KSP-0115
LCD / Touch Base Board
HD200

Hardware Manual

Edition October 2004

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2nd Edition October 2004

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1. Setup and Getting Started Manual for KSP-0115 (LCD/Touch Base Board HD200)

This manual describes PCB revision 4088.2 (schematics 4088.2-001 Rev. 1.0 as of 04/09/2004).

Dimensions:
167 x 110 x 30 mm with mounting holes for direct assembly behind a 5,7" ¼-VGA LCD display

Connections and on-board Features:
- direct back-to-back assembly option for base board with LCD due to same PCB size
- universal connection for alternative LCDs (different types/sizes/resolution/color)
- touch connectivity (for LCD with analog resistive touch panel)
- voltage regulator for CFL background supply (can be mounted on-board)
- supply voltage 8 - 30VDC (integrated DC/DC converter)
- connection and potentiometer for LCD contrast regulation
- connection for dial/encoder (JogDial, e.g. Grayhill)
- 2* RS-232 connectors (DB-9 socket and header connectors)
- 2* CAN connectors (DB-9 plug and header connectors) (1 of them optional optically isolated)
- 1* Ethernet connector (RJ45 socket, 2 LEDs)
- 1* USB connector (USB1.1/2.0, full speed 12 Mbit, type B)
- 1* PS/2 keyboard/mouse connector (miniDIN)
- 1* Multimedia / SecureDigital Card (MM/SD card up to 512 MByte) socket
- 8* analog input 0-10V/16-bit
- 4* analog output 0-10V/10-bit
- 8* digital input (opto-coupler) 24V
- 8* digital output (opto-coupler) 24V/300mA active high
- all interfaces and MCU ports available on header connectors (2.54 mm spacing) for customer-specific expansions

The board supports the following features (depending on the chosen board configuration and the underlying phyCORE module/microcontroller):

Supported phyCORE SBC modules
phyCORE-167/ST10 (PCM-009)
phyCORE-167HSE/ST10 (PCM-018)
phyCORE-XC161 (PCM-020)
phyCORE-XC167 (PCM-021)
phyCORE-ARM7/AT91 (PCM-014)

Supported Displays:
Hitachi SP14/SX14/TX14 (320*240 pixel, 256 colors, STN, TFT or monochrome).
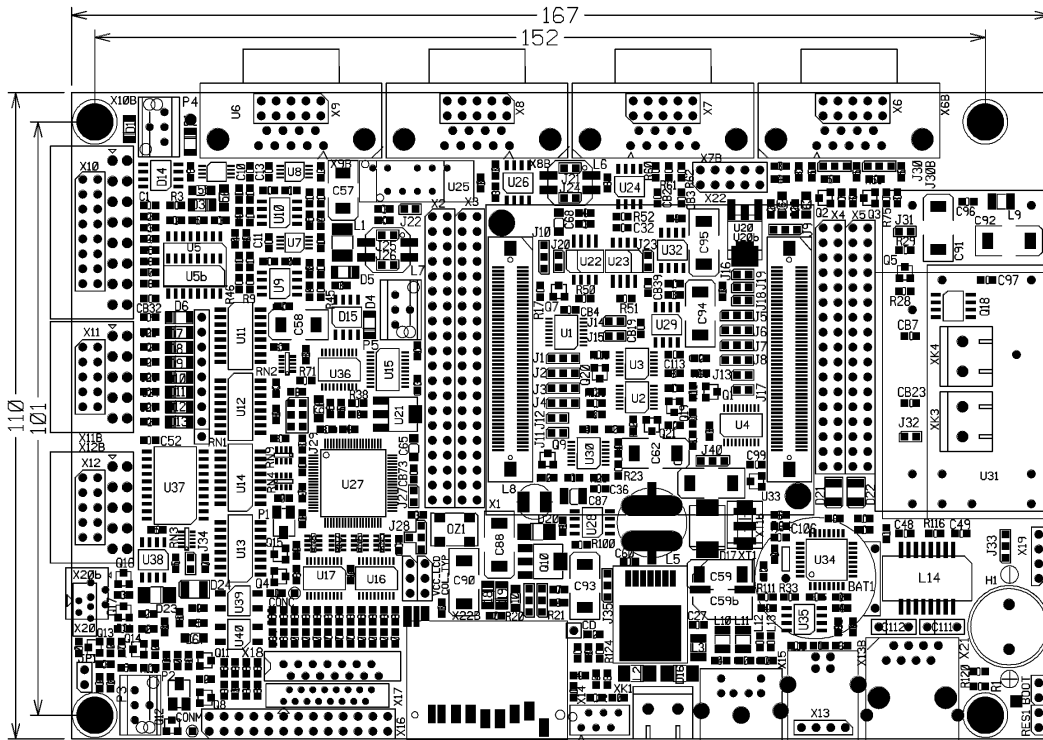
Figure 1:   KSP-0115-0 LCD/ Touch Base Board HD200

2. Interfaces and Connectors

XK1   screw clamp for supply voltage (8 - 30 VDC/1A)

XK3   screw clamp for supply of CFL inverter input (optional)

XK4   screw clamp for supply of CFL inverter output (optional)

X1   receptacle for phyCORE module HD200 (Molex)

X2-5   connector rows with all controller signals (not buffered) (2.54 mm pitch)

X6(B)   first RS-232 interface with reset function (for C167/XC161additional bootstrap function) (DB-9 female)

X7(B)   second RS-232 interface (if supported by the module/controller) (DB-9 female)

X8(B)   first CAN interface (if supported by the module/controller) (DB-9 male, optical isolation option)

X9(B)   second CAN interface (if supported by the module/controller) (DB-9 male)

X10(B)   analog inputs (8*) and analog outputs (4*) (Wago S2L/3.5/n)

X11(B)   digital inputs (8* 24VDC) (Wago S2L/3.5/n)

X12(B)   digital outputs (8* 24VDC/300mA) (Wago S2L/3.5/n)

X13(B)   USB 2.0/1.1 interface (USB-B)

X14   dial encoder interface (Grayhill 62A compatible) (AMP-Micromatch)

X15   PS/2 keyboard/mouse interface

X16   universal LCD (STN/TFT) interface with all signals/voltages

X17   color LCD flex connector (Hitachi SX14 compatible)

X18   monochr. LCD flex connector (Hitachi SP14 compatible)

X19   LCD-CFL connector (background illumination for LCD)

X20   LCD/Touch connector (analog resistive touch panel) (Flex)

X21   Ethernet TP10 interface (RJ45)

X22   SPI interface / synchronous debug connection (PLS-UDE)

X22B   MM/SD card slot (socket with release button)

JP1   connector for external contrast potentiometer

RES1　　connector for external Reset button (/RESIN)
BOOT　　connector for external Boot button /jumper (input for C167/XC16x bootstrap loader at D4)

Miscellaneous:

VCCLCD1　Jumper for configuration of LCD display supply voltage
　　　　　　1+2 = 3.3 V LCD (e.g. Hitachi SX14, color)
　　　　　　2+3 = 5 V LCD (e.g. Hitachi SP14, monochrome)

COLTYP1　Jumper for configuration of color LCD type (+3 V contrast / +23 V contrast)
　　　　　　1+2 = contrast voltage derived from VCC_LCD (e.g. Hitachi SX14)
　　　　　　2+3 = contrast voltage derived from VEE+ (e.g. Lehner-Dabitros)

H1　　　　signal indicator (buzzer), can be controlled via port pin

BAT1　　　Lithium battery 3V (CR2032) = VBAT of the underlying SBC module (RTC/RAM buffer)

P1　　　　contrast for color LCD

P2　　　　contrast for monochrome LCD (function enabled via P3)

P3　　　　contrast voltage LCD-VEE+/-

P4　　　　Reference voltage analog input 1..8 (full-scale)

P5　　　　Reference voltage analog output 1..4 (full-scale)

R20　　　 VEE-CTRL 1+2 = GND at MAX749-CTRL

R21　　　 VEE-ADJ 1+2 = GND at AMX749-ADJ

3. Jumper Configuration and Port Assignment

The following basic jumper settings on the LCD/Touch Base Board HD200 are valid for the different phyCORE SBC module options:

When using a C167/ST10/XC16x-based module:
>   J1 to J8 = closed at 1+2,
>   J9 and J40 = closed at 2+3

When using the ARM7-based module:
>   J1 to J8 = closed at 2+3,
>   J9 and J40 = closed at 1+2

The following terminology is used in the jumper description below:

- "input" means input signal on the microcontroller/phyCORE module (Peripheral components on the LCD/Touch Base Board HD200 provide an output.)
- "output" means output signal on the microcontroller/phyCORE module (Peripheral components on the LCD/Touch Base Board HD200 provide an input.)

def. = factory default state

Jumper	Default	Comment
J1		RDY/Wait input from LCD controller (/WAIT = ARM, /RDY = C167/XC16x)
1 + 2		/Ready signal on C167/XC16x-based modules
2 + 3		/Wait signal on ARM7-based modules
J2		MTSR (SPI-TX) output SPI bus (MOSI = ARM, SSC/P3.9 = C167/XC16x)
1 + 2		P3.9 (MTSR) on C167/XC16x-based modules
2 + 3		PA25 (MOSI) on ARM7-based modules
J3		MRST (SPI-RX) input SPI bus (MISO = ARM, SSC/P3.8 = C167/XC16x)
1 + 2		P3.8 (MRST) on C167/XC16x-based modules
2 + 3		PA24 (MISO) on ARM7-based modules
J4		SCLK (SPI Clock) Output SPI-Bus (SPCK = ARM, SSC/P3.13 = C167/XC16x)
1 + 2		P3.13 (SCLK) on C167/XC16x-based modules
2 + 3		PA23 (SPCK) on ARM7-based modules
J5		Keyboard clock output / encoder A input (SCK0 = ARM, P2.13 = C167/XC16x)
1 + 2		P2.13 on C167/XC16x-based modules
2 + 3		PA14 (SCK0) on ARM7-based modules
J6		/CSADC (SPI /CS for external ADC) output SPI bus (/PCS2 = ARM, P6.5 = C167/XC16x)
1 + 2		P6.5 on C167/XC16x-based modules
2 + 3		PA28 (/PCS2) on ARM7-based modules
J7		/CSMMC (SPI /CS for MMC/SD card) output SPI bus (/PCS3 = ARM, P6.6 = C167/XC16x)
1 + 2		P6.6 on C167/XC16x-based modules
2 + 3		PA29 (/PCS3) on ARM7-based modules
J8		/CDDA1 (SPI /CS for external DAC1) output SPI bus (/PCS0 = ARM, P6.7 = C167/XC16x)
1 + 2		P6.7 on C167/XC16x-based modules
2 + 3		PA26 (/PCS0) on ARM7-based modules
		NOTE: /PCS0 typically controls the CAN controller populating the PCM-014 module, it is only possible to use /PCS0 for either CAN or external DAC1 at any given time!
J9		Configuration of the secondary supply voltage for phyCORE modules requiring VCC2.
1 + 2		5 V for ARM7-based modules
2 + 3		2.5 V XC16x-based modules

Jumper	Default	Comment
J10		Configuration of CAN1 supply
1 + 2		VCC (not optically isolated, J22 must be closed as well!)
2 + 3		Supply via CAN plug pin #9 (J22 must be open, optically isolated)
open		CAN transceiver supplied via DC/DC converter at U25 (J22 must be open, optically isolated)
J11		/TXE (transmitter empty) input from USB controller (P2.9 = C167)
closed		/TXE signal at P2.9 on C167 resp. PA10 at ARM7
		NOTE: PA10 typically controls the RDY input on the CAN controller populating the PCM-014 module, it is only possible to use PA10 for either CAN or /TXE signal at any given time!
open		Port P2.9 (C167) resp. PA10 (ARM7) freely available for other peripherals on the LCD/Touch base board.
J12		/RXF (receiver full) input from USB controller (P2.10 = C167)
closed		/RXF signal at P2.10 (C167) resp. PA11 (ARM7)
		NOTE: PA11 typically controls the interrupt input on the Ethernet controller populating the PCM-014 module, it is only possible to use PA11 for either Ethernet IRQ or /RXF signal at any given time!
open		Port P2.10 (C167) resp. PA11 (ARM7) freely available for other peripherals on the LCD/Touch base board.
J13		/CSDA2 (SPI /CS for external DAC2) output SPI bus (/PCS1= ARM, P2.15 = C167)
1 + 2	X	P2.15 on C167
2 + 3		PA27 (/PCS1) on ARM7
		NOTE: /PCS1 typically controls the serial EEPROM populating the PCM-014 module, it is only possible to use /PCS1 for either SPI /CS or serial EEPROM at any given time!
J14		VEEAdj output for MAX749 (DIO2 bit 6)
closed	X	VEEAdj. can be controlled via DIO2 bit 6.
open		VEEAdj. is set to 1 or 0 via R21 and can not be changed.
J15		VEECtrl output for MAX749 (DIO2 bit 7)
closed	X	VEECtrl can be controlled via DIO2 bit 7.
open		VEECtrl is set to 1 or 0 via P20 and can not be changed.

Jumper	Default	Comment
J16		ENA_CFL (display illumination ON/OFF), output
closed	X	P7.6 (C167) or PB14 (ARM7) can be used to turn display illumination ON or OFF, jumper J31 must be open! (1 = on, 0 = off)
open		P7.6 (C167) or PB14 (ARM7) are freely available, display illumination can not be switched
J17		BEEPER (buzzer H1 ON/OFF), output
closed	X	P7.7 (C167) or PB15 (ARM7) can be used to switch buzzer H1 (1=on, 0=off)
open		P7.7 (C167) or PB15 (ARM7) are freely available, buzzer can not be used
J18		Dial encoder switch, input, switch to GND for the optional dial encoder at X14
closed	X	P5.14 (C167) or PA8 (ARM7) connected to switch output of dial encoder at X14
open		P5.14 (C167) or PA8 (ARM7) are freely available
J19		Digital Out Fail, input, error state output for optional 24 V digital output drivers
closed	X	P5.13 (C167) or PA13 (ARM7) connected to Fail output on 24V drivers (0=Error)
open		P5.13 (C167) or PA13 (ARM7) are freely available, no error diagnosis option for 24V outputs
J22		CAN1 supply
closed	X	CANGND = GND (no isolation)
open		CANGND isolated from GND (with CAN supply via CAN bus or DC/DC converter at U25)
J20, J23		CAN1 transceiver selection
closed	X	Use CAN transceiver populating the phyCORE module, U24 must be unpopulated, no opto-isolation
open		Use CAN transceiver at U24, or X8 unused
J21, J24		CAN choke L6 option (internally used)
closed	X	CAN choke L6 not populated
open		CAN choke L6 is populated
J25, J26		CAN choke L7 option (internally used)
closed	X	CAN choke L7 not populated
open		CAN choke L7 is populated

Jumper	Default	Comment
J27		LCD bus clock (clock of the LCD controller)
closed	X	Bus clock = LCD clock OSZ1 unpopulated = CLKOUT of the CPU supplies LCD clock (OZ1 populated = OZ1 supplies LCD and bus clock, ***NOTE!: CLKOUT of the CPU must be inactive/configured as input!)***
open		bus clock must be supplied from controller's CLKOUT signal, OZ1 supplies LCD clock
J28		LCD OFF signal generation (for internal use only! Type of LCD OFF signal generation
J29		LCD controller bus interface configuration (A0 and /BHE or /WRL and /WRH)
3 + 5, 4 + 6		/WRL and /WRH signals used (only with phyCORE-167, PCM-009)
1 + 3, 2 + 4	X	/WR and /BHE signals used (C167 on PCM-018 and ARM7, PCM-014 ***NOTE: this jumper setting must match the module configuration, e.g. on PCM-018 settings for J34 and J35!***
J30		Reset signal via RS-232 interface lines RTS or CTS, pin #6 or #7 on DB-9 connector X6
1 + 2		RTS signal at X6 (pin #6 on DB-9) can be used to control the /RESET signal of the CPU (1 = active)
2 + 3		CTS signal at X6 (pin #7 on DB-9) can be used to control the /RESET signal of the CPU (1 = active)
J30B		Boot signal (on C167/ST10 only!) via RS-232 interface lines DTR or DSR, pin #4 or #8 on DB-9 connector X6
1 + 2		DTR signal at X6 (pin #8 on DB-9) can be used to control the BOOT signal of the CPU (1 = active)
2 + 3		DSR signal at X6 (pin #4 on DB-9) can be used to control the BOOT signal of the CPU (1 = active)
J31		CFL switch option
closed		CFL inverter always connected to VCC (LCD illumination is always on)
open	X	CFL inverter can be switched on and off via ENABKL (*also refer to J16*)

Jumper	Default	Comment
J32		CFL inverter supply
closed	X	CFL inverter voltage derived from 5V board main supply (VCC5)
open		CFL inverter can be supplied via XK3/XK4 (for external CFL inverter)
J33		CFL inverter configuration
1 + 2		full inverter power on one LCD backlight tube (10 mA/4.5 W)
2 + 3		half inverter power on one LCD backlight tube (6 mA/2.7 W)
open	X	half inverter power on one LCD backlight tube (second output free, 2* 5 mA / 2.25 W)
J34		Type of 24 V output driver (for internal use only!)
closed		18-pin type output driver (UDN2981/82)
open		20-pin type output driver (UDN2987)
J35		ON/OFF input on switching regulator U18
open	X	Soft start
1 + 2		ON
2 + 3		OFF
J40		VCC supply for phyCORE module configuration, VCC = 5 V or 3.3 V
1 + 2		VCC = 3.3 V (for ARM7 module, PCM-014)
2 + 3	X	VCC = 5 V (for all C167/XC16x and ST10-based modules)
J36/37		Option for wiring port lines as digital inputs instead of DIO1
J38/39		Option for wiring port lines as digital outputs instead of DIO1 (requires removing U36!)

Please note the current jumper configuration on the phyCORE modules used in conjunction with this LCD / Touch Base Board HD200 *(refer to the corresponding phyCORE Hardware Manual)*.

Figure 2 indicates the location of the Jumpers (see the next side).
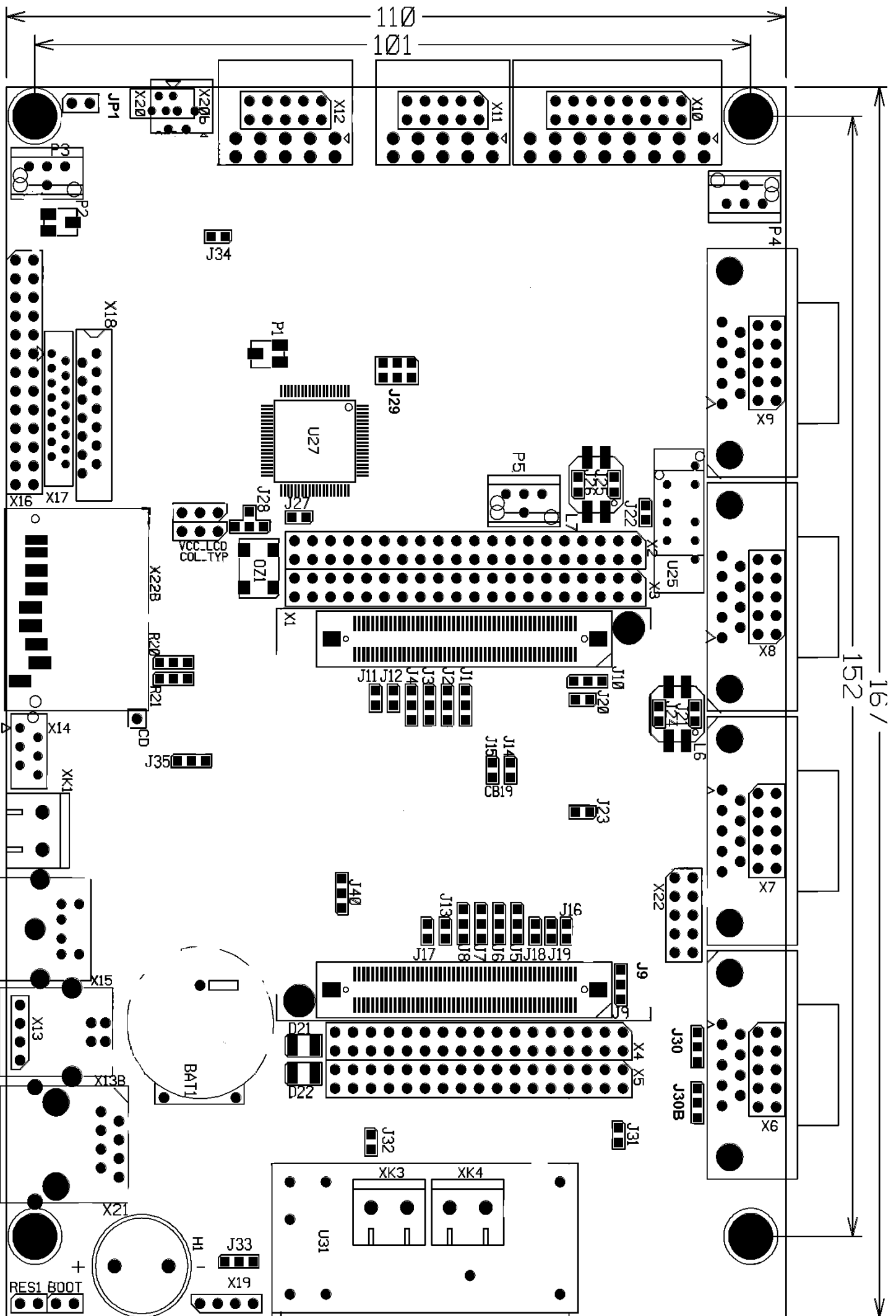
4. Peripheral Components on the LCD / Touch Base Board HD200

Address Decoding (when used with C167-based module):

/CS0 = not used (used on the phyCORE module)
/CS1 = not used (used on the phyCORE module)
/CS2 = see memory map for CSx below.
      (Must not be used on-board on the phyCORE module!)
/CS3ff = not used (can/could be used on the phyCORE module)

Address Decoding (when used with ARM7-based module):

/CS0 = not used (used on the phyCORE module)
/CS1 = not used (used on the phyCORE module)
/CS2 = not used (used on the phyCORE module)
/CS3 = see memory map for CSx below.
      (Must not be used on-board on the phyCORE module!)
/CS4ff = not used (can/could be used on the phyCORE module)

Memory Map:

/CSx+00000 = UART/Ethernet (instead of optional UART on
             phyCORE-167)
/CSx+20000 = USB controller
/CSx+40000 = LCD controller
/CSx+60000 = 24V digital I/O (/RD = read inputs, /WR = set outputs)
/CSx+80000 = DIO2 (/WR = internal functions, see "register/ports")
/CSx+A0000 = external /CS-IO1 (freely available)
/CSx+C0000 = external /CS-IO2 (freely available)
/CSx+E0000 = external /CS-IO3 (freely available)

Memory mapped registers and ports:

Write access to the registers/ports is done via DIO2. These registers are reset after power-on/reset (value = 0).

Bit0..2   Analog input 1...8 (channel selection is binary decoded 000=AIN1, ...111=AIN8)

Bit3   24 V digital output reset (0 = reset = outputs disabled, 1 = outputs active)

Bit4   Touch X out (1 = ON, X-axis is supplied and can be read via AN1)

Bit5   Touch Y out (1 = ON, Y-axis is supplied and can be read via AN0)

Bit6   VEEAD for adjusting the contrast voltage using the MAX749 (for mono LCD SP14.)

Bit7   VEECTRL for contrast voltage on/off switching using the MAX749 (for mono LCD SP14.)

(Bit6+7 low = shut down, Bit6 high+Bit7 low = reset mid-range, Bit6 low-high+Bit7 high = increment voltage)

Note:
The optional analog I/Os are also supplied via VEE+/VEE- that is used for contrast voltage. This means that the contrast voltage must be turned on in order to use the analog 0...10 V I/Os (and the voltage must be at least +/-18 V)!

On-board temperature sensor U33 (LM50C) at AN2:

This sensor can measure the PCB temperature in a range from -40°C to +125°C and queried via controller internal analog input Bit2.

5. Important Note Concerning Production Units with PCB Version 4088.2

All LCD / Touch Base Board HD200 units with this PCB version are configured for use with the PCM-018 (phyCORE-167HSE) and a color LCD (Hitachi SX14Q001) at the time of delivery.

The oscillator output on the microcontroller must be activated (20 - 40 MHz).

In order to activate the on-board inverter for the display background illumination port P7.6 (on C167) or PB14 (on PCM-014/ARM7) must be set to 1 (high). As an alternative jumper J31 can be closed.

Required Configuration Changes on the PCM-018:
Open J8 (CS2=/CSUART), open J26 (P214=ETH/Sleep)
Check configuration of J34+35 (BHE/WRL must match to setting of JP29 on the base board).

For operation with a monochrome displays the contrast voltage VEE must be activated with VEEAD/VEECTRL via the memory mapped register DOI2 (set Bit 6+7 = 1).

For power supply of the analog input multiplexers the +/-15 V voltage must be activated first via VEEAD/VEECTRL (setting DIO2 Bit6 + 7 = 1). As an alternative, resistors R20/R21 can be set accordingly and jumpers J14/J15 be opened.

ARM7/PCM-014:

A long resp. manual reset is required due to the fact the backup voltage is generated from VCC. The reason for that is that the reset signal for the backup controller is delayed for a typical value of one second in order to guarantee a proper startup of the backup controller following power-on (*refer to the AT91M55800EC.pdf data sheet, page 8 for more information*).

Always refer to the corresponding PHYTEC Hardware Manual and the underlying microcontroller Data Sheet and User's Manual for additional information about using the phyCORE module on the LCD / Touch Base Board HD200.

6. Revision History

PCB number 4088.2 (schematics 4088.2-001 revision 1.0 dated 04/09/2004) changes from previous version:

* J41 deleted, DigitalOut register can no longer be turned off.

* All registers and digital outputs are at a defined low (o) lever after /Reset!

* J30 deleted, VEE- now hard-wired to mono LCD (X18 pin 12)

* J30 and J30B with new functions: Boot/Reset via RS-232 (Boot only with C167)
  These signals can now be routed to different pins on the DB-9 connector.

* XK2 deleted: 24 V supply voltage for digital outputs can be supplied via X12.

* Touch connection: improved circuitry and connector moved to the lower left side of the board (matching the Hitachi display layout).

Verified Functions on PCB revision 4088.1:

XK1	Screw clamp for supply voltage (8–30 VDC)	
	(test voltage 7 to 34 VDC)	ok
XK2	Screw clamp for digital output supply voltage (8-30 VDC)	ok
X1	Receptacle connector for phyCORE HD200 (Molex)	
	supporting phyCORE modules PCM-009,-014,-018,-020	ok
X2-5	Connector rows with all controller signals (not buffered)	
	(2.54 mm pitch)	ok
X6(B)	First RS-232 interface with Reset	
	(on C167/XC161 also Boot) function (DB9f)	ok
X10(B)	Analog inputs/outputs (0-10V) via SPI bus on C167	ok
X11(B)	Digital 24 V inputs (optically isolated)	ok
X12(B)	Digital 24 V outputs (optically isolated)	ok
X13(B)	USB 1.1/2.0 full speed (12Mbit/s) interface (USB-B) on PC	ok
X14	Dial encoder interface (Grayhill 62A compatible)	
	(AMP-Micromatch)	ok
X15	PS/2 Keyboard interface	ok
X17	Color-LCD Flex connector (Hitachi SX14Qxxx	
	compatible)	ok
X18	Mono-LCD Flex connector (Hitachi SP14Qxxx	
	compatible)	ok
X19	LCD-CFL connector (background illumination for LCD	
	incl. on/off circuitry via P7.6)	ok
X20(b)	Touch connector for AC041	ok
X21	Ethernet TP10 interface (RJ45) (incl. D21,D22	
	LANLED, LinkLED)	ok
X22	SD/MM Card	no
RES1	Connector for external Reset push button (/RESIN)	ok
BOOT	Connector for external Boot push button or jumper (input	
	for C167 bootstrap loader at D4)	ok
VCCLCD1	Jumper for selecting the supply voltage on LCD displays	ok
COLTYP1	Jumper for selecting the color LCD type	
	(+3 V contrast/+23 V contrast)	ok
H1	Buzzer (Summer), controlled via Port P7.7	ok
P1	Contrast color LCD	ok

P2	Contrast mono LCD
	(VEE must be pre-configured via P3!) ok
P3	Contrast voltage LCD-VEE+/- ok
P4	Reference voltage for 0..10V/16-bit analog inputs ok
P5	Reference voltage for 0..10V/10-bit analog outputs ok

LCD / Touch Base Board Power Consumption (mA / W):

Configuration Input Voltage	PCM-009 (C167CR-20 with SX14 Color LCD and 100% Backlight Proto	PCM-018 (C167CS-40) Proto	PCM-018 (C167CS-40) with LCD and 100% Backlight Proto	ARM7 without LCD Proto	ARM7 with SX14 Color LCD and 100% Backlight 0-series
9°VDC	220 /	700		160	750
12°VDC	120 /	500		120	550
15°VDC	90 /	400		100	440
24°VDC	58 /	250		65	270

7. Product Options

Part # **Description**

KSP-0115-0   LCD Base board without external digital/analog I/Os
KSP-0115-1   LCD Base board with all I/Os and connector clamps
KSP-0115-T1 TFT adapter for LCD Base board (for Sharp/NEC TFT incl. data cable)
KSP-0115-T2 TFT adapter for LCD Base board (for Hitachi TX14D11 TFT incl. data cable)

AC036   LCD display color 5,7" 320x240 256 colors (Hitachi SX14Q001)
AC035   LCD display mono 5,7" 320x240 black/white (Hitachi SP14Q002)
AC024   LCD display mono 5,7" 320x240 blue/white (Hitachi SP14Q003)
AC042   TFT display color 5,7" 320x240 256 colors (Hitachi TX14D11VM)
AC041   Touch Add-on for 5,7" Hitachi LCD displays (analog resistive)

Additional Displays (Sharp/NEC/etc.) as well as other manufacturers available upon request.

SO-412   USB driver for microcontroller and PC/Win98+/2k/XP
SO-413   PS/2 keyboard (ASCII strings) and dial encoder driver
SO-415   MM/SD Card driver for microcontroller
SO-414   MM/SD Card DOS-FAT library for microcontroller (Source)
SO-414-O   MM/SD-Card DOS-FAT library for microcontroller (Object)
SO-414-E   MM/SD-Card DOS-FAT library for microcontroller (Developer)
SO-414-R   MM/SD Card DOS-FAT runtime license
SO-419   LCD Controller driver (source) for microcontroller

SO-416	LCD graphic library mono with bitmap converter and simulator
SO-417	LCD graphic library color with bitmap converter and simulator (source)
SO-417-O	LCD graphic library color with BMP converter and simulator (object)
SO-417-E	LCD graphic library color with BMP converter and simulator (developer)
SO-417-R	LCD graphic library color runtime license
SO-418	LCD-Windows Manager API for LCD graphic library (mono+color)
SO-418-E	LCD-Windows Manager API for LCD graphic library (developer)
SO-418-R	LCD Windows manager runtime license
PCM-009	phyCORE-C167/ST10
PCM-018	phyCORE-C167/ST10-HSE
PCM-014	phyCORE-ARM7/AT91M55800A
PCM-020	phyCORE-XC161
PCM-021	phyCORE-XC167

We also offer additional products, configurations, expansion options, tools and integration services.

Please contact PHYTEC for quantity prices and discounts.

Document:　　　**KSP-0115, LCD / Touch Base Board HD200**
Document number:　**L-644e_2, October 2004**

How would you improve this manual?

Did you find any mistakes in this manual?　　　page

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