Analog Output Signal Conditioning Card

User Manual

CQ9504-AO-16

Concurrent Real-Time 800 Northwest 33rd Street Pompano Beach, FL 33064	Document Number	0810004
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Revision History

Revision	Date	Author	Changes
A	02/13/2025	Jim Millener	Create User Manual from Design Spec

Contents

1. Introduction

This document describes the design and operational aspects of the Concurrent Real-Time CQ9504-AO-16 Configurable Analog Output Signal Conditioning Board.

2. Product Description

2.1 Overview

The Analog Output Signal Conditioner is a board with 16 analog circuits that are designed to be an interface with Concurrent Real-Time Digital to Analog converter products, such as a WC-CP-FIO Programmable FPGA Card, or the WC-DA3218 32-Channel Analog Output Card. The card can be used as an analog interface for other, standalone applications as well. 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 ±15V and power for the output amplifier which can be connected externally to the required ±15V or any supply of ±5V to ±70V. A CCRT Signal Workbench GPSD chassis HS000-SIGWB-8 supplies the ±15V power to support a ±10V output to the CCRT A/D inputs. The card supports analog input signals that can vary up to -60V to +60V. The DIN Mount variant of the card requires an external power supply, such as the CCRT CX-NPSC-PWR1.

2.2 Block Diagram

Figure 1 shows a block diagram of the board identifying the I/O connectors. Figure 2 shows a block diagram of the board showing the locations of the individual channel circuits.

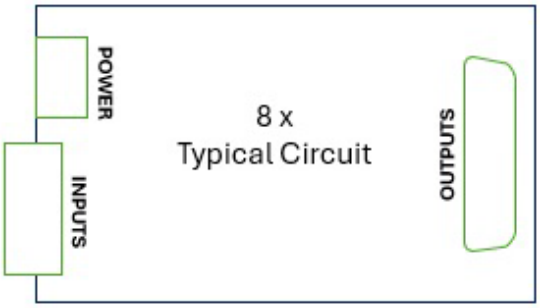


Figure 1

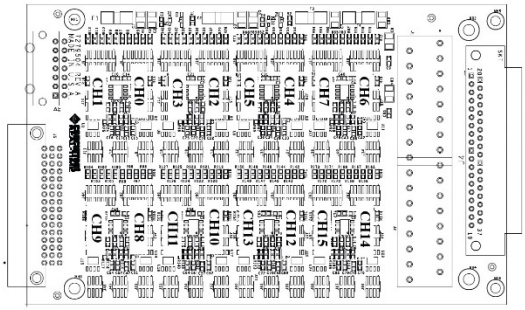
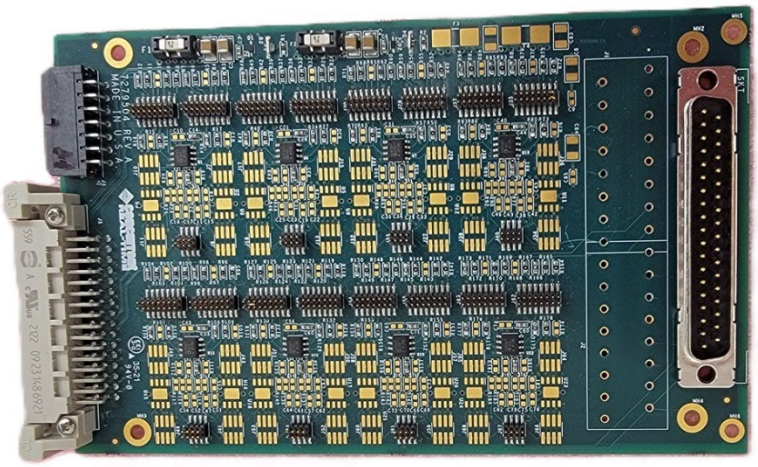


Figure 2

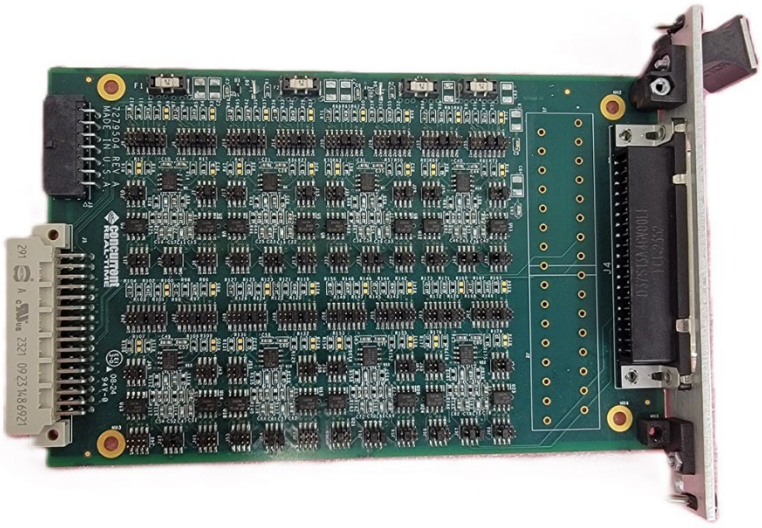
3. Picture

Picture **1** is a picture of the DIN mount board assembly. The configuration of the board in the picture doesn't have the high voltage output amplifier circuits installed.



Picture 1

Picture 2 is a picture of the Workbench mount board assembly.



Picture **2**

4. General Operation

The following sections describes the general steps required for operation. Note that the even channels have a different second stage circuit than the odd channels.

4.1 Initial Configuration Setup

1) Before powering on a system with this board in it, use the Jumper Block Settings 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 +15V indicator LED and the -15V indicator LED are ON. If the high voltage output stage is used, make sure those amplifiers have differential power from PBATT+ and PBATT-. PBATT+ can be connected to +15V by connecting pins 18 and 37 of the DB37 Output connector. PBATT- can be connected to -15V by connecting pins 19 and 36 of the DB37 Output connector. Figure **9** shows the DB37 connector pinout.

4.2 Stage1 Circuit Schematic

There are two stages of amplification for each channel. The first stage has a jumper selectable gain of 1:1 or 2:1 as initially populated. One half of the second stage of the circuit has a jumper selectable gain of 1:1, 2:1, and 4:1. The other half of the output circuit has jumper selectable gains of -1:1, -2:1, and -4:1. Note that every even channel is overall non-inverting and every odd channel is overall inverting. The first stage of the even channel can be applied through jumpers to the non-inverting input of the odd channel to provide an extra gain stage.

Figure 3 shows the typical Stage1 input circuit schematic. Figure 8 shows the relative placement of an even channel and odd channel pair of these circuits.

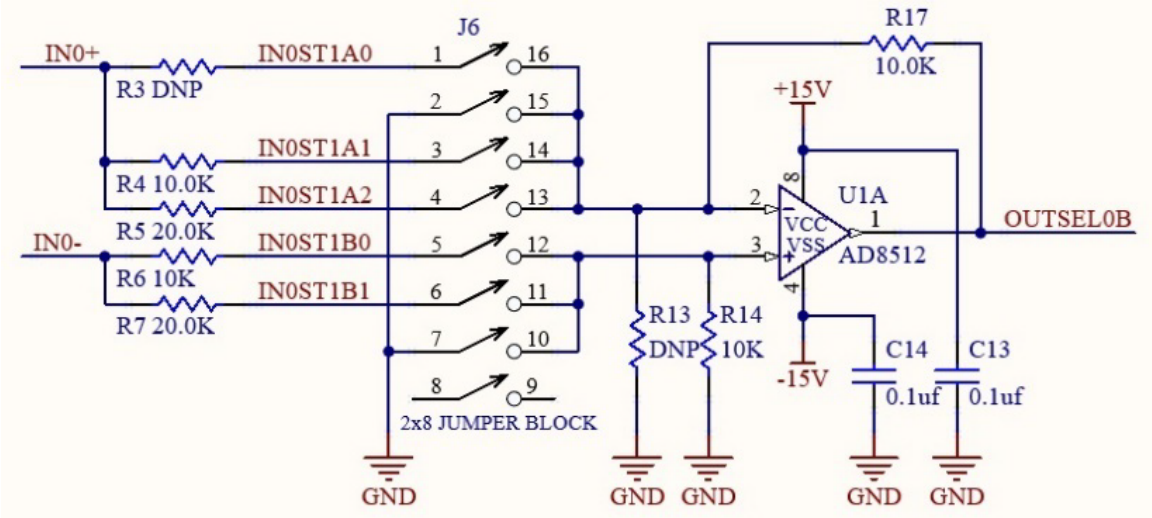


Figure 3

4.3 Stage1 to Stage2 jumper block schematic

Figure 4 shows the jumper block configuration between the two amplifier stages. Note that the output of the even input stage can be fed to the input of the second stage for extra gain. The odd stage can be AC coupled to the output. Also note that the even Stage1 output can be fed to the non-inverting input of the even second stage and the inverting input of the odd second stage to implement a differential output stage. Figure 8 shows the relative placement of an even channel and odd channel pair of these circuits.

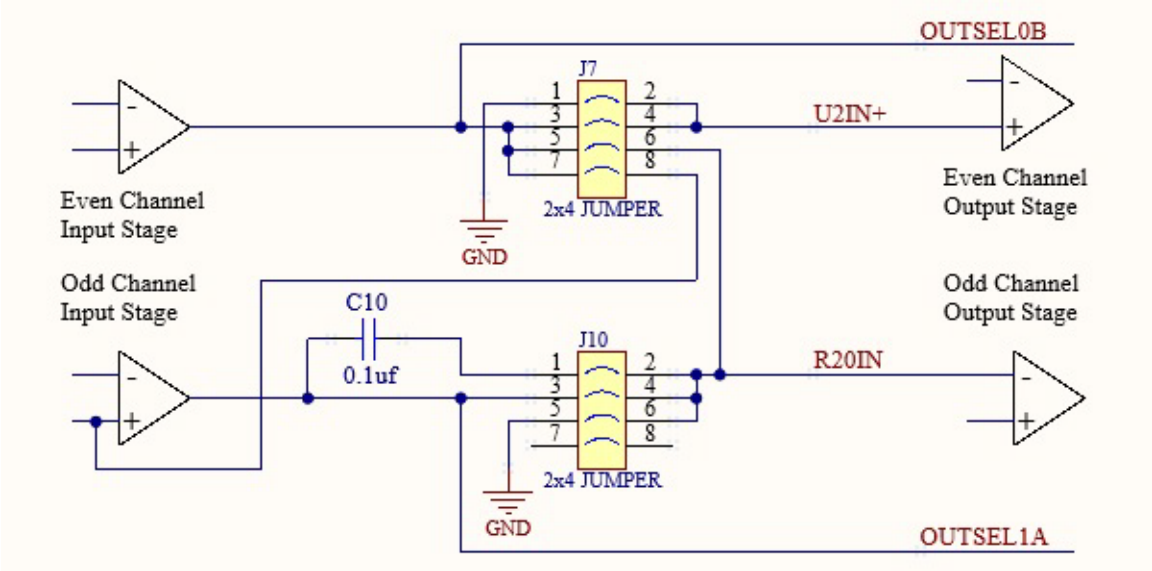


Figure 4

4.4 Stage2 Circuit Schematic

Stage2 of the circuit has different circuits for even and odd numbered channels. All Stage2 channels use an LTC 6090 which is a high voltage amplifier. Stage1 feeds the non-inverting Stage2 input for even numbered channels and feeds the inverting Stage2 input for the odd numbered channels. The Stage 1 to Stage2 jumper block allows connection of the even Stage1 circuit to the even non-inverting Stage2 amplifier and the odd inverting Stage2 amplifier. This allows jumper configuration of differential output amplifiers.

4.4.1 Stage2 Power Source

Note that in all configurations the LTC6090 power is supplied by signals PBATT and NBATT. The supply for the stage 2 amplifier can range from ±15VDC to ±70VDC. Figure **9** shows the pinout of the DB37 connector where that power is typically supplied. The power signals are also available on the DIN48 connector shown in Figure 10 and listed in Table 1. In a Signal Workbench chassis, Stage2 power usually comes from the DB37 pin connector. In a custom version of the Signal Workbench chassis, that power can be supplied internally from the DIN48 connector. In a DIN rail system configuration, Stage2 power can also be supplied through the 2x7 pin Power connector. Figure 11 Shows the pinout of the power supply connector where PBATT and NBATT are available. Table 2 shows the power connector pinout.

4.4.2 Even Channel Stage2 Schematic

Figure 5 shows the schematic for Even Channel, Stage2 amplifier circuits. Note that the input from Stage1 is connected to the non-inverting input of the amplifier. A feedback capacitor can be added for extra stability. Since the amplifier is no-inverting, the gain can be set to 1:1 with jumper pins 7 and 8 connected. The gain can be set to 2:1 with jumper pins 5 and 6 connected. Or the gain can be set to 4:1 with jumper pins 3 and 4 connected.

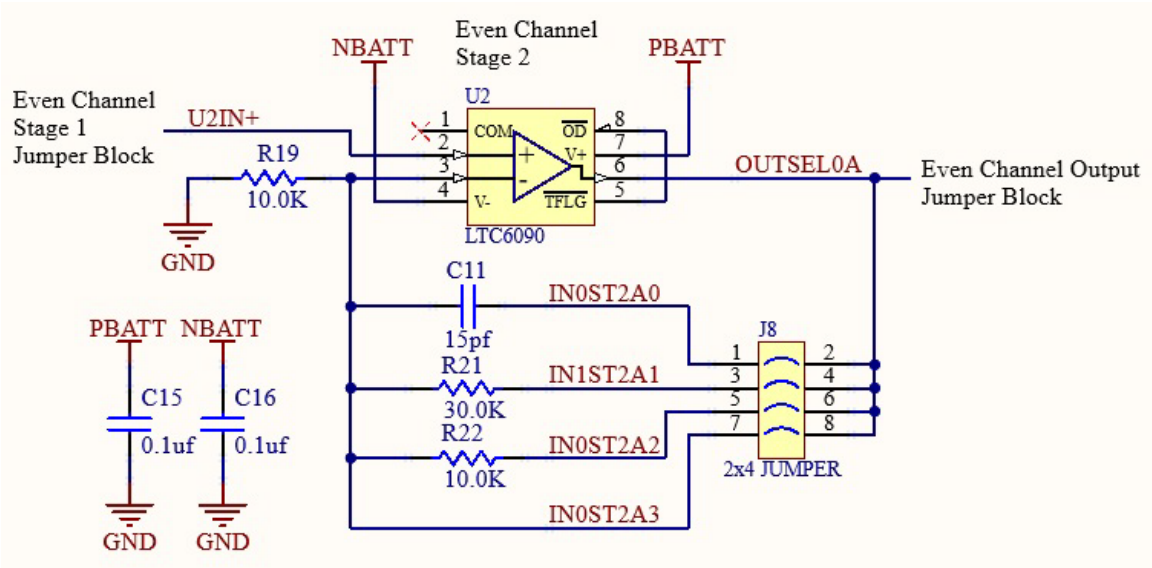


Figure 5

4.4.3 Odd Channel Stage2 Schematic

Figure 6 shows the schematic for Odd Channel, Stage2 amplifier circuits. Note that the input from Stage1 is connected to the inverting input of the amplifier. A feedback capacitor can be added for extra stability. The gain can be set to -1:1 with jumper pins 7 and 8 connected. The gain can be set to -2:1 with jumper pins 5 and 6 connected. The gain can be set to -4:1 with jumper pins 3 and 4 connected.

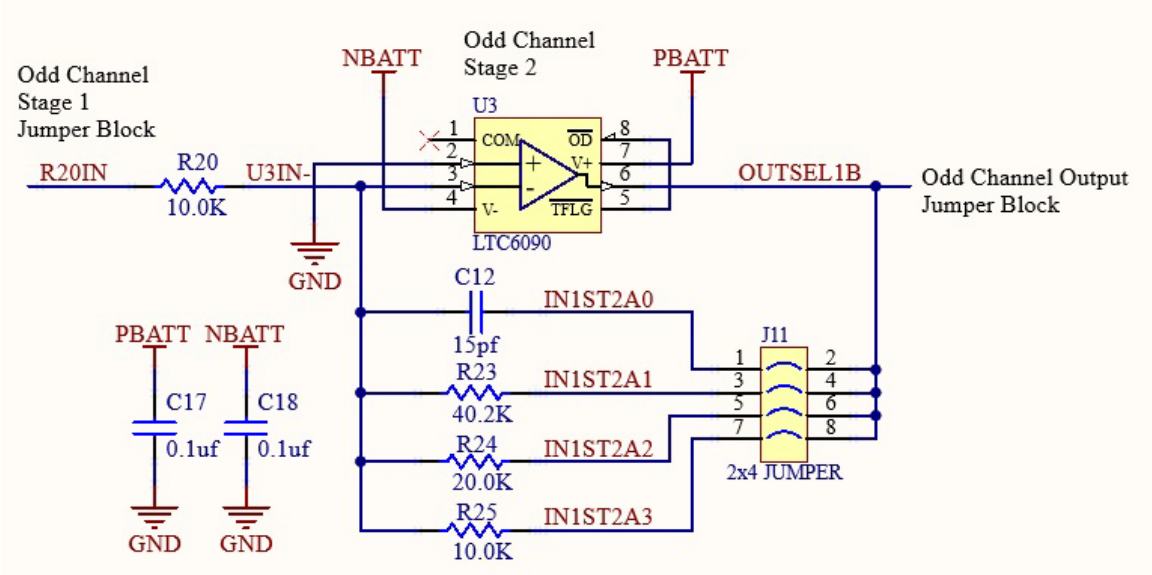


Figure 6

4.5 Output Jumper Block Schematic

The signal to the output connectors can be selected to be either the output of the Stage1 amplifier circuit or the output of the Stage2 amplifier circuit. Figure 7 shows the output jumper block selections.

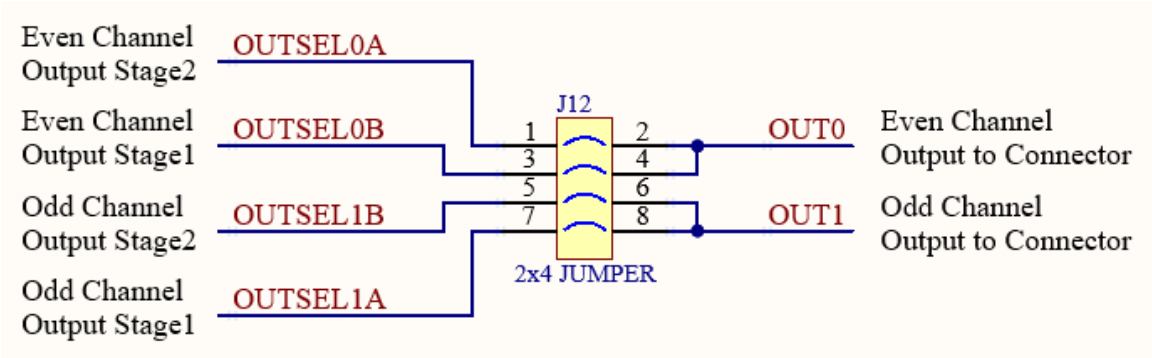


Figure 7

5. Channel Pair Assembly Drawing.

Figure 8 shows the typical layout for a pair of individual circuits. U1 is a dual amplifier forming an even and odd Stage1 pair. The even channel will be on the lower right side of the assembly as it is shown, and the odd channel will be on the lower left of the assembly.

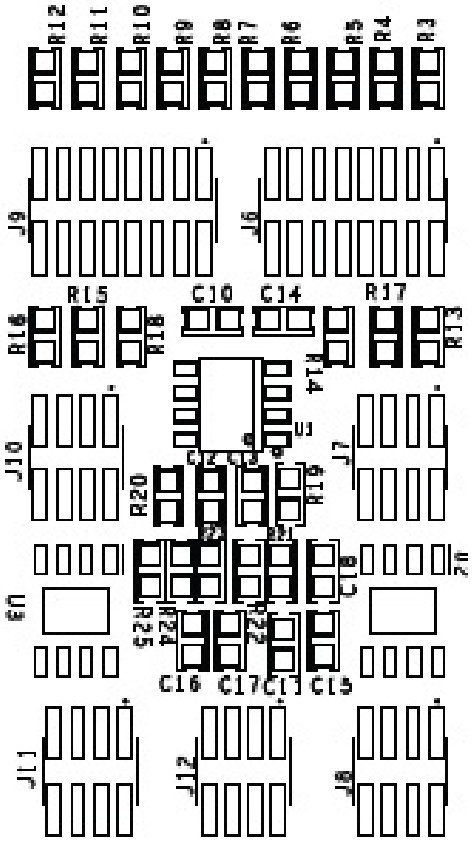


Figure 8

6. Physical Characteristics

The Analog 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 load, but the maximum total power consumption is no more than 1 watt for the ± 15V supply with all channels being used. The high voltage Stage2 amplifier can sink and source up to 50mA but not at ±70V supply.

7. External Connectors

7.1 Analog Output Connector

Analog output connector pin assignment. Inputs are connected to connector J4, Figure 9, is with terminal blocks or DSub37 connector. Outputs use a standard DIN style connector J5 which can be connected to a backplane or cable depending on system requirements. The following are the connector as viewed when looking at the board:

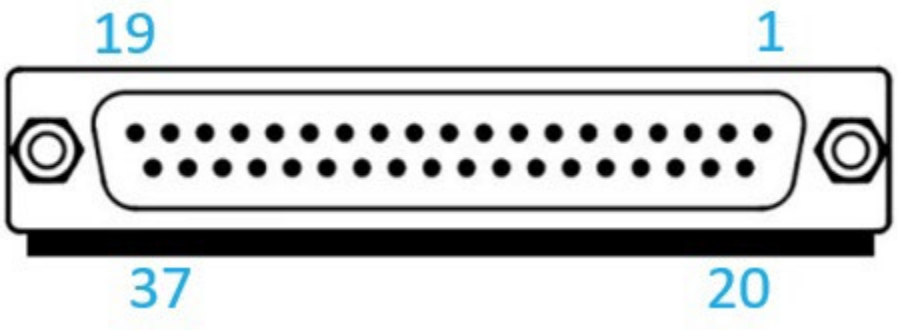
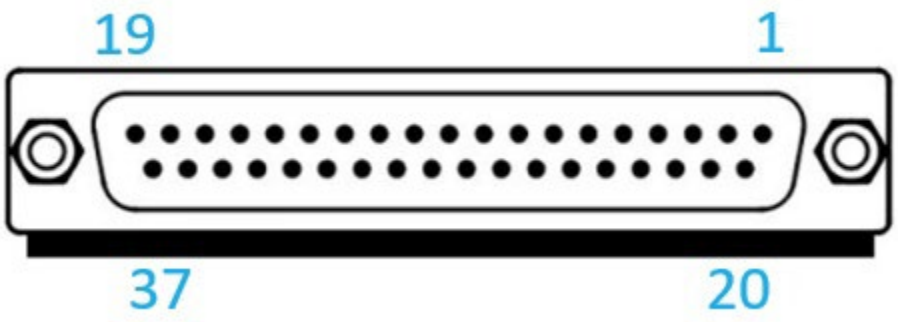


Figure 9

DB37 Pin Assignment for CQ9504-DO-16		
Pin Number	**Name**	**Description**
20	OUT0-	GND
1	OUT0+	Channel 0 Stage1 Output or Stage2 Output.
21	OUT1-	GND
2	OUT1+	Channel 1 Stage1 Output or Stage2 Output.
22	OUT2-	GND
3	OUT2+	Channel 2 Stage1 Output or Stage2 Output.
23	OUT3-	GND
4	OUT3+	Channel 3 Stage1 Output or Stage2 Output.
24	OUT4-	GND
5	OUT4+	Channel 4 Stage1 Output or Stage2 Output.
25	OUT5-	GND
6	OUT5+	Channel 5 Stage1 Output or Stage2 Output.
26	OUT6-	GND
7	OUT6+	Channel 6 Stage1 Output or Stage2 Output.
27	OUT7-	GND
8	OUT7+	Channel 7 Stage1 Output or Stage2 Output.



DB37 Pin Assignment for CQ9504-DO-16		
Pin Number	**Name**	**Description**
28	OUT8-	GND
9	OUT8+	Channel 8 Stage1 Output or Stage2 Output.
29	OUT9-	GND
10	OUT9+	Channel 9 Stage1 Output or Stage2 Output.
30	OUT10-	GND
11	OUT10+	Channel 10 Stage1 Output or Stage2 Output.
31	OUT11-	GND
12	OUT11+	Channel 11 Stage1 Output or Stage2 Output.
32	OUT12-	GND
13	OUT12+	Channel 12 Stage1 Output or Stage2 Output.
33	OUT13-	GND
14	OUT13+	Channel 13 Stage1 Output or Stage2 Output.
34	OUT14-	GND
15	OUT14+	Channel 14 Stage1 Output or Stage2 Output.
35	OUT15-	GND
16	OUT15+	Channel 15 Stage1 Output or Stage2 Output.
36	-15V	System -15V supply. Limited current available.
17	N/C	No connection
37	+15V	System +15V supply. Limited current available.
18	+BATT	Alternate feedback voltage.
19	-BATT	Alternate feedback voltage.

7.2 Analog Input Connector

Analog input connector pin assignment, looking into the connector with the PCB below the connector body.

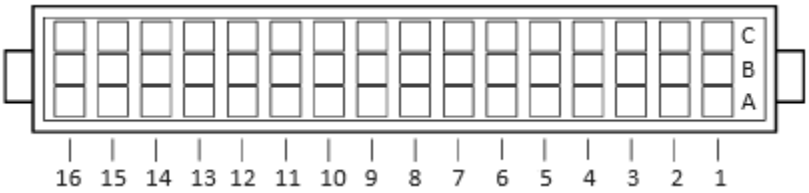


Figure 10

DIN48 Pin Assignment for CQ9504-DO-16							
Pin Num	**Name**	**Pin Num**	**Name**	**Description**	**Pin Num**	**Name**	**Description**
A1	IN15+	B1	IN15-	Analog output 0	C1	N/C	No connect
A2	IN14+	B2	IN14-	Analog output 1	C2	N/C	No connect
A3	IN13+	B3	IN13-	Analog output 2	C3	GND	System ground
A4	IN12+	B4	IN12-	Analog output 3	C4	GND	No connect
A5	IN11+	B5	IN11-	Analog output 4	C5	GND	System ground
A6	IN10+	B6	IN10-	Analog output 5	C6	N/C	No connect
A7	IN9+	B7	IN9-	Analog output 6	C7	+15V	+15V Supply
A8	IN8+	B8	IN8-	Analog output 7	C8	-15V	-15V Supply
A9	IN7+	B9	IN7-	Analog output 8	C9	PBATT	+Alt supply
A10	IN6+	B10	IN6-	Analog output 9	C10	PBATT	+Alt supply
A11	IN5+	B11	IN5-	Analog output 10	C11	NBATT	-Alt supply
A12	IN4+	B12	IN4-	Analog output 11	C12	NBATT	-Alt supply
A13	IN3+	B13	IN3-	Analog output 12	C13	N/C	No connect
A14	IN2+	B14	IN2-	Analog output 13	C14	N/C	No connect
A15	IN1+	B15	IN1-	Analog output 14	C15	N/C	No connect
A16	IN0+	B16	IN0-	Analog output 15	C16	N/C	No connect

Table 1

7.3 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 2 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	NBATT[1]	Negative external Vin	10	PBATT[1]	Positive external Vin
4	NBATT[1]	Negative external Vin	11	PBATT[1]	Positive external Vin
5	GND	Board Ground	12	N15V	Negative 15V
6	GND	Board Ground	13	P15V	Positive 15V
7	GND	Board Ground	14	No Connect	

Table 2

1) NPBATT and PBATT are connected at the power supply connector and at the DIN connector.