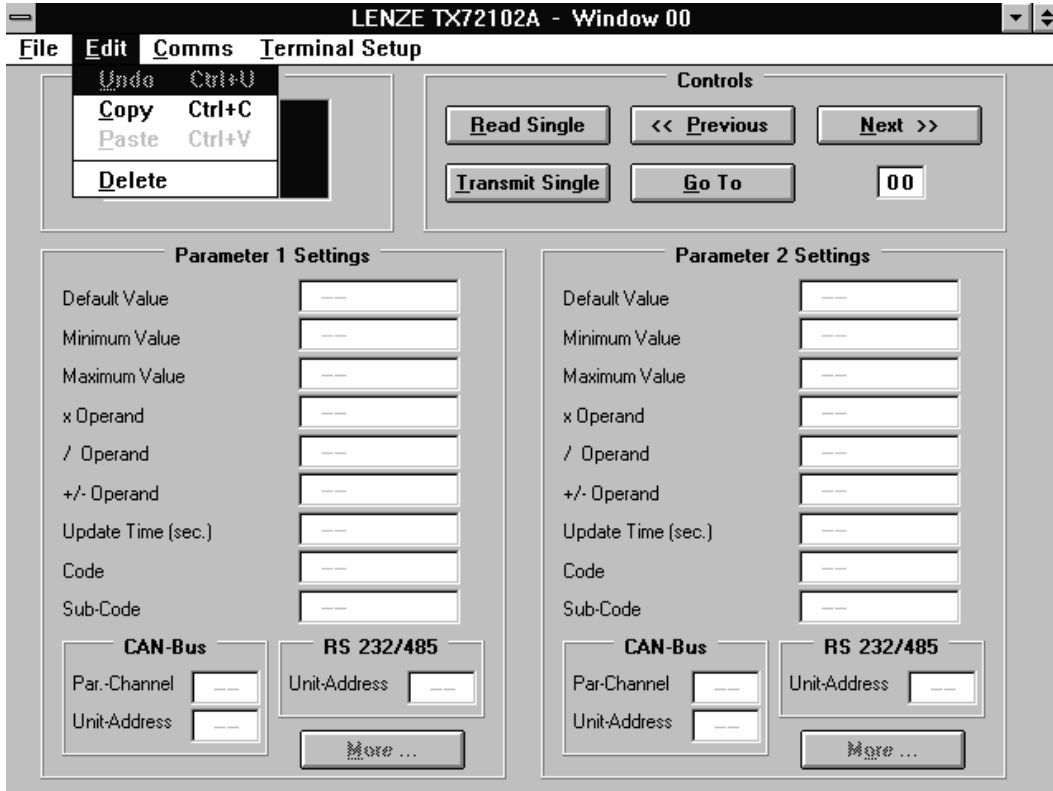
- 6.2 Where we run the program the first time, it is necessary to specify the PC Communication port which we like to use for later communication with a Terminal. Click **"Comms"** in the headline, select your desired COM Port and then "OK".



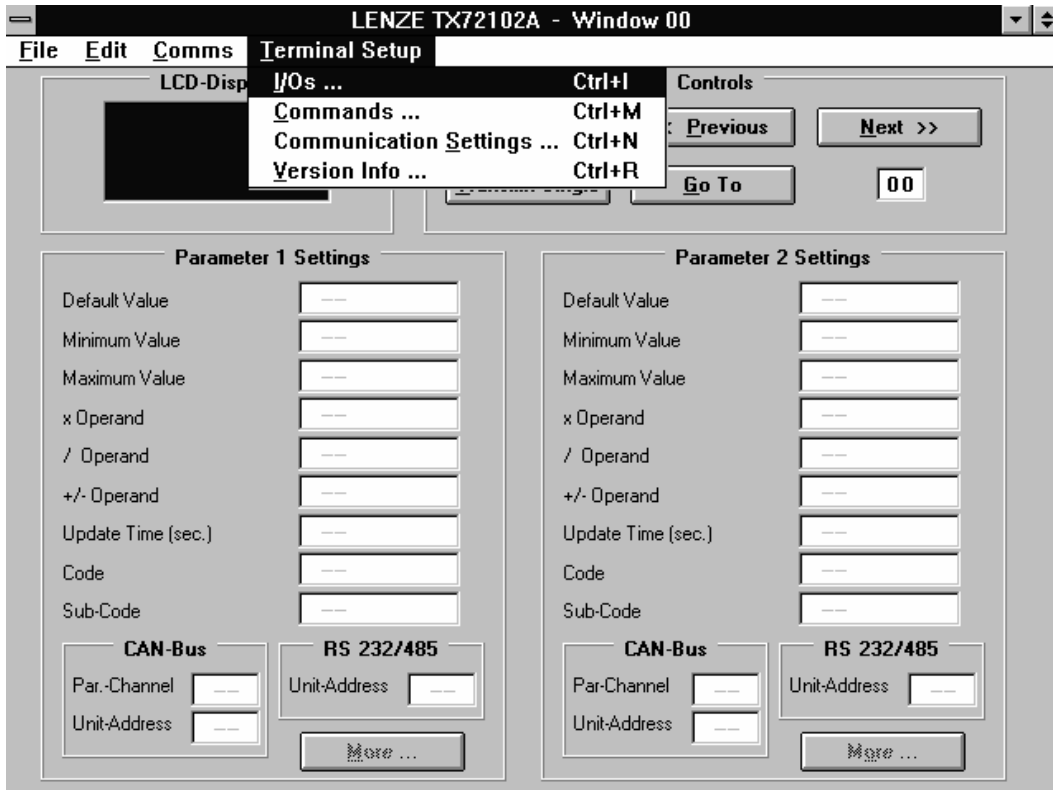
- 6.3 The **"Files"** menu contains all functions to read, load and store complete TX721 Data files.



- 6.4 The "Edit" menu allows to cancel your last action and provides copying, deleting and inserting functions.



- 6.5 The menu „Terminal Setup“ provides settings of the digital I/O functions, customer specific key functions and setting of the desired communication parameters (similar to section 4.)



7. Basic Terminal Setup by PC

(Compare section 4)

Select "Terminal Setup" and then "Communication Settings". Click the buttons to specify the settings desired for later communication.

The "Transmit" button loads down the communication setting to a unit, provided the unit is in the "Serial Setup" state (see 6.).

The "Read" button reads out actual communication settings from a unit.

The "OK" button stores your settings in the PC file only, but not in the operator terminal yet. The settings are transmitted to the unit then while you load down the complete file.

TERMINAL COMMUNICATION SETTINGS

RS 232 / 485 Settings

Serial Mode

RS 232 RS 485 4-Wire RS 485 2-Wire

Baud Rate

19200 Baud
 9600 Baud
 4800 Baud
 2400 Baud
 1200 Baud
 600 Baud

Communication Format

7 Data, 1 Stop, Parity Even 7 Data, 2 Stop, No Parity
 7 Data, 2 Stop, Parity Even 8 Data, 1 Stop, Parity Even
 7 Data, 1 Stop, Parity Odd 8 Data, 1 Stop, Parity Odd
 7 Data, 2 Stop, Parity Odd 8 Data, 1 Stop, No Parity
 7 Data, 1 Stop, No Parity 8 Data, 2 Stop, No Parity

CAN Baud Rate

1 MBaud 125 KBaud
 500 KBaud 50 KBaud
 250 KBaud 25 KBaud

Other Settings

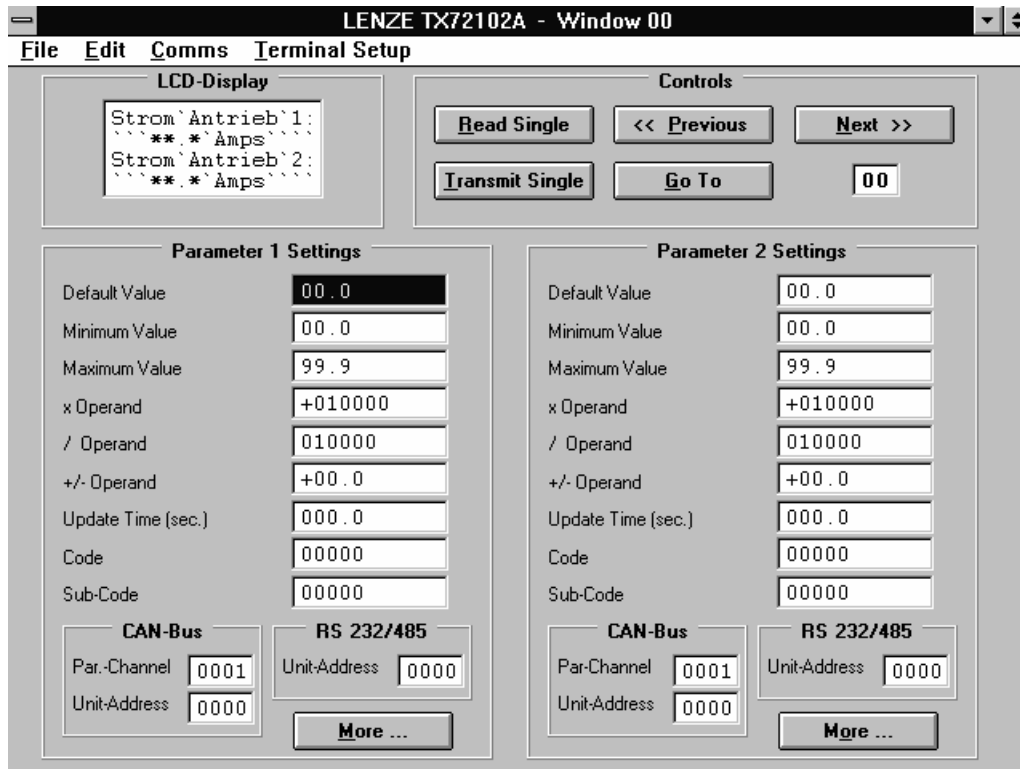
Run Demo Start Window
 Show Version Password

Transmit **Read** **OK**

8. Editing of Texts and Variable Locations

Please note that the operator software uses the "Insert Mode" and that you need to delete an existing character first before it can be replaced by a new character. Use the space key to set spaces and line feeds.

To edit a page, just click into the field representing the **LCD display**. To select the page number, you can either use the "Previous" and "Next" buttons in the "**Controls**" field or you can enter the page number directly to the numeric window and click "Go To" or press Enter. The blue colored head line will show you the actual page number at any time (in our example: Window 00).



You can define variables at any position of the 4 x 16 character screen. Where you like to see a variable value later, enter a corresponding number of asterix (*) and, if applicable, a decimal point at the desired position.

Example: *****.**** defines a variable with totally 5 digits and two decimal positions. **Where you later like to read a variable with a sign, just enter **+***.**** or **-***.****. Do not use spaces within the total expression for a variable. Use point character (not comma) for decimals.**

The PC software allows to specify two variables on each page.

As soon as you have reserved the space for a variable like shown above, the specification field for parameter settings becomes active.

You must meet the following specifications:

Default Value : Serves for transmission of fixed register values.
When selecting a window with a default value specification, this value appears on the display and is transmitted to the target drive when you press the ENTER key. The Default Value function is useful to store several sets of parameters in the terminal (i.e. for different productions) and then load down the desired set to the register of the drive.

Clarification: With normal read/write mode, the terminal would request the actual value from the target unit first and display it on the LCD screen for further editing. Default values set by PC will directly be transmitted without a readout cycle first and without need to enter a value by keypad. Please note, default values cannot be modified by the TX 721 keypad.


- Minimum Value** : Sets the lower limit of the variable. Where no limitation of range is required, enter 00000 (or -99999 when we use a sign). Entering or receiving values lower than specified will result in an error message.
- Maximum Value** : Sets the upper limit of the variable. Where no limitation of range is required, enter 99999 (or +99999 when we use a sign). Entering or receiving values higher than specified will result in an error message.
- X Operand** : The TX721 operator terminal provides full data scaling features, allowing
- / Operand** : display and entry of "engineering units" where the bus data may be scaled
- +/- Operand** : in any other units.

This is how the calculation with operands works:

$$\text{LCD-Display} = \text{Transmit Data} \times \frac{\text{X Operand}}{\text{/ Operand}} + \text{+/- Operand}$$

All operands have 6 decade format and can have a sign (except the /Operand value).

- Update Time** : When you like a variable to be continuously updated, set the desired update cycle here (range 0.001 sec - 999.999 sec) and the terminal will use this time for cyclic request from the target unit and update of the display. (Example: display of the actual line speed)

When the update time is set to 000, the unit requests data from the target unit only one time when the page is selected, and then every time when you press  again, but not in an automatic cycle.

- Code** : Register code of the actual variable (0 - 65535)

- Sub-Code** : Sub position of the register within a main register code (0 - 255)

The subsequent settings specify, how and where the TX721 unit can get access to a variable or a register of a target unit. When specifications are set to the "CAN Bus" field, the terminal searches for information via CAN interface, and all entries in the "RS 232/485" field are cleared. When specifications are set to the "RS 232/485" field, the terminal uses the serial port to access the target unit, and all entries in the "CAN Bus" field are cleared.

Since bus specifications are met individually for each variable, it is easy to get mixed operation where some data use CAN and other data use serial communication.

CAN-Bus:

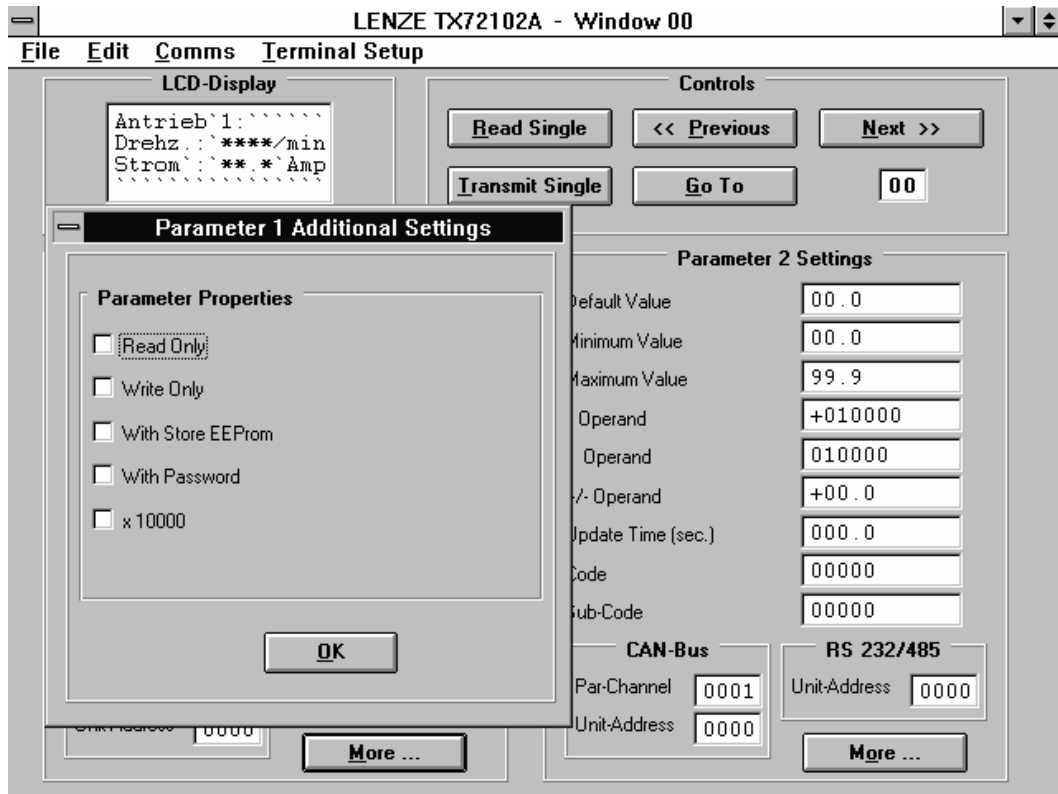
- Par.-Channel** : Selects the desired parameter channel (1 or 2) of the target device.

- Unit Address** : Address of the target device (01 - 63)


RS 232/485:

- Unit Address** : Serial device address (11 - 99)

Further specifications can be made by clicking the “More“ button:



- Read Only** : Limits register access to read operations and disables writing to the register.

- Write Only** : Sets a fixed default value to the window (like specified before) and transmits it to the target unit when pressing .

- With Store EEPROM** : Usually, a target unit would hold operational data in the RAM register. Power down causes loss of RAM data and power up will load initial data from the EEPROM. With the "Store EEPROM" function set, the TX721 terminal will automatically add a "Store" command to each data string and the same data will be available again also after power down.

- With Password** : This function protects registers from unauthorised access. When set, the password must be entered first before any change of the register value becomes possible. Specification to be met separately for every variable.

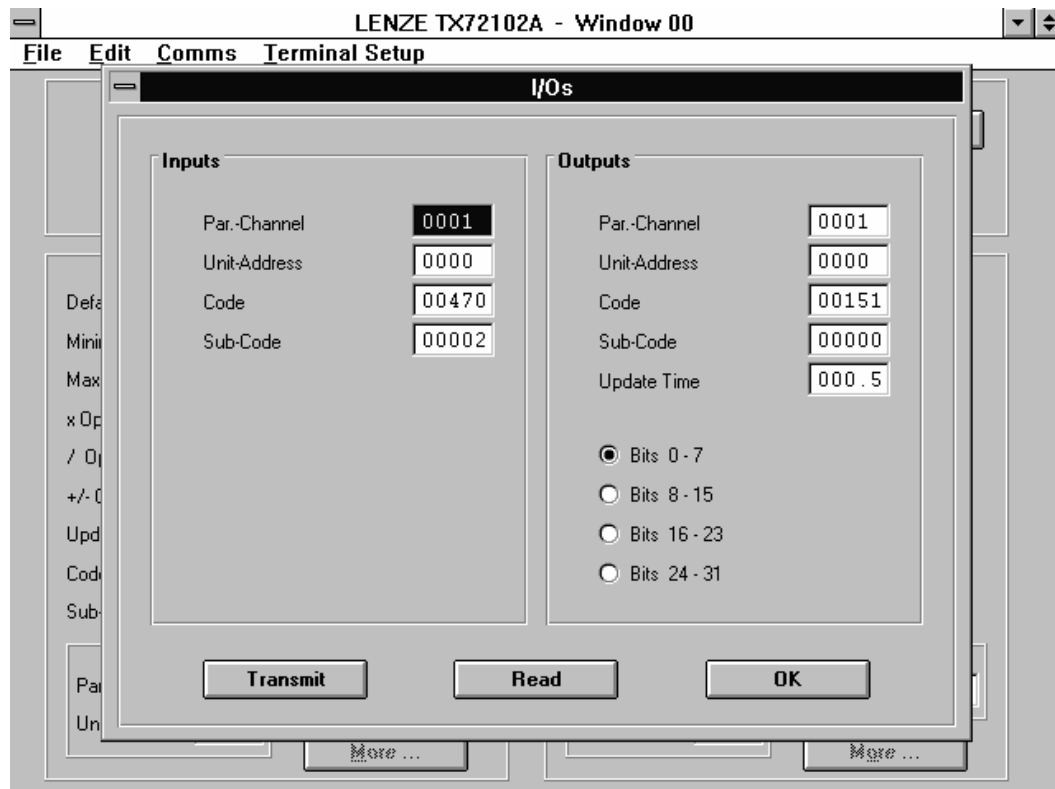
- X 10 000** : Some CAN data use a fixed conversion factor of 10 000. As an example, a ramp time of 1.5 seconds (display) will appear as "15 000" (bus). With this function set, the TX721 terminal will automatically make the conversion in both directions.

9. Programming of the Digital Inputs and Outputs

Where you do not intend to use digital input/output functions, the following settings can be omitted. However, it can be useful to **lock all the keypad** against unauthorized access, by applying a +24V signal to **pin 13 of the rear SUB-D- connector**.

Inputs and Outputs operate as Service Data Objects (SDO, parameter channel) and therefore may not be suitable for applications needing fast real time features. All inputs operate under interrupt control and every change of an input state will immediately cause transmission of an 8 bit data word to the specified register/subregister of the drive. As default, the unit uses Code 470/Subcode 2 for destination of the message.

All outputs switch on/off according to the state of a status word that the terminal requests from the drive continuously with a programmable update cycle. The operator software can select 8 of the totally 32 status bits of the drive to appear at the outputs. As a default, the TX721 uses Code 151/Subcode 0 for status request. For I/O-setup use the I/O menu which you find under the "Terminal Setup" functions on your PC screen.



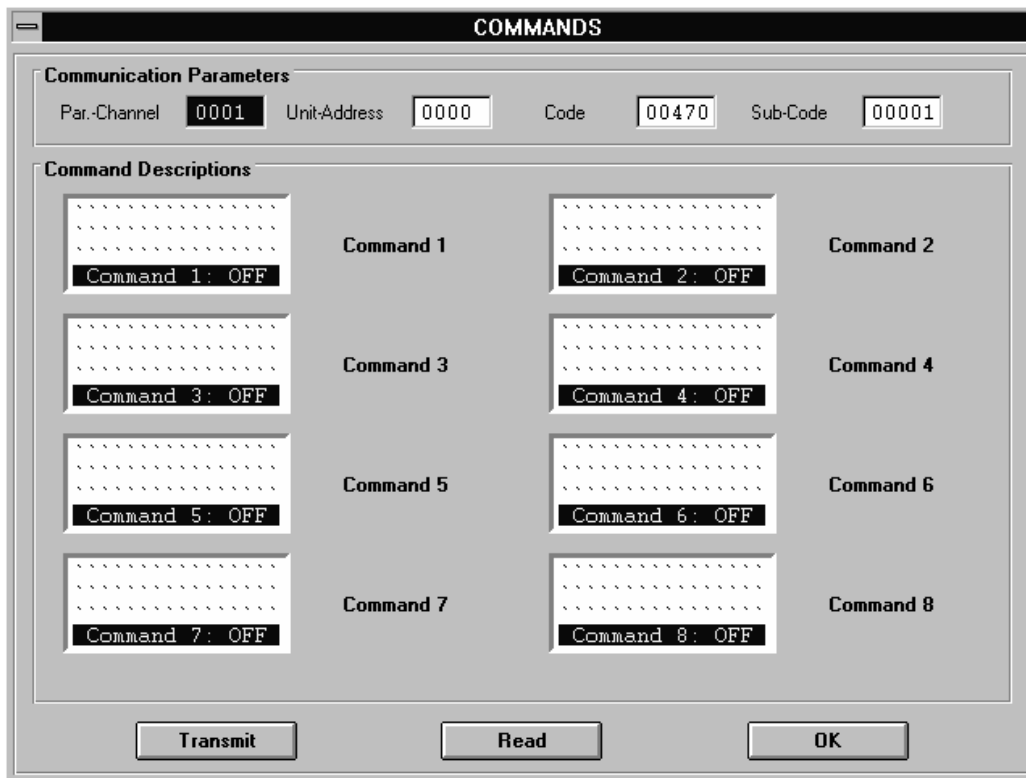
Where you set the unit number to 00, all I/O-functions will be disabled. The Update Time must be entered in "milliseconds".

10. Programming of Special Key Functions

Special key commands can be executed when you keep **F4** down while pressing one of the numeric keys 1-8 and a programmable text in the LCD will explain to the operator what the selected function is (Examples: Jog forward, Jog reverse, Stop etc.) This assumes that the drive itself responds with executing the command when it receives an 8 bit data word. The next section describes how to use the command function, while this section only shows the programming procedure.

Where you do not use special key commands, you can omit the subsequent settings.

Use the „Commands“ function in the „Terminal Setup“ menu to get following screen:



Indications “Command 1“ to “Command 8“ refer to the function of keys **1** to **8** and to Bit 0 to Bit 7 of the data word the terminal transmits to the drive. The corresponding Bit is set to “0“ while the command is “OFF“ and changes to “1“ while the corresponding command is “ON“.

In lines 1 to 3 of the LCD display you can edit any texts and symbols to explain function and operation of the command. Line 4 is reserved for the terminal itself and shows if the corresponding command is actually switched ON or OFF.

11. How to operate the terminal

After power up, the LCD display shows the page which was defined as start window first. The page organisation provides 8 columns (0-7) and 8 rows (0-7) like shown on page 3 of this manual. Page number 12, for example, indicates the page in the second column and the third row.

11.1 How to select a page

Keys **↑** **↓** skip from one row to the next.

Keys **→** **←** skip from one column to the next.

It is easy to reach any of the 64 pages quickly.

You are also free to press **F1** , enter the number of your desired page and press **←** then.

Where you reach a "blank" page (i. e. a page where no text and no variable has been placed), the unit would automatically jump to the subsequent page which is not blank.

Every time you can immediately see the text and the value of the variable of each page.

If the corresponding variable cannot be reached (i. e. because the target unit does not respond to the request), after a short waiting time an error message will appear.

11.2 How to edit and transmit variables

When you read a variable register value which has been declared to be of read/write type, we can overwrite it and retransmit to the target device.

F2 places the cursor to the first digit of the value.

Where we have protected this register, a request for the pass word appears first.

Keys **0** - **9** and **+/-** will overwrite the digit highlighted by the cursor.

→ and **←** place the cursor to the desired position.

↵ will cause retransmission of the new value to the target unit.

11.3 How to use the key command function

When you have set specific commands to the numeric keys 1-8 (see section 10.), you can activate the commands in the following manner:

— Keep **F4** down while you press one of the keys **1** to **8**. The corresponding command window appears on the LCD. The unit immediately requests the actual command state from the drive and displays “Command ON” or “Command OFF” in the last line.

— To switch a command constantly ON, use the **→** key.

To switch a command constantly OFF, use the **←** key.

To switch a command temporary ON while the key is hold and OFF again when you release the key, use **↵**. A corresponding message is transmitted to the drive every time you touch or release one of these keys.

— You can get to the other command windows without activating a command by using keys **↑** and **↓**.

— Key **Prg** exits the command mode and returns to normal operation.

11.4 Display of the version number

When you press **F3**, you will see the version number of the TX721 unit for 3 seconds. The unit then automatically returns to the previous display.

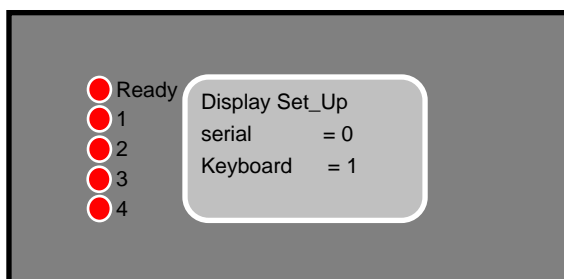
11.5 Editing LCD texts without PC

In general you will always use a PC to edit LCD texts and specify variables or to load down a complete file from a disc.

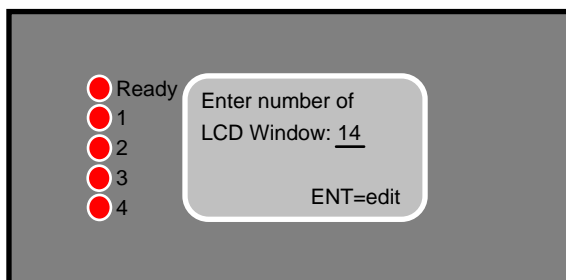
For some exceptional reasons it may be useful to edit or modify texts by the TX721 keyboard directly.

To do this, follow the sequence shown below:

— After power up, press **Prg**



— Then enter "1"



— Now enter the page number you like to edit and press 

— The actual contents of the page (or an empty page) will appear

— On the numeric keys you also find 3 letters (Example: Key 7 is also marked " abc".)

— $F1 + 7 = a$, $F2 + 7 = b$, $F3 + 7 = etc.$

— For capital letters, press $F4$ at the same time

$F1 + F4 + 7 = A$ etc.

— Use the arrow keys to change the cursor position

— Exit the manual editing mode by .

This temporary mode of text editing allows any modification of texts, but does not support setting or changing specifications of variables

12. The Front LED's

Ready	:	Unit ready for operation
1	:	CAN communication
2	:	RS232/485 communication
3	:	Unit in setup state
4	:	Reserved

13. Communication Profiles of CAN Network and Serial Links

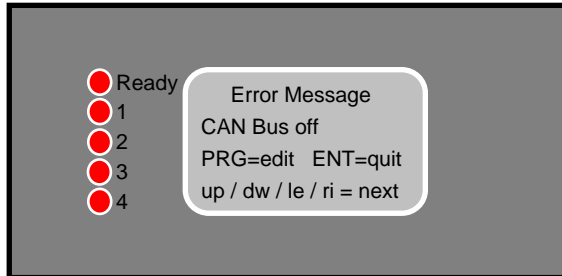
The CAN protocol uses the CAL-based DS 301 profile (CANopen). Serial lines use the extended LECOM A/B protocol, version 2.2.

All communication matches the requirements of LENZE drives and full compatibility is guaranteed.

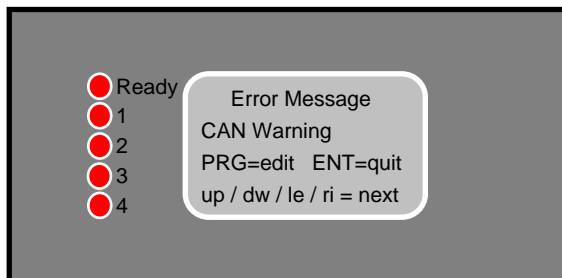
For details about structure of profiles and protocols please refer to literature available from LENZE.

14. Error Messages with CAN Communication

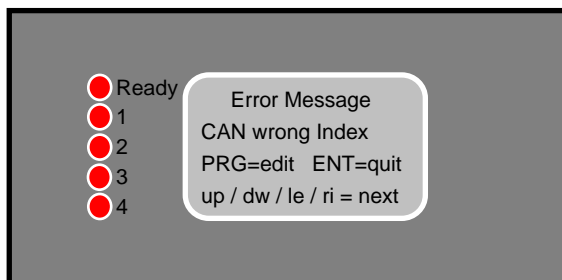
With any problems in communication, the terminal will show one of the following error messages:



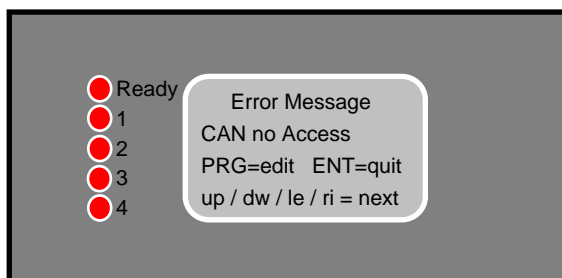
Participant has been automatically removed from the bus because too many errors have been registered previously.



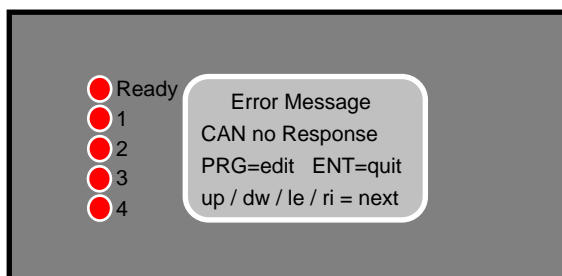
The last 12 attempts for communication were not successful because of errors and the participant is subject to be removed from the bus, soon.



The terminal received an error response (command code 80 hex.) and information 6.6 in data 3/data 4 (wrong index).




The terminal received an error response (command code 80 hex) and information 3.6 in data 3/data 4 (access refused).



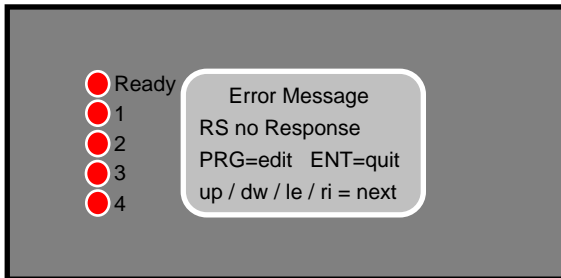
A message or inquiry of the terminal remained unresponded (i. e. because the participant does not exist).

There are two ways how to clear error messages:

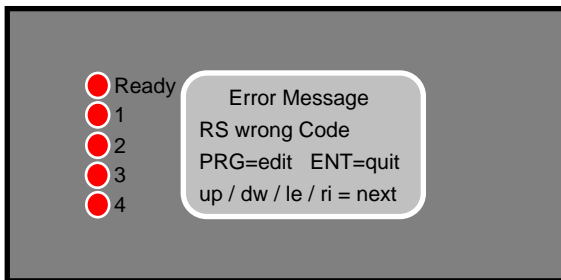
- Press . The communication which caused the error will be repeated. The same message will appear repeatedly when the problem keeps on.
- Select another page temporary until the communication problem has been solved.

15. Error Messages with RS232/485 Communication

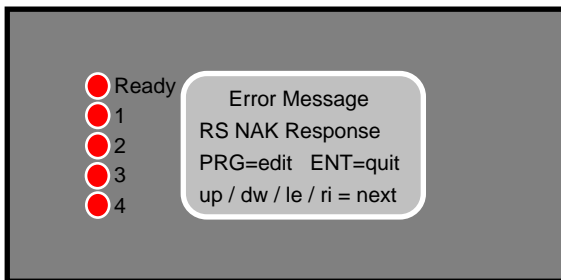
Upon problems with serial communication, the terminal will display one of the following error messages:



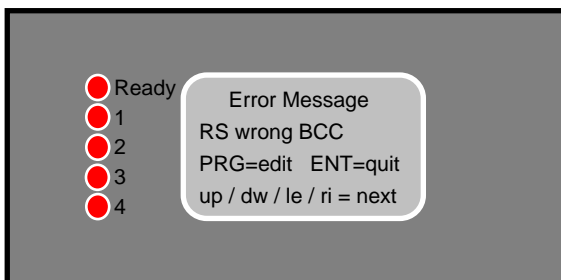
Target unit does not respond or confirm.



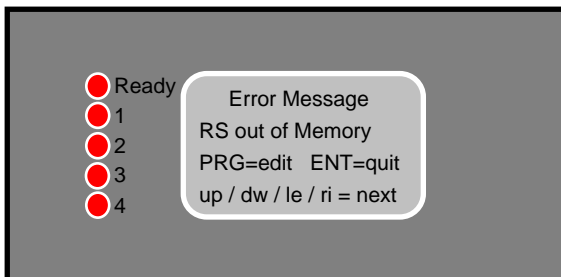
Wrong or unknown register code



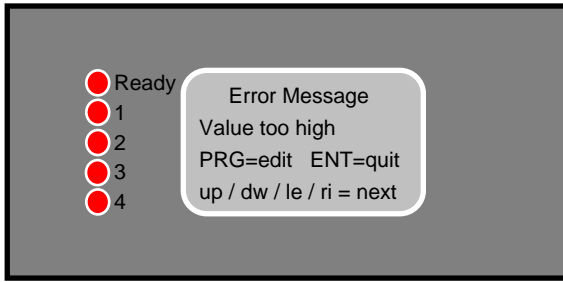
Message was not accepted due to transmission error or other reason



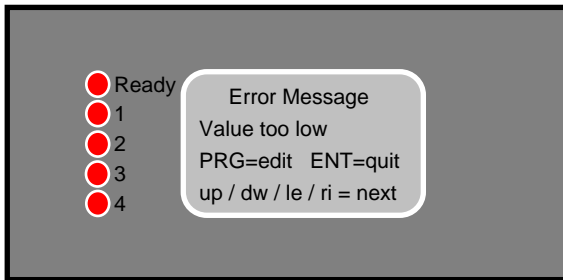
Communication error: Wrong block check character.



Communication string was too long, i. e. contained more than 25 ASCII characters

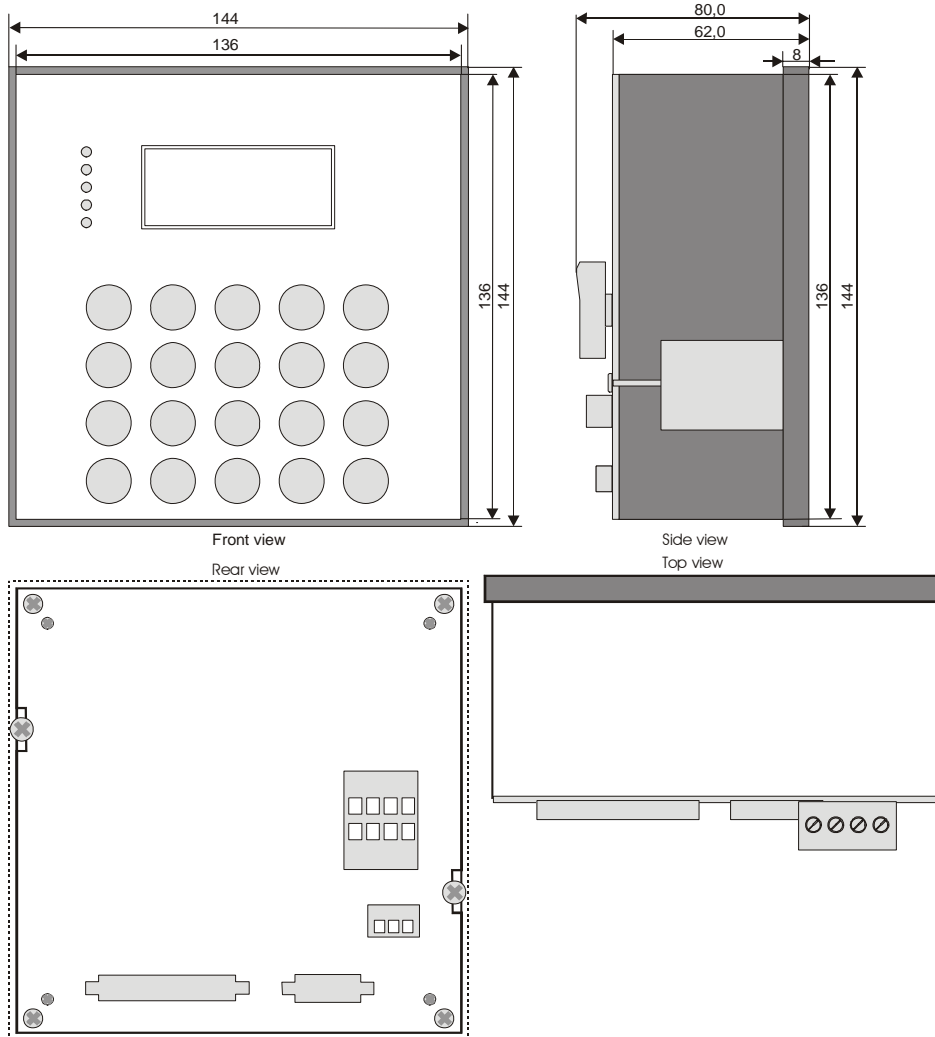


Transmit value was higher than specified by the "Maximum Value" setting



Transmit value was lower than specified by the "Minimum Value" setting.

16. Technical Specifications and Dimensions



Power Supply	: 18....30 VDC, approx. 100 mA
Design	: SMT, multilayer, high speed logic
Display	: LCD with back light, 4 lines x 16 characters
Comms	: CAN, RS 232, RS 485
Protocols	: CANopen resp. LECOM A/B version 2.2
Controller	: H8/325 at 20 Mhz
Memory	1 MByte Flash
Keyboard	: 20 membran Keys
I/OPort	: 8 hardware inputs, 8 hardware outputs
Dimensions	: Aluminium DIN housing 144x144x85 mm
Panel cut out	:139 x 139 mm
Weight	: approx. 600 g
Temperature range	: 0 – 45°
Protection class	: IP 54 (optional IP 65)

These instructions have been written and checked to the best of our knowledge and belief.
However, **motrona** will not be liable for errors and reserves the right for changes at any time without notice.

Remarks to the TX721 PC operator software:

1. According to the state of the art it is impossible to write PC software with fault - free function in all applications and combinations on every hardware.
The PC software included in delivery, in general, is suitable to perform all the functions shown in this manual. However, motrona cannot take any guarantee that the software matches all customer requirements or can operate with all combinations of software products the customer uses on his PC.

2. You are allowed to copy this software, when the copy is used to operate with a TX721 hardware. Copies for use with any other purpose are strictly forbidden.