Commissioning instructions
FTD
Force-torque sensor system

Superior Clamping and Gripping

SCHUNK®

Imprint

Technical changes:

We reserve the right to make alterations for the purpose of technical improvement.

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Dear Customer,

Thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

Customer Management

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Please read the operating manual in full and keep it close to the product.

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1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

This manual is an integral part of the product and must be kept accessible for the personnel at all times.

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

In addition to these instructions, the documents listed under ▸ 1.1.2 [🗋 6] are applicable.

NOTE: The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

1.1.1 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

⚠ DANGER

Dangers for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

NOTICE

Material damage!

Information about avoiding material damage.

1.1.2 Applicable documents

- General terms of business *
- Catalog data sheet of the purchased product *
- Assembly and operating manual of the sensor *
- Help files for FTD DAQ software (ATI DAQ F/T software) **

The documents labeled with an asterisk (*) can be downloaded from **schunk.com**.

The documents labeled with an asterisk (**) can be downloaded from **schunk.com/ft-downloads**.

1.1.3 Variants

This operating manual applies to the following variations:

- Force-torque sensor system FTD with USB data acquisition (DAQ) card for one force/torque sensor
- Force-torque sensor system FTD with USB data acquisition card for up to six force/torque sensors
- Force-torque sensor system FTD with PCI data acquisition card for one force/torque sensor
- Force-torque sensor system FTD with PCI data acquisition card for up to six force/torque sensors
- Force-torque sensor system FTD with terminal block with BNC inputs for one force/torque sensor

1.2 Warranty

If the product is used as intended, the warranty is valid for 12 months from the ex-works delivery date under the following conditions:

- Observe the ambient conditions and operating conditions

Parts touching the workpiece and wear parts are not included in the warranty.

1.3 Scope of delivery

The scope of delivery includes

- Force-torque sensor system FTD in the ordered model
- Force-torque sensor FT with sensor cable
- DAQ cable
- PS box or IFPS box
- Commissioning instructions
- Assembly and operating manual force-torque sensor FT
- Commissioning CD with calibration certificates
- Accessory pack

2 Basic safety notes

2.1 Intended use

The product is used to record, convert and evaluate analog output signals into electrical signals using a data acquisition card.

- Appropriate use of the product includes compliance with all instructions in this manual.

2.2 Inappropriate use

The product is not a safety component in accordance with the EC Machine Directive 2006/42/EC and must not be used in safety-relevant parts of machine control units.

2.3 Constructional changes

Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

- Structural changes should only be made with the written approval of SCHUNK.

2.4 Spare parts

Use of unauthorized spare parts

Using unauthorized spare parts can endanger personnel and damage the product or cause it to malfunction.

- Use only original spare parts or spares authorized by SCHUNK.

2.5 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

2.6 Disposal

Handling of disposal

The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.

- Follow local regulations on dispatching product components for recycling or proper disposal.

2.7 Notes on particular risks

⚠ DANGER

Danger from electric voltage!

Touching live parts may result in death.

- Switch off the power supply before any assembly, adjustment or maintenance work and secure against being switched on again.
- Only qualified electricians may perform electrical installations.
- Check if de-energized, ground it and hot-wire.
- Cover live parts.

3 Technical data

3.1 Ambient conditions and operating conditions

Ambient conditions and operating conditions for PS box and IFPS box

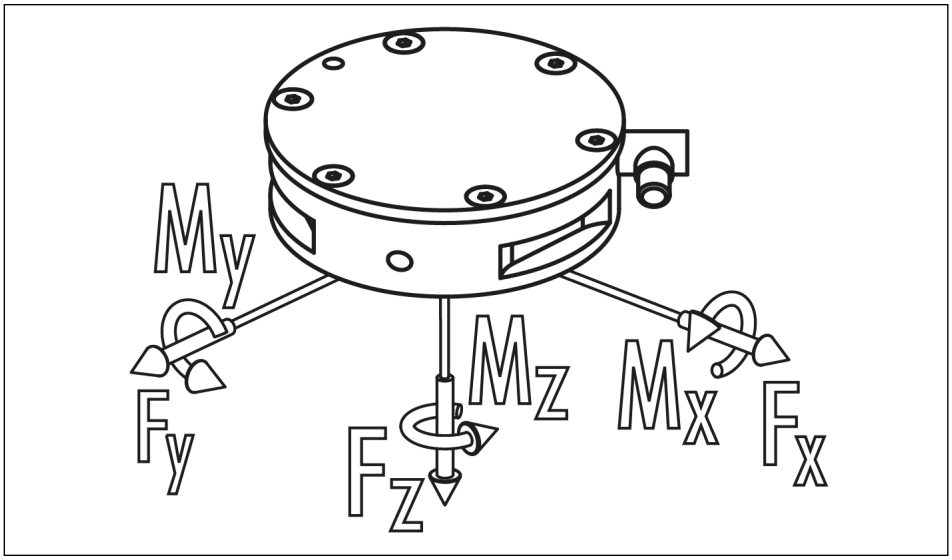
Designation	PS box / IFPS box
Ambient temperature [°C]	
during storage	
min.	-30
max.	75
during operation	
min.	0
max.	60

3.2 Force-torque sensor

NOTE

All forces and torques acting on the sensor must be within the specified range of measurement. Exceeding the range of measurement will reduce the maximum number of load cycles and may lead to damage of the sensor.

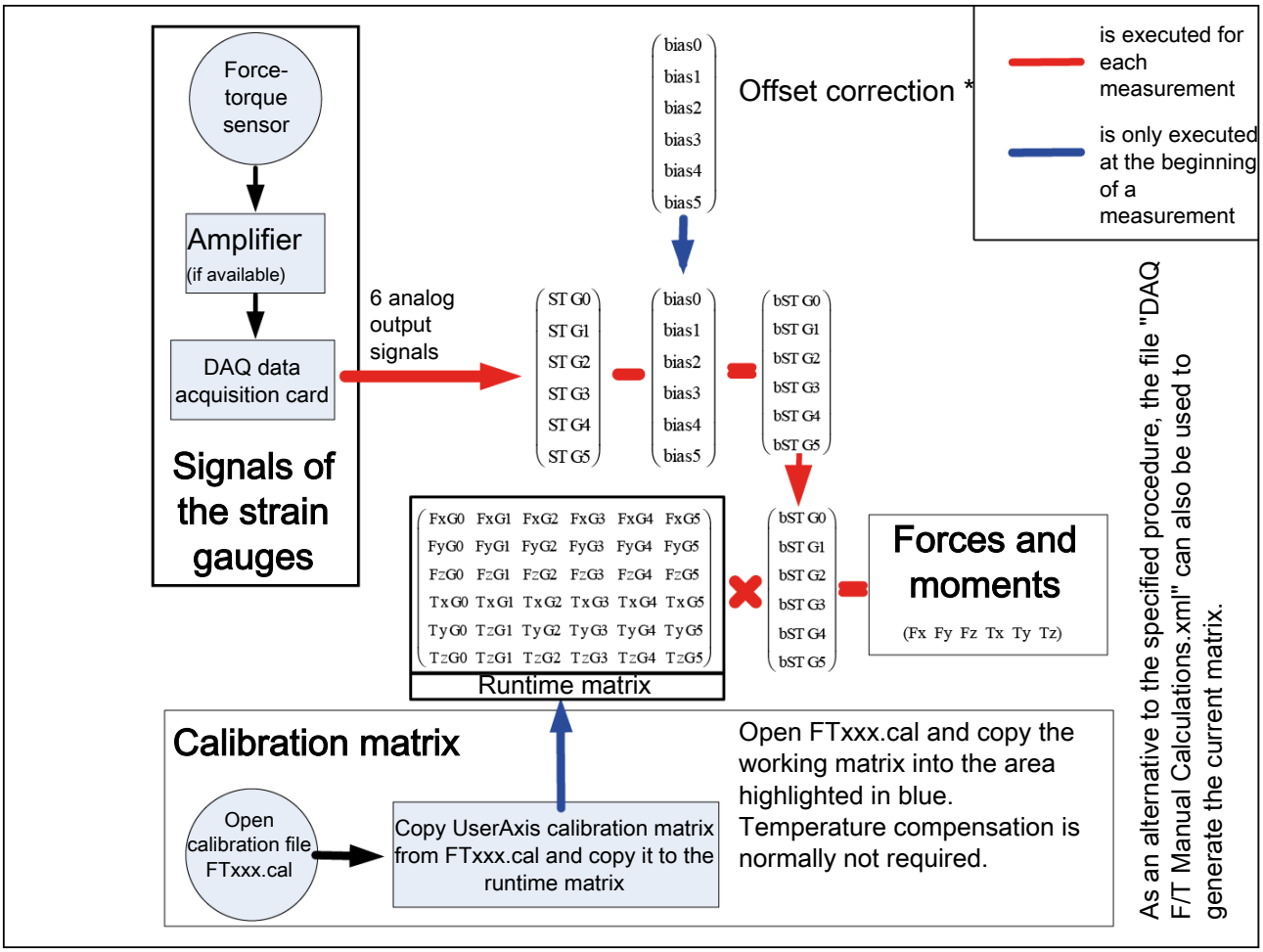
Information on the range of measurement of each individual force-torque sensor is provided in the catalog data sheet. The latest version is always applicable.



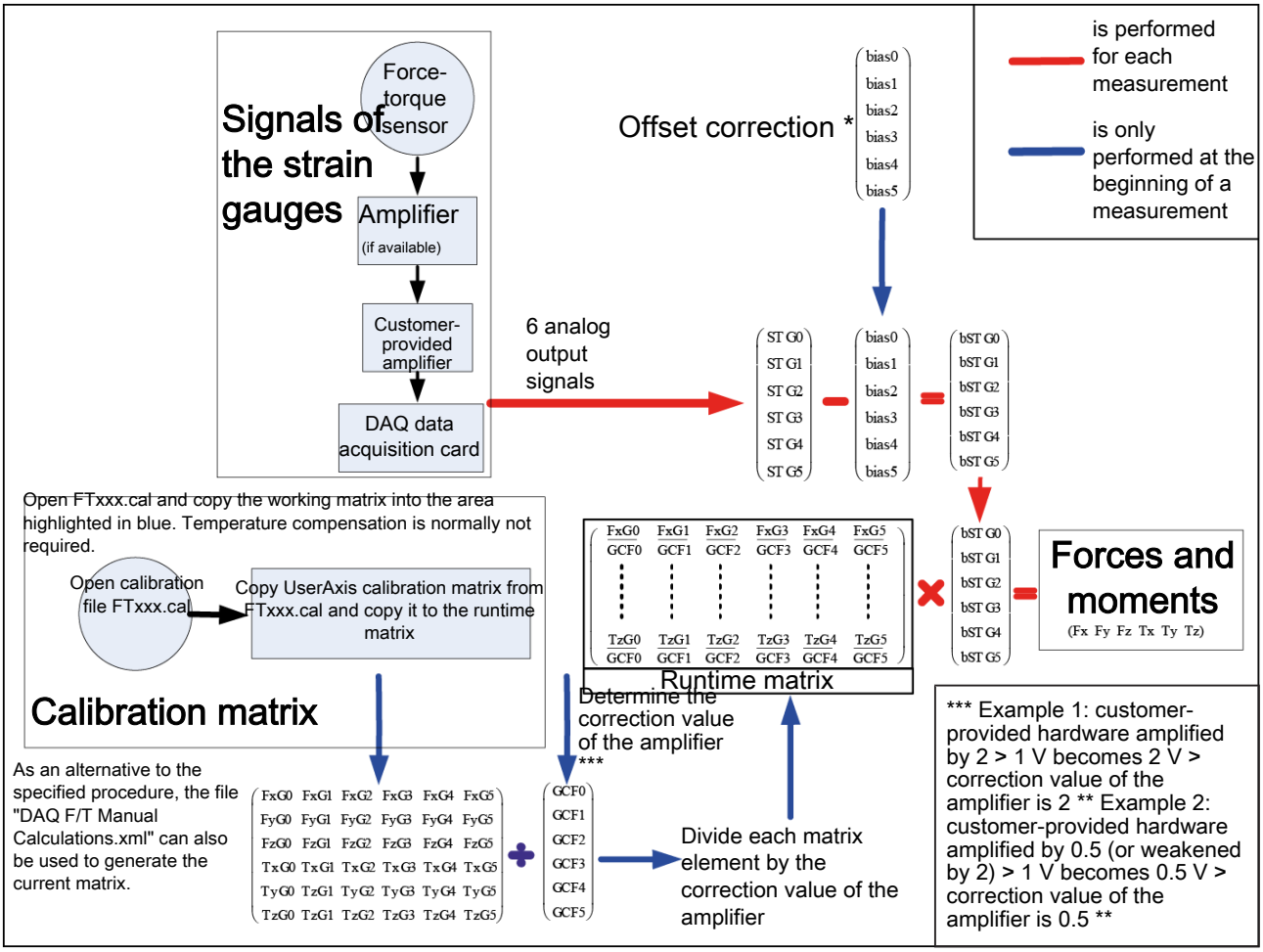
Dimensions and max. loads on the force-torque sensor

Detailed information on the mounting, installation and maintenance of the sensor is provided in the Assembly and Operating Manual for the sensor, ▸ 1.1.2 [🗋 6].

3.3 Calculating the forces and moments



Calculating the forces and moments



Calculating the forces and moments when using an amplifier provided by the customer

*	Offset correction	The offset correction sets the force and moment data to zero in order to avoid falsifications due to external influences. Without offset correction, for example, the weight of the tool would be measured as a force on the sensor. The offset correction sets this measured weight to zero.
**	Correction value of the customer-provided amplifier	The correction value of the customer-provided amplifier is only required if an additional amplifier is used. The factor compensates for the entire calculation.

4 Design and description

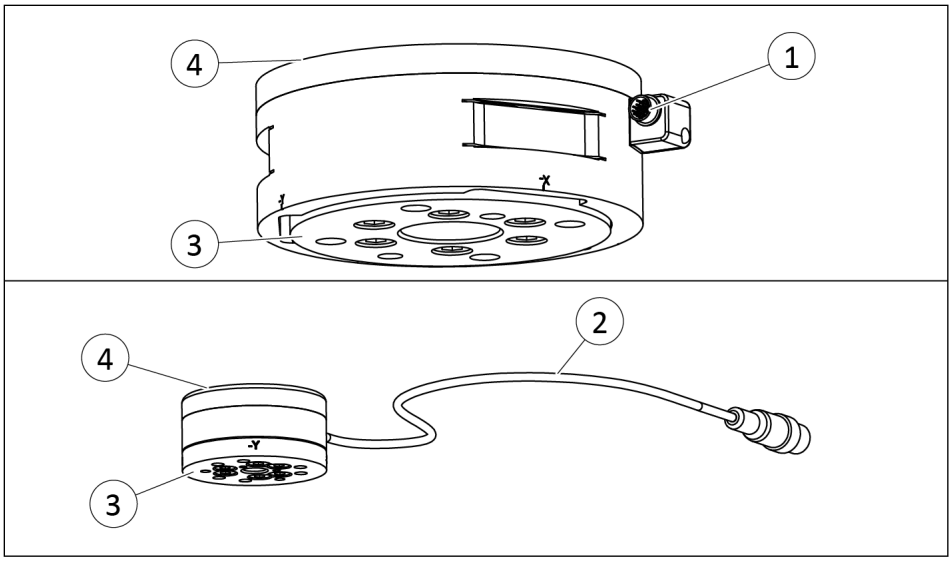
4.1 Design

NOTE

For the sake of clarity, the sizes of the force-torque sensors have been combined into two size groups in some places in this manual:

- FT Nano and FT Mini
- FT Gamma, FT Delta, FT Theta and FT Omega

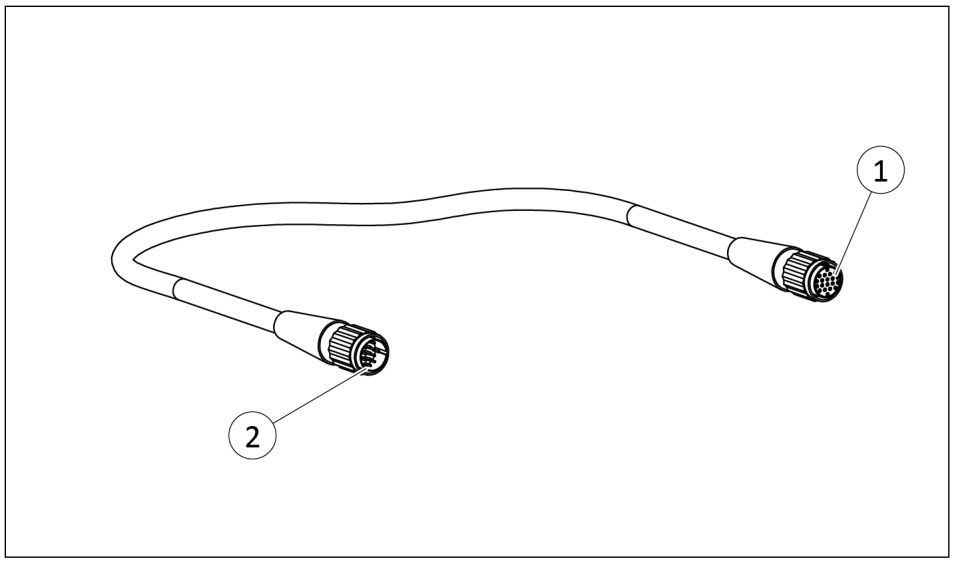
Force-torque sensor



***Top**: Force-torque sensor with interface electronics (from gamma and larger) /*
***Bottom**: Force-torque sensor with sensor cable (Nano and Mini)*

1	Sensor cable connection
2	Integrated sensor cable
3	Tool side adapter plate
4	Robot side adapter plate

Sensor cables



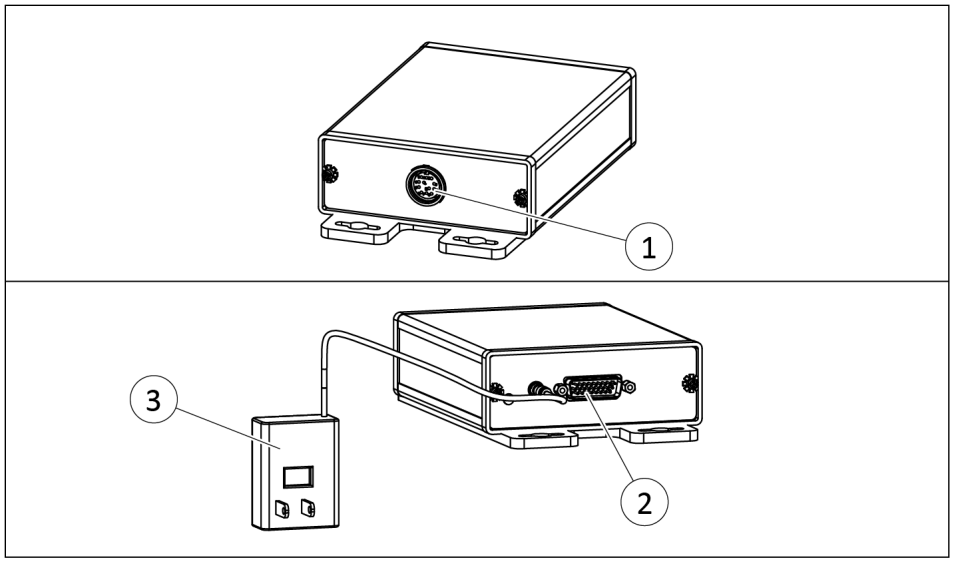
Sensor cables

1	Force/torque sensor connection
2	PS box / IFPS box connection

IFPS box

NOTE

The power supply for the box is either supplied via the 12 V power supply unit provided or via a 5 V power supply through the connected DAQ cable of the customer-provided data acquisition card. Only one power supply is required; if both are connected, the power supply via the 12 V power supply unit is automatically selected.



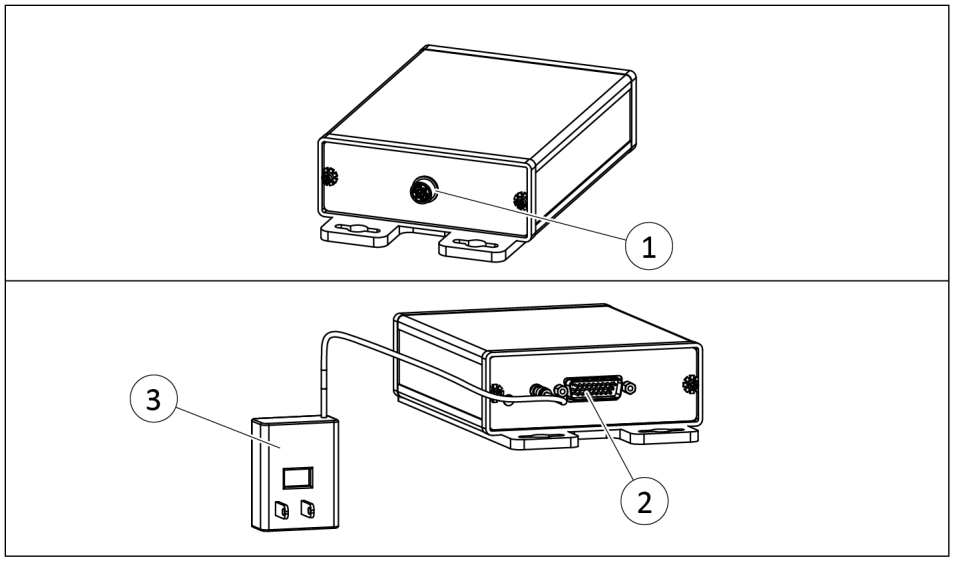
Power supply box for nano / mini force-torque sensors with integrated sensor electronics

1	12-pin socket, sensor cable connection
2	26-pin connector, DAQ cable connection
3	Power supply unit 12 V

PS box

NOTE

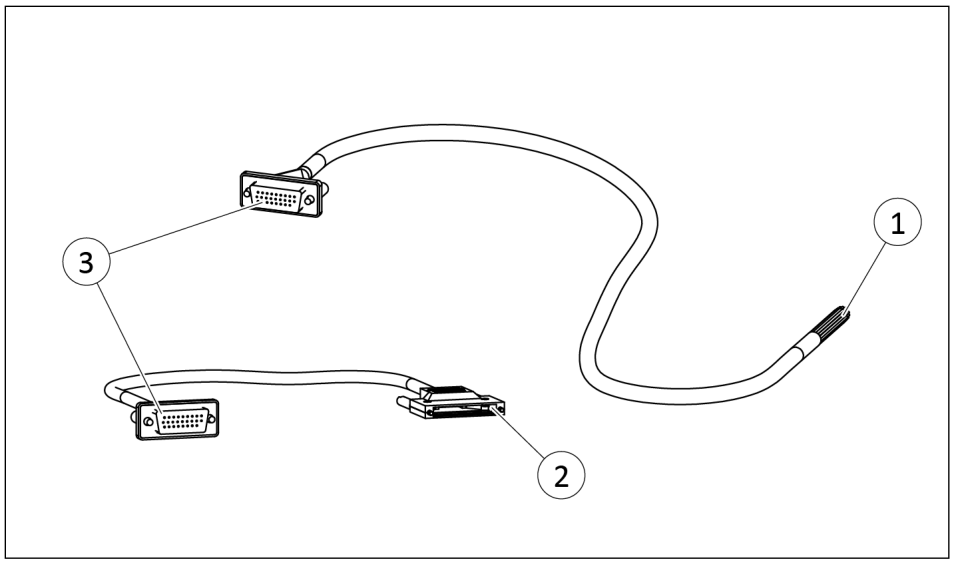
The power supply for the box is either supplied via the 12 V power supply unit provided or via a 5 V power supply through the connected DAQ cable of the customer-provided data acquisition card. Only one power supply is required; if both are connected, the power supply via the 12 V power supply unit is automatically selected.



Power supply box for force-torque sensors starting from gamma and larger

1	20-pin socket, sensor cable connection
2	26-pin connector, DAQ cable connection
3	Power supply unit 12 V

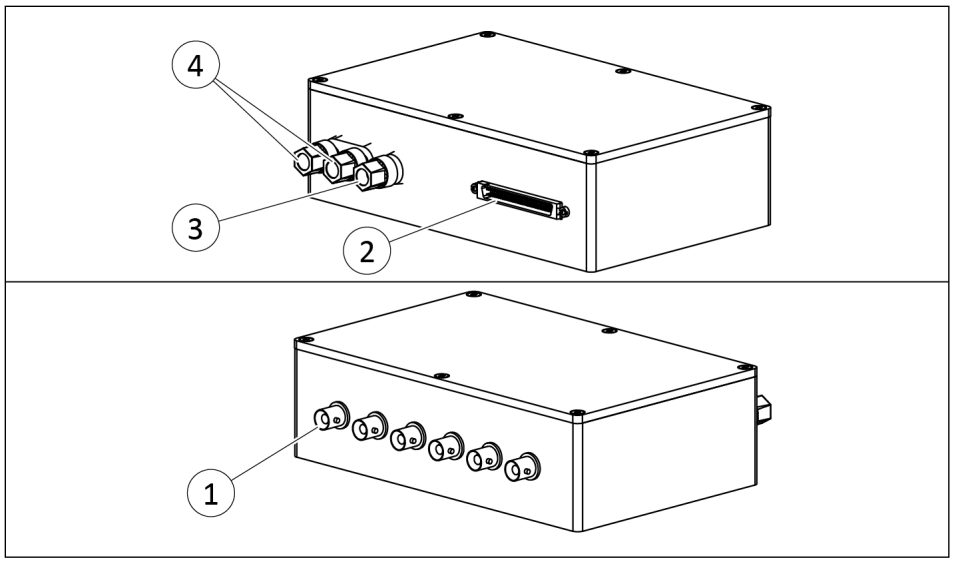
DAQ cable



DAQ cable from PS box / IFPS box to customer-provided data acquisition card

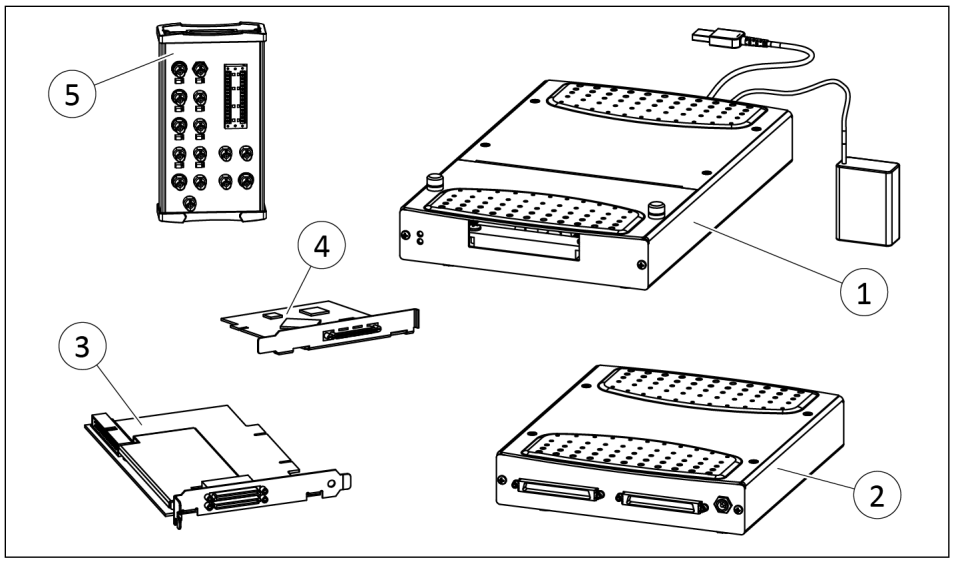
1	Unterminated cable ends
2	68-pin connector (type D) for customer-provided data acquisition card
3	26-pin connector, PS box / IFPS box connection

BNC interface box



1	BNC output connection
2	Connection for sensor signal input
3	Earth
4	Power supply

Data collection



1	USB data acquisition (DAQ) device with screw terminal connections
2	USB data acquisition (DAQ) device
3	PCI DAQ card
4	PCI DAQ card
5	Terminal block with BNC inputs

4.2 Description

The force-torque sensor is connected to the PC by means of a customer-provided data acquisition card. The six analog output signals from the force-torque sensor are converted to digital signals by means of the electronics in the data acquisition card. Afterwards, the software (provided by the customer) uses the calibration matrix to graphically display the occurring forces and torques on the PC if required.

5 Assembly and installation

5.1 Installing and connecting

⚠ DANGER

Danger from electric voltage!

Touching live parts may result in death.

- Switch off the power supply before any assembly, adjustment or maintenance work and secure against being switched on again.
- Only qualified electricians may perform electrical installations.
- Check if de-energized, ground it and hot-wire.
- Cover live parts.

NOTICE

Risk of damage to the electronics!

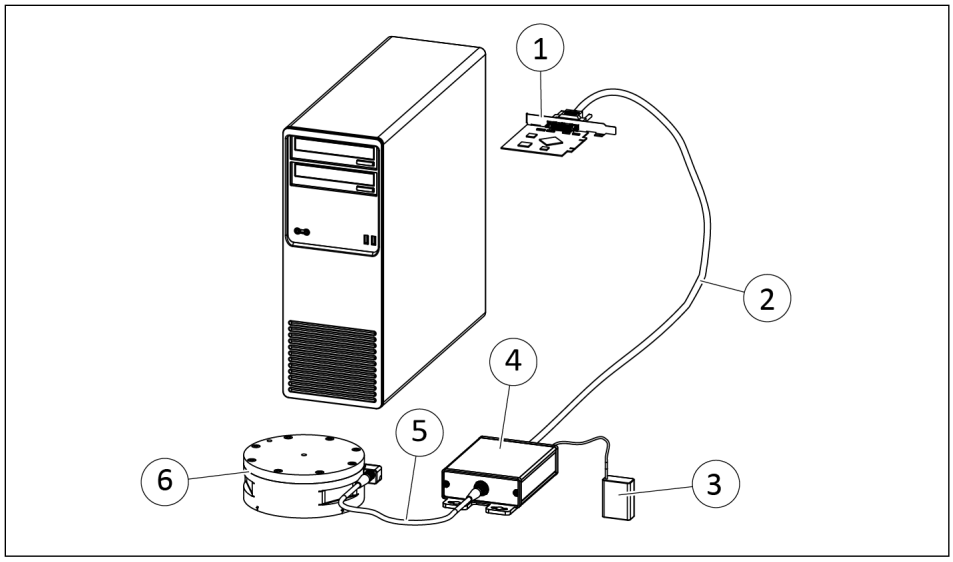
A faulty connection can cause damage to the internal electronics.

- The supply network must be a network of type "PELV" for power and logic.
- Observe the PIN assignment of the connecting terminals.
- Make sure that all components are grounded correctly.

1. Connect components of the force-torque sensor system with each other, ▶ 5.2 [🗋 18].
2. Optional: Install the software, ▶ 5.3 [🗋 31].
3. Check for functionality.
4. Mount the force-torque sensor on the robot, see the installation and operating instructions for the sensor.

5.2 Electrical connection

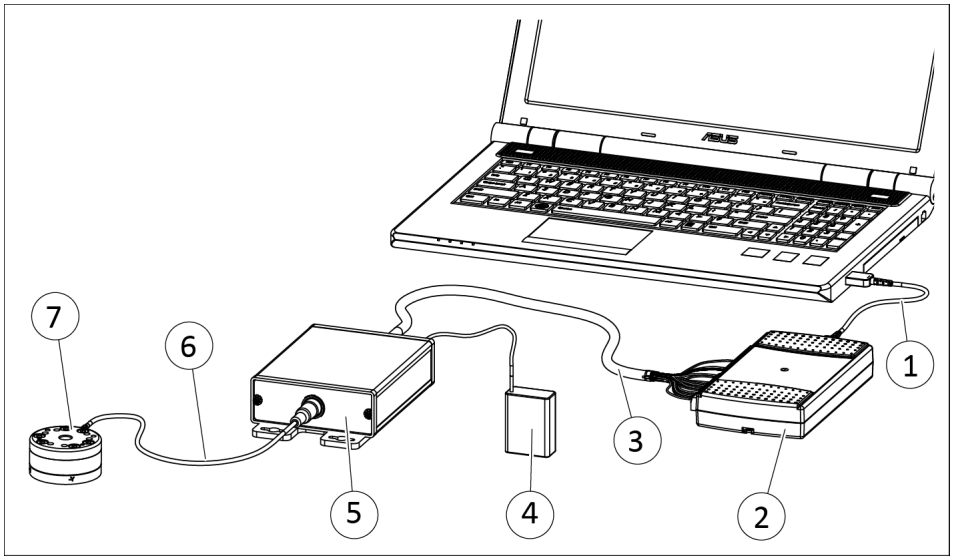
"PCI DAQ card with one force-torque sensor" variant



Connection shown as an example with theta force-torque sensor

1. Connect data acquisition card (1) to PC.
2. Connect DAQ cable (2) to data acquisition card (1).
3. Connect the DAQ cable (2) to the power supply box (4) and tighten the clamping screws on the connector.
4. Connect power supply unit 12 V (3) to power supply box (4).
5. **For FT sensors starting from gamma and larger:** Connect sensor cable (5) to force-torque sensor (6).
6. Connect sensor cable (5) to power supply box (4).
7. Check for functionality.

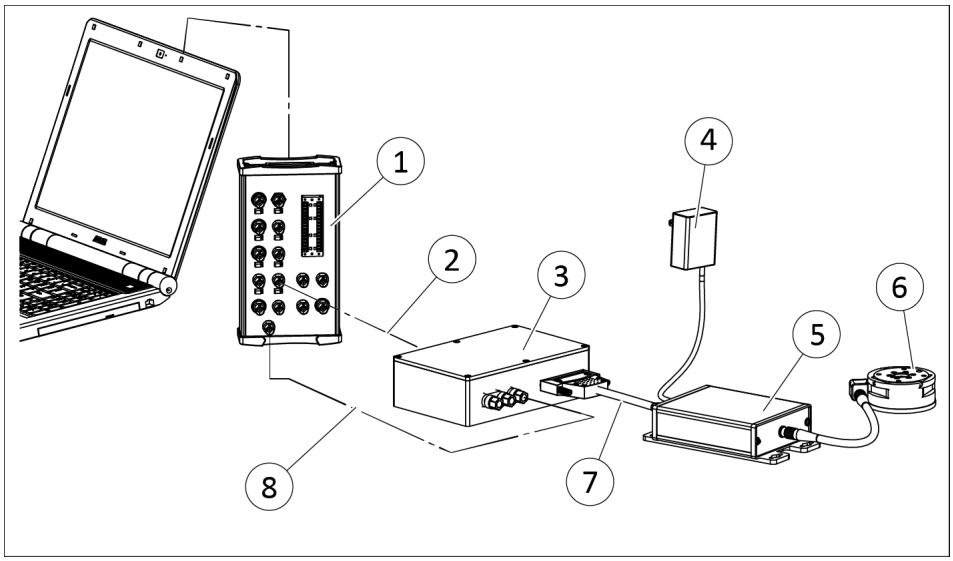
"USB data acquisition (DAQ) device with one force-torque sensor" variant



Connection shown as an example with Mini58 force-torque sensor

1. Connect USB data acquisition (DAQ) device (2) to PC with the USB cable (1).
2. Connect DAQ cable (3) to USB data acquisition (DAQ) device (2).
3. Connect DAQ cable (3) to the power supply box (5) and tighten the clamping screws on the connector.
4. Connect power supply unit 12 V (4) to power supply box (5).
5. **For FT sensors starting from gamma and larger:** Connect sensor cable (5) to force-torque sensor (6).
6. Connect sensor cable (6) to power supply box (5).
7. Check for functionality.

"Terminal block with BNC inputs with one force-torque sensor" variant



Connection shown as an example with gamma force-torque sensor

1. Connect the terminal block with BNC inputs (1) to the PC.
2. Connect the terminal block with BNC inputs (1) to the BNC interface box (3) with the BNC cable (2).
3. Connect the terminal block with BNC inputs (1) to the BNC interface box (3) with the grounding cable (8).
4. Connect the BNC interface box (3) to the power supply box with the BNC interface box cable (7).
5. Connect power supply unit 12 V (4) to power supply box (5).
6. **For FT sensors starting from gamma and larger:** Connect sensor cable (5) to force-torque sensor (6).
7. Connect sensor cable (6) to power supply box (5).
8. Check for functionality.

Connection overview

Pin				ATI signal	Wire strand Cable between PS / IFPS box and data acquisition	Designation NI	
Sensor connection (gamma & larger)		DAQ cable to PS / IFPS box connector	68-pin connector (NI)			32 and 64 pins	64 pins
without IP	with IP						
		2	8	+5 V power	Red	(+5 V)	(+5 V)
		11	13	0 V power	Red / White	(D Gnd)	(D Gnd)
6	1	21		+VANA power			
10	4	22	56	AGnd/ AIGnd	Black	(AIGnd)	(AIGnd)
11	2	23		-VANA power			
1	7	9	68	SG0 output	Brown	(AI 0)	(AI 16)
3	8	18	34	SG0 reference	Brown / White	(AI 8)	(AI 24)
7	9	8	33	SG1 output	Yellow	(AI 1)	(AI 17)
12	10	17	66	SG1 reference	Yellow / White	(AI 9)	(AI 25)
17	11	7	65	SG2 output	Green	(AI 2)	(AI 18)
20	12	16	31	SG2 reference	Green / White	(AI 10)	(AI 26)
8	13	6	30	SG3 output	Blue	(AI 3)	(AI 19)
4	14	15	63	SG3 reference	Blue / White	(AI 11)	(AI 27)
13	15	5	26	SG4 output	Violet	(AI 4)	(AI 20)
18	16	14	61	SG4 reference	Violet / White	(AI 12)	(AI 28)
9	17	4	60	SG5 output	Grey	(AI 5)	(AI 21)
5	8	13	26	SG5 reference	Grey / White	(AI 13)	(AI 29)
14	19	3	25	T out			
19	20	12	58	T ref			
2	5	1	57	reserved			

Pin				ATI signal	Wire strand Cable between PS / IFPS box and data acquisition	Designation NI	
Sensor connection (gamma & larger)		DAQ cable to PS / IFPS box connector	68-pin connector (NI)			32 and 64 pins	64 pins
without IP	with IP						
16	6	10	23	reserved			
15	3	19	52	FTD-C-PS-V68 cable reserved			
			11	FTD-C-PS-NI cable reserved			
Stripping	Stripping	Stripping	Stripping	Shielding	Shielding (twisted pair)	D Gnd	D Gnd

5.2.1 Force-torque sensor

Sensor cable connections

NOTE

The information on force-torque sensor connections only covers force-torque sensors starting from gamma and larger with integrated electronics. Customer-provided connections with force-torque sensors without integrated electronics are not supported and are therefore not considered in this manual.

A force-torque sensor (gamma and larger) without IP protection class fits a Hirose HR25-9TP-20S connector, an IP-protected force-torque sensor (gamma and larger) fits a Lemo FGG3K.320 connector.

Pin		Wire strand	Signal
Sensor without IP	Sensor with IP		
1	7	Brown	SG0 output
2	5	Orange	reserved
3	8	Brown / White	SG0 reference
4	14	Blue / White	SG3 reference
5	18	Grey / White	SG5 reference
6	1	Red	+VANA power input
7	9	Yellow	SG1 output
8	13	Blue	SG3 output
9	17	Grey	SG5 output
10	4	Black	AGnd power input
11	2	Red / White	-VANA power input
12	10	Yellow / White	SG1 reference
13	15	Violet	SG4 output
14	19	White	T out
15	3	Black / White	reserved
16	6	Orange / White	reserved
17	11	Green	SG2 output
18	16	Violet / White	SG4 reference
19	20	White / Black	T ref
20	12	Green / White	SG2 reference
Stripping	Stripping	Shielding	Shield

Electrical specifications and power supply

PS box and IFPS box with connected force-torque sensor

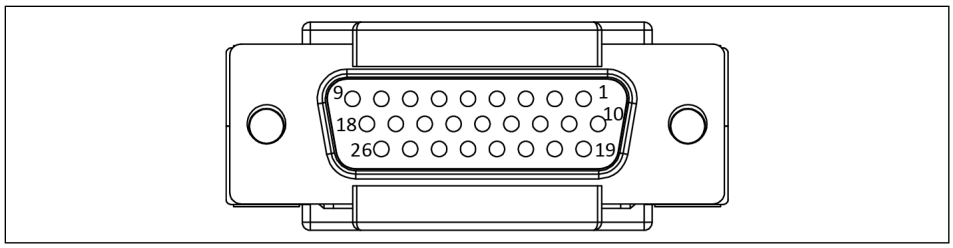
Signal	Minimum	Normal operation	Maximum
+12V external power input supply voltage [VDC]	8	12	15
+5V power input voltage [VDC]	4.65	5	12
+5V power input power [W]		1.6	
+5V power input current @4VDC [mA]		324	
+5V power input current @5VDC [mA]		275	
+5V power input current @12VDC [mA]		140	
+5V power input current @15VDC [mA]		120	
+5V power input noise [mV p-p]			75
+5V power input regulation [%]			0.5

Force-torque sensor with integrated electronics

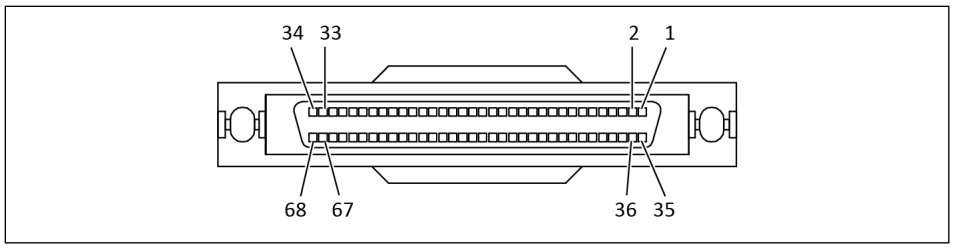
Signal	Minimum	Normal operation	Maximum
$+V_{ANA}$ power input voltage [VDC]	13	15	17
$-V_{ANA}$ power input voltage [VDC]	-17	-15	-13
$+V_{ANA}$ power input current [mA]			50
$-V_{ANA}$ power input current [mA]			-45
V_{ANA} power input noise [mV p-p]			75
V_{ANA} power input regulation [%]			0.5

5.2.2 PS / IFPS box

Connections DAQ cable FTD-C-PS-NI-X



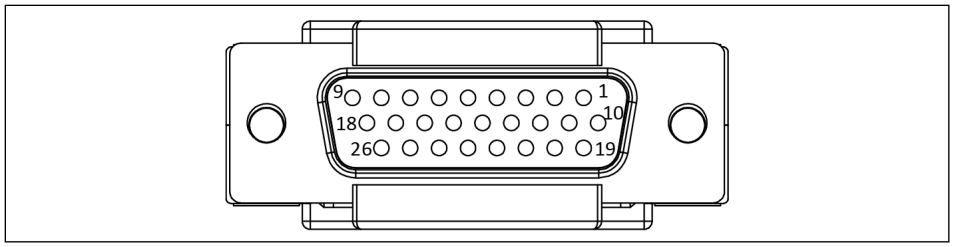
26-pin connector, power supply box connection



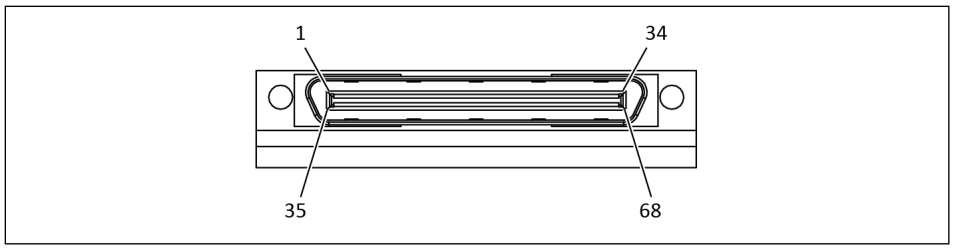
68-pin connector, customer-provided data acquisition card connection

Pin 26-pin connector	Wire strand	Signal	Pin 68-pin connector
1	Orange	Ch7 out	57
2	Red	+5 V power input	8
3	White	T out	25
4	Grey	SG5 output	60
5	Violet	SG4 output	28
6	Blue	SG3 output	30
7	Green	SG2 output	65
8	Yellow	SG1 output	33
9	Brown	SG0 output	68
10	Orange / White	Ch7 ref	23
11	Red / White	DGnd	13
12	White / Black	T ref	58
13	Grey / White	SG5 reference	26
14	Violet / White	SG4 reference	61
15	Blue / White	SG3 reference	63
16	Green / White	SG2 reference	31
17	Yellow / White	SG1 reference	66
18	Brown / White	SG0 reference	34
19	Black / White	DIO0	11
22	Black	AIGnd	56
Stripping	Shielding		Stripping

Connections DAQ cable FTD-C-PS-V68-X



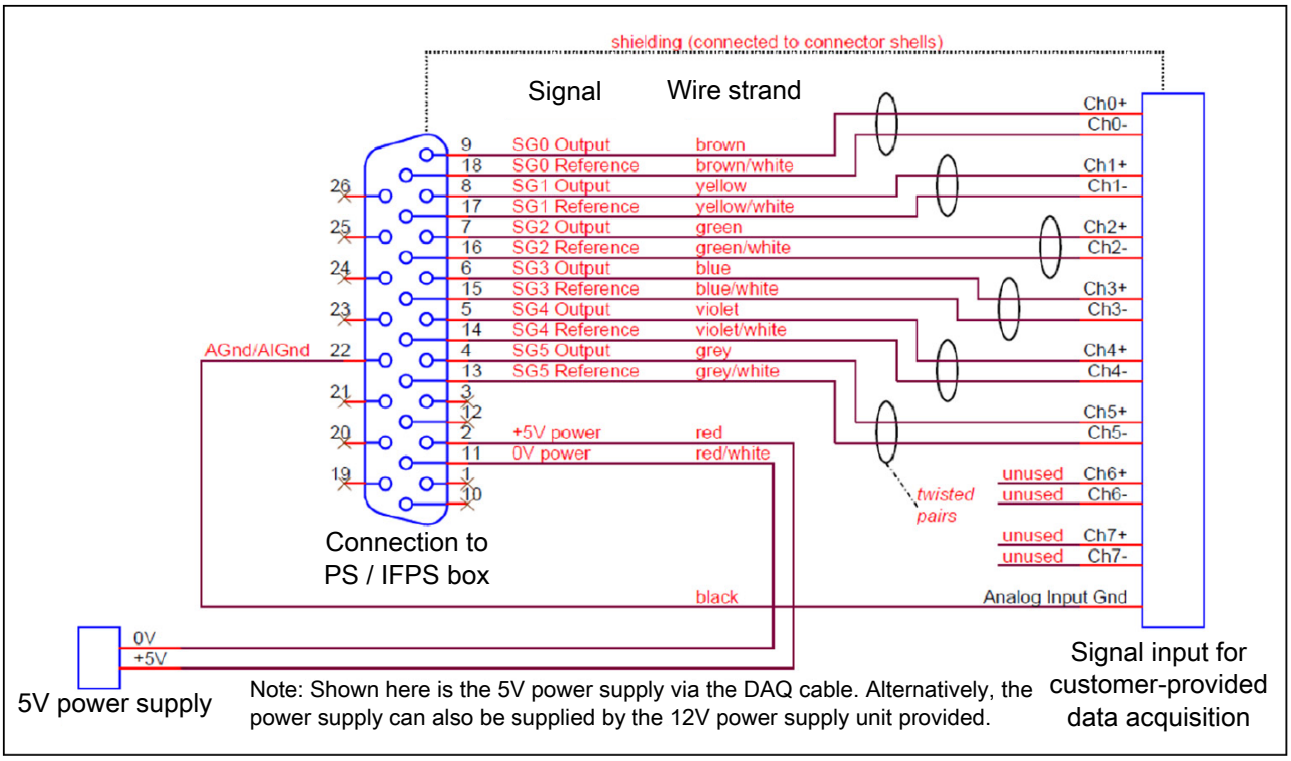
26-pin connector, power supply box connection



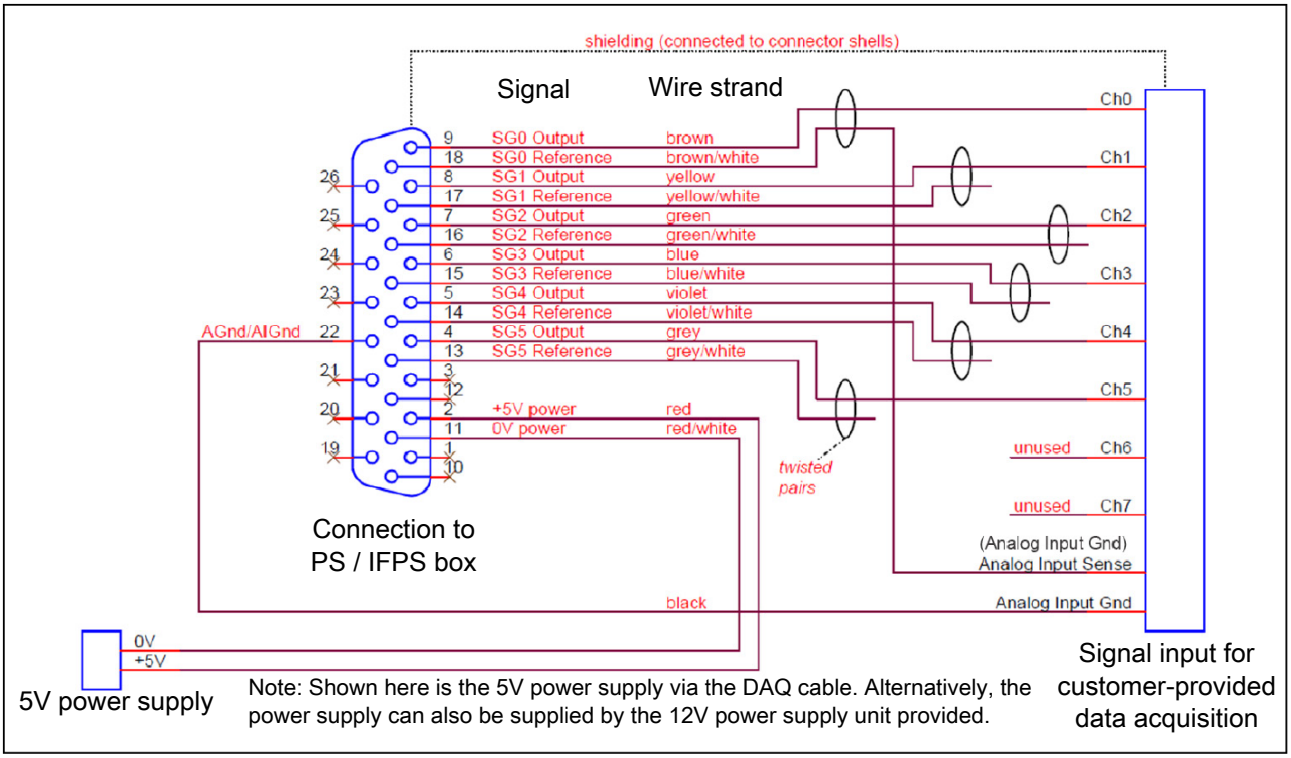
V68 connector, customer-provided data acquisition card connection

Pin 26-pin connector	Wire strand	Signal	Pin V68 connector
1	Orange	Ch7 out	57
2	Red	+5V power input	8, 14
3	White	T out	25
4	Grey	SG5 output	60
5	Violet	SG4 output	28
6	Blue	SG3 output	30
7	Green	SG2 output	65
8	Yellow	SG1 output	33
9	Brown	SG0 output	68
10	Orange / White	Ch7 ref	23
11	Red / White	DGnd	13, 12
12	White / Black	T ref	58
13	Grey / White	SG5 reference	26
14	Violet / White	SG4 reference	61
15	Blue / White	SG3 reference	63
16	Green / White	SG2 reference	31
17	Yellow / White	SG1 reference	66
18	Brown / White	SG0 reference	34
19	Black / White	DIO0	52
22	Black	AIGnd	56
Stripping	Shielding		Stripping

Connections DAQ cable with open wire strands (FTD-C-PS-U-X)



Can be connected to customer-provided data acquisition card (differential)



Can be connected to customer-provided data acquisition card (single-ended)

Pin	Wire strand	Signal	Slot	Pin	Wire strand	Signal	Slot
1	n.c.	No connection	PFI 0/ P0.0 (In)	33	n.c.	No connection	PFI 8/ P0.4 (In)
2	n.c.	No connection	PFI 1/ P0.1 (In)	34	n.c.	No connection	PFI 9/ P0.5 (In)
3	n.c.	No connection	PFI 2/ P0.2 (In)	35	n.c.	No connection	PFI 10/ P0.6 (In)
4	n.c.	No connection	PFI 3/ P0.3 (In)	36	n.c.	No connection	PFI 11/ P0.7 (In)
5	n.c.	No connection	D GND	37	n.c.	No connection	D GND
6	n.c.	No connection	PFI 4/ P1.0 (Out)	38	n.c.	No connection	PFI 12/ P1.4 (Out)
7	n.c.	No connection	PFI 5/ P1.1 (Out)	39	n.c.	No connection	PFI 13/ P1.5 (Out)
8	n.c.	No connection	PFI 6/ P1.2 (Out)	40	n.c.	No connection	PFI 14/ P1.6 (Out)
9	n.c.	No connection	PFI 7/ P1.3 (Out)	41	n.c.	No connection	PFI 15/ P1.7 (Out)
10	n.c.	No connection	+5 V	42	n.c.	No connection	+5 V
11	Twisted shielding	Shielding	D GND	43	Twisted shielding	Shielding	D GND
12	n.c.	No connection	NC oder AO 0	44	n.c.	No connection	NC
13	n.c.	No connection	NC or AO1	45	n.c.	No connection	NC
14	n.c.	No connection	Reser or AO GND	46	n.c.	No connection	AI GND
15	Brown	SG0 output	AI 0	47	Brown	SG0 output	AI 16
16	Brown / White	SG0 reference	AI 8	48	Brown / White	SG0 reference	AI 24
17	Yellow	SG1 output	AI 1	49	Yellow	SG1 output	AI 17
18	Yellow / White	SG1 reference	AI 9	50	Yellow / White	SG1 reference	AI 25
19	Green	SG2 output	AI 2	51	Green	SG2 output	AI 18
20	Green / White	SG2 reference	AI 10	52	Green / White	SG2 reference	AI 26
21	Blue	SG3 output	AI 3	53	Blue	SG3 output	AI 19
22	Blue / White	SG3 reference	AI 11	54	Blue / White	SG3 reference	AI 27
23	n.c.	No connection	AI SENSE	55	n.c.	No connection	AI GND
24	Violet	SG4 output	AI 4	56	Violet	SG4 output	AI 20
25	Violet / White	SG4 reference	AI 12	57	Violet / White	SG4 reference	AI 28

Pin	Wire strand	Signal	Slot	Pin	Wire strand	Signal	Slot
26	Grey	SG5 output	AI 5	58	Grey	SG5 output	AI 21
27	Grey / White	SG5 reference	AI 13	59	Grey / White	SG5 reference	AI 29
28	Black	AGnd power input	AI GND	60	Black	AI GND	AI GND
29	n.c.	No connection	AI 6	61	n.c.	No connection	AI 22
30	n.c.	No connection	AI 14	62	n.c.	No connection	AI 30
31	n.c.	No connection	AI 7	63	n.c.	No connection	AI 23
32	n.c.	No connection	AI 15	64	n.c.	No connection	AI 31

5.3 Installing the software

Preparing the installation

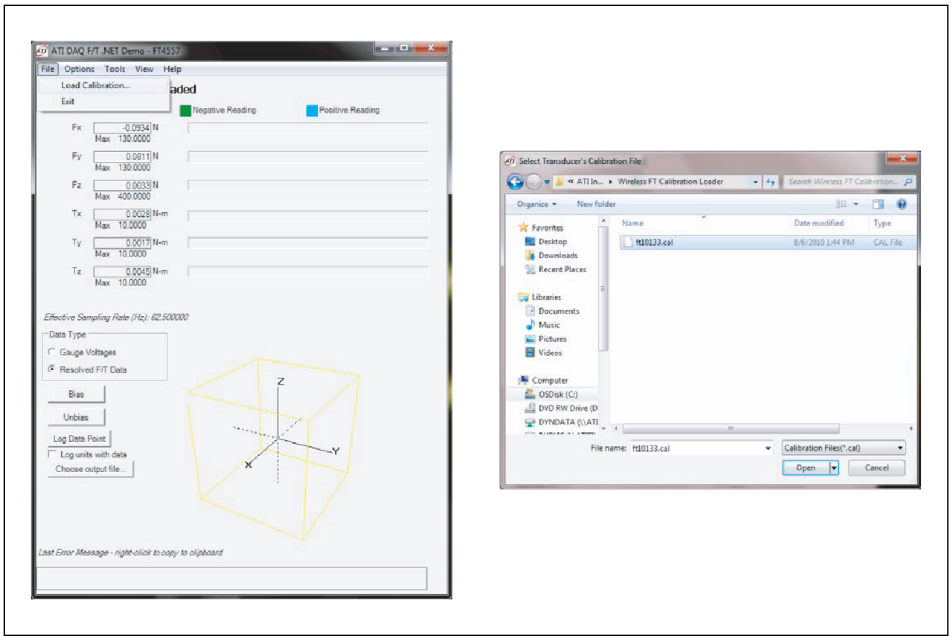
1. **If required**: Download demo software from https://www.ati-ia.com/Products/ft/software/ daq_software.aspx, open the Setup.exe file and follow the installation instructions of the program.
2. Insert CD included in the scope of delivery into the PC.
3. Unpack the ZIP file "FTxxxx.zip".
   ✓ The unzipped files are named after the force-torque sensor designations in FTxxxx.cal format. For the installation, only the file that is named after the force-torque sensor used is required.
4. Copy the file and store it in the program directory "ATI DAQ FT". If several calibrations have been ordered, several files can be copied.

Start demo program

NOTE

The demo program can only be used in conjunction with National Instruments devices.

1. Open the demo program under Programs > ATI DAQ FT > ATI DAQ FT Demo.
   ✓ The program is started.



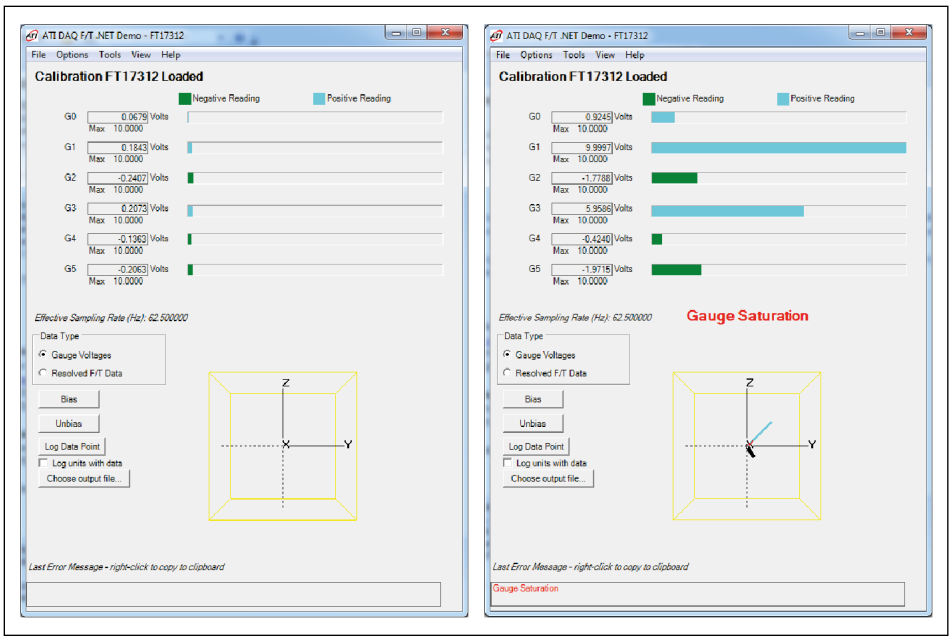
2. In the navigation, click on File > Load Calibration and open the unzipped FTxxxx.cal file.
   ✓ Bar graphs for the measured forces and the measured torques are displayed.

3. Load force-torque sensor carefully. **IMPORTANT! Risk of damage to the sensor! Load the sensor carefully, otherwise irreparable damage may occur.**

   ✓ The bar graphs move according to the load on the sensor.

4. Mount the sensor on the robot or other product. The Assembly and Operating Manual for the sensor contains further information, ▸ 1.1.2 [🗋 6].

5. During sensor installation, use the bar graphs to check that the sensor is not overloaded.



Left: Load within the range of measurement, right: Load outside the permissible range of measurement

6. When the sensor has been successfully mounted, select "Resolved F/T Data" in the "Data Type" box.

✓ The force-torque sensor system is ready for use.

6 Operation

The DAQ software converts the signals of the strain gauges in the FT sensor into force and torque values. With the help of an application, the values can be viewed and edited.

The ATI DAQ F/T software includes software components that can be used to create an application. In addition, the software includes demo programs that make the installation of the force-torque sensor easier.

6.1 Available software interfaces and demo programs

Available software interfaces

The software interfaces "ATI DAQ FT Automation Server" and "C-Library" read out the calibration files, configure the sensor system and convert raw voltages from any data acquisition system into forces and moments.

- ATI DAQ FT: ATI DAQ FT is an ActiveX DLL with reusable code components. To use ATI DAQ FT, the user must read the voltages from the DAQ device and forward these voltages to ATI DAQ FT to calculate the forces and moments. ATI DAQ FT can be used on Windows in a programming environment that supports ActiveX or Automated Containment - i.e. Microsoft Visual Basic 6.0, Microsoft Visual C++, Microsoft NET Platform and National Instruments LabVIEW. For users who do not use NI-DAQ instruments, ATI DAQ FT provides a hardware-independent math library. The ATI DAQ F/T software help file contains further information, ▸ 1.1.2 [🗋 6].
- C library: Reusable components in the C programming language to convert the voltages that have been read into forces and moments. The library uses standard ANSI C and mainly supports non-Windows operating systems.

Demo programs

The demo programs display the forces and moments transmitted by National Instrument devices in real time.

- Windows Demo (Visual Basic 6.0): This demo program offers the possibility of testing the sensor system in the Windows environment. It uses National Instruments software and ATI DAQ F/T software. The program can configure the sensor system and includes a Microsoft Visual Basic 6.0 source.
- LabVIEW Sample: This demo program in LabVIEW uses the ATI DAQ FT automation application and analog input provided by National Instrument devices to represent forces and moments.

6.2 Manual calculations

If no special software is required for the calculation of forces and moments, the values can also be calculated manually using simple matrix multiplication. A prerequisite for this is that the raw data can be read out manually from the DAQ device. The raw data is then the basis for the manual matrix multiplication.

6.3 Creating your own application

As an alternative to the predefined software interfaces, the DAQ-F/T application can also be created manually to convert the signals of the strain gauges in the sensor into force and torque values. Two components are necessary for this:

- Device drivers for the DAQ instrument and target operating system: National Instruments offers a variety of drivers for Windows, including 32-bit DLLs, LabVIEW VIs, and ActiveX controls, for use with your devices. Drivers for other operating systems in combination with National Instruments devices are available from third-party vendors. If other DAQ devices are used, either the device vendors will provide the necessary drivers or the drivers also have to be obtained from third party vendors.
- ATI DAQ FT components or C library: For Windows, SCHUNK recommends the ATI DAQ FT. In some cases ATI DAQ FT cannot be used, e.g. if ActiveX is not supported. In these cases, ATI DAQ FT can assist in the installation of the sensor, but does not have to be part of the final application.

The ATI DAQ F/T software help file contains further information, ▶ 1.1.2 [🗋 6].

7 Troubleshooting

7.1 Saturation

Possible cause	Corrective action
Force-torque sensor or data acquisition hardware is subject to a load or signal that is outside the range of measurement	Pause force application on force-torque sensor until the error disappears. If the error does not disappear, the overload value was exceeded or the power supply was disconnected.

7.2 Signal noise

Possible cause	Corrective action
Signal noise is caused by mechanical vibrations or electrical interference.	Ensure that the system is properly grounded and isolated from external electrical interference.
A component in the system has failed.	

7.3 Measurement data deviation / drift

Possible cause	Corrective action
Measured values are not completely reset after loading and unloading.	Drift is caused, for example, by rapid temperature changes. Have the force-torque sensor adjusted to the ambient temperature before measuring again. Operate all components separately. Thoroughly clean the sensor body and adapter plate of contamination.
There is an internal error in the entire system.	

7.4 Hysteresis

Possible cause	Corrective action
Measured values are not completely reset after loading and unloading.	Operate all components separately. Thoroughly clean the sensor body and adapter plate of contamination.

8 Maintenance

NOTICE

Material damage due to improper disassembly!

Incorrect works can cause damage to the mechanics and internal electronics.

- Disassembly or opening of the product is not permitted.
- Only allow SCHUNK to repair the product.

This product must not be disassembled for maintenance.

Maintenance intervals

Maintenance interval	Maintenance work
weekly	Check all parts for damage and wear.
annual	Send sensor and power supply box to SCHUNK for calibration.
as required	Send damaged products to SCHUNK for repair.

9 EU Declaration of Conformity

Manufacturer/ Distributor	SCHUNK GmbH & Co. KG Clamping and gripping technology Bahnhofstr. 106 - 134 D-74348 Lauffen/Neckar

We hereby declare on our sole authority that the product meets the requirements of the following directives at the time of the declaration.
The declaration is rendered invalid if modifications are made to the product.

Product designation:	Force-torque sensor system FTD This declaration of conformity is valid for all variants mentioned in the appendix.

- **Electromagnetic compatibility (EMC directive) 2014/30/EU**

Applied harmonized standards, especially:

EN 61326-2-3:2013	Electrical equipment for measurement, control and laboratory use - EMC requirements – Part 2-3: Particular requirements – Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning. (IEC 61326-2-3:2012)
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

All related technical documentation has been prepared in electronic form according to Directive 2014/30/EU and will be made available to national authorities on demand. The signatory is resident at the manufacturer's address and is authorized to compile this documentation.

Signed for and on behalf of: SCHUNK GmbH & Co. KG

Lauffen/Neckar, November 2022

Signature: see original declaration

Dr.-Ing. Manuel Baumeister,
Technology & Innovation

10 UKCA Declaration of Conformity

Manufacturer/ Distributor	SCHUNK Intec Limited Clamping and gripping technology 3 Drakes Mews, Crownhill MK8 0ER Milton Keynes

We hereby declare on our sole authority that the product meets the requirements of the following directives at the time of the declaration.
The declaration is rendered invalid if modifications are made to the product.

Product designation:	Force-torque sensor system FTD
ID number	

- **Electromagnetic Compatibility Regulations 2016**

Applied harmonized standards, especially:

EN 61326-2-3:2013	Electrical equipment for measurement, control and laboratory use - EMC requirements – Part 2-3: Particular requirements – Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning. (IEC 61326-2-3:2012)
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

Person authorized to compile the technical documentation:
Marcel Machado, address: refer to manufacturer's address

Signed for and on behalf of: SCHUNK GmbH & Co. KG

Lauffen/Neckar, November 2022

Dr.-Ing. Manuel Baumeister,
Technology & Innovation

11 Appendix to the declaration of conformity

This declaration of conformity is valid for all variants of the force/ torque sensor mentioned in this appendix.

FTD-interface

FTD-Nano-17 SI-12-0.12
FTD-Nano-17 SI-25-0.25
FTD-Nano-17 SI-50-0.5
FTD-Nano-17-T SI-8-0.05
FTD-Nano-17-T SI-16-0.1
FTD-Nano-17-T SI-32-0.2
FTD-Nano-25 SI-125-3
FTD-Nano-25 SI-250-6
FTD-Nano-43 SI-9-0.125
FTD-Nano-43 SI-18-0.25
FTD-Nano-43 SI-36-0.5
FTD-Mini-40 SI-20-1
FTD-Mini-40 SI-40-2
FTD-Mini-40 SI-80-4
FTD-Mini 43 SI-62-0.75
FTD-Mini 43 SI-125-1.5
FTD-Mini 43 SI-250-3
FTD-Mini-45 SI-145-5
FTD-Mini-45 SI-290-10
FTD-Mini-45 SI-580-20
FTD-Mini-58 SI-700-30
FTD-Mini-58 SI-1400-60
FTD-Mini-58 SI-2800-120
FTD-Mini-85 SI-475-20
FTD-Mini-85 SI-950-40
FTD-Mini-85 SI-1900-80
FTD-Gamma SI-32-2.5
FTD-Gamma SI-65-5
FTD-Gamma SI-130-10
FTD-Delta SI-165-15
FTD-Delta SI-330-30
FTD-Delta SI-660-60
FTD-Theta SI-1000-120
FTD-Theta SI-1500-240
FTD-Theta SI-2500-400
FTD-Omega85 SI-475-20

FTD-Omega85 SI-950-40
FTD-Omega85 SI-1900-80
FTD-Omega-160 SI-1000-120
FTD-Omega-160 SI-1500-240
FTD-Omega-160 SI-2500-400
FTD-Omega-191 SI-1800-350
FTD-Omega-191 SI-3600-700
FTD-Omega-191 SI-7200-1400
FTD-Omega-250 SI 4000 500
FTD-Omega-250 SI 8000 1000
FTD-Omega-250 SI-16000-2000
FTD-Omega-331 SI-10000-1500
FTD-Omega-331 SI-20000-3000
FTD-Omega-331 SI-40000-6000

FTN-interface

FTN-Nano-17 SI-12-0.12
FTN-Nano-17 SI-25-0.25
FTN-Nano-17 SI-50-0.5
FTN-Nano-17-T SI-8-0.05
FTN-Nano-17-T SI-16-0.1
FTN-Nano-17-T SI-32-0.2
FTN-Nano-25 SI-125-3
FTN-Nano-25 SI-250-6
FTN-Nano-43 SI-9-0.125
FTN-Nano-43 SI-18-0.25
FTN-Nano-43 SI-36-0.5
FTN-Mini-40 SI-20-1
FTN-Mini-40 SI-40-2
FTN-Mini-40 SI-80-4
FTN-Mini 43 SI-62-0.75
FTN-Mini 43 SI-125-1.5
FTN-Mini 43 SI-250-3
FTN-Mini-45 SI-145-5
FTN-Mini-45 SI-290-10
FTN-Mini-45 SI-580-20
FTN-Mini-58 SI-700-30
FTN-Mini-58 SI-1400-60
FTN-Mini-58 SI-2800-120
FTN-Mini-85 SI-475-20
FTN-Mini-85 SI-950-40

FTN-Mini-85 SI-1900-80
FTN-Gamma SI-32-2.5
FTN-Gamma SI-65-5
FTN-Gamma SI-130-10
FTN-Delta SI-165-15
FTN-Delta SI-330-30
FTN-Delta SI-660-60
FTN-Theta SI-1000-120
FTN-Theta SI-1500-240
FTN-Theta SI-2500-400
FTN-Omega85 SI-475-20
FTN-Omega85 SI-950-40
FTN-Omega85 SI-1900-80
FTN-Omega 160 SI 1000 120
FTN-Omega-160 SI-1500-240
FTN-Omega 160 SI 2500 400
FTN-Omega-191 SI-1800-350
FTN-Omega-191 SI-3600-700
FTN-Omega-191 SI-7200-1400
FTN-Omega-250 SI-4000-500
FTN-Omega 250 SI-8000-1000
FTN-Omega 250 SI 16000 2000
FTN-Omega-331 SI-10000-1500
FTN-Omega-331 SI-20000-3000
FTN-Omega 331 SI-40000-6000

FTE-interface

FTE-Nano-17 SI-12-0.12
FTE-Nano-17 SI-25-0.25
FTE-Nano-17 SI-50-0.5
FTE-Nano-17-T SI-8-0.05
FTE-Nano-17-T SI-16-0.1
FTE-Nano-17-T SI-32-0.2
FTE-Nano-25 SI-125-3
FTE-Nano-25 SI-250-6
FTE-Nano-43 SI-9-0.125
FTE-Nano-43 SI-18-0.25
FTE-Nano-43 SI-36-0.5
FTE-Mini-40 SI-20-1
FTE-Mini-40 SI-40-2
FTE-Mini-40 SI-80-4

FTE-Mini 43 SI-62-0.75
FTE-Mini 43 SI-125-1.5
FTE-Mini 43 SI-250-3
FTE-Mini-45 SI-145-5
FTE-Mini-45 SI-290-10
FTE-Mini-45 SI-580-20
FTE-Mini-58 SI-700-30
FTE-Mini-58 SI-1400-60
FTE-Mini-58 SI-2800-120
FTE-Mini-85 SI-475-20
FTE-Mini-85 SI-950-40
FTE-Mini-85 SI-1900-80
FTE-Gamma IP65 SI-32-2.5
FTE-Gamma IP65 SI-65-5
FTE-Gamma-IP65 SI-130-10
FTE-Delta-IP60 SI-165-15
FTE-Delta-IP65 SI-165-15
FTE-Delta-IP60 SI-330-30
FTE-Delta-IP65 SI-330-30
FTE-Delta-IP60 SI-660-60
FTE-Delta IP65 SI-660-60
FTE-Omega 160-IP60 SI 1000-120
FTE-Omega 160-IP65 SI 1000-120
FTE-Omega 160-IP60 SI 1500-240
FTE-Omega 160-IP65 SI 1500-240
FTE-Omega 160-IP60 SI 2500-400
FTE-Omega 160-IP65 SI 2500-400
FTE-Omega 250 IP60 SI 4000 500
FTE-Omega 250-IP60 SI-8000-1000
FTE-Omega 250-IP60 SI-16000-2000

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