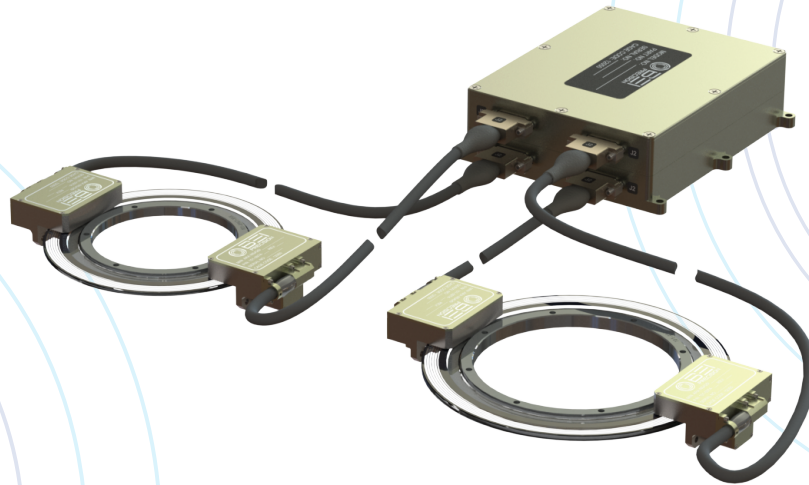


OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA**FEATURES:**

- Modular Kit Optical Encoder
- 28 bit True Absolute Angular Position Output
- Accurate to 1 arcsecond RMS (4.85 μ rad)
- Sample rate to 8 kHz
- Auto-Calibration Capable
- Radial & Tangential Alignment Mode
- Up to 100 krad(Si) radiation tolerant

APPLICATIONS:

- High reliability, Class A missions
- GEO Earth observing satellites
- Deep space, long life missions
- High-Bandwidth Servo Control
- High-Precision Gimbals

FOR MORE INFORMATION CONTACT
SALES@BEIPRECISION.COM

**OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA****DESCRIPTION:**

ARA is BEI Precision's flagship space qualified optical encoder in the nanoSeries® product line. It is the solution for elite space pointing applications when performance and reliability are the highest priority. ARA is a modular encoder design; it can take many forms depending on the application's requirements. Its base form consists of a single readhead, a code disk/hub assembly, and a remote electronics CCA. ARA is capable of supporting multiple axes, multiple readheads per axis, and full redundancy to ensure mission success. A single remote electronics CCA can support up to four readheads or axes. ARA transmits an unambiguous, true absolute rotary position with a resolution of 28 bits. No motion is required after power-up to determine this position.

ARA is a kit encoder, meaning that the optical components (code disk & readhead) can be shipped to the user separately. This gives users the option of aligning and calibrating the encoder at their facility – drastically reducing integration time. Rapid integration can also take place at BEI Precision's facility for users requiring a full performance evaluation on their mechanical assembly. Aligning these components is achieved easily with the introduction of Alignment Mode. This feature reports 2-axis linear alignment error between the readhead and code disk. It provides for quick centering of the code disk to the axis of rotation and alignment of the readhead to the disk. Furthermore, this information can be transmitted back to the user once on orbit to assess the health of the host mechanical assembly and encoder alignment. For detailed information on this feature see MM-247 ARA/AIME-II nanoSeries® Encoder Alignment Mode Technical Bulletin.

Once ARA is properly aligned, it can be calibrated over continuous full revolutions or partial revolution sweeps. This Self-Calibration feature eliminates schedule & cost by fine-tuning all of ARA's sinusoidal signals to achieve its high accuracy, even with a single readhead, in a matter of minutes. Many years of R&D into advanced algorithms have resulted in ARA's self-calibration that achieves a very robust, accurate position word. Best of all, this calibration can be updated while on orbit without ever losing track of position. To account for all contingencies, ARA's self-calibration feature is a must-have.

OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA

GENERAL SPECIFICATIONS:

	Quanta/ Revolution	Resolution (Arc Seconds)	Accuracy (RMS) (Arc Seconds)	Speed (lrps for full accuracy)
NSA 28/xxx	268,435,456 (28-bit)	0.077 (0.375 μrad)	1.0 ⁽¹⁾	5 max
Interrogation Rate/Acquisition Time	8 kHz max./64 μsec typ. Acquisition			
Operating Temperature Range	-40°C to +73°C (Derated per EEE-INST-002)			
Storage Temperature Range	-55°C to +90°C			
Input Voltage	5 VDC ± 5%			
System Power (1 readhead, non-redundant)	4.5 Watts max. @ 5 VDC			
Readhead Power Dissipation	0.73 Watts max.			
EEE Parts Rating	EEE-INST-002 Level 1 or 2, or Engineering Prototype Level			
Vibration	20.7 grms from 10 to 2000 Hz per MIL-STD-202, Method 214, Cond. B			
Communications	ISS ⁽³⁾ over LVDS per TIA/EIA-644			
Radiation Tolerance	100 krad (Si) Total Ionizing Dose			

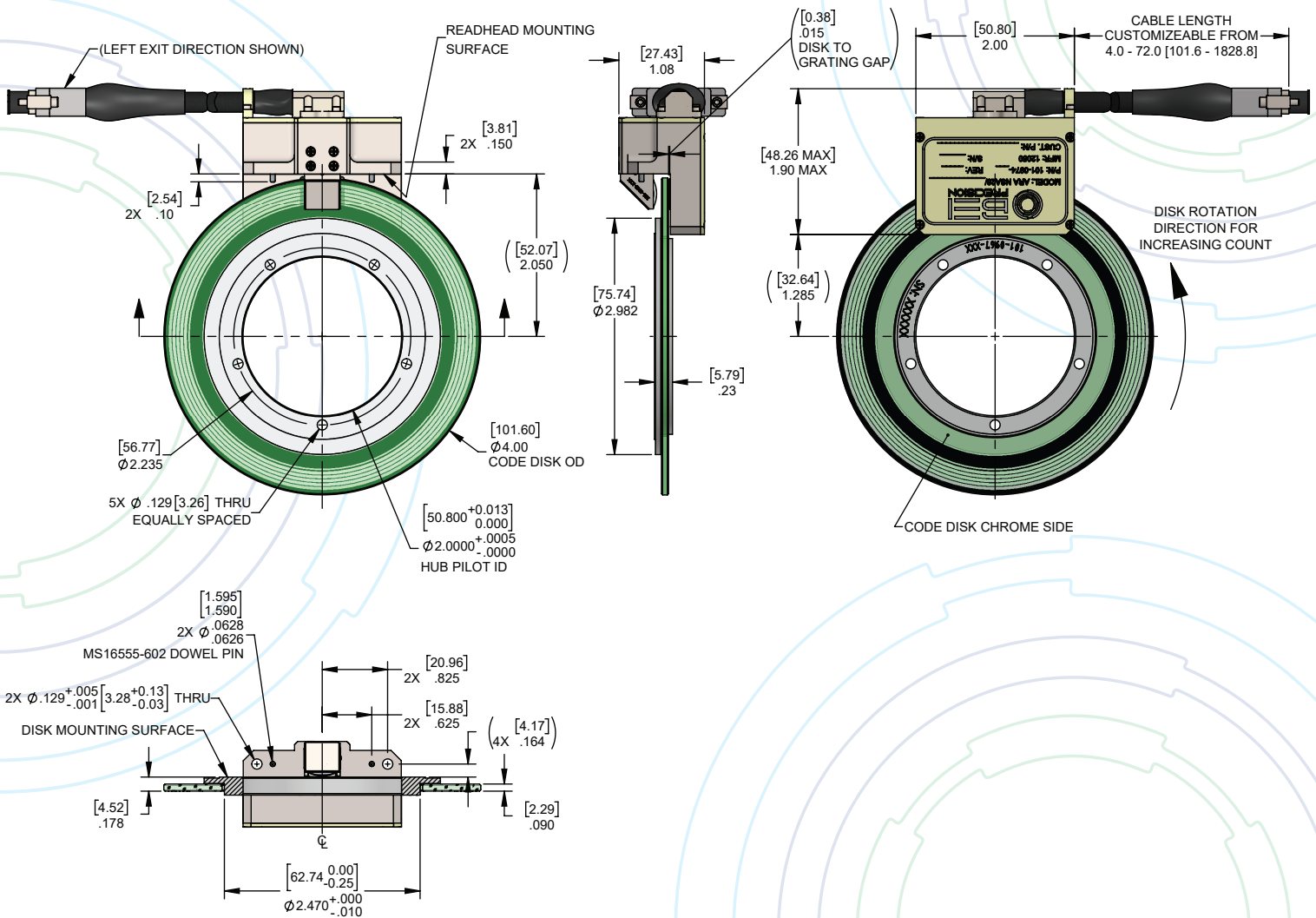
Mass, Max (grams)		Component	Material Option ⁽²⁾	
Remote Box Max. Mass (grams)			Stainless Steel	Titanium
Single Box	Redundant Box	Readhead with 72" cable	269	223
345	625	Readhead with L" cable	134.3+1.87(L)	88.7+1.87(L)
		3.00" Disk/Hub	59	44
		4.00" Disk/Hub	97	72
		5.00" Disk/Hub	144	98
		6.00" Disk/Hub	243	166
		7.25" Disk/Hub	292	210

Shock Response Spectrum		Analyses on File	
Frequency (Hz)	Shock (g's)	Power Dissipation EEE Parts Stress & Derating Thermal (Readhead & Rem. Box) EMC Susceptibility Parts Radiation Tolerance Reliability Prediction Parts & Material List	Structural Venting Signal Degradation Resolution & Accuracy ESD Sensitivity FMEA Humidity & Coating Prop.
200	1.4		
1250	564		
5200	564		
7200	1551		

(1) Single readhead, not including spindle errors

(2) Structural component materials are limited to readhead housing, disk hub, and optics housing. Other components are made of aluminum

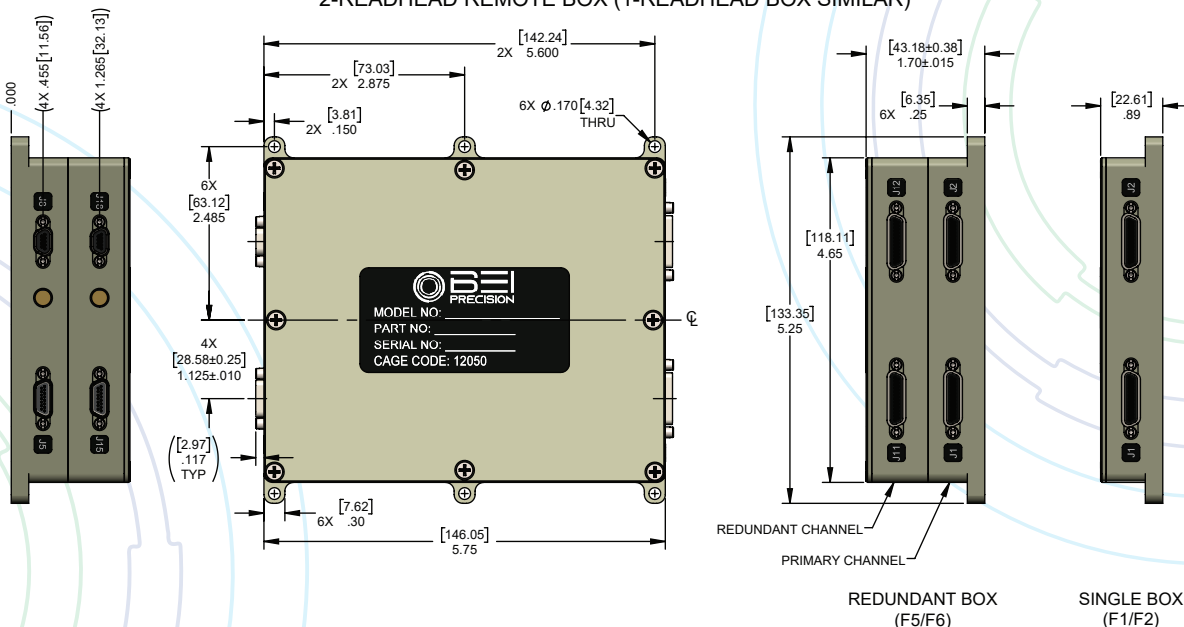
(3) See Technical Bulletin MM-248

OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA
OPTICAL UNIT COMPONENTS, IN INSTALLED STATE
 (4.00" CODE DISK & SINGLE LEFT-EXIT READHEAD SHOWN)

NOTES:

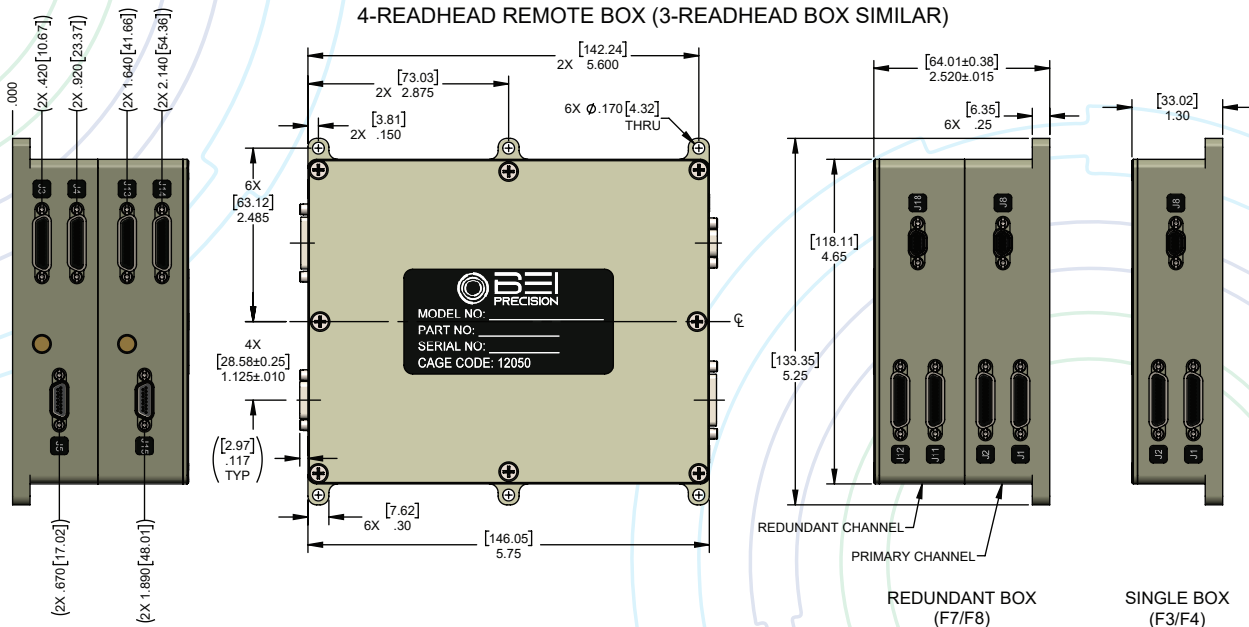
- SEE APPLICABLE OUTLINE DRAWING FOR COMPLETE DIMENSIONAL SPECIFICATIONS AND MOUNTING INTERFACE RECOMMENDATIONS.
 - 190-0314-01 (3.00")
 - 190-0314-02 (4.00")
 - 190-0314-03 (5.00")
 - 190-0314-04 (6.00")
 - 190-0314-05 (7.25")
- UNBRACKETED DIMENSIONS ARE INCHES AND BRACKETED [X.XX] DIMENSIONS ARE MILLIMETERS.

OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA

2-READHEAD REMOTE BOX (1-READHEAD BOX SIMILAR)



4-READHEAD REMOTE BOX (3-READHEAD BOX SIMILAR)



NOTES:

- SEE APPLICABLE OUTLINE DRAWING FOR COMPLETE DIMENSIONAL SPECIFICATIONS.
 - 184-9025-01 (2-READHEAD SINGLE BOX [F2])
 - 184-9025-02 (2-READHEAD REDUNDANT BOX [F6])
 - 184-9025-03 (4-READHEAD SINGLE BOX [F4])
 - 184-9025-04 (4-READHEAD REDUNDANT BOX [F8])
 - 184-9025-05 (1-READHEAD SINGLE BOX [F1])
 - 184-9025-06 (1-READHEAD REDUNDANT BOX [F5])
 - 184-9025-07 (3-READHEAD SINGLE BOX [F3])
 - 184-9025-08 (3-READHEAD REDUNDANT BOX [F7])
- UNBRACKETED DIMENSIONS ARE INCHES AND BRACKETED [X.XX] DIMENSIONS ARE MILLIMETERS.

CONNECTORS

DESCRIPTION	DESIGNATOR	
	PRIMARY	REDUNDANT
READHEAD 0	J1	J11
READHEAD 1	J2	J12
READHEAD 2	J3	J13
READHEAD 3	J4	J14
HOST I/O	J5	J15
DEBUG	J8	J18

OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA
GENERAL SPECIFICATIONS:

The standard nanoSeries® ARA output connector is a 15-pin Micro-D connector (M83513/04-B14N) type with the following pinout:

Pin	Signal Name	I/O	Description
1	HOST_CMD_CLK_P	LVDS	DIFFERENTIAL CLOCK RECEIVED FROM THE HOST FOR LATCHING CMD
2	HOST_CMD_CLK_N	LVDS	
4	HOST_CMD_P	LVDS	DIFFERENTIAL COMMAND DATA BUS RECEIVED FROM THE HOST
5	HOST_CMD_N	LDVS	
10	HOST_DATA_CLK_P	LDVS	DIFFERENTIAL CLOCK TRANSMITTED TO THE HOST FOR LATCHING DATA
11	HOST_DATA_CLK_N	LDVS	
13	HOST_DATA_P	LDVS	DIFFERENTIAL DATA BUS TRANSMITTED TO THE HOST
14	HOST_DATA_N	LDVS	
7	DC_5V	PWR	5VDC INPUT
15	DC_RTN	PWR	POWER GND
9	CHASSIS	GND	CHASSIS GND
3	SPARE 1	TBD	NOT USED
6	SPARE 2	TBD	NOT USED
8	SPARE 3	TBD	NOT USED
12	SPARE 4	TBD	NOT USED

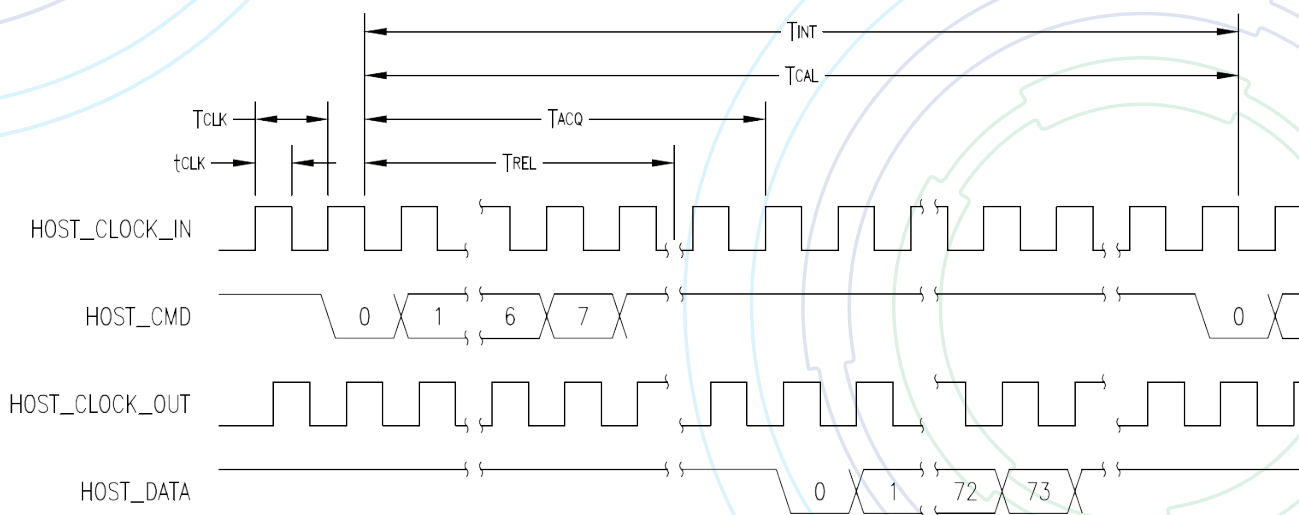
OUTPUT PROTOCOL:


Figure 1.
 Electrical Interface Timing Diagram (System)
 Timing Values Per Table 1

OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA

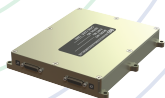
Table 1. Electrical Interface Timing Values (See 190-0308-05 For Details)

Parameter	Symbol	Min	Typical	Max	Units
Encoder Interrogation Period	T_{INT}	125	–	–	μ S
Encoder Interrogation Period During Calibration	T_{CAL}	250	–	–	μ S
Encoder Data Relevancy	T_{REL}	14	16	18	μ S
Encoder Data Acquisition Time	T_{ACQ}		64*		μ S
Host Clock Period	T_{CLK}	100	–	1000	nS
Host Clock Duty Cycle	T_{CLK}	45	50	55	%

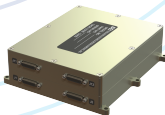
*+1.5 to 2.5 Host CLK Cycles

SPECIAL MODELS:

Many other sizes and configurations are possible at a nominal NRE fee. Available options (priced separately) include special materials, cable or connector variations, custom disk or remote box sizing, etc. Contact the factory for price and delivery information.

ARA CONFIGURATIONS & OPTIONS:
Remote Electronics Options


Single



Redundant

1 Axis:

2 Axis:

3 Axis:

4 Axis:

Axes option for Single Readhead


X2

X3

X4

Axes option for Dual Readhead


X2

Code Disk Diameter

 3.0" to 7.25 OD
 Standard Configuration

 Other sizes available
 with NRE

Other Options

- Stainless or Titanium Housings
- Readhead Cable Length
- Readhead Cable Exit Direction
- EEE Parts Qualification Level

(All Shown without redundancy)

ORDERING INFORMATION:

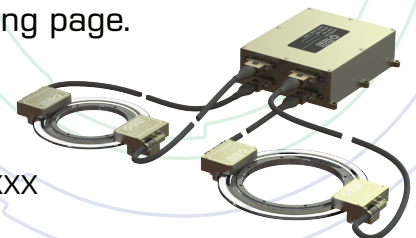
The ARA encoder system is completely described with two model number schemes. The first model number describes the readhead & code disk options. The second model number describes the remote box and specifies the number of axes that a particular ARA system is sensing. See model numbering schemes on the following page.

Example of a Single Readhead, 2-Axis, Redundant System:

5" Disk & Readheads, Ti, Space Level 2 → NSA28/500R3M2S2-LXX-LXX

6" Disk & Readheads, Ti, Space Level 2 → NSA28/600R3M2S2-LXX-LXX

Remote Box, Redundant, Space Level 2 → NSARB/F6E2P1D1S2500600-AXXX-AXXX



OPTICAL ENCODER > ABSOLUTE KIT ENCODER > ARA

