



Detailed Certificate of Calibration

Equipment Calibrated	NIST Traceability Information
Description: Six-Axis Force/Torque Sensor	NVLAP Lab Code: 200495-0
Manufacturer: ATI Industrial Automation	Cal Standard: REF – 1000
Serial Number: FT38188	Cal Standard: REF – 1001
Model: Mini45	Cal Standard: REF – 1183
Calibration: SI-580-20	Cal Standard: REF – 1119
Electronics: Net F/T	
Gain Multiplier: 100%	

Equipment Condition and Notes: Factory new.

Calibration Results: Passed

Offset: Normal

Gain: Normal

Calibrated Ranges (\pm):

Fx	Fy	Fz	Tx	Ty	Tz
580 N	580 N	1160 N	20 N-m	20 N-m	20 N-m

Measurement Uncertainty (95% confidence level, percent of full-scale load):

Fx	Fy	Fz	Tx	Ty	Tz
1.75%	1.25%	1.00%	1.25%	1.75%	1.00%

The above Measurement Uncertainty values are the maximum amount of error for each axis expressed as a percentage of its full-scale load.

Calibration Temperature: $22.2^{\circ}\pm 1.1^{\circ}$ C ($72^{\circ}\pm 2^{\circ}$ F)

Temperature Compensation: hardware

Calibration Method: WI-FTP-105, Net FT Calibration Instructions

Date of Calibration: 07 Dec 2021

Certificate Date: 07 Dec 2021

Calibrated by: Josh Barron, Calibration Technician

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Quality Statement

As part of our commitment to quality, each ATI force/torque transducer undergoes rigorous accuracy testing. This process, which involves applying and verifying a rich set of loading cases designed to cover the transducer's entire six-axis calibrated range, is designed to ensure that your transducer meets the measurement uncertainties listed in this Certificate of Calibration.

Our transducers often exceed our rigorous quality standards for accuracy. To ensure that the published transducer measurement uncertainties listed on page 1 are met, uncertainty targets used during the calibration process are more conservative than the published values. Often, transducers perform exceptionally well in certain loading situations. This report summarizes the performance of your ATI F/T transducer in our factory tests. It can be thought of as a 'best-case scenario' snapshot of your transducer's performance under laboratory conditions, in a variety of loading situations. You can expect the accuracy of your transducer measurements to fall somewhere between its performance during testing and the measurement uncertainties listed on its calibration certificate.

Certificate of Calibration

This calibration is traceable to the National Institute of Standards and Technology (NIST). ATI Industrial Automation (ATI) certifies that the listed product was calibrated in accordance with applicable ATI procedures. These procedures are compliant with the ISO 9001 standard to ensure that the listed product is within ATI's quality specifications. To meet this level of accuracy any loads must be correctly aligned to the transducer origin and the transducer must be robustly mounted to a surface of sufficient material strength and rigidity.

Note: If this is a recalibration of a legacy transducer that does not have precision locating features (such as dowel holes), users may experience additional error in measurements due to inexact mounting location. Precision locating features are highly recommended for best accuracy and can be added by ATI upon request.

The *Calibration Accuracy Section* contains several tables of data. The *Calibrated Ranges* (\pm) table lists the transducer's rated range for each axis. The *Applied Loads* table lists the loads applied during calibration and testing. The *Full-Scale Error* table shows the sensor system's measurement error as a percentage of full scale for each axis in each loading case. The *Offset Report* table, if included, shows transducer readings during offset adjustment and associated control limits. The *Gain-Check Report* table, if included, shows verification of the transducer's sensitivity and associated control limits. If included, the *Before and After Report* table shows a loading case relating the transducer's performance as received to its performance after recalibration.

For best accuracy, be sure to use your transducer's precision location features, and mount your transducer to a stiff surface. If an ongoing guarantee of sensor accuracy is important to you, we recommend that your sensor be tested annually. Contact your ATI Industrial Automation distributor to schedule recalibrations.

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Compliance Information - ISO 9001, A2LA, ANSI Z540, and ISO 17025

ATI Industrial Automation Inc. is an ISO 9001:2015 certified company. ATI's manufacturing facilities are not certified under A2LA, ANSI Z540, or ISO 17025, but our applicable processes are in compliance with these standards. As the designer and Original Equipment Manufacturer (OEM) of our Force/Torque Sensor products, we use validated, product-specific, proprietary manufacturing processes (including software), which no other facilities are capable of replicating. As the OEM of our Force/Torque Sensor products, ATI is not required to be A2LA, ANSI Z540, or ISO 17025 certified under the scope of our manufacturing operations. Parties interested in maintaining compliance with A2LA, ANSI Z540, or ISO 17025 standards as it pertains to their organization will find that our Force/Torque Sensor products meet several common exemption criteria specified in the aforementioned standards. In addition, 100% of our Force/Torque Sensor products are subjected to a testing and calibration sequence, specific to each sensor type, prior to shipping. When a part is returned as part of regularly scheduled maintenance (calibration) or a quality related-issue, it is re-processed through the same OEM testing and calibration sequence. All testing and calibration equipment used in our facilities are maintained in accordance with internal ISO 9001 compliant procedures and are traceable to NIST.

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Calibration Accuracy Section
Sensor System FT38188, Mini45/SI-580-20

Force units: N; Torque units: N-m

Calibrated Ranges (±)					
Fx	Fy	Fz	Tx	Ty	Tz
580	580	1160	20	20	20

	Applied Loads					
	Fx	Fy	Fz	Tx	Ty	Tz
1	0.000	164.584	0.000	-16.702	0.000	0.000
2	-164.584	0.000	0.000	0.000	-16.702	0.000
3	0.000	-164.584	0.000	16.702	0.000	0.000
4	164.584	0.000	0.000	0.000	16.702	0.000
5	0.000	467.063	0.000	-14.178	0.000	0.000
6	-467.063	0.000	0.000	0.000	-14.178	0.000
7	0.000	-467.063	0.000	14.178	0.000	0.000
8	467.063	0.000	0.000	0.000	14.178	0.000
9	0.000	155.688	0.000	-1.186	0.000	-17.875
10	0.000	155.688	0.000	-1.186	0.000	17.828
11	-155.688	0.000	0.000	0.000	-1.186	-17.833
12	-155.688	0.000	0.000	0.000	-1.186	17.813
13	0.000	-155.688	0.000	1.186	0.000	-17.828
14	0.000	-155.688	0.000	1.186	0.000	17.875
15	155.688	0.000	0.000	0.000	1.186	-17.813
16	155.688	0.000	0.000	0.000	1.186	17.833
17	0.000	0.000	222.411	-17.012	0.000	0.000
18	0.000	0.000	222.411	0.000	-17.017	0.000
19	0.000	0.000	222.411	16.966	0.000	0.000
20	0.000	0.000	222.411	0.000	16.949	0.000
21	0.000	0.000	1023.091	0.000	0.000	0.000
22	0.000	0.000	-1023.091	0.000	0.000	0.000
23	0.000	0.000	-222.411	17.012	0.000	0.000
24	0.000	0.000	-222.411	0.000	17.017	0.000
25	0.000	0.000	-222.411	-16.966	0.000	0.000
26	0.000	0.000	-222.411	0.000	-16.949	0.000

Refer to page 2 for important information on regarding this report.

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Full-Scale Error						
	Fx	Fy	Fz	Tx	Ty	Tz
1	-0.25%	0.00%	0.16%	-0.16%	0.59%	0.28%
2	0.35%	-0.04%	0.04%	-0.01%	-0.64%	0.06%
3	-0.17%	-0.07%	0.15%	-0.18%	0.33%	0.09%
4	0.31%	-0.02%	-0.02%	0.22%	-0.52%	0.16%
5	-0.33%	0.21%	0.34%	-0.01%	0.42%	-0.02%
6	0.19%	-0.05%	0.26%	-0.01%	-0.23%	0.20%
7	-0.34%	-0.03%	0.36%	-0.19%	0.51%	0.31%
8	0.49%	-0.07%	0.22%	-0.03%	-0.56%	0.24%
9	0.02%	-0.30%	0.04%	-0.11%	0.41%	0.38%
10	-0.11%	-0.16%	0.06%	0.02%	-0.31%	0.33%
11	0.17%	0.01%	-0.02%	-0.13%	-0.37%	0.03%
12	0.21%	-0.09%	-0.01%	0.27%	-0.22%	0.12%
13	-0.12%	0.20%	0.04%	0.17%	-0.23%	0.02%
14	-0.01%	0.14%	0.03%	0.31%	0.35%	-0.13%
15	-0.25%	-0.04%	0.09%	0.32%	0.16%	-0.08%
16	-0.27%	-0.01%	0.08%	-0.36%	0.15%	0.02%
17	-0.14%	0.11%	-0.02%	0.13%	0.55%	0.00%
18	0.12%	-0.07%	-0.15%	0.02%	-0.29%	0.14%
19	-0.14%	0.08%	-0.03%	-0.04%	0.50%	-0.05%
20	0.14%	-0.09%	-0.08%	-0.10%	-0.51%	-0.13%
21	0.04%	0.12%	0.08%	-0.06%	0.03%	0.05%
22	-0.02%	0.09%	-0.01%	0.08%	0.12%	0.04%
23	-0.22%	0.21%	0.08%	-0.10%	0.29%	0.04%
24	0.25%	0.00%	0.00%	-0.12%	-0.12%	0.07%
25	-0.16%	-0.03%	0.07%	-0.40%	0.05%	0.02%
26	0.39%	0.00%	-0.01%	-0.04%	-0.39%	-0.09%

Refer to page 2 for important information on regarding this report.

Offset Report						
	Fx	Fy	Fz	Tx	Ty	Tz
F/T Offset	0.0182	0.0084	-0.0315	-0.0009	-0.0009	-0.0009
	SG0	SG1	SG2	SG3	SG4	SG5
SG Offset	0.9050	0.7950	0.7650	0.3100	0.6300	0.8900
±SG Limit	1599.9638	1599.9638	1599.9638	1599.9638	1599.9638	1599.9638

Offsets are measured in a unique configuration not available to the user.

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	Gain-Check Report					
	SG0	SG1	SG2	SG3	SG4	SG5
<i>Lower Limit</i>	0.7500	0.7500	0.7500	0.7500	0.7500	0.7500
<i>Lower Output</i>	0.8794	0.8706	0.8600	0.8569	0.8626	0.8687
<i>Upper Output</i>	0.8858	0.8741	0.8650	0.8591	0.8809	0.8691
<i>Upper Limit</i>	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Gain readings are measured in a unique loading configuration.

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