ESI MOTION™
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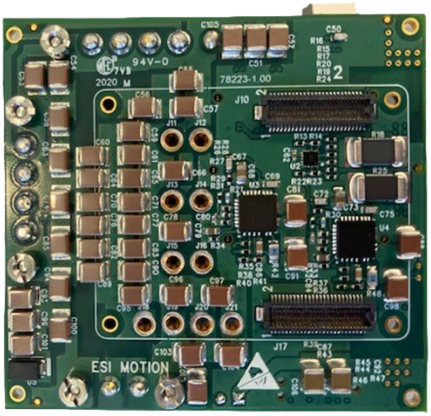
# I/O Board

## for the

# Atom Servo Drive Module



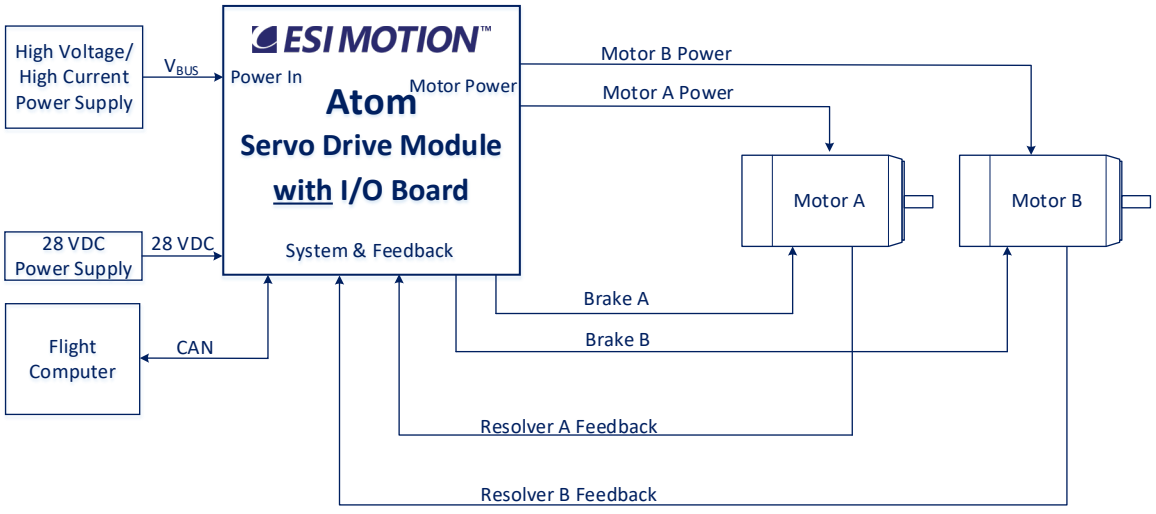

The Atom I/O Board is an optional circuit board that can be purchased along with the Atom Servo Module. The I/O Board provides the user with a platform that can be used for system development, prior to the design of a user-defined board that will mate with the Atom Servo Drive Module. The I/O Board provides all the connections necessary for motor control. Signals are arranged by connector into three groups: J3 Motor A Feedback, J4 System, and J6 Motor B Feedback. Voltages are: $V_{BUS}$ Input Power on J8, 28VDC IN on J4, and Motor A & B Power Outputs on J2 and J5, respectively.

Refer to ESI Document *100282-00, Atom Datasheet* for the electrical characteristics of signals and voltages.

A 5V regulator on the I/O Board is used to power both the Atom Servo Module controller ($V_{LOGIC}$) and external motor feedback devices (up to 0.5A). The I/O Board is designed to work with Main Power (VDC_IN) from 10V to 90V.

## Key Features

- Facilitates fast initial integration and lab test
- Dual-axis (Motor A & Motor B)
- Standard connectors for:
  - VDC_IN
  - Motor A & B Power Outputs
  - Motor A & B Feedback
  - System (incl. Communications and 28VDC In)
  - Brakes
- 5V and 3.3V Power LED Indicators
- Size: 2.2" L x 2.3" W x 0.5" D
- Brake drivers (it accepts TTL brake commands from the Atom and provides outputs to drive brakes)



## User Connectors

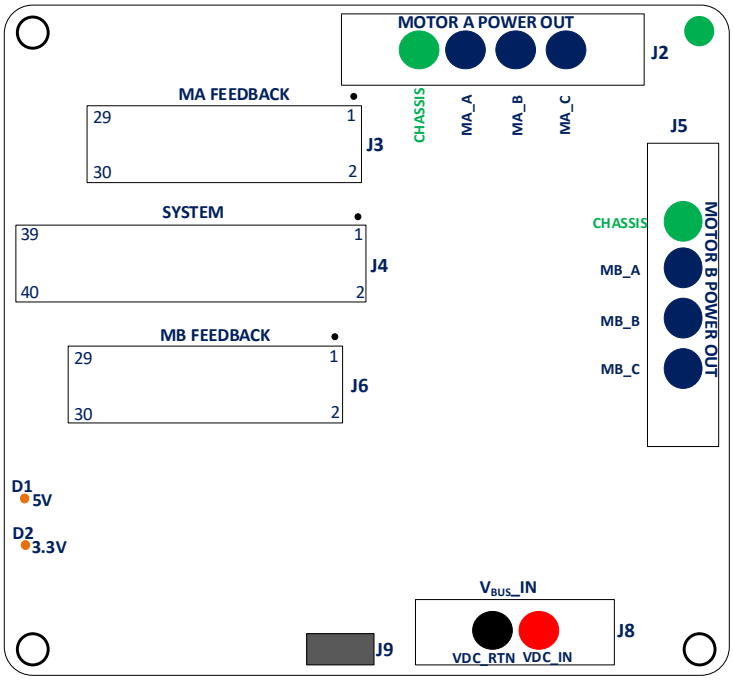
| No. | Function | # Contacts | Description | Atom I/O Board Connector (contacts) | Mating Connector (contacts) |
|---|---|---|---|---|---|
| J8 | VDC Power Input | 2 | Connector, Male, Power, Vertical, Jac-Screw, 2 Pin | Harwin M80-5000000M2-02-PM1-00-000 (pins) | Harwin Datamate Mix-Tek Connector Double Row, Std. Power (20A) 12 AWG M80-4000000F1-02-PF5-00-000 (sockets) |
| J2 | Motor A PwrOut (1) | 4 | Connector, Male, Power, Vertical, Jac-Screw, 4 Pin | Harwin M80-5000000M2-04-PM1-00-000 (pins) | Harwin Datamate Mix-Tek Connector Quad Row, Std. Power (20A) 12 AWG M80-4000000F1-04-PF5-00-000 (sockets) |
| J5 | Motor B PwrOut (1) | 4 | | | |
| J3 | MA_Feedback (1) | 30 | Header, SMD, 0.05" pitch, 2x15 pin | Samtec "Tiger Eye™" TFML-115-02-S-D-LC (pins) | Samtec Wire Cable Assembly (3) SFSD-15-28-G-04.00-S (sockets) |
| J6 | MB_Feedback (1) | 30 | | | |
| J4 | System | 40 | Header, SMD, 0.05" pitch, 2x20 pin | Samtec "Tiger Eye™" TFML-120-02-S-D-LC (pins) | Samtec Wire Cable Assembly (3) SFSD-20-28-G-04.00-S (sockets) |
| J9 | 5V Jumper (2) | 2 | Connector, 1x2 Header, 0.100" Spacing | Samtec TSW-101-06-F-D (header / pins) | Samtec (or Generic) BTSW-102-01-T-S (jumper / sockets) |

Notes:

1. **IMPORTANT: J3 & J6 and J2 & J5 connectors do not have unique keying to prevent mismatching.** Please exercise caution to ensure correct connections.
2. **IMPORTANT:** The J9 jumper installation is required, to connect 5V internally. LED D1 will illuminate to indicate 5V active (and LED D2 will illuminate to indicate 3.3V active).
3. Mating cable assembly examples shown are 4-inch length (see Samtec data sheet for more choices).
4. Connectors J10 & J17 (on bottom of board, not shown in table) mate to the Atom.
5. Pin receptacles (not shown in table) mate to the Atom "nail pins" (J11, J12, J13, J14, J15, J16, J18, J19, J20, J21)
6. J1 and J7 (not shown in table) are reserved.

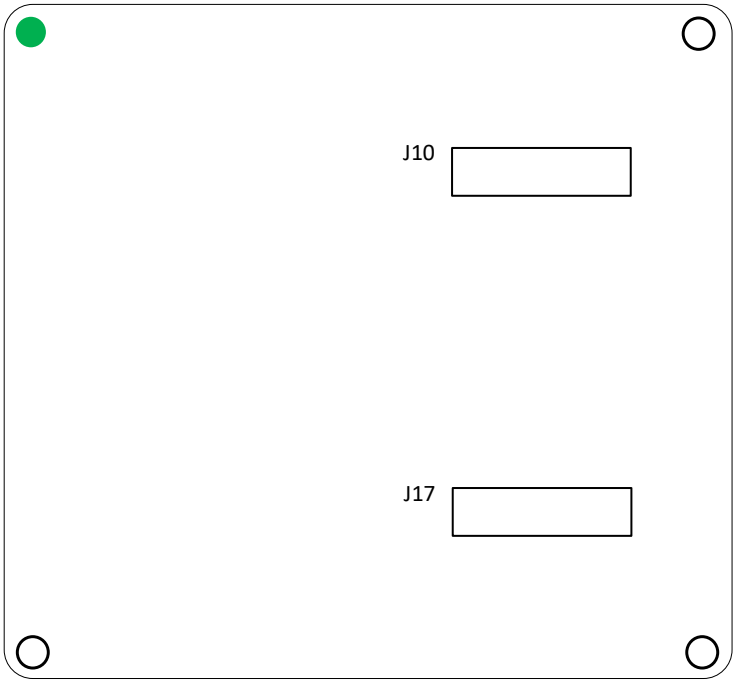
## Connection & LED Locations

The following diagrams depict connection locations. Pin 1 of J3, J4, and J6 are indicated by the dot next to each connector. The top diagram also shows the location of the required J9 jumper, D1 LED (indicates 5V is powered) and D2 LED (indicates 3.3V is powered).




**Top**

The bottom diagram shows the connectors which mate to the Atom.




**Bottom**

# ELECTRICAL INTERFACES

## J8 VDC Power In Pin Assignments

J8 connector provides VDC_IN ($V_{BUS}$) and VDC_RTN power input connections in a two-pin power connector.
See page 2 for part number and mating connector information.
For locations, see diagrams on page 3. See also Mechanical Drawings, for physical details.

| I/O Board_J8 Pin | Name | Description | Wire Gauge | Atom Connector | Type |
|---|---|---|---|---|---|
| A | VDC_IN | Voltage DC In ($V_{BUS}$) | 12-10 | (nail pin) | DC Bus Voltage Input |
| B | VDC_RTN | Voltage DC Return | 12-10 | (nail pin) | DC Bus Return |

## J2 Motor A Phase Power Out Pin Assignments

J2 connector provides Motor A Phase Power Out connections in a four-pin power connector.
See page 2 for part number and mating connector information.
For locations, see diagrams on page 3. See also Mechanical Drawings, for physical details.

| I/O Board_J2 Pin | Name | Description | Wire Gauge | Atom Connector | Type |
|---|---|---|---|---|---|
| A | CHA | Chassis (Case) Ground | 12-10 | I/O Board Upper Right Mounting Hole | Chassis Ground |
| B | MA_A | Motor A Phase A | 12-10 | (nail pin) | Motor Power Out |
| C | MA_B | Motor A Phase B | 12-10 | (nail pin) | Motor Power Out |
| D | MA_C | Motor A Phase C | 12-10 | (nail pin) | Motor Power Out |

Notes:

1. **Connectors J2 and J5 do not have unique keying to prevent mismatching.**
   Please exercise caution to ensure correct connections.

## J5 Motor B Phase Power Out Pin Assignments

J5 connector provides Motor B Phase Power Out connections in a four-pin power connector.
See page 2 for part number and mating connector information.
For locations, see diagrams on page 3. See also Mechanical Drawings, for physical details.

| I/O Board_J5 Pin | Name | Description | Wire Gauge | Atom Connector | Type |
|---|---|---|---|---|---|
| A | CHA | Chassis (Case) Ground | 12-10 | I/O Board Upper Right Mounting Hole | Chassis Ground |
| B | MB_A | Motor B Phase A (2) | 12-10 | (nail pin) | Motor Power Out |
| C | MB_B | Motor B Phase B (2) | 12-10 | (nail pin) | Motor Power Out |
| D | MB_C | Motor B Phase C (2) | 12-10 | (nail pin) | Motor Power Out |

Notes:

1. **Connectors J2 and J5 do not have keying to prevent mismatching.**
   Please exercise caution to ensure correct connections.
2. Motor B connections are for the second motor in Dual Axis Configurations. Also, Motor B Phase pins are used in parallel with Motor A Phase pins for single axis drives with continuous current requirements greater than 10 A (Paralleled Axis configuration).

## J3 Motor A Feedback Pin Assignments

J3 Motor A Feedback connections are provided by a 30-pin, 0.05" pitch, 2x15 configuration header.
These are Samtec Tiger-Eye™ Series headers and mating connectors (see page 2 for part numbers).
Wire gauge can range from 28 to 22 AWG. For locations, see diagrams on page 3. See also Mechanical Drawings, for physical details.
For convenience, the Atom Connector pin number is also shown -- see the Atom Data Sheet (*ESI Document No. 101282-00*), available from the downloads section of ESI Motion's website: https://www.esimotion.com/support/downloads/) for full signal descriptions.

| I/O Board J3 Pin | Atom Connector Pin | Name | I/O | Description | Type |
|---|---|---|---|---|---|
| J3-1 | J1-1 | ANALOG_IN_1+ (CMD+_MA) | I | Analog In 1 (+), *can be used as* Command Positive Motor A | Analog Input |
| J3-2 | J1-2 | ANALOG_IN_1- (CMD-_MA) | I | Analog In 1 (-), *can be used as* Command Negative Motor A | Analog Input |
| J3-3 | J1-3 | SIN+_MA | I | Resolver Sin Positive Motor A | Resolver |
| J3-4 | J1-4 | SIN-_MA | I | Resolver Sin Negative Motor A | Resolver |
| J3-5 | J1-5 | COS+_MA | I | Resolver Cos Positive Motor A | Resolver |
| J3-6 | J1-6 | COS-_MA | I | Resolver Cos Negative Motor A | Resolver |
| J3-7 | J1-7 | EXE+_MA | O | Resolver Excitation Positive Motor A | Resolver |
| J3-8 | J1-8 | EXE-_MA | O | Resolver Excitation Negative Motor A | Resolver |
| J3-9 | J1-21 | +5V_OUT | I | Power to Feedback Devices | Low Voltage Out |
| J3-10 | J1-22 | +5V_RTN (GROUND) | I | Power Return (Ground) | Low Voltage Rtn |
| J3-11 | J1-9 | A+_MA *or* BISS_CLK+_MA | I/O | Digital Encoder A Positive / BiSS-C Clock Positive Motor A | Encoder In / RS-422 BiSS Out |
| J3-12 | J1-10 | A- _MA *or* BISS_CLK-_MA | I/O | Digital Encoder A Negative / BiSS-C Clock Negative Motor A | Encoder In / RS-422 BiSS Out |
| J3-13 | J1-11 | B+_MA | I | Digital Encoder B Positive Motor A | Encoder |
| J3-14 | J1-12 | B-_MA | I | Digital Encoder B Negative Motor A | Encoder |
| J3-15 | J1-13 | I+_MA *or* BISS_DATA+_MA | I/I | Digital Encoder I Positive / BiSS-C Data Positive Motor A | Encoder In / RS-422 BiSS In |
| J3-16 | J1-14 | I-_MA *or* BISS_DATA-_MA | I/I | Digital Encoder I Negative / BiSS-C Data Negative Motor A | Encoder In / RS-422 BiSS In |
| J3-17 | J1-21 | +5V_OUT | I | Power to Feedback Devices | Low Voltage Out |
| J3-18 | J1-22 | +5V_RTN (GROUND) | I | Power Return (Ground) | Low Voltage Rtn |
| J3-19 | J1-15 | HALL_A_MA | I | Hall A Motor A | Hall Encoder |
| J3-20 | J1-16 | HALL_B_MA | I | Hall B Motor A | Hall Encoder |
| J3-21 | J1-17 | HALL_C_MA | I | Hall C Motor A | Hall Encoder |
| J3-22 | J1-22 | GROUND | --- | Ground | Ground |
| J3-23 | J1-22 | GROUND | --- | Ground | Ground |
| J3-24 | J1-22 | GROUND | --- | Ground | Ground |
| J3-25 | J1-19 | MOTOR_TEMP+_MA | I | Temperature Positive Motor A | Temp. Sensor |
| J3-26 | J1-20 | MOTOR_TEMP-_MA | I | Temperature Negative Motor A | Temp. Sensor |
| J3-27 | J2-31 | BRAKE_MA | I | Brake Command Motor A | Digital In |
| J3-28 | J1-18 | DIGITAL_REF | --- | Digital Reference | Digital Ref. |
| J3-29 | J1-22 | GROUND | --- | Ground | Ground |
| J3-30 | J1-22 | GROUND | --- | Ground | Ground |

## J4 System Pin Assignments

J4 System Feedback connections are provided by a 40-pin, 0.05" pitch, 2x20 configuration header.
These are Samtec Tiger-Eye™ Series headers and mating connectors (see page 2 for part numbers).
Wire gauge can range from 28 to 22 AWG. For locations, see diagrams on page 3. See also Mechanical Drawings, for physical details.
For convenience, the Atom Connector pin number is also shown -- see the Atom Data Sheet (*ESI Document No. 101282-00*), available from the downloads section of ESI Motion's website: https://www.esimotion.com/support/downloads/) for full signal descriptions.

| I/O Board J4 Pin | Atom Connector Pin | Name | I/O | Description | Type |
|---|---|---|---|---|---|
| J4-1 | J1-23 | RS422_TX+ | O | RS422 Transmit Positive | RS-422 |
| J4-2 | J1-24 | RS422_TX- | O | RS422 Transmit Negative | RS-422 |
| J4-3 | J1-25 | RS422_RX+ | I | RS422 Receive Positive | RS-422 |
| J4-4 | J1-26 | RS422_RX- | I | RS422 Receive Negative | RS-422 |
| J4-5 | J1-27 | CAN+ | I/O | CAN High | CAN |
| J4-6 | J1-28 | CAN- | I/O | CAN Low | CAN |
| J4-7 | J1-33 | HSSB_TX_CLK | O | High Speed Serial Bus Transmit Clock | HSSB |
| J4-8 | J1-34 | HSSB_RX_CLK | I | High Speed Serial Bus Receive Clock | HSSB |
| J4-9 | J1-35 | HSSB_TX_SYNC | O | High Speed Serial Bus Transmit Sync | HSSB |
| J4-10 | J1-36 | HSSB_RX_SYNC | I | High Speed Serial Bus Receive Sync | HSSB |
| J4-11 | J1-37 | HSSB_TX_DATA | O | High Speed Serial Bus Transmit Data | HSSB |
| J4-12 | J1-38 | HSSB_RX_DATA | I | High Speed Serial Bus Receive Data | HSSB |
| J4-13 | J1-22 | GROUND | --- | Ground | Ground |
| J4-14 | J1-22 | GROUND | --- | Ground | Ground |
| J4-15 | J1-18 | DIG_REF | I/O | Digital Reference | Digital Ref. |
| J4-16 | J1-32 | DIG_IO | I/O | Digital Input / Output | Digital In / Out |
| J4-17 | J2-37 | SCI_TX | O | Serial Communication Interface (SCI) Transmit | SCI |
| J4-18 | J2-38 | SCI_RX | I | Serial Communication Interface (SCI) Receive | SCI |
| J4-19 | J2-39 | RESERVED | --- | Reserved | No Connect |
| J4-20 | J2-40 | RESERVED | --- | Reserved | No Connect |
| J4-21 | J1-39 | BUF_ATP1 | O | Analog Test Point 1 | Analog Out |
| J4-22 | J1-40 | BUF_ATP2 | O | Analog Test Point 2 | Analog Out |
| J4-23 | J1-31 | ANALOG_REF | --- | Analog Reference | Analog Ref. |
| J4-24 | J1-22 | GROUND | --- | Ground | Ground |
| J4-25 | J2-33 | REGEN | O | DC Bus Voltage Regeneration Command | Digital Out |
| J4-26 | J2-34 | INRUSH | O | DC Bus Voltage Inrush (Precharge) Command | Digital Out |
| J4-27 | J2-35 | DISCHARGE | O | DC Bus Voltage Discharge Command | Digital Out |
| J4-28 | J2-36 | VBUS_PRE_INRUSH | I | DC Bus Voltage Monitor Prior to Inrush | Analog In |
| J4-29 | J1-22 | GROUND | --- | Ground | Ground |
| J4-30 | J1-22 | GROUND | --- | Ground | Ground |
| J4-31 | J2-39 | RESERVED | --- | Reserved | No Connect |
| J4-32 | J2-40 | RESERVED | --- | Reserved | No Connect |
| J4-33 | J1-22 | GROUND | --- | Ground | Ground |
| J4-34 | J1-22 | GROUND | --- | Ground | Ground |
| J4-35 | (NC) | BRAKE_A_RTN (1) | O | Motor A Brake Return | BRAKE RETURN |

## J4 System Pin Assignments, cont.

| I/O Board J4 Pin | Atom Connector Pin | Name | I/O | Description | Type |
|---|---|---|---|---|---|
| J4-36 | (NC) | BRAKE_B_RTN (1) | O | Motor B Brake Return | Brake Return |
| J4-37 | (NC) | BRAKE_A (1) | O | Motor A Brake Drive | Brake |
| J4-38 | (NC) | BRAKE_B (1) | O | Motor B Brake Drive | Brake |
| J4-39 | (NC) | 28VDC_IN (2) | I | 28VDC Power Supply In | Power Input |
| J4-40 | (NC) | 28VDC_IN (2) | I | 28VDC Power Supply In | Power Input |

Notes:

1. Brake Drive information: For each motor, the Atom provides a TTL Brake Command output. The Atom I/O Board uses this to provide the output brake drive.
2. For the 80V Atom models, 28VDC IN is **required**. Reference to Ground (such as J4-33 and J4-34).

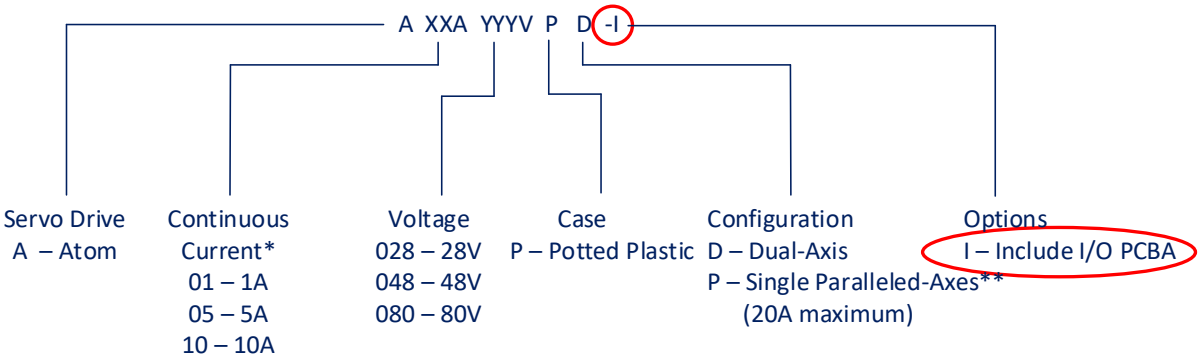
## J6 Motor B Feedback Pin Assignments

J6 Motor B Feedback connections are provided by a 30-pin, 0.05" pitch, 2x15 configuration header.
These are Samtec Tiger-Eye™ Series headers and mating connectors (see page 2 for part numbers).
Wire gauge can range from 28 to 22 AWG. For locations, see diagrams on page 3. See also Mechanical Drawings, for physical details.
For convenience, the Atom Connector pin number is also shown -- see the Atom Data Sheet (*ESI Document No. 101282-00*), available from the downloads section of ESI Motion's website: https://www.esimotion.com/support/downloads/) for full signal descriptions.

| I/O Board J6 Pin | Atom Connector Pin | Name | I/O | Description | Type |
|---|---|---|---|---|---|
| J6-1 | J2-1 | ANALOG_IN_2+ (CMD+_MB) | I | Analog In 2 (+), *can be used as* Command Positive Motor B | Analog Input |
| J6-2 | J2-2 | ANALOG_IN_2- (CMD-_MB) | I | Analog In 2 (-), *can be used as* Command Negative Motor B | Analog Input |
| J6-3 | J2-3 | SIN+_MB | I | Resolver Sin Positive Motor B | Resolver |
| J6-4 | J2-4 | SIN-_MB | I | Resolver Sin Negative Motor B | Resolver |
| J6-5 | J2-5 | COS+_MB | I | Resolver Cos Positive Motor B | Resolver |
| J6-6 | J2-6 | COS-_MB | I | Resolver Cos Negative Motor B | Resolver |
| J6-7 | J2-7 | EXE+_MB | O | Resolver Excitation Positive Motor B | Resolver |
| J6-8 | J2-8 | EXE-_MB | O | Resolver Excitation Negative Motor B | Resolver |
| J6-9 | J2-21 | +5V_OUT | I | Power to Feedback Devices | Low Voltage Out |
| J6-10 | J2-22 | +5V_RTN (GROUND) | I | Power Return (Ground) | Low Voltage Rtn |
| J6-11 | J2-9 | A+_MB *or* BISS_CLK+_MB | I/O | Digital Encoder A Positive / BiSS-C Clock Positive Motor B | Encoder In / RS-422 BiSS Out |
| J6-12 | J2-10 | A- _MB *or* BISS_CLK-_MB | I/O | Digital Encoder A Negative / BiSS-C Clock Negative Motor B | Encoder In / RS-422 BiSS Out |
| J6-13 | J2-11 | B+_MB | I | Digital Encoder B Positive Motor B | Encoder |
| J6-14 | J2-12 | B-_MB | I | Digital Encoder B Negative Motor B | Encoder |
| J6-15 | J2-13 | I+_MB *or* BISS_DATA+_MB | I/I | Digital Encoder I Positive / BiSS-C Data Positive Motor B | Encoder In / RS-422 BiSS In |
| J6-16 | J2-14 | I-_MB *or* BISS_DATA-_MB | I/I | Digital Encoder I Negative / BiSS-C Data Negative Motor B | Encoder In / RS-422 BiSS In |
| J6-17 | J2-21 | +5V_OUT | I | Power to Feedback Devices | Low Voltage Out |
| J6-18 | J2-22 | +5V_RTN (GROUND) | I | Power Return (Ground) | Low Voltage Rtn |
| J6-19 | J2-15 | HALL_A_MB | I | Hall A Motor B | Hall Encoder |
| J6-20 | J2-16 | HALL_B_MB | I | Hall B Motor B | Hall Encoder |
| J6-21 | J2-17 | HALL_C_MB | I | Hall C Motor B | Hall Encoder |
| J6-22 | J2-22 | GROUND | --- | Ground | Ground |
| J6-23 | J2-22 | GROUND | --- | Ground | Ground |
| J6-24 | J2-22 | GROUND | --- | Ground | Ground |
| J6-25 | J2-19 | MOTOR_TEMP+_MB | I | Temperature Positive Motor B | Temp. Sensor |
| J6-26 | J2-20 | MOTOR_TEMP-_MB | I | Temperature Negative Motor B | Temp. Sensor |
| J6-27 | J2-32 | BRAKE_MB | I | Brake Command Motor B | Digital In |
| J6-28 | J2-18 | DIGITAL_REF | --- | Digital Reference | Digital Ref. |
| J6-29 | J2-22 | GROUND | --- | Ground | Ground |
| J6-30 | J2-22 | GROUND | --- | Ground | Ground |

## Ordering Information

The ESI Motion Atom Servo Module ordering information chart is shown below.
For an Atom including the I/O Board, please add the -I option shown below.
For a stand-alone purchase of the Atom I/O Board, please contact ESI Motion at Sales@ESIMotion.com.




* Peak Sine Wave, per axis
** Paralleled Axes rated to 2 x Continuous Current
Current and Voltage values are nominal, refer to the Installation Manual for the full operational range.

Example: Part Number: A10A028VPD-I
Servo Drive: Atom
Continuous Current: 10A
Nominal Voltage: 28V
Case: Potted Plastic
Configuration: Dual-Axis
Options: Include I/O PCBA