EA eDIP240-7

embedded LCD-DISPLAY 240x128 WITH INTELLIGENCE

World first !

EA eDIP240B-7LWTP
Dim. 113x70x12mm

TECHNICAL DATA

* LCD GRAPHICS DISPLAY WITH A RANGE OF GRAPHICS FUNCTIONS
* 8 BUILT-IN FONTS
* FONT ZOOM FROM approx. 2mm TO approx. 50mm, also ROTATED BY 90°
* 3 DIFFERENT ONBOARD INTERFACES: RS-232, I²C BUS OR SPI BUS
* 240x128 PIXELSWITH LED BACKLIGHT, BLUE NEGATIVE OR
* BLACK&WHITE POSITIVE, FSTNTECHNOLOGY
* POWER SUPPLY +5V @ TYPICAL 70mA / 195mA (WITHOUT /WITH LED BACKLIGHT)
* POSITIONING**ACCURATE TOTHE PIXEL** WITH ALL FUNCTIONS
* STRAIGHT LINE, POINT, AREA, AND/OR/EXOR, BAR GRAPH...
* CLIPBOARD FUNCTIONS, PULL-DOWN MENUS
* UPTO 256 IMAGES STORABLE INTERNALLY
* UPTO 256 MACROS PROGRAMMABLE (32 kB EEPROM ONBOARD)
* COMBINATIONS OFTEXT AND GRAPHICS, FLASHING ATTRIBUTES: ON/OFF/ INVERTED FLASHING
* BACKLIGHT CAN BE SWITCHED BY SOFTWARE
* ANALOGTOUCH PANEL: VARIABLE GRID
* FREELY DEFINABLE KEYS AND SWITCHES

ORDER DESIGNATION

240x128 DOTS, WHITE LED BACKLIGHT, BLUE NEGATIVE	**EA eDIP240B-7LW**
AS ABOVE, BUTWITHTOUCH PANEL	**EA eDIP240B-7LWTP**
240x128 DOTS, WHITE LED BACKLIGHT, POSITIVE MODE, FSTN	**EA eDIP240J-7LW**
AS ABOVE, BUTWITHTOUCH PANEL	**EA EDIP240J-7LWTP**
PROGRAMMER FOR USB INCL. CABLE, CD FORWIN98/ME/2000/XP	**EA 9777-1USB**
STARTER KIT, (1 x EA eDIP240B-7LWTP + USB-PROGRAMMER + CD)	**EA START-eDIP240**

ELECTRONIC ASSEMBLY GMBH
making things easy

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Documentation of revision				
Date	**Type**	**Old**	**New**	**Reason / Description**
15.02.04	V1.0			Preliminary version
24.11.04	V1.1	- - Modulo 8	New Command Macro-Process #MD../#MZ../#MS.. Adaptor MAX232 circuit diagramm Modulo 256	new firmware - typing error in protocol description
18.01.05	V1.2	-	New Command Terminal-Cursor Save/Restore #TS/#TR New Command Bargraph send continous #AQ 2	new firmware

CONTENTS

GENERAL

EA eDIP240-7 is the world's first display with integrated intelligence! As well as a number of built-in fonts which can be used with pixel accuracy it also features a whole range of sophisticated graphics functions.
Supplied with 5V, the display is ready for operation immediately. It is controlled via one of the 3 integrated RS-232, SPI or I²C interfaces.
Graphics commands similar to high-level languages are used for programming. There is no longer any need for the time-consuming programming of character sets and graphics routines. The ease of use of this display with its touch panel reduces development time dramatically.

HARDWARE

The display is designed to work with an operating voltage of +5V. Data transfer is either serial and asynchronous using the RS-232 format or synchronous using the SPI or I²C specification. A simple protocol is used for all data transfer variants to improve data reliability.

ANALOGTOUCH PANEL

The EA eDIP240B-7LWTP and EA eDIP240J-7LWTP versions are equipped with an integrated touch panel. You can make entries and menu or bar graph 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 is handled by the integrated software.

LED BACKLIGHT, TYPES B AND J

Both displays in blue-and-white (B) and black-and-white (J) are equipped with a modern, low power consumption LED backlight. Whereas the black-and-white display can still be read even when the backlight is switched off completely, the blue-and-white display requires a minimum level of illumination to be legible. The backlight can be switched off with a software command and the brightness can be adjusted.
We recommend the black-and-white version for use in direct sunlight. For all other applications, we recommend the high-contrast, blue-and-white version.
Note that the LED backlight is subject to aging. That means switching off or dimming backlight is a must for 24-hour-applications.

SOFTWARE

The display is 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**. Flashing attributes can be assigned as often as you like – for graphics as well. Text and graphics can be combined at any time. Up to 16 different character sets can be used. Each one can be zoomed from 2 to 4 times. With the largest character set, the words and numbers displayed will fill the screen.

ACCESSORIES

Programmer for internal EEPROM (in preparation)
The display is supplied fully programmed with a complete set of fonts. The additional programmer is thus generally not required.
If, however, the internal character sets are to be modified or extended, or if images or macros are to be stored internally, the additional EA 9777-1USB-programmer, available as an accessory) will permanently write the data you create to the onboard EEPROM (32 kB).
The Programmer runs under Windows and is connected to the PC's USB interface. A power supply is not required, and an interface cable are supplied together with the programmer.

SPEZIFICATION AND CHARACTERISTICS

Characteristics					
Value	**Condition**	**min.**	**typ.**	**max.**	**Unit**
Operating Temperature		-20		+70	°C
Storage Temperature		-30		+80	°C
Storage Humidity	< 40°C			90	%RH
Operating Voltage		4.5	5.0	5.5	V
Input Low Voltage		-0.5		0.2*VDD	V
Input High Voltage	Pin Reset only	0.9*VDD		VDD+0.5	V
Input High Voltage	except Reset	0.6*VDD		VDD+0.5	V
Input Leakage Current	Pin MOSI only			1	uA
Input Pull-up Resistor		20		50	kOhms
Output Low Voltage				0.7	V
Output High Voltage		4.0			V
Output Current				20	mA
Current	Backlight off		30		mA
	Backlight on		180		mA
Lifetime for half brightness of backlight			20,000		hours

RS-232/RS-422 INTERFACE

Wiring the display as shown below selects the RS-232/RS-422 interface. The pin assignment is shown in the table on the right.

The RxD and TxD lines have a 5V CMOS line level. If “genuine” RS-232 levels are required (e.g. for direct connection to a PC), an external level converter such as the ICL232 is necessary.

Pinout eDIP240-7
RS-232 / RS-422 mode

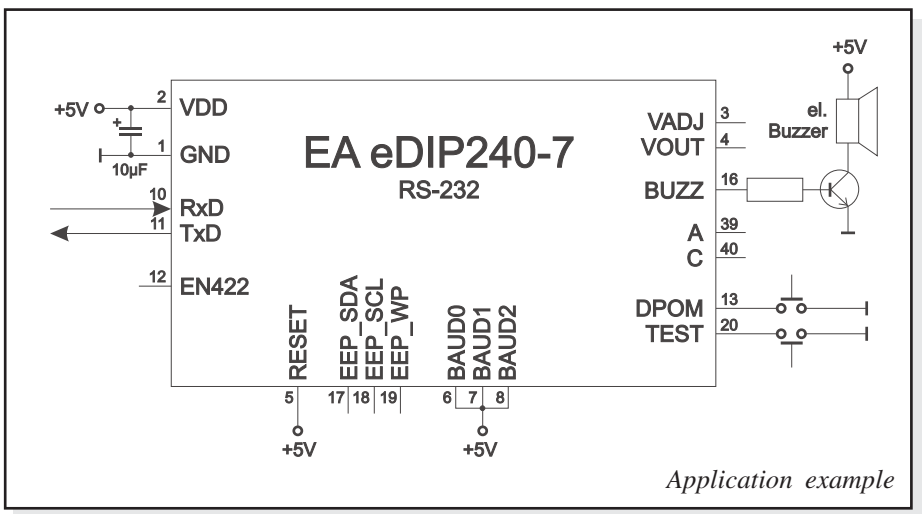
Pin	Symbol	In/Out	Function	Pin	Symbol	Function
1	GND	-	Ground Potential for logic (0V)	21	N.C.	not connected
2	VDD	-	Power supply for logic (+5V)	22	N.C.	not connected
3	VADJ	In	Operating voltage for LC driving (input)	23	N.C.	not connected
4	VOUT	Out	Output voltage for LC driving	24	N.C.	not connected
5	RESET	-	L: Reset	25	N.C.	not connected
6	BAUD0	In	Baud Rate 0	26	N.C.	not connected
7	BAUD1	In	Baud Rate 1	27	N.C.	not connected
8	BAUD2	In	Baud Rate 2	28	N.C.	not connected
9	N.C.		do not connect, reserved	29	N.C.	not connected
10	RxD	In	Receive Data	30	N.C.	not connected
11	TxD	Out	Transmit Data	31	N.C.	not connected
12	EN422	Out	Enable RS-422 driver	32	N.C.	not connected
13	DPOM	In	L: disable Power-On-Macro do not connect for normal operation	33	N.C.	not connected
14	N.C.		do not connect, reserved	34	N.C.	not connected
15	N.C.		do not connect, reserved	35	N.C.	not connected
16	BUZZ	Out	Buzzer output	36	N.C.	not connected
17	EEP_SDA	Bidir.	Serial Data Line for int. EEPROM	37	N.C.	not connected
18	EEP_SCL	In	Serial Clock Line for int. EEPROM	38	N.C.	not connected
19	EEP_WP	In	H: Write Protect for int. EEPROM	39	A	LED backlight+ / internal connection
20	TEST SBUF	IN Out	open-drain with internal pullup 20..50k IN (Power-On) L: Testmode OUT L: data in sendbuffer	40	C	LED backlight- / internal connection

Note:
At pin 20 (SBUF), the display sets a low level to indicate that data is available to be fetched from the internal send buffer. This line can, for instance, be connected to an interrupt input of the host system.

BAUD RATES

The baud rate is set with pins 6, 7 and 8 (Baud0 through 2). The data format is set permanently to 8 data bits, 1 stop bit, no parity.
RTS/CTS handshaking lines are not required. The integrated software protocol takes on the necessary control functions (see pages 8 and 9).

Baud rates			
Baud0	Baud1	Baud2	Data format 8,N,1
0	0	0	1200
1	0	0	2400
0	1	0	4800
1	1	0	9600
0	0	1	19200
1	0	1	38400
0	1	1	57600
1	1	1	115200



Application example

SPI INTERFACE

Wiring the display as shown below activates SPI mode. Data is then transferred over the serial, synchronous SPI interface.
The DORD, CPOL and CPHA inputs are used to match the hardware conditions to the master. For example (see diagram below)
DORD (**D**ata**ORD**er) = 1 = LSB is sent first.
CPOL (**C**lock**POL**ariy) = 1 = SCK idle HIGH.
CPHA (**C**lock**PHA**se) = 1= sample on 2nd. edge

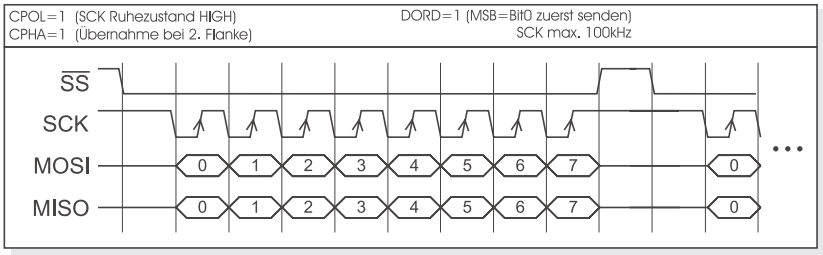
A reasonable communication is possible up to 100 kHz.
Clock frequency may be rised up to 3 MHz, but in this case make shure, that there is a pause between 2 bytes of min. 100 µs.

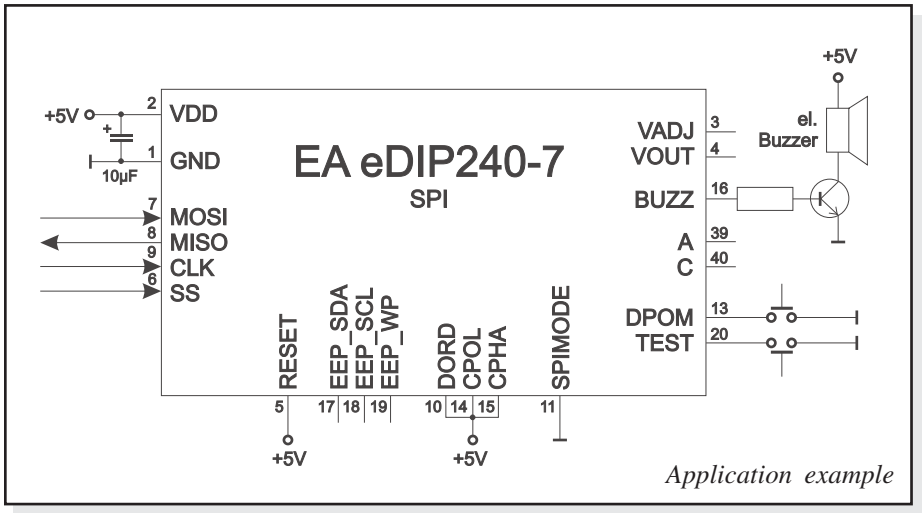
Pinout eDIP240-7
SPI mode

Pin	Symbol	In/Out	Function	Pin	Symbol	Function
1	GND	-	Ground Potential for logic (0V)	21	N.C.	not connected
2	VDD	-	Power supply for logic (+5V)	22	N.C.	not connected
3	VADJ	In	Operating voltage for LC driving (input)	23	N.C.	not connected
4	VOUT	Out	Output voltage for LC driving	24	N.C.	not connected
5	RESET	-	L: Reset	25	N.C.	not connected
6	SS	In	Slave Select	26	N.C.	not connected
7	MOSI	In	Serial In	27	N.C.	not connected
8	MISO	Out	Serial Out	28	N.C.	not connected
9	CLK	In	Shift Clock	29	N.C.	not connected
10	DORD	In	Data Order (0=MSB first; 1=LSB first)	30	N.C.	not connected
11	SPIMODE	In	connect to GND for SPI interface	31	N.C.	not connected
12	N.C.		do not connect, reserved	32	N.C.	not connected
13	DPOM	In	L: disable Power-On-Macro do not connect for normal operation	33	N.C.	not connected
14	CPOL	In	Clock Polarity (0=LO 1=HI when idle)	34	N.C.	not connected
15	CPHA	In	Clock Phase (sampled on 0=1st 1=2nd edge)	35	N.C.	not connected
16	BUZZ	Out	Buzzer output	36	N.C.	not connected
17	EEP_SDA	Bidir.	Serial Data Line for int. EEPROM	37	N.C.	not connected
18	EEP_SCL	In	Serial Clock Line for int. EEPROM	38	N.C.	not connected
19	EEP_WP	In	H: Write Protect for int. EEPROM	39	A	LED backlight+ / internal connection
20	TEST SBUF	IN Out	open-drain with internal pullup 20..50k IN (Power-On) L: Testmode OUT L: data in sendbuffer	40	C	LED backlight- / internal connection

Note:
At pin 20 (SBUF), the display sets a low level to indicate that data is available to be fetched from the internal send buffer. This line can, for instance, be connected to an interrupt input of the host system.

DATA TRANSFER SPI





Application example

I²C BUS INTERFACE

Wiring the display as shown below allows the display to be operated directly on an I²C bus.
4 different base addresses and 8 different slave addresses can be selected at the display.
A data transmission rate of up to 100kHz is possible.
If transmitter will pause for min. 100 µs between each byte, SCL may rise u to max. 400 kHz.

Pinout eDIP240-7
I²C-Bus mode

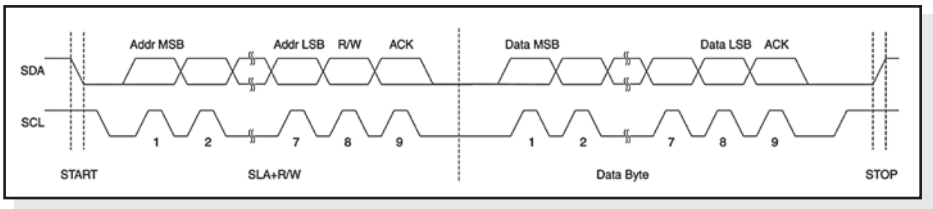
Pin	Symbol	In/Out	Function	Pin	Symbol	Function
1	GND	-	Ground Potential for logic (0V)	21	N.C.	not connected
2	VDD	-	Power supply for logic (+5V)	22	N.C.	not connected
3	VADJ	In	Operating voltage for LC driving (input)	23	N.C.	not connected
4	VOUT	Out	Output voltage for LC driving	24	N.C.	not connected
5	RESET	-	L: Reset	25	N.C.	not connected
6	BA0	In	Basic Adress 0	26	N.C.	not connected
7	BA1	In	Basic Adress 1	27	N.C.	not connected
8	SA0	In	Slave Adress 0	28	N.C.	not connected
9	SA1	In	Slave Adress 1	29	N.C.	not connected
10	SA2	In	Slave Adress 2	30	N.C.	not connected
11	N.C.		do not connect, reserved	31	N.C.	not connected
12	I2CMODE	In	connect to GND for I²C interface	32	N.C.	not connected
13	DPOM	In	L: disable Power-On-Macro do not connect for normal operation	33	N.C.	not connected
14	SDA	Bidir.	Serial Data Line	34	N.C.	not connected
15	SCL	In	Serial Clock Line	35	N.C.	not connected
16	BUZZ	Out	Buzzer output	36	N.C.	not connected
17	EEP_SDA	Bidir.	Serial Data Line for int. EEPROM	37	N.C.	not connected
18	EEP_SCL	In	Serial Clock Line for int. EEPROM	38	N.C.	not connected
19	EEP_WP	In	H: Write Protect for int. EEPROM	39	A	LED backlight+ / internal connection
20	TEST SBUF	IN Out	open-drain with internal pullup 20..50k IN (Power-On) L: Testmode OUT L: data in sendbuffer	40	C	LED backlight- / internal connection

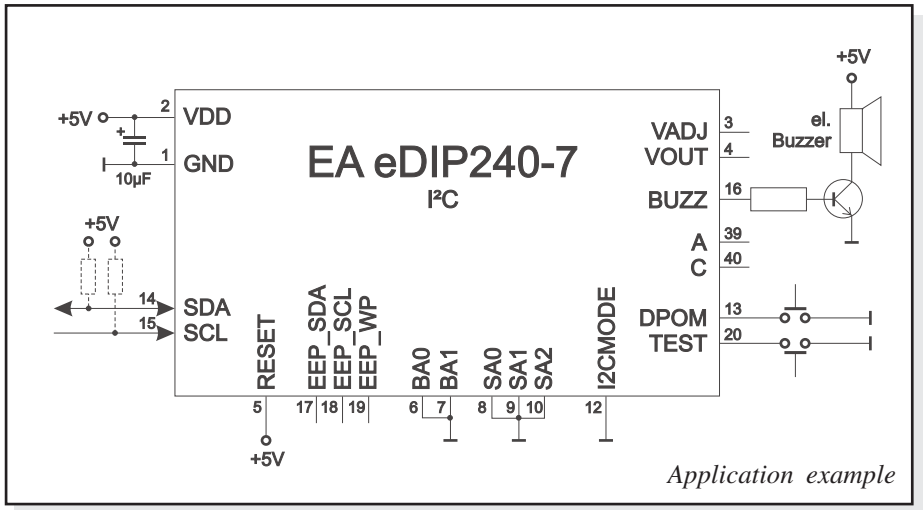
Note:
At pin 20 (SBUF), the display sets a low level to indicate that data is available to be fetched from the internal send buffer. This line can, for instance, be connected to an interrupt input of the host system.

I²C - Address

BA1	BA0	Base address [HEX]	I²C address [BIN]							
0	0	$70	0	1	1	1	SA2	SA1	SA0	RW
0	1	$90	1	0	0	1				
1	0	$B0	1	0	1	1				
1	1	$D0	1	1	0	1				

DATATRANSFER I²C-BUS





Application example

DATA TRANSFER PROTOCOL (SMALL PROTOCOL)

The actual data transfer is embedded in a fixed frame with a checksum (protocol packet). The EA eDIP240-7 acknowledges this packet with <ACK> (=$06) if it is received correctly or <NAK> (=$15) if the checksum is incorrect or buffer is full (packet is rejected and must be re-sent).
If no acknowledgement is sent, at least one byte has been lost. If the missing bytes are not received within the preset timeout of 2 seconds, the entire packet is rejected and must be re-sent. The data length (len) of a packet is restricted to a maximum of 64 bytes.

EXAMPLE

The following example shows a complete protocol packet for sending commands:

Clear display and draw a line from 0,0 to 239,127

	<DC1>	len	ESC D L	ESC G D 0 0 239 127	bcc
>	$11	$0A	$1B $44 $4C $1B $47 $44 $00 $00 $EF $7F		$DA
<	<ACK>				
	$06				

SWITCH OFF SMALL PROTOCOL

The protocol is identical for all three interfaces (RS-232, I²C and SPI). For testing purposes, the protocol can be deactivated by closing the solder strap J2 (see page 20). We urgently recommend, however, that the protocol is activated for normal operation. If this is not done, it would not be possible to detect a receive buffer overflow.

THE 5 PACKET VARIANTS IN DETAIL

Send commands/data to the display

>	<DC1>	len	data...	bcc
<	<ACK>			

The user data is sent enclosed in <DC1>, the data length “len” and the checksum “bcc”. The display responds with <ACK>.
<DC1> = 17(dec.) = $11
len = size of user data in bytes (without checksum, without <DC1>, max. 64)
bcc = 1 byte = sum of all bytes including <DC1> and len, modulo 256
<ACK> = 6(dec.) = $06

Request content of the send buffer

>	<DC2>	1	S	bcc
<	<ACK>			
<	<DC1>	len	data...	bcc

The command sequence <DC2>, 1, S, bcc flushes the display’s send buffer. The display first responds with <ACK> and then starts sending all the collected data such as the pressed touchkeys. Note: "S" has to be a capital letter.
<DC2> = 18(dec.) = $12
<ACK> = 6(dec.) = $06
len = size of user data in bytes (without checksum, without <DC1>)
bcc = 1 byte = sum of all bytes including <DC1> and len, modulo 256

Repeat last data packet

>	<DC2>	1	R	bcc
<	<ACK>			
<	<DC1> <DC2>	len	data...	bcc

If the packet most recently requested contains an incorrect checksum, the complete packet can be requested again. The response can then be the content of the send buffer (<DC1>) or the buffer information (<DC2>). Note: "R" has to be a capital letter.

<DC2> = 18(dec.) = $12
bcc = 1 byte = sum of all bytes including <DC1> or <DC2> and len, modulo 256
<ACK> = 6(dec.) = $06
<DC1> = 17(dec.) = $11
len = size of user data in bytes (without checksum, without <DC1> or <DC2>)

Request buffer information

>	<DC2>	1	I	bcc	
<	<ACK>				
<	<DC2>	2	send buffer bytes ready	receive buffer bytes free	bcc

This command queries whether user data is available to be fetched and how full the receive buffer of the display is. The data itself is only transferred with the command “Request content of the send buffer” (see above). Note: "I" has to be a capital letter.

<DC2> = 18(dec.) = $12
<ACK> = 6(dec.) = $06
send buffer bytes ready = number of bytes ready to be fetched
receive buffer bytes free = space available in the receive buffer
bcc = 1 byte = 92(dec.) = $54 = sum of all bytes including <DC2> and len, modulo 256

Protocol settings

>	<DC2>	3	D	packet size for send buffer	timeout	bcc
<	<ACK>					

This allows the maximum packet size the display is permitted to send to be restricted. The default setting is a packet size with up to 64 bytes of user data. In addition, the timeout (default = 2 seconds) can be set in 1/100s increments.

<DC2> = 18(dec.) = $12
packet size = 1 through 64 (default: 64)
timeout = 0 through 255 in 1/100 second increments (default: 200 = 2 seconds)
bcc = 1 byte = sum of all bytes including <DC2> and len, modulo 256
<ACK> = 6(dec.) = $06

TOUCH PANEL (EA DIP240x-7LWTP only)

The EA DIP240B-7LWTP and DIP240J-7LWTP versions are supplied with an analog resistive touch panel. Up to 60 touch regions (buttons, switches, menus, bar graph entries), can be defined simultaneously. The fields can be defined to single-pixel accuracy. The display supports representation using easy-to-use commands (see page 15). When the touch "keys" are touched, they can be automatically inverted and an external buzzer (pin 16) can sound, indicating they have been touched. 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 (see page 18, *Macro programming*).

TOUCH PANEL ADJUSTMENT

The touch panel is perfectly adjusted and immediately ready for operation on delivery. As a result of aging and wear, it may become necessary to readjust the touch panel.
Adjustment procedure:

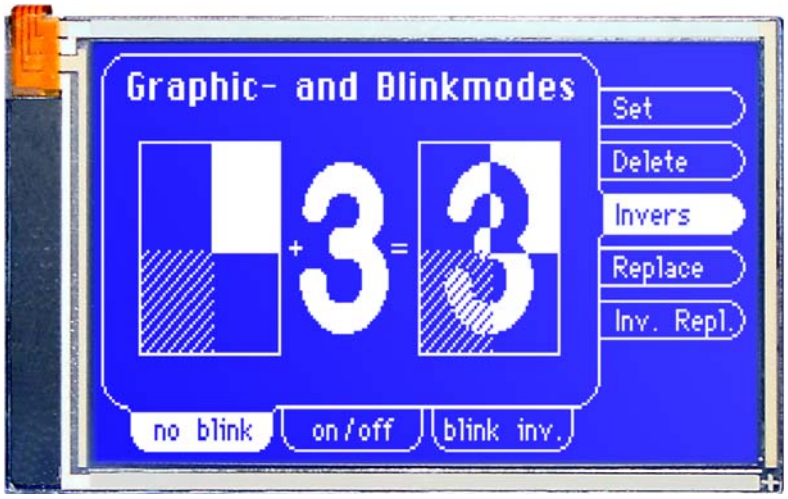
1. Touch the touch panel at power-on and keep touching it. After the message "touch adjustment ?" appears, release the touch panel again (or issue the 'ESC @' command).
2. Touch the touch panel again within a second for at least a second.
3. Follow the instructions for adjustment (press the 2 points upper left and lower right).

FRAMES AND KEY FORMS

A frame type can be set by using the *Draw frame* or *Draw frame box* command or by drawing touch keys. 18 frame types are available (0= do not draw a frame).

BITMAPS AS KEYS

In addition to the frame types, which can be scaled to any size, you also have the option of using any bitmap images (in each case, a pair showing the *not pressed* and *pressed* statuses) as touch keys or switches.
The LCD-Tools*) allows you to incorporate your own buttons in the form of images (compiler statement "PICTURE"). A button always comprises two monochrome Windows BMPs of the same size (one bitmap showing the normal representation of the touch key and one showing the pressed touch key). The active area of the touch key is derived automatically from the size of the button bitmaps.



SWITCHES IN GROUPS (RADIO GROUP)

Touch switches change their status from *ON* to *OFF* and vice versa each time they are touched. A number of touch switches can be grouped together (command: 'ESC A R nr'). If a touch switch in an 'nr' group is now switched on, all other buttons in this group are automatically switched off. This means that one button is only ever on at a time.

*) *see our web site at* http://www.lcd-module.de/deu/touch/touch.htm

INTEGRATED AND EXTERNAL FONTS

Apart from the 8x8 terminal font (font no. 8), 3 additional monospaced fonts, 3 proportional fonts and 1 large numeric font are integrated as standard. The proportional fonts result in a more attractive appearance, and at the same time require less space on screen (e.g. the “i” is narrow and the “W” is wide). Each character can be positioned **with pixel accuracy** and the width and height can be scaled by a factor of 1 - 4.

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

Macro programming permits additional fonts to be integrated (up to 15). Any conceivable font can be created with a text editor and programmed using the LCD-Tools*) (EA 9777-1USB USB-programmer required).

+ 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	{	|	}	~	⌂
$80 (dez: 128)	€	ü			ä										ß	
$90 (dez: 144)					ü					ß	ü				ß	

Font 1: 4x6 monospaced

+ 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	{	|	}	~	⌂
$80 (dez: 128)	€	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å
$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü	¢	£	¥	ß	ƒ
$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	ª	º	¿	⌐	¬	½	¼	¡	«	»
$B0 (dez: 176)																
$C0 (dez: 192)																
$D0 (dez: 208)																
$E0 (dez: 224)	α	ß	Γ	π	Σ	σ	µ	τ	Φ	Θ	Ω	δ	∞	ø	ε	∩
$F0 (dez: 240)	≡	±	≥	≤	⌠	⌡	÷	≈	°	∙	·	√	n	2	3	¯

Font 2: 6x8 monospaced

+ 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	{	|	}	~	⌂
$80 (dez: 128)	€	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å
$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü	¢	£	¥	ß	ƒ
$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	ª	º	¿	⌐	¬	½	¼	¡	«	»
$B0 (dez: 176)																
$C0 (dez: 192)																
$D0 (dez: 208)																
$E0 (dez: 224)	α	ß	Γ	π	Σ	σ	µ	τ	Φ	Θ	Ω	δ	∞	ø	ε	∩
$F0 (dez: 240)	≡	±	≥	≤	⌠	⌡	÷	≈	°	∙	·	√	n	2	3	¯

Font 3: 7x12 monospaced

+ 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	{	|	}	~	⌂
$80 (dez: 128)	€	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å
$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü					
$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	ª	º								
$B0 (dez: 176)																
$C0 (dez: 192)																
$D0 (dez: 208)																
$E0 (dez: 224)		ß														
$F0 (dez: 240)									°							

Font 4: GENEVA10 proportional

Upper \ + Lower	$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	å	ç	ê	ë	è	ï	î	ì	Ä	Å
$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü					
$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	a	o								
$B0 (dez: 176)																
$C0 (dez: 192)																
$D0 (dez: 208)																
$E0 (dez: 224)		ß														
$F0 (dez: 240)									°							

Font 5: CHICAGO14 proportional

Upper \ + Lower	$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	å	ç	ê	ë	è	ï	î	ì	Ä	Å
$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü					
$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	a	o								
$B0 (dez: 176)																
$C0 (dez: 192)																
$D0 (dez: 208)																
$E0 (dez: 224)		ß														
$F0 (dez: 240)									°							

Font 6: Swiss30 Bold proportional

Upper \ + Lower	$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	:					

Font 7: big numbers BigZif57

TYPEFACE

This picture of a screen image shows all the integrated standard fonts.
Macro programming permits some additional fonts to be integrated. Any conceivable font (including Chinese or Cyrillic) can be created with a text editor and programmed using the LCD-Toolkit*) and programmer EA 9777-1USB.

*) *see our web site at* http://www.lcd-module.de/deu/touch/touch.htm

DEFAULT SETTINGS

After power on or a reset, some functions are set to a particular value (see last column entitled '**After reset**' in the table). Please note that all the settings can be overwritten by creating a power-on macro.

EA eDIP240-7: Command table 1													after reset
Command	**Codes**											**Remarks**	
Commands for terminal mode													
Formfeed FF (dez:12)	^L											The contents of the terminal area are deleted and the cursor is placed at pos. (1,1)	
Carriage Return CR(13)	^M											Cursor to the beginning of the line on the extreme left	
Linefeed LF (dez:10)	^J											Cursor is set to the next line	
Cursor position	ESC	T	P	n1	n2							n1=column; n2=line; origin upper-left corner (1,1)	1,1
Cursor On / Off	ESC	T	C	n1								n1=0: Cursor is invisible; n1=1: Cursor flashes;	1
Terminal invisible	ESC	T	A									Terminal display not visible; outputs continue to be executed	
Terminal visible	ESC	T	E									Terminal display is visible again;	visibl
Show revision code	ESC	T	V									Show revision code on terminal layer e.g. "EA eDIP240-7 V1.1 Rev.B"	
Comands for outputting strings													
Output string L: left justified C: centered R: right justified	ESC	Z	L C R	x1	y1	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	ESC	Z	F	n1								Set font with the number n1 (0..16)	0
Font zoom factor	ESC	Z	Z	n1	n2							n1 = X zoom factor (1x..4x); n2 = Y zoom factor (1x..4x)	1,1
Add. line spacing	ESC	Z	Y	n1								Insert n1 pixels between two lines of text as additional line spacing	
Text angle	ESC	Z	W	n1								Text output angle: n1=0: 0°; n1=1: 90°	0
Text mode	ESC	Z	V	n1								Set mode n1: 1=set; 2=delete; 3=inverse; 4=replace; 5=inverse replace;	4
Text blink attribute	ESC	Z	B	n1								n1: 0=text solid, blink off; 1=text blink on/off; 2=text blink inverted;	0
String for terminal	ESC	Z	T	Text ...								Command for outputting a string in a macro to the terminal	
Draw straight lines and points													
Draw rectangle	ESC	G	R	x1	y1	x2	y2					Draw four straight lines as a rectangle from x1,y1 to x2,y2	
Draw straight line	ESC	G	D	x1	y1	x2	y2					Draw straight line from x1,y1 to x2,y2	
Continue straight line	ESC	G	W	x1	y1							Draw a straight line from last end point to x1, y1	0
Draw point	ESC	G	P	x1	y1							Set one dot at coordinates x1, y1	
Point size/line thickness	ESC	G	Z	n1	n2							n1 = X-Punktgröße (1..15); n2 = Y-Punktgröße (1..15);	1,1
Graphic mode	ESC	G	V	n1								Drawing mode n1: 1=set; 2=delete; 3=inverse;	1
Change/draw rectangular areas													
Delete area	ESC	R	L	x1	y1	x2	y2					Delete an area from x1,y1 to x2,yy2 (all pixels out)	
Invert area	ESC	R	I	x1	y1	x2	y2					Invert an area from x1,y1 to x2,y2 (invert all pixels	
Fill area	ESC	R	S	x1	y1	x2	y2					Fill an area from x1,y1 to x2,y2 (all pixels on)	
Area with fill pattern	ESC	R	M	x1	y1	x2	y2	n1				Draw an area from x1,y1 to x2,y2 with pattern n1 (always set)	
Draw box	ESC	R	O	x1	y1	x2	y2	n1				Draw a rectangle x1,y1 to x2,y2 with fill pattern n1 (always replace)	
Draw frame	ESC	R	R	x1	y1	x2	y2	n1				Draw a frame of the type n1 from x1,y1 to x2,y2 (always set)	
Draw frame box	ESC	R	T	x1	y1	x2	y2	n1				Draw a frame box of the type n1 from x1,y1 to x2,y2 (always replace)	
Bitmap image commands													
Image from clipboard	ESC	U	C	x1	y1							The current contents of the clipboard are loaded to x1,y1 with all the image attributes	
Load internal image	ESC	U	I	x1	y1	no						Load internal image with the no. (0..255) from EEPROM to x1,y1	
Load image	ESC	U	L	x1	y1	BLH data ...						Load an image to x1,y1; see image structure for image data	
Image zoom factor	ESC	U	Z	n1	n2							n1 = X zoom factor (1x..4x); n2 = Y zoom factor (1x..4x)	1,1
Image angle	ESC	U	W	n1								Output angle: n1=0: 0°; n1=1: 90°; n1=2: 180°; n1=3: 270°	0
Image link mode	ESC	U	V	n1								Mode n1: 1=set; 2=delete; 3=inverse; 4=replace; 5=inverse replace	4
Image flashing attribute	ESC	U	B	n1								n1=0 Image attribute blink off; n1=1 image blink mode on/off; n1=2 image blink mode inverse	0
Send hard copy	ESC	U	H	x1	y1	x2	y2					A full image is requested in Windows BMP format. The image header is sent first via RS232, followed by the actual image data (9662 bytes).	
Display commands (effect on the entire display)													
Delete display	ESC	D	L									Delete display contents (all pixels off)	
Invert display	ESC	D	I									Invert display contents (invert all pixels)	
Fill display	ESC	D	S									Fill display contents (all pixels on)	
Switch display off	ESC	D	A									Display contents become invisible but are retained, commands continue to be possible	
Switch display on	ESC	D	E									Display contents become visible again	visibl
Show clip-board	ESC	D	C									Show content of clip-board. Standard display output is no longer visible	
Show current	ESC	D	N									Switch back to noraml operation. Standard display output is visible	
Flashing area commands													
Delete flashing attribute	ESC	Q	L	x1	y1	x2	y2					Delete the flashing attribute from x1,y1 to x2,y2	
Inverted flashing area	ESC	Q	I	x1	y1	x2	y2					Define an inverted flashing area from x1,y1 to x2,y2	
Pattern for flashing area	ESC	Q	M	x1	y1	x2	y2	n1				Define flashing area with pattern n1 (on/off) from x1,y1 to x2,y2	
Set flashing time	ESC	Q	Z	n1								Set the flashing time n1= 1..15 in 1/10s; 0=deactivate flashing function	6

EA eDIP240-7: Command table 2

Command	Codes											Remarks	after reset
Bar graph commands													
Define bar graph	ESC	B	R L O U	n1	x1	y1	x2	y2	sv	ev	type pat	Define bar graph to L(eft), R(ight), O(ben) (up), U(nten) (down) with the "nr" (1..32). x1,y1,x2,y2 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	n1	valu							Set and draw the bar graph with the number n1 to the new user "value."	
Draw new bar graph	ESC	B	Z	n1								Draw the bar graph with the number n1 completely	
Send bar graph value	ESC	B	S	n1								Send the current value of bar graph no. n1 on the serial interface	
Delete bar graph	ESC	B	D	n1	n2							Makes definition of bar graph with number n1 invalid. If bar graph was defined as a touch field, active area will become inactive again n2=0: above function and bar graph keeps visible; n2=1: bar graph will be cleared	
Clipboard commands (buffer for image areas)													
Save display contents	ESC	C	B									The entire contents of the display are copied to the clipboard as an image area	
Save area	ESC	C	S	x1	y1	x2	y2					The image area from x1,y1 to x2,y2 is copied to the clipboard	
Restore area	ESC	C	R									The image area on the clipboard is copied back its original position in the display	
Copy area	ESC	C	K	x1	y1							The image area on the clipboard is copied to x1,y1 in the display	
Settings for menu/pop-up and touch panel													
Set font for menu	ESC	N	F	n1								All following menu entries will be written in font n1 (0..16)	0
Set zoom factor	ESC	N	Z	n1	n2							n1 = X-zoom factor (1x..4x); n2 = Y-zoom factor (1x..4x)	1,1
add. line spacing	ESC	N	Y	n1								Add n1 dots as additional line spacing between 2 lines	
Angle for menu	ESC	N	W	n1								Pop-up direction: n1=0: 0°; n1=1: 90°;	0
Set automatic function for touch	ESC	N	T	n1								n1=1: touch menu will pop-up automatically; n1=0: touch menu will not pop-up but 'ESC T 0' will be sent to host; this one is able to pop-up with command 'ESC N T 2' then.	1
Menu/pop-up commands (not valid for touch panel use; for that see table "Commands for the touch panel")													
Define menu and show	ESC	N	D	x1	y1	no	text ...	NUL				A menu is drawn as of the corner x1,y1 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	ESC	N	P									The previous item is inverted or remains at the beginning	
End of menu/send	ESC	N	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	ESC	N	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	ESC	N	A									The menu is removed from the display and replaced with the original background	
Macro commands													
Run macro	ESC	M	N	n1								Call the (normal) macro with the number n1 (0..255) (max. 7 levels)	
Run touch macros	ESC	M	T	n1								Call the touch macro with the number n1 (0..255) (max. 7 levels)	
Run menu macro	ESC	M	M	n1								Call the menu macro with the number n1 (0..255) (max. 7 levels)	
Automatic/cyclic macro													
Macro with delay	ESC	M	G	n1	ts							(normal-) macro n1 (0..255) runs after delay of ts/10s. May be stopped/prevented by any command via serial interface or by touch panel	
Autom. macro cyclical, once	ESC	M	E	n1	n2	ts						Automatically macros n1..n2 once only; ts=pause in 1/10s. Will be stopped by any command via serial interface or by touch panel use	
Autom. macro cyclical	ESC	M	A	n1	n2	ts						Automatically macros n1..n2 cyclically; ts=pause in 1/10s. Will be stopped by any command via serial interface or by touch panel use	
Autom. macro pingpong	ESC	M	J	n1	n2	ts						Automatically macros n1..n2..n1 (pingpong); ts=pause in 1/10s. Will be stopped by any command via serial interface or by touch panel use	
Process macro commands (from V1.1)													
Define process macro	ESC	M	D	no	type	n3	n4	ts				Define process macro number no (1..4) (1=highest priority). (normal-) macro n3..n4 will be served with ts/10s delay. type: 1=once only; 2=cyclical; 3=pingpong n3..n4..n3	
Process macro speed	ESC	M	Z	no	ts							Assign a new delay for process no (1..4) with ts /10s value. ts=0 will stop the automatic	
Stop process macro	ESC	M	S	n1								All process macro will be stopped with n1=0 and continued with n1=1 e.g. to make settings or output via serial interface without interference	1
Other commands													
Wait (pause)	ESC	X	ts									Wait ts tenths of a second before the next command is executed.	
Beep on/off	ESC	Y	S	ts								Switch beeper output (pin 16) ts=2..255 for ts 1/10s to high ts=0 set permanent low, ts=1 set permanent high	OFF
Backlight on/off	ESC	Y	L	ts								LED backlight n1=0: OFF; n1=1: ON; ts=2..255: switches backlight on for ts /10s and then off	1
Backlight brightness	ESC	Y	H	n1								Adjust brightness of backlight n1=0..100% (non linear)	100
Send bytes	ESC	S	B	cnt	data ...							cnt (=1..255) bytes are sent via serial interface data ... = cnt. bytes (e.g. control of an external printer)	
Send version	ESC	S	V									Software versionwill be sent as a string ;e.g. "EA eDIP240-7 V1.2 Rev.B"	

EA eDIP240-7: 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**	**T**	x1	y1	x2	y2	dow code	up code	text ...	NUL		'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	
			U	x1	y1	n1	dow code	up code	text ...	NUL				
Define touch switch (status of the switch toggles after each contact on/off)	ESC	**A**	**K**	x1	y1	x2	y2	dow code	up code	text ...	NUL		'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	
			J	x1	y1	n1	dow code	up code	text ...	NUL				
Define touch key with menu function	**ESC**	**A**	**M**	x1	y1	x2	y2	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**	x1	y1	x2	y2	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**	x1	y1	x2	y2						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 serial interface.	
Set bargraph by touch	**ESC**	**A**	**B**	no									The bar graph with the no=1..32 n1 is defined for input by touch panel.	
Touch: settings														
Touch frame	**ESC**	**A**	**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
			S	n1									Tone sounds briefly when a touch key is touched: n1=0=OFF; n1=1=ON	1
Invert touch key			**N**	code									The touch key with the assigned return code is inverted manually	
Query touch switch			**X**	code									The status of the switch (off=0; on=1) is sent via the serial interface	
Set touch switch			**P**	code	n1								The status of the switch is changed by means of a command n1=0=off; n1=1=on	
Define radiogroup			**R**	no									Within a group only one single switch will be active; ret of them will be deactivated no=0: next switch definitions will keep free of all groups no=1..255: next switch definitions will join to goup number no	0
Delete touch area			**L**	code	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	x1	y1	n1							Remove a special touch area x1,y1 from touch query; n1=0: area stys visible; n1=1: areawil 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														
Label font	**ESC**	**A**	**F**	no									Set font with the number no=0..16 for touch key label	0
Label zoom factor			**Z**	n1	n2								n1 = X zoom factor (1x..4x); n2 = Y zoom factor (1x..4x)	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°	0

Response of EA eDIP240-7 via serial interface							
Id		num	data				Remark
Automatic response							
ESC	A	1	code				Response from the analog touch panel when a key/switch is pressed. code = down 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. transmitted if no corresponding touch 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 N T this request will be sent to host. Then it is necessary that host will open menu with command 'ESC N T 2'.
ESC	H	3	type	x1	y1		The following is transmitted in the case of a free touch area event: type=0 release; t is touch; type=2 is drag within the free touch area at the x,y coordinates (16-bit values)
Response only when requested							
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 w code (the return code). value = 0 or 1
ESC	V	count	char. string...				After the 'ESC S V' command, the version of the KIT firmware is transmitted as a str (end code is the character NUL = $00). The first two bytes of the string always start 'EA'
Response without length specification (num)							
ESC	U	L	x1	y1	*.blh image data...		After command 'ESC UH....' is received a screen copy will be sent x1,y1 = coordinates of the top left corner *.blh image data: 2 bytes (width, height) + count of image data ((width+7)/8*height)

Note:
At pin 20 (SBUF), the display sets a low level to indicate that data is available to be fetched from the internal send buffer. This line can, for instance, be connected to an interrupt input of the host system.

TERMINAL MODE

When you switch the unit on, the cursor flashes in the first line, indicating that the display is ready for operation. All the incoming characters are displayed in ASCII format on the terminal (exception: CR,LF,FF,ESC,'#'). To achieve this, a correctly functioning protocol frame is required (pages 8 and 9) or the protocol must be deactivated (close solder strap J2, page 8 and 20).
Line breaks are automatic or can be executed by means of the 'LF' character. If the last line is full, the contents of the terminal scroll upward. The ´FF´ character (page feed) clears the terminal.
The character '#' is used as an escape character and thus cannot be displayed directly on the terminal. If the character '#' is to be output on the terminal, it must be transmitted twice: '##'.
The terminal has a separate output layer and is thus completely independent of the graphic outputs. If the graphics screen is cleared with 'ESC DL', for example, that does not affect the contents of the terminal window.
The terminal font is permanently in ROM and can also be used for graphics output 'ESC Z...' (set FONT no.=0).

+ 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	{	|	}	~	⌂
$80 (dez: 128)	€	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å
$90 (dez: 144)	É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü	¢	£	¥	ß	ƒ
$A0 (dez: 160)	á	í	ó	ú	ñ	Ñ	ª	º	¿	⌐	¬	½	¼	¡	«	»
$B0 (dez: 176)																
$C0 (dez: 192)																
$D0 (dez: 208)																
$E0 (dez: 224)	α	ß	Γ	π	Σ	σ	µ	τ	Φ	Θ	Ω	δ	∞	φ	ε	∩
$F0 (dez: 240)	≡	±	≥	≤	⌠	⌡	÷	≈	°	∙	·	√	n	2	3	¯

Terminal-Font (Font 0): 8x8 monospaced

PASSING COMMANDS/PARAMETERS

The eDIP240-7 can be programmed by means of various integrated commands. Each command begins with ESCAPE or HASH followed by one or two command letters and some parameters. There thus are two ways to send commands:

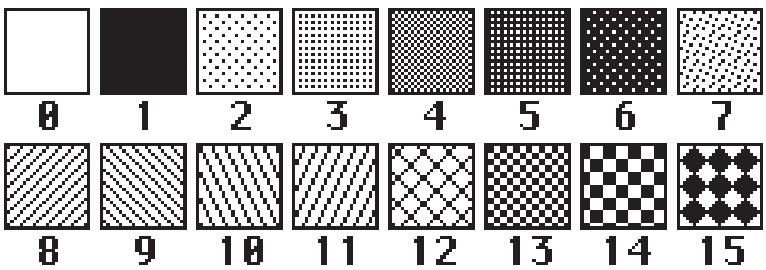
1. ASCII mode
- The ESC character corresponds to the character '**#**' (hex: $23, dec: 35).
- The command letters come directly after the '#' character.
- The parameters are transmitted as plain text (several ASCII characters) followed by a separating character (such as a comma '**,**').
- Strings (text) are written directly without quotation marks and terminated with CR (hex: $0D) or LF (hex: $0A).

2. Binary mode
- The escape character corresponds to the character ESC (hex: $1B, dec: 27).
- The command letters are sent directly.
- The x, y coordinates and all the other parameters are transmitted as 8-bit binary values (1 byte).
- Strings (text) are terminated with CR (hex: $0D) or LF (hex: $0A) or NUL (hex: $00).

No separating characters, such as spaces or commas, may be used in binary mode. The commands require **no final byte**, such as a carriage return (apart from the string: $00).

FILL PATTERNS

A pattern type can be set as a parameter with some commands. In this way, rectangular areas and bar graphs for instance can be filled with different patterns. There are 16 internal fill patterns available.



MACRO PROGRAMMING

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

Normal macros (0 through 255)
These are started by means of an 'ESC MN xx' command via the serial interface or from another macro. A series of macros occurring one after the other can be called cyclically (movie, hourglass, multi-page help text). These automatic macros continue to be processed until a command is received via RS-232 or another macro is activated.
Furthermore these macros may be started by "macro processes" as an individual task (from V1.1). Process macros will not be interupted by any other commands or touch panel use.

Touch macro (1 through 255)
Started when you touch/release a touch field (only in versions with a touch panel - TP) or issue an 'ESC MT xx' command.

Menu macro (1 through 255)
Started when you choose a menu item or issue an 'ESC MM xx' command.

Power-on macro
Started after power-on. You can switch off the cursor and define an opening screen, for example.

Reset macro
Started after an external reset or after a voltage dip under 4.7V (VDD-VSS).

Watchdog macro
Started after a fault/error (e.g. crash).

Brown-out macro
Started after a voltage dip <4V.

Important: If a continuous loop is programmed in the power-on, reset or watchdog macro, the display can no longer be addressed. In this event, execution of the power-on macro must be suppressed. This is achieved by wiring DPOM appropriately.
PowerOff - connect pin 13 (DPOM) to GND - PowerOn - disconnect pin 13 again.

WRITE PROTECTION FOR MACRO PROGRAMMING AND FONTS

A VDD line level at pin 19 (EEP_WP) prevents inadvertent overwriting of the macros, images and fonts in the EEPROM (recommanded in any case!).

MEMORY EXPANSION

The size of the internal EEPROM memory is 32 kB. Generally, this allows sufficient space for a large number of images and macros. If, however, a very large number of images (in particular full-size images) are to be stored, it can be necessary to expand the memory. The memory capacity can be doubled by directly connecting a standard EEPROM of the 24C256 series. It is connected over pins 17, 18 and 19.

IMAGES STORED IN EEPROM

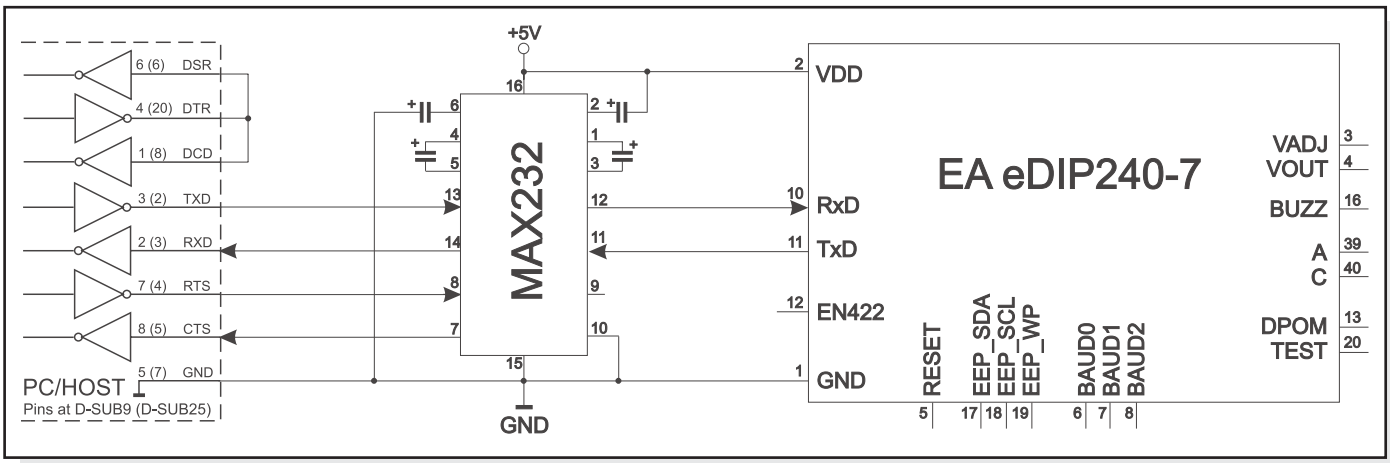
To reduce the transmission times at the interface or to save storage space in the processor system, up to 256 images can be stored in the internal EEPROM. They can be called using the “ESC U I” command or from within a macro. Any images in Windows BMP format (monochrome images only) can be used. They can be created and edited using commercial software such as Windows Paint or Photoshop (only black and white = 1 bit).

CREATING YOUR OWN MACROS AND IMAGES

To create your own macros, you need the following:

- the additional EA 9777-1USB programmer (available as an accessory) or self-created adaptor like application example below,
- the ELECTRONIC ASSMBLY LCD-Tools*) software; this contains a KIT-Editor, KIT-Compiler, Simulator, and examples and fonts (for Windows PCs)
- a PC with a serial port USB or COM

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, the KIT Compiler is started by pressing F5. This creates a file with the name DEMO.EEP which immediately shows the results in a simulator window (virtual display). If display is connected via USB programmer EA 9777-1USB or application below, this file is then automatically burned into the display’s EEPROM. The KIT Compiler recognizes the display with or without the small protocol being activated.
The actual programming operation only takes a few seconds, and you can then use your user-defined macros and images on the display immediately. You will find a detailed description of how to program macros along with examples in the online Help for the ELECTRONIC ASSEMBLY LCD-Tools*) software.

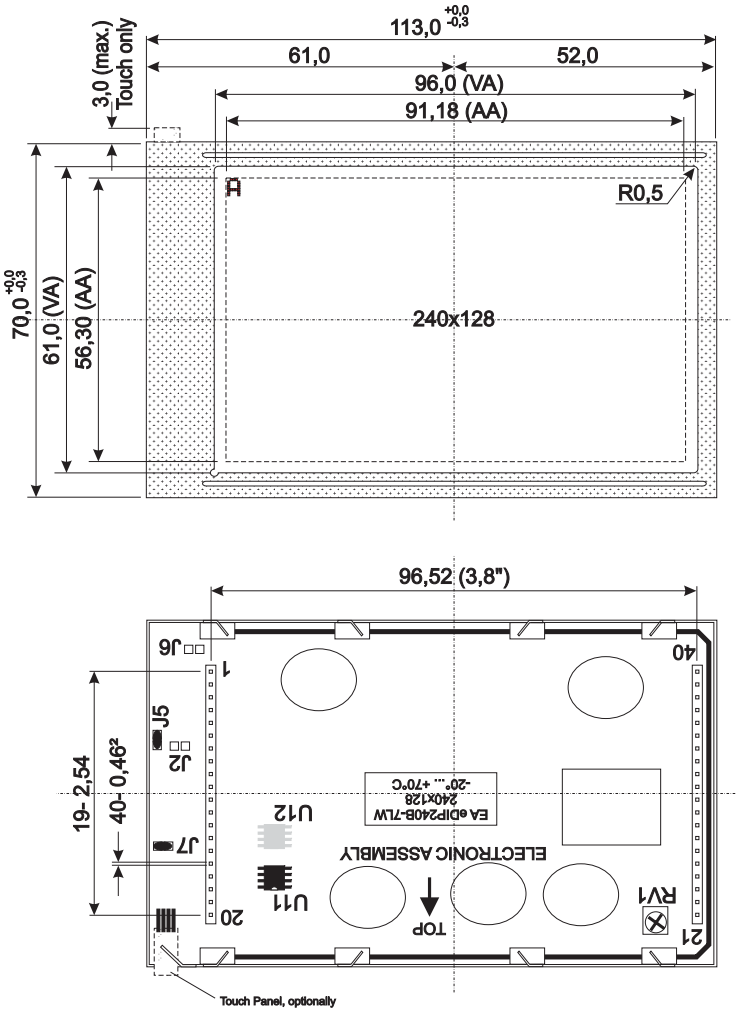


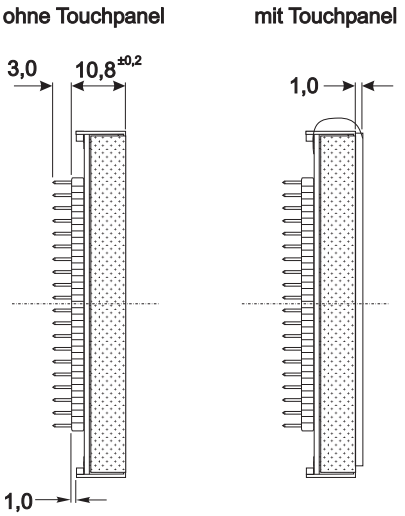
Application example to direct pc interfacing

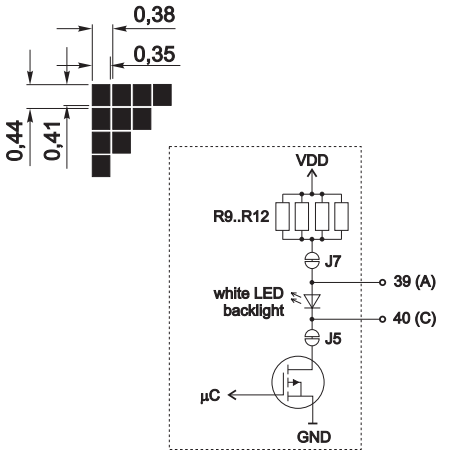
*) see our web site at http://www.lcd-module.de/deu/touch/touch.htm

EA eDIP240-7

DIMENSIONS







all dimensions are in mm

J2: switch off Small Protocoll
J6: Connect Metal frame with GND (ESD / EMV)

NOTES ON HANDLING AND OPERATION

- The following can lead to the electronic destruction of the module: cross-polarity or overvoltage of the power supply, overvoltage or cross-polarity or static discharge at the inputs, short-circuits at the outputs.
- The power supply must be disconnected before the module is removed. All inputs must also be free of voltage.
- The display and the touch screen are made of plastic and must not come into contact with hard objects. The surfaces can be cleaned with a soft cloth. No solvents may be used.
- The module is designed only for operation within buildings. Additional measures must be taken to allow operation in the open air. The maximum temperature range of -20 through +70°C must not be exceeded. The module may not operate correctly and may fail if used in a humid environment. The display must be shielded from direct sunlight.

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ELECTRONIC ASSEMBLY GMBH
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