

A S M A X 2

**DDS FREQUENCY SYNTHESIZED
C-QUAM COMPATIBLE STEREO
AM (DRM capable*) TRANSMITTER
150mW carrier (600mW PEP)**

User's Guide

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

Note: Due to constant enhancements to the device's firmware and/or hardware, this guide is subject to revision, without prior notice. *This revision of the manual is based on firmware v2.70 so there could be some differences from your actual firmware, which you can always update to the latest version. However, the basic functionality remains the same across all versions.*

ASMAX2 is a C-QUAM compatible stereo or mono AM 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.

ASMAX2 is sold as fully assembled and tested board.
Special orders for enclosed units are accepted but these come with an 8x2 LCD instead.

To operate you must connect it to a stabilized 24V power supply. Please avoid cheap wall packs as they do not have proper filtering and may cause undesired noise.

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 Left and Right RCA jacks.

O P E R A T I O N

ASMAX2 features a 20-character by 4-line LCD, and a 4-button keyboard (the board version only has the pin header for connecting four push buttons that activate when shorted to ground).

It is also possible to have a smaller 8-character by 2-line LCD on special models (boxed).

When powered up, the LCD briefly displays the version and a copyright message followed by the current transmission frequency.

The keyboard buttons (**MENU**, **UP**, **DOWN**, and **ENTER**) which, depending on the keyboard type, may appear verbally or symbolically, are described next:

- [■]/[Menu]** Acts as Menu or Escape. It cycles through all possible enabled menu screens (*sequence shown later*) or selections within a single menu item.
- [↑]/[Up]** Acts as Up. It cycles through all possible choices in a forward or upward direction. *Menus with only two possible choices use the [●] key instead to toggle between the two options.*
- [↓]/[Down]** Acts as Down. It cycles through all possible choices in a reverse or downward direction. *Menus with only two possible choices use the [●] key instead to toggle between the two options.*
- [●]/[Enter]** Acts as Enter. It enters the Settings screen from any screen. If inside the Settings screen, it enters the editing mode for the specific item the cursor is currently on. If editing an item, it stops the editing and accepts the changes. For menu items that have only two of few predetermined possible options (*e.g., toggle switches*), pressing [●] toggles or cycles the current option. *Note: Some choices may become active immediately when selected with the [↑]/[↓] buttons while most options (e.g., frequency) are activated only by pressing [●].*

I N F O R M A T I O N A L I T E M S

All pages show a combination of at most four of the following predefined informational items. (8x2 LCDs show a single item with the title on the top line and the value on the bottom line.)

- FRQ:** A line which shows the current OnAir/OffAir status, the frequency of operation in KHz and the indicator [ST] when operating in Stereo Mode. The OnAir indicator is always steady. The OffAir indicator always blinks to draw your attention.
- AIR:** OnAir or OffAir status.
- IF_OFFSET:** The Intermediate Frequency offset in KHz. (This is used only for DRM mode, ignored elsewhere.)
- MODE:** Operating mode can be Stereo, Mono, or DRM.
- RF_LEVEL:** An RF output level indicator.
- OFF_POWER:** Level for RF output when 'Off' due to scheduling. Default is zero.
- MOD:** Shows the modulation level as peak percentage (0 to 130%) and bar graph. (8x2 LCD shows only a bar graph.)
- DATETIME:** Shows the current date as year, month, date, hour, minutes, and seconds. (If not date/time is set, the up time of the device is shown instead.)
- DATE:** Shows the current date as Day-of-week, date, month, and year.

- TIME:** Shows the current time as hours, minutes, and seconds.
- TEMP:** Shows the current LCD backlight level as percentage followed by the internal MCU temperature in approximate degrees Celsius and Fahrenheit.

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

Menus show a different collection of informational items.

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

MAIN IF_OFFSET TEMPERATURE MODULATION

MAIN Displays AIR, FRQ, MODE, RF_LEVEL, DATETIME, and MOD.

Press [**▲**] to increase the RF output level, or to re-attempt going OnAir after auto-OffAir. When the maximum is reached, [H] will display on the LCD.

Press [**▼**] to decrease the RF output level. When the minimum is reached, [L] will display on the LCD. Pressing [**▼**] once again will turn the RF output off and [0] will display on the LCD.

Note: If the OffAir setting is saved to internal memory, then every time the device is restarted, its RF output will be disabled, unless dictated otherwise by the saved schedule on a clock enabled device.

IF_OFFSET Displays AIR, FRQ, MODE, DATE, DATETIME, and IF_OFFSET. This is used only for DRM mode, ignored elsewhere.

Press [**▲**] to increase the IF offset one KHz at a time.

Press [**▼**] to decrease the IF offset one KHz at a time.

TEMPERATURE Displays AIR, FRQ, MODE, DATE, DATETIME, and TEMP.

Press [**▲**] to increase the LCD backlight from off (0%) to full (100%) in 10% increments.

Press [**▼**] to decrease the LCD backlight from full (100%) to off (0%) in 10% decrements.

MODULATION Displays FRQ, DATE, TIME, and MOD.

S E T T I N G S M E N U

FRQ

This setting determines the frequency of operation. The frequency is adjustable with 1 KHz step from 530 KHz to 1710 KHz (*special 'HAM' versions may have a different range*). If a number outside the allowed range is entered, it will be brought to the closest range limit.

IF Offset (for DRM use only)

Adjusts the IF offset in KHz.

Mode

Press [**●**] to cycle the mode STEREO, MONO, and DRM. C-QUAM is compatible with mono receivers so operating in Stereo mode will not affect reception from typical mono receivers.

DRM mode switches the larger part of the modulator circuit so that it is capable of accepting independent I and Q encoded signals (removes the Left-Right matrix from the modulator part) but it requires to connect a small resistor (you will find it underneath the board but unconnected), and adjust one trimmer to null the I component while hearing on a common AM radio receiver until it completely drops to almost unnoticeable levels.

For more detailed instructions on how to set it for DRM use, please contact us.

Off Power

You can set the RF level (as percentage) of the RF output level when the unit goes off as a result of scheduling. This can be used to have a lower RF output during night hours, for example. If you want it to go completely off, set it to zero (the default).

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 [**▲**] or [**▼**] buttons.

Note: If you inadvertently alter this setting and don't remember the original value, please quickly turn the unit's power off and, after about 15 seconds, back on. Do NOT save any settings to internal memory (by exiting the Setting Screen) until power is cycled.

Celsius (°C) Offset

This setting defines a signed offset for the temperature reading.

YY-MM-DD

This setting allows editing the Year (YY), Month (MM), and Date (DD) for the built-in real-time clock.

hh:mm:ss

This setting allows editing the Hours (hh), Minutes (mm), and Seconds (ss) for the built-in real-time clock.

MTWTF

This setting defines an optional schedule's on/off times for workdays (Monday thru Friday). Correct operation depends on an accurate clock setting.

SatSun

This setting defines an optional schedule's on/off times for weekends (Saturday and Sunday). Correct operation depends on an accurate clock setting.

Hint: Pressing [■] while editing a clock item will zero the item.

D E T A I L E D D E S C R I P T I O N O F V A R I O U S S E T T I N G S

Item Editing Mode

Item Editing Mode is indicated by a full-size blinking cursor. When exiting the item editing mode back to Settings Screen item selection mode the cursor changes to a non-blinking solid underline.

Clock

The built-in real-time clock is highly accurate as it is 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 not used but you may do so if you like to have the actual date & time displayed on the screen. An unset clock will start behave as a lapse time timer starting from 00-00-00 00:00:00; you may use this to know how long your transmitter has been continuously on or off. Every time the status changes from OnAir to OffAir or vice versa the counter will reset to zero. The clock will automatically switch from Normal to DST respecting EU time change rules (i.e., last Sunday in March from Normal to DST and last Sunday in October from DST to Normal, at 3:00am - Greece time zone). This may be different from rules in other parts of the world.*

When in clock editing mode the blinking cursor appears on the LCD at the position to edit next. Use [↑]/[↓] to change the current element (e.g., hour), or [■] to clear the current element value to zero. 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: The clock is lost when the unit is powered off, or even when the power supply is momentarily lost. This is not a problem for normal operation unless schedules are defined. When the power returns, and scheduled on/off times will appear to be random.

MTWTF schedule Allows editing of the daily schedule for automatic RF Output On/Off switching. The daily schedule is effective only for weekdays except Saturday and Sunday (which are controlled separately by the SatSun schedule). To edit the current schedule, you must enter the schedule-editing mode by pressing [●]. When in schedule editing mode the blinking cursor appears on the LCD at the position to edit next. Use [↑]/[↓] to change the current element (e.g., hour), or [■] to clear the current element value to zero. The left-hand-side time is for the On Time while the right-hand-side time is for the Off Time. When done editing, press [●] to accept the changes, and exit the editing mode. When exiting the edit mode, the start and end times will be put in the correct order so that the start time is always before the end time.

If you need to disable 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 Time and the Off Time to zeros. The new settings will be effective immediately.

SatSun schedule Defined in the same way as the MTWTF schedule (see above), except that it applies to Saturdays and Sundays only.

Exiting the Setting Screen automatically saves any changes to an internal non-volatile memory. These will be the settings used when ASMAX2 is powered next time.

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 behave as if they were random! Do not count on correct scheduled operation if some form of UPS doesn't protect your device.

All keyboard buttons auto-repeat when held pressed. This is useful mostly for the [↑] or [↓] buttons so you can quickly locate a different value. While selecting from any list in a menu, if you keep the button continuously pressed, the speed will increase from normal to faster. 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 to accept standard line level from an unbalanced source like a PC audio card output, 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. Be careful to not over-modulate it. The modulation meter on the LCD can help you better adjust your modulation to normal levels, and to avoid extreme over-modulation. See further below.

It is possible that your audio source produces a higher or lower level signal than what's expected.

A good method to correctly adjust the audio level is described below:

Turn the RF output level to the minimum (i.e., 'L' indication).

Start by connecting an audio source at its lowest possible level to the appropriate inputs. Both inputs should be given the same signal (monophonic) at the same time. It's better if you can supply a steady 400 Hz tone from your audio source. (Avoid applying 1 KHz tone for this measurement.) Next, start increasing the level of your audio source until the Modulation reading (Mod) shows 100%. Stop the 400 Hz audio generator from the source and connect your actual program audio with a level that will not exceed the level used with the 400 Hz tone when you're reading Modulation of 100%. Nevertheless, it's possible for the program audio to reach 125% momentarily during peaks but it's best to keep it as close as possible to 100% as your compressor allows.

As with all AM broadcasts, it's recommended that you use heavy compression on the audio program before it enters the transmitter. The transmitter has a built-in pre-emphasis for AM, and if using some audio processor with its own pre-emphasis setting, you must have it disabled.

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

It is recommended that the following procedure be followed after the audio level has been set (see above).

There is a digital RF output level adjust from the frequency menu screen.

Normally, the RF output level only has to be set once.

When changing frequencies, the unit will automatically shut off the RF output and when the new frequency is locked the RF output level will gradually climb to the pre-assigned level.

A small distortion to the audio may be noticed when modulation exceeds 100%.

Connect audio at low level and listen for any distortion. A distortion may be caused if the stereo audio signal applied to the inputs is of too high a level. If this should happen, you may need to re-adjust your audio source's modulation to a lower level.

OPTIONAL SERIAL COMMUNICATIONS

Your unit was already shipped with the latest firmware at the time of shipment, so there would be no immediate need to upgrade. However, it's possible to eventually need to upgrade the firmware at some point in the future, either for enhancements or occasional bug fixes.

How to do so:

The PCB has a 3-pin serial communications port (PL-15) where pin 1 is RX (from the device's point of view), pin 2 is ground, and pin 3 is TX.

WARNING: This port operates at the 3V level, so it cannot be connected directly to a PC's RS232, or it will be damaged. It needs some signal level converter/adaptor, such as this one: <http://aspisys.com/rs232adpr.htm> or some other that converts to USB virtual COM port, instead.

If you know enough electronics, you can build one yourself using a MAX3232 (for RS232), or FTDI FT230XS (for USB), or similar (as long as it accepts 3V TX/RX signals, and not just 5V), and an appropriate connector.

Some people may want to take this connectivity even further with a serial-to-Ethernet module for access over the Internet (with appropriate router configuration/permissions).

With such adapter attached, you can now talk to the device using any serial communications terminal program (such as HyperTerm, or PuTTY, or whatever -- hundreds available online for free -- such as <http://aspisys.com/term.exe> for Windows command console). Set the terminal for **38400 bps 8-N-1**, with no hard flow control.

Inside ASMAX2, there is a simple command console running all the time that allows optional full control and monitoring of the device via commands. It also includes an UPGRADE command that will erase the current firmware to allow for new firmware to be loaded.

Pressing ENTER at the console gives a list of all possible commands.

The firmware is a plain ASCII file so once you're in the upgrade mode, a simple copy/paste will load the file to the device.

Current firmware may be found here:

For board version: <http://aspisys.com/firmware/asmax2.s>

For boxed version: http://aspisys.com/firmware/asmax2_boxed.s

Note: Please don't hasten to upgrade your firmware without good reason. It's even possible that the firmware version you received with your unit is a bit newer than the version published on our website as the latter is not updated on a daily basis. So, in that case you'd be downgrading, instead.

VERY IMPORTANT NOTE, READ CAREFULLY

This device is a low power AM 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!

For proper operation, it must be connected to a 50 Ohm load or to a tuned antenna.

IMPORTANT FCC PART 15.219 COMPLIANCE NOTES

If you're interested in an FCC Part 15 compliant unit, please specify this during ordering.

The Part 15.219 compliant version requires a 12 VDC instead of 24 VDC power supply. Please ask before ordering.

Our default version is a higher power unit that is not FCC compliant.

Thank you for purchasing the ASMAX2 by ASPiSYS Ltd.

Technical Specifications

Subject to change without notice

RF Output Frequency	520 to 1710 KHz (HAM version up to 2000 KHz)
Minimum Step	1 KHz
Frequency Accuracy	+/- 0.5 Hz max. (DDS)
RF Output Level (ASMAX2)	Adjustable from 0 to 200 mW max carrier @50 Ω
Output Impedance	50 Ω
Harmonics (out-of-band)	-50 dBc
Audio Level Control	Adjustable
RF modulation	AM (Mono, C-QUAM Stereo System [DRM capable])
Input Level	0.1 V up to 2 V p.p. (adjustable unbalanced)
Input Impedance	10 K Ω
Pre-emphasis	0 and 75 μ S or 50 μ S (preset according to your country system)
Total Harmonic Distortion	<0.4% @ 1 KHz
Operating Voltage	24 VDC (preferably stabilized)
Current Consumption	400mA max.



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