USER MANUAL

Accessory 8K2

Intelligent Power Block (IPB) Interface Board

3Ax-602655-xUxx

October 29, 2003

DELTA TAU
Data Systems, Inc.
NEW IDEAS IN MOTION ...

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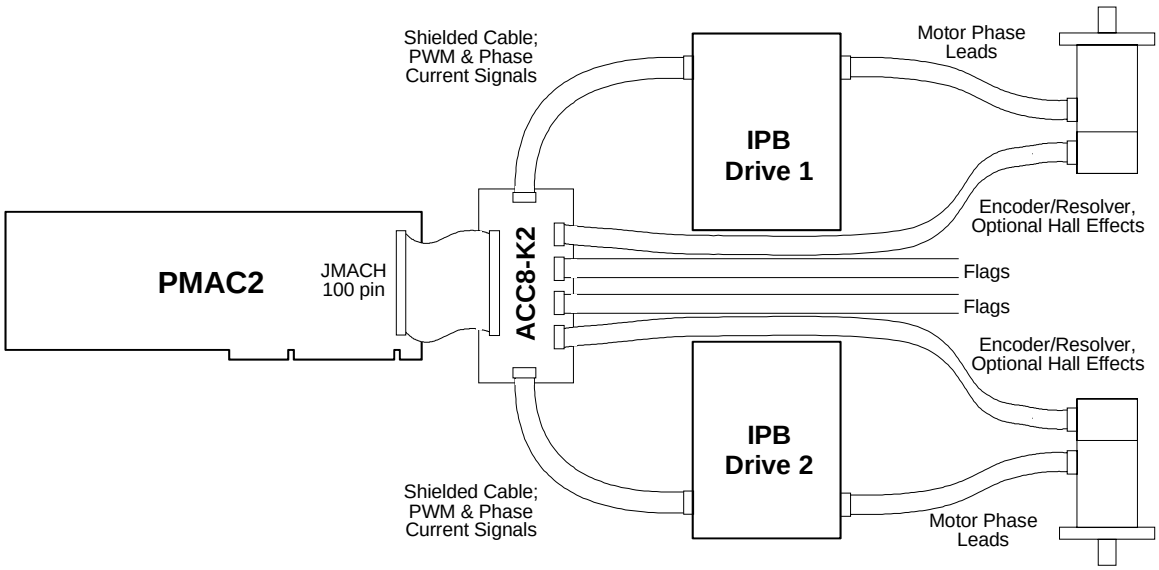
INTRODUCTION

PMAC2's Accessory 8K2 (ACC-8K2) is a 2-axis board designed for easy connection to the Kollmorgen Industrial Drives Power Block product line. The ACC-8K2 allows the Industrial Drives Power Block (IPB) family of servo drivers (using IPB mode 1) to interface with the PMAC2 controller to provide the drive for 3-phasecommutated motors. The ACC-8K2 interface card provides the 3-phase outputs, analog phase current inputs, encoder and flag signals for each of the two axes. The drawing below shows the interconnection of the ACC-8K2, PMAC2, Motors, and servo amplifiers.



The PMAC2 can drive the commutation of a motor through a 3-phase servo amplifier accurately and efficiently using the two current sensors that are provided in the amplifier. Since the IPB product line provides these signals to PMAC2, then the current in a 3-phase permanent magnet brushless servomotor or AC induction motor may be monitored for precise commutation, resulting in precise control of each motor on a per-axis basis.

ACC-8K2 is one of a series of I/O accessories for PMAC2. The interface to the PMAC2 is made using the JMACH connector cable. This 24inch (61cm) cable is supplied with the board.

The ACC-8K2 has 16-pin Molex connectors for the amplifier command signals, 12-pin Molex connectors for the amplifier feedback signals and an 8-pin Molex connector for power. All of these connectors match the pinout at the IPB amp and power supply end so straight-across cables can be used.

The ACC-8K2 (Option 1B) has two DB-25 connectors for the encoder and Hall Effect input signals. These connectors match the Kollmorgen quadrature encoder specification. Option 1A provides terminal connectors for alternate interconnection requirements.

When used with the ACC-8K2, the PMAC2 provides three pairs of pulse trains, which have constant frequency and variable pulse width. This scheme is known as Pulse Width Modulation (PWM).

OPTIONS

One of the following options must be selected when ordering the ACC-8K2:

Option 1A - Encoder and Hall Effect inputs use terminals (TB3, TB4, TB5, TB6).

Option 1B - Encoder and Hall Effect inputs use DSUB connectors (P4, P7).

LED INDICATORS

Refer to the layout diagram of ACC-8K2 for the location of the LED indicators on the board.

Watchdog Fault

This red LED will illuminate when there is a watchdog fault. This LED is identical in function to the red LED on PMAC2's processor board. Refer to the PMAC User Manual for more information on the watchdog operation. This LED is D1 on the circuit card.

AMP1-ENA

This green LED illuminates when the amplifier enable output signal for axis #1 is active. This LED is D2 on the circuit board.

AMP1-FLT

This amber LED will illuminate when the FAULT input to the ACC-8K2 card has been activated on axis #1. When the servo amplifier is indicating a fault state, this LED will illuminate. If the fault state in the amplifier is reset, this LED will cease to be lit. This may occur even if the PMAC2 has not been reset from its fault action. This LED is D4 on the circuit board.

If there is no connection to the fault line from the external servo amplifier, this line will indicate a fault condition.

AMP2-ENA

This green LED illuminates when the amplifier enable output signal for axis #2 is active. This LED is D3 on the circuit board.

AMP2-FLT

This amber LED will illuminate when the FAULT input to the ACC-8K2 card has been activated on axis #2. When the servo amplifier is indicating a fault state, this LED will illuminate. If the fault state in the amplifier is reset, this LED will cease to be lit. This may occur even if the PMAC2 has not been reset from its fault action. This LED is D5 on the circuit board.

If there is no connection to the fault line from the external servo amplifier, this line will indicate a fault condition.

CONNECTORS

Refer to the layout diagram of ACC-8K2 for the location of the connectors on the board. A pin definition listing for each connector begins on page 21 of this manual.

JMACH1

This is the 100-pin connector that attaches the ACC-8K2 to the PMAC2.

P1

This is an 8-pin terminal block that provides the connection for an external power supply. This connector matches the connector on the IPB family of servo power supplies and ACC-8K2 receives its power from the daisy-chained cable that interconnects IPB family products.

P2

This 12-pin connector is the interface for the current feedback for axis #1. The cable at this connector attaches between the ACC-8K2 and the IPB servo amplifier.

P3

This 16-pin connector provides the PWM drive outputs for the servo amplifier at axis #1. The cable at this connector attaches between the ACC-8K2 and the IPB servo amplifier.

P4 (Option 1B)

This 25-pin DSUB connector is used for encoder and Hall effect inputs at axis #1. This connector also provides the input signal for an overtemp sensor. The cable at this connector attaches between the ACC-8K2 and the motor (at its encoder connection).

P5

This 12-pin connector is the interface for the current feedback for axis #2. The cable at this connector attaches between the ACC-8K2 and the IPB servo amplifier.

P6

This is a 16-pin connector that provides the PWM drive outputs for the servo amplifier at axis #2. The cable at this connector attaches between the ACC-8K2 and the IPB servo amplifier.

P7 (Option 1B)

This 25-pin DSUB connector is used for encoder and Hall Effect inputs at axis #2. This connector also provides the input signal for an overtemp sensor. The cable at this connector attaches between the ACC-8K2 and the motor (at its encoder connection).

P8

This 14-pin header provides an alternate input for Hall Effect inputs or TUVW flags and USER flag. This header provides connections for both axes and is used by Delta Tau's sub-count interpolation board.

TB1

This 6-pin connector strip provides the input for user flags on axis #1. These inputs are designed for 12-24 Vdc operation.

TB2

This 6-pin connector strip provides the input for user flags on axis #2. These inputs are designed for 12-24 Vdc operation.

TB3 (Option 1A)

This connector strip is provided for encoder inputs on axis #1. Eight pins are used to connect a quadrature encoder. 5Vdc is provided for encoder power (100mA max).

TB4 (Option 1A)

Hall Effect inputs are connected here for axis #1. 5Vdc is provided at this connector.

TB5 (Option 1A)

This connector strip is provided for encoder inputs on axis #1. Eight pins are used to connect a quadrature encoder. 5Vdc is provided for encoder power (100mA max).

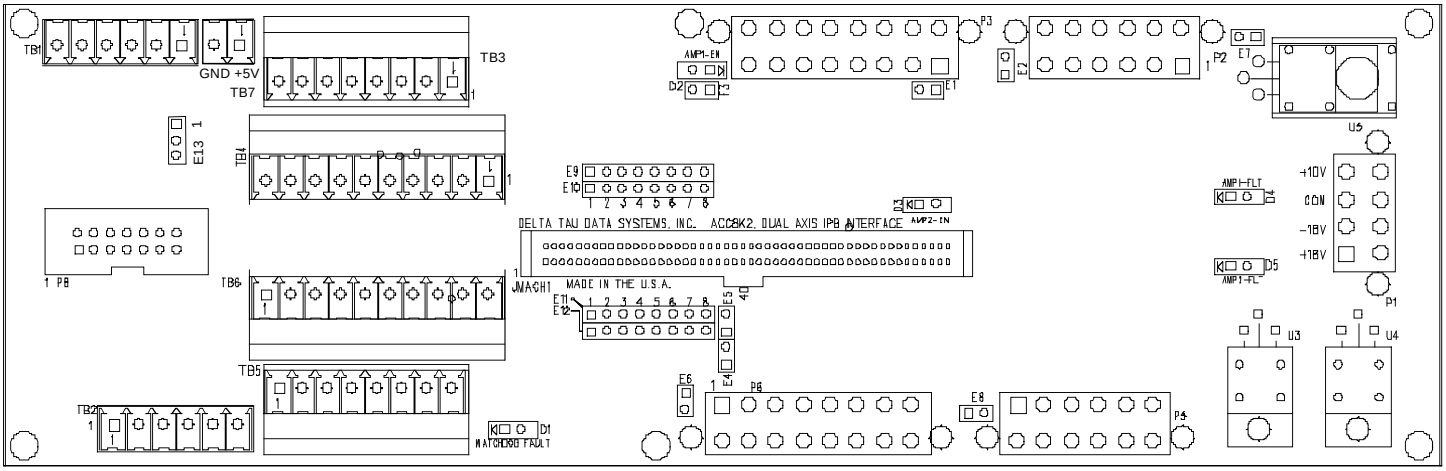
TB6 (Option 1A)

Hall Effect inputs are connected here for axis #1. 5Vdc is provided at this connector.

TB7 (Assys 602655-102 and Later)

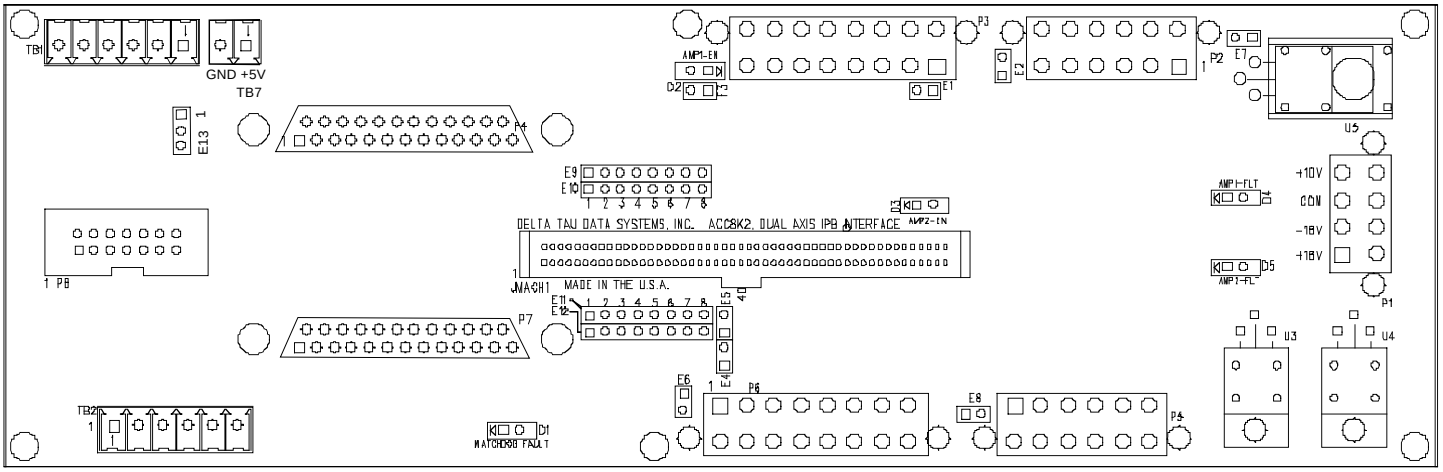
The user provides +5Vdc power here for encoders. By providing an external power supply for the encoders, PMAC can track the motor's position while the amplifier is shut off. This may occur if an E-stop switch removes power from the amplifier.

LAYOUT DIAGRAMS



LAYOUT DIAGRAM ACC-8K2 OPTION 1A

CONNECTORS, JUMPERS, AND LEDs



LAYOUT DIAGRAM ACC-8K2 OPTION 1B

CONNECTORS, JUMPERS, AND LEDs

I-VARIABLE ASSIGNMENTS

There are a group of I-variables that should be set to perform proper PWM motor control functions using the ACC-8K2 interface. Refer to the "PMAC2 Hardware/Software Reference" for more complete details on I-variable assignments. The following I-variables are important to be set properly for PWM interface between the PMAC2 and Kollmorgen IPB:

Global Gate Array Variables

I-Var.	Value	Description	Notes
I900	2183	Maxphase and PWM 1-4 Freq.	13.5 kHz PWM 27 kHz Maxphase
I901	2	Phase Clock Freq. Control	9 kHz
I902	3	Servo Clock Freq. Control	2.25 kHz
I903	2258	Hardware Clock Control CH1-4	See Software Reference
I904	15	PWM Deadtime CH1-4	≈2 μSec
I906	2183	Maxphase and PWM CH5-8 Freq.	13.5 kHz PWM 27 kHz Maxphase
I907	2258	Hardware Clock Control CH5-8	See Software Reference
I908	15	PWM Deadtime CH5-8	≈2 μSec

Channel Specific Gate Array Variables

I-Var.	Value	Description	Notes
I9n0	3	Encoder/Timer n Decode Control	X4 Quadrature Decode CW
I9n6	0	Output n Mode Select	Outputs A,B,C are PWM
I9n7	0	Output n Invert Control	Default

Motor I-Variables

WARNING:

Always disconnect motors from the driven load when running with flags disabled.

I-Var.	Value	Description	Notes
Ix00	1	Motor x Activate	Enable motor calculations
Ix01	1	Commutate Enable	Enable commutate calculations
Ix02	default	Command Output Address	See PMAC2 Software Reference
Ix03	default	Position Loop Address	See Software Reference
Ix04	default	Velocity Loop Address	See Software Reference
Ix08	96	Positive Loop Scale Factor	See Software Reference
Ix09	96	Positive Velocity Scale Factor	See Software Reference
Ix25	$C2xxxx	Limit/Home flag/Amp flag Address	Defeat limit flags ❶
Ix29	0	Output/First Phase Offset	
Ix61	0	Current Loop Integral Gain	Will Be Set During Current Loop Tuning
Ix62	0	Current Loop Prop. Gain (Forward)	Will Be Set During Current Loop Tuning
Ix66	See Note	PWM Scale Factor	Voltage Output Scaling ❷
Ix69	See Note	Output Command Limit	Max Current Level Limit ❸
Ix70	2	Number of Commutation Cycles	Number of Pole Pairs ❹
Ix71	4096	Encoder counts per Rev.	❹❺
Ix72	85	Commutation Phase Angle	Set for IPB value.
Ix76	0	Current Loop Proportional Gain (Backpath)	Will Be Set During Current Loop Tuning
Ix77	0	Induction Motor Mag Cur	Will be Set After Current Loop Tuning
Ix78	0	Induction Motor Slip Gain	Will be Set After Current Loop Tuning
Ix79	0	Output/Second Phase Offset	
Ix82	See Note	Current Loop Feedback Address	See PMAC2 Software Reference ❻
Ix83	See Note	Commutation Position Address	See PMAC2 Software Reference ❼
Ix84	$FFF000	Current-Loop Feedback Mask Word	Bit mask for 12 bit A-D converter

❶ The '2' will defeat limit switches when added to the Limit/Home Flag/Amp Flag address. This is put in the table to remind the user that motors will not run if the flags are enabled with nothing connected to the flag inputs. When reset, the PMAC2 default values are acceptable for typical axis assignments, except that flags are enabled.

❷ The Ix66 parameter is used to limit the maximum drive PWM allowed into the motor phase coils. This value must be non-zero to perform the motor setup procedures. Ix66 is scaled in units to I900 or I906. When Ix66 is set to the same value as I900 or I906, the voltage applied to a motor will approach the maximum that the servo driver can supply. The Ix66 value should take into account the ratio between the motor's maximum line-to-line voltage and the actual bus voltage that the servo amplifier may deliver. The value of Ix66 should be set to I900 + 10% (2401) when the bus voltage on the servo amplifier is close to the voltage rating of the motor. When the motor's maximum voltage rating is less than the amplifier's maximum output, Ix66 *must* be scaled to prevent excess current from damaging the motor. If a motor is used that has a current rating that exceeds the amplifier, Ix66 might be reduced to prevent overcurrent faults in the amplifier.

❸ The Ix69 parameter is used to scale how much current is applied to the motor phase coils. The Ix69 parameter has a maximum value of 32,767. The ratio of Ix69 to 32,767 will scale how much current is provided to the motor coils. Use the peak current of both the motor and the amplifier to determine the Ix69 parameter.

The equation for Ix69 is: $Ix69 = \frac{Ipk\ (motor)}{Ipk\ (amp)} * 32{,}767$

For most applications, Ix69 should be left at the default value of 20480.

❹Each pole pair represents a commutation cycle. If a bias were placed on 1 phase of the motor, the pole pair count would be the number of magnetic 'stops' that would be encountered in 1 rotation of the motor shaft. The number of encoder counts per revolution is divided by the number of commutation cycles per revolution to determine how many encoder counts to use for each commutation cycle.

❺The value of 4096 is used in Ix71 because that is the number of counts per revolution that the resolver puts out in a Delta Tau ACC-8D Option 7 (Resolver to Digital Converter Card). This number will probably need to be different if a quadrature encoder is used.

❻Typical values are:

I182: $C006	I282: $C00E
I382: $C016	I482: $C01E
I582: $C026	I682: $C02E
I782: $C036	I882: $C03E

❼When using encoder inputs, typical values are:

I183: $C001	I283: $C009
I383: $C011	I483: $C019
I583: $C021	I683: $C029
I783: $C031	I883: $C039

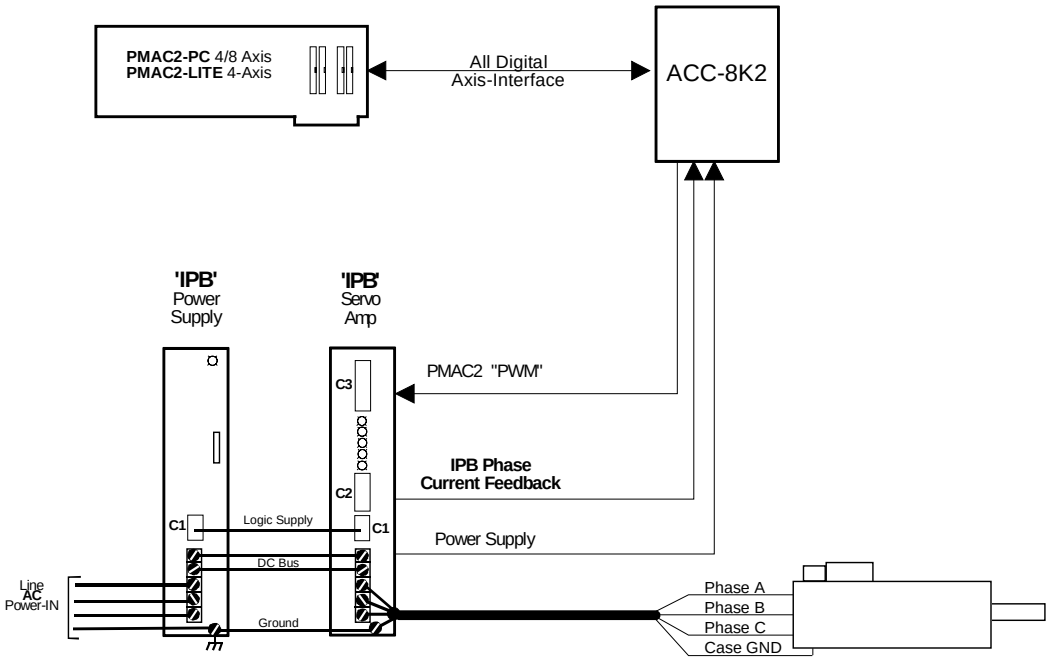
PMAC2, ENCODER, AND MOTOR INTERCONNECTION

Motor

When connecting the motor to the IPB amplifier, be sure to use a wire, which has a suitable thickness for carrying the currents necessary to run the motor at its peak current. Twisting the 3 phase wires will help to reduce noise generated by the phase switching. If maximum noise reduction is desired, a shielded cable may be used.

Always connect the chassis ground wires from the motor to the servo amplifier. Also, be sure that all servo amplifiers have a wire connected between their ground post and the equipment's earth ground.

Motor Wiring



Note - Reduce Radiated noise by twisting Phase wires on motor
Further reduce radiated noise by using Shielded wiring

Encoder

When connecting the encoder to the ACC8-K2 interface be sure to use a wire which is multi-paired with an overall shield such as Belden #8334 or equivalent. The 5Vdc and ground supply conductors may be routed through a 4th pair in the same cable jacket as the encoder signals.

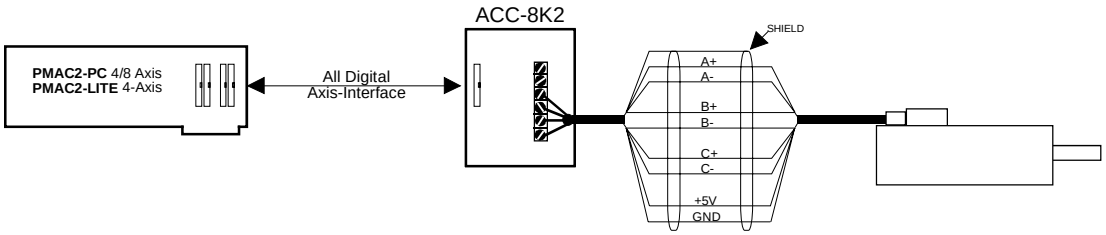
Note

Shielding the power supply lines is *not* required.

Multi-paired cable with individual shields is also acceptable for encoder wiring such as Belden #9728 or equivalent.

Always route the encoder wires back to the ACC8-K2 interface separately from the motor wires. The motor cabling may emit extremely high levels of energy that could damage the encoder or the ACC8-K2 interface card.

Encoder Wiring



Note - Shield wire is only connected at one end.
Conductors are twisted pairs.

Resolver

When connecting a resolver, follow the installation instructions for the ACC-8D Option 7.

Note

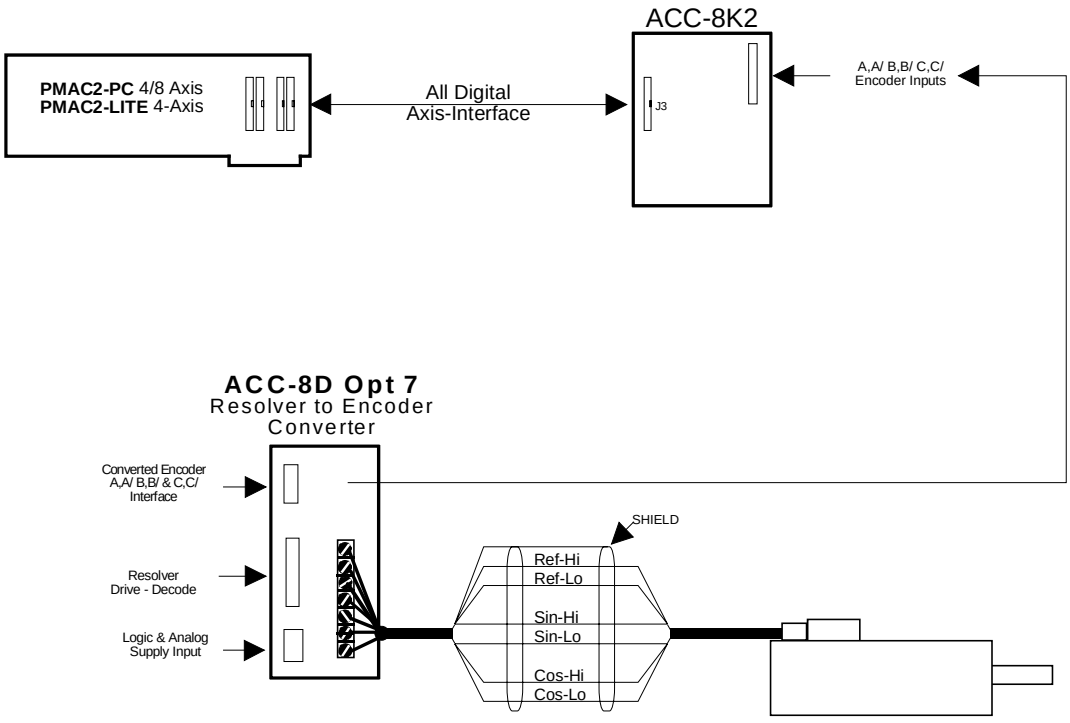
The wire is multi-paired cable with an overall shield such as Belden #8333 or equivalent.

The ACC-8D Opt 7 typically uses a ribbon cable or short lead wires to connect to the ACC-8K2.

Multi-paired cable with individual shields (Belden #9730 or equivalent) is also acceptable for resolver wiring.

Always route the resolver wires back to the ACC-8D Option 7 separately from the motor wires. The motor cabling may emit extremely high levels of energy that could damage the Resolver-to-Digital Converter adapter card.

Resolver Wiring



Note - Shield wire is only connected at one end.
Conductors are twisted pairs.

SETTING UP COMMUTATION

A detailed description for how to set up commutation is provided in the PMAC2 User's Manual.

There are three processes that must be followed when setting up the IPB servo amplifiers for the first time:

1. Testing PWM & Current Feedback Operation
2. Digital Current Loop Tuning For PMAC2
3. PMAC2 Commutation Phase Referencing.

Testing PWM & Current Feedback Operation

This process guarantees that when the motor is wired to the IPB servo amplifier that polarities for encoder UP/DN counting and motor phasing have proper correlation. Since the PMAC2 commutation algorithm uses the encoder input for establishing the phase angle for commutation, it is important to ensure that the motor turns the encoder in the proper direction. When wired per the IPB instruction manual and the I-Variables are set at the values listed in the table above, this procedure will verify the motor connections.

Digital Current Loop Tuning for PMAC2

The commutation process for a motor involves calculating and providing the current path that causes magnetic fields to be developed in the coils of the motor. The total amount of current flowing into each phase coil of a motor must be equal to zero if Norton loop current laws are to be maintained.

There are several parameters that are set up in this process. They provide the PMAC2 with needed parameters to perform phase current drive. These adjustments help establish the response of the PMAC2-Servo amp-Motor system.

PMAC2 Commutation Phase Referencing

Commutation is a position-dependent process that aligns the motor poles to the commutation algorithm.

A register in the PMAC2 receives encoder inputs from the motor shaft. To maintain synchronization between the commutation algorithm and the actual motor position, a ring counter is established which maintains the number of counts per commutation cycle.

The counts per commutation cycle is derived from the ratio of Ix71 to Ix70 (Encoder counts/rev ÷ Number of Pole Pairs).

When the proper phase biasing is provided to the motor, the ring counter gets reset to 0. This will align the commutation calculations to the actual motor position. This process allows the motor to achieve maximum torque.

Things to Know

When tuning the motor parameters and making the motor spin for the first time, the motor should be disconnected from the load.

After tuning is completed, but before connecting the load to a motor, be sure that limit switches are in place. Also, be sure that the I-variable, which corresponds to its LIMIT/HOME FLAG ADDRESS (Ix25), has been enabled by removing the prefix that has been inserted in the setup procedures above. After enabling the flags, if the axis appears not to work, the limit switches should be checked for proper polarity and direction input.

Maximum speed and acceleration are determined for a motor system after the load has been connected.

Note

The amplifier bus voltage may limit the maximum speed that the motor may be allowed to spin. The bus voltage on the IPB is less when it is connected to 120Vac than when it is connected to 3-phase 240Vac. This *will* have an effect on the maximum speed that the motor will spin.

PMAC2 maintains an encoder count input for each axis to accommodate motor commutation. Encoder reliability must be ensured for commutation reliability.

On assemblies 602655-101, TB7 is not included for external encoder power. When E-STOP switches are used to remove supply power from the IPB Servo amplifier, it should be noted that the encoders would lose power also. This creates the need for re-phasing each time after power is applied. In machines that use this kind of circuit that have ASSY 602655-101, you should provide external power to the encoders to maintain count integrity when the amplifier power is removed.

CONNECTOR PINOUTS

Headers, Terminal Blocks, Molex, and DSUB Connectors

JMACH (100-Pin Header)

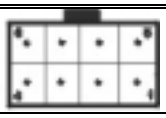
This header provides the connection to the matching 100-pin header on the PMAC2. It contains all the input and output signals between this board and the PMAC2.

Refer to the "PMAC2 Hardware/Software Reference" for a complete listing of JMACH connector pins.

Note

On the ACC-8K2, all channels are numbered 1 or 2. However, if the ACC-8K2 is connected to PMAC2's JMACH2, it represents PMAC2 channels 3-4; JMACH3 represents channels 5-6; JMACH4 represents channels 7-8.

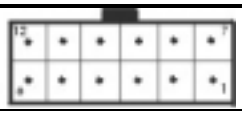
P1 (8-Pin Power Supply Input Molex Connector)

Top View 

Pin #	Symbol	Function	Description	Notes
1	A+18V	Input	Positive supply voltage: +14.5V to +26.5V	Generates +12Vdc supply on ACC-8K2
2	A-18V	Input	Negative supply voltage: -14.5V to -6.5V	Generates -12Vdc supply on ACC-8K2
3	A_COM	Common	Power supply return	Connects to PMAC2 GND
4	A+10V	Input	Positive supply voltage: +6.5V to +14V	Generates +5Vdc supply on ACC-8K2
5	A+18V	Input	Positive supply voltage: +14.5V to +26.5V	Generates +12Vdc supply on ACC-8K2
6	A-18V	Input	Negative supply voltage: -14.5V to -26.5V	Generates a-12Vdc supply on ACC-8K2
7	A_COM	Common	Power supply return	Connects to PMAC2 GND
8	A+10V	Input	Positive supply voltage: +6.5V to +14V	Generates +5Vdc supply on ACC-8K2

This Molex connector provides the input for the power supply for the circuits on the board. It is designed to be directly compatible with the Kollmorgen IPB power supply cable.

P2 (12-Pin Current Feedback Molex Connector)

Top View 

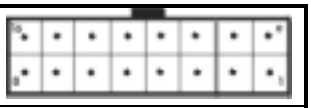
Pin #	Symbol	Function	Description	Notes
1	N.C		No connect	
2	N.C		No connect	
3	N.C		No connect	
4	N.C		No connect	
5	CUR_A1+	Input +	Phase 'A' current input (pos.)	Differential input with CUR_A1- ❶
6	CUR_C1+	Input +	Phase 'C' current input (pos.)	Differential input with CUR_C1- ❶❷
7	N.C		No connect	
8	N.C		No connect	
9	SHIELD		Shield connection	Jumper 'E7' connects to ground
10	N.C		No connect	
11	CUR_A1-	Input -	Phase 'A' current input (neg.)	Differential input with CUR_A1+ ❶
12	CUR_C1-	Input -	Phase 'C' current input (neg.)	Differential input with CUR_C1+ ❶❷

This connector provides the current feedback for the 1st axis amplifier.

❶ Maximum scaled input is +/- 8.5 Vdc.

❷ The Kollmorgen IPB servo driver amplifier returns current measurement for phase C. ACC-8K2 swaps phase B and phase C (i.e. PMAC2's phase B output is connected to IPB's Phase C input).

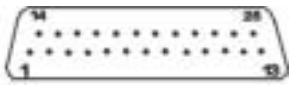
P3 (16-Pin Command Output Molex Connector)

Top View 

Pin #	Symbol	Function	Description	Notes
1	IPB_PHA+	Output	Phase 'A' top command	
2	SHIELD-A1	Shield	Phase 'A' shield	Jumper 'E1' connects to ground
3	IPB_PHB+	Output	Phase 'B' top command	IPB Phase B is PMAC Phase C
4	SHIELD-C1	Shield	Phase 'C' shield	Jumper 'E2' connects to ground
5	IPB_PHC+	Output	Phase 'C' top command	IPB Phase C is PMAC Phase B
6	N.C.		No connect	
7	AENA1-	Output	Amplifier enable control line	Low is enable
8	FAULT RET	Ground	Amplifier fault ret. signal	Grounded on PMAC; pin 16 used as signal
9	IPB_PHA-	Output	Phase 'A' bottom command	
10	SHIELD-B1	Shield	Phase 'B' shield	Jumper 'E3' connects to ground
11	IPB_PHB-	Output	Phase 'B' bottom command	IPB Phase B is PMAC Phase C
12	SHIELD	N.C.		Place to land spare shield wire
13	IPB_PHC-	Output	Phase 'C' bottom command	IPB Phase C is PMAC phase B
14	RST_SRC	Output	+5Vdc	Supply for reset optos in amp.
15	1OUT3	Output	Fault reset	Taken low, then high, to reset amplifier after amplifier enable
16	FAULT1+	Input	Amplifier fault signal	Amplifier holds low when not in fault

This connector provides the command outputs for the 1st axis.

P4 (25-Pin Encoder and Hall-Effect Feedback DSUB Connector) {Option 1B only}

Top View 

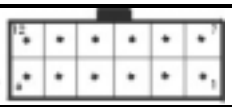
Pin #	Symbol	Function	Description	Notes
1	A1	Input	Encoder CHAN A+	
2	/A1	Input	Encoder CHAN A-	
3	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
4	B1	Input	Encoder Channel B+	
5	/B1	Input	Encoder Channel B-	
6	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
7	E5V_RET	Common	Enc. Supply return	
8	E5V_RET	Common	Enc. Supply return	
9	HALL11-	Input	For CHU flag	❶
10	HALL12-	Input	For CHV flag	❶
11	HALL13-	Input	For CHW flag	❶
12	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
13	THERM1+	Input	For CHT FLAG	Motor Thermal Sensor
14	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
15	INDEX1	Input	Encoder Channel C+	
16	/INDEX1	Input	Encoder Channel C-	
17	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
18	E5V_SUPPLY	Output	Supply for encoder	
19	E5V_SUPPLY	Output	Supply for encoder	
20	E5V_SUPPLY	Output	Supply FOR encoder	
21	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
22	HALL11+	Input	For CHU flag	❷
23	HALL12+	Input	For CHV flag	❷
24	HALL13+	Input	For CHW flag	❷
25	THERM1-	Input	For CHT Flag	Motor thermal sensor

This connector provides the encoder and hall-effect feedback for the 1st axis.

❶ A Negative signal can be used for differential line driver pair with SIP jumper installed in E10 position. To select open-collector operation, move SIP jumper to E9.

❷ A Positive signal can be used for differential line driver pair with SIP jumper installed in E10 position. When selected for open-collector operation (SIP jumper at E9), these inputs are not used.

P5 (12-Pin Current Feedback Molex Connector)

Top View 

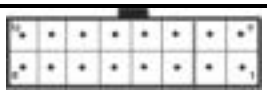
Pin #	Symbol	Function	Description	Notes
1	N.C		No connect	
2	N.C		No connect	
3	N.C		No connect	
4	N.C		No connect	
5	CUR_A2+	Input +	Phase 'A' current input (pos.)	Differential input with CUR_A2- ❶
6	CUR_C2+	Input +	Phase 'C' current input (pos.)	Differential input with CUR_C2- ❶❷
7	N.C		No connect	
8	N.C		No connect	
9	SHIELD		Shield Connection	Jumper 'e8' connects to ground
10	N.C		No connect	
11	CUR_A2-	Input -	Phase 'A' current input (neg.)	Differential input with CUR_A2+ ❶
12	CUR_C2-	Input -	Phase 'C' current input (neg.)	Differential input with CUR_C2+ ❶❷

This connector provides the current feedback for the 2nd axis.

❶ Maximum scaled input is +/- 8.5 Vdc.

❷ The Kollmorgen IPB servo driver amplifier returns current measurement for phase C. ACC-8K2 swaps phase B and phase C (i.e. PMAC2's phase B output is connected to IPB's Phase C input).

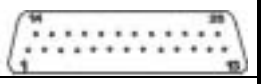
P6 (16-Pin Command Output Molex Connector)

Top View 

Pin #	Symbol	Function	Description	Notes
1	IPB_PHA+	Output	Phase 'A' top command	
2	SHIELD-A2	Shield	Phase 'A' shield	Jumper 'E4' connects to ground
3	IPB_PHB+	Output	Phase 'B' top command	IPB Phase B is PMAC Phase C
4	SHIELD-C2	Shield	Phase 'C' shield	Jumper 'E5' connects to ground
5	IPB_PHC+	Output	Phase 'C' top command	IPB Phase C is PMAC Phase B
6	N.C.		No connect	
7	AENA2-	Output	Amplifier enable control line	Low is enable
8	FAULT RET	Ground	Amplifier fault ret signal	Grounded on PMAC; pin 16 used as signal
9	IPB_PHA-	Output	Phase 'A' bottom command	
10	SHIELD-B2	Shield	Phase 'B' shield	Jumper 'E6' connects to ground
11	IPB_PHB-	Output	Phase 'B' bottom command	IPB Phase B is PMAC Phase C
12	SHIELD	N.C.		Place to land spare shield wire
13	IPB_PHC-	Output	Phase 'C' bottom command	IPB Phase C is PMAC Phase B
14	RST_SRC	Output	+5Vdc	Supply for reset optos in amp.
15	2OUT3	Output	Fault reset	Taken low, then high, to reset amplifier after amplifier enable
16	FAULT2+	Input	Amplifier fault signal	Amplifier holds low when not in fault

This connector provides the command outputs for the 2nd axis.

P7 (25-Pin Encoder and Hall-Effect DSUB Connector) {Option 1B only}

Top View 

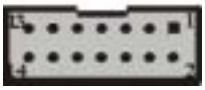
Pin #	Symbol	Function	Description	Notes
1	A2	Input	Encoder CHAN A+	
2	/A2	Input	Encoder CHAN A-	
3	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
4	B2	Input	Encoder Channel B+	
5	/B2	Input	Encoder Channel B-	
6	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
7	E5V_RET	Common	Enc. Supply return	
8	E5V_RET	Common	Enc. Supply return	
9	HALL21-	Input	For CHU flag	❶
10	HALL22-	Input	For CHV flag	❶
11	HALL23-	Input	For CHW flag	❶
12	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
13	THERM2+	Input	For CHT FLAG	Motor thermal sensor
14	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
15	INDEX2	Input	Encoder Channel C+	
16	/INDEX2	Input	Encoder Channel C-	
17	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
18	E5V_SUPPLY	Output	Supply for encoder	
19	E5V_SUPPLY	Output	Supply for encoder	
20	E5V_SUPPLY	Output	Supply FOR encoder	
21	SHIELD	Shield	Not connected inside ACC-8K2	Tied at other end only
22	HALL21+	Input	For CHU flag	❷
23	HALL22+	Input	For CHV flag	❷
24	HALL23+	Input	For CHW flag	❷
25	THERM2-	Input	For CHT Flag	Motor thermal sensor

This connector provides the encoder and hall-effect feedback for the 2nd axis.

❶ A Negative signal can be used for differential line driver pair with SIP jumper installed in E12 position. To select open-collector operation, move SIP jumper to E11.

❷ A Positive signal can be used for differential line driver pair with SIP jumper installed in E12 position. When selected for open-collector operation (SIP jumper at E11), these inputs are not used.

P8 (14-Pin Sub Count Input Header)

Top View 

Pin #	Symbol	Function	Description	Notes
1	CHT1+	Diff. Input	For #1 CHT flag	
2	CHT1-	Diff. Input	For #1 CHT flag	
3	CHU1+	Input	For #1 CHU flag	
4	CHV1+	Input	For #1 CHV flag	
5	CHW1+	Input	For #1 CHW flag	
6	USER1+	Input	For #1 user flag	
7	CHT2+	Diff. input	For #2 CHT flag	
8	CHT2-	Diff. input	For #2 CHT flag	
9	CHU2+	Input	For #2 CHT flag	
10	CHV2+	Input	For #2 CHV flag	
11	CHW2+	Input	For #2 CHW flag	
12	USER2+	Input	For #2 user flag	
13	GND		IPB & PMAC2 ground	
14	+5VRG		From IPB power supply	

This connector provides access to the T, U, V, W and User flags for sub-count resolver inputs. When inputs are used at this connector, corresponding inputs are not used at encoder inputs.

TB1 (6-Pin Input Flag Terminal Block)

Top View 

Pin #	Symbol	Function	Description	Notes
1	USER1	Input	General capture flag	Sinking or sourcing
2	PLIM1	Input	Positive limit flag	Sinking or sourcing
3	MLIM1	Input	Negative limit flag	Sinking or sourcing
4	HOME1	Input	Home flag	Sinking or sourcing
5	FLG_1_RET	Common	Return for all flags	+V (12 to 24V) or 0V
6	FLG_1_RET	Common	Return for all flags	Connected to pin 5

This terminal block provides the connection for the standard machine input flags for the 1st axis. For flag sensors that use sinking-outputs (open collector), connect the "Flag Return" lines to +V (12-24Vdc) power. For sourcing-output flag sensors, the "Flag Return" lines should be connected to -V (ground or power supply return) on the flag sensors' power supply.

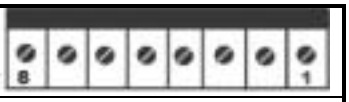
TB2 (6-Pin Input Flag Terminal Block)

Top View 

Pin #	Symbol	Function	Description	Notes
1	USER2	Input	General capture flag	Sinking or sourcing
2	PLIM2	Input	Positive limit flag	Sinking or sourcing
3	MLIM2	Input	Negative limit flag	Sinking or sourcing
4	HOME2	Input	Home flag	Sinking or sourcing
5	FLG_2_RET	Common	Return for all flags	+V (12 to 24V) or 0V
6	FLG_2_RET	Common	Return for all flags	Connected to pin 5

This terminal block provides the connection for the standard machine input flags for the 2nd axis. For flag sensors that use sinking-outputs (open collector), connect the "Flag Return" lines to +V (12-24Vdc) power. For sourcing-output flag sensors, the "Flag Return" lines should be connected to -V (ground or power supply return) on the flag sensors' power supply.

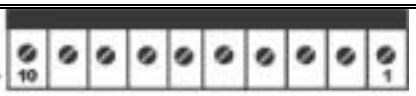
TB3 (8-Pin Encoder Interface Terminal Block) {Option 1A only}

Top View 

Pin #	Symbol	Function	Description	Notes
1	CHA1+	Input	Enc. 1 pos. A Chan.	Also Pulse input
2	CHA1-	Input	Enc. 1 neg. A Chan.	Also Pulse input
3	CHB1+	Input	Enc. 1 pos. B Chan.	Also direction input
4	CHB1-	Input	Enc. 1 neg. B Chan.	Also direction input
5	CHC1+	Input	Enc. 1 pos. C Chan.	Index channel
6	CHC1-	Input	Enc. 1 neg. C Chan.	Index channel
7	ENC+5 V	Output	Digital supply	100mA max
8	GND	Common	Digital ground	

This terminal block provides the interface to a quadrature encoder or the signals of a simulated encoder for the 1st axis.

TB4 (10-Pin Hall-Effect Interface Terminal Block) {Option 1A}

Top View 

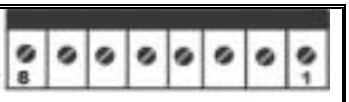
Pin #	Symbol	Function	Description	Notes
1	HALL11+	Input	For CHU flag	❷
2	HALL11-	Input	For CHU flag	❶
3	HALL12+	Input	For CHV flag	❷
4	HALL12-	Input	For CHV flag	❶
5	HALL13+	Input	For CHW flag	❷
6	HALL13-	Input	For CHW flag	❶
7	THERM1+	Input	For CHT FLAG	Thermal Sensor
8	THERM1-	Input	For CHT FLAG	Thermal Sensor
9	ENC+5V	Output	Digital supply	
10	GND	Common	Digital ground	

This terminal block provides the interface to the set of hall-effect flags for the 1st axis.

❶ A Negative signal can be used for differential line driver pair with SIP jumper installed in E10 position. To select open-collector operation, move SIP jumper to E9.

❷ A Positive signal can be used for differential line driver pair with SIP jumper installed in E10 position. When selected for open-collector operation (SIP jumper at E9), these inputs are not used.

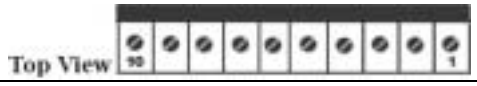
TB5 (8-Pin Encoder Interface Terminal Block) {Option 1A only}

Top View 

Pin #	Symbol	Function	Description	Notes
1	CHA2+	Input	Enc. 2 pos. A Chan.	Also Pulse input
2	CHA2-	Input	Enc. 2 Neg. A Chan.	Also Pulse input
3	CHB2+	Input	Enc. 2 pos. B Chan.	Also direction input
4	CHB2-	Input	Enc. 2 neg. B Chan.	Also direction input
5	CHC2+	Input	Enc. 2 pos. c Chan.	Index channel
6	CHC2-	Input	Enc. 2 neg. c Chan.	Index channel
7	ENC+5V	Output	Digital supply	100mA max
8	GND	Common	Digital reference	

This terminal block provides the interface to a quadrature encoder or the signals of a simulated encoder for the 2nd axis.

TB6 (10-Pin Hall-Effect Interface Terminal Block) {Option 1A only}



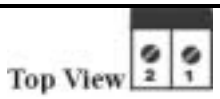
Pin #	Symbol	Function	Description	Notes
1	HALL21+	Input	For CHU flag	❷
2	HALL21-	Input	For CHU flag	❶
3	HALL22+	Input	For CHV flag	❷
4	HALL22-	Input	For CHV flag	❶
5	HALL23+	Input	For CHW flag	❷
6	HALL23-	Input	For CHW flag	❶
7	THERM2+	Input	For CHT flag	Thermal sensor
8	THERM2-	Input	For CHT flag	Thermal sensor
9	ENC+5V	Output	Digital supply	
10	GND	Common	Digital ground	

This terminal block provides the interface to the set of hall-effect flags for the 2nd axis.

❶ A Negative signal can be used for differential line driver pair with SIP jumper installed in E12 position. To select open-collector operation, move SIP jumper to E11.

❷ A Positive signal can be used for differential line driver pair with SIP jumper installed in E12 position. When selected for open-collector operation (SIP jumper at E11), these inputs are not used.

TB7 (2-Pin Encoder Power Terminal Block) (Assys 602655-102 and later)



Pin #	Symbol	Function	Description	Notes
1	+5Vdc	Input	Encoder power	
2	GND	Common	Encoder return	

This terminal block is where the user provides power for encoders.

JUMPERS

Jumper	Description	Notes	Default
E1	PWMA1 shield	Connects PWMA1 shield to digital gnd	Not Installed❶
E2	PWMB1 shield	Connects PWMB1 shield to digital gnd	Not Installed❶
E3	PWMC1 shield	Connects PWMC1 shield to digital gnd	Not Installed❶
E4	PWMA2 shield	Connects PWMA2 shield to digital gnd	Not Installed❶
E5	PWMB2 shield	Connects PWMB2 shield to digital gnd	Not Installed❶
E6	PWMC2 shield	Connects PWMC2 shield to digital gnd	Not Installed❶
E7	CUR1 shield	Connects CUR1 shield to digital gnd	Not Installed❶
E8	CUR2 shield	Connects CUR2 shield to digital gnd	Not Installed❶
E9-E10	AXIS #1 HALL EFFECT Input select	E9 selects single-ended input E10 selects differential input	E9 (single ended input)❷
E11-E12	AXIS #2 HALL EFFECT Input select	E11 selects single-ended input E12 selects differential input	E11 (single ended input)❷
E13	Encoder Power	1 - 2 User supplies encoder +5Vdc 2 – 3 PMAC supplies encoder +5Vdc	1 - 2 (User supplied encoder power)❸

❶ Jumpers E1 - E8 are used to connect the differential input shields to PMAC2's gnd. Typically, the ground connection is provided by the IPB at the amplifier end. Placing a jumper at these locations may result in ground loop noise problems or excessive current between the IPB and the PMAC2 system.

❷ The jumpers used for E9-E10 and E11-E12 consist of a SIP resistor pack. Place the resistor pack into either E9 or E10: E11 or E12.

❸ You should provide uninterrupted power to the encoders. TB7 allows the user to do so when jumpered in the default position.