TSM Digital Recorder RAY+ Series User Manual

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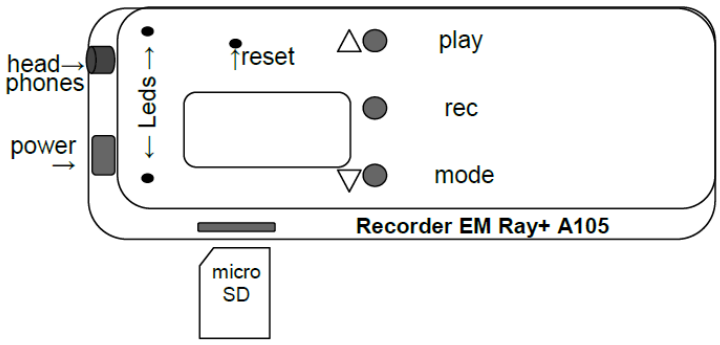
Purpose and Recorder's Appearance



Purpose:

The Edic-mini Ray+ series of professional voice recorders with an adaptive directional pattern and advanced features including playback mode in the Recorder itself and an OLED indicator. The use of 8 digital microphones with built-in 24-bit audio codec provides maximum recording quality in the most difficult conditions, high acoustic sensitivity (up to 20 meters), and a wide dynamic range (24-bit). The availability of markers allows it to confirm the authenticity of the recording in court. The recording is performed on a microSD card up to 256GB, which provides up to 1 year of continuous recording. When recording in noisy, echoing premises at long distances it is impossible to achieve the desired recording quality using conventional recorders with 1 or 2 microphones. The problem is that when recording at a considerable distance the recorder records not only the necessary signal but also some external noise and the reflection of sound. This interference increases quadratically depending on the distance from the sound source and at a distance of several meters it really can drown out the desired signal. The only solution is to form a signal source direction pattern on the desired signal with maximum drowning of signal from other directions. To generate a direction pattern there are 8 microphones used in the Edic-mini Ray+ recorders forming a so-called phased array (similar to the one used in radar). The application of 8 microphones also reduces the inherent noise of the microphones by 2.5 times. In the end, record gain from the use of 8 microphones can be from 2 up to 6 (depending on the recording conditions) as compared to a recorder with one microphone. LEDs are used to indicate the Recorder's battery charge level and free memory capacity. There is a configuration file on the memory card to set Recorder's operation modes. This is a regular text file and can be edited with any text editor on the PC.

Technical Characteristics

- Signal-to-noise ratio 79 dB
- Dynamic range 116 dB
- Microphones sensitivity -26 dB
- Record format mono/stereo
- Sampling rate (At a frequency of 32 kHz, recording is performed only in mono mode, regardless of the set settings) 8/16/32 kHz
- Frequency band from 60 to 15 000 Hz
- Bitrate 8/16/24 bit (At 8-bit, u-Law compression is used)
- Average current consumption in Record Mode 16KHz – 16bit (mono) (current consumption depends on the type of memory card) 2.5 mA (for memory card Samsung Evo plus 32Gb)
- Average current consumption in Record Mode 16KHz – 16bit (mono) with the Soft limitation of microphone overload function enabled 4.5 mA (for memory card Samsung Evo plus 32Gb)
- Current consumption in Continuous Sound Check mode 3 mA
- Current consumption in Periodical Sound Check mode with intervals from 30 to 120 sec:
- In Standby Mode, in the specified intervals from 30 to 120 sec 5 μA
- In direct Sound Level Control mode (after sound level activation, during the time interval while recording is being carried out, current consumption will correspond to regular record mode) 3 mA
- Average current consumption in Playback mode 7 mA
- Current consumption in the off state with a memory card installed 5,5 μA
- Current consumption in the off state with memory card removed 2,5 μA

All recorded files are protected by a digital signature. Use a special utility to prove the authenticity of files and check for any editing. The files can also be protected by a user password. While playing back these files there will be only ‘white noise’. Use a special utility to decode it.

Preparing microSD Card

- MicroSD card which is in the delivery set doesn’t require any preliminary preparation. It has a configuration text file CONFIG_CARD24.INI containing Recorder’s settings.
- If you need to use a new memory card:
- The memory card used in the Recorder must be formatted in accordance with FAT 16, FAT 32 or exFAT file system – for memory cards with a capacity of more than 32 GB.
- After inserting a formatted memory card into the Recorder, there will be a short flash of the red LED, and the Recorder will record the CONFIG_CARD24.INI configuration file of the operation modes onto the card.
- After that, the card can be removed and the configuration file can be edited in accordance with the settings needed. For more details, see the section ‘Changing Settings with Configuration File’.

Operating the Recorder

Notes:
Pressing the button twice – briefly press the button twice within 2 seconds. Pressing the button three times – shortly press the button three times within 3 seconds. Single pressing of two buttons – press and release both buttons simultaneously, so that they are pressed simultaneously.

Standby Mode
When none of the functions of the Recorder is activated, the Recorder is in Standby mode, and there is no LED

indication.

Install/Remove Memory Card
Insert the memory card into the slot by pressing it with a little effort (press again to remove the memory card). The Recorder will automatically check the card, and if it is operational, formatted, and suitable for recording, there will be a short flash of the red LED (the LED flashes during card initialization time; as a rule, this process takes several seconds). If the red LED starts flashing frequently (indicating card error), remove the card, wait until the LED stops flashing, and then reinstall the card. If the above procedure doesn't help and the LED continues to flash frequently, that means the card is not operational, not formatted, or not suitable for recording. In this case, remove the card and check it on any other device, and if necessary the card can be formatted.

Enabling Recording
After a single short pressing of the REC button, the Recorder switches from Standby mode to Record mode, and there is a short flash of the red LED. After that, the Recorder starts recording. During recording, the red LED indicates operating mode in two series of flashes. The first series of LED flashes corresponds to the battery charge level and the second to free memory capacity. The interval between the first and second series of flashes is 3 seconds and between the second and first 7 seconds. The dependence of the number of flashes on the battery charge level, or on the amount of free memory is shown in the following table:

Number of flashes	Battery charge level (1st series)	Free memory capacity (2nd series)
1	80-100%	75-100%
2	20-80%	50-75%
3	2-20%	25-50%
4		1-25%

To stop recording, press the REC button once. Red LED will be on to indicate recording has stopped. Since the Recorder needs some time to close the recorded file (about 3 seconds), the red LED will be indicating this process and stating the card can't be removed. As soon as the LED goes off, the memory card can be removed. Failure to do so may damage the recorded file. If during recording free memory runs out and the circular recording function is not enabled in the Recorder's settings, the Recorder makes three flashes of the yellow LED, stops recording, and switches to Standby mode. Further attempts to enable recording (with circular recording turned off) will lead to triple flashes of the yellow indicator stating there is no capacity on the memory card, and the Recorder will go to standby mode. If during recording, the battery charge level is too low, the Recorder stops recording, closes the current file, and exits the operating mode. Each time recording is enabled, a new file is created, the name of which corresponds to: <EM_CARD24S_yyyymmdd-hhmmss_123_xxxxxx.wav> where:

- yyyymmdd – year, month, and date of recording, respectively
- hhmmss – recording start time, hours, minutes, and seconds, respectively
- 123 – options for the recorded file:
    1. the voice activation system (VAS): N – disabled, V – enabled;
    2. start recording by one of the timers: T – recording started by timer, M – recording was made in regular mode;
    3. recording mode: L – linear recording mode, C – circular mode.
- xxxxxx is a six-digit serial number

Record Playback
The records can be played back via headphones. The Recorder switches from standby mode to playback mode by short once pressing the PLAY button. The Recorder starts playing back the last file recorded indicating the battery charge level with periodic series of green LED flashes

- single flashes indicate the battery is fully charged;
- double flashes indicate average battery charge;

- triple flashes mean the battery is low and the Recorder must be charged.

When there is an end of the recording, or after moving to the end of it using navigation functions, playback stops, and the green LED starts flashing frequently. After that, if there are no buttons pressed for 10 seconds, the Recorder switches to Standby Mode.

Navigation in Playback Mode

- Enter Playback Mode…….. Press the PLAY button once
- Quit Playback Mode……. Press both buttons simultaneously once
- Go to the beginning of the current record…… Press the REC button once
- Go to the end of the current record…….. Press the PLAY button once
- Go to the beginning of the previous record……. Press the REC button twice
- Go to the beginning of the next record…….. Press the PLAY button twice
- Go to the beginning of the first record…… Press the REC button thrice
- Go to the beginning of the last record……. Press the PLAY button thrice

Setting recording parameters and Recorder's operation
Editing configuration files through a word processor

First, make sure the Recorder is not in record or playback mode. Then remove the microSD card from the Recorder. Using a MicroSD-USB or SD-microSD adapter, connect the card to the PC, smartphone, or tablet. Open the CONFIG_CARD24.ini file using a word processor, and start editing. To set the recording parameter, as well as to enable/disable settings, select the corresponding value in the line with the parameter after the "=" symbol.

Configuration program for creating a configuration file

The supplied microSD card contains a folder with the corresponding software. There is a Confiq_card24 prog program in this folder.

- Run the Confiq_card24 prog program on your device, select the required settings and click the button 'Download new settings'
- This program generates a new configuration file for your Recorder
- Delete the old configuration file from the microSD card replacing it with the newly created one

This program is designed as a java application, it uses any browser available on the device (your PC, tablet, smartphone, etc.). The program operates offline (no internet connection is needed). Online configurator to create a configuration file: **https://telesys-market.ru/wa-data/public/site/PO/Configuration-Card24S/index.html**

Recording quality parameters
To configure record mode (record quality), open CONFIG_CARD24.ini in any word processor and set the desired parameters.

Record mode
There are 8 record modes available

Record Mode	Record quality	Hours in 1 Gb		Hours in 32 Gb	
		mono	stereo	mono	stereo
0	PCM 8 KHz 16 bit	18.6	9.3	595	297
1	PCM 16 KHz 16 bit	9.3	4,6	297	148
2	PCM 32 KHz 16 bit	4,6	not available	148	not available
3	PCM 8 KHz 24 bit	12,4	6,2	396	198
4	PCM 16 KHz 24 bit	6,2	3,1	198	99
5	PCM 32 KHz 24 bit	3,11	not available	99	not available
6	uLaw 8 KHz 8 bit	37,2	18,6	1190	595
7	uLaw 16 KHz 8 bit	18,6	9,3	595	297
8	uLaw 32 KHz 8 bit	9,3	not available	297	not available

The mode is selected in the line RecordMode=1, where ‘1’ corresponds to the selected mode with quality 16 kHz 16 bit

Selecting the Number of Record Channels
Ray+ series of voice recorders has 1, 2, 4, 6, 8 channels (microphones), which allows it to form a directional diagram. Use the SoundProcessor 0.5.9 program to check all the options of forming a diagram, it is available for download at ts-market.ru

A number of record channels (1-mono, 2-stereo, etc.)
The number of record channels (number of microphones) can be set in the line NumRecChannels=1, where ‘1’ is the selected number of channels (1-mono)

Microphone gain level
To configure the microphone gain level, open config.ini in any word processor and set the desired parameters. The gain level increases depending on the value selected (from 1 to 7). It can be combined with file size restrictions.
This is set as GainLevel=4, where ‘4’ is the selected microphone gain.

Important!
With an increased gain level, microphone overload may occur when recording at a short distance.

Soft limitation of microphone overload

To eliminate microphone overload occurring in case of loud sounds coming from a sound source located too close to the Recorder, there is an option ‘Soft limitation of microphone overload’.

Important!!!
When this setting is enabled, the current consumption in record mode increases by 2 times. This fact should be taken into account when estimating operation autonomy.

The function is active by default
This is set as “Soft limitation of microphone overload: 0 – disabled; 1 – enabled”

- SoftLimitation=1
- Circular Recording
- Use the configuration file to enable and configure circular recording. If the circular recording is enabled, after the entire memory capacity is full, the oldest data are deleted to continue recording over the freed space. The

choice is made by setting CircularRecording=0, where “0” – circular recording is disabled (“1”- enabled)

Setting File Size Restrictions
File size restrictions can be activated and adjusted via a configuration file. If during recording, the file size exceeds the maximum permitted size, the file is closed and recording continues in a new file. If at the end of recording, the recorded file is smaller than the minimum allowable size, it is deleted. Restrictions are operational only as long as they are active. If the restrictions are off, files of any small size are saved in the Recorder’s memory card. Old file is closed and the recording continues in a new file only in case of file size approaching the level of 2GB.

- File size limit: 0 – disabled; 1 – enabled
- Enabling
- Limit Enable=0, where “0” is the file size limit disabled (“1” is enabled)
- The file size is set by the parameters
- MaxFileSizeMB=1000 and MinFileSizeMB=1. where “1000” is the maximum file size in Mb, and “1” is the minimum file size in Mb.

Timer Recording
The Recorder has 4 timers to automatically start recording at the preset time. Timers are enabled and configured via a configuration file (CONFIG_CARD24.INI). If at least one of the timers is on, the Recorder will switch from standby mode to record mode at the specified time, which is indicated by flashes of the red LED. If the timers overlap in time, enabling and disabling the timer following the earlier one will shift by the time of the intersection. For each timer the following parameters are set: operation mode, enable time, and duration in hours. The operation mode is set by the parameter: TimerType = 0, where ‘0’ states the timer is disabled (‘1’ – daily timer ‘2’ – once timer)

- The timer start date is set by the parameter:
- TimerStartDate = 01/01/2020 in day / month / year format
- Timer start time:
- TimerStartTime = 12:00 in 24 hour format
- Recording duration after timer start:
- RecordDuration = 1, where ‘1’ – time in hours,
- Once timer can be set for any time within 600 hours.

Voice Activation System (VAS)
Recording by sound level can be activated and adjusted via a configuration file. If the function of sound level recording is on, then when switching to record mode, the Recorder does not start recording immediately but needs to check the sound level, a blue LED will be flashing frequently. After the sound appears, its level exceeding the threshold specified in the configuration file, the Recorder starts recording. Red and green LEDs start flashing simultaneously, the number of flashes corresponding to battery charge level and free memory capacity, similar to the recording process. If there is no sound, the Recorder continues recording for the time set in the configuration file. After that, the Recorder stops recording.

The sound check can be continuous, or periodical. During periodic testing, current consumption is reduced, but sounds that fall between the checks are not recorded. During recording, the Recorder checks the sound level continuously, regardless of the check regularity configured. While checking the sound level, there are short blue LED flashes with an interval of 3 seconds. While periodic testing with the interval from 15 to 120 seconds, the LED will flash right at the moment of testing, i.e. once in 15, 30, 60, or 120 seconds with an interval of about 6 seconds.

Password Protection of Records
Use the configuration file (CONFIG_CARD24.INI) to set password protection of records. Password is set in the

corresponding section [Security]. Enter an 8-digit password in the field [Password]. After the memory card has been installed into the Recorder, the digits of the password in the configuration file will be automatically replaced with '*' symbols to avoid obtaining the password by unauthorized persons. To cancel password protection, enter 8 zeros in the field Password. To change the previously set password, instead of the symbol ******** simply enter a new digital password in the Password field.

Important!!!
After setting the password, the recordings will not be freely available for listening, it will become impossible to listen through headphones. In addition, it will be impossible to decrypt encrypted records if the password is lost!

Decoding Records after Setting Password
Records encrypted with a password are decoded through a special program CARD24_FileDecoder (available for download on the website ts-market.com on the Recorder's page) This utility does not require installation, just unpack the archive into the desired directory (folder). After starting the CARD24_FileDecoder1.1.exe program, a dialog box appears to enter the password. The user needs to enter an 8-digit password that was set on the Recorder to protect the files. When entering a password, the [OK] button is not active until all 8 characters have been entered. After entering the password and pressing the [OK] button, the dialog box to enter the password closes and the [Select record] button appears, a click on which will open a window with the choice of the file for decoding. Then select the file to be decoded. At the end of the process, there is a message, decoding has been completed successfully. A new file will be created in the same directory from which the file for decoding was selected. It will have the same name as the encoded file, with the prefix 'decoded'.

Setting Time and Date
Time and date can be set via the configuration file and is specified in the field [Service]. Time and date need to be set correctly for proper timer operation and system time accounting. In order to set a new time, specify a new time and date value in the corresponding fields of the configuration file, allow time update by setting the SysUpdate option value as 1, and insert a memory card into the Recorder. The Recorder reads the configuration file each time a new memory card is inserted into the slot. In this case, the red LED makes a short flash, stating the configuration file has been read successfully. After the Recorder sets system time, the SysUpdate option in the configuration file is automatically rewritten to '0'. It is done so in order there is no subsequent change in system time during subsequent installation and removal of the card if this is not required by the user.

Changing Settings with Configuration File (CONFIG_CARD24.INI)
All the Recorder's settings are made using the CONFIG_CARD24.INI configuration file. This is a text configuration file, which is to be written by the user onto the memory card. Any word processor on your PC can be used to open the CONFIG_CARD24.INI file, make changes to it, and save it. Then insert a memory card into the Recorder, and the file will be read by the Recorder, which will be indicated by the flash of the red LED indicator for several seconds, and the settings specified in the file will be accepted by the Recorder. The lines of the configuration file should be edited only in the corresponding fields; adding new comments to the file or deleting existing lines is not permissible, and may lead to incorrect reading of the file.

If you accidentally delete a configuration file, a sample of it will be automatically rewritten onto the memory card. Attention! Before removing the microSD card, the record must not be in one of the operation modes, and the LED indication should be off. Failure to do so may result in an incorrect recording completion and loss of all information on the memory card. If a memory card error occurred during Recorder's operation, the Recorder's LED will start flashing frequently. In this case, remove the memory card and check its functionality on any other device.

Battery Charging

Before starting, make sure the rechargeable battery is charged. Charge the battery if necessary. Connect the supplied cable to the micro USB connector of the Recorder. Then connect the cable to the USB port of the PC or any power supply unit with a USB connector, an output voltage 5V, and a current of at least 500 mA. There is a red LED on during charging and a green LED upon completion. Full charging takes 2-3 hours.

IMPORTANT!
After charging has been completed, remove the cable from the Recorder to avoid any mechanical damage.

Indication of errors in the operation of the Recorder and troubleshooting

- Sequential three-fold flashing of the red and green indicators – firmware file is damaged, and software needs to be updated.
- Frequent continuous flashing of the red indicator – the memory card can not be initialized or is unusable for recording. Remove the card, wait about 2 seconds and reinstall it (see ‘Insert/ Remove Memory Card’ section).

Constant red indicator glow – card initialization error. Reinstall the card or press Reset.
Important! Pressing the Reset button will reset the Recorder’s settings, as well as the loss of the system time and date. Deleting the Configuration file also leads to the reset of settings, because if there is no configuration file, the Recorder will generate a basic configuration. In this case, the time and date are saved.

Firmware Update

1. Download the firmware file for your model from the website www.ts-market.com in the technical support section of your series
2. Connect the microSD card to the PC and format it (Fat32, cluster size 32)
3. Copy the previously downloaded firmware file to the microSD card
4. Remove the card from the PC (with Safe device removal)
5. Insert the card into the Recorder (the battery level on the recorder shouldn’t be less than 3.5 volts)
6. The card will be read automatically, during flashing there is a flashing of green and red LEDs, and upon completion a brief flash of red LEDs. If the automatic reading did not occur, press the Reset button (marked as R/Res/Reset on the Recorder’s case)
7. Your Recorder is updated and ready for use. The firmware version can be found in the CONFIG_CARD24.ini file in the service information block

Important!
if the file with the settings was not deleted before the firmware upgrade, delete it and let the Recorder form a new one (otherwise the Recorder will be updated, but the firmware information in the configuration file will remain the same). P.S. If you need to perform a downgrade procedure, the procedure is similar.

Documents / Resources

	TSM Digital Recorder RAY+ Series [pdf] User Manual Digital Recorder RAY Series, Digital Recorder, RAY Series Digital Recorder, Digital Recorder, Recorder

References

- TS-Market: professional miniature audio and video devices
- TS-Market: professional miniature audio and video devices
- Настройка диктофонов EDIC-mini CARD16