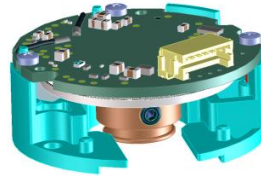


## Datasheet

# N35ST Series

## N35ST Single-Turn Absolute Encoder Module



### Description

N35ST series encoder is a high-resolution optical absolute encoder module, which offers up to 23 bits single turn resolution. This absolute encoder series is a module encoder consisting of a patterned disk, a light source, and photosensitive elements to translate the mechanical motion into electrical signals. The single-turn encoder is available with an RS-485 standard compliant communication protocol, supported by a half-duplex differential line transmissions driver, offering good noise immunity for a robust data transmission at 2.5Mbps in harsh industrial applications. Alternatively, the industry standard single-directional Synchronous Serial Interface (SSI) protocol is offered at a data transmission rate of 1MHz.

One of the key advantages of the N35ST series is the low profile module assembly. After assembly, the encoder module is only 16.5mm in overall height. With fast installation and easy one-touch calibration process, the N35ST series is well suited for direct motor assembly into small motors size of 40mm and above. As the product is intended for industrial applications, ESD protection circuitry has been designed to meet the industry standard of IEC-61000-4-2 for class 4 applications.

### Features

- Selectable resolution up to 23 bits
- High accuracy:  $\pm 300$  arc-sec
- Selectable communication protocol: half-duplex RS485, SSI 1 MHz
- Wide operating temperature range:  $-40$  to  $105^{\circ}\text{C}$
- High response speed up to 12 kRPM
- Compact size:  $\varnothing 35$  mm, and height 16.5 mm
- Hassle-free installation with 1 touch calibration

### Benefits

- High accuracy  $\pm 300$  arc-sec (12 bits)
- High precision for position or speed control
- Fast installation and calibration for motor assembly
- Suitable for industrial operating temperature
- Compact size to cater for 40mm motor
- Modular solution for ease of integration into systems
- Cost-effectiveness solution

### Applications

- Servo motor
- Robotic engineering and automation
- Factory & automotive automation
- Specialized equipment

**NOTE** Our encoders are not recommended for use in safety critical applications. E.g. ABS braking systems, power steering, life support systems and critical care medical equipment. Please contact sales representative if more clarification is needed.

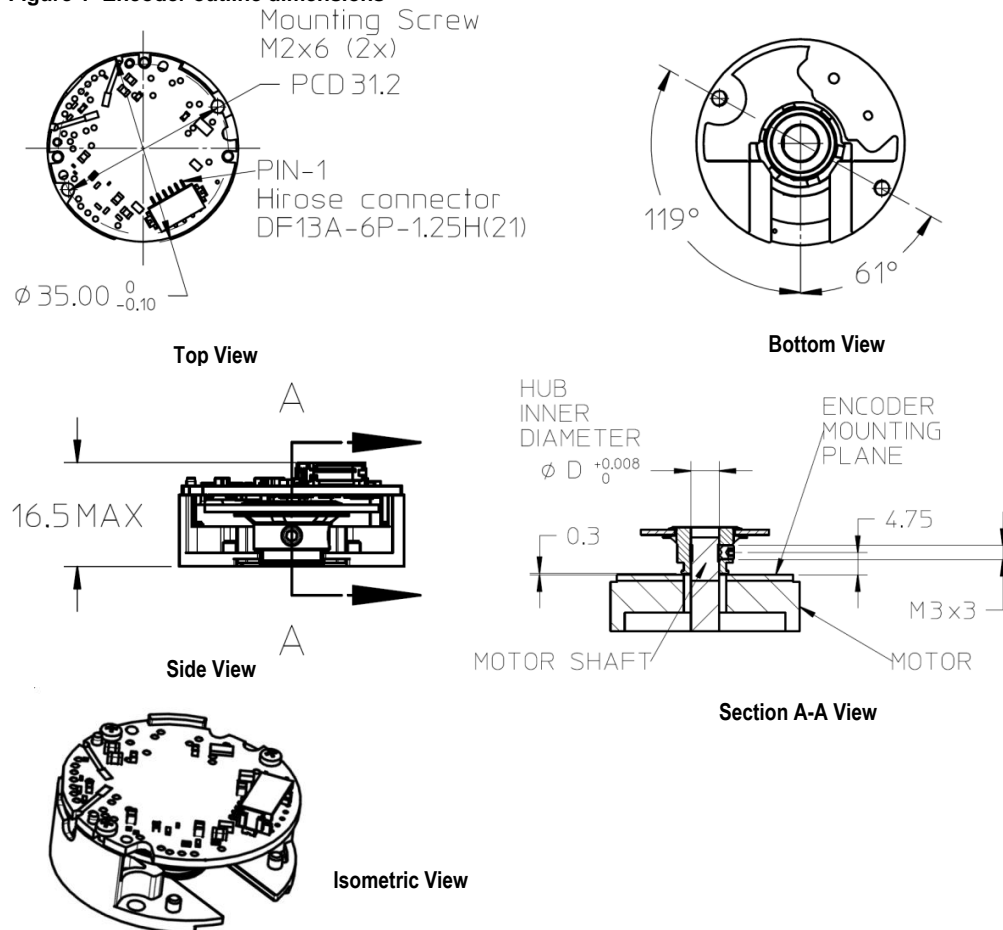
Released

N35ST-DS0001  
June 4, 2019

## Mechanical Outlines

### Standard Blind Hollow Hub Option ( $\Phi D$ )

Figure 1 Encoder outline dimensions

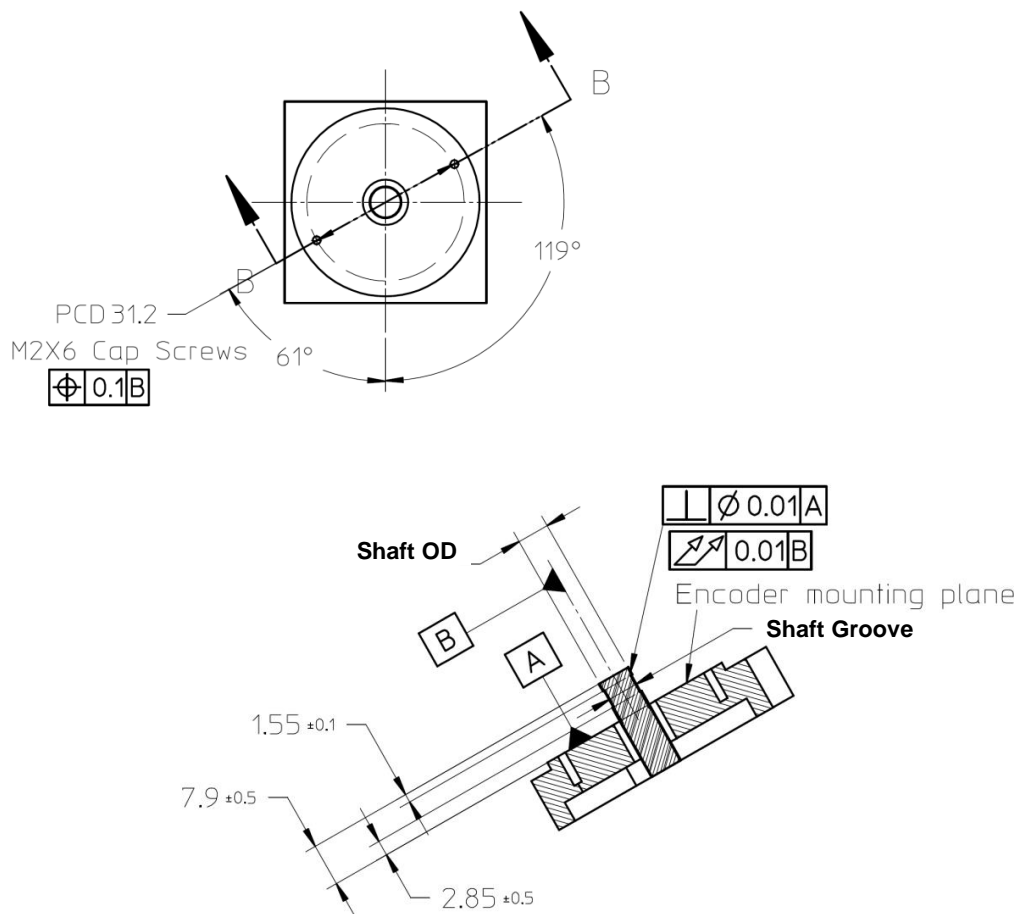


#### NOTE

1. Dimensions are in millimeters.
2. 3rd Angle Projection.
3. Unless otherwise specified, all tolerances are within  $\pm 0.5$  mm.
4. Refer to Table 3 for available shaft diameter options.

## Recommended Shaft and Mounting Requirements

Figure 2 Recommended customer shaft and motor base



### NOTE

1. Dimensions are in millimeters.
2. 3rd Angle Projection.
3. Unless otherwise specified, all tolerances are within  $\pm 0.5$  mm.
4. Recommended to have a recess on motor mounting surface to prevent encoder shaft interference with motor base.
5. Refer to the Motor Shaft Specifications table for the required shaft OD and groove tolerances.

## Product Specifications

### Encoder Operating Conditions

Table 1 Recommended operating conditions

Parameter	Symbol	Value			Units	Notes
		Min	Typical	Max		
DC Supply Voltage	VCC	+4.5	+5.0	+5.5	V	
Current Consumption	I <sub>cc</sub>		80	120	mA	Without load, T <sub>amb</sub> = 25°C
Ripple of Supply Voltage				100	mVpp	100kHz
Spikes provided by Supply Voltage				200	mVpp	20MHz
Operating Temperature	T <sub>op</sub>	-40	+25	+105	°C	Motor temperature
Storage Temperature	T <sub>storage</sub>	-40	+25	+105	°C	
Encoder Shaft Speed				12,000	min <sup>-1</sup>	Also applicable from stationary
Electrically Permissible Acceleration				1.0x10 <sup>5</sup>	rad/s <sup>2</sup>	
Relative Humidity	RH			90	%	T <sub>amb</sub> = 40°C, IEC61800-2, non-condensing

### Mechanical Specifications

Table 2 Motor & System Specifications

Parameter	Value	Units	Notes
System Accuracy	±300	Arc-sec	T <sub>amb</sub> = 25°C
Mechanical Permissible Speed	12,000	min <sup>-1</sup>	
Shaft Radial Play	+/-0.05	mm	
Shaft Axial Play	+/- 0.15	mm	
Codewheel Set Screw Size	M3x3.0		2pcs

### Motor Shaft Specifications

Table 3 Motor Shaft Specifications

Shaft OD & Tolerance (mm)			Shaft Groove & Tolerance (mm)		
Nominal	Lower	Upper	Nominal	Lower	Upper
5.0	-0.004	-0.014	4.5	-0.2	+0.2
6.0	-0.004	-0.014	5.5	-0.2	+0.2
6.35	-0.004	-0.014	5.85	-0.2	+0.2

## Encoder Specifications

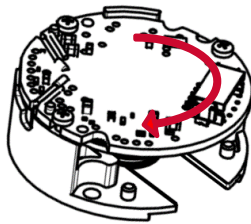
**Table 4 Encoder specifications**

Parameter	Remarks
Resolution	Single Turn: up to 23 Bits ( 8388607 counts )
Counting Direction	Increase with clockwise shaft rotation, view from encoder PCB top surface (Figure 3)
User accessible Memory size	5K bits (RS485 option only)

## Environmental Specifications

**Table 5 Encoder Environmental Specifications**

Parameters	Conditions	Specifications
Vibration	Per IEC 60068-2-6	10G; 10~2000Hz
Shock	Per IEC 60068-2-27	6ms; Half Sine; 200G
Discharge of Static Electricity (ESD)	Per IEC 61000-4-2	± 8kV contact discharge, ± 12kV air discharge
Electrical Fast Transient / Burst Immunity	Per IEC 61000-4-4, Capacitive Coupling	± 2 kV / 5 kHz / 15ms
Dielectric Resistance	Leakage <1mA	1000Vac, 1Min
Insulation Resistance	At 1kV	10MΩ



**Figure 3 Encoder counting direction**

## Electrical Connection

### Full-Duplex Transceiver (SSI Mode Protocol):

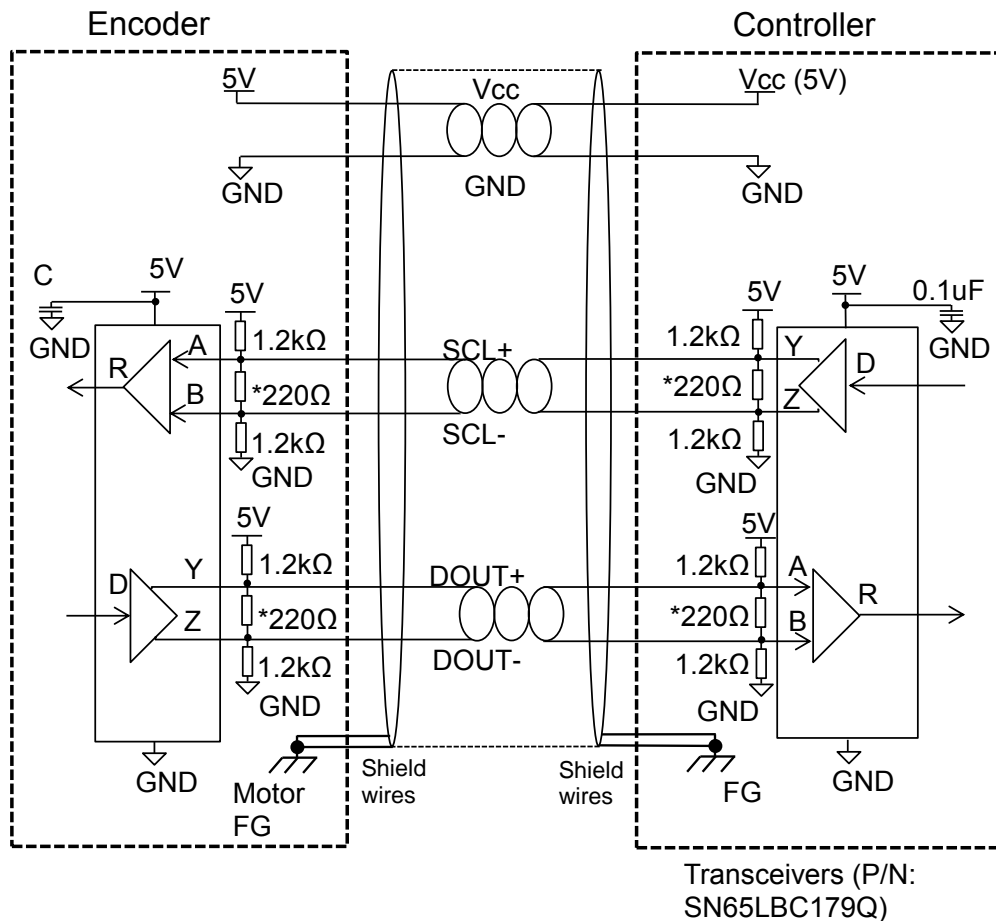


Figure 1. Circuit diagram of full-duplex transceiver

#### NOTE

1. Termination resistor, \*220ohm is recommended but may depend on the characteristic impedance of types of cable used.
2. Recommended Differential Transceiver P/N: SN65LBC179Q.
3. Recommended to use shielded, twisted pair cable and connect the cable shield to frame ground (FG) in application for enhanced noise immunity in harsh operating conditions.
4. Maximum cable length: 25m.

## Half-Duplex Transceiver (RS-485 Half-Duplex Protocol):

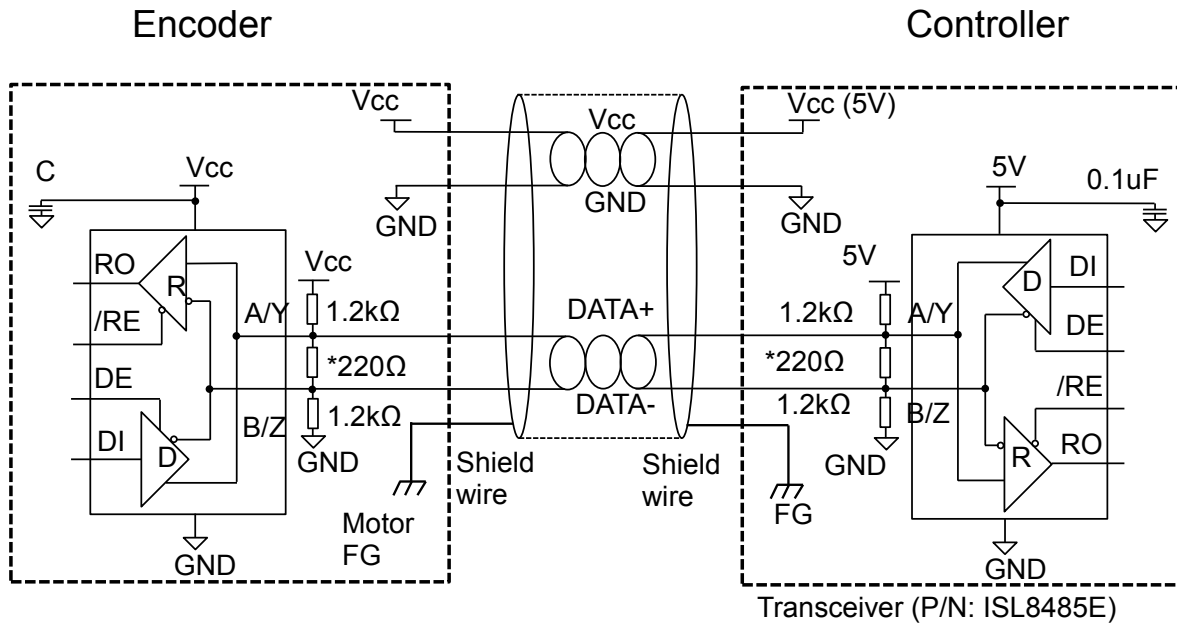


Figure 2. Circuit diagram of half-duplex transceiver

### NOTE

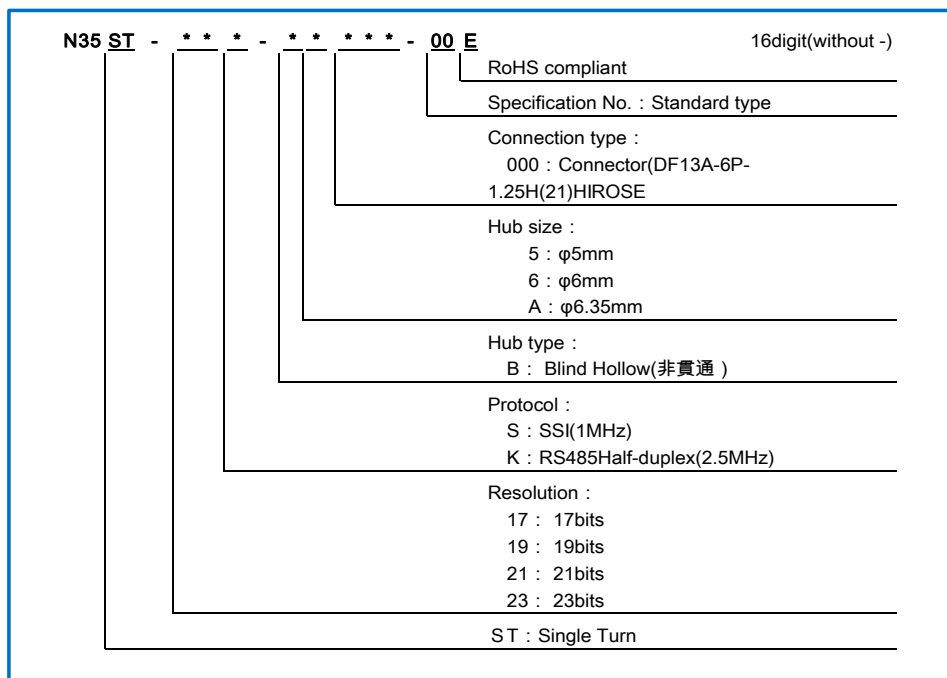
1. Termination resistor, \*220ohm is recommended but may depend on the characteristic impedance of types of cable used.
2. Recommended Differential Transceiver P/N: ISL8485E.
3. Recommended to use shielded, twisted pair cable and connect the cable shield to frame ground (FG) in application for enhanced noise immunity in harsh operating conditions.
4. Maximum cable length: 25m.

## Connector Pin Output Assignments

Pinout	Description (RS485 Protocol)	Description (SSI Protocol)
1	GND, Ground	GND, Ground
2	VCC, Encoder Supply	VCC, Encoder Supply
3	Data -	DOUT-
4	Data +	DOUT+
5	NA	SCL-
6	NA	SCL+

## Ordering Information

### Encoder Part Numbers



**NOTE** Refer to the factory for sample order and lead time.



Abbreviation /Term	Meaning
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## Definitions of Terms

Arc-sec / Arc-second	Angular measurement where 1 mechanical degree (°) is 60 arc-minutes, 1 arc-minute = 60 arc-seconds
ASIC	Application Specific Integrated Circuit
CRC	Cyclic redundancy check, Checksum
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electromagnetic Compatibility
FG	Frame Ground
IC	Integrated Circuit
min <sup>-1</sup>	Rotational speed in revolution per min
PCB	Printed circuit board
RPM	Revolution per Minute, angular rotational speed of motor or encoder shaft
sec / s	Second, a time unit
ST	Single turn
MT	Multi turn
tbd	To be defined / determined

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