



FireOne

XLII+™ Control Panel
User Guide

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Introduction

FireOne's XLII+™ Control Panel

features two (2) independent outputs with 2-Wire interconnection designed to operate with FireOne's innovative microprocessor controlled, capacitor discharge, firing modules. Each of the Control Panel's two outputs is designed to control 20 firing modules for a total of 40 modules. The distinct advantage of the XLII™, compared to traditional control units, is that each output features independent power and data channels that operate on 2-conductor lamp cord or wirelessly. In addition to the simplicity and cost savings of 2-Wire operation, the two outputs provide a high degree of redundancy when more than one output is utilized for a fireworks display.



The XLII+™ Control Panel is another addition to the most successful pyrotechnic control system of the 21st Century. Worldwide more companies and individuals trust the FireOne System to articulate and execute their fireworks displays than any other system. This trust is built on a simple premise: a highly effective, capacitive discharge, control system that operates both wirelessly and via a 2-Wire interface rather than the complex multi-core tangle of wires or unreliable interfaces. The ability of the FireOne system to seamlessly control firework displays, wired or wirelessly, is at the heart of FireOne's worldwide success.

In full operation the XLII+™ will control, test and fire 40 firing modules. Each firing module has 32 output circuits (cues). Therefore, the XLII+™ will easily control 1280 (40 x 32) individual firing circuits with flexibility and capabilities that are not available with any other firing system in the world. This Operations Manual documents the many features and benefits of the XLII+™ Control Panel.

The XLII+™, weighing in at 16.5 pounds, incorporates an unprecedented amount of features and capabilities into a small, 6.25" high by 10.625" deep and 14" wide, footprint. Operating a full complement of firing modules, the XLII's™ run time exceeds eight hours on internal battery. Two additional power inputs, including AC power and external battery inputs provide auxiliary power to operate the panel for unlimited run times. Displays that utilize less than 40 modules increase the run time correspondingly.

The XLII+™ is an all-inclusive tool for firing pyrotechnic displays. Whether executing a manually fired display, a fully automatic display, a semi-automatic display (manual and automatic firings), a time code derived display, a wireless display, a display for stage, screen or special effects, a remotely controlled display, a very small or extremely large display, the XLII+™ Control panel provides the capability and features required to handle any pyrotechnic related job.

The XLII+™, used in its most basic form, is an extremely easy to set up and operate manual “push button” firing panel. With minimal familiarization, an operator can execute a basic manually fired display with the basic “building block” pieces: The XLII+™ control panel and simple, two conductor, “speaker wire or lamp cord”, a firing module and a connection rail.

The smallest display requires one of each: Control Panel, Connection Wire, Firing Module and Connection Rail. This configuration will provide 32 individual firing circuits. Adding one or more firing modules and connection rails will expand the system to fire more circuits (We call each circuit a “Cue”). Each addition of a firing module and connection rail adds 32 more cues. The XLII+™ Control Panel is designed to operate 20 firing modules on each of its two outputs for a total of 40 modules or 1280 cues.

Safety Notice

Pyrotechnics Management, Inc., herein referred to as “PMI”, manufactures digital pyrotechnic ignition products for use by professionals who work in the firework, stage show and special effects industry. PMI products are intended expressly for use by experienced professionals for the purpose of igniting pyrotechnic devices used in fireworks displays, stage shows and special effects. Pyrotechnic devices, including the generic term fireworks, are explosives that are inherently dangerous, and may cause injury or death to operators and/or spectators. It is specifically understood that the buyers/owners of PMI products are solely responsible for the proper training of any persons who might operate these products. Further, the operator of any PMI products is solely responsible for the proper and safe operation of PMI products.

Hold Harmless

Safety is the responsibility of the buyers and operators of products manufactured by PMI. Safe use of these products is beyond the control of PMI, its employees and agents. The buyers and operators of all PMI products assume any and all liability associated with use of these products. Further, the buyers and operators agree, by purchase and/or use of PMI products, to indemnify and hold harmless PMI, its employees and agents, against any and all damages, claims, liabilities, expenses, injury or loss, whether direct or indirect, as a consequence or arising out of the use, or inability to use, any PMI products.

Limited Warranty

The seller provides a one year limited warranty covering parts, material and labor that applies to defects in parts, material and workmanship. This warranty does not apply to damages caused by the operator. The buyer shall be responsible for any applicable shipping costs incurred to return warranted equipment to PMI. Equipment upgrades and software updates are not provided under this warranty.

XLII+™ Operational Overview

The XLII+™ Control Panel, in conjunction with FireOne's firing modules, will fire pyrotechnic devices in four distinct modes of operation:

- Manual Firing Mode
- Internal "Down Loaded" Mode
- Computer Assisted Mode
- Mixed Mode.

Manual Mode

In the Manual Firing Mode, simply depressing the membrane switch pads, on the front panel, will activate the unit to fire one or more of 1248 cues from a maximum of 39 Firing Modules. The 39 module limit is determined by the number of membrane buttons on the front panel. Each cue can fire multiple electric matches; ten wired in parallel (We recommend five wired in parallel.) and twenty wired in series. This is the most basic configuration of the FireLite XLII+™.

Internal Mode

In the Internal Mode the FireLite XLII+™ will execute a preloaded digital fire file, for a precision fired display or a Semi Automatic digital fire file, for stage shows or displays that are dependent on operator intervention between groups of cue firings. Operation in this mode requires the FireOne UltraFire software (Supplied with the panel) to download the file(s) into FireLite XLII+™. The FireLite XLII+™ will activate 1280 cues (40 firing modules) with a preloaded file. The XLII+™ will store a total of eight individual fire files in its memory.

Computer Assisted Mode

In the Computer Operated Mode, FireLite XLII+™ exhibits all the attributes of a full FireOne System including all the on-screen prompts and features while controlling 1280 cues (40 firing modules). Operation in this mode requires the FireOne UltraFire software (Supplied with the panel) to download the file(s) into FireLite XLII+™.

Mixed Mode

In the Mixed Mode FireLite XLII+™ provides the dual capability of Computer Assisted Mode and Manual Firing Mode simultaneously. The user can be firing a complex display controlled by a computer and manually fire cues utilizing the FireLite XLII+™ front panel membrane buttons. This powerful feature is useful when firing displays that are primarily choreographed but require a few cues to be fired at times "to be determined".

2-Wire Operation and Wireless Operation

FireOne's simple 2-wire operation eliminates costly cable and cable connectors. In the FireOne world, wiring is five to ten cents per foot. Compare this to one dollar per foot for other wired systems. With no connectors to break or maintain, FireOne's 2-wire system is foolproof and provides fast and efficient setup and connection. Additionally, FireOne's 2-Wire system eliminates the requirement for boosters, splitters, amplifiers and other costly and troublesome add-ons.

Wireless operation is accomplished with the addition of a wireless transceiver and a FireOne wireless firing module. Alternately, with two wireless transceivers, control panels may communicate wirelessly. This provides extra flexibility as one wireless enabled control panel could control many other wireless control panels from a central location. This feature is extremely useful for displays with challenging wiring schemes or large complex displays.

Care and Maintenance

The XLLL+ control panel will benefit from occasional cleaning as particulate fallout from pyrotechnic products, combined with airborne moisture, can damage even rugged surfaces over a period of time. Large particulate matter should be vacuumed from the button membrane using a soft brush attachment. Once all solids have been removed, the membrane surface can be cleaned with a mild glass and hard-surface cleaner such as Windex®. A small amount of cleaner should be sprayed onto the central section of the membrane and then a clean cloth used to wipe the membrane. Cleanser should NOT be sprayed into any of the connectors or the FIRE POWER key switch. Once clean, leave the XL4 control panel open for several hours to thoroughly air dry.

If the 2-Wire connectors become stiff to operate due accumulation of debris apply a small amount of high grade, non-silicone based, lubricant such as LPS 2®. Any excess lubricant should be immediately removed from the connectors using an absorbent cloth.

The case can be cleaned with normal detergent as per the manufacturer's guidelines, but please ensure that the case is properly closed before applying any liquids to the exterior surface. In the event that liquids are accidentally spilled on the button membrane, quickly wipe up the spillage and then contact Pyrotechnics Management, Inc. for further advice. Under no circumstances should the case be closed with moisture on the membrane as the case lid contains an o-ring that will seal in liquids which will then cause damage to the electronics.

Operating Instructions

The FireLite XLII+™ Control Panel is self-contained with built-in batteries that provide up to eight hours of continuous operation. The internal battery charger will recharge the battery in twelve hours. FireOne recommends charging the battery often as chronic under-charging will cause total battery failure! (See *Charging Internal Battery* on page 30). Additionally, the internal power supply will power the control panel, from an AC source, while simultaneously charging the battery.

Self Contained Operation (Without Computer Support)

Manual panel pushbuttons operation

Connect the required firing modules to the appropriate output connector(s). Each of the two outputs will support 20 firing modules. When connecting wired firing modules, use 2-conductor 18 gauge stranded wire, for optimum results.

Clear personnel from the firing area and verify that spectators are a safe viewing distance from the fireworks products.

Verify that the Fire Power switch is in the *Off* position.

Push the Master Power Switch to the *On* position. The XLII+™ will take a few seconds to boot-up. The control panel is automatically in the test mode.

Electric match continuity test

Depress the Module Selection membrane switch(s) for the desired firing module under test. For module #1, actually #01, select the “0” multiplier button, on the top row, and then module #1 from the lower row. For module #10, select the “10” multiplier button, on the top row, and the “0” button on the lower row. Module #21 would be selected by using the “20” multiplier and the “1” button on the lower row.

View the test results on the Cue Selection LED matrix (Light Emitting Diode) indicators. Each of the 32 cues on a firing module are related to one of the 32 LEDs on the control panel matrix. When an electric match is properly connected, the relevant LED will illuminate green, indicating a successful test and proper continuity.

(Additionally the test results will be displayed on the LCD screen. A successful communications test of module #1 will be indicated as “Test: M01 Response.” If the module is not connected, the response will be “Test: M01 No Respon.”)

If the LED for a particular cue is not illuminated there are no electric match(es) connected to the cue or they are improperly connected.

If none of the LEDs illuminate:

- The firing module has no electric matches connected to it.
- The firing module is not connected.
- The firing module is addressed incorrectly or is non-functional.

By observing the LCD display and the cue matrix, the user can readily diagnose connection issues. Further diagnoses may be accomplished by utilizing the firing module front panel LEDs.

When a test or firing command is sent from the control panel to a firing module :

- The firing module yellow LED will illuminate to indicate reception of a command.
- The firing module green LED will illuminate to indicate when the firing module replies to the control panel.

This simple testing procedure simultaneously tests communications, electric match continuity and the ability of the firing module to fire electric matches.

Fire Power Test

Fire Power is the presence of firing potential at each firing module.

Clear personnel from the firing area and verify that spectators are a safe viewing distance from the fireworks products.

Activate Fire Power by rotating the Fire Power key switch 90 degrees clockwise. The control panel will emit a beeping sound for six seconds indicating that the unit is armed to fire.

Warning! *It is extremely important to avoid inadvertently depressing the “Fire” button or any “Cue” buttons as this will cause any associated product to fire.*

To test for the presence of fire power at module #1, actually #01, select the “0” multiplier button on the top row, and then module #1 from the lower row. When fire power is present at module #1 the green LED will turn red indicating that sufficient firing potential is present to fire electric matches. Test each firing module by depressing the buttons corresponding to the module’s address number.

After testing all firing modules for fire power, turn the Fire Power key switch to the off position.

Manual Firing Operation

In the Manual Firing Mode The XLII+™ provides an easy to operate manual firing panel that is energized to fire when the Fire Power Switch is rotated to the *On* position. By selecting (depressing) any combination of the 39 desired firing modules in the Module Selection area, and then selecting (depressing) the desired cue from the Cue Selection area, the selected module/cue will fire. The XLII+™ will fire a maximum of 1248 cues (39 firing modules) in the Manual Firing Mode.

Prior to firing, clear all personnel from the firing area and verify that spectators are a safe viewing distance from the fireworks products.

Verify that the Fire Power switch is in the *Off* position.

Turn the Master Power switch to the “On” position.

Perform module and cue tests. (See “Electric Match Continuity Test” above.)

To enter the firing-mode, rotate the Fire Power Key Switch to the *On* position. The Fire Power LED will illuminate red indicating fire power is activated. Additionally, the control

panel and all firing modules will emit a beeping sound for six seconds providing an audible indication that fire power is activated.

Verify that firing voltage is normal at the firing modules by performing the firepower test before attempting to fire. The fire power test is easy: Push the individual firing module buttons and verify that the LED directly above each button turns from green to red. Red indicates sufficient firing potential to fire electric matches.

Select the desired firing module by depressing any combinations of the 39 desired firing module membrane buttons from the Module Selection area.

Fire the desired cue by depressing one of the 32 membrane buttons from the Cue Selection area.

Warning! This will fire the selected cue!

Note that as cues are fired the green test LED extinguishes and the “next to fire” cue is indicated by the presence of a red LED. The operator may fire module and module cues in any sequence. The test memory, indicated by illuminated green LEDs, will indicate those cues that are available to be fired. Fired or blank cues will not be illuminated and the “next cue to fire” for each module will be indicated by a red LED.

Firings may be initiated from the optional handheld controller that plugs directly into the Safety connector on the front panel of the XLII+™. Note: When the safety “deadman” button is not activated, the “Short” LEDs between each set of output terminals will illuminate and stay on. This is also an indication that the safety plug is missing.

Presets (Using the Load Button)

A unique feature of the Manual Firing Mode is the ability to assign “presets” prior to firing any cues. A “preset” is a group of firings that are manually programmed by the operator immediately before firing. This provides the operator with the ability to fire multiple cues on multiple modules by simply depressing the *Fire* button one time.

To activate a preset sequence:

- Depress the *Load* button while the *Fire Power* Switch is activated. (This temporarily changes the operation of the module and cue buttons to “selector” buttons.)
- Proper “preset” selection is accomplished by first selecting the desired module number and then selecting all the cues for that module. The selected cue LEDs will illuminate red. If another module(s) is desired to fire in this “preset” select the next module and then the associated cues.
- Move from module to module until all module/cue selections are made. After all preset selections are made depressing the *Fire* button will fire the “preset” and return the *Module* and *Cue* buttons to their normal operation.

Internal “Down Loaded” Mode (Firing without computer)

The FireLite XLII+™ control Panel will accept a download of a Fire file or a Semi fire file from FireOne’s UltraFire software. The subject file is stored in the control panel’s internal memory and will remain in memory until it is displaced by another Fire file or Semi file or

erased. The Control Panel will accept a total of eight fire files in its internal memory. These files may be downloaded with the aid of a laptop computer and FireOne's UltraFire software. Each file may be downloaded independently and may be retrieved from memory with or without the aid of the software. The Control Panel's LCD display will indicate the respective fire file name when retrieved from memory. See *Loading Semi Auto or Auto fire files in XLII+™* on page 12.

Automatic Operation

The XLII+™ control panel has the ability to operate in the Auto mode. The Auto mode allows the control panel to execute a series of preprogrammed firings that are part of file that is either hand-edited with the UltraFire field software or automatically choreographed with FireOne's ScriptMaker choreography software package. These firings may be simple or complex; instantaneous or timed intervals; single or multiple cues; or any combination.

Automatic operation requires the compilation of an Auto (fire) file for proper operation. This file provides data that the control panel requires to execute the proper sequence of firing events. For the most basic fire file this data is comprised of three pieces of information. This includes #1) The Launch Time; #2) The Module number and #3) The Cue number. With this data the system knows when to fire, what module number to fire and what cue on the module to fire.

All of the above information may be hand entered and edited with the UltraFire field software via the "Create New" menu selection from the "File" pull down menu.

To enter the Automatic fire file information by hand open the UltraFire software and select the "File" pull down menu. Select "Create New". The edit screen will appear with the following columns from left to right. The fields are: "Launch Time"; "Module"; "Cue" and "Description", "Comment", "Priority" and "Position".

To create a Fire file the user enters the required data from left to right. As an example one might choose 10 seconds for the first launch time (This is the time that the product will ignite or fire from the launch tube.)

- With the Launch Time entry field hi-lighted type 1000 and select the "enter" key on the keyboard. Note that the UltraFire intelligent entry system will enter the data as 00:00:10.0. This is 10 seconds.
- Use the right arrow key to move to the "event" column. It is defaulted to 1 for the 1st "event".
- Use the right arrow key to move to the "Module" column. It is defaulted to 1 to indicate firing modules #1.
- Use the right arrow key to move to the "Cue" column. It is defaulted to "Cue" 1 to indicate cue #1 on module #1.
- Use the right arrow key to move to the "Description" column. The proper entry here is the color and name of the product being used. For this example enter Test #1.
- Use the right arrow key to move to the "Comment"; "Priority" and "Position" columns. At the Position column select the "Enter" key, on the keyboard. The next row of information will appear with the Launch Time column hi-lighted and ready for data entry for the next row.

Follow this procedure until all the launch, module and cue information, required for the display, is entered. Save the completed fire file by electing the “Save” menu item in the “File” pull down menu.

For complex displays FireOne’s ScriptMaker choreography software is designed to automate this process and is designed to accommodate music score input.

Priority Disable with Automatic Files

Priority Disable is an extremely powerful feature that provides the user with a method to inhibit the firing of selected product(s) while a display is actively executing. This feature depends upon the user assigning a priority number between 1 and 16 to products as they are entered during the creation of the fire file. The default priority number is 1. (Priority numbers can be edited or changed at any time utilizing the editing features of the FireOne Field Software.)

The “Priority Disable” feature provides the user with the ability to disable any or all pyrotechnic devices, from firing, even while the remainder of the display continues to fire normally. Therefore “enabling” a priority refers to the action of causing all products, with the selected number, to not fire.

To use the Priority feature, with the XLII+ control panel (Priorities may also be enabled when using the FireOne Field Software.), the user must first download a fire file into the control panel. The file must have more than one priority assigned during the construction of the file.

The priorities assigned to the selected file can be viewed by selecting the priority function button. The function buttons on the XLII+ are comprised of the 0, 10, 20, and 30 module selection buttons located in the upper left portion of the control panel adjacent to the LCD display.

To view priorities select and hold the “0” (Function) button and then push the “30” button (Priority). The “Cue Selection” button matrix and associated LEDs will now display the priorities by illuminating the green LED above any assigned priorities. The possible numbers are 1 through 16. When a priority is selected the green LED will change to red. It will remain red until the priority is unselected wherein it will change back to green. All pyrotechnic devices that have been assigned the selected priority number will not fire until that priority number is selected again and the LED changes back to green.

Note that the LCD display will indicate that the control panel is in the priority mode AND that the fire button is disabled while viewing the priorities. This is only a precaution when viewing the files. During normal firing of an automatic display the “Cue Selection” button matrix will automatically change to display priorities during the execution of the display. This feature provides the user with immediate access to the “Priority” function while a display is firing.

Priority enables are automatically displayed when the control panel is in the firing mode, i.e firing the display. The menu function simply allows you to preview the Priorities before firing.

In the firing mode the “Cue Selection” button matrix will automatically display the assigned priorities by illuminating the green LED above any assigned priorities. The possible numbers are 1 through 16. When the fire file is actually being executed a priority can be selected by pushing a selected (Cue) Priority button. The green LED will change to red. It will remain red until the priority is unselected wherein it will change back to green. All pyrotechnic devices that have been assigned the selected priority number will not fire until that priority number is selected again and the LED changes back to green.

A suggested method to assign priorities would be to assign priority number 1 to all pyrotechnic devices that are considered to have a low potential for malfunctioning or causing problems. Such a type of device could be a 28 mm gerb.

At the other end of the priority assignments are those devices that have the greatest potential to cause problems or those devices that may not be required due to changing conditions during a display. These devices may be common elements that are not fired due to the relative positioning of actors (stage shows) or audience members or other safety concerns. Alternately, for outdoor displays these devices could be very large diameter aerial shells or perhaps devices that have “fallout” that could reach the ground while still burning. This type of device could be assigned a priority number 16.

Priorities between 1 and 16 would then be assigned to each pyrotechnic device based on the users’ experience. Priorities that would have high numbers such as 12, 13, 14, 15, 16 would be those devices that have higher levels of potential to cause a problem.

Semi Auto Operation

The XLII+™ control panel has the ability to operate in the Semi-Auto mode. The Semi-Auto mode combines attributes of both manual and automatic firing.

Semi-Auto operation requires the compilation of a Semi-Auto (fire) file for proper operation. This file provides data that the control panel requires to execute the proper sequence of firing events. (In this example a firing “Event” is a data address that comprises three pieces of information. 1) A firing module address. 2) A cue (or line) number for the firing module between 1 through 32. 3) A time that the firing is to occur. An “Event” may consist of only one firing or it may consist of multiple firings. These firings may be simple or complex; instantaneous or timed intervals; single or multiple cues; or any combination. A single “Event” may consist of one firing or many complex firings.

Therefore, a Semi-Auto file is a compilation of “Events”. Each “Event” contains firings. Each “Event” may be a single firing or a group of firings. Further an XLII+™ control panel provides the ability to control 999 such “Events”. Given that an “Event” may consist of one or more firings a Semi file may contain 4000 firings.

The Semi file, comprised of “Events’ that are in turn comprised of firings is a mix of manual and automatic firings. Each “Event” is initiated through the input of the operator. After each “Event” is finished, the control panel stops sequencing until the operator initiates the next “Event”. In this manner the control panel is operated similar to the manual mode. If each “Event” contains only one firing, the control panel operation appears to be similar to manual

firing. However, the powerful feature of Semi-Auto firing is that each “Event” may consist of a complex, timed sequence of firings that may consist of multiple firing modules in multiple locations. This is the automatic firing attribute of the Semi file.

With this additional information, it is obvious that the user may preprogram sequences that are useful for many applications.

- Stage shows that require multiple firings at different locations but are conditioned upon the tempo of the stage show.
- Musical events are timed by a musical conductor (Director) rather than time code.
- Theatrical events that occur as the play progresses.
- Fireworks to live orchestral music. (Such live presentations are broken into “Events” that represent one or more bars/measures in the music score.)

Creating Semi-Auto Fire Files

Semi-Auto fire files are created using the UltraFire field software or FireOne’s optional ScriptMaker/CueMaker software. The majority of Semi files can be easily created using UltraFire’s editing capabilities. (For details regarding the operation of ScriptMaker/CueMaker software refer to the ScriptMaker/CueMaker manual.)

This section will explain how to use UltraFire software to create a Semi file.

Open the UltraFire software and select the “File” pull down menu. Select “Create New”. The edit screen will appear with the following columns from left to right. The fields are: “Launch Time”; “Module”; “Cue” and “Description”. The additional fields, “Comment”, “Priority” and “Position” are optional to the operation of a Semi-Auto file.

Use the “View” pull down menu to select “View Columns” and then select “Event Number”. This will add the “Event” column to the list.

The edit screen will now appear with the “Event” column. The fields displayed from left to right are now: Launch Time”; “Event”; “Module”; “Cue”; “Description”; “Comment”; “Priority” and “Position”

To create a Semi file the user enters the required data from left to right. As an example one might choose 10 seconds for the first launch time (This is the time that the product will ignite or fire from the launch tube.)

- With the Launch Time entry field hi-lighted type 1000 and select the “enter” key on the keyboard. Note that the UltraFire intelligent entry system will enter the data as 00:00:10.0. This is 10 seconds.
- Use the right arrow key to move to the “event” column. It is defaulted to 1 for the 1st “event”.
- Use the right arrow key to move to the “Module” column. It is defaulted to 1 to indicate firing modules #1.
- Use the right arrow key to move to the “Cue” column. It is defaulted to “Cue” 1 to indicate cue #1 on module #1.

- Use the right arrow key to move to the “Description” column. The proper entry here is the color and name of the product being used. For this example enter Test #1.
- Use the right arrow key to move to the “Comment”; Priority” and Position columns. At the Position column select the “Enter” key, on the keyboard. The next row of information will appear with the Launch Time column hi-lighted and ready for data entry.

Enter the next row of data following the previous entry procedure with one exception. The “Event” column number will be entered as #2. This indicates that this Semi file has two “Events”. Note that the “Delay Time” column will automatically appear after the #2 event is entered. The software has determined that this must be a Semi file because there are now two “Events” in this file. By definition a *Semi* file has two or more “Events” while a *Fire* file (A *Fire* file is a fully automated firing file) consists of only one “Event”.

The “Delay Time” column is an important feature of Semi files.

The “Delay Time” column is the active column that a Semi file uses to determine the ignition time of each firing in a given “Event”. This is in contrast to a Fire file where the ignition time is determined by the Launch Time column.

Note that the “Delay Time” column is automatically updated to reflect correct delay values whenever the following occurs. (The “Delay Time” column may not be edited manually.)

- The “Delay Time” column is updated when the “Refresh Delays” menu item is selected from the “Edit” pull down menu.
- The “Delay Time” column is updated whenever the user *Saves* or exits the “Edit” screen.

The calculated value that is entered into the “Delay Time” column is determined by the relationship between the “Event” column and the “Launch Time” column. The “Delay Time” column may not be edited manually.

- At each change of the “Event:” number the delay time is reset to zero. Therefore, each time the control panel “Fire” button is depressed, the first firing in an event will immediately fire. (The Semi-Auto *firing screen* has a feature that allows the user to change the 00:00:00.00 to a new value. Right clicking on the “Delay Time” value will provide the user with a method to enter an alternate value.)
- For multiple firing times within the same “Event” the succeeding “Delay Time” values are calculated by subtracting the first “Launch Time” in the “Event” from the following “Launch Time” values. The result is that a series of “Launch Times” are translated into a series of “Delay Times” that are directly related to the “Launch Times” originally entered.

Converting Auto Fire Files to Semi-Auto Fire Files

Intuitively it is relatively easy to change a Fire file into a Semi file.

- Start the software and *Open* the required Fire file.
- Select the *View* pull down menu and then select *View Columns*.
- From *View Columns* select *Event Number*. This will display the “Event” column on the edit screen.
- Using the “Event” column enter the “Event” number as required.
- When the user exits or *Saves* the edit screen, the program will populate the “Delay Time” column to create the Semi Auto file.

Loading Semi Auto or Auto fire files in XLII+™

After the Semi file is created the user must download the completed file into the control panel. (The procedure is similar for the Automatic fire files.)

Downloading

The *Download* tab provides the user with features to download files into the control panels and verify all files that have been downloaded.

- Start UltraFire software on the computer.
- Select and load the required file into the software
- Select the *Tools* pull down menu.
- Select the *Download to Panel* menu item.
- The *Download* tab provides the user with the option to download the fire file into one of eight different control panel memory locations.
- Select the desired location and push the *Download* button.
- The *Download Successful* message indicates that the download was completed.
- If additional files are going to be loaded, close the Downloader; load a new fire file into the software and follow the download procedure again.

Show Control

The *Show Control* tab has provisions to interrogate the control panel to verify all files that reside in the control panel.

- Select the *Tools* menu.
- Select the *Download to Panel* menu item.
- Select the *Show Control* tab.
- Select the *Get Show Data* button. The file names of each of the eight possible fire files will be displayed.

Priority Disable with Semi-Auto Files

Priority Disable is an extremely powerful feature that provides the user with a method to inhibit the firing of selected product(s) while a display is actively executing. This feature depends upon the user assigning a priority number between 1 and 16 to products as they are entered during the creation of the fire file. The default priority number is 1. (Priority numbers can be edited or changed at any time utilizing the editing features of the FireOne Field Software.)

The “Priority Disable” feature provides the user with the ability to disable any or all pyrotechnic devices, from firing, even while the remainder of the display continues to fire normally. Therefore “enabling” a priority refers to the action of causing all products, with the selected number, to not fire.

To “enable” a priority, with the XLII+ control panel (Priorities may also be enabled when using the FireOne Field Software.), the user must first download a fire file into the control panel AND select the first event to be fired. The semi-file must have more than one priority assigned.

The priorities assigned to the selected semi-file can be viewed by selecting the priority function button. The function buttons on the XLII+ are comprised of the 0, 10, 20, and 30 module selection buttons located in the upper left portion of the control panel adjacent to the LCD display.

To view priorities select and hold the “0” (Function) button and then push the “30” button (Priority). The “Cue Selection” button matrix and associated LEDs will now display the priorities by illuminating the green LED above any assigned priorities. The possible numbers are 1 through 16. When a priority is selected the green LED will change to red. It will remain red until the priority is unselected wherein it will change back to green. All pyrotechnic devices that have been assigned the selected priority number will not fire until that priority number is selected again and the LED changes back to green.

Note that the LCD display will indicate that the control panel is in the priority mode AND that the fire button is disabled while viewing the priorities. This is only a precaution when viewing the files. During normal firing the user may select the priority feature while the system is executing the fire file. During the firing of a Semi-File the user must manually select the priority feature. (Note that this is not the case during automatic firing where the “Cue Selection” button matrix will automatically change to display priorities during the execution of the display.) If the “Cue Selection” button matrix automatically changed from “Event” selection to “Priority” selection the result would be too confusing. The concept is to view and change priorities between “Events” or during “Events” when the selected event is of sufficient time duration.

A suggested method to assign priorities would be to assign priority number 1 to all pyrotechnic devices that are considered to have a low potential for malfunctioning or causing problems. Such a type of device could be a 28 mm gerb.

At the other end of the priority assignments are those devices that have the greatest potential to cause problems or those devices that may not be required due to changing conditions during a display. These devices may be common elements that are not fired due to the relative positioning of actors (stage shows) or audience members or other safety concerns. Alternately, for outdoor displays these devices could be very large diameter aerial shells or perhaps devices that have “fallout” that could reach the ground while still burning. This type of device could be assigned a priority number 16.

Priorities between 1 and 16 would then be assigned to each pyrotechnic device based on the users' experience. Priorities that would have high numbers such as 12, 13, 14, 15, 16 would be those devices that have higher levels of potential to cause a problem.

Selecting and Loading Semi Auto or Auto fire files from Control Panel Memory

The XLII+™ Control panel will store a total of eight fire files in memory. The files may be Semi Auto files or Fire (Automatic) files. Each file may contain a maximum of 2000 individual shots. If a file exceeds 2000 shots the UltraFire download software will prompt the user for permission to utilize two memory locations. When two memory locations are utilized, the maximum file size becomes 4000 shots.

- Set the XLII+™ Power Switch to the on position.
- The Control panel will take five seconds to boot.
- Select the *Auto* button followed by the *Load* button.

Cue Selection buttons 1 through 8 correspond to the eight memory location in the control panel. An illuminated green LED above any of the eight buttons indicates that a fire file is loaded into the memory location.

The name of each fire file in memory will be displayed on the LCD display when any of these buttons are selected. The user may push each button to find the required file.

After the required file is located, the file may be loaded into the control panel active memory by depressing the *OK* button (*Module Selection* button #6). To verify that this is the correct file the LCD message directs the user to select the "Event" to be loaded. .) For a Fire File (automatic file) there is only one "Event" to select. Note that the *Fire* button becomes active as indicated by the green LED illuminating when selecting the "Event" to be fired. After a file is selected and loaded into active memory the *Cue Selection* matrix indicates the number of "Events" in the file. Since an automatic file only has one "Event", only one of the *Cue Selection* button LEDs will illuminate. Button #1! When #1 is depressed the control panel is fully loaded and ready to be armed to fire the display.

Semi fire files by definition have more than one event. Intuitively, a Semi file could have up to 32 events, since there are 32 buttons and LEDs in the *Cue Selection* matrix. However, control panels that have firmware versions equal to or greater than v4.5.50 will manage Semi files with more than 32 events. These control panels can utilize as many as 999 events (See "Event Pages" below.).

Auto fire files Operation Procedure

A fully automatic fire file consists of one event. Therefore the process to select and load the fire file would be as follows.

- a. Select the Auto button.
- b. Select the Load button
- c. Select the appropriate fire file from one of the eight memory locations indicated by the Cue Selection buttons 1 through 8. The selected fire file name will appear in the LCD display.

- d. If there is more than one fire file in memory press the Module Selection button #6, directly under the “OK” message in the LCD. This step is not necessary and is omitted if only one fire file is in memory.
- e. Press the #1 Cue Selection button. (This action enables the Fire button to start firing the display or alternately enables time code to start firing the display.)
- f. Press the Fire button to begin firing. (For time code driven displays attach a time code source to begin firing.)

Semi Auto fire files Operation Procedure

A Semi automatic fire file typically consists of multiple events. Therefore the process to select and load a Semi Auto fire file would be as follows.

- Select the Auto button.
- Select the Load button
- Select the appropriate fire file from one of the eight memory location indicated by the Cue Selection buttons 1 through 8. The selected fire file name will appear in the LCD display.
- If there is more than one fire file in (Remember a fire file may be either an automatic file or a semi automatic file.) memory press the Module Selection button #6, directly under the “OK” message in the LCD. This step is not necessary and is omitted if only one fire file is in memory.
- Press the #1 Cue Selection button. This is the first event in the Semi Auto file. (This action enables the Fire button to initiate the first event. Note that time code cannot start a Semi Automatic fire file.) The quantity of illuminated Cue Selection buttons are an indication of the number of events in the Semi Auto fire file. i.e. If Cue buttons 1 through 10 are illuminated there are 10 events in the semi file.
- After the initial event is selected pressing the Fire button will begin the next event in numerical order. Events may be randomly selected by utilizing the Cue Selection buttons followed by pressing the Fire button. The control panel is capable of 999 events as shown in the next section, “Event Pages”.
- **NOTE:** It is always necessary to press the Fire button to initiate the firing of each event.

Event Pages

After a file is selected and loaded into active memory the *Cue Selection* matrix indicates the number of “Events” in the file. A typical Semi file will show multiple events by illuminating multiple cue buttons. Obviously, a normal size Semi file can be managed with the 32 buttons in the *Cue Selection* matrix. However, if the file contains more than 32 events the control panel is capable of displaying many sets of the *Cue Selection* matrix. We call these individual *Cue Selection* matrices “pages”. The maximum number of “pages” available are 32 for a total of 999 events.

A Semi file is handled slightly differently than an Automatic file as explained below including how to access multiple pages of events.

- If the Semi file has more than two but less than thirty-three “Events”, the “Events” will all be displayed via the green LEDs in the *Cue Selection* matrix. Typically, the user will begin to fire the Semi-Auto file with “Event” #1, but any “event” may be randomly selected.

- The “Events” may be fired in any sequence desired. If random selections are made for each “Event”, the user must select each new “Event” after the preceding “Event” is fired. If the “events” are fired in sequential order the control panel will automatically sequence to the next “Event”.
- If the Semi file contains more than 32 “Events” the control panel will display the “Events” in sets or “pages”. Each “page” may contain 32 “Events”.
 - Multiple “pages” of “Events” are selected and displayed by the *Module Selection* buttons and corresponding green LEDs.
 - To access the 1st “page” of a 999 “Event” Semi file depress *Module Selection* button #1. The *Cue Selection* matrix will indicate all the “Events” programmed into this “page”.
 - To access “page” 32 of a 999 “Event” Semi file depress *Module Selection* buttons # 30 and #2. The *Cue Selection* matrix will indicate all the “Events” programmed into this “page”.
 - If the user randomly moves from “page” to “page” to access various “Events” each “page” will retain the memory pertaining to what has been fired (The Green LEDs extinguish for each fired “Event”). Additionally, a red LED indicates the next “Event” to be fired on each page.

For specific instructions regarding the creation and processing of multi-page events please refer to the “Event Manager” section of UltraFire software Users Guide.

Testing Semi-Auto Files

Testing Semi-Auto files is similar to Testing Electric Match Continuity on page 5. For small displays, this method may be adequate. For larger displays, a faster, logical approach may be to use the automatic test procedure that is part of the firmware in the XLII+™ Control Panel. Alternately, the UltraFire field software has advanced testing and editing facilities that are fast, efficient and very powerful.

XLII+™ Automatic Testing

The XLII+™ Control Panel features built-in testing for electric match continuity and for fire power testing.

Electrical Match Testing

1. Load the appropriate file into the control panel.
2. Access the LCD Menu by depressing the “0” and “20” Module Selection button simultaneously.
3. *Show File Test* appears in the LCD display.
4. Push the *Select* button (#7).
5. Select the required fire file using #1 through #8 of the *Cue Selection* buttons. (The file name will appear on the LCD screen.)
6. Select the *OK* button (#7)
7. *E-Match Test* is displayed on the LCD
8. Select SNGL or ALL to test the electric match continuity.
9. Results are displayed on LCD

Fire Power Testing

1. Load the appropriate file into the control panel.
2. Access the LCD Menu by depressing the “0” and “20” Module Selection button simultaneously.
3. *Show File Test* appears in the LCD display.
4. Push the *Select* button (#7).
5. Select the required fire file using #1 through #8 of the *Cue Selection* buttons. (The file name will appear on the LCD screen.)
6. Select the *OK* button (#7)
7. Using the >> arrows (Button #6) advance to the Fire Power Test
8. Select the *OK* button (#7)
9. Select SNGL or ALL to tests Fire Power for each modules.
10. Results are displayed on LCD.

Firing Semi-Auto Files

Firing a Semi-Auto “Event” requires three steps.

1. Load and select the appropriate “Event” into the control panel’s active memory. (Note that the green LED above the *Fire* button changes to green.)
2. Rotate the *Fire Power* key switch to the on position.
3. Push the *Fire* button. (Alternately the Handheld Control may be used to fire the “Event”.)

Internal Firing with Time Code

When an Automatic fire file down loaded into the control panel memory, it may be fired from the control panel’s internal time clock by following the description for Internal Firing and simply depressing the front panel Fire button. (See *Internal Mode* page 8, above.)

Optionally, the file in memory may be fired utilizing external time code. The time code must be ported into the control panel via one of the *Time Code* input connectors located on the front panel. The control panel will operate correctly with FireOne FSK Time Code or with SMPTE time code. Any of these time codes may be connected to the unbalanced (small) connector or the balanced (large), three-pin connector. When valid time code is connected to either of the *Time Code* connectors, the blue time code lock LED, located adjacent to the large *Time Code* connector, will illuminate.

WARNING! Once a fire file is started, with time code, the fire file will continue to execute even if time code is stopped! If it is desirable to stop a time code driven fire file, the operator should depress the Load button on the front panel. This will immediately stop the file from firing. The automatic time code backup feature of the control panel is the default operational mode for time code. In those instances where automatic internal backup, in the event of time code loss, is not desirable, the operator may disable the automatic time code backup feature.

To deactivate automatic time code backup:

Depress the *Backup On/Off* button. The *Backup On/Off* button toggles the internal automatic time code backup feature on and off. When automatic time code backup feature is activated the green LED on the *Backup On/Off* button will illuminate. When the backup feature is off, the green LED will be extinguished.

Note that this operation must be followed each time the control panel is set up to fire a downloaded firing file. The control panel defaults to automatic time code backup each time the unit is turned off and back on.

Automatic time code backup operation may be changed so that the default is no time code backup by utilizing the “Control Panel Configuration” feature in the FireOne UltraFire field software or the control panel LCD Menu feature. (See pages 18 and 19 for a full description of control panel Menu features.)

In the field software The “Control Panel Configuration” menu is located under the “Tools” menu. To view the control panel default values, select and click on the “Retrieve Control Panel Configuration” button. The existing defaults will be displayed. Select the “Auto Backup Off” option. To confirm this as the default selection, click on the “Set Control Panel Configuration” button. This will reprogram the control panel for the no time code backup operation.

To utilize time code to fire a display, follow the procedure for Internal Firing with a few minor additions. The entire detailed procedure follows. Note that this is far less complex than it appears.

- Load a Fire file by connecting a computer to the *Data Input* connector.
- Verify that the *Fire Power* switch is in the *Off* position.
- Turn the control panel’s *Master Power* Switch to the “On” position.
- Load the UltraFire field software onto the computer and select the desired file to download.
- Select the *Download* Option from *Tools* pull down menu and load the desired file into the control panel. The Down Load feature will indicate when the file has been successfully loaded.
- Disconnect the computer cable from control panel.
- Select the *Auto* button followed by the *Load* button.
Cue Selection buttons 1 through 8 correspond to the eight memory location in the control panel. An illuminated green LED above any of the eight buttons indicates that a fire file is loaded into the memory location.
The name of each fire file in memory will be displayed on the LCD display when any of these buttons are selected. The user may push each button to find the required file.
- After the required file is located, the file may be loaded into the control panel active memory by depressing the *OK* button (*Module Selection* button #6). To verify that this is the correct file, the LCD message directs the user to select the “Event” to be loaded. (Note that the *Fire* button becomes active, as indicted by the green LED illuminating, when selecting the “Event” to be fired.) For a Fire (automatic file) there is only one “Event” to select.
- Prior to firing a downloaded file, maintain safety by clearing personnel from the firing area and verifying that spectators are a safe viewing distance from the fireworks products.
- Rotate the *Fire Power* switch to the “On” position. The *Fire Power LED* will illuminate red indicating fire power is activated. Additionally, the internal alarm will emit a beeping sound for six seconds providing an audible indication that fire power is activated.

- Verify that firing voltage is normal at the firing modules by performing the firepower test before attempting to fire. The fire power test is easy: Push the individual firing module buttons and verify that the LED directly above each button turns from green to red. Red indicates sufficient firing potential to fire electric matches.
- When time code is connected to either of the front panel Time Code connectors the internal file will begin to **automatically** fire cues when the time code reaches the preprogrammed firing times.
- At the completion of the Fire file the Fire button LED will turn back to green to indicate that the Fire file has been completely fired. Thereby, the color indication of the Fire button LED will indicate when the control panel is firing.

LCD Menus

The LCD display provides the user with a broad range of control panel supported features. To view the LCD features select the “LCD Menu” by depressing the “0” and “20” Module Selection button simultaneously. Activating the Menu will enable the LCD to display the menu selections.

- **Show File Test Menu**
 - Select Display
 - E-Match Test (See page 18: *Automatic Testing*)
 - SNGL or ALL
 - Fire Power Test (See page 18: *Automatic Testing*)
 - SNGL or ALL
- **UltraFire Menu**
 - Select Display
 - Enter Verify Code
 - Load (Fire File)(See page: 25 UltraFire Loading & Testing Without Software)
 - Verify (Fire File))(See page: 25 UltraFire Loading & Testing Without Software)
- **Control Panel Menu**
 - Select Display
 - Warning Alert
 - Timed / On / Off
 - Auto Backup
 - On / Off
 - Mix Mode
 - Disabled or Enabled (See page 28: *Mixed Mode*)
 - LCD Backlight
 - Off / On
 - Auto Cue Advance
 - Yes / No
 - Auto Module Advance
 - Yes / No
 - Auto Page Advance
 - Yes / No
 - Auto Semi Advance
 - Yes / No

Wireless Master
On / Off
Firepower Dump
On or Off (See page 27: *Firepower Dump*)

Control Panel Menu Selection Operations

Warning Alert
Timed / On / Off

Auto Backup
On / Off (See page 19 *To Deactivate automatic time code backup*)

Mix Mode
Disabled or Enabled (See page 28: *Mixed Mode*)

LCD Backlight
Off / On (Changing to “ON” defaults the LCD Backlight to always ON)

Auto Cue Advance
Yes / No (Changing to “No” defeats the auto-cue advance feature during manual firing)

Auto Module Advance
Yes / No (Changing to “No” defeats the auto-module advance feature during manual firing.)

Auto Page Advance
Yes / No (See page 17 *Event Pages*)

Auto Semi Advance
Yes / No (Changing to “No” defeats the auto-semi file advance feature during in panel semi firing.)

Wireless Master
On / Off (See pages 30 thru 35 *Wireless Operation*)

Firepower Dump
On or Off (See page 27: *Firepower Dump*)

UltraFire Software Operation

All XLII+™ Control Panels incorporate FireOne’s revolutionary UltraFire technology. When connected to UltraFire compatible firing modules, UltraFire provides the unprecedented ability to fire any sequence of firings, anywhere in the system, with no restrictions or time latencies. UltraFire operation is sub-frame timing accurate and has no limit on the number of firing that may be initiated at any given time.

UltraFire operation empowers designers to create firing sequences that were previously impossible to fire. UltraFire completely eliminates all firing restrictions: i.e. Fire 100 cues in 100 different locations absolutely simultaneously! This firing could be 100 e-matches or 1000 e-matches, all fired absolutely simultaneously! If the designer can imagine an effect, UltraFire can fire it!

UltraFire's ability to eliminate any firing differential also enables extremely fast or complex firing sequences regardless of the number of firings involved or their relationship to the control location. UltraFire uses a simple but powerful technique that eliminates all timing errors from the firing equation. Instead of broadcasting firing data to the firing modules, firing modules are downloaded with the required firing patterns for the display. When the firing system is activated, the system broadcasts time message to all firing modules. At the appropriate time, each module will fire any or all cues relevant to the time message that is received. In this manner all firing modules will receive the same time information simultaneously, and initiate required firings with zero latency.

(Note that UltraFire operation requires FireOne's UltraFire field software that is supplied with each XLII+ Control Panel.)

UltraFire operation requires the user to download firing data, using the FireOne Field software, into the firing modules. The Fire File contains the firing data for each firing module. (NOTE that UltraFire capable modules must be used for UltraFire. This includes all modules manufactured by FireOne as of January 2007. These modules can be identified by their version number: Version 5.0.08 or higher. Although modules manufactured as early as 2003 will support Ultrafire the 2007+ versions features improved performance.)

The downloaded Fire File determines each module's firing patterns in the UltraFire mode. Therefore, it is important that the operator is aware of the fire file data that is loaded into the firing modules before firing a display.

To help the operator keep track of the files that have been downloaded into the firing modules, FireOne has developed a two step process that includes loading the firing modules with the required fire file data and then verifying the data prior to firing the display. The verification process enables the modules to fire in UltraFire mode only when the correct verification code is used. Here is how it works.

In the Tools menu of the UltraFire field software one of the selections is "Download to Firing Modules". This is where the user begins the two step UltraFire process. Step #1 is to download the fire file in the modules. During the UltraFire module download process the operator is required to enter a verify code before the downloading will begin. The verify code may be the date or any four digit number such as 3,4,5,6 or 9,0,8,2, etc. During the download process the verify code is stored in the firing modules with the fire file data. The modules will store this data until the user enters new firing data during a new download process. Even if the modules are in storage for many months the modules will remember this data.

Step #2 of the UltraFire process is entering an UltraFire verify code immediately prior to firing the display. This means that the operator must know the original verify code or the system will not enter the UltraFire mode.

Absence of the original verify code effectively prevents the operator from firing, in the UltraFire mode. This is an important safety feature! However, in the event that the user does not verify the firing modules for UltraFire operation, the control panel will fire the display from the control panel memory or the FireOne Field software. The only effect is that the display will not fire in the UltraFire mode; which is more precise than the normal mode and may be required for complex display designs.

The safety of the verify system is very important. The backup provision that allows the system to fire from the control panel or the FireOne software assures that the FireOne System will execute the display successfully even if the operator does not have the proper verify code. This method enables the operator to fire the display even if the verification code is unknown. Therefore, the user can have incorrect files loaded into the firing modules, but still fire the correct display using the control panel memory or the firing software.

It should be apparent that if the operator has no knowledge of the original verification number he or she may simply reload the firing modules utilizing a new verify code.

Loading and Verifying UltraFire Operation with Software

Loading

1. Load the desired fire file into FireOne's UltraFire software.
2. Select the "Tools" menu and navigate to the "Download to Modules" selection.
3. The screen indicates the parameters of the file that will be downloaded into the firing modules. This includes the number of modules that are in the file.
4. The menu selections in the downloader screen provide the ability to load all or any portion of the file in to the modules. As an example the user may desire to not load module number one. Simply unselect number one and it will turn to a gray color. This indicated that it will not be downloaded.
5. Select the desired verify code. Choose either the date, by using the "verify date" input box or any four digit code by using "verify code" input box.
6. Click on the "download" button and allow the download process to complete.

Verifying

The second part of the UltraFire process is to verify that the proper fire file is in the firing modules. The verify process is required before a display may be fired with UltraFire. This is a safety measure to ascertain that the correct fire file is going to be used.

1. Go to the Auto Fire screen.
2. Click on the UltraFire box so that the checkmark appears.
3. **IMPORTANT!** ARM the firing module hardware by turning the control panel Fire Power key switch to the On position. This step assures that with complex displays that use many, many modules an electrically triggered reset does not erase the verify code when fire power is applied to the modules.
4. Select the "UltraFire Verify" button.
5. The Verify screen will display.
6. Enter the appropriate verify date or verify code and select "Verify and Arm" button and allow the verify process to complete.
7. Close the "Verify and Arm Successful" dialog box.

8. Close the Verify screen and return to the Auto Fire Screen.
9. Note that the “Armed” and “Disarmed” displays indicate the modules properly armed and disarmed for UltraFire operation. Additionally the Auto Fire screen displays “UltraFire” to indicate that the system is in UltraFire mode.
10. **IMPORTANT!** The control panel must not be powered down or UltraFire will be canceled. This is a precautionary feature to prevent the user from firing an incorrect display. Therefore, each time the control panel is powered down the “Verify” process must be fulfilled prior to arming the system to fire the display.

UltraFire Loading, Testing and Firing without Software

Another powerful feature of the FireOne System is that the UltraFire download process can be accomplished using the FireOne software or alternately via the LCD and associated control panel buttons on all XLII+™ and XL4™ control panels.

Loading Firing Modules for UltraFire Operation

To use the XLII+™ control panel for UltraFire downloading, select the “LCD Menu” by depressing the “0” and “20” Module Selection button simultaneously. Follow the LCD prompts to perform the UltraFire module download.

1. The LCD display will indicate “Show File Test”.
[Note that Module Selections buttons 4, 5, 6 and 7 correspond to actions (functions) on the LCD display.]
Selecting the “5” button moves the selections back.
Selecting the “6” button moves the selections forward.
2. Selecting the “5” button will change the selection and the display will indicate “UltraFire”.
3. Push the “7” button for “Select”.
4. The LCD display prompts the user to “Enter Verify Code”. The verify code may be the date or any four digit number such as 3,4,5,6 or 9,0,8,2, etc. (Note that the 0 thru 9 module selection buttons are now available.)
5. Use the 0 thru 9 module selection buttons to enter the four digit verify code for this display.
6. Select “LOAD” from the LCD display selections of “BACK, CODE, LOAD, VERIFY”.
7. The load process will begin and the LCD display will indicate the progress of each module as it is loaded.
8. Follow the final prompts to finalize the UltraFire download process.

Verifying

The UltraFire “Verify” process is similar to the download process. The primary difference is that the “VERIFY” selection is used rather than the “LOAD” selection in the LCD display.

IMPORTANT! ARM the firing module hardware by turning the control panel Fire Power key switch to the On position. This step assures sure that modules do not reset, thus canceling the verify step, when fire power is applied to the modules.

After the “Verify” process is completed, the LCD display will indicate that the control panel is in the UltraFire mode by displaying the symbol “UF” in the upper right corner of the LCD. If the UF is preceded by a + sign (+UF) this indicates that all the modules have successfully

verified. When the LCD display indicates –UF one or more of the firing modules did not properly verify.

Note: It is important that the user ARM the firing module hardware by turning the control panel Fire Power key switch to the On position **PRIOR** to the verify process. This will cause the control panel and the firing modules to sound an alarm for 10 seconds.

UltraFire Firing

Note that after the “Verify” process is finished the LCD display indicates that the system is in the UltraFire “ready” mode, but the control panel must not be powered down or UltraFire will be canceled. This is a precautionary feature to prevent the user from firing an incorrect display. Therefore, each time the control panel is powered down the “Verify” process must be fulfilled prior to arming the system to fire the display.

Immediately after the “Verify” process is fulfilled, the control panel is ready to fire in the UltraFire mode. This can be quickly verified by viewing the “UF” in the upper right corner of the LCD display.

Time Code

FireOne’s control panels feature two *Time Code* input connectors. The connectors are electrically identical. The difference between the two is mechanical, to facilitate connections to user cabling. One is a “balanced” input (XLR type connector) and the other is “unbalanced” (RCA type connector). In general either input may be used to connect time code to the control panel.

Time Code is time information that may be connected to the control panel’s “Time Code” input, to force the control panel’s internal time clock to synchronize (mirror) to the received time code information. Time code is primarily utilized to maintain synchronization for productions that have been designed to operate with multiple medias. Examples are: Music and fireworks; stage events, lightning and fireworks; lasers, music and fireworks; etc. (See page 18, above, “Internal Firing with Time Code”). For a detailed discussion regarding time code see page 51 *How Do I Synchronize Music to Fireworks*.

Typically, time code is utilized to synchronize automatic fire files. This fire file may be downloaded into the control panel’s memory or may be fired from an external computer. The time code must be ported into the control panel via one of the *Time Code* input connectors located on the front panel. The control panel will operate correctly with FireOne FSK Time Code or with SMPTE time code. Any of these variations of time code may be connected to the unbalanced (small) connector or the balanced (large), three-pin connector. When valid time code is connected to either of the *Time Code* connectors, the blue time code lock LED, located adjacent to the large *Time Code* connector, will illuminate and the burbling audio sound associated with time code can be heard emanating from the control panel internal speaker.

The *Time Code* inputs should NOT be used for audio other than Time Code. High power audio levels will damage the internal speaker.

Priority Disable

Priority Disable feature is a powerful feature that provides users with a method to inhibit selected product(s) from firing while a display is actively executing. This feature depends upon the user

assigning a priority number between 1 and 16 to products as they are entered into construction of the fire file. The default priority number is 1. (Priority numbers can be edited or changed at any time utilizing the editing features of the FireOne Field Software.)

A detailed description of Priority operation is outlined on page 8 for automatic fire file operation and on page 12 for semi-automatic fire file operation.

Firepower Dump

The Firepower Dump menu item is a selectable feature that provides the operator with the ability to configure the Hand Held Controller regarding the “Deadman” operation. To comply with NFPA regulations all control panels must be supplied with a method to disable the control panel when the “Deadman” is deactivated.

FireOne Control Panel “Deadman” or Hand Held Controllers attach to the “Safety” jack on the front of the panels. The Hand Held Controller provides two distinct functions. The first is the “Deadman” feature which is activated via the trigger button on the controller. The second function is manual firing or manual Event activation via the push button located on the top of the controller and accessed by the operator’s thumb.

The general nature of “Deadman” controls requires the operator to depress a button to maintain the operation of the control panel. If the operator releases the button the system ceases to function. All FireOne Control Panels are factory configured with the “Deadman” set to completely deactivate the system in the event that the “Deadman” button is released. This configuration instantly stops all commands to the firing modules and additionally removes all power to the system thereby powering down the control panel and all ancillary equipment. This is an extremely effective method to kill all system operations, however re-enabling the “Deadman” (Depressing the trigger button) will not cause instant re-activation of the control panel. In fact the re-activation process takes several seconds. In those situations wherein the operator finds this configuration cumbersome and requires instant re-activation the firepower dump mode can be changed.

Although FireOne suggests that the standard firepower dump mode of operation is the safe and effective mode of operation the operator may, at their own risk, elect to change the firepower dump configuration to the Off mode. In the Off mode the operation of the “Deadman” is changed to only disable the commands that emanate from the control panel. This disabling of commands instantly stops the system from firing and provides instant enabling when the operator depresses the trigger button.

The control panel menu is used to modify the Firepower Dump operation. To access the menu use the upper level Module Selection buttons that are labeled with *Function* and *Menu*. These buttons are the 10’s multiplier digits in the upper row and are button 0 and 20. The 0 button is labeled *Function* and the 20 button is labeled *Menu*. Depressing and holding the *Function* button while pressing the *Menu* button will cause the LCD display to change to the internal menus and display the top level menu item *Show Test File*.

Use the Module Selection buttons directly below the << and >> indicators (The 5 and 6 buttons) to navigate through the three main menu items; *Show File*, *Ultra Fire*, and *Control Panel*. The

Control Panel menu is where the various internal control panel operational functions may be modified.

Change the operation of the Deadman Dump feature by following this procedure. Access the *Control Panel* menu item. While viewing the *Control Panel* menu use the select button (Module Selection button 7.) to access the *Control Panel* menu items. The possible selections are *Warning Alert*, *Auto Backup*, *Mix Mod* and *Firepower Dump*.

Navigate to the *Firepower Dump* menu item using the << and >> indicators (The 5 and 6 buttons).

The *Firepower Dump* Menu can be changed by selecting the edit menu item (button 7). The two choices are ON and Off. When set to ON the “Deadman” button will cause the complete dump of outgoing commands AND control panel power. Conversely when choice is set to Off the “Deadman” button will only stop the outgoing commands. The Off selection provides instant starting of firing commands when the “Deadman” is engaged.

To save selections simply exit the menu by using the Module Selection buttons that are labeled with *Function* and *Menu*. These buttons are the 10’s digits in the upper row and are button 0 and 20. The 0 button is labeled *Function* and the 20 button is labels *Menu*.

Computer Assisted Operation

Auto or Semi Auto Operation with UltraFire Software

The XLII+™ control panel may be operated with FireOne’s UltraFire software. UltraFire provides an unprecedented level of features and benefits that make it a highly desirable addition to the XLII+™. To operate the Control Panel with a computer and UltraFire software, connect the computer serial connector to the Control Panel’s *Data Input* connector. All of the features of the control panel are available through the UltraFire software. This includes Manual Testing and Firing; Automatic Testing and Firing; Semi Auto Testing and Firing and UltraFire Operation.

- Load FireOne UltraFire software onto the computer.
- Verify that the Fire Power switch is in the *Off* position.
- Turn the Master Power switch to the *On* position. Note that the control panel Auto LED will illuminate green to indicate that the computer is controlling the XLII+™.
- Load the appropriate Fire file or Semi Auto file into the UltraFire software. (Note that it is not necessary to download the file into the Control Panel.)
- All of the testing, diagnostic and interactive firing features of UltraFire (See FireOne manual for details.) are assessable to operate the Control Panel.
- When operating a Control Panel with the computer, the Time Code inputs, Hand-Held Safety controller, Master Power switch, Fire Power switch and Volume up and down operate normally. Most other buttons on the membrane panel are not activated when a computer is connected. (Unless the system is configured to operate in *Mixed Mode*. See *Mixed Mode* below.)

Mixed Mode

Mixed Mode provides all the attributes of the Computer Operated Mode and the Manual Firing Mode simultaneously. This provides the ability to fire a complex, choreographed, time

code driven display with manually fired push button firings. This is a great feature for live stage shows or events that require critical interaction that cannot be precisely predetermined.

To activate Mixed Mode can be activated via the Menu feature of the control panel LCD display or alternately through the FireOne field software that is delivered with the control panel.

Mixed Mode configuration via the Control Panel LCD display is fast and easy.

To access the Menu features use the upper level Module Selection buttons that are labeled with *Function* and *Menu*. These buttons are the 10's multiplier digits in the upper row and are button 0 and 20. The 0 button is labeled *Function* and the 20 button is labeled *Menu*. Depressing and holding the *Function* button while pressing the *Menu* button will cause the LCD display to change to the internal menus and display the top level menu item *Show Test File*.

Use the Module Selection buttons directly below the << and >> indicators (The 5 and 6 buttons) to navigate through the three main menu items; *Show File*, *Ultra Fire*, and *Control Panel*. The *Control Panel* menu is where the various internal control panel operational functions may be modified.

Select the >> button change the display to *Control Panel*. Chose Select (The number 7 button) to enter *Control Panel* menu selections. Select the >> button to navigate to the Mix Mode selection menu. The choices are *Disabled* (default) or *Enabled*. Selecting the Edit (The number 7 button) will immediately affect the change. The Back button is selected to exist the menu system.

When changing the Mixed Mode configuration via the field software the Control Panel Configuration Menu is the pathway. To activate Mixed Mode, select the *Tools* pull down menu and select *Control Panel Configuration*. Use the configuration menu to retrieve the control panel setting. Select the Mixed Mode operation desired and enter the information into the control panel memory by pushing the *Set Control Panel Configuration* button.

The configuration menu provides three states of Mixed Mode status. Mixed Mode Disabled, Mixed Mode Enabled and Mixed Mode Start. Mixed Mode Disabled is the default setting. In this mode Mixed Mode is disabled. Mixed Mode Start automatically allows the control panel to enable Mixed Mode features when the control is powered up. Mixed Mode Enabled provides the user with the ability to toggle Mixed Mode operation on and off from the front panel membrane buttons. To enter the Mixed Mode operation when Mixed Mode Enabled has been selected through the software Tools menu simply select and push the *Mixed Mode* button on the front panel. The "PC" indication in the LCD display will change to "Mixed" indicating that Mixed Mode has been entered.

Wireless operation

Wireless operation may be utilized during any mode of operation and is achieved by one of two methods. Method one is to utilize one XLII+™ Control Panel, as the wireless control unit, and one or more wireless firing modules, as the receiving units. The wireless Firing Modules will operate exactly as though they were connected via wires to the XLII+™ panel.

Alternately, wireless operation may be accomplished between two wireless XLII+™ Control Panels. Regular (wired) firing modules may be connected to the receiving XLII+™, therefore providing wireless operation between control panels. This method of operation is useful for those applications where multiple firing modules will be located at a remote location such as barges, roof tops, etc. The multiple firing modules would be connected, via wires to the “receive” wireless XLII+™ control panel.

To utilize the wireless features of the FireOne System requires a minimum of three pieces of equipment.

1. A FireOne control panel. All FireOne control panels are wireless capable.
2. A wireless transceiver. The transceiver is a little white box with antenna. It also has two terminals that can be connected to the 2-wire terminals on the control panel.
3. A FireOne wireless firing module or another control panel and associated transceiver. (Note that when wirelessly communicating between control panels you can connect 2-wire modules to the remote control panel. In this setup no wireless modules are required because the master control panel can wirelessly operate all the modules that are wired to the remote control panel.

FireOne wireless equipment utilizes Frequency Hopping Spread Spectrum technology. This system was developed for the military to be immune from interference. Due to its ability to transmit and receive for only a few milliseconds on a given frequency, within its operational band, Frequency Hopping Spread Spectrum technology provides a high level of operational confidence and security. The benefits to this system include improved privacy and decreased interference, for both the user and other radio frequency users in the general area, and increased signal capacity.

The FireOne Spread Spectrum Frequency Hopping can be designated to operate over a diverse range of frequencies. FireOne’s software-hardware interface provides a quick and convenient method for the user to adjust the wireless frequency and hop sequence parameters if the need arises. The capability of this system to operate in the most hostile radio frequency environments is due to the combined attributes of FHSS technology and the user interface which provides quick field adjustments, if required.

The power output of the wireless units are 500milliwatts. The supplied standard antenna increases the effective radiated power (ERP) to 1 watt. Optional hi-gain antennas will significantly improve the receive sensitivity of the equipment for long distance operation.

FireOne’s wireless communication system is capable of operating with distances exceeding 6 km; however these parameters are subject to a number of variables. (We recommend that optional hi-gain antennas be utilized when the distance between wireless units exceeds 1.5 km.)

Experience will determine the distance over which the wireless system will operate in your situation. The wireless transceiver that is connected to the transmit or “master” XLII+™, should be placed in a location that is as high as possible. This will provide line-of-sight communications between the transmit antenna and the receive antenna(s). It is important that line-of-site is established for each antenna for optimum operation. Failure to establish line-of-site between each antenna will result in reduced range.

An XLII+™ control panel may be operated as either a transmit or receive unit. To enable an XLII+™ control panel to be the “master” transmit unit, simply depress the “Wireless” button located in the lower right corner of the front panel. The blue LED located above the button will illuminate. Correspondingly, the blue LED on the wireless transceiver will illuminate. This feature may also be accessed via the “Tools” menu in the FireOne software.

All receive units that are associated with this “master” XLII+™ control panel will have corresponding blue LED(s) that illuminate to indicate that the receive units are in the wireless mode. It is important to note that all other control panels, that may be used as wireless receive units, must be powered and have nothing else done to them. NOTHING! (Do not press the Wireless button on the receive XLII+™ control panel.)

Wireless Operation Configuration and Setup

Verification of proper operating conditions for FireOne’s wireless components, wireless module or wireless transceivers is quite easy. Follow these steps:

- Simply wire up the desired configuration of control panels and/or wireless modules. If you are connecting wired firing modules and a wireless transceiver to the same control panel output please adhere to the *Wireless System Setup* diagram (On the next page) by connecting the modules through a 150 foot cable as indicated by the red wiring.
- After the equipment is properly wired initiate wireless operation by pushing the “Wireless” button on one, and only one, of the control panels. The blue lights on all the equipment will illuminate indicating that each piece of equipment is now operating in the wireless mode. Wireless modules must have the power switch turned to the “On” position.
- Connect you computer to the control panel and start up the FireOne UltraFire software
- Select the “Tools” pull-down menu.
- Select Communications Tester from the menu items.
- Under “Module Selection” hi-light the modules that are wirelessly connected.
- Click on the “Start” button and the software will automatically and continuously test the selected modules.
- The Communications Tester screen will tally all good and all bad communications messages so that you can easily verify the quality of the wireless link(s). Bear in mind that over a 15 to 20 minute time period a few dropped messages are acceptable. i.e. 2

or 3 out of 1000 is acceptable. In the event that a large number of messages are bad the problem should be corrected.

- Start by verifying that the wireless antennas are all line-of-sight. (Can you see them with your eyes.) If the distance is more than 100 meters this is a very important consideration. The antennas must be able see each other.

Additionally, the antennas should be oriented in the same plane; all vertical or all horizontal. If the antennas are properly oriented and the Communications Tester is indicating a large number of bad messages one of three scenarios is likely.

1. The distance is too far and an external “hi-gain” antenna must be used. (Contact FireOne for a data sheet) We recommend the hi-gain antennas when the distance exceeds 325 meters or 1000 feet.
2. The operating channel must be changed via the UltraFire software due to interference. (This is only rarely the case.)
3. One of the wireless units is defective.

IMPORTANT . . . NEVER ENABLE (PUSH) THE WIRELESS BUTTON ON MORE THAN ONE CONTROL PANEL. PUSHING THE WIRELESS BUTTON ENABLES THAT CONTROL PANEL TO BE THE WIRELESS MASTER! IF YOU PUSH MORE THAN ONE CONTROL PANEL WIRELESS BUTTON YOU WILL HAVE TWO (OR MORE) CONTROL PANELS TRYING TO BE THE MASTER UNIT. YOU CANNOT HAVE MORE THAN ONE MASTER WIRELESS CONTROL PANEL!

When in the wireless mode all testing and firing functions should act exactly like the modules were wired to the “master” XLII+ control panel.

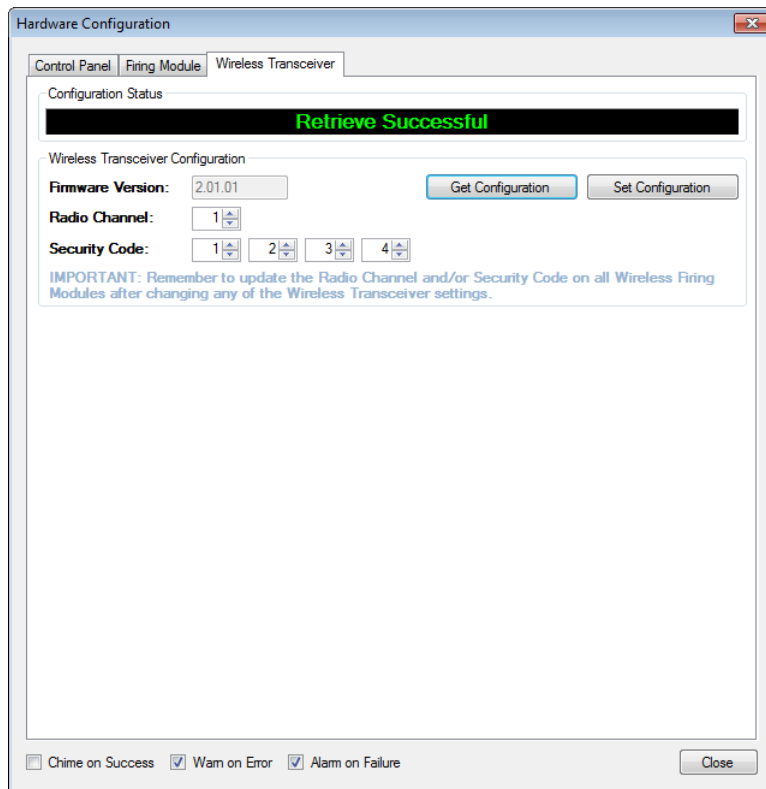
Wireless Firing Module & Transceiver Channel and Security Settings

It is important to note that all of wireless firing modules and wireless transceivers must be on the same *Radio Channel* and *Security Code*. A powerful feature of FireOne's wireless system is that you can change the operating channel and the security code at any time to match new or added equipment.

Transceiver *Radio Channel* and *Security Code* Settings

1. Connect the transceiver to a control panel and then connect a computer to the control panel. Turn the control panel on and open the FireOne software.
2. Select the "TOOLS" pull down menu.
3. Select "HARDWARE CONFIGURATION".
4. Select the "WIRELESS TRANSCEIVER" tab.
5. Click on the "GET CONFIGURATION" button.

Note that the Wireless Transceiver Radio Channel box will now have a *Channel Number* displayed. Additionally, the Wireless Transceiver *Radio Pass Code* will now have four numbers displayed.



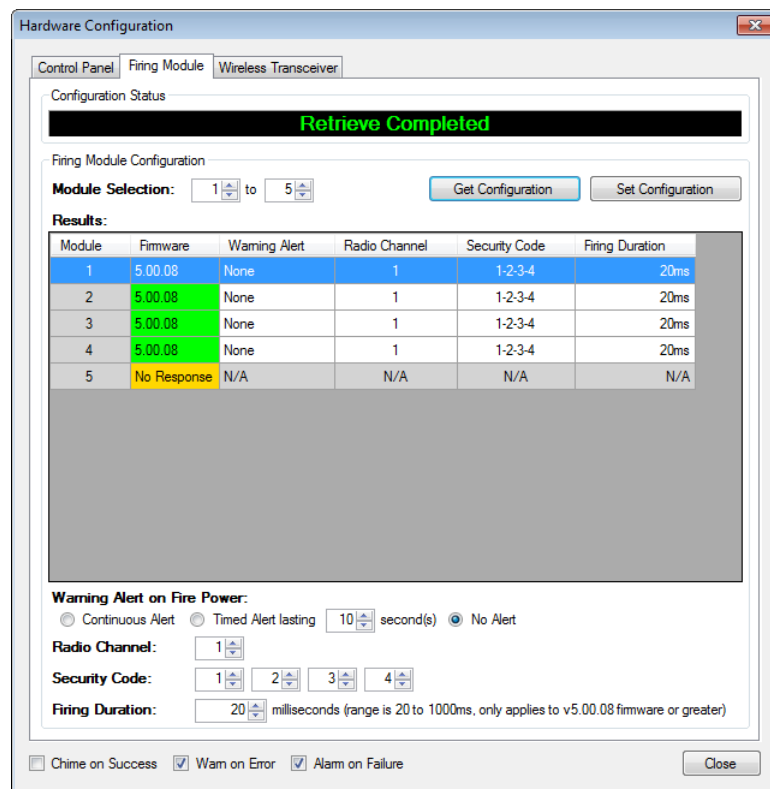
These numbers, wireless transceiver *Radio Channel* and wireless transceiver *Security Code*, determine if the equipment will communicate correctly with other that is similarly configured. Therefore all the wireless transceivers (and associated wireless firing modules) must be set to the same *Radio Channel* and *Security Code* for successful operation.

When changing the *Radio Channel* or the *Security Code* you must click on the "SET CONFIGURATION" button to save any changes.

To verify all changes click on the “GET CONFIGURATION” button.
It may be useful to temporarily write these numbers on a piece of paper.

Firing Module *Radio Channel* and *Security Code* Settings

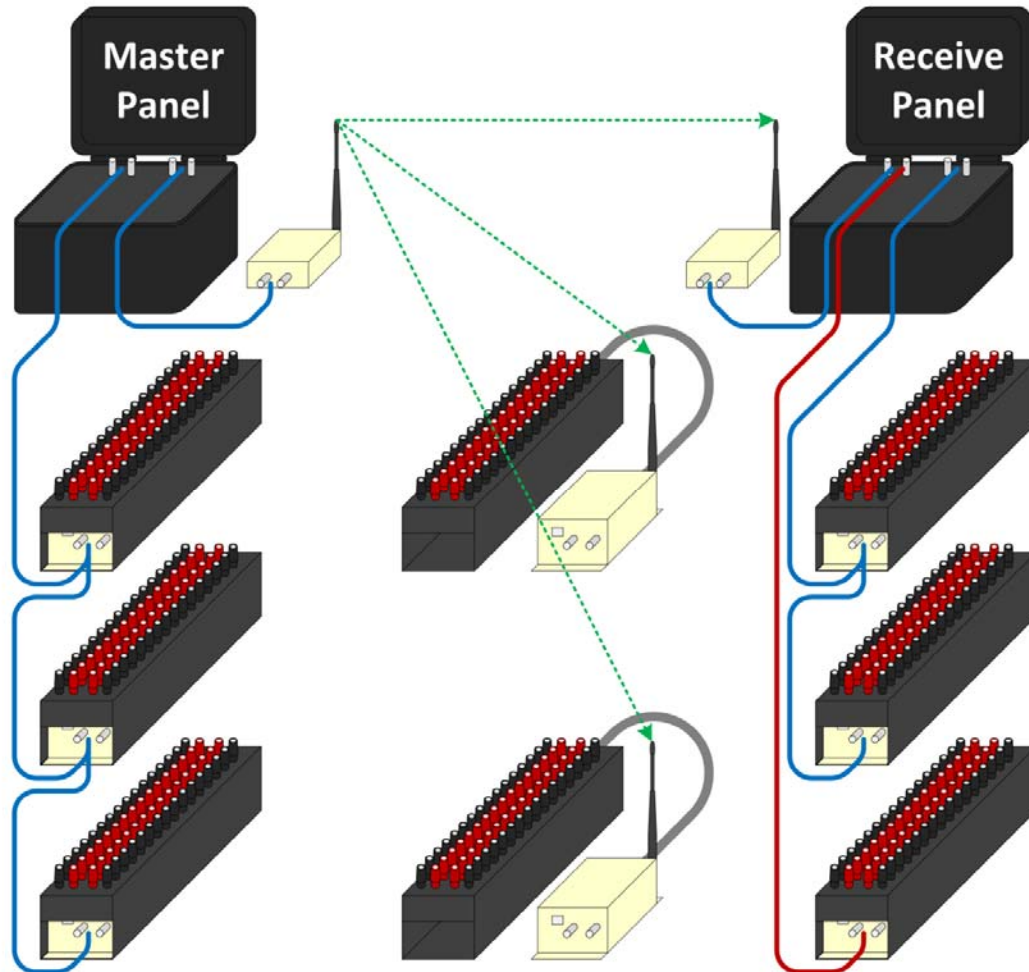
1. Use wires to connect the Wireless Firing Modules to the Control Panel.
2. Open the FireOne software and go to the "TOOLS" pull down menu.
3. Select "HARDWARE CONFIGURATION".
4. Select the “FIRING MODULE” tab.
5. Click on the “GET CONFIGURATION” button. The *Radio Channel* and the *Radio Security Code* numbers are now displayed. Enter data into the *Radio Channel* box and the *Security Code* boxes.
6. Click the “SET CONFIGURATION” button to store the new numbers.
7. To verify that the changes have taken place click on the “GET CONFIGURATION” button to verify.



Please note that after the Radio Channel and Pass Code have been changed proper operation can only be verified when the modules and transceivers are separated by a minimum of 50 feet (15 meters). Testing the units directly next to each other will result in improper operation.

Wireless system Setup

The FireOne Wireless System may be operated in two different configuration. To operate the wireless system you must have the following minimum equipment: #1. Control Panel; #2. Wireless Transceiver. (This connects to the Control Panel to make it wireless.); #3. Wireless firing module(s) or another Control panel and wireless transceiver.



Warning: It is highly recommended that the connection wire between any control panel that is operated with a wireless transceiver and wired firing modules on the same output have a minimum of 150 feet (50 meters) of wire between the output terminals and the first firing module. (See red wire in above diagram.) This will assure that both the transceiver and the associated firing modules operate properly.

From the diagram you can see that the wireless system will operate with either setup; Wireless panel to Wireless firing modules or Wireless panel to Wireless panel.

The advantage of the Wireless panel to Wireless firing module setup is that you can place individual firing modules wherever you would like them. Since they are wireless they can be placed where you cannot run wires.

The advantage of the Wireless panel to Wireless panel setup is that you can operate a lot of firing modules from each control panel. The firing modules that are connected to the receiving (remote) wireless control panel can all be regular firing modules instead of wireless firing modules. This is less expensive because the regular firing modules are less expensive than the wireless firing modules.

Wi-Fi Operation

Not implemented in this version of control panel.

Charging the Internal Battery

To charge the internal battery, connect the power cable to the 120-240 VAC input connector and the other end to a 120 or 240 AC electrical outlet. The Control Panel power supply will accept an input of 100 to 240 volt, 50/ 60 Hertz. This is acceptable for most AC power sources, worldwide.

- The green LED power indicator, located at the top right of the *AC Input* connector, will illuminate. This indicates that the charger is connected to electrical power. The red LED, located at the top left of the *AC Input* connector, will also illuminate. The red LED will remain on as long as the battery is charging. When the red charge LED extinguishes, the battery is fully charged. A flashing red LED indicates that charging is about to stop. It is highly desirable to leave the charger connected as long as necessary to fully charge the battery. The internal charger will not overcharge the battery unless it is connected to a power source for many months. If the panel is used regularly, it is more desirable to keep charging the battery than to forget to charge the battery. Most batteries fail due to chronic undercharging. Normal charging time is 12 to 14 hours. (WARNING: Do not leave the charger plugged in for months at a time.)
- The FireLite XLII+™ will operate for eight hours on a fully charged battery.
- FireLite XLII+™ may be operated with a discharged battery by connecting the control panel to an electrical outlet. The AC power will operate the control panel even if the battery is discharged. If the battery is discharged, the AC power will charge the battery and operate the control panel simultaneously, although the preferred charging condition is with the *Master Power* switch in the off position.
- The *Battery Indicator* LEDs, located adjacent to the power switch, indicate the amount of DC voltage at the battery terminals. When the red, yellow and green LEDs are illuminated the battery is fully charged. The red LED illuminates at 11 volts. The yellow LED illuminates at 11.8 volts. The green LED illuminates at 12.0 volts. With a normal battery the Control Panel will operate for three hours after the green LED extinguishes. The actual battery voltage is displayed in the upper left corner of the LCD display.

General Battery Maintenance

FireOne control panels are primarily battery operated although the control panels may also be operated from an AC source and, through the front panel DC Input connectors, an external battery. The control panel internal batteries are lead-acid gel batteries. These batteries are known for their stability, ruggedness and reserve power capacity. Additionally, FireOne wireless firing modules operate via an internal nickel-metal hydride battery (NiMH) and the LCD displays in 2-Wire modules are supported by a small “coin” cell.

Control Panel Battery

The lifetime of (lead acid gel cell) batteries, in the control panel(s), is two to five years, depending upon how well the battery is maintained . FireOne recommends that the control panel batteries should be replaced, to avoid operational problems, at the 36 month time period.

Wireless Firing Module Battery

Each wireless firing modules contain a Nickel Metal Hydride (NiMH) battery. The NiMH battery is charged via a wall transformer that connects to the rear of the firing modules and then into an AC source. Charge time is 4 to 12 hours depending on the amount of charge remaining in the battery. The lifetime of the wireless module NiMH battery is typically four to five years. FireOne recommends replacement of this battery every 4 years.

2-Wire Firing Module LCD Battery

The 2-Wire Firing Modules contain a small “coin” style memory battery that enables the LCD display when the modules are not connected to the system. This “coin” battery will maintain power to the LCD display for up to 12 months if the module is not used. When the battery becomes discharged the LCD numbers become faded and may flash on and off. Typically this battery is recharged each time the modules are connected to the control panel to fire a display.

In the event that the modules are not used for an extended period of time the “coin” battery may be charged by simply connecting the firing modules to the control panel and switching the control panel power switch to the “On” position. (It is wise to connect the control panel to an AC power source to ensure that the control panel battery is not discharged in the process). This recharging process takes four to five days as these batteries charge slowly. The “coin” battery, in the firing modules, requires replacement every ten years.

Firing Modules and Permissible Cable Lengths

FireOne’s design incorporates the features of a capacitive discharge system in each firing module. The benefit of this “distributed system” is that the power to fire electric matches resides in the firing module. This provides a huge advantage over conventional firing systems. With conventional firing systems the power to fire electric matches is derived from the control panel. This approach limits the flexibility of the firing setup because the lengths of wire required “current limits” the system, therefore requiring the operator to calculate wire lengths, voltage drops and current values. The FireOne capacitive discharge “distributed system” eliminates 99% of these issues, and in the process, display site setup becomes logical and easy to master.

The design philosophy of the FireOne system provides enough flexibility that a user never really needs to calculate wire length resistances, voltage drops and resultant current. The firing modules, logically located directly adjacent to the product to be fired, provide the power source that fires the e-matches. When the power source is this close, the need to remember electrical calculations is eliminated. This is in sharp contrast to 99% of the other firing systems on the market today. These systems derive the firing power from the control panel, which may be several hundred feet away from the electric matches.

Note that there is NO relationship between cable lengths from the Control Panel to the Firing Modules and the number of e-matches that can be fired! This is an extraordinary feature of FireOne's capacitive discharge system. Remember, every FireOne firing module derives the power source to fire electric matches from a capacitive discharge firing circuit that is inside the actual firing module. Therefore, the power to fire the matches is typically within a few feet of the pyrotechnic product. The most intelligent use of this type of system is to place the firing modules as close as practical to the product to be fired. The use of long extension wires from the firing modules to the product to be fired defeats this feature. It is practical and advisable to use long connection wires (cables) between the control panel and the firing modules.

With FireOne, short current paths to the e-matches are usually the norm while with other systems LONG current paths are usually the norm. This is why FireOne has significantly superior ability to fire electric matches when long distances from the control panel are encountered.

This indicates that every firing module, regardless of its distance from the control unit, has the same ability to fire electric matches. A firing module that is one mile (1.625 KM) from the operator is able to fire five to twenty electric matches on each cue, simultaneously (A total 640 electric matches on each module at the exact same time!); exactly like a firing module that is located 100 feet (30 meters) from the operator.

Distance has no effect on the amount of electric matches that can be fired because the firing potential is generated by the firing module NOT by the control panel battery, as in conventional systems.

Every FireOne firing module produces 24 volts DC, in the firing mode, with a capability to produce 5 amperes of current on every single cue SIMULTANEOUSLY. That means that if a display is designed that fires all cues on one firing module simultaneously, in one shot, your firing modules have the capability to produce 160 amperes at 24 volts dc. Other than FireOne, there are few, if any, firing systems that have this capability!

FireOne's technology is so advanced that extremely long cables are not an operational problem as with conventional systems. Typical users will never approach the practical limits of operation of the FireOne System.

In a controlled environment, FireOne firing modules are capable of firing 10 electric matches, in parallel, on any given cue and 20 electric matches, in series, on any given cue at any time in a display. We acknowledge that fireworks displays are seldom fired in controlled environments or under optimum conditions. Therefore, to assure that all displays fire properly, we strongly suggest the following guidelines.

A maximum of five electric matches, in parallel, will fire successfully on any given cue.

A maximum of ten electric matches, in series, will fire successfully on any given cue.

This provides a 100% margin for error when users run long lengths of electric match wire, have resistive connections, etc. Additionally, we strongly recommend that the user test fire the wiring configuration by firing electric matches with the actual wiring circuit whenever possible.

Typically the user may connect a maximum of twenty firing modules to one output of a control panel. Although the control panel or FireOne UltraFire software will warn the operator of unacceptable display wiring, the user will find it helpful to have a working knowledge of the

practical limits for the wiring between the control panel and the firing modules. This relationship between cable lengths and number of modules is outlined below. This provides guidelines for the operator when setting up those displays that are unusual.

Firing Modules and Wire Length Relationship

(Assumes 18 gauge stranded two conductor wire. Larger gauge wire, such as 16 or 14 gauge, will improve the performance of the system.)

This table assumes the worst case scenario: All Firing Modules connected to one output with all modules at the extreme end of the wire.

5000' (1524 meters) maximum number of firing modules = 10

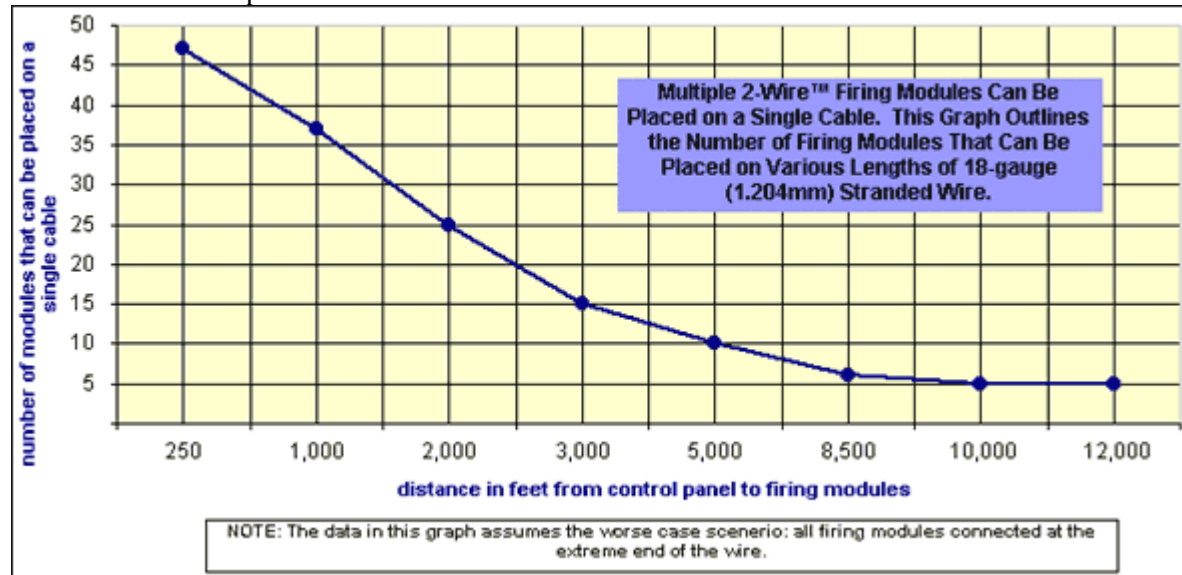
3500' (1067 meters) maximum number of firing modules = 20

2000' (610 meters) maximum number of firing modules = 25

1000' (305 meters) maximum number of firing modules = 25- maximum modules recommended for XLII+™ on one output channel.

500' (153 meters) maximum number of firing modules = 25-maximum modules recommended for XLII+™ on one output channel.

250' (76 meters) maximum number of firing modules = 25 - maximum modules recommended for XLII+™ on one output channel.



The table illustrates that 48 modules can be connected to the outputs of an XLII+™ control panel. While this is technically accurate, FireOne suggests a more moderate approach. For all FireOne control panels, FireOne suggest that the maximum number of firing modules connected to any one output be limited to 20. This guideline indicates that a two output XLII+™ control panel may control 40 wired firing modules. This conservative approach provides a significant margin in the event that the user exceeds the guidelines.

These module operational guidelines are based on the power distribution capabilities of the control panel. Obviously, these guidelines do not apply to wireless modules as they do not consume power from the control panel. The quantities of wireless modules that can be attached to an XLII+™ are unlimited.

Miscellaneous

- **Panel Light:** The optional panel light is switched on and off by the *Master Power* switch. Leaving the panel light on for extended periods will discharge the internal batteries.
- **USB Input:** The preferred connection for computer-assisted operation is the serial connection. The secondary *Data Input* connector is a USB type connector. For proper operation the USB software drivers must be installed on the computer prior to using the USB connection. The USB drivers are automatically installed on the computer when the FireOne software is installed. They are located in a directory named “USB”. The path to this directory is *C:\Program Files\FireOne\USB*. Upon first connecting the computer to the XLII+™ USB input the computer software will indicate that it has detected new hardware. Instruct the installation routine to locate the drivers in the USB directory and the software will automatically install the drivers. (See “*Installing USB Drivers on page #43.*”)
Additionally, all laptop computers should be configured so that windows cannot alter the USB operation during firing. It is extremely important to follow the “USB Configuration for Laptops” as outlined on page 47.
- **Misc. Buttons:** The XLII+™ Control Panel incorporates several additional buttons for ease of use. These buttons are the Backlight button, Wireless button, the Backup On/Off button, and the Vol – and the Vol + buttons.

Backlight: The Backlight button turns the LCD backlight on and off. With the backlight on, the LCD display can be viewed in total darkness.

Wireless: The Wireless button is utilized to enable the wireless features of the control panel. When the Wireless button is pushed, the blue LED will illuminate to indicate wireless operation.

Backup On/Off: The Backup On/Off button and associated green LED indicate when the control panel is in the automatic internal time code backup mode. When the LED is green, the automatic backup is enabled. When the LED is off, the automatic backup is disabled.

Vol – and Vol +: The Volume – and + buttons provide a convenient method to raise or lower the volume of the control panel’s internal speaker. The internal speaker is used to audibly verify the presence of time code.

- **8-Wire Operation:** XLII+™ supports FireOne’s legacy 8-Wire firing modules in addition to FireOne’s 2-Wire Firing Modules. FireOne manufactures a 2-Wire to 8-Wire adapter specifically to support 8-Wire Firing Modules. Call or email FireOne for current pricing.
- **Hand Held Control:** The optional hand held “trigger” firing control provides two functions. When plugged into the *Safety* connector on FireLite XLII+™ front panel, it acts as an optional *Fire* button and as a *Safety* button. The *Fire* button is mounted on the top of the hand control. The *Safety* button is located on the front of the hand control and is activated by the operator’s index finger.
 - The trigger finger *Safety* button must always be held in the “on” position to activate the electronic circuits in XLII+™. Releasing the trigger during firing will deactivate XLII+™ and cause the firing sequence to stop. Note that

releasing the *Safety* button will immediately stop XLII+™ from firing but it may take approximately three seconds for the firing module sensing circuit to discharge firepower. This is normal. The activation (release) of the *Safety* button provides an effective emergency “stop” of the firing system. The top mounted, thumb activated *Fire* button has the same effect as depressing the membrane Fire button on XLII+™ front panel.

- Next to Fire Memory: When firing cues in random order, the next-to-fire cue will illuminate red. When firing randomly it is possible for the next-to-fire cue indicator to be illuminated on a cue that has already been fired.
The next-to-fire, red, sequencing LED indicator is a memory feature that is activated when a fire file begins to fire. When it is desirable to clear the next-to-fire memory, it is necessary to turn the *Master Power* switch off.
- Buttons Disabled: When operating XLII+™ in the Computer Operated Mode, connecting the computer to XLII+™ *Data Input* connector disables most of FireLite XLII's™ front panel buttons. Additionally, fire files that have been downloaded into XLII+™ will be inoperative and the computer will determine what fire file is utilized.

Installing USB Drivers

Computer Character Setting for Japanese and Chinese

1. To enable Asian versions of Windows XP to correctly operate FireOne software, go to ‘Control Panel’, then ‘Regional and Language Options’.
 - a. Under ‘Regional Options’ select 英語(米国) (stands for English (U.S.)) And the ‘Location’ should be 米国
 - b. Under the tab ‘Languages’, go to Details, and select 英語(米国)
 - c. Under the tab ‘Advanced’, select 英語(米国)
2. Go to ‘Control Panel’ and select ‘Date and Time Properties’. ‘Time Zone’ should be GMT 05:00.
3. Apply all setting and exit the ‘Control Panel’.

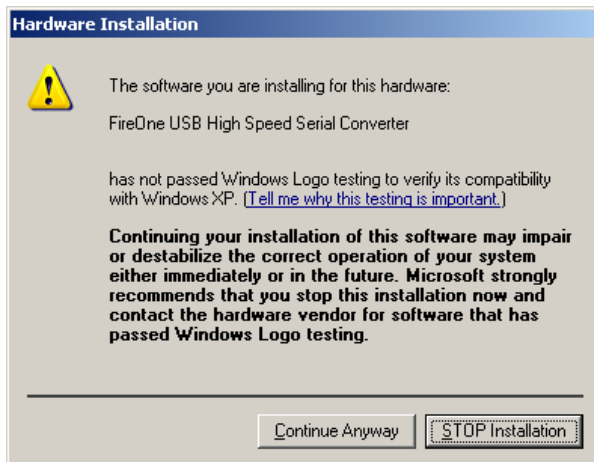
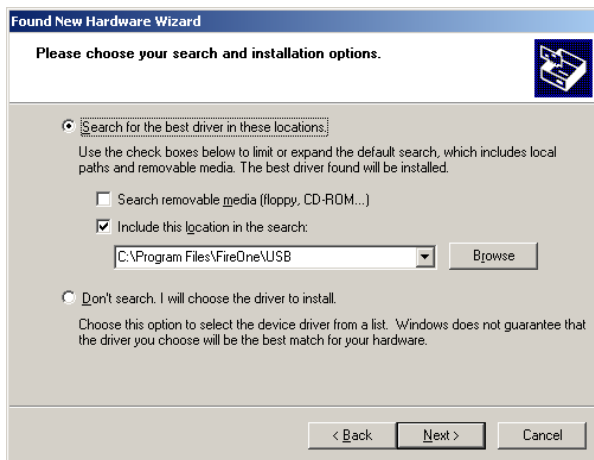
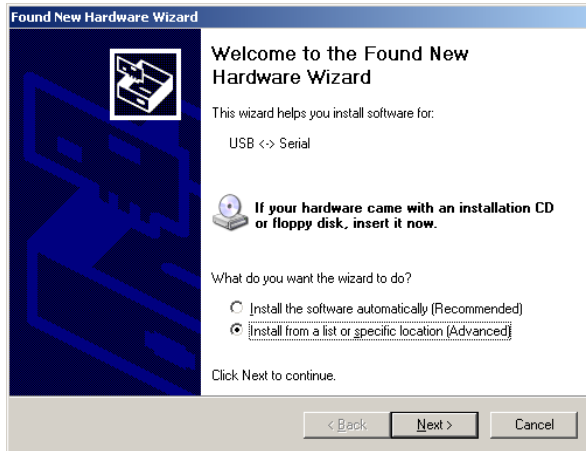
Installing USB Drivers into Japanese Windows XP

1. Connect USB cable between computer and FireLite.
2. Right click on ‘My Computer’ and select ‘プロパティ (R)’. (stands for property) Select third tab ‘ハードウェア’ (hardware).
3. Click デバイス ‘マネージャ (D)’ (Device manager). USB is recognized under ‘その他のデバイス’ (Other devices) Double click.
4. Go to ‘全般 (general). Then click ‘ドライバの再インストール(I)’ (Reinstall the driver).
5. Wizard comes up. Choose second one ‘一覧または特定の場所からインストールする(S)’ (Locate the file). Click ‘次へ’(next).
6. Click ‘参照 (browse) and find the file.
7. Warning comes, but click ‘続行 (C). And click ‘完了’(finish).

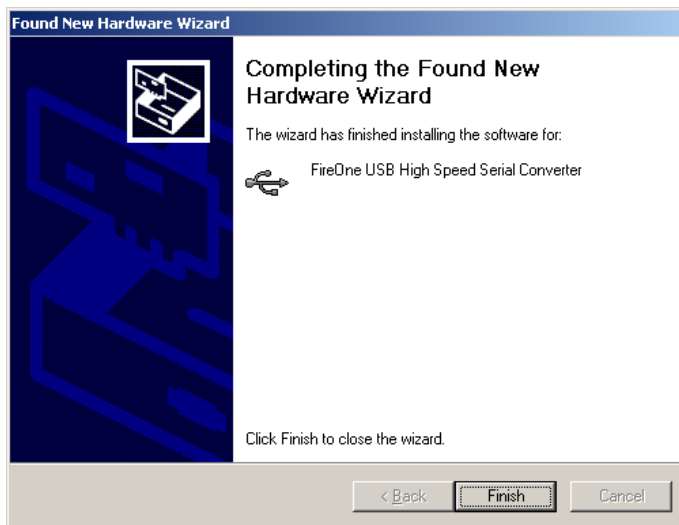
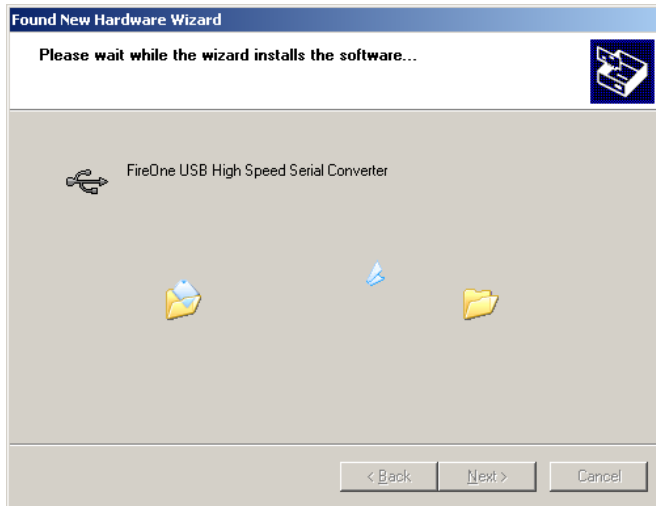
Installing USB Drivers with Windows

IMPORTANT Connect USB cable between computer and FireLite.

Windows will automatically determine that there is new hardware attached to the computer. The following dialog box will appear on the screen: *Found New Hardware Wizard*.

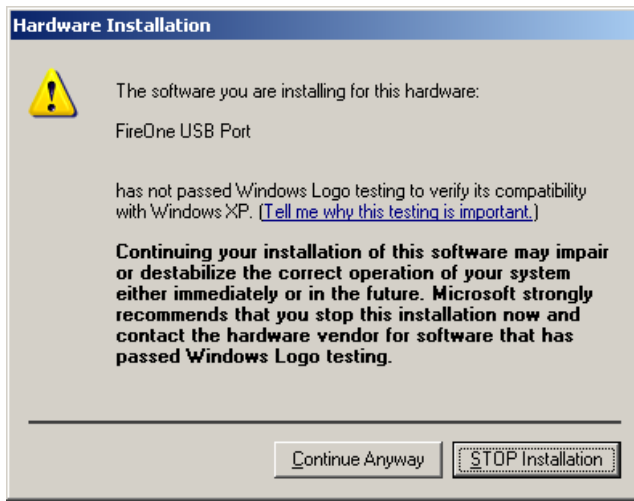
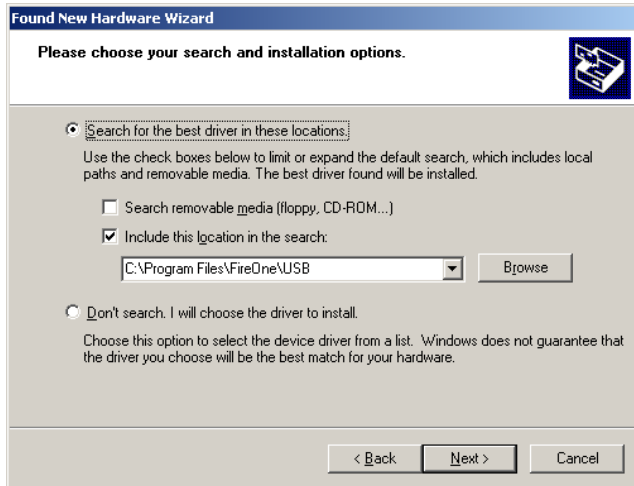


Select "Continue Anyway".

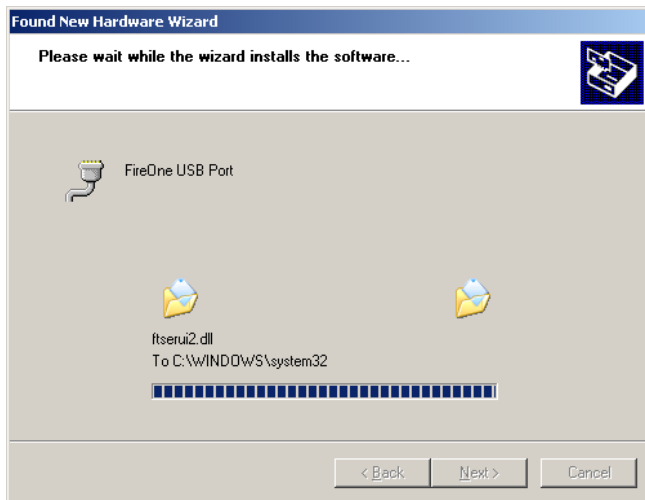


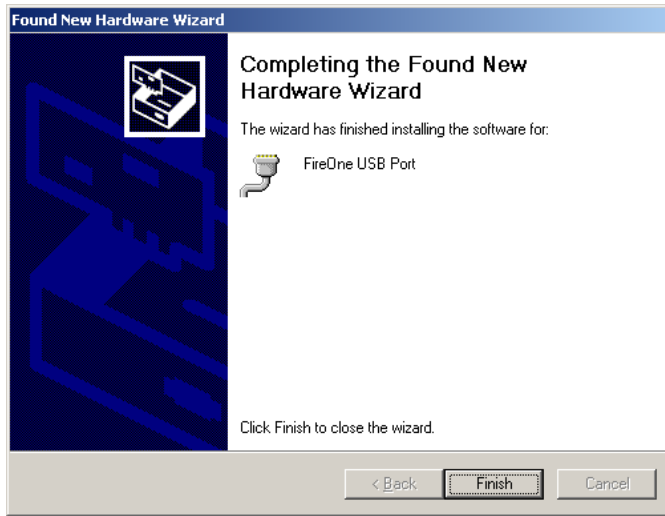
This finishes installing the USB drivers. The second part of the procedure is to install the virtual serial port. Installing the virtual serial port for FireOne follows the exact procedure for installing the USB drivers. The Found Hardware Wizard will appear a second time. Follow the same procedure, as follows:





Select "Continue Anyway".

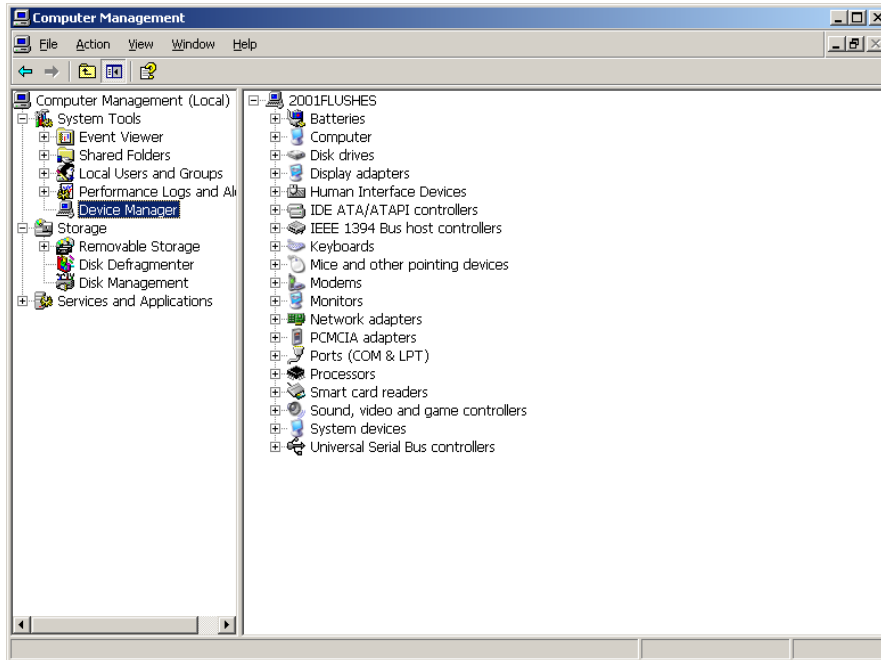




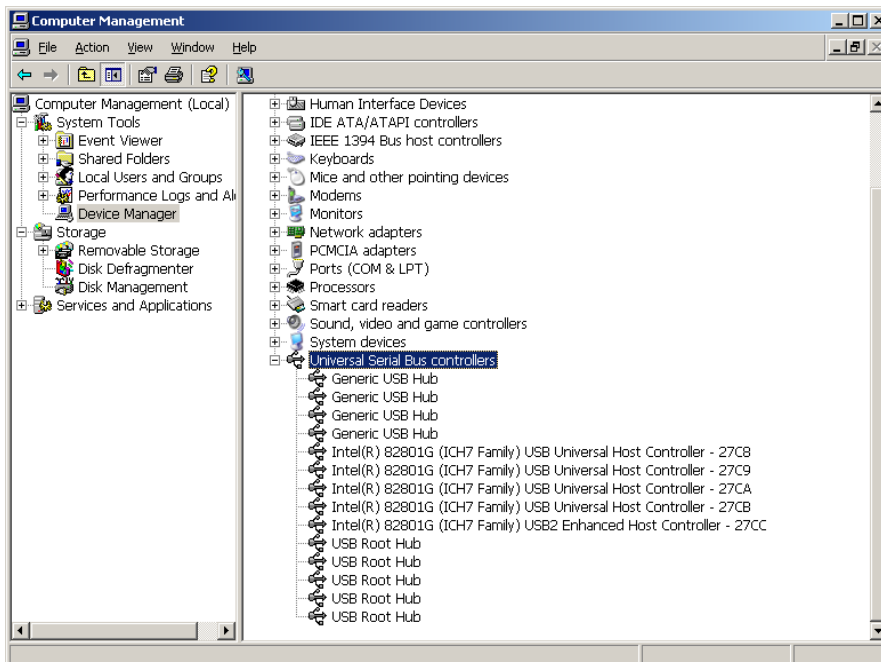
At the conclusion of the installation of the USB drivers and virtual port, the FireOne software will connect to any of the FireOne control panels via the USB cable.

USB Configuration for Laptop Computers (HIGHLY RECOMMENDED)

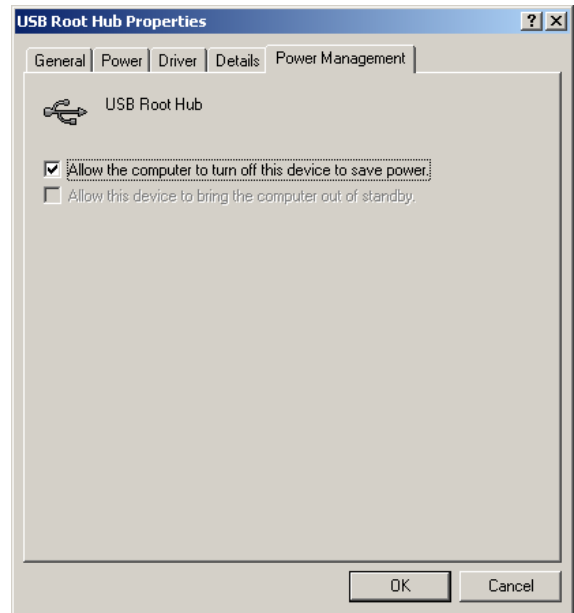
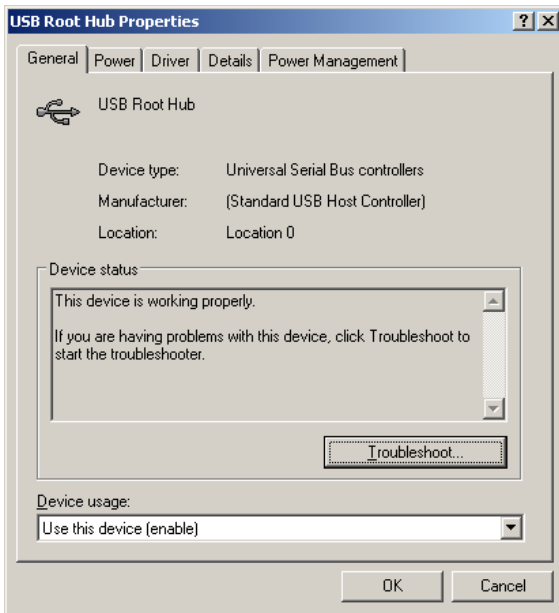
Right click *'My Computer'* and select *'Manage'*. Under the *'System Tools'* select *'Device Manager'* and you should see a screen similar to the one below.



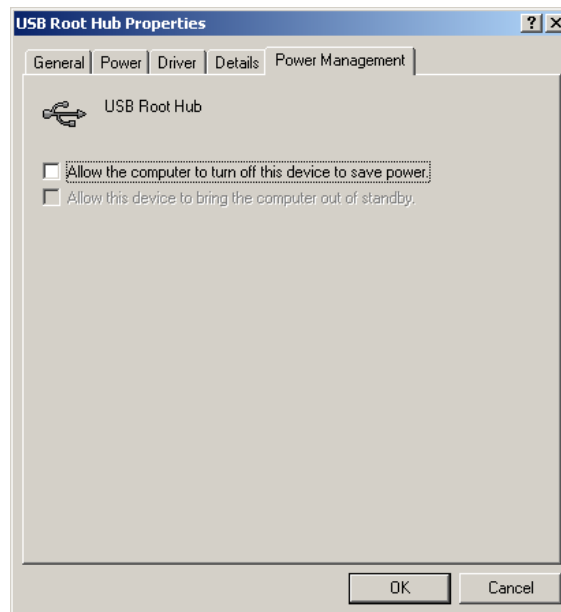
Expand the *'Universal Serial Bus controllers'* in the Right-hand pane. You will then see something similar to the following:



For *each* 'USB Root Hub' that is listed. Right-click and select '*Properties*' and then select the '*Power Management*' tab

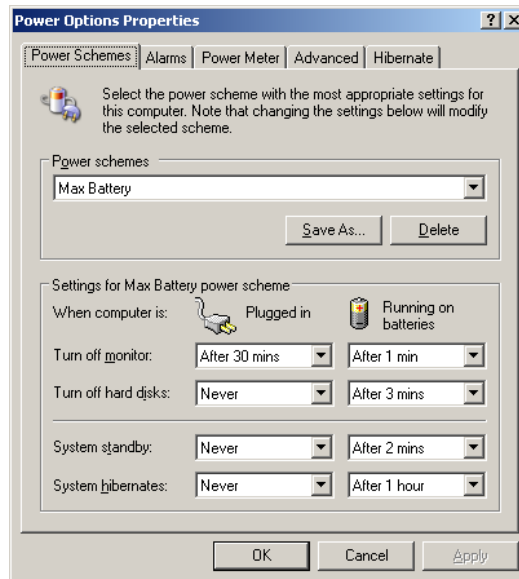


Make sure the setting '*Allow the computer to turn off this device to save power*' is **NOT CHECKED**. Then click '*OK*'.

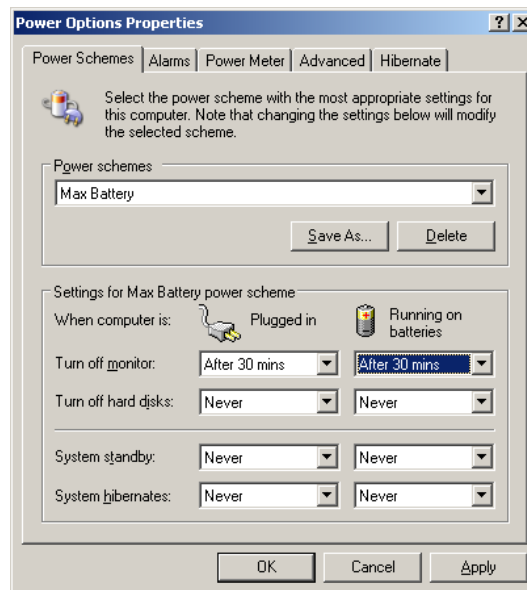


PERFORM THE ABOVE PROCEDURE FOR EACH 'USB Root Hub' listed in the device manager.

Change power saving options to ‘Never’ when firing a show (Particularly the *Hard disk*, *System standby* and *System hibernate* should be set to ‘Never’). Go to ‘Control Panel’ then ‘Power Options’ and the ‘Power Schemes Tab’.



Change the times for both the ‘Plugged in’ and ‘Running on batteries’ to ‘Never’.



While this is not a requirement it is highly suggested. USB devices sometimes have problems if the computer goes in to or comes out of standby or hibernation while the USB device is being utilized.

Frequently Asked Questions

How many modules will the XLII™ control?

The XLII™ will control 40 firing modules as a stand-alone Control Panel. For wireless modules this number is unlimited.

Why 2 outputs?

Recognizing that display operators could not afford to trust their displays to firing systems that depended on control panels with one output FireOne pioneered the multiple-output firing system control panel over 25 years ago. FireOne's multiple output control panels provide a high level of redundancy compared to the single source output systems. With a FireOne system if an output fails, the other outputs with independent power and data sources continues to fire your display, rather than shut down the entire display.

If one output is shorted, how does this affect the other outputs?

No effect on other outputs!

What is the battery life?

Battery run time, with a fully charged battery, is typically 6 to 8 hours depending on the number of firing modules connected to the XLII™ control panel. In the event that operation is required exceeding the run time, of the internal battery, the XLII™ may be powered via an external battery or from an AC power source.

External battery operation requires a user supplied 12 volt lead acid battery and the (optional) 12 DC Input Battery cable. **WARNING!** To connect the external battery properly follow this procedure:

1. Connect the 12 DC Input Battery cable to the auxiliary battery via the red and black clip terminal. It is important to observe polarity with the red clip connected to the positive battery terminal and the black clip connected to the negative terminal.
2. After the 12 DC Input Battery cable is fully connected to the battery plug the other end of the cable into the 12 DC Input Battery jack on the XLII control panel. Note that the plug and jack are keyed. This makes it possible to only insert the plug correctly. If you find it difficult to insert the plug into the jack stop and look at the plug and jack. Locate the large and small lugs on the jack and plug and insert correctly.

The lifetime of (Lead acid gel cells) batteries, in the Control Panel(s), is two to five years, depending upon how well the battery is maintained. FireOne recommends that control panel batteries be replaced, to avoid operational problems, at the 36 month time period.

What is GPS?

The Global Positioning System (GPS) is a satellite constellation that freely and continuously provides positioning, navigation, and timing (PNT) information. FireOne control panels (See XL4 Manual or Time Machine Manual) can use this information, via the GPS antenna, to provide highly accurate time that is utilized to control system operation. (See expanded discussion regarding GPS Timing in XL4 or TimeMachine Manual.)

Why is the Wireless transceiver not built-in to the XLII™ Control Panel?

The FireOne wireless transceiver is an optional and separate piece of hardware for the XLII™ control panel. This feature provides the user with the ability to locate the transceiver some vertical distance from the control panel and the operator. The two huge benefits of this approach are that the user is not exposed to the RF energy of the transceiver and additionally, the range of the system is greatly expanded. This is possible because an increase in height is exactly the same as an increase in power. This provides a huge advantage over competitive systems and is another reason why FireOne's wireless system outperforms other systems.

Why Does the Short LED between the Output Terminals Come On?

The "Short" light illuminates whenever the voltage on the output terminals drops from its initial 24 volts to below 10 volts. The loss of voltage is the definition of a short circuit. In a full short circuit (Where wires are shorted the red LED will come on and stay on because the output is shunted and the voltage drops very low or near zero). You can try this by placing a jumper across the output. (You can't hurt it). This effectively occurs 100% of the time when only a few modules are initially attached to the control panel on relatively short wiring. Typically with long wiring this does not occur.

Here is what is happening. The capacitive discharge circuit, in each module, acts like a short circuit when the module initially "sees" Fire Power turned on. The output voltage drops below 10 volts for a few seconds and the "short" LED illuminates. Within a few second the modules recognize that the system is trying to charge them and they accept the fire power voltage (24 volts) and the "Short" LED goes out. Typically, users who do small or indoor displays see this phenomenon regularly. Users who are doing large outdoor displays with long wires rarely see this occur.

What is a Ground Loop?

Any control system that can accommodate multiple input sources is prone to errant grounding issues; commonly referred to as "ground loops".

In audio systems the "ground loop" manifests itself as a harsh low level noise or hum.

With control systems such as FireOne's distributed control system the "ground loop" manifests itself as a sudden lack of communications.

When two or more devices are connected to ground through different paths, a ground loop occurs. Currents flow through these multiple paths and develop voltage drops which can cause noise, 50Hz/60Hz hum or even damage the equipment. To prevent ground loops, all interconnected devices need to go to one common ground location. When this is not possible and multiple grounding points cannot be avoided the offending device(s) must be isolated from the control system.

All users of control, sound, video and computer systems must contend with ground loops. The use of any standard 120-volt or 240-volt single-phase AC system brings potential grounding problems. Ground loops are an after-the-fact type of problem in which the end-user blames the equipment, the technicians or the manufacturer. Actually nobody is at fault. It is impossible to predict where a ground loop will occur. The cure for this problem is simple: eliminate the multiple ground locations. The system should only be referenced to ground, or earth, at one

point. While this is a simple fix finding the source of the multiple ground(s) is a bit of detective work.

The basic approach is to test the system with no external inputs such as AC power, Time Code cables, etc. All the equipment can be powered by the internal battery of the control panel. Test the system for proper operation. After proper operation is established apply the required connection as needed. As each item is connected it is important to establish that the system is operating properly. If one of the added connections disrupts communications a potential ground loop has occurred. In simple terms this indicates that the attached device has created a new ground source for the system. This “accidental” ground must be located and eliminated.

Why not program shots at time 00:00:00.00

00:00:00.00 is not a real time for the system.

In our training we explain that the system has no way to use the time 00:00:00.00 because it is not a real time. Ask yourself the question: When does 00:00:00.00 occur? Is it now? Is it in a few minutes from now? It is an undefined time. Therefore the user should not program any devices to fire at 00:00:00.00.

It actually takes the firing modules some part of the first second to realize that the system is firing. You could say that the system is "aware" at .0000000001 seconds but we suggest that One second is a more appropriate time to use. We suggest that it is unwise to program any devices to fire until after 1 second. For best results use a time that is after 5 or 10 seconds so that the operator can determine that the system is running correctly and it has time to synchronize itself.

How do I Synchronize Music to Fireworks or How to Provide Time Code to my Control Panels

The design of the FireOne System provides for complete flexibility in many areas of operation. This flexibility is applicable to the synchronization of choreographed fireworks to a music soundtrack. This discussion assumes that the user has completed the choreography process and has derived a fire file that will be utilized to fire the fireworks display. The fire file may have been designed using FireOne’s ScriptMaker software or alternately, for very small displays, FireOne’s UltraFire field software. This discussion will provide five distinct methods to synchronize a fireworks display utilizing the FireOne System.

The assumption is that the user has completed the following four steps.

#1. Create your music wav file. This is done with some music editing software and has nothing to do with any FireOne software. The resulting music file must be 44.1kHz 16 bit stereo.

#2. Using ScriptMaker or FireOne Design Studio load the music file into ScriptMaker. Note that ScriptMaker must be set up with all the shell database information relating to the products you use. The resulting choreography file (“scr” file) contains the music to fireworks data for your display.

#3. Use CueMaker or FireOne Design Studio to load the “scr” file. CueMaker or F.O.D.S. will provide the ability to assemble the display in a logical manner and provide printed packing and

loading lists to set up the display. CueMaker or F.O.D.S. will output a “fir” file that will be used to fire the display.

#4. To fire the display load the “fir” file into FireOne UltraFire field software or download the file into your control panel.

Definitions:

Fire file

A fire file is a data file that the FireOne System requires to initiate an automated fireworks display. The fire file data includes, at minimum, three important items.

1. The address for each firing or “Cue” (We call this a “Cue” while some users call this a “Line.”) such as module #1 cue #19.
2. The exact time for the cue to be activated or fired.
3. Priority number. A Priority is a safety function that features an assignable number for selected pyrotechnic products. The user may select a Priority during the firing of a display which will disable all firings with the selected Priority number.

Choreography

The art of selecting appropriate pyrotechnic devices to correspond to a music soundtrack based on musical tempo, inflection, mood, style, variations, volume levels, etc.

Sound Track or Music Wav File

The compilation or collection of music songs or selections into a program meant to accompany or be synchronized to a fireworks display. Note that wav files are required for accurate synchronization. MP3 or other compressed files do not employ the timing accuracy of wav files.

Timecode

A sequence of numeric codes generated at regular (time) intervals by FireOne’s Time Code Wizard software or FireOne’s TimeMachine. This timecode may be automatically incorporated into a Sound Track or Music Wav File via Time Code Wizard (TCW) software. The output of TCW is a newly created wav file that contains both music and timecode. Although timecode is available in many formats these discussions generally assume the use of FireOne’s standard FSK timecode. It should be noted that Methods 3 and 4 are uniquely not suitable for SMPTE timecode transmission while Methods 2 and 5 will handle SMPTE. (See page 26 for additional information regarding Time Code.)

Method #1

This method could be called the “No Time Code Method” as there is no time code track required. This is the most basic method to perfectly synchronize a choreographed fire file to music and it only requires FireOne’s UltraFire field software. The software has the capability to fire the display and play the music sound track simultaneously. (For a good overview read *UltraFire Users Guide* page 81-82.)

Using this method the user opens the UltraFire software and selects the fire file for the display. After verifying that fire file is correct the user proceeds to select the correct wav file for the display. (Note: The wav file required here is the original wav file that was used during the choreography process. The wav file in this case does not require a timecode track and

should not be confused with a wav file that has been processed by Time Code Wizard.) After verifying that the wav file is correct the user simply selects the “Fire” button. The computer will output the firing commands to the FireOne Control Panel while simultaneously outputting the music from the computer’s audio output connector. The computer’s audio output is connected to the sound system for the audience to hear. While this method is extremely easy and requires minimal additional equipment it is generally used when the sound system and the firing system are near to each other. The good news is that FireOne’s innate ability to communicate with its field modules over very long control lines, or wirelessly, makes this method practical as the control panel and laptop computer can be located next to the sound system which may be many hundreds of feet from the fireworks and firing modules.

Method #2

This method could be called the “Direct Wiring Method”. This is the first method that requires the user to create a time code track for synchronizing the display. To create a timecode track the user opens FireOne software Time Code Wizard (TCW) and selects the original wav file that was used during the choreography process. Following the Time Code Wizard prompts the user creates a new wav file that contains the music program and the time code track.

As with all methods that require a time code track for synchronization the newly created wav file, created by TCW, is required to be utilized for firing the display. It is important that users understand that there are now two radically different wav files: The original wav file that was used to choreograph the display and the new wav file that contains both music and timecode. The music/timecode wav file should only be used to fire the display when timecode is required. The original, music only, wav file is used only for choreography purposes and when Method #1 Or method #5 is employed; the “NO Timecode Method”. Read this paragraph again as this distinction is important, Knowing the difference will save the user from many headaches!

After the time code wav file is created it is necessary to determine what playback method will be employed. If playback is via a wav file playing device the wav file only needs to be transferred to that playback device. If the wav file is to be played back via a CD player then the wav file must be transferred to a CD. These processes are not performed by a FireOne program but rather by programs or devices designed for this purpose.

When firing the display the music portion (track) of the wav file will be connected, via a cable to the sound system for playback to the audience. The time code track will be connected, via a cable to either of the time code input jacks on the control panel. When the control panel and computer software, if used, (The timecode methods of synchronization do not require the use of a computer or UltraFire software although the software provides features that are not available when using only the control panel.) is properly armed the timecode will automatically start the display at the appropriate time and keep the music and firings in perfect synchronization.

Method #3

This method could be called the “Radio Link Method”. There are number of hardware options available for putting together a data link to wirelessly transmit time code to the firing system. With this method the radio link replaces the hard wired cables in Method #2 above.

One of the most common radio link methods is to use a "Marti" radio link (A Marti radio is a brand name of a professional broadcasters data link, used for radio station live broadcasts.) for the transmit end and then common scanners radio (A Uniden BC125AT Handheld Scanner is suitable receiver that is relatively low cost.) or two way radio for the receive end. The need for the Marti transmitter is that the transmit portion of the radio link must be on at all times. Most two-way radio systems are only designed to transmit momentarily. A suitable transmitter must be obtained that is designed for continuous duty.

You can find Marti at <http://bdcast.com/products/details/remote-pickup-transmitters/srpt-40a>

This unit is a 450 mhz frequency agile transmitter that can transmit fsk time code data over a selected frequency that would be received, at the control panel(s) by an inexpensive scanner receiver or two way radio. This setup, the Marti Transmitter (~\$2600.00) and the scanner receiver (~\$130.00) has a cost of approximately \$2700.00.

The implementation and firing of the display is identical to Method #2 above.

Method #4

This method could be called the “Mobile Phone Method”. The option is to use mobile phones for the link. Yes. . . mobile (cell) phones. All that is required is a low grade data link for FSK timecode. As noted earlier this method is not suitable for SMPTE timecode. To use this option construct a cell phone wiring connection that will provide Time code audio INTO the phone through the microphone jack. On the receiving end the audio must be extracted from the receiving cell phone that is connected to your control panel. This time code audio can be extracted through the cell phone's earphone jack.

There are so many different cell phones and options for these phones that we cannot provide specific information on models and configurations. To use this option we suggest contacting a supplier who will work with you to get the cabling and connections so that you can put audio into the phone at one end and get it back out at the other and 'viola' you will sync up your system.

The implementation and firing of the display is identical to Method #2 above.

Method #5

This method would appropriately be called the TimeMachine method. This is a concept pioneered by FireOne. The TimeMachine is a small hardware device that will receive, send, generate or convert timecode. Connections are standard via wired, wireless or Ethernet. Wired and wireless operation assumes that the control location, in addition to every receive location, will employ a separate TimeMachine. Ethernet operation generally is reserved for fixed installations but could be used in temporary applications if Ethernet connectivity is

available. See the TimeMachine Users Guide for a complete description of the TimeMachine's features and operation.

The TimeMachine would replace all timecode (wired or wireless) components AND eliminate the need to create a timecode track since the TimeMachine generates timecode in real time. Simply connect the TimeMachine timecode output to the control panel's timecode input(s). The implementation and firing of the display would be identical to Method #2 above.

The TimeMachine is an extremely powerful device that can originate timecode AND your music track AND communicate with other TimeMachines AND provide a host of functions all in one compact package. See TimeMachine Users Guide for complete information.

Troubleshooting Communications Problems

For a pyrotechnics firing system to operate correctly it must be able perform a number of tasks quickly and efficiently. The most basic required parameter of any system is its ability to communicate. When a system fails to properly communicate many, if not all functions, cease.

FireOne's Digital Firing System provide 2-way communications via a robust proprietary data link that is provided over cost effective two wire 18 gauge stranded cable. In North America this cable is commonly known as speaker wire, lamp cord or "zip" cord. In European countries it is termed 2 core, 1sq mm cable. This cable is easily available at most home supply centers, hardware stores or home lighting supply stores. This cable was chosen for the system due to its universal availability and low cost. Typically this cable cost is 5 to 10% of the wiring required for other firing systems.

The FireOne System communicates and powers associated equipment via the 2-Wire cable by utilizing a balanced-line data link. The balanced-line feature provides robust communication that is significantly immune from potential interfering signals, electrical impulses, noise and out-of-band signals. Additionally, internal electronic circuitry provides filtering of undesirable signals. The result is an extremely reliable system that communicates in 99.99% of all environments. For fixed installations or operation in physically congested areas where high power radios signals (High power radio signal are typical on high-rise building that employ radio antennas for communication.) or large diameter, high voltage, power cables may be encountered it is advisable to use shielded 2 conductor cable. This will eliminate any potential communications interference.

These instruction are to help the user understand those unique situations where the communications system may be compromised and therefore not communicate properly.

Normal communications tests are performed one of three ways.

- The most basic communications test is to push the module selection buttons on the control panel. To test module #1 (This assumes that module #1 is wired to the control panel.) push the module #1 button. This sends a communications test to module #1. Module #1 will reply to the control panel and the LCD display will indicate "Response" if the communications test is successful. (If there are any e-matches attached to the

module they will be indicated by green LEDs in the Cue Selection area.) A “No Resp” indicates that the module did not respond.

- This same test can be accomplished with FireOne Field software. Once the computer is attached to the control panel the “comms” can be run to ascertain the module replies.
- The third and most useful way to troubleshoot communications faults is to use the Communications tester in the software. The “Communications Tester” may be accessed in the “Tools” menu under the title “Communications Tester”. The Comms Tester is a fully automatic tester that will continuously run comms tests until the user stops it from running. This is an effective method to find communications faults and to ascertain the overall reliability of the system. This tester is particularly valuable for wireless system testing when looking for potential interference issues.

Recognizing communications as opposed to equipment faults:

One must recognize the difference between communication problems and equipment faults. Communications errors are typically incoherent, seemingly random, “moving target” type of failures. An example would be that module #2 and 8 failed in the first test and 2 and 12 failed on the second test. Further testing might indicate that 2 and 8 were once again failing to communicate. This indicates that the problem is possibly a communications fault. (Typically, a hardware fault does not change over a short period of time.)

To troubleshoot this further the user would substitute known good modules for the ones that are failing. This means that modules #2, 8 and 12 would be replaced. Repeating the original tests with the new modules will indicate if the communications fault has been cured. This troubleshooting procedure is straight forward and provides results that indicate whether the fault is hardware oriented or communications oriented.

Curing Communication Faults

The common communications faults that have occurred over the years can be categorized into four groups.

Ground Loops

The most common communications problem a user will experience is caused by inadvertently connecting the control panel to multiple electrical grounds. This is termed a ground loop.

Any control system that can accommodate multiple input sources is prone to errant grounding issues; commonly referred to as “ground loops”. With control systems such as FireOne’s distributed control system a “ground loop” manifests itself as a sudden lack of communications.

Ground loops occur when one piece of equipment is connected to an electrical ground in more than one location. This is not as complicated as it sounds. The premise is simple. When you connect any piece of electrical equipment to a power source; when you plug it into the wall outlet, you are grounding the equipment. Therefore, when you plug the control panel into a power source you have also connected it to an electrical ground. This is the first ground connection.

Next you may connect your computer to the control panel. This action also electrically connects the control panel to the computer. If the computer is plugged into a power source

the computer is grounded. Therefore the control panel is now grounded a two locations: the ac cord from the control panel is one ground source and the computer power cable is the second ground source. This constitutes a ground loop.

Next you may connect the time code cable into the control panel. The time code cable is connected to an audio source. This source may be a radio receiver, a CD player, a computer, an audio board, or large sound system. If any of these items are connected to an ac power source it is grounded. Therefore the control panel is now grounded a three locations: the ac cord from the control panel is one ground source and the computer power cable is the second ground source and the time code cable is the third ground. This constitutes a ground loop.

To avoid ground loops first test the system with no external inputs such as AC power, Time Code cables, etc. The equipment can be powered by the internal battery of the control panel. Test the system for proper operation. After proper operation is established apply the required connection as needed. As each item is connected it is important to establish that the system is operating properly. If one of the added connections disrupts communications a potential ground loop has occurred. In simple terms this indicates that the attached device has created a new ground source for the system. This “accidental” ground must be located and eliminated. An effective device for eliminating undesirable grounds is a device called a ground lifter.

www.filmtools.com/griadco41.html

A source for more information on ground loops can be found at <http://www.epanorama.net/documents/groundloop/groundlift.html>

Unbalanced Communications Lines

If the comms lines are inadvertently unbalanced the communications will become noisy and thereby susceptible to errors. The cure is to find the location where the system comms lines (2-Wire terminals or a splice in the wire?) are grounded or touching “something”. In rare cases it is possible for the grounding to occur because the modules are simply sitting on a large piece of metal that is connected the ground. This could be a large areas or stadium. If you suspect this is occurring the cure is to put an insulator between the module and the metal that it is sitting on.

High Power Signals

If the modules are located in an area where high power radio signals are present such as near a large high power television or radio station the communications system can be overwhelmed by the sheer power of the transmitters and thereby not work.

This is a rare situation but it can be found in large cities on the roof tops of buildings. When you find yourself in this situation generally cell phone and two-way radios will not work. The cure working around high power transmitters is to move the system away from the transmitting signals.

Inducted Power

The last case is high power cabling. This is commonly found at large stage shows or stadium events when high power sound systems or lighting systems are used. These high power

cables are typically ¾” to 1” in diameter and are designed to handle hundreds and amperes of current. These high power cables can inductively induce noise into communication cables and cause communications to be erratic.

The cure is to not run any of FireOne’s 2-Wire lines in parallel with this type of cable for any distance. The only way to cope with this situation is to stay away. If there is a cable raceway that houses these cables do not put your wires in it. If it is necessary to cross over these wires cross over then at 90 degree angles only.

In those cases where you absolutely have to work with high power radio transmitters or high power cables the cure is to use shielded cable in place of the normal 2-Wire cable. Shielded cable has a shield or foil that completely covers the two conductors of the communications lines to help “shield” the communications wires from the induced power and noise.

When employing this wiring scheme it is important to maintain the continuity of the shield when jumping from module to module. It is vitally important that the shield conductor is grounded at one end to the wiring only. Typically the grounding is accomplished at the control panel end. When the shield wire is spliced together (typically at a firing module.) the shield wire should not touch anything else. With this precaution the shield will only be grounded at or near the control panel resulting in maximum shielding and protection from noise.