APPLICATIONS
- Raster Imaging
- Optical Layout Templates
- Optical Coherence Tomography
- Laser entertainment (light show) displays
- Laser Marking (including XY2-100 support)

UNIQUE ScannerMAX FEATURES
- PC-based Graphical User Interface
- Six user-configurable test / status outputs
- Up to four, instantly-accessible scanner tunings
- Built-in diagnostic and performance analysis tools
- Supports PD, PID, PDF and PDFF servo control laws

BENEFITS
- Compact package size
- Modest power requirements
- Highly configurable and versatile
- Single package handles both X and Y axis
- Ability to add customizations via firmware updates

GENERAL DESCRIPTION
The Mach-DSP servo driver is Pangolin’s latest and most advanced development in galvo control technology. By taking advantage of high-speed floating-point Digital Signal Processors, 16-bit data converters, direct digital command input, and highly configurable servo algorithms, the Mach-DSP provides full-function, two-axis servo driver electronics in a cost-effective and compact package. Many advanced techniques and user-customizable features are embodied within the Mach-DSP which, when combined with Pangolin’s ScannerMAX scanners, deliver a level of speed, accuracy and convenience that were unattainable before now.

The Mach-DSP can be accessed using a PC-based Graphical User Interface software package, where the built-in Test Pattern Generator, Oscilloscope and Dynamic Signal Analyzer can be used to monitor and adjust the more than 50 performance parameters per axis. These performance parameters can be stored in four separate memory areas (called “tunings”) for instant access and recall at any time. Additional features and behavioral customizations can be added via firmware updates that take only a few minutes to download, helping to make the Mach-DSP “future-proof”.

The Mach-DSP servo driver was created with OEMs in mind, incorporating a simple yet comprehensive and flexible interface structure, consisting of the usual analog command input and analog position output, but also including two optically-isolated TTL inputs and outputs, two serial ports, and six user-configurable analog outputs. This, together with the modest power requirement and compact size allows laser system manufactures to package the servo driver electronics, the scanners, and often the power supply as well, directly into the laser projector head.

OUTLINE DRAWING
### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Units and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage (standard configuration)</td>
<td>±24 V</td>
<td>Volts, DC</td>
</tr>
<tr>
<td>Power Supply Range (upon special order)</td>
<td>±12 to ±30 V</td>
<td>Volts, DC</td>
</tr>
<tr>
<td>Power Supply Quiescent Current</td>
<td>+200, -230 mA</td>
<td>mA, with ±24V power supply</td>
</tr>
<tr>
<td>Motor Drive RMS Current</td>
<td>5 A</td>
<td>Amperes, RMS, Per Axis</td>
</tr>
<tr>
<td>Motor Drive Peak Current</td>
<td>10 A</td>
<td>Amperes, Maximum, Per Axis</td>
</tr>
<tr>
<td>Analog Command Input Signal</td>
<td>up to ±10 V</td>
<td>Volts, user-configurable Scale</td>
</tr>
<tr>
<td>Analog Command Input Impedance</td>
<td>20 KΩ</td>
<td>differential</td>
</tr>
<tr>
<td>XY2-100 compatible Digital Command Input Signal</td>
<td>16-bits or 18-bits</td>
<td>3.3V direct-connect or RS-422 signaling</td>
</tr>
<tr>
<td>Digitizing Resolution</td>
<td>16-bits</td>
<td>for all analog inputs and outputs</td>
</tr>
<tr>
<td>Enhanced Resolution (for low dither applications)</td>
<td>17 / 18-bits</td>
<td>for Position / Command</td>
</tr>
<tr>
<td>Sample rate for analog inputs and outputs</td>
<td>200 / 300 Dual-axis / Single-axis, ksps</td>
<td></td>
</tr>
<tr>
<td>Position Test Point Output</td>
<td>±10 V</td>
<td>Volts, scanner-dependent scale</td>
</tr>
<tr>
<td>Current Test Point Output</td>
<td>±10 V</td>
<td>Volts, full scale (1 volt per amp)</td>
</tr>
<tr>
<td>AGC Test Point Output</td>
<td>0 to -15 V</td>
<td>Volts, full scale</td>
</tr>
<tr>
<td>Six separate user-configurable Analog Outputs</td>
<td>±5 V</td>
<td>Volts, User-configurable Scale</td>
</tr>
<tr>
<td>Two separate programmable Digital Inputs</td>
<td>TTL-level</td>
<td>Optically-isolated</td>
</tr>
<tr>
<td>Two separate programmable Digital Outputs</td>
<td>TTL-level</td>
<td>Optically-isolated</td>
</tr>
<tr>
<td>Bi-directional Serial / USB and Control Panel Ports</td>
<td>3.3V TTL-level</td>
<td>Asynchronous and Synchronous</td>
</tr>
<tr>
<td>Size (inches)</td>
<td>2.95 x 3.94 x 1.3</td>
<td>W x L x H, Inches</td>
</tr>
<tr>
<td>Size (millimeters)</td>
<td>75 x 100 x 33</td>
<td>W x L x H, mm</td>
</tr>
<tr>
<td>Mass</td>
<td>170 Grams</td>
<td></td>
</tr>
</tbody>
</table>
Mach-DSP Connector Locations and Pinout

### CONNECTORS

<table>
<thead>
<tr>
<th>Connector Function</th>
<th>Connector Housing P/N</th>
<th>Pin P/N</th>
<th>AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER</td>
<td>Molex 0039012040</td>
<td>0039000007 or 0039000074</td>
<td>#18-#24</td>
</tr>
<tr>
<td>COMMAND INPUT</td>
<td>Molex 04302506000</td>
<td>0430300001 through 0430300012</td>
<td>#20-#30</td>
</tr>
<tr>
<td>X &amp; Y SCANNER</td>
<td>Molex 0430251000</td>
<td>0430300001 through 0430300012</td>
<td>#20-#30</td>
</tr>
<tr>
<td>CONTROL PANEL</td>
<td>Molex 0050579405</td>
<td>00160200082 or 0016020088</td>
<td>#22-#30</td>
</tr>
<tr>
<td>TEST POINTS</td>
<td>Molex 0430251800</td>
<td>0430300001 through 0430300012</td>
<td>#20-#30</td>
</tr>
<tr>
<td>STATUS / CONTROL</td>
<td>Molex 0430250800</td>
<td>0430300001 through 0430300012</td>
<td>#20-#30</td>
</tr>
<tr>
<td>USB / SERIAL PORT</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### MACH-DSP Connector Pinout Diagram

#### X SCANNER
- Motor-X-M 10 Motor-X-M
- Motor-X-P 9 Motor-X-P
- Motor Body 8 +AGC-X
- PD-X-B 6 PD-X-A
- PD-X-C 7 PD-X-Cm
- Motor Body 8 +AGC-X
- PD-X-B 6 PD-X-A

#### POWER
- +24V 2 -24V
- GND 4 GND

#### Y SCANNER
- Motor-Y-M 10 Motor-Y-M
- Motor-Y-P 9 Motor-Y-P
- Motor Body 8 +AGC-Y
- PD-Y-B 6 PD-Y-A
- PD-Y-C 7 PD-Y-Cm

#### INPUT
- XIN-M 6 YIN-M
- NIN 5 GND
- XIN-P 4 YIN-P

#### STATUS / CONTROL
- TP3-SCOPE 9 TP6-SCOPE
- TP2-SCOPE 8 TP5-SCOPE
- TP1-SCOPE 7 TP4-SCOPE
- GND 15 X-Y THERM
- TP-AGC-X 14 TP-AGC-Y
- TP-I-SENSE-X 13 TP-I-SENSE-Y
- TP-CMD-X 12 TP-CMD-Y
- TP-POS-X 11 TP-POS-Y
- GND 10 GND

#### CONTROL PANEL
- Tip 5 RX
- Ring 4 TX
- Base 3 TXD
- #5V 2 RXD

#### SERIAL PORT
- LED1 (yellow, (heat lead))
- LED2 (red, (out 2))
- LED3 (red, (out 1))
- LED4 (red, (power))
- LED5 (green, (control))
MORE INFORMATION

More information about ScannerMAX scanners and servo drivers, including additional application hints and tips can be found at www.ScannerMAX.com.

LASER SCANNING BOOK AVAILABLE

Detailed information about galvanometer scanners, servo driver techniques, and scanner applications can be found in the #1 best-selling book LASER SCANNERS: Technologies and Applications, written by Pangolin’s President William R. Benner, Jr. The book can be found at www.LaserScanningBook.com.

PATENT AND TRADEMARK INFORMATION

ScannerMAX products are covered by one or more of the following patents:

US Utility Patent Number: 7,092,135
US Utility Patent Number: 7,688,432
US Utility Patent Number: 7,940,380
US Utility Patent Number: 8,254,045
US Utility Patent Number: 8,508,726
US Utility Patent Number: 8,963,396
US Utility Patent Number: 9,077,219
US Utility Patent Number: 9,195,061
US Utility Patent Number: 9,244,273
US Utility Patent Number: 9,270,144
US Utility Patent Number: 9,366,860
US Utility Patent Number: 9,530,559
US Utility Patent Number: 9,991,773
US Utility Patent Number: 10,284,038
US Utility Patent Number: 10,305,358
US Utility Patent Number: 10,539,433
German Patent (Utility Model) Number: 20 2012 009 275.8
German Patent (Utility Model) Number: 20 2013 000 369.3
German Patent (Utility Model) Number: 20 2013 003 263.4
German Patent (Utility Model) Number: 20 2014 000 846.9
German Patent (Utility Model) Number: 20 2014 002 094.9
German Patent (Utility Model) Number: 20 2016 000 737.9
German Patent (Utility Model) Number: 20 2019 002 282.1
German Patent (Utility Model) Number: 20 2020 000 007.8
Chinese Patent No. ZL201110066043.6
Chinese Patent No. ZL201210363949.9
Chinese Patent No. ZL201210363955.4
Chinese Patent No. ZL201310151544.3
Chinese Application for Invention No. 201310128586.5
Chinese Utility Model No. ZL201420101575.8
Chinese Utility Model No. ZL201420102156.6
Chinese Utility Model No. ZL201620112019.X
Other US and International Patents Pending.

Mach-DSP and ScannerMAX are trademarks of Pangolin Laser Systems, Inc.

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