KÖNG
金 钢

Tactile Servo

TS20

Product Brief

Beijing King Kong Technology Co., Ltd.

Product Overview

The TS20 Tactile Servo is a miniature, high-precision integrated joint. A permanent-magnet synchronous motor, reducer, dual encoders and driver are integrated into a compact body. Two gear-ratio options, 50:1 and 100:1, are available, with RS485 communication support.

Key Features

- **Compact Design** Ø20 mm x 35 mm; fits tight spaces
- **Ultra-light** Only 35 g, reducing robot payload
- **High Torque** Supports 3-4x overload
- **Force Feedback** Backdrivable with highly sensitive force feedback

Applications

- Dexterous robotic-hand joint modules
- Small-robot joint modules
- Desktop-robot joint modules
- Motion actuators for precision automation
- High-precision positioning servos for medical robots
- Miniature aerospace servo systems

Selection: 50:1 for high speed and medium torque; 100:1 for high torque and precision positioning. Both versions share the same structure and are mechanically interchangeable.

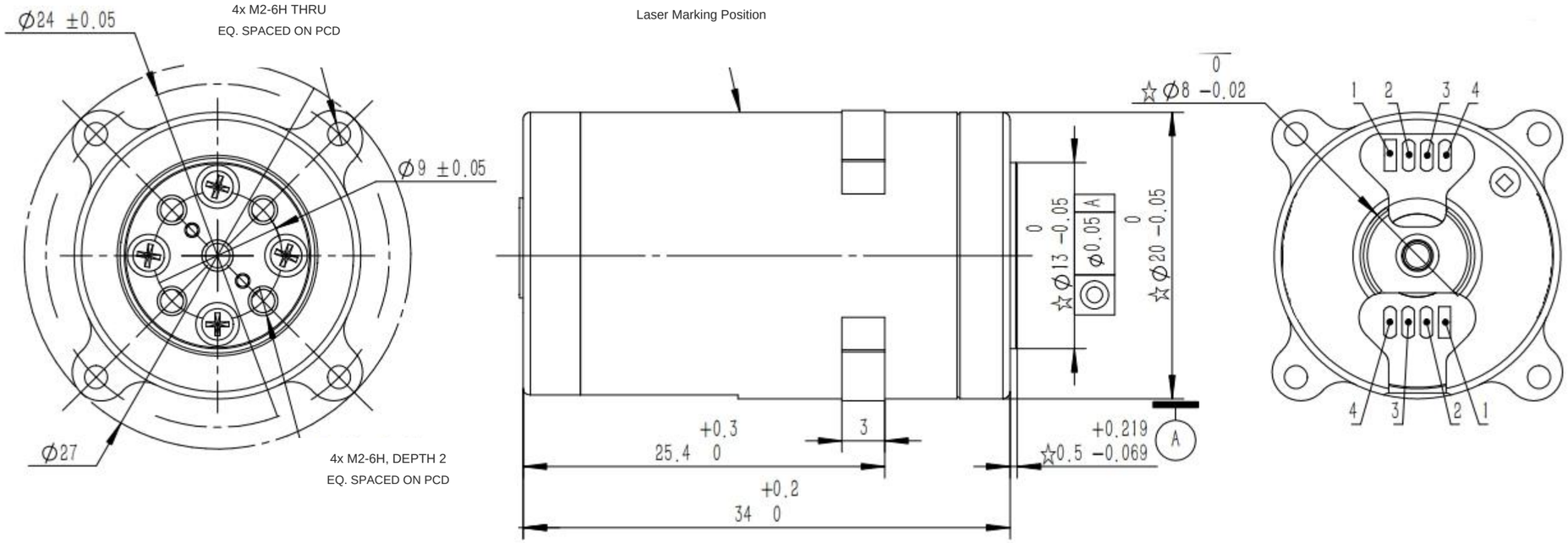
Technical Specifications

	TS20-50	TS20-100
Gear ratio	50	100
Rated torque	0.7 N.m	1.5 N.m
Peak torque*	2 N.m @ 300 ms	4 N.m @ 300 ms
Max. no-load speed	31.4 rad/s	15.7 rad/s
Backlash	<20 arc-second	<20 arc-second
Dual encoders	Dual 24-bit	Dual 24-bit
Outer dia. x length	Ø20 mm x 35 mm	Ø20 mm x 35 mm
Hollow bore	Ø1.7 mm	Ø1.7 mm
Motor weight	35 g	35 g
Rated voltage	24 V DC	24 V DC
Backdrivable	Supported	Supported
Communication	RS485	RS485

* Duration is configurable

Installation and Communication

Engineering Drawing



Installation Guidelines

- Fixed side: locate with the Ø24 mm flange pitch diameter; fasten with M2 screws.

- Load side: connect the load via the Ø9 mm flange pitch diameter; ensure coaxial alignment.

- Cable exit: side exit; allow sufficient cable bend clearance.

Communication Pinout

No.	Pin
1	VCC
2	GND
3	485_N
4	485_P

Communication Protocol v3.4 (Transmit)

$$\tau = Kp\,(\theta_{des} - \theta) + Kd\,(\omega_{des} - \omega) + \tau_{des}$$

Byte	Type	Symbol	Description	Value	Range
0	uint8	ID:4	Device ID	—	0 ~ 15
		T:1	Watchdog enable	0: Off / 1: On (Default mode after >1 s without a command)	—
		CMD:3	Command code	0 Default: stop; 1 MIT: FOC closed loop; 2 ClearFault: clear errors (bytes 2-13 = 0xFF); 3 Reset: reboot (bytes 2-13 = 0x00; valid only in Default)	—
1	uint8	—	Reserved	0	—
2-3	uint16	Kp_{set}	Output position stiffness	$Kp=Kp_{set}/1024$ *e.g.* $Kp_{set}=1024 \rightarrow Kp=1$	$0 \le Kp \le 64$
4-7	int32	θ_{set}	Output position	$\theta_{des}=\theta_{set}/16777216\times 2\pi$ *e.g.* $\theta_{set}=4194304 \rightarrow \theta_{des}=1.5708$ rad	$\lvert\theta_{des}\rvert \le 804.2$ rad (≈ ±128 rev)
8-9	int16	τ_{set}	Output feedforward torque	$\tau_{des}=\tau_{set}/2048$ *e.g.* $\tau_{set}=1024 \rightarrow \tau_{des}=0.5$ N·m	$\lvert\tau_{des}\rvert \le 16$ N·m
10-11	int16	ω_{set}	Output speed	$\omega_{des}=\omega_{set}/512$ *e.g.* $\omega_{set}=512 \rightarrow \omega_{des}=1.0$ rad/s	$\lvert\omega_{des}\rvert \le 64$ rad/s
12-13	uint16	Kd_{set}	Output speed stiffness	$Kd=Kd_{set}/32768$ *e.g.* $Kd_{set}=32768 \rightarrow Kd=1.0$	$0 \le Kd \le 2$ N·m/(rad/s)
14-15	uint16	CRC16	CRC16 check	CRC16-CCITT	—

Serial Port Configuration

Item	Setting
Interface	RS485
Baud rate	7.5 Mbps
Data format	8 data bits, no parity, 1 stop bit (8N1)
Byte order	Little-endian

Communication Protocol v3.4 (Receive)

Byte	Type	Symbol	Description	Value	Range
0	uint8	ID:4	Device ID	Echoes request	0 ~ 15
		T:1	Watchdog status	0: No timeout / 1: Timeout (motor stops; clear with ClearFault)	—
		CMD:3	Command code	Echoes request	—
1	int8	T_{fet}	FET temperature	°C	-128 ~ 127
2	int8	T_{mot}	Motor temperature	°C	-128 ~ 127
3	uint8	Fault	Fault flag	See fault table	—
4-7	int32	θ_{get}	Current output position	$\theta_{mea}=\theta_{get}/16777216\times 2\pi$ *e.g.* $\theta_{get}=8192 \rightarrow \theta_{mea}=1.5708$ rad	$\lvert\theta_{mea}\rvert \le 804.2$ rad (≈ ±128 rev)
8-9	int16	τ_{get}	Current output torque	$\tau_{mea}=\tau_{get}/2048$ *e.g.* $\tau_{get}=2048 \rightarrow \tau_{mea}=1.0$ N·m	$\lvert\tau_{mea}\rvert \le 16$ N·m
10-11	int16	ω_{get}	Current output speed	$\omega_{mea}=\omega_{get}/512$ *e.g.* $\omega_{get}=512 \rightarrow \omega_{mea}=1.0$ rad/s	$\lvert\omega_{mea}\rvert \le 64$ rad/s
12-13	uint16	CRC16	CRC16 check	CRC16-CCITT	—

Fault Table

Bit	Name	Stops motor	Clear method
0	Overcurrent	Yes	ClearFault
1	Overvoltage	Yes	ClearFault
2	Undervoltage	Yes	ClearFault
3	Transient overvoltage	No	Auto-clear after 100 ms (braking resistor control)
4	FET overtemperature	Yes	ClearFault
5	Motor overtemperature	Yes	ClearFault
6	Encoder error	Yes	Reset

Check Code

CRC16–CCITT

```
uint16_t crc16(const uint8_t *data, size_t len) {
    uint16_t crc = 0xFFFF;
    for (size_t i = 0; i < len; i++) {
        crc ^= (uint16_t)data[i] << 8;
        for (int j = 0; j < 8; j++)
            crc = (crc & 0x8000) ? (uint16_t)((crc << 1) ^ 0x1021)
                                 : (uint16_t)(crc << 1);
    }
    return crc;
}
```