APPLICATION NOTE

AN-126

Reedholm System with HP 4062 Probe Card Interface

Overview

A customer wanted to use a couple of Reedholm test systems, but also wanted to use HP 4062 circular probe cards. Fortunately, the architecture of the 4062 test head made it straightforward to pull out the "bird cage" motherboard and attach it to the top cover of the prober. No special hardware was needed for the prober or the interface. Reedholm only had to wire the analog matrix cables to the “bird-cage” motherboard. A removable top cover was created so the customer has almost complete light and electrostatic shielding. Test throughput of the completed system is several times higher than with the 4062 without sacrificing measurement sensitivity.

The top cover of the customer’s prober was hinged at the rear, allowing the probe card interface to rotate upwards. This allows circular cards to be inserted into the bottom of the motherboard. Electrostatic and light shielding is close to 100% once the circular cover is clamped down. But a little bit of light can raise havoc with low-level measurements. If light has to be eliminated, thin gasket material can be placed under the cover and around the left-side opening for the prober analog cable.

Figure 1 – Completed Interface with Standard Cables

Production or Development Cabling

Two systems were delivered. One had a 24-pin CPM matrix that permits production-worthy current measurements without unrealistic test times. For example, dielectric and reverse biased junction leakage current measurements can be made to |100pA| in one second with |10V| bias.

Another system was also targeted for production, but was going to be used for development and characterization as well. So a 24-pin picoammeter matrix with effective resolution 1000 times better (50fA instead of 100pA) was installed. The 4062 bird cage supports |100pA| performance quite well, but is not able to deliver the |50fA| performance of the PAM matrix, but it is able to deliver measurements to <|1pA| within a second.

HP 4062 Probe Card Interface

The HP probe card interface includes a circular mechanical assembly and two pcb’s. The top board is where the HP pogo-pins contacted the assembly and is where the Reedholm cables are terminated.

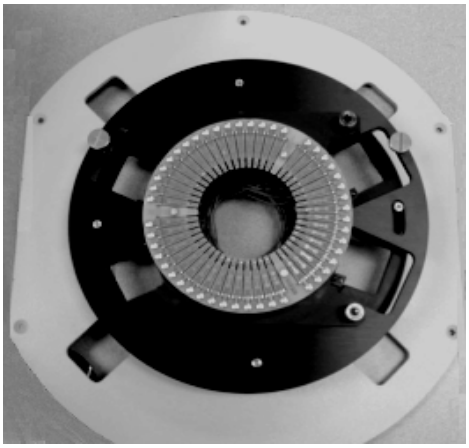

Figure 2 – Top View of HP Bird Cage

Wiring for 24-Pin Test Structure Access

The two boards in the birdcage are connected with red jumper wires, but there is not a one-to-one relationship among matrix, interface, and probe needles. Table 1 shows the relationship. Tester columns refer to Reedholm matrix pins, I/F columns refer to HP birdcage locations where Reedholm matrix cables attach, and Needle columns refer to blade or needle mounting locations on the probe cards.

Seeing Where to Probe

Because most probers are used for product testing with identical die and fully developed test plans, parametric test probing involves hitting unique sites and sub-sites, with frequent test development. For that, being able to see the probe site helps. And that is why cabling to the bird cage was dressed so a microscope could verify location and site with the top cover removed. Figure 3 is the view with the very low current cabling, and figure 4 shows standard cables.

Tester	I/F	Needle	Tester	I/F	Needle	Tester	I/F	Needle
1	2	2	9	18	21	17	34	37
2	4	4	10	20	23	18	36	39
3	6	6	11	22	25	19	38	51
4	8	8	12	24	27	20	40	53
5	10	10	13	26	29	21	42	55
6	12	12	14	28	31	22	44	57
7	14	14	15	30	33	23	46	59
8	16	16	16	32	35	24	47	60

Table 1 – Test System, Interface, and Probe Needle Translation Table

Analog cables consisting of shielded twin-ax wires are lap soldered to the top of the probe card assembly at the pogo-pin contact points. Table 1 shows where the tester pins are attached. Guards were soldered to the adjacent hole or circular pad.

In addition, a jumper was added to the upper board between pins 47 and 48, as pin 48 goes to the chuck with a BNC connector.

Cable Strain Relief

In addition, a hole was drilled into the left side of the assembly, 7.5” to the left of center, where a strain relief device was installed. The device includes a built-in cable clamp that can be released by depressing the locking mechanism. This allows some cable adjustment if the prober is positioned differently than in the initial installation.

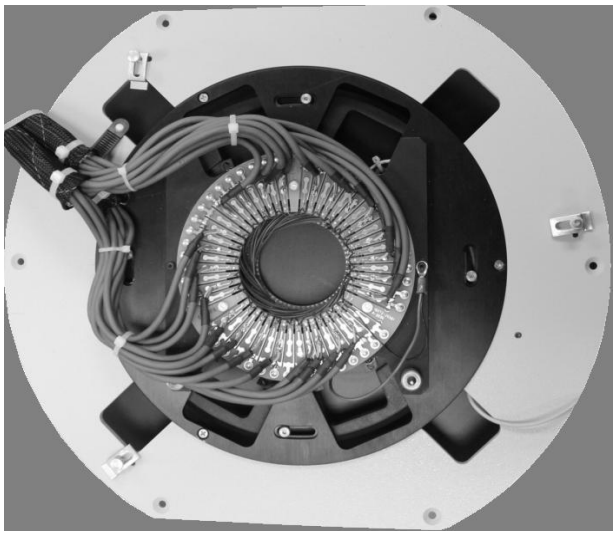

Figure 3 - Picoammeter Cable Attachment

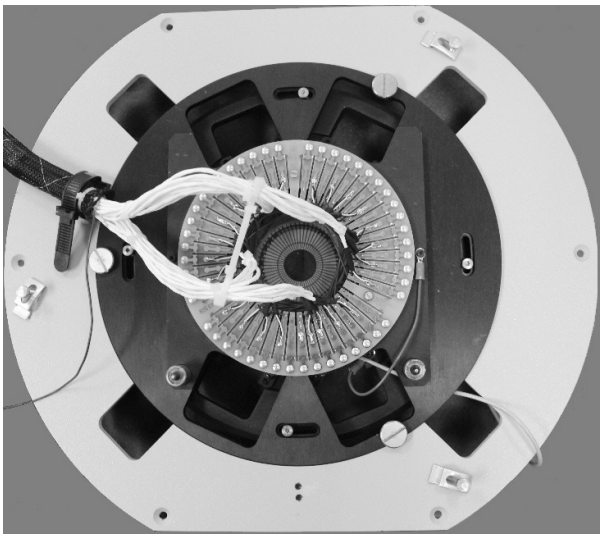

Figure 4 – Standard Cable Attachment

Validating System Performance

Reedholm systems have fast, thorough self-test programs that confirm performance to specifications out to, and including, the probe card interface. For the HP 4062 interface, two blank probe cards are modified to provide system assurance.

Loopback Confirmation

One card is modified to short pin-pairs; (i.e., 1 to 3, 2 to 4, etc.) for all pins in the matrix. This card allows shorts and opens to be detected throughout the system, especially the matrix relays and probe card interface.

Figure 5 is of a 4062 card with loopback connections for a 24-pin matrix. In addition, this card has three $10^9\Omega$ resistors used in diagnostic testing as well as self-calibration of three picoammeter modules (PAM's). The system DMM is used to measure the high value resistors prior to their being used for PAM assurance, thus calibration traceability is provided to extremely low currents in an environment that is not extremely well shielded.

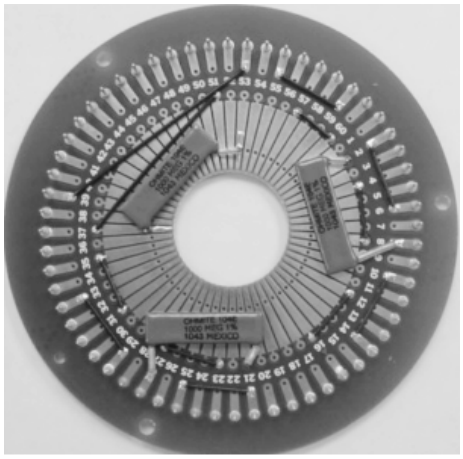

Figure 5 - Loopback Card with PAM Resistors

Checkout with Packaged Fixtures

System acceptance and training usually involve use of some robust IC's, resistor arrays, etc. that plug into a 16-pin DIP socket mounted on a probe card. The 4062 implementation is shown in figure 6.

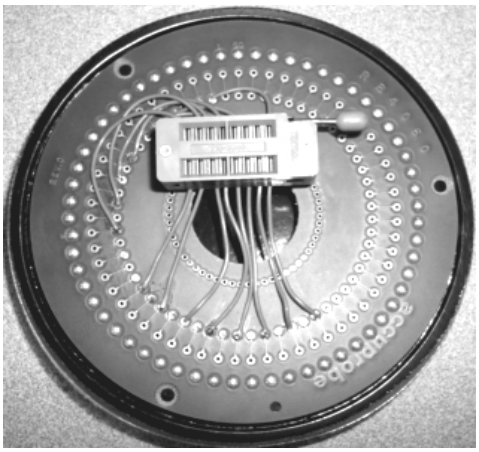

Figure 6 – 16-Pin DUT

Capacitance Traceability

The Reedholm SelfCal module provides accuracy traceability of all dc instruments in the system through an external, precision digital multimeter.

Accuracy of capacitance measurements is assured through a test fixture containing three discrete capacitors whose values are stable with time and temperature. Capacitors on that fixture are measured with traceable capacitance meters, and then Reedholm calibration software creates correction tables that force the system capacitance meters to produce results that match. The standard capacitance fixture plugs into the 16-pin DUT card.