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Amplifier Control Board v20 (11/2007)

Tame your RF amplifier with this new swiss-knife controller board

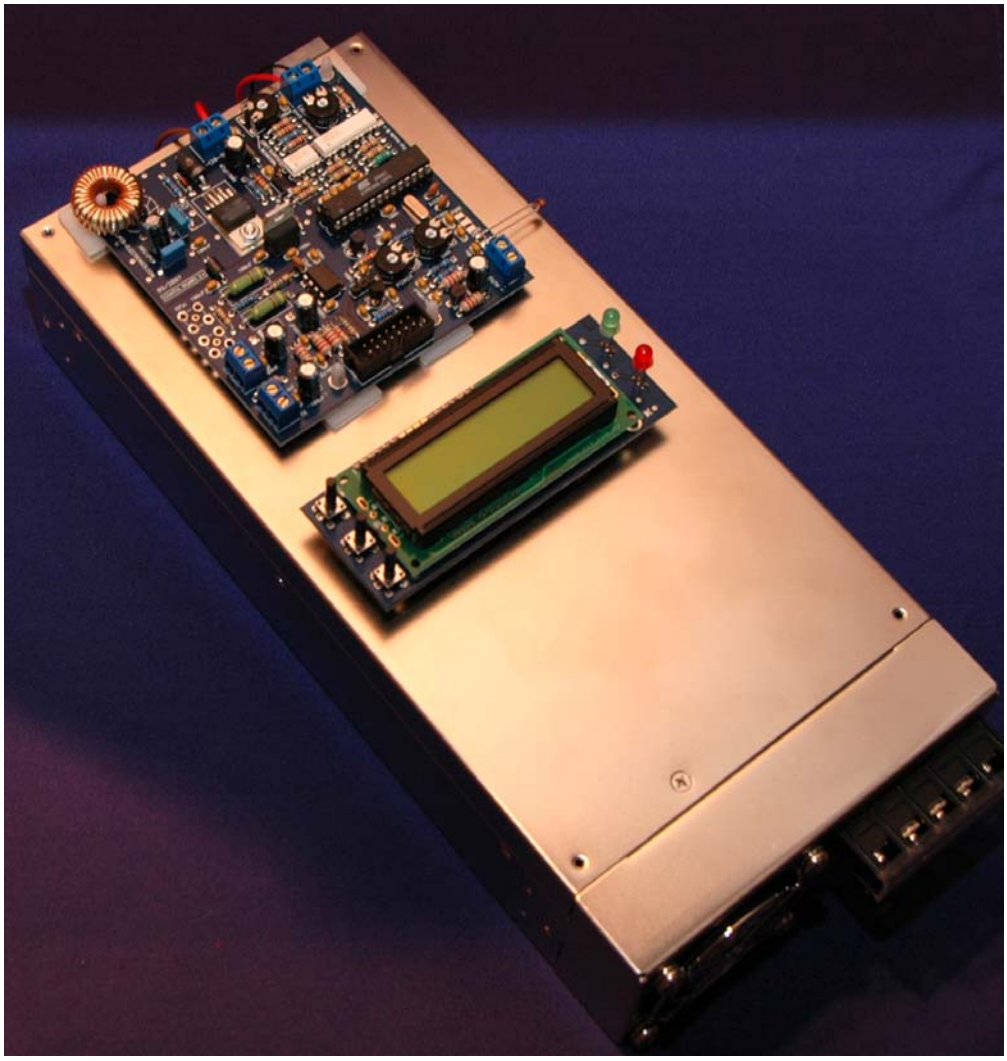

Fig.1: Universal Amplifier Control Board 2.0

Whatever make or model your current RF amplifier module might be, this controller board is sure to please you. It lets you monitor frequency, output power, SWR, supply voltage and temperature. Sounds impressive? The list goes on; it lets you control output power, set fan activation temperature and swr alarm level. Did I mention it also keeps track of uptime time so you can check if there was power outage and when it happened? And yes, it also provides LC-filtered 13-15V DC voltage for your optional exciter and fans.
Unit will soon also support remote monitoring via USB or RS232, this functionality will require a simple upgrade (plug-in IO board)!

Why is Control Board v2.0 so great?
- Built-in frequency meter covering 50-300MHz
- Enables power adjustment virtually from zero to full power
- Supports up to 1KW modules (ask for more, if needed).
- Supports 18V to 52V DC mains power supply models.
- Provides 13-15V from 18-52V DC (really convenient for exciter module or stereo encoders)
- Automatic FAN activation at adjustable temperature.
- RF EQ function (gain/supply voltage boost at band edges).
- Power, SWR and temperature read-out.
- Uptime counter (hours, minutes).
- Remote monitoring available with an easy upgrade
- Power supply voltage monitor

Technical specifications:
- RF amp mains PSU output voltage: 18-52V
- Frequency meter: 50-300MHz, 5KHz accuracy
- Temperature meter: 0-99deg. C, 5deg accuracy
- Power readout range: 1KW max (ask if more is needed)
- On-Board uptime counter
- PCB size: 100x93mm
- On-board DC/DC converter: Output 13.8V/2A, can be adjusted to 12-15V
- On-board optional attenuator (1-2dB for better match with the amplifier, you don't have to use it). Attenuator can handle up to 2-3W of input power
- One 12V fan header (always on)
- One automatic 12V fan header (activated at adjusted temperature; set via LCD module)
- On-board DC/DC converter: Output 13.8V/2A, can be adjusted to 12-15V
- On-board temperature meter
- Standard PCS LCD display with several views and a number of menu settings (SWR/temp alarm)
- Ready for remote control upgrade (just add IO module for USB/RS232 connectivity)
- Supply voltage monitor, +/- 1V

Included items:
- Control board v20
- LCD module
- Flat cable
- SWR/PWR RF pickup board
- Modified mains power supply for the RF amplifier needs to be ordered separately (since various models exist)

What do the jumpers and controls do?
Trimmer 1: Minimum limit: Sets minimal voltage limit for the RF amp
Trimmer 2: Maximum power limit limit: Sets maximum voltage limit for the RF amp
Trimmer 3: Adjust power readout accuracy (calibrate with swr/power meter)
Trimmer 4: Adjust swr readout accuracy (calibrate with swr/power meter)
PWR, SWR solder pads: Connect SWR/PWR pickup board here (the middle pad is ground)
NTC solder pads: Temp sensor is connected here
RF in: connect fm exciter/rf input here
RF out: connect input of your RF amplifier here
I2C jumper: In the future it will be possible to connect this board directly to the MAX PRO 3+ exciter, not to be used at this time
LCD control board offers "Lock Keys" jumper, installing a jumper here disables the menu system and keys
The board also offers: fan terminals, DC power

What else can I do with this card?
Due to a very universal nature of this product, you can as well use it for other frequency bands. A 2m HAM band amplifier is one such example, but it can also be used for CB or other short-wave bands, 70cm and everything in-between. The only limitation is supported voltage range, which is about 18-55V DC.

INTRODUCTION - PRINCIPLES OF OPERATION

There are generally three ways to control the amplifiers output power; by either changing its supply voltage, varying its drive level or changing its working point by changing bias voltage:
- Changing drive power works well for amplifiers operating in linear range, but such amplifiers are almost never used in the output stages of FM band amplifiers due to poor efficiency and large amounts of generated heat. When you reduce drive level of a typical fm band amplifier you may at some point experience instability and rise of spurious output. This method is definitely not the best you can do.
- Changing bias voltage works better, but can as well produce a rise of harmonic content or even instability at some points of the curve.
- Best results can be obtained by changing supply voltage to the amplifier. This guarantees power efficiency (no unnecessary heat generated in low power modes), stability and good control virtually down to zero watts output.
We have chosen the best method of the three, even though it is not the simplest one to implement. It makes things pretty easy for you, the end user, to wire and install.

Besides controlling power our swiss-knife Controller Board v20 also takes care of a number of other convenient tasks, such as:
- Its DC/DC converter provides 12-15V DC/2A for the other devices you might need.
- On-board frequency meter lets you check the frequency of your signal at a glance. Not necessary, but definitely convenient.
- Temperature monitoring facility makes it possible to automatically turn on the fan at a desired temperature. It can also shut down RF output if the amplifier gets too hot.
- SWR and PWR measuring facility makes it possible to display power and swr. It can also shut down RF output if SWR becomes too high.
- On-board attenuator which is effectively inserted between exciter and amplifier improves impedance matching between the exciter and the amplifier, ensuring better stability (amplifier often does not have a perfect 50 ohm input impedance).

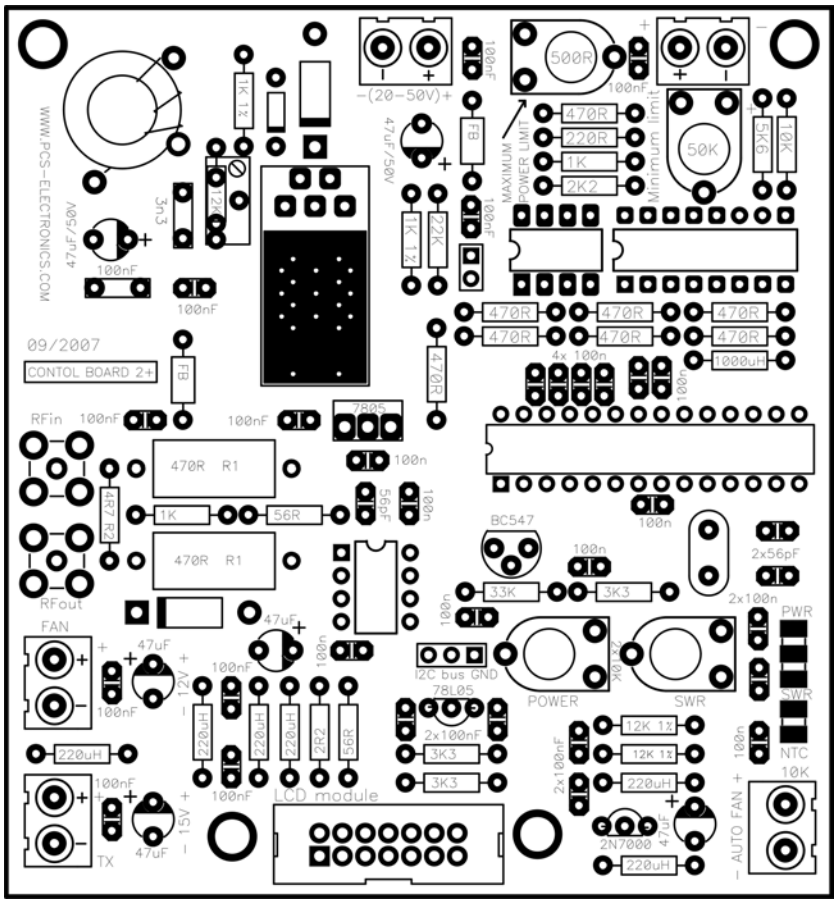

Fig. 2: ***Amplifier Control Board v20***

WIRING IT ALL UP TOGETHER

1. Mains power supply
Our control board is only available with the mains power supply included. The reason is complexity and potential hazard of such modifications, if performed by customer on their own. Control board comes with a number of reasonably priced power supply options so this is hardly a problem. The result of this is that there is hardly any work involved with mains power supply. What remains to be done is connecting mains power supply to the mains socket. Standard safety procedures should be followed as mains voltage can be lethal. We recommend the use of our fused mains socket with built-in switch, fuse and LC filter. All conveniently packet into single small metal enclosure, minimizing work involved with installation. You can find the socket here.

2. LCD module
Simply insert the flat cable into LCD module and Controller board. Note that it may be difficult to mount LCD into enclosure unless you've got good metalwork skills. Suitable 2H rack can be purchased here.



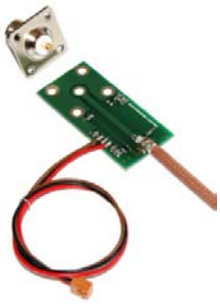

Fig. 3: ***Mains socket, 19" 2H rack in SWR/PWR pickup board***

3. RF amplifier
There are a few things to consider when connecting the RF power supply to the control board:
- Connect the DC power leads to the mains power supply.
- Connect RF input (RF power amp) to RF out (control board). This inserts the 1-2dB attenuator between the amp and the exciter. We recommend the thin teflon cable here or use RG174. Since the attenuator can't handle more than 3W of RF power, do not use it if you have stronger drive requirements. If you're not using the on-board attenuator and want to keep your frequency meter running, you may need to attach a piece of wire to the RF input (control board) and move it close to a life RF circuit (either amp or coaxial cable). Wrapping it around coaxial cable works as well.
- Connect RF input (control board) to your FM exciter or RF input terminal on your enclosure (BNC, N or whatever connector you're using).

4. SWR/PWR pickup board
- Connect RF output (RF power amp) to SWR/PWR pickup board. This lets control board read the power and swr.
- Now connect SWR/PWR pickup board to control board.

5. Fans
- Connect the fans. We suggest you use one fixed fan (either connect it to 220V, our control board's 12v screw terminals or RF power amplifier's fan jumper) and one 12V automatic fan. The automatic fan is controlled by the control board and only engages when the temperature reaches preset value (adjustable via LCD).

6. DC 12-15V
- Wire 12-15V wherever its needed inside your installation.

Finally, if this all sounds too engaging, consider buying a finished and tested product here. Check next page for a quick reference to all connections to the control board.

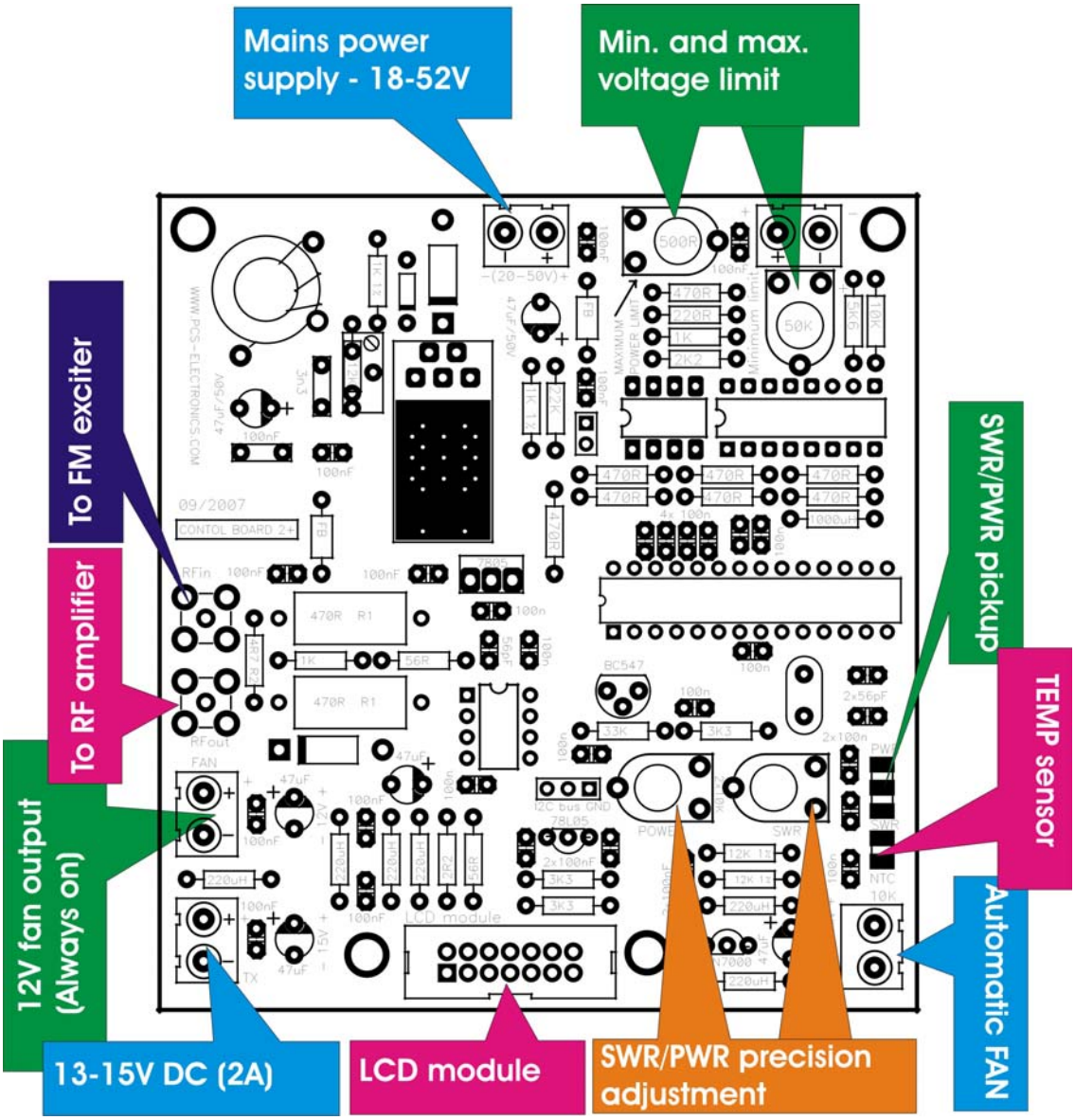

Fig. 4: ***Amplifier Control Board v20 quick reference***

USING CONTROLLER BOARD

1. Minimum and maximum voltage limit trimmers

These two trimmers let you limit the maximum and minimum DC voltage for the amplifier module.
Minimal voltage is usually set to about 17-18V, which is needed to maintain stable operation of the controller board and its on-board DCDC 13.8V supply.
Maximum voltage is tailored to the maximum power you're trying to get out of the RF amplifier and safety considerations. Higher voltage usually limits output transistors lifetime and sensitivity to high SWR.

2. SWR and POWER trimmers

Use these trimmers to set accuracy for the POWER and SWR readout. It is best done with a reliable and good SWR/POWER meter used to calibrate readout.

3. LCD menu system

The rest of the parameters can be set via LCD menu system and you can learn more about them in the next chapter.

LCD MENU SYSTEM

The front of the LCD unit starts with the three keys on the left, followed by the backlit LCD display. LCD control module is equipped with our new menu system. It can be modified on request to include your call sign or any other messages you want displayed on the LCD. PCS Electronics welcome screen can be removed on request.

The UP and DOWN keys are used to change parameter value. In normal mode the LCD is simply showing the selected overwiev screen. You can always use the UP/DOWN keys in this mode to increase or decrease output RF power.
Menu key can be used to enter the menu mode, repeatedly pressing this key brings up the following menus: SWR ALARM, TEMP ALARM, VIEW TYPE, RF EQ, LCD CONTRAST, FIRMWARE VER, BAUD SPEED and FAN MODE. Pressing the UP or DOWN key selects the desired parameter and allows you to modify its value. Another tap on the MENU key and you're back to normal overwiev mode.

NOTE: Default and recommended values are usually represented with a (D) behind the parameter value.

MAIN SCREEN
This is the general appearance of the LCD display in idle state, during normal use when various view types are selected. For example if we look at the first view type we have frequency at the top left corner, measured output power in top right corner and adjusted output power bar in the bottom line. Any of the presented view types can be selected as the default main screen.

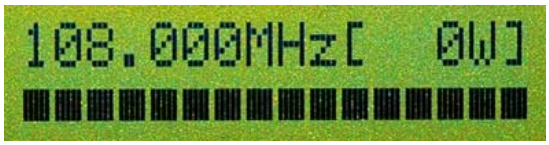

Fig. 5: ***Default view type (1)***

Fig. 6: V*iew type 2 (measured output power, measured reflected power and adjusted output power; bar-graph in bottom line)*

Fig. 7: V*iew type 3 (temperature, measured power supply voltage and adjusted output power; bar-graph in bottom line)*

Fig. 8: V*iew type 4 (Frequency, temperature, voltage and measured output power)*

Fig. 9: V*iew type 5 (Up-time in days, hours and minutes)*

SWR ALARM
This option allows you to set the amount of reflected power that triggers SWR alarm. When the level of reflected RF power (Pref) exceeds the preset level (>30W on the LCD below) it activates SWR alarm, which decreases output power, turns-on the red LED diode and prints a warning message on the LCD screen.

Fig. 10: ***SWR ALARM menu and adjustment***

TEMP ALARM
This option allows you to set the temperature that triggers TEMP alarm. When the temperature reaches the preset level (50 deg. C on the LCD below) it activates TEMP alarm, which decreases output power, turns-on the red LED diode and prints a warning message on the LCD screen.

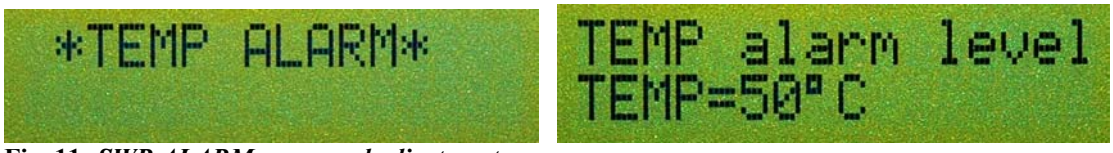

Fig. 11: ***SWR ALARM menu and adjustment***

VIEW TYPE
This menu option lets you select desired view type:

Fig. 12: View type selection

RF EQ
This is a new revolutionary setting that lets you control how your output power rolls off at band edges. Several settings are available and are represented by a graphic, the function should be obvious from the appearance.
Default setting does not try to equalize the output power at band edges.
Second setting gives a slight power boost at the band edges around 88 and 108MHz by slightly increasing supply voltage around band edges. This typically flattens-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.

Fig. 13: RF EQ selection

LCD CONTRAST
This option lets you change LCD contrast

Fig. 14: LCD contrast

FIRMWARE VER
This option displays Firmware version.

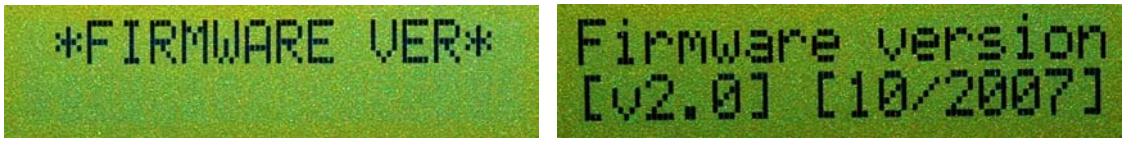

Fig. 15: Firmware version

BAUD SPEED
Lets you select BAUD speed for remote access to your amplifier via COM port or USB port.

Fig. 16: BAUD SPEED selection

FAN MODE
Lets you select fan mode. It can either be active permanently or when the temperature reaches a certain preset value. Display on the right below shows a situation with fan activating at temperatures above 70 deg Celsius.

Fig. 17: FAN MODE

THANK YOU FOR PURCHASING OUR AMPLIFIER CONTROL BOARD !

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!

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