

MTN Series

Mid-Travel Steel Linear Stages



Newport®

Experience | Solutions

USER'S MANUAL

Precision Motion – **Guaranteed™**

Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's discretion.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

This warranty does not apply to defects resulting from modification or misuse of any product or part.



CAUTION

Please return equipment in the original (or equivalent) packing.

You will be responsible for damage incurred from inadequate packaging if the original packaging is not used.

CAUTION

Warranty does not apply to damages resulting from:

- **Incorrect usage:**
 - Load on the stage greater than maximum specified load.
 - Carriage speed higher than specified speed.
 - Improper grounding.
 - Connectors must be properly secured.
 - When the load on the stage represents an electrical risk, it must be connected to ground.
 - Excessive or improper cantilever loads.
- **Modification of the stage or any part thereof.**

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

No part of this manual may be reproduced or copied without the prior written approval of Newport Corporation.

This manual has been provided for information only and product specifications are subject to change without notice. Any changes will be reflected in future printings.

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EC Declaration of Conformity

MTN Series

EC Declaration of Conformity

following Annex II-1A
of Directive 2006/42/EC on machinery



The manufacturer:

MICRO-CONTROLE Spectra-Physics,
9, rue du bois sauvage
F-91006 Evry FRANCE

Hereby declares that the machinery:

- Description: " MTN"
- Function: Mid-Travel Steel Linear Stages
- Models: MTN100/200/300-CC/PP/PPV6

– the technical file of which was compiled by:

Mr Dominique DEVIDAL, Quality Director,
MICRO-CONTROLE Spectra-Physics, Zone Industrielle - B.P.29
F-45340 Beaune La Rolande France

– complies with all the relevant provisions of the Directive 2006/42/EC on machinery.
– complies with all the relevant provisions of the Directive 2014/30/EU relating to electro-magnetic compatibility.

– was designed and built in accordance with the following harmonised standards:

- NF EN 61326-1:2013 « Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements »
- NF EN 55011:2010/A1:2011 Class A

– was designed and built in accordance with the following other standards:

- NF EN 61000-4-2
- NF EN 61000-4-3
- NF EN 61000-4-4
- NF EN 61000-4-5
- NF EN 61000-4-6

ORIGINAL DECLARATION

Done in Beaune La Rolande on 26 June 2015
Dominique DEVIDAL
Quality Director

DC1-EN rev:A

Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the product where safety-related issues occur.

General Warning or Caution



The exclamation symbol may appear in warning and caution tables in this document. This symbol designates an area where personal injury or damage to the equipment is possible.

The following are definitions of the Warnings, Cautions and Notes that may be used in this manual to call attention to important information regarding personal safety, safety and preservation of the equipment, or important tips.



WARNING

Warning indicates a potentially dangerous situation which can result in bodily harm or death.



CAUTION

Caution indicates a potentially hazardous situation which can result in damage to product or equipment.

NOTE

Note indicates additional information that must be considered by the user or operator.

European Union CE Mark



The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

Warnings and Cautions



ATTENTION

This stage is a Class A device. In a residential environment, this device can cause electromagnetic interference. In this case, suitable measures must be taken by the user.

Warnings



WARNING

The motion of objects of all types carries potential risks for operators. Ensure the protection of operators by prohibiting access to the dangerous area and by informing the personnel of the potential risks involved.

WARNING

Do not use this stage when its motor is emitting smoke or is unusually hot to the touch or is emitting any unusual odor or noise or is in any other abnormal state.

Stop using the stage immediately, switch off the motor power and then disconnect the electronics power supply.

After checking that smoke is no longer being emitted contact your Newport service facility and request repairs. Never attempt to repair the stage yourself as this can be dangerous.

WARNING

Make sure that this stage is not exposed to moisture and that liquid does not get into the stage.

Nevertheless, if any liquid has entered the stage, switch off the motor power and then disconnect the electronics from power supply.

Contact your Newport service facility and request repairs.

WARNING

Do not insert or drop objects into this stage, this may cause an electric shock, or lock the drive.

Do not use this stage if any foreign objects have entered the stage. Switch off the motor power and then disconnect the electronics power supply.

Contact your Newport service facility for repairs.

WARNING

Do not place this stage in unstable locations such as on a wobbly table or sloping surface, where it may fall or tip over and cause injury.

If this stage has been dropped or the case has been damaged, switch off the motor power and then disconnect the electronics power supply.

Contact your Newport service facility and request repairs.

WARNING

Do not attempt to modify this stage; this may cause an electric shock or downgrade its performance.

WARNING

Do not exceed the usable depth indicated on the mounting holes (see section “Dimensions”). Longer screws can damage the mechanics or cause a short-circuit.

Cautions

CAUTION

Do not place this stage in a hostile environment such as X-Rays, hard UV,... or in any vacuum environment (except vacuum compatible versions).

CAUTION

Do not place this stage in a location affected by dust, oil fumes, steam or high humidity. This may cause an electric shock.

CAUTION

Do not leave this stage in places subject to extremely high temperatures or low temperatures. This may cause an electric shock.

- Operating temperature: +10 to +35 °C
 - Storage temperature: -10 to +40 °C (in its original packaging)
 - Vacuum compatible versions can be steamed at +60 °C
-



CAUTION

Do not move this stage if its motor power is on.

Make sure that the cable to the electronics is disconnected before moving the stage. Failure to do so may damage the cable and cause an electrical shock.

CAUTION

Be careful that the stage is not bumped when it is being carried. This may cause it to malfunction.

CAUTION

When handling this stage, always unplug the equipment from the power source for safety.

CAUTION

When the carriage is in its end-of-run position, it is strongly recommended not to go beyond this point as this may damage the stage mechanism.

CAUTION

Contact your Newport service facility to request cleaning and specification control every year.

Mid-Travel Steel Linear Stages

MTN Series

1.0 Introduction

This manual provides operating instructions for the stage that you have purchased in the MTN Series:

- MTN-PP
- MTN-PPV6 ⁽¹⁾
- MTN-CC

^{D)} REMARK

Vacuum compatible stages to 10^{-6} hPa. In this case, the max. speed have to be divided by two and the +CX axial load capacity is limited at 50 N.



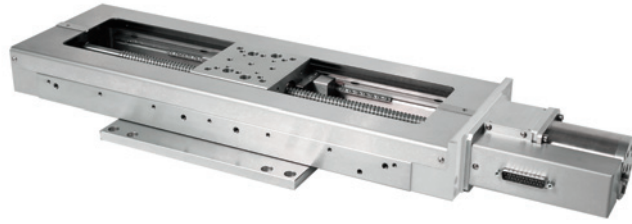
MTN-CC linear stages.

RECOMMENDATION

We recommend you read carefully the chapter “Connection to electronics” before using the MTN stage.



MTN200PP linear stage.



MTN300PPV6 linear stage.



ATTENTION

Before the first use of your stage, it is essential to remove:

- MTNPP & MTN-CC: The clamping bracket of the carriage and the handling straps.
- MTN-PPV6: The clamping bracket of the carriage.

NOTE

Keep removed components in order to re-use them during a next transportation of the stage.

2.0

Description

The MTN Series linear stages are durable, all-steel construction linear stages with excellent stiffness, load capacity and thermal stability. They are available in DC and Stepper motor versions and are ideal for applications that require moving heavy loads with sub-micron precision (MIM). Available up to 300 mm of travel, MTN stages can bear up to 100 kg with an axial load capacity of up to 200 N. Features include: opposing single-row bearings, a lead screw and a precision nut. The nut design includes anti-backlash preloading and a sophisticated decoupling system ensuring little to no carriage movement. The non-migrating ball cage design prevents any ball cage drift, particularly in vertical applications.

2.1

Design Details

Base Material	Stainless Steel
Bearings	Linear ball bearings with anti- cage migration
Drive Mechanism	Backlash-compensated leadscrew
Drive Screw Pitch	4 mm
Feedback	CC: 20,000 cts/rev. PP: No encoder
Limit Switches	Optical
Origin	Optical, centered
Vacuum Compatibility	MTN-PPV6 version to 10 ⁻⁶ hPa
Cable	3 m (included for ambient environment only)



NOTE

This product complies with the RoHS directive (Restriction of Hazardous Substances).

3.0 Characteristics

3.1 Definitions

Specifications of our products are established in reference to ISO 230 standard part II “Determination of accuracy and repeatability of positioning numerically controlled axes”.

This standard gives the definition of position uncertainty which depends on the 3 following parameters:

(Absolute) Accuracy

Difference between ideal position and real position.

On-Axis Accuracy

Difference between ideal position and real position after the compensation of linear errors.

Linear errors include: cosine errors, inaccuracy of screw or linear scale pitch, angular deviation at the measuring point (Abbe error) and thermal expansion effects. All Newport motion electronics can compensate for linear errors.

The relation between absolute accuracy and on-axis accuracy is as follows:

$$\text{Absolute Accuracy} = \text{On-Axis Accuracy} + \text{Correction Factor} \times \text{Travel}$$

Repeatability

Ability of a system to achieve a commanded position over many attempts.

Reversal Value (Hysteresis)

Difference between actual position values obtained for a given target position when approached from opposite directions.

Minimum Incremental Motion (MIM or Sensitivity)

The smallest increment of motion a device is capable of delivering consistently and reliably.

Resolution

The smallest increment that a motion device can theoretically move and/or detect. Resolution is not achievable, whereas MIM, is the real output of a motion system.

Yaw, Pitch

Rotation of carriage around the Z axis (Yaw) or Y axis (Pitch), when it moves.

The testing of on-axis accuracy, repeatability, and reversal error are made systematically with test equipment in an air-conditioned room (20^{±1} °C).

A linear cycle with 21 data points on the travel and 4 cycles in each direction gives a total of 164 points.

Guaranteed Specifications

Guaranteed maximum performance values are verified per Newport's A167 metrology test procedure. For more information, please consult the metrology tutorial section in the Newport catalog or at www.newport.com

3.2 Mechanical Specifications



	MTN-CC	MTN-PP; MTN-PPV6
Travel Range (mm)		100, 200, 300
Minimum Incremental Motion (μm)	0.6	MTN-PP: 0.1 MTN-PPV6: 0.4
Uni-directional Repeatability (μm)		1.5
Bi-directional Repeatability ⁽¹⁾ (°)	3.0 or ±1.5	5.5 or ±2.75
On-Axis Accuracy ⁽¹⁾ (°)		5 or ±2.5 Travel 300: 6 or ±3
Maximum Speed (mm/s)	100 (No load)	40; 20 ⁽⁴⁾
Pitch ⁽¹⁾⁽²⁾ (μrad) ⁽³⁾		40 or ±20
Yaw ⁽¹⁾⁽²⁾ (μrad) ⁽³⁾		35 or ±17.5

¹⁾ Shown are peak to peak, guaranteed specifications or ± half the value as sometimes shown. for the definition of typical specifications which are about 2X better than the guaranteed values.

²⁾ For 100 mm travel.

³⁾ To obtain arcsec units, divide mrad value by 4.8.

⁴⁾ With the PPV6 version the maximum speed is reduced by a factor of two.



CAUTION

To reach specifications stated, stages must be fixed on a plane surface with a flatness of 5 μm.

3.3 Load Specification Definitions

Normal Load Capacity (Cz)

Maximum load a stage can move while maintaining specifications.

This value is given with speed and acceleration specified for each stage, and with a load perpendicular to bearings.

Axial Load Capacity (±Cx)

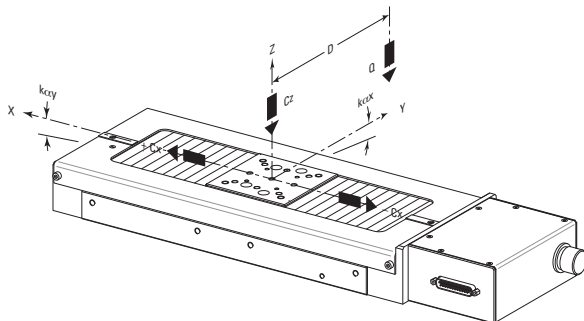
Maximum load along the direction of the drive train.

Off-Centered Load (Q)

Maximum cantilever-load a stage can move: $Q \leq C_z \div (1 + D/100)$

D: Cantilever distance.

3.4 Load Characteristics and Stiffness



	MTN-PP & MTN-CC	MTN-PPV6
Cz, Normal centered load capacity on bearings		1000 N
Cx, Direct load capacity on X axis	200 N	50 N
-Cx, Inverse load capacity on X axis		21 N
k_cx, Compliance in roll		4 μrad/Nm
k_cy, Compliance in pitch		6 μrad/Nm
k_cz, Compliance in yaw		5 μrad/Nm
Q, Off-center load		$Q \leq C_z \div (1 + D/100)$
where: D = Cantilever distance in mm		

REMARK

For MTN-PPV6 vacuum compatible stages to 10⁻⁶ hPa, the max. speed have to be divided by two and the +CX axial load capacity is limited at 50 N.

3.5 Stage Weights

Weights indicated in the table below are average values.

	Weight [lb (kg)]		
	MTN-CC	MTN-PP	MTN-PPV6
MTN100	22.05 (10.0)	23.59 (10.7)	31.31 (14.2)
MTN200	27.12 (12.3)	28.66 (13.0)	36.38 (16.5)
MTN300	32.19 (14.6)	33.73 (15.3)	41.45 (18.8)

NOTE

For a XY assembly with 2 MTN-PPV6 stages, reduce by 8.16 lb (3.7 kg) corresponding to the weight of the removed base plate of the upper stage.

4.0

Drive

4.1 Stepper Drive Versions

This version is not equipped with an encoder. The micro-step (0.1 μm) is equivalent to 1/200 of the full-step (20 μm).

Micro-Step Drive

Used in stepper motors, where one pulse from the driver corresponds to a fraction of the motor's full step.

Full-Step Drive

Used in stepper motors, where one pulse from the driver corresponds to a motor's full step.

Stepper Motor Performance Specifications

	Speed (mm/s)	Motor
MTN-PP	40	UE56PP
MTN-PPV6	20	UE56PPV6

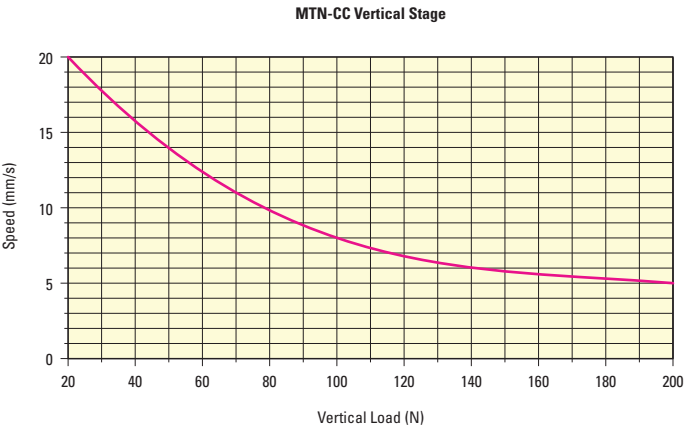
4.2 DC-Servo Drive Version

The DC-motor-driven configuration has a resolution of 0.2 μm.

DC-Motor Performance Specifications

	Resolution (μm)	Speed (mm/s)	Motor
MTN-CC	0.2	100 ¹⁾	UE40CC

¹⁾ 20 mm/s max. for vertical usage, see curve below

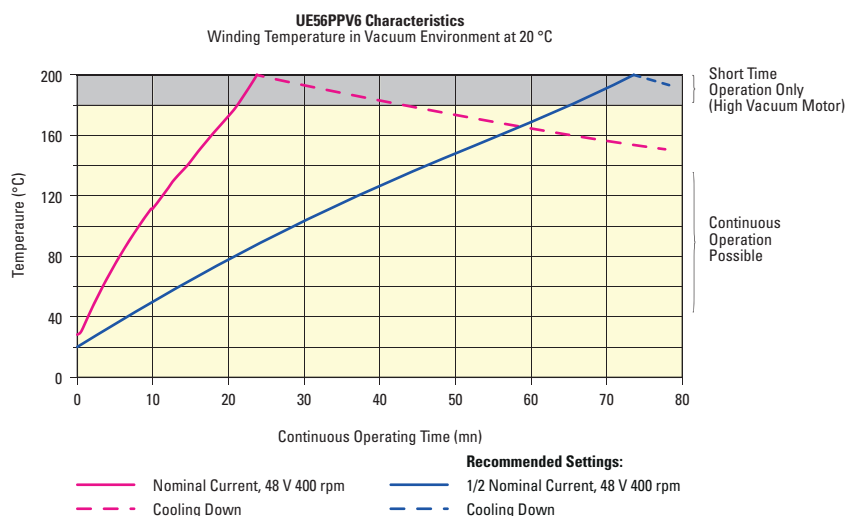
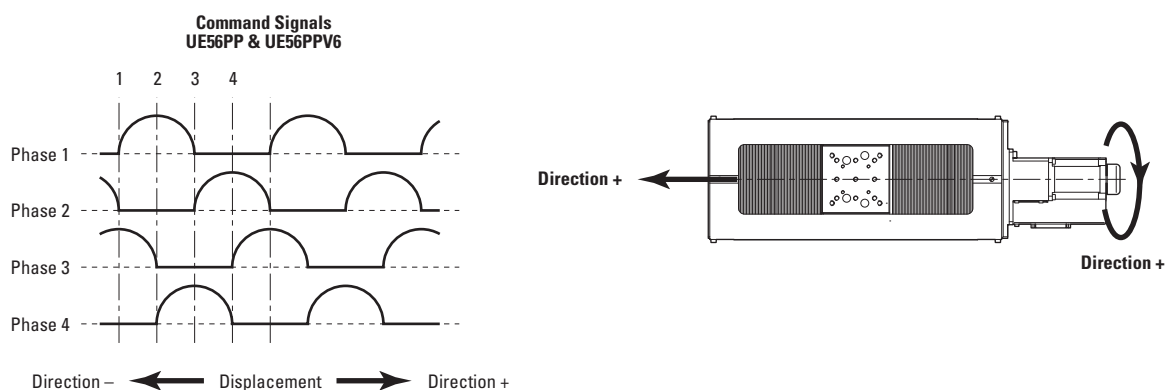


5.0 Motor

5.1 Stepper Motor Characteristics

Motor	Angle by Step (°)	RMS Current per Phase (A)	Resistance (Ω)	Inductance (mH)	Newport Utilization
UE56PP	1.8	1.8	0.94	4	Micro-Step
UE56PPV6	1.8	1.25	0.8	2.9	Micro-Step

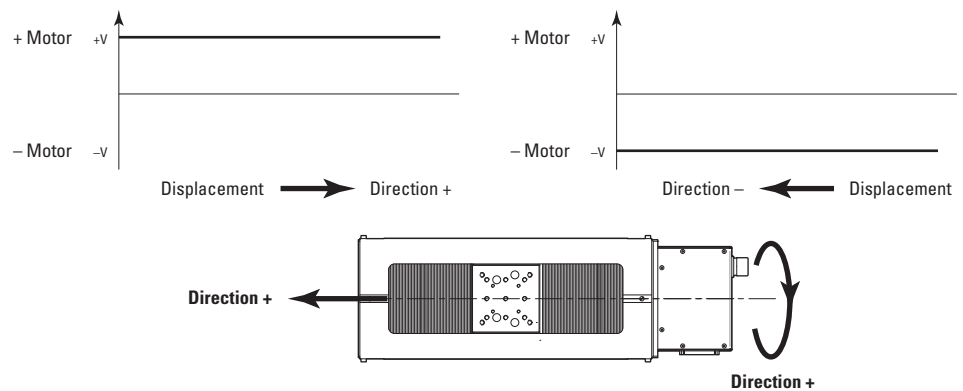
5.2 Command Signals for the Stepper Motor



5.3 DC-Motor Characteristics

Motor	Nominal Voltage (V)	Max. RMS Current (A)	Max. Peak Current (A)	Resistance (Ω)	Inductance (mH)
UE40CC	48	3	5	1.16	0.33

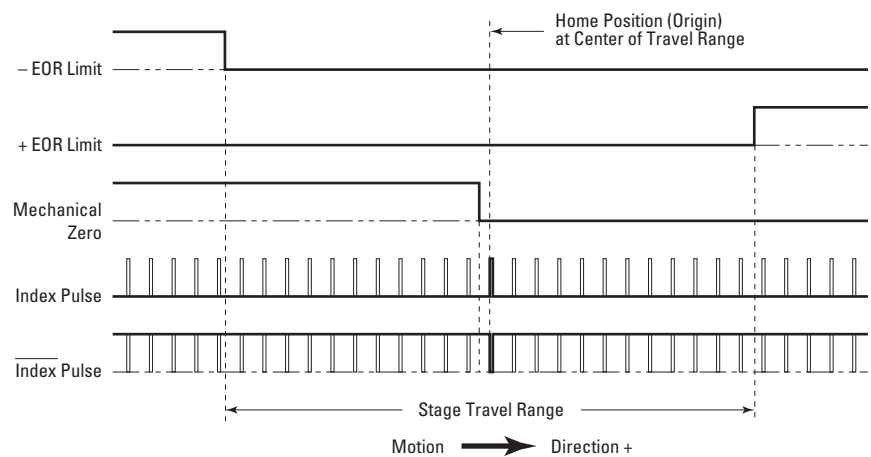
5.4 Command Signals for the DC-Motor



In the above drawings, + Motor signal is referred to – Motor signal.

- ① When the stage moves in + Direction, the + Motor voltage is higher than – Motor voltage.
- ② When the stage moves in – Direction, the + Motor voltage is lower than – Motor voltage.

5.5 Sensor Position



End-of-Run and Mechanical Zero are 5 V open collector type.

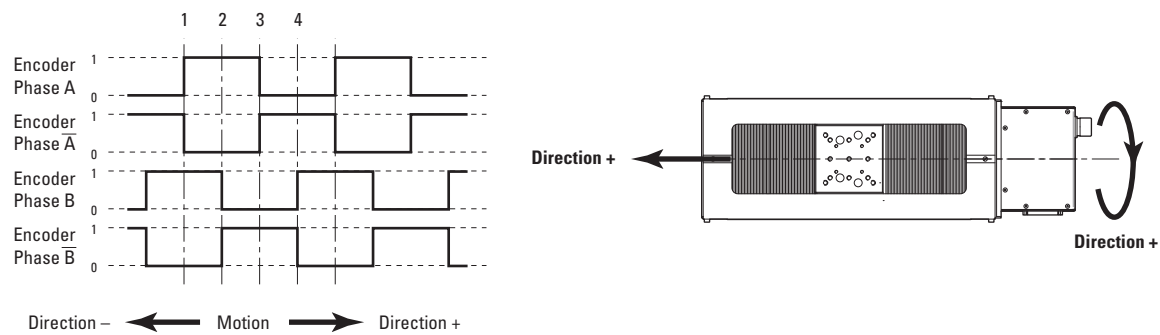
The Index Pulse provides a repeatable Home Position at ± 1 step.



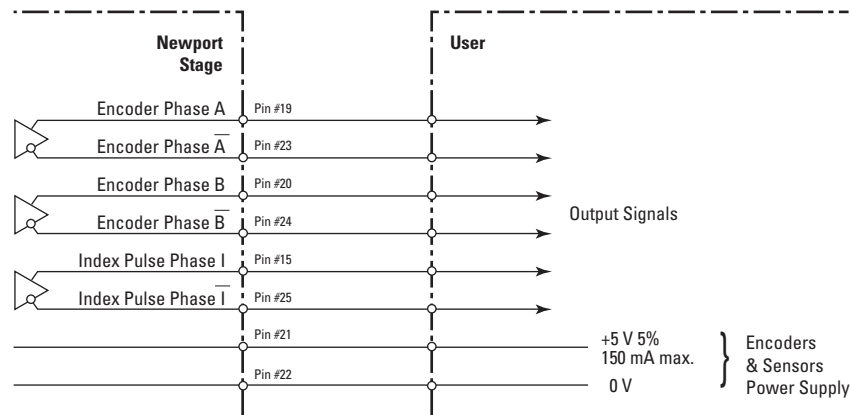
CAUTION

“End-of-Run” and “Mechanical Zero” are active signals and should not be connected to any other source.

5.6 Feedback Signal Position



The incremental sensor consists of an optical scale and an encoder head. When the carriages of the stage move, the encoder head generates square signals in quadrature, sent to pins #19, #20, #23 and #24 of the SUB-D25 connector.

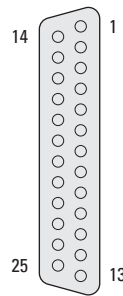


“Encoder” and “Index Pulse” are “differential pair” (type RS-422) type output signals. Using these signals permits a high immunity to noise. Emission circuits generally used by Newport are 26LS31 or MC3487. Reception circuits to use are 26LS32 or MC3486.

5.7 Pinouts

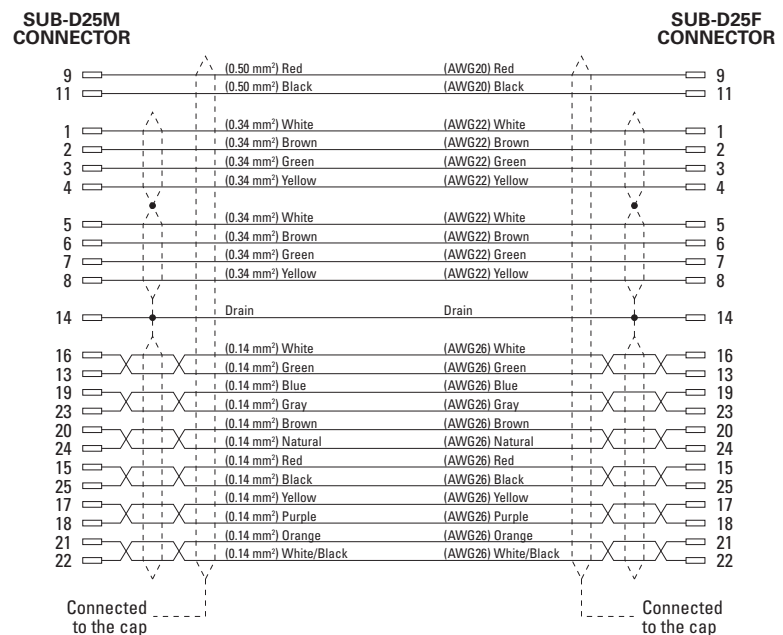
The 25-pin Sub-D connection for the MTN stages is given in the following table:

MTN-PP & MTN-PPV6 UE56PP & UE56PPV6		MTN-CC UE40CC	
1	+ Phase 1	1	N.C.
2	+ Phase 1	2	N.C.
3	– Phase 1	3	N.C.
4	– Phase 1	4	N.C.
5	+ Phase 2	5	+ Motor
6	+ Phase 2	6	+ Motor
7	– Phase 2	7	– Motor
8	– Phase 2	8	– Motor
9	N.C.	9	N.C.
10	N.C.	10	N.C.
11	N.C.	11	N.C.
12	N.C.	12	N.C.
13	Mechanical Zero	13	Mechanical Zero
14	Ground	14	Ground
15	Index Pulse I	15	Index Pulse I
16	0 V	16	0 V
17	+ End-of-Run	17	+ End-of-Run
18	– End-of-Run	18	– End-of-Run
19	N.C.	19	Encoder Phase A
20	N.C.	20	Encoder Phase B
21	N.C.	21	+5 V Encoder
22	0 V	22	0 V Encoder
23	N.C.	23	Encoder Phase /A
24	N.C.	24	Encoder Phase /B
25	Index Pulse /I	25	Index Pulse /I



5.8 MCAB-3 Cable

A MCAB-3 cable is supplied with each stage.



6.0 Connection to Newport Controllers

6.1 Warnings on Controllers

Controllers are intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possible injury. Read the controller user's manual carefully before operating the instrument and pay attention to all written warnings and cautions.

WARNING

Disconnect the power plug under the following circumstances:

- If the power cord or any attached cables are frayed or damaged in any way.
- If the power plug is damaged in any way.
- If the unit is exposed to rain, excessive moisture, or liquids are spilled on the unit.
- If the unit has been dropped or the case is damaged.
- If you suspect service or repair is required.
- Whenever you clean the electronics unit.

CAUTION

To protect the unit from damage, be sure to:

- Keep all air vents free of dirt and dust.
- Keep all liquids away from the unit.
- Do not expose the unit to excessive moisture (85% humidity).
- Read this manual before using the unit for the first time.



WARNING

All attachment plug receptacles in the vicinity of this unit are to be of the grounding type and properly polarized.

Contact your electrician to check your receptacles.

WARNING

This product is equipped with a 3-wire grounding type plug.

Any interruption of the grounding connection can create an electric shock hazard.

If you are unable to insert the plug into your wall plug receptacle, contact your electrician to perform the necessary alterations to ensure that the green (green-yellow) wire is attached to earth ground.

WARNING

This product operates with voltages that can be lethal.

Pushing objects of any kind into cabinet slots or holes, or spilling any liquid on the product, may touch hazardous voltage points or short out parts.

6.2 Connection

On each stage is represented a label which indicates its name and its serial number.



WARNING

Always turn the controller's power OFF before connecting to a stage.

Stages may be connected to the rear panel motor connectors any time prior to power-up with the supplied cable assemblies.

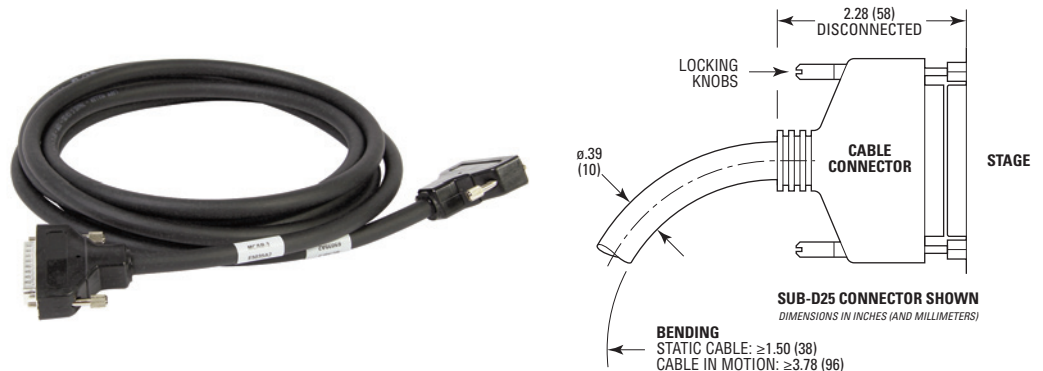
NOTE



These stages are ESP compatible. Enhanced System Performance is Newport's exclusive technology that enables Newport ESP motion controllers to recognize the connected Newport ESP stage and upload the stage parameters. This ensures that the user can operate the motion system quickly and safely.

6.3 Cables

All our MTN stages are delivered equipped with a **MCAB-3** 3-meter cable with a SUB-D25M connector so they can be directly connected to our controllers/drivers.



WARNING

This cable is shielded correctly. For a correct operation, make sure to lock connectors (ground continuity provided by the cable).

For applications where the standard 3-meter cable (**MCAB-3**) included with your stage is not adequate, Newport offers longer length cables designed to ensure the integrity of your positioning application.

These cables are specially shielded and terminated with Newport's standard SUB-D25 connectors. They are available in 5-m (**MCAB-5**), 7-m (**MCAB-7**) or 10-m (**MCAB-10**) lengths.



WARNING

Keep the motor cables at a safe distance from other electrical cables in your environment to avoid potential cross talk.

7.0

Connection to Non-Newport Electronics

7.1

Connections

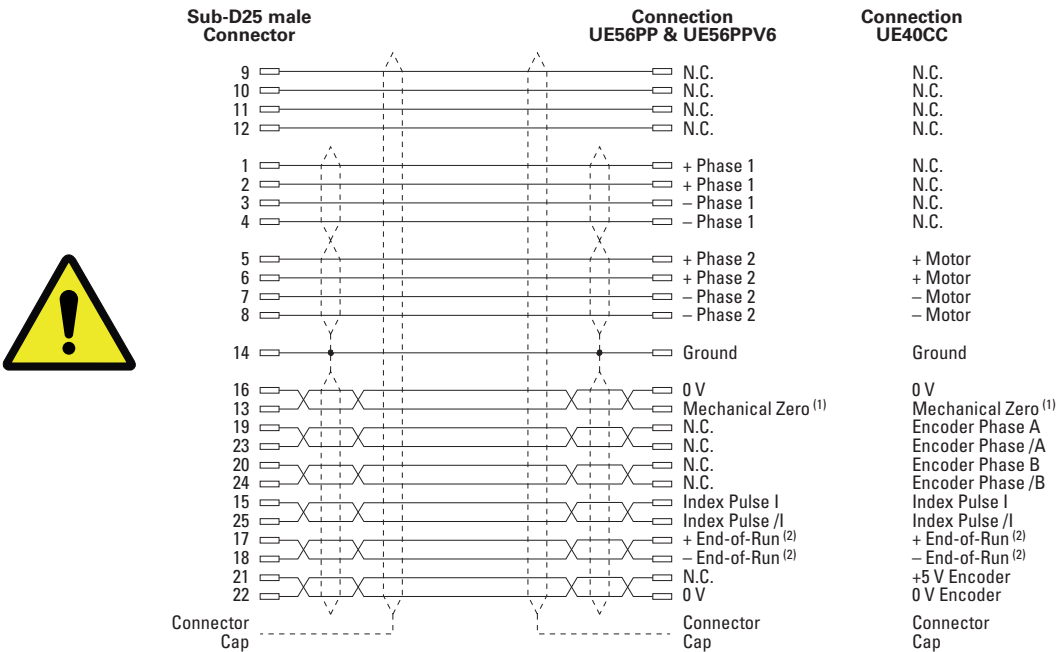
WARNING

Newport is not responsible for malfunction or damage to a MTN translation stage when it is used with non- Newport controllers.

WARNING

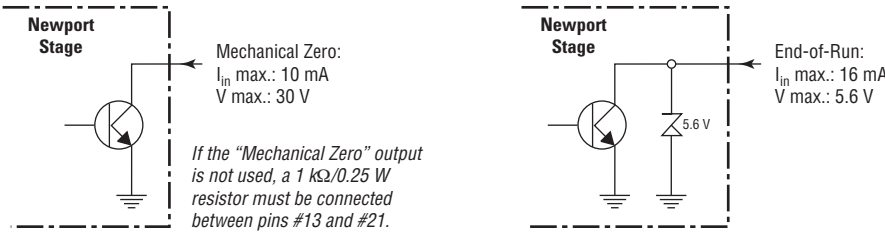
Newport guarantees “CE” compliance of the MTN translation stages only if they are used with Newport cables and controllers.

Nevertheless, the figure below shows the wiring when a MTN stage is used with non-Newport controllers.



⁽¹⁾ The Mechanical Zero logic signal is open collector type. It supports until 30 V and 10 mA.

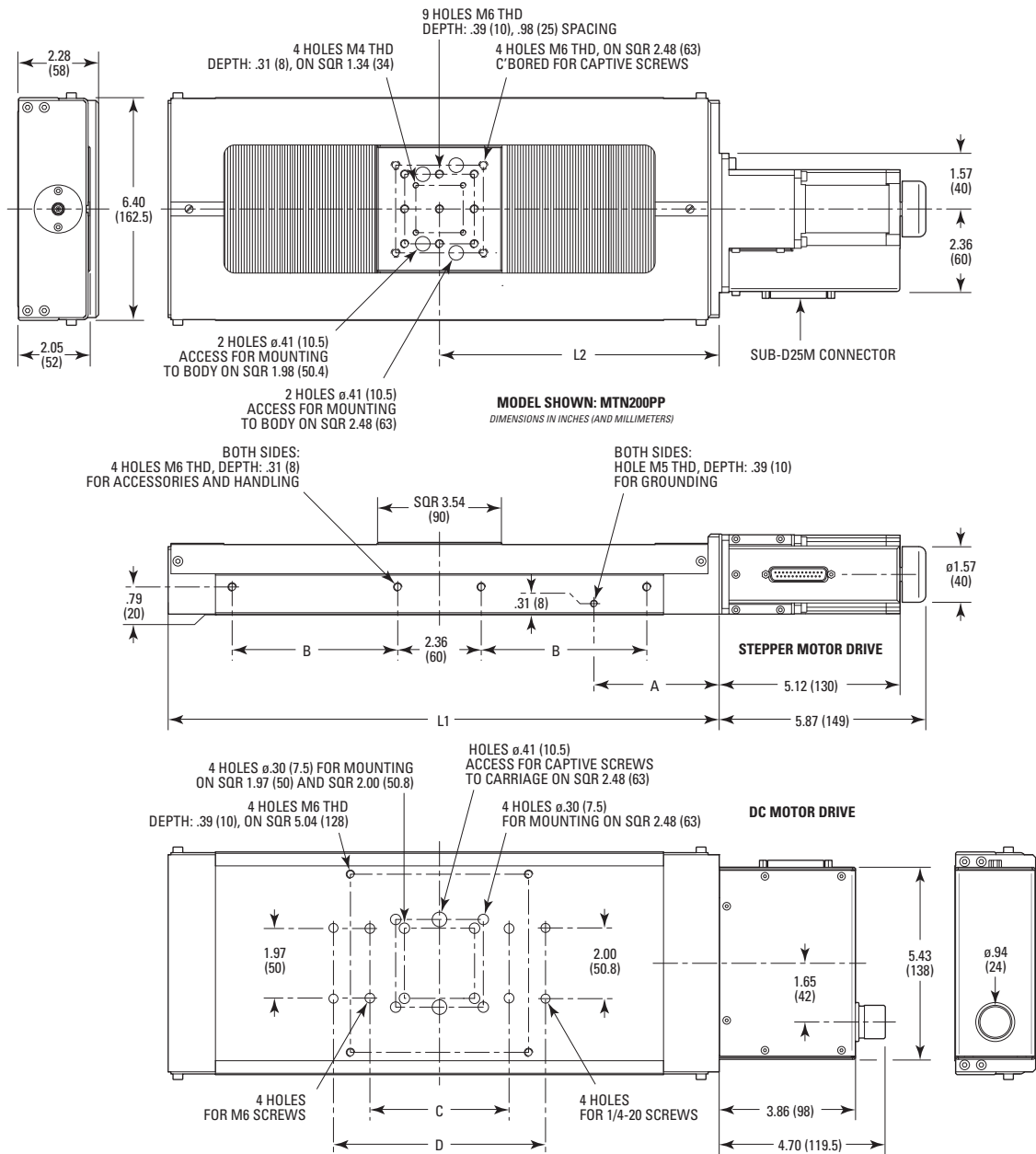
⁽²⁾ Open collector type with a 5.6 V protective Zener diode.



“Encoder” and “Index Pulse” are “differential pair” (type RS-422) type output signals. Using these signals permits a high immunity to noise. Emission circuits generally used by Newport are 26LS31 or MC3487. Reception circuits to use are 26LS32 or MC3486.

8.0 Dimensions

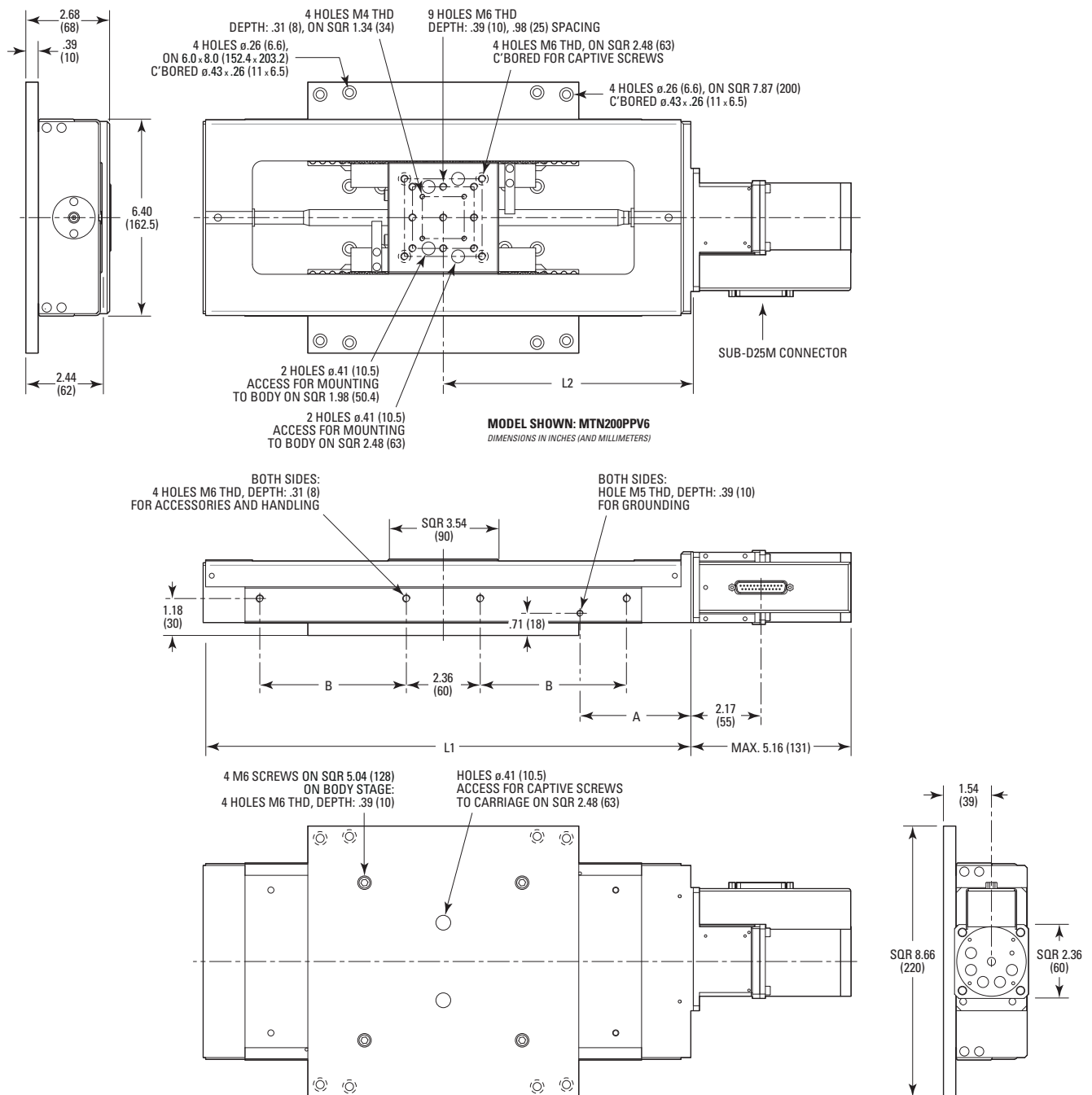
8.1 MTN-CC and MTN-PP Stages



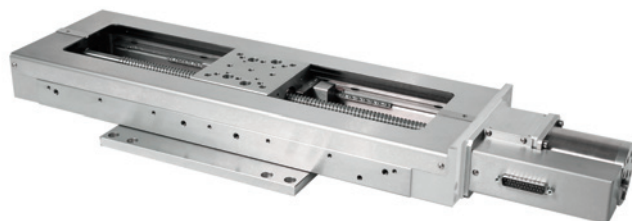
MODEL	A	B	C	D	L1	L2
MTN100CC	2.95 (75)	2.20 (56)	—	—	11.69 (297)	5.94 (151)
MTN100PP	3.03 (77)					
MTN200CC	3.54 (90)	4.69 (119)	3.94 (100)	6.00 (152.4)	15.63 (397)	7.91 (201)
MTN200PP	3.62 (92)					
MTN300CC	3.54 (90)	6.14 (156)	9.84 (250)	8.00 (203.2)	19.57 (497)	9.88 (251)
MTN300PP	3.62 (92)					



8.2 MTN-PPV6 Stages



MODEL	A	B	L1	L2
MTN100PPV6	3.03 (77)	2.20 (56)	11.69 (297)	5.94 (151)
MTN200PPV6	3.62 (92)	4.69 (119)	15.63 (397)	7.91 (201)
MTN300PPV6	3.62 (92)	6.14 (156)	19.57 (497)	9.88 (251)



NOTE

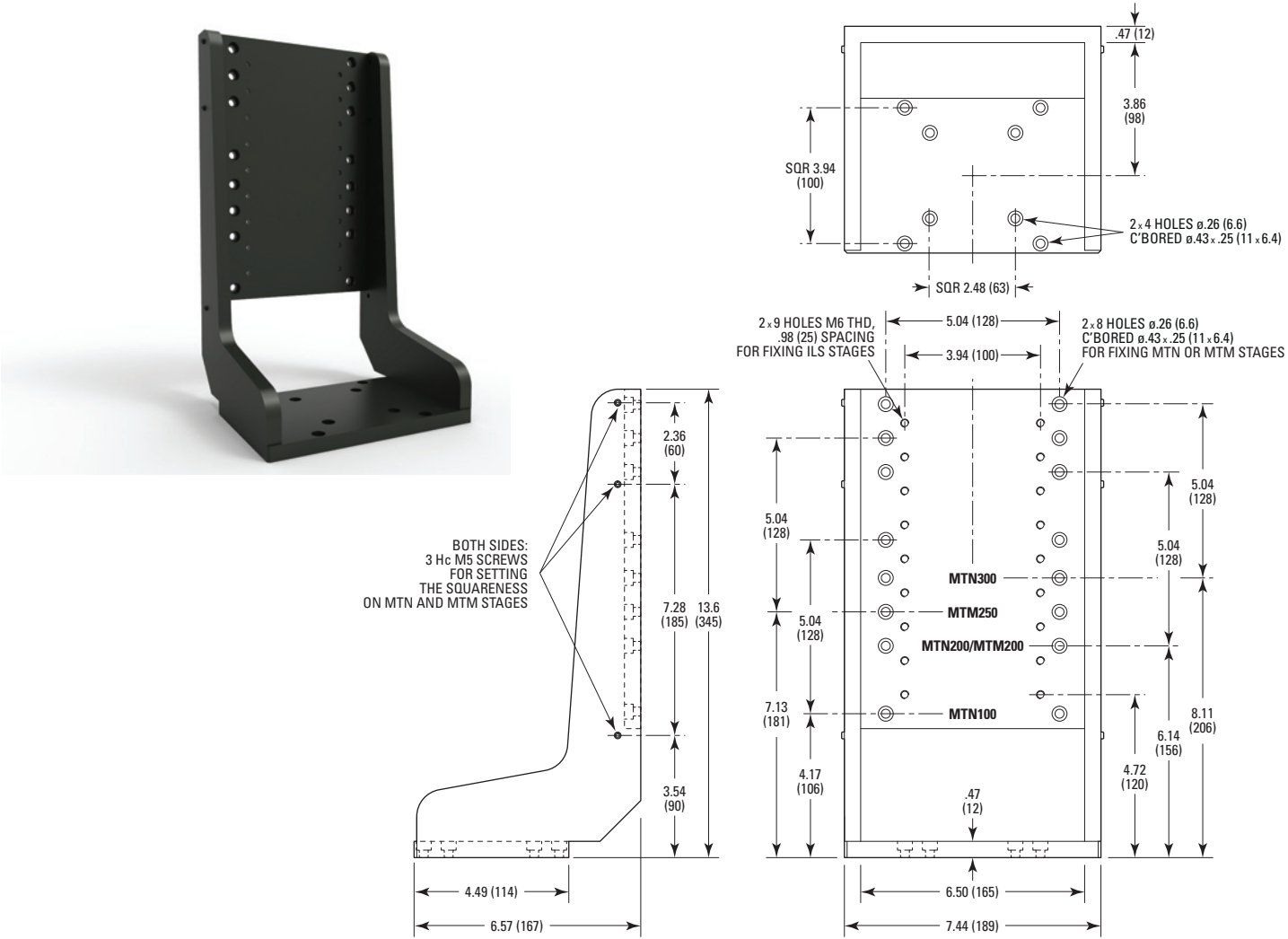
The base plate must be removed of the upper stage for an XY assembly with MTN-PPV6 stages or in a Z mounting with the EQ160 bracket.

9.0

Accessories

9.1 EQ160 Brackets

The EQ160 right-angle brackets (to order separately) can be used for vertical mounting configurations of an MTN stage.

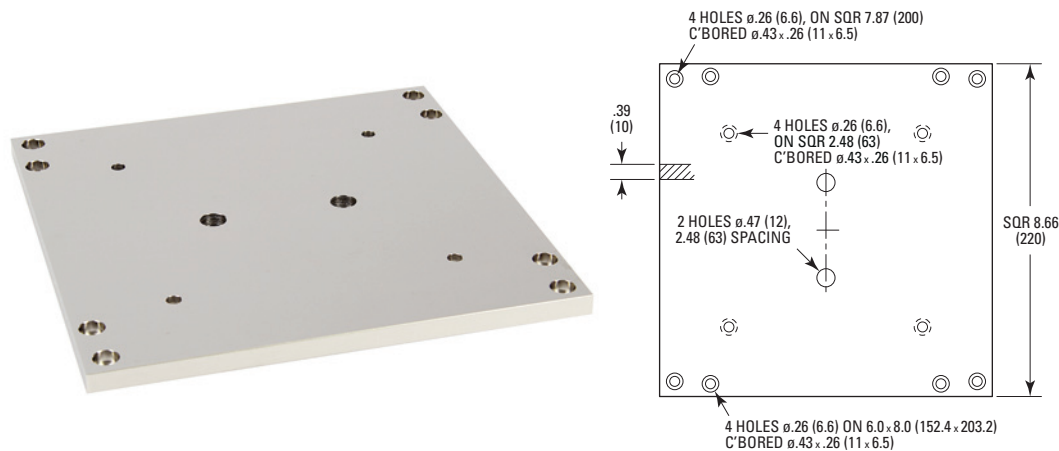


NOTE

The base plate of a MTN-PPV6 stge must be removed for a vertical mounting with the EQ160 bracket..

9.2 MTN-BP Base Plate

The MTN-BP base plate must be ordered separately (except MTN-PPV6 stages).



NOTE

For an XY assembly, the lower stage must be equipped with a MTN base plate.

It also allows to fasten the stage to an interface with an imperial hole pattern.

9.3 MTN-TP Top Plate

This MTN-TP top plate is necessary if you need an interface with an imperial hole pattern. It must be ordered separately.



10.0 Maintenance

RECOMMENDATION

It is recommended to contact our After Sales Service which will know to define the appropriate maintenance for your application.

10.1 Maintenance

The MTN stage requires no particular maintenance. Nevertheless, this is a precision mechanical device that must be kept and operated with caution.

PRECAUTIONS

The MTN stage must be used or stocked in a clean environment, without dust, humidity, solvents or other substances.

RECOMMENDATION

It is recommended to return your MTN stage to Newport's After Sales Service after every 2000 hours of use for lubrication.

If your stage is mounted on a workstation and cannot be easily removed, please contact Newport's After Sales Service for further instructions.

10.2 Repair

CAUTION



Never attempt to disassemble a component of the stage that has not been covered in this manual.

To disassemble a non specified component can cause a malfunction of the stage.

If you observe a malfunction in your stage, please contact us immediately to arrange for a repair.



CAUTION

Any attempt to disassemble or repair a stage without prior authorization will void your warranty.

10.3 Calibration



CAUTION

It is recommended to return your MTN stage to Newport once a year for recalibration to its original specifications.

Service Form

Your Local Representative

Tel.: _____

Fax: _____

Name: _____

Return authorization #: _____

(Please obtain prior to return of item)

Company: _____

Address: _____

Date: _____

Country: _____

Phone Number: _____

P.O. Number:

P.O. Number: Fax Number:

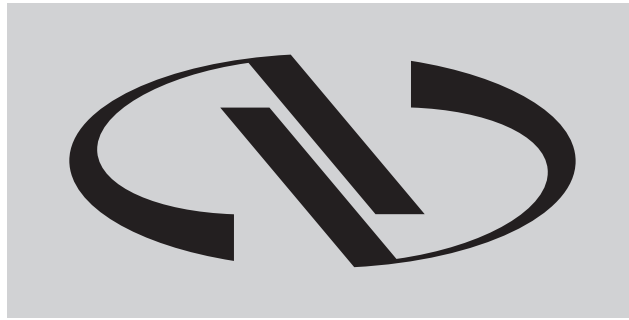
Item(s) Being Returned:

Model #: _____

Serial #: _____

Description: _____

Reasons of return of goods (please list any specific problems): _____



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