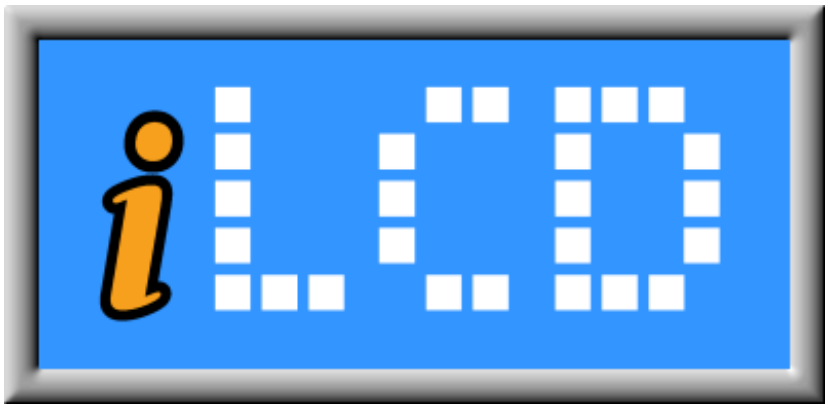

Next Generation Intelligent LCDs

Universal Controller Board DPB-UNIC Series Specification

Version 1.2
Document Date: June 21, 2005

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General Description

The iLCD controller boards allow the user to carry out all graphic and font needs via an easy and comfortable way without having to deal with pixel addressing, low level functions or hardware details. Controlling the screen contents is done either via a serial port, I^2C port or via USB.

Numbering System

Example:

DP	B	-	UNIC	-	5	7	7	1
1	2	3	4	5	6	7	8	9

Description:

No.	Description	Explanation	
1	Brand	demmel products	
2	Product type	B = iLCD Controller Board	
3	Separator	-	-
4	Product	iLCD Universal Controller Board	
5	Separator	-	-
6	ILCD Controller	1 = DPC1010 3 = DPC1030	5 = DPC1050
7	Control ports [1])	0 = 5 Volt serial + I^2C 1 = RS-232 port	2 = USB port 4 = RS-422/RS-485 port
8	I/O Ports [1])	0 = No I/O ports 1 = General purpose I/O	2 = Touch panel control 4 = Relay outputs
9	Options [1])	0 = No options 1 = Keyboard inputs	2 = Micro power reference 2.5 Volt 4 = Micro power reference 4.0 Volt

Note:
1. The resulting number is calculated by adding the options' numbers.

Features

Display Specific Data

Item	
Max. Display Size	320 x 240 pixels
Supported LCD Controller [1])	SED1520, SPLC501C, SED1565, KS107/108, T6963C, SED1335/S1D13305, S1D13700
Max. LED Backlight Current [2])	1000 mA
Max. Contrast Voltage [3])	±26 Volt

Note:
1. Support of LCD controllers is an issue of the iLCD's controller firmware. Updating the iLCD's controller firmware may give support to additional LCD controllers. Please ask demmel products if you do not find your required LCD controller in the list above.
2. The LED backlight is driven by a short circuit protected current source with thermal shut down.
3. The maximum contrast voltage is specified at 25° Celsius. As the contrast voltage is temperature compensated, the maximum contrast voltage may vary between ±24 and ±28 Volt depending on the actual ambient temperature (from 0° to 50° Celsius).

Electrical Specific Data

Item	All models (depending on installed options)
Connectivity	USB 1.1 / RS-232 / RS-232 5 Volt / RS-422 / RS-485 / I^2C
I/O Ports	4 general purpose ports (8 bit ADC 0..5 Volt or digital input or LED output), 2 LED outputs, keyboard with max. 32 keys, 2 relays outputs with 100 mA, control of a 4-wire analog touch panel, built in 5 Volt regulator with up to 12 Volt input voltage

Mechanical Specification

Item	Specification	Unit
Module Dimension	90 x 60	mm

Maximum Ratings

Item	Symbol	Minimum	Maximum	Unit
Supply Voltage	V_{CC}	-0.3	5.5	V
Input Voltage	V_{IN}	-0.3	V_{CC} + 0.3	V
Operating Temperature	T_{OPR}	0	50	°C
Storage Temperature	T_{STR}	-10	60	°C
Humidity			90	%RH

Electrical Characteristics

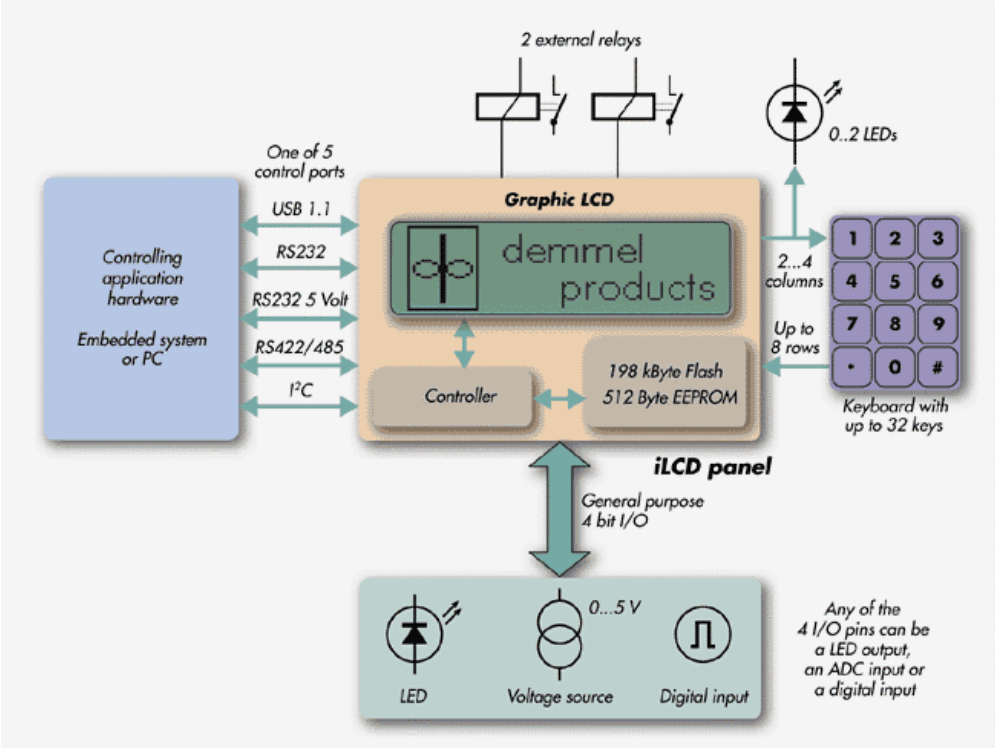
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}	-	4.75	5.0	5.25	V
Input Voltage H Level [1])	V_{IH}	-	0.7 V_{CC}	-	V_{CC}	V
Input voltage L Level [1])	V_{IL}	-	0.0	-	0.8	V
RS-232 Input Voltage Operating Range					±30	V
RS-232 Input Threshold Low	V_{IRL}	V_{CC} = 5V	0.8	1.3		V
RS-232 Input Threshold High	V_{IRH}	V_{CC} = 5V		1.8	2.4	V
RS-232 Input Hysteresis	V_{IRH}	V_{CC} = 5V	0.2	0.5	1	V
RS-485/RS-422 Driver Differential V_{OUT}	V_{OD2}	R_{LOAD} = 50 Ω	2	3		V
RS-485/RS-422 Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ 12V	-0.2		0.2	V
Current Consumption	I_{DD}	No ports active, B/L off, no LCD connected		30		mA
LED Backlight Current [2]) [5])	I_{BL}	Max. intensity selected via iLCD controller	12		1000	mA
Positive Contrast Voltage [3]) [6])		Max. contrast selected via iLCD controller		26		V
Negative Contrast Voltage [3]) [4]) [6])		Max. contrast selected via iLCD controller	-26		+3.5	V

Note:
1. For digital inputs only.
2. Depending on the setting of the position of the backlight current potentiometer and the backlight current jumper.
3. The maximum contrast voltage is specified at 25° Celsius. As the contrast voltage is temperature compensated, the maximum contrast voltage may vary between ±24 and ±28 Volt depending on the actual ambient temperature (from 0° to 50° Celsius).

4. Depending on the setting of the position of the contrast potentiometer.
5. Please read more about setting the maximum backlight current under Backlight Current Setting (P1)
6. Please read more about setting the contrast voltage under Contrast Voltage Setting (P2)

Module Function Description

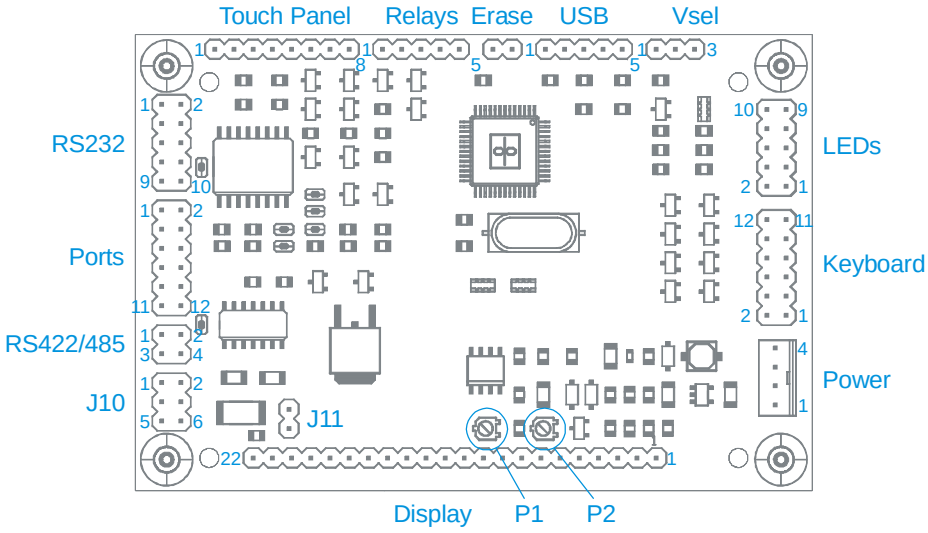
Block Diagram



Connectors and Jumpers

This section describes and illustrates the connectors and jumpers of the iLCD DPB-UNIC series iLCD controller boards.

WARNING! Reversed power supply connections (Vcc and Gnd) made to the board or invalid power supply voltage greater than 5.5 Volt will cause module damage.



DPB-UNIC series connector and jumper locations

Power Supply Connector (Power)

This connector applies the 5 Volt power supply to the controller board if there is no USB port connected to the module. The connector used for this connection is the same as the power supply connector for a 3 ½" floppy disk drive, and has the same pinning.

Pin	Description
1	Not connected
2	Ground
3	Ground
4	V_{CC} (+5 Volt)

Power Supply Configuration Connector (Vsel)

Only one jumper is allowed to be set to select the power source for the iLCD module as follows:

Jumper Location		Description
Pin	Pin	
1	2	Enables the power supply connector's pin 4 (V_{CC})
2	3	Enables supplying the iLCD module via the USB port

Serial Port Connector (RS232)

This connector allows the driving application or PC to send and receive data from and to the iLCD controller board via standard RS232 signals. A cable can be made by simply using a straight flat cable connection between a 10 pin flat cable connector to a 9 pin female Sub-D (10th wire of the flat cable removed at the Sub-D side). The pinning will match the standard layout of a PC's serial port then.

Pin On Board	Pin On Sub-D	Direc-tion	Description
1	1	-	Not connected
2	6	-	Not connected
3	2	Out	RX - data sent from the iLCD module to the controlling application / PC
4	7	In	RTS – not in use, but connected to the iLCD's RS232 driver
5	3	In	TX - data sent from the controlling application / PC to the iLCD module
6	8	Out	CTS – iLCD's output for hardware flow control [1])
7	4	-	Not connected
8	9	-	Not connected
9	5	-	Signal ground
10	-	-	Not connected

Note:
1. See iLCD's command description about why you should connect this pin and when it is not necessary to use hardware flow control.

General Port Connector (Ports)

This connector enables you to connect the second RS232 port (**5 Volt signals only, no standard RS232 signal level of ± 9 Volt**), the I²C, and some other signals described below.

Pin	Direc-tion	Description
1	-	Vcc (+5 Volt)
2	In/Out	I²C Data [1])
3	Out	RX2 - data sent from the iLCD module to the controlling application / PC
4	In/Out	I²C Clock [1])
5	In	TX2 - data sent from the controlling application / PC to the iLCD module
6	Out	I²C Alert – signals unexpected data to be sent to the application (e.g. a keystroke)
7	Out	CTS - iLCD's output for hardware flow control – see iLCD's command description [2])
8	-	Used for production programming – DO NOT USE THIS PIN
9	In/Out	/RESET – Pulling this pin low resets the iLCD module [3])
10	-	Used for production programming – DO NOT USE THIS PIN
11	-	Ground
12		Used for production programming – DO NOT USE THIS PIN

Note:
1. This pin is pulled high via a 3k3 resistor on the iLCD board to match the I²C specification.
2. The 5 Volt CTS output connected to this pin is connected to the CTS port driver of primary RS232 port internally. This means that the iLCD's hardware flow control pin CTS is common for both RS232 ports.
3. The board's internal power up reset signal can be seen on this pin as well.

RS422/RS485 Data Connector (RS422/RS485)

This connector enables you to connect the second RS232 port via RS422 or RS485. The 5 Volt RS232 port and the RS422/RS485 port cannot be active at the same time. RS422 and RS485 do not use hardware flow control. Please read the iLCD's command description about when it is not necessary to use hardware flow control.

When the iLCD module shall be controlled via RS485, RX+ must be connected with TX+ and RX- must be connected with TX-.

Pin	Direc-tion	Description
1	In	TX- - data sent from the controlling application to the iLCD module
2	In	TX+ - data sent from the controlling application to the iLCD module
3	Out	RX- - data sent from the iLCD module to the controlling application
4	Out	RX+ - data sent from the iLCD module to the controlling application

Please note that using RS422 or RS485 requires setting the jumpers as shown below.

RS422/RS485 Configuration Connector (J10)

Pin	Pin	Description
1	2	A jumper must be set between pin 1 and 2 to enable RS422 or RS485. When using the 5 volt mode for the secondary RS232 port, the jumper must be removed.
3	4	Set a jumper between pin 3 and 4 to use the on-board terminating 100E resistor for RX+ / RX-
4	5	Set a jumper between pin 3 and 4 to use the on-board terminating 100E resistor for TX+ / TX-

USB Connector (USB)

This connector enables you to connect iLCD's USB port to a USB port on a PC. The board is supplied via the USB connector as well.

Pin	Direc-tion	Description
1	In/Out	USB+
2	-	Ground
3	In/Out	USB-
4	-	Pin does not exist. Used as a polarization key.
5	-	Vcc +5 Volt

General Purpose I/O Connector (LEDs)

Depending on the settings in the iLCD's setup software the four general purpose I/O ports can be a digital input, a LED output or an ADC input.

Pin	Direc-tion	Description
1	-	Vcc +5 Volt
2	Out	LED 4 (Power LED)
3	Out	LED 5
4	In/Out	LED 0 output / ADC 0 input / General purpose input 0 [1])
5	-	Not connected
6	In/Out	LED 1 output / ADC 1 input / General purpose input 1 [1])
7	-	Not connected
8	In/Out	LED 2 output / ADC 2 input / General purpose input 2 [1])
9	-	Ground
10	In/Out	LED 3 output / ADC 3 input / General purpose input 3 [1])

Note:
1. The functionality of this pin is set via the iLCD's setup software.

Please note that LED 4 and LED 5 share the same controller outputs as column 2 and 3 of the keyboard. Although there is no visual effect when using LEDs, there are short glitches on the corresponding outputs when the keyboard is scanned, therefore it is not recommended to use this outputs for something other than LEDs. If column 2 / 3 of the keyboard is in use, LED 4 / 5 should not be turned on, as pressing a key can collide with iLCD's internal display processing routines.

Please note that pin 4 and 6 cannot be used if a touch panel is in use.

Display Connector (Display)

This connector allows you to connect your LCD to the iLCD controller board. Depending on the controller of your LCD the pins of this connector have a different functionality. Please note that the iLCD controller always uses the 8080 mode and not the 6800 mode if both modes are available for the given controller (currently the only controller without 8080 mode supported by the iLCD controllers is the KS107/108).

Pin	Name	Direc-tion	Description
1	V_{CC}	-	5 Volt power supply for the LCD
2	GNS	-	Ground
3	V_O	-	Negative voltage (temperature compensated) for driving the LCD (+ 3.5 … -26.8 Volt) depending on contrast value set via the iLCD controller and the contrast potentiometer P2 [1])
4 … 11	DB0	I/O	Data bus line 0 … 7
12	/CS /CS1	Out	Chip select or chip select 1 (active low)
13	/CS2 /RES	Out	Chip select 2 or display reset (active low) issued by iLCD controller
14	/RST	Out	Hardware reset at power up (active low)
15	/RD R/W	Out	LCD read pin (active low) or LCD R/W (H = read, L = write mode)
16	AD A0 D/I	Out	H = data register, L = Instruction register access
17	/WR /E	Out	LCD write pin (active low) or LCD enable (active low)
18	-	-	Not connected
19	BL/A	Out	Backlight LED anode [2])
20	BL/C GND	-	Backlight cathode [2])
21	CL	Out	Clock output with approx. 8 kHz, duty cycle varies between 5% and 95% corresponding to the contrast value set via the iLCD controller
22	V+	-	Positive voltage of max. 26.8 Volt (temperature compensated) at 25° Celsius depending on contrast value set via the iLCD controller

Note:
1. Please read more about setting the contrast voltage under Contrast Voltage Setting (P2)
2. Please read "Backlight Current Setting (P1)" to learn how to set the maximum backlight current.

Keyboard Connector (Keyboard)

The iLCD module supports up to 32 keys, which are connected in a matrix with 4 columns and 8 rows. The scan code / key code sent by the iLCD module can be set via the setup software for any of the 32 keys.

Pin	Direc-tion	Description
1	In	Row 0
2	In	Row 1
3	In	Row 2
4	In	Row 3
5	In	Row 4
6	In	Row 5
7	In	Row 6
8	In	Row 7
9	Out	Column 0
10	Out	Column 1
11	Out	Column 2
12	Out	Column 3

Please note that LED 4 and LED 5 share the same controller outputs as column 2 and 3 of the keyboard. Although there is no visual effect when using LEDs, there are short glitches on the corresponding outputs when the keyboard is scanned, therefore it is not recommended to use this outputs for something other than LEDs. If column 2 / 3 of the keyboard is in use, LED 4 / 5 should not be turned on, as pressing a key can collide with iLCD's internal display processing routines.

Touch Panel Connector (Touch Panel)

The iLCD controller board can control a 4-wire analog touch panel. Please note that only firmware versions ≥ 2.0 of the DPC1050 iLCD controller are capable of controlling the touch panel

Pin	Direc-tion	Description
1	-	Ground
2	In	ADC 0 input 0 to be connected to X2 (pin 5)
3	In	ADC 1 input 0 to be connected to Y2 (pin 7)
4	Out	X1 of touch panel
5	Out	X2 of touch panel
6	-	Not connected
7	Out	Y2 of touch panel
8	Out	Y1 of touch panel

Please note that General Purpose I/O 0 and 1 (pin 4 and 6) of the General Purpose I/O Connector cannot be used if a touch panel is in use.

Relays Connector (Relays)

The two relays, which may be connected to the iLCD board, can be supplied using up to 24 Volts. The iLCD module contains a diode for any of the two relays outputs to protect the switching transistor against reverse voltage. To enable the diodes to protect the transistors, the relay supply voltages must be connected to the board too.

Pin	Direc-tion	Description
1	-	Relay 1 positive supply voltage
2	Out	Relay 1 output (minus pin of relay)
3	-	Ground
4	Out	Relay 0 output (minus pin of relay)
5	-	Relay 0 positive supply voltage

Relay 0 can also be used to drive a speaker or buzzer and relay 1 can be used to generate a pulse-width modulated output voltage. Please have a look to the extra document "iLCD Commands" to learn more about how to control these output ports in this case.

Erase Jumper (Erase)

When a jumper is connected to this connector, the iLCD module erases all user data from the Flash memory at boot time. A corresponding message is shown on the LCD. Please remove the jumper after startup to avoid consecutive erasing of Flash contents at the next startup.

Backlight Current Range Configuration Jumper (J11)

The maximum current for the LED backlight can be set via the potentiometer P1 (see below) in the range of approximately 12 to 130 mA when the jumper J11 is not set and between approximately 130 mA and 1000 mA when the jumper is set. Please take care not to accidentally set the jumper J11, as this may damage the LCD's backlight LEDs when they get a too high current.

Backlight Current Setting (P1)

With potentiometer P1 you can control the maximum current sourced by the current source for the backlight LEDs of your display. Depending on the setting of the Backlight Current Range Configuration Jumper (J11) you can set a maximum current of about 12 to 130 mA and 130 mA and 1000 mA. Please take care not to change the setting of this potentiometer when a display is connected as this may exceed the maximum allowed backlight current of your LCD display causing a possible destruction of the backlight LED.

To set the maximum backlight current proceed as follows:

- Ensure that you have disconnected the LCD's backlight connection and ensure there is no power supply connected to the controller board.
- Connect an ampere meter between pin 19 and 20 of the Display Connector (Display)
- Connect your data communication (serial port or USB) to a PC and power on the iLCD controller board. Start the iLCD setup & test software and ensure you have the maximum backlight intensity selected and the backlight is on (on the Setup screen of the program).
- Now set the potentiometer P1 as required (right turn increases current) to get the current specified in the datasheet of your LCD display. Note that setting the Backlight Current Range Configuration Jumper (J11) increases the maximum current to be between about 130 mA and 1000 mA, leaving this jumper open gives a range of about 12 to 130 mA.

The current source of the iLCD controller board is short circuit protected and has a thermal shutdown. If the setup procedure takes a longer time and you have set a high current, the current source may shut down when the power dissipation gets too high and the controlling FET gets too hot (this will never happen if a backlight LED is connected). After powering off the board for some minutes the current source will be functional again.

Please note that when powering the board from an USB port, the maximum total current of the board cannot exceed 500 mA (this is limitation of the general USB specification). Depending on the number of active USB devices connected to the PC the maximum current may be even lower than 500 mA.

After you have correctly set the maximum current of the LED backlight you can connect the LCD's backlight when the board is unpowered.

Contrast Voltage Setting (P2)

With potentiometer P2 you can control the maximum voltage for the LCD contrast voltage outputted at pin 3 of the Display Connector (Display). Most LCDs need a negative voltage between –3 and –16 Volt. This value is often referred as "LCD driving voltage" VDD – VO and stated as a positive value as VDD is +5 Volt and VO is e.g. –15 Volt thus giving +5 – (–15) a value of 20 Volt. In case of any doubt call the distributor of

your display to check the correct maximum voltage, as some LCDs really need a positive contrast voltage and applying the wrong polarity or the a voltage which is too high may destroy your LCD.

The voltage on pin 3 of the Display Connector (Display) can be set via potentiometer P2 between approximately +3 and –26 Volt (referred to Ground) when the maximum contrast is set via the iLCD controller (this can be done via the iLCD setup & test software). The voltage outputted on pin 3 is internally sourced from the V_{CC} voltage, so if your LCD display does not sink current for the contrast voltage you have to connect a resistor of 47k between pin 3 and V_{CC} (pin 1 of the Display Connector (Display)). This is true for some displays which have a built in DC/DC converter for the contrast voltage and require a control voltage between 0 and +3 Volt (referred to Ground) for setting the contrast only.

Setting the maximum contrast voltage should be done as follows:

- Ensure that you have disconnected the LCD's contrast voltage and ensure there is no power supply connected to the controller board.
- Connect a voltmeter between pin 1 and 3 of the Display Connector (Display) measuring VDD – VO.
- Connect your data communication (serial port or USB) to a PC and power on the iLCD controller board. Start the iLCD setup & test software and ensure you have a middle contrast selected (on the Setup screen of the program).
- Now set the potentiometer P2 as required (right turn increases the negative voltage amount) to get the typical contrast voltage specified in the datasheet of your LCD display for 25° Celsius.

You may now connect the contrast voltage to your LCD when the board is unpowered.

Please note that the contrast voltage can be varied by about ±10% via the iLCD controller's contrast value setting either via the appropriate command or via the iLCD setup & test software. Besides that the outputted contrast voltage is temperature compensated to fit the necessary variation of this voltage in a range of 0° to 50° Celsius of a typical LCD display.

When using pin 22 of the Display Connector (Display) - outputting a positive contrast voltage of typically +21.7 to +26.8 Volt (at 25° Celsius) depending on the iLCD controller's contrast value setting - the above paragraph is still true. The only difference between using pin 22 and pin 3 is that pin 22 outputs a positive voltage, which cannot be adjusted via the potentiometer P2. When using this pin, an external voltage divider consisting of two resistors with appropriate values fitting the positive contrast voltage requirements of the LCD has to be used. Please note that the sum of the two resistor values should be higher than 10k.

Connecting an LCD to the iLCD Controller Board

Before you drive your valuable LCD with the iLCD controller board ensure that you have checked the following things:

- Read the documentation of the LCD and find out the typical contrast voltage and the maximum backlight current. Set these values as noted in Backlight Current Setting (P1) and Contrast Voltage Setting (P2) without having the LCD connected to the board. Take care not to exceed the maximum values as this may damage your LCD.
- Connect all necessary pins of your LCD to the Display Connector (Display); take care to e.g. connect control lines like selection of 6800/8080 mode to Ground or V_{CC} as required. demmel products offers connector cables with mini-latch connectors (order number DPA-CL10P15) which helps you to reduce the amount of time for wiring the LCD.
- Make a new or take an existing Flash data setup file and take care about setting the correct LCD display controller and LCD width and height under Setup → Edit → Setup Data… → Hardware. Ensure that the Hardware Setting is updated and download to Flash data to the iLCD controller.

Command Set

Please see the extra document "iLCD Commands" which describes the common command set available for all iLCD modules.

Revision History

Date	Rev. #	Revision Details
June 21, 2005	1.2	Added hint not to use LED 4/5 when keyboard column 2/3 is in use
December 18, 2004	1.1	Corrected touch panel connector description
November 17, 2004	1.0	First Issue

If you find any errors in this document, please contact demmel products at support@demmel.com