

SS73L HALL EFFECT SWITCH TRANSDUCER ASSEMBLY



The SS73L Hall Effect Switch Transducer is used for detecting pedal or flywheel rotations on a cycle ergometer. Types of tests performed with this transducer include the Wingate Anaerobic Test (WAnT) covered in BIOPAC *PRO* lesson H05. This transducer detects the presence of a Neodymium Disc magnet (13 mm dia, 4.8 mm thick, 2.3 kg max pull) up to a distance of 18 mm.

The SS73L Hall Effect Switch Transducer is compatible with MP36, MP35, or MP45 hardware (Biopac Student Lab 4.0.1 or higher software,) or MP36R hardware (AcqKnowledge 4.4 or higher software).

The SS73L assembly includes an adhesive magnet, four adhesive wire tie mounts and four wire ties as shown in the above figure. The Switch Transducer has double-sided tape on the back side for mounting.



Caution: The neodymium disc magnet produces a strong magnetic field. Do not place near sensitive electronics (i.e. computers with hard drives). The magnet is shipped in protective foam with a prominent warning label.

SS73L SPECIFICATIONS

Parameter	Specification
Interfaces to:	MP36, MP36R, MP35, MP45
Input connector:	DB9 Male
Cable Length:	3 meters
Output Voltage range:	0 to 1 Volt
Signal Output Voltage Logic:	Magnet detected: 0 – 5 millivolt Magnet not detected: 1 Volt
Supply Voltage (From MP):	+5 Volts
Supply Current:	20 mA
Attenuation:	5 dB
Frequency Response:	0 – 1.6 KHz (+- 20%)
Noise Voltage (0 – 1,000 Hz):	0.02 mV RMS
Weight:	125 grams
Size of Hall Effect Switch housing (L x W x H):	26 mm x 11 mm x 3 mm
Magnet:	Neodymium Disc. Nickel plated, 13 mm diameter, 4.8 mm thick, 2.3 kg max pull
Maximum Sensing distance using the above magnet:	18 mm

NOTE: The magnet must be oriented such that the South Pole faces the Hall Effect switch.
The SS73L is not compatible with MP30 hardware.

SS73L HALL EFFECT SWITCH TRANSDUCER SETUP

The following describes the setup and use of the BIOPAC Hall Effect Switch transducer assembly (SS73L) with BSL *PRO* or *AcqKnowledge* software to count and record pedal revolutions of a cycle ergometer.

EQUIPMENT:

- BIOPAC Student Lab System:
 - MP36, MP36R, MP35 or MP45 hardware
 - Software: BSL 4.0.1 or higher or *AcqKnowledge* 4.4 or higher (*AcqKnowledge* is compatible with MP36R hardware only)
- BIOPAC Hall Effect Switch Transducer (SS73L) assembly*
- Plate loaded or pendulum balance cycle ergometer

Note*: The SS73L Hall Effect Switch Transducer assembly, includes a stick-on magnet, four stick-on wire tie mounts and four wire ties as shown in Figure 1. The switch has double-sided tape on the back side for mounting.

Caution: The neodymium disc magnet produces a strong magnet field. Do not place it near sensitive electronics (i.e., computer hard drives). It is shipped in protective foam.



Figure 1

HARDWARE SETUP

There are many types of cycle ergometers. Some have an exposed flywheel (Figure 2) and others conceal the flywheel with a plastic cover.

1. Locate the optimal position for attaching the Hall effect switch and the magnet on the ergometer. Placing the magnet on the flywheel is preferred because the flywheel rotates multiple times per pedal revolution and gives better pedal cadence (RPM) resolution. Find locations that meet these requirements.

If the Flywheel is exposed:

- The Hall effect switch can be securely mounted to the frame.
- The magnet can be placed on the flywheel such that it will pass by the center of the Hall effect switch (Figure 3).
- The gap between the Hall effect switch and the magnet is no more than 18 millimeters.



Figure 2

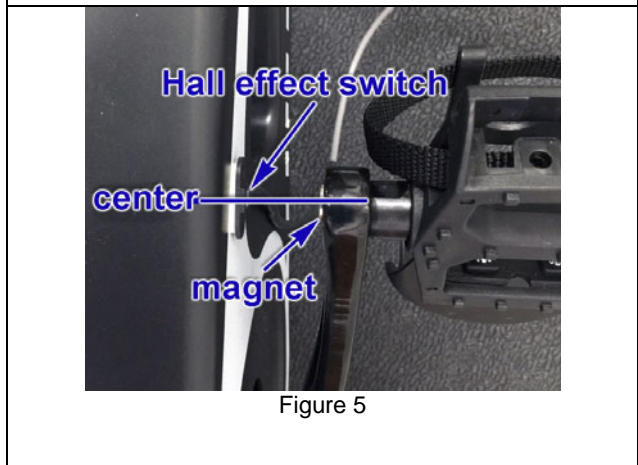
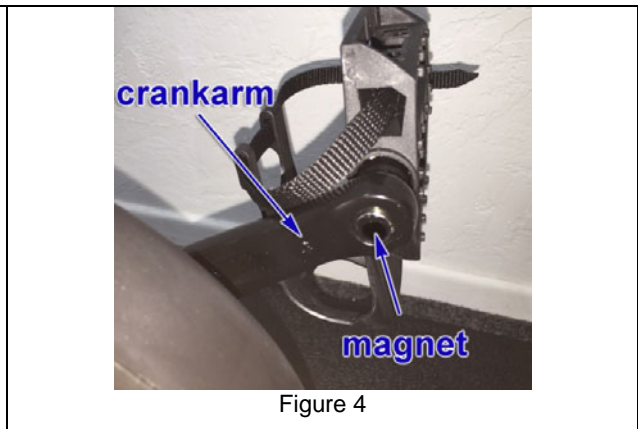
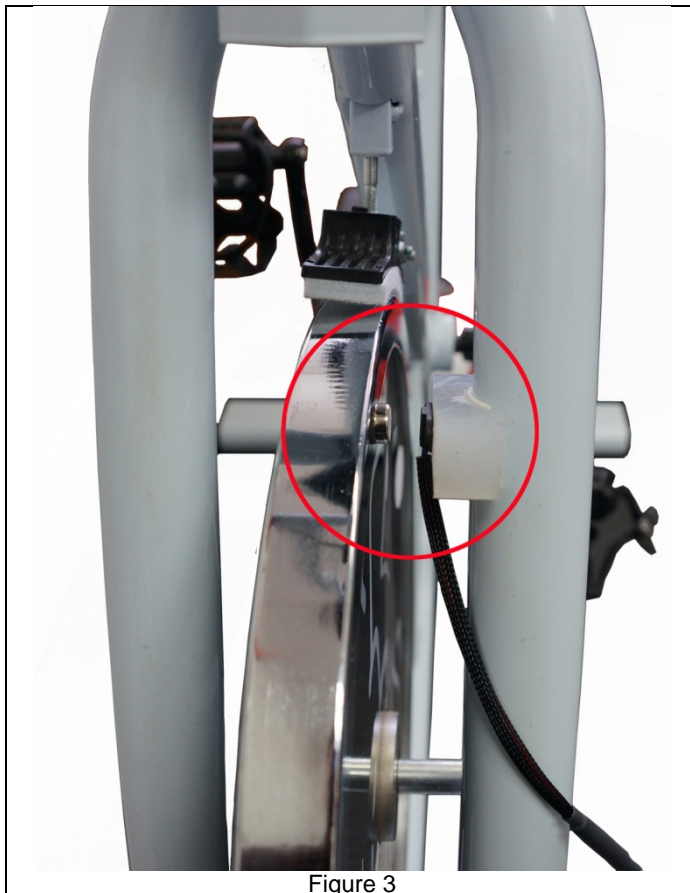
If the flywheel is concealed, or if there is no way to mount magnet on the flywheel:

- The magnet is placed on the inner side of the crank arm, held in place by the tape as well as magnet’s attraction to the iron in pedal’s shaft (Figure 4).
- The Hall Effect Switch can be securely mounted to the frame or chain cover such that the magnet will pass by the center of the switch (Figure 5).
- The gap between the Hall Effect Switch and the magnet is no more than 18 millimeters.

Some improvising may be necessary to meet the requirements (i.e. using spacers, etc.). The Hall Effect Switch can be held in place using the included double-sided tape, screws, or wire ties. Figure 3 shows an example of flywheel placement. Since the ergometer frame is round, a spacer/support piece was constructed out of plastic to firmly hold the switch, to align the switch and the magnet, and to keep the distance between them less than 18 mm.

Before attaching:

- Clean the mounting locations with isopropyl alcohol.
 - It is important that the south pole of the magnet be facing towards the Hall Effect switch. If the magnet’s polarity is reversed, the switch will not function. The south pole will be the side *opposite* the double-backed tape. If no tape is available, it is recommended to not attach the magnet until Step 8, where it can be moved back and forth near the Hall Effect switch to verify that it is detected. If the magnet is not oriented correctly, it can be difficult to remove due to the magnet’s strong pull-strength.
2. Peel off the protective layer of the double-backed tape and press the Hall effect switch and the magnet into position.



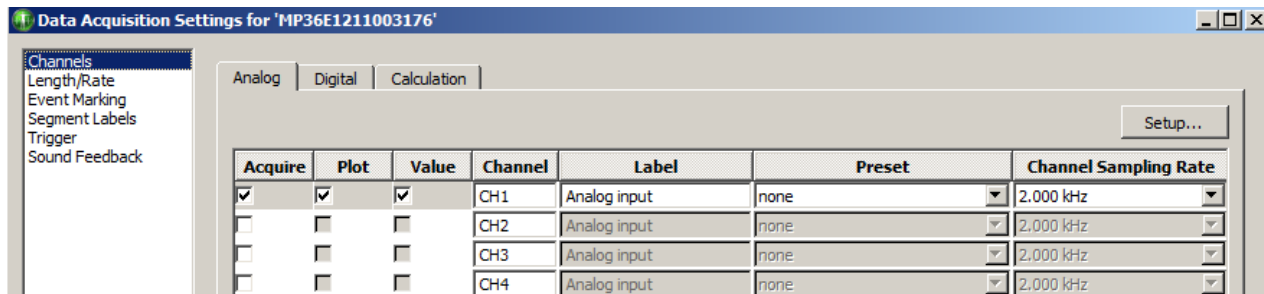
3. To protect the cable from moving parts, attach stick-on wire tie mounting plates in strategic locations and secure the cable using wire ties.
4. Determine the flywheel to pedal rotation ratio which is the precise number of rotations the flywheel makes for each rotation of the pedal (may not be an even integer): **Flywheel to pedal rotation ratio:** _____

It is assumed that the MP36/35/45 is connected to the host computer and that BSL *PRO* software has been installed. If using an MP36 or MP35, it should be connected to its power supply but turned OFF. If using an MP45, which obtains its power from the USB port, the unit will remain powered ON.

5. Plug the BIOPAC Hall Effect switch (SS73L) into an MP Input Channel (CH 1 used in examples).
6. Turn on the MP36/36R/35. Turning ON the hardware after the connections are made minimizes the chance of instrumentation errors caused by Electrostatic Discharge (ESD) during plug-in.

SOFTWARE SETUP

Launch the BSL 4 or *AcqKnowledge 5* software and choose “**Create/Record a new experiment.**” Make sure “**Create empty graph**” is selected and click **OK**. The new empty graph will open to the following settings (CH1 enabled, “Acquire,” “Plot” and “Value” checked as shown below.)



If using BSL 4.1.3 or higher or AcqKnowledge 5.0.3 and higher (SS73L presets established):

- a. Select “**Switch, Hall Effect (SS73L)**” from the CH1 “**Preset**” menu list.
- b. Click the “**Calculation**” tab, select “Acquire,” “Plot,” and “Value” for C1 and then select the Preset: “**Pedal Cadence (from SS73L)**.”
- c. Click the “**Setup**” button to open the Metachannels.
- d. Select the “**C1.0**” row and then click “**Setup Subchannel.**”
- e. Make sure that the Source channel is set to “**Primary Source Channel: Ch 1, Hall Effect Switch**” as shown in Figure 6.

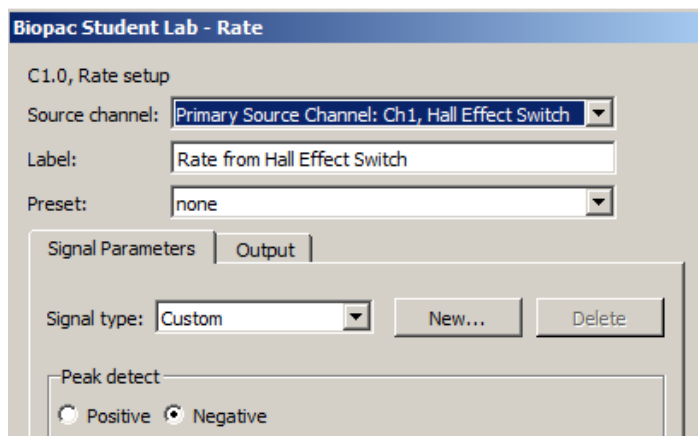


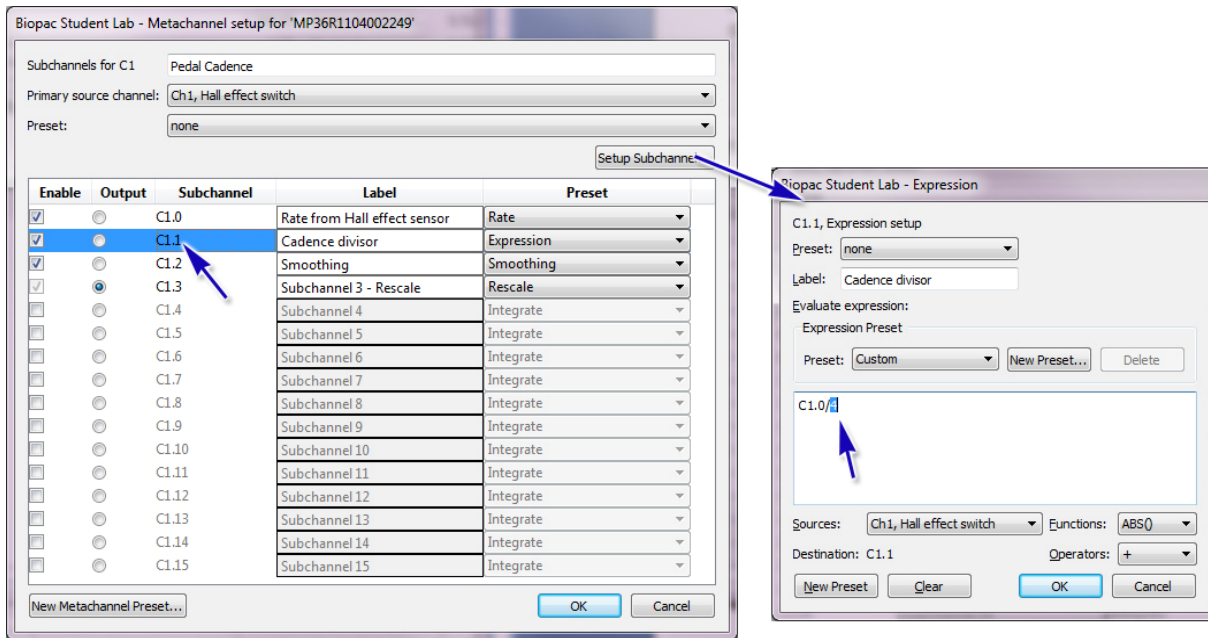
Figure 6

- f. Click **OK** to close the two Metachannel Setup dialogs.
- g. Select “**Length/Rate**” from the left column in Data Acquisition Settings. Verify that “Sample rate” is set to at least 2000 samples/second and adjust other parameters if necessary.
- h. Close out of the Data Acquisition Settings dialog and continue to **Step 7** on following page.

If using BSL 4.1.2 or prior OR AcqKnowledge 5.0.2 or prior (SS73L presets NOT established):

Contact [BIOPAC](http://www.biopac.com) to obtain a pre-configured graph template for these software versions.

7. Continue to **Step 8** if magnet is located on crank arm. If the magnet is placed on the flywheel, the following changes must be made prior to recording:
 - a. Enter this number into the Pedal Cadence calculation channel as follows:
 - i. Select “MP menu > Set Up Data Acquisition > Channels.”
 - ii. Click the “Calculation” tab, select “C1” and click “Setup.”
 - iii. Select Subchannel C1.1 (Cadence Divisor) and click “Setup Subchannel.”
 - iv. Replace the default divisor, “1,” with the “Flywheel to pedal rotation ratio” obtained in Step 4 on page 3. Be careful to not alter any other text in the expression.




- v. Click “OK” in the Metachannel and Calculation channel dialogs and close the “Input Channels Setup” dialog.

8. Test the setup by clicking **Start** to begin a recording and then rotate the pedals a few rotations, and then click **Stop**. The data should look similar to that in Figure 7.

CH1 baseline level should reside at 1000 mV and negative going pulses should indicate when the magnet passed by the Hall effect switch. The pedal cadence should show changes in RPM corresponding to interval between switch pulses.

If no pulses are seen on CH1:

- The distance between the magnet and the Hall Effect switch is too great.
- The magnet does not pass over the center of the Hall Effect switch.
- The magnet polarity is incorrect and the magnet must be flipped.

Click the Rewind button  to erase the setup data.

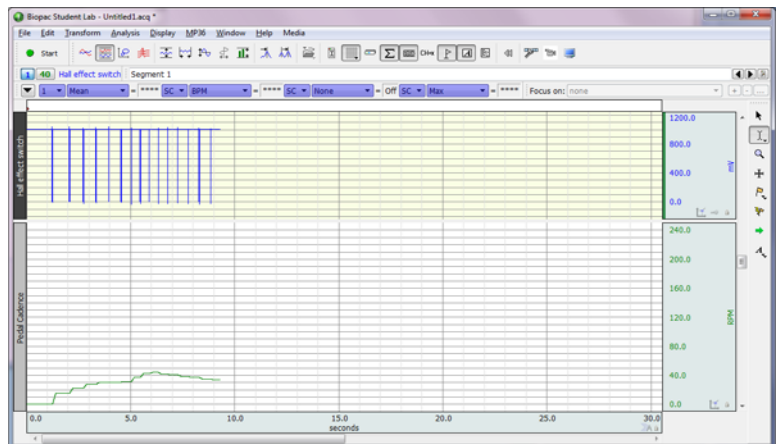


Figure 7

IMPORTANT: Save the template with the new settings so these steps do not need to be repeated. Select File > Save As and choose “Save as type: Graph Template (*.gtl).” Use a different filename so as to not overwrite the original. Organize the files so the new template will be used in the future.