

| HS35

3,5" BLIND - HOLLOW SHAFT INCREMENTAL ENCODERS - ORDINARY & HAZARDOUS LOCATIONS

The HS35 combines the rugged, heavy-duty features usually associated with shafted encoders into a hollow shaft style. Its design includes dual bearings and shaft seals for NEMA 4, 13 and IP65 environmental ratings, a rugged metal housing, and a sealed connector or cable gland. The HS35 accommodates shafts up to 1" in diameter. With optional insulating inserts, it can be mounted on smaller diameter shafts. It can be mounted on a through shaft or a blind shaft with a closed cover to maintain its environmental rating. The HS35 is also available with a dual output option (inset) to provide redundant encoder signals, dual resolutions, or to supply two separate controllers from a single encoder.

GEN²

For **Generation 1**
datasheet [click here](#).



Features

HS35 Rotary Incremental Encoder:

- Robustness and excellent resistance to shocks / vibrations
- High Protection Level IP65 (NEMA 4 & 13)
- High Resolutions Available: Up to 500 000 ppr
- Universal Electronic Circuits from 4.75 to 30 Vdc
- High Performance in Temperatures -40°C to 100°C
- High bandwidth: Up to 1MHz
- Resolution and outputs HTL/TTL programmable
- Hard anodization available in special features
- Certifications in Hazardous Locations: Intrinsically safe or Non-incendive UL/Atex/IECEx

Applications

- Steel, Glass, Paper mills
- Wood industry
- Wind energy
- Power generators
- Mining drilling
- Gas engines

SPECIFICATIONS

Mechanical

Material		Cover: Die cast Aluminum with Iridite finish Body: Aluminium Shaft: AISI 303 Stainless Steel
Bearings		6807 Series - sealed
Maximum Loads	Axial	50 N
	Radial	80 N
Shaft inertia		2,852 oz-in-sec ² (1") SS 2,8125 oz-in-sec ² (1") BS
Torque ⁽¹⁾		Through shaft version (SS) = 11,3 in-oz (at 1000 min ⁻¹) Blind shaft version (BS) = 8,5 in-oz (at 1000 min ⁻¹)
Permissible Max. Speed		6 000 min ⁻¹
Continuous Max. Speed		4000 min ⁻¹
Encoder Weight (Approx.)		22,92 Oz
Theoretical Mechanical Lifetime 109 turns (Faxial / Fradial)		140x10 ⁹ at 25 N / 40 N 17x10 ⁹ at 50 N / 80 N

⁽¹⁾ The rubber shaft seal is recommended in virtually all installations. The most common exceptions are applications requiring a very low starting torque or those requiring operation at both high temperature and high speed. For these exceptions, a felt shaft seal is recommended. Felt seals require very low starting torque and can virtually eliminate frictional heat. Encoders ordered with felt shaft seals will have an enclosure rating of IP50 and will have less than 1/10th the Starting Torque specified under Mechanical Configurations.

Electrical

Certification	CENELEC Classification	Electronic	Output Signals (4) (5)	Operating Voltage +V	Supply Current (no loads)	Current per Channel	Short Circuit Proof	Overvoltage protection	Reverse Polarity Tolerant	Frequency Capability	Resolutions category ⁽¹⁾	Operating Temperature Range ^{(2) (3)}
Ordinary Location + Non-Incendive	Ex ec IIC T4 Gc Ex ec IIC T3 Gc	28/V	HTL	4,75-30V	<75mA	<40mA	Yes	Up to 33V	Yes	Up to 1MHz	Standard	-40°C.. +100°C
											Low	
											High	
		28/X	HTL / TTL selectable	4,75-30V	<75mA	<40mA	HTL: refer RG5 TTL: refer RG2	Up to 33V	Yes	Up to 1MHz	Full Programmable	-40°C.. +100°C
											Multiplier Programmable	
		15/V	HTL	9-16V	<75mA	<40mA	Yes	Up to 18V	Yes	Up to 300kHz	Standard	-40°C.. +100°C
											Low	
		28/0	Open Collector	4,75-30V	<75mA	<40mA	Yes	Up to 33V	Yes	Up to 300kHz	Standard	-40°C.. +100°C
											Low	
											High	
		28/5	TTL	4,75-30V	<75mA	<40mA	Yes (Except to +V)	Up to 33V	Yes	Up to 1MHz	Standard	-40°C.. +100°C
											Low	
											High	
Intrinsically safe	Ex ia IIC	5/V	TTL	4,5-6V	<75mA	<40mA	Yes	Up to 6,8V	Yes	Up to 1MHz	Standard	-40°C.. +80°C
											Low	
											High	
		5/0 ⁽⁶⁾	Open Collector	4,5-6V	<75mA	<40mA	Yes	Up to 6,8V	Yes	Up to 300kHz	Standard	-40°C.. +80°C
											Low	
											High	
	Ex ia IIB	9/V	HTL	8-12V	<75mA	<40mA	Yes	Up to 16V	Yes	Up to 1MHz	Standard	-40°C.. +80°C
											Low	
											High	
		9/0 ⁽⁶⁾	Open Collector	8-12V	<75mA	<40mA	Yes	Up to 16V	Yes	Up to 300kHz	Standard	-40°C.. +80°C
											Low	
											High	

⁽¹⁾ See resolutions section for details.

⁽²⁾ Surface encoder temperature

⁽³⁾ UL Listed: -20°C +80°C. Device must be supplied by a Class 2, LPS or SELV limited energy source 250mA.

⁽⁴⁾ Complementary outputs are recommended for use with line driver type (source/sink) outputs. When used with differential receivers, this combination provides a high degree of noise immunity.

⁽⁵⁾ Output IC's are available as either Line Driver or NPN Open Collector types. Open Collectors require external pull-up resistors, resulting in higher output source impedance (sink impedance is similar to that of line drivers). In general, use of a Line Driver style output is recommended.

Line Drivers source or sink current and their lower impedance mean better noise immunity and faster switching times.

Warning: Do not connect any line driver outputs permanently to 0V,+V or to any other signal. This may overtime damage the driver. Unused outputs should be isolated and left floating.

Our applications specialists would be pleased to discuss your system requirements and the compatibility of your receiving electronics with Line Driver type outputs.

-28/V: Line Driver (HTL): this is the recommended replacement for 3904R and 7406R open collector outputs with internal pullup resistors.

It is also a direct replacement for any 4469, 88C30, 8830 or 26LS31 line driver.

Important to note : this driver is TTL compatible when used with 5 volt supply.

-28/5: Line Driver (TTL): this low power but efficient driver, powered at 24V is ideal for long cables and high frequencies.

-28/0: NPN Open Collector (OC) : this replaces prior IC's with designations of 3904, 7406, 3302, 681 and 689.

Outputs require external pull-up resistors and may be pulled up to voltage other than supply voltage (30V max).

-5/OCR, 15/OCR, 24/OCR: Open Collector are often replaced by the 28/V in system upgrades. Consult factory.

⁽⁶⁾ - Output IC's NPN Open Collector are also available with internal 2,7K ohm pull-up resistors : 5/OCR or 9/OCR

Environmental

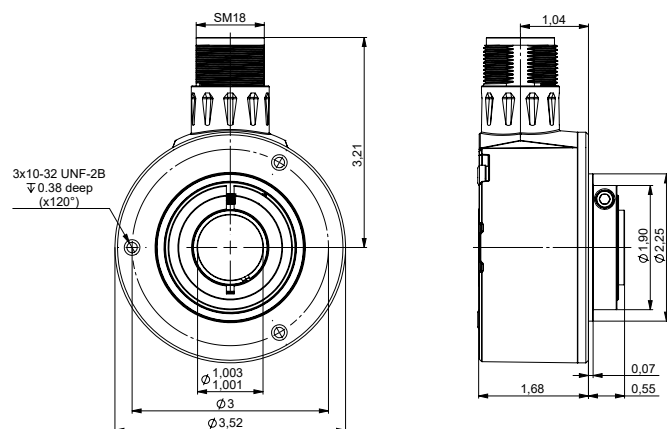
Shocks (EN 60068-2-27)	≤ 500 m.s-2 (during 11 ms)
Vibrations (EN 60068-2-6)	≤ 200 m.s-2 (5...2 000Hz)
EMC	EN 61000-6-2, EN 61000-6-4
Isolation	1 000V eff
Operating Temperature ⁽¹⁾	See Electrical table above
Storage Temperature	-40°C ... +100°C
Protection (EN 60529)	IP 65 (NEMA 4 & 13)
Humidity	93% RH non-condensing at 20 °C

⁽¹⁾ Extended temperature ratings : some models can operate down to -55°C. Extended temperature ranges can affect other performance factors. Consult with factory for more specific information.

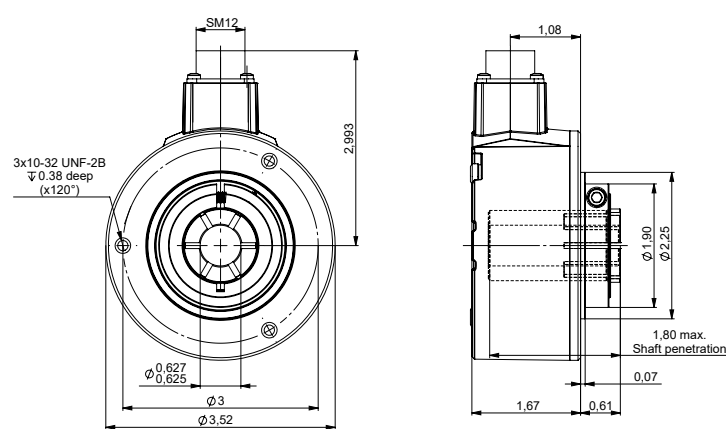
DIMENSIONS

Dimensions in inches

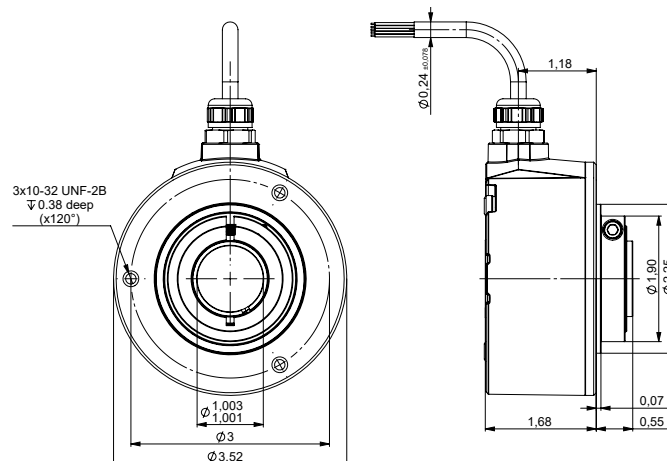
MS Connector Termination



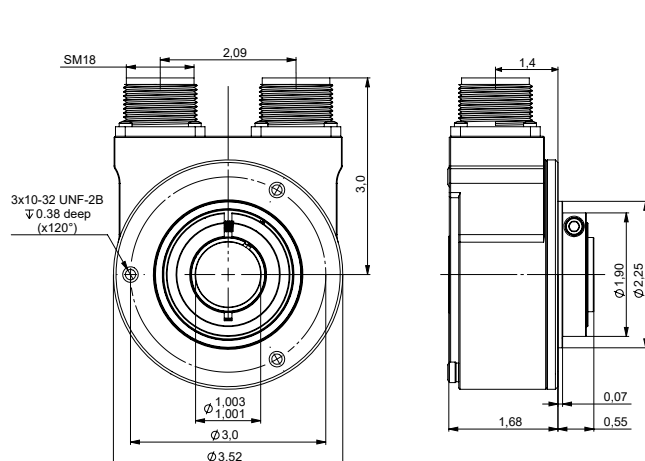
M12 Connector Terminations



Cable Terminations

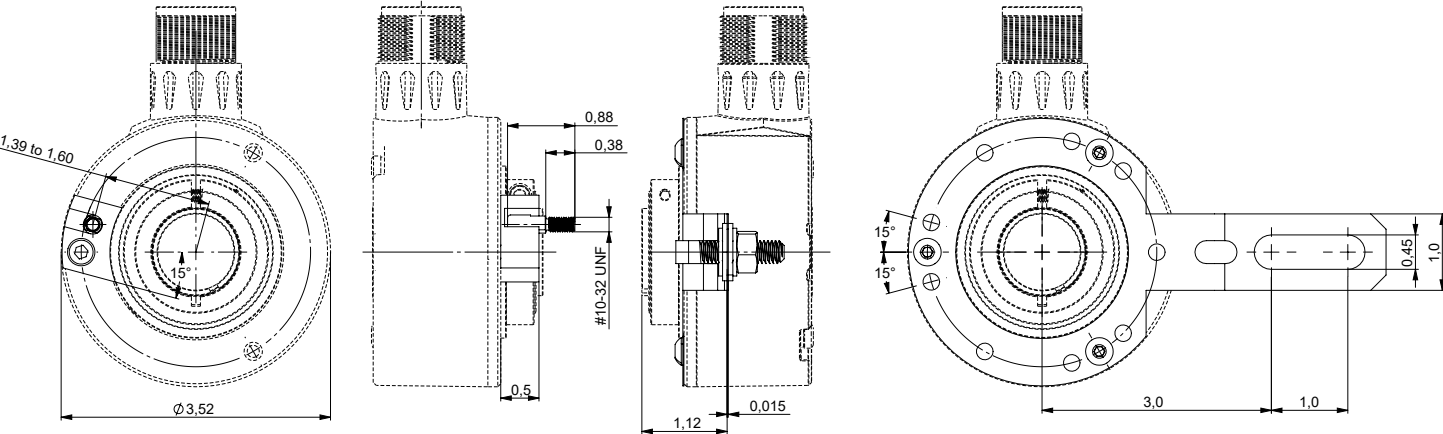


Dual MS Connector Termination



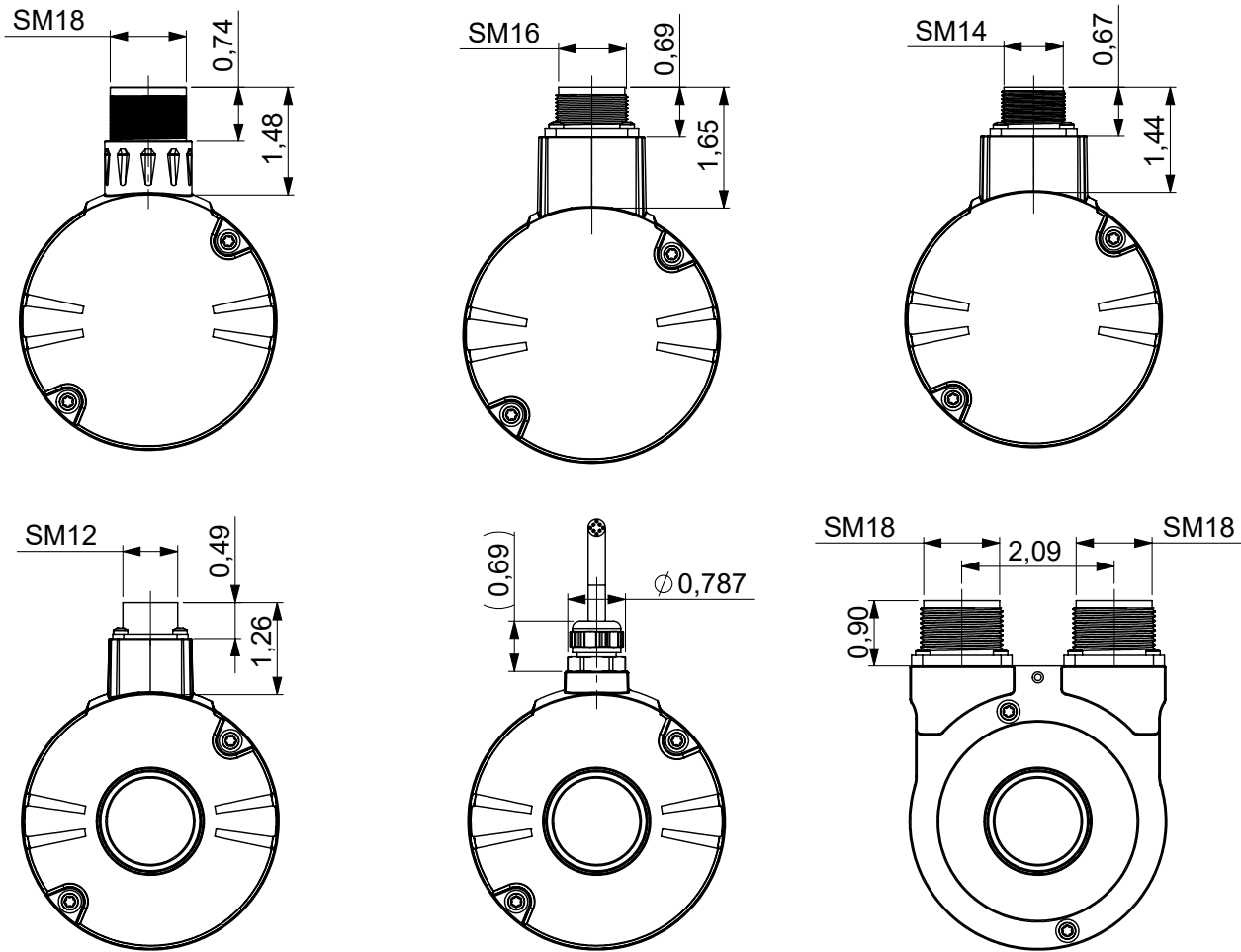
R1 Tether Block and Pin

R2 Tether Arm



Note: The typical hollow shaft product is supported by, and clamped to, the driving shaft. A flexible tether is used to keep the housing from rotating.

CONNECTION DIMENSIONS



STANDARD CONNECTIONS

		0V	+V	A	B	Z	A/	B/	Z/	Case Ground	Shield Drain
M18	M18 Connector 10 Pins	F	D	A	B	C	H	I	J	G	—
M12	M12 Connector 10 Pins	F	D	A	B	C	H	J	K	G	—
M16 - ABZ	M16 Connector 7 Pins	F	D	A	B	C	—	—	—	G	—
M16 - ABC		F	D	A	B	—	C	E	—	G	—
CABLE - ABZ	PVC Cable 9 Wires	BK (Black)	RD (Red)	YE (Yellow)	BU (Blue)	OG (Orange)	—	—	—	GR (Green)	WH (White)
CABLE - ABC		BK (Black)	RD (Red)	YE (Yellow)	BU (Blue)	—	WH/YE (White/Yellow)	WH/BU (White/Blue)	—	GR (Green)	WH (White)
CABLE - ABZC		BK (Black)	RD (Red)	YE (Yellow)	BU (Blue)	OG (Orange)	WH/YE (White/Yellow)	WH/BU (White/Blue)	WH/OR (White/Orange)	GR (Green)	WH (White)

RESOLUTIONS

Standard resolutions:

1000, 1024, 1800, 2000, 2048, 2500, 3600, 4000, 4096, 5000, 7200, 10000

Low resolutions ⁽¹⁾: (not found in the Standard resolutions range):

Any resolution within the 1-2500ppr range.

High resolutions: (not found in the Standard resolutions range)

All multipliers of 1000, 1024, 1800, 2500 from 1 to 200.

Programmable resolutions ⁽¹⁾ (28/X electronics):

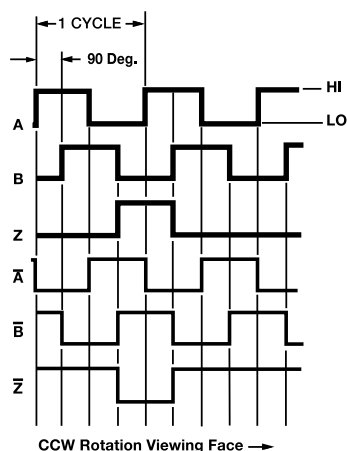
- Full programmable (XPROG): from 1 to 10kppr with direction and alternate index tracks configuration
- Multiplier programmable (1000, 1024, 1800, 2500 native): Programmability of the native resolution multiplier from 1 to 200 with direction and all index tracks configurations possibilities

All those versions can be configured with one of the following programming tool P/N (ordered separately):

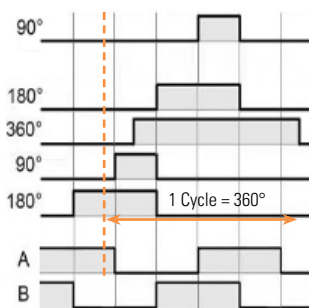
EAP-004 (for encoder with "SM18" connection)

Programming procedure available in Instruction Manual.

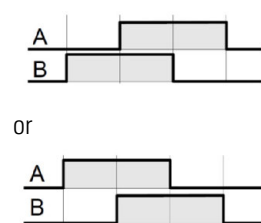
Channel Synchronization ⁽⁴⁾



Index track gating possibilities ⁽²⁾⁽³⁾ XPROG (Full Programmable Version)



Directions Possibilities ⁽²⁾



⁽¹⁾Signal tolerances available in Instructions Manual

⁽²⁾Signals are shown for CW rotation when viewed from the face side of the encoder

⁽³⁾Non-standard index widths and multiple indices are available by special order. Consult factory.

⁽⁴⁾With dual output option, both AB signals are not synchronized, and Index signals locations are displaced around 180° (mechanical)

ORDERING OPTIONS

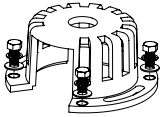
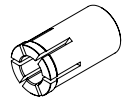
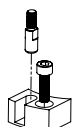
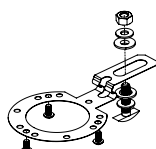
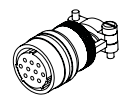
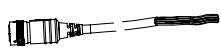
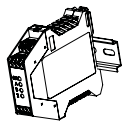
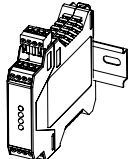
Items highlighted with this are standard Express Encoders and ship in few days. in North America

Encoder	X	HS35	F	100	R1	SS	2048	ABZ	C	28/V	SM18		S
X: Express Encoder Blank: Standard Leadtime													
Type													
HS35: Hollow Shaft, 3,5" Encoder Diameter													
Housing Configuration													
F: Standard													
Shaft Bore													
100: 1.00" 87: 0.875" 75: 0.75" 62: 0.625" 50: 0.50" etc. Metric bores available													
Tether													
R1: Tether Block and Pin R2: Tether Arm Others tether configurations available													
Shaft Seal Configuration													
SS: Through Shaft, Rubber Seals BS: Blind Shaft, Rubber Seal FS: Through Shaft, Felt Seals (option not available with Haz loc rating)													
Cycles per Turn													
(Enter Cycles) Standard/Low/High resolutions and Multiplier programmable. See available resolutions in "Resolutions" section. EPROG: Full programmable 1-10kppr (standard index tracks configurations). XPROG: Full programmable 1-10kppr (alternate index tracks configurations).													
No. of Channels													
A: Single Channel AB: Dual Quad Channel ABZ: Dual with Index AZ: Single with Index													
Complements													
C: Complementary Outputs Blank: No Cable													
Voltage / Output													
Ord. loc + Non-incendive 15/V = 5-15 Vin/out 28/V = 5-28Vin/out 28/5 = 5-28Vin/5Vout 28/O = 5-28Vin/OCout													
Intrinsically safe 5/V = 5 Vin/out 5/O = 5 Vin/OCout 9/V = 8-12 Vin/out 9/O = 8-12 Vin/OCout													
Output Termination													
SM12: MS3112E12-10P SM16: MS3102R16S-1P SM18: MS3102R18-1P SCS: Shielded/Jacketed Cable with Cable Seal. Length of Cable is specified in inches. (i.e. SCS18 = 18 inches) (Indicate "S" for single or "D" for Dual (i.e. DM18 = Dual). Dual option not available with Intrinsically Safe rating) (See Connections Section)													
Hazardous Area Ratings													
Blank: None EX: Intrinsically Safe NI: Non-Incendive Contact factory for voltage options													
Special Features													
S: Special Features specified on Purchase Order. -S at the end of the model number is used to define a variety of non-standard features such as hard anodization, special shaft lengths, voltage options, or special testing. Please consult the factory to discuss your special requirements.													

AGENCY APPROVALS & CERTIFICATIONS

Harardous Area Ratings	Agency		Ratings and Markings	File Number
Blank		CE	EN 55011: Electromagnetic Disturbance (EMI) EN 61000-6-2: Electromagnetic Compatibility (EMC)	-
EX Intrinsically Safe		UL	Class I, Groups A, B, C, D Class II, Groups E, F, G	E78446
		DEMKO	Ex II 1 G Ex ia IIC T4 Ga (9V/O is II 1 G Ex ia IIB T4 Ga)	DEMKO 24 ATEX Pending
		IEC/IECEx	Ex ia IIC T4 Ga (9V/O is Ex ia IIB T4 Ga) -40°C ≤ Ta ≤ +85°C	IECEx UL Pending
NI Non-Incendive		UL	Class I, Div. 2, Groups A, B, C, D Class II, Div. 2, Groups F, G	E78446
		DEMKO	Ex II 3 G Ex ec IIC T3 Gc	DEMKO 24 ATEX Pending
		IEC/IECEx	Ex ec IIC T3 Gc -40°C ≤ Ta ≤ +85°C	IECEx UL Pending



Description	Part Number	
Protection Cover kit Hardware included 	23145-002 = Protective cover, pilot dia. 6.38", without fasteners 26068-001 = Protective cover, pilot dia. 6.58", with fasteners	
Reduction sleeve 	Imperial sizes shaft bore, PEEK ⁽¹⁾ 9434/E8 = 1" 9434/E7 = 0.875" 9434/E6 = 0.75" 9434/E5 = 0.625" 9434/E4 = 0.5" ⁽¹⁾ Except 9434/E8: GF Polycarbonate	Metric sizes shaft bore, PEEK 9434/I25 = 25mm 9434/I20 = 20mm 9434/I15 = 15mm 9434/I12 = 12mm
R1 Tether Block and Pin Hardware included 	31215-003 = 382323-001 Tether block + dia. 0.25" x lg. 0.75" pin (cap screw 10-32 UNF x 5/8 included) 31215-006 = 382323-001 Tether block + dia. 0.25" x lg. 0.75" pin + Collet clamp (cap screw 10-32 UNF x 5/8 included)	
Tether arm kit Hardware included 	31187-016 = R2 tether kit 31187-012 = R11 tether kit 31187-015 = R14 tether kit Other stator coupling configurations available on request	
Connector Mates 	MS3106F18-1S = Mates to standard M18 style, 10pin conn. MS3106F16S-1S = Mates to standard M16 style, 7pin conn. MS3106F14S-6S = Mates to standard M14 style, 6pin conn. MS3116F12-10S = Mates to standard M12 style, 10pin conn.	
Connector Cable Assemblies 	31186-1810 = M18, 10pin, 10 ft length 31186-1820 = M18, 10pin, 20 ft length 31186-1850 = M18, 10pin, 50 ft length 31186-1610 = M16, 7pin, 10 ft length 31186-1620 = M16, 7pin, 20 ft length 31186-1650 = M16, 7pin, 50 ft length	31186-1410 = M14, 6pin, 10 ft length 31186-1420 = M14, 6pin, 20 ft length 31186-1450 = M14, 6pin, 50 ft length 31186-1210 = M12, 10pin, 10 ft length 31186-1220 = M12, 10pin, 20 ft length 31186-1250 = M12, 10pin, 50 ft length
Electronic Modules 	60001-010 = Opto isolator 60011-001 = Broadcaster 60002-000 = Encoder tester *There are many options for Electronic modules, consult factory for help selecting the best one for your application	
Intrinsic Safety Barrier 	This galvanically isolated barrier provides both power and signal isolation for an incremental encoder. With differential line driver outputs, it can carry signals up to 500 feet with a bandwidth of up to 250 kHz. For detailed ordering options, refer to accessory specification sheet.	

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