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Creo Products Inc.

LIONEL Board
10-4801B-B-CP01
Connector Pin List

Revision History

Revision	Date	Author	Comments
Draft	February 8, 2001	Jesse Malm	Initial Release.
B-A	February 21, 2001	Jesse Malm	Updated for version B-A
B-B	November 23, 2001	Jesse Malm	Updated for version B-B

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1. INTRODUCTION

This document contains the connector pinouts for the LIONEL (10-4801A-A) board.

2. CONNECTOR SUMMARY

Table 1. Connector Summary

Designator	Label on Board	Connector Type	Description
J1	PWM_OUT2	2X4 Molex Minifit Jr	1A open-drain PWM output connector #2
J2	SOL_DRV1	2X8 Shrouded Header	Open-drain digital output connector #1
J3	1WIRE	1X2 Molex Minifit Jr.	External 1 Wire Interface Connector
J4	BDM	2X3 Header	BDM connector
J5	PWM_OUT1	2X3 Molex Minifit Jr.	1A open-drain PWM output connector #1
J6	+24V.SAFE	1X2 Header	+24V.SAFE for daughter board
J7	DIG_IN2	2X10 Shrouded Header	Digital input connector #2
J8	DIG_IN3	2X15 Shrouded Header	Digital input connector #3
J9	SCON2	2X5 Molex Minifit Jr.	Expansion bus connector #2
J10	-	2X8 Header	Daughter board expansion connector
J11	DIG_IN1	2X7 Shrouded Header	Digital input connector #1
J12	-	2X10 Header	Daughter board expansion connector
J13	SCON1	2X8 Molex Minifit Jr.	Expansion bus connector #1
J14	AN_3	1X6 MTA	Analog 4-20mA connector #3
J15	BOOT	1X2 Jumper	BOOT jumper
J16	AN_2	1X6 MTA	Analog 4-20mA connector #2
J17	AN_1	1X6 MTA	Analog 4-20mA connector #1
J18	-	1X2 Jumper	Jumper for +12V power on serial port
J19	-	1X2 Jumper	Jumper for +12V power on serial port
J20	RS232 PORT 1	DB9F	RS232 connector
J21	TEMP	2X3 Amp Mini Mate-n-Lock	Temperature (thermistor) input

3. CONNECTOR PINOUTS

3.1 Configuration Jumpers

Boot Jumper (J15)

Pin #s		Function
1-2	Installed	Enter debug boot routine on reset
	Uninstalled	Enter normal operation on reset

+12V on RS232 Connector Jumpers (J18, J19)

Pin #s		Function
J18 1-2	Installed	+12V on RTS/CTS lines
	Uninstalled	RTS/CTS unaffected
J19 1-2	Installed	+12V on DTR/DSR lines
	Uninstalled	DTR/DSR unaffected

3.2 Debug/Programming

BDM Port Connector (2X3 Header) (J4)

Pin #	Pin Name	Function
1	BKGD	Background debug data line
2	GND	
3	N.C.	
4	RESET/	Board RESET/ line
5	N.C.	
6	VCC	Used to power BDM module during programming

3.3 Digital Inputs

Plate Registration Board Input Connector (DIG_IN1) (2X7 Shrouded Header) (J11)

Pin #	Pin Name	Signal	Function
1	+24V		+24V.FUSED supply
2	+24V		
3	EREG.PD+		VCC.FUSED to cable detect loopback
4	EREG.PD-		Cable detect input
5	EREG.SEN0+	PREG0	Connected to 100 Kohm pullup resistor to VCC
6	EREG.SEN0-		Connected to GND
7	EREG.SEN1+	PREG1	

Pin #	Pin Name	Signal	Function
8	EREG.SEN1-		
9	EREG.SEN2+	PREG2	
10	EREG.SEN2-		
11	EREG.SEN3+	PREG3	
12	EREG.SEN3-		
13	GND		
14	-	-	

Digital Input Connector #2 (DIG_IN2) (2X10 Shrouded Header) (J7)

Pin #	Pin Name	Signal	Function
1	SENS4.LED+	SENS4	Connected to VCC.FUSED
2	SENS4.C		Connected to 100 Kohm pullup resistor to VCC
3	SENS4.E		Connected to GND
4	SENS4.LED-		Connected to 220 ohm resistor to ground
5	SENS5.LED+	SENS5	
6	SENS5.C		
7	SENS5.E		
8	SENS5.LED-		
9	SENS6.LED+	SENS6	
10	SENS6.C		
11	SENS6.E		
12	SENS6.LED-		
13	SENS7.LED+	SENS7	
14	SENS7.C		
15	SENS7.E		
16	SENS7.LED-		
17	SENS8.LED+	SENS8	
18	SENS8.C		
19	SENS8.E		
20	SENS8.LED-		

Digital Input Connector #3 (DIG_IN3) (2X15 Shrouded Header) (J8)

Pin #	Pin Name	Signal	Function
1	SENS9.LED+	SENS9	Connected to VCC.FUSED
2	SENS9.C		Connected to 100 Kohm pullup resistor to

Pin #	Pin Name	Signal	Function
			VCC
3	SENS9.E		Connected to GND
4	SENS9.LED-		Connected to 220 ohm resistor to ground
5	SENS10.LED+	SENS10	
6	SENS10.C		
7	SENS10.E		
8	SENS10.LED-		
9	SENS11.LED+	SENS11	
10	SENS11.C		
11	SENS11.E		
12	SENS11.LED-		
13	SENS12.LED+	SENS12	
14	SENS12.C		
15	SENS12.E		
16	SENS12.LED-		
17	SENS13.LED+	SENS13	
18	SENS13.C		
19	SENS13.E		
20	SENS13.LED-		
21	SENS14.LED+	SENS14	
22	SENS14.C		
23	SENS14.E		
24	SENS14.LED-		
25	SENS15.LED+	SENS15	
26	SENS15.C		
27	SENS15.E		
28	SENS15.LED-		
29	GND		
30	GND		

3.4 Temperature Sensor

Temperature (Thermistor) Input Connector (TEMP) (2X3 AMP Mini Mate-N-Lock) (J21)

Pin #	Pin Name	Signal	Function
1	+5VDC		VCC.FUSED
2	GND		
3	TEMP+	TEMP.SENS	Temperature sensor + input
4	TEMP-		Temperature sensor – input
5	PD.TEMP+		VCC.FUSED to cable detect loopback

Pin #	Pin Name	Signal	Function
6	PD.TEMP-		Cable detect input

3.5 Analog (4-20mA) Inputs

4-20mA Input Connector #1, #2, and #3 (AN_1, AN_2, AN_3) (1X6 MTA Header) (J17, J16, J14)

Be careful when interfacing with these connectors, as +24V is exposed!

Pin #	Pin Name	Signal	Function
1	+24V		+24V.FUSED power to the sensor
2	SIG	OPTOREFLx	Analog current input from the sensor (0 to 20 mA)
3	PD-		Cable detect input (connected to pin 6)
4	GND		Signal ground
5	PD+		+VCC.FUSED for cable detect loopback
6	PD-		Cable detect input (connected to pin 3)

3.6 PWM Outputs

PWM Output Connector #1 (PWM_OUT1) (2X3 Molex Minifit Jr.) (J5)

+24V connections are fused at 2.5A for this connector.

Pin #	Pin Name	Function
1	+24V	+24V (fused at 2.5A) to PWM0
2	+24V	+24V (fused at 2.5A) to PWM1
3	PD.PWM_OUT1+	Output for cable detect loopback (20K to +24V)
4	PWM0-	Open drain output for PWM0 (maximum 1A current)
5	PWM1-	Open drain output for PWM1 (maximum 1A current)
6	PD.PWM_OUT1-	Cable detect input

PWM Output Connector #2 (PWM_OUT2) (2X4 Molex Minifit Jr.) (J1)

+24V connections are fused at 2.5A for this connector.

Pin #	Pin Name	Function
1	+24V	+24V (fused at 2.5A) to PWM2
2	+24V	+24V (fused at 2.5A) to PWM3

Pin #	Pin Name	Function
3	PWM4-	Open drain pull-down for PWM4
4	PD.PWM_OUT2+	Output for cable detect loopback (20K to +24V)
5	PWM2-	Open collector pull-down for PWM2
6	PWM3-	Open collector pull-down for PWM3
7	PWM5-	Open collector pull-down for PWM5
8	PD.PWM_OUT2-	Cable detect input

3.7 Solenoid Outputs

Solenoid Output Connector #0 (SOL_DRV1) (2X8 Shrouded Header) (J2)

+24V.SAFE connections are fused at 0.9A for this connector.

Pin #	Pin Name	Function
1	ACT0+	Open collector output to coil (also used as Cable Detect Input; should be looped to Pin 3 {ACT1+}). If either ACT0+ or ACT1+ are driven LOW, then the cable detect will not work.
2	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
3	ACT1+	Open collector output to coil (also used as +24V to Cable Detect Input; should be looped to Pin 1 {ACT0+}). If either ACT0+ or ACT1+ are driven LOW, then the cable detect will not work.
4	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
5	ACT2+	Open collector output to coil
6	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
7	ACT3+	Open collector output to coil
8	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
9	ACT4+	Open collector output to coil
10	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
11	ACT5+	Open collector output to coil
12	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
13	ACT6+	Open collector output to coil
14	+24V.SAFE	+24V.SAFE fused at 0.9A to coils
15	ACT7+	Open collector output to coil
16	+24V.SAFE	+24V.SAFE fused at 0.9A to coils

3.8 Expansion Bus

Expansion Bus Connector #1 (SCON1) (2X8 Molex Minifit Jr) (J13)

This connector's pinout is defined in the SCON Physical Layer document.

Pin #	Pin Name	Function
1	SAT_+48SAFE	Switched +48V (9A maximum current)
2	SAT_+48RTN	Switched +48V Return (9A maximum current)
3	SAT_+24SAFE	Switched +24V (9A maximum current)
4	SAT_+24SRTN	Switched +24V Return (9A maximum current)
5	SAT_+24V	Unswitched +24V (9A maximum current)
6	BRD_LOC+	VCC.FUSED through 1K5 resistor to board detect inputs
7	BRD_LOC1-	Board Detect Bit 1
8	BRD_LOC3-	Board Detect Bit 3
9	CAN_H	CanBus High communcation signal
10	CAN_L	CanBus Low communcation signal
11	CHASSIS	
12	TERM_DET	Expansion Bus Termination detect
13	SAT_+24RTN	Unswitched +24V Return (9A maximum current)
14	BRD_LOC+	VCC.FUSED through 1K5 resistor to board detect inputs
15	BRD_LOC0-	Board Detect Bit 0
16	BRD_LOC2-	Board Detect Bit 2

Expansion Bus Connector #2 (SCON2) (2X5 Molex Minifit Jr) (J9)

This connector's pinout is defined in the SCON Physical Layer document.

Pin #	Pin Name	Function
1	SAT_+48SAFE	Switched +48V (9A maximum current)
2	SAT_+48RTN	Switched +48V Return (9A maximum current)
3	SAT_+24SAFE	Switched +24V (9A maximum current)
4	SAT_+24SRTN	Switched +24V Return (9A maximum current)
5	SAT_+24V	Unswitched +24V (9A maximum current)
6	CAN_H	CanBus High communcation signal
7	CAN_L	CanBus Low communcation signal
8	CHASSIS	
9	TERM_DET	Expansion Bus Termination detect
10	SAT_+24RTN	Unswitched +24V Return (9A maximum current)

3.9 RS232

RS232 Connector (RS232 PORT) (Female DB9) (J20)

Pin #	Pin Name	Function
1	Data Carrier Detect (DCD)	Not connected
2	Receive Data (RD)	Data output to connected DTE device
3	Transmit Data (TD)	Data input from connected DTE device
4	Data Terminal Ready (DTR)	DTR is looped to DSR.
5	Signal Ground (GND)	Signal ground.
6	Data Set Ready (DSR)	DSR is looped from DTR.
7	Request to Send (RTS)	RTS is looped to CTS.
8	Clear to Send (CTS)	CTS is looped from RTS.
9	Ring Indicator (RI)	Not connected.
10	Connector Case	Connected to chassis ground.
11	Connector Case	Connected to chassis ground.

3.10 1Wire

1Wire Bus Connector (1WIRE) (1X2 Molex Minifit Jr.) (J3)

Pin #	Pin Name	Function
1	1Wire	1Wire Bus
2	GND	

3.11 Daughter Board Connectors

Daughter Board Connector #1 (2X10 Header) (J12)

Pin #	Pin Name	Function
1	+5V	VCC to daughter board (not fused!)
2	+5V	VCC to daughter board (not fused!)
3	DFAST0	Connected to SENS4. **Note the DFAST* inputs are not ESD protected and are connected straight to the microcontroller!**
4	DFAST1	Connected to SENS5
5	DFAST2	Connected to SENS6
6	DFAST3	Connected to SENS7
7	GND	
8	GND	

Pin #	Pin Name	Function
9	XIRQ/	Connected to SENS12. Can be used as a non-maskable interrupt line. **Note the XIRQ/IRQ inputs are not ESD protected and are connected straight to the microcontroller!**
10	IRQ/	Connected to SENS13. Can be used as a maskable interrupt line.
11	PWMOUT0	Connected to PWM0 line. CMOS logic levels.
12	PWMOUT1	Connected to PWM1 line. CMOS logic levels.
13	PWMOUT2	Connected to PWM2 line. CMOS logic levels.
14	PWMOUT3	Connected to PWM3 line. CMOS logic levels.
15	DAUT.DET0	Daughter board detect bits. Pulled low with 100K resistor.
16	DAUT.DET1	
17	DAUT.DET2	
18	DAUT.DET3	
19	+24V	Connected to +24V (unfused)
20	+24V	Connected to +24V (unfused)

Daughter Board Connector #2 (2X8 Header) (J6)

Pin #	Pin Name	I/O (relative to LIONEL)	Function
1	+5V	-	VCC to daughter board
2	+5V	-	VCC to daughter board
3	CAN1.TXD	Output	Secondary CAN transmit line
4	CAN1.RXD	Input	Secondary CAN receive line
5	GND	-	
6	GND	-	
7	UART.TXD	Output	Secondary RS232 TX Output
8	UART.RXD	Input	Secondary RS232 RX Input
9	RESET/	I/O	Board RESET/ line. Any signals driving this line must be open-drain or tristate.
10	SPI.CS/1	Output	SPI chip select #1
11	SPI.CS/2	Output	SPI chip select #2
12	SPI.CS/3	Output	SPI chip select #3
13	SPI.SCK2	Output	SPI clock
14	SPI.RCLK	Output	SPI Latch
15	SPI.MOSI	Output	SPI Data output
16	SPI.MISO	Input	SPI Data input

Daughter Board Connector #3 (1X2 Header) (J10)

Pin #	Pin Name	Function
1	+24V.SAFE	+24V.SAFE (unfused)
2	+24V.SAFE	+24V.SAFE (unfused)

4. TEST POINTS

List of Test Points

Designator	Signal Name	Description
TP1	GND	
TP2	VCC	VCC. Should be approximately 5V relative to GND.
TP3	GND	
TP4	GND	
TP5	GND	

[end]