



Analog Input Signal Conditioning Card

User Manual

CQ9515-AI-16

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| | Author | JCMII |

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2/5/2025

Revision History

| Revision | Date | Author | Changes |
|-----------------|-------------|---------------|-------------------------------------|
| A | 10/29/2020 | Andrew Joyner | Initial Release, design spec. |
| B | 12/11/2024 | Jim Millener | Create User Manual from Design Spec |
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1. Introduction

This document describes the design and operational aspects of the Concurrent Real-Time CQ9515-AI-16 Configurable Analog Input Signal Conditioning Board.

2. Product Description

2.1 Overview

The Analog Input Signal Conditioner is a board with 16 analog circuits that are designed to be a front end to Concurrent Real-Time Analog to Digital converter products, such as a WC-CP-FIO Programmable FPGA Card, or the WP-ADS6418 64-Channel Analog Input 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 $\pm 15V$ and supports gains of 1:1, 1:3, and 1:6. A CCRT Signal Workbench GPSD chassis HS000-SIGWB-8 supplies the $\pm 15V$ power to support a $\pm 10V$ 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.

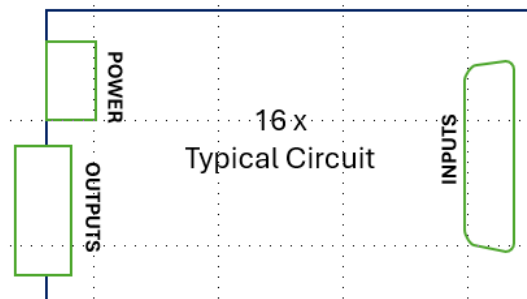


Figure 1

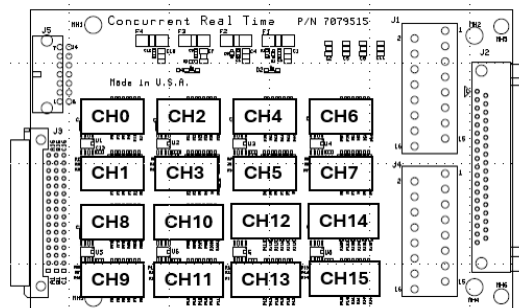
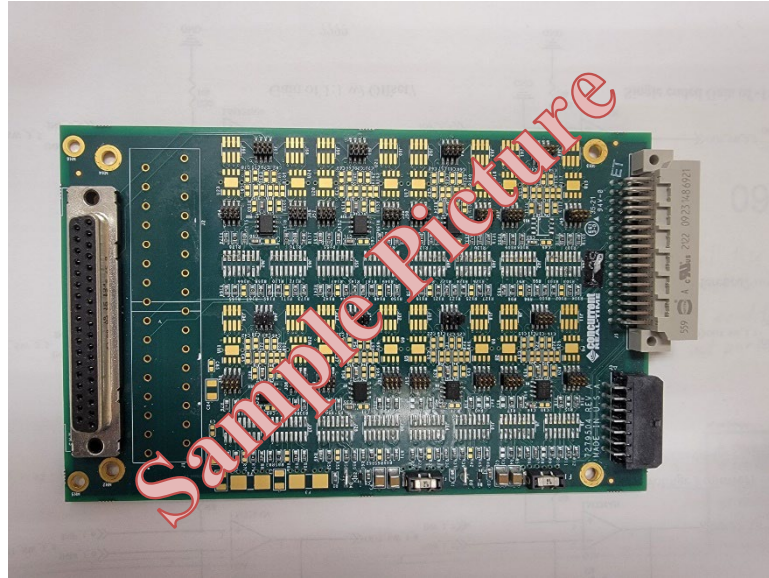


Figure 2

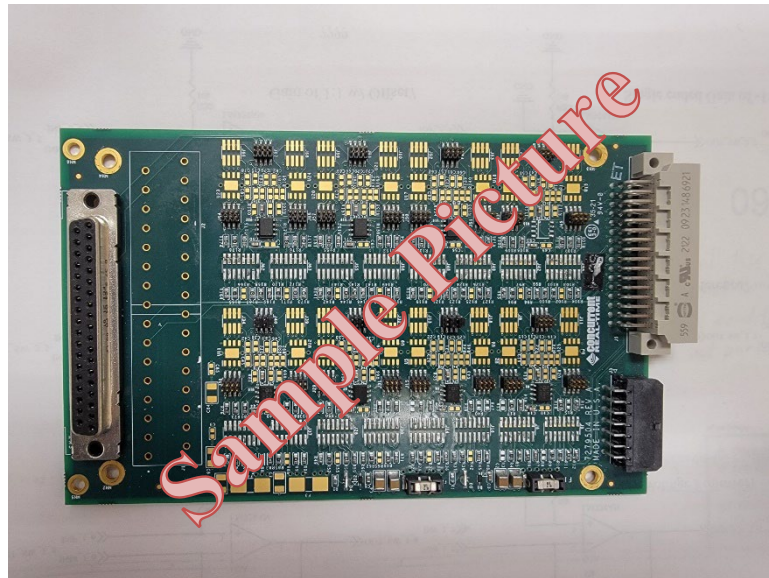
3. Picture

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



Picture 1

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



Picture 2

4. General Operation

The following sections show the general steps required for operation.

4.1 Initial Configuration Setup

- 1) Before powering on a system with this board in it, use the Dip Switch 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.

4.2 Typical circuit schematic.

Figure 3 shows the typical input circuit schematic. Shows the relative placement of a pair of these circuits.

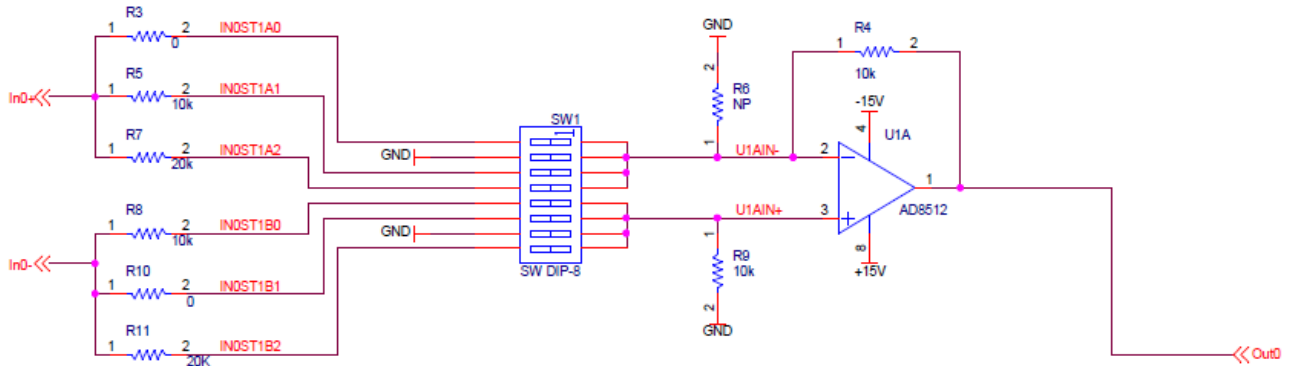


Figure 3

The typical layout for a pair of individual circuits.

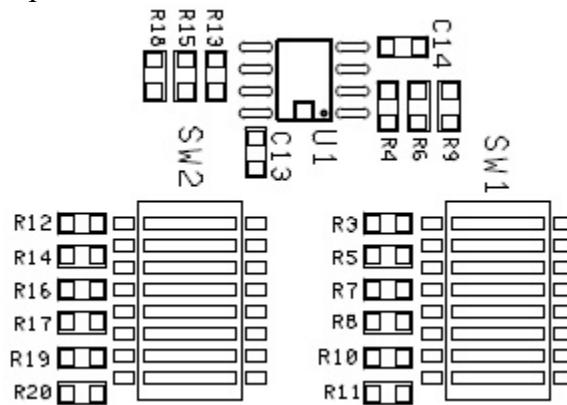


Figure 4

4.3 Settings.

The gains are selected by setting DIP switches in the appropriate positions. Figure 5 shows a picture of a DIP switch. When the white piece in the switch (handle) is moved toward the side of the switch that says 'ON CTS', a switch is considered 'ON'. When the white piece is moved away from the side of the switch that says 'ON CTS' a switch is considered off.

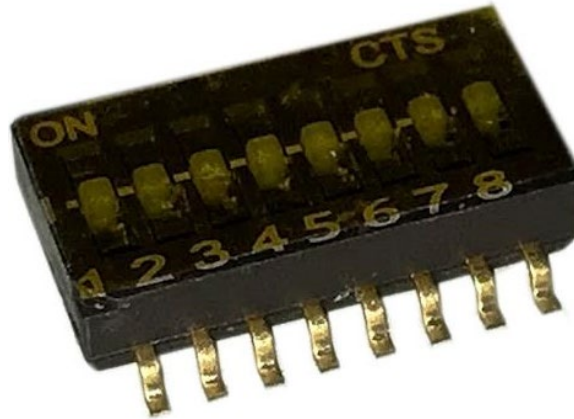


Figure 5

Figure 9 shows the pin numbering of J2, DB37F pin connector on the Analog Input card. This connector provides the input interface for the card. There are 16 differential input channels and power connections available. The circuit outputs are single ended analog signals designed to drive A/D converters on a CCRT FPGA board or a user system.

4.3.1 1:1 Gain.

To set a channel up for a gain of 1, set switch 3 and switch 5 to ON and set all other switches for that channel away from ON as shown in Figure 6 (The switch handle is white in the drawing).



Figure 6

4.3.2 1:3 Gain.

To set a channel up for a gain of 1/3, set switch 4 and switch 8 to ON and set all other switches for that channel away from ON as shown in Figure 7 (The switch handle is white in the drawing).

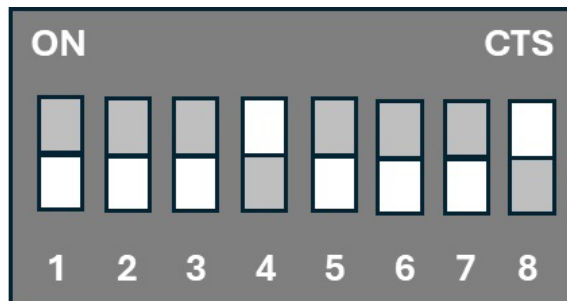


Figure 7

4.3.3 1:6 Gain.

To set a channel up for a gain of 1/6, set switch 1 and switch 6 to ON and set all other switches for that channel away from ON as shown in Figure 8 (The switch handle is white in the drawing).

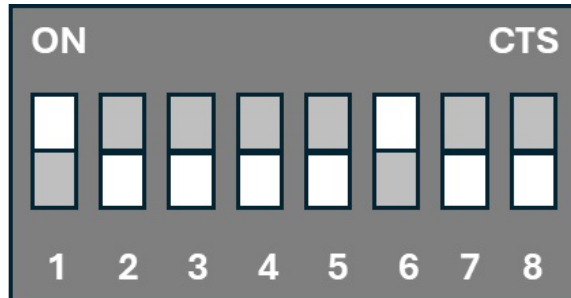


Figure 8

5. 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.

6. External Connectors

6.1 Analog Input Connector

Analog input 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:

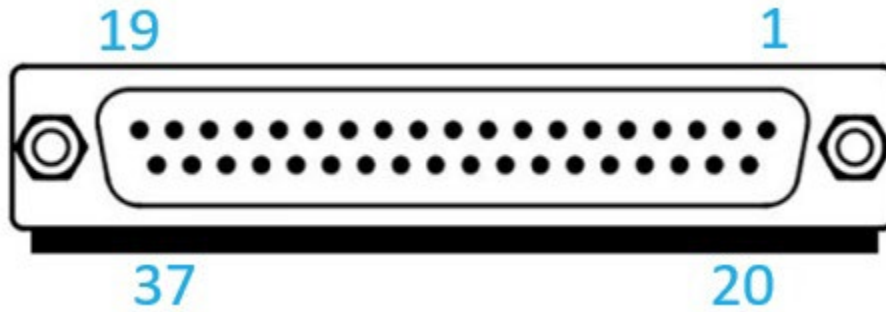
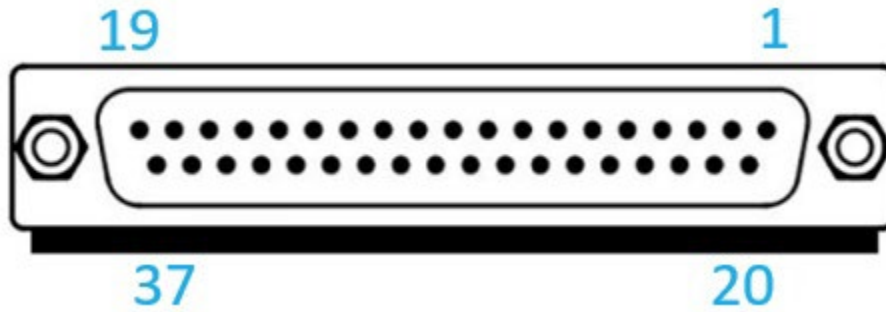


Figure 9

| DB37 Pin Assignment for CQ9515-DI-16 | | |
|--------------------------------------|------|-------------------------------|
| Pin Number | Name | Description |
| 20 | IN0- | Non-inverting analog input 0. |
| 1 | IN0+ | Inverting analog input 0. |
| 21 | IN1- | Non-inverting analog input 1. |
| 2 | IN1+ | Inverting analog input 1. |
| 22 | IN2- | Non-inverting analog input 2. |
| 3 | IN2+ | Inverting analog input 2. |
| 23 | IN3- | Non-inverting analog input 3. |
| 4 | IN3+ | Inverting analog input 3. |
| 24 | IN4- | Non-inverting analog input 4. |
| 5 | IN4+ | Inverting analog input 4. |
| 25 | IN5- | Non-inverting analog input 5. |
| 6 | IN5+ | Inverting analog input 5. |
| 26 | IN6- | Non-inverting analog input 6. |
| 7 | IN6+ | Inverting analog input 6. |
| 27 | IN7- | Non-inverting analog input 7. |
| 8 | IN7+ | Inverting analog input 7. |



| DB37 Pin Assignment for CQ9501-AI-16 | | |
|---|-------------|--|
| Pin Number | Name | Description |
| 28 | IN8- | Non-inverting analog input 8. |
| 9 | IN8+ | Inverting analog input 8. |
| 29 | IN9- | Non-inverting analog input 9. |
| 10 | IN9+ | Inverting analog input 9. |
| 30 | IN10- | Non-inverting analog input 10. |
| 11 | IN10+ | Inverting analog input 10. |
| 31 | IN11- | Non-inverting analog input 11. |
| 12 | IN11+ | Inverting analog input 11. |
| 32 | IN12- | Non-inverting analog input 12. |
| 13 | IN12+ | Inverting analog input 12. |
| 33 | IN13- | Non-inverting analog input 13. |
| 14 | IN13+ | Inverting analog input 13. |
| 34 | IN14- | Non-inverting analog input 14. |
| 15 | IN14+ | Inverting analog input 14. |
| 35 | IN15- | Non-inverting analog input 15. |
| 16 | IN15+ | Inverting analog input 15. |
| 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. |

6.2 Analog Output Connector

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

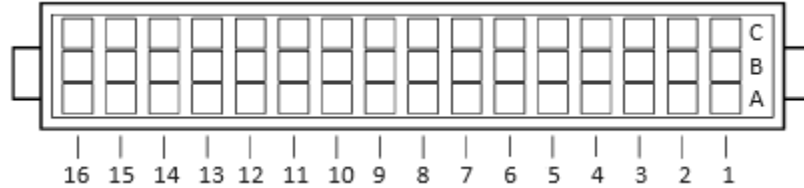


Figure 10

| DIN48 Pin Assignment for CQ9515-AI-16 | | | | | | | |
|---------------------------------------|-------|---------|------|------------------|---------|-------|---------------|
| Pin Num | Name | Pin Num | Name | Description | Pin Num | Name | Description |
| A1 | OUT0 | B1 | GND | Analog output 0 | C1 | N/C | No connect |
| A2 | OUT1 | B2 | GND | Analog output 1 | C2 | N/C | No connect |
| A3 | OUT2 | B3 | GND | Analog output 2 | C3 | GND | System ground |
| A4 | OUT3 | B4 | GND | Analog output 3 | C4 | N/C | No connect |
| A5 | OUT4 | B5 | GND | Analog output 4 | C5 | GND | System ground |
| A6 | OUT5 | B6 | GND | Analog output 5 | C6 | N/C | No connect |
| A7 | OUT6 | B7 | GND | Analog output 6 | C7 | +15V | +15V Supply |
| A8 | OUT7 | B8 | GND | Analog output 7 | C8 | -15V | -15V Supply |
| A9 | OUT8 | B9 | GND | Analog output 8 | C9 | +BATT | +Alt supply |
| A10 | OUT9 | B10 | GND | Analog output 9 | C10 | +BATT | +Alt supply |
| A11 | OUT10 | B11 | GND | Analog output 10 | C11 | -BATT | -Alt supply |
| A12 | OUT11 | B12 | GND | Analog output 11 | C12 | -BATT | -Alt supply |
| A13 | OUT12 | B13 | GND | Analog output 12 | C13 | N/C | No connect |
| A14 | OUT13 | B14 | GND | Analog output 13 | C14 | N/C | No connect |
| A15 | OUT14 | B15 | GND | Analog output 14 | C15 | N/C | No connect |
| A16 | OUT15 | B16 | GND | Analog output 15 | C16 | N/C | No connect |

6.3 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.

| | | | | | | |
|----|----|----|----|----|---|---|
| 14 | 13 | 12 | 11 | 10 | 9 | 8 |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 |

Figure 11

Table 1 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 1

1) NPBATT and PBATT are connected between the power supply connector and the DIN connector, but are not used in this design.