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High-Resolution Rotation Stages
URM Series

1.0 Introduction

This manual provides operating instructions for the rotation stage that you have purchased in the URM80 or URM100 Series:

- (M-)URMPP
- (M-)URMPE
- (M-)URMCCHL
- (M-)URMCC
- (M-)URMMS



It indicates equally minimum maintenance operations, useful to a good equipment functioning.

RECOMMANDATION

We recommend you to read attentively the chapter “Connection to electronics” before URM stage using.

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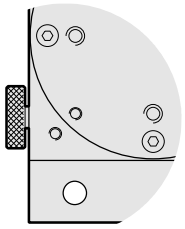
2.0 Description

URM80 and URM100 rotation stages feature steel construction with preloaded crossed-roller bearing slides for superior backlash-free and repeatable trajectory. Precise rotation is ensured by a precision-ground, hardened worm and gear drive (worm gear ratio: 1/180), which provides smooth motion.

All URM stages are equipped with ±170° mechanical limit switches and a home position allows the stage to be returned to a reference origin position.

Position measuring is performed with a 2000 pts/rev. encoder, integral with the motor shaft.

All URM Series stages are equipped with a knurled knob for a manual control.



URM Series rotation stages are designed to complement the performance of UTM Series translation stages in precision multiple-axis applications.

While all featuring 0.001 degree angular resolution, the modular design of URM stages brings you the flexibility to choose the drive configuration that best matches your specific application requirements: manual, DC motor or stepper motor driven versions, with mini-step or full-step drive options, 20 °/sec versions.

For optimum positioning performance and seamless compatibility, we recommend our MotionMaster family of motion controllers for these devices. The URM Series stages are supplied with a 3-meter cable for connection to the MotionMaster controllers.

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3.0 Characteristics

3.1 Position Precision

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

This norm gives definition of position uncertainty which depends of the 3 following quantitites:

Position Error

Difference of postion between ideal position and real position.

Position Repetabilty (Repetability)

Variation between ideal postion and real position approached “n” times.

Reversal Error (Hysteresis)

Difference of position dued to direction of approach of ideal position.

Position uncertainty depends of 2 quantities:

- The first one is dued to service condition (temperature, position of article on the carriage) and to uncertainty on screw pitch.
- The second one is dued to conception of our positionning stages.

The first quantity varies on a linear way with travel. It can be compensated by mean of controller.

The second term is intrinsic to our stages ans cannot be compensated. We call it on axis accuracy.

NOTE

In this manual we will use: On axis accuracy, repetability, Hysteresis.

Those definitions are valid for linear stages as well as for rotary stages.

The controls of on axis accuracy, repetability, and reversal error are made systematically with our test equipement in an air-conditioned room (20 °C $^{\pm 1\ °C}$).

Linear stages are controlled with laser interferometry (Hewlett-Packard, resolution 10 nm).

Rotary stages are controlled with precision optical encoder (Heidenhain, resolution 5/10000°).

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

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3.2 Mechanical Specifications Definitions

Sensitivity (unidirectional)

Minimum motion that a stage can make. Our stages and our kinematic chain are conceived on such a way that sensitivity is better than resolution of encoders (tipically 1 µm, 0.1 µm or 1/1000 deg).

Resolution

The smallest motion a metrology fixed to the stage can measure.

For manual stages, resolution is given by graduation on micrometer.

For motorized stages, resolution is given by reading of encoder information, as well for translation stage as for rotation stages.

Concentricity

Displacement of the geometric center of a rotation stage from the rotation axis in the plan defined by bearings.

Wobble

Tilt of rotation axis during rotation of a stage.

3.3 Mechanical Specifications

Diameter	(mm)	80; 100
Drive		Stepper (PP; PE) DC (CCHL; CC) Manual (MS)
On Axis Accuracy	(°)	0.023
Repeatability	(°)	0.003
Hysteresis	(°)	0.006
Wobble	(µrad)	70

3.4 Load Specifications Definitions

Load Capacity (Cz)

Maximum load a stage can move.

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

Off-Centerd Load (Q)

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

D: Cantilever distance.

a: Construction parameter.

On Axis Load Capacity (Cx)

Direct load capacity on axis with specified speed and acceleration.

Angular stiffness (kα)

This is dued to stage cosntruction.

We specify this stiffness around X axis ($k\alpha x$) and around Y axis ($k\alpha y$) for translation, and perpendicular to rotatio axis for rotary stages. It allows

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Nominal Torque (Mz)

Maximum torque a rotary stage can supply. This value is specific to the motor used. So we specify it for each kind of motor.

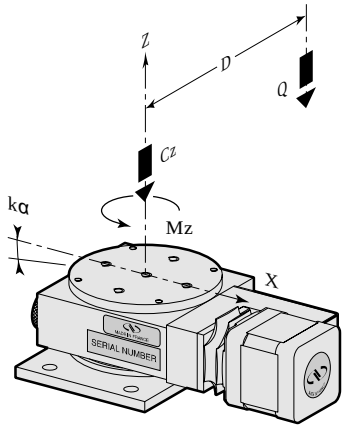
When rotary stages are used in vertical, the load moment is created by an off-centered load.

Maximum inertia

Maximum inertia that a stage can move around its rotation axis.

3.5 Off-center Load Characteristics

		(M-)URM80	(M-)URM100
Cz	(N)	200	300
a	(mm)	30	44
kα	(µrad/N.m)	60	20
Mz	(N.m)	1.3	1.8



with:

Q : Off-center load, $Q \leq Cz / (1 + D/a)$

Cz : Normal center load capacity on bearings

D : Cantilever distance in millimeters

a : Construction parameter

kα : Transversal stiffness

Mz : Nominal torque

3.6 Motorized Stages Weight

Weights indicated into the below table are average values for stages with the drive unit.

(M-)URM80	(kg)	1.2
(M-)URM100	(kg)	2

The weight variation according to the drive unit is not very significant.

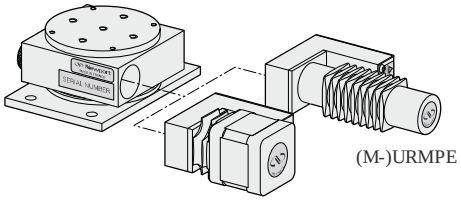
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4.0 Drives

4.1 Stepper Motor Drive

Stepper-motor-driven stages are offered in two variants:

- One mini-step drive version: (M-)URMPP.
- One full-step version: (M-)URMPE.



Full-Step Drive

Is used for stepper motors, when 1 pulse emmited by electronic corresponds to theoritical physical motion of 1 full step of the motor.

Our full-step stages have one more specification: minimum increment of kinematic chain equals encoder resolution.

Mini-Step Drive

Is used for stepper motors, when 1 pulse emmited by electronic corresponds to theoritical physical motion of a fraction of a full step of the motor.

For these stages a mini-step equals 1/10 of a full step.

Stepper Motor Performance Specifications

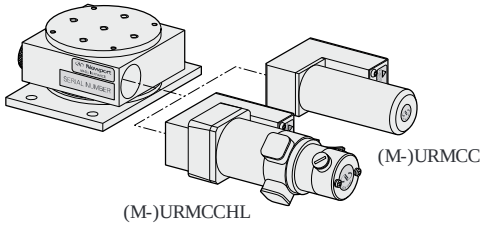
	Resolution (°)	Speed (°/sec)	Motor
(M-)URM80PP (M-)URM100PP	0.001	20	UE41PP
(M-)URM80PE (M-)URM100PE	0.001	2	UE31PP

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4.2 DC Motor Drive

Two DC-motor-driven configurations are available:

- One version equipped with a tachometer: (M-)URMCCHL.
- One low-power version: (M-)URMCC.



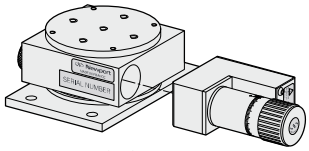
DC Motor Performance Specifications

	Resolution (°)	Speed (°/sec)	Motor
(M-)URM80CCHL (M-)URM100CCHL	0.001	20	UE404CC
(M-)URM80CC (M-)URM100CC	0.001	2.5	UE31CC

4.3 Manual Drive

One manual drive version is available, equipped with a rotary encoder: (M-)URMMS.

Our CV1000 Display Counter permits to read the position.



Manual Performance Specifications

	Resolution (°)	Nb (°/rev.)
(M-)URMMS	0.001	2

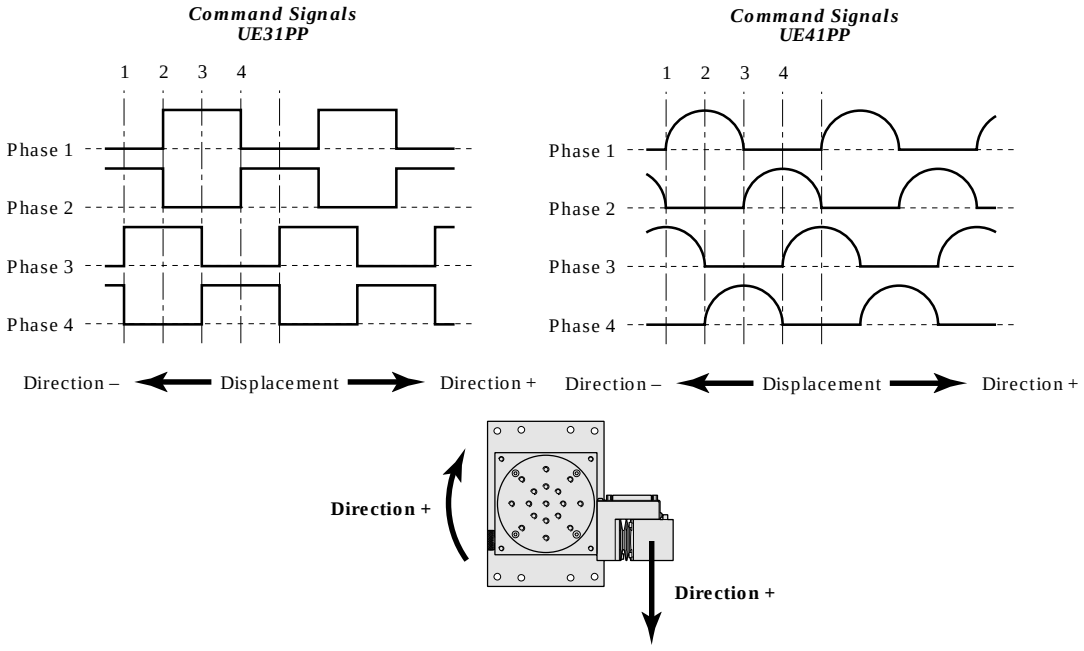
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5.0 Motorization

5.1 Newport Stepper Motor Characteristics

Motor	Angle by Step (°)	Current (A)	Resistance (Ω)	Inductance (mH)	Newport Utilization
UE31PP	3.6	0.56	7.6	8.4	Full-Step
UE41PP	1.8	1.2	3	4.3	Full-Step or Mini-Step

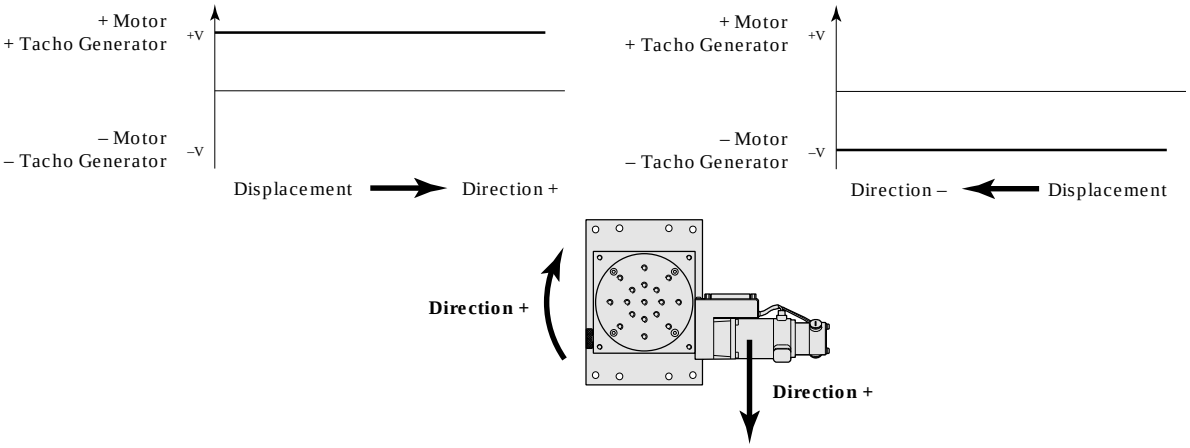
5.2 Command Signals for Newport Stepper Motors



5.3 Newport DC Motor Characteristics

Motor	Mechanical Power (W)	Nominal Voltage (V)	Armature Resistance (Ω)	Tachometer (V/Krpm)
UE31CC	2.53	24	57	–
UE404CC	40	75	18.6	3 (±10%)

5.4 Command Signals for Newport DC Motors

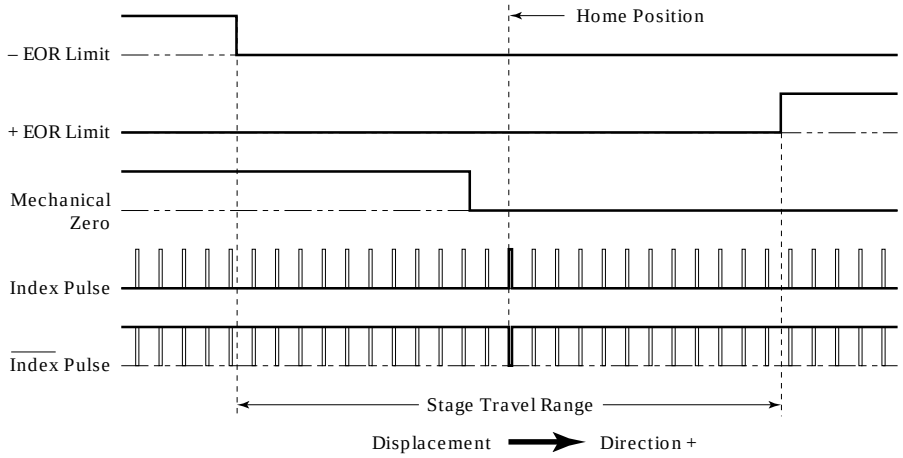


In the above drawings, + Motor signal is referred to – Motor signal, + Tacho Generator signal is referred to – Tacho Generator signal.

1 When the stage moves in + Direction, the + Motor voltage is higher than – Motor voltage, and + Tacho Generator voltage is higher than – Tacho Generator voltage.

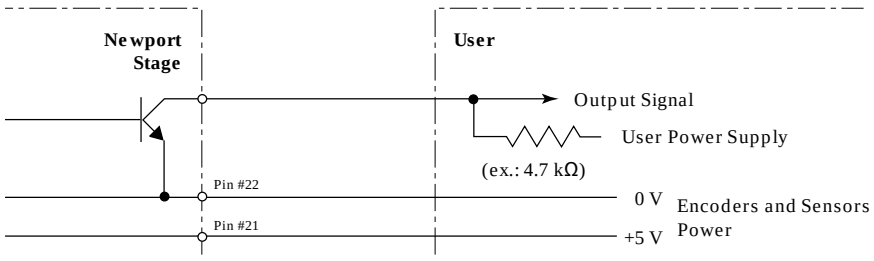
2 When the stage moves in – Direction, the + Motor voltage is lower than – Motor voltage, and + Tacho Generator voltage is lower than – Tacho Generator voltage.

5.5 Sensors Position



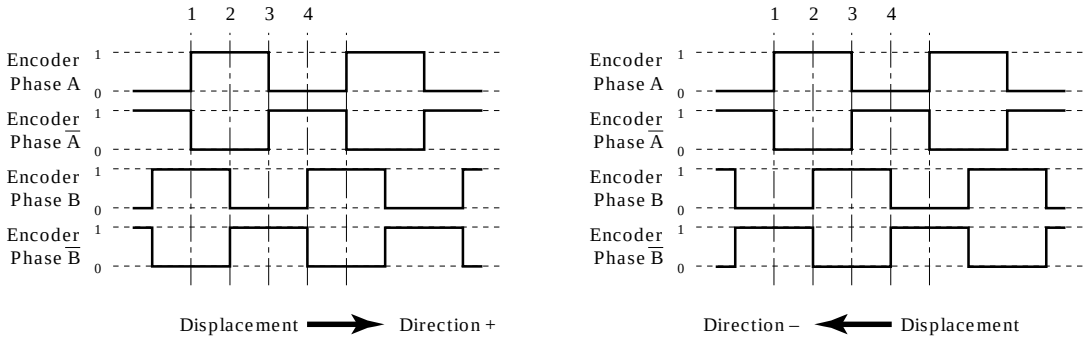
End-of-Run and Mechanical Zero are “Open Collector” type output signals. Their use needs a pull-up resistance connected to the power supply (generally the power supply of the board where signals are sent).

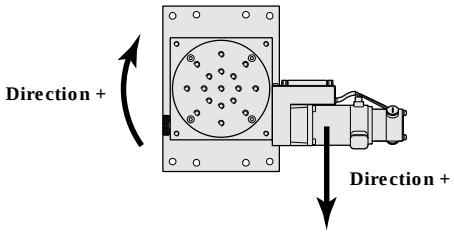
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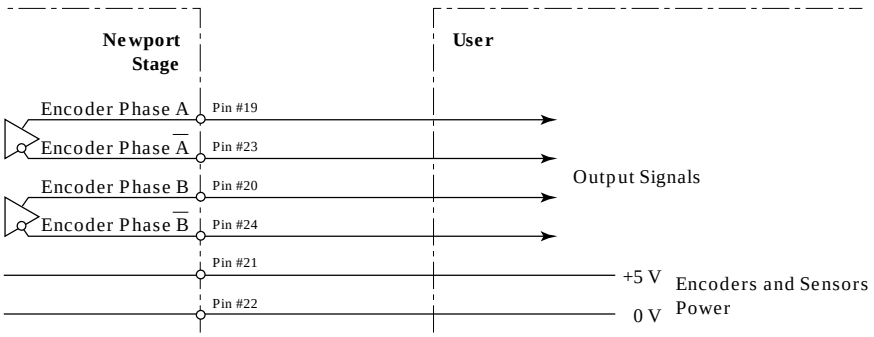
Index Pulse and $\overline{\text{Index Pulse}}$ are “differential pair” type output signals. Using these signals permits a high immunity to noise. Emission circuits generally used by Newport are 26LS31 or MC3487. Reception circuits to use are 26LS32 or MC3486.

5.6 Feedback Signals Position





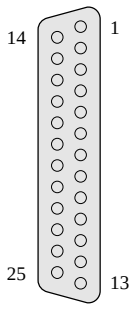
The incremental sensor operates following the photoelectric measurement principle, with a disk including slides. When the sensor shaft turns, the sensor generates square signals in quadrature, sent to pins #19, #20, #23 and #24 of the 25-pin Sub-D connector.



Encoders are “differential pair” type 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.

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5.7 Pinouts



The 25-pin Sub-D connection for each (M-)URM stage is given in the following table:

	UE31PP: **(M-)URMPE** UE41PP: **(M-)URMPP**	UE31CC: **(M-)URMCC**	UE404CC: **(M-)URMCCHL**	Manual: **(M-)URMMS**
1	Phase 1	N.C.	+ Tacho Generator	N.C.
2	Phase 1	N.C.	+ Tacho Generator	N.C.
3	Phase 2	N.C.	– Tacho Generator	N.C.
4	Phase 2	N.C.	– Tacho Generator	N.C.
5	Phase 3	+ Motor	+ Motor	N.C.
6	Phase 3	+ Motor	+ Motor	N.C.
7	Phase 4	– Motor	– Motor	N.C.
8	Phase 4	– Motor	– Motor	N.C.
9	Common phase 3-4	N.C.	N.C.	N.C.
10	N.C.	N.C.	N.C.	N.C.
11	Common phase 1-2	N.C.	N.C.	N.C.
12	N.C.	N.C.	N.C.	N.C.
13	Mechanical Zero	Mechanical Zero	Mechanical Zero	Mechanical Zero
14	Shield Ground	Shield Ground	Shield Ground	Shield Ground
15	Encoder Index Pulse I	Encoder Index Pulse I	Encoder Index Pulse I	Encoder Index Pulse I
16	0 V logic	0 V logic	0 V logic	0 V logic
17	+ End-of-Run	+ End-of-Run	+ End-of-Run	+ End-of-Run
18	– End-of-Run	– End-of-Run	– End-of-Run	– End-of-Run
19	Encoder Phase A	Encoder Phase A	Encoder Phase A	Encoder Phase A
20	Encoder Phase B	Encoder Phase B	Encoder Phase B	Encoder Phase B
21	Encoder Power: +5 V	Encoder Power: +5 V	Encoder Power: +5 V	Encoder Power: +5 V
22	0 V Encoder	0 V Encoder	0 V Encoder	0 V Encoder
23	Encoder Phase /A	Encoder Phase /A	Encoder Phase /A	Encoder Phase /A
24	Encoder Phase /B	Encoder Phase /B	Encoder Phase /B	Encoder Phase /B
25	Encoder Index Pulse /I	Encoder Index Pulse /I	Encoder Index Pulse /I	Encoder Index Pulse /I

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6.0 Connection to a Newport Electronics

6.1 Warnings on electronic units

Electronic units are intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possible injury. Read the electronics manual carefully before operating the instrument and heed 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 case.**

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 assure that the green (green-yellow) wire is attached to earth ground.

WARNING

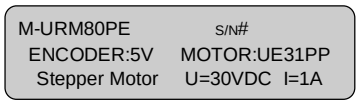
This product operates with voltages that can be lethal.

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.

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6.2 Connection

On each stage is represented a label which indicates its name, its serial number and the motor it is equipped (ex.: UE31PP).



WARNING

Before to begin any connection, make sure that the name of the motor indicated on the stage corresponds to the name of the motor indicated on the driver module.

WARNING

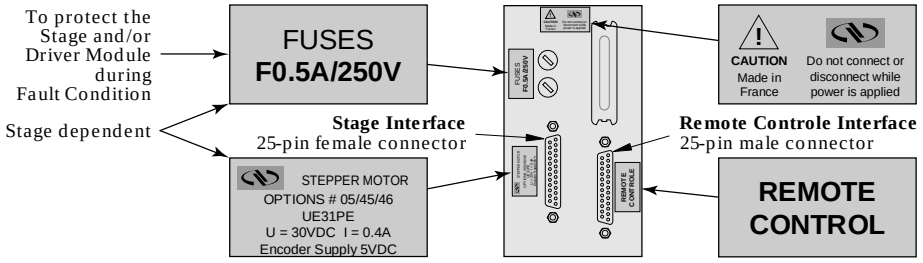
Always turn power OFF electronics units to link up before to connect them stages.

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

WARNING

Damage to stage may occur if the stage is not the same type as shown on driver label located near the stage interface connector (see drawing below).

Check that the option number specified on this label correspond to the number indicated in the driver module options table for your stage (see next page).



WARNING

Do not mistake the 25-pin Remote Control Interface Connector with one of the Stage Connector Interface on MD1000 and MM2500 units.

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6.3 Driver Module Options

Driver modules for our MotionMaster (MM) Series controllers are available for each of the URM Series stages.

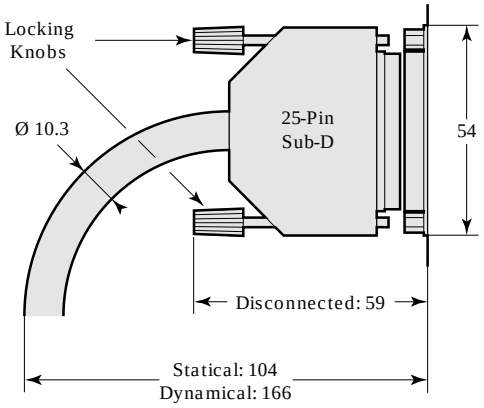
They are referenced as 2-digit coded options to be used in the motion controller part number and are listed in the following table.

	MM2000	MD1000		MM2500		MM3000	MM4005
Electronics:							
Display + Manual Control:		Without	With	Without	With	(1)	Display + Keyboard
(M-)URMPP	–	12	51	12	51	12	12
(M-)URMPE	–	05	46	05	46	03	05
(M-)URMCCHL	–	72	92	–	–	72	7G
(M-)URMCC	05	64	83	–	–	63	64

1) Front panel with keypad and display is ordered as a chassis option.

6.4 Cables

All our stages are delivered with a 3-meter cable with 25-pin Sub-D connector. So they can be directly connected to our controllers/drivers of MM series.



WARNING

These cables are shielded correctly. For a correct operating, make sure for connectors locking (grounds continuity provided by cables).

For long distance applications, higher lengths cables are available in standard.

Electronic cable from MM controllers/drivers to stages with 25-pin Sub-D connector are available in 5 m or 10 m length.

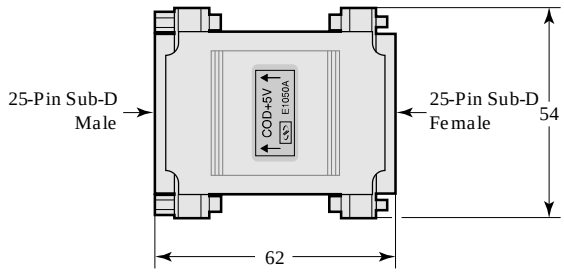
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WARNING

Cables creep into a typical industrial environment: separtes motor cables and power supply cables. Motor cables must be a specific csbles creep.

Electronic components included in our stages need 5V regulated voltage.

If you use cables longer than 3 m, you have to add a voltage regulator.



This regulator with 25-pin Sub-D connector has to be fixed on the stage.

Others lengths (up tu 25 m) are available on request.

Please contact your sales representative.

A Sub-D 25M/Sub-D 25F cable is necessary to connect a stage from a MM2000 board, via a UIB box.

7.0 Connection to other electronics

AVERTISSEMENT

The responsibility of Newport will not be able to be committed in case of bad functioning or damage of a stage used with an electronics non provided by Newport.

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8.0 Mounting

8.1 Stage Mounting

WARNING

Before to use a (M-)URM stage, it is imperative to fix it:

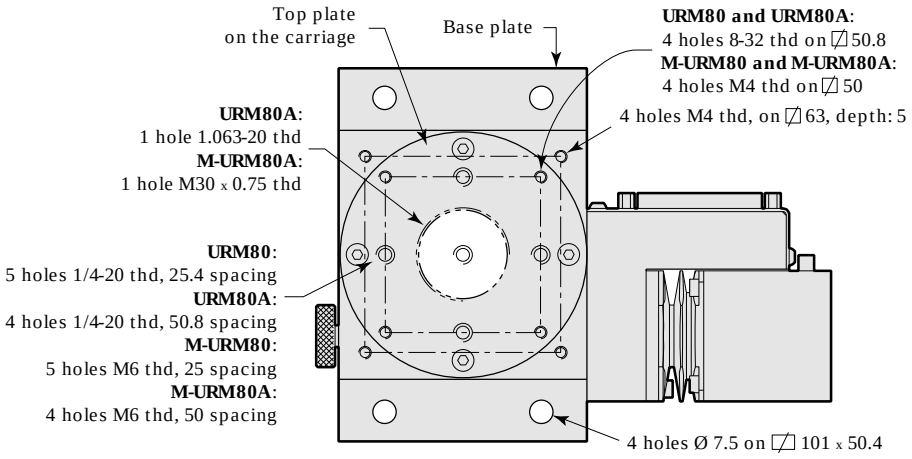
- **directly on a rectified working surface, from holes located on the mounting plate,**
- **on an other stage, directly or with a mounting interface.**

but in no case, the stage has to remain without fastening.

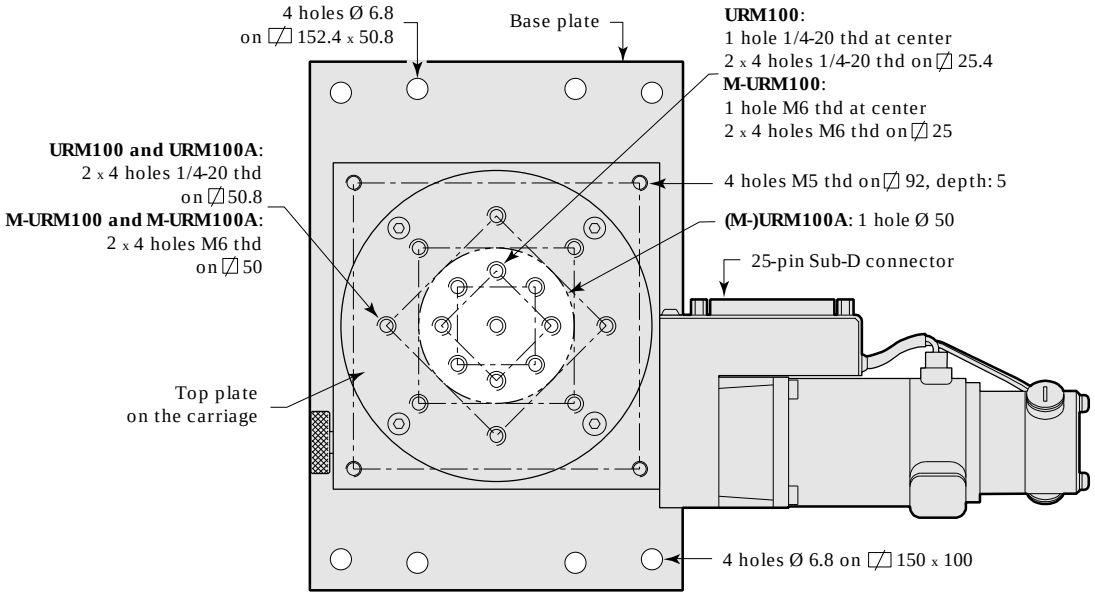
It is equally necessary to fasten the device to move on the carriage:

- **directly,**
- **removing the plate on the top of the stage.**

(M-)URM80



(M-)URM100



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CAUTION

The working surface flatness directly influences on stages accuracy and performances.

8.2 Interfaces Disassembling

1 Disassemble the top plate of the rotation stage, fixed with 4 CHc M4 screws.

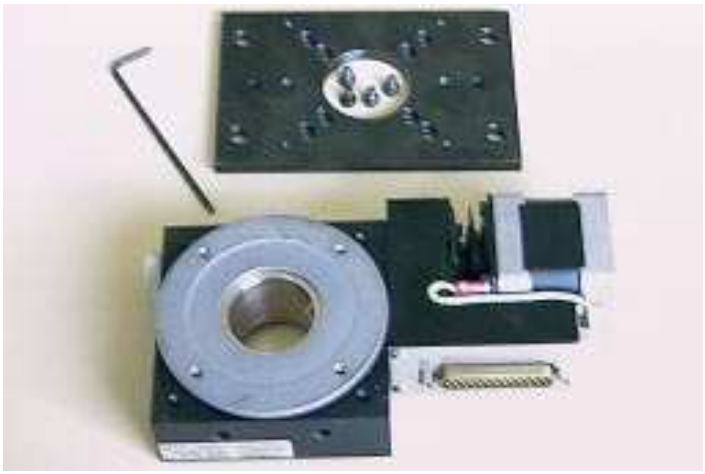




2 Turn the stage upside down.

3 Disassemble the base plate fixed with 4 CHc M4 screws, on the body stage.





8.3 Interface Plates Mounting

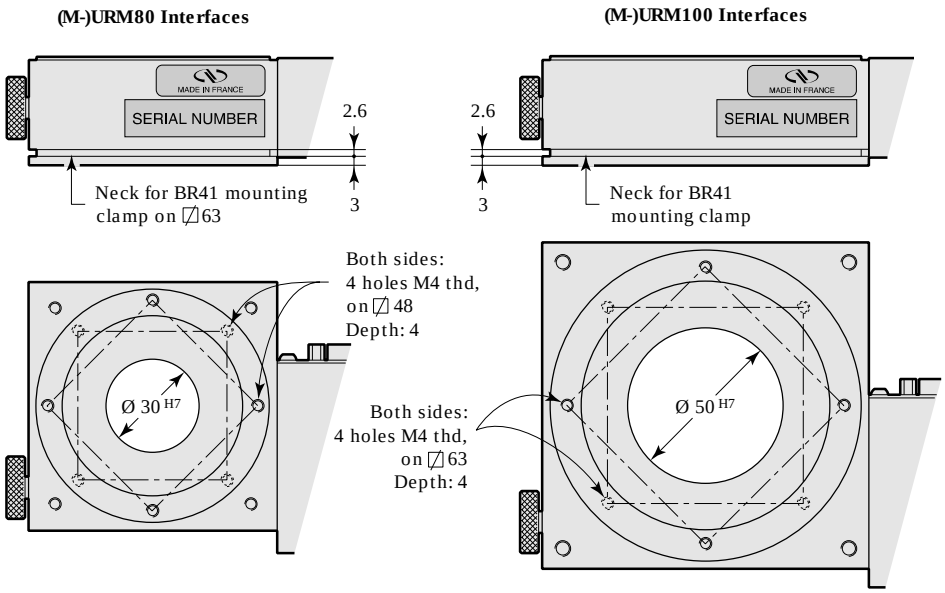
Make steps of “Interfaces Disassembling” chapter in the opposite order.

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8.4 Assembly Pattern

Stacking URM Series stages either together or with other Newport's stages is easily accomplished. Below are example schematics of the assembly patterns used. These interfaces are accessed to by unscrewing and removing the upper and/or lower plates of the stages (see dimension drawing).



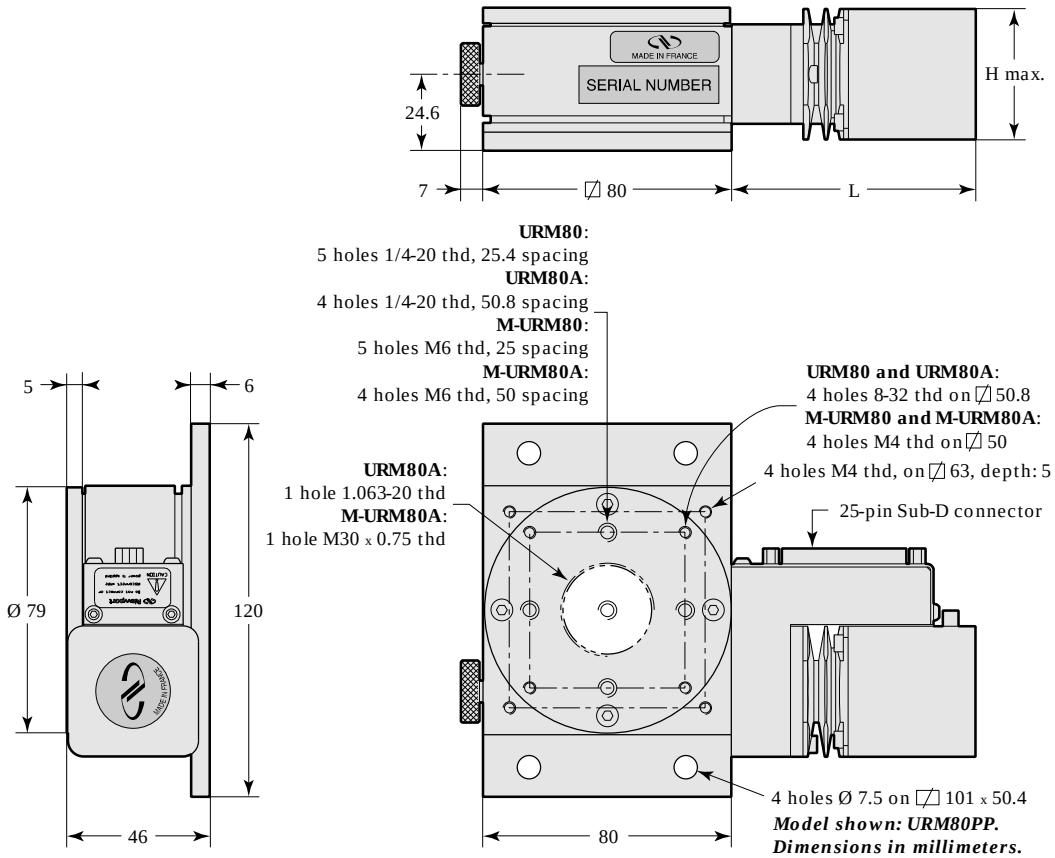




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9.0 Dimensions

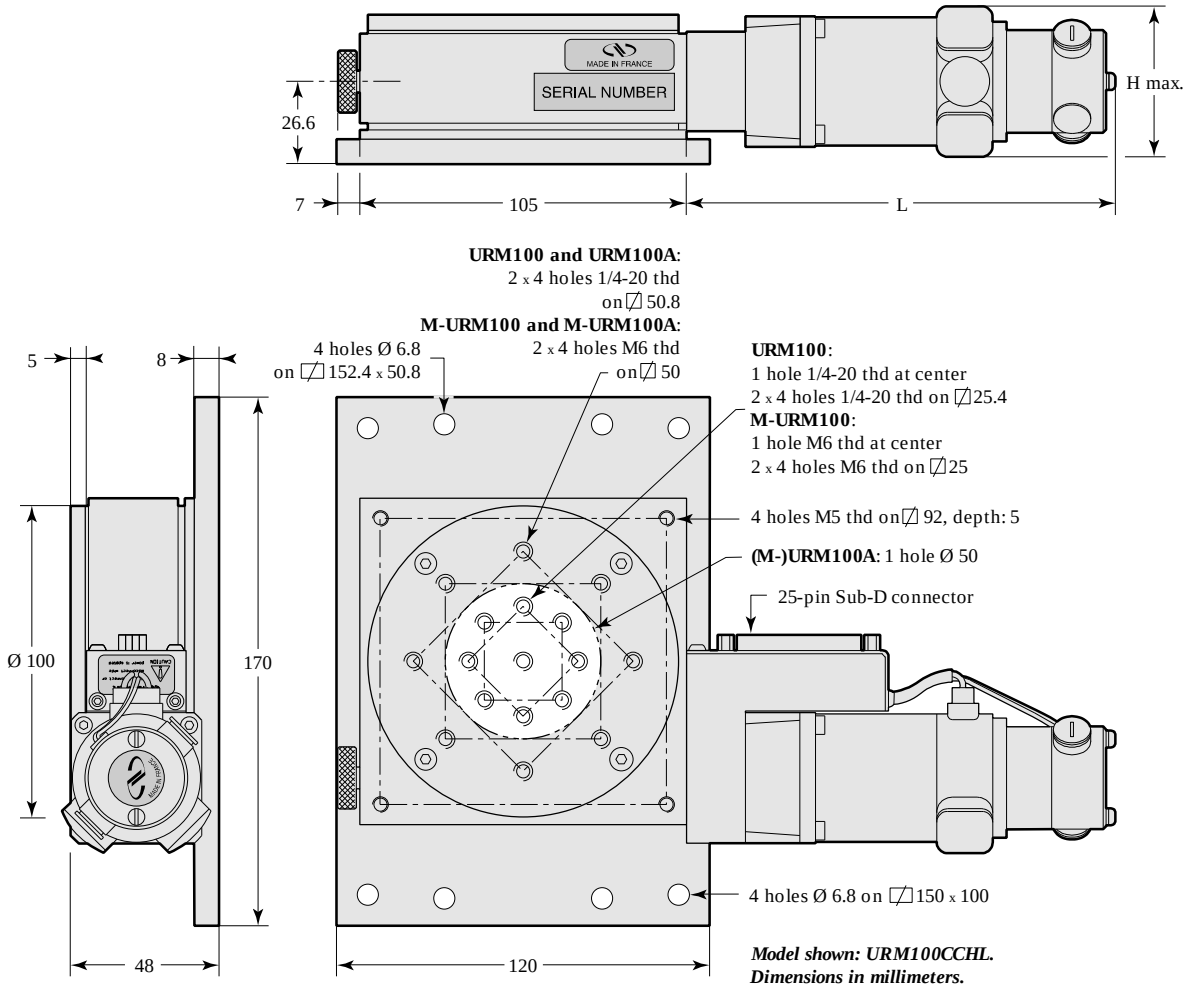
9.1 (M-)URM80



	L	H
(M-)URM80PP	80.5	42
(M-)URM80PE	129	32
(M-)URM80CCHL	141	48.5
(M-)URM80CC	106.5	32
(M-)URM80MS	90.5	32

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9.2 (M-)URM100



Model shown: URM100CCHL.
Dimensions in millimeters.

	L	H
(M-)URM100PP	80.5	42
(M-)URM100PE	129	32
(M-)URM100CCHL	141	48.5
(M-)URM100CC	106.5	32
(M-)URM100MS	90.5	32

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10.0 Maintenance

10.1 Maintenance

URM Series stages necessitate no particular maintenance. Nevertheless, this are precision mechanical device that must be maintained and manipulated with precaution.

PRECAUTIONS

URM Series stages must operate, or to be stocked in a clean environment, without dusts, humidity, solvent or other substances.

10.2 Repairing

CAUTION

Never attempt to disassemble an element of the stage that has not been specified in this manual (base and interface plates).

To disassemble a non specified element can provoke a bad functioning of the stage.

If you observe a bad functioning of your stage, please contact immediately your sale representative that will know to indicate you manipulations to undertake, or instructions to return us the equipment.

CAUTION

All disassembling attempt or repair of stage without authorization will interrupt your warranty.

10.3 Control

CAUTION

It is recommended to return us your stage every year for a control of its specifications.

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Service Form

Your Local Representative
Tel. : _____
Fax: _____

Name: _____ Return Authorization #: _____
(Please obtain prior to return of item)

Compagny: _____

Adress: _____ 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): _____

Motorized Translation & Rotation Stages

EC Declaration of Conformity

We declare that the accompanying product, identified with the "CE" mark, meets all relevant requirements of Directive 89/336/EEC for Electro-Magnetic Compatibility.

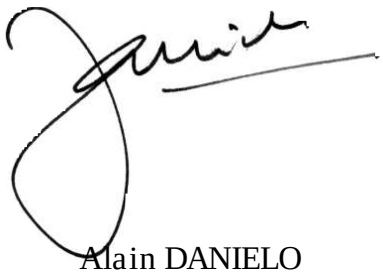
Compliance was demonstrated to the following specifications:

EMISSION:

Radiated and Conducted Emission per EN 50081-1
"Residential, Commercial and Light Industry" Standard.

IMMUNITY:

Radiated and Conducted Immunity per EN 50082-2
"Industrial" Standard.

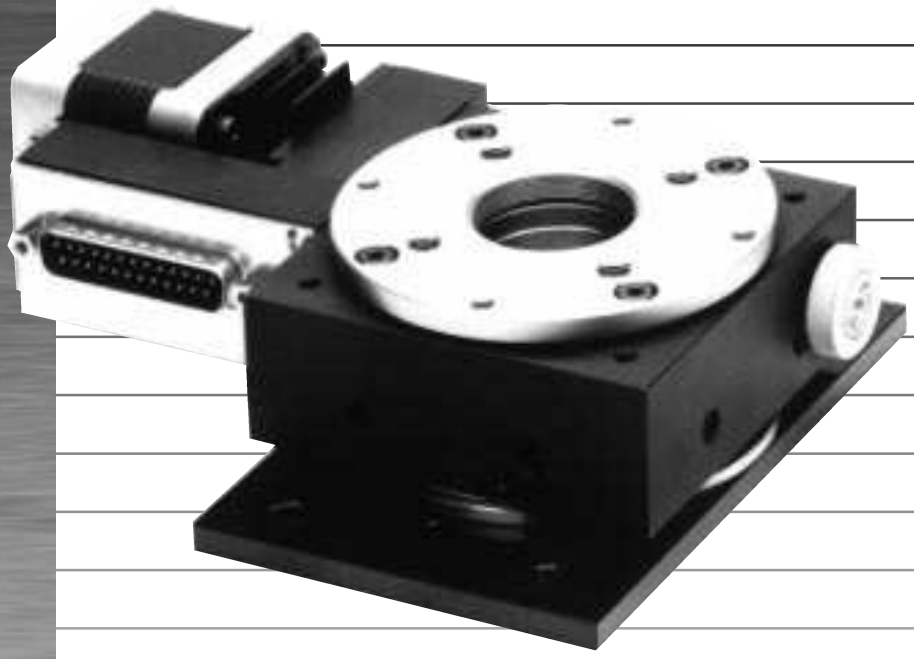


Alain DANIELO
VP European Operations
Zone Industrielle
45340 Beaune-la-Rolande, France

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URM

High-Resolution Rotation Stages



USER'S MANUAL

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Caution

CAUTION

Do not place this stage in a damp or dusty place. This may cause an electric shock, or alter mechanical parts.

CAUTION

Do not place this equipment in a location affected by oil fumes or steam. This may cause an electric shock.

CAUTION

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

CAUTION

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

Then ensure that the cable to 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.

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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 option.

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 aplly to dammages resulting from:

- **a bad utilization**
  - **Load on the stage graeter than specified load.**
  - **Carriage speed higher than specified speed.**
  - **Non respected grounds continuity.**
    - ¬ **Connectors locking.**
    - ¬ **When the load on the stage represents an electrical risk, inevitably it must be connected to the ground.**
  - **Bad mounting stage or fixing load.**
- **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 informations only and product specifications are subject to change without notice. Any changes will be reflected in future printings.

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Service Form 23

We declare that the accompanying product, identified with the "CE" mark, meets all relevant requirements of Directive 89/336/EEC for Electro-Magnetic Compatibility.

Generic Standard:	Emission	EN50081-1
	Immunity	EN50082-2

"Residential, Commercial and Light Industry" and per IEC 1000-4-5 "Surge Immunity" Standard.

Newport Corporation shall not be liable for damages when using the product:

- Modification of the product.
- Using modified connector, or modified or not supplied cables.
- Connecting this product to non-CE equipments.

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Warnings

WARNING

Do not use this stage when its motor is emitting srnoke is unusually hot to the touch 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 is dangerous.

WARNING

Do not use this stage if any water has entered the stage. Switch off the motor power and then disconnect the electronics power supply.

Contact your Newport service facility and request repairs.

WARNING

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 and request repairs.

WARNING

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 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.

WARNING

Take care that this stage is not exposed to moisture and that water does not get into the stage.

WARNING

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

WARNING

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

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