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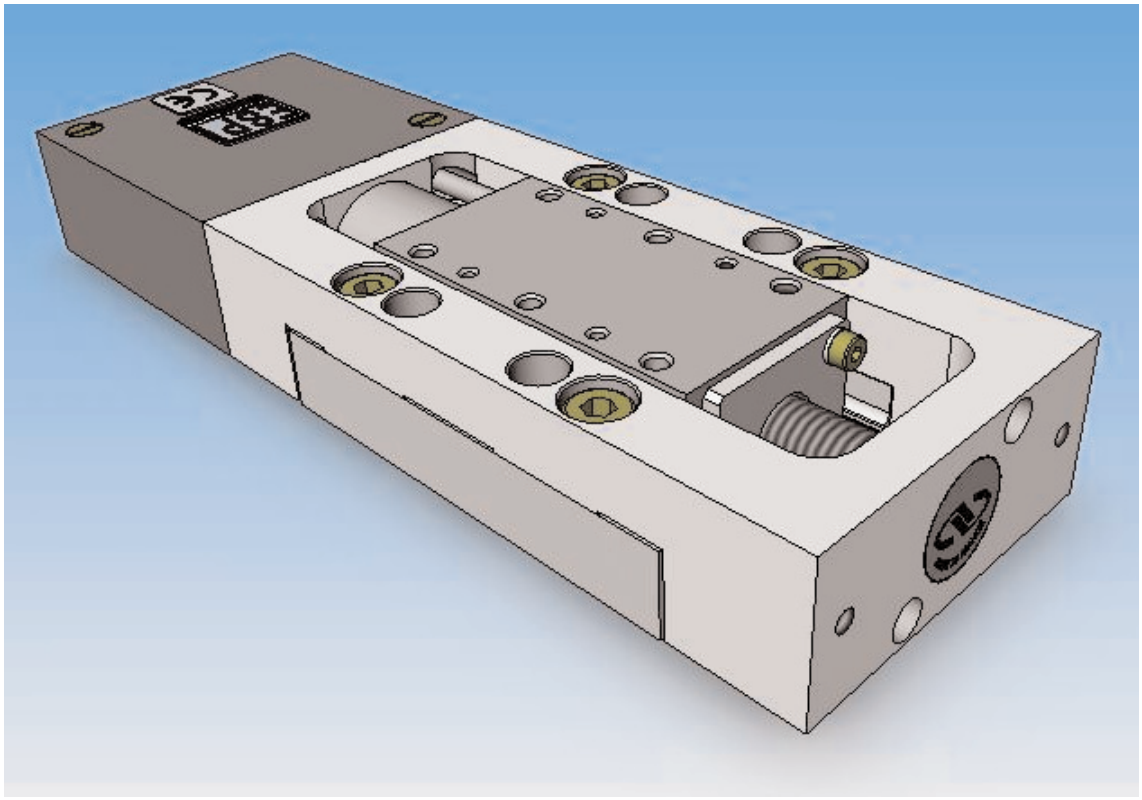
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Find the *Newport MFA-CC* at our website: ***Click HERE***

MFA Series

Miniature Linear Stages



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USER'S MANUAL

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

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.**

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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EU Declaration of Conformity

MFA

Miniature Linear Stages

Newport®
Experience | Solutions

We declare that the accompanying product, identified with the "CE" mark, meets all relevant requirements of Directive:

- 73/23/CEE, for Low Voltage Compatibility.
- 89/336/EEC for Electromagnetic Compatibility.

Compliance was demonstrated to the following specifications:

EMISSION:

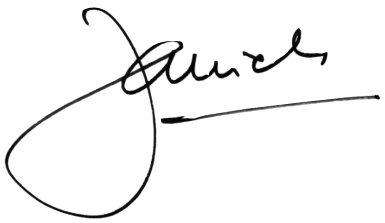
Radiated and Conducted Emission in accordance with relative prescription to the EMC, NF EN61326-1: Standards for measurement, lab and control equipment.

IMMUNITY:

Radiated and Conducted Immunity in accordance with relative prescription to the EMC, NF EN61326-1: Standards for measurement, lab and control equipment.

SAFETY:

CEI 1010-1, safety standards for measurement, lab and control equipment.



Alain DANIELO
Vice-President & General Manager
Newport ISTD Europe
Zone Industrielle
45340 Beaune-la-Rolande, France

Warnings

WARNING

The translation 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 or hard UV.

CAUTION

Do not place this stage in a location affected by dust, oil fumes or steam. 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).**

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

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

Miniature Linear Stages
MFA Series

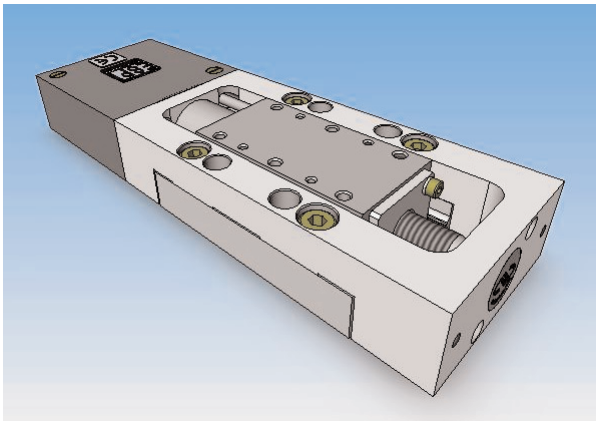
1.0 Introduction

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

- MFA-CC
- MFA-CCV6 (1)
- MFA-PP

1) REMARK

Vacuum compatible stages to 10^{-6} hPa. In this case, max. speed and load capacity have to be divided by two.



MFA miniature linear stage.

RECOMMENDATION

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

2.0 Description

Designed for space-limited applications and compact multi-axis assemblies, MFA Series linear stages supply very high resolution, single-axis translation in a low-cost, motorized package. Typical applications for this stage are fiber optic alignment, laser diode research, biomedical applications and inspection systems.

MFA linear stages are available in two variants: The MFA-CC features a miniature DC-motor with integrated gear-box and a motor mounted high resolution rotary encoder with 2,048 cts/rev. The high-resolution position feedback and low-friction mechanical design ensures ultra-smooth motion with 50 nm sensitivity. The DC motor supplies an optimized output torque that permits the use of a lower ratio step-down gear allowing for faster motion with higher reliability and lower backlash. Hence, the MFA-CC is the recommended choice for applications that require small incremental motion with high dynamic speed range and good repeatability. The stepper motor version MFA-PP is a more economic solution for less demanding applications. End-of-run limit switches prevent bearing damage from accidental over-travel.

Components mount to the top surface of the stage via tapped mounting holes. Modular stage design facilitates easy assembly of MFA Series stages into multi-axis configurations.

2.1 Design Details

Base Material	Stainless steel
Bearings	Double row linear ball bearings
Drive Mechanism	Backlash compensated leadscrew
Drive Screw Pitch (mm)	0.5
Reduction Gear	MFA-CC: 1:14
	MFA-PP: 1:43
Feedback	MFA-CC: Motor mounted rotary encoder; 2,048 cts/rev MFA-PP: None
Limit Switches	Mechanical switches
Origin	Uses motor side limit for homing, typically < 4 µm repeatability
Motor	MFA-CC: DC servo motor UE1724SR MFA-PP: 2-phase stepper motor UE16PP, 1 full step = 0.485 µm*
Cable Length (m)	1.5
Vacuum Compatibility	Vacuum compatible versions are available up to 10^{-6} hPa using a DC motor (MFA-CCV6). Data about outgassing and temperature rise is available upon request.
MTBF	10000h at a 1 kg load with a 20% duty cycle

* 1 pulse = 0.00757 µm, that is to say 1/64 of a full step with a Newport electronic.

3.0 Characteristics

3.1 Definitions

Specifications of our products are established in reference to ISO 230 standard part II “Determination of the position, precision and repeatability of the machine tools with CNC”.

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

(Absolute) Accuracy

Difference between ideal position and real position.

On-Axis Accuracy

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

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

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

Absolute Accuracy = On-Axis Accuracy + Slope x 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 (Sensitivity)

Minimum motion that a stage can achieve.

Resolution

The smallest motion an encoder fixed to the stage can measure.

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 our test equipment in an air-conditioned room (20 ± 1 °C).

Each stage is tested with a laser interferometer.

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

3.2 Mechanical Specifications

	MFA-PP	MFA-CC
Travel Range [in. (mm)]	1 (25)	
Resolution (µm)**	0.00757	0.0175
Minimum Incremental Motion (µm)	0.1	0.050
Unidirectional Repeatability (µm) guaranteed	0.5	0.3
Bidirectional Repeatability (µm) guaranteed*	2.5	2
On Axis Accuracy (µm) guaranteed	10	8
Maximum Speed (mm/s)	0.3	2.5
Pitch (µrad) guaranteed	100	
Yaw (µrad) guaranteed	100	

* After backlash compensation

**Equals 1/64 of a full step

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)

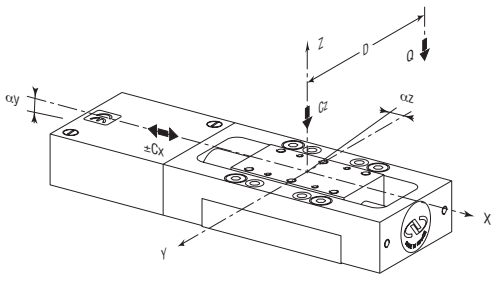
Maximum load along the direction of the drive train.

Off-Centered Load (Q)

Maximum cantilever-load a stage can move: $Q \leq Cz / (1 + D/20)$

D: Cantilever distance.

3.4 Load Characteristics and Stiffness



Cz	(N)	50
-Cx	(N)	10
+Cx	(N)	10
kαx	(µrad/Nm)	60
kαy	(µrad/Nm)	100

Q	Off-center load, Q≤Cz / (1 + D/20)
D	Cantilever distance in mm
Cz	Normal center load capacity on bearings
+Cx	Direct load capacity on X axis
-Cx	Inverse load capacity on X axis

REMARK

For MFA-CCV6 vacuum compatible stages to 10^{-6} hPa, max. speed and load capacity have to be divided by two.

3.5 Stage Weights

The weight indicated is the average value for stages with their cable installed.

MFA	[lb (kg)]	1.3 (0.6)

The weight variation between drive units is not very significant.

4.0 Drive

4.1 DC-Motor Drive Version

One DC-motor-driven configuration is available: MFA-CC.

DC-Motor Performance Specifications

	Resolution (µm)	Speed (mm/s)	Motor
MFA-CC	0.0174	2.5	UE1724SR

REMARK

For MFA-CCV6 vacuum compatible stages to 10^{-6} hPa, max. speed and load capacity have to be divided by two.

4.2 Stepper Drive Version

Stepper-motor-driven stages are offered in one half-step drive version: MFA-PP.

Micro-Step Drive

This is the drive for stepper or pulse-driven motors, transmitted by the electronic unit, which entails a theoretical movement of the motor by one fraction of a full-step. For these translation stages, the micro-step is equivalent to 1/64 of the full-step.

Stepper Motor Performance Specifications

	Resolution [1] (µm)	Speed (mm/s)	Motor
MFA-PP	0.00757	0.3	UE16PP

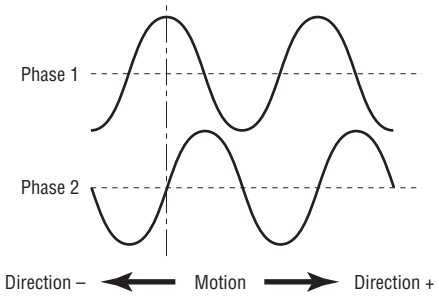
1) Micro-step driving.

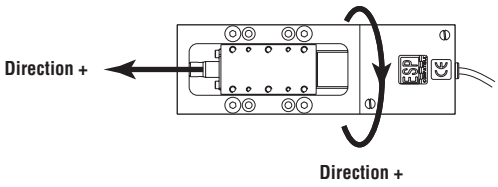
5.0 Motor

5.1 UE16PP Motor Characteristics

Motor	Angle by Micro-Step (°)	Current (A)	Resistance (Ω)	Inductance (mH)	Newport Utilization
UE16PP	0.23	0.25	12.5	5.5	Micro-Step

5.2 Command Signals for the Stepper Motor

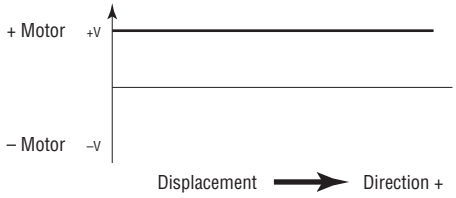


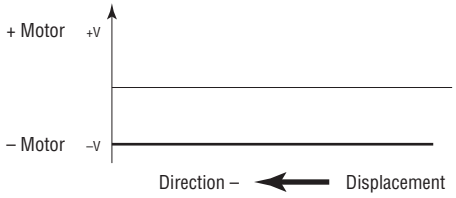


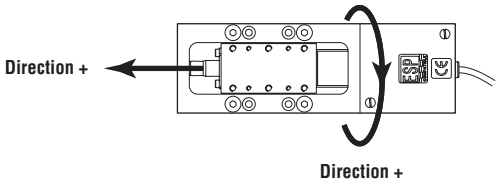
5.3 UE1724SR Motor Characteristics

Motor	Nominal Voltage (V)	Max. Current (A)	Resistance (Ω)	Inductance (mH)
UE1724SR	24	0.2	54.6	1.19

5.4 Command Signals for the DC-Motor





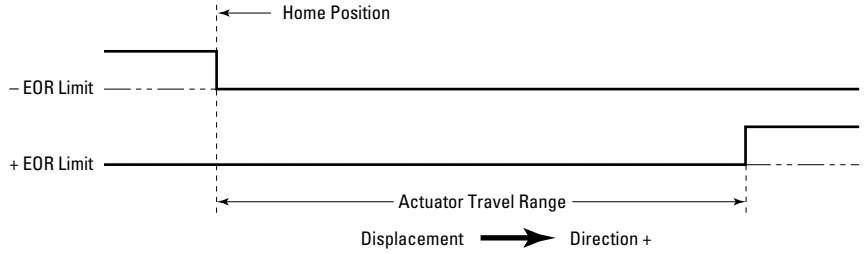


In the above drawings, + Motor signal is referred to – Motor signal.

❶ When the stage moves in + Direction, the + Motor voltage is higher than – Motor voltage.

❷ When the stage moves in – Direction, the + Motor voltage is lower than – Motor voltage.

5.5 Sensor Position

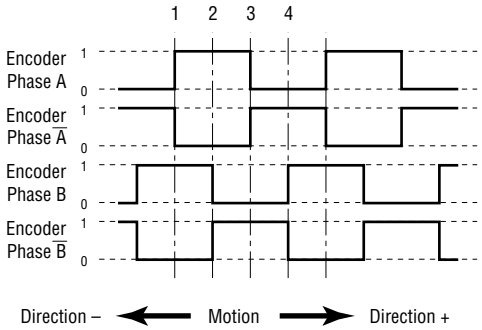


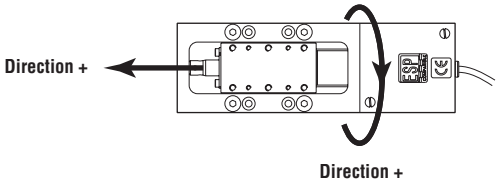
End-of-Run are TTL type: 5 V ±5%, 2 mA max.

CAUTION

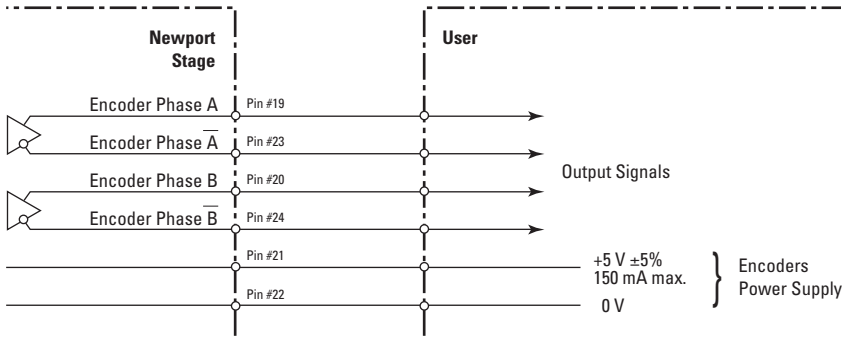
"End-of-Run" are active signals and should not be connected to any other source. Use appropriate TTL type receivers.

5.6 Feedback Signal Position for the MFA-CC





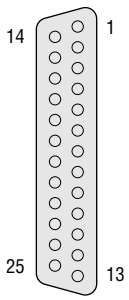
The incremental sensor consists of a optical scale and an encoder head. When the sensor shaft turns, the encoder head generates square signals in quadrature, sent to pins #19, #20, #23 and #24 of the 25-pin Sub-D connector.



Encoders are "differential pair" (type RS422) 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 respectively.

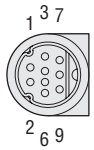
5.7 Pinouts

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



	UE1724SR **MFA-CC**		
1	N.C.	**14**	Shield Ground
2	N.C.	**15**	N.C.
3	N.C.	**16**	0 V logic
4	N.C.	**17**	+ End-of-Run
5	+ Motor	**18**	– End-of-Run
6	+ Motor	**19**	Encoder Phase A
7	– Motor	**20**	Encoder Phase B
8	– Motor	**21**	Encoder Power: +5 V
9	N.C.	**22**	0 V Encoder
10	N.C.	**23**	Encoder Phase /A
11	N.C.	**24**	Encoder Phase /B
12	N.C.	**25**	N.C.
13	Mechanical Zero		

The 9-pin Mini-DIN connection for MFA-PP stages is given in the following table:



	UE16PP **MFA-PP**
1	– End-of-Run
2	Phase 1a
3	+5 V
4	Phase 2b
5	N.C.
6	Phase 2a
7	Phase 1b
8	0 V
9	+ End-of-Run

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.

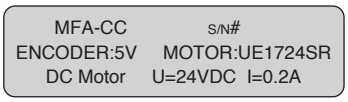
WARNING

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, its serial number and the motor it is equipped with (ex.: UE17SR).



WARNING

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

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

WARNING

When using a MM4006 controller, damage to stage may occur if its motor (UE1724SR) is not the same type as shown on driver label located near the actuator interface connector.

7.0 Connection to Non-Newport Controllers

WARNING

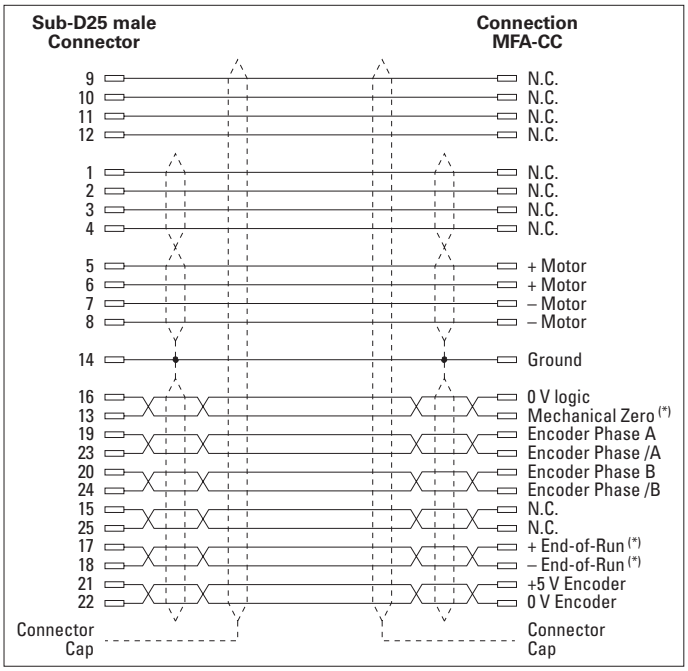
Newport takes no responsibility for improper functioning or damage of a stage when it is used with any non- Newport controllers.

7.1 MFA-CC Stages

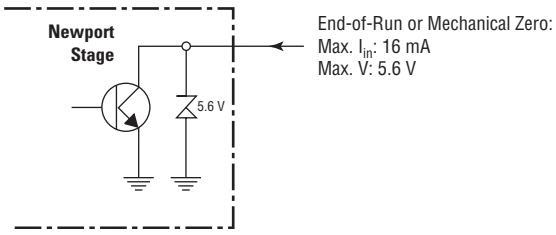
WARNING

Newport guarantees the "CE" compliance of the MFA translation stages only if they are used with Newport cables and controllers.

Nevertheless, the figure below indicates the recommended wiring when a MFA-CC stage is used with non-Newport controllers.



*** Open collector type with a 5.6 V protective Zener diode.**



If the "Mechanical Zero" output is not used, a 1 kΩ/0.25 W resistor must be connected between pins #13 and #21.

"Encoder" are "differential pair" 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.

7.2 MFA-PP Stages

WARNING

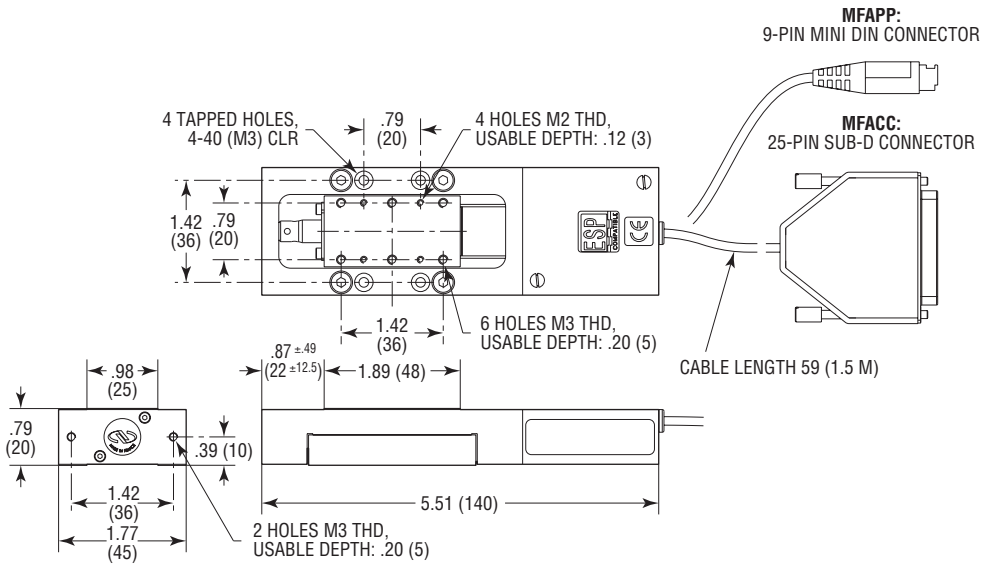
MFA-PP stages are equipped with a 9-pin mini-DIN non-standard connector and must only be used with our Newport NSC100 controller/driver.



NSC100 Single-Axis Low-Power Motion Controller/Driver.

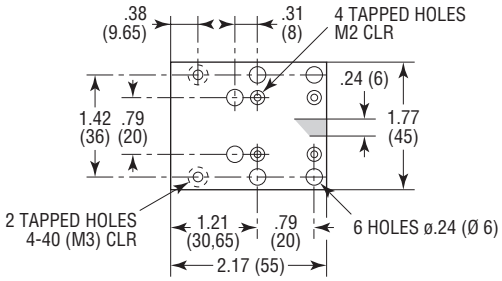
8.0 Dimensions

8.1 MFA Stages

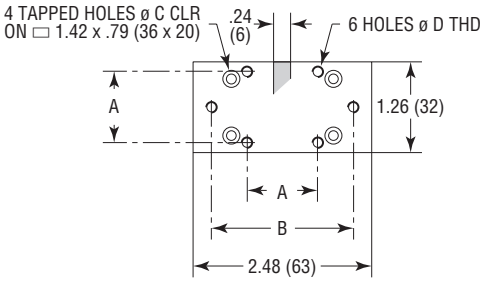


8.2 MFA-BK Plate

The MFA-BK top plate is used for XZ and XYZ assemblies with MFA stages.

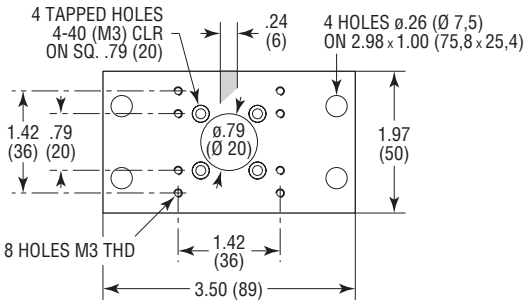


8.3 (M-)MFA-TP Top Plates



	DIMENSIONS [in. (mm)]		THREAD	
	A	B	C	D
MFA-TP	1.00 (25.4)	2.00 (50.8)	4-40	8-32
M-MFA-TP	.98 (25.0)	1.97 (50.0)	M3	M4

8.4 MFA-BP Base Plate



NOTE

These plates are not included with MFA stages and must be ordered separately.

9.0 Maintenance

RECOMMENDATION

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

9.1 Maintenance

The MFA stage requires no particular maintenance. Nevertheless, this is a precision mechanical device that must be kept and manipulated with precaution.

PRECAUTIONS

The MFA stage must operate, and be stocked in a clean environment, without dust, humidity, solvents or other substances.

RECOMMENDATION

It is recommended to return your stage to our After Sales Service after every 2000 hours of use for lubrication.

If your MFA stage is mounted on a workstation and cannot be easily dismantled, please contact our After Sales Service for further instructions.

9.2 Repairing

CAUTION

Never attempt to disassemble an element of the stage that has not been specified in this manual.

Disassembling a non specified element can cause a malfunction of the stage.

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

CAUTION

All disassembly attempts or repair of stage without authorization will void your warranty.

9.3 Calibration

CAUTION

It is recommended to return your stage to Newport once a year for a 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: _____

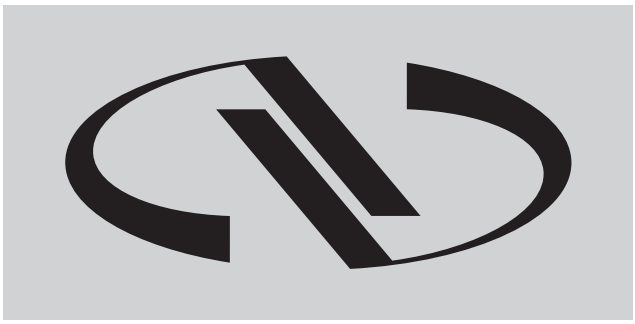
P.O. Number: _____ Fax Number: _____

Item(s) Being Returned:

Model #: _____ Serial #: _____

Description: _____

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



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