PSKMETER
USERS MANUAL
VERSION 2.1
12/24/2013

INTRODUCTION

PSK31 is one of the most exciting and friendly modes of operation in amateur radio!

PSK31 is a great way to communicate across the country and around the world, working DX with almost any power level.

PSK31 is a good use for your computer and its sound card. Using waterfall presentations in frequency space revolutionizes the way we think of tuning our radios. User-defined macros let you swap information with buttons. Keyboard –to-keyboard communication lets you send and receive information in a friendly and efficient way.

For all of its advantages, however, PSK31 has an important requirement that you need to be constantly mindful of—overmodulation! PSK31 depends very directly on the audio level that you have set in your computer's sound card. If the audio level is too low, your signal will be weak and noisy. If the audio level to too high, you will have plenty of power, but also plenty of splatter! Every PSK31 operator has seen other stations signals that are overdriven: instead of seeing two clean tracks on the waterfall display, you will see multiple tracks every 31 Hz on both sides of the signal, creating interference for other QSOs. An overmodulated signal is also going to have more received character errors than a clean signal.

The problem is that while you can certainly see problems with other's signals, you cannot know whether *your* signal is weak and noisy, or overdriven and creating splatter. The reason is that you cannot "see" your own RF signal.

What you need is an RF monitor that can sample your transmitted output, knowing what PSK31 signals should ideally look like, and inform you that your audio needs to be increase or decreased. You can actually do this with an oscilloscope: attach your scope's lead to your RF output and observe the shape of the RF envelope when the signal is idling. Then increase the audio level until the envelope is not longer sinusoidal. Easy enough, but there are some drawbacks: 1) who wants to tie up an expensive resource like a 100MHz scope?, and 2) you have to continually tune up your audio to optimize your signal.

What you might find a better solution is a special device that samples your RF output, digitizes it, and reports PSK31 "frames" of bits back to your computer. In software, your computer can not only display the your signal in real time, but can analyze the signal and determine if your audio setting is too low or too high. The best part is that because this software can access the sound card, the software can automatically set your audio to give you *perfect* PSK31 signals all the time without you having to do anything. You are free to make and enjoy QSOs knowing your signal is at the highest possible power level that is free of intermodulation distortion (splatter).

The kit you now own is exactly that!

Your kit contains:

- The PSKMETER printed circuit board
- All the components for the PSKMETER circuit
- The PSKMETER microprocessor, pre-programmed ready to go
- An optional enclosure that exactly mates with the circuit board
- This set of assembly, testing, and operating instructions
- The PSKMETER software for your Windows computer

By connecting your PSKMETER to a free comport on your computer (or connecting to a USB port with the optional Serial/USB converter), connecting your transmitter's RF output via a 'T' connector, and running the PSKMETER software application, your signals will be perfectly adjusted, automatically for you. Ready to build it? The next section walks you step-by-step through the assembly process.

PSKMETER
ASSEMBLY INSTRUCTIONS

Assembling your PSKMETER takes about 60 minutes if you are new to kit building or have very modest electronics experience. We have tested the assembly process by giving these instructions to my 12 year-old son, KG6IAD, and 60 minutes later he completed the assembly with a unit that worked perfectly on startup. Of course if you have more extensive kit building experience, you can expect the assembly time to be much shorter. The instructions are written assuming you have no kit building or electronics experience.

<u>Before you begin</u>

    a. Print out this document. The final two pages of the document are a "parts palette," which will allow you to methodically sort out the kit components, locate them easily at assembly time, and check the checkbox on the palette as you go along, documenting the component is assembled.

    b. Place each component in the appropriate square on the parts palette that you printed out. For example, the first square on page 1 of the parts palette is a 39K ohm resistor. The parts palette shows you are looking for an orange-white-orange resistor. Find this resistor in the bag of parts shipped to you, and place it in the first square of the parts palette page. Do this for all the parts on the palette. You will have used up all the parts shipped to you in the kit, except for the printed circuit board (and optional enclosure if you ordered one).

    c. In the unlikely event a part is missing from your kit (i.e., a square on the parts palette is empty), please send us a message via email to <u>support@softwarescience.net</u>, providing us with the part ID (e.g., R1) and a mailing address. We will promptly send you the missing part!

    d. Next, get your tools ready. Here are the tools and supplies you will need for the assembly of the PSKMETER:

- The kit parts, of course.
- A low wattage pencil-type soldering iron with a small tip.
- Thin rosin-core solder (see below for what solder <u>not</u> to use).
- Diagonal wire clippers
- Pen or pencil
- Voltmeter
- Drill with ½" drill bit (if you purchased the optional enclosure)
- A large strong magnifying glass for those with weak vision (or an assistant with good vision)—a few of the parts are labeled with very tiny lettering

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WARNING. Do *not* build your PSKMeter kit using solders which contain "no-clean" or "water-soluble" fluxes. For example, do *not* use solders with the following types of flux core:

Kester "245" No-Clean Solder
Kester "331" Water-Soluble Solder
or any solder with a "No-Clean" or "Water-Soluble" flux core.

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    e. Once you have assembled your PSKMETER, you will then need
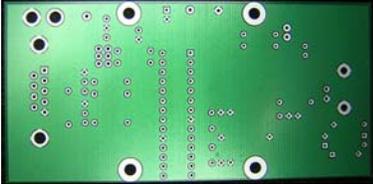
- +9 - +12 VDC power adapter (or 9V battery)

- Coax cable from transmitter to PSKMETER
- BNC Tee (available from our website http://www.ssiserver.com/info/pskmeter, click on the "Order" link)
- DB9 serial cable
- PSKMETER Software (downloaded from our web site)

<u>Let's Go!</u>

❒ Step 1.

Inspect your printed circuit board. Notice that there is a "component" side to the board. This is the side on which you will insert all the components, and is easy to identify since it has the white "silk screen" markings, parts outlines, and so on. The other side of the board is the "solder side." The solder side has no markings, and most of area of this side is plated with a ground plane. This is the side on which you will solder the component leads that poke through their plated "through holes." Just to be sure you understand: parts leads go through the plated through holes on the component side of the board, and you will apply the solder to the solder side of the board. When you complete each step, check the check box on this manual, and also on the parts palette sheet.

Component Side:

Solder Side:
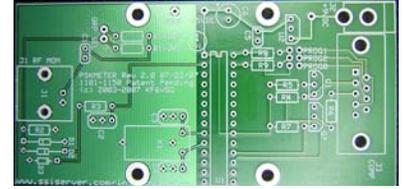
Something that might be new to you when you first inspect the board: the through-hole pads are white, not metallic and shiny. At first, you might think that it is not possible to solder to the pads because they don't have the classic metallic appearance. The reason is that your printed circuit board is RoHS compliant. This new technology uses no lead in the production of the board. You can certainly solder to the pads with no problem, using traditional solder, and lead-free solder as well. However, this lead-free technology requires a slightly higher temperature for the solder to bond to the pad. If your solder joints are "cold" or the solder does not flow and bond nicely to the pad, just increase the temperature of your soldering iron at bit.
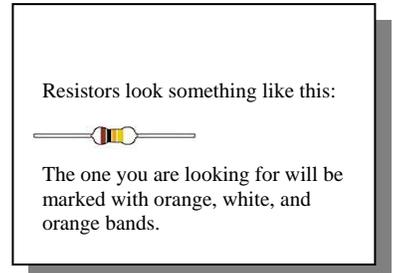
❒ Step 2.

Solder the 39K resistor R1-QRO at location R1 QRO. You can identify all the resistors by their color band markings. In this case, look for orange-white-orange. There will be a fourth color band, the tolerance band, which you can ignore.
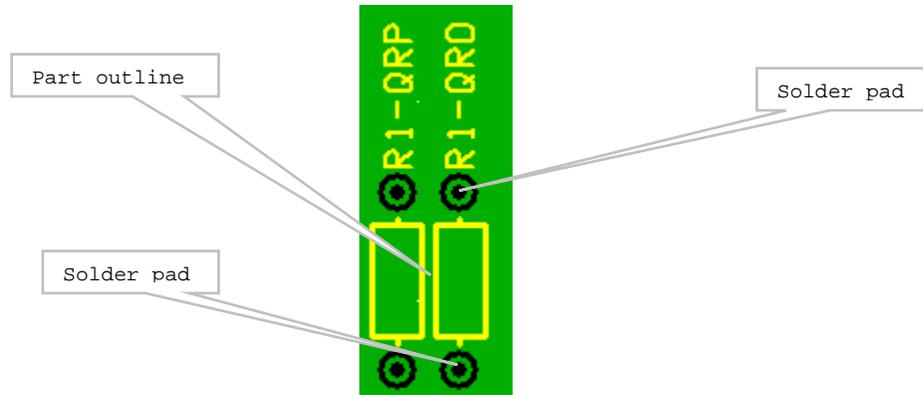
To insert the part, just bend the leads 90 degrees close to the body of the part. Find the location on the board, identified by

- It's part number
- It's part outline
- The solder pads associated with the part outline. Solder pads are the round or square metallic shapes with plated through-holes in the center.

For example, for this part (R1-QRO), look for these markings:

Resistors look something like this:

The one you are looking for will be marked with orange, white, and orange bands.

Part number

Part outline

Solder pad

Solder pad

You will find that the hole spacing is just right to accept leads bent this way. Insert the leads all the way through their solder pads, so that the part is as close to the printed circuit board as possible.

Resistors can be soldered at their location in either direction.

Always make sure when you solder that the lead and pad are heated enough for the solder to flow and "wet" the lead and pad. Otherwise you will have a "cold solder joint," and that's not going to work. This is especially true when the plated through hole ends up on the ground plane. The ground plane dissipates a lot heat, and it will take a few moments longer to heat before the solder flows. You also want to watch for a solder "bridge." This is where you apply too much solder, and it jumps over the solder "mask" and connects to a pad that it wasn't intended for. So remember: for each solder connection you make, always check that you don't have a cold solder joint, or a solder bridge. This will guarantee that when you are done, the circuit will work!

After soldering, clip the leads with a wire clipper as close to the solder pad as possible. As you clip, don't pull on the leads, as this might tear the solder pad away from the board.

When you have completed this step, check the check box above, and on the now-empty square on your component palette. You are ready to proceed to the next step.

❐ Step 3.

Solder the 6.8K resistor R1-QRP (blue-gray-red) at location R1 QRP.

❐ Step 4.

Solder the 2.2K resistor R2 (red-red-red) at location R2.

❐ Step 5.

Solder the 100K resistor R3 (brown-black-yellow) at location R3.

❐ Step 6.

Solder the four 2.7K resistors R4, R5, R6, R7 (red-violet-red) at locations R4,R5,R6, and R7.

❐ Step 7.

Solder the germanium diode D1 at location D1. The germanium diode can be shipped in various forms. Most often it is clear glass with a black band on one end. However your kit may contain diodes from another manufacturer and

Germanium diodes have a glassy appearance:

Look for the black band on one end of glassy-type diodes, or a white band on the end of black case diodes. The lead on this end goes to the square solder pad on the printed circuit board. Bend the leads carefully and away from the body of the diode to avoid shattering the part.

are black with a white band and white lettering ("1N270"). The banded end of the diode should go into the square solder pad, the pad closest to the silk screen marking with the band, and in this case closest to the edge of the printed circuit board. Pay close attention to this detail! Diodes installed in the wrong direction will guarantee that your PSKMETER will definitely not work! Also note that the glass body RF diodes are *very* fragile and can easily shatter if you bend the leads too closely.

❐ Step 8.

Solder the germanium diode D2 at location D2. As mentioned in the previous step, the second germanium diode is either clear glass with a black band on one end, or black with a white band. The banded end of the diode should go into the square solder pad, the pad closest to the silk screen marking with the band, and in this case furthest from the edge of the printed circuit board.

❐ Step 9.

Solder the 5.1 volt Zener diode D3 at location D3. The zener diode may be black with a white band, or light gray with a dark gray band, or even glassy with a black bank on one side and a copper appearance on the other. The banded end of the diode should go into the square solder pad, the pad closest to the silk screen marking with the band, and in this case farthest from the edge of the printed circuit board. The zener diode is usually smaller than the germanium diodes.

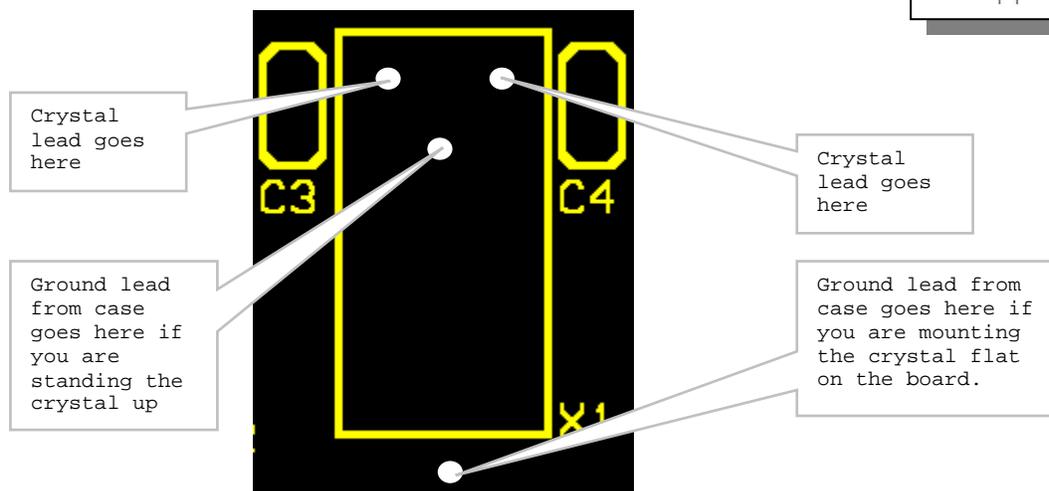Your Zener diode will look something like this:

The white band is not quite visible on this picture, but it is readily apparent on the part you have. Make sure you solder the lead closest to the white band to the square solder pad.

❐ Step 10.

Solder the 20MHz crystal X1 at location X1. You will want to bend the leads so that the crystal is lying down flat on the printed circuit board. Be careful in bending the leads that they don't touch the case of the crystal! The silk screen markings look like this:

The crystal is easy to identify. If you can ground the case to the ground plane, do so.

Crystal lead goes here

Crystal lead goes here

Ground lead from case goes here if you are standing the crystal up

Ground lead from case goes here if you are mounting the crystal flat on the board.

The crystal can be mounted either way, but it is always a good idea to mount the part so that its value markings are facing up (so they are visible).

If your crystal has a third lead that is attached to the case, you will want to solder this lead through the either the pad close to the active leads, or the pad at the top end of the crystal. Both of these pads are ground, and guarantee that the crystal case is grounded. This is a pretty good idea, since there is going to be RF frequencies on the board and you don't want those mixing with or effecting the operation of the crystal. If your crystal doesn't have a case lead, you may want to consider using a lead from a part you have already installed and clipped as a connection from the case to ground.

❒ Step 11.

Solder the monolithic 22 pf capacitors C2,C3,C4 to locations C2, C3, and C4. These capacitors will be marked "22" or "220". NOTE: We have discovered that this particular value of capacitor in 0.1" spacing can at times be difficult to obtain. In that case we ship the same capacitor with 0.2" spacing. The printed circuit boards are designed to accept either 0.1" or 0.2" lead spacings for these capacitors. Therefore, you will observe 3 plated through holes for each of these parts, rather than the 2 plated through holes you would normally expect.

Monolithic capacitor s look like this. The one pictured is red, but your kit will contain either blue or tan ones. Color is not important. Be sure the part is marked "22" or "220" . See the instructions the left regarding lead spacing.

If the kit was shipped with 0.2" leads, just ignore the middle hole.

If the kit was shipped with 0.1" leads, insert the parts as follows:

C2: Insert one lead in the center hole, and the other lead in the hole closest to the crystal X1.
C3, C4: Insert one lead in the center hole, and the other lead in the hole closest to the microprocessor, U1.

❒ Step 12.

Solder the 28-pin DIP socket to location U1. Insert the socket so that the end with the notch (half circle cut out from the body of the socket) lines up with the notch in the silk screen markings (the end with the "① " silk screen marking.

Pictured here is a 16 pin version of what you are looking for. Your socket will have 28 pins.

16-pin, 0.3"W version

❒ Step 13.

Solder the monolithic 0.1 uf capacitor C1 to location C1. This capacitor will either be blue and marked ".1K" or "104", or will be yellow and marked "104".

❒ Step 14.

Solder the monolithic 0.1 uf capacitor C5 to location C5. As in step 13, this capacitor will either be blue and marked ".1K" or "104", or will be yellow and marked "104".

❒ Step 15.

PSKMeter requires two NPN fast switching transistors. These can be either 2N4401 or 2N3904. Your kit may contain either 2N4401s or 2N3904s (or one of each). Solder the NPN transistors Q1 and Q2 to locations Q1 and Q2. These transistors have 3 leads and are marked on the flat side with "2N4401" or "2N3904." They can be easily confused with the voltage regulator U2, so it is very important to correctly identify these two transistors. The transistors have a half-round side and a flat side. The flat side is marked 2N4401 or 2N3904 in very tiny lettering. You will have to use your magnifying glass or eagle-eyed assistant to identify these parts correctly. Be sure to orient the transistors to match the silk screen markings. You may have to spread the leads out to the sides a bit and work the transistors into their solder pads.
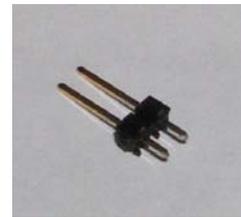
Be careful! The transistors you are looking for look like this, but so does the voltage regulator! The transistors will have the marking 2N4401 or 2N3904 in teensy-tiny print on the flat side of the package.

❒ Step 16.

Solder the +5 volt regulator, 7805, U2 to location U2. This integrated circuit has 3 leads, and is marked on the flat side as "78L05." It can be easily confused with the transistors mentioned in step 15, so it is important to double check the identity of this part before soldering. The flat side is marked 78L05 in very tiny lettering. You will have to use your magnifying glass or eagle-eyed assistant to identify these parts correctly. The part has a half-round side and a flat side. Be sure to orient the regulator to match the silk screen markings.

❒ Step 17.

Solder the QRP SEL jumper pins to the pads labeled "QRP SEL". These pads are located next to the resistors R1. The jumper pins are embedded in a small black plastic block, and there is a short end sticking out of the block, and a long end sticking out of the black. See the illustration to the right. Solder the <u>short</u> end to the solder pads.

❒ Step 18.

Solder the DB-9 right-angle female PCB connector J3 to the printed circuit board, labeled J3.

This is the edge connector you are looking for.

❒ Step 19.

Solder the 10 uf electrolytic capacitor C6 to location C6. This capacitor is a cylinder with both leads on the same end of the part, and labeled as "10 uf." The orientation of this part is very important! Notice that one lead is closest to the marking on the capacitor that has a white strip, with one or more oval markings. This is the negative side of the capacitor. Another way to identify the negative lead is that it is the short lead. Once you have identified the negative lead, the other lead is of course the positive lead. Insert the part so that the <u>positive</u> lead is in the <u>square</u> pad, which is also silk screen marked with a "+" sign, and is also the pad closest to the end of the board.

This component is "polarized," meaning it should not be inserted backwards. Look for the short negative lead which goes to ground. The longer positive lead should go to the square solder pad, also marked in silk screen with a "+"

❒ Step 20.

Insert the 2.1 mm power jack, J2, into the large holes at location J2. The part is mounted so that the opening of the part faces away from the board. The holes are oriented so that you cannot incorrectly mount the part. Solder the two in-line leads to the pads on the solder side of the board. This will leave a third unused lead to hang over the edge of the board. You will observe that the leads are flat, but the holes are round. To establish a good electrical connection, just solder the edge of the leads that touch the circle of the holes.

❒ Step 21.

Insert the BNC connector J1 at location J1. There are two leads on this connector, and also two posts. Solder the two leads, but also apply some solder to the two posts. The posts have no electrical significance, but they add mechanical strength and integrity to the connector.

❒ Step 22.

Solder the two 4.7K resistors R8 and R9 (yellow-violet-red) at locations R8 and R9. NOTE: In some kits, these resistors have a blue sleeve and the colors may be hard to identify. The yellow and violet bands are easy to see, but the red band may appear to you to be so dark as to be black. However, if the resistor sleeve is blue, and two of the bands are yellow and violet, you are holding the 4.7K resistor. If you have any doubt about this, you may wish to use your ohmmeter to confirm the resistance value.

YOU ARE DONE SOLDERING! Your printed circuit board should now look like what you see below (except that you have not inserted the microprocessor into the socket yet).
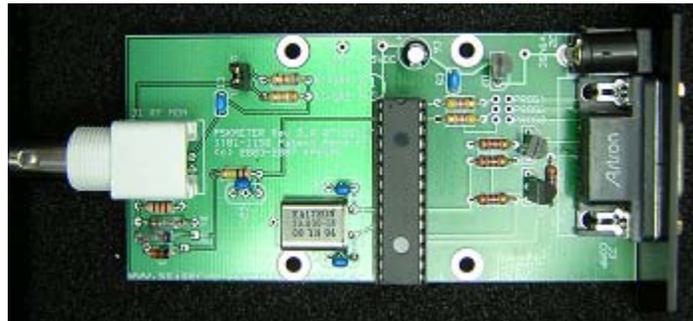
WARNING! At this point, you might be tempted to clean up the solder side of the board by dissolving the flux using a solvent such as isopropyl alcohol. The problem with that is that oftentimes the solvent finds it way under the 28-pin socket and manages to leave a residue that results in a high impedance "short" between pins of the microprocessor. If this happens between pins 1 and 2 for example, the ADC will read a significant voltage and will completely spoil the operation of the circuit. If that happens the only remedy is to unsolder the 28 pin socket, clean the board, and replace the socket. This can be time-consuming and an unpleasant task. If you insist on cleaning up the excess flux, be very careful to not allow any solvent to get underneath any component!

<u>Let's start testing!</u>

❒ Step 23.

Now inspect the solder side of the board for poor or cold solder joints. All pads should be shiny and smooth. Inspect for any undesired solder bridges.

❒ Step 24.

Get out your voltmeter and measure the resistance between the pad labeled "+5VDC" and the pad labeled "GND" (these will be near the electrolytic capacitor C6). The resistance should be approximately 5K ohms or greater. If you are seeing a short (say less than 3K ohms) between these points, don't go on to the next step until you resolve where the short is coming from.

❒ Step 25.

You will need a power adapter ("wall wart") that provides 9 to 15 volts DC, with a 2.1 mm jack with the center pin positive (not supplied). Verify with your voltmeter that you are getting the right voltage at the right polarity before you connect to the PSKMETER!

If you don't have a power adapter, you can use an ordinary 9V battery. The PSKMETER doesn't draw a lot of current, so a 9V battery can work for many hours with no problem. Just be sure you connect the battery with the right polarity! Check with your voltmeter that you really have 9 volts.

Connect your power adapter (or battery) to J2.

WARNING: Applying power backwards will immediately "smoke" the 7805 voltage regulator. But *sure* you have the *positive* polarity going to the *center* pin of the jack!
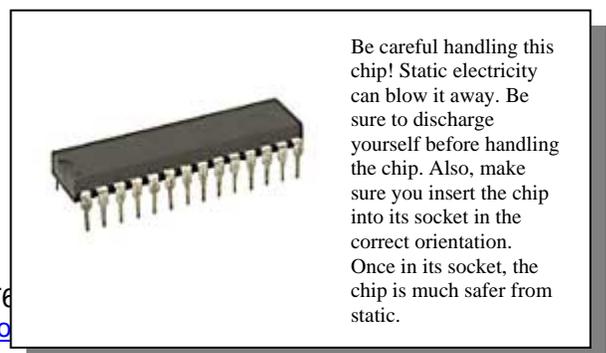
❒ Step 26.

With your voltmeter, measure the voltage between the two pads labeled "GND" and "+5VDC". You should see 5 volts to within 1% (4.95 – 5.05). If you don't see this voltage, check your work before going on.

❒ Step 27.

Feel the components on the board and verify that none of the parts are running hot, or even warm. If any part seems warm to the touch, you have an indication that something is wired incorrectly.

❒ Step 28.

Remove power from the board. Before handling the microprocessor (MicroChip PIC microprocessor IC, U1), be sure you have grounded yourself to a large metal object and there is no static electricity around to discharge and spoil this chip! Now insert the chip into the socket at location U1. The notch on the chip should match the notch on the socket, and the notch on the silk screen. The notch on the chip should be closest to the "① " on the silk screen.

Be careful handling this chip! Static electricity can blow it away. Be sure to discharge yourself before handling the chip. Also, make sure you insert the chip into its socket in the correct orientation. Once in its socket, the chip is much safer from static.

WARNING: an improperly inserted chip may result in permanent damage to the chip.

You will find that the pins on the chip are spread out a little bit too wide to find into the socket. Just take the chip and place the pins on a flat surface and gentle apply pressure so that all the pins on one side of the chip are bent just a little bit closer to the other row of pins. Do this to both sides of the chip. You will find that the chip can now be easily inserted into the socket. Push the chip all the way into the socket.

❏ Step 29.

Connect a serial cable (not included) from J3 on the PSKMETER to a com port (i.e., 9-pin serial port) on your Windows computer (also not included!). NOTE: the serial cable should be a so-called "straight" cable, and not a "crossed" cable (or null modem). This means that pin number "n" on one end connects to the same pin number "n" on the other end.

What if your computer doesn't have a serial com port? Many desktop and laptop computers these days don't have serial ports. In that case you will need to use a USB-to-serial adapter. The adapter allows you to connect your PSKMeter to any USB port on your computer. If you have a USB-to-serial adapter, and have installed the driver for it, then you are all set to go to the next step. If you don't have a USB-to-serial adapter, you can order one from our page at http://www.softsci.com/p-psk-usb.htm.

❏ Step 30 (for Windows users other than Vista for Windows 7/8).

Now let's test the serial connection to your PSKMETER. If you are using Windows XP, launch the Windows accessory Hyperterm. The following instructions pertain to Hyperterm. If you are using Windows Vista, 7 or 8, skip below to Step 30 (for Vista, 7, 8 users).


Open Hyperterm by clicking on Start, Programs, Accessories, Communciations, Hyperterm. This will open a window with the Hyperterm program. Click on the Hyperterm.exe application. You should see the dialog box shown at the left.
Enter "PSKMETER" or something similar in the Name field and click on Ok.

On the next screen, shown on the right, select the com port you want to use in the field "Connect using:". Normally this would be com1 or com2. Select a port you not already using for another application. Click on Ok.
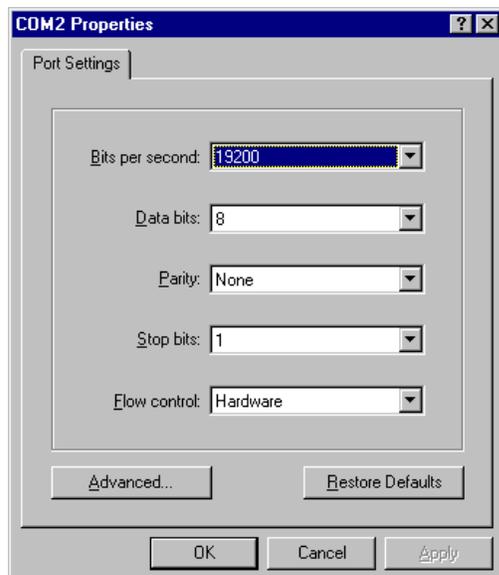
On the com port properties dialog box, shown at the left, set the following parameters:

Bits per second: 19200
Data bits: 8
Parity:None
Stop bits: 1

Flow control: NONE. On some version of Windows, either Hardware or NONE will work. On all versions of Windows, NONE will work. Therefore we recommend setting flow control to NONE.
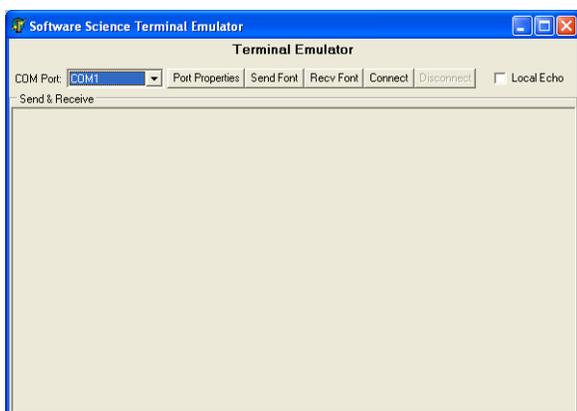
And then click on Ok.

You will now see the Hyperterm display window with a winking cursor ready to exchange text data on the com port you specified. You are now ready to skip to step 31.

❒ Step 30 (for Windows Vista, 7, and 8 users).

Vista, Windows 7/8 are not shipped with Hyperterm. However, you can download a free copy of SSITerm from our website at http://www.ssiserver.com/info/pskmeter/ssiterm.exe.

Download and save a copy of ssiterm.exe to your pskmeter directory. When you launch ssiterm, it will look like this:

Select the comport you want to use from the pulldown list of available comports at the top left of the window.

Then click on the Port Properties button. Enter the serial communication parameters as shown below:
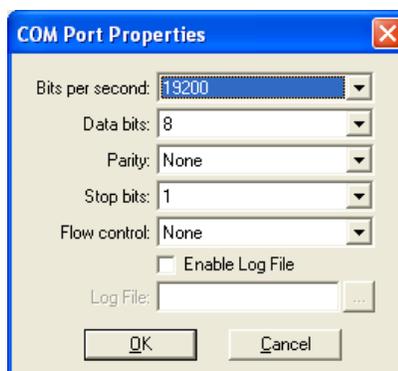
Then click Ok, to close the COM Port Properties window. Now click on the Connect button, and proceed to the next step.

❒ Step 31.

Apply power to your PSKMETER. You should see the message

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PSKMETER Firmware Version 1.10
(c) 2013 KF6VSG
www.ssiserver.com/info/pskmeter
```

(or similar) appear in the window. You should also be able to type a lower case "v" to see this message on demand. You will not see the "v" you type, only the version information coming back from the PSKMETER. If you see this message, your PSKMETER is alive and well and ready to work for you! If you don't see this message, check your com port setting, your baud rate, and your cabling, and whether you are applying power to the board. *Check the sidebar on the next page for more information if you are having trouble.*

NOTE: In pskmeter version 1.0 and 1.1 (marked in silkscreen on the component side of the board), the circuit does not respond to hardware handshaking required by some PC serial ports. In this case, there will be no response to the 'v' character. If you have either of these versions, the patch is very simple:

Solder a short wire from the solder pad of pin 4 of the DB9 connector to the solder pad of pin 6 of the connector. You can identify these pins very easily. Pin 4 is on the component side of the board, second pad away from the marking "J3 COMP". Pin 6 is on the solder side of the board, first pad on the right as you hold the board so that the DB9 connector is at the top of the board.

What if I don't see the copyright notice, or I get no response from the "v" key?

Here is a checklist for assist in your trouble-shooting:

1. Make sure that hardware flow control in HyperTerm or SSITerm is set to NONE.
2. Verify that you have 5 volts at the voltage regulator output.
3. If you are using a hardware serial COM port:
    a. Verify that the serial cable you are using is a straight cable, i.e., pin 2 connects to pin 2, and likewise for pins 3,4,5 and 6. Check with an ohmmeter to be certain your cable is good.
    b. Check that the serial cable is connected to the proper serial port on your computer. That is, if you are testing with Hyperterm configured to COM1, be sure your cable is connected to the COM1 port on the computer.
4. If you are using a USB to serial converter:
    a. Make sure you have the drivers provided by the converter manufacturer installed.
    b. Click on Start|Control Panel|System|Device Manager and expand the Ports item in the list. You should see a COM port associated with your converter. If you don't, the driver has not been installed.
    c. Is the COM port 1 or 2? You may find that the COM port associated with your converter is at a port higher than 2. Determine the com port number and adjust your settings in HyperTerm or SSITerm to match.
5. Apply the patch from pin 4 to pin 6 as described in the sidebar above.
6. Click on Start|Control Panel|System|Device Manager and expand the Ports item in the list. Select the COM port you are using, and click on Properties. Click on the Port Settings tab. Click on the Advanced button. Lower the settings for the TX and RX buffers. Click on Ok and close the open windows.

Once you have confirmed that the serial connection is working, you will not have to concern yourself with Hyperterm (or SSITerm) again, as we just used it as a post-construction diagnostic tool. Close Hyperterm (or SSITerm).

❐ Step 32.

You are now ready to put the meter to work for you. If you haven't done so already, download the pskmeter Windows program from the pskmeter web site at www.ssiserver.com/info/pskmeter and copy it to your hard drive. There is no installation program to run, just copy what you download (pskmeter.exe) to any directory you like and create a shortcut to it. You may also want to put pskmeter.exe in your Windows StartUp directory, so that it is launched whenever your computer boots.

❐ Step 33.

Launch pskmeter.exe. Here is what you should see:

PSKMETER © 2013 KF6VSG
http://www.ssiserver.com/info/pskmeter

The caption bar of the program will inform you of the com port that PSKMETER is communicating on. It will not necessarily be the com port you entered in Hyperterm. If you see the message "NO SIGNAL" then everything is working correctly to this point. However, if instead you see the message "PSK METER NOT RESPONDING" is means that something is wrong. The possible failure modes are:

- The PSKMETER is not powered up
- There is no cable from the com port of your computer to the PSKMETER
- The cable is connected but is an inverting (null modem) cable
- The cable is not connected to the com port used by the software.
- The com port is in use by another program
- You have version 1.0 or 1.1 of the printed circuit board (see side bar above)
- The PSKMETER program is not set to the correct com port (see instructions below)

To set the com port, place your mouse over the display area of the program and click the right mouse button. A menu will popup.
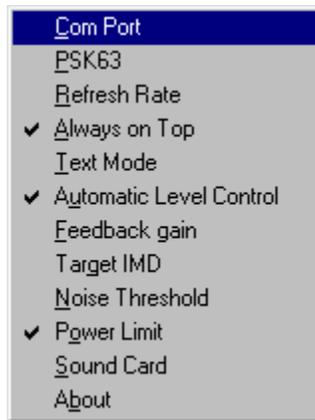
Click on the first menu choice, "Com Port." A window will open that will allow you to set the com port you want to use to talk to the PSKMETER hardware. Once you have selected a com port, the application will remember this setting for all future use.

IMPORTANT NOTE: The PSKMeter application allows you to select either COM 1 or COM 2. However, your may want to use a higher COM port number (especially if you are using a USB to Serial Converter that automatically selects a COM port greater than 2). In that case, proceed as follows:

Using Windows notepad, open the file pskmeter.ini located in your C:\WINDOWS directory. If you are running Vista or Windows 7/8, the pskmeter.ini file will not be in the C:\WINDOWS directory. Instead look for it in either:

```
c:\Desktop\<your name>\AppData\Local\virtualstore\windows
or
c:\users\<your name>\AppData\Local\virtualstore\windows
```

where you should replace <your name> with the user name you are logged in as.

When you have opened the file in notepad, you will find the following specification:

```
[COM PARMS]
Port=1
```

Now edit the port number to the comport you plan to use. For example, if you would like to use COM port 6, edit Port=1 to read Port=6. Then save the file and close notepad. When you start the PSKMeter application, it will open and use the com port you specified.

Once you see "NO SIGNAL" displayed, it means that the software has detected the presence of the PSKMETER hardware and communications are working. In fact, you can right click, and click on "About", and a window will popup showing the firmware version number, and message that comes from the
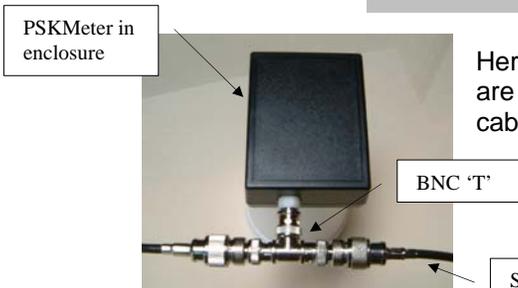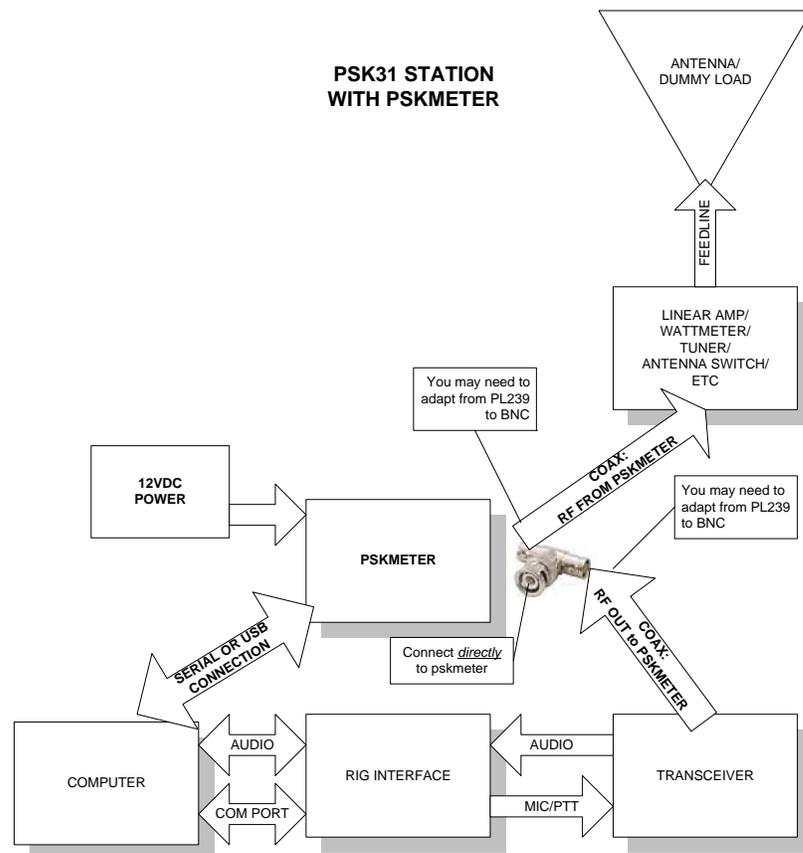
microprocessor. This is a sure-fire indication that your computer and the PSKMETER are getting along just great.

☐ Step 34.

Now attach a BNC 'T' connector to the BNC jack on the printed circuit card. Connect the RF output of your transmitter to one end of the 'T'. Connect a dummy load (or antenna) to the other end of the 'T'.

IMPORTANT! The PSKMETER is a "high input impedance" device, meaning it will not look anything like 50 ohms to your transmitter! Directly connecting your transmitter to the PSKMETER, without a 50 ohm dummy load or an antenna, would be just like transmitting to an unterminated cable. Your signal will simply reflect back into your transmitter with infinite SWR, which cannot possibly benefit your equipment! Therefore, always keep in mind that the PSKMETER is a *monitor* that samples your RF signal, and you need to provide an impedance matching device (like your antenna) that your transmitter looks into.

Just to be sure we understand one another, here is a diagram of how PSKMETER is connected to your PSK31 station:

**PSK31 STATION
WITH PSKMETER**

ANTENNA/
DUMMY LOAD

FEEDLINE

LINEAR AMP/
WATTMETER/
TUNER/
ANTENNA SWITCH/
ETC

You may need to adapt from PL239 to BNC

COAX:
RF FROM PSKMETER

You may need to adapt from PL239 to BNC

12VDC
POWER

PSKMETER

COAX:
RF OUT to PSKMETER

SERIAL OR USB
CONNECTION

Connect *directly* to pskmeter

COMPUTER

AUDIO

RIG INTERFACE

AUDIO

TRANSCEIVER

COM PORT

MIC/PTT

PSKMeter in enclosure

Here's a photo illustrating how this connection will look when things are correctly connected (not shown are the DC power cord or serial cable both of which would connect to the other side of the enclosure):

BNC 'T'

Short coax to transmitter RF output

Coax to antenna (or tuner, or linear amp)
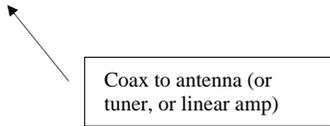
NOTE: Do not run a coax from the center of the BNC 'T' to the PSKMeter, since this will act like a "stub" and will only result in power being reflected to the rig and increasing your SWR.

Another interesting point to ponder: you may want to add a magnetic toroid to the coax cable between the PSKMETER and your antenna to reduce any signal that attempts to come back on the ground braid of your coax. Your antenna is not a perfect radiator, and has an SWR greater than 1 no matter how slight. Since not all energy is transferred to the antenna, some will be reflected back. This energy looks at all possible paths and some will try to come back on the grounding shield of the coax. Imagine that only 100 milliwatts finds its way through the ground braid. This would result in a ground voltage of several volts which will get introduced into the input side of your PSKMETER. Because the PSKMETER is an integrating device at RF frequencies, most of this effect is reduced. However, if you are running QRO it would be a good idea to increase the impedance seen by reflected ground RF by adding inductance to your feed line. The usual way of doing this is to loop the coax 4 or 5 times at the antenna feedpoint, but in addition it is advisable to add a toroid at the shack end of the feedline also.

❏ Step 35.

Next, you need to set the "QRP SEL" jumper setting if you are running low power. With the jumper removed, the PSKMETER will work well with signals from about 10 W through 100 W. If you are running low power (3W to 10W), such as with a Small Wonders Lab transceiver, WinWarbler, or other QRP transceiver, you will need to insert the supplied jumper block over the two gold-plated pins near the BNC connector. The supplied jumper block looks like this:

with a contact spacing of 0.1 inches. If you want you can store the jumper block so that is fits over one of the posts. When slipped over only one post, the block has no electrical effect. When slipped over both posts, the PSKMETER is more sensitive to lower input voltages.

❏ Step 36.

Next, launch your favorite PSK31 software program, for instance, Digipan. Click on the button to start transmitting (such as "T/R" in Digipan). You should then observe the RF wave form in the PSKMETER window, which should be two ½ wave sine waves, like this:
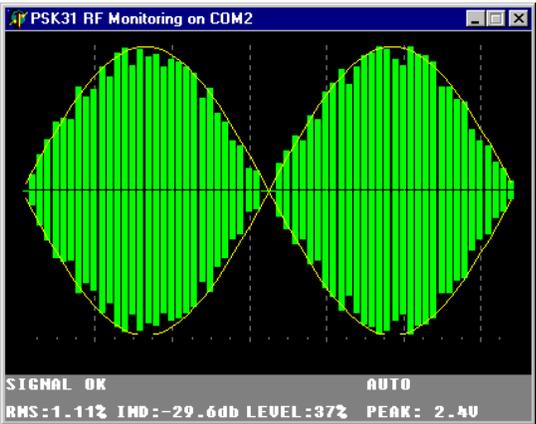
Your PSKMETER is working!

You might immediately notice that the text line in PSKMETER is telling you that your signal is splattering, is underdriven, or SIGNAL OK. The software is analyzing your RF signal and reporting back information you didn't know before!

More than just reporting the health of your signal, if you watch for while you will see that the software is slowly adjusting your audio level to *make* your signal OK. You can observe this by noticing the LEVEL reported. This is your line-out audio level as a percent of full-scale audio out. If you open your Windows Audio Mixer, you can actually see the slider controls for your audio line out moving (up if the software thinks you are underdriving, or down if the software thinks you are

splattering). After 10 or 20 seconds, your signal will settle into the "sweet spot" where your RF is optimized.
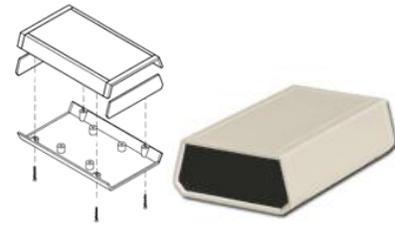
Now you can unkey the transmitter (via the "T/R" button in Digipan, or equivalent in other programs). We are done testing. Before we document all the features and settings in PSKMETER, and talk about some com port and USB options, let's finish the construction of the meter.

❐ Step 37 (Optional Enclosure)

If you ordered the optional PSKMETER enclosure, it is now time for the final assembly of your kit.

The enclosure is a "clam shell" style box, with two end panels, like the one shown at the right.

Open the box and remove the end rectangular end panels. Notice that the printed circuit card is designed to fit on the bottom, shallow half of the clam shell, component side up. You have some choices in how you want to proceed:

Option 1. You can decide to not use either end panel. In that case, you will need to mount the printed circuit board to the shallow clam shell with 4 self-taping screws, using the 4 mounting hole provided in the printed circuit board, which mate to the 4 plastic "bosses" on the clam shell. Having done that, just snap the top half of the clamshell to the bottom half, and use the 4 machine screws provided to attach the two halves.

The custom PSKMETER enclosure looks just like the one pictured, except that it is black.

Option 2. For a more finished look, you can use the two end panels. One end panel will need a hole for the DB9 plug, and another hole for the power supply. The other panel will need a hole for the BNC connector. Making a hole for the DB9 connector is not easy, since the hole should be rectangular. If you ordered the enclosure "upgrade", we supply an end panel with a DB9 hole already cut out. You still will need to add a hole for the power supply, but that is easy to make with a drill and ¼" drill bit. The distance from the center of the mounting hole of the DB9 connector to the center of the 1/4" hole for the plug should be 0.325 inches. The vertical position should be centered on the end panel, i.e., the 1/4" hole should be in line with the mounting holes for the DB9. By using the end panels, it is not necessary to screw the printed circuit board to the clamshell, as the end panels will hold the board snugly in place.

Enclosure upgrade comes with a pre-punched DB-9 cut-out:

Here are the hole patterns for the panel end plate with DB9 and power:
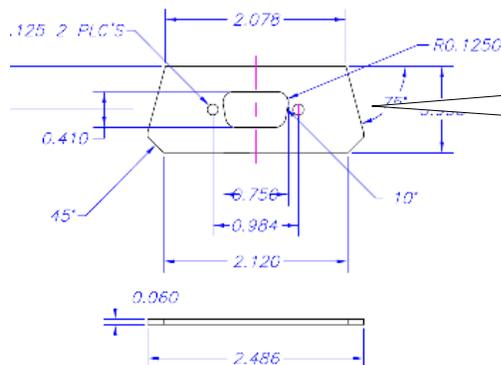
Hole for power supply: on vertical center line, 13/16" (0.812") from horizontal center, ¼" diameter.

The hole pattern for the panel end plate with the BNC is simply to center a 1/2" hole in the end plate.

Once your end panels are drilled, assemble them to your printed circuit board, put the end panels into the the guide slot on the bottom clamshell, attached the top clamshell and used the supplied screws to hold the two shells together. If you ordered the enclosure upgrade, we also supply 4 rubber feet that can now be attached to the bottom of the enclosure. Your PSKMETER is complete!

NOTE: Because of variations in the styles of parts, you are advised to make a final measurement of these dimensions before you drill or cut!

The finished product should look like the one at our shack, shown below:

❒ Step 38.

Start enjoying PSK31 knowing your PSKMETER is always tuning up your signal for best results! The next section of the manual documents the PSKMETER software. The software is very easy to use, but you also may want to take the time to learn about the features and options of the program.

❒ Step 39. Sign up for the KF6VSG *HamPost* newsletter. *HamPost* is published quarterly, it's free, and it's loaded with articles on theory, design and fun projects. You can subscribe to *HamPost* by going to

http://www.softsci.com/hamradio/opt_page.asp

and providing your email address.

PSKMETER
SOFTWARE DOCUMENTATION

<u>Installing PSKMETER</u>

The PSKMETER application comes as a single Windows executable file, pskmeter.exe. If your operating system is Windows NT or Windows 2000, you might also want to download a special driver, comhook.sys, that allows the PSKMETER to share the same comport as your PSK31 software. All you have to do is to download a copy of pskmeter.exe (and comhook.sys) from http://www.ssiserver.com/info/pskmeter and copy the file(s) to any directory of your choosing on your hard drive. You may want to create shortcut icon on your desktop to pskmeter.exe to launch PSKMETER, but even better is to put the application in your startup directory so that it launches each time you boot your computer.

If you have a copy of pskmeter.exe that you previously downloaded before you build your kit, it is always a wise idea to go and get the absolute latest version now that your kit is built and you are ready to add it to your rig.

<u>Adding PSKMETER to the StartUp directory</u>

In Windows explorer, navigate to the Windows | Start Menu | Programs | Start Up folder. This folder contains short cuts to all the programs that automatically load when Windows boots. Click on File | New | Short Cut. In the "Create Shortcut" window that appears, click on the Browse button. Navigate to the directory where PSKMETER is located, and highlight the pskmeter.exe program, the click on the Open button. Then click on Next. Enter the name for the shortcut, which defaults to pskmeter.exe. Click on the Finish button. You will now see pskmeter.exe in the Start Up folder.

<u>Making Copies of PSKMETER.</u>

Pskmeter.exe is free and you are welcome to make archival copies, post the software on the internet, send copies to your friends in any way you like. If you loose your copy you are welcome at any time to download a fresh copy from the web site www.ssiserver.com/info/pskmeter. Occasionally check in and see if there is a newer version than the one you have. Even getting a fresh version of this manual from the web site is a good idea.

<u>Adding PSKMETER to your "Brag File"</u>

If you find PSKMETER a useful addition to your PSK31 operations, you might want to spread the word to other hams by mentioning PSKMETER in your "brag file" macro that describes your rig and a reference to our web site http://www.ssiserver.com/info/pskmeter.

Before you start transmitting, PSKMETER looks like this:
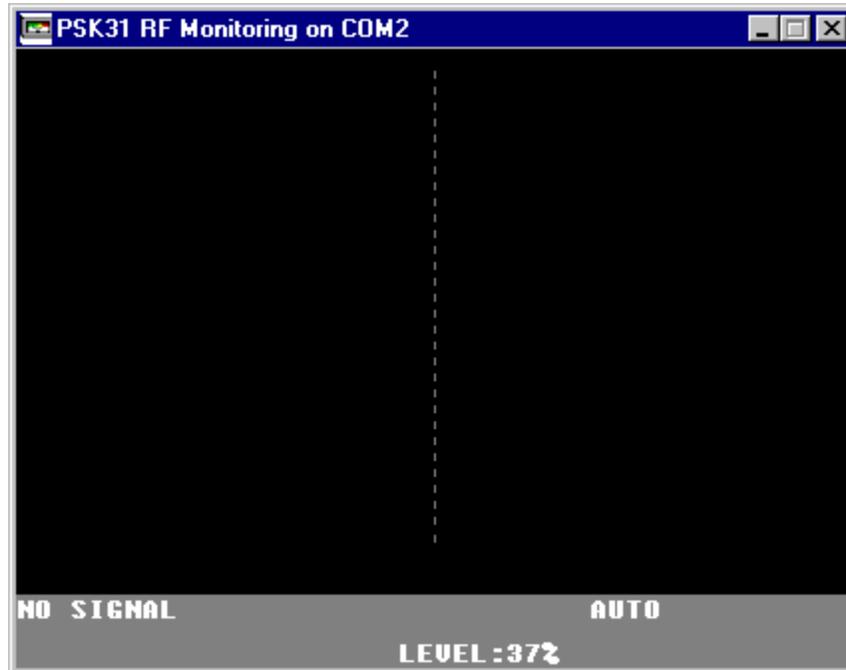
The caption bar of the window indicates the com port that pskmeter is using to communicate with the meter hardware. If you want to change com ports, see the section "Setting the Com Port."

In the absence of an RF signal, you will be see three pieces of information on the gray status area of the display:

> **NO SIGNAL** indicates that the meter is communicating with the software, but no RF is detected at the meter's input.

> **AUTO** indicates that the software is in "Automatic Level Control" mode, meaning that when an idle signal is detected, the software automatically sets the audio level of your sound card for the optimum signal.

> **LEVEL** indicates the current setting of your sound card audio level in percent of full scale.

When you key up your transmitter, and are in idle mode (i.e., not transmitting characters), PSKMETER will look something like this:
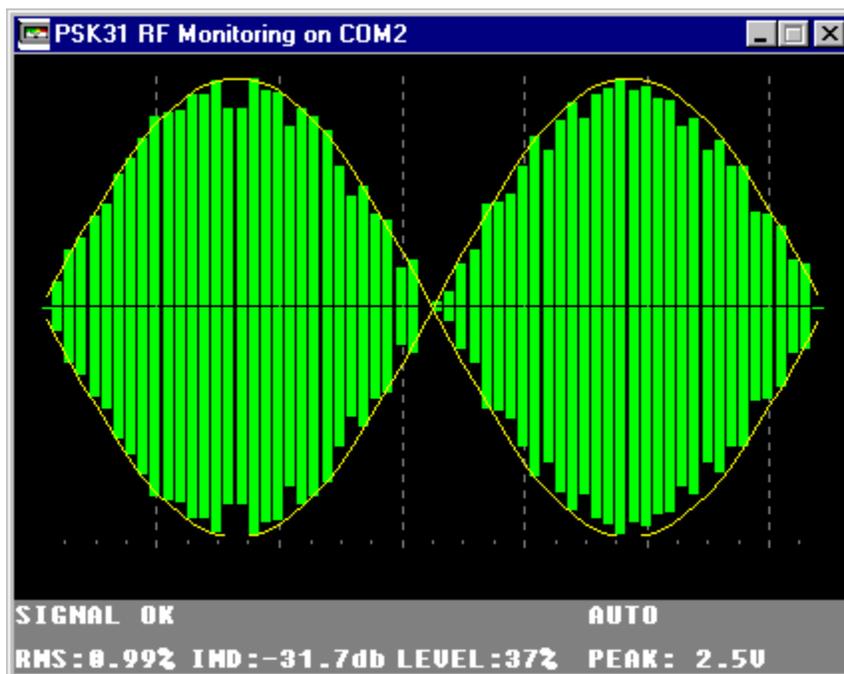
Remember, the pskmeter.exe display will only look like the below figure only when idling. When transmitting actual data the pskmeter.exe display will look similar to this (depending on the bit pattern of the data you happen to be sending):
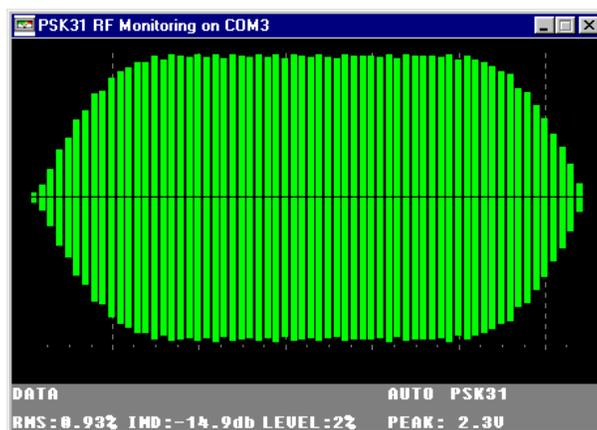
The additional information you are getting from this display is:

- An oscilloscope trace (green bars) that displays two PSK31 cycles. Each cycle is 32 milliseconds, so you can think of the "horizontal sweep" as being 64 milliseconds total. The amplitude of the trace is always normalized to "unit gain."

- An ideal sine wave envelope is displayed as a thin yellow lines. When your signal, as presented by the green bars, matches the yellow envelop you are running with a clean PSK31 signal.

- In the status area, the condition of your signal displayed in text. In the example above, the phrase "SIGNAL OK" is displayed. This means that your signal is strong and undistorted. However, you will

also see "UNDERDRIVING", or "SPLATTER!" If you are running in automatic mode, PSKMETER will make the necessary adjustments to your audio level to bring your signal back into the SIGNAL OK range. When you are transmitting data (i.e., sending ASCII characters), the status area will display "DATA." The status DATA will also appear for a moment whenever you stop transmitting (i.e., switch back to receive mode in your PSK31 software). *NOTE: PSKMETER only makes adjustments to your signal level when the PSK31 signal is in "idle mode." PSKMETER does not modify the audio level while you are sending data.*

- RMS displays the root mean square of your signal compared to a sinusoidal envelope, as a percentage of full scale amplitude. A small value of rms is good. It means your signal closely matches an ideal sine wave envelope with zero harmonics.

- IMD shows you what your signals intermodulation distortion is. This is normally something you would have to ask the other operator in the QSO to measure and tell you. Because PSKMETER knows exactly what you are transmitting, it can compute the harmonic amplitudes of your signal and calculate the value of IMD for you. As you probably already know, you want large (negative) values of IMD. In the screen shot above, the signal shows an IMD of –31db, which is excellent. Good signals have IMDs in the range of –20 to –30.

- PEAK is the peak voltage of the signal as sampled by the ADC on board your PSKMETER. You want the peak voltage to be in the range of 1 volt to 5 volts. Under 1 volt means that you are running QRP and perhaps have not set the QRP SEL jumper on your printed circuit board. If you have the QRP SEL jumpered, and still see only 1 volt (and PSKMETER has been given an opportunity to increase the audio level to boost the signal), it means that you are either running with very low power (less than 1 watt), or your sound card is not providing the audio output it should.

  Similarly, if the PEAK voltage is 5 volts, it means that you are at the end of the measurement range of the ADC. You might be running QRO with the QRP SEL jumper set, in which case the solution is to remove the jumper. Or, you might be running more than 100 watts. If this is the case, you will need to replace resistor R1 QRO with a resistor of greater resistance.

- Observe that PSKMETER also adds a tray icon to the tray area at the bottom of your screen. The icon is a small square that is color coded. If the square is white, no signal is detected. If black, the signal is undermodulated. If blue, the signal is in the optimum range. And if red, the signal is overmoduled. With this icon, you can minimize the PSKMETER application and recover all the real estate on your screen, and still have a visual clue as to the condition of your signal.

- Note that when PSKMETER is minimized, the button on the task tray will show you the condition of your signal in a short text message.
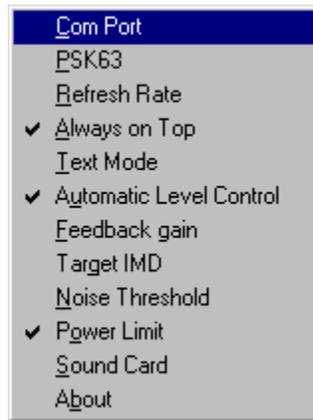
Configuring PSKMETER

Now let's investigate how to set various options.

     Window Size and Placement. Of course you can drag the window anywhere on your screen, and you can resize the display to any size. When PSKMETER launches, it remembers those settings and restores them. You might want to reduce the size and place the window in an unused area of your PSK31 software (e.g., Digipan), so that you can always glance at what your signal is doing.

On the other hand, you might want to simply minimize the window, and not be distracted by the meter at all. When the application is minimized, it is functioning exactly the same way as when it is visible.

Setting the Com Port. Place the mouse cursor over the display area and right click the mouse. You will see this popup menu:


By clicking on Com Port, you will be able to set which comport PSKMETER uses to communicate with the hardware. There are a variety of options and configurations, as well as restrictions, you should be aware of when setting the com port:

Windows NT, Windows 2000, Windows XP	All other 32-bit Windows Operating Systems
PSKMETER can share the same comport with whatever PSK31 software you are using to key up your transmitter. For example, you can set Digipan to com 1, and PSKMETER to com 2, but you can also set PSKMETER to com 1 as well. If you decide you want to use just one com port, you will have to observe the following rules: • You will have to make up a special serial cable that on one end plugs into the single comport on your computer, and on the other end splits into two DB9 connects, one of which goes to the rig-computer interface, and the other into PSKMETER. You can find the circuit diagram for this at the end of this document. • PSKMETER will have to be launched before your PSK31 software. This is because PSKMETER installs a special serial driver, comhook.sys, that permits both applications to address the same serial port. Be sure that comhook.sys exists in the same directory as pskmeter.exe. • If you don't wish to use fabricate this cable, you have the option to purchase a serial-to-USB converter at our web site www.ssiserver.com/info/pskmeter. This allows you to connect either the PSKMETER or rig-to-computer to a USB port on your computer, which adds a virtual com port to your computer. This option is documented in the section of this manual entitled "Serial-to-	PSKMETER *cannot* share com ports with any other program. Each program requires its own comport. For instance, if you have configured Digipan to key your transmitter using com 1, you cannot successfully set PSKMETER to com 1 also. You will have to select another com port. This raises the question "what if I only have one com port?" There are several solutions for that: • The obvious answer is to add another serial communications card to your computer. They are inexpensive and easy to install. This might be possible and desirable if you are using a desktop computer. If you are using a laptop, this might be impossible. • Upgrade your operating system to Windows NT or Windows 2000. With these operating systems, PSKMETER automatically installs a driver that permits the sharing of comports. See the column on the left for details. • If your computer supports USB, purchase a serial-to-USB converter at our web site www.ssiserver.com/info/pskmeter. This allows you to connect either the PSKMETER or rig-to-computer to a USB port on your computer, which which adds a virtual com port to your computer. This option is documented in the section of this manual entitled "Serial-to-USB Converter."

USB Converter."	

PSK63. PSKMETER also supports the new PSK mode called PSK63. PSK63 sends data at twice the bit rate as PSK31, which is certainly attractive, but keep in mind that it does this at twice the bandwidth. That means, of course, that your signal will have half the "brightness" than at PSK31, and therefore your received signal will drop 3 dB. All the more reason to use PSKMETER to squeeze the most you can out of your signal. When transmitting in PSK63 (supported by the newer PSK programs such as WinWarbler 2.6.7), be sure to put pskmeter in the same mode by using this switch. If you forget to do this, PSKMETER will display 4 peaks instead of 2 and will not be able to optimize your signal. When PSKMETER is switch to PSK63 you will see the usual double peak and the meter will work correctly. Similarly, if PSKMETER is in PSK63 mode and you switch your PSK software to PSK31, you will only see one peak displayed and the meter will certainly not understand this. Bottom line: use this switch to match the mode you are transmitting in.

Refresh Rate. When you click on this option of the popup menu you will see this dialog:
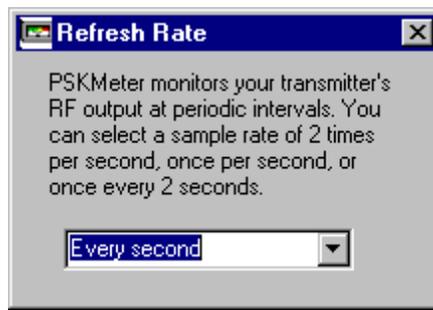
This allows you to adjust the sampling interval that PSKMETER checks your signal.

Always On Top. You may have already noticed that PSKMETER when maximized is always visible, even when other applications are selected. This is provided so that your signal information is always available to you at a glance. However, this can also get in your way. This option, therefore, can be turned off, so that PSKMETER is visible only when it is the active application.

Text Mode. In the event you would like to see exactly what the microprocessor is seeing for input data, you can do this with this option checked. The data there is 8-bit, meaning that voltages are represented from 0 (zero volts) to 255 (5 volts).

Automatic Level Control. This is the most important and useful functions of PSKMETER. With Automatic Level Control checked, PSKMETER is permitted to set your sound card's audio level (line out) output in such a way to give you the strongest possible signal without appreciable distortion. This is done in the background by sampling the signal, computing the rms and IMD, and then determining if the level should be left as it, increased or decreased as small amount. Over time, the audio level setting settles to a value that gives a strong clean signal. When this option is unchecked, PSKMETER not longer interacts with your sound card. It becomes a passive meter only. In this mode, it is your job to set the audio level to provide good signals.

Feedback Gain. When you select this option, the following window appears:
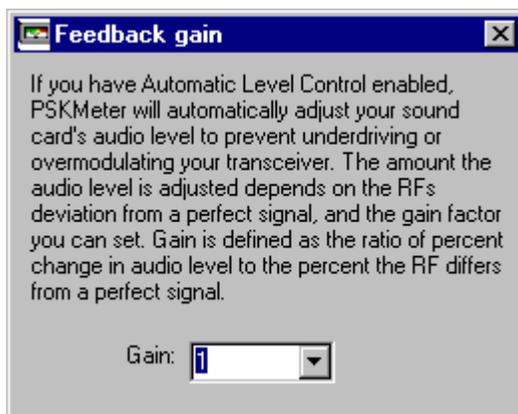
Gain will determine how fast your audio settles to an optimum level. As you increase the gain, PSKMETER makes larger corrections after each sample. This can be desirable, but be aware that gain settings that are too high can result in oscillation, i.e., audio will be either too weak or too strong after each sample, rather than "sneaking up" on the best level. Experiment.

NOTE: By setting the gain too high, you can induce wild oscillations in the way PSKMeter adjusts the audio--swinging between almost no audio to full audio. This is an example of an underdamped, overdriven feedback loop. If you observe your PSKMeter making large, wild adjustments to the audio level, and never settling on a stable audio level, the most likely cause is too much gain. Reduce the gain until you see PSKMeter making audio adjustment in "baby steps."

Target IMD Value. Clicking on this option results in this dialog:
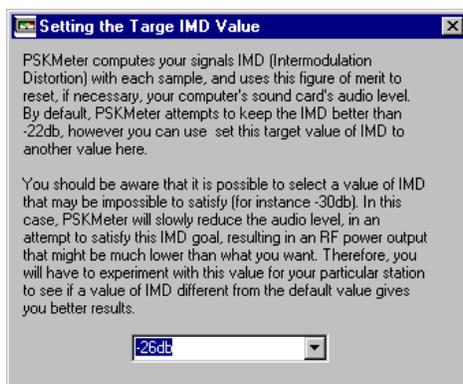
This parameter lets you force PSKMETER to attempt achieving very good IMD levels. As the dialog explains, however, you can be asking PSKMETER to do something impossible, which will result in weak signal strength. The default value as shipped might be perfectly ok for you, but if you are feeling curious, just experiment and see what happens.

Noise Threshold. If your antenna is near a source of strong RF interference and is picking up a signal more than a few millivolts, PSKMETER will not be able to resolve this signal from a true PSK signal from your transmitter. For example you might experience this problem on Field Day, where there are nearby transmitters and antennas on the same or even different bands. In this unusual situation, you can use this setting to set a number of millivolts of "noise floor", below which PSKMETER will not process signals. Thus, when you are not transmitting, PSKMETER will ignore stray noise. When PSKMETER cannot detect signal above the noise, "NOISE" is displayed on the status line.

Power Limit. This setting provides an option for you to specify the maximum power you wish to transmit.

By default, PSKmeter sets the audio level of your sound card to the value that gives you the highest possible power without splatter. However, you might want to limit your output power to some desired value. If that is the case, you can use the settings here to establish that limitation.

With this feedback selection enabled, PSKmeter will not permit your transmitter power to exceed what you specify. If the peak signal exceeds what you specify, PSKmeter will reduce the sound card level regardless of the measured IMD.

Sound Card. Most computers have one sound card, which pskmeter detects and uses to control the audio level. However, if your computer has more than one sound card, you can select which sound card is being used to provide audio to your rig.

About. Clicking on About present a dialog that shows you the current pskmeter.exe version number, and also the version number in the firmware. If pskmeter.exe cannot establish communication with the card, the firmware version will come back as "PSKMETER firmware not detected." Therefore, you can use About as a way to test and confirm the serial connection with the hardware.

Transmitter Settings

In addition to configuring PSKMeter to operate the way you desire, you may also need to pay some attention to your transmitter options and settings. If you are running a rig like the Small Wonders Lab transceiver there really aren't any settings available to you, and you can skip this section. On the other hand, if you are running with a full-blown HF rig, you may want to check the following:

Mike Gain. The default value of the microphone gain on your rig is probably 50%. This might be perfectly ok, but experience shows that the line out of computer sound cards is a giant signal for the microphone input. The result of this is that the Windows mixer sliders will have to be set quite low, near the bottom of their range. It means that PSKMeter doesn't have a lot of room to operate in terms of setting the audio. If you observe that PSKMeter is always setting very low audio levels (<10%), it makes more sense to lower the Mike Gain on your rig. By lowering the Mike Gain to a value that PSKMeter is setting audio levels to approximately their 50% point, it means that the sound card output is well matched to the microphone input, and PSKMeter has the most possible "play" in the sliders to properly control your output signal.

RF Power. Of course PSKMeter cannot provide more power than the limit set by your rigs output power setting. If you are seeking the most possible power from your rig, you will want to adjust this setting to its maximum possible value. PSKMeter will then drive the transmitter will then cause your rig to transmit the highest power consistent with no distortion.

Similarly, if you select the Power Limit option of PSKMeter, you need to be sure that your rig can supply this power. For example, if you set the Power Limit in PSKMeter to 5 watts, be sure that your rig's power setting is reasonable greater than 5 watts.

Serial-to-USB Converter

Most likely you are using a com port to key up your transmitter. PSKMETER also expects to use a com port to communicate to your computer. What if you have run out of com ports, or just don't want to use up another com port? If you are running Windows NT, Windows 2000 or Windows XP, pskmeter can be set to share a single com port, but you need to make up a special serial cable. See the section in this manual "Running with One Com Port" for details on that.

If you are running another version of Windows, or don't want to make up a special cable, and you have a spare USB port, you can choose to run PSKMETER over that USB port. To do that you will need a Serial-to-USB converter which you can order from http://www.ssiserver.com/info/pksmeter.

This is one type of cable that may have been shipped to you. However, you may also have received an equivalent cable that looks different from this one.

The converter consists of a cable (shown at the left) and a driver that quickly installs on your computer. Once installed, you will see that as far as the computer is concerned, it thinks it has one more com port than it physically has. For instance, if you normally have just COM1, you will have COM1 and COM2 available. COM1 is your usual com port, but COM2 will actually be coming through your USB port! If you already have COM1 and COM2, after installing the converter, your computer will show three com ports available.

The process consists of

- Connecting the converter cable to your PSKMETER on one end and to your computer's USB port on the other,
- Installing the driver.
- Assigning PSKMETER to the virtual com port.

And that is all there is to it. By the way, this handy converter can be used with *any* serial device, not just PSKMETER.

Running with One Com Port

If your computer is running under Windows NT, Windows 2000, or Windows XP, PSKMETER let's you talk to the computer over the same serial cable as the one you are using to key up your transmitter. The only things you have to do is

- Make sure that the special driver, comhook.sys, is copied to the same directory where you are running pskmeter.exe from. You can get a copy of comhook.sys from http://www.ssiserver.com/info/pskmeter.

- Launch pskmeter.exe *before* launching your PSK31 software (such as Digipan).

- Make up a special cable (shown at the end of this manual) that plugs into one of your computer's com port on one end, and into your transmitter (or rig interface), and your PSKMETER on the other ends.
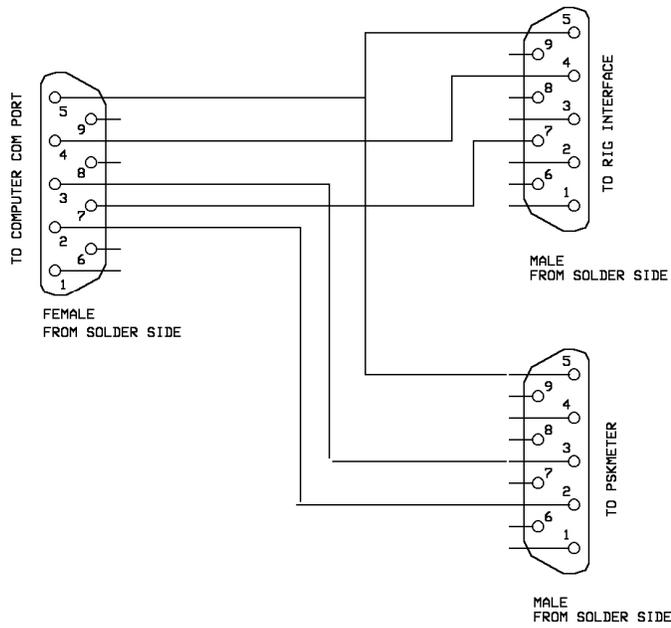
This will allow you to set both your PSK31 software and PSKMETER software to the same com port.

STEP 2 ☐	STEP 3 ☐	STEP 4 ☐	STEP 5 ☐
R1-QRO 39K RESISTOR ORANGE-WHITE-ORANGE	R1-QRP 6.8K RESISTOR BLUE-GRAY-RED	R2 2.2K RESISTOR RED-RED-RED	R3 100K RESISTOR BROWN-BLACK-YELLOW

STEP 6 ☐	STEP 7 ☐	STEP 8 ☐	STEP 9 ☐
R4 2.7K RESISTOR RED-VIOLET-RED R5 2.7K R6 2.7K R7 2.7K	D1 Germanium diode	D2 Germanium diode	D3 5.1V Zener diode

STEP 10 ☐	STEP 11 ☐	STEP 12 ☐	STEP 13 ☐
X1 20MHz crystal	C2 22 pf MONOLITHIC CAPACITOR C3 22 pf C4 22 pf	28 PIN DIP SOCKET	C1 0.1uf MONOLITHIC CAPACITOR

STEP 14 ☐	STEP 15 ☐	STEP 16 ☐	STEP 17 ☐
C5 0.1uf MONOLITHIC CAPACITOR	Q1 2N4401 OR 2N3904 NPN TRANSISTOR Q2 2N4401 OR 2N3904	U2 7805 +5V REGULATOR LM7805 In Out Com	JUMPER PINS (QRO SEL)

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STEP 18 ☐	STEP 19 ☐	STEP 20 ☐	STEP 21 ☐
J3 DB9 Female connector	C6 10uf electrolytic capacitor	J2 2.1mm POWER SOCKET	J1 BNC CONNECTOR

STEP 22 ☐	STEP 28 ☐	OPTIONAL PARTS ☐	
R8 4.7K YELLOW-VIOLET-RED R9 4.7K	U1 MICROPROCESSOR EITHER PIC 16F876 OR PIC 18F2455	QRP SEL JUMPER BLOCK	

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TO COMPUTER COM PORT

FEMALE
FROM SOLDER SIDE

TO RIG INTERFACE

MALE
FROM SOLDER SIDE

TO PSKMETER

MALE
FROM SOLDER SIDE

KF6VSG		
Shared Com Port Cable		
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Circuit Diagram for PSKMETER
Version 1.0
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