BOTA SYSTEMS

October 2020
Zurich, Switzerland

Bota Systems develops state of the art sensing technology for companies and institutes. In Bota Systems, we bring to life the most compact and yet powerful force torque sensors.

High performance and cost effective, our sensors serve efficiently robots that need to interact with humans and their environment. High overload values, as result of a series of design optimization, make them an impact robust sensing module with integrated electronics. Our technology was initially developed for quadruped robots, intended for measuring the ground reaction forces when walking and running at harsh environments.

Offering these features and built to be reliable, Bota Systems technology can be used for robotic arms, construction robots, exoskeletons or prosthetic devices, force plates, robotic surgery platforms, underwater force sensing.
Our products are made in Switzerland. www.botasys.com

- Insertion
- Finishing, Polishing
- Precision Assembly
- Product testing and inspection
- Aerial manipulation
- Assistive devices
- Robotic Assistance and Rehabilitation

WE GIVE MACHINES THE SENSE OF TOUCH

THE SWISS ARMY KNIFE OF ROBOTICS & AUTOMATION

OUR TECHNOLOGY

Static and dynamic force torque measurement devices measure strain induced from the applied forces/torques using resistive, capacitive and optical technologies. Among these technologies, the most mature, that offers the most reliable and predictable measurements, is the resistive metal foil strain gauges. Compared to the other technologies, resistive strain gauges can be used on steel, aluminum or titanium in a very effective way.

Our sensors are manufactured with special aluminum alloy with long term stability of elasticity, high yield strength and are heat treated to deliver excellent creep characteristics for long term reliable measurements. To avoid accumulated errors that cannot be controlled by software, we minimize hardware nonlinearities. Temperature and gain offset compensation, ratio-metric voltage conversion, symmetrical loading, EMI shielding, parasitic capacitance and inductance compensation, high accuracy calibration, are some of the techniques utilized to minimize errors and maximize signal-to-noise ratio.

KEY ADVANTAGES OF OUR TECHNOLOGY:

- ✓ High overload values on very compact and lightweight structure
- ✓ High stiffness transducer with high bandwidth
- ✓ Drift from temperature change is compensated on the hardware
- ✓ Drift from mechanical creep is negligible due to metallic force transducer
- ✓ Minimized crosstalk
- ✓ Repeatable and accurate measurements
- ✓ Long-life duration

BOTA SYSTEMS SENSING TECHNOLOGY

THE MOST RELIABLE METHOD TO MEASURE FORCE & TORQUE

KEY FEATURES:

- ✓ Highly integrated electronics with DAQ, IMU and temperature sensors
- ✓ Ultra-low-noise signal at high output rates
- ✓ No other components are required for analog or digital signal conversion
- ✓ The signal output is directly connected to EtherCAT, USB or RS422 ports
- ✓ Dust and water resistance
- ✓ Precise contact detection
- ✓ Gravitational and inertial compensation
- ✓ Plug & Play

SensONE

High performance force torque sensor

- ✓ Negligible temperature drift
- ✓ High impact robustness
- ✓ Noise level better than 0.01% of nominal range
- ✓ Up to 1000 Hz update rate
- ✓ Enhances your robot with the sense of touch
- ✓ Precise contact force detection
- ✓ Path recording through hand guiding
- ✓ High tolerance assembly
- ✓ Easy integration of 3D Camera
- ✓ Plug & Play

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APPLICATIONS

Insertion | Finishing | Precision Assembly | Product testing and inspection

TECHNICAL SPECIFICATIONS

Serial

The best value for money solution for force feedback applications for collaborative robots. Its USB or RS422 output can deliver up to 1000 samples per second. A compact dustproof and waterproof package with an integrated ISO 9409-1-50-4-M6 mounting flange. Only fasteners are needed to integrate on UR

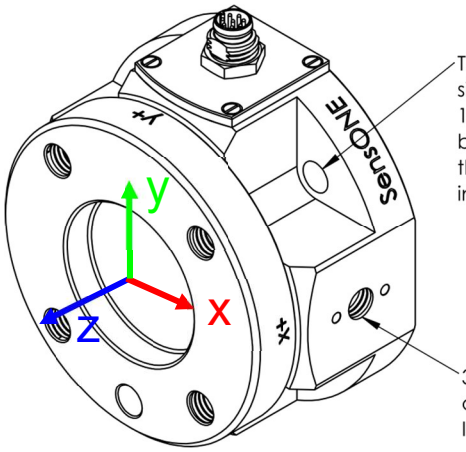
EtherCAT

Lightweight advanced applications for industrial automation and mobile robotics that require ultra-accurate force torque measurements without bulky electronics. It is integrated with 6-DoF IMU, temperature sensors it is up to IP67 (waterproof and dustproof) and a big range of power supply from 9 to 70 V

	Serial	EtherCAT
Range (F_{xy}, F_z, M_{xy}, M_z,)	700 N, 1200 N, 15 Nm, 15 Nm	700 N, 1200 N, 15 Nm, 15 Nm
Overload (F_{xy}, F_z, M_{xy}, M_z,)	2500 N, 4500 N, 35 Nm, 40 Nm	2500 N, 4500 N, 35 Nm, 40 Nm
Noise free resolution (100Hz)*	0.15 N, 0.15 N, 0.005 Nm, 0.002 Nm	0.15 N, 0.15 N, 0.005 Nm, 0.002 Nm
Weight	220 g	220 g
Size (DxL)	70 x 35 mm	70 x 35 mm
Communication	USB, RS422	CANopen over EtherCAT
Sampling rate (max.)	800 Hz	1000 Hz
Ingress Protection	dustproof and waterproof	dustproof and waterproof
Accel	-	±2g, 4g, 8g, 16g,
Gyro	-	±250°/sec, ±500°/sec, ±1000°/sec, ±2000°/sec

E-mail: info@botasys.com

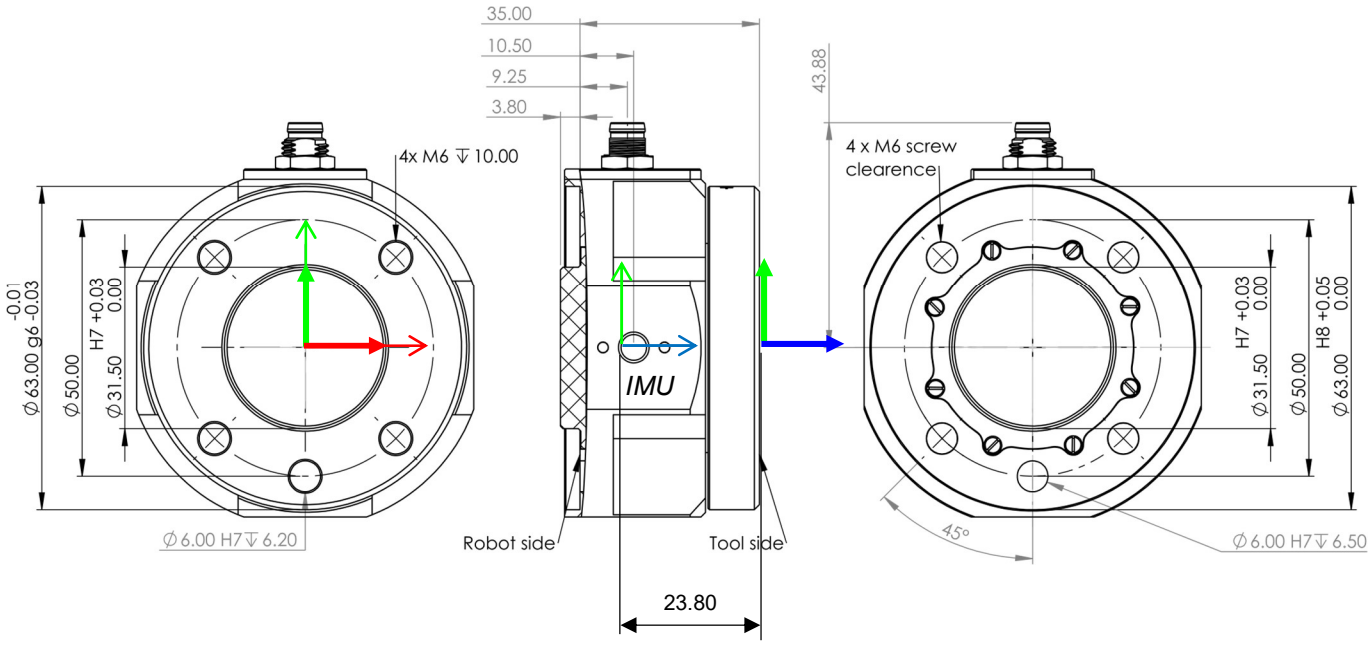
OVERVIEW

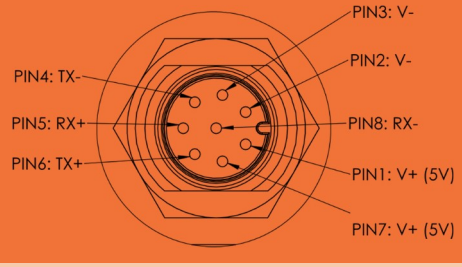
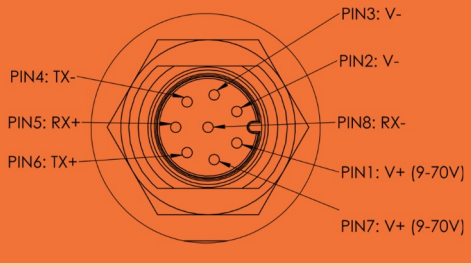


The mounting flange of the sensor is the same for both sides. The patternof the mounting flange is of ISO 9409-1-50-4-M6. Bolts 10.9 equivalent or stronger bolts should be used. For the robot's mounting surface please use the bolts provided with the sensor or ask info@botasys.com for details

3 x Mounting flange for other tools or sensors. It can be used for example with Intel RealSense camera of Microsoft Kinect

MECHANICAL DIMENSIONS



M8 Connector Pinout	Serial	EtherCAT
		
Power Supply	5 V, 1.0W	9 – 70 V, 1.5W
Operating temperature	0 – 55 Celsius	0 – 55 Celsius
Signal	USB, RS422	CANopen over EtherCAT

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Rokubi

Miniature force torque sensor for limited space and payload

- ✓ Negligible temperature drift
- ✓ High impact robustness
- ✓ Noise level better than 0.01% of nominal range
- ✓ Up to 1000 Hz update rate
- ✓ Enhances your robot with the sense of touch
- ✓ Precise contact force detection
- ✓ Path recording through hand guiding, high tolerance assembly
- ✓ Plug & Play

WE GIVE MACHINES THE SENSE OF TOUCH

APPLICATIONS

Aerial manipulation | Insertion | Finishing | Precision Assembly | Assistive devices

TECHNICAL SPECIFICATIONS

	Serial	EtherCAT
	Game - Changing 6-Axis Force Torque Sensor for automation and robotics industry. Its USB or RS422 output can deliver up to 1000 samples per second. It is integrated with electronics in a very compact, dust-proof and waterproof package. An innovative product that delivers high quality measurements at a hard to compete price point	Industrial Premium lightweight 6-Axis Force Torque Sensor integrated with IMU for advanced applications in automation and robotics industry. Its EtherCAT output can deliver up to 1000 Samples per second. It is integrated with a 6-DoF IMU, Temperature sensors, IP67 and a big range of power supply from 9 to 70 V
Range (F_{xy}, F_z, M_{xy}, M_z)	700 N, 1200 N, 15 Nm, 15 Nm	700 N, 1200 N, 15 Nm, 15 Nm
Overload (F_{xy}, F_z, M_{xy}, M_z)	2500 N, 4500 N, 35 Nm, 40 Nm	2500 N, 4500 N, 35 Nm, 40 Nm
Noise free resolution	0.15 N, 0.15 N, 0.005 Nm, 0.002 Nm	0.15 N, 0.15 N, 0.005 Nm, 0.002 Nm
Weight	120 g	120 g
Size (DxL)	48 x 32 mm	40 x 32 mm
Communication	USB, RS422/RS485	CANopen over EtherCAT
Sampling rate (max.)	800 Hz	1000 Hz
Ingress Protection	dustproof and waterproof	dustproof and waterproof
Accel	-	±2g, 4g, 8g, 16g,
Gyro	-	±250°/sec, ±500°/sec, ±1000°/sec, ±2000°/sec

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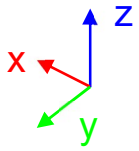
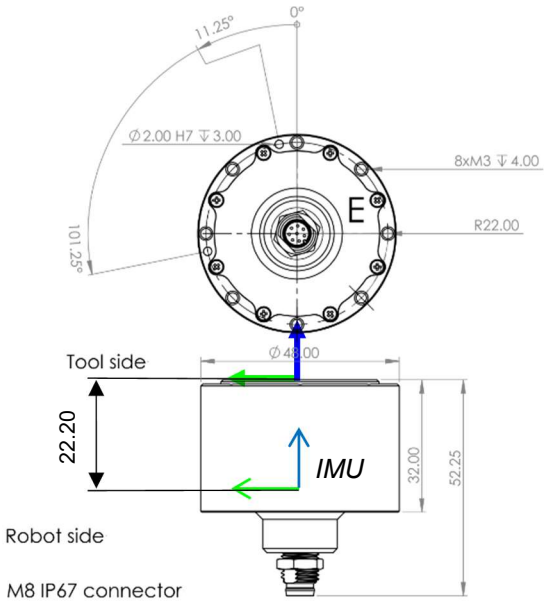
OVERVIEW

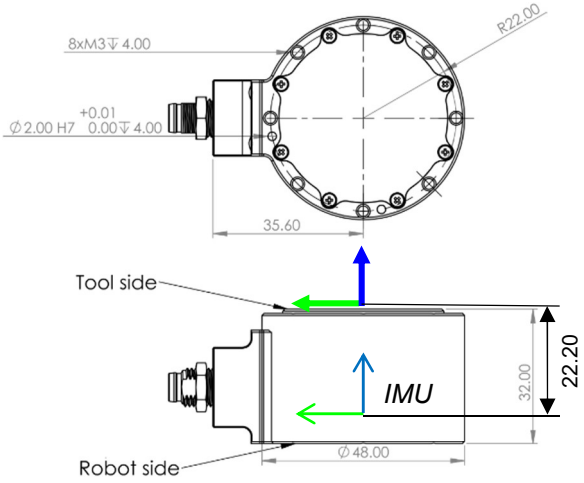
Axial connector

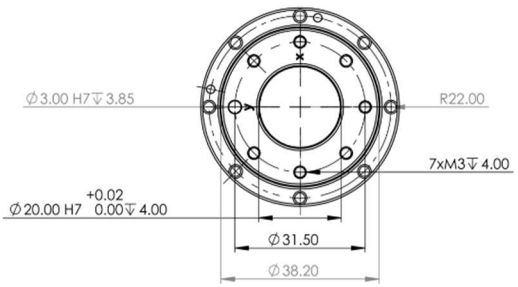
Side connector

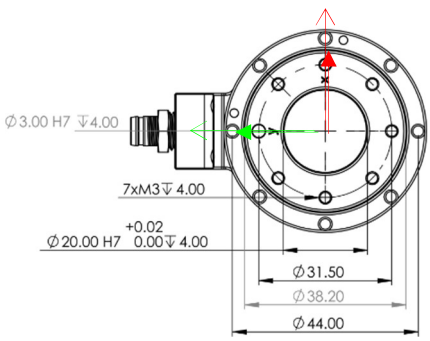


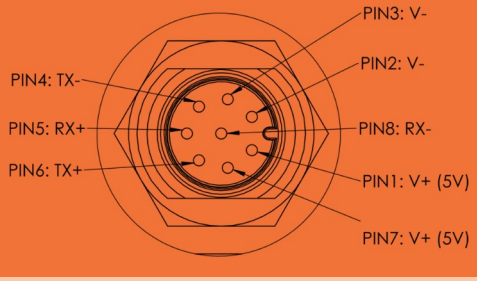
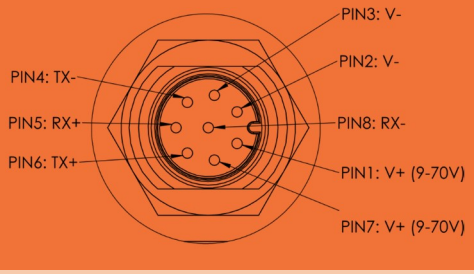
MECHANICAL DIMENSIONS









M8 Connector Pinout	Serial	EtherCAT
		
Power Supply	5 V, 1.0W	9 – 70 V, 1.5W
Operating temperature	0 – 55 Celsius	0 – 55 Celsius
Communication	USB, RS422	CANopen over EtherCAT

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ORDER

Send your inquiry and questions at info@botasys.com

	Product Number	Description
NO additional external box is needed. Electronics are embedded. Default kit includes: Fasteners, User Manual, Test Sheet, Calbration Sheet and CAD, Mechanical Drawings and Software for Linux(ROS)/Windows	BFT-ROK-11-01-03	Rokubi 6-axis FT sensor with side M8-USB interface
	BFT-ROK-11-01-04	Rokubi 6-axis FT sensor with axial M8-USB interface
	BFT-ROK-11-02-03	Rokubi 6-axis FT sensor with side M8-RS422 interface
	BFT-ROK-11-02-04	Rokubi 6-axis FT sensor with axial M8-RS422 interface
	BFT-ROK-11-SER-AXI	**Rokubi 6-axis FT sensor with axial serial interface**
	BFT-ROK-11-SER-SID	**Rokubi 6-axis FT sensor with side serial interface**
	BFT-ROK-11-04-03	Rokubi 6-axis FT sensor with side M8-EtherCAT interface
	BFT-ROK-11-04-04	Rokubi 6-axis FT sensor with axial M8-EtherCAT interface
	BFT-ROK-11-ETH-AXI	**Rokubi 6-axis FT sensor with axial EtherCAT interface**
	BFT-ROK-11-ETH-SID	**Rokubi 6-axis FT sensor with side EtherCAT interface**
	BFT-SEN-11-01-03	SensONE 6-axis F/T sensor with side M8-USB interface
	BFT-SEN-11-02-03	SensONE 6-axis F/T sensor with side M8-RS422 interface
	BFT-SEN-11-SER	**SensONE 6-axis F/T sensor with Serial interface**
	BFT-SEN-11-04-03	SensONE 6-axis F/T sensor with side M8-EtherCAT interface
	BFT-SEN-11-ETH	**SensONE 6-axis F/T sensor with EtherCAT interface**
Universal Robots kit 	KIT-UR	• 1x BFT-SEN-11-SER • 1x 30 cm cat6 RJ45 to RJ45 • 1x RJ45 IP67 plug for UR kit • 1x cap for the RJ45 IP67 connector • 1x Custom length cable with RJ45 to M8 for UR kit • 1x USB to Serial adapter RS422 RJ45 • 4xM6 bolts, 1 Φ6.00 locating pin
Meca500 kit 	KIT-ROK-MECA500	• 1x BFT-ROK-11-04-03 • 1x Cat6e M8 to RJ45, 3 meters cable • Mechanical adapter for Rokubi and meca500 • Mechanical adapter for Rokubi and meca500 gripper • 8xM3 bolts, 1xΦ3.00 locating pin • PoE 802.3af mode B • 48V power supply for EtherCAT devices