BiSS encoder **for SHA25**

1. Overview

   The *BiSS* encoder equipped on the SHA25 series is a battery-backup multi-rotary absolute encoder supporting C-mode (two-way) *BiSS* serial protocol.

· About *BiSS-C (two-way)*

   BiSS-C (two-way) is a high-speed synchronous serial interface between the master (servo driver, robot controller, etc.) and slave (encoder). The clock sent from the master controls the timing to acquire the position and the data communication speed. The encoder operates as a slave. Two pairs of differential signal wires (MA, SLO) are used for full duplex communication between the master and slave. The *BiSS* encoder for SHA25 resets itself and clears errors by using two-way communication of *BiSS-C* (using the CDM bit contained in MA and the CDS bit contained in SLO). It can also monitor the internal temperature of the encoder and error details simultaneously by acquiring the positional data.

   (Differential signal wire)
   MA+/MA-   : A clock signal sent to the salve from the master
   SLO+/SLO- : A data signal sent to the master from the salve. The position, error, alarm and CRC data are sent in sync with the MA signal for this encoder.

2. Main encoder specification

Resolution per rotation	: 17 bit *1
Multi-rotation counter	: 16 bit
Main power voltage	: 5V ± 5%
Backup power voltage	: 3.6V (Typ)
Communication speed	: 5MHz (Max)
Current consumption	: 155mA (Typ), 185mA (Max)
Current consumption (backup)	: 50uA (Typ), 70uA (Max)
Time to start communication	: 5s (since the main power voltage reaches 4.5V)
Position detection precision	: ±0.1°
Detection error, warning	: Multi-rotation counter error (PSERR), one rotation data error (STERR), overspeed (OVSPD), battery warning (BATT), battery error (MTERR), heating error (OVTEMP), CRC error (CRC), Multi-rotation counter overflow warning (OVF)

*1: This is the resolution in a single encoder. The resolution on the output shaft when combined with the reduction gear is multiplied by the moderating ratio. See the SHA technical data for details.

3. Data format
   The data format is shown below.
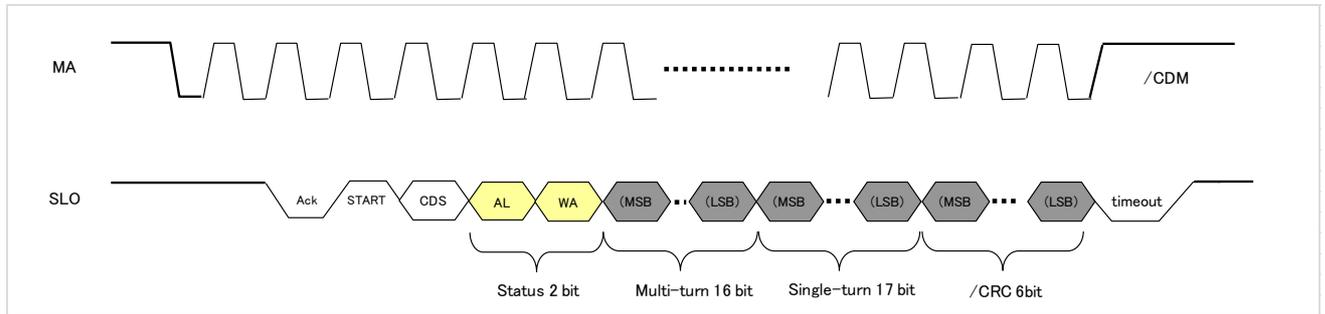
CDS [1bit]	:	Data bit used for two-way communication
Alarm bit (AL) [1bit]	:	Outputs the logical addition of PSERR, STERR, MTERR, CRC, OVSPD and OVTEMP.
Warning bit (WA) [1bit]	:	Outputs the logical addition of BATT and OVF.
Multi-turn [16bit]	:	Outputs the value of the multi-rotation counter in 16 bits.
Single-turn [17bit]	:	Outputs the absolute value in a rotation in 17 bits.
CRC [6bit]	:	CRC bits for the alarm bit, warning bit, multi-turn and single-turn: The CRC polynomial expression is "$X(6)+X(1)+X(0)$" output in a reversal format.
Timeout	:	The timeout time of this encoder is 40us. Reserve 40us plus data communication time or more for the interval between a data request and the next request to the encoder.

4. Connector specification
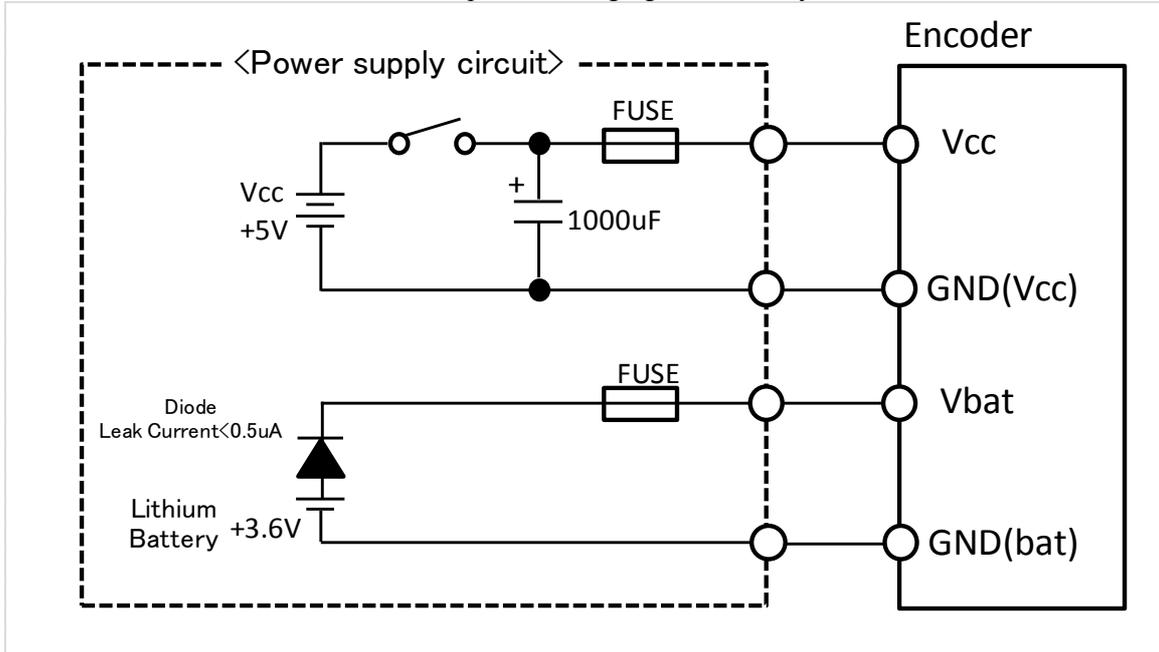   The encoder connector specification is shown below.
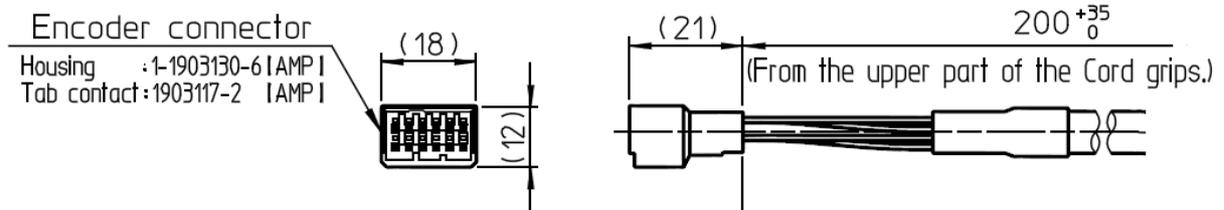
Encoder connector

Pin No.	Color	Signal	Pin No.	Color	Signal
1A	Red	Vcc	1B	Gray	GND(Vcc)
2A	Blue	Vbat	2B	White	GND(bat)
3A	—	—	3B	—	—
4A	Yellow	MA+	4B	Brown	MA−
5A	Green	SL0+	5B	Black	SL0-
6A	Shield	FG	6B	—	—

5. Recommended circuit

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The recommended power circuit is shown below. We recommend that you set up a battery protection diode with 0.5uA leak current or less to prevent charging to the battery.

6. Communication circuit
   An example of a transmitting and receiving circuit between the encoder and controller is shown below.
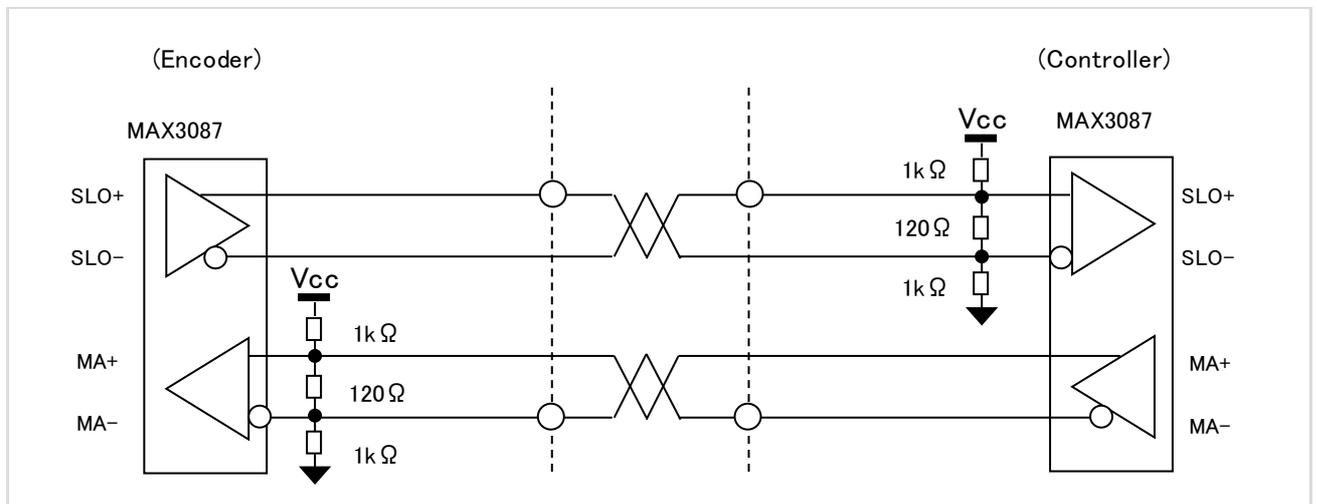
See the *BiSS* encoder specification for the detail of other encoders.

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