

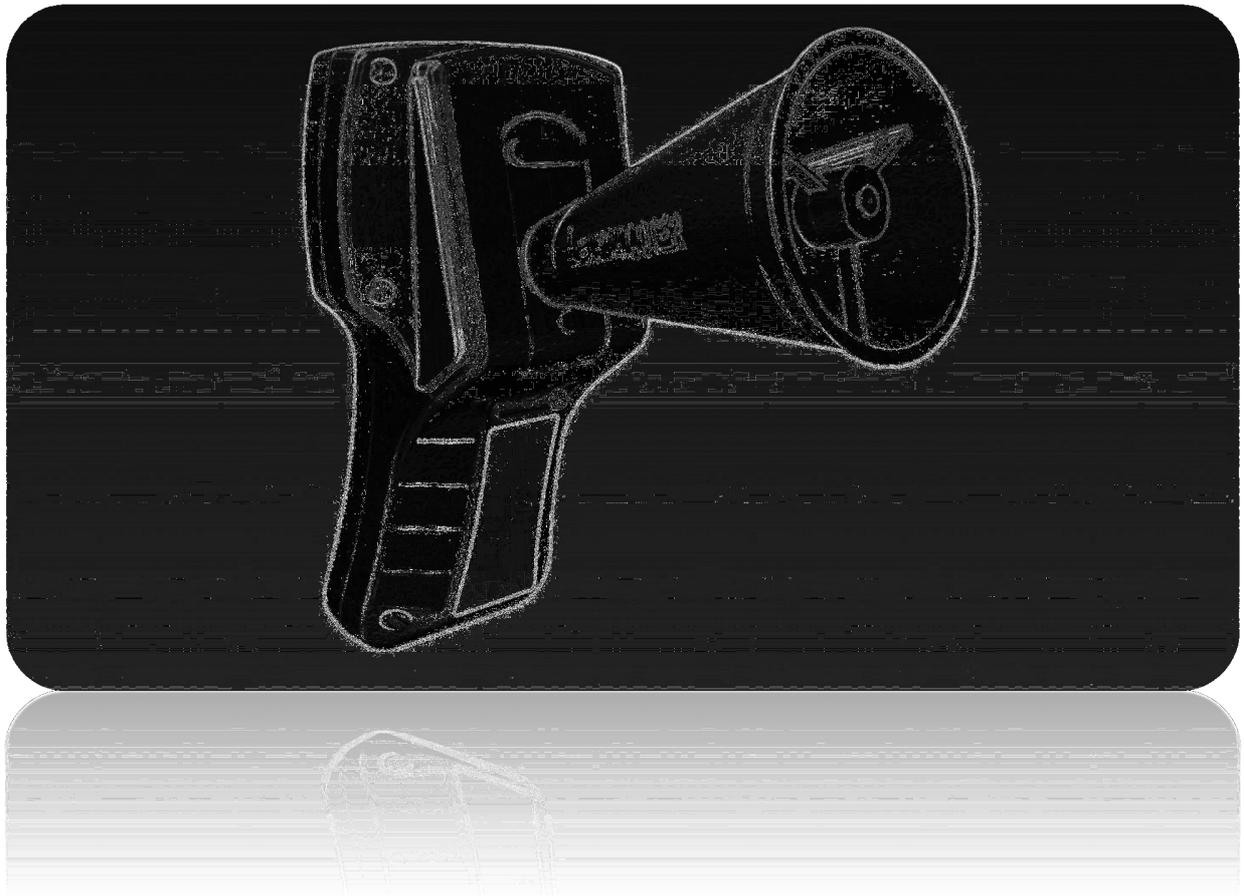


LEAKSHOOTER-LKS1000

USER MANUAL (VERSION 1.2)

ULTRASONIC DETECTION CAMERA

(PATENT PENDING)



WHAT IS LEAKSHOOTER LKS1000 ?

LEAKSHOOTER LKS1000 IS A PORTABLE DEVICE WHICH GIVES YOU THE POSSIBILITY TO HEAR, MEASURE, VIEW AND STORE THE LEAKS.

MAIN FUNCTIONS:

- DETECTION AND LOCALIZATION OF ULTRASOUND THANKS TO AUTOMATIC DYNAMIC TARGET
- LISTEN TO THE ULTRASOUND WITH HETERODYNE TECHNIQUE (40kHz > 2.5kHz)
- MEASURE AND DISPLAY OF RMS IN REAL TIME AND MAX RMS ON A COLORED BARGRAPH
- VISUALIZATION ON SCREEN OF ULTRASONIC WAVES PRESENCE (EXACT LOCATION OF LEAK)
- NUMBERED AND STAMPED RECORDING OF THE BITMAP WITH ALL ULTRASONIC INFORMATION

LEAKSHOOTER LKS1000, THE FIRST ULTRASONIC DETECTION CAMERA DEDICATED TO LEAKS, THOUGHT AND DEVELOPED BY LEAKSHOOTER, A DIVISION OF SYNERGYS TECHNOLOGIES (FRANCE).



BENEFIT OF ULTRASOUND TECHNIQUE TO FIND GAS LEAK (COMPRESSED AIR OR OTHER ELSE GAS IN PRESSION / DEPRESSION)

WHEN A GAS MOVE FROM A HIGH PRESSURE STATE (COMPRESSED AIR IN A PIPE AT 6 BAR FOR EXAMPLE) TO A LOW PRESSURE STATE (LEAK IN A PIPE FOR EXAMPLE, WITH EXTERNAL ATMOSPHERE PRESSURE), THERE IS A DEPRESSION PHENOMENON WHICH CREATE A TURBULENCE (SEE FIG 1).

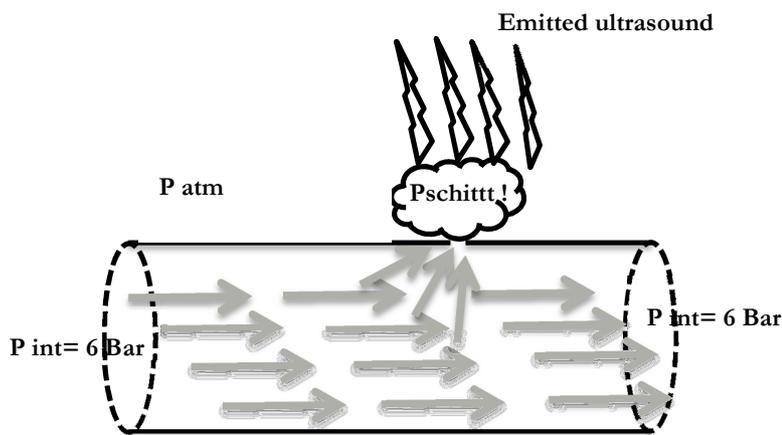


FIG 1

THIS TURBULENCE GENERATES A NOISE WITH LARGE FREQUENCY SPECTRUM WHICH CONTAINS THE ULTRASOUND, DUE TO THE FRICTION OF THE MOLECULES (AIR FOR EXAMPLE) THROUGH THE ORIFICE.

HUMAN HEARS CORRECTLY UP TO 20 KHZ. SO, HUMAN DOES NOT HEAR THE ULTRASOUND WHICH ONLY START AT THIS FREQUENCY.

THIS IS WHY, BY USING VERY SENSITIVE ULTRASONIC DETECTOR AND HETERODYNE TECHNIQUE, OFTEN CENTERED AROUND 40 KHZ, IT IS POSSIBLE TO FIND AND LISTEN TO THE LEAK, EASILY.

WHY ULTRASONIC WAVES ARE EASY TO FIND WITH AN ULTRASONIC DETECTOR?

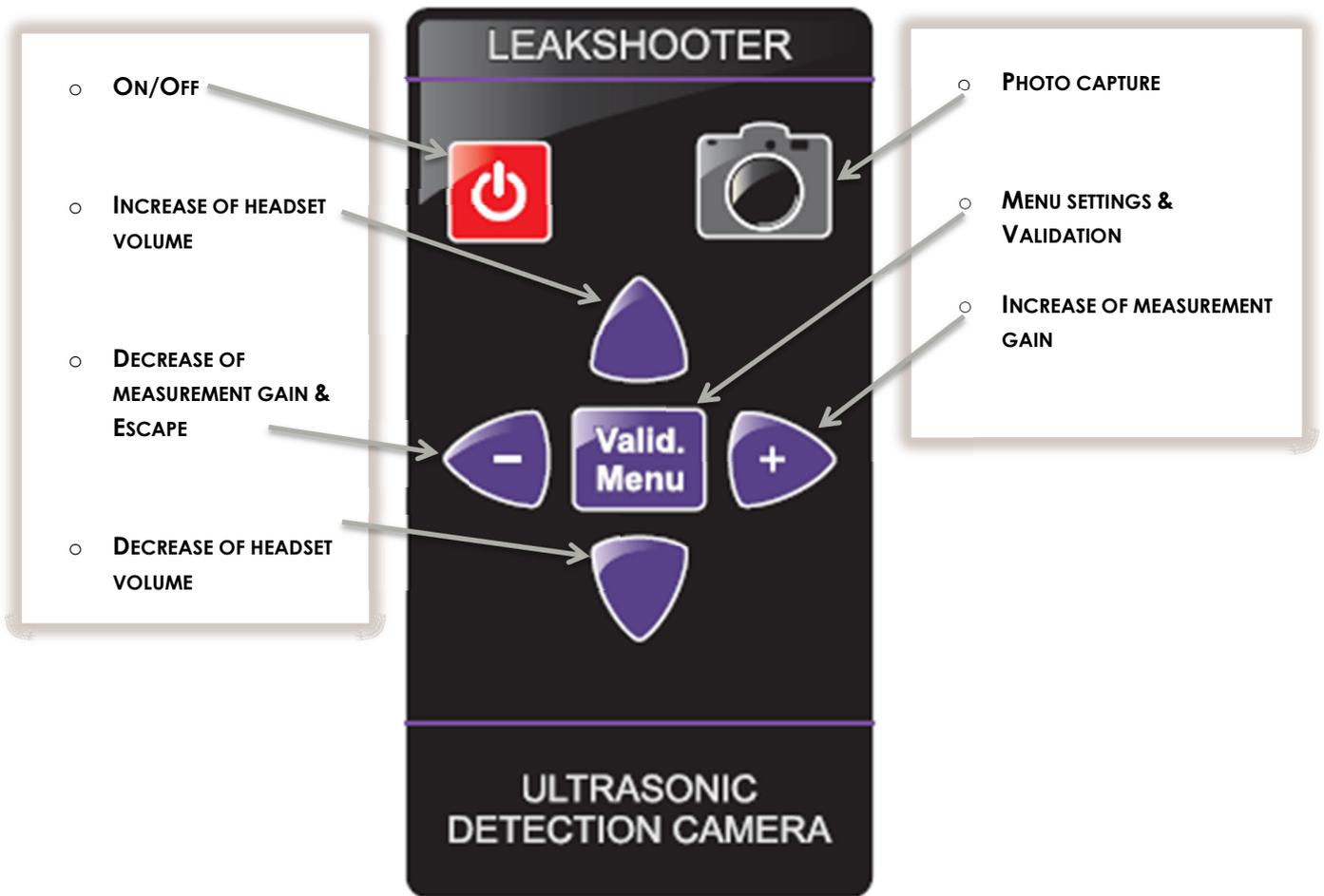
- THEY ARE VERY DIRECTIONAL, THEY EMIT IN A PRECISE DIRECTION
- THEY GENERATE A STRONG ULTRASONIC INTENSITY NEAR THEIR EMISSION SOURCE, DECREASING QUICKLY WHEN LEAVING AWAY FROM THE LEAK
- THEY CAN BE EASILY HEARD THANKS TO HETERODYNE TECHNIQUE (DEMODULATION OF A HIGH FREQUENCY WAVE (HERE, ULTRASOUND NOT AUDIBLE FOR HUMAN) TO LOW FREQUENCY (AUDIBLE FOR HUMAN))
- THEY CAN BE DETECTED IN A NOISY INDUSTRIAL ENVIRONMENT, CORRECTLY FILTERED BY THE DETECTOR



ULTRASOUND TECHNOLOGY HAS THE MAJOR ADVANTAGE TO BE EASY TO USE AND ACCESSIBLE TO EVERYONE.

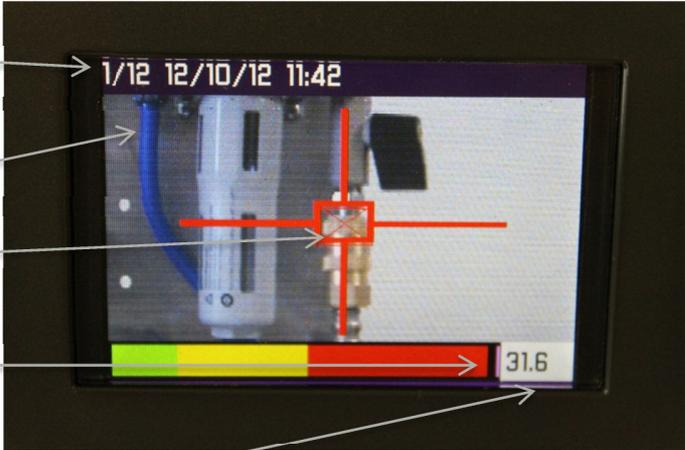
DESCRIPTION OF LEAKSHOOTER LKS1000

- **KEYBOARD**



- **COLOR SCREEN**

- **PHOTO NUMBER AND TIMESTAMP STORED IN MEMORY**
- **CAMERA REAL TIME VIEW**
- **DYNAMIC TARGET SHOWING LEAK ZONE**
- **REAL TIME RMS AND MAX RMS VALUES**
- **RMS MEASUREMENT VALUE**



- **CONNECTORS ON BOTTOM VIEW**

- **POWER**
- **USB PC**
- **JACK FOR AUDIO HEADPHONE**



- **CONNECTOR ON TOP VIEW**

- **JACK FOR EXTERNAL PROBE**



LEAKSHOOTER LKS1000 KIT DETAILS:

- **ALUMINUM TRANSPORT CASE - LKS CASE**
- **ULTRASONIC DETECTION CAMERA – LKS 1000**
- **HEADSET WITH JACK CABLE (SNR 31) - LKS EAR**
- **UNIVERSAL BATTERY CHARGER – LKS POWER**
- **USB CABLE FOR PC – LKS USB**
- **USER MANUAL ON CD – LKS MANUAL**
- **SOFTWARE FOR PC – LKS PC VIEWER**



FLEXIBLE 400 MM SENSOR OPTION AVAILABLE FOR LKS 1000:



BATTERIE CHARGING:

LEAKSHOOTER LKS1000 IS EQUIPPED WITH A LITHIUM-ION BATTERY. ITS CAPACITY IS AROUND 6 HOURS, DEPENDING OF SETTING USES (CAMERA ACTIVATED OR NOT, SCREEN BACKLIGHT...).

IT CAN BE CHARGED WITH ONLY DELIVERED UNIVERSAL BATTERY CHARGER KIT (5V DC, 2A).

CHARGING TIME IS AROUND 5 HOURS.

CAREFUL! :

THANKS TO BE CAREFUL WHEN GETTING MESSAGES ON LEAKSHOOTER LKS1000 SCREEN ABOUT BATTERY CHARGING INSTRUCTIONS.

LEAKSHOOTER LKS1000 AUTOMATICALLY SWITCH OFF, WHEN VOLTAGE BATTERY IS TOO LOW (BATTERY EMPTY).

TO HAVE THE BEST CHARGING TIME, THE BEST CAPACITY, YOU SHOULD CHARGE BATTERIES ONLY WHEN MESSAGE APPEARS.

LEAKSHOOTER LKS1000 SWITCH ON & OFF :

SWITCH ON:

PRESS QUICKLY THE KEY , LEAKSHOOTER LKS1000 SWITCH ON 1-2 SECONDS AFTER INITIALIZATION.

SWITCH OFF:

PRESS LENGTHILY (1-2 SECONDS) THE KEY , LEAKSHOOTER LKS1000 SWITCH OFF.

IF THE BATTERY IS FULLY EMPTY, LEAKSHOOTER LKS1000 COULD NOT SWITCH ON. YOU SHOULD CHARGE IT FULLY (AROUND 5-6 HOURS).

LEAK DETECTION SEARCH PROCEDURE WITH SCANNING METHOD AND CONE

LEAKSHOOTER LKS1000 HAS BEEN DESIGNED TO SHOW YOU IN REAL TIME ON A VISIBLE SCENE CAPTURE (MEASUREMENT SCENE), THE COMPRESSED AIR LEAK LOCATION OR OTHER GAS, THANKS TO VISUAL DYNAMIC REAL TIME TARGET.

REGARDING THE LEAK IMPORTANCE (ULTRASONIC WAVES RECEIVED AT AROUND 40 KHz), THE DYNAMIC TARGET WILL BE IN YELLOW OR IN RED COLOR.

LEAKSHOOTER LKS1000 IS EQUIPPED WITH A SPECIAL DETECTION REAL TIME FUNCTION OF MAX VALUE, WHICH WITH THE TARGET, SHOW YOU IF YOU ARE MORE NEAR THE LEAK (SIMPLE SQUARED TARGET) OR EXACTLY FACE TO THE LEAK (SQUARED TARGET WITH A CROSS INSIDE).

THE METHOD IS TO SCAN THE MEASUREMENT SCENE, QUIETLY AND CONSCIENTIOUSLY.

- AUTO GAIN MODE (DEFAULT MODE USED AFTER LKS1000 POWER ON):

THIS MODE IS USED FOR CLASSICAL APPLICATION (SMALL AND MEDIUM LEAKS), WHERE THE GAIN WILL BE AUTOMATICALLY ADJUSTED FACE TO THE ULTRASONIC SEVERITY LEVEL (RESULT IN AUTO MODE IS OPTIMAL FOR GAIN BETWEEN 70 DB TO 110 DB).

IN THIS MODE, RMS VALUE WILL BE CALCULATED WITH COMPENSATION, TO HAVE THE BETTER REAL VALUE OF THE LEAK.

SCAN THE MEASURED SCENE FOR EXAMPLE FROM LEFT TO RIGHT AND FROM HIGH TO LOW (SEE FIG 2), IN ORDER TO PASS NEAR THE LEAK AND THEN TO DETECT THE MAX VALUE, FROZEN ON SCREEN DURING A FEW SECONDS (VERTICAL LARGE BLACK LINE IN THE COLORED BARGRAPH).

THEN, TRY TO COME BACK IN THE RIGHT DIRECTION TO FIND NEWLY THIS MAX VALUE (ALIGN REAL TIME RMS WITH MAX). YOU WILL SEE A SQUARED TARGET WITH A CROSS INSIDE; YOU ARE FACE TO THE LEAK.

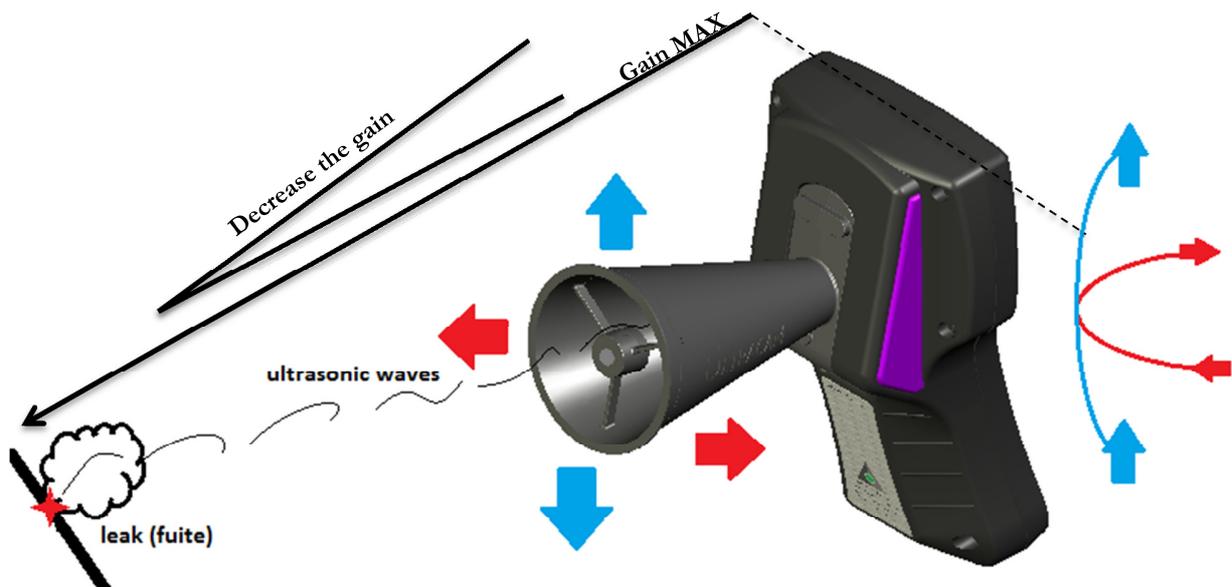


FIG 2

- **MANUAL GAIN MODE (USED AFTER LKS1000 POWER ON AND CLICK TWICE ON  KEY):**

THIS MODE IS USED FOR BIG LEAKS OR ULTRASONIC SATURATED ZONE.

START AT 110 DB AND DECREASE GAIN VALUE (MINIMUM IS 50 DB) UNTIL AUTOMATIC TARGET GOES SMALL TO IGNORE THE HIGH SATURATED ULTRASONIC NOISE YOU HAVE IN YOUR ZONE. THEN USE THE SAME SCANNING METHOD THAN BEFORE (FIG 2.).

THE MORE YOU WILL USE A LOW GAIN, THE BETTER YOU WILL DETECT THE BIG LEAKS (BETTER DIRECTIVITY).

WHEN YOU START TO BE NEAR FROM THE LEAK, TARGET WILL BE YELLOW, IF YOU ARE FACE TO THE LEAK, TARGET WILL BE RED WITH A CROSS INSIDE.

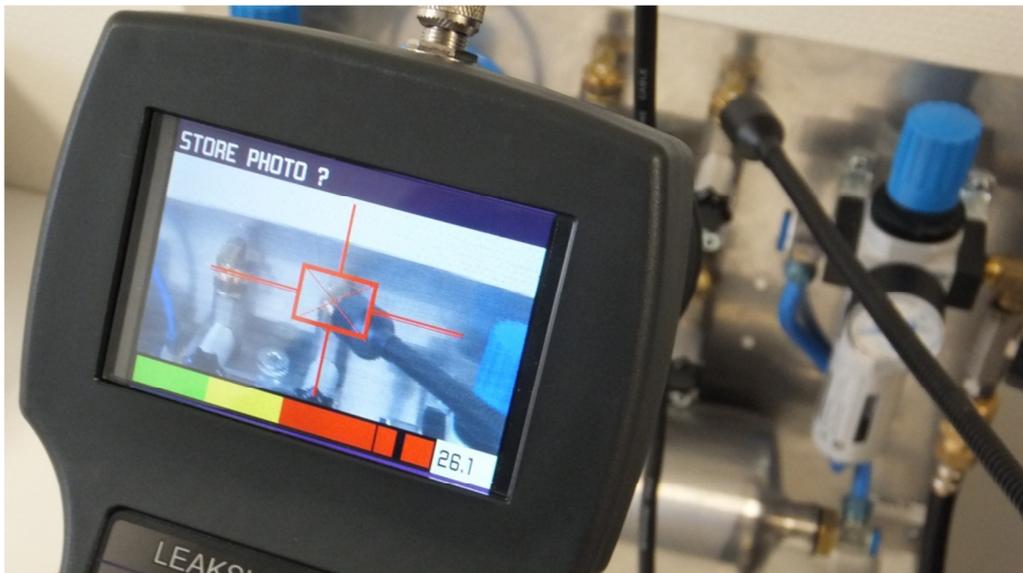
DO NOT FORGET TO READJUST THE GAIN TO THE MAX OR IN AUTO WHEN YOU CHANGE YOUR LEAKS RESEARCH!

LEAK DETECTION SEARCH PROCEDURE WITH FLEXIBLE SENSOR

WHEN YOU ARE WORKING ON VERY SMALL CONNECTORS OR WHEN YOU HAVE A DIFFICULT ACCESS TO A CONNECTOR, YOU CAN USE THE FLEXIBLE 400 MM SENSOR INSTEAD OF THE CONE.

YOU CAN WORK WITH AUTO OR MANUAL MODE AS BEFORE.

THE BEST IS TO FIND THE LEAK WITH THE FLEXIBLE SENSOR AND THEN, TO PUT THE CAMERA IN THIS DIRECTION TO TAKE A PICTURE OF YOUR LEAK.

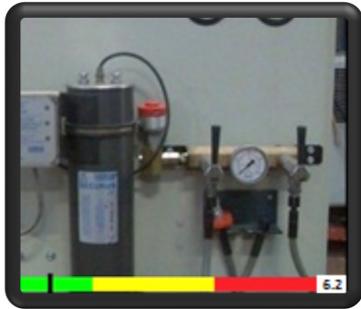


REMARK:

YOU CAN ALSO USE THE HEADPHONE. IT GIVES YOU THE LEAK AUDIBLE WHEN YOU ARE NEAR OR FACE FROM IT.

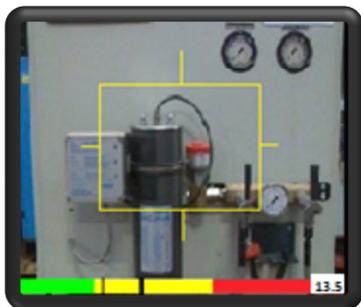
DIFFERENT POSSIBLE MEASUREMENT SCREENS

CASE N°1: NO LEAK



- REAL TIME RMS = \pm MAX AND IN GREEN COLOR
- NO NOISE IN THE HEADPHONES

CASE N°2: NEAR A SMALL LEAK

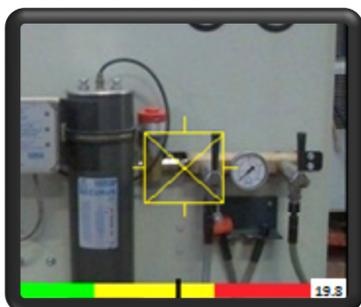


- REAL TIME RMS < (MAX -3dB) AND IN YELLOW COLOR
- **YELLOW TARGET** SHOWING YOU APPROACH THE LEAK
- LIGHT LEAK NOISE IN THE HEADPHONES

REMARK:

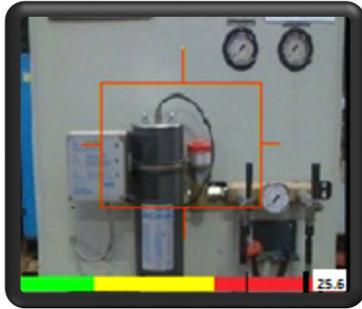
THE MORE THE REAL TIME RMS APPROACH THE MAX, THE MORE THE TARGET SHRINK INTO ITS CENTER. WHEN THE REAL TIME RMS WILL BE LESS THAN 3 dB UNDER THE MAX, THEN YOU ARE FACE TO THE LEAK LOCATION (SEE BELOW, CASE N°3).

CASE N°3: FACE TO A SMALL LEAK



- REAL TIME RMS > (MAX -3dB) AND IN YELLOW COLOR
- **YELLOW TARGET WITH CENTERED CROSS** SHOWING THE LEAK LOCATION
- LEAK NOISE IN THE HEADPHONES

CASE N°4: NEAR AN IMPORTANT LEAK

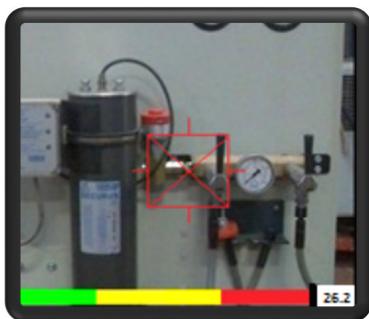


- REAL TIME RMS < (MAX -3dB) AND IN RED COLOR
- RED TARGET SHOWING YOU APPROACH THE LEAK
- HEAVY LEAK NOISE IN THE HEADPHONES

REMARK:

THE MORE THE REAL TIME RMS APPROACH THE MAX, THE MORE THE TARGET SHRINK INTO ITS CENTER. WHEN THE REAL TIME RMS WILL BE LESS THAN 3 DB UNDER THE MAX, THEN YOU ARE FACE TO THE LEAK LOCATION (SEE BELOW, CASE N°5).

CASE N°5: FACE TO AN IMPORTANT LEAK



- REAL TIME RMS > (MAX -3dB) AND IN RED COLOR
- RED TARGET WITH CENTERED CROSS SHOWING THE LEAK LOCATION
- VERY HEAVY LEAK NOISE IN THE HEADPHONES

REMARK FOR THESE 5 DIFFERENT CASES:

IT IS POSSIBLE TO ADJUST THE HEADPHONES VOLUME DURING THE MEASURE. PLEASE JUST CLICK ON HIGH AND LOW BUTTONS ON THE KEYBOARD (VOLUME SETTING FROM 0 TO 10). BE CAREFUL NOT TO LISTEN DURING A LONG TIME WITH A HIGH LEVEL VOLUME ON YOUR EARS!

SYNERGYS TECHNOLOGIES WILL NEVER BE RESPONSIBLE OF AN INAPPROPRIATE SETTING OF THE HEADPHONES VOLUME WHICH CAN CAUSE ON A LONG TERM, AUDITION PROBLEMS.

DUE TO THE EFFICIENCY OF LEAKSHOOTER LKS1000 FIRMWARE (DYNAMIC TARGET, MAX AND RMS VALUES), IT IS POSSIBLE NOT TO USE CONTINUOUSLY THE HEADPHONE.

MENU AND SETTINGS :

LEAKSHOOTER LKS1000 MENU IS ACCESSIBLE WITH  BUTTON ON THE KEYBOARD.



YOU CAN WITH IT, ACCESS TO: (BY SELECTING WITH  . AND UP AND DOWN BUTTONS, ESCAPE WITH LEFT KEY )

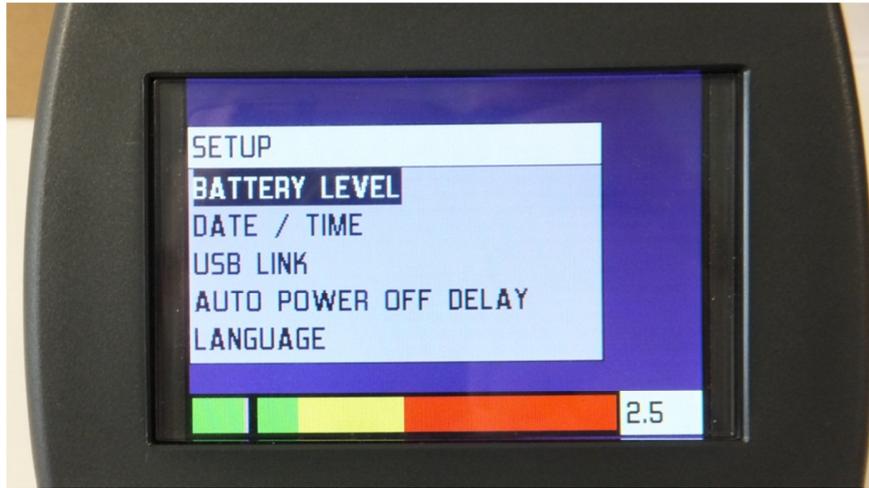


- **DETECTION FREQ : FREQUENCY MIXER IN KHZ (VARIABLE FROM 34 TO 46 KHZ)**
 - ▶ *THE FREQUENCY MIXER ALLOWS TO HAVE A BETTER FINEST SIGNAL RESULT, EFFICIENCY ON HEADPHONES LISTENING, BECAUSE OF THE CAPABILITY TO ADAPT MIXING FREQUENCY FROM 34 TO 46 KHZ FOR STANDARD LEAK APPLICATIONS.*
- **STORED PHOTO:**
 - ▶ **FOR REVIEW OF THE PHOTO STORED IN LKS1000 MEMORY.**
- **SCREEN BRIGHTNESS (0 TO 10)**
- **CAMERA BRIGHTNESS (0 TO 10)**
- **CAMERA USE: DEACTIVATION/ACTIVATION OF THE CAMERA, FOR BATTERIES ENERGY SAVING.**



NOW IF YOU CONTINUE TO GO DOWN "CAMERA USE", YOU CAN SEE **SETUP**, CLICK ON IT WITH **Valid. Menu** BUTTON.

- **SETUP SCREEN**



- **BATTERY LEVEL** : YOU WILL SEE THE VOLTAGE OF THE BATTERIES AND TIME APPROXIMATION REMAIN USE
- **DATE/TIME**
- **USB LINK** : TO PREPARE **USB** CONNECTION WITH **PC**
- **AUTO POWER OFF DELAY** : TIME DELAY TO SWITCH OFF THE DEVICE AUTOMATICALLY
- **LANGUAGE (FRENCH, ENGLISH, DEUTSCH)**

TO NAVIGATE THROUGH THE MENU, USE UP AND DOWN BUTTONS ON THE KEYBOARD.



TO MODIFY AND VALID A SETTING, CLICK ON **Valid. Menu** BUTTON.



TO ESCAPE THIS SETTING MENU, CLICK ON **ESCAPE LEFT** BUTTON

HOW TO CATCH AND STORE PHOTOS TAKEN BY LEAKSHOOTER LKS1000

STORE A PHOTO:

FIG A: WHEN YOU ARE IN FRONT OF THE LEAK (TARGET AND CROSS INSIDE ON SCREEN, REAL TIME RMS=MAX), CLICK

ONE TIME ON  BUTTON. PICTURE IS FROZEN ON SCREEN AND READY TO BE STORED.

IF YOU WISH ESCAPE NOW AND NOT STORE THE PICTURE, THEN CLICK ON ESCAPE LEFT BUTTON



FIG B: OTHERWISE, CLICK ONE MORE TIME ON  BUTTON. PICTURE IS NOW WAITING A NUMBER INFORMATION.

PICTURE WILL BE NUMBERED (NUMBER SET BY DEFAULT OR SET BY USER (USING THE JOYSTICK) BETWEEN 000 AND 999) AND TIME STAMPED.

FIG C: THEN CLICK ON  BUTTON, PICTURE WILL BE FINALLY STORED IN MEMORY WITH CHOSEN NUMBER.



FIG A



FIG B



FIG C

DELETE A PHOTO:

TO DELETE ALL PHOTO (BE SURE BEFORE DELETION) IN MEMORY, PLEASE SELECT A ONE SETUP/STORED PHOTO) BY USING UP

AND DOWN BUTTONS AND CLICK ON  BUTTON DURING 2 SECONDS, THEN VALID FOR DELETION.

TO DELETE ONE PHOTO IN MEMORY, PLEASE SELECT A ONE (SETUP/STORED PHOTO) BY USING UP AND DOWN BUTTONS AND

CLICK ON  BUTTON.

PLEASE CONFIRM WITH  BUTTON AFTER "DELETE THIS PHOTO?" MESSAGE.

IF THERE IS NO PHOTO IN MEMORY, A MESSAGE "NO PHOTO" APPEARS ON SCREEN.