PPC-E7+

ARM9 Panel PC

User Manual

REV. 1.3

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1 PPC-E7+ Product Summary

1.1 Features

- **Atmel AT91SAM9G45 or AT91SAM9M10 400Mhz ARM based Processor**
- **Inexpensive Open-Frame Design**
- **10/100BaseT Ethernet with on-board PHY**
- **3 RS232 & 1 RS232/422/485**
- **1 USB 2.0 (High Speed) Host port**
- **1 USB 2.0 (High Speed) OTG port**
- **Up to 256MB of SDRAM**
- **Up to 512MB of NAND Flash**
- **Up to 4MB of Serial Data Flash**
- **Battery backed Real Time Clock**
- **2 Micro SD/MMC Flash Card Sockets**
- **1 I^2S Audio port with Line-In/Line-Out**
- **1 Audio Beeper**
- **Timer/Counters and Pulse Width Modulation (PWM) ports**
- **4 Channel 10-bit Analog-to-Digital converter**
- **Operating Voltage of 12 to 26 Vdc.**
- **Graphic LCD Interface with optional 2D acceleration & hardware CODECs (9M10)**
- **WVGA (800 x 480) Resolution LCD with LED Backlight**
- **Touchscreen Interface and Software Controlled Backlight On/Off & Brightness**
- **JTAG for debug, including real-time trace**
- **FREE Eclipse IDE with GCC & GDB development tools**

1.2 Standard PPC Specifications

- **CPU:** Embedded Atmel AT91SAM9G45 or AT91SAM9M107 processor running at 400 MHz.
- **Flash**:
  - **SoM-9G45:** 256 MB NAND Flash & 4 MB of Serial Data Flash.
  - **SoM-9M10:** 1 GB NAND Flash & 4 MB of Serial Data Flash.
- **RAM:**
  - **SoM-9G45:** 128 MB 133 MHz DDR2.
  - **SoM-9M10:** 128 MB 133 MHz DDR2 & 128 MB of SDRAM, (256 MB Total).
- **Video:**
  - **SoM-9G45:** LCD Video Interface with up 1280 x 860 resolution.
  - **SoM-9M10:** 2D Accelerated LCD Video Interface with up 1280 x 860 resolution.
    - **Hardware CODECs:** H.264, MPEG-4, MPEG-2, VC-1, H.263.
    - **Image Processing:** Image scaling, color conversion & image rotation
- **Touchscreen:** 10-Bit, 4 wire analog resistive Touchscreen
- **Flash Disk:** 2, 4-bit Parallel or SPI serial SDHC/MMC interfaces one of which terminates to an on-board Micro SD socket.
- **System Reset:** Supervisor with external Reset Button provision.
- **RTC:** Battery backed Real Time Clock/Calendar using 32-bit free running counter.
- **Timers/Counters:** 2, 3 channel, 16-bit timers/counters with capture, compare, and PWM. 20-bit interval timer plus 12-bit interval counter.
- **Watchdog Timer:** External Watchdog/Supervisor using Maxim MAX823 chip.
- **Digital I/O:** 32 General Purpose I/Os with 16 ma. drive when used as outputs.
- **Analog I/O:** 8 channel, 10-bit A/D, with 4 channels utilized for 4-wire touchscreen interface.
- **Power:** Power Management Controller allows selectively shutting down on processor I/O functionality and running from a slow clock.
- **JTAG:** JTAG for debug, including real-time trace

LCD

- **Display Type:** 7" TFT Color LCD
- **Resolution:** 800 x 480 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
- **Light Transparency:** 80%
- **Controller:** Built-In
- **Driver:** WinCE, Linux
- **Durability:** Over one million touches

Ethernet interface

- **Ethernet MAC:** on chip MAC
- **Ethernet PHY:** Micrel KSZ8041 with software PHY shutdown control
- **Ethernet Type:** 10/100 Base-T Ethernet
- **Ethernet Interface:** On-Board RJ-45 connector

Solid-state Flash Disk

- **Resident:** up to 1 GB NAND Flash
- **Removable:** 8+ GB of SD, MMC, or SDHC Flash Disk
- **Utility:** up to 4 MB of serial on-board NOR Flash

Mechanical and environmental

- **Dimensions:** 7.55" L x 4.15" W x 1.5" H
- **Power supply voltage:** +12 to +26 Vdc
- **Power requirements:**
  - Typical: ~500 mA @ 12 Vdc.
  - APM Sleep: ~130mA @ 12 Vdc.
- **Operating temperature:** 0 ~ 60° C (32 ~ 140° F)
- **Weight:** 1.06 lbs

Standard Parts Inventory

- PPC-E7+ Assembly with 7” 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

2 PPC-E7+ Product Details

2.1 Jumper Configuration & Connector Descriptions

The PPC-E7+ 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	Position B
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
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

2.2 Power Connectors

The PPC-E7+ 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# 3-640600-3 power connector. 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-E7+'s power input uses a switching regulator and allows a voltage input of +12V DC.

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-E7+, jumper JB1 should be moved to the "A" position.

2.3 Ethernet

The PPC-E7+ 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.

2.4 Serial Ports

The PPC-E7+ 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 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 422. To select RS485, set jumper JB6 to 4xx and jumper JB5 to 485.

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 Number	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 Number	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 Number	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 Number	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	-

2.5 USB Host Ports

The PPC-E7++ provides one, USB 2.0 (USB PortA) high speed host port (JK3). USB PortA and PortB can be accessed from the bulkhead connector (HDR5). EMAC can provide a cable (CAB-40-004) to access these ports.

In addition to the one USB Host port, the PPC-E7+ 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 up to 1 amp of power.

2.6 Audio Port

The PPC-E7+ 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.

2.7 LCD Brightness Control

The PPC-E7+ 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.

2.8 MicroSD Card Socket

The PPC-E7+ provides two a high capacity MicroSD sockets. One socket is resident on the Carrier and accessible from the board coast line, the other is resident on the module. Both sockets are 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 while the socket on the module does not provide a status LED. 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-E7+ can be read by another computer using an MicroSD card reader. The MicroSD interface is compatible with Standard and High Capacity MicroSD cards

2.9 Keyboard/Mouse

The PPC-E7+ does not provide a PS/2 type keyboard/mouse interface. However, a USB keyboard and mouse can be used if required.

2.10 Analog Inputs

The analog inputs are available on HDR1 (see table 5 below) and are labeled as analog_04, analog_05, analog_06 and analog_07. Note: Using these A/Ds may degrade the touch screen performance and/or accuracy.

2.11 I/O Expansion

The Processor used by the PPC-E7+ provides a number of unused I/O lines. The PPC-E7+ provides access to these lines on connector HDR1. This 44-pin dual row header contains GPIO lines, SPI bus, I^2C bus, A/D lineS, 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	ADC5	20	GND
21	ADC6	22	GND
23	ADC7	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

2.12 Real-Time Clock

The PPC-E7+ 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.

2.13 Serial Flash

PPC-E7+ is equipped with 4MB of SPI based serial NOR flash. The PPC-E7+ can high-level boot from either the Serial Data NOR Flash or the NAND Flash (selected through the low-level bootloader). It is recommended to high-level boot from the Serial Data Flash, as this Flash is more reliable than the NAND Flash. The NAND flash is ideal for the Operating System's File System which can normally handle marked bad blocks.

The Serial Data Flash is connected to SPI0 and uses SPI0_NPCS0 to enable it. The Serial Data Flash also has a Write Protect Provision. To Write Protect the Serial Data Flash set JB3 to position B. See the software drivers for details on accessing this.

2.14 PCD-E12 Expansion

If additional I/O is required the PCD-E12 daughter card can be utilized. This card connects to the PPC-E7+ via SPI bus on connector ABJ1. The PCD-E12 features CAN, A/D, D/A, Serial Ports, and GPIO. For more info on the PCD-E12 go to:
www.emacinc.com/sbc_pc_compatible/pcm_53e52.htm.

2.15 Status LEDs and Reset

The PPC-E7+ 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.

3 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

Note: All of the links in this document are subject to change. Please contact EMAC for updated link locations if necessary.

4 Appendix A: *Connector Pinouts*

4.1 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

4.2 USB Connector (JK3, JK4, HDR5)

4.2.1 PortA (JK3 - Host)

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

4.2.2 PortC (JK4 - OTG)

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

4.2.3 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

4.3 Power Jack (JK1)

Pin	Signal
Center	5V DC
Barrel	GND

4.4 Power Connector (J1)

Pin	Signal
1	Vin
2	Chassis GND
3	System GND

4.5 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

4.6 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

4.7 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

4.8 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

Note: The PCD-E12 is a 5V powered board. As such, logic signals are transferred from 3V to 5V and 5V to 3V for communication between the PPC-E7+ and the PCD-E12.

4.9 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

4.10 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	--

4.11 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	-

4.12 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	--

4.13 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	ADC5	20	GND
21	ADC6	22	GND
23	ADC7	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

4.14 Touch Screen Connector (CN1)

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

4.15 Touch Screen Connector (CN3)

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

4.16 LCD Backlight Connector (CN4)

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

5 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

Jumper	Position	Setting
Pins 2 & 3	A	Resident Flash Disable
Pins 1 & 2*	B	Resident Flash Enable

* Default setting

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

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