

**SUMMARY OF THE ENGLISH EDITION**

April 8, 1987

♣ **FUNCTIONS SELECTION:**

♥ 1 - CHANNEL SELECTION .....	Page F-1
♥ 2 - TO CALL A FUNCTION WITH DISPLAY OF ITS NAME .....	Page F-1
♥ 3 - TO CALL A FUNCTION WITHOUT DISPLAY OF THE NAME .....	Page F-1
♥ 4 - DISPLAY OF THE FUNCTIONS TABLE .....	Page F-1
♥ 5 - FUNCTIONS TABLE .....	Page F-2

♣ **ADJUSTMENT OF THE PARAMETERS:**

♥ 1 - SUMMARY OF THE ADJUSTMENT OF THE PARAMETERS .....	Page P-1
1-1 Numeric adjustment .....	Page P-1
1-2 Incremental/decremental adjustment .....	Page P-1
1-3 Adjustment with the remote control numeric potentiometer ....	Page P-1
1-4 Adjustment from the RS232 Interface .....	Page P-1
♥ 2 - MODE SELECTION .....	Page P-1
♥ 3 - NUMERIC MODE .....	Page P-1
♥ 4 - INCREMENTAL/DECREMENTAL MODE .....	Page P-1
♥ 5 - ADJUSTMENT FROM THE POTENTIOMETER OF THE REMOTE CONTROL .....	Page P-2

♣ **MEMORIES OF FUNCTIONS AND PARAMETERS:**

♥ 1 - SUMMARY OF FUNCTIONS AND PARAMETERS MEMORIES .....	Page M-1
♥ 2 - SELECTION OF ONE OR TWO CHANNELS .....	Page M-1
♥ 3 - SELECTION OF THE NUMBERS OF THE FUNCTION MEMORIES .....	Page M-1
3-1 Numeric method .....	Page M-1
3-2 Incremental/decremental mode .....	Page M-2
♥ 4 - LOADING OF THE FUNCTION MEMORIES .....	Page M-2
♥ 5 - RECALL OF THE FUNCTIONS MEMORIES .....	Page M-2

♣ **FUNCTION 1: DELAY:**

♥ 1 - SUMMARY OF THE FUNCTION DELAY .....	Page 1-1
♥ 2 - HOW TO CALL THE FUNCTION DELAY .....	Page 1-1
♥ 3 - APPLICATIONS OF THE FUNCTION DELAY .....	Page 1-1
3-1 For recording: phase-shift compensation between microphones	Page 1-1
3-2 In mixing: Phasing .....	Page 1-1
3-3 In mixing: Double and triple voices .....	Page 1-1
3-4 In mixing: Space effects .....	Page 1-2
3-5 In video and cinema post synchronization .....	Page 1-2
3-6 For live .....	Page 1-2

♣ **FUNCTION 2: ECHO:**

♥ 1 - SUMMARY OF THE ECHO FUNCTION .....	Page 2-1
♥ 2 - HOW TO CALL THE ECHO FUNCTION .....	Page 2-1
♥ 3 - DURATION OF THE LOOP .....	Page 2-1
♥ 4 - FEEDBACK .....	Page 2-1
♥ 5 - APPLICATIONS OF THE ECHO FUNCTION .....	Page 2-1
5-1 Emphasized phasing .....	Page 2-1
5-2 Tube effects .....	Page 2-1
5-3 Space effects .....	Page 2-1
5-4 Accumulator effects .....	Page 2-1

♣ **FUNCTION 4: PITCH-SHIFTING:**

♥ 1 - SUMMARY OF FUNCTION 4.....	Page 4-1
♥ 2 - HOW TO CALL THE FUNCTION 4 .....	Page 4-1
♥ 3 - PITCH-RATIO .....	Page 4-1
♥ 4 - ADDED DELAY .....	Page 4-2
♥ 5 - PITCH-SHIFTING ALGORITHMS .....	Page 4-2
♥ 6 - MIDI CHANNEL NUMBER .....	Page 4-3
♥ 7 - MIDI VOICE NUMBER .....	Page 4-3
♥ 8 - POLYPHONIC TOTAL VOICE NUMBER .....	Page 4-4
♥ 9 - EVOLVING VIBRATO .....	Page 4-5
9-1 Frequency .....	Page 4-5
9-2 Depth .....	Page 4-5
9-3 Delay of modulation .....	Page 4-5
9-4 Modulation mode .....	Page 4-5
♥ 10 - AUTOMATIC ARPEGGIO .....	Page 4-6
10-1 Application 1 .....	Page 4-6
10-2 Application 2 .....	Page 4-6
10-3 Application 3 .....	Page 4-7
10-4 Application 4 .....	Page 4-7
♥ 11 - SPECIAL USE OF THE AUX KEY FOR THE FUNCTION 4 .....	Page 4-7

♣ **FUNCTION 7: REVERBERATION PRESET PROGRAMS:**

♥ 1 - SUMMARY OF THE PRESET REVERBERATION .....	Page 7-1
♥ 2 - HOW TO CALL THE PRESET REVERBERATION .....	Page 7-1
♥ 3 - EDITING OF A PRESET REVERBERATION .....	Page 7-1
♥ 4 - SAFEGUARD OF A USER ADJUSTMENT .....	Page 7-1
♥ 5 - PRESET REVERBERATIONS LIST .....	Page 7-2

♣ **FUNCTION 8: PARAMETRIC REVERBERATION:**

♥ 1 - SUMMARY OF THE PARAMETRIC REVERBERATION .....	Page 8-1
1-1 Block diagram .....	Page 8-1
1-2 Parameters list .....	Page 8-1
1-3 Basic principle .....	Page 8-2
♥ 2 - HOW TO CALL THE FUNCTION 8 .....	Page 8-3
♥ 3 - SIZE .....	Page 8-3
♥ 4 - DECAY TIME .....	Page 8-4
♥ 5 - ATTENUATION OF THE REVERBERATION .....	Page 8-4
♥ 6 - BASS DECAY TIME COEFFICIENT .....	Page 8-5
♥ 7 - TREBLE DECAY TIME COEFFICIENT .....	Page 8-5
♥ 8 - PREREFLECTIONS .....	Page 8-5
8-1 Special case: "Ping-pong" delay .....	Page 8-6

♣ **FUNCTION 9: HANDLING OF MEMORIZED SOUNDS:**

♥ 1 - SUMMARY OF THE FUNCTION 9 .....	Page 9-1
1-1 Principle .....	Page 9-1
1-2 Main applications .....	Page 9-1
1-3 Parameters list .....	Page 9-1
♥ 2 - MODEL SESSION N°1: TRIGGERED RECORDING .....	Page 9-2
2-1 Function memory selection .....	Page 9-2
2-2 Now call the function 9 .....	Page 9-2
2-3 Now proceed to the level adjustment .....	Page 9-2
2-4 Now proceed to the recording itself .....	Page 9-2
2-5 Automatic branch into reading mode .....	Page 9-3
2-6 Interruption of the recording .....	Page 9-3
2-7 Three modes of display for the reading mode .....	Page 9-3
2-8 Triggering of the reading by the AUX key .....	Page 9-4
2-9 Reading controlled from a MIDI keyboard .....	Page 9-4
2-10 Reading in loop mode .....	Page 9-4
2-11 Reading triggered by the A input signal .....	Page 9-4
2-12 Reading triggered by the B input signal .....	Page 9-4

♥ 3 - SECOND MODEL SESSION: MULTI-SAMPLING .....	Page 9-5
3-1 Function memory selection .....	Page 9-5
3-2 Now call the function 9 .....	Page 9-5
3-3 Now proceed to the adjustment of the levels .....	Page 9-5
3-4 Now proceed to the recording of the first sound .....	Page 9-5
3-5 How to stop the recording of the current sound .....	Page 9-6
3-6 Recording of the following sound .....	Page 9-6
3-7 Successive recordings .....	Page 9-6
3-8 How to go into the reading mode .....	Page 9-6
3-9 Samples selection without MIDI key .....	Page 9-7
3-10 Selection of a sample through the MIDI keyboard .....	Page 9-7
♥ 4 - THIRD MODEL SESSION: BIPHONIC CHROMATIC STACK .....	Page 9-8
4-1 Selection of the parameters memories .....	Page 9-8
4-2 Selection of the function 9 on the two channels .....	Page 9-8
4-3 Preset of parameters before recording .....	Page 9-8
4-4 Adjustment of the levels .....	Page 9-11
4-5 Recording .....	Page 9-11
4-6 Recording of the following sample .....	Page 9-12
4-7 Successive recordings .....	Page 9-12
4-8 Going into reading mode .....	Page 9-12
♥ 5 - SPECIAL USE OF THE FUNCTION MEMORIES FOR THE FUNCTION 9 .....	Page 9-13
♥ 6 - SELECTION OF THE RECORDING STARTING MODE .....	Page 9-14
6-1 Mode 2 .....	Page 9-14
6-2 Mode 0 .....	Page 9-14
6-3 Mode 1 .....	Page 9-14
♥ 7 - RECORDING STEP .....	Page 9-15
♥ 8 - SELECTION OF THE STOP RECORDING MODE .....	Page 9-15
8-1 Mode 1: Stop of the recording by the AUX key .....	Page 9-15
8-2 Mode 0: Stop of the recording after a preset time .....	Page 9-15
♥ 9 - WAIT STATE .....	Page 9-16
♥ 10 - IN READING PHASE, 3 DISPLAY MODES .....	Page 9-16
10-1 Numerical display, numerical adjustment .....	Page 9-16
10-2 Numerical display, incremental/decremental adjustment .....	Page 9-16
10-3 Graphic display, incremental/decremental adjustment .....	Page 9-16
♥ 11 - FIVE READING MODES .....	Page 9-17
11-1 Mode 0: loop .....	Page 9-17
11-2 Mode 1: Triggering by the audio input of the A channel .....	Page 9-18
11-3 Mode 2: Triggering by the audio input of the B channel .....	Page 9-18
11-4 Mode 3: MIDI triggering and selection of the samples .....	Page 9-18
11-5 Mode 4: Chromatic stack .....	Page 9-20
♥ 12 - MIDI PARAMETERS .....	Page 9-22
♥ 13 - START POINT AND END POINT .....	Page 9-23
13-1 Adjustment of the start point .....	Page 9-23
13-2 Adjustment of the end point .....	Page 9-24
13-3 Reversed sound .....	Page 9-24
♥ 14 - EVOLUTIVE VIBRATO .....	Page 9-24
♥ 15 - SPEED LINK .....	Page 9-25
15-1 Null speed link .....	Page 9-25
15-2 Active speed link (=1) .....	Page 9-25
♥ 16 - PITCH-RATIO .....	Page 9-26
16-1 Définition .....	Page 9-26
16-2 Applications .....	Page 9-26
♥ 17 - SPEED ADJUSTMENT .....	Page 9-27
17-1 Définition .....	Page 9-27
17-2 Applications .....	Page 9-27
♥ 18 - ATTACK TIME .....	Page 9-27
18-1 Définition .....	Page 9-27
18-2 Applications .....	Page 9-27
♥ 19 - TO RECORD AGAIN A SAMPLE .....	Page 9-28
♥ 20 - RECORDING OF THE BLANK MEMORY AREA .....	Page 9-28

### ♣ 1 - CHANNEL SELECTION:

- ◆ Push the keys SET A or SET B, one or twice, so that to select one or the two channels on which you wish to do the new function.
- ‡ To call a function on the A channel only, the SET A LED must be lighted and the SET B LED switched off.
- ‡ To call a function on the B channel only, the SET B LED must be lighted and the SET A LED switched off.
- ‡ To call simultaneously the same function on channels A and B, LED's SET A and SET B must be both lighted.

### ♣ 2 - TO CALL A FUNCTION WITH DISPLAY OF ITS NAME:

- ‡ When you do not know the machine, it is useful to visualize the name of the function selected and to proceed as follows :
- ◆ Push the FUNCTION key -> The Machine displays:

**SET No, THEN ENTER OR PARAMETER**

- ◆ Dial the number of the selected function ; for instance, 4
- ◆ Press the ENTER key -> The machine shows the N. with the name of the function :

**04 = PITCH-SHIFTING**

- ◆ Press the PARAMETER key -> the function is validated, and the display shows the the first parameters of the function :

**PITCH-RATIO=1,260 DEL= 10,00ms**

### ♣ 3 - TO CALL A FUNCTION WITHOUT DISPLAY OF THE NAME:

- ◆ When you are familiar with the functions, you can save time, by jumping above the name display step, and proceed as follows :
- ‡ Press the FUNCTION key
- ‡ Dial the number of the selected function
- ‡ Press the PARAMETER key
- ‡ You have gained one handling (the ENTER key)

### ♣ 4 - DISPLAY OF THE FUNCTIONS' TABLE:

- ‡ To display the functions table, proceed as follows :

- ◆ Press the FUNCTION key
- ◆ Press the USER GUIDE key -> The Machine shows the first function :

**\*\*\* FUNCTIONS TABLE \*\*\***

**01 = DELAY**

- ‡ If you make nothing else, the machine shows gradually all the existing functions. Each name of function is displayed during about 2 seconds, before the next one.

‡ You can move yourself into the table as follows :

- ◆ Press the key "+" -> You display the following function.
- ◆ Press the key "-" -> You display the previous function.
- ◆ Press the key "0" -> You stop the unrolling of the guide.

---

‡ 5 - FUNCTIONS' TABLE:

‡ At the time of that manual the INFERNAL MACHINE lays the following functions out :

- 01 = DELAY
- 02 = ECHO
- 04 = PITCH-SHIFTING
- \* 05 = SMPTE PITCH-TRACKING
- 07 = REVERBERATION PRESET PROGRAMS
- 08 = REVERBERATION PARAMETRIC
- 09 = SOUND MEMORY HANDLING
- 50 = LANGUAGE SELECTION
- \* 60 = SMPTE/EBU GENERATOR SELECTION
- \* 61 = SMPTE/EBU INPUT DISPLAY
- \* 62 = SMPTE/EBU SYNCHRO PROGRAMMING
- \* 63 = SMPTE/INPUT REAL TIME OFFSET
- \* 64 = TIME RECALIBRATION OF EVENTS
- \* 65 = SMPTE/EBU BANK ERASE
- \* 66 = SMPTE SYNCHRO DISPLAY MODE

(\*) THIS FUNCTION NEEDS THE SMPTE/EBU INTERFACE BOARD.

---

---

## ♣ 1 - SUMMARY OF THE ADJUSTMENT OF THE PARAMETERS:

♣ Each function of the INFERNAL MACHINE is controlled by one or several parameters adjustable by the user. Those adjustments can be effected in several modes. Whatever the kind of method selected, the adjustment is effected on one or two channels. A channel is adjusted when the corresponding "SET" LED is lighted.

### ♥ 1-1 Numeric adjustment:

♣ The parameter value is directly entered from the numerical keyboard of the machine or its remote control.

### ♥ 1-2 Incremental/decremental adjustment:

♣ The selected parameter can be incremented or decremented at adjustable speed.

### ♥ 1-3 Adjustment with the numeric potentiometer of the remote control:

♣ The selected parameter can be incremented or decremented by the potentiometer of the remote control.

### ♥ 1-4 Adjustment from the RS232 interface:

♣ The parameters can be adjusted from a terminal or a computer if the machine is fitted with RS232 interface (in option).

---

## ♣ 2 - MODE SELECTION:

♣ The PARAMETER LED has two states, and by pushing the PARAMETER key you pass from one state to the other.

♣ When the PARAMETER LED is lighted permanently, you are in the numeric mode position.

♣ When the PARAMETER LED is blinking, you are in the INCREMENTAL/DECREMENTAL mode.

EXCEPTION : Concerning the function 9 there is an additional state regarding the graphic display. Refer to FUNCTION 9 of the present manual.

---

## ♣ 3 - NUMERIC MODE:

♣ By pressing on the "-" key, you display the previous parameter and its value blinks.

♣ By pressing on the "+" key, you display the following parameter and its value blinks.

♣ When you have selected the parameter you wish to adjust :

◆ Dial the new numeric value of this parameter with the numeric keyboard -> The new value is blinking, but is not yet validated.

♣ To make valid the new value :

◆ Either you press the ENTER key.

◆ Either you press the "-" key, which makes valid the parameter in progress and then goes to the previous.

◆ Either you press the "+" key, which makes valid the parameter in progress and then goes to the following parameter.

◆ Either you leave the mode in progress.

◆ Either you turn the potentiometer of the remote control -> The parameter is validated and then follows the potentiometer control.

- ‡ If the selected value exceeds the limits (lower or higher) of this parameter, the machine displays an error message :

TOO HIGH            I SET THE MAXIMUM

or

TOO LOW            I SET THE MINIMUM

The parameter is then adjusted on its limit value (low or high), the error message disappears after about 1 second and we find again the parameter display.

**Example:** If you want to adjust for the function 4:

- PITCH RATIO: 1,059
- ARPEGGIO FEEDBACK: 85%

- ◆ Press the FUNCTION key
- ◆ Press the key 4
- ◆ Press the PARAMETER key -> The PARAMETER LED is lighting permanently and the Machine displays :

PITCH-RATIO=1,260 DEL=    10,00ms

The value 1,260 blinks.

- ◆ Dial 1 0 5 9
- ◆ Press the "-" key -> 1,059 is validated and the Machine displays the new parameter which blinks:

ARPEGGIO            FEEDBACK =    0%

- ◆ Dial 8 5
- ◆ Press the ENTER key -> The Machine displays:

ARPEGGIO            FEEDBACK = 85%

#### ‡ 4 - INCREMENTAL/DECREMENTAL MODE:

*(The PARAMETER LED is blinking)*

- ◆ Press the "+" key -> The actual parameter is incremented of 1 unit.
- ◆ Press a figure from 1 to 9 -> The parameter increases gradually, at a speed which depends on the figure selected: 1 for the smallest speed, 9 for the highest.
- ◆ Press an other key from 1 to 9 -> the speed changes according to the figure selected.
- ◆ Press the "-" key: the value of the parameter goes decreasing.
- ◆ Press the "0" key: the parameter stops on its current value.

- ‡ If the parameter reaches a limit value (lower or higher), the parameter stops on the limit value.

#### ‡ 5 - ADJUSTMENT FROM THE POTENTIOMETER OF THE REMOTE CONTROL:

- ‡ The remote control has an endless numeric potentiometer with optical coding which allows a flexible adjustment of the parameters at a variable speed, according to one turns more or less quickly. By turning clockwise the parameter increases, in the opposite way it decreases.
- ‡ It is only efficient when the PARAMETER LED is permanently lighted.

♣ 1 - SUMMARY OF FUNCTIONS AND PARAMETERS MEMORIES:

- ‡ The INFERNAL MACHINE has 400 memories of functions and parameters.
- ‡ Those memories are intended to store the functions adjusted by the user, with all their parameters.
- ‡ They are non volatile, i.e. their content is not damaged when the power is off.
- ‡ They enable to safeguard specific adjustment effected by the user, with the purpose to find them again later on.
- ‡ In the continuation of that manuel we shall use only the abridged designation : FUNCTION MEMORIES.

♣ 2 - SELECTION OF ONE OR TWO CHANNELS:

- ‡ At each channel of the Machine a number of function memory is given.
- ‡ The number of the FUNCTION MEMORY of the A channel is displayed by a red LED display, the one of the B channel by a yellow LED display.
- ‡ The 400 function memories are common to the A AND B channels, which allows transfers of function from one channel to another.
- ‡ The three basic controls: selection of the number, load of the memory or calling memory, are effected on only one of the channels A or B, or on both simultaneously, according to the channel selection.
- ‡ To drive one channel by one of those three controls, it needs and it is sufficient that the LED SET A or SET B corresponding be lighted.
- ◆ To select the LEDs SET A and SET B, press one or twice on the keys SET A or SET B.

♣ 3 - SELECTION OF THE NUMBERS OF FUNCTION MEMORIES:

♥ 3-1 Numeric method:

- ◆ Press the key MEMORY SELECT -> The display(s) of the selected channel(s) blink(s).
- ◆ Dial the wanted number.
- ◆ Press the ENTER key -> The selected number is validated on the selected channel(s).

Example: If you wish to select the number 101 for the A channel, 201 for the B channel:

- ◆ Press the SET A key, zero, one or twice according to the initial state, in order to light only the SET A LED (SET B is switched off).
- ◆ Press the MEMORY SELECT key -> The red display blinks.
- ◆ Dial 1 0 1
- ◆ Press the SET B key -> 101 is validated the SET A LED is switched off, the SET B LED lights and the yellow display blinks.
- ◆ Dial 2 0 1
- ◆ Press the ENTER key -> 201 is validated, and the Machine displays:

XX	101
--	-----

XX	201
--	-----

(X = previous display unchanged)



### ♥ 3-2 Incremental/decremental mode:

- ◆ Press the MEMORY SELECT key (only if th MEMORY SELECT LED was OFF)-> The MEMORY SELECT LED is ON.
- ◆ Press the "-" key -> on each selected channel, the number of the function memory is decremented.
- ◆ Press the "+" key -> on each selected channel, the number of the function memory is incremented.

Example: Let us take again the continuation of the previous example:

- ◆ Press the "-" key -> The Machine displays:

XX	100
--	-----

XX	200
--	-----

- ◆ Press the "+" key twice -> The Machine displays:

XX	102
--	-----

XX	202
--	-----

### ♣ 4 - LOADING OF FUNCTION MEMORIES:

- ◆ Press the MEMORY IN key

-> For each selected channel the current function is loaded with all its parameters in the selected function memory.

#### CAUTION:

1 - Before loading a function memory, make sure it does not already contain datas to be preserved. In such a case, change the N°.

2 - If you make a simultaneous loading on both channels (with the SET A and SET B LED both ON), verify that the selected numbers are different for both channels ; if the numbers were equal, the functions and the parameters of the B channel would "crush" in the memory those of the A channel.

### ♣ 5 - RECALL OF THE FUNCTION MEMORY:

- ♣ The MEMORY OUT key is a toggle key ; by pressing that key once the MEMORY OUT LED state is toggled : if it was OFF it becomes ON, if it was ON it becomes OFF.
- ◆ When you light the MEMORY OUT LED, on each selected channel, the contents of the displayed memory is loaded in the relative channel: You call one function with all its parameters.
- ◆ If the MEMORY OUT LED is already ON, when you change the number of a function memory, then for each selected channel the contents of the new selected memory is loaded in the selected channel(s). This is applied in the numeric mode and in the incremental/decremental mode.

---

**◆ 1 - SUMMARY OF THE FUNCTION DELAY:**

- ♥ The FUNCTION DELAY allows to obtain an adjustable delay on the audio signal
- 

**◆ 2 - HOW TO CALL THE FUNCTION DELAY:**

- ◆ Press the FUNCTION key
- ◆ Press the 1 key
- ◆ Press the PARAMETER key

‡ -> The machine displays:

<b>DELAY = 49,00ms</b>
------------------------

- ◆ Adjust the delay as stated in the PARAMETERS ADJUSTMENT section
  - ‡ In the above case, the audio signal available on the output N° 1 of the selected channel is delayed of 49 milliseconds comparatively to the input signal.
  - ‡ The minimum delay is of 0,04 milliseconds (40 microseconds)
  - ‡ The maximum delay depends on the memory option:
    - In the case of "short" option, maximum delay = 5 242,00 milliseconds
    - In the case of "long" option, maximum delay = 20 930,00 milliseconds
- 

**◆ 3 - APPLICATIONS OF THE FUNCTION DELAY:****♥ 3-1 For recording: equalization of the phase-shift between microphones**

When you record with several microphones in the same space, it happens effects of shifting phase due to the speed of the sound in the air: The sound being propagated at the speed of 340 meters per second, for each meter covered in the atmosphere the sound takes a delay of 2,94 milliseconds. The machine being fitted with two divided channels, you can put in phase up to 3 microphones. The adjustment depends on the relative position of the sound sources and microphones, as well as of the sound sources that you wish to reinforce.

**♥ 3-2 For mixing: Phasing:**

By mixing an original sound with the same sound slightly delayed, you obtain a filtering effect which is called PHASING. The frequency response of the phasing mode is going up and down many times, from low to high frequencies. The medium adjustment regarding that effect goes from 0,04 to 10 milliseconds.

**♥ 3-3 In mixing: double and triple voices:**

If you mix an original audio signal with the same delayed signal you can obtain a subjective effect of two voices. If you take for example a play back singer, you will have a feeling that two people are singing the same thing together. That effect is more efficient if you use the two channels of the Machine set in function delay with different adjustments, mixed with the direct signal: This makes a total of three voices. The adjustment bracket for that effect goes from 10 to 150 milliseconds. (NOTE: This effect can be amplified with the FUNCTION 4: refer to application of the function 4).

## ♥ 3-4 In mixing: Space effect:

By mixing the origine signal with the same delayed signal one or twice, you can obtain a space effect, which is different from echo or reverberation. The range of adjustments regarding that effect goes from 150 to 500 milliseconds.

## ♥ 3-5 In video and cinema post synchronization:

First you read the original sound with a constant advance on the corresponding picture, then you compensate that advance with the INFERNAL MACHINE in function delay. This gives you the possibility to change the value of the delay in order to compensate the difference between sound and picture at each time where such a difference occurs. When the value of the delay changes, the transition comes with a cross fading effect between the previous delay and the new one, in such a way that this transition is very little audible if it comes on the signal and is un audible if it takes place during a silent.

You can make an optimum use of that function by taking the synchronization by the SMPTE/EBU code, so that the delay evolving automatically in synchronization with the picture.

## ♥ 3-6 For live:

With the two delays you can compensate the phase-shifts and delays between three separate loud-speakers. The sound speed in the atmosphere being of 340 meters per second, any space between two loud-speakers will involve a time difference of 2,94 milliseconds by meter of space between the loud-speakers.

### ♣ 1 - SUMMARY OF THE ECHO FUNCTION:

- ♥ The ECHO FUNCTION allows to obtain on a sound an effect of repetition at regular intervals, with a gradual attenuation from one repetition to the following.

This effect is obtained with a digital delay and a digital feedback which sends back on the input of the delay a part of the output signal.

### ♣ 2 - HOW TO CALL THE ECHO FUNCTION:

- ◆ Press the function KEY
- ◆ Press the 2 key
- ◆ Press the PARAMETER key
- ♣ -> The Machine displays

ECHO LOOP= 250,00ms FEEDB=84%

### ♣ 3 - DURATION OF THE LOOP:

- ♥ LOOP = Abbreviation for: Duration of the LOOP  
This parameter allows to adjust the interval of time between two successive reflections.
- ♣ MINIMUM LOOP TIME = 0,04 milliseconds
- ♣ MAXIMUM LOOP TIME = 5 242 milliseconds for short option
- ♣ MAXIMUM LOOP TIME = 20 930 milliseconds for long option

### ♣ 4 - FEEDBACK:

- ♥ FEEDB = Abbreviation for FEEDBACK  
The FEEDBACK parameter defines the part of the output signal which is sent back in the input. This feedback is digital and consequently perfectly linear in frequency, so that you can adjust a high ratio (99%) without taking a risk to produce unwanted whistlings.
- ♣ MINIMUM FEEDBACK = 0%. In this case you have a simple delay.
- ♣ MAXIMUM FEEDBACK = 99%. In this case the sound is looping for a longer time, and the output level exceeds clearly the input level: It can be useful to decrease the input level in order not to saturate the output.

### ♣ 5 - APPLICATIONS OF THE ECHO FUNCTION:

- ♥ 5-1 *Emphasized phasing* - By adjusting:  
LOOP from 0,04 to 10 milliseconds - FEEDBACK from 50% to 99%  
You get a phasing effect more accentuated than the one obtained with the DELAY function.
- ♥ 5-2 *Tube effects* - By adjusting:  
LOOP from 5 to 100 milliseconds - FEEDBACK from 85% to 99%  
You get a tube effect: You have the feeling that the sound went through a tube.
- ♥ 5-3 *Space effects* - By adjusting:  
LOOP from 100 to 1000 milliseconds - FEEDBACK from 50 to 90%  
You get spaces effects
- ♥ 5-4 *Accumulator effects* - By adjusting:  
LOOP = 1 second and over - FEEDBACK = 99%  
You get an accumulator effect: The sounds are accumulating in the Machine memory and last very long before disappearing.

### ♣ 1 - SUMMARY OF FUNCTION 4:

♥ With the FUNCTION 4 you can perform simultaneously the following functions on an input audio signal: Pitch-shifting (which shifts the frequency of the input signal), evolving vibrato, automatic arpeggio (with feedback), added delay, and you can control it by an external MIDI keyboard.

#### ♥ Parameters list:

- ‡ PITCH RATIO (output frequency/input frequency)
- ‡ ADDED DELAY
- ‡ PITCH-SHIFTING ALGORITHM
- ‡ MIDI CHANNEL
- ‡ MIDI VOICE (N° of voice for MIDI polyphony)
- ‡ TOTAL OF VOICES IN POLYPHONY (Selection of the priority logic for MIDI mode)
- ‡ VIBRATO FREQUENCY
- ‡ VIBRATO DEPTH
- ‡ VIBRATO DELAY AT THE ATTACK OF THE NOTE
- ‡ FEEDBACK FOR AUTOMATIC ARPEGGIO

### ♣ 2 - HOW TO CALL THE FUNCTION 4:

- ◆ Press the FUNCTION key
- ◆ Press the 4 key
- ◆ Press the PARAMETER key -> The Machine displays:

<b>PITCH-RATIO=1,260 DEL= 10,00ms</b>
---------------------------------------

### ♣ 3 - PITCH-RATIO:

♥ **PITCH-RATIO** = Abbreviation for PITCH-RATIO BETWEEN OUTPUT AND INPUT SIGNAL. All the input frequencies are multiplied by this ratio. In the above example if you send in the input of the Machine a frequency of 1000 Hz, you will get on the output a frequency of 1260 Hz.

- ‡ - If PITCH-RATIO = 1,000, the pitch of the sound is not modified
- ‡ - If PITCH-RATIO < 1,000, the sound is lower in frequency
- ‡ - If PITCH-RATIO > 1,000, the sound is higher in frequency
- ‡ - The effect obtained gives the same auditive effect as a magnetic tape the speed of which is changed. The difference is that in the INFERNAL MACHINE the process is made in real time.
- ‡ - The basic principle is to make a continuous variation of the delay (Doppler effect). The sound is memorized at a rate of 50000 samples per second, and then is read with a variable speed. In order to remain in real time and not to have an excessive delay, the Machine uses improved algorithms which tests the phase of the signal and keep permanently the delay at its mean value while keeping the phase of the signal, in order to reduce the effects of "glitches" inherent to that kind of effects.
- ‡ - The pitch-ratio can be expressed in semi-tones. The following table gives the semi tones versus the pitch-ratio. It uses an equal temperament scale (The ratio between a semi-tone and the preceeding one is equal to 1,05946).

SEMI-TONES	PITCH-RATIO
-24	0.250
-23	0.265
-22	0.281
-21	0.297
-20	0.315
-19	0.334
-18	0.354
-17	0.375
-16	0.397
-15	0.421
-14	0.446
-13	0.472

SEMI-TONES	PITCH-RATIO
-12	0.500
-11	0.530
-10	0.561
-9	0.595
-8	0.630
-7	0.667
-6	0.707
-5	0.749
-4	0.794
-3	0.841
-2	0.891
-1	0.944

SEMI-TONES	PITCH-RATIO
0	1.000
+1	1.059
+2	1.122
+3	1.189
+4	1.260
+5	1.335
+6	1.414
+7	1.498
+8	1.587
+9	1.682
+10	1.782
+11	1.888
+12	2.000

- ♣ MINIMUM PITCH-RATIO = 0,250 = minus two octaves
- ♣ MAXIMUM PITCH-RATIO = 2.000 = plus one octave

#### ♣ 4 - ADDED DELAY:

- ♥ *DEL* = Abbreviation for ADDED DELAY
- ♥ This parameter gives you the possibility to add a delay to the pitch-shifted sound. It sets a mean value of the delay; the principle of the pitch-change is to use a variable delay, therefore this one cannot be absolutely fixed. The actual delay, compared with the displayed delay, can vary in a range of 15 milliseconds.
- ♣ MINIMUM ADDED DELAY = 1 millisecond
- ♣ MAXIMUM ADDED DELAY = 5,242 seconds for the short option
- ♣ MAXIMUM ADDED DELAY = 20,930 seconds for the long option

#### ♣ 5 - PITCH-SHIFTING ALGORITHM:

- ♥ The pitch-shifting effect is obtained by a continuous variation of a delay. In order to prevent this delay from becoming infinite, it is necessary to have algorithms which bring it back permanently to its mean value. The Machine has 4 improved algorithms, which make a phase analysis of the audio signal, in order to bring back permanently the delay to its mean value while reducing the effects of "glitches" in the sound inherent to this kind of process. Each algorithm is more specially fitted to a type of sound :

PITCH-ALGO=1 FOR HUMAN VOICE A

PITCH-ALGO=2 FOR STRINGS

PITCH-ALGO=3 FOR HUMAN VOICE B

PITCH-ALGO=4 FOR COMPLEX SOUND

- ♥ *PITCH-ALGO* = Abbreviation for ALGORITHM of the PITCH-SHIFTING.
- ♣ For each sound you can test the different algorithms and select the one giving the cleanest sound.

### ♣ 6 - MIDI CHANNEL NUMBER:

**MIDI - CHANNEL No= 1 VOICE No=1**

- ♥ **MIDI** = Abbreviation of "Musical Instrument Digital Interface".  
This is a serial interface which sends numerical data at the speed of 32500 bits per second. This interface is now universal in the musical field, where it allows to connect together the synthesizers, sequencers, keyboards and other electronic musical devices.
- ♣ The **INFERNAL MACHINE** is fitted with a MIDI codes receiver which allows to control it from a keyboard or a MIDI sequencer.
- ♥ **CHANNEL No** = Abbreviation for MIDI CHANNEL Number
- ♣ The MIDI codes include a channel number from 1 to 16. The **INFERNAL MACHINE** will receive these codes only if it is adjusted on the channel number corresponding to the received code. This allows you to address a channel of the **INFERNAL MACHINE** with dedicated MIDI codes; when several units are connected on the same MIDI source, the **MIDI CHANNEL NUMBER** allows you to control the **INFERNAL MACHINE** independently of the other units.
- ♣ **MINIMUM CHANNEL NUMBER** = 1
- ♣ **MAXIMUM CHANNEL NUMBER** = 16

### ♣ 7 - MIDI VOICE NUMBER:

- ♥ **VOICE No** = VOICE Number assigned to this channel of the Machine in MIDI polyphony.
- ♣ This parameter allows you to work in polyphony from a MIDI keyboard. The **INFERNAL MACHINE** includes a priority logic which manages the numbers of the notes received from the MIDI interface, and dispatches them on the channels of the connected **MACHINE (s)**.
- ♣ We assume that the voice N°1 is the one that is operated when only one note is played. The voice N°2 is the one that is operated when a second note is played, the note N°1 being still pressed. And so on, up to 8 voices. Each Machine includes two channels. With two Machines you can play with 4 voices, and so on... until 8 voices. In polyphony, each channel of Machine must have a different voice number. For 8 voices this gives :

<b>MIDI - CHANNEL No= 1 VOICE No=1</b>	Channel A MACHINE No 1
<b>MIDI - CHANNEL No= 1 VOICE No=2</b>	Channel B
<b>MIDI - CHANNEL No= 1 VOICE No=3</b>	Channel A MACHINE No 2
<b>MIDI - CHANNEL No= 1 VOICE No=4</b>	Channel B
<b>MIDI - CHANNEL No= 1 VOICE No=5</b>	Channel A MACHINE No 3
<b>MIDI - CHANNEL No= 1 VOICE No=6</b>	Channel B
<b>MIDI - CHANNEL No= 1 VOICE No=7</b>	Channel A MACHINE No 4
<b>MIDI - CHANNEL No= 1 VOICE No=8</b>	Channel B

‡ 8 - POLYPHONIC TOTAL VOICE NUMBER:

POLYPHONIC TOTAL VOICE NUMBER= 2
----------------------------------

- ‡ This parameter shows the total number of MACHINE channels which are used in MIDI polyphony.
- ‡ Its value by default is 2, and it is not useful to adjust it if you use only one MACHINE: with only one MACHINE, the response of the priority' logic is completely defined by the adjustment of the numbers of the voices (as mentioned above).
- ‡ But when you use several MACHINES in polyphony, it is necessary to inform each MACHINE of the total number of used channels. In the case of the above example, this parameter must be set to 8, and this in each MACHINE.
- ‡ This parameter optimises the priority logic, which assigns each channel of the MACHINE to the keys which are played. This priority logic is submitted to the following rules :
  - 1 - The first played note is assigned to the MACHINE voice N°1
  - 2 - When a new note is played, the priority logic searches what are the available MACHINE voices, (not assigned), and assigns to the played note the channel which has the lowest found voice number.
  - 3 - When a channel of MACHINE is assigned to one note, it remains assigned to it as long as the corresponding key is pressed. When the key is released, the MACHINE voice which was assigned to it becomes again available.
  - 4 - Consequence of the above rules : when all the MACHINE voices are assigned, the additional notes which are played are not taken into account.
  - 5 - When all the voices are assigned, and when one or several notes are pressed exceedingly, as soon as one of the assigned voices is available, it is assigned to one of the notes which was in excess. This rule allows to miss no notes, when one plays very quickly on a MACHINE voice, while keeping a tune on all the other MACHINE voices.
  - 6 - EXCEPTION: When you play with only one MACHINE voice, each new note played is immediately taken into account, even if previous notes are still pressed: This in order to avoid to miss any note when you play quickly.



### ♣ 9 - EVOLVING VIBRATO:

VIB F=10, 0Hz DEP= 5 DEL=0, 2s M=0

‡ The vibrato effect is obtained by a sine wave modulation of the pitch-ratio (frequency modulation). This modulation is centred on the mean value of the pitch-ratio, adjusted by the pitch-ratio parameter (refer to section 3).

‡ It can evolve with the time. This evolving shape is triggered by each new MIDI note or by pressing the AUX key. With the 0 mode you obtain a delayed vibrato, with the 1 mode you obtain an appogiature.

#### ♥ 9-1 FREQUENCY:

‡ F = Abbreviation for F REQUENCY

‡ This parameter allows you to adjust the number of vibrations per second. It is adjustable between 0,1 and 50,0 vibrations per second.

#### ♥ 9-3 DEPTH:

‡ DEP = Abbreviation for DEP TH

‡ This parameter allows you to adjust the peak value of the frequency shift on a scale from 1 to 99.

#### ♥ 9-3 DELAY OF MODULATION:

‡ DEL = Abbreviation for DEL AY OF MODULATION

‡ This parameter adjusts the time which runs between the hit on one MIDI key (or the AUX key), and the appearance of the vibrato (for mode 0) or the disappearance of the vibrato (for mode 1). It is adjustable from 0,0 to 9,9 seconds.

#### ♥ 9-4 MODULATION MODE:

‡ M = Abbreviation for M ODULATION MODE :

‡ - If M=0, the vibrato is delayed and comes after a delay adjustable by the previous parameter. The start point of this delay is defined either by sending a MIDI note, either by pressing on the AUX key. In the case of a MIDI keyboard, there is no vibrato at the attacks of the notes: It appears only if the note is maintained long enough. The AUX key allows you to make disappear manually the vibrato at selected times of the sound material.

‡ - If M=1, the vibrato appears at the attack of the MIDI notes, or when pressing on the AUX key, and disappears after a delay adjustable by the previous parameter: It is an APPOGIATURE effect.

‡ - If the frequency is adjusted low enough, the coming effect is perceived as a single impulse which shifts the sound when the notes are hit (or when the AUX key is pressed on).

♥ You can obtain a large variety of effects, according to the arrangement of the adjustments of these four parameters.