



# Univox<sup>®</sup> FSM 2.0

Multitone Field Strength Measurement  
Microprocessor controlled

User Guide



FSM 2.0, Part No 401040

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# Introduction

We thank you for having chosen a Univox product and hope that you will be satisfied. Please read this User Guide carefully before use of this product.

In the package you will find the following product parts:

- Univox FSM 2.0
- XLR/RCA adaptor
- RCA/3.5mm cable for connection of the signal source to the loop amplifier
- Earphone adapter
- USB-card with full user guide, product information and measuring signals (wav files)
- Measurement protocol Certificate of Conformity
- Bag



1. LCD display
2. Blue LED, Ready
  - A. Flashes after each completed measurement
  - B. Continuous light in Hold mode
3. **Start**  
Starts/activates the FSM or proceeds to the next measurement step
4. **Light**  
Illuminates LCD when pressed.  
Increases battery drain, use with caution.
5. **Stop**  
Turns the instrument off (saves battery)
6. **Hold**  
Toggle switch (On/Off) freezes display
7. Output for headphones or external measurement equipment
8. Output level adjustment
9. 9V-battery compartment (rear side)

## Note

0dB = 400mA/m

# System overview

Univox FSM 2.0 is an advanced Field Strength Meter with several features not seen elsewhere. It is based on the experience from Univox FSM which was the first true rms Field Strength Meter in the world.

As the very first of its kind, Univox FSM 2.0 makes fast and accurate frequency measurements possible by using multitone measurements (several sine waves simultaneously presented). Multitone measurements have up to now only been possible in laboratories or similar environments.

Overspill measurement below the background noise level is for the first time possible with the built-in sharp programmable notch filter in Univox FSM 2.0.

The LCD display and microprocessor ( $\mu$ P) make Univox FSM 2.0 easy and straight forward to use. The measurement process is controlled by the  $\mu$ P and displays a step-by-step procedure, according to the international standard IEC 60118-4.

Univox FSM 2.0 has many built-in features that are controlled by the  $\mu$ P: Calibrated A-weighted filter, tracking switching capacitor filters, automatic gain range setting, auto off/battery save function etc. With all these features it is possible to perform many different kinds of measurements. The  $\mu$ P can easily be updated in case of future IEC standard enhancements.

Please note Specification could change without notice.

Univox FSM 2.0 can also be connected to external measurement equipment. Read more in the section Connection to external measurement equipment.

## Signal sources

### Multitone and sine wave signals

Some of the measurements are based on precise frequencies and other are based on multitone signals. Four input signals are stored on the USB card: **1kHz.wav**, **1kHz\_pulse.wav**, **3\_freq.wav** and **16\_freq.wav**.

Use a verified quality computer, MP3 or CD player as signal source. It is recommended to keep the wav format to maintain quality. Do not change the format to a compressed one. Do not use any other standard signals as frequency calibration is very precise and vital for correct results.

The measurements are based on exact sine wave frequencies and complex multitone signals in each sound file (5 min duration). The signals are mathematically generated and are down sampled to 44kHz/16bit.

- **1kHz.wav**  
1kHz sine wave, peak level = -3dB (rms -3dB) re FS (Full Signal)
- **1kHz\_pulse.wav**  
1kHz sine wave pulses (1.5 sec on/3 sec off), peak level = -3dB (rms -3dB) re FS
- **3\_freq.wav**  
Simultaneous sine waves: 100Hz, 1kHz, 5kHz, max peak level = -3.3dB (rms -11.1dB) re FS
- **16\_freq.wav**  
16 simultaneous sine waves: 100-10kHz, max peak level = -2dB (rms -10.5dB) re FS. Each sine wave level is -20dB re FS.

The file **3\_freq.wav** consists of three multitone sine waves and is suitable for quick basic check of the upper 5kHz and lower 100Hz frequencies in relation to the 1kHz value.

The file **16\_freq.wav** is a more complex and wide multitone signal for comprehensive frequency measurements. The simultaneously presented 16 sine waves with the  $\mu P$  tracking filter gives a more correct and steady measurement compared to pink noise. The wide band signal is compatible with frequency dependent AGC-circuitries and alike.

## Speech signals

The following speech signal sources are stored on the enclosed USB card as wav files:

1. ITU-speech, file **ITU.wav** is an artificial speech based on many different languages. It is a mathematically well-defined signal with separate male and female voices. As level is the primary test, the male and female signals are mixed together.
2. **HAspeech.wav** is a wav file used by the Hearing Instrument manufacturers for testing equipment with “real world signals”.

Real speech or a synthesized speech signal is recommended for commissioning of the loop system for 400mA/m with  $\pm 3$ dB according to IEC.

Use a verified quality computer or MP3 player as signal source. Do not convert the files to any compressed format.

# Basic program description

There are 5 different programs, numbered 1-5. Each press on the Start button will either start the Univox FSM 2.0 or proceed to the next program. Each measurement repeats continuously. The blue LED will flash once for each completed measurement. The completion time depends on the complexity of the program.

## **Measurements/programs**

1. Noise measurement, dB and dB(A), approximately 1 measurement/sec
2. Field distribution and overspill measurements, dB, approximately 3 measurements/sec
3. Frequency, dB at 100 – 1000 – 5000Hz re 1kHz (IEC) 1.1 sec/measurement
4. Frequency spectrum (16 frequencies) re 1kHz, each measurement 5-8 sec
5. Field Strength level, 3 measurements/sec

Measurement 4, frequency spectrum, is not compulsory according to the IEC standard. To save battery life, the Auto on/off function will shut down the Univox FSM 2.0 after approximately 60 sec without use.

# To start/activate Univox FSM 2.0

Press **Start**. Univox FSM 2.0 activates and program 1 starts.

## Using the instrument

1. Hold the instrument in vertical position for measuring the vertical field strength
2. Measure at the correct listening place and height (normally 1.2m for sitting and 1.7m for standing positions)
3. Hold Univox FSM 2.0 in a fixed position during measurements (between each flash of the blue LED)
4. The displayed resolution is 1dB. It must be taken into consideration when interpreting the values

## Step by step description how to fill out a Certificate of Conformity

Activate FSM 2.0, see Using the instrument above and the Measurement protocol Certificate of Conformity.

### 1. Background noise measurement



#### Description

The auto-range feature sets the instrument's gain automatically, depending on the noise level, individually for the A-weighted and flat response for the best dynamic range for noise measurements.

#### Procedure

1. Disconnect the Loop Amplifier from mains power
2. Document the dB and dBA value on different locations throughout the listening area

**Note** If the level for dBA and dB is equal, the background noise is more likely to be audible in the hearing aid.

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## IEC 60118-4

1. For long time listening it is recommended that the background noise level is below -47dB(A)
2. If the background noise level is higher than -32dB(A), the owner of the premises should be informed and given some suggestions how to accomplish a lower background noise level
3. For short time announcements, background noise levels of up to -22dBA, can be accepted

## 2. Field strength variation/overspill



### Description

The precise 1kHz frequency signal together with the tracking filter in Univox FSM 2.0 make measurements below the background noise level possible.

### Procedure

1. Press **Start** to activate program 2 **Coverage**
2. Connect the signal source, file **1kHz.wav** to the amplifier and adjust the input level according to the amplifier's manual. Adjust the field strength to approximately -12dB at a reference measuring point
3. Measure the variation inside the listening area at (1.2m) for sitting and/or (1.7m) for standing height (Field Strength Variation)
4. If necessary, measure the overspill distribution outside of the loop (as overspill is not regulated in the IEC 60118-4 standard, the overspill can be defined as magnetic field above -32dB)
5. Press **Start** again for  $\frac{1}{4}$  of second to advance to next program



## IEC 60118-4

Stated field strength variation is  $\pm 3$ dB within the listening volume.

**Note** Australian standard AS1428.2 accepts level of +3, -9dB for strongly reinforced constructions.

### 3. Basic frequency test



#### Description

Univox FSM 2.0 automatically calculates the levels for 100Hz, 1kHz and 5kHz relative to 1kHz. The level for measurement is set automatically.

As all three frequencies are presented simultaneously (multi-frequency test) the old measurement problem with AGC-systems is solved. Another advantage is the speed. Full measurement with all frequencies is made approximately once every second.

**Note 1** High frequency drop is caused by the condition of the room. The highest drop will normally be in the middle of the loop.

**Note 2** A loop amplifier cannot fully compensate for high frequency drops (normally occurs in the center of the loop), as the variation is due to the physical variation of the room, not the amplifier. The only real solution is to decrease the distance between the loop wires to reduce the metallic influence. Tone controls (often called metal loss correction or alike) cannot control local frequency variation caused by the room. After any frequency adjustment(s), double-check that the amplifier does not saturate/clip AND that it can deliver the full 400 mA/m (0dB in program peaks).

#### Procedure

1. Connect the signal source, file **3\_freq.wav**
2. Adjust the input level according to the amplifier's instruction manual
3. Make sure that the output does NOT saturate or clip. -12dB field strength level is a secure level (the -12dB level is normally already set in step 2)
4. Perform the frequency test at 1.2m for sitting and 1.7m for standing listening height. If both sitting and standing positions are preferred, 1.45m measuring height is used according to IEC.

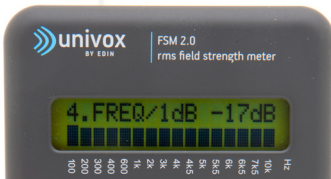
5. Document the results in the certificate
6. Press **Start** again for ¼ of a second to advance to the next program

## IEC 60118-4

Specified frequency variation is  $\pm 3\text{dB}$  for 100Hz and 5kHz relative to 1kHz (0dB)

**Note** Please see **Overspill/Field strength variation measurement** for details.

### 4. Comprehensive frequency measurement (not required for IEC certificate)



#### Description

Univox FSM 2.0 makes a full automatic frequency/spectrum measurement without the need for manual calibration or setting of the level of the measurement. This also avoids common mistakes when trying to set correct levels for frequency measurements. The program makes relative frequency measurements possible with accurate results.

1. Each frequency is measured
2. The gain is calculated and corrected for each frequency for highest dynamic range
3. The highest measured level is calculated
4. All other levels on other frequencies are in relation (-dB) to the frequency with the highest measured level
5. Frequency levels are presented as bar graphs on the lower display with 1dB resolution (total 8dB)
6. The field strength level is presented on the upper right of the display (normally -12dB)

## Procedure

1. Connect the signal source, file **16\_freq.wav**
2. Make sure that the output does NOT saturate or clip. -12dB field strength level is a secure level (the -12dB level is normally already set in step 2)
3. Check the frequency variation at 1.2m for sitting and 1.7m for standing height. At installations for sitting audience only, measurement for 1.7m is not necessary.
4. Press **Start** again for ¼ of a second to advance to the next program

## Adjustments

High frequency drop is caused by the condition of the room. The highest drop will normally be in the middle of the loop.

## IMPORTANT!

Any high frequency corrections strongly increase the saturation/clipping risk in the amplifier. A 12dB increase in correction increases the power demand from the amplifier by 16 times!

Any high frequency correction made at a low level (-12dB/100 mA/m) will **LIKELY** saturate the amplifier for normal program signal peaks of 400 mA/m.

Frequency measurements are not correlated to the field strength. The output performance **must** be checked after any frequency corrections.

## 5. Adjustment of field strength level



## Description

The FSM 2.0 measures the magnetic field strength level approximately 3 times/sec.

## Procedure

1. Connect the signal source, file **1kHz\_pulse.wav**
2. Adjust the input level according to the amplifier's manual

3. Read the highest value within 2-5 seconds and adjust the output current until peak values of 0dB (400mA/m)  $\pm$ 3dB are reached. A good reference measurement point is midway between the center of the loop and the loop perimeter
4. Check the variation at 1.2m for sitting and 1.7m for standing height. Document the result in the certificate. It is only necessary to document the used height, i.e. if only sitting position is used only that position needs to be documented.

## IEC 60118-4

Accepted variation is  $\pm$ 3dB re 400mA/m (0dB) through the whole listening volume.

## 6. Final confirmation and commissioning

Connect the actual signal source/s, preferably speech, and adjust the input level according to the instructions of the amplifier's manual.

If a microphone is used, speak normally into the microphone. If the ITU or HA synthesized speech signals are preferred, use the audio sources available on site (CD player or audio system).

Verify that the highest peak is 400mA/m (0dB). As real signals like speech fluctuate, several measurements have to be performed, usually for 20-30 seconds. The time it will take before an accurate peak value is reached, is depending on the evenness of the program signal (crest factor).

Document the highest peak value into the certificate.

Another easy way of confirming that the magnetic field strength level is OK, is to use Univox Listener. If the LED lights up green occasionally the level is according to the IEC standard.

# Connection to external measurement equipment

The FSM 2.0 can be connected to external measurement equipment using the headphone output. Output level is 100mV RMS at max volume setting. Max load 1k $\Omega$ .

Therefore any system – computer, level meter, smartphone or alike with appropriate software can use the FSM 2.0 as a field strength measurement "head".

## Other information

### **Security/Warranty**

Basic knowledge in audio installation techniques is required to achieve existing regulations. The installer is responsible for the installation hereby avoiding any risk or cause of fire. Please also note that warranty is not valid for any damage or defects on the product due to incorrect or incautious handling.

### **Maintenance and care**

Under normal circumstances Univox products do not need any special maintenance. Should the unit become dirty, wipe the unit with a slightly damp cloth. Do not use solvent or heavy cleaning agents.

### **Trouble shooting guide**

When Univox FSM 2.0 automatically shuts down quickly, please replace the batteries. If the buttons are pressed down too hard, the Univox FSM 2.0 might shut itself off. If so, just activate the FSM 2.0 again by pressing the Start button.

### **Service**

Should the system not work after having replaced the batteries, please contact the local distributor of the product for further instructions. If the product is to be sent to Bo Edin AB, please enclose a filled out Service Form, see [www.univox.eu](http://www.univox.eu), Support.

## Technical data



For additional information, please refer to product data sheet/brochure and CE certificate which can be downloaded from [www.univox.eu](http://www.univox.eu), Download. If required, spare part lists or other technical documents can be ordered through [support@edin.se](mailto:support@edin.se).

## Recycling directives/Environment/Correct disposal



When this product is finished with, please follow existing disposal regulations. Thus if you respect these instructions you ensure human health and environmental protection.

# Notes

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Distributor

Univox by edin, the world's leading expert and producer of high quality hearing loop systems, created the very first true loop amplifier 1969. Ever since our mission is to serve the hearing community with the highest degree of service and performance with strong focus on Research and Development for new technical solutions.

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