



## **Array Solutions SO2R Master**

### **Two Radio Single Operator Control Interface**



**SO2R Master System**

Thank you and congratulations for purchasing the Array Solutions SO2R Master control interface. You will find the construction and quality of this product to be excellent.

The SO2R Master was designed using the input of well-known leading contesters. We also put a few special convenience features into the system to aid in station setup and to make it very flexible. We have added enough flexibility to take care of all of the unusual situations we can think of for the traveling contester, too. The SO2R Master should be able to work with any contest program and DXing software package. The full-size schematics (tape pages together) are provided to allow you to see what is going on and to be able to quickly find out how to adapt the functions to your special needs.

#### **Description**

The SO2R Master consists of two boxes. There is a larger I/O box you will locate back with the radios and the PC. It has a couple of key-way holes in the bottom so that you can screw it “upside-down” to the top of a shelf as well. It has all the connectors for the I/O cables in back, and

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LED's in front which give you a visual indication as to which radio is transmitting. There are also a couple of screwdriver holes in front to allow you to adjust the manual key delay function and a stereo mix pot.

The smaller box is the controller. It has a brushed stainless steel plate which holds the control switches. It is connected to the I/O box with a db15 cable. Your headphones will plug into a connector on its side.

The SO2R Master features manual and automatic control via a toggle switch on the controller. There also is a rotary switch to allow setting the audio manually. 95% of the time you will not be using the controller at all, but instead allowing the PC to drive the SO2R Master automatically. There are controls to override the PC for special occasions. You may want to go split, or you may want to change the audio settings for a special purpose like a huge pile-up where you don't want to be distracted by the automatic audio switch to the second radio until things slow down.

Either radio can be the "Run" radio or "Mult" radio. The LED's on the I/O module let you know when you're transmitting on the A (left) radio or B (right) radio. The LED's are coded as Green Left and Red Right and are located on the left and right sides of the I/O module respectively.

The SO2R Master will interface to NA, CT, TR , and Writelog through the LPT port, as well as other DXing software programs that adhere to the LPT standards set by these programs.

If you don't have LPT support such as a Windows 2000 interface, the box can be driven from the PTT signals from the radios set to VOX mode. You can also derive the A/B radio signal from possibly another interface on the PC that is supported (more on this in a later section).

The SO2R Master will support the functions of these programs activated in the LPT port, such as keying, radio selection, PTT, foot-switch, CW out, iambic key in.

The I/O box also supports external keyers for voice and CW, such as our Super Combo Keyer which does both. The I/O module wants you to route your iambic paddle through it first before being sent to an external keyer or the PC keyer (LPT port).

The SO2R Master also has some intelligence built into it . It can sense when you are using the paddle, and it will inhibit the automatic audio switching so you can hear the monitor tone in the run radio.

In Automatic mode when sending CQs and exchanges it will steer the "Mult" radio's audio into both ears to make using the second radio easy.

It also supports the SUB receivers in stereo for working splits if your radio is stereo, such as the Yeasu 1000XX series.

There is a stereo mix pot in the front of the I/O board to allow you to custom mix how you listen to both radios. Some operators like to listen to a little of the other radio in both ears.

Microphone steering is supported as well, either PC sound card or external voice keyer, or just plug in your mic. It has isolated switched microphone grounds.

## Cabling the System

Figure 2 Back of I/O module



### Rear of I/O Module

Going from left to right:

SW1 - On-Off toggle switch

J1 – 12V DC input

J2 – LPT port - plug the supplied LPT 6-foot cable into this jack

J3 – Key In - plug your iambic key paddle into this ¼ inch stereo jack

J4 – To Ext Keyer - ¼ inch stereo jack to your external CW keyer input

J5 Up – RCA Phono Ext CW In - return your external keyer output to this jack

J5 Down – RCA Phono Foot Switch In - (If you use it) - It will be routed to the LPT port as well as internally driving the PTT signal to the selected “Run” radio

J6 Up/Down – RCA Phono PTT Radio A / B – route to your radios’ PTT input/output. These are bi-directional PTT signals and can be driven from your radio transmit ground or PTT line if you need to do so.

J7 Up/Down – RCA Phono – CW out to Radios A /B

J8 – 1/8 inch mono jack – Microphone in

J9 – 1/8 inch mono jack – Microphone out A

J10 – 1/8 inch mono jack – Microphone out B

J11 – DB15 female – connect the supplied DB15M-DB15M 6 foot cable to this connector and also to the DB15 connector on the back of the controller module.

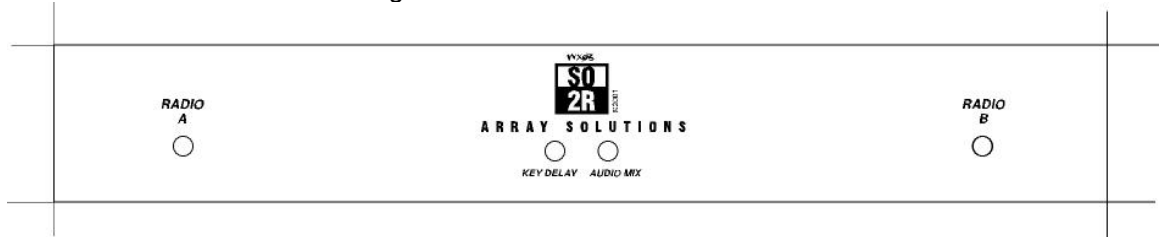
J12 – ¼ inch stereo jack – Audio Radio A, Tip Left Ear, Ring Right Ear, Common radio ground

J13 – ¼ inch stereo jack – Audio Radio B, Tip Left Ear, Ring Right Ear, Common radio ground

**NOTE** - A few words about hum in the stereo audio. We have tried the system with all the common radios used and manufactured by Yeasu, Icom, Kenwood, and Ten-Tec. No hum has been heard except for these two reasons. 1. One forgets to ground the radios to a common ground. If you have hum in your audio, be sure to check that you indeed have a ground that is continuous from both radios.

Take a good clean wire and connect both of the ground lugs together and then take this to your RF station ground. Or 2; one wired your microphone line to the PTT ground and not the Mic Ground pin of the 8 pin Mic plug. Our cable sets are now available for all radios and Heil adapters and are wired with proper grounds, and also include the capacitor for Icom radios.

Figure 3. Front of I/O Module



#### Front of I/O Module

Going from left to right:

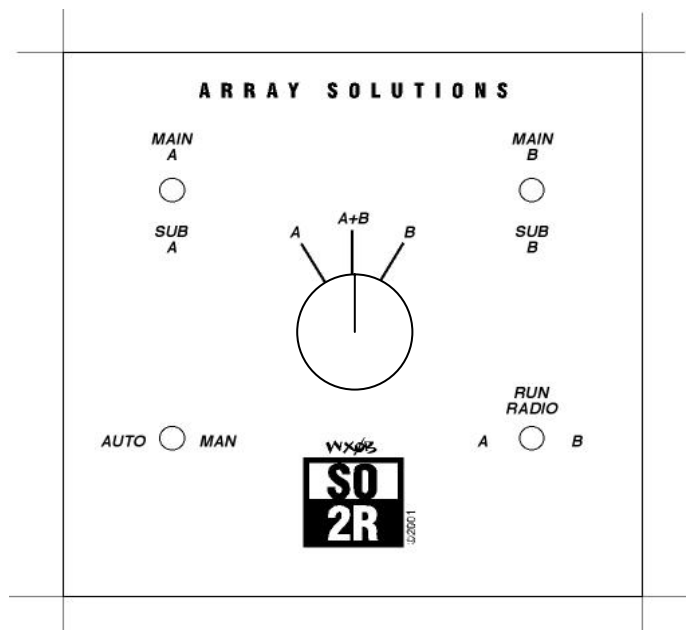
LED - Radio A LED – Green LED indicates Radio A (left) is transmitting. In the manual mode (see below) both LEDs will light as in indication that you are in the manual mode.

KEY DELAY – Screwdriver hole for internal potentiometer which sets the timer circuit delay for the override circuit to drop out when in the automatic mode and when keying manually. Set this for the slowest CW speed you will use in a contest to allow 5 dashes to be heard in the monitor before it drops out. Factory setting should be adequate but you may wish to change this. Once set you will not need to adjust it again.

AUDIO MIX – You may adjust this 200 ohm potentiometer to mix in more or less audio from both radios. You can also change the value of R25 (100 ohms) or clip it out if you wish no mixing. Adding a little mixed audio brings the audio image a little forward for a more pleasing acoustical experience and relationship of the radios.

LED – Radio B LED – Red LED indicates Radio B (right) is transmitting. In the manual mode (see below) both LEDs will light as in indication that you are in the manual mode.

Figure 4. The Controller



## Controller Switches

From lower left counter-clockwise:

**AUTO/MAN toggle switch** – Auto selects PC control. Manual inhibits the PC automatic audio switching. Choose a setting on the center rotary switch while in manual mode. This is a useful function if you wish to be able to listen to the monitor in the run radio while listening to the mult radio at the same time.

**RUN RADIO A or B toggle switch** – When PC control is not possible. The jumpers inside the box on Header H1 can be adjusted to allow fully manual control by removing the jumper 2-4. This will allow you to send CW or SSB to either radio by using this switch. Be sure you know what band you are on when logging. This is a very dangerous control and should not be used in a contest. It will allow you to log on the wrong band. For normal PC operation leave this control in the “A” position.

**MAIN B – SUB B toggle switch** – Used when wanting to split your radio and listen to both frequencies. Set the rotary switch to B, and the toggle switch from Main B to Sub B. You will hear the Sub B receiver in the right ear and the Main B receiver in the left. Be sure to set your PC to run on B radio.

**MAIN A – SUB A toggle switch** - Used when wanting to split your radio and listen to both frequencies. Set the rotary switch to A, and the toggle switch from Main A to Sub A. You will hear the Sub A receiver in the right ear and the Main A receiver in the left. Be sure to set your PC to run on A radio.

**Phone Jack** - ¼ inch stereo jack on left of controller for your headphones.

**DB15 Rear** – Plug the supplied DB15 –DB15 6-foot cable into this connector. It is the cable that connects the controller to the I/O module.

## Operation of the SO2R Master

There are several modes of operation and set-ups possible with this equipment. We have several experts with the different software packages who have volunteered to write up specific set-ups and operation addenda to this manual. We will publish them on the Array Solutions web-site as they are written.

From the previous descriptions you should have cabled your radios, keyer, sound cards, or external voice and CW keyer to the PC.

Running and multiplier hunting at the same time is accomplished by choosing which radio will be running by setting the PC to drive that radio. You can CQ and work stations on this radio by setting the controller to AUTO, and setting the rotary switch to either A,B, or A+B, depending on how you like to hear your radios.

For example, in a CW contest, lets say we're set to run on A and A is on 20 meters. B is on 15 meters. While we CQ on A, Radio B is applied to both ears by the relays in the SO2R Master. We can tune Radio B for a multiplier or other contact. When the CQ is finished the SO2R Master will default to the setting you have on the rotary switch. When the rotary switch is on A, the ears of the headphones will be steered to hear radio A. We can hear an answering station to our CQ, log him into the computer, and push the send exchange key. Since we know the exchange, we don't have to hear it being sent. The green LED tells us it's being transmitted while we concentrate on tuning for a contact on Radio B. Say we find one on 15 meters. If your software allows it, you can log the call into the computer and have it set up and ready for a contact.

Otherwise just leave Radio B on that frequency and be ready to call him. Now the exchange has been sent and the audio is once again steered to Radio A. We log the exchange sent to us from the other station and either start a new CQ or flip the computer to Radio B to work the mult. Switch the controller rotary switch to B or A+B, and send your call to the mult station. If you put the rotary switch to A+B you can hear what your run frequency is doing, and perhaps you may want to work more stations calling you there while you're waiting for the mult station to finish with a contact. To do so you can change the PC back to Radio A.

Finally the mult station and you are both free at the same time, and you send the PC to Radio B and dump in your call. The mult sends you his exchange and you send him yours. While you're sending yours, you will hear Radio A in both ears, so you can hear who is calling you there. You finish with the mult station and then switch the PC back to Radio A to continue your run.

Now you can search for another station on Radio B while running on A.

Most operators will leave the rotary switch in the A+B position unless there is a specific reason to flip it to hear the run radio in both ears. One such reason is when the band is noisy and stations are weak. Another is when fatigue is setting in and you want to hear the radio in both ears.

With practice you can become quite smooth. Your software will allow you to work a mult, and the guys on the run frequency will not suspect you have even left the frequency.

### **Hand-keying**

The manual keying will be steered to the run radio set on the PC, so saying hello to a friend or asking or giving a fill with the paddle is easily accomplished on the run radio. A circuit detects when you're using the paddle and will inhibit the automatic audio switching to the mult radio.

### **Internal Jumpers**

On the I/O module circuit board you will notice 5 jumpers. This is what they do:

JP1 – Switches A/B bit pins from pin 14 standard setting to pin 2 of the LPT port. Some older CT versions used pin 2.

H1 – 6 pin header. You can switch the A/B from positive to negative or disconnect PC control with these jumpers. Normal setting is 1-3 shorted and 2-4 shorted. Radio A = +5 Volts, B = 0 Volts. By shorting 3-5 and 4-6 you can change this polarity.

By pulling the 2-4 shorting jumper you can totally control the RUN A/B with the toggle switch on the controller. First place the AUTO/MAN toggle in the MAN setting. There is no AUTO mode anymore. (All new units have a toggle switch on the front to short pins 1 and 3. This toggle switch allows the SO2R Master to be used without the PC being turned on.)

JP2 – Normally open, but you can move the shorting jumper to short these pins to disable the manual keying sense inhibit function. Probably not something you want to do, but you can.

FL1 – Microphone RF filter. We found that most of the recommended circuits in the contest logging programs did not have a filter for preventing RF from getting into mic lines, but we also felt it might be good to have a place to put some filtering if someone had a bad RF situation. You can solder in a Panasonic ELKAH103EB filter, or you can put in an inductor, ferrite bead and capacitor if you need to eliminate RF from your mic lines.

## **VOX vs. PTT**

You can use either mode or both with this unit. Some logging programs will provide a PTT signal, which can be set "early" to be asserted several ms before CW, or SSB is sent. This is useful in allowing an amp TR relay to settle down before RF is applied. We recommend you do not use VOX since using PTT from the PC will allow the amps to switch faster and keep things quieter in your headset for SO2R operation. False noise triggers on Vox can also disturb SO2R operation.

### **Operation with NA contesting software**

NA and the SO2R Master are compatible with one small modification that must be done to take advantage of the two different ways the NA LPT port can be configured.

NA 's two-radio A/B bit may be configured in two different ways with the configuration software.

They are:

LPT with a DVK active use LPT pin 7

LPT with ANT or band data bits active use LPT pin 3

Basically it means the A/B bit can be on LPT pin 7 or pin 3. See the NA manual if you need clarification of this.

Set up NA according to one of the above configurations. If you chose to have DVK active then LPT port pin 7 will be used, if you chose to have ANT bits active then Pin 3 will be used to steer the SO2R master radio A radio B relays.

- Take the cover off of the I/O box by removing the 4 number 6 screws and washers.
- Remove the PCB from the SO2R master. This will require taking off the nuts and washers on the ¼ inch stereo jacks, 3 number 2 screws and hardware holding the RCA jacks to the side of the case, and 5 number 4 screws and washers holding the board down to the metal box. Push the LED's through their holes and lift the board out of the box.
- Next locate the LPT port connector and cut the trace from pin 2 that goes to jumper JP1 next to the fuse holder. This trace is on the bottom side of the board. Use a razor blade to make the cut.
- Solder a small wire from pin 7 or pin 3 of the LPT port connector depending on the option you will use.
- Place JP1 jumper block to jumper 2 and 3 together.
- Reassemble PCB, being sure to place the LED's back into their holes and before you put the cover back on.

Once the LPT port is connected to the PC, and power is turned on the SO2R master, you should hear the relays click as you toggle from radio A and radio B with the NA contest software.

**All of the following Modifications are installed in all SO2Rs being sold since 11/10/01**

**Modifications that can add more functionality to the SO2R Master**

- LPT port on some PCs will key a radio when the PC is turned off and the SO2R Master is on. Here is a simple modification to fix this. Solder a 3.3 K Ohm resistor from R8 (lead closest to the front of the I/O box) which is +5V to CR9 (lead closest to the back of the I/O box).
- Making the manual mode available when the PC is off so one can use the SO2R in manual mode with out removing the top cover and pulling a jumper.

Add a small toggle switch to the front panel of the I/O box, by drilling a small hole and mounting a small on/off toggle switch. Solder two wires to the switch and solder one each to Header H1 pin 1 and pin 3. Of course remove the jumper block first.

Now when you want to use two radios to casually DX with the PC off, you can flip the switch to "open" the manual jumper, put the SO2R master controller switch in "manual mode" and use the Run A / Run B switch to select which radio to transmit on.

Looking from the front of the I/O box find R9 and R10 on the right hand side of the PCB. You can see that these two resistors are soldered together by the trace on the board to the right of the bodies of these two resistors. Unsolder the leads from this trace and solder them together with a small jumper of hookup wire. Solder the other end of the wire to the striped end of CR2. This will now allow full use of the manual mode.

- PTT - Modification

Some software logging programs allow the use of the footswitch to do other than PTT generation to a radio. To allow for this function we have placed a Diode CR14 on the circuit board. This diode may be clipped out of the circuit to allow the software only to see the footswitch closure from the LPT port. It will then provide the function you programmed it to perform in the software. TR is one such program that allows several choices of functions.

If you have other suggested modifications to the SO2R Master please send them to us. We will test them and place them on this page. For modifications used on this page we will compensate you with a \$100 of certificate for Array Solutions products. These mods will be added to the next generation SO2R Master.



## **Operation with the NA Contest Logging Program**

by

**Dave Pruett, K8CC and NA author**

The SO2R Master can be used with the NA Contest Logging Program after the following changes have been made:

1. Take the cover off the I/O box by removing the four #6 screws and washers.
2. Remove the PC board from inside the SO2R Master. This will require taking off the nuts and washers on the ¼ inch stereo jacks, the three #2 screws and hardware holding the RCA jacks to the side of the case, and the five #4 screws and washers holding the PC board into the metal box. Push the two LEDs out of their holes in the front panel, then lift the PC board out of the box.
3. Position the PC board to work on the non-component side. Locate the circuit trace from pin 2 of the LPT port connector that goes to header JP1 next to the fuse holder. Cut this trace using a razor blade or sharp knife.
4. Solder a small wire from pin 3 of the LPT port connector to pin 3 of JP1.
5. Position the jumper block on JP1 to connect pins 2 and 3.
6. On header H1, move the jumper blocks to connect pins 3 to 5, and pins 4 to 6. Note the modification of adding a toggle switch to the I/O box below. Solder the toggle switch to pins 3 and 5 of the this header and you can have the "manual mode" function working with the SO2R Master with the PC turned off.
7. Re-assemble the PC board into the case, reversing the process from step 2. Position the LEDs through their holes in the front panel and re-install the cover on the I/O box.

Connect the SO2R Master to the computer by following the instructions elsewhere in this documentation.

To configure the NA Contest Logging Program for use with the SO2R Master, run the NA Configuration Editor (CONFIG.EXE) and select F5 – EQUIPMENT CONFIGURATION. Move to the parameter "Radio 1/2" and select the "w/ant" choice that matches the LPT port the SO2R Master is connected to. For example, if the SO2R Master is connected to LPT2, select "LPT2 w/ant". Exit from the Configuration Editor while saving the new configuration.

Operation of the NA Contest Logging Program with the SO2R Master will be as described elsewhere in this documentation. Press Ctrl-R within NA to toggle between Radio A and Radio B. (NA displays this as Radio #1 or Radio #2 on the Command Bar).

All SO2R transmitter control functions described within the NA documentation are supported by the SO2R Master. However, keyboard control of monaural or stereo received audio (NA's Ctrl-S key) is not supported but this function is supported by the controller interface next to your keyboard.

## **Operation with TR Contest Logging Program**

by

**George Freemin, K5TR**

WX0B SO2R box and TR-Log.

The WX0B SO2R switch box allows you to use tap into TR-Log's many two radio features. To take advantage of these features you need to add a few lines to your

TR-Log configuration file. If you want to have the SO2R switch box active every time you use TR-Log you should add these commands to a file called STD.CFG.

To enable the WX0B switch box you should add these lines to your CFG file.

(Assumes you are using LPT 1 on your computer)

KEYER OUTPUT PORT = PARALLEL 1

PADDLE PORT = 1

RELAY CONTROL PORT = 1

FOOT SWITCH PORT = 1

PTT = ENABLE

Now to define and expand on the above:

KEYER OUTPUT PORT

This tells TR-Log what port you will be using to key your radios. Normally when using two radios with TR-Log you would define two ports (one for each radio) but with the SO2R box you only need to define one port – all CW will go to that port.

PADDLE PORT

This allows you to use TR-Log as your keyer.

One command that might be useful is SWAP PADDLES. The SWAP PADDLES command reverses the DIT and DAH paddles for the keyer so if it is backwards to the way you send you can use this command to fix the paddles.

RELAY CONTROL PORT

This tells TR-Log what port you have the SO2R box plugged into.

If you find that the radios are "backwards" from what you wanted – like you wanted the A radio to be on the left but it is on the right you can swap them by using the SWAP RADIO RELAY SENSE command.

## FOOTSWITCH PORT

This tells TR-Log where you have your footswitch connected. The footswitch can be used to key the radio's PTT or it can be used to perform several functions in TR-Log.

By using the command FOOTSWICH MODE you can set the footswitch modes.

These mode include:

## CONTROLENT

Acts as if the CTRL-ENTER key was pressed, advancing the QSO one step without sending any CW.

## CW GRANT

When you try to send CW the PTT signal will be asserted but no CW will be transmitted until you depress the footswitch.

## DISABLED

This disables any foot switch action.

## DUPECHECK (or DUPE CHECK)

Executes the ALT-D command when the foot switch is pressed.

## F1

Acts just as if you had pressed the F1 key in either CQ or S&P modes.

## LAST CQ FREQ

Returns you to the last frequency you called CQ on when pressed.

## NEXTBANDMAP

Moves the frequency of the rig to the next (higher) frequency of a station whom you have not yet worked.

## NORMAL

The normal mode makes the foot switch behave just as if it was connected to the PTT of the active transmitter. This allows you to use the TR program to route your foot switch to the proper radio.

## QSO NORMAL

In the QSO NORMAL mode, the foot switch is used to advance the normal QSO process one step. This means hitting the footswitch will behave just as if you pressed the <ENTER> key.

## QSO QUICK

Same as QSO NORMAL, except when finishing a CQ MODE QSO, the QUICK QSL MESSAGE will be used instead of the QSL MESSAGE. SWAP RADIOS Acts just as if you pressed the ALT-R key.

## START SENDING

Acts just as if the STAR SENDING NOW KEY was pressed. This will start sending the characters you have in the call window, but allow you to enter more

until you press <ENTER>.

If you are using PTT for the first time with TR-Log and the SO2R Master, you may need to adjust the PTT delay times. You can do that with these commands:

## PTT TURN ON DELAY

This determines the amount of time that elapses between the assertion of the PTT signal and the start of the first CW character. The value is multiplied by 1.7 milliseconds. A value of zero disables this feature. The default value is 15

## PADDLE PTT HOLD COUNT

You can adjust the hold time after finishing CW with the paddle until the PTT drops out with the PADDLE PTT HOLD COUNT command. This command determines the number of dit counts that the PTT will be held before being released. The default value is 13. (The PTT drops out immediately following memory sent CW)

To use PTT for any of the above uses besides PTT remove CR14 by clipping it out of the circuit card. This will remove it from being hard wired to the PTT ports.

TR PC Digital Voice Keyer - For a great free sound card voice keyer check out this site

<http://fermi.la.asu.edu/w9cf/sbdvp/dvp.html#SECTION00060000000000000000>

## Operation with Write Log Contest Logging Program

by

**Jim Idelson, K1IR**

### Hooking Up to WriteLog

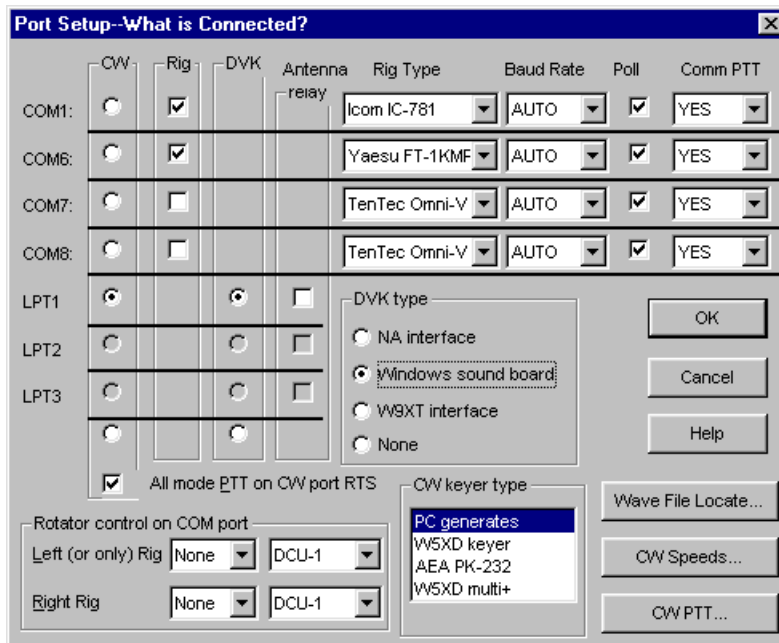
The SO2R master works great with WriteLog. It's truly plug'n-play. Here's one way to do it under Windows 98 using the PC to generate cw or ssb messages:

1. Connect all your cables as described earlier in this manual. You will use the SO2R Master for all switching functions EXCEPT microphone audio. Instead, connect microphone audio cables to the stereo output of your pc sound card as specified in the WriteLog documentation.
2. Open the Setup/Ports... dialogue and set up your radios on the COM ports with the correct control information.

3. Select the LPT port and control settings as shown below. Note that LPT1 is selected for both CW and DVK. The DVK selection causes the Radio A/B signal to be output on the parallel port pin 14. This setting is required for proper operation of the SO2R Master.

4. Lift the end of R13 closest to the DB25 (LPT connector) and solder a small wire to a ground.

WriteLog is driving the SO2R master differently than other software – They do not use the LPT pin 1 STROBE signal other software logging packages use.



5. You'll want to select the proper CW PTT control from the CW PTT... menu.

6. Under the Radio menu, select Number of Radios/2.

7. Close the Port Setup dialogue.

At this point, your radios should be exchanging frequency information with WriteLog and you should be able to switch between radios by changing the focus of WriteLog from the Left Radio to the Right Radio callsign entry field. You'll want to test cw and ssb transmit functions. When the WriteLog focus is on the Right, you should get cw and ssb messages to that radio, and vice versa.

You can make this setup work with the W5XD Multi+ Keyer, as well. Just run one radio through its COM port connections and treat its cw functions as an external keyer to the SO2R Master.

GL and CU in the contests!

Jim K1IR

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If you have other suggested modifications to the SO2R Master please send them to us. We will test them and place them on this page. For modifications used on this page we will compensate you with a \$100 of certificate for Array Solutions products. These mods will be added to the next generation SO2R Master.

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