

# Public Missiles, Ltd.



## CoPilot v3 Dual-Deployment Recovery Altimeter

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## System Overview

The Public Missiles Ltd. CoPilot v3 altimeter (hereafter referred to as “**CP3**”) was developed exclusively for PML by Missile Works Corp., and was designed specifically for PML’s CPR3000 Recovery System (though it can be used in other applications as well, such as scratch-built deployment systems). The CP3 provides two-stage deployment of rocket recovery systems and equipment. Using the CP3 altimeter and CPR3000 technology, a small drogue or streamer is deployed at apogee allowing for a fast but controlled descent. At a user-selectable lower altitude, the altimeter fires a second charge to deploy the main chute allowing for a soft landing. This system allows a high-altitude flight to be returned much closer to the launch area than if the main chute were deployed at apogee.

The CP3 unit is designed to work “out of the box” with a typical CPR3000 flight of “drogue at apogee, mains at 500 feet.” No pre-programming is necessary to use the unit in this fashion.

## Primary Features

- Drogue and Main Outputs, with a configurable third “Aux” output
- Configurable Deployment operations
- Configurable Arming and Main Deploy altitudes
- 15 flight memory at up to 28 minutes recording per flight
- User-selectable beep frequency
- Rugged, reliable, and uses a standard 9v alkaline battery
- “Fore” and “Aft” markings to aid in proper mounting
- USB connection port (requires user-provided USB-A to Mini-B cable)

## Specifications

<b>Operational Range</b>	0-40000 ft. MSL
<b>Arming Mode</b>	Barometric
<b>Minimum Altitude for Arming</b>	100 ft. AGL (adjustable)
<b>Main Deployment Ranges</b>	300 - 3000 ft. AGL, in 100 ft. increments
<b>Altitude Reporting Accuracy</b>	± 3%
<b>Battery Power Range</b>	9V / 7-10V
<b>Nominal Battery Load</b>	6-14 ma
<b>Continuity Current</b>	25 µa
<b>Firing Current</b>	5 A for 1 second
<b>Dimensions</b>	1.35" W x 5.0" L x ~0.80" H
<b>Weight (w/9V alkaline battery)</b>	85 grams (3.0 oz)

MSL = Mean Sea Level; AGL = Above Ground Level; µa = microamps; ma = milliamps

## Default Base Settings

<b>Arming Altitude</b>	300 ft. AGL
<b>Main Deployment Altitude</b>	500 ft. AGL
<b>Deployment Mode</b>	Drogue at Apogee, Main at 500 ft. AGL
<b>Audio Options</b>	Continuity Beep
<b>Units</b>	Feet/Feet Per Second
<b>Low Voltage Lockout</b>	Disabled
<b>Piezo Tone</b>	1.04 KHz
<b>Drogue Delay</b>	1 second

For a more detailed description of each of the above settings refer to *Base Settings Description*, later in this manual

## Handling Precautions

- The CP3 altimeter should always be handled in a properly grounded environment. ESD (Electro-Static Discharge) damage is not covered under warranty.
- Never touch/handle the CP3 when it is powered ON and connected to live pyrotechnic charges as this may cause premature detonation of the charges.

- Always allow the CP3 to adjust to ambient temperature conditions prior to connecting, arming and flying.
- Avoid exposure of a powered ON CP3 to high intensity light (including direct sunlight), heat, cold, wind, or other extreme environmental conditions.
- Always prepare your rocket and recovery system components with the CP3 powered OFF.
- Never cycle the power switch off, then immediately back on. Always allow the switch to remain OFF for at least 10 seconds prior to restoring power.

## Overview

Figure 1 depicts the general component layout of the PML CP3. The CP3 is designed for several different modes of operation. All user input and output connections are made to the eight terminals as shown. These terminals include: SW (for an external power switch), Drogue (for external deployment charges or controls), Main (for external deployment charges or controls), and Aux (additional pyro control). All terminals are marked on the board for reference. The CP3 also has:

- USB connection on the back side (dotted line in drawing) for smartphone connection and interface and connection to PC. Requires a user-provided USB-A to Mini-B cable (one of the most common USB cables)
- 10-pin connector between the piezo buzzer and pushbutton for connection to a MissileWorks LCD Terminal Module.
- Access to the **Base Settings** is made available via the CP3 DIP switch and pushbutton interface. The value of all these settings can be verified or reconfigured at any time without the use of the optional LCD Terminal or smartphone/PC USB interface. They provide a “manual” way to set up the CP3. However, the easiest and fastest way to configure the CP3 is via the optional LCD Terminal Module or via the free mDACS PC software available at [www.publicmissiles.com](http://www.publicmissiles.com).

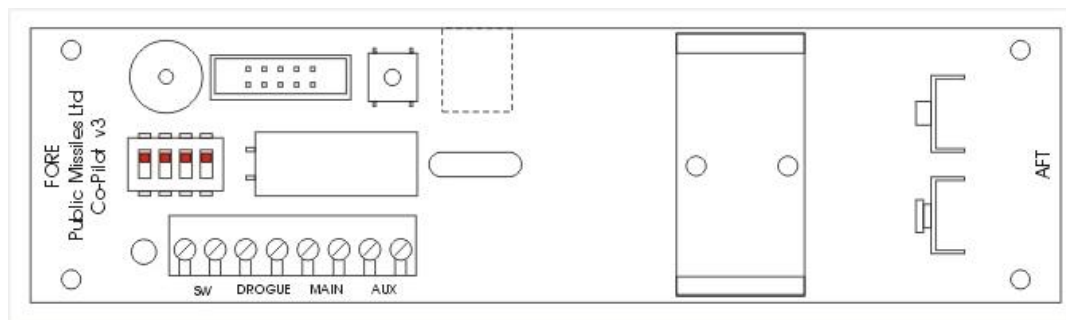


Figure 1 - Component Layout of the CoPilot v3

## Flight and Recovery Operational Description

The CP3 has several distinct modes in its normal operation sequence. The piezoelectric beeper and the status LED indicator identify these modes of operation. These modes are discussed below in their order of occurrence in operation.

- Power-Up Mode
- Barometric Initialization Delay
- POST Mode
- Launch Commit Test
- Continuity beeps while awaiting Launch Detect

The CP3 will take approximately 30 seconds to complete the boot-up and testing sequence and be ready for flight.

### Power-Up Mode

When the switch connected to the Switch terminals of the CP3 is turned ON, the unit will produce a continuous 5-second beep to indicate it has been turned ON. During this 5-second beep period, the CP3 is looking for either a tap of the Program button (invoking Dip Switch Operations Mode) or a “Host Connection” message from a host PC computer (attempting to connect in Host or Simulation mode).

These operations are covered later in this manual. The LED will remain on continuously during the Power Up mode.

## Barometric Initialization Delay

After the Power-Up mode, the CP3 goes into a 10-second Barometric Initialization start up delay. The LED will flash on and off every 2 seconds during this period. This start-up delay allows stabilization of the electronics and establishes an initial launch site pressure level reading. The CP3 then bases all other pressure changes on this pressure reading. The CP3 essentially “zeroes” itself to the current pressure level of the launch site.

## POST Mode (Power On Self Test)

Once the barometric initialization is completed, the CP3 performs several POST checks to validate the integrity of all sensors and to check the current ambient environmental conditions (pressure and temperature).

If there are any detected system warnings or faults, or conditions that fall outside of specified ranges, the altimeter enters a POST Fault Code loop, where it repeatedly reports the specific fault that it encountered. The CP3 is unable to fly until the fault or warning is corrected.

POST Fault Codes are preceded by a very distinct warning tone (7 very quick low beeps), followed by the beeping and flashing of the specific fault code.

POST Fault Code	Description
1	User invoked Settings Default to Factory Settings warning
2	LCD Terminal Fault / LCD is attached and a DIP Switch is ON
3*	Barometric sensor Fault / No communication reply
4*	Barometric sensor Fault / Prom CRC Mismatch
5*	Barometric pressure Fault / Pressure < 10 mbar or > 1200 mbar
6*	Temperature Fault / Temperature < -40 deg. C or > 85 deg. C
7	Low Battery Lockout Fault / Replace Battery
8**	Ambient Barometric Fault / Unstable conditions during Launch Commit Test

### POST Code Notes:

\* Codes 3 thru 6 indicate a hardware fault. Contact PML for warranty or service details.

\*\* Code 8 indicates that ambient baro conditions are unstable for the currently programmed Arming Altitude. Either raise the Arming Altitude setting, or consider flying in more stable conditions. Heavy, gusting winds are typically the cause of Code 8.

## Audio Options Report Mode

If you have enabled any of the Pre-Launch Audio options of the CP3, they will be beeped/flashed at this stage of operations. These audio options include beeping/flashing of battery voltage and Deployment modes. (see the following “Base Settings” section if the manual for more details).

## Launch Detect Mode

When all previous modes are complete, the unit transitions into Launch Detect mode. The piezo beeper and the LED indicate the continuity status of the Drogue and Main output terminals every 5 seconds as follows:

Long Beep/Flash	No continuity on Drogue or Main
1 Short Beep	Continuity on Drogue only
2 Short Beeps	Continuity on Main only
3 Short Beeps	Continuity on Drogue and Main

The unit also monitors the barometric sensor for a change in altitude as specified by the current Arming Altitude setting to determine the launch of the rocket. After this change is sensed, the CP3 is activated; “Launch Detect” is declared and the unit is “live” and sensing the flight.

## Apogee Detect Mode

At this point, the rocket has detected launch and is in flight. The LED and piezo will be off. During this mode the CP3 is sampling for apogee. When apogee is detected, the Drogue output will activate. (The Main output may activate as well if the unit has been programmed to do so at apogee.

## Main Detection Mode

After the unit has detected apogee, it will transition to Main Detection mode. The unit will continue to sample barometric pressure during the descent phase of the flight until it reaches the designated Main Altitude setting.

## Landing Detection Mode

Once the Main deployment has occurred, the CP3 starts monitoring for a Landing Event, defined as when current velocity is greater than -3 feet per second for 2 seconds. When Landing is detected, data recording stops.

## Report Mode

After Landing Detection, the CP3 will report the peak altitude it measured during flight. The piezo beeper and the LED will continuously report the peak altitude by chirping/flushing out the individual digits of the measurement. Depending on the peak altitude, the unit will chirp out (and flash) 3, 4, or 5 digits. For example, let's say the rocket flew to a peak altitude of 1302 feet. The CP3 would beep (and flash) as follows:

- Beep (1)...pause
- Beep, Beep, Beep (3)...pause
- Beeeeeeeeeeeep (0; a long beep means zero)... pause
- Beep, Beep (2)...
- then a short buzz indicating end of report, and then repeat the report

The altitude reporting repeats every 10 seconds until the CP3 is turned off.

## Flight Log Memory and Flight Data Memory

The CP3 contains two types of memory for retaining flight data.

Flight **Data** memory is a memory chip area that records up to 15 flights of up to 28 minutes each. Each flight on the CP3 is written to the Flight Data area continuously throughout the flight. Once the memory is full, as the newest flight is written, the oldest flight will be deleted and "pushed off the end". Flight Data memory is only retrievable via PC software via USB upload; it is more of a "data storage" area than an area to be read at the field.

Flight **Log** memory is a small flash memory area in the main processor chip. The Flight Log contains a recap of the *last flight* made by the CP3. If you don't read or review the Flight Log data, it is overwritten by the next flight. The data in the Flight Log is available via DIP switch, LCD Terminal Module display, or via USB to the mDACS software on PC. The data in the Flight Log is easily available at the field, and is beeped out by the unit after each flight.

To restate: Flight LOG data is written and retrievable NOW, and is cleared when you fly again. Flight DATA memory is written on each flight for review LATER, and will hold up to 15 flights.

The easiest and fastest way to retrieve data is via the optional LCD Terminal Module or via the free mDACS PC software available at [www.publicmissiles.com](http://www.publicmissiles.com)

## Base Settings Description

The CP3 "**Base Settings**" are a collection of settings and controls that provide all the basic functions of the altimeter. As noted previously, none of these settings *REQUIRE* your adjustment. The CP3 is Ready-To-Fly out of the box with settings of Apogee Drogue Deploy and 500' Main Deploy. However, there are a number of settings you can change to better suit your needs or preferences if you wish.

NOTE: To reset the CP3 to the default factory settings:

1. Push and hold the Programming button
2. Apply power while holding the Programming button down.
3. Continue holding the button for approximately 5 seconds
4. Release the pushbutton when it beeps (refer to POST codes in the Operational Modes section)
5. Turn the CP3 off

**Arming Altitude**                      **Range: 10 to 30 (100 ft. to 300 ft.) / Default: 30 (300 ft.)**

This setting establishes the minimum AGL altitude (in feet) required for the altimeter to arm itself for flight operations and to commence the drogue chute and main chute recovery controls. The setting is entered in 10 ft. increments. If the rocket does not reach this altitude deployments will not occur.

**Main Deployment Altitude**                      **Range: 3 to 30 (300 ft. to 3000 ft.) / Default: 5 (500 ft.)**

This setting defines the AGL altitude (in feet) at which the main deployment event is activated during the descent phase of the recovery. The main deployment event is always preceded by the drogue deployment event. The setting is entered in 100 ft. increments.

**Deployment Mode**                                      **Range: 1 to 3 / Default: 1**

The Deployment Mode setting defines how and when the altimeter activates the drogue and main deployment events during a flight. There are 3 distinct deployment modes:

1. *Dual Deploy Primary*      Drogue @ Apogee / Main @ Main Deployment Altitude
2. *Dual Deploy Backup*      Drogue @ Apogee + Drogue Delay / Main @ Deployment Altitude
3. *Apogee Only*                  Drogue @ Apogee / Main @ Apogee + 1 sec

(The Drogue Delay in #2 is when the CP3 is being used as a backup altimeter. The Drogue Delay should be set to the number of seconds you want the CP3 to wait after apogee has been reached to activate the Drogue output; how many seconds you want to wait before deciding to fire your backup charge).

**Audio Options**                                      **Range: 1 to 32 / Default: 32**

The Audio Options setting controls how the onboard piezo beeper is utilized throughout flight operations. Aside from the drogue or main activation, activating the piezo it is the single-most battery intensive task the altimeter performs. The setting is specified in a (binary-based) value according to the following table:

Beep Battery Voltage (X.X volts) Pre-Launch	Setting Value + 1
Beep Deployment Mode and Main Altitude Pre-Launch	Setting Value + 2
Enable Pad Power Saver Mode (disable continuity beeps)	Setting Value + 4
Beep Peak Flight Velocity Post-Flight	Setting Value + 8
Beep Time to Apogee (seconds) Post-Flight	Setting Value + 16
Disable all Audio Options	Setting Value + 32

For example, if you wanted to beep the Pre-Launch Battery Voltage (+1) and in addition, employ the use of the Pad Power Saver Mode (+4), you would set the Audio Options setting to (5). If you wanted to beep your Peak Flight Velocity (+8) and Time To Apogee (+16) after the flight, you'd set Audio Options to (24).

All of the audio option settings are basically self-explanatory; the exception however is the Pad Power Saver Mode. If this option is enabled, the continuity beeping you hear initially in Launch Detect Mode will stop after 5 minutes. In place of continuity beeping, the altimeter will emit 1 short "beep" every 15 seconds to indicate it is armed and in launch detect mode, saving a lot of battery power for your inevitable pad wait time and subsequent flight.

**Data Reporting Units                      Range: 1 to 4 / Default: 1**

The Data Reporting Units setting determines how the CP3 will report all the flight performance values. This setting applies to all forms of data reporting (the audio “beeping”, the data displayed on the optional LCD terminal, etc). Choose a setting that is most appropriate for you as follows:

1. Imperial Units (feet, deg F) / Velocity (feet per second / fps)
2. Metric Units (meters, deg C) / Velocity (Kilometers per hour / KPH)
3. Imperial Units (feet, deg F) / Velocity (Miles per hour /MPH)
4. Metric Units (meters, deg C) / Velocity (meters per second /mps)

**Low Voltage Lockout Level                      Range: 2 to 9 / Default: 2**

This setting will validate the CP3 battery voltage is above a minimum voltage level that’s appropriate for your battery system. A setting of (2) disables this lockout feature. If this lockout feature is enabled, and the battery voltage is at or below the specified setting, the unit will not arm itself for flight, and instead activate the POST fault code report mode (see the *POST fault codes*). The setting is entered in volts; since 2 is the disabling setting, the actual “working range” is 3 to 9 volts. For the CP3 using a 9v Alkaline battery, PML recommends a low voltage lockout setting of 8 volts.

**Piezo Tone    Range: 2 to 12 / Default: 12**

This setting determines the frequency the piezo “beeper” will operate at. The *lowest* setting will result in a *higher* frequency (6.25 KHz), and the highest setting results in the lowest frequency (1.04 KHz). Use this when multiple electronics are onboard your rocket to distinguish the beeping of one unit from another, or to adjust the tone to a frequency that you can hear. Try them all to choose the one you like.

**Drogue Delay    Range: 1 to 30 / Default: 1**

The Drogue Delay is used whenever you have selected a Deployment Mode setting of *Dual Deploy Backup*. In all other cases this settings is not used. Whenever the CP3 is designated in a backup role when using redundant altimeter systems, you can delay the CP3 Drogue event using this setting. Should this delay setting be set for a long period, and the CP3 determines the Main Event requires activation; the CP3 will also override the Drogue Delay timer and activate the Drogue Event. The setting is entered in seconds.

## DIP Switch and Pushbutton Operations

Access to all the **Base Settings** is made available via the CP3 DIP switch and pushbutton interface. The value of all these settings can be verified or reconfigured at any time without the use of the optional LCD Terminal or smartphone USB interface. They provide a “manual” way to set up the CP3. (The easiest and fastest way to configure the CP3 is via the optional LCD Terminal Module or via the free mDACS PC software available at [www.publicmissiles.com](http://www.publicmissiles.com)).

In addition to providing access to all these settings, the DIP switch and pushbutton interface can also provide access to the altimeter resident **Flight Log** data and an interactive **Test Mode** that can validate basic operational integrity of the CP3 (these are covered in their own section of this manual). DIP Switch 4 determines this selection: Settings access, or Flight Log/Test Mode access.

### Setting the CP3 via DIP switch and pushbutton

To start a setting session, ensure the CP3 is powered off, and that it has a battery and power switch attached. **Also ensure the DIP switch 4 is in the OFF position.**

Turn on the power switch. You should hear the start of the 5 second “init” tone. At any point during this 5 second tone, tap the **PROGRAM** button (the small black button underneath the piezo beeper and the LCD connector on the upper RH portion of the CP3). The beeper and LED should go out, and the unit will begin its Base Settings operation.

The position of DIP Switches 1 thru 3 determines which of the 8 **Base Settings** that you want to verify, or re-program. The Base Settings operation follows a simple process flow:

1. The CP3 reads the position of DIP Switches.
2. The CP3 beeps/flashs the current value of the associated setting.
3. The CP3 pauses for 5 seconds, and then repeats Step 1. (“*Programming Pause*”)

By this process repeating itself over and over and over you can go through each setting, confirming it or changing it, then moving on to the next one.

You can change DIP Switches 1 thru 3 at any time to select a new setting for verification. (The tip of an ink pen works well to move the switches back and forth). Using this process, you can validate the values of all 8 **Base Settings**. The DIP switch / Settings positions to check or change each Base Setting are:

<b>SW1</b>	<b>SW2</b>	<b>SW3</b>	<b>Base Setting Item</b>
<b>OFF</b>	<b>OFF</b>	<b>OFF</b>	Arming Altitude
<b>ON</b>	<b>OFF</b>	<b>OFF</b>	Main Deployment Altitude
<b>OFF</b>	<b>ON</b>	<b>OFF</b>	Deployment Mode
<b>ON</b>	<b>ON</b>	<b>OFF</b>	Audio Options
<b>OFF</b>	<b>OFF</b>	<b>ON</b>	Audio /LCD / Telemetry Units
<b>ON</b>	<b>OFF</b>	<b>ON</b>	Low Voltage Lockout / Alarm Level
<b>OFF</b>	<b>ON</b>	<b>ON</b>	Piezo Tone
<b>ON</b>	<b>ON</b>	<b>ON</b>	Drogue Delay

Step 3 of the above process flow is what we’ll refer to as the “*Programming Pause*”. If you want to re-program the setting you currently have selected, you would tap in a new value during this pause time. Let’s say you wanted to re-program the Main Altitude setting from the default of 500’ to 1000’.

Here are the steps you’d perform:

1. Select the Main Altitude Setting via DIP Switch (1 ON / 2 OFF / 3 OFF)
2. Verify the current setting value of 5 via beep/flash
3. During the “*Programming Pause*”, tap the Program pushbutton 10 times
4. The CP3 will provide a double-beep “acknowledge tone” (new setting is saved)
5. Verify the NEW setting value of 10 via beep/flash (10 x 100’ = 1000’)

Done... Programming complete!

Repeat the sequence again should you want to change it to something else, or select a new setting via DIP switch to verify or change. When you’re done, simply power off the CP3. It’s now ready to fly with the newly programmed settings.

## Accessing the CP3 Flight Log via DIP switch and pushbutton

As mentioned in the previous section, the DIP switch and pushbutton interface can also provide access to the altimeter resident *Flight Log* data.

To start a Flight Log session, ensure the CP3 is powered off, and that it has a battery and power switch attached and ready. **Also ensure the DIP switch 4 is in the ON position.**

Turn on the power switch. You should hear the start of the 5 second “init” tone. At any point during this 5 second tone, tap the **PROGRAM** button. The beeper and LED should go out, and the unit will begin its Flight Log/Diagnostic operation.

The position of DIP Switches 1 thru 3 determines which of the 6 *Flight Log* items that you want to review. The Flight Log/Diagnostic operation follows a simple process flow:

1. The CP3 reads the position of DIP Switches.
2. The CP3 beeps/flashs the value of the associated Flight Log/Diagnostic item(s).
3. The CP3 pauses for 5 seconds, and then repeats Step 1.

You can change DIP Switches 1 thru 3 at any time to select a new item for review. Using this process, you can review/select all 6 *Flight Log* items. The *Flight Log* DIP switch positions are:



SW1	SW2	SW3	Flight Log Item
OFF	OFF	OFF	Peak Altitude AGL
ON	OFF	OFF	Peak Velocity
OFF	ON	OFF	Time to Apogee
ON	ON	OFF	Total Descent Time
OFF	OFF	ON	Drogue Descent Rate Average
ON	OFF	ON	Main Descent Rate Average

The CP3 Flight Log data always contains the data from the last flight. Each new flight overwrites the prior flight information. The items in the Flight Log are all beeped/flushed in the units chosen by the *Data Reporting Units* setting.

## CP3 Diagnostics and Testing via DIP switch and pushbutton

There are 2 Diagnostic Modes available that the CP3 supports while in the **Flight Log** DIP Switch mode. Start in the same manner described in the above section. Set the DIP switches as follows:

SW1	SW2	SW3	Diagnostic Testing Type
OFF	ON	ON	Baro Millibars, Temperature, Firmware version
ON	ON	ON	Continuity Inputs & All Outputs Test

### BARO/TEMPERATURE DIAGNOSTIC

The *Baro/Temperature* diagnostic will read the ambient baro and temperature data directly from the onboard sensor, and then beep/flash accordingly. Lastly, this diagnostic wraps up by beeping the current CP3 firmware build version. It takes the form of X.x, allowing you validate the active build you are running. Use this Diagnostic to quickly validate and test the operational integrity of the barometric sensor system.

### CONTINUITY INPUTS/ACTIVATE OUTPUTS DIAGNOSTIC

The *Continuity Inputs* diagnostic will read the status of the Drogue, Main, and Auxiliary and then beep/flash the input status accordingly. This test mimics the same continuity status beeping/flushing while in Launch Detect Mode:

Long Beep/Flash	No continuity on Drogue, Main, or Aux
1 Short Beep	Continuity on Drogue only
2 Short Beeps	Continuity on Main only
3 Short Beeps	Continuity on Drogue and Main only
4 Short Beeps	Continuity on Auxiliary only
5 Short Beeps	Continuity on Drogue and Auxiliary only
6 Short Beeps	Continuity on Main and Auxiliary only
7 Short Beeps	Continuity on Drogue, Main, and Auxiliary

**IMPORTANT: ALWAYS USE EXTREME CAUTION and ensure that you have NO LIVE PYRO CHARGES attached to CP3 when activating the Output test operation.**

At any point during this diagnostic, if you tap the "Program" button, you will simultaneously activate all 3 outputs (Drogue, Main, and Auxiliary) for the standard 1 second activation time used by the Flight controls.

## Battery and Power Source Considerations

The CP3 is designed to be operated with a standard 9-volt alkaline battery. Always use high-quality, name-brand alkaline batteries. 9-volt NiCad, NiMH, LiPo, or other battery types may also be used. PML recommends a

**IMPORTANT: Always use a battery system less than 10 Volts to avoid damaging the CP3.**

## Pre-Flight Load Testing of Battery

**IMPORTANT:** Always load-test your battery prior to flight to ensure adequate power reserve for reliable operation and ignition of the ejection charges. Also consider potentially long wait times with the rocket and recovery system armed at the pad when determining if your battery will be good enough for launch.

To load-test a 9V battery, you will need a DC multimeter capable of DC amp measurement with a 10-amp capability. A 9-volt battery can easily source in excess of 5 amps. Briefly connect the meter leads across the battery terminals to measure the DC current capacity. If the measurement is close to or drops below 2 amps, do not use the battery. Nominal load during operation is about 6-14 ma. During output firing, the unit can draw well over 1 amp with low current e-matches.

## Battery Retention

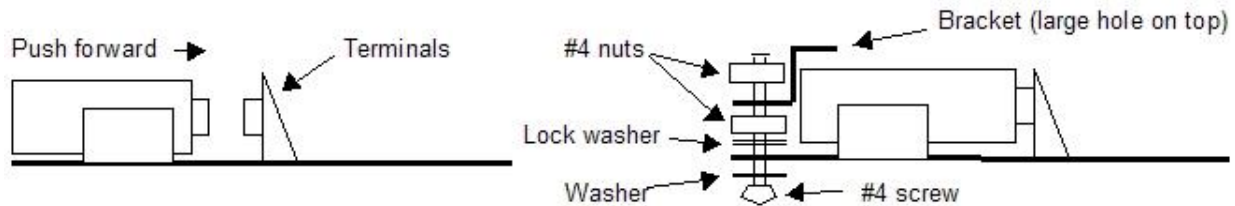


Figure 2 - Battery Retention Clip Detail

## E-matches and Ejection Charges

The topic of e-matches and ejection charges is often overlooked and not given a proper evaluation. The ejection charge is as critical a component as the electronics. Improper selection or application of e-matches can result in failure of the recovery system and total loss of the rocket. It is foolhardy to attempt to “save money” on an ejection charge ignition device considering the hundreds of dollars invested in the electronic-based rocket, the altimeter, the motor casing, and the motor reload itself. The cost of a quality ignition device for each ejection charge is insignificant compared to the overall investment, yet the failure of an ignition device can cause destruction of the entire rocket. The message is clear: buy good-quality ejection ignition devices!

- **IMPORTANT:** Always ground test the type of e-match you'll be using under actual flight-ready conditions prior to committing to flight.
- Improper selection of an e-match will result in a malfunction. Always use an e-match that is suited for the firing conditions of the CP3 (e.g., do not use a match with very low current or very high current requirements).
- Always check your e-match, igniter, or flashbulb devices for continuity and proper resistance prior to using them under testing or actual flight conditions.
- PML recommends that all flashbulbs and electric matches have their electrical wires twisted together until just before installation in the rocket system. This may help prevent accidental ignition of the device due to static discharge.

## Selecting an Electric Match for Deployment Charge Ignition

We recommend the M-Tek or J-Tek series e-matches from MJG Technologies ([www.electricmatch.com](http://www.electricmatch.com)) for the CP3, as well as low-current Daveyfire or Oxral e-matches.

## Launch Day

It's best to prepare your rocket carefully and not to bypass any critical steps. The following list is a guideline of the necessary steps you should take in the preparation of your CoPilot v3. Also follow the directions given for your CPR3000 rocket kit.

### At the Prep Table

1. Load test the battery; after testing OK, install in CP3 and install retaining clip
2. Check continuity and resistance of the ignition devices (e-matches, flashbulbs, etc.)
3. Install e-matches/flashbulbs into CPR3000 system following CPR3000 instructions.
4. Make final wiring connections to the ejection charges. Connect the (-) terminal first.
5. Arm the electronics and verify ejection charge continuity; turn CP3 OFF after continuity check
6. Prepare and pack the recovery components (parachutes, streamers, etc.)

7. Put on safety glasses and protective gloves.
8. Install BP charges as recommended in your CPR3000 instructions
9. Install CoPilot v3/CPR3000 altimeter bay assembly into rocket
10. Assemble the rocket and check all deployment coupling junctions, ensuring a snug and adequate fit
11. Prepare and load the rocket motor

## At the Pad

1. Place the rocket on the launch rod or rail
2. Turn on the arming switch for the altimeter, and listen for the startup sequence. The altimeter startup sequence is as follows :
3. 5 second long beep (init mode)
4. 10 second baro history init time (silence)
5. Settings beep (when enabled) or POST fault code beep (if a fault, see POST fault codes)
6. 10 second launch commit test time (silence)
7. Launch Detect mode (continuity beeps)
  - A long beep indicates no continuity on any event terminal.
  - One short beep indicates continuity on only the drogue terminal.
  - Two short beeps indicate continuity on only the main terminal.
  - Three short beeps indicate continuity on the main and drogue terminals.
8. Insert the igniter in your rocket motor
9. You're ready to launch!

## Product Warranty

Missile Works Corporation has exercised reasonable care in the design and manufacture of this product and warrants the original purchaser that the CP3 altimeter is free of defects and that will operate at a satisfactory level of performance for a period of one year from the original date of purchase. If the system fails to operate as specified, contact [sales@publicmissiles.com](mailto:sales@publicmissiles.com) or telephone 810-327-1710 9-5pm EST Mon.- Fri. within the warranty period for repair or replacement. PML will discuss your claim with you and direct you as to how to proceed, up to and including returning the CP3 to Missile Works for warranty repair. **PML MUST PRE-AUTHORIZE YOUR WARRANTY CLAIM**; DO NOT SEND THE CP3 TO MISSILE WORKS WITHOUT PML AUTHORIZATION OR IT WILL BE RETURNED TO YOU UNREPAIRED. The CP3 must be returned by the original purchaser, and be free of modification or any other physical damage which renders the system inoperable. Upon repair or replacement of the CoPilot v3, Missile Works Corporation will return the CP3 postage paid to the original purchaser.

For repairs after the CP3 is out of the warranty period, contact Missile Works Corporation directly.

[www.missileworks.com](http://www.missileworks.com)

**Mail, Service & Repair Address:**

Missile Works Corporation  
PO Box 1725  
Lyons CO 80540

## Product Disclaimer and Limit of Liability

Because the use and application of this equipment are beyond our control, the purchaser or user agrees to hold harmless Missile Works Corporation and Public Missiles, Ltd. and their agents from any and all claims, demands, actions, debts, liabilities, judgments, costs, and attorney fees arising out of, claimed on account of, or in any manner predicated upon loss or damage to property of, or injuries to or the death of any and all persons arising out of the use this equipment. Due to the nature of electronic devices and the application and environments for those devices, the possibility of failure can never be totally ruled out. It is the responsibility of the purchaser or user of this equipment to properly test and simulate the actual conditions under which the device is intended to be used to ensure the highest degree of reliability and success.