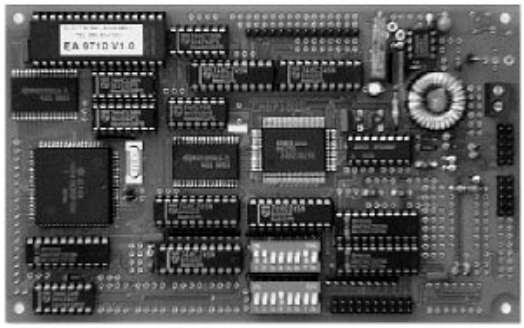
# RS-232 / RS-485 / CENTRONICS CONTROLLER FOR GRAPHIC MODULES

**FOR DIRECT CONNECTION TO BELOW LISTED GRAPHIC MODULES:**

| | | | |
|---|---|---|---|
| EA 7160-7NEL | 160 | x 128 | dots |
| EA 7240-6NEL | 240 | x 64 | dots |
| EA 7240-7NEL | 240 | x 128 | dots |
| **EA 7320-7,9NC** | **320** | **x 240** | **dots** |
| EA 7640-6N | 640 | x 64 | dots |
| **EA 7640-7,5N3C** | **640** | **x 200** | **dots** |
| EA 7640-8,5NC | 640 | x 400 | dots |
| **EA 7640-8,8BWC3** | **640** | **x 480** | **dots** |
| EA 7720-8,5NEL | 720 | x 400 | dots |



*Dimensions 160x100x20(max) mm*

## FEATURES

* SUPPORTS ALL KNOWN LCD- GRAPHIC DISPLAYS (MONOCHROME)
* CONNECT EITHER TO RS-232 OR RS 485 OR CENTRONICS OR TO 8-BIT BUS
* TERMINALMODE VT-52 I.E. 640x400 DISPLAY: 80/40 CHAR., 25/50 LINES
* INTELLIGENT GRAPH COMMANDS LIKE DRAW LINE, DELETE, SET DOTS,
* DISPLAY WINDOWS, TEXTROTATION IN 90° STEPS
* POWER SUPPLY: VDD= + 5V ±5%, approx. 150mA
* DISPLAY SELECTION WITH DIP-SWITCHES B
* KEYBOARDCONNECTION: MF-102 OR 8x8 MATRIX (RS-232 AND RS 485 ONLY)
* INTERFACE PARAMETER SETTING WITH DIP-SWITCHES A
* INCLUDING TEST- AND DEMO PROGRAMS FOR PC's
* 5 INTEGRATED CHARACTER SETS (8x8, 8x16, 16x16, 16x32, 32x56)
* BIG NUMERALS (56x80) FOR EASY DISPLAY READING, INTEGRATED
* DOWNLOADABLE CHARACTERSETS, I.E. KYRILLIC, FRENCH, ETC.

* ADRESSABLE: SEVERAL EA 9710's ON A SINGLE SERIAL INTERFACE
* NEG. DISPLAY SUPPLY VOLTAGE $V_{EE}$ INTEGRATED, DIGITAL SETABLE

## OPTIONAL

* VOLTAGE REGULATOR FOR 8-12 VOLTS INPUT: EA OPT-REGLER

## ORDERING INFORMATION

| | |
|---|---|
| RS-232- TERMINAL FOR LCD-GRAPHS, KEYB. CONNECTOR | **EA 9710-V24** |
| RS 485- TERMINAL FOR LCD-GRAPHS, KEYB. CONNECTOR | **EA 9710-485** |
| CENTRONICS- / BUS- TERMINAL FOR LCD-GRAPHMODULES | **EA 9710-BUS** |
| VOLTAGE REGULATOR FOR 8-24 VOLTS INPUT | **EA OPT-REGLER** |
| VARIOUS TEST- AND DEMOPROGRAMS ON FLOPPY DISC | **EA DISK9710** |
| RS-232 / RS485 CABLE WITH 9 POL SUB-D CONNECTOR | **EA KV24-9B** |

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## CONTENTS



## GENERAL

We designed our EA 9710 controller especially for simple and timesaving installation to operate all customery monochrome LCD-graphic displays. The onboard Graphcontroller MSM 6255 supplies all needed signals (LP, CP, FLM, M, UD0..3, LD0..3) for driving LCD-graphic modules. Display sizes in ranges up to 720x400 respectively 640x480 dots can be connected. The usual negative supply voltage for Graphic displays is also generated on board.
This outstanding 8-bit microcontroller system allows thanks to a 1 MBit display memory a very comfortable use of advanced programming-commands like "ASCII-characters to coordinate (X,Y)" or "Box to coordinate (X1,Y1,X2,Y2)" etc. When Terminalmode is choosed, a VT-52 terminal will be emulated. Commands like "Carriage Return" and "Line Feed" and all Cursor movements are available. Also mixed operation in both modes is allowed.

## OPERATING WITH RS-232, RS 485, BUS, CENTRONICS

EA 9710 boards can be connected either to RS-232 (EA 9710-V24), RS 485 (EA 9710-485) or to CENTRONICS- Interfaces (EA 9710-BUS). Interface parameters are set with DIP- switches according to table 15. A performance increase of your processor system can be achieved by direct connecting the processor bus to the EA 9710-BUS. By doing that, the main processor is relieved from unnessesary computing work for display outputs.
Additional it is possible to connect an AT keyboard (MF-102) or a Matrix keypad (8x8 keys), for EA 9710-V24 and EA 9710-485 only. Also switched output gates may be used.

## PUTTING INTO OPERATION

- Test mode: After connecting the display with flat type cable to the appropriate plug, you should set DIP-B switches (1..7) into "Off" position and switch 8 to "On" (factory setting, see table 1). The Module now is in Test- mode. Various display initial screens are carried out automatically. Vertical strips should alternate with entire black- respective white displays.
- Demo mode: When previous test is done well, set DIP-B switch No. 8 to "On" and switches No. 1..7 to the Type number of the Display ( table 1). Now you can watch a little demo program.
- Standard mode: If previous tests have been performed correctly, set DIP-B switch No. 8 to "Off" (Standard mode).

| Type of Display | | Resolution | DIP B 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Connect | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| all | | - | off | off | off | off | off | off | off | ON | | Test VEE, MUX |
| Set Type of Display on DIP 1..7 | | - | Set to Type of Display | | | | | | | ON | | Demo Program |
| EA 7128-6N | DMF697, 50051, 50202 | 128 x 64 | ON | off | off | off | off | off | off | off | - | |
| | DMF50374 | 160 x 64 | ON | ON | off | off | off | off | off | off | 5 | |
| EA 7160-7N | DMF608 | 160 x 128 | off | off | ON | off | off | off | off | off | - | |
| EA 7240-6N | DMF633 | 240 x 64 | ON | off | ON | off | off | off | off | off | - | Close solder bridge xx , add 1MOhm (Rxx) |
| EA 7240-7N | DMF660 | 240 x 128 | off | ON | ON | off | off | off | off | off | - | Close solder bridge xx |
| | DMF50239 | 256 x 128 | ON | ON | ON | off | off | off | off | off | - | |
| EA 7320-7,9NC | DMF50081, 50174 | 320 x 240 | off | off | off | ON | off | off | off | off | 5 | |
| EA 7480-6N | DMF612 | 480 x 64 | ON | off | off | ON | off | off | off | off | - | |
| EA 7480-7N2 | DMF6102 | 480 x 128 | off | ON | off | ON | off | off | off | off | 5 | |
| EA 7640-6N | DMF690 | 640 x 64 | off | off | ON | ON | off | off | off | off | - | |
| EA 7640-7N2 | DMF651A, 50357 | 640 x 200 | ON | off | ON | ON | off | off | off | off | 5 | |
| EA 7640-7,5N3C | DMF50036 | 640 x 200 | off | ON | ON | ON | off | off | off | off | 5 | |
| | DMF50380 | 640 x 200 | off | ON | ON | ON | off | off | off | off | - | |
| EA 7640-8,5N | DMF666A, 50069 | 640 x 400 | ON | ON | ON | ON | off | off | off | off | 6 | |
| | DMF665 | 640 x 400 | ON | ON | ON | ON | off | off | off | off | - | |
| | DMF50262, 50263 | 640 x 400 | ON | ON | ON | ON | off | off | off | off | 7 | |
| | DMF675 | 640 x 400 | off | off | off | off | ON | off | off | off | 6 | |
| EA 7640-8,8BWC | DMF50147 | 640 x 480 | ON | off | off | off | ON | off | off | off | - | |
| EA 7640-8,8BWC3 | DMF50260, 50261, 50383 | 640 x 480 | ON | off | off | off | ON | off | off | off | 7 | |
| EA 7640-8,8N | DMF6106 | 640 x 480 | off | ON | off | off | ON | off | off | off | 6 | |
| | DMF50107, 50419 | 640 x 480 | ON | ON | off | off | ON | off | off | off | - | |
| | DMF684N, 685NK | 720 x 350 | off | off | ON | off | ON | off | off | off | - | |
| | DMF676 | 720 x 400 | ON | off | ON | off | ON | off | off | off | - | |

*Table 1*
*Display Selection*

## COMMANDS IN TERMINAL MODE

After power on the module is ready for receiving in terminal mode. All received characters are shown in ASCII format. Line carriage return is done automatically and, if display is filled, the page is scrolling to the top. The extended VT-52 terminal commands are listed in table 2.

| Terminal mode (extended VT-52) | | | | | |
|---|---|---|---|---|---|
| **Command** | **Codes** | | | | **Description** |
| Backspace (decimal: 08) | ^H | | | | Delete characters left of cursor, close up remaining line |
| Linefeed (decimal: 10) | ^J | | | | Cursor to next line, position of columns remain |
| Formfeed (decimal: 12) | ^L | | | | Clear display, cursor to left hand, top corner (position 1,1) |
| Carriage return (dec.: 13) | ^M | | | | Cursor to left hand border |
| Cursor home | ESC | H | | | Set cursor to left hand, top corner (position 1,1) |
| Cursor up | ESC | A | | | Move cursor to next line above |
| Cursor down | ESC | B | | | Move cursor to next line below |
| Cursor right | ESC | C | | | Move cursor one character to the right |
| Cursor left | ESC | D | | | Move cursor one character to the left |
| Cursor scroll to top | ESC | I | | | Cursor to line above, scrolling top border, than cursor to the left |
| Save cursor position | ESC | j | | | Save actual cursor position |
| Load cursor position | ESC | k | | | Set cursor to saved position |
| Set cursor to position | ESC | Y | s+32 | z+32 | Set cursor to absolute position column s and line z |
| Cursor on | ESC | e | | | Cursor on (visible) |
| Cursor off | ESC | f | | | Cursor off (invisible), conserves cursor type |
| Block cursor | ESC | 1 | | | Cursor type: inverted block |
| Block cursor, flashing | ESC | 2 | | | Cursor type: inverted block, flashing |
| Underline cursor | ESC | 3 | | | Cursor type: underline |
| Underline cursor, flashing | ESC | 4 | | | Cursor type: underline, flashing |
| Delete display image | ESC | E | | | Clear screen, cursor to top lleft hand position 1,1) |
| Delete line | ESC | l | | | Delete cursor pointed line |
| Delete line | ESC | M | | | Delete cursor pointed line, remaining image scrolls up |
| Delete to the end of line | ESC | K | | | Delete line from cursor position onward (incl.cursor position) |
| Delete to the end of page | ESC | J | | | Delete total image beyond cursor position (incl. cursor position) |
| Delete line up to cursor | ESC | o | | | Delete line up to cursor position |
| Delete image up to cursor position | ESC | d | | | Delete image up to cursor position |
| Delete character | ESC | P | | | Delete character at cursor position, move back remaining line |
| Insert blanks | ESC | @ | | | Insert a blank at the place of cursor position |
| Insert new line | ESC | L | | | Insert blank line in place of actual line; cursor moves to the left |
| Set to inverted letter | ESC | p | | | Next images are shown inverted |
| Switch off inverted letters | ESC | q | | | Next images are shown standard |
| Display inverted | ESC | r | | | Inverse total display |
| Display standard | ESC | s | | | Standard display |
| Autom. line overflow on | ESC | v | | | Set cursor from right hand border automatic to the start of new line |
| Autom. line overflow off | ESC | w | | | Cursor stays at right hand border |

*Table 2: Commands in Terminal Mode*

## COMMANDS IN GRAPHIC MODE

Keying in: "ESC" "ESC" "G" changes to Graphic Mode. Letters x and y in table 3 are used for input of coordinates, where the origin of coordinate (0,0) is situated in the left hand, top display corner.

| Graphic mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Command** | **Codes** | | | | | | | **Description** |
| Clear display | D | L | | | | | | Delete display |
| Fill display | D | F | | | | | | Fill display |
| Invert display | D | I | | | | | | Invert display |
| Set graph mode | V | n1 | | | | | | n1: 1=set; 2=delete; 3=exor (dots, lines) |
| Line pattern | F | x | | | | | | Binary 16-bit form of line patterns |
| Set dot size | Q | n1 | n2 | | | | | Set dot size n1=widht, n2=hight in dots |
| Dot | P | x1 | y1 | | | | | Set dot to coordinates x1,y1 |
| Straight line<br>Straight line up to | G<br>T | x1<br>x1 | y1<br>y1 | x2 | y2 | | | Draw straight line with act. dot size/ line pattern<br>Draw line from last stop to x1,y1 |
| Rectangular | K | x1 | y1 | x2 | y2 | | | Draw rectangular with act. dot size / line pattern |
| Clear range | L | x1 | y1 | x2 | y2 | | | Delete a defined display area |
| Fill range | E | x1 | y1 | x2 | y2 | | | Fill a defined display ara |
| Invert range | I | x1 | y1 | x2 | y2 | | | Invert a defined display area |
| Copy range | C | x1 | y1 | x2 | y2 | x3 | y3 | Copya defined area to x3, y3 (multiples of 8 only) |
| Box | B | x1 | y1 | x2 | y2 | | | Draw blank box with border (actual dot size) |
| Box with shadow | N | x1 | y1 | x2 | y2 | n1 | | Box with border + shadow at x2,y2 ( n1=distance) |
| Set text mode | M | n1 | | | | | | n1: 1=set; 2=delete; 3=exor; 4=replace; 5=invert |
| ASCII- character | A | x1 | y1 | n1 | | | | Set sign n1 to pos. x1,y1 setzen |
| Character chain | Z | x1 | y1 | ... | <cr> | | | Display a character chain (...); Carrige return= end |
| Rescue image | S | n1 | | | | | | Copy visible image to buffer n1 (1 <= n1 <= max.) |
| Get image | R | n1 | | | | | | Copy image from buffer memory n1 into visible image |
| Divert graphic transfer | J | n1 | | | | | | Divert into image buffer n1 (0:= visible image) |
| Load range of image (upload) | U | x1 | y1 | Datei | | | | Load a defined image area to x1,y1 (multiples of 8) |
| Save range of image (download) | O | x1 | y1 | x2 | y2 | | | Save image range via V.24 resp. RS485 (multipl. of 8) |

*Table 3: Commands in Graphic Mode*

## PARAMETER HANDOVER IN GRAPHIC MODE

Coordinates may be handed over in two ways:

**- ASCII format:** If commands are given in "CAPITAL LETTERS", the terminal expects values for coordinates (x,y,n) in numerals 0..9, separated by comma. Each command has to be closed either with semikolon or with return.

i.E. set point at coordinate 258,10: **P258,10;**

**- Binary format:** If commands are given in "small letters", the terminal expects binary values. Coordinates (x,y) must be transmitted as 16 bit binary values (low-byte first, followed by high-byte). Other parameters (n) must be transmitted as 8 bit binary values too, (insert no separating byte between coordinates and parameters). Commands don't need any closing byte.

i.E. set point at coordinate 258,10: **$70 $02 $01 $0A $00**

## COMMON COMMANDS FOR TERMINAL- AND GRAPHIC MODE

Several special commands are applicable in Graphic Mode as well as in Terminal Mode. Parameter handover follows the same capital/small-letter rules as described under Graphic Mode.

| Common commands for terminal- and graphic mode | | | | | | |
|---|---|---|---|---|---|---|
| **Command** | **Codes** | | | | | **Description** |
| Graphic mode | ESC | ESC | G | | | Change to graphic-mode, image remains on display |
| Terminal mode | ESC | ESC | T | | | Change to terminal-mode, image remains on display |
| Select font | ESC | ESC | F | n1 | n2 | n1:1-10 get font from Eprom n1:11-20 get upload Font<br>n2: 0: 0°; 1: 90°, 2: 180°, 3: 270°; rotation |
| Upload font | ESC | ESC | U | n1 | Datei | Load individual defined font Nr. n1=11-20 |
| Font into upload area | ESC | ESC | Y | n1 | | Safe actual font as an upload font n1: 11-20 |
| Increase contrast | ESC | ESC | P | | | Increase display voltage for one step |
| Decrease contrast | ESC | ESC | M | | | Decrease display voltage for one step |
| Contrast default | ESC | ESC | Z | | | Set display voltage to default |
| Auto transmit on | ESC | ESC | E | | | Enable auto transmit of keyboard strokes |
| Auto transmit off | ESC | ESC | A | | | Disable auto transmit of Keyboard strokes |
| Query matrix keypad | ESC | ESC | B | | | Query actual status of matrix keypad |
| Select | ESC | ESC | S | n1 | | Select EA 9710 by adress n1 (n1=255: all) |
| Deselect | ESC | ESC | D | n1 | | Deselect EA 9710 by adress n1 (n1=255: all) |
| Pause | ESC | ESC | H | n1 | | n1: 1..255 x 0,1 seconds pause |

*Table 4: Common Commands for Terminal- and Graphic Mode*

## ADRESSING SEVERAL EA 9710's ON A SINGLE INTERFACE

Commands "Select" and "Deselect" allow to adress and operate several terminals connected to a single interface bus. The individual terminal adress is stored in EPROM (27C1000) at adress $00AD. EPROM value $FF (factory setting) can be reprogrammed any time to another value.

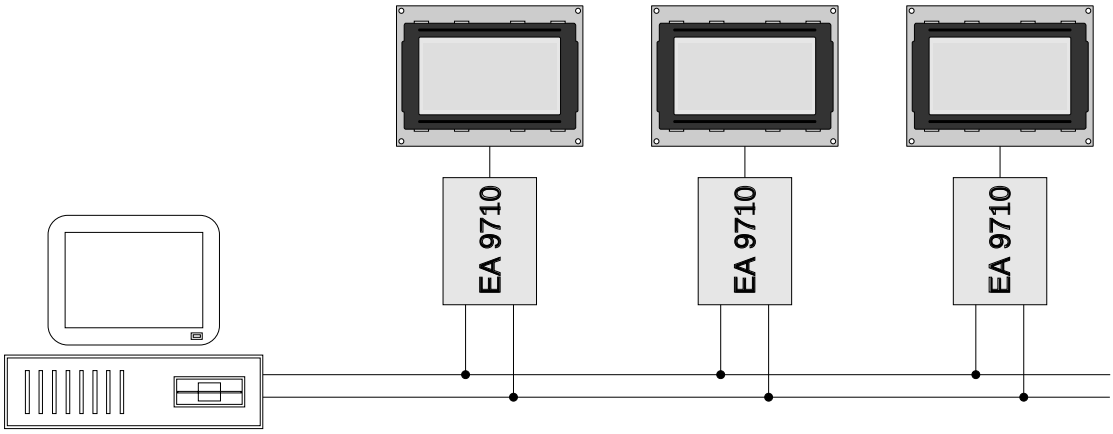



*Figure 1*

## BUILT IN CHARACTER SETS

Terminal is delivered with 6 different character sets, already installed. Up to 10 more character sets may be added by download.
Because of the fact, that character sets does not always content all characters from 0 to 255, table 5 shows the available characters. For instance the built in font No. 6, "BIG DIGITS", contents only numerals 0..9 and signs "-", "/", ".", ":".
All characters are available in Text- and in Graphic Mode. Listed graphmode coordinates references to the left hand top corner of the character.

| Font | Size in pixels | ASCII- Range | Description |
|---|---|---|---|
| 1 | 8 x 8 | 0..255 | Extended ASCII-code |
| 2 | 8 x 16 | 0..255 | Extended ASCII-code |
| 3 | 16 x 16 | 0..255 | Extended ASCII-code |
| 4 | 16 x 32 | 32..127 | ASCII-code |
| 5 | 32 x 56 | 32..63 | Numbers, punctuation, ... |
| 6 | 32 x 56 | 64..95 | Capital letters |
| 7 | 32 x 56 | 96..127 | Small letters |
| 8 | 56 x 80 | 45..58 | Big numbers |
| 9 | n/a | | |
| 10 | n/a | | |

*Table 5*

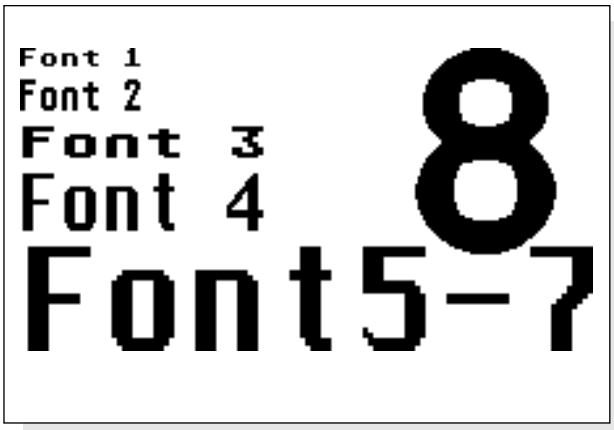



*Figure 2*

## EXAMPLE FOR DISPLAY CONTROL

To demonstrate, how a complete display readout is "programmed" with a few commands, an example is printed below. Figure 3 shows the result of this demoprogram. Applied for that was a ¼-VGA display with 320x240 dots resolution.

| Command | Description | Result (Display) |
|---|---|---|
| ESC ESC F4,0 Z0,0,Temperatur | Font No. 4, Text on Coordinate 0,0 | Temperatur |
| N4,120,300,220,8 | Box with gray shadow on Coordinate (120,300) | |
| ESC ESC F8,0 Z40,130,25.4 | Font No. 8, Text on Coordinate (40,130) | 25.4 |
| ESC ESC F4,1 Z8,198,Innen | Font No. 4, Text on Coordinate (8,198) | Innen |
| ESC ESC F3,0 Z264,130,°C | Font No. 3, Text on Coordinate (264,130) | °C |
| G160,40,160,105 G155,100,300,100 | Line from (160,40) to (160,105)... | |
| G160,50,190,95 T220,45 T300,70 | Line from (160,50) to (300,70) | |
| F255 G160,80,230,70 T250,30 T300,90 | Line Pattern No. 255, Line from (160,80) to (300,90) | |

*Table 6*

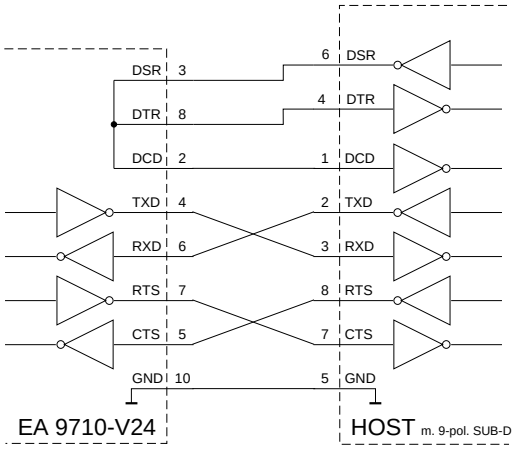

*Figure 3*

## CONNECTING EA 9710-V24

On board RS-232- drivers generate true RS-232 level with voltage amplitudes of approx. ±10V. This guarantees safe transmissions up to 57600 Baud, even on long lines (up to15 meters). Communication parameters are set on DIP-switch A according to table 15 (see page 11)

Input Datas takes connector J2 on EA 9710-V24. Pinout can be seen in aside table. Connecting i.E.to a PC is particulary simple with cable EA KV24-9, which is available as an option. Using this cable enables direct (1:1) plug in of EA 9710-V24 into serial PC- ports (i.E. COM1, 9-pin SUB-D connector).

| RS-232 connector J2 | | | |
|---|---|---|---|
| Pin | Symbol | In/Out | Function |
| 1 | NC | - | n/c |
| 2 | DCD | - | Connected with pin 3 and pin 8 |
| 3 | DSR | - | Connected with pin 2 and pin 8 |
| 4 | TxD | Out | Transmit Data |
| 5 | CTS | In | Clear To Send |
| 6 | RxD | In | Receive Data |
| 7 | RTS | Out | Request To Send |
| 8 | DTR | - | Connected with pin 2 and pin 3 |
| 9 | NC | - | n/c |
| 10 | GND | - | Ground |



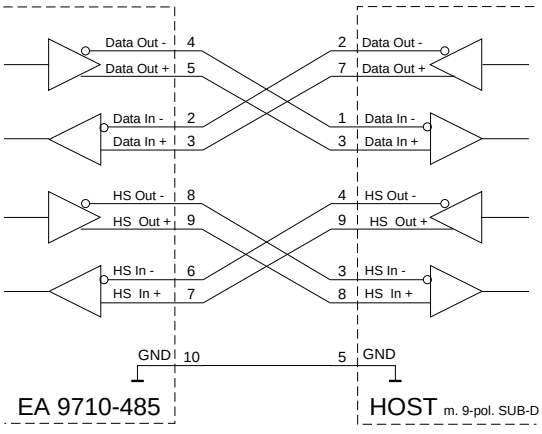

If cable EA KV24-9 is not used, proceed according to figure 4. In case, that wires for handshakes are not available, pins RTS and CTS must be bridged on EA 9710-V24 . In this way EA 9710-V24 supports a special mode for software handshakes XON / XOFF.

*Figure 4*

## CONNECTING EA 9710-485

| RS422 / RS485 connector J2 | | |
|---|---|---|
| Pin | Symbol | Function |
| 1 | NC | n/c |
| 2 | Data In - | Receive Data |
| 3 | Data In + | Receive Data |
| 4 | Data Out - | Transmit Data |
| 5 | Data Out + | Transmit Data |
| 6 | HS In - | Handshake |
| 7 | HS In + | Handshake |
| 8 | HS Out - | Handshake |
| 9 | HS Out + | Handshake |
| 10 | GND | 0V, Ground |

On board RS422 / 485- drivers are generating differential voltages with approx. ±5V amplitudes. This guarantees an extremely safe transmission up to 57.600 Baud, even on very long lines (up to 1.200 meters). Communication parameters are set on DIP- switch A according to table 15.
Input Datas takes connector J2 on EA 9710-485. Pinout can be seen in aside table. Connecting i.E. to a PC is particulary simple with cable EA KV24-9, which is available as an option. Using this cable enables direct (1:1) plug in of EA 9710-V24 into serial PC- ports (i.E. COM1, 9-pin. SUB-D connector).




If cable EA KV24-9 is not used, proceed according to figure 5. In case, that wires for handshakes are not available, pins RTS and CTS must be bridged on EA 9710-485. In this case, EA 9710-485 supports a special mode for software handshakes XON / XOFF.

*Figure 5*

## CONNECTING EA 9710-BUS, CENTRONICS

Connector J3 is assigned for connection to Centronics interface. A 25-pin Centronics connector (male) can be crimped direct onto a flat type cable, and allows in this combination i.E. direct operation with PC.
It´s also possible to operate the terminal directly via Centronics interface on a processor system bus. Hereby the input "Strobe" takes over the function of a low active "Enable". Data takeover happens at the L-H edge. On fast processor systems should be waited until pin "Busy" is on low level, before transfer new datas.

| Centronics bus connector J3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Symbol** | **Level** | **Function** | | **Pin** | **Symbol** | **Level** | **Function** |
| 1 | Strobe | L | Data transfer | | 2 | NC | - | n/c |
| 3 | Data 0 | H / L | Bit 0 LSB | | 4 | VDD | H | + 5V |
| 5 | Data 1 | H / L | Bit 1 | | 6 | NC | - | n/c |
| 7 | Data 2 | H / L | Bit 2 | | 8 | NC | - | n/c |
| 9 | Data 3 | H / L | Bit 3 | | 10 | GND | L | 0V Ground |
| 11 | Data 4 | H / L | Bit 4 | | 12 | GND | L | 0V Ground |
| 13 | Data 5 | H / L | Bit 5 | | 14 | GND | L | 0V Ground |
| 15 | Data 6 | H / L | Bit 6 | | 16 | GND | L | 0V Ground |
| 17 | Data 7 | H / L | Bit 7 MSB | | 18 | GND | L | 0V Ground |
| 19 | Ack | L | Acknowledge | | 20 | GND | L | 0V Ground |
| 21 | Busy | H | In progress | | 22 | GND | L | 0V Ground |
| 23 | GND | L | 0V Ground | | 24 | GND | L | 0V Ground |
| 25 | VDD | H | + 5V | | 26 | NC | - | n/c |

*Table 9*

## DISPLAY CONNECTION

On board are four rows solder terminals for direct connection (1:1 link) to most customary LCD-Graphic Modules.

| Display connector J5 | | | |
|---|---|---|---|
| **Pin** | **Symbol** | **Level** | **Function** |
| 1 | FLM | H/L | Frame Signal |
| 2 | LP | H/L | Data Latch Signal |
| 3 | CP | H/L | Data Shift Clock |
| 4 | M | H/L | Alternate Signal |
| 5 | VADJ | - | Contrast adjustment |
| 6 | VDD | H | Positive supply for electronic |
| 7 | VSS | L | Negative supply for electronic |
| 8 | VEE | - | Display voltage |
| 9 | D0 | H/L | Display Data 0 |
| 10 | D1 | H/L | Display Data 1 |
| 11 | D2 | H/L | Display Data 2 |
| 12 | D3 | H/L | Display Data 3 |

*Table 10*

| Display connector J6 | | | |
|---|---|---|---|
| **Pin** | **Symbol** | **Level** | **Function** |
| 1 | FLM | H/L | Frame Signal |
| 2 | LP | H/L | Data Latch Signal |
| 3 | CP | H/L | Data Shift Clock |
| 4 | M | H/L | Alternate Signal |
| 5 | VADJ | - | Contrast adjustment |
| 6 | VDD | H | Positive supply for electronic |
| 7 | VSS | L | Negative supply for electronic |
| 8 | VEE | - | Display voltage |
| 9 | DU0 | H/L | Display Data 0 (Upper) |
| 10 | DU1 | H/L | Display Data 1 (Upper) |
| 11 | DU2 | H/L | Display Data 2 (Upper) |
| 12 | DU3 | H/L | Display Data 3 (Upper) |
| 13 | DL0 | H/L | Display Data 0 (Lower) |
| 14 | DL1 | H/L | Display Data 1 (Lower) |
| 15 | DL2 | H/L | Display Data 2 (Lower) |
| 16 | DL3 | H/L | Display Data 3 (Lower) |

*Table 11*

| Display connector J7 and J7-2 | | | |
|---|---|---|---|
| **Pin** | **Symbol** | **Level** | **Function** |
| 1 | FLM | H/L | Frame Signal |
| 2 | LP | H/L | Data Latch Signal |
| 3 | CP | H/L | Data Shift Clock |
| 4 | DOFF | H | H: Display on (L:OFF) |
| 5 | VDD | H | Positive supply for electronic |
| 6 | VSS | L | Negative supply for electronic |
| 7 | VEE | - | Display voltage |
| 8 | DU0 | H/L | Display Data 0 (Upper) |
| 9 | DU1 | H/L | Display Data 1 (Upper) |
| 10 | DU2 | H/L | Display Data 2 (Upper) |
| 11 | DU3 | H/L | Display Data 3 (Upper) |
| 12 | DL0 | H/L | Display Data 0 (Lower) |
| 13 | DL1 | H/L | Display Data 1 (Lower) |
| 14 | DL2 | H/L | Display Data 2 (Lower) |
| 15 | DL3 | H/L | Display Data 3 (Lower) |

*Table 12*

## CONNECTING (MATRIX-) KEYPAD

Connector J4 allows connection to single keys or to Matrix- keypads with up to 8x8 keys. The contact bouncing is eliminated by software. Please take into consideration, that this keypad functions are supported by version RS-232 and version RS 485 only.
Keys are connected to input- and output gates, where each input gate is shunted by a 100kΩ pullup resistor. Up to 8 keys may be connected to a single output gate.
In order to recognize fast double keystrokes, the output gates have to be decoupled. Best way to achieve that is using Schottky- Diodes (i.E. BAT 43).
On multiple keystrokes (>2) each individual key must be decoupled by separate diode.

**Matrix - Keypad connector J4**

| Pin | Symbol | Function | | Pin | Symbol | Function |
|---|---|---|---|---|---|---|
| 1 | GND | 0V Ground | | 2 | VDD | + 5V |
| 3 | OUT 1 | output line 1 | | 4 | OUT 2 | output line 2 |
| 5 | OUT 3 | output line 3 | | 6 | OUT 4 | output line 4 |
| 7 | OUT 5 | output line 5 | | 8 | OUT 6 | output line 6 |
| 9 | OUT 7 | output line 6 | | 10 | OUT 8 | output line 8 |
| 11 | IN 1 | input column 1 | | 12 | IN 2 | input column 2 |
| 13 | IN 3 | input column 3 | | 14 | IN 4 | input column 4 |
| 15 | IN 5 | input column 5 | | 16 | IN 6 | input column 6 |
| 17 | IN 7 | input column 7 | | 18 | IN 8 | input column 8 |
| 19 | GND | 0V Ground | | 20 | VDD | + 5V |

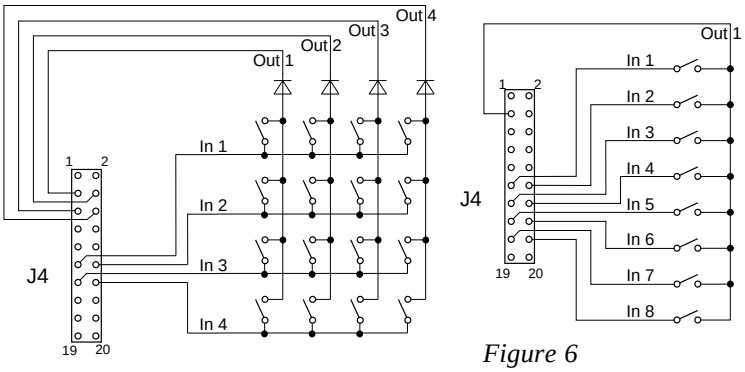



*Figure 6*

### Transmitting keystrokes

After the terminal is swichted on, all keystrokes will be stored. For automatic transmitting of each change on input gates, the command "automatic transmission on" (ESC ESC E) must be given. It's also possible, to query the actual status of keystrokes by commands: ESC ESC B. This makes sense, especially when several terminals operate on one line, it prevents a datacrash when single terminals are transmitting arbitrary.

### Identifications

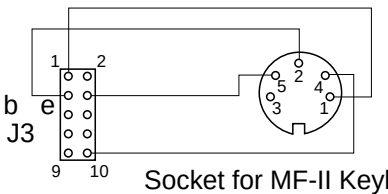
In order to distinguish transmitted datas (Matrix, MF-102) from each other, an ASCII-character ´m´ will be sent first via the RS-232/RS485 interface to identify the Matrix keypad. Than, the keystroke numbers follow in binary format, finally followed by a closing byte (binary: 0). On each change, pressing and releasing a key, all key strokes will be still transmitted. The number of an individual key can be evaluated:
**Number of key = (output -1) * 8 + input**, output and input must be a number between 1 and 8.

## CONNECTING AT-KEYBOARD (MF-102)

An AT-keyboard can be connected to connector J3. Please be aware, that keyboard functions are supported by versions RS-232 and RS 485 only.
Received MF-102 keyboard datas are buffered in terminal memory and will be transfered via RS-232/RS485 interface. The output starts only after command "Auto Transmit On" is given. When operating several terminals on one line, its advisable to give immediate after data receiving the command "Automatisch senden aus" to prevent datacrashes when single terminals are transmitting arbitrary. No conversion (i.E.) to ASCII-characters takes place, therefore various on market available keyboards can used. An identification string, like it's usual on matrix- keypads, won't be issued.

**MF-102 Keyboard connector J3**

| Pin | Symbol | Function | | Pin | Symbol | Function |
|---|---|---|---|---|---|---|
| 1 | CLK | Clock line | | 2 | - | n/a |
| 3 | DATA | Data line | | 4 | VDD | + 5V |
| 5 | - | n/a | | 6 | - | n/a |
| 7 | - | n/a | | 8 | - | n/a |
| 9 | - | n/a | | 10 | GND | 0V Ground |




Socket for MF-II Keyboard
(Solder side)

*Figure 7*

## RS-232 / RS 485 DATA TRANSMITTING

| V.24 / RS 485 Parameter | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DIP A | | | | | | | | Description |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| On | On | On | | | | | | 7 data bits, 1 stop bit, no parity |
| | On | On | | | | | | 7 data bits, 2 stop bits, no parity |
| Off | | | | | | | | |
| On | | On | P | | | | | 7 data bits, 1 stop bit, parity |
| | Off | | P | | | | | |
| | | On | P | | | | | 7 data bits, 2 stop bits, parity |
| Off | Off | | P | | | | | |
| On | On | | | | | | | 8 data bits, 1 stop bit, no parity |
| | | Off | | | | | | |
| | On | | | | | | | 8 data bits, 2 stop bits, no parity |
| Off | | Off | | | | | | |
| On | | | P | | | | | 8 data bits, 1 stop bit, parity |
| | Off | Off | P | | | | | |
| | | | P | | | | | 8 data bits, 2 stop bits, parity |
| Off | Off | Off | P | | | | | |
| | | | | On | On | On | H | 57600 Baud |
| | | | | | | | H | |
| | | | | | On | On | H | 28800 Baud |
| | | | | Off | | | H | |
| | | | | On | | On | H | 19200 Baud |
| | | | | | Off | | H | |
| | | | | | | On | H | 9600 Baud |
| | | | | Off | Off | | H | |
| | | | | On | On | | H | 4800 Baud |
| | | | | | | Off | H | |
| | | | | | On | | H | 2400 Baud |
| | | | | Off | | Off | H | |
| | | | | On | | | H | 1200 Baud |
| | | | | | Off | Off | H | |
| | | | | | | | H | 300 Baud |
| | | | | Off | Off | Off | H | |
| | | | P | | | | | P= On: even parity<br>P= Off: odd parity |
| | | | P | | | | | |
| | | | | | | | H | H= On: operation without handshake<br>H= Off: operation with handshake |
| | | | | | | | H | |

DIP-switch A allows presetting of all customery transmission parameters up to 57 600 Baud. Voltage level correspond to RS 232C Standard (approx. ±10V with EA 9710-V24), respectively specification from
RS 485 (EA 9710-485).
This Terminal is equiped with an integrated 2 kByte buffer for commands. Before the buffer is filled totally, an overflow warning is shown in time to the transmitter via RTS line. If a transmission without handshake is choosed, the overflow warning is given by XON and XOFF codes (software handshake). However, this software handshake is active only, when the command "Auto Transmit On" was given before.

*Table 15*

## DIMENSIONS, POSITION OF CONNECTORS AND DIP- SWITCHES

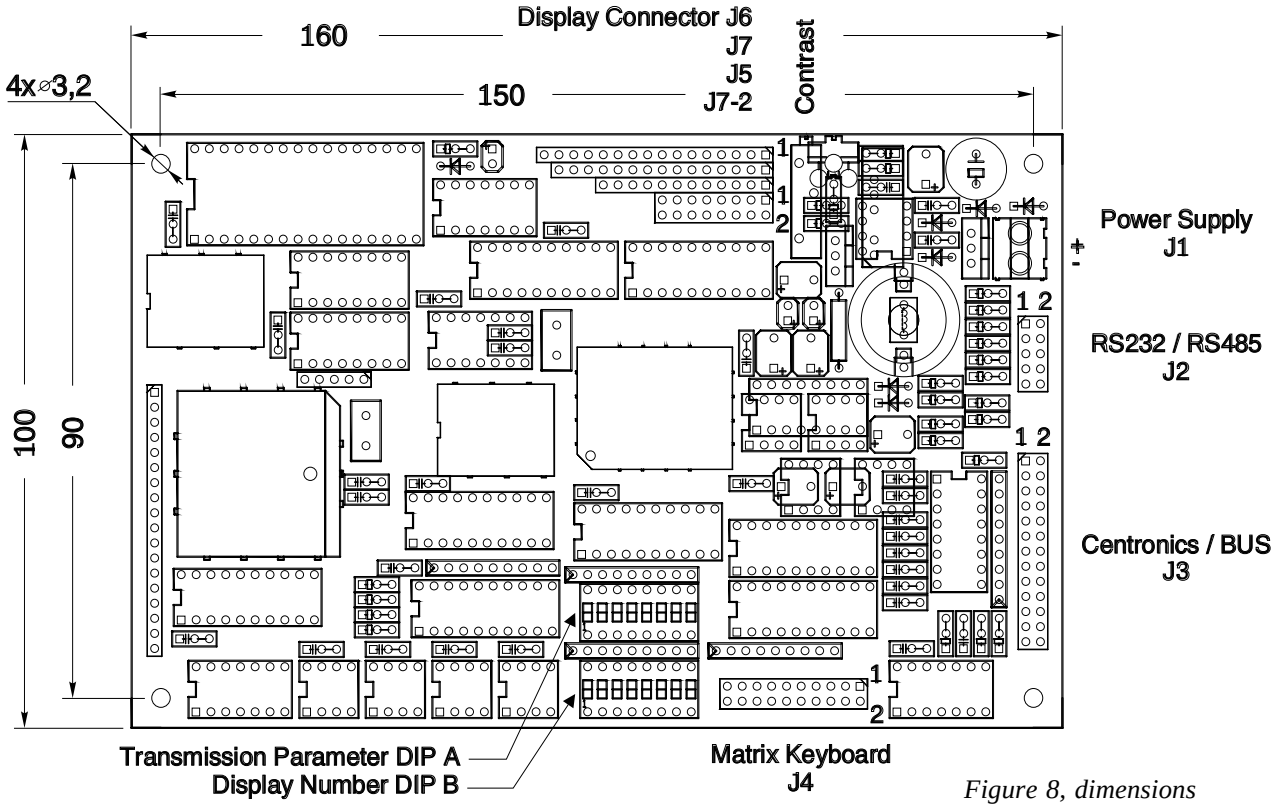



*Figure 8, dimensions*

## SOLDER BRIDGES

In order to adapt EA 9710 to various hardware configurations, several bridging strips are placed at the solder surface of the board. This solder bridges are presetted by factory. Therefore no change should be made normaly. In case, that that bridges must be altered for special purposes, we ask you to contact us.

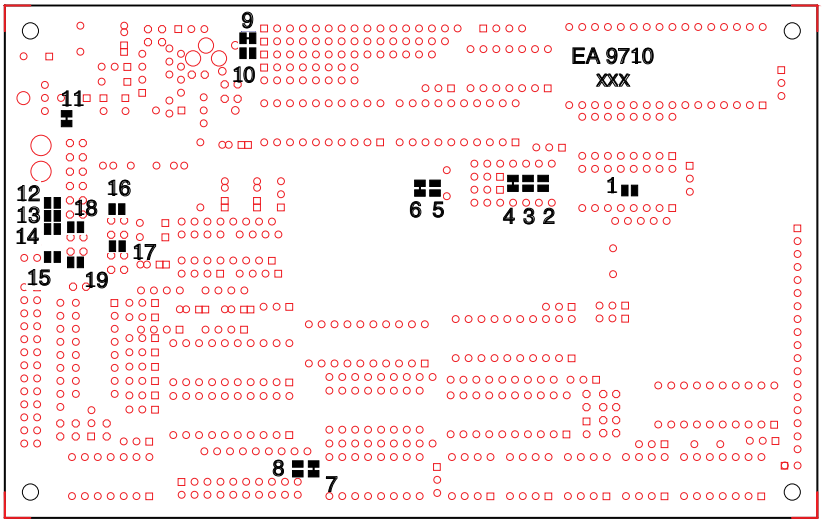



*Figure 9 view of solder surface*

| Bridge | Function | Description |
|---|---|---|
| 1 | MF102 | Closed bridge for an AT-Keyboard on modules EA 9710- V24 , EA 9710-485. Open bridge for EA 9710-BUS !! |
| 2 | 4,6 MHz | Generates an external pixel clock frequency for graphic controller. Must be set individually according to display model. Only one closed solder bridge is allowed. |
| 3 | 9,2 MHz | |
| 4 | 2,3 MHz | |
| 5 | ext. / 2 (int.) | Driving the graphic controller with an external pixel frequency: clock rate may be divided, respectively a board owned oscillator can be added onto graphic controller board. |
| 6 | ext. | |
| 7 | Pullup | All inputs for a matrix keypad are on 100 kOhm pullup resistors. They may be reconnected for pulldown opera- tion, but have no software support. |
| 8 | Pulldown | |
| 9 | Vadj = Vee | A separate input (Vadj) for contrast adjustment is available at some displays. Standard connection on controller board EA 9710 is to Vee. When necessary, Vadj may be connected to +5V. |
| 10 | Vadj = +5V | |
| 11 | opt. Regler | For an onboard 5V-voltage regulator: this bridge must be open. |
| 12 | +5V an J2 | +5V may be applied to pin 1 of connector J2. |
| 13 | DCD - DSR | Often needed connections on V.24 / RS 232 interfaces (see figure 4, con- necting EA 9710-V24) are easy to make with this solder bridges. |
| 14 | DCD - DTR | |
| 15 | RTS - CTS | |
| 16 - 19 | RV für V.24 | Protection resistors in V.24/ RS232 lines can be bridged here. |

*Table 16*