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HARDWARE REFERENCE MANUAL

PMAC2 VME Ultralite

VME Ultralite Control Board

3xx-602643-xHxx

June 1997



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Email: support@deltatau.com
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INTRODUCTION

Overview

The PMAC2 VME Ultralite control board is a member of the PMAC2 family of controllers that replaces the local axis interface circuitry with the MACRO ring network interface. The Ultralite name is used because of the lack of any direct on-board axis interface circuitry. In other words, the interface hardware for channels 1 through 8 is missing on the Ultralite.

Features

Input/Output

The Ultralite board does retain the local general purpose I/O of the PMAC family, including:

- JDISP display port
- JTHW multiplexer port
- JIO general I/O port
- JHW handwheel port
- JRS232 serial port
- JRS422 serial port

The Ultralite board's MACRO interface is available in one of three forms; one of the three must be ordered:

- SC optical fiber interface
- BNC coaxial cable interface
- RJ-45 "phone jack" interface

The following ports are not available on the PMAC2 VME Ultralite:

- JANA analog input port
- JEQU position compare output port
- JMACHn axis interface ports

Firmware

The firmware for the Ultralite functions identically to that of other members of the PMAC2 family, which is very similar to the firmware for the original PMAC family. Because of the hardware differences, there are some differences in the use of the firmware.

- Variables I910 to I989, which control the setup of machine interface channels 1-8, are useless, because these machine interface channels are not present on the Ultralite. In an Ultralite system, equivalent functions are implemented on the remote drives.
- Variables I900 to I909, which control the overall hardware setup on non-Ultralite boards, are useless on the Ultralite boards because they require some of the "missing" hardware. On a PMAC2 Ultralite, these functions are implemented by variables in the I990s. The comparison is given in the table 1-1.
- The values of the motor I-variables that specify the addresses of the outputs and inputs for that motor, and the setup of the encoder conversion table that pre-processes the position feedback will be different on the PMAC2 Ultralite.

Function	Non-Ultralite Variable	Ultralite Variable
MaxPhase/PWM Freq	I900, I906	I992
Phase Clock Freq	I901	I997
Servo Clock Freq	I902	I998
Hardware Clock Freq	I903	I993
Deadtime/Pulse Width	I904	I994

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DSPGATE2 I/O ASIC

Delta Tau has designed its own custom application-specific integrated circuits (ASICs) for the PMAC2 VME Ultralite using the latest sub-micron gate-array technology. Each ASIC contains 45,000 active logic gates. These ASICs contain all of the digital interface circuitry to tie the DSP to the machine; the rest of the circuitry on the board is buffer circuitry. The DSPGATE2 ASIC has three parts:

- General-purpose digital I/O: 56 I/O points for JIO, JTHW, and JDISP ports
- Servo interface circuitry for 2 supplemental channels with clock generation
- MACRO ring interface circuitry

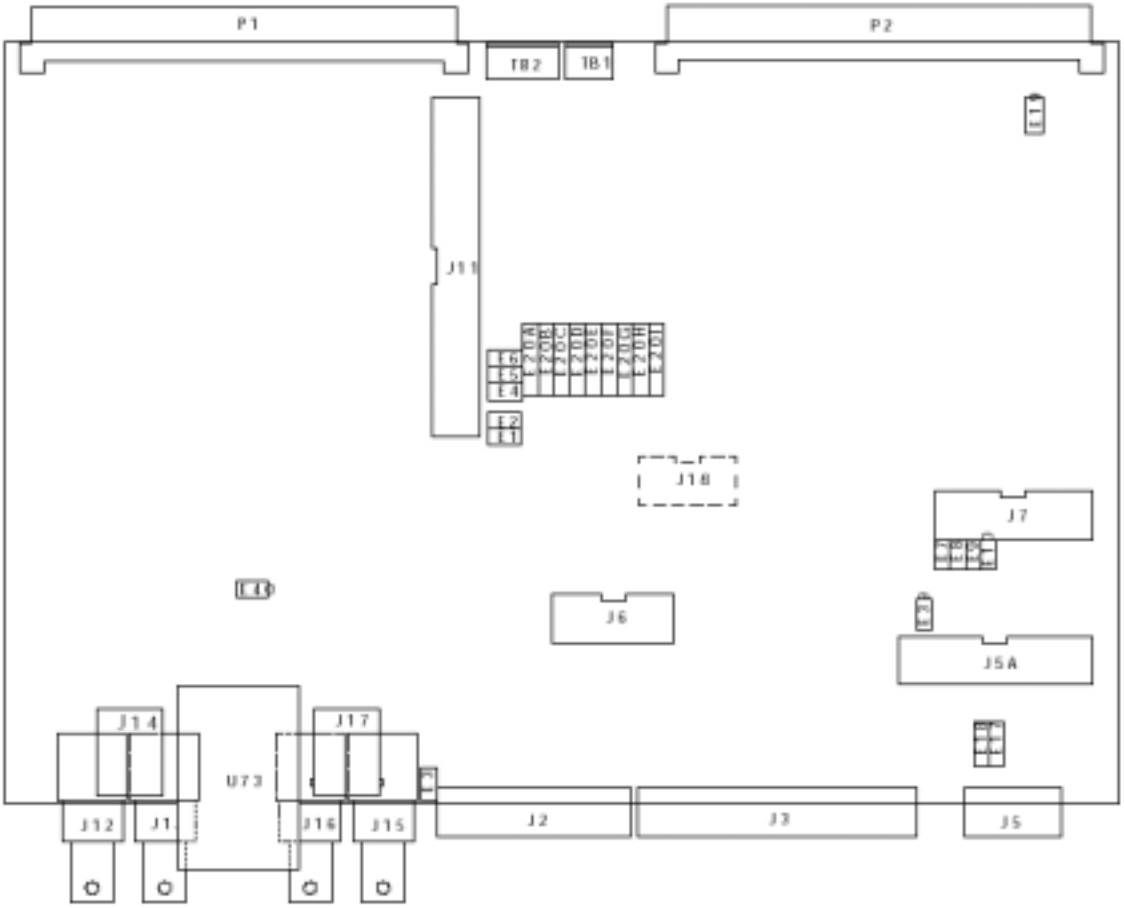
The general-purpose I/O and the servo interface circuitry on the DSPGATE2 generally share pins, except for two 2-channel encoder inputs and 2 PWM/PFM output sub-channels. On a PMAC2 VME Ultralite board, the shared pins are usually used for general-purpose I/O instead of extra servo interface circuitry, but this is up to the individual user.

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CONNECTORS AND JUMPERS

Connector Summary

The following paragraphs provide a brief description of each connector on the PMAC2 VME Ultralite, its use, and individual pinout information.



PMAC VME Layout Diagram

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J2/JTHW (26-Pin Header)



Pin #	Symbol	Function	Description	Notes
1	GND	Common	PMAC Common	
2	GND	Common	PMAC Common	
3	DAT0	Input	Data-0 Input	Data input from MUX port accessories
4	SEL0	Output	Select-0 Output	Address/data output for MUX port accessories
5	DAT1	Input	Data-1 Input	Data input from MUX port accessories
6	SEL1	Output	Select-1 Output	Address/data output for MUX port accessories
7	DAT2	Input	Data-2 Input	Data input from MUX port accessories
8	SEL2	Output	Select-2 Output	Address/data output for MUX port accessories
9	DAT3	Input	Data-3 Input	Data Input From MUX Port Accessories
10	SEL3	Output	Select-3 Output	Address/data output for MUX port accessories
11	DAT4	Input	Data-4 Input	Data input from MUX port accessories
12	SEL4	Output	Select-4 Output	Address/data output for MUX port accessories
13	DAT5	Input	Data-5 Input	Data input from MUX port accessories
14	SEL5	Output	Select-5 Output	Address/data output for MUX port accessories
15	DAT6	Input	Data-6 Input	Data input from MUX port accessories
16	SEL6	Output	Select-6 Output	Address/data output for MUX port accessories
17	DAT7	Input	Data-7 Input	Data input from MUX port accessories
18	SEL7	Output	Select-7 Output	Address/data output for MUX port accessories
19	N.C.	N.C.	No Connection	
20	GND	Common	PMAC Common	
21	BRLD/	Output	Buffer Request	Low is Buffer Req.
22	GND	Common	PMAC Common	
23	IPLD/	Output	In Position	Low is in position
24	GND	Common	PMAC Common	
25	+5V	Output	+5Vdc Supply	Power supply out
26	INIT/	Input	PMAC Reset	Low is reset

Note: The JTHW connector provides eight inputs and eight outputs at TTL levels; typically, these are used to create multiplexed I/O with accessory boards such as Acc-18 (Thumbwheel) and Acc-34 (Discrete I/O). The port I/O may also be used directly, as non-multiplexed I/O.

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J3/JIO (40-Pin Header)

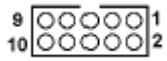


Pin #	Symbol	Function	Description	Notes
1	I/O00	In/Out	Digital I/O0	Software direction control
2	I/O01	In/Out	Digital I/O 1	Software direction control
3	I/O02	In/Out	Digital I/O 2	Software direction control
4	I/O03	In/Out	Digital I/O 3	Software direction control
5	I/O04	In/Out	Digital I/O 4	Software direction control
6	I/O05	In/Out	Digital I/O 5	Software direction control
7	I/O06	In/Out	Digital I/O 6	Software direction control
8	I/O07	In/Out	Digital I/O 7	Software direction control
9	I/O08	In/Out	Digital I/O 8	Software direction control
10	I/O09	In/Out	Digital I/O 9	Software direction control
11	I/O10	In/Out	Digital I/O 10	Software direction control
12	I/O11	In/Out	Digital I/O 11	Software direction control
13	I/O12	In/Out	Digital I/O 12	Software direction control
14	I/O24	In/Out	Digital I/O 13	Software direction control
15	I/O14	In/Out	Digital I/O 14	Software direction control
16	I/O15	In/Out	Digital I/O 15	Software direction control
17	I/O16	In/Out	Digital I/O 16	Software direction control
18	I/O17	In/Out	Digital I/O 17	Software direction control
19	I/O18	In/Out	Digital I/O 18	Software direction control
20	I/O29	In/Out	Digital I/O 19	Software direction control
21	I/O20	In/Out	Digital I/O 20	Software direction control
22	I/O21	In/Out	Digital I/O 21	Software direction control
23	I/O22	In/Out	Digital I/O 22	Software direction control
24	I/O23	In/Out	Digital I/O 23	Software direction control
25	I/O24	In/Out	Digital I/O 24	Software direction control
1	I/O00	In/Out	Digital I/O 0	Software direction control
26	I/O25	In/Out	Digital I/O 25	Software direction control
27	I/O26	In/Out	Digital I/O 26	Software direction control
28	I/O27	In/Out	Digital I/O 27	Software direction control
29	I/O28	In/Out	Digital I/O 28	Software direction control
30	I/O29	In/Out	Digital I/O 29	Software direction control
31	I/O30	In/Out	Digital I/O 30	Software direction control
32	I/O31	In/out	Digital I/O 31	Software direction control
33	GND	Common	Reference Voltage	
34	GND	Common	Reference Voltage	
35	Phase/	Output	Phase Clock	For latching data
36	Servo/	Output	Servo Clock	For latching data
37	GND	Common	Reference Voltage	
38	GND	Common	Reference Voltage	
39	+5V	Output	Supply voltage	To power external circuitry
40	+5V	Output	Supply voltage	To power external circuitry

Note: The JI/O connector provides 32 input/output pins at TTL levels. Direction can be controlled in byte-wide groups.

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J5/JRS232 (10-Pin Header)



Front View

Pin #	Symbol	Function	Description	Notes
1	PHASE	In/Out	Phasing Clock	
2	DTR	Bidirect	Data Term Ready	Tied to "DSR"
3	TXD/	Input	Receive Data	Host transmit data
4	CTS	Input	Clear to Send	Host ready bit
5	RXD/	Output	Send Data	Host receive data
6	RTS	Output	Req. to Send	PMAC ready bit
7	DSR	Bidirect	Data Set Ready	Tied to "DTR"
8	SERVO	In/Out	Servo Clock	See Note 2
9	GND	Common	PMAC Common	
10	+5V	Output	+5Vdc Supply	Power supply out

The JRS232 connector provides the PMAC2 VME Ultralite with the ability to communicate serially with an RS232 port. Jumpers E17 and E18 must connect pins 1 and 2 to use this port for serial communications.

This connector cannot be used for daisy chain communication interconnection of multiple PMACs, although it can be used to share servo and phase clocks for synchronicity. The J5A RS-422 interface is required for daisy chain communication.

Note: If communicating over this connector with a modem-style terminal emulator such as Microsoft Windows Terminal, line 1 should not be connected. Servo and Phase are outputs if jumper E1 is OFF; they are inputs if jumper E1 is ON.

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J5A/JRS422 (26-Pin Header)



Front View

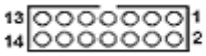
Pin #	Symbol	Function	Description	Notes
1	CHASSI	Common	PMAC Common	
2	S+5V	Output	+5Vdc Supply	Deactivated by "E8"
3	RD-	Input	Receive Data	Diff. I/O low true **
4	RD+	Input	Receive Data	Diff. I/O high true*
5	SD-	Output	Send Data	Diff. I/O low true **
6	SD+	Output	Send Data	Diff. I/O high true *
7	CS+	Input	Clear to Send	Diff. I/O high true **
8	CS-	Input	Clear to Send	Diff. I/O low true *
9	RS+	Output	Req. to Send	Diff. I/O high true **
10	RS-	Output	Req. to Send	Diff. I/O low true *
11	DTR	Bidirect	Data Term Read	Tied to "DSR"
12	INIT/	Input	PMAC Reset	Low is "reset"
13	GND	Common	PMAC Common	**
14	DSR	Bidirect	Data Set Ready	Tied to "DTR"
15	SDIO-	Bidirect	Special Data	Diff I/O low true
16	SDIO+	Bidirect	Special Data	Diff. I/O high true
17	SCIO-	Bidirect	Special Ctrl.	Diff. I/O low true
18	SCIO+	Bidirect	Special Ctrl.	Diff. I/O high true
19	SCK-	Bidirect	Special Clock	Diff. I/O low true
20	SCK+	Bidirect	Special Clock	Diff. I/O high true
21	SERVO-	Bidirect	Servo Clock	Diff. I/O low true***
22	SERVO+	Bidirect	Servo Clock	Diff. I/O high true ***
23	PHASE	Bidirect	Phase Clock	Diff. I/O low true***
24	PHASE+	Bidirect	Phase Clock	Diff. I/O high true ***
25	GND	Common	PMAC Common	
26	+5V	Output	+5Vdc Supply	Power supply out

The JRS422 connector provides the PMAC with the ability to communicate in both RS422 and RS232. In addition, this connector is used to daisy chain interconnect multiple PMACs for synchronized operation.

Note: Jumpers E17 and E18 must connect pins 2 and 3 to use this port for serial communications.

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J6/JDISP (14-Pin Header)

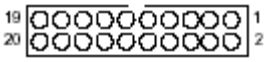


Front View

Pin #	Symbol	Function	Description	Notes
1	Vdd	Output	+5V Power	Power supply out
2	Vss	Common	PMAC Common	
3	Rs	Output	Read Strobe	TTL signal out
4	Vee	Output	Contrast Adjust. Vee	0 to +5 Vdc *
5	E	Output	Display Enable	High is enable
6	R/W	Output	Read or Write	TTL signal out
7	DB1	Output	Display Data1	
8	DB0	Output	Display Data0	
9	DB3	Output	Display Data3	
10	DB2	Output	Display Data2	
11	DB5	Output	Display Data5	
12	DB4	Output	Display Data4	
13	DB7	Output	Display Data7	
14	DB6	Output	Display Data6	

The JDISP connector is used to drive the 2 line x 24 character (Acc-12), 2 x 40 (Acc-12A) LCD, or the 2 x 40 vacuum fluorescent (Acc 12C) display unit. The DISPLAY command may be used to send messages and values to the display.

J7/JHW (20-Pin Header)



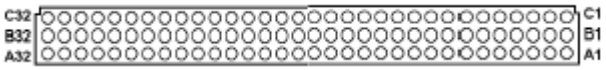
Front View

Pin #	Symbol	Function	Description	Notes
1	GND	Common	Reference Voltage	
2	+5V	Output	Supply Voltage	To power external Circuitry
3	HWA1+	Input	HW Positive A Channel	Also pulse input
4	HWA1-	Input	HW Negative A Channel	Also pulse input
5	HWB1+	Input	HW Positive B Channel	Also direction input
6	HWB1-	Input	HW Negative B Channel.	Also direction input
7	HWA2+	Input	HW Positive A Channel	Also pulse input
8	HWA2-	Input	HW Negative A Channel	Also pulse input
9	HWB2+	Input	HW Positive B Channel	Also direction input
10	HWB2-	Input	HW Negative B Channel	Also direction input
1	GND	Common	Reference Voltage	
11	DIR1+	Output	PFM Positive Dir. Out	Also PWM output
12	DIR1-	Output	PFM Negative Dir. Out	Also PWM output
13	PUL1+	Output	PFM Positive Pulse	Also PWM output
14	PUL1-	Output	PFM Negative Pulse	Also PWM output
15	DIR2+	Output	PFM Positive Dir. Out	Also PWM output
16	DIR2-	Output	PFM Negative Dir. Out	Also PWM output
17	PUL2+	Output	PFM Positive Pulse	Also PWM output
18	PUL2-	Output	PFM Negative Pulse	Also PWM output
19	GND	Common	Reference Voltage	
20	+5V	Output	Supply Voltage	To power external Circuitry

This connector provides the interface for two quadrature encoders, typically to be used as handwheel or time base master encoders.

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P1 JVME (96-Pin Header)



Front View

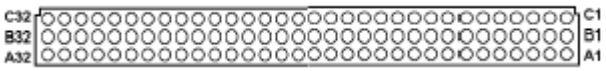
Pin #	Row A	Row B	Row C
01	D00	BBSY/	D08
02	D01	BCLR/	D09
03	D02	ACFAIL/	D10
04	D03	B0IN/	D11
05	D04	BG0OUT/	D12
06	D05	BG1IN/	D13
07	D06	BG1OUT/	D14
08	D07	BG2IN/	D15
09	GND	BG2OUT/	GND
10	SYSCLK	BG3IN/	SYSFAIL/
11	GND	BG3OUT/	BERR/
12	DS1/	BR0/	SYSRESET/
13	DS0/	BR1/	LWORD/
14	WRITE/	BR2/	AM5
15	GND	BR3/	A23
16	DTACK/	AM0	A22
01	D00	BBSY/	D08
17	GND	AM1	A21
18	AS/	AM2	A20
19	GND	AM3	A19
20	IACK/	GND	A18
21	ACKIN/	ISERCLK	A17
22	IACKOUT/	SERDAT/	A16
23	AM4	GND	A15
24	A07	IRQ7/	A14
25	A06	IRQ6/	A13
26	A05	IRQ5/	A12
27	A0	IRQ4/	A11
28	A03	IRQ3/	A10
29	A02	IRQ2/	A09
30	A01	IRQ1/	A08
31	-12	+5V STDBY	+12V
32	+5V	+5V	+5V

This is the standard VME connector. It is sufficient for 16-bit or 24-bit addressing and for 8-bit or 16-bit data. For 32-bit addressing, the B-row of P2 must be used as well. PMAC does not support 32-bit data transfers over the bus, even with the B-row of P2.

NOTE: If P1 is connected to the VME backplane, PMAC is connected to the +5V supply and GND automatically. In this case, no other +5V supply should be connected.

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P2 JVME (96-Pin Header)



Front View

Pin #	Row A	Row B	Row C
01	+5V	+5V	+5V
02	GND	GND	GND
03	DB6	(Reserved)	DB7
04	DB4	VA24	DB5
05	DB2	VA25	DB3
06	DB0	VA26	DB1
07	R/W-	VA27	E
08	Vee	VA28	RS
09	CTRL2	VA29	CTRL3
10	CTRL0	VA30	CTRL1
11	No Connect	VA31	No Connect
01	+5V	+5V	+5V
12	No Connect	GND	No Connect
13	No Connect	+5V	No Connect
14	No Connect	VD16* (Not used)	No Connect
15	INIT-	VD17* (Not used)	BRST-
16	PHASE-	VD18* (Not used)	PHASE+
17	SERVO-	VD19* (Not used)	SERVO+
18	RS+	VD20* (Not used)	RS-
19	CS+	VD21* (Not used)	CS-
20	SD-	VD22* (Not used)	SD+
21	RD-	VD23* (Not used)	RD+
22	No Connect	GND	No Connect
23	PUL_2+	VD24* (Not used)	PUL_2-
24	DIR_2+	VD25* (Not used)	DIR_2-
25	PUL_1+	VD26* (Not used)	PUL_1-
26	DIR_1+	VD27* (Not used)	DIR_1-
27	HW2_B2+	VD28* (Not used)	HW2_B2-
28	HW2_A2+	VD29* (Not used)	HW2_A2-
29	HW1_B1+	VD30* (Not used)	HW1_B1-
30	HW1_A1+	VD31* (Not used)	HW1_A1-
31	GND	GND	GND
32	+5V	+5V	+5V

The P2 connector is only used to support 32-bit addressing on the VME bus. The PMAC2 VME Ultralite does not support 32-bit data transfers on the VME bus.

Note: Versions of the board before the -102 revision had only no connect on the A and C rows.

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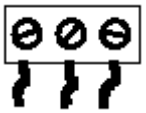
TB1 (2-Pin Terminal Block)



Pin #	Symbol	Function	Description	Notes
1	GND	Common	Reference Voltage	
2	+5V	Input	Positive Supply Voltage	Supplies all PMAC digital circuits

This terminal block can be used to provide the input for the power supply for the circuits on the PMAC2 board when it is not in a bus configuration. When the PMAC2 is in a bus configuration, these supplies come through the bus connector from the bus power supply automatically; in this case, this terminal block should not be used.

TB2 (3-Pin Terminal Block)



Pin #	Symbol	Function	Description	Notes
1	WD_NC	Output	Watchdog relay out	Normally closed
2	COM	Input	Watchdog return	+V or 0V
3	WD_ No	Output	Watchdog relay out	Normally open

Note: The normally closed relay contact is open while PMAC2 is operating properly (it has power and the watchdog timer is not tripped) and closed when the PMAC2 is not operating properly (either it has lost power or the watchdog timer has tripped).

This terminal block provides the output for PMAC2's watchdog timer relay, both normally open and normally closed contacts. The normally open relay contact is closed while PMAC2 is operating properly and open when PMAC2 is not operating properly.

MACRO Interface Connectors

Version 1: Fiber Optic Transceiver

- Lower port - transmit optical data
- Upper port - receive optical data

Version 2: Coaxial Cable Connectors

- J12 - receive main data
- J13 - receive complementary data
- J15 - transmit complementary data
- J16 - transmit main data

Version 3: RJ-45 Phone Jack Connectors

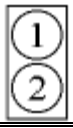
- J14 - receive data
- J17 - transmit data

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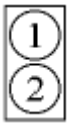
Jumper Summary

Refer to the PMAC2 VME Ultralite layout diagram (see diagram) for jumper locations.

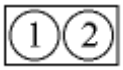
E1: Card 0 Select

E Point and Physical Layout	Location	Description	Default
E1 		Remove jumper to specify that this PMAC is Card 0, which generates its own phase and servo clock (default). Jump pins 1 to 2 to specify that this PMAC is not Card 0, but Card 1 to F (15), which requires external phase and servo clock signals from the serial port to operate.	No jumper installed

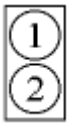
E2: 40MHz/60MHz CPU Operation

E Point and Physical Layout	Location	Description	Default
E2 		Remove jumper to specify 40 MHz operation of the PMAC CPU (2 x crystal frequency). Jump pins 1 to 2 to specify 60 MHz operation of the PMAC CPU (3 x crystal frequency).	No jumper installed (standard) 1-2 jumper installed (Option 5B)

E3: Re-Initialization On Reset Control

E Point and Physical Layout	Location	Description	Default
E3 		Remove jumper for normal reset mode (default). Jump pins 1 to 2 for re-initialization on reset.	No jumper installed

E4-E6: (Reserved For Future Use)

E Point and Physical Layout	Location	Description	Default
E4-E6 			No jumper installed

E7: Multi-Board Daisy-Chain Configure

E Point and Physical Layout	Location	Description	Default
E7 		Jump pin 1 to 2 to receive clock signals over RS-232 port (single-ended) as board @1 to @F. Jump pin 2 to 3 to receive clock signals over RS-422 port (differential) as board @1 to @F.	1-2 Jumper installed
This jumper is only present on prototype PMAC2 VME Ultralite boards (-100).			

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E8: RS232 Converter Power Supply Control

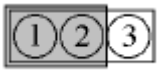
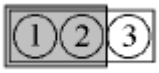
E Point and Physical Layout	Location	Description	Default
E8 		Jump pin 1 to 2 to apply +5V to J5A pin 2 (JRS422). This can be used to power optional RS422 to RS232 converter module which requires +5V for operation. Remove jumper to leave pin open.	Jumper installed
Note: This jumper is present only on prototype PMAC2 VME Ultralite boards (-100).			

E9 - E16: Serial Interface Handshake Control

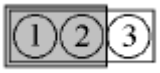
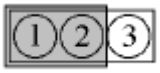
E Point and Physical Layout	Location	Description	Default
E9 E10 		Jump E9-1 to E9-2 to allow TXD/ to be input on J5A-11; jump E10-1 to E10-2 to allow RXD/ to be output on J5A-13. Jump E9-1 to E10-1 to allow TXD/ to be output on J5A-11; jump E9-2 to E10-2 to allow RXD/ to be input on J5A-13.	1-2 Jumpers installed
E11 E12 		Jump, E11-1 to E11-2 to allow TXD to be input on J5A-12; jump E11-1 to E11-2 to allow RXD to be output on J5A-14. Jump E11-1 to E12-1 to allow TXD to be output on J5A-12; jump E9-2 to E10-2 to allow RXD to be input on J5A-14.	1-2 Jumpers installed
E13 E14 		Jump E13-1 to E13-2 to 1-2 allow RTS to be input on J5A-15; jump E14-1 to installed E14-2 to allow CTS to be output on J5A-17. Jump E13-1 to E14-1 to allow RTS to be output on J5A-15; jump E13-2 to E14-2 to allow CTS to be input on J5A-17	1-2 Jumpers installed
E15 E16 		Jump E15-1 to E15-2 to 1-2 allow RTS/ to be input on J5A-16; jump E16-1 to E16-2 to allow CTS/ to be output on J5A-18. Jump E15-1 to E16-1 to allow RTS/ to be output on J5A-16; jump E15-2 to E16-2 to allow CTS/ to be input on J5A-18	1-2 Jumpers installed
Note: E9 -E16 jumpers control whether the RS-422 port is DCE or DTE. They are present only on the prototype PMAC2 VME Ultralite. The default configuration sets up a DTE device for direction connection to the DCE COM port of an IBM PC or compatible.			

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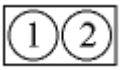
E15A-H, E16A-H: DPRAM Byte Order Control

E Point and Physical Layout	Location	Description	Default
E15A-H 		Jump pins 1 to 2 to tie DPRAM data lines 8-15 to VMEbus data lines 8-15 (Motorola big endian format). Jump pins 2 to 3 to tie DPRAM data lines 8-15 to VMEbus data lines 0-7 (Intel little endian format)	1-2 Jumpers installed
E16A-H 		Jump pins 1 to 2 to tie DPRAM data lines 0-7 to VMEbus data lines 0-7 (Motorola big endian format). Jump pins 2 to 3 to tie DPRAM data lines 0-7 to VMEbus data lines 8-15 (Intel little endian format)	1-2 Jumpers installed (Motorola format)
Note: This jumper function is implemented differently on the prototype PMAC2 VME Ultralite boards (-100) than it is on subsequent versions (-101 and greater). All E15A-H and E16A-H jumpers must be in the same setting for DPRAM communications to work.			

E17 - E18: Serial Connector Select

E Point and Physical Layout	Location	Description	Default
E17 		Jump pins 1 to 2 to use RS-232 serial interface. Jump pins 2 to 3 to use RS-422 serial interface.	1-2 Jumper installed
E18 		Jump pins 1 to 2 to use RS-232 serial interface. Jump pins 2 to 3 to use RS-422 serial interface	1-2 Jumper installed
Note: E17 and E18 control whether the RS-232 or RS-422 serial port is used.			

E19: Watchdog Control Jumper

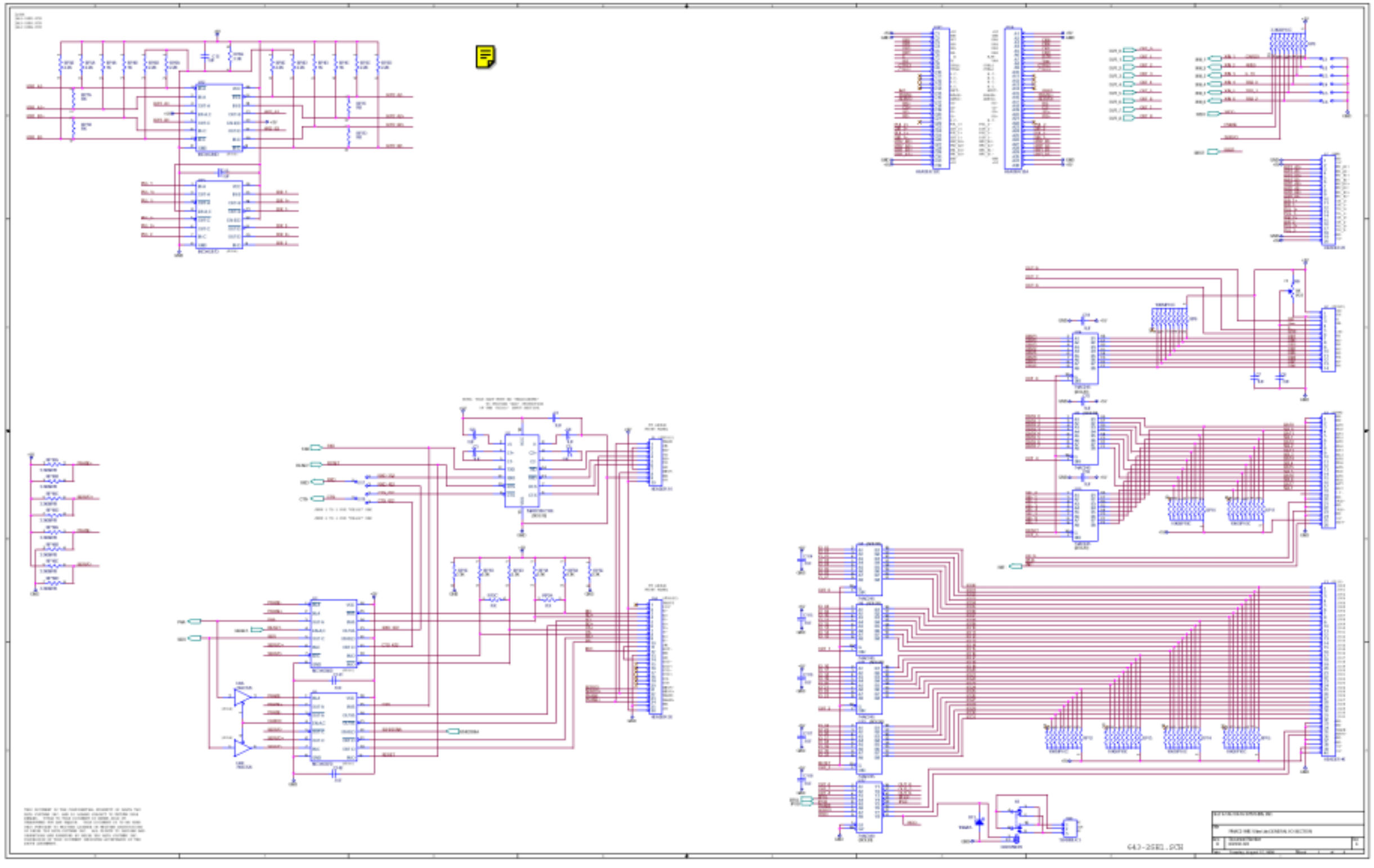
E Point and Physical Layout	Location	Description	Default
E19 		Jump pin 1 to 2 to disable Watchdog timer. Remove jumper to enable Watchdog timer.	No jumper installed

E20-E21: DPRAM Byte Read/Write Order Control

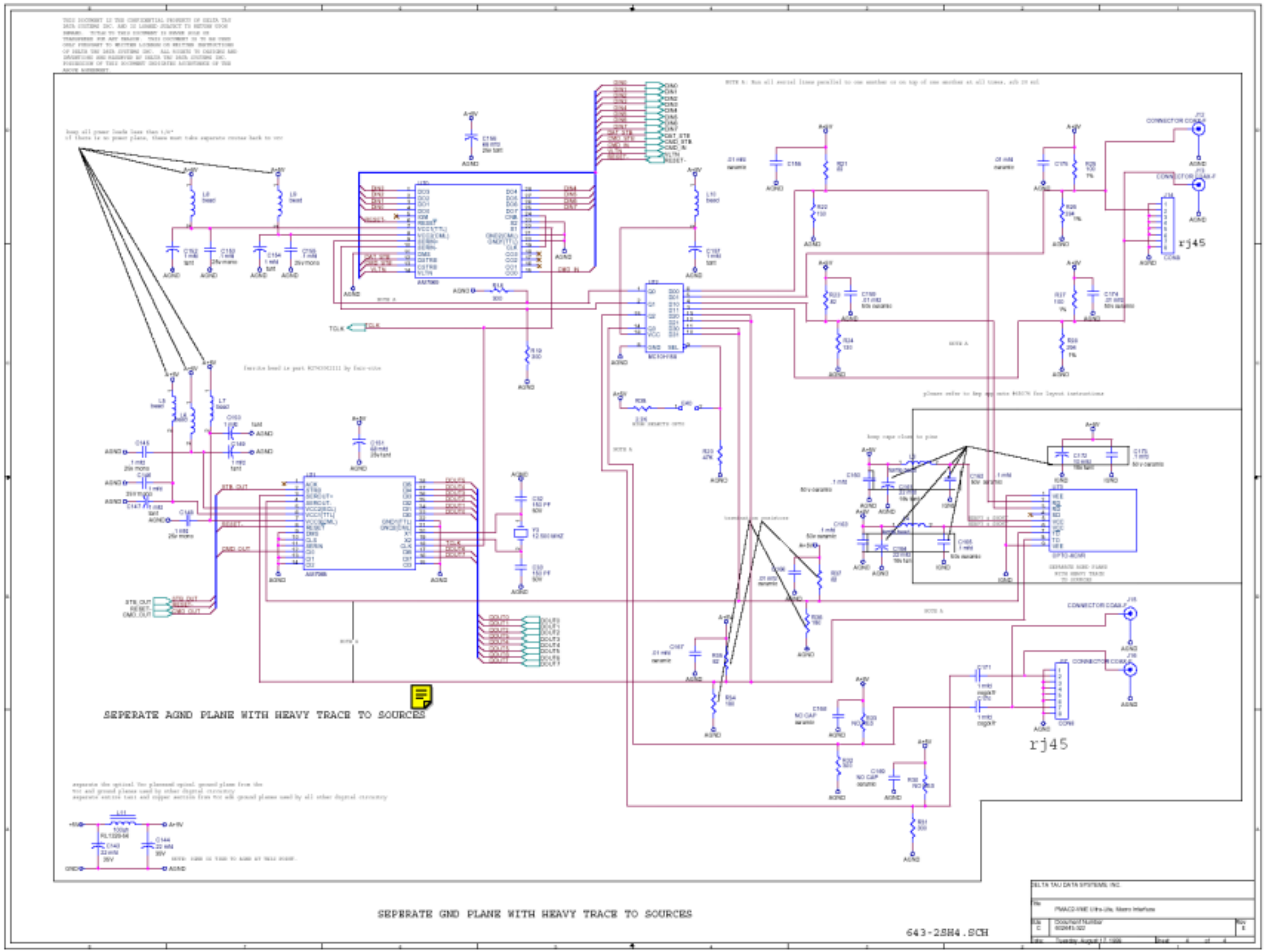
E Point and Physical Layout	Location	Description	Default
E20 E21  		Jump E20-1 to E20-2 to tie VME bus signal VDS0- to upper byte select of DPRAM; jump E21-1 to E21-2 to tie VDS1- to lower byte select (Motorola format). Jump E20-1 to E21-1 to tie VME bus signal VDS0- to lower byte select of DPRAM; jump E20-2 to E21-2 to tie VDS1- to upper byte select (Intel Format).	-2 Jumpers installed
Note: This jumper function is implemented differently on the prototype PMAC2 VME Ultralite boards (-100) than it is on subsequent versions (-101 and greater).			

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SCHEMATICS



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