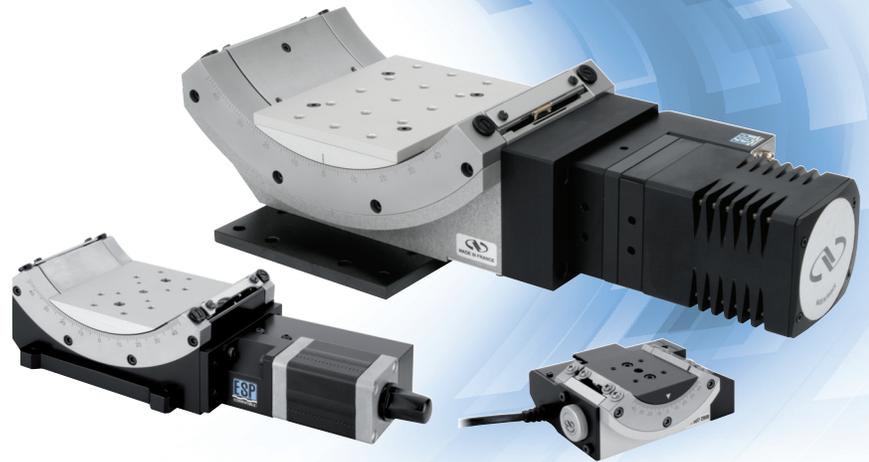


# Goniometric Cradles

BG SERIES



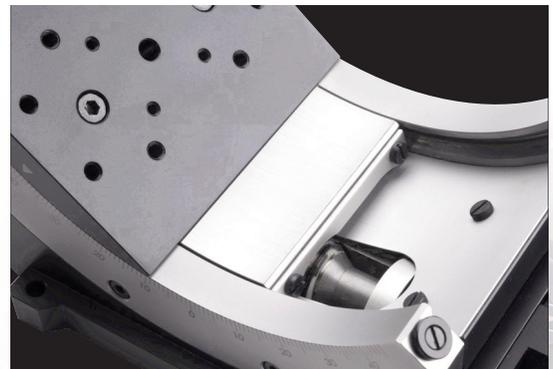
BG Series Goniometric Cradles are designed to provide precision transverse axis rotational motion with maximum free access to the rotating platform and an MIM to 0.0002°. BG stages can be stacked for two-axis rotation about the same pivot point. Mounting a rotation stage under the assembly adds a third orthogonal rotation axis through the same point. Features include: a precision ground, hardened worm gear drive for high accuracy rotation; single row ball bearings and precision ground tool-steel races to ensure smooth rotational motion with minimal wobble and eccentricity; and a home switch conveniently located at the center of travel. BG Series goniometric cradles are available in 5 sizes and may be configured with DC motors (CC) or stepper motors (PP with mini-step or PE with full-step), depending on the applications. These highly versatile stages can be used for applications with high loads or torques, vacuum applications and compact multi-axis rotation assemblies.

The CONEX-BGS50CC is a goniometric cradle stage with the integrated CONEX-CC controller/driver and is pre-configured for the highest level of out-of-the-box control. The CONEX-CC is a very compact and inexpensive driver for Newport's low power DC servo motor driven devices.

- $\pm 45^\circ$  transverse axis rotation with maximum free access to the rotating platform ( $\pm 30^\circ$  for BGS50)
- Nested cradles provide orthogonal rotation about the same point
- Precision machined ball bearing races assure smooth motion and high stability
- Precision ground worm gear provides 0.001° resolution
- Vacuum compatible versions up to 10<sup>-6</sup>



CONEX-BGS50CC



## Stepper Drive Versions

Stepper motor-driven stages are available in 2 versions:

- The mini-step drive version (PP) enables high angular speed up to 20 °/s. The larger models, BGM120PP to BGM200PP, 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 (PE) 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.

## 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.

## 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 <sup>(1)</sup> : None BGM160 <sup>(1)</sup> and BGM200 <sup>(1)</sup> : 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 <sup>-9</sup> hPa using full step motor (BGM120PE to BGM200PE only)

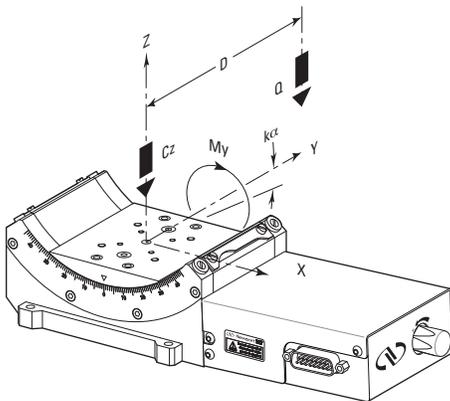
<sup>1)</sup> Additional motor mounted 10:1 reduction gear with PE versions.

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 <sup>(1)</sup> (°)	0.001	0.001	0.001	0.001	0.004
Bi-directional Repeatability, Typical <sup>(1)</sup> (°)	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 <sup>(1)</sup> (°)	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 PP: 20, PE: 2
Wobble, Typical <sup>(1)</sup> (µrad)	200 or ±100	200 or ±100	200 or ±100	200 or ±100	200 or ±100
MTBF (h)			20,000		
Weight (kg)	0.8	0.8	2.1	2.1	BGM120: 8.5, BGM160: 18, BGM200: 38

<sup>1)</sup> Shown are peak to peak, typical specifications or ±half the value as sometimes shown. For the definition of typical specifications which are about 2X better than the guaranteed values, visit [www.newport.com](http://www.newport.com) for the Motion Control Metrology Primer. The actual performance of BG stages are not verified on all production units, hence typical specifications are provided.

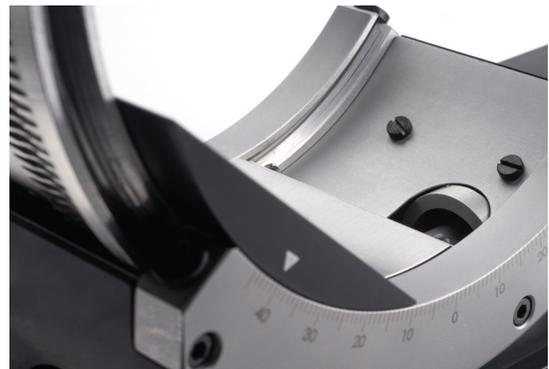
LOAD CHARACTERISTICS AND STIFFNESS



	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
kα, Radial compliance (µrad/Nm)	100	20	10	5	2
My, Maximum torque (Nm)					
PE:	–	–	10	20	29
PP:	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					

RECOMMENDED CONTROLLERS/DRIVERS

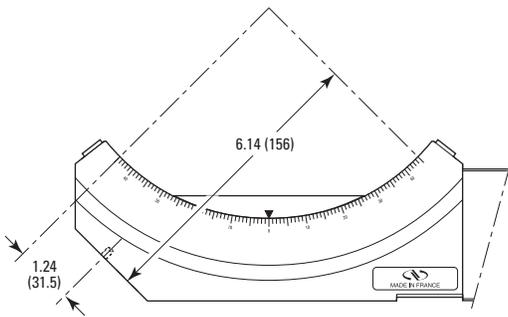
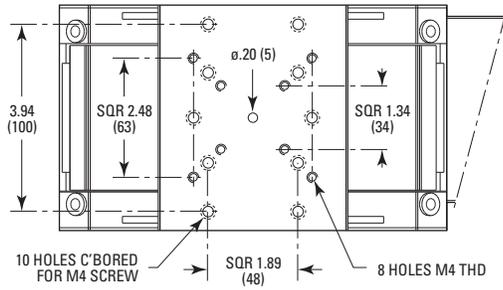
<b>XPS</b>	Universal High-Performance Motion Controller/Drive
<b>ESP301</b>	3 Axis Motion Controller/Driver
<b>SMC100CC</b>	Single-Axis DC Motion Controller BGS50CC and BGS80CC only
<b>SMC100PP</b>	Single-Axis Stepper Motion Controller BGS50PP and BGS80PP only
<b>CONEX-CC</b>	Goniometers With Integrated CONEX Motion Controller BGS50CC only



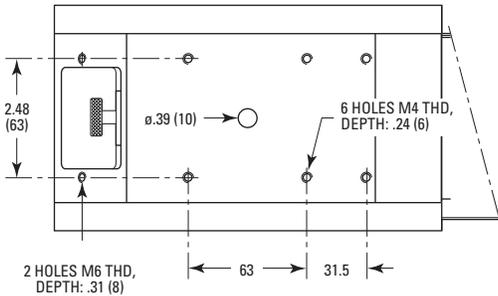
# BG SERIES

## ASSEMBLY PATTERN

**BGM120 CARRIAGE INTERFACE  
AFTER REMOVING THE TOP PLATE**  
DIMENSIONS IN INCHES (AND MILLIMETERS)



**BGM120 STAGE INTERFACES  
AFTER REMOVING THE BASE PLATE**



**Note:** To access the interface holes of the carriage, simply move the bottom stage to its extreme position. Two c'bores 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.

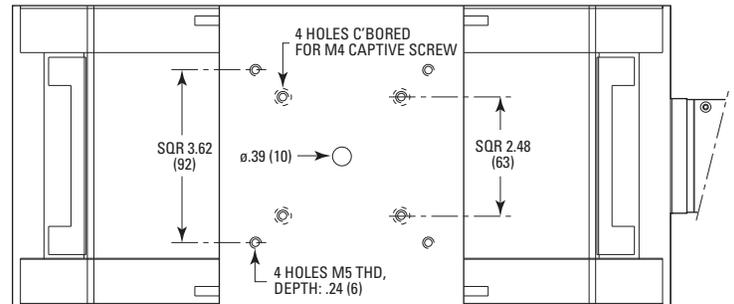


*Adjacent sizes of BG cradles can easily be stacked to provide orthogonal 2 axis rotation around a fixed point.*

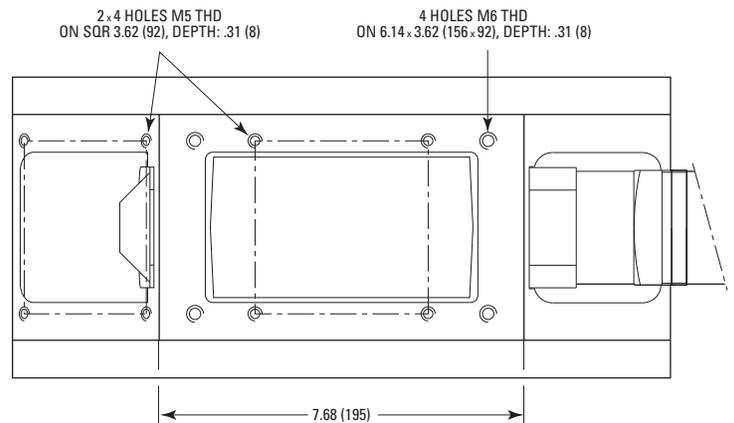
Stacking BG Series stages with other Newport stages is easy. Here are shown the assembly patterns used.

For BGM goniometric cradles, these interfaces are accessed by removing the upper and/or lower plates of the stages (see dimension drawings).

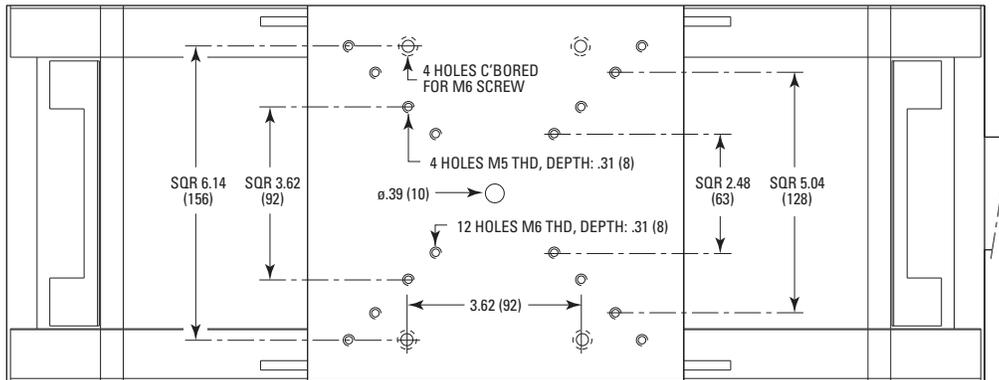
**BGM160 CARRIAGE INTERFACE  
AFTER REMOVING THE TOP PLATE**  
DIMENSIONS IN INCHES (AND MILLIMETERS)



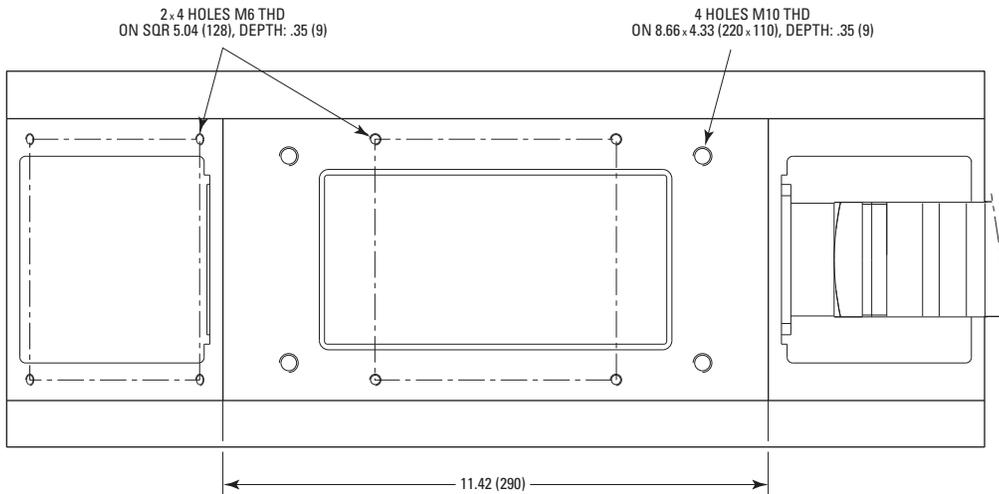
**BGM160 STAGE INTERFACES  
AFTER REMOVING THE BASE PLATE**



**BGM200 CARRIAGE INTERFACE  
AFTER REMOVING THE TOP PLATE**  
DIMENSIONS IN INCHES (AND MILLIMETERS)



**BGM200 STAGE INTERFACES  
AFTER REMOVING THE BASE PLATE**



**ORDERING INFORMATION**

Model	Series	Travel (mm)	Drive	Vacuum Prep. <sup>(2)</sup>
M-	BGM	50 <sup>(3)</sup>	CC PP PE <sup>(1)</sup>	V6
		80		
		120		
		160		
		200		

*Example:  
The **BGM80PE** is an BGM goniometric cradle with a full-step motor drive, English version.*

<sup>1)</sup> Only available as BGM Series stage.  
<sup>2)</sup> Vacuum compatible to 10<sup>-6</sup> hPa. In this case max. speed and load capacity are divided by two.  
<sup>3)</sup> BGS50BCC is also available with integrated CONEX controller (CONEX-BGS50CC).

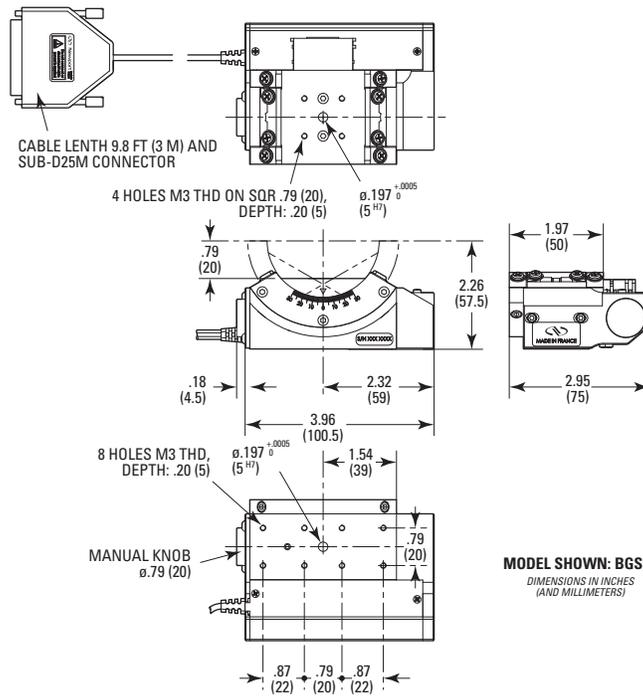
M-: For metric version  
 CC: DC motor  
 PP: Micro-step motor  
 PE: Full-step motor

# BG SERIES

## DIMENSIONS

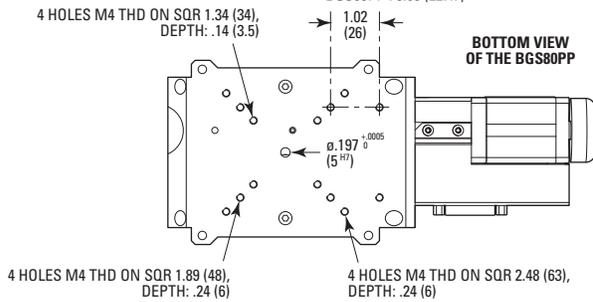
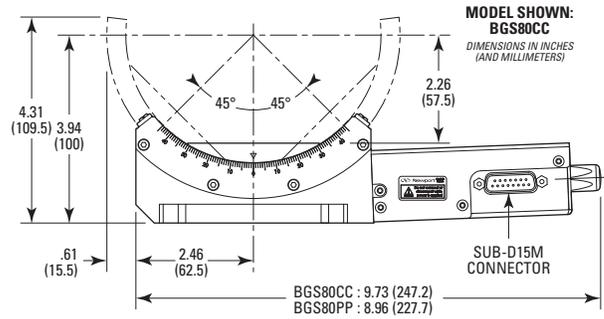
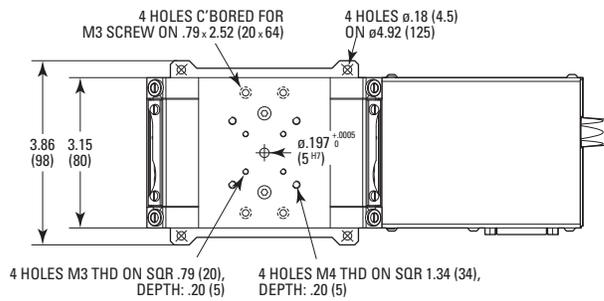


**BGS50**

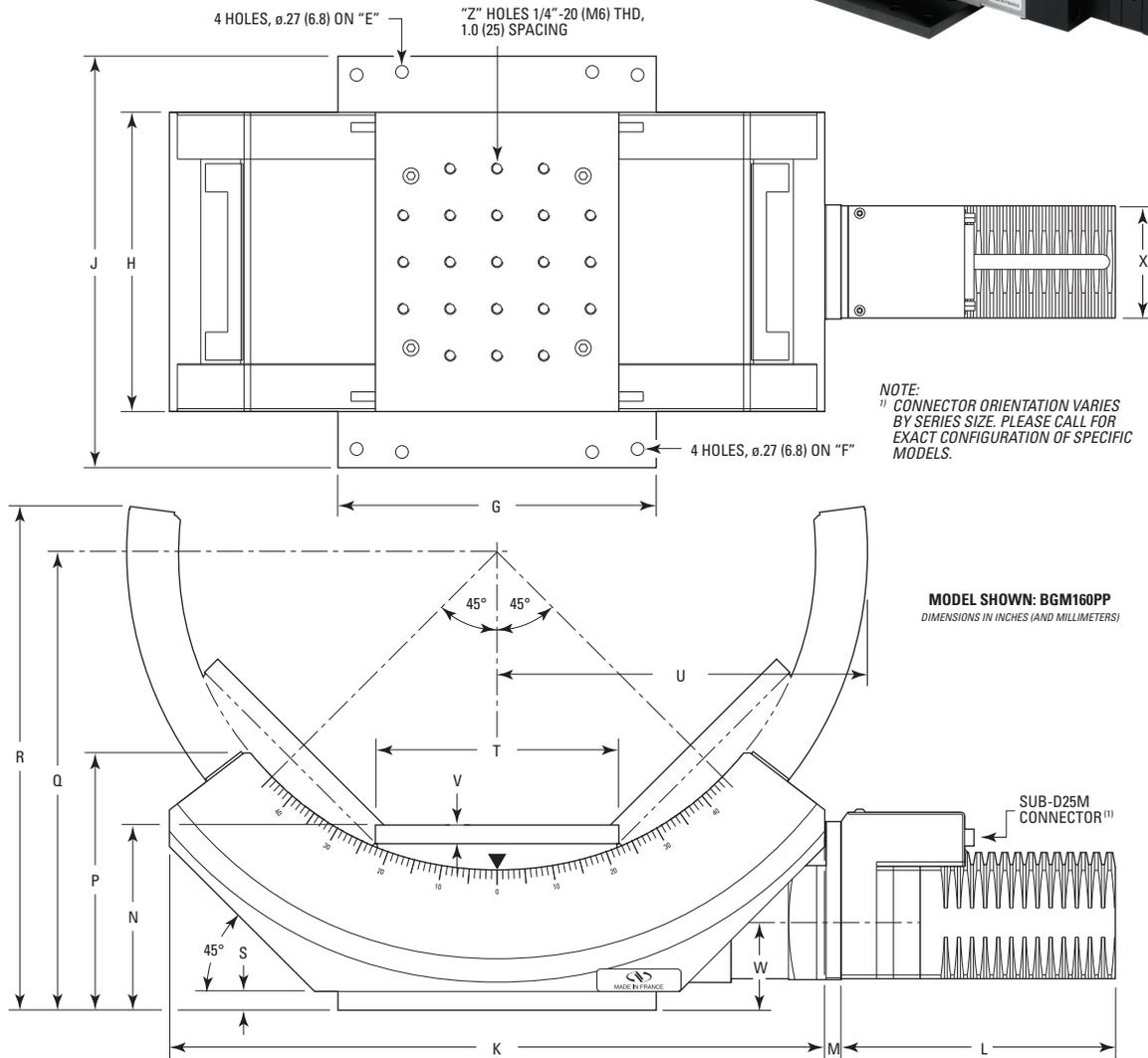




**BGS80**



BGM120 to BGM200



MODEL (METRIC)	E	F	G	H	J	K	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)	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)	.34 (8.7)
(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)	-

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)	15.67 (360)	15.67 (398)	.39 (10)	7.87 (200)	11.81 (300)	.39 (10)	2.46 (62.5)	49



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