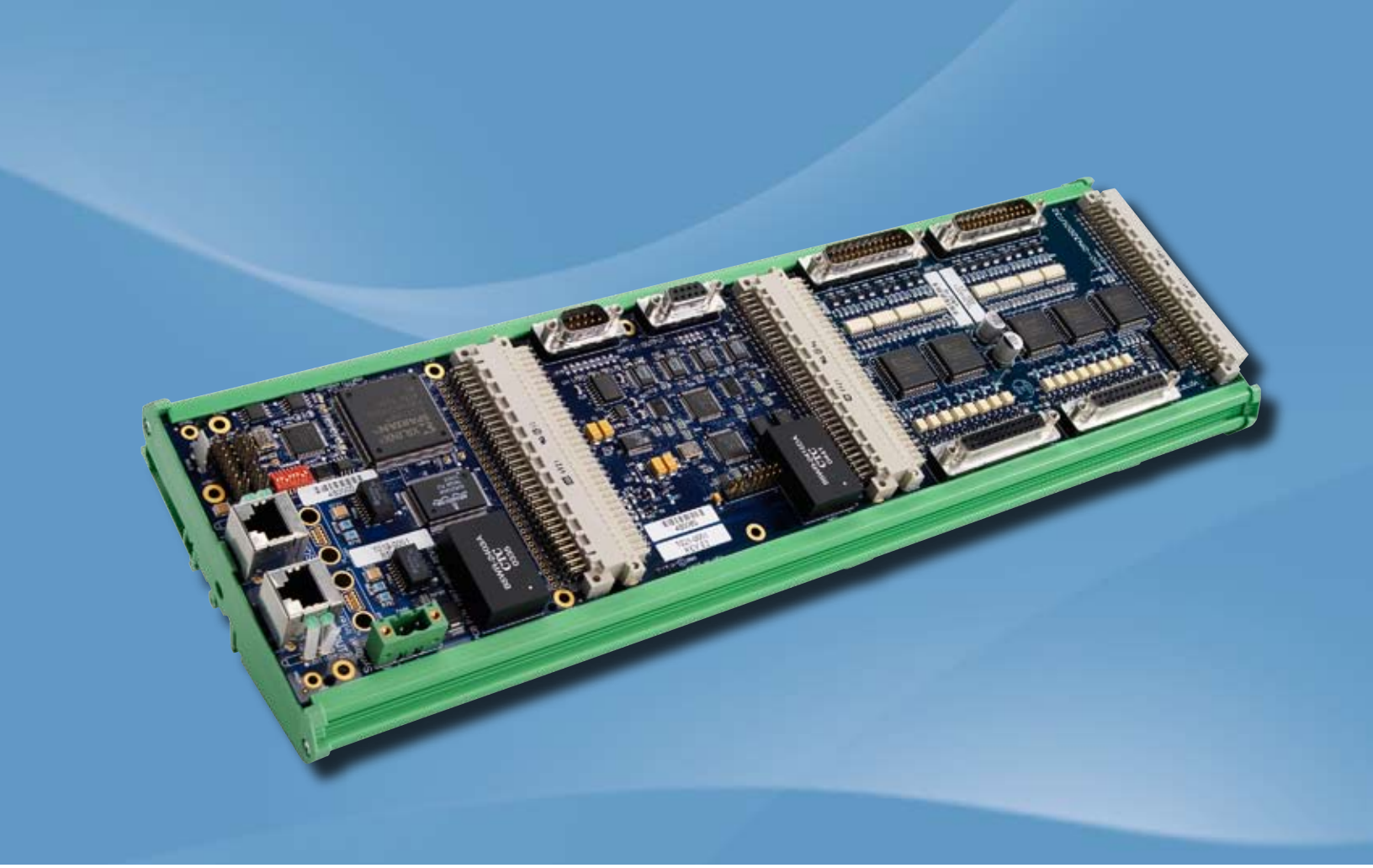


SQIO - SynqNet I/O Solutions

Hardware Specification

DANAHER MOTION

Helping you build a better machine, ***faster.***

SQIO Hardware Specification

DANAHER MOTION | SynqNet™

Key Features

- SQIO Reference Design Kits bring SynqNet connectivity to existing customer designed I/O
- Standard SQIO modules provide flexible analog and digital I/O solutions tailored to machine requirements
- Place high-speed input capture points at any node on the network allowing more design flexibility
- I/O and motion performance data gathered together in real-time for in-depth system visibility and analysis
- Reduce system development time through tight integration between motion applications and I/O

Flexible SynqNet I/O Integration

The SQIO product family was designed with flexibility in mind for both SynqNet I/O solutions, as well as custom I/O device integration on a SynqNet network. SQIO is comprised of a SynqNet Interface Device with on-board connectors that accept standard digital and/or analog I/O boards. All the SQIO products connect together, so adding I/O capacity is as simple as plugging in additional SQIO boards. SQIO is also available as part of the SQIO Reference Design Kits, so custom add-on boards can be developed to be used with the SynqNet Interface Device ('SQID').

With the SQIO product line, a single network and the Motion Programming Interface (MPI: application programming interface) can now be utilized for both high performance complex motion control and I/O.

SQIO takes advantage of the 100 Mbit specification of SynqNet to achieve a new level of I/O performance. Error reporting and diagnostic data for SQIO is supported through the MPI, allowing error-recovery to be fully customized in the motion application. In addition, MotionConsole™ allows you to quickly scan, identify, and test all I/O associated with a XMP or ZMP-SynqNet type controller. And you can graph motion parameters against any I/O bit with MotionScope™, a powerful Windows® tool for motion analysis and real-time data graphing.

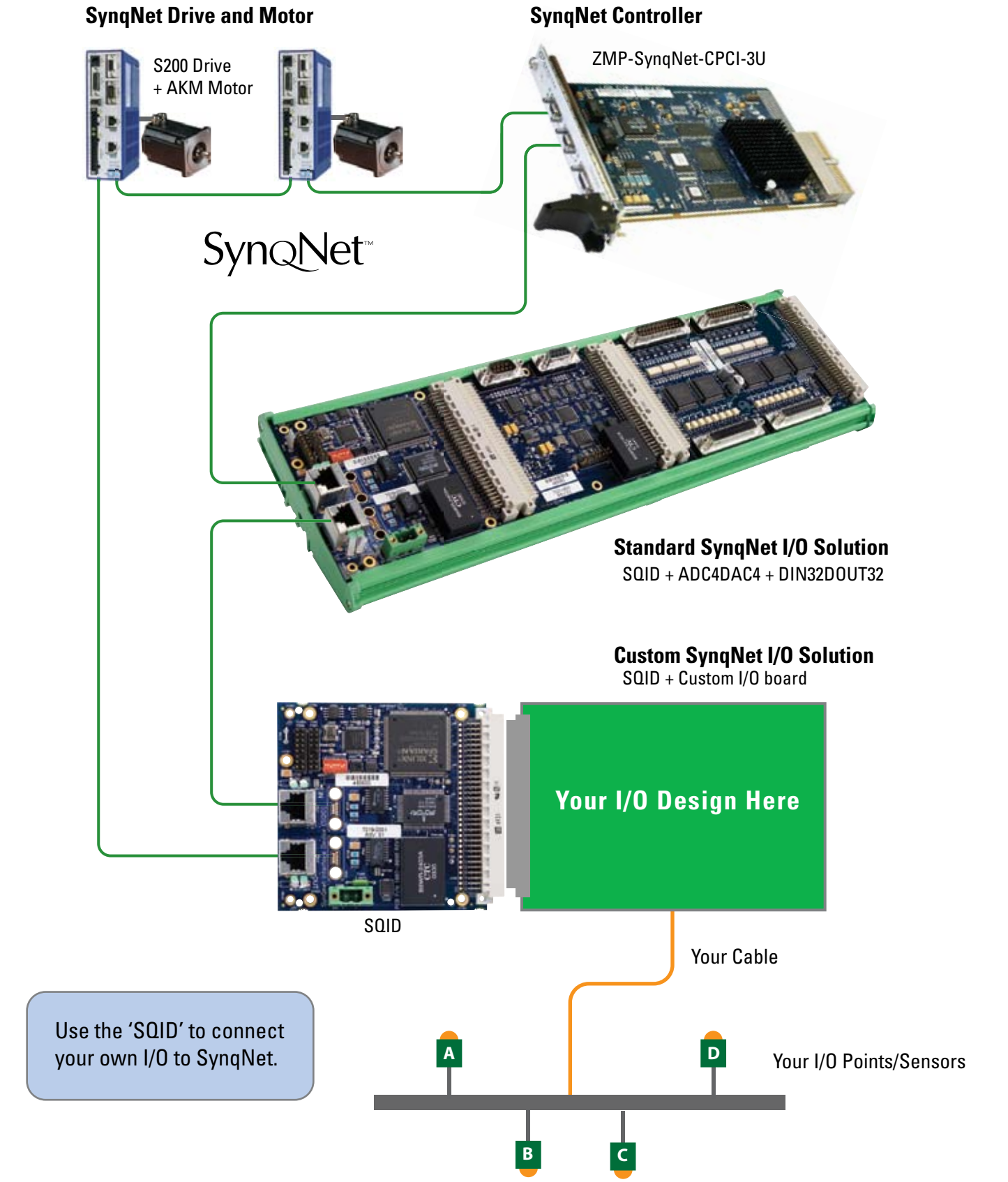
SynqNet Platform Overview

SynqNet is a digital machine control network specifically designed to meet the flexibility, performance, and safety requirements of today's demanding machine control applications. Built on the 100BT physical layer, SynqNet provides a synchronous real-time connection between motion controllers, servo drives, stepper drives, I/O modules, and custom devices.

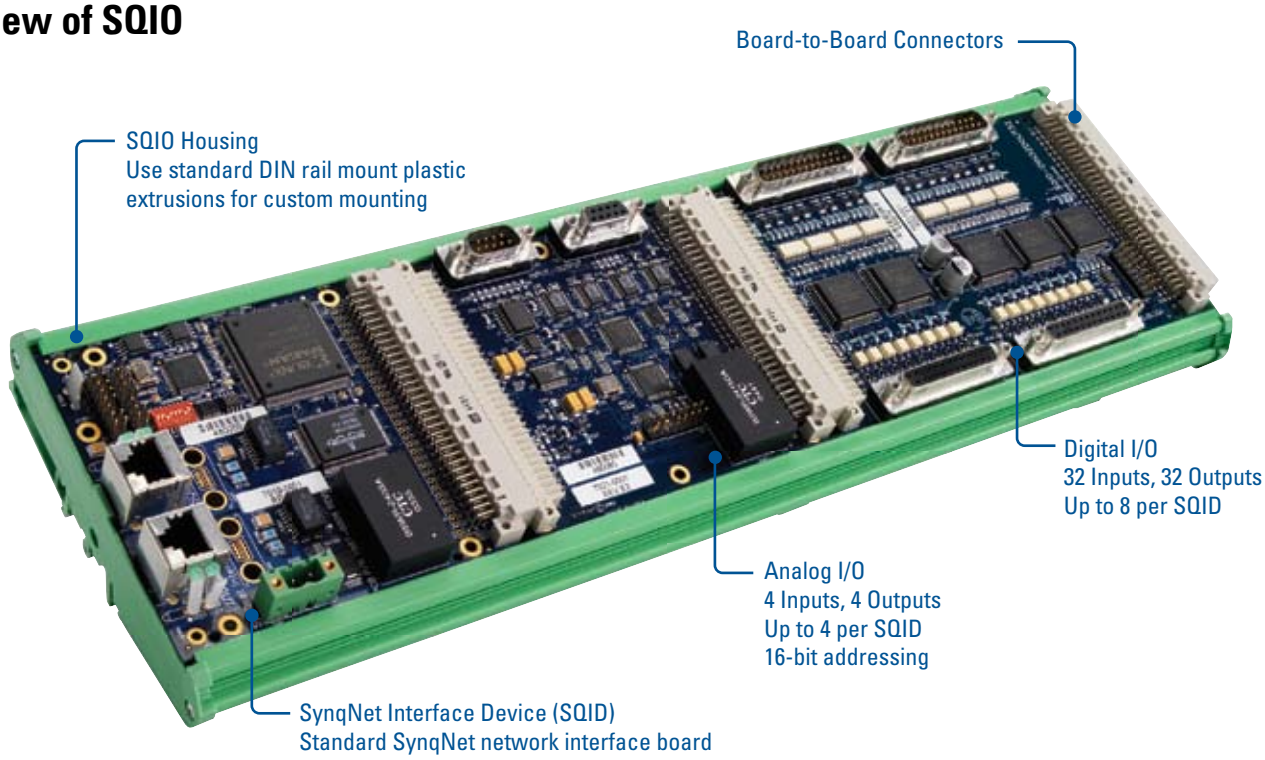
Unique Features of SynqNet

- Network bandwidth for servo updates up to 48 kHz
- Support for up to 64 coordinated axes and 252 nodes
- Multi-vendor interoperable network
- Remote diagnostics over SynqNet
- Firmware and drive configuration download
- "Self-Healing" Fault tolerant operation using ring topology
- "HotReplace" allowing replacement of node without network shutdown

SynqNet Connectivity Diagram



Overview of SQIO



SynqNet Interface Device
'SQID'
T019-0001, T019-0002,
T019-0003, T019-0004

Provides SynqNet network interface & power to all other I/O boards. Use a 'SQID' and your own custom-built I/O board to interface your own system I/O with the SynqNet network.

Analog I/O Device
'ADC4DAC4'
T021-0001

Provides 4 analog inputs and 4 analog outputs per board, 16 bit addressing, (2) 9 'D' analog I/O connectors, and board-to-board connectors for easy integration and future expansion. Up to 4 boards per SQID.

Mixed Module
I/O Device
'MIXEDMODULE1'
T022-0002

A combination of Digital and Analog I/O on one board.

Digital I/O Device
'DIN32DOUT32'
T020-0001

Provides 32 digital inputs and 32 digital opto-isolated outputs per board, (4) 25-pin 'D' digital I/O connectors, and board-to-board connectors for easy integration and future expansion. Up to 8 'DIN32DOUT32' boards per SQID.

High Speed Capture Device
'HSIN32'
T024-0001

Provides 32 digital inputs designed for high-speed capture (probe).

Digital I/O Breakout Board
'DIN32DOUT32-BO'
8001-0042

Provides easy prototyping and wiring.
Connects via the 'D' connectors on the 'DIN32DOUT32.'
Convenient Phoenix Combicon vertical connectors.

Standard SQIO Implementations

SQID + HSIN32

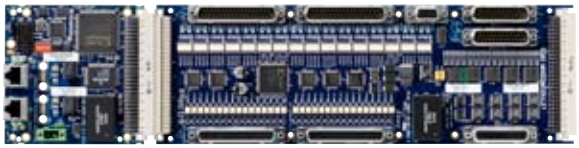
10cm x 18.9cm

SQID + ADC4DAC4

10cm x 21.8cm

SQID + DIN32DOUT32

10cm x 27.5cm



SQID + MIXEDMODULE1

10cm x 40.5cm

SQID + DIN32DOUT32 + ADC4DAC4

10cm x 40.5cm

Assemble your own custom SQIO module by using a SQID interface board and any combination of SQIO I/O boards.

Here is a sample of common SQIO implementations.

NOTE: The HSIN board must be used with the appropriate SQID (T019-0004).

Custom SQIO Implementations

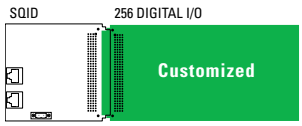
SQIO Reference Design Kits are also available for independent development of 'exact-fit' I/O solutions. Customize your own I/O modules and/or use a combination of existing SQIO I/O products to meet your I/O needs.

The SynqNet Reference Design Kits include:

- Reference schematics for various SynqNet nodes
- Reference Bill of Materials (BOM) w/approved vendors list
- SQID Module EEPROM specification
- SQIO Designers Manual
- Standard FPGA binary image (boot and run-time)
- Standard CPLD binary image
- Software API & Utilities for verification and debugging
- Full integration support

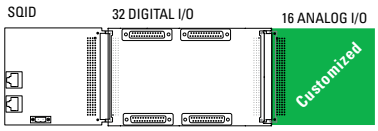
Example 1

Build a custom board for use with the SQID.



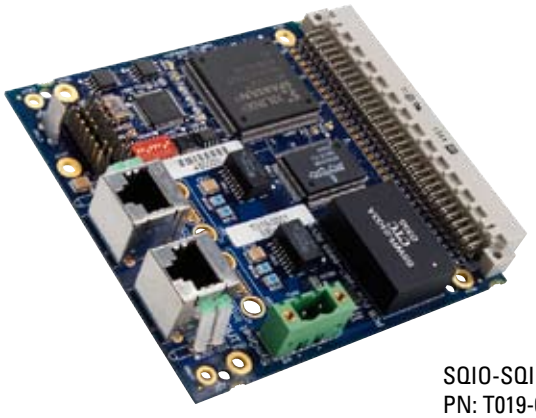
Example 2

Build a custom board for use with the SQID and another I/O board.



SynqNet Interface Device Board - 'SQID'

The SQID provides the necessary interface and power between I/O modules and the SynqNet network.

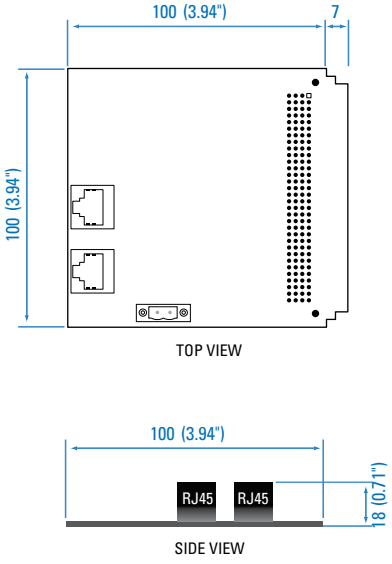


SQIO-SQID
PN: T019-0001, T019-0002,
T019-0003, T019-0004

Specifications

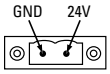
Function	Parameter	Specification
Connectors	SynqNet Connectors	RJ-45 standard or Micro-D option
	SQID-to-Board Connectors	96-pin Type C
Environment	Operating Temperature	0-50° C
	Storage Temperature	0-50° C
	Humidity	20-80% RH, non-condensing
Power	Input	24 Vdc
	Current Consumption	100mA @ 3.3V 300mA @ 1.8V

Dimensions

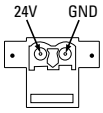


Pinouts and Connector Information

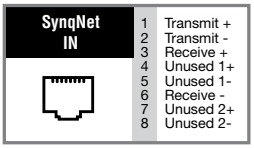
Power Connector
Phoenix Connectors
Mfg P/N 17 77 07 3



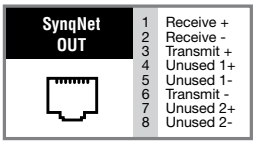
Mating Connector
Phoenix Connectors
Mfg P/N 17 77 98 9



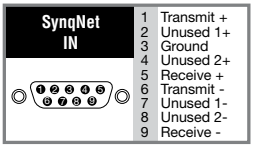
SynqNet Connector
Standard RJ45



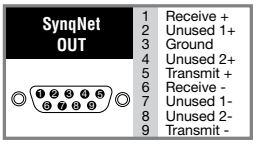
Mating Connector
Shielded RJ45
Recommended



(Optional)
Micro-D Connector
Molex Inc.
Mfg P/N 83611-9006



Micro-D Mating Connector
Molex Inc.
Mfg P/N 83421-9014



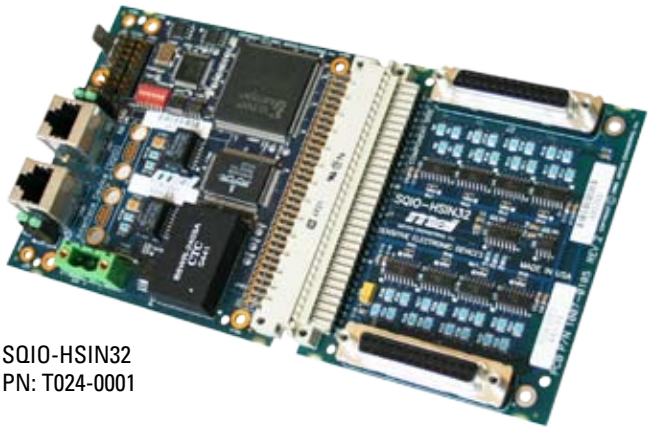
Part Number Table

Part Number	Description	SynqNet Connector
T019-0001	SQIO-SQID-RAFT-RJ-VERT	RJ45 vertical orientation
T019-0002	SQIO-SQID-RAFT-RJ-RA	RJ45 right angle orientation
T019-0003	SQIO-SQID-RAFT-UD-VERT	Micro D9, vertical orientation
T019-0004*	SQIO-SQID-RAFT-RJ-VERT-300	RJ45, vertical orientation

* The 'HSIN' must be used with the T019-0004.

High Speed Capture (Probe) Support

SQID + High Speed Digital Input Board (HSIN32) – 32 digital inputs designed for high-speed capture



SQIO-HSIN32
PN: T024-0001

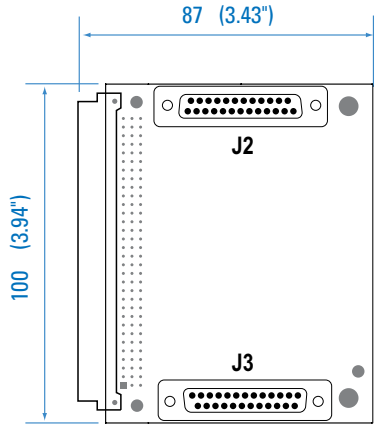
Specifications

Function	Parameter	Specification
Connectors	Digital Input Connectors	25-pin 'D' - (2F)
	Board-to-Board Connectors	96-pin Type R & Type C
Motor I/O	Motor Resources	2
	Digital Inputs	32 opto-isolated
	High-speed Capture Registers	16 (8/motor)
	Capture Latency	< 1 microsecond
Environment	Operating Temperature	0-50° C
	Storage Temperature	0-50° C
	Humidity	20-80% RH, non-condensing

Use up to 16 simultaneous high-speed capture inputs—the perfect solution for multiple position captures for on-the-fly adjustments.

*The HSIN32 must be connected to the (T019-0004) 'SQID' and cannot be attached onto another SQIO I/O board.

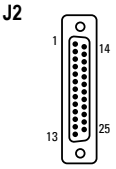
Dimensions



Pinouts and Connector Information

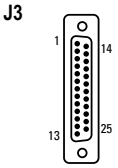
Digital I/O Connectors
Standard 25-pin 'D' Connectors

Digital In 0 — J2



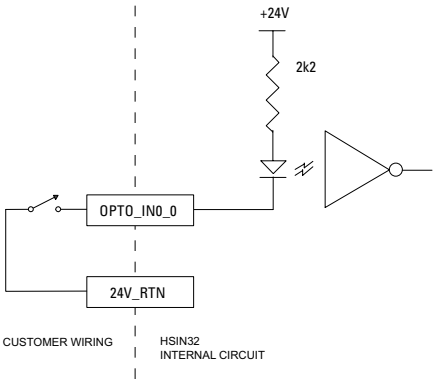
1	OPTO_IN0_0	14	OPTO_IN0_11
2	OPTO_IN0_1	15	OPTO_IN0_12
3	OPTO_IN0_2	16	OPTO_IN0_13
4	OPTO_IN0_3	17	OPTO_IN0_14
5	OPTO_IN0_4	18	OPTO_IN0_15
6	OPTO_IN0_5	19	+24V (output)
7	OPTO_IN0_6	20	24V_RTN
8	OPTO_IN0_7	21	NC
9	+24V (output)	22	NC
10	24V_RTN	23	NC
11	OPTO_IN0_8	24	NC
12	OPTO_IN0_9	25	NC
13	OPTO_IN0_10		

Digital In 1 — J3

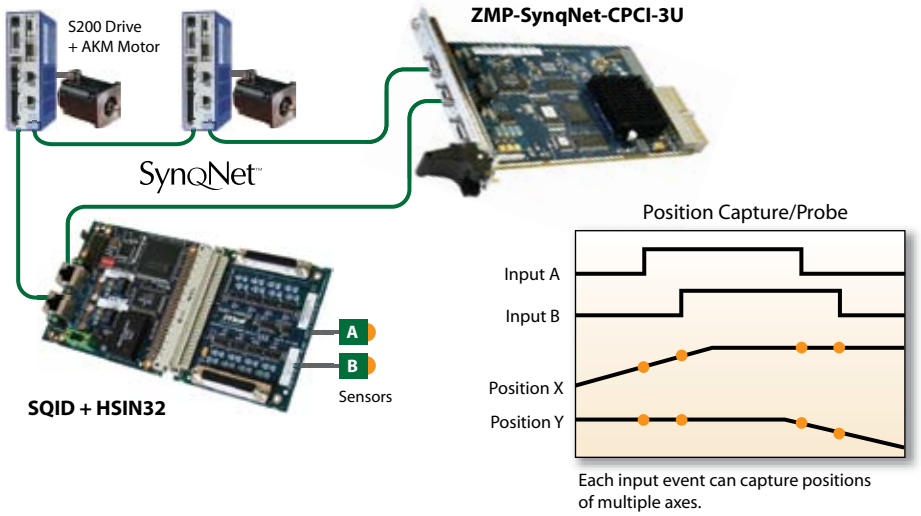


1	OPTO_IN1_0	14	OPTO_IN1_11
2	OPTO_IN1_1	15	OPTO_IN1_12
3	OPTO_IN1_2	16	OPTO_IN1_13
4	OPTO_IN1_3	17	OPTO_IN1_14
5	OPTO_IN1_4	18	OPTO_IN1_15
6	OPTO_IN1_5	19	+24V (output)
7	OPTO_IN1_6	20	24V_RTN
8	OPTO_IN1_7	21	NC
9	+24V (output)	22	NC
10	24V_RTN	23	NC
11	OPTO_IN1_8	24	NC
12	OPTO_IN1_9	25	NC
13	OPTO_IN1_10		

Digital Input Internal Circuit Diagram



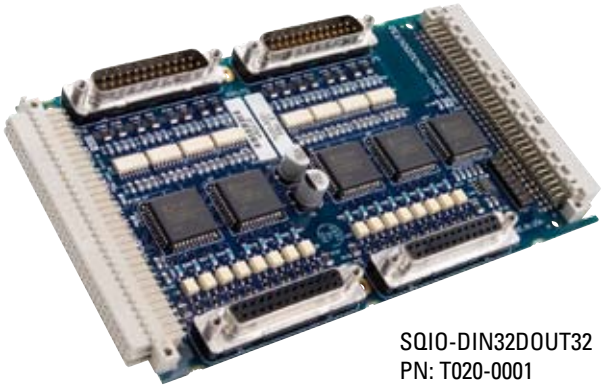
Sample Setup



Each input event can capture positions of multiple axes.

Digital I/O Board - 'DIN32DOUT32'

The Digital I/O board contains 32 digital inputs and 32 digital outputs.

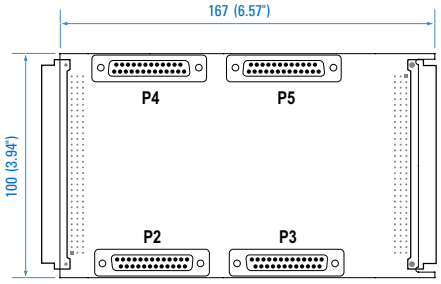


SQIO-DIN32DOUT32
PN: T020-0001

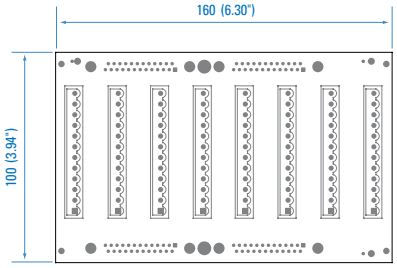
Specifications

Function	Parameter	Specification
Connectors	Digital I/O Connectors	6.35mm 25-pin 'D' - (2M & 2F)
	Board-to-Board Connectors	96-pin Type R & Type C
Digital I/O	Digital Inputs	32 opto-isolated
	Digital Outputs	32 opto-isolated
	Voltage	5-24 Vdc
	Total Current Consumption	Max 200mA @ 3.3V
Environment	Operating Temperature	0-50° C
	Storage Temperature	0-50° C
	Humidity	20-80% RH, non-condensing
Power	Total Current Consumption	Max 300mA @ 3.3V Max 70mA @ 24V

Dimensions



Breakout Connector Board



Pinouts and Connector Information

Digital I/O Connectors

Standard 25-pin 'D' Connectors

Digital In 0-1 — P4

1	B0 DIN 0	14	B0 DIN 1
2	B0 DIN 2	15	B0 DIN 3
3	B0 DIN 4	16	B0 DIN 5
4	B0 DIN 6	17	B0 DIN 7
5	NC	18	NC
6	B0 COM	19	B0 COM
7	NC	20	B1 DIN 0
8	B1 DIN 1	21	B1 DIN 2
9	B1 DIN 3	22	B1 DIN 4
10	B1 DIN 5	23	B1 DIN 6
11	B1 DIN 7	24	NC
12	NC	25	B1 COM
13	B1 COM		

Digital In 2-3 — P5

1	B2 DIN 0	14	B2 DIN 1
2	B2 DIN 2	15	B2 DIN 3
3	B2 DIN 4	16	B2 DIN 5
4	B2 DIN 6	17	B2 DIN 7
5	NC	18	NC
6	B2 COM	19	B2 COM
7	NC	20	B3 DIN 0
8	B3 DIN 1	21	B3 DIN 2
9	B3 DIN 3	22	B3 DIN 4
10	B3 DIN 5	23	B3 DIN 6
11	B3 DIN 7	24	NC
12	NC	25	B3 COM
13	B3 COM		

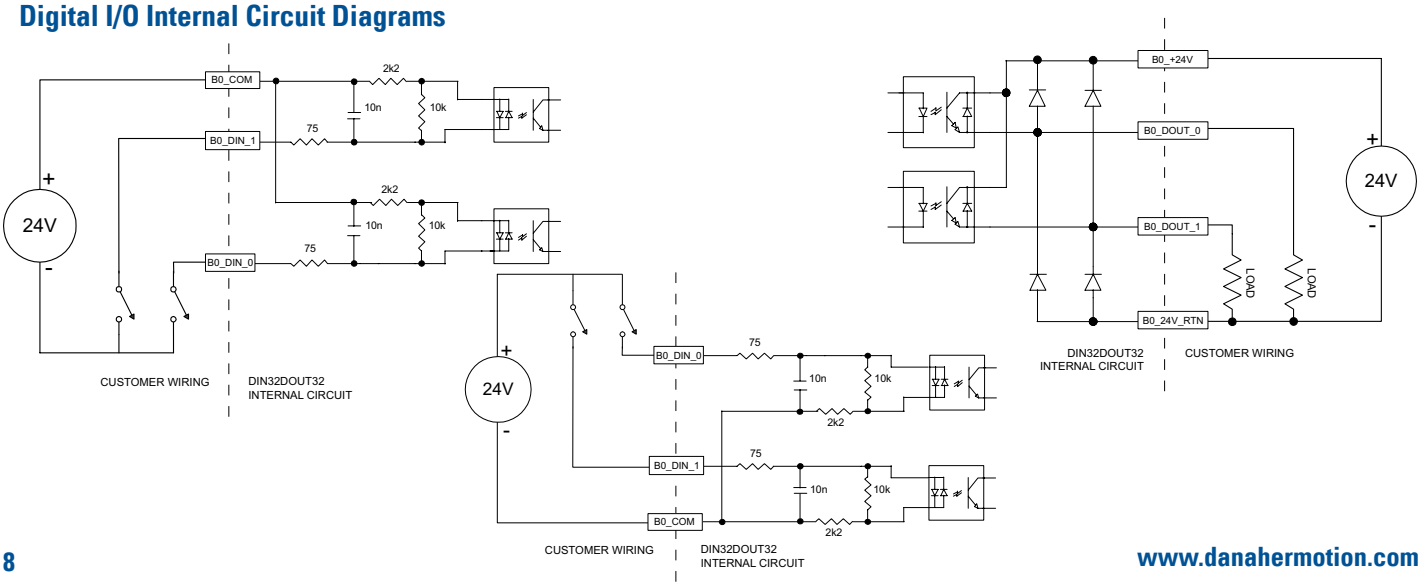
Digital Out 0-1 — P2

1	B0 DOUT 0	14	B0 DOUT 1
2	B0 DOUT 2	15	B0 DOUT 3
3	B0 DOUT 4	16	B0 DOUT 5
4	B0 DOUT 6	17	B0 DOUT 7
5	BO +24V	18	BO +24V
6	BO 24V RTN	19	BO 24V RTN
7	NC	20	B1 DOUT 0
8	B1 DOUT 1	21	B1 DOUT 2
9	B1 DOUT 3	22	B1 DOUT 4
10	B1 DOUT 5	23	B1 DOUT 6
11	B1 DOUT 7	24	B1 +24V
12	B1 +24V	25	B1 24V RTN
13	B1 24V RTN		

Digital Out 2-3 — P3

1	B2 DOUT 0	14	B2 DOUT 1
2	B2 DOUT 2	15	B2 DOUT 3
3	B2 DOUT 4	16	B2 DOUT 5
4	B2 DOUT 6	17	B2 DOUT 7
5	B2 +24V	18	B2 +24V
6	B2 24V RTN	19	B2 24V RTN
7	NC	20	B3 DOUT 0
8	B3 DOUT 1	21	B3 DOUT 2
9	B3 DOUT 3	22	B3 DOUT 4
10	B3 DOUT 5	23	B3 DOUT 6
11	B3 DOUT 7	24	B3 +24V
12	B3 +24V	25	B3 24V RTN
13	B3 24V RTN		

Digital I/O Internal Circuit Diagrams



Analog I/O Board - 'ADC4DAC4'

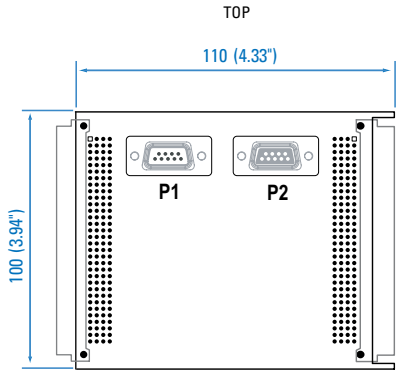
The Analog I/O board contains 4 ADC and 4 DAC.

SQIO-ADC4DAC4
PN: T021-0001

Specifications

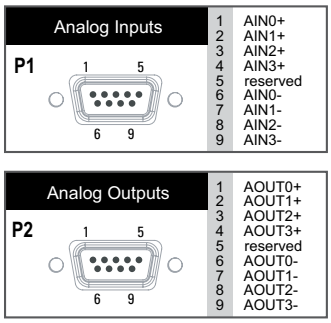
Function	Parameter	Specification
Connectors	Analog I/O Connectors	9-pin 'D' - (1M & 1F)
	Board-to-Board Connectors	96-pin Type R & Type C
Analog I/O	Analog Inputs	4
	Analog Outputs	4
	Addressing	16-bit addressing
	Input Voltage & Output Voltage	±10V, fully differentiated
	Slew & Settling Time	11µS
	Total Current Consumption	106mA @ ± 15V
Environment	Operating Temperature	0-50° C
	Storage Temperature	0-50° C
	Humidity	20-80% RH, non-condensing
Power	Total Current Consumption	Max 120mA @ 3.3V Max 120mA @ 24V

Dimensions

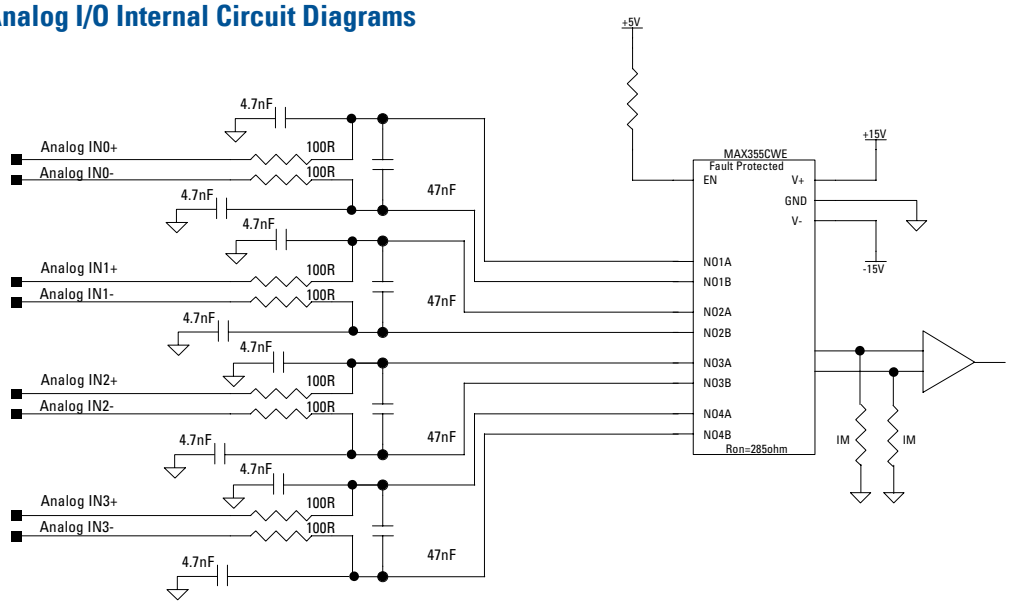


Pinouts and Connector Information

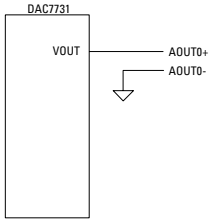
Analog I/O Connectors
Standard 9-pin
'D' Connectors



Analog I/O Internal Circuit Diagrams



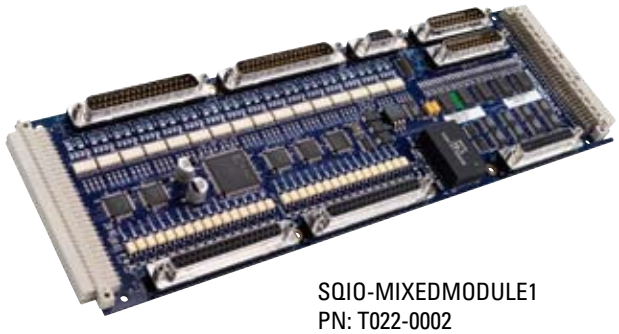
Analog Input



Analog Output

Mixed Module I/O Board - 'MIXEDMODULE1'

The Mixed Module I/O board contains 64 digital inputs, 64 digital outputs, 16 ADC, and 8 DAC.



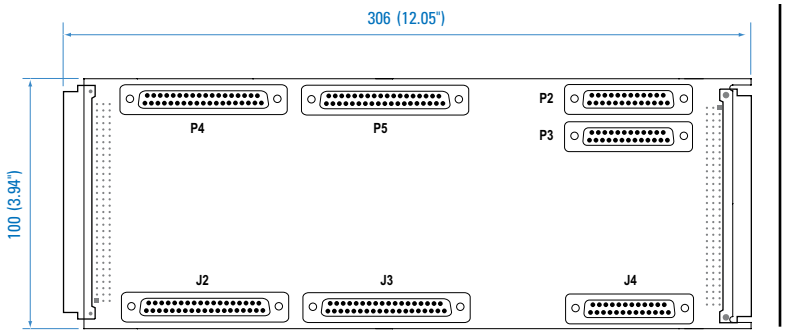
SQIO-MIXEDMODULE1
PN: T022-0002

NOTE: The wiring diagrams for the MixedModule1 are the same as the Digital I/O and Analog I/O boards.

Specifications

Function	Parameter	Specification
Connectors	Analog I/O Connectors	9-pin 'D' - (1M & 1F)
	Board-to-Board Connectors	96-pin Type R & Type C
Digital I/O	Digital Inputs	64 opto-isolated
	Digital Outputs	64 opto-isolated, current sourcing
	Max. Input Voltage	28.8 Vdc
	Total Current Consumption	Max 200mA @ 3.3V
Analog I/O	Analog Inputs	16, differential
	Analog Outputs	8, single ended
	Addressing	16-bit addressing
	Input Voltage & Output Voltage	±10V, fully differentiated
	Slew & Settling Time	11µS
	Total Current Consumption	106mA @ ± 15V
Environment	Operating Temperature	0-50° C
	Storage Temperature	0-50° C
	Humidity	20-80% RH, non-condensing
Power	Total Current Consumption	Max 650mA @ 3.3V Max 200mA @ 24V

Dimensions



Pinouts and Connector Information

Digital I/O Connectors
Standard 37-pin 'D' Connectors

Digital In 0-31					
P4	1	B2_DIN_0	20	B2_DIN_1
	2	B2_DIN_2	21	B2_DIN_3
	3	B2_DIN_4	22	B2_DIN_5
	4	B2_DIN_6	23	B2_DIN_7
	5	B3_DIN_0	24	B3_DIN_1
	6	B3_DIN_2	25	B3_DIN_3
	7	B3_DIN_4	26	B3_DIN_5
	8	B3_DIN_6	27	B3_DIN_7
	9	NC	28	NC
	10	B0123_COM	29	B0123_COM
	11	NC	30	B0_DIN_0
	12	B0_DIN_1	31	B0_DIN_2
	13	B0_DIN_3	32	B0_DIN_4
	14	B0_DIN_5	33	B0_DIN_6
	15	B0_DIN_7	34	B1_DIN_0
	16	B1_DIN_1	35	B1_DIN_2
	17	B1_DIN_3	36	B1_DIN_4
	18	B1_DIN_5	37	B1_DIN_6
	19	B1_DIN_7		

Digital Out 0-31				
J2	1	B2_DOUT_0	20	B2_DOUT_1
	2	B2_DOUT_2	21	B2_DOUT_3
	3	B2_DOUT_4	22	B2_DOUT_5
	4	B2_DOUT_6	23	B2_DOUT_7
	5	B3_DOUT_0	24	B3_DOUT_1
	6	B3_DOUT_2	25	B3_DOUT_3
	7	B3_DOUT_4	26	B3_DOUT_5
	8	B3_DOUT_6	27	B3_DOUT_7
	9	B0123_24V	28	B0123_24V
	10	B0123_24V_RTN	29	B0123_24V_RTN
	11	NC	30	B0_DOUT_0
	12	B0_DOUT_1	31	B0_DOUT_2
	13	B0_DOUT_3	32	B0_DOUT_4
	14	B0_DOUT_5	33	B0_DOUT_6
	15	B0_DOUT_7	34	B1_DOUT_0
	16	B1_DOUT_1	35	B1_DOUT_2
	17	B1_DOUT_3	36	B1_DOUT_4
	18	B1_DOUT_5	37	B1_DOUT_6
	19	B1_DOUT_7		

Digital In 32-64				
P5	1	B6_DIN_0	20	B6_DIN_1
	2	B6_DIN_2	21	B6_DIN_3
	3	B6_DIN_4	22	B6_DIN_5
	4	B6_DIN_6	23	B6_DIN_7
	5	B7_DIN_0	24	B7_DIN_1
	6	B7_DIN_2	25	B7_DIN_3
	7	B7_DIN_4	26	B7_DIN_5
	8	B7_DIN_6	27	B7_DIN_7
	9	NC	28	NC
	10	B4567_COM	29	B4567_COM
	11	NC	30	B4_DIN_0
	12	B4_DIN_1	31	B4_DIN_2
	13	B4_DIN_3	32	B4_DIN_4
	14	B4_DIN_5	33	B4_DIN_6
	15	B4_DIN_7	34	B5_DIN_0
	16	B5_DIN_1	35	B5_DIN_2
	17	B5_DIN_3	36	B5_DIN_4
	18	B5_DIN_5	37	B5_DIN_6
	19	B5_DIN_7		

Digital Out 32-64				
J3	1	B6_DOUT_0	20	B6_DOUT_1
	2	B6_DOUT_2	21	B6_DOUT_3
	3	B6_DOUT_4	22	B6_DOUT_5
	4	B6_DOUT_6	23	B6_DOUT_7
	5	B7_DOUT_0	24	B7_DOUT_1
	6	B7_DOUT_2	25	B7_DOUT_3
	7	B7_DOUT_4	26	B7_DOUT_5
	8	B7_DOUT_6	27	B7_DOUT_7
	9	B4567_24V	28	B4567_24V
	10	B4567_24V_RTN	29	B4567_24V_RTN
	11	NC	30	B4_DOUT_0
	12	B4_DOUT_1	31	B4_DOUT_2
	13	B4_DOUT_3	32	B4_DOUT_4
	14	B4_DOUT_5	33	B4_DOUT_6
	15	B4_DOUT_7	34	B5_DOUT_0
	16	B5_DOUT_1	35	B5_DOUT_2
	17	B5_DOUT_3	36	B5_DOUT_4
	18	B5_DOUT_5	37	B5_DOUT_6
	19	B5_DOUT_7		

Analog I/O Connectors
Standard 25-pin 'D' Connectors

Analog In 0-7				
P2	1	AIN0+	14	AIN0-
	2	ANALOG_GND_2	15	AIN1+
	3	AIN1-	16	ANALOG_GND_2
	4	AIN2+	17	AIN2-
	5	ANALOG_GND_2	18	AIN3+
	6	AIN3-	19	ANALOG_GND_2
	7	AIN4+	20	AIN4-
	8	ANALOG_GND_2	21	AIN5+
	9	AIN5-	22	ANALOG_GND_2
	10	AIN6+	23	AIN6-
	11	ANALOG_GND_2	24	AIN7+
	12	AIN7-	25	ANALOG_GND_2
	13	ANALOG_GND_2		

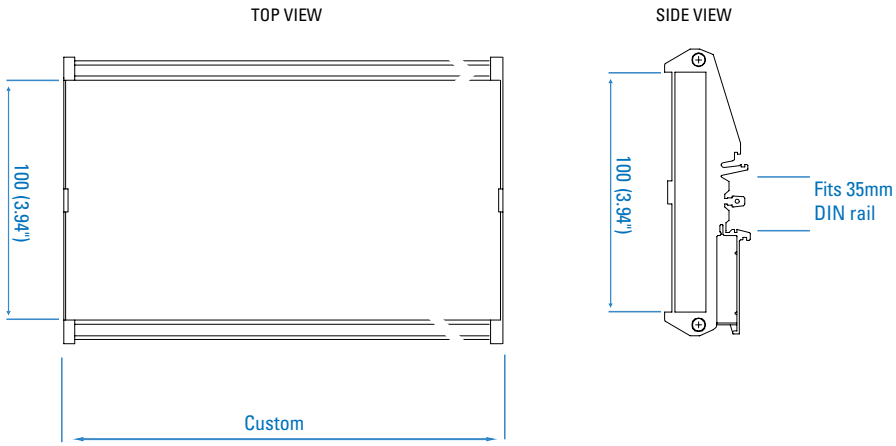
Analog In 8-15				
P3	1	AIN8+	14	AIN8-
	2	ANALOG_GND_2	15	AIN9+
	3	AIN9-	16	ANALOG_GND_2
	4	AIN10+	17	AIN10-
	5	ANALOG_GND_2	18	AIN11+
	6	AIN11-	19	ANALOG_GND_2
	7	AIN12+	20	AIN12-
	8	ANALOG_GND_2	21	AIN13+
	9	AIN13-	22	ANALOG_GND_2
	10	AIN14+	23	AIN14-
	11	ANALOG_GND_2	24	AIN15+
	12	AIN15-	25	ANALOG_GND_2
	13	ANALOG_GND_2		

Analog Out 0-7				
J4	1	AOUT0+	14	AOUT0-
	2	ANALOG_GND_1	15	AOUT1+
	3	AOUT1-	16	ANALOG_GND_1
	4	AOUT2+	17	AOUT2-
	5	ANALOG_GND_1	18	AOUT3+
	6	AOUT3-	19	ANALOG_GND_1
	7	AOUT4+	20	AOUT4-
	8	ANALOG_GND_1	21	AOUT5+
	9	AOUT5-	22	ANALOG_GND_1
	10	AOUT6+	23	AOUT6-
	11	ANALOG_GND_1	24	AOUT7+
	12	AOUT7-	25	ANALOG_GND_1
	13	ANALOG_GND_1		

Mounting Information

Mounting Information
SQIO modules utilize standard Phoenix Contact DIN rail mount plastic extrusions.
www.phoenixcon.com

Plastic Extrusion:
29 52 02 0 / UM100 / Custom Length



Precut SQIO Housing

Part Number	SQIO Setup	Description
1016-0300	SQID + DIN32DOUT32	Housing, Kit, SQIO, 27.15cm
1016-0301	SQID + ADC4DAC4	Housing, Kit, SQIO, 21.45cm
1016-0302	SQID + MIXEDMODULE1	Housing, Kit, SQIO, 40.35cm
1016-0303	SQID + DIN32DOUT32 + ADC4DAC4	Housing, Kit, SQIO, 38.25cm
1016-0304	SQID + ADC4DAC4 + ADC4DAC4	Housing, Kit, SQIO, 32.55cm
1016-0305	SQID + DIN32DOUT32 + DIN32DOUT32	Housing, Kit, SQIO, 43.95cm
1016-0306	SQID + HSIN32	Housing, Kit, SQIO, 18.45cm

Accessories

Digital I/O Breakout Board
'DIN32DOUT32-BO'
8001-0042

Used with the 'DIN32DOUT32' board for easy prototyping and wiring.
Connects via the 'D' connectors.
Convenient Phoenix Combicon vertical connectors.

Additional SQIO products are also available upon request.

- **Board Protective Covers**
  Protects I/O electrical circuits from direct exposure.

- **Optional DIN Rail Mounting**
  Customizable extruded mounting material that conforms to any configuration.

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