



Pyrodigital®™ Consultants, Inc. - Infinity Visions, Inc.

Pyrphoros System

ITU Region 1: Europe, Russia and Middle East

Pyrodigital®™ Consultants, Inc. Officially Certified Product

User Manual

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User Manual

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1 Abstract

The Pyrodigital RF Firing Unit is a radio-controlled unit to fire electrical igniters for fireworks.

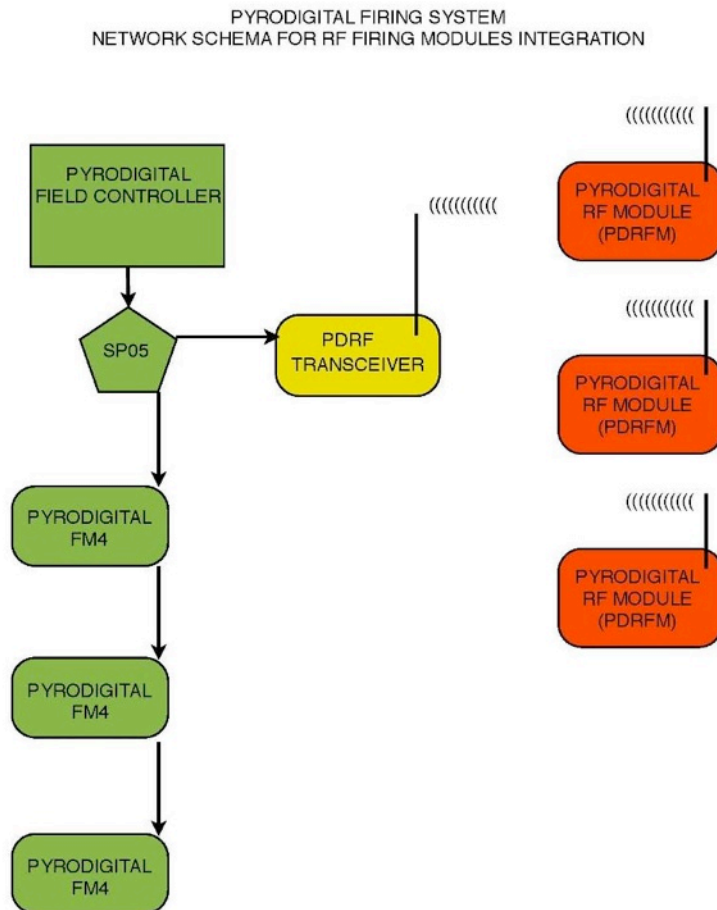
It features 16 terminal blocks to attach igniters. A Pyrodigital RF Field Controller or the Pyrodigital FC-3 Field Controller combined with a PD RF Transceiver is used to control the Firing Unit(s).

The Pyrodigital RF Firing Unit is especially rugged designed for safe outdoor operation.

However, still keep in mind that it is electronic equipment and therefore handle the units with appropriate care.

Pyrodigital Consultants Inc. / Infinity Visions, Inc. do not take any responsibility due to malfunction of their products and thereof caused damage or loss.

User is responsible for operation the system in ITU Region 1: Europe, Russia, and Middle East, or obtaining authorizations in Regions 2 and 3, as required.



2 System Overview

2.1 System Setup

The Pyrodigital RF System consists of one PD FC-3 Field Controller connected to a PD RF Transceiver unit that acts as a master and multiple Firing Units which act as slaves. The PD FC-3 Field Controller and the PD RF Transceiver are located in close proximity to each other for full operator control.

Each Firing Unit has to be located within an optimal radius of 500 meters around the PD RF Transceiver. The system has fired up to 800+ meters, but the range is reduced, if they are not in line of sight (inter-visibility) between the Transceiver and the Firing Unit(s).

During the setup of the system, the Transceiver is constantly scanning each Firing Unit and reading back the occupied state of its terminal blocks as well as the field strength received.

During the fireworks display, the Field Controller sends the firing commands through the PD RF Transceiver to each Firing Unit in real-time.

2.2 Operating States

The Pyrodigital RF System identifies three operating states: SAFE, ARMED and FIRE. The state of the system is shown on the display of each Firing Unit.

SAFE

The Firing Unit is automatically set into SAFE state when powered on. In the SAFE state, the capacitors, which accumulate energy to fire off the igniters, are empty. Also any firing command will simply be ignored. This double security concept protects against any firing by accidental errors in the operation.

While in SAFE state, the operator is allowed to be near by the Terminal and handle the igniters.

ARMED

In ARMED state, any firing command will still be ignored. However, the capacitors, which accumulate energy to fire off the igniters, are now charged. As soon as the system is in ARMED state, any operator shall move to a safe place for security reasons.

FIRE

In FIRE state, the capacitors, which accumulate energy to fire off the igniters, are charged now and any received fire command will be executed. While in FIRE state, any operator **MUST** be in a safe position.

NOTE:

While using the check function with the aerial in low position, the Firing Unit is in the SAFE state. In addition, the radio receiver is internally switched off and therefore no commands can be received. This will prevent the Firing Unit from changing into ARMED state, even if demanded by the Transceiver, and therefore enhance the security of the operator.

NOTE:

Changing from SAFE to ARMED state means, that the capacitors, which accumulate energy to fire off the igniters, have to get charged. The capacitors need a few minutes to charge. This gives anyone enough time to reach a safe place before any ignition possibly can take place.

2.3 Operating with the Pyrodigital Field Controller

The Pyrodigital Field Controller is the controller for the Pyrodigital RF wireless Firing Units.

In this case, the PD RF Transceiver is the interface between the wire-based Pyrodigital Field Controller and the radio communication of the Pyrodigital RF System.

The Pyrodigital RF Transceiver for the radio communication is connected to the Pyrodigital Field Controller like a Pyrodigital Firing Module.

Consequently all wireless Pyrodigital RF Firing Units act like wired Firing Modules to the Pyrodigital Field Controller. A mix of wired Pyrodigital Firing Modules and wireless Pyrodigital RF Firing Units in combination with the Pyrodigital Field Controller is possible.

During the system setup, the Transceiver display shows a character map referring to all Firing Units found and indicating their field strength received. You are now able to check with the Pyrodigital Field Controller the conventionally connected wired igniters as well as the wireless linked igniters.

2.4 Changing the operating state with the Pyrodigital Field Controller

SAFE

The Transceiver is operated in the setup mode, which also sets the system in SAFE state. During the setup of the display AND after the display, the Transceiver MUST always be operated in the setup mode.

During setup mode, it is allowed to turn the Pyrodigital Field Controller key on, to carry out the igniter check.

ARMED

To enter ARMED state, set the Transceiver into armed mode. This mode is prevented to be entered unintentionally.

During ARMED state, you MUST NOT perform any igniter check and do not turn the Pyrodigital Field Controller key on!

FIRE

To set the system into FIRE state, turn the Pyrodigital Field Controller key on while the Transceiver is in armed mode.

3 Getting started

To setup a display the following procedure has to take place:

3.1 Wiring

Connect the igniters to the Firing Units and set the appropriate addresses. Replace batteries if required. Leave the aerial in the low position at this stage. If all Firing Units are wired at site, turn the Firing Units on by bringing the aerial of each Terminal to the upright position.

3.2 System check

If all firing sites are ready, turn on the Field Controller and set it into the setup mode. Give the system some time to wake up all the Firing Units and collect its information. If some Firing Units do not show up, check if they are turned on (aerial in upright Position) and that there is no request to change its batteries. If the display shows no or a low field strength (below 40%), make sure that they are in line of sight (inter-visibility). To enhance communication you might bring the Firing Unit in a position several feet above ground. Make sure no wires are placed close to the aerial.

3.3 Prior to the show

Turn on the Field Controller and set it into ARMED state about 15 minutes prior to the display. The Firing Units will now again be woken up and start charging their capacitors. After about 10 minutes, the capacitors are charged to fire off the igniters. Remain in ARMED state until the display actually starts, since in ARMED state there is a higher security level as compared to the FIRE state.

NOTE:

Do not change back to SAFE state if not necessary. For security reasons, in SAFE state the capacitors will be discharged immediately. After switching back to SAFE state you will have to remain for at least 10 minutes in ARMED or FIRE state again, before being able to fire off any igniter.

3.4 When the show starts

Shortly before the display starts change into FIRE state. Any fire command will now be executed and fire off the corresponding igniter.

3.5 After the show

Set the Transceiver back to SAFE state after the display. All capacitors will immediately be discharged and therefore it is ensured that no igniter will be fired off unintentionally.

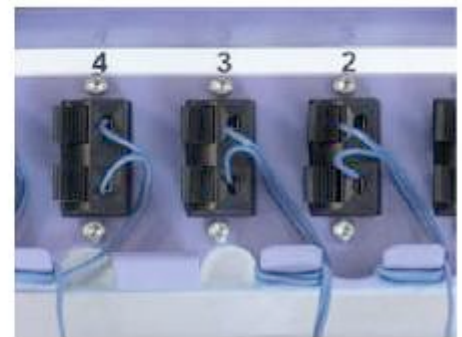
4 Pyrodigital RF Firing Unit

4.1 Terminal blocks

The 16 terminal blocks (8 terminals on each side) of the Firing Unit are located in a protected position right underneath the wings.



After attaching an igniter, wind its cable twice around the corresponding bar



4.2 Igniter Check

Press any button on either side of the Firing Unit to set it into the check state. Now the display powers up and each connected igniter is indicated.

The Firing Unit does measure the electrical resistance of each igniter. An igniter resistance between about 1 ohm and 25 ohms is accepted, shown on the display and reported back to the Field Controller. In case of a result of less than about 1 ohm the system assumes a short and above 25 ohms, it assumes that there is nothing connected. The short is also shown on the display with a circle and a bar in the centre.

4.3 Address setting

Press any button on either side of the Firing Unit to set it into check state. Now the display powers up and the currently set terminal block address is shown in big letters in the central area of the display. Press the button in the same corner where the up/down arrows are shown in the display. The Display shows up and down arrows now to indicate that the address can be changed with the corresponding buttons in small and big steps.

**IMPORTANT:**

The initially pressed button at the up/down position has to be held to change the address. This ensures that no address will be changed by mistake!

4.4 Power On

Lift up the aerial to power on the Firing Unit. The Unit is now ready to operate within the Pyrodigital RF System. Igniter state and address as well as SAFE state and field strength received are shown. If the Transceiver is within reach the quality of the radio connection can be verified. If no data is received, the Firing Unit switches to standby mode and shows "standby" in the display.

4.5 Battery management

The Firing Unit contains two battery sets to achieve a full redundancy to battery failure. The Terminal always runs on the older set and keeps the new set as a spare. If the old battery set is empty, the Unit automatically switches to the new set and the request for replacement is shown on the display. After replacing the batteries, the user has to confirm the replacement.

4.6 Battery replacement

To replace the batteries, the bottom cover has to be removed. Press hard in the corners of the cover and slide it to the side.

Replace the battery set as shown in the display. After changing the batteries, confirm the replacement.

Depending on the quality of the batteries their lifetime may vary. It is recommended changing the batteries after operating 75h, or and standby 400h per battery set.

5.0 Communication Quality and Safety

The Communication System of all PD-Pyrphoros components is protected from external interferences by the following means:

Redundant Communication

During the System installation, the control unit defines two interference-free frequencies, which are subsequent constantly used to transmit the signals. In case of frequency interferences, the firing units automatically switch to the second frequency. To achieve an optimal transmission the controlling unit is equipped with two antennas.

Frequency ranges

Frequency ranges can be chosen to set clear limitations towards other transmitting systems. As agreed, the operators can use completely different frequency ranges. To guarantee the immunity and the interference-free operation of the system, do not choose adjacent ranges. If there is no agreement possible, the controlling unit automatically defines a free frequency range, for used frequency ranges are identified as faulty. Though it is possible, the system chooses adjacent ranges.

System identification

The system connection of each PD-Pyrphoros component is defined by personal system identification.

Operating distance

Under standard conditions and in line of sight the operating distance of the PD-Pyrphoros systems is in the range of 500 meters.

With absolutely perfect conditions, an operating distance up to 1000 meters is possible. On the other side, with bad conditions the operating distance can be reduced to 200 meters.

The following factors can influence the operating distance:

Line of sight, weather conditions, interferences, using adjacent frequency ranges.

Please note the PD-Pyrphoros system is designed as a wireless firing system, which allows for example to place fireworks on both sides of the river. To overcome very long distances is not the mean target of the system development.

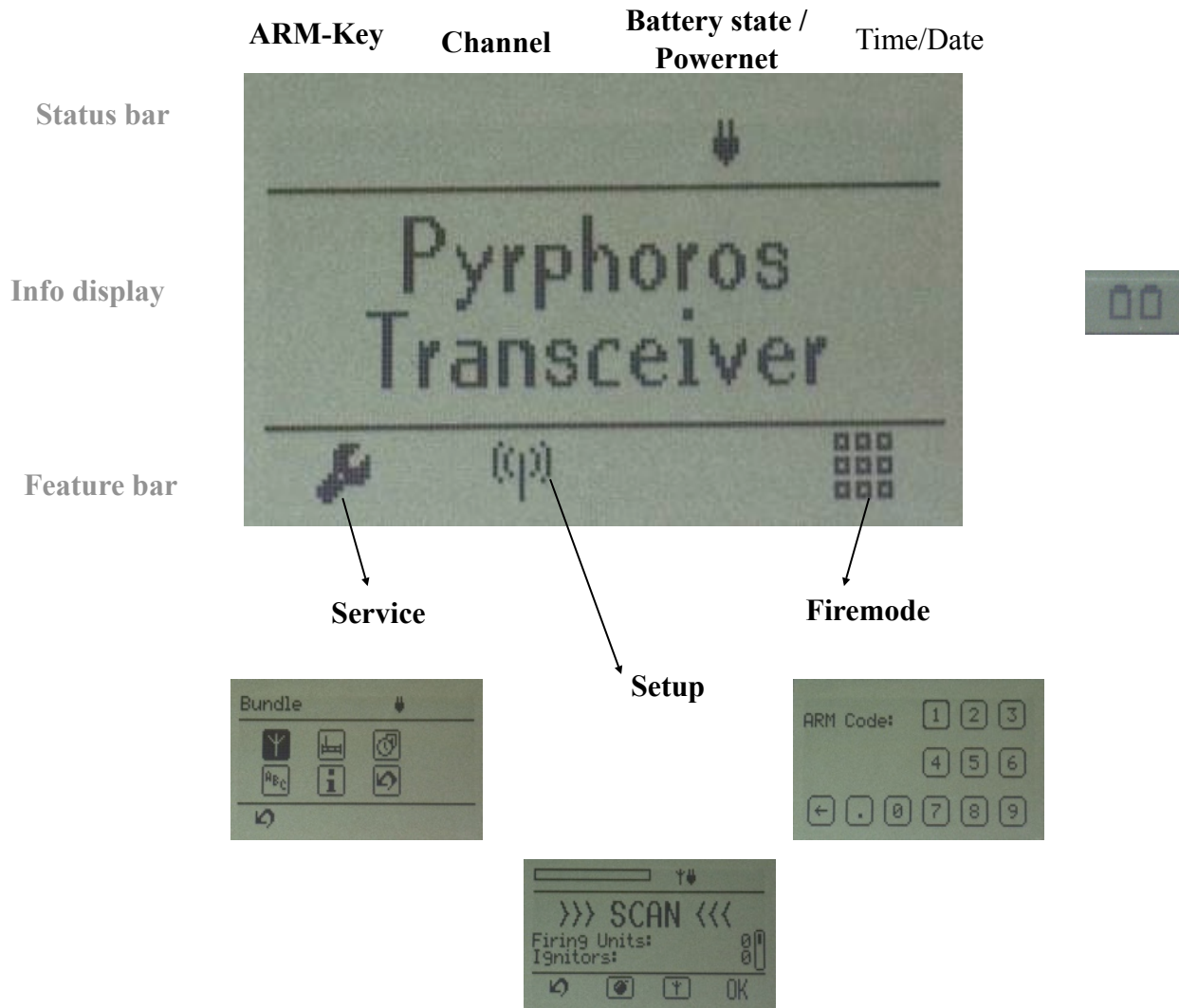
6.0 Technical Data

Pyrodigital RF Transceiver Europe and Pyrodigital RF Firing Unit Europe

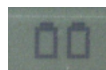
	Transceiver Europe	Firing Unit Europe
RF		
Frequency	434MHz ISM Band	
Power	10mW	
Sensitivity	-111dB	
Modulation	GFSK	
Protocol	Proprietary	
Interface		
Type	Pyrodigital Firing Module Bus	
Connector	Dsub-9 female	
Ignition		
Circuits	16	
Voltage	25V	
Energy	300mJ	
Supply		
Voltage	6V	4.5V
Battery	Rechargeable NiMH Package, 2 x	Alkaline LR6 (AA-size), 2 x 3 pcs.
Battery lifetime	~ 25h per Package	operating: 100h; standby: 500h per battery set (3 pcs.)
Mechanical		
Dimensions	160mm x 252mm x 65mm	270mm x 190mm x 98mm
Weight	2kg incl. Batteries	2kg incl. Batteries
Surface	Stainless steel / PE-HD	
Temperature		
Operating	- 20°C - + 50°C	
Storage	- 30°C - + 60°C	
Display	Graphical LCD Display with backlight	
Colors	Stainless steel grey , different shades grey and black	

1 Pyrphoros Transceiver

To power on the transceiver lift up any aerial
Operate by touchscreen and keyboard



Battery state

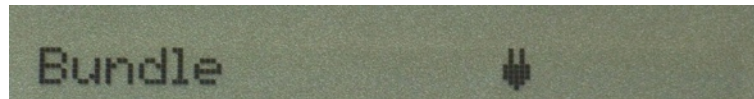


One bar graph for each battery. Empty bar mean empty battery.

Feature: Service

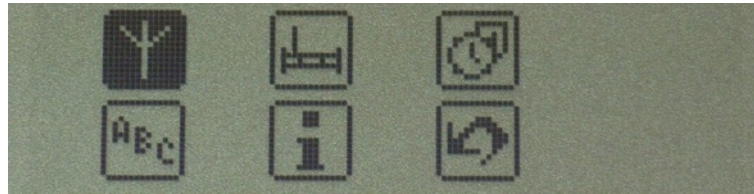
Operate by touch screen, keyboard or jog wheel

Status bar



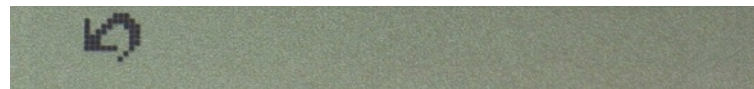
Info display

Radiofrequency **FU Parameter** **Date / Time**
change bundle change last address change time and date

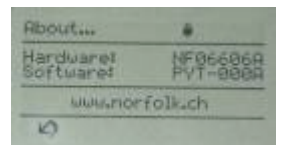
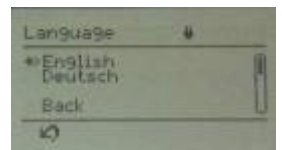
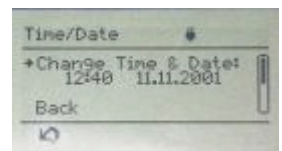
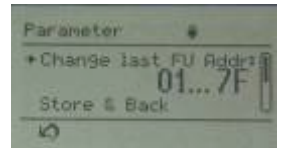
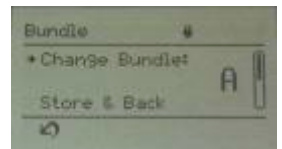


Language **About** **Back**
change display language Systeminform

Feature bar



Back

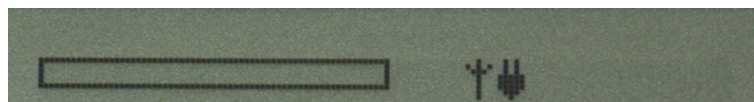


Feature: Setup

Operate by touchscreen or keyboard

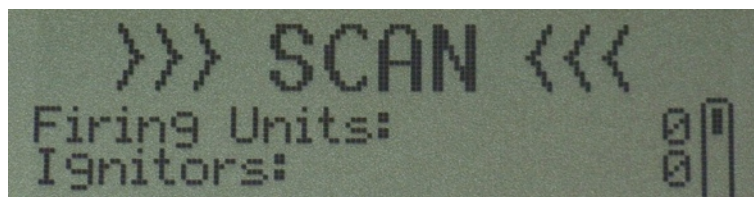
FU Progressbar
Number and field strength

Status bar

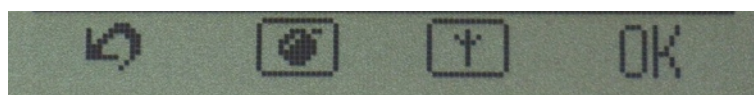


Info bar

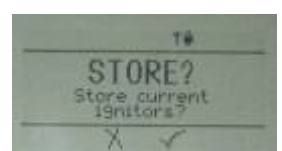
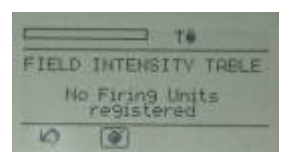
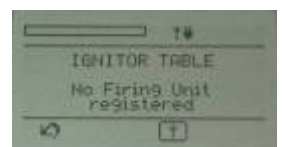
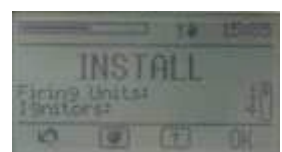
Info display



Feature bar



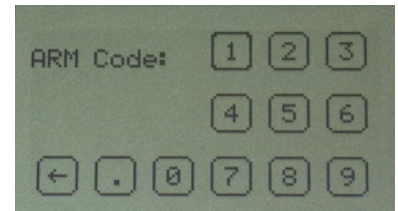
Back **Ignitor Table** **Field Intensity** **OK**
Table and store?



Feature: Arm- and Firemode

Enter ARM code by using the touchscreen

← Back

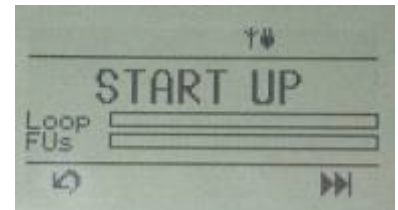


Start up:

Loop progress bar and FU progress bar:

All FU's and ignitors as accepted during the Setup are scanned.

A full bar indicates, that all FU's are found.



Back

Next step

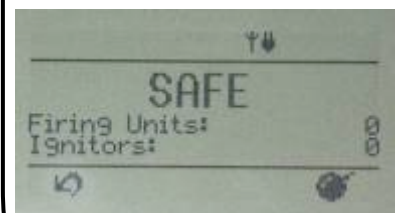
Start up:

Ignitor Table: Indicates all ignitors found

Field Intensity Table: Indicates field strength received

If you are ok with the result, although it does not match the setup, you can go on with arming

only shown if the start up shows differences



Back

Arming

Safe:

You can safe the system despite the differences to the setup.

If you want to change something, you have to go back and restart the setup

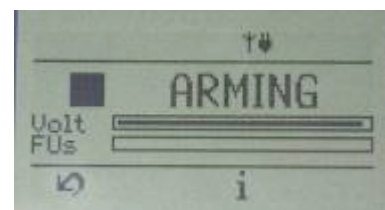
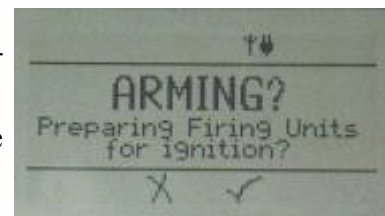
Arming

The Firing Units will be woken up and start charging their capacitors.

After about 10 minutes, the capacitors are charged to fire off the igniters.

During the Arming this LED display shows the state of arming:

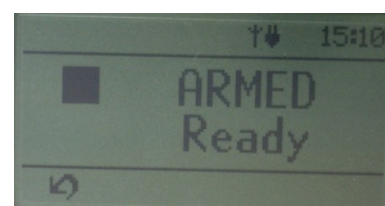
- fast blinking > still arming
- slow blinking > armed
- continuous glow > firemode



Arming

Volts progress bar

FU progress bar



PD Controller Key

Fire

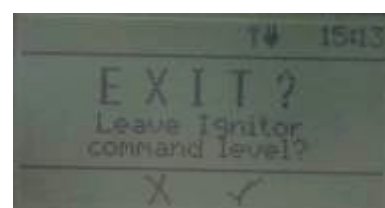
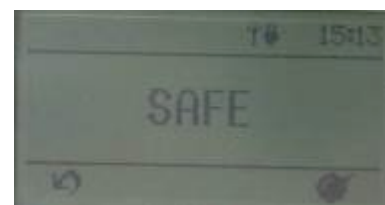
To set the system into FIRE state, turn the Pyrodigital Controller key on while the Transceiver is in armed mode.

During the show the info display indicates each last FU and ignitor fired off.

After the display / quit the Firemode

Turn off the Pyrodigital controller Key and set the Transceiver back to SAFE state.

All capacitors will immediately be discharged and therefore it is ensured that no igniter will be fired off unintentionally.



Technical Data

	Pyrphoros Transceiver Europe	Pyrphoros Firing Unit Europe
RF		
Frequency	434MHz ISM Band	
Power	10mW	
Sensitivity	-111dB	
Modulation	GFSK	
Protocol	Proprietary	
Interface		
Type	Pyrodigital Firing Module Bus	
Connector	Dsub-9 female	
Ignition		
Circuits		16
Voltage		25V
Energy		300mJ
Supply		
Voltage	6V	4.5V
Battery	Rechargeable NiMH Package, 2 x	Alkaline LR6 (AA-size), 2 x 3 pcs.
Battery lifetime	~ 25h per Package	operating: 75h; standby: 400h per battery set (3 pcs.)
Mechanical		
Dimensions	160mm x 252mm x 65mm	270mm x 190mm x 98mm
Weight	2kg incl. Batteries	2kg incl. Batteries
Surface	Stainless steel / PE-HD	
Temperature		
Operating	- 20°C - + 50°C	
Storage	- 30°C - + 60°C	
Display	Graphical LCD Display with backlight	
Colors	stainless steel grey, black	