

USB-2404-U

USB-based Universal Analog Input Device

User's Guide

Trademark and Copyright Information

Measurement Computing Corporation, InstaCal, Universal Library, and the Measurement Computing logo are either trademarks or registered trademarks of Measurement Computing Corporation. Refer to the Copyrights & Trademarks section on mccdaq.com/legal for more information about Measurement Computing trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies.

© 2012 Measurement Computing Corporation. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form by any means, electronic, mechanical, by photocopying, recording, or otherwise without the prior written permission of Measurement Computing Corporation.

Notice

Measurement Computing Corporation does not authorize any Measurement Computing Corporation product for use in life support systems and/or devices without prior written consent from Measurement Computing Corporation. Life support devices/systems are devices or systems that, a) are intended for surgical implantation into the body, or b) support or sustain life and whose failure to perform can be reasonably expected to result in injury. Measurement Computing Corporation products are not designed with the components required, and are not subject to the testing required to ensure a level of reliability suitable for the treatment and diagnosis of people.

Table of Contents

Preface

| | |
|--|----------|
| About this User's Guide | 5 |
| What you will learn from this user's guide | 5 |
| Conventions in this user's guide | 5 |
| Where to find more information | 5 |
| Hazardous voltages | 5 |
| Hazardous locations | 5 |

Chapter 1

| | |
|--|----------|
| Introducing the USB-2404-UI | 6 |
| Overview: USB-2404-UI features | 6 |
| Functional block diagram | 7 |

Chapter 2

| | |
|--|----------|
| Installing the USB-2404-UI | 8 |
| What comes with your USB-2404-UI shipment? | 8 |
| Hardware | 8 |
| Documentation | 8 |
| Unpacking | 8 |
| Installing the software | 8 |
| Installing the hardware | 8 |
| Calibrating the USB-2404-UI | 9 |

Chapter 3

| | |
|--|-----------|
| Functional Details | 10 |
| Components | 10 |
| Spring terminal connectors | 10 |
| Strain relief slot | 11 |
| USB connector | 11 |
| LED | 11 |
| Connecting wires to the spring terminals | 11 |
| TEDS sensor connections | 12 |
| Signal source connections | 12 |
| Timing options | 12 |
| USB-2404-UI circuitry | 13 |
| Analog input circuitry | 13 |
| Voltage and current modes | 13 |
| 4-wire resistance and 4-wire RTD modes | 13 |
| 3-wire RTD mode | 14 |
| 2-wire resistance and quarter-bridge modes | 14 |
| Half-bridge and full-bridge modes | 14 |
| Thermocouple mode | 15 |
| Excitation protection | 15 |

Chapter 4

| | |
|-----------------------------|-----------|
| Specifications | 16 |
| Analog input | 16 |
| Input mode ranges | 16 |
| Accuracy | 17 |
| Stability | 17 |
| Input noise | 18 |
| Excitation level | 18 |
| Power | 18 |
| Bus interface | 19 |

| | |
|--|-----------|
| Environmental | 19 |
| Mechanical | 19 |
| Safety voltages..... | 19 |
| Spring terminal connectors | 19 |
| Accessory products..... | 20 |
| Declaration of Conformity | 21 |

About this User's Guide

What you will learn from this user's guide

This user's guide describes the Measurement Computing USB-2404-UI data acquisition device and lists device specifications.

Conventions in this user's guide

For more information about ...

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

bold text **Bold** text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about USB-2404-UI hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation by phone, fax, or email with specific questions.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Hazardous voltages

You can connect hazardous voltages to the USB-2404-UI device's spring terminals. A hazardous voltage is a voltage greater than 42.4 V_{pk} or 60 VDC to earth ground. Take the following precautions if you connect hazardous voltages to the USB-2404-UI:

Caution! Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

Do not mix hazardous voltage circuits and human-accessible circuits on the same device.

Make sure that devices and circuits connected to the USB-2404-UI are properly insulated from human contact.

When device terminals are hazardous voltage LIVE (>42.4V_{pk}/60 VDC), ensure that devices and circuits connected to the USB-2404-UI are properly insulated from human contact. A high voltage screw terminal backshell (ACC-176) must be installed when using hazardous voltages to ensure that the terminals are not accessible.

Hazardous locations

The USB-2404-UI is not certified for use in hazardous locations.

Introducing the USB-2404-UI

Overview: USB-2404-UI features

This user's guide contains all of the information you need to connect the USB-2404-UI to your computer and to the signals you want to measure.

The USB-2404-UI is a USB 2.0 high-speed device that is supported under popular Microsoft® Windows® operating systems. The USB-2404-UI is fully compatible with both USB 1.1 and USB 2.0 ports.

The USB-2404-UI provides four channels of 24-bit universal analog input with integrated signal conditioning. The device can be used to measure several signals from sensors such as RTDs, thermocouples, load cells, and other powered sensors. The four channels are individually configurable, so a different measurement type can be performed on each channel. All channels are measured simultaneously at up to 100 S/s per channel.

The USB-2404-UI can perform the following measurements:

- Voltage
- Current
- Thermocouple
- RTD (4-wire and 3-wire)
- Resistance (4-wire and 2-wire)
- Bridge-based sensors (quarter-, half-, and full-bridge)

Measurement ranges vary for each type of measurement.

The device features built-in current and voltage excitation. The excitation circuit is protected from overcurrent and overvoltage fault conditions. Each channel also has a built-in thermistor for cold-junction compensation (CJC) calculations when measuring thermocouples.

An analog pre-filter removes noise that may be present in the signals prior to conversion. With 250 VAC channel-to-channel and channel-to-ground isolation, the USB-2404-UI protects the individual channels and connected computer from ground spikes, and ensures a reliable data stream. An on-board LED indicates the status of the device.

Each channel has a detachable six-position spring terminal for field wiring connections. Additional connectors are available for purchase. A strain relief kit is also available to secure signal wires.

The USB 2.0 high-speed driver transfers data at rates up to 480 Mbps. The USB-2404-UI is powered by the +5 volt USB supply from your computer. No external power is required.

Functional block diagram

USB-2404-UI functions are illustrated in the block diagram shown here.

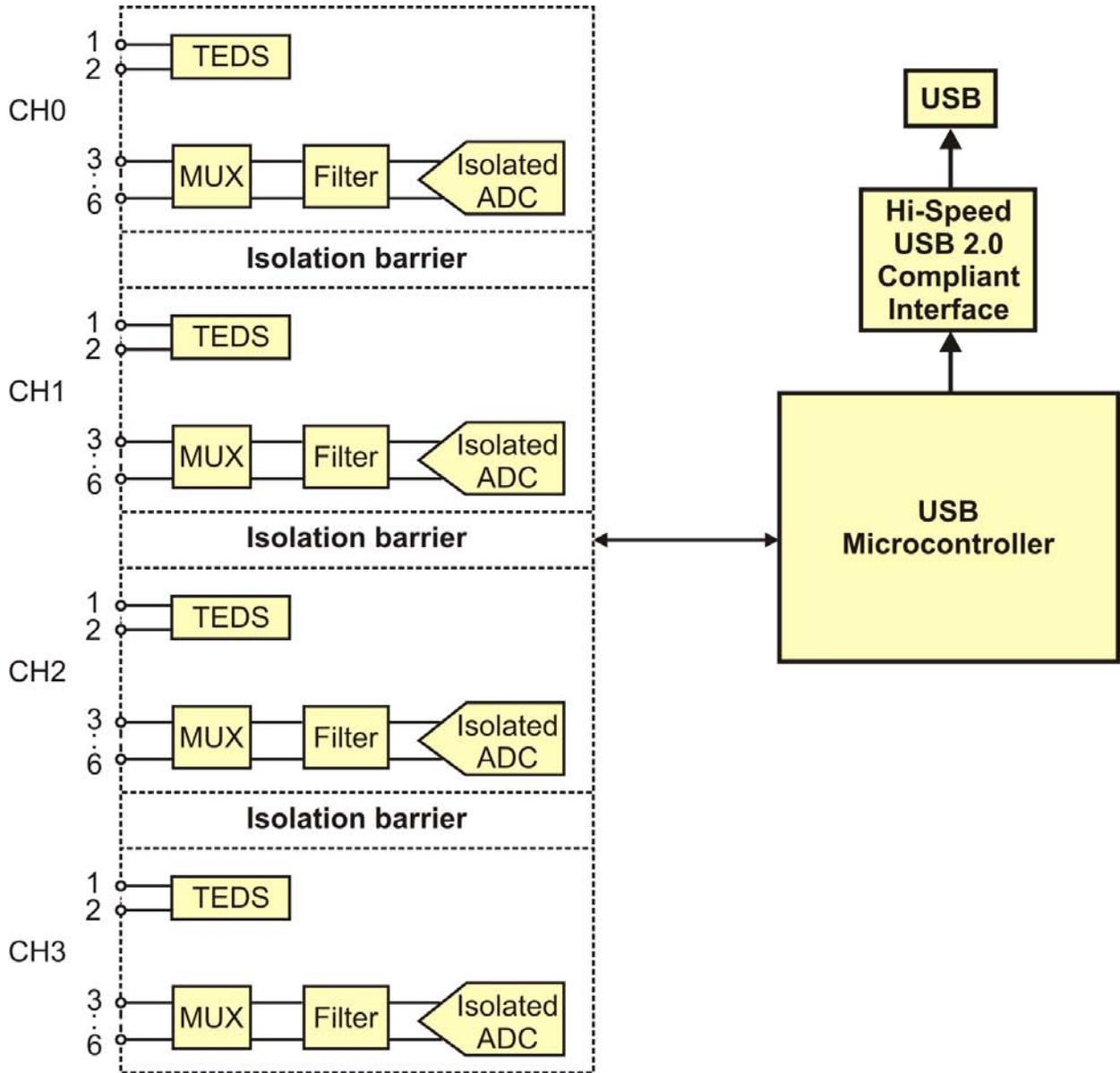


Figure 1. USB-2404-UI functional block diagram

Installing the USB-2404-UI

What comes with your USB-2404-UI shipment?

As you unpack your USB-2404-UI, verify that the following components are included.

Hardware

- USB-2404-UI
- USB cable (2 meter length)

Documentation

In addition to this hardware user's guide, a *Quick Start Guide* booklet is included with the USB-2404-UI shipment. This booklet provides an overview of the MCC DAQ software you received with the device, and includes information about installing the software. Please read this booklet completely before installing any software or hardware.

Optional accessories

- ACC-164 — Six-position screw terminal connector blocks (quantity four).
- ACC-176 — Backshell for use with the ACC-164 six-position spring terminal connector blocks. Provides strain relief and operator protection from high-voltage signals (quantity four).

Unpacking

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the USB-2404-UI from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If your USB-2404-UI is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

For international customers, contact your local distributor. Refer to the International Distributors section on our web site at www.mccdaq.com/International.

Installing the software

Install Universal Library and InstaCal when you want to develop data acquisition applications using Windows programming languages.

Universal Library and InstaCal software are included on the CD that ships with the device. Refer to the *Quick Start Guide* booklet for instructions about installing Universal Library and InstaCal software.

Installing the hardware

Install the software before you install your device

A driver needed to run the USB-2404-UI device is installed when you install the software. Therefore, you need to install the software package you plan to use before you install the hardware.

For operation on a Windows operating system, we recommend that you run Windows Update to update your operating system with the latest USB drivers.

Be sure you are using the latest system software

Before you install your USB-2404-UI, run Windows Update to update your operating system with the latest USB drivers.

To connect the USB-2404-UI to your system, turn your computer on, and connect the USB cable to a USB port on your computer or to an external USB hub that is connected to your computer. The USB cable provides power and communication to the USB-2404-UI.

USB 2.0 port or hub recommended

For optimum performance, connect the USB-2404-UI to a USB 2.0 Hi-Speed host controller (480 Mbps) and USB 2.0 high-speed hub. The USB-2404-UI can be connected to a USB 1.1 Full-Speed port or hub, although performance may be affected.

To connect a USB-2404-UI device to your system, turn on your computer and connect the USB cable to an available USB port on the computer or to an external USB hub connected to the computer. Connect the other end of the USB cable to the USB connector on the device. No external power is required.

When you connect the device for the first time to a computer running Windows, a **Found New Hardware** dialog opens when the operating system detects the device. The dialog closes after the device is installed.

The green LED on the USB-2404-UI blinks steadily to indicate that the device is initialized and receiving power.

Allow the USB-2404-UI to operate for at least 30 minutes before using the device. This warm up time is required to achieve the specified rated accuracy of measurements.

Caution! Do not disconnect any device from the USB bus while the computer is communicating with the USB-2404-UI, or you may lose data and/or your ability to communicate with the device.

If the LED is off

If the LED is on but then turns off, the computer has lost communication with the USB-2404-UI device. To restore communication, disconnect the USB cable from the computer and then reconnect it. This should restore communication, and the LED should turn on.

Calibrating the USB-2404-UI

The USB-2404-UI is shipped fully calibrated. Calibration coefficients are stored in EEPROM. Return the device to Measurement Computing Corporation when calibration is required. The normal calibration interval is once per year.

Functional Details

Components

The USB-2404-UI has the following external components:

- Spring terminal connectors
- Strain relief slot for USB cable
- USB connector
- LED

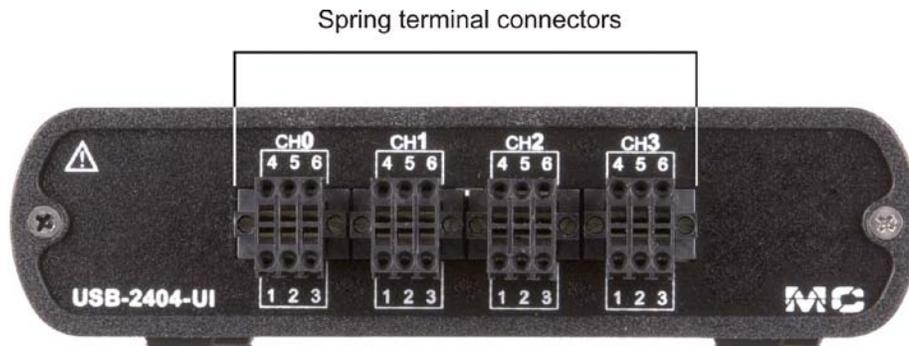


Figure 2. Front panel

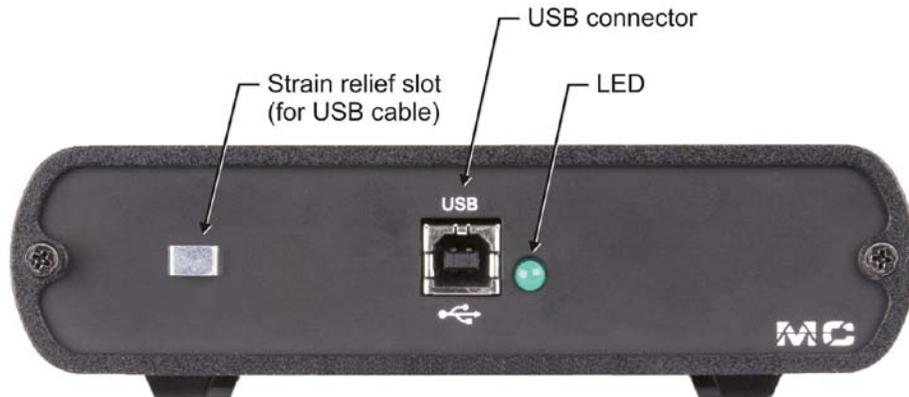


Figure 3. Rear panel

Spring terminal connectors

The USB-2404-UI has four 6-terminal connectors (CH0 to CH3) that provide connections for four analog input channels. The signal names for the spring terminal in each connector are listed in the table below.

6-terminal connector signal names

| Terminal number | Signal name | Signal description |
|-----------------|-------------|-------------------------------------|
| 1 | T+ | TEDS Data |
| 2 | T- | TEDS Common |
| 3* | EX+/HI | Positive excitation or input signal |
| 4 | HI | Positive input signal |
| 5* | EX-/LO | Negative excitation or input signal |
| 6 | LO | Negative input signal |

* Depending on the input mode, terminals 3 and 5 are either excitation signals or input signals.

- Connect the positive signal of the signal source to the positive input signal terminal (**HI**).
- Connect the negative signal of the signal source to the negative input signal terminal (**LO**).
- Connect to the excitation terminals (**EX+**/**EX-**)-if the sensor requires a separate excitation connection.

The spring terminal assignments for each input mode are listed in the following table.

6-position spring terminal assignments per input mode

| Terminal | Voltage TC | Current | Bridge | | | Resistance | | RTD | |
|----------|------------|---------|--------|------|---------|------------|--------|--------|--------|
| | | | Full | Half | Quarter | 2-wire | 4-wire | 4-wire | 3-wire |
| 3 | — | HI | EX+ | EX+ | HI | | EX+ | EX+ | |
| 4 | HI | — | HI | HI | — | | HI | — | |
| 5 | LO | LO | EX- | EX- | LO | | EX- | EX- | |
| 6 | — | — | LO | LO | — | | LO | LO | |

Refer to "USB-2404-UI circuitry" on page 13 for information about connections in each mode.

Strain relief slot

Use the strain relief slot to keep the USB cable from disconnecting from the device inadvertently. Feed a tie wrap through the slot and secure to the USB cable when it is connected to the device.

USB connector

The USB connector provides +5 V power and communication. The voltage supplied through the USB connector is system-dependent, and may be less than 5 V. No external power supply is required.

LED

The LED indicates the device status. When connected to a USB port, the LED blinks steadily to indicate that the device is initialized and receiving power. Refer to the following table for the possible LED states.

LED state/device status

| LED state | Device status |
|-------------------------|---|
| Not lit | The device is not connected to a USB port or hub. |
| Continuous single-blink | The device is operating normally. |
| Continuous double-blink | The device is operating normally. (Connected to a USB 1.1 port or hub.) |

Connecting wires to the spring terminals

Use a flathead screwdriver with a blade smaller than 2.3 x 1.0 mm (0.09 x 0.04 in.) to connect wires to the detachable spring terminal connectors. Use 18 to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end when wiring connections.

Insert the screwdriver into the spring clamp activation slot and press a wire into the corresponding connector terminal, then remove the screwdriver to clamp the wire into the terminal.

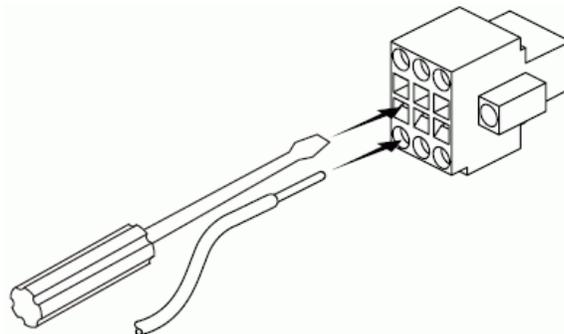


Figure 4. Connecting a wire to the spring terminal connector

TEDS sensor connections

The USB-2404-UI supports class II TEDS "smart" sensors only. Connect the two TEDS lines to **TEDS Data** (T+) and **TEDS Common** (T-), and ensure that neither T+ nor T- is tied in common to any of the signal inputs (terminals 3 through 6).

Signal source connections

You can connect ground-referenced or floating signal sources to the USB-2404-UI. For optimum signal quality, use shielded cables and twisted pair wiring whenever possible.

When making a floating connection between the signal source and the USB-2404-UI, make sure the voltages on the positive and negative connections are within the channel-to-earth voltage range. Refer to the *Specifications* chapter for operating voltages and information about overvoltage protection.

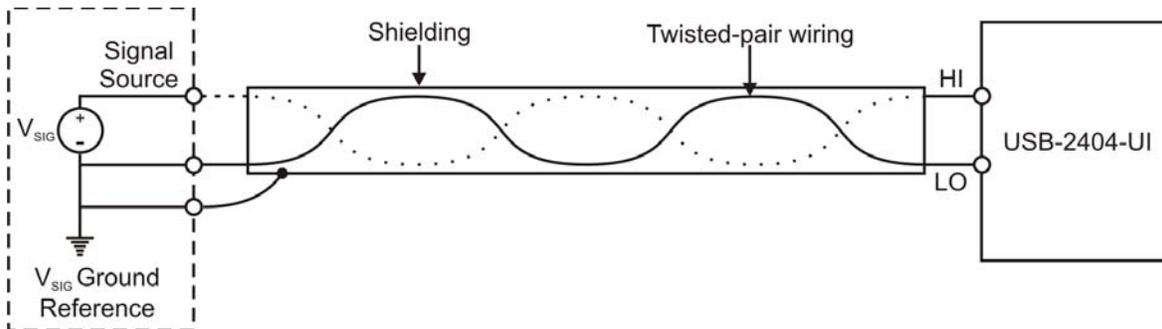


Figure 5. Connecting a grounded signal source

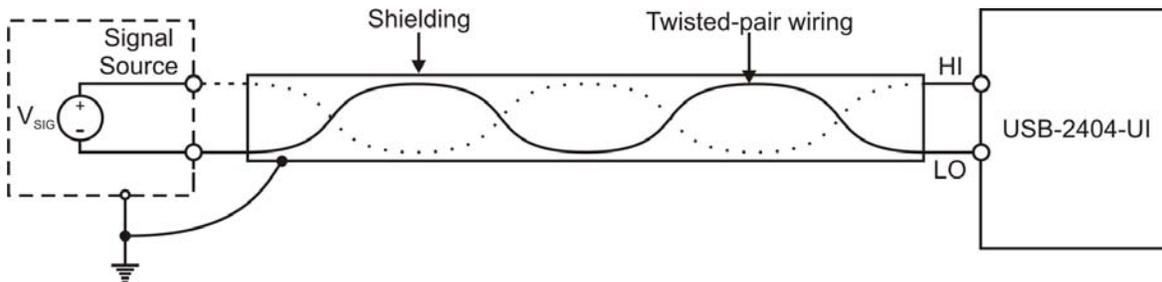


Figure 6. Connecting a floating signal source

Don't connect to signals or use for measurements within category III or IV

Refer to the "Safety voltages" section in the *Specifications* chapter for information about Measurement Categories.

Timing options

The USB-2404-UI supports four timing options. Each option is optimized for different types of applications by using different ADC conversion times.

- **High Speed:** optimized for high-speed applications at the expense of noise rejection.
- **Best 60 Hz Rejection:** optimized for rejection of 60 Hz noise.
- **Best 50 Hz Rejection:** optimized for rejection of 50 Hz noise.
- **High Resolution:** optimized for maximum overall noise rejection, and provides a good rejection of both 50 Hz and 60 Hz noise.

Refer to the analog input specifications for the conversion time and rejection ratio of each option.

USB-2404-UI circuitry

Analog input circuitry

The USB-2404-UI is channel-to-channel isolated. Four 24-bit analog-to-digital converters (ADCs) simultaneously sample all four analog input channels. An excitation circuit is enabled for all input modes that require excitation. The ADC and excitation circuits are reconfigured in each mode to accommodate each sensor type. Figure 7 shows the input circuitry for one channel.

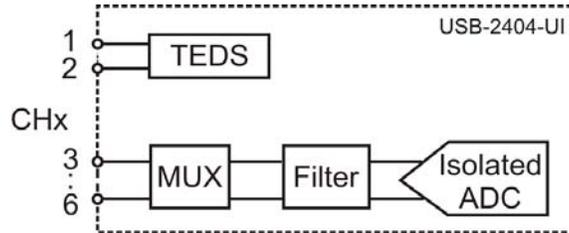


Figure 7. Input circuitry for one channel

Voltage and current modes

In voltage and current modes, connect the signal source to the USB-2404-UI across the HI and LO terminals. The current is computed from the voltage that the ADC measures across an internal shunt resistor. Voltage and current mode connections are shown in Figure 8.

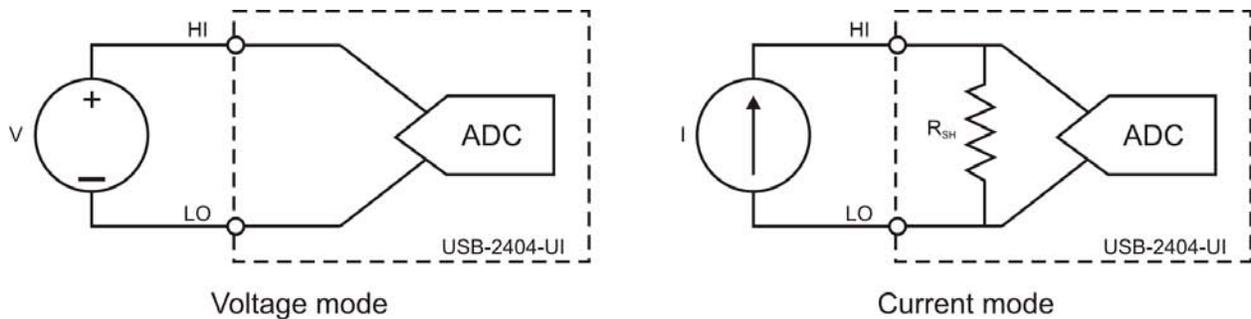


Figure 8. Voltage and current mode connections

4-wire resistance and 4-wire RTD modes

4-wire resistance and 4-wire RTD modes source a current which varies based on the resistance of the load between the EX+ and EX- terminals. The measured resistance is calculated from the resulting voltage reading.

These modes are not affected by lead wire resistance, because a negligible amount of current flows across the HI and LO terminals due to the high impedance of the ADC. 4-wire resistance and 4-wire RTD mode connections are shown in Figure 9.

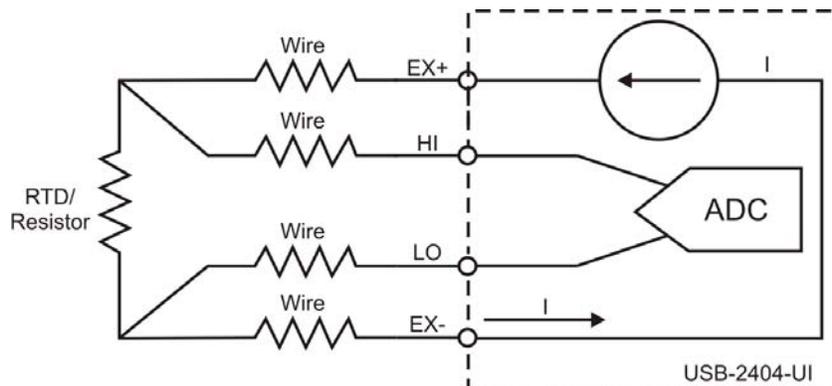


Figure 9. 4-wire resistance and 4-wire RTD mode connections

3-wire RTD mode

3-wire RTD mode sources a current which varies based on the resistance of the load between the EX+ and EX- terminals. This mode compensates for lead wire resistance in hardware if all lead wires have the same resistance. A gain of 2x is applied to the voltage across the negative lead wire. The ADC uses this voltage as the negative reference to cancel the resistance error across the positive lead wire. 3-wire RTD mode connections are shown in Figure 10.

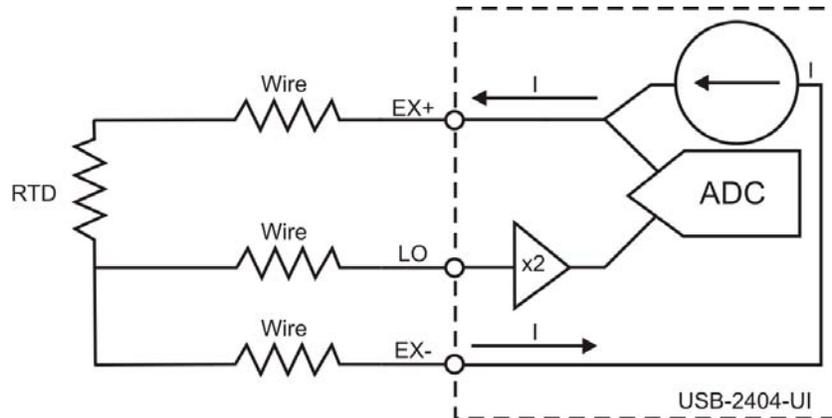


Figure 10. 3-wire RTD mode connections

2-wire resistance and quarter-bridge modes

In 2-wire resistance and quarter-bridge modes, connect the two ends of the resistor or gauge to the USB-2404-UI across the HI and LO terminals. These modes source a current which varies based on the resistance of the load between the HI and LO terminals. The resulting resistance is calculated from the voltage measurement. 2-wire and quarter-bridge modes do not compensate for lead wire resistance. 2-wire resistance and quarter-bridge mode connections are shown in Figure 11.

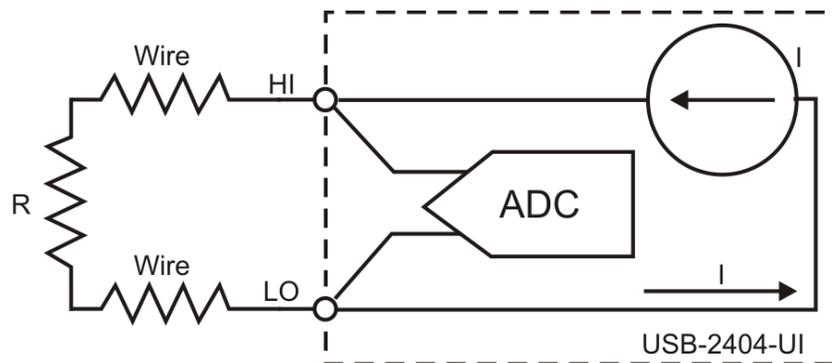


Figure 11. 2-wire resistance and quarter-bridge mode connections

Half-bridge and full-bridge modes

Half-bridge and full-bridge modes use the internal voltage excitation to set the input range of the ADC, and return voltage readings that are proportional to the excitation level. The internal excitation voltage is nominally 2.5 V, but it can vary based on the resistance of the sensor. Refer to the *Specifications* chapter for more information about excitation levels.

In half-bridge mode, the HI input is referenced to EX-. In full-bridge mode, the ADC reads the HI and LO inputs differentially.

Half-bridge and full-bridge mode connections are shown in Figure 12. The dotted lines in the figure represent the portion of the circuit that is only connected in full-bridge mode.

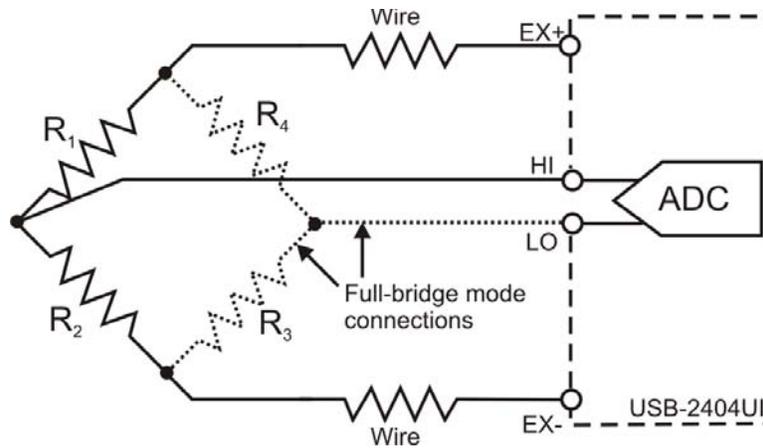


Figure 12. Half-bridge and full-bridge mode connections

Thermocouple mode

In thermocouple mode, connect the positive end of the thermocouple to HI, and the negative end of the thermocouple to LO. This mode uses the ± 1.25 mV range of the ADC to return a voltage reading. Use shielded cables and twisted pair wiring, and ground the shielded cables.

Each channel has a built-in thermistor for cold-junction compensation (CJC) calculations. For improved CJC sensor accuracy, operate the USB-2404-UI in a stable temperature environment, and avoid placing heat sources near the device or its connectors. Open thermocouple detection is not supported. Refer to the *Specifications* chapter for more information about accuracy. Thermocouple mode connections are shown in Figure 13.

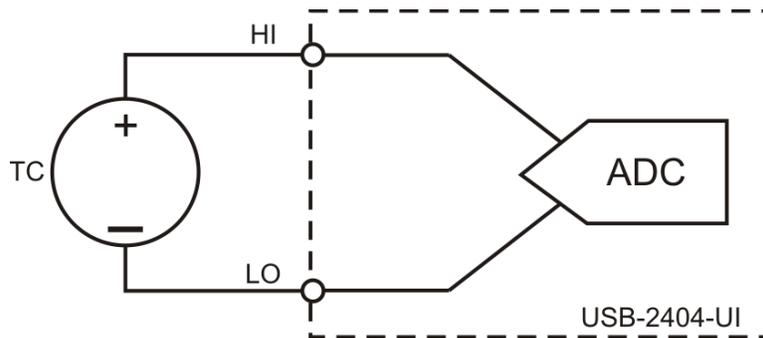


Figure 13. Thermocouple mode connections

Excitation protection

The USB-2404-UI excitation circuit is protected from overcurrent and overvoltage fault conditions. The circuit is automatically disabled in the event of a fault condition. Whenever possible, channels automatically recover after the fault is removed.

Specifications

All specifications are subject to change without notice.
Typical for the range 0 to 60 °C unless otherwise noted.

Analog input

Table 1. Analog input specifications

| Parameter | Conditions | Specification |
|--|---|---|
| Number of channels | | 4 |
| A/D converter resolution | | 24-bit |
| A/D converter type | | Delta-Sigma with analog pre-filtering |
| Sampling mode | | Simultaneous |
| TEDS sensor type supported | | IEEE 1451.4 TEDS Class II (interface) |
| Input mode | | <ul style="list-style-type: none"> ▪ Voltage ▪ Current ▪ Resistance (4-wire and 2-wire) ▪ RTD (3-wire and 4-wire) ▪ Thermocouple ▪ Quarter-bridge ▪ Half-bridge ▪ Full-bridge |
| Conversion time (No channels in TC mode) | High speed | 10 ms for all channels |
| | Best 60 Hz rejection | 110 ms for all channels |
| | Best 50 Hz rejection | 130 ms for all channels |
| | High resolution | 500 ms for all channels |
| Conversion time (One or more channels in TC mode) | High speed | 20 ms for all channels |
| | Best 60 Hz rejection | 120 ms for all channels |
| | Best 50 Hz rejection | 140 ms for all channels |
| | High resolution | 510 ms for all channels |
| Overvoltage protection | Terminals 1 and 2 | ±30 V |
| | Terminals 3 through 6, across any combination | ±60 V |
| Input impedance | Voltage mode (±60 V, ±15 V, ±4 V) | 1 MΩ |
| | Current mode | <40 Ω |
| | All other modes | >1 GΩ |
| Input bias current | | <1 nA |
| Integral non-linearity (INL) | | ±15 ppm |
| Common mode rejection ratio (CMRR) | | >100 dB |
| Normal mode rejection ratio (NMRR) | Best 60 Hz rejection | 90 dB at 60 Hz |
| | Best 50 Hz rejection | 80 dB at 50 Hz |
| | High resolution | 65 dB at 50 Hz and 60 Hz |

Input mode ranges

Table 2. Input mode range specifications

| Input mode | Nominal range(s) | Actual range(s) |
|------------|-----------------------------------|-----------------------------------|
| Voltage | ±60 V, ±15 V, ±4 V, ±1 V, ±125 mV | ±60 V, ±15 V, ±4 V, ±1 V, ±125 mV |

| | | |
|------------------------------|-----------------------|--------------------------|
| Current | ±25 mA | ±25 mA |
| 4-wire and 2-wire resistance | 10 kΩ, 1 kΩ | 10.5 kΩ, 1.05 kΩ |
| Thermocouple | ±125 mV | ±125 mV |
| 4-wire and 3-wire RTD | Pt 1000, Pt 100 | 5.05 kΩ, 505 Ω |
| Quarter-bridge | 350 Ω, 120 Ω | 390 Ω, 150 Ω |
| Half-bridge | ±500 mV/V | ±500 mV/V |
| Full-bridge | ±62.5 mV/V, ±7.8 mV/V | ±62.5 mV/V, ±7.8125 mV/V |

Accuracy

Table 3. Accuracy specifications

| Mode, range | Gain error (percent of reading) | Offset error (ppm of range) |
|--|--|-----------------------------|
| | Typical 25 °C, ±5 °C, –40 to 70 °C maximum | |
| Voltage, ±60 V | ±0.3, ±0.4 | ±20, ±50 |
| Voltage, ±15 V | ±0.3, ±0.4 | ±60, ±180 |
| Voltage, ±4 V | ±0.3, ±0.4 | ±240, ±720 |
| Voltage, ±1 V | ±0.1, ±0.18 | ±15, ±45 |
| Voltage/Thermocouple, ±125 mV | ±0.1, ±0.18 | ±120, ±360 |
| Current, ±25 mA | ±0.1, ±0.6 | ±30, ±100 |
| 4-wire and 2-wire (note 1) resistance, 10 kΩ | ±0.1, ±0.5 | ±120, ±320 |
| 4-wire and 2-wire (note 1) resistance, 1 kΩ | ±0.1, ±0.5 | ±1200, ±3200 |
| 4-wire and 3-wire RTD, Pt 1000 | ±0.1, ±0.5 | ±240, ±640 |
| 4-wire and 3-wire RTD, Pt 100 | ±0.1, ±0.5 | ±2400, ±6400 |
| Quarter-bridge, 350 Ω | ±0.1, ±0.5 | ±2400, ±6400 |
| Quarter-bridge, 120 Ω | ±0.1, ±0.5 | ±2400, ±6400 |
| Half-bridge, ±500 mV/V | ±0.03, ±0.07 | ±300, ±450 |
| Full-bridge, ±62.5 mV/V | ±0.03, ±0.08 | ±300, ±1000 |
| Full-bridge, ±7.8 mV/V | ±0.03, ±0.08 | ±2200, ±8000 |
| Cold-junction compensation sensor accuracy | | ±1 °C, typical |

Note 1: 2-wire resistance mode accuracy depends on the lead wire resistance. This table assumes 0 Ω of lead wire resistance.

Stability

Table 4. Stability specifications

| Measurement conditions | Gain drift (ppm of reading/ °C) | Offset drift (ppm of range/ °C) |
|-------------------------------------|---------------------------------|---------------------------------|
| Voltage, ±60 V | ±20 | ±0.2 |
| Voltage, ±15 V | ±20 | ±0.8 |
| Voltage, ±4 V | ±20 | ±3.2 |
| Voltage, ±1 V | ±10 | ±0.2 |
| Voltage/thermocouple, ±125 mV | ±10 | ±1.6 |
| Current, ±25 mA | ±15 | ±0.4 |
| 4-wire and 2-wire resistance, 10 kΩ | ±15 | ±3 |
| 4-wire and 2-wire resistance, 1 kΩ | ±15 | ±30 |
| 4-wire and 3-wire RTD, Pt 1000 | ±15 | ±6 |
| 4-wire and 3-wire RTD, Pt 100 | ±15 | ±60 |
| Quarter-bridge, 350 Ω | ±15 | ±120 |
| Quarter-bridge, 120 Ω | ±15 | ±240 |
| Half-bridge, ±500 mV/V | ±3 | ±20 |

| | | |
|------------------------------|---------|----------|
| Full-bridge, ± 62.5 mV/V | ± 3 | ± 20 |
| Full-bridge, ± 7.8 mV/V | ± 3 | ± 20 |

Input noise

Table 5. Input noise (ppm of rangers) specifications

| Mode, range | Conversion time | | | |
|---|-----------------|-------------------------|-------------------------|-----------------|
| | High speed | Best of 60 Hz rejection | Best of 50 Hz rejection | High resolution |
| Voltage, ± 60 V | 7.6 | 1.3 | 1.3 | 0.5 |
| Voltage, ± 15 V | 10.8 | 1.9 | 1.9 | 0.7 |
| Voltage, ± 4 V | 10.8 | 2.7 | 2.7 | 1.3 |
| Voltage, ± 1 V | 7.6 | 1.3 | 1.3 | 0.5 |
| Voltage/Thermocouple, ± 125 mV | 10.8 | 1.9 | 1.9 | 1.0 |
| Current, ± 25 mA | 10.8 | 1.9 | 1.9 | 1.0 |
| 4-wire and 2-wire resistance, 10 k Ω | 4.1 | 1.3 | 0.8 | 0.3 |
| 4-wire and 2-wire resistance, 1 k Ω | 7.1 | 1.8 | 1.2 | 0.7 |
| 4-wire and 3-wire RTD, Pt 1000 | 7.6 | 1.7 | 1.1 | 0.4 |
| 4-wire and 3-wire RTD, Pt 100 | 10.8 | 1.9 | 1.9 | 0.9 |
| Quarter-bridge, 350 Ω | 5.4 | 1.0 | 1.0 | 0.7 |
| Quarter-bridge, 120 Ω | 5.4 | 1.0 | 1.0 | 0.7 |
| Half-bridge, ± 500 mV/V | 3.8 | 0.5 | 0.5 | 0.2 |
| Full-bridge, ± 62.5 mV/V | 5.4 | 1.0 | 1.0 | 0.8 |
| Full-bridge, ± 7.8 mV/V | 30 | 4.7 | 4.7 | 2.3 |

Excitation level

Table 6. Half-bridge and full-bridge mode excitation level specifications

| Measurement conditions | Load resistance (Ω) | Excitation (V) |
|------------------------|------------------------------|----------------|
| Half-bridge | 700 | 2.5 |
| Half-bridge | 240 | 2.0 |
| Full-bridge | 350 | 2.7 |
| Full-bridge | 120 | 2.2 |

Table 7. Resistance, RTD, and quarter-bridge mode excitation level specifications

| Load resistance (Ω) | Excitation (mV) |
|------------------------------|-----------------|
| 120 | 50 |
| 350 | 150 |
| 1,000 | 430 |
| 10,000 | 2,200 |

Power

Table 8. Power specifications

| Parameter | Specification |
|------------------------------|-----------------|
| Current consumption from USB | 500 mA, maximum |

Bus interface

Table 9. Bus interface specifications

| Parameter | Specification |
|-------------------|------------------|
| USB specification | USB 2.0 Hi-Speed |

Environmental

Table 10. Environmental specifications

| Parameter | Specification |
|-----------------------------|------------------------------|
| Operating temperature range | 0 to 60 °C |
| Storage temperature range | –40 to 85 °C |
| Operating humidity | 10 to 90% RH, non-condensing |
| Storage humidity | 5 to 95% RH, non-condensing |
| Maximum altitude | 2000 meter (6562 feet) |

Note 2: The USB-2404-UI is intended for indoor use only, but may be used outdoors if installed in a suitable enclosure

Mechanical

Table 11. Mechanical specifications

| Parameter | Specification |
|------------|---|
| Dimensions | 5.27" (L) x 5.64" (W) x 1.54" (H) (134 mm x 143 mm x 39 mm) |
| Weight | 1.25 lbs (567 grams) |

Safety voltages

Connect only voltages that are within the limits specified in this table.

Table 12. Safety specifications

| Parameter | Conditions | Specification |
|-----------------------------------|------------|--|
| Channel-to-earth ground isolation | Continuous | 250 VAC, Measurement Category II (Note 3) |
| | Withstand | 2300 VAC, verified by a 5 second dielectric withstand test |
| Channel-to-channel isolation | Continuous | 250 VAC, Measurement Category II (Note 3) |
| | Withstand | 1390 VAC, verified by a 5 second dielectric withstand test |

Note 3: Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example 115 V for US or 230 V for Europe.

Caution! Do *not* connect the device to signals or use for measurements within Measurement Categories III or IV.

Spring terminal connectors

Table 13. Spring terminal specifications

| | |
|------------------------|--|
| Connector type | Four 6-position spring terminal connectors |
| Spring terminal wiring | 18 to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end. |

Table 14. Signal names

| Terminal number | Signal name | Signal description |
|-----------------|-----------------|-------------------------------------|
| 1 | T+ | TEDS Data |
| 2 | T- | TEDS Common |
| 3 | EX+/HI (Note 4) | Positive excitation or input signal |
| 4 | HI | Positive input signal |
| 5 | EX-/LO (Note 4) | Negative excitation or input signal |
| 6 | LO | Negative input signal |

Note 4: Depending on the input mode, terminals 3 and 5 are either excitation signals or input signals.

Table 15. Terminal assignments per input mode

| Input mode | Signal terminals | | | | | |
|-------------------|------------------|----|-----|----|-----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Voltage | T+ | T- | — | HI | LO | — |
| Current | T+ | T- | HI | — | LO | — |
| 4-wire resistance | T+ | T- | EX+ | HI | EX- | LO |
| 2-wire resistance | T+ | T- | HI | — | LO | — |
| Thermocouple | T+ | T- | — | HI | LO | — |
| 4-wire RTD | T+ | T- | EX+ | HI | EX- | LO |
| 3-wire RTD | T+ | T- | EX+ | — | EX- | LO |
| Quarter-bridge | T+ | T- | HI | — | LO | — |
| Half-bridge | T+ | T- | EX+ | HI | EX- | — |
| Full-bridge | T+ | T- | EX+ | HI | EX- | LO |

Accessory products

Table 16. Accessory products

| | |
|---------|---|
| ACC-164 | 6-position spring terminal connector block (quantity four) |
| ACC-176 | Backshell for use with the ACC-164 6-position spring terminal connector blocks. Provides strain relief and operator protection from high-voltage signals (quantity four). |

CE Declaration of Conformity

Manufacturer: Measurement Computing Corporation
Address: 10 Commerce Way
Suite 1008
Norton, MA 02766
USA
Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

USB-2404-UI

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EC EMC Directive 2004/108/EC: General Requirements, EN 61326-1:2006 (IEC 61326-1:2005).

Emissions:

- EN 55011 (2007) / CISPR 11(2003): Radiated emissions: Group 1, Class B
- EN 55011 (2007) / CISPR 11(2003): Conducted emissions: Group 1, Class B

Immunity: EN 61326-1:2006, Table 3.

- IEC 61000-4-2 (2001): Electrostatic Discharge immunity.
- IEC 61000-4-3 (2002): Radiated Electromagnetic Field immunity.

To maintain compliance to the standards of this declaration, the following conditions must be met.

- The host computer, peripheral equipment, power sources, and expansion hardware must be CE compliant.
- All I/O cables must be shielded, with the shields connected to ground.
- I/O cables must be less than 3 meters (9.75 feet) in length.
- The host computer must be properly grounded.
- The host computer must be USB 2.0 compliant.
- Equipment must be operated in a controlled electromagnetic environment as defined by Standards EN 61326-1:2006, or IEC 61326-1:2005.

Note: Data acquisition equipment may exhibit noise or increased offsets when exposed to high RF fields (>1V/m) or transients.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in April, 2009. Test records are outlined in Chomerics Test Report #EMI5285.09.

We hereby declare that the equipment specified conforms to the above Directives and Standards.



Carl Haapaoja, Director of Quality Assurance

Measurement Computing Corporation
10 Commerce Way
Suite 1008
Norton, Massachusetts 02766
(508) 946-5100
Fax: (508) 946-9500
E-mail: info@mccdaq.com
www.mccdaq.com