

## Series 21 Hollow-Shaft Rotary Optical Encoders

*Digital incremental or sine/cosine and absolute format*

Allied Motion's Series 21 are cost effective, hollow shaft optical encoders that are easy to mount and provide high data rate capabilities. These compact devices have their own bearing system and are enclosed in a high-grade glass filled plastic resin housing with an IP40 protection rating. The Series 21 provides significant performance benefits in applications that would be limited by traditional modular encoder solutions.

A flexible mount allows for much greater tail shaft runout and TIR than can be tolerated by other modular encoder designs.

The Series 21 is capable of providing incremental digital (with commutation) or analog formats. And the incremental versions offer exceptional resolutions of over 2 million pulses per revolution.

The Series 21 encoders are also available in absolute formats. The new 16-bit binary or gray code absolute provides high measuring step count per revolution with low position error, enabling smooth drive performance and exceptional position accuracy. High bandwidth and noise immunity ensure excellent speed, stability, and command signal response in industrial environments.

The Series 21 also supports the BiSS C protocol for incremental and absolute versions. This high-speed serial protocol is great for dynamic axes that require high acceleration, smooth velocity control, outstanding bi-directional repeatability, and solid positional stability.

Programmable and easy to configure for a variety of output types, the Series 21 encoders simplify machine design by allowing the same model encoder to be used for a multitude of applications.

### Features & Benefits

- Compact mechanical dimensions (2.1" O.D. x 1.2" H) for easier system integration
- Robust bearing system
- Industrial ball bearings enable up to 10,000 RPM shaft speed
- Simplified direct-mount design
- Software configurable resolution
- Circuit protection: Short circuit, reverse polarity, transient voltage suppression
- ASIC-based design for excellent matching and reliability
- Fast BiSS C serial data communications via RS-485 differential driver pair
- High noise immunity
- RoHS compliant

### Options

- Wide range of line counts and pulses: up to 4096 lines incremental, over 2 million pulses
- Range of shaft diameters: up to 0.5 in. (12.7 mm)
- 4, 6, 8, 10, & 12 pole commutation tracks, single-ended TTL
- Gray code or binary absolute position data format
- Absolute position value of 8- to 16-bit SSI output per user clock input pulse
- Fast SSI serial communication via 2-wire or 3-wire RS-485
- Absolute position value to 13-bit parallel output per user connection
- Custom cable and/or connector



- Compact, robust hollow-shaft size-21 rotary optical encoder
- Digital incremental, sine/cosine, or absolute format
- Single-ended commutation data for up to 12 poles
- Over 2 million incremental pulses/revolution
- Absolute single-turn resolution of up to 16-bit
- Absolute angular position data instantly available on power up
- Fast 13-bit absolute parallel version with data in real time

# Encoders

## Series 21 Hollow-Shaft Rotary Optical Encoders

### SPECIFICATIONS - INCREMENTAL ENCODERS

Model	S21A Series	S21D Series	S21H Series	S21W Series	S21C Series
Type	Incremental, sine/cosine	Incremental, digital	Incremental, digital, high-count	Incremental, digital, with commutation	Incremental, BiSS C
Format	1 Vpp, 2.5 VDC offset	Differential A quad B and index			Serial
Resolution (cycles/rev; 1 cycle/rev = 4 counts/rev)	1000, 1024, 4096	1000 to 409,600 (see resolution tables, page 6)	2000 to 2,048,000 (see resolution tables, page 6)	2048 to 204,800 (see resolution tables, page 6)	2000 to 2,048,000 (see resolution tables, page 6)
Frequency Response	125 kHz max.	500 kHz	1.5 MHz	500 kHz	5 MHz Clock
Output	Analog driver	Line-driver	CMOS line-driver	Line-driver	BiSS driver (75179)
Power Supply	+5 VDC, 40 mA	+5 VDC, 30 mA	+5 VDC, 60 mA	+5 VDC, 35 mA	+5 VDC, 104 mA
Max. Shaft Bore, in. (mm)	0.5 (12.7)				
Min. Shaft Length, in. (mm)	0.250 (6.35)				
Max. Shaft Length, in. (mm)	1.125 (28.58) through-shaft option				
Axial Shaft Movement, in. (mm)	±0.025 (0.635)				
Max. Shaft Speed (RPM)	10,000				
Mounting Pattern, in. (mm)	#4-40 2-places on 1.812 (46.03) bolt circle				
Operating Temp, °C	-40 to +85	-25 to +100	-25 to +85	-25 to +100	0 to +70
Storage Temp, °C	-55 to +125		-40 to +100	-55 to +125	-40 to +125
Relative Humidity	90%, non-condensing				
Shock, g	100 (6 ms duration)				
Vibration, Hz	10 - 2000 at 10 g				
Environmental Protection	IP 40				

### Incremental Encoder Connections

Model	S21A		S21D, S21H		S21W		S21C	
Connector	DF11-8DP-2V				F1-W15P-HFE		B10B-ZR (LF)(SN)	
	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin
	NCOS	1	A	1	VDC	1	SLI+	1
	PCOS	2	A-	2	GND	2	SLI-	2
	NSIN	3	B	3	N/A	3	MAO-	3
	PSIN	4	B-	4	Z-	4	MAO+	4
	NZ	5	Z	5	Z	5	MA+	5
	PZ	6	Z-	6	B-	6	MA-	6
	VDC	7	VDC	7	B	7	SLO-	7
	GND	8	GND	8	A-	8	SLO+	8
					A	9	5 VDC	9
					N/A	10	GND	10
					W	11		
					N/A	12		
					V	13		
					N/A	14		
					U	15		

## Series 21 Hollow-Shaft Rotary Optical Encoders

### SPECIFICATIONS - ABSOLUTE ENCODERS

Model	S21B Series	S21G Series	S21P Series
Type	Absolute, Serial	Absolute, Serial	Absolute, Parallel
Format	2-wire or 3-wire SSI binary	2-wire or 3-wire SSI Gray code	Parallel Gray code
Resolution	8- to 16-bit binary SSI	8- to 16-bit Gray code SSI	13-Bit Gray code
Frequency Response	5 MHz clock		300 kHz word rate
Output	SSI driver (75179)		TTL push-pull driver
Power Supply	+5 VDC, 45 mA		+5 VDC, 60 mA
Max. Shaft Bore, in. (mm)	0.5 (12.7)		
Min. Shaft Length, in. (mm)	0.250 (6.35)		
Max. Shaft Length, in. (mm)	1.125 (28.58) through shaft option		
Axial Shaft Movement, in. (mm)	±0.025 (0.635)		±0.010 (0.254)
Max. Shaft Speed (RPM)	10,000 Max.		
Mounting Pattern, in. (mm)	#4-40 2-places on 1.812 (46.03) bolt circle		
Operating Temp, °C	0 to +70		-40 to +85
Storage Temp, °C	-40 to +125		-55 to +100
Relative Humidity	90%, non-condensing		
Shock, g	100 (6 ms duration)		
Vibration, Hz	10 - 2000 at 10 g		
Environmental Protection	IP 40		

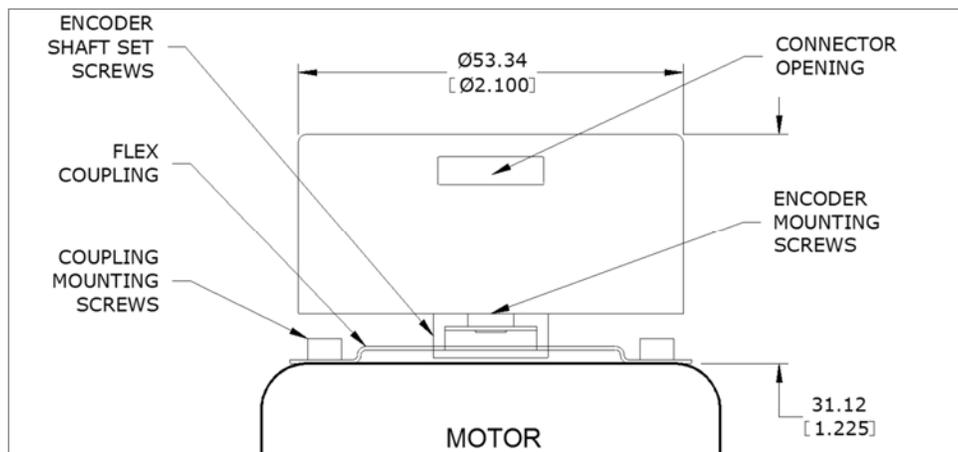
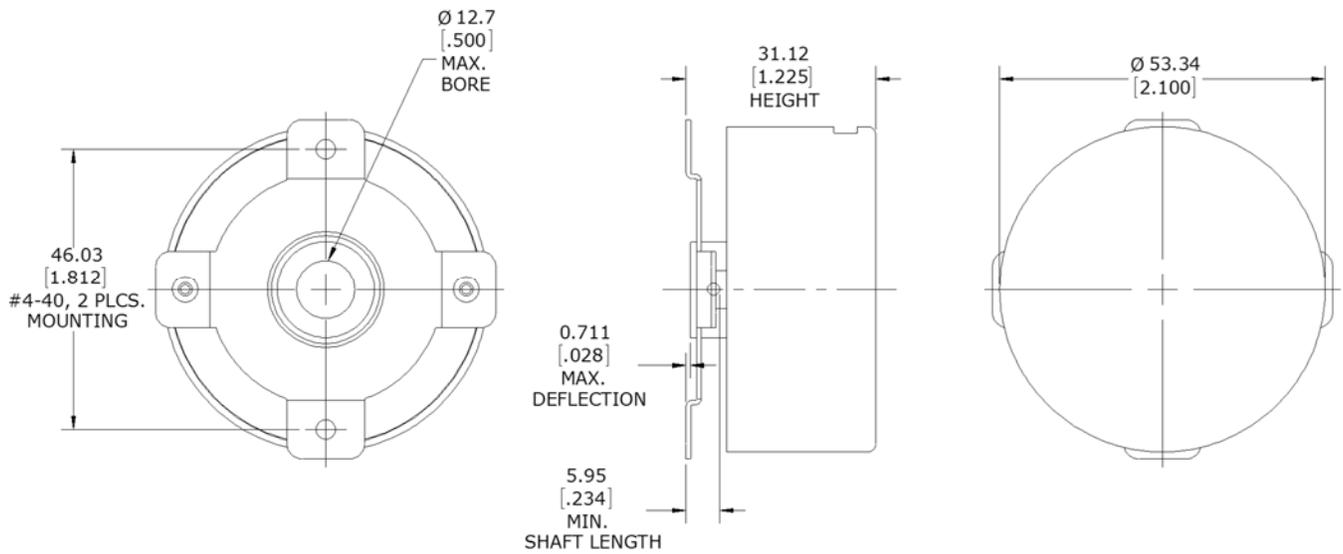
### Absolute Encoder Connections

Model	S21B, S21G		S21P	
Connector	DF11-8DP-2V		F1-W15P-HFE	
	Signal	Pin	Signal	Pin
	DATA+	1	GND	1
	DATA-	2	VDC	2
	CLOCK+	3	G12	3
	CLOCK-	4	G11	4
	5 VDC	5	G10	5
	GND	6	G9	6
	NC	7	G8	7
	NC	8	G7	8
			G6	9
			G5	10
			G4	11
			G3	12
			G2	13
			G1	14
			G0	15

# Encoders

## Series 21 Hollow-Shaft Rotary Optical Encoders

### DIMENSIONS

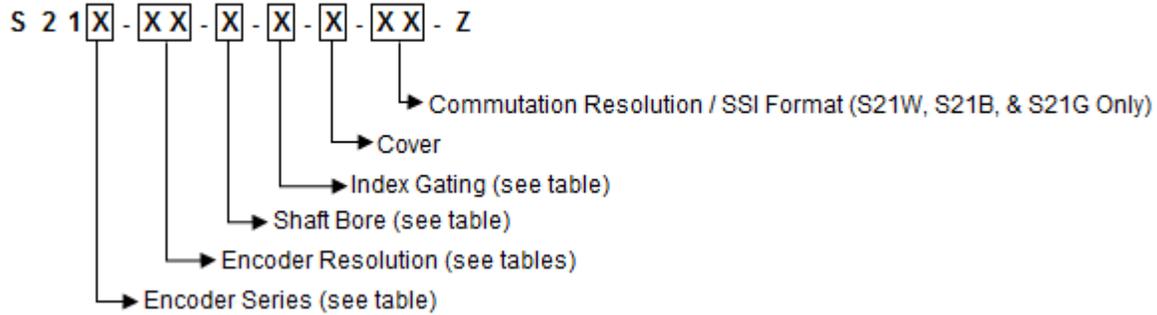




# Encoders

## Series 21 Hollow-Shaft Rotary Optical Encoders

### MODEL NUMBERING



Series
A = Analog
B = Binary Code
C = BiSS
D = Digital
G = Gray Code
H = High Count
P = Parallel
W = Commutation

Shaft Bore
1 = 0.2498 in.
2 = 0.2501 in.
3 = 0.3123 in.
4 = 0.3748 in.
5 = 0.3751 in.
6 = 0.5001 in.
7 = 6 mm
8 = 8 mm
9 = 10 mm

Index Gating
1 = QUAD 1
2 = QUAD 2
3 = QUAD 3
4 = QUAD 4
5 = A
6 = B
7 = A-
8 = B-
9 = 360°

Cover
1 = Blank
2 = Through Hole

Commutation / SSI
2 = 2 Wire
3 = 3 Wire
4 = 4-Pole
6 = 6-Pole
8 = 8-Pole
10 = 10-Pole
12 = 12-Pole

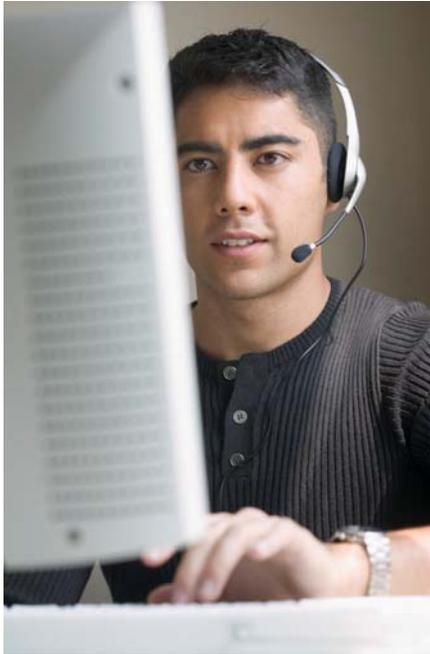
Resolution	
01	900
02	1000
03	1024
04	1800
05	2000
06	2048
07	2700
08	3000
09	3072
10	3600
11	4000
12	4096
13	4500
14	5000
15	5120
16	5400
17	6000
18	6144
19	6250
20	6400
21	7200
22	8000
23	8192
24	9000

Resolution	
25	10000
26	10240
27	10800
28	12000
29	12288
30	12500
31	12800
32	14400
33	16000
34	16384
35	18000
36	20000
37	20480
38	21600
39	22500
40	24000
41	24576
42	25000
43	25600
44	28800
45	31250
46	32000
47	32768
48	40000

Resolution	
49	40960
50	43200
51	45000
52	48000
53	49152
54	50000
55	51200
56	62500
57	64000
58	65536
59	80000
60	81920
61	86400
62	90000
63	96000
64	98304
65	100000
66	102400
67	125000
68	128000
69	131072
70	196608
71	200000
72	204800

Resolution	
73	250000
74	256000
75	262144
76	393216
77	400000
78	409600
79	500000
80	512000
81	524288
82	1024000
83	1048576
84	2048000
85	2097152

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