

D R M A X - 2
DDS FREQUENCY SYNTHESIZED
DRM
MW TRANSMITTER

User's Guide

(Please read carefully before using for the first time!)

DRMAX2 is a low-power DRM MW transmitter. It achieves extremely high stability thanks to the latest technology DDS-based frequency generator which provides better stability than that typical of PLL-based systems.

To operate you must connect DC from 24V (center pin positive) to the power supply jack.

To avoid damage, always operate the unit with the RF Out connected to an antenna, or a 'dummy load'.

Connect your audio source to the corresponding RCA jacks. The yellow RCA jack is for the left channel, and the red RCA jack is for the right channel (red cable from PC card).

The recommended encoder software for your PC is 'SPARC DRM Modulator' which you can download as freeware from www.drm-sender.de which works extremely well. (This information is only provided for your reference. We have no ties with this company or site.)

Note: the freeware version supports monophonic DRM broadcasts because it uses conventional audio encoder, while the licensed version supports full DRM stereo quality as used by professional stations. More details can be obtained from SPARC's web site (listed above).

F R E Q U E N C Y S E L E C T I O N

IMPORTANT: Before you decide which frequency to use, take extra care to first select a frequency on your AM radio set that isn't occupied by any station, and - if possible - not even one with a weak signal. Selecting a 'clean' frequency will give you a better sound at a longer distance and avoid unwanted possible interference on your neighbor's radio. To set the actual frequency, please see the MW FREQ menu section below.

O P E R A T I O N

The DRMAX2 features an 8-character by 2-line LCD and a 4-button keyboard. When powered up, the LCD displays a brief version and copyright message followed by the current transmission frequency.

The keyboard buttons are marked as follows:

- [↑] Acts as [Up]. Cycles through the possible choices in a forward or upward direction. Menus with only two possible choices use the [●] key instead to toggle between the two.
- [↓] Acts as [Down]. Cycles through the possible choices in a reverse or downward direction. Menus with only two possible choices use the [●] key instead to toggle between the two.
- [■] Acts as [Menu] or Escape. Cycles through the possible menu screens (the sequence is shown farther below), or selections within a single menu screen. For menus that require [●] to be pressed to accept the changes, this button can be used to escape from the changes made so far if pressed instead of [●].
- [●] Acts as [Enter]. Accepts the current setting in some menus. *Note: Some choices may become active immediately when selected with the [↑]/[↓] buttons while others (e.g., frequency) are activated only by pressing [●].*

M E N U S E Q U E N C E

The menu sequence is as shown below. Menus do not necessarily show these exact titles. The titles below are indicative of the function and may appear slightly different on the actual LCD.

MW FREQ | IF KHZ | RF OUT | RF LEVEL | CLOCK | DAILY SCHEDULE | WEEKEND SCHEDULE | SAVE | LOAD | BFO TRIM

MW FREQ Allows selection of the transmission frequency, using a 1KHz step from 530KHz to 1710KHz (special versions may have a different range). Once a new frequency is selected you must press the [●] button to accept your selection. If you decide to not change frequency, simply continue to another menu item.

IF KHZ This setting must coincide with the IF setting of the encoder software (i.e., SPARC). Typically, both settings (PC and device) should be at zero. The audio output of the PC audio card must be set at about $\frac{3}{4}$ of the full volume, and never at full volume. Press [↑]/[↓] to increase/decrease the value and then press the [●] button to save the new value. The change is effective immediately.

RF OUT Enables or disables the RF Output (without having to turn off the device). Use the [●] key to toggle between the two selections or [■] to leave this menu. *Note: If the Off setting is saved to internal memory, then every time the device is restarted, its RF output will be disabled.*

RF LEVEL Adjusts the RF output level from 0 to 100%. Use the [↑]/[↓] keys to increase/decrease the level, or [■] to leave this menu.

CLOCK and related menus are not available in all versions. The clock allows display and editing of the highly accurate built-in real-time clock based on a TCXO module. *The only required use for the clock is when schedules are defined (see below). You do not need to set the clock if schedules are disabled.* When you arrive at this menu, a very brief display of the current day of week is displayed on the lower LCD line, then the current date (upper LCD line) and time (lower LCD line) are displayed (clock display mode). *An unset clock will start counting from August 8, 2008*

00:00:00; you can use this to know how long your transmitter has been continuously on. The clock will automatically switch from Normal to DST based on the EU rules (i.e., last Sunday in March from Normal to DST and last Sunday in October from DST to Normal, at 3:00am). This is different from rules in other parts of the world.

If you prefer to have a clock display rather than a frequency display you can leave the unit set at this menu.

To edit the clock, you must enter the clock editing mode by pressing [●]. When in clock editing mode a blinking cursor appears on the LCD at the position to edit next. Use [↑]/[↓] to change the current element (e.g., hour), or [■] to move to the next element (in sequence, from left to right, and top to bottom). On the opposite LCD line from the one you're currently editing, a short help message will appear to indicate which element of the date time clock you're actually editing (e.g., the message "Hour" will appear on the upper LCD line while editing the hour element on the lower LCD line). When done editing, press [●] to accept the changes, and exit the editing mode returning back to the clock display mode. The clock will continue running with the new settings. **WARNING:** *Since there is no internal backup battery, the clock is lost if the unit is turned off, or the power supply is momentarily lost. This is no problem for normal operation unless schedules are defined. In that case, it is presumed that you make sure power is constantly available to the unit at ALL times (e.g., using appropriate UPS systems).*

DAILY SCHEDULE Allows display and editing of the daily schedule for RF Output On/Off switching. The daily schedule is effective only for weekdays except Saturday and Sunday (which are controlled separately by the WEEKEND SCHEDULE). To edit the current schedule, you must enter the schedule editing mode by pressing [●]. When in schedule editing mode a blinking cursor appears on the LCD at the position to edit next. Use [↑]/[↓] to change the current element (e.g., hour), or [■] to move to the next element (in sequence, from left to right, and top to bottom). The upper LCD line is for setting the On Time while the lower LCD line is for setting the Off Time. When done editing, press [●] to accept the changes, and exit the editing mode. If you need to cancel the current schedule (so that the unit operates full time in the inherited RF Output state during the corresponding days for the current schedule), you need to set both the On and Off Time to zero. The new settings will be effective immediately.

WEEKEND SCHEDULE Allows display and editing of the weekend schedule for RF Output On/Off switching. The weekend schedule is effective only for Saturday and Sunday; the remaining days are controlled separately by the DAILY SCHEDULE. Except for the difference in which days are affected, it works exactly the same way as the DAILY SCHEDULE (see above).

SAVE Saves current settings to internal non-volatile memory. These will be the settings used when the DRMAX2 is powered next time. Press [●] to save the settings or [■] to leave this menu. *Important note: Current clock is lost when the device is powered off (or if there is any loss of power supply), but any saved Daily or Weekend schedules aren't. This means when the unit is powered up again (with an incorrect clock setting), the schedules will appear to be random! Do not use schedules if your device isn't protected by some form of UPS.*

LOAD Loads the settings saved in the internal non-volatile memory. It is almost the same as cycling power to your unit. Press [●] to load the settings or [■] to leave this menu. *Note: The current clock settings aren't affected.*

BFO TRIM This is a very special setting that is normally only for use at the factory during initial calibration after manufacturing. **DO NOT CHANGE THIS SETTING** unless you have the necessary skills, the necessary precision measurement instruments, and a very good reason to feel a re-calibration will make a difference in the accuracy of the output frequency (as compared to the displayed frequency). In either case, make sure to make a note of the current factory value so you can restore the unit if you happen to change it. The new value is effective immediately after pressing the [↑] and [↓] buttons. Press [■] to leave this menu. **Note: If you inadvertently make changes to this setting, please turn the unit's power off and, after about 5 seconds, back on. Do NOT save any settings to internal memory until power is cycled.**

All buttons auto-repeat if held pressed. Useful mostly for the [↑] and [↓] buttons so you can quickly locate a frequency. While selecting from any list in a menu, if you keep the button continuously pressed, the speed will increase from normal to fast to faster. This is helpful especially in the frequency selection menu where there are too many possibilities to select from in the normal speed. If while searching in faster speed you happen to go beyond the selection you want, you can use the opposite direction ([↑]/[↓]) button from the one you were using to go back, either continuously or one at a time.

A U D I O L E V E L A D J U S T

Although the unit is factory trimmed, the trimmers next to the Audio RCA jacks can be used to adjust the audio level to your liking, for each channel (left and right) separately. Turn clockwise to increase the audio level.

The factory setting is based on laboratory standards, and it is possible that your audio source produces a higher or lower level signal than what's expected. This adjustment requires a Spectrum Analyzer so that the two levels must be set at the same point, independently.

Turning the trimmer clockwise, you increase the audio level; turn counter-clockwise to decrease it.

R F O U T P U T L E V E L A D J U S T

IMPORTANT: OLDER UNITS (shipped before 2018). By turning the trimmer fully clockwise, you get the minimum RF power output, while by turning it counter-clockwise you get the maximum RF power output.

NEWER UNITS (2018 and later). The RF output level is digitally controlled by keyboard commands.

The level is from 0 to 100%. At 100% it is at full peak crest power (it will exceed 500mW depending on the audio level provided at the input). It is tested to work in full power with input level set from a standard PC sound card just above the middle point. It is preferred to avoid setting the sound card at full level as some sound cards may produce noise at their full scale output. This can be avoided by setting the sound card output not above 70% of the full available range. At the lab, we have set the left and right input levels to be balanced between them. If there is no good reason to adjust them, we recommend not changing them. In any case, if you would like to change these levels correctly, we'd need to have a spectrum analyzer to adjust each one independently from the other until the image product (will be visible at double the IF offset) of each one drops to the lowest possible level. The best adjustment is when it almost disappears below the noise level of the spectrum analyzer (more than -60db with regards to the main DRM signal).

Although the unit is factory trimmed to output 50mW average DRM signal @ 50 Ohm load, and recommended not to be changed, there are cases where the antenna used is not approximately 50 Ohm, and it may be required to adjust the RF output level. This is done because if a different load (other than 50 Ohm) is connected to the antenna output, the final RF amplifier may cause distortions to the modulated signal due to this antenna mismatch.

First, before changing the factory settings, attempt to tune the antenna with unmodulated carrier, so that it has the least VSWR possible or, if you can't measure low power signals with your VSWR meter, check that you obtain the maximum signal strength at your receiver. Remember to always have the DRM encoding connected and operational as with DRM there is no carrier without an active encoder. This of this as an SSB transmitter which presents RF output signal only when there is modulated input. **Without the presence of a DRM encoded signal, do NOT expect to see any RF output.** An alternative method (for tuning) is to use a 1 KHz tone at both inputs, and at a level equal to that of the DRM encoder output. In that case, there should an RF signal at the output.

VERY IMPORTANT NOTE, READ CAREFULLY

This device is a low power MW transmitter. Use of this device may be in violation of local laws/regulations, depending on your region. If unsure, please check with your local telecommunications authorities. Under no circumstances should it be used in violation of any such laws/regulations. The responsibility for legal/proper usage rests solely on you!

Thank you for purchasing the DRMAX2 by ASPiSYS Ltd.

Technical Specifications

Subject to change without notice

RF Output Frequency	520 to 1710 KHz (Special versions may vary according to requirements)
Minimum Step	1 KHz
Frequency Accuracy	+/- 0.5Hz max. (DDS)
RF Output Level	50mW AVG DRM signal (500mW peak crest factor) @50Ω
Output Impedance	50 Ω
Harmonics (out-of-band)	-35 dBc
Audio Level Control	Adjustable
RF modulation	DRM I/Q compatible
Input Level	0.1V up to 1.0V p.p. (adjustable)
Input Impedance	10KΩ unbalanced
IMD	-30dBc
Operating Voltage	24VDC at 350mA max.



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