KONG
金 钢

Tactile Servo

TS20

Product Brief

v0.3



KingKong Robotics

Product Overview

The TS20 Tactile Servo is a miniature, high-precision integrated joint. Its compact housing combines a permanent magnet synchronous motor, gearbox, dual encoders and a drive. Multiple gear ratios and RS485 communication are available.

Key Features

- Compact: Ø20 mm × 35 mm for confined spaces
- Lightweight: just 35 g to reduce robot payload
- High torque: supports 2–4× overload
- Force feedback: backdrivable with high sensitivity

Applications

- Dexterous robot hand joints
- Small robot joints
- Desktop robot joints
- Actuators for precision automation
- Precision positioning servos for medical robots
- Miniature aerospace servo systems

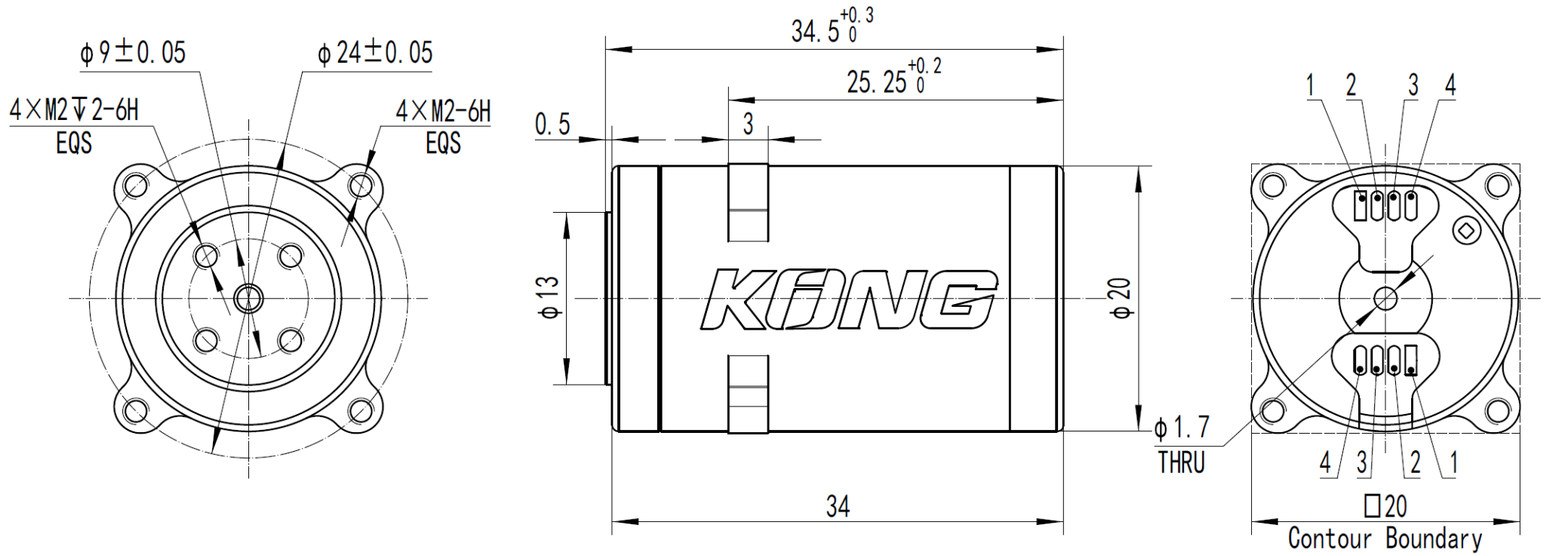
Technical Specifications

	High-Precision Models Precision equipment, surgical robots, gimbals, dexterous hands		High-Peak-Torque Models Small robots, dexterous hands	
	TS20-50	TS20-100	TS20-49C	TS20-99C
Rated Torque	0.7 N.m	1.5 N.m	0.7 N.m	1.5 N.m
Peak Torque	1.5 N.m	3 N.m	3 N.m	6 N.m
Max. No-Load Speed	31.4 rad/s	15.7 rad/s	52.4 rad/s	26.2 rad/s
Accuracy	1 arc-minute	1 arc-minute	15 arc-minutes	15 arc-minutes
Encoders	Dual 24-bit	Dual 24-bit	Dual 24-bit	Dual 24-bit
Diameter × Length	Ø20mm × 35mm	Ø20 mm × 35 mm	Ø20 mm × 35 mm	Ø20 mm × 35 mm
Rear Bearing Seat	No	No	Yes	Yes
Motor Weight	35g	35 g	38 g	38 g
Rated Voltage	24V (10 ~ 36 V)	24V (10 ~ 36 V)	24V (10 ~ 36 V)	24V (10 ~ 36 V)
Operating Temperature	-20 ~ 90 ℃	-20 ~ 90 ℃	-20 ~ 90 ℃	-20 ~ 90 ℃
Interface	RS485	RS485	RS485	RS485
Baud Rate	7.5 Mbps	7.5 Mbps	8 Mbps (configurable: 1–8 Mbps)	8 Mbps (configurable: 1–8 Mbps)

Dimensions (High-Precision Models)

TS20-50

TS20-100



Installation Guidelines

- Fixed end: locate using the Ø24 mm flange PD and secure with M2 screws
- Load end: connect via the Ø9 mm flange PD and ensure coaxial alignment
- Cable routing: allow space for cable bends at the side exit

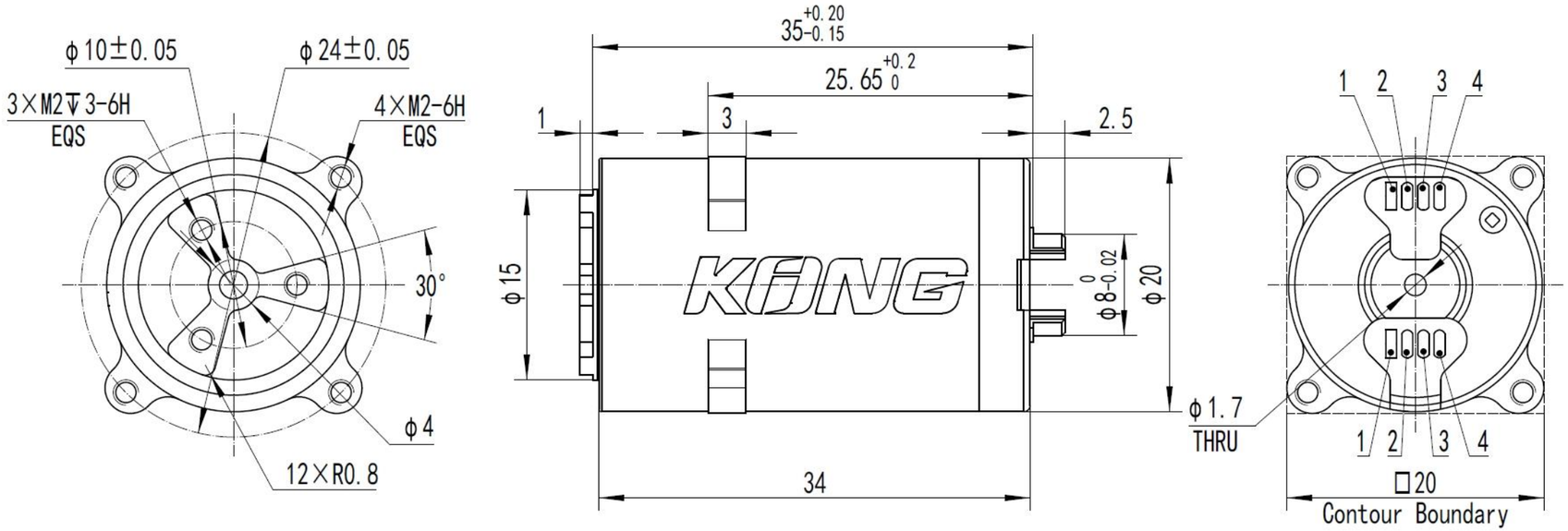
Interface Pinout

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

Dimensions (High-Peak-Torque Models)

TS20-49C

TS20-99C



Installation Guidelines

- Fixed end: locate using the Ø24 mm flange PD and secure with M2 screws
- Load end: connect via the Ø10 mm flange PD and ensure coaxial alignment
- Cable routing: allow space for cable bends at the side exit

Interface Pinout

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

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 Disabled 1 Enabled (Default mode after >1 s without commands)	—
		CMD:3	Command Code	0 Default: stop 1 MIT: closed-loop FOC 2 ClearFault: clear faults (bytes 2–13: all 0xFF) 3 Reset: restart (bytes 2–13: all 0x00, Default mode only)	—
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($\approx \pm 128$ turns)
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 Velocity	$\omega_{des}=\omega_{set}/512$ 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 Velocity 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 Checksum	CRC16-CCITT	—

Serial Port Settings

Item	Setting
Interface	RS485
Baud Rate	See specifications
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 (stops motor, cleared by 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 Flags	See fault table	—
4–7	int32	θ_{get}	Measured 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($\approx \pm 128$ turns)
8–9	int16	τ_{get}	Measured 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}	Measured Output Velocity	$\omega_{mea}=\omega_{get}/512$ e.g. $\omega_{set}=512 \rightarrow \omega_{mea}=1.0$ rad/s	$\lvert\omega_{mea}\rvert \le 64$ rad/s
12–13	uint16	CRC16	CRC16 Checksum	CRC16-CCITT	—

Fault Table

Bit	Name	Motor Stop	Clear Method
0	Overcurrent	Yes	ClearFault
1	Overvoltage	Yes	ClearFault
2	Undervoltage	Yes	ClearFault
3	Transient Overvoltage	No	Auto-clear after 100 ms (controls braking resistor)
4	FET Overtemperature	Yes	ClearFault
5	Motor Overtemperature	Yes	ClearFault
6	Encoder Error	Yes	Reset

Checksum 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;
}
```