Paradigm Elements for Ports – Getting Started

This tutorial demonstrates how to add marker/trigger commands to an existing Paradigm experiment. We assume you have a basic understanding of how Paradigm works. If you have never built an experiment in Paradigm before, please work through the “Getting Started” guide available in Paradigm’s “Help” menu first.

Open the PortElementsTutorial sample experiment located in the Port Elements Samples directory of the Paradigm Experiments folder. This experiment presents a simple “oddball” experiment.

1. Initialize device communication using the Begin Session Element
   The Begin Session Element establishes communication with your external device when the experiment begins. You must add this Element to your experiment or it will not be able to communicate with your device.

Add a Begin Session Element
1. Click the “View experiment properties” icon in the Event Sequence toolbar (highlighted in red above).
2. Select the Ports toolbox on the left, and drag a Begin Session Element into the Commands list.
3. **Begin Session** allows you to specify the pulse width of each trigger or marker sent to your device. The default is 11ms which is usually fine for most devices. This value indicates that Paradigm will send each trigger/marker value for 11ms and then reset the port to zero. If you are not seeing your markers appear in the devices data you may want to increase the pulse width.

2. **Enable a port device in the Device Manager**

Enable the port device you wish to use to send triggers in Paradigm's Device Manager. You can access the device manager from the "Devices" menu or by clicking on the gear icon on the Paradigm toolbar. Select the device type and then enable an available device by checking its checkbox. Most EEG/MEG systems and Biopac will use a Parallel Port connection. If you have installed an “add-on” Parallel Port card you will typically have to set its “LPT Port” property to LPT3. *Emotiv* EEG devices will use a Serial Port connection.

![Device Manager](image)

3. **Send a trigger to your device**

Use the **Send Marker** element to mark stimulus events in your device’s data. You can send triggers/markers synchronized with an event’s onset, or wait for a specified duration after the event’s onset to send the marker allowing you to send markers during movies and long sound stimuli.

![Send Marker Element](image)

Add a Send Marker element to the Expression event.

1. Select the *Expression* Event, and drag **Send Marker** from the *Ports* toolbox into its *Commands* list.
2. Double-click on “Send Marker1,” and specify a Marker Value (e.g. 120) and the Onset Time as “Same as event”. The same marker value can be sent for each trial, or it can be changed with each trial, using a Connection, to correspond to each presented stimulus (see below).

3. Select the Port Type, which can be a Parallel Port, Serial Port, Network Port, PCI-DIO24 or the Paradigm USB-to-Parallel converter and a Port Name. If your Paradigm machine has only one parallel port, Parallel1 will usually be the correct Port Name. Serial Ports will typically use Serial1. Network Port devices will always use NetworkPort1. If you are using the DIO-24 you have a choice of three channels. Which one of these is the best to use depends on the device. You may have to experiment to figure out which port name works. The Paradigm USB-to-Parallel converter does not use a port name.

**Note:** Paradigm allows you add multiple Send Marker Elements to a single event enabling you to send multiple triggers per stimulus (e.g. during a movie) or communicate with multiple devices simultaneously (e.g. a combined EEG, Biopac study).

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**Defining marker values that change with trial:**

1. With the Expression Event still selected, click on the Connections tab in Trial Table View.
2. Add a column to the Trial Table to hold your marker values (call it “Trigger”).
3. Find “Marker” under Send Marker1, and drag it onto the “Triggers” column (as shown above). You will see the round circle next to the Marker property turn green when you have successfully created a Connection.
4. Enter values to uniquely identify each stimulus or condition. If you are using a Parallel Port, Serial Port, DIO24 card, or the Paradigm USB-to-Parallel converter, trigger/marker values must be between 1 and 255 for most EEG systems and either 1, 2, 4, 8, 16 or 32 for Biopac. If you are using a network port you can send arbitrary strings to your device.
5. Paradigm will now send a unique trigger to your device that will identify each stimulus or trial condition.

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**4. Send a response trigger to mark subject responses**

If you are creating an experiment that has correct responses, you can mark subject responses in your device’s data using the Send Response Element. Paradigm will send a Correct or Incorrect trigger to your EEG or Biopac
device based on the *CorrectResponses* property of the device that the subject uses to respond. If the subject does not respond during the trial, a *No Response* trigger will be sent to your device.

![Send Response Element](image)

**Send a Response Marker for the Expression event.**

1. Drag a Send Response Element from the Ports toolbox into the *Expression* event’s *Commands* list.
2. In the dialog that appears, enter marker values for *Correct*, *Incorrect*, and *No Response Markers*. These values can also be changed with each trial using a Connection in the Trial Table.
3. Select the Port Type and Port Name as you did when adding a *Send Marker* Element. Typically these settings will be the same for Send Marker and Send Response Elements.

**5. Run the experiment**

The experiment is complete. Run the experiment to ensure that all of the Port Element commands are sending the property triggers/markers to your device. If you are not seeing your markers appear you may need to change your port device’s settings in the Device Manager or try a longer pulse width.

**6. Configuring Biopac AcqKnowledge (optional)**

*Paradigm Elements for Ports* includes an AcqKnowledge template that is correctly configured to work with Paradigm. You can find the template in *Paradigm Experiments/Port Elements Samples/Biopac Samples.*

To configure an existing AckKnowledge project for Paradigm capability:

1. Open your AckKnowledge file and click on *Set Up Channels* in the *MP150* menu.
2. Click on the *Digital* tab and check off Acquire and Plot for channels D8-D15 as shown below.
3. You can optional rename these channels Paradigm 1-8.
You can now send triggers to your Biopac system using Paradigm.