Universal Specialty Cell Connection Kit Information

The Universal Specialty Cell Connection Kit (Part # AB01ESA01) enables users to easily interface any potentiostat cell cable with a Pine Research specialty cell. Specialty cells compatible with this connection kit include the Compact Voltammetry Cell (for screen-printed electrodes), Honeycomb Cell (for spectroelectrochemistry), and Synthony™ Cells (for organic electrosynthesis).

Pine Research offers a variety of cell cables which permit direct connection between Pine Research specialty electrochemical cells and Pine Research WaveNow and WaveDriver series potentiostats, and users of Pine Research potentiostats are encouraged to make use of these simple and direct cabling solutions. Users of third-party potentiostats can also enjoy using Pine Research specialty cells by making cell connections via the Universal Specialty Cell Connection Kit.

1. General Product Overview

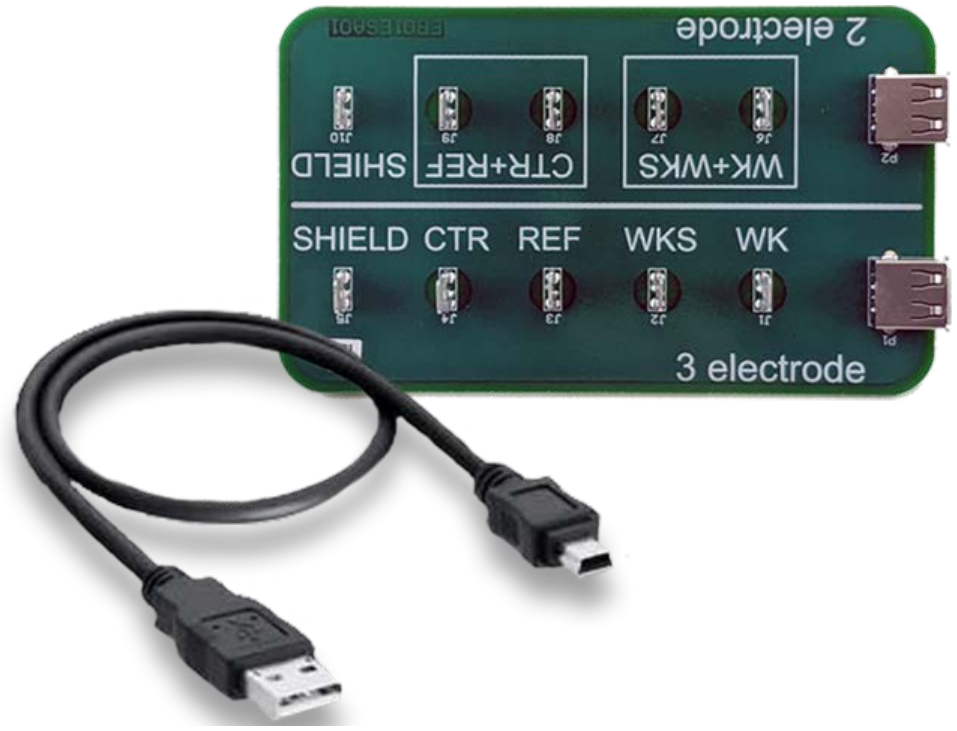

Figure 1. Universal Specialty Cell Connection Kit

The Universal Specialty Cell Connection Kit allows the cell cable for many third-party potentiostats to be connected with the USB Mini-B connector found on Pine Research specialty cells (see Figure 1). The kit includes a circuit board and a USB Standard-A to USB Mini-B cable. The circuit board

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provides convenient connection points for either two-electrode or three-electrode operation of the electrochemical cell. The connections for two-electrode operation are located on one half of the circuit board (see Figure 2A), and the connections for three-electrode operation are on the other half of the board (see Figure 2B).

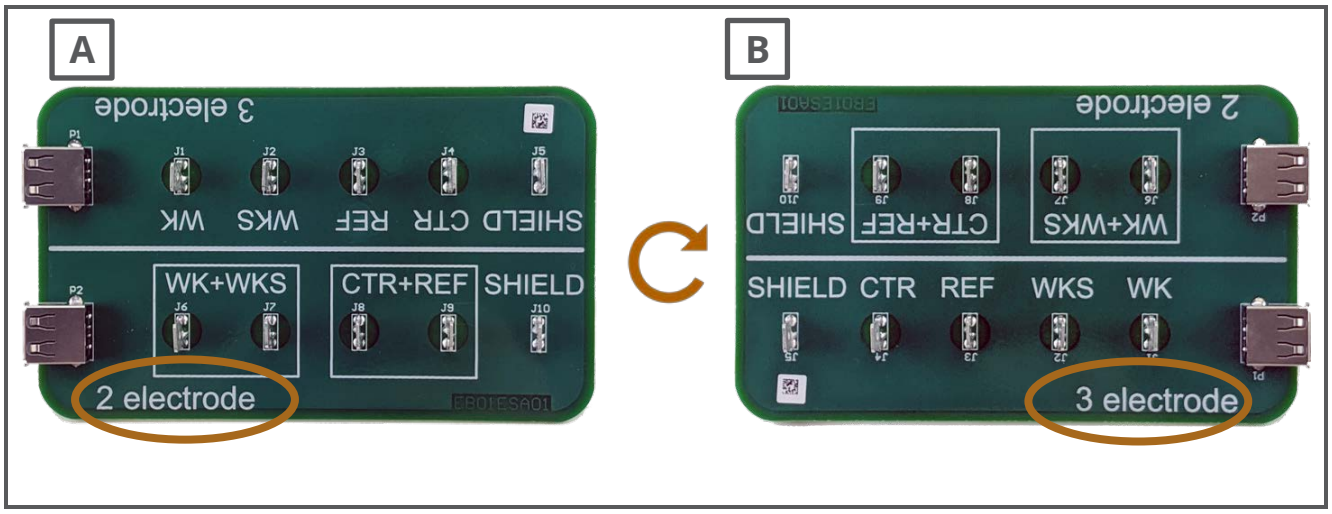


Figure 2. University Specialty Cell Circuit Board with [A] 2-Electrode and [B] 3-Electrode Connections

Most third-party potentiostat cell cables terminate in alligator clips, and these clips can be easily connected to the vertically-oriented blades on the circuit board (see Figure 3). There are separate connection blades for the working electrode drive line (WK), the working electrode sense line (WKS), the reference electrode sense line (REF), and the counter electrode drive line (CTR).

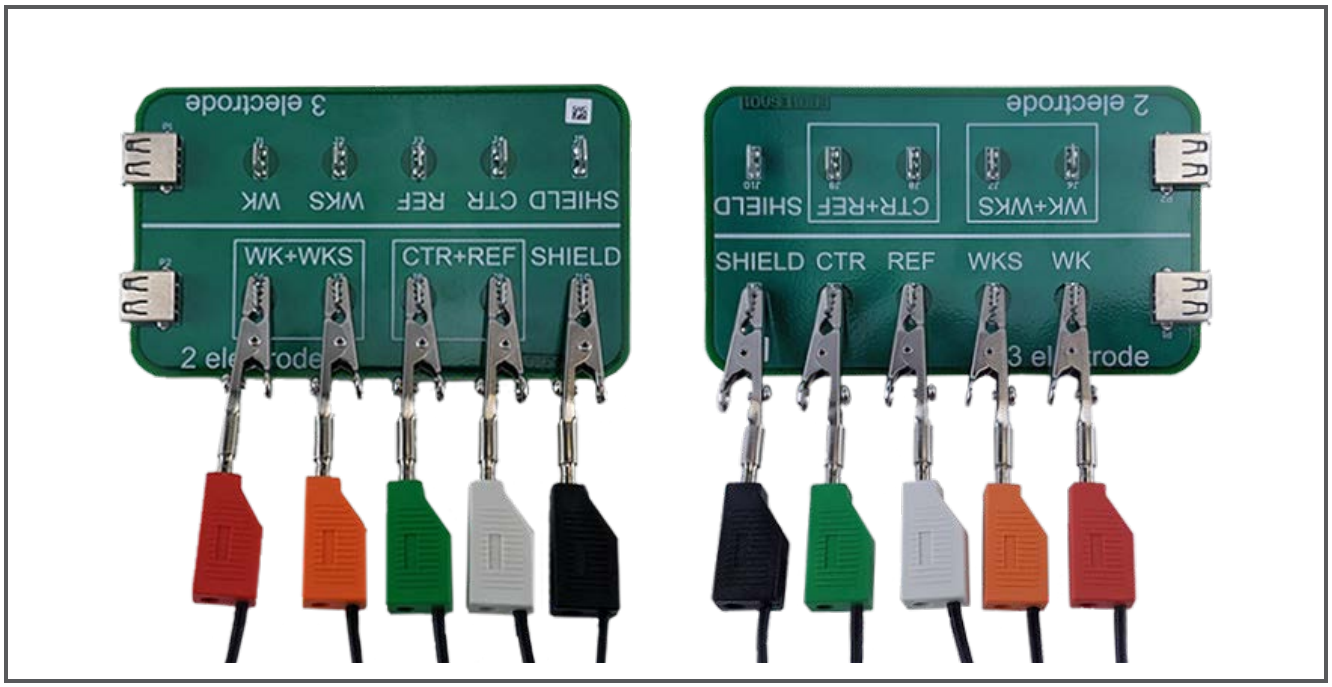


Figure 3. Universal Specialty Cell Circuit Board with Potentiostat Cell Cables Connected

The circuit board also offers a connection point to the shield line (SHIELD) of the USB Standard-A to USB Mini-B cable. The SHIELD is typically connected to the instrument chassis or some other convenient grounding point provided by the third-party potentiostat. Such a grounding connection is sometimes needed to prevent environmental noise from interfering with the signals travelling through the USB cable, the circuit board, and the cell cable.

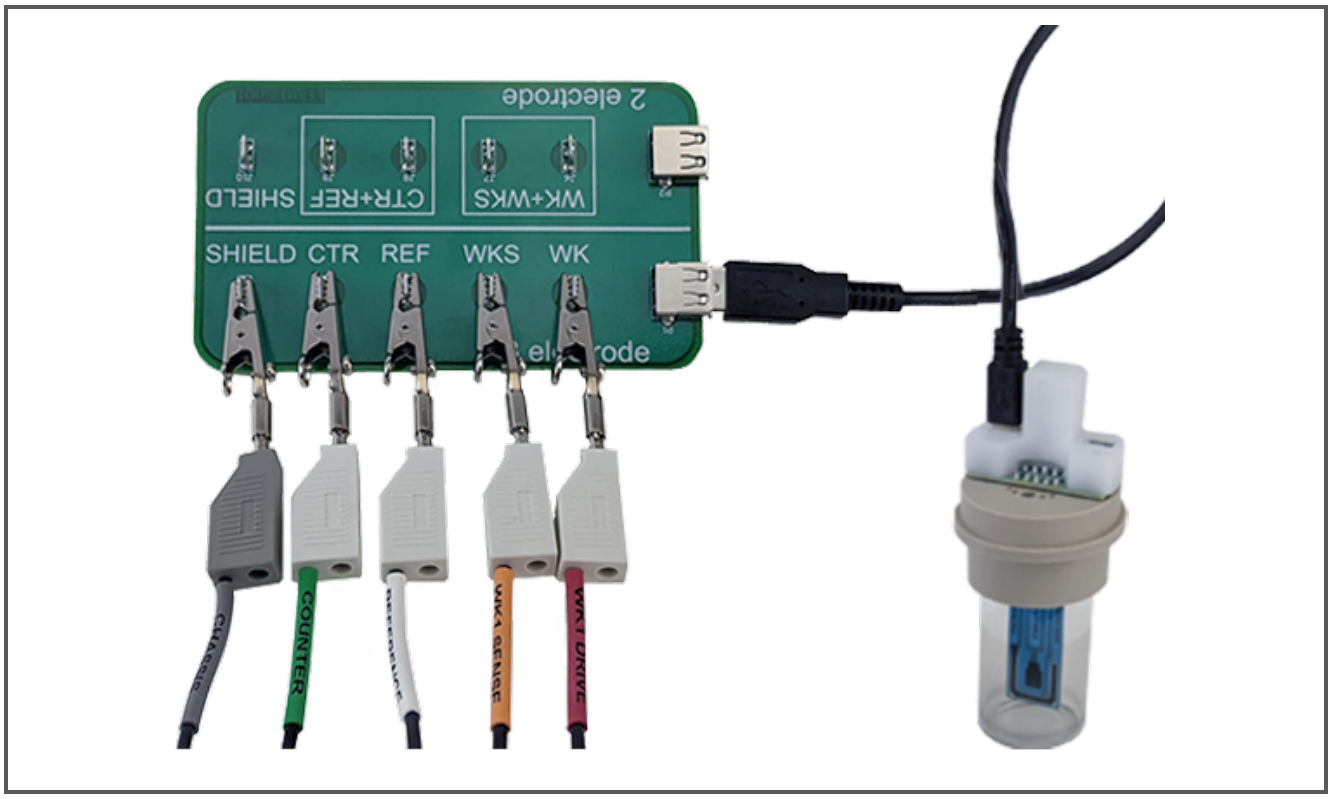


Figure 4. Universal Specialty Cell Circuit Board Connections to a Compact Voltammetry Cell

Once the cell cable alligator clips have been connected to the appropriate blades on the circuit board, connect one end of the USB cable to the circuit board (USB Standard-A port), and the other end of the cable to the specialty cell (USB Mini-B port). Connections to the USB Mini-B port on a Pine Research Compact Voltammetry Cell (with a screen-printed electrode) are shown as an example (see Figure 4). Similar USB Mini-B ports are also found on spectroelectrochemical and organic electrosynthesis cells offered by Pine Research (see Section 4).

2. Two-Electrode Cell Connections

Some electrochemical cells have only two electrodes, and the Universal Specialty Cell Connection Kit can be used in a two-electrode configuration. The cell cable provided with a potentiostat almost always has separate signal lines for the working electrode (WK), the counter electrode (CTR), and the reference electrode (REF), and many modern potentiostats actually separate the working electrode connection into a working electrode drive line (WK) and a working electrode sense line (WKS).

When operating a two-electrode cell, the counter and reference electrode signal lines (CTR + REF) are usually connected to the first electrode, and the working electrode signal lines (WK + WKS) are connected to the second electrode. One of the nice features of the Universal Specialty Cell Connection Kit is that these signal line connections are handled for you by the two-electrode half of the circuit board (see Figure 5A). That is, the circuit board shorts together the working electrode lines (see Figure 5B) and connects them to the first electrode, and it also shorts together the counter and reference lines (see Figure 5C) and connects them with the second electrode.

2.1 Common Two-Electrode Experiments

The most common electrochemical techniques involving a Pine Research specialty cell and only two electrodes are as follows:

- Open Circuit Potential (OCP): The potentiostat makes a passive measurement of the potential difference between the two electrodes without any significant current between the two electrodes.
- Constant-Potential Bulk Electrolysis (BE): The potentiostat applies a constant potential difference across the two electrodes while measuring the current between the electrodes.
- Constant-Current Bulk Electrolysis: In this variation of bulk electrolysis, the potentiostat drives a constant current between the electrodes while measuring the potential difference between the electrodes.

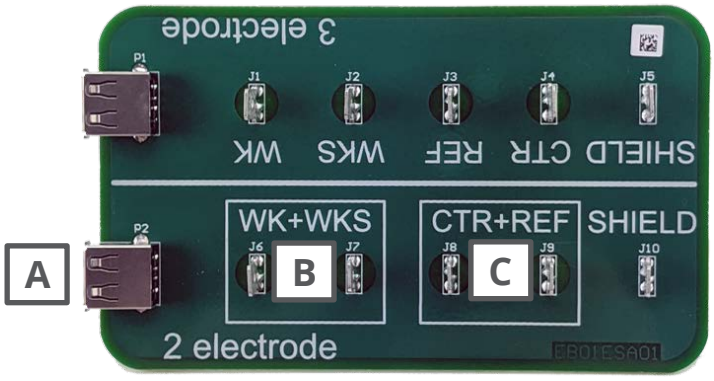
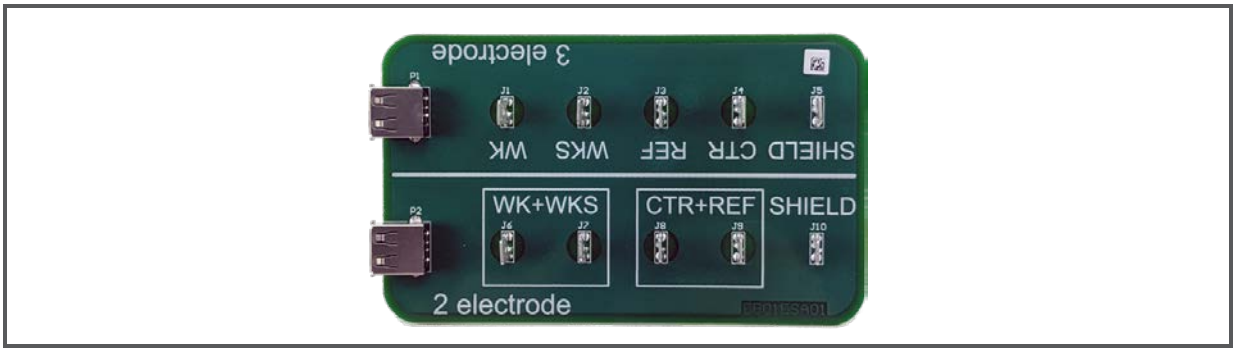


Figure 5. Connections for a Two-Electrode Electrochemical Cell. A) The Two-Electrode Half of the Circuit Board; B) The Working Electrode Connections to the First Electrode; and C) The Counter and Reference Connections to the Second Electrode

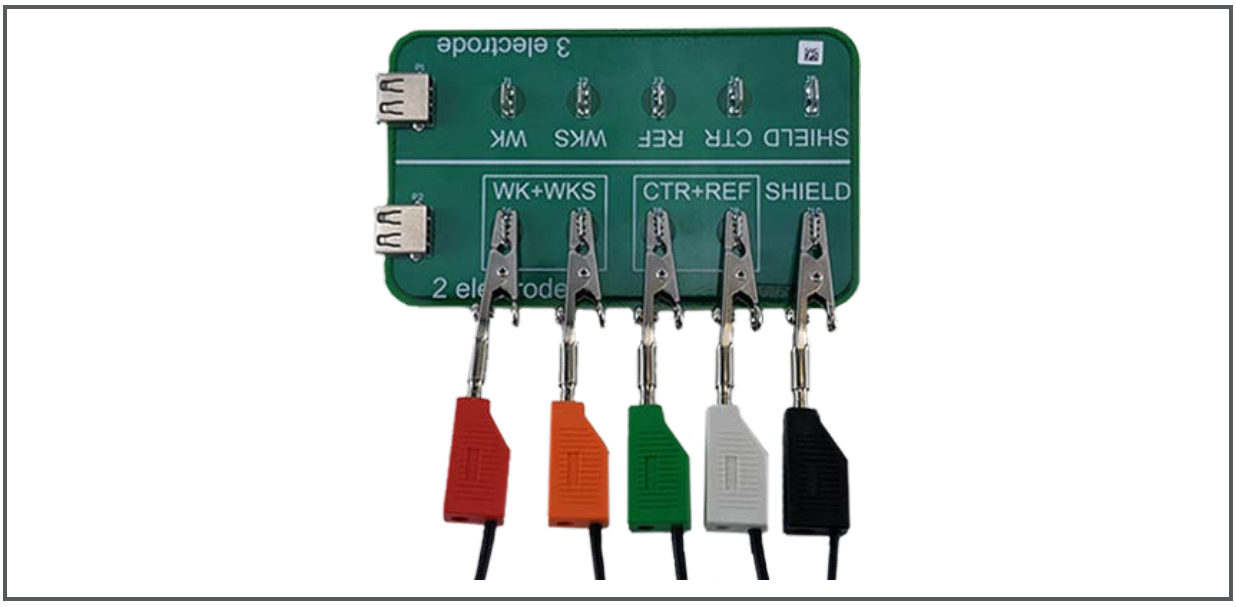
Bulk electrolysis techniques are typically used with two-electrode electrosynthesis cells where a certain amount of charge must be delivered to the cell in order to convert a certain amount of reactant to a desired product.

2.2 Instructions for Two-Electrode Use

1. Place the Universal Specialty Cell Circuit Board on a flat surface near your experimental setup. The circuit board has four rubber feet on the bottom to keep it from sliding around.

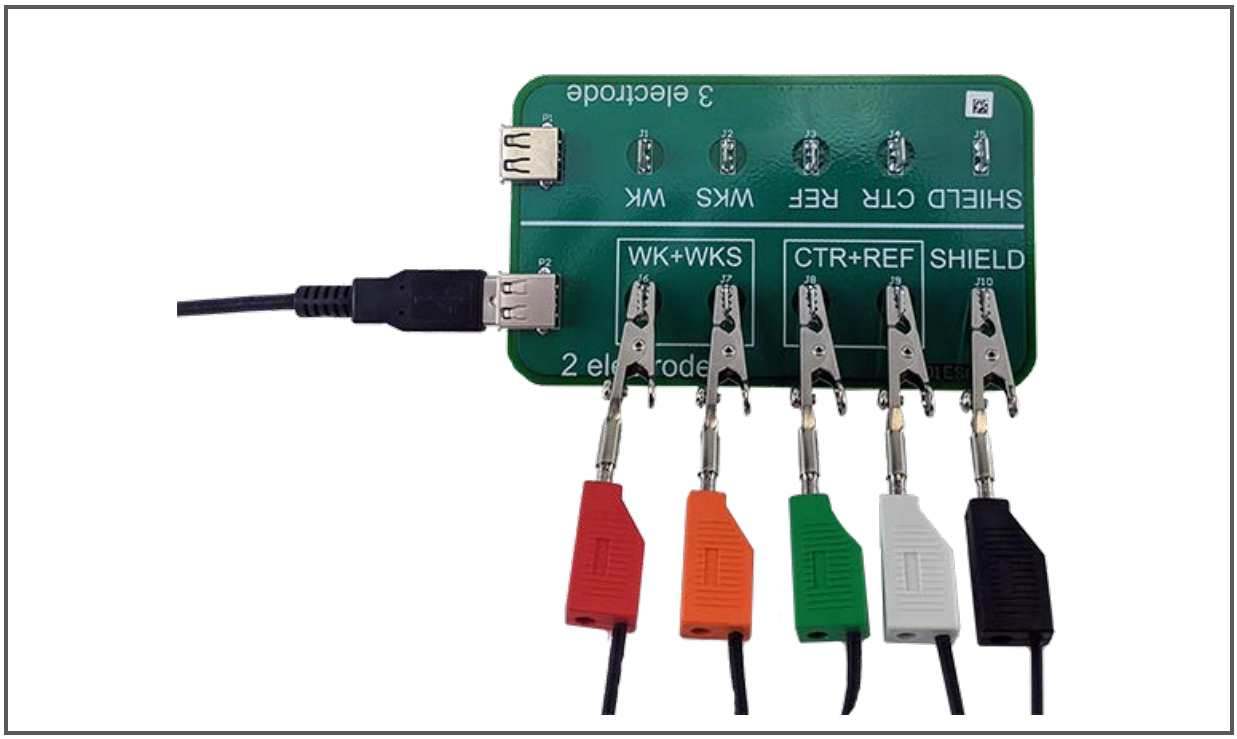


2. Connect the three primary cell cable leads from the potentiostat (working, reference, and counter) to the corresponding blades (WK, REF, and CTR) on the circuit board.
3. If the potentiostat also offers a separate working electrode sense line, then connect this sense line to the appropriate blade (WKS).

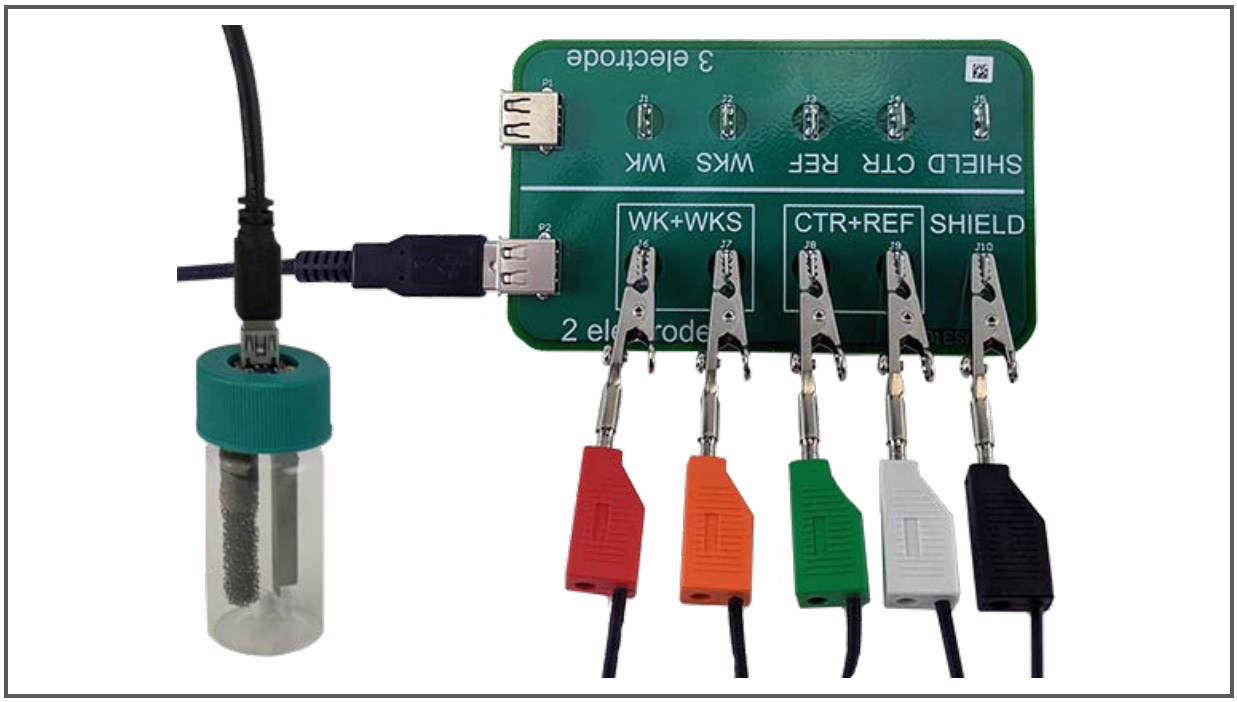


4. If the potentiostat offers an instrument chassis or other useful grounding point, then an optional connection to the USB shield line (SHIELD) may also be made.

5. Connect the USB cable to the USB port located nearest to the “2 electrode” label.



6. Connect the other end of the USB cable to the USB Mini-B connector on the specialty cell.



3. Three-Electrode Use

Electrochemical cells used for electroanalysis typically have three electrodes, and the Universal Specialty Cell Connection Kit can be used in a three-electrode configuration. The cell cable provided with a potentiostat almost always has separate signal lines for the working electrode (WK), the counter electrode (CTR), and the reference electrode (REF), and many modern potentiostats actually separate the working electrode connection into a working electrode drive line (WK) and a working electrode sense line (WKS).

When operating a three-electrode cell, the counter and reference electrode signal lines are connected to the counter and reference electrodes, respectively. The working electrode drive line and the working electrode sense line (if available) are both connected to the working electrode at a point near the electrochemical cell. One half of the circuit board supplied with the Universal Specialty Cell Connection Kit is intended for use with three-electrode cells (see Figure 6). The circuit board routes the electrode lines to the electrochemical cell via the USB Standard-A cell port and the signal lines within the USB cable.

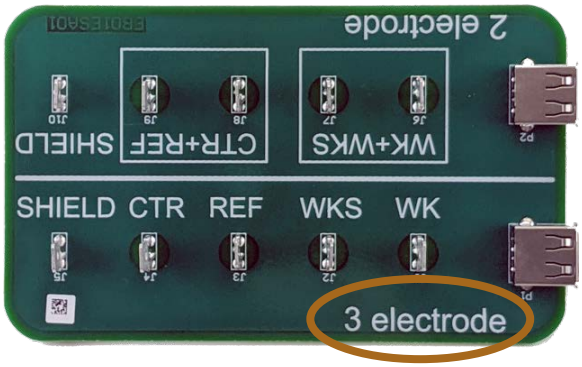


Figure 6. The Three-Electrode Half of the Circuit Board

3.1 Common Three-Electrode Experiments

The most common electrochemical techniques involving a Pine Research specialty cell and three electrodes are as follows:

- Cyclic Voltammetry (CV): The potentiostat sweeps the potential difference between the working and reference electrodes while measuring the current between the working and counter electrodes. This technique is commonly used with Pine Research Compact Voltammetry Cells.
- Constant-Potential Bulk Electrolysis (BE): The potentiostat holds a constant potential difference between the working and reference electrodes while measuring the current between the working and counter electrodes. This technique is commonly used with Pine Research *Synthony*™ electrosynthesis cells.
- Spectroelectrochemistry (BE): The potentiostat steps through a series of potential differences between the working and reference electrodes while a spectrometer acquires

spectra of the layer of solution near the working electrode. This technique is commonly used with Pine Research Honeycomb Spectroelectrochemical cells.

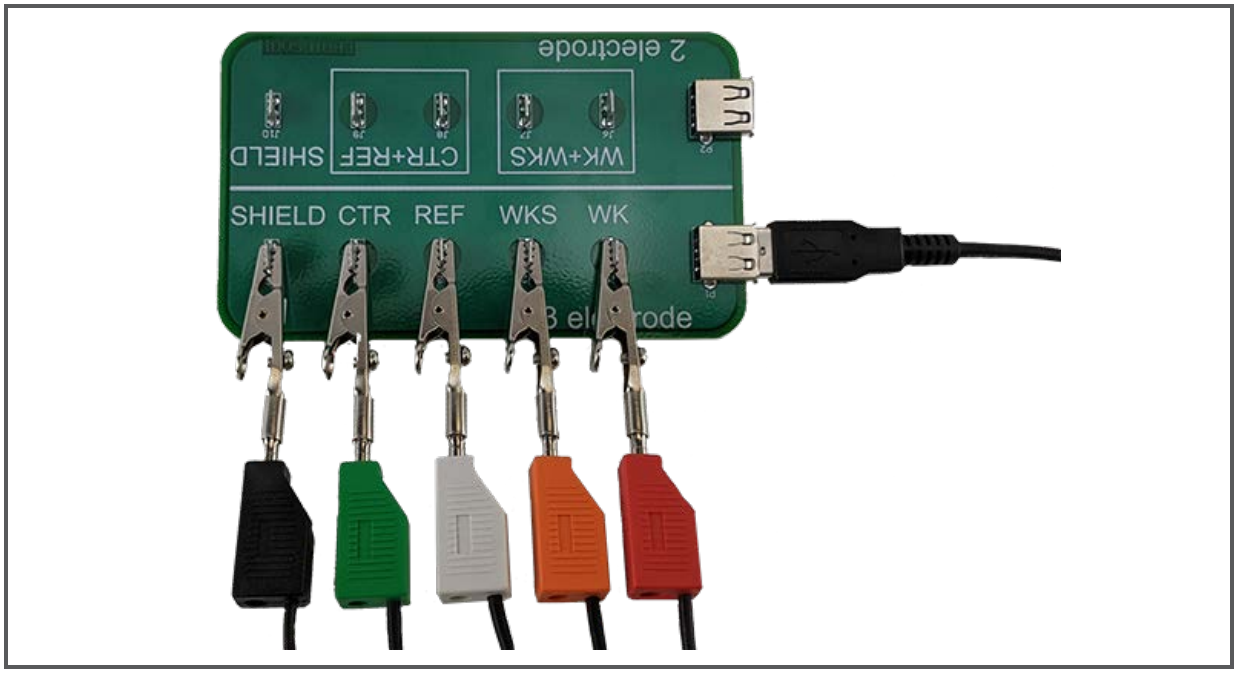
3.2 Instructions for Three-Electrode Use

1. Place the Universal Specialty Cell Circuit Board on a flat surface near your experimental setup. The circuit board has four rubber feet on the bottom to keep it from sliding around.

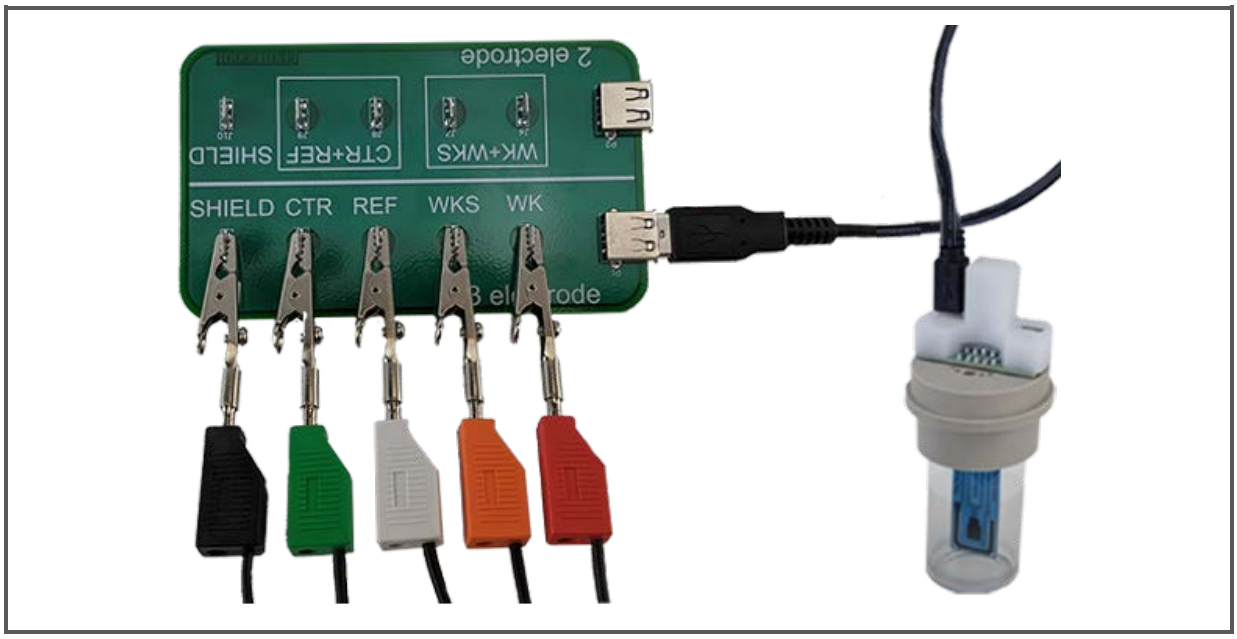
2. Connect the three primary cell cable leads from the potentiostat (working, reference, and counter) to the corresponding blades (WK, REF, and CTR) on the circuit board.
3. If the potentiostat also offers a separate working electrode sense line, then connect this sense line to the appropriate blade (WKS).

4. If the potentiostat offers an instrument chassis or other useful grounding point, then an optional connection to the USB shield line (SHIELD) may also be made.

5. Connect the USB cable to the USB Standard-A port located nearest to the “3 electrode” label.



6. Connect the other end of the USB cable to the USB Mini-B connector on the specialty cell.



4. Specialty Cell Connections

Pine Research offers many types of electrochemical cells for special applications. Many of these specialty cells make use of a USB Mini-B connector to provide a quick-and-easy connection to the electrodes in the cell. The location of the USB Mini-B connection on each cell is described below.

4.1 Screen-Printed Electrode Cells

The Pine Research Compact Voltammetry Cell Kit contains a mounting grip which holds a screen-printed electrode (SPE). The grip has two USB Mini-B type connectors (see Figure 7) which make connections to the electrode pattern printed on the screen-printed electrode.

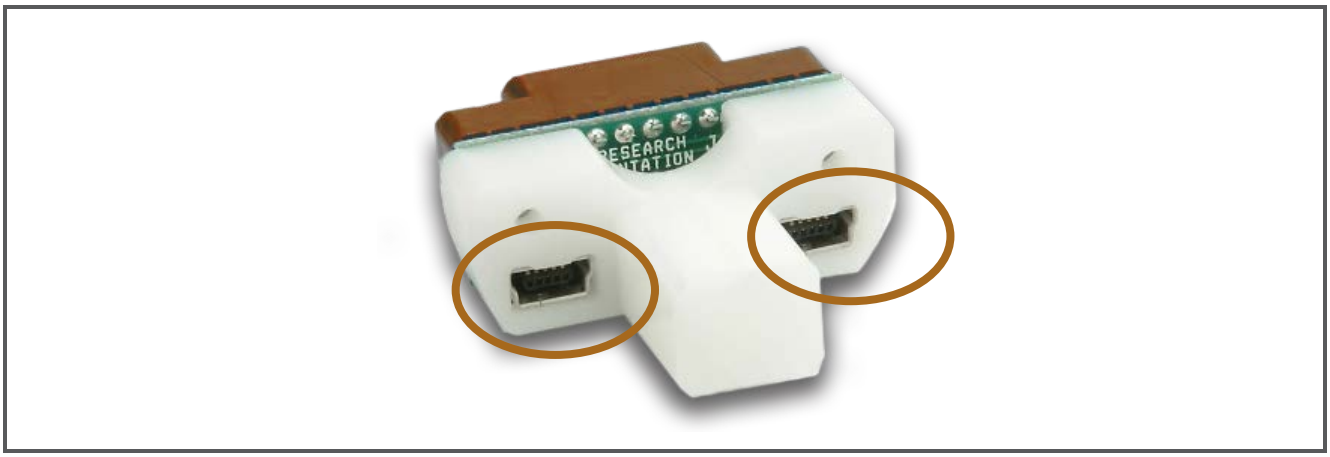


Figure 7. Compact Voltammetry Cell Kit Grip with Mini-B USB Style Connectors

4.2 Spectroelectrochemical Cells

The Pine Research Honeycomb Spectroelectrochemical Cell (see Figure 8) has working and counter electrode connections which are made via a USB Mini-B connector. Connection to the reference electrode in this cell is typically made via a separate pin connector rather than via the USB Mini-B connector.

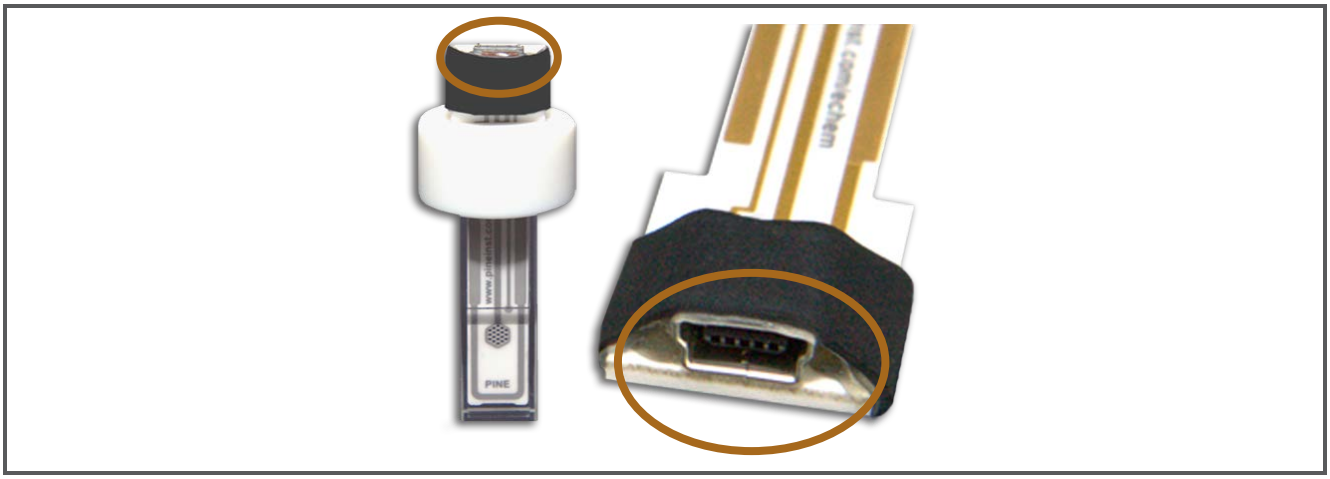


Figure 8. Honeycomb Spectroelectrochemical Electrodes with Mini-B USB Style Connectors

4.3 Electrosynthesis Cells

The *Synthony*™ electrosynthesis cell kits include a special cap in which the electrodes are mounted. On top of this cap is a USB Mini-B style connector (see Figure 9) which provides electrical connection to the electrodes inside the cell.

Figure 9. *Synthony*™ Electrosynthesis Cell with Mini-B USB Style Connector

5. Cell Cable Cross Reference

The blades on the Universal Specialty Cell Connection Kit circuit board accept alligator clips that are either permanently attached to the cell cable or which slide on to (2 mm or 4 mm) banana plugs. This makes the circuit board compatible with the cell cables on most third-party potentiostats. Each potentiostat manufacturer uses a different color-coding scheme for marking the leads on a potentiostat cell cable. Below is a cross reference for some common potentiostat sources which may aid you in using the Universal Specialty Cell Connection Kit (see Table 1).

	Working (WK)	Working Sense (WKS)	Counter (CTR)	Reference (REF)	Shield
Pine Research	**Red**	**Orange**	**Green**	**White**	**Black or Gray**
Gamry	**Green**	**Blue**	**Red**	**White**	**Black**
Bio-Logic	**Red**	**Red**	**Blue**	**White**	**Black**
CH Instruments	**Green**	*N/A*	**Red**	**White**	*N/A*
Ametek	**Green**	**Gray**	**Red**	**White**	*N/A*
Metrohm	**Red**	**Red**	**Black**	**Blue**	**Green**
BASi	**Black**	*N/A*	**Red**	**White**	*N/A*

Table 1. Electrode Lead Colors Cross Reference (leads marked "N/A" are unavailable on certain cables)

6. Contact Us for Support

If you have any questions, please do not hesitate to contact us:

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7. Trademark Information

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