

# Thoughts on Refurb

I do seem to have pretty much gotten into the used test equipment business as yet another *money machine* income stream. Both on my *website bargain pages* and on *eBay*. So I thought we might look into the perils and pitfalls that may be involved.

On one hand, really primo used test equipment can now be profitably resold at pennies on the dollar. For great end user bargains. You can easily build your own superb dream lab from stuff that "fell off the truck" somewhere along the way. And there's often good vibes in recycling old gear.

Then again, older low-demand items are often bulky and heavy, as they often lack modern switching power supplies. They may not even be worth storing, let alone shipping. Or may not be microprocessor controlled. Repairs can take forever or demand unobtainable manuals or parts.

Worst of all, they may not provide for a PC or Internet interface. The days of making your measurement, writing it down in a notebook, and later copying it to a report are thankfully long gone. Fewer and fewer people are aware what electronic hardware is, let alone trying to build their own. Finally, simulation often can eliminate much of what classic test gear did.

## Establishing Value

By far the two most in-demand brands of used test gear are *Hewlett Packard* (now renamed Agilent) and *Tektronix*. For oscilloscopes, the only choices will end up *Tektronix*, *Tektronix*, or *Tektronix*. The urban lore fantasy that HP knew how to build oscilloscopes went out with the 130C.

And has been downhill ever since.

With few exceptions, there is not much point at all in worrying about other brands. Yeah, *Fluke* did have some interesting frequency counters and thermocouple readouts, *Wavetek* (now Acterna) several nice function generators and sweepers, and *IFR* built outstanding comm monitor gear. *ESI* remains a useful source for lab standards. And, of course, *General Radio* forms a unique niche market for collectibles of the finest test equipment ever built.

"Service Grade" equipment such as *B&K* or *Sencore* or *Simpson* or *Triplett* or others of their ilk is not usually worth the hassle of removing it from a skid. If you must bid over \$2.50 for the lot, make sure the skid is solid oak and has no splinters. *EICO* and "radio school" gear is less than useless. Certain *Heathkit* products are eagerly sought by collectors (such as analog computers or Hero robots ferinstance), while others have little demand.

There's also a strange low end market for vacuum tube

era test gear by the *boatanchor* aficionados on the web. Boatanchor enthusiasts can often be spotted by their very long arms. The shipping charges usually eat you alive.

There are several ways to establish the current value of used test equipment. The closest thing to a "blue Book" are all those free catalogs from *Test Equipment Connection*. Divide these prices by *six* to get the best possible *eBay* selling price and by *thirty* to get the absolute maximum you should ever pay for anything.

A search on *eBay* should give you their current price spreads of more popular items. Note that these vary widely with how clean the instrument is, which accessories are provided, and presence or absence of manuals and docs. Plus warranties, cal or inspection privileges. Supply and demand plus the competence of the seller also makes a huge difference on your final price. Be sure to check the completed auctions, not the current ones. Final prices are typically determined by last second snipers.

National Serial Numbers, or NSN's sometimes will tell you what the government paid for any piece of test gear. Along with how old it was and how long it was popular. These are available free from *Surplus Bid*, but normally only on their current items. Other NSN's can sometimes be gotten for a fee through *USA Info*.

Be certain to divide any NSN price by *100* to get the absolute maximum you should pay.

Ads in Nuts & Volts, Poptronix, or ham magazines also give you some largely useless test equipment pricing.

Other dealers can also be checked into for price quotes. Those I've found useful include *Tucker*, *Test Equity*, and *Megahertz Electronics*. Plus good old *Fair Radio Sales* for older military surplus electronics.

Naturally, a good way to establish price is to try and buy the item on the web. A surprising number of scientific or other more specialized instruments may still have current or upgraded versions in production. Sometimes, you can simply guess at their website as *www.theirname.com* If this does not work, try the purple search engine buttons on my *Guru's Lair* website. Especially *Hotbot* and *Google*. Also visit newsgroups such as *sci.electronics.equipment* or *sci.electronics.repair*.

Plus the good old *Thomas Register*.

## Scoring the Goodies

Your overall goal is to average out buying for one cent on the dollar and selling for ten. While trying to make a nine percent profit in the process.

My own policy is to watch out for inefficient, unpopular, surplus, or distress markets. And buying in quantity. From distances that are **U-haulable** from my home.

As mentioned I'll rarely bid over 1/100th of the NSN value or 1/30th of the TEQ bluebook value. Mixed skids are normally bid at 0.25 cents on the original dollar, rarely going as high as a lofty third of a cent.

I firmly believe that if more than five percent of my bids are accepted, then I am paying too much. I'll make up for this by bidding on **twenty times** what I can use.

Alas, direct military surplus bargains are no more. In the process of selling stuff for an average of 0.8 cents on the dollar, they managed to rack up admin costs of \$1.60 or so for each \$1.00 in actual sales. All that usually remains on **DRMO Websites** are hazmat and term sales.

Instead, the feds have privatized military surplus sales. Mostly to one company which goes by their three names of **Levy-Latham**, or **Government Liquidation**, or **Surplus Bid**. Both live internet auctions and sealed bid sales are currently offered. Side deals are sometimes possible when working directly with their sales managers. Called POC's.

As in **point of contact**.

Military gear almost always starts out first rate and fully loaded. And typically has very little wrong with it. Some of it can end up way too specialized to resell, though.

It pays to restrict your range. Distant sites create preview problems. When you have to involve a third party packer or shipper, the chances are you will lose every time. Paying extra for shipping heavy and useless trash.

Community college auctions have been extremely useful to me. But the days of them phasing out their electronics departments are largely gone. I have done best with poorly announced sales at remote rural sites. But I've found high school and university auctions not nearly as useful.

Because of too much trash and highgrading.

**Hamfests** have long been a useful source for electronic bargains. But these have gotten a lot more junky.

Dot.bomb bankruptcies can offer exceptional bargains as can related distress auctions. I've found the best results on auctions that list only a very few electronic or techie items in an otherwise large sale. **Auction Advisory** is a superb source to pin down these events.

Needless to say, you never get yourself into a pissing contest at an auction. Either start off with a ridiculously lowball bid and quit early, or bid your max once very late in the process. Note that you can cut your bid increment in half by waving your hand across your chest palm down.

Most web truckload "palletized salvage" outfits are best avoided. Cherry picking and scams are the norms.

## What to Avoid

Anything excessively bulky or heavy, of course. Certainly anything that cannot be shipped by **UPS**. A good rule...

**avoid involving yourself with anything you cannot hold extended at arms length.**

I had a huge load bank sit in my driveway for over a year. No way you could call it a white elephant, though. Seems it was a perfectly normal gray elephant color. And size. My first clue that all was not well with this was when the **DRMO** loader guy got off his regular forklift and fired up his huge all-terrain one. In all fairness, though, it did

make an excellent toaster. Doing thirteen loaves at a time.

That F-size HP Plotter did make a graciously understated credenza in the dining room for many months.

Uh, avoid anything over ten years old. Anything in sad shape, unless you get a lot of them for pennies. And are heavily into refurb.

The real losers are oscilloscope cameras (save the lens) and carts (save the casters; check the drawer for surprise goodies), paper chart recorders, pen drafting machines, analog X-Y plotters and graphic tablets. Older and heavier logic analyzers and digitizers are extremely hard to sell. As are outdated communications protocol analyzers. But the pods and manuals for either of these can go quite well at outrageously high prices.

Any specialized laboratory gear (such as a particle size analyzer) is difficult to find interest in. But if and when you do, price is usually no object. It is easy to overvalue stuff in fields that you know nothing about.

Surprisingly, power supplies may not do well at all. "As new" industrial brick supplies including all the bells and whistles (remote sensing, load protection, etc...) may be worth \$17 on **eBay**. Those beautiful Mac LC power supplies would appear perfect for homebrew experimenter use, but I have not even been able to give them away. Anybody can, of course, strip a free power supply out of an old PC.

Older, full metered **Lambda**, HP, or Harris (merged into HP) lab supplies of sane size and weight are still very much in demand, though.

Lightweight and quite clean unused motors, syncros, servos, certain steppers, and such can do pretty well if you get them in quantity, clearly identify them and their specs, link **data and tutorial websites** and keep your time and expenses down. But the heavies don't seem very popular. I'm now in the process of throwing one never used \$1500 super premium motor per week into our local trash pickup. It will take months to flush them.

"Real" military specialized test sets are generally less than useless. Despite their outrageously high acquisition costs. But some **Collins** gear has high collector interest.

Middle age computers, of course, are an outright joke. But I have found 286 and 386 computers at auctions to be a cheap way to pick up line cords. A cord new costs \$4. But attached to a palletized 286, it costs twelve cents.

Ancient computers are another story entirely as they can sell quite well to the collectible market. Especially the real Apples (no Macs, of course), Commodores, and, above all, early KIM-1 class logic trainers. But avoid monitors.

Lots of links and more assistance on these topics on our **Auction Help** library page.

## Getting Manuals & Data

If you ever see the least technical problem on something apparently worth fixing...

**Do not attempt serious repairs without full manuals and proper test gear!**

By far the easiest way to pick up manuals is to **use eBay as a lending library**. Popular and some obscure manuals are often found in the \$12 to \$30 range, and CD collections of military electronics stuff are readily available.

You can often resell the manual on eBay for more than you paid for them. Or else add new value to the equipment

by including the new manual with it. Either way, all of the manuals should be "free".

Of the commercial manual vendors, I very much prefer **HK Porter**. His competitors include **Tannebaum, Manual Man**, and **Manuals Plus**. There are hundreds more, easily found through the **Boatanchor Circle**.

Besides our previously mentioned links, chances are also good that somebody has posted something to a random newsgroup, so be sure to try **Deja News**, which recently has become a part of **Google**.

If you can luck into a few pallets of Tek or HP manuals in your wanderings, they can be worth a fortune.

### Actual Refurb

I try to refurb mid quality ready-to-use products for resale. They are all thoroughly cleaned and have their cosmetics improved. Most major functions are checked out and they often will be guaranteed serviceable. Some calibration is checked but usually not redone.

There's a fifteen day inspection privilege. But we normally do **not** offer warranties, full calibration, manuals, excessive handholding, or any **NIST** tracking services. We do try to understate condition and overstate problems.

Heavier repairs are made only when getting a manual is justified and the process seems like it will end up time and cost effective. Some units are simply stashed until another one shows up.

Refurb can be easiest when you can start with six nearly identical instruments. And then create four great ones, one useful one, and a future parts store from them. Ferinstance, you can combine good case bottoms with tops and put the best knobs on your first unit.

Very often, improving cosmetics, cleaning switches, and tightening knobs is all you will really need. Once again, serious repairs should not be attempted without the proper manuals, tools, and test gear on hand.

I'll normally do only a brief check and minimal crucial repairs on an item before offering it for sale. Just enough to be fairly certain it can be brought up to decent condition. Only after the item sells do we do a thorough cleaning and most of the cosmetic improvements. Unless there is a zillion of them in stock. In which case I'll try to stay two or three ahead. There is no point in wasting time and energy on something that will not sell at a decent price.

Your two most important refurb tools are an .050 hex Allen wrench (buy them by the dozen) and a can of **Radio Shack** tuner cleaner. The latter to deal with noisy switches. Other items high on the "must have" list are an ac power pen detector (**Radio Shack** model **1LAC-A VoltAlert**) or equivalent, a tube of superglue, fuses, some silicon rubber adhesive/sealant, and a strong household cleaner such as Simple Green. Plus glop removers. Perhaps full strength Citra-solv or Armorall or De-Solv-it. Tire cleaner works surprisingly well to renew black Bakelite cases.

Some tips: Soak problem stickers or whatever overnight before you try to remove them. Removing the "top half" of a label makes getting the glop part off easier. A small sponge bungee corded in place helps a lot. Plastic spatulas and toothbrushes can also be a great help. Steel wool may be too harsh. Try to match missing screws.

Be sure you get all knobs in the correct position after tightening! I had a Tek TG501 bounce because I forgot this

crucial but easily forgotten detail.

Repainting is usually a bad scene and should always be avoided. But Sharpie permanent marker "retouch" pens can cover multiple sins. Especially on those **Wavetek** knobs. Solder damage on plastic bezels can sometimes be fixed by a little filing or sanding. A good rule on cosmetics is to "take half and leave half" when improving appearance.

Should parts be needed, search the web for collectors or specialists. Then try **Questlink** or **Chipcenter** or similar resources on our **E.E. Resources** library pages. For obsolete semiconductors, check into **Rochester Electronics** or try **Luke Systems**. Or **Electronic Expeditors International**.

Additional links appear on **my website**.

It is **not** a good idea to do much refurb on a collectible. The buyer may want to do this himself in an "approved" manner. Even powering up an older piece of vacuum tube gear is fraught with peril. Because the electrolytics are almost certainly shorted and may need replacement.

Instead, you simply state the exact condition of what you are offering.

Be on the lookout for locals who can help you in strange and unexpected ways. Amazingly, a nearby glass company charges around \$1.15 to replace a broken meter face. A dentist has proved extremely useful for repairing cases, evaluating X-ray testers, snooping into potted mystery modules, and sculpting missing "front incisor" triggers for barcode readers. Our rug company is perfect for free giant shipping tubes. Check Wal-Mart, your local furniture store, and other merchants for free recycled shipping materials, peanuts, and bubble wrap.

It is exceptionally important to package your items so they can withstand a howitzer at point blank range.

### Tek scopes

Once again, when it does not say "Tektronix" on its front panel, an oscilloscope is probably unsellable at any price. There are several different ages and classes of Tek scopes, all of which may appeal to different markets. Needless to say, clean working scopes with probes and manuals will command much higher prices than untested junk.

Oldest are those Tek vacuum tube "doghouses". These are of interest mostly to hard core collectors and are useless for general lab work due to their outrageous size and weight. Of these, the 515 545A and 561 are probably the best of the lot. Their 570 vacuum tube curve tracers still can bring outrageously high prices to a niche market.

**Stan Griffiths** is a recognized authority on older Tek restorations, having published **Oscilloscopes — Restoring a Classic**. His **website** includes definitive resources.

Somewhat newer are the tek 5000 mainframes. These have virtually zero demand due to poor performance. Next are the 7000 series which still sees modest popularity, especially for the higher speed horizontal plugins.

The industry standard workhorse scope for years and years was the Tek 465 or its related 455 plastic or its mil ruggedized versions. These were the first "modern" scopes. Being portable, reasonably light weight, fast, and largely solid state. While they remain eminently useful, they are getting somewhat long in the tooth.

The best and most desirable Tek scopes for resale today are the 2213 and 2215 for individuals and students, or the 2246 for serious professionals. The newer digital scopes are

somewhat specialized and all but the latest cannot handle certain traditional analog measurements very well. Consult [eBay](#) for the current model-by-model going rate.

Rebranded scopes such as Tek/Tequipment or Tek/Sony generally don't sell well. Tek scopes whose model numbers begin with "T" are typical of this breed. Most Tek spectrum analyzers do command premium prices, but replacing the sometimes burned out mixer diodes may need advanced skills or big bucks. Note that the newest spectrum analyzers use wildly improved FFT computer techniques, leaving all of the older versions in the dust.

As mentioned, awkward and heavier scope carts are not usually worth bothering over, but there can be some real surprises hidden in their drawers. Some carts may also have valuable TM-series mainframes or plugins that can easily and profitably be removed and sold separately.

While you can visit the [Tektronix](#) website, support for older equipment is limited and the prices for service parts is several orders of magnitude beyond outrageous.

One useful source for older Tek parts is [Deane Kidd](#).

### Strip it

It pains me deeply to smash thousands to millions of dollars worth of unused top quality equipment per month. But if all else fails, surprising value can be found in strange nooks and crannies. Just by selling bits and pieces.

Case in point: I paid \$36 to the feds for a \$96,000.00 relay rack full of brand new but horribly ancient [Gould](#) chart recorders. Your tax dollars at work.

I got it delivered free by giving our ISP the mint rack itself. But those insanely heavy recorders went unsold on [eBay](#). Even for a cent on the dollar.

So I stripped them. Selling three sets of heavy duty rack sliders for \$72, dozens of big wirewound pots at \$3 each (snapped up by tattoo parlors), and the three steppers and drivers for \$80. While saving some small pieces of plastic that were perfect to repair some other instruments.

I was unable to sell the 24 pen motors at any price. But by simply renaming them as "laser light show galvo kits", they flew out of here to overjoyed customers. At \$15 each.

Other strippable components that remain in demand are clean analog panel meters, larger stepper motors (especially [SloSyn](#)) with drivers, SMA microwave plumbing, certain modern wireless components, attenuators, flowmeters, adaptors, or precision mechanical positioners. Be sure to scarf the lenses off obsolete video cameras or similar gear. But expect other photo items to drop precipitously in the near future. Do save any smaller knobs or feet or hardware that may fit something useful.

The sad thing about stripping is that you generally end up throwing 95% of the instrument away. Especially the worthless trash such as older circuit cards and unmarked transformers. But the bulk and weight sure goes down in the process. Pruning shears and ten inch Vise Grip pliers are very useful tools here. But a tad on the light side.

Failing to get rid of useless junk eats up storage costs and drives you out of house and home. Continuous triage is absolutely essential.

### Sell it

I've found [eBay](#) to be best for actual test instrument sales and more in-demand electronic parts. While the more

scientific stuff (such as thermocouples or eddy current probes) seems to do better long term up on my website's [Bargain Pages](#). Additional eBay selling info appears in my [MYEBAYS.PDF](#), [EBAYPHEN.PDF](#) and newer files on our [Auction Help](#) library pages.

Here's a summary of some [eBay](#) guidelines that seem to be working very well for me...

- **Seek a 30:1 difference between buy and sell price.**
- **VISA/MC, Paypal or instant epayments only.**
- **Keep terms under fifteen words absolute max.**
- **Outstanding images are an absolute must.**
- **Never sell anything unsuited to the buyer's needs.**
- **No foreign bidders, buyers, or trans-shipments.**
- **Pack exceptionally ruggedly and carefully.**
- **Give a fifteen day inspection privilege.**
- **Offer additional inventory to the top bidders.**
- **Clearly state revenue neutral shipping policies.**
- **Always give email tracking info. Always insure.**
- **Give feedback ~only~ after item receipt.**
- **No color, sound, music, or similar annoyances.**
- **Answer all questions, then improve descriptions.**
- **Understate condition; overstate shortcomings.**
- **Give hot links to tutorial and reference sites.**

The key secret to top eBay prices on test equipment is to make each and every callout in the image clearly legible. A scanner is often a better choice than a digital camera, since it offers a hundred times the resolution.

One thing I cannot emphasize too strongly:

***Spend an absolute minimum of two hours doing your image prep!***

More details in [IMAGIMAG.PDF](#)

Your images can be protected by subtle [steganography](#) tricks. Such as interchanging the focus and intensity knobs on an oscilloscope photo.

We've gone over this on our [Auction Help](#) library pages. I'll try to work up additional details in some future [Blatant Opportunist](#) ezine columns.

### For More Help

Start with our [Auction Help](#) page, followed up by the equipment tutorials you'll find in our [Tech Musings](#) columns and ezines. Then our [InfoPack](#) services. ♦

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