

# DAC-4U SERIES DIGITAL TO ANALOG CONVERTER

TECHNICAL REFERENCE



Click for more info: [www.eeci.com/dac-4up.htm](http://www.eeci.com/dac-4up.htm)

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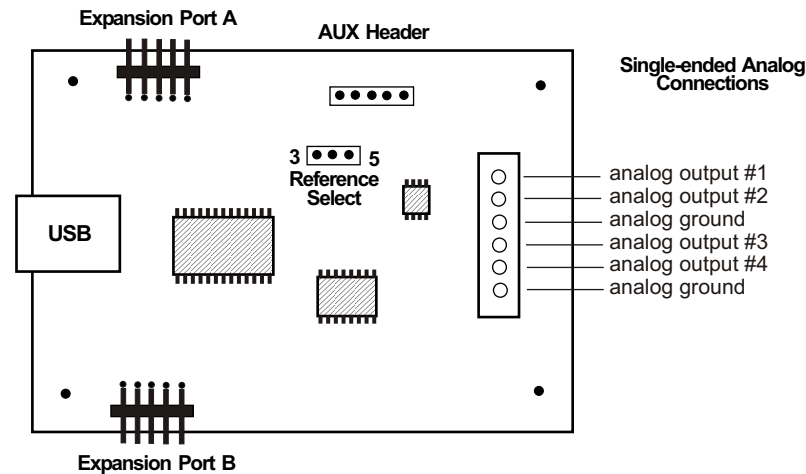
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## SPECIFICATIONS

Power Supply.....	Powered from USB port (5 volts DC)
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 Outputs.....	4 analog output channels (10 or 12 bit resolution)
	DAC-4U10 (10 bit resolution will divide your analog output level into 1,024 different increments)
	DAC-4U12 (12 bit resolution will divide your analog output level into 4,096 different increments)
Analog Voltage Output Range.....	0 to 5 volt (default range) 0 to 3.3 volt user supplied in the range of 1 volt to 5 volts
Expansion Capability.....	expandable to control up to 144 relays/inputs (or combinations) using EX-8M, EXM-8, EXM-16 or EXM-32 Relay I/O Expansion Modules
Interface.....	USB (also available in WiFi version (DAC4-WIFI), Ethernet version (DAC4-ENET) RS-232 version (DAC4-RS232) or RS-485 version (DAC4-RS485))
Software Compatibility.....	Windows XP, Vista, Windows Server, Windows 7, Windows 8 and Windows 10 Windows 2000 and Windows ME using alternate software
Weight.....	.75 ounce
Size.....	1.875 inches by 2.5 inches

## SET-UP AND TESTING

### CONNECTION DIAGRAM DAC-4U SERIES DIGITAL TO ANALOG CONVERTER



### DESCRIPTION

The DAC-4U series Digital to Analog converters connect to any available USB port on your desktop or laptop PC (including some tablets and phones). Four analog outputs channels are provided for conversion from 10 or 12 bit digital format. Three optional expansion ports are available for connection of up to 144 relays, 144 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 DAC-4U

The DAC-4U series Digital to Analog Converters are warranted against factory defects for a period of 90 days from the date of purchase. The DAC-4U has proven to be extremely reliable in actual operation during field tests. We recommend that the DAC-4U 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.

Upon receiving your DAC-4U, you should connect and test the operation of the hardware to verify proper operation. Please set-up and test the DAC-4U as follows (Windows XP\*, Vista, Windows Server 2008, 2012, Windows 7, 8 or later) \*service pack 3

(1) Connect your DAC-4U Digital to Analog converter to your computer USB port using a CC-USB B cable (1 to 10 foot). A high percentage of systems will already have a USB Com driver installed and this is indicated by a pop up balloon in the lower right side of your screen. The balloon message may automatically assign a com port to your DAC-4U and the com port assigned will be shown. If this occurs then make note of the com port for step 4 and go to step 2. The balloon message may also indicate that a driver has been located on your system and is being installed and after which a com port is assigned to the DAC-4U. If this occurs then make note of the com port for step 4 and go to step 2.

The balloon message may request to search Windows Update for the correct driver. If you are connected to the Internet, you may click yes and allow the USB com driver to be installed and after which a com port is assigned to the DAC-4U. If this occurs, then make note of the com port for step 4 and go to step 2.

With Windows XP, the "Found New Hardware Wizard" may pop up. If you have an Internet connection, allow the wizard to connect to Windows Update and install the USB com driver, then go to step 2.

If none of the above actions occur or if an error message is shown, you may install the USB Com driver\* from the supplied CD by clicking the "Install USB Com Driver" button in the CD start window. After the USB com driver is installed, disconnect your DAC-4U from the USB port, wait 5 seconds and plug back in. You may see a balloon message with the com port assigned to the DAC-4U (if not, you will find the com port assigned in step 2).

\*before installing a new USB com driver, go to Control Panel/Device Manager/Ports to check if a Prolific driver is shown (expand the category by clicking on the + or arrow). If you see a "Prolific USB to Serial Comm Port (COM-)" entry, the number to the right of COM is your com port. Right click on the entry, then properties, then the driver tab to check the version. If you have an out of date version and an Internet connection, click the "Update Driver" button to install the updated driver. Please note that it may be necessary to remove the outdated Prolific Com driver before the updated driver will correctly install (the supplied CD driver installation feature has a remove option - click Install Com Driver).

(2) Check your USB Com driver by going to Control Panel/Device Manager/Ports (see detail on the next page for your Windows version) or click the "Open Control Panel" button on the supplied CD start window. Click the small triangle (or +) to the left of Ports to expand the Ports category, right click the Prolific USB to Serial Comm Port, click properties and open the driver tab. Your USB Com driver must be Prolific version 3.4.62.293 or higher (dated 10/17/2013 or later). If your USB Com driver is up to date then please note the Com port number assigned and jump to step 3.

If your USB Com driver is not up to date, click the "Update Driver" button (under driver tab). If the driver does not update, disconnect the DAC-4U USB cable from your computer and install the updated USB Com driver (located on your DAC-4U CD from the start window, in the USB Com driver folder or from Windows Update). Please see detail\*

(3) After you have verified or installed an up to date USB Com driver, reconnect your DAC-4U Digital to Analog to any available USB port on your computer and insert the DAC-4U CD. Install the DAC-4U Driver/User Interface\* by clicking the "Install Driver/Interface" button in the CD start window (if you have auto-start disabled, you may browse to the Windows Test Program folder and double click on setup.exe). A desktop icon for the DAC-4U will be created.

\*Please note that the Microsoft .Net Framework must be installed on your system. If the .Net Framework is not installed on your computer, the installation program (for DAC-4U Driver) will attempt to download and install the .Net Framework from the Microsoft web site 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".

After the installation is complete, a pop-up window will ask for the com port to be used with your DAC-4U Digital to Analog converter. Enter the com port found during steps 1 or 2 and click OK. Your screen should show a row of four channels with four analog level input boxes along with the set buttons. The default reference voltage is set to 5 volts (0 to 5 volt analog output range)

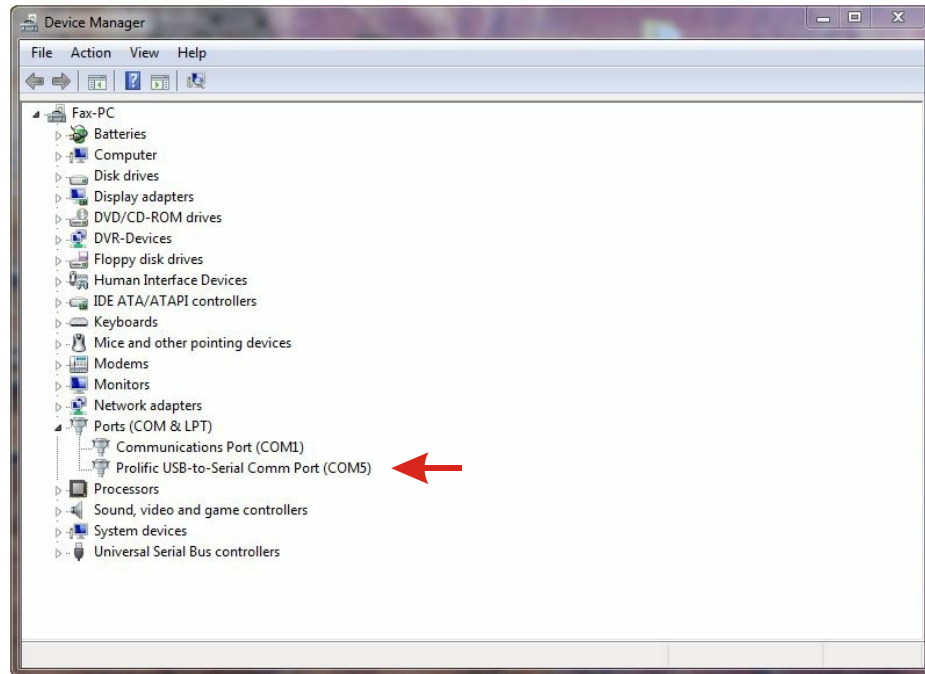
(4) Test each analog output by entering a number (0 to 1,023 for 10 bit) or (0 to 4,095 for 12 bit) in the text box for the channel. Press the S button to set the analog output level to this number. The analog voltage output should increment from 0 to 5 volts, (in 0 to 1,023 increments for 10 bit) or (in 4,096 increments for 12 bit) as you increase the number. For example... to set the analog output level to mid range (2.5 volts) enter: (512 for 10 bit converters) or (2,048 for 12 bit converters).

(5) If operation of the analog outputs are normal, then testing is now complete and your DAC-4U may be placed in service. If problems are encountered during testing, proceed to the trouble-shooting procedures shown on page 5.

### 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, 8.1, 10 and Windows Server 2012

Move your mouse cursor to the lower right side of your screen and click on Settings. Click on Control Panel near the top and click on the Device Manager icon.

### TROUBLE-SHOOTING THE DAC-4U

(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 8/15/2014 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 DAC-4U 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 DAC-4U. You may do this by watching the entry in Device Manager and unplugging your DAC-4U from your computer USB port. The entry should disappear and then re-appear when you plug the DAC-4U back in to your computer USB port.

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

(4) Verify that the DAC-4U Driver is correctly installed and running. Click the red 4 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 (select the processes tab).

(5) Remove the DAC-4U USB cable from your computer, wait 5 seconds and plug back in. Open the DAC-4U User Interface by clicking on the red 4 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 DAC circuit areas or other connected hardware. Check for shorts on all analog output channels.

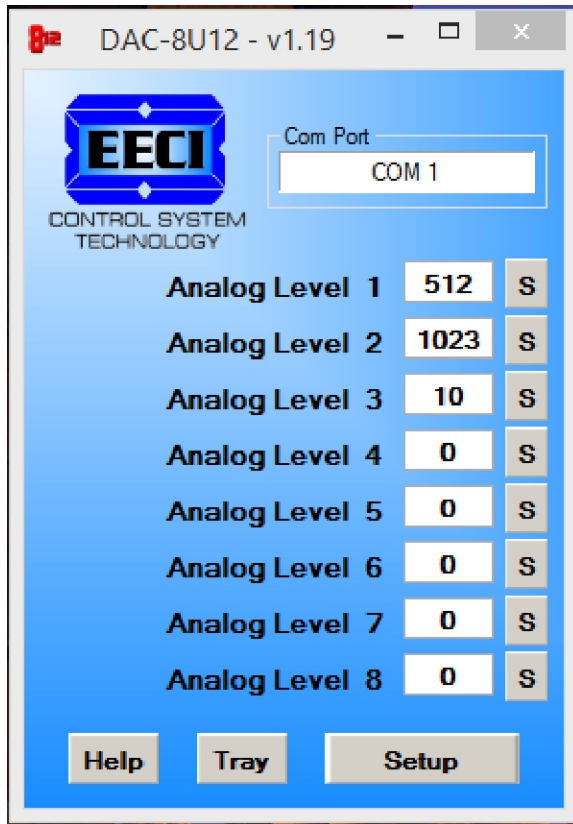
(7) When an external reference is used, the reference voltage must not exceed 5 volts or go below 1 volt and must not be allowed to go negative.

(8) Be sure that you have only one instance of the DAC-4U user interface running. Click the tray button to put the user interface in driver only mode and check your task bar to see if another instance is running.

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

### EXPANSION PORTS

The DAC-4U provides two expansion ports for additional I/O operations using the same COM port. The expansion ports may be used to connect up to 16 relays (8 per expansion port) or to connect up to 16 inputs (or combinations of relays and inputs) using EX-8M expansion cards. A third expansion port is provided that will permit an additional 128 relays/outputs/inputs to be added using the EXM-8, EXM-16 or EXM-32 Relay I/O Expansion Modules. The relay output ports on the EX-8M and expansion modules are similar to those on the AR-16, EX-16 and EX-32 and accept the same relay cards and other accessories as the AR-16. A variety of relay cards with various contact configurations are available for connection to the expansion cards/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 to the EX-8M Technical Reference available on the EECI web site.



## THE DAC-4U USER INTERFACE

The DAC-4U User Interface allows you to set all of the basic operating characteristics of the hardware and permits the DAC-4U to send and receive data from other Windows applications or programs that you create.

When the user interface is started for the first time you are prompted for the com port that is to be used with the DAC-4U. This com port number is saved in the settings file "dac4u-set.ini" which is created in the folder c:\eecl\dac-4u. The driver will then start 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 clicking Apply. To manually set the analog output levels, enter the desired output level and click the S button to set the analog output voltage for that channel. Enter (0 to 1,023 for 10 bit) or (0 to 4,095 for 12 bit).

Clicking the Setup button allows you to label the analog outputs for each of the 4 channels. The com port, baud rate and sampling rate settings are changed below. Un-checking the Allow External Commands box will prevent other Windows applications from sending or receiving data from the DAC-4U. The data logger may be enabled by checking the box in the data logger section and

entering the file type information. The logger will log an event each time an analog output level is updated.

The DAC-4U User Interface may be started in driver only mode by checking the Start Minimized box. 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 dac8u-set.ini file so that when the user interface is shut down, it will restart with the new settings. Click the Tray button (driver only mode) to close the window after the DAC-4U User Interface is set-up for your application. A red 8 icon will appear in your system tray (click to re-open the user interface). The DAC-4U User Interface may be left open if an external application is not used. The DAC-4U User Interface may be completely shut down (and driver unloaded) by clicking the red X on the top right of the user interface. Once shut down, you will need to double click the DAC-4U desktop icon to re-start the DAC-4U Driver (or clicking the DAC-4U icon under All Programs in the EECl folder). The Help button will provide additional assistance if you installed the Help files from the DAC-4U installation CD.

### AUTO START-UP FOR THE DAC-4U DRIVER

To automatically start the DAC-4U driver, copy your DAC-4U desktop icon (right click) and paste in your computer Startup folder. In Windows XP up through Windows 7, the start-up folder is located by clicking your Start button and clicking on All Programs then scrolling down to the Startup folder. In Windows 8.1 and 10, move your cursor to the lower right of your screen and then click on Search. In Search, type "run" and select. Enter "shell:startup" (no quotes) and click OK. Your computer will start up normally with the DAC-4U User Interface running and shown in your system tray. You may also place your own application in the start-up folder to boot directly to your

application (set the DAC-4U Software Interface to start minimized).

## THE DAC-4U DATA LOGGER

The DAC-4U User Interface provides a data logger function that will save analog input readings to a file each time an analog output level is updated. Channel labels may be edited by clicking the Analog Setup button under setup. The DAC-4U 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. 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. 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 example, copy the code module (supplied on your CD) to a sub called setOutputs(). From the toolbox, drag (4) textboxes and a timer control to your form. Insert the following code into the timer sub. The (4) DAC-4U analog outputs levels are entered using textboxes 1 through 4. If you wish to update the analog outputs 4 times per second (for example), set the timer interval to: Timer1.Interval = 250

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

```
setOutputs() 'set analog outputs
```

```
End Sub
```

### VISUAL C# EXAMPLE (Microsoft Visual Studio)

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

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#, C++ and ASP .Net. Additional source code examples are available in several other variations which may be more suitable for alternate programming languages. DLL's and LabVIEW examples are also provided. Please contact EECl technical support for more information.



## VOLTAGE REFERENCE INPUT

The DAC-4U allows for several different reference voltage configurations. The reference voltage determines the voltage output range for all (8) analog output channels. The following configurations are selectable. Option 1 is the default setting.

Option 1: 5 volt - allows a (0 to 5) volt output range ((4) channels single ended) (default setting)

Option 2: 3.3 volt - allows a (0 to 3.3) volt output range ((4) channels single ended)  
external reference voltage selected with circuit board shunt.

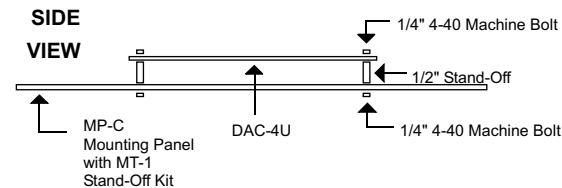
Option 3: User supplied - must be in the range of 1 volt to 5 volts and should have an output impedance of 500 ohms or less reference voltage from user is applied to the 2 position AUX header.  
Example: 2 volts applied to the AUX header provides a (0 to 2) volt output range (single ended)

## CONNECTING DEVICES TO THE DAC-4U ANALOG OUTPUTS

A large variety of devices (temperature controllers, adjustable speed AC drive controllers, VFD motors, adjustable flow valves, lighting controllers, audio level controllers) and other devices that require an analog input may be connected to the DAC-4U. The cable used to connect devices to the DAC-4U analog outputs should be twisted pair or shielded twisted pair to suppress environmental noise. Low cost CAT 5 cable (or shielded CAT 5) works well when multiple devices are in the same location. The DAC-4U may be used to control the current in a 4-20mA loop by adding the CO-420T transmitter. The CO-420T4 may be used to convert four of the DAC-4U outputs to four 4-20mA transmitters.

## MOUNTING

The DAC-4U 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 DAC-4U will attach to the 4 stand-off spacers using 4-40 machine screws (4 mounting holes are provided on the DAC-4U). Contact technical support for more information on mounting panels and various mounting layouts.



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