



## SERIES: NEMA17-AMT112S | DESCRIPTION: STEPPER SERVO MOTOR

### FEATURES

- CUI AMT112S encoder + LIN Engineering stepper motor
- stepper motor with encoder for closed-loop mode when paired with a controller
- small, compact NEMA 17 frame size
- up to 110 oz-in (0.77 N-m) holding torque
- patented capacitive encoder ASIC technology
- incremental resolutions up to 4096 PPR
- resolutions programmable with AMT Viewpoint™ PC software
- digitally set zero position



IN PARTNERSHIP WITH



| MODEL                  | step angle | current/<br>phase | resistance/<br>phase         | inductance<br>/phase    | max<br>holding<br>torque | max<br>optimal<br>speed | body length   |
|------------------------|------------|-------------------|------------------------------|-------------------------|--------------------------|-------------------------|---------------|
|                        | (°)        | (A)               | typ<br>( $\Omega \pm 10\%$ ) | typ<br>(mH $\pm 20\%$ ) | (oz-in)                  | (RPS)                   | max<br>(inch) |
| NEMA17-13-04SD-AMT112S | 1.8        | 0.67              | 9.9                          | 12.52                   | 42.0                     | 6                       | 1.34          |
| NEMA17-13-04PD-AMT112S | 1.8        | 1.33              | 2.5                          | 3.09                    | 42.0                     | 11                      | 1.34          |
| NEMA17-16-06SD-AMT112S | 1.8        | 0.70              | 10.8                         | 21.84                   | 63.0                     | 3                       | 1.58          |
| NEMA17-16-06PD-AMT112S | 1.8        | 1.40              | 2.7                          | 5.46                    | 63.0                     | 6                       | 1.58          |
| NEMA17-19-07SD-AMT112S | 1.8        | 2.10              | 1.3                          | 9.36                    | 83.0                     | 5                       | 1.89          |
| NEMA17-19-07PD-AMT112S | 1.8        | 1.05              | 5.2                          | 2.34                    | 83.0                     | 5                       | 1.89          |
| NEMA17-23-01D-AMT112S  | 1.8        | 2.00              | 2.0                          | 2.91                    | 110.0                    | 7                       | 2.34          |

## AMT112S ENCODER ELECTRICAL

| parameter                    | conditions/description | min     | typ | max | units |
|------------------------------|------------------------|---------|-----|-----|-------|
| power supply                 | VDD                    | 4.5     | 5   | 5.5 | V     |
| start up time                |                        |         | 200 |     | ms    |
| current consumption          | with unloaded output   |         | 16  |     | mA    |
| output high level            |                        | VDD-0.1 |     |     | V     |
| output low level             |                        |         |     | 0.1 | V     |
| output current (per channel) |                        |         |     | 15  | mA    |
| rise/fall time               |                        |         | 8   |     | ns    |

## INCREMENTAL CHARACTERISTICS

| parameter                           | conditions/description  | min | typ | max | units   |
|-------------------------------------|---|-----|-----|-----|---------|
| channels                            | CMOS Voltage: A, B, Z   |     |     |     |         |
| waveform                            | CMOS voltage square wave  |     |     |     |         |
| phase difference                    | A leads B for CCW rotation (viewed from front)  |     |     |     |         |
| quadrature resolutions <sup>1</sup> | 48, 96, 100, 125, 192, 200, 250, 256, 360, 384, 400, 500, 512, 768, 800, 1000, 1024, 1600, 2000, 2048, 2500, 4096 |     |     |     | PPR     |
| index <sup>2</sup>                  | one pulse per 360 degree rotation   |     |     |     |         |
| accuracy                            |   |     | 0.2 |     | degrees |
| quadrature duty cycle               |   |     | 50  |     | %       |

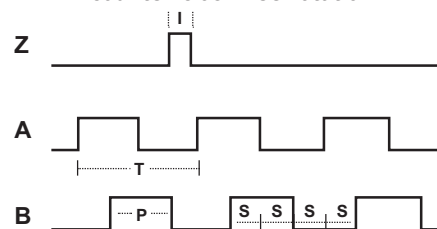
Notes: 1. Resolution programmed with AMT Viewpoint™ PC software. Default resolution set to 400 PPR.  
2. Zero position alignment set with AMT One Touch Zero™ module, AMT Viewpoint™ PC software, or serial commands

## MECHANICAL

| parameter                             | conditions/description  | min | typ  | max  | units |
|---------------------------------------|---|-----|------|------|-------|
| weight                                |   |     | 15.7 |      | g     |
| rotational speed (at each resolution) | 48, 96, 100, 125, 192, 200, 250, 256, 384, 400, 500, 512, 800, 1000, 1024, 2048 |     |      | 8000 | RPM   |
|                                       | 360, 768, 1600, 2000, 4096  |     |      | 4000 | RPM   |
|                                       | 2500  |     |      | 2500 | RPM   |

## ENCODER WAVEFORMS

**Figure 1**  
Quadrature signals with index showing counter-clockwise rotation




The following parameters are defined by the resolution selected for each encoder, where R = resolution.

| Parameter | Description     | Expression | Units              |
|-----------|-----------------|------------|--------------------|
| T         | period          | $360/R$    | mechanical degrees |
| P         | pulse width     | $T/2$      | mechanical degrees |
| I         | index width     | $P/2$      | mechanical degrees |
| S         | A/B state width | $P/2$      | mechanical degrees |

## STEPPER MOTOR SPECIFICATIONS

| parameter           | conditions/description                         | min | typ   | max   | units              |
|---------------------|--|-----|-------|-------|--------------------|
| motor frame size    | NEMA Size 17                                   |     |       |       |                    |
| step angle          |  |     | 1.8   |       | °                  |
| rated current/phase | see page 1 for details                         |     |       |       |                    |
| rated voltage       |  |     | 24-48 |       | Vdc                |
| resistance/phase    | see page 1 for details                         |     |       |       |                    |
| inductance/phase    | see page 1 for details                         |     |       |       |                    |
| connection type     | bipolar  |     |       |       |                    |
| rotor inertia       | NEMA17-13-04SD-AMT112S, NEMA17-13-04PD-AMT112S |     | 0.18  |       | oz-in <sup>2</sup> |
|                     | NEMA17-16-06SD-AMT112S, NEMA17-16-06PD-AMT112S |     | 0.28  |       | oz-in <sup>2</sup> |
|                     | NEMA17-19-07SD-AMT112S, NEMA17-19-07PD-AMT112S |     | 0.37  |       | oz-in <sup>2</sup> |
|                     | NEMA17-23-01D-AMT112S                          |     | 0.56  |       | oz-in <sup>2</sup> |
| max holding torque  | see page 1 for details                         |     |       |       |                    |
| bearing type        | ABEC3  |     |       |       |                    |
| front shaft OD      |  |     | 5     |       | mm                 |
| front shaft length  |  |     | 0.94  |       | inch               |
| max optimal speed   | see page 1 for details                         |     |       |       |                    |
| max axial load      |  |     |       | 6     | lb                 |
| radial play         | at 1 lb load                                   |     |       | 0.001 | inch               |
| end play            | at 2 lbs load                                  |     |       | 0.003 | inch               |
| shaft run out       |  |     | 0.002 |       | inch TIR           |
| dielectric strength |  |     | 500   |       | V                  |
| EMI/EMC             | EN 55014-1:2007                                |     |       |       |                    |

## SWITCHING SEQUENCE

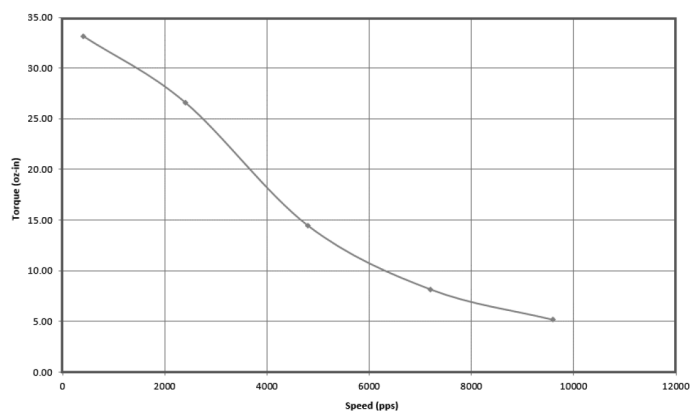
| SWITCHING SEQUENCE  |      |   |   |   |   |
|---|------|---|---|---|---|
| CCW   | STEP | A | A | B | B |
|  | 1    | + | - | + | - |
|   | 2    | + | - | - | + |
|   | 3    | - | + | - | + |
|   | 4    | - | + | + | - |
|   | 1    | + | - | + | - |
| Motor Rotation Viewed from Front Shaft End  |      |   |   |   |   |

## ENVIRONMENTAL

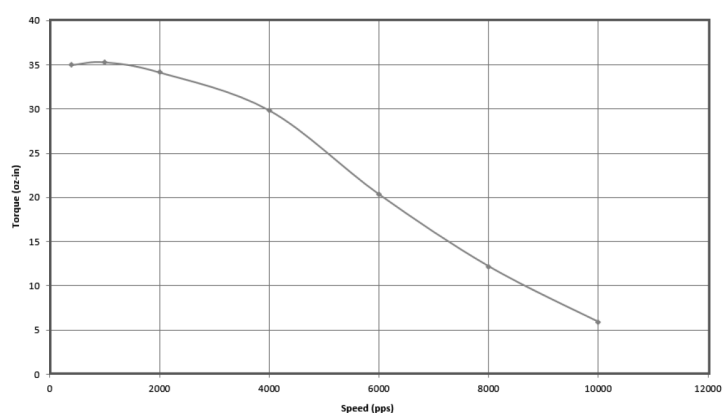
| parameter             | conditions/description                         | min | typ | max | units |
|-----------------------|--|-----|-----|-----|-------|
| operating temperature |  | -20 |     | 50  | °C    |
| storage temperature   |  | -20 |     | 100 | °C    |
| humidity              | non-condensing                                 |     |     | 85  | %     |
| vibration             | 10~500 Hz, 5 minute sweep, 2 hours on each XYZ |     |     | 5   | G     |
| shock                 | 3 pulses, 6 ms, 3 on each XYZ                  |     |     | 200 | G     |
| RoHS                  | yes  |     |     |     |       |

## TORQUE CURVES

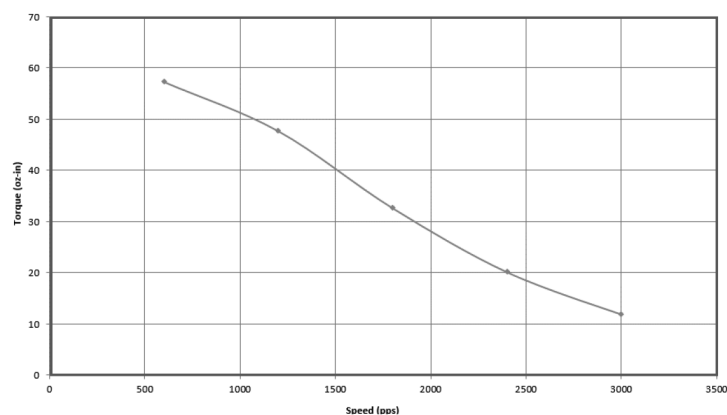
CUI P/N NEMA17-13-04SD-AMT112S

Lin Engineering P/N WO-4118S-04S (1.8 Step Motor)  
24 Vdc, 0.67 Amp/Phase, IB463, 1/2 Stepping

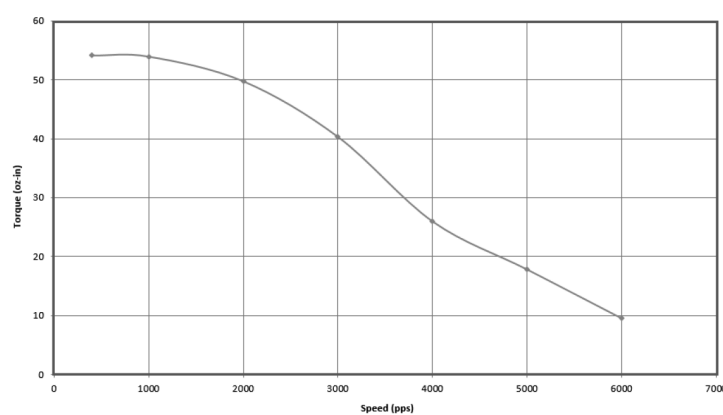
CUI P/N NEMA17-13-04PD-AMT112S

Lin Engineering P/N WO-4118S-04P (1.8 Step Motor)  
24 Vdc, 1.33 Amp/Phase, IB462, 1/2 Stepping

CUI P/N NEMA17-16-06SD-AMT112S

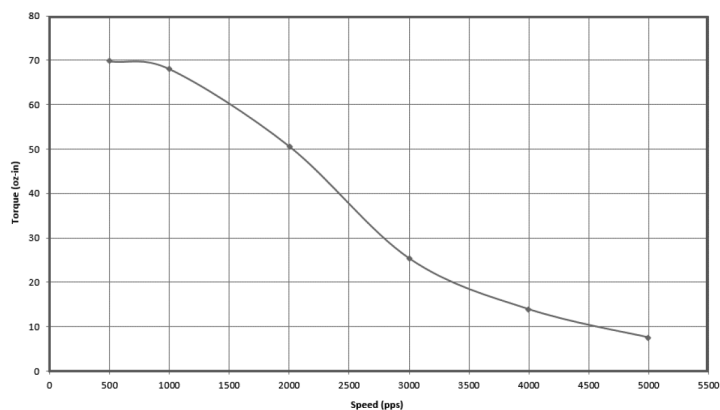
Lin Engineering P/N WO-4118M-06S (1.8 Step Motor)  
24 Vdc, 0.7 Amp/Phase, R208, 1/2 Stepping

CUI P/N NEMA17-16-06PD-AMT112S

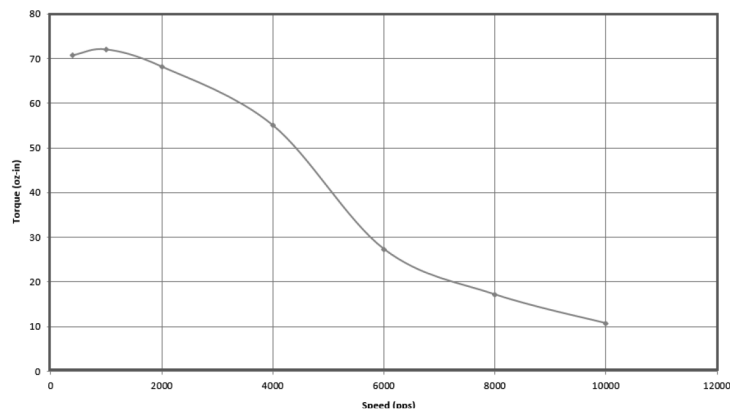
Lin Engineering P/N WO-4118M-06P (1.8 Step Motor)  
24 Vdc, 1.4 Amp/Phase, IB462, 1/2 Stepping

## TORQUE CURVES (CONTINUED)

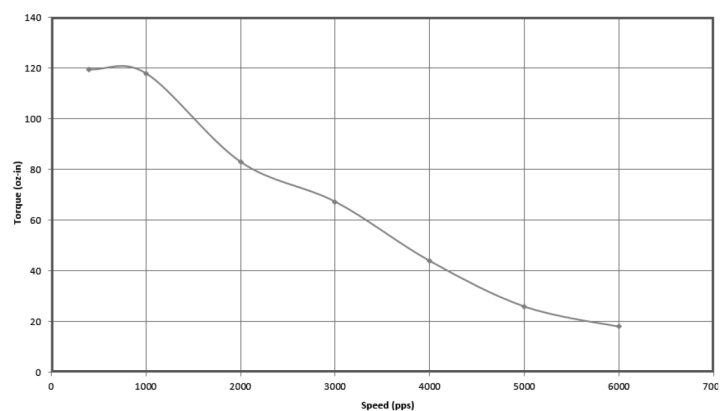
CUI P/N NEMA17-19-07SD-AMT112S  
Lin Engineering P/N WO-4118L-07S (1.8 Step Motor)  
24 Vdc, 1.05 Amp/Phase, IB462, 1/2 Stepping



CUI P/N NEMA17-19-07PD-AMT112S  
Lin Engineering P/N WO-4118L-07P (1.8 Step Motor)  
24 Vdc, 2.1 Amp/Phase, IB463, 1/2 Stepping



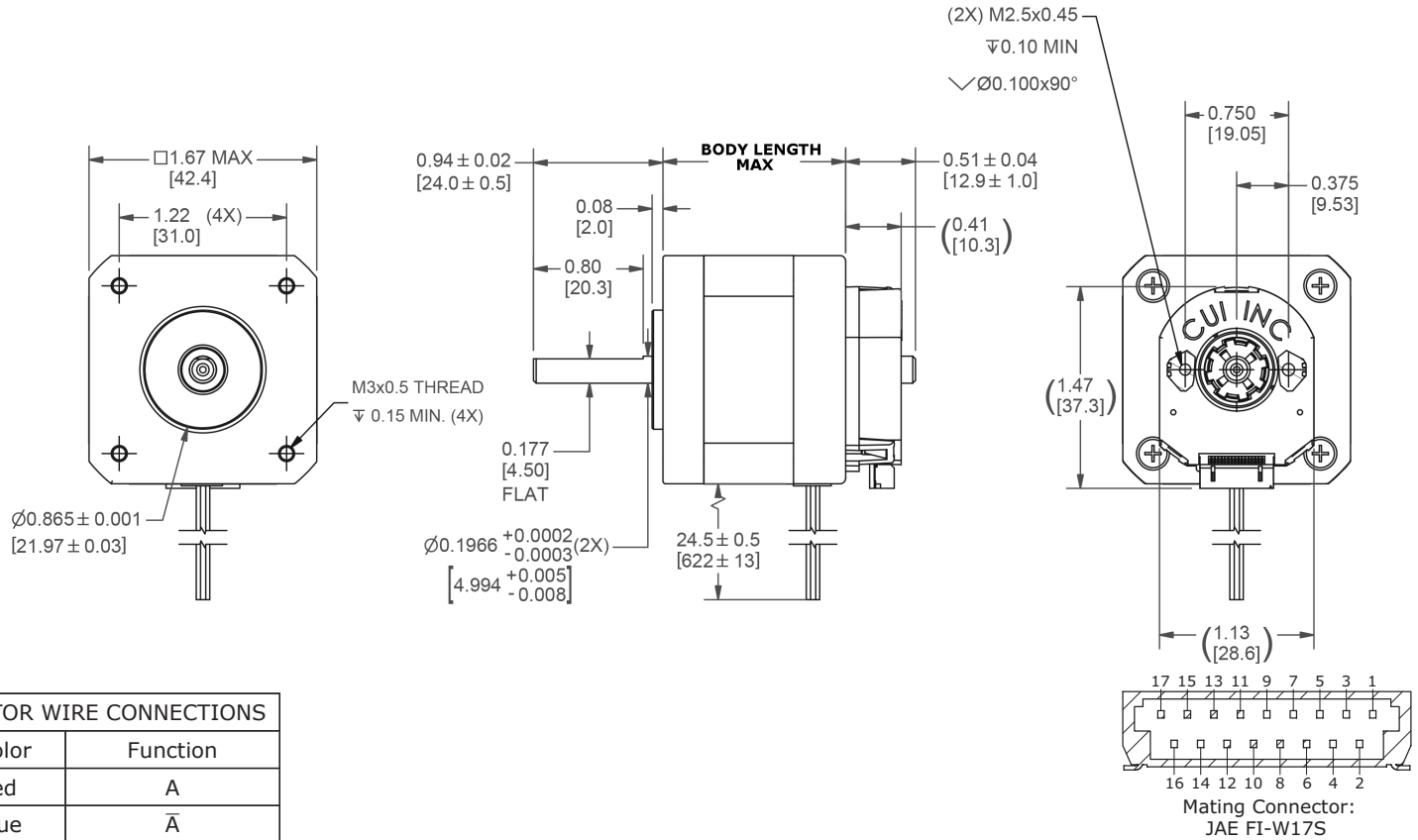
CUI P/N NEMA17-23-01D-AMT112S  
Lin Engineering P/N WO-4118C-01 (1.8 Step Motor)  
24 Vdc, 2 Amp/Phase, IB463, 1/2 Stepping



## MECHANICAL DRAWING

units: inch [mm]

tolerance:

X.XX  $\pm 0.01$  [ $\pm 0.25$ ]X.XXX  $\pm 0.005$  [ $\pm 0.13$ ]X.XXXX  $\pm 0.0005$  [ $\pm 0.013$ ]

### MOTOR WIRE CONNECTIONS

| Color                     | Function  |
|---------------------------|-----------|
| red                       | A         |
| blue                      | $\bar{A}$ |
| green                     | B         |
| black                     | $\bar{B}$ |
| 26 AWG <sup>3</sup> , PVC |           |

| MODEL NO.              | BODY LENGTH (inch) | WEIGHT (lb) |
|------------------------|--------------------|-------------|
| NEMA17-13-04SD-AMT112S | 1.34               | 0.50        |
| NEMA17-13-04PD-AMT112S | 1.34               | 0.50        |
| NEMA17-16-06SD-AMT112S | 1.58               | 0.65        |
| NEMA17-16-06PD-AMT112S | 1.58               | 0.65        |
| NEMA17-19-07SD-AMT112S | 1.89               | 0.80        |
| NEMA17-19-07PD-AMT112S | 1.89               | 0.80        |
| NEMA17-23-01D-AMT112S  | 2.34               | 0.90        |

### ENCODER CONNECTIONS

| #  | Function          |
|----|-------------------|
| 1  | TX_ENC+           |
| 2  | RX_ENC+           |
| 3  | N/A               |
| 4  | GND               |
| 5  | N/A               |
| 6  | +5 V              |
| 7  | N/A               |
| 8  | B+                |
| 9  | N/A               |
| 10 | A+                |
| 11 | N/A               |
| 12 | Z+                |
| 13 | N/A               |
| 14 | MCLR <sup>B</sup> |
| 15 | N/A               |
| 16 | N/A               |
| 17 | N/A               |

Note 3. NEMA17-19-07PD-AMT112S &amp; NEMA17-23-01D-AMT112S models have 22 AWG wires.

## REVISION HISTORY

| rev. | description     | date       |
|------|-----------------|------------|
| 1.0  | initial release | 06/26/2018 |

The revision history provided is for informational purposes only and is believed to be accurate.



**CUI INC<sup>®</sup>**

**Headquarters**  
20050 SW 112th Ave.  
Tualatin, OR 97062  
**800.275.4899**

Fax 503.612.2383  
**cui.com**  
techsupport@cui.com

CUI offers a one (1) year limited warranty. Complete warranty information is listed on our website.

CUI reserves the right to make changes to the product at any time without notice. Information provided by CUI is believed to be accurate and reliable. However, no responsibility is assumed by CUI for its use, nor for any infringements of patents or other rights of third parties which may result from its use.

CUI products are not authorized or warranted for use as critical components in equipment that requires an extremely high level of reliability. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.