Discrete Input Signal Conditioning Card

User Manual

CQ9518-DI-16

Concurrent Real-Time 800 Northwest 33rd Street Pompano Beach, FL 33064	Document Number	0810007
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Revision History

Revision	Date	Author	Changes
A	07/10/2025	Jim Millener	UM Initial Release

TABLE OF CONTENTS

1. Introduction

This document describes the design and operational aspects of the Concurrent Real-Time CQ9518-DI-16 Configurable Discrete Input Signal Conditioning Board.

2. Product Description

2.1 Overview

The Discrete Input Signal Conditioner is a board with 16 digital circuits that are designed to be a front end to Concurrent Real-Time digital input device, such as a WC-CP-FPGA-2, WC-CP-FPGA-3, WC-CP-FPGA-4, or WC-CP-FPGA-5 Programmable FPGA Cards, or other discrete digital input interfaces. There are two variants of the card, The standard version is designed to be installed into a CCRT Signal Workbench General Purpose Signal Conditioning (GPSD) chassis HS000-SIGWB-8. The DIN variant is designed to be mounted on a DIN rail. The board requires a power supply of +5VDC at 1W. The output can be set up as LVDS to drive inputs of the newer FPGA cards, open drain pulled up to a +5VDC supply, or open drain pulled up to a +3.3VDC supply. One jumper selects the pullup voltage, +5V or +3.3V, for all 16 channels. Each input supports 4 voltage ranges, 5VDC, 12-15VDC, 24-28VDC, and 48-60VDC. With the correct setup, the inputs can support AC voltages. The DIN Mount variant of the card requires an external power supply, such as the CCRT CX-NPSC-PWR1.

3. Block Diagram

Figure 1 shows a block diagram of the board identifying the I/O connectors. Figure 2 is a block diagram of the board showing the locations of the individual channel circuits that can be used to locate channel specific jumpers.

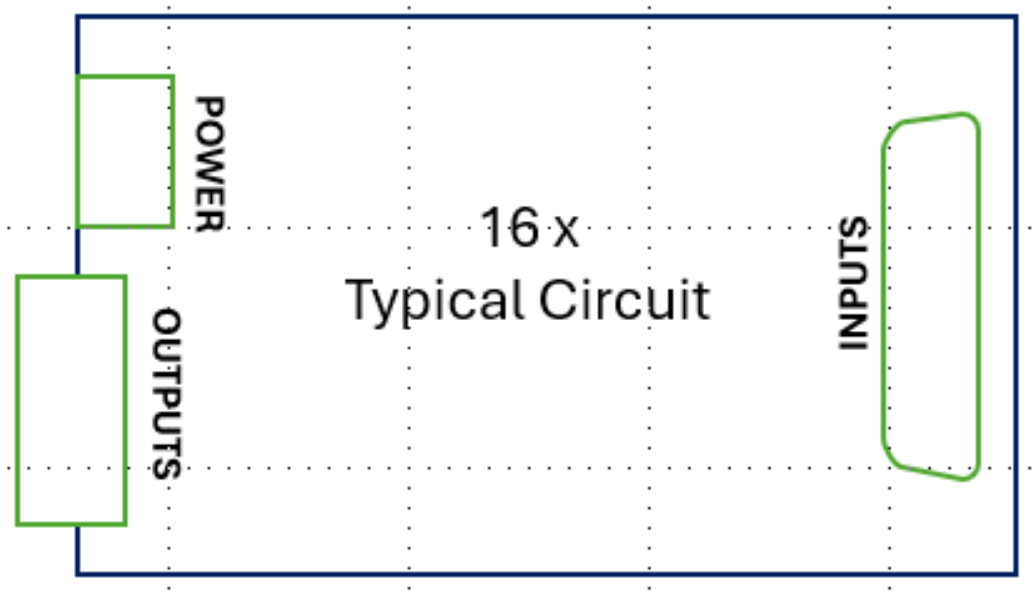


Figure 1

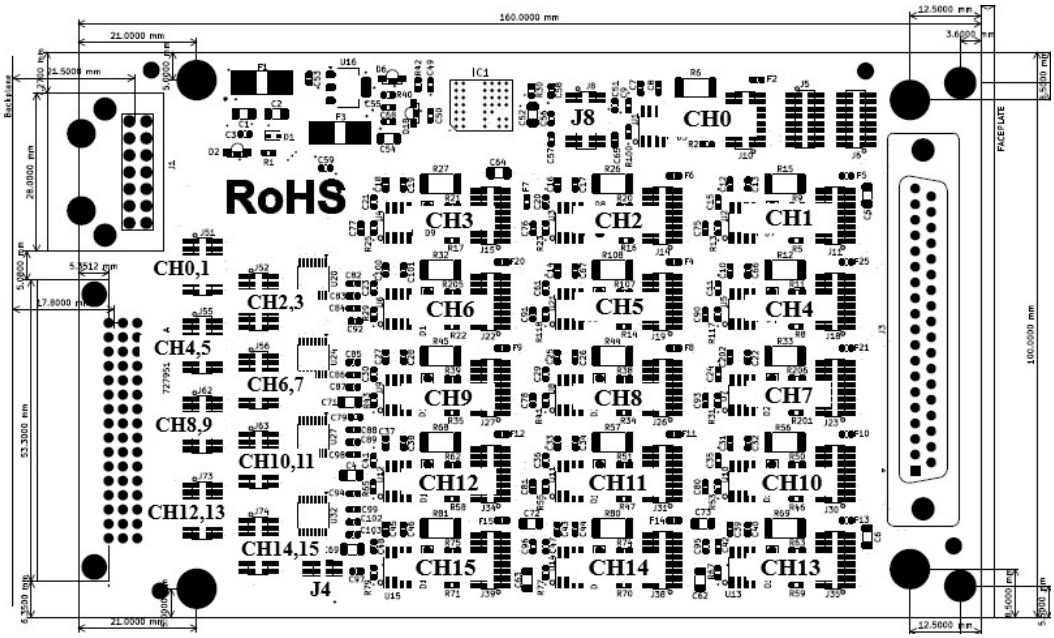
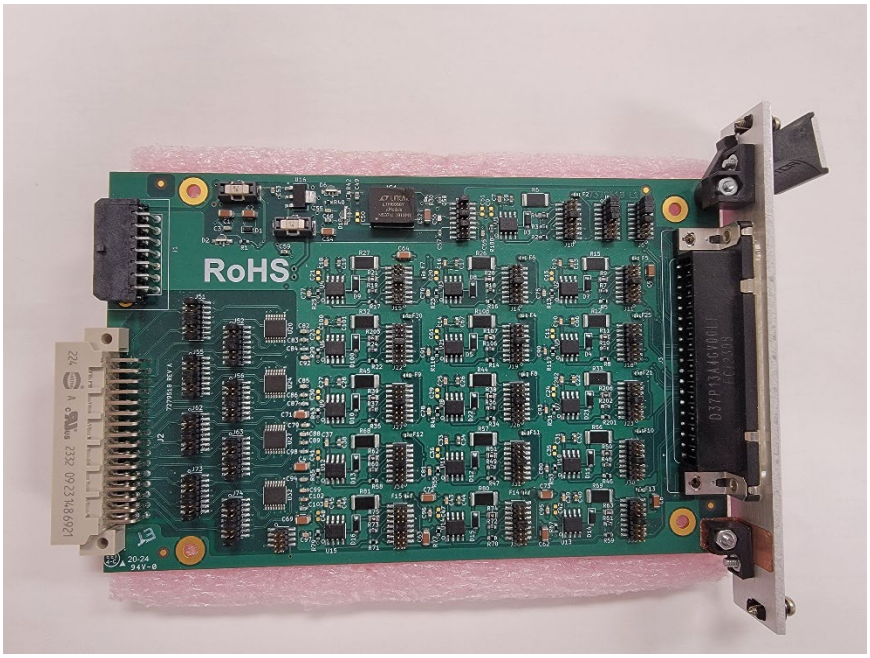


Figure 2

4. Picture

Picture 1 is a picture of the Workbench mount board assembly.



Picture 1

5. General Operation

The following sections show the general steps required for operation.

5.1 Initial Configuration Setup

1) Before powering on a system with this board in it, configure the jumpers as described in this document to make sure that the I/O is configured as necessary.
2) Connect cables from the I/O interface to the system.
3) After power is applied to the system, if the LEDs are visible, confirm that the +5V and the +3.3V indicators LED are ON.

5.2 Feature Selections

There are three features that are required to be set up to use the circuitry on this board. These features are set up using jumpers on header J8 which can be located using Figure 2. Figure 3 shows a schematic of the selection jumper. The LVDS drivers need to be enabled if any channel uses them or disabled if they are not used in all channels. Place a jumper on J8 pins 7-8 to enable all the LVDS drivers. Place a jumper on J8 pins 5-6 to disable all the LVDS drivers. Do not place jumpers in both positions. There is an isolated +5V supply that is commonly used when contact inputs are present. To enable the supply, place a jumper on J8 pins 1-2. To disable the supply, place a jumper on J8 pins 3-4. Do not place jumpers in both positions. The outputs of the isolators is an open drain with a pullup resistor. The pullup voltage, V_SEL, can be set to +5V or to +3.3V. To select +5V for V_SEL, place a jumper on J8 pins 9-10. To select +3.3V for V_SEL, place a jumper on J8 pins 11-12. Do not place jumpers in both positions.

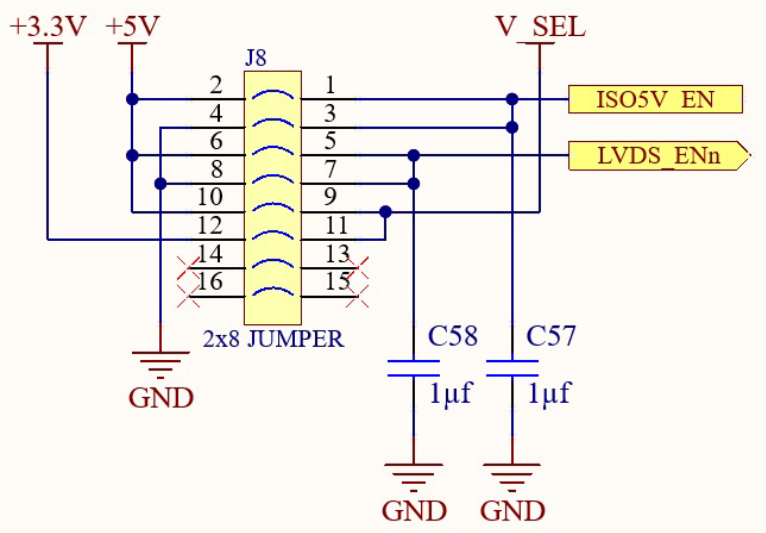


Figure 3

5.3 Typical input circuit schematic.

The typical input circuit is shown in Figure 4. Each input is isolated from all the other inputs. There are 5 selections of current limiting for each input. Only one jumper should be placed on a pin pair from pin numbers 7 through 16. There is a single +5V supply that has galvanic isolation from the output circuitry that can be used by the inputs. The isolated supply has been included so you can detect a switch closure without the need for other hardware. To read an isolated switch, Jumper pins 5-6 and 1-2 to use the isolated 5V supply. Current will flow from the 5V supply through R2 and the isolator LED to ground presenting a '0' to TTLx. Then jumper pins 7-8 which will place a ground on the anode of the isolator diode through a closed contact between Inx+ and Inx-, thus turning it off which presents a '1' to TTLx. Table 1 provides descriptions for the input jumper selections. Other than the contact input selection, each jumper selects what voltage range each input is designed to support. The user can provide the current limit for the isolator using jumper selection pins 7-8. Care must be taken when using this option. The isolator LED works well between 3mA and 10mA. If more current is supplied, damage may occur.

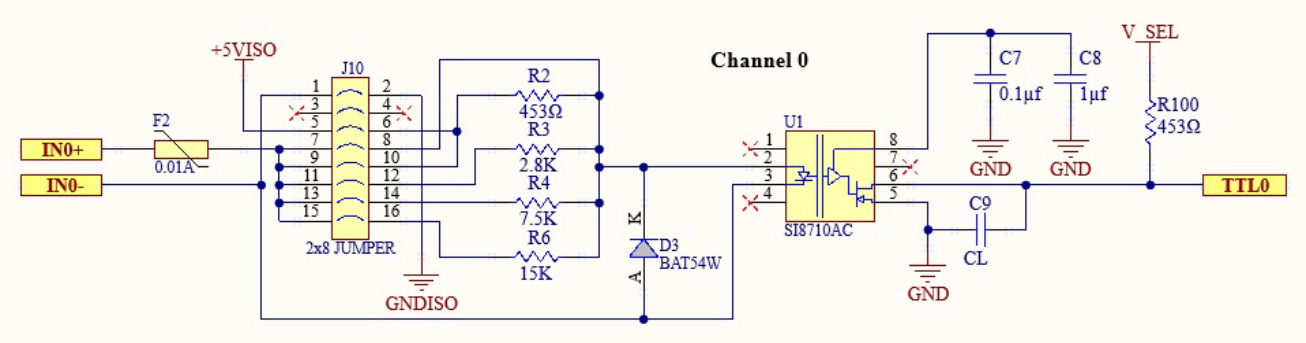


Figure 4

AC voltage detection can be achieved as well. Note that the peak current of 10mA that the isolator can tolerate would occur at the peak of an AC wave form. The input detection values listed in Table 1 are for the peak voltages of an AC input. If the outputs of this board are driving a Concurrent Real-Time FPGA board, a timer can be used to detect the presents or absence of the AC input.

CQ9518-DI-16 Input Jumper Table								
Description	Pins 1-2	Pins 3-4	Pins 5-6	Pins 7-8	Pins 9-10	Pins 11-12	Pins 13-14	Pins 15-16
Isolated contacts (switch)	In	N/A	In	In	Out	Out	Out	Out
3-9V	Out	N/A	Out	Out	In	Out	Out	Out
10-18V	Out	N/A	Out	Out	Out	In	Out	Out
24-30V	Out	N/A	Out	Out	Out	Out	In	Out
46-60V	Out	N/A	Out	Out	Out	Out	Out	In

Table 1

5.4 Typical output circuit schematic.

Figure 5 shows the output circuit. The power for all the output circuits is set by a jumper on J8, Figure 3. Placing a jumper on J8 pins 9-10 will select +5V as the output of the isolator. Then placing jumpers on J51 pins 1-2 and on pins 7-8 will apply the +5V-GND digital signal to the output. Placing a jumper on J8 pins 11-12 will select +3.3V as the output of the isolator. Then placing jumpers on J51 pins 1-2 and on pins 7-8 will apply the +3.3V-GND digital signal to the output. Select the isolator to +3.3V output when using the LVDS drivers. Then placing jumpers on J51 pins 3-4 and on pins 5-6 will apply the LVDS signal to the output when LVDS_ENn is selected on J8 pins 7-8, see Figure 3.

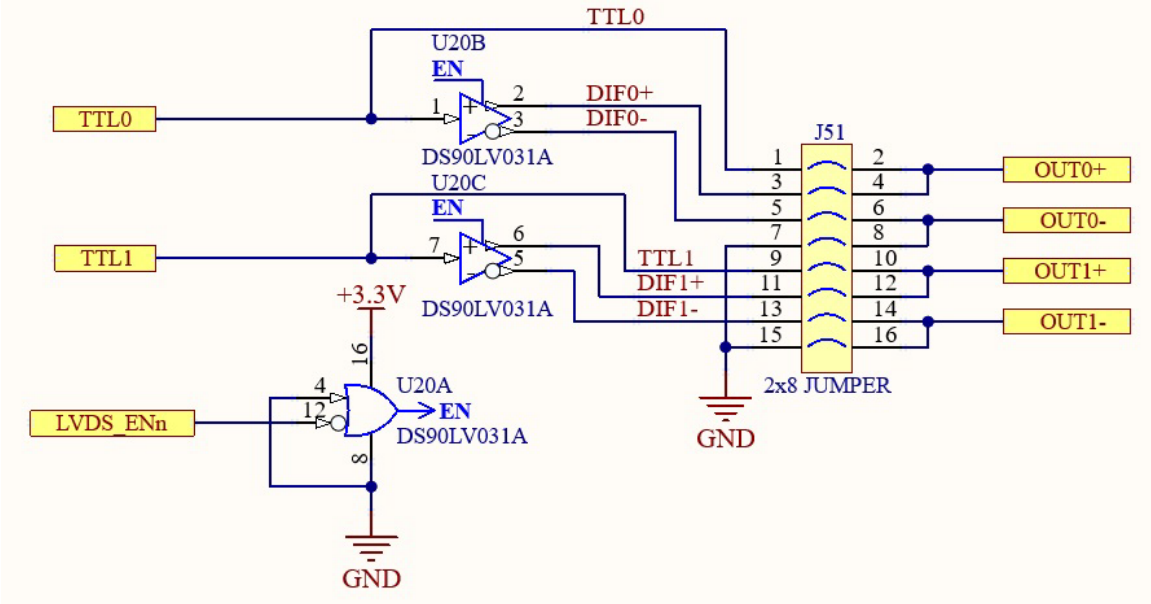


Figure 5

5.5 Shield ground circuit schematic

Figure 6 shows the shield ground connection that can connect the D-Sub shield as well as the mounting holes to signal ground. Place a jumper on J4 pins 7-8 to connect the grounds.

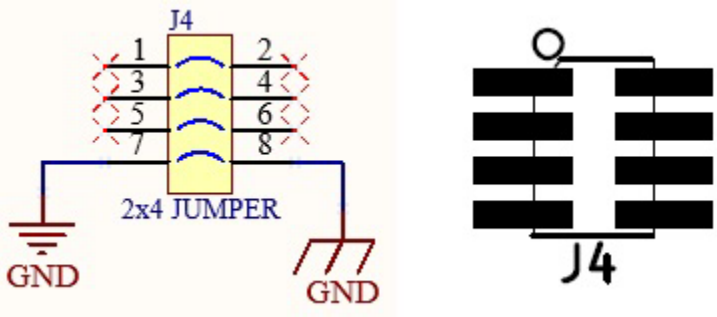


Figure 6

6. Circuit assembly

Figure 7 shows the layout of a single typical input circuit, channel 0.

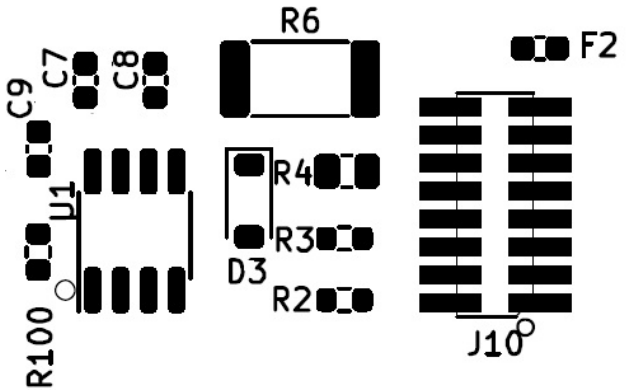


Figure 7

Figure 8 shows the layout of a single typical output circuit, channel 0.

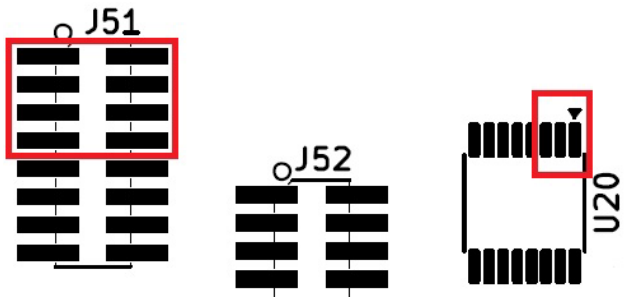


Figure 8

7. Timing

The propagation delay through the isolator is less than 50nS. Delays on the output circuit would be mainly due to the off-board impedance. Capacitor CL (Channel 0 C9) is not normally inserted.

8. Physical Characteristics

The Discrete Input Signal Conditioner Board is a 100mm X 160mm card that can be mounted on a DIN rail or in a 3U Signal Workbench chassis, HS000-SIGWB-8. Power consumption depends on the load, but the maximum total power consumption is roughly 2 watt for the +5V supplies with all channels being used.

9. External Connectors

9.1 Digital Input Connector

Inputs are connected to connector J3, a 37 Pin D-Sub connector. Outputs use a standard 3row x 16pin DIN style connector J2 which can be connected to a Signal Workbench backplane or cable depending on system requirements. The following are the connector as viewed when looking at the board:

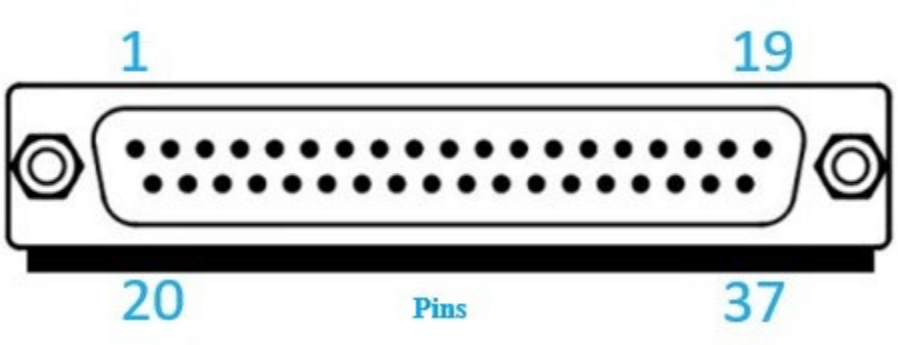


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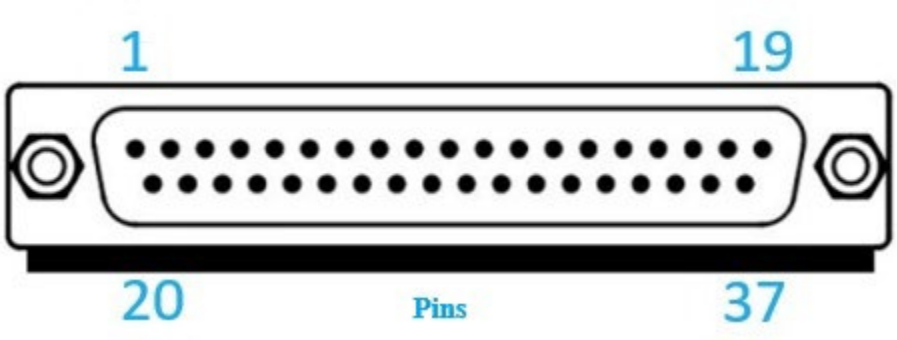
Figure 9

DB37 Pin Assignment for CQ9518-DI-16		
Pin Number	Name	Description
1	IN15-	Negative side of input 15.
20	IN15+	Positive side input 15.
2	IN14-	Negative side of input 14.
21	IN14+	Positive side input 14.
3	IN13-	Negative side of input 13.
22	IN13+	Positive side input 13.
4	IN12-	Negative side of input 12.
23	IN12+	Positive side input 12.
5	IN11-	Negative side of input 11.
24	IN11+	Positive side input 11.
6	IN10-	Negative side of input 10.
25	IN10+	Positive side input 10.
7	IN9-	Negative side of input 9.
26	IN9+	Positive side input 9.
8	IN8-	Negative side of input 8.
27	IN8+	Positive side input 8.

Table 2



DB37 Pin Assignment for CQ9518-DI-16		
Pin Number	Name	Description
9	IN7-	Negative side of input 7.
28	IN7+	Positive side input 7.
10	IN6-	Negative side of input 6.
29	IN6+	Positive side input 6.
11	IN5-	Negative side of input 5.
30	IN5+	Positive side input 5.
12	IN4-	Negative side of input 4.
31	IN4+	Positive side input 4.
13	IN3-	Negative side of input 3.
32	IN3+	Positive side input 3.
14	IN2-	Negative side of input 2.
33	IN2+	Positive side input 2.
15	IN1-	Negative side of input 1.
34	IN1+	Positive side input 1.
16	IN0-	Negative side of input 0.
35	IN0+	Positive side input 0.
17	N/C	No Connect
36	GND	Circuit GND
18	+5V	+5V Supply
37	N/C	No Connect
19	N/C	No Connect

9.2 Discrete Output Connector

Figure 10 shows the discrete output connector and Table 3 shows the pin assignment, looking into the connector with the PCB below the connector body.

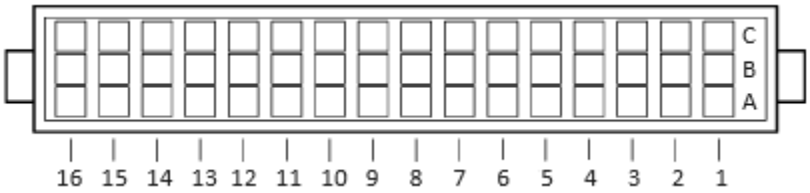


Figure 10

DIN48 Pin Assignment for CQ9518-DI-16							
Pin Num	**Name**	**Pin Num**	**Name**	**Description**	**Pin Num**	**Name**	**Description**
A1	OUT15+	B1	OUT15-	Discrete output 0	C1	N/C	No connect
A2	OUT14+	B2	OUT14-	Discrete output 1	C2	N/C	No connect
A3	OUT13+	B3	OUT13-	Discrete output 2	C3	GND	System ground
A4	OUT12+	B4	OUT12-	Discrete output 3	C4	GND	System ground
A5	OUT11+	B5	OUT11-	Discrete output 4	C5	GND	System ground
A6	OUT10+	B6	OUT10-	Discrete output 5	C6	+5V	+5V Supply
A7	OUT9+	B7	OUT9-	Discrete output 6	C7	N/C	No connect
A8	OUT8+	B8	OUT8-	Discrete output 7	C8	N/C	No connect
A9	OUT7+	B9	OUT7-	Discrete output 8	C9	N/C	No connect
A10	OUT6+	B10	OUT6-	Discrete output 9	C10	N/C	No connect
A11	OUT5+	B11	OUT5-	Discrete output 10	C11	N/C	No connect
A12	OUT4+	B12	OUT4-	Discrete output 11	C12	N/C	No connect
A13	OUT3+	B13	OUT3-	Discrete output 12	C13	N/C	No connect
A14	OUT2+	B14	OUT2-	Discrete output 13	C14	N/C	No connect
A15	OUT1+	B15	OUT1-	Discrete output 14	C15	N/C	No connect
A16	OUT0+	B16	OUT0-	Discrete output 15	C16	N/C	No connect

Table 3

9.3 Power Connector

Power connector pin assignment. Figure 11 is a view of the power connector looking into the pins on the PCB with the key on the top.

Figure 11

Table 4 shows the pin names and descriptions of the signals in the power connector.

Pin	Signal Name	Description	Pin	Signal Name	Description
1	No Connect		8	No Connect	
2	No Connect		9	No Connect	
3	No Connect		10	No Connect	
4	No Connect		11	No Connect	
5	GND	Board Ground	12	No Connect	
6	GND	Board Ground	13	No Connect	
7	GND	Board Ground	14	P5V	+5V Supply

Table 4