

isoPods™

& Pod-Vu™  
software



[www.edaq.com](http://www.edaq.com)

# eDAQ USB isoPods



These isoPods, Figure 1, are miniature electrically isolated amplifiers that connect to a computer via a USB port or hub, which also provides power to the device. Available isoPods include:

**pH & ISE isoPod** suitable for use with most pH, ion selective, dissolved CO<sub>2</sub> or NH<sub>3</sub>, and ORP electrodes.

**Conductivity isoPod** for use with 2-electrode conductivity cells.

**Thermocouple isoPod** can be used to connect a B, E, J, K, N, R, S, or T-type thermocouple probe for temperature measurement.

**Thermistor & RTD isoPod** can be used with eDAQ ET020 30 kohm thermistor, or ET021 1000 ohm RTD, temperature probes.

**dO<sub>2</sub> isoPod** for use with Clark-type (polarographic) dissolved oxygen electrodes.

**Nitric Oxide isoPod** for use with nitric oxide polarographic electrodes.

**Biosensor isoPod** for use with amperometric (polarographic) biosensors comprising a pair of electrodes (anode and cathode).

## Why isolation?

Electrical isolation ensures minimal signal noise and crosstalk.

When multiple sensors are used simultaneously in the same sample, it is possible they will interfere with one another. For example the signal from a pH electrode (which measures potential) will often be affected by a nearby oxygen electrode (which passes a small current through the sample).

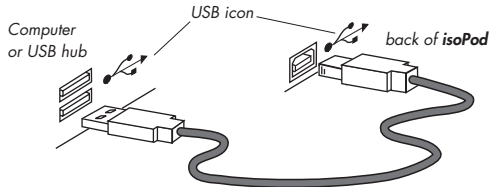
Electrical isolation of one, or preferably both, of the monitoring units ensures that no electrical current actually passes between the sensors. Similarly, metal-walled reaction vessels are often electrically grounded, or provide other electrical pathways, that cause problems. Isolation of the monitoring devices ensures there is no interference from the reaction vessel.

NOTE: isoPods use a virtual COM port (VCP) software driver that causes a USB isoPod to appear as a serial (COM) port. Latest drivers are available at [www.ftdichip.com/Drivers/VCP.htm](http://www.ftdichip.com/Drivers/VCP.htm)



**Figure 1**  
eDAQ isoPods

**Figure 2**  
Connection to a  
computer




## Serial Communication

Each eDAQ USB isoPod features a serial (RS232) protocol comprising a set of specific commands. These are described in the notes for each individual isoPod. Users can write their own software to gather data using this protocol, for example using LabView. However in most cases it is easier to use eDAQ Pod-Vu software to record the various signals. Pod-Vu software requires no prior knowledge of programming, or of the serial protocols.

## Installation

Install the software supplied on the USB memory stick with your isoPod. This will install drivers for all isoPod models as well as the Pod-Vu software.

### Connection

Connect the isoPod to the USB port of a computer or, USB hub, with the cable provided, Figure 2. USB ports are usually denoted with a trident-like, , icon. If more than four isoPods are to be used on the same computer, then a good quality powered USB hub is recommended.

# Pod-Vu Software

Use the USB stick supplied with the isoPod to install the Pod-Vu software and USB software drivers for the isoPods.

Pod-Vu software enables Windows computers to calibrate and monitor signals from eDAQ USB isoPods. Signals from up to eight isoPods can be graphically displayed and tabulated in real time. Data can be copied and pasted to other software for further analysis or reporting, or saved in text format which can be read by spreadsheet or word processor software.

*For best Pod-Vu results:*

- *set your computer to 'never' go to sleep when recording signals with Pod-Vu*
- *turn 'Windows updates' off if you are using Pod-Vu to record signals overnight*
- *use the latest version of Pod-Vu software, which can be downloaded at [edaq.com/support.php](http://edaq.com/support.php)*

## First Use

The first time you use the Pod-Vu software it will ask for a license code to be entered. After this, a new Pod-Vu file will open and show the signals from any connected isoPods.

If you do not have a license code then you can still use Pod-Vu but you will not be able to copy, save, or print data. Licenses can be purchased from your eDAQ supplier.

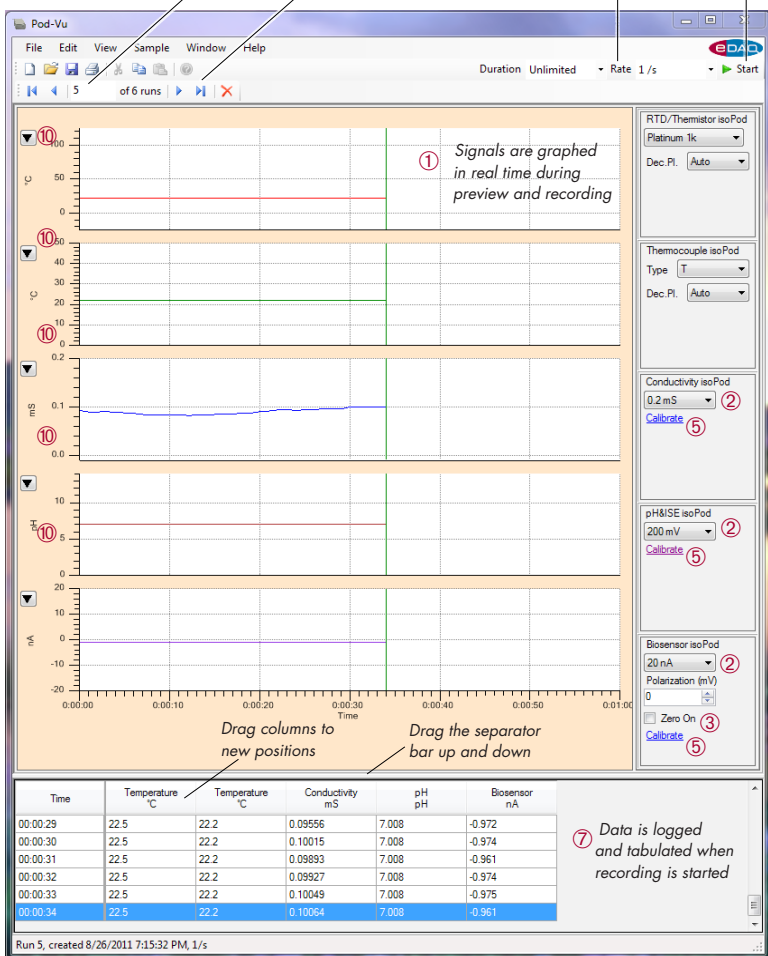
## Software Features

Figure 3 shows some of the basic features available when you use Pod-Vu software with various isoPods connected.

- ① Pod-Vu will **preview isoPod signals** as soon as it opens. You should now set gain ranges, and calibrate signals as described below.
- ② On some isoPods you can **select a gain range** (signal sensitivity). Use a range about twice as large as the biggest signal you expect to see for best results.
- ③ On some isoPods you can **zero the signal** (baseline correction) while in preview mode. This may take a few seconds to complete. The zero setting will remain active until the zero box is unchecked.
- ④ **Select a rate** (the speed at which data points will be collected) suitable for your experiment.
- ⑤ Some isoPods allow user **calibration** of the signal (see page 6).
- ⑥ To **start/stop** a run click the Start/Stop button. (The button toggles between the two modes.)
- ⑦ When started Pod-Vu will **log data** at the specified rate. When stopped Pod-Vu can be used to preview ⑨ the incoming signal
- ⑧ Many runs can be stored in the same Pod-Vu file. Review past runs in the file, or
- ⑨ preview the signal for the next run.
- ⑩ Use a pop-up menu to set the **Y-axis scaling**.

**Figure 3**  
Pod-Vu features

- ⑧ Select a previously recorded run
- ⑨ Preview the signal for the next run
- ④ Select a rate
- ⑥ Start/Stop recording



Recording can be set to be for a fixed period or unlimited duration, *Duration Unlimited*.

When reviewing an old data set you can drag the pointer over a region of the signal to obtain a zoom view.

## Sensor Calibration

Pod-Vu recognises the isoPod models and has calibration controls appropriate for the signal that is being monitored.



### pH & ISE isoPod

For pH and ISE electrodes you will need one or two solutions of known pH (or ion concentration for ISE electrodes). Calibration is not required when measuring a signal in raw millivolts.

Clicking the **Calibrate** button accesses the Calibration window, Figure 4. You can enter unit names, ①, and  $n$  values, ②, for different ions, and the temperature of the solution (in °C), ③.

Dip the electrode in a calibration solution while previewing the signal. When the signal has stabilised click the **Apply** button, ④, to enter the signal value on the table then enter the value of calibration solution, ⑤. Repeat this procedure with a second calibration solution.

For pH and ion selective electrodes the relationship between observed potential and ion concentration is described by the Nernst equation,  $E = E_0 + (RT/nF) \ln(a)$  where:

$E$  is the observed potential, in volts,

$E_0$  is the potential (volts) when  $\ln(a) = 0$ ,

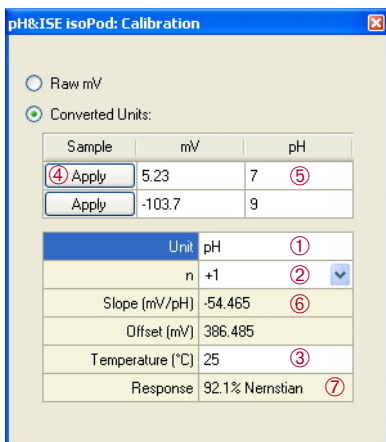
$R$  is the gas constant, 8.314 J/K/mol,

$T$  is the temperature in Kelvin,

$F$  is the Faraday constant, 96487 C/mol,

$n$  is the number of electrons transferred at the electrode (usually the charge of the ion), and

**Figure 4**  
pH and ISE  
calibration



**pH&ISE isoPod: Calibration**

Raw mV

Converted Units:

Sample	mV	pH
④ Apply	5.23	7 ⑤
Apply	-103.7	9

Unit	pH	①
n	+1	②
Slope (mV/pH)	-54.465	⑥
Offset (mV)	386.485	
Temperature (°C)	25	③
Response	92.1% Nernstian	⑦

$\ln(a)$  is the natural logarithm of the concentration in mol/L, (or more correctly the 'activity') of the ionic species.

When considering pH, defined as  $-\log_{10}[H^+]$ , The Nernst equation is written as:

$$E = E_0 - 2.303(RT/nF)pH, \text{ or}$$

$$E = E_0 - 0.0591pH \text{ at } 25^\circ\text{C}$$

The value of  $-2.303RT/nF$ , is the ideal slope of the electrode response when  $E$  is plotted versus pH, or other  $-\log_{10}[a]$ . This is compared with the experimentally determined value (mV/pH), ⑥, to determine the percentage Nernstian response, ⑦. New, and good quality, electrodes will have a Nernstian response in the range 95–102%, but as electrodes age or foul this value will get smaller.

Selecting **Converted Units**: will apply the calibration to the main signal which will now be displayed in units of pH (or pF, pNa, etc.)

RTD/Thermistor Pod  
 Probe **Platinum**  
 Dec.Pl. **Auto**

## RTD/Thermistor isoPod

This can be used with the eDAQ ET020 Thermistor, and ET021 RTD temperature probes. These probes are accurate to better than  $\pm 0.2^\circ\text{C}$  (from 0 to  $60^\circ\text{C}$ ) without user calibration. Just select the probe type and number of decimal places to be displayed.

dO<sub>2</sub> isoPod  
 20000 nA  
 Polarization (mV)  
 -800  
 Zero On  
 Calibrate

## dO<sub>2</sub> isoPod, Nitric Oxide isoPod, Biosensor isoPod

These all operate the same way. First set **Polarization (mV)** to the desired value. Click the **Calibrate** button to access the calibration window, Figure 5. You need two solutions of known analyte concentration. Often the first calibration solution contains no analyte and is for a zero point measurement (eg nitrogen-bubbled water can be used for dO<sub>2</sub> or nitric oxide sensors). Immerse the sensor in the first calibration solution while previewing the signal. When the signal has stabilised click the **→** button to place the signal value, ①, then enter the value of calibration solution, ②. Repeat this procedure with a second calibration solution, ③ and ④, and then enter the desired unit name, ⑤. Finally display the signal, calibrated in the desired units, with the **Apply** button, ⑥.

Nitric Oxide isoPod  
 2000 nA  
 Polarization (mV)  
 800  
 Zero On  
 Calibrate

Biosensor isoPod  
 20000 nA  
 Polarization (mV)  
 400  
 Zero On  
 Calibrate

**Figure 5**  
 Calibration for  
 dO<sub>2</sub>, Nitric Oxide,  
 and Biosensor  
 isoPods

dO<sub>2</sub> isoPod: Units

→ 1.386 ① nA ≡ 0 ② Units: ppmO<sub>2</sub> ⑤

→ 128 ③ nA ≡ ④

Revert Clear ⑥ Apply Close

Thermocouple Pod

Type

Dec.Pl.

## Thermocouple isoPod

Select the type of thermocouple and the number of decimal places to be displayed. The isoPod applies an ice point correction and then a polynomial calibration function according to the NIST ITS-90 tables. See the NIST website, <http://srdata.nist.gov/its90/main/> for more details. The data will be accurate to the specifications of the thermocouple probe. Calibration is not required when measuring a signal in raw millivolts.

Conductivity isoPod

[Calibrate](#)

## Conductivity isoPod

Calibration is not required when measuring a sample to obtain an absolute conductance measurement (eg when you need to determine the conductance, in Siemens, of an electrical resistor). In all other cases a calibration solution of known specific conductivity (or TDS value) should be prepared. Potassium chloride solutions are often chosen for this task. Click the [Calibrate](#) button to access the calibration window, Figure 6. For specific conductivity determinations, ①, enter the specific conductance, ②, of the calibration solution and then click the [Apply](#) button, ③, the cell constant will be determined, ④, and used to calibrate the signal. Alternatively if the cell constant is known beforehand it can be entered directly.

For salinity (total dissolved solids, TDS) determinations enter the known value of the calibration solution, ⑤, and then click the [Apply](#) button, ⑥, the TDS factor, ⑥, will be determined and used to calibrate the signal.

**Figure 6**  
Calibration of conductivity signal

Conductivity isoPod: Units

Raw Conductivity (mS)

Specific Conductivity (mS/cm) ①

Cell constant, k =  /cm ④  
or  
calibration solution =  mS/cm ②

[Apply](#) ③

Total Dissolved Solids (ppm)

TDS factor =   
or  
calibration solution =  ppm ⑤

[Apply](#) ⑥

Specific conductivity,  $\kappa$ , of KCl solutions at 25°C

KCl mol/L	$\kappa$ mS/cm
0.0001	0.01494
0.001	0.147
0.005	0.718
0.01	1.413
0.02	2.768
0.05	6.668
0.10	12.880
0.5	58.67
1.0	111.7



## Pod-Vu Menus

### File menu

The **File** menu has standard commands for opening new or existing Pod-Vu files, saving files, printing the data, and exiting the software. The **Save As** command can be used to save data as text files for exporting to other software. The **Save**, **Save As**, and **Print** commands are disabled unless a valid licence code has been entered.

### Edit menu

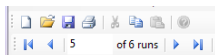
Use the **Copy** command in the Edit menu to transfer selected data in the Pod-Vu table by pasting into spreadsheet and word processor documents. This command is disabled unless a valid license code has been entered.

Use the **Delete Run** command to excise the currently displayed run from the Pod-Vu data file.

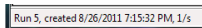
Use the **Select All** command to select all the data in the Pod-Vu table for the currently displayed run.

### View menu

Use the **Toolbar** command to lock the toolbars in place (otherwise you can drag them to a new location at the side of the screen). The **Status Bar** command will hide/show the Status bars at the bottom of the Pod-Vu Window. There are also menus, ⑩ Figure 3, to change the scaling of the vertical axes of the graphic displays of the Pod-Vu channels.



Toolbars



Status bar

### Sample menu

The **Start/Stop** command duplicates the function of the Start/Stop button in the main Pod-Vu window, ⑥ Figure 3.

### Window menu

The **Hardware** command displays the status of the various isoPods that are connected to the computer.

### Help menu

The **License** command allows entry of a valid license code for the Pod-Vu software. The **About** command displays the Pod-Vu software version number, and computer configuration information.

# Specifications

## Pod-Vu

Operating system:	Windows XP, Windows Vista, Windows 7.
Communication:	USB virtual serial port
Channels:	1 – 8
Saved data format:	Pod-Vu native format, or space delimited ASCII text (suitable for Excel, etc)
Data display:	Tabular and graphic
Graphic Y-axis scaling:	Full scale, autoscaling, user selected limits
Channel calibration:	as defined by isoPod firmware
Data acquisition rates:	1/s (default) 30, 15, 10, 5, 2, 1/min 30, 15, 10/h

## isoPods\*

Isolation:	> 250 V rms
Connector:	mini USB socket
COM port settings:	115200 baud; 8 bits; 1 stopbit; no parity; flow NONE.
Dimensions (l x w x h):	108 x 58 x 35 mm
Weight:	~200 g
Operating conditions:	0 – 40 °C, 0 – 90% humidity (non condensing)

## pH & ISE isoPod (EPU353)

Input connector:	BNC
Input impedance:	$10^{13}$ ohm
Input ranges:	$\pm 2000$ mV (> pH 0–14), $\pm 200$ mV (pH 3.6–10.4)
DC drift:	5 $\mu$ V/°C
DC Offset error:	< 0.1% full scale
Amplifier noise:	< 6 $\mu$ V pp
Calibration:	Single or double point

## Conductivity isoPod (EPU357)

Input connector:	BNC
Input ranges:	200, 20, 2, 0.2, 0.02 0.002 mS
DC drift:	5 $\mu$ V/°C
DC Offset error:	< 0.1% full scale
Amplifier noise:	< 6 $\mu$ V pp
Calibration:	Single point. Conductivity or TDS

\* Specifications when used with Pod-Vu software. Use of the isoPods with user-written software may take advantage of other features of the serial command protocol embedded in the internal memory of the isoPod.

## Thermocouple isoPod (EPU356)

Input connector:	Mini thermocouple
Thermocouple types:	B, E, J, K, N, R, S, T, or raw mV
Input range:	20 mV
Input impedance:	> 20 Mohm (differential) > 10 Gohm (common mode)
Cold junction compensation:	$\pm 0.1^{\circ}\text{C}$ over $0 - 40^{\circ}\text{C}$ ambient
DC drift:	$< 0.1 \mu\text{V}/^{\circ}\text{C}$
Gain error:	$< 0.05\%$
Zero error:	$< 5 \mu\text{V}$
ICMRR:	$> 140 \text{ dB}$
Calibration:	ITS-90 polynomial automatically applied

## RTD/Thermistor isoPod (EPU358)

Input connector:	BNC
Probe types:	1000 ohm platinum RTD, or 30 kohm thermistor
Probe error:	$\pm 0.2^{\circ}\text{C}$ ( $0$ to $70^{\circ}\text{C}$ ) with ET020 Thermistor Probe $\pm (0.10 + n/600)^{\circ}\text{C}$ at $n^{\circ}\text{C}$ with ET021 RTD probe
Temperature ranges:	$-25$ to $+125^{\circ}\text{C}$ (RTD or thermistor) $-10$ to $+70^{\circ}\text{C}$ (thermistor)
DC drift:	$5 \mu\text{V}/^{\circ}\text{C}$
DC Offset error:	$< 0.1\%$ full scale
Amplifier noise:	$< 6 \mu\text{V p-p}$

## dO<sub>2</sub> isoPod (EPU354)

Input connector:	BNC
Input ranges:	$\pm 20000$ , $\pm 2000$ , $\pm 200 \text{ nA}$ , $\pm 20 \text{ nA}$
Polarization:	$0$ , then $-500$ to $-1000 \text{ mV}$ in $50 \text{ mV}$ steps
Zero offset range:	$\pm 20 \mu\text{A}$
Typical RMS noise:	$1 \text{ pA}$ when sampling at $1/\text{s}$
Calibration:	2 point

## Nitric Oxide isoPod (EPU355)

Input connector:	BNC
Input ranges:	$\pm 2000$ , $\pm 200$ , $\pm 20$ , $\pm 2 \text{ nA}$
Polarization:	$0$ , then $+500$ to $+1000 \text{ mV}$ in $50 \text{ mV}$ steps
Zero offset range:	$\pm 2 \mu\text{A}$
Typical RMS noise:	$30 \text{ fA}$ when sampling at $1/\text{s}$
Calibration:	2 point

## Biosensor isoPod (EPU352)

Input connector:	BNC
Input ranges:	$\pm 20000$ , $\pm 2000$ , $\pm 200$ , $\pm 20 \text{ nA}$
Polarization range:	$\pm 2000 \text{ mV}$
Zero offset range:	$\pm 20 \mu\text{A}$
Typical RMS noise:	$1 \text{ pA}$ when sampling at $1/\text{s}$
Calibration:	2 point



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## Warranty

eDAQ Pty Ltd warrants **e-corder** units, eDAQ Amps, and eDAQ isoPods, to be free of defects in material and workmanship of one year from the date of purchase. eDAQ Pty Ltd will repair or replace defective equipment as appropriate.

To obtain a warranty repair/replacement you must first notify us before return of the instrument and we will issue you with a RAN (return authorization number). You must ship the defective product at your expense. We will pay return shipping. The product should be packed safely (preferably in its original packaging) and have the RAN on the shipping label. Returns sent without a RAN may be refused delivery.

This warranty does not cover hardware that has:

- been modified by the user in any way;
- been subjected to unusual physical, electrical, or environmental stress. This includes damage due to faulty power sockets, inadequate earthing, or power spikes or surges;
- been damaged because of incorrect wiring to ancillary equipment, or because of substandard, connectors or cables; or
- had the original identification marks removed or altered.

## Software License

You have the non-exclusive right to use the supplied eDAQ Pod-Vu software. (Your employees or students, for example, are entitled to use it, provided they adhere to this agreement.) Each separate purchase of the Pod-Vu software licenses it to be used on two computers at any given time (on one computer for data acquisition with isoPod hardware units, and on a second computer for the analysis of existing data files). Although multiple copies of a program may exist on several computers, more than two copies must not be used simultaneously. Departmental/company licences are available if you wish to run more than two copies simultaneously.

## Jurisdiction

eDAQ Pty Ltd is bound by the laws of New South Wales in Australia, and any proceedings shall be heard by the Supreme Court of New South Wales in Australia.

## Technical Support

Technical assistance is available via email. Make sure that you are using the latest version of the Pod-Vu software, which can be downloaded at <http://www.edaq.com/support.php> Please describe the problem with as much detail as possible. Include a small example data file, if appropriate. Please also state:

- the models and serial numbers of your isoPod units; and
- the type of computer and operating system being used (for example Windows Vista).

We endeavor to answer all your questions, but in some cases, for example where the problem relates to the other equipment that you are using, a nominal fee may be charged.

## Disclaimer

1. eDAQ Pty Ltd reserves the right to alter specifications of hardware and software without notice.
2. No liability can be accepted for consequential damages resulting from use of eDAQ products.

Document Number: U-ES350-0811

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