

## Support For Consumer Electronics

by Dennis L Feucht

**Q:** As electronics equipment and consumer electronics are manufactured globally, its maintenance or repair is becoming more difficult. Some suppliers want to control repair either through authorized dealers or by shipping the product back to their factory. This is not feasible when shipping costs are a significant fraction of the product price or when board-level replacement is done by dealers at exorbitant after-sales replacement prices. What are some possible strategies for handling this problem?

**A:** One of the degenerating aspects of product support occurs near the end of development: after-sales technical support. As global economics impacts the electronics industry, one undesirable trend is the destruction of the *total ownership* concept of products. An example or two are given from recent experience along with suggestions on what can be done to deal with problem suppliers or their products once you own them.

### The Total Ownership Concept

Product ownership can be traced through its product life. At the outset, a responsible decision must be made whether it is wise to even acquire the product in question. The *total ownership concept* is an application of the more general *sustainability concept*. It was not too many years ago that manufacturers provided details on not only how to use a product but what it was and how to maintain it. Look at the product manuals of Tektronix or H-P in the 1960s, for instance, or the Apple II or other early microprocessor-based computers. These companies assumed that the owners of their equipment would want to know at least enough about them to maintain them. The Instruction Manuals of Tektronix went even farther, educating the buyer with a Circuit Description section, accompanied by complete schematic diagrams, parts lists, and mechanical drawings. The Apple II red book contained circuit diagrams, firmware source code, and other technical details. Tektronix and Apple had an esteem for technology that was shared with the customer. Total ownership goes beyond purchase and physical possession of the item. It includes its maintenance and disposal at end of life. The sale is only the formal beginning of total ownership.

Over recent years, the concept of ownership for a purchased item has degenerated into *usership*. This is especially true of rapidly-changing consumer technology, with ever-shorter life cycles. The manufacturer no longer assumes that the buyer considers the item a long-term investment. It is to be kept temporarily, until the next generation of *better* devices replaces it. If it breaks, it is assumed that it will be thrown away, for it costs more to repair cheap consumer electronics than to replace it. In this climate, service manuals are irrelevant. Neither are these items designed to be fixed. Over time, both manufacturer

and buyer develop a throw-away mentality, and the buyer accepts dependency upon a continual stream of products from the manufacturer to sustain a given set of functions.

Beside the question of usefulness relative to cost, the entire product life plan should be examined before purchase. Is the product made to last, or is it poorly designed and/or built, and made to be replaced soon? The repeat purchase of durable consumer goods is profitable for manufacturers, but hardly promotes optimal ownership. Spending more on a high-quality item with a long expected life and adequate documentation is often a wise choice when viewed as an investment of resources and freedom from supplier dependency.

At the end of product life, the question of disposal looms. Three possibilities are: dispose, recycle, or reuse. Disposal is the dominant choice in a throw-away society, leading to burgeoning landfills and earth-management inefficiency. By putting out of use so much that otherwise could be kept in use, new materials must be acquired, through mining and processing. On a large scale, this *open-loop* approach will eventually reach its limits. Some environmentally-knowledgeable people think that humanity is now feeling the consequences of those limits. Reuse is like recycling, except that buyers instead of manufacturers re-use the expended material.

### **The Feasibility of Product Maintenance**

As technology becomes more advanced, field repair of electronics becomes more difficult and works against the total ownership concept. For instance, cars now require specialized test equipment that connect to the engine computer for diagnosis. Unless this kind of equipment is acquired, the buyer is dependent upon others for maintaining what in some cases is necessary transportation.

The same applies to the newer consumer electronics. Before about 1990, it was possible to repair electronics products by a technician with a well-stocked electronics parts inventory and a Howard W Sams packet of detailed technical information on the product. This information was commonly supplied by the manufacturers. Now, board-level repair is the norm and return of equipment to the manufacturer for repair is expected. Product manuals no longer contain the required technical information. Although manufacturer policies of not technically supporting customers can be found for old vacuum-tube radios, the greater complexity in a single product nowadays and the difficulty of field repair of surface-mount boards also contribute to it. Even so, if the documentation was made available, repair could be performed in the field, though tiny surface-mount integrated circuit packages require finesse with a soldering iron.

The more advanced the technology becomes with the present approach, the less it is amenable to total ownership. One solution to this problem is to freeze the technology (like the Amish did in the 1820s) to what the technically knowledgeable buyer will use and which is capable of total ownership. This is largely, though not entirely, possible in

practice. Some kinds of equipment, such as GPS receivers, came into being only after the newer usership approach caught on.

The recommended alternative is a policy shift by suppliers toward technical support of buyers of their products. In the large automotive after-market, one can buy hand-held test equipment for under \$200 US that plugs into engine computer connectors and gives diagnostic readings. Though more electronics is in the automobile, the market for support of vehicle repair is large enough to merit the creation of products for total automotive ownership. Though it too is sold in high volume, this is not the case for consumer electronics because of the far greater number of different products. As consumer suppliers scrounge for greater market share, the fear of a competitor copying their product (though the design may be of marginal value) is large enough to discourage total-ownership support. Most non-technical buyers follow the throw-away approach. Even engineers not wanting to spend time on repair might do this. Yet if technical information was readily available, a larger fraction of technical buyers would probably fix their consumer devices instead, or have their local electronics repair shop fix them.

### **From *Ship It and Forget It* to a Tech User Webring**

Unlike cell phones and GPS receivers, some consumer products (such as low-cost power inverters) are easily repairable with bench tools used for through-hole technology. Typically, these products are built in Asia on single-sided, through-hole circuit-boards. This is a market in which US-based companies with foreign manufacturing flood the market with low-cost and unreliable products. I spent a few weeks reverse-engineering a pile of broken inverters of different suppliers. From this exercise in total ownership the hard way – through reverse engineering – I have not only gained a *Consumer Reports* kind of knowledge of how low-cost inverters are designed, but also why they fail. It is simply a trade-off between better design and slightly higher cost.

There is not a large range of quality in some competitive products of low cost and quality. Of necessity, the sometimes arduous task of reverse-engineering deters even electronics engineers with their sleeves rolled up from total ownership. In my limited experience, manufacturers are completely uncooperative in providing any technical field support. In one instance, the pleasant customer service person even checked with the company lawyers. The policy remained: to send back broken units to the factory for repair. That is hardly feasible if you live far away, no less outside the US, where customs also becomes an issue. The shipping cost might be a large fraction of the purchase price, even within the US. What do companies with such policies suppose the buyer should do? The implication is to throw away the broken product and buy a replacement.

An *open-source* approach to product support, in contrast, allows anyone with technical repair skills anywhere in the world to repair the product. Any electronics repair shop becomes a de facto support unit to the open-source company in after-sale support of their product. Supplier concern about incompetent maintenance of products by unauthorized service centers is rather a moot point when the design is also incompetent. And repeat

customer purchase of unreliable products hardly sends the right message back to the manufacturer.

The usership policies of some manufacturers leaves technical buyers in a position of having to do their own support. There is a need for a technically-detailed webring of websites where total-ownership buyers can post our product experiences, observations, technical analyses, reverse engineering, and redesigns for the benefit of other technical owners. This separate community of after-sales support would not be a large fraction of the population, but would constitute a highly useful and practical interchange. It would best be implemented as a ring of technical product support websites. Some might even offer product information on a business basis, like the old Howard Sams schematics. Perhaps Sams Publishing could even take it up as a new phase of an old business based on a good idea.

At the least, manufacturers could be supportive of such a webring, though the more frightened of them will view it as an undesirable disclosure of their trade secrets. In this case, such products would best remain undisclosed by avoidance of their purchase, or even their manufacture as junk products. I took apart several different brands of inverters and did not find a single inverter copied by another company. Yet they all used the same basic scheme. It takes only a couple of days to reverse engineer these products and there is nothing to prevent it. One company scratched off the part number of a PWM IC in their VEC050D inverter stage. How large is the selection of PWM ICs suitable for the application? Not many. The pinout will fit a single PWM IC out there. I found it easily. This is hardly going to defeat any serious attempt at reverse engineering.

As it now stands, manufacturers are anywhere from indifferent to hostile toward buyers who are total owners. What can we do? We could try to pressure manufacturers into a different policy, but that would be like pushing a string. It would be better to put the effort into building an after-sale community on the Web that provides these neglected company functions just as Linux users support Linux themselves as a user community. Unlike Linux, which is a single entity, there are thousands of consumer electronics products. At the same time, there are thousands of buyers who are technically oriented. Some reasonable coverage of major brands and their products should be possible on a webring. Anyone interested in setting up the ring structure? If you do, please let me know and I'll try to provide some publicity for it through the EN-Genius Network.

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