Bota Systems

January 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

WE GIVE MACHINES THE SENSE OF TOUCH

THE SWISS ARMY KNIFE OF ROBOTICS & AUTOMATION

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

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 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 are utilized to minimize errors and maximize signal-to-noise ratio.

KEY ADVANTAGES OF OUR TECHNOLOGY:

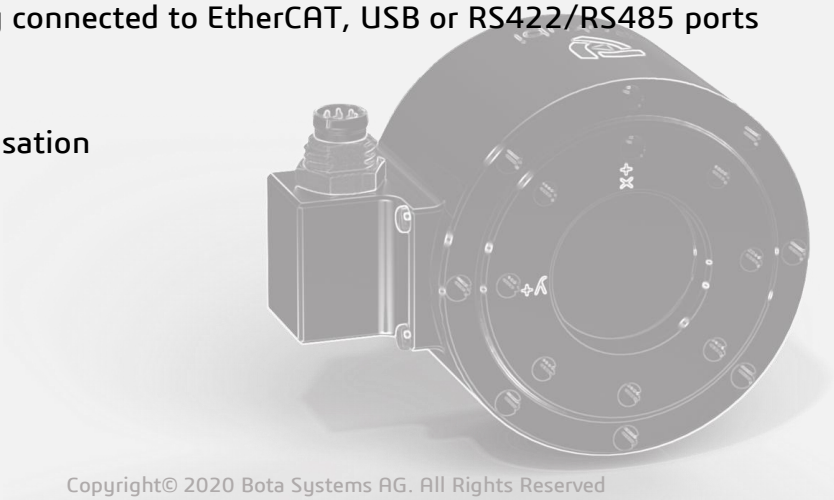
- ✓ High overload values on very compact and lightweight structure
- ✓ High stiffness transducer with high bandwidth
- ✓ Drift from temperature change is compensated on the hardware
- ✓ Drift from mechanical creep is negligible due to metallic force transducer
- ✓ Re calibration is not needed
- ✓ Repeatable 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/RS485 ports
- ✓ Dust and water resistance
- ✓ Precise contact detection
- ✓ Gravity 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

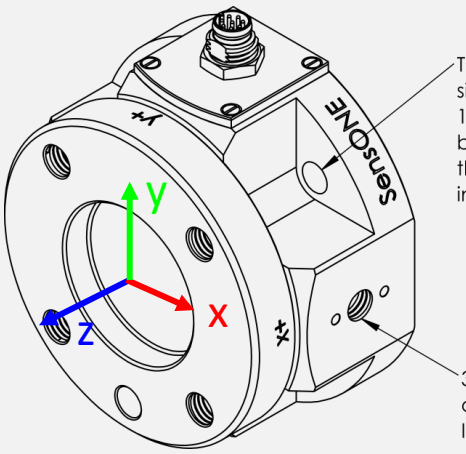
Product testing and inspection

TECHNICAL SPECIFICATIONS

	Serial	EtherCAT
	The best value for money solution for force feedback applications for collaborative robots. Its USB or RS422/RS485 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	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
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, 0.1 N, 0.003 Nm, 0.001 Nm	0.15 N, 0.1 N, 0.003 Nm, 0.001 Nm
Weight	220 g	220 g
Size (DxL)	70 x 35 mm	70 x 35 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

E-mail: info@botasys.com

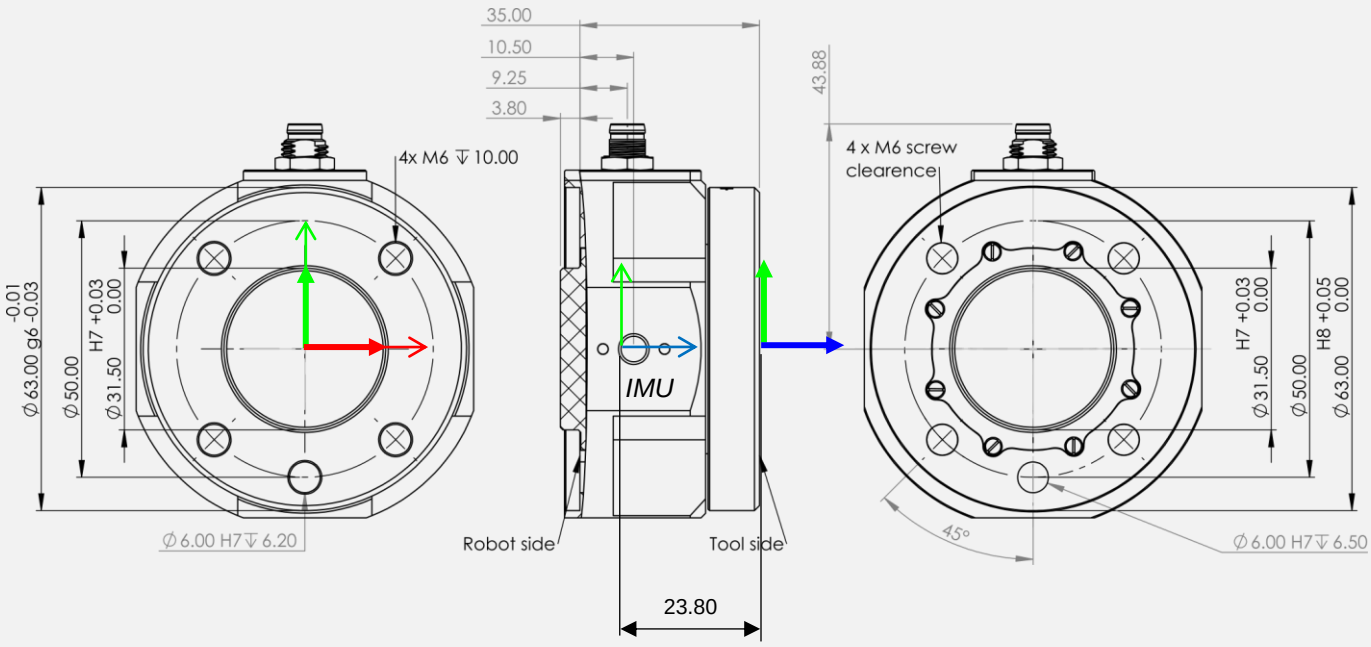
OVERVIEW

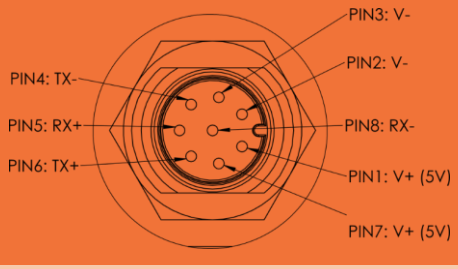
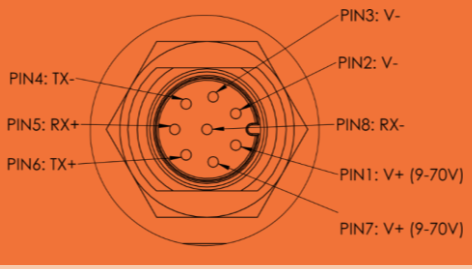


The mounting flange of the sensor is the same for both sides. The patternof the mounting flange is of ISO 9409-1-50-4-M6. Bolts 10.9 equivalent or stronger bolts should be used. For the robot's mounting surface please use the bolts provided with the sensor or ask info@botasys.com for details

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/RS485	CANopen over EtherCAT

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Rokubi

Compact 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 Game - Changing 6-Axis Force Torque Sensor for automation and robotics industry. Its USB or RS422/RS485 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	EtherCAT 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, 0.1 N, 0.003 Nm, 0.001 Nm	0.15 N, 0.1 N, 0.003 Nm, 0.001 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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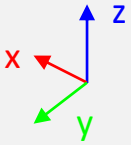
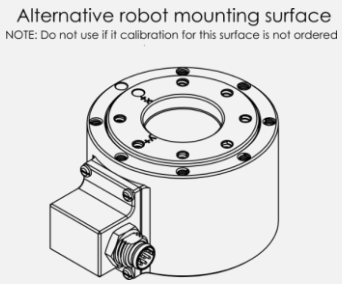
OVERVIEW

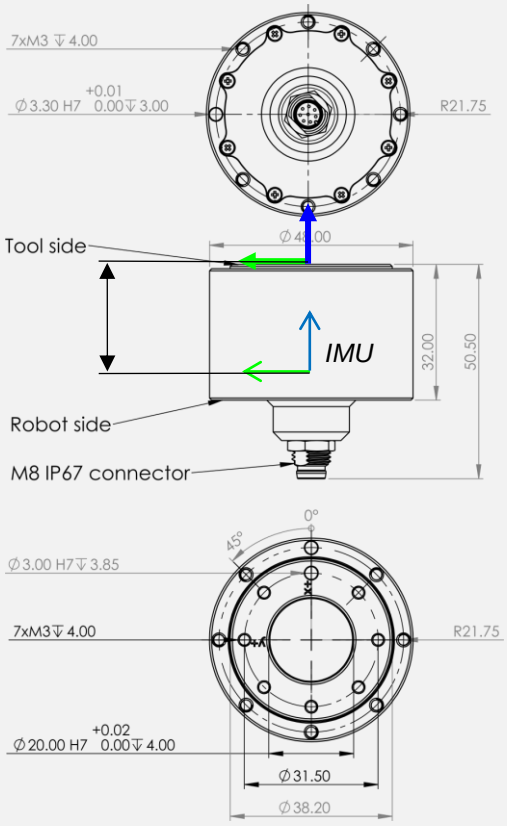
Axial connector

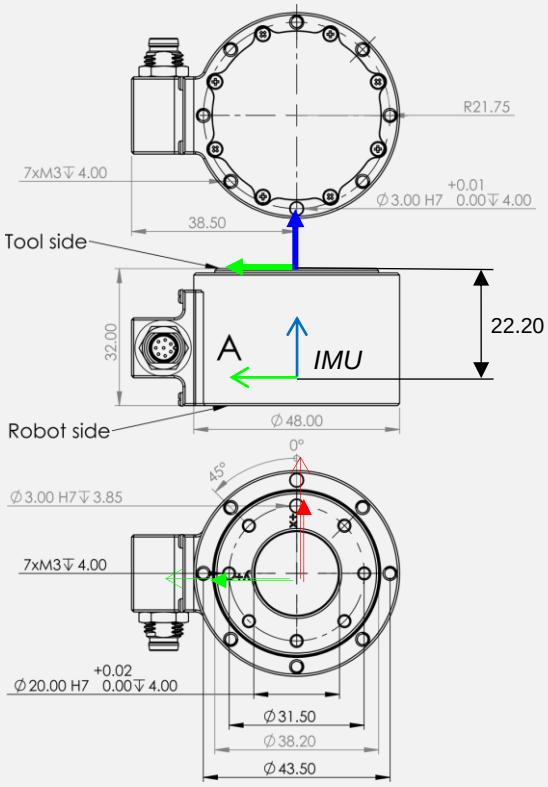


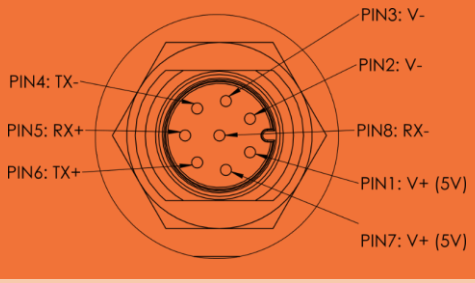
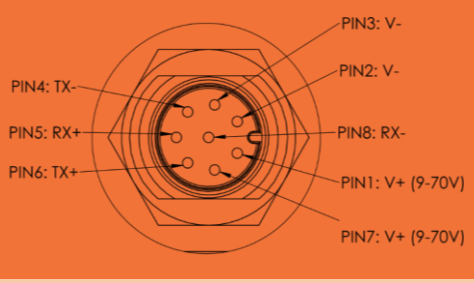
Side connector



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/RS485	CANopen over EtherCAT

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ORDER

Send your inquiry and questions at info@botasys.com

Standard Rokubi and SensONE kit		
Default Kit includes: M8 cable connector, M8 cable assembly, fasteners for SensONE, Power injector for EtherCAT, Power Supply 48V, User Manual, Test Sheet, Calbration Sheet and Mechanical Drawings	**Product Number**	**Description**
	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-11-03-03	Rokubi 6-axis FT sensor with side M8-RS485 interface
	BFT-ROK-11-03-04	Rokubi 6-axis FT sensor with axial M8-RS485 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-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-11-03-03	SensONE 6-axis F/T sensor with side M8-RS485 interface
	BFT-SEN-11-04-03	SensONE 6-axis F/T sensor with side M8-EtherCAT interface
Accessories		
	BAD-SEN-01	Mechanical Adapter for SensONE and RealSense
	BAD-SEN-02	Mechanical Adapter for SensONE and Kinova Gen 3
	BCA-ETH	Bota EtherCAT cable assembly, M8 to RJ45 - 8 pin
	BCA-USB	Bota USB cable assembly, M8 to USB - 8 pin
	BCA-RS4-22	Bota RS422 cable assembly, M8 to 4 pin terminal
Calibration		
	BCA-SEN-01	Calibration for SensONE
	BCA-ROK-01	Calibration for Rokubi