Delfa – 3-Axis F/T Sensor

Datasheet

Properties

This compact, lightweight, and cost-effective **3-axis force/torque sensor** measures axial force (Fz) and torques about the X- and Y-axis (Mx and My). Designed for small robots, it is installed between the robot flange and the end-of-arm tooling (EOAT) to monitor interaction forces and torques. The sensor can be mounted directly to an ISO 9409-1:2004-31.5-4-M5 flange and features **fully integrated electronics** that provide digital measurement data via UART, USB, Modbus RTU, or EtherCAT, eliminating the need for an external signal amplifier.

- **Small, lightweight design** (62 × 23.5 mm, ~80 g)
- **Easy installation** via standardized ISO-flange
- **Plug-and-play operation** with no additional signal amplifier required
- **Digital communication** via UART, USB, Modbus RTU, and EtherCAT
- **Robust, rubber-like sensing element** withstanding shear forces, shocks, and vibration

Applications

- Force and Torque Measurement on Robotic End-of-Arm Tooling (EOAT)
- Pick-and-place operations
- Peg-in-hole assembly and insertion tasks
- Grinding, polishing, and surface-processing applications
- Display testing
- Humanoid robotics

Delfa Systems GmbH ♦ Im Altseiterstal 7 ♦ 66538 Neunkirchen ♦ info@delfasys.de ♦ +49 (0) 68 21–91 37 100

Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.

© Delfa Systems, 2026.

Technical Data

- Different information within one row describes orderable options, see chapter ordering code for details.
- All the following information represents our technical standard. Other configurations/specifications are available on request.

Mechanical and Environmental Data

Parameter	Symbol	Value			Unit	Comments
Measurement Range	F_z	± 20			N	
	M_x / M_y	± 0.5			Nm	
Overload capacity		500			% FS	in z-direction (compression)
Weight	m	~ 80			g	Sensor with electronic w/o cable and flange
Stiffness	Y	120			N/mm	in z-direction
Electrical Connector		Bare ends	USB-A connector	EtherCAT adapter		Other connector configurations available upon request.
Operating Temperature	T_{op}	5 … 40			°C	Extended range upon request
Storage Temperature	T_{st}	-40 … 150			°C	
IP Classification		IP62	IP67			

Electrical Data

Parameter	Symbol	Value (dependent on variant)		Unit	Comments
		UART/Modbus RTU	USB		
Supply Voltage	V_{sup}	5 – 36	5	V	± 10%
Power Consumption	P_{tot}	≤ 0.5	≤ 0.35	W	with LEDs deactivated
Communication	/	UART / Modbus RTU	USB	/	

Performance Data

Parameter	Symbol	Value	Unit	Comments
Sampling Frequency*	f_s	≤250	Hz	Maximum refresh rate
Resolution Fz		<0.02 0.4	N N	Smallest detectable output change … including noise
Resolution Mx/My		<0.25 3	mNm mNm	Smallest detectable output change … including noise
Repeatability Fz		<0.15	N	Maximum error when loaded to same value
Repeatability Mx/My		<3	mNm	Maximum error when loaded to same value
Hysteresis Fz		<+/-0.4	N	Complete Cycle 0 N -> 20 N ->0 N
Hysteresis Mx/My		<+/-13	mNm	Complete Cycle 0 Nm -> 0.5 Nm ->0 Nm

*Specifications performed at 125 Hz

Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.

© Delfa Systems, 2026.

Materials

Part	Material
Housing	Anodized Aluminum
Cable	TPU
Sensor element	PDMS
Others	PA12

Please contact us for further information.

Other Materials are available on request.

Electrical Connection

Each sensor is supplied with a 2 m connection cable.

Bare Ends

This configuration is available with UART or Modbus RTU protocol via RS485.

Color	Description	Comment
brown	VCC	5 – 36 V (ONLY for bare ends variant!)
blue	GND	
green	A	RS485 differential line
white	B	RS485 differential line
yellow	COM	Pull HIGH to send 'Tare' command
orange	Enable	Pull LOW to power down the sensor electronics
copper	Shield	Cable/housing shield

USB

The device is equipped with a USB-A connector and can communicate via USB.

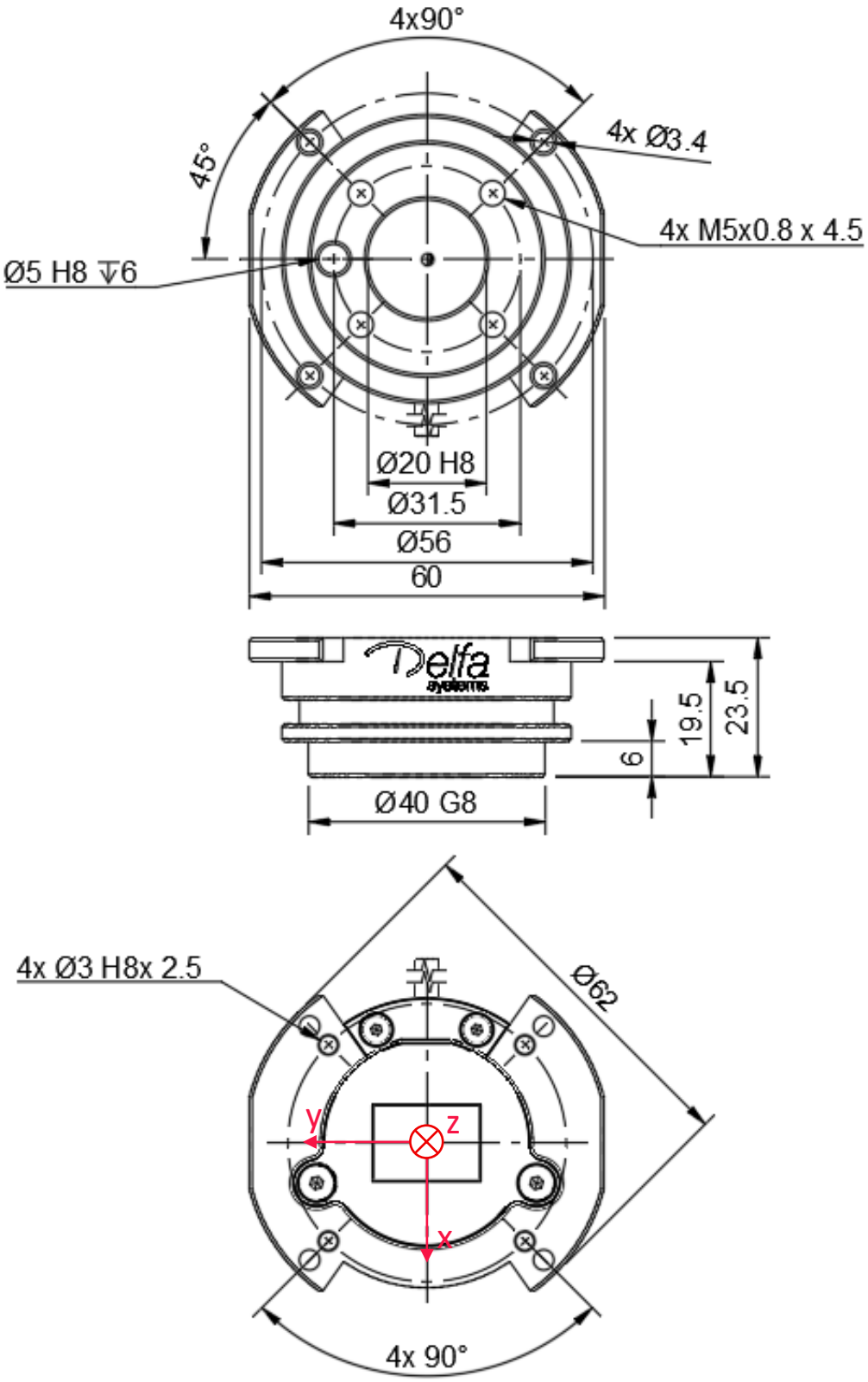
EtherCAT

This version is supplied with a 2 m cable terminated with an EtherCAT adapter providing two RJ45 sockets for bus connection.

Other electrical connections are available on request!

Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.
© Delfa Systems, 2026.

Mechanical Dimensions in mm



Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.
© Delfa Systems, 2026.

Order Code

AX3 - AL31 - 020005 - MBED - 1Q - XXXX

Type	
AX3	3-Axis F/T Sensor

Housing Type	
AL31	Material: EN AW-7075 Flange: ISO 9409-1-31.5-4-M5

Measurement Range	
020010	± 20 N; ±0.5 Nm

Electrical Connection	
UBED	2 m cable with Bare Ends; UART
MBED	2 m cable with Bare Ends; Modbus RTU
USBD	2 m cable with USB
ETCD	2 m cable with Ether CAT Adapter und RJ45

Sampling Rate	
1Q	125 Hz
2H	250 Hz

Optional Features (separate table)

Standard Product

Other options (sensor range, supply & output voltage, housing, communication, cable lengths, ...) available on request.

Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.

© Delfa Systems, 2026.

Optional Features

Add corresponding suffix to end of order code without separator.
Leave blank if no options are desired.

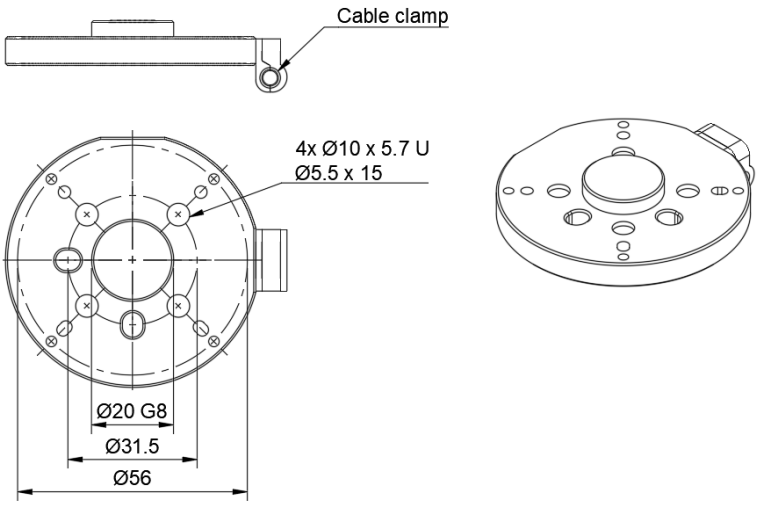
Order code table	
IP	IP67 protection

Customer-specific sensor systems are assigned a factory order code.

Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.
© Delfa Systems, 2026.

Accessories

Mounting flange ISO 9409-1:2004-31.5-4-M5



Subject to change without notice. All information describes our products in general terms. It does not constitute a guarantee of quality or liability in accordance with §443 BGB. The information does not constitute any liability. Specifications are subject to change without prior notice.

© Delfa Systems, 2026.