Harowe Resolvers & Feedback Systems

- Housed resolvers in industry-standard sizes 8 and 11
- Ruggedized resolver and encoder feedback packages for harsh environment applications
- Frameless resolvers in sizes 10 to 55 for motor commutation and positioning

Deltran PT

A Danaher Motion Company

Deltran PT

Harowe Resolvers & Feedback Systems

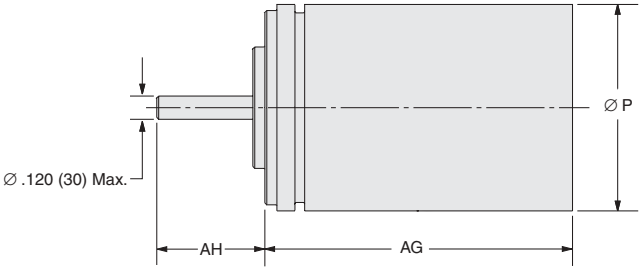
Contents

Housed Brushless Resolvers

- Reliable in harsh environments
- Brushless construction—ideal mate for brushless servo motors
- Excellent angular accuracy & repeatability
- Maintenance free
- Shortest length in industry for easy packaging
- Temperature rating of 155°C for high temp applications
- Ideal for use in high shock applications

Harowe housed resolvers are available in a wide variety of electrical and mechanical configurations. Our brushless construction uses a rotary transformer to pass the reference signal to the rotor. This design eliminates the normal brush and slip ring sliding contact used in conventional resolvers. Since the brush and slip ring are life limiting components and can be a source of noise in harsh environments, the transformer coupled units enhance reliability and performance.

The industry-standard Size 11 resolver series has its own precision bearing system, making it ideal for coupling mounting. Alternately, the R11 shaft accepts pinions or pulleys for use in rack and pinion or cable measuring systems.



Size	AG in (mm)	AH in (mm)	P in (mm)
Size 8	1.240 (31.5)	0.375 (9.5)	0.753 (19.1)
Size 11	1.590 (40.4)	0.562 (14.3)	1.062 (27)

Family Model	Speed*	Primary Winding	Accuracy ± Arc-Min	Input Voltage (Vrms)	Frequency (Hz)	Maximum Input Current (ma)	Transformation Ratio (Vout/Vin) ± 10%	Phase Shift (degrees)	Total Null Voltage (mV)
8BRCX-300-E	1	Rotor	7	6.0	1,000	11	0.45	10	30
8BRCX-300-F	1	Rotor	7	5.9	2,500	12	1.00	9	30
11BRW-300-B	1	Stator	10	12.0	400	10.9	1.75	12	30
11BRW-300-F	1	Stator	7	12.0	2,500	3.1	0.50	–2	30
11BRW-300-M	1	Stator	7	10.0	5,000	8.3	0.50	–5	30
11BRCT-300-F	2	Stator	10	12.0	2,500	8.3	0.50	0	15
11BRCT-300-M	2	Stator	10	11.8	2,500	70.0	1.02	–1	30
11BRCT-300-T	4	Stator	5	12.0	2,500	6.0	0.53	–2	15
11BRCT-300-P	5	Stator	4	12.0	2,500	1.4	0.39	–7	15
11BRCX-300-A	1	Rotor	7	7.5	4,000	13.5	0.54	–2	20
11BRCX-300-B	1	Rotor	7	7.5	4,000	40.0	1.07	–2	15
11BRCX-300-C	1	Rotor	7	6.0	1,000	15	0.45	4	15
11BRCX-300-G	1	Rotor	7	26.0	400	40.0	0.45	12	30
11BRCX-300-J	1	Rotor	7	7.0	5,000	10.9	0.95	–6	15
11BRCX-300-N	1	Rotor	7	8.5	1,000	14.0	1.00	3	30
11BRCX-300-M	2	Rotor	7	7.0	5,000	10.9	0.95	–2	30
11BRCX-300-T	4	Rotor	7	7.0	5,000	11.0	0.84	7	20
11BRCX-300-P	5	Rotor	6	10.0	5,000	5.0	0.55	–3	20
R11-S01F-1A	1	Rotor	20	1.88	2,250	21.0	1.40	11	15
R11-S01F-1B	1	Rotor	20	6.00	2,000	12.0	0.454	8.5	15
R11-S01F-1A	1	Rotor	6	1.88	2,250	21.0	1.40	11	15

*Speeds are defined as follows: 1 = single speed; 2 = 2-speed; etc.

R25 Heavy-Duty Industrial Resolvers

- Rugged housing with IP-65 protection rating
- Ideal for high temperatures, high shock environments
- Standard MS-style connectors
- Flange- and servo-mount styles
- Shielded, spaced-support bearings provide up to 10X the life of duplex bearings

Harowe's R25 H-D brushless resolvers are designed for reliability in adverse operating conditions. Resolvers are the better choice over encoders for applications that involve very high temperature, vibration and shock and/or dirty environments. R25s will quickly recover their cost by eliminating frequent downtime caused by less robust transducers. You can trust the R25 to operate reliably 24 hours a day, 365 days a year in the worst industrial environments.

Unlike similar duplex-bearing packages, the R25 uses a front-and-rear bearing arrangement. This provides from two to three times the radial load bearing capacity and up to ten times the L10 life of a package with duplex bearings. The increase in load bearing capacity applies equally to static, dynamic, and shock loading.

Features

- Excellent noise immunity
- Standard +125°C continuous duty operating rating
- Corrosion resistant finishes
- Accuracy grades from ± 7 to ± 20 arcmin
- Withstands shock to 200g, vibration to 40g

Typical Applications

- Textile machines
- Robotic mechanisms
- Packaging machines
- Pulp & paper processing equipment
- Plastics & film manufacturing equipment
- Chemical & food processing equipment
- Construction equipment
- Material handling and conveying systems
- CNC & NC machine tools
- Metal forming & cutting equipment
- Punch presses

R25 Series Model Numbering System

R25 - F - B - S - R - N - 1B - 10 - 00

Series
R25 = Heavy Duty Resolver

Front End Bell
F = Flange
S = Servo

Connector

Style	Exit
B = 16S	**R** = Rear
C = 18	**S** = Side
F = Flying Leads	

Shaft
R = Round
F = Round w/Flat

Shaft Seal
Y = Yes
N = None

Electrical Parts Kit
1A
1B(1)
1C
1D
1F
2A
3A

Accuracy (arc min)

02 = 2	**07** = 7
03 = 3	**10** = 10
04 = 4	**15** = 15
05 = 5	**20** = 20

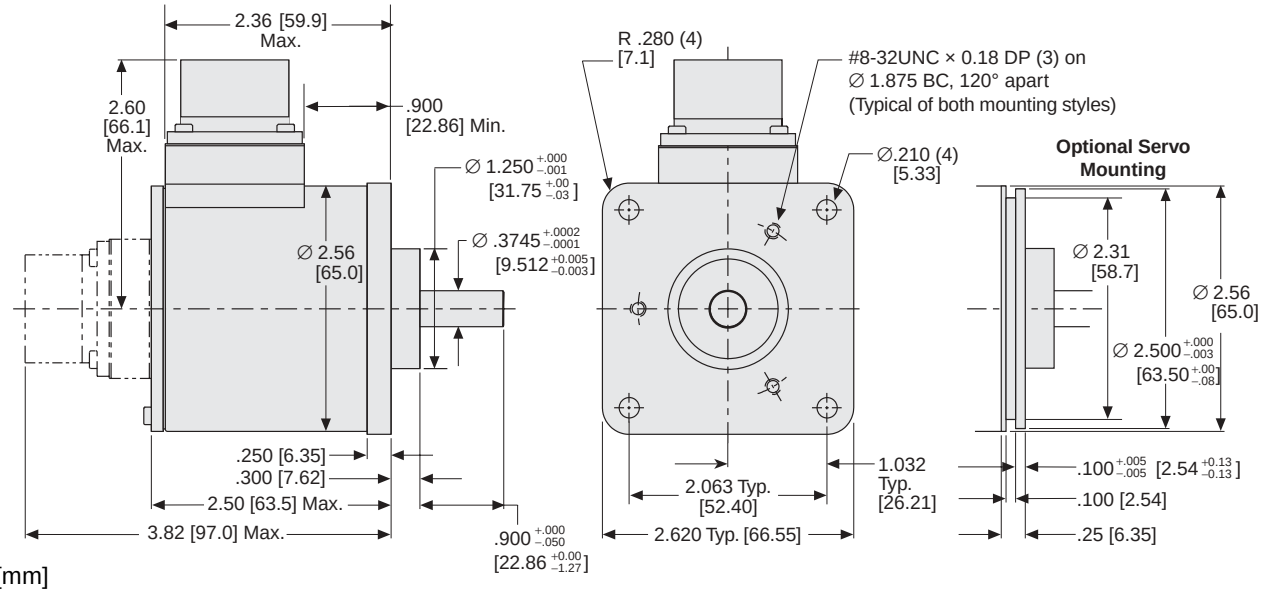
Special
XX = Factory assigned designator

(1) Recommended for use with RE-1024 Converter

Elec. Kit	Speed (No. of Poles)	Xformer Ratio (V in/V out)	Input Voltage (Vrms)	Max. Curr. Input (mA)	Ref. Freq. (Hz)	Phase Shift (min)	Pri. Wndg.
1A	1 (2)	0.500	5.3	3	4000	-3	Stator
1B*	**1(2)**	**0.500**	**4.0**	**25**	**5000**	**-6**	**Rotor**
1C	1 (2)	0.471	4.25	55	7000	+4 ±3	Rotor
1D	1 (2)	0.500	7.0	25	2500	+6	Rotor
1E	1 (2)	0.950	7.0	12	5000	-3	Rotor
1F	1 (2)	1.000	2.0	10	5000	-8	Rotor
2A	1 (2)	0.250	8.0	20	4000	+5.5 ±3	Rotor
3A	3 (6)	0.470	4.25	55	7000	+5.5 ±3	Rotor

*Recommended for use with RE-1024 converter. Note: 20,000 rpm max. operating speed.

Inertia	0.0040 oz-in-sec^2
Friction	2 oz-in (5 oz-in w/shaft seal)
Shaft Load (max.)	40 lb (axial), 60 lb (radial)
Shaft Material	#416 S/S
Play (max.)	Radial: .0015 in @ 1 lb load; End: .005 in @ 5 lb load
Bearing Life	2 × 10^8 revs at rated shaft loading



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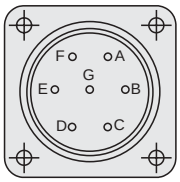
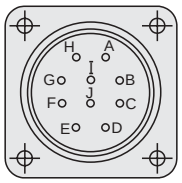
Connector Pin Outs



MS3102E-16S-1P

Pin	A	B	C	D	E	F	G
Signal	R1	R2	S1	S3	S4	S2	(Open)

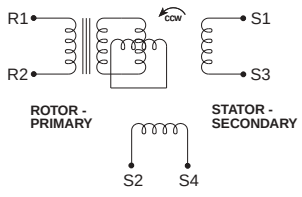


MS3102R-18-1P

Pin	A	H	B	I	C	J	G
Function	R1	R2	S1	S3	S4	S2	(Open)

Use of Harowe's mating connectors and low capacitance cable is recommended (or equivalent such as Belden 8163 cable with twisted-pairs for R1/R2, S1/S3 and S2/S4).

Basic Schematic, R25



E25 Heavy-Duty Industrial Encoders

- Rugged housing with IP-65 protection rating
- Standard MS-style connector
- Industry-standard mounting flange with precision pilot
- Shielded, spaced-support bearings provide up to 10X the life of duplex bearings
- Standard size 25 dimension and mechanical interface

The E25 series of heavy duty industrial encoders provides an optical encoder feedback solution with the ruggedness and sealing to stand up to harsh industrial environments.

Many industrial position feedback applications do not require the high temperature and shock resistance of a resolver. These applications are better served by the E25 Industrial Optical Encoders. If your application has continuous duty under 85°C, relative humidity under 98%, and vibrations less than 20G, the E25 may be the solution.

E25 Series Model Numbering System

E25 - F - C - R - R - N - 0500 - LD - 0 - 00

Series
E25 = Heavy Duty Encoder

Front End Bell
F = Flange
S = Servo

Connector

Style	Exit
B = 16S	**R** = Rear
C = 18*	**S** = Side
F = Flying Leads	

Shaft
R = Round
F = Round w/Flat

Shaft Seal
Y = Yes
N = None

Encoder Line Count
0024 = 24 line
0032 = 32 line
0050 = 50 line
0100 = 100 line
0200 = 200 line
0250 = 250 line
0300 = 300 line
0360 = 360 line
0500 = **500 line***
0512 = **512 line***
0800 = 800 line
0900 = 900 line
1000 = **1000 line***
1024 = **1024 line***

Output
LD = Line Driver*
B4 = Buffer (7404) Output
B6 = Internal Pull-Up (7406 & 470Ω)
OC = Open Collector (7406)

Index Gating
0 = No Gating*
1 = Gating

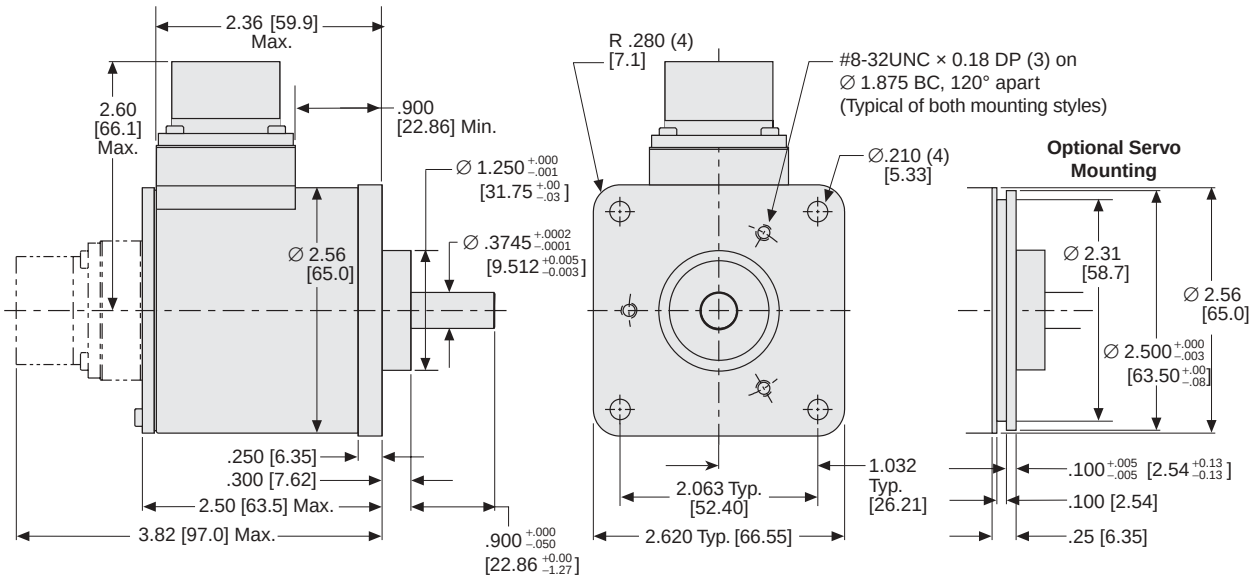
Special
XX = Factory assigned designator
17CCW = + count

*Standard Options

Standard Resolutions*	24, 32, 50, 100, 200, 250, 300, 360, **500**, **512**, 800, 900, **1000**, **1024**, lines/rev
Accuracy	15 arc-sec
Max. Flutter	1%
Max. RPM	12,000
Max. Acceleration	1×10^6 radians/sec^2
Input Voltage	+5VDC ±5%
Max. Current	175 mA
Frequency Response	100 kHz
Shock	100 G

*Bold values preferred standard resolutions.

Vibration	20 G
Starting Torque	2 oz-in (5 oz-in w/shaft seal)
Shaft Load (max.)	40 lb (axial), 60 lb (radial)
Shaft Material	#416 S/S
Play (max.)	Radial: .0015 in @ 1 lb load: End: .005 in @ 5 lb load
Bearing Life	2×10^8 revs at rated shaft loading
Weight	1.2 lb. (0.54 kg)
Operating Temperature	-10°C to +85°C
Storage Temperature	-30°C to +110°C
Relative Humidity (non-condensing)	98% max.



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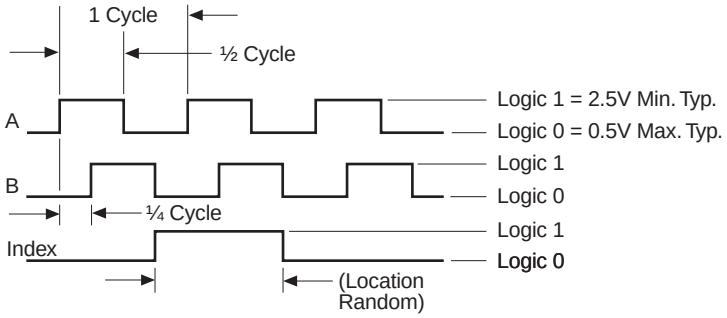
Output Signal Configuration

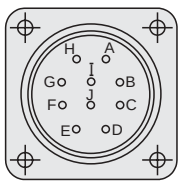


Minimum transition-to-transition edge separation of A and B is 45° over operating temperature and frequency. Complementary outputs are not shown for simplicity. CW viewing encoder shaft.

Gating Options

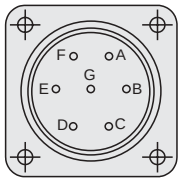
Code	Option	Index Width
0	Ungated (standard)	360° ± 20%
1	Gated by A and B	90° ± 45°

Connector Pin Outs



MS3102R-18-1P

Pin	A	B	C	D	E	F	G	H	I	J
Function	A	B	Z	+5VDC	(Open)	Common	Case	$\overline{A}$	$\overline{B}$	$\overline{Z}$



MS3102E-16S-1P

Pin	A	B	C	D	E	F	G
Function	A	B	Z	+5VDC	(Open)	Common	Case

Use of Harowe's mating connectors and low capacitance cable is recommended (or equivalent such as Belden 8164 cable with twisted-pairs for A/$\overline{A}$, B/$\overline{B}$ and Z/$\overline{Z}$).

RE Resolver-to-Encoder Converter

- Emulates standard incremental optical encoder signals
- Makes a resolver as easy to use as an encoder
- Works with R25 and other resolvers
- 1024 line count A-quad-B with index and complements
- 12-bit serial or parallel absolute position interface

In many automation applications it is desirable to have both the ruggedness of the resolver and the digital simplicity of the digital interface. Harowe's RE resolver-to-encoder converter module is a convenient way to meet that need. Combined with our R25 H-D resolver, the RE module emulates an encoder, providing A-quad-B and index outputs with their complements plus direction or analog velocity signals. Other models provide 12-bit serial or parallel absolute positive data.

The compact, panel-mountable RE module provides the resolver reference signal (selectable frequency) and converts the resolver signals to digital information which is available as A-B-Z, serial or parallel data. The RE consumes less than two watts, and can be powered by a standard 5 volt logic supply, making it and our R25 resolver the ideal replacement for encoders in demanding industrial applications.

Features

- 12-bit absolute position data
- Allows resolver to be used with low-cost, digital-only controllers
- Scalable analog velocity output
- Quadrature encoder signals at up to 350 kHz
- 5-volt or 6 to 26-volt operation

Features	Model			
	RE-1024	RE-1024V	RE-12S	RE-12P
A-B-Z Quadrature	X	X		
16 A-B-Z Resolutions		X		
Serial Absolute			X	
Parallel Absolute				X
Analog Velocity	X(1)	X	X	X
6 to 26-Volt Operation	5-Volt only	X	X	X

(1) User selects between the velocity output and the drection output.

RE Model Numbering System

RE - 1024 - LD - D - N - 02(1) - 40(1) - XX

RE = Resolver-to-Encoder

Resolution(2)
- **1024** = 1024 Lines
- **1024V** = Various Line Options
- **12S** = Serial 12-bit
- **12P** = Parallel 12-bit

Output
- **LD**(4) = Line Driver
- **B4**(4) = TTL
- **OC**(4) = Open Collector
- **XX** = RE-12

Vel/Dir
- **V**(4) = Velocity
- **D** = Direction
- **X**(4) = All others

Reserved

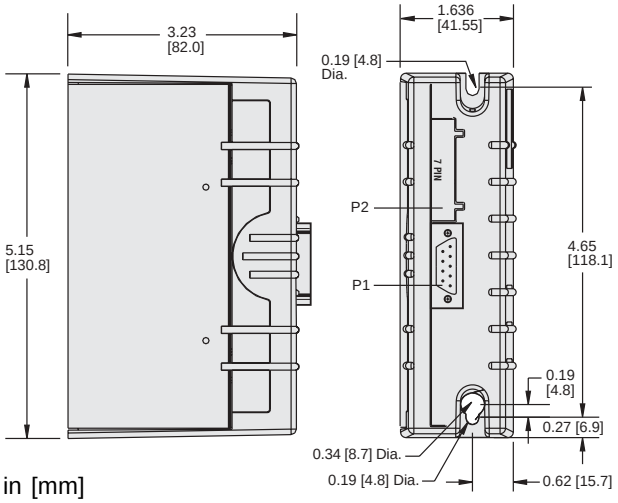
Frequency
- **02** = 2 kHz
- **05** = 5 kHz
- **10** = 10 kHz
- **20** = 20 kHz

Voltage(3)
- **20** = 2.0 Volts
- **26** = 2.6 Volts
- **40** = 4.0 Volts
- **60** = 6.0 Volts

Special Options
XX = Factory assigned designator

Notes

1. The RE Converter may be used with any resolver that has electrical specifications similar to the 1B electrical kit. For use with other resolvers, consult our application engineers.
2. Greater effective line counts may be obtained by using a multispeed resolver: 2× = 2048; 3× = 3072; 4× = 4096; 5× = 5120. For this configuration the max tracking rate is divided by the resolver speed (2, 3, 4, or 5) and there will be 2, 3, 4, or 5 Z pulses per shaft revolution. Multispeed versions of the R25, size 11 and frameless resolvers are available.
3. Other voltages available.
4. Field selectable on RE-1024 only.



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P2 (7 pin)
Function and Cable Configuration

Pin #	Function	CA Color & Pinout	
1	Ref Lo (R2)	Black w/White	B
2	Ref Hi (R1)	White	A
3	Sin Lo (S4)	Blue	E
4	Sin Hi (S2)	Black w/Blue	F
5	Cos Lo (S3)	Black w/Green	D
6	Cos Hi (S1)	Green	C
7	Shield	Shield	G

Internally connected; tie all shields to pin 7.

Resolver Excitation	2, 5, 10 or 20 kHz; 1 to 7 Vrms (Resolver TR= 2 to 0.29); 50 mA (max) [RE-1024: 1.8 to 7 Vrms, TR=1 to 0.29]	
Resolver Inputs	Sine or Cosine	1.8 to 2.2 Vrms at maximum (0 = 0 for Cosine); Input impedance is 1.0 MΩ
Power Requirements	RE-12x, RE-1024V	500 mA (max) at +5.5 to +26 Vdc
	RE-1024	400 mA (max) at +4.75 to + 5.25 Vdc
Temperature	Operating (Storage)	0ºC to + 70ºC for Vin >5 Vdc derate 2°C / V above 5 Vdc (-40ºC to +70ºC)

RE Series Data and Power Interface

P1 - 15-Pin High Density Socket D-Sub

Pin #	Pin Function		
	RE-1024V	RE-12S	RE-12P
1	A	NC	D0
2	B	NC	D1
3	Z	NC	D2
4	V+ (6-26V)	V+ (6-26V)	V+ (6-26V)
5	DIR	DATA	D3
6	$\overline{A}$	NC	D4
7	$\overline{B}$	NC	D5
8	$\overline{Z}$	NC	D6
9	GND	GND	GND
10	$\overline{DIR}$	$\overline{DATA}$	D7
11	NC	CS LOW	D8
12	NC	$\overline{CS\ LOW}$	D9
13	NC	CLK	D10
14	NC	$\overline{CLK}$	D11
15	VEL	VEL	VEL

NC = No Connector

P1 - 9-Pin Plug D-Sub

Pin #	Pin Function
	RE-1024
1	A
2	B
3	Z
4	V+ (5V)
5	VEL/DIR
6	$\overline{A}$
7	$\overline{B}$
8	$\overline{Z}$
9	GND

Connector And Cable Accessories

Deltran PT offers MS3106-style connectors and cable assemblies to mate with our Harowe heavy-duty E25 encoder and R25 resolver packages.

Cables are low capacitance type (13 pF/ft) with individually shielded twisted pairs. They are available in one foot incremental lengths as standard, and custom lengths by special order.

Pin outs match our E25 and R25 and are consistent with industry standards for size 25 encoder and resolver packages.

Connector and Cable Accessory Model Numbering System

CA - **18** - **R** - **0010** - **XX**

- **CA** = Cable Assembly
- **18** = MS3106F-18-1S; **16** = MS3106F-16S-1S
- **E** = E25 Encoder; **R** = R25 Resolver
- **Cable Length**(1) (ft.); **0010** = 10 ft.
- **Special**; **XX** = Factory assigned designator

(1) Other cable lengths available

Connector And Cable Assembly Dimensions/Pin Outs

Encoder Mating Connector & Cable Assembly Pin Outs

MS3106F-18S-1S

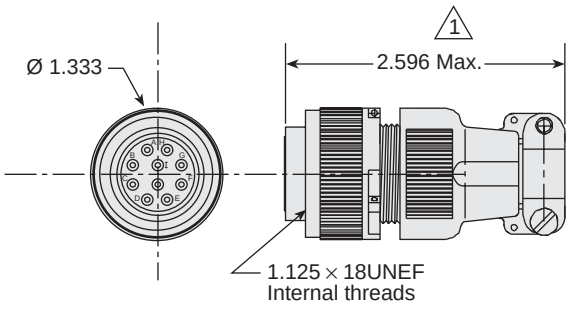
Pin	Function	Cable Lead Color
A	A	White
B	B	Green
C	Z	Blue
D	+VCC	Red
E	(Open)	(Open)
F	Common	Black w/Red
G	Case/Gnd	
H*	$\bar{A}$	Black w/White
I*	$\bar{B}$	Black w/Green
J*	$\bar{Z}$	Black w/Blue

Resolver Mating Connector & Cable Assembly Pin Outs

MS3106F-16S-1S

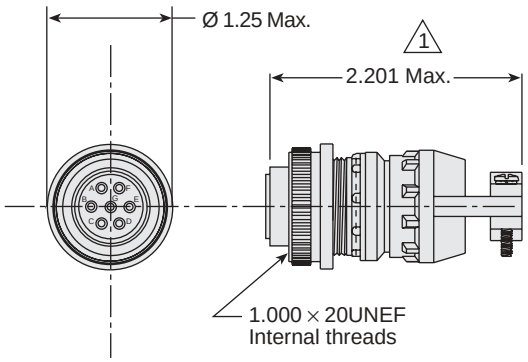
-16S-1S	-18-1S	Function	Cable Lead Color
A	A	R1 (Rotor Hi)	White
B	H	R2 (Rotor Lo)	Black w/White
C	B	S1 (Cos Hi)	Green
D	I	S3 (Cos Lo)	Black w/Green
E	C	S4 (Sin Lo)	Blue
F	J	S2 (Sin Hi)	Black w/Blue
G	G	Open	

MS3106F-18-1S Connector



Length is with threads fully engaged.

MS3106F-16S-1S Connector



Frameless Brushless Resolvers

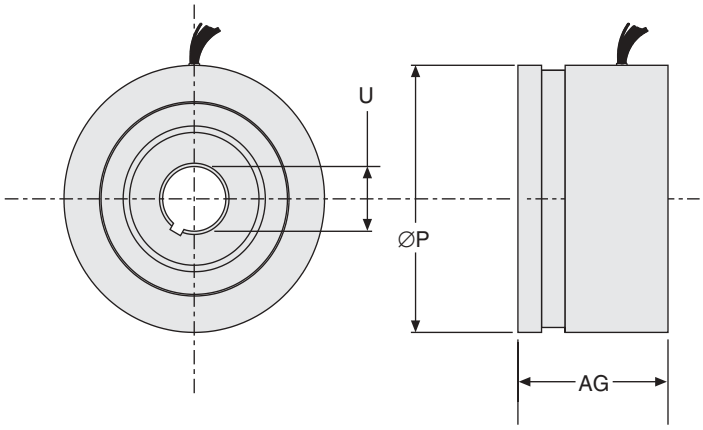
- Provide accurate, absolute position feedback
- Rugged and able to withstand high shock and vibration levels
- Highly resistant to EMI noise and radiation effects
- Impervious to most industrial contaminants and temperature extremes
- Brushless, lightweight devices that consume little power

Harowe's brushless resolvers are the ideal position feedback transducer for brushless motors, robots and direct-drive motors in precision rotary platforms and similar servo applications.

Resolvers are the most versatile position transducers available for instrumenting rotary axes. They are rugged, reliable, able to operate at 155°C and impervious to most particulate and liquid process contaminates. In addition, resolvers provide absolute position information over one revolution (single speed types), and can be combined with an inexpensive integrated circuit to provide up to 16-bit digital word or emulated incremental encoder output, (for example, by using Harowe's RE1024 converter module), plus direction and analog velocity signals.

Options

- Multiple speeds available (up to 32 on Size 55)
- Flux shielding technology
- Steel or aluminum housings
- Radiation hardened
- High temperature up to 220°C
- Flanged or Servo-groove mounting



Servo-groove mounting shown

Model*	AG in (mm)	P in (mm)	U in (mm)
10BRCX	.65 (16.5)	1.05 (26.5)	.237 (6.0) Max.
15BRCX	1.00 (25.4)	1.45 (36.8)	.472 (12.0) Max
21BRCX	1.25 (31.8)	2.06 (52.4)	.8007 (20.34) Max
31BRCX	1.25 (31.8)	3.05 (77.5)	1.5763 (40.04) Max
55BRCX	1.25 (31.8)	5.50 (139.7)	3.6515 (92.75) Max

* Available as transmitter, control transformer and differential types,

www.deltranpt.com

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Contact Deltran PT for assistance in locating your local distributor.