ADC-8U15HG
ANALOG TO DIGITAL CONVERTER

TECHNICAL REFERENCE

Click for more info: www.eeci.com/adc-8u15hgp.htm

PHONE................... (937) 349-6000
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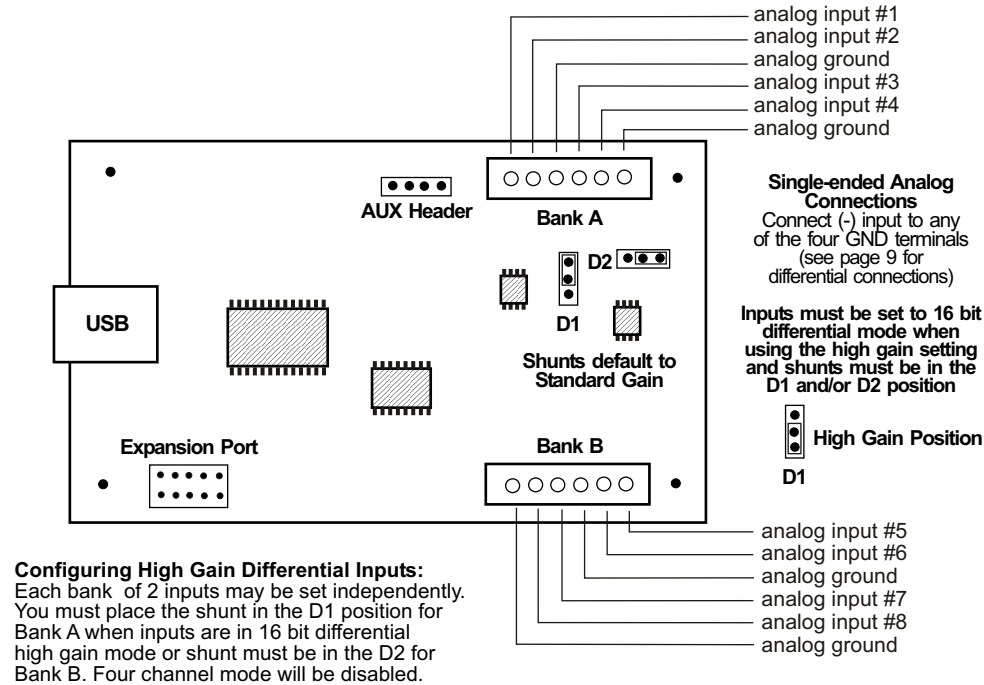
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TABLE OF CONTENTS

SPECIFICATIONS

Power Supply...................... 5 volts DC - powered from USB port (USB version only)

Operating Temp. Range...... -40° C to +85° C

Serial Data Protocol............. 75 to 6,000,000 baud - auto detect (defaults to 115,200 baud)
Full duplex operation (data bits, parity, stop bits will auto detect)

Maximum Sampling Rate...... 100 samples per second or better

Analog Inputs...................... 8 single-ended inputs (15 bit resolution) - no missing codes
or 4 fully differential inputs (16 bit resolution) - no missing codes
(15 bit resolution will divide your measurement range into 32,768 different increments)
(16 bit resolution will divide your measurement range into 65,536 different increments)

Voltage Input Range............ Standard Gain: 0 to 512 mv, 0 to 1.024 volt, 0 to 2.048 volts, 0 to 2.5 volts, 0 to 5 volts
+/-512 millivolt, +/- 1.024 volt, +/- 2.048 volts, +/- 5 volts in 16 bit differential
High Gain: 0 to 256 millivolt, 0 to 128 millivolt ,0 to 64 millivolt, 0 to 32 millivolt
or 0 to 16 millivolt when inputs are 15 bit single ended
+/-256 millivolt, +/-128 millivolt ,+/- 64 millivolt, +/-32 millivolt or +/-16 millivolt
when inputs are 16 bit differential
(bank must be set to 2 channel 16 bit differential mode when using high gain settings)
Single ended inputs may connected to High Gain channels with 15 bit output only

Data Logger......................... 8 channel formatted, select by event, seconds or minutes, text, csv or delimited

Expansion Capability............ expandable to control up to 136 relays/inputs (or combinations) using
EX-8M, EXM-16 or EXM-32 Relay I/O Expansion Modules

Interface.............................. USB (also available in WiFi version (ADC8-15HGWIFI), Ethernet version
(ADC8-15HGENET) RS-232 version (ADC8-15HGRS232) or
RS-485 version (ADC8-15HGRS485))

Software Compatibility......... Windows XP, Vista, Windows Server, Windows 7, 8.1, Windows 10 and Windows 11

Weight/Size......................... .5 ounce, 1.875 inches by 3.125 inches

CONNECTION DIAGRAM

ADC-8U15HG HIGH GAIN
ANALOG TO DIGITAL CONVERTER

analog input #1
analog input #2
analog ground
analog input #3
analog input #4
analog ground

AUX Header

Bank A

USB

D2

D1

Shunts default to
Standard Gain

Expansion Port

Bank B

Single-ended Analog Connections
Connect (-) input to any of the four GND terminals (see page 9 for differential connections)

Inputs must be set to 16 bit differential mode when using the high gain setting and shunts must be in the D1 and/or D2 position

High Gain Position

D1

analog input #5
analog input #6
analog ground
analog input #7
analog input #8
analog ground

Configuring High Gain Differential Inputs:
Each bank of 2 inputs may be set independently. You must place the shunt in the D1 position for Bank A when inputs are in 16 bit differential high gain mode or shunt must be in the D2 for Bank B. Four channel mode will be disabled.

DESCRIPTION

The ADC-8U15HG Analog to Digital converters connect to any available USB port on your desktop or laptop PC (including some tablets and phones). Eight analog inputs channels are provided for conversion to 15 bit digital format. The converters may be set to four channel fully differential mode with 16 bit resolution if required. Two optional expansion ports are available for connection of up to 136 relays, 136 status inputs or combinations of relays and inputs.

24 HOUR TECHNICAL SUPPORT

Technical support for our products is available by calling (937) 349-6000. If a technical adviser is not available, please leave your name, phone number and a time that you can be reached. Your call will be returned as soon as possible and within 8 hours. Calls received during normal business hours are usually returned within minutes.

WARRANTY AND CARE OF THE ADC-8U15HG

The ADC-8U15HG Analog to Digital Converters are warranted against factory defects for a period of 90 days from the date of purchase. The ADC-8U15HG has proven to be extremely reliable in actual operation during field tests. We recommend that the ADC-8U15HG and associated hardware be installed in a suitable enclosure (4 mounting holes are provided on the circuit board) and that reasonable precautions be taken to protect the circuit from static discharge, electrical storm transients and over-voltage to the inputs.

SET-UP AND TESTING

Upon receiving your ADC-8U15HG, you should connect and test the operation of the hardware to verify proper operation. Please set-up and test the ADC-8U15HG as follows (Windows XP*, Vista, Windows Server, Windows 7, 8.1, Windows 10 or Windows 11)   *service pack 3

(Step 1) Connect to the Internet. This permits any security or software updates to occur during installation. If you do not have an Internet connection, you may skip this step.

(Step 2) Connect your ADC-8U15HG Analog to Digital Converter to any available USB port on your computer using a CC-USBB cable (1 to 15 foot). A high percentage of systems will be up to date and you will not see any activity or a pop-up message (allow up to 30 seconds for any system message). If your USB Com driver is out of date, you may receive a message that your system is being updated or a new driver is being installed. Allow the update to occur before you move to the next step. If you do not see activity or receive a system message, proceed to step 3.

(Step 3) Insert the installation CD or USB flash drive and wait for the security message (with a USB flash drive, you may need to browse to the drive icon from your My Computer link). OK or click the startup.exe file to start the installer dialog.

(Step 4) Check your USB Com driver by clicking on the "Open Device Manager" button in the installer dialog window and expanding the "Ports (COM & LPT)" category (expand the category by clicking on the + or arrow, see Device Manager on page 5 or go directly to Device Manager from Control Panel). If you see a "Prolific USB-to-Serial Comm Port" entry, this is your USB Com driver* and the com port assigned is to the right of the entry. Right click on the entry and select "Properties"and click the "Driver" tab. Your USB Com driver must be Prolific version 3.8.40.0 or higher (dated 5/13/2021 or later). If your USB Com driver is not up to date, right click on the entry and select "Update Driver Software". If your USB Com driver is up to date then please note the Com port number assigned and jump to step 5.
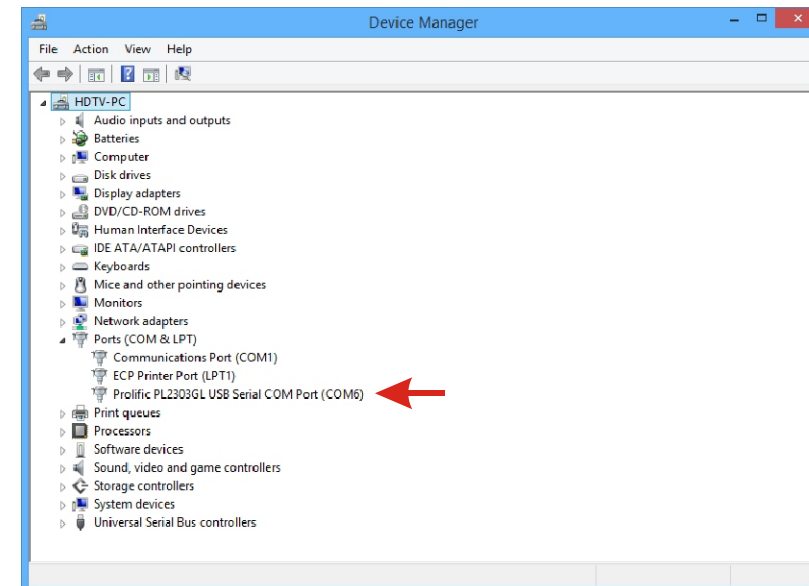
*verify that this is the com port assigned to the ADC-8U15HG by unplugging the ADC-8U15HG from your USB port and watching the entry in device manager. The entry should disappear and then reappear when you plug the ADC-8U15HG back in.

If you do not have an Internet connection or are having problems with the USB Com driver installation, disconnect the ADC-8U15HG USB cable from your computer and install the USB Com driver from your CD by clicking on the "Install USB Com Driver" button. Please note that you may have to remove any out of date Prolific Com drivers on your system before the current driver will install correctly. It is important that you use the remove feature on your CD (not the remove feature in Device Manager). The remove feature is shown after clicking the "Install USB Com Driver" button from the installer dialog window (allow up to 30 seconds for the installer to load and appear).

(Step 5) After you have verified or installed the up to date USB Com driver, reconnect (if not already connected*) your ADC-8U15HG Analog to Digital Converter to the same USB port and install the ADC-8U15HG device driver** by clicking the "Install EECI Device Driver" button from the installer dialog window (if you have auto start disabled, you may browse to the Windows Driver folder and double click on setup.exe). A desktop icon for the ADC-8U15HG will be created. When installing the ADC-8U15HG device driver on a Windows XP or Vista computer, double click on setup.exe in the XP-Vista folder.   *if you reconnect your ADC-8U15HG to a different USB port, a different com port may be assigned.

**Please note that the Microsoft .Net Framework must be installed on your system. The .Net Framework is already installed if you have Windows 7 or higher. If the .Net Framework is not installed on your computer, the installation program will attempt to download and install the .Net Framework from the Microsoft Update website through your internet connection. This may take 5 minutes or longer. In order for the .Net Framework to install correctly, your computer must be up to date with Windows Update. This is especially important with Windows XP* and Vista. You may update your computer by clicking on the start button, All Programs, Windows Update and clicking on "Check for updates". *for XP, Service Pack 3 must be installed.
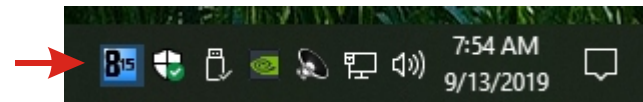
(Step 6) After the ADC-8U15HG device driver is installed, the ADC-8U15HG com port should be detected and a pop-up will prompt you for the com port to be used with your ADC-8U15HG A to D Converter (correct com port should be shown).You may edit the com port if incorrect. The ADC-8U15HG User Interface will now open and the label just under the COM port indicator should show that Com port open. Please Note: When the ADC-8U15HG inputs are floating (no connection) the inputs may show random or changing values from noise picked up by the high impedance inputs. Click the "Install Help Files" button to install important trouble-shooting and reference information before you close the installer.

(Step 7) Test your analog inputs by applying a test voltage to each input. The test voltage must be within the selected reference voltage and of the correct polarity (the default reference voltage is 2.048 volts, providing a voltage input range of 0 to 2.048 volts DC). You may use the analog test circuit shown below to provide the test voltage. When using a 9 volt smoke detector battery, use a multimeter to check for the correct voltage since the voltage can go well over the reference voltage if the potentiometer is turned beyond 10K. The input in the ADC-8U15HG User Interface should increment from 0 to 32,767 (in 1 unit increments) as the potentiometer is turned from 0 volts to 2.048 volts.

Differential inputs may be tested using the same analog test circuit (below) except you will connect the test voltage to inputs 1 and 2 (differential channel 1) or inputs 3 and 4 (differential channel 2). When the ADC-8U15HG is set to differential mode, the ADC-8U15HG will display a range from -32,768 to +32,767 in 65,536 increments (16 bit) as the input voltage swings from -2.048 volts to +2.048 volts. The negative side of the signal is generated by reversing the polarity of the test signal (or reversing the battery polarity). The inputs are changed to differential mode by going to the Setup dialog in the ADC-8U15HG User Interface.

Click the Analog Setup button to enable analog inputs 5 to 8. After testing is complete, you may label your analog inputs, set scale and offsets, set precision and add a suffix (such as °, PSI, mA, etc) by going to the setup window in the ADC-8U15HG User Interface and clicking the Analog Setup button. The ADC-8U15HG Data Logger may be started by checking the Enable box. The data log entry interval may be set to minutes or seconds (click the M or S button) and entering the desired time interval. The settings will not go into effect until the Apply button is clicked.

Click the "Tray" button to place the User Interface in "driver only" mode. You will see a blue 8 icon in your system tray by the clock (bottom right of screen as shown below).

Click the blue 8 icon to re-open the ADC-8U15HG User Interface. Click the "Unload Device Driver" to unload the ADC-8U15HG device driver.
Please note that by default, the ADC-8U15HG device driver is only loaded on demand to conserve system resources. To re-start the ADC-8U15HG device driver, double click the red and blue ADC-8U15HG desktop icon or under Applications.
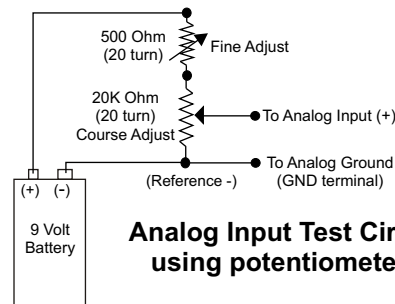
Analog Input Test Circuit using potentiometers

You may install the ADC-8U15HG device driver permanently by checking the "Driver Only" check box under Setup in the ADC-8U15HG User Interface. You will then always see the ADC-8U15HG system icon in your system tray along with the other system devices (such as your speaker, printer or display adapter).

If operation of the analog inputs are normal, then testing is now complete and your ADC-8U15HG may be placed in service. If problems are encountered during testing, proceed to the trouble-shooting procedures shown below.

HOW TO OPEN DEVICE MANAGER

Windows XP, VISTA or Windows 7: Click the Start Button (lower left of screen), then Control Panel (right side). With the view set to classic view, small or large icons, click (or double click) the Device Manager icon. With Windows XP you will need to click the System icon (in Control Panel) then the Hardware Tab then the Device Manager button. You may also use the supplied CD to open Device Manager by clicking the "Open Device Manager" button when the CD auto starts.

Windows 8.1, 10, 11 and Windows Server: Search for Device Manager **or m**ove your mouse cursor to the lower right side of your screen and click on Settings. Click on Control Panel and click on the the Device Manager icon.

TROUBLE-SHOOTING THE ADC-8U15HG

(1) Verify that your USB com driver is installed by going to Device Manager and checking for the Prolific USB to Serial Comm Port entry. Right click on the entry, then Properties, select the Driver tab and verify that the driver is dated 5/13/2021 or later. If the driver is out of date, connect to the Internet and click the Update Driver button. Please note that an out of date driver may allow the ADC-8U15HG to partially function and/or with erratic operation.

(2) Verify that the Prolific USB to Serial Comm Port entry is the com port used by your ADC-8U15HG. You may do this by watching the entry in Device Manager and unplugging your ADC-8U15HG from your computer USB port. The entry should disappear and then re-appear when you plug the ADC-8U15HG back in to your computer USB port.

(3) Try replacing the USB cable and/or using a different USB port.

(4) Verify that the ADC-8U15HG device driver is correctly installed and loaded. Click the blue 8 icon in your system tray (bottom right) and check for the correct com port setting (should show the correct com (port open). If the window below the COM indicator shows "COM Not Found!" then a com port issue is the problem (check for another program that may be using the com port). You may right click the taskbar at the bottom of your screen, then Task Manager to view running applications.
.
(5) Remove the ADC-8U15HG USB cable from your computer, wait 5 seconds and plug back in. Open the ADC-8U15HG User Interface by clicking on the blue icon in your system tray and double click on the blue EECI logo to reset the com port. You should see a reset message followed by a COM open indication. Click Setup and uncheck "Allow External Commands". If this corrects the issue that you are experiencing then an external application is the problem.

(6) If erratic operation is experienced, check for loose connections at the terminal block (tug on each wire going into the terminal block), check for short circuits caused by metal contact to the ADC circuit areas or other connected hardware. Check for ground reference problems (analog ground is connected to earth ground via USB power).

(7) The input voltage to any of the analog inputs must not exceed the reference voltage (nor should the input go negative with respect to the reference when not in differential mode) or erratic data may be generated on one or more of the analog channels.

Please contact EECI Support at (800) 842-7714 or (937) 349-6000 if you require additional assistance or have questions.

EXPANSION PORTS

The ADC-8U15HG provides two expansion ports for additional I/O operations using the same COM port. The expansion ports may used to connect up to 136 relays or to connect up to 136 inputs (or combinations of relays and inputs) using EX-8M and/or EXM-16 expansion modules. The relay output ports on the EX-8M and EXM-16 are identical to those used on all EECI products and accept the same relay cards and other

accessories. A variety of relay cards with various contact configurations are available for connection to the expansion modules. A partial list of relay cards includes the RD-8, RD-8M, RG-8, RH-8, RI-8, RJ-8, RL-8, RN-8, RN-8M, RP-8 and RJ-8. The RYD-8 relay driver card may be used to control larger power relays, contactors, solenoids, valves or other devices. The DA-1 Digital to Analog converter may be used to output a 0 to 5 volt or a 0 to 10 volt analog level. For additional information on the EX-8M Expansion card, please refer the the EX-8M Technical Reference available on the EECI web site.

THE ADC-8U15HG USER INTERFACE
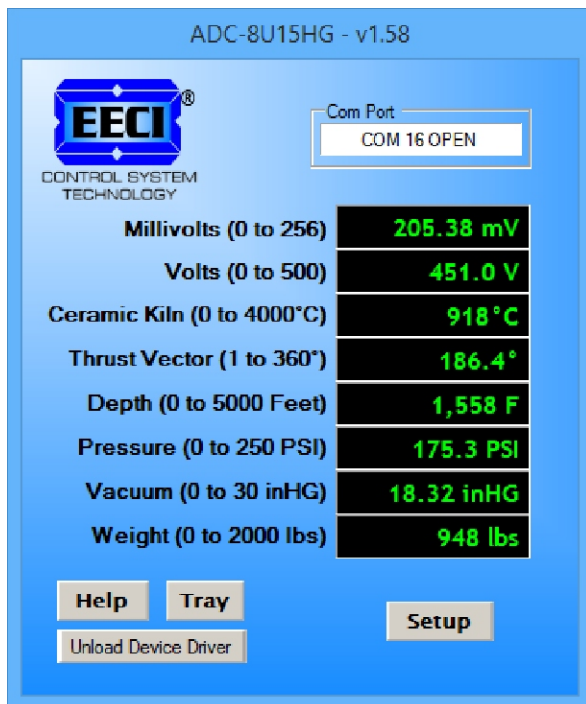
The ADC-8U15HG User Interface allows you to set all of the basic operating characteristics of the hardware and permits the ADC-8U15HG to send and receive data from other Windows applications or programs that you create. Please see page 12 for the Setup dialog.

When the device driver is started for the first time you are prompted for the com port that is to be used with the ADC-8U15HG. This com port number is saved in the settings file "adc8u15hg-set.ini" which is created in the folder c:\eeci\adc-8u15hg. The user interface will then open using the com port assigned. The com port indicator should have a "COM Open" message as shown to the left with the correct com port shown. The com port may be changed by clicking the Setup button and changing the com number in the Com Port window and then clicking Apply. Available com ports are updated by clicking the "Com Port" button under Setup.

Clicking the Setup button allows you to label the analog inputs for each of the 8 channels. The com port, baud rate and sampling rate settings are changed below. Select the differential input option under Input Mode to allow differential inputs to be connected to the terminal blocks on the ADC-8U15HG (display will change to two channel mode for that bank). High Gain inputs are enabled in 2 channel differential mode only (for a total of 4 high gain inputs). Mixed 3 channel mode is enabled in Standard Gain only. Each bank of four analog inputs is completely independent and allows one bank to be set to High Gain with the other in Standard Gain. The options for reference input allow you to set the desired voltage input range. Un-checking the Allow External Commands box will prevent other Windows applications from sending or receiving data from the ADC-8U15HG. The data logger may be enabled by checking the box in the data logger section and entering the desired time interval and file type information. See page 12 for additional information.

The ADC-8U15HG User Interface may be started in driver only mode by checking the Start Minimized box under Setup. Any changes made to Setup will not take effect until you click the Apply button. Clicking the Apply button saves the new settings to the adc8u15hg-set.ini file so that if the device driver is unloaded, it will restart with all the new settings. Click the Tray button (driver only mode) to close the user interface after the ADC-8U15HG is set-up for your application. A blue 8 icon will appear in your system tray (click to re-open the user interface). The ADC-8U15HG User Interface may be left open when used as a stand alone data logger or if an external application is not used. The ADC-8U15HG User Interface may be completely shut down (and driver unloaded) by clicking "Unload Device Driver" at the bottom of the user interface. Once shut down, you will need to double click the ADC-8U15HG desktop icon to re-start the ADC-8U15HG device driver (or clicking the ADC-8U15HG icon under All Programs in the EECI folder).The Help button will provide additional assistance if you installed the help files from the ADC-8U15HG installation CD.

AUTO START-UP FOR THE ADC-8U15HG DEVICE DRIVER

By default, the ADC-8U15HG device driver is only loaded on demand to conserve system resources. You may install the ADC-8U15HG device driver permanently by checking the "Driver Only" check box under Setup in the

ADC-8U15HG User Interface. You will then always see the ADC-8U15HG system icon in your system tray* along with the other system devices (such as your speaker, printer or display adapter). Click the blue 8 icon in your system tray to open the ADC-8U15HG User Interface. If the ADC-8U15HG device driver is not installed permanently, you will need to double click the ADC-8U15HG desktop icon to load the ADC-8U15HG device driver each time your system starts.

*you may need to expand the arrow in your system tray to see all the icons (the tray is the row of icons on the lower right of your screen, next to your clock).

THE ADC-8U15HG DATA LOGGER

The ADC-8U15HG User Interface provides a data logger function that will save analog input readings to a file at preset time intervals. Scale and offset values may be factored into the recorded data event along with an input label by entering the desired values at the setup screen by clicking the Analog Setup button. The ADC-8U15HG data logger may be used stand alone if an external application is not used. The file output format may be set to plain text, CSV or text delimited formats and may be imported into database or spreadsheet applications if required. The data log interval may be set to seconds or minutes by clicking the button to the right of the setting. A suffix may be added to the logged value (such as PSI, Volts, °, etc.). Extended ASCII characters may be added by holding down the alt key and entering the ASCII code on your keyboard keypad. Example: to display a degree symbol, hold down the alt key and enter 248 on your keypad. You may also use copy and paste for non-keyboard symbols. The precision setting allows you to log your data in integer only, tenth, hundredth, thousandth or auto select.

PROGRAMMING EXAMPLES

VISUAL BASIC EXAMPLE (Microsoft Visual Studio)

'To use these examples, copy the code module (supplied on your CD) to a sub called readInputs(). From the toolbox, drag (4) labels and a timer control to your form. Insert the following code into the timer sub.

```
Private Sub Timer1_Tick(sender As Object, e As EventArgs) Handles Timer1.Tick

readInputs()        'collect analog inputs   set timer interval to desired sample rate

For W = 1 To 4
MyLabelArray(W).Text = inputByte(W)
Next W

End Sub
```

VISUAL C# EXAMPLE (Microsoft Visual Studio)

```
    private void timer1_Tick(object sender, EventArgs e)
    {
       ReadInputs();

       for (int i = 1; i < 5; i ++)
       {
        MyLabelArray[i].Text = inputByte[i].ToString();
       }
    }
```

The entire source code program examples and the complete project code are provided on your installation CD along with additional source code examples in other programming languages. The programs are intended to demonstrate the fundamentals needed for development of your own software. The program examples may be copied to your program and used as a subroutine if desired.

These examples will run in all versions of Visual Studio including Visual Studio Express. The installation CD will have examples in all the programming languages used with Microsoft Visual Studio including Visual Basic, Visual C# and C++. Python and ASP examples are also provided. Please contact EECI support for more information.

VOLTAGE REFERENCE INPUT

The ADC-8U15HG allows for several different reference voltage configurations using it's built-in programmable instrument amp. The reference voltage determines the voltage input range for all (4) analog input channels or (2) channels in differential mode for each Bank. The following configurations are selectable from the ADC-8U15HG Setup. Option 1 is the default setting (this allows exactly 16 increments per mv). Each Bank may be set as follows:

STANDARD GAIN MODE:
Option 1: 2.048 volt - allows a (0 to 2.048) volt input range or (-2 to +2) in differential mode (= 0 to 2,048mv)
 (4) channel single ended or (2) channel fully differential - 16 increments per mv

Option 2: 1.024 volt - allows a (0 to 1.024) volt input range or (-1 to +1) volts in differential mode (= 0 to 1,024mv)
 (4) channel single ended or (2) channel fully differential - 32 increments per mv

Option 3: .512 volt - allows a (0 to .512) volt input range or (-.5 to +.5) volts in differential mode (= 0 to 512mv)
 (4) channel single ended or (2) channel fully differential - 64 increments per mv

Option 4: 2.5 volt/Analog Supply - allows a (0 to 2.5) volt input range or (-2.5 to +2.5) in 16 bit (= 0 to 2,500mv)
 (4) channel single ended or (2) channel (gain shunt on default) - 13.1 increments per mv

Option 5: 5 volt/Analog Supply - allows a (0 to 5) volt input range (15 bit) or (-5 to +5) in 16 bit (= 0 to 5,000mv)
 must be in (2) channel differential mode (gain shunt on D) - 6.6 increments per mv

Option 6: User supplied - must be in the range of .75V to 2.5V (or 5V in diff mode) (applied to R1 or R2 headers)
Example: 2 volts applied to the R1 or R2 header input will provide a (0 to 2) volt input range single ended or (-2 to +2) volts for differential inputs. Please specify when ordering (headers are omitted when not used to reject noise).

RATIOMETRIC: Both the External/Ratiometric and Analog Supply options may be used for ratiometric input (such as potentiometer input). Use the A2.5V header pin to supply + voltage to the potentiometer when set to Analog Supply.

IMPORTANT NOTE: The analog ground on the USB and RS-232 versions will be connected to an earth ground via the USB or RS-232 ground and through the computer ground (3rd prong power cord ground). Under certain conditions this may raise a ground reference issue.

HIGH GAIN MODE: ---- GAIN SELECT SHUNT MUST BE IN THE D1 (and/or) D2 POSITION ---
Option 7: .256 volt - allows a (0 to .256) volt input range or (-.25 to +.25) volts fully differential (= 0 to 256mv)
 15 bit single ended or 16 bit fully differential - 128 increments per mv.

Option 8: .128 volt - allows a (0 to .128) volt input range or (-.128 to +.128) volts fully differential (= 0 to 128mv)
 15 bit single ended or 16 bit fully differential - 256 increments per mv.

Option 9: .064 volt - allows a (0 to .064) volt input range or (-.064 to +.064) volts fully differential (= 0 to 64mv)
 15 bit single ended or 16 bit fully differential - 512 increments per mv.

Option 10: .032 volt - allows a (0 to .032) volt input range or (-.032 to +.032) volts fully differential (= 0 to 32mv)
 15 bit single ended or 16 bit fully differential - 1,024 increments per mv.

Option 11: .016 volt - allows a (0 to .016) volt input range or (-.016 to +.016) volts fully differential (= 0 to 16mv)
 15 bit single ended or 16 bit fully differential - 2,048 increments per mv.

When using High Gain mode, the bank must be set to 2 channel mode for a total of 4 channels with both banks. High Gain single ended inputs must be connected to the differential input terminals. The GND terminals are not used.

INPUT SCALING AND OFFSETS

Analog inputs may be scaled and offsets added by opening the user interface and clicking Setup and then Analog Setup. This allows you to directly display temperature, pressure, position, etc. by adjusting the raw analog data

coming from the sensor to the actual units (such as degrees, PSI, mm, GPM, RPM, etc,). The Precision setting allows the units to be displayed in integer, tenth, hundreds, etc. Use the Suffix box to change the display from the default Units to the required specifier (see page 7). You may check the "Raw" checkbox to disable all formatting.
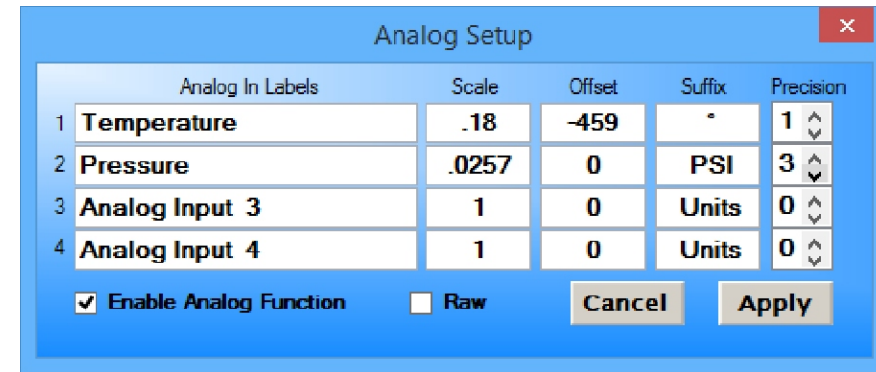
INPUT MODE AND HIGH GAIN SHUNT CONFIGURATION

The Gain Select shunts must be placed in the "D" position and the Input Mode must always be (2) Channel Differential when using the high gain reference voltages. Each Bank of 2 inputs may be set independently to high gain or standard gain (D1 is for Bank A and D2 is for Bank B). A total of 4 inputs may be set to High Gain mode (2 inputs per bank). When a bank is set to High Gain, the GND terminals are not used (single ended inputs are connected to the differential inputs with only the positive range used in 15 bit format).
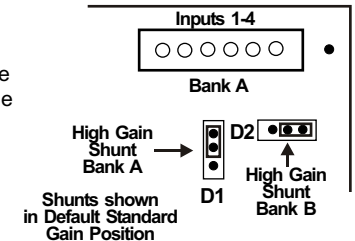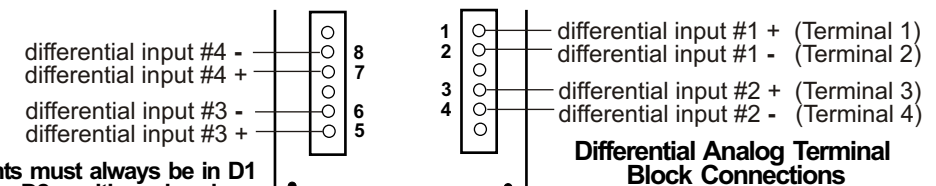

Single Ended and Mixed Mode: The Gain Select shunt for the given bank must always be in the Default (Standard Gain) position when in (4) Channel Single Ended or (3) Channel Mixed modes. High Gain is disabled and all single ended inputs will be 15 bit except for Mixed mode differential inputs which will be 16 bit. Each bank may be independently set to (4) Channel Single Ended, (2) Channel Differential or (3) Channel Mixed modes.
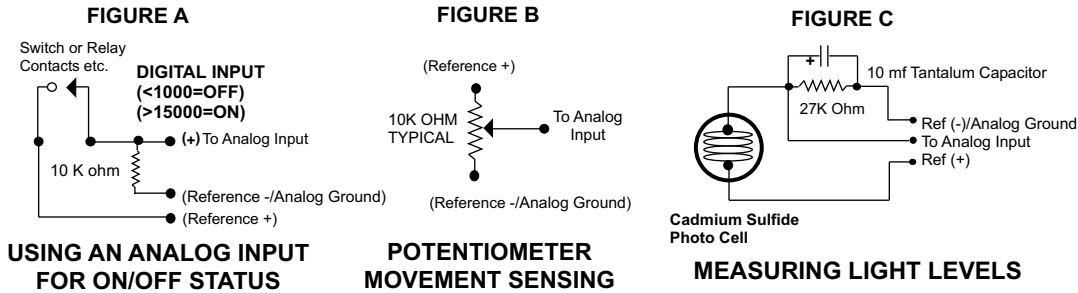
Analog Supply Option: When the Analog Supply reference voltage is selected in (4) Channel Single Ended or (3) Channel Mixed modes, all inputs in that bank will have a 0 to 2.5 volt input range (gain select shunt must be in the Default position for the given bank). Single ended inputs will connect (-) to the GND terminals.
The 0 to 5 volt input reference is selected by choosing the Analog Supply option and placing the Gain select shunt for the given bank in the "D" position and selecting (2) Channel Differential mode. The GND terminal will not be used. Single ended 0 to 5 volt inputs will connect to the differential input terminals with only the positive range used in 15 bit format (allowing only a total of four 0 to 5 volt inputs (2 per bank). Differential +/- 5 volt inputs are connected normal.

DIFFERENTIAL ANALOG INPUTS

The ADC-8U15HG may be set to accept (4) fully differential inputs in place of the (8) single ended inputs. The differential voltage input range is determined by the reference setting as shown on the previous page. The differential input signal connects to terminals 1 and 2 for differential channel 1 and terminals 3 and 4 for differential channel 2. The GND terminal connections are not used. Each Bank of 2 inputs may be set independently.

Differential Analog Terminal Block Connections

FIGURE A

Switch or Relay
Contacts etc.

DIGITAL INPUT
(<1000=OFF)
(>15000=ON)

(+) To Analog Input

10 K ohm

(Reference -/Analog Ground)

(Reference +)

**USING AN ANALOG INPUT
FOR ON/OFF STATUS**

FIGURE B

(Reference +)

10K OHM
TYPICAL

To Analog
Input

(Reference -/Analog Ground)

**POTENTIOMETER
MOVEMENT SENSING**

FIGURE C

10 mf Tantalum Capacitor

27K Ohm

Ref (-)/Analog Ground
To Analog Input
Ref (+)

Cadmium Sulfide
Photo Cell

MEASURING LIGHT LEVELS

Fuse or Limiting Resistor (330 ohm 1 watt)

1 Amp Diode (50 volt)

FIGURE D   AC Primary Voltage
120, 277, 480 etc.

6 or 12 Volt
Secondary

R1

R2

100 mf
35 volt

(+)

To Analog
Input

(-)

24 ga Communication Cable

Diode
(if AC)

R1

(1 ma maximum current
through resistors)

(+)

1/4 Amp Fuse

FIGURE E   High Voltage
AC/DC Input

R2

10 Volt 5 Watt
Zener Diodes

(+)

To Analog
(-) Input

(-)

The additional safety components
are not needed at lower safe levels
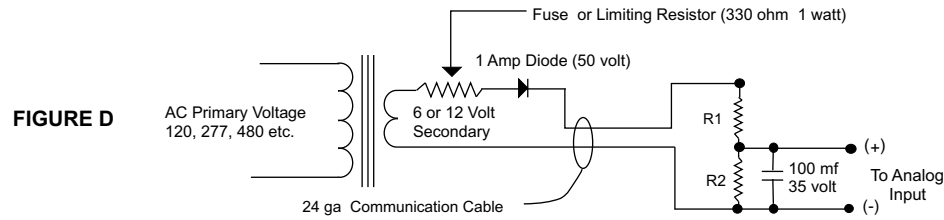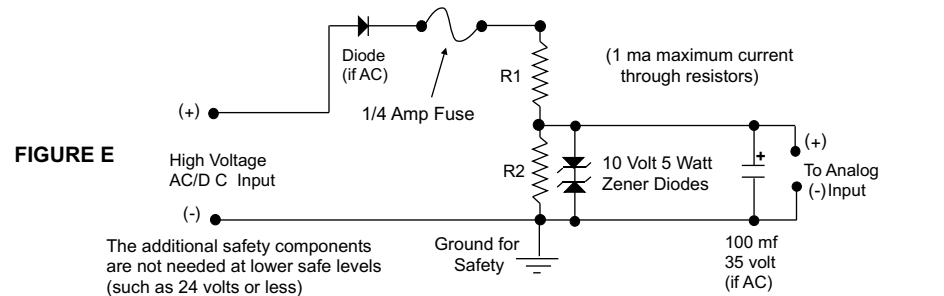(such as 24 volts or less)

Ground for
Safety

100 mf
35 volt
(if AC)

SINGLE ENDED ANALOG VOLTAGE INPUTS

Voltages up to hundreds of volts may be divided down to the 5 volt range by using a simple resistance divider as shownabove (the signal source must be capable of driving a 1 ma load). The voltage input source may be located up to several hundred feet from the ADC. The wire which connects the ADC to the signal source should be a twisted pair to reduce possible input noise (22 or 24 gauge communication cable or CAT5 typical). Shielded cable may be used to further protect against EMI or lightning noise (the shield should be left disconnected at the source and connected to an earth ground/equipment ground at the ADC).

NOTE: When the analog inputs are left floating (no connection), the ADC will transmit fluctuating numbers as a result of noise present at the high impedance inputs. We recommend that any unused inputs be connected to GND (reference (-)) to prevent possible errors on other channels (short both inputs together with differential inputs).

FILTERING INPUT NOISE: A .1 uf filter capacitor is installed on the ADC inputs (one for each channel) which significantly reduces errors and fluctuation as a result of input noise. A 2.7 mf or 10 mf tantalum capacitor may added for additional filtering (input response time will be slower).

HIGH VOLTAGE INTERFACING

CAUTION: When working with high voltages, the potential for fire, explosion, electrocution, eye injury or blindness and life threatening injuries or death exists. If you are not familiar with the precautions needed when working with high voltages, do not attempt to connect high voltage up to these circuits. To prevent the danger of a high voltage

feeding back to the ADC and the fire/injury/electrocution hazard caused by an open or short circuit, 10 volt 2 watt zener diodes and a 1/4 amp fuse should be connected as shown in figure E. Wire used to interconnect a high voltage input must be rated for use with the higher voltage. When connecting the ADC to high voltage AC equipment the method shown in figure D above is recommended.

The following method is used to divide a high voltage down to the 5 volt range needed for input into the ADC. This method involves the use of two resistors (R1 and R2) which together add up to Rt (total resistance). The total resistance is determined by using the Ohms Law to compute the resistance needed for a 1 milliamp current flow through the resistors. EXAMPLE: If your full scale voltage is 100 volts (R = E divided by I) 100 volts divided by .001 amp = 100,000 ohms (100K ohm). To determine the proper ratio, divide 5 volts by the full scale voltage. 5 divided by 100 volts = .05. Multiple this ratio by the total resistance to determine the value of R2. R1 is then equal to the difference between the total resistance and R2. EXAMPLE: ratio .05 times total resistance 100,000 ohms = 5,000 ohms (the value of R2). Total resistance 100,000 ohms less R2 5,000 ohms = 95,000 ohms (the value of R1). To determine the power rating needed for the resistor, use the following formula: P = I squared times R. EXAMPLE: .001 squared = .000001 times R1 95,000 ohms = .095 watts. A 1/8 or 1/4 watt resistor would be sufficient.

MPORTANT: The full scale voltage used should be the highest possible voltage that could be present at the high voltage input.

AC voltages may be applied to the high voltage input if a diode is connected in series and a filter capacitor (100 mf, 35 volt typical) is connected between the ADC analog input and the ADC reference (-). AC voltages over 24 volts or great enough to create an electrical shock hazard or fire should be connected to the ADC analog input using a step-down transformer to reduce the high voltage down to the 5 volt range as shown in figure D. A diode and filter capacitor must be connected on the secondary side of the transformer (a common low current power transformer may be used).
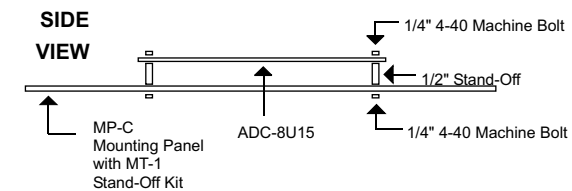
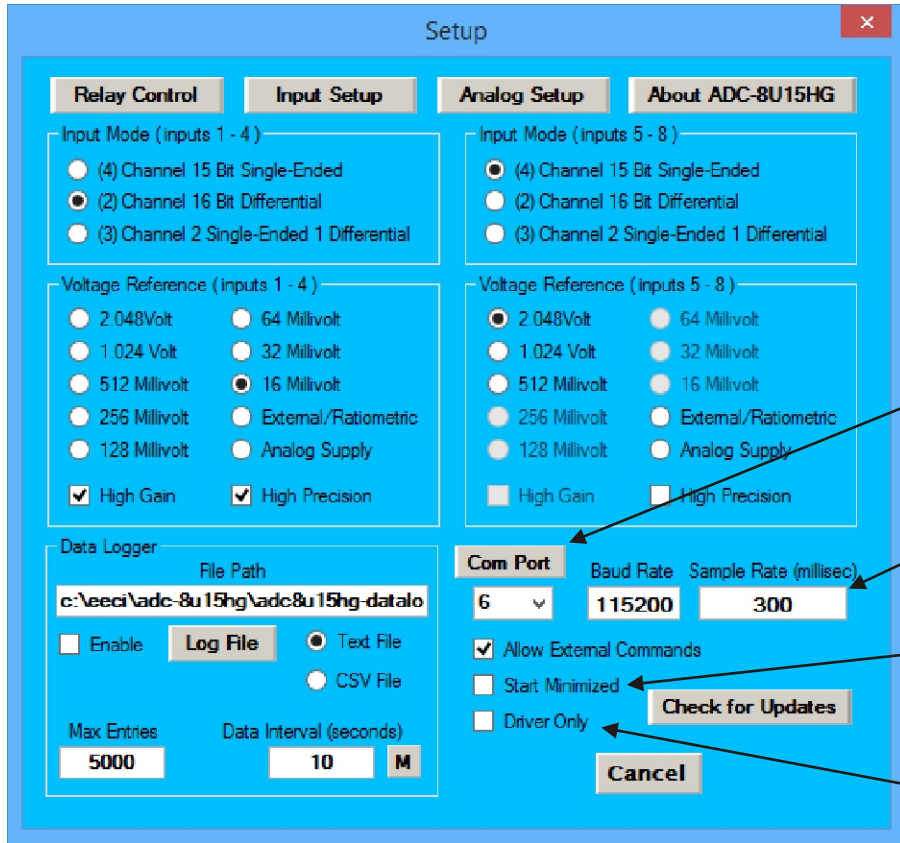**CONNECTING SENSORS TO THE ADC-8U15HG**

A large variety of sensors, transducers, load cells and other devices that provide an analog output may be connected to the ADC-8U15HG. Most types of sensors may be located up to 1,000 feet from the ADC-8U15HG. Pull up resistors may be installed on the underside of the ADC-8U15HG for 2 wire sensors that receive power from the USB port. The cable used to connect sensors to the ADC-8U15HG should be twisted pair or shielded twisted pair to suppress environmental noise. Low cost CAT 5 cable works well when multiple sensors are in the same location.

ADC-8U15

Twisted Pair

Pressure
Transducer

Power

ADC-8U15

Twisted Pair

2 wire
temperature
sensor
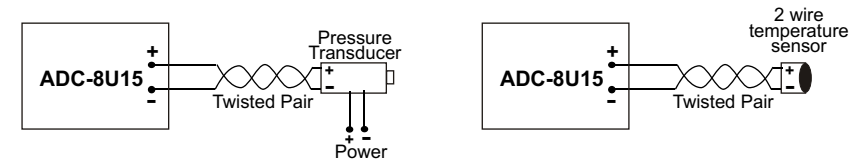
MOUNTING

The ADC-8U15HG Analog to Digital card may be mounted in an enclosure (part # EN-C or EN-D) or on a metal mounting panel using the MT-1 stand-off mounting hardware as shown below. The ADC-8U15HG will attach to the 4 stand-off spacers using 4-40 machine screws (4 mounting holes are provided on the ADC-8U15HG). Contact technical support for more information on mounting panels and various mounting layouts.

**SIDE
VIEW**

1/4" 4-40 Machine Bolt

1/2" Stand-Off

MP-C
Mounting Panel
with MT-1
Stand-Off Kit

ADC-8U15

1/4" 4-40 Machine Bolt

Setup

Relay Control and Input Setup are only used when EX-8M or EXM modules are connected

Check the High Precision box when high sample rates are not needed

Click to Refresh Com Ports
(use the pull-down to select, then Apply to set)

Rate at which Analog Inputs are Updated**

Load Driver Only and show Tray Icon when Driver Loads

Driver Auto Loads on System Start*

NOTE: Once a change is made, the Apply Button will appear. Changes will not be applied until you click the Apply button. The changes are saved to the adc8u.ini file.

Relay and Input labels may be changed by clicking the Relay Control or Input Setup buttons. Click the Analog Setup button to make changes to the analog labels, suffix, scale, offset or precision. These also apply to logged data.

The voltage input range may be set by selecting 1 of the 10 possible gain levels using the built in instrument amp.

Start the data logger by checking the Enable box. The logger will roll-over or stop based on the setting in the Max Entries box. The Data Interval may be set to minutes or seconds and will log the data based on the setting in the box.

To completely automate the ADC-8U15HG, check Start Minimized, Driver Only* and Allow External Commands. In this mode of operation, your program has complete control of the ADC-8U15HG and the User Interface does not open. *do not check unless the ADC-8U is always connected to a USB port.

**all four or eight analog inputs are updated at the same rate which you set under Setup in the User Interface. The default setting is every 250ms with an effective sample rate of 16 samples per second (or each channel sampled four times per second). A setting of 1000 will sample all four inputs once per second or a setting of 2500 every 2.5 seconds, etc. Use caution when making changes to this setting as a time setting too low will waste processor resources. A setting below 10ms will degrade system performance and will not allow for any change of the analog level due to the filter cap and decoupling resistor on the analog input (which average the signal level to reduce noise).

Check the Start Minimized box to start the ADC-8U15HG device driver in "driver only" mode. Blue 8 icon will show in your system tray.

INPUT MODE

Select the Differential Input option under Input Mode to allow differential inputs to be connected to the terminal blocks on the ADC-8U15HG (display will change to two channel mode for that bank, see page 9). High Gain inputs are enabled in 2 channel differential mode only (for a total of 4 high gain inputs). Mixed 3 channel mode is enabled in Standard Gain only with the differential input connected to terminals 3 and 4 for Bank A and terminals 7 and 8 for Bank B. Each bank of 2, 3 or 4 analog inputs is completely independent and allows one bank to be set to High Gain with the other in Standard Gain. A total of 8 single ended analog inputs may be connected in Standard Gain mode with the (-) input connected to any of the GND terminals. The GND terminal will not be used in differential mode.

HIGH PRECISION INSTRUMENT AMP

The built-in high precision programable instrument amplifier utilizes 10 predefined precision voltage references that have been selected to provide an exact voltage measurement per increment as follows:

STANDARD GAIN:		(15 bit single ended or 16 bit differential)
512 mv	.015625 mv increments	(64 per mv)
1.024 v	.03125 mv increments	(32 per mv)
2.048 v	.0625 mv increments	(16 per mv)
2.5 v	.076294 mv increments*	(13.1 per mv)
5 v	.152588 mv increments*	(6.6 per mv) *non-optimized

HIGH GAIN:		(15 bit single ended or 16 bit differential)
256 mv	.0078125 mv increments	(128 per mv)
128 mv	.0039062 mv increments	(256 per mv)
64 mv	.001953125 mv increments	(512 per mv)
32 mv	.0009765625 mv increments	(1024 per mv)
16 mv	.00048828125 mv increments	(2048 per mv)

Check the High Precision box when high sample rates are not needed (< 3 SPS). The internal processor will then average the input voltage to provide a greater degree of accuracy.

RAW ANALOG DATA

The ADC-8U15HG will present the raw analog data as a number between 0 and 32767 when in 15 bit single ended mode and a number between -32768 and +32767 when in 16 bit differential mode. Click the Analog Setup button and then check the "Raw" checkbox to display only the raw analog data. Analog Bank A or B may be enabled or disabled by checking the check boxes.

UPDATES FOR THE ADC-8U15HG DEVICE DRIVER/USER INTERFACE

Click the "Check for Updates" button under Setup in the ADC-8U15HG User Interface or contact EECI support. There is no charge for the updates.

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