

1. KM60 Multi-turn Absolute Encoder (Through shaft)

1.1 Introduction:

KM60 is a through shaft design, high precision multi-turn absolute photoelectric encoder, capable to outputting 24Bits of single-turn position information, expandable up to 32Bits, and can read multi-turn position information up to 24Bits.
The structure is sturdy and durable.

1.2 Feature:

- External diameter Ø60mm, thickness 39.8mm, diameter of shaft up to Ø15mm.
- Sturdy structure.
- Adopt non-contact photoelectric reflection principle.
- Interface: BiSS_C or SSI.
- Accuracy: ±80".
- Single-turn resolution of 24Bits is expandable up to maximum 32Bits.
- Support multi-turn data recording without power failure, the maximum recording is 24 Bits.

1.3 Application:

Servo motor, robot and other industrial automations.

1.4 Connection:

- Radial socket (M12 8pin male socket)
- Radial socket (M23 12pin male socket)
- Radial cable (length 1000mm)

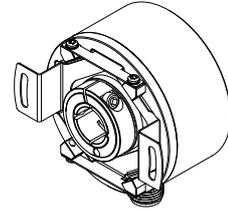
1.5 Protection:

IP65

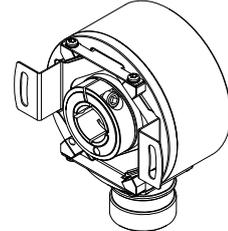
1.6 Weight:

About 350g

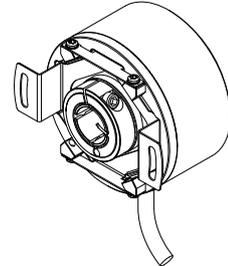
KM60-C



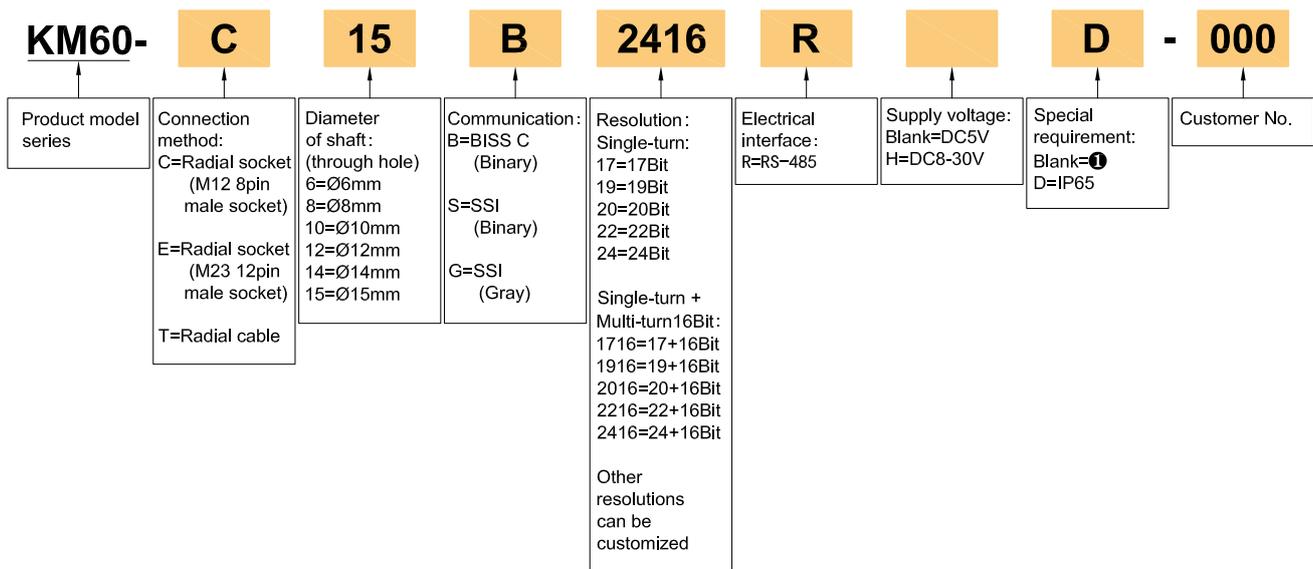
KM60-E



KM60-T



2. Model composition (select parameters)



Special requirement:

- ❶. IP=50; cable length 1m, if need to change the length C+number, max 100m(indicated by C100).

KM60 MULTI-TURN ABSOLUTE BISS/SSI

Ver. 7.0 Page 2/12

3. Basic Specification

3.1 Resolution

Single-turn(ST)		Multi-turn(MT)	
17Bits	$2^{17}(0\sim+131071)$	16Bits	$2^{16}(65536 \text{ turn})$
19Bits	$2^{19}(0\sim+524287)$	16Bits	$2^{16}(65536 \text{ turn})$
20Bits	$2^{20}(0\sim+1048575)$	16Bits	$2^{16}(65536 \text{ turn})$
22Bits	$2^{22}(0\sim+4194303)$	16Bits	$2^{16}(65536 \text{ turn})$
24Bits	$2^{24}(0\sim+16777215)$	16Bits	$2^{16}(65536 \text{ turn})$

Under 24Bits as standard, expandable up to Max 32Bits

16Bits is the standard product, others can be customized, Max 24Bits

3.2 Parameter

Name	Parameter	Remark
Scanning principle	Photoelectric	
Accuracy	$\pm 80''$	
Response speed	Normal action: 6000min^{-1}	
RMS position signal noise	$\pm 2 @ 18 \text{ Bits/r}$	
Communication	BiSS_C (Binary)	Pls refer to BiSS_C standards
	SSI (Binary / Gray code)	Pls refer to SSI standards
Communication clock frequency	$\leq 10 \text{ MHz(BiSS)}$ or $\leq 5 \text{ MHz(SSI)}$	
Max resolution	24 Bits expandable up to Max 32 Bits	For frame information, please refer to P9 & P10 (data frames)
Starting time	Typical value: 13 ms	
Absolute position sampling period	$\leq 75 \text{ ns}$	
Allowable speed	$\leq 32200 \text{ r/min}$	Restricted by mechanical speed limit
Electrical connection	Radial socket & Radial cable	Pls refer to page 6,7
Cable	Differential 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	$-40^{\circ}\text{C} \sim 95^{\circ}\text{C}$	

KM60**MULTI-TURN ABSOLUTE BISS/SSI****Ver. 7.0 Page 3/12**

3.3 Mechanical specification

Name	Parameter	Remark
Mechanical Connection	Ring locking with shaft, flexible spring plate fixed connection	
Diameter of shaft	Ø6mm、Ø8mm、Ø10mm、Ø12mm、Ø14mm、Ø15mm (Material:stainless steel)	Pls refer to page 5 for dimensions
Starting Torque	less than 9.8×10^{-3} N·m	
Inertia Moment	less than 6.5×10^{-6} kg·m ²	
Shaft load	Radial 30N; Axial 20N	
Allowed speed	≤6000 rpm	
Shell material	Aluminium alloy	
Weight	about 350g	

3.4 Environmental parameter

Name	Parameter
Environmental temperature	Operating: -40~95°C
	Storage: -40~+95°C
Environmental humidity	Operating and storage:35~85%RH (Noncondensing)
Vibration	Amplitude 1.52mm ,5~55HZ,2h for X,Y,Z direction individually
Shock	980m/s ² 11ms three times for X,Y,Z direction individually
Protection	IP65

4. Electrical Specification

4.1 Absolute maximum ratings

Symbol	Instructions	Minimum	Maximum	Unit
V _{CC}	Supply Voltage	-0.3	+6.0	V
V _{BAT}	Backup Voltage	-0.3	+6.0	V
T _{STG}	Storage Temperature	-40	+100	° C
T _J	Junction Temperature	-	150	° C

4.2 Electrical parameter

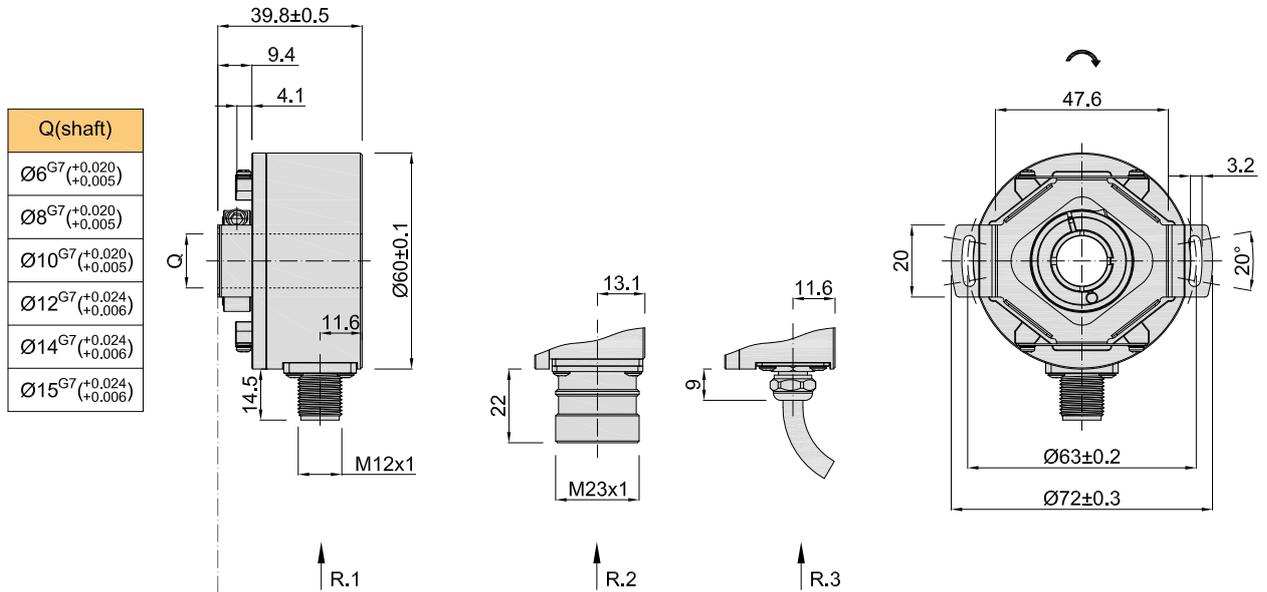
Symbol	Instructions	Minimum	Typical value	Maximum	Unit
V _{CC}	Supply Voltage DC5V	4.75	5.0	5.5	V
	Supply Voltage DC8-30V	7.75	30	32	V
I _{DD}	Supply Current	-	-	120	mA
V _{BAT}	Backup Voltage ❶	3.0	3.6	4.2	V
I _(BAT)	Backup Current	-	-	35	uA
f _{BISS} ❷	BISS Communication clock frequency	-	-	10	MHz
	SSI Communication clock frequency	-	-	5.0	MHz
T _a	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.

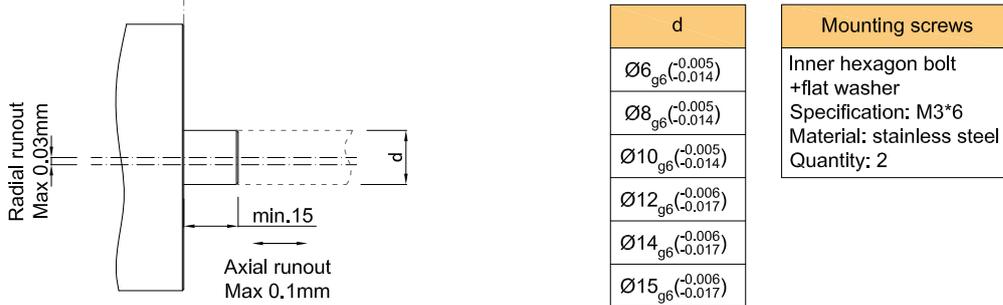
❷ Pls refer to BISS_C and SSI standards.

KM60 MULTI-TURN ABSOLUTE BISS/SSI Ver. 7.0 Page 5/12

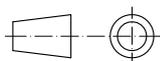
5. Basic Dimensions



6. Specification For Mounting Shaft



Unit: mm

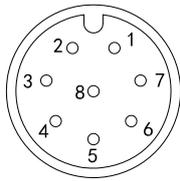


- ↻ = Shaft rotation direction of the signal output
- R.1 = Radial socket(M12x1 8pin male socket)
- R.2 = Radial socket(M23x1 12pin male socket)
- R.3 = Radial cable (Standard length 1000)

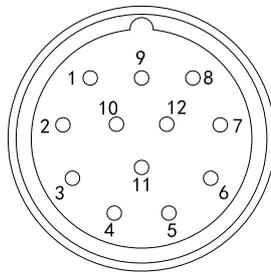
KM60 MULTI-TURN ABSOLUTE BISS/SSI Ver. 7.0 Page 6/12

7. Interface Definition

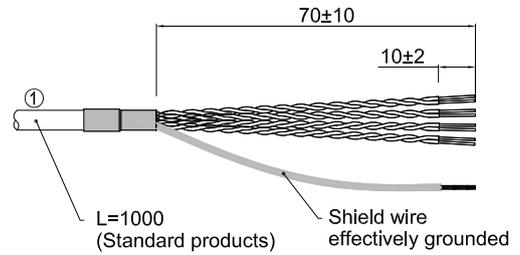
7.1 Functional definition of socket pins and wire colors BISS_C (Binary)



M12 8pin male socket pin distribution diagram



M23 12pin male socket pin distribution diagram



Radial cable connection

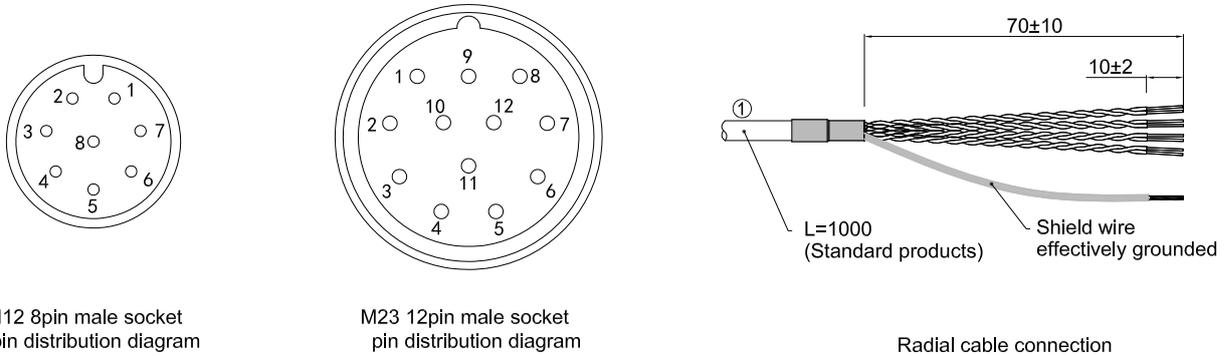
Socket Pin No. / Wire color			Signal		Function	Twisted-paired cable
M12 8pin	M23 12pin	Wire color	BISS_C ST	BISS_C MT		
1	1	Red	Up	Up	Power positive	
2	2	Black	Un	Un	Power negative	
3	3	White	SL-	SL-	Data signal	
4	4	White/BK	SL+	SL+	Data signal	
5	5	Green	MA-	MA-	Clock signal	
6	6	Green/BK	MA+	MA+	Clock signal	
7	7	Yellow	N.C.	Vbat	Backup power supply	
8	8	Yellow/BK	N.C.	0V	0V	
-	9	-	N.C.	N.C.	Unallocated	-
-	10	-	N.C.	N.C.	Unallocated	
-	11	-	N.C.	N.C.	Unallocated	
-	12	-	N.C.	N.C.	Unallocated	

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

Unit: mm

KM60 MULTI-TURN ABSOLUTE BISS/SSI Ver. 7.0 Page 7/12

7.2 Functional definition of socket pins and wire colors SSI (Binary / Gray)



Socket Pin No. / Wire color			Signal		Function	Twisted-paired cable
M12 8pin	M23 12pin	Wire color	SSI ST	SSI MT		
1	1	Red	Up	Up	Power positive	
2	2	Black	Un	Un	Power negative	
3	3	White	DATA-	DATA-	Data signal	
4	4	White/BK	DATA+	DATA+	Data signal	
5	5	Green	CLOCK-	CLOCK-	Clock signal	
6	6	Green/BK	CLOCK+	CLOCK+	Clock signal	
7	7	Yellow	N.C.	Vbat	Backup power supply	
8	8	Yellow/BK	N.C.	0V	0V	
-	9	-	N.C.	N.C.	Unallocated	-
-	10	-	N.C.	N.C.	Unallocated	
-	11	-	N.C.	N.C.	Unallocated	
-	12	-	N.C.	N.C.	Unallocated	

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

Unit: mm

7.3 Electrical connection

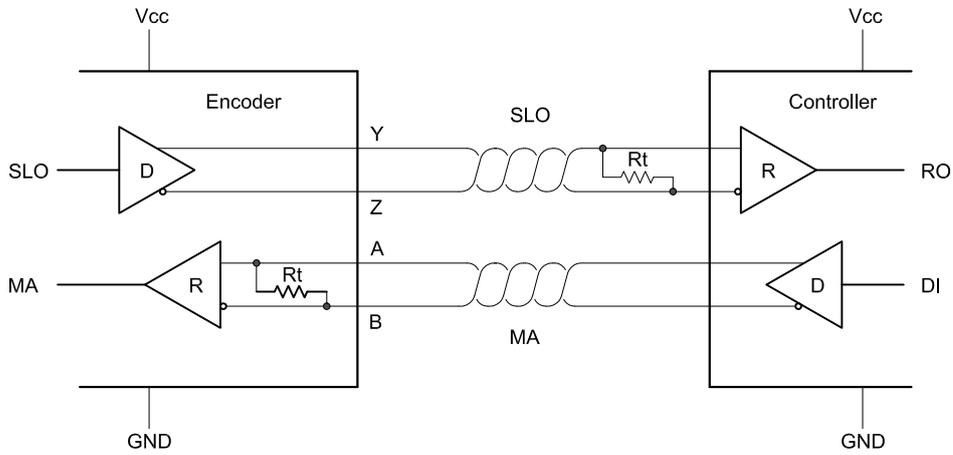


Figure 1: Point-to-point configuration

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.

7.4 BISS_C communication

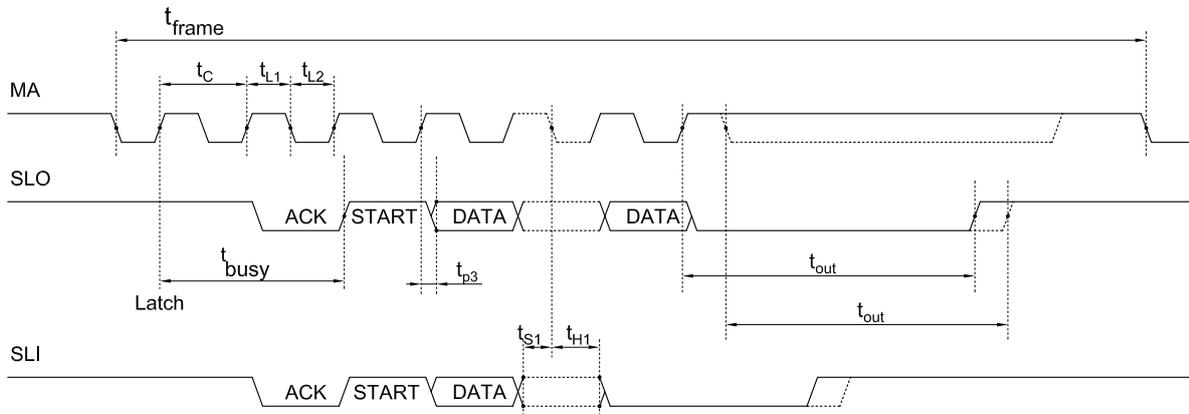


Figure 2: BISS-C Timing

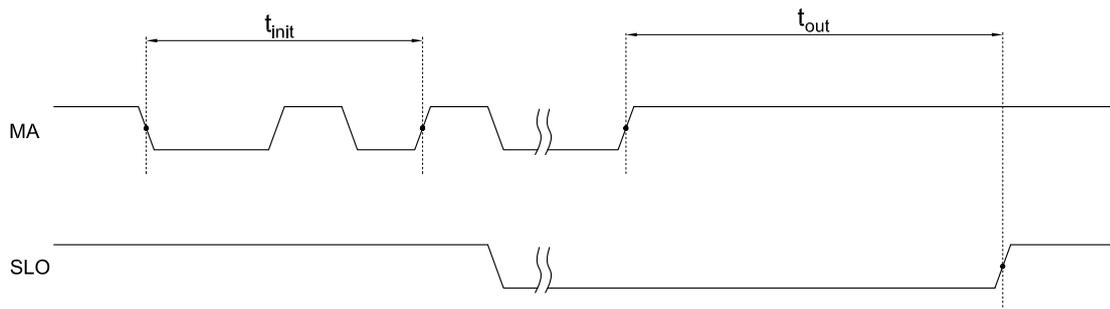


Figure 3: BISS-C (SSI) Slave Timeout Sequence

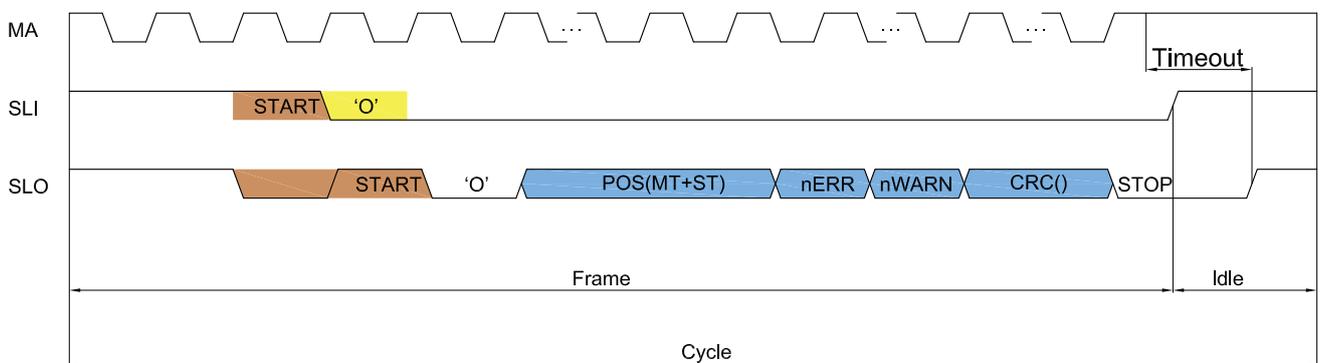


Figure 4: BISS Frame Structure

7.5 SSI communication

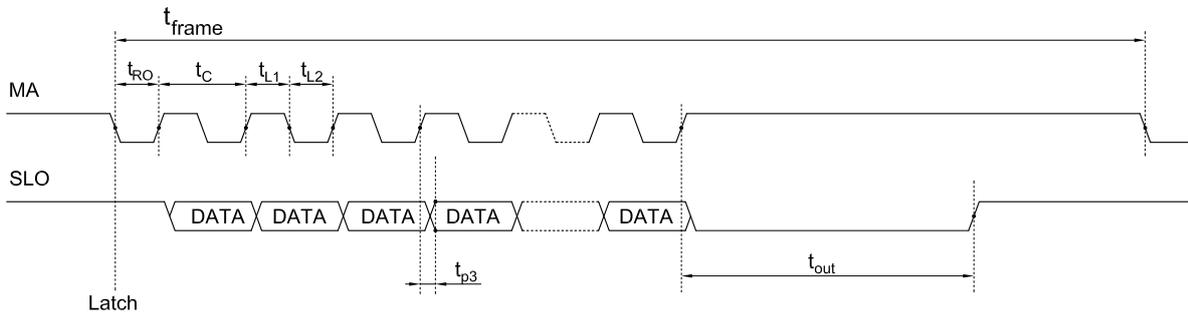


Figure 5: SSI Timing

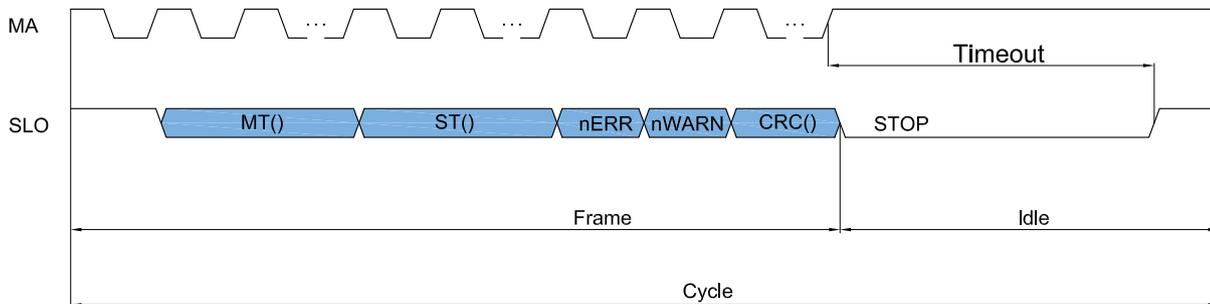


Figure 6: SSI Frame Structure

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	Instructions
[55:32]	MT[23:0]	Recording the accumulative number of the encoder running after power on
[31:8]	ST[23:0]	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. Recommended Accessories

Plug and cable	Brief description	No.	Order No.
	C2C=Connection type head A: M12, 8-pin female straight connector; Connection type head B: M12, 8-pin male straight connector; Cable length: 2M 8-core with shield,halogen-free PUR	KM60C2C	44400014
	C5C=Connection type head A: M12, 8-pin female straight connector; Connection type head B: M12, 8-pin male straight connector; Cable length: 5M 8-core with shield,halogen-free PUR	KM60C5C	44400015
	C1=Connection type head A: M12, 8-pin female straight connector; Connection type head B: Bare wire end; Cable length: 1M 8-core with shield,halogen-free PUR	KM60C1	44400016
	C2=Connection type head A: M12, 8-pin female straight connector; Connection type head B: Bare wire end; Cable length: 2M 8-core with shield,halogen-free PUR	KM60C2	44400017
	C5=Connection type head A: M12, 8-pin female straight connector; Connection type head B: Bare wire end; Cable length: 5M 8-core with shield,halogen-free PUR	KM60C5	44400018
	E1=Connection type head A: M23, 12-pin female straight connector; Connection type head B: Bare wire end; Cable length: 1M 8-core with shield,halogen-free PUR	KM60E1	44400019
	E2=Connection type head A: M23, 12-pin female straight connector; Connection type head B: Bare wire end; Cable length: 2M 8-core with shield,halogen-free PUR	KM60E2	44400020
	E5=Connection type head A: M23, 12-pin female straight connector; Connection type head B: Bare wire end; Cable length: 5M 8-core with shield,halogen-free PUR	KM60E5	44400021

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.