

1- KEY SPECIFICATIONS

1-1 THREE-AXIS MAGNETOMETERS

1-1-1 Introduction

Metrolab's Three-axis Magnetometers are used to measure magnetic flux density. Simultaneous measurement of all three components of the magnetic field provides the total field no matter the probe's orientation, which significantly facilitates many measurement tasks such as field mapping.



THM1176-LF

Three-axis Hall Magnetometer – Low Field



THM1176-MF

Three-axis Hall Magnetometer – Medium Field



THM1176-HFC

Three-axis Hall Magnetometer – High Field Compact



TFM1186

Three-axis Fluxgate Magnetometer



Laptop connected to THM1176-LF



Tablet connected to THM1176-LF, front and side view



THM1176-MF





THM1176-LF



TFM1186

1-1-2 EZMag3D Software

EZMag3D Software functions:

Windows, macOS, or Linux

Meter mode:

Vector components, magnitude, and oscillations

Numeric, plot, compass, vector, and table displays

Spectrum mode:

Spectral plot of vector components, magnitude or oscillations

Table of spectral peaks

AC Analysis mode:

RMS, Peak-peak, Standard Deviation

Plot, numeric, and table displays

Mapping mode:

Manual or mechanized mapping

Numeric, plot, table, and vector plot display

Exposure limits: graphic overlays and alarms

Control of range, units, trigger, acquisition & display rates, oversampling

Auto-ranging, Hold, Max, and Alarm functions

Zero offset correction

Save and replay from memory or disk

Save and restore settings

Context-sensitive help

1-1-3 Measurement

Data output

Bx, By, Bz (ASCII or binary, single point or array, calibrated or not)

Temperature (uncalibrated) (not available with TFM1186)

Timestamp (167 ns resolution)

Sample rate:

- Immediate trigger (default)

Approx. 6.8 kSa/s (free-running, until internal buffer is full)

Into internal buffer: 0.36 Sa/s to 5.3 kSa/s (jitter ~ 0.2 μ s std. dev.)

- Timed trigger

During USB readout: 0.36 Sa/s to 2.3 kSa/s (jitter ~ 1.2 μ s std. dev.)

Up to approx. 400 Hz (until the internal buffer is full)

- Bus trigger (via USB)	Note: 1 sample = (Bx, By, Bz); Internal buffer size = 4096 samples
Bandwidth	DC to 8 kHz
Interface	USB 2.0, full speed (12 Mbps)
Class / USB driver	USBTMC (USB Test & Measurement Class) / USB488 DFU (Device Firmware Upgrade)
Protocol	IEEE 488.2, SCPI (Standard Commands for Programmable Instruments)
Connector	USB Type-A
Power	USB bus-powered, 4.3 V to 5.25 V 35 mA min (idle, power-saver on), 90 mA max
Wake-up time from power-saver	100 ms
Operating temperature	0°C to +40°C
Storage temperature	-20°C to +60°C
Operating magnetic field	Instrument electronics: 3 T max
Warranty	Two years
Recommended calibration interval	18 months
Certification	CE approved
Maintenance	Firmware and software upgradable by end-user

1-1-4 Definitions of often confused words

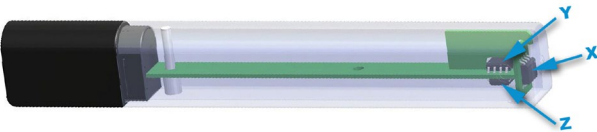
Resolution	Measures the ability of a magnetometer to distinguish ("resolve") two nearly identical field values. Averaging of N measurements improves the resolution by approximately square root (N).
Accuracy	How close a measurement confirms to reality! – i.e. the internationally accepted value in Tesla. The accuracy is given for arbitrary field orientation; typically, it is x10 better along the primary axes.
Precision	How closely multiple measurements will be clustered. Also called reproducibility or repeatability.

1-2 THE THM1176 FAMILY, THREE-AXIS HALL MAGNETOMETERS

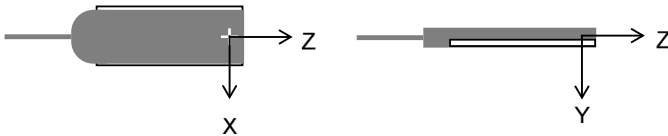
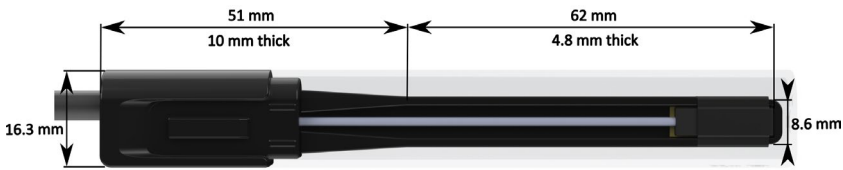
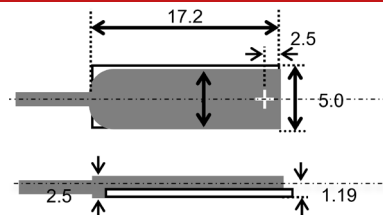
1-2-1 Measurement

MEASUREMENT PRINCIPLE: HALL EFFECT

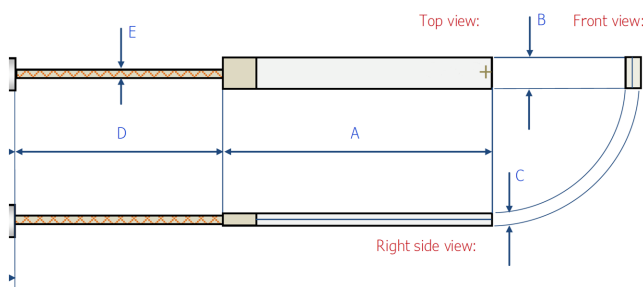
1-2-2 THM1176-LF

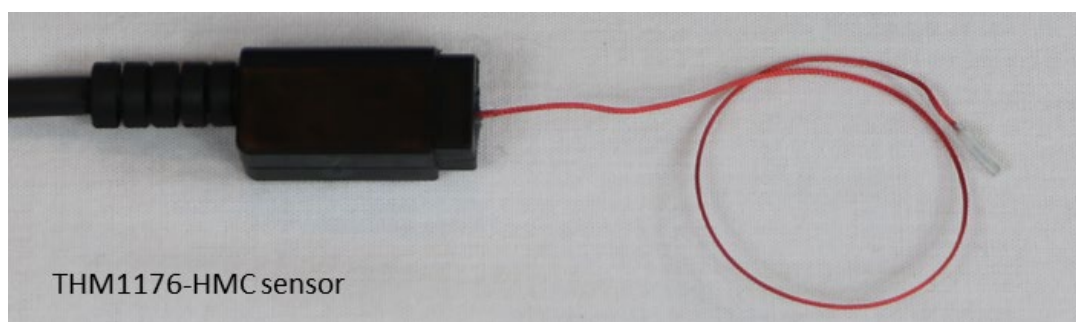
Sensor	Assembly of 3 single-axis Hall sensors, with on-chip flux concentrators Integrated temperature sensor
Ranges	8.0 mT
Units	T, mT, μ T, G, mG
Calibration range	Up to 8.0 mT
Resolution	2 μ T
Accuracy	$\pm 20 \mu$ T
Field Sensitive Volume	6 x 3.4 x 3 mm ³
Dimensions:	
- Instrument electronics	76 x 22.5 x 14 mm ³
- Probe with housing	113 x 16 x 10 mm ³
Cable length	3 m, optionally 6 m Note: Includes 1 m of USB cable.
Weight	160 g (3 m cable); 290 g (6 m cable)
Axis orientation	
Sensor locations	

1-2-3 THM1176-MF

Sensor	Single-chip 3-axis Hall sensor Integrated temperature sensor
Ranges	100 mT, 300 mT, 1 T, 3 T You should try to use the lower ranges whenever possible; the best is to leave the instrument in auto-ranging mode
Units	T, mT, μ T, G, kG, MHz p (proton NMR frequency)
Calibration range	Up to 3 T
Resolution	0.1 mT
Accuracy	Up to 1.5 T ± 0.5 % of reading or specified resolution, whichever is greater Above 1.5 T ± 1 % of reading or specified resolution, whichever is greater
Axis orientation relative to the sensor	
Axis orientation relative to the housing	
Field sensitive volume	200 μ m x 200 μ m x 5 μ m
Dimensions:	76 x 22.5 x 14 mm ³
- Instrument electronics	113 x 16 x 10 mm ³
- Probe with housing	
- Probe without housing	16.3 mm
Cable length	3 m, optionally 6 m Note: Includes 1 m of USB cable
Weight	160 g (3 m cable); 290 g (6 m cable)
Sensor dimensions	"+" marks the center of the field sensitive volume. All dimensions are in mm. Tolerances are ± 0.1mm PCB length: 17.2 mm 

1-2-4 THM1176-HFC

Sensor	Single-chip 3-axis Hall sensor with integrated temperature sensor
Ranges	100 mT, 500 mT, 3T, 20T
Units	T, mT, μ T, G, kG, MHz p (proton NMR frequency)
Calibration range	The 20 T range is only calibrated up to 1.5 T Use lower ranges whenever possible; best is to stick to auto-ranging mode.
Resolution	0.3 mT
Accuracy	Up to 1.5 T ± 0.5 % of reading or specified resolution, whichever is greater
Location of field sensitive point and axis orientation relative to the sensor	Marked by "+" on the top of the chip. $X = 1.0 \pm 0.1$ mm $Y = -0.25 + 0.05/-0.00$ mm $Z = -0.3 \pm 0.05$ mm
Field sensitive volume	150 μ m x 150 μ m x 10 μ m
Dimensions: - Instrument electronics - Probe dimensions	76 x 22.5 x 14 mm³ A = 8.0 ± 0.2 mm B = 2.0 ± 0.5 mm C = $0.5 + 0.05/-0.00$ mm D = 50 ± 1 mm E = $\varnothing 0.8 \pm 0.1$ mm 
Cable length:	3 m, optionally 6 m Note: Includes 1 m of USB cable.
Weight:	150 g (3 m cable); 280 g (6 m cable)
Small and fragile probe	Be very careful when handling; even the instrument cable's weight is sufficient to damage the probe. Damage to either the sensor package or signal cable will destroy the sensor. We strongly suggest storing the probe in its protective case when not in use.
Electrostatic Discharge (ESD)	The sensor is sensitive to ESD. Be sure to ground yourself and follow the proper procedure when handling the sensor.



1-3 THE TFM1186 THREE-AXIS FLUXGATE MAGNETOMETER

1-3-1 Measurement

MEASUREMENT PRINCIPLE: FLUXGATE

1-3-2 TFM1186

Sensor	3-axis fluxgate sensor No temperature sensor
Ranges	100 μ T (200 μ T special order)
Units	T, mT, μ T, nT, G, mG
Calibration range	Up to 100 μ T Note: recommended every 18 months
Resolution	4 nT
Accuracy	$\pm 0.5\%$ of reading and ± 100 nT
Axis orientation	Printed on the sensor
Field Sensitive Volume	Several mm
Dimensions: - Instrument electronics - Probe housing	76 x 22.5 x 14 mm ³ 70 x 30 x 32 mm ³
Cable length	3 m Note: Includes 1 m of USB cable.
Weight	310 g

Sensor package



1-4 PC TABLET HANDHELD KIT (OPTIONAL)

1-4-1 System

Dimensions (W x H x D)	208.5 x 150.6 x 27 mm
Weight	520g with battery
IP Rating	IP54
Drop Resistance	1.2m
Regulatory	CE
CPU	Intel® Atom™ x5-Z8350 Processor (2M Cache, up to 1.84 GHz)
Graphic	Intel® HD Graphic Chipset
OS	Windows 10 Enterprise 2016 LTSB
Memory	2GB DDR3L / 4GB DDR3L
Storage	64GB eMMC
Audio	1 x integrated microphone 2 x 0.5W integrated stereo speaker 1 x 3.5mm headphone jack

1-4-2 Peripherals and Devices

Camera	Front: 2.0 MP camera Rear: 8.0 MP camera with autofocus
Sensor	Gyroscope, E-compass, light sensor
WLAN	IEEE 802.11 a/b/g/n/ac
Bluetooth	Bluetooth® 4.1
NFC	ISO 14443A/B, ISO15693 (On back cover)
Display	8" TFT LCD (4:3) 1024 x 768
Touch screen	10-point Projected Capacitive Touch w/ Corning® Gorilla® Glass
Tablet I/O Interface	1 x Micro USB 2.0 port (OTG support) 1 x microSD card slot

1-4-3 Tablet battery consumption and power supply

Operating Mode	3.5 hours (continuously playing YouTube video)
Standby Mode	29 to 33 hours
Battery Type	Lithium-ion rechargeable battery

Battery Capacity 3.8V, 4000mAh

Operating Temp. -10°C to 45°C

Storage Temp. -20°C to 60°C

1-4-4 Accessories included in handheld kit

Charging Temp. 0°C to 40°C



Hand strap



Pistol grip w/ 8000mAh power bank and power status LED



Tablet connected to THM1176-LF; front view



Tablet and pistol grip connected to THM1176-LF, side view



Tablet and handstrap, back view

1-5 WARRANTY, CALIBRATION, CERTIFICATION AND MAINTENANCE

Warranty	2 years
Recommended calibration interval:	18 months (3-Axis Hall Probe only)
	Note that for logistical reasons, Metrolab recalibrates the THM1176 in batches. Four weeks in the year are fixed to perform batch calibrations:
	Week 10, Week 24, Week 37, Week 48
	To benefit from the discounted pricing for this batch operation, you must ensure that your instrument arrives at Metrolab the week before.
Certification:	CE approved
Maintenance:	Firmware and software upgradable by end user