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# Re-Purposing an Obsolete Instrument Enclosure

*Recovered obsolete test equipment becomes a rugged and attractive new project enclosure.*

While searching for an enclosure for a new project, I was not impressed by the folded sheet-metal boxes typically available. I wanted something better that wouldn't cost much more than those typical boxes but would be rugged and relatively easy to modify. Searching the Internet, I stumbled on an advertisement for an HP-436A Power Meter "non-working, parts only" for US$20 from an industrial liquidation firm just across town. I found they had two units available. Both had obviously seen a lot of use, but I happily handed over the $20 for the one that appeared least abused. It was about the right size for my project, if I could strip out the innards and if the instrument's "bones" were recoverable.

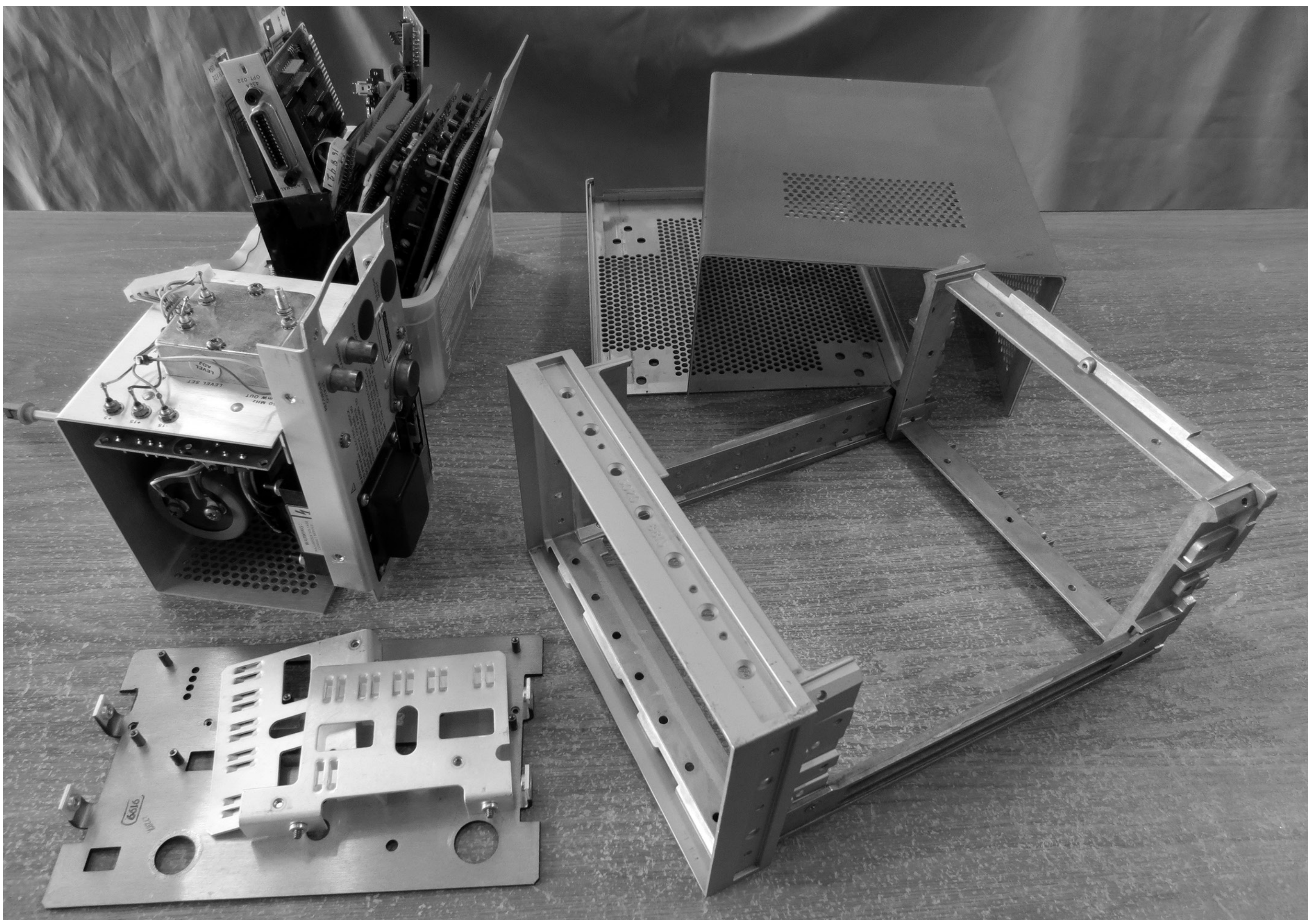

**Figure 1 — Disassembled HP-436A power meter.**

## Background

The HP-436A Power Meter dates from the mid-1970s, and its industrial design was based on the rugged Hewlett-Packard System II instrument enclosure.[1] This cabinet design was used with many HP laboratory instruments and was compatible with standard 19-in equipment racks. The cabinets could easily nest together to form rack-mountable systems, or could be used individually on a lab bench. The HP-436A was a half-rack wide — about 8-5/8 in — and had a standard 4-EIA height — just under 6 in with feet attached — and a depth just under 11 in. Its cast-aluminum internal front and back frames, and the two horizontal side frames, were designed to form a very rigid frame held together by 8 flat-head #8-32 machine screws in threaded holes. With the top and bottom covers installed, the enclosure also provided some degree of RF shielding.

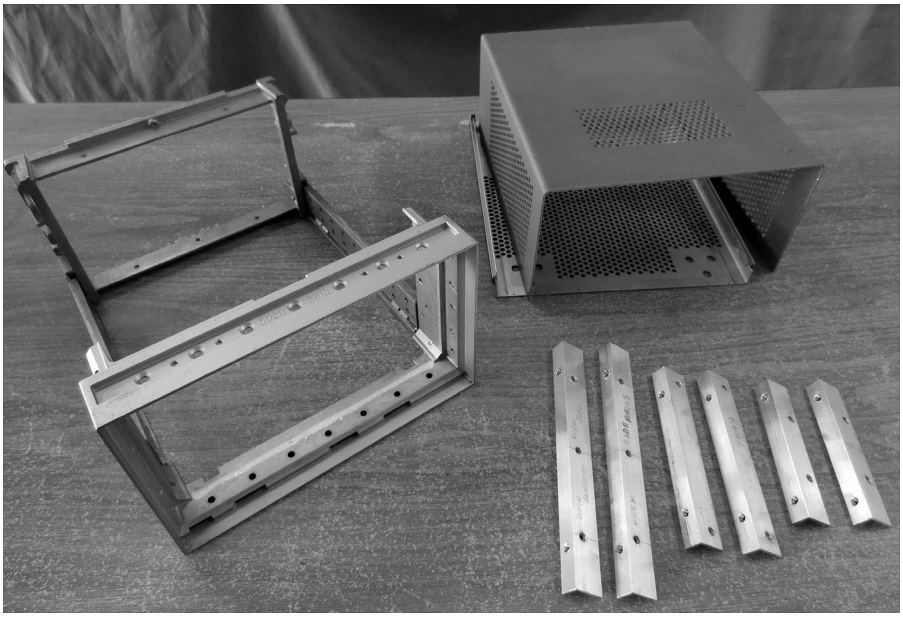

**Figure 2 — Recovered instrument frame and new brackets.**

**Figure 3 — Instrument frame with new brackets installed.**

## Disassembly

Just to make sure it really was non-working, I plugged it in, and saw that some, but not all, of the display digits lit up. I saw no smoke, but I didn't leave it turned on very long just in case. As advertised, it was "non-working." Having satisfied my lingering guilt that I might destroy a repairable instrument, I began a careful disassembly. I took my time because they don't build stuff like this anymore.

Several pleasant hours later I had recovered the cast-aluminum front and rear panel frames, two cast-aluminum horizontal frame parts, the outer enclosure shell (top and bottom painted sheet aluminum covers), and some useful screws. I set the rest aside for recycling, including the original front panel and rear panel with integral power supply (Figure 1). While potentially useful, I didn't need this power supply for my intended project, and the holes in the front and rear panels were not where I wanted them. I also set aside a pair of printed circuit card support frames that were not suitable for my new project.

Clearly the result of superb industrial design, I was pleased to find this instrument case in reasonably good physical condition. There was clear evidence of heavy use and possibly some abuse. The slightly indented front panel in the area of a type-N connector suggested that the instrument had once been dropped on its face. I was planning to make a new front panel anyway so this minor damage didn't matter. Liquid stain marks on the inside surface of the shell, along with some dried, brown sludge on the horizontal frame parts, implied that perhaps a small quantity of heavily-sugared coffee or brown soft drink had been spilled into the instrument long ago. A dish-soap warm water scrub of the disassembled structural components removed these remnants of a hard prior life.

## Reassembly

I then got busy cutting new flat sheet aluminum front and rear panels, and an internal electronics deck to hold the new project.[2] The original design for the front and rear panels used sheet metal with bent integral brackets screwed directly into the frame. It's a great design if you are building lots of these, but this was more than I wanted to tackle for my one-off job. Figure 2 shows six L brackets, each several inches long, that I cut from 1/2 by 3/4-in extruded aluminum angle stock bought at a local home supply store. This angle stock came in 48-in long


Figure 4 — Finished enclosure showing sheet aluminum panels installed.

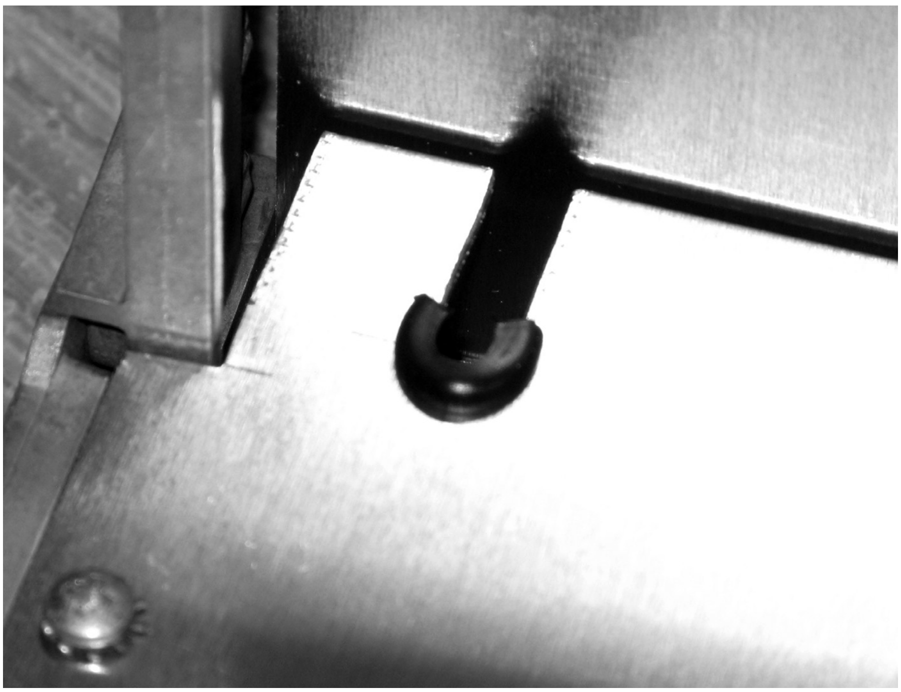

Figure 5 — Access slots in electronics deck facilitate wire/cable routing.

pieces, which easily allowed for the six brackets and some mistakes!

To simplify assembly, I mounted #6-32 swage or self-clinching nuts in the angle bracket mounting holes to avoid having to deal with nuts and washers.[3] Swage nuts also allow quick removal of both the front and rear panels. Mounting these nuts was tricky — not having an arbor press, I managed to press them into the mounting holes with a small and a large vice. I clamped the small vice to a support so the jaws closed vertically and used it to make an initial set. Then I used the large vice with horizontally closing jaws to make the final set. This seemed to work reasonably well.

Figure 3 shows the new brackets ready to hold the front and rear panels to the front and rear frames and the internal deck to the side rails. I mounted the electronics deck brackets on the side rails such that the brackets were even with the upper edge of the side rails. This arrangement provided more than an inch of clearance below the deck and about 3 inches above. The deck turned out to have just over 65 square inches of usable surface area. Figure 4 shows the completed frame with the front and rear panels and the electronics deck installed.

I thought about routing wires or cables between the upper and lower parts of this deck using simple holes and grommets. Instead, I punched 1/4-in diameter holes about an inch from each deck corner then used a metal nibbler to cut a connecting slot from the edges facing the nearby front and rear panels (Figure 5). A vinyl grommet cut in half provided abrasion relief. This way I don't need to remove the electronics deck just to route some wires, but can access these slots by removing a panel.

Table 1 shows that the finished material cost was just under \$70. Figure 6 shows the final product, a rugged and attractive enclosure ready for my next project.

*Scott Roleson, KC7CJ, was licensed in 1964. He has a BSEE from Arizona State University, and MSEE from the University of Arizona, is a licensed professional engineer in California, and is a Life Senior Member of the IEEE. From 1993 to 1995 he was a Distinguished Lecturer of the IEEE EMC Society, and was the Distinguished Lecturer program chair*

**Table 1**
**Re-purposed instrument materials list.**

| *Item* | *Qty* | *Suggested source* | *Cost, US\$* |
|---|---|---|---|
| HP-436A, non-working | 1 | See Note 4 | 20 |
| Aluminum, grade 5052, 12 by 24 in sheet, 0.063 in thick | 1 | **amazon.com** | 27 |
| Aluminum angle stock, 0.75 x 0.5 inches, 0.063 in thick, 48 in long | 1 | **www.homedepot.com** | 6 |
| Clinch nuts, #6-32-2 | 30 | **www.fastenal.com** | 15 |
| **Total** | | | **\$68** |

*1995-1997. Scott retired after a 32-year career in electrical engineering where he worked on spectrum analyzer design, EMC and telecom regulatory engineering. Scott now gets to pick his own projects and maximize the fun return on investment.*

## Notes

[1]E. Allen Inhelder, "A New Instrument Enclosure with Greater Convenience, Better Accessibility, and Higher Attenuation of RF Interference," *Hewlett-Packard Journal*, Vol. 27, No. 1, Sept. 1975, pp. 19-24. [Online: **www.hparchive.com/hp_journals.htm**]

[2]Sheet aluminum is available from several online vendors. I bought a 12 by 24 in sheet of 1/16 in grade-5052 aluminum from **amazon.com**. This was more than sufficient for the front and rear panels and the internal deck.

[3]Swage or "self-clinching" nuts are designed to permanently anchor in sheet metal and provide load-bearing threads. They do away with the need for separate, loose nuts and washers. See **www.pemnet.com/fastening_products/pdf/Handbook.pdf** and **https://www.fastenal.com/content/product_specifications/SCN.Z.pdf**.

[4]Possible sources of surplus equipment include hamfests, swap meets, and ham estate sales, as well as, Sphere Research Corporation, **www.sphere.bc.ca** +1-250-769-1834, and Test Equipment Depot, **www.testequipmentdepot.com**.


**Figure 6 — Finished re-purposed enclosure is both rugged and attractive.**