Magnetic Integrated Technology

# 15 BIT SINGLE TURN ABSOLUTE ENCODER SPECIFICATION (Open Type)



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|---|---|
| FILE NO | 1-KEM15S-OT V0.1 |
| VER DATE | 2021-4-27 |
| ORG. RELEASE | 2019-7-30 |

| ITEM NO | MODEL | CUSTOMER P/N |
|---|---|---|
| | KEM15S-OT | |
| | ======== | |
| | | |

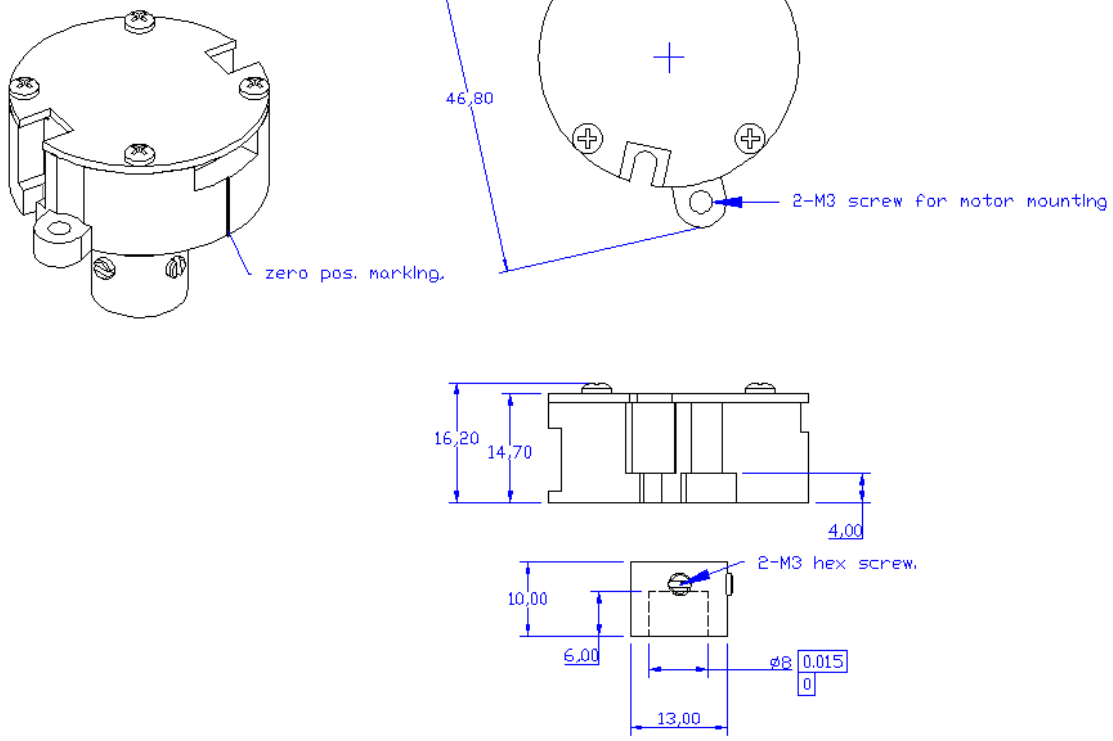
| MANAGER | MARKETING | ENG | QA |
|---|---|---|---|
| | | | |

| CUSTOMER APPROVAL | | |
|---|---|---|
| | | |

| MODEL | PRODUCT DESCRIPTION | Encoder Assembly<br>Incl. 500mm long, ø5.4mm cable<br>with 4-AWG#28 wire & shielding |
|---|---|---|
| KEM15S-OT | 15 BIT ABSOLUTE ENCODER,<br>SINGLE-TURN SEPARATE | |

1. DIMENSIONS

1-1. OUTLINE DIMENSION




| Magnetic Integrated Technology<br>承康科技 | DRAWING NUMBER<br>1-KEM15S-OT | DATE<br>2021.4.27 |
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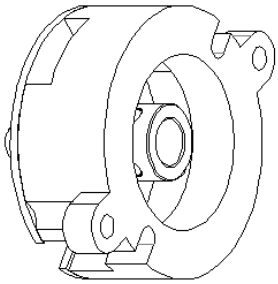
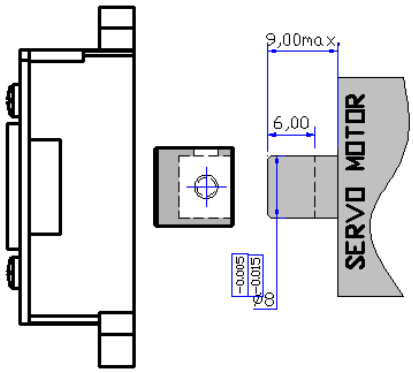
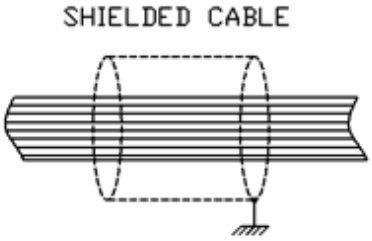
## 1-2. ENCODER HOLLOW SHAFT & MOTOR SHAFT INSTALLATION






Refer to Appendix for other details.

## 1-3. SHIELDING WIRE CONNECTION



## 2. WIRING DESCRIPTION

Cable Specification: ø5.4 shielded, 500mm length, 4-AWG#28 wire.

| Color | Function | Note |
|---|---|---|
| RED | DC5V | POWER SUPPLY |
| BLACK | GROUND | |
| YELLOW | RS485 A | SERIAL DATA SIGNAL |
| GREEN | RS485 B | |

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| 3. APPLICATION SCOPE | | This encoder is suitable for servo motors for robot. | |
| 4. MODEL & DESCRIPTION | | KEM15S-OT<br>15-bit Single-Turn Absolute 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 | CONDITION | SPECIFICATION |
| 7.1 | Operating Temp | | Normal : -30℃ ~ +85℃<br>Special Model : -60℃ ~+85℃ |
| 7.2 | Storage Temp | | -20℃ ~ +85℃ |
| 7.3 | Operating Voltage | | 5.0 ± 0.5 VDC |
| 8. SPECIFICATION | | | |
| 8.1 | Operating Type | | Motor Shaft Operating |
| 8.2 | Resolution | Single Turn, 15-bit, 32768 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, $T_A \leqslant$ -30℃ | 500mA max. |
| 8.7 | Rotation Speed | RPM | ⩽6K Recommended |
| 8.8 | Output Delay | | 5 μs |
| 8.9 | Output Digital Voltage | Push-pull (Iout=2mA) | High: $V_{OH} \geqslant 4.9V$<br>Low: $V_{LO} \leqslant 0.1V$ |
| 8.10 | Magnet | NdFeB, N35~N40, supplied w/ encoder | Dimension Ø5x2 or Ø6x2;<br>Radial Magnetized. |
| 8.11 | DATA MEMORY | EEPROM | 762 bytes |
| 8.12 | Serial Communication | RS485 | Communication rate 2.5Mbps |
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| 9. RELIABILITY | | | |
| 9.1 | Cycle Life | | Infinitive |
| 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/s2 (50G), 11 ms | 2 hrs each axis, total 18 hrs |
| 9.11 | Vibration | 5 ~ 40Hz , Amplitude 1.5 mm; 40 ~ 200Hz , 49m/s2 (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 |
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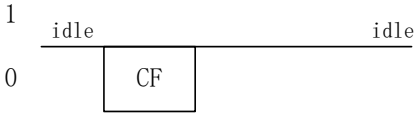
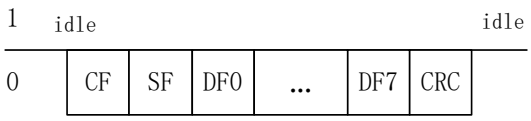
| 11. COMMUNICATION PROTOCOL | | | |
| 11.1 | Frame Format | | |
| 11.1.1 | Data Readout from EM35ARS017 | | |
| | Request to encoder |  | |
| | Respond Data out from encoder |  | |
| | #Abbreviation | CF: Control Field; SF: Status Field; DF: Data Field | |

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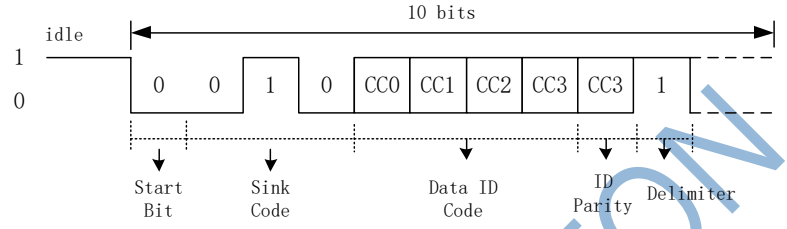
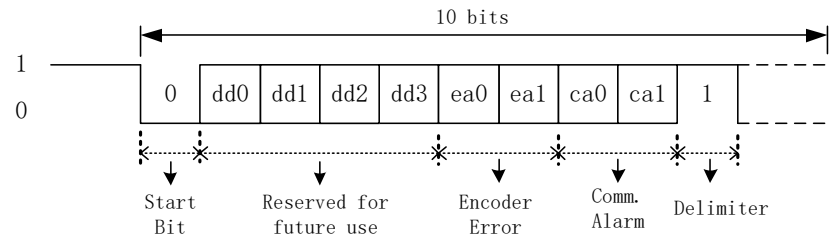
| 11.1.2 | Details | |
| | CF (Control Field) |  <br>Start Bit: Fixed "0"<br>Sink Code: Fixed "010"<br>Data ID Code:<br>Server sending request in one of the DATA ID CODE that lists in Table 1, then the specific responding data shown in Table 2 will be transmitted from encoder.<br>**Table 1**<br>**Request** / **DATA ID** / **CODE** (cc0 cc1 cc2 cc3) / **Parity** (cc4)<br>Readout Data: 0 — 0 0 0 0 0<br>Readout Data: 2 — 0 1 0 0 1<br>Readout Data: 3 — 1 1 0 0 0<br>Reset: 8 — 0 0 0 1 1<br>Error Correction: 9 — 1 0 0 1 0<br>Delimiter: Fixed "1" |
| | SF (Status Field) |  <br>Start Bit: Fixed "0"<br>dd0:dd3: "0000", Reserved for future use<br>ea0 : "1",when error occurs. i.e., encoder counting error. (Mostly due to magnetic reasons)<br>ea1: "1", Reserved<br>ca0:ca1: "00", Reserved |

*Note*:*

*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"

DF (Data Field)

**Table 2**

| DATA ID CODE | DF0 | DF1 | DF2 | DF3 | DF4 | DF5 | DF6 | DF7 |
|---|---|---|---|---|---|---|---|---|
| 0 | ABSA0 | ABSA1 | ABSA2 | | | | | |
| 2 | ENID | | | | | | | |
| 3 | ABSA0 | ABSA1 | ABSA2 | ENID | ABSA0 | ABSA1 | ABSA2 | ALMC |
| 8 | ABSA0 | ABSA1 | ABSA2 | | | | | |
| 9 | ABSA0 | ABSA1 | ABSA2 | ALMC | | | | |

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

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

ABSA0：Always 0;

ENID: Encoder ID, Fixed "06H"

ALMC: Encoder Error Alarm

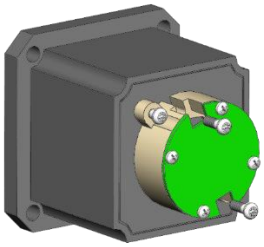
| BIT | $DF_70$ | $DF_71$ | $DF_72$ | $DF_73$ | $DF_74$ | $DF_75$ | $DF_76$ | $DF_77$ |
|---|---|---|---|---|---|---|---|---|
| Error occurred | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

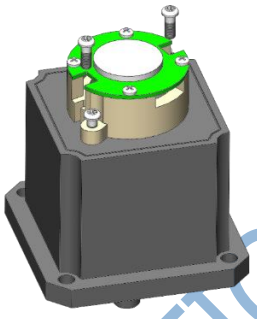
$DF_70$: when the rotation speed exceeding the upper limitation, this bit is set to high (1).

$DF_72$: Counting Error (CE), mostly caused by magnetic error.

$DF_70$~$DF_77$: LSB first.

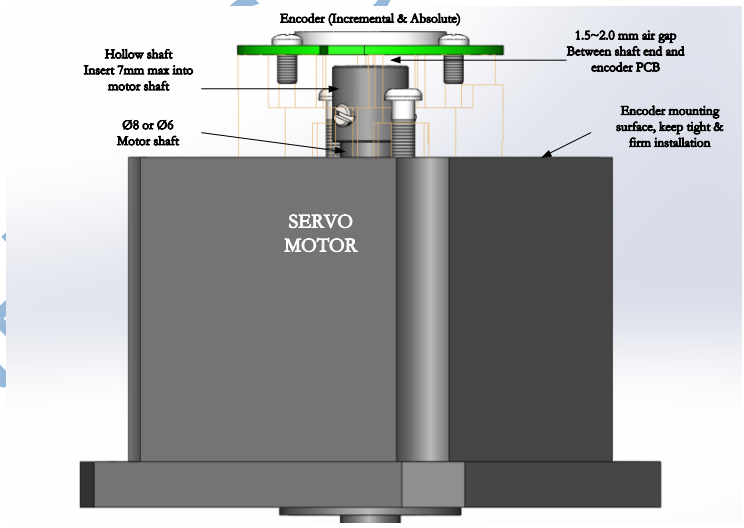
## 12. Appendix: The Installation





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 encoders hollow shaft for 7mm depth, tighten the M3 hex screws into the hollow shaft after the neural 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.

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