Hand in hand for tomorrow

Technical Product Guide FTS

Version english

24.10.2025

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FTS

Product Overview

FTS 047

FTS 056

FTS 070

FTS 085

FTS 105

FTS 125

FTS 160

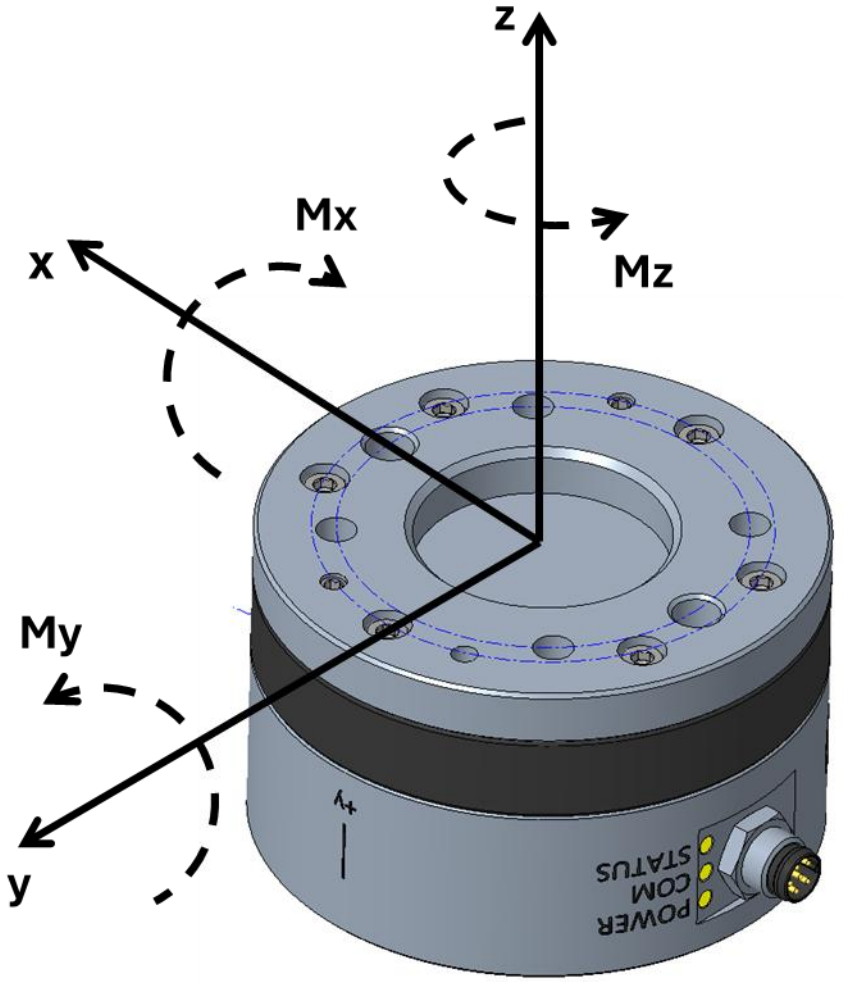
FTS 200

FTS 250

What is a 6 axis Force Torque Sensor?

- 6 axis force and torque measuring device
  - Fx / Fy / Fz
  - Mx / My / Mz (Tx / Ty / Tz)

- Applications
  - Quality Control
  - Process Monitoring
  - Grinding and Polishing with robot
  - Constant force joining and assembly processes
  - Component distinction
  - „enabling the robot to have a sense of touch“



Market Overview Force Torque Sensors

FT-Sensors for laboratory and measurement use

- Highest accuracy and performance
- Analog output + external amplifier
- complex integration in industrial interfaces
- No robot and tool compatible mechanical interfaces
- Higher cost

High End FT-Sensors for industrial use

- High measurement accuracy, resolution, performance, stiffness, low drift, precisely calibrated
- Integrated amplifier electronics
- Industrial Bus Interfaces
- Industrial robots and tools compatible mechanical interfaces

Entry level FT-Sensors for industrial or cobot use

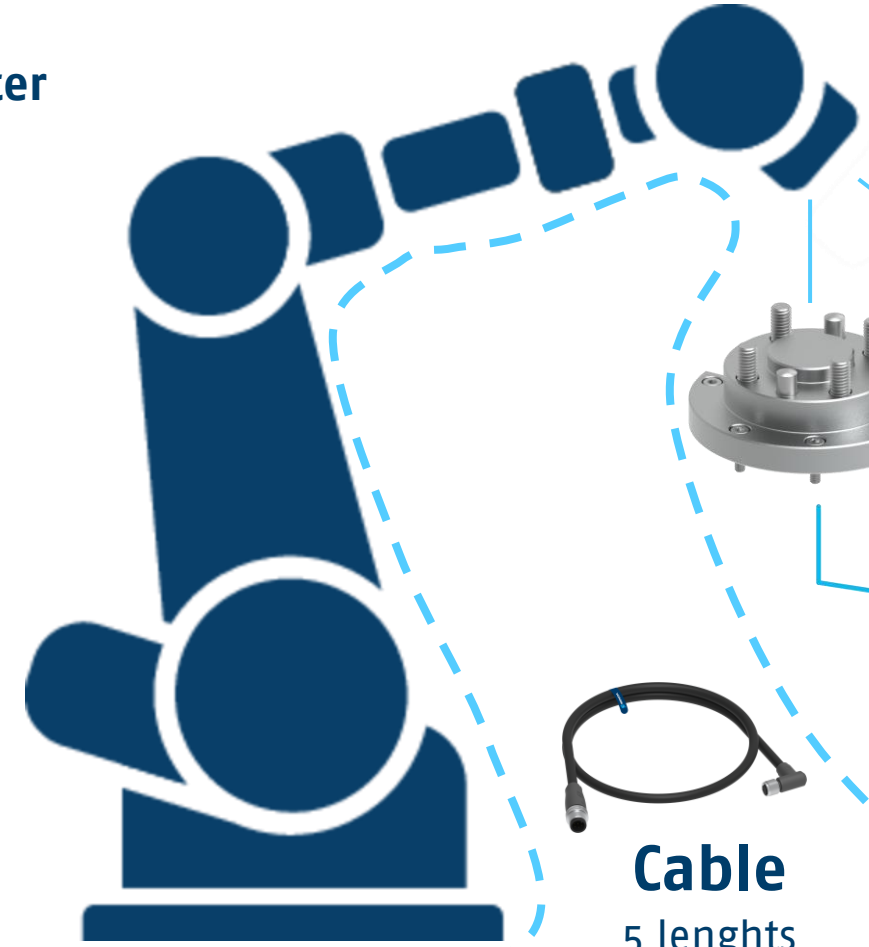
- lower measurement accuracy and performance, stiffness, high drift, less precise calibration
- Integrated amplifier electronics
- Industrial Bus Interfaces
- Industrial robots, cobots and tools compatible mechanical interfaces
- lower cost

FTS Portfolio

Control Center

Interface-Box

1 for all sizes
2 Variants (IP)
4 interfaces

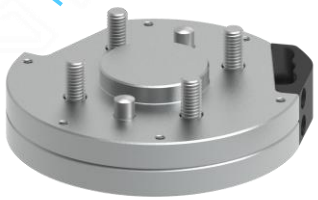


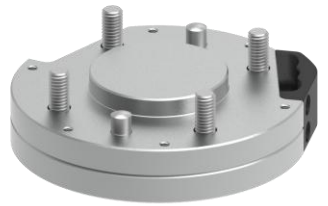
Cable

5 lenghts
2 variants

ISO Adapter

3-4 sizes for each FTS size





Sensor

9 sizes

Product description FTS

FTS	056	600	11
Series Force Torque Sensor	**Size** Outer Diameter Ø56mm	**Measurement Range** Fz 600 N	**Measurement Range** Mxyz 11 Nm

FTS	IFB	PN	
Series Force Torque Sensor	Interface Face Box	PN ProfiNet EI Ethernet/IP EC EtherCAT EN Ethernet	- **IP67 (optional)**

FTS	C	M8	M12	5
Series Force Torque Sensor	Cable	M8 Size 047 – 085 M12 Size 105 – 250	M12 Interface Box	5 m Cable length

Product description FTS

A	IS050	FTS056
Series Adapter	**Robot Flange Type** ISO 9409-1-50-4-M6	**Sensor Size** 056

Size	Tool Side	Robot Side (optional)		
FTS	Integrated in FTS	S (small)	M (medium)	L (large)
047	ISO 31,5	ISO 25	ISO 31,5	ISO 40
056	ISO 40	ISO 31,5	ISO 40	**ISO 50**
070	ISO 50	ISO 31,5 + ISO 40	ISO 50	ISO 63
085	ISO 63	ISO 50	ISO 63	ISO 80
105	ISO 80	ISO 63	ISO 80	ISO 100
125	ISO 100	ISO 80	ISO 100	ISO 125
160	ISO 125	ISO 100	ISO 125	ISO 160
200	ISO 160	ISO 125	ISO 160	ISO 200
250	ISO 200	ISO 160	ISO 200	ISO 250

Configuration Part number including sensor, cable and Interface Box

- No Configuration Part number anymore
- Parts will be sell as single parts as shown on slide 7
- Example:

1x	1610487	A-IS0050/FTS056
1x	1598246	FTS 056-600-11
1x	1608054	FTS C-M8-M12-5
1x	1603602	FTS IFB-EI

Interface Box options

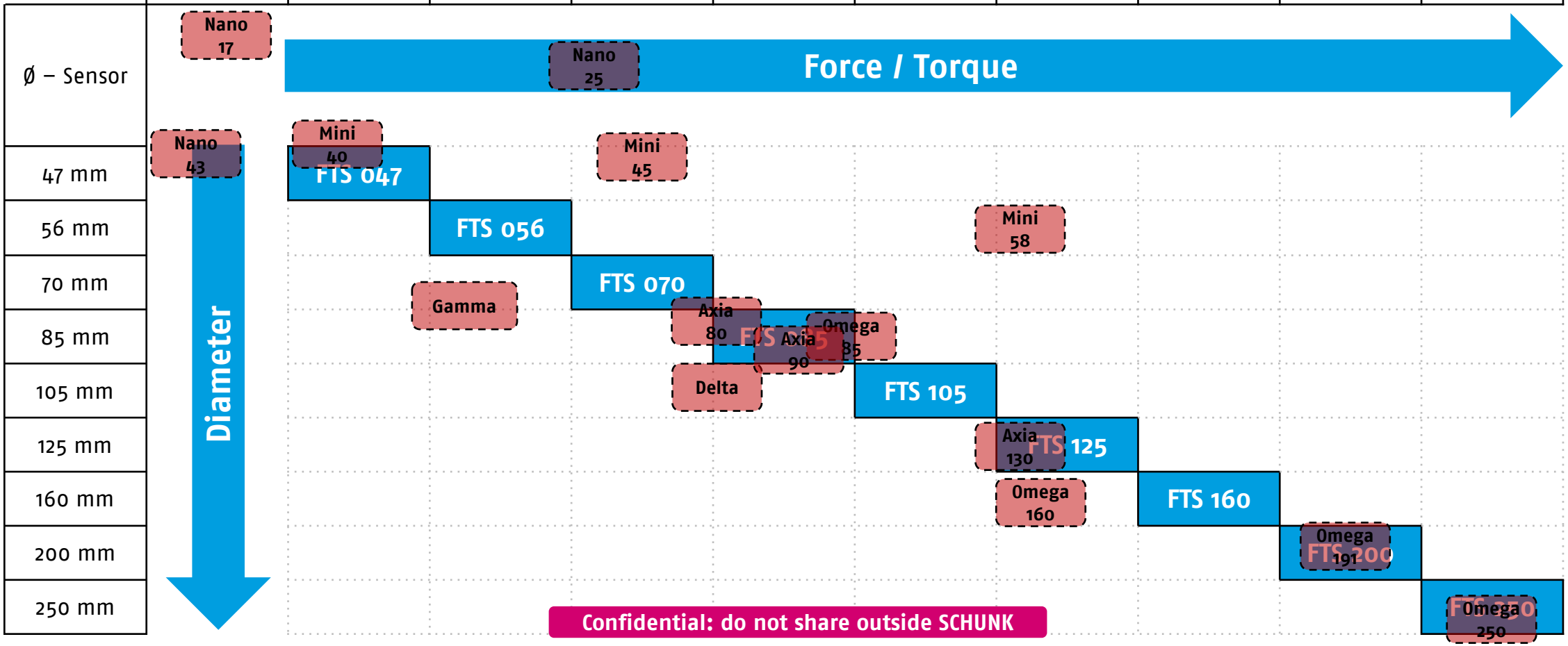
- Ethernet TCP/UDP
- EtherNet & Ethernet/IP
- EtherCAT
- PROFINET

FTS

Continuous Series with 9 FTS sizes	Inconsistent and confusing portfolio with 19 sizes
One calibration per FTS size	Up to 3 calibration optional available
Standard IP67 for all FTS sizes	Depending on size in Non-IP; IP60; IP64; IP65; IP67 & IP68 available
LED´s for Power, Communication & Sensor Status integrated in all FTS sizes (with exception size FTS 047)	Only EtherCAT starting size GAMMA-IP60 and AXIA series with LED´s
Standardised mechanical connection on the tool and actuator side with sufficient screw-in depths and no possibility of damage due to incorrect installation	Partly no mechanical interface on sensor, possibility of damaging the sensor while installation
All FTS sizes with digital signal output, sensor is independent of cable and Interface Box.	Small Nano/Mini sizes with analog output, sensor is depending on cable and Interface Box in case of recalibration or cable damage
Standardized cable type for all FTS sizes	Different cables depending on the FT Sensor size, IP protection and interface
Standardized Interface Box Design for all available Interfaces. On request, the interface of the box can be changed via software update	Each Interface requires different Interface Box depending on FT-Sensor size
The Interface Box has In and Out connections and can therefore be easily integrated into existing network topologies.	Only the Profinet Box has the In and Out option. All others do not have this option.
In case of recalibration, we only need the FTS sensor at SCHUNK HQ. All other components (cable & Interface Box) remain in the customer's system.	In case of recalibration, the cable located directly on the sensor and the matching interface box (identical FT-XXXX) number must be sent in for the NANO and MINI sizes.
Product configuration: SCHUNK Control Center allows easy setup and easy data logging.	Product configuration: For FTN-Sensors you can access the webserver located on the NET-Box. All others do not have such an easy option. For Data logging seperate Data Viewer available

FTS Overview comparison

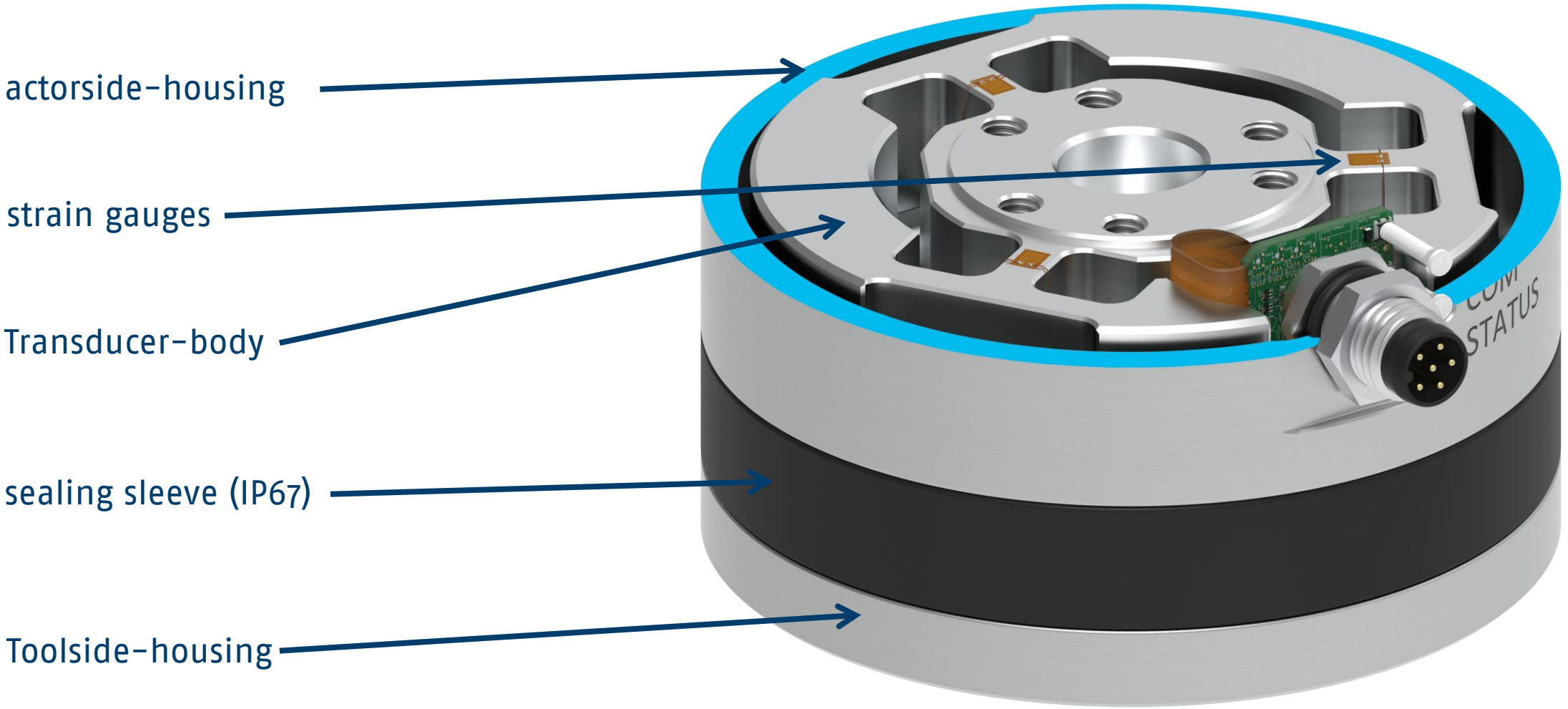
	Fx/Fy	125 N	250 N	500 N	1000 N	2000 N	3200 N	5000 N	10000 N	16000 N
	Fz	300 N	600 N	1200 N	2400 N	4800 N	7800 N	12500 N	20000 N	32000 N
	Mx/My/Mz	4,5 Nm	11 Nm	28 Nm	70 Nm	175 Nm	350 Nm	700 Nm	1400 Nm	2800 Nm



Improvements: FTS vs. FT (ATI)

	SCHUNK	ATI Industrial Automation – A Novanta Company
		
Electronics	Modular electronic Concept	Different electronics concept for different sizes and interfaces
Strain Gauges	Foil Strain Gauges in combination with low noise integrated amplifier electronics for easier manufacturing process	Semiconductor Strain Gauges
Connector	Standardized M8/M12	not standardized and different depending on the Interface
Resolution	Approximately 2.5 times improved resolution for single calibration due to state of the art low noise integrated amplifier electronics	Dual or tripple calibration neccesary

Sectional diagram



Dimensioning FTS

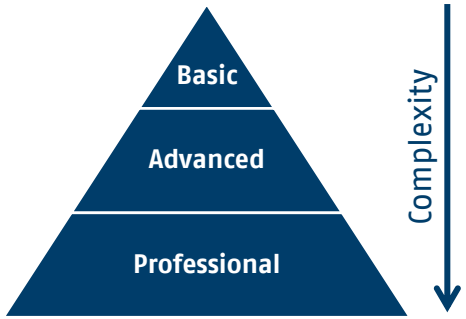
- High customer requirements for accuracy and strength
- High competitive pressure Price/performance

→ Clarification and differentiation of requirements necessary

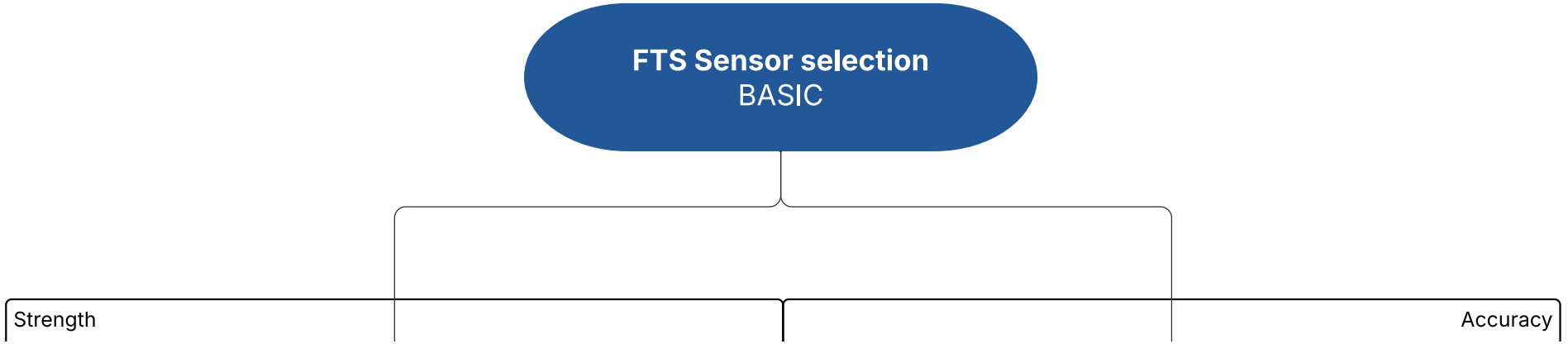
→ „Step-by-step plan" for sensor dimensioning

→ Definition of a dimensioning process

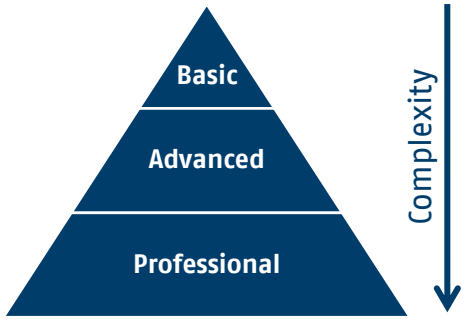
Dimensioning FTS – BASIC

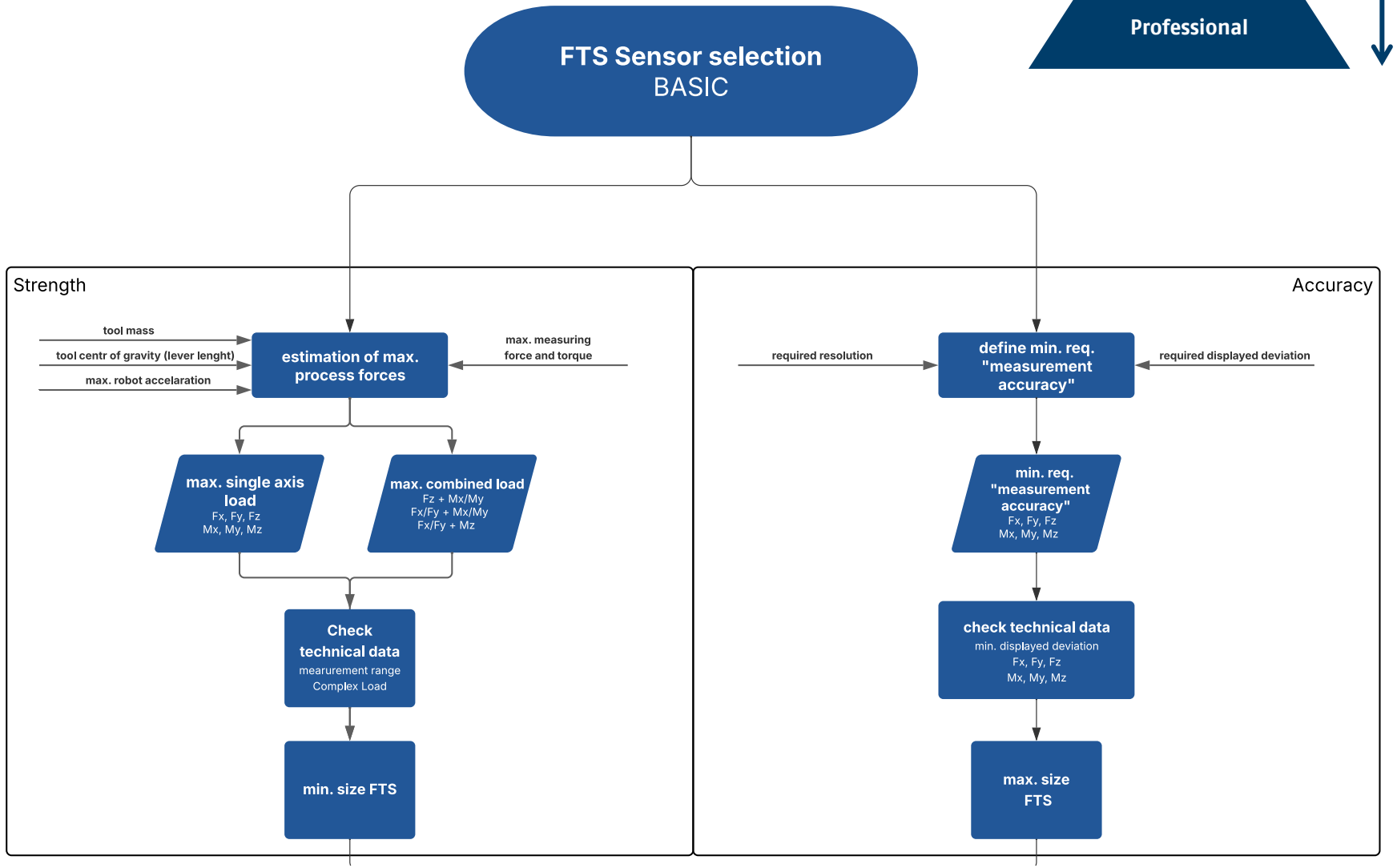


- Use the FTS-checklist from the Sales Tool Box and fill in all the required information.
- Go through the BASIC design process (following slides)
- The **strength** and **accuracy** paths must be considered

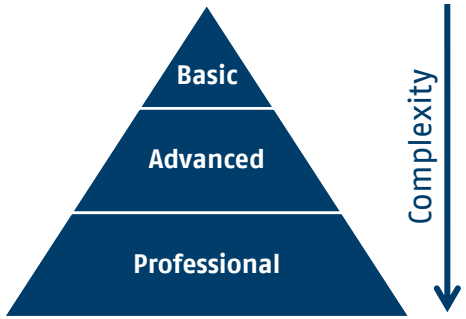


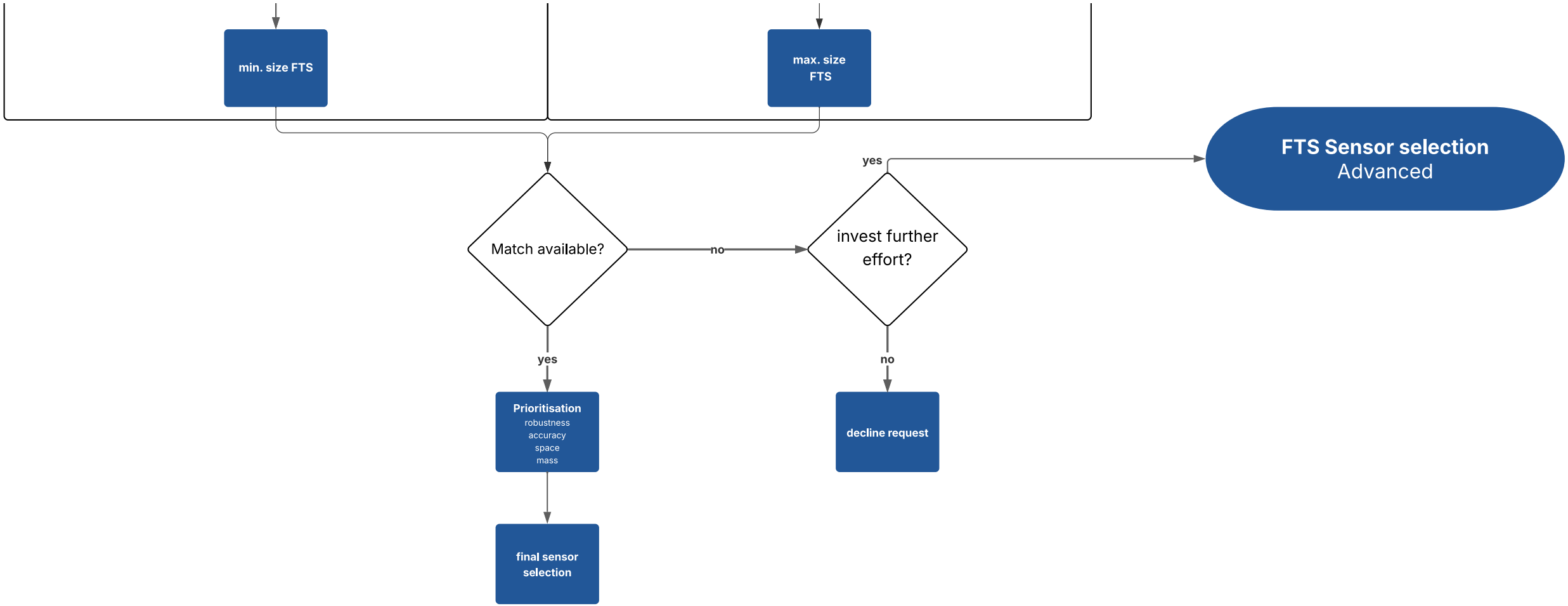
Dimensioning FTS – BASIC



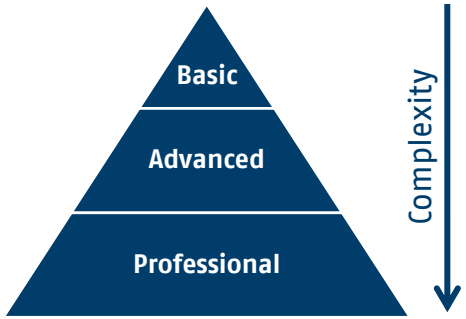


Dimensioning FTS – BASIC





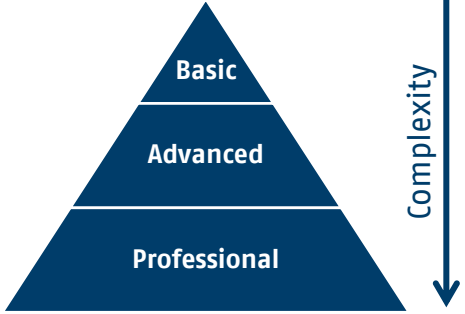
Dimensioning FTS – BASIC



Estimation of max. process forces and torques

When selecting the right FTS sensor, the most critical torque load must be taken into account, which is usually the decisive factor in the choice of sensor. In robotics, this load often results from the acceleration of the end effector, weight and center of mass.

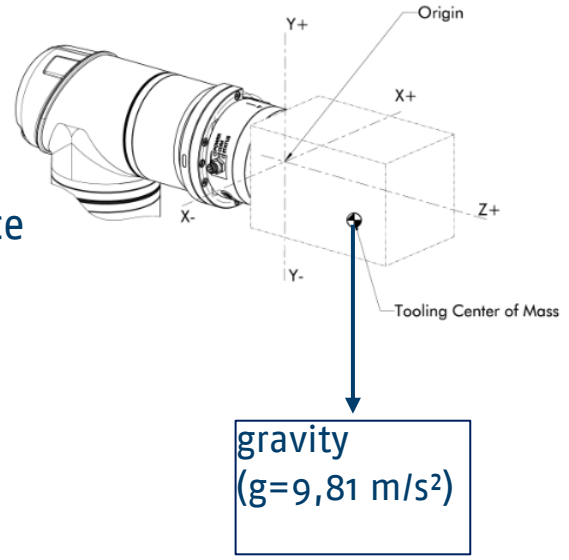
Dimensioning FTS – BASIC

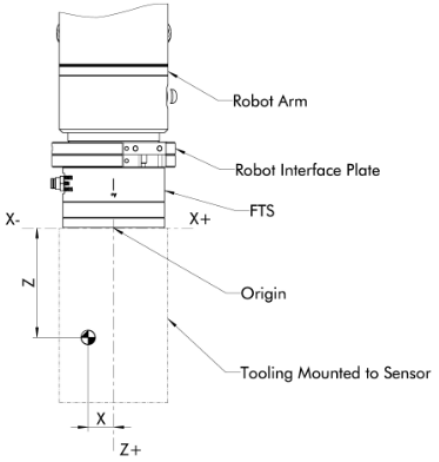


Estimation of max. process forces and torques

Example:

- Mass = 40 kg
- Distance to centre of gravity from z-axis = 50 cm
- Max. robot accelaration in x, y und z Richtung = 5 m/s²
- the maximum force occurs when weight force and mass inertia force are combined
  - $F_{xy} = 40\ kg \cdot \left(9{,}81\ \frac{m}{s^2} + 5\ \frac{m}{s^2}\right) = 592{,}4\ N$
  - $M_{xy} = 592{,}4\ N \cdot 0{,}5\ m = 296{,}2\ Nm$





→ **minimum size FTS 125-7800-350**

Fz = 7800N

Fxy = 3200N

Mxyz = 350Nm

→ **Measuring range verification** ✓ + **Complex-Load verification**

Dimensioning FTS – BASIC

→ min. FTS 125-7800-350
Fz = 7800N
Fxy = 3200N
Mxyz = 350Nm

Check Complex-Load Diagramm (manual)

Example:

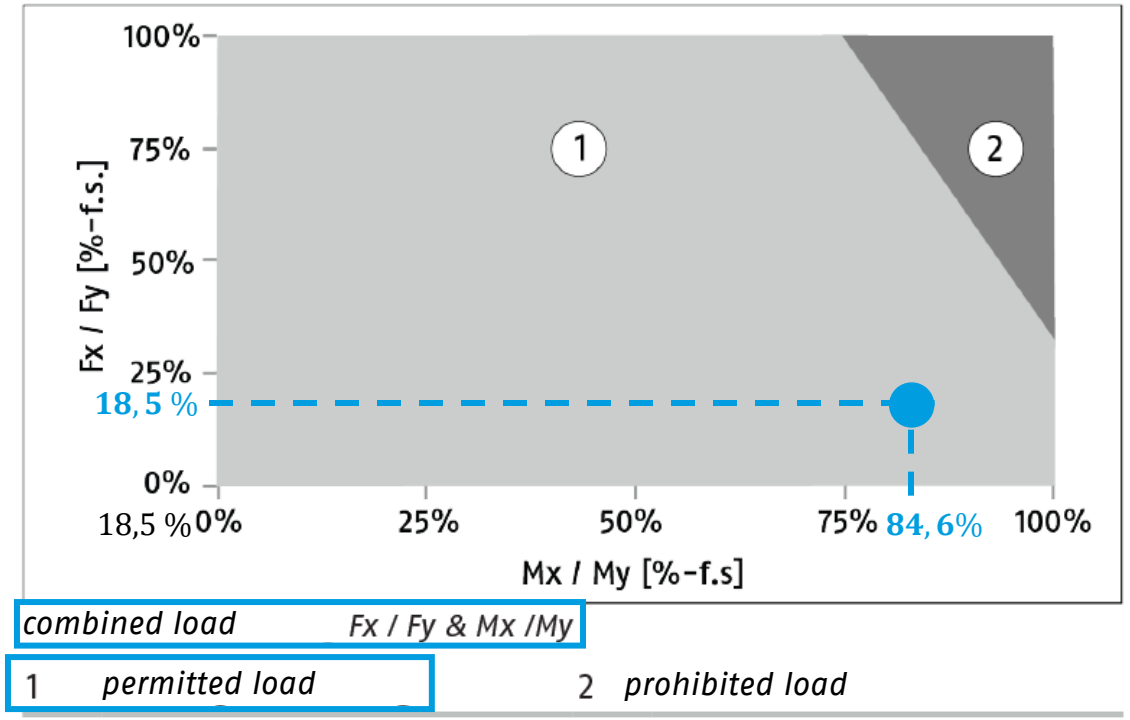
- $F_{xy} = 592{,}4\ N \rightarrow \frac{592{,}4\ N}{3200\ N} = \mathbf{18{,}5\ \%}$
- $M_{xy} = 296{,}2\ Nm \rightarrow \frac{296{,}2\ Nm}{350\ Nm} = \mathbf{84{,}6\ \%}$

→ **Select the appropriate complex load diagram**

→ **Draw in ‚Load point' or check with the value table**

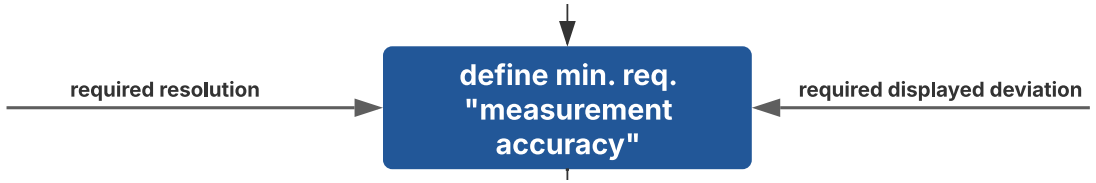
→ **Check whether the load point is within the allowed range**

→ **Complex-Load verification** ✓

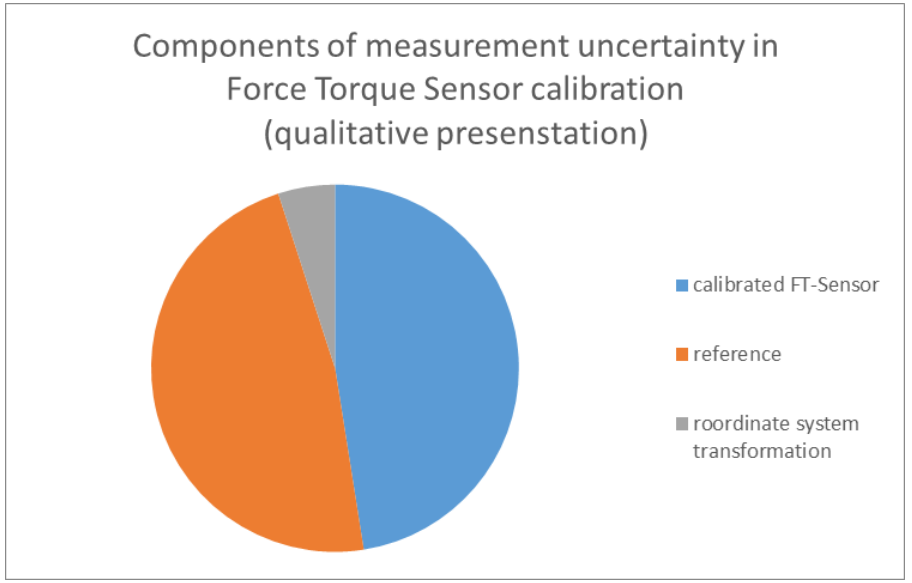


Sensor size	Fx / Fy		Mz		Fz		Mx / My		Fx / Fy		Mx / My	
	[N]		[Nm]		[N]		[Nm]		[N]		[Nm]	
125-7800-350	33,3 %	1066,6	350	100 %	33 %	2574	3502	100 %	33 %	1056	350	100 %
	100 %	3200	262,5	75 %	100 %	7800	231	66 %	100 %	3200	262,5	75 %

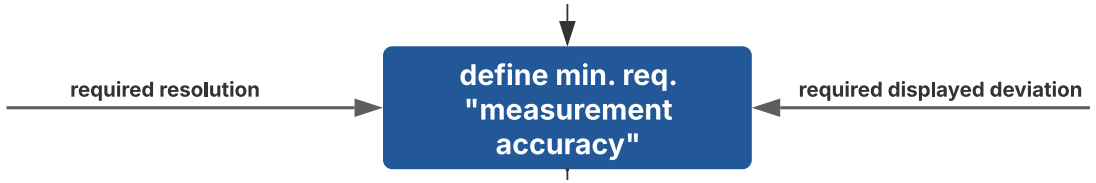
Dimensioning FTS – BASIC



- **Define minimum required measurement accuracy**
  - What is ~~‚measurement accuracy'~~? → **measurement uncertainty:** *p.a. Fz = 100 N ± **1 N** (measurement result ± **measurement uncertainty**)*
  - What measurement uncertainties are specified in the calibration certificate?→ **measurement uncertainty of the calibration and** as well as its components
    - **calibrated object**: meas. unc. of calibrated sensor **(FTS)**
    - **reference**: meas. unc. of the calibration device **(‚the calibration machine')**
    - **Coordinate transformation**: meas. unc. of the conversion from the coordinate system of the reference to the coordinate system of the object



Dimensioning FTS – BASIC

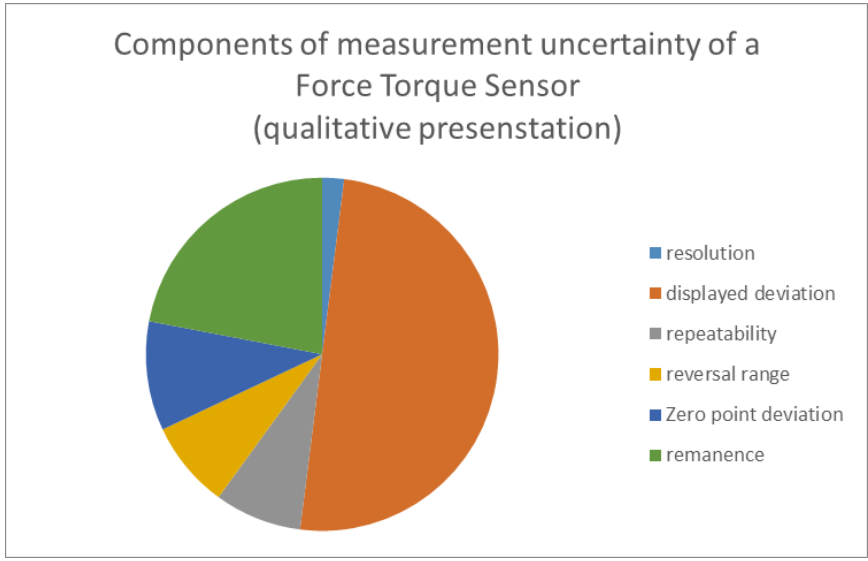


- **Define minimum required measurement accuracy**
  - What is relevant for the customer's application? → **The measurement uncertainty of the calibrated object** or perhaps only individual components

Advanced / Professional

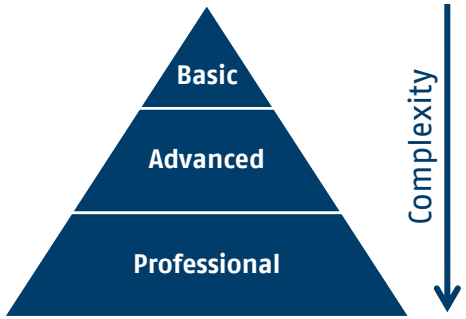
Basic

- **resolution:** smallest, noisefree displayed signal
- **displayed deviation:** Deviation of the displayed forces & torques from the actual applied loads. With the SCHUNK FTS, these are mainly linearity deviations and the crosstalk of the individual channels.
- **repeatability:** Deviation of the displayed forces & torques for two identical consecutive measurements
- **Reversal range:** Deviations of the displayed values with increasing and decreasing load (‚hysteresis')
- **Zero point deviation:** Deviation of the zero point after loading in one direction (‚zero point hysteresis')
- **remanence:** Deviation of the zero point after loading in positive and negative direction (‚alternating zero point hysteresis')



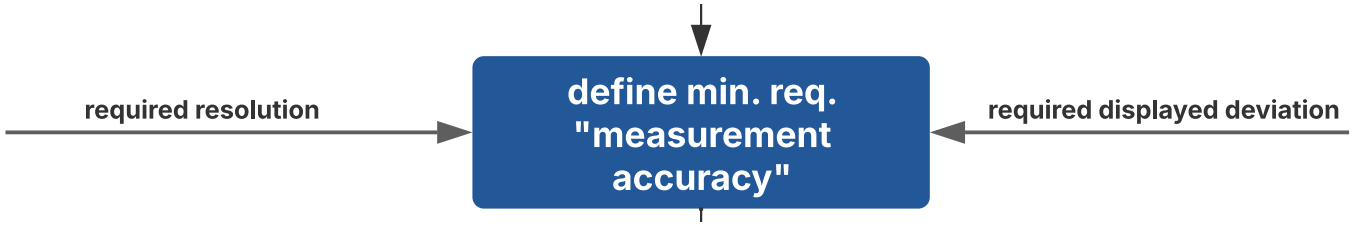
- → for most applications, the consideration of **resolution** and **displayed deviation** is sufficient.

Dimensioning FTS – BASIC

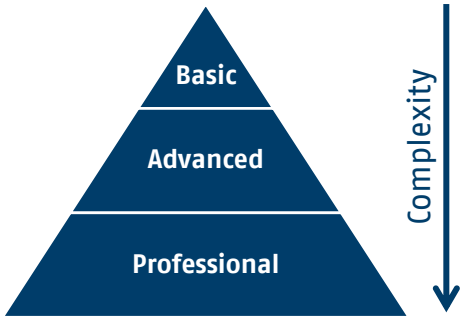


Define minimum required measurement accuracy

- It is important to understand the customer's requirements precisely
  - „I want to join two workpieces and no shear force/shear moment above 0.2 Nm may occur during the joining process, otherwise the workpiece will be damaged“ → **required resolution Mx/My < 0,2 Nm**
    - **Characteristics of resolution:** No measurements of the exact amount necessary, sensitive control required
  - „I want to ensure that the part engages in the end position during this joining process, but also that it is not damaged. It engages with 300 N and with over 500 N it is overstretched and damaged (target force Fz 400 N ±100 N)“ → **required displayed deviation Fz < 100 N**
    - **Characterisitics of displayed deviation:** Amount of force or torque is relevant, measured value must be evaluated



Dimensioning FTS – BASIC



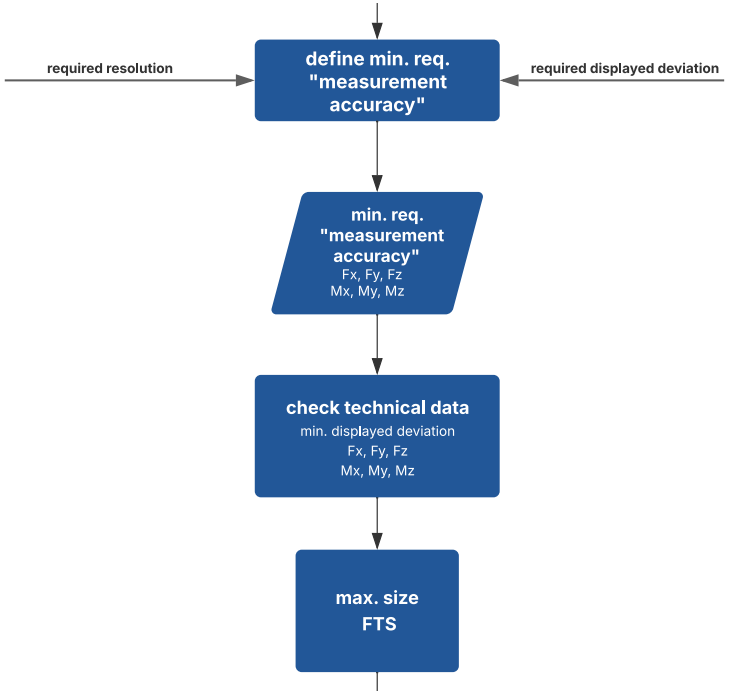
Check technical data and define maximum possible size

- Required resolution **Mx/My < 0,2 Nm**
- Required displayed deviation **Fz < 100 N**

→ max. size according resolution requirements: FTS 250

→ max. size according displayed deviation requirements : **FTS 125**

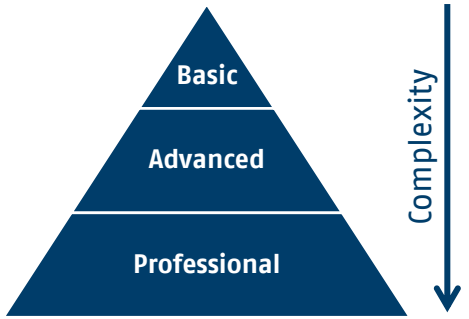
Check technical data ✓



FTS 125-7800-350	Fxy	Fz	Mxy / Mz
Measurement range	3200 N	7800 N	350 Nm
Max.rel. Displayed deviation	<1,0 %-f.s.	<1,0 %-f.s.	<1,0 %-f.s.
Max. displayed deviation	<32 N	<78 N	<3,5 Nm
resolution*	0,16 N	0,31 N	0,014Nm / 0,011 Nm

*: fiktives Beispiel

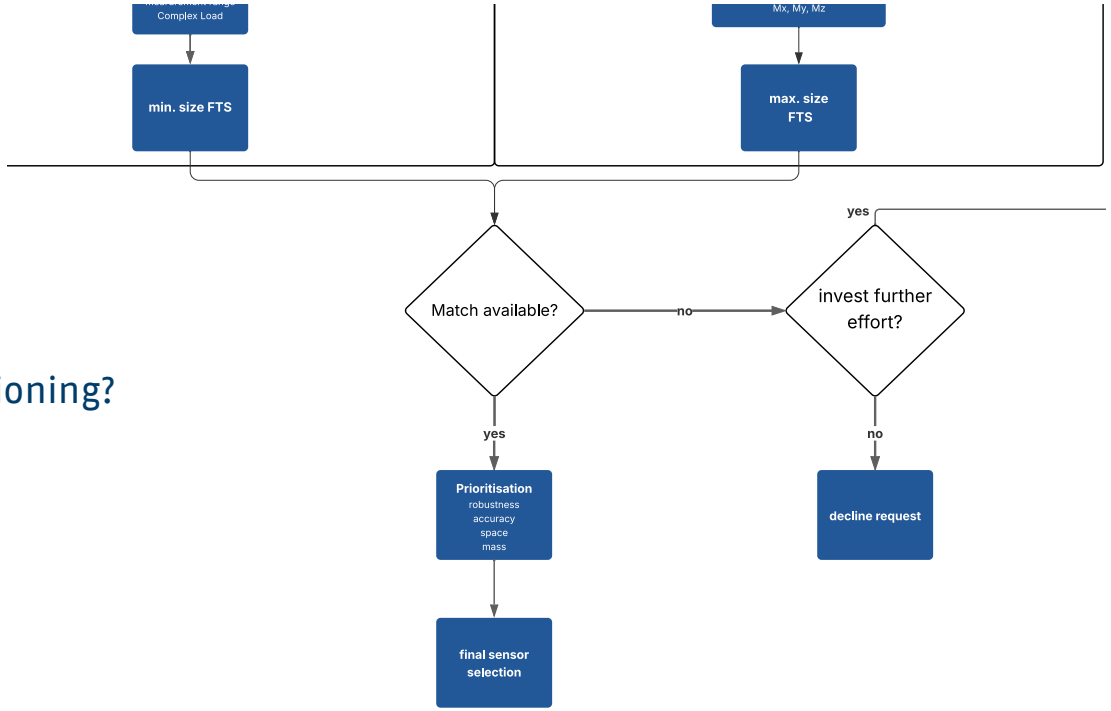
Auslegung FTS – BASIC



Match available?

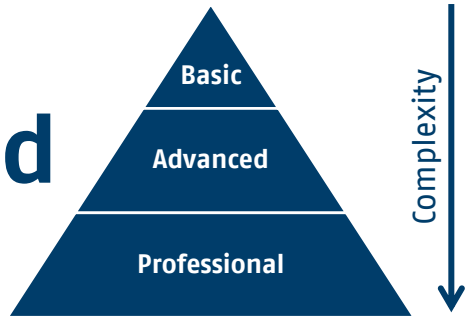
→ Yes **FTS 125-7800-350**
- No further possibilities

→ final selection of the sensor: **FTS 125-7800-350**



→ No?
- →Does it make sense to invest further effort in a more precise dimensioning?
  - Questioning feasibility?
  - Unrealistic cost expectations of the customer?
  - ExistingTurnover potential for SCHUNK?
- →Yes?
- →**Perform Dimensioning Advanced (contact FTS expert)**

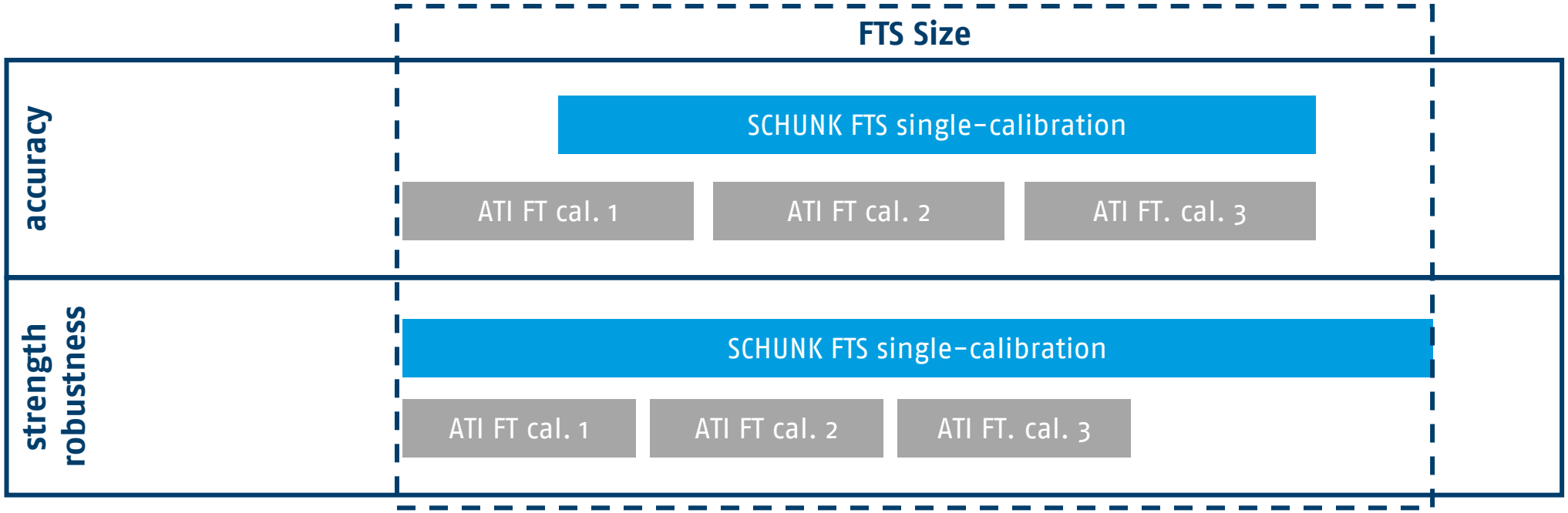
Dimensioning FTS – Advanced



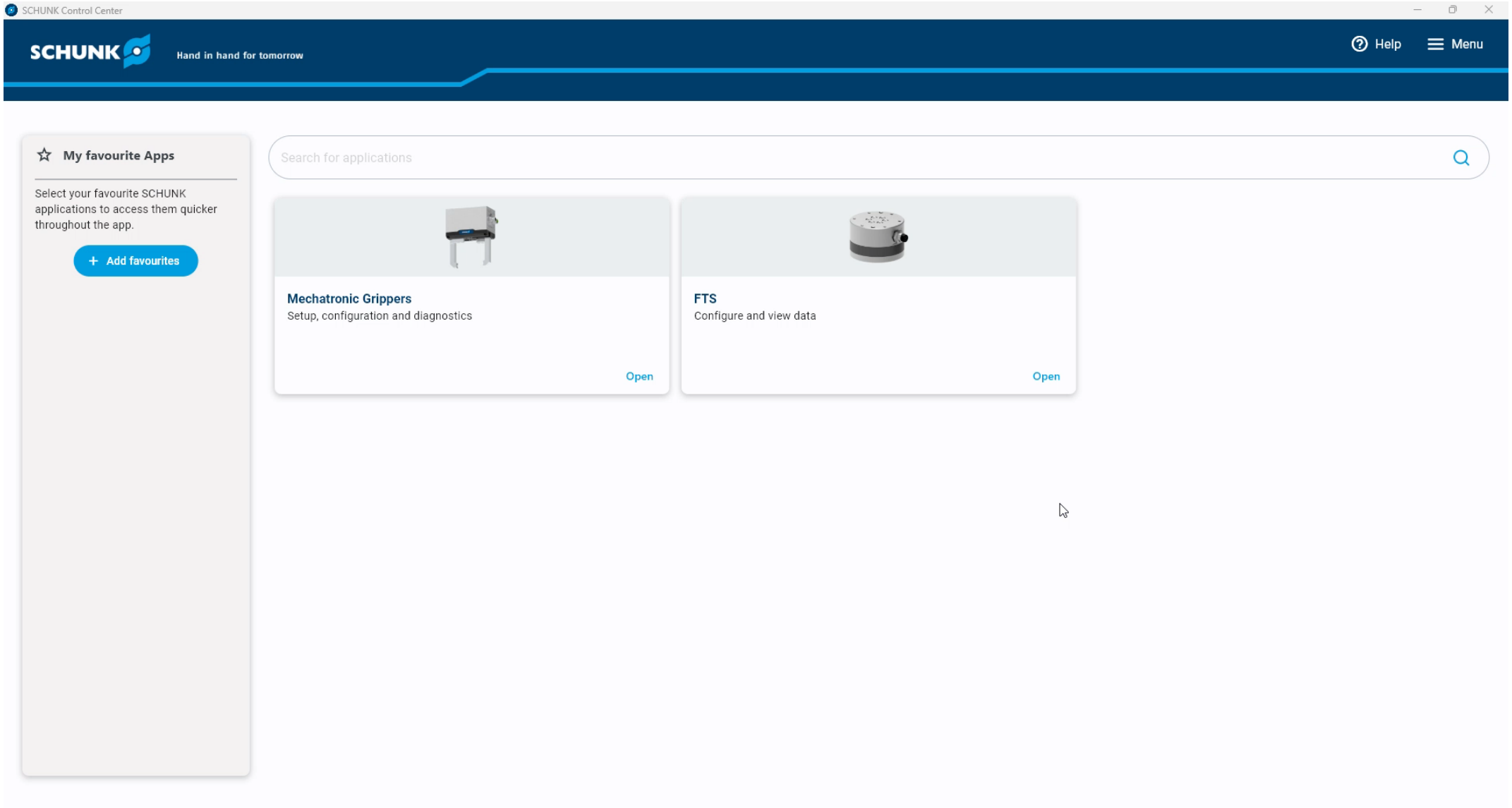
- What are the potentials of a more detailed consideration of customer requirements?
  - The customer likes to generalise requirements and these become unattainable or are oversized
  - reasons / examples:
    - Requirements can be combined, considered separately or individually („or“, „max.“ instead „and“)
      - Example strength: Load A occurs in process step 1 and load B in process step 2, customer requests ‘(A+B)’ instead of max(A,B)
      - Example of accuracy: The customer requires a measurement uncertainty over the entire process of 10 N in Fz. At best, the sensor achieves a total measurement uncertainty of 20 N in Fz. However, the customer tares in each process step, i.e. many uncertainty contributions do not have to be considered for the application and the sensor then achieves a display deviation of 9 N in the respective process steps and can therefore be used.

Performance Comparisons

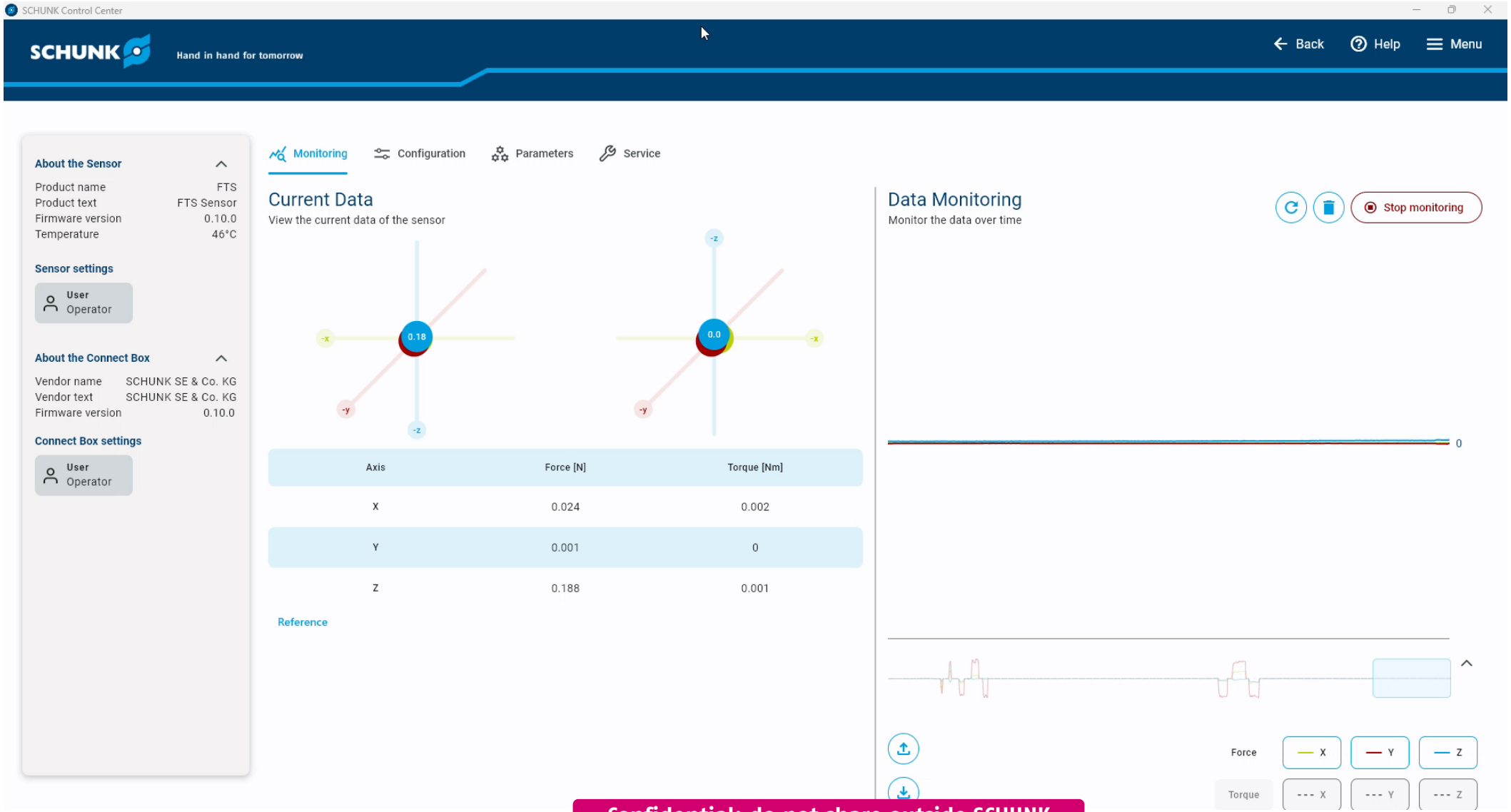
- Direct performance comparisons between ATI FT sensors and SCHUNK FTS are difficult
- **ATI FT-Sensors with triple-calibration have a wider range in accuracy but a smaller range in strength and robustness**
- **Example:**



SCHUNK Control Center & FTS Sensor



SCHUNK Control Center & FTS Sensor



Calibration Certificate Example

1 Kalibriergegenstand
Calibrated object

Beschreibung: *Description*	Mehrkomponentenaufnehmer (6 MK)		
Hersteller: *Manufacturer*	SCHUNK		
Typ: *Type*	FTS 085-2400-70		
Identnummer: *Ident number*	1582296		
Seriennummer: *Serial number*	BBMV6394		
Baujahr: *Year of manufacture*	--		
Nennlasten: *Nominal loads*	F_x = 1000 N M_x = 70 N·m	F_y = 1000 N M_y = 70 N·m	F_z = 2400 N M_z = 70 N·m
Messbereich: *Measurement range*	F_x = 1000 N M_x = 70 N·m	F_y = 1000 N M_y = 70 N·m	F_z = 2400 N M_z = 70 N·m
Kabellänge: *Cable length*	5 m		
Nullsignal: *Zero signal*	F_x = 1228,381 AE M_x = 1369,499 AE	F_y = 716,615 AE M_y = 1334,358 AE	F_z = 1110,723 AE M_z = 771,75 AE
Anschlusstechnik: *Connection technology*	Ethercat		
Bemerkung: *Comment*			

6 Konformitätsaussage
Conformity statement

Die binäre Konformitätsaussage bezieht sich auf die bei der Kalibrierung vorliegenden Umgebungsbedingungen, auf alle Messwerte bei einaxialer Belastung und gemischter Belastung unter Verwendung der einfachen Akzeptanz (ohne Berücksichtigung eines Sicherheitsbandes). Das Prüfunsicherheitsverhältnis gibt das Verhältnis der Akzeptanzgrenze geteilt durch die erweiterte Messunsicherheit der Kalibrierung an.

The binary conformity statement refers to the environmental conditions determined during calibration and to all measured values under uniaxial load and mixed load using simple acceptance (without taking a safety band into account). The test uncertainty ratio indicates the ratio of the acceptance limit divided by the expanded measurement uncertainty of the calibration.

	F_x	F_y	F_z	M_x	M_y	M_z
Akzeptanzgrenze: *Acceptance level:*	1,0 % f.s.	1,0 % f.s.	1,0 % f.s.	1,0 % f.s.	1,0 % f.s.	1,0 % f.s.
Konformitätsaussage einaxiale Belastung: *Conformity statement uniaxial loading:*	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed
Konformitätsaussage gemischte Belastung: *Conformity statement mixed loading:*	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed	Bestanden - Passed
Min. Prüfunsicherheits-verhältnis: *Min. Test Uncertainty Ratio:*	1,59	1,54	1,71	1,67	1,46	1,06
Max. rel. Abweichung: *Max. rel. deviation:*	0,67 % f.s.	0,64 % f.s.	0,19 % f.s.	0,27 % f.s.	0,24 % f.s.	0,57 % f.s.

Technical Questions

Is it possible to recalibrate ATI FT Sensor?

➢ Yes, please contact service department.

Are there still all IP Protection Classes available?

➢ No, new FTS Sensors with standard IP67 class.

Are the same Interface options available?

➢ Focus on Industrial Field Bus (EtherNet/IP; PROFINET & EtherCAT), FTD (analog DAQ Interface) no longer available.

What is SCHUNK Control Center?

➢ The SCHUNK Control Center is a user-friendly software platform designed for programming, controlling, and monitoring SCHUNK automation components such as grippers and Force Torque Sensors, offering features like real-time diagnostics, configuration management, and simulation.

Technical Questions

Can we support customers in integrating the measurement data into customers Robot Controller/PLC?

➢ Please contact Robot Accessories Team for support.

Can we offer DaKKs calibration standard?

➢ Yes, please contact service department.

Is there a low cost FT Sensor (replacement AXIA) in the new portfolio?

➢ Not at market launch, but we have the know-how in-house and can therefore respond to all customer inquiries in the future.

What is the difference between resolution and accuracy?

➢ Resolution is the smallest change in force or torque that can be detected by a sensor.

➢ Accuracy describes the difference between a measured value and the deviation of the value output by the FTS sensor system.

Technical Questions

What is crosstalk?

➢ Crosstalk is the error seen when a load applied straight along one axis causes an output in another axis of the FTS Sensor.

How to manage Sensor output drift?

➢ Consider warm up phase (FTS manual)

➢ Tare the FTS sensor as often as possible

How often I should recalibrate the FTS Sensor?

➢ SCHUNK recommend to reaclibrate the FTS once a year.

Please note it´s up to the customer and his processes.

Hand in hand for tomorrow

schunk.com