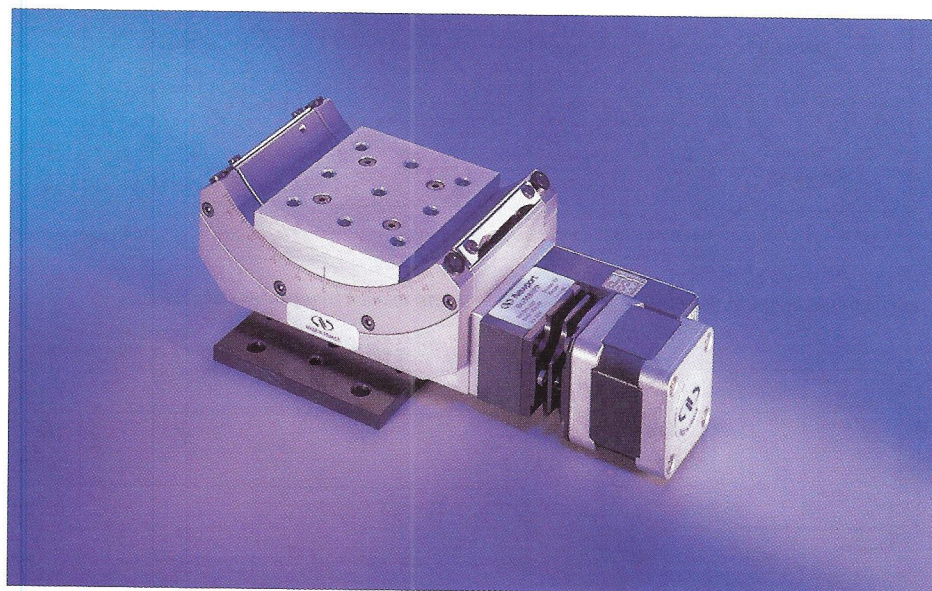


BGM Series

Goniometric Cradles



Key Features

- $\pm 45^\circ$ transverse axis rotation with maximum free access to the rotating platform
- Nested cradles provide orthogonal rotation about the same point
- All-steel design, with precision machined ball bearing races, assures smooth motion and high stability
- Precision ground worm gear provides 0.001° resolution
- Vacuum compatible versions up to 10^{-6} Torr

BGM Series goniometric cradles rotate about a transverse axis above the platform. Compared to 360° rotation stages, they offer maximum free access to the rotating part and allow construction of very compact multi-axis rotation assemblies. BGM cradles are designed so that orthogonal mounting of two adjacent-size cradles (e.g., BGM50 and BGM80) provides two perpendicular axes of rotation about the same point in space. Mounting a rotation stage under the assembly adds a third orthogonal rotation axis through the same point.

All BGM Series cradles feature 0.001° angular resolution and may be configured with manual drives, DC motors or stepper motors, with mini-step or full-step drive options, and speeds to $20^\circ/\text{sec}$. Single-row ball bearings and precision-ground tool-steel races ensure smooth rotation with minimal wobble and eccentricity. A convenient center home facilitates return of the platform to a level position.

Stepper Drive Versions

- One mini-step drive version (PP) with 1/10-step per encoder count enabling high angular speed motions up to 20°/sec.
- One full-step version (PE) with motor mounted step-down gear allowing for angular speeds to

2°/sec. This version is primarily designed for applications requiring the direct positioning accuracy to be maintained to within the stage's mechanical resolution when power is switched off, such as operation in vacuum.

	Maximum Speed (°/s)	Motor
BGM50PP & 80PP	20	UE41PP
BGM120PP	20	UE62PP
BGM160PP & 200PP	20	UE63PP
BGM50PE & 80PE	2	UE31PP
BGM120PE to 200PE	2	UE41PP

DC-Servo Drive Versions

- BGM50 and BGM80: These use low-power DC-servo motors enabling speeds to 2.5°/sec.
- BGM120, BGM160 and BGM200: These use higher torque DC-servo

motors, which allow for angular speeds up to 20°/sec. The motor also features a built-in tachometer to provide superior speed stability.

	Resolution (°)	Maximum Speed (°/s)	Motor
BGM50CC & 80CC	0.001	2.5	UE31CC
BGM120CC to 200CC	0.001	20	UE511CC

Manual Drive Versions

The BGM Series goniometric cradles are also available with manual drive (MS). These are offered with angular resolution of 0.001° and 2° rotation per revolution. In addition to the

vernier scale on the manual drive, position may be determined using the output from the incremental shaft encoder. A connector for the CV1000 encoder display is provided.

Motion Controller Options

For optimum performance and seamless compatibility, we recommend using one of the following Motion Controllers/Drivers:

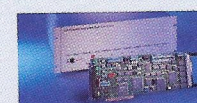
ESP7000
(page 1084)
Module Option 01
Except BGMPEV6



MM4006
(page 1088)



ESP6000 with
UNIDRIV6000
(page 1094)
Except BGMPEV6



ESP6000 with DCIB
(page 1101)
Only BGM50CC and
BGM80CC



ESP300 (page 1104)
All BGM, except:
BGM120CC to
BGM200CC
BGM120PP to BGM200PP
BGMPEV6



ESP100 (page 1107)
All BGM, except:
BGM120CC to
BGM200CC
BGM120PP to BGM200PP
BGMPEV6



Design Details

Base Material	Stainless steel
Bearings	Ball bearings
Drive Mechanism	Ground worm gear
Worm Gear Ratio	BGM50 to BGM120: 1:180 BGM160 and BGM200: 1:60
Reduction Gear	3:1 on BGM160 and BGM200 ⁽¹⁾
Feedback	2,000 pts/rev. rotary encoder with index pulse
Limit Switches	Mechanical, at $\pm 45^\circ$
Origin	Optical
Cable	3 m long cable included
Vacuum Compatibility	Vacuum compatible versions are available up to 10^{-6} Torr using full-step motor (PE)

Note: 1) Additional motor mounted gear on some drive options, see page 1116

Specifications

Resolution	0.001°
Uni-directional Repeatability	0.004°
Reversal Value (Hysteresis)	0.02°
Origin Repeatability	0.002°
On Axis Accuracy	0.05°
Wobble	200 μ rad

Load Characteristics

		50	80	120	160	200
Cz	(N)	40	120	200	300	500
a	(mm)	30	40	70	90	120
k α	(μ rad/Nm)	200	20	10	5	2
My	(PE)	1.5	1.7	10	20	29
	(PP)	1.5	1.7	6	16	17
	(CC)	1.5	1.7	9	10	10
	(MS)					

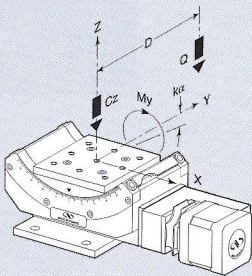
Ordering Information

The BGM Series goniometric cradles are numbered as follows:

Model	Series	Size (mm)	Drive	Vacuum Preparation ⁽¹⁾
M-	BGM	50	PP PE CC MS	V6
		80		
		120		
		160		
		200		
Example <i>The BGM80PE is a BGM goniometric cradle of 80 mm size, English version, with (2°/sec) full-step motor drive.</i>				
M-: Metric version PP: Mini-step PE: Full-step CC: DC MS: Manual				

¹⁾ Vacuum compatible to 10^{-6} Torr. In this case max. speed and load capacity have to be divided by two.

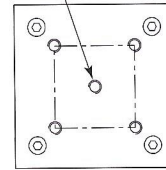
- Q Off-center load, $Q \leq Cz/(1 + D/a)$
 Cz Normal center load capacity on bearings
 D Cantilever distance in millimeters
 a Construction parameter
 k α Transversal stiffness
 My Maximum forward rotation torque



Dimensions

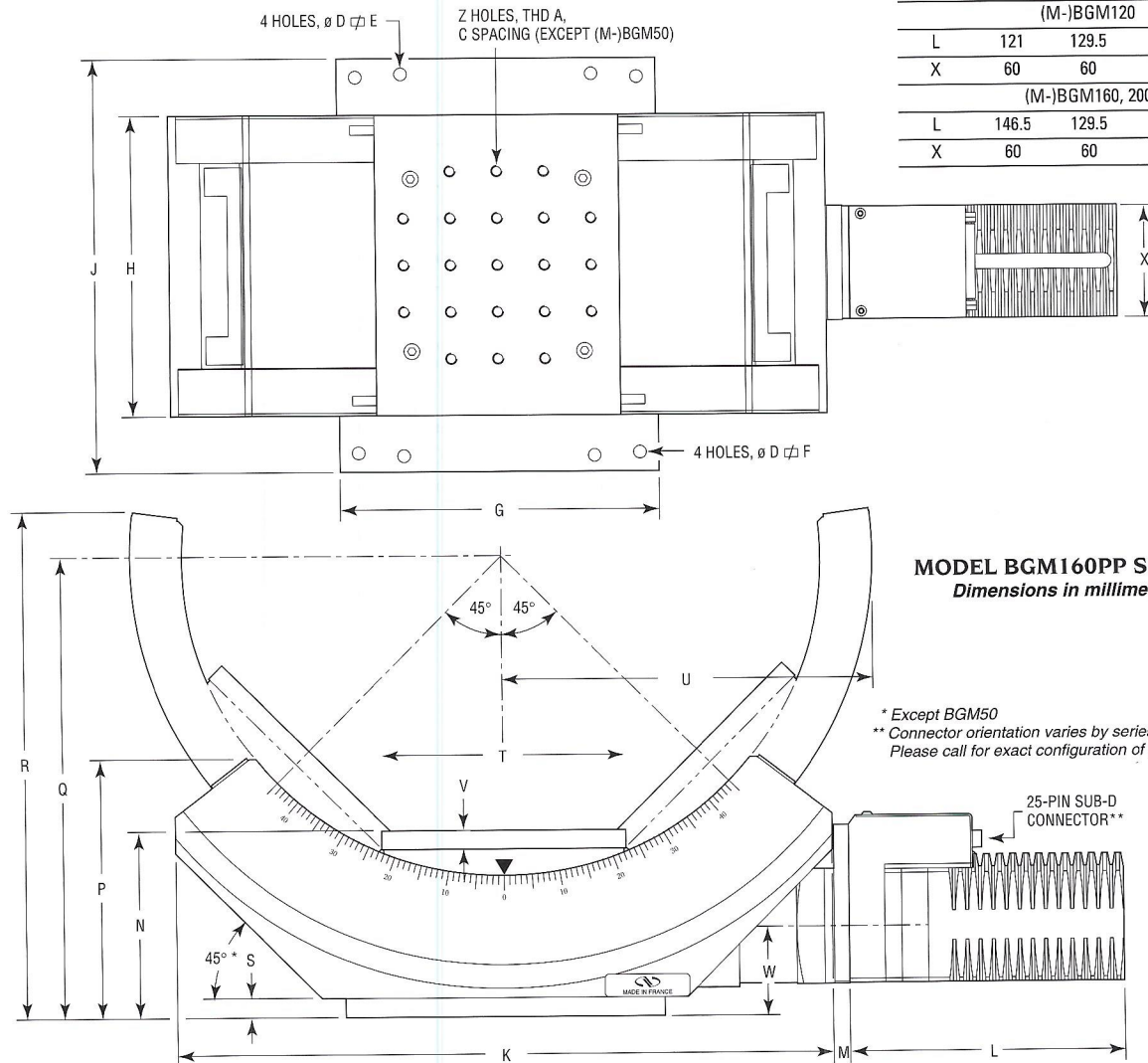
	THREAD		SPACING	
	A	B	C	Z (No. Holes)
ENGLISH				
BGM50	8-32		25.4	
BGM80		1/4-20	25.4	9
BGM120		1/4-20	25.4	15
BGM160		1/4-20	25.4	21
BGM200		1/4-20	25.4	49
METRIC				
M-BGM50	M4		25	
M-BGM80		M6	25	9
M-BGM120		M6	25	15
M-BGM160		M6	25	21
M-BGM200		M6	25	49

4 HOLES, THD A, Z/C,
1 HOLE, THD A, CENTER



(M-)BGM50 TOP PATTERN

DIM.	PP	PE	CC	MS
(M-)BGM50, 80				
L	80.5	129	106.5	90.5
X	42	32	32	32
(M-)BGM120				
L	121	129.5	192	143.4
X	60	60	60	60
(M-)BGM160, 200				
L	146.5	129.5	192	143.4
X	60	60	60	60



MODEL BGM160PP SHOWN
Dimensions in millimeters

* Except BGM50
** Connector orientation varies by series size.
Please call for exact configuration of specific models.

MODEL	DIAMETER		DIMENSIONS														
	D	E	F	G	H	J	K	M	N	P	Q	R	S	T	U	V	W
BGM50	7.5	75.4 x 25.4		50	50	89	78	5	53.5		63.5	74.1	6	50		5	22.5
BGM80	7.5	101 x 50.4		80	80	120	125	5	54.5	61.5	106	116	6	70	78.5	6	23.15
BGM120	6.8	152.4 x 50.8	150 x 100	120	120	170	206	31	70	94	164	180	8	99	128	6	43.2
BGM160	6.8	203.2 x 101.6	200 x 150	170	160	220	350	8.7	99	138.2	245	270	10	130	197.5	10	46.8
BGM200	6.8	254 x 203.2	250 x 250	270	200	270	520		135	196	360	398	10	200	300	10	62.5

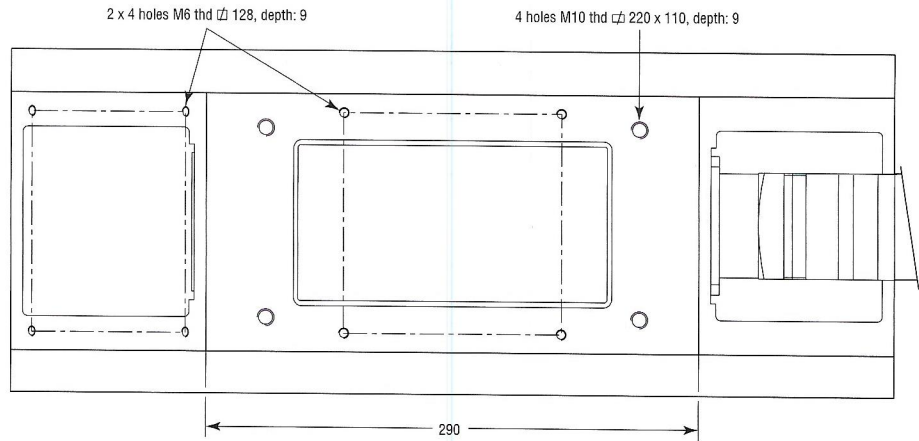
Assembly Pattern

Stacking BGM Series stages with other Newport stages is easily accomplished. Below are the assembly

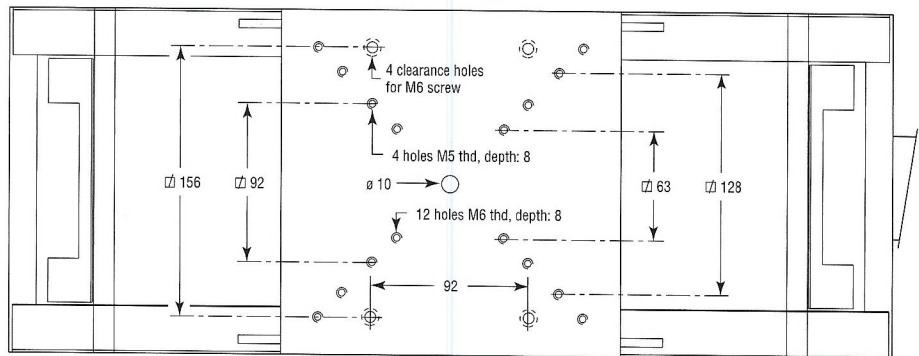
patterns used. These interfaces are accessed by removing the upper and/or lower plates of the stages.

Dimensions in millimeters

(M-)BGM200 Body Interface



(M-)BGM200 Carriage Interface



The BGM Series goniometers can easily be stacked providing two axes of motion.