FEATUERS
* SUPERTWIST BLUE NEGATIVE
* WITH WHITE LED BACKLIGHT
* EXTREME POWER SAVING: LED CURRENT 15mA OFF (max. 75mA)
* CHARACTER HEIGHT 4.75..12.7mm
* ALL DISPLAYS WITH INTEGRATED CONTROLER
* INTERFACE FOR 8-BIT BUS (ALSO 4 BIT) OR ALTERNATIVELY VIA RS-232 INTERFACE
* ALPHANUMERIC: ASCII CHARACTER SET+SPECIAL CHARACTER+8 FREE DEFINABLE
* POWER SUPPLY +5V
* OPERATING TEMPERATURE RANGE (WITH DERATING) -20°C ... +70°C (0°C+50°C)
* STORAGE TEMPERATURE -30..+80°C (-20..+70°C)

ACCESSORIES
* FRONTAL BEZEL WITH ANTI-GLARE WINDOW: SERIES EA 017-xxUKE
* RS-232 OR RS-422 INTERFACE EA 9707-V24S
8 FREE DEFINABLE CHARACTER

All displays in BlueLine series are able to show 8 free definable character additionally to the 192 fixed ROM based character (ASCII codes 0..7).

1.) The command "CG RAM Address Set" set the pointer (bit 3,4,5) to the 1st dot line of the new character. The individual dot line will be addressed by bits 0,1 and 2. With this example a character with ASCII code $00 will be defined.

2.) The command "Data Write" defines the upper dot row (here: 0x40). The next "Data Write" commands are for the other dot rows. Full definition requires 8 write cycles where the last one is the cursor line.

3.) This new defined character will be used like a "normal" ASCII character 0x00 ("DD RAM Address Set", "Data Write").
### COMMAND SET HD44780

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Code</th>
<th>Description</th>
<th>Execute Time (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Display</td>
<td>0 0 0 0 0 0 0 1 1</td>
<td>Clears all display and returns the cursor to the home position (Address 0).</td>
<td>1.64ms</td>
</tr>
<tr>
<td>Cursor At Home</td>
<td>0 0 0 0 0 0 0 1 1</td>
<td>Returns the Cursor to the home position (Address 0). Also returns the display being shifted to the original position. DD RAM contents remain unchanged.</td>
<td>1.64ms</td>
</tr>
<tr>
<td>Entry Mode Set</td>
<td>0 0 0 0 0 0 1 1 D C B</td>
<td>Sets the Cursor move direction and specifies or not to shift the display. These operation are performed during data write and read.</td>
<td>40µs</td>
</tr>
<tr>
<td>Display On/Off Control</td>
<td>0 0 0 0 0 0 1 1 D C B</td>
<td>Sets ON/OFF of all display (D) cursor ON/OFF (C), and blink of cursor position character (B).</td>
<td>40µs</td>
</tr>
<tr>
<td>Cursor / Display Shift</td>
<td>0 0 0 0 0 1 1 S/C R/L *</td>
<td>Moves the Cursor and shifts the display without changing DD RAM contents.</td>
<td>40µs</td>
</tr>
<tr>
<td>Function Set</td>
<td>0 0 0 0 1 1 DL N F *</td>
<td>Sets interface data length (DL) number of display lines (N) and character font (F).</td>
<td>40µs</td>
</tr>
<tr>
<td>CG RAM Address Set</td>
<td>0 0 0 1 1 ACG</td>
<td>Sets the CG RAM address. CG RAM data is sent and received after this setting.</td>
<td>40µs</td>
</tr>
<tr>
<td>DD RAM Address Set</td>
<td>0 0 1 1 ADD</td>
<td>Sets the DD RAM address. DD RAM data is sent and received after this setting.</td>
<td>40µs</td>
</tr>
<tr>
<td>Busy Flag / Address Read</td>
<td>0 1 1 BF</td>
<td>Reads Busy flag (BF) indicating internal operation is being performed and reads address counter contents.</td>
<td>-</td>
</tr>
<tr>
<td>CG RAM / DD RAM Data write</td>
<td>1 1 1</td>
<td>Writes data into DD RAM or CG RAM</td>
<td>40µs</td>
</tr>
<tr>
<td>CG RAM / DD RAM Data Read</td>
<td>1 1 1</td>
<td>Reads data from DD RAM or CG RAM</td>
<td>40µs</td>
</tr>
</tbody>
</table>

**Explanation:**

- **I/D:** I: DD-RAM increment address automatically, D: DD-RAM decrement address automatically
- **S:** S: Shift display content after read/write, 0: Move cursor after read/write
- **D:** D: Display on/off, 0: Display off
- **C:** C: Cursor visible, 0: Cursor invisible
- **S/C:** S/C: Shift display for 1 position (direction depends on R/L), 0: Static character
- **R/L:** R/L: Shift to the right, 0: Shift to the left
- **DL:** DL: Interface: 8-Bit data bus (DB0..7), 0: Interface: 4-Bit data bus (DB4..7)
- **N:** N: 1-line display (also 8+8), 0: 2-line display (also 8+8)
- **F:** F: 5x7 dot display, 0: 5x10 dot display
- **BF:** BF: Controller is busy

**Hint:**
The execution time shown in table are valid with active check for “Busy Flag” only; that means that before reading or writing data from or to the display the “Busy Flag” BF needs to be checked for “0”. If there’s no explicite “Busy Flag” check but delay then execution time may be definitely longer. The 4 bit mode requires the “Busy Flag” check every byte only.

### RELATIONSHIP DD-RAM ADDRESS AND POSITION ON DISPLAY

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Anfangs - Endadresse (HEX)</th>
<th>Bemerkung</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x8</td>
<td>S00-S07</td>
<td>MUX 1:8</td>
</tr>
<tr>
<td>1x16</td>
<td>S00-S0F</td>
<td></td>
</tr>
<tr>
<td>1x16 (8+8)</td>
<td>S00-S07</td>
<td>MUX 1:16 (links Halft)</td>
</tr>
<tr>
<td>1x20</td>
<td>$40-$47</td>
<td>(rechte Halft)</td>
</tr>
<tr>
<td>1x40</td>
<td>S00-$13</td>
<td></td>
</tr>
<tr>
<td>2x8</td>
<td>S00-$07</td>
<td>$40-$57</td>
</tr>
<tr>
<td>2x12</td>
<td>S00-$08</td>
<td>$40-$4F</td>
</tr>
<tr>
<td>2x16</td>
<td>S00-$13</td>
<td>$40-$53</td>
</tr>
<tr>
<td>2x20</td>
<td>S00-$17</td>
<td>$40-$5F</td>
</tr>
<tr>
<td>2x40</td>
<td>S00-$27</td>
<td>$40-$67</td>
</tr>
<tr>
<td>4x16</td>
<td>S00-$0F</td>
<td>$40-$4F</td>
</tr>
<tr>
<td>4x20</td>
<td>S00-$13</td>
<td>$40-$53</td>
</tr>
<tr>
<td>4x40</td>
<td>S00-$27</td>
<td>$40-$67</td>
</tr>
</tbody>
</table>

- 1. Kontroller (Enable 1)
- 2. Kontroller (Enable 2)
POWER-ON-RESET
The internal Power-On-Reset works only at following conditions:

Input E (Enable) is the control pin for data lines DB0 to DB7. At E = H and R/W = 1 (µC reads data from display) the LCD controller switches it's data lines to output. Writing data from µC to the display will be done at the falling edge of E (Enable). The fall time of Enable signal (max. 25ns) is essential for an error free communication. IDC cable may deform signals even at a length of 20cm (depends on driver circuit, ambient condition, noise pinout etc.). Improvement can be done with:
- "slower" data communication via port pins (if data setup or data hold time is too short)
- Pull-Up resistor connected directly to the „E“ pin at display side
- better driver on µC side
- Schmitt trigger on display side for Enable line
- shorten the cable (max. 10cm)

INPUT-OUTPUT CHARACTERISTICS

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Measuring Conditions</th>
<th>Standard Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable Cycle Time</td>
<td>CYCE</td>
<td>see Figs. 1 and 2</td>
<td>1000 - - ns</td>
</tr>
<tr>
<td>Enable Pulse Width, High Level</td>
<td>PMBH</td>
<td>see Figs. 1 and 2</td>
<td>460 - - ns</td>
</tr>
<tr>
<td>Enable Rise and Delay Time *</td>
<td>IER, IR</td>
<td>see Figs. 1 and 2</td>
<td>- - 25 ns</td>
</tr>
<tr>
<td>Address Setup Time, RS, R/W-E</td>
<td>IAS</td>
<td>see Figs. 1 and 2</td>
<td>140 - - ns</td>
</tr>
<tr>
<td>Data Delay Time</td>
<td>IDDR</td>
<td>see Fig. 2</td>
<td>- - 320 ns</td>
</tr>
<tr>
<td>Data Setup Time</td>
<td>DSW</td>
<td>see Fig. 1</td>
<td>195 - - ns</td>
</tr>
<tr>
<td>Data Hold Time</td>
<td>IH</td>
<td>see Fig. 1</td>
<td>10 - - ns</td>
</tr>
<tr>
<td>Data Hold Time</td>
<td>IDHI</td>
<td>see Fig. 2</td>
<td>20 - - ns</td>
</tr>
<tr>
<td>Address Hold Time</td>
<td>IAH</td>
<td>see Figs. 1 and 2</td>
<td>10 - - ns</td>
</tr>
</tbody>
</table>

*) Important parameter!
Use "74LS" or "74HC" gate

VCC=5.0V ±5%, Tt=25°C

INITIALISIERUNGSBEISPIEL FÜR DEN 4-BIT MODUS

<table>
<thead>
<tr>
<th>Befehl</th>
<th>RS</th>
<th>R/W</th>
<th>DB7</th>
<th>DB6</th>
<th>DB5</th>
<th>DB4</th>
<th>Standard Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function Set</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4-Bit Datenlänge einschalten (noch im 8-Bit Modus)</td>
</tr>
<tr>
<td>Function Set</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4-Bit Datenlänge, 1-zeiliges Display, 5x7 Font</td>
</tr>
<tr>
<td>Display ON/OFF</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Display ein, Cursor ein, Cursor blinken</td>
</tr>
<tr>
<td>Clear Display</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Display löschen, Cursor auf 1. Spalte von 1. Zeile</td>
</tr>
<tr>
<td>Entry Mode Set</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Cursor Auto-Increment</td>
</tr>
</tbody>
</table>

INITIALISIERUNGSBEISPIEL FÜR DEN 8-BIT MODUS

<table>
<thead>
<tr>
<th>Befehl</th>
<th>RS</th>
<th>R/W</th>
<th>DB7</th>
<th>DB6</th>
<th>DB5</th>
<th>DB4</th>
<th>DB3</th>
<th>DB2</th>
<th>DB1</th>
<th>DB0</th>
<th>Standard Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function Set</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8-Bit Datenlänge, 1-zeiliges Display, 5x7 Font</td>
</tr>
<tr>
<td>Display ON/OFF</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Display ein, Cursor ein, Cursor blinken</td>
</tr>
<tr>
<td>Clear Display</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Display löschen, Cursor auf 1. Spalte von 1. Zeile</td>
</tr>
<tr>
<td>Entry Mode Set</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Cursor Auto-Increment</td>
</tr>
</tbody>
</table>
ORDERING CODE
1x16 CHARACTER, 9,66mm, BLUE/WHITE, LED BACKLIGHT BEZEL (WINDOW 98,5x12,8mm)

LED current max. 30mA@+25°C
external series resistor at Pin 15 and 16 required
$V_{EE}$= typ. 4.5V@20°C

Kompatibilität mit EA E161-ENLW

<table>
<thead>
<tr>
<th>Tätigkeit</th>
<th>Werte</th>
<th>Anmerkung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Widerstand RA einlöten</td>
<td>RA = 56 Ohm</td>
<td>ILED= max. 30mA</td>
</tr>
</tbody>
</table>

EA W161B-ENLW
EA 017-6UKE
EA W162B-N3LW  2x16 CHARACTER 5,56mm

ORDERING CODE
2x16 CHARACTER, 5,56mm, BLUE/WHITE, LED BACKLIGHT
BEZEL (WINDOW 60,0x14,8mm)

EA W162B-NLW  2x16 CHARACTER 5,56mm

ORDERING CODE
2x16 CHARACTER, 5,56mm, BLUE/WHITE, LED BACKLIGHT
BEZEL (WINDOW 60,0x14,8mm)
EA W162B-BNLW

**2x16 CHARACTER 9,66mm**

- **ORDERING CODE**: 2x16 CHARACTER, 9,66mm, BLUE/WHITE, LED BACKLIGHT BEZEL (WINDOW 97,4x22,4mm)

- **LED current max.**: 45mA@+25°C
- **external resistor at Pin 15 and 16 required**
- **VEE= typ. 4,4V@20°C**

---

**EA DIP162-DN3LW**

**2x16 CHARACTER 6,68mm**

- **ORDERING CODE**: 2x16 CHARACTER, 6,68mm, BLUE/WHITE BEZEL (WINDOW 60,0x14,8mm)

- **LED current max.**: 45mA@+25°C
- **external resistor at Pin 17 and 18 required**
- **VEE= typ. 4,8V@+20°C**
## EA W202B-NLW

2x20 CHARACTER 5,55mm

**Ordering Code**

2x20 CHARACTER, 5,55mm, BLUE/WHITE, LED BACKLIGHT

BEZEL (WINDOW 81,5x17,2mm)

**Specifications**

- **Top.** -20..+70°C

**LED Parameters**

- **LED current max.** 30mA@+25°C
- **External Resistor** at Pin 15+ and 16-
- **VEE=** typ. 4,4V@+20°C

### Table: Compatibility with EA E242-NLW

<table>
<thead>
<tr>
<th>Task</th>
<th>Value</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>J15 and J16 open</td>
<td>Pins 15 and 16 free</td>
<td></td>
</tr>
<tr>
<td>Resistances J1 and J2 identical</td>
<td>J1 = 0 Ohm, J2 = 0 Ohm</td>
<td></td>
</tr>
<tr>
<td>Voltage RA</td>
<td>RA = 33 Ohm, LED= typ. 40mA</td>
<td></td>
</tr>
</tbody>
</table>

### Diagram

- [Diagram of EA W202B-NLW]

---

## EA W242B-NLW

2x24 CHARACTER 5,55mm

**Ordering Code**

2x24 CHARACTER, 5,55mm, BLUE/WHITE, LED BACKLIGHT

BEZEL (WINDOW 92,0x14,8mm)

**Specifications**

- **Top.** -20..+70°C

**LED Parameters**

- **LED current max.** 30mA@+25°C
- **VEE=** typ. 4,8V@+20°C

### Table: Compatibility with EA E242-NLW

<table>
<thead>
<tr>
<th>Task</th>
<th>Value</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>J15 and J16 open</td>
<td>Pins 15 and 16 free</td>
<td></td>
</tr>
<tr>
<td>Resistances J1 and J2 identical</td>
<td>J1 = 0 Ohm, J2 = 0 Ohm</td>
<td></td>
</tr>
<tr>
<td>Voltage RA</td>
<td>RA = 33 Ohm, LED= typ. 40mA</td>
<td></td>
</tr>
</tbody>
</table>

### Diagram

- [Diagram of EA W242B-NLW]
EA E202-CNLW

2x20 CHARACTER 12,7mm
Operating temperature 0..+50°C

ORDERING CODE
2x20 CHARACTER, 12,7mm, BLUE/WHITE, LED BACKLIGHT BEZEL (WINDOW 145,0x33,8mm)  
EA E202-CNLW
EA 017-27KE

LED current max. 60mA@+25°C
Pin 15+ and 16- directly at 5V

ELECTRONIC ASSEMBLY reserves the right to change specifications without prior notice.
**EA W164B-NLW**

**ORDERING CODE**
4x16 CHARACTER, 4,75mm, BLUE/WHITE, LED BACKLIGHT
BEZEL (WINDOW 60.8x24.2mm)

**4x16 CHARACTER 4,75mm**

\[ T_{\text{op.}} = -20 \ldots +70^\circ C \]

**Temp. Comp. built-in**

LED current max. 45mA@+25°C
external resistor at Pin 15+ and 16- required
VEE= typ. 4.5V@+20°C

**EA W164B-NLW**
EA 017-8UKE

---

**EA W204B-NLW**

**ORDERING CODE**
4x20 CHARACTER, 4,75mm, BLUE/WHITE, LED BACKLIGHT
BEZEL (WINDOW 75.0x24.2mm)

**4x20 CHARACTER 4,75mm**

\[ T_{\text{op.}} = -20 \ldots +70^\circ C \]

**EA W204B-NLW**
EA 017-9UKE
EA DIP203B-4NLW

4x20 CHARACTER 3,75mm

ORDERING CODE
4x20 CHARACTER, 3,75mm, BLUE/WHITE

EA DIP203B-6NLW

4x20 CHARACTER 6,45mm

ORDERING CODE
4x20 CHARACTER, 6,45mm, BLUE/WHITE

LED current max. 45mA@+25°C
external resistor at Pin 17 and 18 required

LED current max. 75mA@+25°C
external resistor at Pin 23 and 24 required
EA T204B-BNLW

4x20 CHARACTER 9,22mm

ORDERING CODE
4x20 CHARACTER, 9,22mm, BLUE/WHITE, LED BACKLIGHT BEZEL (WINDOW 121,0x41,5mm)

EA T204B-BNLW
EA 017-25KE

LED current typ. 60mA@+25°C
interner LED-Vorwiderstand
**BlueLine**

**EA W402B-NLW**

2x40 CHARACTER 5,55mm

ORDERING CODE

2x40 CHARACTER, 5,55mm, BLUE/WHITE, LED BACKLIGHT

BEZEL (WINDOW 153,0x14,8mm)

**EA W404B-NLW**

4x40 CHARACTER 4,89mm

ORDERING CODE

4x40 CHARACTER, 4,89mm, BLUE/WHITE, LED BACKLIGHT

BEZEL (WINDOW 145,0x28,0mm)
This page is intentionally left blank.
This page is intentionally left blank.
BLUETIME DISPLAYS
WITH RS-232 / RS-422

FEATURES
* SUPPLY VOLTAGE +5V
* SET BAUDRATE BY JUMPER: 300, 1200, 2400 OR 9600 BAUD
* AUTOMAT. LINE MANAGEMENT: CR / LF / SCROLL / PLACE CURSOR
* MULTIPLE DISPLAYS AT 1 RS-232 LINE, ADDRESSABLE
* SHIPMENT INCL. BEZEL WITH ANTIGLARE WINDOW

OPTIONALLY
* DIP SWITCH INSTEAD OF SOLDER LINK TO SET THE ADDRESS: EA OPT-DIP6
* RS-422 INTERFACE INSTEAD OF RS-232C (STANDARD): EA OPT-RS422

ACCESSORY
* EA KV24-9B: CABLE WITH 9-PIN D-SUB CONNECTOR (FEMALE)

ORDERING CODE
1x16 CHARACTER, 9,66mm, RS-232  EA SER161-ENLW
2x16 CHARACTER, 5,56mm, RS-232  EA SER162-N3LW
2x16 CHARACTER, 5,56mm, RS-232  EA SER162-NLW
2x16 CHARACTER, 9,66mm, RS-232  EA SER162-BNLW
2x20 CHARACTER, 5,55mm, RS-232  EA SER202-NLW
2x20 CHARACTER, 12,7mm, RS-232  EA SER202-CNLW
2x24 CHARACTER, 5,55mm, RS-232  EA SER242-NLW
4x20 CHARACTER, 4,75mm, RS-232  EA SER204-NLW
4x40 CHARACTER, 5,55mm, RS-232  EA SER402-NLW
4x40 CHARACTER, 4,89mm, RS-232  EA SER404-NLW