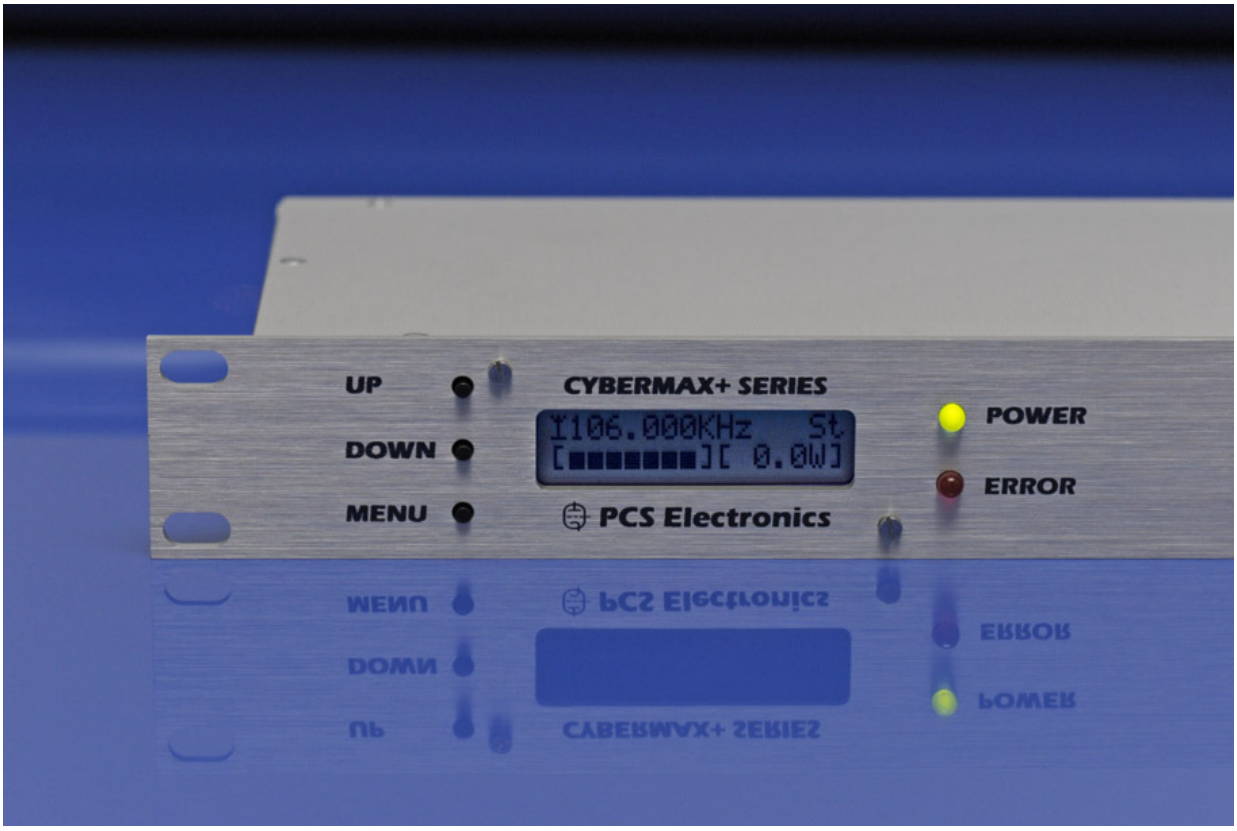

CyberMax FM+ 15W DSP/RDS

High performance FM radio broadcasting exciter

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 a proof.

- Mains cable is typically not included with our mains power supplies and units. Since these cables vary from country to country and we had trouble finding the exact type we decided against including them, especially since finding them is so easy and cheap locally. They 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.

- Study local regulations and ensure you are operating in compliance.

- Do not open the unit or attempt service yourself. Deadly mains voltage is present inside. There are also high RF voltage points that can cause burns and discomfort if touched.

- Finally, never ever operate any transmitter or amplifier without a properly tuned antenna!

Table of Contents

Chapter

1

Introducing CYBERMAX FM+ series of transmitters

Our series of rack mounted stereo FM radio transmitters with optional RDS and DSP processing

This manual covers our 15W CYBERMAX FM+ transmitters. Even though the design of these units evolved radically over the years transmitters from this series remain one of our best selling items. Today our customers still enjoy the incredible price/performance ratio and more reliability, power and features than ever before. In this manual you will find all of its little exciting secrets.

What makes this FM transmitter series so great?

Besides offering all the standard basic features these units also display a number of useful parameters on the LCD display: transmitted power, reflected power, exciter temperature, exciter voltage, frequency, audio modulation level, amplifier voltage and amplifier temperature. They are available in mono (MPX input) and stereo (with regular or DSP stereo encoder). RDS (Radio Data System) is also available. Of course this unit is completely no-tune and works either from car battery (12-15V) or with our universal mains power supply which works worldwide.

Comfortably sized 1H 19" rack enclosure offers easy access to all internal components and assures good ventilation. A number of protection circuits helps prevent disasters. Temperature and SWR are monitored by on-board computer and alarm threshold can be set via LCD module. Hardware fold back SWR protection is also built-in as a backup. Unit is rugged and made for 24/7/365 operation. In our opinion the best quality/price ratio possible.

General features:

- True wideband no-tune operation (no tuning required to make it work, just set the frequency and antenna)
- Covering entire FM broadcasting band with clean signal and great sounding audio
- Built-in SWR and TEMP protection for peace of mind
- High power (12-15W typ, 20W max) from either mains power or battery (12-15V), perfect for mobile or solar powered installations.
- Digital output power adjustment (with up/down keys)
- Both DSP and analog models have extremely sharp audio filters
- DSP model offers complete control over audio parameters via LCD menu system
- Optional high-performance RDS encoder with scrolling PS and many other features.

Technical specifications:

RF section:
- Frequency range: 87.5-108MHz and 76-90MHz in Japanese band mode (reduced output power below 87.5MHz)
- RF Output Power: 0 to 15 Watts (20W max, 12-15W typ, digitally adjustable with UP/DOWN keys)
- Output connector: BNC (N and SO239 adapters freely available)
- Output Impedance: 50 Ohms
- PLL steps: 5KHz (10/25/50/100/200KHz adjustable via lcd)
- Frequency stability: +/- 20Hz
- Spurious/Harmonic rejection: Harmonics: >50dB, Spurious: -90dB
- RF output ruggedness: SWR protection, TEMP protection, reduced power with LCD warning and RED LED
- Quartz locked PLL frequency control, ultra stable & clean output
- S/N ratio: >90 dB
- No expensive test equipment required to setup

Audio section:
- Audio performance: Less than 0.2% distortion, 20Hz-75KHz
- Pre-emphasis, 50uS, 75uS or none selectable
- Audio Input Level: 0 dB
- Stereo separation: > 50dB
- Audio low pass filter with 19KHz notch filter: Yes, all models
- Audio input impedance: 10Kohms balanced, 1Kohms unbalanced
- Limiter: Yes, all models
- Pre-emphasis: Yes, precision 50uS, 75uS or none for all models
- DSP: Yes, in DSP models

General:
- Power supply: 11-15V/2.5A or car battery (does not require 15V for full power)
- Power jack: 2.1mm power socket, center (+), polarity protection (diode + fuse)
- LCD display shows: Power, reflected power, frequency, temperature, supply voltage, modulation level and uptime counter
- Optional AC mains power: 110-240V 50/60Hz universal, works anywhere on this planet
- Ambient temperature: -5° to +45°C
- External dimensions (W x D x H) 19" x depth (130mm) x height 1HE (44mm)
- Weight 1kg

Thank you for purchasing CyberMaxFM+ transmitter

We hope you will enjoy it as much as we do and if you do remember to tell your friends and colleagues about it. Please feel free to leave your comments at our website or post your experience in our forum. And if you encounter a problem please let us know so that we may improve our products, offer advice and suggestion. From all of us we wish you happy broadcasting!

Your PCS Electronics team

Chapter 2

Front and back panel layout

Fig. 1: Front panel

Reference	Function
1	Three push buttons, the UP, DOWN and MENU keys.
2	LCD display that lets you control the unit and monitor various parameters.
3	The green led. Green signals power is ON.
4	Red error led. Turns on while VCO is tuning into selected frequency and in case of SWR or TEMP error.
5	Power switch in the middle of the panel is actually a standby switch. To really disconnect the unit from mains power use the main switch at the back.

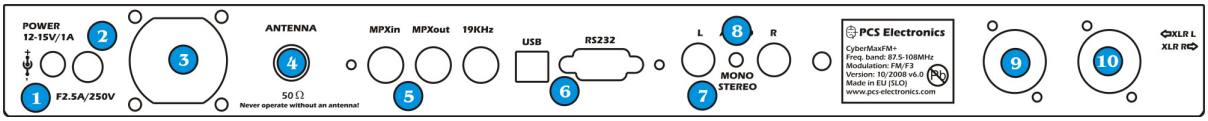

Fig. 2: Back panel

Reference	Function
1	Power jack, center is positive. 12-15V DC, 2.5A
2	Fuse, F3A/250V
3	Ventilation aperture
4	Antenna connector, BNC. Do not operate without antenna.
5	BNC connectors for MPXin, MPXout and 19KHz pilot.
6	RS232/USB for controlling your RDS encoder.
7	Audio inputs, RCA jacks for left and right channel
8	STEREO mode indicator.
9, 10	Balanced audio inputs, left and right channel XLR (Canon)

Chapter 3

What's inside the box?

CyberMaxFM+ 15W units are available in several configurations. Exact internal configuration depends on the particular model. Since we sometimes change configurations it is best to check our website for latest information. Below are the basic building blocks of the exciter. Note that the RDS encoder is optional and only available in models with RDS capability. Similarly DSP encoder is only available in DSP capable models. We are now going to have a look at these building blocks one at a time:

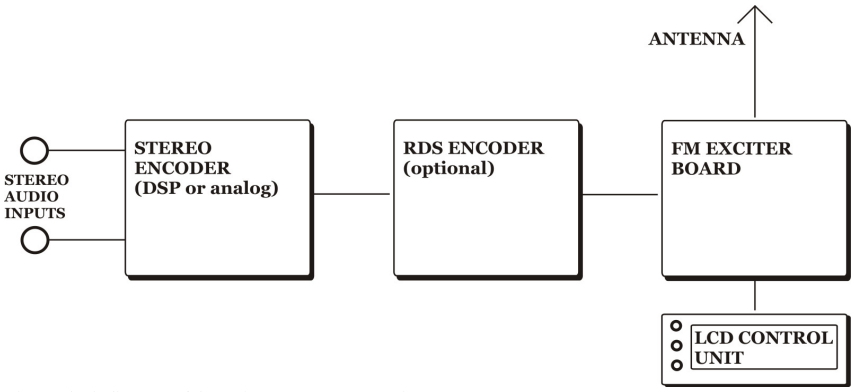

Fig. 3: Block diagram of the CyberMaxFM+ transmitter

FM Exciter board

15W CyberMaxFM+ units utilize our MAX PRO series FM exciters

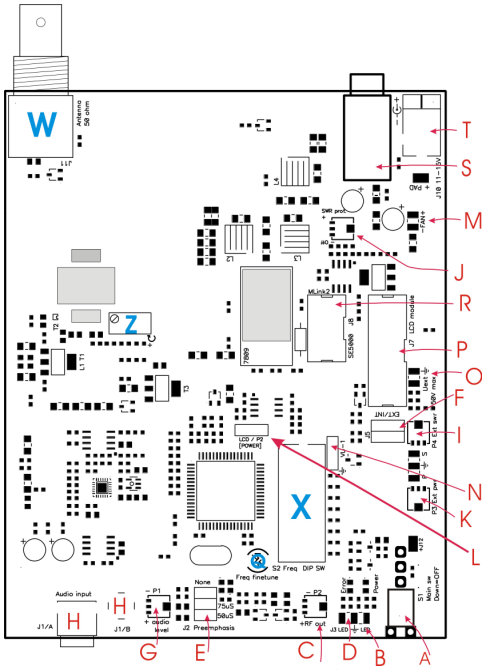

Fig. 4: MAXPRO3000+ FM exciter board layout

Ref	Function
A	On-OFF switch
E	Pre-emphasis. For mono operation set to OFF
G	Modulation level
H	Audio input
R	6-pin header to the stereo encoder
P	14-pin header to the LCD module
J	LCD power meter accuracy
M	FAN power pads
S	Fuse, F3A250
T	Power supply, (+) center, 12-15V/3A stabilized
W	Antenna connector, BNC

Stereo encoder board

15W CyberMaxFM+ units utilize our SE5000 DSP+ and SE3000 AN+ stereo encoders

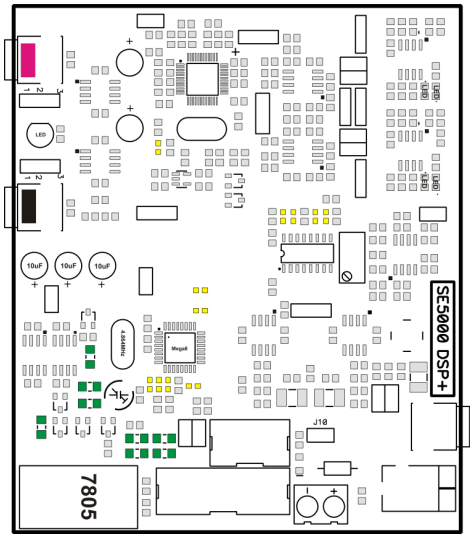

Fig. 5: SE5000 DSP+ stereo encoder board layout

Ref	Function
J1-2	Audio Inputs
J3-4	Pre-emphasis selection
J7	MPX out, going to FM exciter audio input
J10	Mode select, don't install in this configuration
J11	Maxlink 6-pin cable going to MAX PRO 3000+ exciter
J12	Install to reduce pilot level slightly
J14	Stereo/mono selection, do not install jumper here

RDS encoder board

15W CyberMaxFM+ units utilize our RDS MAX 4000+ and RDSMAX4000+ mini RDS encoders

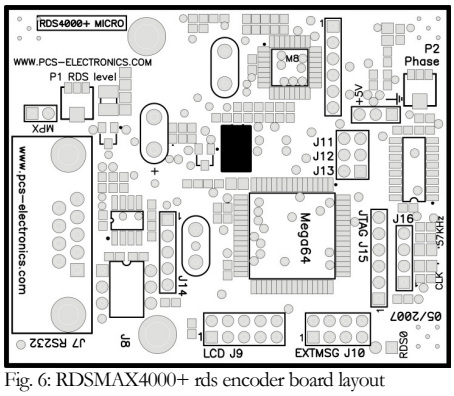

Fig. 6: RDSMAX4000+ rds encoder board layout

Ref	Function
P1	RDS level
P2	RDS carrier phase relationship to stereo pilot
J11-13	Baud speed selection, leave at default
CLK	RDS clock led, should blink at around 1Hz
57KHz	PLL lock led, should be off in stereo mode

Where can I find more info?

Separate extensive manuals for all of the built-in components are available on our website. We have a section in our forum dedicated to all of the manuals and you can discuss each of the manuals with other forum members here:

http://www.pcs-electronics.com/phpBB2/viewforum.php?f=33

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 located 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 making adjustments. 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 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 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 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, too.

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 hazard 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 ohm 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 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 H500 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.

Mains power supply and mains power cable

Do not underestimate the importance of mains power supply, despite 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 2 amps 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, if you use less than 15V this effectively lowers your output power. The lower the supply voltage the lower the power.

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.

Chapter

5

Wiring everything together

Wiring things up and first power-up

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

- 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 one 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 power switch is off connect mains power cable into the mains power supply and connect mains power supply into the back of the transmitter.

- 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 mute since you did not connect any audio sources yet.

- Observe SWR and output power. If everything seems ok enter <RF power> menu on your amplifier again. Increase power to full.

- You can now connect audio sources of choice and verify audio performance. You should not sound louder than other stations, in fact unless you have an expensive high performance software or hardware sound processor you should sound quieter than other stations.

Chapter

6

Using the CyberMaxFM+ series transmitter

Basically there are three push-buttons available for the menu system; **UP**, **DOWN** and **MENU**. By pushing **UP** or **DOWN** you get 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 setup many of the options and DSP functions of this unit.

Lcd control module menu system: Power and DSP functions

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>, <STEREO MODE>, <VIEW SELECT>, <TREBLE>, <BASS>, <COMPRESSION>, <THRESHOLD>, <ATTACK>, <DECAY>, <INTEGRATION>, <LCD CONTRAST>, <RIGHT CH VOL>, <LEFT CH VOL>, <PLL STEP>, <RF EQ>, <FIRMWARE VER>, <PWR/SWR METER>, <TEMP ALARM>, <SWR ALARM>, <BAND SELECT>, and <RF AMP CONTROL>. 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

Simply press the UP/DOWN button to change frequency. Depending on PLL STEP setting your frequency will go down in 5/10/25/50/100/200KHz steps. If you keep pressing a key for a while the PLL STEP switches to fast tuning mode and jumps in 500KHz steps.

Note: Frequency changes also when you select a view type which does not show frequency, such as UPTIME.

<RF POWER>

This setting allows you to set output power. Select desired power with the UP/DOWN keys and press MENU key to exit the menu system and return to normal operation. 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 same amount of gas pedal. Likewise here your supply voltage can affect the actual output power slightly.

<STEREO MODE>

You can set your transmitter to MONO or STEREO here.

<VIEW SELECT>

CyberMaxFM+ is capable of displaying a number of various parameters. Since the LCD real-estate is limited to 2x16 characters we prepared a number of 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+Mode+Te+Ue] – This view shows frequency, mono/stereo mode, exciter temperature and exciter supply voltage

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

- [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 than 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 have to wait a few seconds for the view to change.

<TREBLE> and <BASS>

This option allows you to set the amount of TREBLE and BASS in your audio. Recommended values are marked with (D).

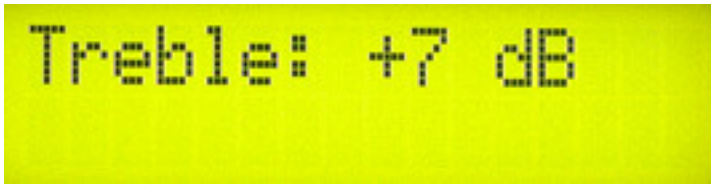

Fig. 7: Setting treble

Compressor Settings

A number of MENU settings control the operation of the compressor. Lets 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.

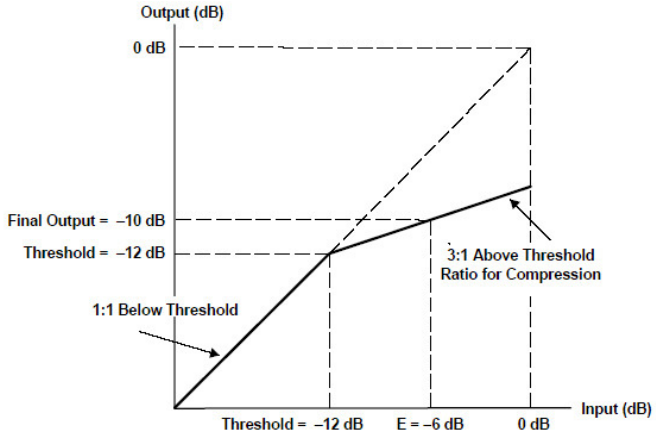

Fig. 8: Explanation of the compressor settings

Fig. 9: Setting the compression level

Fig. 10: Setting the compression threshold

Fig. 11: Setting the attack time, this is the time between the input signal and the actual response of the compressor

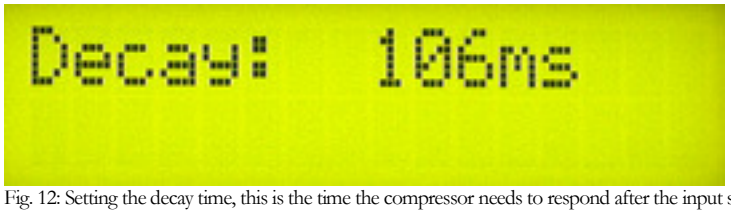

Fig. 12: Setting the decay time, this is the time the compressor needs to respond after the input signal falls back to normal level (below threshold).

Fig. 13: Setting the integration interval, this is the time the DSP evaluates the signal to establish whether it should respond or not

Integration interval determines the energy needed to trip the compressor. In simple words; it determines how long the audio needs to be loud for the compressor to respond by reducing the gain. This is not to be confused with attack time. Attack time of 50ms means the compressor will respond in 50ms after the signal spike is detected, regardless of duration of that spike, even if it is just a very short event. With longer integration interval, on the other hand, compressor only responds if a long spike or a substantial number of spikes is detected (meaning more signal energy).

<LCD CONTRAST>

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

Fig. 14: Changing contrast

Left and right channel volume (only with DSP stereo encoders)

This option allows you to precisely adjust the input sensitivity of both audio channels. This is very useful when your audio source has either too high or too low output level.

Fig. 15: Changing right input channel gain

<PLL STEP>

Frequency can normally be adjusted in smallest steps of 5KHz or larger steps of 10KHZ, 25KHz, 50KHz or 100KHz. We recommend you to select 100KHz as this lets you change frequency fast and there is rarely need for fine tuning. However, you can enter this menu and select a PLL step of 5KHz for example and take advantage of these small steps.

<RF EQ>

Just leave this setting at default. It is better suited for our 100-1000W units. It is a new setting that lets you control how your transmitter rolls off at the band edges. Several settings are available and are represented by a graphic. Default setting tries to provide the same amount of power across the whole band.

Another setting gives a slight power boost at the band edges around 88 and 108MHz helping flatten-out the frequency response of many RF amplifiers which tend to have lower output power and gain at the band edges.

There are additional two settings, one of these gives more power at the top of the band around 108MHz and the other does the opposite, providing more gain at the bottom of the band around 88MHz. These four settings should cover any situation you are likely to encounter, whatever your amplifier's attitude might be.

<FIRMWARE VER>

This option allows you to display current LCD module firmware version. At the time of writing firmware version was [MP3K+ V2.0 7/09]

Fig. 16: Firmware version

<PWR/SWR METER>

This is how you tell the exciter that you are going to use external directional coupler and power amplifier. By selecting "External" the exciter assumes that you've set the J5 jumpers into external position and attached external directional couplers or our ControlMini2 board. You can read more about ControlMini2 in the MAX PRO 3000+ manual.

<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 (ControlMini2), if you are using external PWR/SWR METER.

<SWR ALARM>

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

<BAND SELECT>

CyberMaxFM+ supports three bands:

[87.5-108MHz]D – This is default band, used in most of the world. CyberMaxFM+ works perfectly across the entire band.

[76-90MHz/Japan] – This band was developed specifically for Japan. You can experience slightly lower output power below 87.5MHz. Also filtering is a bit less aggressive below regular FM band (87.5MHz).

[44-54MHz] – While the PLL and driver fully support this frequency band, you will have to change coils in the output matching network and output filter to obtain usable RF signal out of the exciter. We have provided this band for the wireless links in the lower VHF band (around 50MHz). This last option is only for people who know how to use it so please don't use this setting unless you understand it.

<RF AMP CONTROL>

This menu option lets you choose how the MAX PRO 3000+ controls the amplifier. It offers three options, described in the manual for the MAX PRO 3000+. Please leave this setting at default value (D) No amplifier as it has no function in 15W exciters since they don't have additional external amplifiers.

- [No amplifier]D – Default option, you will not be using an amplifier

- [Controlmini1] – Basically mode A for the system described in appendix I

- [ControlMini2] – Basically mode B for the system described in appendix I

Troubleshooting

We hope you'll never get to this step. We all know bad things happen but do not despair! Cybermax FM+ is 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.

Fig 17: So, do you think you can handle it? We think you sure can!

PROBLEM DESCRIPTION	POSSIBLE SOLUTIONS
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
Red LED constantly on	1. High SWR. Check SWR and adjust antenna, if needed 2. Wait a few seconds. Unit turns this LED on when changing frequency just for a few seconds until VCO stabilizes. This is normal behavior also at power-up.
Audio too quiet	1. Open the top lid and open the modulation trimmer on MAX PRO 30000+ exciter board a little bit. 2. Increase level on your audio source a little bit, start using software or hardware compressor
Audio too loud	Open the top lid and close the modulation trimmer on MAX PRO 30000+ exciter board a little bit.
Audio without any treble	Set pre-emphasis to either 50uS or 75uS. If you're using stereo model, enable pre-emphasis there (see manual for stereo encoder module , SE5000 or SE3000).
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.
Audio distortion on high peaks, for example on "s" sound.	Your audio input level is slightly too high, reduce input audio level slightly at your audio source. Use some kind of compressor to remove over-modulation peaks.
There is HUM in audio	- Move antenna as far away from the transmitter and audio gear as possible - Use balanced audio inputs (XLR audio connectors) rather than RCA - Make sure SWR is low - Keep audio cables short and away from antenna and RF coaxial cable - Form a coil from coaxial cable going to the antenna, make a few turns. This stops RF currents that might be flowing on the outer braid of the coaxial cable. This usually happens when you connect unbalanced cable to balanced antenna without proper BALUN (balanced-unbalanced converter) resulting in coaxial cable becoming part of the antenna and radiating RF energy as well…causing hum.
Loss of settings after power off	Check firmware version and contact our support for upgrade options.
Output power less than expected	We set our transmitters to work best with our 15V power supply. If you intend to use 11-12V you can increase bias current a little bit, this is done with the blue trimmer next to the output transistor.
Output power less than expected	If unit is overheating it will start reducing output power, make sure it is sufficiently cooled!
Output power less than expected	Units can have slightly reduced output power at the band edges around 88 and 108 MHz. You can improve performance by tweaking coils in filter a little bit.

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:

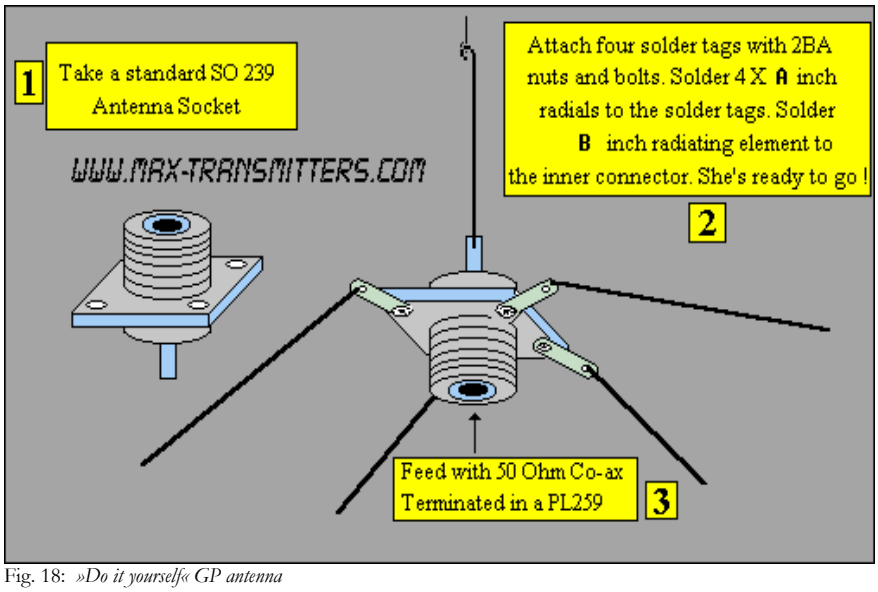

Fig. 18: *»Do it yourself« GP antenna*

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 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: General tips for setting up transmitters

Typical FM transmitter setups

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

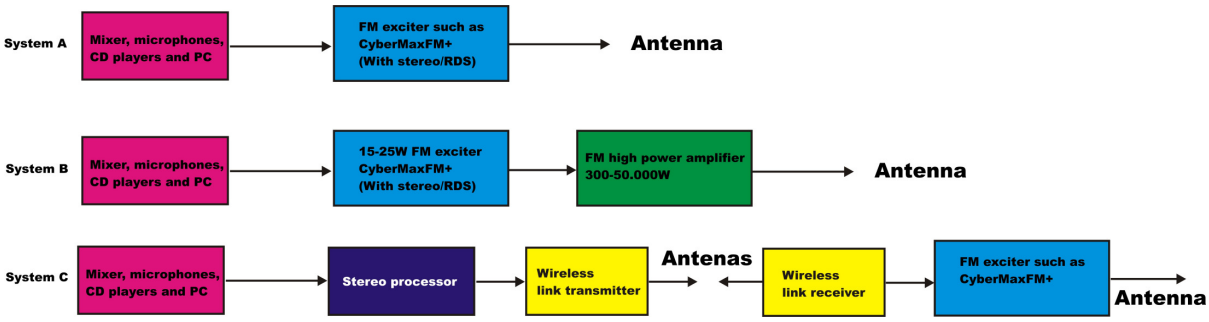

Fig. 19: Typical broadcasting systems

Lets look at **system A** first. It consists of 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 located 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. Disadvantage of this system is that you have to keep studio, transmitter and antenna close. Now you usually can't place 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 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 this the two audio channels are first combined with stereo processor. Resulting MPX signal is than 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 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.

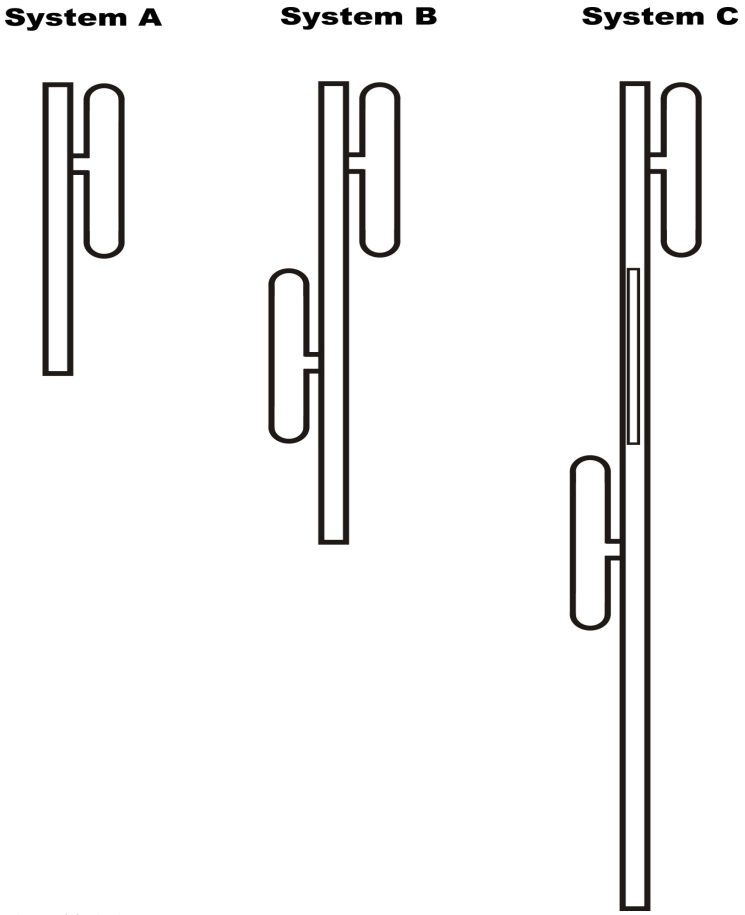

Fig. 20: Typical antenna setups

Lets 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. 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. 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 power. For example, a 1KW transmitter with this antenna system and perfect coaxial cable (losses=0) would have ERP of 4000W. Note the antennas are mounted at an angle of 90 degrees between each other to help make radiation pattern as omni-directional as possible.

System C has theoretically double 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.

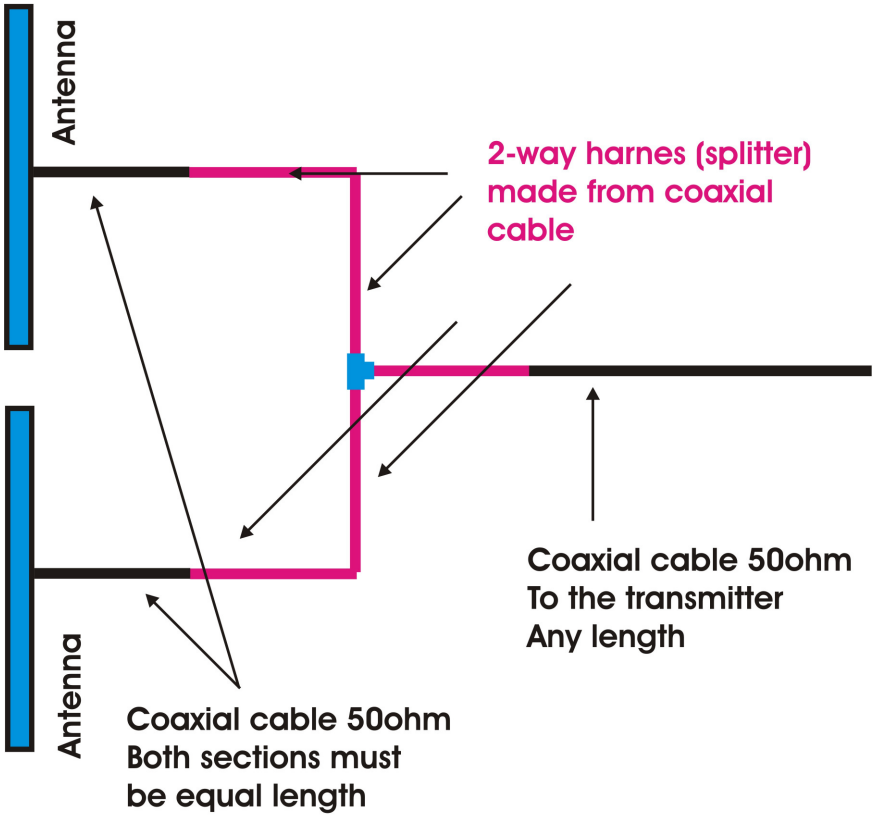

Fig. 21: Wiring multi-bay antennas

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 system with more dipoles. It is also possible to have cables of different lengths, but you have to know velocity factor of the cable so we have omitted this for simplicity reasons. If you want more info please contact our technical staff.

Appendix

C

Appendix C – Attaching external stereo processor

You may prefer to use another external stereo sound processor. Usually this could be for two reasons, either because you obtained a professional grade high-performance stereo sound processor or because you are using a wireless link. Here is what your system would look like for wireless studio-transmitter link:

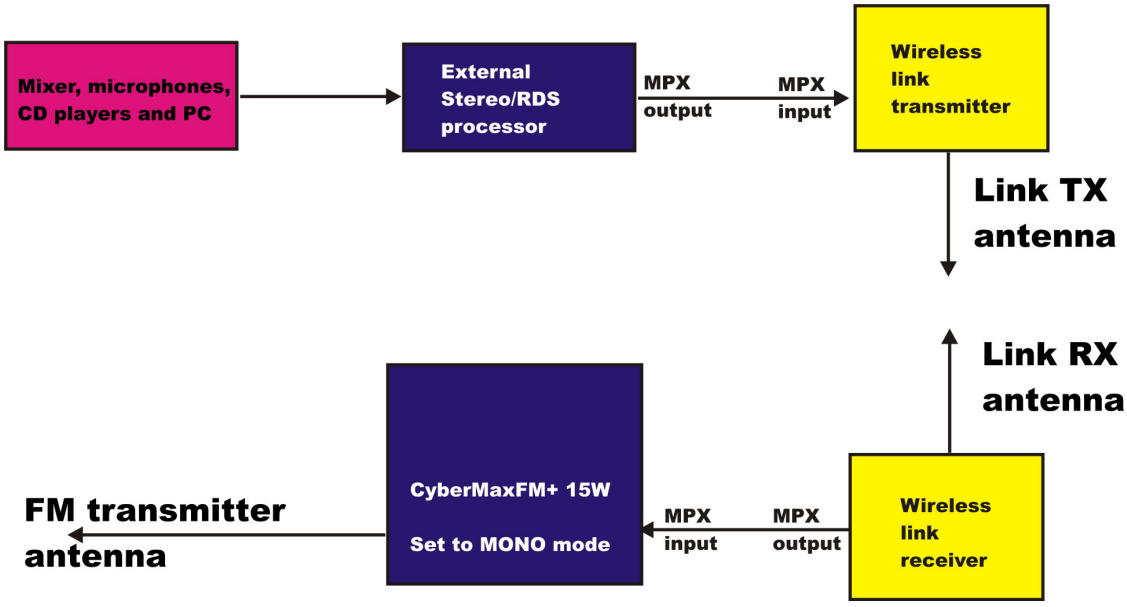

Fig. 22: Using external stereo/rds processor for wireless link

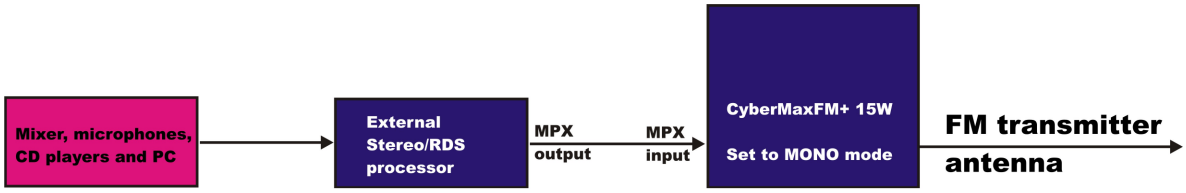

Fig. 23: Using external professional stereo/rds processor

It is important that you set the CyberMaxFM+ unit in these two systems to MONO. This ensures that the two stereo encoders are not interfering with each other. Next you can connect external stereo encoder or wireless link receiver to the MPXin input at the back of the unit. If you get stuck or need our advice please contact our technical department.

Appendix

D

Appendix D – Using and setting up the RDS encoder

Software installation

Look for the RDSMAX 4000+ driver on the provided CD or download the latest setup from our website. You can access all resources for our RDSMAX 4000+ RDS encoders here:

http://www.pcs-electronics.com/phpBB2/viewtopic.php?t=2018

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 click Finish when done.

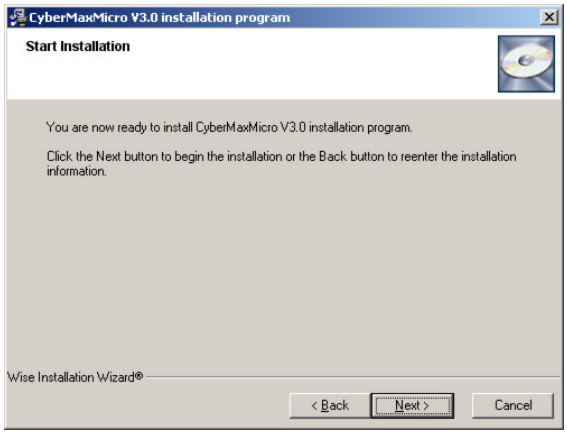

Fig. 24: RDSMAX 4000+ setup is about to start

Fig. 25: RDSMAX 4000+ windows application splash screen

Once the installation is done you are ready to start the program. You are now ready to establish connection with the RDS encoder and configure all the RDS parameters.

Configuring RDS communications ports

The only setup required is minimal. Start the RDSMAX4000+ program, the icon should now be on the desktop. Now click File and setup. The following window will open. If you are using USB make sure to set COM port to 5 and baud rate to 14400! When using RS232 please set COM port to 1. These settings are usually correct. If not, we will explain the installation and setup process for USB control cable in more detail below.

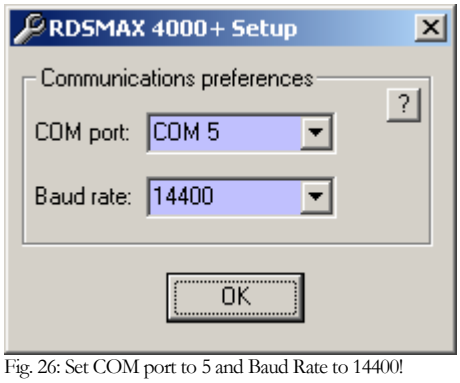

Fig. 26: Set COM port to 5 and Baud Rate to 14400!

Installing USB driver (USB IO board)

Unzip the archive_usb2comport_driver.zip file that you either downloaded off our website or located on installation CD. Now run the IO BOARD USB-COM port.exe file. Wait for the following screen to appear and select the installation directory (best left alone at default location). Click Install and wait for the installation to finish.

Fig. 27: 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:

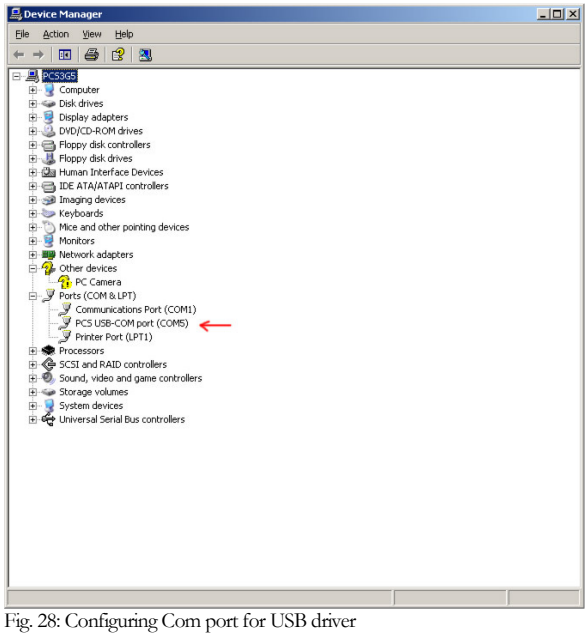

Fig. 28: Configuring Com port for USB driver

Take note of the COM port number here, you will need it later to configure the COM port inside RDSMAX4000+ 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:

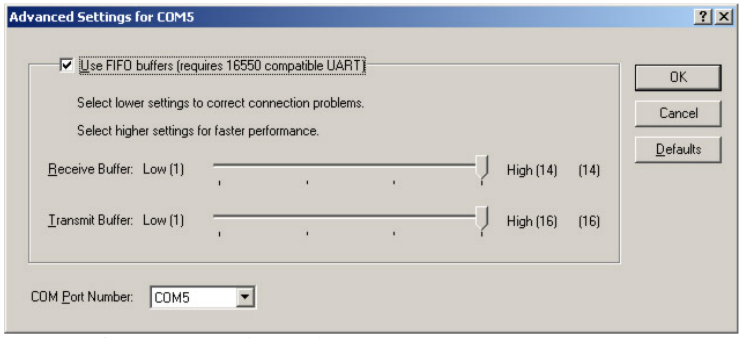

Fig. 29: Configuring Com port for USB driver

Using windows control program

See the screen capture of the panel below. You can set main RDS parameters here. Click the question mark next to the parameter for explanation of its functionality.

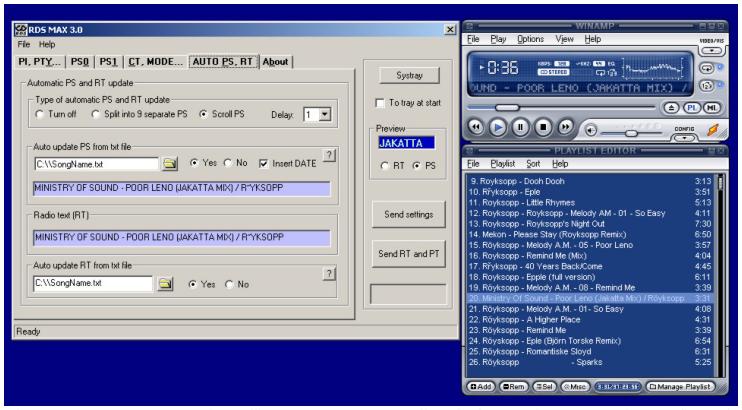

Fig. 30: RDSMAX 4000+ is pulling mp3 song name directly from Winamp (can be configured to insert song name into PS or RT or both

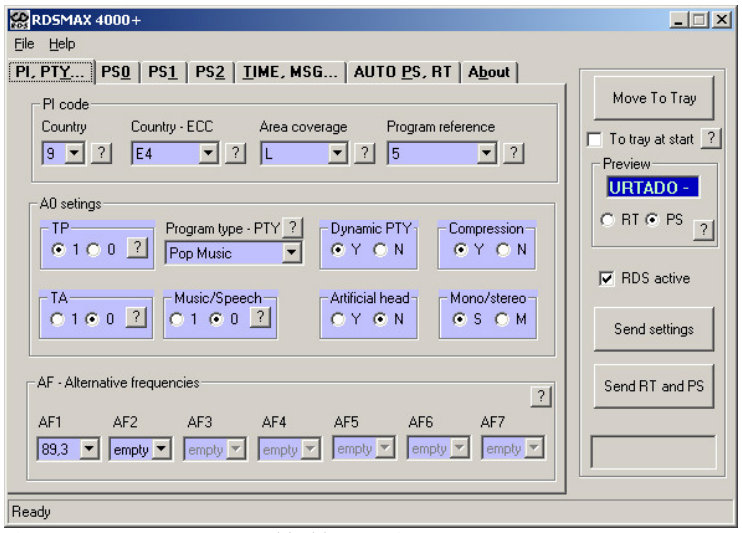

Fig. 31: RDSMAX 4000+ AF, MS, TA, TP, DI codes, ECC, PI….

If you want more info about the RDS encoder and using it or even developing your own RDS application, please look at the manual for the RDS MAX 4000+ encoder. Also look at the manual for CyberMaxMicro 30, it also includes lots of useful information about RDS.

Appendix E – 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 final RF transistor as it can be damaged by using defective or poorly matched antenna. An exception is as well any mishandling or abuse by the customer. 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 of our customers.

Legal info

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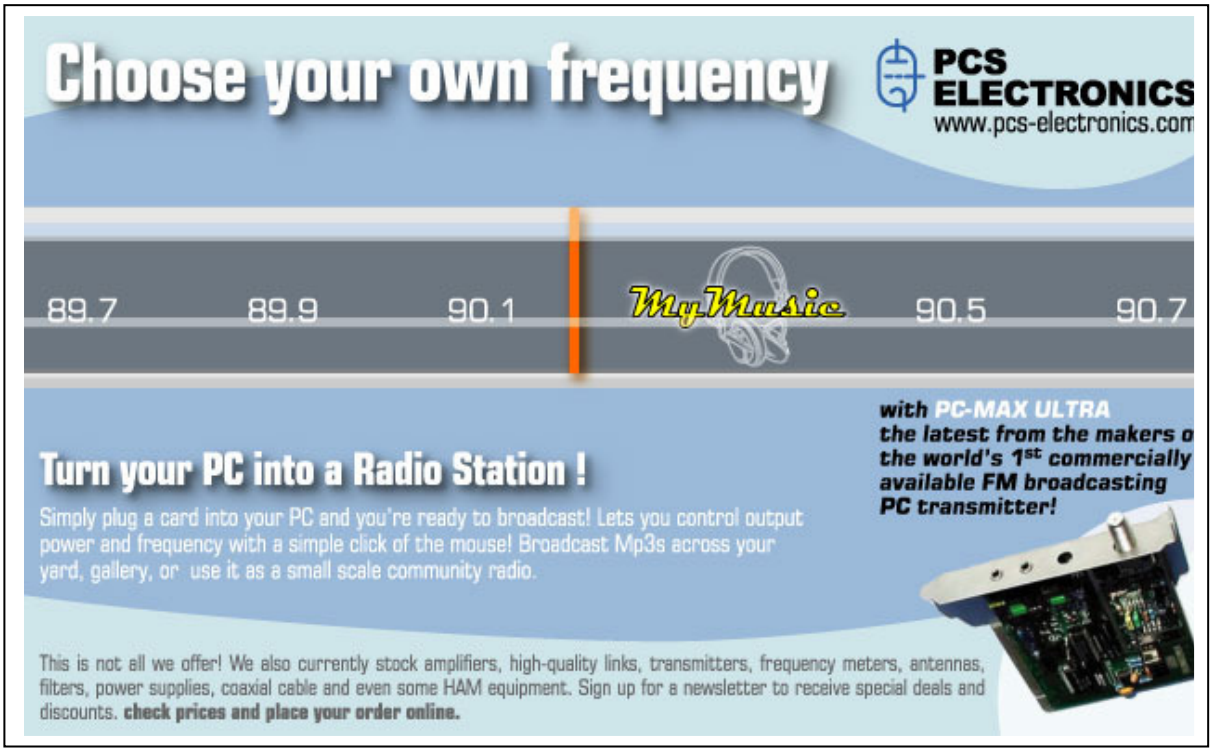
Also available from www.pcs-electronics.com

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)
- A large number of beginners guides to get you started
- A large selection of free schematics is as well available 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

V20 (Dec 2009): Release version of new manual format

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

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