[A][C][S] NEWSLETTER

INPUT/OUTPUT ISSUE

a publication of the
AMATEUR COMPUTER SOCIETY

Number 2 October 1966

MEMBERSHIP

Inquiries about ACS membership have been received from 77 men thus far, in 23 states, Canada, Switzerland and Italy. Of these, 36 have sent in the $3 to become members (4 have sent in more), including the Canadian, so the ACS is now an international group.

INPUT/OUTPUT

Although there are a great many types of input/output equipment, nearly all are beyond the financial reach of the average amateur, or they take up too much space. Card readers and punches, magnetic tape, electric typewriters, electroluminescent panels, printers, crt display -- these are usually too expensive and most of them are too big. In the middle ground are such devices as rear-projection display, Nixie tubes, paper tape readers and punches, magnetic drums -- expensive if new, often reasonable when used or surplus. That leaves, at the cheap end of the scale, lamps and pushbuttons.

With only lamps and pushbuttons as input/output, automatic program loading is not possible, nor is the read-in of external data. Output consists of reading the register lamps.

This is well and good for the first stages of computer building, but sooner or later the amateur wants to get into automatic operation. His first step is often in the direction of Teletype gear.

The ACS is fortunate to have a member with much Teletype experience, Jim Haynes, who has analyzed the various models of Teletype equipment for us:

Teletype Equipment

Although Teletype gear is slow and awkward to use, it is readily available and relatively cheap. The only stuff that is widely available uses the 5-level Murray (often called Baudot) code.

The old Model 12 has the advantage, for computer use, of having a parallel-input printer and a parallel-output keyboard. This is so old it is obsolete even for amateur use, but probably some of the machines can be obtained from hams in the New York area, which was its mainstay.

The more recent and more popular Model 15 is quite widely available (for example, see the Alltronics-Howard ads in QST magazine). This, like the rest of the later Teletype line, has the disadvantage for computer use of requiring serial signals. Thus one must build an electronic serial/parallel/serial converter, or find an electromechanical one (not too hard to find, particularly in New York).

The current Model 28 line is usually available, and although serial in operation, is more attractive for computer use because of its higher speed capability (100 wpm, 10 char/sec) and because it is more readily recoded to a more computer-compatible code. In fact, one who is ambitous could even convert it to a

Model 35, which uses the ASCII code. But probably it would be easier to keep the 5-level code and just rearrange the numeric characters for a BCD code. However, once one has a program in and running, he can convert code to Murray in the computer, so that odd-coding would be needed only to get the initial program in and running. For a serial computer, this might well be done as in the Raytheon 250, loading one bit for each character of input.

For information on the availability of 28-line equipment, contact Bert A. Prall, 558 Ridge Ave., Winnetka, Illinois. If one plans to do his own rebuilding and repairing, this should be specified, as the gear is much cheaper that way.

One can also get new Teletype gear from the factory; the Model 33 8-level ASCII machine is quite popular with small computer makers, and can be had for about $600. Contact Mr. R.R. Bogdan, Teletype Corp., 5555 Touhy Ave., Skokie, Illinois.

Teletype also has punched-tape apparatus capable of higher speed (105 char/sec). There is very little of this on the surplus market, but Bert Prall is the one to try.

Some saving can be had on the Teletype equipment new from the factory, by buying the bare-bones units (typing unit, keyboard) separately and doing your own cabinet or cover. The regular keyboard has to have the typing unit to make it work.

One nice feature of the 33 line is that the keyboard is parallel and there is an electrical parallel/serial converter. Thus one can use the parallel interface rather than the serial interface that is normally used for communication purposes. Also, the paper tape reader in this line is magnet-driven, which makes it nice if one wants to use the tape reader by itself. The punch is made to be used with the typing unit and cannot practically be used alone.

Then there is the more rugged Model 35 line, but an amateur would not likely want any of this, as it is quite a bit more expensive. (This is used in some SDS and Univac computers, and others.)

If one wants to be a bit archaic, he could find out all he wants to know about the Teletype and magnetic-wire I/O gear used with SEAC by contacting the National Bureau of Standards. This is, of course, completely obsolete by today's standards. However, one might be able to do something in the way of working over a cheap tape recorder to get high-speed operation on the computer and slow-speed recording and playback from Teletype gear.

(National Bureau of Standards Circular 551, issued Jan. 25, 1955, "Computer Development (SEAC and DYSEAC) at the National Bureau of Standards," was at one time available for $2 from the Supt. of Documents, Govt. Printing Office.)

This is about all except to mention that in San Francisco one should try Buckley's. He usually has Teletype gear, and he once had some old IBM Electrowriter stuff, although the latter was in pretty bad condition. But the Electrowriter is not at all wanted by hams, which should hold its price down.

P.S. The 5-level Murray code is a bit awkward to handle, but then one could rearrange the Teletype keyboard and the type pallets to get his own 5-level code based on

BCD or excess-3 or whatever is desired. But then, in a machine of any size, one can do the code conversion by programming, or by making an off-line converter, so that the standard machine may be used, thus preserving the normal keyboard arrangement. Therefore, the major I/O problem is what to do when Teletype equipment isn't fast enough.

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Another member, Fred Strother, has furnished the names and addresses of companies that sell used Teletype equipment:

Where to Buy Used Teletype Gear

Atlantic Surplus Sales Corp.
250 Columbia Street
Brooklyn, New York
(catalog)

J. Thomsen W9YVP
11001 South Pulaski Road
Chicago, Illinois 60655

Alltronics-Howard Co.
Box 19
Boston, Massachusetts 02101

Elliott Buchanan W6VPC
1067 Mandana Boulevard
Oakland, California

Columbia Electronics (catalog)
4365 W. Pico Boulevard
Los Angeles, California 90019

R.E. Goodheart Co., Inc.
Box 1220-A
Beverly Hills, California 90213

Fred suggests the Teletype Model 14 reperforators and tape distributors, available at a very nominal price. These units print and perforate 9/16" tape from a five-level coded signal. The keyboard and the tape distributor both generate the same 5-level code.

Neon Drivers

Jim Haynes writes that a most economical and satisfactory display is a neon indicator driver by a high-mu triode such as a 12AX7 or 5965. The grid of the tube can be driven direct from the usual sort of logic voltages in a transistor system. A 100K series resistor at the signal source prevents the indicator-circuit wiring capacitance from loading the circuit at all.

One can get very nice-looking neon indicators encased in plastic for panel mounting for around 20 cents each. Jim puts ten of the 12-volt tubes across the power line so that no filament transformer is needed. An isolation transformer capable of supplying about 1 ma per lamp is satisfactory for the plate supply. A full-wave bridge rectifier without a filter is satisfactory.

This arrangement doesn't load the circuit as a transistor-driven indicator would, and it is much cheaper than either a transistor-driven indicator or a 6977 indicator triode. It gives a nice bright light, and allows the use of isolating resistors to prevent capacitive loading from bothering anything.

With integrated circuits and low-voltage transistor logic there are problems with this arrangement, however, because the gain of the triodes isn't high enough. And there is the problem of all that heat from the tubes.

Neon Lamps

According to Pete Showman, neon lamps are cheaper and more efficient than incandescents, an NE-2 costing 10¢ and a #1819 with socket costing 32¢. However, there doesn't seem to be a 22¢,

70-volt neon-driver transistor, and incandescent drivers can be had for about 10¢, surplus. Sylvania's incandescent display lamps are much easier to use, but cost about 65¢ per bit, with sockets.

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Information on how to age and select neon lamps is contained in "Build This Electronic Computer," in the November, 1966, issue of Electronics Illustrated. The device is actually an accumulator rather than a computer.

Voice Output

One member has a voice output for his computer. Two stereo heads are staggered to provide four tracks. Each track is subdivided into three sub-bands to provide ten channels and a control channel.

CRT Display

For those amateurs interested in cathode-ray-tube display, an informative survey article is contained in the January 1965 issue of Electro-Technology, "Digital-to-Visible Character Generators," by Sherman H. Boyd, pages 77-78, 80, 84, 87-88. The systems most likely to appeal to amateurs are dot generators and vector generators.

Pete Showman believes a crt system to be considerably cheaper than a Nixie-tube readout for more than one register, and infinitely more versatile. He thinks an alpha-numeric display could be built for under $150, and a numeric-only system for about half as much.

An interesting twist is found in "Forming Handwritten-Like Digits on CRT Display," by R.L. White, in Electronics, March 13, 1959, pages 138 to 140. The ten number generators produce the necessary horizontal and vertical wave-shapes by a simple shaping of a 60-cycle input.

COMPUTER SCHEMATICS

Control Data has, for $34.50, a maintenance and training manual, containing some diagrams, on the LGP 21 and the RPC 4000, both in the same publication, Pub. No. ESD 10600.

The CDC 160-A Computer System Customer Engineering Diagrams Manual, Pub. No. 600 142 00, is $2.70 per copy.

All inquiries and orders should be sent to:

Literature Distribution Center
Control Data Corporation
1015 South 6th Street
Minneapolis, Minn. 55440

The LGP and RPC were previously sold by the Librascope Division of General Precision; before that, the RPC was sold by the Royal McBee Corp.

The LGP 21 has 460 transistors, 375 diodes and no cores. Still in production, its main frame costs $16,000. Desk-size, it weighs 90 pounds, has a magnetic-disk memory with 4,096 31-bit words, 23 instructions. Single-address, serial arithmetic. Paper tape and typewriter input/output.

The RPC 4000 contains 500 transistors, 4500 diodes, no cores. Original price, $87,000; now, out of production, $28,000. The size of two desks, it weighs 900 lbs, has a drum memory with 8008 words, 32 bits each. Two-address, serial arithmetic, 36 instructions. Paper tape and typewriter input/output.

The 160-A contains 1700 transistors, 11,900 diodes and 402 cores. Original cost, $90,000; now, out of production, $35,000. Desk-size, it weighs 850 pounds, has optional core, drum, disk or tape memory. Single-address, parallel arithmetic, 12-bit words, 130 instructions. Paper tape I/O.

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Although many ACS members write that designing the computer is half the fun, there are just as many who are interested in obtaining schematics. So we'll keep on looking.

INTEGRATED CIRCUITS IN QUANTITY

Pete Showman has volunteered to help ACS members take advantage of the much lower prices of IC's when bought in large quantities. If you want to buy IC's in quantities of 50 or more, write, giving full details of exactly what you want, to:

Peter S. Showman
403 School St.
Watertown, Mass. 02172

ANSWERS TO PREVIOUS PROBLEMS

1-1. Who sells computer parts?

Herbach and Rademan, Inc.
1204 Arch St. (catalog)
Philadelphia, Pa. 19107

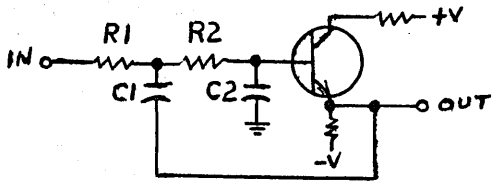
Gadgeteers Surplus Electronics
5300 Vine St. (catalog)
Cincinnati, Ohio 45217

Selectronics
12 South Napa St.
Philadelphia, Pa.

Leeds Radio Co.
75 Vesey St.
New York, N.Y. (no catalog)

1-7. How can a 10-μsec delay line be designed using RC elements?

Jim Haynes doubts that a very practical delay line can be built with RC elements. If one insists, perhaps an active circuit will do:



This is an active low-pass filter, so presumably it produces a pure delay below the cutoff frequency. However, a lot of sections would be needed if a good pulse shape is to be preserved. R1C1 should be made equal to R2C2, and the C1/C2 ratio is a critical parameter.

Pete Showman says delay lines are easy to make, if you don't need large bandwidth and a long delay together. Look in the Radiotron Designer's Handbook under pi-section low-pass LC filters for some data. $Z_o = \sqrt{L/C}$, $f_{co} = 1/(\pi\sqrt{LC})$, delay per stage $\cong 180^o$ @ f_{co}, so $T \cong \frac{1}{2}\pi\sqrt{LC}$ per stage. Try winding the inductors on long polystyrene rods, with spacing about equal to winding length (or more). Choose L and C from cutoff frequency and impedance. The delay time determines the number of stages needed, so, for instance, a 300-ohm, 5-MHz, 1-μsec line needs 30 stages.

Bill Greene says he's found two companies in the New York area that can supply magnetostrictive delay lines for $125 to $156, for 2 to 5-msec types:

Sealectro Corp.
139 Hoyt St.
Mamaroneck, N.Y.

Digital Devices
212 Michael Drive
Syosset, N.Y.

The Amateur Computer Society is open to all who are interested in building and operating a digital computer that can at least perform automatic multiplication and division, or is of a comparative complexity.

For membership in the ACS, and a subscription of at least eight issues of the Newsletter, send $3 (or a check made out to me)to:

Stephen B. Gray
Amateur Computer Society
219 West 81 St
New York, N.Y. 10024

The Newsletter will appear about every eight weeks.

1-8. What are the pros and cons of serial versus parallel operation and associated circuit requirements?

Jim Haynes feels that the pro of serial operation is the small hardware requirement and the con is the slowness, which is why serial operation has all but disappeared from modern commercial computers.

If serial operation is to be used, Jim strongly recommends that negative numbers be represented in two's complement form, which simplifies things enormously. A good write-up on a serial computer is in the book, "Analog and Digital Computer Technology," by Scott.

Serial operation is good with drum or disk or delay-line storage, which is a pretty cheap form of storage. For registers, one could use short delay lines, drum or disk tracks with multiple read heads, or the new IC shift registers that have a lot of bits on one chip. These IC's are rather expensive ($75 or so), but that is cheaper than most brand-new delay lines and is certainly cheaper than a flip-flop register.

PROBLEMS FOR THIS ISSUE

2-1. Is there a book or article on designing memory-core drivers?

2-2. Where can one buy one of the new pushbutton telephone dials?

Herbach and Rademan have a 16-button Western Electric 508 pushbutton switch for $24.95.

See "A Pushbutton Telephone for Alphanumeric Input," in the April 1966 issue of Datamation, pages 27-30. The system described requires 12 pushbuttons.

2-3. Can hams get used Teletype gear from Western Union?

Yes. Through arrangements with the ARRL (American Radio Relay League) surplus teleprinter and related equipment is made available at no charge to licensed radio amateurs.

Western Union is disposing of surplus equipment, including the Model 2B (same as Model 14 narrow tape printer), Model 26 and Model 100 page printers. Later WU expects to dispose of Model 14 reperforators, as well as Model 15 and Model 19 equipment.

Hams desiring more info, write to:
Frank C. White (Coordinator-WUSP)
2706 Harmon Road
Silver Spring, Maryland 20902

NEXT ISSUE will be about computer circuits, mostly about build-your-own and where to get the schematics, also some info on surplus circuits and IC's. If you have any experience with these, or thoughts to share, please send details. Where do you get schematics for surplus circuits? Are homemade printed-wiring boards cheap enough to use? How do you use boards with broken-off terminal contacts?