



17 BIT SINGLE TURN
16 BIT MULTI-TURN
ABSOLUTE ENCODER
SPECIFICATION

FILE NO	KEM17M-OT V0.1
VER DATE	2020-10-30
ORG. RELEASE	DRAFT

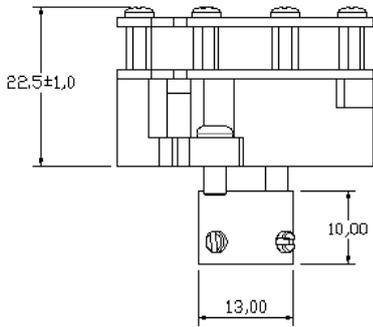
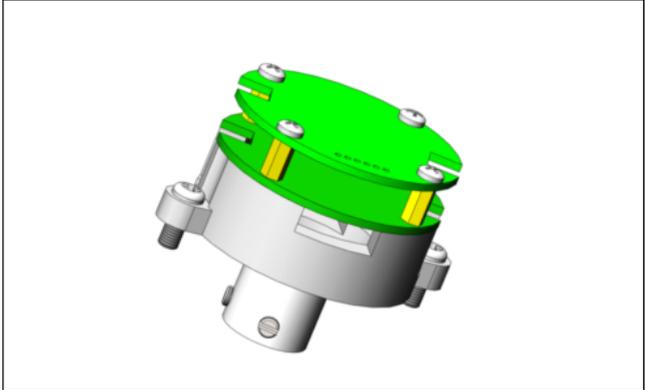
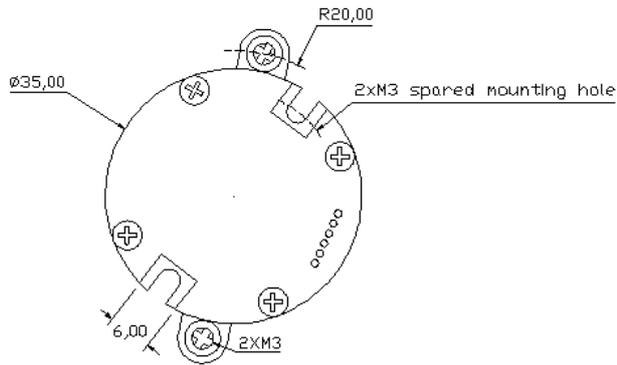
MANAGER	MARKETING	ENG	QA

CUSTOMER APPROVAL		

MODEL	PRODUCT DESCRIPTION	Encoder Assembly Incl. 500mm long, ø5.4mm cable with 6-AWG#26 wire & shielding.
KEM17M-OT-35mm	16 BIT MULTI TURN 17 BIT SINGLE TURN ABSOLUTE ENCODER	

1. DIMENSIONS

1-1. OUTLINE DIMENSION



ENGINEER

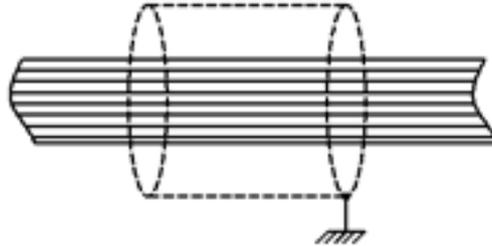
	DRAWING NUMBER	DATE
	KEM17M-OT-35mm	2020.10.30

1-2. SEPARATE SHAFT, ENCODER AND MOTOR SHAFT INSTALLATION

Refer to Appendix for other details

1-3. SHIELDING WIRE CONNECTION

SHIELDED CABLE

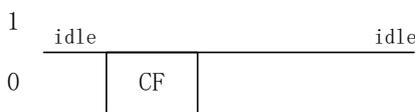
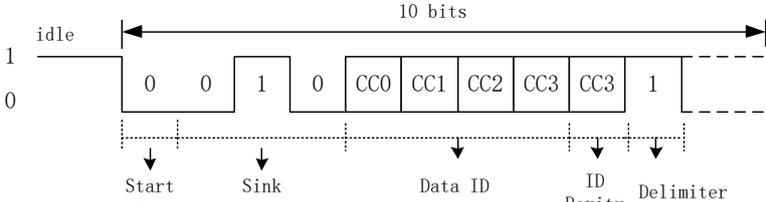


2. WIRING DESCRIPTION

Cable Specification: 500mm length, ø5.4 shielded, RVVP 6 * 0.15mm wire.

Color	Function	Note
RED	DC5V	POWER SUPPLY
BLACK	GROUND	
GREEN	RS485 A	SERIAL DATA SIGNAL
YELLOW	RS485 B	
WHITE	POWER SUPPLY	BATTERY
BROWN	GROUND	BATTERY

3.	APPLICATION SCOPE	This encoder is suitable for servo motors for robot.	
4.	MODEL & DESCRIPTION	KEM17M-OT-35mm 17-bit Absolute 16-bit Multi-Turn Encoder	
5.	APPEARANCE	There shall be no remarkable damage in visual inspection. Products shall be judged by boundary samples if there are any doubts.	
6.	DIMENSIONS	REFER TO CLAUSE 1 OUTLINE DIMENSIONS	
7.	RATINGS		
	NO.	ITEM	SPECIFICATION
	7.1	Operating Temp	Normal : -30°C ~ +85°C Special Model : -60°C ~ +85°C
	7.2	Storage Temp	-20°C ~ +105°C
	7.3	Operating Voltage	5.0 ± 0.5 VDC
8.	SPECIFICATION		
	8.1	Operating Type	Motor Shaft Operating
	8.2	Resolution	16 bit Multi-Turn, 17-bit one turn 131, 072 absolute positions
	8.3	Output Signals	Pure Binary
	8.4	Rated Power	0.1W @ Vdd=5V for normal model.
	8.5	Power-up Time	3ms max.
	8.6	Consumption Current	@Vdd=5.0V, T _A ≤-30°C 500mA max.
	8.7	Rotation Speed	RPM ≤6K Recommended
	8.8	Output Delay	5 μs
	8.9	Output Digital Voltage	Push-pull (I _{out} =2mA) High: V _{OH} ≥4.9V Low: V _{LO} ≤0.1V
	8.10	Magnet	NdFeB, N35~N40, supplied w/ encoder Radial Magnetized.
	8.11	DATA MEMORY	EEPROM 762 bytes
	8.12	Serial Communication	RS485 Communication rate 2.5Mbps

9. RELIABILITY			
9.1	Cycle Life		Infinite
9.2	Weight		40g±10g
9.3	High Temp	16 hours@80±2°C	Output variation <0.2%;
9.4	Low Temp	16 hours@-20±2°C	Output variation <0.2%;
9.5	Humid	2 hours@60±2°C, 90~95% RH	Output variation <0.1%;
9.6	Insulation Resistance	100ns by DC 500V Megohm meter, between Case & Ground	50MΩ
9.7	Dielectric Strength	1 minute, between Case & Ground	AC500V
9.8	PMS		
9.9	DIPi		
9.10	Shock	490 m/s ² (50G), 11 ms	2 hrs each axis, total 18 hrs
9.11	Vibration	5 ~ 40Hz , Amplitude 1.5 mm; 40 ~ 200Hz , 49m/s ² (5G)	2 hrs each axis, total 6 hrs
10. ENVIRONMENTAL		ROHS	Compliant
10.1	ESD; HUMAN	MIL-STD-883G Method 3015.7	(±)1000V ~ 4000V, Step : (±)500V
10.2	ESD; MACHINE	JEDEC EIA/JESD22-A115	(±)100V ~ 300V, Step : (±)50V
11. COMMUNICATION PROTOCOL			
11.1	Frame Format		
11.1.1	Data Readout from EM35ARS017		
	Request to encoder		
	Respond Data out from encoder		
#Abbreviation		CF: Control Field; SF: Status Field; DF: Data Field	
11.1.2	Details		
	CF (Control Field)		

Start Bit: Fixed “0”

Sink Code: Fixed “010”

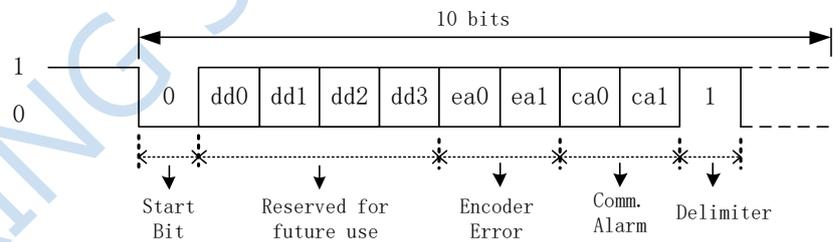
Data ID Code:

Server sending request in one of the DATA ID CODE that lists in Table 1, then the specific responding data shown in Table 2 will be transmitted from encoder.

Table 1

Request	DATA ID	CODE				Parity
		cc0	cc1	cc2	cc3	
Readout Data	0	0	0	0	0	0
	1	1	0	0	0	1
	2	0	1	0	0	1
	3	1	1	0	0	0
Reset	7	1	1	1	0	1
Error Correction	9	1	0	0	1	0
Reset multi-turn	C	0	0	1	1	0

Delimiter: Fixed “1”



Start Bit: Fixed “0”

dd0:dd3: “0000”, Reserved for future use

SF (Status Field)

ea0 : “1”,when error occurs. i.e., encoder counting error. (Mostly due to magnetic reasons)

ea1: “1”, Logic 1-OR of Multi-turn error, Battery error and Battery alarm is transmitted.

ca0:ca1: “00”, Reserved

Note*:

When an error occurs in the bit of ea1, request "Data ID 3" to confirm the contents of ALMC in the data frame. Because Full absolute status, Over-speed and Counter overflow are not included in ea1, confirm them in ALMC.

When Communication alarm is occurred, the received data should be invalid, and transmit the same Request signal again. Check the Encoder and repower if necessary.
 Delimiter: Fixed "1"

Table 2

DATA ID CODE	DF0	DF1	DF2	DF3	DF4	DF5	DF6	DF7
0	ABSA 0	ABS A1	ABS A2					
1	ABM 0	ABM 1	AMB 2					
2	ENID							
3	ABSA 0	ABS A1	ABS A2	ENI D	AB SA0	AB SA1	AB SA2	AL MC
7	ABSA 0	ABS A1	ABS A2					
9	ABSA 0	ABS A1	ABS A2	AL MC				
C	ABSA 0	ABS A1	ABS A2					

DF (Data Field)

Note: Blank in above table means no data to be transmitted.

ABSA0~ABSA2: Absolute data within single-turn revolution.

ENID: Encoder ID, Fixed "06H"

ABM0~ ABM2: Multi-turn data:

ABM0 is located to lower bite and ABM2 is located to higher bite in the frame of total 24 bits. ABM2 is always logic "0", and then the valid data consists of total 16 bits.

ALMC: Encoder Error Alarm

Table 3 ALMC

BIT	DF7 ₀	DF7 ₁	DF7 ₂	DF7 ₃	DF7 ₄	DF7 ₅	DF7 ₆	DF7 ₇
Error occurred	1	0	1	0	0	1	1	1
Name & its symbol	Over speed	---	Counting error	Counter overflow	---	Multi-turn error	Battery error	Battery alarm

DF7₀: when the rotation speed exceeding the upper limitation, this bit is set to high (1).

DF7₂: Counting Error (CE), mostly caused by magnetic error.

DF7₃: Counting overflow, mostly caused logic "1" is transmitted when the multi-turn counter is overflow. The multi-turn counter continues to operate as a cyclic counter of 0~ 65,535.

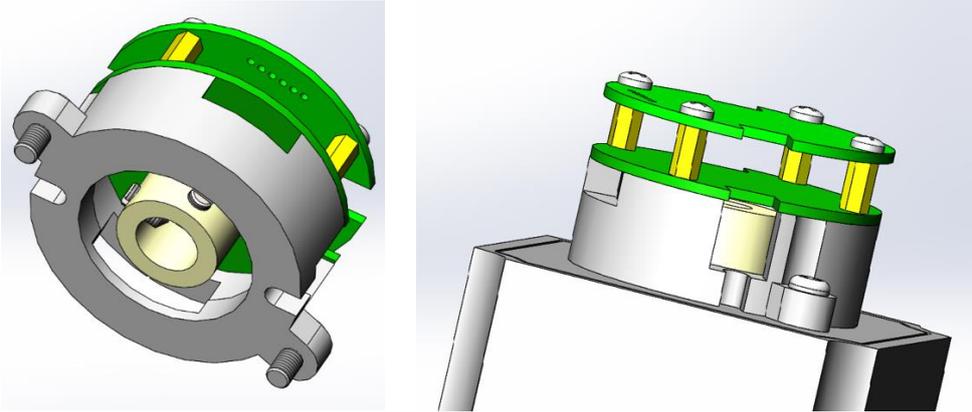
DF7₅: Multi-turn error, Logic "1" is transmitted, when reversals and counting errors occur.

DF7₆: Logic "1" is generated when the external battery voltage is $3.32 \pm 0.25V$ or less during main power-off.

DF7₇: Battery error: Logic "1" is transmitted, when the external battery voltage is $3.47 \pm 0.1 V$ or less during main power-on.

DF7₀~DF7₇: LSB first.

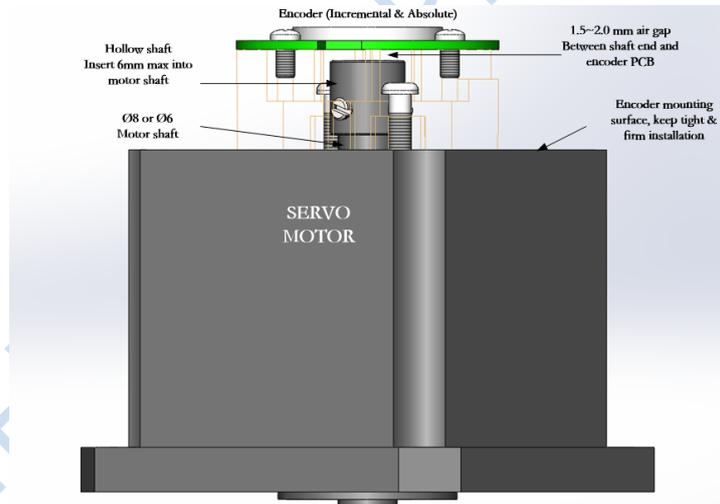
12. Appendix: The Installation



KEM encoder is usually using hollow shaft to allow motor shaft directly inserting in, no flexible mounting plate is needed.

Encoder is installed at the rear end of servo motor, shown as below pictures. The 8mm dia. motor shaft is standard and 6mm is optional. Insert the motor rear shaft into encoder's hollow shaft for 7mm depth, tighten the M3 hex screws into the hollow shaft after the neutral position alignment, then firmly install the encoder mounting surface onto motor rear end by two M3 screws.

An additional installation method is available for the 29mm mounting pitch, see above picture for reference.



After coupling the encoder hollow shaft with the rigid motor shaft, always fasten attached screws securely. Be sure to firmly tighten two hex-screws that located at encoder's hollow shaft, apply threads-lock glue and tightly screwed in for long-term use. Also follow above procedures for the encoder M3 screws when mounting the encoder onto servo motor.

Copy Rights and Disclaimer

1. This document may not be reproduced or duplicated, in any form, in whole or in part without prior written consent of MST . Copyrights © 2020, MST Incorporated.
2. MST reserves the right to make changes to the information published in this document at any time without notice.
3. MST's products are limited for use in normal commercial applications. MST's products are not to be used in any device or system, including but not limited to medical life support equipment and system.

ENGINEERING SPECIFICATION