SYSTEM FIREMASTER III

"Millennium"

RADIO-CONTROLLED SYSTEM FOR REMOTE SHOOTING OF PYROTECHNIC SHOWS

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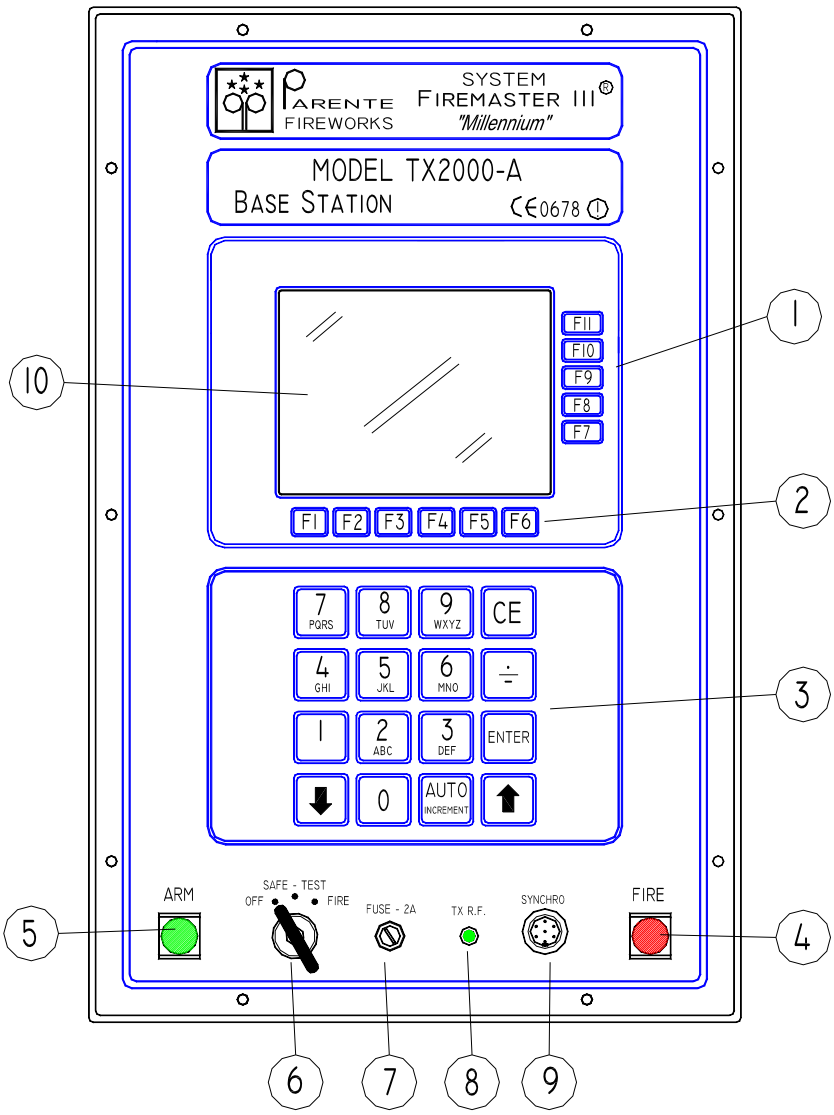
1. COMMAND UNIT MODEL TX 2000 - A

BASE STATION MODEL TX2000 - A

1.1 FRONT-PANEL DIAGRAM



1.2 ***Front-panel commands description***

1. ***FUNCTION Keys* F7 - F11 -** the specific function of these keys varies with the mask actually displayed on the screen and it is described by means of a specific graphic icon placed near the key.

2. ***FUNCTION Keys* F1 - F6 -** the specific function of these keys varies with the mask actually displayed on the screen and it is described by means of a specific graphic icon placed near the key.

3. **Numeric keypad:** it allows the entry and modification of the numeric parameters inside the functions**.**

4. **FIRE Pushbutton** – When pressed **together with** the ARM key, starts immediately the firing of all lines with the sequence number actually displayed. ARM and FIRE buttons, if **pressed alone**, **have NO EFFECT**. When a sequence has been fired, in order to step to the next one (or to allow the auto-increment function to do it automatically), it will be necessary to **release BOTH buttons**.

5. **ARM Pushbutton** – When pressed, the system (if the selector key is on the FIRE position), is ARMED and ready to fire.

6. **Selector Key:** 3-position switch with safety key

   - **OFF** – system switched OFF

   - **SAFE** – safe operation position: in this mode it will be possible to test the lines of all field units and to check/modify the sequences programming WITHOUT ANY RISK TO activate a FIRE condition.

   - **FIRE** – firing position: in this mode the show parameters cannot be changed anymore, but it will be only possible to address the needed sequence and to FIRE it.

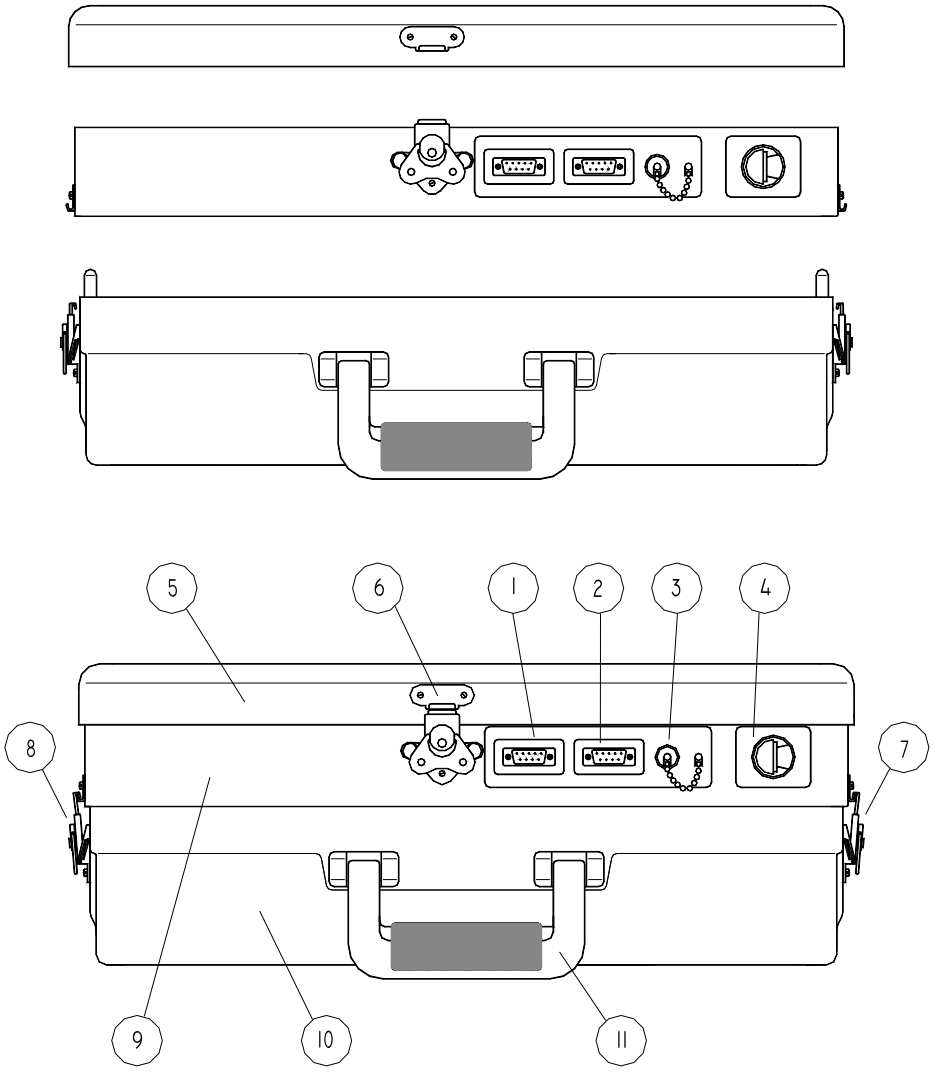
7. **Main fuse**: fast-blow type 2A, 250V, 5x20mm

8. **R.F. Carrier indicator**. When this LED turns ON, the radio transmitter is ACTIVE and sending a message to the remote units.

9. **7-pole connector to connect to the external system of sound reproduction (for *pyromusical* shows).** The signals at this connector are: ARM and FIRE keys contacts, the AUDIO synchronism tone output (to be recorded on the musical base) and the AUDIO input to decode the synchronism signals during the show. ***In order to use the music synchronism system, the INTERNAL OPTIONAL MODULE must be installed.***

10. **LCD graphic screen** with back-lighting. B/W type, high graphic resolution (320x240 pixels -1/4 VGA).

1.2.1 ***Instrument and connectors description***



1. **RS-232 standard SERIAL Port**. Male DB-9 connector. This port is used to connect the TX2000 module to a PC. For the connection DO NOT USE a COMMERCIAL RS-232 cable, but the ones supplied with the system. In detail:

- For all the *download* and *upload* functions of pyrotechnic show data already generated on a PC with EXTERNAL SOFTWARE (e.g.: PyroMotion, FIREONE, etc.), one must use a cable provided of 3 wires only (TX, RX and GND - pin 2,3,5)

- Only to *download* eventual **program updates, patches and custom-made releases** supplied directly by Parente Fireworks, use the RED marked cable (for this function detailed instructions will be supplied for any specific case)

2. **RS-485 standard SERIAL Port.** Female DB-9 connector. This port is used to connect the base Unit TX2000 to the Remote Units RX24-B when a CABLE CONNECTION is required in place of the standard RADIO link (or to implement a mixed-type connection: CABLE+RADIO). The connection wiring requires TWO WIRES ONLY (pins 1-2-6 and 4-5-9). Third wire (common) connection to the pins 3-7-8 IS OPTIONAL.

3. **R.F. OUTPUT - BNC connector. O**utput for test purposes only. It is coupled with a 1pF capacitor and allows to monitor the output R.F. signal with an oscilloscope or a frequency counter.

4. **Main Antenna. Turret for the attachment of the whip antenna supplied with the instrument.** The antenna resonates at λ/4 on 40,675MHz. NOTE: use the original antenna only.

5. **Protection Cover.** During the field use can be completely removed sliding out the hinges from the receptacles.

6. **Butterfly-type lock to fasten the top cover.**

7. **Butterfly-type lock to fasten the TX2000 Unit to the Battery Pack(10).**

8. **Butterfly-type lock to fasten the TX2000 Unit to the Battery Pack(10).** Make sure the locks (7) and (8) are ALWAYS perfectly fastened and blocked both during the use and transport!

9. **TX2000 Base Unit.** This detachable section contains: tall electronic circuits, the radio communication system, the keyboard and the graphic LCD screen.

10. **Battery Pack.** This detachable section contains: the batteries for the system supply, the batteries for the fire lines supply (used only if the battery pack is connected to a RX24-B Unit), the microcontroller system for the battery charging management and the mains supply. NOTE: the battery packs are similar each other and can be interchanged without limitations between the RX24-B units and between the TX-2000 Base Units .

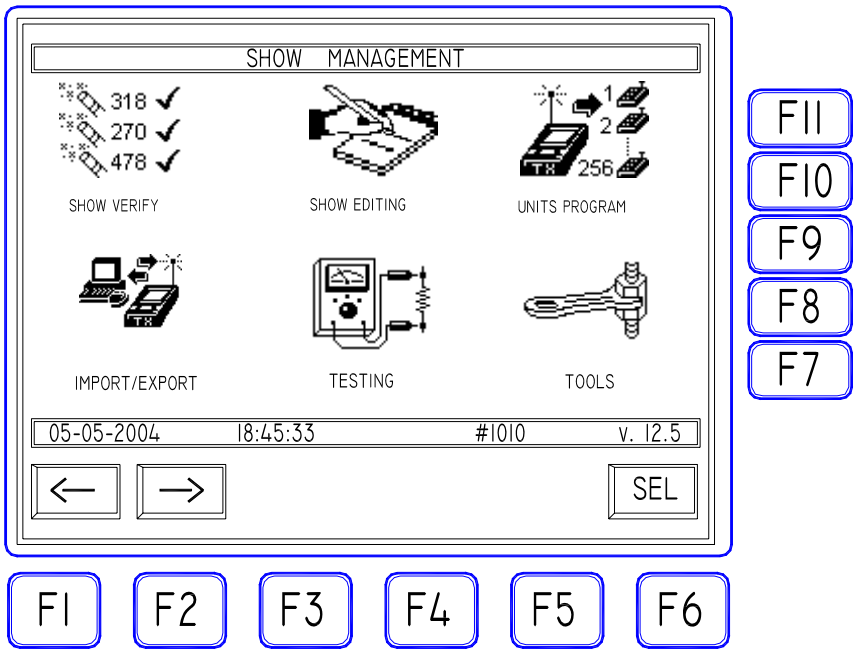
11. **Carrying handle.**

1.3 *Operation*

1.4 Base Station TX2000 usage procedure

- Turn the key selector on **SAFE** position: the display light will turn on and the graphic logo "FIREMASTER III PLUS" will appear. The logo will remain 10 seconds and the main menu mask will be automatically displayed. Pressing any key before the 10 seconds period is elapsed, the main menu mask will be immediately displayed.

NOTE the display back lighting is timed and automatically turns off after 30 seconds. Pressing any key it will turn on again immediately



The MAIN MENU mask SHOW MANAGEMENT contains 6 icons for every operation mode:

The selection of the proper icon is made with F1 and F2 keys: the six icons will be evidenced in sequence. The F6 "SEL" key "opens" the highlighted icon. Inside this mask, all other keys are INACTIVE.

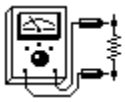
1.5 *"SHOW MANAGEMENT" Mask description*

"SHOW VERIFY" Icon. It can be used only if one is operating using a show created externally on a PC and already loaded on the TX2000 Base Unit memory. It allows to carry out in a completely automatic mode the query of all remote units active on the field and to perform a complete verify of the data inside each Unit with the data of the whole show stored inside the TX2000 Base Unit. All data discrepancies will be reported in order to allow a fast and effective correcting action.

- **"SHOW EDITING" Icon.** It can be used only if one is operating using a show created externally on a PC and already loaded on the TX2000 Base Unit memory. It allows to manually modify the parameters of the internally-stored show.

- **"UNITS PROGRAM" Icon.** It can be used only if one is operating using a show created externally on a PC and already loaded on the TX2000 Base Unit memory. It allows to transfer a program (a show) from the Base Unit memory to the remote units on field. The remote units will be automatically "called" in sequence and the base Unit will provide to download for each unit the needed programming parameters. Should any unit fail to reply, the "*download*" process will be halted and an error message will be displayed.

- **"IMPORT/EXPORT" Icon.** It can be used only if one is operating using a show created externally on a PC. It allows to transfer the show data created on an external PC to the memory of the Base Unit TX2000 and *vice-versa*. For all data transfers the serial port RS-232 will be used.



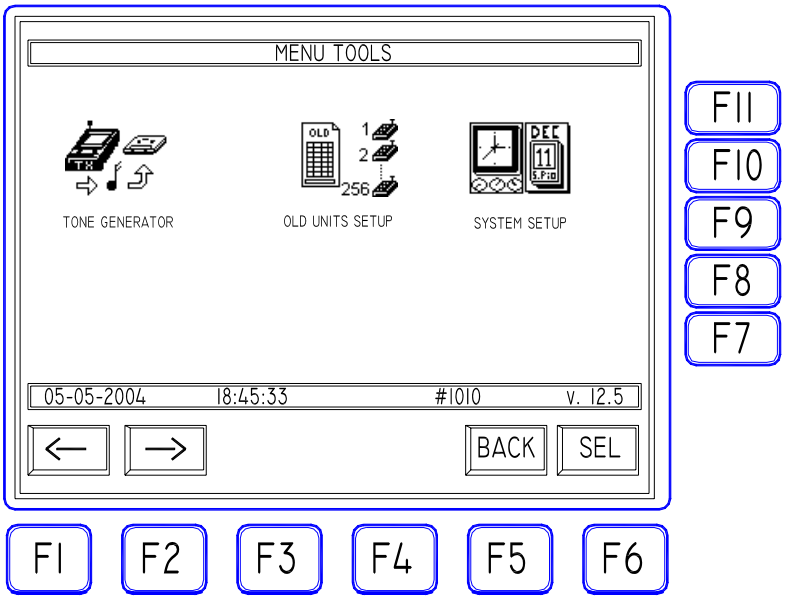
- **"TESTING" Icon.** This icon allows access to the most important functions of the FIREMASTER III SYSTEM. By means of these functions the shooter can verify, modify and program all the remote units creating a complete show on the field or at the company. Unlike a show created on a PC and loaded on the base Unit TX2000 (it remains permanently stored in memory), all data loaded "manually" on the RX24-B remote units with these functions, will remain stored on the memory of each remote unit only. It will be then impossible any automatic function of verify of the whole show. The verify must be performed "manually" unit by unit, checking the returned data with a paper copy of the show program.

- **"TOOLS" Icon.** It gives access to the "auxiliary" functions of the FIREMASTER SYSTEM such as: real time clock and calendar setting, data transmission mode (CABLE or RADIO), mark up of the "old units" (FIREMASTER II) units in order to obtain the full compatibility with existing units of the previous generation, management of the music synchronization system (tone generation).

- The lower data bar (always present in all masks) shows the following data: time, date, the internal system battery voltage and the ***user's code (user's #)***. The "user's #" is the **system owner** personal code number (4 digits). Every user has a different code, generated at the moment of the first purchase of the System. This code must match with the corresponding one on all Remote Units. This prevents the risk of cross-interference when two or more **FIREMASTER SYSTEMS are used at the same time by** different companies on the same site. **The personal code also protects against any malicious competitor that, using his TX2000 Unit, could try to intentionally interfere with the regular show execution.**

1.6 ***"TOOLS" Mask***

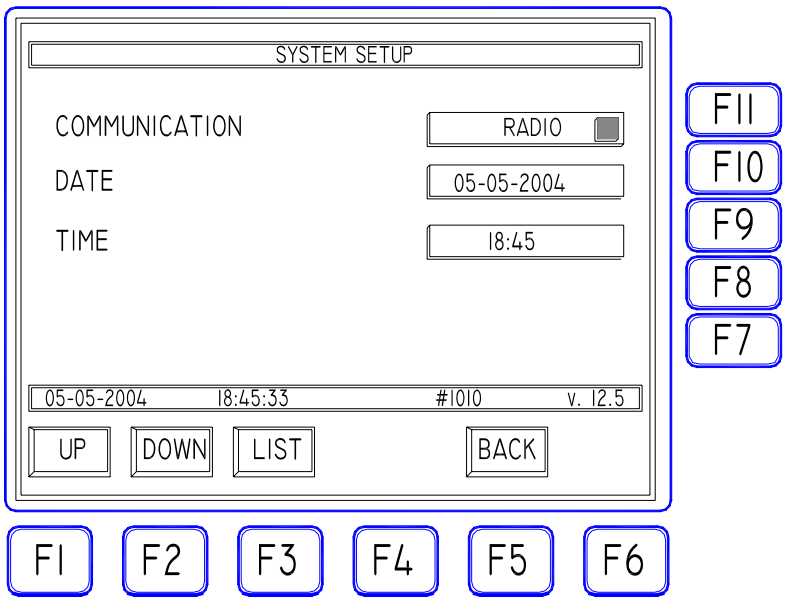
Selecting this icon, the sub-menu of the auxiliary functions and system setup is accessed.



The Icon selection is made by means of the F1 and F2 keys allowing to highlight in sequence the three available icons. with F6 "SEL" key the selected icon will be activated. With F5 "BACK" key the main menu is selected again. Inside this mask all other function keys are disabled.

1.7 *"SYSTEM SETUP" Icon*

Selecting this icon the following three functions can be accessed:
- Real-time clock setup
- Date setup
- Transmission mode setup



REAL-TIME CLOCK SETUP: with "UP" and "DOWN" keys (F1 and F2), select the "TIME" bar. Type on the keyboard the new value for TIME (format **hh .mm**) and press ENTER. The TIME will be immediately updated to the new value. Seconds will be put to **00** automatically.

DATE SETUP: with "UP" and "DOWN" keys (F1 and F2), select the "DATE" bar. Type on the keyboard the new value for DATE (format **dd.mm.yyyy)** and press **ENTER.** The **DATE** will be immediately updated with new values.

TRANSMISSION MODE SELECTION: with "UP" and "DOWN" keys (F1 and F2), select the "COMMUNICATION" bar, press the "LIST" key (F3) to open the pop-down showing the two possible options "RADIO" or "CABLE". Select with "UP" and "DOWN" keys the needed mode and confirm using ENTER. The "BACK" key allows to exit the mask returning to the previous menu.
***"RADIO"* MODE:** only the data relative to the FIRE COMMANDS will be sent to the remote units both by radio link and cable (using the RS-485 port). The operator is thus allowed to use a "mixed" link mode connecting by cable the units that, due to critical conditions of radio propagation, shouldn't receive correctly the radio signals. The

remaining units NOT connected by cable, will continue to operate using the RADIO link.

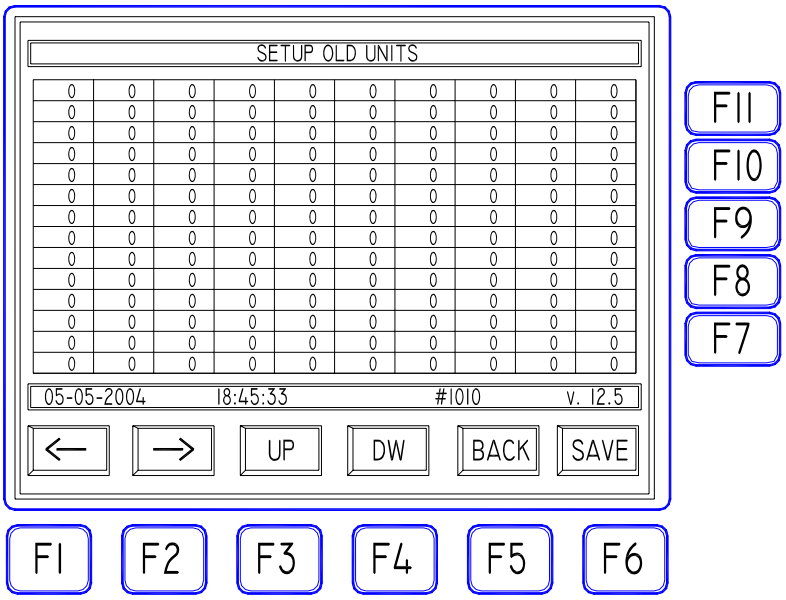
***"CABLE"* MODE:** only the data relative to the FIRE COMMANDS, will be sent to the remote units using THE CABLE CONNECTION ONLY **(RS-485** port**)**. The RADIO transmitter of the Base Station will be completely DISABLED during this operation mode and thus ALL REMOTE UNITS must be connected together and with the Base Station, using a two-wire line and the RS-485 ports present on all units for this purpose.
One should use this operating mode *only* if the radio propagation conditions are really poor (due to the particular ground configuration or to the presence of natural or artificial obstacles) and the received signal strength should be below 20dBµV, or when special security dispositions or local laws should forbid THE USE OF RADIO TRANSMISSIONS.
WARNING!: the "CABLE" operating mode can be used ONLY to issue the FIRE commands (show execution). For any other TEST or PROGRAMMING operation (key switch on "TEST-SAFE" position), the "RADIO" mode MUST be used instead!

1.8 *"OLD UNITS SETUP"Icon*

The FIREMASTER III SYSTEM has been designed in order to easily implement the system expansion for all customers already using a ***previous-generation*** FIREMASTER SYSTEM (FIREMASTER II and FIREMASTER II-T). It will be then possible to use a ***mixed system*** composed by "new" and "old" units.
Three different cases exist:

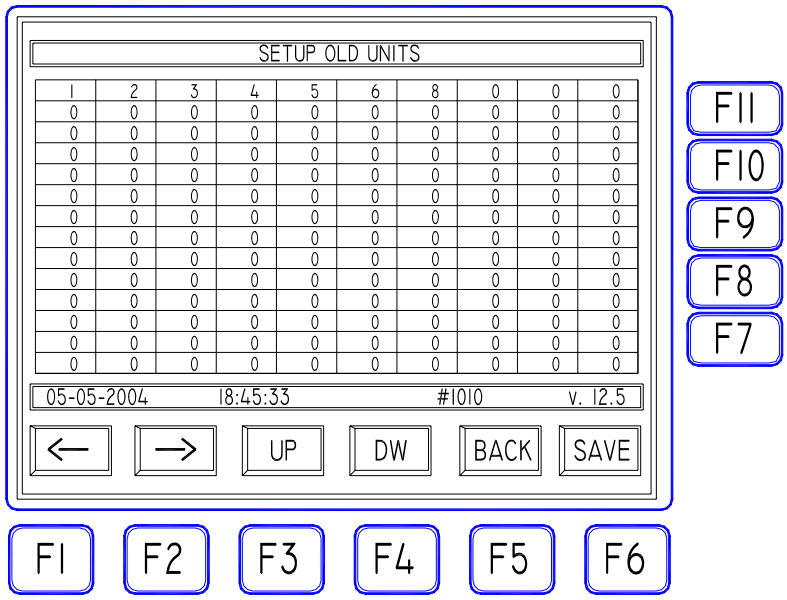
1- TX2000 BASE UNIT and RX24-B Remote Units (FIREMASTER III): the whole system is of "new generation" type, all new features are normally available and the present icon can be completely disregarded (all data will remain at ZERO)
2- TX1000 Base Unit and RX24-B Remote Units (FIREMASTER III): the whole system will operate correctly but, due to use an "old generation" Base Station, all new functions will be NOT AVAILABLE. The whole system will operate exactly as being composed by "old generation" Remote Units (RX24-A FIREMASTER II). Because all new commands and functions cannot be activated from the "old" transmitter, even in the present case, the icon can be ignored and all data will remain at zero
3- TX2000 Base Unit and mixed Remote Units (partly RX24 and partly RX24-B) or all Remote Units RX24 ("old" type FIREMASTER II). In the latter case, in order to avoid errors due to the reception of "new" commands (executable only by the

"new generation" Units) by the "old" type Units, it will be necessary to insert in the "boxes" displayed in this mask, THE NUMBERS OF ALL REMOTE UNITS of "old generation" type. The System will be able to automatically recognize these units when the TEST or PROGRAMMING signals are issued. PRACTICALLY: the User will define once for all the "old generation" type Units and will type the corresponding numbers in the cells of this mask.



The numbers of the "old generation" type Units, can be inserted IN ANY ORDER and IN ANY CELL among the 140 available. For an obvious readability reason, it is suggested to proceed orderly starting from the **uppermost cell on the left**. One should insert ONLY the numbers of the FIREMASTER II "old generation" Remote Units, leaving at ZERO all other cell values.

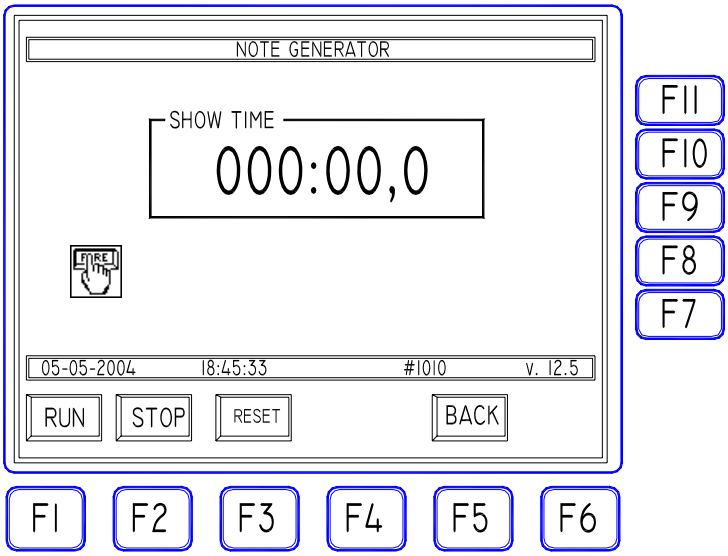
Just suppose an user already owing 8 "old generation" Units numbered 1 to 8 and purchasing 10 more Units of "new generation" (FIREMASTER III) numbered 9 to 18, plus one Base Unit TX2000. In order to operate indifferently with all Units and to completely take advantage from the resources of the new system, he should set the "SETUP OLD UNITS" mask as follows:



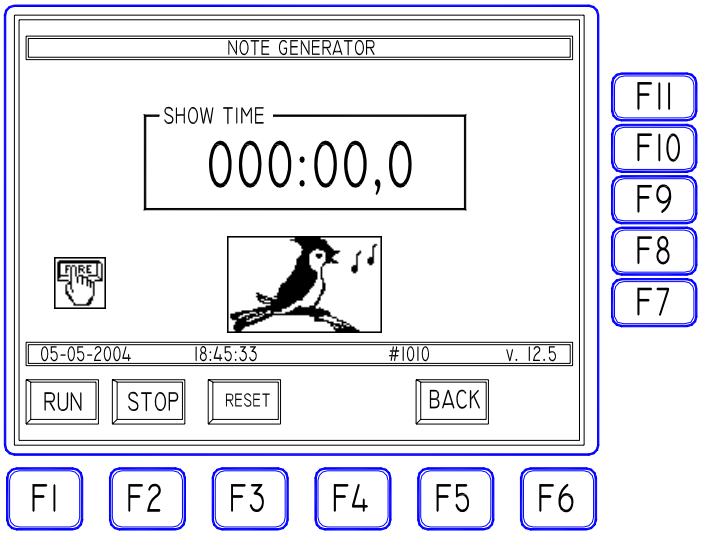
Once the numbers of the "old generation" type Units, will be correctly entered, press the F6 "SAVE" key to confirm and leave the mask using F5 "BACK".

1.9 *"TONE GENERATOR" Icon*

Selecting this icon, one will access the function for the GENERATION of a FIRE COMMAND coded as an audio tone (AFSK) available to the "SYNCHRO" connector.



This signal is intended to be recorded on the musical *base* in order to obtain a synchronism with the accompanying music during the *pyromusical* shows. (For more details, see the relative chapter).
Operating inside this mask, every time the "FIRE" key is activated, a coded audio tone will be generated and this is marked by the icon with the bird and a long buzzer sound.

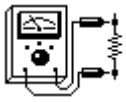


When the "FIRE" key is pressed the first time (start of the show), the time counter (SHOW TIME) starts to advance displaying minutes, seconds and tenths of a second elapsed (up to 999minutes, 59 seconds and 9 tenths). At any

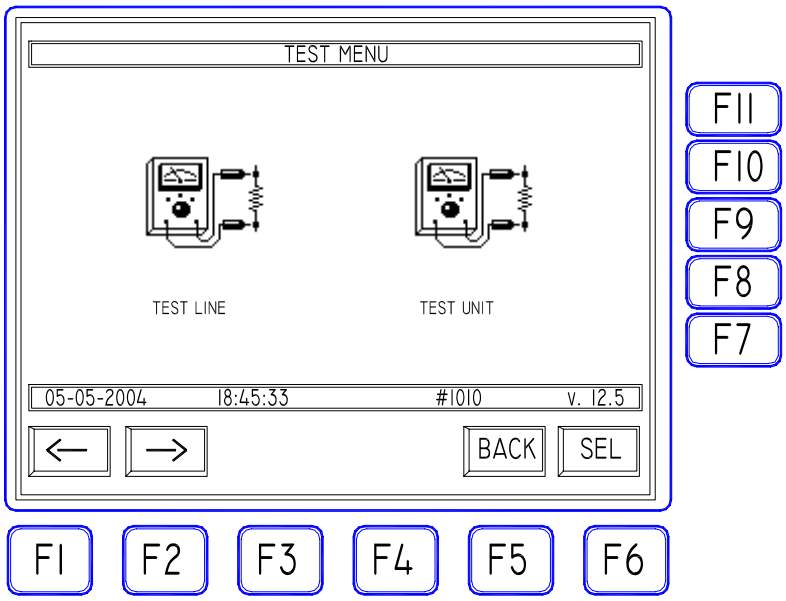
time the time counter can be STOPPED ("STOP" F2), RESET TO ZERO ("RESET" F3) and RE-STARTED ("RUN" F1) using the relative function keys. As usual the "BACK" key allows to exit the function and to return to the previous mask.

NOTE: the time counter values are given for INDICATION PURPOSE ONLY and can be used to help the operator to issue the synchronism tones at the exact moment. THE TIME VALUES DISPLAYED **ARE NOT RECORDED** nor doesn't have any effect on the functions of the Base Unit TX2000.

2 . "TESTING" ICON



This mask allows to select the functions for SET, MODIFY and CHECK all parameters of the Remote Units active at the same moment.

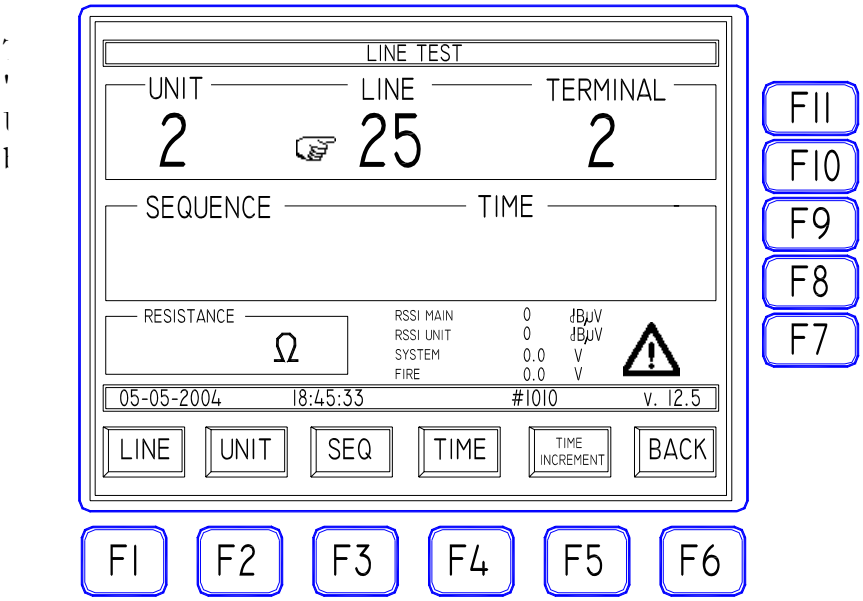


Using keys F1 and F2, one can select one of the two possible operating modes: "TEST LINE" and "TEST UNIT". With "SEL" F6 it will be open the mask relative to the selected icon.

2.1 *"TEST LINE" ICON*

This icon selects the menu of SINGLE LINE TEST. This operating mode is the same used in the previous version FIREMASTER II: it is possible to "call" one line at the time and the following parameters will be returned: the number of the Remote Unit containing this line, the sequence of that line, the ohmic resistance of the line, the batteries voltages, the level of the radio signals both received and transmitted and, if the sequence is of "*timed*" type, also the time value. The **sequence** and **time** parameters can be modified at any time and the variations will take place immediately being stored in the memory of the remote unit.
NOTE: any modification made with this function, WILL BE NOT COPYED in the memory of the Base Unit and thus the "SHOW" data eventually downloaded from a PC with the serial line, will REMAIN UNCHANGED. The user must have well clear in mind as, if the show has been created on a PC using a commercial program of show management and then loaded in memory, it will be mandatory to verify, test and modify it using **exclusively** the functions of "SHOW EDITING", "SHOW VERIFY", "IMPORT/EXPORT" and "UNITS PROGRAM" providing a constant parallelism between the data stored in the Remote Units and the

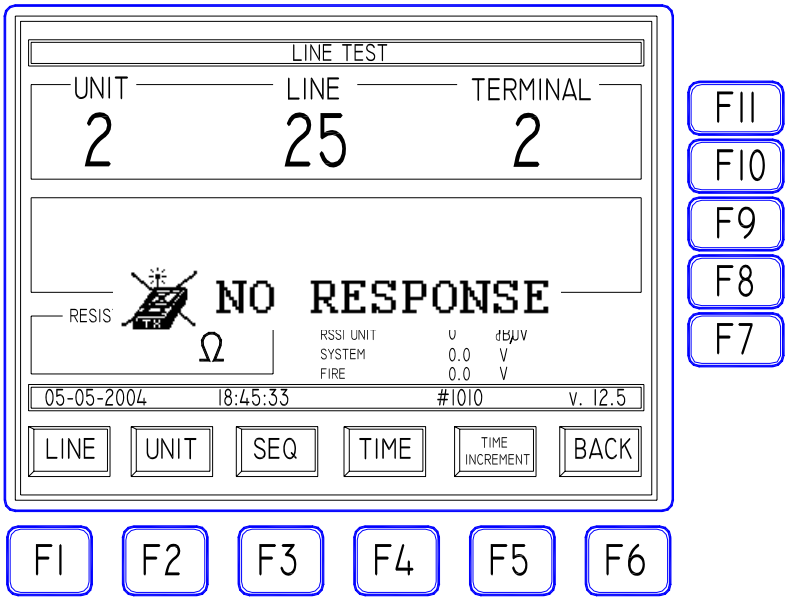
equivalent data stored inside the base Unit (containing the "image" of the whole show).
If, on the contrary, the show is managed "manually" using the functions of the mask "TEST LINE" or "TEST UNIT", all the programming operations must be performed inside these masks and the Base Unit TX2000 will NOT MAINTAIN ANY MEMORY OF THE SHOW (just as in the previous FIREMASTER II SYSTEM).



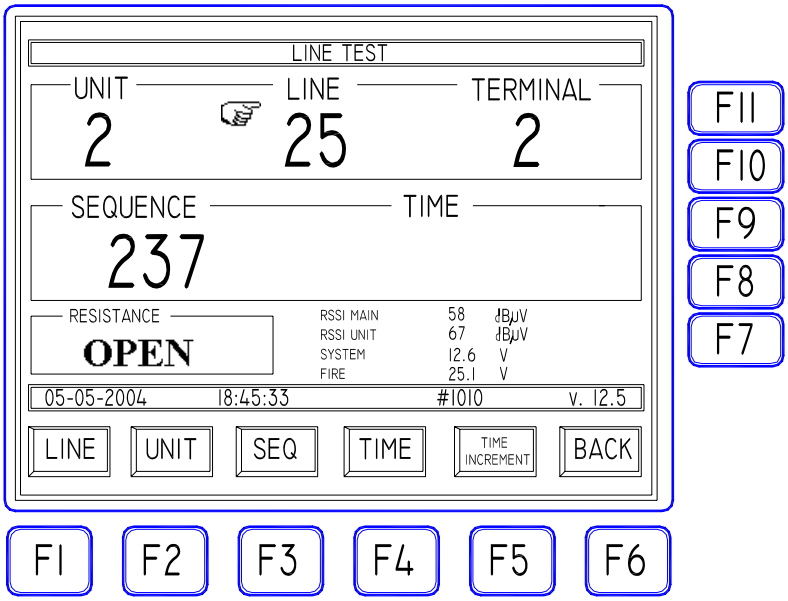
Using F1 and F2 keys, the parameter to be controlled, "UNIT" or "LINE", can be selected (the icon with the "finger" appears).
If the choice is for a query of a specific **Remote Unit**, type on the keyboard the number of that Unit (i.e. 2) and press ENTER
If the a specific **line** must be checked, type the line number (e.g.:25) and press ENTER. In both cases the TX2000 unit will calculate automatically the value of the remaining parameter and of the terminal; a ***data request*** will be sent to the Remote Unit selected..
At this point two cases are possible:

1) the Remote Unit selected doesn't "answer" for one of the following reasons:
   - The Unit is switched OFF or **doesn't exist**
   - The Unit is ON but the User's Code doesn't match the TX2000 one.
   - The Unit is ON, the User's Code is correct but a failure arrived.
   - The radio signal strength is too low or the signal is strongly interfered.

For all the above cases, the **error message "NO RESPONSE"** will be



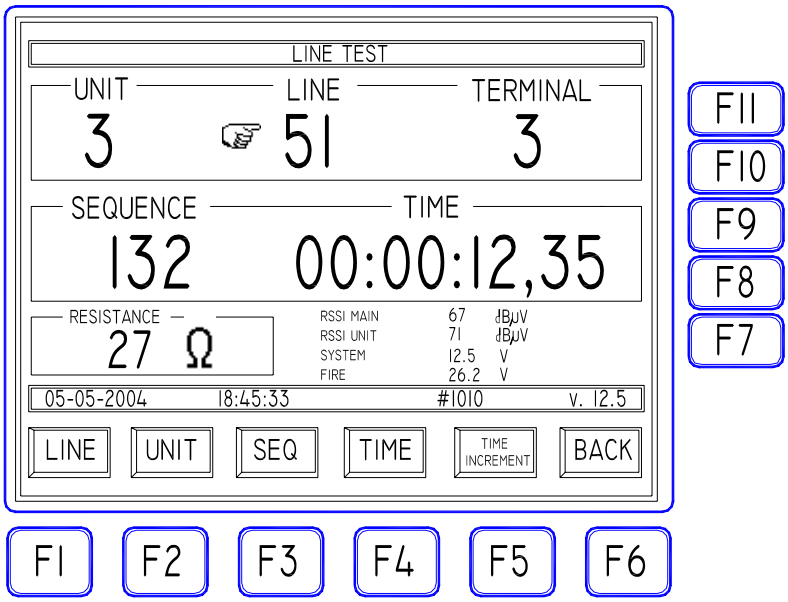
2) The Remote Unit selected "answers back" and the data will be printed on the LCD screen. In the example below: the selected line is NOT connected or the line resistance is greater than 99 ohm and the sequence of that line is of "no timed" type. The data will be displayed as follows:



The indication "OPEN" in the cell "RESISTANCE" just warns as the line resistance is greater than 99 ohm (too high to grant a safe firing with a 24V line voltage) or the line is OPEN.
The "TIME" value is not shown because the sequence 237 for line 25 of the Remote Unit N°2, is not a ***timed*** one.
RSSI Main shows a 58dBµV value. This parameter represents the **field intensity** (at the antenna of the TX2000 Unit) of the radio signal received from the Remote Unit. The measuring range spans from 0 to 80dBµV. When the signal goes down to 20dBµV, the "WARNING" icon appears: the signal is too low and some **communication error** could be encountered.
RSSI Unit shows a value of 67dBµV. This parameter represents the **field intensity** (at the antenna of the Remote Unit RX24-B) of the radio signal received from the Base Unit during the DATA REQUEST of the TX2000. The measuring range and the details about the signal level are the same as for the previous example.
SYSTEM shows a value of 12. 6V. This is the voltage of the battery powering the whole SYSTEM (radio, microcontroller, peripherals, etc.) of the Remote Unit checked. Should this voltage drop below 11.6V, the "WARNING" icon will be displayed because the correct voltage level to the system circuits could be no longer granted.
FIRE shows a value of 25.1V. This is the voltage of the batteries powering the firing lines of the Remote Unit checked. Also in this case, should the value drop below 23V, The "WARNING" icon will be displayed because the necessary power level could be no longer available for the firing lines.

NOTE: when the "WARNING" icon appears, the system can be still used as usually. One should anyway consider as the system is working near to the lower limit of its possibilities and thus some problems more or less severe could be encountered such as: firing failures, no response from the Remote Unit, errors reading data, etc. Using the system when the "WARNING" signal is ON, is fully under the responsibility of the operator: he must evaluate if the show importance is worth the risk of operating near to the safety limits. IN ALL CASES THE SYSTEM ALWAYS GRANTS A SAFE OPERATION AGAINST UNDUE OR PREMATURE FIRINGS.

3) The selected Remote Unit ANSWERS and data are displayed on the screen. The selected line is connected to a series of 10 squibs with a total resistance (squibs + cables) of 27 ohm, the SEQUENCE for that line is a ***timed*** one with a delay of 12 seconds and 35 hundredths of second. Data will appear as follows:



When a Remote Unit transmits back data and the situation is similar to the one depicted at point (2) or (3), the operator can simply read the data values (if the query was made just to make a CONTROL), or he can take the suitable actions if some parameter should fall outside the acceptable limits, such as: recharge or replace the Battery Pack if the read voltages are too low, replace the antenna or vary the position of the Remote Unit attempting to increase a weak radio signal, or

verify the firing line if the resistance value is too far from the expected value with reference to the number of connected squibs and the cable length.
If otherwise THE PARAMETERS OF THAT LINE MUST BE MODIFIED (new programming), then the operation will be as described in the next chapter.

2.1.1 *Modify the line parameters*

Inside the "TEST LINE" mask, when the Remote Unit sent back the data (a situation similar to the one described at points (2) or (3) of the previous chapter), the operator can MODIFY THE PROGRAMMING PARAMETERS. In detail:

MODIFY A SEQUENCE: press the SEQ key to select the displayed sequence value, type on the numeric keypad A NEW VALUE FOR THE SEQUENCE you want to give to this specific line and press ENTER. The Remote Unit containing that line, will be called and the new value will be written in its memory. The new sequence value displayed on the screen, CONFIRMS as the whole operation has been correctly executed (the new value is first written, read back and displayed. In case of failure the error message "NO RESPONSE" will be issued instead).

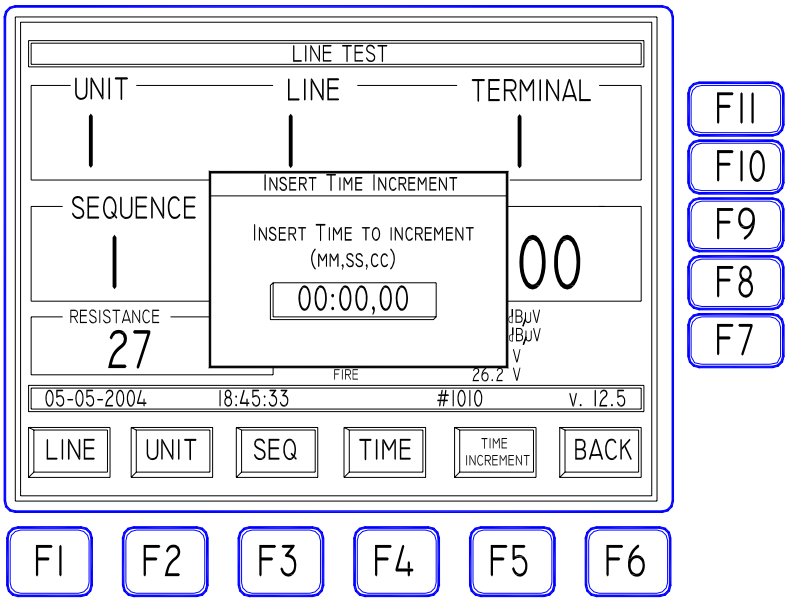
HOW TO CHANGE A NORMAL SEQUENCE TO A *TIMED* ONE
If it is needed to define a sequence as a ***"timed"*** one, proceed as follows:
Select first a line corresponding to the BEGINNING of the timed sequence to be built and press ENTER. When the data will appear on the screen, press the SEQ (F3) key and type the SEQUENCE number. If the sequence is not yet *timed,* press "TIME" (F4) to *time* it (initially the time value will be 00:00:00,00). Type in the delay time value this line must have inside the sequence (if it is the FIRST SHOT of the sequence, then the time value will be left to ZERO). In order to ***time*** other lines and to give the respective delay values inside the sequence, proceed as follows.

HOW TO CREATE A *TIMED* SEQUENCE WITH SEVERAL LINES:
remain with the index pointing SEQUENCE and use F11 and F7 keys to INCREASE or DECREASE by one the LINE NUMBER. Modify now both the SEQUENCE NUMBER (all lines of the same *timed* sequence must have the SAME SEQUENCE NUMBER), and the TIME value. Should the time intervals between the sequence shots not equally spaced, TIME must be selected and the proper time value must be typed for each line inside the sequence.
Note as it is NOT NECESSARY to type ALL the zeroes of the time value, but just the significant figures. E.g.: if the screen displays a time value of 00:00:00,00 and a new value of 1,5 seconds must be entered, IT WILL BE NOT NECESSARY to type 00:00:01,50, BUT JUST 1.5 or 1.50 or again 150.

If otherwise the time intervals between the shots of the same sequence are EVENLY SPACED, then the job can be greatly simplified using the "TIME INCREMENT" (F5) function. Lets just suppose to create the *timed* sequence N°1 including 10 lines starting at 1 and equally spaced by 1 second. Then proceed as follows:

- "call" the first line of the sequence (1 in this example)
- give this line the needed SEQUENCE VALUE (1).
- If not otherwise *timed*, use F4 key to assign the time value (00:00:00,00)

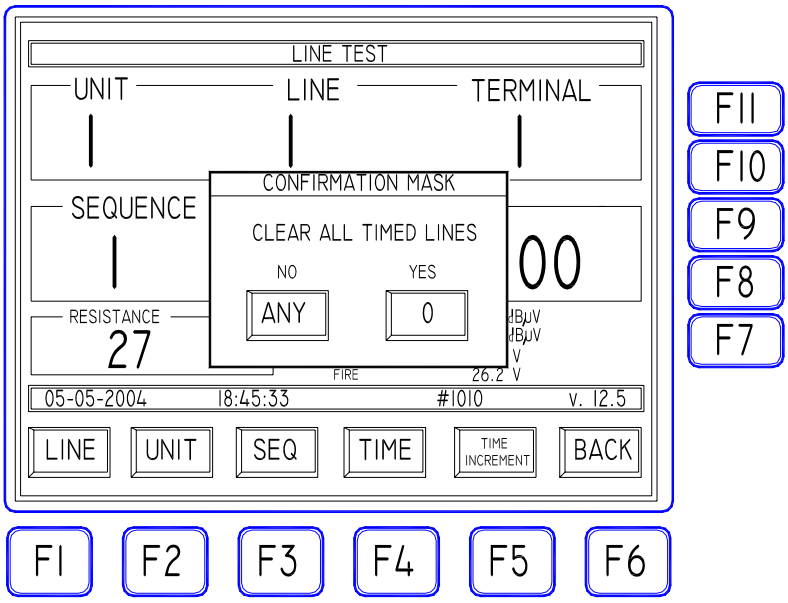
- press F5 "TIME INCREMENT": on the middle of the LCD screen the mask below will appear. Type now the VALUE FOR THE CONSTANT TIME INCREMENT spacing the shots of the sequence (1.00 or 100 meaning ONE second) and press ENTER to confirm.



Proceed now INCREASING the LINE value with F11 and press the "AUTO INCREMENT" key on the main keyboard: the time value will be automatically incremented by the selected quantity and the sequence, if not otherwise set, will be automatically *timed*. Continue the same way till the sequence end.

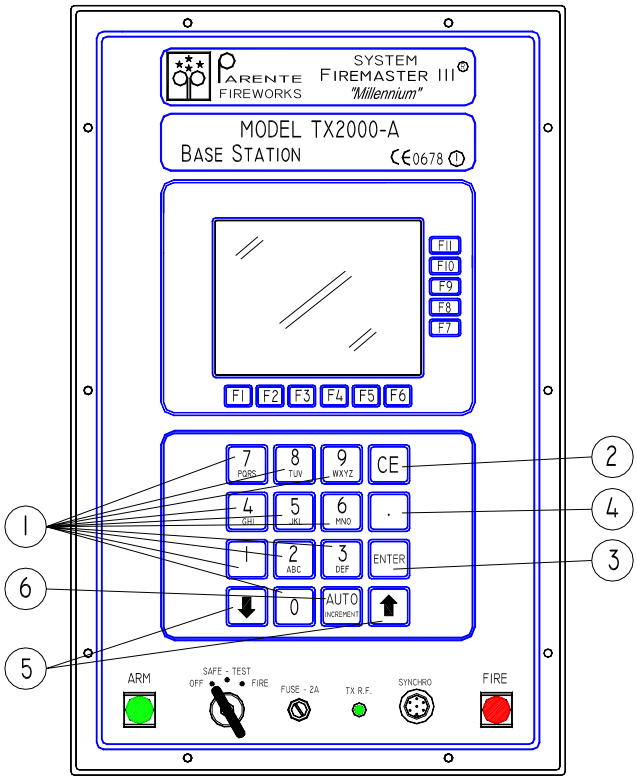
REMOVE THE TIMING FROM A SEQUENCE ALREADY TIMED.
Select the line with the sequence to modify, press now F4 to select "TIME": the timing option will be CANCELLED simply using the ↓ key. If the timing should be RESTORED, press the ↑ key.
WARNING: in order to cancel the timing of a line, IT IS NOT SUFFICIENT to set at ZERO the time value! You must use the above procedure instead.

HOW TO REMOVE ALL TIMED SEQUENCES FROM THE SAME REMOTE UNIT.
When a new show is to be created and all Remote Units are to be completely re-programmed, it could be advisable to define first as NOT TIMED all the lines of the Units to be used in that show and then proceed to a new programming as required. It could result UNSAFE (when this should not generate more serious problems during the show execution), to leave defined as ***timed*** one or more lines EVEN IF NOT USED.
The FIREMASTER SYSTEM (just as its previous version) has a practical function used to do that. It can be activated with F9 key and the following mask will appear:



When the "0" key on the numeric keypad will be pressed, a RESET command will be issued to the selected Remote Unit and all 24 lines will return to the "normal" mode (no timing). On the completion of this operation the message **"OK, DONE!"** will be issued as confirm. Pressing ANY OTHER KEY instead (ANY), the operation will be cancelled and the function terminated.

2.2 GENERAL NOTES USING THE NUMERIC KEYPAD



1) Keys 0 to 9 are used to enter numeric values for the parameters requiring so. Letters are used to insert literal strings for some functions requiring so (password, show description, etc.)

2) The "CE" key (Clear Entry) is used to cancel a numeric value just after it has been typed and before it is confirmed.

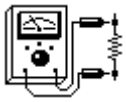
3) The "ENTER" key is used to confirm the numeric value just typed in or to send a command to the Remote Units.

4) The "." key is used to insert the comma for the numeric values requiring so or as a field separator. It is also used to enter the separator (:) for the time and date values.

5) The keys "ARROW UP" and "ARROW DOWN" allow to INCREMENT or DECREMENT by ONE the numeric values of the parameter selected by the index.

6) The "AUTO INCREMENT" key allows to set a constant value for the time increment used when a sequence must be ***timed*** (see previous chapter).

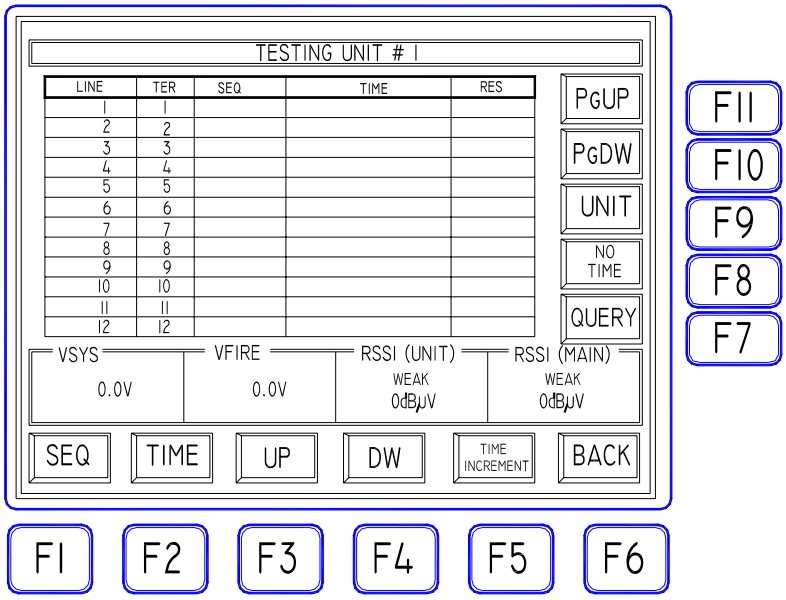
2.3 *"TEST UNIT" ICON*



The high-resolution graphic display of the new FIREMASTER III SYSTEM, allows to display at the same time a lot more information than it was possible on the previous version.
The "TEST UNIT" function in particular, uses this possibility to display, WITH A SINGLE COMMAND, the complete situation relative to **all 24 lines of a selected Remote Unit.**

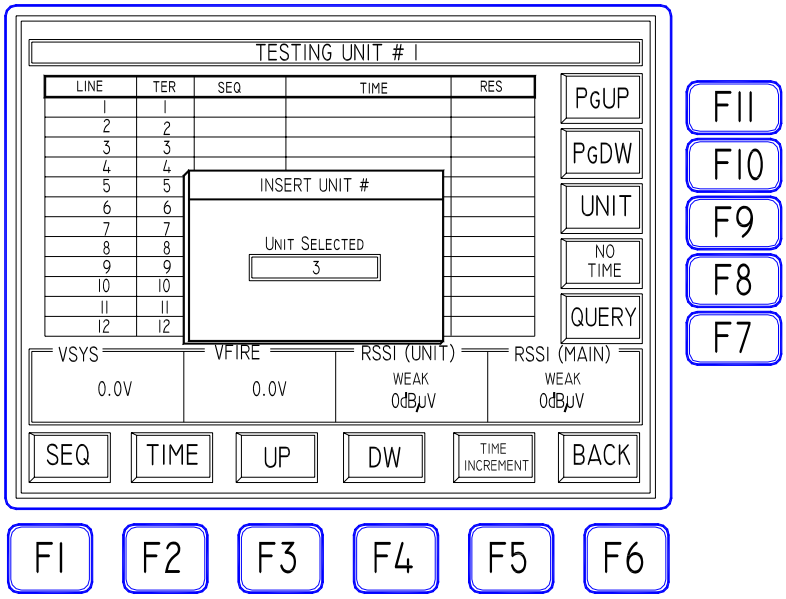
IMPORTANT NOTICE: as previously remarked, the new FIREMASTER III "*Millennium*", is completely compatible with the previous version FIREMASTER II. Nevertheless, the behavior of the "old" Remote Units RX24-A, when inquired using the "TEST UNIT" function, cannot be identical to the one of the new generation Units. The compatibility has been anyway maintained to the detriment of the response time. While the new RX24-B Units implement a special function to send back a whole "block" of data relative to the 24 lines with a single operation, the previous RX24-A Units will do that A LINE AT THE TIME and it will be then necessary 24 consecutive transmission. This process is carried out in a complete automatic way and it results completely "transparent" to the user, provided he previously specified correctly the numbers relative to the RX24-A Units in the "OLD UNITS SETUP". However, when a TEST UNIT request is sent to a RX24-B Unit (new type), the parameters relative to ALL 24 LINES will be displayed in only about 4 seconds. If the same command is otherwise sent to a RX24-A Unit ("old" type), exactly the same result will be obtained, but it will be necessary to wait about 25 seconds (the 24 lines are tested automatically one at the time). If otherwise the TEST UNIT function is used with an "old" typ RX24-A Unit, without previously specify its number inside the "OLD UNITS SETUP" mask, then the Unit WILL NOT RECOGNIZE THIS COMMAND (the "LINE TEST" menu must be used instead).

From inside the mask "TEST MENU" select the "TEST UNIT" icon: the mask "TESTING UNIT #…" will appear

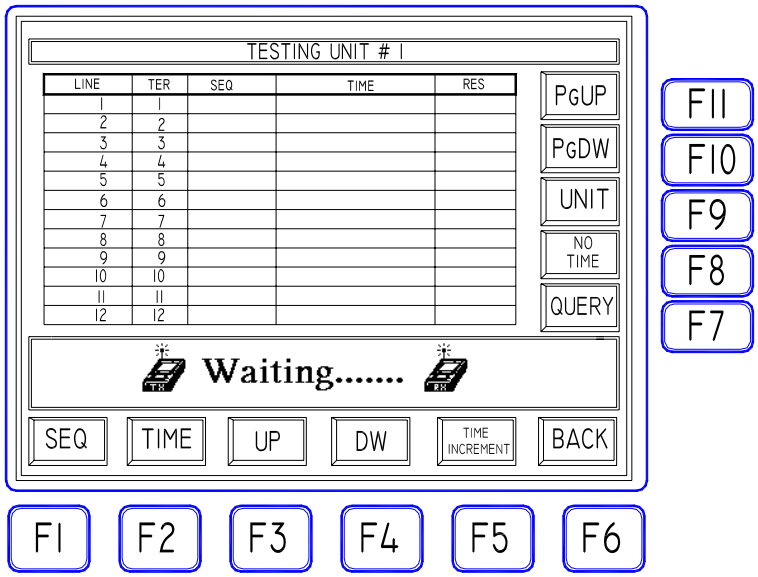


Because a specific Remote Unit has been not selected nor checked yet, by *default,* it will be shown the 12 first lines situation of Remote Unit #1. All parameters are still unassigned or set to ZERO.

Press the key F9 "UNIT" to select, among the ACTIVE Remote Units, the one to be checked. It will be shown a window to type in the Unit number (1 to 255).

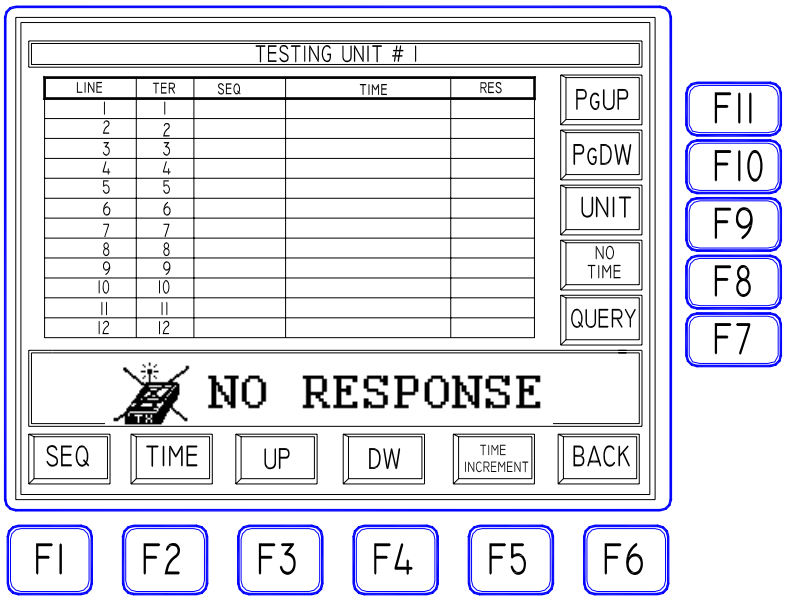


Press "ENTER" to confirm the data: the Base Unit TX2000 will start immediately to send a data request for the selected Remote Unit. A time interval of about 4 seconds is necessary to check the Unit and obtain the answer with all data. During this time, the following message will be displayed.

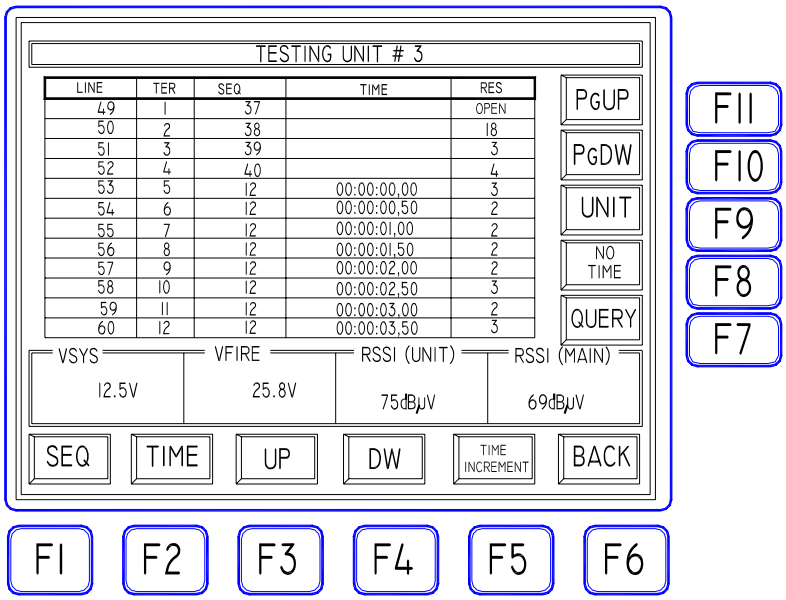


If the Remote Unit shouldn't reply immediately, two more attempts of connection will be automatically made: after that an error message will be issued.

We already listed the possible causes of answering failure (***the Unit is switched OFF or doesn't exist, the Unit is ON but the USER'S CODE doesn't match the TX2000 one, the Unit is ON and the code is correct but a FAILURE occurred, the radio signal intensity is too low or the signal is strongly interfered***).



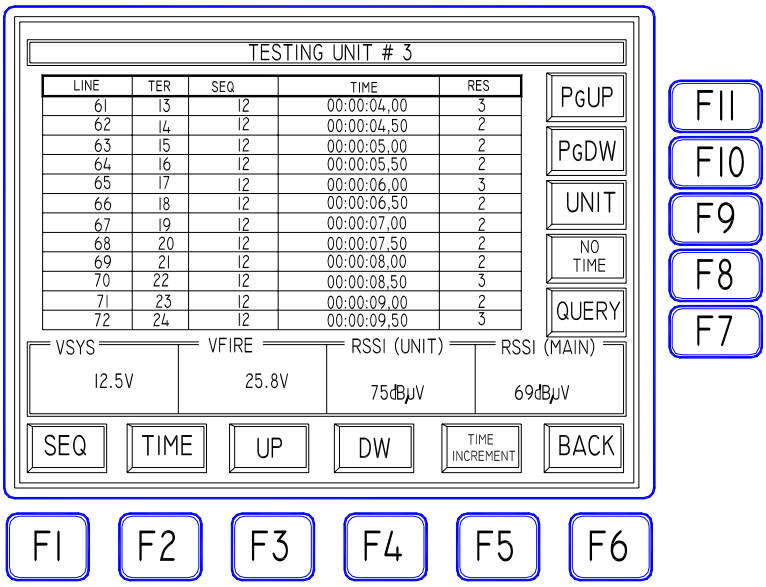
If otherwise the Remote Unit answers correctly, all data sent back will be displayed inside the table cells:



In the example above, the Remote Unit #3 has been checked and it sent back **all data contained in its memory** : sequence (SEQ) and relative time (TIME) for all lines eventually defined as ***"timed sequence".*** The following **real-time measurements** have also been received and displayed: SYSTEM battery voltage (VSYS), LINE battery voltage (VFIRE), RECEIVED radio signal strength (RSSIunit), intensity of the radio signal SENT BACK (RSSImain) and ohmic resistance of each firing line (RES).

Note as, while the **real-time measurements,** represent the actual values read during the Unit check (they can vary at each new query), all data relative to the firing lines are **permanently stored** inside the Unit memory and will **remain unchanged** until the operator will overwrite it using the specific commands.

Due to the limited space on the graphic LCD screen, it is impossible to display **at the same time** the situation of all 24 lines for the Remote Unit under test. The data relative to the first 12 (1 to 12) lines will be shown and the operator can visualize the remaining 12 (13 to 24), using the F10 key "PGdw". Using F11 "Pgup" the first 12 lines can be visualized again. Note as these operations produce **just a change in displaying data** and NOT A NEW DATA REQUEST to the Remote Unit that **already sent all data since the first call**.



To REPEAT the call to the **same Remote Unit,** it will be sufficient to press F7 "QUERY". The operation can be repeated as many times as needed and can be used **to control in real time** an eventual variation of the working parameters of the Remote Unit (line resistance, battery voltage, radio signals intensity).

To call a **different Remote Unit,** it will be necessary to use F9 "UNIT" as previously described.

2.3.1 *DATA MODIFICATION*

Data, as received from a Remote Unit and displayed on the screen of the Base Unit TX2000, can be ***edited*** following the show requirements.

With reference to the pictures of the previous example (data received from the Remote Unit #3), let us see, step by step, how to proceed.

It must be pointed out first as some of the displayed data are relative to **real-time measurements** or **factory settings** and thus they **cannot be edited.** In detail:

- **LINE:** this is the line number of a specific Remote Unit for each of its 24 lines. The line numbers are **PERMANENTLY ASSIGNED** for each Unit and thus, when a Remote Unit is called, they are **automatically defined**.

- **TER:** this is the physical position of the binding posts of a specific line on the panel of the Remote Unit. In our example, **TER 3** means the **third couple** of terminals of Unit #3: this couple has been permanently given the line number 51.

- **RES:** this is the value, measured in OHM, of the line resistance connected to the terminals of the Unit. This measurement is made each time the Unit or a specific line is called. All lines with a resistance greater than 99 ohm, or NOT

CONNECTED, are regarded as OPEN CIRCUIT and the corresponding message "OPEN" will be displayed in the cell RES

- **VSYS:** this is the value, measured in volt, of the SYSTEM battery (microcontroller, peripherals, radio) on the Remote Unit. The measurement is made EACH TIME the Unit or a specific line is called. If the voltage of this battery falls down a preset value, the error message "FAULT" will be displayed. This message shouldn't regarded as a catastrophic failure on the Remote Unit, but it is just a WARNING about the poor charge level of the battery (a recharge is urgently needed!)

- **VFIRE:** this is the value, measured in volt, of the FIRING LINES BATTERIES on the Remote Unit (2 batteries in series for 24V total in the STANDARD version or 4 batteries in series for 48V in the SPECIAL version). The measurement is made EACH TIME the Unit or a specific line is called. If the voltage of these batteries falls down a preset value, the error message "FAULT" will be displayed. This message shouldn't regarded as a catastrophic failure on the Remote Unit, but it is just a WARNING about the poor charge level of the batteries (a recharge is urgently needed!).

- **RSSI(unit):** it represents the value, in **dBµV**, of **the field strength** present at the receiving antenna on the Remote Unit. Practically: this reading gives an idea of the *quality of the radio reception* on the Remote Unit during a request of data. The measuring range is between 0 and 80dBµV (0dBµV = NO SIGNAL, 80dBµV = MAXIMUM SIGNAL). When the reading is BELOW 20dBµV, some error in data reception could occur and it would be advisable to check the antenna or Unit position (see specific notes to the relative chapter) in order to improve the radio signal level. When the reading is down to 12dBµV, the warning message "WEAK" is displayed.

- **RSSI(main):** it represents the value, in **dBµV**, of **the field strength** present at the receiving antenna on the Base Unit. Practically: this reading gives an idea of the *quality of the radio reception* on the Base Unit during the reception of answer back from the Remote Unit. All other details are the same as in the previous case.

The only data the operator can modify are: **SEQ** ("SEQUENCE") and **TIME.**

In order to modify these parameters, the keys F1 (SEQ), F2 (TIME), F3 (UP), F4 (DW - down) will be used. Eventually also F11 (Pgup) and F10 (PGdw) if the data to be modified are not displayed in the actual page. In any case F3 and F4 keys, provide to scroll automatically the displayed lines when the table limits are reached.

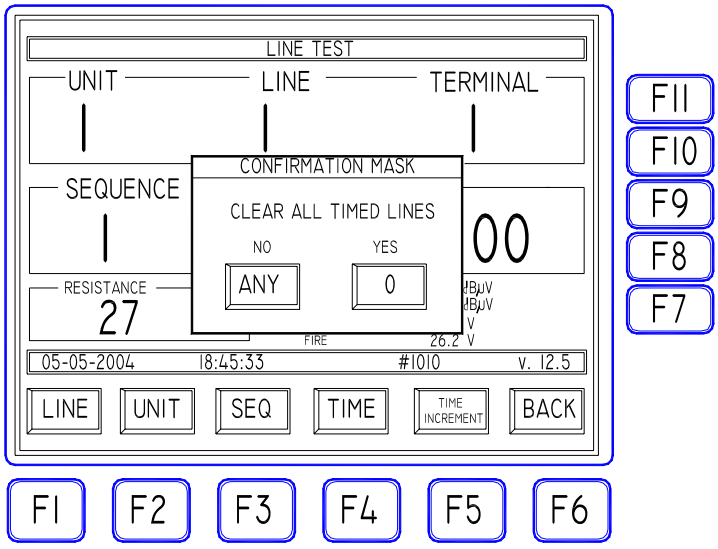
Using the above listed keys, it will be marked (in reverse) the parameter relative to the specific line to be changed and the new value will be typed in directly using the numeric keypad; ENTER will confirm the value and the new data will be immediately sent to the Remote Unit and stored accordingly in memory.

All data relative to TIME can be also typed without the separators and disregarding all non-significant zeroes. E.g.: the time value 00:17:12,35 (17 minutes, 12 seconds and 35 hundredths) can be typed "171235" as well as "17.12.35" or "00.17.12.35" or again as "00171235". It will be accepted in all cases.

2.3.2 HOW TO REMOVE ALL TIMED SEQUENCES FROM THE SAME REMOTE UNIT

Press the F9 key "UNIT" followed immediately by the F8 key "NO TIME": the following mask will appear

When the "0" key on the numeric keypad will be pressed, a RESET command will be issued to the selected Remote Unit and all 24 lines will return to the "normal" mode (no timing). On the completion of this operation the message **"OK, DONE!"** will be issued as confirm. Pressing ANY OTHER KEY instead (ANY), the operation will be cancelled and the function terminated.



3. "FIRE" FUNCTION

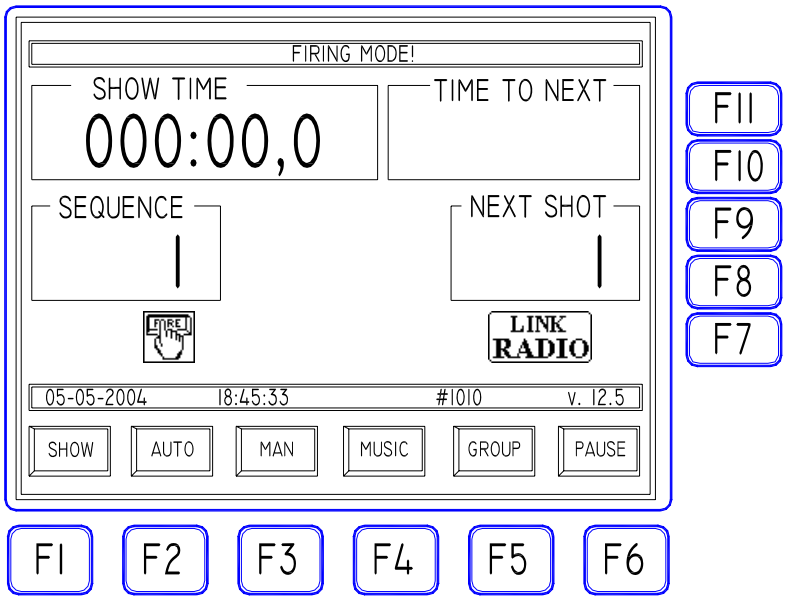
3.1 FOREWORD

All functions just described have been used with the key switch selector of the Base Unit TX2000 in position **"TEST-SAFE"**.
In this operating mode it is **TOTALLY INHIBITED** the transmission of a **particular code** regarded by all Remote Units as a **FIRE COMMAND.** All Remote Units have thus the batteries powering the lines, PHYSICALLY DISCONNECTED. In this way all test operations can be carried-out with the maximum safety degree and, even if a severe failure should occur to one or more Units, IT NEVER WILL BE POSSIBLE TO HAVE A PREMATURE OR UNDUE FIRING OF ANY SQUIB CONNECTED TO THE SYSTEM.

When otherwise the show MUST BE FIRED, the ***fire code*** must be always sent along with the data relative to the lines to be activated**.** Only in this way, all Remote Units involved in firing one or more lines, will provide to connect accordingly the LINE BATTERIES to the lines to be fired. This connection is made during a time interval reduced to the **minimum indispensable** to provide the line activation and to transfer the energy quantum for firing. After this interval the batteries are DISCONNECTED again bringing back all Units to a SAFE CONDITION. Only during a **"*timed*" sequence,** because the allotted time between shots is too short to connect and dis-connect the batteries, the **FIRE VOLTAGE is maintained along the whole sequence duration and for all Units involved in that sequence**.

3.2 THE "FIRE"MASK

At any moment and from inside any mask of the "SAFE-TEST" function, it is possible to switch to the "FIRE" mode simply placing the rotary keyswitch on this position.
The following mask will be immediately displayed:



By *default* the following operating modes will be selected:

- SHOW TIME: set to ZERO, waiting for the first fire command.
- TIME TO NEXT: not active in MANUAL MODE.
- SEQUENCE 1: all lines with sequence 1 will be set off
- NEXT SHOT 1: in manual mode it does always have the same value as SEQUENCE.

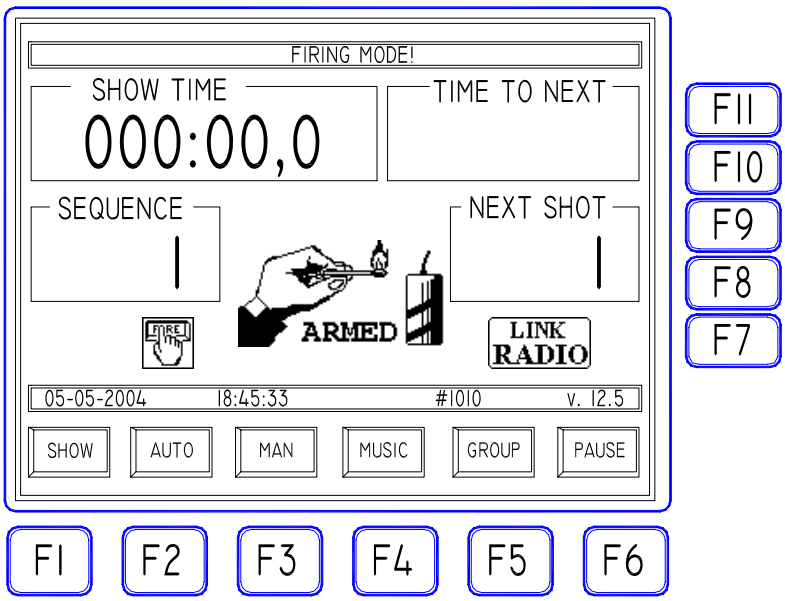
- MANUAL MODE (also selectable with F3 key)

- COMMUNICATION: RADIO. This icon shows the setting made in the "TOOLS" mask relative to the communication mode (RADIO or CABLE)

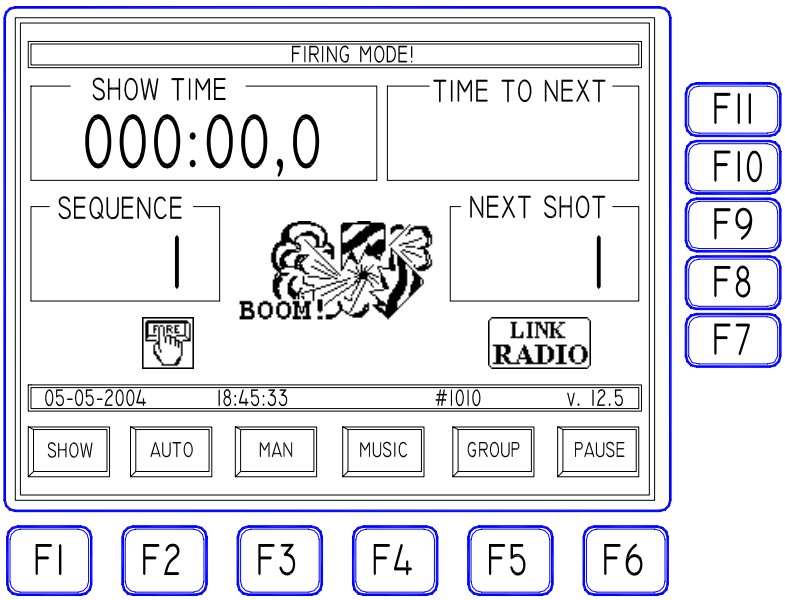
If it should be necessary to fire a sequence other than the displayed one, it will be sufficient to type the sequence number on the numeric keypad and confirm with "ENTER". To move 1 digit more or less with respect the displayed value, the two "arrow" ↑ ↓ keys can be used instead.
To send the FIRE command, it will be necessary to press in rapid succession the pushbuttons "ARM" and "FIRE" .

Pressing only one pushbutton (indifferently ARM or FIRE), the system will "***arm***" itself and the FIRE command will be immediately sent when the other button will be pressed. To proceed with the NEXT SHOT, it is necessary to release first BOTH BUTTONS. The sequence of "ARM" and "FIRE" operations will be shown to the operator with two different icons displayed on the screen:

SYSTEM "ARMED"



FIRE!



3.3 FIRING OPTIONS

The SYSTEM FIREMASTER III can operate in different modes in order to match any show characteristics.

The different firing modes can be selected by the operator inside the "FIRE" mask and immediately before the show begins.

Also in this case, it will be useful to remind as TWO WELL DISTINCT USING MODES OF THE FIREMASTER III SYSTEM exist:

a) PROGRAM CREATED AND "LOADED" MANUALLY in the Remote Units using the functions already listed in chapter "2.0 - TESTING".

b) PROGRAM CREATED WITH EXTERNAL SOFTWARE AND "LOADED" FROM A PC by the serial communication port RS-232.

When one mode is selected, the other is automatically EXCLUDED!

In case **a)**, the system will only operate in "MANUAL" or "MUSIC" mode only"

In case **b)**, the "SHOW" MODE can be used.

It is theoretically possible to fire in MANUAL MODE a show created externally and loaded in the memory of the base Unit TX2000 from a PC. Not to mention the poor interest in such an operation, ALL THE INFORMATIONS RELATIVE TO THE TIMING OF THE FIRING SEQUENCES, **WILL BE LOST**!
It is highly suggested to AVOID operating with "mixed" modes: this could lead to unexpected and catastrophic results for the show performance!

3.3.1 MANUAL MODE

This mode has been described at the beginning of the chapter and quoted as an example. This operating mode is selected using key F3 "MAN". Should be also active the "SHOW" mode, the latter must be cancelled using the key F1 "SHOW" (used as *toggle*).
All the AUTOMATIC TIMING functions will be made NOT ACTIVE and the operator will be free to manage the show times following his fantasy or the voice commands coming from the show director to the headset. The "SHOW TIME" indicator can be used just as REFERENCE: it starts to count the time (in minutes, seconds and tenths) **immediately after the first shot** and stops if the show is momentarily halted turning the key switch to the "SAFE-TEST" position.

The time count will start again switching back to "FIRE" mode and sending a new FIRE command: finally the counter will display the total show duration without taking into account for eventual pauses decided by the operator. The time is RESET only when the base Unit TX2000 is switched OFF. The time count can be also ***paused*** in "FIRE" mode, using the toggle key F6 "PAUSE". When the time count is halted in this mode, the indication **"Paused!"** is displayed on the screen.

3.3.2 "MUSIC" MODE

In this mode the built-in ***pyromusical synchronizer*** is activated (when the option has been installed in the Base Unit TX2000).
The operating mode is similar to the MANUAL one with one exception: the "ARM" and "FIRE" buttons will be "pressed" automatically each time the system decoder will recognize a valid FIRE command in form of an AUDIO CODE coming from the EXTERNAL sound system. If it will be provided in advance to record as many audio sync signals as the shows sequences and these signals are correctly placed with respect the musical base, then the whole show will proceed in a complete automatic mode and the fireworks effects will remain perfectly synchronized with the music. As a matter of precaution the **"ARM" AND "FIRE" KEYS WILL REMAIN ACTIVE:** should a sync tone, for any reason, be lost , the operator can enter manually at any time a FIRE command filling the gap.

3.3.3 MANUAL "SHOW" MODE

AVAILABLE AFTER JUNE 1st 2004

3.3.4 AUTOMATIC "SHOW" MODE

AVAILABLE AFTER JUNE 1st 2004

3.3.5 PYROMUSICAL "SHOW" MODE

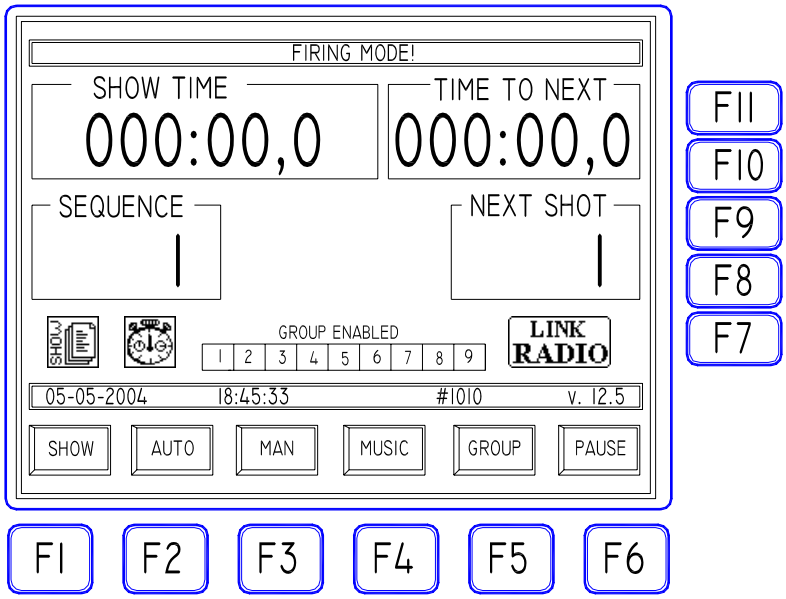
AVAILABLE AFTER JUNE 1st 2004

3.3.6 OPTIONS IN "SHOW" MODE

For the three "SHOW" modes, a further option is available: this option is shown in the "FIRE MODE!" mask. This is the possibility of EXCLUSION of one or more "groups" of fireworks previously defined.

It happens quite often that some pyrotechnic effects, as the "weeping willow" or others with possibility of burning fallout, shouldn't be used if the wind conditions during the show, doesn't grant the safety margins (risk of fire propagation). It could also happen that, at the last moment, for accidental causes, a section of the show is damaged and thus it must be removed..

THE FIREMASTER III SYSTEM allows, when operating with a show created on a PC (SHOW mode), to define in advance up to 9 "groups" of fireworks or effects. From the "FIRE MODE!" mask the operator is enabled, in real-time, to disable as needed, one or more groups of fireworks just as required by the show conditions at that moment. Obviously it is also possible, with a simple command, to restore immediately the original conditions re-enabling the groups.



3.3.7 OPERATION NOTES WHEN IN "FIRE MODE!"

When the keyswitch is turned on the "FIRE" position, the transmitter of the Base Unit TX2000, immediately starts to send automatically a special code ("*watch dog*"). This code is sent at regular intervals of about 5 seconds: the "TX R.F." green LED will flash shortly each time.

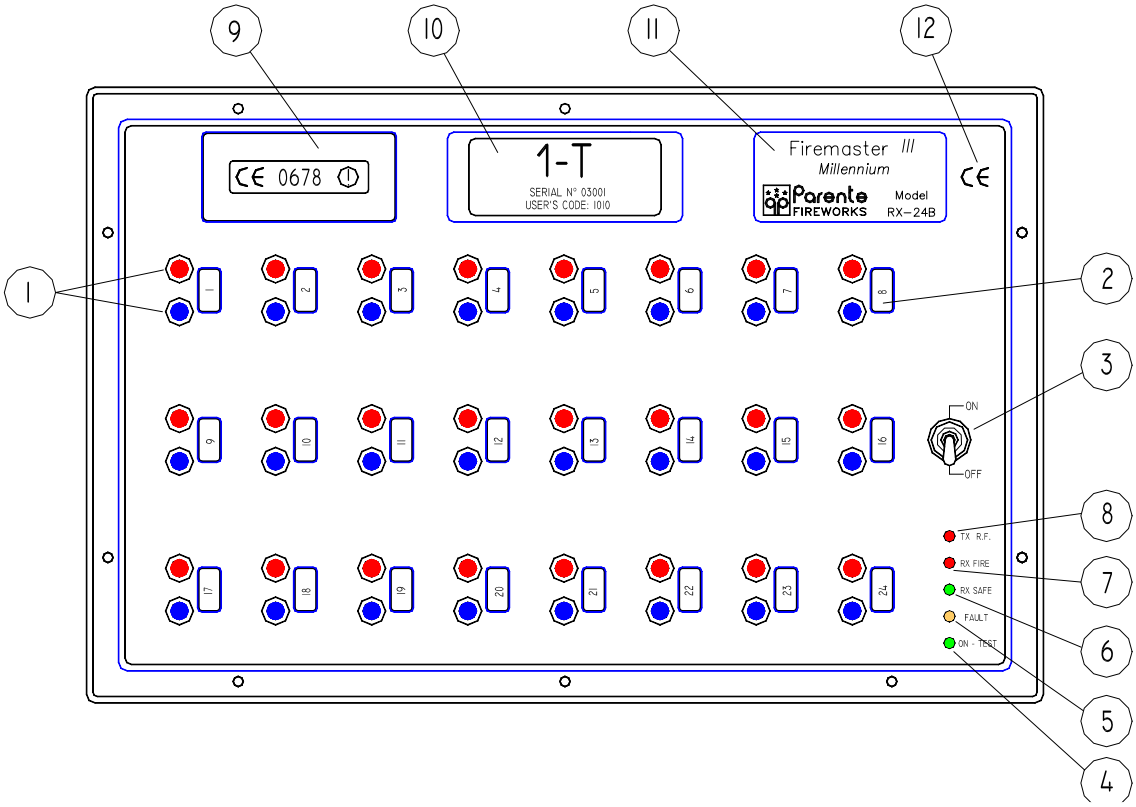
This signal is received at the same time by ALL REMOTE UNITS being active and is used to notify as the TX2000 transmitter is ACTIVE and in FIRE mode. All remote Units will use this signal only during the execution of a TIMED SEQUENCE. During the execution of these "rapid" sequences in fact the Base Unit TX2000 sends just the FIRST SHOT of the sequence, while all successive shots are controlled automatically following the time parameters stored inside each Remote Unit. In these conditions the Base Unit couldn't have no longer control over the execution of *timed* sequences of some length: this is clearly in contrast with the safety rules. In fact: should the Base Unit be suddenly damaged while a long timed sequence is running, there will be no way to stop the show (and since it is in theory possible to build a whole show with a single timed sequence, one can easily understand as this situation could be extremely dangerous!). The ***watch dog*** signal has been introduced in order to overcome this unlucky possibility: In fact: should the Base Unit stop for any reason (failure, destruction, power fail, etc.) to operate, the ***watch dog*** signal will also immediately cease. All the Remote Units are programmed in such a way to STOP IMMEDIATELY ANY FIRE ACTIVITY when **at least two successive *watch dog*** signals are lost**.** This function grants, when the operator's has no longer control over the show, that any *timed* sequence will be automatically interrupted within 10 seconds maximum (2 ***watch dog*** cycles).

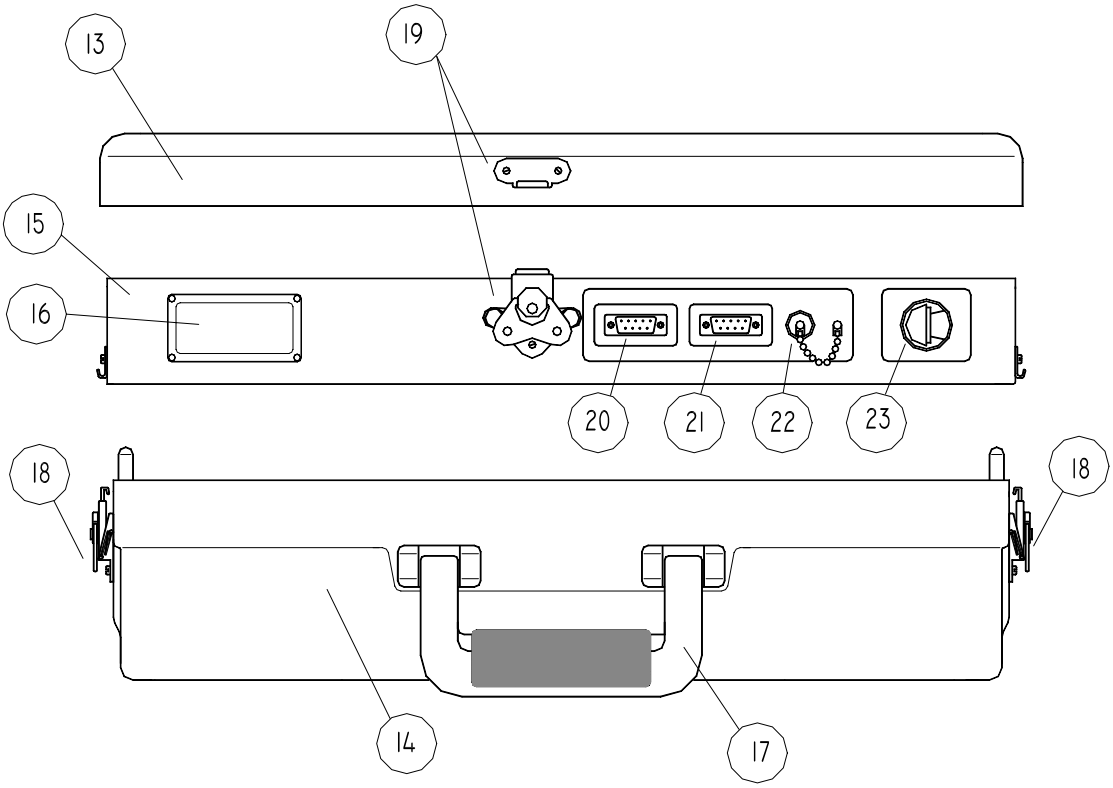
The operator shouldn't be afraid seeing, when the keyswitch is in FIRE position, the "TX R.F." LED flashing even if no command has been issued! (on the contrary: he should be afraid if NOT!)

The operator can at any moment abort any timed sequence IMMEDIATELY simply switching the key on the "TEST-SAFE" position . In this case the Base Unit TX2000 will send A SPECIFIC "TURN-OFF" CODE that is received immediately and recognized by ALL Remote Units.

4. REMOTE UNITS RX24-B (RECEIVERS)

4.1 FRONT-PANEL DIAGRAM





4.2 COMMANDS DESCRIPTION

1. BINDING POSTS with quick-connection feature. Nickel-plated metal. Used to connect the squibs lines.

2. INDIVIDUAL numbering for each line. The RX24B Remote Units are numbered in PROGRESSION and the same for the outputs of every single line. E.g.: the Unit N°1 has the outputs numbered 1 to 24, Unit N°2 has its outputs numbered 25 to 48 and so on.

3. Main power switch with 2 positions and rubber lever protection (waterproof).

   - **ON Position:** Unit switched ON and ACTIVE. The INTERNAL batteries **cannot be re-charged while operating**.

   - **OFF Position:** Unit switched OFF. The Battery Pack can be removed and connected to the mains to perform both the test and the re-charging of the internal batteries.

4. **TEST-ON** GREEN LED: it flashes quickly during the initial test at power on. If all lines pass the test, then the LED will become STEADY: the Unit is ready for operation.

5. **FAULT** YELLOW LED: it turns ON PERMANENTLY when, during the power-on test any FAULT is detected (faulty lines, battery problems, data errors of the internal EEPROM).

- **LINE ERROR** If a fault should be detected during the line test, then the YELLOW LED **FAULT** will turn ON while the GREEN one (**TEST - ON**) will flash slowly several times: counting the flashes between two long pauses, it will be possible to detect, among the 24 lines, the faulty one.

- **BATTERY ERRORS** it turns ON **permanently and the SYSTEM <u>will remain BLOCKED</u>.** The following cases are possible:

- The open-circuit of the SYSTEM battery is BELOW 11V

- The VARIATION between the OPEN-VOLTAGE and the measurement UNDER LOAD of the SYSTEM battery is more than 25%

- The VARIATION between the OPEN-VOLTAGE and the measurement UNDER LOAD of the LINE battery is more than 20%

It turns ON ***momentarily*** and at the same time a long buzzer sound is generated in the following cases:

- The VARIATION between the OPEN-VOLTAGE and the measurement UNDER LOAD of the SYSTEM battery is more than 15%

- The VARIATION between the OPEN-VOLTAGE and the measurement UNDER LOAD of the LINE battery is more than 10%

In the cases above the SYSTEM **can be used normally** but one must take into account as the batteries are **NOT FULLY EFFICIENT** and they must be checked and re-charged as soon as possible.
Connecting the RS-232 port of the Remote Unit to a PC with any communication program running (Telix, Hyperterminal, etc.) it will be possible **to read directly the details** of the FAULT condition.

- **DATA ERROR** when CORRUPTED DATA are detected in the memory (data relative to the LINES parameters), the TEST-ON" and "FAULT" LED's will start to flash alternately. **This condition doesn't forbid the system's operation:** it will be sufficient to "call" the Unit or even **any single line** of that Unit and to modify a parameter (e.g.: the SEQUENCE number). The error condition will be RESET. **WARNING!**: **this operation doesn't restore other data eventually corrupted**. Since this indication warns about a GENERIC data loss in memory (it could be relative to one or more data), it will be a good choice to **RE-PROGRAM COMPLETELY THE UNIT**.

6. 🟢 **RX SAFE** GREEN LED It flashes shortly every time the Unit receives and decode a radio signal containing its User's Code (even if the command was not directed to that particular Unit). It could be used as status indicator for the correct performance of the RADIO RECEIVER.

7. 🔴 **RX FIRE** RED LED it flashes shortly every time the Unit receives a FIRE COMMAND addressed specifically to it.

8. 🔴 **TX R.F.** RED LED It flashes shortly when the TRANSMITTER of the Unit is ON (typically when the Unit is answering to a command of the Base Unit or when is sending data).

9. **CE** MARKING with a certification number released by a "***Notified Body***" and attention symbol.

10. Marking with IDENTIFYING NUMBER of the Unit and SERIAL NUMBER.

11. Marking with the PRODUCER NAME, NAME AND MODEL of the Unit.

12. Generic **CE** marking

13. Protection Cover. During the normal use it can be completely removed sliding the hinges out of the receptacles.

14. **Battery Pack.** This section (separable from the others) contains: the battery for the SYSTEM operation, the batteries to supply the fire lines, the

microcontroller system for the controlled charging management and the mains power supply. NOTE: the Battery Packs are all IDENTICAL each other and can be interchanged without limitations both among the the various RX-24B Units and the TX-2000 base Unit. (See the specific chapter for details).

15. **RX24-B Remote Unit.** This section (separable from the other) contains: the whole electronic circuitry, the radio communication system and the power drivers for the fire lines.

16. Label with data for the instrument's identification

17. Carrying handle.

18. Butterfly latches to secure the RX24-B Unit to the Battery Pack (14). Make sure these latches are always PERFECTLY LOCKED both during the use and transport!

19. Butterfly latches for the top cover.

20. **Standard RS-232 SERIAL PORT**. DB-9 male connector. It is used to connect the RX24-B Unit to a PC. It will be used to *download* eventual update programs, *patches* and customizations, supplied by Parente Fireworks, DO NOT USE a standard commercial RS-232 cable, but use always the special cable (red marking) supplied with the instrument (to implement such a function , it will be sent always specific instructions).

21. **Standard RS-485 SERIAL PORT.** DB-9 female connector. It is used to connect the Remote Unit RX24-B to other Units and to the base Unit TX2000: to be used if a CABLE CONNECTION is preferred to the standard RADIO LINK (or when a MIXED connection, cable+radio) is realized. This connection needs ONLY TWO WIRES (pins 1-2-6 and 4-5-9). The third wire (comune) connection to pins 3-7-8 IS NOT MANDATORY.

22. **R.F. OUTPUT - BNC connector. O**utput for test purposes only. It is coupled with a 1pF capacitor and allows to monitor the output R.F. signal with an oscilloscope or a frequency counter.

23. **Main Antenna. Turret for the attachment of the whip antenna supplied with the instrument.** The antenna resonates at λ/4 on 40,675MHz. NOTE: use the original antenna only.

4.3 GENERAL DESCRIPTION

- Up to **255** Remote Units RX24-B can be used at the same time up to a maximum of **6120 independent lines**!

- All Remote Units are **individually marked with a progressive number on the front-panel**

- Each Unit has **24 lines individually marked:** Unit number **ONE** has lines 1 to 24, Unit TWO from 25 to 48 and so on for all existing Units.

- The batteries can be charged removing the **Battery Pack** from the Unit itself and connecting it to a mains receptacle (230V 50Hz or 115V 60Hz optionally). The whole process of test and charge is automatically controlled by dedicated microcontroller. During the test and charge operations, the Unit **cannot be used**.

- The program for the fire sequences is **permanently stored** inside the memory of each single Remote Unit and it is maintained until the operator will overwrite it with new data.

- Any number of remote Units can be added or removed from the System without altering the program of the remaining Units.

- The fire sequences can be altered at any moment , even few minutes before the show take place, with the maximum of ease, at distance and without need to be present on the fire site.

- The Base Unit TX2000 (when the "SHOW" mode is NOT in use) behaves just as a COMMUNICATOR and doesn't contain any memory of the fire sequences (the sequences are stored inside the Remote Units RX24), the Base Unit, if damaged, can be replaced IMMEDIATELY without any modification of the fire sequences already programmed. In "SHOW" mode too the Remote Units store the whole show sequence: should be necessary to replace at the last moment the Base Unit, it will be just necessary to reload on it the **show image** from a portable PC in few seconds.

4.4 Power ON procedure

- **Main switch to** "**ON**"
- The green **LED** flashes quickly (all lines are tested in sequence)
- The green **LED** pauses (the fire battery is now controlled)
- If all test are passed, the green LED remains lit permanently: the Unit is READY TO OPERATE
- Should a test fail, the yellow **LED** "**FAULT**" will turn ON. In this case: TURN OFF the instrument, wait some seconds and TURN ON AGAIN: if now the green LED remains lit, probably it was just a bad reading and all is OK. If otherwise the FAULT yellow LED should turn ON again, repeat the test once more and finally DISCARD THE UNIT (it must be serviced). If the yellow LED turns On during the final pause, then the fault is probably caused by the FIRE BATTERIES: in the latter case it could be just sufficient TO HAVE A RECHARGE. **If no activity is noticed (no LED's ON), then verify the internal fuses.**
- **If the yellow LED "FAULT" turns ON immediately when the Unit is switched ON, probably the SYSTEM BATTERY voltage is BELOW the minimum value of 10,2V and the Unit, for safety reasons, automatically enters a TOTAL BLOCKING condition.**
- **Both the battery problems can be recovered in two modes: if the time left before the show is enough, RECHARGE BATTERIES. If otherwise the problem should arrive when a re-charge is no longer possible, turn the main switch OFF, disconnect the Battery Pack and replace it with a spare one.**
- **During the whole OPERATING PERIOD, the RX24-B Units generate an INTERMITTENT TONE: this helps to find the Units in the dark when the show is over and avoid the risk to store the Unit still operating (this will cause the complete battery discharge in few days with the risk of permanent damage)**

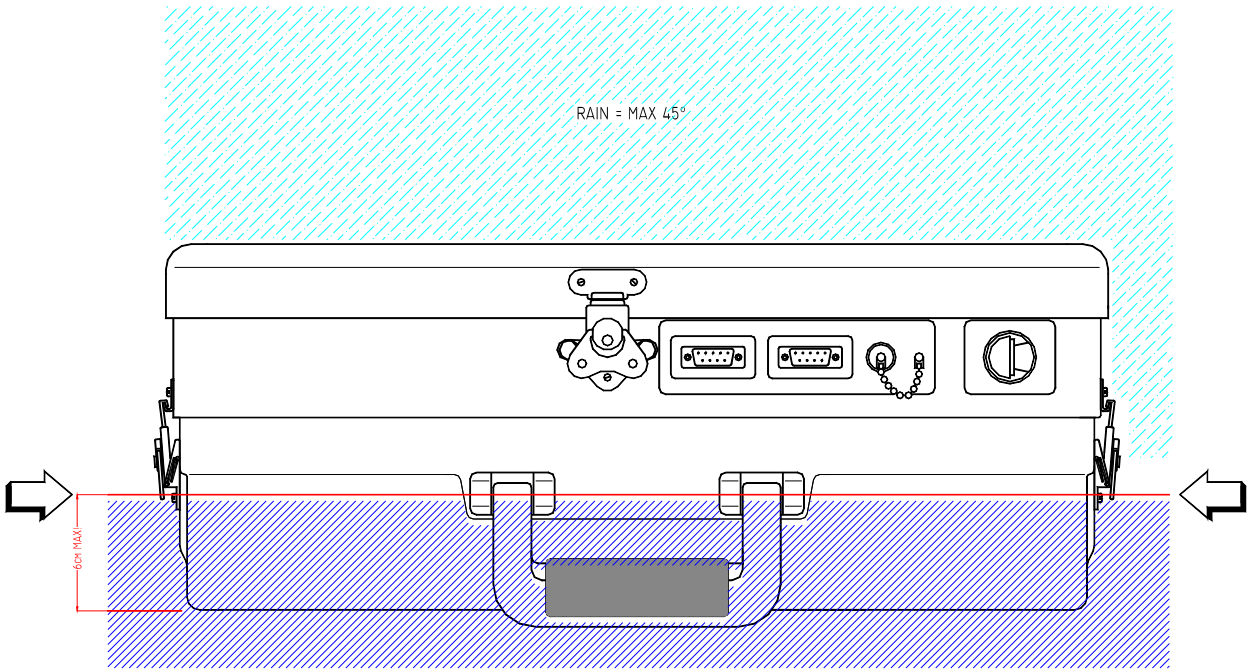
4.5 Units Field Usage

4.5.1 Protection

1) The Remote Units on field are subject to burning fallout with consistent risk of permanent damage of the plastic front-panel. An excellent protection is offered by the sturdy aluminium case an the top cover (the lateral openings on the cover allow the cables to pass and the normal operation while the COVER IS CLOSED) A further protection (mainly to avoid damages to the Unit's paint) can be obtained using the special fiberglass covers (supplied upon request as special accessory).

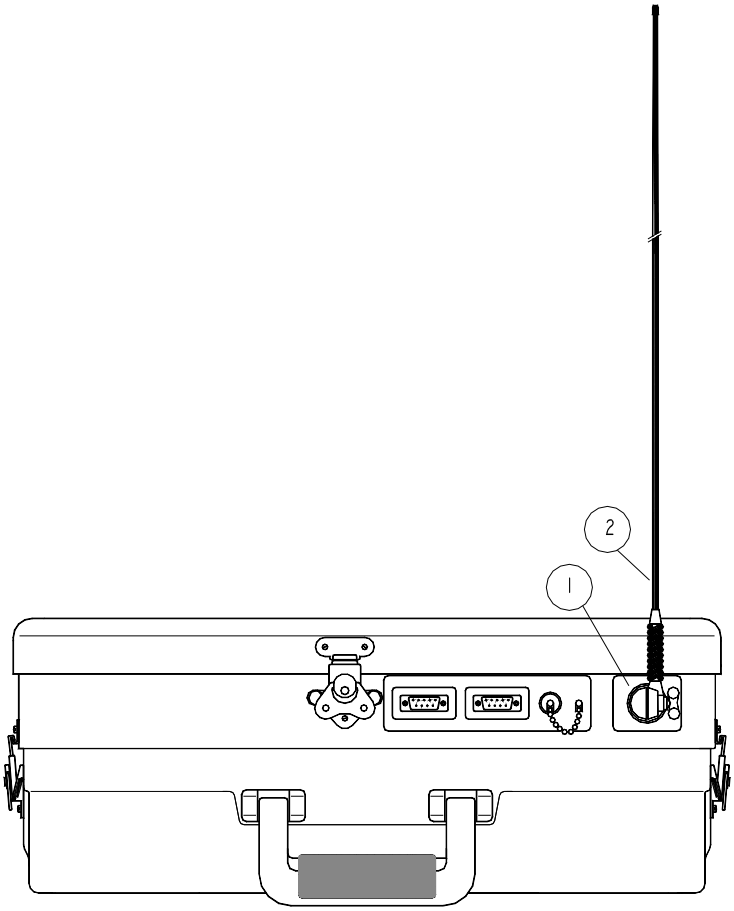
2) Should the user decide to provide otherwise to the Units protection, it is suggested to cover the top panel with aluminum foil paying great attention to avoid any SHORT CIRCUIT between the line wires and mainly to AVOID ANY CONTACT WITH THE ANTENNA CONNECTORS (it must be always perfectly insulated and must be never in contact with other metal parts).

3) The metal cases of the FIREMASTER SYSTEM, thanks to the particular structure, grant a good waterproofing degree against the water spillage or the rain falling quite vertical (no mre than 45°). The BOTTOM part of the cases (Battery Pack and charger) is completely waterproof **BUT ONLY UP TO ABOUT 6cm FROM THE BOTTOM!** (see figure below)**,** all the elements mounted on the front panel (switches, connectors, binding posts) ARE NOT WATERPROOF, they grant a good protection against the water spray BUT MUST BE PROTECTED AGAINST THE HEAVY RAIN OR THE IMMERSION!



4.5.2 Antennas

1) The antenna supplied with the FIREMASTER III *"Millennium",* is INTEGRAL WITH THE INSTRUMENT and it is used the same type both for the Base Unit TX2000 and the Remote Units RX24-B. These antennas are whip type in λ/4 resonating at 40,700MHz. The antenna is realized completely in fiberglass, and it is very flexible and fire resistant. The connection to the Unit is pivot-type one with wing nut.
2) In order to obtain the best results concerning the radio coverage field, even in presence of natural or artificial obstacles, the Remote Units should be placed at least ONE METER above the ground. Remember as, consistently with the terrain type and the show's needs, HIGHER THE ANTENNAS ARE PLACED, MORE COVERAGE RANGE IS OBTAINED AND THE SAFETY MARGIN IS INCREASED ACCORDINGLY.
3) The metal parts of the antennas (CONNECTOR, SPRING, WING NUT) **ARE ELECTRICALLY ACTIVE: AVOID ANY CONTACT WITH ANY OTHER METAL PART OF THE CASE** (SWITCHES, HANDLES, LINE CABLES, ETC). Avoid also any contact with the antennas of the next Units and other metal objects. IN GENERAL: the antennas must be installed in VERTICAL POSITION, far from any other object by at least 2 meters.
4) The reading of the field strength, in dBμV, displayed on the base Unit TX2000, give a good indication about the system ability to communicate. Avoid to operate when the reading is BELOW 15dBμV: it could happen some problem of partial data decoding with the result of SOME MISFIRE AT THE FIRST ATTEMPT **(IN ANY CASE IT IS ABSOLUTELY EXCLUDED ANY RISK OF PREMATURE OR UNDUE FIRE!!!).**



1) Connection with wing nut

2) Fiberglass whip antenna

4.6 Connections

4.6.1 Firing lines

The RX24-B Remote Units are provided with 24 couples of binding posts to connect 24 **independent** firing lines.
Each line is powered by the internal batteries of the Unit itself. The batteries for the lines supply are **exclusively dedicated to this duty** (all other circuits are supplied with a **separate battery**) All Units are normally supplied with two 12V batteries connected in series for a total of 24V available to the fire lines.
Being these batteries of the **lead-acid type** with gel immobilized electrolyte, the available peak current to each line (during short periods) can be very high (up to 10A peak). On special demand it is possible to install inside the Remote Unit two more batteries for a total line voltage of 48V.
Using standard igniters with a resistance of 1.5 to 2 ohm, it will possible to connect **no more than 10 devices IN SERIES** and **no more than 8 IN PARALLEL** (the latter configuration **IS NOT SUGGESTED** anyway).
Using non-standard igniters, it will be possible to calculate approximately the maximum number of devices to be connected IN SERIES, taking into account for the resistance value and the minimum firing current (specifications supplied by the manufacturer). Proceed first calculating the maximum allowable resistance on a firing line **Rmax** given by:

$$\mathbf{Rmax} = \frac{\mathbf{Vfire}}{\mathbf{Imin}} - \mathbf{Rline}$$

where: **Vfire**=24V (or 48V for the special version)
Imin=minimum fire current of each (in amperes, as declared by the manufacturer).
Rline=resistance (in OHM) of the connection wires to the Unit.

It will be then calculated the maximum number of igniters **Nmax** to be connected IN SERIES to a single line using the following equation:

$$\mathbf{Nmax} = \frac{\mathbf{Rmax}}{\mathbf{Rign}} - \mathbf{2}$$

where: **Rmax** is the value obtained from the previous calculation
Rign is the resistance value of a **single igniter**

Eg.: using a standard Unit with a 24V battery, a connection line of 25 meters made of copper wire (section 0,22mm^2), ***daveyfire X2*** igniters with 5meter of connection cables, con cavi da 5mt, it will be obtained:
Vfire=24V, I min=0.8A, Rline=3ohm (about)

$$\mathbf{Rmax} = \frac{\mathbf{24}}{\mathbf{0.8}} - \mathbf{3} = \mathbf{27ohm}$$

$$\mathbf{Nmax} = \frac{27}{3} - 2 = 7$$

From the above calculations, it will be possible to connect IN SERIES up to 7 igniters of this type with a **100% warranty of ignitions**. These calculations are **very prudential** and theoretical: in practice it would be possible to connect in series a lot more igniters (giving up some safety margin).
In any case, when more igniters are to be connected in series, **it is mandatory using devices EACH OTHER IDENTICAL:** not only of the same brand and model, but possibly also coming from the SAME PRODUCTION LOT.

THE *PARALLEL* OR, WHORSE THE *MIXED SERIES-PARALLEL* CONNECTIONS, MUST BE AVOIDED. ALSO THE *SERIES* CONNECTIONS SHOULD BE REDUCED TO THE MINIMUM POSSIBLE.

- The line connectors must be clean and free from oxidation (this will increase the total line resistance).
- Make sure the connection wire has a sufficient section in order to grant a good contact to the binding post. Eventually bend several time the terminal part of the wire.
- Make sure the terminal part of the wire inserted in the binding post is completely free from the insulating sleeve (many misfires are due to this inadvertence!)
- Make sure the unprotected parts of wire eventually coming out of the connector doesn't contact any other metal parts of the Unit (antenna, case, connectors of other lines, etc.).

4.6.2 RS-485

The connection using the RS-485 line, allows the FIREMASTER III System to be used eliminating the RADIO circuits.

When this operating mode is used, it will be necessary to take into account for some limitations:

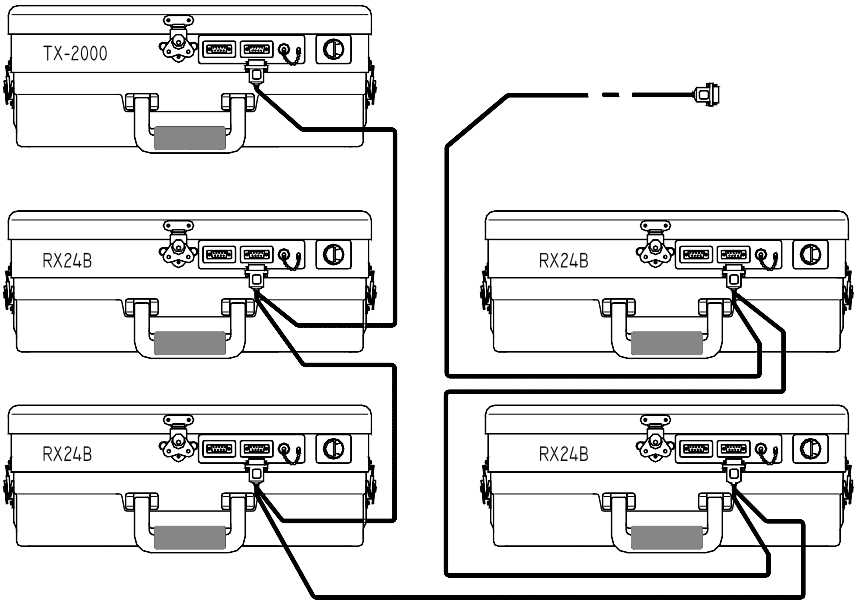
- The maximum number of Remote Units that can be connected together must be limited to about 20

- The communication by RS-485 serial line is available for the FIRE mode only. All the programming, testing and modify operations to the Remote Units, must be still performed using the RADIO link.

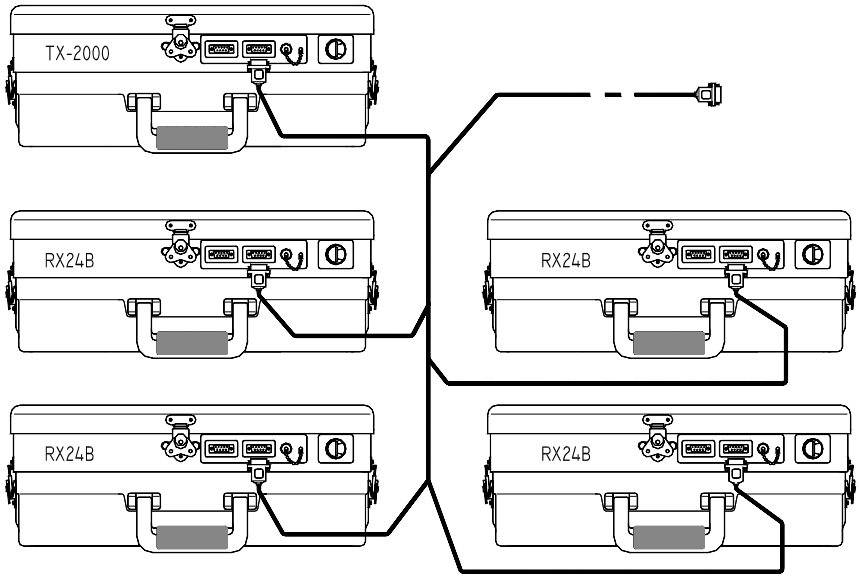
- The RS-485 port, when in FIRE mode, is always active: this allows to use the Firemaster System with a MIXED MODE (RADIO + CABLE).

- If the MIXED mode is used, then the Remote Units must be programmed in RADIO LINK mode and the antennas must be CONNECTED. Only if ALL THE REMOTE UNITS have been programmed in "CABLE" mode, it will be possible to remove the antennas (FOR THE "FIRE" FUNCTION ONLY).

When the connection by serial RS-485 line is used, all the Units (TX2000 and RX-24B) must be connected each other with a TWO-WIRE cable (available upon request). It can be used indifferently a "STAR" connection or a "CHAIN" connection".

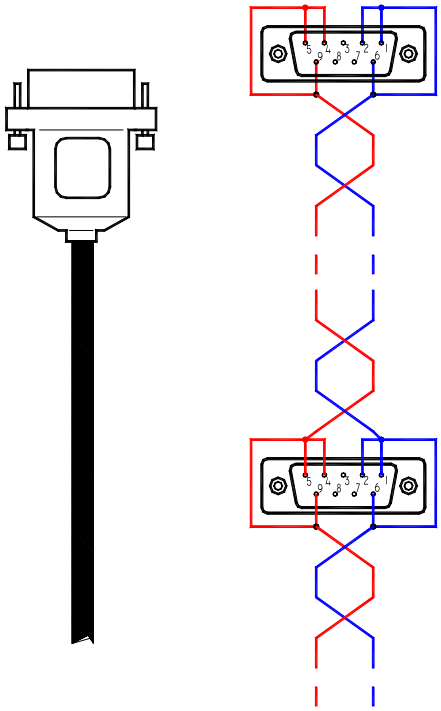


"CHAIN" CONNECTION



"STAR" CONNECTION

The connectors wiring must be realized following the diagram below:



4.6.3 RS-232

The RS-232 interface, installed both on the Remote Units RX24B and the Base Unit TX2000, can be used for three different purposes:

A) ***Download*** of data concerning a pyrotechnic show created with specific software (supplied by the User). This function is possible on the **TX2000 ONLY**

B) ***Download*** of **new versions, releases, patches** for internal program of the Firemaster System (supplied by **Parente Fireworks only**). This function is possible on the **TX2000 ONLY**

C) Connection to an external PC to read the data concerning the Unit type or the error messages issued during the test. This function is available on **BOTH** the **TX2000 and the RX24-B.**

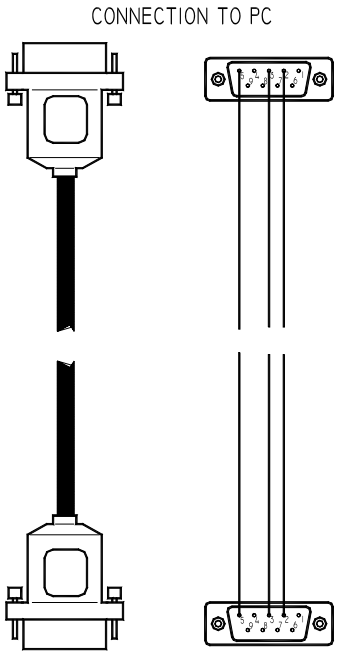
For the first two case the software supports will be supplied in order to operate directly. These software aids will be sent to the customer on CD-ROM or sent as *files* by E-mail.

The (A) case is the most common one and it is used to "load" in the internal memory of the Base Unit TX2000 the data concerning a pyrotechnic show created externally on a PC using a dedicated software commonly available on the market (PyroMotion, FireOne, etc.). In order to use this operating mode, other than to have all necessary software supports (normally supplied by the manufacturer of the "Show Management" program), it will be necessary also to have a special connection cable to be used between the PC serial port and the Base Unit TX2000.

DO NOT USE FOR THIS PURPOSE A COMMERCIAL CABLE! The connection cable to be used is the one supplied with the FIREMASTER SYSTEM and it has just three wires connected (the commercial ones have all 9 pins connected). This connection cable will be also used for the (C) mode.

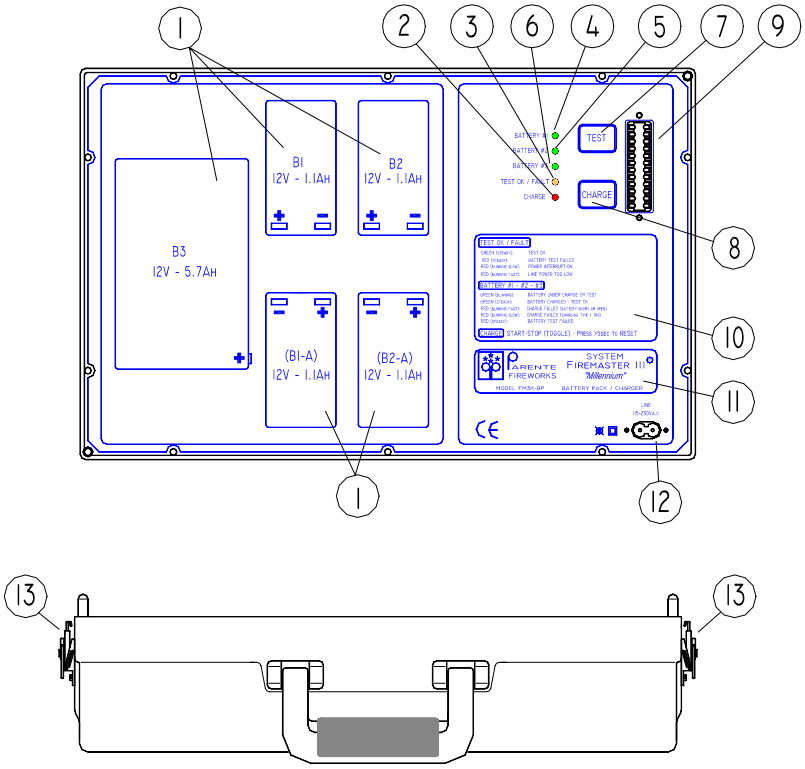
For the (B) mode only and when the internal managing program of the Unit itself must be reloaded, a special cable will be supplied along with the software release.

Concerning the details of the PC communication ports, data transfer mode and baud rate, they will be supplied everytime.



5.0 FM3K-BP BATTERY PACK

5.1 FRONT- PANEL DIAGRAM



1) Batteries placement inside the container.

2) "CHARGE" GREEN LED it turns ON when the charger is connected to the mains.

3) "TEST OK - FAULT" bi-color LED (RED-GREEN): it indicates a condition of "battery test running" (GREEN), or an "ERROR" condition (RED).

4) "BATTERY #1" bi-color LED (RED-GREEN) it indicates the state of charge for the line battery #1 : blinking green = battery under charge, steady green = battery charged, red = error during the charge process

5) "BATTERY #2" bi-color LED (RED-GREEN) it indicates the state of charge for the line battery #2 : blinking green = battery under charge, steady green = battery charged, red = error during the charge process.

6) "BATTERY #3" bi-color LED (RED-GREEN) it indicates the state of charge for the SYSTEM battery #3 : blinking green = battery under charge, steady green = battery charged, red = error during the charge process

7) "TEST" key: if it is pressed for at least one second, the automatic check of the status for all batteries of the System, is activated. If the battery Pack is NOT connected to the mains, the status test can be carried-out anyway, but the "TEST" key must be held down as long as the test takes place.

8) "CHARGE" key: when the charger is connected to the mains, pressing this key will activate the automatic charging process for all batteries of the Unit.

9) 24-pole connector to connect the Battery Pack to the Unit above.

WARNING: the metallic contacts of this connector carry directly the batteries voltage and **NO FUSE PROTECTION IS PROVIDED! AVOID ABSOLUTELY ANY ACCIDENTAL CONTACT OF THESE PINS EACH OTHER OR WITH OTHER METALLIC PARTS: THE CONTACTS WILL BE FUSED AND THE BATTERIES COULD BE PERMANENTLY DAMAGED!!!**
Exercise also the maximum care to maintain these contacts always PERFECTLY CLEAN AND DRY.

10) Indications printed on the panel about the main key function and the LED meaning.

11) Indications printed on the panel about: instrument model, manufacturer, CE marking.

12) Insulated bipolar receptacle for the mains supply cable.

WARNING: the Unit is NOT PROVIDED WITH A GROUND CONNECTION (this condition is marked with the specific symbol). The user's protection is obtained using components with a DOUBLE INSULATION.

13) Butterfly latches to secure the Battery Pack to the upper Unit (TX2000 or RX-24B).

WARNING: make always sure these latches are always PERFECTLY LOCKED before moving the instrument!

5.2 GENERAL DESCRIPTION

The Battery Pack **FM3K-BP** is an **autonomous Unit containing the following elements**:

- Batteries for the fire lines: TWO (FOUR optionally) 12V 1,2Ah batteries. Lead-acid type, sealed with gel-immobilized electrolyte.
- Battery for the System supply: ONE 12V 5,7Ah battery. Lead-acid type, sealed with gel-immobilized electrolyte.
- Line power supply (230Va.c 50Hz or 117Va.c. 60Hz) for the re-charge system.
- Automatic charging circuit, supervisor and battery status manager, **controlled by a dedicated microprocessor.**
- Highly impact-resistant case (aluminum cast)
- Front-panel with LED indicators for the batteries charge status and membrane keyboard for the functions selection
- 24-pole connector to carry power to the upper Unit.

The Battery Pack can verify the charge status of all batteries (both System and Lines), to provide an optimal recharge of the batteries and to signal accurately any inconvenience detected during the charge or the test.

5.3 OPERATION DESCRIPTION

5.3.1 TEST

The battery test can be carried-out both when the Battery pack is connected to the mains (provided a charge cycle is not already running) and when it is disconnected.

During the TEST, the batteries, one at the time, are measured OPEN CIRCUIT, measured UNDER LOAD and the results are displayed turning ON accordingly the LED indicators on the front-panel.

5.3.1.1 TEST (UNIT CONNECTED TO MAINS)

The mains cord must be connected to a line receptacle with the correct characteristics (check for the voltage), the "CHARGE" LED must be ON. A charging process must be NOT already running (the LED indicators of the three batteries must be OFF).

Press for at least one second the "TEST" button and release it: the "BATTERY#1" and "TEST OK - FAULT" LED's will start to flash (green light) while the test of the corresponding battery is carried-out. The "BATTERY#2" and "BATTERY#3" will also start to flash in sequence. If the battery passes correctly the test, the corresponding LED will stop to flash and will remain ON steady (green), if otherwise any problem should be encountered, a RED light will turn ON signaling a FAULT situation.

5.3.1.2 TEST (UNIT NOT CONNECTED TO MAINS)

The battery test can be also carried-out on the field when the Battery Pack is not connected to the mains. The procedure (and the results too) are identical to the ones previously described: it will be only necessary to HOLD DOWN THE "TEST" KEY AS LONG AS THE TEST PROCEEDS

5.3.2 TEST CONDITIONS

The test conditions are summarized in the table below:

PARAMETER	SYISTEM Battery	LINE Battery
TYPE	Sealed- Lead-acid	Sealed- Lead-acid
Nominal voltage	12V	12V
Charge capacity	5.7Ah	1.2Ah
CHARGE voltage	13.9V	14.2V
CHARGE limit current	1.2A	500mA
FAILED Battery voltage	≤8.0V	≤8.0V
Battery having to be charged voltage	≤11.5V	≤11.5V
Battery CHARGED voltage	≥12.3V	≥12.3V
END-OF_CHARGE current	≤75mA	≤18mA
Max time with LIMIT CURRENT	∞	30'
Max charging time	12h	12h
OPEN-LOAD Percentage (TEST)	≤15%	≤20%
OPEN-LOAD Percentage (after charging)	≤10%	≤12%

5.3.3 BATTERY TEST BEFORE CHARGING

The test before charging (or just to check the System before using it) must be carried-out MANUALLY by the operator pressing the TEST key.

For every battery contained inside the Battery Pack, it will be first measured the voltage OPEN-CIRCUIT: if this reading is below the table value, the corresponding RED LED will turn ON and the test UNDER LOAD will NOT take place (the battery needs charging ANYWAY). The battery is then loaded , the voltage is measured again and the variation percentage with respect the first OPEN-CIRCUIT reading is then calculated. If this percentage falls between the the specified limits, the battery can be safely used being the internal resistance good and

the charge level sufficient: this situation is indicated turning ON (steady) the corresponding green LED.

When a battery fails to pass the test above, two cases are possible:

- the battery is still efficient but requires charging
- the battery is failed and must be DISCARDED

During the successive charging process, the proper condition will be discriminated.

5.3.4 CHARGE

The Battery Pack must be first connected to the mains: the green LED "CHARGE" will turn ON. If, during the previous charge cycle, a power fail should occurred, the "CHARGE" LED will be RED blinking slow: this is just a warning and doesn't prevent the charge process. If otherwise, during the power ON, the "CHARGE" LED should be RED BLINKING FAST, then **the line voltage is TOO LOW and the charge process cannot take place.**

Press "CHARGE" key for one second: a test of the batteries will be repeated but using different parameters (see table). All batteries that shouldn't pass this test, will be indicated by the corresponding LED turning ON with RED light (FAULT): these batteries will be NOT charged being considered FAILED and TO BE REPLACED.

If the second test is passed, the charge process will take place automatically and it will stop when the full charge is reached. The charge process stops anyway after 12 hours even if the full charge has been not reached: in this case an ERROR condition will be displayed.

When the charge process is over, a final test is carried-out (using even different parameters) and eventual error conditions will be indicated turning ON accordingly the RED LED's.

TO REST THE ERROR CONDITIONS (the status is permanently stored in memory) THE "CHARGE" key must be held down for at least 5 seconds, wait for the automatic test cycle to be executed and finally make a MANUAL TEST cycle using the TEST key.

5.3.5 BATTERY TEST AFTER CHARGING

When the charging is done, a TEST cycle will be automatically executed to verify the good result of the process: the measured parameters must fall within the limits of the table. A battery passing the test BEFORE CHARGING but failing the test AFTER THE CHARGE, is probably FAULTY or near to be. Before discarding definitely these batteries, it is suggested to REPEAT AT LEAST TWICE THE CHARGING CYCLE.

5.3.6 ERROR CONDITIONS LISTING

The table below resumes all the possible error conditions and the way they are indicated by the LED lamps on the front-panel of the Battery Pack. The same information is printed on the front-panel itself.

LED "TEST OK - FAULT"	
CONDITION	**MEANING**
GREEN BLINKING	Test in progress
GREEN STEADY	Test OK (after charge)
GREEN (OFF)	Test OK (manual)
RED STEADY	Test battery FAILED
RED BLINKING SLOW	Interruption of the line voltage during charging
RED BLINKING FAST	Line voltage TOO LOW
LED B#1 - B#2 - B#3	
CONDITION	**MEANING**
GEEN STEADY	Battery charged and tested - OK
GREEN BLINKING	Battery under charge
VERDE (OFF)	Waiting
RED STEADY	Charge NOT in progress: the pre-charge test FAILED
RED BLINKING SLOW	ERROR: the full charge has been NOT reached within the 12H limit
RED BLINKING FAST	ERROR: the battery could be both OPEN or SHORT CIRCUITED

5.4 BATTERIES

All batteries used by the FIREMASTER III *"Millennium*" SYSTEM, are of SEALED lead-acid type with GEL solid electrolyte. These are very reliable batteries requiring very little precautions and need PRACTICALLY NO SERVICE.

Considering however as the good result of a pyrotechnic show of several thousands dollars worth, depends for a large extent by the good battery behavior, it seems adequate to insist on the absolute necessity of ACCURATE AND FREQUENT CONTROLS of the battery situation. In particular:

1) Avoid exposing the battery to **extreme temperatures (below 0°C or OVER 45°C)** for long periods.
2) When the SYSTEM is NOT IN USE, provide to charge regularly the batteries: the lead-acid batteries have a much longer life if maintained ALWAYS FULLY CHARGED. It is suggested a charge cycle of **12 hours every 30 days.** The internal microprocessor system will take care to maintain the optimum charge level in any condition.
3) When the System is NORMALLY USED (periodic duty), it is suggested to have a 12-hour charge before all shows.
4) If the batteries have been DEEPLY DISCHARGED it is suggested to have a full charge for at least **24 hours** (eventually repeat TWICE the automatic charge cycle).
5) Make periodic controls of the battery status at least every 2-3 months by visual inspection after removing it from the container: if any swelling, spot, salt or liquid spill are noticed, DISCARD IMMEDIATELY THE SUSPECT DEVICE even if apparently it does still give energy enough.
6) If measured OPEN CIRCUIT (without any load applied) all lead-acid batteries, when a common voltmeter (tester) is used, **always give 12V <u>even if quite completely discharged</u>** . It will be then necessary to always measure the battery voltage while a suitable load is applied. To do that, REMOVE the batteries from the Unit case, measure the voltage across the terminal with a voltmeter and connect **<u>momentarily</u>** a load sinking about **1A current**. For a 12V battery a common wire-wound resistor rated **10ohm 10W** can be used or optionally a 12V car bulb (e.g.: the one used for the headlight). The DIFFERENCE between the voltage measured OPEN CIRCUIT and UNDER LOAD shouldn't be MORE THAN 10% - 15%. E.g.: if a battery measured OPEN CIRCUIT gives a reading of 12,2V and, when LOADED with the resistor or the lamp, the reading decreases to 11,5V, it can be still regarded as a GOOD ONE. On the contrary, if the voltage measured UNDER LOAD should fall below 11V (or less), it will be then necessary to have a full charg for at least 12 hours and then the test will be repeated. If, after the charge, the test above is passed, OK: the battery was just discharged and can be still used. If otherwise the battery still exhibits an excessive voltage reduction under load, then it **MUST BE IMPERATIVELY DISCARDED** AND REPLACED WITH A NEW ONE.
   NOTE: all batteries installed inside the Battery Pack of the SYSTEM, are AUTOMATICALLY TESTED with the method above.
7) The MEAN LIFE of a lead-acid battery is ABOUT 2 YEARS. It is thus suggested, in a prudential way, to REPLACE ANYWAY YEARLY all batteries giving test results LESS THAN PERFECT (even if apparently acceptable). **EVERY TWO YEARS ALL SYSTEM BATTERIES MUST BE REPLACED.** The recovered batteries, if still passing the load test, can be used as EMERGENCY EXTERNAL BATTERIES.

We recall here the RECYCLING RULES concerning the battery disposal: it must absolutely avoided to dispose the failed batteries with the common garbage, call instead a specialized collecting center enabled for the recycling of this polluting waste!

5.5 INTERNAL BATTERIES REPLACEMENT

When it is necessary to access the internal batteries for a check or replacement, proceed as follows:

1) If not already done, SWITCH OFF the Unit (Remote or Base).
2) Unlatch the butterfly latches securing the Battery Pack to the body of the Unit.
3) Remove the battery Pack
4) Unscrew the top panel and remove the two steel points.
5) Remove VERY CAREFULLY the top panel. Avoid any internal circuit or component touching the metal case.
6) Dis-connect the batteries from the circuits by removing the cable connectors (FASTON).
7) Check or replace all batteries needing that.
8) Restore the connections to all batteries **RESPECTING THE CORRECT POLARITY (CHECK MORE THAN ONCE FOR SAKE OF SAFETY!)**
9) Restore the rubber spacers placed between the batteries and the metal panel.
10) Close the panel securing it with the screws and the two steel points (don't forget the nylon washers!)
11) **When a battery replacement is needed, USE THE ORIGINAL SONNENSCHEIN - DRYFIT BATTERIES ONLY**.

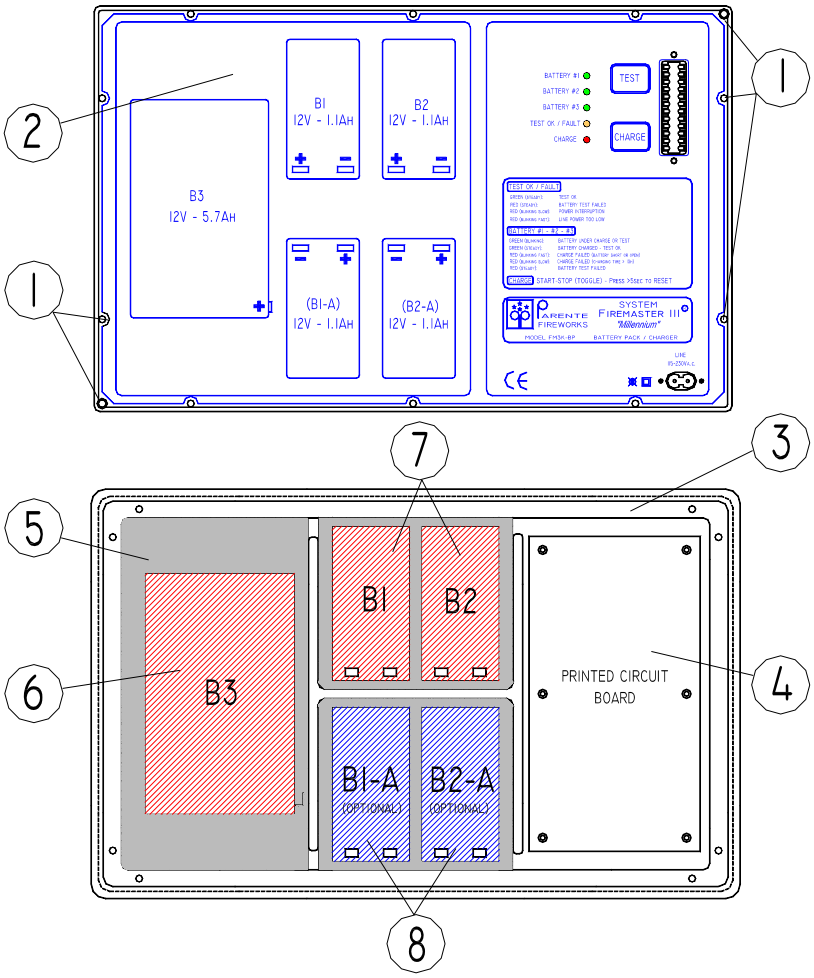
The battery types used on the FIREMASTER III "*Millennium*" are the following:

- **TRANSMITTER (TX2000): ONE 12V 5,7Ah battery series dryfit A300 SERIAL 07 191432 00 (optionally it can be used the same type series A200 SERIAL 07 191432 00)**
- **RICEIVERS (RX24-B): - ONE SYSTEM BATTERY 12V 5,7Ah series dryfit A300 SERIAL 07 191432 00 (optionally it can be used the same type series A200 SERIAL 07 191432 00) - TWO (optionally FOUR 4) LINE BATTERIES 12V 1,1Ah seris dryfit A300 SERIAL 07 191185 00 (optionally it can be used the same type series A200 SERIAL 07 190185 00)**

WARNING: using battery types OTHER THAN the specified ones, other than NOT GRANTING a normal working autonomy, could also require a complete RE-TUNING of the recharge circuits: this operation requires the manufacturer intervention.

The charging voltage of the Sonnenschein dryfit batteries (limited current) is 13,9V/14,2V at 20°C: the internal charging circuits are set to this value. Batteries of different manufacturers, could require different charging values up to 14,9V.
The dryfit Sonnenschein batteries are SOLID GEL IMMOBILIZED and can be used without restrictions IN ANY POSITION. Several other SEALED BATTERY have a LIQIUD IMMOBILIZED electrolyte: even if equivalent from a functional point of view, they CANNOT OPERATE FOR LONG PERIODS LAID DOWN, or a sudden LOSS OF CHARGE CAPACITY will be faced. In any case the SYSTEM BATTERY must be NEVER replaced with such a type, because it PERMANENTLY OPERATES IN THIS POSITION.

5.6 BATTERIES INSTALLATION INSIDE THE FM3K-BP BATTERY PACK



1) Securing screws for the front-panel and steel points
2) Battery Pack FM3K-BP with the panel closed
3) Battery Pack FM3K-BP with the top panel REMOVED. Take care of the connections between the panel components and the printed circuit!
4) Printed Circuit of the battery-charger and the microprocessor supervisor system.
5) Rubber containers for the batteries
6) SYSTEM BATTERY 12V 5.7Ah
7) LINES BATTERY two identical devices 12V 1,2Ah
8) OPTIONAL LINE BATTERIES (upon special request only) two identical devices 12V 1,2Ah

6. GENERAL SAFETY RULES AND WARNINGS

The following rules and suggestions should be accurately followed in order to be compliant with most obvious safety rules, to avoid serious and permanent damage to the FIREMASTER system and to obtain always the best performance:

1) Avoid any water spillage or spray on the front-panel of the Remote Units RX24B (also on the TX2000 of course!). The Units are NOT COMPLETELY WATERPROOF. Dry immediately any Unit that accidentally received a spray of fresh water or rain. Disconnect and dispose any Unit wet of SEAWATER: these Units must have service as soon as possible to clean out the internal circuits.
2) Never clean the front panels using solvents such as: alcohol, organic solvents, acids or alkali. The panels must be cleaned using a soft cloth or paper tissue wet with a little neutral detergent (no foaming type). Avoid to scratch the surfaces!
3) During the show execution, protect the Remote Units RX-24B the burning fallout using the aluminum covers provided with lateral slits for the cable passage. For an increased protection and to save the cover paint, special fiberglass covers can be obtained upon request from the manufacturer or the local representative.
4) Avoid if possible to place the Remote Units RX-24B directly on the ground (in particular if it is frozen, wet or muddy). The Units should be always placed at least 50cm - 1 meter ABOVE THE GROUND using adequate supports **not flammable**: **avoid thus cardboard, plastics or wood boxes!**
5) Use ONLY ONE ANTENNA AT THE TIME. Using two antennas at the same time (the availability of two separate connectors could suggest to do that!), other than reducing quite to zero the transmitter efficiency, could impair permanently the transmitter circuitry.
6) **Never use the System Units (both the RX-24B and the TX2000) without the antenna connected**.
7) Never use the System exposing it for long periods to extreme temperatures (above 35°C or below 0°C).
8) The Units must be stored in a dry place with an ambient temperature between 5°C and 30°C (maximum limits).
9) Avoid to charge the internal batteries for more than 24 hours (forcing the repetition of the charge cycle). The internal charge supervisor limits the charge time to 12 hours maximum.
10) **Switch OFF all the Units before the storage in the shelf**
11) Replace immediately all faulty batteries or the ones suspected to have poor performance (the cost of a battery doesn't worth a fiasco!)
12) Dispose the discarded batteries following the local rules for recycling this type of material.
13) Let always enough space around the antennas. It is a good rule to avoid the presence of large metal surfaces far less than 10 meters from the antenna.

14) When possible try to raise the Unit as much as possible from the ground: the propagation of the radio signals increases considerably if the antenna is placed far from the ground.
15) Avoid to operate with large natural or artificial obstacles (houses, hills, wire mesh) between the TX2000 and the Remote Units. Always try to operate with all the field Units in "line of sight" with the TX2000 transmitter.
16) **Avoid absolutely any contact of the metal base of the antenna and its connector with wires, metal parts or external circuits**.
17) **Never use the System near to or inside storage of flammable, explosive materials or products sensitive to strong electromagnetic fields**.
18) **Never recharge the Units inside the powders storage or inside dangerous areas. Never store or switch on the Units in presence of high concentrations of combustible dust or solvent vapors**
19) Never connect to the Units external devices other than the accessories of the same product line directly supplied by the manufacturer.
20) Never make connections or dis-connections of the squibs on the SYSTEM when the RX-24B are switched ON! Always switch OFF all the Units before beginning any operation with the squibs. When the squibs are connected, always make sure that nobody could, accidentally or willingly, turn on the TX2000 Base Unit and operate on it.
21) Don't use testers ohmmeters or circuit testers to verify the line continuity when the wires are already connected to the binding posts of the Remote Units! Always use for this purpose the system facilities!
22) **Don't use absolutely any external power source in order to increase the line voltage or current**.
23) **Clear the fire site from the personnel when, with the mortars already loaded and squibs connected, the FIREMASTER Base Unit is switched ON and during the whole period of lines and sequences programming. Any operation concerning programming and testing must be carried-out in conditions of maximum safety for all the personnell on duty.**
24) **Remove the safety key from the TX2000 during the squibs connection, mortars loading, etc. Prevent the improper use of the SYSTEM by personnel not qualified and at the wrong moment**.
25) **Do not use cellular phones, cordless, walky-talky, transmitters, brush motors, high-energy electric apparatus, industrial lamps with reactors, etc. near to the FIREMASTER System while operating (both in programming and in FIRE mode) and mainly when the squibs are already connected to the system**.
26) Avoid absolutely any electric contact between the squib wires connected to the binding posts and any other external circuit or metal part. Avoid also the accidental contact with metal parts of the Unit itself. **To each binding post must be connected only two insulated wires of a single line and completely free from any other connection**.
27) Never connect more than 5 squibs in parallel or 10 in series to the same line. If the line connection wires are longer than 10 meters or the line be realized with small-section conductors, then the connection for each line should be limited to 3 squibs in parallel and 5 in series.

28) Carefully insulate all the wire joints and avoid any electric leakage (wires or joints wet!) between the wires of different lines or between the wires and the ground or metal surfaces.
29) **Imperatively never use the FIREMASTER SYSTEM other than for control and firing of PYROTECHNIC SHOWS**.

INOBSERVANCE OF THE ABOVE RULES, OTHER THAN PRODUCING FAULTY OPERATION, PERMANENT FAILURES TO OBJECTS OR PERSONAL INJURIES, WILL ALSO IMMEDIATELY VOID THE WARRANTY OF THE FIREMASTER SYSTEM

7.0 TECHNICAL SPECIFICATIONS

7.1 TX2000 BASE UNIT - TECHNICAL SPECIFICATIONS

- CODE TRANSMISSION SYSTEM: bi-directional RADIO link
- RECEIVER: single-conversion super heterodyne, quartz-controlled, FM
- RECEIVING SENSITIVITY: 0.15µV/m at 20db S/N
- RECEIVING FREQUENCY: 40.665MHz
- TRANSMITTER: 4-stage, FM, quartz-controlled.
- TRANSMISSION FREQUENCY: 40.685MHz ±12kHz
- TRANSMISSION POWER: in conformity with FCC Cfr. 47 part.15 sub B
- SAFETY CODING: 36-bit binary sequence with fire code protection, user's code, parity.
- DISPLAY (for parameters and sequences displaying): GRAPHIC LCD 320x240 pixels (1/4VGA) with LED backlight.
- R.F. CARRIER INDICATION: LED indicator on the front-panel
- RECEIVED SIGNAL INDICATOR: direct reading in dBµV
- SYSTEM AUTONOMY WITH FULLY-CHARGED BATTERIES: more than 10 hours
- SAFETY KEY SWITCH: OFF - SAFE/TEST - FIRE
- KEYBOARD: membrane type, splash proof, 27 keys
- MICROPROCESSOR: 16-bit – 20MHz - H8S family
- SHOW PROGRAM AND CODES STORAGE: E^2PROM
- MAIN PROGRAM STORAGE: FLASH EPROM
- MAIN FIRE SEQUENCES: 1 to 24.000 sequential, random or with auto-increment
- MAXIMUM NUMBER OF REMOTE UNITS IN A SINGLE SYSTEM: 255
- MAXIMUM NUMBER OF INDEPENDENT LINES: 6120
- STANDARD INTERFACES: RS-232, RS-485, ANALOG I/O for the pyromusical synchronization with AUDIO tones

7.2 RX24-B REMOTE UNITS TECHNICAL SPECIFICATIONS

- CODE TRANSMISSION SYSTEM: bi-directional RADIO link
- RECEIVER: single-conversion super heterodyne, quartz-controlled, FM
- RECEIVING SENSITIVITY: 0.15µV/m at 20db S/N
- RECEIVING FREQUENCY: 40.685MHz
- TRANSMITTER: 4-stage, FM, quartz-controlled.
- TRANSMISSION FREQUENCY: 40.665MHz ±12kHz
- TRANSMISSION POWER: in conformity with FCC Cfr. 47 part.15 sub B
- SAFETY CODING: 36-bit binary sequence with fire code protection, user's code, parity.
- R.F. CARRIER INDICATION: LED indicator on the front-panel
- RECEIVED SIGNAL INDICATOR: direct reading in dBµV
- MEAN DECODING TIME FOR A VALID FIRE COMMMAND: 0,1s
- FIRE PULSE DURATION: 0.5s
- CODES AND SEQUENCES PROGRAMMING: by RADIO link from the Base Unit or with RS-232 serial port
- MAXIMUM NUMBER OF AVAILABLE SEQUENCES: 9999
- LINES AND SQUIB TEST: automatic measure of the total resistance, direct reading in ohm
- TEST CURRENT FOR SQUIBSI: 1mA (10mA max.)
- FIRING LINES: 24 independent. Quick-connecting terminals, metal-plated.
- LINE DRIVERS: solid-state with MOS-FET transistors.

7.3 FM3K-BP BATTERY PACK TECHNICAL SPECIFICATIONS

- SYSTEM BATTERY: sealed accumulator, lead-acid type with solid gel electrolyte - 12V 5.7Ah
- FIRING LINES BATTERIES: 2 sealed accumulators lead-acid type with solid gel electrolyte - 12V 1.2Ah (up to 4 devices can be installed for a total capacity of 48V - 1.2Ah)
- LINE CURRENT: 1A continuous, up to 8A peak
- CONTROL SYSTEM: with dedicated microprocessor
- CHARGE SISTEM: from mains, internal power supply, dedicated microprocessor
- FUNCTIONS: automatic sequential test of all batteries, automatic charge with control, automatic shut-off.
- MEASUREMENTS: open-circuit voltage, voltage under load, variation percentage, maximum charging current, end-of-charge current.

8 CERTIFICATIONS

The **FIREMASTER III "*Millennium*"** SYSTEM is provided with the mandatory **CE** marking and fulfills all the rules and product specifications as required by the Law. In particular the FIREMASTER System has been tested by a qualified TEST CENTER recognized at European level as "***Certified Body***" : the following certifications have been obtained:

- ELECTROMAGNETIC COMPATIBILITY: **EN 301 489-03 V1.3.1 (2001) - Rif. R&TTE**
- RADIO SECTION: **EN 300 220-3 V1.1.1 (09-2002) - Ref. R&TTE**
- ELECTRIC SAFETY: **EN 60950-1 (2001) - Ref. R&TTE**
- FCC CERTIFICATION: **CFR47 Part.15 sub B. Par.15.107 and 15.109, Part 15 sub C Par. 15.231**

FCC I.D.: SLO-FIREMASTER3

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

8.1 WARRANTY

PARENTE FIREWORKS s.r.l
Via Oberdan, 105
45037 MELARA (RO) -ITALY
Tel. ++39-(0)425-89035
Fax ++39-(0)425-89640
www.parente.it
info@parente.it

Manufacturer of the FIREMASTER III "Millennium" SYSTEM and its accessories, grants all Units free from manufacturing defects for a period of 12 months from the purchasing date.

All Units requiring service within the warranty period, must be sent back to PARENTE FIREWORKS - ITALIA or to an authorized laboratory at Customer's charge.

Before sending any Unit or part for servicing under warranty, make sure all procedures described in the present manual have been carefully followed.. ALWAYS CONTACT IN ADVANCE A PARENTE FIREWORKS REPRESENTATIVE TO OBTAIN A WRITTEN AUTHORIZATION FOR THE SERVICE DETAILS.

When the Units are sent back for servicing, please send also a short description of failures and problems encountered as well as a description of the ambient and operating conditions existing when the problem occurred.

We recall here as ALL BATTERIES are EXCLUDED from the present warranty.

8.2 WARNINGS - DECLARATION

8.2.1 DECLARATION

Hereby

PARENTE FIREWORKS s.r.l
Via Oberdan, 105
45037 MELARA (RO) -ITALY

declares that this

"SYSTEM FIREMASTER III "Millennium"

composed by the following sub-assemblies:

BASE UNIT Model TX2000-A
REMOTE UNIT Model RX-24B
BATTERY PACK Model FM3K-BP

Is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC

8.2.2 REMARKS

IMPORTANT REMARKS

Changes or modifications not expressly approved by the party responsible for compliance, could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different
from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.