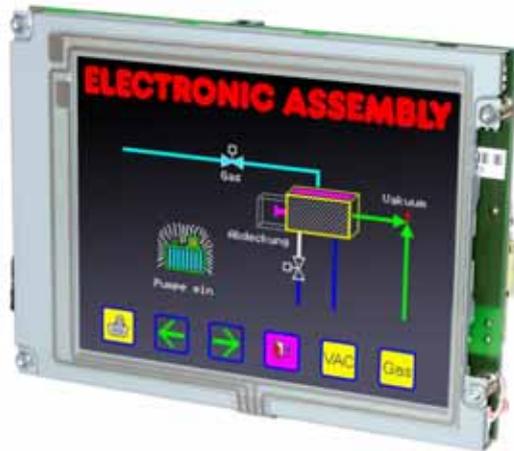


5.7" COLOR LCD- CONTROL PANEL INCL. TOUCH PANEL

with connection for
textdisplay
(HD44780)



EA KIT320F-8LWTP
Outline dim. 155 x 115mm

FEATURES

- * 5.7" COLOR LCD GRAPHIC DISPLAY WITH MANY GRAPHICS FUNCTIONS AND FONTS
- * 320x240 PIXEL, 16 COLOURS WITH CFL BACKLIGHT
- * FONT ZOOM OF approx. 2mm UPTO approx. 80mm, FONT ROTATION, 90° STEP
- * SUPPLY VOLTAGE +5V±2% @ 320mA OR +9..35V OPTIONALLY
- * RS-232 OR RS-422 WITH BAUD RATE 1,200~115,200 BD
- * POSITIONING **ACCURATE TO THE PIXEL** WITH ALL FUNCTIONS
- * STRAIGHT LINE, POINT, AREA, AND/OR/EXOR, BAR GRAPH...
- * CLIPBOARD FUNCTIONS, PULL-DOWN MENUS
- * STORE UPTO 256 BITMAPS
- * UPTO 1380 MACROS PROGRAMMABLE (512kB FLASH ONBOARD)
- * TEXT AND GRAPHIC CAN BE MIXED, FLASHING TEXT, INVERSE TEXT
- * SWITCH BACKLIGHT BY SOFTWARE CONTROL (OFF, ON, HALF BRIGHTNESS)
- * ANALOGUE TOUCH PANEL: CAN BE SET INDIVIDUALLY (e.g. 10x8 FIELDS)
- * DEFINE KEYS AND SWITCHES
- * OPERATE MENU AND BAR GRAPH ADJUSTMENT BY THE USE OF TOUCH PANEL
- * 8 DIGITAL INPUT AND 8 OUTPUT LINES
- * 2 ANALOGUE INPUT 0..200mV WITH SCALING FUNCTION
- * CONNECTOR FOR ALPHANUMERIC DISPLAY WITH HD44780

ORDER INFORMATION

CONTROL UNIT COLOR 5.7", TOUCH PANEL, 320x240 DOTS, RS-232 **EA KIT320F-8LWTP**
SAME BUT WITHOUT TOUCH PANEL **EA KIT320F-8LW**

SUPPLY VOLTAGE +9..35V = INSTEAD OF +5V =

RS-422 INTERFACE INSTEAD OF RS-232

OPTO COUPLER (8xIN, 8xOUT) ON BOARD

ALUMINIUM BEZEL FOR MOUNTING, BLACK ANODIZED

CABLE 1.5m WITH 9-PIN SUB-D (RS-232 FEMALE)

EA OPT-9/35V

EA OPT-RS4224

EA OPT-OPTO16

EA 0FP320F-8SW

EA KV24-9B

**ELECTRONIC
ASSEMBLY** GMBH

ZEPPELINSTRASSE 19 · D-82205 GILCHING
PHONE +49-8105-778090 · FAX +49-8105-778099 · <http://www.lcd-module.de>

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

Documentation of revision				
Date	Type	Old	New	Reason / Description
5.2.04	Simulator	F1: help function	Shift-F1: help function	continous terminal functionality F1..F10
5.2.04	Data sheet		Page 6: Extension for analogue input description Page 22: Insert command for calibration	
6.2.04	Data sheet		Page 9: Insert "Create own key form", "Use bitmap as a key", "Radio groups"	
8.10.10	Display	EA KIT320F-8C EA KIT320F-8CTP	EA KIT320F-8LW EA KIT320F-8LWTP	Backlight changed from CFL into LED type

CONTENT

GENERAL	3
HARDWARE, CONNECTOR, PINOUT	4
DIGITAL INPUT / OUTPUT, KEYBOARD INTERFACE	5~7
TOUCH PANEL	8, 9
MACRO PROGRAMMING	10, 11
CHARACTER SETS	12, 13
COLORS AND ATTRIBUTES	14
COMMAND SYNTAX, PROGRAMMING EXAMPLE	16
COMMAND TABLES	17~22
RESPONSE OF CONTROL UNIT	23
DIMENSIONS	24

GENERAL

The EA KIT320F graphics kit is a fully assembled control and operating unit with a variety of integrated functions. The display has very compact dimensions and offers excellent super-twist contrast, which means the unit can be put into operation immediately. It is controlled via the standard RS-232 or RS-422 interface. In addition to complete graphics routines for display output, the graphics kit also contains a wide variety of fonts. Graphics command similar to those used in high-level programming languages are used for programming. There is thus no longer any need for the time-consuming programming of character sets and graphics routines. The ease of use offered by macros and input via touch panel make it a real power display.

HARDWARE

The graphics kit is designed for an operating voltage of +5V. A supply voltage of 9..35V is also possible. Serial asynchronous data transfer is carried out in RS-232 or RS-422 format. The transmission format is set permanently to 8 data bits, 1 stop bits, and no parity. A transmission rate of between 1200 and 115,200 baud can be selected by means of DIP switches. RTS and CTS handshake lines are available.

Data format:



TOUCH PANEL

The EA KIT320F-8LWTP is equipped with an integrated touch panel. You can make entries and choose menu settings by touching the display. The labeling of the "keys" is flexible and can also be changed during runtime (different languages, icons). The drawing of the individual "keys" and the labeling or grouping of several fields is handled by the integrated software.

SOFTWARE

The graphic kits are programmed by means of commands such as *Draw a rectangle from (0,0) to (64, 15)*. No additional software or drivers are required. Strings can be placed with **pixel accuracy**. Text and graphics can be combined at any time. Up to 16 different character sets can be used. Thus, when the 8-times zoom is used with character set 16x8, the words and numbers fill the screen.

ACCESSORIES

Front panel for mounting

A front panel made of anodized aluminum is available as an accessory. This allows the graphics kit to be mounted without any screws visible. Installing it is child's play. The color for the EA 0FP320F-8SW front panel is black.

Creating macros with the Kit-Compiler

With the ELECTRONIC ASSEMBLY LCD-Tools^{*)} individual macros and fonts may be created.

More information on macro functionality is on the pages 10 and 11.

Simulator Software for Windows

To get familiar with this display, an easy, fast and cheap way is to download the ELECTRONIC ASSEMBLY LCD-Tools^{*)} with its Simulator software from our web site. All KIT-functions can be simulated there !

Even later on for software development, this Simulator is a great utility.

Cable for PC

To enable simple connection to PCs (macro programming), we provide a 1.5m cable and a 9-pin SUB-D female connector (EA KV24-9B). Simply insert it into COM 1 or COM 2 and get started. Note: The cable is not suitable for the RS-422 version (EA OPT-RS4224).

^{*)} full version is free available on web at <http://www.lcd-module.com/products/touch.html>

EA KIT320F-8 COLOR

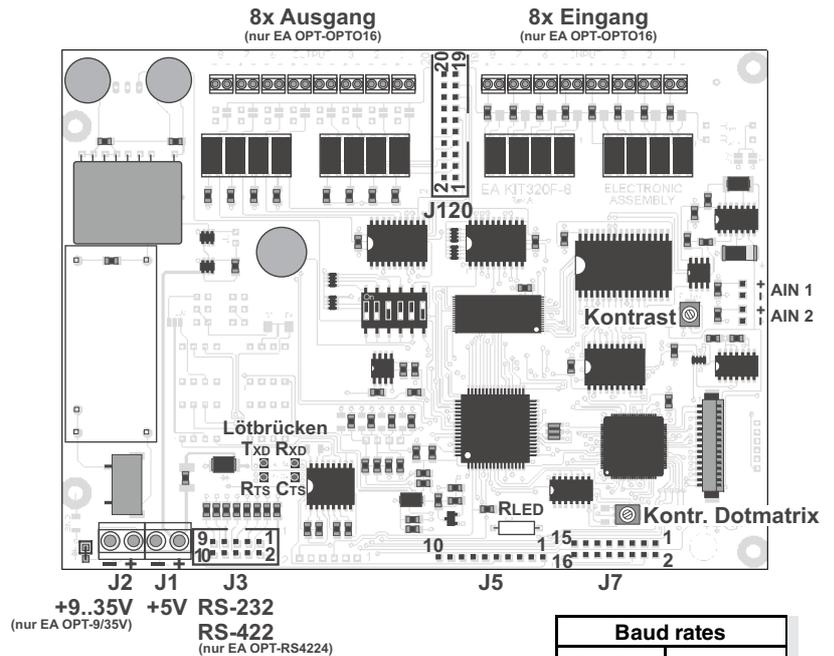
ELECTRONIC ASSEMBLY

SUPPLY VOLTAGE / EA OPT-9/35V

In the standard model, the supply voltage of +5V is fed in via screw-type terminal J1. In the case of the version for 9..35V (EA OPT-9/35V), the power is supplied via J2.

Important: It is imperative that the polarity is correct. Polarity reversal, even for a very short time, can cause the immediate destruction of the entire display.

View from rear side



BAUD RATES

The baud rate can be set by means of the 3 DIP switches on the left. 9,600 baud is set at the factory (DIP 3 ON). Please note that the internal data buffer only holds 128 bytes. It is therefore imperative that the RTS handshake line be queried (a level of +10V means data can be accepted; a level of -10V means the display is busy). The data format is fixed at 8 data bits, 1 stop bit and no parity.

DIP switches			Data format
1	2	3	8,N,1
ON	ON	ON	1200
OFF	ON	ON	2400
ON	OFF	ON	4800
OFF	OFF	ON	9600
ON	ON	OFF	19200
OFF	ON	OFF	38400
ON	OFF	OFF	57600
OFF	OFF	OFF	115200

RS-232/RS-422 CONNECTION

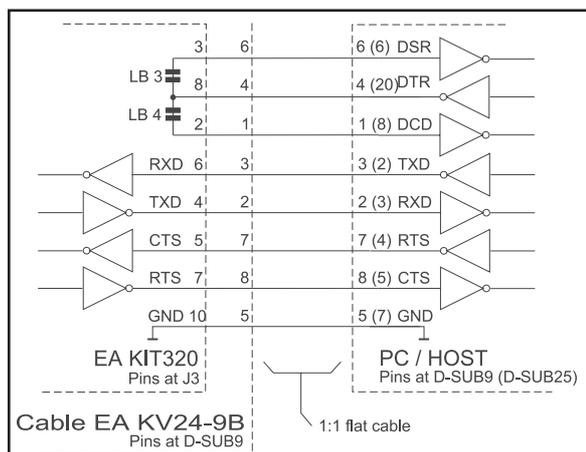
The graphics kit is shipped with an RS-232 interface as standard. The pin assignment of the plug connector (J3) is as shown in the table on the left. The J3 has a 2.54mm grid.

RS-232 J3 connection			
Pin	Symb	In/Out	Function
1	VDD	-	+ 5V supply
2	DCD	-	Strap to DTR
3	DSR	-	Strap to DTR
4	TxD	Out	Transmit data
5	CTS	In	Clear to send
6	RxD	In	Receive data
7	RTS	Out	Request to send
8	DTR	-	See pin 2, pin 3
9	-	-	NC
10	GND	-	0V ground

If the graphics kit is ordered together with the EA OPT-RS4224 optional component, RS-422 drivers are fitted. In this case, the pin assignment is as shown in the table on the right.

The same serial data with 5V levels and TTL logic is available at the J5 eyelet strip. These levels are suitable for direct connection to a µC. However, if these signals are used, 4 solder links TXD, RXD, RTS, CTS had to be cut before !

RS-422 J3 connection		
Pin	Symbol	Function
1	VDD	+ 5V supply
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



J5 add-on			
Pin	Symbol	In/Out	Function
1	VU	-	9..35V supply
2	VDD	-	+ 5V supply
3	GND	-	0V, ground
4	TxD5	Out	Transmit data
5	RxD	In	Receive data
6	RTS	Out	Request to send
7	CTS	In	Clear to send
8	RESET	In	H: reset
9	SCL	Out	I2C bus, clock
10	SDA	In/Out	I2C bus, data

DIGITAL INPUT AND OUTPUT

All control units EA KIT320F-8 are featured with 8 digital input and 8 digital output lines (5V CMOS level, grounded).

8 outputs

Each line can be controlled individually using the "ESC Y W" command. A maximum current of 6mA can be switched per line. This gives the opportunity to drive a low power LED in direct way. To source higher current please use an external transistor (see application below).

8 Eingänge

The inputs can also be queried and evaluated directly via the serial interface ("ESC Y R"). In addition to that every port change may start an individual port- or bit-macro. Each of these port macros can change the contents of the screen or switch an output, thus enabling a wide range of control functions. Command "ESC Y A 0" disables automatic port query.

Port Macro: when the 8 lines are combined, up to 256 port macros can thus be addressed.

Bit Macro: watching a single line. Bit Macro 1..8 will be started when one of the lines 1..8 changes to high (rising edge). Bit Macro 9..16 will be started when one of these lines is going to low (falling edge).

If both macros (Port and Bit macro) are defined, every change will start Bit Macro first and then Port Macro. If there's no macro defined, port status will be sent via RS232/RS422.

To create the port macros you need a PC and the EA DISK320F floppy disk.

Note: The logic circuitry is designed for slow operations; in other words, more than 3 changes per second cannot be easily executed. Open input are high because of internal 100 kOhm pull-up.

INPUT AND OUTPUT VIA OPTOCOUPLER (EA OPT-OPTO16)

Digital input and output are optionally featured with optocoupler (EA OPT-OPTO16). All the 8 inputs and 8 outputs are isolated from the rest of the electronic components as well as each other. The connection is made via 16 different screw-type terminals.

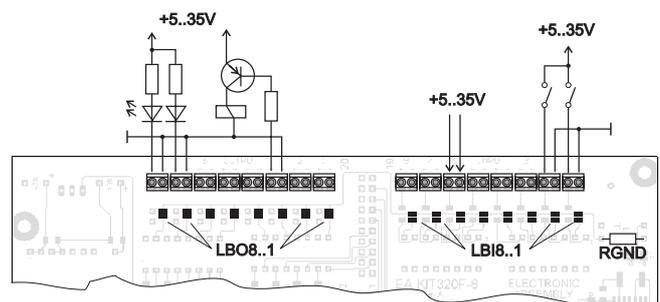
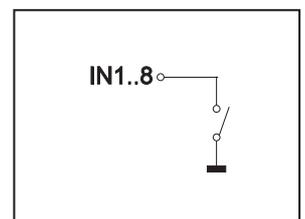
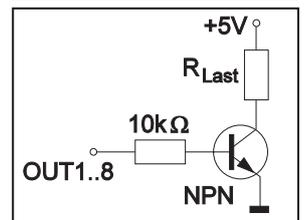
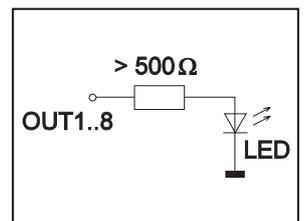
All input lines can be connected with 5..35V directly. Level above 4V are H-level, a voltage below 2V stay for L-level. Voltage between 2V and 4V are undefined.

The collector and emitter of a transistor is brought out at the screw-type terminals as the output. Each output can switch a maximum of 10mA.

Note: The negative pole of each screw-type terminal can be interconnected by closing the solder straps LBI1..8 and LBO1..8. These solder straps can also be connected to system ground GND (solder 0Ω strap R_{GND}).

Note: The optocouplers invert the input logic (all inputs open: port macro 255). It is advisable here (in the power-on macro, for example) to use the "ESC Y I 1" command to evaluate the inputs inversely (all inputs open: port macro 0).

Input and output J120					
Pi	Symbol	Function	Pi	Symbol	Function
1	VDD	+5V supply	2	GND	0V, Ground
3	OUT1 / MO8	Port output 1 Matrix output 8	4	IN1 / MI8	Port input 1 Matrix input 8
5	OUT2 / MO7	Port output 2 Matrix output 7	6	IN2 / MI7	Port input 2 Matrix input 7
7	OUT3 / MO6	Port output 3 Matrix output 6	8	IN3 / MI6	Port input 3 Matrix input 6
9	OUT4 / MO5	Port output 4 Matrix output 5	10	IN4 / MI5	Port input 4 Matrix input 5
11	OUT5 / MO4	Port output 5 Matrix output 4	12	IN5 / MI4	Port input 5 Matrix input 4
13	OUT6 / MO3	Port output 6 Matrix output 3	14	IN6 / MI3	Port input 6 Matrix input 3
15	OUT7 / MO2	Port output 7 Matrix output 2	16	IN7 / MI2	Port input 7 Matrix input 2
17	OUT8 / MO1	Port output 8 Matrix output 1	18	IN8 / MI1	Port input 8 Matrix input 1
19	GND	0V, Ground	20	VDD	+5V supply



EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

INTERFACE FOR TEXT DISPLAY WITH HD44780

Eyelet J7 is a interface for an external alphanumeric LCD with HD44780 controller onboard. All popular sizes from 1x8 up to 4x20 (2x40) characters are supported. Software with terminal functions via command 'ESC T xx' is already built-in. By command 'ESC L xx' low level programming for controller HD44780 is possible. Potentiometer for contrast adjustment is built-in, too. Customer is able to add a series resistor R_{LED} for LED backlight on-board.

HD44780 LCD-interface J6 + J7			
Pin	Symbol	Level	Function
1	VSS	L	Power supply, Ground
2	VDD	H	Power supply +5V
3	VEE	-	Contrast voltage 0V-5V
4	RS	H / L	Register Select
5	R/W	H / L	H: Read / L: Write
6	E	H	Enable
7	D0	H / L	Data line 0 (LSB)
8	D1	H / L	Data line 1
9	D2	H / L	Data line 2
10	D3	H / L	Data line 3
11	D4	H / L	Data line 4
12	D5	H / L	Data line 5
13	D6	H / L	Data line 6
14	D7	H / L	Data line 7
15	A	-	Anode for LED (RLED)
16	K	L	Cathode f. LED (=VSS)

ANALOGUE INPUT AIN1 AUND AIN2 ↪ PAGE 20

For analogue measurement 2 inputs with a range of 0..+250mV are available. Each input is grounded (GND) and DC impedance is 10k Ω . Please make shure that only positive voltages will be supplied there. Internal resolution is 10 Bit, equal to a 3-digit DVM modul. Linearity (after adjustment) is around 0.5%.

Adjustment

Analogue inputs are not calibrated when shipped out. A procedure for adjustment may be like that:

- 1.) Put a well known voltage within a range of 150-250mV to analogu input (example: 200mV, AIN1)
- 2.) Run command for calibration (see page 20). Example: "ESC V @ 1 200.0 NUL".

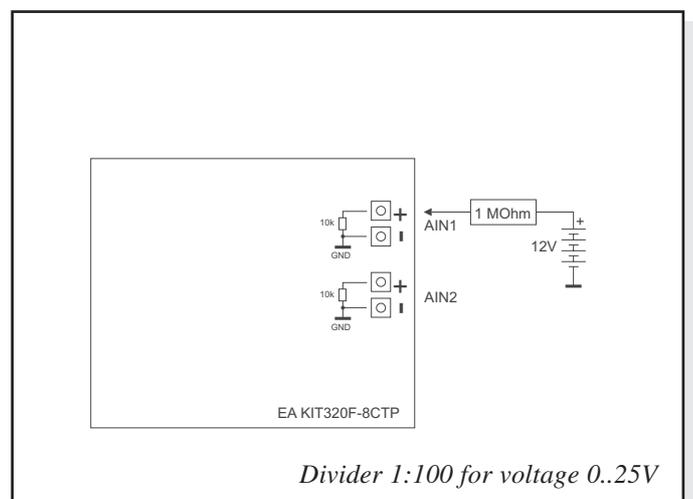
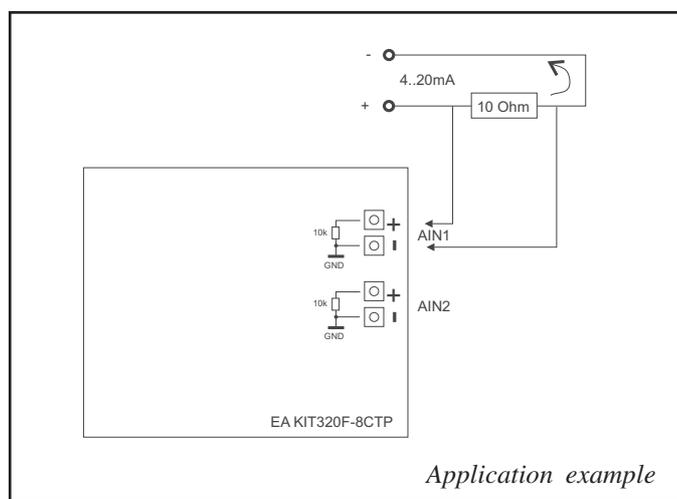
This command may be put into a Touch-macro, too, which will be started touching the display.

Measurement

Each input query can be done via RS-232 (RS-422) or directly shown on display (as digits or bargraph in various colors and sizes).

Best way for direct visualisation are Process-macros or one of Analogue-macros (e.g. starting at every voltage change, or above/below a limit).

Both input lines are scaleable from 0 to ± 9999.9 . Scaling will be done via definition at 2 votages (value1 > string1, value2 > string2).



EXTERNAL KEYBOARD

A keyboard (anything from individual keys to a 8x8 matrix keyboard) can be connected at the plug-in connector J120. Command 'ESC Y M n1 n2 n3' define the count of input lines (n1=1..8) and output lines (n2=1..8, see page 5). n3 set debounce function with 50ms steps (n3=0..7). Please note that count of digital input and output lines will be reduced while connecting an external keyboard at the same port.

Each key is connected with 1 output and 1 input. All inputs are terminated with a 100kΩ pull-up resistor. For double-keystroke function decoupling of outputs is necessary. For that please use schottky diodes (e.g. BAT 46).

Transmitting the keystrokes

At each keystroke, the associated key number (1..64, see page 21 "ESC M") is transmitted or - if a corresponding Matrix-Macro is defined, Matrix-Macro will be started. The release of the key is not transmitted. If the release of the key is to be transmitted as well, this can be done by defining Matrix-Macro no. 0.

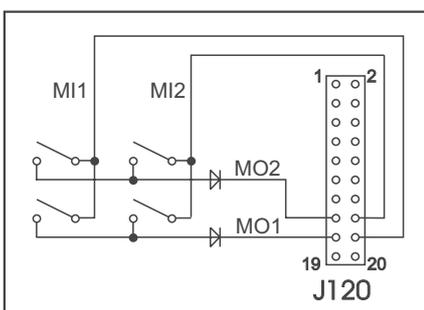
Note: If the handshake line (e.g. CTS) does not permit transmission, up to 8 keystrokes will be stored in internal buffer. While buffer overrun keystrokes may be lost!

Calculation of key numbers:

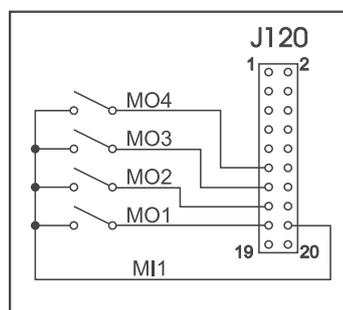
Key number = (output -1) * count of inputs + input (output=MOx, count of inputs=MIx).

Example: Connecting 4 keypads in 3 ways

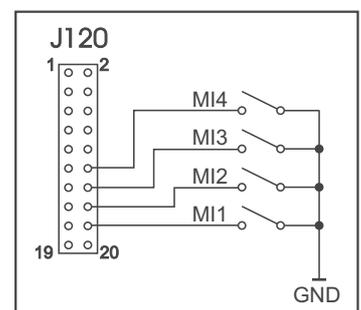
- 2x2 matrix: Command 'ESC Y M 2 2 ..' defines the 2x2 matrix. Keypad will need input lines MI1, MI2 and output lines MO1, MO2. Output lines are decoupled by diodes; this is for double-keystrokes necessary, only. 6 input and 6 output lines remain free for other requirements.
- 1x4 matrix: Command 'ESC Y M 1 4 ..' defines the 1x4 matrix. Keypad will need output lines MO1..MO4 and a single input line MI1. With that connection 7 input and 4 output lines remain free for other requirements.
- 4x0 matrix: Using one single output only (physically 4x1 Matrix), all keys can switch to GND. So no output line is necessary and command 'ESC Y M 4 0 ..' defines 4 input lines only. With that connection 4 input and 8 output lines remain free for other requirements.



2x2 matrix



1x4 matrix



4x0 matrix

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

TOUCH PANEL (EA KIT320F-8LWTP ONLY)

Version EA KIT320F-8CTP comes with an integrated touch panel, analogue resistive type. Up to 80 touch areas can be defined (summary of all keys, switch, menu, bargraph-input). This control unit supports all of them with many comfortable commands (see page 18). When the touch keys are touched, they can be automatically inverted and a tone can sound, indicating they have been touched. At the same time, the defined return code of the key is transmitted via the serial interface, or an internal touch macro with the number of the return code is started.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80

Pre-definition of a keypad when using commands 'ESC AC' or 'ESC AG'

TOUCH PANEL ADJUSTMENT

Touch panel is ready to use and well adjusted when module will be shipped out. Because of aging and attrition a re-adjustment may be necessary.

Adjustment procedure:

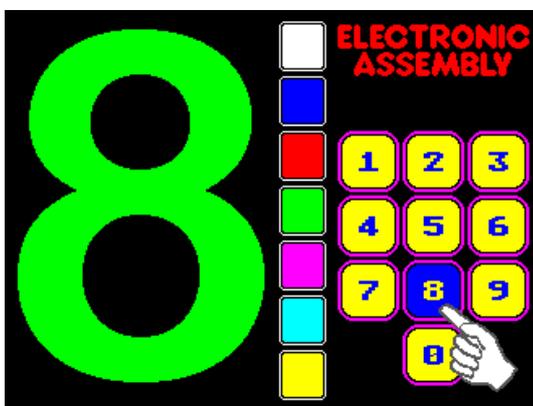
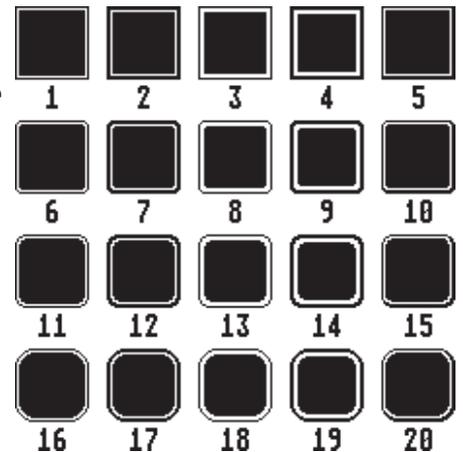
1. While switching on display, touch the display surface and keep it touched until display shows the question "touch adjustment ?" (or transmit 'ESC @' command).
2. Within 1 second touch again the display surface for min. 1 second.
3. Follow instructions for adjustment (touch 2 points *opleft* and *bottomright*).

FRAMES AND KEY STYLES

Both commands *draw box frame* and *draw touch* defines key style. You can choose one fo 20 internal defines frame types; furthermore some personal styles can be defined via compiler *k320comp.exe* (see DOKU.DOC on floppy disk EA DISK320F: Compiler code "BORDER")

All of them can be used in various sizes via coordinates. Each frame is split into 4 segments: the edges (not for type 1-5), outer frame, inner frame and filling.

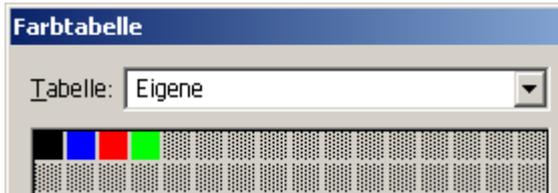
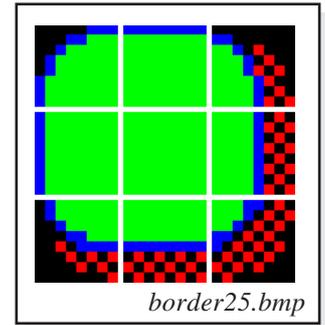
Each segment will get an individual colour and attribute. This will give the user the opportunity, when touching a field, the individual part of the key will be inverted only.



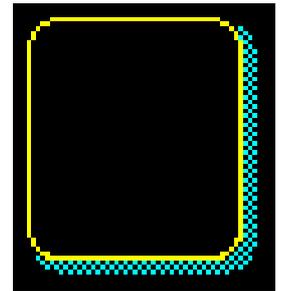
SELF-DEFINABLE SHAPES

With the help of Kitcompiler *k320comp.exe* you are able to generate individually created shapes for touch-fields (see K320COMP.DOC on floppy disk EA DISK320F: compiler directive "BORDER").

Each of these new shapes will be stored as a Windows-BMP file with 16 colours and 24x24 dots resolution (9 segments with 8x8 dots each: 4x edge, 4x middle part, 1x filling). Scaling for bigger touch fields will be done by repetition of these 8x8 dot segments. This makes it necessary to keep the 8x8 size in every case.



The first 4 colors will be used for the 4 frame colors f1..f4 (see also command table on page 20). Auf der Diskette EA DISK320F sind einige Beispielrahmen im Verzeichnis *'DISK320F\BITMAPS\border'* vorhanden



border25:
50x56 Pixel Grösse

BITMAPS ALSTASTEN

Ausser den Rahmentypen, die in der Grösse frei skalierbar sind, gibt es noch die Möglichkeit beliebige Bitmaps als Touch-Tasten oder -Schalter zu verwenden. Über den Kitcompiler *k320comp.exe* können bis zu 127 eigene Buttons eingebunden werden (siehe K320COMP.DOC auf der Diskette EA DISK320F: Compileranweisung "BUTTON").

Ein Button besteht immer aus zwei gleich grossen 16-farbigen Windows-BMPs (ein Bitmap für die gedrückte Touchtaste und ein Bitmap für normale Darstellung der Touchtaste). Die aktive Fläche der Touchtaste ergibt sich automatisch aus der Grösse der Button-Bitmaps.

Werden Buttons nachträglich beschriftet, so muss das Farbattribut SOLID gesetzt sein um ein Überschreiben des Textes beim Drücken zu verhindern.



RadioBlack75x15_0.bmp
RadioBlack75x15_1.bmp

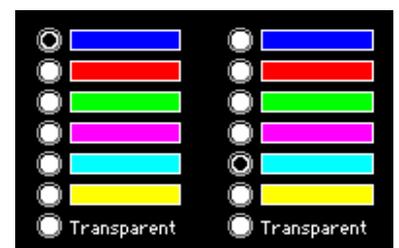


Die Farbpalette der Button-Bitmaps wird nicht zur Darstellung verwendet. Die Buttons werden immer in den 16 KIT-Grundfarben gezeichnet.

Auf der Diskette EA DISK320F sind einige Beispielbuttons im Verzeichnis *'DISK320F\BITMAPS\button'* vorhanden.

SCHALTER IN GRUPPEN (RADIO GROUP)

Touch-Schalter ändern ihren Zustand bei jeder Berührung von EIN in AUS und umgekehrt. Mehrere Touchschalter können zu einer Gruppe zusammengefasst werden (Befehl: 'ESC A R nr'). Wird nun ein Touch-Schalter innerhalb einer Gruppe 'nr' eingeschaltet, dann werden automatisch alle andern Touch-Schalter dieser Gruppe ausgeschaltet. Es ist also automatisch immer nur ein Schalter gesetzt.



Beispiel von zwei Radio-Gruppen mit Touch-Schaltern

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

MACRO PROGRAMMING

Single or multiple command sequences can be grouped together in macros and stored in the Data-FLASH. You can then start them by using the *Run macro* commands. There are several different types of macros:

Normal Macros (0..255)

These are started by means of a command via the serial interface (ESC MN xx) or from another macro. A series of macros occurring one after the other can be called cyclically (movie, hourglass, multi-page help text). This kind of automatic macro will run until data from RS-232/422 will be received or until another macro will be started (Touch- Port- or matrix-Macro)

Touch Macros (1..255)

These are started when you touch a touch field (in versions with a touch panel - TP) or command 'ESC MT xx' will be received. Touch macro no. 0 is different: It is started when you release a key.

Menu Macros (1..255)

will start after a choice in menu entry or by command 'ESC MM xx'.

Bit Macros (1..8) and (9..16)

will start voltage at a single line IN 1..8 (bitwise) will change or by command 'ESC MB xx'. Bit- Macro 1..8 are good for rising edge and Bit Macro 9..16 are good for falling edge at input 1..8.

Port macros (0..255)

These are started when voltage (binary) is applied to IN 1..8 or by command 'ESC MP xx'.

Matrix Macros (0..64)

Matrix Macro 1..64: start when keypressed or by command 'ESC MX xx'.

Matrix Macro 0: start after release of key or by command.

For more details please refer to page 7.

Analogue Macros (0..19)

will start whenever voltage changes or limit exceeds or by command 'ESC MV xx'. See table at the right:

Process Macros (0..255)

automatic start at fixed period (0.1s up to 25s) or by command 'ESC MC xx'. Up to 16 individual process may be defined by command 'ESC MD ..'. These Process Macro will never be stopped by other commands or activities.

Power-on Macro

Normal macro no. 0 is different: It is executed automatically after power-on. It allows you to switch off the cursor and define an opening screen, for example.

Reset Macro

Start after external reset or power supply break-down below 4.7V (VDD-VSS).

Watchdog Macro

Start after system error.

Analogue Macro		
Macro No.		Macro starts at
AIN1	AIN2	
0	10	every change of input voltage
1	11	falling input voltage
2	12	rising input voltage
3	13	below lower limit
4	14	above lower limit
5	15	below upper limit
6	16	above upper limit
7	17	outside of both limits
8	18	inside of both limits
9	19	lower than other channel

Note: Doing with Power-On-, Reset- or Watchdog Macro an endless loop, display can no longer be reached. In that case: set DIP switch no. 5 to ON position, power-off, power-on, and then DIP 5 back to OFF. All Macros are need to be downloaded again.

CREATING INDIVIDUAL MACROS AND IMAGES

- ELECTRONIC ASSEMBLY LCD-Tools^{*)}, which contains a kit editor, kit compiler and examples and fonts (for Windows PCs)
- A PC with a serial COM interface

To define a sequence of commands as a macro, all the commands are written to a file on the PC (e.g. DEMO.KMC). You specify which character sets are to be integrated and which command sequences are to be in which macros.

If the macros are defined using the kit editor, you start the eDIP320 compiler using F5. This creates a file called DEMO.DF. If the display is connected to the PC, this file is automatically downloaded in the display's data flash memory.

You will find a detailed description of the programming of the macros together with examples in the ELECTRONIC ASSEMBLY LCD-Tools^{*)} help system.

WRITE PROTECTION FOR PROGRAMMED MACROS

You can use DIP switch # 6 and set to OFF position to prevent the programmed macros, images and fonts from being inadvertently overwritten. Re-programming the FLASH memory need to have the DIP switch #6 at ON.

STORING 256 IMAGES IN THE ON-BOARD FLASH PROM

To reduce the transmission times of the serial interface or to save storage space in the processor system, up to 256 images can be stored in internal FLASH PROM. They can be called using the "ESC U I" command via the serial interface or from within any macro. All the images can be used in the Windows .BMP format (monochrome or 16 colors). They can be created and edit using widely available software such as Windows Paint or Photoshop.

^{*)} full version is free available on web at <http://www.lcd-module.com/products/touch.html>

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

INTEGRATED FONTS

6 mono-spaced, 6 proportional character sets and 1 big numbers are built-in. Terminal mode will display mono-spaced fonts only. In graphics mode all fonts can be used accurate to the pixel. Imaging of proportional font is more beautiful. And it is space-saving (e.g. a narrow "i" do need less room as the fat "W").

Each character set can be used in graphics mode from normal up to 8-times height. Independently of the height, the width can also be increased two to eight times.

Each character can be positioned with **pixel accuracy**. Text and graphics can be combined as required. Several different font sizes can also be displayed together.

Font		Char. height	Lines x chars.	Size in pixels	ASCII area	Note
No.	Name					
1	FONT4x6	2.1 mm	40 x 80	4 x 6	32 - 158	micro size, mono-spaced
2	FONT5x6	2.1 mm	40 x 64	5 x 6	32 - 158	mini size, mono-spaced
3	FONT6x8	2.8 mm	30 x 53	6 x 8	32 - 255	extended ASCII code without frame symbols (176-223) mono-spaced
4	FONT8x8	2.8 mm	30 x 40	8 x 8	32 - 255	
5	FONT7x12	4.3 mm	20 x 45	7 x 12	32 - 255	
6	FONT8x16	5.7 mm	15 x 40	8 x 16	32 - 255	
7 : 16						10 free definable character sets
17	GENEVA12	4.3 mm	20 x 32>	<10 x 12	32 - 168	Geneva, proportional
18	CHICAGO16	5.7 mm	15 x 26>	<12 x 16	32 - 168	Chicago, proportional
19	TIMES20	7.2 mm	12 x 17>	<18 x 20	32 - 168	Times, proportional
20	TIMES26	9.3 mm	9 x 13>	<24 x 26	32 - 168	
21	SWISS28	10.0 mm	8 x 11>	<27 x 28	32 - 168	Swiss, proportional
22	SWISS38	13.6 mm	6 x 10>	<33 x 38	32 - 168	
23	BIGZIF57	20.5 mm	4 x 8>	<37 x 57	43 - 58	Big numbers '0'-'9' and '+,-,:'

Each text can be output left justified, right justified or centered. 90° rotation (for vertical installation of the display) is also possible.

EXTERNAL FONTS

Macro programming permits the inclusion of up to 10 additional fonts (7..16) and the complete redesign of the individual characters. Via text editor you are able to create and program in any font you like with a size of up to 256x240 pixels. These fonts will be stored into display-FLASH with *K320COMP.EXE* software.

STRING PARAMETER

Within a character string color and attribute may be changed locally. This does not affect global definition (ESC FZ). Command will start with '\ ' (backslash) followed by a capital character from table besides.

Please find all options at right table.

Color and attribute within a string			
CMD	Note	CMD	Note
	New line	V0	Color 0: Black
@...@	Text between both '@' will blink invers (Text color and background color)	V1	Color 1: Blue
~...~	Text between both '~' will blink on/off (Text color and background color)	V2	Color 2: Red
	Character ' ' (pipe)	V3	Color 3: Green
@	Character '@' (at)	V4	Color 4: Magenta
~	Character '~'	V5	Color 5: Cyan
\	Character '\ (backslash)	V6	Color 6: Yellow
V	Attribute- and color for text (=default)	V7	Color 7: White
H	Attribute- and color for background	V8	Color 8: Dark gray
L	Attribute 0: Clear attribute	V9	Color 9: Orange
S	Attribute 16: SOLID (non invertible)	VA	Color 10: Pink
I	Attribute 32: blink INVERS	VB	Color 11:
O	Attribute 48: blink ON/OFF	VC	Color 12:
		VD	Color 13: Yellow/green
		VE	Color 14: Light blue
		VF	Color 15: Light gray
		VT	Color 64: Transparent

ELECTRONIC ASSEMBLY

CHARACTER SET

Below are shown the built-in character sets.

+ Lower Upper	\$0 (0)	\$1 (1)	\$2 (2)	\$3 (3)	\$4 (4)	\$5 (5)	\$6 (6)	\$7 (7)	\$8 (8)	\$9 (9)	\$A (10)	\$B (11)	\$C (12)	\$D (13)	\$E (14)	\$F (15)
\$20 (dez: 32)		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
\$30 (dez: 48)	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
\$40 (dez: 64)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
\$50 (dez: 80)	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
\$60 (dez: 96)	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
\$70 (dez: 112)	p	q	r	s	t	u	v	w	x	y	z	{		}	~	Δ
\$80 (dez: 128)	€	ü	é	â	ä	à	ã	ç	ê	ë	è	ï	î	ì	ñ	ñ
\$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	ö	ü	ç	£	¥	β	f
\$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	á	o	¿	¬	½	¼	i	«	»	
\$B0 (dez: 176)																
\$C0 (dez: 192)																
\$D0 (dez: 208)																
\$E0 (dez: 224)	α	β	Γ	π	Σ	σ	μ	τ	Ϛ	θ	Ω	δ	φ	Φ	Ε	Π
\$F0 (dez: 240)	≡	±	≥	≤	∫	J	÷	≈	°	•	.	√	∞	²	³	-

ASCII codes for monospaced fonts 1 and 2

+ Lower Upper	\$0 (0)	\$1 (1)	\$2 (2)	\$3 (3)	\$4 (4)	\$5 (5)	\$6 (6)	\$7 (7)	\$8 (8)	\$9 (9)	\$A (10)	\$B (11)	\$C (12)	\$D (13)	\$E (14)	\$F (15)
\$20 (dez: 32)		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
\$30 (dez: 48)	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
\$40 (dez: 64)	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
\$50 (dez: 80)	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
\$60 (dez: 96)	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
\$70 (dez: 112)	p	q	r	s	t	u	v	w	x	y	z	{		}	~	Δ
\$80 (dez: 128)	€	ü	é	â	ä	à	ã	ç	ê	ë	è	ï	î	ì	ñ	ñ
\$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	ö	ü	ç	£	¥	β	f
\$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	á	o	¿	¬	½	¼	i	«	»	
\$B0 (dez: 176)																
\$C0 (dez: 192)																
\$D0 (dez: 208)																
\$E0 (dez: 224)	α	β	Γ	π	Σ	σ	μ	τ	Ϛ	θ	Ω	δ	φ	Φ	Ε	Π
\$F0 (dez: 240)	≡	±	≥	≤	∫	J	÷	≈	°	•	.	√	∞	²	³	-

ASCII codes for monospaced fonts 3 - 6

TYPING EXAMPLE

This hardcopy shows all 13 built-in fonts



+ Lower Upper	\$0 (0)	\$1 (1)	\$2 (2)	\$3 (3)	\$4 (4)	\$5 (5)	\$6 (6)	\$7 (7)	\$8 (8)	\$9 (9)	\$A (10)	\$B (11)	\$C (12)	\$D (13)	\$E (14)	\$F (15)
\$20 (dez: 32)		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
\$30 (dez: 48)	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
\$40 (dez: 64)	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
\$50 (dez: 80)	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
\$60 (dez: 96)	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
\$70 (dez: 112)	p	q	r	s	t	u	v	w	x	y	z	{		}	~	Δ
\$80 (dez: 128)	€	ü	é	â	ä	à	ã	ç	ê	ë	è	ï	î	ì	ñ	ñ
\$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	ö	ü	ç	£	¥	β	f
\$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	á	o	¿	¬	½	¼	i	«	»	
\$B0 (dez: 176)																
\$C0 (dez: 192)																
\$D0 (dez: 208)																
\$E0 (dez: 224)		β														
\$F0 (dez: 240)									o							

ASCII codes for proportional fonts 17 - 22

+ Lower Upper	\$0 (0)	\$1 (1)	\$2 (2)	\$3 (3)	\$4 (4)	\$5 (5)	\$6 (6)	\$7 (7)	\$8 (8)	\$9 (9)	\$A (10)	\$B (11)	\$C (12)	\$D (13)	\$E (14)	\$F (15)
\$20 (dez: 32)												+	,	-	.	
\$30 (dez: 48)	0	1	2	3	4	5	6	7	8	9	:					

ASCII codes for font 23 (BigZif57)

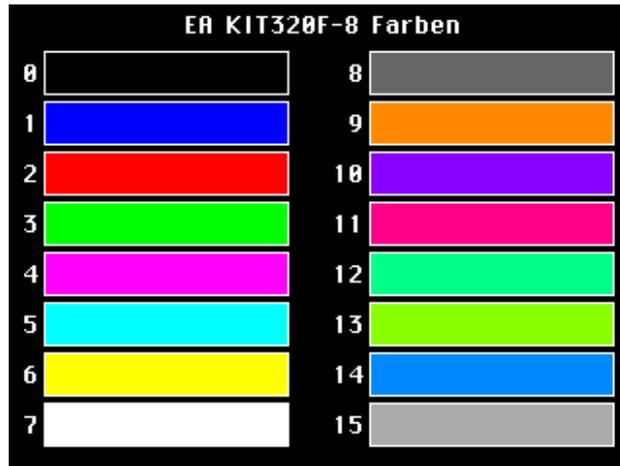
EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

COLORS

EA KIT320F-8 is able to work with 16 colors (0..15) used for text and graphic output functions. Color no. 64=transparent is special and can be used for background of character e.g. That means that for placing a character no rectangular field will be deleted around the character itself.

The senseless combination of transparent background and transparent foreground is used to invert all dots (=complementary). Two times inverted will end same as action was started (original drawing is restored).



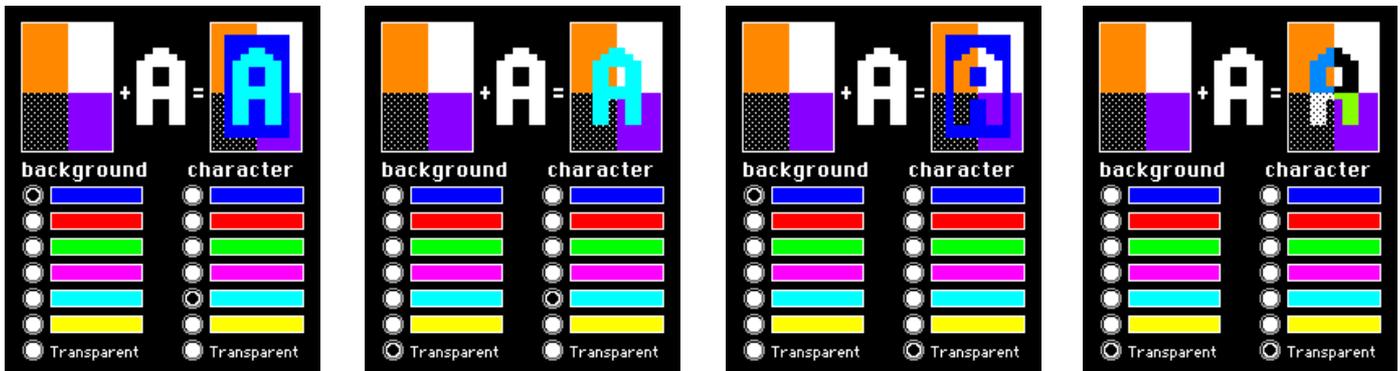
Colors	
No	Name
0	Black
1	Blue
2	Red
3	Green
4	Magenta
5	Cyan
6	Yellow
7	White
8	Dark Gray
9	Orange
10	Pink
11	
12	
13	Yellow/Green
14	Light Blue
15	Light Gray
64	Transparent

COLORATTRIBUTES

There are 3 different attributes for all colors. Just add attribute value to color value. Please note that only one attribute can be added to color value!

Color attributes (add to color value)		
Value	Name	Description
+ 0	no attribute	
+ 16	SOLID	Color will never be inverted
+ 32	BLINKINVERS	Color will blink invers. Color for invers will be set by command 'ESC QE'
+ 48	BLINKONOFF	color will blink ON/OFF. Color for OFF will be set by command 'ESC QF'

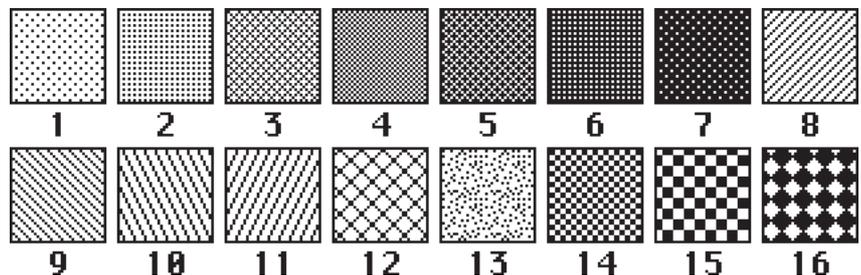
Please find below some examples to write the letter "A" onto a fixed background:



PATTERN

A pattern type (pat = 1..16) can be set as a parameter with some commands. In this way, rectangular areas, bar graphs and even texts can be linked to different patterns and displayed.

Some more own pattern can be defined via text editor and flashed by KITcomp.exe



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EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

PARAMETERS

The graphics kit can be programmed by means of various integrated commands. Each command begins with ESC followed by one or two command letters and then some parameters. There are two ways to encode parameters:

1. ASCII Mode

- Escape code is '#' (hex: \$23, dez: 35).
- Command letter will follow directly.
- Parameter will be expected as ASCII codes with separation like ','
- Strings (text) will be transmitted without any question mark " but terminated by CR (hex: \$0D) or LF (hex: \$0A).

2. Binäry Mode

- Escape code is ESC (hex: \$1B, dez: 27).
- Command letter will follow directly.
- Coordinates xx and yy will follow binary (16 bit, starting with LOW byte and then HIGH byte).
- All other parameter are binary 8 bit.
- Strings (text) will be put between two question marks " and terminated by CR (hex: \$0D) or LF (hex: \$0A) or NUL (hex:\$00)

In binary mode there must be no separation codes like ',', ' ' or ';'. Commands do not need any **terminating byte** like Carrige Return (except "place a string": \$00).

PROGRAMMING EXAMPLE

The following table shows an example in which the string "Test" is output left justified at coordinate 117 / 32.

Example	Codes can be output in ASCII mode	
for terminal.exe	#ZL117, 32,Test	<Return>
for Turbo-Pascal	write(aux, '#ZL117, 32,Test', chr(13));	
for 'C'	fprintf(stdaux, "#ZL%d,%d,%s\x0D", 117, 32, "Test");	
for Q-Basic	OPEN "COM1:9600,N,8,1,BIN" FOR RANDOM AS #1 PRINT #1,"#ZL117,32,Test"+CHR\$(13)	

Example	Codes can be output in binary mode											
in ASCII	ESC	Z	L	u	NUL	space	NUL	T	e	s	t	NUL
in Hex	\$1B	\$5A	\$4C	\$75	\$00	\$20	\$00	\$54	\$65	\$73	\$74	\$00
in Decimal	27	90	76	117	0	32	0	84	101	115	116	0
for Turbo-Pascal	write(aux, chr(27), 'Z', 'L', chr(117), chr(0), chr(32), chr(0), 'Test', chr(0));											
for 'C'	fprintf(stdaux, "\x1BZL%c%c%c%c%c%s\x00", 117, 0, 32, 0, "Test");											
for Q-Basic	OPEN "COM1:9600,N,8,1,BIN" FOR RANDOM AS #1 PRINT #1,CHR\$(27)+"ZL"+CHR\$(117)+CHR\$(0)+CHR\$(32)+CHR\$(0)+"Test"+CHR\$(0)											

COLOR EA KIT320F-8

ELECTRONIC ASSEMBLY

TERMINAL MODE

After power-on a cursor flashes at the top left corner and display is ready to receive some data. All ASCII codes will be displays with terminal function (excetion: CR,LF,FF,ESC,'#'). Linefeed will be done automatically or by command 'LF' (\$0A). If terminal window is full, text will scroll. Code 'FF' (Formfeed, \$0C) clears window and places cursor to the top left.

Size of window can be set by command 'ESC TW'.

Attention: Graphic commands are able to draw inside terminal window. For example 'ESC DL' will delete terminal window, too.

Character '#' will be used as Escape code and cannot be displayed direct in terminal mode. To show this code, just send it double like '##'.

EA KIT320F-8: Command table for terminal mode										nach Reset	
Command	Codes					Remarks					
Commands for terminal mode											
FF: Form feed (dec:12)	^L					The contents of the terminal area are deleted and the cursor is placed at pos. (1,1)					
CR: carriage return (d:13)	^M					Cursor to the beginning of the line on the extreme left					
LF: line feed (dec:10)	^J					Cursor is set to the next line					
Position cursor	ESC	T	P	n1	n2	n1=column; n2=line; origin upper-left corner (1,1)				1,1	
Save cursor position			S			saves current cursor position					
Restore cursor position			R			places cursor to saved position					
Cursor on/off			C	n1			n1=0: Cursor is invisible; n1=1: Cursor flashes;				1
Terminal mode			M	n1			n1=0: Clear mode; n1=1: Overwrite mode; n1=2: Scroll mode				2
Autom. line feed			Z	n1			The automatic line feed is switched on (n1=1) or off (n1=0)				1
Terminal invisible			A				Terminal display not visible; outputs continue to be executed				
Terminal visible			E				Terminal display is visible again;				On
Redirect terminal outputs											
Suppress terminal	ESC	T	N			ASCII characters,FF,CR,LF are suppressed. Commands (ESC T) are executed					
Terminal output internal			I			All terminal outputs/commands affect the internal terminal of the EA KIT320F-8				Intern	
Terminal output external			X			All terminal outputs/commands affect the external dot-matrix module					
Settings for the internal terminal											
Set terminal color	ESC	F	T	fg	bg	Preset color for terminal mode: fg= foreground color; bg= background color				7 / 0	
Set font			F	no		Set font no=1..6 for terminal mode (monospaced fonts only)				5	
Add. line spacing			Y	n1			n1 pixels are defined additionally for the current font as the line spacing				
Define window	ESC	T	W	xx1	yy1	xx2	yy2	w	The terminal output is executed only within the window from xx1,yy1 (=upper-left corner) to xx2,yy2 (=lower-right corner); xx=0..319; yy=0..239; w=angle (0=0°; 1=90°; 2=180°; 3=270°) of the terminal display	0, 31 0, 239	
Settings for the external dot-matrix module (optionally to J6 or J7)											
Initialize dot-matrix module	ESC	T	D	n1	n2	Initialize an external dot-matrix display (HD44780 compatible) - n1 = number of characters; n2 = number of lines					

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

ALL COMMANDS AT A GLANCE

The following command tables will give an overview of all built-in functions of EA KIT320F-8. After power-on or reset, some functions are set to a particular value (see last column 'After reset' in table). Please note that all the settings can be overwritten by creating a power-on macro.

EA KIT320F-8: Command table 1							After reset		
Command	Codes		Remarks						
Display commands (effect on the entire display)									
Set display color	ESC	F	D	fg	bg	Defines color for display and areas: fg=foreground color; bg=background color	7		
Delete display	ESC	D	L	Delete display contents (all pixels to background color)					
Fill display			S	Fill display contents (all pixels to foreground color)					
Fill display with color			F	co	Fill complete display content with color co				
Invert display			I	Invert display content (all colors without SOLID attribute)					
Switch display off			A	Display contents become invisible but are retained, commands continue to be possible					
Switch display on			E	Display contents become visible again			On		
Display update			U	n1	n1=0: Display outputs are no longer visible (but continue to be executed) n1=1: Display outputs are visible immediately n1=2: Refresh display contents (previous outputs become visible)			1	
Rechteckige Bereiche verändern / zeichnen									
Delete area	ESC	R	L	xx1	yy1	xx2 yy2	Delete an area from xx1,yy1 to xx2,yy2 (fill with background color)		
Fill area			S	xx1	yy1	xx2 yy2	Fill an area from xx1,yy1 to xx2,yy2 (fill with foreground color)		
Fill area with color			F	xx1	yy1	xx2 yy2	co	Fill an area from xx1,yy1 to xx2,yy2 with color co	
Invert area			I	xx1	yy1	xx2 yy2		Invert an area from xx1,yy1 to xx2,yy2 (all colors except those with SOLID attribute)	
Area with fill pattern			M	xx1	yy1	xx2 yy2	n1	Draw an area from xx1,yy1 to xx2,yy2 with pattern n1 (uses display colors)	
Set colors for box comand	ESC	F	O	fg	bg	fc	fg=foreground color; bg=pattern and background color; fc=color for frame	7,0,7	
Draw box	ESC	R	O	xx1	yy1	xx2 yy2	n1	Draw a rectangle xx1,yy1 to xx2,yy2 with fill pattern n1	
Set color for frame	ESC	F	R	f1	f2	f3	f4	Frame segments: f1=edges; f2=frame outside; f3=frame inside; f4=filling	7070
Draw frame box	ESC	R	T	xx1	yy1	xx2 yy2	n1	Draw a frame box of the type n1 from xx1,yy1 to xx2,yy2	
Draw straight lines and points									
Set color for lines	ESC	F	G	fg	bg		Colors: fg = color for line; bg = pattern background	7,64	
Draw rectangle	ESC	G	R	xx1	yy1	xx2 yy2		Draw four straight lines as a rectangle from xx1,yy1 to xx2,yy2	
Draw straight line			D	xx1	yy1	xx2 yy2		Draw straight line from xx1,yy1 to xx2,yy2	
Continue straight line			W	xx1	yy1			Draw a straight line from last end point to xx1, yy1	0
Draw point			P	xx1	yy1			Set one point at coordinates xx1, yy1	
Point size/line thickness			Z	n1	n2			n1 = X point size (1..15); n2 = Y point size (1..15);	1,1
Pattern			M	n1				Set straight line/point pattern no. n1; 0 = do not use pattern	0
Comands for outputting strings									
Set text color	ESC	F	Z	fg	bg		Color for string and character: fg = text color; bg = background color	7	
Output string L: left justified, C: centered R: right justified	ESC	Z	L	text			NUL	A string (...) is output to xx1,yy1. 'NUL' (\$00), 'LF' (\$0A) or 'CR' (\$0D) = end of string; several lines are separated by the character ' ' (\$7C); text between two '-' (\$7E) characters flashes on/off; text between two '@' (\$40) characters flashes inversely;	
Set font			F	n1	Set font with the number n1 (1..23)				5
Font zoom factor			Z	n1	n2	n1 = X zoom factor (1x..8x); n2 = Y zoom factor (1x..8x)			1,1
Add. line spacing			Y	n1	Insert n1 pixels between two lines of text as additional line spacing				
Text angle			W	n1	Text output angle: n1=0: 0°; n1=1: 90°; n1=2: 180°; n1=3: 270°;				0
Text pattern	M	n1	Link text with pattern no. n1; 0 = do not link text with pattern				0		
String for terminal	ESC	Z	T	text ...			Command for outputting a string in a macro to the terminal		
Bitmap image commands									
Load image	ESC	U	L	xx1	yy1	data ...	Load an image to xx1,yy1; see EA DISK320F for image structure and image data, use BMP2BH7.EXE to convert from *.BMP		
Load internal image			I	xx1	yy1	no	Load internal image with the no. (0..255) from FLASH-PROM to xx1,yy1		
Send hard copy			H	A full image is requested in Windows BMP format. The image header is sent first via RS232, followed by the actual image data (77878 bytes).					
Commands for monochrome bitmaps									
Set bitmap colors	ESC	F	U	fg	bg		painting color for monochrome bitmaps fg = foreground color; bg = background color	7,0	
Image zoom factor	ESC	U	Z	n1	n2		n1 = X zoom factor (1x..8x); n2 = Y zoom factor (1x..8x)	1,1	
Image angle			W	n1	Output angle: n1=0: 0°; n1=1: 90°; n1=2: 180°; n1=3: 270°;			0	
Image pattern			M	n1	Link image with pattern no. n1; 0 = do not link image with pattern			0	
Commands for colored bitmaps (16 colors)									
Attribut for colored bitmap	ESC	U	A	n1	n1=0 no attribute for colored bitmaps; n1=16 bitmap is non invertable (SOLID) n1=32 itmap is blinking On/Off; n1=48 bitmap is blinking invers			16	
Set color palette			P	n1	n1=0: no palette will be used; colors are internal 0..15 like defined on page 13 3 different palettes n1=1..3 can be used for 3 bitmaps with individual palettes			1	
Transparency for bitmap			T	n1	n1=0 show picture with all 16 colors (rectangular); n1=1 color of the first dot at top left side will be defined as transparent (like a mask)			0	

COLOR EA KIT320F-8

ELECTRONIC ASSEMBLY

EA KIT320F-8: Command table 2										After reset				
Command	Codes		Remarks											
Bar graph commands														
Set color for bargraph	ESC	F	B	fg	bg	fc	colors: fg = foreground; bg = background; fc = color for frame				7,0,7			
Define bar graph			R L O U	n1	xx1	yy1	xx2	yy2	sv	ev	Typ.	pat	Define bar graph to L(ef), R(ight), O(ben) (up), U(nten) (down) with the "nr" n1. xx1,yy1,xx2,yy2 form the rectangle enclosing the bar graph. sv, ev are the values for 0% and 100%. Type=0: bar; type=1: bar in rectangle; pat=bar pattern type=2: line; type=3: line in rectangle; pat= line width	No bar define
Update bar graph	ESC	B	A	no	valu	Set and draw the bar graph with the number no to the new user "value."								
Draw new bar graph			Z	no	Draw the bar graph with the number no completely									
Send bar graph value			S	no	Send the current value of bar graph no.on the serial interface									
Delete bargraph			D	n1	n2	Undefine bargraph no. n1. If bargraph was defined as an analogue touch input, even this touch field will be cleared n2=0: Bar keeps visible; n2=1: Bar will be overwritten with background color								
Clipboard commands (buffer for image areas)														
Select clipboard no.			N	no	2 clipboards are available, the current clipboard is selected with no=(1,2).					1,blan				
Save display contents			B	The entire contents of the display are copied to the clipboard as an image area										
Save area			S	xx1	yy1	xx2	yy2	The image area from xx1,yy1 to xx2,yy2 is copied to the clipboard						
Restore area			R	The image area on the clipboard is copied back its original position in the display										
Copy area			K	xx1	yy1	The image area on the clipboard is copied to xx1,yy1 in the display								
Restore color palette			P	n1	n1=0: palette will not be resored n1=1: palette will always be restored n1=2: palette will be resored for full bitmap (320x240 dots) only					2				
Flashing area commands / attributes														
Flashing time			Z	n1	Set the flashing time n1= 1..15 in 1/10s; 0=deactivate flashing function					6				
Blink attribute On / Off			O	xx1	yy1	xx2	yy2	Set blink area (on/off) for xx1,yy1 to xx2,yy2 (Attribute BLINKONOFF)						
Blink color for Off			F	bg	Set background color for on/off blinking									
Blink attribute inverting			I	xx1	yy1	xx2	yy2	Set blink area (invers) for xx1,yy1 to xx2,yy2 (Attribute BLINKINVERS)						
Blink color for inverting			E	c1	c2	color c1=0..15 will be defined as inverting color c2=0..15								
Attribute solid			S	xx1	yy1	xx2	yy2	Set fixed area xx1,yy1 to xx2,yy2 which will not be inverted (Attribute SOLID)						
Clear attributes			L	xx1	yy1	xx2	yy2	Clears all attributes BLINKONOFF, BLINKINVERS and SOLID for xx1,yy1 to xx2,yy2						
Rotate palette			R	f1	f2	n1	n2	Color numbers from f1 to f2 (=0..15) within palette n1=0..3 will rotate with n2/10sec. speed (n2=0: stop rotation). Rotation will be done for colors with attribute SOLID only						
Menu/pop-up commands														
Set colors for menu	ESC	F	N	fg	bg	fc	fg = foreground; bg = background; fc = color for frame				7,0,7			
Set menu font			F	no	Set font with the number no (1..23) for menu display					5				
Menu font zoom factor			Z	n1	n2	n1 = X zoom factor (1x..8x); n2 = Y zoom factor (1x..8x)					1,1			
Add. line spacing			Y	n1	insert n1 pixels between two menu items as additional line spacing									
Menu angle	ESC	N	W	n1	Menu display angle: n1=0: 0°; n1=1: 90°; n1=2: 180°; n1=3: 270°;					0				
Automatic function for touch menu			T	n1	n1=1: touch menu will open automatically; n1=0: touch menu will not open automatically but 'ESC T 0' will be sent via RS-232/422 to host; afre that touch menu can be opened with command 'ESC N T 2'					1				
Menu/pop-up commands (not for touch-controlled menu)														
Define menu and display			D	xx1	yy1	no	text	...	NUL	A menu is drawn as of the corner xx1,yy1 with the current menu font. no: currently inverted entry (e.g.: 1 = 1st entry) Text:= string with menu items. The different items are separated by the character ' ' (\$7C,dec:124) (e.g. "item1 item2 item3"). The background of the menu is saved automatically. If a menu is already defined, it is automatically canceled+deleted				
Next item	ESC	N	N	The next item is inverted or remains at the end										
Previous item			P	The previous item is inverted or remains at the beginning										
End of menu/send			S	The menu is removed from the display and replaced with the original background. The current item is sent as a number (1..n) (0=no menu displayed)										
End of menu/macro			M	n1	The menu is removed from the display and replaced with the original background. Menu macro n1 is called for item 1, menu macro nr+1 for entry 2, and so on									
End of menu/cancel			A	The menu is removed from the display and replaced with the original background										

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

COMMANDS FOR TOUCH PANEL SUPPORT

EA KIT320F-8: Commands for the touch panel											After reset			
Command	Codes		Remarks											
Touch: Define areas														
Define touch key (key remains depressed as long as there is contact)	ESC	A	C	f1	f2	dow code	up code	text ...	NUL		'C': The touch fields f1 to f2 are defined for a key. 'T': The area from xx1,yy1 to xx2,yy2 is defined as a key. 'U': Image no=1..255 is loaded to xx1,yy2 and defined as a key. 'down code':(1-255) Return/touch macro when key pressed. 'up code': (1-255) Return/touch macro when key released. (down/up code = 0 press/release not reported). 'text': A string that is centered with the current touch font in the touch key follows; multiline text is separated with the character ' ' (\$7C, dec: 124; 'NUL': (\$00) = end of string			
			T	xx1	yy1	xx2	yy2	dow code	up code	text ...	NUL			
			U	xx1	yy1	no	dow code	up code	text ...	NUL				
Define touch switch (status of the switch toggles after each contact on/off)	ESC	A	G	f1	f2	dow code	up code	text ...	NUL		'G': The touch fields f1 to f2 are defined for a switch. 'K': The area from xx1,yy1 to xx2,yy2 is defined as a switch. 'J': Image no. n1 is loaded to xx1,yy2 and defined as a switch. 'down code': (1-255) Return/touch macro when switched on. 'up code': (1-255) Return/touch macro when switched off. (down/up code = 0 on/off not reported). 'text': A string that is centered with the current touch font in the touch key follows; multiline text is separated with the character ' ' (\$7C, dec: 124; 'NUL': (\$00) = end of string			
			K	xx1	yy1	xx2	yy2	dow code	up code	text ...	NUL			
			J	xx1	yy1	n1	dow code	up code	text ...	NUL				
Define touch key with menu function	ESC	A	M	xx1	yy1	xx2	yy2	dow code	up code	mnu code	text ...	NUL	The area from xx1,yy1 to xx2,yy2 is defined as a menu key. 'down code':(1-255) Return/touch macro when pressed. 'up Code':(1-255) Return/touch macro when menu canceled 'mnu Code':(1-255) Return/menu macro+(item no. 1) after selection of a menu item. (down/up code = 0 activation/cancellation of the menu not reported). 'text':= string with the menu key text and the menu items. The different items are separated by the character ' ' (\$7C,dec:124) (e.g. "key item1 item2 item3". The key text is drawn with the current touch font and the menu items are drawn with the current menu font. The background of the menu is saved automatically.	
Define drawing area	ESC	A	D	xx1	yy1	xx2	yy2	n1	A drawing area is defined. You can then draw with a line width of n1 within the corner coordinates xx1,yy1 and xx2,yy2.					
Define free touch area	ESC	A	H	xx1	yy1	xx2	yy2	A freely usable touch area is defined. Touch actions (down, up and drag) within the corner coordinates xx1,yy1 and xx2,yy2 are sent via RS232./RS422						
Set bargraph by touch	ESC	A	B	no	The bar graph with the no=1..16 n1 is defined for input by touch panel.									
Touch: settings														
Set touch frame colors	ESC	F	E	f1	f2	f3	f4	f1=edges; f2=frame outside; f3=frame inside; f4=filling						
Touch frame			E	n1	The frame type for the display of touch keys/switches is set with n1						1			
Touch key response			I	n1	Automatic inversion when touch key touched: n1=0=OFF; n1=1=ON;						1			
Invert touch key			S	n1	Tone sounds briefly when a touch key is touched: n1=0=OFF; n1=1=ON						1			
Query touch switch			N	Cod	The touch key with the assigned return code is inverted manually									
Set touch switch			X	Cod	The status of the switch (off=0; on=1) is sent via the serial interface.									
Define radiogroup	ESC	A	P	Cod	n1	The status of the switch is changed by means of a command n1=0=off; n1=1=on. Within a group only one single switch will be active; ret of them will be deactivated n1=0: next switch definitions will keep free of all groups n1=1..255: next switch definitions will join to goup no. n1					0			
Delete touch area			R	n1										
			L	Cod	n1	The touch area with the return code (code=0: all touch areas) is removed from the touch query. When n1=0, the area remains visible on the display; when n1=1, the area is deleted from the display.								
			V	xx1	yy1	n1	Remove a special touch area xx1,yy1 from touch query; n1=0: area stys visible; n1=1: areawill be overwritten with background color							
Send bar value on/off			Q	n1	Automatic transmission of a new bar graph value by touch input is deactivated (n1=0) or activated (n1=1)						1			
Touch query on/off			A	n1	Touch query is deactivated (n1=0) or activated (n1=1)						1			
Touch: Label font														
Font color	ESC	F	A	fg	bg	Color for touch labeling. fg=foreground; bg=background color					fg=7 bg=0			
Label font			F	no	Set font with the number no=1..23 for touch key label						5			
Label zoom factor	ESC	A	Z	n1	n2	n1 = X zoom factor (1x..8x); n2 = Y zoom factor (1x..8x)					1,1			
Add. line spacing			Y	n1	Insert n1 pixels between two lines of text as additional line spacing									
Label angle			W	n1	Text output angle: n1=0: 0°; n1=1: 90°; n1=2: 180°; n1=3: 270°;						0			

COLOR EA KIT320F-8

ELECTRONIC ASSEMBLY

COMMANDS FOR MACRO, PORT AND MISCELLANEOUS

EA KIT320F-8: Commands for Macro, Port and Misc										after Reset		
Command	Codes				Remarks							
Macro commands												
Run macro	ESC	M	N	no	Call the (normal) macro with the number no (0..255) (max. 7 levels)							
Run touch macros			T	no	Call the touch macro with the number no (0..255) (max. 7 levels)							
Run port macro			P	no	Call the port macro with the number no (0..255) (max. 7 levels)							
Run bit macro			B	no	Call the bit macro with the number no (1..16) (max. 7 levels)							
Run menu macro			M	no	Call the menu macro with the number no (0..255) (max. 7 levels)							
Run matrix macro			X	no	Call the matrix macro with the number no (0..64) (max. 7 levels)							
Run analogue macro			V	no	Call the analogue macro with the number no (0..19) (max. 7 levels)							
Run process macro			C	no	Call the process macro with the number no (0..255) (max. 7 levels)							
Inhibit macro	ESC	M	L	type	n1	n2	Inhibit macro execution for type='N','T','P','B','M','X','V' or 'C' (type='A' alle types) will be inhibited from no. n1 to n2 (no longer executed)					
Enable macro			U	type	n1	n2	Enables macro execution for type='N','T','P','B','M','X','V' or 'C' (type='A' alle types) from no. n1 to n2					
Automatic (normal-) macro												
Macro execution with delay	ESC	M	G	no	n2	Normal macro with no=0..255 will be executed after n2/10sec. Execution will be interrupted by other commands (via RS-232./RS422 Touch-, Port-, Bit-, Matrix macro)						
Run autom. macros once			E	n1	n2	n3	Run all macros n1..n2 automatically one after another once; n3=pause in 1/10sec. steps. Execution will be interrupted by other commands (via RS-232./RS422 Touch-, Port-, Bit-, Matrix macro)					
Run autom. macro cyclical			A	n1	n2	n3	Run all macros n1..n2 automatically one after another cyclically; n3=pause in 1/10sec. steps. Execution will be interrupted by other commands (via RS-232./RS422 Touch-, Port-, Bit-, Matrix macro)					
Run auto. macro pingpong			J	n1	n2	n3	Run all macros n1..n2 automatically one after another (pingpong mode: e.g. n1,n2,n3,n4,n3,n2,n1,n2...); n3=pause in 1/10sec. steps. Execution will be interrupted by other commands (via RS-232./RS422 Touch-, Port-, Bit-, Matrix macro)					
Process macros												
Define process macro	ESC	M	D	no	type	n3	n4	zs	Define process macro no (no=1..16, 1=highest priority) All macros no. n3 to n4 will be started one after another with pause zs (1/10sec); type: 1=run oncel; 2=run cyclically; 3=run pingpong mode			
Set pause			Z	no	zs	Set new pause (zs/10 sec.) for macro pcess no (no=1..16). zs=0 will stop execution						
Stop process macro			S	n1	Stop all process macros with n1=0 gestoppt and restart with n1=1; important for some settings and outputs via RS-232/RS422 that may not be interrupted					1		
Port commands												
Write output port	ESC	Y	W	n1	n2	n1=0: Set all 8 output ports in accordance with n2 (=8-bit binary value) n1=1..8: Reset output port n1 (n2=0); set (n2=1); invert (n2=2)					Ports 1-8=0	
Read input port			R	n1	n1=0: Read all 8 input ports as 8-bit binary value n1=1..8: Read input port <n1> (1=H level=5V, 0=L level=0V)							
Port scan on/off			A	n1	The automatic scan of the input port is n1=0: deactivated; n1=1: activated					1		
Invert input port			I	n1	The input port is n1=0: normal; n1=1: evaluated inverted					0		
Matrix keyboard			M	n1	n2	n3	Specifies an external matrix keyboard at the inputs and outputs. n1=number of inputs (1..8); n2=number of outputs (0..8); n3= debouncing (0..7)					
Illumination on/off/half			L	n1	CFL/LED illumination n1=0: OFF; n1=1: ON; n1=2: half brightness;					1		
Beep on/off			S	n1	n1=1..255: Tone on for n1 1/10s					OFF		
Other commands												
Redefine color	ESC	F	P	n1	r16	g16	b16	Set RGB value (r16,g16,b16=0..15) for color no. n1=0..15				
Increase contrast	ESC	P	I	Increase contrast for 1 step (more bright)								
Decrease contrast			D	Decrease contrast for 1 step (more dark)								
Set contrast			S	n1	Set contrast to value n1=0..40							20
Wait (pause)	ESC	X	n1	Wait n1 tenths of a second before the next command is executed.								
Send bytes	ESC	S	B	num	data ...						num (=1..255) bytes are sent on the RS-232/RS-422 data ... = num bytes (e.g. control of an external serial printer)	
Send version			V	The software version no. + date is sent as a string on the RS-232/RS-422								
Commands to HD44780	ESC	L	B	num	data ...						num (=1..255) commands are sent to the ext. dot-matrix module with HD44780.	
Data to HD44780			D	num	data ...						num (=1..255) data is sent to the ext. dot-matrix module with HD44780.	
Read EEPROM	ESC	E	R	addr	num	data ...					num (=1..255) bytes are requested from the internal user EEPROM as of the address addr and sent via the RS-232/RS-422.	
Write EEPROM			W	addr	num	data ...						num (=1..255) bytes are written to the internal user EEPROM as of the address addr. data... = num bytes
Read I2C bus	ESC	I	R	addr	num	data ...					num (=1..255) bytes are requested from the block on the I2C bus with the device address addr and sent via the RS-232/RS-422.	
Write I2C bus			W	addr	num	data ...						num (=1..255) bytes are sent on the I2C bus for the block with the device address addr. data... = num bytes

EA KIT320F-8 COLOR

ELECTRONIC ASSEMBLY

COMMAND FOR ANALOGUE INPUTS

Table below shows functionality for analogue inputs AIN1 and AIN2. Range is 0..+250mV and resolution is 10 bit (like a 3 digit DVM).

EA KIT320F-8: Commands for analogue AIN1, AIN2											After reset			
Command	Codes				Remarks									
Commands for analogue inputs														
Enable/disable analogue-in	ESC V	A	n1			n1=0 disables input scan for AIN1 and AIN2; n1=1 enable input scan					1			
Send analog value		D	ch			Voltage [mV] will be sent for channel ch=1..2 via RS-232/RS-422								
Limit for analog macro		K	ch	n1	n2	n3	Sets limits for channel ch=1..2. n1 = lower limit [mV] n2 = upper limit [mV] n3 = hysteresis [mV]					0		
Bargraph for AIN1/AIN2	ESC V	R L O U	ch	n1	xx1	yy1	xx2	yy2	sv	ev	type	pat	Define bargraph for channel ch=1..2 to L(ef), R(ight), O(beh) (up), U(n)ten (down) with no. n1. xx1,yy1,xx2,yy2 form the rectangle enclosing the bar graph sv, ev are the values for 0% and 100% [mV]. Type=0: bar; type=1: bar in rectangle; pat=bar pattern type=2: line; type=3: define line in rectangle; pat= line width	no bar graph define
Redraw bargraph	ESC V	B	ch			redraw all bar graphs defined for channel ch=1..2								
Format text output														
Calibration	ESC V	@	ch	String	NUL		Calibration procedure is as follows: 1.) Apply defined voltage to AIN1 (channel1, ch=1) or AIN2 (channel2, ch=2) 2.) Run this command with channel information ch=1..2 and "String"; "String" are ASCII characters like e.g. "200.0"					nicht kalibriert		
Scaling		E	ch	Format String... NUL		Set scaling factor for channel ch=1..2. Assign 2 voltages (0..200mV) 2 numerical strings (max. 5 digits + decimal point + sign) Format String: mV1=voltage1;mV2=voltage2. 'NUL' (\$00) = termination Example: display for 200 mV input should be "-123.45" and "0.00" for 100mV Format String: "200=-123.45;100=0"					0=0; 200= 200.0			
Send string		S	ch			This will send current voltage as formatted string for channel ch=1..2 via RS-232/RS-422								
Display on terminal		T	ch			Show formatted string of channel ch=1..2 on terminal window								
Display on graphic layer	G	ch	xx1	yy1	Show formatted string of channel ch=1..2 at coordinate xx1,yy1									
String color	ESC F	V	ch	fg	bg		Set color for string output of channel ch=1..2; fg= foreground, bg= background color					7 / 0		
Font	ESC V	F	ch	n1		Set font n1 for channel ch=1..2					5			
Foom factor		Z	ch	n1	n2		Set zoom factor for channel ch=1..2. n1 = X zoom factor (1x..8x); n2 = Y zoom factor (1x..8x)					1,1		
Text pattern		M	ch	pat		Set fill-pattern for string of channel ch=1..2; pat= pattern no.; 0 = no pattern					0			
Text angle		W	ch	n1		Set writing angle for channel ch=1..2; n1=0: 0°; n1=1: 90°; n1=2: 180°; n1=3: 270°;					0			

COLOR EA KIT320F-8

ELECTRONIC ASSEMBLY

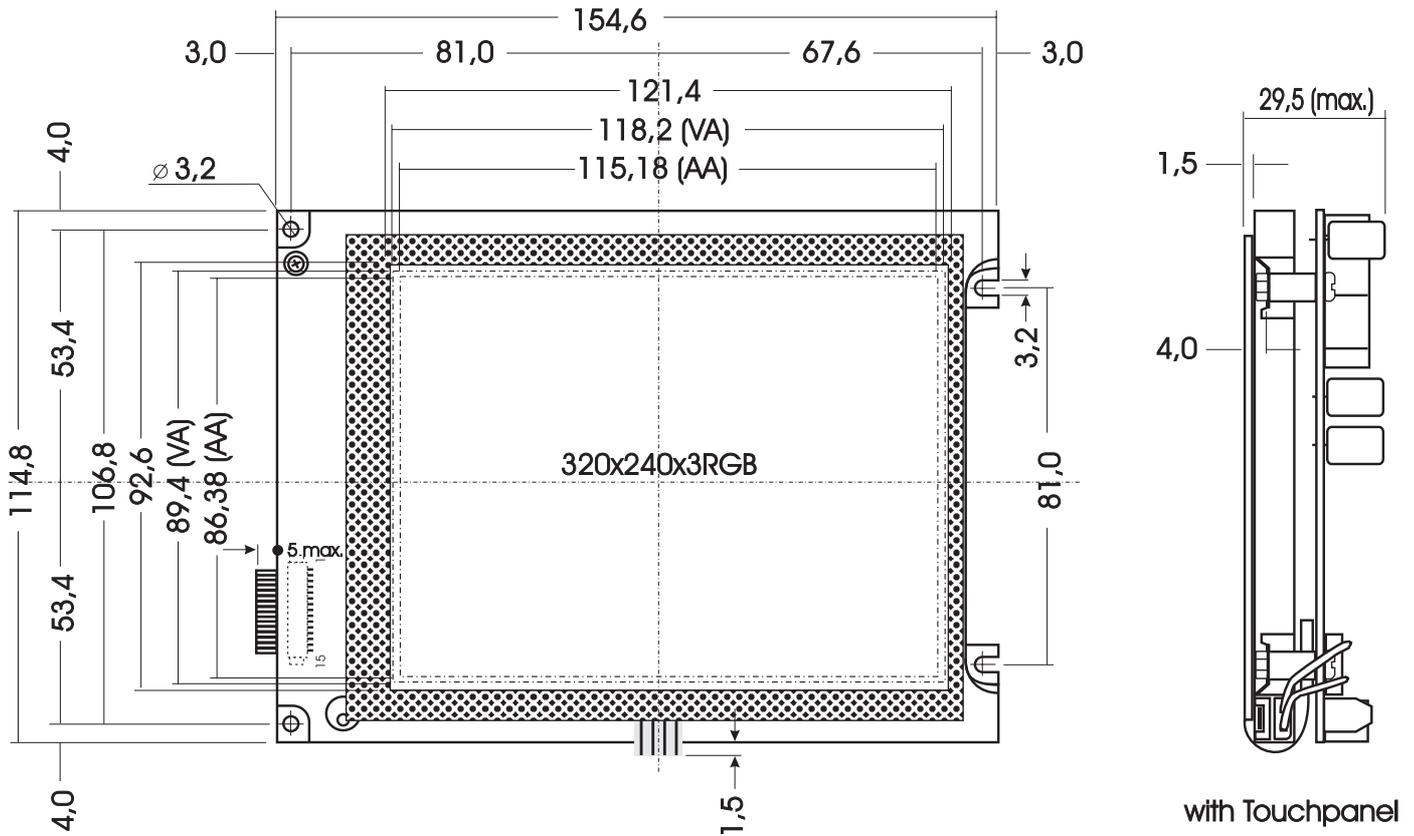
RESPONSE OF THE EA KIT320F-8 VIA SERIAL INTERFACE

The table below contains all response codes of EA KIT320F-8. Some response data will come automatically some others on request. In addition to that with command 'ESC SB ...' user is able to transmit individual data packages via RS-232/RS-422.

Responses of the EA KIT320F-8 via the serial interface														
Id		num	data				Remarks							
Automatic response from the KIT320														
ESC	A	1	code				Response from the analog touch panel when a key/switch is pressed. code = down or up code of the key/switch. Only transmitted if no corresponding touch macro is defined !							
ESC	N	1	code				After a menu item is selected by touch, the selected menu item code is transmitted. Only transmitted if no corresponding touch macro is defined !							
ESC	P	1	value				After the input port is changed, the new 8-bit value is transmitted. The automatic port scan must be activated. See the 'ESC Y A n1' command. It is only transmitted when there is no corresponding port macro defined !							
ESC	M	1	no				When a keystroke of the external matrix keyboard is detected, the newly pressed key number nr is transmitted. Only transmitted if no corresponding matrix macro is defined !							
ESC	B	2	no				value				When a bar graph is set by touch, the current value of the bar is transmitted with no. Transmission of the bar value must be activated (see the 'ESC A Q n1' command).			
ESC	T	0					When automatic-open-mode for menu function is disabled (via command 'ESC NT n1'), this request will be sent to host. Then it is necessary that host will open menu with command 'ESC NT 2'.							
ESC	H	5	Typ.	xLO	xHI	yLO	yHI	The following is transmitted in the case of a free touch area event: type=0 release; type=1 is touch; type=2 is drag within the free touch area at the x,y coordinates (16-bit values)						
Response only when requested by command														
ESC	N	1	no				After the 'ESC N S' command, the currently selected menu item is transmitted. no=0: no menu item is selected.							
ESC	B	2	no				value				After the 'ESC B S n1' command, the current value of the bar is transmitted with no.			
ESC	X	2	code				value				After the 'ESC A X' command, the current status of the touch switch is transmitted with code (the return code). value = 0 or 1			
ESC	Y	2	no				value				After the 'ESC Y R' command, the requested input port is transmitted. no=0: value is an 8-bit binary value of all 8 inputs. no=1..8: value is 0 or 1 depending on the status of the input no			
ESC	D	3	ch	LO-byt value	HI-byt value					After the 'ESC S D ch' command, the requested voltage of channel ch=1..2 will be sent (value = 0..2500 means 0..250mV)				
ESC	V	cnt	ch	scaled ASCII string ...							After the 'ESC V S ch' command, the requested voltage of channel ch=1..2 will be sent as scaled ASCII characters (length of string = cnt-1).			
ESC	E	num	data ...								After the 'ESC E R addr num' command, the requested bytes are transmitted from the user FLASH-PROM.			
ESC	I	num	data ...								After the 'ESC I R addr num' command, the requested bytes are transmitted from the I2C bus.			
Response without ESC and length specification (num)														
B	M	77,876 bytes of image data								After the 'ESC UH' command, 77,876 bytes bytes are transmitted (=320x240 BMP image with 256 colors). The first two bytes of the BMP image always begin with 'BM'				
E	A	String ..				NUL				After the 'ESC S V' command, the version of the KIT firmware is transmitted as a string (end code is the character NUL = \$00). The first two bytes of the string always begin with 'EA'				

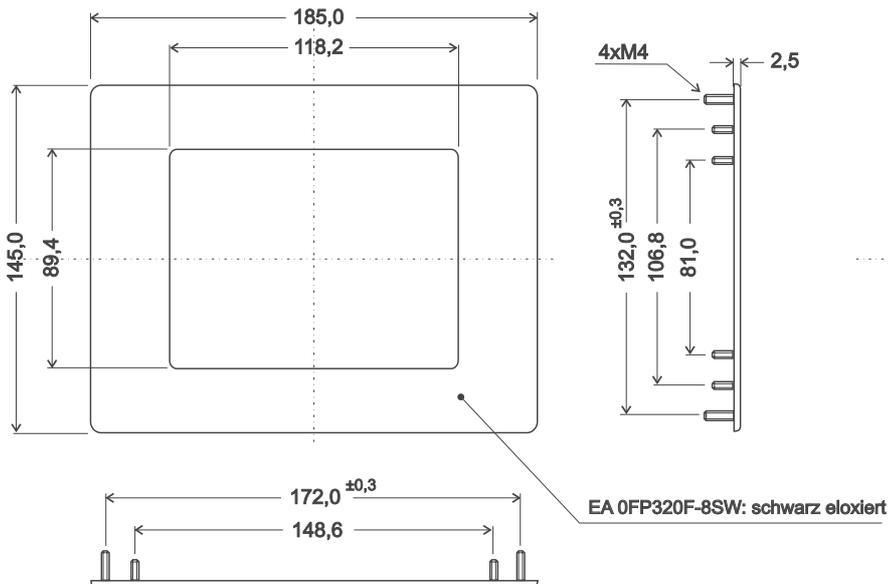
EA KIT320F-8 COLOR

DIMENSION



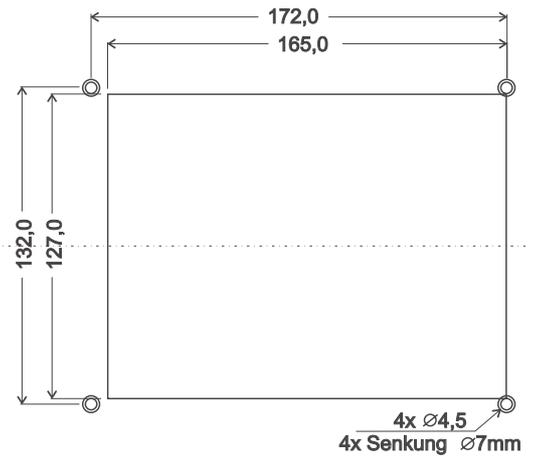
all dimensions are in mm

MOUNTING BEZEL EA 0FP320F-8SW



PANEL CUT OUT

(also good for blue/white version EA KIT320-8CTP)



all dimensions are in mm