PPC-E10

ARM Cortex A8 Panel PC

User Manual

REV. 2.0

Copyright 2014,
EMAC, Inc.

Table of Contents

Disclaimer

EMAC Inc. does not assume any liability arising out of the application or use of any of its products or designs. Products designed or distributed by EMAC Inc. are not intended for, or authorized to be used in, applications such as life support systems or for any other use in which the failure of the product could potentially result in personal injury, death or property damage.

If EMAC Inc. products are used in any of the aforementioned unintended or unauthorized applications, Purchaser shall indemnify and hold EMAC Inc. and its employees and officers harmless against all claims, costs, damages, expenses, and attorney fees that may directly or indirectly arise out of any claim of personal injury, death or property damage associated with such unintended or unauthorized use, even if it is alleged that EMAC Inc. was negligent in the design or manufacture of the product.

EMAC Inc. reserves the right to make changes to any products with the intent to improve overall quality, without further notification.

PPC-E10 Product Summary

1.1   Features

- **Texas Instruments AM3517 600Mhz ARM Cortex A8 based Processor**
- **Inexpensive Open-Frame Design**
- **Up to 512 MB of SDRAM (256 MB Standard)**
- **2GB eMMC Flash**
- **Battery backed Real Time Clock**
- **10/100BaseT Ethernet with on-board PHY**
- **3 RS232 & 1 RS232/422/485 Port**
- **1 USB 2.0 (High Speed) Host ports (USB 1.1 Compatibility)**
- **1 USB 2.0 (High Speed) OTG Host/Device port**
- **1 CAN 2.0B Port**
- **1 Micro SD Flash Card Socket**
- **1 I2S Audio port with Line-In/Line-Out**
- **Timer/Counters and Pulse Width Modulation (PWM) ports**
- **1 Channel 12-bit Analog-to-Digital converter**
- **Operating Voltage of 12 to 26 Vdc.**
- **Graphic LCD Interface with 2D/3D acceleration**
- **WVGA (1024x600) Resolution with LED Backlight**
- **Analog Resistive Touchscreen and Software Controlled Backlight On/Off & Brightness**
- **JTAG for debug, including real-time trace**
- **FREE Eclipse IDE or QT Creator with GCC & GDB development tools for Linux**
- **Android Available**

1.2 Standard PPC Specifications

- **CPU:** Fanless ARM Cortex A8 600Mhz Processor
- **Flash:** 2GB of eMMC Flash.
- **RAM:** 256MB of DDR2 RAM.
- **Video:** 1024 x 600 WVGA @ 256K Colors
- **Touchscreen:** 12-Bit, 4 wire analog resistive Touchscreen
- **Flash Disk:** 1 Micro SD flash card socket
- **System Reset:** Processor Internal Reset Management with External Reset Button provision
- **RTC:** Battery backed Real Time Clock/Calendar.
- **Timers:** 11, general purpose Timers, & Counter/PWM
- **Watchdog Timer:** 2 Internal Watchdog Timers
- **Analog I/O:** 1 channel, 12-bit Analog-to-Digital converter (ADC)
- **GPIO:** 16 Programmable 3.3V I/O lines

Serial Interfaces

- **UARTS:** 3 serial RS232 serial ports with handshaking & 1 RS232/422/485 with Auto RS485
- **SPI:** High-Speed SPI port with Chip Selects.
- **I2C:** I2C port
- **Audio:** I2S Synchronous Serial Controller with Stereo Line In/Out
- **CAN:** CAN 2.0B Port
- **USB:** 2 USB 2.0 (High Speed) Host ports
  1 USB 2.0 (High Speed) OTG Host/Device port

LCD

- **Display Type:** 10" TFT Color LCD
- **Resolution:** 1024 x 600 WVGA @ 256K Colors
- **Dot pitch:** 0.19mm x 0.19mm
- **Luminance:** 330 (cd/m²)
- **Viewing Angle:** 55°
- **Brightness:** Software controlled
- **Backlight:** White LED (33 LEDS)

Touchscreen

- **Type:** 4 Wire Analog Resistive
- **Resolution:** Continuous
- **Controller:** Built-In
- **Driver:** Linux
- **Durability:** Over one million touches

Ethernet interface

- **Ethernet MAC:** Built-In
- **Ethernet PHY:** Micrel KSZ8041
- **Ethernet Type:** 10/100 Base-T Ethernet

- **Ethernet Interface:** On-Board RJ-45 connector

Solid-state Flash Disk

- **Supports:** External Removable SDIO SDHC/MMC interface up to 32+ GB Flash Disk

Mechanical and environmental

- **Power Supply Voltage:** +12 to +26 Vdc.
- **Power Consumption:** typical ~250 ma. @ 24 Vdc.
- **Operating Temperature:** 0 ~ 60° C (32 ~ 140° F; LCD Constraint)

Standard Parts Inventory

- PPC-E10 Assembly with 10" Touchscreen LCD
- Stainless Steel Mounting Bracket
- Resident on-board flash disk loaded with Operating System
- Three Serial Port cables
- CD ROM with manuals and drivers

1.3   Description

The PPC-E10 is a rugged embedded Open Frame Panel PC (PPC). The PPC-E10 utilizes a modular System on Module (SoM) design which extends the longevity and flexibility of the PPC-E10.

The PPC-E10 is comprised of a Processor Module and a Carrier board in which the Module plugs into. If more memory is required or speed is required a different pin compatible Module offering these features can be inserted into the Carrier board in place of the standard Module that is provided. Additionally, if the processor or memory go End Of Life another processor Module can be utilized extending the life of the product.

PPC-E10 Product Details

1.4 Jumper Configuration & Connector Descriptions

The PPC-E10 comes factory configured. In the event that jumpers need to be verified or modified this section provides the information required, including instructions on setting jumpers and connecting peripherals, switches and indicators. Be sure to read all the safety precautions before you begin any configuration procedure. See Appendix A for connector pinouts and Appendix B for Jumper Setting descriptions.

Table 1: Jumpers

Label	Function	Default
JB1	Boot0 Source Selection	Position B
JB2	Boot1 Source Selection	Position A
JB3	Resident Flash Write Protect (GPIO_62)	Position A
JB4	RTC Battery ON/OFF	Off
JB5	Serial Port RS422/485 Tx Enable	422
JB6	Serial Port RS232 or 422/485 Mode	232

Table 2: Connectors

Label	Function
CN1	7" Touch Screen Connector
CN2	Serial Port COM A
CN3	10" Touch Screen Connector
CN4	7" LCD Backlight Connector
CN6	7" LCD Data Connector
J1	Vin Locking Connector
JK1	Vin Power Barrel Jack
JK2	Ethernet
JK3	USB Host Port A & Port B
JK4	USB OTG Port C
JK5	Audio Input Jack
JK6	Audio Output Jack
HDR1	Misc. I/O Connector
HDR2	Serial Port COM D
HDR3	Serial Port COM B
HDR4	Serial Port COM C
HDR5	Bulkhead USB Connector Port A & B
HDR6	LVDS & Touch Signal Connector
SOK1	MicroSD Card Socket
SOK2	200 pin SOM Socket
ABJ1	PCD-E12 Expansion Module Connector

1.5 Power Connectors

The PPC-E10 provides two power connectors. J1 is an AMP/Tyco locking power connector (part# 640445-3), three-pin type connector that mates with TE Connectivity part# 647402-3 power connector using crimp pins part# 3-647406-1. Using this power input provides for a more rugged/industrial locking connection. JK1 is a standard 5.5mm barrel jack with an inner diameter of 2.1mm with a center V+ connection. This jack allows for easy

connection to a wall mount power supply (EMAC part number PER-PWR-00035). The PPC-E10's power input uses a switching regulator and allows a voltage input of +12Vdc to +26Vdc.

The pinout for the J1 power connector is as follows:

Pin	Signal
1	+Vin (+12Vdc to 26Vdc)
2	Chassis GND
3	System GND

Before powering up the PPC-E10, jumper JB1 is in the "B" position

1.6 Ethernet

The PPC-E10 provides 10/100 Base-T full duplex Ethernet and uses a standard RJ-45 connector (JK2). It can be connected straight to a hub, or another computer via a crossover Ethernet cable. The Ethernet MAC & PHY are integrated into the SoM processor module. Activity and Link LEDs are integrated into the RJ45 connector.

1.7 Serial Ports

The PPC-E10 is equipped with four serial ports, one of which terminates to a male DB9 and the other three which terminate to 10pin header connectors (see table 2, 3, & 4 below). Three 10-pin header to male DB9 connector cables are provided, giving easy access to these ports. Baud Rate, stop bits, etc. are all programmable for each port via software.

COM A is an RS232 compatible port with a full complement of handshaking lines (through the use of GPIO lines) allowing it to communicate with modems and other devices requiring hardware flow control.

COM B is an RS232 port. This port offers no handshake lines.

COM C can be configured to RS232, RS422, and RS485 via 2 jumpers. To select RS232 set jumper JB6 to 232 (this is the default). For RS422 set jumper JB6 to 4xx and jumper JB5 to 485. To select RS485, set jumper JB6 to 4xx and jumper JB5 to 422.

When using COM C in the RS422/485 mode, a terminating resistor (~120 Ohm) is recommended on the two far ends of the network.

COM D is an RS232 port. This port offers no handshake lines.

Table 1 (COM A Pinout)

#	Pin Description for DB9 Connector
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI
10	Shield

Table 2 (COM B Pinout)

#	Pin Description for 10-Pin Header	Pin Description for DB9 Connector
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	-

Table 3 (COM C Pinout)

#	Pin Description for 10-Pin Header	Pin Description for DB9 Connector
1	422/485 TX-	422/485 TX-
2	NC	232 RX, 422/485 TX+
3	232 RX, 422/485 TX+	232 TX, 422/485 RX+
4	RTS	422/485 RX-
5	232 TX, 422/485 RX+	GND
6	CTS	NC
7	422/485 RX-	RTS
8	NC	CTS
9	GND	NC
10	NC	-

Table 4 (COM D Pinout)

#	Pin Description for 10-Pin Header	Pin Description for DB9 Connector
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	-

1.8   USB Host Ports

The PPC-E10 provides two, USB 2.0 (USB PortA & PortB) high speed host ports (JK3). USB PortA and PortB can also be accessed from the bulkhead connector (HDR5). EMAC can provide a cable (CAB-40-004) to access these ports.

In addition to the two USB Host ports, the PPC-E10 provides a USB On-The-Go (OTG) port. This port can be used as either a USB Host or USB Device port.

All of the USB ports are equipped with 500mA re-settable Polyfuses. If a USB Device tries to draw more than 500mA from the port, the fuse will open until the device is unplugged or its current requirement is reduced. There

is no software provision for shutting down power to the Ports or detecting when a port is drawing too much current.

Note: When sizing a power supply, make sure to allow for USB Device consumption. A device can potentially draw 500mA, therefore these devices could use a total of over 1 amp of power.

1.9   Audio Port

The PPC-E10 provides Audio Line Out and Line In capability through two standard audio jacks (JK5 & JK6). Audio Jack JK5 is stereo line level input and Audio Jack JK6 is stereo line level output. The processor interfaces to the Audio CODEC through its I^2S interface. Command control of the CODEC is done using the processor's SPI interface. The CODEC is the Cirrus CS4271, which is a high performance 24-bit Stereo CODEC offering superior sound quality.

Both the input and output are line level. You will probably not be able to drive an unamplified speaker although standard headphones will work. Likewise, an un-amplified microphone probably will not work as an input although the line out of a CD player will work.

1.10 LCD Brightness Control

The PPC-E10 offers LCD brightness control that can change the brightness of the LCD via software. The LCD utilizes LED backlighting. The board provides the backlight with approximately 10 volts at about 220mA. The processor provides a PWM (SoM pin# 85) that is used to drive the LCD backlight. Changing the duty-cycle of the PWM directly affects the brightness of the LCD. In addition, the backlight can be turned off or on via SoM port line GPIO0 (SoM pin#114). This allows screensaver software to automatically turn off the backlight when the unit is not being used and to automatically turn it back on when the touchscreen is touched.

1.11 MicroSD Card Socket

The PPC-E10 provides a high capacity MicroSD socket. The socket is resident on the Carrier and accessible from the board coast line. The socket is hot-swappable and can accept a wide variety of Flash Cards. A green activity light (LED LD3) is located towards the left side of the socket on the Carrier. When the processor is accessing the Flash card this LED will be lit and the card should not be removed at this time. A card that is written to by the PPC-E10 can be read by another computer using an MicroSD card reader. The MicroSD interface is compatible with Standard and High Capacity MicroSD cards

1.12 Keyboard/Mouse

The PPC-E10 does not provide a PS/2 type keyboard/mouse interface. However, a USB keyboard and mouse can be used if required.

1.13 Analog Inputs

A 12-Bit analog input is available on HDR1 (see table 5 below) and is labeled as analog_04.

1.14 I/O Expansion

The Processor used by the PPC-E10 provides a number of unused I/O lines. The PPC-E10 provides access to these lines on connector HDR1. This 44-pin dual row header contains GPIO lines, SPI bus, I^{2}C bus, A/D, interrupts and power pins. Signal names listed in the table below are the SoM names as defined in the SoM 200 pin specification.

Pin	Signal	Pin	Signal
1	3.3V	2	3.3V
3	GPIO1	4	GPIO4
5	GPIO2	6	GPIO5
7	GPIO3	8	GPIO6
9	INT0	10	GPIO7
11	INT1	12	GND
13	OSC0	14	GND
15	OSC1	16	GND
17	ADC4	18	GND
19	NC	20	GND
21	NC	22	GND
23	NC	24	GND
25	SPI_MISO	26	GND
27	SPI_MOSI	28	GND
29	SPI_CLK	30	GND
31	SPI_CS3	32	GND
33	SPI_CS1	34	GND
35	I2C_DAT	36	GND
37	I2C_CLK	38	GND
39	*SOM_RSTOUT	40	GND
41	5V_VCC	42	5V_VCC
43	GND	44	GND

1.15 Real-Time Clock

The PPC-E10 is equipped with an external battery for backing up the module's Real-Time Clock (RTC). Drivers to access the RTC are included in the operating systems. Jumper JB4 should be placed in the ON position in order to retain system time when powered down.

1.16 Status LEDs and Reset

The PPC-E10 provides two status LEDs, LD1 (Green) and LD2 (Red). These can be controlled independently via software (GPIO13 & GPIO12 respectively). LD1 and LD2 are located just to the left of the SD/MMC socket.

Also provided is a Reset Button (PB1). Pressing this button will cause the system to reset.

Software

This Product offers a wide variety of software support from both open source and proprietary sources.

For more information on software support, please visit the EMAC Wiki Software Section at:

http://wiki.emacinc.com/wiki/Software

Appendix A: *Connector Pinouts*

1.17 Ethernet 10/100 Base-T connector (JK2)

Pin	Signal
1	XMT+
2	XMT-
3	RCV+
4	N/C
5	N/C
6	RCV-
7	N/C
8	N/C

1.18 USB Connector (JK3, JK4, HDR5)

1.18.1 PortA (JK3 - Host)

Pin	Signal
1	USB_PWR (5Vdc)
2	USB_Data-
3	USB_Data+
4	GND

1.18.2 PortB (JK3 - Host)

Pin	Signal
1	USB_PWR (5Vdc)
2	USB_Data-
3	USB_Data+
4	GND

1.18.3 PortC (JK4 - OTG)

Pin	Signal
1	USB_VBUS
2	USB_Data-
3	USB_Data+
4	USB_ID
4	GND

1.18.4 PortA/B (HDR5)

Pin	Signal	Pin	Signal
1	USB_PWR_A	2	USB_PWR_B
3	USB_HOSTA-	4	USB_HOSTB-
5	USB_HOSTA+	6	USB_HOSTB+
7	GND	8	GND
9	Chassis GND	10	NC

1.19 Power Jack (JK1)

Pin	Signal
Center	5V DC
Barrel	GND

1.20 Power Connector (J1)

Pin	Signal
1	Vin
2	Chassis GND
3	System GND

1.21 MicroSD Socket (SOK1)

Pin	Signal
1	DAT2
2	CD/DAT3
3	CMD
4	VCC (3.3V)
5	SCLK
6	GND
7	DAT0
8	DAT1
9	SD Card Detect

1.22 TTL LCD/Touch/Backlight (CN6)

Pin	Signal
1	CLK
2	HSYNC
3	VSYNC
4	GND
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	GND
12	G0
13	G1
14	G2
15	G3
16	G4
17	G5
18	GND
19	B0
20	B1
21	B2
22	B3
23	B4
24	B5
25	GND
26	DEN
27	VCC
28	VCC
29	R/L
30	U/D

1.23 LVDS LCD/Touch/Backlight (HDR6)

Pin	Signal	Pin	Signal
1	GND	2	GND
3	3.3V	4	3.3V
5	RED -	6	RED +
7	GND	8	GND
9	GREEN -	10	GREEN +
11	GND	12	GND
13	BLUE -	14	BLUE +
15	GND	16	GND
17	CLOCK -	18	CLOCK +
19	VLED +5V	20	VLED +5V
21	BRIGHTNESS	22	GND
23	EDID DATA	24	EDID CLOCK
25	3.3V	26	VLED +5V
27	Y2	28	X2
29	Y1	30	X1
31	GND	32	GND
33	VIN	34	VIN

1.24 PCD-E12 Expansion connector (ABJ1)

Pin	Signal
1	Vin
2	Reset
3	GND
4	SPI_MOSI
5	INT2 (5V)
6	SPI_MISO (5V)
7	SPI_CS0
8	SPI_CLK
9	(5V)
10	GPIO15

1.25 COMA RS-232 serial port (CN2)

Pin	DB9 Signal
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

1.26 COMB RS-232 Serial Port (HDR3)

Pin	HD3 Signal	DB9 Signal
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	--

1.27 COMC RS-232/422/485 Serial Port (HDR4)

Pin	HD3 Signal	DB9 Signal
1	422/485 TX-	422/485 TX-
2	NC	232 RX, 422/485 TX+
3	232 RX, 422/485 TX+	232 TX, 422/485 RX+
4	RTS	422/485 RX-
5	232 TX, 422/485 RX+	GND
6	CTS	NC
7	422/485 RX-	RTS
8	NC	CTS
9	GND	NC
10	NC	-

1.28 COMD RS-232 Serial Port (HDR2)

Pin	HD3 Signal	DB9 Signal
1	NC	NC
2	NC	RxD
3	RxD	TxD
4	NC	NC
5	TxD	GND
6	NC	NC
7	NC	NC
8	NC	NC
9	GND	NC
10	NC	--

1.29 Misc. General Purpose I/O (HDR1)

Pin	Signal	Pin	Signal
1	3.3V	2	3.3V
3	GPIO1	4	GPIO4
5	GPIO2	6	GPIO5
7	GPIO3	8	GPIO6
9	INT0	10	GPIO7
11	INT1	12	GND
13	OSC0	14	GND
15	OSC1	16	GND
17	ADC4	18	GND
19	NC	20	GND
21	NC	22	GND
23	NC	24	GND
25	SPI_MISO	26	GND
27	SPI_MOSI	28	GND
29	SPI_CLK	30	GND
31	SPI_CS3	32	GND
33	SPI_CS1	34	GND
35	I2C_DAT	36	GND
37	I2C_CLK	38	GND
39	*SOM_RSTOUT	40	GND
41	5V_VCC	42	5V_VCC
43	GND	44	GND

1.30 Touch Screen Connector (CN1)

Pin	Signal
1	Y+
2	X+
3	Y-
4	X-

1.31 Touch Screen Connector (CN3)

Pin	Signal
1	Y+
2	X+
3	Y-
4	X-

1.32 LCD Backlight Connector (CN4)

Pin	Signal
1	VOUT (+)
2	SWITCHED GND (-)

Appendix B: *Jumper Settings*

```
JB1    Boot0 Source Selection
       Jumper        Position            Setting
       Pins 2 & 3    A                   Serial Boot Loader Download (EBI)
       Pins 1 & 2*   B                   Normal Boot from Flash (DBI)

* Default setting


JB2    Boot1 Option Selection

       Jumper        Position            Setting
       Pins 2 & 3*   A                   Flash Enable (FE)
       Pins 1 & 2    B                   Flash Disable (FD)

* Default Setting


JB3    Flash Write Protect (Software Pollable via GPIO_62)
       Jumper        Position            Setting
       Pins 2 & 3    A                   Logic 0
       Pins 1 & 2*   B                   Logic 1

* Default setting

Note: the SoM used in the PPC does not have any hardware lock for the accessing the
flash however a software scheme can be utilized by reading GPIO_62.


JB4    RTC Battery Enable
       Jumper        Position            Setting
       Pins 1 & 2    ON                  Enable Battery Backup
       Pins 2 & 3*   OFF                 Disable Battery Backup

* Default setting


JB5    RS485/RS422 Select
       Jumper        Position            Setting
       Pins 1 & 2    485                 Select RS485
       Pins 2 & 3*   422                 Select RS422

* Default setting


JB6    RS232/RS4xx Select
       Jumper        Position            Setting
       Pins 1 & 2*   232                 Select RS232
       Pins 2 & 3    4xx                 Select either RS422 or RS485 depending on JB5

* Default setting
```

Appendix C: *Mechanical drawing of Mounting Plate with dimensions*