

KOLLMORGEN

www.DanaherMotion.com

PicoDAD-SN Compact Dual-Axis SynqNet Servo Drive

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Quick Start Guide
Revision No: 0.1
Date: 30 November 2005

1 General

1.1 Part number

PDD 04 **XX** 165

where

- **XX** refers to the current level that the drive can source.
 - 10: 10 Amps RMS continuous and 10 Amps RMS peak
 - 20: 10 Amps RMS continuous and 20 Amps RMS peak

1.2 Where to get support

Danaher Motion is committed to quality customer service. Our goal is to provide the customer with information and resources as soon as they are needed. In order to serve in the most effective way, contact your local sales representative for order status and delivery information, product information and literature, and application and field technical assistance. If you are unaware of your local sales representative, please contact us at:

Email: sep@danahermotion.com

Specify "SynqNet Support" in the subject line.

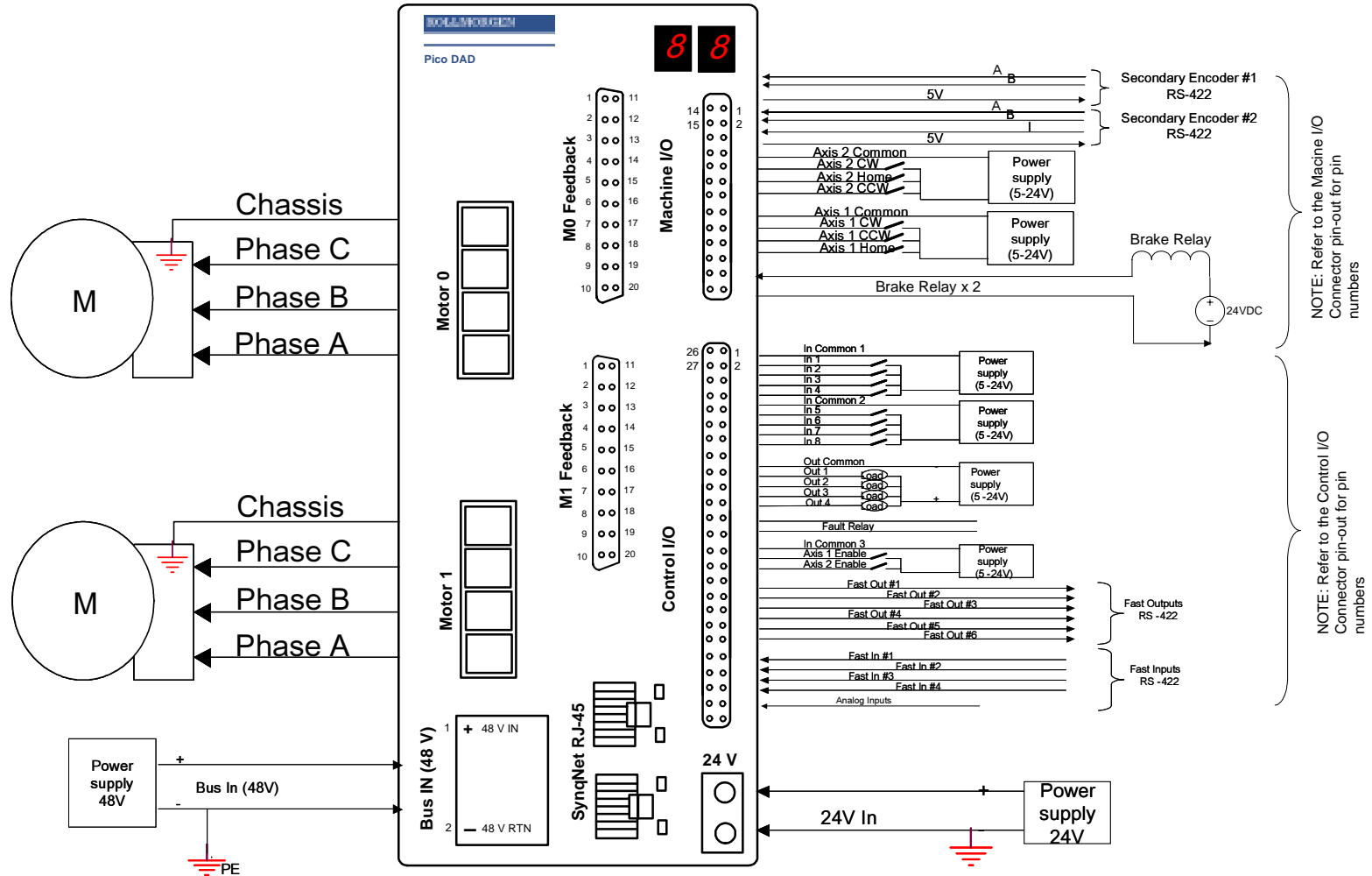
1.3 Manual Download Location

Complete product manuals can be downloaded from the Danaher Motion MEI Support Website, at

http://support.motioneng.com/Hardware/Drives/SynqNet-Drives/drive_kollmorgen_picodad.htm

2 Wiring

2.1 Wiring Diagram



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2.2 Connector Pin-Outs

2.2.1 Logic Power

Connector Definition		
Manufacturer	Phoenix Contact	
Part Number	MSTB 2,5/2-GF-5,08	
Mating Connector Part Number	MSTBT 2,5/ 2-STF-5,08	
Pin Out		
Pin #	Description	Comments
1	Logic Power	24VDC
2	Logic Power return	Refer to Grounding Tree

2.2.2 Bus Power

Connector Definition		
Manufacturer	Molex	
Part Number	42820-2212	
Mating Connector Part Number	42816-0212 (Housing) 42815-0011 (Pins) 63813-0500 (Manual Extraction Tool)	
Pin Out		
Pin #	Description	Comments
1	Bus Power	48VDC; regulated or unregulated
2	Bus Power return	Refer to Grounding Tree

2.2.3 Motor Power

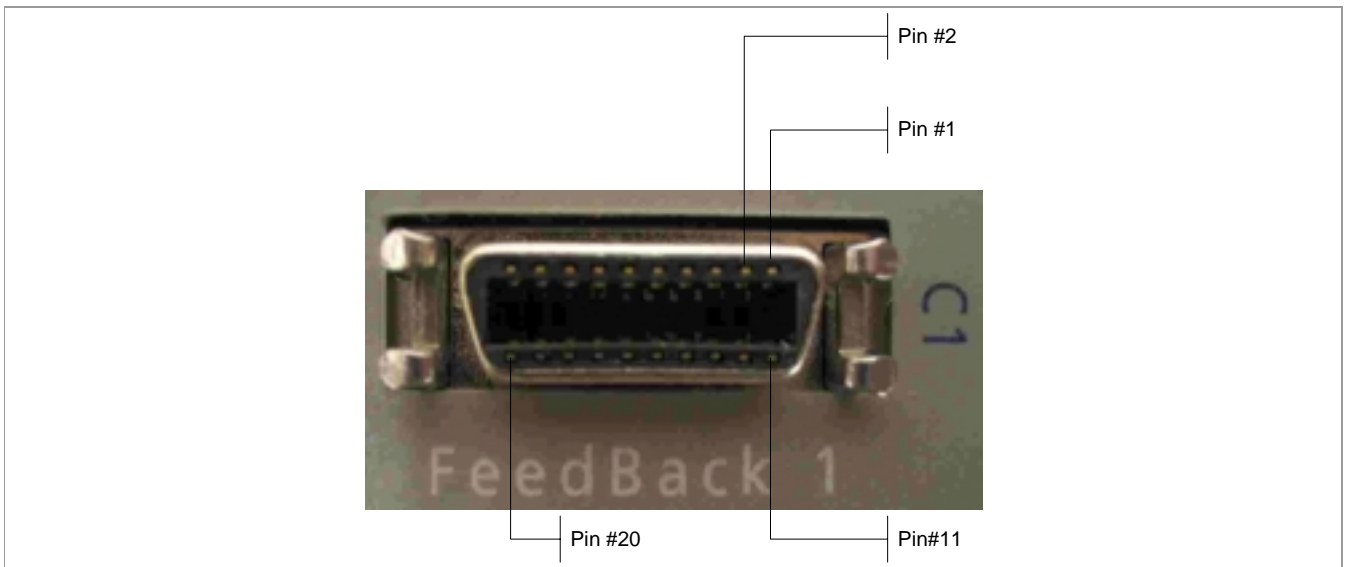
Connector Definition		
Manufacturer	Molex	
Part Number	43160-3104	
Mating Connector Part Number	44441-2004 (Housing) 43375-0001 (Pins) 63813-0500 (Manual Extraction Tool)	
Pin Out		
Pin #	Description	Comments
1	Chassis	Refer to Grounding Tree
2	Phase C	
3	Phase B	
4	Phase A	

2.2.4 Feedback

2.2.4.1 Connector Definition

Manufacturer	Connectors from any of the following manufacturers are used: 3M; ACON; Hirose		
Part Number	3M	N10220-52B2VC	
	ACON	HBR20-20K3211	
	Hirose	DX106GM-20SE	
Mating Connector Part Number	3M	Connector: 10120-6000EC Housing: 10320-3210-00 Cable: 3M 3444C-10P	

2.2.4.2 Connector Pin Arrangement



2.2.4.3 Pin Out

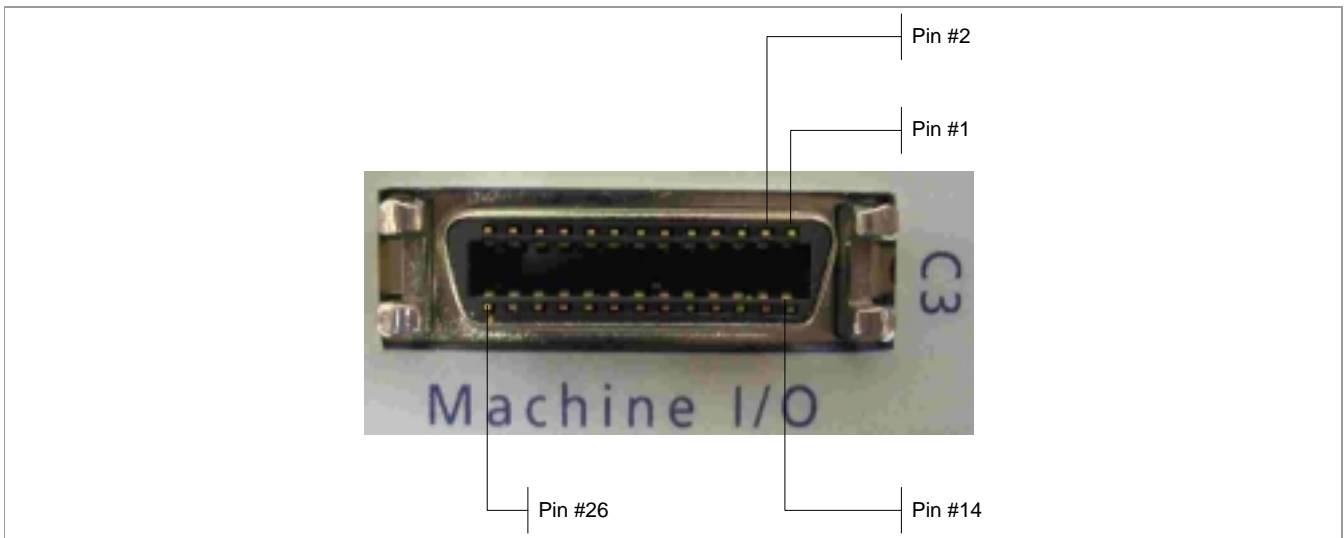
Pin #	Incremental Encoder	Resolver	Sine Encoder EnDat	Sine Encoder C/D
1	E5V	E5V	E5V	E5V
2	E5V	E5V	E5V	E5V
3	A	Sine	A	A
4	A\	Sine\	A\	A\
5	Z	Ref		
6	Z\	Ref\		
7	Hall1		SSI Data	C
8	Hall1\		SSI Data\	C\
9	Hall3			
10	Hall3\			
11	DGND	DGND	DGND	DGND
12	DGND	DGND	DGND	DGND
13	B	Cosine	B	B
14	B\	Cosine\	B\	B\
15	DGND	DGND	DGND	DGND
16	DGND	DGND	DGND	DGND
17	Hall2		SSI Clock	D
18	Hall2\		SSI Clock\	D\
19	Motor temp sensor	Motor temp sensor	Motor temp sensor	Motor temp sensor
20	Motor temp sensor return	Motor temp sensor return	Motor temp sensor return	Motor temp sensor return

2.2.5 Machine I/O

2.2.5.1 Connector Definition

Manufacturer	Connectors from any of the following manufacturers are used: 3M; ACON; Hirose
Part Number	3M N10226-52B2VC ACON HBR26-20K3211 Hirose DX106GM-26SE
Mating Connector Part Number	3M Connector: 10126-6000EC Housing: 10326-3210-00 Cable: 3M 3444C-13P

2.2.5.2 Connector Pin Arrangement



2.2.5.3 Pin Out

Pin #	Description	Comments
1	Common for Axis 1 inputs	Common for CW, CCW and Home
2	Axis 1 negative limit	Opto input; 5-24V; Wired to SynqNet FPGA Referenced to Common on pin #1
3	Axis 1 secondary encoder B signal	RS-422 input
4	Axis 1 secondary encoder B-complement signal	
5	Axis 1 secondary encoder A signal	RS-422 input
6	Axis 1 secondary encoder A-complement signal	
7	Axis 2 positive limit	Opto input; 5-24V; Wired to SynqNet FPGA Referenced to Common on pin #20
8	Axis 2 home signal	Opto input; 5-24V; Wired to SynqNet FPGA Referenced to Common on pin #20
9	Axis 2 negative limit	Opto input; 5-24V; Wired to SynqNet FPGA Referenced to Common on pin #20
10	Axis 2 secondary encoder Index signal	RS-422 input; wired to SynqNet FPGA
11	Axis 2 secondary encoder Index-complement signal	
12	Axis 2 brake+ contact	Dry contact relay; controlled by SynqNet FPGA. Note polarization
13	Axis 2 brake- contact	

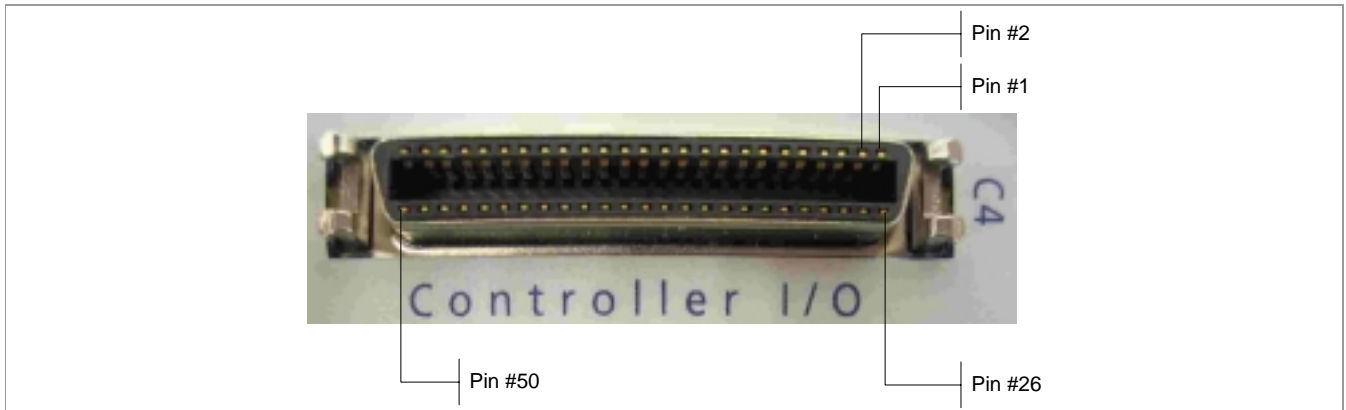
Pin #	Description	Comments
14	Axis 1 positive limit	Opto input; 5-24V; Wired to SynqNet FPGA Referenced to Common on pin #1
15	5VDC supply to secondary encoder	Fuse-protected; resettable fuse
16	Axis 1 home signal	Opto input; 5-24V; Wired to SynqNet FPGA Referenced to Common on pin #1
17	Ground for secondary encoder power	Connected to Digital Ground in the drive
18	Axis 1 brake+ contact	Dry contact relay; controlled by SynqNet FPGA. Note polarization
19	Axis 1 brake- contact	
20	Common for Axis 2 inputs	Common for CW, CCW and Home
21	Axis 2 secondary encoder B-complement signal	RS-422 input; wired to SynqNet FPGA
22	Axis 2 secondary encoder B signal	
23	Ground for secondary encoder power	Connected to Digital Ground in the drive
24	Axis 2 secondary encoder A-complement signal	RS-422 input (with pin 26); wired to SynqNet FPGA
25	5VDC supply to secondary encoder	Fuse-protected; resettable fuse
26	Axis 2 secondary encoder A signal	RS-422 input (with pin 24); wired to SynqNet FPGA

2.2.6 Controller I/O

2.2.6.1 Connector Definition

Manufacturer	Connectors from any of the following manufacturers are used: 3M; ACON; Hirose		
Part Number	3M	N10250-52B2VC	
	ACON	HBR50-20K3211	
	Hirose	DX106GM-50SE	
Mating Connector Part Number	3M	Connector	10150-6000EC
		Housing	10350-A200-00
		Cable:	3M 3444C-25P

2.2.6.2 Connector Pin Arrangement



2.2.6.3 Pin Out

Pin #	Description	Comments
1	Common for Opto-isolated Inputs 1, 2, 3, 4	
2	Motor 0, OPTO IN2	Referenced to Common on pin #1
3	Motor 0, OPTO IN1	Referenced to Common on pin #1
4	Motor 1, OPTO IN2	Referenced to Common on pin #30
5	Motor 1, OPTO IN1	Referenced to Common on pin #30

Pin #	Description	Comments
6	Motor 1, REMOTE ENABLE	Referenced to Common on pin #33
7	Motor 0, REMOTE ENABLE	Referenced to Common on pin #33
8	Common for Opto-isolated Outputs 1, 2, 3, 4	
9	Motor 1, OPTO OUT1	Referenced to Common on pin #8
10	Motor 1, OPTO OUT0	Referenced to Common on pin #8
11	Motor 0, RS422 OUT3	RS-422 output; wired to SynqNet FPGA
12	Motor 0, RS422 OUT3 Complement	
13	Motor 0, RS422 OUT2	RS-422 output; wired to SynqNet FPGA
14	Motor 0, RS422 OUT2 Complement	
15	Motor 1, RS422 OUT1 Complement	RS-422 output; wired to SynqNet FPGA
16	Motor 1, RS422 OUT1	
17	Motor 0, RS422 IN2	RS-422 input; wired to SynqNet FPGA
18	Motor 0, RS422 IN2 Complement	
19	Motor 0, RS422 IN1	RS-422 input; wired to SynqNet FPGA
20	Motor 0, RS422 IN1 Complement	
21	Analog Ground	Reference ground for Axis 1 analog inputs. This pin should be connected to the ground of the analog command source.
22	Analog Ground	Reference ground for Axis 2 analog inputs. This pin should be connected to the ground of the analog command source.
23	Axis 1 Analog Input #2	Differential analog Input; $\pm 10Vdc$
24	Axis 1 Analog Input #2 Complement	
25	Axis 2 Analog Input #2	Differential analog Input; $\pm 10Vdc$. Paired with pin #50
26	Fault Relay Terminal #1	Dry contact relay. Polarity of wiring is not constrained
27	Fault Relay Terminal #2	
28	Motor 0, OPTO IN4	Referenced to Common on pin #1
29	Motor 0, OPTO IN3	Referenced to Common on pin #1
30	Common for Opto-isolated Inputs 5, 6, 7, 8	
31	Motor 1, OPTO IN4	Referenced to Common on pin #30
32	Motor 1, OPTO IN3	Referenced to Common on pin #30
33	Common for Remote Enable Inputs	
34	Motor 0, OPTO OUT1	Referenced to Common on pin #8
35	Motor 0, OPTO OUT0	Referenced to Common on pin #8
36	Motor 0, RS422 OUT1 Complement	RS-422 output; wired to SynqNet FPGA
37	Motor 0, RS422 OUT1	
38	Motor 1, RS422 OUT2	RS-422 output; wired to SynqNet FPGA
39	Motor 1, RS422 OUT2 Complement	
40	Motor 1, RS422 OUT3 Complement	RS-422 output; wired to SynqNet FPGA
41	Motor 1, RS422 OUT3	
42	Motor 1, RS422 IN1 Complement	RS-422 input; wired to SynqNet FPGA
43	Motor 1, RS422 IN1	
44	Motor 1, RS422 IN2 Complement	RS-422 input; wired to SynqNet FPGA
45	Motor 1, RS422 IN2	
46	Axis 1 Analog Input #1	Differential analog Input; $\pm 10Vdc$
47	Axis 1 Analog Input #1 Complement	
48	Axis 2 Analog Input #1	Differential analog Input; $\pm 10Vdc$
49	Axis 2 Analog Input #1 Complement	
50	Axis 2 Analog Input #2 complement	Differential analog Input; $\pm 10Vdc$. Paired with pin #25

2.2.7 SynqNet

Connector Definition		
Connector Type	RJ-45	
Manufacturer	Molex	
Part Number	85505-0001	
Mating Connector Part Number	Mates with industry standard FCC 68 plugs	
Pin Out		
Pin #	IN	OUT
1	TD0+	RD0+
2	TD0-	RD0-
3	RD0+	TD0+
4	TTERM0	RTERM1
5	TTERM1	RTERM1
6	RD0-	TD0-
7	RTERM0	TTERM1
8	RTERM1	TTERM1

2.2.8 RS-232

Connector Definition		
Connector Type	Male 9 pin D-Sub	
Manufacturer	e-tec	
Part Number	SSM-009-U908-02/R	
Mating Connector Part Number		
Pin Out		
Pin #	Description	Comments
1	NC	
2	Rx	RS-232 Receive
3	Tx	RS-232 Transmit
4	NC	
5	DGND	Ground. Used for Hardware Ember
6	NC	
7	HW Ember	Used for Hardware Ember
8	BRXD	Daisy chain Receive
9	BTXD	Daisy chain Transmit



Note: The RS-232 cable between a computer or terminal and the PicoDAD must have **only** pins 2, 3 and 5 connected.

2.3 Wiring a Motor to the Drive

2.3.1 Kollmorgen AKM Motors

The motor phases and feedback signals must be wired as described in the following tables. In addition, set drive parameter MOTORTYPE to the value '3'.

Motor Phases

Historically Kollmorgen motor phases have been designated with the letters 'A', 'B', and 'C' for each of the 3 phase connections. The AKM motors are labeled 'U', 'V', and 'W'. The relationship of these signals is shown in the following table:

Motor Phase	Wire Color	Drive Phase
U	BLUE	C
V	BROWN	B
W	VIOLET	A

Commutation Track Signals (for the encoder motor):

Motor Signal Name	Drive feedback signal name	Drive feedback pin number
U	HALL3	9
U\	HALLS3\	10
V	HALL2	17
V\	HALL2\	18
W	HALL1	7
W\	HALL1\	8

Wiring of the commutation track signal complements is optional; for improved noise immunity it is recommended to connect them.

Encoder Feedback Signals

Motor Signal Name	Wire Color	Drive feedback signal name	Drive feedback pin number
A	BLUE	B	13
A\	BLUE/BLK	B\	14
B	GREEN	A	3
B\	GRN/BLK	A\	4
Z	VIOLET	Z	5
Z\	VIOLET/BLK	Z\	6

Resolver Feedback Signals

Motor Signal Name	Wire Color	Drive feedback signal name	Drive feedback pin number
S1, SIN+	RED	Cosine	13
S3, SIN-	BLACK	Cosine\	14
S2, COS+	YELLOW	Sine\	4
S4, COS-	BLUE	Sine	3
R1, REF+	RED/WHT	Ref\	6
R2, REF-	BLK/WHT	Ref	5

2.4 Connector Kit

A connector / integration kit is available. This kit contains mating connectors and crimp pins for the power connectors, and cables with MDR connectors on the one end and flying leads on the other for the feedback and I/O connectors. The part number for this kit is

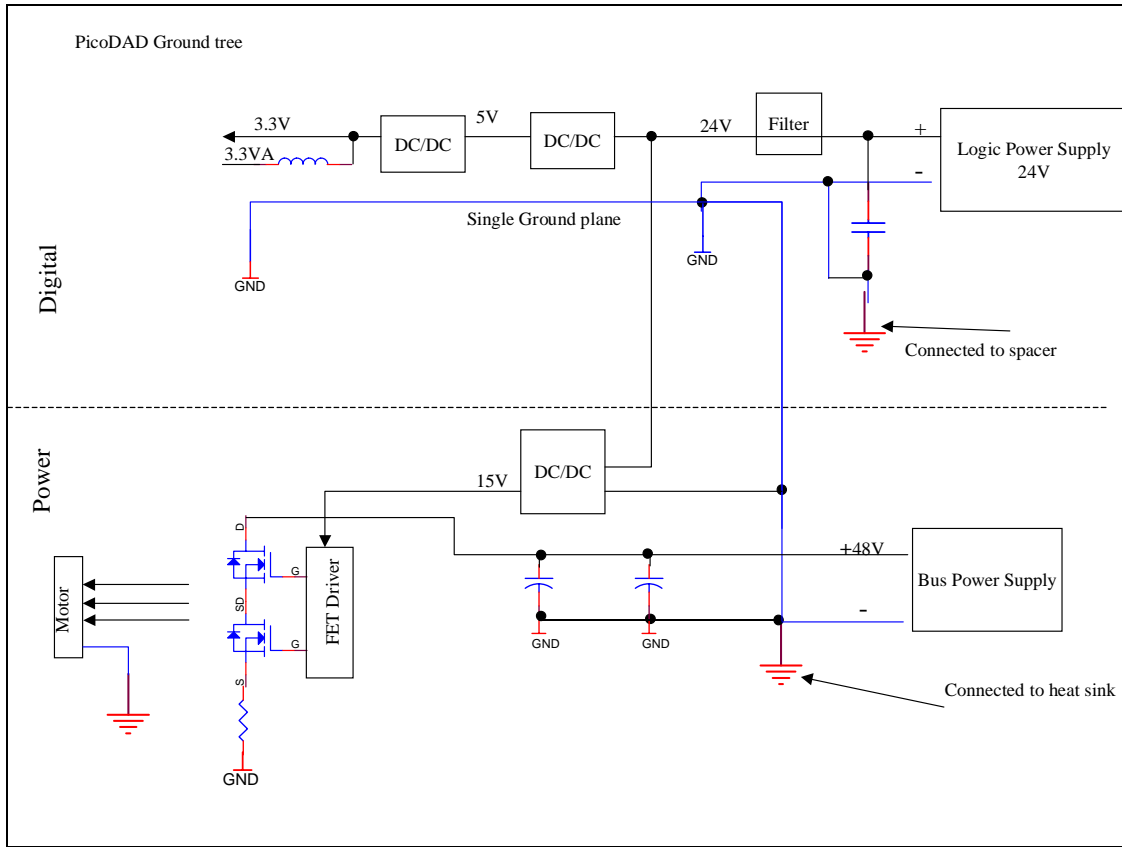
CON-KIT-STX-2

The exact contents of the kit are as follows:

Item Description	Quantity
Motors feedback cables	2
26-pin Machine I/O cable	1
50-pin Control I/O cable	1
Bus power (48V) connector	1
Logic power (24V) connector	1
Motors power connectors	2
Crimp pins for motor power connector	8
Crimp pins for bus power connector	2

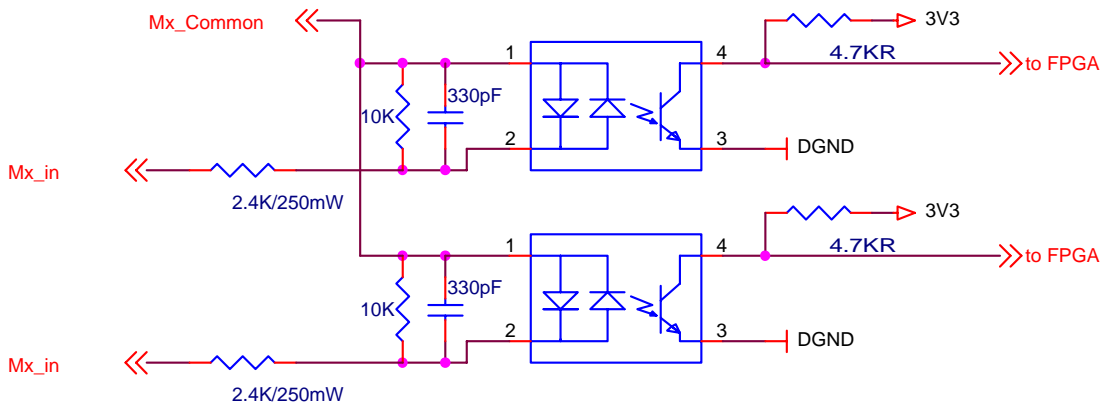
This connector kit is available from the Danaher Motion facility of Kollmorgen Servotronics only. Contact sep@danahermotion.com for details.

2.5 Grounding Tree

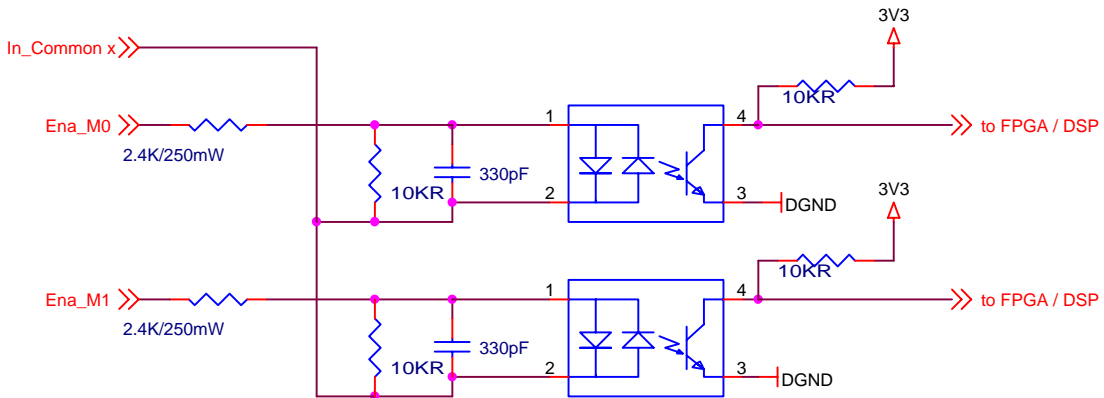


2.6 I/O Electrical Interface

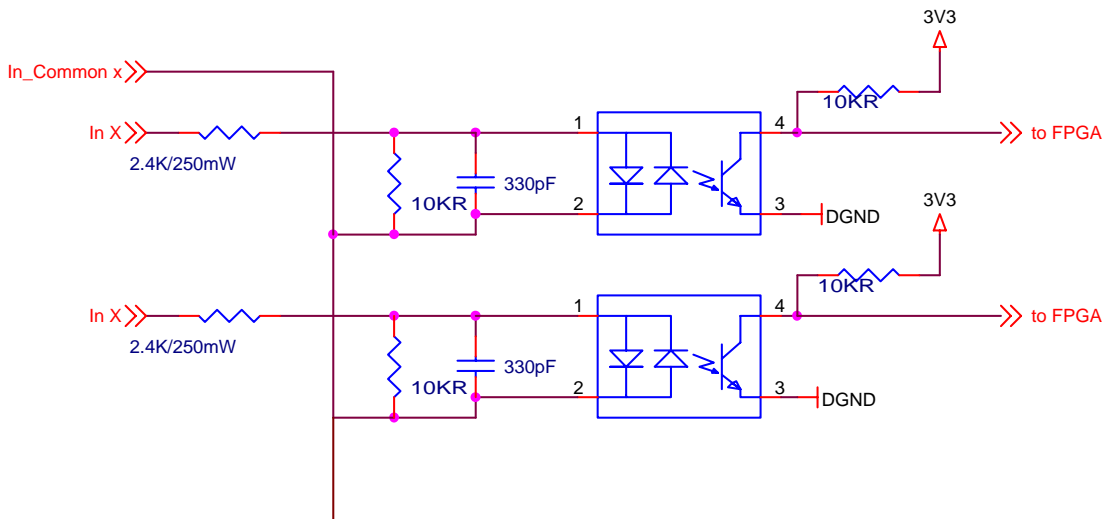
2.6.1 Over-Travel Limits and Home



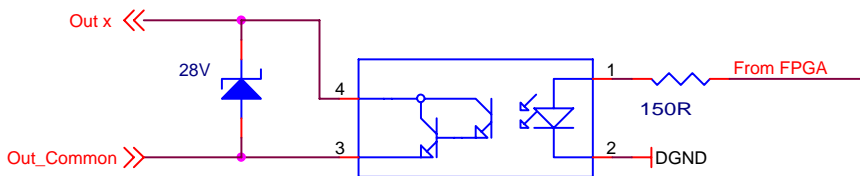
2.6.2 Remote Enable



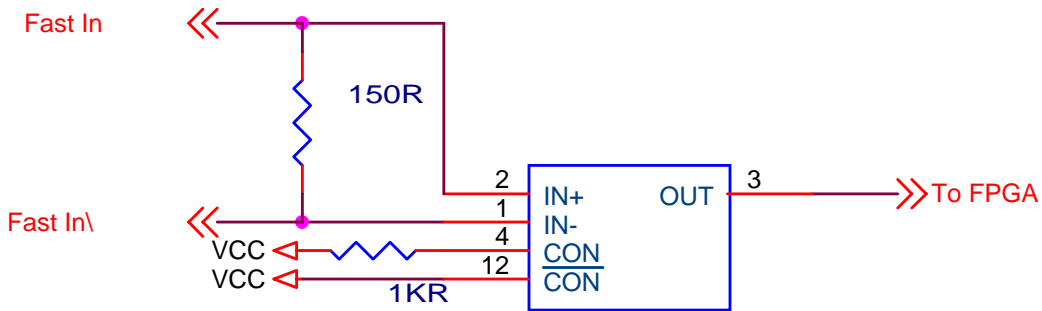
2.6.3 General-Purpose Inputs



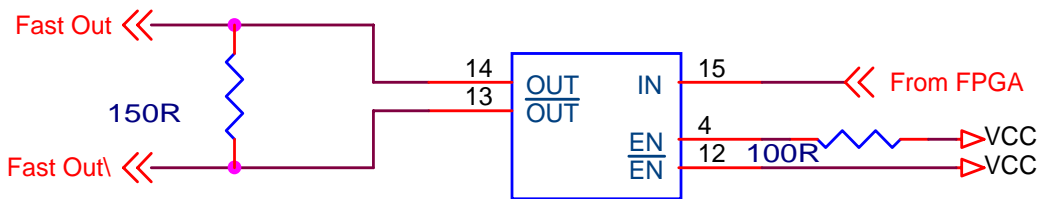
2.6.4 General-Purpose Outputs



2.6.5 High Speed Inputs

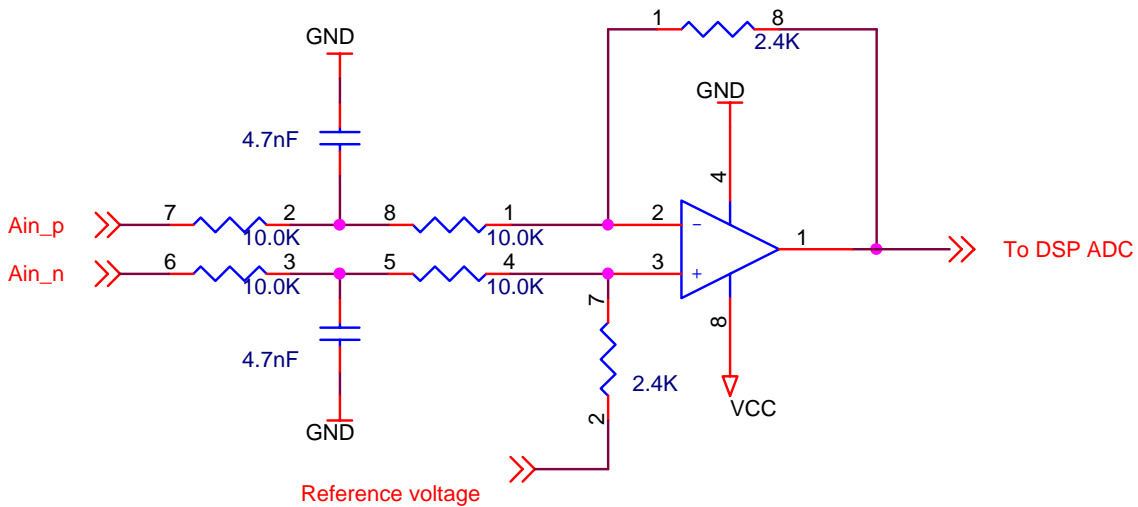


2.6.6 High Speed Outputs

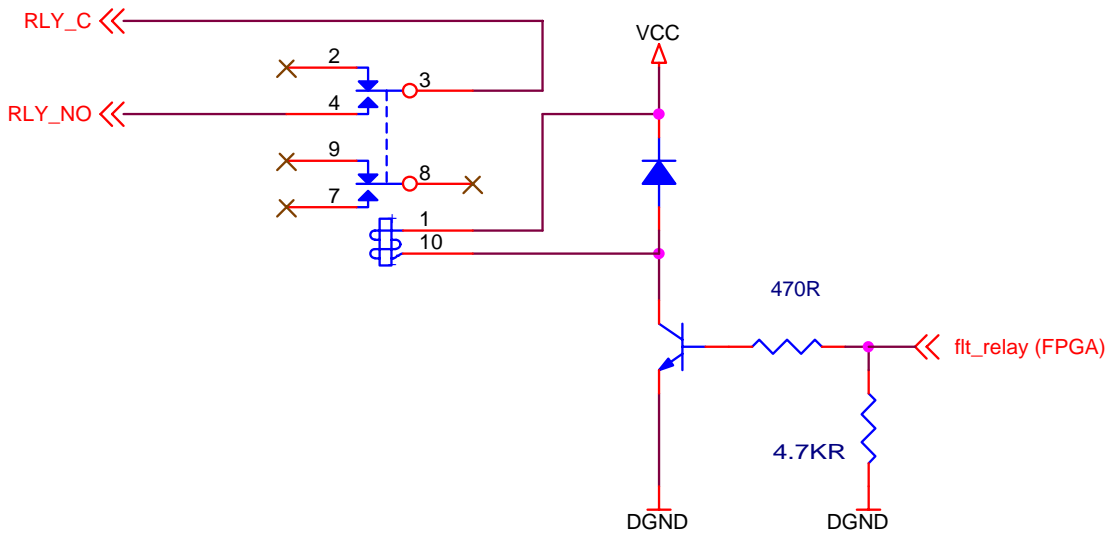


2.6.7 Analog Inputs

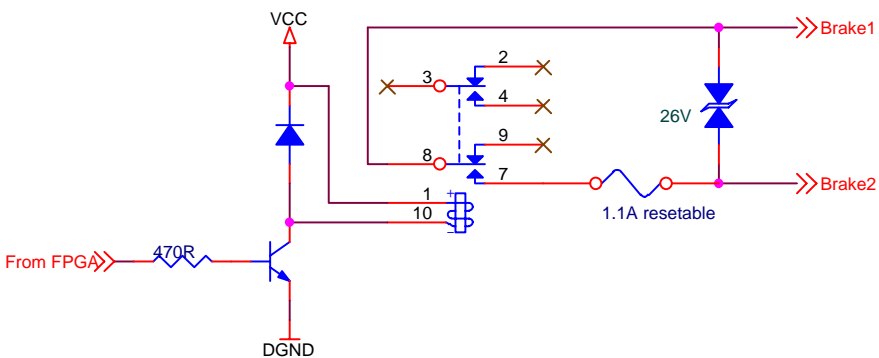
The Analog inputs are differential, but the common mode is limited. The AGND pin should be connected to the ground of the analog command source.



2.6.8 Fault Relay



2.6.9 Brake Relay



3 Filtering and Bonding for Noise Reduction

3.1 Filter and Bonding Diagram

3.2 Filter and Bonding Diagram Notes

4 Basic Operation

4.1 Powering Up

One of the characteristics of SynqNet drives is that at power up, the drive DSP is held in a RESET state by the SynqNet FPGA in the drive. The DSP reset is only released when a SynqNet RESET command is issued from the controller. Once this is done, the drive will come up.

The SynqNet RESET can be done in two ways:

- Using MotionConsole: Click on the RESET button in the Controller Summary window (on the ACTIONS tab)
- Using a DOS command:
 - Open a DOS PROMPT window in the * XMP\ Bin\ WinNT folder

- o Type RESET at the command prompt

4.2 SynqNet Utilities

A set of SynqNet utilities is installed in the *XMP\BIN\WINNT folder. These utilities can be used to perform many drive configuration operations over SynqNet. This manual references many of these utilities, but provides, for the purposes of legibility, only an abbreviated description of their syntax. The complete syntax is found on the Motion Engineering support web site, at <http://support.motioneng.com/>. Reference should be made to the web site for complete syntax information.

4.3 Rotary Switch Configuration

The PicoDAD is equipped with a 16-pole rotary switch, accessible from the top of the unit. The switch has no functional use for either the drive or the network. It can be used at the application level to identify specific nodes on a network.




Caution: The switch must be set to a non-zero value. Setting it to zero causes the SynqNet RESET to be bypassed, and the drive will not function correctly on the SynqNet network.

4.4 Description of Display

Drive Status is indicated using the 7-segment LED that is located on the front panel. This display shows drive status and drive fault codes. In the case that more than one fault exists, fault codes are displayed on the 7-segment LED according to their priority and only one fault code will be displayed. Read the Fault Status Word for a complete fault summary.

Most faults (except for Over-Current) are resettable, and do not require power cycling. When a fault occurs, remove the source of the fault and then execute the Fault Clear instruction. See section on Clearing Faults.

The following table shows the display codes, the description and the fault priority.

Description	Comments	Fault Display Priority
Decimal point only	After logic power is applied, the LED will show a decimal point only. The drive is not operational at this point; A SynqNet RESET needs to be executed in order to bring the drive to an operational state	
Steady '2' only	Torque Mode: the drive is configured and ready to be enabled	
Steady '2' with a decimal point	The decimal point is on when the drive is enabled	
Flashing '2'	When using MENCTYPE 4 (WNS encoder initialization), this indicates that the drive is configured and ready to be enabled. The encoder initialization process will begin when the drive is enabled.	
Steady 'F'	Drive in foldback (current limiting). This is a <i>warning</i> only.	
Flashing 	Flash memory checksum failure (at power up). Need to re-configure the drive's parameters and SAVE them in the flash memory.	1 (highest priority)
Flashing 'P'	Over-current. Results from either a short circuit on the motor power, or by excessive current loop gain. This fault can only be cleared by cycling the power of the drive.	2
Flashing 'o'	Over-voltage. Generally caused by regenerative voltage when decelerating the motor. Use a regen resistor to absorb the regen energy.	3
Flashing 't'	Drive over-temperature	4
Flashing 'u'	Under-voltage. This fault will appear when the main AC power is not connected. It may also appear during high accelerations. If this is the case, consider programming UVMODE to ride through temporary voltage sags, and UVRECOVER to determine how the drive recovers from an under-voltage fault. The under-voltage threshold may also need to be set appropriately, and this is done using the UVTRESH parameter.	5
Alternating '1' and minus sign (-)	The drive is not configured. Load a configuration file and execute the Configuration instruction (Direct Command 0x20). This fault will also appear if any of the motor parameters were changed. As above, execute the Configuration instruction to re-configure the drive.	6
E	EEPROM fault. This is a hardware failure and the drive must be returned for repair	7
Alternating 'c' and '1'	SynqNet communications fault. Check that the SynqNet cables are in place.	10
Alternating 'r' and '4'	Encoder wire break. Check that the encoder is properly connected. Check that differential encoder signals are being used.	11

Description	Comments	Fault Display Priority
Alternating 'r' and '6'	Illegal Halls. A state of either '000' or '111' was detected on the Halls signals.	12
Alternating 'r' and '5'	Index line break. Check that the Index is properly connected, and that a differential signal is being used. This fault may also appear if the drive is configured (using the MENCTYPE parameter) to recognize an index pulse, but the index is not connected. In this case, set MENCTYPE to the value 6.	13
Alternating '4' and minus sign (-)	The commutation initialization process has failed. Make sure that the values for MJ , IENCSTART and INITGAIN are set correctly.	14
Alternating 'r' and '1' and '0'	EnDat communications fault. The firmware initializes communication with the EnDat in following cases: 1) Commutation initialization required (power up, feedback loss, CONFIG command when encoder related parameters changed e.g. MSININT, MENCRES, etc.). 2) Execution of a user command that initializes communication with EnDat (HWPOS , HSAVE). Check that the EnDat encoder is connected, or check the MENCTYPE parameter to verify that it is correctly set.	15
Alternating 'r' and '8'	A/B out of range. For a sine encoder and a resolver, the drive checks that $\sin^2 + \cos^2 = 1$, within tolerance. This fault indicates that the signal amplitudes are out of tolerance. This fault is not relevant for Encoder feedback.	16
Flashing 'H'	Motor over-temperature. This fault may be triggered if the motor does not contain a temperature-sensing device. If this is the case, set THERMODE to 1, which will tell the drive to ignore this fault.	17
Alternating 'A' and '4'	Internal 1.5V reference failure. This is a drive hardware failure; the unit must be returned for repair.	18
Alternating '3' and minus sign (-)	An Enable command was issued before an ENCSTART command. When working in MENTYPE=3, an explicit ENCSTART command is required before enabling. The Phase Finding procedure should be followed.	
Three horizontal bars	Watchdog: drive firmware failure	

4.5 Drive Configuration

The drive functionality is set using various drive parameters and instructions, which are communicated over the serial port or over SynqNet™. The parameters are stored in non-volatile memory in the drive, to be used on each power-up. Refer to the User Manual for detailed information.

4.6 Enabling the Drive

The drive is enabled by a combination of 3 signals or states:

- Remote Enable. This is a signal in the range of 5-24Vdc, applied to the Remote Enable input on the Controller I/O connector. The state of this signal can be checked using the REMOTE parameter. The drive can be configured to ignore the Remote Enable signal by setting the RMTMODE parameter to the value of 1.
- Software Enable. This command is provided by the motion controller.
- The drive can be enabled only when no faults exist.

By default, the Software Enable is *disabled* at power up.

5 Electrical Specifications

5.1 Input Power

Drive Model		10A	20A
Main Input Power (both axes)	Voltage (DC) Nominal \pm 10%	48VDC	
	KVA		
	Continuous current (Amps)		
	Peak Current (Amps) for 500 msec		
	Peak Current (Amps) for 2 sec		
	Line fuses		
Rated Output Power (Per Axis)	Continuous Power (VA) at 48VDC Input and 45°C (113°F) Ambient	0.35	
	Continuous Current (Arms)	10A for each axis	10A for each axis
	Peak Current (Arms) for 500 mSec	10A for each axis	20A for each axis
	Peak Current (Arms) for 2 Sec	10A for each axis	TBD
	PWM Frequency (kHz) PWM	16	
	Motor Current Ripple (kHz)	32	
	PWM Saturation	92.5% ¹	
Logic Power	+24 VDC Ext. Logic Voltage (volts)	22 to 27	
	+24 VDC Ext. Logic Current (amps sink)		
	+24 VDC Ext. Logic Current (amps max in-rush)	2A for 5msec, and then 1.5A for 7msec	

5.2 Protection and Environment

Protective Functions	Under Voltage trip	User programmable from 12 to 36VDC
	Over Voltage Trip	60VDC (FW versions up to and including 0.1.9) 70VDC (FW versions above 0.1.9)
	Over Temperature Trip	80° C / 176° F
Environment	Operating Temperature	5°C (41°F) to 45°C (113°F)
	Storage Temperature	0°C (32°F) to 70°C (158°F)
	Ambient Humidity	10% to 90%

5.3 I/O

Analog Inputs	Maximum Voltage	\pm 12.5 V differential
	Operating Voltage Range	\pm 10 V differential
	Input Resolution	12 bit
	Sensitivity	6.1mV ²
	Input Impedance/CMR	> 10 K ohms/50 dB
	Frequency Response	LPF at 3.8Khz
	Accuracy	
	Repeatability	

¹ PWM saturation affects the useable bus voltage. With a 48V input and with PWM saturation set to 92.5%, the effective bus voltage is 44.4V. This affects the maximum achievable speed.

² 25V(full span)/4096 (12 bit)

Bus Voltage Measurement	Filtering	LPF at 3Hz
Drive Temperature Measurement	Filtering	LPF at 1.5kHz
General Purpose Digital Inputs Over-Travel and Home Remote Enable	Input circuit characteristic	Opto-coupler
	Input voltage	5-24Vdc
	Maximum current	10mA per input
	Delay	
General Purpose Digital Outputs	Output circuit characteristic	Opto-coupler; open collector, common emitter, Sink configuration
	Maximum load capacity	24Vdc / 60mA
	Maximum saturated voltage	2V
Fast Inputs	Input Signal Characteristic	RS422
	Maximum frequency	2.5MHz
Fast Outputs	Output format	RS422
	Maximum frequency	2.5MHz

5.4 Encoder Feedback

Encoder power supply	Encoder supply Voltage	5VDC
	Encoder supply current	300mA for each encoder interface
Quadrature Encoder	Signal Characteristics	
	A/B	Differential RS422
	Index	Differential RS422
	Halls	Differential, single-ended or open-collector
	Maximum quadrature input frequency	3MHz (before quadrature)
Sine Encoder	Signal Characteristics	
	A/B	Differential, 1Vp-p @ 2.5V offset
	Index	Differential 1Vp-p or RS422
	Halls	Differential, single-ended or open-collector
	EnDat	RS422 data + clock
	Maximum sine encoder input frequency	-3dB at 265kHz
Interpolation	Set by a drive parameter (MSININT) Maximum value is x512 before quadrature. Equivalent resolution in counts per rev is $MENCRES * MSININT * 4$	



Note: The quadrature encoder **must** have differential RS-422 A, B, Z signals. The PicoDAD will not work with single-ended TTL feedback signals.

5.5 Resolver

The PicoDAD can use single-speed (two-pole) resolver feedback to monitor the motor shaft position. A resolver can be thought of as a transformer whose output is unique for any given shaft position (an absolute position feedback). The transformer is driven with a sine wave reference signal. Two AC signals are returned from the resolver into the Sine and Cosine inputs.

Type	Single-pole
Transformation Ratio	0.4 to 0.6 (dependant on the Resolver itself)
Modulation Frequency	8kHz
Input Voltage (From Drive)	
Max DC Resistance	
Max Drive Current	
Output Voltage (To Drive)	
Accuracy	
ResBW = 300	TBD ArcMin
ResBW = 600	TBD ArcMin
Repeatability	
ResBW = 300	TBD ArcMin
ResBW = 600	TBD ArcMin

6 Hardware Specifications