

DF-60-32

Absolute position, rotary Electric Encoder™

The DF-60 is a member of the DF series of Electric Encoders™, based on Netzer Precision proprietary technology. The Electric Encoder™ offers many advantages - some unparalleled

- Low profile (10 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
- Digital interfaces.

Mechanical

| | |
|---------------------------------|----------------------------|
| Allowable mounting eccentricity | ±0.1 mm |
| Allowable rotor axial motion | ±0.1 mm |
| Rotor inertia | 8,669 gr · mm ² |
| Total weight | 38 gr |
| Outer Ø / Inner Ø / Height | 60 / 27 / 10 mm |
| Material (stator, rotor) | Aluminum |
| Nominal air gap (stator, rotor) | 0.6 mm |

Electrical

| | |
|-----------------|-------------------|
| Supply voltage | 5V ± 5% |
| Interconnection | Shielded cable or |
| Cable Length | 1,500 mm MAX |

Environmental

| | |
|-----------------------------|------------------------------------|
| EMC | IEC 6100-6-2, IEC 6100-6-4 |
| Operating temperature range | -40°C to +85°C (-55°C optional) |
| Storage temperature | -60°C to +95°C |
| Relative humidity | 98% Non condensing |
| Shock endurance | 100 g for 11 ms |
| Operation altitude (max) | 70,000 ft |

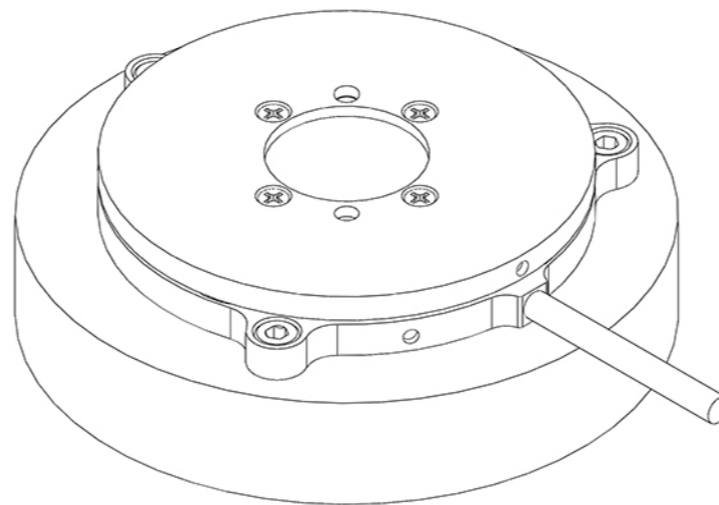
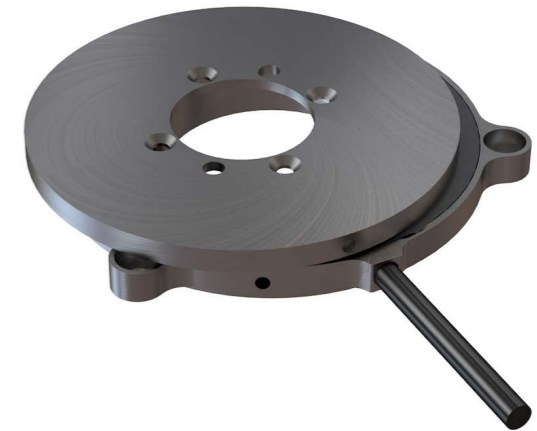
Characteristics

| | |
|-----------------------------------|-----------------------|
| Angular resolution | 18 bits ; 262,144 CPR |
| Static error | < 10 mDeg |
| Maximum operational speed | 750 rpm |
| Measurement range | Unlimited rotation |
| Power On - Max. operational speed | 3.3 RPM, ≤ 20°/sec |
| Build In Test BIT | Optional |

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.



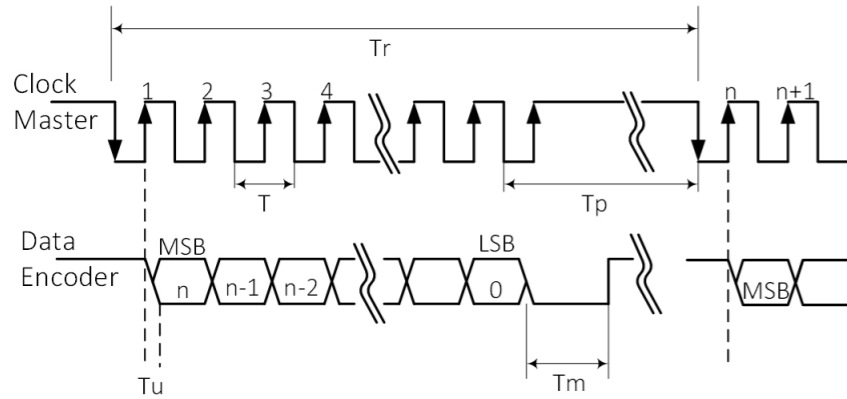


DF-60-32 Absolute position, rotary Electric Encoder™

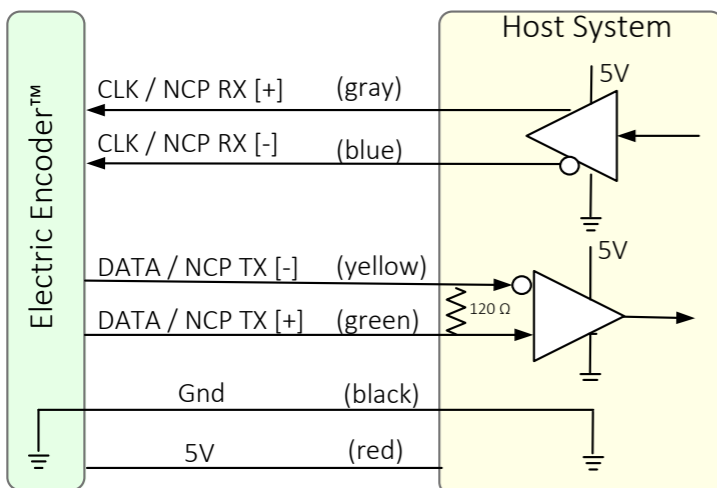


Digital SSI Interface

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 | |



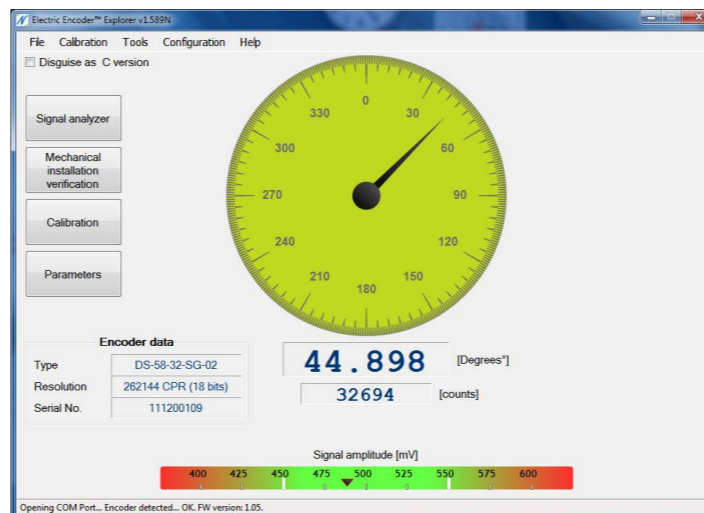
| SSI / BiSS Output signal parameters | |
|-------------------------------------|---------------------|
| Signal latency | ~250 μSec |
| Output code | Binary |
| Serial output | Differential RS-422 |
| Clock | Differential RS-422 |
| Clock Frequency | 0.5 ÷ 2.0 MHz |
| Position update rate (Max) | 30 KHz |
| Current consumption | 180 mA |

| SSI | |
|---------------|---------|
| Monoflop time | 25 μSec |

| SSI / BiSS interface wires color code | | |
|---------------------------------------|--------|--------------|
| Clock + | Grey | Clock |
| Clock - | Blue | |
| Data - | Yellow | Data |
| Data + | Green | |
| GND | Black | Ground |
| +5V | Red | Power supply |

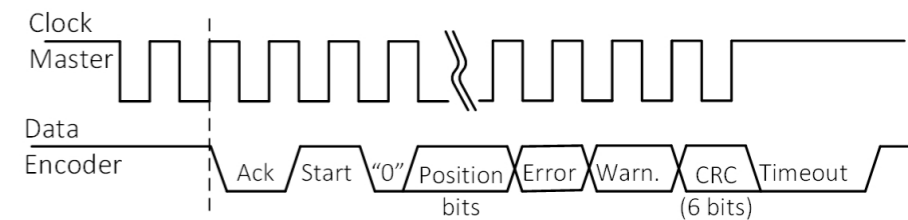
Software tools: (SSI / BiSS - C)

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.

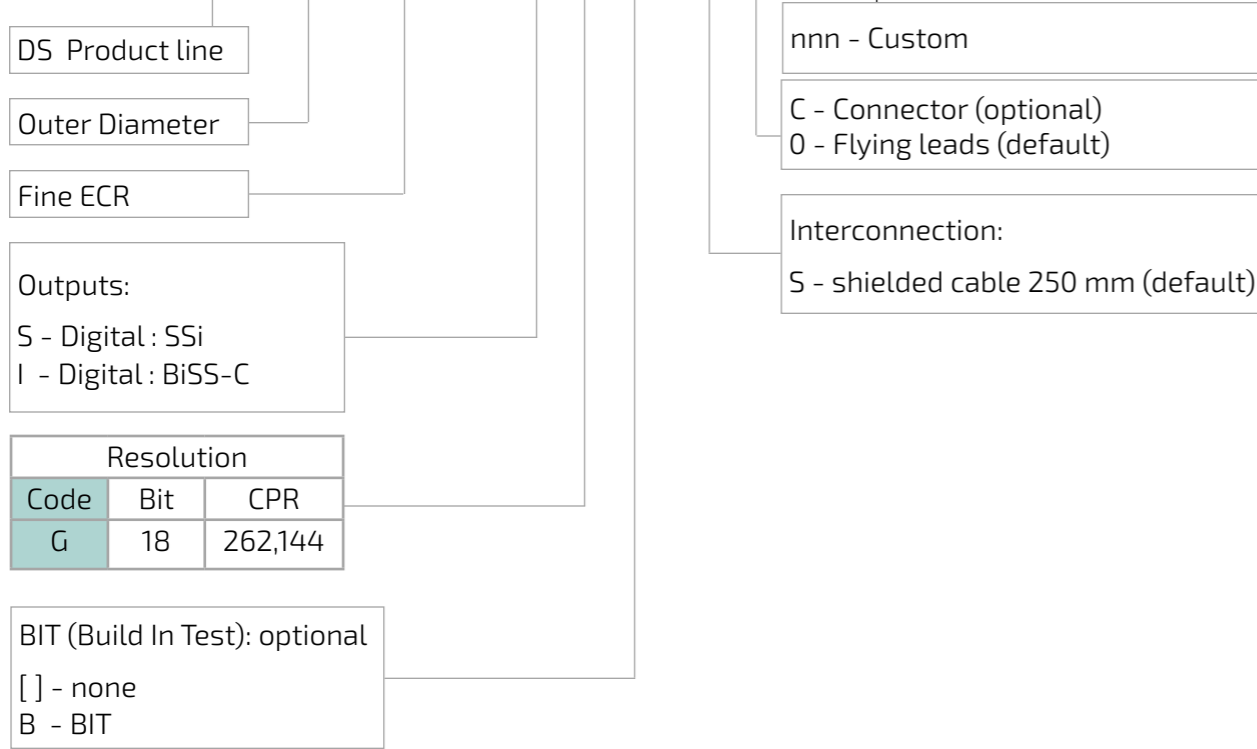


| bit # | | Description | Default | Length |
|--------|---------|---|---------|---------|
| 28 | Ack | Period during which the encoder calculates the absolute position , one clock cycle | 0 | 1/clock |
| 27 | Start | Encoder signal for "start" data transmit | 1 | 1 bit |
| 26 | "0" | "start" bit follower | 0 | 1 bit |
| 8...25 | AP | Absolute Position encoder data | | |
| 7 | Warn. | Warning | 1 | 1 bit |
| 6 | Error | Error | 1 | 1 bit |
| 0...5 | CRC | The CRC polynomial for position, error and warning data is: $x^6 + x^1 + x^0$. 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 |



DF-60-32 Absolute position, rotary Electric Encoder™

DF - 60 - 32 - SG - S0 - n n n



Netzer Cat No.: CB-00014

Provider: Ray-Q USA. wire CAT No: RQ213210

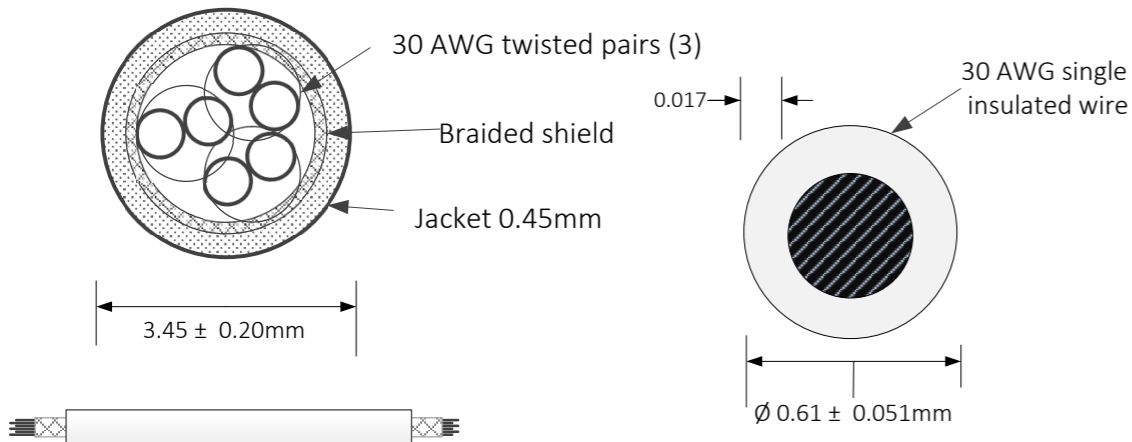
Cable: 30 AWG twisted pair (3) :2 (30 AWG 25/44 finned copper , 0.15 PFE to $\varnothing 0.6 \pm 0.05$ OD).

Temperature rating: -60 to +150 Deg C.

Braided shield: Thinned copper braided 95% min. coverage.

Jacket: 0.45 silicon rubber jacket $\varnothing 3.45 \pm 0.2$ OD

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



Related documents:

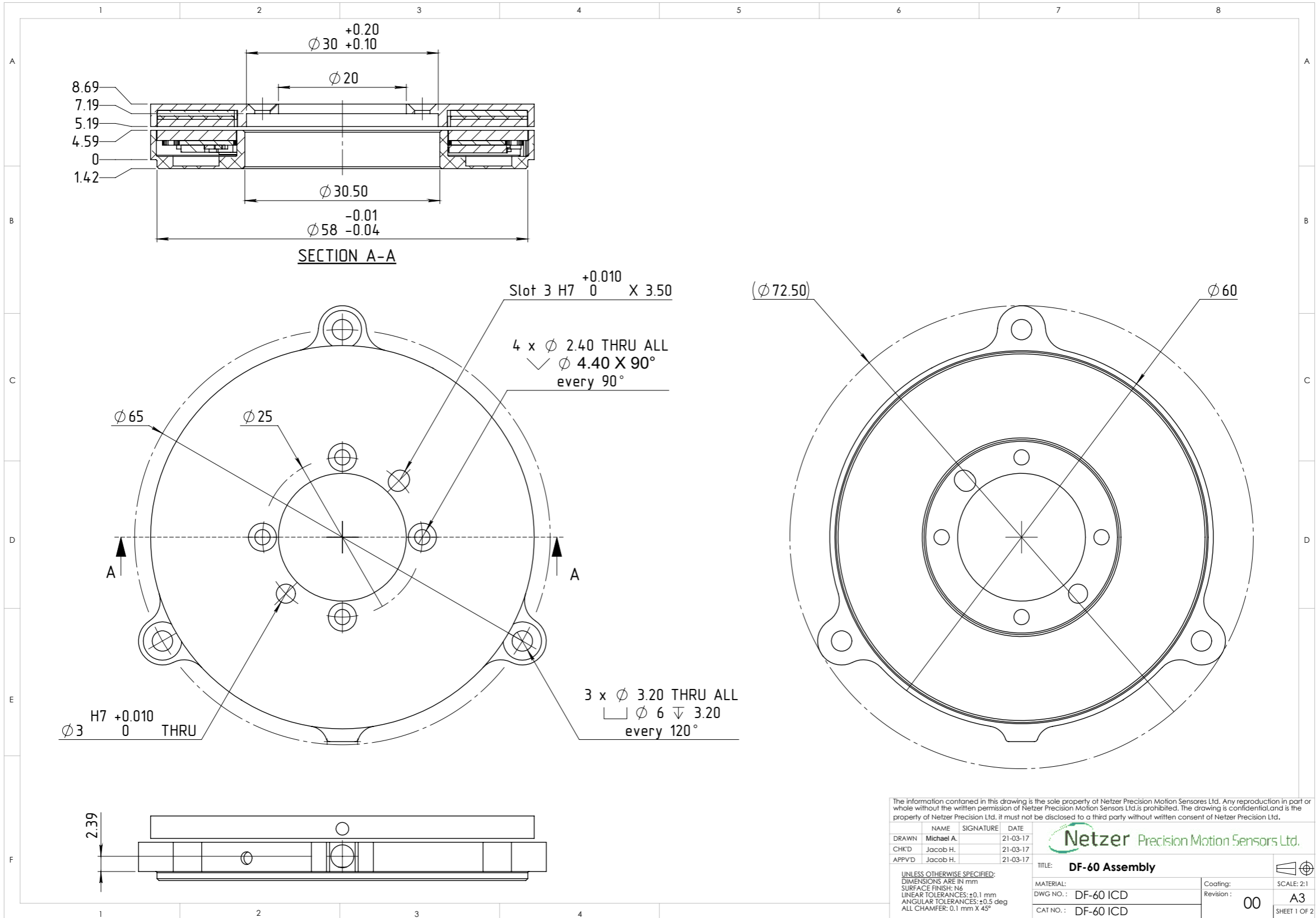
DF-60 User Manual : Mechanical , Electrical and calibration setup.

Demonstration Kit:

DKIT-DF-60-32-SG-S0: SSi interface
DKIT-DF-60-32-IG-S0: BiSS interface
Includes ,mounted encoder on rotary jig ,

DF-60-32

Absolute position, rotary Electric Encoder™



The information contained in this drawing is the sole property of Netzer Precision Motion Sensors Ltd. Any reproduction in part or whole without the written permission of Netzer Precision Motion Sensors Ltd. is prohibited. The drawing is confidential, and is the property of Netzer Precision Ltd. It must not be disclosed to a third party without written consent of Netzer Precision Ltd.

| | NAME | SIGNATURE | DATE |
|-------|------------|-----------|----------|
| DRAWN | Michael A. | | 21-03-17 |
| CHKD | Jacob H. | | 21-03-17 |
| APPVD | Jacob H. | | 21-03-17 |

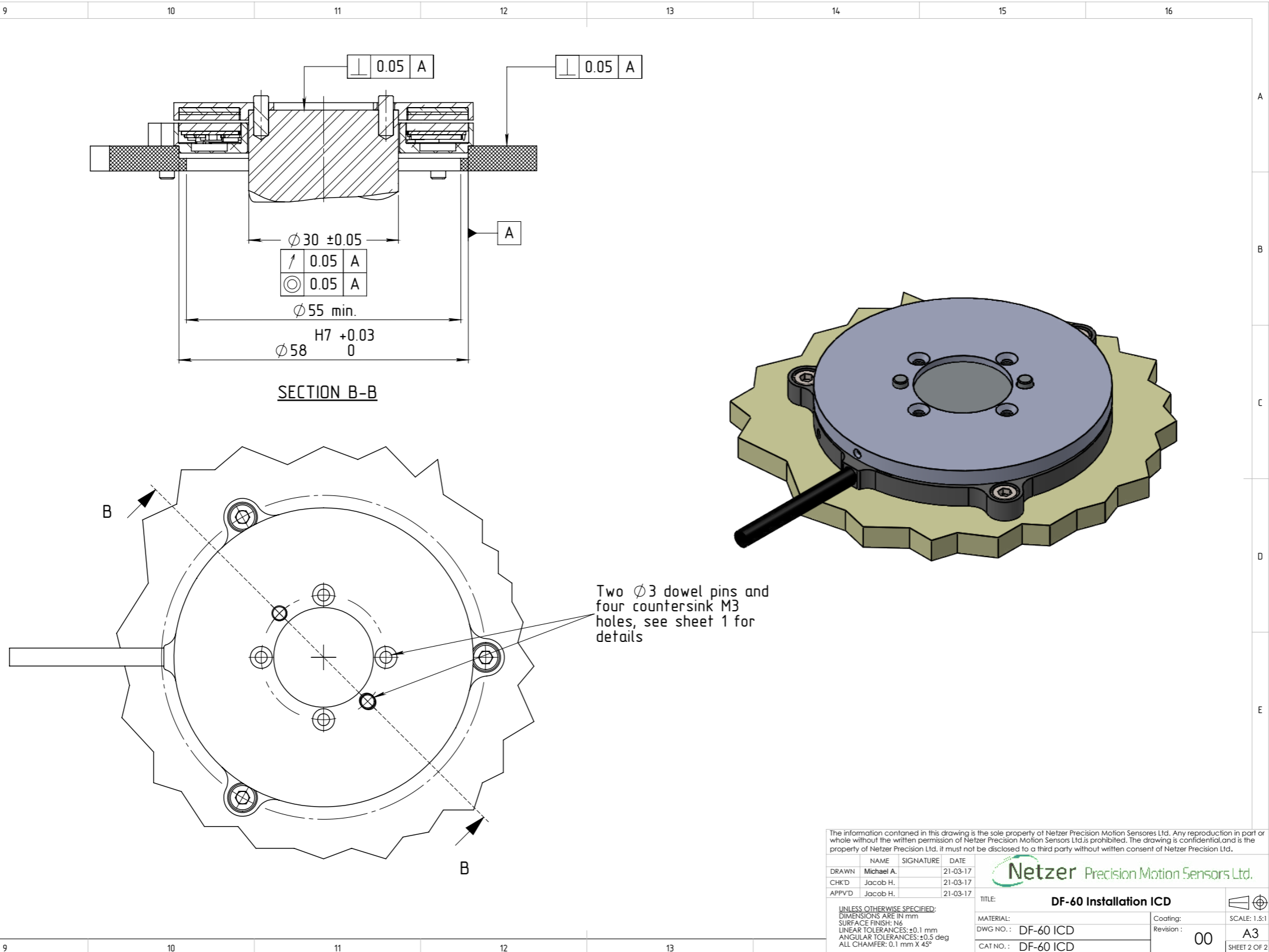
Netzer Precision Motion Sensors Ltd.

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN mm
 SURFACE FINISH: N6
 LINEAR TOLERANCES: ± 0.1 mm
 ANGULAR TOLERANCES: ± 0.5 deg
 ALL CHAMFER: 0.1 mm X 45°

| | |
|------------------------------|---------------------|
| TITLE: DF-60 Assembly | SCALE: 2:1 |
| MATERIAL: | Coating: |
| DWG NO.: DF-60 ICD | Revision: 00 |
| CAT NO.: DF-60 ICD | A3 |
| | SHEET 1 OF 2 |

DF-60-32

Absolute position, rotary Electric Encoder™



The information contained in this drawing is the sole property of Netzer Precision Motion Sensors Ltd. Any reproduction in part or whole without the written permission of Netzer Precision Motion Sensors Ltd. is prohibited. The drawing is confidential and is the property of Netzer Precision Ltd. It must not be disclosed to a third party without written consent of Netzer Precision Ltd.

| | NAME | SIGNATURE | DATE |
|-------|------------|-----------|----------|
| DRAWN | Michael A. | | 21-03-17 |
| CHKD | Jacob H. | | 21-03-17 |
| APPVD | Jacob H. | | 21-03-17 |

Netzer Precision Motion Sensors Ltd.

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN mm
 SURFACE FINISH: N6
 LINEAR TOLERANCES: ±0.1 mm
 ANGULAR TOLERANCES: ±0.5 deg
 ALL CHAMFER: 0.1 mm X 45°

| | | | |
|--------------------------------------|---------------------------|---------------------------------|---|
| TITLE: DF-60 Installation ICD | | Coating: Revision: 00 | SCALE: 1.5:1 A3 SHEET 2 OF 2 |
| MATERIAL: | DWG NO.: DF-60 ICD | | |
| CAT NO.: DF-60 ICD | | | |