

# ***PPC-E4+***

## ***ARM9 SOM-9G45M Based Panel PC***

### **User Manual**

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# 1 PPC-E4+ Product Summary

## 1.1 Features

- **SoM-212ES Carrier with 200 Pin SODIMM SoM Connector**
  - **Atmel ARM9 EP9G45 400Mhz Based SoM-9G45 Fanless Low Power Processor installed**
  - **Up to 256 MB of SDRAM**  
**Up to 1 GB of Flash**  
**4 MB of Serial Flash**
  - **Graphic LCD & Touch Interface**
- **Inexpensive Open-Frame Design**
- **10/100BaseT Ethernet with on-board PHY**
- **3 RS232 ports with handshaking**
- **1 RS232/422/485 port**
- **1 USB 2.0 (High Speed) Host port**
- **1 USB 2.0 (High Speed) OTG port**
- **Battery backed Real Time Clock**
- **2 Micro SD Flash Card Sockets**
- **1 SPI & 1 I2C port**
- **1 Audio Beeper**
- **Timer/Counters and Pulse Width Modulation (PWM) ports**
- **4 Channel 10-bit Analog-to-Digital converter**
- **WQVGA LCD (480 x 272) Resolution with LED Backlight**
- **Software Controlled Backlight On/Off & Brightness**
- **FREE Eclipse IDE with GCC & GDB development tools**
- **WinCE 6.0 BSP and SDK available**
- **Optional Hardware Graphics Acceleration and Video CODECs**
- **Optional Power Over Ethernet (POE)**
- **Optional Audio with Line-in/out**

## 1.2 Standard PPC Specifications

- **CPU:** Embedded Atmel AT91SAM9G45 processor running at 400 MHz.
- **Module:** SOM-9G45M
- **Carrier board:** SOM-212ES
- **Flash:** 256 MB NAND Flash & 4 MB of Serial Data Flash.
- **RAM:** 128 MB 133 MHz DDR2.
- **Touchscreen:** 10-Bit, 4 wire analog resistive Touchscreen
- **Flash Disk:** Two Micro SDHC Sockets (one on the module & one on the carrier).
- **System Reset:** Supervisor with external Reset Button provision.
- **RTC:** Battery backed Real Time Clock/Calendar using 32-bit free running counter.
- **Timers:** 2, 3 channel, 16-bit timers/counters. 20-bit interval timer plus 12-bit interval counter.
- **Watchdog Timer:** External Watchdog/Supervisor using Maxim MAX823 chip.
- **Analog I/O:** 8 channel, 10-bit A/D converter with 4 channels utilized for 4-wire touchscreen interface.
- **Digital I/O:** 32 General Purpose I/Os with 16mA. drive when used as an output
- **Power:** Power Management Controller allows selectively shutting down on processor I/O functionality and running from a slow clock.

### LCD

- **Display Type:** 4.3" TFT Color LCD
- **Resolution:** 480 x 272 WQVGA @ 256K Colors
- **Dot pitch:** 0.198mm x 0.198mm
- **Luminance:** 330 (cd/m<sup>2</sup>)
- **Viewing Direction:** 6 o'clock
- **Brightness:** Software controlled
- **Backlight:** White LED (10 LEDs)

### Touchscreen

- **Type:** 4 Wire Analog Resistive
- **Resolution:** Continuous
- **Controller:** Built-In
- **Driver:** WinCE, Linux
- **Transparency:** 80%
- **Durability:** Over one million touches

### Ethernet interface

- **Ethernet MAC:** Built-In
- **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

- **Supports:** Standard SD interface supporting over 16+ GB Flash Disks

### Mechanical and Environmental

- **Dimensions:** 4.8 " L x 3.0" W x 1.2" H
- **Weight:** 5.7 oz.
- **Power Supply Voltage:** +5V DC or 8 to 35V DC.
- **Power Consumption:** typical <~1.0A. @ 5V DC.
- **Operating Temperature:** 0 ~ 60° C (32 ~ 140° F)

## **Standard Parts Inventory**

- PPC-E4+ Assembly with 4.3" Touchscreen
- Molded plastic LCD mounting bracket and standoffs
- SoM-9G45-110 System on Module
- Resident on-board flash disk loaded with Operating System
- Four Serial Port cables

## 2 PPC-E4+ Product Details

### 2.1 Jumper Configuration & Connector Descriptions

The PPC-E4+ 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 Settings.

**Table 1: Jumpers**

Label	Function	Default
JB1	Boot0 Source Selection	Position B
JB2	Boot1 Source Selection	Position A
JB3	Flash Write Protection	Position NP

**Table 2: Connectors**

Label	Function
JK1	Power Supply Input
JK2	USB OTG PortC
JK3	Ethernet
HDR1	I/O Interface
HDR2 COM C	COM 3 Serial Port
HDR3 COM B	COM 2 Serial Port
HDR4 COM A	COM 1 Serial Port
HDR5 COM D	COM 4 Serial Port
HDR6	USB Port A & B (B is not supported w/ 9G45)
SOK1	200 pin SOM Socket
SOK2	MicroSD Card Socket
CN1	Power Interface
CN2	CAN Interface
CN3	LCD & Touch Interface Cable Socket
CN4	Audio Input
CN5	Audio Output

## 2.2 Power Connectors

The SoM-212 provides two power connectors. CN1 is a standard four-pin type, PC floppy disk power connector that mates with standard floppy disk drive power connectors. 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 5V DC wall mount power supply (EMAC part number PER-PWR-00032). The SoM-212's power input uses a switching regulator and allows a voltage input of +5V DC to 36V DC only if you are using the CN1 power connector. NOTE: If using JK1 a 5V DC supply must be used.

- To power the SoM-212 from 5V DC use either the JK1 or Pin #1 on CN1.
- To power the SoM-212 from 8V to 36V DC use Pin #4 on CN1.
- Alternatively the SoM-212 can be power from a Power Over Ethernet (POE) Switch provided the SoM-212 POE option is installed.

The pinout for the CN1 power connector is as follows:

Pin	Signal
1	+5V DC
2	Chassis GND
3	Chassis GND
4	+Vin DC (+8 to +36V)

Note: Do not drive both the +5V and the +Vin power inputs. Drive one or the other.

## 2.3 Ethernet

The PPC-E4+ provides 10/100 Base-T full duplex Ethernet and uses a standard RJ-45 connector. It can be connected straight to a hub, or another computer via a crossover Ethernet cable. The Ethernet MAC is integrated into the AT91SAM9G45 processor and the Micrel KSZ8041 performs the PHY responsibilities. Activity and Link LEDs are integrated into the RJ45 connector.

## 2.4 Serial Ports

The PPC-E4+ is equipped with three dedicated RS232 ports, all of which terminate to 10-pin header connectors (see Table 4, 5, & 7 below) and a RS232/422/485 port (Table 6). Four 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 (Console Port). This port offers the RTS and CTS handshake lines.

COM C can be configured to RS232, RS422, and RS485 via four software controlled port pins (see table 3 below). To select RS232 set SoM pin 109 & 120 Low and pin 118 & 119 High (this is the default). For RS422 set SoM pin 109 & 120 High and pin 118 & 119 Low. To select RS485, selectively set SoM pin 109 & 119 as required while keeping pin 118 Low. The processor provides for Auto 485 by having the transmitter automatically turned on when required, eliminating the need to manually control this line via RTS (see processor manual).

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 the RTS and CTS handshake lines.



**Table 3**

SODIMM Pin#	SoM Pin Name	Processor Pin Name(s)	Function
109	COMC_RTS	RTS2/PC9	RS422/485 Tx Enable
118	GPIO4	ISI_D3/PB23	~RS232 Shutdown
119	GPIO5	ISI_D4/PB24	~RS422/485 Rx Enable
120	GPIO6	ISI_D5/PB25	~RS232 Enable

**Table 4 (COM A Pinout) (HDR4)**

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

**Table 5 (COM B Pinout) (HDR3)**

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

**Table 6 (COM C Pinout) (HDR2)**

#	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 7 (COM D Pinout) (HDR5)**

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

## 2.5 USB Host Ports

The PPC-E4+ provides one USB 2.0, high speed host port (PortA) and one USB 2.0, high speed OTG port (PortC). USB PortA and PortB can be accessed from HDR6. PortC can be accessed from the on-board USB connector JK2. Note: PortB is not available when using the SoM-9G45 SoM as it only supports two USB ports, A & C.

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-E4+ provides optional Audio Line Out and Line In capability through a two 4-pin 1.25mm headers (CN4 & CN5). A special cable (included with the Audio Option) converts the signals present on the header to two standard miniature audio jacks. The processor interfaces to the Audio CODEC through its I<sup>2</sup>S 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.

## 2.5 LCD Brightness Control

The PPC-E4+ 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 a constant current source of 20mA which results in a voltage of approximately 30 volts. 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 by setting SoM Pin #114 low. 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.

## 2.6 MicroSD Card Socket

The PPC-E4+ provides a high capacity MicroSD socket. This socket is hot-swappable and can accept a wide variety of Flash Cards. A green activity light (LED LD2) is located towards the left side of the socket. 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-E4+, can be read by another computer, using a MicroSD card reader. The MicroSD interface is compatible with Standard and High Capacity MicroSD cards.

## 2.7 Keyboard/Mouse

The PPC-E4+ does not provide a PS/2 type keyboard/mouse interface. However, a USB keyboard and mouse can be used if required.

## 2.8 Analog Inputs

The analog inputs are available on HDR1 (see table 6 below) and are labeled as analog\_04, analog\_05, analog\_06 and analog\_07. Voltages applied to the inputs must be in the range of 0V to 3.3V with reference to ground. Different operating systems may provide access to the analog inputs differently or even not at all. See the operating system documentation for details. Note: In some cases using the Analog Inputs can have adverse effect on the touchscreen sensitivity.

## 2.9 I/O Expansion

The Processor used by the PPC-E4+ provides a number of unused I/O lines. The PPC-E4+ provides access to these lines on connector HDR1. This 20-pin dual row header contains GPIO lines, SPI bus, I<sup>2</sup>C 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.

Table 8

Pin	Signal	Pin	Signal
1	GND	2	3.3V
3	I2DAT	4	I2CLK
5	~RESET_OUT	6	SPI_MISO
7	SPI_CLK	8	SPI_MOSI
9	SPI_CS1	10	SPI_CS0
11	SPI_CS3	12	GPIO07
13	ANALG_05	14	GPIO13
15	ANALG_06	16	IROA
17	ANALG_04	18	GPIO15
19	ANALG_07	20	GPIO12

## 2.10 Real-Time Clock

The PPC-E4+ emulates a real time clock using the AT91SAM9G45 / 9M10's onboard real time timer. Battery backup is provided from the carrier board using the VSTBY pin. The SoM-9G45 / 9M10 will retain the RTT value register during reset and hence use it as a RTC. The RTC has the provision to set Alarms that can interrupt the processor. For example the processor can be placed in sleep mode and then later awakened via the Alarm function.

## **2.11 Serial Flash**

Also equipped is 4MB of SPI based bootable serial flash. To select this device the Boot1 jumper JB2 must be in the B position and SPI0\_CS0 must be active. JB3 can be used to Write Protect the serial flash when in the FWP position. The serial flash can be used to Boot from or can be a handy place to store non-volatile configuration data. See the software drivers for details on accessing this.

The Module can high-level boot from either the Serial Data 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.

## **2.12 Status LEDs and Reset**

The PPC-E4+ provides a status LEDs on the SoM-9G45 module, LD1 (Green) which is connected to processor port pin PA7. Additionally, a Green power LED (LD1) and a SD Activity status LED (LD2) are provided on the Carrier.

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

## **2.13 CAN Port**

The PPC-E4+ is constructed from the SoM-9G45 module and the SoM-212 carrier. The SoM-212 carrier provides for a un-isolated CAN port, however the SoM-9G45 does not provide a CAN controller so this functionality is not available in the standard PPC-E4+ product. EMAC has other modules that do provide CAN should CAN be required.

### 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 (JK3)

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 Host connector Port A & B (HDR6)

Pin	Signal	Pin	Signal
1	USB_A_VBUS	2	USB_B_VBUS
3	USB_A_HOST+	4	USB_B_HOST+
5	USB_A_HOST-	6	USB_B_HOST-
7	GND	8	GND
9	NC	10	NC

### 4.3 USB Port C OTG (JK2)

Pin	Signal
1	USB_OTG_VBUS
2	USB_Data-
3	USB_Data+
4	USB_OTG_ID
5	GND

### 4.4 Power Jack (JK1)

Pin	Signal
Center	5V DC
Barrel	GND

### 4.5 Power Connector (CN1)

Pin	Signal
1	5V DC
2	GND
3	GND
4	+Vin (+8v to 36V)

### 4.6 CAN Interface (CN2)

Pin	Signal
1	CAN+
2	CAN-
3	GND

#### 4.7 LCD/Touch/Backlight (CN3)

<b>Pin</b>	<b>Signal</b>
FN1	GND1 GND
2	BCKLT_LEDA
3	GND
4	3.3V
5	RED0_R
6	RED1_R
7	RED2_R
8	RED3_R
9	RED4_R
10	RED5_R
11	RED6_R
12	RED7_R
13	GREEN0_R
14	GREEN1_R
15	GREEN2_R
16	GREEN3_R
17	GREEN4_R
18	GREEN5_R
19	GREEN6_R
20	GREEN7_R
21	BLUE0_R
22	BLUE1_R
23	BLUE2_R
24	BLUE3_R
25	BLUE4_R
26	BLUE5_R
27	BLUE6_R
28	BLUE7_R
29	GND
30	LCDCLOCK_R
31	LCDPWR_ON/~OFF
32	NC
33	NC
34	LCDEN_R
35	NC
36	GND
37	TOUCHF_X+
38	TOUCHF_Y+
39	TOUCHF_X-
40	TOUCHF_Y-
FN2	RGND

#### 4.8 Stereo Audio Input (CN4)

<b>Pin</b>	<b>Signal</b>
1	Right In
2	GND
3	GND
4	Left In

#### 4.9 Stereo Audio Output (CN5)

Pin	Signal
1	Right Out
2	GND
3	GND
4	Left Out

#### 4.10 Micro SD Socket (SOK2)

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

#### 4.11 COM A RS-232 Serial Port (HDR4)

Pin	HD3 Signal	DB9 Signal
1	DCD	DCD
2	DSR	RxD
3	RxD	TxD
4	RTS	DTR
5	TxD	GND
6	CTS	DSR
7	DTR	RTS
8	RI	CTS
9	GND	RI
10	NC	-

#### 4.12 COM B RS-232 Serial Port (HDR3)

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



#### 4.13 COM C RS-232/422/485 Serial Port (HDR2)

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	-

#### 4.14 COM D RS-232 Serial Port (HDR5)

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

#### 4.15 Misc. I/O (HDR1)

Pin	Signal	Pin	Signal
1	GND	2	3.3V
3	I2DAT	4	I2CLK
5	RESET_OUT	6	SPI_MI
7	SCLK	8	SPI_MOSI
9	SPI_CS1	10	SPI_CS0
11	SPI_CS3/FRM	12	GPIO07
13	ANALG_05	14	GPIO13
15	ANALG_06	16	IROA
17	ANALG_04	18	GPIO15
19	ANALG_07	20	GPIO12

## 5 Appendix B: Jumper Settings

JB1	Boot Source Selection		
	<b>Jumper</b>	<b>Position</b>	<b>Setting</b>
	Pins 2 & 3	A	Line pulled LOW
	Pins 1 & 2*	B	Line pulled HIGH

\* Default setting

JB2	Boot Option Selection		
	<b>Jumper</b>	<b>Position</b>	<b>Setting</b>
	Pins 2 & 3*	A	Line pulled LOW
	Pins 1 & 2	B	Line pulled HIGH

\* Default Setting

JB3	Flash Write Protect Selection		
	<b>Jumper</b>	<b>Position</b>	<b>Setting</b>
	Pins 1 & 2	A	Flash Write Disable
	Pins 2 & 3*	B	Flash Write Enable

\* Default Setting

## 6 Appendix C: Mechanical drawing with dimensions

