

GAM GSL Series

ROBOTIC STRAIN WAVE GEARBOXES

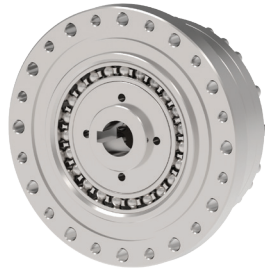


GAM

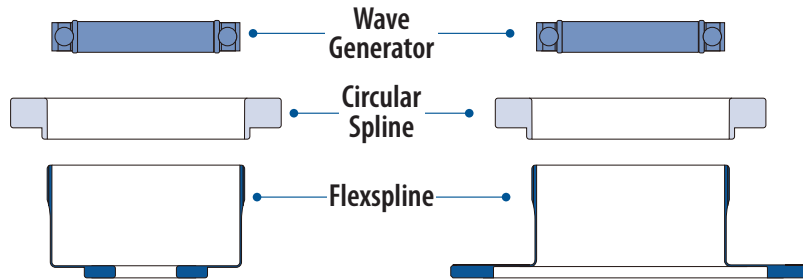
GAM CAN.

GAM GSL ROBOTIC STRAIN WAVE GEARBOXES

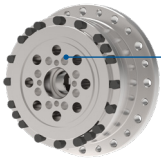
GSL-C: Cup-Style



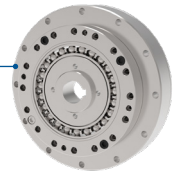
GSL-H: Hat-Style



- **Cup-shaped** flexspline
- Smaller diameter
- Flange output eases mounting of pinions or shafts

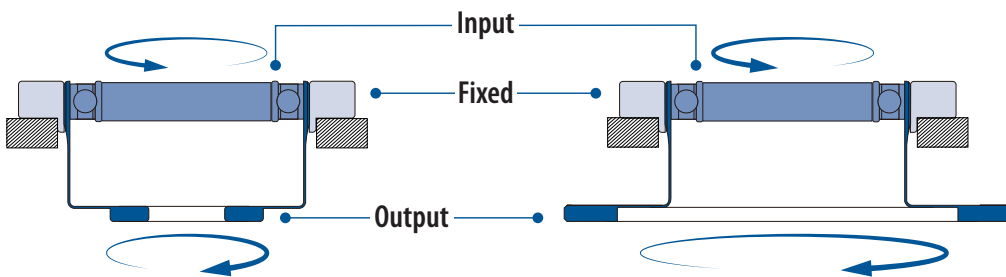


- **Hat-shaped** flexspline
- Lower profile
- Rotating outer housing useful for AGV wheels or robot joints



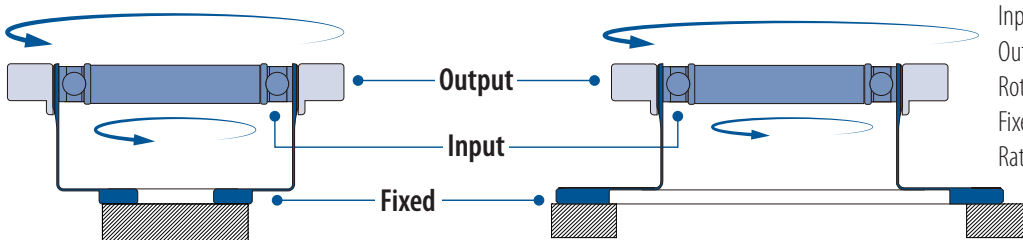
GSL Relative Rotation

Common Operation



Input	Wave Generator
Output	Flexspline
Rotation	Opposite Direction
Fixed	Circular Spline
Ratio	Ratio, e.g. 50:1

Alternate Operation



Input	Wave Generator
Output	Circular Spline
Rotation	Same Direction
Fixed	Flexspline
Ratio	Ratio+1, e.g. 51:1

Robotic Strain Wave Gearboxes



GAM's GSL Series Robotic Strain Wave Gearboxes provide zero-backlash and high torque in a small, lightweight gearbox.

- Backlash of ≤ 0.5 arcmin (≤ 30 arcsec)
- High repeatability and positional accuracy for fine positioning
- High reduction ratios in a single stage: 50:1 to 160:1
- Simple design for integration into housing or machine
- High torque density with low inertia
- Drops in for popular competitor gearboxes

Strain Wave Operating Principle

Strain wave gear reducers have three basic components:

Wave Generator

Made up of an elliptical cam and a ball bearing. It is usually attached to the driving component. The inner ring of the bearing is fixed around the cam causing the bearing to deform to an elliptical shape.

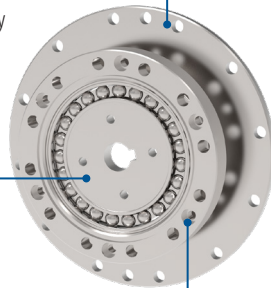


Flexspline

An elastic, thin-walled component with gear teeth on the outer surface. The flexspline is either cup or hat shaped, with a rigid base for transmitting torque. Most commonly the output component

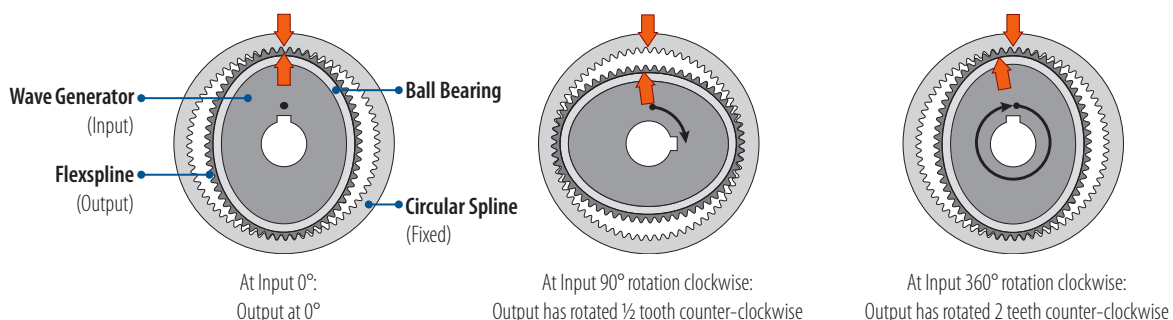
Circular Spline

Rigid steel ring with internal teeth. It has 2 more teeth than the flexspline. Most commonly the fixed component.



Operation

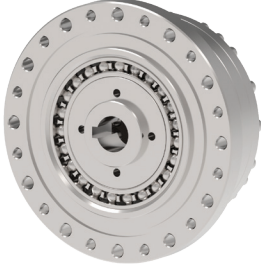
1. The Wave Generator mounts inside the Flexspline forcing the Flexspline into an elliptical shape.
2. The Flexspline teeth engage the Circular Spline teeth along the major axis of the ellipse of the Wave Generator. The Flexspline has two fewer teeth than the Circular Spline.
3. The rotation of the Wave Generator continuously deforms the Flexspline resulting in the teeth engaging and disengaging the teeth of the Circular Spline, rotating the Flexspline in the opposite direction
4. As the Wave Generator moves through 360°, since the Flexspline has two fewer teeth it "runs out" of teeth to engage with the Circular Spline before it gets to the first tooth and so moves two teeth in the opposite direction of the Wave Generator.
5. The distance (degrees) the Flexspline rotates depends on the reduction ratio: at 50:1 it moves 360/50 or 7.2°



GSL Series Models

GSL-CS: Standard Profile (Cup)

- Cup-Style Flexspline
- Small diameter



GSL-CS-A/B

- Keyed or set screw input
- Optional Oldham's coupling (B)
- Cup-style flexspline
- Frame sizes 014-032

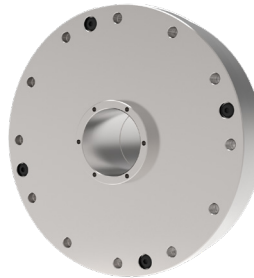
GSL-HS: Standard Profile (Hat)

- Hat-Style Flexspline
- Low Profile



GSL-HS-A/B

- Keyed or set screw input
- Optional Oldham's coupling (B)
- Frame sizes 014-032



GSL-HS-C

- Hollow shaft input
- Frame sizes 014-040



GSL-HS-D

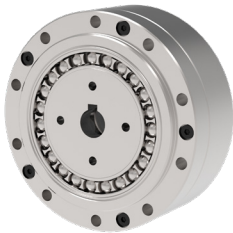
- Shaft input
- Frame sizes 014-032



GSL-HS-E

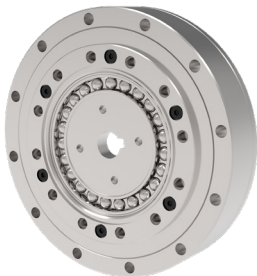
- Basic design
- Includes output bearing but no housing for more complete integration
- Frame sizes 014-032

GSL- T: Compact/Ultra-Low Profile



GSL-CT-A

- Compact, low profile
- Keyed input
- Cup-style flexspline
- Frame sizes 014-017



GSL-HT-A

- Ultra-low profile
- Keyed input
- Hat-style flexspline
- Frame sizes 014-017

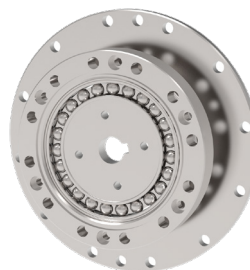
GSLC Components

Includes wave generator, flexspline, and circular spline only for full integration into customer application



GSLC-CS

- Keyed input
- Cup-style flexspline

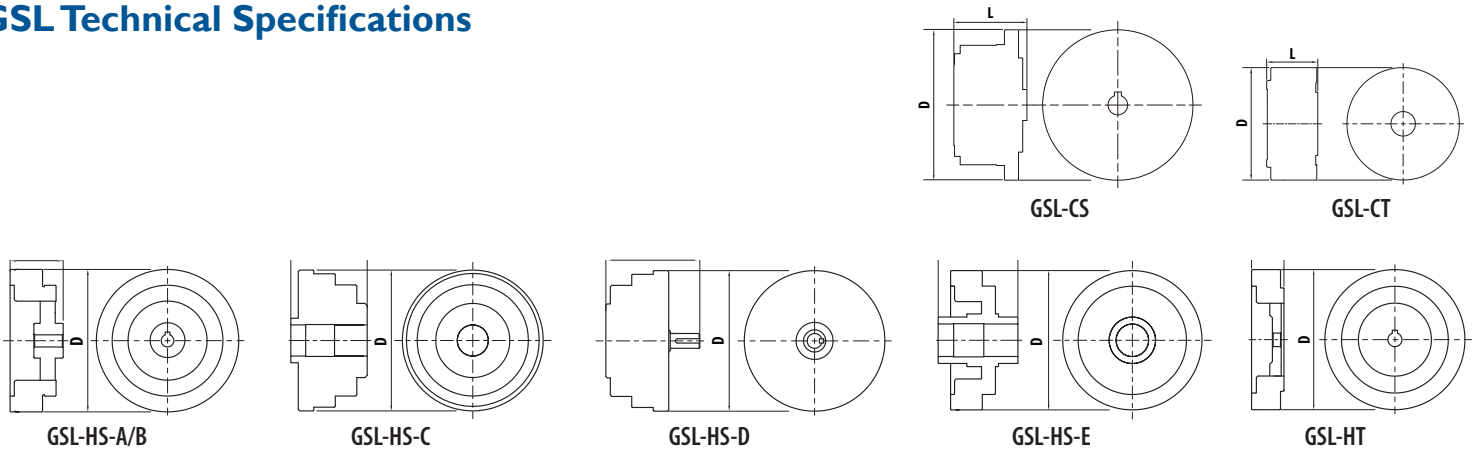


GSLC-HS

- Keyed input
- Hat-style flexspline

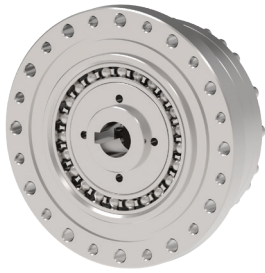
GAM GSL TECHNICAL SPECIFICATIONS

GSL Technical Specifications



Gearbox Style		GSL-CS						GSL-CT		GSL-HS						GSL-HT	
Frame Size		Input	014	017	020	025	032	014	017	014	017	020	025	032	040*	014	017
Overall Diameter	mm	A-B-E	72	79	9	107	138	55	62	70	80	90	110	142	-	70	80
		C-D	-	-	-	-	-	-	-	74	84	95	115	147	175	-	-
Overall Length	mm	A-B	41	45	45.5	52	62	25	26.5	28.5	32.5	33.5	37	37	44	17.5	18.5
		C-E	-	-	-	-	-	-	-	52.5	56.5	51.5	55.5	65.5	79	-	-
		D	-	-	-	-	-	-	-	50.5	56	63.5	72.5	84.5	-	-	-
Weight	kg	A-B	0.22	0.30	0.38	0.6	1.1	0.35	0.45	0.39	0.56	0.73	1.23	2.54	-	0.35	0.45
		C	-	-	-	-	-	-	-	0.71	0.98	1.34	2.04	4.2	7.2	-	-
		D	-	-	-	-	-	-	-	0.66	0.9	1.28	1.99	4.1	-	-	-
		E	-	-	-	-	-	-	-	0.55	0.7	0.98	1.5	3.15	-	-	-
Nominal Torque	Nm	50:1	7.9	29.9	39	63	124	4.8	18	7.9	29.9	39	63	124		4.8	18
		80:1	12.7	31	54	100	192	5.9	21	12.7	31	54	100	192		5.9	
		100:1	12.7	45	56	124	248	7.7	27	12.7	45	56	124	248	432	7.7	
		120:1			56	124	248					56	124				
		160:1			56							56					
Acceleration Torque	Nm	50:1	20.7	39	64.4	113	248	12	23	20.7	39	64.4	113	248		12	23
		80:1	27	49.5	85	158	350	16	30	27	49.5	85	158	350		16	
		100:1	32	62	94.3	181	383	19	37	32	62	94.3	181	383	660	19	
		120:1			100	192	406					100	192				
		160:1			112							100					
Emergency Stopping Torque	Nm	50:1	40.3	80.5	112.7	213.9	439	24	48	40.3	80.5	112.7	213.9	439		24	48
		80:1	54.1	100.1	146.1	293.3	653	31	58	54.1	100.1	146.1	293.3	653		31	
		100:1	62.1	124.2	169.1	326.6	744	35	71	62.1	124.2	169.1	326.6	744	1232	35	
		120:1			169.1	349.6	789					169.1	349.6				
		160:1			169.1							169.1					
Rated Torque at 2000 rpm Input Speed	Nm	50:1	6.2	18.4	28.8	44.9	87.4	3.7	11	6.2	18.4	28.8	44.9	87.4		3.7	11
		80:1	9	25.3	39.1	72.5	135.7	4.2	14	9	25.3	39.1	72.5	135.7		4.2	
		100:1	9	27.6	46	77.1	157.6	5.4	16	9	27.6	46	77.1	157.6	308	5.4	
		120:1			46	77.1	157.6					46	77.1				
		160:1			46							46					
Average Allowable Input Speed	RPM	3,000 RPM					3,500 RPM		3,000						3500		
Maximum Input Speed	RPM	7,000	6,500	5,600	4,800	4,000	8,500	7,300	7000	6500	5600	4800	4000	400	8500	7300	
Backlash	arcsec	≤30															
Life	hours	15,000					7,000	10,000	15,000						7,000	10,000	

GAM GSL STRAIN WAVE GEARBOXES



TYPE CODES FOR GSL-C SERIES

Example: GSL - CS - 025 - 050A - M0000 - H0000 - C0000

Gearbox Series GSL = With Housing
GSLC = Gearing Only

Gearbox Style C = Cup

Gearbox Profile S = Standard
T = Compact Low Profile (014/017 only)

Gearbox Size 014, 017, 020, 025, 032

Ratio 050, 080, 100, 120, 160 [:1]

Configuration Code (Assigned by GAM)

Output Code (Assigned by GAM)

Motor Code (Assigned by GAM)

Input Design
A = Keyed/Set Screw
B = Keyed/Set Screw with Oldham's Coupling

Series	Style/ Profile	Frame Size	Ratio					Input
			50:1	80:1	100:1	120:1	160:1	
GSL, GSLC	CS	014	x	x	x			A, B
		017	x	x	x			A, B
		020	x	x	x	x	x	A, B
		025	x	x	x	x		A, B
		032	x	x	x	x		A, B
GSL	CT	014	x	x	x			A
		017	x	x	x			A

TYPE CODES FOR GSL-H SERIES

Example: GSL - HS - 025 - 050A - M0000 - H0000 - C0000

Gearbox Series GSL = With Housing
GSLC = Gearing Only

Gearbox Style H = Hat

Gearbox Profile S = Standard
T = Compact Low Profile

Gearbox Size 014, 017, 020, 025, 032, 040

Ratio 050, 080, 100, 120, 160 [:1]

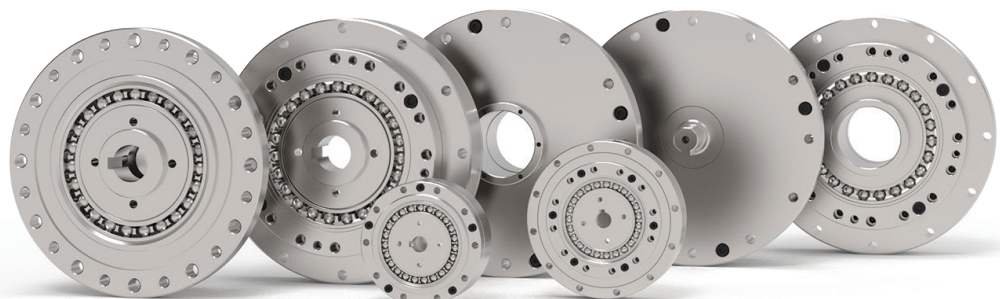
Configuration Code (Assigned by GAM)

Output Code (Assigned by GAM)

Motor Code (Assigned by GAM)


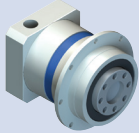
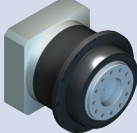
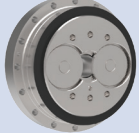
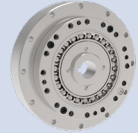
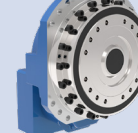
Input Design
A = Keyed/Set Screw
B = Keyed/Set Screw with Oldham's Coupling
C = Hollow Shaft
D = Shaft Input
E = Basic with Hollow

Series	Style/ Profile	Frame Size	Ratio					Input
			50:1	80:1	100:1	120:1	160:1	
GSL, GSLC	HS	014	x	x	x			A, B, C, D, E
		017	x	x	x			A, B, C, D, E
		020	x	x	x	x	x	A, B, C, D, E
		025	x	x	x	x		A, B, C, D, E
		032	x	x	x			A, B, C, D, E
		040				x		
GSL	HT	014	x	x	x			A
		017	x					A



GAM Gearbox Range

GAM offers a full range gearboxes from planetary servo gearboxes through zero-backlash robotic gearboxes for a wide variety of applications.

INCREASING PRECISION - DECREASING BACKLASH 										
	Planetary EPL-F		Helical Planetary SPH-F		Cycloidal GCL		Strain Wave GSL		Robotic Planetary GPL	
										
	Precision Inline for general servo applications		High precision inline for demanding servo applications		Zero-backlash cycloidal with impact resistance of 5x nominal torque. Available with integral pre-stage		Zero-backlash strain wave with high torque density and small, lightweight design for easy integration		Zero-backlash planetary with the lowest backlash. Vibration-free for high positional accuracy. Maintains lifetime zero-backlash	
Backlash:	≤ 8-20 arcmin		≤ 1 - 3 arcmin		≤ 1 arcmin		≤ 0.5 arcmin (≤ 30 arcsec)		≤ 0.1 arcmin (≤ 6 arcsec)	
Ratio:	3:1 - 1000:1		3:1 - 1000:1		57:1 - 258:1 Integral pre-stage option for additional ratio		50:1 - 160:1		50:1 - 200:1 Integral pre-stage option for additional ratio	
Torque Range (Nm)	Model	Nominal Torque (Nm)	Model	Nominal Torque (Nm)	Model	Nominal Torque (Nm)	Model	Nominal Torque (Nm)	Model	Nominal Torque (Nm)
≤ 15	EPL-F-047	14					GSL-CS-014	12.7		
							GSL-HS-014	14		
16-25							GSL-HS-017	17		
							GSL-HS-020	20		
							GSL-HS-025	25		
26 - 50	EPL-F-064	42					GSL-HS-032	32		
							GSL-HS-040	40		
							GSL-CS-017	45		
51 - 100	EPL-F-090	100	SPH-F-075	100			GSL-CS-020	56		
101 - 250					GCL-F-020	167	GSL-CS-025	124		
	EPL-F-110	210	SPH-F-100	250			GSL-CS-032	248		
251 - 500	EPL-F-140	340	SPH-F-140	450	GCL-F-040	412			GPL-F-056	445
501 - 1000					GCL-F-080	784			GPL-F-080	770
1001 - 2500					GCL-F-110	1078			GPL-F-112	1165
					GCL-F-160	1565			GPL-F-160	1450
									GPL-F-224	1820
2501 - 5000					GCLC-F-320	3136			GPL-F-300	2690
					GCLC-F-450	4500			GPL-F-400	3505

Applications

The GSL can be used in a variety of applications with requirements such as:

- Zero-backlash and high positional accuracy
- Low profile, compact form-factor
- High torque ratio
- Full Integration into a mechanism or machine

Applications include:

- Robot joints
- Antenna and solar panel positioning
- Autonomous robotic vehicle drives



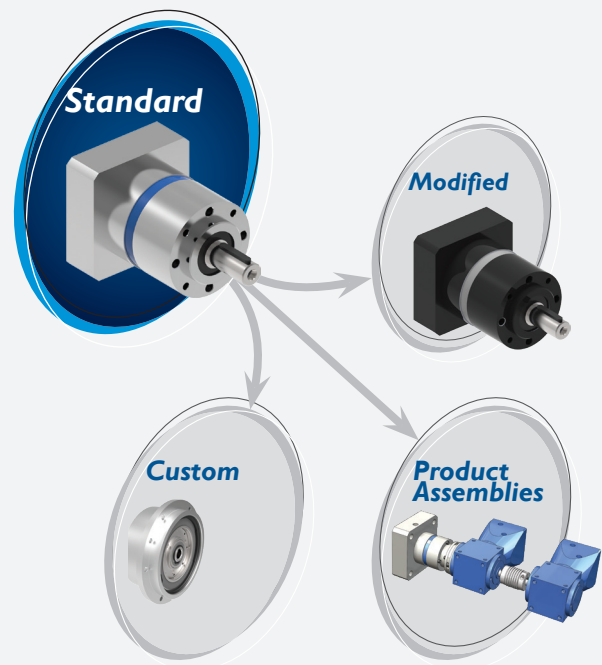
The GAM Advantage

Find the your exact solution at GAM!

GAM's product range of gear reducers, couplings, and other specialized mechanical drive solutions is one of the largest in the industry. Even with such a wide offering, we realize that you may not find a standard product that meets your exact requirements.

One of our greatest strengths is our ability to modify standard designs, provide completely customized solutions, and integrated product assemblies to meet your specific application requirements. And, because of our flexible manufacturing, we can cost-effectively produce small batches of customized product in short lead-times.

So if you can't find what you are looking for, just ask!



GAM, a U.S. company, is your complete source for robotic and servo gear reducers, rack & pinion systems, servo couplings, linear mounting kits, and other precision mechanical drive solutions used in automation technology.

With one of the largest product offerings in the motion control industry as well as the engineering expertise and manufacturing capabilities to develop customized solutions, GAM can help with your application.

U.S. manufacturing, being flexible to meet the needs of customer requests, and great service are what set us apart from the rest.

GAM Can.

GAM Enterprises, Inc.

801 E. Business Center Drive | Mt. Prospect, IL 60056
Toll-Free: 888.GAM.7117 | Ph: 847.649.2500 | Fax: 847.649.2501
www.gamweb.com | info@gamweb.com



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