Introduction to Class 5 Connectivity

Power:
Each SmartMotor™ is operated from 24 to 48VDC. Some of the larger SmartMotor servos can draw high current. It is highly recommended to use heavy gage wire to connect the larger motors. As a result, the “Add-A-Motor” is recommended for the 17 and 23 frame series only.

Communications:
Each SmartMotor has a primary RS-232 serial port and a secondary RS-485 port by re-assignment of ports E and F of the 7 I/O points. Up to 100 SmartMotor servos may be separately addressed and are identifiable on either RS-232 or RS-485. The most common and cost effective solution is typically RS-232 serial communications. Under this structure, each motor is placed in an electrical serial connection such that the transmit line of one motor is connected to the receive line of the next. Each motor will be set to “echo” the incoming data to the next motor down with approximately 1 millisecond propagation delay. There is no signal integrity loss from one motor to the next, which results in highly reliable communications.

The following cables/devices are used for RS-232 and Power connectivity:

- **CBLPWRCOM2-xM**: Power and communications cable with flying leads or in conjunction with DIN-RS232 8 channel isolated communications board
- **CBLSM1-xM**: Power and communications cable with DB-9 serial connector and power supply connector that fits our enclosed power supplies
- **CBLSM1-DEMO**: Testing cable used with our PWR116 “laptop” type power supply
- **CBLSM1-x-y-z**: Custom length multi-drop RS-232 daisy chain cable

The following cables are used for RS-485 and Power connectivity:

- **RS485-ISO**: Converts primary RS-232 to isolated RS-485 (Note: uses Port G I/O pin)
- **CBLSM2-x-y-z**: Custom multi drop isolated RS-485 (multiple RS485-ISO adapters)

Interfacing with I/O devices:
Each SmartMotor has 7 TTL level user-configurable I/O. Each can be used as either inputs or outputs. The following is a quick review of I/O interfacing connectivity options:

- **CBLIO5V-xM**: Direct connection to 5V TTL I/O
- **CBLIO5V-xM via OPTO2**: 24VDC isolation and conversion of 5V signals
- **CBLIO5V-xM via DINIO7**: Motor breakout board to industry standard OPTO relays
- **CBLIO-ISO1-xM**: Isolated 24VDC logic conversion cable

The following pages are a roadmap to motor connectivity. These pages show the physical layout of how cables are used including power, communications and I/O interconnection.
### Class 5 Connector Pinouts

**MAIN POWER Specifications:**
- **PIN 1:** I/O – 6 GP or “G” command 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 2:** +5VDC out 50mAmps Max (total)
- **PIN 3:** RS-232 Transmit Channel(0) 115.2Kbaud Max
- **PIN 4:** RS-232 Receive Channel(0) 115.2Kbaud Max
- **PIN 5:** SIG Ground
- **PIN A1:** Main Power: +20-48VDC
- **PIN A2:** Ground

**I/O CONNECTOR (5V TTL I/O) Specifications:**
- **PIN 1:** I/O – 0 GP or Enc. A or Step Input 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 2:** I/O – 1 GP or Enc. B or Dir. Input 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 3:** I/O – 2 Positive Over Travel or GP 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 4:** I/O – 3 Negative Over Travel or GP 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 5:** I/O – 4 GP or RS-485 A Channel(1) 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 6:** I/O – 5 GP or RS-485 B Channel(1) 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 7:** I/O – 6 GP or “G” command 25mAmp Sink or Source 10Bit 0-5VDC A/D
- **PIN 8:** Phase A Encoder Output
- **PIN 9:** Phase B Encoder Output
- **PIN 10:** RS-232 Transmit Channel(0) 115.2Kbaud Max
- **PIN 11:** RS-232 Receive Channel(0) 115.2Kbaud Max
- **PIN 12:** +5VDC Out 50mAmps Max (total)
- **PIN 13:** SIG Ground
- **PIN 14:** Ground
- **PIN 15:** Main Power: +20-48VDC

**CAN bus Connection:**
- **PIN 1:** NC
- **PIN 2:** NC
- **PIN 3:** GND_CAN Isolated CAN ground
- **PIN 4:** CAN-H 1M Baud max
- **PIN 5:** CAN-L 1M Baud max

**Isolated 24VDC I/O Connector Max Load (sourcing):**
- **PIN 1:** I/O – 16 GP 150mAmps
- **PIN 2:** I/O – 17 GP 150mAmps
- **PIN 3:** I/O – 18 GP 150mAmps
- **PIN 4:** I/O – 19 GP 150mAmps
- **PIN 5:** I/O – 20 GP 300mAmps
- **PIN 6:** I/O – 21 GP 300mAmps
- **PIN 7:** I/O – 22 GP 300mAmps
- **PIN 8:** I/O – 23 GP 300mAmps
- **PIN 9:** I/O – 24 GP 300mAmps
- **PIN 10:** I/O – 25 GP 300mAmps
- **PIN 11:** +24Volts Input 18-32VDC
LED Status Power-up:

**with no program**
- the travel limit inputs are not grounded:
  - LED0 will be solid red indicating the motor is in a fault state due travel limit fault.
  - LED1 will be off

**LED Status Power-up:**
- with no program
- and the travel limits are hard wired to ground:
  - LED0 will be solid red for 500 milliseconds and then begin flashing green.
  - LED1 will be off

**LED Status Power-up:**
- with a program that only disables travel limits and nothing else
  - LED0 will be solid red for 500 milliseconds and then begin flashing green.
  - LED1 will be off 

**LED0:** Drive Status Indicator
- Off: No Power
- Solid green: Drive On
- Flashing green: Drive Off
- Flashing red: Watchdog Fault
- Solid red: Major Fault
- Alt. red/green: In Boot Load, Needs Firmware

**LED1:** Trajectory Status Indicator
- Off: Not Busy
- Solid green: Drive On, Trajectory In Progress

**LED2:** CAN Bus Network Fault (Red LED)
- Off: No Error
- Single Flash: At least One Error exceeded Limit
- Double Flash: Heartbeat or Guard Error
- Solid: Busy Off State

**LED3:** CAN Bus Network Status (Green LED)
- Blinking: Pre-Operational State, (during boot-up)
- Solid: Normal Operation
- Single: Device is in Stopped State
### Class 5 Connection Maps

#### 15 Pin D-Sub I/O

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A I/O</td>
</tr>
<tr>
<td>2</td>
<td>B I/O</td>
</tr>
<tr>
<td>3</td>
<td>C I/O</td>
</tr>
<tr>
<td>4</td>
<td>D I/O</td>
</tr>
<tr>
<td>5</td>
<td>E I/O</td>
</tr>
<tr>
<td>6</td>
<td>F I/O</td>
</tr>
<tr>
<td>7</td>
<td>G I/O</td>
</tr>
<tr>
<td>8</td>
<td>Encoder A Out</td>
</tr>
<tr>
<td>9</td>
<td>Encoder B Out</td>
</tr>
<tr>
<td>10</td>
<td>RS232 Transmit</td>
</tr>
<tr>
<td>11</td>
<td>RS232 Receive</td>
</tr>
<tr>
<td>12</td>
<td>+5V Out</td>
</tr>
<tr>
<td>13</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>Power Ground</td>
</tr>
<tr>
<td>15</td>
<td>Power</td>
</tr>
</tbody>
</table>

#### 7 Pin Combo D-Sub Power & I/O

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>+20V to +48V DC</td>
</tr>
<tr>
<td>A2</td>
<td>Power Ground</td>
</tr>
<tr>
<td>1</td>
<td>Sync or I/O</td>
</tr>
<tr>
<td>2</td>
<td>+5V Out</td>
</tr>
<tr>
<td>3</td>
<td>RS232 Transmit</td>
</tr>
<tr>
<td>4</td>
<td>RS232 Receive</td>
</tr>
<tr>
<td>5</td>
<td>RS232 Ground</td>
</tr>
</tbody>
</table>

#### 5 Pin CAN

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
</tr>
<tr>
<td>3</td>
<td>GND CAN</td>
</tr>
<tr>
<td>4</td>
<td>CAN-H</td>
</tr>
<tr>
<td>5</td>
<td>CAN-L</td>
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</table>

#### 12 Pin Expanded I/O Connector

<table>
<thead>
<tr>
<th>PIN</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>I/O-16 GP</td>
</tr>
<tr>
<td>2</td>
<td>I/O-17 GP</td>
</tr>
<tr>
<td>3</td>
<td>I/O-18 GP</td>
</tr>
<tr>
<td>4</td>
<td>I/O-19 GP</td>
</tr>
<tr>
<td>5</td>
<td>I/O-20 GP</td>
</tr>
<tr>
<td>6</td>
<td>I/O-21 GP</td>
</tr>
<tr>
<td>7</td>
<td>I/O-22 GP</td>
</tr>
<tr>
<td>8</td>
<td>I/O-23GP</td>
</tr>
<tr>
<td>9</td>
<td>I/O-24 GP</td>
</tr>
<tr>
<td>10</td>
<td>I/O-25 GP</td>
</tr>
<tr>
<td>11</td>
<td>+24 Volts Input</td>
</tr>
<tr>
<td>12</td>
<td>GND I/O</td>
</tr>
</tbody>
</table>

#### Power Supplies & Shunts

- PS24V8AG-110 or PS42V6AG-110

#### Gear Heads

- CBLIP-CAN-FL-xMRA (5 Pin)
- CBLIP-IO-FL-xMRA (12 Pin)

### Courtesy of Steven Engineering, Inc.

230 Ryan Way, South San Francisco, CA 94080-5370
Main Office: (650) 588-9200 - Outside Local Area: (800) 258-9200 - www.stevenengineering.com
Class 5 Multi-Axis Connection Maps

RS232 Multidrop using Add-A-Motor Cable

CAN Bus Multidrop using CAN Bus Y Cables

15 Amps maximum continuous load

HIGHLY RECOMMENDED OPTION. PLEASE READ!

Hardware "DE" Option:
The DE option allows the controller and drive-amplifier to be powered from separate 24-48 VDC power supplies.

- Controller can be powered from a standard 24 VDC supply
- Position will not be lost on loss-of-drive-power
- No need to re-home
- Load surges will not cause power surge on controller
- Standard battery options are made simpler

Note:
The same supply may be used for Control and Drive power, but maximum protection is provided with separate power supplies.

Drive Amp Power Supply: (20-48VDC)

Control Power Supply: (20-48VDC)

Note: All IP sealed SmartMotors are designed to always have separate drive and control power. As a result, no DE designation is available for IP sealed SmartMotors. Control power on IP sealed SmartMotors is rated for 24VDC, maximum of 32VDC.
RS-232 Communications Using USB Adapter

RS-232 Communications with Power Supply & Protective Shunt

RS-232 Multidrop using Add-A-Motor™ Cables

RS-232 Multidrop using Custom Order Cable

RS-485 Isolated Communications Using Custom Order Cable
Class 5 Connection Maps (Continued)

Isolated RS-232 Communications for up to 8 SmartMotor servos

Demonstration & Development Configurations

Isolated RS-485 Communications

Interfacing with 24V I/O Devices

Recommended Power Supply

Recommended Shunts

Courtesy of Steven Engineering, Inc. - 230 Ryan Way, South San Francisco, CA 94080-5370 - Main Office: (650) 588-9200 - Outside Local Area: (800) 258-9200 - www.stevenengineering.com
CBLSM1-3M

Power and Communications Cable for Main 7W2 Connector on Animatics SmartMotor™

CBLSM1 series is the main power and communications cable consisting of a 7W2 main motor connector split out to a pre-wired RS-232 DB-9 connector to plug directly into any standard PC serial port.

The power is split off and has a connector that plugs into our enclosed frame power supplies.

<table>
<thead>
<tr>
<th>Standard Length</th>
<th>Part Number</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBLSM1-3M</td>
<td>3 meters</td>
<td></td>
</tr>
<tr>
<td>CBLSM1-10M</td>
<td>10 meters</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Custom Length</th>
<th>Part Number</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBLSM1-x</td>
<td>x (in feet)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Communications Shield is connected at the DB-9 end, but NOT the motor end. The power cable is connected at the motor connector shell but electrically isolated from the any internal electronic components.