THE CAMAC STORY

In the January issue we mentioned the reputed existence of a standard system of mechanical packaging and logical interconnection called CAMAC. In response to our request for information to substantiate the legend, we have received material from Charles V. L. Smith at the Atomic Energy Commission and from Louis Costrell at the Bureau of Standards. Now we can report authoritatively that there really is a CAMAC; and anyone can learn all about it with little difficulty. See below.

genesis

In the beginning Western Electric created the telephone relay and the 19-inch panel to put them on. (So far as we know, this dimension was chosen because 20 relays would fit on it with hardly any waste space. The fact that 19 is an integer and is prime may or may not have entered into the matter.) Throughout all its history the electronics industry has had this one modular packaging system, based on integral multiples of a 1¾-inch vertical panel dimension. While it would be hard to think of a more appropriate to mount a bunch of telephone relays, the system has some obvious drawbacks for other kinds of equipment; this became especially apparent when transistors came along, followed by integrated circuits. In recent years manufacturers have independently devised a number of other packaging systems; some based on sub-dividing the basic 19-inch panel, and others discounting the whole standard entirely. This was fine for the manufacturer of everything from nuts and bolts to systems, but it didn’t do much for the purchaser, or for the manufacturer contemplating a more limited product line.

While everyone else was contributing to the proliferation of boxes of odd sizes and shapes the nuclear laboratories in this country and abroad were doing something about the problem. Their design goals were approximately as follows:

1. The basic module should be appropriate for typical small instruments, so that space is rarely wasted.
2. The module should have a common DC power supply serving several instruments, since transistorized equipment consumes so little power.
3. The connector interface between an individual module and its containing system should be standardized electrically and mechanically, so that any instrument will fit into any available mounting position.

the nifty NIM

The outcome was a system called NIM (Nuclear Instrument Modules). NIM provides two sizes of bins, mounting in 5½ inch or 8½ inch spaces in a 19-inch relay rack. A bin will hold 12 individual modules of the corresponding height. Larger modules have the same height and a width which is a multiple of the single module width (approximately 1.4 inches). Since it was introduced in 1964 the NIM system has been extremely popular. It is estimated that 95% of the modular nuclear instruments now being produced are built to the NIM standard. (As we look at the conglomeration of test equipment stacked precariously on our workbenches, we wonder why this kind of standardization couldn’t have happened to the electronics industry as a whole!)

As digital techniques have come to prominence in the nuclear business some modifications and extensions to the NIM standards have become advisable. These form the basis of the CAMAC system.

Mechanically, the CAMAC crate divides the NIM module in half, and to this end (with a few other changes) provides space for 25 individual modules spaced 17.2 mm centers. The expensive module-to-bin connector of NIM is replaced with an 86-contact printed circuit edge connector (43 double-sided positions on 0.1 inch centers). Hence a single-width module might be a single etched circuit board.

they went dataway

Of more interest to computer designers will be the interface specification for CAMAC modules, which in the best English-English is called a Dataway. The Dataway specification reads just like a computer-to-peripheral interface specification. The basic idea is to have a crate controller module occupying the designated 25th mounting position and serving as an interface between the standard Dataway and any computer or other external equipment. The Dataway contains:

1. One module-addressing line, individual to the module. All other Dataway lines are common to all modules.
2. 24 data lines in each direction.
3. Four sub-address and 5 function code lines.
4. 8 other lines for strobes, service requests, etc.
5. 6 mandatory power supply voltage lines.
6. 5 lines unspecified, may be used for anything.
7. Other lines reserved for additional power voltages.

While we computer types are still grumbling over interface standards the CAMAC standard is becoming internationally accepted. (The specification is available in English, French, German, and Italian.) If I were planning the design of a new computer system, and especially if it were to be an instrumentation, process-control, or minicomputer system, I would take a long look at CAMAC before setting the interface standard. If any of our readers has done this we would welcome his comments for publication.

For more information on NIM and CAMAC, contact:

Mr. Louis Costrell, Chairman AEC Committee on Nuclear Instrument Modules
Radiation Physics Building
National Bureau of Standards
Washington, DC 20234
(European readers might prefer to contact EURATOM.)

Mr. Costrell sent me the following:

5. "CAMAC Organization of Multi-Crate Systems," September 1970, which goes into the CAMAC crate controller in more detail. Aside from that...

Our non-IBM readers should at least be aware of IBM Manual Form A22-6843-3, "IBM System/360 I/O Interface — Channel to Control Unit — Original Equipment Manufacturers Information." This describes the System/360 peripheral interface and is available to the general public through IBM branch offices. If other computer manufacturers make this kind of information generally available we would be happy to hear about it and to publish its availability. Of course the prominent minicomputer houses do an excellent job of making this kind of information available in the little paperback handbooks that DEC and Varian have made so popular.