

## Programmable Remote Microphone with AGC system (PMFA project)



### Technical characteristics

- Power voltage: 2.7V – 3.6V (version without linear stabilizer),
- 2.7V – 6.0V (version with linear stabilizer);
- Useful current: 0.8mA – in basic mode, 1.4 mA – in “time in setup mode” (1-4 min);
- Frequency band: 300 Hz – 12 KHz (depending on the current amplification);
- Maximum amplification: up to 1000 (60 dB);
- Minimum amplification: 1 (0dB).

## Operating Manual

The microphone turns on when connected to the recorder. With power supply the microphone turns on automatically, and the LED flashes once (1 sec) to indicate it.

After the microphone is turned on the setup mode is available within the specified time (1-4 min). The setting is carried out through speakers or headphones connected to the PC. Playback sound volume on the PC must be set at the level for the sound to be audible at the distance of no less than 0.5-1 meter from the sound source. Then launch the setup program on the PC, specify new parameters of the microphone (attack time, recovery time and time in setup mode) and press the button "Apply". After the "Apply" button is pressed the program performs an audio-coded setting (DTMF code is used) for the microphone which takes 1.5-2 sec. If the sound volume is adequate for the microphone and the time in setup mode hasn't expired, the microphone accepts setting and indicates it by a single flash of the LED (1 sec).

If the sound volume is too heavy and there are loud side tones, the LED flashes shortly (~50 ms) to indicate overload. In this case you must either

reduce the volume on the PC (make it twice as low) or increase the distance to the microphone (make it twice as long).

If the sound volume isn't sufficient and the time in setup mode has expired, the LED doesn't flash when setting from the PC. In this case you must increase the volume on the PC (make it twice as high) or cut the distance to the microphone (make it twice as short).

The specified settings can be saved in the program on the PC as a file. To do this, go to "File" and submenu "Save As". The program displays a standard file record dialogue. In the field "File name" enter the required file name, select a folder for recording (through control element "Folder") and press the button "Save".

Further the settings can be uploaded onto the program from the file. To do this select "File" and its submenu "Open". The program displays a standard file record dialogue. Select the setup file and press "Open".

## Operation description of the electric circuit

Current circuit PMFA\_v14.sch dated July, 20, 2008 Programmable Remote Microphone with AGC system is based on the gain adjustment by applying a microcontroller. The circuit of noncomplementing amplifier with DA1 operational amplifier, resistors R5 and R6, JFET transistor VT1 and capacitor C3. Noncomplementing circuit has been selected because it doesn't aggravate zero offset of the operational amplifier and that's why it is not critical for this parameter of operational amplifier at large required amplification (~1000). C3 capacitor is intended for a single amplification at permanent current and a required amplification at alternate current. Input level offset is set as  $\frac{1}{2}$  off the power and specified by the R3 and R4 resistors. C2 capacitor is intended for removing the direct component from the electret microphone. The R1 resistor sets operating voltage on the microphone and R2 and C1 provide power filtration against distortions.

Gain control is carried out through JFET transistor VT1. When the voltage in the control gate of the transistor equals the drain-to-source voltage the transistor is fully open and its resistance is close

to zero. In this case the amplification of circuit is defined by the R5 and R6 resistors. When increasing the difference between control gate and the drain-to-source the transistor is closed, its resistance increases and reduces the gain. When achieving the difference of transistor closure voltage, its resistance is approaching infinity, and the whole circuit amplification tends to 1 which means that the circuit provides amplification adjustment from the maximum specified by the R5 and R6 resistors to one.

To control voltage on the control gate of JFET transistor PWM output of the microcontroller is used at frequency 14560 Hz. The PWM output is filtered by the RC filters (R9-C5 and R9-C6), the maximum level is divided into 2 (dividing circuit R7 and R8+R9) for better using of PWM range (as the level more than  $\frac{1}{2}$  off the power is not needed).

Microcontroller digitizes the signal at the operational amplifier output for defining the current level of the amplified signal.

The R10-C7 filter is intended for minimization of impact leakage caused by analog-to-digital converter of microcontroller that affects the operating functionality of the circuit as impulse interference penetrates into the operational

amplifier output through the R7 resistor (and its parasitic capacitance). When the signal level at the output is less than the one specified in the microcontroller, microcontroller enhances circuit amplification (with time response Release Time). When the signal level at the operational amplifier output is more, than the one specified in the microcontroller, microcontroller decreases circuit amplification (with time response Attack Time).

Fix amplification channel with bipolar transistor VT2 is intended for programming the microphone from the PC. The program from the PC sends audio coded signals (DTMF code), and the microcontroller digitizes them at the built-in analog-to-digital converter and then decodes them. Code sequence is protected by CRC-16 to prevent data corruption. To confirm a successful acquisition of command from the PC the VD1 LED of microcontroller flashes once.