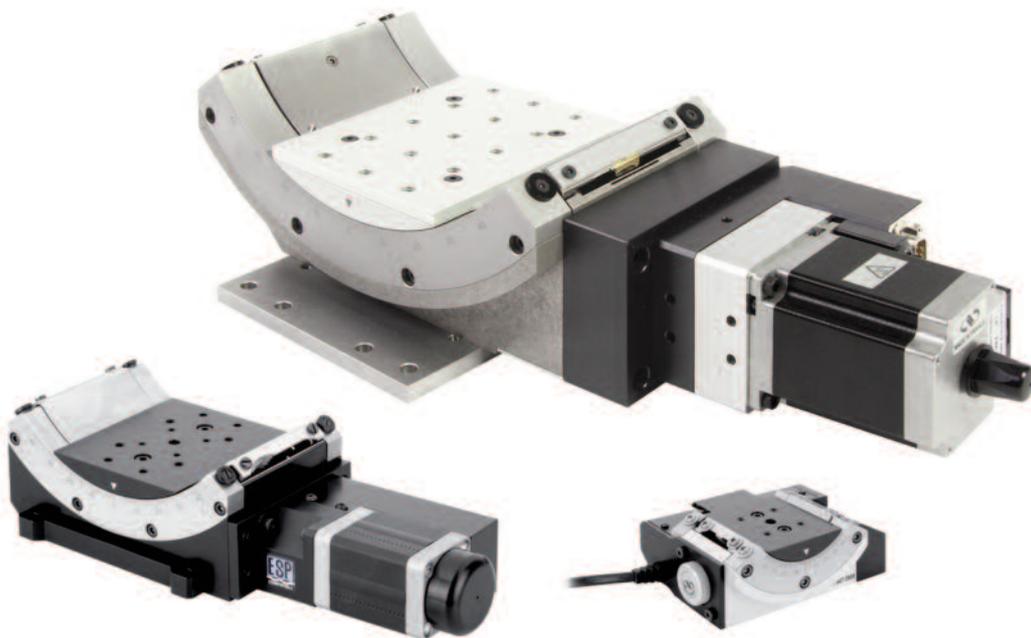




BG Series

Goniometric Cradles



 **Newport**[®]

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 thereof.**



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.

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.

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Original instructions.

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EC Declaration of Conformity



2 Tech Drive
 Andover, MA 01810
www.mksinst.com

EU27 Declaration of Conformity

Application of Council Directive(s):

- Electromagnetic Compatibility Directive (EMCD) – 2014/30/EU
- Machinery Directive – 2006/42/EC
- Restriction of Hazardous Substances Directive (RoHS3) – (EU) 2015/863⁽⁷⁾
- Waste Electrical and Electronic Equipment – Directive 2012/19/EU



Standard(s) to which conformity is declared:

- EN 61326-1:2013 – (EMC)
- EN ISO 12100:2010 Safety of Machinery – General Principles of Design – Risk Assessment and Risk Reduction

Emissions:

- EN 55011: 2016 +A1:2017 ⁽⁴⁾ Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

Immunity:

- EN 61000-4-2:2009 EMC/Electrostatic Discharge Immunity Test
- EN 61000-4-3:2006+A2:2010 EMC/Radiated Radio Frequency Electromagnetic Field Immunity Test
- EN 61000-4-4:2012 EMC/Electrical Fast Transient/Burst Immunity Test
- EN 61000-4-5:2014+A1:2017 EMC/Surge Immunity Test
- EN 61000-4-6:2014 EMC/Conducted Disturbances induced by Radio Frequency Fields Immunity Test

Manufacturers Name: MKS Instruments, Inc., 2 Tech Drive, Andover, MA 01810 USA

Authorized Representatives Name & Location: _____

Equipment Type/Description: **High Precision Goniometers**

Model Number(s) ⁽⁶⁾: **BGS50/80/-CC/-PP ; M-/BGM120/160/200/-CC/-BPP/-BPE/-PEBV6**

The object of the declaration described above is in conformity with the relevant Community harmonization legislation. MKS product conforms to the above Directive(s) and Standard(s) only when installed in accordance with manufacturer’s specifications. This declaration has been issued under the sole responsibility of the manufacturer.

Date: 4/1/2022

Le Cointe Hervé – Quality Director

4) Class A, Group 2
 6) Compliance of the above model numbers requires the use of a braided shielded cable properly terminated at both ends – if so noted in the MKS Instruction Manual.
 7) RoHS Directive has to be checked for in scope products; cannot CE mark without compliance to RoHS. RoHS Directive can be unchecked only for systems which MKS sells which qualify for “Large Scale Industrial Tool” exclusion.

UK Declaration of Conformity



2 Tech Drive
 Andover, MA 01810
www.mksinst.com

UK Declaration of Conformity

Application of Council Directive(s):

- Electromagnetic Compatibility Directive (EMCD) – 2014/30/EU
- Machinery Directive – 2006/42/EC
- Restriction of Hazardous Substances Directive (RoHS3) – (EU) 2015/863⁽⁷⁾
- Waste Electrical and Electronic Equipment – Directive 2012/19/EU



Standard(s) to which conformity is declared:

- BS EN 61326-1:2013 – (EMC)
- BS EN ISO 12100:2010 Safety of Machinery – General Principles of Design – Risk Assessment and Risk Reduction

Emissions:

- EN 55011: 2016 +A1:2017 ⁽⁴⁾ Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

Immunity:

- BS EN 61000-4-2:2009 EMC/Electrostatic Discharge Immunity Test
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- BS EN 61000-4-5:2014+A1:2017 EMC/Surge Immunity Test
- BS EN 61000-4-6:2014 EMC/Conducted Disturbances induced by Radio Frequency Fields Immunity Test

Manufacturers Name: MKS Instruments, Inc., 2 Tech Drive, Andover, MA 01810 USA

Authorized Representatives Name & Location: _____ / _____

Equipment Type/Description: **High Precision Goniometers**

Model Number(s) ⁽⁶⁾: **BGS50/80/-CC/-PP ; M-/BGM120/160/200/-CC/-BPP/-BPE/-PEBV6**

The object of the declaration described above is in conformity with the relevant Community harmonization legislation. MKS product conforms to the above Directive(s) and Standard(s) only when installed in accordance with manufacturer’s specifications. This declaration has been issued under the sole responsibility of the manufacturer.

Date: 1/4/2022

Le Cointe Hervé – Quality Director

4) Class A, Group 2
 6) Compliance of the above model numbers requires the use of a braided shielded cable properly terminated at both ends – if so noted in the MKS Instruction Manual.
 7) RoHS Directive has to be checked for in scope products; cannot CE mark without compliance to RoHS. RoHS Directive can be unchecked only for systems which MKS sells which qualify for “Large Scale Industrial Tool” exclusion.

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.

Caution

CAUTION

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

Only the BGM-PEBV6 stages are compatible and can be used in a vacuum environment up to 10^{-6} hPa.

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)

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.

Goniometric Cradles

BG Series

1.0 Introduction

This manual provides operating instructions for the BG series goniometric cradles:

- (M-)BGM-BPP
- (M-)BGM-BPE
- (M-)BGM-PEBV6⁽¹⁾
- (M-)BGM-CC
- BGS-PP
- BGS-CC

(M-) indicates that imperial and metric interface versions are available (e.g. BGM160BPP and M-BGM160BPP). Mechanical and electrical characteristics are identical for both models.

¹⁾REMARK

Vacuum compatible goniometric cradles to 10⁻⁶ hPa. In this case, max. speed and load capacity have to be divided by two.



BGS50CC, BGS80PP and BGM120BPP goniometric cradles.

RECOMMENDATION

We recommend you read carefully the chapter “Connection to electronics” before using the BG goniometric cradle.



Adjacent sizes of BG cradles can easily be stacked to provide orthogonal 2 axis rotation around a fixed point.

2.0 Description

BG Series goniometric cradles rotate on a transverse axis above the platform. Compared to full 360° rotation stages, they offer maximum access to the rotating part and allow construction of very compact multi-axis rotation assemblies. BG cradles are designed so that orthogonal mounting of two adjacent-sized cradles (e.g., BGS50 and BGS80) provides two perpendicular axes of rotation at about the same point in space. Mounting a rotation stage under the assembly adds a third orthogonal rotation axis through the same point.

Precise rotation is ensured by a precision ground, hardened worm gear drive. Single-row ball bearings and precision-ground tool-steel races ensure smooth rotation with minimal wobble and eccentricity. A home switch, conveniently located at center of travel, facilitates the return of the platform to a level position.

BG Series goniometric cradles are available in 5 sizes and may be configured with DC motors or stepper motors. The selection of the motorization is dependent on the application.

2.1 Design Details

Base Material	Stainless steel with aluminum body
Bearings	Ball bearings
Drive Mechanism	Ground worm gear
Worm Gear Ratio	BGS50, BGS80 and BGM120: 1:180 BGM160 and BGM200: 1:60
Reduction Gear	BGS50CC: 14:1, BGS50PP: 43:1, BGS80CC: 44:20 BGS80PP and BGM120 ⁽¹⁾ : None BGM160 ⁽¹⁾ and BGM200 ⁽¹⁾ : 3:1
Feedback	BGS50CC: Motor mounted rotary encoder, 2,048 cts/rev BGS50PP and BGS80PP: none BGS80CC: Worm mounted rotary encoder with index pulse, 4,000 cts/rev BGM120 to BGM200: Worm mounted rotary encoder with index pulse, 2000 cts/rev
Limit Switches	Mechanical, at ±45° (for BGS50 Mechanical, at ±30°)
Origin	Optical, at 0°
Cable	3 m long cable included
Vacuum Compatibility	Available up to 10 ⁻⁶ hPa using full step motor (BGM120BPE to BGM160BPE only)

¹⁾ Additional motor mounted 10:1 reduction gear with PE versions.

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.

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:

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

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.

Eccentricity

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

Wobble

Tilt of rotation axis during rotation of a stage, measured on a reference surface.

The testing of accuracy, repeatability, and reversal error are made systematically with test equipment in controlled environment (20^{±1} °C).

A linear cycle with 21 data points on the travel and 4 cycles in each direction gives a total of 168 points.

Guaranteed and Typical 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



	BGS50CC	BGS50PP	BGS80CC	BGS80PP	BGM120, BGM160, BGM200
Travel Range (°)	±30	±30	±45	±45	±45
Minimum Incremental Motion (°)	0.0005	0.0002	0.0005	0.0002	0.002
Uni-directional Repeatability Typical ⁽¹⁾ (°)	0.001	0.001	0.001	0.001	0.004
Bi-directional Repeatability, Typical ⁽¹⁾ (°)	0.013 or ±0.0065	0.016 or ±0.008	0.003 or ±0.0015	0.005 or ±0.0025	0.024 or ±0.012
Absolute Accuracy, Typical ⁽¹⁾ (°)	0.05 or ±0.025	0.07 or ±0.035	0.05 or ±0.025	0.06 or ±0.03	0.05 or ±0.025
Maximum Speed (°/s)	10	4	20	20	CC and BPP: 20, BPE: 2
Wobble, Typical ⁽¹⁾ (µrad)	200 or ±100	200 or ±100	200 or ±100	200 or ±100	200 or ±100
MTBF (h)			20,000		

¹⁾ For the definition of Typical and Guaranteed specifications see "Motion Basics Terminology & Standards" Tutorial at www.newport.com
The actual performance of BG stages are not verified on all production units, hence typical specifications are provided.



CAUTION

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

3.3 Load Specification Definitions

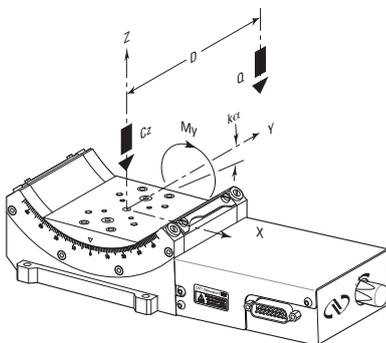
Normal Load Capacity (Cz)

Maximum load a rotation stage can move while maintaining specifications. This value is given with speed and acceleration specified for each rotation stage, and with a load perpendicular to bearings.

Off-Centered Load (Q)

Maximum cantilever-load a rotation stage can move: $Q \leq Cz \div (1 + D/a)$
D: Cantilever distance.

3.4 Load Characteristics and Stiffness



	BGS50	BGS80	BGM120	BGM160	BGM200	
Cz, Normal centered load capacity (N)	20	60	200	300	500	
a, Construction parameter (mm)	30	40	70	90	120	
kcx, Radial compliance (µrad/Nm)	100	20	10	5	2	
My, Maximum torque (Nm)	BPE:	—	10	20	29	
	BPP:	0.5	1	6	16	17
	CC:	0.5	1	9	10	10
Q, Off-center load:			$Q \leq Cz \div (1 + D/a)$			
Where D = Cantilever distance in mm						

3.5 Goniometric Cradle Weights

Weights indicated into the below table are average values for goniometric cradles with a typical drive unit installed, without any cable.

	Weight [lb (kg)]
BGS50	1.76 (0.8)
BGS80	4.63 (2.1)
3-meter MSCABLE-3 Cable for BGS80 models	0.66 (0.3)
(M-)BGM120	18.7 (8.5)
(M-)BGM160	39.7 (18.0)
(M-)BGM200	83.8 (38.0)
3-meter MCAB-3 Cable for (M-)BGM models	1.32 (0.6)

The weight variation between drive units is not very significant.

4.0 Drives and Motors

4.1 Stepper Drive Versions

Stepper motor-driven stages are available in 2 versions:

- The mini-step drive version (PP and BPP) enables high angular speed up to 20 °/s. The larger models, BGM120BPP to BGM200BPP, feature a worm mounted rotary encoder for improved accuracy and repeatability. The encoder also provides a method for detecting motor stalling, an important feature for applications with loads or high torques. The BGS50PP and BGS80PP are not equipped with an encoder. Instead, position is attained by the number of commanded steps and micro-steps. The high output torque of the stepper motor, combined with extensive performance tests, ensures position accuracy as long as the recommended load and torque are not exceeded. The BGS50PP and BGS80PP provide very high motion sensitivity with good linearity between commanded micro-steps and the actual motion of the stage at a very reasonable price.
- The full-step version (BPE) is equipped with a reduction gear providing higher torque. This version is only available on the models BGM120 to BGM200 and is recommended for high inertia payloads and vacuum applications.

Mini-Step Drive

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

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

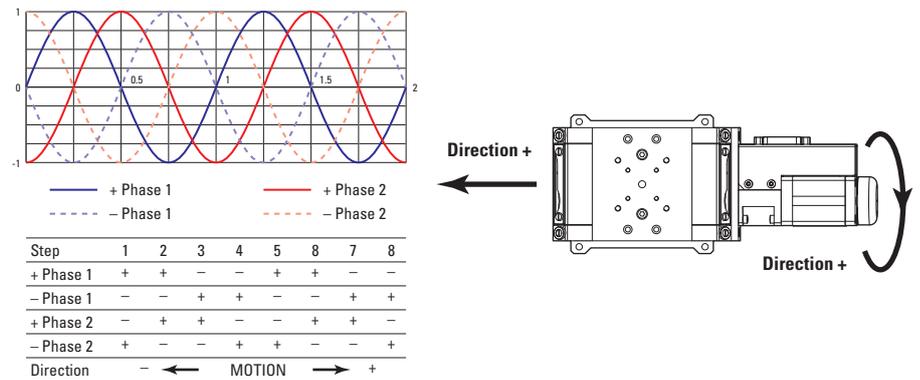
Full-Step Drive

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

Stepper Motor Performance Specifications and Characteristics

	Resolution (°)	Speed (°/s)	Angle by Step (°)	RMS Current per Phase (A)	Resistance (Ω)	Inductance (mH)
BGS50PP	0.0000969	4	0.23	0.25	12.5	5.5
BGS80PP	0.001	20	1.8	0.71	1.7	2.8
BGM120BPP	0.001	20	1.8	1.0	1.13	3.6
BGM160 & 200BPP	0.001	20	1.8	1.77	0.85	3.0
BGM120 to 200BPE	0.001	2	1.8	1.68	1.65	3.2

Command Signals for the Stepper Motors



4.2 DC-Servo Drive Versions

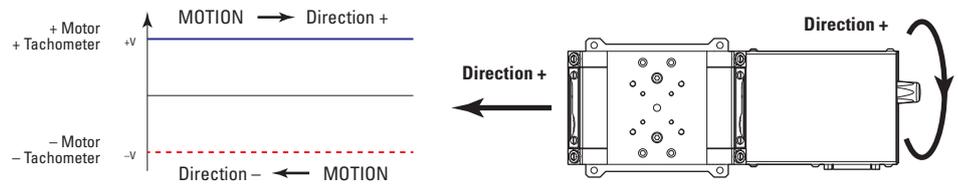
DC motor-driven stages use 3 different motors and encoders depending on the size of the cradle:

- The BGS50CC uses a miniature DC servo motor with a motor mounted rotary encoder, a reduction gear and a belt drive in order to fold the motor. The result is a very small and lightweight package providing very high resolution output and great minimum incremental motion capability. However, reversibility is compromised due to some backlash and hysteresis in the reduction gear and belt drive system.
- The BGS80CC features a high resolution 4,000 cts/rev rotary encoder with index pulse for precision homing and is the recommended choice for applications requiring accurate bi-directional positioning. For tightest position control, the rotary encoder is directly mounted on the worm screw. This avoids the majority of drive train error sources that affect other stages with indirect position read-out.
- The BGM120CC to BGM200CC use higher-torque DC servo motors. The motor also features a built-in tachometer to provide superior speed stability.

DC-Motor Performance Specifications and Characteristics

	Resolution (°)	Speed (°/s)	Nominal Voltage (V)	Max RMS Current (A)	Max. Peak Current (A)	Resistance (Ω)	Inductance (mH)	Tachometer Const. (V/krpm)
BGS50CC	0.0000698	10	24	0.15	0.21	54.6	1.19	–
BGS80CC	0.001	20	48	0.9	1.8	2.52	0.51	–
BGM120 to 200CC	0.001	20	48	1.5	2.3	5.1	3.2	7 (±10%)

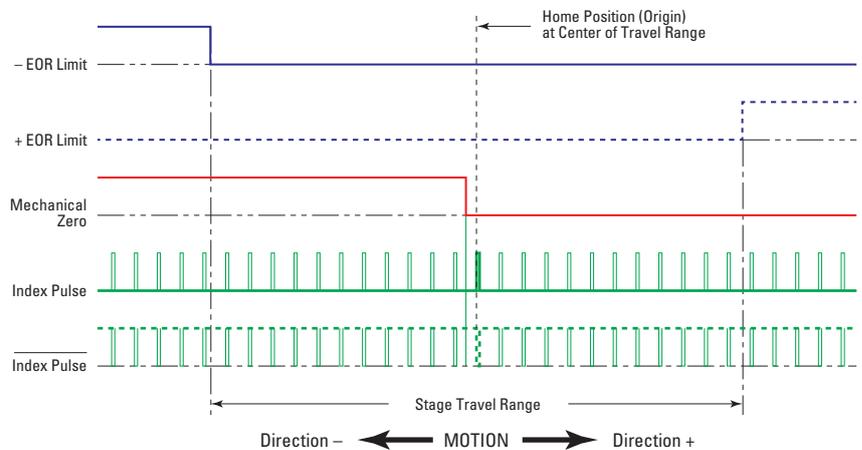
Command Signals for the DC-Motors



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.

4.3 Sensor Position



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

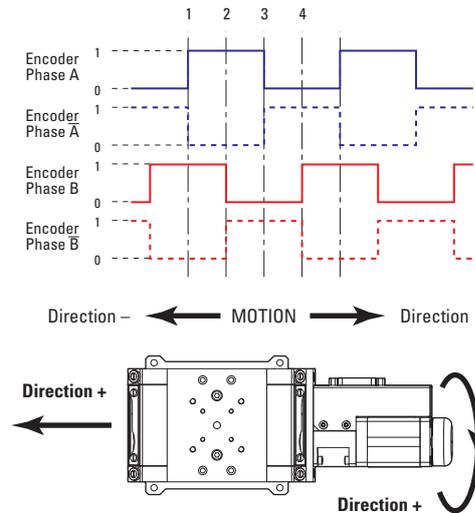
The Index Pulse provides a repeatable Home Position at ±1 step.



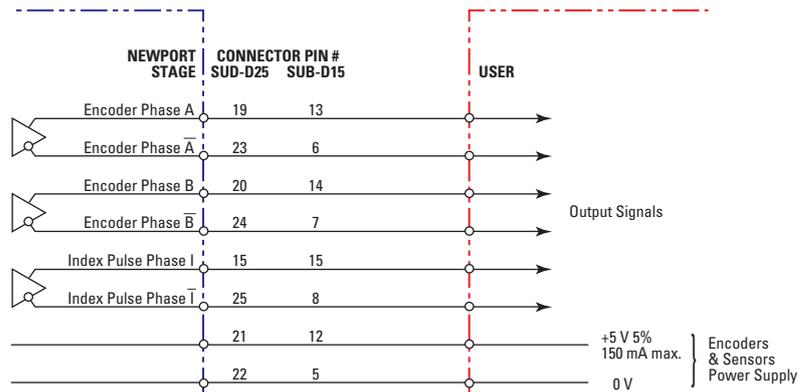
CAUTION

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

4.4 Feedback Signal Position



The incremental sensor consists of an optical scale and an encoder head. When the carriage moves, the encoder head generates square signals in quadrature and sends to pins #19, #20, #23 and #24 of the SUB-D25 connector or pins #6, #7, #13 and #14 of the SUB-D15 connector.

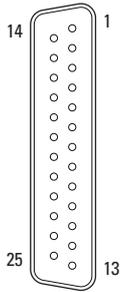


“Encoder” and “Index Pulse” are “differential pair” (type RS-422) type output signals. Using these signals permits a high immunity to noise. Emission circuits generally used by Newport are 26LS31 or MC3487. Reception circuits to use are 26LS32 or MC3486.

4.5 BGS Pinouts

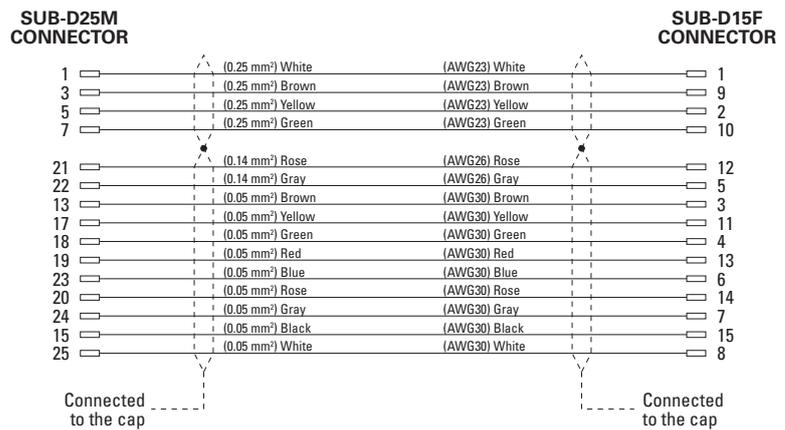
The pinout diagrams for BGS stage SUB-D connectors are shown below:

	BGS50PP		BGS80PP		BGS50CC		BGS80CC	
	1	+ Phase 1	1	+ Phase 1	1	N.C.	1	N.C.
	2	N.C.	2	+ Phase 2	2	N.C.	2	+ Motor
	3	- Phase 1	3	Mechanical Zero	3	N.C.	3	Mechanical Zero
	4	N.C.	4	- End-of-Run	4	N.C.	4	- End-of-Run
	5	+ Phase 2	5	0 V	5	+ Motor	5	0 V
	6	N.C.	6	N.C.	6	+ Motor	6	Encoder Phase /A
	7	- Phase 2	7	N.C.	7	- Motor	7	Encoder Phase /B
	8	N.C.	8	N.C.	8	- Motor	8	Index Pulse /I
	9	N.C.	9	- Phase 1	9	N.C.	9	N.C.
	10	N.C.	10	- Phase 2	10	N.C.	10	- Motor
	11	N.C.	11	+ End-of-Run	11	N.C.	11	+ End-of-Run
	12	N.C.	12	+5 V	12	N.C.	12	+5 V
	13	Mechanical Zero	13	N.C.	13	Mechanical Zero	13	Encoder Phase A
	14	Ground	14	N.C.	14	Ground	14	Encoder Phase B
	15	N.C.	15	N.C.	15	N.C.	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	+5 V			21	+5 V		
	22	0 V			22	0 V		
	23	N.C.			23	Encoder Phase /A		
	24	N.C.			24	Encoder Phase /B		
	25	N.C.			25	N.C.		



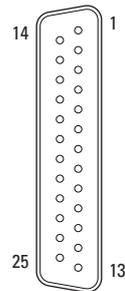
4.6 MSCABLE-3 Cable

A 3-meter length MSCABLE-3 cable is supplied with each BGS80 goniometric cradle.



4.7 BGM Pinouts

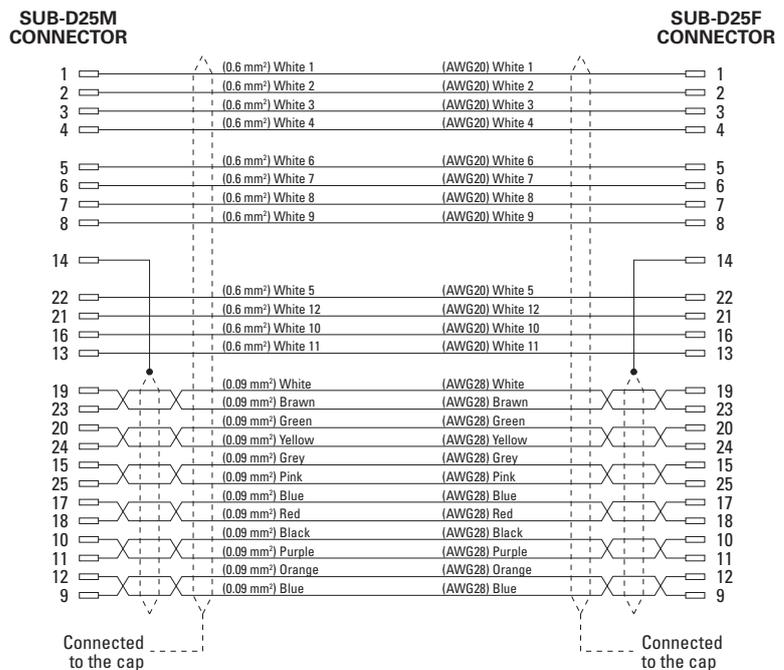
The pinout diagrams for BGM stage SUB-D25 connectors are shown below:



BGM-BPP & -BPE		BGM-CC	
1	+ Phase 1	1	+ Tachometer
2	+ Phase 1	2	+ Tachometer
3	- Phase 1	3	- Tachometer
4	- Phase 1	4	- Tachometer
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	Encoder Phase A	19	Encoder Phase A
20	Encoder Phase B	20	Encoder Phase B
21	+5 V	21	+5 V
22	0 V	22	0 V
23	Encoder Phase /A	23	Encoder Phase /A
24	Encoder Phase /B	24	Encoder Phase /B
25	Index Pulse /I	25	Index Pulse /I

4.8 MCAB-3 Cable

A 3-meter length MCAB-3 cable is supplied with each BGM goniometric cradle.



5.0 Connection to Newport Controllers

5.1 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.

5.2 Connection

There is a label on every stage indicating its part and serial numbers.



WARNING

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

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.

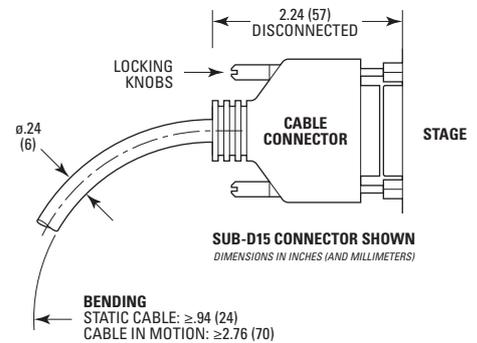
5.3 Cables

All BG goniometric cradles are delivered with a 3-meter cable.

This cable is linked to the body of the stage for the BGS50 goniometric cradles.

BGS80 stages are delivered with a **MSCABLE-3** cable and BGM stages with a **MCAB-3** cable. This cable is equipped with a SUB-D25M for direct connection to Newport Controllers.

5.4 MSCABLE-3 Cable



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 (**MSCABLE-3**) included with your stage is not adequate, Newport offers a 10-m longer length cable (**MSCABLE-10**) designed to ensure the integrity of your positioning application.

REMARK

The cross section of the MSCAB-10 cable is different from the one of the MSCABLE-3 cable to allow a longer length. The MSCAB-10 cable has the same mechanical properties as the MCAB-10 cable.

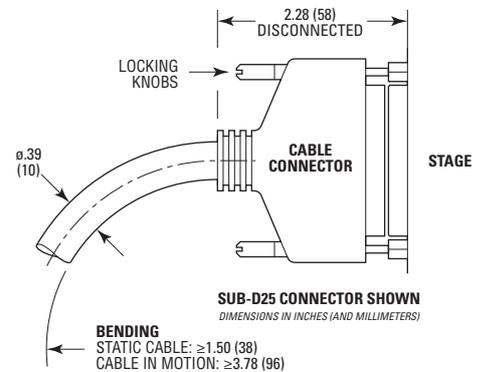
These cables are specially shielded and terminated with Newport's standard SUB-D15 and SUB-D25 connectors.



WARNING

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

5.5 MCAB-3 Cable



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.

6.0 Connection to Non-Newport Electronics

6.1 Connections

WARNING

Newport is not responsible for malfunction or damage of BG goniometric cradles when used with non-Newport controllers.

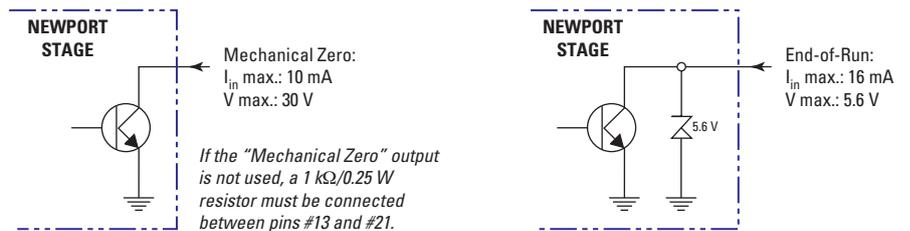
WARNING

Newport guarantees “CE” compliance of BG goniometric cradles only if used with Newport cables and controllers.

It is the customer's responsibility to modify the cable and take care of sensor signal connections, when using the stage with non-Newport controllers.



- The Mechanical Zero logic signal is open collector type. It supports up to 30 V and 10 mA.
- The End-of-Run signal is open collector type with a 5.6 V protective Zener diode.



7.0 BGM Goniometric Cradles Assembly Pattern

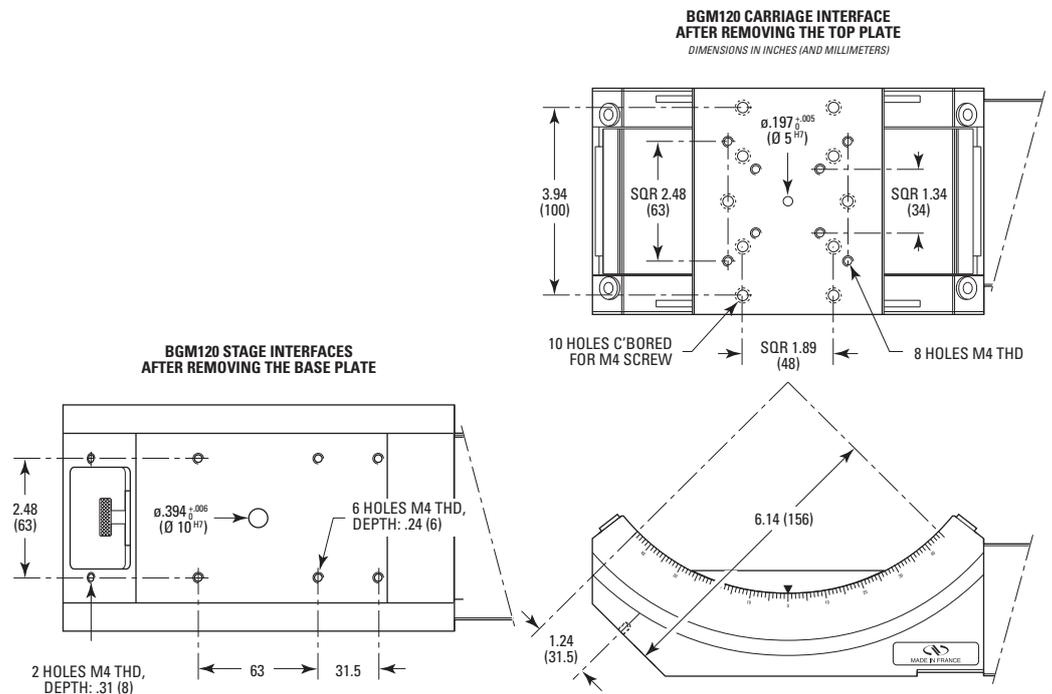
Stacking BG goniometric cradles either together or with other Newport stage is easily accomplished. Below are example schematics of the assembly patterns used. For BGM stages, these interfaces are accessed by unscrewing and removing the upper and/or lower plates of the stages (see dimension drawings).

NOTE

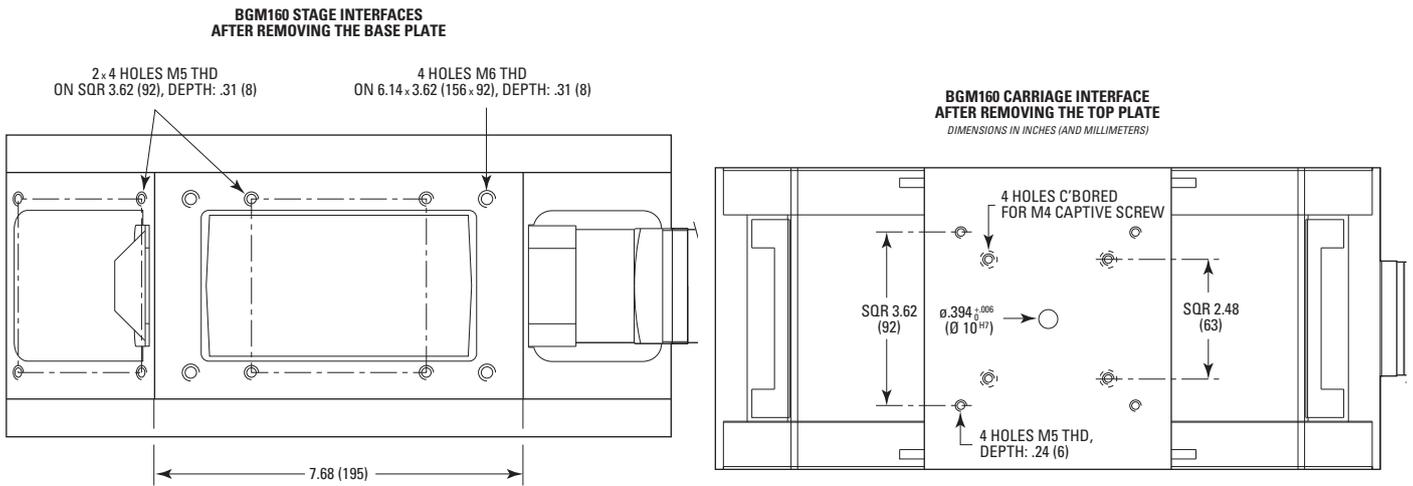
To access the interface holes of the carriage, simply move the bottom stage to its extreme position. Two c'bored holes will be accessible from one end of travel and the other two holes will be accessible from the other end of travel. For example, between the BGM160 and BGM200, use the M6 holes in a 6.14 x 3.62 (156 x 92 mm) pattern. BGS80 on BGM120, use M4 holes in a SQR 1.89 (48 mm) pattern.

To access the mounting holes, move the bottom stage carriage to one end of travel. The 2 x M4 c'bores on the BGM120 carriage will now be accessible. Install the M4 SHCS, and tighten - finger-tight only. Move the carriage to the other end of travel and access the other 2 x M4 holes (SQR 1.89 (48 mm) pattern). Install the other 2 M4 SHCS. Visually inspect the orthogonality and tighten using an Allen wrench. Move to the previous end of travel and tighten the two screws with an Allen wrench.

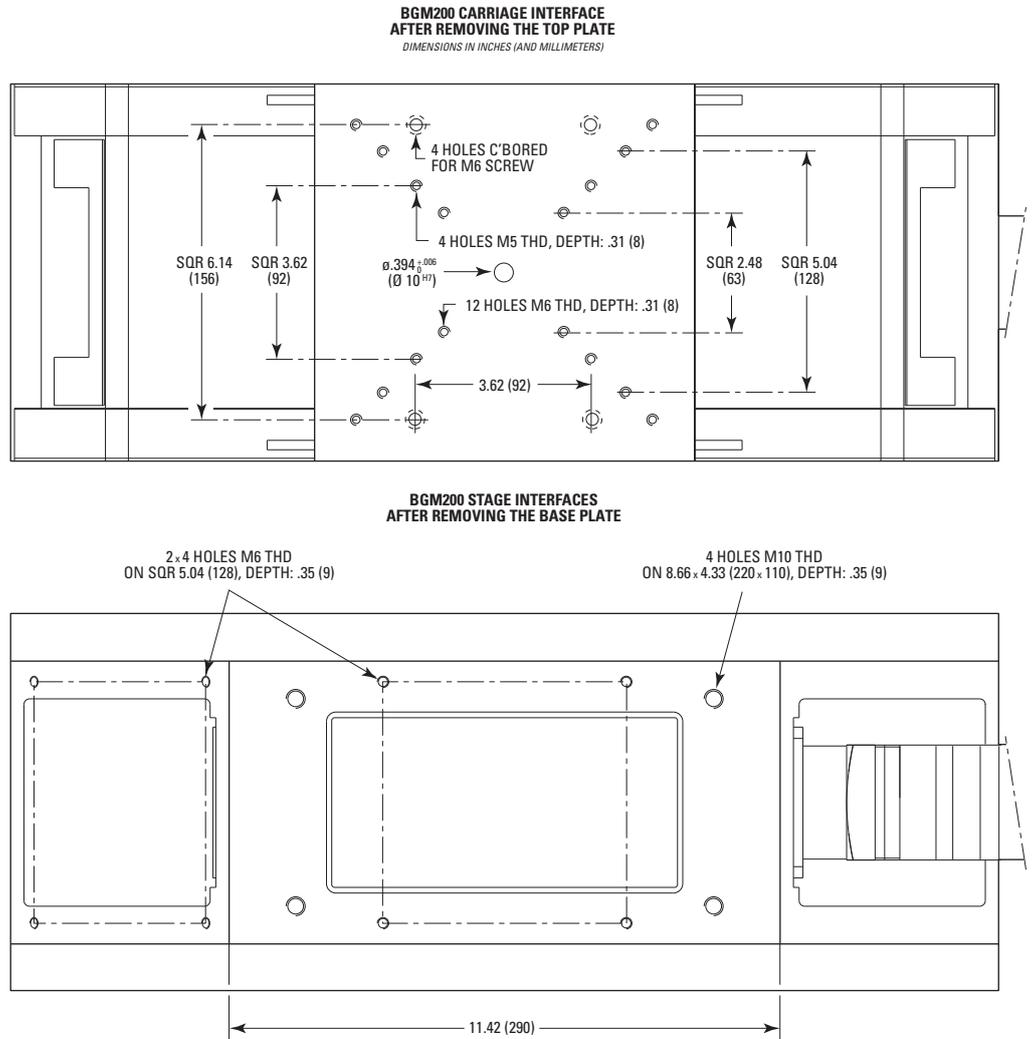
7.1 BGM120 Interfaces



7.2 BGM160 Interfaces

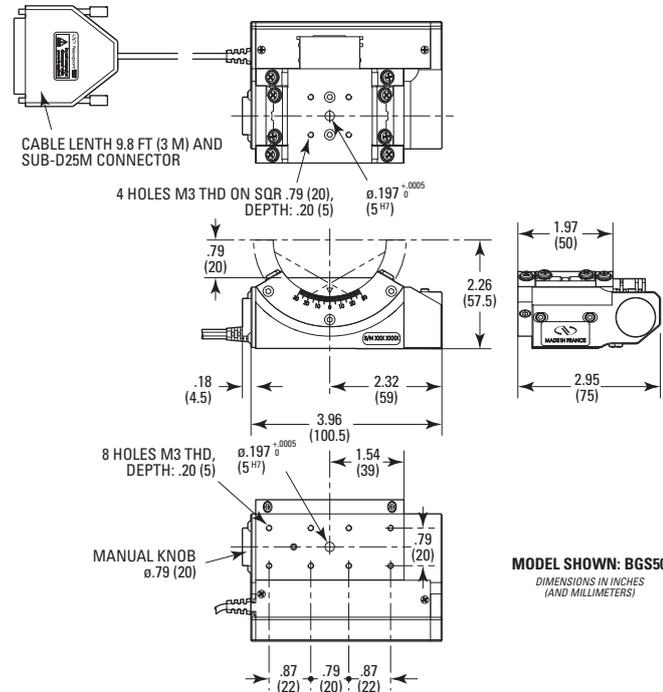


7.3 BGM200 Interfaces



8.0 Dimensions

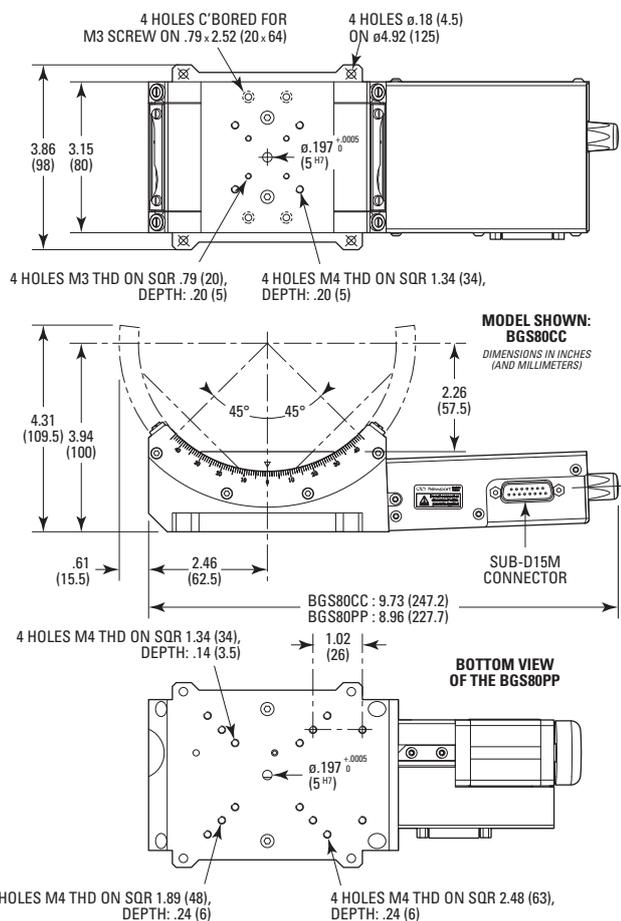
8.1 BGS50 Models



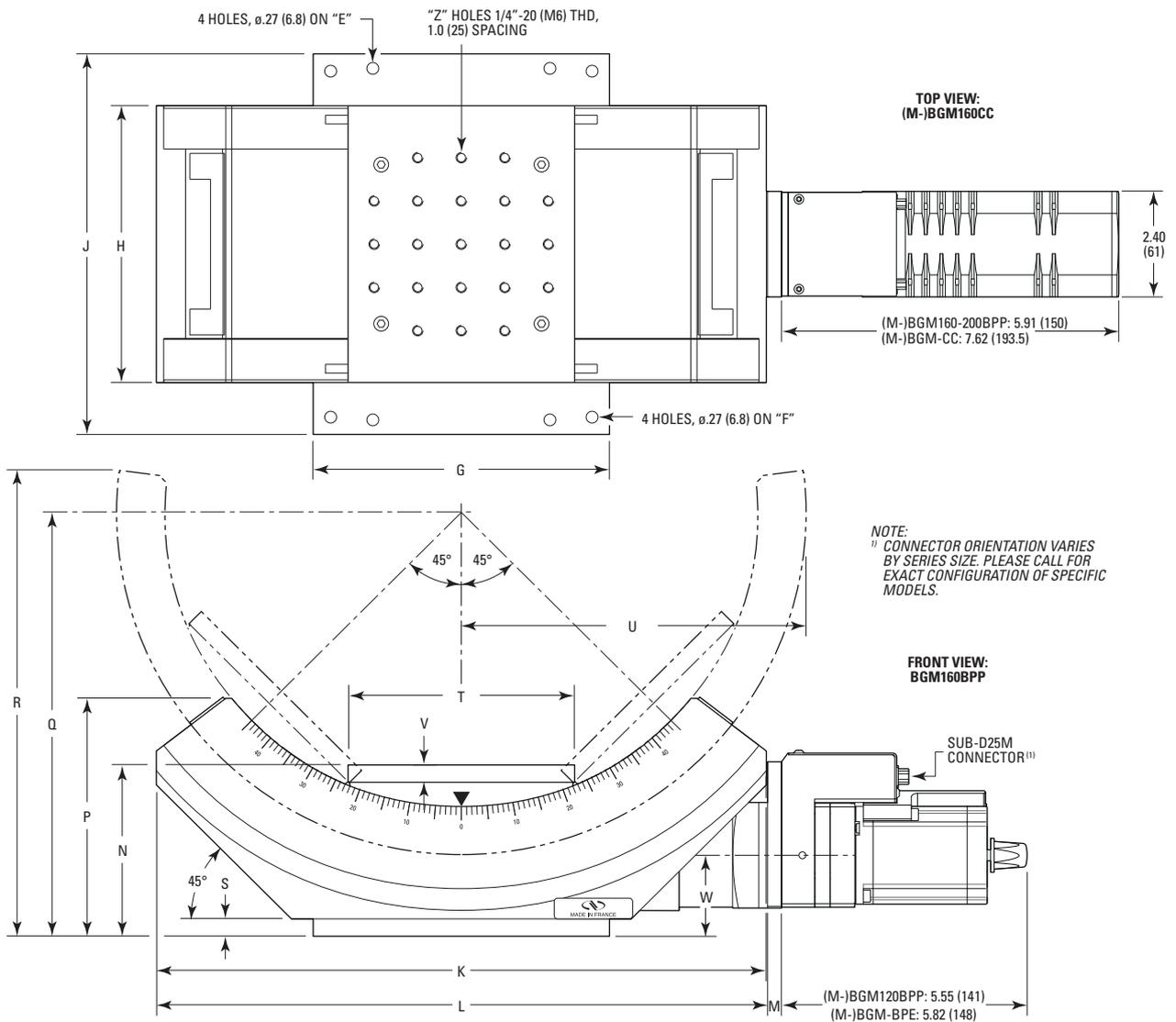
8.2 BGS80 Models



Note: BGS80 goniometric cradles are supplied with a 3-m cable equipped with SUB-D15F and SUB-D25M connectors.



8.3 BGM Models



MODEL SHOWN: BGM160
DIMENSIONS IN INCHES (AND MILLIMETERS)

MODEL (METRIC)	E	F	G	H	J	K	L	M
(M-)BGM120	6.0 x 2.0 (152.4 x 50.8)	5.91 x 3.94 (150 x 100)	4.72 (120)	4.72 (120)	6.69 (170)	8.11 (206)	8.11 (206)	1.22 (31)
(M-)BGM160	8.0 x 4.0 (203.2 x 101.6)	7.87 x 5.91 (200 x 150)	6.69 (170)	6.30 (160)	8.66 (220)	13.78 (350)	13.81 (350.7)	.31 (8)
(M-)BGM200	10.0 x 8.0 (254 x 203.2)	9.84 x 9.84 (250 x 250)	10.63 (270)	7.87 (200)	10.63 (270)	20.47 (520)	18.11 (460)	.31 (8)

MODEL (METRIC)	N	P	Q	R	S	T	U	V	W	Z
(M-)BGM120	2.76 (70)	3.70 (94)	6.46 (164)	7.09 (180)	.31 (8)	3.90 (99)	5.04 (128)	.24 (6)	1.70 (43.2)	15
(M-)BGM160	3.90 (99)	5.44 (138.2)	9.65 (245)	10.63 (270)	.39 (10)	5.12 (130)	7.78 (197.5)	.39 (10)	1.84 (46.8)	21
(M-)BGM200	5.31 (135)	7.72 (196)	14.17 (360)	15.67 (398)	.39 (10)	7.87 (200)	11.81 (300)	.39 (10)	2.46 (62.5)	49



BGM120BPP.

9.0 Maintenance

RECOMMENDATION

Please contact Technical Sales Support team for recommendations on application specific maintenance.

9.1 Maintenance

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

PRECAUTIONS

The BG goniometric cradle must be used or stocked in a clean environment, without dust, humidity, solvents or other substances.

RECOMMENDATION

It is recommended to return the stage to Newport for re-lubriaction after 2000 hours of use.

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

9.2 Repair

CAUTION



Never attempt to disassemble a component of the goniometric cradle 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 goniometric cradle, please contact us immediately to arrange for a repair.

CAUTION



Any attempt to disassemble or repair a BG goniometric cradle without prior authorization will void your warranty.

9.3 Calibration

CAUTION



It is recommended to return your BG goniometric cradle to Newport once a year for recalibration to its original specifications.



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