BEI Model H25X Absolute Optical Encoder

The H25X series single turn encoder is designed for those applications that require 14 or 15 bits of resolution in a compact, easy-to-integrate package. Gray Code and Natural Binary outputs are available for installations using a parallel input with the controller. For simplicity of data transmission, ease of cabling and better noise immunity, an SSI (Serial Synchronous Interface) is also offered. This encoder works with the BEI Serial-to-Parallel converter, allowing for system upgrades from parallel output to SSI.

The H25X is built to the exacting mechanical standards used with the H25 design, including: dual preloaded ABEC 7 bearings; matched thermal coefficients on critical components and electronically centered code disks for high accuracy and stability over a range of environments. Specify the H25X when you need high pointing accuracy and ruggedness in a 14 or 15 bit absolute encoder for your telescope, antenna, robotics, material handling or general industrial automation.

Figure 1
Gray Code

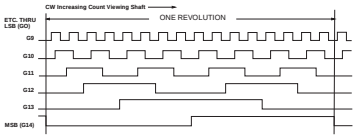
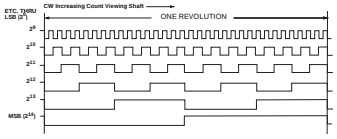
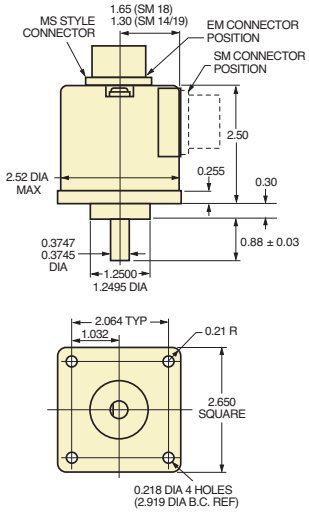


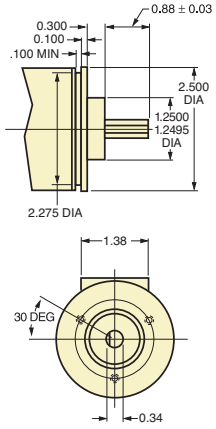
Figure 2
Natural Binary



H25XD Square Flange

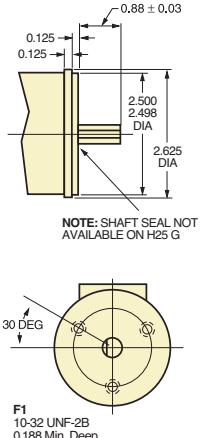


H25XE 2.50 Servo Mount



F4
6-32 UNC-2B
0.250 Min. Deep
3 places equally spaced
on a 2.00 Dia. bolt circle.

H25XG 2.62 Dia Servo Mount



NOTE: SHAFT SEAL NOT AVAILABLE ON H25 G

F1
10-32 UNF-2B
0.188 Min. Deep
3 places equally spaced
on a 1.875 Dia. bolt circle.

TOLERANCES: .XX = ± 0.01, .XXX = ± 0.005

Mechanical Specifications

Shaft Diameter: 3/8" (1/2"as special feature)
Flat On Shaft: 3/8" Shaft: 0.80 long X 0.03" deep; 1/2" Shaft: 0.80 long X 0.04" deep
Shaft Loading: 3/8" shaft: Up to 25 pounds axial and radial; 1/2" shaft: Up to 90 pounds axial and 80 pounds radial
Shaft Runout: 0.0005 T.I.R. at midpoint regardless of shaft diameter
Starting Torque at 25°C: Without shaft seal 1.0 in-oz (max); With shaft seal 8 in-oz (max); 1/2" shaft with shaft seal: 3.5in-oz (max)
Bearings: Class ABEC 7 standard, ABEC 5 for 1/2" shaft
Shaft Material: 416 stainless steel
Bearing Housing: Die cast aluminum
Cover: Die cast aluminum
Bearing Life: 2 X 10^8 revs (1300 hrs at 2500 RPM) at rated load 1 X 10^{10} revs (67,000 hrs at 2500 RPM) at 10% of rated load
Maximum RPM: 12,000 RPM nominal, 8000 RPM with 1/2" shaft (see Frequency Response, below)
Moment of Inertia: 4.1 X 10^{-4} oz-in-sec^2; 5.2 X 10^{-4} oz-in-sec^2 with 1/2" shaft
Weight: 13 oz typical, 14.5 oz typical with 1/2" shaft

Connector

MS3112E14-19P, 19–pin connector on encoder body, mates to MS3116F14-19S (or equivalent); MS3102R18-1P, 10-pin connector on encoder body, used for SSI

Electrical Specifications

Code: 14 or 15 bits NB or GC
Counts Per Shaft Turn: 16,384 or 32,768
Count Transition Accuracy: ± 1/2 bit max
Supply Voltage: 5 – 28 VDC
Current Requirements: 100 mA typical, output load 250mA max
Output Formats: Parallel: Gray Code, Natural Binary; Serial: Serial Synchronous Interface (SSI) compatible;
Voltage/Output:
28V/V: Line Driver, 5–28 VDC in, $V_{out} = V_{in}$
28V/5: Line Driver, 5–28 VDC in, $V_{out} = 5$ VDC
28V/OC: Open Collector, 5–28 VDC in, OC_{out}
SSI: 5–28 VDC in, $V_{out} = 5$ VDC
Protection Level: Reverse, overvoltage and output short circuit protection (7272 only)
Frequency Response: 500kHz (1830 RPM for 14-bits, 915 RPM for 15-bits)

Environmental Specifications

Enclosure Rating: NEMA 4 & 13 (IP 66) when ordered with shaft seal (on units with an MS connector) or a cable gland (on units with cable termination).
Temperature: Operating, 0° to 70° C; extended temperature testing available; Storage, -25° to 90° C unless extended temperature option called out.
Shock: 50 g's for 11 msec duration
Vibration: 5 to 2000 Hz @ 20 g's
Humidity: 98% RH without condensation

H25X Absolute Ordering Options FOR ASSISTANCE CALL 800-350-2727

Use this diagram, working from left to right to construct your model number (example: H25XD-F4-SS-14GC-28V/V-CW-SM14/19).

H25X – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ] – [ ]

TYPE:
Heavy Duty
2.5 inch Dia.
X=Extended Resolution

HOUSING :
D = Square Flange
E = 2.5 inch dia. servo mount
G = 2.62 inch dia. servo mount
See dimensions

FACE MOUNTS:
F1
F4

SHAFT SEAL CONFIGURATION:
SS = Shaft Seal

NUMBER OF BITS:
14 = 14-Bits, 16,384 counts per turn
15 = 15 Bits, 32,768 counts per turn

CODE TYPE:
GC = Gray Code
NB = Natural Binary

VOLTAGE/OUTPUT:
28V/V: 5–28$V_{in/out}$
28V/5: 5–28V_{in}/5V_{out}
28V/OC:5–28V_{in}/OC_{out}
S3 = Serial Synchronous Interface
See back

DIRECTION CONTROL:
CW = Clockwise increasing count
CCW = Counter clockwise increasing count

OUTPUT TERMINATION LOCATION:
E = End
S = Side

TERMINATION TYPE:
M14/19 = 19 pin connector (Parallel)
M18=10Pin(SSI)
CS= Cable with gland seal
Cable length specified in inches
(i.e. C18 = Pigtail 18" long)
See termination tables on back

SPECIAL FEATURES:
S = Special features specified on purchase order (consult factory)

BEI INDUSTRIAL ENCODERS Tel: 805-968-0782 / 800-350-2727 | Fax: 805-968-3154 / 800-960-2726 | 7230 Hollister Ave., Goleta, CA 93117-2807 | **www.beiied.com**

Specification No. 924-02085-001F Rev. 06-07

Serial Synchronous Interface (SSI)

SSI output provides effective synchronization in a closed-loop control system. A clock pulse train from a controller is used to clock out sensor data: one bit of position data is transmitted to the controller per one clock pulse received by the sensor. The use of a differential driver permits reliable transmission of data over long distances in environments that may be electrically noisy. The encoder utilizes a clock signal, provided by the user interface, to time the data transmission. Receiving electronics must include an appropriate receiver as well as line terminating resistors.

Features

- Synchronous transmission
- Transmission lengths to 1000 feet
- Accepts clock rates from 100 KHz to 1.8 MHz

Data Transmission Sequence

1. Output driver of the encoder is a MAX 491 transceiver in transmit mode. It is recommended to use any RS–422/485 compatible receiver and provide a termination resistor based on the RS–422/485 specification for your specific voltage and DATA line strength.
2. The CLOCK signals are RS–422/485 compatible, differential TTL, with 180 Ohm termination resistor internal to the encoder. A series of pulses from the controller, on the CLOCK lines, advance the data.
3. On the first HIGH-to-LOW CLOCK transition, the encoder latches its data at the current position and prepares to transmit. The DATA signal during this transition is a START bit, which is always HIGH.
4. The encoder shifts data to the data line on each LOW-to-HIGH transition beginning with the MSB. The controller reads data on the HIGH-to-LOW transition of the next 16 CLOCK CYCLES ending with parity (optional and = logic 'lo' if not specified). Bit 15, if specified, is provided on the 15th CLOCK CYCLE and = logic 'lo' if 14 Bit encoder is specified.
5. Parity is even. The sum of all data bits and the parity bit is even.
6. After the last CLOCK High-to-LOW transition, a minimum of 40 microseconds must pass before the beginning of the next CLOCK series.

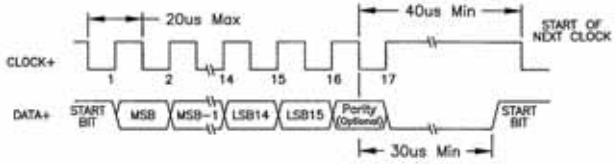
Interfacing Long Data Lines

Cable impedance can create a transmission delay, in effect, shifting the phase relationship between the clock pulse and the data. If this phase shift exceeds 180°, then the wrong bit position will be sampled by the receiver. As a result, the maximum allowable clock frequency is a function of the cable length. For 24 AWG, stranded, 3 pair cable (BEI part number 37048-003 or equivalent) the group delay is 1.36ns/ft. The table below shows the maximum transmission rate allowable as a function of cable length to ensure a phase shift of less than 90°.

CLOCK, Maximum (kHz) = 92,000 / Cable Length (ft)CW

Cable Length (ft)	50	100	200	300	500	1000
Max Freq (kHz)	1800	900	500	300	200	100

SSI Compatible Output with Parity Option Timing Diagram:



Example Encoder Model Number:

H25XD - SS - 14NB - S3 - CW - SM18 - S

To specify SSI Output

Specials: -S = Parity Bit

Parallel Code (14 & 15 Bit)					
	Gray Code		Natural Binary		M14/19 Connector
	14 BIT	15 Bit	14 BIT	15 Bit	
MSB	G_{13}	G_{14}	2^{13}	2^{14}	A
	G_{12}	G_{13}	2^{12}	2^{13}	B
	G_{11}	G_{12}	2^{11}	2^{12}	C
	G_{10}	G_{11}	2^{10}	2^{11}	D
	G_9	G_{10}	2^9	2^{10}	E
	G_8	G_9	2^8	2^9	F
	G_7	G_8	2^7	2^8	G
	G_6	G_7	2^6	2^7	H
	G_5	G_6	2^5	2^6	J
	G_4	G_5	2^4	2^5	K
	G_3	G_4	2^3	2^4	L
	G_2	G_3	2^2	2^3	M
	G_1	G_2	2^1	2^2	N
LSB14	G_0	G_1	2^0	2^1	P
LSB15	DIR CONTROL	G_0	DIR CONTROL	2^0	R
	CASE GROUND				S
	OV (CIRCUIT COMMON)				T
	LATCH	DIR/LATCH	LATCH	DIR/LATCH	U
	+V (SUPPLY VOLTAGE)	+V (SUPPLY VOLTAGE)	+V (SUPPLY VOLTAGE)	+V (SUPPLY VOLTAGE)	V

Direction Control: Standard is CW increasing when viewed from the shaft end. Direction Control is normally HI (or N/C) and is pulled up with a 10K ohm resistor internally to +V. To reverse the count direction, Direction Control must be pulled LO (COMMON).

Latch control: Encoder outputs are active and provide continuous parallel position information when latch is HI (or N/C). Latch is pulled up with a 10K ohm resistor internally to +V. When latch is LO (COMMON) the encoder outputs are held at the logic state present when the latch is applied and stays held until latch is no longer grounded.

Enable: Output is active when this pin is HI. When pulled LO (Circuit Common) all outputs go to high impedance state (Tri-state) and are inactive until LO state is removed. This pin is pulled HI with a 10K ohm resistor internally to +V.

15-Bit Encoders: Due to a limited number of connector pins, either direction control, latch or enable are available on Pin U. Direction control is standard. Latch or enable can be ordered as a special feature and will replace direction control on Pin U.

M18 Connector is a MS3102R18-1P, 10-pin connector on the encoder body and mates to an MS3106F18-1S connector or can be used with a standard cable/connector assembly, BEI P/N 924-31186-18XX (Where X = 10, 20 or 30 for a 10, 20, or 30 foot length). This is the preferred connector for SSI output.

M14/19 Connector is a MS3112E14-19P, 19-pin connector on the encoder body and mates to an MS3116F14-19S or equivalent. Or cable ASSY 31219–14x (XX = cable length in feet, i.e., 10, 20, 30 = 10, 20, 30 feet respectively)

SSI Compatible Serial Code (S3):					
		Connector		Term Board	
Function	Cable	M18	M14/19	H40	H38
DATA+	YEL	A	A	1	4
DATA-	WHT/YEL	H	B	7	7
CLOCK+	BLU	B	C	2	5
CLOCK-	WHT/BLU	I	D	8	8
DIRECTION CONTROL	ORN	C	R	3	6
ENABLE (OPTIONAL)	WHT/ORN	J	P	9	9
SUPPLY VOLTAGE (+V)	RED	D	V	4	3
CIRCUIT COMMON (OV)	BLK	F	T	5	2
CASE GROUND	GRN	G	S	6	1
SHIELD DRAIN	BARE	–	–	–	–