

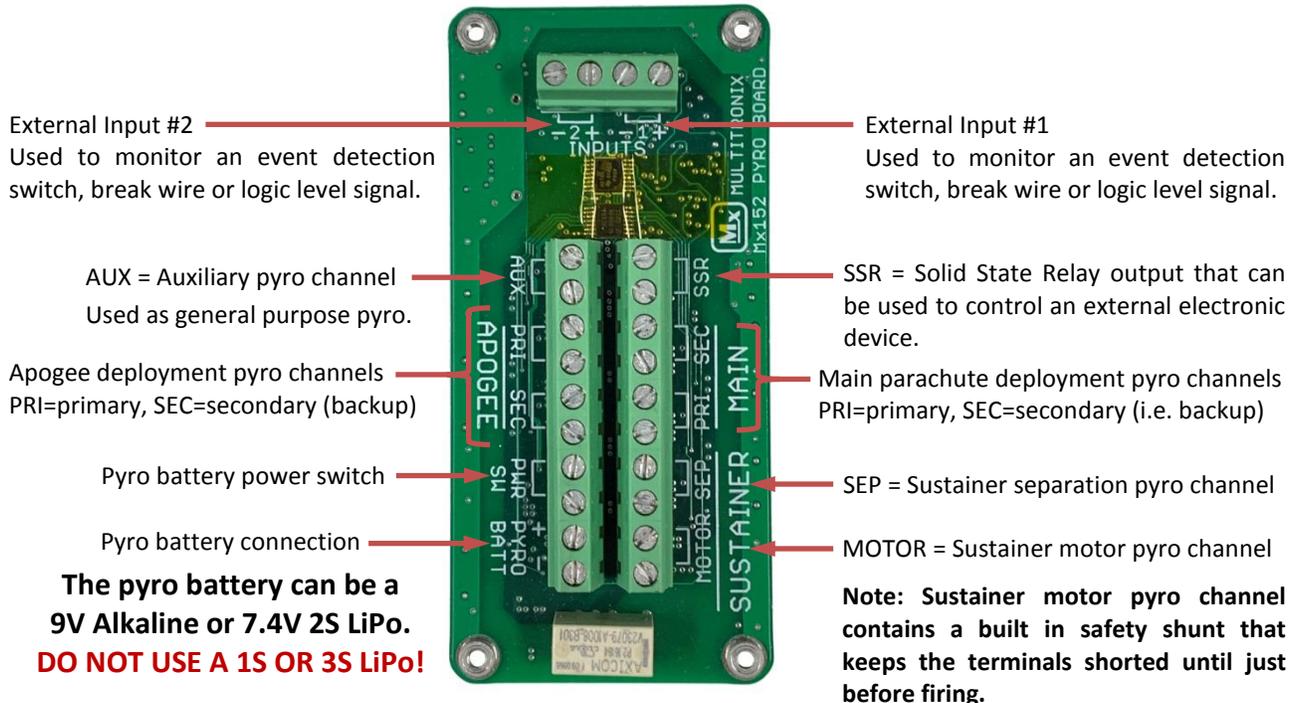


Pyro Board Quick Start Guide

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This Quick Start Guide is intended to help a new user become familiar with the Multitronix Pyro Board. The Pyro Board plugs onto the backside of an Mx150 "Kate 2.0" transmitter and adds deployment and staging capability. All pyro events can be configured with the receiver. No computer is needed. This guide will explain how to configure the Pyro Board. It assumes the user is at least somewhat familiar with the operation of the Mx120 Receiver. (See manual for more details.)

Mx152 Pyro Board



All pyro channels are designed to fire ematches such as those sold by MJG Technologies (www.electricmatch.com). This includes the regulated J-Tek ematches and the unregulated Firewire Initiators. All pyro channels (except the sustainer motor channel) will fire for 0.5 seconds. The sustainer motor channel firing time is adjustable from 0.5s to 5.0s. The sustainer motor channel also has a built-in safety shunt that keeps both ematch leads disconnected from the firing circuit and shorted together until just before the motor is to be fired. The safety shunt is automatically operated so there is nothing special required for the user to do.

The main parachute and apogee deployment channels will fire their primary (PRI) outputs for 0.5 seconds, then wait 0.5 seconds and then fire their secondary (SEC) outputs for 0.5 seconds.

All pyro channels have a built-in 5 Amp electronic current limit. However, a shorted output can cause the pyro channel thermal protection circuit to engage which will reduce the current limit to 2.5 Amps.

The pyro board is shipped with a jumper installed between the two pyro battery switch terminals. **When the pyro board is installed into your rocket, the jumper should be removed and a switch wired in place.** The switch is in series with the pyro battery and provides a mechanical disconnect as an extra level of safety. Tripoli Rocketry Association rules now require a mechanical switch to disconnect the pyro battery anytime the rocket is anyplace other than at the launch pad.

The solid state relay (SSR) channel acts like a switch. It can be used to control an external electronic device such as a camera. Maximum current rating is 1.5 Amps. It is bipolar so there is no +/- polarity to worry about when connecting it.

Two external inputs are provided that can be used to monitor external switch closures, break wires or logic level signals. The inputs are sampled and recorded five times per second. The input states are also transmitted to the ground.

Power-on Pyro Board

Pyro board power-on, setup and arming are done remotely by sending commands from the Mx120 Receiver. Start by powering on the transmitter and the receiver and then establish a radio link between them. Note: Powering-on the transmitter does NOT power-on the pyro board even though the pyro board is connected to the transmitter. This enhances safety since the pyro board can be powered up remotely from a safe distance after the rocket is put vertical.

To power-on the pyro board, start by selecting receiver menu pages: MAIN MENU ⇨ LAUNCH ⇨ PYRO SYSTEM. At this point you should see the menu shown in Screen-1. Select PYRO BOARD and you will see Screen-2. Select TURN-ON PYRO BOARD on Screen-2. Confirm you want to power it on by answering YES on Screen-3. Screen-4 shows that the pyro board power-on was successful and that the pyro board self-test completed successfully.

<pre>■ PYRO SYSTEM ■■■■■ ▶ PYRO BOARD: NO-GO BATTERIES: NO-GO DEPLOYMENT: NO-GO STAGING: NO-GO ARM PYRO's: NO-GO</pre>	<pre>■ PYRO BOARD ■■■■■ POWERED-ON: NO-GO SELF TEST: NO-GO ▶ TURN-ON PYRO BOARD ENABLE/DISABLE USE</pre>	<pre> READY TO POWER-UP THE PYRO BOARD? ▶ YES NO</pre>	<pre>■ PYRO BOARD ■■■■■ POWERED-ON: GO SELF TEST: GO ▶ TURN-OFF PYRO BOARD ENABLE/DISABLE USE</pre>
Screen-1 Select PYRO BOARD	Screen-2 Select TURN-ON	Screen-3 Select YES	Screen-4 Pyro board is now powered on and has passed self-test.

Specify Pyro Battery Type

Once the pyro board is powered-on, you should make sure the pyro battery type is set correctly. To do so, go back to the menu in Screen-1 and select BATTERIES. This will take you to the menu shown in Screen-5 below.

<pre>■ BATTERIES ■■■■■ PYRO-BATT SVS-BATT 8.92v 3.81v 97% 62% TYPE: 9V ▶ CHANGE TYPE</pre>	Select CHANGE TYPE if the battery type displayed is not correct. Setting the correct type (9V or LiPo) will make sure the system knows what voltage to expect from the pyro battery. This will also make sure the remaining battery life percentage is reported correctly.
Screen-5	

Deployment Settings

To configure the pyro board deployment events, go back to the menu shown in Screen-1 and select DEPLOYMENT. You should now see the menu shown in Screen-6. Select SETTINGS in Screen-6 to view or change the deployment settings. This will bring you to the menu shown in Screen-7. Review the settings in Screen-7 and then select APPROVE SETTINGS if you want to use them as is. Otherwise, change the settings as desired and then select UPDATE PYRO BOARD to save them. The settings will be saved in the pyro board and retained even if it is powered off. This allows the settings to be configured at home before ever traveling to the launch site.

<pre>■ DEPLOYMENT ■■■■■ CONTINUITY: GO ▶ SETTINGS: NO-GO</pre>	<pre>■ DEPLOYMENT ■■■■■ MAIN CHUTE: 2000 ft GPS ALTITUDE: USE BARO SENSOR: USE ACCELEROMETER: USE APOGEE TIMER: NO-USE ▶ APPROVE SETTINGS</pre>	The settings shown in Screen-7 are the recommended settings. However, be sure to set the main parachute deployment altitude to be what you want.
Screen-6 Select SETTINGS	Screen-7 Select APPROVE SETTINGS	Note: GPS will be used as the primary source for altitude to trigger deployments. However, if GPS is unavailable the accelerometer or the barometric pressure sensor will need to be used instead. Therefore, it is a good idea to leave them enabled (i.e. "USE") as shown in the default settings in Screen-7.

ATTENTION: If the Barometric pressure sensor is enabled as shown in Screen-7 then be sure to provide vent holes in the airframe for the pressure sensor to be able to monitor the outside air pressure!

Select CONTINUITY in Screen-6 to view the ematch continuity for each of the deployment pyro channels. Continuity is shown as "GO" in Screen-6 when the apogee and main parachute pyro channels all have good continuity.

Staging Parameters

To configure the pyro board staging parameters, go back to the menu shown in Screen-1 and select STAGING. You should now see the menu shown in Screen-8. If this is NOT a staged flight then select ENABLE/DISABLE from the menu shown in Screen-8 and disable staging. If this flight is staged then select CONTINUITY from the menu in Screen-8. This will bring you to Screen-9 which indicates that the sustainer motor igniter needs a continuity check. To check the continuity the safety shunt on the motor igniter needs to be removed. To do so, select CHECK MOTOR IGNITER from the menu in Screen-9.

```

■ STAGING ■■■■■
STAGING ENABLED!
▶ CONTINUITY: NO-GO
  SETTINGS: NO-GO
  ENABLE/DISABLE
  
```

Screen-8
Select CONTINUITY

```

■ CONTINUITY ■■■■■
SEP: GOOD
MOTOR: NEEDS CHECK
▶ CHECK MOTOR IGNITER
  SPECIFY USE
  
```

Screen-9
Select CHECK MOTOR IGNITER

Indicates sustainer motor continuity still needs to be checked.

Select CHECK MOTOR IGNITER to check continuity. It will then ask you to confirm. If you do so, it will then temporarily remove the safety shunt, check the continuity, report the result and then restore the safety shunt.

Now go back to Screen-8 and select SETTINGS. This will take you to Screen-10 so that you can select each of the three different screens used to configure all the staging parameters.

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■ STAGING ■■■■■
▶ SEPARATION: NO-GO
  MOTOR ARMING: NO-GO
  MOTOR FIRING: NO-GO
  
```

Screen-10

As shown here, the staging parameters are divided into three sets. The first set defines when the staging separation charge should be fired. The second set defines when the sustainer motor pyro channel should be armed. The third set defines when the sustainer motor should be fired.

```

■ FIRE SEP ■■■■■
TIME>LIFTOFF +4.0 s
TIME<BURNOUT +2.0 s
VELOCITY>300 ft/s
VELOCITY<1200 ft/s
ALTITUDE>1000 ft
▶ APPROVE SETTINGS
  
```

Screen-11

Select SEPARATION in Screen-10 to bring up Screen-11. These are the parameters that control when the separation charge will be fired. To adjust any parameter, position the cursor on the line and press the center button. Edit bars will then appear over the parameter to be edited. Use the up, down, left and right arrow keys to change the value. When the value is correct, press the center button to finish with it. If any given parameter is not needed then just set it to a value which makes it always true. Or at least is easily met during the expected flight profile. You must then select APPROVE SETTINGS (or UPDATE PYRO BOARD) in order to commit them for the flight.

```

■ ARM STAGING ■■■■■
TIME>LIFTOFF +5.0 s
TIME<LIFTOFF+99.9 s
BOOSTER ACCEL > 5 G
VEL>400 fps AT 3 s
ALT>1500 ft AT 5 s
▶ APPROVE SETTINGS
  
```

Screen-12

Select MOTOR ARMING in Screen-10 to bring up Screen-12. These are the parameters that define when to arm the sustainer motor pyro channel. If any given parameter is not needed then just set it to a value which makes it always true. Or at least is easily met during the expected flight profile. You must then select APPROVE SETTINGS (or UPDATE PYRO BOARD) in order to commit them for the flight. BOOSTER ACCEL, VEL and ALT are criteria intended to make sure the booster performed as expected before allowing the sustainer to be armed. This serves as an additional sanity check and safety interlock.

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■ FIRE SUSTAINER ■■■■■
TIME>BURNOUT +4.0 s
TIME<BURNOUT+15.0 s
TILT<20° FOR 2.0 s
200<VEL<1200 ft/s
1000<ALT<99999 ft
▶ APPROVE SETTINGS
  
```

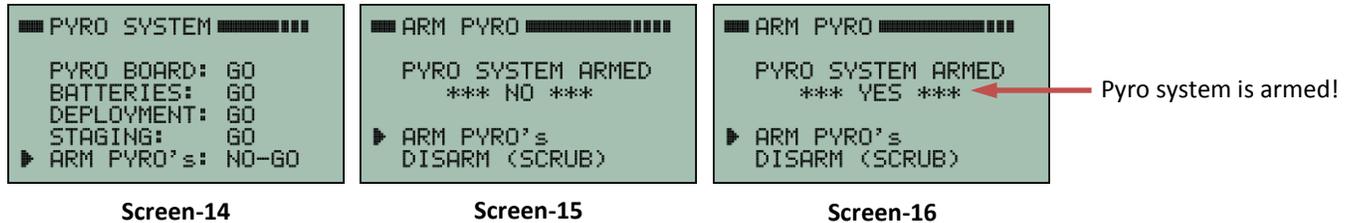
Screen-13

Select MOTOR FIRING in Screen-10 to bring up Screen-13. These are the parameters that define when the sustainer motor should be fired. In order to be fired, all the arming criteria in Screen-12 and all the firing criteria shown here in Screen-13 must all be met simultaneously.

All of the staging parameters are saved in the pyro board and retained even if it is powered off. This allows the parameters to be configured at home before ever traveling to the launch site.

Arming the Pyro System

The last step in pyro board setup is to arm the entire pyro system. This should be done after the rocket is vertical on the launch pad and everyone is at a safe distance. Go back to Screen-1 and it should now appear as shown in Screen-14 below. Everything in the checklist should be "GO" except for pyro arming. Select ARM PYRO and it will bring you to Screen-15. Select ARM PYRO's in Screen-15 and the blinking "NO" will change to a blinking "YES" indicating the pyro system has been successfully armed.



Pyro board setup is complete once the pyro system is armed. If it becomes necessary to scrub a flight then the pyro system can be disarmed by selecting DISARM from the menu in Screen-16. Better yet, the easiest way to completely scrub a flight is to simply send a command to turn-off the transmitter. Doing so will initiate an automatic and orderly shutdown of the entire system, including disarming the pyro board before it switches off power to the transmitter. At that point, the rocket would be safe to be lowered back down to a horizontal orientation. To turn off the transmitter, select MAIN MENU ⇒ COMMANDS ⇒ TRANSMITTER ⇒ TURN OFF TRANSMITTER ⇒ CONFIRM SHUTDOWN.

Simulating Launch

A simulated launch can be run to test the entire system. Ematches or small light bulbs can be connected to the pyro board in order to see when pyro channels are fired during a simulated launch. (A suitable light bulb is part number CM7371-ND available from www.digikey.com) Simulated launches can be performed by selecting MAIN MENU ⇒ COMMANDS ⇒ NEXT MENU ⇒ SIMULATE A FLIGHT ⇒ YES. It can be fun watching the pyro board operate while Kate also narrates the simulated launch exactly the same way as for a real launch.

Manual Deployment

The apogee and main parachute pyro charges can be fired manually if desired. This is done by selecting MAIN MENU ⇒ COMMANDS ⇒ PYRO SYSTEM ⇒ DEPLOYMENT ⇒ MANUAL DEPLOYMENT. The resulting menu is shown in Screen-17. Select either FIRE APOGEE CHARGES or FIRE MAIN CHARGES and confirm the firing by selecting YES. This can be done during a flight if desired. It is also very handy for ground testing the deployment charges. For ground testing, just turn-on the pyro board, arm the pyro system and then fire the charges manually from a safe distance.

