Table of Contents

- EM1-S-O EDGE Motor ............................................................... 1
- EM4X-S-1-0 EDGE 4X Motor ..................................................... 3
- ER-15-4 Rotary Piezo Motor ...................................................... 5
- RS08/RS08A Rotary Shutter/Actuator ......................................... 7
- S787 NUC Shutter ..................................................................... 12
- LF14 Linear Filter Changer .......................................................... 14
- S840 Miniature Precision Rotary Stage ........................................ 16
- S851 Precision Steering Module Stage ...................................... 18
- XCD-EDGE-BD-03 Drive and Control ........................................ 20
- XCD-2 Dual Axis Drive & Control ................................................. 22
- S77515X000-03 Controller Driver ............................................ 26
- IC000028 XCD Component ....................................................... 28
- EAE00009 ASIC Component ..................................................... 30
EM1-S-O

EDGE Motor

Application Recommendations

The EDGE motor is well suitable for a large range of applications, excelling in those where weight, form factor and power consumption are of prominence, such as:

- NUC Shutters
- Shutter & Aperture Control Components
- Filter Changer Components
- Auto Focus Modules
- Unattended Ground Sensor Modules
- Optical Image Stabilization Modules
- Mirrors Positioning

Product Description

Nanomotion’s Edge motor is the smallest industrial motor of its kind available in the marketplace today. Providing unlimited linear or rotary motion, the Edge motor offers extensive opportunities in applications that suit a wide range of industries. The Edge motor works with a uniquely designed, compact ASIC-based driver, and can be operated with any servo controller. The Edge can be easily integrated into most bearing structures, and is ideal for mass production opportunities.

Edge Motor Key Features:

- Extremely small dimensions
- Excellent move and settle characteristics
- Mil-rated
- ASIC drive and control
- Wide dynamic velocity range
- High resolution
- Zero backlash
- Holds position at power off
- Silent operation
- Negligible EMI
TECHNICAL SPECIFICATIONS

Mechanical
- Weight/Mass: 0.55 gr
- Dimensions: 13.5 x 7.6 x 3.15 mm

DYNAMIC
- Driving Force (max): 0.32N
- Velocity (max): 200 mm/sec

ENVIRONMENTAL
- Operation Temperature: -40 ºC ÷ 80 ºC
- Vibrations: 10 g rms
- Shock: 350 g

ELECTRICAL
- Motor Voltage (max): 8.5 ÷ 11 V AC
- Motor Current (max): 130 mA AC

VELOCITY/LOAD CHARACTERISTICS

MECHANICAL DRAWINGS AND INTERFACE

ELECTRICAL INTERFACE

<table>
<thead>
<tr>
<th>pin number</th>
<th>pin name</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P_1</td>
<td>NM MOTOR PHASE 1</td>
</tr>
<tr>
<td>2</td>
<td>P_2</td>
<td>NM MOTOR PHASE 2</td>
</tr>
<tr>
<td>3,4</td>
<td>COM</td>
<td>NM MOTOR COMMON</td>
</tr>
</tbody>
</table>
EDGE-4X Motor

Application Recommendations

The EDGE-4X motor expands the Nanomotion’s product line of low voltage piezo motors, bringing 4 times the force of the Edge motor. The EDGE-4X provides up to 1.3N force with unlimited travel for linear or rotary applications. Continuing to optimize size, weight and power, the EDGE-4X is well suited to:

- Auto Focus & Zoom Requirements
- Pan & Tilt Gimbal Drive
- Optical Image Stabilization Modules

Product Description

The EDGE-4X motor offers a small footprint for unlimited linear and rotary motion. The EDGE-4X provides 1.3N max force and is capable of achieving 200mm/sec maximum velocity. The EDGE-4X can easily adapt to numerous bearing structures to provide high resolution motion control for a wide range of applications in defense optronics, medical and semiconductor markets.

EDGE-4X Moto Features:

- Small operating footprint
- Wide dynamic velocity range
- Zero backlash
- Holds position at power off
- Silent operation
- Negligible EMI
- Non-magnetic motor
**TECHNICAL SPECIFICATIONS**

**Mechanical**
- Weight/Mass: 2.2g
- Dimensions: 22.8 x 12.4 x 4.3 mm

**DYNAMIC**
- Driving Force (max): 1.3N
- Velocity (max): 200mm/sec

**ENVIRONMENTAL**
- Operation Temperature:
  - -40 °C to 80 °C
- Vibrations: 10g rms
- Shock: 350g, 0.8ms half sine

**ELECTRICAL**
- Motor Voltage (max): 14VAC
- Motor Current (max): 250mA AC
- *5V DC Drive Circuitry Available

---

**VELOCITY/LOAD CHARACTERISTICS**

**Load/Speed Characteristics**

![Load/Speed Characteristics Graph]

**MECHANICAL DRAWINGS AND INTERFACE**

![Mechanical Drawings and Interface Diagram]

**ELECTRICAL INTERFACE**

<table>
<thead>
<tr>
<th>pin number</th>
<th>pin name</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTC OUT</td>
<td>TERMINAL RESISTOR</td>
</tr>
<tr>
<td>2</td>
<td>NTC IN</td>
<td>TERMINAL RESISTOR</td>
</tr>
<tr>
<td>3</td>
<td>P2</td>
<td>NM MOTOR</td>
</tr>
<tr>
<td>4</td>
<td>P1</td>
<td>NM MOTOR</td>
</tr>
<tr>
<td>5</td>
<td>COM</td>
<td>NM MOTOR COMMON</td>
</tr>
<tr>
<td>6</td>
<td>COM</td>
<td>NM MOTOR COMMON</td>
</tr>
</tbody>
</table>

---

**Nanomotion Ltd.**
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
- t: +972 73 2498000
- f: +972 73 2498099
- e: nano@nanomotion.com

**Nanomotion Inc.**
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
- t: (800) 821-6266
- f: (631) 585-3000
- e: nanoUS@nanomotion.com

www.nanomotion.com
ER-15-4

Rotary Piezo Motor

FEATURES
Silent Operation (no gears)
Zero Backlash
Best SWaP performance
MIL-STD-810F Compliant for shock, vibration and temperature
Safe & Reliable

ORDERING INFORMATION
Part Number: ER-15-4

RELATED PRODUCTS/ACCESSORIES
Part Number: S775150000-02
XCD Controller/Driver Board

Application Recommendations

- Focus/Zoom Modules
- Shutter & Filter Control
- Field Switch
- Pan & Tilt Modules

Product Description

Nanomotion’s ER Motor family leverages the many advantages of our piezo technology, applied in a traditional motor housing. Utilizing a piezo drive inside the motor, the ER family offers silent motor operation with zero backlash (no gears) and built-in holding and braking without power consumption.

Motors can be provided with a closed back, rear-shaft, or with a built-in rotary encoder. Closed loop operation is supported with Nanomotion’s S775 XCD card, which is a closed loop drive and control module. The S775 can be provided as a small board or chip level based controller for integration into other electronics.
**Rotary Piezo Motor**

**TECHNICAL SPECIFICATIONS**

**Mechanical**
- Weight: 12 gr
- Dimensions: 15.0 Ø x 23.5 mm

**PERFORMANCE**
- Torque (max): 10 mNm
- Velocity (max): 300 rpm
- Encoder Resolution: 4096 CPR (with EO version)
- Operation: from -40°C to 70°C
- Vibrations: 10 g rms (holds position without power)
- MTBF: 50,000 hours

**ELECTRICAL**
- Drive voltage: 5V
- Power consumption: 2W (max)

**ORDERING INFORMATION**
- Part Number: ER-15-4 (no backside interface)
- Part Number: ER-15-4-S0 (with back shaft)
- Part Number: ER-15-4-E0

**TORQUE / VELOCITY CURVE**

<table>
<thead>
<tr>
<th>VELOCITY [rpm]</th>
<th>0</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>350</th>
</tr>
</thead>
<tbody>
<tr>
<td>TORQUE [Nmm]</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**MECHANICAL DRAWINGS AND INTERFACE**

**ELECTRICAL INTERFACE**

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
<th>Motor Pinout</th>
<th>Encoder Pinout</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTC OUT</td>
<td>Vdd (+5V)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NTC IN</td>
<td>GND (OV)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>P2</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>P1</td>
<td>Ri</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>COM</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>COM</td>
<td>CASE</td>
<td></td>
</tr>
</tbody>
</table>
Product Features

- Silent operation – undetectable
- Low surge current
- Best SWaP Performance
  - Mass: 2g
  - Embedded drive & control electronics in shutter body
- Holding and braking without power consumption
- MIL-STD-810F Compliant for shock, vibration, and temperature – Safe & Reliable

Product Description

The RS08 is the first shutter of its kind, utilizing a silent, miniature piezo actuator in an 8mm x 20mm package including the drive electronics. The RS08 is designed to work from a 3.3v battery and supports travel ranges from 35° to 120°. Shutter blades can vary in size and material, up to a 25mm diameter paddle. Using Nanomotion’s proprietary feedback system, the shutter is fully operational as a closed loop device, stopping on electrical limits to avoid any noise from a mechanical hardstop.
Rotary Shutter

TECHNICAL SPECIFICATIONS

Mechanical
- Weight: 2 gr
- Dimensions: Ø8mm x 20mm Long

Performance
- Drive Mode: Closed Loop
- Stroke Angle: up to 120° ±2°
- Stroke Time: <50msec for 90°
- Operating Temperature: -40°C to 70°C

ELECTRICAL
- Drive/Control Board Embedded
- Drive Voltage: 3.3V

Power Consumption
- Max: 400mW
- Idle (on): 8mW

Communication
- IIC

Optronics Systems
- Thermal imaging (NUC) shutters
- Laser Shutters
- Filters

MECHANICAL DRAWINGS AND INTERFACE

<table>
<thead>
<tr>
<th>pin number</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VCC 3.3V</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
</tr>
<tr>
<td>3</td>
<td>RESET</td>
</tr>
<tr>
<td>4</td>
<td>SDA</td>
</tr>
<tr>
<td>5</td>
<td>SCL</td>
</tr>
</tbody>
</table>
Product Features

- Blade-less actuator for shutter or filter change operation
- Silent operation – undetectable
- Low surge current
- Best SWaP Performance
  - Mass: 2g
  - Embedded drive & control electronics in shutter body
- Holding and braking without power consumption
- MIL-STD-810F Compliant for shock, vibration, and temperature – Safe & Reliable

Product Description

The RS08A is the first actuator of its kind, utilizing a silent, miniature piezo actuator in an 8mm x 20mm package including the drive electronics. The RS08A is designed to work from a 3.3v battery and supports travel ranges from 35˚ to 120˚.

The RS08A allows for user definable shutter blade or filter changer, based on appropriate motion analysis of mass and moment of inertia. Nanomotion’s proprietary feedback system is integrated into the grid, for closed loop device operation, stopping on electrical limits to avoid any noise from a mechanical hardstop.
MECHANICAL DRAWINGS AND INTERFACE

### TECHNICAL SPECIFICATIONS

#### Mechanical
- Weight: 2 gr
- Dimensions: Ø8mm x 20mm Long

#### Performance
- Drive Mode: Closed Loop
- Stroke Angle: up to 120° ±2°
- Stroke Time: <50msec for 90°
- Operating Temperature: -40°C to 70°C
- Vibration: 10g rms hold position without power
- MTBF: 50,000

### ELECTRICAL

- Drive/Control Board Embedded
- Drive Voltage: 3.3V

#### Power Consumption
- Max: 400mW
- Idle (on): 8mW

#### Communication
- IIC

### Optronics Systems
- Thermal imaging (NUC) shutters
- Laser Shutters
- Filters

---

**Nanomotion Ltd.**
**Worldwide Headquarters**
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
t: +972 73 2498000
e: nano@nanomotion.com

**Nanomotion Inc.**
**U.S. Headquarters**
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
t: (800) 821-6266
t: (631) 585-3000
e: nanoUS@nanomotion.com

---

**RS08A**
**Rotary Actuator**

---

**ER-15-4**
Rotary Actuator
Product Description

The RS08 Rotary Shutter is designed to operate with the lowest power consumption, over all other shutter technologies. The normal force of the piezo actuator, inside the shutter body, provides built-in holding and braking without power consumption. This eliminates the need for any ‘magnetic latching’ to hold position (which requires a peak current to overcome, resulting in reduced battery life).

The chart below reflects the minimum, maximum and average power consumption relative to data points taken at different PWM values. At 40% PWM, the expected shutter actuation time is approximately 70msec. At 60% PWM, the expected actuation time is 55msec.
NANOMOTION
A Johnson Electric Company

S787
NUC Shutter

Application Recommendations

• NUC Shutters for thermal sensors

Product Description

Nanomotion’s S787 series of NUC shutter is designed to meet the most challenging operating conditions of infrared imaging systems. The S787 shutter operates linearly with a direct drive EDGE motor, providing the lightest weight configuration while maintaining the closest proximity to the FPA.

The S787 series is provided with a 17mm x 15mm leaf that is capable of moving 15mm in 100mseconds. The moving blade is supported by the Edge – Actuator bearing structure on one side and an outboard shaft bearing to eliminate any blade deflection and vibration.

Standard configurations utilize Nanomotion's Edge motor with a miniature position sensor, integral to the shutter assembly, for closed loop operation. The shutter is supported by our ASIC that closes the position loop and serves as a drive & control.

Example of S787 NUC Shutter
**TECHNICAL SPECIFICATIONS**

**Mechanical**
- Weight: 15 gr
- Dimensions:
  - Aperture area: 14.7 x 17.0 mm
  - Moving mass of 1.5 gr
  - Back working distance: 2.2 mm

**PERFORMANCE**
- Stroke time: 150msec
- Operation from -40 °C to 70 °C
- Vibration: 10 g rms (holds position without power)
- Shock: 300 g, any orientation
- Position holding @ power off: 10g linear acceleration
- MTBF: 50,000 hours

**ELECTRICAL**
- Drive voltage: 4.2V
- Power consumption at idle:
  - Max: 500mW
  - Idle: 8mW (keeps position)

---

**VELOCITY/LOAD CHARACTERISTICS**

![Graph showing velocity/load characteristics](image)

**MECHANICAL DRAWINGS AND INTERFACE**

![Mechanical drawings and interface diagram](image)

**ELECTRICAL INTERFACE**

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>DISCONNECTED</td>
</tr>
<tr>
<td>2</td>
<td>SC_1</td>
<td>PR1 COLLECTOR</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>GROUND</td>
</tr>
<tr>
<td>4</td>
<td>SA_1</td>
<td>PR1 ANODE LED</td>
</tr>
<tr>
<td>5</td>
<td>COM</td>
<td>NM MOTOR COMMON</td>
</tr>
<tr>
<td>6</td>
<td>P_2</td>
<td>MN MOTOR PHASE 2</td>
</tr>
<tr>
<td>7</td>
<td>P_1</td>
<td>NM MOTOR PHASE 1</td>
</tr>
<tr>
<td>8</td>
<td>SA_2</td>
<td>PR2 ANODE LED</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>GROUND</td>
</tr>
<tr>
<td>10</td>
<td>SC_2</td>
<td>PR2 COLLECTOR</td>
</tr>
</tbody>
</table>

---

**Nanomotion Ltd.**
**Worldwide Headquarters**
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
- t: +972 73 2498000
- f: +972 73 2498099
- e: nano@nanomotion.com

**Nanomotion Inc.**
**U.S. Headquarters**
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
- t: (800) 821-6266
- f: (631) 585-3000
- t: (631) 585-1947
- e: nanoUS@nanomotion.com

www.nanomotion.com
Nanomotion’s LF14 Linear Filter Changer is designed to meet the most challenging operating conditions of optical systems. The LF14 operates linearly with a direct drive Edge motor, providing the lightest weight configuration while maintaining the closest back working distance.

The LF14 is provided with a blade that can accommodate different filter diameters and is capable of moving 14mm in 100 msec. The filter housing is supported by the Edge-Actuator bearing structure on one side and an outboard shaft bearing on the other, to eliminate any deflection or vibration.

Standard configurations utilize the Edge motor with a miniature position sensor, integral to the filter changer assembly, for closed loop operation. The filter changer is supported by our ASIC that closes the velocity loop and serves as a drive & control.

Product Features

- Silent operation – undetectable
- Best SWaP Performance
- Closest Back Working Distance
- Negligible EMI/RFI signature – no distortion
- Holding and braking without power consumption
- MIL-STD-810F Compliant for shock, vibration, and temperature – Safe & Reliable
**LF14 Linear Filter Changer**

### TECHNICAL SPECIFICATIONS

**Mechanical**
- Retainer Diameter: Ø 11 mm
- Total weight: 15 gr
- Moving mass of 1.5 gr
- Back working distance: 3.5mm

**Performance**
- Stroke time: 150msec
- Operation from -40 °C to 70 °C
- Vibration: 10 g rms (holds position without power)
- Shock: 300 g, any orientation
- Position holding @ power off: 10g linear acceleration
- MTBF: 50,000 hours

**Electrical**
- Drive voltage: 4.2V
- Power consumption at idle:
  - Max: 500mW
  - Idle: 8mW (keeps position)

### MECHANICAL DRAWINGS AND INTERFACE

![Mechanical Drawing]

### ELECTRICAL INTERFACE

![Electrical Interface]

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N.C.</td>
<td>DISCONNECTED</td>
</tr>
<tr>
<td>2</td>
<td>SC_1</td>
<td>PR1 COLLECTOR</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>GROUND</td>
</tr>
<tr>
<td>4</td>
<td>SA_1</td>
<td>PR1 ANODE LED</td>
</tr>
<tr>
<td>5</td>
<td>SCL</td>
<td>NM MOTOR COMMON</td>
</tr>
<tr>
<td>6</td>
<td>P_2</td>
<td>NM MOTOR PHASE 2</td>
</tr>
<tr>
<td>7</td>
<td>P_1</td>
<td>NM MOTOR PHASE 1</td>
</tr>
<tr>
<td>8</td>
<td>SA_2</td>
<td>PR2 ANODE LED</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td>GROUND</td>
</tr>
<tr>
<td>10</td>
<td>SC_2</td>
<td>PR2 COLLECTOR</td>
</tr>
</tbody>
</table>

---

**Nanomotion Ltd.**
**Worldwide Headquarters**
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
- **t:** +972 73 2498000
- **f:** +972 73 2498009
- **e:** nano@nanomotion.com

**Nanomotion Inc.**
**U.S. Headquarters**
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
- **t:** (800) 821-6266
- **t:** (631) 585-3000
- **f:** (631) 585-1947
- **e:** nanoUS@nanomotion.com

www.nanomotion.com
Miniature Precision Rotary Stage

Application Recommendations

The S840 Rotary module contains a 50,000 cpr precision optical encoder (external interpolator), with Nanomotion’s Edge motor technology and the XCD drive/control.

This integrated design consists of a complete motion solution, including the motors, bearings, encoder, drive & control captured in a 30mm cube.

This miniature rotary module can be adapted for:

- Hand-held (soldier carry) use
- Integration to LTLM / CLRF devices
- Vehicle use
- Other mechanisms

Product Description

The outside configuration can be adapted to support different customer electronics (Mounting Orientation), while the rotary module moves 90° - for a precise quartering process.

The S840 is designed for a calibration process of an IMU (inertial measurement unit) to eliminate the drift and improve north finding precision. It is intended to reduce the cycle time and improve the precision based on current IMU availability.
Miniature Precision Rotary Stage

TECHNICAL SPECIFICATIONS

Stage Travel: Continuous Rotation
Velocity: 180°/sec.
Resolution: 26 arc seconds
Torque: 14mNm

Typical MoveProfile:
180° in less than 1 second

Position Repeatability:
± 52 arc seconds

Assembly Weight:
Less than 50g

Power Consumption:
<500mW

Operating Temperature:
-20°C to 70°C

Lifetime: >20,000 hours

The S840 has the control card completed integrated into the rotary module. The module construction consists of (2) angular contact bearings with (4) Edge motors and a 50,000 cpr quadrature encoder (external interpolation). The control is based on Nanomotion's XCD chip and can be provided as an integrated solution or on a chip level for customer integration.

MECHANICAL DRAWINGS AND INTERFACE
Application Recommendations

The S851 Steering Module is a precision tilt stage, used as a stand-alone axis or in pairs for beam steering. This module utilizes a precision, absolute encoder with resolution down to 0.1µrad, with positional accuracy to 14µrad.

The mounting surface can be configured to support a mirror or other optical components. The module is driven by Nanomotion’s Edge-4X motor and capable of operation during 30g's of vibration.

This steering module can be adapted for:
- Ground based laser steering
- Flight based steering

Product Description

The S851 uses the Edge-4X motor to achieve ±3° travel operation at 8Hz, with total travel of 8° (or more). Designed to work with Nanomotion’s XCD2 board level, dual axis controller, precision motion can be supported for working as a single axis or in pairs.
**S851**

**Steering Module Stage**

**Dual Axis Drive & Control**

The S851 is designed for extremely high dynamic response for rapid steering of a laser beam. While used in pairs, each tilt stage has a natural frequency of greater than 400Hz, allowing for high speed motion control.

As a pair of steering stages the S851 is supported by Nanomotion’s XCD2 dual axis drive and control. The XCD2 can support a variety of Edge & Edge-4X motor configurations (power stage) and supports both absolute and incremental encoders. The XCD2 can be provided on board level or chip level, depending on integration requirements.

**TECHNICAL SPECIFICATIONS**

- **Stage Travel:** 8˚ standard, (10K with modification)
- **Velocity:** 1˚ in 30msec
- **Resolution:** 0.1µrad (Absolute encoder)
- **Position Accuracy:** 14µrad
- **Typical Move For Steering:** 1˚ in 30msec.
- **Operating Temperature:** -40˚C to 70˚C
- **Lifetime:** >20,000 hours

**MECHANICAL DRAWINGS AND INTERFACE**

---

**Nanomotion Ltd.**
Worldwide Headquarters
Mordot HaCarmel Industrial Park
Yokneam 20692 Israel
t: +972 73 2498000
t: +972 73 2498099
e: nano@nanomotion.com

**Nanomotion Inc.**
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
t: (800) 821-6266
t: (631) 585-3000
t: (631) 585-1947
e: nanoUS@nanomotion.com

[www.nanomotion.com](http://www.nanomotion.com)
Ordering Information

Part Number: XCD-EDGE-BD-03
Drive and Control

Related Products/Accessories

Part Number:
- EM1-S-0
- EM1-V-0
- EDGE motor

Product Number: XCDE150100-00
XCD EDGE Motherboard Assembly

Application Recommendations

- Auto Focus/Zoom Modules
- Shutter & Aperture Control
- Filter Changers
- Pan and Tilt Modules

Product Description

Nanomotion’s XCD – Drive & Control redefines the art of miniaturized drive and control electronics with the smallest hardware for operating piezo ceramic servo motors. The XCD provides complete servo control for the OEM market, coupled with the power stage and drive electronics on one board. XCD will have an OEM specific, motherboard for connecting to the motor, position sensor, communication and power.

The XCD for the Edge motor is provided as a single axis board which can operate in the ‘AB5’ mode with brake on/off, or in the more traditional AB1A mode. The XCD for the Edge motors accepts a single ended encoder signal and is programmed via an IIC interface and the NanoCommander user software.
TECHNICAL SPECIFICATIONS

Dimensions:
35.0 x 25.0 x 10.65 mm
Motors supported: EDGE
Input Power: 5 V
Drive Mode AB5
(brake on/off) or AB1A mode
Communication IIC
Operating Temperature:
-40 to 85 ºC

ELECTRICAL

Power Consumption:
500 mW (max)

ELECTRICAL INTERFACE

<table>
<thead>
<tr>
<th>pin number</th>
<th>pin name</th>
<th>pin description</th>
<th>pin number</th>
<th>pin name</th>
<th>pin description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5v</td>
<td>5vdc pc/motor input</td>
<td>11</td>
<td>sda</td>
<td>12c serial data</td>
</tr>
<tr>
<td>2</td>
<td>+5v</td>
<td>5vdc pc/motor input</td>
<td>12</td>
<td>scl</td>
<td>12c serial clock</td>
</tr>
<tr>
<td>3</td>
<td>spi clk</td>
<td>spi clock</td>
<td>13</td>
<td>gpi01</td>
<td>ppw</td>
</tr>
<tr>
<td>4</td>
<td>spi en</td>
<td>spi enable</td>
<td>14</td>
<td>gpi02</td>
<td>n/a</td>
</tr>
<tr>
<td>5</td>
<td>miso</td>
<td>master in slave out</td>
<td>15</td>
<td>gpi03</td>
<td>general purpose digital output 3</td>
</tr>
<tr>
<td>6</td>
<td>mosi</td>
<td>master out slave out</td>
<td>16</td>
<td>gpi04</td>
<td>general purpose digital output 4</td>
</tr>
<tr>
<td>7</td>
<td>n.c.</td>
<td>ncl connected</td>
<td>17</td>
<td>an2</td>
<td>analog input 1</td>
</tr>
<tr>
<td>8</td>
<td>n.c.</td>
<td>not connected</td>
<td>18</td>
<td>an1</td>
<td>analog input 2</td>
</tr>
<tr>
<td>9</td>
<td>rxd</td>
<td>rs232 receive</td>
<td>19</td>
<td>emergency</td>
<td>emergency stop</td>
</tr>
<tr>
<td>10</td>
<td>txd</td>
<td>rs232 transmit</td>
<td>20</td>
<td>an3</td>
<td>analog input 3</td>
</tr>
<tr>
<td>11</td>
<td>sda</td>
<td>12c serial data</td>
<td>21</td>
<td>anlg out2</td>
<td>analog output 2</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>22</td>
<td>anlg out1</td>
<td>analog output 1</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td>23</td>
<td>n.c.</td>
<td>n/a</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td>24</td>
<td>pwm out</td>
<td>keep alive</td>
</tr>
<tr>
<td>24</td>
<td>pwm out</td>
<td>keep alive</td>
<td>25</td>
<td>gnd</td>
<td>system ground</td>
</tr>
<tr>
<td>25</td>
<td>gnd</td>
<td>system ground</td>
<td>26</td>
<td>gnd</td>
<td>system ground</td>
</tr>
</tbody>
</table>

Nanomotion Ltd.
Worldwide Headquarters
Mordat HaCarmel Industrial Park
Yokneam 20692 Israel
t: +972 73 2498000
t: +972 73 2498099
e: nano@nanomotion.com

Nanomotion Inc.
U.S. Headquarters
1 Comac Loop, Suite 14B2
Ronkonkoma, New York 11779
t: (800) 621-6266
t: (631) 585-3000
t: (631) 585-1947
e: nanoUS@nanomotion.com
XCD2

Dual Axis Drive and Control

Application Recommendations

- Auto Focus/Zoom Modules
- Pan & Tilt Gimbal with Gyro Stabilization
- Beam Steering & Stabilization
- Target Acquisition Devices

Product Description

XCD2 Multi axis amplifier & control board is a dual axis OEM amplifier and control board designed for applications using the Edge & Edge-4X motors. The board level product serves as a dual axis controller and can support a mixture of motor configurations, with multiple Edge motors or multiple Edge-4X motors per axis.

The XCD2 also supports Nanomotion’s gyro input for dual axis stabilization. The XCD2 is programmed via IIC and can support quadrature (incremental) encoder input as well as BiSS (absolute) encoder input.

The XCD2 supports 2 axes of motion in the AB1 or AB5 mode of operation. It is an advanced 32-bit ARM 168MHz floating point processor with a configurable servo rate, up to 20KHz.

Communications via UART, I2C, SPI and USB are supported, along with an embedded gyro interface using the SPI port.

Advanced I/Os with (8)GPIO, (16) ADC and (2) DACs, with configurable parameters.
XCD2

Drive and Control

TECHNICAL SPECIFICATIONS
Mechanical
Dimensions: 50mm x 50mm

PERFORMANCE
• Motors Supported: 1, 2, 3, or 4 Edge Motors per axis
• 1 or 2 Edge-4X Motors per axis
• Drive mode: AB1 or AB5 (Brake on/off)
• Communication: IIC, UART, SPI and USB
• Operating Temperature: -40°C to 70°C

POWER CONSUMPTION
Input: 5V 5% tolerance
CPU: 100mA
Edge-4X: 300mA per motor
Edge: 100mA per motor
Inputs & Outputs are 3.3V

MECHANICAL DRAWINGS AND INTERFACE (Dimensions in mm)

BLOCK DIAGRAM
Drive and Control

POWER STAGE & CONNECTION OPTIONS

The XCD2 drive/control board offers a variety of options to connect:

- Host Adapter Board
- Motor power stage
- Incremental or Absolute Encoders
- Gyro (Nanomotion defined)

HOST ADAPTER BOARD

The host adapter board provides an easy way to connect to the XCD2 main board. A standard header connector has pin to pin connection to HOST connector and has the same signals as the small HOST connector. In additional the board has a power jack connector to supply 5V.

Three boards are available:

- A – RS232 and RS485 communication interfaces
- B – Contains pin to pin connection between the HOST connector and a 100mill header
- C – I2C, SPI and UART communication interfaces

MOTOR POWER STAGE

The XCD2 is designed to work with Nanomotion’s Edge and Edge-4X motors. The controller can support two axes with any configuration of 1 through 4 Edge motors and 1 to 2 Edge-4X motors.

Each power stage board is available with standard flat ribbon cables and connectors.

ENCODER INTERFACE

The XCD2 supports either an incremental, A-quad-B encoder or an absolution, BiSS encoder. Both connection boards are available.
GYRO INTERFACE

The embedded gyro interface uses the SPI port and provides (8) stabilized presets allowing for easy transition between modes (encoder + gyro).

The gyro interface only supports the InvenSense MPU-6000 gyro.

EVALUATION KITS

For application development, Nanomotion offers a variety of development kits that consist of both motor/mechanical axes and the various board configurations. Nanomotion can also supply a single XCD2 board, providing all of the component options, in a ‘snap-off’ board configuration, allowing flexibility to change between power stage, encoder choices and communications.

Most applications ultimately lead to the integration of our XCD2 chip or power stage being integrated into customer electronics, to save space. However, all applications can be supported through the use of various evaluation boards and even custom production board based on specific requirements.
Application Recommendations

- Auto Focus/Zoom Modules
- Shutter & Aperture Control
- Filter Changers
- Pan and Tilt Modules

Product Description

S775150000-03 controller driver is designed to support the ER-15 rotary motor, as a closed loop drive/control for (4) Edge motor elements. The drive/control board is based on Nanomotion's XCD chip, with an expanded power stage. The S775 board takes a single ended quadrature encoder input and is fully programmable via the Nano-Commander software and IIC user interface.

- Can drive and control ER-15 rotary motor or up to (4) EDGE motors
- PC interface through Nanocommander
- Interfaces with host through IIC
TECHNICAL SPECIFICATIONS
Mechanical Dimensions: 45.7 x 33.3 x 7.2 mm

PERFORMANCE
Motors supported: ER-15-4, XE EDGE motors
Encoder Input: Quadrature
Input Power 5 V
Power Consumption: 2 W (max)
Drive Mode: AB5 (brake on/off) or AB1A mode
Communication: IIC
Safety End of travel limits and E-Stop
Digital Inputs 3 – TTL 3.3 to 5 V
Operating Temperature: -40 to 85 ºC

ELECTRICAL INTERFACE

<table>
<thead>
<tr>
<th>Type</th>
<th>Motor Type</th>
<th>Host Controller</th>
<th>Encoder Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTC OUT</td>
<td>VCC 5V</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>NTC IN</td>
<td>XDA N/C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>P2/PHASE 2</td>
<td>SCL N/C</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>P1/PHASE 1</td>
<td>UART RXD N/C</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>COM</td>
<td>UART TXD +5V</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>COM</td>
<td>GPIO 3 0V</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>–</td>
<td>GPIO 4 A SIGNAL</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>–</td>
<td>TDO ISIGNAL</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>–</td>
<td>RESET B SIGNAL</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>–</td>
<td>GND GND</td>
<td></td>
</tr>
</tbody>
</table>
XCD Component

Application Recommendations

- Auto Focus/Zoom Modules
- Shutter & Aperture Control
- Filter Changers
- Pan and Tilt Modules
- OEM Stages

Product Description

Nanomotion’s XCD drive & control is a miniature closed loop servo control with the smallest hardware for operating piezo ceramic servo motors. The XCD provides complete servo control for Security market applications with a built in motor driver.

The XCD component is provided on a chip level and can be integrated into user electronics with the addition of a motor power stage. The component level product will accept single ended or differential encoder input (motor size dependent) and is programmed via an IIC interface and our NanoCommander user software.
TECHNICAL SPECIFICATIONS

Mechanical:
- Dimensions: 12mm x 12mm
- Height: 1.2 mm

Functional:
- Motors supported: All Nanomotion motors
- Drive mode: AB5, AB1
- Support AQB sensor (Single ended 5V/3.3V)
- Communication: I2C, SPI (slave, master), UART (LVTTL)
- Limit switch: left limit, right limit
- Emergency (optional)
- 2 x input TTL (5v/3.3v)
- 2 x Input/Output LVTTL (3.3v)
- 3 x Analog input: NTC, Joystick, Potentiometer
  (Vin range: 0V to 3.3V)
- 2 x Analog out (pwm)

ELECTRICAL
- Main power: 5V

ENVIRONMENTAL
- Operating Temperature: -40°C–85°C
ASIC Component

Application Recommendations

- Auto Focus/Zoom Modules
- Shutter & Aperture Control
- Filter Changers
- Pan and Tilt Modules

Product Description

Nanomotion’s ASIC controller/driver component can support the Edge motor and Edge based modules working in either the traditional AB1A mode or in AB5 mode (linear voltage to velocity profile). The AB1A mode supports up to two motors in parallel, doubling the force output.

The ASIC component can be provided for integration in customer electronics and supports open loop operation, as a driver only or closed loop operation based on Nanomotion’s proprietary analog position sensor.

The ASIC driver board is configured for open loop, driver operation only.
TECHNICAL SPECIFICATIONS

Mechanical
Package: 32-pin QFN, 5mm x 5mm height 1.2mm

Functional:
Controller/Driver, or driver only
Motors supported: up to 2 EDGE motors
Drive mode: AB5, AB1
IIC interface at max 100 KHz
3 OPAMPs inputs
2 A/D inputs

ELECTRICAL INTERFACE

ELECTRICAL
Supply voltage:
2.7V to 4.2V
25ua leakage current at sleep mode (at 3.7V)

ENVIRONMENTAL
Operating Temperature:
-40°C – 85°C