

INCREMENTAL ENCODERS

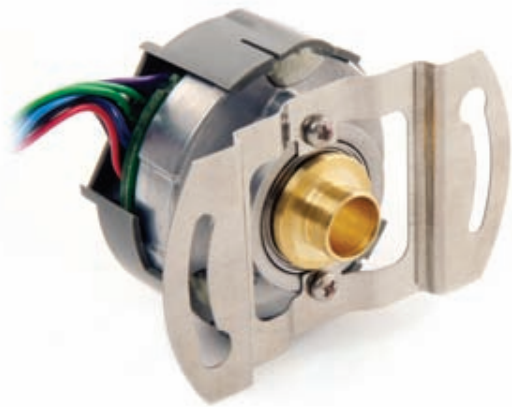
SERIES F14

Dynapar™ brand

For Stepper & Small Servo Motors

Key Features

- Easy to install non-marring hollowshaft design with flex tether
- Up to 5000 PPR for smooth low-speed motor control
- Up to 120C temperature range doesn't limit motor performance

SSM
Servo Small Motor

Product shown with optional flex tether



SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 1000 - 5000 PPR incremental with 4, 6 and 8 pole commutation channels
Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.
Phasing for CCW rotation of motor shaft (viewing encoder cover): A leads B by 90° and U leads V leads W by 120° .
Minimum edge separation A to B is 45° .
Index to U channel: $\pm 1^\circ$ mech. index pulse center to U channel edge.
Index Pulse Width: 90° gated A and B high; (180° gated B high gating options available - consult factory)

ELECTRICAL

Input Power Requirements: $5 \pm 10\%$ VDC at 150 mA max (incremental only); 175 mA max. (incremental and commutation), excluding output load
Output Signals:
Incremental: 26LC31 Differential Line Driver, sink / source 40 mA max.
Commutation: Open Collector Commutation 30 mA sink max. (2.0 k Ω pull-ups in encoder)

Frequency Response:

PPR ≤ 1000 : 250 kHz; PPR > 1000 : 500 kHz
Termination: 16 pin, fully shielded, 2mm pitch, double row header. Accessory mating cable assembly available: 26 AWG twisted pair, jacketed and shielded with copper drain wire

MECHANICAL

Bore Diameters: 1/4", 6mm, 8mm standard
Bore Dia. Tolerance: $+0.001"/-0.000"$ ($+0.025$ mm/ -0.000 mm)
Dimensions: Outside Diameter with cover: 1.55" (39.8mm), without cover 1.45" (36.8mm); Outside collar height 1.36" (34.6mm), inside collar height 1.28" (32.4mm)
Mating Shaft Length: 1.35" (34.3 mm) minimum for outside shaft collar. 0.50 inch minimum for inside shaft collar
Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)
Mating Shaft Axial movement: $\pm 0.060"$ (± 1.52 mm)
Mounting Configuration: Two standard configurations are available for tethers. A choice of U.S. or Metric screws are included. Mounting holes should be 0.01" (0.254 mm) true position to shaft for best encoder operation.

Shaft clamp: 2 #6-32 set screws in collar around hub shaft (will not mar shaft)

Electrical/Mechanical Alignment Range:
 $\pm 15^\circ$ mechanical typical (see tether options)

Acceleration: 100,000 rad/sec.² max.

Max. Velocity: RPM = (Frequency / PPR) x 60; or 12,000 RPM, whichever is less

Moment of Inertia: 8.2×10^{-5} in-oz sec.² (5.8 gm-cm²)

Housing & Cover Material: Bearing housing: aluminum; Cover: high temperature, glass filled polymer;

Hub: Brass; Disk: 0.030" thick glass; Cover Finish: RAL 7010 (dark grey)

Weight: 1.6 oz. (45gm) typ.

ENVIRONMENTAL

Operating Temperature: 0° to $+120^\circ$ C

Storage Temperature: -40° to $+120^\circ$ C

Shock: 100 Gs for 6 msec duration

Vibration: 2.5 Gs at 5 to 2000 Hz

Humidity: 90% (non-condensing)

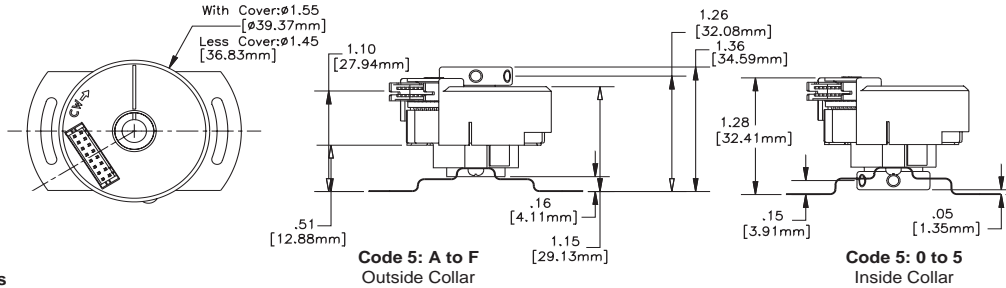
Enclosure Rating: NEMA 1 / IP40 (for models with cover)

INCREMENTAL ENCODERS

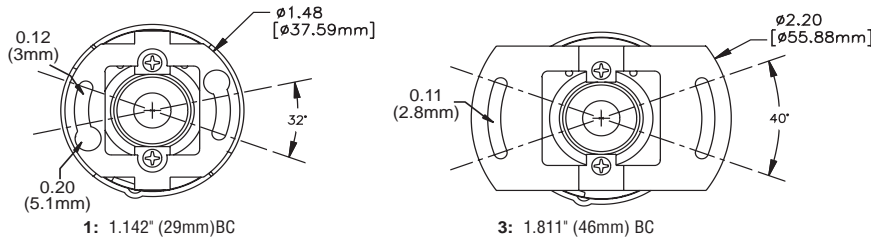


SERIES F14

Dimensions



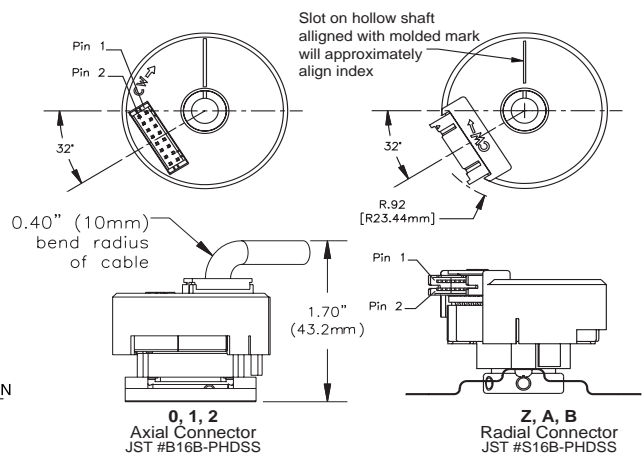
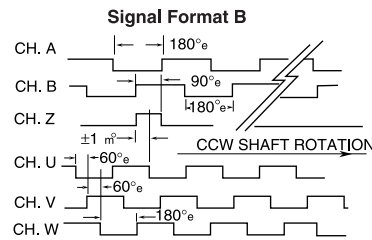
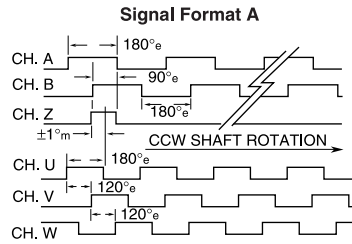
Code 3: Tethers



Electrical Connections

Output Waveforms

| Pin | Function* | Cable Wire Color |
|-----|-----------|------------------|
| 1 | VCC | RED |
| 2 | U | Brown |
| 3 | GND | BLACK |
| 4 | V | GRAY |
| 5 | A | BLUE |
| 6 | W | WHITE |
| 7 | A̅ | BLUE/BLACK |
| 8 | NONE | NONE |
| 9 | B | GREEN |
| 10 | U̅ | BROWN/BLACK |
| 11 | B̅ | GREEN/BLACK |
| 12 | V̅ | GRAY/BLACK |
| 13 | Z | VIOLET |
| 14 | W̅ | WHITE/BLACK |
| 15 | Z̅ | VIOLET/BLACK |
| 16 | NONE | NONE |



* Function availability dependant on Model

Mating Cable Assembly:
 Incremental only, 111752-000x
 Incremental + Comm., 111753-000x
 x= length in feet

Ordering Information

To order, complete the model number with code numbers from the table below:

| Code 1: Model | Code 2: PPR, Poles | Code 3: Tether | Code 4: Electrical | Code 5: Bore | Code 6: Termination |
|---------------|--------------------|----------------|--------------------|--------------|---------------------|
| F14 | □□□□/□ | □ | □ | □ | □ |

| Ordering Information | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|--|---------------------------|-------|--|--|---|---|--|------|--|--|--------|-----------------|------|--|-------|--------|---------|--|----------|----------|------------|------|----------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|----------|----------|----------|-------|
| F14 | Size 14 Commutating Encoder | Incremental channels only | | 0 No Tether 1 2 #2 on 1.181" Diameter 3 2 #4 on 1.811" Diameter 6 2 M2.5 on 30 mm Diameter 8 2 M3 on 46 mm Diameter | Available when Code 2 is ≤ 1024/0 0 5V in, open collector out incremental only - Format A C 5V in, open collector out incremental only - Format B Available when Code 2 is XXXX/0 3 5V in, line driver out incremental only - Format A D 5V in, line driver out incremental only - Format B Available when Code 2 is XXXX/4, XXXX/6, or XXXX/8 6 5V in, line driver out incr.; 5V in, open collector out comm. Format A E 5V in, line driver out incr.; 5V in, open collector out comm. - Format B 9 5V in, line driver out incr.; 5V in, line driver out comm. Format A F 5V in, line driver out incr.; 5V in, line driver out comm. - Format B | Inside Collar: 0 1/4 in. 4 6 mm 5 8 mm Outside Collar: A 1/4 in. E 6 mm F 8 mm | <table border="1"> <thead> <tr> <th colspan="3">Code</th> <th rowspan="2">Length</th> </tr> <tr> <th>Connector/Cable</th> <th>Wire</th> <th></th> </tr> <tr> <td>Axial</td> <td>Radial</td> <td>Pigtail</td> <td></td> </tr> </thead> <tbody> <tr><td>0</td><td>Z</td><td>N/A</td><td>None</td></tr> <tr><td>1</td><td>A</td><td>J</td><td>1 Ft.</td></tr> <tr><td>2</td><td>B</td><td>K</td><td>2 Ft.</td></tr> <tr><td>3</td><td>C</td><td>L</td><td>3 Ft.</td></tr> <tr><td>4</td><td>D</td><td>M</td><td>4 Ft.</td></tr> <tr><td>5</td><td>E</td><td>N</td><td>5 Ft.</td></tr> <tr><td>6</td><td>F</td><td>P</td><td>6 Ft.</td></tr> <tr><td>7</td><td>G</td><td>Q</td><td>7 Ft.</td></tr> <tr><td>8</td><td>H</td><td>R</td><td>8 Ft.</td></tr> </tbody> </table> | | Code | | | Length | Connector/Cable | Wire | | Axial | Radial | Pigtail | | 0 | Z | N/A | None | 1 | A | J | 1 Ft. | 2 | B | K | 2 Ft. | 3 | C | L | 3 Ft. | 4 | D | M | 4 Ft. | 5 | E | N | 5 Ft. | 6 | F | P | 6 Ft. | 7 | G | Q | 7 Ft. | 8 | H | R | 8 Ft. |
| | | Code | | | | | Length | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Connector/Cable | Wire | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Axial | Radial | Pigtail | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | Z | N/A | None | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | A | J | 1 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | B | K | 2 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | C | L | 3 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | D | M | 4 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | E | N | 5 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | F | P | 6 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | G | Q | 7 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | H | R | 8 Ft. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Incremental plus Commutation channels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

† Available with 4, 6 or 8 pole.
 e.g. 1000/6 is 1000PPR with 6 poles

CONNECTION OPTIONS
 You may choose an integral connector mounted in axial or radial position. Available with or without mating connector/cable. Alternatively, a direct-solder pigtail cable is offered.

INCREMENTAL ENCODERS

SERIES F18

Dynapar™ brand

For Stepper & Small Servo Motors

Key Features

- Under 2.0" Diameter Package with High 4,096 PPR Capability
- Easy to Install Hollowshaft and Spring Tether Design
- Up to 120°C Temperature Range Doesn't Limit Motor Performance

SSM
Servo Small Motor

Product shown with optional spring tether



SPECIFICATIONS

STANDARD OPERATING CHARACTERISTICS

Code: Incremental with commutation option, Optical
Resolution: 500 - 4096 PPR incremental with 4, 6, 8 or 12 pole commutation channels.

Accuracy: Incremental: ± 2.5 arc-mins. max. edge to any edge; Commutation: ± 6 arc-mins. max.

Phasing for CCW rotation of motor shaft (viewing encoder cover): A leads B by 90° and U leads V leads W by 120° .

Minimum edge separation A to B is 45° .

Index to U channel: $\pm 1^\circ$ mech. index pulse center to U channel edge.

Index Pulse Width: 90° gated A and B high; (180° gated B high gating options available - consult factory)

ELECTRICAL

Input Power Requirements: $5 \pm 10\%$ VDC at 150 mA max (incremental only); 175 mA max. (incremental and commutation), excluding output load

Output Signals:

Incremental: 26LC31 Differential Line Driver, sink / source 40 mA max.

Commutation: Open Collector Commutation 30 mA sink max. (2.0 k Ω pull-ups in encoder)

Frequency Response:

PPR ≤ 2048 : 250 kHz; PPR > 2048 : 500 kHz

Termination: 16 pin, fully shielded, 2mm pitch, double row header. Accessory mating cable assembly available: 26 AWG twisted pair, jacketed and shielded with copper drain wire

MECHANICAL

Bore Diameters: 1/4", 3/8", 7/16", 1/2", 6mm, 8mm, 10mm, 12mm standard

Bore Dia. Tolerance: $+0.001"/-0.000"$ ($+0.025$ mm/ -0.000 mm)

Dimensions: Outside Diameter with cover: 1.96" (49.8mm), without cover 1.85" (47.0mm); Outside collar height 1.71" (43.4mm), inside collar height 1.50" (38.1mm)

Mating Shaft Length: 1.62" (41 mm) minimum for outside shaft collar. 0.50 inch minimum for inside shaft collar

Mating Shaft Runout: 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)

Mating Shaft Axial movement: $\pm 0.060"$ (± 1.52 mm)

Mounting Configuration: Four standard configurations are available for tethers. A choice of U.S. and Metric screws are included. Mounting holes should be 0.01" (0.254 mm) true position to shaft for best encoder operation.

Shaft clamp: 2 #6-32 set screws in collar around hub shaft (will not mar shaft)

Electrical/Mechanical Alignment Range: $\pm 15^\circ$ mechanical typical (see tether options)

Acceleration: 100,000 rad/sec.² max.

Max. Velocity: RPM = (Frequency / PPR) \times 60; or 12,000 RPM, whichever is less

Moment of Inertia: 5.3×10^{-4} in-oz sec.² (37.3 gm-cm²)

Housing & Cover Material: Bearing housing: aluminum; Cover: high temperature, glass filled polymer;

Hub: Brass; Disk: 0.030" thick glass; Cover Finish: RAL 7010 (dark grey)

Weight: 4 oz. (110 gm) typ.

ENVIRONMENTAL

Operating Temperature: 0° to $+120^\circ$ C

Storage Temperature: -40° to $+120^\circ$ C

Shock: 100 Gs for 6 msec duration

Vibration: 2.5 Gs at 5 to 2000 Hz

Humidity: 90% (non-condensing)

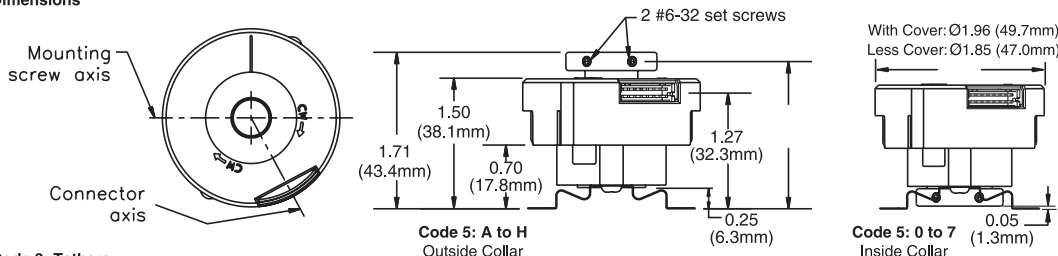
Enclosure Rating: NEMA 1 / IP40 (for models with cover)

INCREMENTAL ENCODERS

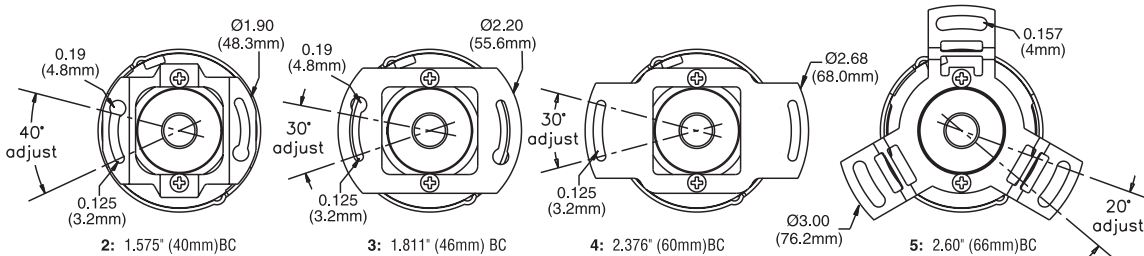


SERIES F18

Dimensions



Code 3: Tethers



Electrical Connections

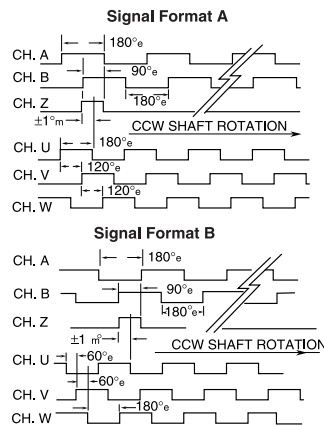
| Pin | Function* | Cable Wire Color |
|-----|-----------|------------------|
| 1 | VCC | RED |
| 2 | U | Brown |
| 3 | GND | BLACK |
| 4 | V | GRAY |
| 5 | A | BLUE |
| 6 | W | WHITE |
| 7 | A | BLUE/BLACK |
| 8 | NONE | NONE |
| 9 | B | GREEN |
| 10 | U | BROWN/BLACK |
| 11 | B | GREEN/BLACK |
| 12 | V | GRAY/BLACK |
| 13 | Z | VIOLET |
| 14 | W | WHITE/BLACK |
| 15 | Z | VIOLET/BLACK |
| 16 | NONE | NONE |

* Function availability dependant on Model

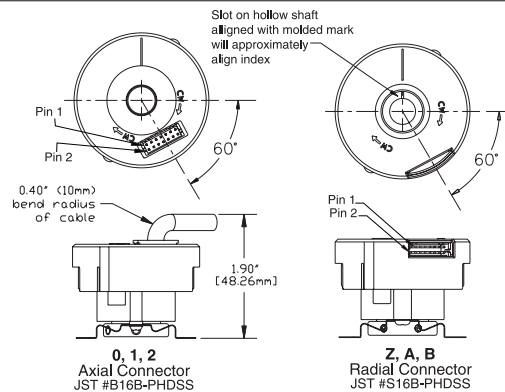
Mating Cable Assembly:

Incremental only, 111752-000x
 Incremental + Comm., 111753-000x
 x= length in feet

Output Waveforms



Code 6: Termination



Ordering Information

To order, complete the model number with code numbers from the table below:

| Code 1: Model | Code 2: PPR, Poles | Code 3: Tether | Code 4: Electrical | Code 5: Bore | Code 6: Termination |
|---------------|--------------------|----------------|--------------------|--------------|---------------------|
| F18 | □□□□/□ | □ | □ | □ | □ |

Ordering Information

| F18 | Size 18 Commutating Encoder | Incremental channels only | | 0 No Tether | Available when Code 2 is ≤ 2048/0 | Inside Collar: | Code | | | |
|-----|-----------------------------|---------------------------|--------|----------------------------|---|-----------------|-----------------|------|--------|-------|
| | | 0500/0 | 2048/0 | | | | Connector/Cable | Wire | Length | |
| | | 1000/0 | 2500/0 | 2 2 #2 on 1.575" Diameter | 0 5V in, open collector out incremental only | 0 1/4 in. | 0 | Z | N/A | None |
| | | 1024/0 | 4096/0 | 3 2 #4 on 1.811" Diameter | C 5V in, open collector out incremental only - reverse phase | 1 3/8 in. | 1 | A | J | 1 Ft. |
| | | 2000/0 | | 4 2 #4 on 2.376" Diameter | Available when Code 2 is XXXX/0 | 2 7/16 in. | 2 | B | K | 2 Ft. |
| | | | | 5 3 #4 on 2.60" Diameter | 3 5V in, line driver out incremental only | 3 1/2 in. | 3 | C | L | 3 Ft. |
| | | | | 7 2 M2.5 on 40 mm Diameter | D 5V in, line driver out incremental only - reverse phase | 4 6 mm | 4 | D | M | 4 Ft. |
| | | | | 8 2 M3 on 46 mm Diameter | Available when Code 2 is XXXX/4, XXXX/6, XXXX/8 or XXXX/C | 5 8 mm | 5 | E | N | 5 Ft. |
| | | | | 9 2 M3 on 60 mm Diameter | 6 5V in, line driver out for incremental; 5V in, open collector out for commutation | 6 10 mm | 6 | F | P | 6 Ft. |
| | | | | A 3 M3 on 66 mm Diameter | E 5V in, line driver out for incremental; 5V in, open collector out for commutation - reverse phase | 7 12 mm | 7 | G | Q | 7 Ft. |
| | | | | | F 5V in, line driver out for incremental; 5V in, line driver out for commutation - reverse phase | Outside Collar: | 8 | H | R | 8 Ft. |
| | | | | | | A 1/4 in. | | | | |
| | | | | | | B 3/8 in. | | | | |
| | | | | | | C 7/16 in. | | | | |
| | | | | | | D 1/2 in. | | | | |
| | | | | | | E 6 mm | | | | |
| | | | | | | F 8 mm | | | | |
| | | | | | | G 10 mm | | | | |
| | | | | | | H 12 mm | | | | |

† Available with 4, 6, 8 or 12 pole. (12 pole is designated by character "C")

Examples: 1024/8 is 1024PPR, 8 pole; 2000/C is 2000PPR, 12 pole

CONNECTION OPTIONS
 You may choose an integral connector mounted in axial or radial position. Available with or without mating connector/cable. Alternatively, a direct-solder pigtail cable is offered.