This document provides technical details of options or features on the PCpi that were not offered on the PC/II+p.

1 COM3: RS232/RS485 option

When configured for the RS485 option, the RS485 driver (MAXIM MAX1486) is configured for half-duplex operation. A system GPIO is used to enable and disable the driver output. This function is handled by the megatel BIOS when standard BIOS INT14h serial functions are used. The driver output is enabled when the transmit function is invoked (INT14h, fcn: 01). The driver is disabled when the receive function is invoked.

Only the following serial signals are used when COM3 is configured for RS485 operation; all other signals are not connected.

MASS IO COM3 SIGNAL NAME	SIGNAL DESCRIPTION (RS-232E)	RS485 NAME
Ring Indicate (RI)	NC (no connect) Non-inverting receiver input. This signal is terminated with a weak (1Mohm) pull-down resistor, and should be either grounded or not connected..	XD+ Non-inverting bi-directional signal. This signal is terminated with a weak (1Mohm) pull-down resistor.
Receive Data (RXD)	RXD- Inverting receiver input.	XD- Inverting bi-directional signal.
Request to Send (RTS)	This signal is terminated to +3.3V with a 1K resistor.	This signal is terminated to +3.3V with a 1K resistor.
Transmit Data (TXD)	TXD- This signal provides RS232 transmit data.	TXD- This signal provides RS232 transmit data.

2 Video Input (Frame Grabber) option

The PCpi video input option incorporates a Texas Instruments TVP5145 NTSC/PAL/SECAM Digital Video Decoder with Macrovision Detection. This device acts as a frame grabber (analog video capture device) attached to the (required) onboard SVGA controller's zoom-video port. The video controller can be programmed to overlay analog video images onto the screen. Up to four analog video signals (four composite inputs, or two S-video inputs, or a single component video input) can be interfaced to this device via the Mass I/O Connector, J904.

The TVP5145 is driven by a 14 MHz clock. The chip generates any frequencies necessary for synchronization with the supplied video signal. The chip incorporates dual fully differential CMOS analog preprocessing channels with clamping and automatic gain control (AGC) for ideal S/N performance, and dual high-speed 2x over-sampling 10-bit A/D converters. Teletext and closed-caption decode with FIFO is also supported.

The TVP5145 is accessed via the I2C bus at device address 1011101xb. The I2C host interface allows control of brightness, contrast, saturation and hue. Megatel has defined extended BIOS services under INT1Ah to manipulate I2C devices in 16-bit applications. A BIOS32 interface is provided to manipulate I2C devices in a 32-bit environment, such as Linux. Details and sample interface code is available from megatel.

For a detailed register map, please refer to the Texas Instruments "TVP5145" datasheet, available at http://www.ti.com.

Please contact Megatel for an up-to-date list of support software such as drivers.

2.1 Video Input Interface Pinout

J904 – Video Input Interface

PIN NAME	MASS-IO PIN#	SIGNAL NAME	SIGNAL DESCRIPTION
VIDIN_1A	D34	Analog video	Analog video input (Channel 1a)
VIDIN_1B	B07	Analog video	Analog video input (Channel 1b)
VIDIN_2A	E34	Analog video	Analog video input (Channel 2a)
VIDIN_2B/3A	C34	Analog video	Analog video input (Channel 2b and 3a)

3 Controller Area Network (CAN) Controller option

The PCpi contains an integrated Philips SJA1000 CAN controller, which provides full CAN 2.0B protocol compatibility. The chip supports data rates up to 1Mbits/sec, and both 11-bit and 29-bit identifiers. The differential data signals are provided on the Mass I/O Connector, J904

The CAN controller is driven by a 14 .318MHz clock. The differential signals are normally supplied to provide a 3.3V swing, but can be factory set to provide 5V swing if required.

The CAN controller is accessed via IO ports 0x66 (data) and 0x67 (index). For a detailed register map, please refer to the Philips "SJA1000 Stand-alone CAN controller" datasheet, available at http://www.semiconductors.phillips.com.

The interface consists of a single pair of differential signals, CAN_X0 and CAN_X1. The SJA1000 supports use of external transceivers, which are not required, but can be integrated off-board if the OEM application requires their use.

Please contact Megatel for an up-to-date list of CAN controller support software such as drivers.

NOTE that the SJA1000 is software compatible with the Philips PCA82C200, and example Linux source (among other things) is available at http://www.port.de/engl/canprod/sw_linux.html

3.1 CAN Interface Pinout

J904 – CAN Interface

PIN NAME	PIN #	Without external driver	With external driver
CAN_X0	E17	Negative Differential Data [CAN-] SJA1000 pins 14,19	Transmit Data [TXD] SJA1000 pin 19
CAN_X1	D17	Positive Differential Data [CAN+] SJA1000 pins 13,20	Received Data [RXD] SJA1000 pin 13

NOTES:
1. There are 15K pull-down resistors on each signal (CAN_X0, CAN_X1).

4 Touch Screen

The PCpi contains an integrated Texas Instruments TSC2003 I2C touch screen controller. A suitable resistive-matrix touch screen is required. Four analog touch screen interface signals and four analog voltage input signals are provided on the Mass I/O Connector, J904. The TSC2003 controller can digitize at either 8-bit or 12-bit resolutions at up to 50ksps.

The TSC2003 is accessed via the I2C bus at device address 1001011xb. Please refer to the I2C device section below.

For a detailed register map, please refer to the Texas Instruments (/Burr Brown) "TSC2003" datasheet (see document sbas162a.pdf), available at http://www.ti.com.

Please contact Megatel for an up-to-date list of support software such as drivers.

4.1 Touch Screen Interface Pinout

J904 – Touch Screen Interface

PIN NAME	PIN #	SIGNAL NAME	RANGE	SIGNAL DESCRIPTION
TS_YP	A17	Touch (Y+)	12-bit	Resistive Touch Screen signal
TS_YN	D18	Touch (Y-)	12-bit	Resistive Touch Screen signal
TS_XP	B18	Touch (X+)	12-bit	Resistive Touch Screen signal
TS_XN	E19	Touch (X-)	12-bit	Resistive Touch Screen signal
TS_IN1	A18	Analog Vin 1	12-bit, 0 to 2.5V	Analog voltage input
TS_IN2	B17	Analog Vin 2	12-bit, 0 to 2.5V	Analog voltage input
TS_VB1	C18	Analog Vin 3	12-bit, 0.5 to 6V	Analog voltage input (Battery monitor)
TS_VB2	E18	Analog Vin 4	12-bit, 0.5 to 6V	Analog voltage input (Battery monitor)

4.2 Thermal Throttle

The PCpi may optionally include a thermal monitor that can throttle the CPU clock frequency to attempt to maintain the CPU within its designed operating temperature. The thermal monitor (which is located below the CPU) will signal when the sensed temperature exceeds a programmable upper threshold (default is 80C). When this occurs, the CPU will be "throttled" to a programmed fraction of it's normal power (default is $1/8^{th}$), until the sensed temperature drops below the lower thermal threshold (default is 75C).

The threshold values and the throttle ratio can be customized for the needs of the OEM. Please contact megatel for further information.

The LM75 temperature sensor, which sets the throttle threshold, is accessed via the I2C bus at device address 1001000xb. Please refer to the I2C device section below.

5 Power connector

Please note that the 5V Only configuration is provided only for compatibility for OEMs upgrading from the PC/II+p and other megatel legacy products. The +3.3V & +5V configuration is lower power, and is recommended for all new designs.

+5V Only configuration

		Note
1.	+5V	
2.	Reserved	1
3.	Reserved	1
4.	VBaux option	2
5.	Ground	
6.	Ground	
7.	Ground	
8.	Ground	
9.	Ground	
10	Reserved	1
11	Reserved	1
12.	+5	

+3.3V & +5V configuration

		Note
1.	+5V	
2.	+3.3V	
3.	+3.3V	
4.	VBaux option	2
5.	Ground	
6.	Ground	
7.	Ground	
8.	Ground	
9.	Ground	
10.	+3.3V	
11.	+3.3V	
12.	+5	

NOTES:
1. These signals MUST BE ISOLATED in the 5V Only configuration;
2. When configured for the “off-board RTC” option, Vbaux is connected to an external 3V source for battery-backup of NVRAM and RTC, otherwise this connection should be grounded.

6 I2C Devices

The Megatel BIOS provides functions to access I2C devices in both ‘real’ mode (BIOS INT 1Ah), and ‘protected’ mode (BIOS32 functions).

6.1 “Real” Mode I2C Device Access – BIOS INT 1Ah

The following functions provide access to I2C devices when the processor is in “real” mode.

FUNCTION 0FFh – READ / WRITE I2C DEVICE BYTE
This function reads a byte from, or writes a byte to an I2C device.

```
        MOV     AH,0FFh
        MOV     DL,<register number>
        MOV     DH,<I2C address / Direction>        Bit 0 = 0 (WRITE), Bit 0 = 1 (READ)
                                                    Bit 1-7 = I2C Device Address
        MOV     AL,<8-Bit Value to be Written if DH.0 = 0>
        INT     1Ah
returns:
        /FLAGS.CF = 1 (Error)
        /FLAGS.CF = 0 (No Error)
                AH = Destroyed
                AL = value read from I2C Device
```

FUNCTION 0FEh – READ / WRITE I2C DEVICE WORD
This function reads a word from, or writes a word to an I2C device.

```
        MOV     AH,0FEh
        MOV     DL,<register number>
        MOV     DH,<I2C address / Direction>            Bit 0 = 0 (WRITE), Bit 0 = 1 (READ)
                                                        Bit 1-7 = I2C Device Address
        MOV     AL,<8-Bit MSB Value to be Written if DH.0 = 0, LSB=0>
        INT     1Ah
returns:
        /FLAGS.CF = 1 (Error)
        /FLAGS.CF = 0 (No Error)
                AX = value read from I2C Device
```

6.2 "Protected" Mode I2C Device Access – BIOS32 function $M1A

Access to I2C devices when the processor is in "protected" mode is provided by the BIOS32 $M1A function. In order to use BIOS32 functions, it is first necessary to locate the BIOS32 Directory structure. The algorithm to locate and validate the BIOS32 directory services can be obtained from PCI system BIOS documentation.

Once found and validated, the BIOS32 directory service is called to obtain the entry point for the $M1A service. The entry point for this service is returned in EDX, along with other information in other registers. The $M1A service is then called with appropriate values listed below.

FUNCTION 0FFh – READ / WRITE I2C DEVICE BYTE
This function reads a byte from, or writes a byte to an I2C device.

```
        MOV     AH,0FFh
        MOV     DL,<register number>
        MOV     DH,<I2C address / Direction>            Bit 0 = 0 (WRITE), Bit 0 = 1 (READ)
                                                        Bit 1-7 = I2C Device Address
        MOV     AL,<8-Bit Value to be Written if DH.0 = 0>
        LCALL   <M1A_ENTRY>
returns:
        /FLAGS.CF = 1 (Error)
        /FLAGS.CF = 0 (No Error)
                AH = Destroyed
                AL = value read from I2C Device
```

FUNCTION 0FEh – READ / WRITE I2C DEVICE WORD
This function reads a word from, or writes a word to an I2C device.

```
        MOV     AH,0FEh
        MOV     DL,<register number>
        MOV     DH,<I2C address / Direction>            Bit 0 = 0 (WRITE), Bit 0 = 1 (READ)
                                                        Bit 1-7 = I2C Device Address
        MOV     AL,<8-Bit MSB Value to be Written if DH.0 = 0, LSB=0>
        LCALL   <M1A_ENTRY>
returns:
        /FLAGS.CF = 1 (Error)
        /FLAGS.CF = 0 (No Error)
                AX = value read from I2C Device
```

6.3 I2C Address Map

I2C Address Map

I2C Address			
Binary	HEX		
	Read	Write	DEVICE
1001000x	91	90	LM75 Thermal Monitor
1011101x	BB	BA	TPV5145 Video Input
1001011x	97	96	TSC2003 Touch Screen
1010XXXx	---	Ax	Reserved (Synthesizer)
1011100x	---	B8	Reserved (Synthesizer)

NOTES
(1) The low bit of the I2C Addresses above is set during read transactions, and clear during write transactions..

7 MASS IO Pinout

Pinout – MASS I/O J904 – 5 X 36 2mm HM Connector (Full 36 row build option)

PIN GROUP	POS	ROW e	ROW d	ROW c	ROW b	ROW a
L1-PANEL	1	L1-FPD23	L1-FPD22	GND	L1-FPD21	+5V
L1-PANEL	2	L1-FPD20	L1-FPD19	L1-FPD18	L1-FPD17	L1-FPD16
L1-PANEL	3	L1-FPD15	L1-FPD14	L1-FPD13	L1-FPD12	L1-FPD11
L1-PANEL	4	L1-FPD10	L1-FPD9	L1-FPD8	L1-FPD7	L1-FPD6
L1-PANEL	5	L1-FPD5	L1-FPD4	L1-FPD3	L1-FPD2	L1-FPD1
L1-PANEL	6	L1-FPD0	L1-SHFCLK	L1-LP	L1-FLM	L1-ENAVEE
L1-PANEL MS-SPEAKER	7	L1-ENAVDD	L1-M	GND	VID_IN_1B	MS-SPKOUT
MR-RESET, MISC K1-KEYBOARD / USB1	8	MR-RSTSW	PWRGOOD	K1-DAT [U1-D-]	K1-CLK [U1-D+]	+3.3V
M1-MOUSE / USB2 P1-PARALLEL1 - LPT1	9	M1-DAT [U2-D-]	M1-CLK [U2-D+]	P1-STB#	P1-AFD#	P1-D0
P1-PARALLEL1 - LPT1	10	P1-ERR#	P1-D1	P1-INIT#	P1-D2	P1-SLIN#
P1-PARALLEL1 - LPT1	11	P1-D3	P1-D4	P1-D5	P1-D6	P1-D7
P1-PARALLEL1 - LPT1 C1-SERIAL1 - COM1	12	P1-AKN#	P1-BUSY	P1-PE	P1-SLCT	C1-DCD
C1-SERIAL1 - COM1	13	C1-DSR	C1-RXD	C1-RTS	C1-TXD	C1-CTS
C1-SERIAL1 - COM1 C2-SERIAL2 - COM2	14	C1-DTR	C1-RI	C2-DCD	C2-DSR	C2-RXD
C2-SERIAL2 - COM2	15	C2-RTS	C2-TXD	C2-CTS	C2-DTR	C2-RI
U3-USB3 C3-SERIAL3 – COM3	16	U3-D-	U3-D+	C3-RXD	C3-RXD_P	C3-TXD
CAN-CAN BUS TS-TOUCH SCREEN	17	CAN_X0	CAN_X1	Reserved (AC gnd)	TS_IN2	TS_YP
TS-TOUCH SCREEN	18	TS_VB2	TS_YN	TS_VB1	TS_XP	TS_IN1
TS-TOUCH SCREEN U1-USB1 U2-USB2	19	TS_XN	U1-D+	U1-D-	U2-D+	U2-D-
F1-FLOPPY1	20	F1-DENSL0#	F1-INDEX#	F1-MTR0#	F1-DS1#	F1-DS0#
F1-FLOPPY1	21	F1-MTR1#	F1-DIR#	F1-STEP#	F1-WDATA#	F1-WGATE#
F1-FLOPPY1	22	F1-TRK0#	F1-WP#	F1-RDATA#	F1-HDSEL#	F1-DKCHG#
V1-VIDEO1 - CRT1	23	V1-R	V1-G	V1-B	V1-HSYNC	V1-VSYNC
A1-IDE1	24	A1-DD7	A1-DD8	A1-DD6	A1-DD9	A1-DD5
A1-IDE1	25	A1-DD10	A1-DD4	A1-DD11	A1-DD3	A1-DD12
A1-IDE1	26	A1-DD2	A1-DD13	A1-DD1	A1-DD14	A1-DD0
A1-IDE1	27	A1-DD15	A1-DMARQ	A1-DIOW#	A1-DIOR#	A1-IORDY
A1-IDE1	28	A1-DMACK#	A1-INTRQ	GND	A1-DA1	A1-DA0
A1-IDE1	29	A1-DA2	A1-CS0#	A1-CS1#	Reserved	Reserved
	30	Reserved	Reserved	Reserved	Reserved	Reserved
	31	Reserved	Reserved	Reserved	Reserved	Reserved
	32	Reserved	Reserved	Reserved	Reserved	Reserved
POWER	33	Reserved	GND	GND	+5V/[NP]	+5V/[NP]
Video Input – E0	34	VID_IN_2A	VID_IN_1A	VID_IN_2B	E0-MX3+	E0-MX3-
E1-ETHERNET1	35	E1-RX-	E1-RX+	E1-LED/CTP E0-MX2-	E1-TX+	E1-TX-
E0-ETHERNET0	36	E0-RX-	E0-RX+	E0-LED/CTP	E0-TX+	E0-TX-
III		E0-MX1-	E0-MX1+	E0-MX2+	E0-MX0+	E0-MX0-