

DS-58-32

Absolute Position, Rotary Electric Encoder™



The **DS-58-32** is a member of the **DS** series, based on Netzer Precision **Electric Encoder™** technology. This state-of-the-art encoder technology offers many advantages, some unparalleled:

- Low profile (17 mm)
- Hollow, floating, shaft
- No bearings or other contacting elements
- High precision
- High tolerance to temperature, shock, moisture
EMI, RFI and magnetic fields
- Multiple protocol interface options
- Continues output

Demanding application suited to the **DS-58-32** include:
Aerospace, medical, instrumentation, automation, etc.

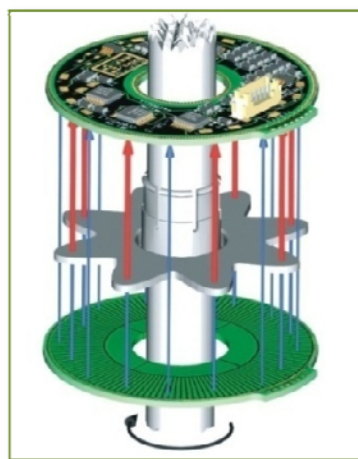
| <i>Mechanical</i> | |
|--|------------------------|
| Allowable mounting eccentricity ⁽²⁾ | ±0.3 mm |
| Allowable rotor axial motion ⁽²⁾ | ±0.3 mm |
| Rotor inertia | 800 gr·mm ² |
| Total weight | 36 gr |
| Outer diameter / Inner diameter / profile | 58 / 12.7 / 17 mm |
| Material (stator, rotor) | Reinforced Ultem™ |

| <i>Electrical</i> | |
|-----------------------------|---|
| Supply voltage | +4.6 to +5.5 V ⁽³⁾ |
| Supply current | ~ 10 mA ⁽⁴⁾ |
| Maximum load current | 5 mA |
| Output resistance | <1 Ω |
| Servo bandwidth | DC to 1 kHz |
| Interconnection | 6 pin connector + 25 cm Teflon-coated, AWG-32 wires |
| <i>Environment</i> | |
| EMC ⁽⁵⁾ | IEC 6100-6-2, IEC 6100-6-4 |
| Operating temperature range | -55°C to +125 °C ⁽⁶⁾ |
| Relative humidity | <98 % non condensing |
| Shock endurance | IEC 60068-2-27 ; 100 g for 11 ms |
| Vibration endurance | IEC 60068-2-6 ; 20 g 10 – 2000 Hz |
| Protection ⁽⁷⁾ | IP 40 |

The holistic ⁽¹⁾ structure of the **Electric Encoder™** provides generous mounting tolerance, thus obviating the need for internal ball bearings.

The absence of ball bearings and components such as flexible couplers, glass disc, light sources and detectors, along with very low power consumption makes the **DS-58-32** encoder virtually failure free.

The internally shielded, DC operated **DS-58-32** includes an electric field generator, a field receiver, a sinusoidal-shaped dielectric rotor, and processing electronics.



ANALOG – Sine / Cosine, Absolute position

| Performance | |
|--|----------------------|
| Electrical Cycles/Revolution – Fine/Coarse ⁽⁸⁾ | 32 / 1 |
| Angular resolution (using 12bit A/D conversion) ⁽⁹⁾ | 18 bits |
| Static accuracy (with offset compensation) ⁽¹⁰⁾ | < 30 mdeg° |
| Maximum operational speed ⁽¹¹⁾ | 1,500rpm |
| Output signal latency ⁽¹²⁾ | 250 µsec |
| Fine-mode output noise (DC to 1kHz) ⁽¹³⁾ | 100 µV |
| Fine-mode output amplitude ⁽¹⁴⁾ | ±0.5V ±20% |
| Measurement range | full rotation |
| Phase relationship (- seen from top) | Sine leads Cosine |

| Wires color coding | | | |
|--------------------|--------|--------|---------------|
| 1 | GND | Black | Ground |
| 2 | C/F | Gray | Coarse / Fine |
| 3 | Sine | Blue | Sine signal |
| 4 | Vr | Green | V reference |
| 5 | Cosine | Yellow | Cosine signal |
| 6 | +5V | Red | Power supply |

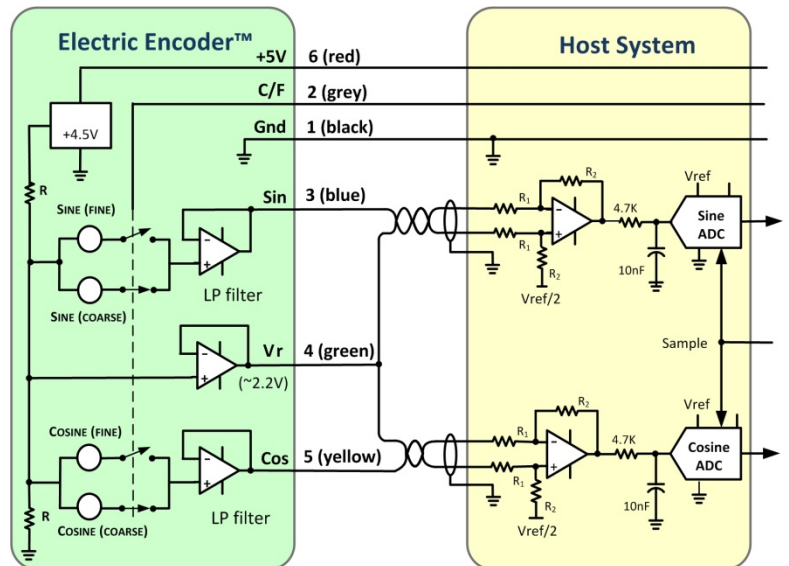
Coarse and Fine channels

The DS-58-32 has two operation modes, selectable by a logic C/F command; logic "0" 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.

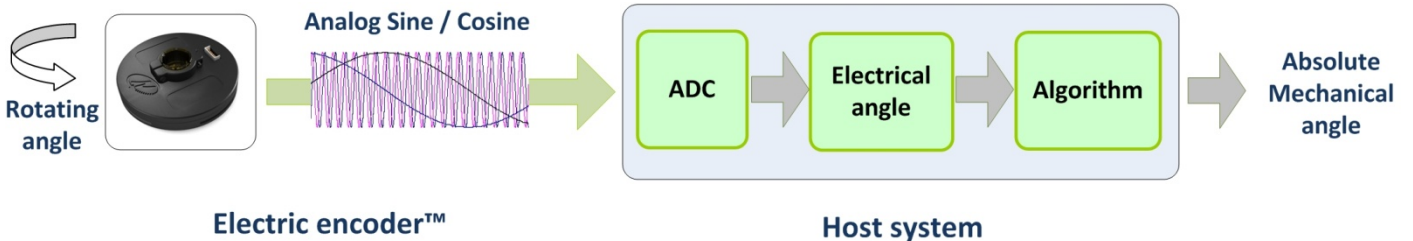
The Coarse-mode outputs need to be read only upon system initiation, the encoder is then switched to the Fine mode (switching time is ~1 ms). Coarse and Fine sine/cosine pairs are used to calculate the initial absolute position, from that point tracking the Fine channel outputs provides the absolute mechanical rotation angle with the specified accuracy and resolution.

All output signals are referenced to an internally generated voltage Vr (~2.2V)

Consult **AN-02** and **AN-03** for additional data and factory-supplied algorithms and



Electrical Interface, please refer to AN-02 for more details



Notes

1. The output signals are generated by the **whole** periphery of the rotor - see **AN-01**.
2. Accuracy degrades depending on mounting tolerances.
3. The encoder includes a 4.5V LDO voltage regulator.
4. For a micro-power version with current consumption down to 50 μA @ 3V consult factory.
5. Standard **DS** encoders are also insensitive to ESD and stray magnetic and capacitive coupling from the host system. However it is advisable to allow a discharge path of no more than several tens of **k Ω** between the machine shaft and the electronic's ground, not leaving it electrically floating
6. Consult factory.
7. For higher ingress protection the encoder should be mounted inside a sealed enclosure.
8. The number of electrical sine/cosine cycles generated over one mechanical rotation.
9. The ratio of the **Fine channel** amplitude and the encoder inherent encoder noise determines the **angular** resolution – see **AN-05**.
10. Not including **dynamic error**. For higher **static accuracy** consult factory.
11. Determined by the Fine-channel EC/Rs and the internal low pass filters.
12. An inherent signal delay inversely proportional to the internal filter's cut-off frequency (1 kHz, 3rd order Bessel) and resulting in a **dynamic error** proportional to the rotation speed - see **AN-05**
13. On how to measuring the noise and validate the best interconnection see **AN-02**.
14. With the rotor at its nominal axial position - **AN-02**.

Further Output Options

The time-continuous nature of the sine/cosine outputs can be used to enhance performance. For example:

- Increased resolution is possible by oversampling the outputs and averaging the digitized values, the improvement is limited only by the acceptable added latency – see **AN-02**.
- Speed/tacho information (highly stable, and very low noise) can be derived, in addition to the absolute position, with a factory supplied algorithm that combines the analog outputs with their differentiated versions – see **AN-04**
- In applications where analog outputs cannot be accepted, a digital position output can be obtained using factory supplied modules that provide the following formats: **SSI** absolute ([SC2SSI](#)) , incremental **AqB** with index ([SC2AqB](#)) and analog **Potentiometer** (SC2POT) - consult factory for details.

| Resolution In bits | Steps /360° | mDeg /step | Arc-sec /step | mRad /step |
|-----------------------|----------------|---------------|------------------|---------------|
| 12 | 4,096 | 87.8906 | 316.4063 | 1.5340 |
| 13 | 8,192 | 43.9453 | 158.2031 | 0.7670 |
| 14 | 16,384 | 21.9727 | 79.1016 | 0.3835 |
| 15 | 32,768 | 10.9863 | 39.5508 | 0.1917 |
| 16 | 65,536 | 5.4932 | 19.7754 | 0.0959 |
| 17 | 131,072 | 2.7466 | 9.8877 | 0.0479 |
| 18 | 262,144 | 1.3733 | 4.9438 | 0.0240 |
| 19 | 524,288 | 0.6866 | 2.4719 | 0.0120 |
| 20 | 1,048,576 | 0.3433 | 1.2360 | 0.0060 |
| 21 | 2,097,152 | 0.1717 | 0.6180 | 0.0030 |
| 22 | 4,194,304 | 0.0858 | 0.3090 | 0.0015 |

| Related Documents | |
|-------------------|--|
| AN-01 | The Electric Encoder™ |
| AN-02 | Electrically interfacing sine/cosine Electric Encoders |
| AN-03 | Absolute angle computation |
| AN-04 | Deriving speed information from the sine/cosine DS Electric Encoder™ |
| AN-05 | Accuracy, Resolution, and Repeatability |
| DS-58 | Mechanical Installation Guide |

Order Format



DS Product Line

OD mm

Fine ECR
32 (Standard)

Outputs
 0 - Analog, Sine / Cosine
 Digital -
 B - AqBiSS
 C - AqB + Index (external module – SC2AqB)
 D - SSI (external module – SC2SSI)

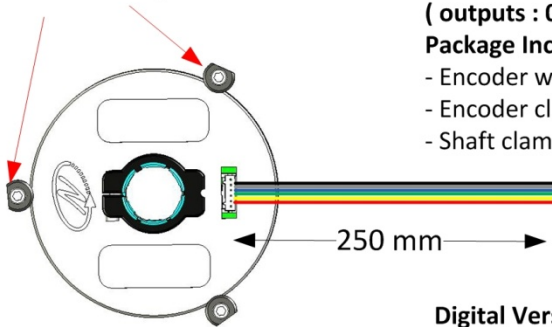
Options
 C – 6 pins connector (Standard)

Package Includes:
 - Encoder
 - Cable + connector (250 mm)
 - Encoder clamps
 - Shaft clamp

Resolution CPR – Digital outputs

| Binary | Decimal |
|-------------|----------------|
| A - 4,096 | K – 8,000* |
| B - 8,192 | L – 16,000 |
| C - 16,384 | M – 32,000 |
| D - 32,768 | N – 64,000 |
| E - 65,536 | O – 128,000* |
| F - 131,072 | |
| G - 262,144 | * For SSI only |

Encoder clamps

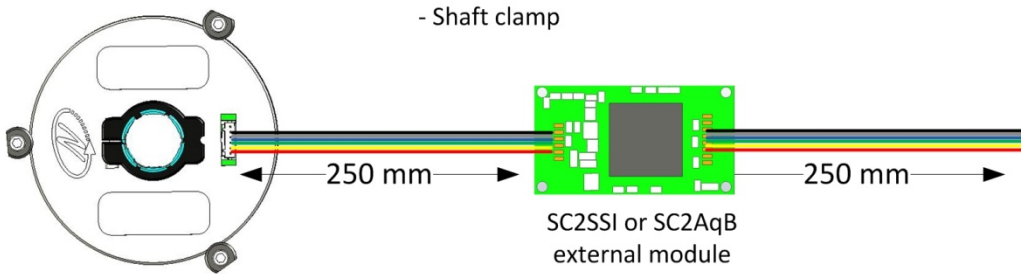


Analog Version or Internal Digital Version (outputs : 0 , A , S)

Package Includes:
 - Encoder with 250 mm loose wires
 - Encoder clamps
 - Shaft clamp

Digital Version with External Module (outputs : C , D)

Package Includes:
 - Encoder with 2 x 250 mm loose wires
 - External module
 - Encoder clamps
 - Shaft clamp



TOP VIEW

SECTION VIEW A-A

BOTTOM VIEW

