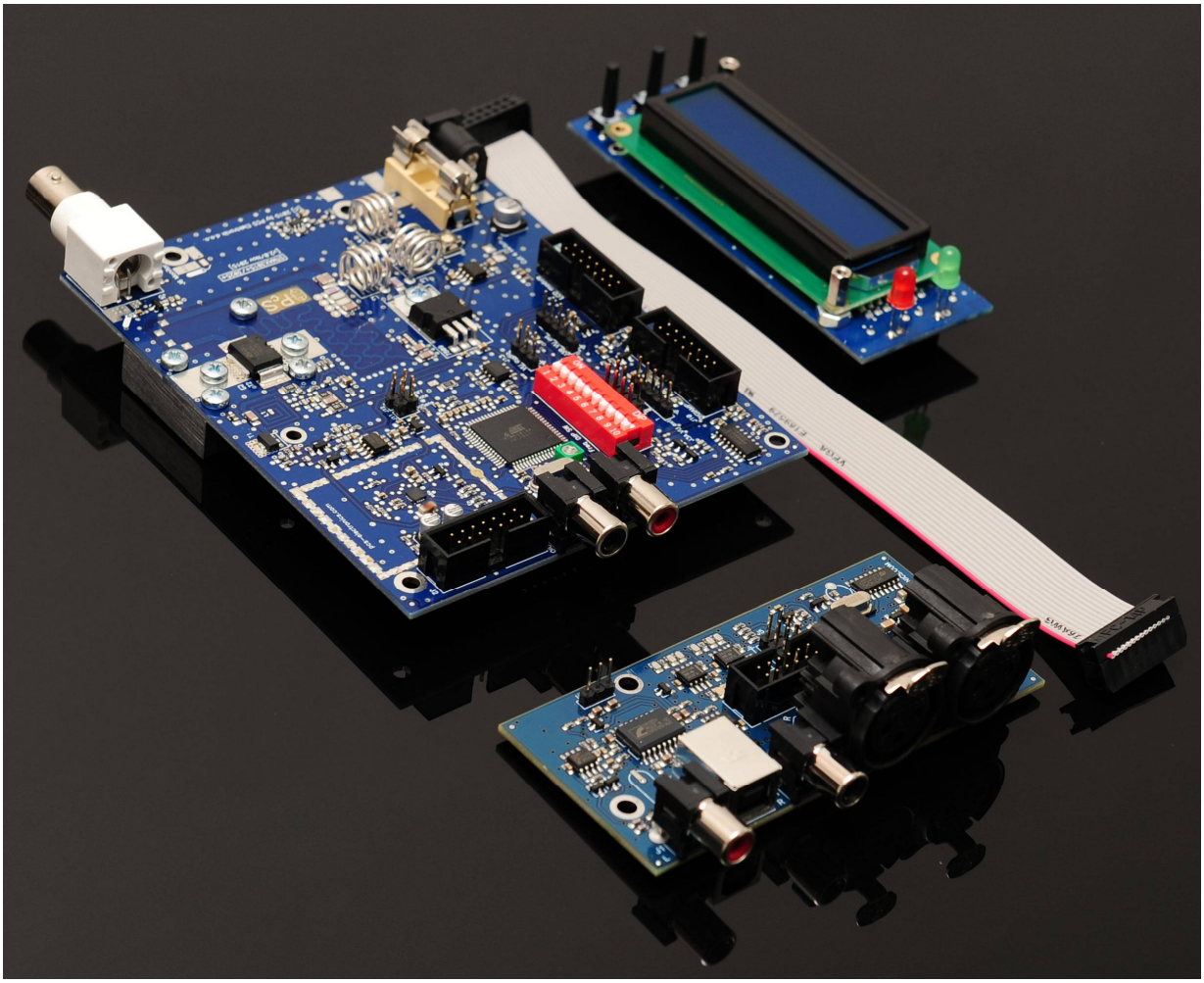


STMAX3015+/3025+/3050+ and STMAX3100+ v2

Digital FM STEREO RDS radio exciter/transmitter used in CyberMaxNano+ FM transmitters

Manual

IMPORTANT NOTE

Upon receiving your order inspect the packaging material and unit for apparent damage. Any damage should be reported immediately so we can make a claim with the shipping company. Take photos, if you can, they can be used as proof.

IMPORTANT! If you want to connect an amplifier to this exciter please first make sure that output power is set correctly and does not exceed maximum recommended input power of the amplifier. See appendix for additional tips on driving amplifiers. Please note STMAX/NANO series transmitters are primarily recommended for remote regions and low powers!

Study local regulations and ensure you are operating in compliance.

Never ever operate any exciter/transmitter or amplifier without a properly tuned load/antenna!

TABLE OF CONTENTS

Chapter

1

Introducing the STMAX 3000+ FM transmitter series

With digital modulator, integrated on-board stereo DSP and RDS and up to 100W of power.

Designed either as a stand-alone community 1W to 100W FM stereo rds transmitter or a cost effective driver for an amplifier. Impressive features with optional AES/EBU digital inputs and solid audio performance with easy to setup RDS give amazing value at an accessible price, perfect for remote areas in need of a small FM radio transmitter.

What makes this FM exciter so great?

STMAX 3015/3025/3050/3100+ are based on digital modulator and is fully configurable via LCD. This includes power, frequency, RDS parameters, stereo pilot level, RDS pilot level and many other parameters. It also displays several useful parameters on the LCD display: transmitted power, reflected power, temperature, voltage, frequency, amplifier voltage, amplifier power, swr, amplifier temperature and others. Power and all other parameters including RDS and audio settings can be controlled with keys on the LCD module or remotely via RS232/USB interface. This unit is fully no-tune and comes with on-board stereo and rds encoders and offers impeccable performance 24/7/365. Even as a stand-alone unit this transmitter doubles as an excellent community radio station and can easily cover a small city with a suitable antenna. Optional audio input board adds RCA and XLR, there is even a new version with digital AES/EBU digital input.

Key features

- On-board stereo and RDS, all adjustable via LCD

- Displays frequency, power, audio level, reflected power, temperature, exciter voltage, amplifier voltage and amplifier current (depends on used filter) on the LCD.

- SWR and TEMP protection with adjustable sensitivity

- Adjustable software power limit when driving external amplifier (up to 9900W, ask if you need more)

- Four power range jumpers which let you set output power range from 0-1W, 0-2W, 0-3W, 0-4W etc all the way to the full 0-15W (25W/50W/100W). If your pallet requires 4W simply set the power range to 0-4W for precise and convenient drive.

- High power (up to ~100W)

- True wideband no-tune operation, constant power across entire FM band

- Flat audio response, excellent bass

- Supports DIGIAMP interface from MAXPRO8000 series

Where is it better to use the standard MAXPRO2015+ and MAXPRO8015+ series?

- For professional applications you should use the MAXPRO2015+ or MAXPRO8015+ with separate stereo encoder such as SE2000/SE5000/SE8000 or other. The reason is that these exciters have cleaner RF output required for professional applications. DDS modulator is not as clean.

- MAXPRO2015+ and MAXPRO8000+ series have better spurious output (cleaner signal with reduced spurs)

- STMAX3015+ does not have MPX input so it is not suitable for MPX wireless links. MAXPRO2015/8015 both have MPX input.

Technical specifications for STMAX3015+ series:

- RF output power at 15V DC: 0 to 15W, 0-25W, 0-~50W

- RF output power at 48V DC (100W model): 100W

- Output connector: BNC, 50 Ohms
- Frequency range: 87.5-108MHz, stability +/- 20Hz (fine adjustable with trimmer)
- PLL steps: 50 KHz
- Spurious/Harmonic rejection: Harmonics: >50dB, Spurious: ~-50dB
- Power supply (15W): 11-15V or car battery (2.5A max for 15W)
- Power supply (25W model): 13.5-15V or car battery (4A max for 25W)
- Power supply (50W model): 13.5-15V or car battery (7,5A max for 50W)
- Power supply (100W model): 48V (4-5A max for 100W)
- Power connector: 2.1mm power socket (center +) or 2-pin jack for stronger models
- Quartz locked PLL frequency control
- No expensive test equipment required
- Audio performance: Flat sensitivity across FM band, less than 0.1% distortion, 20Hz-15 KHz
- RF output ruggedness: SWR protection
- Temp protection
- Pre-emphasis, 50uS, 75uS or none selectable via LCD
- Audio Input Impedance: 2x 1Kohm, unbalanced, RCA connectors
- Audio Input Level: 4dBV or -10dBV (selectable via LCD)
- Audio S/N ratio: >80 dB
- PC Board Size (15W/25W/50W/100W): 100x125mm (see page 10 for drilling template)
- RF monitor output: Yes, solder pads, -30dB

Thank you for purchasing STMAX 3000+ series FM exciter

We hope you will enjoy it as much as we do and remember to tell your friends about it. Please feel free to leave your comments at our website or post your experience in our forum. From all of us we wish you happy broadcasting!

Your PCS Electronics team

Chapter 2

STMAX3015/25/50 board layouts

RF board layouts

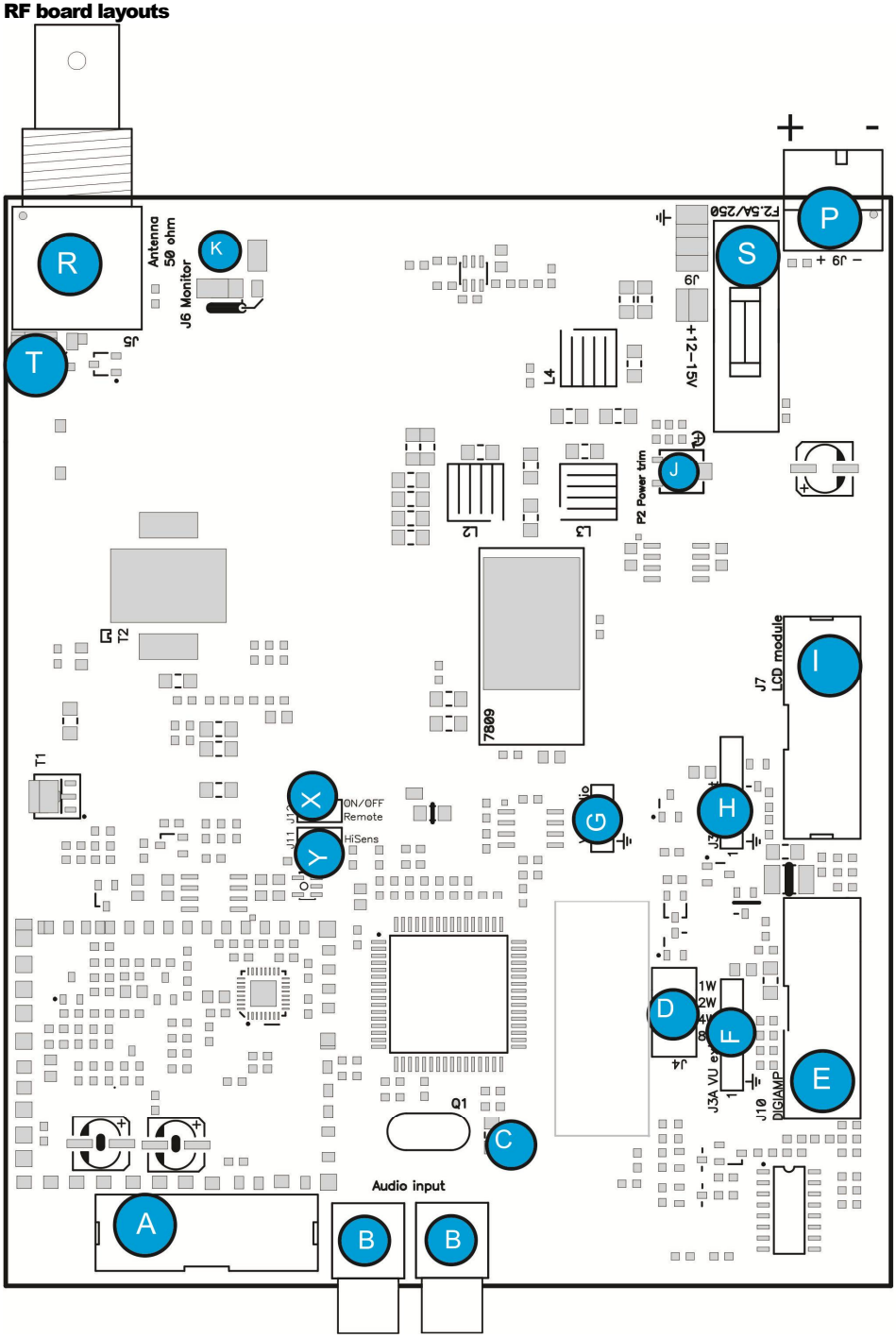


Fig. 1: STMAX3015/25/50/100+ v1 RF board layout

A	Audio input-extension board. You can connect to the audio input extension board here. The extension board contains balanced inputs, a low pass filter and limiter. It can be connected via 14-pin flat cable.
B	Audio inputs, two RCA connectors.
C	Lets you fine-tune the frequency. You can use this trimmer to set the frequency to exactly 100.000KHz if it's slightly off (for example if frequency meter shows 100.002KHz).
D	Power range jumper J12, use to set output power range to 0-1W,0-2W, 0-3W, 0-4W or any other range all the way to 0-15W. Setting is binary, that is if you place 1W and 8W jumpers the power range will be 1+8=9W (0-9W). No jumpers = full power
E	Digiamp connector enables easy control of RF amplifiers. This greatly simplifies the process of building FM transmitters. You can read more about this connector in the appendix. The flat cable is non-crossed type.
F	VU bargraph meter. Connect the 5-pin jumper to VU meter here. If connected here it will show SWR and PWR from external power meter.
G	VU bargraph meter for audio. Connect the 3-pin jumper to VU meter here.
H	VU bargraph meter. Connect the 5-pin jumper to VU meter here. If connected here it will show SWR and PWR from internal power meter. The remaining 3 pins from VU meter connect to stereo encoder.
I	LCD control unit, attach your LCD control module here. The flat cable used is crossed.
J	Internal power meter accuracy adjustment. If the internal power display on the LCD is a bit off, you can correct its accuracy with this trimmer. You have to "reboot" to verify the setting as the power detector has some DC offset which is measured once when the unit powers up.
K	RF monitor output. This output contains a small sample of output signal, suitable for monitoring RF signal quality with instruments such as frequency meter, frequency analyzer or modulation monitor.
P	Power supply connector if barrel type than center is positive. DO NOT use more than 15V for STMAX3015-3050 series. The connector for 100W is different and requires 48V.
R	RF output connection. BNC jack. Use a properly matched FM band antenna. The range and success of your transmissions will depend primarily upon the quality and position of your antenna.
S	Fast (F) fuse. Always replace with original type for continued protection against short-circuit, current rating depends on the model.
T	You can connect coaxial cable which goes to the pallet/amplifier here. RG-178 is recommended.
X	Remote stand-by, you can put unit in standby by closing/shorting these two pins. The power will go to zero immediately. It will recover slowly as at power-up.
Y	Doubles sensitivity of external power and SWR meter signals, great when your directional couplers are not sensitive enough to produce proper reading.

Table 1: Description of various elements of the STMAX3000+ FM stereo RDS exciter board

LCD module layout

LCD control module is simple and self-explanatory, but let us have a quick look, note you can disable keys by soldering over the "Lock Keys" solder bridge:

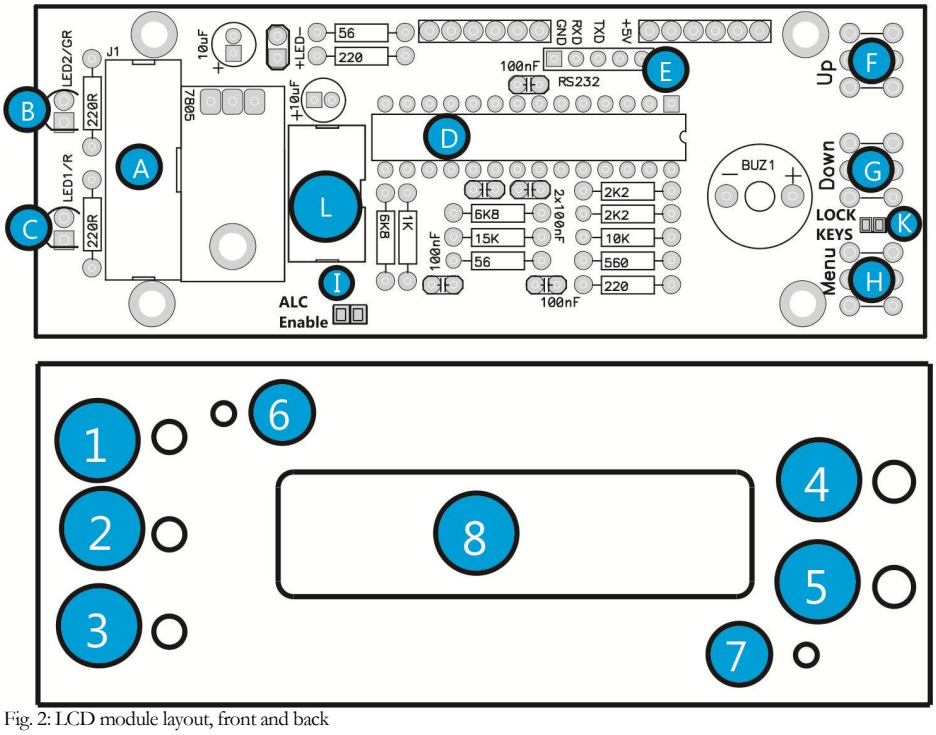


Fig. 2: LCD module layout, front and back

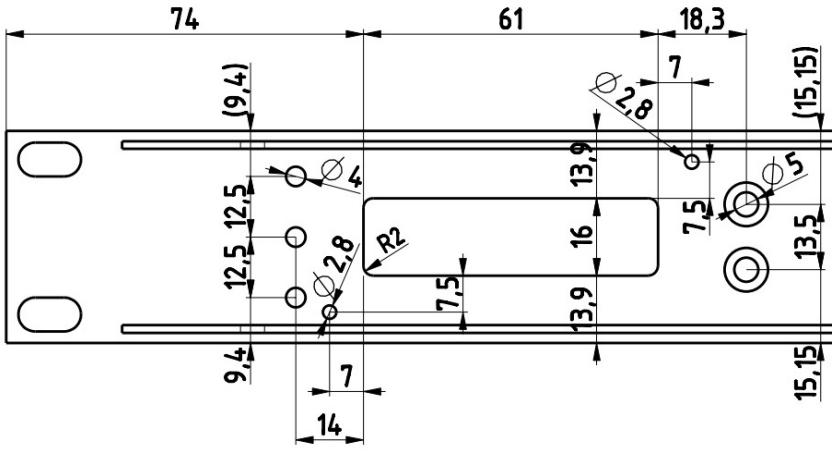


Fig. 3: LCD module drill template, cutouts and holes, all measurements in mm

Fig 3: Installing display board into an enclosure, side view

1, F	UP key
2, G	DOWN key
3, H	MENU key
4, B	POWER indicator LED. Illuminated whenever you turn on the exciter.
5, C	ERROR indicator LED. This LED is activated when RF output stage is NOT active. For example, whenever temperature protection is activated, this LED illuminates and RF power is reduced. Important: This LED is also illuminated whenever you change frequency as the control unit turns RF power off until adjustments are finished and VCO is locked. In such case this does not signal a problem with temperature or SWR.
6,7	Mounting screws, M2.5 metric screw is to be used here.
8	LCD module, with backlight
A	14-pin connector for flat cable going to the RF board
D	Microcontroller with software
E, L	Connections to the IO board (RS232, USB) for remote control
I	ALC enable, soldering this together lets you set power limit (ALC). Also lets you set band in STL model.
K	You can disable keys by cutting the lead between the two pads between the "Lock Keys" solder bridge. If you want to re-enable the keys, solder the two pads "Lock Keys" back again. You can also connect a lock-switch here.
+LED-	You can connect the LED diode here (usually used for the on/off switch.

Table 2: Description of various elements of the LCD display module

LCD module layout – rotary encoder model

Let us have a quick look at, note you can disable keys by cutting the lead between the two pads in the "Lock Keys" solder bridge. If you want to re-enable the keys, solder the two pads "Lock Keys" back again.

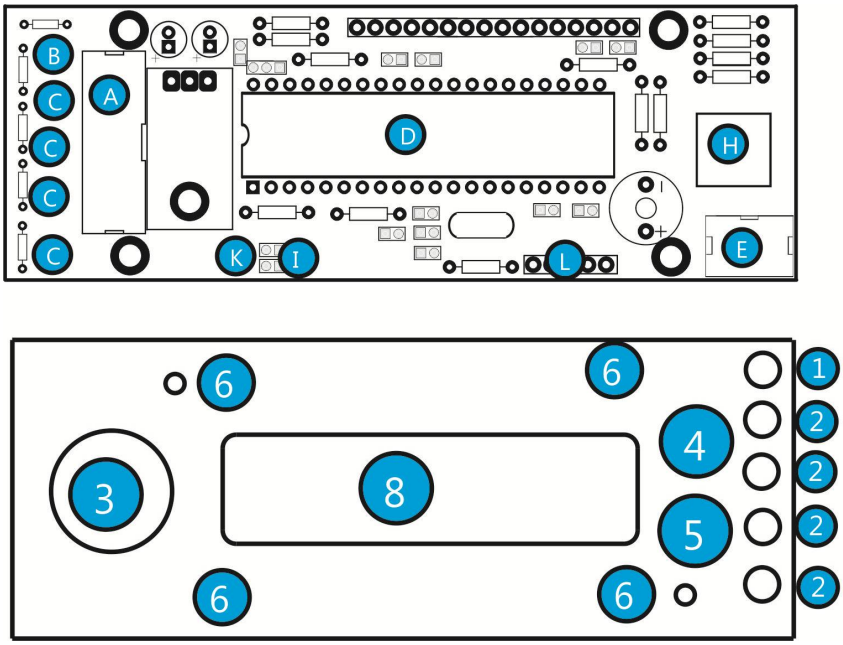


Fig. 4: LCD module layout, front and back, rotary encoder version 2x16

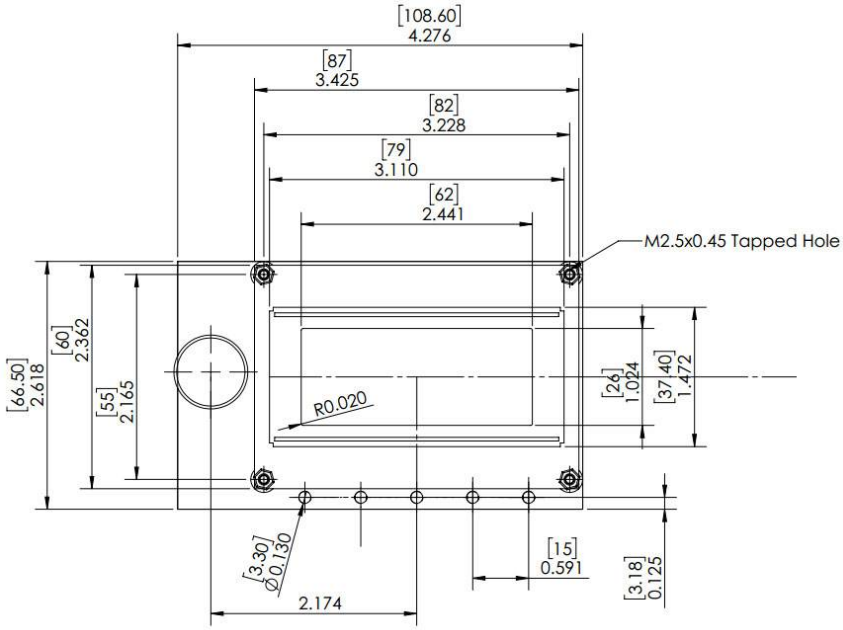


Fig. 5: LCD module with rotary encoder version 4x16

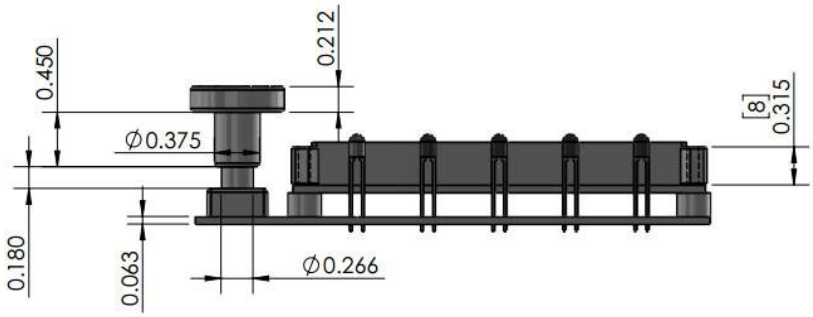


Fig. 6: LCD module with rotary encoder version 4x16, side view

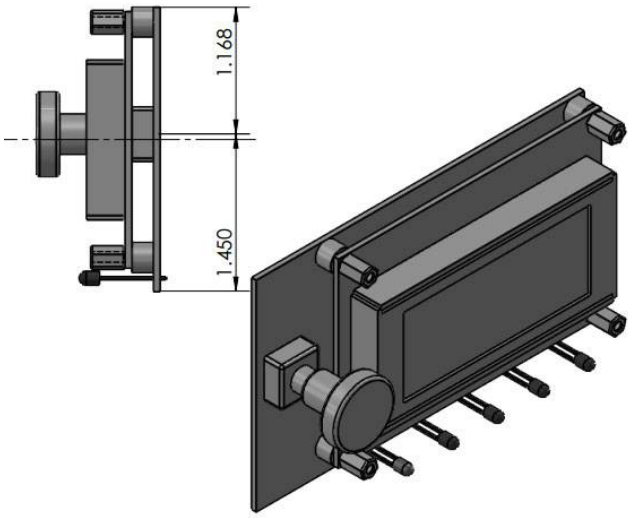


Fig. 7: LCD module with rotary encoder version 4x16

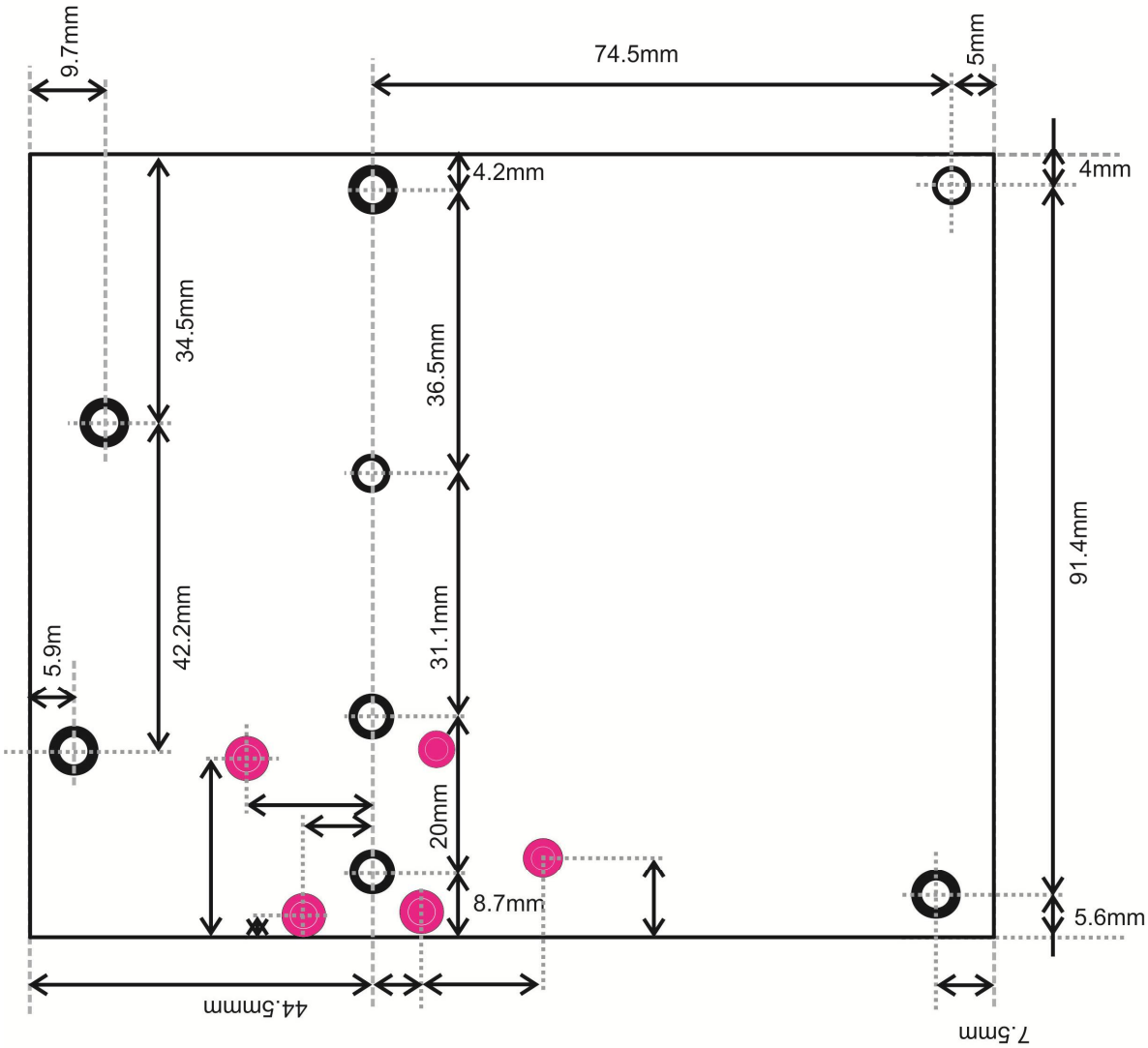


Fig. 8: RF module drill template for STMAX3015/25+, all measurements in mm, all holes are for M3 metric screws. The board is 10mm above the enclosure due to heat sink running under the entire length of the board. Use metal spacers under the driver transistor hole as it also serves to cool the driver stage. Note several holes marked red, we will release measurements for these later. The drill template for 50W and 100W differs slightly.

Audio input board layout

For those who want top performance we put together an optional special input board. This is more convenient as you can have inputs wired to the exciter with flat cable and exciter can be mounted somewhere else. The board comes with XLR balanced inputs with RF filters and ESD protection, RCA inputs, USB audio interface, low pass audio filter and a limiter. Balanced inputs are an instant cure for most noise problems, and this is why all professional installations usually use them. USB audio input can also cut any noise down to zero in an instant.

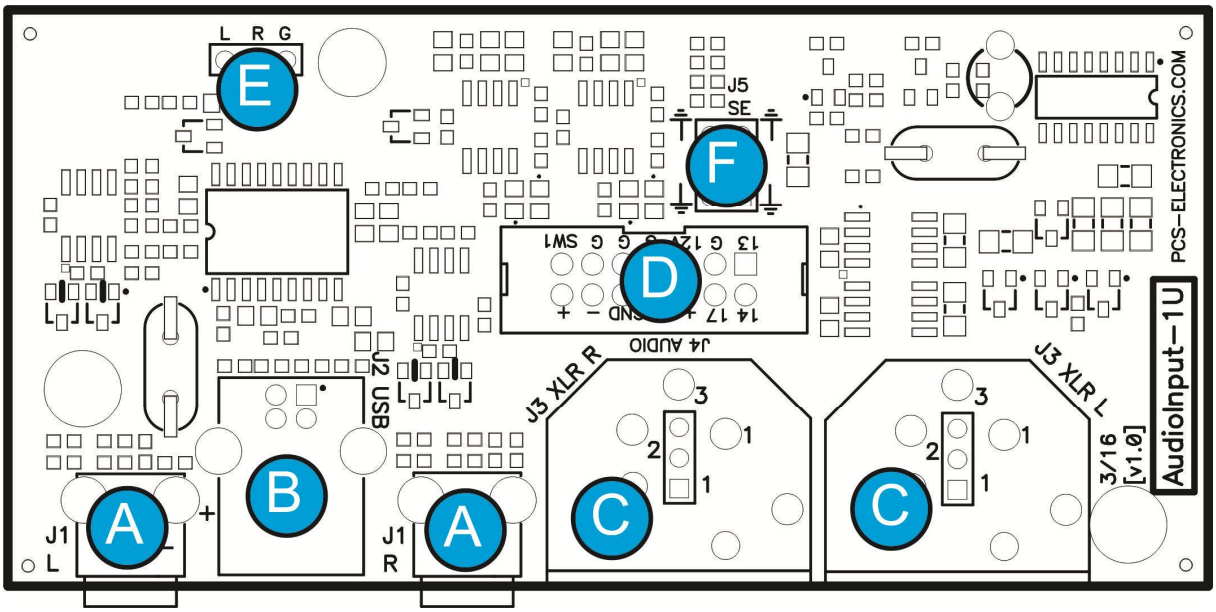


Fig. 9: Audio input board with balanced inputs, USB and XLR

A	Audio inputs – RCA
B	USB audio interface, connect to any PC
C	Audio Inputs, XLR balanced (AES/EBU - special digital version of input board)
D	14-pin flat cable going to STMAX3015 board
E	Optional external audio input, can be connected to MP3 player or some other audio source
F	Audio output, this output can be wired to the input of the old SE5000 stereo encoder to improve its performance

Table 3: Description of various elements of the Audio Input board

Chapter 3

What's under the hood?

The block diagram of the STMAXPRO3000+ series exciter is shown below. It is simplified as the actual block diagram would be too complex for this manual. Only the basic building blocks of the exciter are shown and briefly explained one by one.

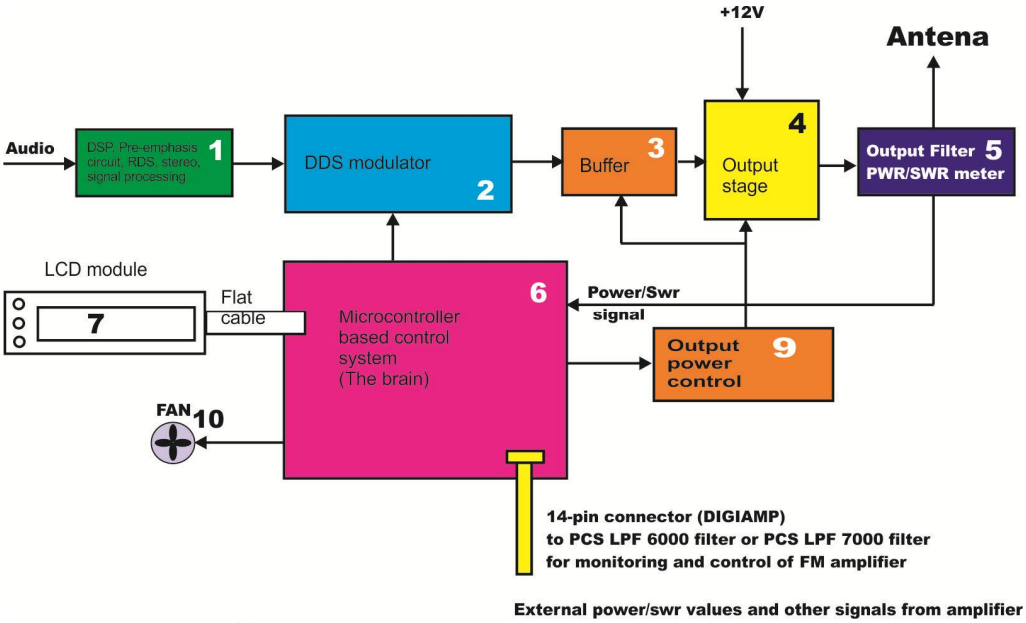


Fig. 10: Block diagram of the STMAXPRO3000+ series FM exciter

1	DSP signal processing, including low pass filter, pre-emphasis, limiter, compressor, RDS and stereo generator
2	DDS digital FM modulator generates transmitter frequency.
3	Buffer amplifies VCO signal to 1-2W.
4	Output stage additionally amplifies signal to full 15W/50W.
5	Output filter with power and SWR meter ensures clean signal and provides signals for the power/SWR meter.
6	The microcontroller is a small computer which coordinates all the functions of the transmitter.
7	LCD module makes it possible to monitor and set many of the parameters of this product.
9	Output power control circuitry controls output power.
10	The microcontroller also provides control signal for a small fan which can be used to cool the unit.
DIGIAMP	This is a 14-pin connector, designed for controlling RF amplifiers. You can read more about connecting and controlling amplifiers at the back of this document.

Table 4: Description of various blocks of the STMAX 3000+ series block diagram

Chapter 4

Before you start

It is recommended that you read this section before you power your unit up for the first time. Let us clear up some basics you should know about. You will also find some useful tips in our guides and forum at http://www.pcs-electronics.com. Here is what you need to get your TV transmitter on the air:

Antenna

Preferred type of antenna is affected by several factors, but mostly by desired radiation pattern, space available and your budget. If you are in the middle of the area you want to cover, you'll need an omni-directional antenna which transmits equally in all directions. If you are located at the edge of your desired coverage area you can beam the signal into the target area with a directional antenna. Directional antennas are also practical for point-to-point communications. Another thing to consider is that directional antennas usually have much higher gain than omni-directional antennas since the power which is radiated in all directions with omni antenna is concentrated mainly into one direction with directional antenna. Antennas with more gain thus have narrower beam. A compromise is usually made depending on budget and space available, higher gain antennas are often bigger and often more expensive.

Once you've chosen and installed your antenna there is another thing to consider. You can read more about it in the next section (So what is this SWR everyone talks about). Before powering up your transmitter on the air you should tune your antenna to get minimal SWR. This is typically done by adjusting the position of the antenna and any adjustable pieces. Aim for 2:1 or less. Use low power into the antenna when tuning it up and adjusting. If you were using full power and a bit of the antenna came off in your hand the VSWR could be so bad as to blow the final transistor. For the same reason check the DC continuity of the antenna with an ohmmeter before plugging it in, to be sure it's what it's meant to be, either a short circuit or an open one, depending on the antenna type. For instructions regarding construction of antennas please see our website: http://www.pcs-electronics.com (guides section - antennas).

Antenna is a crucial part of the system so take special care. It is usually a good idea to place the antenna away from your transmitter, power supply and audio system. Also, any transmitter should be in a metal case which shields circuitry from the radiation of the antenna. If you cannot meet these requirements, you could experience feedback and other RF problems. We cannot guarantee proper operation of any transmitter/amplifier unless a suitable antenna system is used, and transmitters are in ventilated metal enclosure! This applies to any transmitter. Interestingly, strong RF field can make CD players and other digital devices go bezerk. Try placing an antenna next to yours and see what happens. Most of the modern audio gear is not RF shielded – reducing costs is unfortunately the mantra today. This is why keeping antenna away from audio gear is a good idea.

If you are going to place your antenna outside, on your roof, please take care of the grounding. This should be done to prevent lightning hazards and should be done by a company specializing in lightning protection. You can read more about lightning protection in the book recommended below or many of the websites (Google up "lightning protection ham radio" for example) .

I hope this basic introduction will not scare you too much, it should be sufficient for the time being although we encourage you to explore this exciting subject further with the help of a book such as the ARRL Antenna Book:

http://www.amazon.com/exec/obidos/ASIN/0872598047/mightyspiraterad

So, what is this swr (vswr) everyone talks about?

SWR is a measure of how well two devices are impedance matched to each other. Typical radio/TV transmission equipment is designed for 50-ohm load impedance, so we usually use 50-ohm cables and build or buy antennas that are specified for 50 ohm. While most cables have flat impedance over frequency (they measure 50 ohms at all frequencies you are likely to use) the same is not true of the antennas.

A 1.0:1 VSWR is a perfect match. That means the load impedance is exactly 50 ohms. A 2.0:1 VSWR is obtained when the load impedance is either 25 ohms or 100 ohms.

Because most transmitters will deliver full power with a load VSWR of up to 2.0:1, this value is usually considered the limit for acceptable operation. Many prefer to keep their VSWR below that however, but for all practical purposes, it is unnecessary to spend time or money trying to get much below a VSWR of 1.5:1. The benefits will be hard to measure and even harder to notice.

On the other hand, coaxial cable losses increase rapidly, for a given frequency of operation, when the antenna VSWR exceeds 2.0:1. This can even, in some extreme cases, result in the coaxial cable burning, even when running 100 W. Using a higher grade of cable will definitely improve things, but even high-quality coaxial cable becomes very lossy when VSWR exceeds 3.0:1 at higher HF frequencies (or VHF and higher).

Coaxial cable

Coaxial cable is an electrical cable consisting of a round, insulated conducting wire surrounded by a round, conducting sheath, usually surrounded by a final insulating layer. The cable is designed to carry a high-frequency or broadband signal, usually at radio frequencies. Coaxial Cabling is a two-conductor closed transmission medium that is often used for the transmission of RF energy. It yields excellent performance at high frequencies and superior EMI control/shielding when compared to other types of copper cabling. Coaxial cabling is commonly found in broadcast and networking systems. Most coaxial cables have a characteristic impedance of either 50 or 75 ohms. The RF industry uses standard type-names for coaxial cables. The U.S military uses the RG-# or RG-#/U format (probably for "radio grade, universal", but other interpretations exist).

The common RG-58 from Radio Shack is NOT the best you can do and can eat a lot of your effective power out! Use it only for short runs. BELDEN makes terrific coaxial cable in various qualities and with very low loss (measured in dB's…decibels). 3 dB loss = 1/4 of your signal strength - either lost or gained. Watch out for the correct impedance; RG58, RG213, H-500, H-2000 and H-155 have 50 Ohms, RG-59 and RG-6 have 75 Ohms. Most antennas and transmitters, including ours are 50 ohm. Check our website for good coax. Don't buy more than you need to make the long run to your antenna and don't make up a few "jumpers" to go between your exciter, VSWR meter and your antenna as all you'll do is create higher SWR and more line losses. H-155 or H-200 are good choices! RG-142 with Teflon is recommended for wiring inside cabinets, for baluns, Wilkinson couplers and everywhere where resistance to heat is required as insulation won't melt during soldering or operation.

BNC connector

A connector comes between coaxial cable and your transmitter. It's a standard VHF RF connector for low power applications, just like the one used for older Ethernet networks. You might get it along with your antenna. Try to find a good quality BNC connector as PC type usually uses cheap plastic instead of Teflon. The good ones are usually easily recognized by higher prices. Another reliable method is a test with soldering iron; Teflon won't melt while plastic will. BNC to N or BNC to SO239 converters are available and will make it possible to connect N or PL259 (CB type or UHF) connector directly.

Mains power supply and mains power cable

Do not underestimate the importance of mains power supply, despite the abundance of all kinds of cheap units available today they unfortunately do not always meet requirements. What you need is a well stabilized DC 15V mains power supply that can supply at least 3 amps (for 15W, 5A for 25W and 7,5A for 50W) of continuous current without overheating, introducing buzzing, dropping the voltage down to 12V or lower (a classic case) or acting up in other way. Whenever in doubt please buy our mains power supply. One final note, our units are set for 15V and if you use less this may lower your output power a bit. For example, 25W unit may only do 20-22W at 12V.

The 100W model requires a different power supply with higher voltage: 48V. It must supply at least 5A of current.

If you ordered and received our mains power supply (which is recommended) you'll notice the mains cable is not included, but can be obtained in any radio/computer/hardware shop at the cost of about 1 US$. It is the type used in your PC for mains power. Since these cables vary from country to country and we had trouble getting the exact type locally we decided against including them, especially since finding them is so easy locally.

Audio source with mixer, microphone etc

You need some kind of audio source to drive your transmitter. This will typically be either a computer (just plug the cable into your sound card outputs, a mixer and a variety of audio sources, such as a microphone, CD player, DAT player, tape deck, gramophone, MP3 player etc.

Enclosure and cooling for STMAX 3000+ series exciters

Use metal (preferably aluminum) for your enclosures and allow some free space for future add-ons (stereo encoders etc.) and heat dissipation, also make ventilation holes at the top and/or back of the enclosure. Fix the PCB and heat-sink with all screws tightly. Read again, ALL screws. Make sure they make good contact with the metal enclosure and if there is paint remember to remove it under the spacers. Use metal spacers, not plastic. Flat cable should be wired away RF sections or if you are not sure where that is move it away from the board in general. A fan is needed, 40x40x25mm will work, but larger fan is usually quieter, you can connect it to the provided pads which also regulate fan speed according to output power. **Make sure you tightly screw the RF board to the enclosure as this is how the output transistor dissipates its heat!** Especially 50W and 100W generate a lot of heat so it is important that you follow these guidelines. If you still experience instability, make sure there are metal shields between compartments in your enclosure. You can also sand off the black anodizing off the heat sink where the heat sink meets the enclosure and board to ensure better contact. Anodizing creates isolating layer. You can remove that also for the top heat sink where it meets the board. 50W and 100W models require a substantial airflow to keep cool. This means a suitably powerful 80x80 (or more) size fan. For suitable fans please look at our website.

External audio input board with balanced audio inputs, audio LPF, USB audio, limiter and even digital AES/EBU

Due to space limitations, we moved this circuitry to an add-on audio input board. Actually, often this is more convenient as you can have inputs wired to the exciter with flat cable and exciter can be mounted somewhere else. The board comes with XLR balanced inputs with RF filters and ESD protection, RCA inputs, USB audio interface, low pass audio filter and a limiter. Balanced inputs are an instant cure for most noise problems, and this is why all professional installations usually use them. USB audio input can also cut any noise down to zero in an instant.

Digital version of audio input board now even comes with AES/EBU digital audio input! The left XLR input serves this purpose. AES/EBU digital mode must be enabled via the LCD.

Chapter

5

Wiring everything together

Wiring things up and first power-up

Wiring the STMAX3000+ is easy, just make sure you read the previous chapter and setup enclosure, antenna and coaxial cable correctly. Then proceed with the following:

- Install STMAX3015/25/50/100W+ in a suitable enclosure and provide a small cooling fan which will blow across the board.

- If you want you can use the optional audio input board.

- Connect LCD module via flat cable.

- Set the power limit jumper (J12) into the lowest position (1W), this will prevent any damage due to high SWR.

- If you don't have artificial load (dummy load) erect antenna tower and install antenna securely. Make sure your antenna is well away from any metal objects. Ensure your antenna tower is grounded securely. Connect one end of your 50ohm coaxial cable to the antenna. If you have SWR analyzer, you can now verify SWR of your antenna. If your antenna is already tuned connect the other end of coaxial cable to the antenna connector (BNC) at the back of the transmitter. If you have SWR/POWER meter, you can wire that inline between antenna and transmitter as well. Make sure the SWR meter supports the frequency band required (87-108MHz).

- Ensure all connectors are firmly secured and antenna is mounted securely.

- While making sure the power switch is off, connect the mains power cable into the mains power supply and connect mains power supply into the back of the exciter.

- Inspect all cables quickly again and make sure everything is secure.

- Turn on a radio receiver and set it to your intended transmitter frequency.

- Flip the POWER switch and wait for the unit to turn on. Enter the menu system by pressing the bottom key (Menu) repeatedly and look for the <RF power> menu item. Now set desired output power with the UP/DOWN keys. For tuning and testing use around 25-50% of full power. Press Menu again to exit back to main display. Now you can use the UP/DOWN keys to set the desired frequency of operation. Wait a few seconds for the red LED diode to turn off. Your radio should now be mute since you have not connected any audio sources yet.

- You can now connect audio sources of choice and verify audio performance.

- Observe SWR and output power. If everything seems ok, you can enter <RF power> menu again and increase power to full. Remove or reposition the power limit jumper (J12) if more power is desired.

Chapter

6

Using the STMAX3000+ series exciter

LCD control module – two types

The basic LCD display is controlled with 3 keys. The advanced display is equipped with a rotary encoder instead. Basically, with the keys there are three push-buttons available for the menu system: **UP**, **DOWN** and **MENU**. By pushing **UP** or **DOWN** you get a change of parameter or a shift of frequency in corresponding direction. Hold any of these keys for a few seconds and the jumps will increase to 500 KHz. The new frequency is saved automatically. The third button (**MENU)** gives you an option to select and set up many of the options and DSP functions of this unit. Note that for most users setting frequency and power are the two important/useful settings, leave the rest alone at default. The default setting is depicted with [D].

Units with rotary encoder have the same menu system. The difference is that for UP and DOWN you must rotate the knob in the corresponding direction. For MENU you must push the rotary button. Two more things, the rotary button version has password protection (you can lock the display). Also, the position of frequency and power menu are exchanged.

LCD control module menu system

The UP and DOWN keys are used to change parameter values. In normal mode the LCD simply shows the frequency and power or whatever view you select. Menu key can be used to enter the menu mode, repeatedly pressing this key brings up the following menus: <RF POWER> or <FREQUENCY> depending on model of LCD display, <STEREO MODE>, <VIEW SELECT>, <LCD CONTRAST>, **<DSP UP/DOWN>**, <AUDIO INPUT>, <AUDIO FORMAT>, <COM/LIM MODE>, <COMPRESSION>, <THRESHOLD>, <ATTACK>, <DECAY>, <PREEMPHASIS>, <AUDIO LEVEL>, <MUTE L/R CHAN>, **<ALARMS UP/DWN>**, <CURRENT ALARM>, <TEMP ALARM>, <SWR ALARM>, <U AMP ALARM>, **<RFSETUP UP/DN>**, <PLL STEP>, <BAND SELECT>, <RF POWER ALC>, <FIRMWARE VER>, <MPX DEVIATION>, <19KHz PILOT D >, <RDS PILOT DEV>, **<RDS SETTINGS>**, <RDS ENCODER>„ <RDS PTY>, <RDS TP>, <RDS TA>, <RDS M/S>, <RDS D3D2D1D0>, <RDS PS>, <RDS RT 0-15>, <RDS RT 16-31>, <RDS RT 32-47>, <RDS RT 48-63>, <RDS ECC>, <RDS PI setup>, <RDS groups>, <RDS AF> . Pressing the UP or DOWN key selects the desired parameter and allows you to modify its value. Another press on the MENU key and you're back to the normal mode. Note that all these settings except power and frequency are already set as they should be so changing them should not be necessary and is not recommended.

Changing frequency: <FREQUENCY>

Press the MENU key or rotary button to enter the menu system, select [Frequency] menu system. Simply press the UP/DOWN button to change frequency. Depending on PLL STEP setting your frequency will go down in 50/100/200KHz steps. If you keep pressing a key for a while the PLL STEP switches to fast tuning mode and jumps in 500 KHz steps. Note 108.000KHz equals 108MHz. 1000 KHz=1MHz. 100.100KHz= 101.1MHz in some countries a decimal separator is a dot and in others a comma.

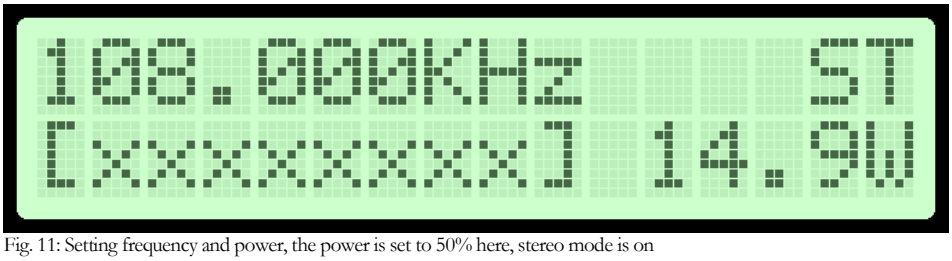


Fig. 11: Setting frequency and power, the power is set to 50% here, stereo mode is on

Changing output power: <RF POWER>

Select desired power with the UP/DOWN keys at any time. Selected power is displayed on the LCD as a line of bars. Think of this setting as an accelerator (gas) pedal in your car. Think of the power in watts that is shown on the LCD as the speed meter in your car. Depending on the road going uphill or downhill speed meter will show different values even if your accelerator pedal is fixed in the same position. If you go downhill your speed will be greater with the same amount of gas pedal. Likewise, here your supply voltage can affect the actual output power slightly. After changing power, the LCD display will go back to primary display mode (view 0) and after a while it will revert to the view which you selected manually. **Note:** UP/DOWN keys change power also when you have set a view type which does not show frequency, such as in UPTIME view.

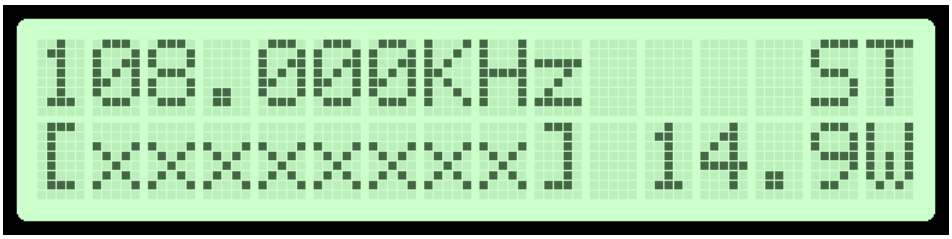


Fig. 12: Setting power, the power is set to full here, stereo mode is on

<STEREO MODE>

You can set your transmitter to MONO or STEREO here.

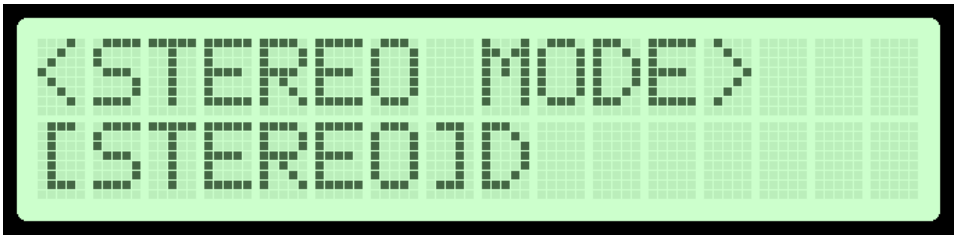


Fig. 13: Setting mode to stereo.

<VIEW SELECT>

STMAX3015+ can display several various parameters. Since the LCD real-estate is limited to 2x16 or 4x16 characters we prepared several pre-programmed views that only show a selected number of parameters. At the time of writing these views were available:

- [Freq+Mode+Pwr] – This view shows frequency, mono/stereo mode, and output power

- [Fr+Ie+Te+Ue] – This view shows frequency, Exciter output stage current, exciter temperature and exciter supply voltage

- [Po+Pr+Uamp+Ta] – This view shows output power, reflected power, amplifier supply voltage and amplifier temperature

- [Po+Pr+Uamp+Ia] – This view shows output power, reflected power, amplifier supply voltage and amplifier current

- [Audio Level] – This view shows audio level bar graph. For this to work you the W solder bridge on the LCD module needs to be closed-soldered.

- [Uptime D:H:M] – This view shows how long the transmitter has been operating without mains power going out. It is sometimes useful in diagnosing mains power failures.

- [Auto Scroll]D – This is the default view, it shows each of the above listed views for a short while and then moves on to the next in an endless loop. This way you can see all the relevant parameters without having to go through the menu system to change the view type; you just must wait a few seconds for the view to change.

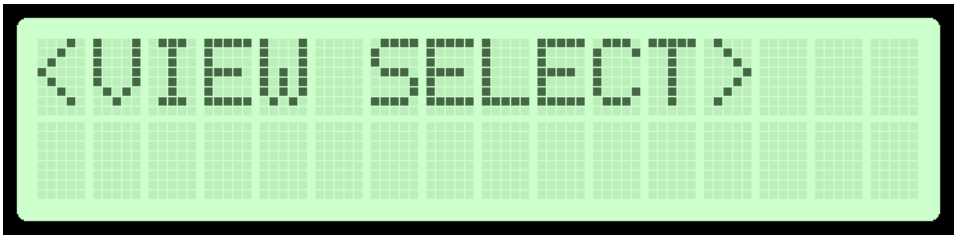


Fig. 14: View select

<LCD CONTRAST>

Select for the best visibility. Contrast is slightly affected by ambient temperature, and you can adapt it to your needs here.

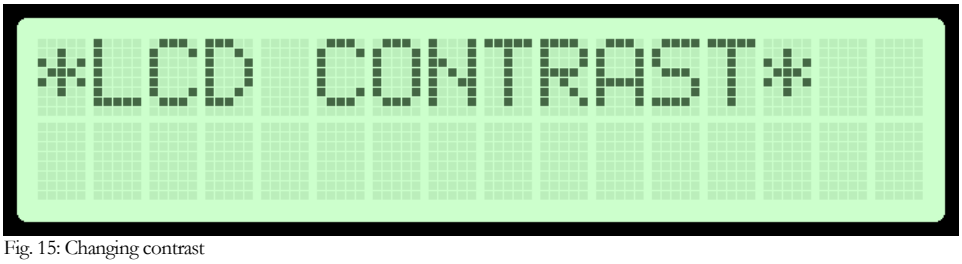


Fig. 15: Changing contrast

<DSP UP/DOWN>

This is a gateway/entrance into to a group of settings. This was done to group similar settings into sub-categories and make setup easier. These settings all affect the way internal DSP processes audio. To enter the sub-menu of settings you must press UP or DOWN key (or turn rotary button up or down). Once inside the sub-menu continue pressing the MENU key until you get to the desired setting. Settings listed inside <DSP UP/DOWN> are listed below:

<AUDIO INPUT>

Lets you select audio input. Digital input is required for AES/EBU inputs (requires special input board).

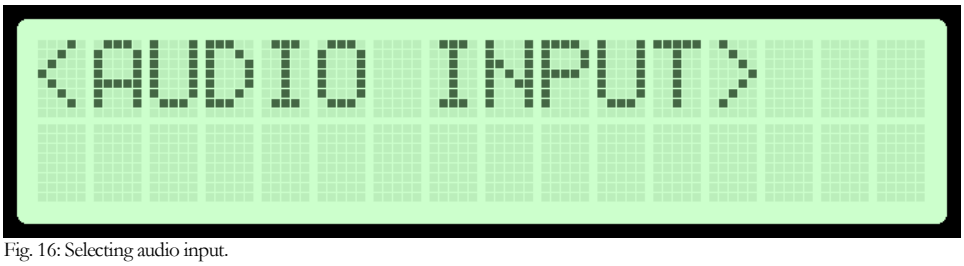


Fig. 16: Selecting audio input.

<COM/LIM MODE>

Selecting compressor-limiter mode.

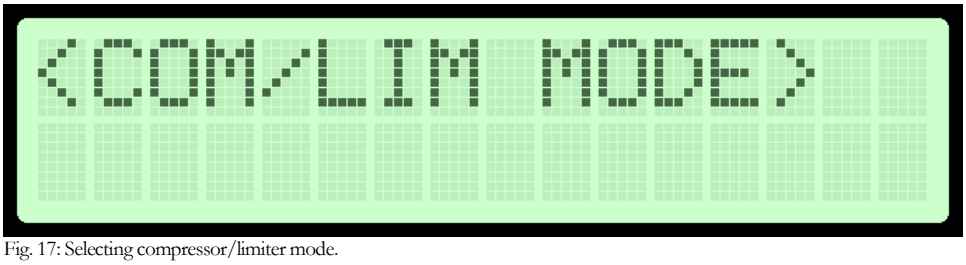


Fig. 17: Selecting compressor/limiter mode.

Compressor Settings

Several MENU settings control the operation of the compressor. Let's assume that the audio signal enters the transmitter at some low level. Compressor does nothing to the signal until at one point as the input signal increases the signal reaches the compression threshold. Digital signal processor starts compressing the signal beyond that point. The higher the compression ratio the higher the compression. For example, compression ratio of 1:∞ would in effect be a limiter.

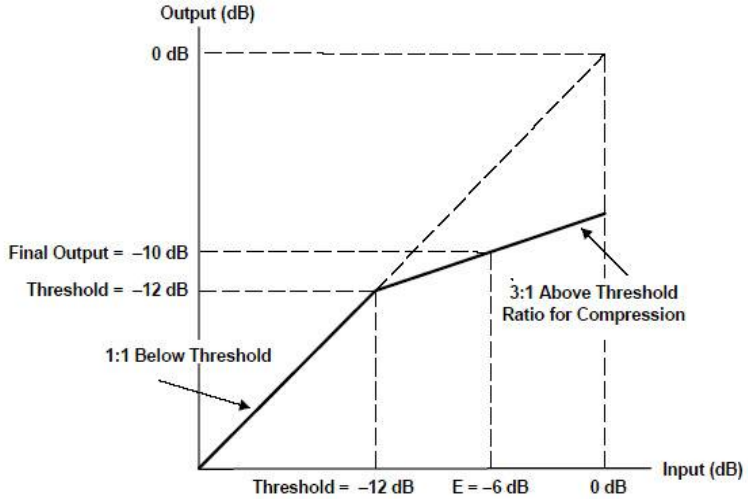


Fig. 18: Explanation of the compressor settings

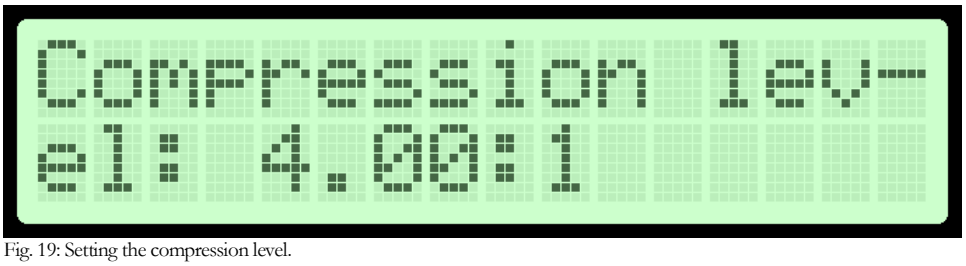


Fig. 19: Setting the compression level.

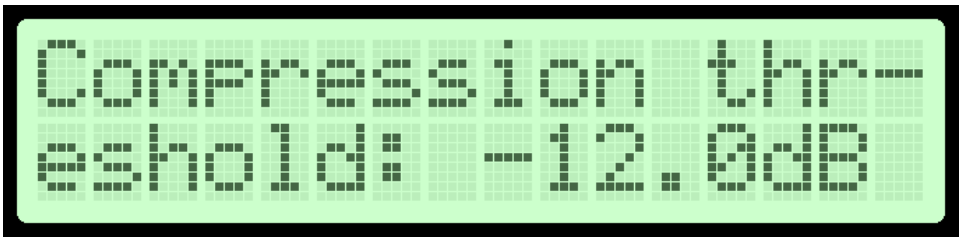


Fig. 20: Setting the compression threshold.

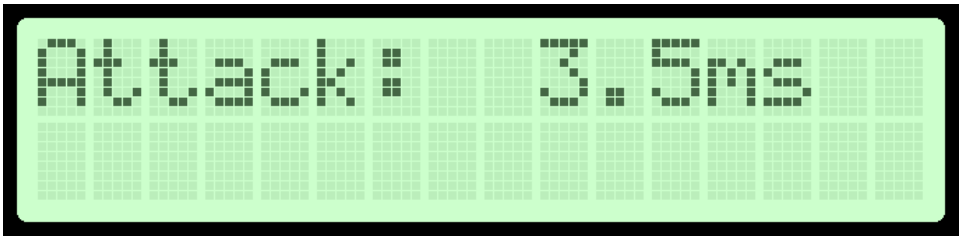


Fig. 21: Setting the attack time, this is the time between the input signal and the actual response of the compressor.

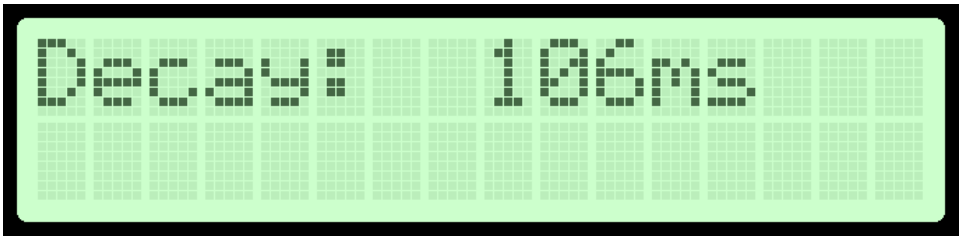


Fig. 22: Setting the decay time, this is the time the compressor needs to respond after the input signal falls back to normal level (below threshold).

<PREEMPHASIS>

Selecting pre-emphasis for audio. 50uS is typical for EU, 75 for Japan and USA.

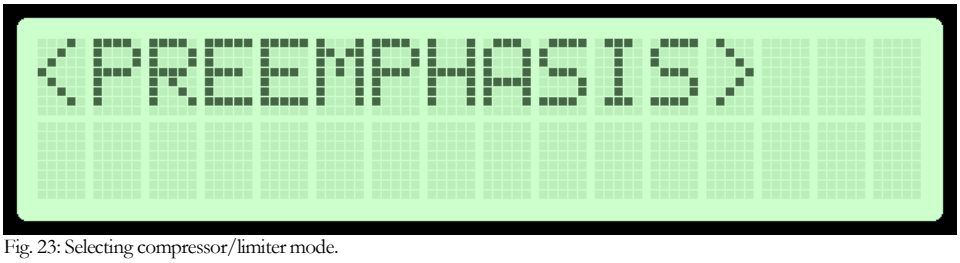


Fig. 23: Selecting compressor/limiter mode.

<AUDIO LEVEL>

Selecting analog audio input sensitivity. Two settings are available.

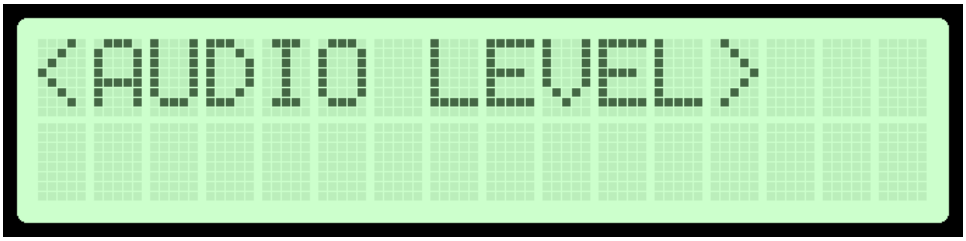


Fig. 24: Selecting analog audio input sensitivity.

<MUTE L/R CHAN>

Lets you mute one or both of the audio channels.

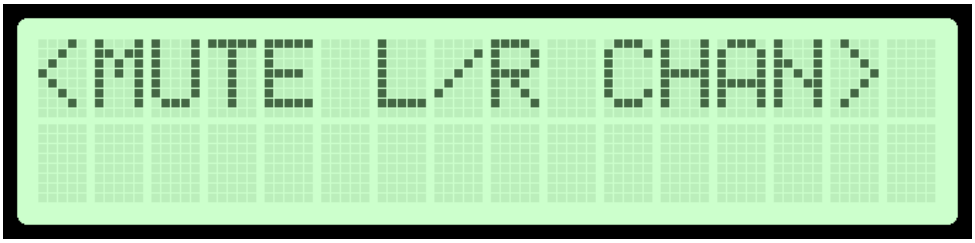


Fig. 25: Selecting analog audio input sensitivity.

<ALARMS UP/DWN>

This is a gateway/entrance into to a group of settings. This was done to group similar settings into sub-categories and make setup easier. These settings all affect sensitivity of the alarms. To enter the sub-menu of settings you must press UP or DOWN key (or turn rotary button up or down). Once inside the sub-menu continues pressing the MENU key until you get to the desired setting. Settings listed inside <ALARMS UP/DWN> are listed below:

<CURRENT ALARM>

You can set the sensitivity of amplifier current alarm here. We recommend you set these according to your amplifier. This alarm only works if you use our filter with MAXLINK interface and current sensor. The current meter is not very accurate.

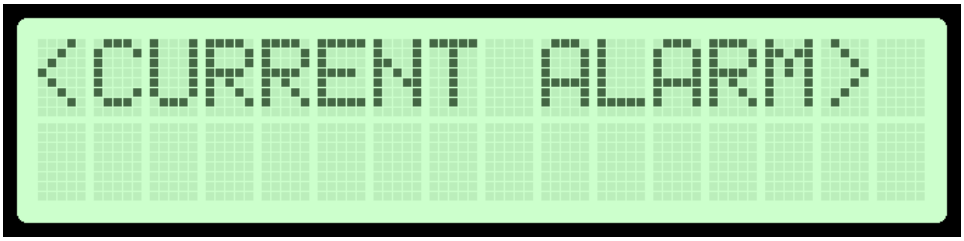


Fig. 26: Current alarm.

<TEMP ALARM>

You can set the sensitivity of temperature alarm here. We recommend you set these to 70-80 degrees Celsius. A properly installed unit with a tiny fan will typically run at 55 degrees C at maximum output power. This alarm applies to externally sensed temperature if you are using external filter or directional coupler connected via DIGIAMP.

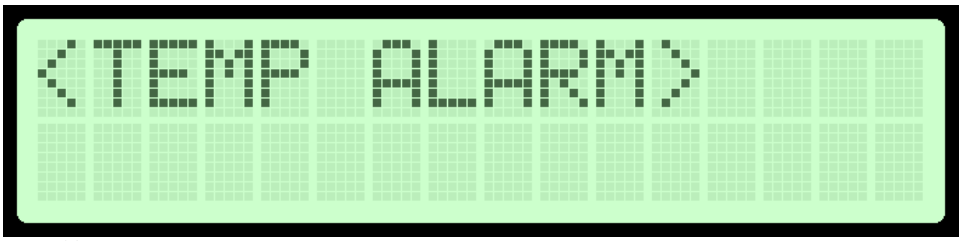


Fig. 27: Temperature alarm.

<SWR ALARM>

You can set the sensitivity of software driven SWR alarm here.

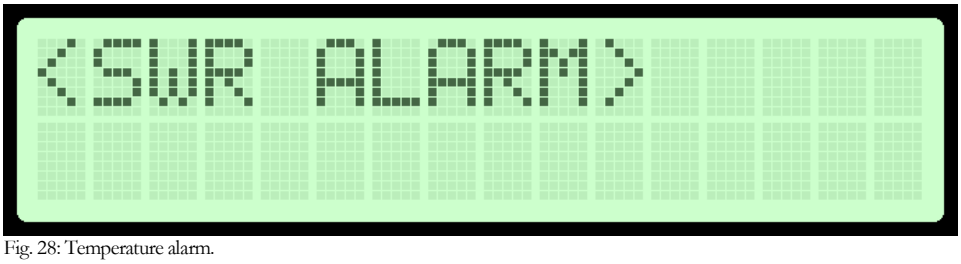


Fig. 28: Temperature alarm.

<U AMP ALARM>

You can set the sensitivity of amplifier supply voltage alarm here. We recommend you set these according to your amplifier. Usually this is around 50V. This alarm only works if you use PCS LPF 6000/7000 filters with voltage sensor.

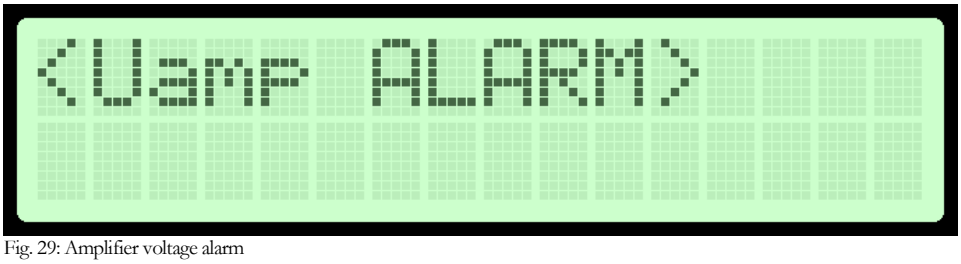


Fig. 29: Amplifier voltage alarm

<RFSETUP UP /DN>

This is a gateway/entrance into to a group of settings. This was done to group similar settings into sub-categories and make setup easier. These settings all affect the RF section of the transmitter. To enter the sub-menu of settings you must press UP or DOWN key (or turn rotary button up or down). Once inside the sub-menu continue pressing the MENU key until you get to the desired setting. Settings listed inside <RFSETUP UP/DN> are listed below:

<PLL STEP>

Frequency can normally be adjusted in smallest steps of 50 KHz or larger steps of 100 KHz. We recommend you select 100 KHz as this lets you change frequency fast and there is rarely a need for fine tuning. However, you can enter this menu and select a PLL step of 5 KHz for example and take advantage of these small steps.

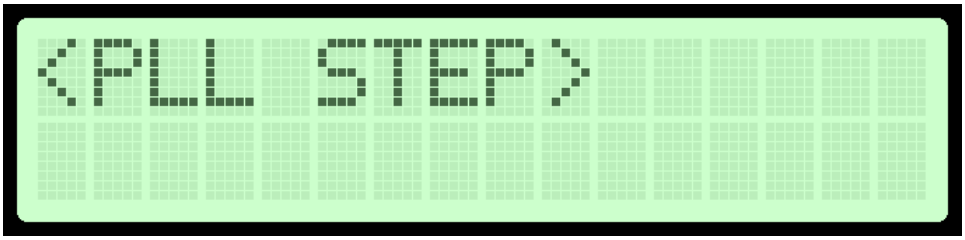


Fig. 30: Changing PLL step size

<BAND SELECT>

STMAX30XX+ exciters support FM band, if you want us to modify design for another frequency, please let us know and we'll quote you a modified version. [87.5-108MHz]D – This is default band, used in most of the world.

<RF POWER ALC>

This menu option is useful for situations where your exciter drives a pallet or other FM amplifier. It is possible to set a limit power level (for example 500W) and exciter will reduce its output power if needed to prevent overdriving. This is a very useful feature when you are, for example building a 500W, 1000W or stronger FM transmitter; it ensures constant power across the band without overdriving. This is disabled by default to prevent tinkering with the settings by unauthorized personnel; you can enable it by soldering a particular bridge on the LCD module.

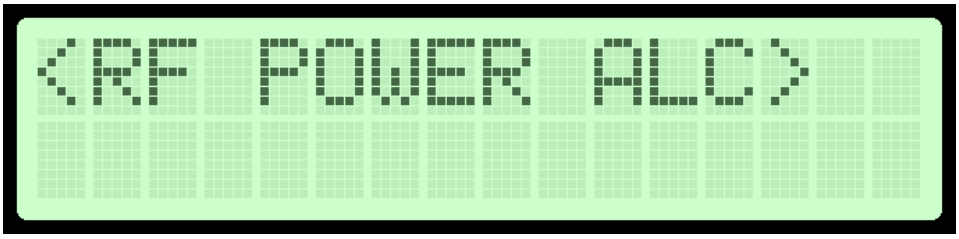


Fig. 31: Changing amplifier power limit value

<FIRMWARE VER>

This option allows you to display the current LCD module firmware version.

<MPX DEVIATION>

This menu lets you select carrier deviation for FM radio signal. Leave at default (D).

<19KHz PILOT D>

This menu lets you select carrier deviation for 19KHz stereo pilot signal. Leave at default (D).

<RDS PILOT D>

This menu lets you select carrier deviation for RDS signal. Leave at default (D).

<RDS SETTINGS>

This is a gateway/entrance into to a group of settings. This was done to group similar settings into sub-categories and make setup easier. These settings all affect the RDS section of the transmitter. To enter the sub-menu of settings you must press

UP or DOWN key (or turn rotary button up or down). Once inside the sub-menu continue pressing the MENU key until you get to the desired setting. Settings listed inside <RDS SETTINGS> are listed below:

<RDS ENCODER>

You can enable or disable RDS here. If interested about RDS google Radio Data System parameters.

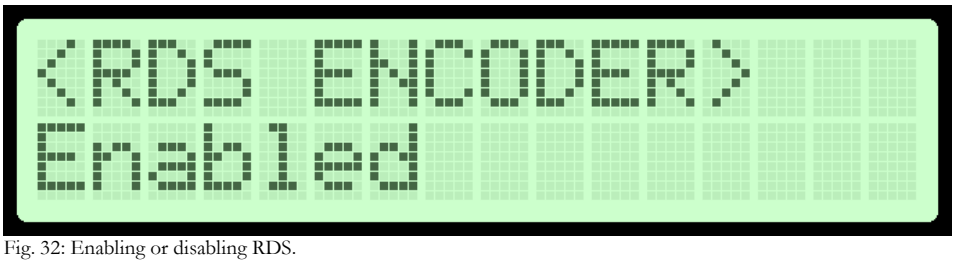


Fig. 32: Enabling or disabling RDS.

<RDS PTY>

You can set the program type for RDS here. If interested about RDS google Radio Data System parameters.

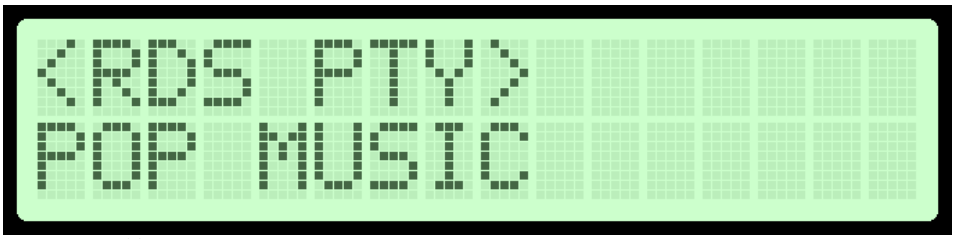


Fig. 33: RDS PTY

<RDS TP>

You can set the Traffic Program flag for RDS here. If interested about RDS google Radio Data System parameters.

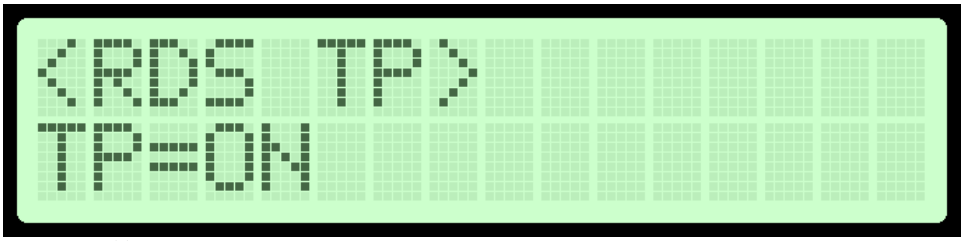


Fig. 34: RDS TP

<RDS TA>

You can set the Traffic Announcement flag for RDS here. If interested about RDS google Radio Data System parameters.

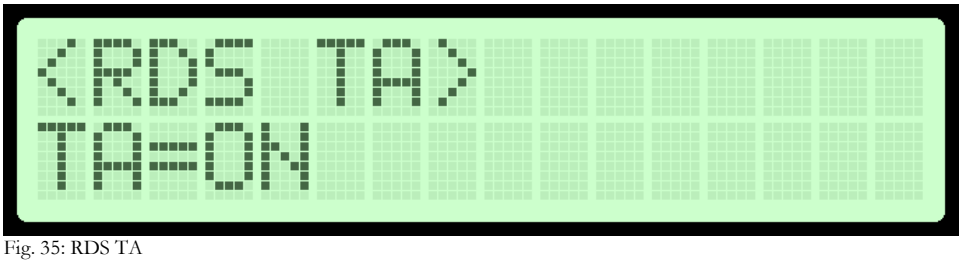


Fig. 35: RDS TA

<RDS M/S>
You can set Mono/Stereo flag for RDS here. If interested about RDS google Radio Data System parameters.

<RDS D3D2D1D0>
You can set D3, D2, D1 and D0 for RDS here. If interested about RDS google Radio Data System parameters.

<RDS PS>
You can set PS (station name) here. This setting has 8 characters. Once you enter this sub-menu you will be able to change the highlighted letter with the up/down keys or rotary encoder up/down. Once you're happy with the highlighted letter you can move on to the next one by pressing menu key. Starting from the left you slowly move towards the end until all letters are changed. If you make a mistake you will have to repeat the procedure. If it happens that you can't change a given character wait a few seconds and then try again. It is a known bug that sometimes happens; we are working on finding a solution.

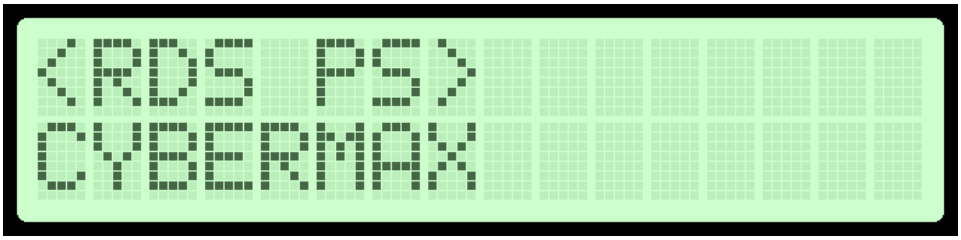


Fig. 36: Changing PS text, radio station name

<RDS RT 0-15>, <RDS RT 15-31>, <RDS RT 32-47>, <RDS RT 48-63>
You can set Radio Text for RDS here. RT has 64 characters. To simplify setup, they are split into 4 groups of 16 characters. Once you enter this sub-menu you will be able to change the highlighted letter with the up/down keys or rotary encoder up/down. Once you're happy with the highlighted letter you can move on to the next one by pressing the menu key. Starting from the left you slowly move towards the end until all letters are changed. If you make a mistake you will have to repeat the procedure. If it happens that you can't change a given character wait a few seconds and then try again. It is a known bug that sometimes happens; we are working on finding a solution.

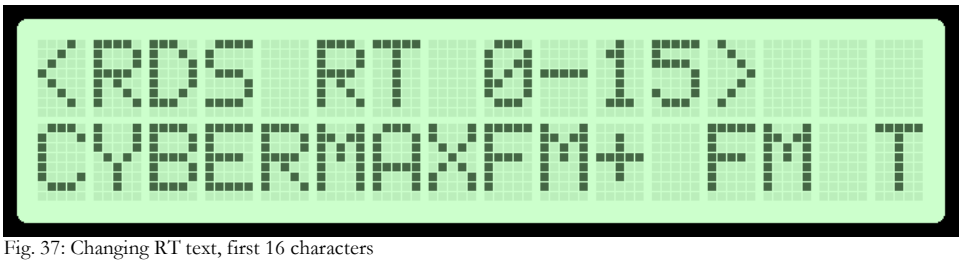


Fig. 37: Changing RT text, first 16 characters

<RDS ECC>
You can set ECC here for RDS. ECC is extended country code.

<RDS PI>
You can set a PI (program identifier) for RDS. Usually issued by national telecommunications agency to ensure each station has its unique PI.

<RDS groups>
You can select which RDS groups are transmitted for RDS.

<RDS AF>
You can select AF for RDS. AF stands for Alternative Frequency; this is used for networks of transmitters operating on several frequencies.

<PASSWORD>

Rotary display version of the display also lets you lock the display with a password. For this to work you must install a LOCK jumper to pins marked LOCK on the LCD display. Anytime you want to do something with the display you will have to enter a password first. The LCD stays unlocked for about a minute after that.

Once you enter this sub-menu you will be able to change the highlighted number with the up/down keys or rotary encoder up/down. Once you're happy with the highlighted number you can move on to the next one by pressing the menu key. Starting from the left you slowly move towards the end until all the numbers are changed. The default password is 000.

Chapter

7

WINDOWS CONTROL PROGRAM – CyberNanoFM+ v1.0

SOFTWARE INSTALLATION AND COMMUNICATION SETUP

Software installation and setting up connection via serial COM port or USB port are described in Appendix I.

COM PORT SETUP

Select correct COM port here.

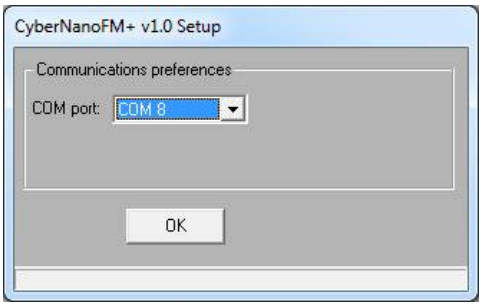


Fig. 38: COM port setup.

The selected COM port must match the COM port detected under Device Manager. To open device manager, enter "Device Manager" into search box in Windows, than click Device Manager:

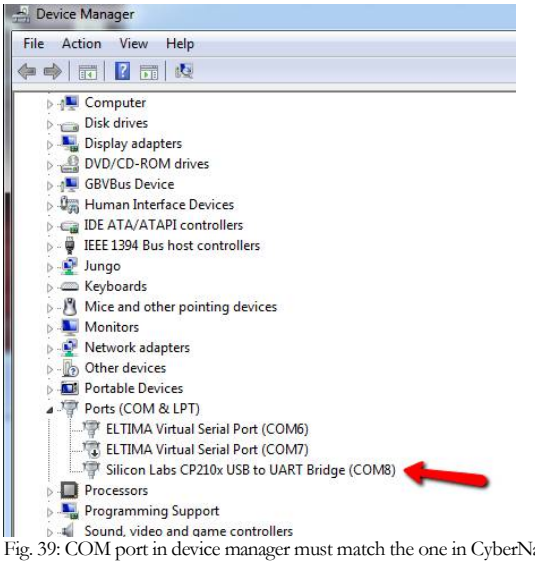


Fig. 39: COM port in device manager must match the one in CyberNano program.

FM TX main tab – transmitter setup

Main FM transmitter parameters are presented in this dialog, they are described below:

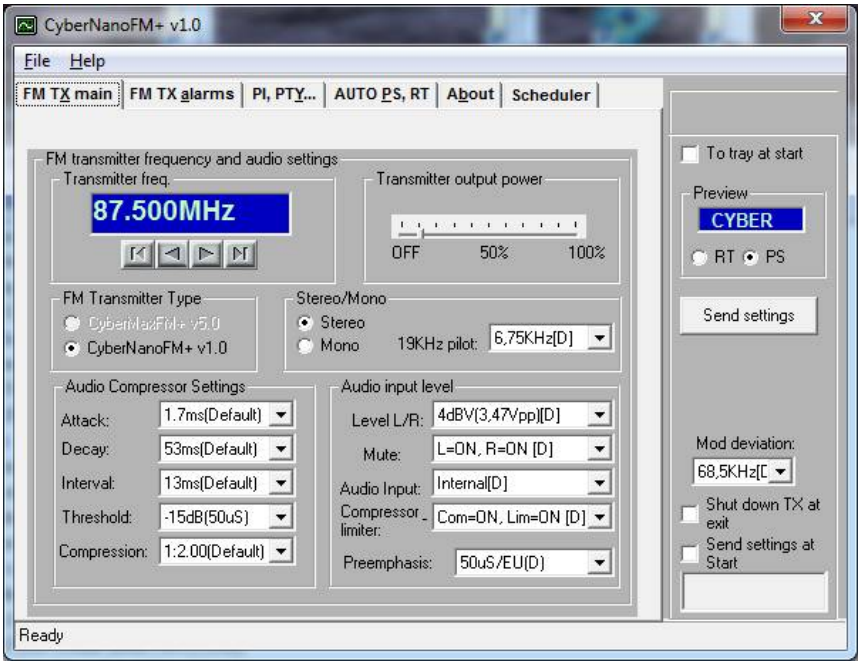


Fig. 40: FM transmitter setup

FM transmitter type
FM transmitter type, you can't change this.

FM transmitter frequency
Set the frequency in 500KHz or 50KHz steps with the direction buttons (UP/DOWN).

Transmitter output power
Set the desired output power.

Stereo/Mono
Select stereo mode here.

19KHz stereo pilot deviation
Select stereo carrier deviation here. Default value is denoted with [D]

Audio input level
Select audio input sensitivity here. Two settings are available. Default value is denoted with [D]

Mute
You can mute one or both channels here.

COMPRESSOR/LIMITER:
You can turn on the limiter, compressor or both here. Default value is denoted with [D]

Pre-emphasis:
Set to 50uS for most of the world, set to 75uS for USA and Japan. Default value is denoted with [D]

Audio Compressor Settings
These are settings which control the operation of the compressor. These settings are described in more detail in the menu system description.

FM TX alarms

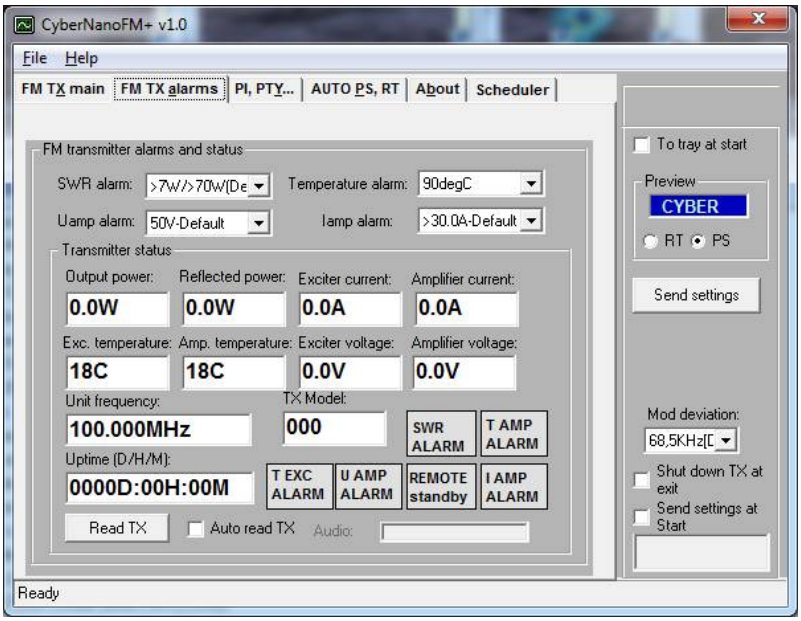


Fig. 41: Setting up alarms.

In this tab you can observe several operating parameters including alarms. Threshold values of alarms can be set, too.

Read TX
Click this button to get the status of your hardware.

Auto read TX
Check this box to activate automatic continuous hardware status reading.

PI, PTY... (RDS settings)

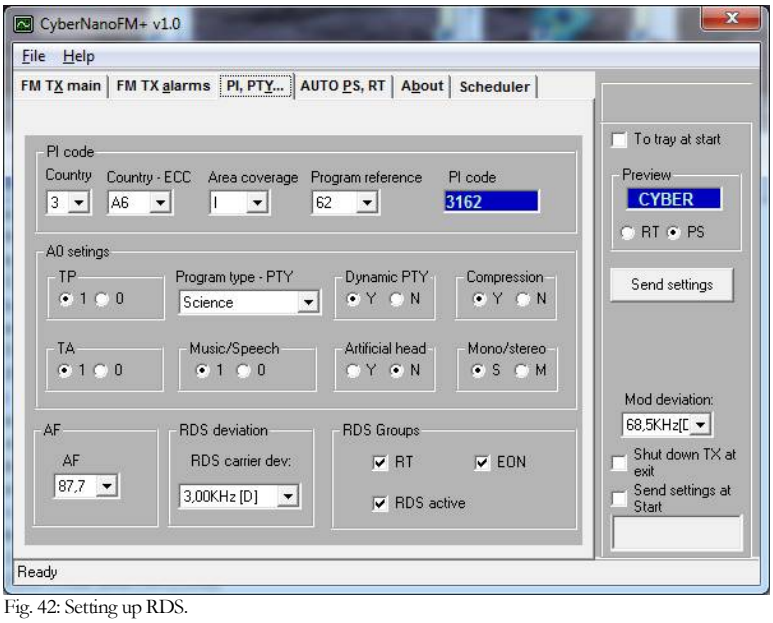


Fig. 42: Setting up RDS.

PI code
This information consists of a code enabling the receiver to distinguish between countries, areas in which the same programme is transmitted, and the identification of the programme itself. The code is not intended for direct display and is assigned to each individual radio programme, to enable it to be distinguished from all other programmes. One important application of this information would be to enable the receiver to search automatically for an alternative frequency in case of bad reception of the programme to which the receiver is tuned; the criteria for the change-over to the new frequency would be the presence of a better signal having the same Programme Identification code.

TP/TA flag
TP is a flag to indicate that the tuned program carries traffic announcements. The TP flag must only be set on programs which dynamically switch on the TA identification during traffic announcements. The signal shall be considered during automatic search tuning, so I recommend turning this flag on even though you don't transmit any traffic announcements.

Program type PTY
This is an identification number to be transmitted with each program item and which is intended to specify the current Program type within 31 possibilities. This code could be used for search tuning. The code will, moreover, enable suitable receivers and recorders to be pre-set to respond only to program items of the desired type. The last number, i.e., 31, is reserved for an alarm identification which is intended to switch on the audio signal when a receiver is operated in a waiting reception mode.

Music/Speech
This is a two-state signal to provide information on whether music or speech is being broadcast. The signal would permit receivers to be equipped with two separate volume controls, one for music and one for speech, so that the listener could adjust the balance between them to suit his individual listening habits.

AF - Alternative Frequencies
The list of alternative frequencies gives information on the various transmitters broadcasting the same program in the same or adjacent reception areas. This facility is particularly useful in the case of cars and portable radios. When the PI code indicates local coverage-area, i.e., only one frequency is used, AF list may contain this frequency.

AUTO PS, RT
In this tab you can set PS station name and radio text – RT.

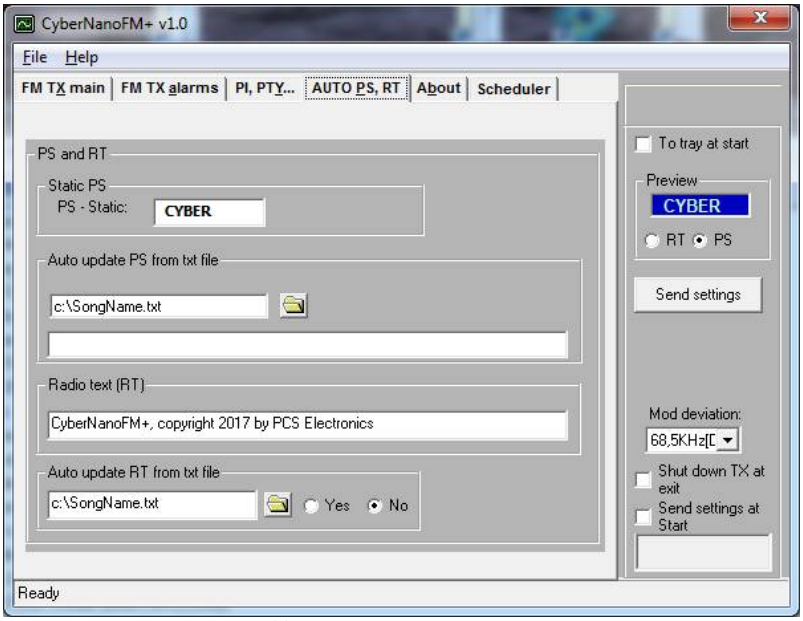


Fig. 43: Setting up RDS – PS and RT

PS is the label of the program service. This is the most interesting feature for 99% of customers out there so we will dedicate a bit more time to it. RDS standard provides for an 8-character PS string which is used to identify radio stations and is displayed by RDS-enabled radio receivers. Some countries prohibit changing this text dynamically, but others don't. Whatever your decision may be, this product supports either static or dynamic PS. It is best to check with the local authorities before setting up the RDS.

Auto PS and RT update is another hugely popular feature. Basically, you can take the song title from Winamp or another program via text file. Winamp must be setup to write its song info into a text file; this is done with TitleSpy plug-in. Most

other playback programs can easily be set up to write song info into a text file. You can use this info to update PS or RT text. PS text is limited to 8 characters so the entire song title can either be scrolled or split into 8-character blocks. A popular and nifty feature indeed. This feature requires your PC to be always connected to the transmitter during music playback.

Auto update PS from txt file

This mode makes it possible to have the PS updated automatically. Several very useful features make this mode extremely useful. It is possible to insert time, date, or song name from external file. This external file can be updated via Winamp or any other program. If you want to collect data from Winamp (MP3 ID tag, song name) please use winamp plug-in called VtitleSpy. This little program is usually packaged into an installation file; you will find it in the installation folder where you installed the program. Run the exe file and configure it to output winamp song info into your text file and then set CyberNano+ program to read song name from that file. Also make sure you setup VtitleSpy plug-in to limit song name to 64 characters.

Auto update RT from txt file

This is another popular feature, RDS allows for 64-character text string to be displayed on the receiver. However, this feature is rarely used as you need to press a button to display it (PS is always displayed by default). Another "nail in RTs' coffin" is the fact that typical receiver only displays a maximum of 8-characters at a time meaning the message needs to be scrolled. However popular or unpopular it may be, we support it. The field at the top (RT) shows the currently active RT message.

The auto update RT field makes it possible to collect the RT from any text file. In order to pick RT from a text file select the text file with the browse button and enable auto update by selecting the Yes option. CyberMaxFM+ will check the file once every second and update the encoder automatically if it detects any changes of the text file. If you want to collect data from Winamp (MP3 ID tag, song name) please use winamp plug-in called VtitleSpy. This little program is usually packaged into an installation file; you will find it in the installation folder where you installed the program. Run the exe file and configure it to output winamp song info into your text file and then set CyberMaxFM+ program to read song name from that file. Also make sure you setup VtitleSpy plug-in to limit song name to 64 characters.

About

Fig. 44: About…

Firmware version

This is the firmware version of your FM transmitter board. For this to display you need to read data from the transmitter at least once (Read TX or Auto read TX).

Common controls

Fig. 45: Common controls

These are common controls belonging to all program tabs.

ToTray at start
Check ***To tray at start*** checkbox to start the program minimized in system tray.

Send settings
Sends all settings to the FM transmitter.

Shut down TX at exit
Check this box to automatically reduce transmitting power to 0 when exiting the program.

Send settings at start
Check this box to automatically send TX settings at starting the program. This may come handy when *Shutdown TX at exit* is activated to automatically raise TX power when next time starting the program.

Audio histogram
Every time the transmitter status is read, a new audio level value is added at the histogram. Status may be read manually (by clicking *Read TX button*) or automatically (by checking *Auto TX read* checkbox). Levels above 80% are marked in red color.

Status window
Some communication activities can be observed here.

Scheduler

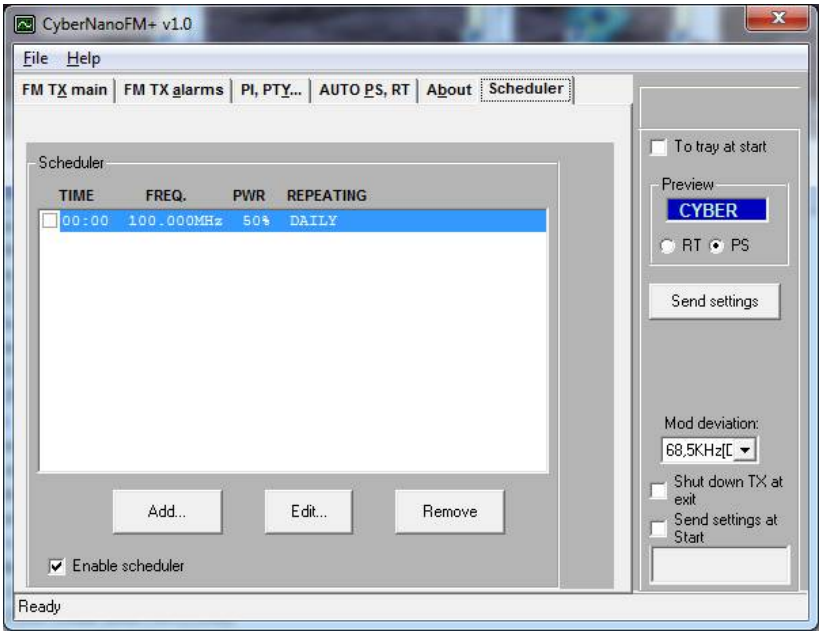


Fig. 46: Scheduler

The built-in scheduler allows the user determine automatic switching of transmitting power and frequency according to predefined scheme. Schemes can be defined on a daily or weekly basis. **To accomplish this task the PC must be connected to the transmitter and the program must be running all the time!**

Up to 20 controlling lines can be entered into the list box. Each line defines transmitting power, frequency and switching time. Put a tick at the beginning of each line to make that line active. There can be many lines active if desired. It is recommended to be careful while entering lines not to make time-overlapping lines active at the same time.

Example: if you define a line daily and at the same time another weekly based line is active the results may be unpredictable. You can always enter many lines and then decide which of them should be momentarily active by putting ticks into checkboxes.

Enable
Check this box to make the scheduler active in general.

Add...
Click the Add... button to open the Add form to add a new line into list box.

Edit
Select desired line first, then click Edit to open Edit form.

Remove
Select desired line first, then click Remove to delete it.

Add scheme dialog

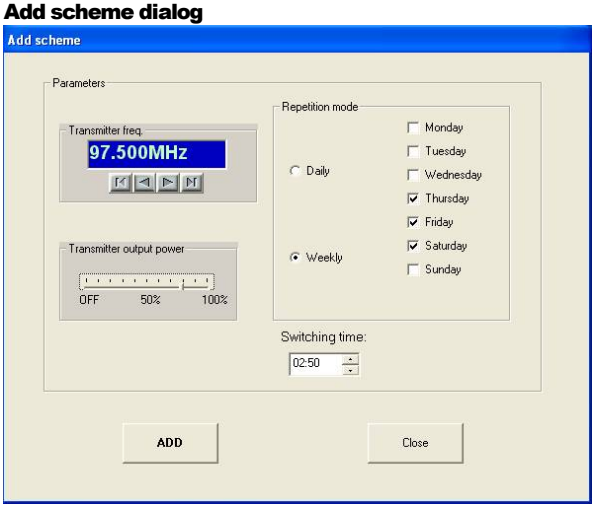


Fig. 47: Scheduler, adding scheme.

Add scheme dialog lets you enter the following parameters:

Transmitter frequency, transmitter power and repetition mode which can be either Daily or Weekly. Daily repetition mode switches every day at the same time. To make sense, at least two daily based lines should be active at the same time. Weekly repetition mode allows individual selection for each day in the week.

Add or Modify

Click this button to accept changes. In the case of adding lines more lines can be entered subsequently.

Close or Cancel

Click this button to finish adding lines or to cancel editing.

Chapter

8

Troubleshooting

We hope you'll never get to this step. We all know bad things happen but do not despair! MAX PRO 6000+ series exciters are protected with a fuse, SWR and TEMP protection. Fuse is the first thing to check. Make sure your coaxial cable leading to the transmitter or antenna is not shorted or open. Next check the troubleshooting table on the next page. If you have problems, you cannot solve yourself, please see our website for contact information and support resources in our forum.

Do you think you can handle it ??

Fig 48: So, do you think you can handle it? We think you sure can!

PROBLEM DESCRIPTION	POSSIBLE SOLUTIONS
Everything appears normal, but there is no RF power	1. Wait a few more seconds, STMAX3000+ series exciters need about 10 seconds to get their power to full 2. Maybe one of the alarms was triggered and power was reduced, try to power off and power back on, whenever an alarm is triggered, power may be reduced until you power off and back on
RF output power is too low	1. Check the power limit jumper J12 2. Maybe one of the alarms was triggered and power was reduced, try to power off and power back on or wait a few minutes for power to recover. 3. Find out which alarm was triggered, maybe your unit is over-heating, or your antenna (SWR) may be way off. Let the unit cool off and ensure proper cooling in the future. Perhaps you adjusted TEMP ALARM or another alarm too low, set it slightly higher. 4. Exciter may not give full 15W/25W/40W when you use a supply voltage of less than 15V.
LCD display keeps showing TEMP/SWR error warning	1. Unit is probably over-heating, or your antenna is faulty. Let the unit cool off and ensure proper cooling in the future. Perhaps you adjusted TEMP ALARM too low, set it slightly higher. 2. It is very likely that your antenna is not working correctly, check cable and check SWR. You may need to adjust SWR ALARM slightly higher (but first make sure your antenna and cable are OK).
Audio without any treble	Set pre-emphasis to either 50uS or 75uS.
Unit blows fuses and draws excessive current	You have managed the impossible: You have burned the output transistor. You've probably tried to squeeze out more output power by using higher supply voltage above 15V or even changing the bias current. It is time to order a replacement final transistor and get the soldering iron. Next time think twice about doing these things.
Power supply is blinking	Probably the same thing as above. Blinking power supply means its protection is shutting it off and back on, probably due to excessive current draw caused by burned final.
There is HUM in audio	- Move antenna as far away from the transmitter and audio gear as possible - Use balanced audio inputs or USB audio (XLR audio connectors on audio input board) rather than RCA - Make sure SWR is low - Did you miss the part about metal enclosure? Put your unit in enclosure!! - Keep audio cables short and away from antenna and RF coaxial cable
Output power less than expected	Verify position of the J12 power limit jumpers. A jumper installed there will limit maximum power to 2W, 5W or 8W. If you want full power, please remove the jumper. Using a pallet amplifier and our filter? Make sure ALC power limit and SWR protection trimmers are not set too aggressively. Also check the pallet, it may be burned.
Output power less than expected	If the unit is overheating it will start reducing output power, make sure it is sufficiently cooled! Reduced power will return only after you power off and, on the unit, (or change power setting).

Table 5: Troubleshooting STMAX 3000+ series FM exciter

Chapter 9

Limiting maximum adjustable power for driving pallets

STMAX 3015 (3025 and 3050 are usually too strong for driving RF amplifiers) has been developed also as a pallet driver for remote areas and it is ideal for this task. Of course, for most situations 15W will be too much and you will want to limit maximum output power of this FM transmitter to a lower value and at the same time prevent accidental setting of higher power via LCD module. This is especially important when you use this exciter to drive an amplifier. Most amplifiers will not appreciate over-driving the input and will eventually be damaged by excessive power on the input. There are scenarios and ways to limit output power, they are described below with their advantages and disadvantages. You should **PERFORM THESE ADJUSTMENTS BEFORE CONNECTING AMPLIFIER** as otherwise it may be too late, a short burst of full power before you turn the power off or adjust the trimmer may kill the amplifier. A very good design practice is also to use an attenuator (just a small 1-3dB) between exciter and amplifier, remember amplifiers input impedance can be a long way from prescribed 50 ohms and attenuator nicely equalizes that out.

Step1 – establish needed drive power.

Check the datasheet/specs of your amplifier, it will state how much drive power is needed. For simplicity let us assume that the datasheet asks for 3.2W of drive power. Since there is some variation from pallet to pallet and we want to have a tiny bit of headroom also for the attenuator lets set output power to 4W.

Step2 - set maximum output power to 4W.

Look for power limit jumper J12, it is located close to the telemetry connector. Set J12 to 4W, this will limit output power to about 4W. Thanks to the new design of the STMAX3015+ this output power is flat across the entire FM band.

Step3 – reduce 4W down to the needed 3.5W with attenuator (optional, but recommended)

As already mentioned before a very good design practice is to use an attenuator (just a small 1-2dB) between exciter and amplifier, remember amplifiers input impedance can be a long way from prescribed 50 ohms and attenuator nicely equalizes that out. We are going to use such an attenuator to bring 4W down to around 3.2W.

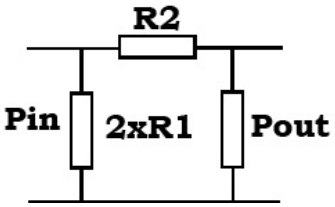


Fig 49: Attenuator

Loss in dB	R1 ohms	R2 ohms	Input power (Pin) for 3.2W output power (Pout)
1	870	5.8	4W
2	436	11.6	5.12W

Table 7: Resistor values for required attenuation.

It seems 1dB will be just perfect. You can use 2x820ohm 2W resistors and 1x5.6ohm 2W resistors. Use regular carbon 2W resistors (not! wire-wound), they will work well for this purpose at 100MHz, just keep the leads very short.

Step4 – verify performance before connecting the pallet.

Now you should have about 3.2W at the output of the attenuator, it is recommended that you now measure this output power to verify performance before you power-up the pallet. Don't worry if you get slightly more, we will focus on that later. You should worry about getting a lot more than 3.2W as that would mean something is not as it should be and excessive drive power could damage the pallet. After you're done with verification set power down to zero via LCD module and power off the exciter.

Step5 – wiring up the pallet and first power up.

Make sure your exciter's output is set to zero and everything is powered off. Now connect the pallet, the filter and directional couplers (swr/pwr meters). We recommend our filters as they can be easily connected to Digiamp. You can also use your own directional coupler, connect it to J8. Wire everything and verify it carefully to make sure there are no shorts. Make sure dummy load is connected for the test and wire power meter inline so you can monitor the power output. Set the sensitivity trimmers for SWR and PWR on the filters to maximum. Set ALC trimmer to zero (turn it towards digiamp connector) and SWR protection trimmer next to it to OFF.

Step6 – first power up and setup

Power up the entire setup and slowly increase drive power while observing the output power from the pallet on the power meter, also monitor temperature. Be careful never to exceed the power rating of the pallet. A 500W pallet shouldn't be pushed beyond 500W. Setup the SWR and PWR trimmers on the filters so that the power shown on the LCD is the same as on the power meter. If you are getting SWR alarms, you may need to reduce the SWR trimmer.

Step7 – check the ALC and set it to prevent overdriving.

Make sure that ALC (automatic level control) is not limiting your power; you can do so by turning it carefully. Set the ALC trimmer to start limiting a bit below your target power level, for example in a 500W setup you can set it to start limiting around 480W. If you still can't reach full power, you need slightly more drive, look at the attenuator and reduce R2 a little. You can do that by connecting another resistor in parallel, for example 10 ohms.

Step8 – RF POWER ALC (software power limit)

We have included a very important new feature in the STMAX3000 series exciters, we call it RF POWER ALC, and it is basically a software power limit. There is a menu option with this name, and it lets you select the maximum power allowed. For example, you can set it to several pre-defined values, such as 50W, 300W, 500W, 1000W etc. This menu option is usually locked, to unlock it look at the LCD module board and solder a bridge across "Free". You will now be able to enter and change the RF POWER ALC setting. After changing this value, please remove the solder bridge, accidental or malicious change will allow the exciter to overdrive the amplifier which will probably result in damage. How does it work? It relies on the accurate power signal from directional coupler. After start-up the exciter will increase its drive slowly until the amplifier reaches, for example 500W. As soon as the power limit is reached the exciter will stop increasing its drive. This ensures 500W across the band without any over-driving problems. Obviously, this only works well when the directional couplers are setup properly and power readout needs to be calibrated correctly with trimmers such as the PWR trimmer on the PCS LPF 6000/7000 filter.

PERFORM STEPS 1-4 BEFORE CONNECTING AMPLIFIER/PALLET!

ALWAYS MAKE SURE OUTPUT POWER OF THE EXCITER DOES NOT EXCEED AMPLIFIER INPUT POWER!

Appendix

A

Appendix A: DIY antenna and improvement tips

Simple GP antenna design

You can build an inexpensive 1/4 wave antenna from 1 so-239 chassis mount RF connector and 5 - 3' bronze welding rods, cut to the proper length. Here is how it looks:

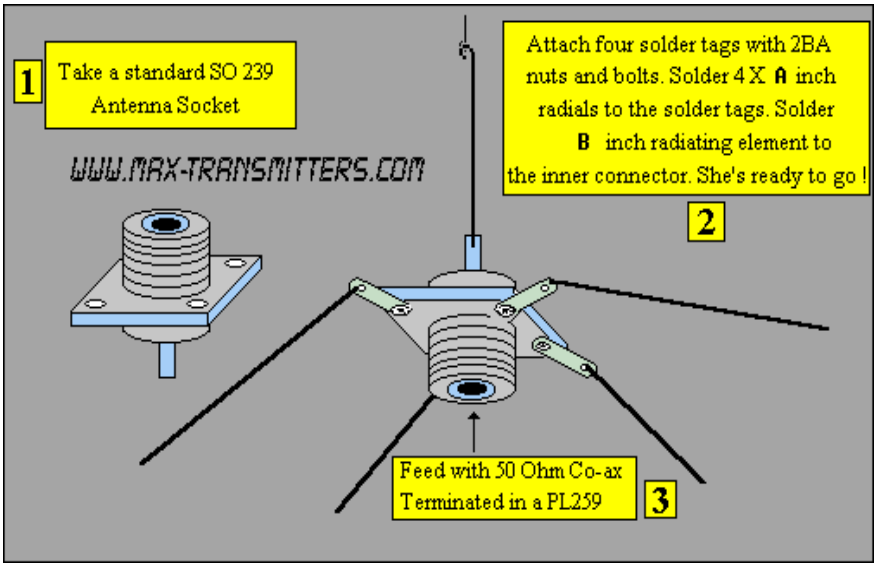


Fig. 50: »Do it yourself« GP antenna

If you have a SWR meter, leave a bit longer radiator and adjust it later by cutting to achieve minimum SWR.

Most designs on the web don't compensate for the fact that GP antennas are not wideband antennas. Here is a Freq/element length chart for this simple GP antenna, all element lengths are in millimeters:

Frequency	Radiator - B	Radials - A
108MHZ	660mm	693mm
104MHz	684mm	720mm
100MHz	713mm	749mm
90MHz	792mm	819mm

For other antenna designs check our web site here: http://www.pcs-electronics.com/guide_antenna.php

Some more improvement tips

Think about purchasing an SWR meter to tune and align your antenna. A good antenna system is extremely important and can make up for a lot of power. For a suitable SWR meter check:

http://www.pcs-electronics.com/cn101l-daiwa-power-meter-p-347.html

If you can't get much range with your homebrew antenna, have a look at these:

http://www.pcs-electronics.com/antennas-c-38.html

Still not enough range? Well, how about a 750W amplifier?

http://www.pcs-electronics.com/750w-digital-amplifier-19inch-rack-p-1295.html

Appendix

B

Appendix B: DIGIAMP connector pin out.

MAXPRO 60XX+ can read a variety of parameters from the amplifier. These parameters are shown based on signals received from the amplifier via DIGIAMP connector. Below is the pin out of the max pro 60XX+ DIGIAMP connector:

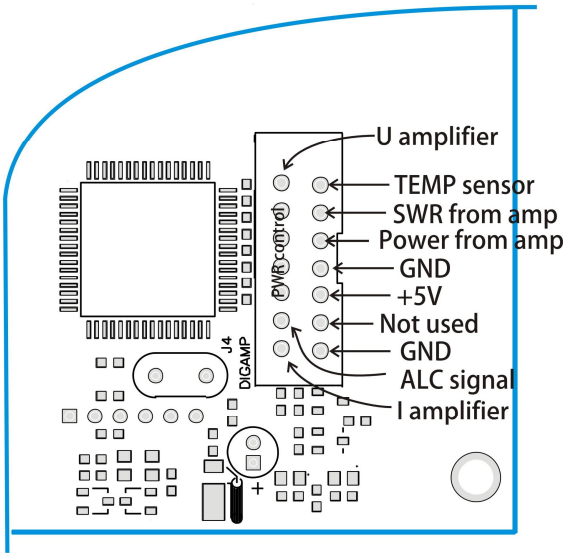


Fig. 51: DIGIAMP pin out

Below is an explanation of internal wiring for our PCS LPF 6000 filter, it shows how directional coupler is wired and how ALC is wired. You can use this to construct your own ALC circuit with another directional coupler.

TEMP sensor is a 10K NTC resistor, connected to ground. There is also 12K resistor going from this NTC resistor to +5V.

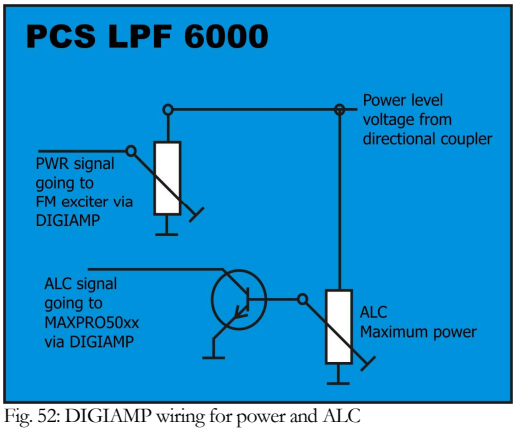


Fig. 52: DIGIAMP wiring for power and ALC

Appendix

C

Appendix C: General tips for setting up transmitters.

Typical FM transmitter setups

Below are several of the typical broadcasting systems that can be encountered worldwide.

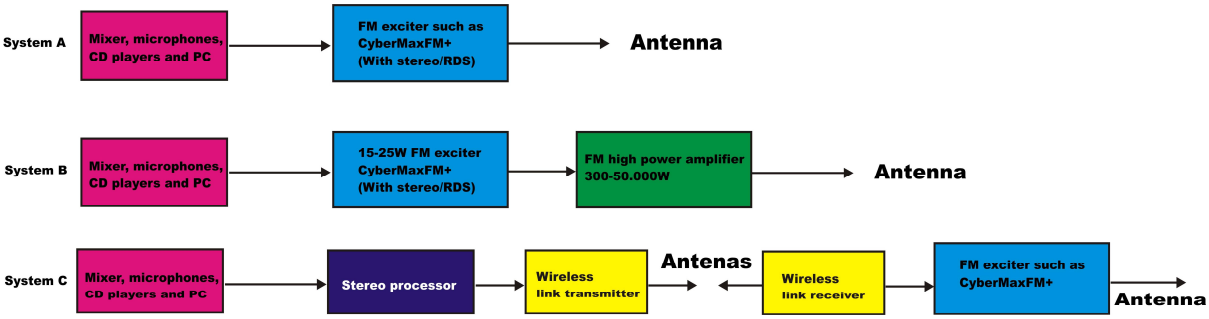


Fig. 53: Typical broadcasting systems

Let's look at **system A** first. It consists of an audio source (mixer, microphones, CD players and a PC), FM exciter with integrated RDS and stereo encoder (such as our CyberMaxFM+ units from 15W-300W) and antenna. Note antenna in this system is in the same location as the transmitter and studio, typically it would be placed on a small tower or a pole at the top of the building with studio. The disadvantage of this system is that you must keep studio, transmitter, and antenna close. Now you usually can't place a studio on the top of a mountain for practical reasons, so this limits your range. This is a typical small community radio with output powers of up to 300-500W.

System B is very similar to system A, but operators have decided to add an additional amplifier to boost the range. Such stations can go into kilowatts, but they are starting to hit another speed limit. Since the studio is typically located in a town, high RF powers aren't desirable due to interference with other services and safety regulations. So, the range is still limited compared to system C stations.

System C is radically different in one respect. Antenna and transmitter are no longer located at the same place with the studio. To accomplish these two audio channels are first combined with stereo processor. The resulting MPX signal is then passed to the STL wireless link transmitter (STL=Studio Transmitter Link). Up in the mountains is a STL wireless link receiver that receives the signal from the studio and passes I to the exciter. In this case the exciter does not need to be stereo anymore since composite MPX signal is passed to its MPX input (all mono transmitters have this input). Such exciters can than optionally drive big amplifiers with powers going into tens of KW with maximum range.

You can check our amplifiers here: http://www.pcs-electronics.com/fm-amplifiers-c-41.html

You can check our wireless STL links here: http://www.pcs-electronics.com/wireless-audio-links-c-42.html

Typical FM broadcasting antenna setups

Below are several of the typical broadcasting antenna systems that can be encountered worldwide.

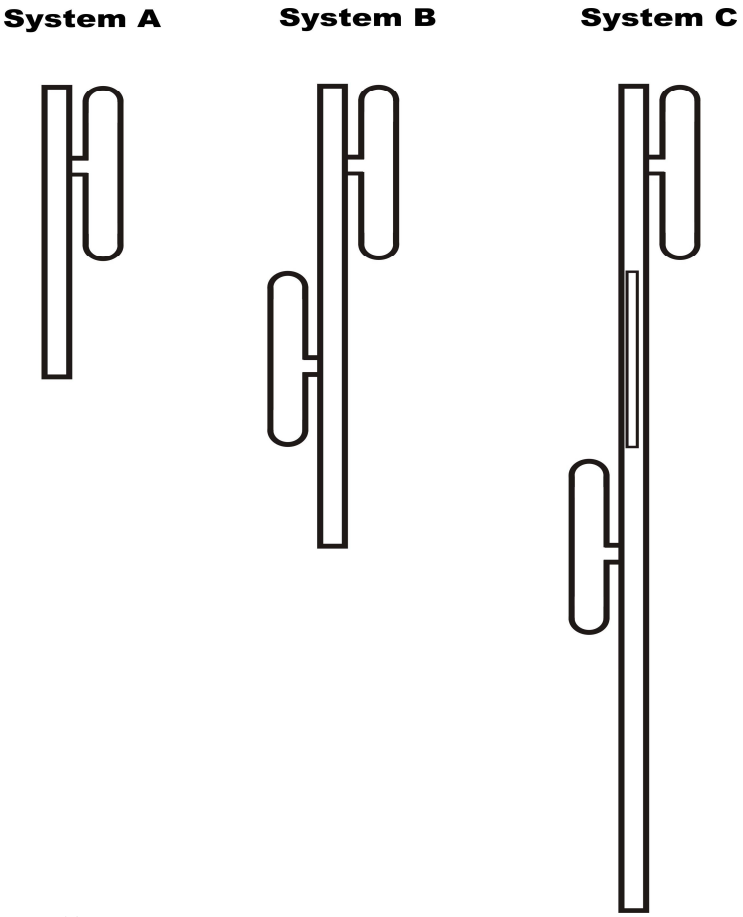


Fig. 54: Typical antenna setups

Let's look at **system A** first. It's a simple vertical dipole antenna, mounted on a pole. The gain of this antenna is 0dBd and if we assume that the coaxial cable does not have any losses the ERP of this system equals transmitter power. For example, a 1KW transmitter with this antenna system and perfect coaxial cable (losses=0) would have ERP of 1000W. The radiation pattern of this system is more-less omni-directional but since the metal pole holding the antenna blocks the signal there is a null of signal exactly on the opposite side of the pole.

System B has two simple dipole antennas mounted on a pole. The gain of this antenna is slightly less than 3dBd (due to losses in harness – splitter). If we assume that the coaxial cable does not have any losses the ERP of this system equals double transmitter power. For example, a 1KW transmitter with this antenna system and perfect coaxial cable (losses=0) would have ERP of 2000W. Note the antennas are mounted on the opposite sides of the pole to help make radiation pattern as omni-directional as possible.

System C has four simple vertical dipole antennas mounted on a pole. One of the antennas is behind the pole and is not visible. Note the antennas are mounted at an angle of 90 degrees between each other to help make radiation pattern as omni-directional as possible. The gain of this antenna is slightly less than 6dBd (due to losses in harness – splitter). If we assume that the coaxial cable does not have any losses the ERP of this system equals 4x transmitter's power. For example, a 1KW transmitter with this antenna system and perfect coaxial cable (losses=0) would have ERP of 4000W.

System C has theoretically doubled the range of the System A although in practice it takes 4-6x increase of power to double the range. 4x increase of power is equal to 6dB of gain. And you get 3dB of gain by doubling the number of dipoles. So to upgrade system C to 9dBd you'd need 8 dipoles. And for 12dBd you'd need 16 dipoles. 16 dipoles would in theory increase your range 4x compared to a single dipole. In practice there would be some losses in combining so many dipoles. You can use circular dipoles in very similar configurations.

Wiring antennas in multi-bay configurations

We have observed typical multi-dipole (called multi-bay) antenna configurations on the previous page. However, there are some things to keep in mind.

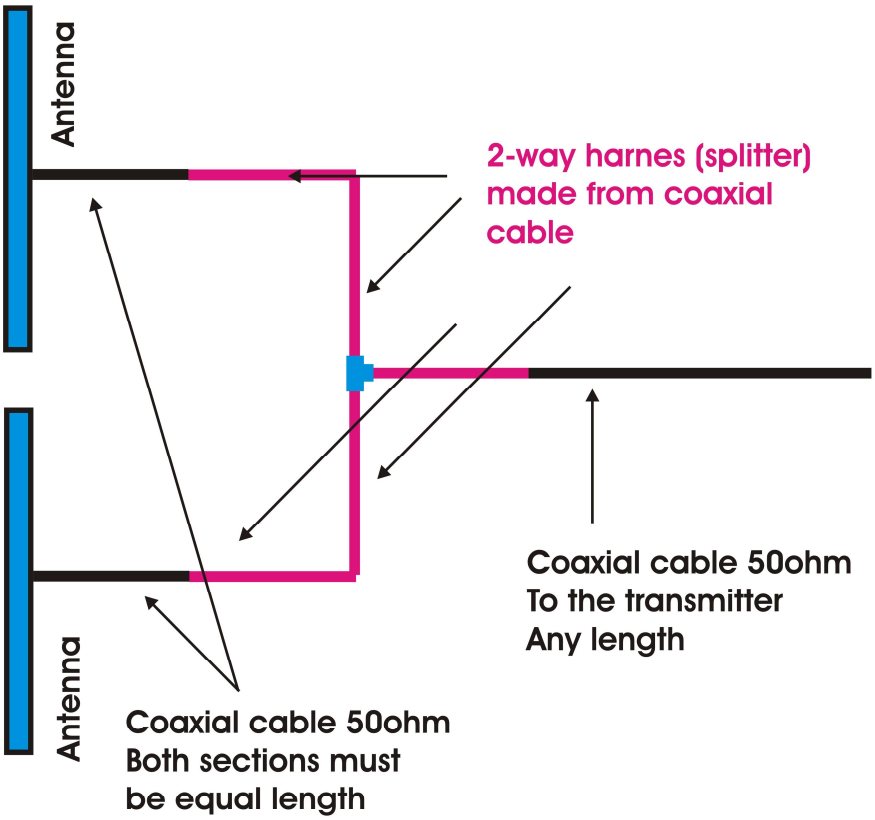


Fig. 55: Wiring multi-bay antennas.

Look at the diagram above. This is a simple system with two dipole antennas and a 2-way coaxial splitter (harness). This splitter is made from sections of coaxial cable with such impedance and length which ensure perfect match at specific frequency. Do not attempt to assemble from regular 50-ohm coaxial cable. What is important here is that the two sections of coaxial cable going from antenna to the splitter should be of exact equal length. These two sections are shown in black. The same rule applies for systems with more dipoles. It is also possible to have cables of different lengths, but you have to know the velocity factor of the cable so we have omitted this for simplicity reasons. If you want more info, please contact our technical staff.

Appendix

D

Appendix D – IO board and PC remote control

Software installation

Download the latest CyberMaxWave+ setup file from our website.

Once you have the setup file run it and install the program on your computer. This process is very straight-forward and should only take a few minutes. Wait for the installation to complete and click Finish when done.

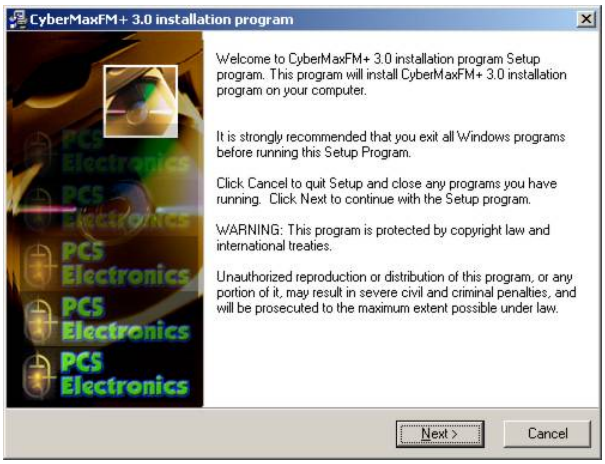


Fig. 56: Setup is about to start.

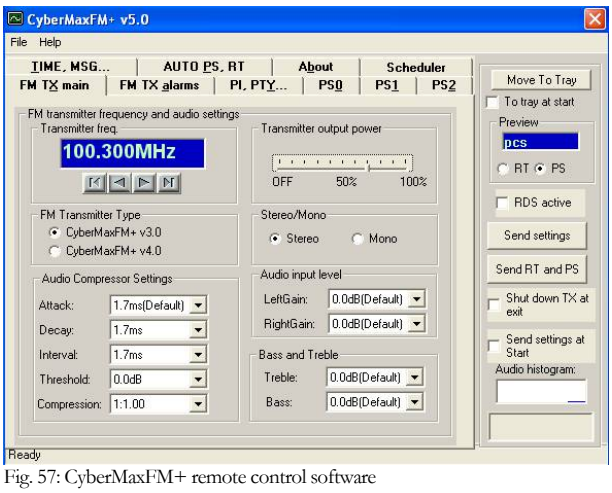


Fig. 57: CyberMaxFM+ remote control software

As you can see, this program lets you control all the parameters of your FM transmitter including RDS parameters. It also lets you read all the available information, such as output power, temperature, frequency, uptime etc. (you cannot read the RDS data, we are working on adding this functionality at some time in the future).

Once the installation is done you are ready to start the program. But before you do, please establish physical connection between the transmitter and the PC, configure the COM port and take a note of the COM port used.

Using existing COM port

If you want to use the RS232 cable to connect to the transmitter board, connect the RS232 IO board and connect the RS232 cable to your computer. In this case the COM port to be used will usually be COM1 or COM2. Please note that our CyberMaxFM transmitters usually ship with only USB port active so to use RS232 you will have to open the cover and switch to RS232 internally. 99% of people nowadays prefer USB so this is not really a problem. Modern computers don't even have COM ports.

Installing USB driver (only for USB IO board)

Download the USB COM port driver, you can find it here:

http://www.pcs-electronics.com/phpBB2/viewtopic.php?t=2505

Now run the setup file. Wait for the following screen (or very similar) to appear and select the installation directory (best left alone at default location). Click Install and wait for the installation to finish.

Fig. 58: Installing USB driver.

Configuring USB driver

In Windows go to Start > Settings > Control Panel > System > Hardware tab > Device Manager (This can vary depending on your Windows version). You should have something like this on your screen at this point:

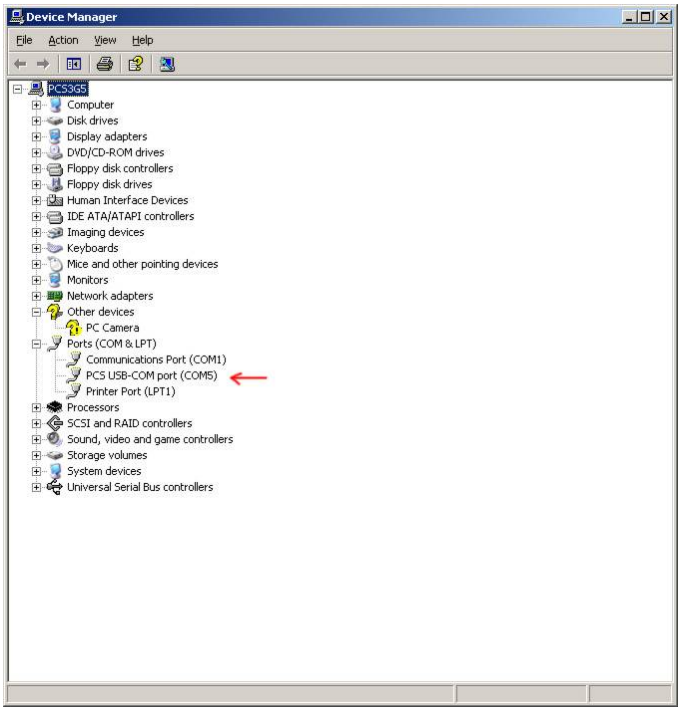


Fig. 59: Configuring Com port for USB driver.

Take note of the COM port number here, you will need it later to configure the COM port inside CyberMaxFM+ windows control program. If you wish to change this port right, click on the PCS USB-COM port and select Properties. Now select the Port settings tab and click Advanced. Note you can set the COM port number as you wish:

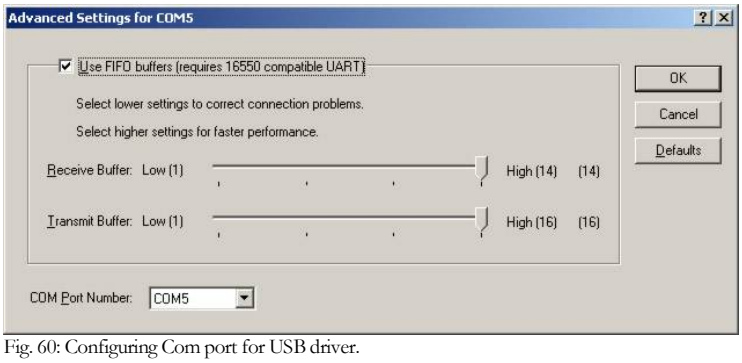


Fig. 60: Configuring Com port for USB driver.

Setting up com port in CyberMaxFM+ program

The only setup required is minimal. Start the CyberMaxFM+ program, the icon should now be on the desktop. Now click File and Setup. The following window will open. You can set COM port manually or you can use the Autoscan feature. Make sure to set FM Transmitter type correctly (4.0 for new versions of MAXPRO6000 series) and make sure the exciter board is turned on! A short guide for manual settings: read above and make note of the used COM port. If you are using USB it will usually be COM5, when using RS232 it will usually be COM1 or 2. You can use the Communication test tool to verify the selected COM port.

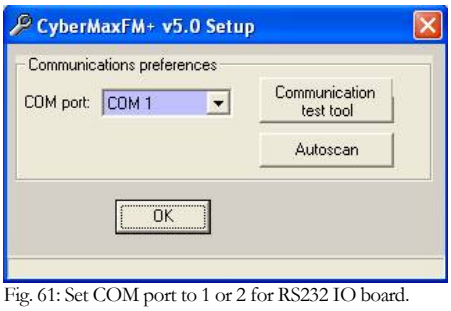


Fig. 61: Set COM port to 1 or 2 for RS232 IO board.

Appendix

E

Appendix E – Setting up remote control via Ethernet

Software installation

Download the latest EthernetVirtualPort.exe from our website. You can find it here:

http://www.pcs-electronics.com/phpBB2/viewtopic.php?t=2268

Once you have the driver run the setup file and install the program on your computer. This process is very straight-forward and should only take a few minutes. Wait for the installation to complete and then start the program.

Connect the MAXPRO6000 series exciter or CYBERMAXFM+ FM transmitter (which contains this exciter board) to your network via Ethernet cable (cable not included). The Ethernet adapter is set up to accept IP from your router's DHCP server. It is possible to set up Ethernet adapter with fixed IP or to login directly to ADSL modem. If you need MAC address of the Ethernet adapter open the cover of the unit and look at the Ethernet adapter, the MAC address is shown on the adapter. Now create and configure a connection between the PC and CYBERMAXFM+ as shown below. Note the IP will differ, but make sure the port is set to 5005!

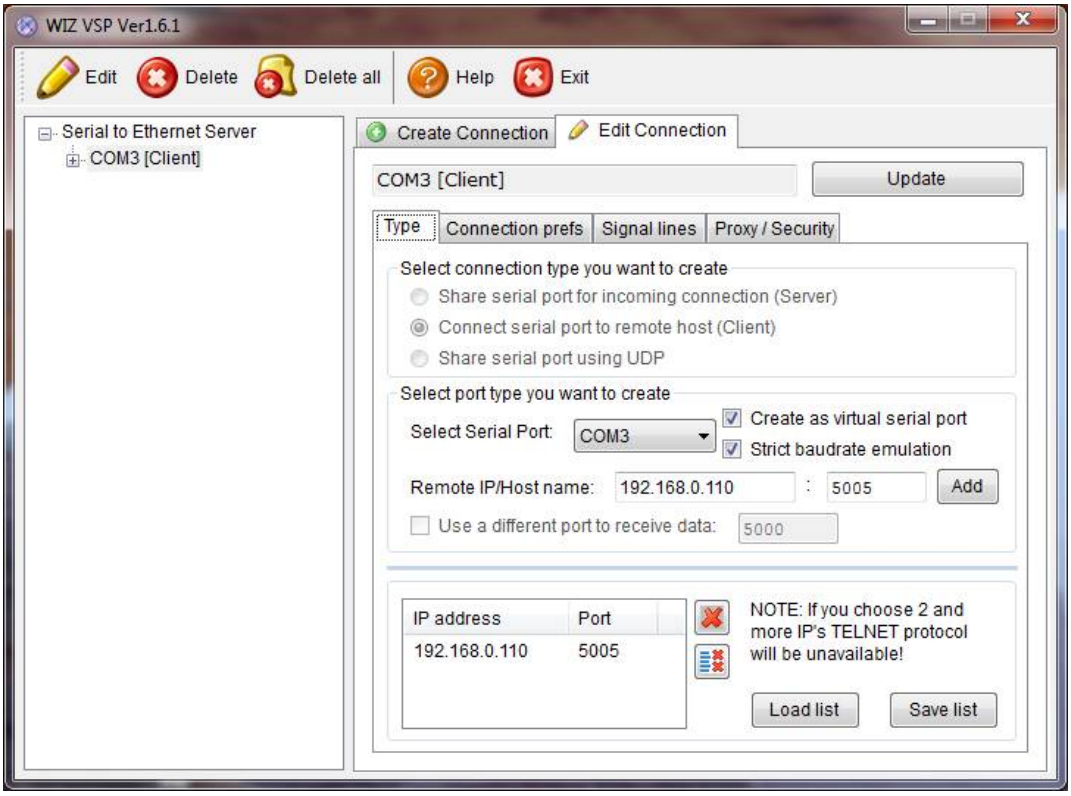


Fig. 62: Setting up Ethernet connection for CYBERMAXFM+, screen 1.

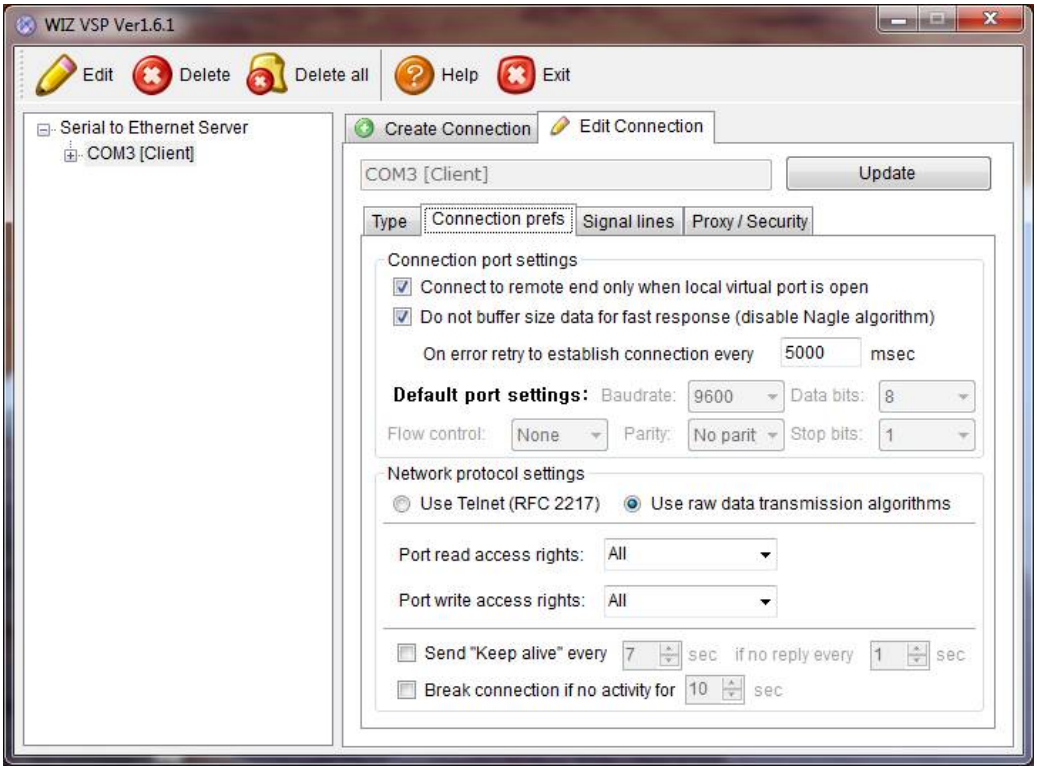


Fig. 63: Setting up Ethernet connection for CYBERMAXFM+, screen 2.

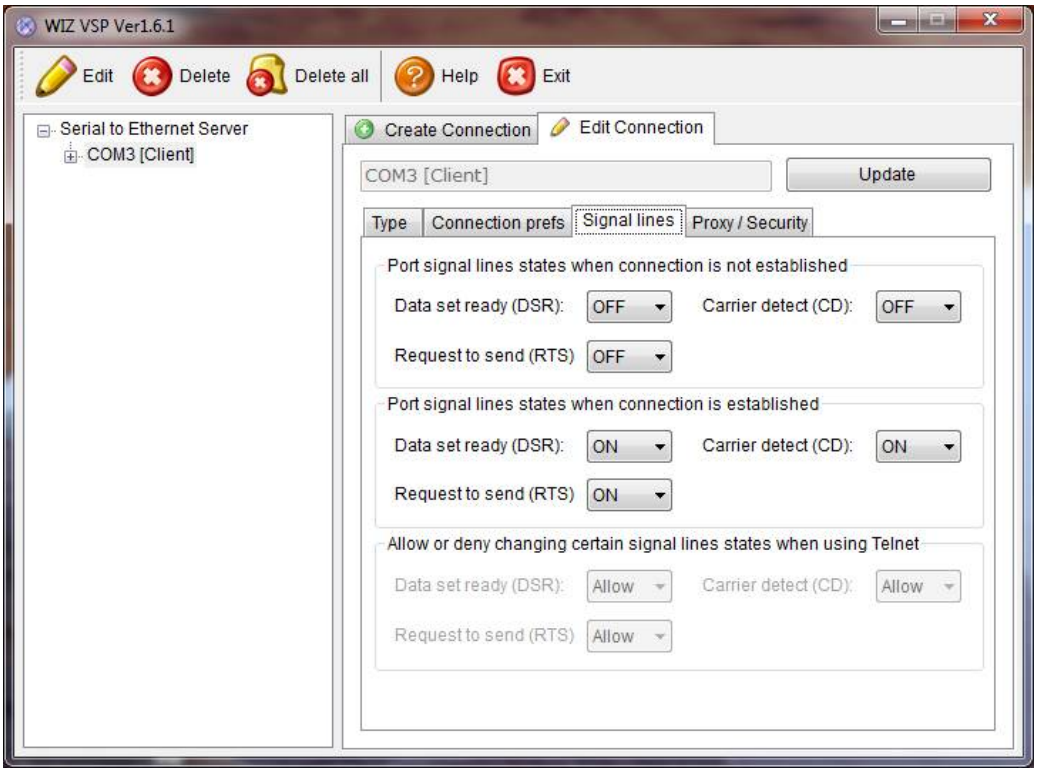


Fig. 64: Setting up Ethernet connection for CYBERMAXFM+, screen 3.

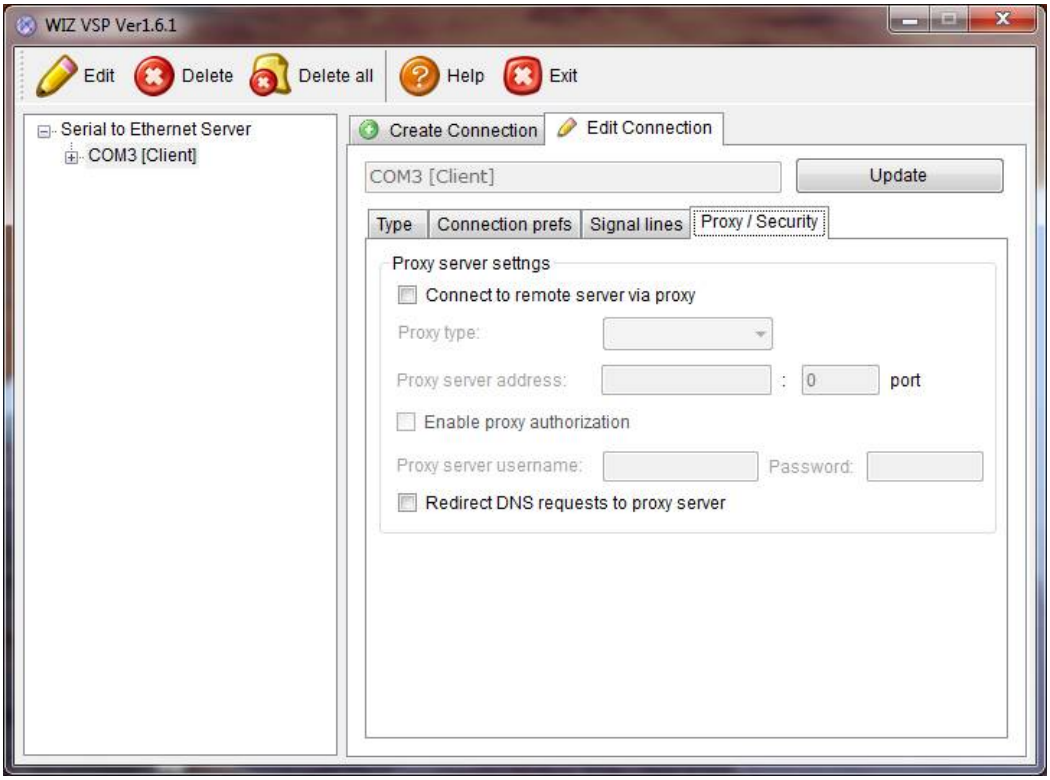


Fig. 65: Setting up Ethernet connection for CYBERMAXFM+, screen 4.

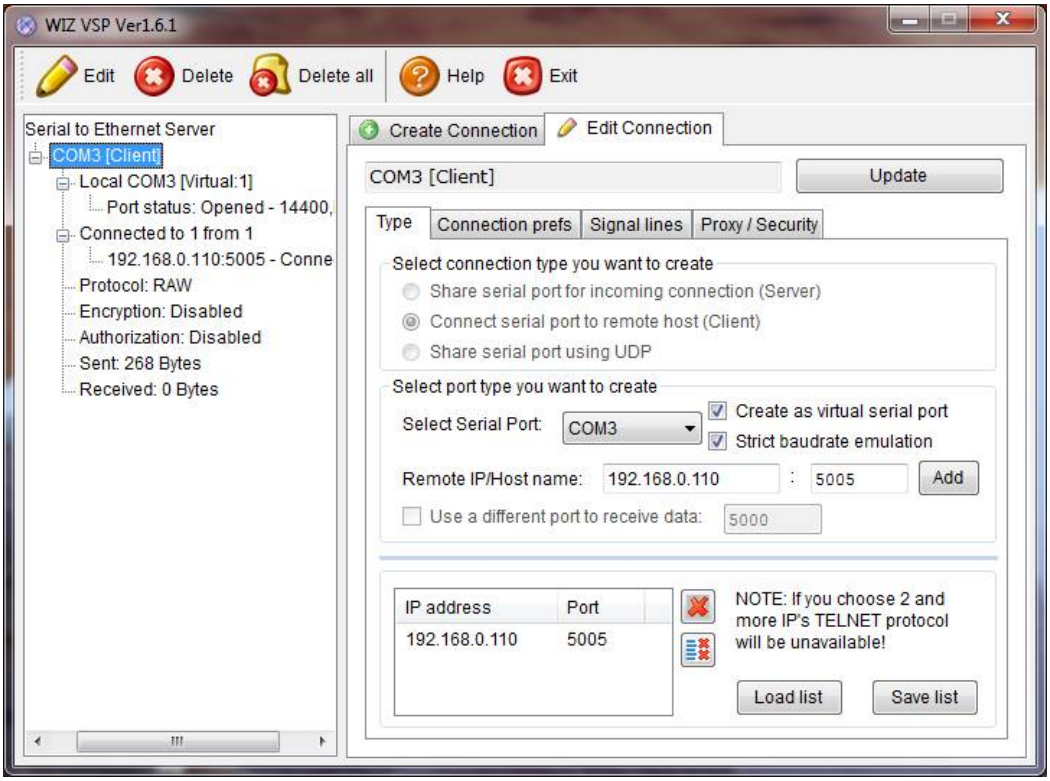


Fig. 66: Setting up Ethernet connection for CYBERMAXFM+, overview.

Appendix

F

Appendix F: Communication protocol explanation

If you are one of the many interested in developing your own remote-control application, look no further. The entire protocol will be explained here in detail. If you want our sample VB application do drop us an email and explain what you are trying to do, we will probably be able to supply you with the source code.

Baud rate and COM port

Communication with CyberMaxFM+ uses RS232 serial protocol even when used with USB. The supported speed is 9600 baud.

A simple VB code would look like this:

```
MSComm1.Settings = "9600,N,8,1"
MSComm1.InputLen = 0
MSComm1.PortOpen = True
```

General Command Format

This is the format of a typical command sent to the RDSMAX encoder:
<StartByte>Command<EndCommandByte>Value<EndByte>

<StartByte>: Signals start of new incoming command/parameter
The hey/binary value of this byte is 0x00 (0b00000000).
VB basic example: MSComm1.Output = Chr$(0) 'Start (0)

Command: Command/parameter that you wish to send to the encoder
Simply send the command/parameter in ASCII form.
VB basic example: MSComm1.Output = "TA"

<EndCommandByte>: Signals end of the new incoming command, tells encoder to expect incoming command/parameter value
The hey/binary value of this byte is 0x01 (0b00000001).
VB basic example: MSComm1.Output = Chr$(1) 'End Command start of value(1)

Value: Command/parameter value that you wish to send to the encoder
The method varies a bit from parameter to parameter, but usually you can simply send the command/parameter value in ASCII form. Check each parameter individually for correct setting.
VB basic example: MSComm1.Output = "1" 'sets TA to ON

<EndByte>: Signals the end of complete incoming command including command/parameter value, it tells encoder to process the received data
VB basic example: MSComm1.Output = Chr$(2) 'End Command and value

PS (RDS parameters)

This is the most interesting feature for 99% of customers out there so we will dedicate a bit more time to it. RDS standard provides for a 8-character PS string which is used to identify radio stations and is displayed by RDS-enabled radio receivers. Some countries prohibit changing this text dynamically, but others don't. Whatever your decision may be, RDSMAX supports either static or dynamic PS. It is best to check with the local authorities before setting up the RDS encoder.
The mechanism for handling dynamic (or static) PS text is best demonstrated by the following example:

Imagine a train traveling in a round trip involving 100 train stations. The train starts on station 00 (PS00) and goes through stations 01, 02…. until it passes through station 99 and finally returns to station 00. Every time a train stops at the station it sends the message back to the headquarters (PS text shown on RDS receiver). The amount of time the train stays at the station (delay – PD00 to PD99) varies and can be from 0 minutes (train does not stop) to 9 minutes. I hope this little analogy has illustrated the process. You have 100 8-character strings (PS00 to PS99) which are displayed one after the other until the entire loop repeats itself. You can define how long each of these strings is displayed; the parameter which defines this is PD (PD00 to PD99).

Example: If you wish to just have one static PS, set all delays to 0 and set just PD00 to 1. Then set PS00 to desired static PS which will be displayed indefinitely.

General Command Format
This is the format of a PS00 command, which sets PS00 to **TEST**:
<StartByte>PS00<EndCommandByte>TEST**<EndByte>**

VB basic example:
```
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "PS00"
MSComm1.Output = Chr$(1)   'End Command start of value(1)
MSComm1.Output = "**TEST**"
MSComm1.Output = Chr$(2)   'End Command and value
```

This is the format of a PD00 command, which sets PD00 to 5:
<StartByte>PD00<EndCommandByte>5<EndByte>

VB basic example:
```
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "PD00"
MSComm1.Output = Chr$(1)   'End Command start of value(1)
MSComm1.Output = "5"
MSComm1.Output = Chr$(2)   'End Command and value
```

It is recommended to put a short delay of 10ms after sending of each data packet. So the example above becomes:

```
MSComm1.Output = Chr$(0)   'Start (0)
Sleep 10
MSComm1.Output = "PD00"
Sleep 10
MSComm1.Output = Chr$(1)   'End Command start of value(1)
Sleep 10
MSComm1.Output = "5"
Sleep 10
MSComm1.Output = Chr$(2)   'End Command and value
Sleep 10
```

RT (RDS parameters)
This is another popular feature, RDS allows for 64-character text string to be displayed on the receiver. However, this feature is rarely used as you need to press a button to display it (PS is always displayed by default). Another "nail in RTs' coffin" is the fact that typical receiver only displays a maximum of 8-characters at a time meaning the message needs to be scrolled. However popular or unpopular it may be, we support it.

General Command Format
This is the format of a PS00 command, which sets PS00 to **TEST**:
<StartByte>RT<EndCommandByte>THIS IS A TEST OF RADIO TEXT FEATURE**<EndByte>**

VB basic example:
```
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "RT"
```

```
MSComm1.Output = Chr$(1)   'End Command start of value(1)
MSComm1.Output = "**THIS IS A TEST OF RADIO TEXT FEATURE**"
MSComm1.Output = Chr$(2)   'End Command and value
```

Format descriptions for the other supported parameters:

```
'Sending TP (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "TP"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(TP)
temp = LTrim(temp)
MSComm1.Output = temp

'Sending STEREO/MONO status (FM transmitter parameter)
MSComm1.Output = Chr$(0)    'Start (0)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FS"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(TXStereo)
temp = LTrim(temp)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending RDS active (PWR) (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "PWR"    'Program reference, lower byte of PI
MSComm1.Output = Chr$(1)   'End command and start of data (1)
If Check1.Value = 1 Then
temp = "1"            'turn RDS on
Else
temp = "0"            'turn RDS off
End If
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finished transmission

'Sending CCAC  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "CCAC"    'Program reference, lower byte of PI
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(CountryCode * 16 + AreaCoverage)
temp = LTrim(temp)
If Len(temp) = 2 Then temp = "0" & temp
If Len(temp) = 1 Then temp = "00" & temp
If Len(temp) = 0 Then temp = "000"
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finished transmission

'Sending ProgReference  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "PREF"    'Program reference, lower byte of PI
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(ProgramReference)
temp = LTrim(temp)
If Len(temp) = 2 Then temp = "0" & temp
If Len(temp) = 1 Then temp = "00" & temp
If Len(temp) = 0 Then temp = "000"
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finished transmission

'Sending PTY  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "PTY"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(PTY)
temp = LTrim(temp)
If Len(temp) = 1 Then temp = "0" & temp
If Len(temp) = 0 Then temp = "00"
MSComm1.Output = temp

'Sending TP  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "TP"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(TP)
```

```
temp = LTrim(temp)
MSComm1.Output = temp

'Sending TA  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "TA"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(TA)
temp = LTrim(temp)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending MS  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "MS"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(MS)
temp = LTrim(temp)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending Did0  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "Did0"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Str$(DId0)
temp = LTrim(temp)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending AF0 (af number) (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "AF0"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Chr$(AFNum + 224 + 4)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending AF1  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "AF1"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Chr$(AF1 + 4)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending RT  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "RT"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = RT & Chr$(13) & Chr$(13) & String(64, Chr(13))
If Len(temp) > 64 Then temp = Left(temp, 64)
MSComm1.Output = temp   'RT
MSComm1.Output = Chr$(2)   'Finish command

'Send PS  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "PS00"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = "your text"
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending ECC  (RDS parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "ECC"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Chr$(ECC + 4)
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending RF POWER status  (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FO"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
```

```
If Option25(13).Value = True Then
temp = Chr$((Int(TXPower / 100 * 34)) + 4)
Else
temp = Chr$((Int(TXPower / 100 * 44)) + 4)
End If
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending Frequency (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FF"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = Chr$((Int(TXFrequency / 5) - Int(Int(TXFrequency / 5) / 128) * 128) + 4) 'low part of freq
temp = temp & Chr$((Int(Int(TXFrequency / 5) / 128)) + 4) 'high part of freq
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings – Treble (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDT"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Treble + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings – Bass (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDB"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Bass + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings – Attack (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
                                                    MSComm1.Output = "FDA"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Attack + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings – Decay (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDD"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Decay + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings - Threshold
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDH"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Threshold + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings – Compression (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDC"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Compression + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings – Integration (FM transmitter parameter)
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDI"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(Integration + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings - LeftGain
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FDGL"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(LeftGain + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending DSP settings - RightGain
MSComm1.Output = Chr$(0)   'Start (0)
```

```
MSComm1.Output = "FDGR"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(RightGain + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending settings - TEMP alarm
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FAT"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(TEMPAlarm + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending settings - SWR alarm
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FAS"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(SWRAlarm + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending settings - Uamp alarm
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FAU"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(UampAlarm + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending settings - Iamp alarm
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FAC"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
MSComm1.Output = Chr$(IampAlarm + 4)
MSComm1.Output = Chr$(2)   'Finish command

'Sending Store command, commits changes
MSComm1.Output = Chr$(0)   'Start (0)
MSComm1.Output = "FW"
MSComm1.Output = Chr$(1)   'End command and start of data (1)
temp = 0
MSComm1.Output = temp
MSComm1.Output = Chr$(2)   'Finish command
```

Appendix

G

Appendix G – Warranty and legal info

Important notice!

Please remember to turn off the transmitter/amplifier when not in use! This goes especially for high powered transmitters. Remember that anything you broadcast through the transmitter can be heard by anyone tuning in to that frequency. Although it is unlikely certain weather conditions may allow the signal to go further than your immediate listening area so please don't broadcast anything you don't mind anyone else hearing.

Warranty and servicing!

Within one (1) year of receiving your order, if any product proves to be defective; please contact us via e-mail or our feedback form. Please DO NOT ship the product back to us without contacting us first and receiving return instructions. After we receive the defective merchandise, we will test it, if need be, and we will ship back to you a non-defective replacement product. Please note that this doesn't cover the final RF transistor as it can be damaged by using defective or poorly matched antenna. An exception is any mishandling or abuse by the customer as well. If the product is defective, you will receive a replacement. If you choose to return the defective item, rather than replace it, we will charge a 20% restocking fee and your original shipping and handling charges will not be refunded. The return of the product is at your expense. We believe that this is a fair policy because lower overhead results in lower prices for all our customers.

Legal info

It may be illegal to operate this device in your county. Please consult local authorities before using our products! PCS Elektronik d.o.o. is not responsible for any damage to your PC arising from use of this product and will not be held responsible for any violation of local laws pertaining to the use of this product. It is entirely your responsibility that you make sure you operate in accordance with local laws and/or regulations.

Limitation of liability

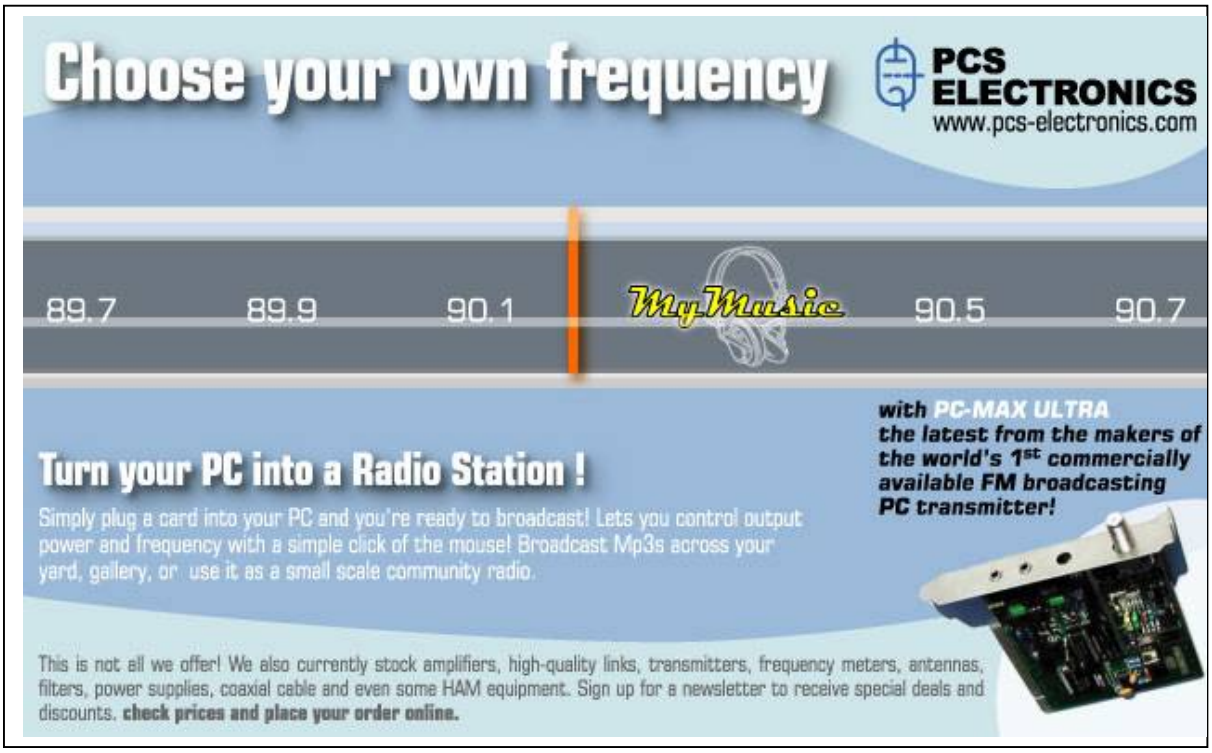
To the law, in no event shall PCS Elektronik d.o.o. or its suppliers be liable for any special, incidental, indirect, or consequential damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or any other pecuniary loss) arising out of the use of or inability to use the PRODUCT, even if PCS Elektronik d.o.o. has been advised of the possibility of such damages. In any case, PCS Elektronik d.o.o.´s entire liability under any provision of this agreement shall be limited to the greater of the amount actually paid by you for the PRODUCT or U.S. $5.00; because some states and jurisdictions do not allow the exclusion or limitation of liability, the above limitation may not apply to you.

Also available from www.pcs-electronics.com

We also carry a big range of:

- FM transmitters in assembled and KIT form
- TV transmitters in assembled and KIT form, VHF and UHF
- AM transmitters with extremely clear modulation (PWM design)
- Various accessories for professional and hobby FM radio stations
- A large assortment of hard to obtain RF components (RF transistors; MRF, 2SC, coils, silver plated wire, coaxial cable, capacitors, quartz crystals and many others)
- PC based FM transmitters (PCI MAX pc-based FM transmitter turns your PC into a radio station)
- Many beginners guides to get you started
- A large selection of free schematics is available as well at our website.

If you can't get much range with your homebrew antenna, have a look at these: http://www.pcs-electronics.com



Revisions and errata

V1.1 (May,2023): 1st update

Please report any errors you see in this manual; you will be helping us and many other users out there. Thank you!

Index