We conclude our series on proposed compatibility systems: the *Karmic* standards.

By Jim Weir

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We set out in the October '97 KITPLANES® to establish a set of connector standards and guidelines for the various radios in the airplane. The thought was to set up an inexpensive way for everybody to interconnect aircraft components easily. This was done with a view toward portability of radios and other devices from aircraft to aircraft.

In the two previous columns, we've covered compatible connectors for com radios and aviation headsets.

This will be the third and (for now) the final chapter on setting connector standards. We will now cover the rest of the airplane components all the way from nav radios through nav lights. Let me tell you right up front, though, that these proposed standards have brought me more e-mail comments (favorably, with the exception of the folks who don't sell the style of connector I have suggested) than anything I've ever written in my 30-year career as an author. One EAA chapter wants to reprint the standards in its newsletter. (The magazine granted the request, requiring the usual "Reprinted courtesy of KITPLANES," but copyright rules require getting individual permission.)

Several folks e-mailed me that they have already wired their com radios in accordance with the *Karmic* (KITPLANES Aircraft Radio Intermediate Connector) standards and that it appears to work just like the article said.

Now let's get down to business We have nav radios, marker receivers, transponders, altitude encoders, clocks, lights and "music" radios to worry about. Let's steam on.

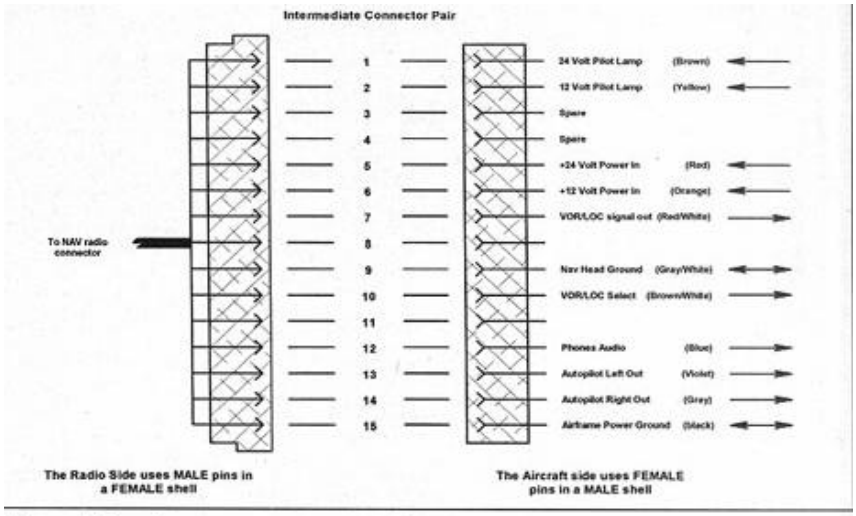

Figure 1. *Karmic* nav power connector pinout.

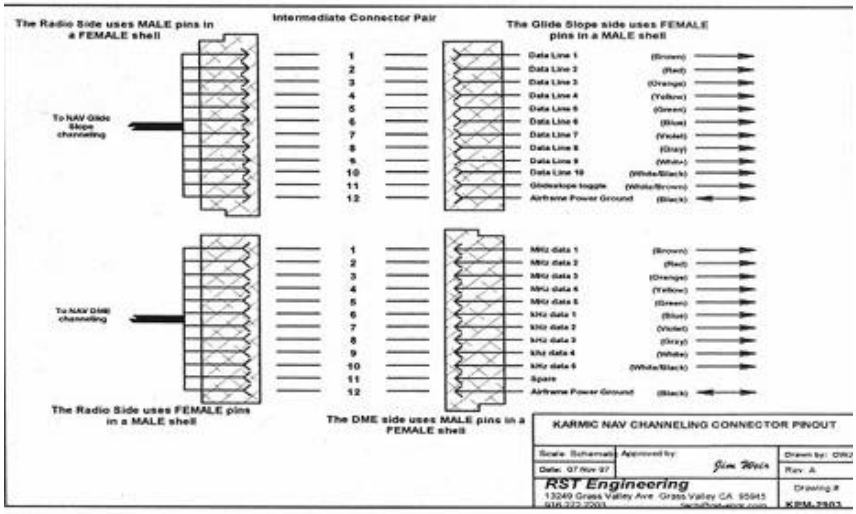

Figure 2. *Karmic* nav channeling connector pinout.

Nav Radios

Nav radios have an easy part and a hard part. The easy part is that they only have supply voltage in, an autopilot voltage, OMNI signal and headphone audio out. The hard part is that they can also be used to channel both a glideslope and a DME as well as run a nav converter external head.

DME is on the way out, but for the time being (since it is required above 24,000 feet *MSL)* we will have to accommodate it. Worse than that, channeling these slave radios takes almost as many pins as the com radio took. It is going to be a real trick to get all those connectors onto a single navcom radio so that Joe Hamhand at the avionics shop can't plug the radio in backward. Wiring the nav radio power (or the nav side of the navcom) as shown in Figure I should accommodate all permutations of most current and past nav radios. Note that I've used the same size and sex of connector on the nav radio side that I used on the com radio. Note also that the unique signals out of the nav radio use the "spare" pins of the corn radio. This was done on the off chance that a nav radio would get inadvertently plugged in to a com radio connector. It won't work properly that way, but it won't blow up the radio either. Besides, I need both sexes of the 12-pin connector for the next step and I'd rather take a chance on reversing *them* than the radio power.

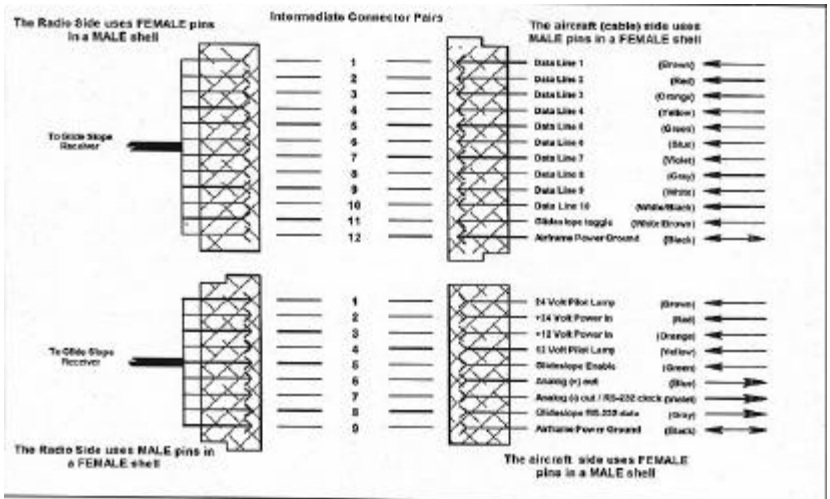

Figure 3. *Karmic* glide slope receiver connector pinout.

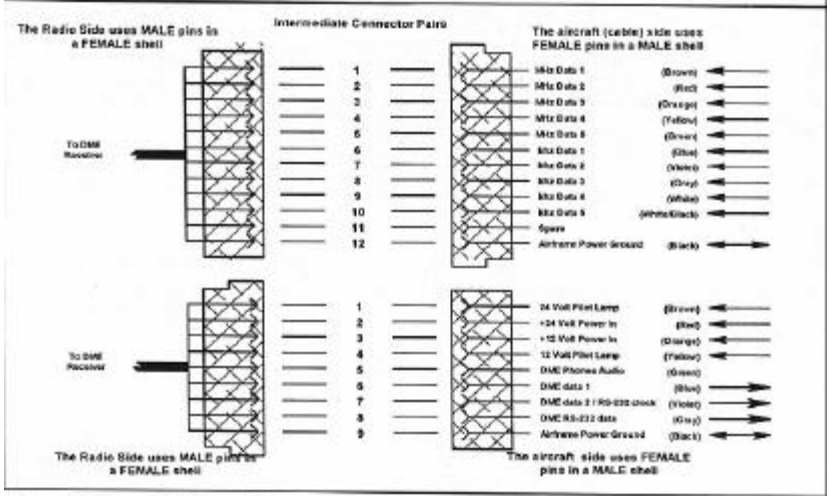

Figure 4. *Karmic* DME receiver connector pinout.

What we have to do now is to get the DME and the glide slope channeling information out of the nav radio and going toward the DME/glide slope radios. Figure 2 shows the two connectors that will achieve that goal. Note that we are using 12-pin connectors on both these channeling functions, but that we have *reversed* the sex of the connector so that you can't plug the DME channeling information into the glide slope channeling and the other way around.

Now guess what we are going to do at the glide slope end. Yup. Figure 3 shows the same pinout as we used on the radio, but reversed so that if we want to run it on the bench, we can simply plug the glideslope channeling connector directly in to the radio side plug. You can leave the harness in the airplane and test it on the bench without any more adapter cables. This little trick alone should save beaucoup bucks when you pull both boxes and take them to the bench.

Note also on the glide slope radio that we are defining a new 9-pin power plug for all radios that have only power and lamps coming in and perhaps headphone audio coming out. We will use this same pinout for the glide slope, DME, loran, GPS and all other radios that don't have additional outputs. Note that we have provided for both analog and digital (RS-232) outputs, but not at the same time.

The same thing holds true at the DME as shown in Figure 4. There will be one plug for the channeling (which is the same pinout as the nav receiver that does the channeling) and one power plug with the same pinout as the glide slope receiver. Since there is ident audio coming out of the DME receiver, we use Pin 5 of the power connector as the audio output pin.

The marker receiver (Figure 5) has a unique requirement to provide lamp outputs, so we will have to use the full pinout of the connector to get all the inputs and outputs that we need.

The Transponder

Our transponder has an easy part and a hard part as shown in Figure 6. The easy part is the power plug, which will be the same 9-pin convention that we've used for our radio connections in this chapter. The hard part is that the transponder has altitude encoder inputs.

To make things easy, we need to say that the altitude encoder will probably never be used above 60,000 MSL in our class of aircraft. This limitation tells us how many bits or lines of information we need to interconnect the altitude encoder and the transponder. A 15-pin data connector will be adequate to make this interconnecting cable. Of course, (Figure 7) the altitude encoder needs a corresponding and mating connector, which is quite easy to do.

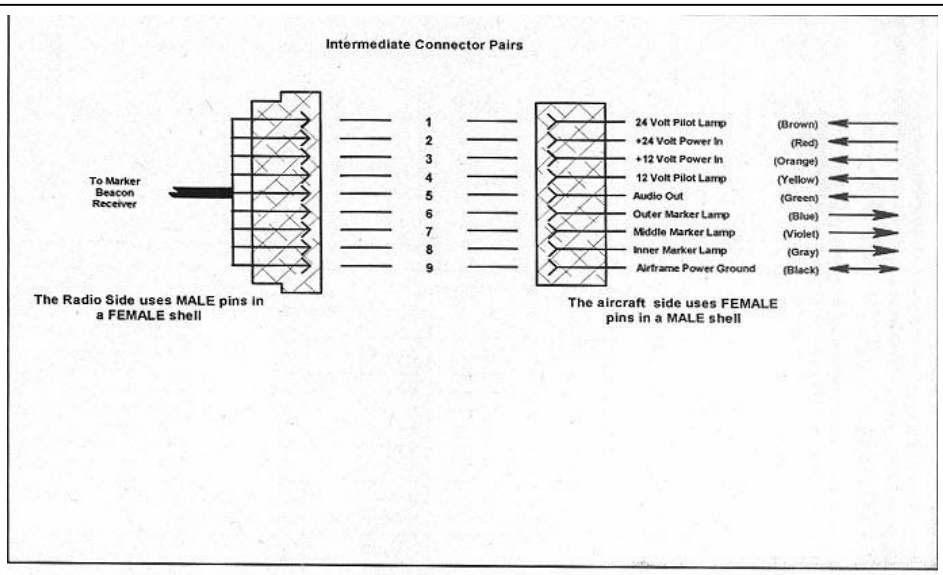

Figure 5. *Karmic* marker beacon receiver connector pinout.

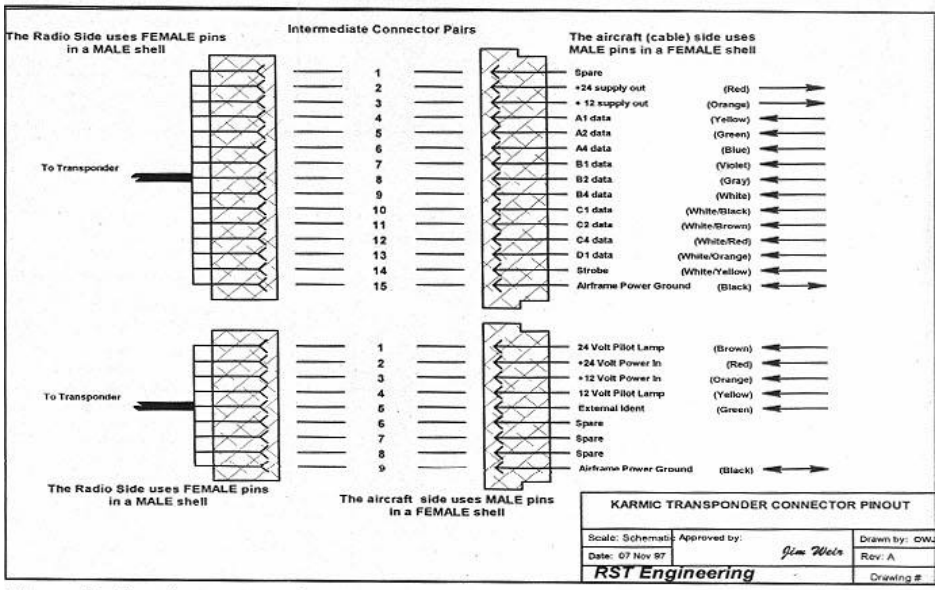

Figure 6. *Karmic* transponder connector pinout.

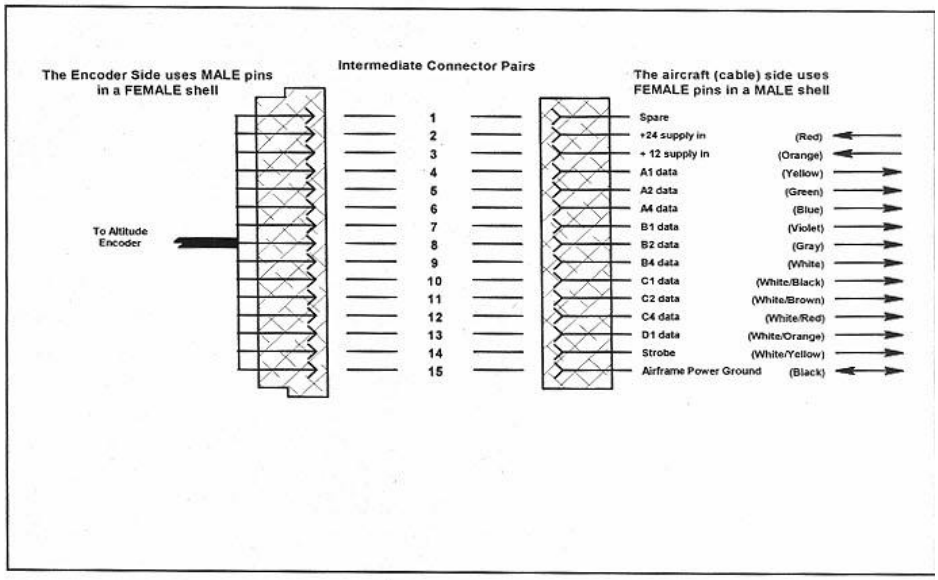

Figure 7. *Karmic* altitude encoder connector pinout.

Entertainment

A lot of us fly around with music radios in our airplanes, and most of them were intended for groundbound vehicles. Now let's be Realistic about it (pun intended). While a Karmic connector isn't, strictly speaking, intended for anything but aviation-type radios, we ought to cover all our bases. Thus in Figure 8, we have set a Karmic standard for the entertainment radio in the airplane.

While 99.9% of them will only work on +12 systems, we might just as well be consistent and set the 24-volt pins to comply with everything else we've done in this connector system.

One thing we've done on this radio is to specify a keep-alive pin. Most automobile radios will lose their memory if a continuous voltage isn't fed to this pin to retain the internal memory. Most aircraft radios don't use a keep-alive, relying instead on an internal battery that keeps the memory going.

Lamps and Things

Now the lights and general electrical devices. We've got nav lights on the wingtips, strobes/beacons on the tail, clocks, landing lights, and all the rest of the illumination and such on the airplane.

Why would you ever want to put a connector on any of these devices? To start with, when you remove the wingtip, it is a lot easier to unplug the nav light than to unscrew the connection to the light itself. And when you want to fix your clock, it is a lot easier on the bench than in the airplane, and a standard connector makes the process a lot easier.

Our standard 9-pin connector will allow us to do all this (Figure 9). *Please note:* These little connectors are good for only 5 amperes per pin, so you might want to think a bit about that 200-watt landing light that takes 16 amps on a 12-volt supply. I've shown an alternate Karmic standard with a 12 pin connector that will allow up to 15 amperes to be drawn from either a 12- or 24-volt system for the heavy-duty uses. The standard 9pin connector is good for 10 amperes with each supply (and ground) taking two pin holes at 5 amperes per pin.

Note also in this scheme that the connector has a maximum voltage rating of 250 volts. Running high voltage strobe wires with this style of connector isn't a good idea. There are ways to do it, bot for right now, let's KISS and BURP *(keep it simple, stupid;* and *build it under the required price).*

This magazine does not have enough pages for a drawing for every radio. Moreover, there are going to be radios in the years to come that we can't foresee. How many of us had a clue that GPS would be this big when we planned our panels back in 1990? Or 1993, for that matter.

What we have in Figure 10 is a generic set of radio connectors that uses the 9-pin setup for the power and limited input/output functions and a 12-pin connector for the rest of the data. For example, if I'm putting in a panel-mount GPS, I'll use the 9-pin connector for ship's power and to take the RS-232 data in and out. For things like autopilot guidance, waypoint alert, failure alert, I'll use the 12-pin connector. When these radios become as standardized as, say, a navcom, then we can set Karmic standards for which pins are the autopilot, which pins are the lamp drivers, and on.

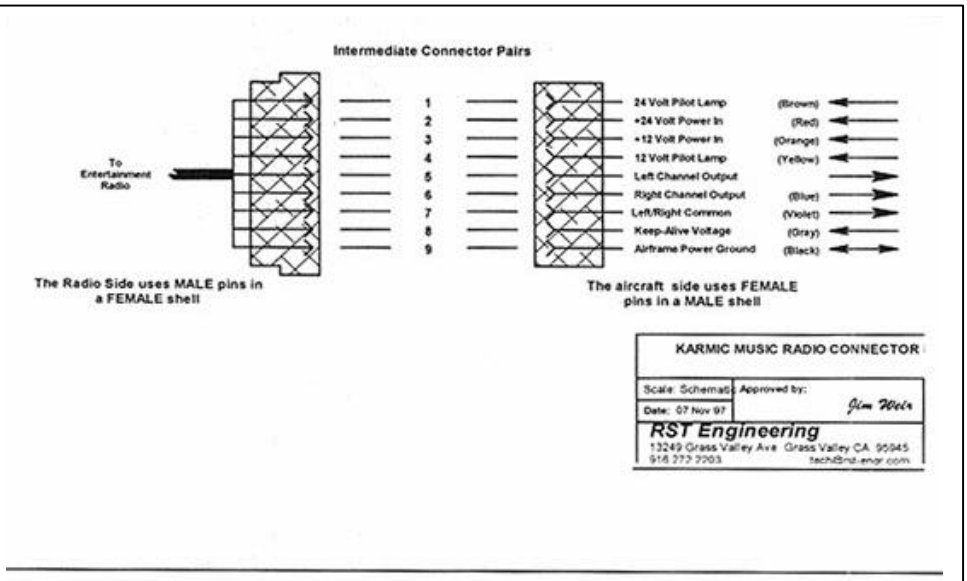

Figure 8. *Karmic* music radio connector pinout.

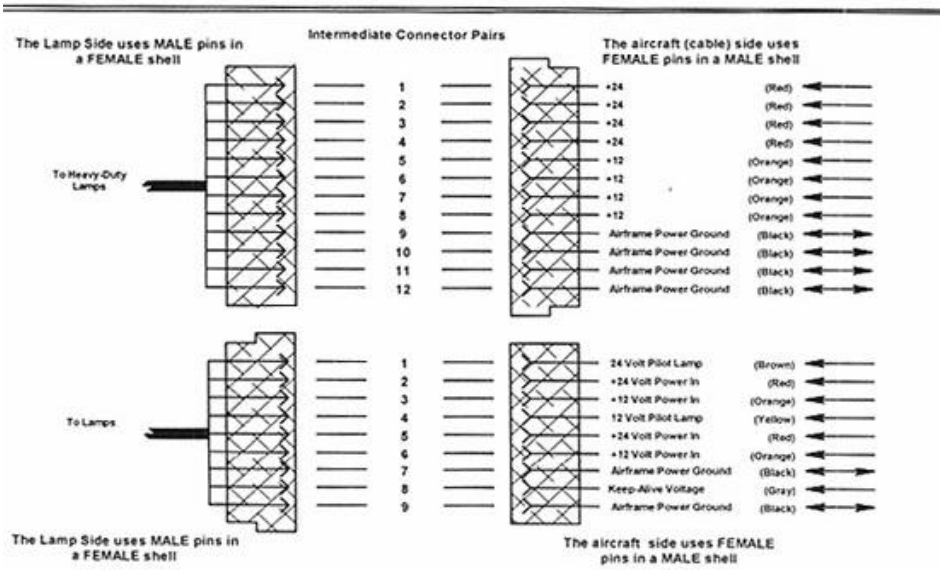

Figure 9. *Karmic* lamp/clock connector pinout.

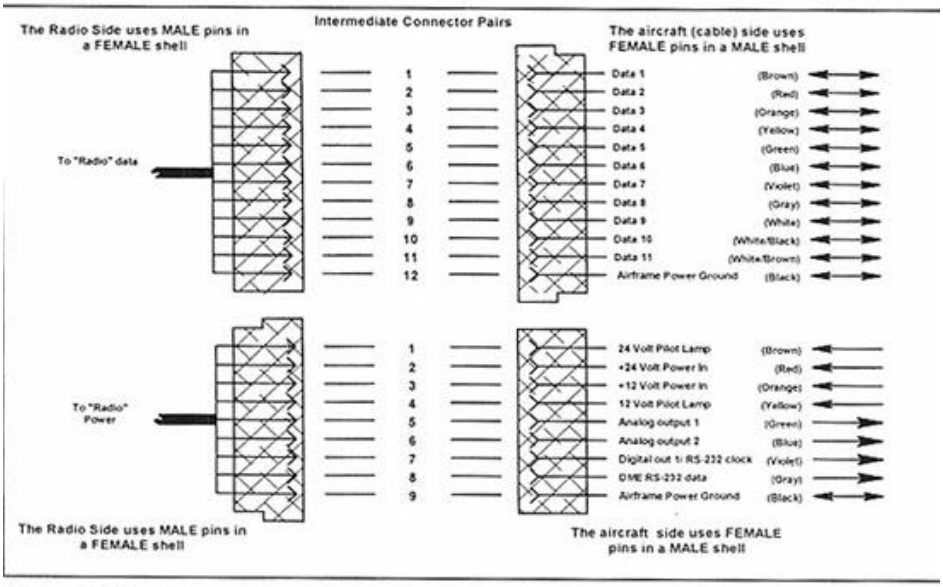

Figure 10. *Karmic* generic radio connector pinout.

That's it for the current KARMIC standards. Later this year when GPS shakes itself out, I'll take a stab at a generic GPS Karmic standard. In the April column, though, I'll try to do something with this Karmic standard for the altitude encoder. I won't give away the whole story here, but understand that the last few times I've taken the company C-182 up, ATC has told me that I'm more than 200 feet off between my altimeter and my encoder. We ought to be able to use our Karmic principles to make a dandy little altitude encoder tester for less than $10 that will allow me to determine whether it is the altimeter or the encoder that is off.You know me. I'd certainly never adjust an instrument without an instrument shop rating from the FAA, but I've got this friend Ernie that wants to know how to do it. ***KP***

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