

## COUNTPULSE MANUAL V1.1

Congratulations on the purchase of CountPULSE, the traffic counting industry's most advanced pneumatic tube data collection device. The CountPULSE is unlike any other road tube counter on the market today.

CountPULSE uses the power of the internet to set up counts and download traffic data using a mobile device in the field.

### 1) GETTING STARTED

#### **Download the CountPULSE App**

- **Download the CountPULSE App** from Apple App Store or Google Play Store to a mobile device (i.e. phone or tablet) with an internet connection. The internet connection is needed to log in to your account, geotag the location, and upload data to the cloud.
- **Make sure your device gives the app permission to access your location and store information on your device.** If you do not see a pop-up asking permission the first time you download the app, go to your device's Settings to make sure the app has access to your location and data storage. (Checking the Android app permission only works in version Marshmallow and up).
- **Make sure your device has Bluetooth turned "on"** or the app will not be able to communicate with the CountPULSE device.

Once the CountPULSE app is installed, create your new CountPULSE account following the prompts in the app. If you already have an account setup, access the account using your login.

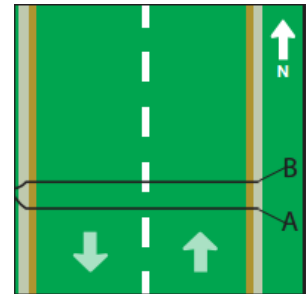
Once you log in to the app on your mobile device, you will be directed to the dashboard. The dashboard has three tabs; Active, Completed, and Create New.

- **Active.** Current, active studies can be found here. To the right of the name of the study, a progress wheel tells you how much time is remaining until the study is to be completed.
- **Completed.** Completed studies whose data has been retrieved can be found here. You can always upload data from a completed study by tapping the study and selecting '**upload**'.
- **Create New.** A new study is set up in this section.

## Create a New Study

Choose **Create New** tab to set up a new study. Enter the name of the study, and all other information needed to define the project. Here is a breakdown of each study setting:

- **Name.** Insert name of the study.
- **Start/End Date.** Enter the start and end dates and times the CountPULSE is to start and stop collecting and recording data. Note that the CountPULSE will only collect and record data within the parameters of the start/end date. Make sure the period for data collection is within the parameters of the start/stop dates.
- **Configuration.** Here is where you enter the details of the road you are collecting data on. If collecting data on a road with bi-directional traffic, select '**2 Way**'. If you are collecting data on a road with one direction traffic, select '**1 Way**'. If you would like to collect only volume data with one tube, select '**1 Tube**'. To collect bi-directional volume, speed, and/or classification data, select '**2 Tubes**'. (see '2. Road Tube Installation' for information on proper road tube installation.)
- **Direction.** Add specifics noting which direction traffic is flowing with traffic hitting the "A" tube first. For the diagram (right) the N would be selected, as northbound traffic hits the "A" tube first. Remember, if you are only using one tube, you will not be able to collect directional data but you must still select a direction or the app will not let you finish creating the study.
- **Spacing.** Enter the amount of space between road tubes. We recommend spacing of 36 inches. If you are using one tube you will not have any spacing to enter and can leave this cell blank.
- **Location.** Enter the location where the study is taking place. Most of the time, the location is set automatically. If not, type in the address of the study location and tap ENTER. The coordinates should now be visible at the bottom.
- **Speed Limit.** Adjust the slider to the speed limit of the road you are collecting data on. This will be on the report and calibrates the hardware dwell (debounce) setting to filter out false hits and provide clean data. You can increase the dwell setting when processing data if needed
- **Notes.** Enter any notes to be included on this study. This is not required, and the study setup can be completed without entering any information.



Once all your study details are entered, tap '**Save Study**' button to access the study review page. Here you can check all the study information just entered to make sure it is correct. After verifying all the study information, tap '**Finish Setup**' to complete the setup. If the information you entered is incorrect, tap '**Cancel Setup**' to delete the current study and create a new one.

## Pair CountPULSE Device to Study

- In order to collect data, the study must then be paired with your CountPULSE device.
- Once the new study has been created, you will find it in the **'Active'** tab. If you do not see your study in the active tab, refresh the screen by dragging a finger down the screen vertically and then releasing.
- Tap the study you just created on the Active tab in the main Dashboard screen. This will open the study page. Here you can connect to the CountPULSE device to pair the study or end the study at any time.
- Make sure the device running the app has Bluetooth turned on. Otherwise, it will not be able to connect to the CountPULSE device.
- Press the button on the CountPULSE device to put the device in pairing mode, your CountPULSE device will be discoverable for the next 20 seconds.
- Select 'CountPULSE' from the list of devices. If using multiple CountPULSE, make sure the device ID matches the one on your CountPULSE device. If you do not see 'CountPULSE' in your list of devices, refresh the list by dragging a finger down the screen vertically and then releasing.
- After pairing the study to the CountPULSE device and connecting road tubes (see section 2 for proper road tube installation), you can see the Live Strike of each road tube. If you do not see the Live Strikes occurring when cars are driving over the tube (or during simulation) reconnect the device and it should appear.

That's it! Your study is now running and your CountPULSE device is collecting data. Press the 'Disconnect Device' button to disconnect your phone's connection to the device and move on to the next device setup.

All studies and data you collect will be stored on your account and can be accessed on the CountPULSE website, <http://www.theCountHub.com>.

## 2) ROAD TUBE INSTALLATION

Proper road tube installation is crucial to collecting good, accurate data with any road tube traffic counter. This section reviews the equipment needed and how to properly install road tubes at a study site.

### **Tube Recommendations**

The objective of the road tube is to deliver an air pulse (signal) to the sensors of the CountPULSE when a vehicle passes over it. Road tubes come in various lengths, shapes, and materials and the CountPULSE is compatible with most, if not all road tubes on the market.

Road tubes come in two main types – “mini” and “heavy”. For best results and longevity, we recommend using a round tube made of Ethylene Propylene Diene Monomer, or EPDM. EPDM is a synthetic rubber and is the most popular rubber used for road tubes because it performs well over a wide temperature range. Natural rubber can be degraded by exposure to UV from sunlight, whereas EPDM has been formulated to be resistant to UV degradation.

- **Mini Road Tubes** are popular because they are lighter and more pliable than heavy tubes, but do not hold up as well to traffic wear as a heavy tube.
- **Heavy Road Tubes** have a thicker tube wall, are more durable and generally will last longer than a “mini” road tube. If you are collecting data on a road where there will be a high volume of heavy truck/commercial vehicle traffic, a heavy road tube is more suited for this application and will hold up to the wear and tear better. Heavy road tubes should also be used on roads with a gravel surface as their larger size will produce a better signal than mini road tubes.

### **Tube Length**

Road tubes typically come in either 50-foot or 100-foot lengths. The CountPULSE has been optimized for use with 50-foot tubes. **NOTE:** when collecting speed and classification data, both road tubes used at a single location must be the same length for best results. When collecting data on a road with wide lanes or shoulders, or if there is not an object to lock the CountPULSE to near the edge of the road, a longer road tube may be necessary. To ensure proper signal attenuation, using a road tube over 50 feet in length is not recommended.

### **Plugging the Tube End**

It is highly recommended that the open end of the road tube be plugged. This will prevent dirt, grit and moisture from entering. Moisture in the tube can block the airway, and dirt and grit inside the tube can cause rapid breakdown of the tube, by lacerating the inside surface when vehicles compress the hose as they drive over it. Dirt, grit, and hose particles can also eventually vibrate to the sensors and cause them to become clogged and non-functional.

If you are in need of new road tubes, CountPULSE approved tubes are available from SpackSolutions.com.

## **Fasteners**

Anchors, Nylon Loops, Tape and Nylon Straps are used to secure road tubes to the roadway.

- An anchor is the device installed on the edges of the road to keep the tube in place.
- Nylon Loops are used to attach the road tube to the anchor.
- Tape may also be used to secure the tube on the roadbed to keep the tube from moving while vehicle drive over the road tube.
- Nylon Straps may be used to hold the tube to the road surface to keep the tube from moving during counts.

### *Anchor Type Recommendations*

- Bituminous Road or Shoulder                      2 in. (5 cm) pavement nails
- Gravel Road or Gravel Shoulder                      12 in. (30.5 cm) spike
- Concrete Road or Shoulder/Gutter                      Concrete pin

### *Nylon Loops*

Use nylon loops to secure the road tube to the anchor. Unlike metal loops or “Chinese fingers”, nylon will not damage the tube. Nylon loops are also durable and reusable. Unlike metal clamps, they are quick and easy to install and uninstall and are much less expensive.

### *Polyken Tape*

In addition to using anchors and nylon loops, we recommend taping tubes to the roadway. This will ensure the tubes stay parallel to each other (when collecting vehicle speed and classification data) and will not ‘bow’ as vehicles pass over them. This will also reduce the amount of tube bounce, resulting in fewer false hits and better data. Placing tape every 6-8 feet is sufficient. Due to the harsh environment, we recommend using military grade Polyken tape.

### *Nylon Straps*

In situations where the road is wet during installation, or has a gravel surface, tape will not adhere to the road sufficiently. Use nylon straps secured to the road tube at the center of the road. The strap is held in place with a pavement nail or concrete pin. In high traffic areas the concrete pin can be inserted using a powder-actuated tool for speed of installation.

## **Road Tube Location Considerations**

- Install tubes perpendicular to the roadway, not angled across the road.

- Avoid installing road tubes on a curved section of roadway. If this is not possible, angle the tubes slightly so that as a vehicle is driving around the curve, both of the vehicle's tires contact the tube at the same time.
- Set the road tube as far from the intersection as practical. If the intersection is signalized or has stop signs, install the tube far enough away from the intersection to prevent vehicles from stopping on or over the road tube. It should also be far enough away so that cars are not accelerating, or decelerating, as they go over the tube.
- **Do NOT** install tubes across potholes.
- **Do NOT** install tubes adjacent to driveways.
- Avoid areas of pavement with depressions or wheel tracks.

### **Two-Tube Data Collection**

For speed and/or vehicle classification, two tubes are needed. There are additional factors to consider when collecting speed and classification data. Following are some important guidelines:

- Both tubes should be cut to the same length. In addition, both tubes need to be the same length from the shoulder edge of the roadway to the counter.
- Both hoses must be mounted parallel to each other, equally spaced on either side of the road.
- Confirm the "A to B" direction of traffic is properly entered in the study details of the CountPULSE app.

When installing anchors for the second tube, they must be an equal distance from the anchors for the first tube on both sides of the road. This ensures the tubes are parallel to each other and accurate data is collected. We recommend tube spacing of 36 inches (91.44cm), however spacing of 24 inches

(60 cm) to 48 inches (121.92 cm) can be used. Make sure you input the correct spacing value when creating the new study in the CountPULSE app.

### **Collecting Bi-Directional Data**

When collecting data on two lanes of bi-directional traffic, be aware that the accuracy of the data may be affected. When vehicles cross the tubes at the same time traveling in opposite directions, determining accurate vehicles becomes difficult. Generally, if you are collecting data on a low volume road where the probability of two vehicles crossing the tubes simultaneously is low, you can expect to be very good.

If you are collecting data on a high-volume road where the probability of two vehicles crossing the tubes simultaneously is high, you can expect a decrease in the quality of data.

## **Collecting Bi-Directional Data**

When collecting data on two lanes of traffic going the same direction, it is highly recommended that the user install two units at the site, one for each lane. When two vehicles are crossing the tubes simultaneously, or in close proximity traveling at the same speed, the resulting axle hits may be very difficult or impossible to distinguish from a heavy vehicle. Because of this, processing speed, volume, and classification to an acceptable degree of accuracy is difficult.

For any multi-lane data collection, use best judgement to assess the site conditions and acceptable loss of data quality to determine if one or two units should be used.

## **One-Tube Data Collection**

For collection of uni-directional volume data ONLY on a roadway, just one tube needs to be installed. The same guidelines mentioned earlier apply for this type of installation.

You will still need to select an "A to B" direction when creating the new study in the CountPULSE App. As a default, only use the "A" port on the CountPULSE device and select the direction traffic crossing the "A" tube is going. If you are collecting bi-directional volume data, or are using both ports of the CountPULSE device to collect volume data during a median installation, clarify which direction the A tube and the B tube are counting in the notes section of the study. The single tube setup converts axle hits to vehicles assuming 3% of the vehicle stream is heavy vehicles with four axles per the Highway Capacity Manual.

## **Anchor Placement**

Anchors should be installed as close to the edge of the road as possible on both sides of the roadway.

- To install a pavement nail or 12 in. (30.48 cm) spike, use a 3 - 6 lb. handheld sledgehammer to drive the nail/spike into the edge or shoulder of the road. Good practice is to always angle the anchor slightly away from the road. (A slightly angled anchor will have less chance of being pulled up by the tube, especially in warmer climates or on hot days. Bituminous surfaces can become soft in these conditions and the anchors are more susceptible to being pulled out.)
- To install a concrete pin, drill a hole with a hammer drill and hammer the concrete pin into the opening.
- When installing the second anchor, make sure it is located directly across the road from the first, so the road tube will not cross the road at an angle. If the tube is crossing the road at an angle, the wheels of a vehicle's axle will hit the tube at different times and will not produce quality data.

## **Secure Road Tubes**

Once anchors are installed, attach the tubes to the anchors on both sides of the road with nylon loops to secure the tube to the roadway.

- Position the plugged end of the tube on the opposite side of the road from where the CountPULSE will be located and secure with a nylon loop.
- Once the tube is spread across the road, secure it to the anchor on the CountPULSE side of the road with another nylon loop. The tube should be taut, but not too tight. In general, once the tube is laying straight across the road, stretching the tube an additional 4-6 inches is sufficient. If the tube is too tight, the anchors could be pulled out.
- Place road tape every 6 to 8 feet over the tube across the road. In situations where the road is wet or near freezing during installation, or has a gravel surface, tape will not adhere to the road sufficiently. In these situations, use a 6 in. (15.24 cm) nylon strap and one of the alternate anchors depending on the road surface.

### **Connect the Road Tube to the CountPULSE**

- Attach the road tube approximately ½ inch (1.27 cm) onto the barb of the CountPULSE. It is not necessary to attach the tube all the way on the barb and will make it more difficult to remove.
- After connecting the tubes to the CountPULSE, coil any excess tube in 18 in. (45.72 cm) loops and secure with tape. Place coiled tube near the CountPULSE. Coiling the excess tube is not only courteous, but will help filter out false hits caused by bouncing tubes.

### **Securing the CountPULSE**

It is highly recommended you secure your CountPULSE to a nearby sign, utility pole, or tree with a lock and chain to discourage theft. Locks are available at [SpackSolutions.com](http://SpackSolutions.com).

- **Do NOT** secure your CountPULSE to any private property (unless given permission).
- **Do NOT** secure your CountPULSE to a fire hydrant or other emergency service infrastructure.
- Although a chain and lock is very effective, anything left on the side of the road unattended is susceptible to theft. Labeling all your devices with proper contact information in case it goes missing is recommended.

### **Critical Counts**

Critical counts are counts for a one-time event, and/or counts at remote locations where recounting is not an option.

Any count study can go bad for any number of reasons. If you are doing a critical count where re-counting is not a possibility, you should take extra precautions when collecting data. This means double checking all input values and measurements, and perhaps also



doing simultaneous duplicate counts. The extra cost for running a duplicate count is nothing compared to losing a critical count.

- If you are running single hose volume only count, consider running a second tube in the extra channel parallel to the first for redundancy. If something happens to one tube the second tube data will hopefully still be accurate.
- In remote locations, vandalism can be an issue. If possible, a redundant count is recommended. Place the second CountPULSE as far from the primary counter as possible.

Once you have the road tubes installed, your CountPULSE connected and secured, and a study created and paired to the CountPULSE device, the installation is complete. (See Section 1 for setup and pairing instructions.)

### 3) **RETRIEVING AND UPLOADING DATA**

Retrieving data from the CountPULSE and uploading it to the Cloud is easy. This section provides instructions on how to get data from your CountPULSE and how to access it online.

#### **Data Retrieval**

Each studies data collection will end automatically when the end time set in the CountPULSE app is reached. To retrieve the CountPULSE data (or to end the study manually), follow these steps:

- On the CountPULSE app, go to the '**Active**' tab and tap on the name of your study. Then, connect to your mobile device (i.e. phone or tablet) by pushing the pairing button on your CountPULSE, tap the '**Connect to Device to Sync**' button in the app, and select CountPULSE from the list of devices.
- Tap '**End Study**' and the number of road tube hits will be shown at the top of the screen, next to '**Results**'. The number of rows may appear briefly as 0 but after a second it should show the actual number of rows. Each row represents an axle hit on the road tube.
- Tap '**Retrieve Data**' and wait for the data to download. During this process, it is important that you leave the CountPULSE app open and do not leave the data retrieval page. If you leave the page, the data retrieval will stop.
- **NOTE:** Make sure the mobile device running the CountPULSE app is less than 10 feet from the CountPULSE you are retrieving data from.
- After retrieving the data, you can choose to '**upload**' the data to the study page immediately or later. If you do not upload the data immediately, the study will still be listed under the '**Active**' tab.
- After you upload the data, the study will be listed under the '**Completed**' tab.

#### **Accessing Data Online**

Once you have uploaded your data, it will be available on your account online. To access your data online, login to your account at [www.theCountHub.com](http://www.theCountHub.com). Use the same login credentials used to log in to your CountPULSE app to create the study.

Select **My Data** to view your uploaded studies. Select the study data you want from the list of uploaded studies on the left of the page. Once you have selected the study, the details of the study will appear on the right side of the screen. On the right, you will see two data download options.

#### **Accessing Data Online**

- Select “**show details**” to fine tune the CountPULSE algorithm to make sure your data is the most accurate. Here you can adjust the ACF (Axle Correction Factor) for one tube studies, adjust the tube spacing, as well as chose to have “**auto dwell**” which allows the algorithm to analyze the data and implement the appropriate setting, or manually adjust the dwell setting. Here you can also download timestamped axle hits, a.k.a raw data. For more information on dwell settings, see “**Dwell settings in Depth**”

### **Generate Vehicle List**

- Select this option to download a list of timestamped vehicles, the direction they are traveling, the speed, classification, and number of axles of each vehicle counted.
- At the top of the document, you can find total volumes for the study, as well as average and 85th percentile speeds, and percent truck numbers for the entire study.

### **Generate Vehicle Report**

- Select this option to download a detailed vehicle report categorized in 1-hour bins. This report will present direction 1, direction 2, and total vehicle volumes, speeds and classifications on an hourly basis. Speeds are grouped into 5 mph bins, and classes are bined in the 13 FHWA classification scheme.
- At the top of the report, you can find total volumes for the study, as well as average and 85th percentile speeds, and percent truck numbers for the entire study. Daily AM and PM peak hours are also displayed here.
- Depending on the size of the study, it can take a moment for the algorithm to process the data. Once the data has been processed, a .csv report is downloaded.
- By default, all uploaded studies are public, this way you can share your data with anyone who has a CountPULSE account. This enables traffic professionals around the world to access a vast data base of study data from numerous scenarios. If you do not wish to share data from your study, you can change the visibility to private on the bottom of the screen. The Default sharing preferences can be changed in the CountPULSE App by selecting ‘private’ in the settings.

### **1-Tube Studies**

- If you are conducting a 1-tube study (volume only) you can only download the vehicle report. This report will provide “A tube” and “B tube” volumes categorized in 1-hour bins. If you are collecting data in an area with a known higher percentage of 3+ axle vehicles, you can adjust the ACF under “show details” before processing data.

## **4) TROUBLESHOOTING**

Sometimes things don’t work as they should. This section will review some common errors and how to resolve them.

## Resetting the Device

If your CountPULSE device is experiencing issues, there is a reset device button in the app. To reset the device, create a new 'dummy' study and then connect the device to the new study. As soon as it is connected, scroll to the bottom and tap **Reset Device** two times. This will reset the device. Tap the top left back button and make sure to delete the newly created study.

If the CountPULSE device appears to be frozen or non-responsive, you can try to re-start the device. To re-start the device, press and hold the bottom button for 3 seconds.

## If Data Doesn't Look Right

If you download the data from a study and the results are not what you were expecting, there are a couple common reasons why this may have happened.

- **Incorrect Input Values.** If the data looks inaccurate, double check the values entered when the study was created. You can see these values on the right side of the screen when viewing a study on TheCountHub.com website. Verify that the A to B direction is correct and the tube spacing was entered correctly. Depending on the error, the data collected may still be usable. If the error is too severe, a study reset may be necessary, and data will need to be recollected.
- **Faulty Road Tubes.** If your A tube and B tube hits are widely off, it is most likely caused by a faulty tube. Over time, even heavy tubes wear out and will need to be replaced. The most common tube failure is caused by a split/puncture in the tube, resulting in weak signals being produced. If this is the case, a study reset is necessary and data will need to be recollected. It is recommended you test your tubes frequently to ensure they are still usable. Road tube testing equipment is available at CountingCars.com.

## 5) ADDITIONAL SUPPORT

### **Bluetooth Transfer Speed**

In order to ensure all of the traffic data captured by the CountPULSE hardware is sent wirelessly to your mobile device during Data Retrieval, we have designed the CountPULSE app and device to use the standard Bluetooth 'indicate' data transfer method. This increases reliability at the expense of speed.

Technical jargon aside, this means the speed of the data transfer is dependent on your mobile device's Bluetooth hardware. This transfer time can vary depending on your mobile device. A progress bar is shown in the App as the data is extracted so you can better monitor progress and learn how long it takes for your mobile device.

Generally, we have found Android devices to be considerably faster than IOS/Apple devices. This is a limitation of the IOS hardware.

### **Dwell Settings**

Dwell handles the potential presence of an 'echo' in the road tubes by setting an amount of time after a 'good' strike to not record any other strikes on the same tube. So, if your data is showing 'echoes' (false strikes) at regular intervals, setting a dwell to be equal to or slightly greater than that period of time, would be recommended. Generally, a Dwell setting of 55 - 65ms handles most situations for tubes with high amounts of echo. A hardware dwell is set to your device based on the speed limit you input when creating the study, an additional software dwell can be added when processing data on the website, however, you can not decrease the software dwell below the hardware dwell setting. To set the hardware dwell to '0' set the speed limit input to 100 when creating a new study.

### **Battery Charging**

The CountPULSE utilizes an internal chargeable battery that is recharged using a micro-USB. A cable has been provided with your CountPULSE. The internal battery has an expected battery life of six months to one year, depending on frequency of use. When your battery reaches the end of its charge, it can easily be recharged using the following steps:

- Remove the CountPULSE's rubber boot
- Located the micro-USB plug located on the side of the CountPULSE
- Plug in the provided Micro-USB cable and charge. The indicator light on the back of the CountPULSE will light up red during charging
- Once the CountPULSE is fully charged the indicator light will turn green. This can take up to 8-hours.
- **NOTE:** If you do not use the provided Micro-USB cable there is a chance the indicator light will remain red. If this occurs the device is still charging and after 8-

hours the device should be near or fully charged. Try using a high quality, higher current charger of at least 2A to avoid this.

- Replace the rubber boot.
- Test the device to ensure it works with the App

### **Restarting the CountPULSE**

If the CountPULSE device appears to be frozen or non-responsive, a hard reset can be completed using the following steps:

- Remove the CountPULSE's rubber boot
- Remove the five screws and open the top shell
- Located the "reset" button located in the middle of the CountPULSE device and firmly press the button until you hear a small clicking noise. Using a pen or paperclip can help with this process.
- Replace the top shell carefully making sure the sealing gasket is in place.
- Replace the five screws.
- Replace the rubber boot
- Test to ensure the device works properly.

6) **Frequently Asked Questions**

**How will I know when it's time to charge the battery?**

Every time you connect to the CountPULSE the CountPULSE App will check the device's battery life. When battery life reaches 20% or less, a notification will pop up warning you of the device's low battery.

**Is the CountPULSE 'Weather-Proof'?**

The CountPULSE was designed to operate in all climates and weather conditions.

**Where can I find more information and support for the CountPULSE?**

Our Help Center, located on our website, SpackSolutions.com, has additional information, downloads, and training videos for the CountPULSE device. If you can not find an answer to your question within the Help Center, contact Spack Solutions Support through creating a tech support ticket or by emailing [Help@SpackSolutions.com](mailto:Help@SpackSolutions.com) (Creating a tech support ticket through our website is the fastest way to get help).