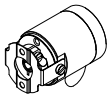
1. KM16 Multi-turn Absolute Encoder (Through Shaft)

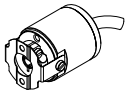
1.1 Introduction

KM16 is a miniaturzed design, high precision multi-turn absolute photoelectric encoder, capable of outputting 17Bits of single-turn position information, expandable up to 20Bits, can read up to 16Bits of multi-turn position information.
The structure is unique, suitable for small spaces.

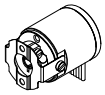
KM16-A-J



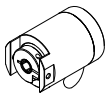
KM16-A-L



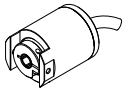
KM16-A-P



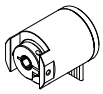
KM16-B-J



KM16-B-L



KM16-B-P



1.2 Feature:

- External diameter Ø16mm、diameter of shaft up to Ø3mm.
- Compact and sturdy structure.
- Adopt non-contact photoelectric reflection principle.
- Interface: BiSS_C or SSI.
- Accuracy: ±80".
- Single-turn resolution of 17Bits is expandable up to maximum 20Bits.
- Support multi-turn data recording without power failure, the maximum recording is 16 Bits.

1.3 Application:

Servo motor, micro motor, robot and other industrial automations.

1.4 Connection:

- Radial cable (standard length 0.5M);
- Axial cable (standard length 0.5M);
- Radial alignment (standard length＜0.15M)。

1.5 Protection:

- Radial alignment （IP50）;
- Radial and axial cable （IP65）。

1.6 Weight:

About 25g

2. Model Selection Guide

Model composition (select parameters)

KM16-	B	P	3	G	16	R		-	000
Product model series	Installation method: A=with spring plate B=without spring plate	Connection: J=Radial cable L=Axial cable P=Radial alignment	Diameter of shaft: (Blind hole) 3=Ø3mm	Communication: B=BISS C (Binary) S=SSI (Binary) G=SSI (Gray)	Resolution Single-turn: 10=16Bit 11=16Bit 12=16Bit 13=16Bit 14=16Bit 15=16Bit 16=16Bit 17=17Bit 18=18Bit 19=19Bit 20=20Bit Single-turn+ Multi-turn： List： 1616=16+16Bit 1716=17+16Bit 1816=18+16Bit 1916=19+16Bit 2016=20+16Bit	Electrical interface: R=RS-485	Special requirement: Blank=❶		Customer No.

Special requirement：

❶. cable length 0.5m，if need to change the length C+number，max 10m(indicated by C10).

3. Basic Specification

3.1 Resolution

Single-turn(ST)		Multi-turn(MT)	
13Bits 2^{13}(0～+8191)	Under 17Bits as standard, expandable up to Max 20Bits	16Bits 2^{16}(65536 turn)	Max 16Bits
14Bits 2^{14}(0～+16383)		16Bits 2^{16}(65536 turn)	
15Bits 2^{15}(0～+32767)		16Bits 2^{16}(65536 turn)	
16Bits 2^{16}(0～+66535)		16Bits 2^{16}(65536 turn)	
17Bits 2^{17}(0～+131071)		16Bits 2^{16}(65536 turn)	

3.2 Parameter

Name	Parameter	Remark
Scanning principle	Photoelectric	
Accuracy	±80″	
Response speed	Normal action: 6000min^{-1}	
Position data jitter	±2 @18 Bits/r	
Communication	BiSS_C (Binary)	Pls refer to BiSS_C standards
	SSI (Binary / Gray code)	Pls refer to SSI standards
Communication clock frequency	≤10 MHz(BiSS) or ≤5 MHz(SSI)	
Resolution	17 Bits expandable up to Max 20 Bits	For frame infomation,please refer to P9 & P10 (data frammes)
Starting time	Typical value: 13 ms	
Absolute position sampling period	≤75 ns	
Allowable speed	≤32200 r/min	Restricted by mechanical speed limit
Electrical connection	Radial cable & Axial cable & Radial alignment	Pls refer to page 7
Cable	Twisted-paired cable	
Cable length	200mm - 10000mm	
Internal single-turn position update rate	15000kHz	Access rate is limited by communication frequency
Internal multi-turn position update rate	11.5kHz	
Temperature alarm limit value	-40℃～85℃	

3.3 Mechanical specification

Name	Parameter	Remark
Mechanical connection	Ring locking with shaft, flexible spring plate fixed connection	
Diameter of shaft	Ø3mm(L=11mm, blind hole)	Pls refer to P5 & P6 for dimensions
Shaft material	Stainless steel	
Starting torque	＜0.005Nm at 25℃	
Inertia moment	Less than 0.3×10^{-6} kg·m²	
Shaft load	Radial 2N; Axial 2N	
Allowed speed	≤6000 rpm	
Shell material	Aluminium alloy	
Weight	About 25g	

3.4 Environmental specification

Name	Parameter
Environmental temperature	Operaing：－40～85℃
	Storage：－40～+85℃
Environmental humidity	Operating and storage:35～85%RH (Noncondensing)
Vibration	10～2000Hz/10G
Shock	100G 11ms
Protection	Alignment（IP50） & cable（IP65）

4. Electrical Characteristic

4.1 Absolute maximum ratings

Symbol	Instructions	Minimum	Maximum	Unit
Vcc	Supply Voltage	-0.3	+6.0	V
V_{BAT}	Backup Voltage	-0.3	+6.0	V
T_{STG}	Storage Temperature	-40	+95	° C
T_J	Junction Temperature	-40	+95	° C

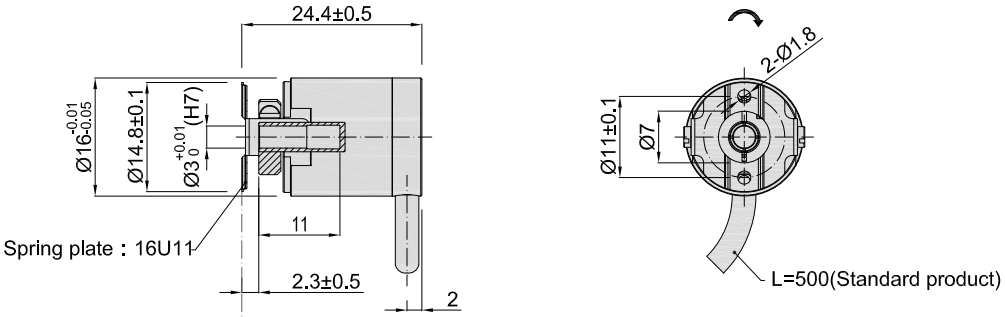
4.2 Electrical parameter

Symbol	Instructions	Minimum	Typical value	Maximum	Unit
Vcc	Supply Voltage DC5V	4.75	5.0	5.5	V
I_{DD}	Supply Current	-	-	120	mA
V_{BAT}	Backup Voltage ❶	3.0	3.6	4.2	V
$I_{(BAT)}$	Backup Current	-	-	35	uA
f_{BISS}❷	BISS Communication clock frequency	-	-	10	MHz
	SSI Communication clock frequency	-	-	5.0	MHz
Ta	Operating temperature	-40		+95	° C

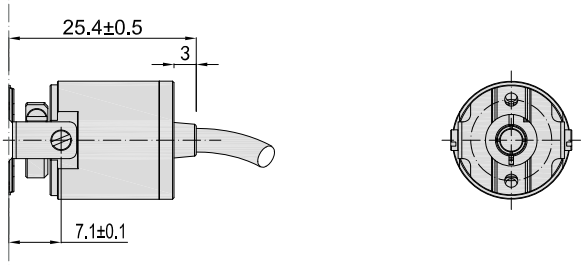
❶ For the power supply sequence of multi-turn absolute encoders, be sure to power on the system after the battery has been powered up.
❷ Pls refer to BiSS_C and SSI standards.

5. Basic Dimension

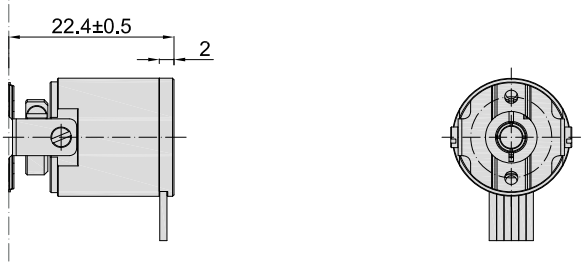
5.1 KM16-A-J



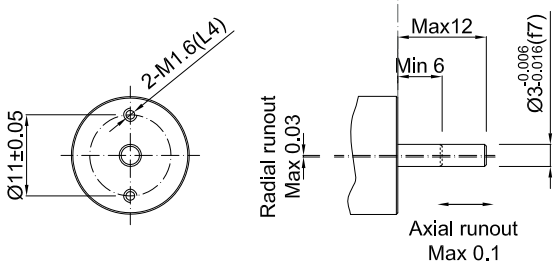
5.2 KM16-A-L
(other dimensions are the same as KM16-A-J)



5.3 KM16-A-P
(other dimensions are the same as KM16-A-J)

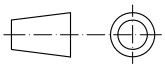


5.4 Specification for mounting shaft



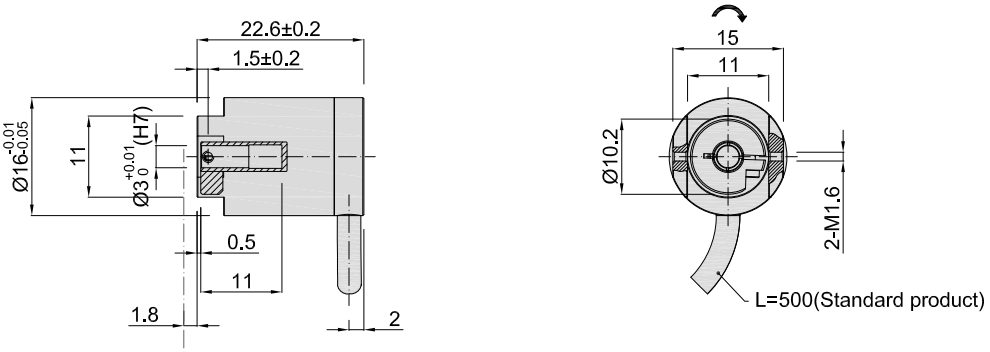
Mounting screws
Slotted bolted + flat washers Specification:M1.6*3 Material：stainless steel Quantity：2

Unit: mm

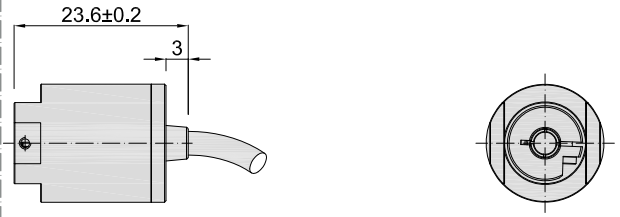


= Shaft rotation direction of the signal output

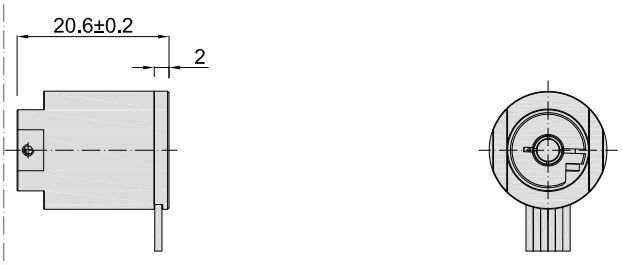
5.5 KM16-B-J



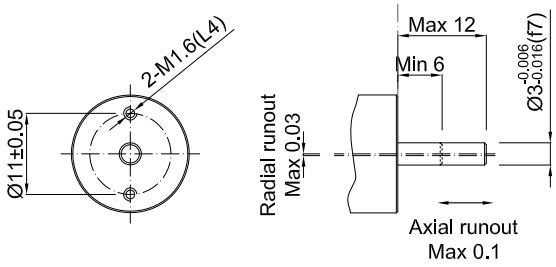
5.6 KM16-B-L
(other dimensions are the same as KM16-B-J)



5.7 KM16-B-P
(other dimensions are the same as KM16-B-J)

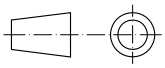


5.8 Specification for mounting shaft



Mounting screws
Slotted bolted + flat washers Specification:M1.6*3 Material：stainless steel Quantity：2

Unit: mm



= Shaft rotation direction of the signal output

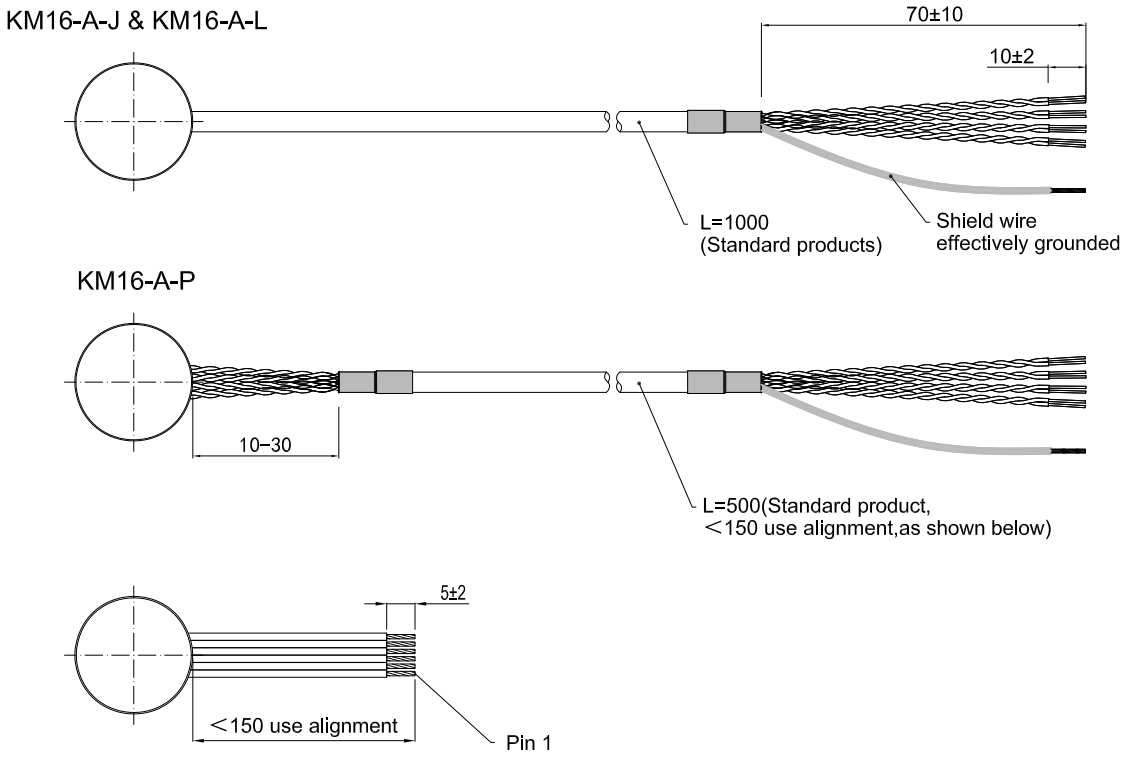
6. Interface Definition

6.1 Funtional definition of wire color BISS_C / SSI

Alignment	Cable wire	Signal				Function	Twisted-paired cable
		BISS_C ST	BISS_C MT	SSI ST	SSI MT		
1	Red	Up	Up	Up	Up	Power positive	
2	Black	Un	Un	Un	Un	Power negative	
3	White	SL-	SL-	DATA-	DATA-	Data signal	
4	White/BK	SL+	SL+	DATA+	DATA+	Data signal	
5	Green	MA-	MA-	CLOCK-	CLOCK-	Clock signal	
6	Green/BK	MA+	MA+	CLOCK+	CLOCK+	Clock signal	
7	Yellow	N.C.	Vbat	N.C.	Vbat	Backup power supply	
8	Yellow/BK	N.C.	0V	N.C.	0V	0V	

① Cable length 1M is our factory standard, the longest can be purchased up to 10M.

6.2 Cable specification definition



Unit: mm

7. Electrical Connection

7.1 Electrical connection diagram

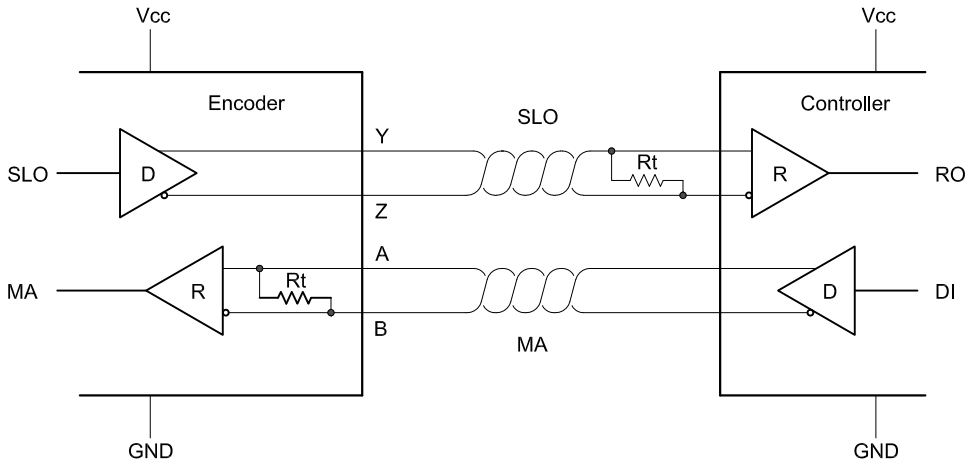


Figure 1: Point-to-point configuration

Note: Both the MA and SLQ lines are differential twisted-paired cable transmission, compatible with RS422.
The terminal resistor of the MA transmission line has been integrated inside the encoder.

7.2 BiSS_C communication

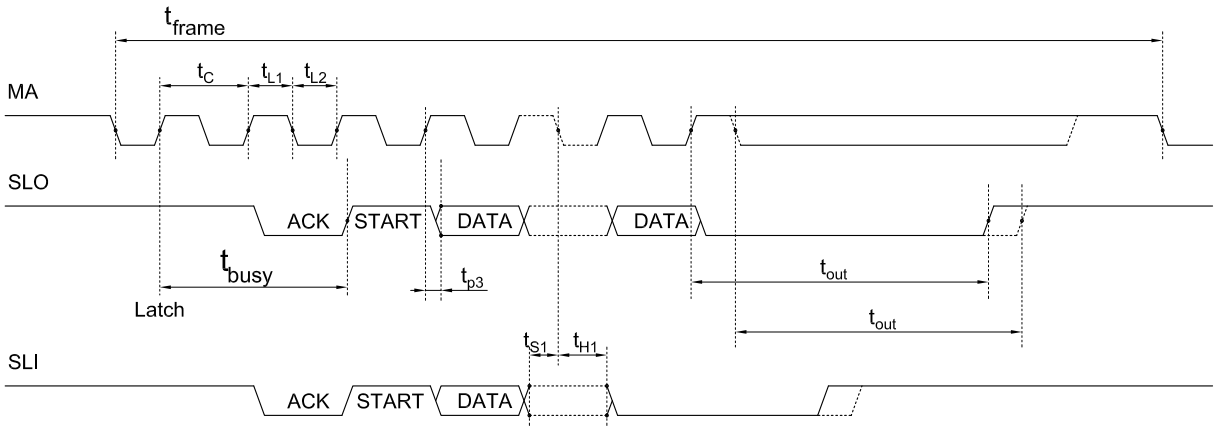


Figure 2: BiSS-C Timing

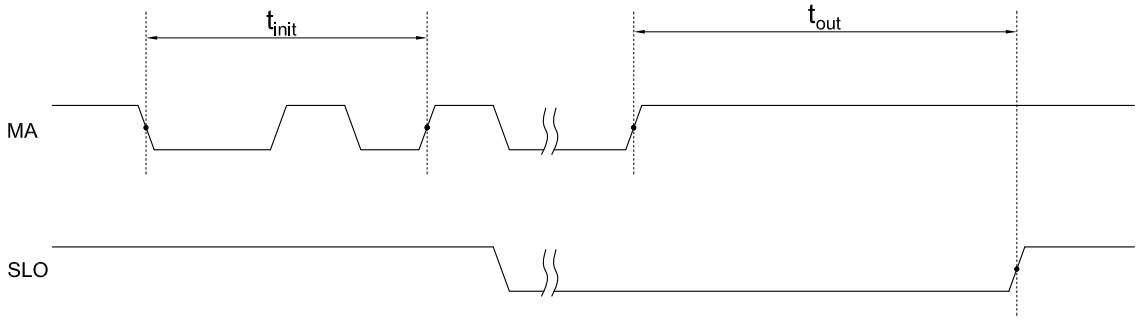


Figure 3: BiSS-C (SSI) Slave Timeout Sequence

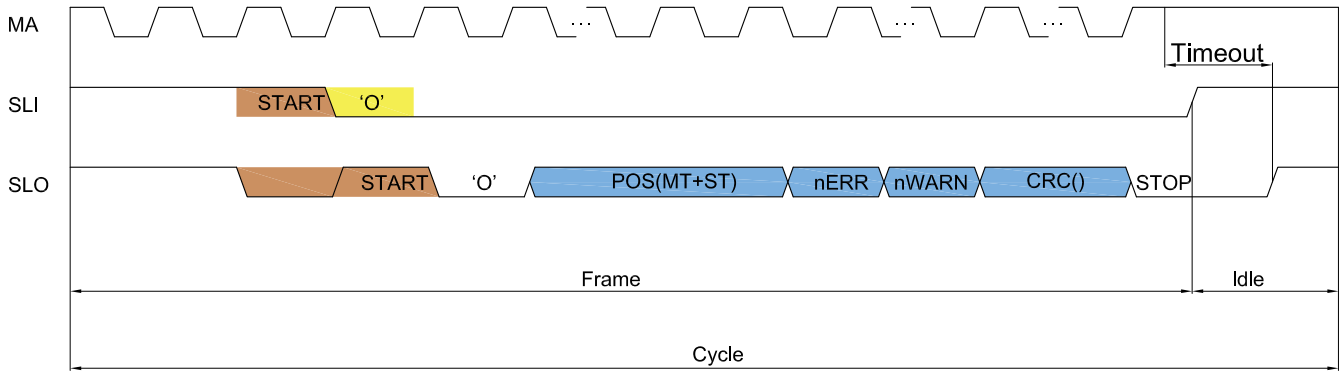


Figure 4: BiSS Frame Structure

7.3 SSI communication

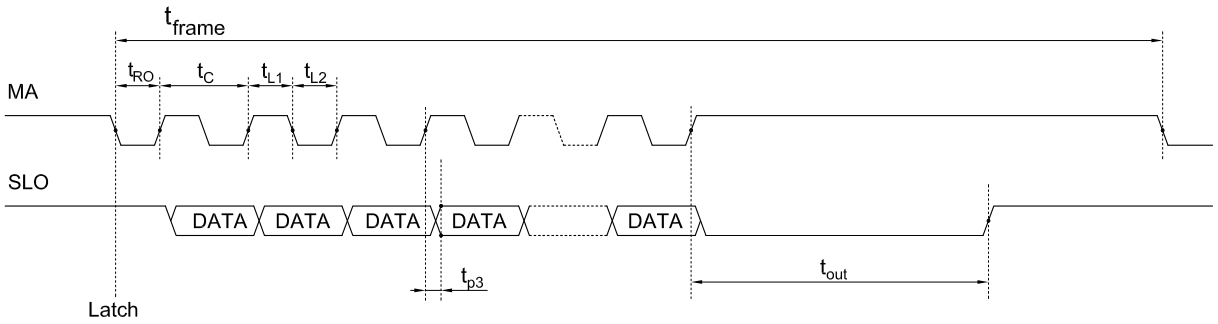


Figure 5: SSI Timing

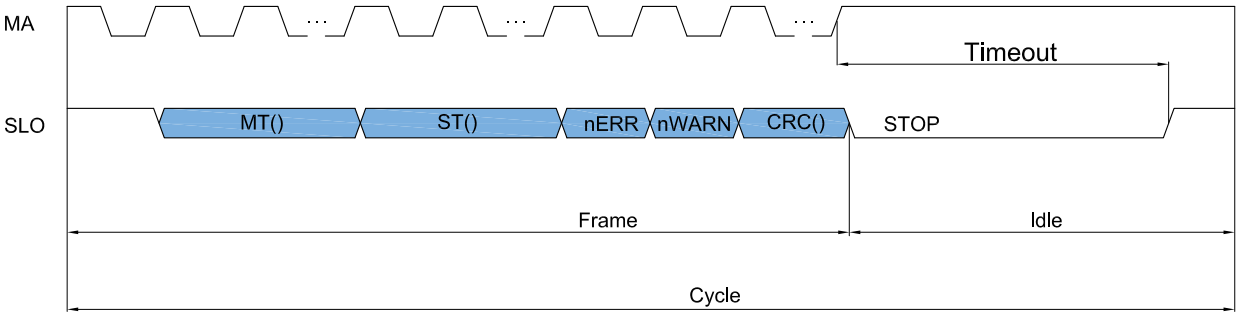


Figure 6: SSI Frame Structure

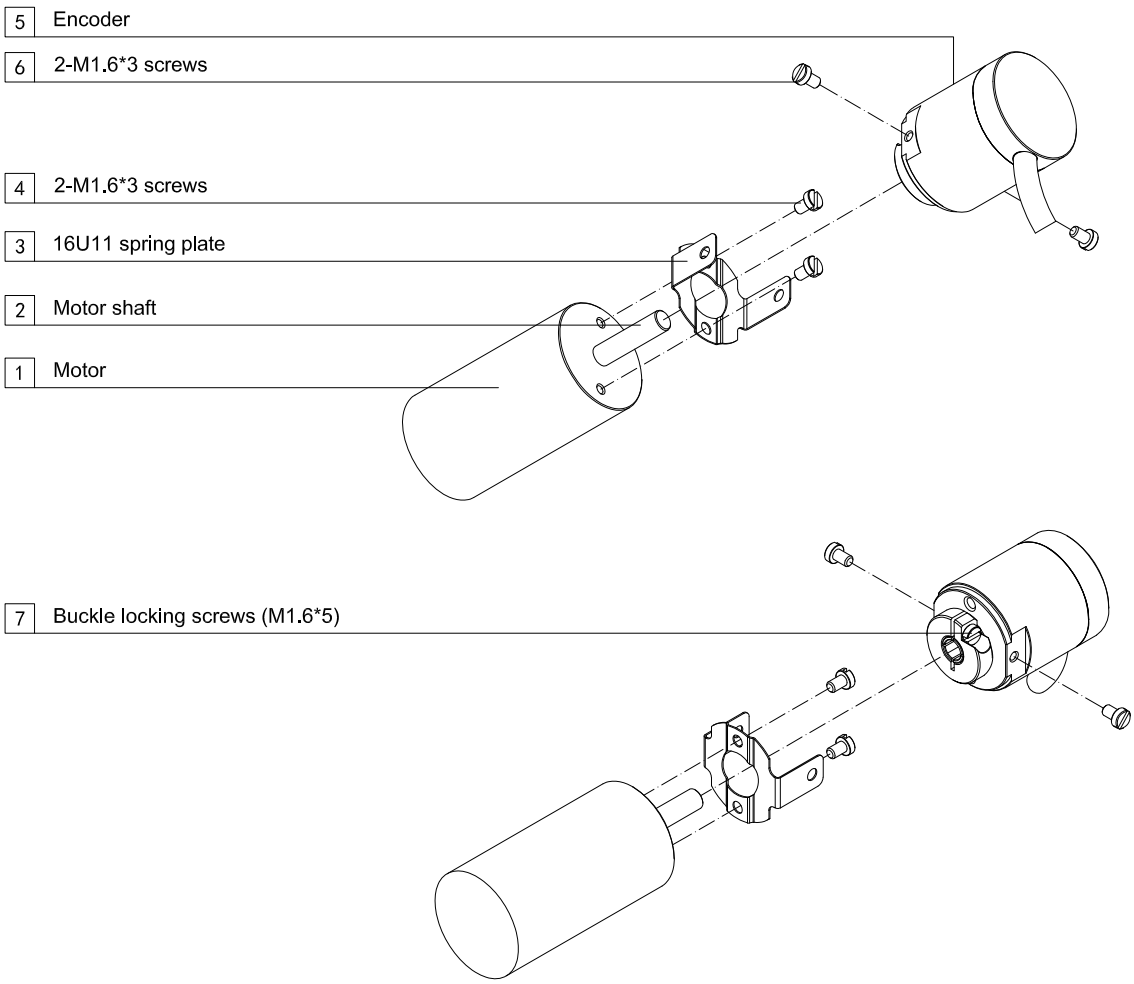
The frame is composed of frame structure and data to be transmitted. The sequence of data transmission first is MSB, error bit and alarm bit are low effective, cyclic redundancy check transmitted inverted. The specific data composition is shown in the below table:

Bits No.	Data	Instruction
[43:28]	MT[15:0]	Recording the accumulative number of the encoder running after power on
[27:8]	ST[19:0]	Current data of absolute location
[7]	nERR	Error output, active low
[6]	nWARN	Warning output, active low
[5:0]	CRC[5:0]	Check bit CRC polynomial of 0x43 with a starting value of 0 (output at flip level)

8. Installation Diagram

Installation steps：

1. First, install the spring plate（3）on the motor and tighen the two screws（4）(note that the center of the spring plate is basically concentric with the motor shaft).
2. Put the encoder on the motor shaft, align the two screw holes on the side of the encoder with the two holes on the spring plate, and then tighten the two screws （6）.
3. Finally, tighten the locking screw（7）.
4. It is recommended to apply thread glue to all screws before use.



9. Caution

9.1 Caution for operation

- The working temperature shall not exceed the storage temperature.
- The working humidity shall not exceed the storage humidity.
- Do not use where the temperature changes dramatically and have fog.
- Do not close to corrosive and flammable gas.
- Keep away from dust,salt and metal powder.
- Keep away from places where you will use water, oil, or medicine.
- Undue vibration and shock will impact the encoder.

9.2 Caution for Installation

- Electrical components should not be subjected to excessive pressure, etc., and electrostatic assessment of the installation environment should be conducted.
- Do not close the cable of the motor power to the encoder.
- The FG wire of the motor and mechanical device should be grounded.
- The shielding wire must be effectively grounded since the shielding is not connected to the encoder.

9.3 Caution for wiring

- Use the encoder under the specified supply voltage. Please note that the supply voltage range may drop due to the wiring length.
- Do not put the encoder wiring and other power lines through the same duct, and do not use them by bundling in parallel.
- Please use twisted pair wires for the signal and power wires of encoder.
- Please do not apply excessive force to the cable of encoder, or it will may be damaged.