BROADCOM®

Datasheet

35AT -S Series Encoders

33, 39 or 41 Bits Battery Backup Multi-Turn Absolute Encoder

Introduction

35AT-S series encoder is a high-resolution optical absolute encoder produced by Broadcom Wuxi that offers 17, 23 or 25 bits single turn and 16 bits multi-turn counts, hence a combined resolution of up to 41 bits. The 35AT-S encoder is a house encoder consisting of a patterned disk, a light source, and photosensitive elements to translate the mechanical motion into electrical signals. The 35AT-S option of encoders come with RS-485 standard compatible communication protocol, supported by a half-duplex differential line transmissions drive, offering good noise immunity for a robust transmission of data at the standard 2.5Mbps baud rate in harsh industrial applications.

The key advantage of 35AT-S series is its multi-turn tracking employs battery backup technology. Its gearless multi-turn counting method eliminates the gear worn out or acoustics noise issues, which are encountered in conventional geared multi-turn encoders. As the product is intended for industrial applications, ESD protection circuitry has been designed by meeting the industry standard of IEC-61000-4-2 class 4.

Features

- 17, 23 or 25 bits single turn counting options available
- 16 bits battery backup multi-turn counting
- Built-in RS-485 half-duplex communication protocol
- 2.5, 5.0, 10Mbps communication speed options
- Ø37 mm OD and typical mounting height of 28 mm

Benefits

- High resolution and high measurement accuracy for better speed ripple control.
- Immediate position detection upon power up without the need of system homing.
- 9mm (1:10) hollow taper shaft design for China Servo Motor market.
- 8mm blind or through hollow shaft design options are available.
- Small OD and low assembly height for ease of integration to small size motors.

Applications

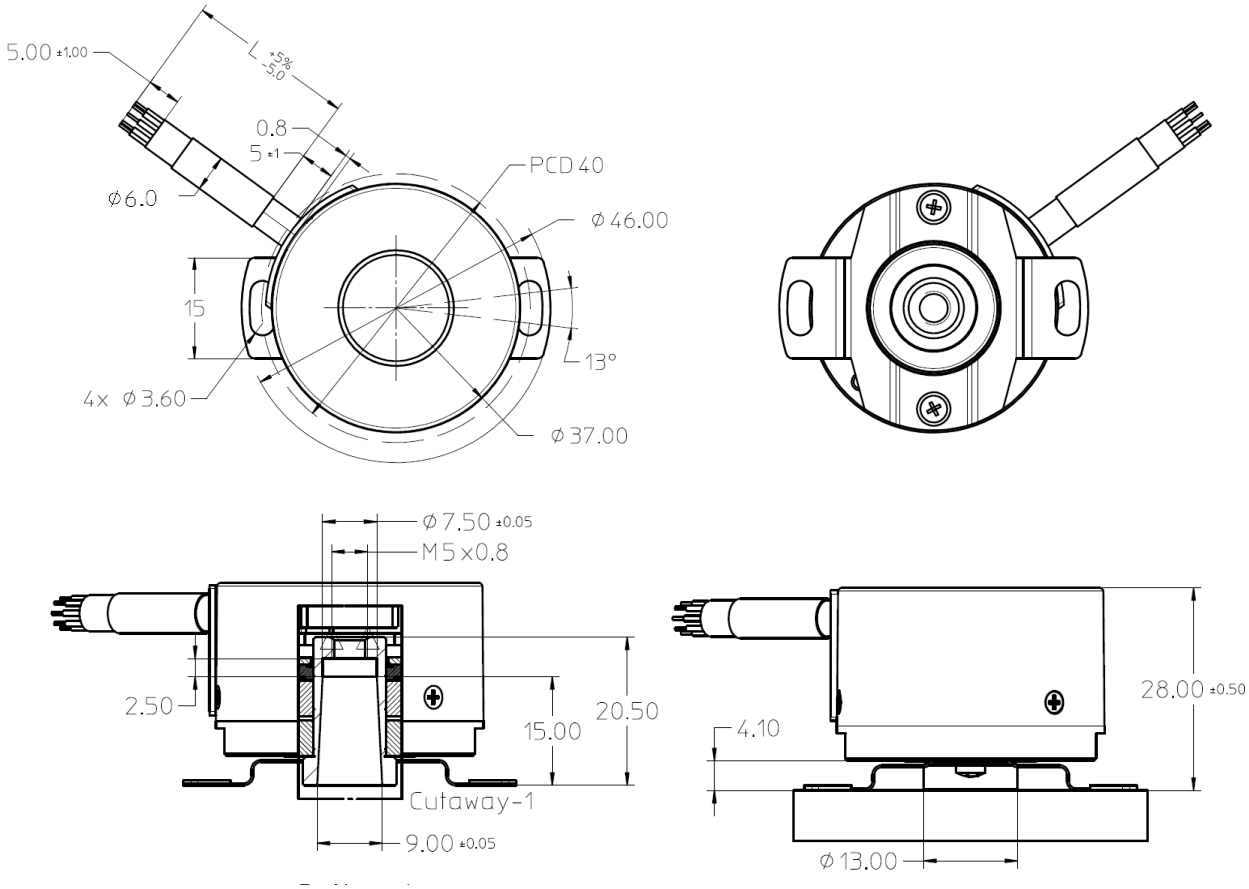
- Robotics
- Factory automation
- CNC machine tool

NOTE

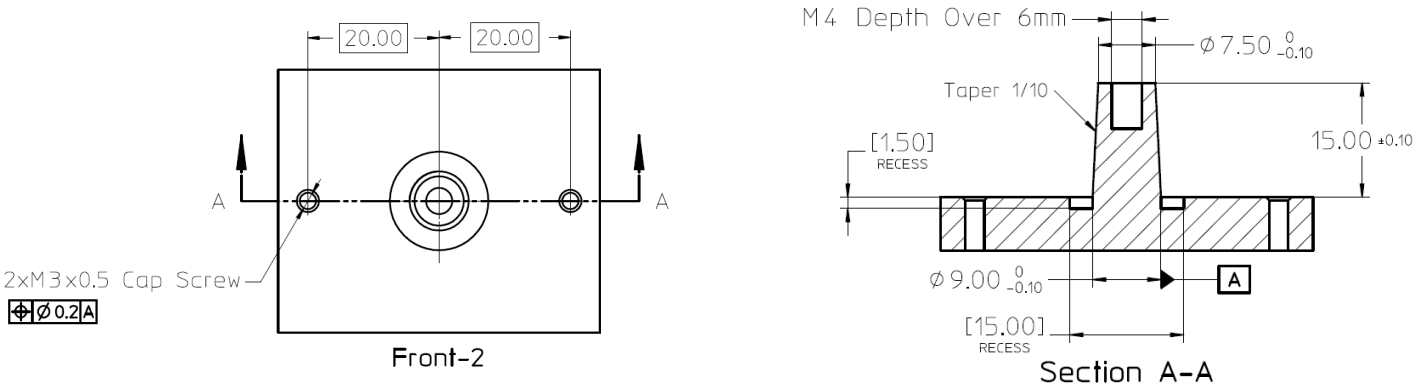
Broadcom Wuxi encoders are not specifically designed or manufactured for use in any specific device. Customers are solely responsible for determining the suitability of this product for its intended application and solely liable for all loss, damage, expense or liability in connection with such use. Please contact Broadcom Wuxi sales representative if more clarification is needed.

Mechanical Outlines

Standard Taper Shaft Option (Ø 9-Φ7.5mm; 1:10) [Cable length= L]; Coupling PCD= 40mm



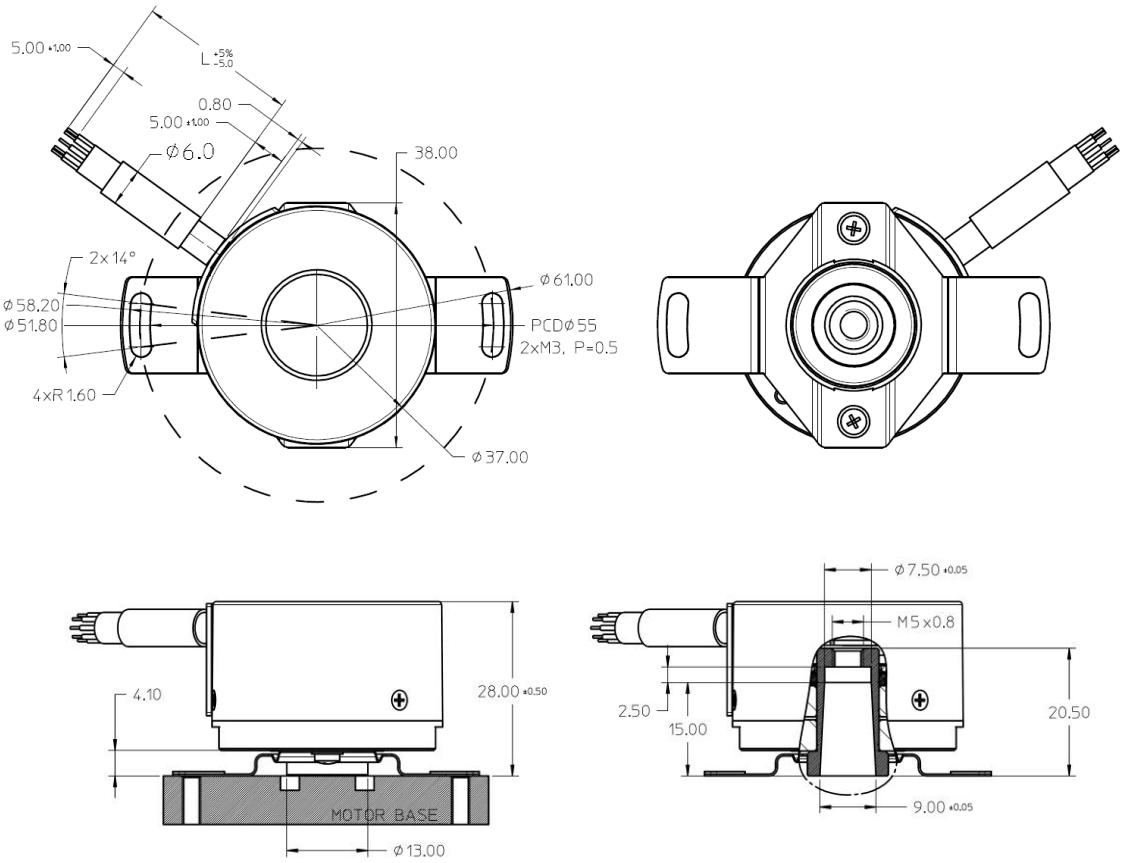
Recommended Shaft and Mounting Requirements



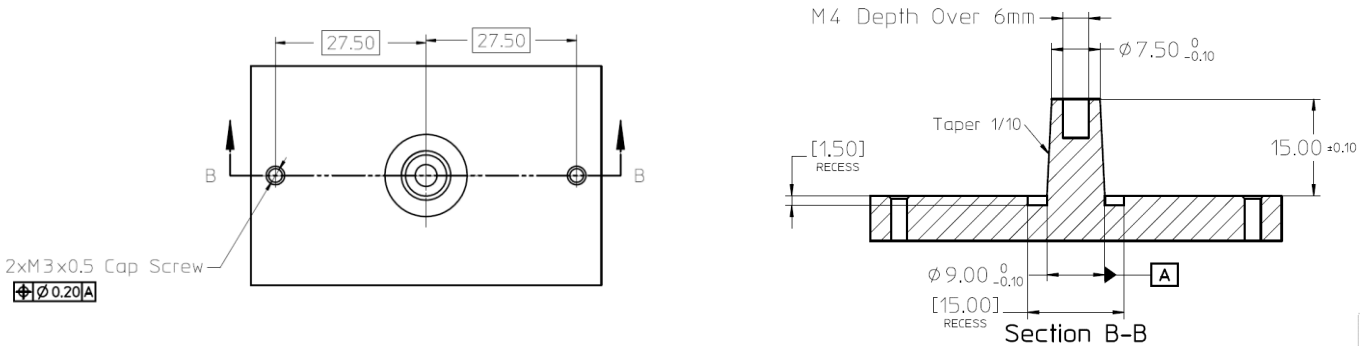
NOTE

- Dimensions are in millimeters.
- 3rd Angle Projection.
- Unless otherwise specified, all tolerances are within ±0.5 mm.
- It is recommended to have a recess on the motor mounting surface to prevent interference between the encoder shaft and the motor base.

Standard Taper Shaft Option (Ø 9-Φ7.5mm; 1:10) [Cable length= L]; Coupling PCD= 55mm



Recommended Shaft and Mounting Requirements



NOTE

- Dimensions are in millimeters.
- 3rd Angle Projection.
- Unless otherwise specified, all tolerances are within ±0.5 mm.
- It is recommended to have a recess on the motor mounting surface to prevent interference between the encoder shaft and the motor base.

Product Specifications

Electrical Specifications

Parameters	Conditions	Min	Typ	Max	Units
Current Consumption	Without load, T_{amb} = 25˚C	–	50	–	mA
Supply Voltage, V_{CC}	–	4.5	5	5.5	V
Electrically Permissible Speed	–	–	–	8,000	rpm
Electrically Permissible Acceleration	Normal mode (1)	–	–	$8.0x10^4$	rad/s^2
	Battery mode (2)	–	–	$4.0x10^4$	
External Battery Supply Voltage	V_{cc} >4.5V	–	3.6	4.5	V
	V_{cc} >4.75V	–	3.6	4.75	V
Battery Mode Current Consumption	T_{amb} = 25˚C	–	35	–	µA
Recommended Cable Length	Twisted pair, shielded	–	–	30	meter
Temperature sensor accuracy	At T_{amb} = 120 °C	–	±3	–	°C
Encoder ready upon power up	–	–	–	500	ms

NOTE

1. Normal mode: Encoder operates on encoder main power supply.
2. Battery mode: Encoder operates in “OFF” State, while multi-turn data is tracked by battery circuitry.

Power Supply Considerations

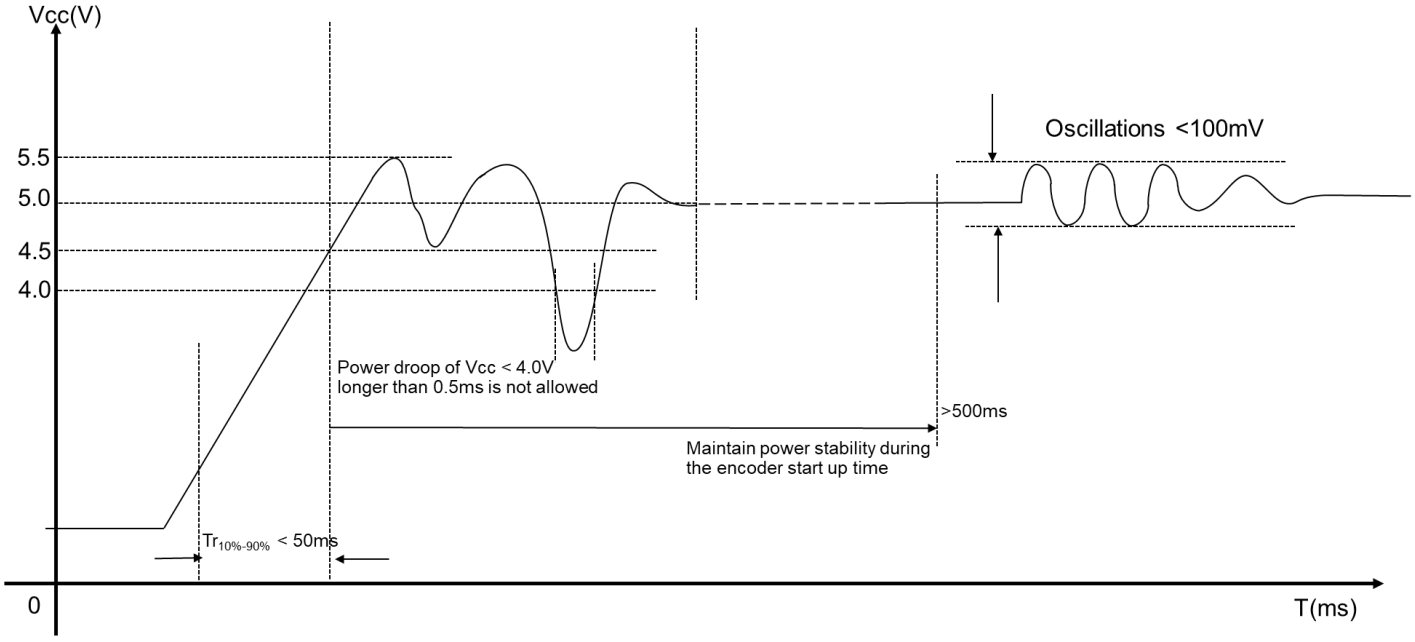


Figure 1 Encoder power up considerations

NOTE

- Power droop during the initial power up should be avoided.
- Power up rise time of <50ms is recommended.
- Encoder communication ready after 500ms.

Battery Mode Operation

Recommended External Battery

Figure 2 Recommended external battery

Product name = Toshiba ER6V/3.6V ER6VP
Manufacturer part number = ER6VP
Brand = Toshiba Ultra Lithium
Nominal voltage = 3.6V
Nominal capacity = 2000mAh
Operating temperature range = -55 ~ +85˚C
Size = AA

CAUTION

- Multi-turn data position is maintained with battery power during battery mode. Battery replacement process will cause data lost, therefore it is required to reset the multi-turn counter after every battery change.
- Battery life calculation depends on user application condition, please consult factory if assistance is needed.

Mechanical Specifications

Parameters	Conditions	Min	Typ	Max	Units
System Accuracy	T_{amb} = 25˚C	–	±50	–	Arc-sec
Mechanical Permissible Speed	–	–	–	8,000	min^{-1}
Shaft Radial Play	–	–	–	±0.05	mm
Shaft Axial Play	–	–	–	±0.1	mm
Starting torque	T_{amb} = 25˚C	–	–	$9.8x10^{-3}$	N.m

Environmental Specifications

Parameters	Conditions	Min	Typ	Max	Units
Storage Temperature	–	-20	–	105	°C
Operating Temperature	–	-20	–	105	°C
Relative Air Humidity (Non-Condensing)	T_{amb} = 40˚C, Per IEC 61800-2	–	–	90	RH%
Ingress Protection	After assembly to customer motor, Class 2	–	IP50	–	–
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	AC 500V, 1Min	Leakage <0.3			mA
Insulation Resistance	DC 500V	20			MΩ

Encoder Specifications

Parameter	Remarks
Resolution	Single Turn: 17 Bits (131,072 counts), 23 Bits (8,388,608 counts), or 25 Bits (33,554,432 counts) Multi Turn: 16 Bits (65536 counts)
Counting Direction	Increases with counter clockwise shaft rotation, view from the coupling end (Figure 1)
User accessible Memory size	5K bits

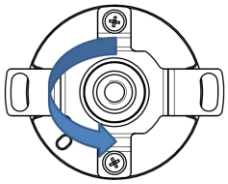
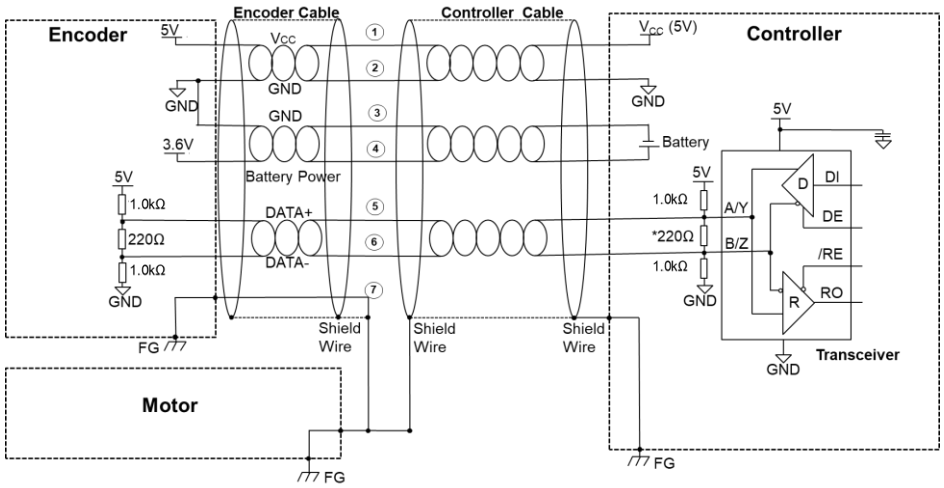


Figure 3 Counting direction

Typical Electrical Connection



Connection with a 7+1, 9X Cable (shield wire is not connected at encoder end)

Figure 4 Typical RS485 connection

NOTE

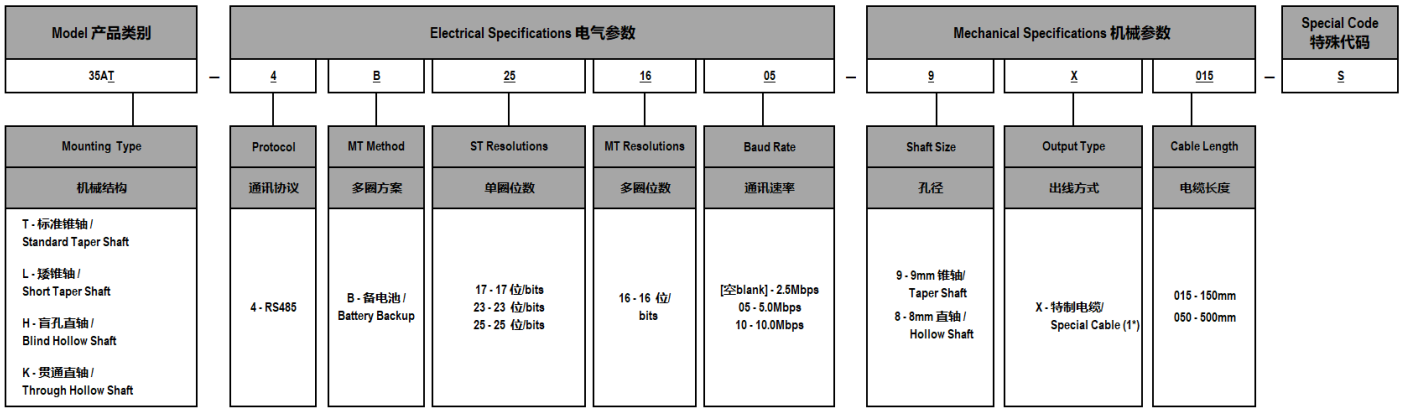
- It is strongly recommended to provide encoder power supply, Vcc within 4.5V ~ 5.5V. Typical value is 5V.
- For best noise immunity, it is recommended to use twisted-pairs shielded cable for connection to controller (servo driver), up to 30m in length.
- It is recommended to connect encoder chassis and cable shield to frame ground (FG) in application for enhanced noise immunity in harsh operating condition.
- Recommended differential transceiver P/N: ISL8485E or equivalent.
- To prevent undesirable signal reflections, the termination resistor is needed. Termination resistor, *220ohm 1/4W is recommended but may depend on the characteristic impedance of cable used.

Cable Output Assignment

Electrical Pinout Connection with 7+1 Cable Assembly (9x Option)

Pin Number (Encoder End)	**Wire Color (7+1 Cable End)**	**Description**
1	Red	VCC, Encoder Supply
2	Black	GND, Ground
3	White	Data +
4	White/Black	Data -
5	Brown	BATPWR(External Battery)
6	Brown/Black	GND (External Battery)
7	Gray	Encoder Chassis, Connect to Motor Chassis
-	Cable Shield Strand	Cable Shield, Connect to Motor Chassis

Ordering Information



型号示例：35AT-4B2516-9X015-S

注意

1. "T"和"L" 标准孔径为 9mm, “H”和"K"标准孔径为 8mm
2. 本编码器产品出厂是单独附板簧，有 PCD40 及 PCD55 两种规格可选，下单时请注明所需板簧规格
3. 出线方式“X”：1) 电缆直出; 2) 电缆规格为 AWG28; 3) 屏蔽线在编码器端不连接; 4) 增加一条由编码器本体引出的灰色芯线
4. 关于产品订单和交货时间,请咨询博通无锡工厂