# USB Conductivity isoPod™ (Model EPU357)

- Software controlled
- USB/virtual serial port (RS232) connectivity
- Electrical isolation minimizes noise and crosstalk
- Input ranges 2 μS to 200 mS
- Measure conductivity, specific conductivity, TDS
- Plug and play with Pod-Vu software

## Description

An electrically isolated, compact signal conditioner with a USB/ virtual serial port connection, for monitoring solution conductivity or TDS (salinity, total dissolved solids).

## Compatibility

This isoPod be used with most types of two-electrode conductivity cells, including:

- ET915 Dip-In Conductivity Electrode
- ET908 Flow-Thru Conductivity Electrode (for 1⁄8" OD tubing)
- ET916 Flow-Thru Conductivity Electrode (for 1⁄16" OD tubing)

Use with serial compatible software (RS232) or later, on Windows XP or later computers with USB port. A virtual serial port is created. Can be used with serial compatible software such as such as:

- Connect™, www.labtronics.com/DI/RS232_Software.htm
- WinWedge®, www.taltech.com/products/winwedge.html
- Tera Term, http://logmett.com/
- Pod-Vu, http://www.edaq.com/

or with your own software written in LabView, Visual Basic or C++ etc.

## Applications

Studies where continuous monitoring of solution electrical conductance or TDS is required – e.g. ion chromatography, flow injection analysis, or conductiometric titrations.

## Theory of Operation

The Conductivity isoPod measures the alternating current (AC) across a suitable conductivity cell by applying a square bipolar potential pulse across the pair electrodes that comprise the cell. The isoPod can automatically set excitation amplitude and frequency to an optimal value for a given gain range. Digital data is output at a user defined rate, or by polling, using a serial (RS232) protocol over a USB connection.

## Calibration

The specific conductivity of a solution is obtained by calibrating the conductivity cell. First measure the conductance of a solution of known value (e.g. 0.1 mol/L KCl) then equate this signal to the known specific conductivity, or ppm value, using the appropriate serial protocol command.

## Pod-Vu Software

A demonstration version of eDAQ Pod-Vu software is included on the isoPod Installer USB stick. If you have purchased Pod-Vu then a license code will also have been provided to enable all Pod-Vu features.

Pod-Vu will automatically configure the virtual serial ports and locate all connected USB isoPods. Refer to the Pod-Vu manual for operating instructions.

Pod-Vu will communicate with up to eight isoPod units, calibrate sensors, log data, and graphically display the signals in real time.

## Specifications

| | |
|---|---|
| Input ranges: | 0.002, 0.02, 0.2, 2, 20, 200 mS |
| Error: | <1 % FS on 200 mS and 2 μS ranges<br>< 0.1% FS on other ranges |
| Isolation: | > 250 V rms |
| AC waveform amplitude: | 0 – 200 mV p-p |
| AC waveform shape: | Square pulse |
| AC waveform frequency: | 10 Hz to10 kHz |
| Common mode rejection: | > 120 dB |
| Output data: | ASCII or 32 bit binary IEEE floating point |
| Output rate: | Up to 100 /s |
| Noise: | < 0.1% full scale |
| Input connector: | BNC |
| Power: | < 50 mA from USB connection |
| Dimensions (l x w x h): | 108 x 58 x 35 mm<br>(4.25" x 2.28" x 1.38") |
| Weight: | 200 g (7 oz) |

## Serial Communication

The isoPod is fitted with a USB port. This can be used as a virtual serial port with Windows, Mac OSX, and Linux computers. USB drivers for Windows XP and later computers are located on the eDAQ USB stick supplied with the isoPod. Otherwise you can download a suitable driver from

http://www.ftdichip.com/Drivers/VCP.htm

Software can then be written to communicate with the isoPod as a serial (RS232) device, for example using LabView, Visual Basic, or C++.

The serial port number must first be established. Serial Ports 1 and 2 on Windows computers are reserved for the mother board. Thus it is common to find that the isoPod is located on serial port 3 (COM3) or greater.

The virtual serial port should be configured as 115200 baud, 8 bits, 1 stopbit, no parity. Set the flow control to NONE.

When correctly configured the unit will send the prompt **EPU357>** to indicate that a new command can be sent.

## Interactive Communication

You can use terminal emulation software (eg Tera Term) to manually interact with the isoPod:

1. Download the Tera Term installer from http://logmett.com
2. Install Tera Term choosing the 'Compact Installation' option to reduce unnecessary extras.
3. Connect the isoPod and provide the computer with the isoPod Installer USB stick if a USB driver is requested.
4. Open the Windows device manager and find the isoPod and its corresponding COM port listed under 'Ports (COM & LPT)'. On first use there is no way to know in advance what COM port will be assigned to the isoPod, except that it will be COM3 or greater.
5. Start the Tera Term software, go to the Serial port... command in the Setup menu and configure the serial port as above. Click OK to return to the main Tera Term window and use the Return key to get the **EPU357>** prompt.

Once interactive communication is established you can be confident that the serial communications are working and can proceed to write your own software.

## Serial Protocol

**EPU357> help**
**EPU357> ?**
Returns a list of commands

**EPU357>** **set range <r> auto**
Set range, **<r>** = 200, 20, 2, 0.2, 0.02, 0.002 mS
Frequency, excitation voltage, etc. are automatically selected.
A confirmation string is returned.

**EPU357> set range <r> <Ve> <f>**
Set range, specifying range, **<r>** = 200, 20, 2, 0.2, 0.02, 0.002 mS
Set excitation voltage **<Ve>** between 0 – 0.2 V
Set excitation frequency **<f>** between 10 – 10000 Hz
A confirmation string is returned.

**EPU357> show range**
Returns the range and excitation parameters.

**EPU357> set k <value>**
Set the k value (cell constant) of the conductivity probe, if known.
If **<value>** = 0 then raw conductances (G, in milliSiemens) are reported, otherwise conductivity (kappa) values (in mS/cm) are reported. A confirmation string is returned.

**EPU357> calc k <kappa>**
Take a reading from a calibration solution and calculate **k**, given the specific conductivity value **<kappa>** in units of mS/cm**.** A confirmation string is returned. Subsequent readings will have units of mS/cm

**EPU357> show k**
Returns the **k** value.

**EPU357> set tds <value>**
Set the tds factor, **<value>**, of the probe, if known.
If **<value>** = 0 then tds conversion is not applied and raw conductances (G) are reported in units of mS, otherwise the tds readings are reported with units of ppm. A confirmation string is returned.

**EPU357> calc tds <TDS>** -
Take a reading from a calibration solution and calculate **tds** given the **<TDS>** value which should have units of ppm.

**EPU357> show tds**
Returns the **<TDS>** value used for calibration.

**EPU357> zero now**
Take a reading and apply an offset to adjust the reported value to zero. This offset will be applied to subsequent readings.

**EPU357> zero off**
No offset will be applied to subsequent readings.

**EPU357>** **r** -
Return a single reading.

**EPU357> v** -
Return a single value. That is the reading is returned as a number, without extraneous text such as unit name etc.

**EPU357> sample ascii <freq> [N]**
**EPU357> sample binary <freq> [N]**
Return readings at a frequency of **<freq>**, an integer between 1 and 100 Hz. Readings are returned as ASCII or 32 bit binary IEEE floating point data. Specify an optional integer, **[N]**, to return that number of samples. Send ! to exit this mode. If **<freq>** is the character # the a single sample is returned every time a # is sent, or send ! to exit this mode.

**EPU357> interval ascii <time> [N]**
**EPU357> interval binary <time> [N]**
Return one sample every **<time>** seconds. Specify an optional integer, **[N]**, to return a fixed number of samples. Send ! to exit this mode.

**EPU357> version**
Returns the firmware version number.

**EPU357> prompt off**
Turns off the **EPU357>** prompt.

**prompt on**
Reinstates the **EPU357>** prompt.

## How to start

If you intend to write your own software using these protocols then it is a good idea to commence by sending each command manually to the isoPod using a terminal emulation program for example Tera Term, see above. This will confirm the responses expected, so that you can be sure that any recent changes in the protocols will be accounted for.

## Example Commands

### Take a single reading

```
EPU357> r
EPU357 Reading 12.399171 mS
```

### Take a single value

```
EPU357> v
12.399171
```

### Continuous sampling

```
EPU357> sample ascii 5
EPU357 Sampling at 5 Hz, ascii mode
12.397526 mS
12.397526 mS
12.397526 mS
12.397526 mS
12.397526 mS
12.397855 mS
      ....
```

### Sample on demand

```
EPU357> sample ascii #
EPU357 Sampling (user sends # to sample, ! to exit), ascii mode
#
12.398184 mS
#
12.398541 mS
#
12.399197 mS
      ...
```

## Setting the input gain/range

```
EPU357> set range 20 auto
EPU357 Range 20 mS Auto Excitation 0.100 V Frequency 9995 Hz
```

## Setting the cell constant, k, (if known)

```
EPU357> set k 0.2
EPU357 k set to 0.200000

EPU357> set k 0
EPU357 k disabled
```

## Calculating the cell constant, k

```
EPU357> calc k 12.88
EPU357 k set to 1.080668

EPU357> r
EPU357 Reading 12.88002 mS/cm
```

## Setting the total dissolved solids cell constant, tds, (if known)

```
EPU357> set tds 10
EPU357 tds set to 10.000000

EPU357> set tds 0
EPU357 tds disabled
```

## Calculating the total dissolved solids constant, tds

```
EPU357> calc tds 5000
EPU357 tds set to 403.2206

EPU357> r
EPU357 Reading 4999.4692 ppm
```