The DS-37 is a member of the DS series of Electric Encoders™, based on Netzer Precision proprietary technology. The Electric Encoder™ offers many advantages - some unparalleled

- Low profile (8 mm)
- Hollow, floating shaft
- No bearings or other contacting elements
- High resolution and precision
- High tolerance to temperature extremes, shock, moisture, EMI, RFI and Magnetic fields
- Very low weight
- Holistic signal generation
- Analog or Digital interfaces

The Electric Encoder™ is unique in being holistic, i.e., its output reading is the averaged outcome of the whole area of the rotor, This feature makes the Electric Encoder™ forgiving to mounting tolerances, mechanical wander etc.

The absence of components such as ball bearings, flexible couplers, glass disc, light sources and detectors, along with very low power consumption makes the Electric Encoder™ virtually failure free.

The internally shielded, DC operated Electric Encoder™ includes an electric field generator, a field receiver, a sinusoidal shaped dielectric rotor, and processing electronics.

The output signals of Electric Encoder™ are analog Sine / Cosine representing the rotation angle. The digital outputs are obtained by further processing - which may be either internal or external to the encoder.

The combination of precision, low profile, low weight and high reliability have made Netzer Precision encoders particularly suitable to a wide variety of critical applications including, but not limited to medical equipment and aerospace.

General

Angular resolution	17-19 bit
Maximum tested static error	±0.025°
Extended accuracy static error	±0.015°
Maximum operational speed	1,500 rpm
Measurement range	Unlimited rotation
Power On - Max. operational speed	3.3 RPM, <=20°/sec
Rotation direction	Adjustable CW/CCW*
Build In Test BIT	Optional

* Default same direction from bottom side of the encoder

Mechanical

Allowable mounting eccentricity	±0.1 mm
Allowable axial mounting tolerance	±0.1 mm
Rotor inertia	70.93 gr · mm²
Total weight	10 gr
Outer Ø /Inner Ø/ Height	37 / 10 / 8 mm
Material (stator, rotor)	TRVX-50

Electrical

Supply voltage	5V ± 5%
Interconnection	Shielded cable
Cable length	1,500 mm MAX

Environmental

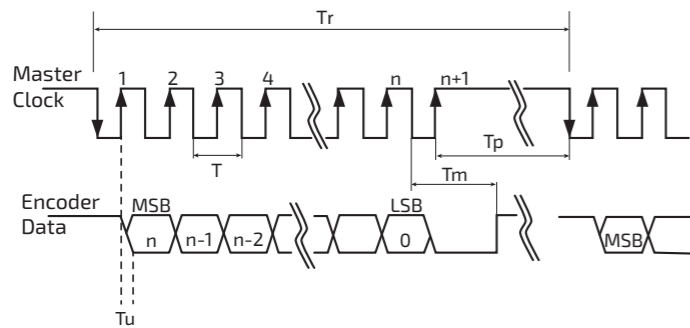|	
EMC	IEC 6100-6-2, IEC 6100-6-4
Operating temperature range	-40°C to +85°C
Storage temperature	-50°C to +100°C
Relative humidity	98% Non condensing
Shock endurance	100 g for 11 ms
Vibration endurance	20 g 10 – 2000 Hz
Protection	IP 40

DS-37-V02
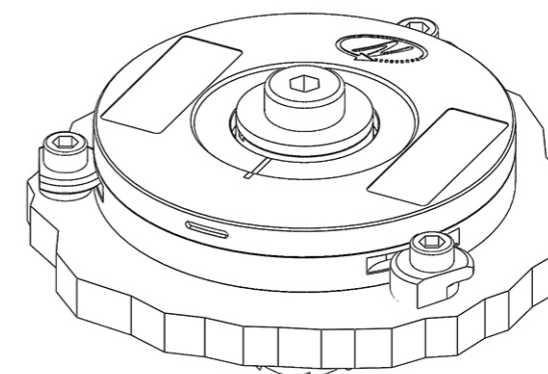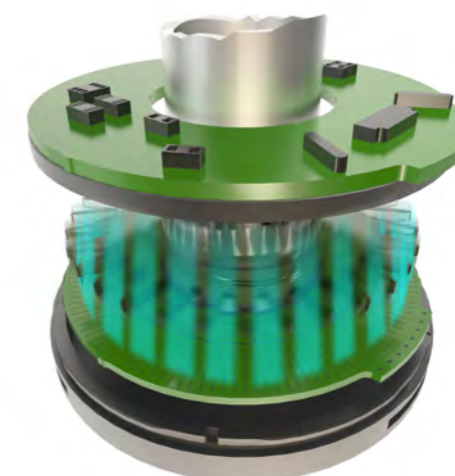
Digital SSi Interface

Synchronous Serial Interface (**SSI**) is a point to point serial interface standard between a master (e.g. controller) and a slave (e.g. sensor) for digital data transmission.

Description		Recommendations
n	Total number of data bits	12 - 22
T	Clock period	
f= 1/T	Clock frequency	0.5 - 2.0 MHz
Tu	Bit update time	200 nsec
Tp	Pause time	26 - ∞ µsec
Tm	Monoflop time	>25 µsec
Tr	Time between 2 adjacent requests	Tr > n*T+26 µsec
fr=1/Tr	Data request frequency	

SSi / BiSS Output signal parameters

| Output code	Binary
Serial output	Differential RS-422
Clock	Differential RS-422
Clock frequency	0.5 ÷ 2.0 MHz
Position update rate (Max)	30 kHz
Current consumption	180 mA

SSi / BiSS interface wires color code

Clock +	Grey	Clock
Clock -	Blue	
Data -	Yellow	Data
Data +	Green	
GND	Black	Ground
+5V	Red	Power supply

Software tools: (SSi / BiSS - C)

Advanced calibration and monitoring options are available by using the factory supplied Electric Encoder Explorer software, This facilitates proper mechanical mounting, offsets calibration and advanced signal monitoring.
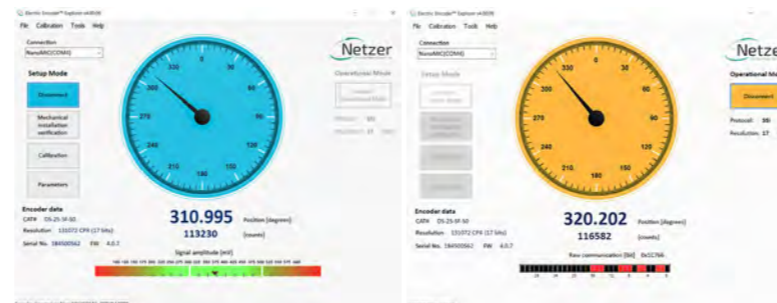

Digital BiSS-C Interface

BiSS – C Interface is unidirectional serial synchronous protocol for digital data transmission where the Encoder acts as "slave" transmits data according to "Master" clock. The BiSS protocol is designed in B mode and C mode (continuous mode) .The BiSS-C interface as the SSi is based on RS-422 standards.
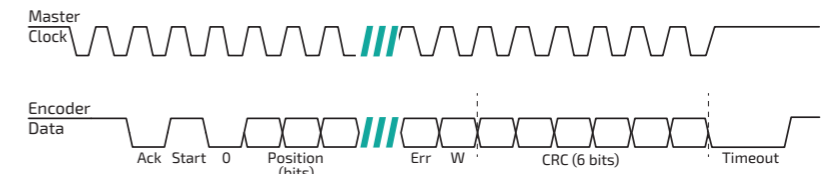
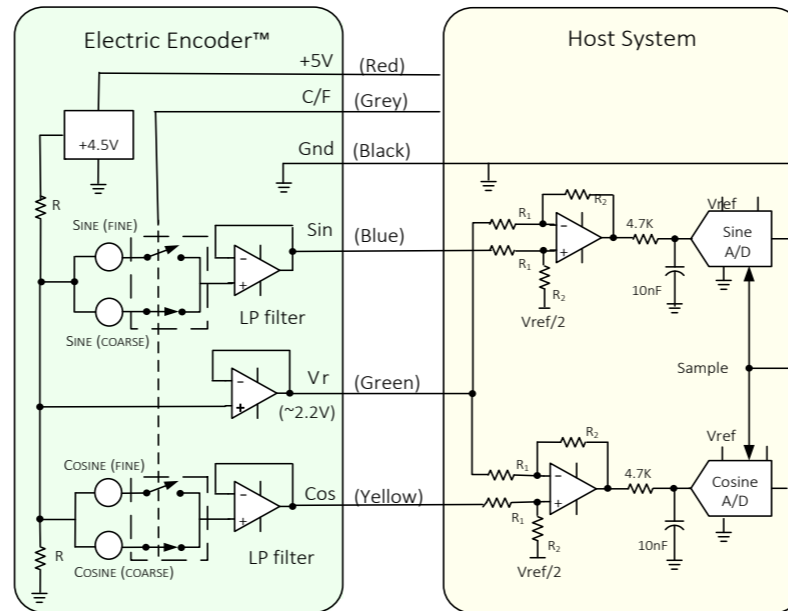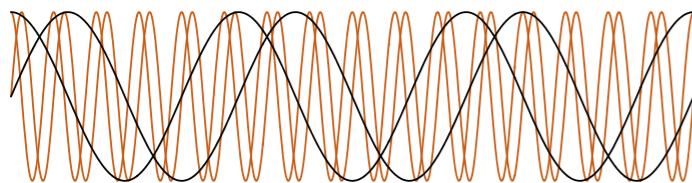| bit #		Description	Default	Length
27	Ack	Period during which the encoder calculates the absolute position, one clock cycle	0	1/clock
26	Start	Encoder signal for "start" data transmit	1	1 bit
25	"0"	"start" bit follower	0	1 bit
8...24	AP	Absolute Position encoder data		
7	Error	Error (amplitude levels)	1	1 bit
6	Warn.	Warning (non active)	1	1 bit
0...5	CRC	The CRC polynomial for position, error and warning data is: $x6 + x1 + x0$. It is transmitted MSB first and inverted. The start bit and "0" bit are omitted from the CRC calculation.		6 bits
	Timeout	Elapse between the sequential "start"request cycle's.		25 µs
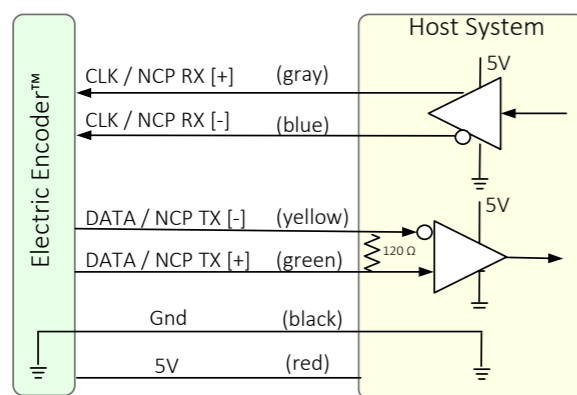
Analog Interface

Coarse and Fine channels

The DS-37 has two operational modes: a Coarse-mode and a Fine-mode - equivalent to two separate encoders in a common housing. The modes are selectable by a logic C/F command; logic "0" (0V to +0.5V) selects the Coarse-mode, which has 3 Electrical Cycle/Revolution (EC/R) while logic "1" (+3V to +5V) selects the Fine-mode which has 16 EC/R.

The switching time is less than 1 ms.

The Coarse-mode outputs need to be read only upon system initiation after which the encoder is permanently switched to the Fine mode. Coarse and Fine sine / cosine pairs are used to calculate the initial absolute position, from that point tracking the Fine-channel outputs provides the absolute mechanical rotation angle with the specified accuracy and resolution.

All output signals are referenced to an internally generated voltage Vr (~2.25V)

Output signal parameters

Electric Cycles (Fine / Coarse channels)	16 / 3
Signal latency	250 µSec
Fine-mode output noise (DC to 1kHz)	100 µV (p-p)
Fine-mode output amplitude	±400mV ± 20%
Coarse-mode output amplitude	±300mV ± 20%
Phase relationship (CW shaft rotation - seen from top)	Sine leads Cosine
Signal bandwidth	DC to 1 kHz
Current consumption	10mA

Analog interface wires color code

1	GND	Black	Ground
2	C/F	Grey	Coarse / Fine
3	Sine	Blue	Sine signal
4	Vr	Green	V referenceCosine signal
5	Cosine	Yellow	Cosine signal
6	+5V	Red	P.S.

Absolute position calculation

The analog Sine / Cosine outputs convey the Electrical angle of the Coarse or Fine signals. The Absolute mechanical angle is computed by digitizing the analog signals.

Netzer Precision Position Sensors

ABSOLUTE POSITION
ROTARY ELECTRIC ENCODER™

HARSH
ENVIRONMENT | DS-37

DATA SHEET

Ordering Code

DS – 37 – 16 – S F – S 0 – n n n

DS Product line

Outer Diameter

Fine ECR

Output

S	Digital - SSi
I	Digital - BiSS-C
O	Analog - 1 Vp-p

Resolution

Code	Bit	CPR
F	17	131,072
G	18	262,144
H	19	524,288
0	Analog	

BIT (Build In Test): optional

[ ]	None
B	BIT

EA	Extended Accuracy
nnn	Custom

Interconnection
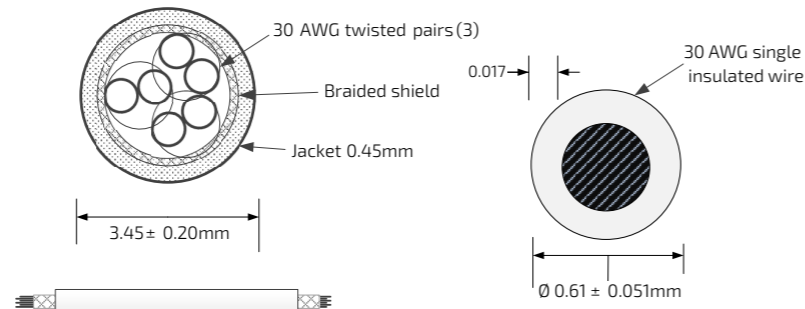
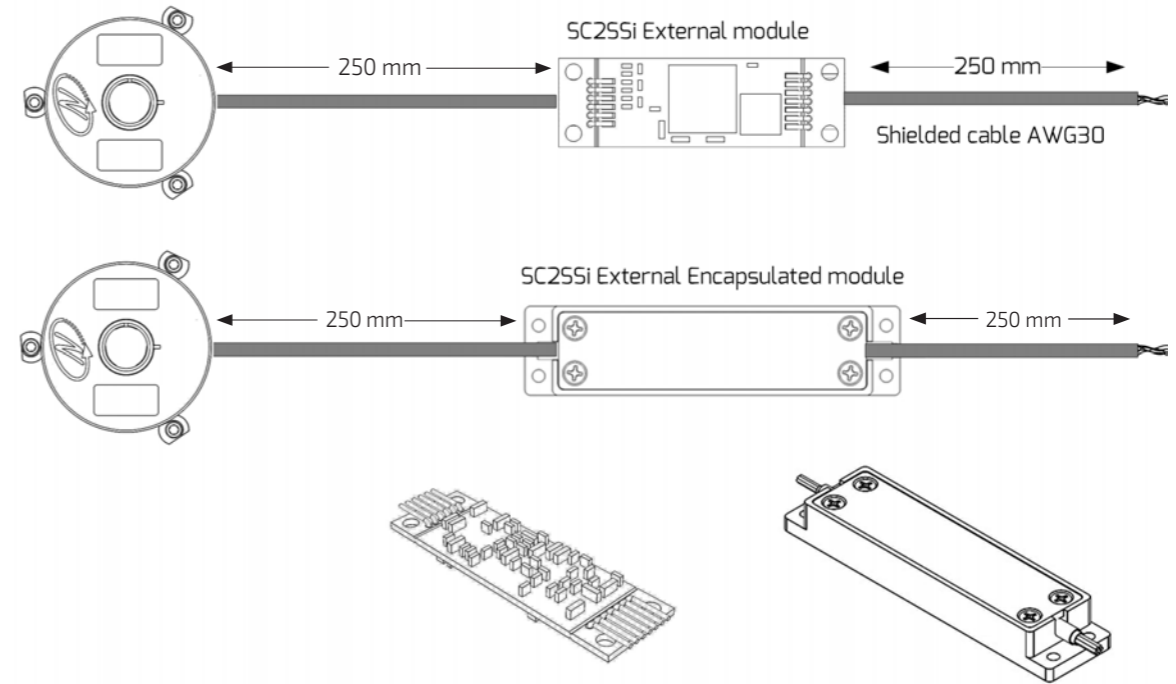|	
0	250 mm Flying leads (default)
1	500 mm Flying leads
2	750 mm Flying leads
3	1000 mm Flying leads
C	Connector (optional)

S	Shielded cable 250 mm
C	Encapsulated external module

Cable: 30 AWG twisted pair (3):2 (30 AWG 25/44 finned copper, 0.15 PFE to Ø0.6 ± 0.05 OD).
Temperature rating: -60 to +150 Deg C.
Braided shield: Thinned copper braided 95% min. coverage.
Jacket: 0.45 silicon rubber jacket Ø3.45 ±0.2 OD

Pair #	Color
1	Red / Black
2	Gray / Blue
3	Green / Yellow

30 AWG twisted pairs (3)
Braided shield
Jacket 0.45mm
3.45± 0.20mm

0.017
30 AWG single insulated wire
Ø 0.61 ± 0.051mm

Digital Output SSi / BiSS-C

SC2SSi External module
250 mm
250 mm
Shielded cable AWG30

SC2SSi External Encapsulated module
250 mm
250 mm

Related documents

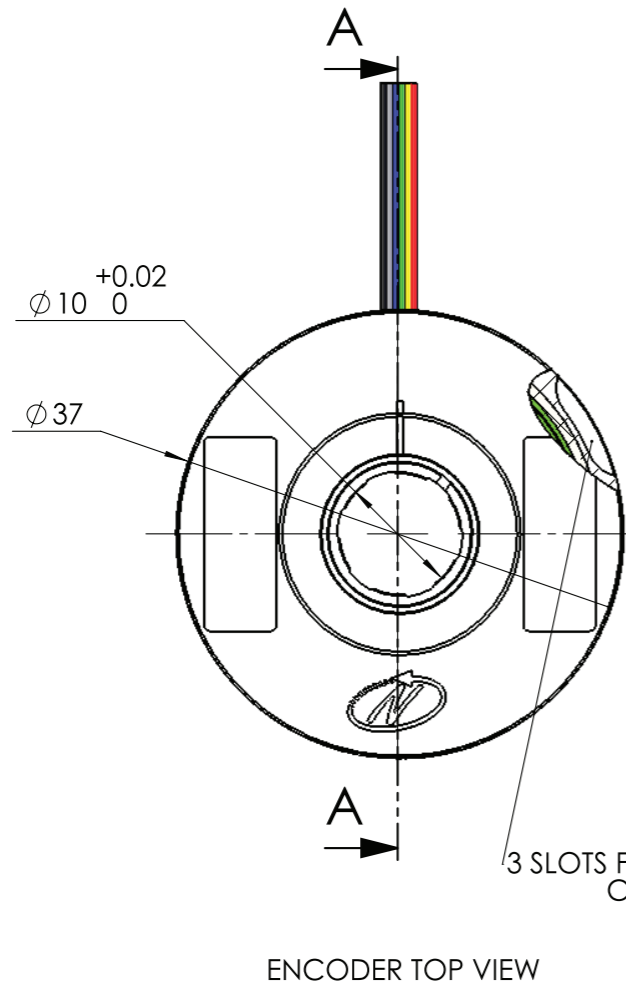DS-37 User Manual: Mechanical, Electrical and calibration setup.

Optional Accessories
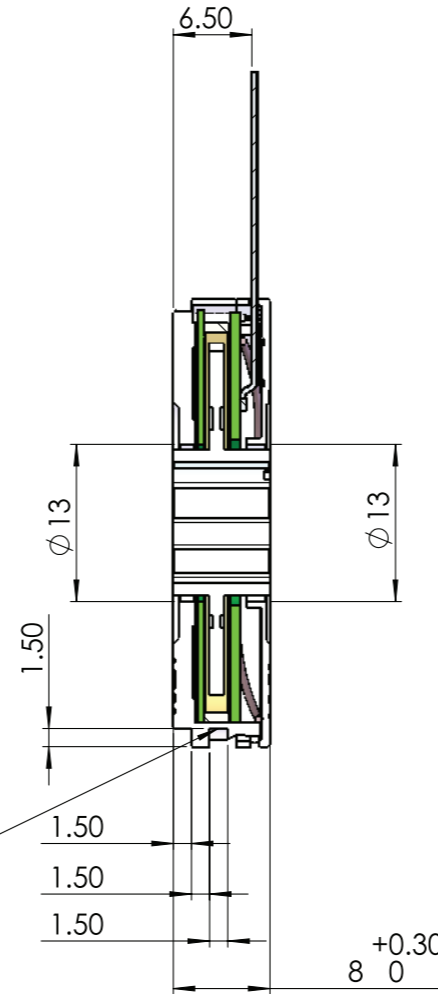
Demonstration Kit

DKIT-DS-37-16-DF-0C - SSi interface
DKIT-DS-37-16-EF-0C - BiSS interface
The Demo kit Includes: mounted encoder on rotary jig, and RS-422 to USB converter.
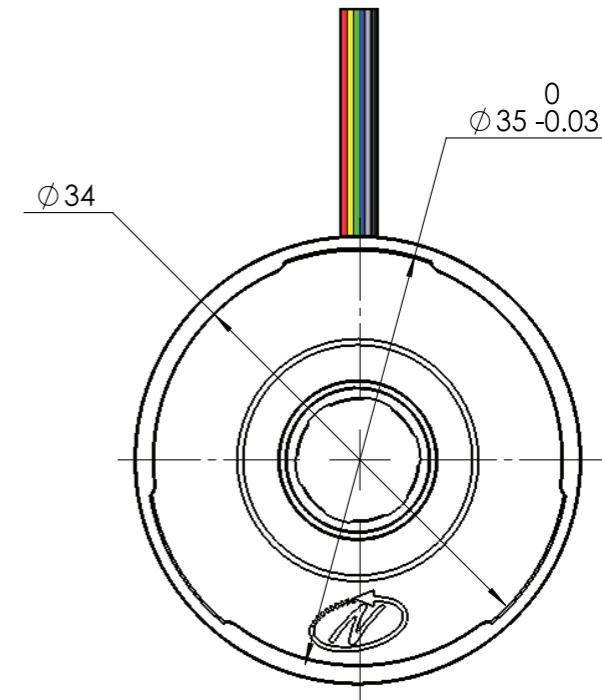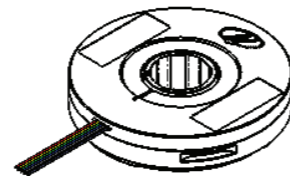
A

A

$\phi 10 \ ^{+0.02}_{\ \ 0}$

$\phi 37$

3 SLOTS FOR ENCODER
CLAMP EQ.SP

ENCODER TOP VIEW

6.50

$\phi 13$

$\phi 13$

1.50

1.50

1.50

1.50

$8 \ ^{+0.30}_{\ \ 0}$

SECTION A-A
SCALE 2 : 1

$\phi 34$

$\phi 35 \ ^{0}_{-0.03}$

ENCODER BOTTOM VIEW

Unless Otherwise Specified	
Dimensions are in: mm	Surface finish: N6
Linear tolerances	
0.5-4.9: ±0.05 mm	5-30: ±0.1 mm
31-120: ±0.15 mm	121-400: ±0.2 mm

Netzer
Precision Position Sensors

ABSOLUTE POSITION
ROTARY ELECTRIC ENCODER™

HARSH
ENVIRONMENT | DS-37

DATA SHEET

⊥ | 0.02 | B

⊥ | 0.05 | A

B

+0.02
⌀35   0

◎ | 0.02 | B

A

⌀10 0 / -0.02

B

⫽ | 0.05 | A

⊥ | 0.02 | C

C

M4 ⤓ 10mm

⌀12 max

⌀32

⌀9

SECTION E-E

SECTION A-A

3HOLES M2 EQ.SP.

⌖ | 0.1 | A

⌀42

0 / 1.60 -0.05

0.50

2 min

1.50 REF

A

A

A

3

4

2

1
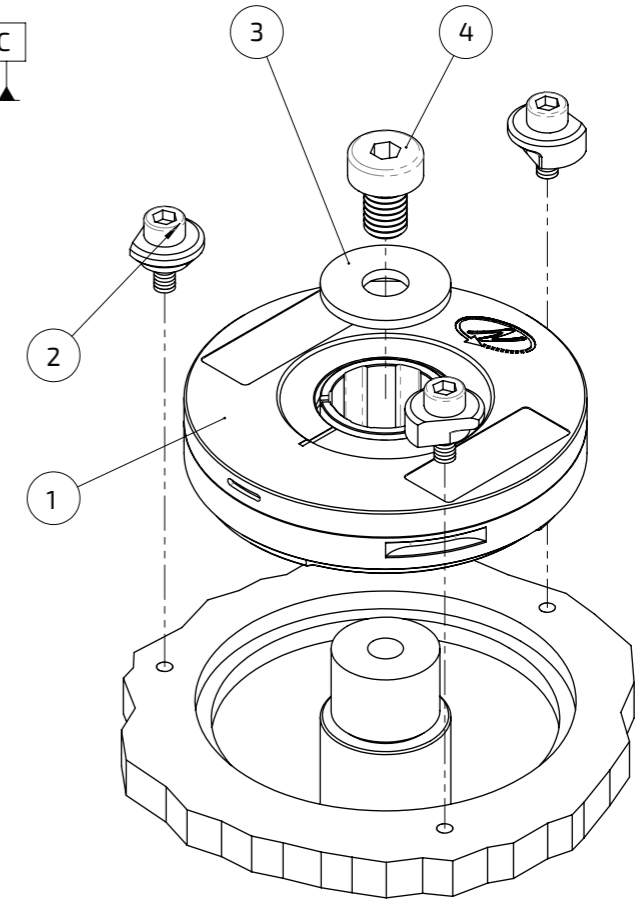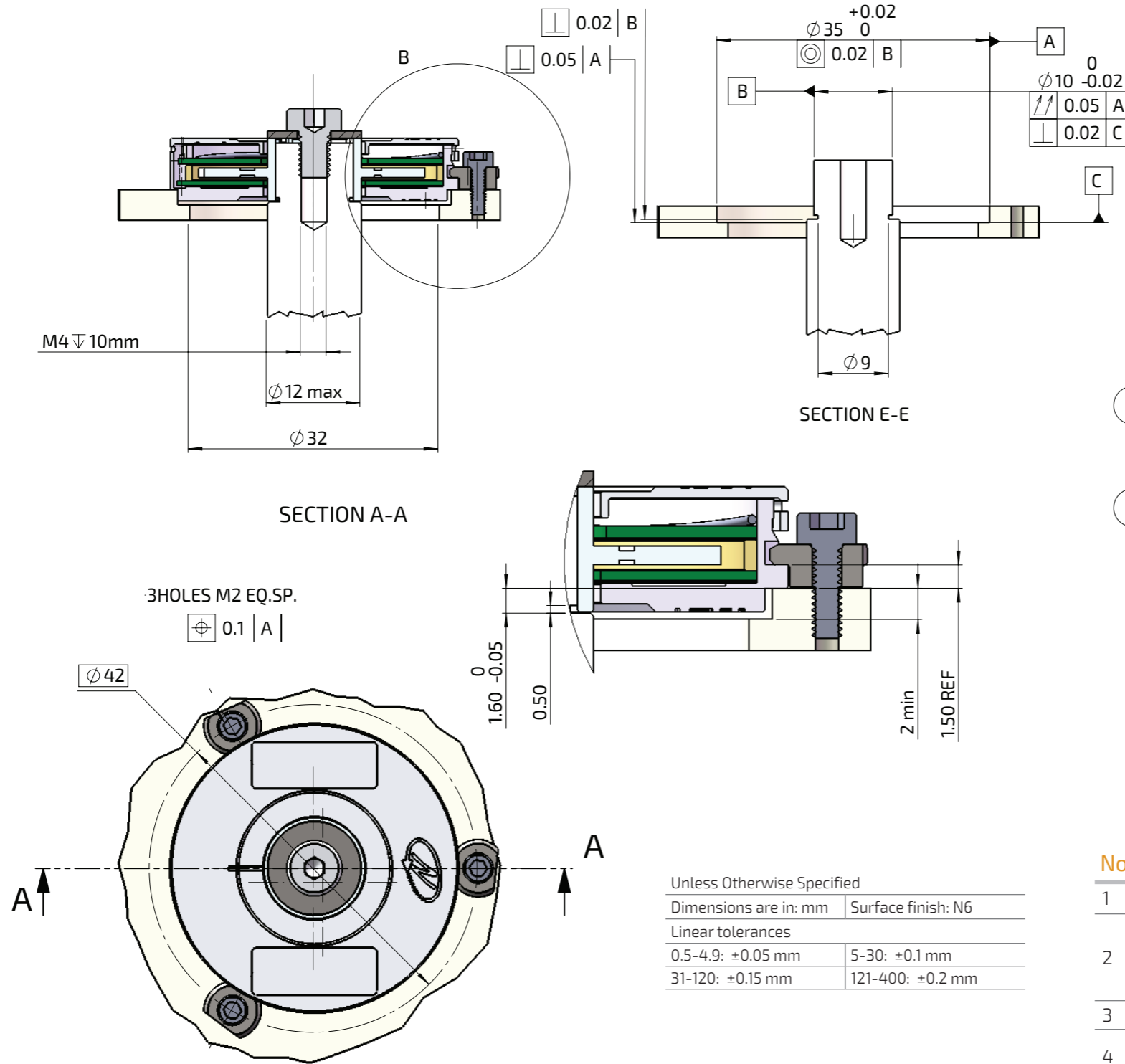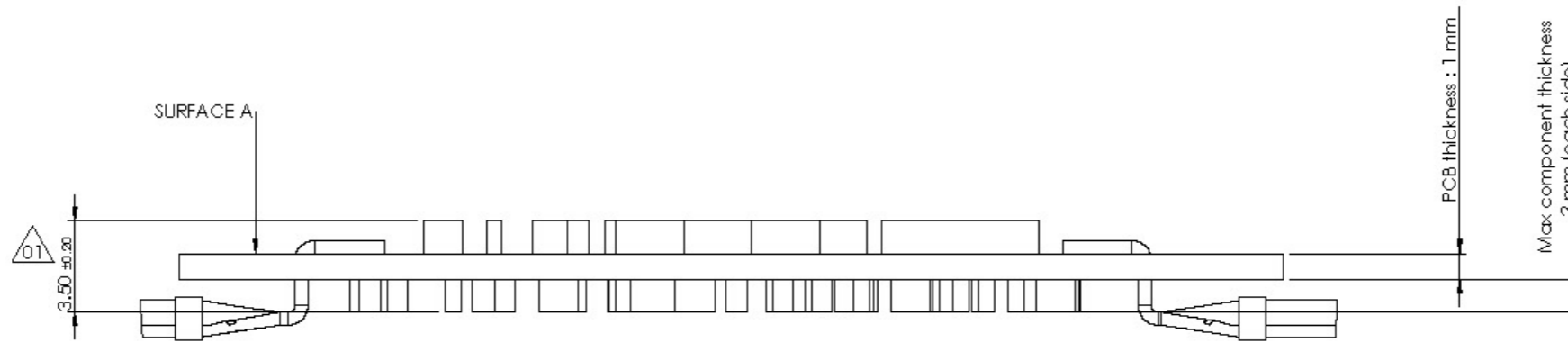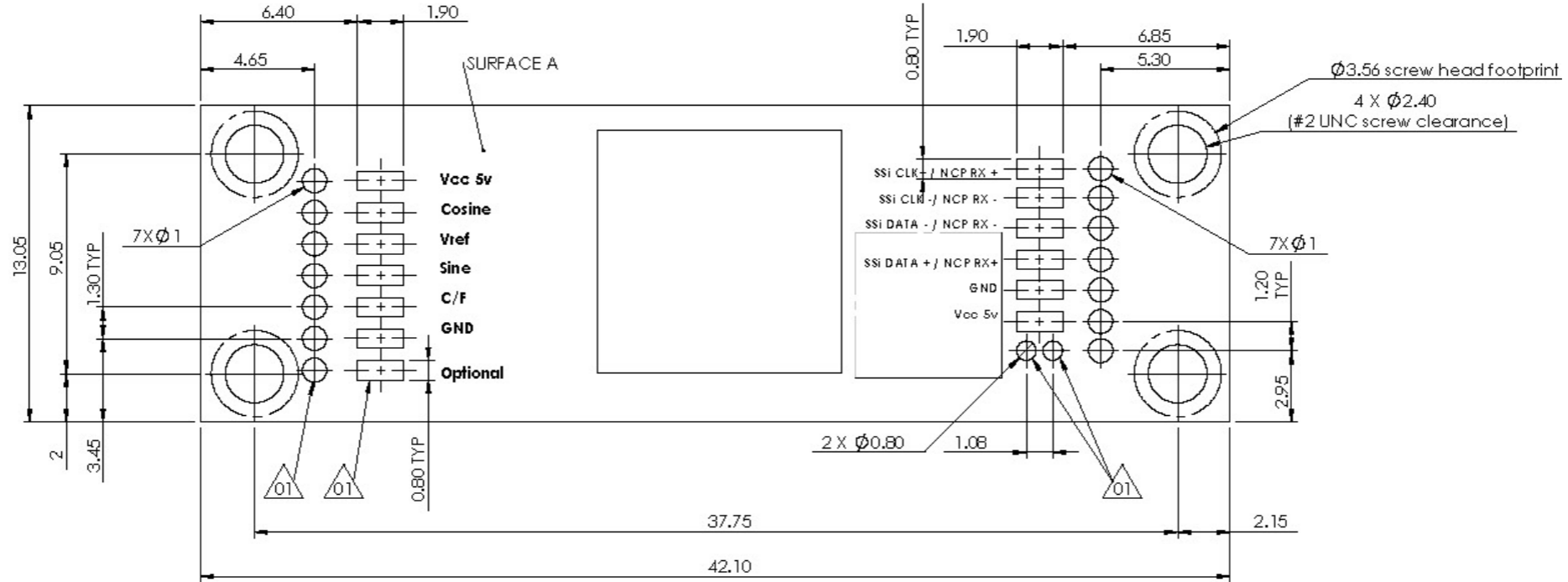
Unless Otherwise Specified

Dimensions are in: mm	Surface finish: N6
Linear tolerances	
0.5-4.9: ±0.05 mm	5-30: ±0.1 mm
31-120: ±0.15 mm	121-400: ±0.2 mm

No	Part			Description	QTY.
1	DS-37-16	Included		DS-37 encoder	1
2	EAPK005	Included	Kit	3 x M2 encoder clamps	1
3	MA-DS37-004	Optional	Shaft End installation kit	Washer DIN9021	1
4				Screw DIN 7984 M4x6	3

Critical dimensions marked with "*"

SURFACE A

6.40
1.90
4.65

0.80 TYP
1.90
6.85
5.30

Ø3.56 screw head footprint
4 X Ø2.40
(#2 UNC screw clearance)

13.05
9.05
1.30 TYP
7 X Ø1

Vcc 5v
Cosine
Vref
Sine
C/F
GND
Optional

SSi CLK + / NCP RX +
SSi CLK - / NCP RX -
SSi DATA - / NCP RX -
SSi DATA + / NCP RX+
GND
Vcc 5v

7 X Ø1
1.20 TYP
2.95

2
3.45
0.80 TYP

2 X Ø0.80   1.08

37.75
42.10
2.15

SURFACE A

PCB thickness : 1 mm
Max component thickness
2 mm (each side)

3.50 ±0.20

DS-37-V02

Unless Otherwise Specified	
Dimensions are in: mm	Surface finish: N6
Linear tolerances	
0.5-4.9: ±0.05 mm	5-30: ±0.1 mm
31-120: ±0.15 mm	121-400: ±0.2 mm

SC2SSi, DS-37 external digital module (SSi/BiSS)

No	Part		Description	QTY.
1	SC2SSi-03	Included	with DS-37 CAT No.	1