

USB-5100 Series

Multi-Channel Data Loggers



Features

- Stand-alone, remote multi-channel data loggers
- The USB-5104 is a high-accuracy, four-channel thermocouple data logger that records temperature in indoor environments
- The USB-5106 is a high-accuracy, four-channel analog data logger that records temperature, current, and voltage in indoor environments
- Built-in LCD screen displays readings and other device information
- Software-selectable logger alarm indicates high or low readings
- Logger control buttons for manual control of logging, display options, and event generation
- Powered by two AAA batteries (included)
- Includes mini-USB cable
- Includes built-in magnets and accessory kit for logger mounting
- Compatible sensors sold separately

Software

- Easy-to-use USB-5100 Series software available as a free download*
- Configure, launch and perform data read out of data loggers
- Displays logger status and current readings
- Plots, filters, and exports logger data (convert to .csv, .txt, or Microsoft® Excel® format)
- Create and save custom graphs to a project file
- Calculate minimum, maximum, average, and standard deviation statistics

* The USB-5106 requires USB-5100 Series software v. 3.7.1 or later



USB-5100 Series data loggers offer low-cost, stand-alone collection from multiple data channels. The USB-5106 (shown above) can log temperature, current, or voltage on each of its four analog channels.

- **Supported Operating Systems:**
 - Windows 8, Windows 7 (Pro, Ultimate and Home Premium), Windows XP (Pro and Home), 32-bit or 64-bit (required Java™ Runtime Environment available for installation with software)
 - Mac® OS X version 10.6.x or later (32-bit or 64-bit)
- Adobe Reader required to view the [USB-5100 Series Software Help PDF](#)

Overview

The USB-5100 Series consists of the following multi-channel data loggers:

The USB-5104 logs data from up to four thermocouple (TC) sensors, and includes an internal 12-bit, 10K thermistor to record ambient temperature.

This TC data logger supports any combination of standard-type TC sensors (sold separately) on its four, 20-bit channels.

The USB-5106 logs data from up to four 16-bit analog channels and accepts input from temperature, 4-20 mA, and voltage input sensors.

Both devices have 4 MB of memory – the USB-5104 can store up to 1.6 million measurements, and the USB-5106 can store up to 1.9 million measurements.

All USB-5100 Series loggers support software-selectable burst logging, enabling the logger to record data at a different intervals based on user-specified conditions

Users can easily configure logger logging intervals (one second to over 18 hours), high/low alarms for each type of data being logged using the USB-5100 Series Data Logger software.

Burst logging can also be configured through software, allowing the logger to vary logging intervals based on changing sensor conditions.

USB-5100 Series Comparison Chart						
Model	Channels	Measurement Type	Logging Interval	Memory	Maximum # of Readings	Features
USB-5104	4	Thermocouple	1 s to 18 h, 12 min, 15 s	4 MB	1.6 million	Internal 10K thermistor
USB-5106	4	Temperature, current, voltage	1 s to 18 h, 12 min, 15 s	4 MB	1.9 million	Supports linear scaling

USB-5100 Series

General Information



The built-in LCD screen displays the sensor reading, logging status, battery use, and memory consumption in between readouts.

All USB-5100 Series devices are powered by two AAA batteries (standard included; rechargeable supported).

Sensor Input

USB-5104

The USB-5104 provides four high-accuracy TC input channels that support J, K, T, E, R, S, B, or N type TC sensors. Each channel can be individually-configured based on the connected TC type.

The USB-5104 also includes an internal 10K thermistor to record ambient temperature and to provide cold-junction compensation of the TC output.

Refer to [Sensors on page 8](#) for a list of supported thermocouple sensors that can be purchased separately.



The USB-5104 offers four individually-configurable channels that support standard TC sensors.

USB-5106

The USB-5106 provides four high-accuracy analog input channels (using 2.5 mm connector) that support temperature, current, and voltage inputs.

Refer to [Sensors on page 8](#) for a list of supported temperature, current, and voltage sensors that can be purchased separately.

Device Buttons

USB-5100 Series devices provide two software-configurable buttons on the device for users to manually control logging and data display.

Start/Stop button: Depending on the software configuration, users can:

- press this button for three seconds to start/resume logging, or to stop logging.
- press this button for one second to record an internal event or to turn on the LCD screen

Alarm/Stats button: Depending on the software configuration, users can:

- press this button to clear a tripped alarm
- press this button to switch between statistics, alarm readings, and the current sensor reading (and the internal temperature reading, if supported)

LCD Screen

USB-5100 data loggers include a LCD screen that displays the following information:

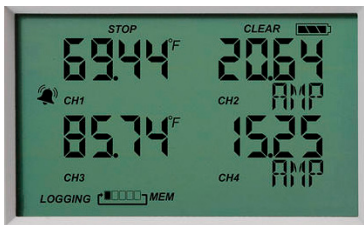
START	The device is waiting to be launched by pressing the Start/Stop button.
STOP	The device is currently logging; stop logging by the pressing Start/Stop button.
LOGGING	The device is currently logging.
	A sensor reading is above or below the high or low alarm that you configured.
CLEAR	An alarm waiting to be cleared by pressing the Alarm/Stats button for three seconds.
	Battery indicator displays the approximate battery power remaining.
10008	Temperature reading – the displayed temperature units are configured in software.
CH1	The channel number associated with the TC reading (channel 1 in this example). Up to four channels are displayed at one time.
05:38 <i>m:s</i>	The logger is configured to start logging at a set date/time. The display counts down in days, hours, minutes, and seconds until logging begins.
	The logger is configured to stop logging when memory fills. The memory bar indicates the approximate space remaining in the logger to record data.
	The logger is configured to never stop logging (wrapping). The logger records data indefinitely, with newest data overwriting the oldest data.
max min avg sd	These symbols indicate the maximum, minimum, average, and standard deviation values most recently calculated by the logger.
alm	The sensor reading that tripped the alarm.

USB-5100 Series

Software Information

LCD Screen (cont'd)

Load	The launch settings are being loaded onto the logger from software.
Err	An error occurred while loading the launch configurations onto the logger from software.
Stop	The logger has been stopped by software or because the memory is full.
AMP	Voltage and Current Sensor Channels Only: Example of the units entered for a current sensor, which appears to the right of the channel number. Enter the unit type in the LCD Units field for that sensor in the USB-5100 Series software. Units for temperature sensors are displayed as °F or °C only.



The LCD screen on USB-5100 Series data loggers displays information on readings, alarms, statistics, memory, and battery power.

USB-5100 Series Software

Logging Interval

The USB-5100 Series software provides both preset and custom logging intervals that range from 1 second to over 18 hours (18 hours, 12 minutes, and 15 seconds maximum) depending on your data collection needs. The logger stores the data and users can upload it to a computer through USB when collection is complete.

Logging Modes and Filters

The following logging modes can be configured using the USB-5100 Series software:

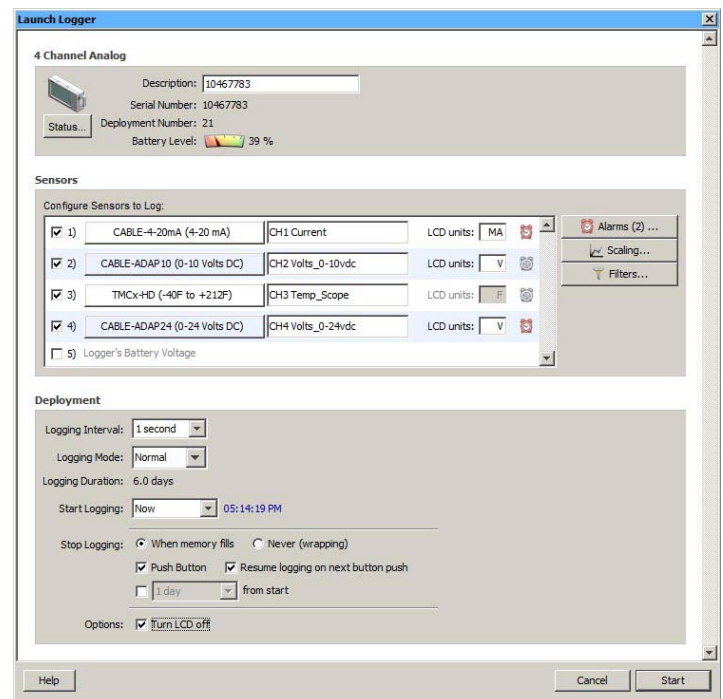
- **Normal:** Configures the logger to collect data at the selected logging interval.
- **Burst Logging:** Configures the logger to use a different logging interval when specific conditions are met. Burst logging is not available for the internal temperature channel.
- **Statistics:** Configures the logger to calculate maximum, minimum, average, and standard deviation values during logging for all enabled sensors except battery voltage. Statistics logging is not available for the internal temperature channel.

Statistics are calculated for each logging session, and can be displayed on the LCD screen.

You can also create custom statistics, called a *filtered* series, by selecting a configured channel, selecting a filter (maximum, minimum, or average), and selecting how often to calculate the filter for the channel. A filtered series is calculated when you read out and plot the logger data, and are not displayed on the LCD screen.

Linear Scaling Assistant (USB-5106 Only)

The USB-5106 also supports the Linear Scaling Assistant, which converts a data series from a compatible sensor to some other measurement when you enter two raw values and their corresponding measurement values. The conversion must be based on a linear relationship.



The USB-5100 Series software provides options for configuring alarms, filters, and scaling of logger data, and logging intervals, modes, and start/stop conditions.

USB-5100 Series

Software Information



Start Logging Modes

The following start logging modes can be configured using the USB-5100 Series software:

- **Now:** Logging begins by clicking **Start** in the **Launch Logger** software window.
- **At Interval:** Logging begins at an exact interval (for example 9:00:00 rather than 8:47:00 when you choose a one-hour logging interval). The exact start time depends on the selected logging interval you choose.
- **On Date/Time:** Logging begins at a selected date and time, up to approximately six months from the present. The LCD screen counts down to the start date/time and then logging begins.
- **Push Button:** Logging starts when the Start/Stop button on the logger pressed for three seconds. The LCD screen on the logger displays **START** until the button is pressed.

Stop Logging Modes

The following stop logging modes can be configured using the USB-5100 Series software:

- **When memory fills:** The logger stops recording data once the memory is full.
- **Never (wrapping):** The logger records data continuously until either the logger battery runs out or the Start/Stop button on the logger pressed for three seconds. When the logger memory is full, the newest data overwrites the oldest data.
- **Push button:** The logger stops recording data when the Start/Stop button on the logger is pressed for three seconds. The LCD screen on the logger displays **STOP** when this option has been selected.
- **Resume logging on next button push:** Resume a stopped logger by pressing the Start/Stop button for three seconds (only available when **Push button** is selected as a **Stop Logging** option).
- **Specific stop date:** Select the date that the logger stops recording data. Choose either a preset time or set your own custom date and time.

Alarms

USB-5100 Series loggers provide high alarm and low alarm options that can be set through software. Alarm conditions and readings are indicated on the LCD screen (refer to [LCD Screen on page 2](#)).

Alarms can be set based on the number of readings outside the alarm range – for example, trip an alarm when five readings are above/below the configured alarm value. Alarms conditions can be *cumulative* – five readings out-of-sequence trip an alarm – or *consecutive* – five readings in a row trip an alarm.

Alarms are not supported when Burst Logging is selected.

The following options are available for maintaining alarms and clearing alarms based on the following conditions:

Alarm Reset Condition	Definition
Host has relaunched logger	Alarm remains visible on the LCD until the logger is relaunched.
Sensor reading within limits	Alarm clears once sensor reading returns to the normal range between the high and low alarm limits.
Cleared with button press	Alarm remains visible on the LCD until the Alarm/Stats button on the logger is pressed.

Internal Logger Events

USB-5100 Series loggers can track logger operation and status by recording the following internal events. You can plot these events in the USB-5100 Series software after reading out the logger and opening the data file.

Event Name	Definition
Host Connected	The logger was connected to the computer.
Started	The Start/Stop button was pressed to begin logging.
Stopped	The logger received a command to stop recording data (from software or by pushing the Start/Stop button).
Button Up/Button Down	The Start/Stop button was pressed for 1 second.
Chan <#> Alarm Tripped	An alarm has tripped on that channel.
Chan <#> Alarm Cleared	An alarm has cleared on that channel. This event also contains the value that was furthest out of range for the sensor before the alarm cleared.
New Interval	The logger has entered or exited burst logging mode.
Safe Shutdown	The battery level dropped below 1.85 V; the logger performs a safe shutdown.

USB-5100 Series

Software Information



Reading Out and Plotting Data

After configuring a logger and logging data, users can stop the logger, save the data to file, and plot the data.

The USB-5100 Series software interface provides the following visual components when plotting logged data:

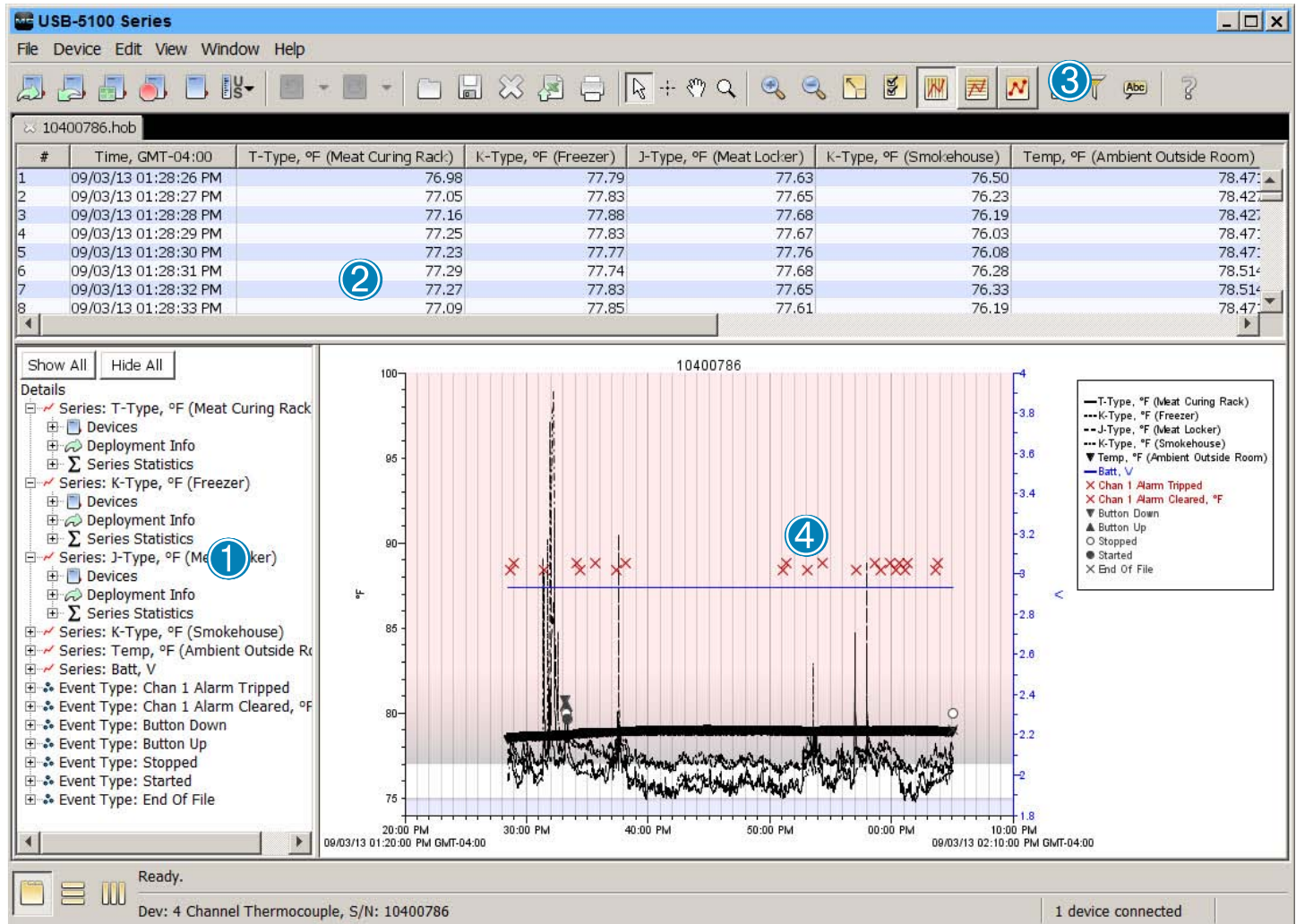
Points Table – Chronologically lists data points (values) and logged events displayed in the plot. The Points Table is linked to the graph – only the data for the series and events on the plot are listed in the Points Table.

Plot – The plot displays the data series and events in a graph, and includes a time axis (x-axis), value axis (y-axis), and legend for each series

Details Pane – Shows information for each series and event displayed in the plot including, such as device information (model and serial numbers), deployment information, (launch description, start time, logging interval), and series statistics (total number of sensor samples and events, time of the first and last sample, and the maximum, minimum, average, and standard deviation for each plotted sensor series).

Toolbar Icons – The toolbar includes icons that enable users perform the following operations on the plot or on a specific series:

- show/hide gridlines, data point markers, legend, title, and border
- zoom in/out
- convert units
- create a filtered series
- several other graph/plot options
- add graph labels
- show graph at full scale



The USB-5100 Series software interface includes the ① Details Pane, which shows information for each series and event displayed in the plot; the ② Points Table, which chronologically lists data points and logged events; the ③ Toolbar Icons that perform operations on the Plot or individual series; and the ④ Plot, which displays the data series and events in a graph.

USB-5100 Series

Software Information & Specifications



Exporting Data

The data plotted and displayed in the Points Table can be exported to a .csv, .txt, or Microsoft Excel (.xls) file. Information in the Details Pane can be exported to a .txt file.

Saving to a Project File

Logged data along with any customized display and analysis settings can be saved to a custom project file.

Customizations made when the file was saved will display when you open the project.

Specifications

All specifications are subject to change without notice.
Typical for 25 °C unless otherwise specified.

All USB-5100 Series Devices

Operating Range

Logging: -20 °C to 70°C (-4 °F to 158°F); 0% to 95% RH (non-condensing)
Launch/Readout: 0 °C to 50 °C (32 °F to 122 °F) per USB specification

Logging Rate: 1 s to 18 h, 12 min, 15 s

Logging Modes: Normal, burst, or statistics

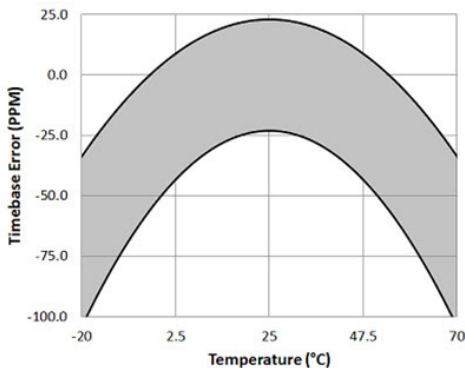
Memory Modes: Wrap when full or stop when full

Start Modes: Immediate, push button, date & time, or next interval

Stop Modes: When memory full, push button, or date & time

Restart Mode: Push button

Time Accuracy: ±1 min per month at 25 °C (77 °F) (see Plot A)



Plot A: USB-5100 Series Time Accuracy

Battery Life: 1 year, typ with logging rate of 1 min and logging interval of 15 s or greater

Battery Type: Two AAA batteries or non-rechargeable lithium batteries

Memory: 4 MB

USB-5104: 1.6 million measurements, max)

USB-5106: 1.9 million measurements, max)

Download Type: USB 2.0 interface

Full Memory Download Time: Approximately 1.5 min

LCD: LCD is visible from 0 °C to 50 °C (32 °F to 122 °F); the LCD may react slowly or go blank in temperatures outside this range

Size (L × W × H): 10.8 × 5.41 × 2.54 cm (4.25 × 2.13 × 1 in.)

Weight: 107.5 g (3.79 oz)

Environmental Rating: IP50

USB-5104

USB-5104 Thermocouple Accuracy			
Type	Range	Accuracy	Resolution
J	-210 °C to 760 °C (-346 °C to 1,400 °F)	±0.6 °C (±1.08 °F) ± TC probe accuracy	0.03 °C (0.06 °F)
K	-260 °C to 1,370 °C (-436 °C to 2,498 °F)	±0.7 °C (±1.26 °F) ± TC probe accuracy	0.04 °C (0.07 °F)
T	-260 °C to 400 °C (-436 °C to 752 °F)	±0.6 °C (±1.08 °F) ± TC probe accuracy	0.02 °C (0.03 °F)
E	-260 °C to 950 °C (-436 °F to 1,742 °F)	±0.6 °C (±1.08 °F) ± TC probe accuracy	0.03 °C (0.05 °F)
R	-50 °C to 1,550 °C (-58 °F to 2,822 °F)	±2.2 °C (±3.96 °F) ± TC probe accuracy	0.08 °C (0.15 °F)
S	-50 °C to 1,720 °C (-58 °F to 3,128 °F)	±2.2 °C (±3.96 °F) ± TC probe accuracy	0.08 °C (0.15 °F)
B	550 °C to 1,820 °C (1,022 °F to 3,308 °F)	±2.5 °C (±4.5 °F) ± TC probe accuracy	0.1 °C (0.18 °F)
N	-260 °C to 1,300 °C (-436 °F to 2,372 °F)	±1.0 °C (±1.8 °F) ± TC probe accuracy	0.06 °C (0.11 °F)

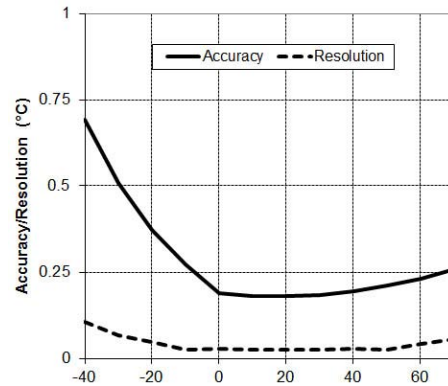
Environmental (Internal 10k Thermistor (Temperature))

Range: -20 °C to 70 °C (-4 °F to 158 °F)

Accuracy: ±0.21 °C from 0 °C to 50 °C (±0.38 °F from 32 °F to 122 °F) (see Plot A)

Resolution: 0.024 °C at 25 °C (0.04 °F at 77 °F) (see Plot B)

Drift: <0.1 °C (0.18 °F) per year



Plot B: USB-5104 Internal Temperature Accuracy and Resolution

USB-5100 Series Specifications



USB-5106

Connected to TMC6-HD Air/Water/Soil Temp Sensor

The TMC6-HD measures temperature in air, water, or soil, and is attached to a 1.8 m (6 ft.) cable. This sensor can be plugged directly into the external input jacks of the USB-5106.

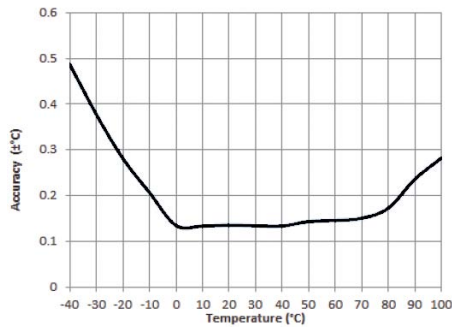
The TMC6-HD can be used indoors and underwater.

Connector Type: 2.5 mm plug

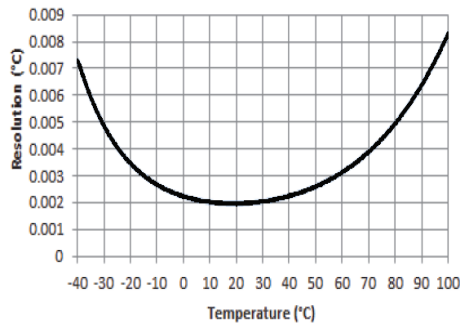
Temperature Measurement Range: $-40\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$ to $122\text{ }^{\circ}\text{F}$) in water; $-40\text{ }^{\circ}\text{C}$ to $100\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$ to $212\text{ }^{\circ}\text{F}$) in air

Temperature Accuracy: $\pm 0.15\text{ }^{\circ}\text{C}$ from $0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$ ($\pm 0.27\text{ }^{\circ}\text{F}$ from $32\text{ }^{\circ}\text{F}$ to $158\text{ }^{\circ}\text{F}$), insert probe 2.3 cm (0.9 inches) min

Temperature Resolution: $0.002\text{ }^{\circ}\text{C}$ at $25\text{ }^{\circ}\text{C}$ ($0.003\text{ }^{\circ}\text{F}$ at $77\text{ }^{\circ}\text{F}$)



Plot C: USB-5106 Accuracy with TMC6-HD



Plot D: USB-5106 Resolution with TMC6-HD

Drift: $< 0.1\text{ }^{\circ}\text{C}$ ($< 0.2\text{ }^{\circ}\text{F}$) per year

Response Time in Air: 2 minutes typ to 90% in air moving 1 m/s (2.2 mph)

Response Time in Stirred Water: 30 sec. typical to 90%.

Operating Range: Sensor tip and cable immersion in fresh water up to $+50\text{ }^{\circ}\text{C}$ ($122\text{ }^{\circ}\text{F}$) for 1 year

Sensor Housing: Copper-plated sensor tip

Sensor Dimensions: $5.1 \times 33\text{ mm}$ ($0.2 \times 1.3\text{ in.}$)

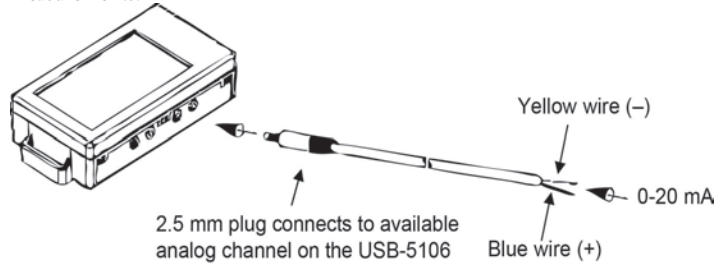
Sensor Weight: 34 g (1.1 oz)

Sensor Mounting Considerations: Mount the sensor where there is good air circulation for measuring air temperature, and mount the sensor tip as far off of the mounting surface as possible so temperature measurements are not affected by the surface itself.

Connected to a 4-20 mA Sensor (CABLE-4-20MA)

The CABLE-4-20MA connects a 4-20 mA output to a USB-5106. This sensor is attached to a 47 cm (18.5 in.) cable and can be plugged directly into the external input jacks of the USB-5106.

This sensor must be connected so that the current flows through, and with the proper polarity, as shown below. Do not expose to current above 20 mA or negative current. Do not cut off the end of the gray cable where it connects to the blue and yellow wires as that contains the precision resistor required for current measurements.



Connector Type: 2.5 mm plug

Measurement Range: 0 mA to 20.1 mA

Accuracy: $\pm 0.001\text{ mA}$ $\pm 0.2\%$ of reading

Resolution: $0.3\text{ }\mu\text{A}$

Length: 47 cm (18.5 in)

Connected to a DC Voltage Sensor (CABLE-ADAPxx)

The USB-5106 supports the following voltage sensors:

CABLE-ADAP5 Supports sensor inputs of 5 VDC max

CABLE-ADAP10 Supports sensor inputs of 10 VDC max

CABLE-ADAP24 Supports sensor inputs of 24 VDC max

Connector Type: 2.5 mm plug (all voltage sensors)

Measurement Range

CABLE-ADAP5: 0 V to 5 V

CABLE-ADAP10: 0 V to 10 V

CABLE-ADAP24: 0 V to 24 V

Accuracy

CABLE-ADAP5: $\pm 0.2\text{ mV}$ $\pm 0.3\%$ of reading

CABLE-ADAP10: $\pm 0.4\text{ mV}$ $\pm 0.3\%$ of reading

CABLE-ADAP24: $\pm 1.0\text{ mV}$ $\pm 0.3\%$ of reading

Resolution:

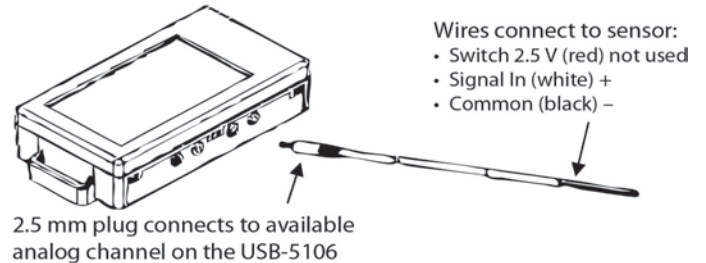
CABLE-ADAP5: $80\text{ }\mu\text{V}$

CABLE-ADAP10: $160\text{ }\mu\text{V}$

CABLE-ADAP24: $384\text{ }\mu\text{V}$

Length: 1.9 m (6.3 ft) (all models)

Weight: 38.6 g (1.4 oz) (all models)



USB-5100 Series

Ordering

Ordering Information





Part No.	Description
USB-5104	Battery-powered four-channel thermocouple data logger; includes mini-USB cable, Command™ strip, double-sided tape, hook & loop strap, and two AAA 1.5 V alkaline batteries
USB-5106	Battery-powered four-channel analog data logger; includes mini-USB cable, Command™ strip, double-sided tape, hook & loop strap, and two AAA 1.5 V alkaline batteries

Software


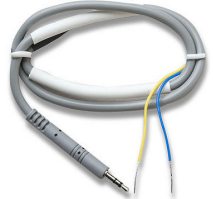

Part No.	Description
USB-5100 Series software	Software for USB-5100 Series Data Loggers on Windows and Mac platforms.

Sensors

Compatible with USB-5104

Part No.	Description	
CN-144-JM	Type J male thermocouple connector	
CN-144-KM	Type K male thermocouple connector	
CN-144-TM	Type T male thermocouple connector	
745690-J001	J-type thermocouple wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F) 1 m	
745690-J002	J-type thermocouple wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F) 2 m	
745690-K001	K-type thermocouple wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F) 1 m	
745690-K002	K-type thermocouple wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F) 2 m	
745690-T001	T-type thermocouple wire, fiberglass (0 °C to 260 °C, 32 °F to 500 °F) 1 m	
745690-T002	T-type thermocouple wire, fiberglass (0 °C to 260 °C, 32 °F to 500 °F) 2 m	

Comptible with USB-5106

Part No.	Description	
TMC6-HD	Air/water/soil temperature sensor, 1.8 m (6 ft.)	
CABLE-4-20mA	4-20 mA input cable, 47 cm (18.5 in.)	
CABLE-ADAP5	Supports sensor inputs of 5 VDC max, 1.9 m (6.3 ft.)	
CABLE-ADAP10	Supports sensor inputs of 10 VDC max, 1.9 m (6.3 ft.)	
CABLE-ADAP24	Supports sensor inputs of 24 VDC max, 1.9 m (6.3 ft.)	