



MEASUREMENT COMPUTING USB-2020 Ultra High-Speed Simultaneous USB Device User Guide

[Home](#) » [MEASUREMENT COMPUTING](#) » MEASUREMENT COMPUTING USB-2020 Ultra High-Speed Simultaneous USB Device User Guide 

MEASUREMENT COMPUTING USB-2020 Ultra High-Speed Simultaneous USB Device User Guide



Contents

- 1 What you will learn from this user's guide
- 2 Conventions in this user's guide
- 3 Where to find more information
- 4 Introducing the USB-2020
- 5 Functional block diagram
- 6 Installing the USB-2020
 - 6.1 Unpacking
 - 6.2 Installing the software
 - 6.3 Installing the hardware
- 7 Calibrating the hardware
- 8 Board connections
- 9 Functional Details
 - 9.1 Analog input acquisition modes
- 10 Board components
- 11 Signal connections
 - 11.1 Trigger input
- 12 Mechanical drawing
- 13 Specifications
 - 13.1 Analog input
 - 13.2 Analog input calibration
 - 13.3 Digital input/output
- 14 External trigger
 - 14.1 External clock input/output
 - 14.2 Memory
 - 14.3 Power
 - 14.4 Environmental
 - 14.5 Mechanical
 - 14.6 USB
 - 14.7 Signal I/O connectors
- 15 Trademark and Copyright Information
- 16 Documents / Resources
 - 16.1 References
- 17 Related Posts

What you will learn from this user's guide

This user's guide describes the Measurement Computing USB-2020 data acquisition device and lists device specifications.

Conventions in this user's guide

For more information

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-2020 hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: kb.mccdaq.com
- Tech support form: www.mccdaq.com/support/support_form.aspx
- Email: techsupport@mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support

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

Introducing the USB-2020

The USB-2020 is a high-speed data acquisition USB board supported under the Windows® operating system.

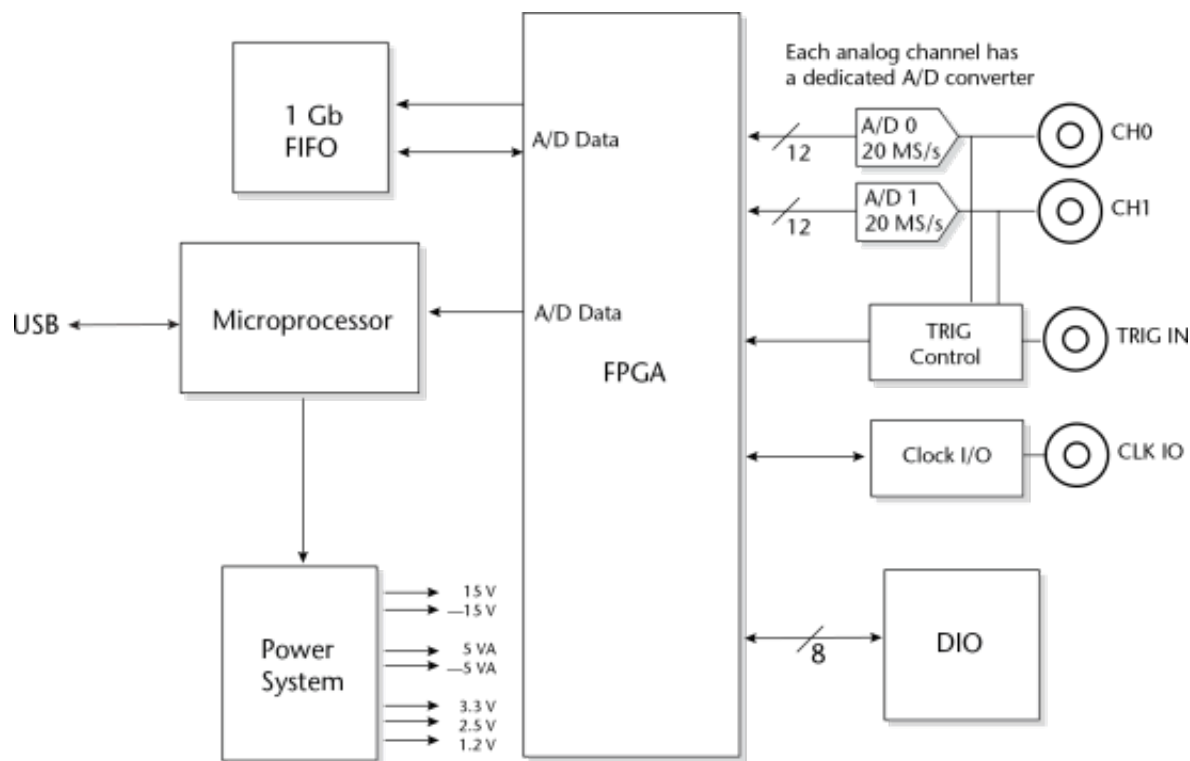
The USB-2020 is compatible with both USB 1.1 and USB 2.0 ports. The speed of the device may be limited when using a USB 1.1 port due to the difference in transfer rates on the USB 1.1 versions of the protocol (low-speed and full-speed).

The USB-2020 device provides the following features:

- two 20 MS/s analog inputs
 - simultaneous sampling
 - 1 A/D per channel
 - 12-bit resolution
 - ± 10 V, ± 5 V, ± 2 V, ± 1 V voltage ranges (software-selectable)
 - 17 MHz input bandwidth
- 64 megasample onboard memory
 - 40 MS/s overall rate to onboard memory when acquiring from both channels (20 MS/s per channel)
 - 8 MS/s throughput to host computer
- Analog and digital triggering (level and edge)
- Analog and digital gating
- Eight digital I/O lines
- Internal or external pacing of analog scans
- Eight digital I/O lines
- BNC connectors and 40-pin auxiliary connector for signal connections

Functional block diagram

USB-2020 functions are illustrated in the block diagram shown here.



Installing the USB-2020

Unpacking

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the device 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.

Contact us immediately if any components are missing or damaged.

Installing the software

Refer to the MCC DAQ Quick Start and the USB-2020 product page on our website for information about the software that supports the device.

Install the software before you install your device

The driver needed to run the USB-2020 is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

Installing the hardware

Before you connect the USB-2020 to your computer, connect the external power supply that was shipped with the device.

Disconnect USB, then power supply

When disconnecting the USB-2020, disconnect the USB cable first, and then disconnect the power supply.

Connecting the external power supply

Refer to Figure 4 on page 12 for the location of the connectors and LEDs mentioned in the following procedure.

Power to the USB-2020 is provided with the 9 VDC external power supply (CB-PWR-9).

Connect the external power supply before connecting the USB cable to the USB-2020 and your computer.

Complete the following steps to connect the power supply to the USB-2020:

1. Connect the external power cord to the USB-2020-power connector.
2. Plug the power supply into a power outlet.

The top (Device Ready) LED is on (blue) when 9 VDC power is supplied the USB-2020 and a USB connection is established. If the voltage supply is less than 7.3 V and/or a USB connection is not established, the Device Ready LED is off.

Connecting the USB-2020

Complete the following steps to connect the USB-2020 to your system:

1. Connect the USB cable that was shipped with the device to the USB connector on the USB-2020.
The USB cable supplied with the USB-2020 has a higher gauge wire (24 AWG minimum VBUS/GND, 28 AWG minimum D+/D-) than generic USB cables, and is required for proper enumeration of the USB-2020.
2. Connect the other end of the USB cable to a USB port on your computer or to an external USB hub that is connected to your computer. The bottom (USB Activity) LED turns on. The USB cable only provides communication to the USB-2020.

If you are running Windows XP and connect the device to a USB 1.1 port, a message displays Your USB device can perform faster if you connect to a USB 2.0 port. You can ignore this message.

The USB-2020 functions properly when connected to a USB 1.1 port, although USB bandwidth is limited.

If the Device Ready LED turns off

If communication is lost between the device and the computer, the Device Ready LED turns off. Disconnect the USB cable from the computer and then reconnect it. This should restore communication, and the Device Ready LED should turn on.

If your system does not detect the USB-2020

If a USB device not recognized message appears when you connect the USB-2020, complete the following steps:

1. Unplug the USB cable from the USB-2020.
2. Unplug the external power cord from the power connector.
3. Plug the external power cord back into the power connector.
4. Plug the USB cable back into the USB-2020.

Your system should now properly detect the USB-2020 hardware. Contact technical support if your system still does not detect the USB-2020.

Removing USB-2020 boards from Windows XP systems

Device Manager may require up to 30 seconds to detect the removal of a USB-2020 board from a Windows XP system with Service Pack 2 installed. This time increases with each additional connected device. If you remove four devices from your system, the time required for Device Manager to update may be almost two minutes.

If you re-attach the USB-2020 to your system before Device Manager updates, the bottom LED does not turn on. Your system does not detect new hardware until Device Manager first detects that hardware has been removed. InstaCal software is unresponsive during this re-detection time. Wait until Device Manager updates with the new hardware before running InstaCal. The USB-2020 is detected by the system when the top (Device Ready) LED is on.

Calibrating the hardware

The Measurement Computing Manufacturing Test department performs the initial factory calibration. The calibration coefficients are stored in non-volatile RAM.

You can use InstaCal to recalibrate the USB-2020. No external equipment or user adjustments are required. At run time, the calibration factors are loaded into system memory and are automatically retrieved each time a different ADC range is specified. A full calibration typically takes less than two minutes.

Before you calibrate the device, turn your computer on and allow at least 30 minutes for the surrounding temperature to stabilize. For best results, calibrate the device immediately before making critical measurements.

The high-resolution analog components on the board are sensitive to temperature. Pre-measurement calibration insures that your device is operating with optimum calibration values.

Board connections

The table below lists the board connector types, applicable cables, and compatible products for the USB-2020.

Board connectors, cables, accessory equipment

| Parameter | Specification |
|---|--|
| Connector types | <ul style="list-style-type: none"> • Four standard BNC female connectors for analog input, clock I/O, and digital trigger input • 40-pin IDC connector |
| Compatible cable for the BNC connectors | Standard BNC cable |
| Compatible cables for the 40-pin IDC connector | C40FF-x: 40-conductor ribbon cable, female both ends, x = length in feet. |
| | C40-37F-x: 40-pin IDC to 37-pin female D connector, x = length in feet. |
| Compatible accessory products using the C40FF-x cable | CIO-MINI40 |
| Compatible accessory products using the C40-37F-x cable | CIO-MINI37 SCB-37 |

Cabling

You can use the CIO-MINI40 screw terminal board and C40FF-x cable for signal connections and termination.

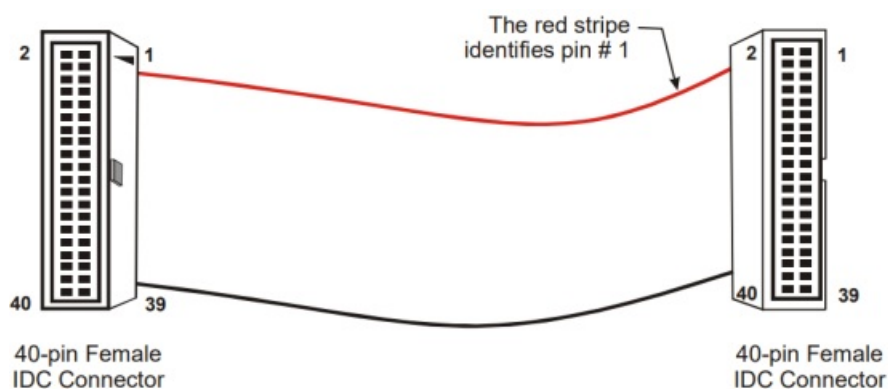


Figure 2. C40FF-x cable

You can use the C40-37F-x or C40F-37M-x cable for connections to 37-pin connectors or boards.

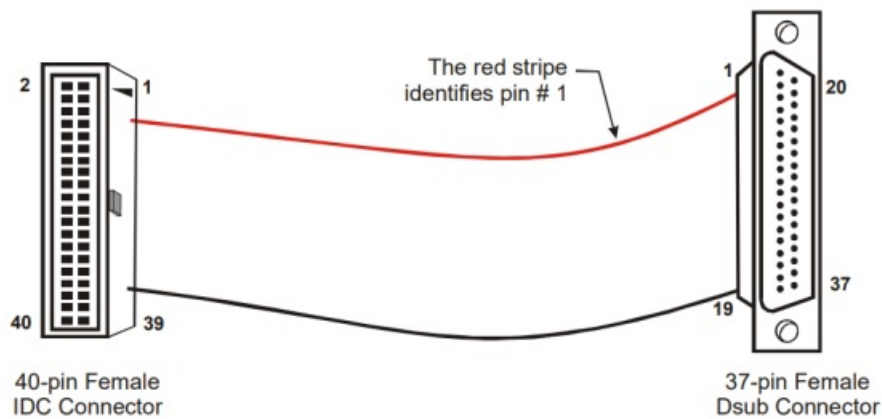


Figure 3. C40-37F-x cable

Field wiring, signal termination and conditioning

You can use the 40-pin CIO-MINI40 universal screw terminal board to terminate field signals and route them into the USB-2020 using the C40FF-x cable:

You can use the following MCC screw terminal boards to terminate field signals and route them into the USB-2020 using the C40-37F-x cable directly:

- CIO-MINI37 – 37-pin universal screw terminal board.
- SCB-37 – 37-conductor, shielded signal connection/screw terminal box

Functional Details

Analog input acquisition modes

The USB-2020 can acquire analog input data in three different modes – software paced, continuous scan (hardware paced), and BURSTIO.

Software paced

In software paced mode, you can acquire one analog sample at a time. You initiate the A/D conversion by calling a software command. The analog value is converted to digital and returned to the computer. You repeat this procedure until you have the total number of samples that you want from one channel.

The typical throughput sample rate in software paced mode is 4 kS/s (system-dependent).

Continuous scan (hardware paced)

Continuous scan mode enables data to be directly transferred to the host computer during acquisition. The maximum rate in continuous scan mode is 8 MS/s for all acquired data (one channel or two channels). The maximum rate achieved depends on the host computer.

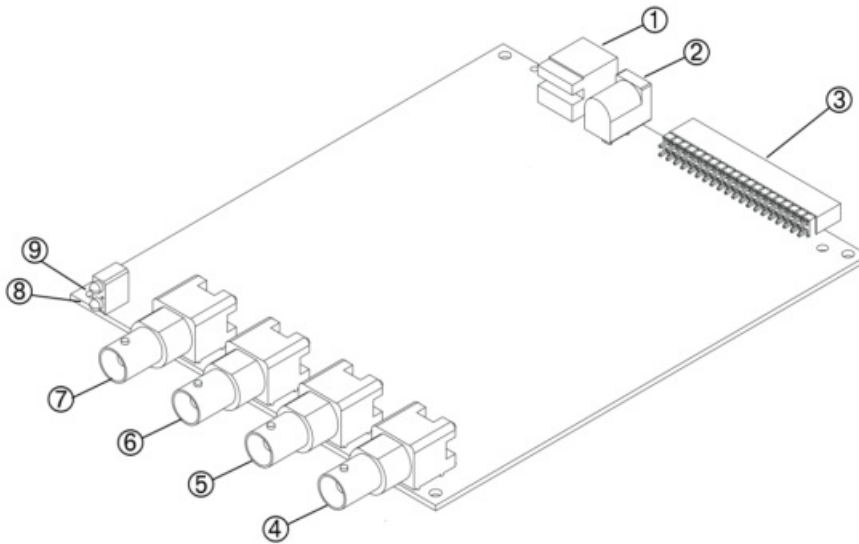
BURSTIO

When using BURSTIO, the USB-2020 can acquire data at the maximum rate of 20 MS/s per channel to the internal memory buffer (up to 64 megasamples)

The acquired data is read from the FIFO and transferred to a user buffer in the computer. You can initiate a single acquisition sequence of one to two channels with either a software command or an external hardware trigger event.

When BURSTIO is enabled, scans are limited to the depth of the onboard memory, as the data is acquired at a rate faster than it can be transferred to the computer. Time must be allowed between scans for the acquisition and the transfer of the data.

Board components



1. USB connector
2. Clock I/O BNC connector (CLK IO)
3. Analog input channel 0 BNC connector (CH0)
4. External power connector
5. External digital trigger input BNC connector (TRIG IN)
6. USB Activity LED
7. 40-pin IDC auxiliary connector
8. Analog input channel 1 BNC connector (CH1)
9. Device Ready LED

BNC connectors

The USB-2020 has four BNC connectors that provide connections for the following signals:

- Two single-ended analog inputs
- One external digital trigger input
- One clock input/output

The external digital trigger input signal is also available on the 40-pin IDC connector.

Status LEDs

The Device Ready LED turns on after the device is enumerated by the system and is associated with a hardware

driver.

The USB Activity LED turns on when the USB-2020 is transmitting or receiving data.

USB connector

The USB connector provides power to the USB-2020 and communication with the host computer.

External power connector

The USB-2020 requires external power. Connect the CB-PWR-9 power supply to the external power connector. This power supply provides 9 VDC, 15 A power, and plugs into a standard 120 VAC outlet.

40-pin IDC auxiliary connector (J9)

The 40-pin auxiliary connector provides the following connections for all I/O signals except for analog input and clock I/O:

- Eight digital I/O (DIO0 to DIO7)
- Digital trigger input (TRIG IN)
- 12 ground connections (GND)
- Two +5V power outputs (+VO)

The signals that are available on the 40-pin IDC connector are listed below. Connect signals on the 40-pin IDC connector using a C40FF-x cable or C40-37F-x cable.

40-pin IDC connector pinout

| Pin Description | Signal Name | Pin | | | Pin | Signal Name | Pin Description |
|-------------------|-------------|-----|---|---|-----|-------------|--------------------------------|
| Ground | GND | 1 | • | • | 2 | +VO | Power output |
| Ground | GND | 3 | • | • | 4 | N/C | Do not connect |
| Digital I/O bit 7 | DIO7 | 5 | • | • | 6 | N/C | Do not connect |
| Digital I/O bit 6 | DIO6 | 7 | • | • | 8 | N/C | Do not connect |
| Digital I/O bit 5 | DIO5 | 9 | • | • | 10 | TRIG IN | External digital trigger input |

| | | | | | | | |
|-------------------|------|----|---|---|----|-----|----------------|
| Digital I/O bit 4 | DIO4 | 11 | • | • | 12 | GND | Ground |
| Digital I/O bit 3 | DIO3 | 13 | • | • | 14 | GND | Ground |
| Digital I/O bit 2 | DIO2 | 15 | • | • | 16 | GND | Ground |
| Digital I/O bit 1 | DIO1 | 17 | • | • | 18 | GND | Ground |
| Digital I/O bit 0 | DIO0 | 19 | • | • | 20 | GND | Ground |
| Ground | GND | 21 | • | • | 22 | N/C | Do not connect |
| Do not connect | N/C | 23 | • | • | 24 | N/C | Do not connect |
| Ground | GND | 25 | • | • | 26 | N/C | Do not connect |
| Do not connect | N/C | 27 | • | • | 28 | N/C | Do not connect |
| Ground | GND | 29 | • | • | 30 | N/C | Do not connect |
| Do not connect | N/C | 31 | • | • | 32 | N/C | Do not connect |
| Ground | GND | 33 | • | • | 34 | N/C | Do not connect |
| Power output | +VO | 35 | • | • | 36 | N/C | Do not connect |
| Ground | GND | 37 | • | • | 38 | N/C | Do not connect |
| Do not connect | N/C | 39 | • | • | 40 | N/C | Do not connect |

40-pin to 37-pin signal mapping

Signal mapping on the C40-37F-x cable is not a one-to-one ratio. The table below lists the signals on the 40-pin end and the associated signals on the 37-pin end.

Signal mapping on the C40-37F-x cable

| 40-pin cable end | | 37-pin cable end | |
|------------------|-------------|------------------|-------------|
| Pin | Signal Name | Pin | Signal Name |
| 1 | GND | 1 | GND |
| 2 | +VO | 20 | +VO |
| 3 | GND | 2 | GND |
| 4 | N/C | 21 | N/C |
| 5 | DIO7 | 3 | DIO7 |
| 6 | N/C | 22 | N/C |
| 7 | DIO6 | 4 | DIO6 |
| 8 | N/C | 23 | N/C |
| 9 | DIO5 | 5 | DIO5 |
| 10 | TRIG IN | 24 | TRIG IN |
| 11 | DIO4 | 6 | DIO4 |
| 12 | GND | 25 | GND |

| | | | |
|----|------|----|------|
| 13 | DIO3 | 7 | DIO3 |
| 14 | GND | 26 | GND |
| 15 | DIO2 | 8 | DIO2 |
| 16 | GND | 27 | GND |
| 17 | DIO1 | 9 | DIO1 |
| 18 | GND | 28 | GND |
| 19 | DIO0 | 10 | DIO0 |
| 20 | GND | 29 | GND |
| 21 | GND | 11 | GND |
| 22 | N/C | 30 | N/C |
| 23 | N/C | 12 | N/C |
| 24 | N/C | 31 | N/C |
| 25 | GND | 13 | GND |
| 26 | N/C | 32 | N/C |
| 27 | N/C | 14 | N/C |
| 28 | N/C | 33 | N/C |

| | | | |
|----|-----|----|-----|
| 29 | GND | 15 | GND |
| 30 | N/C | 34 | N/C |
| 31 | N/C | 16 | N/C |
| 32 | N/C | 35 | N/C |
| 33 | GND | 17 | GND |
| 34 | N/C | 36 | N/C |
| 35 | +VO | 18 | +VO |
| 36 | N/C | 37 | N/C |
| 37 | GND | 19 | GND |
| 38 | N/C | | |
| 39 | N/C | | |
| 40 | N/C | | |

Signal connections

Analog input

The USB-2020 has two single-ended simultaneous sampling analog inputs that provide sampling at rates of up to 20 MS/s to internal memory when using BURSTIO and at rates of up to 8 MS/s (system-dependent) to the host computer in continuous scan mode. The input ranges are software-selectable for ± 10 V, ± 5 V, ± 2 V, ± 1 V.

When using BURSTIO, the internal memory can store up to 64 mega samples at the maximum rate for transfer to the computer after the acquisition is complete. Data is transferred to the host computer at a maximum rate of 8 MS/s (system-dependent).

Buffer size limitations on Windows systems

When creating very large buffers in Windows, you may receive the message “The requested amount of Windows page-locked memory is not available” when you try to start a scan. This error occurs when there is enough memory to create the buffer, but the memory cannot be locked down. For example, the driver can only lock a maximum buffer size of 67,107,800 bytes (33,553,900 samples) on Windows XP systems. A workaround for this is available when BURSTIO is enabled, allowing you to transfer the entire 64 MS of data from the onboard memory to the Windows buffer. Refer to the USB-2020 topic in the UL Help for more information.

You can pace analog input operations with the internal A/D clock or with an external clock source. When using an external input scan clock, connect the clock source to the CLK IO BNC connector.

For more information about signal connections

For more information about signal connections, refer to the Guide to DAQ Signal Connections (available for download from www.mccdaq.com/support/DAQ-Signal-Connections.aspx.)

External clock I/O

USB-2020 analog input scanning operations can be paced with the internal A/D clock or with an external clock source. The CLK IO connector can be configured through software for input (default) for external pacing, or for output to pace a connected device.

Digital I/O

You can connect eight digital I/O lines to DIO0 through DIO7 on the 40-pin IDC connector. When a bit is configured for input, it can detect the state of any TTL-level input.

Digital input voltage ranges of up to 0 to 15 V are permitted, with thresholds of 0.8 V (low) and 2.0 V (high).

Each DIO channel is an open-drain, which can sink up to 150 mA for direct drive applications when used as an output.

Figure 5 shows an example of a typical digital output connection.

Typical DIO channel

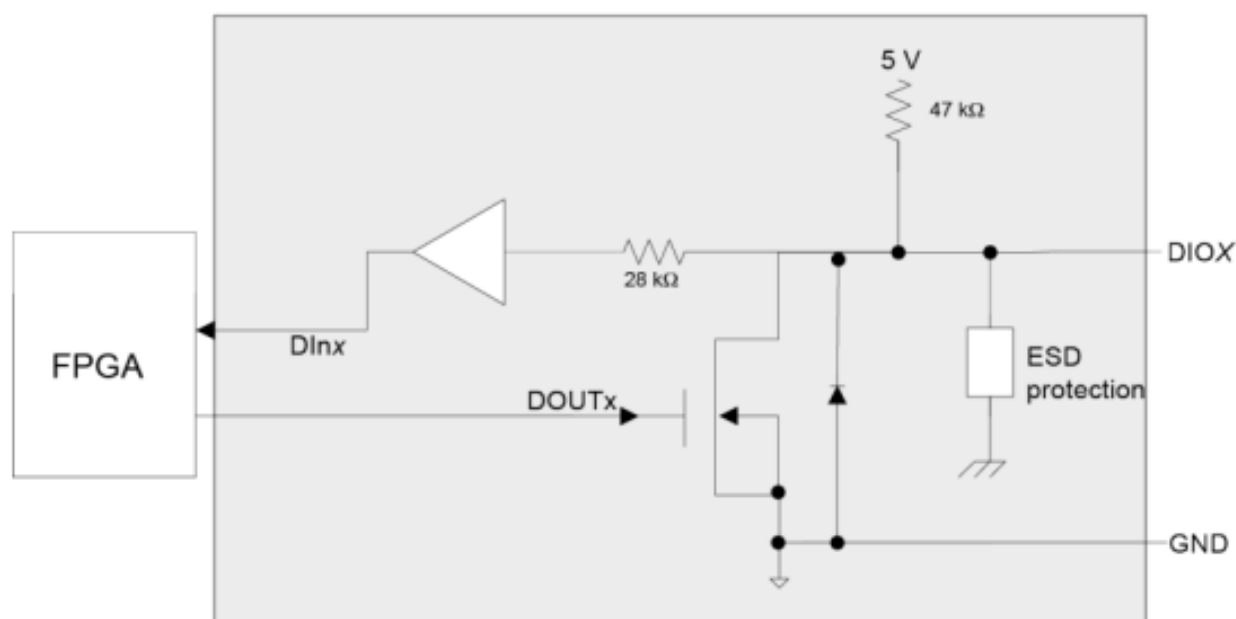


Figure 5. Digital output connection

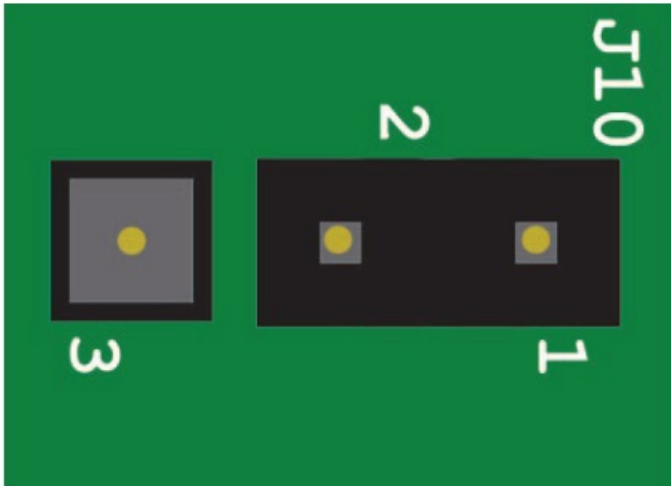
External pull-up capability

Inputs are pulled high by default to 5 V through 47 k Ω resistors on the circuit board. The pull-up voltage is common to all 47 k Ω resistors.

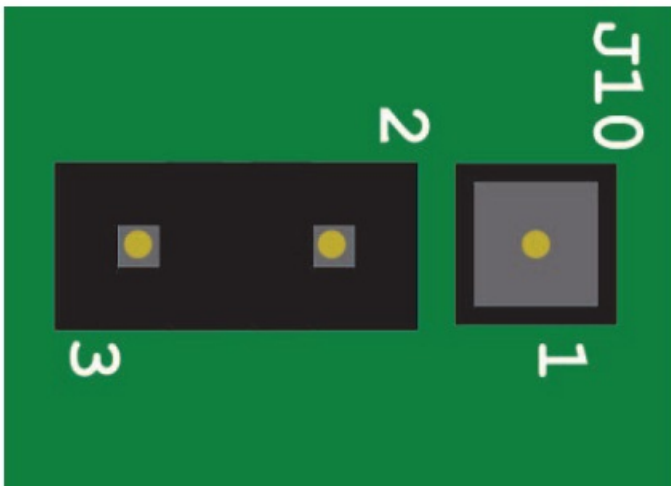
You can configure the pull-up/pull-down state by changing the placement of the shorting block located at the three-pin header J10. Pull-up is the default factory configuration

Figure 6. Pull-up and pull-down jumper configurations (J10)

Pull-up default configuration (factory default)



Pull-down configuration



An external pull-up resistor can be used to pull the DIO bit up to a voltage that exceeds the internal 5 V pull-up voltage (15 V maximum). Be aware that this would place the 47 k internal pull-up resistor in a parallel resistance configuration that could offset the logic high voltage level.

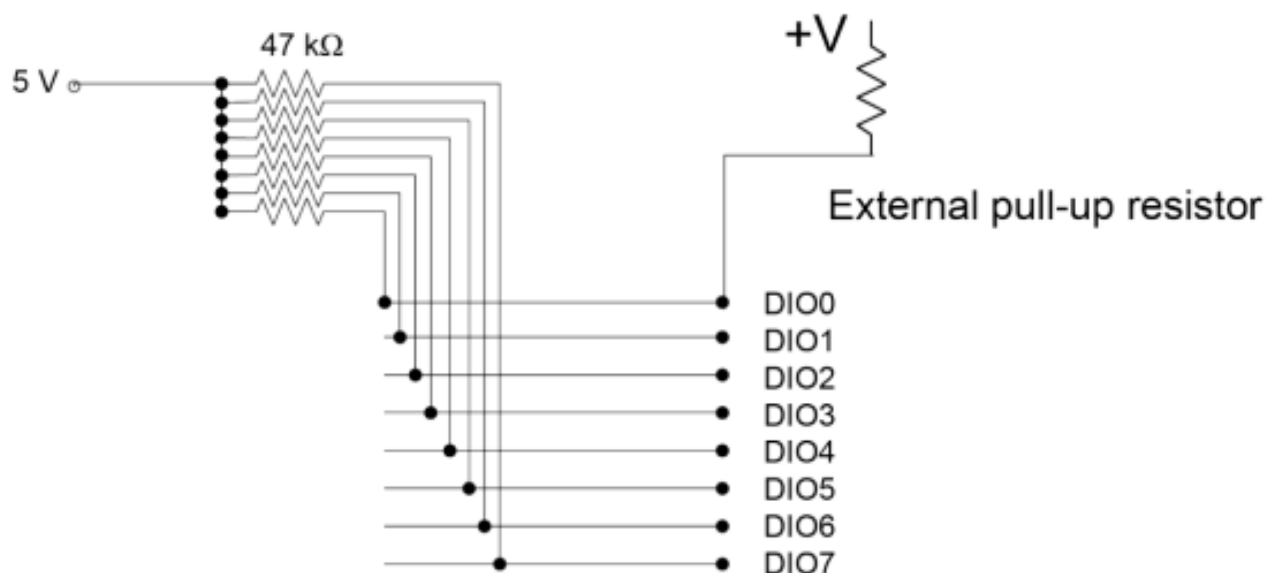


Figure 7. Digital I/O external resistor configuration

Trigger input

Both the TRIG IN BNC connector and the TRIG IN IDC pin are external digital trigger/gate inputs that you can configure through software.

An analog scan can have a trigger or a gate, but not both. For example, you cannot use an analog trigger and use the TRIG IN BNC connector to gate at the same time.

A trigger or gate can be digital or analog.

- Digital triggers can be configured for rising or falling edge, or for high or low level.

USB-2020 User's Guide Functional Details

- Analog triggers can be configured for software-selectable high or low level, or for rising or falling edge with software-selectable hysteresis.
- Digital gates can be configured for high or low level.
- Analog gates can be configured for software-selectable high or low level, or for in or out of software selectable window.

Each configuration is explained below:

- High or low level
- Trigger or gate an acquisition when an input signal is higher or lower than the specified voltage.
- Rising or falling edge
- Trigger an acquisition when input signals cross a specified voltage (rising or falling)
- Window
- Gate an acquisition when the input signal is within or outside two specified voltages (in/out of window)
- Hysteresis
- After the input signal has passed through one specified voltage, trigger an acquisition when the input signal

passes through a second voltage (positive or negative). For example, once the signal goes below 5 V, a rising edge that crosses 4 V must occur to trigger an acquisition.

Mechanical drawing

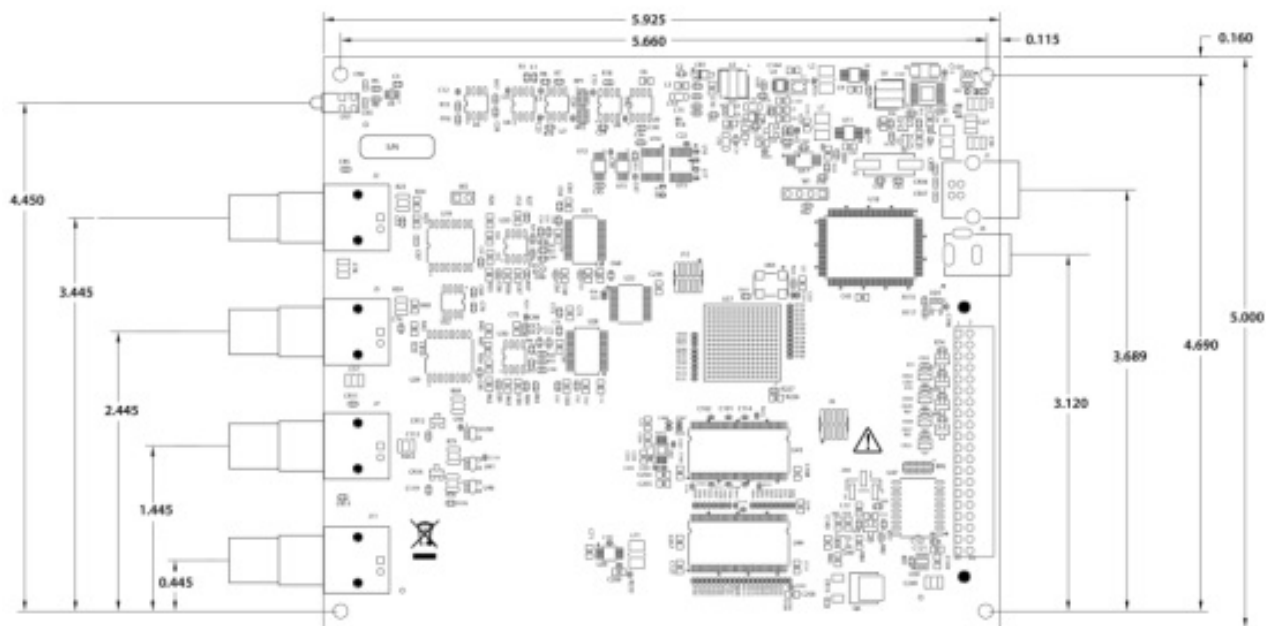


Figure 8. USB-2020 circuit board dimensions

Specifications

All specifications are subject to change without notice.
Typical at 25 °C unless otherwise specified Specifications in italic text are guaranteed by design.

Analog input

Table 1. Analog input specifications

| Parameter | Condition | Specification |
|--------------------|-----------|---------------|
| A/D converter type | | AD9225 |
| Number of channels | | 2 |
| Resolution | | 12-bits |

| | | |
|--------------------------------|------------------|--|
| Input configuration | | Single-ended, individual A/D per channel |
| Sampling method | | Simultaneous |
| Input ranges | | ± 10 V, ± 5 V, ± 2 V, ± 1 V, software-selectable |
| Connection type | | BNC |
| Input coupling | | DC |
| Absolute maximum input voltage | | ± 15 V max (power on) |
| Input impedance | | 1.5 M Ω typ |
| <i>Input leakage current</i> | | 2 μ A typ, 10 μ A max |
| Input bandwidth (3 dB) | All input ranges | 17 MHz typ |
| Crosstalk | DC to 10 kHz | –90 dB |
| Trigger source | Digital | TRIG IN (BNC connector and 40-pin connector) See External trigger for more information |
| | Analog | CH0 or CH1 |
| | Internal | 1 kHz to 20 MHz max |

| | | |
|--|---------------------|--|
| Sample clock source | External | CLK IO (BNC connector) See External clock input/output for more information |
| Throughput | Software paced | 33 S/s to 4 kS/s typ; system-dependent |
| | Continuous scan | 1 kS/s to 8 MS/s, system-dependent |
| | BURSTIO | 1 kS/s to 20 MS/s to 64 MS onboard memory |
| Data transfer rate | From onboard memory | 10 MS/s typ |
| Signal-to-noise ratio (SNR) | | 66.6 dB |
| Signal-to-noise and distortion ratio (SINAD) | | 66.5 dB |
| Spurious free dynamic range (SFDR) | | 80 dB |
| Total harmonic distortion (THD) | | 80 dB |

Accuracy

Table 2. DC Accuracy components and specifications. All values are (\pm)

| Range | Gain error (% of reading) | Offset error (mV) | INL error (% of range) | Absolute accuracy at Full Scale (mV) | Gain temperature coefficient (% reading/°C) | Offset temperature coefficient (μV/°C) |
|-------|------------------------------|----------------------|---------------------------|--------------------------------------|--|--|
| ±10 V | 0.11 | 5.2 | 0.0976 | 35.72 | 0.0035 | 30 |
| ±5 V | 0.11 | 5.2 | 0.0488 | 20.46 | 0.0035 | 110 |
| ±2 V | 0.11 | 1.1 | 0.0244 | 8.18 | 0.0035 | 10 |
| ±1 V | 0.11 | 1.1 | 0.0122 | 4.64 | 0.0035 | 25 |

Noise performance

For the peak-to-peak noise distribution test, a single-ended input channel is connected to AGND at the input BNC connector and 20,000 data samples are acquired at the maximum rate.

Table 3. Noise performance specifications

| Range | Counts | LSB _{rms} |
|-------|--------|--------------------|
| ±10 V | 5 | 0.76 |
| ±5 V | 5 | 0.76 |
| ±2 V | 7 | 1.06 |
| ±1 V | 7 | 1.06 |

Analog input calibration

Table 4. Analog input calibration specifications

| Parameter | Specification |
|--------------------------|---|
| Recommended warm-up time | 15 minutes min |
| Calibration method | Self calibration, with calibration factors for each range stored onboard in non-volatile memory |
| Calibration interval | 1 year (factory calibration) |

Digital input/output

Table 5. Digital I/O specifications

| Parameter | Specification |
|--|---|
| Digital type | CMOS |
| Number of I/O | 8 |
| Configuration | Each bit can be independently configured as input (power on default) or output Input bits can be read at any time whether the digital output is active or tri-stated. |
| Input voltage range | 0 V to 15 V |
| Input characteristics | 47 k Ω pull-up/pull-down resistor, 28 k Ω series resistor |
| <i>Abs. Maximum input voltage</i> | <i>+20 V max</i> |
| Pull-up/pull-down configuration | The port has 47 k Ω resistors that can be configured as pull-up or pull-down with an internal jumper. The factory configuration is pull-up (J10 shorting block default position is pins 1 and 2). Pull down capability is available by placing the J10 shorting block across pins 2 and 3. |
| Digital I/O transfer rate (software paced) | 33 S/s to 4,000 S/s typ; system-dependent |
| Input high voltage | 2.0 V min |
| Input low voltage | 0.8 V max |

| | |
|---|---|
| Output characteristics | 47 k Ω pull-up, open drain (DMOS transistor, source connected to ground) |
| Output voltage range | 0 V to 5 V (using 47 k Ω internal pull up resistors) 0 V to 15 V max through optional, user-supplied external pull-up resistors (Note 1) |
| Drain to source breakdown voltage | 42.5 V min (Note 2) |
| Off state leakage current | 1.0 μ A |
| Sink current capability | <ul style="list-style-type: none"> • 150 mA max (continuous) per output pin • 150 mA max (continuous), total for all eight channels |
| DMOS transistor on-resistance (drain to source) | 4 Ω |

- **Note 1:** Adding external pull-up resistors connects the output bit in parallel with the internal 47 k Ω pull-up resistor. The resulting load voltage depends on the value of the external resistor value and the pull-up voltage used. In general, external 10 K Ω pull-up resistors are sufficient for most applications.
- **Note 2:** Does not include the additional leakage current contribution that can occur when using an external pull-up resistor.

External trigger

Table 6. External trigger specifications

| Parameter | Condition | Specification |
|------------------------------|-----------|--|
| Trigger source | Digital | TRIG IN (BNC connector and 40-pin connector) |
| | Analog | CH0 or CH1 |
| Trigger mode | Digital | Rising or falling edge, high or low level |
| | Analog | Trigger above or below software-selectable level, rising or falling edge with software-selectable hysteresis |
| A/D gate source | Digital | TRIG IN (BNC connector and 40-pin connector) |
| | Analog | CH0 or CH1 |
| A/D gate modes | Digital | High or low level |
| | Analog | Software-selectable high or low level, in or out of software-selectable window |
| Trigger latency | | 50 ns max |
| Trigger pulse width | | 25 ns min |
| Input type | Digital | 49.9 Ω series resistor |
| Input high voltage threshold | Digital | 2.0 V min |
| Input low voltage threshold | Digital | 0.8 V max |
| Input voltage range | Digital | -0.5 V to 6.5 V |

External clock input/output

Table 7. External clock I/O specifications

| Parameter | Specification |
|------------------------------|---|
| Terminal name | CLK IO (BNC connector) |
| Terminal type | ADC clock input/output, software-selectable for input or output (default is input) |
| Terminal description | <p>n When configured for input, receives sampling clock from external source</p> <p>n When configured for output, outputs the internal sampling clock</p> |
| Clock rate | 1 kHz to 20 MHz max |
| Stability | ±50 ppm |
| Input impedance | 1 MΩ |
| Maximum rate | 20 MHz |
| Input range | -0.5 V to 5.5 V |
| Clock pulse width | 25 ns min |
| Input type | 49.9 Ω series resistor |
| Input high voltage threshold | 2.0 V min |
| Input low voltage threshold | 0.8 V max |
| Output high voltage | 3.8 V min |
| Output low voltage | 0.6 V max |

| | |
|----------------|----------------|
| Output current | ± 8 mA max |
|----------------|----------------|

Memory

Table 8. Memory specifications

| Parameter | Specification |
|---------------------|--|
| Data FIFO | 64 MS using BURSTIO, 4 kS not using BURSTIO |
| Non-volatile memory | 32 KB (30 KB firmware storage, 2 KB calibration/user data) |

Power

Table 9. Power specifications

| Parameter | Specification |
|----------------------------|--|
| Supply voltage | 9 VDC to 18 VDC; MCC plug-in power supply CB-PWR-9 recommended |
| Supply current | 0.75 A max (Note 3) |
| Power jack configuration | Two conductor, barrel |
| Power jack barrel diameter | 6.3 mm |
| Power jack pin diameter | 2.0 mm |
| Power jack polarity | Center positive |
| +VO voltage range | 4.50 V to 5.25 V |
| +VO current sourcing | 10 mA max |

Note 3: This is the total quiescent current requirement for the device that includes up to 10 mA for the Status LED.

This value does not include potential loading of the DIO bits or the +VO pin.

Environmental

Table 10. Environmental specifications

| Parameter | Specification |
|-----------------------------|------------------------------|
| Operating temperature range | 0 °C to 50 °C max |
| Storage temperature range | −40 °C to 85 °C max |
| Humidity | 0% to 90% non-condensing max |

Mechanical

Table 11. Mechanical specifications

| Parameter | Specification |
|------------------------|--|
| Dimensions (L × W × H) | 142.24 × 180.34 × 38.09 mm (5.6 × 7.1 × 1.5 in.) |
| Weight | 1.5 lb |

USB

Table 12. USB specifications

| Parameter | Specification |
|----------------------|--|
| USB device type | USB 2.0 (high-speed) |
| Device compatibility | USB 2.0 |
| USB cable type | A-B cable, UL type AWM 2527 or equivalent. (min 24 AWG VBUS/GND, min 28 AWG D+/D−) |
| USB cable length | 3 m (9.84 ft) max |

Signal I/O connectors

Table 13. Connector specifications

| Connector | Specification |
|--|--|
| USB | B type |
| Auxiliary connector (J9) | 40-pin header connector |
| Compatible cables for the 40-pin auxiliary connector | <ul style="list-style-type: none"> • C40FF-x • C40-37F-x |
| Compatible accessory products with the C40FF-x cable | CIO-MINI40 |
| Compatible accessory products with the C40-37F-x cable | <ul style="list-style-type: none"> • CIO-MINI37 • SCB-37 |

BNC connectors

Table 14. BNC connector pinout

| BNC signal name | Signal description |
|-----------------|---|
| CH0 | Analog input channel 0 |
| CH1 | Analog input channel 1 |
| TRIG IN | BNC connection for external digital trigger (Note 4) |
| CLK IO | BNC connection for the ADC clock input/output, software-selectable for input or output (default is input) |

Note 4: Also available on auxiliary connector J9.

Auxiliary connector J9

Table 15. 40-pin connector J9 pinout

| Pin | Signal name | Pin description | Pin | Signal name | Pin description |
|-----|-------------|-----------------|-----|-------------|-----------------|
| 1 | GND | Ground | 2 | +VO | Power output |
| 3 | GND | Ground | 4 | N/C | Do not connect |

| | | | | | |
|----|------|-------------------|----|---------|--------------------------------|
| 5 | DIO7 | Digital I/O bit 7 | 6 | N/C | Do not connect |
| 7 | DIO6 | Digital I/O bit 6 | 8 | N/C | Do not connect |
| 9 | DIO5 | Digital I/O bit 5 | 10 | TRIG IN | External digital trigger input |
| 11 | DIO4 | Digital I/O bit 4 | 12 | GND | Ground |
| 13 | DIO3 | Digital I/O bit 3 | 14 | GND | Ground |
| 15 | DIO2 | Digital I/O bit 2 | 16 | GND | Ground |
| 17 | DIO1 | Digital I/O bit 1 | 18 | GND | Ground |
| 19 | DIO0 | Digital I/O bit 0 | 20 | GND | Ground |
| 21 | GND | Ground | 22 | N/C | Do not connect |
| 23 | N/C | Do not connect | 24 | N/C | Do not connect |
| 25 | GND | Ground | 26 | N/C | Do not connect |
| 27 | N/C | Do not connect | 28 | N/C | Do not connect |
| 29 | GND | Ground | 30 | N/C | Do not connect |
| 31 | N/C | Do not connect | 32 | N/C | Do not connect |
| 33 | GND | Ground | 34 | N/C | Do not connect |

| | | | | | |
|----|-----|----------------|----|-----|----------------|
| 35 | +VO | Power output | 36 | N/C | Do not connect |
| 37 | GND | Ground | 38 | N/C | Do not connect |
| 39 | N/C | Do not connect | 40 | N/C | Do not connect |

Note 5: N/C = no connection, not used

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.

© 2021 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.

Measurement Computing Corporation 10 Commerce Way Norton, Massachusetts 02766

(508) 946-5100

Fax: (508) 946-9500

E-mail: info@mccdaq.com

www.mccdaq.com


NI Hungary Kft H-4031 Debrecen, Hátar út 1/A, Hungary

Phone: +36 (52) 515400








Fax: +36 (52) 515414

<http://hungary.ni.com/debrecen>



| | |
|---|--|
|  | <p>MEASUREMENT COMPUTING USB-2020 Ultra High-Speed Simultaneous USB Device [pdf]</p> <p>] User Guide</p> <p>USB-2020 Ultra High-Speed Simultaneous USB Device, USB-2020, Ultra High-Speed Simultaneous USB Device</p> |
|---|--|

References

-  [Engineer Ambitiously - NI](#)
-  [Measurement Computing Data Acquisition Knowledgebase](#)
-  [Legal](#)
-  [Data Acquisition \(DAQ\) - Measurement Computing](#)
-  [International Distributors](#)
-  [Guide to DAQ Signal Connections](#)
-  [Tech Support Form](#)