Zettlex

Precision in the Extreme

Product Guide
IncOder™
Inductive Angle Encoders

Version 4.00 January 2012

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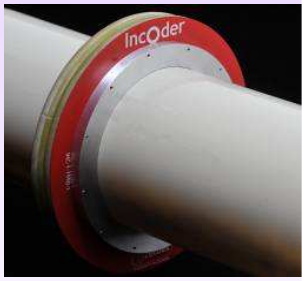
- ☑ No contacts
- ☑ No bearings
- ☑ No couplings
- ☑ No maintenance
- ☑ Absolute
- ☑ Compact
- ☑ Easy installation
- ☑ Accurate
- ☑ Robust
- ☑ Integral electronics
- ☑ Digital output
- ☑ Economical
- ☑ Global support

……..it ticks all the boxes







Zettlex IncOders are non-contact, absolute angle measuring devices. They use a unique inductive technique and may be considered as an inductive encoder.

IncOders are ideally suited to applications that need precise measurement in harsh environments - where electrical contacts, optical or capacitive devices may prove unreliable.

IncOders have 2 parts – a Stator and a Rotor. Each is shaped like a flat ring. The large bore makes it easy to accommodate through shafts, slip rings, optic fibres, pipes, cables etc.

The Stator is powered and the Rotor is passive. The Stator contains all electronics necessary to receive power and generate the output signals. The output signals from the Stator show the absolute position of the Rotor relative to the Stator right from power up.

There is no need for compliant couplings and the Rotor & Stator can simply be connected to the host product. Precise mechanical mounting is not required and there are no bearings.

Operation is unaffected by condensation or dust. Robust, anodized aluminium alloy housings and monolithic constructions are used for both Rotor and Stator.

There are no contacting, delicate or wearing parts which means no need for periodic replacement, service or maintenance.

IncOders are used in a wide variety of applications including:-

- Rotary joints & gimbals
- Actuator servos & motor encoders
- Electro-optic & infra-red camera systems
- Heliostats & solar equipment
- Robotic arms & CNC Machine tools
- Test & calibration equipment
- Light & heavy calibre weapons systems
- Targeting systems & range finders
- Antenna pointing devices & telescopes
- Packaging & laboratory automation
- Medical scanners & surgical equipment
- Cranes & telescopic manipulators.

IncOders have a solid track record in safety related applications including airborne equipment and weapons systems.

IncOders are made in the United Kingdom, contain no ITAR restricted components and do not require an arms export licence unless they are >1000mm diameter.

Standard Products

The standard IncOder range offers various options and accessories. The options are specified using the IncOder part number when you order (see page 18). Each IncOder contains one Stator and one Rotor.

Mechanical Format : Servo Clamp format or Screw Mount format. It is possible to mix Servo format Rotor with Screw Mount format Stator and vice versa – see part numbering data on page 18.

Size of IncOder : stated as outer diameter: 75, 100, 125, 150, 175, 200, 225 & 250mm.

Communication Interface : SSI or asynchronous serial data interface. *Optimal choice depends on the nature of the resident, host control system. Both options cost the same. For new applications we recommend asynchronous serial interface.*

Connector Orientation : axial or radial.

Voltage : 5, 12 or 24VDC

Accessories

Accessories may be purchased separately from the main IncOder.

Cable : supplied with 2m long PVC sheathed and shielded cable with a plug connector (with 2 jack screws) to match IncOder's socket connector on the Stator.

Servo Clamp : supplied with M3 stainless steel screw and stainless clamp with internal nylon lock.





Custom Products

Zettlex can customize IncOders to specific OEM requirements. Options include alternative:-

- size (up to 570mm outer diameter)
- mechanical mounts and materials including stainless steel
- voltage supplies
- electrical outputs
- measurement performance (up to 24 bit resolution)
- connectors & cables
- surface finish – clear anodized, chromate or black anodized
- temperature range
- low weight or low inertia
- ATEX certified.

Simply consult Zettlex or your local representative for further information. Typically, custom products are an economical option for OEMs in volumes of >50 units/year.

The images below show some examples of customized IncOders:-

End of shaft arrangement with black anodized custom housing & military style connector for fighting vehicles.

Custom housing with chromate surface finish & integral cable for remotely controlled gimbal.

Ultra lightweight unit for airborne application.

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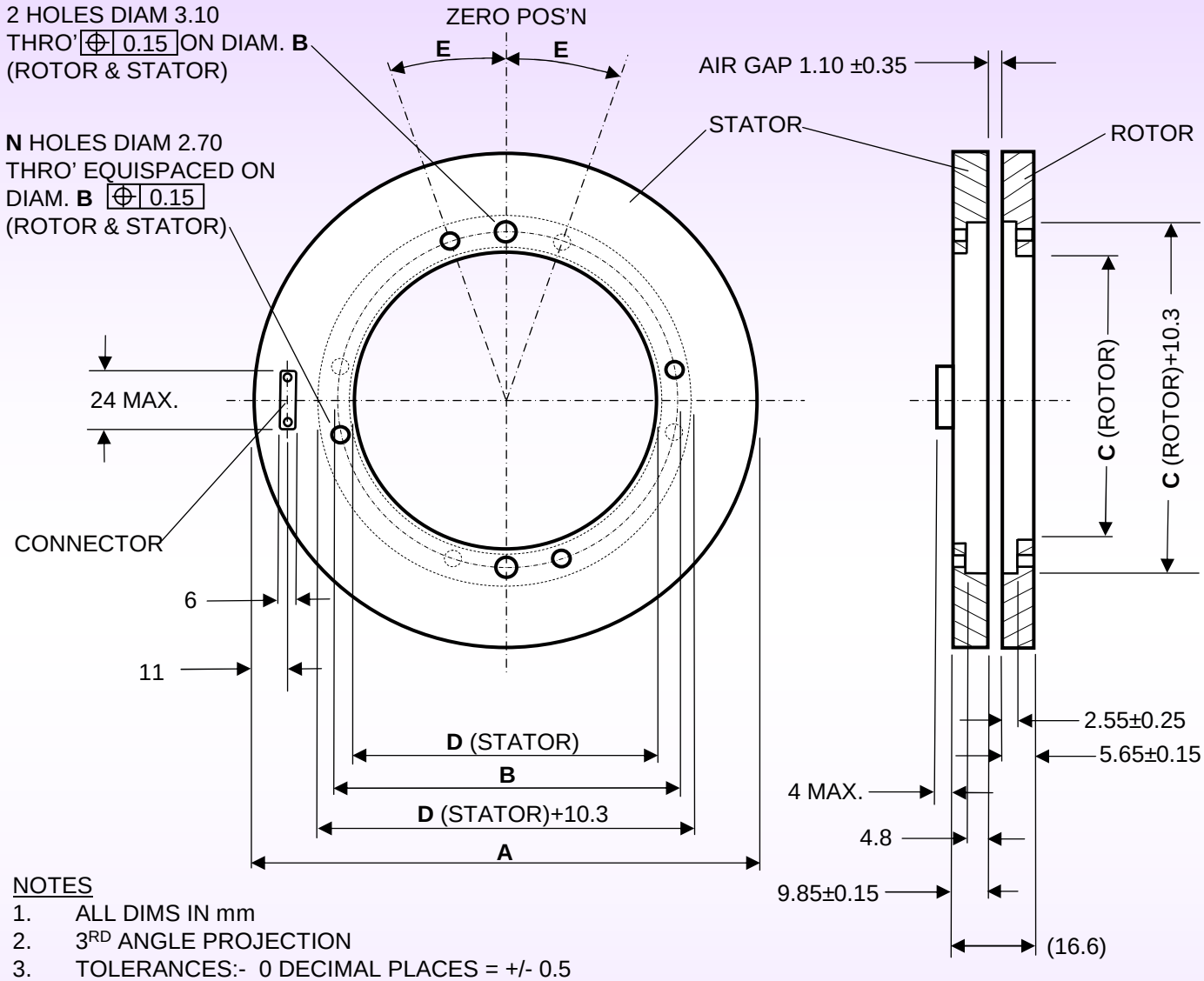
Dimensions – Screw Mount Format – INC-3



NOTES
1. ALL DIMS IN mm
2. 3RD ANGLE PROJECTION
3. TOLERANCES:- 0 DECIMAL PLACES = +/- 0.5
1 DECIMAL PLACES = +/- 0.2
2 DECIMAL PLACES = +/- 0.1

UNIT SHOWN WITH AXIAL CONNECTOR

	INC-3-75	INC-3-100	INC-3-125	INC-3-150	INC-3-175	INC-3-200	INC-3-225	INC-3-250	
Dim. A - Stator / Rotor Body O.D.	75 ± 0.1	100 ± 0.1	125 ± 0.1	150 ± 0.1	175 ± 0.1	200 ± 0.1	225 ± 0.1	250 ± 0.1	mm
Dim. B. - Pitch Circle Diameter	30.5 ± 0.1	55.5 ± 0.1	80.5 ± 0.1	105.5 ± 0.1	130.5 ± 0.1	155.5 ± 0.1	180.5 ± 0.1	205.5 ± 0.1	mm
Dim. C. - Rotor I.D.	25 ± 0.1	50 ± 0.1	75 ± 0.1	100 ± 0.1	125 ± 0.1	150 ± 0.1	175 ± 0.1	200 ± 0.1	mm
Dim. D. - Stator I.D.	25.8 ± 0.1	50.8 ± 0.1	75.8 ± 0.1	100.8 ± 0.1	125.8 ± 0.1	150.8 ± 0.1	175.8 ± 0.1	200.8 ± 0.1	mm
Dim E - Offset Angle from T.D.C.	30	30	30	30	30	30	30	20	degrees
N Number of screw clearance holes	4	4	4	6	6	6	6	8	
Max. radial misalignment	0.25								mm
Rotor & stator fixings	Steel screws cap head M2.5 & steel dowels M3								

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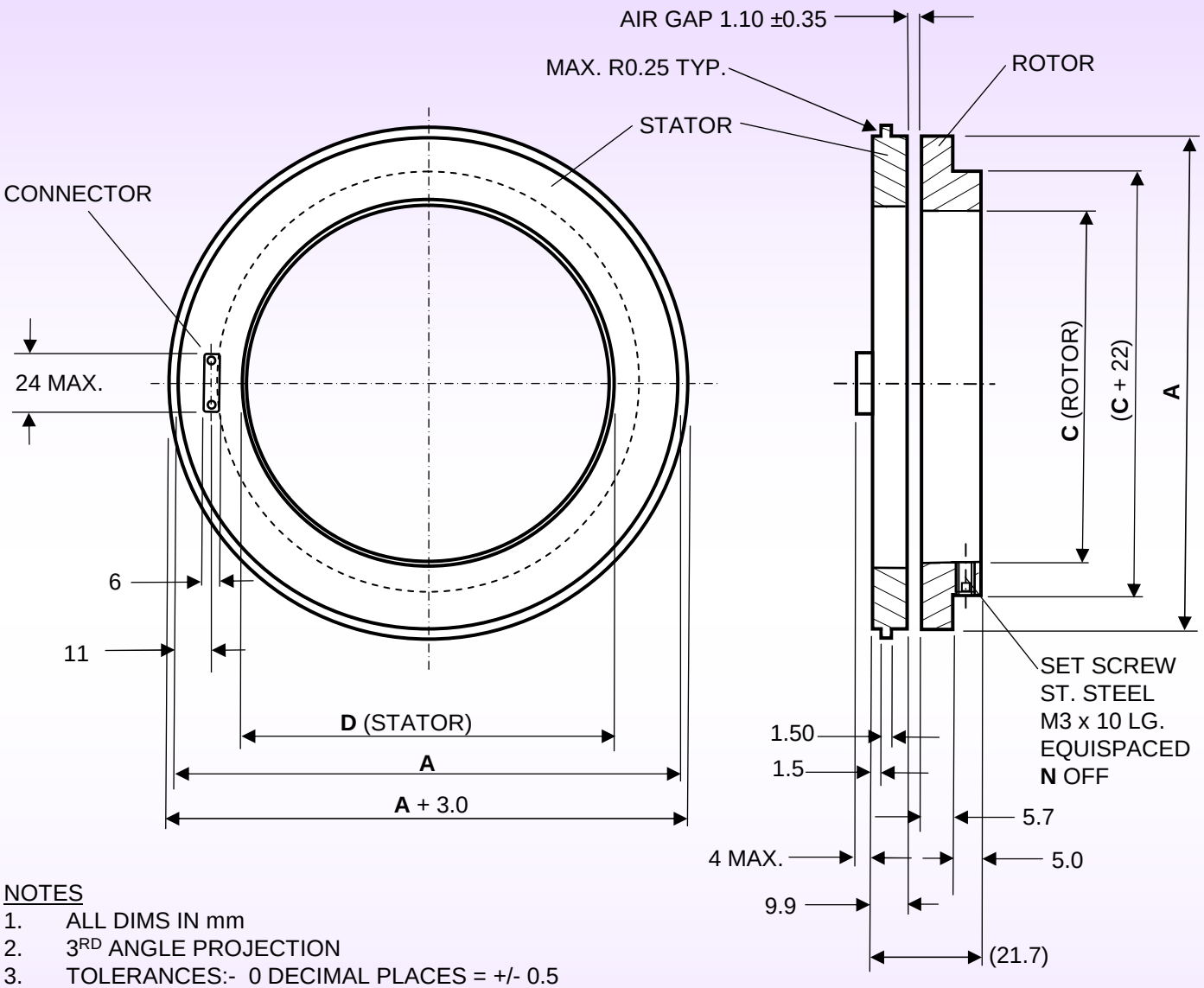
Dimensions – Servo Clamp Format - INC-4



NOTES
1. ALL DIMS IN mm
2. 3RD ANGLE PROJECTION
3. TOLERANCES:- 0 DECIMAL PLACES = +/- 0.5
1 DECIMAL PLACES = +/- 0.2
2 DECIMAL PLACES = +/- 0.1

UNIT SHOWN WITH AXIAL CONNECTOR

	INC-4-75	INC-4-100	INC-4-125	INC-4-150	INC-4-175	INC-4-200	INC-4-225	INC-4-250	
Dim. A - Stator / Rotor Body O.D.	75 ± 0.1	100 ± 0.1	125 ± 0.1	150 ± 0.1	175 ± 0.1	200 ± 0.1	225 ± 0.1	250 ± 0.1	mm
Dim. C. - Rotor I.D.	35 ± 0.1	60 ± 0.1	85 ± 0.1	110 ± 0.1	135 ± 0.1	160 ± 0.1	185 ± 0.1	210 ± 0.1	mm
Dim. D. - Stator I.D.	36.0 ± 0.1	61.0 ± 0.1	86.0 ± 0.1	111.0 ± 0.1	136.0 ± 0.1	161.0 ± 0.1	186.0 ± 0.1	211.0 ± 0.1	mm
N Number of Set Screws	3	3	3	3	4	4	6	6	
Max. radial misalignment	0.25								mm
Rotor & stator fixings	Rotor by Set Screws St. Steel (supplied) and Stator by Servo Clamps (ordered separately - see Accessories)								

Radial Connector Dimensions

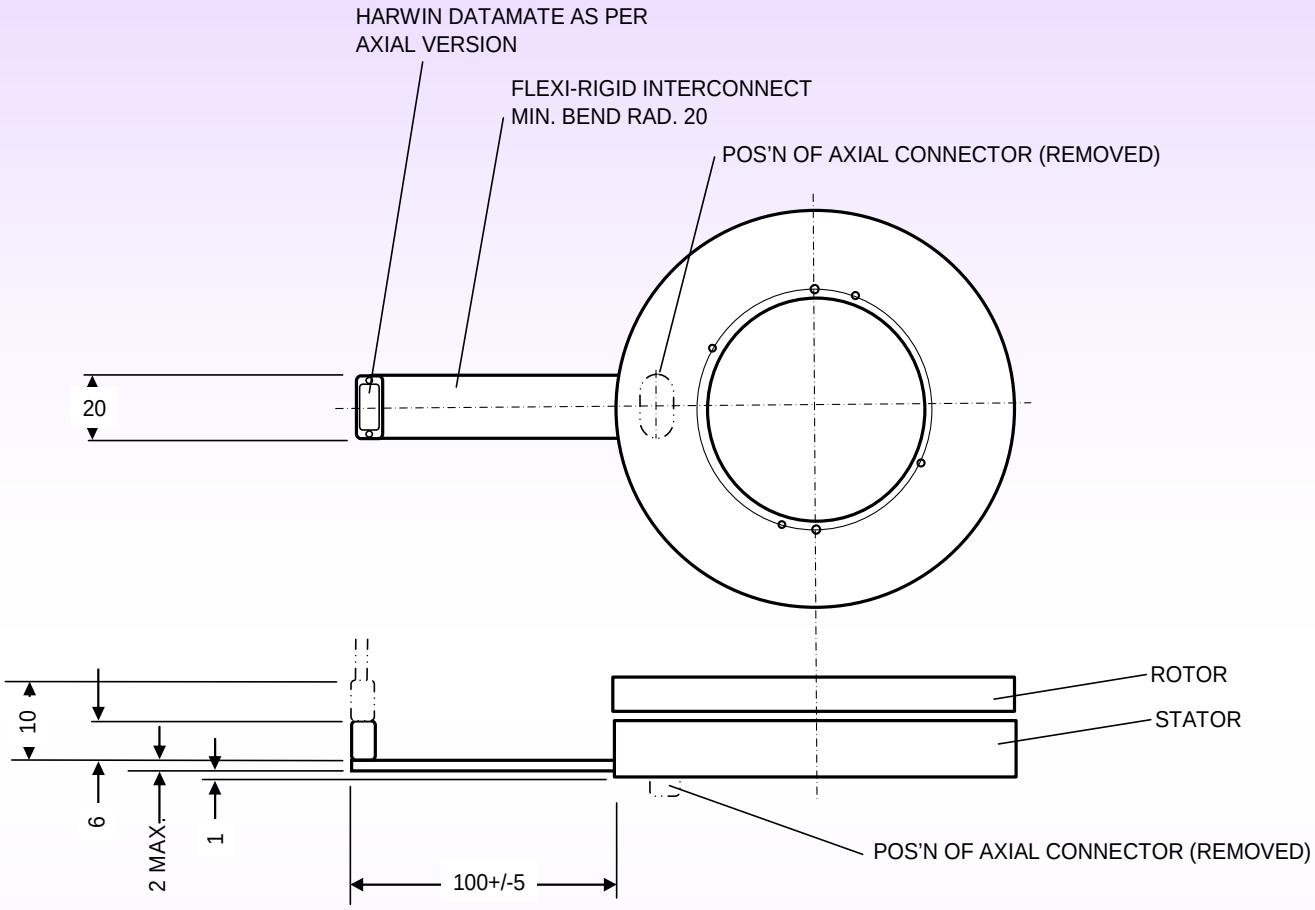


Photo of IncOder type INC-3-125 with Radial Connector.
Rotor shown out of position for clarity.

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Materials	INC-x-75	INC-x-100	INC-x-125	INC-x-150	INC-x-175	INC-x-200	INC-x-225	INC-x-250	
Rotor & Stator Housings	Exposed Surfaces:- Clear anodized aluminium alloy. Sensor surfaces: FR4 grade epoxy Contact Zettlex for alternative, non-standard al. alloy surface finishes such as black anodized or chromate finish								
Connector (Axial)	PPS with Stainless Steel Screw Fixings and Gold & Tin Electrical Connections								
Connector (Radial)	PPS with Stainless Steel Screw Fixings and Gold & Tin Electrical Connections on FR4 Flexi								
Measurement Performance									
Measurement	Absolute over Full-Scale of 360°								
Resolution	18	18	18	19	19	19	19	19	bits
Resolution	5	5	5	2.5	2.5	2.5	2.5	2.5	arc-seconds
Resolution	0.02424	0.02424	0.02424	0.01212	0.01212	0.01212	0.01212	0.01212	milliradians
Repeatability (measured at 1kHz)	≤1	≤1	≤1	≤1	≤1	≤1	≤1	≤1	Least sig. bit
Repeatability (measured at 1kHz)	≤5	≤5	≤5	≤2.5	≤2.5	≤2.5	≤2.5	≤2.5	arc-seconds
Repeatability (measured at 1kHz)	≤0.02424	≤0.02424	≤0.02424	≤0.01212	≤0.01212	≤0.01212	≤0.01212	≤0.01212	milliradians
Repeatability (measured at 10kHz)	≤3	≤3	≤3	≤3	≤3	≤3	≤3	≤3	Least sig. bit
Repeatability (measured at 10kHz)	≤15	≤15	≤15	≤7.5	≤7.5	≤7.5	≤7.5	≤7.5	arc-seconds
Repeatability (measured at 10kHz)	≤0.07272	≤0.07272	≤0.07272	≤0.03636	≤0.03636	≤0.03636	≤0.03636	≤0.03636	milliradians
Linearity over Full-Scale	≤130	≤100	≤80	≤65	≤60	≤50	≤45	≤40	arc-seconds
Linearity over Full-Scale	≤0.63	≤0.49	≤0.39	≤0.32	≤0.29	≤0.24	≤0.22	≤0.20	milliradians
Internal Position Update Rate	1.1 ± 0.1								kHz
Thermal Drift Coefficient	≤0.25								ppm/K full-scale
Thermal Drift Coefficient	≤0.20								arc-secs/K full-scale
Thermal Drift Coefficient	≤0.001								millirads/K full-scale
Max. speed for angle measurement	1000	800	650	550	500	500	500	500	r.p.m
Max. physical speed	10,000								r.p.m
Electrical interface									
Data Outputs	RS422 Compatible, supports SSI (Serial Synchronous Interface) or asynchronous serial interface with clock frequency/Baud rate of 10kHz - 1MHz								
Power Supply	5VDC±5% or 12VDC (8-15VDC) or 24VDC (15-29VDC)								VDC
Current Consumption	<100 (typically 75)								milliAmp
Reverse Polarity	PSU Reverse polarity protected to max. supply voltage								VDC
Connector on IncOder (axial option)	Harwin Data Mate Vertical Plug 10 Way with 2 Jack Screw Sockets Type M80-500-10-42								
Connector on IncOder (radial option)	Harwin Data Mate Vertical Plug 10 Way with 2 Jack Screw Sockets Type M80-510-10-42 For alternative connectors such as integral cable or military shell type contact Zettlex								
Mating Connector	Harwin Data Mate Vertical Socket Type M80-461-10-42 (alternative M80-461-10-05) for either connector option.								
Zero Setting	Via Connector Pin - see details for set and reset on page 14								
Zero Position Variation	≤1								LSBit
Power Up Time To 1st Measurement	<50								millisecond

	INC-x-75	INC-x-100	INC-x-125	INC-x-150	INC-x-175	INC-x-200	INC-x-225	INC-x-250	
Environmental									
Operating Temp.	Minus 40 to +85 Operation outside limits to be qualified by user. At elevated temperatures duration should be minimized. At lower temperatures device should be allowed to warm up (self heating) for >1 minute or constantly powered								Celsius
Storage Temp.	Minus 55 to +125								Celsius
IP Rating - Rotor & Stator	IP67 for 30 minutes & 1m depth (Installed with mechanically protected connector) IncOders for long term immersion applications are feasible - contact Zettlex								
IP Rating - Connector	IP54 For long term immersion applications contact Zettlex or your local representative								
Humidity	RH 0-99% non-condensing - *but unaffected by occasional condensation*								
Salt Fog	(Installed with protected cable & connector) Compliant with DEF STAN 00-35 Part 3 Issue 4, Test CN2 Salt Mist Test								
Bio Hazards	(Installed with protected cable & connector) Compliant with DEF-STAN 00-35 Part 4 Issue 4 Section 11 (Hazards)								
Induced Dust & Sand	Compliant with DEF STAN 00-35 Part 3 Issue 4, Test CL25 (Turbulent Dust) Cat 1								
Mechanical Impact Resistance	IK07 - s*uitable for mechanical impacts from objects of >200gramms from 1m height*								
Shock	IEC 60068-2-6 100g for 11ms - *suitable for airborne, marine & armoured vehicles* In all high shock environments connecting cable must be locally strain relieved. For extreme shock conditions (e.g. gunnery mounts) contact Zettlex for alternative cable/connectors								
Vibration	IEC 60068-2-6 20g for 10-2000Hz - *suitable for high vibration & airborne environments* In all high vibration environments connecting cable must be locally strain relieved. For extreme vibration conditions (e.g. gunnery mounts) contact Zettlex for alternative cable/connectors								
Environmental pressure range	0 to 4								Bar
Max. permissible press. change rate	1								Bar/second
EMC Susceptibility	(Installed) Complies with IEC 6100-6-2 - *suitable for fitment in harsh EMC environments*								
EMC Emissions	(Installed) Complies with IEC 6100-6-4 - *suitable for fitment adjacent to EMI sensitive devices*								
Miscellaneous									
Mass Rotor INC-3 type (max)	50	70	90	110	130	150	170	192	grams
Mass Rotor INC-8 type (max)	75	105	135	165	195	225	255	287	grams
Mass Stator INC-3 type (max)	83	117	150	184	217	250	284	319	grams
Mass Stator INC-8 type (max)	79	111	143	174	206	238	270	303	grams
Moment of Inertia Rotor INC-3 type (max)	4.8E-05	1.3E-04	2.5E-04	4.4E-04	7.5E-04	1.2E-03	1.8E-03	2.5E-03	Kgm2
Moment of Inertia Rotor INC-8 type (max)	7.2E-05	1.9E-04	3.7E-04	6.6E-04	1.1E-03	1.8E-03	2.7E-03	3.8E-03	Kgm2
MTBF	0.22 failures per 1M hours based on MIL-HBK-217+ method for ground military vehicles at 20Celsius average								
MTBF	0.35 failures per 1M hours based on MIL-HBK-217+ method for naval sheltered at 35Celsius average								
Hazardous materials	Not used								
Outgassing materials	Complies with NASA classification of low outgassing materials for spacecraft with TML of <1% and CVCM of <0.1% measured at 125C over 24hours in vacuum according to ASTM E-595-90								
ITAR Restricted Components	Not used								
Approvals	Flammability Rating UL94V-0 ; RoHS Compliant								
Marking	Zettlex, logo, CE & UL94V-0 printed on Rotor & Stator faces; Part Number engraved on Rotor & Stator								
Country of Manufacture	UK								
Packaging	Primary pack of ESD bubble bag & printed label. Secondary pack of cardboard carton. All non-returnable.								
Export Licence Requirements	Not required for products of <1000mm diameter								

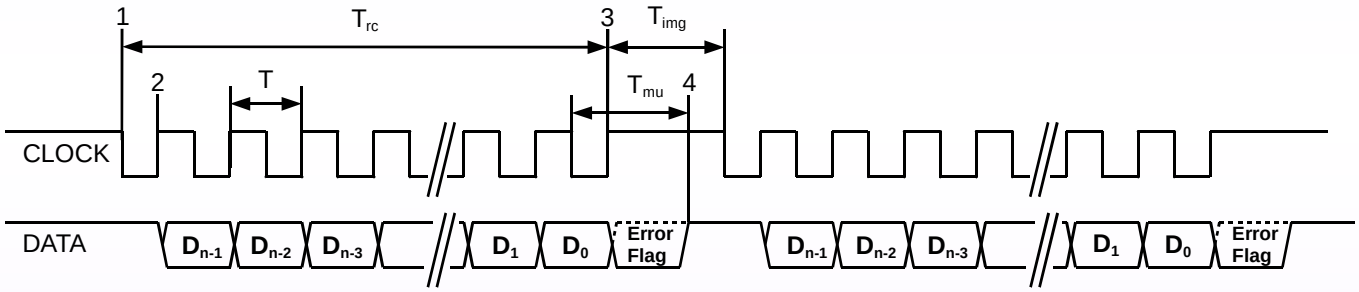
Data Outputs

The data Interface conforms to the RS422 Standard and implements a differential output for the DATA (connector pins 5 and 7) and a differential input for the CLOCK (connector pins 6 and 8). Note that the DATA outputs and the CLOCK Inputs are not terminated with load resistors.

The Data interface supports a variety of protocols, which are described below.

Synchronous Serial Interface (SSI) – Generic Protocol Definition

SSI is a widely used serial interface between position sensors and controllers. Synchronous SSI uses a clock sequence from a controller to initiate the transmission of position data from the sensor (a Read Cycle), with the latest position data (see page 9 for position update rate) available for transmission after each SSI Read Cycle is completed. See timing information below:-



T: Clock Period (1/T = 100 kHz to 1 MHz)
Trc: Read cycle time: This is defined as n x T = 0.5 x T
Tmu: Message Update time. The time from last falling edge of clock to when new data is ready for transmission. Tmu = 20us +/- 1 us. The DATA line will be HIGH after this time indicating a new Read Cycle can be started.
Timg: Intermessage Gap time. Must be > Tmu otherwise position data will be indeterminate.
n: The number of bits in the message (not including the Error Flag).
In idle state CLOCK and DATA are both HIGH

Notes:
1. The first falling edge after Tmu starts the Read Cycle and the transfer of data.
2. Each rising edge of the CLOCK transmits the next data bit of the message, staring with Dn-1.
3. After the last rising edge of the clock sequence, the data line is set by the Error Flag (if supported) for the period Tmu – 0.5xT
4. After Tmu, the latest position data is now available for transmission in the next Read Cycle – see page 9 for position update rate.

SSI – Specific Protocol Definition

SSI can support a variety of protocols in which different data is transmitted depending on the requirements of the SSI controller. **IncOder can be supplied with any of the following protocols – just choose the option you require when ordering (see page 18)**. If the protocol you require is not listed here then please contact Zettlex.

SSI1 (n = 24)

D23	DV:	Data Valid Flag. Set to 1 when data is valid, otherwise 0 (the inverse of the ERROR FLAG).
D22	ZPD:	Zero Point Default. Set to 1 when the Zero Point is at Factory Default, otherwise 0
D21-D0	PD[21:0]:	Binary position data. If resolution of device is less than 22 bits, then the most significant bits of this field are set to 0. The LSB of this field is in D0. When DV is 0, PD[21:0] value is not defined.

SSI2 (n = 24)

D23-D2	PD[21:0]:	Binary position data. If resolution of device is less than 22 bits, then the most significant bits of this field are set to 0. The LSB of this field is in D2. When Alarm bit is 1, PD[21:0] value is not defined.
D1	P:	Parity Bit 0 indicates an even number of 1's in data (D23-D2), 1 indicates an odd number of 1's in data.
D0	A:	Alarm Bit – 0 indicates normal operation, 1 indicates error condition.

SSI3 (n = 16)

D15-D0	PD[15:0]:	Binary position data. When EF is 1, PD[15:0] value is not defined.

SSI4 (n = 32)

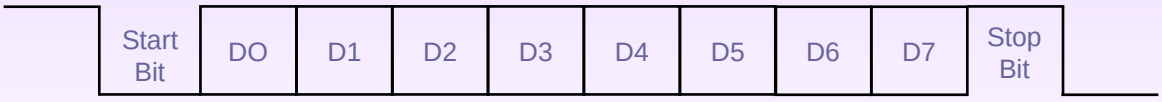
D31	PV:	Position Valid Flag. Set to 1 when position data is valid, otherwise 0 (the inverse of the ERROR FLAG).
D30	ZPD:	Zero Point Default. Set to 1 when the Zero Point is at Factory Default, otherwise 0
D29-D11	PD[18:0]:	Binary position data. If resolution of device is less than 19 bits, then the most significant bits of this field are set to 0. The LSB of this field is in D11. When PV is 0, PD[18:0] value is not defined.
D10-D0	TS[10:0]	Time stamp data. The value of the Time Stamp counter when the position was measured. This data is always valid. The Time Stamp counter is a continuously incrementing counter in the range: 0.00ms to 20.47ms (at which point it restarts at 0.00ms). It has a resolution of 10us, with an accuracy better than 1% (based on the system oscillator).

SSI5 (n = 16)

D15-D0	PD[15:0]:	Gray code, position data. When EF is 1, PD[15:0] value is not defined.

Asynchronous Serial Interface – Generic Protocol Definition

Data is transmitted by the IncOder as the internal position data is updated and is formatted into Frames. Each Frame consists of a number of 8 bit data words. Each 8 Bit data word (or byte) is transmitted from a standard UART using N-8-1 (no parity, 8 data bits, 1 stop bit) with a Baud rate of 230400. See below for the data format of each transmitted data word.



Asynchronous Serial Interface – Specific Protocol Definition

IncOder can support various protocols to suit the host controller. The following is the default Asynchronous Serial Data protocol specified as ASI1 when ordering (see page 18).

Each frame is defined as 6 bytes and the data format is defined as follows:
First byte (transmitted first):

D7	D6	D5	D4	D3	D2	D1	DO
1	DV	ZPD	0	0	PD[21:19]		

D7	D6	D5	D4	D3	D2	D1	DO
0	PD[18:12]						

D7	D6	D5	D4	D3	D2	D1	DO
0	PD[11:5]						

D7	D6	D5	D4	D3	D2	D1	DO
1	PD[4:0]					CRC[15:14]	

D7	D6	D5	D4	D3	D2	D1	DO
1	CRC[13:7]						

D7	D6	D5	D4	D3	D2	D1	DO
1	CRC[6:0]						

Data Definition

DV	Data Valid flag. Set to 1 when data is valid, otherwise set to 0
ZPD	Zero Point Default. Set to 1 when the Zero Point is at Factory Default, otherwise set to 0.
PD[22]	IncOder Position Data. If resolution of device is less than 22 bits then the MSBs of this field are set to 0. The LSB of this field is in PD[0]
CRC[16]	CRC-16: To verify transmission, calculate the CRC of all 48 bits of the message but with CRC[15] set to 0. The resulting CRC result should be the same as the received CRC[15:0]. Use the following CRC-16 parameters: Polynomial 0x8005 Initial data 0x0000 MSB first (not reversed) No final XOR calculation.

Zero Point, Zero Set & Zero Reset.

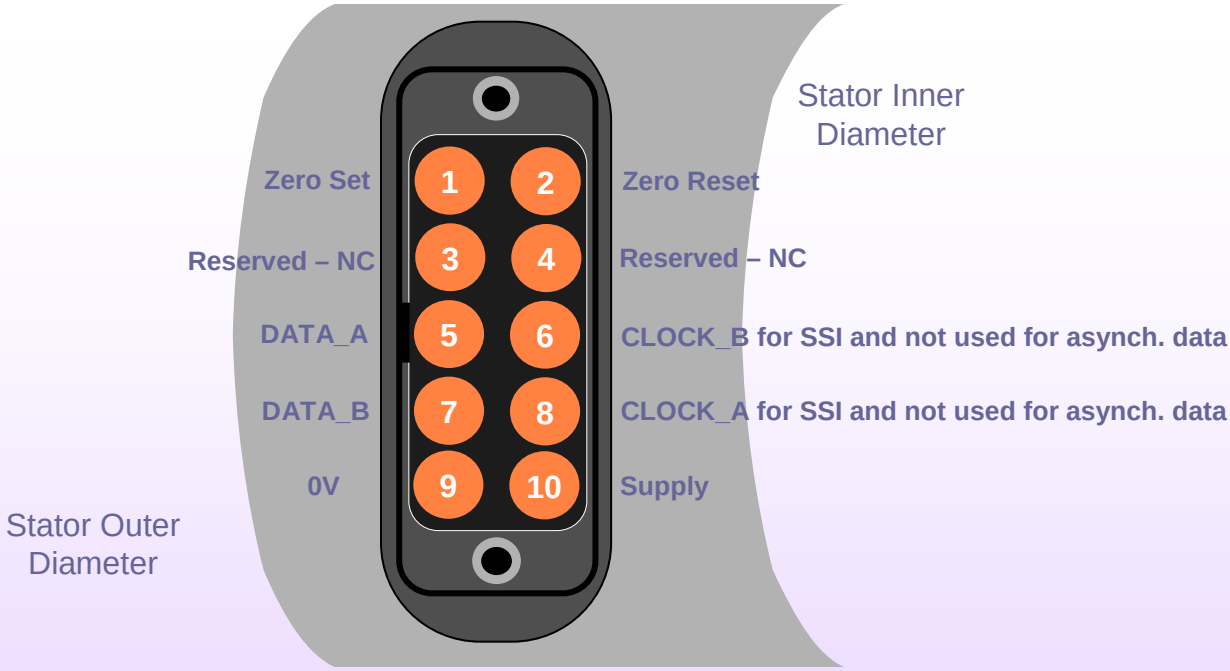
The Zero Point is the datum from which angle is measured. As supplied, the IncOder carries a factory Zero Point setting. (For the Screw Mount format products this is with the Rotor and Stator dowel positions at 12 o'clock). The Zero Point can be changed using the Zero Set and Zero Reset signals on pins 1 & 2 of the connector respectively.

The Zero Set signal will set the current IncOder position as the Zero Point (this is maintained in memory when power is removed).

The Zero Reset signal will reset the Zero Point to the factory setting (this is maintained in memory when power is removed).

To use these signals, the relevant pin should be connected to 0V for at least 1 second at power up. These signals should be left unconnected during normal operation.

Connector Pin Diagram



Top 20 Frequently Asked Questions:-

1. How do IncOders work?
IncOders work in a similar way to resolvers. The IncOder Stator receives a DC power source and produces a low power AC electromagnetic field between Stator & Rotor. This field is modified as the Rotor rotates. The field is sensed by the Stator and the rotation angle computed. Unlike resolvers, IncOders use laminar circuits rather than wound wire spools. This enables high accuracy, compact form, low mass and low inertia.

2. Is IncOder measurement truly absolute?
Yes. Measurement will be the same before and after a power interruption. No motion is required.

3. Does measurement performance vary with Rotor concentricity?
Resolution, repeatability & linearity will be as specified, provided Rotor concentricity is within +/-0.25mm. One might expect that accuracy would degrade substantially with concentricity but because IncOders use the full faces of both Rotor & Stator any error effects are nulled out by diametrically opposing factors. This is quite different to optical encoders where performance is highly dependent on tightly toleranced concentricity.

4. Can IncOders be used at <-40Celsius or >85Celsius?
Operating temperature limits are set by some of IncOder's electronic components rather than the measurement technique. The electronic components used in IncOder are rated to -40 or 85Celsius operation but storage down to -55Celsius. Some IncOders are successfully used outside the operating temperature limits following qualification by the users. At temperatures <-40Celsius the devices should either be constantly powered or allowed to warm up (from self heating) for >1 minute following cold start. At temperatures >85Celsius the duration of any elevated temperature should be minimized.

5. What happens if the Rotor or Stator get wet or dirty?
Measurement performance is unaffected by humidity, condensation, dirt, dust, mud or sand. IncOders will survive temporary immersion (<1 hour) to depths of 10m of salt or fresh water. Extended or frequent exposure to liquids should be avoided. Consult Zettlex in such applications for liquid immersion units.

6. How can an IncOder be calibrated?
Calibration is only relevant for some ultra high accuracy applications such as large astronomical telescopes. Readings from an IncOder are stored and compared to a reference in a look-up table in the host system. Such an arrangement will tend to null out any non-linearity due to inherent non-linearity or installation tolerances. Resolution and repeatability are unaffected by calibration.

7. Can IncOder be used for airborne applications?
Yes. IncOders are used in military manned and unmanned aerial vehicles.

8. Can we route the cable out radially rather than axially?
Yes – simply order radial connection option.

9. Can an IncOder run with a different electrical output such as A/B pulses or 0-10V?
Contact Zettlex or your local representative (see page 20).

10. At what Baud rate can the Data interface operate at and does this effect cable length?.
The longer the transmission distance (Cable Length) the slower the recommended Baud Rate. This table shows recommended Baud Rates vs. Cable Length.

Baud Rates For Data Transmission				
Cable Length (m)	<30	<60	<120	<250
*Baud Rate**	<400 kHz	<300 kHz	<200kHz	<100 kHz

11. Are there lightweight IncOder versions?
Contact Zettlex or your local representative (see page 20).

12. Are IncOders suitable for use in harsh electromagnetic fields?
Yes. Many IncOders are used in close proximity to powerful sources of electromagnetic noise such as motors or transformers. IncOder's aluminium housing produces a Faraday cage effect around the internal electronics and the IncOders are purposefully designed so that any incoming electromagnetic radiated noise is either filtered out or self cancelling.

13. Are IncOders affected by magnets?
No. Magnets produce DC fields. IncOder's operation is based on the detection of AC electro-magnetic fields at a specific frequency.

14. Do IncOders produce electromagnetic emissions?
Any radiated emissions are small and limited to the internal sensor faces of an IncOder. The aluminium IncOder housing has a Faraday cage effect. IncOders are regularly used in close proximity to sensitive devices such as navigation aids.

15. What if we need to earth the IncOder casing?
Some applications require an electrical connection or earthing strap to the IncOder casework. The standard IncOder housing finish is clear anodized which is non-conductive. A connection can be made using an earthing strap with a crinkle washer which penetrates the anodized surface. Alternatively, remove the anodized surface in the immediate vicinity of the strap (usually located using one of the attaching screws) using a file or abrasive. A chromate (conductive) finish may be requested for custom products.

16. Can IncOders be used as a motor encoder?
Yes. The IncOder version specified in this Product Guide is suitable for motor encoders of up to 1000r.p.m. For higher speeds please contact Zettlex for alternative higher speed outputs such as A/B pulses or 1V peak to peak sin/cos.

17. Does measurement performance vary with Rotor to Stator gap?
Resolution, repeatability & linearity will be as specified, provided gap is within 1.10+/-0.35mm.

Within limits, the IncOder's measurement resolution and repeatability are independent of air gap. If the air-gap tolerance is increased from ±0.35mm to ±0.50mm the *quoted* measurement non-linearity will double. For example, if a 250mm IncOder has an air-gap tolerance of ±0.50mm the *quoted* linearity will increase from +/-40 arc-seconds to +/-80 arc-seconds.

If the specified linearity is required then the specified air-gap tolerance should be maintained. This is most easily achieved by using the Servo Clamp format Rotor. Preferably the Rotor's inner diameter should be a close fit to the through shaft. If vibration conditions are extreme then a screw through the shaft or a roll pin (sometimes referred to as a 'spring pin') should be used to lock the Rotor in to position. In some applications, the Rotor may also be bonded on to the shaft once the gap is set.

18. Are ATEX rated versions of IncOder available?
Contact Zettlex or your local representative (see page 20).

19. How do we fit the Rotor in the Servo Clamp arrangement?

- Fit IncOder Stator & Rotor around the shaft
- Fit IncOder Stator using servo clamp screws – gradually tightening opposite screws
- Place 1,1mm thick plastic Setting Pieces between faces of Stator and Rotor/Collar assembly
- Abut the Rotor to the Setting Pieces
- Secure Collar using grub screws – gradually tightening opposite screws
- Remove the Setting Pieces
- Check that gap is within the range 1.45mm to 0.75mm.

20. Do IncOders carry out self checking?

Yes. IncOders carry out 10 self checks. If any of the self checks indicate an internal error then an error signal is generated (see earlier description of SSI comms & error flagging). The 10 self checks are:-

- Stator Continuity/Damage.
- Presence of Rotor.
- Rotor Continuity/Damage.
- Out of range Rotor.
- Gross electromagnetic malfunction.
- Window watchdog timer - this is reset multiple times per internal measurement cycle.
- Power on reset.
- Power brownout reset.
- SSI timeout implemented for SSI clock input.
- Internal flash data memory value check and read/write timeouts (applies to Zero Set & Reset).

Part Numbering & Ordering Information:-

Note 1 IncOder includes 1 Stator & 1 Rotor but excludes cables or other accessories

INC- X – XXX – XXXXXX – XXXX – XXXX – X – AN

Mechanical Format
Screw Mount - **3**
Servo Clamp - **4**

Outer Diameter
75
100
125
150
175
200
225
250

(Max.) Resolution measured in bits.
(18 Bits sizes ≤ 125mm) **180101**
(19 Bits sizes ≥150mm) **190101**

Host Communications Interface
SSI1 *(for Synchronous SSI Type 1)*
SSI2 *(for Synchronous SSI Type 2)*
SSI3 *(for Synchronous SSI Type 3)*
SSI4 *(for Synchronous SSI Type 4)*
SSI5 *(for Synchronous SSI Type 5)*
ASI1 *(for Asynchronous Serial Interface)*

Connector
AC1 *(for axial connector)*
RFC1 *(for radial connector)*

Supply Voltage
5
12
24

Finish
Clear anodized

Examples:-

INC - 3 - 075 - 180101 – SSI1 – AC1 – 12 - AN
Screw mount format, 75mm diameter, 18 bit resolution, SSI1, axial connector, 12V, clear anodized

INC - 8 - 150 -190101 – ASI1 – RFC1 – 24 - AN
Servo clamp format, 150mm diam., 18 bit resolution, asynchronous serial data, radial connector, 24V, clear anodized

If you required the above unit with a Screw Mount Rotor, part numbers would be:-
INC – 8 – 150 - 180101 – ASI1 – RFC1 – 24 – AN STATOR ONLY plus
INC – 3 – 150 – 180101 – ASI1 - RFC1 - 24 - AN ROTOR ONLY

INC - ACME - 508 - 12 – 10V – AB – 10 – ALOCROM
Example of fully custom version for ACME Inc.
Screw mount, 508mm diameter, 12 bit resolution, 0-10V output, MIL. connector, 10V supply, ALOCROM finish

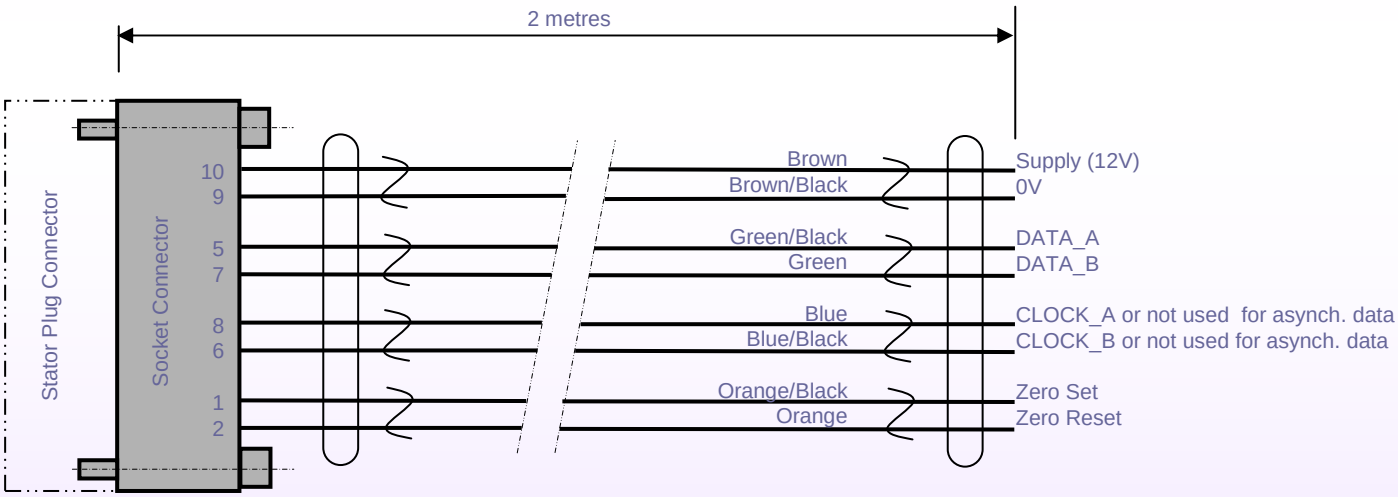
Part Number & Ordering Information for Accessories

Cable

Mating connector and tinned wires on other end

INC – CAB3 - X

Cable length
in metres
2
Contact Zettlex for alternative length

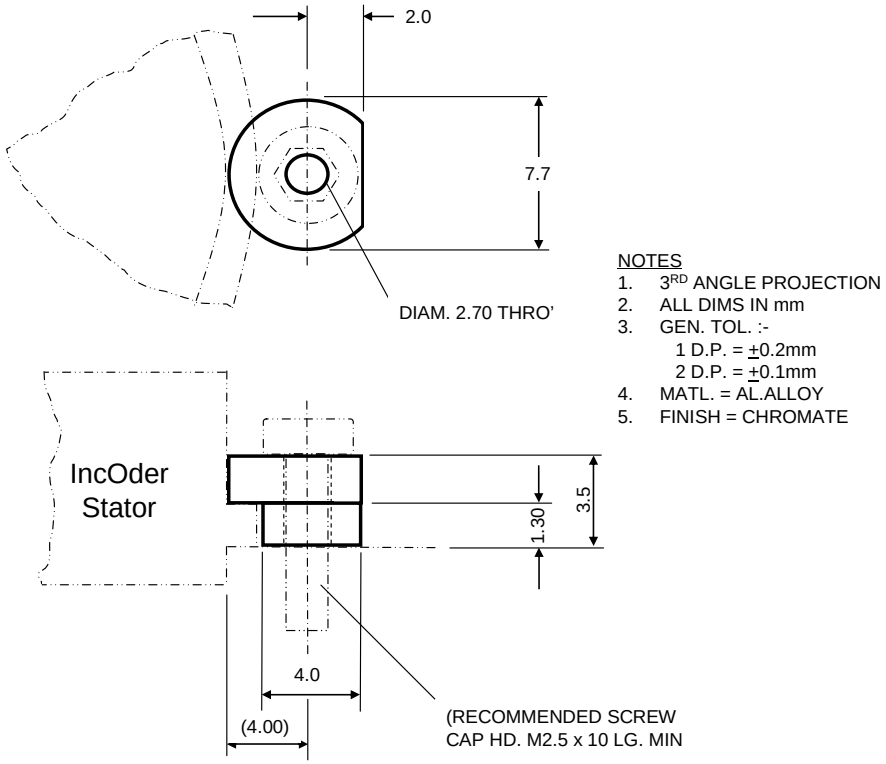


Socket Connector = Harwin DataMate J-Tek 10-way with 2 jack screws, part number M80-461-10-42
Cable diameter = 6mm
Cable sheath = PVC
Conductor Insulation = Polyethylene
Cable type = 4 twisted pairs (26 AWG), overall screen

Servo Clamp

INC – CLAMP1

For use with INC-4 style IncOder Stators. *Sometimes referred to as 'Clamp Cleat' or 'Screw Clamp'.* Zettlex recommends the use of at least 3 Clamps to be used with each Stator. Zettlex recommends the Clamps fasten in to at least 3 M2.5 locations equispaced on a P.C.D. of IncOder dimension (**A** + 8.00).



NOTES
1. 3RD ANGLE PROJECTION
2. ALL DIMS IN mm
3. GEN. TOL. :-
   1 D.P. = ±0.2mm
   2 D.P. = ±0.1mm
4. MATL. = AL.ALLOY
5. FINISH = CHROMATE

Zettlex

Precision in the Extreme

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All products available from your local reseller or from the Zettlex web-site at
www.zettlex.com/store

Message from Mark Howard, Zettlex General Manager:

Ours is a simple business ethic: hard work, honesty & great customer service. I hope you will find our products useful.

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