Data Acquisition Expansion Pod™

User's Guide

Contents

Chapter 1: Introduction

The Allegro CX™, combined with the Data Acquisition Expansion Pod™ ("DAQ Expansion Pod™"), places the functionality of National Instruments' DAQCard into the palm of your hand. The DAQ Expansion Pod maintains the environmental seal of the Allegro CX unit while still bringing you the interface capability of the NI DAQCard. The DAQ Expansion Pod takes advantage of the NI DAQCard's wide range of data acquisition capabilities. Coupled with National Instruments' LabVIEW PDA graphical programming environment, the DAQ Expansion Pod brings a powerful new perspective to any application requiring rugged handheld data acquisition.

▲ Physical Description

The DAQ Expansion Pod consists of an Allegro CX expansion pod fitted with a 50-pin D connector that channels data from the NI DAQCard to the connector through a flexible circuit. The functionality of the NI DAQCard is enhanced by the Allegro CX expansion pod through the addition of a Sensor Excitation output. The Sensor Excitation Output is capable of supplying 200mA of output current at a voltage of 0 to 4.8 volts (as specified by the Analog Output 0 or AO0), perfect for powering external sensors.

▲ DAQPod Features

- ❑ 14 analog in channels
- ❑ 8 digital I/O lines
- ❑ 9 PFI (programmable function interface) connections
- ❑ 1 Digital Analog Converter (DAC) output
- ❑ Sensor Excitation Output
- ❑ 2 general purpose counters/timers

Chapter 2: Before Connecting the Data Acquisition Expansion Pod

This chapter contains instructions for connecting to the DAQ Expansion Pod. It tells you how to—

- ❑ Find a compatible data acquisition card
- ❑ Find the necessary mating connector
- ❑ Recognize signal modifications

Review this section before installing or running any software or making any connections to the expansion pod.

▲ Compatible Data Acquisition Cards

The DAQ Expansion Pod is designed to fully integrate the following National Instruments DAQCard models.

Recommended National Instruments PCMCIA 68-pin E Series Data Acquisition Cards:

- ❑ NI 6024E 200 kS/s, 12-Bit, 16 Analog Input Multifunction DAQ
- ❑ NI 6036E 200 kS/s, 16-bit, 16 Analog Input Multifunction DAQ

The following card is compatible with the DAQ Expansion Pod, but we do not recommend it because the card cannot achieve the maximum sample rate of 500 kS/s using the Allegro CX.

- ❑ NI 6062E 500 kS/s, 12-Bit, 16 Analog Input Multifunction DAQ

CAUTION: Using any card model other than those listed above may damage both the NI DAQCard and the Allegro CX.

▲ Recommended Mating Connector

The DAQ Expansion Pod is outfitted with a male, 50-pin D connector for sensor input. We recommend purchasing a mating connector that uses a stainless steel connector with gold plated pins for corrosion resistance and good electrical connections. Positronic Industries' standard D-subminiature connector meets these standards. You can purchase this connector at *www.connectpositronic.com*.

▲ Understanding Signal Differences from Standard E Series Devices

The DAQ Expansion Pod uses a 50-pin D connector to provide a

rugged environmental seal. The connector's large size makes wiring easy, and its universal design lets you integrate a variety of test and measurement applications.

The standard NI DAQCard output is designed for a 68-pin connector; the D connector on the DAQ Expansion Pod only has 50-pins. This means that some of the NI E Series DAQCard signals do not connect with the 50-pin connector. The next section lists NI DAQCard signals that have been changed or eliminated to adapt to the 50-pin connector.

NI DAQCard signals not available with the DAQ Expansion Pod

Some of the signals on the NI DAQCard are not available with the DAQ Expansion Pod. These signals include:

- EXSTROBE
- Analog Input channel 7
- Analog Input channel 15

E Series devices from National Instruments provide 16 analog channel inputs; the DAQ Expansion Pod provides 14 available analog channels.

For a complete listing of available signals and their descriptions, please refer to *Chapter 5: Signal Descriptions*.

Sensor excitation

Sensor excitation is controlled by the Analog Output 0 (AO 0) signal and generated by the +5V power supply from the NI DAQCard. This +5V digital power supply is inherently noisy. A filter circuit has been added to remove much of this noise.

Note: To prevent unnecessary noise in the output that can affect your sensor readings, set the Sensor Excitation output to a level less than or equal to 4.8V.

Make sure the Sensor Excitation Output voltage is above 0V whenever the application controlling the NI DAQCard is closed. To do this, see the section called "Continuously enable the Sensor Excitation Output" in Chapter 6.

When you use the Sensor Excitation Output, stay within the following constraints.

CAUTION: Damage can occur to the Allegro CX or NI DAQCard if these constraints are not followed.

1) The output voltage must be between 0 and + 4.8V. Setting a negative voltage may damage the DAQ Expansion Pod excitation circuit.
2) Voltages too near supply rails (over 4.8V) will result in digital noise that adversely affects sensors.
3) Output current is limited to a maximum of 200mA.

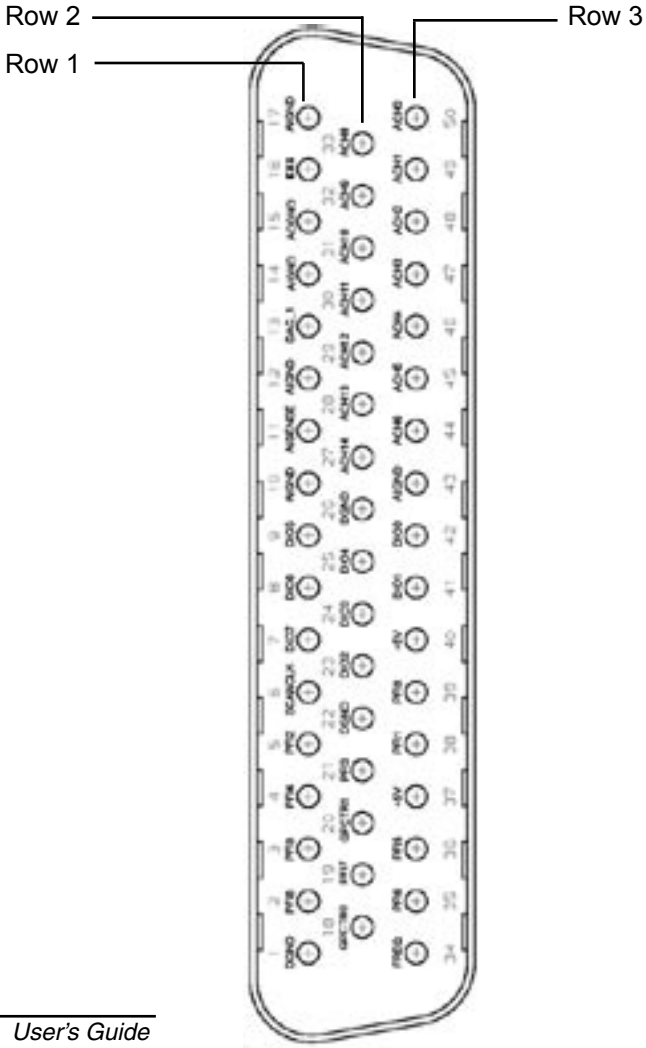
Chapter 3: Connecting the Expansion Pod

This chapter provides the following:

- ❑ A diagram of the 50-pin D connector
- ❑ A chart with pinout assignments for the connector
- ❑ Software recommendations for the DAQ Expansion Pod

▲ Connector Diagram and Pinout Chart

The following diagram illustrates the pinout for the 50-pin D connector as viewed from the outside of the DAQ Expansion Pod. The chart on the next page shows the pinouts assigned to each row.



Row 1	Row 2	Row 3
1 – DGND	18 – GPCTR0_OUT	34 – FREQ_OUT
2 – PFI8	19 – PFI7	35 – PFI6
3 – PFI9	20 – GPCTR1_OUT	36 – PFI5
4 – PFI4	21 – PFI3	37 – +5V
5 – PFI2	22 – DGND	38 – PFI1
6 – SCANCLK	23 – DIO2	39 – PFI0
7 – DIO7	24 – DIO3	40 – +5V
8 – DIO6	25 – DIO4	41 – DIO1
9 – DIO5	26 – DGND	42 – DIO0
10 – AIGND	27 – ACH14	43 – AIGND
11 – AISENSE	28 – ACH13	44 – ACH6
12 – AIGND	29 – ACH12	45 – ACH5
13 – DAC_1_OUT	30 – ACH11	46 – ACH4
14 – AIGND	31 – ACH10	47 – ACH3
15 – AOGND	32 – ACH9	48 – ACH2
16 – SENSOR_EXC	33 – ACH8	49 – ACH1
17 – AIGND		50 – ACH0

▲ Recommended Software to Gather and Analyze Data

To use the DAQ Expansion Pod and the NI DAQCard, you have two options:

- ❑ You can develop your own application-specific software. (Consult the documentation that came with your NI DAQCard or contact National Instruments for more information.)
- ❑ Purchase LabVIEW and LabVIEW PDA from National Instruments.

LabVIEW software allows you to generate applications for your desktop computer. LabVIEW PDA, an add-on software module, lets you load and run your applications on your Allegro CX. To purchase LabVIEW software, visit *http://www.ni.com/labview/*. To read more about how LabVIEW works with the Allegro CX, visit the following sites:

- Article: “What is the LabVIEW PDA module?” Site: *http://www.ni.com/labview/what_is_pda*
- Article: “Build Rugged Mobile Test Instruments Using LabVIEW PDA and the Allegro CX” Site: *http://zone.ni.com/devzone/conceptd.nsf/webmain/89E2526061AEA3D686257004004D1A4F*

Chapter 4: Finding More Information

To find more information about the DAQ Expansion Pod, the Allegro CX, NI DAQCards, LabVIEW, or LabVIEW PDA, use the resources listed in the chart below.

For help with . . .	Contact
Data Acquisition Expansion Pod	Juniper Systems® Technical Support Phone: 435-753-1714, 8 am to 5 pm MST Email: techsupport@junipersys.com
Allegro CX	Juniper Systems, Inc. See contact information above
National Instruments E Series DAQCards	National Instruments E Series documentation National Instruments: *http://www.ni.com* Help file: *http://sine.ni.com/nips/cds/view/p/lang/en/nid/1038* Manual: *http://digital.ni.com/manuals.nsf/*
LabVIEW or LabVIEW PDA	National Instruments *http://www.ni.com*

To order other Allegro CX expansion pods (e.g., GPS and barcode), visit *http://www.junipersys.com.*

Chapter 5: Signal Descriptions

▲ I/O Connector Signal Descriptions

The following table describes the signals found on the I/O connectors. The information is based on documentation provided in the National Instruments E Series help file (*http://sine.ni.com/nips/cds/view/p/lang/en/nid/1038).*

NOTE: The first two signals (SENSOR EXC and A1) have been added to the original chart to show the additional functions of the DAQ Expansion Pod.

Signal name	Reference	Direction	Description
Addition to the DAQ Expansion Pod			
SENSOR EXC	AO GND	Output	Sensor Excitation—This pin provides up to 200mA excitation current, driven by the voltage output of AO channel 0. The output follows a one-to-one relationship with the voltage applied to AO channel 0. Voltage must be maintained between 0 and 4.8V. Do NOT allow negative voltages and never exceed output voltage of 4.8V.
Signal with reduced functionality for the DAQ Expansion Pod			
AI <0..6, 8..14>	AI GND	Input	AI Channels 0 through 6 and 8 through 14—You can configure each channel pair, AI <i, i+8> (i = 0..7), as either one differential input or two single-ended inputs.

Signal name	Reference	Direction	Description
Standard National Instruments E Series DAQCard Signals			
AI SENSE	—	Input	AI Sense—This pin is the reference node for AI <0..15> in NRSE mode.
AO 1	AO GND	Output	Analog Channel 1 Output—This pin supplies the voltage output of AO channel 1.
AO GND	—	AO Ground	The AO voltages are referenced to these pins. All three ground references—AI GND, AO GND, and D GND—are connected on the device.
D GND	—	Digital Ground	These pins supply the reference for the digital signals at the I/O connector as well as the +5 VDC supply. All three ground references—AI GND, AO GND, and D GND—are connected on the device.
DIO <0..7>	D GND	Input or Output Digital I/O Signals	You can individually configure each signal as an input or output. P0.6 and 7 can also control the up/down signal of general-purpose counters 0 and 1, respectively.
+5 V	D GND	Output	+5 V Power Source—These pins provide +5 V power.
PFI 0/AI START TRIG	D GND	Input	PFI 0—As an input, this pin is a programmable function interface (PFI).
		Output	AI Start Trigger Signal—As an output, this pin is the ai/StartTrigger signal. In posttrigger DAQ sequences, a low-to-high transition indicates the initiation of the acquisition sequence. In pretrigger applications, a low-to-high transition indicates the initiation of the pretrigger conversions.

Signal name	Reference	Direction	Description
PFI 1/AI REF TRIG	D GND	Input	PFI 1—As an input, this pin is a PFI.
		Output	AI Reference Trigger Signal—As an output, this pin is the ai/ReferenceTrigger signal. In pretrigger applications, a low-to-high transition indicates the initiation of the posttrigger conversions. AI REF TRIG is not used in posttrigger applications.
PFI 2/AI CONV CLK	D GND	Input	PFI 2—As an input, this pin is a PFI.
		Output	AI Convert Clock Signal—As an output, this pin is the ai/ConvertClock signal. A high-to-low edge on AI CONV indicates that an A/D conversion is occurring.
PFI 3/CTR 1 SRC	D GND	Input	PFI 3—As an input, this pin is a PFI.
		Output	Counter 1 Source Signal—As an output, this pin is the Ctr1Source signal. This signal reflects the actual source connected to the general-purpose counter 1.
PFI 4/CTR 1 GATE	D GND	Input	PFI 4—As an input, this pin is a PFI.
		Output	Counter 1 Gate Signal—As an output, this pin is the Ctr1Gate signal. This signal reflects the actual gate signal connected to the general-purpose counter 1.

Signal name	Reference	Direction	Description
PFI 5/AO SAMP CLK	D GND	Input	PFI 5—As an input, this pin is a PFI.
		Output	AO Sample Clock Signal—As an output, this pin is the ao/SampleClock signal. A high-to-low edge on AO SAMP indicates that the AO primary group is being updated.
PFI 6/AO START TRIG	D GND	Input	PFI 6—As an input, this pin is a PFI.
		Output	AO Start Trigger Signal—As an output, this pin is the ao/StartTrigger signal. In timed AO sequences, a low-to-high transition indicates the initiation of the waveform generation.
PFI 7/AI SAMP CLK	D GND	Input	PFI 7—As an input, this pin is a PFI.
		Output	AI Sample Clock Signal—As an output, this pin is the ai/SampleClock signal. This pin pulses once at the start of each AI sample in the interval sample. A low-to-high transition indicates the start of the sample.
PFI 8/CTR 0 SRC	D GND	Input	PFI 8—As an input, this pin is a PFI.
		Output	Counter 0 Source Signal—As an output, this pin is the Ctr0Source signal. This signal reflects the actual source connected to the general-purpose counter 0.
PFI 9/CTR 0 GATE	D GND	Input	PFI 9—As an input, this pin is a PFI.
		Output	Counter 0 Gate Signal—As an output, this pin is the Ctr0Gate signal. This signal reflects the actual gate signal connected to the general-purpose counter 0.

Signal name	Reference	Direction	Description
CTR 0 OUT	D GND	Output	Counter 0 Output Signal—As an output, this pin emits the Ctr0InternalOutput signal.
CTR 1 OUT	D GND	Output	Counter 1 Output Signal—This pin emits the Ctr1InternalOutput signal.
FREQ OUT	D GND	Output	Frequency Output Signal—This output is from the frequency generator.

Table used with permission from National Instruments.

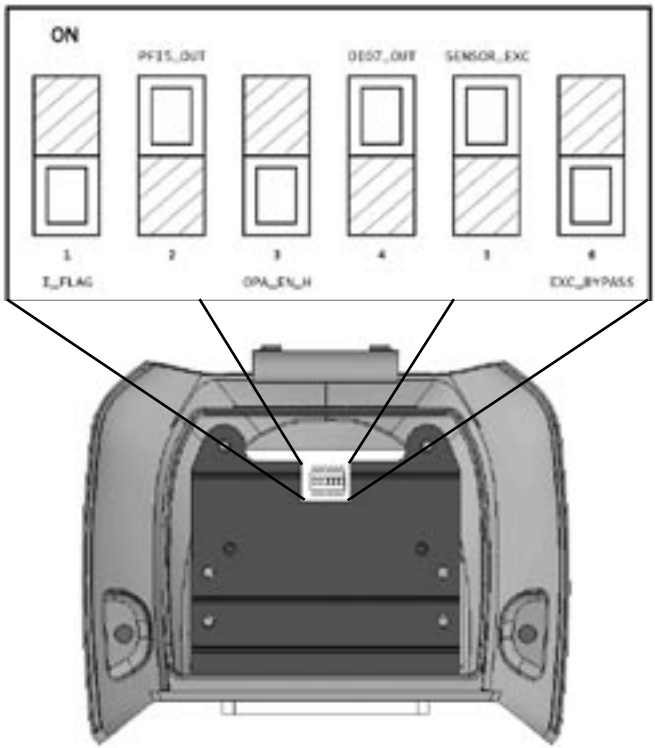
Chapter 6: Configuration Switches

The configuration switches in the DAQ Expansion Pod let you configure how the pod functions. This chapter describes the default settings of the switches and how to reconfigure them.

CAUTION: Incorrect configuration may result in damage to the pod and to any connected peripheral device. Please review all of the information in this chapter before making configuration changes.

▲ Default Switch Settings

The following diagram shows the location of the configuration switches and their default settings:



The chart below shows the name and default setting of each switch.

Switch #	Switch Name	Default Setting
1	I_FLAG	OFF
2	PFI5_OUT	ON
3	OPA_EN_H	OFF
4	DIO7_OUT	ON
5	SENSOR_EXC	ON
6	EXC_BYPASS	OFF

With the switches in their default positions, the DAQ Expansion Pod is configured as follows:

- ❑ The current limit monitoring of the Sensor Excitation Output is disabled.
- ❑ PFI 5 is connected directly to the 50-pin D connector.
- ❑ The Sensor Excitation is enabled continuously.
- ❑ DIO 7 may be used for standard digital input and output.
- ❑ The Sensor Excitation is output rather than the Analog Out 0 signal.

▲ Configuring Switches

This section shows you how to reconfigure the switches of the DAQ Extension Pod. Specifically, it shows you how to:

- ❑ Continuously enable the Sensor Excitation Output
- ❑ Use DIO7 to enable/disable the Sensor Excitation Output
- ❑ Output the Analog Output 0 rather than the Sensor Excitation
- ❑ Enable current limit monitoring
- ❑ Disable current limit monitoring

Continuously enable the Sensor Excitation Output

By setting the configuration switches as shown in the following table, the Sensor Excitation is continuously output at the voltage set by Analog Out 0. The Sensor Excitation Output uses Pin 16 on the 50-pin connector.

To continuously enable the Sensor Excitation Output, configure the switches below to the following settings:

Switch #	Name	Setting	Result
3	OPA_EN_H	OFF	Sensor Excitation control is enabled continuously
4	DIO7_OUT	ON	
5	SENSOR_EXC	ON	The Sensor Excitation Output is enabled; the Sensor Excitation Bypass is disabled
6	EXC_BYPASS	OFF	

Use DIO7 to enable/disable Sensor Excitation Output

The configuration switches let you program the DIO7 to enable or disable the Sensor Excitation Output circuitry. Switch 3 configures DIO 7 as the Sensor Excitation enabler. In turn, DIO 7 is controlled through whatever program is running on the Allegro CX. Switch 4 disconnects the DIO7 signal from the 50-pin connector.

Set the switches as shown in the following table to make the DIO7 control the Sensor Excitation Output.

Switch #	Switch Name	Switch Settings	Result
3	OPA_EN_H	ON	Sensor Excitation is controlled by DIO7
4	DIO7_OUT	OFF	
5	SENSOR_EXC	ON	Sensor Excitation Output is enabled; Sensor Excitation Bypass is disabled
6	EXC_BYPASS	OFF	

Bypass the Sensor Excitation (Output Analog Out 0 rather than the Sensor Excitation)

The Sensor Excitation Output can be bypassed, routing the signal from the Analog Output 0 directly to Pin 16 on the 50-pin connector rather than first routing through the Sensor Excitation.

IMPORTANT: Become familiar with the Analog Ouput voltage current limitations in the documentation of your NI DAQCard before reconfiguring the Sensor Excitation to this setting. Some peripheral devices may require more voltage than the Analog Output 0 current alone can provide.

Switch #	Switch Name	Switch Settings	Result
3	OPA_EN_H	OFF	Sensor Excitation control is enabled continuously
4	DIO7_OUT	ON	
5	SENSOR_EXC	OFF	Sensor Excitation Output disabled; Sensor Excitation Bypass enabled
6	EXC_BYPASS	ON	

CAUTION: Switch 5 and Switch 6 should NEVER be in the "ON" position at the same time. This could damage the NI DAQCard.

Enable current limit monitoring

The internal circuitry of the Sensor Excitation Output provides a Current Limit Flag. The flag lets you determine if the devices attached to the Sensor Excitation are drawing more current than the Sensor Excitation is capable of supplying.

You can set the PFI5 Output on the NI DAQCard to monitor the Current Limit Flag. Note that when the switches are set to do this, the PFI5 is no longer available through the 50-pin D connector.

Switch #	Switch Name	Switch Settings	Result
1	I_FLAG	ON	Current Limit Monitor Enabled; PFI5 Output used to monitor voltage current
2	PFI5_OUT	OFF	

Note: For the pod to function correctly, make sure Switch 1 and Switch 2 are never in the "ON" position at the same time.

Disable current limit monitoring and reconnect the PFI5 signal to the 50-pin connector

To make the PFI5 available again through the 50-pin D connector again, set the switches as shown in the following table.

Switch #	Switch Name	Switch settings	Result
1	I_FLAG	OFF	Current Limit Flag is enabled; the Current Limit Monitor is disabled
2	PFI5_OUT	ON	

▲ Locating Switches on the Schematic

The Appendix shows a five-page schematic. The schematic provides an in-depth view of the DAQ Expansion Pod, including switch settings. A table at the beginning of the the Appendix lists each switch's designator as it appears in the schematic.

Appendix: DAQ Expansion Pod Schematic

The next five pages shows the schematic used to build the DAQ Expansion Pod. The following table shows the reference designators associated with each configuration switch in the schematic.

Switch #	Switch Name	Reference designator
1	I_FLAG	S1-A, SW_6_POS
2	PFI5_OUT	S1-B, SW_6_POS
3	OPA_EN_H	S1-C, SW_6_POS
4	DIO7_OUT	S1-D, SW_6_POS
5	SENSOR_EXC	S1-E, SW_6_POS
6	EXC_BYPASS	S1-F, SW_6_POS

DAQPod

Data Acquisition Expansion Pod

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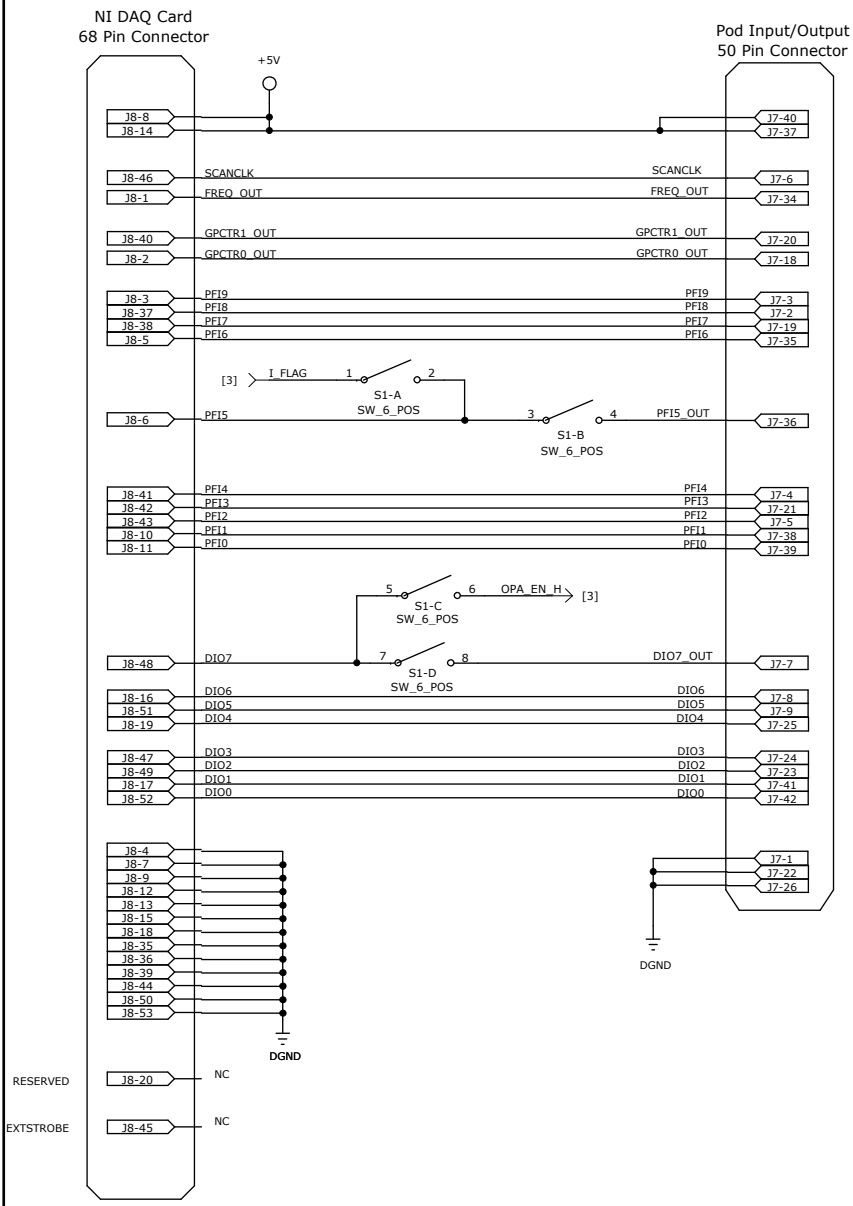
Misc. mounting holes, pads, keepouts, etc.

Associated PCB: 14960-01		Juniper Systems Logan, Utah 84321 (435) 753-1881	
Engr: G. D. Spence	17 May 06	Cover Sheet Data Acquisition Expansion Pod Allegro CX	
Drawn: A. D. Woodcox	17 May 06		
Approved			
Next Higher Assembly		Size: B	Drawing Number: 14961 — Rev: 01
Filename: 14961-01.sch		Rev Date: 17 May 2006	Sheet 1 of 3


NI DAQ Card
68 Pin Connector
Pod Input/Output
50 Pin Connector
+5V
J8-8
J8-14
J7-40
J7-37
J8-46
SCANCLK
SCANCLK
J7-6
J8-1
FREQ_OUT
FREQ_OUT
J7-34
J8-40
GPCTR1_OUT
GPCTR1_OUT
J7-20
J8-2
GPCTR0_OUT
GPCTR0_OUT
J7-18
J8-3
PFI9
PFI9
J7-3
J8-37
PFI8
PFI8
J7-2
J8-38
PFI7
PFI7
J7-19
J8-5
PFI6
PFI6
J7-35
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SW_6_POS
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S1-B
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PFI4
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J8-42
PFI3
PFI3
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7
8
DIO7_OUT
J7-7
S1-D
SW_6_POS
J8-16
DIO6
DIO6
J7-8
J8-51
DIO5
DIO5
J7-9
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J8-12
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J8-15
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J8-50
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DGND
J7-1
J7-22
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EXTSTROBE
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NC

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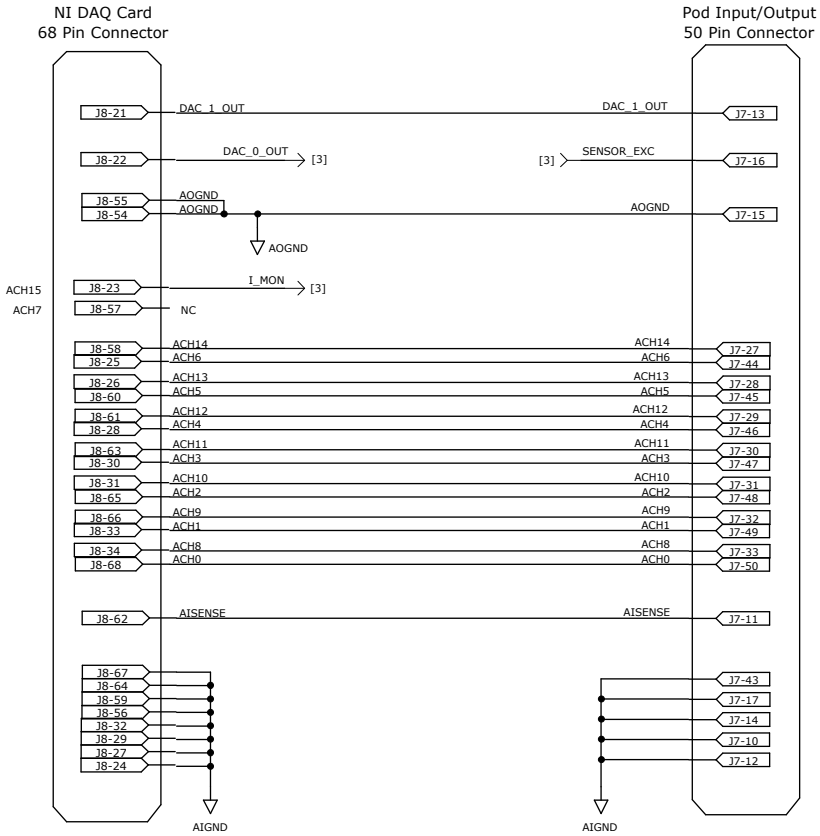

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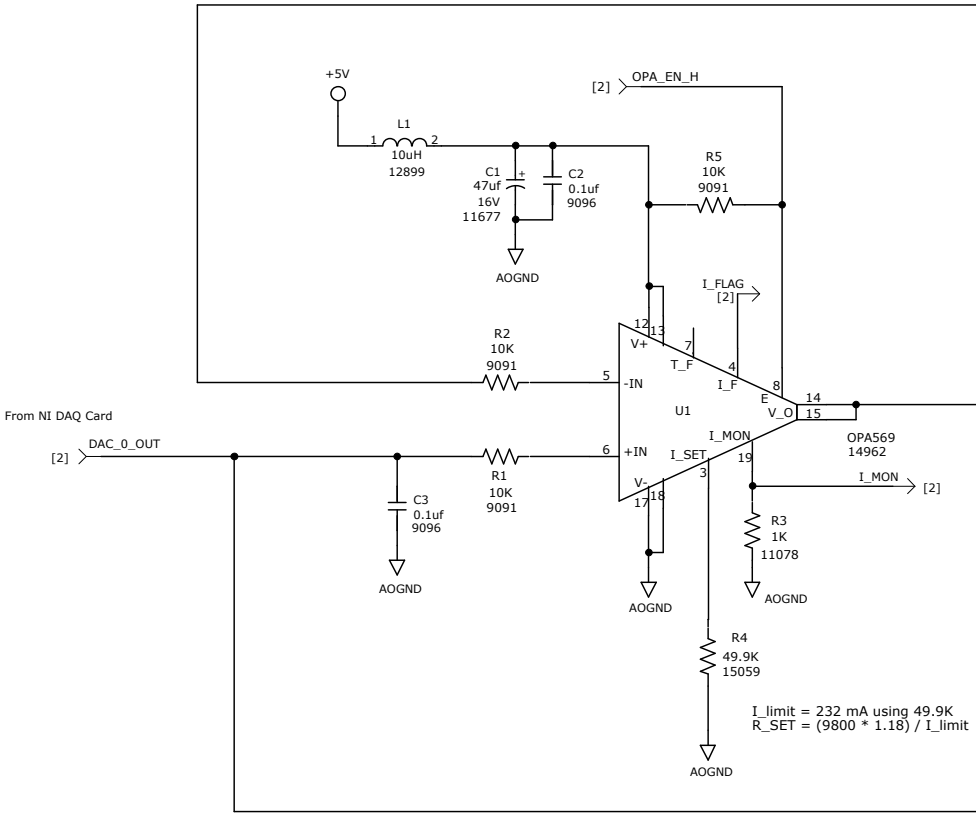
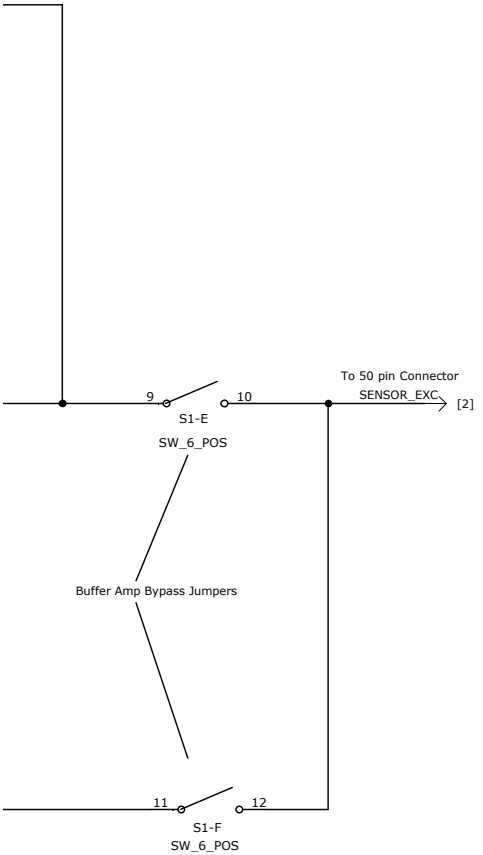
Connections from Card to Pod
Data Acquisition Expansion Po
Allegro CX

Size	Drawing Number
B	14961
Rev Date: 17 May 2006	Sheet 2

High Current DAC Buffer Amplifier





Juniper Systems Logan, Utah 84321 (435) 753-1881	
High Current DAC Buffer Amp National Instr. Expansion Pod All Data Acquisition Expansion Pod	
Size: B	Drawing Number: 14961 — Rev: 01
Rev Date: 17 May 2006	Sheet 3 of 3

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Part #	15081-00
Released	08.2006
Editor	J. Johns

Mobile Field Computers and Mobile GIS/GPS
HarvestMaster™ Brand Data Collection Tools for Agriculture