H. Anderson

INTEROFFICE MEMORANDUM

DATE April 26, 1963

SUBJECT TRADE SHOW SHIPMENTS FROM EXHIBIT HALLS.

TO Distribution List

FROM H. O. Painter

Due to a rather unfortunate experience we are (I am) having with a shipment from the Biology Meeting at Atlantic City Convention Hall, it seems wise at this point to set down a few rules which we should all follow:

1. Make sure that the trucker who is picking up the shipment is in fact a DEC authorized agent. If a person who claims to be the authorized agent presents himself, ask for a bill of lading (check carefully that it is either a Wm. McDonald Co. (of Boston) or a Bekins representative - either generally used by us).

   In addition, the driver or agent should have an inventory of the goods to be shipped, or at least an inventory copy of the goods originally shipped to the exhibit. If the driver or agent has neither of these, make him fully and completely identify himself (name, rank and serial number type thing) before he starts loading. Also identify the truck that the equipment is to be placed on (license number, marking, ICC plate, etc.).

2. Notify Brad Towle or me immediately if anything seems out of line.

3. Under no circumstances have anything to do with a 5'10", dark haired, obese (approx. 45-50" waist), thirtyish guy who calls himself "Dreer" (Sidney or Joel), "McDonald" (and claims he represents the Wm. McDonald Co. of Boston), or anyone representing World Wide Agents, Inc. of Philadelphia or Dean Van Lines. If the above are seen around any exhibit halls, it would be wise to advise the Exhibits Manager.

4. A centralized shipping procedure has been established, with Brad Towle handling all arrangements for show shipments. Bill Farnham and Jim Myers will also be kept informed of these shipments.

This is a "closing the barn door, etc..." type of thing, but perhaps we can save future horses.

INTEROFFICE MEMORANDUM

DATE April 25, 1963

SUBJECT

TO Harlan Anderson

FROM Ed Harwood

I have applied for transfer from Associate to Member grade in the I.E.E.E and have used your name as a reference for the following resumé.

Present Occupation

Title or Position - Manager, computer test

Firm - Digital Equipment Corporation, Maynard, Mass.

Nature of Work Done by Firm - Manufacture Modules, Computers and Special Systems

Nature of Your Work - Responsible for all computer assembly and testing

Professional Experience

July 1959 to Present	Digital Equipment Corporation, Worked on the design of the PDP-1 and PDP-4 computers and am now supervising the complete system testing of these computers.
June 1952 to July 1959	Lincoln Laboratory, Worked on the design of Cape Cod System, the Sage System, also was involved in the design, construction and assembly of the TX-0 and TX-2 computers. I also did much of the testing of these computers.

DATE April 26, 1963

SUBJECT PDP-6

TO Computer Guidance Committee
Richard Best
Arthur Hall

FROM Gordon Bell

Beginning now, Arthur Hall will be the Administrative Coordinator of the PDP-6 project. His present duties should be phased out, since this will be more than a full-time job in the next six months.

The Prototype

The prototype system includes these items:

1. 16K Core memory, 2 - new PDP-1 types. We will borrow 2 - 4K PDP-1 systems when the memory control module is ready to check, and replace them with the 2 - 16K new PDP-1 systems as soon as possible. The 16K PDP-1 might then be replaced soon after with the 4.0 microsecond PDP-6 system, or possibly never. Checkout of the PDP-6 memory control will be done on a PDP-6 memory exercisor (a special sub-system connected to the PDP-4).

   Actually, I now believe the PDP-6 simulator should be done on a PDP-4 which has a PDP-6 core memory connection. This exercisor connection consists of an 18 bit MA, and a 36 bit MB (all 1 mc f/f). The control is handled by PDP-4 IOT's. Thus, both simulation, memory exercising, and memory checkout is accomplished.

2. The fast flip-flop section, connected to the same PDP-4 memory control should be designed, and checked using the PDP-6 sub-system.

3. The IO interface must be determined immediately, resulting in I/O equipment design starts. A PDP-6 I/O simulator must then be connected to PDP-4 for item 4 (especially important are items 4a, 4b.

4. The I/O equipment design.

   a. Micro Tape Control
   b. IBM - Type Control
   c. Display (points, grids, characters)
   d. Card Reader
   e. Line Printer (120 col.) modification

5. Program Processor

   a. Skeletal Design
   b. Floating Point Logic
   c. Character Manipulation Logic
   d. I/O Section (Data, Program Interrupt)
   e. Reader, Punch, Teletype
   f. All Processor Circuits

6. IO Data Processor

   a. System & CPU --- A. Kotok, G. Bell, Summer student for Floating Point.
   b. Programming --- Dit Morse, et al
   c. Publications co-ordination, Marketing, Programming Manual --- R. Lane
   d. Circuitry --- Burton Scudney
   e. Design Production --- E. Harwood, R. Reed, W. Colburn
   f. Design Automation --- L. Hantman
   g. Memory --- A. Blumenthal/Ted Johnson
   h. Magnetic Tape Sustems (Micro, & IBM) --- Roland Boisvert
   i. Display, Line Printer --- Bob Savell

Present Commitments for Arthur Hall

The basic jobs which require immediate and future attention are:

1. Establishment of distribution lists.
2. Establishment of development cost accounting system and procedures for various sub-systems.
3. System, sub-system accounting control.
4. System, sub-system scheduling
5. Drawing numbering systems
6. Allocation of manpower, machine testing time, projects phasing, etc.
7. Coordinate maintenance manual

INTEROFFICE MEMORANDUM

DATE April 25, 1963

SUBJECT Results of PDP-6 Meeting April 23, 1963

TO K. Olsen
H. Anderson
N. Mazzarese
S. Olsen
R. Best
A. Blumenthal
A. Hall
G. O'Dea
S. Grover

FROM Gordon Bell

1. The PDP-6 configuration drawings and operation codes were presented.

2. Al Blumenthal agreed that a 4.0 microsecond memory would be available for the prototype and for advertising purposes. There was discussion as to whether the machine could accept higher speed memories should be mentioned in the literature.

3. The prototype configuration was agreed on, and includes:

   16K memory (core)
   10 word flip-flop
   3 pr. of micro tape & control
   Display -- including character generation, line drawing, point plotting.
   Reader -- Punch (paper tape)
   200 card per minute reader
   120 column - 300 lines/min. printer
   3 Teletypes
   Tape Control for 200/556/800 bpi, IBM tape
   2 - Tape transports (for above control)

   The above will be purchased this fiscal year.

4. An accounting system procedure will be published for charging the development costs for PDP-6. This should show a breakdown of all components, programming, etc.

5. We will order a 65K word, serial drum Type 24C for PDP-4. This will be installed on PDP-4-1 for:

   PDP-6 Simulator
   PDP-6 Wiring lists
   Accounting

6. A schedule for components will be forthcoming.

7. Literature will be available for the SJCC, and the prototype at FJCC.

8. The complete system for PDP-6 includes:

    1. Arithmetic Processor
    2. 2 Microsecond Memories (core)
    3. .25 -5 Microsecond Memories (flip-flop, thin film, etc)
    4. Teletype I/O
    5. Paper Tape (Reader/Punch)
    6. Card Reader
    7. Displays
    8. Micro Tape
    9. IBM Type Tape
    10. Line Printers (120 column, 16 column)
    11. Time Sharing Logic (relocation, boundaries)
    12. Drum (Parallel Type) 8-16μs / 2 way word
    13. Additional Processor inputs to memory
    14. I/O Processor

H. Anderson

J. Smith
April 24, 1963

Computer Delivery Probability

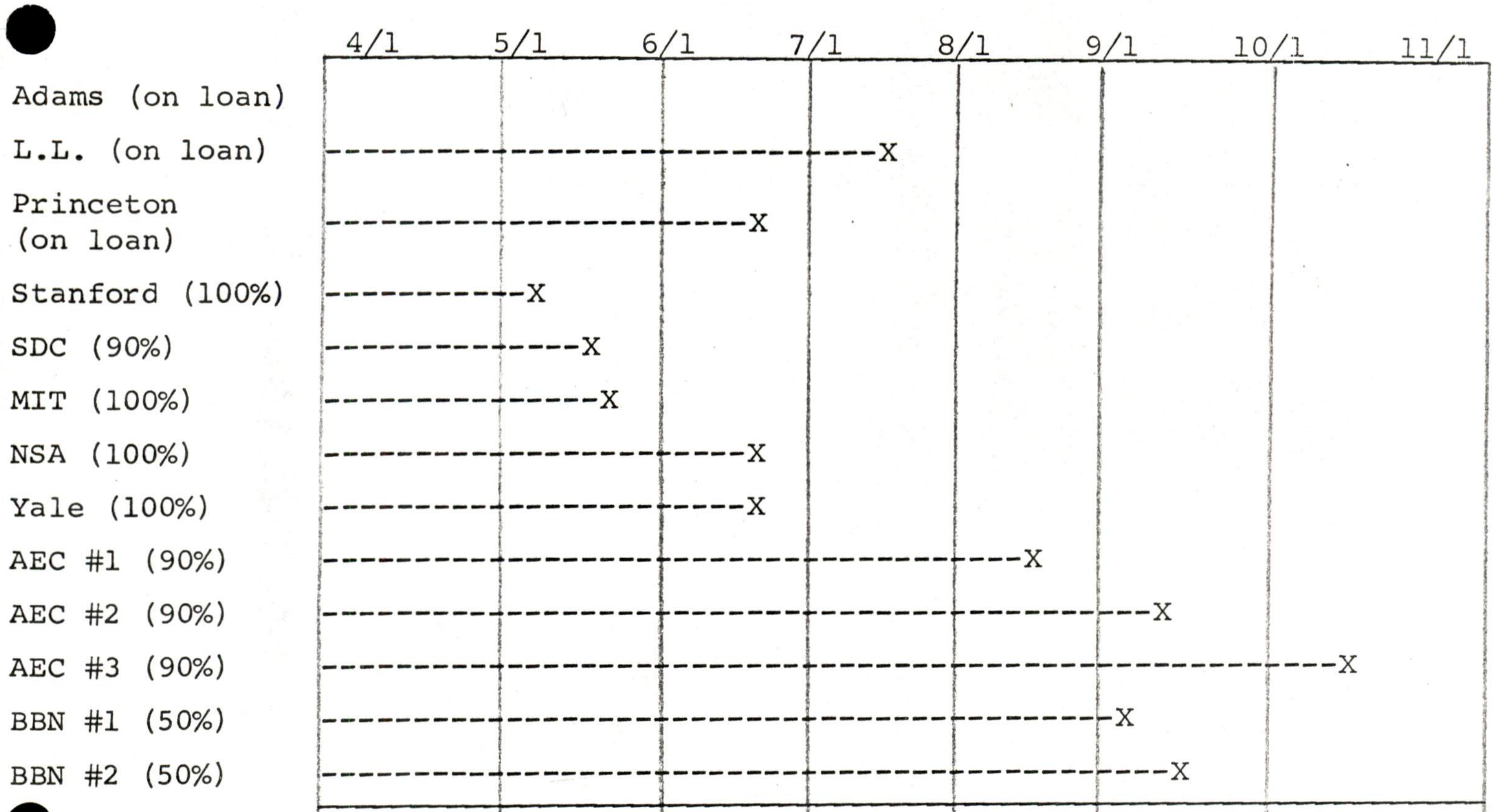
PDP-4

	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1
Mass. Gen. (on loan)								
JPL #1 (100%)	--X							
JPL #2 (100%)	------	------	---X					
Harvard (90%)	------	---X						
Fox. (U.S.) (100%)	------	------X						
Fox. (50%)	------	------	---X					
Bell Labs (70%)	------	------	---X					
AECL (80%)	------	------	------	------	------	------	---X	
Eng. (DEC)	------	---X						
In Checkout	9	10	8	6	7	8	8	
Shipments	1	3	3	0	0	0	1	
Reserved*Order for Customer	4	3	0	0	0	1	0	
Available for Commitment	+4	+4	+5	+6	+7	+7	+7	
On Loan	1	1	1	1	1	1	1	
*	JPL #2 Fox (U.S.) Harvard Eng. (DEC)	JPL #2 Fox. Bell Labs				AECL		

J. Smith
April 24, 1963

Computer Delivery Probability

PDP-1



	4/1	5/1	6/1	7/1	8/1	9/1	10/1
In Checkout	7	7	6	5	6	6	4
Shipments	1	2	2	0	1	3	1
Reserved for Customer Order*	4	2	0	1	3	1	0
Available for Commitment	+2 #41 #43	+3 #41 #44 #43	+4 #41 #44 #43 #45	+4	+2	+2	+3
On Loan	3	3	2	2	2	2	2
*	SDC MIT NSA Yale	NSA Yale		AEC #1	AEC #2 BBN #1 BBN #2	AEC #3	

HEA.

MEMORANDUM

SUBJECT: FORTRAN
DATE: April 24, 1963
TO: Ken Olsen
FROM: Dit Morse

On April 30, we will be prepared to deliver to Foxboro the following:

1. FORTRAN II Compiler
2. PDP-4 Assembler to accept Compiler produced programs
3. Operating system consisting of -
   a) Subscript calculator
   b) Sub-routine caller & returner
   c) Floating point interpreter
   d) Floating point +, -, x, /, fix, float
   e) Teletype I/O

The above will allow the user to write, compile, and execute self contained programs.

Included will be a rough draft of a manual, sufficient to get Foxboro operating.

Input/Output will consist of the commands -

accept A

print A

The above will meet our commitment to Foxboro, in my opinion.

The schedule after April 30, will be:

May 10 - Sub-routines and functions in compiler
May 17 - Final draft of manual
May 17 - Complete I/O - similar to 1620 FORTRAN II, with format
May 30 - Relocatable Assembler
May 30 - Published documentation

The above is necessary for the final "software" offering, but the initial system (April 30th) is in itself useful, and suffices to satisfy our software obligations.

cc: √H. Anderson, A. Hall, S. Piner, N. Hurley, D. Fellows

\# # # #

H. Anderson

INTEROFFICE MEMORANDUM

DATE April 24, 1963

SUBJECT Midwestern 3000 series transport

TO Computer Guidance Committee

FROM Steve Lambert

The following modifications should be made to the Midwestern 3000 series transport.

1. The Hub Spool (½ I.B.M. Reel Assembly) should be redesigned without using rubber friction rings.
   Reason: The tolerance and durability of rubber rings results in difficulty of loading reels and short term life. It took me five (5) minutes to load the tape reel onto the hub assembly.

2. Status and command levels should all be compatible.
   Reason: Undesirable special circuits must be constructed. The interface becomes expensive.

3. The first 5 sec. thermal delay in series for rewind should be removed.
   Reason: As the circuit stands now, a rewind command given 3 or 4 feet from load-point results in a no-load and a fail condition exists.

4. The load-point sensing station should be on the outside of tape not the inside .
   Reason: IBM compatibility.

5. The load-point marker should be sensed in the rewind state no matter how close the marker is to the sensing station.
   Reason: Programmer have the tendency to rewind after writing 1 or 2 records on tape. This puts the marker about a foot away from the sensing station.

6. After a rewind command the transport should stay in the remote state.
   Reason: When rewinding, it does not necessarily mean that the programmer is through using tape. Presently it requires the programmer to go over to the transport and select remote after rewinding.

7. A status level should be made available to indicate that the transport has tape in the chambers, no fail condition exists, and the transport is <u>ready</u> to accept a tape function.

8. The write lock (inhibit) switch should be pulled in while the plastic ring is in the reel. A status level should be made available externally.
   Reason: If the switch lever is not pulled away from the plastic ring, the ring will be shreded when the tape reel is in motion.

9. The cabinet has to be redesigned to DEC standards.
   Reason: The present cabinet is flimsy and internal areas are not easily accessible. A transport select switch must be incorporated in the cabinet design.

10. New mounting panels must be made for installation within the area assigned.

11. Fixed tape guides must be compatible with IBM in reference to channel 1.
    Reason: Tape widths vary to some degree.

SL/nbh

INTEROFFICE MEMORANDUM

SUBJECT 28th Meeting of the Test Equipment Committee

DATE April 24, 1963

TO Richard L. Best

FROM Russell Doane

Members of the Committee:

Robert Hughes, Chairman
Russell Doane, Secretary
Donald White
George Gerelds
Dave Dubay
Dick Tringale
Jim Cudmore
Larry White
Ken Wakeen
Steve Lambert

1. The Ballantine AC VTVM has arrived.

2. Our X-Y plotting needs can be satisfied to 600 Mc by 567 oscilloscopes, of which we have three. No additional equipment is needed, since a previously unobserved control setting for X-Y plotting is built-in.

3. We now have a second lens for the Tektronix oscilloscope camera which provides for as many as three images on the same frame in addition to the original lens which gives only one large size image.

4. Bob Hughes suggested buying a model 20 Fairchild leakage tester. Its cost would be about $2000, and it performs leakage tests down to values of leakage which are several orders of magnitude smaller than the tightest spec we now have. Instead Russ Doane will design a tester specifically for our in-house testing of leakage, with the Boonton electronics DC microammeter being used as the measuring device.

5. It was proposed that Bob Savell may need the new Tektronix 40 KV probe. On the contrary, he says he cannot use probes with such high division ratios because he wants to measure small ripple voltages, etc. and consequently, a high voltage capacitor would be better for his purposes.

6. A Hewlett Packard 175A oscilloscope will be assigned to Bill Long.

7. Barbera Stephenson requested a second type E preamplifier for making very low level measurements on analog modules. This has been requisitioned. We own one now, but it is already in constant use, and the second one is necessary to make increased production of analog modules possible.

8. Dave Dubay reported that we need to order still more 630 NA Triplett meters. We decided to investigate first whether some of this money could be spent for a few special purpose instruments to replace any of the general purpose multimeters which now may be used to make only a single measurement repetitively. We will decide what to do at the next meeting.

9. We will order a Tektronix type CT 1 current probe which has a one kilomegacycle bandwidth compatible with our sampling oscilloscopes. This will allow measurements of currents for the VHF modules and other uses for which our present current probes are much too slow (about 20 Mc bandwidths).

10. The standards subcommittee reported some progress in studying available standards. At present the information we would need to intelligently select equipment for standardizing voltages in the range required for analog to digital converting modules accurate to .01% or better is not available since the progress of analog to digital modules for the near future is not mapped out. This question has been referred to the engineering projects committee and Tom Stockebrand and Barbera Stephenson are reviewing this whole area. Meanwhile we will immediately purchase standard resistors at ± .005% accuracy from E.S.I. for $.15. each in the following sizes: 1 ohm; 10 ohms; 100 ohms; 1000 ohms. This will help to establish confidence in our resistor measurements on the E.S.I. resistance bridge for the range of values most commonly measured. We will also buy from General Radio both .001 mfd and .01 mfd capacitance standards ± .05% for establishing confidence in incoming inspection measurements made with our E.S.I. capacitance bridge. These standards will allow us to check the operation of our resistance and capacitance bridges without delay in the event that a manufacturer claims that measurements are used as a basis for rejecting returning incoming material were erroneous.

A second step which we can take to increase the confidence with which we can make accurate measurements will be to compare our three Fluke meters and our .01% Kintell power supply with each other every three months. This does not establish traceability but does provide some protection against any large change in any one of these instruments which might otherwise go undetected over the period of calibration.

We have constructed curves that show the upper limit of rated accuracy for the best equipment that the company has available for making various electrical measurements. A copy of each of these curves is attached to your minutes this month for reference.

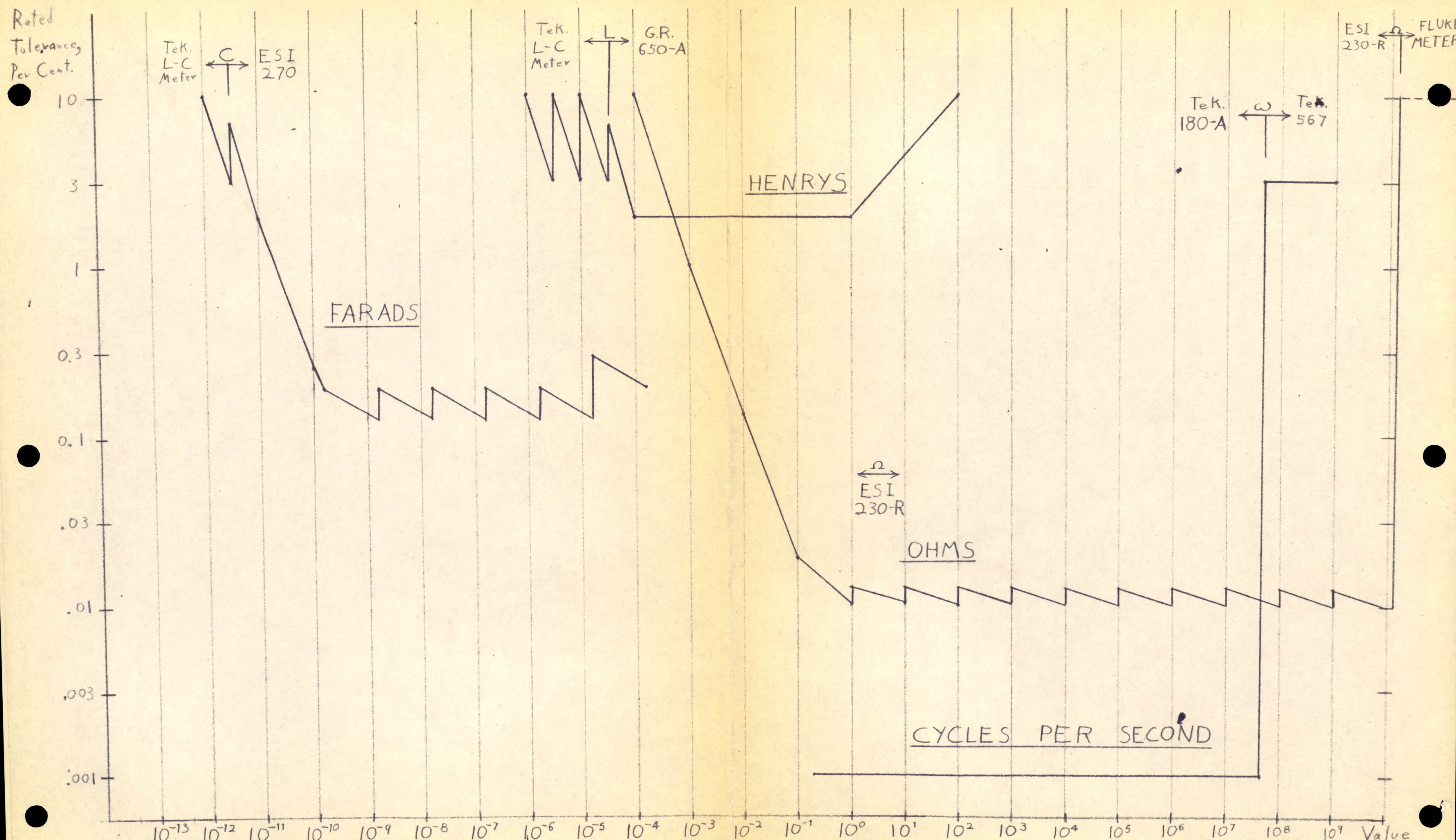
11. Russ Doane wants to buy a set of Kelvin Klips for our resistance bridge, which will allow increased accuracy of measurements for low resistances (from 10 ohms down. For example, changing the positioning of a 2 ohm resistor being measured by 1" changed the reading 0.15%). It will also facilitate heat sink measurements, for which the equivalence between electrical and thermal conductivity for metals can be used to advantage if 4-terminal measurements can be used to get adequate accuracy on the very low resistances involved.

12. It's hard to keep track of oscilloscopes, but we must! Ken Olsen feels strongly that the man who signs one out has responsibility for it. This means that when you are asked to find your 'scope for calibration or reassignment, "I don't know who has it" is not your last word. The only alternative to being held accountable for the whereabouts of your test equipment is to insist that the borrower signs it out before you lend it.

Because of serious consequences to the man who is responsible for test equipment if he loses it, common decency requires a borrower to keep the lender informed (leave a note). Don't be guilty of causing someone a wasted hour to track down his equipment.

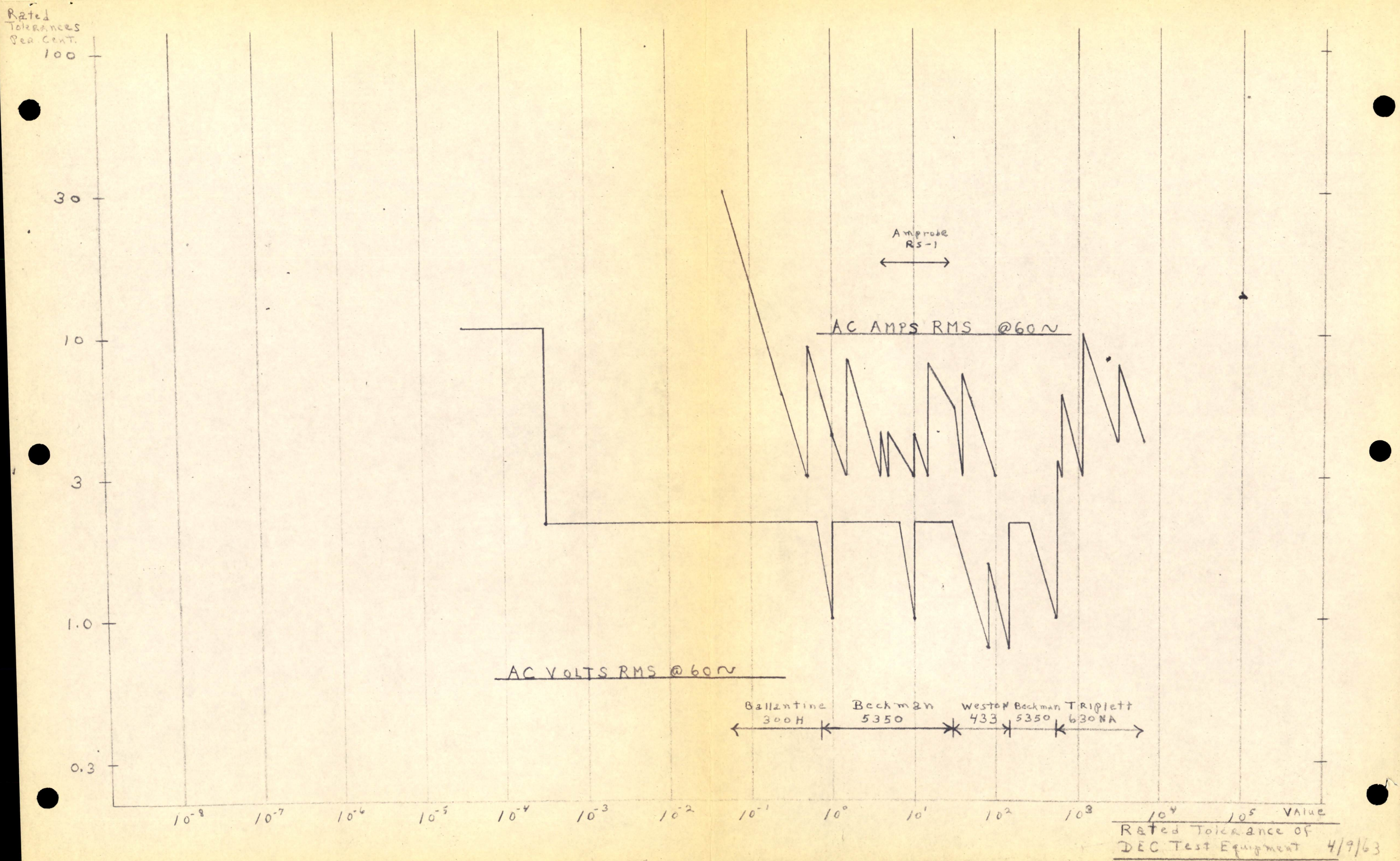
The next meeting of the Test Equipment Committee will be on Tuesday, May 14, at 1:30 P.M. in Bob Hughes' office.

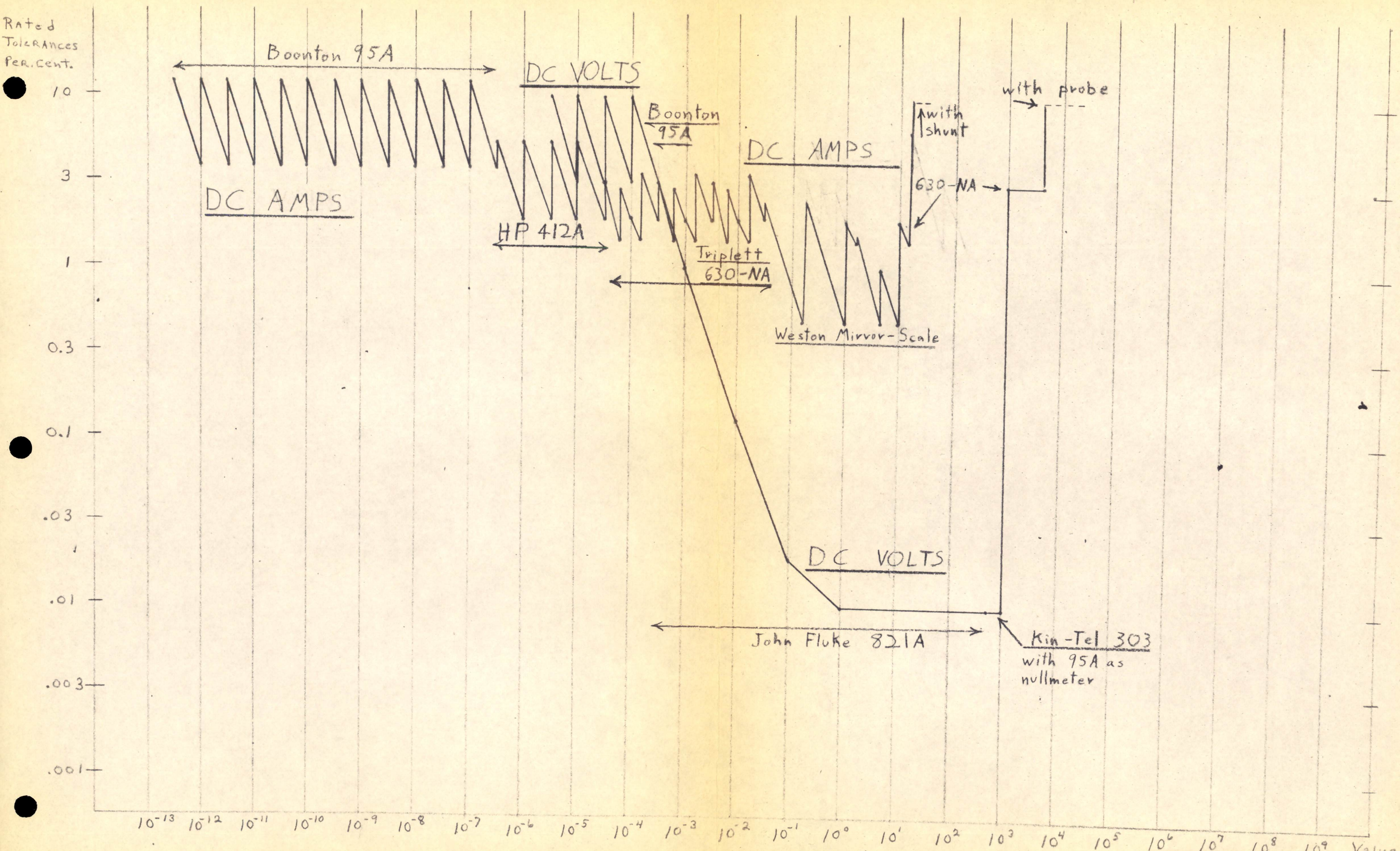
cc: H. Anderson
B. Beckman
W. Hindle
N. Mazzarese
R. Mills
J. O'Connell
G. O'Dea
K. Olsen
S. Olsen
H. Painter
G. Rice
M. Sandler
Engineers
Technicians



Rated Tolerance of DEC Test Equipment

4/9/63


Rated Tolerances Per Cent.
100
30
10
3
1.0
0.3
Amprobe RS-1
AC AMPS RMS @60~
AC VOLTS RMS @60~
Ballantine 300H
Beckman 5350
Weston 433
Beckman 5350
Triplett 630NA
10^{-8}
10^{-7}
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
Value
Rated Tolerance of DEC Test Equipment
4/9/63



Rated Tolerance of DEC Test Equipment 4/9/63

April 23, 1963

Control & Format of PDP-4 Maintenance Programs

PDP Distribution List

Bill Colburn/Leo Gossel

The following set of rules are for most cases sufficiently easy to comply with and will result in usage of maintenance programs being much simplified.

1. All programs shall start with a halt at location 100. The program must enter to this halt at program read in, and at end of a single pass of program under control of ACS 17.

2. Only routines for cal or interrupt handling, or the use of the auto-index registers is permitted below register 100.

3. Use of the AC Switches for program control:

ACS 17=1	Stop program at end of each pass of program with AC = -0 & L set, prog. will stop at initial halt at loc. 100.
ACS 0=1	Loop on a single test -- no error halts or printouts permissable. This switch control to take high priority over all others.
ACS 1=1	Loop on a single test error halts or print-outs controlled by ACS's 2 & 3 respectively.
ACS 2=1	Don't halt if error
ACS 3=1	Don't print if error

It is desirable that further usage of ACS's to control use/non-use of program be for an ACS =1 to inhibit rather than permit a function.

INTEROFFICE MEMORANDUM

DATE May 23, 1963

SUBJECT Inspection of Facilities At Mid Western Instruments, Tulsa, Oklahoma

TO Ken Olsen
Harlan Anderson
Richard Best
Gordon Bell

FROM Roland Boisvert

Persons Contacted:

R. Morrow	President of Mid Western
S. Keller	Vice President Telex
W. Harrison	Chief Engineer
B. Hall	Production Manager
B. Brown	Marketing Manager

Itenerary of Visit:

A. Plant Tour
B. General Engineering Meeting
C. Marketing Practices Meeting
D. Revisit To Areas Of Interest
E. Seminar On PDP-4
F. Discussion of general nature concerning transports at CDC, and short seminar on all products with emphasis on the PDP-6.

Additions To The Plant Tour:

A. Machine facilities: These are divided into two groups; a model shop approximately the size of our machine shop with approximately the same facilities, and a production facility of 15 to 20 lathes from 10" to possibly 16" capacity, although probably only 14", and about 25 milling machines. Approximately two-thirds of these are Bridgeports of various ages and sizes and the remainder are #2 Brown and Sharpe milling machines. They also have at least one Harding horizontal miller for extremely precise work on the magnetic heads. They have surface grinders, but I did not see any other grinding facilities. Their machine facilities are much too crowded to be efficient, and all of their production is stagered through ESF units that is sequentially put through the machine facility. Separate machines or separate groups are not assigned to any particular project. They do a considerable amount of lapping and they have excellent equipment for this work. Production is in charge of Mr. Burl Hall. He not only seems to know their operations but also the short comings of their operations. I am sure that he is aware of what the increase in production of tapes we contemplate would mean to his operation. They can do considerable in-plant manufacturing of details which would have to be sent to outside vendors. The facility for making printed boards is just barely that, and is the minimum that can be gotten along with. The camera facilities are a real jury rig and they are using ammonium sulfate for etching with the barest facilities imaginable.

B. We spent considerable time discussing the tape hub with the personnel directly involved in the assembly of the tape transport and Bruce Brown of the Sales Department. Several sketches were made of the improvements that we felt were necessary. The most difficult thing, I believe, for them to do would be to bring the air through bleeding holes directly over the tape gaps as suggested by Roland. This is not impossible as they use a shear type valve to bring air into the arms at the present time. There is no reason why this same type of nozzle valve could not be used to bring air into the clamp unit that is directly over these heads. This would mean some modification and experimentation to prove its worth, but the feasibility is quite reasonable.

C. I believe our strongest contacts, that is the people most sympathetic to our position and most cognizant of it, are Mr. Steve Keller and Mr. William Brown from Technical Instruments, their representatives in this area. Mr. Keller again raised the question of whether or not they could use our control circuits and our logic and have us manufacture these for them if they felt it was an advantage. They do have an outside source in or about Tulsa that can make printed circuit boards for them but, as mentioned above, they do not have sufficient facilities for in-plant manufacture of these items. Both Mr. Keller and Mr. Brown are well aware of the advantage of putting a working transport in each of our sales offices in this country, and I believe they will bring what prestige they have to bear to bring this about.

D. The welding area is very small and is geared to their five transports per month. Evidently they do not use this area for much other than producing frames for these transports. At present it consists of one National Cylinder Gas Company's 200 amphere heliarc welding machine and associated equipment, very good welding jigs, an experienced welder, and possibly two helpers. I do not believe they would experience any difficulty in expanding the facility or to change it over to steel welding if they decide to go along with our cabinetry and to produce it in that area. They have room for expansion for a reasonably large welding shop. The man in charge seems to be extremely competent. I have seen no report in the bi-weekly that people from Mid Western called at our booth, but I believe their engineer in charge of marketing and Mr. M. E. Morrow were in Detroit for a directors meeting at the Telex Corporation. Probably both of these people called at our booth. Mr. Keller was in

Detroit later in the week and may have called to look over our set-up at the Eastern Joint Computer show.

Mr. R. G. Morrow is president of Mid Western Instruments Company, Mr. M. E. Morrow is chairman of the board of both the Telex Corporation and Mid Western Instrument, and General Gregory is Mr. M. E. Morrow's first administrative assistant. I believe General Gregory was in the Air Force and was instrumental in the development of the Sikorsky helicopter for use with the Air Force.

Loren Prentice

****

The plant tour consisted of a visit to the production area, the administrative area, and the engineering area of Mid Western Instruments. In general, we were very impresssed with both the plant and the personnel that we met in all the areas.

The manufacturing of tape units is presently set at five per month, and Mid Western does have the facilities and the man power to expand this production effort to approximately 32 transports per month before taxing either personnel or facilities. In addition, there is, if necessary, approximately 10,000 square feet of expansion space available in the present building.

The traffic flow through Mid Western is somewhat broken. However, sometime in the next year they plan to correct this factor and give a straight flow to their production lines. The special area of interest to us was the construction of the heads and transports. In both of these areas we saw much improvement over the previous production practices employed by Mid Western. To be specific, one of these areas was the change in the manner of referencing the vacuum column to the main casting.

Roland Boisvert

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My impression of the plant was that they had no production line of tape transports. There were two completed transports and several empty frames. I felt that the work force looked padded in all areas except head assembly.

Bob Hughes

****

While walking through the Mid Western plant, I was not impressed by their production line. There seemed to be disorganization of parts flow through the line. Production is accomplished through many departments where each department is scattered randomly throughout the building. I was told that steps are being taken towards smoother production operations.

The standards lab was well equipped with secondary standards and I noticed they have resistor and voltage standards that are better than ours. The scopes are checked every three months against the Tektronix, oven controlled frequency meter.

Static skew tests for the M3000 read/write head are accomplished with an off line testing rig. The read head is used as a write head during these tests. Likewise the write head is used as a read head.

Reliability or life tests are recorded with a pen-graph recorder. Mid Western has accumulated a large amount of reliability data on a few transports and we will receive the data sheets in the near future.

Steve Lambert

******

B. General Engineering Meeting

The general engineering meeting consisted of discussing with the chief engineer and the production engineers those modifications which we considered necessary to effectively operate the Mid Western transport from the computer. The problems that were involved on Mid Western's part were presented in a general plan of attack which will wait upon our decision to either accept or reject the transport. In addition, we discussed reel hubs. The quick release hub they have designed we found to be unsatisfactory, and we gave them a short dissertation on what we thought a quick release hub should be. We found that on their 728 Audio Tape Recorder this hub in basic principle existed, and that a slight modification to this hub would readily fit our requirements. We also talked about the possibility of blowing air on the tape such that it would act over the pole tips of the head onto the tape thereby creating what we felt would be very intimate tape contact with the head.

Roland Boisvert

****

C. Marketing Practices

At the marketing practices meeting we discussed the standard contracts and arrangements that Mid Western has with O.E.M. customers and their favorite customer, the government. Basically, these amount to ordering a certain amount of transports at a particular price and then a re-order would move us into a new discount category. Our account would then be credited on the basis of the total order for the transports in a year's time. We also at this time talked to Steve Keller about buying the transports at CDC and having them retro-fitted for the state purposes both here and the factory and possibly in field offices and for show purposes. Mr. Keller said that he could not speak with authority to actually do this at this time but he would go into it with the president of Telex. He advised us that he felt that Mid Western would be much happier to present to us five transports at cost rather than to see us do anything at all with CDC. He very strongly stated that, "they bought those things, now let them rot with them". He did indicated that he felt that some reasonable agreement as far as transports for display purposes could be reached.

Roland Boisvert

****

The problem here is not changing O.E.M. accounts less than the government. The government does not want a "favored customer" (unless it is the government).

Bob Hughes

****

Mr. Keller stated catagorically that Mid Western would, "rather give Digital Equipment Corporation units at cost rather than rework those C.D.C. units" and even "give to Digital Equipment Corporation five units on consignment rather than have Digital Equipment Corporation pick up the five C.D.C. machines."

We discussed with Bruce Brown the sequence of negotiations between Mid Western and Digital Equipment Corporation. There seems to be three distinct phases through which we will pass:

A. Prototype - return to Digital Equipment Corporation of prototype after Pierrre Foret completes the rework as defined by Digital Equipment Corporation. Tie to our computer and decide if the tape deck is acceptable. An estimated price of this tape deck is $11,900. including Mid Western's hardware and read/write electronics. To be concluded prior to June 15th.

B. Semi Modified Transports: As defined by actual commitments a minimum number of tape transports be ordered as semi modified units. Bruce Brown feels that a firm pricing structure will not be available at this point in time - estimated to be July 1 - and that the best approach would be to price the transports after this first order is nearly completed. However, on this point I feel we should, as a point of considering Mid Western as a source, have an estimate of pricing in all quantities based on the prototype.

C. Final configuration specifications and pricing: Based upon the prototype as a standard the final specifications are to be written and final pricing structure to be established in quantities to one hundred units and an O. E. M. contract be written.

Mr. J. A. Arrington is sending along a statement of Mid Western's O.E.M. Account Policy for reference in establishing an O.E.M. discount based on accumulated orders over an approximate twelve month period.

Henry Crouse

****

Interface Meeting

While the marketing practices meeting was being held, Mr. Griffen, Mr. Foret, Loren Prentice and I held a meeting to discuss the mechanical and electrical interface requirements. Mr. Griffen submitted a list of modifications (enclosed) that Mid Western would like to supply. It was decided that if all the specs listed were included in the transport that much of our control logic would be redundant. Therefore, some of the items will be deleted.

PDP-4 Seminar

During Monday afternoon, I gave a one and one half hour seminar to approximately twenty Mid Western employees. A classroom approach was used in describing computer systems in general. Half of the individuals present were not familiar with comput ers. Thus, I purposely took time to familiarize them with computer jargon. I discussed the majority of options available and how they are attached to the computer. Particular emphasis was placed on tape systems describing the use of a computer and options to test tape transports. I emphasized the fact that the same computer may be used by different departments. Also, an explanation of customer service, PDP-4 reliability, quality and sales advantages was pointed out. A note was added on the programming material available.

Everyone seemed to be very attentive throughout the seminar. There were pointed questions on practically all the items I spoke about. It was evident that at this time Mid Western does not feel like buying a PDP-4. However, there was a great deal of interest. Bruce Brown asked if we would rent the PDP-4 to them. I referred him to Harlan Anderson.

Steve Lambert

****

MIDWESTERN INSTRUMENTS

MI-428-1 A

From: Mr. T. H. Griffin

To: Mr. P. G. Foret

Date: May 15, 1963

Subject: M3000 (DEC) Signal Definitions

The following signals have been incorporated in the DEC modification in compliance with their requests and our effort to achieve closer IBM compatibility. There are some departures from IBM in that some additional status lines are made available, such as status EOT, LOCAL AND WRITE LOCKOUT, and the prime of SELECT & LOAD POINT is not made available.

The balance of the standard IBM input/output lines will be included in the 800 BPI program.

All inputs require minus 6 volts ±1 volt to initiate their respective functions, and zero volts to disconnect. Input impedances are on the order of 15K thus allowing parallel operation of several transports without appreciable loading on the source.

All outputs supply a low impedance minus 6 volt ±1 volt level, capable of driving up to a 10 ma load, in the active state and a low impedance 0 volt level corresponding to the function's logical prime.

All functions require d-c level control with the exception of the RWD operation which may be initiated by means of a pulse whose "up-time" is sufficiently long to insure relay closure.

The following is a brief description of the proposed modifications including signal definitions.

out

SELECT: There are ten (10) machine select lines made available for the purpose of remotely selecting a particular transport for on-line operation. Each of the 10 lines corresponds to a particular manual address switch setting such that upon energizing that line corresponding to the preselected setting, the transport will be logically enabled.

If the proper line is not selected, no REMOTE operation may be performed; however, all LOCAL functions will remain intact. There are no rise time specifications on this line.

out

SELECT & READY: This output says that the machine has been selected, the tape is loaded into the vacuum columns, all interlocks are closed, and the transport is under REMOTE control. This line will remain at minus 6 volts (except during RWD) until the select line is dropped, the address selector switch is changed, the machine is placed in LOCAL control, or any one of the interlocks are broken.

REWIND: Upon energizing this line, any existing tape motion command is interrupted and inhibited until completion of the REWIND operation. This line may be pulsed provided that the pulse time duration is sufficient to allow relay closure (approx. 10 ms). The only requirement to initiate the REWIND operation is that there be tape on both reels as sensed by means of the "Broken-tape" optical sensing station.

The operation overrides a normal fail condition and may be started with tape in or out of the vacuum columns. Once started, the operation depends upon the tape distribution on the take-up (machine) reel. If sufficient tape is on the reel (high speed zone), tape will be drawn out of the vacuum columns, if it is not already out, and a normal high speed rewind will commence. Upon optically sensing a low tape condition, the high speed operation will terminate and the tape is automatically loaded in the columns. Upon closing the column interlocks, a low speed (normal velocity) rewind begins until LOAD POINT is sensed at which time the transport stops and the REWIND operation terminates.

Had REWIND been selected in a low tape zone, the operation would simply drive the tape REVERSE to LOAD POINT.

Once a REWIND has been initiated, it may not be interrupted in REMOTE until LOAD POINT has been reached or a broken tape condition occurs.

Switching from REMOTE to LOCAL does not affect REWIND; however, the operation may be manually terminated by depressing the STOP pushbutton. In LOCAL control, the transport will sense and stop on both end-of-tape and load-point reflective markers. Either of these markers may be cleared by depressing the FWD or RVS pushbuttons.

In REMOTE control, the end-of-tape marker is sensed but does not alter machine operation.

If the transport happens to be at LOAD POINT, the REWIND function is inhibited. The next GO command will clear the internal interlock in REMOTE whereas depressing either the FWD or REVERSE pushbuttons will clear LOAD POINT in LOCAL operation.

REWIND & UNLOAD: Functionally, this operation is equivalent to the REWIND operation with the exception that LOAD POINT is logically disabled and tape is allowed to completely unload off the machine reel.

The operation may be selected by means of a pulse whose duration is sufficiently long to insure relay closure. This signal may initiate a RWD & UNLOAD operation or, if energized during a normal RWD, it will cause tape to be unloaded.

Both the REWIND and REWIND & UNLOAD lines require that the transport be selected, however the SELECT line may be dropped, after a time sufficiently long to insure the rewind relay to pull in to conserve computer time.

SELECT & REWIND: This is an output indicating that the transport has started to rewind. This line switches from 0 volts to -6 volts as soon as the rewind relay has been energized. It is held at this level until either the select line is dropped or the rewind operation is completed.

SELECT & LP: This output indicates that the transport has been selected, the load point reflective marker is photo sensed, and the unit is ready for the next instruction.

This line will remain at 0 volts if a RWD & UNLOAD is in progress even though the load point reflective marker is momentarily photo sensed.

SELECT & EOT: This output indicates that the transport has been selected and the End-of-Tape reflective marker is photo sensed. The output is in the form of a minus 6 volt pulse, the duration of which is a function of tape velocity.

FORWARD: This input requires a minus 6 volt level and if the unit has been selected and ready (not in rewind), it will initiate forward tape motion at the specified velocity. If in LOCAL operation, forward tape motion will be interrupted upon photo sensing the end-of-tape reflective marker.

REVERSE: This input requires a minus 6 volt level and if the unit has been selected and ready (not in rewind), it will initiate reverse tape motion at the specified velocity. Photo sensing the load-point reflective marker will terminate the REVERSE tape drive operation in both LOCAL and REMOTE operation.

The absence of both FORWARD and REVERSE tape motion commands with the unit selected and ready will result in the STOP tape motion condition.

The unit may be programmed without regard to tape motion command sequence under automatic control; however, each command must be a minimum of 1 ms in duration in order to allow the tape motion control circuitry to stabilize.

In LOCAL control the STOP pushbutton must be depressed prior to changing direction of tape motion in order to clear the previous motion command.

STATUS LOCAL: All transport output lines are logically disabled (0 volts) upon selecting LOCAL operation except for this line which switches to minus 6 volts thus indicating the unit is not under automatic control.

STATUS WRITE LOCKOUT: This line indicates that the write lockout ring has been mounted on the supply reel thus enabling the transport recording circuitry.

T. H. Griffin

THG:mc

INTEROFFICE MEMORANDUM

DATE May 23, 1963

SUBJECT PERMANENT MEMOS

TO R L Best
H Anderson
K Olsen
R Beckman

FROM J Ebner

In an effort to up date the Permanent Memo file, I have had a discussion with J Koudela and received his thinking on the subject. Also, Sandy Moore, Program Librarian, checked her records and made the encircled pencil recordings on the left margin of the attached sheets.

My attempt is -

A. To coordinate the terminology and number of each Permanent Memo which has been written as a Tape Write-Up, with the terminology applied to the Tape Write-Up. The Permanent Memo will then be so noted and retained in the file.

B. Designate those memos as "obsolete" which are so determined by management.

C. To label those Permanent Memos which have been revised, or added to and produced in another form, namely a manual or a brochure, i.e., M 1159 DC 12 Tech Specs;; PDP 5 Brochure F 51, May '63.

Also, this effort, as suggested by S Moore, should bring into focus those Permanent Memos which are not now but should be written as a Tape Write-Ups

I have had a number of requests, among them T Johnson's, for a list of our Permanent Memos but have hesitated to issue such a list without the above revision.

Will you please evaluate the attached lists and add your comments.

Thank you.

Encl

digital MEMO

DATE 4/23/63

TO K. Olsen

FROM B. Maxcy

H. Anderson
S. Olsen
N. Mazzarese
D. Best
E. Harwood
B. Beckman
J. Smith
G. Bell

PDP-4-12 has been designated as the Engineering machine.

April 22, 1963

S.N.A. FILING ON RENEGOTIATION

PERIOD 7/1/62 - 3/31/63

	Total Sales	Less Non. Ren.	Total Ren. Sales	Less Ren. Sales W/35% or more in Non-Ren.	Ren. Sales to be reported	Bases
Modules & Accessories:						
Reg.	$2,748,812.65	$993,494.74	$1,755,317.19	$440,756.36	$1,314,561.55	Individual
Less Returns & Allowances	(35,223.56)					Models
*Total	$2,713,589.09	$993,494.74	$1,755,317.19	$440,756.36	$1,314,561.55	
Systems:						
Reg.	840,365.10	577,457.80	262,907.30		262,907.30	All Misc.
Rentals						
Total	$840,365.10	$577,457.80	$262,907.30		$262,907.30	
Computers:						
Reg.	4,333,128.58	2,588,908.00	1,744,220.58	1,246,600.00	497,620.58	By Central
Rentals	56,043.04	36,805.04	19,238.00		19,238.00	Processes and
Field Service	2,797.28	2,797.28				Options
Total	$4,391,968.90	$2,628,505.32	$1,763,458.58	$1,246,600.00	516,858.58	
Total to date (all)	$7,945,914.09	$4,199,457.86	$3,781,683.79	$1,687,356.36	$2,094,327.43	

*Module Total and Grand Total do not crossfoot due to Returns & Allowances (35,223.56) not being reflected in Individual Models.

INTEROFFICE MEMORANDUM

DATE April 22, 1963

SUBJECT Duke University

TO Harlan Anderson

FROM Gerald Moore

The name of the person at Duke University who visited our booth at the recent show in Atlantic City is:

Howard K. Thompson Jr., M.D.
Associate in Medicine
Duke Hospital
Durham, North Carolina

He gave us the names of the following additional persons:

Henry D. McIntosh, M.D.
Director, Cardiovascular Laboratory
Duke Hospital
Durham, North Carolina

Mr. Frank Starmer (Computer Programming)
Duke Hospital
Durham, North Carolina

vg

INTEROFFICE MEMORANDUM

DATE April 22, 1963

SUBJECT WEDNESDAY SEMINAR ON DIGITAL MODULES

TO Tech Pubs Personnel
Cost Center Managers

FROM Jack Atwood

CC: K. H. Olsen
✓H. E. Anderson
G. T. O'Dea
W. R. Hindle, Jr.
J. J. O'Connell

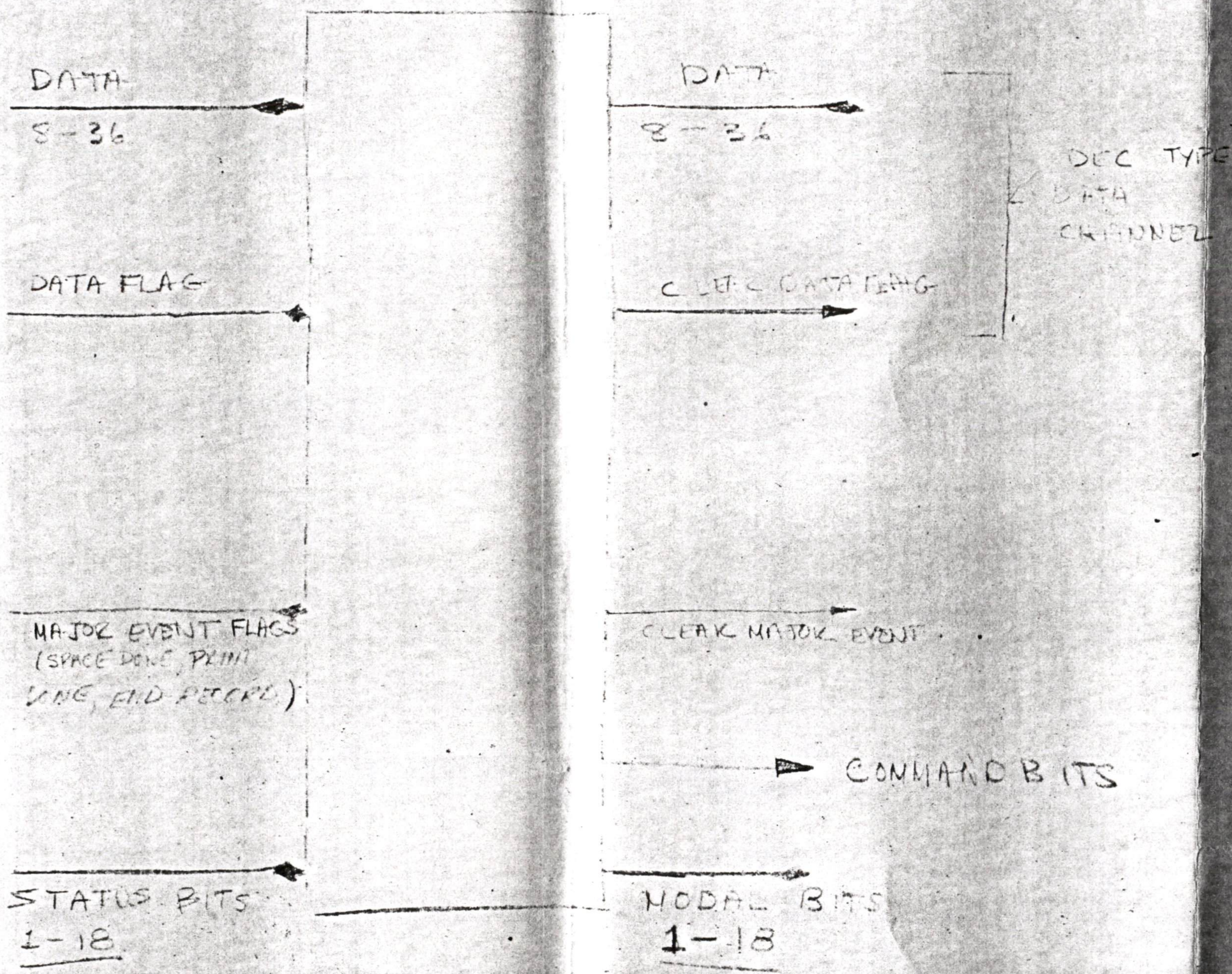
Reviewing the first 12 weeks of our Wednesday noon meetings, we concluded that the films should be supplemented by talks and demonstrations, particularly about our products, their applications and their markets.

Jack O'Connell has kindly consented to give the first of these talks on Wednesday, April 24, at 12:30 p.m. in my office. Using the Logic Kit demonstrator, Jack will discuss the reasons why Digital Modules have become the leading line of computer circuit packages on the market today.

Because this kind of talk may be helpful to personnel in other departments, we would like to offer all cost center managers the opportunity to "audit" the seminar if their schedules permit.

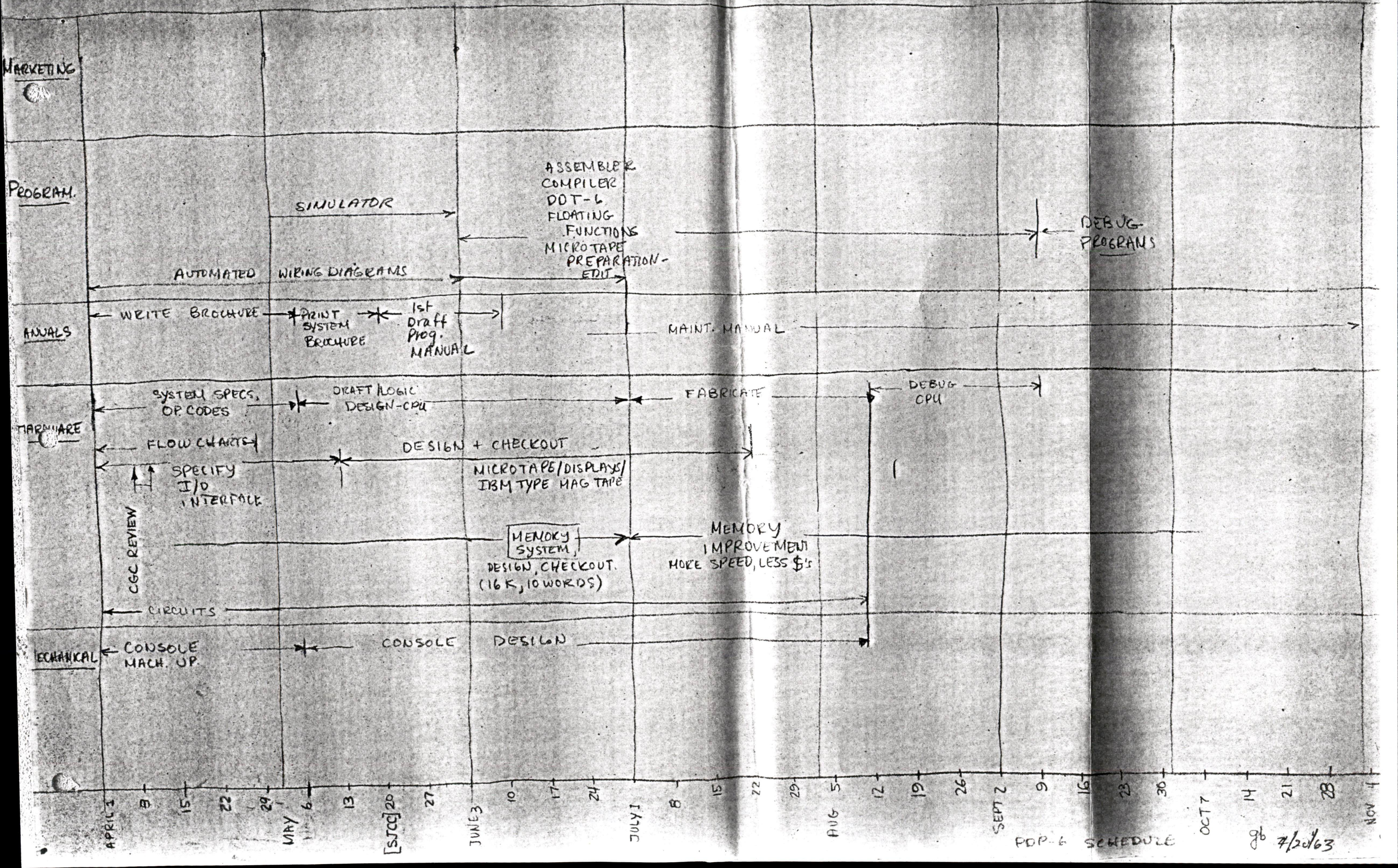
P.S. You will get more out of this meeting if you take the opportunity to glance through the new "Laboratory Module Handbook" beforehand.

MAX SIZE	
1. u. tape controls	2 ± 4
2 IBM "	2+
3 P. TAPE PUNCH	1
4 Card Punch	1
5 P TAPE Reader	1
6 Line printer	2
7 Card Reader	2
DISPLAYS	N
TYPE IN	N
TYPE OUT	N
u tape units	2N
DRUM	



GENERAL I/O CONFIGURATION
gl 4/10/63

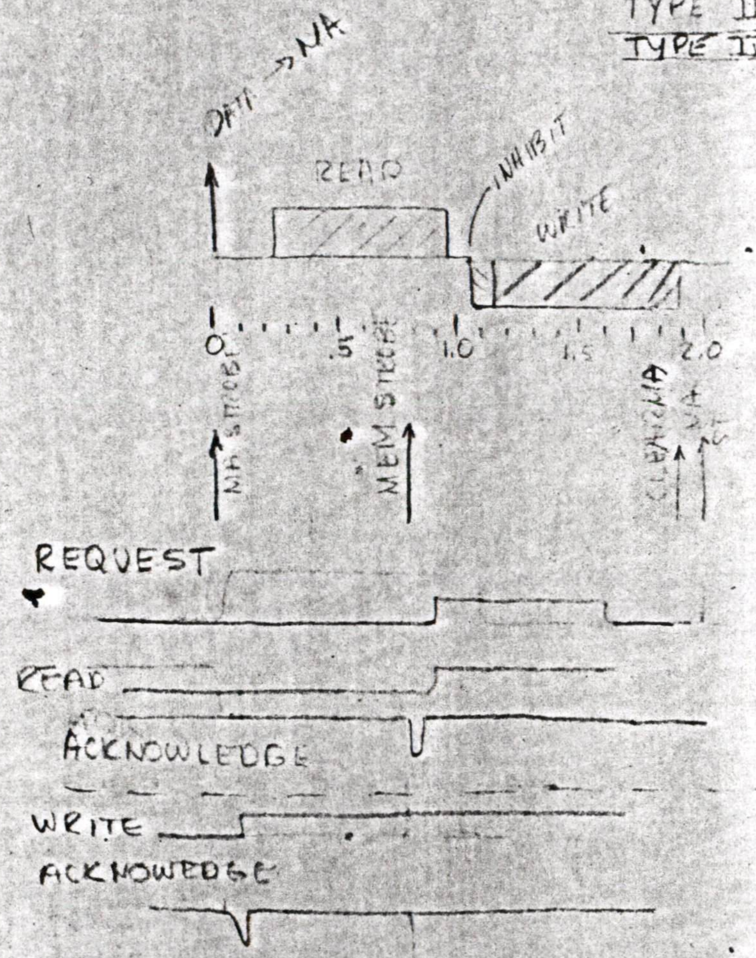
RLB/AB/AH3/SG/LP/SWM3/AK



	MEM. TYPE	CYCLE TIME MIN.	CYCLE TIME MAX.	WORD CAPACITY		NO. USED
TYPE I	CORE	2 μs	6 μs	8 K	32 K	8 MAX
TYPE II	CORE	.5	1.0	128	1024	1
TYPE III	FAST F/F	.5	1.0	10	32	1
TYPE IV	?	1	20 μs	—	>16K	262K

(INEXPENSIVE)

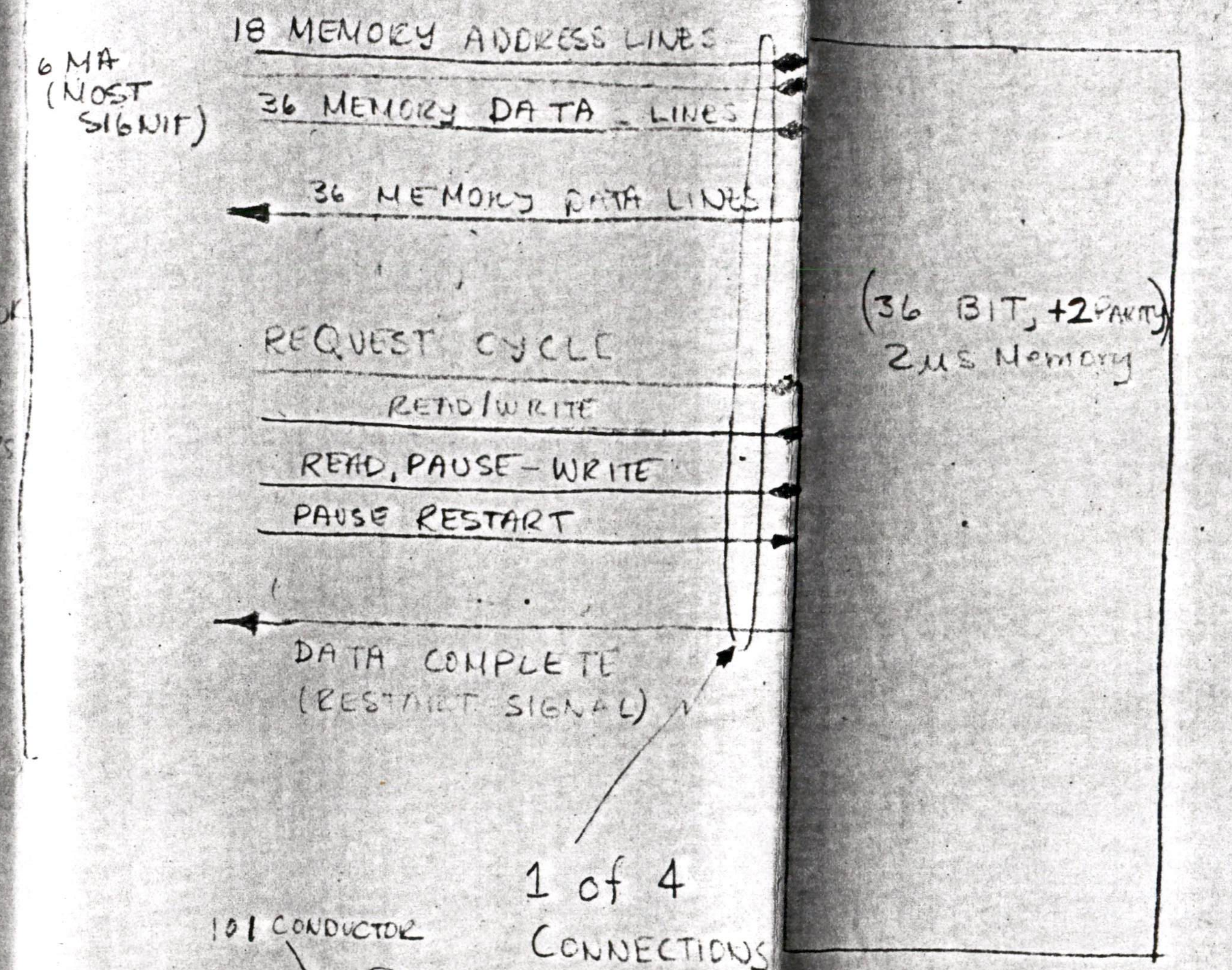
CHART OF MEMORY CHARACTERISTICS



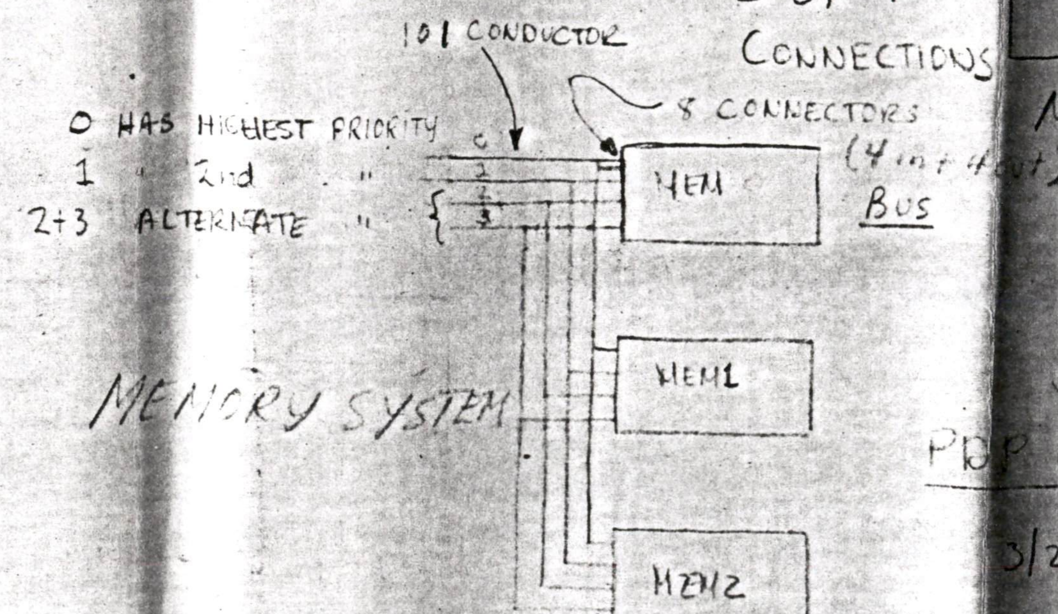
MEMORY TIMING INFO

TO PROCESSOR

96+5 CONDUCTORS (4 Cables)



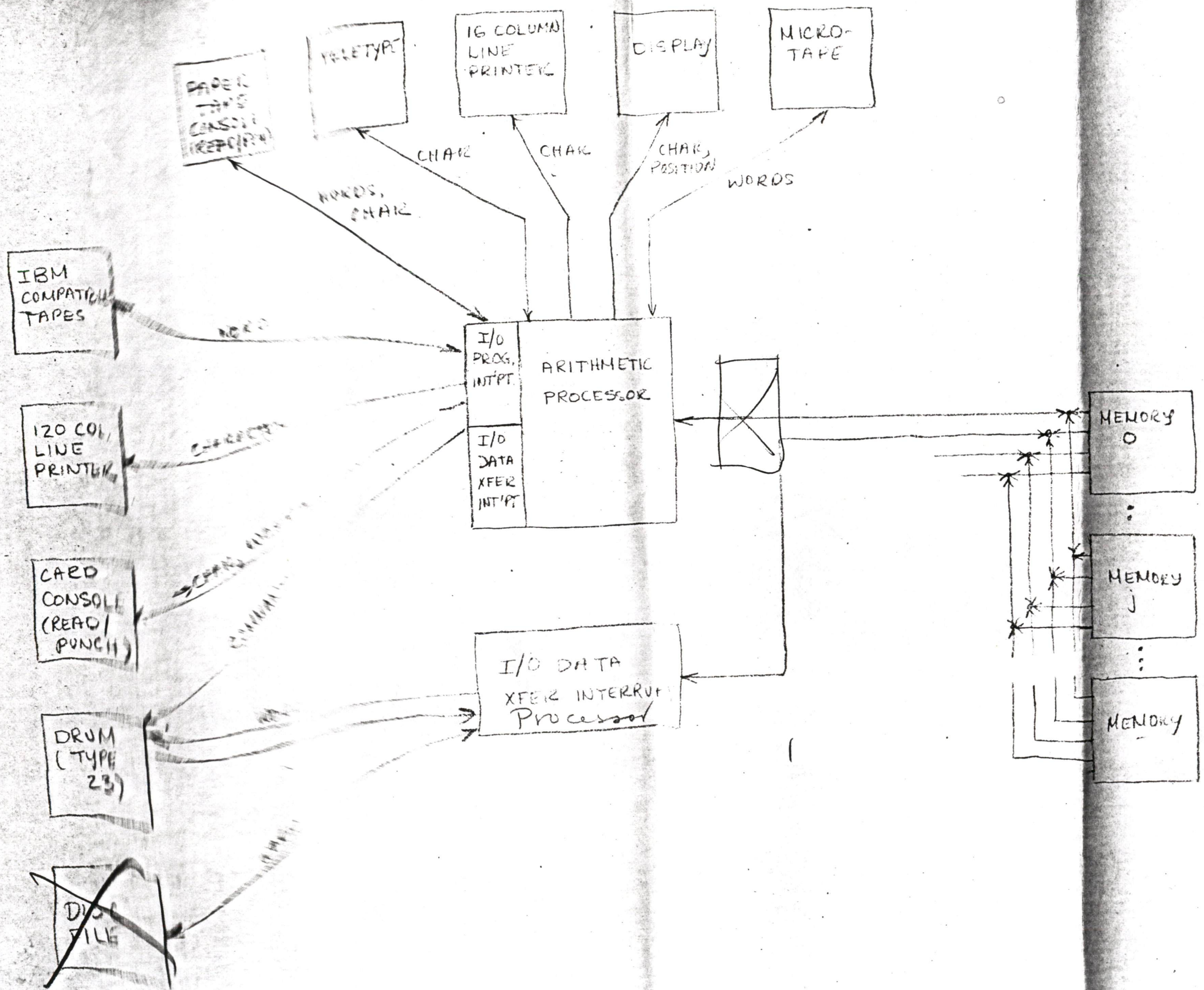
MEMORY SIGNALS



MEMORY SYSTEM

PDP 6A Memory System

3/26/63, 4/8/63



TELETYPE
16 COLUMN LINE PRINTER
DISPLAY
MICRO-TAPE
CHAR
CHAR
CHAR, POSITION
WORDS
WORDS, CHAR
IBM COMPATIBLE TAPES
I/O PROG. INT'PT
ARITHMETIC PROCESSOR
I/O DATA XFER INT'PT
120 COL LINE PRINTER
MEMORY 0
MEMORY J
MEMORY
CARD CONSOLE (READ/PUNCH)
I/O DATA XFER INTERRUPT Processor
DRUM (TYPE 23)
DISC FILE
4/20/63

dec

INTEROFFICE MEMORANDUM

DATE 4/19/63

SUBJECT Educational Use of PDP-4

TO Harlan Anderson
Nick Mazzarese

FROM Ted Johnson

As a result of discussions with Fred Gruenberger of Rand Corp., we might have an interesting program started in using our WCO PDP-4 for teaching selected high school students elements of computing. Within the next 2 weeks, he and I will meet with Mr. David Randolph, Industrial Coordinator for the L.A. Public School System, and try to generate a plan for a course to be held on Saturday mornings in our office, starting next fall. DEC provides the equipment. ACM provides instructors (as well as DEC local people). Randolph will take our specifications and come up with selected students.

Ted

April 18, 1963

S.N.A. FILING ON RENEGOTIATION

PERIOD 7/1/62 - 3/31/63

	Total Sales	Less Non Ren.	Total Ren. Sales	Less Ren. Sales W/35% in Non Reg.	Ren. Sales to be reported	Basis
Modules & Accessories:						
Reg.	$2,748,812.65	$993,494.74	$1,755,317.91	$ 471,810.71	$1,283,507.20	Class
Less Returns & Allowance	(35,223.56)					Exemption
* Total	$2,713,589.09	$993,494.74	$1,755,317.91	$ 471,810.71	$1,283,507.20	
Systems:						
Reg.	840,365.10	577,457.80	262,907.30		262,907.30	All Misc.
Rentals						
Total	$840,365.10	$577,457.80	$ 262,907.30		$262,907.30	
Computers:						
Reg.	4,333,128.58	2,588,908.00	1,744,220.58	1,246,600.00	497,620.58	
Rentals	56,043.04	36,805.04	19,238.00		19,238.00	By
Field Service	2,797.28	2,797.28				Options
Total	4,391,968.90	2,628,505.32	1,763,458.58	1,246,600.00	516,858.58	
*Total to date (all)	7,945,914.09	4,199,457.86	3,781,683.79	1,718,410.71	2,063,273.08	

*Module Total and Grand Total do not crossfoot due to Returns & Allowances (35,223.56) not being reflected in the class exemption.

dec

INTEROFFICE MEMORANDUM

DATE 18 April 1963

SUBJECT Trip to Geotech

TO R. Beckman

FROM Jack Shields

cc: H. Anderson ←
R. Boisvert
L. Gossel
E. Harwood
N. Mazzarese
S. Olsen

The attached is a report of the recent trip taken to The Geotechnical Corporation.

########

REPORT OF GEOTECH TRIP - APRIL 9, 10, 11, 1963

April 9, 1963

2:30 pm
R. Boisvert, J. Shields, and L. Gossel of DEC arrived at AFTAC. There we met Gerry Clawson and Ray Arnold of Geotech. A meeting was arranged with Mr. Clawson to explain the purpose of the trip, and how we proposed to solve their mag tape problems.

3:00 pm
Started working on the mag tape hardware problems using L. Gossel's mag tape diagnostic program. The program gave indications of inter-record trash being written on the tape. Subsequent investigation of these diagnostic indications showed a hardware wiring error which is described in Figure 1-A accompanying this report. The hardware wiring error was corrected and we proceeded with the mag tape tests. All checks for mechanical adjustments revealed that everything was true and proper except that the head vacuum was weak. Our first thought on this was that the problem was due to the vacuum motor brushes and as we did not have any brushes on hand, I made a call to DEC to send a set of motor brushes to AFTAC. The weak vacuum in the Potter head did not cause any detrimental problems as far as tape operation at this time, so we proceeded with the tests.

After extensive tests, we had fairly well determined that, hardware-wise, the tape unit was operational, excepting the vacuum problem. We discussed a course of action on attacking various software problems at this installation. At 7:30 pm we left AFTAC for the evening.

April 10, 1963

8:30 am
Drove R. Boisvert to the airport and returned to AFTAC. L. Gossel started to rewrite the type-block program which was used by Geotech in order that it use a smaller area of core. This was necessary due to the fact that Leo Gossel's tape control program had used more registers than the previous tape control program. Since

Geotech's applications required that minimum core space be used while maintaining comparatively corresponding registers in core, Leo was faced with the dilemma of rewriting a 200 register program to a 100 register program without taking away any of the ability or operational facilities of this program.

While L. Gossel worked on the software, Ray Arnold and Jack Shields looked at the status bits in the mag tape coming back to the computer; made sure that these were correct and that all the prints were up to date.

1:00 pm
Drove to Alexandria to pick up the vacuum motor brushes which were sent the previous day from DEC. Returned to AFTAC, pulled the vacuum motor down and checked the brushes. They were only one-third used and still had approximately 700 hours of operation left on them. Further investigation of the weak vacuum problem revealed a loose clamp on the vacuum blower hose. Tightening this clamp corrected the vacuum problem. We then started a software checkout to determine if the new programs would be compatible to the old programs. Due to program compatibility problems and the lateness of the hour, we decided to call it a day.

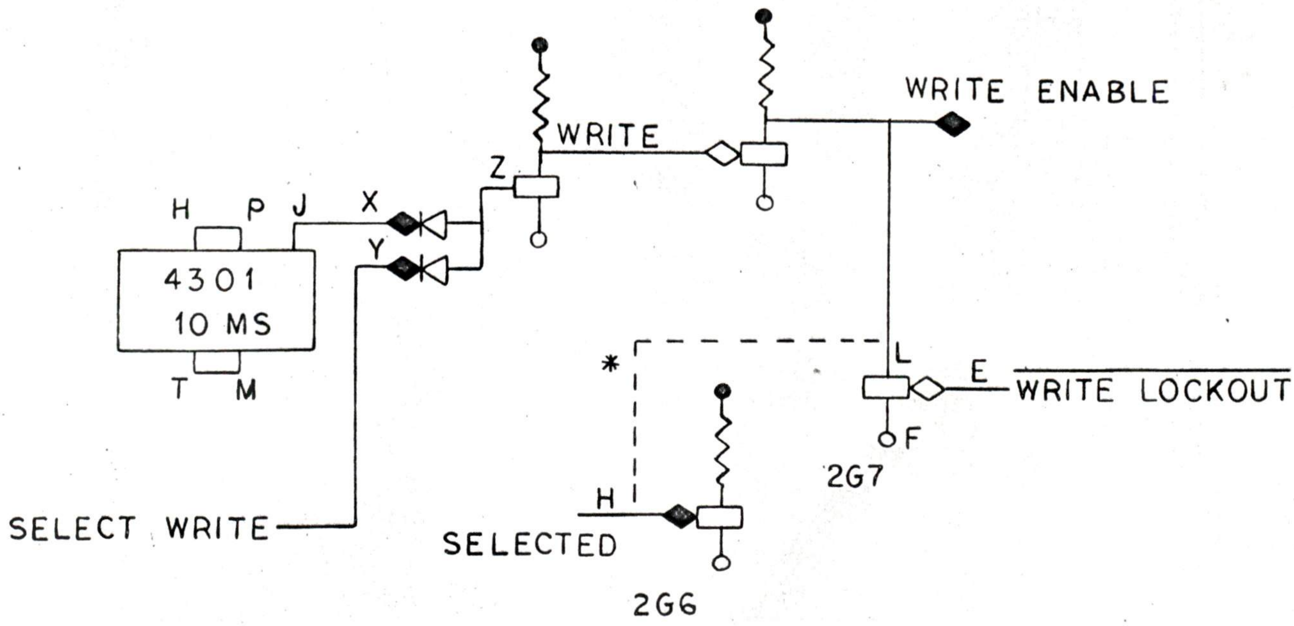
<u>April 11, 1963</u>

Met R. Beckman from DEC and Mr. Beckman, Mr. Gossel, and Mr. Shields returned to AFTAC to see if problems could be completely resolved this day. After many software incompatibility problems L. Gossel finally resolved all these and had all the operational programs down to the specific and minimum core space allotted. A complete problem was run using all the rewritten operational programs which were done by L. Gossel. These operational programs were run for approximately four and one half hours without one failure. At this time, we decided to have a meeting with all the people concerned with this system. Mr. Brooks, a representative of the government, two Air Force representatives, Mr. Clawson and Mr. Arnold from Geotech, and Mr. Beckman, Mr. Gossel, and Mr. Shields from DEC were present. Mr. Clawson from Geotech opened the meeting with an explanation of the various software problems which occured and the measures we had taken to correct them.

In conclusion, Mr. Clawson said that he was very appreciative of the assistance which DEC had given, even though this equipment was off warranty. At this point, Mr. Beckman explained some of the reasons why these problems had occured and why we felt we had problems with the tape unit from the software and communications point of view. After this, J. Shields spoke on the hardware difficulties and the various adjustments, etc. required on the tape unit; how it must be cleaned and the overall reliability of this tape unit and its use with their AA system. At this point things became fairly informal and discussions were made of sending Air Force people to a Macro introductory programming class at DEC, and also possibilities of sending more people to the maintenance class.

I feel that the government, Air Force, and Geotech representatives were well pleased with the effort expended by DEC, and the results of this trip.

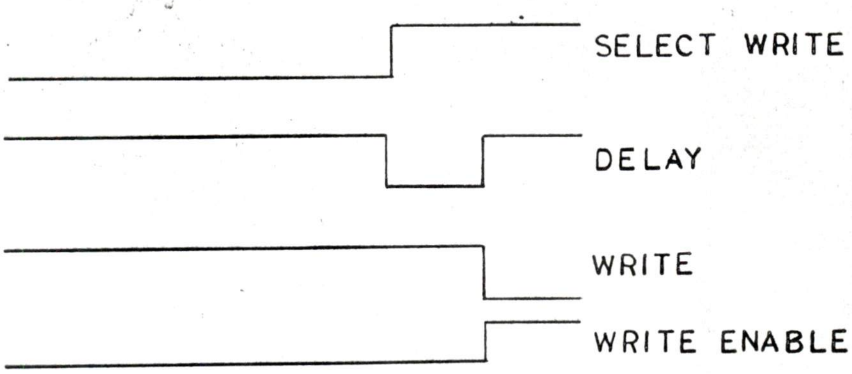
#########



* DOTTED LINE INDICATES WIRING ERROR.

2G6H TO 2G7L

CORRECT TIMING CHART



TIMING WITH WIRING ERROR

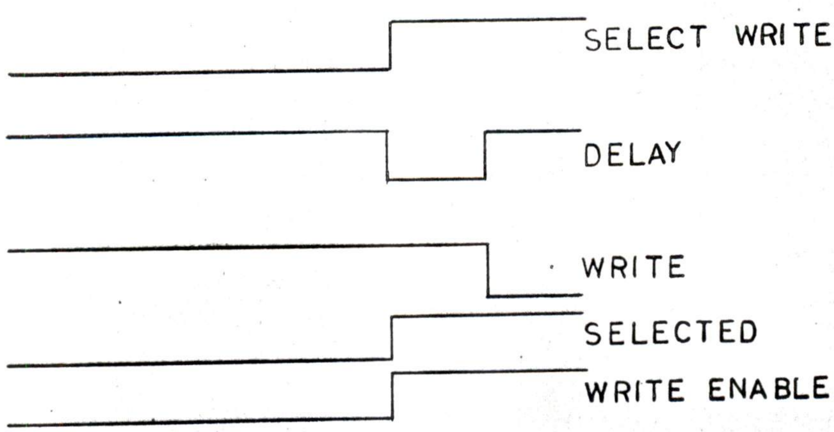


FIGURE 1-A

J. SHIELDS
4/18/63

dec INTEROFFICE MEMORANDUM

DATE April 17, 1963

SUBJECT Drawing Standards Committee Recommendations

TO Engineering Projects Committee (See distribution list)

Drawing Standards Committee (See distribution list)

FROM Paul Barber

The Drawing Standards Committee was formed to examine the several existing systems of drawing DEC logic diagrams with the purpose of devising some standard methods of presenting logical information. Because of the varied interests involved, different systems have evolved in the Computer, Peripheral Equipment, Special Systems, Technical Publications, and Advertising sections of the company.

The goal of the Committee is to ease the customers understanding by reducing the various systems presently in use to two, a single standard for DEC logic diagrams and the present one that is used in the Module Catalog and Application Notes. A third will also exist for the lab modules. Besides making new diagrams easier to understand, the proposed system will aid in reducing space and drafting time. The ease of reproducing and drawing, the possibility of misinterpretation, the future use of transparent stickers and a line printer, and overall artistic appearance were considered before arriving at any recommendation.

The Committee approached its task in the light of the basic purpose of a logic diagram, i.e., a shorthand method of representing the operation of a system. The Committee felt it was imperative that only a relatively few standard symbols be used and that assumptions and rules be kept to a minimum. A criterion for judging each symbol was a hypothetical technician in some customer's maintenance department who had learned DEC symbology several years before he was called to use it in troubleshooting DEC equipment. With this background, the Committee presents its recommendations.

A. FORMAT

1. The mainstream of signal flow will be from left to right and from bottom to top. Notable exceptions to this will occur in counters and shift registers, which will be laid out so that the least significant bit is on the right or bottom. If significant savings are realized, and the main flow of information is not disturbed, signal flow can be from right to left and from top to bottom.

2. The logical function of each unit will be unmistakably identified within its enclosure according to its function. Identification will consist of appearance or words, preferably abbreviated. Simplicity will be the governing criterion.

3. Each logical unit will contain related pertinent information (module type and location, particular name, and time functions) within its enclosure. If this information cannot be contained within the circuit enclosure, it will be contained within a dotted line enclosing the circuit symbol.

4. Dotted lines will be used to enclose multiple logical units located within a single module when the units do not contain internal nomenclature. Dashed lines will indicate mechanical connections.

5. Symbols will be used to identify the input and output signals of a module or of separate logical units within a module. No symbols will be used between logical elements within a module if the connection is not available at a terminal. Exceptions will be found in cases which necessitate a detailed description of operation, as in the Module Catalog and Manuals.

6. Bussing through a logical unit is permitted if no ambiguity results.

7. All external components will be shown by their standard electronic symbols, and their value will be given.

8. Use of any module containing internal jumpers where a change is necessary will always be indicated by the letter J as a suffix to the module number; e.g., 4123J.

9. Circles shall be used for all terminals other than module connections, which will not be shown in engineering drawings. All module terminals will be designated outside the solid line of the logical circuit.

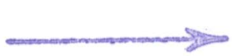
10. Only those terminals and elements actually used must be shown. If other terminals might later be used for modifications and drawing them would not introduce too much extraneous noise, they may be shown. Examples might be unused OR gate inputs or unused flip-flop outputs and inputs.

B. BASIC SIGNAL SYMBOLS

The present standard DEC symbols will be used where applicable, and new nonstandard symbols will be used where necessary. These are as follows:

Positive Standard Pulse, from ground to +2.5 volts. No pulse width specified but obtainable from the module series identification or nomenclature.

Negative Standard Pulse, from ground to -2.5 volts. No pulse width specified but obtainable from the module series identification or nomenclature.



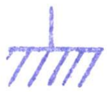
Nonstandard signal. No limitation on contents. Must be identified by name.

Standard ground level.

Negative Standard -3 volt level.

Standard signal whose levels are either ground or -3 volts, both of which are assertive conditions for particular functions.

Signal ground. May also be used for chassis ground if both are identical. Must always be shown in this orientation.



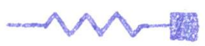
Chassis ground. Must be shown in this orientation.

Electrical connection. Small dot at all junctions that do not have an assertive symbol.

C. LOGICAL SYMBOLS

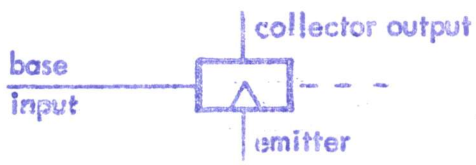
The following symbology will be used in all new logic diagrams. The ideas for clarity and function behind these symbols should be considered for all new module diagrams, whether for internal use or for the Module Catalog.

Standard Clamped Load Resistor. Any position.

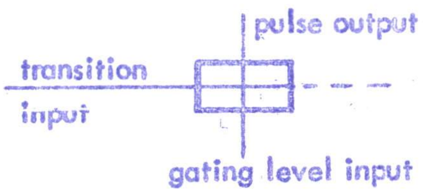


Non-standard Clamped Load Resistor.

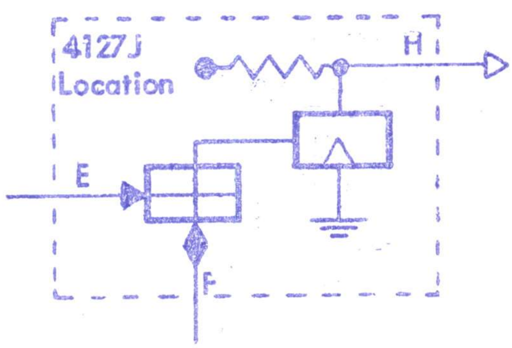
Pulse Inverter. Used only with Capacitor-Diode Gates when different from standard Inverters



Inverter. Always shown with emitter down and internal triangle. Triangle filled in only for publications. Always uses signal symbols.



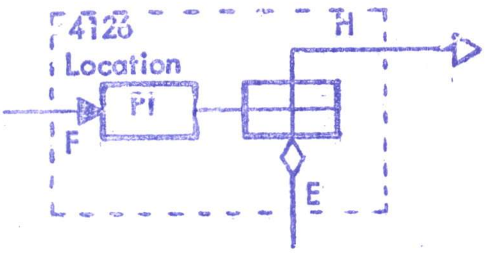
Capacitor-Diode Gate. Always shown with level input down. Signal symbols on inputs if externally accessible.



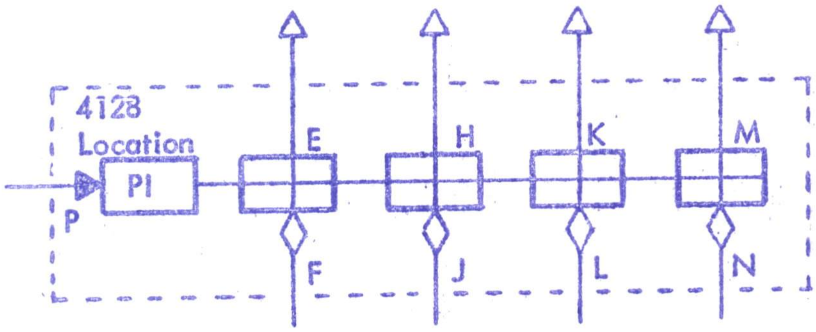
One of six logical units on module. Internally jumpered clamped load resistor. Signal symbols for external terminals only. Terminals identified by letter.

Signal flow left-to-right and bottom-to-top.

Dotted lines do not touch signal lines.



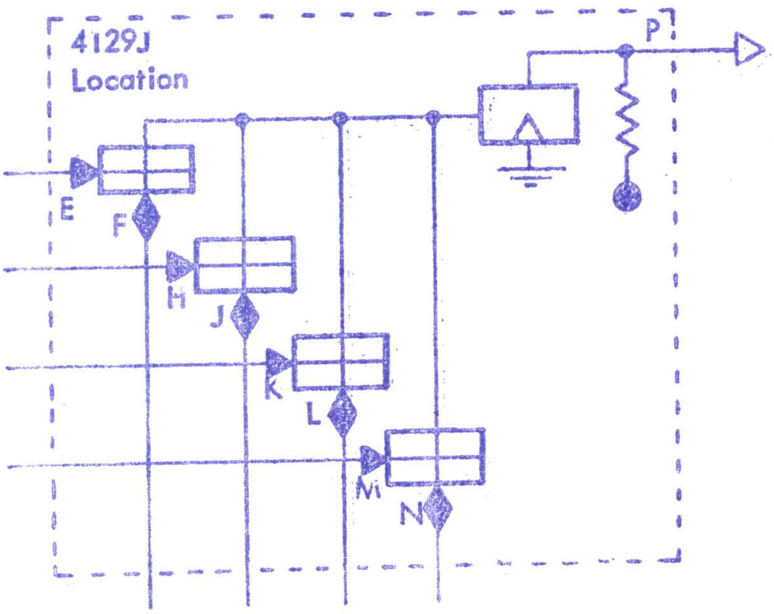
One of six logical units on module.
Pulse inputs on left, pulse outputs on right, level gate inputs on bottom.



One of two logical units on module.

Capacitor-Diode gates bussed through.

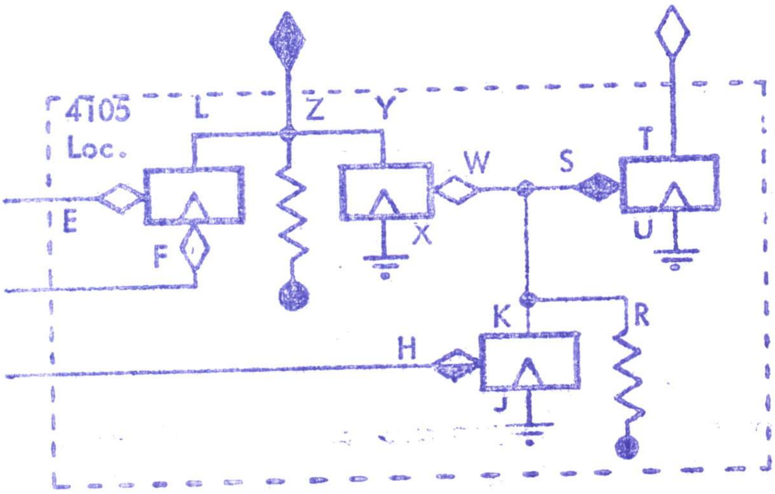
Pulse input on left, level gate inputs on bottom, pulse outputs on top.



One of two logical units on module.

Four capacitor-diode gates bussed to an inverter, with an internally jumpered clamped load resistor.

Pulse inputs on left, level gate inputs on bottom, pulse output on right.

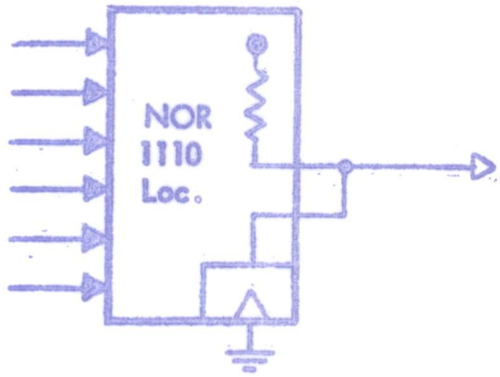


Four of five logical units on module. Two of three clamped load resistors.

Various possible configurations shown.

Split diamond to indicate both assertion levels are used.

digital



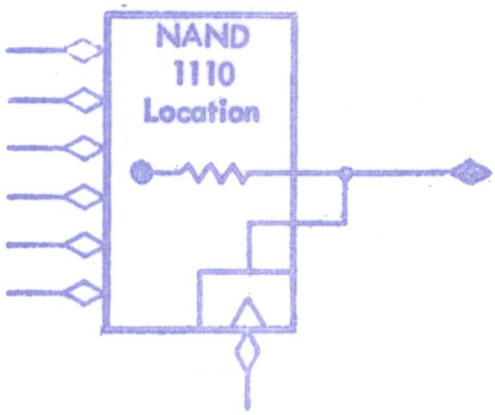
All diode gates to be shown as a single rectangular box for the logic unit. Inverter and clamped load resistor to be inside the box.

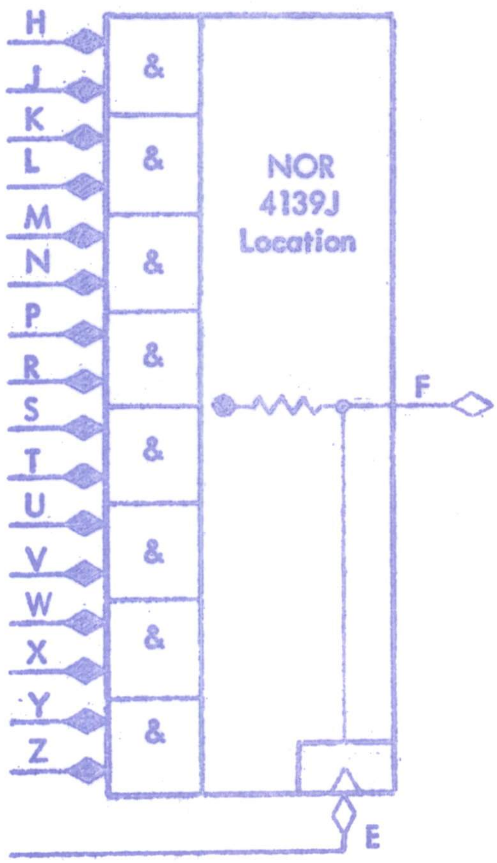
Name of logical function, module type, and location to be inside the box.

Terminal designations to be outside the box.

Every input must have a signal symbol. All diode inputs to be on one side, the output on the other.

Gating input to inverter emitter will always be on the bottom.





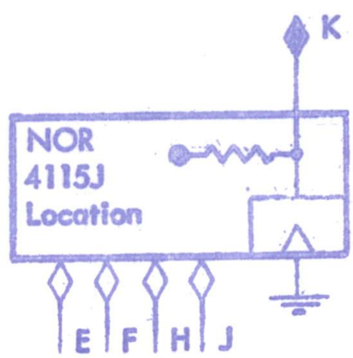
Ampersand symbol for AND configuration. OR for OR configuration.

NAND for AND configuration with an output of the opposite polarity.

NOR for OR configuration with an output of the opposite polarity.

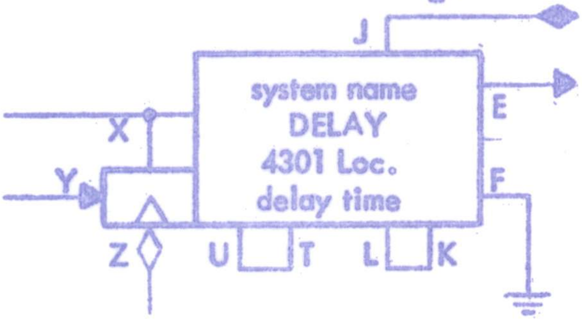
Internal jumpers not shown, but indicated by letter J after module type number. Jumpers deductable from logical unit configuration.

Inputs on bottom permisable if necessary.



Delay Lines use full name.

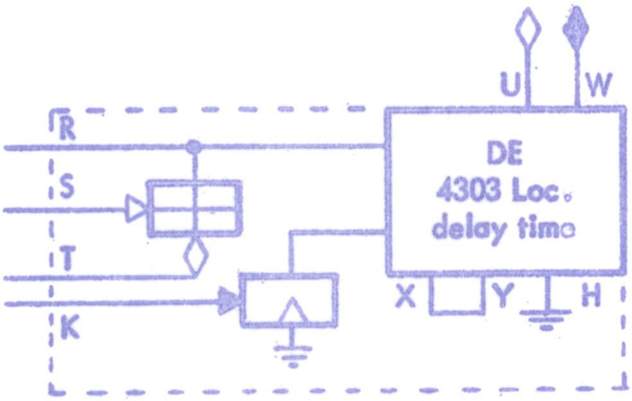
Input on left, output on right, jumpers and inverter emitter on bottom.



Multivibrator Delays may use DE if no particular name is given.

Input pulses on left.

Pulse transformer output terminals on right. Lower one always grounded, upper one with signal symbol. Level output on top, jumpers and/or external components on bottom. Left pair of jumpers for potentiometer, right pair for capacitor.



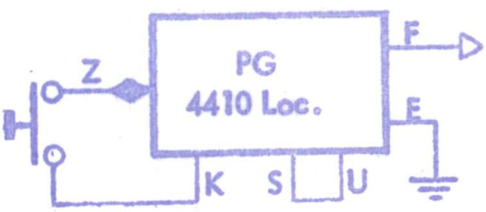
Level outputs on top, inputs on left.

Left pair of jumpers for external potentiometer, right jumper to select internal capacitor.

Pulse Generators use PG if no particular name is given.

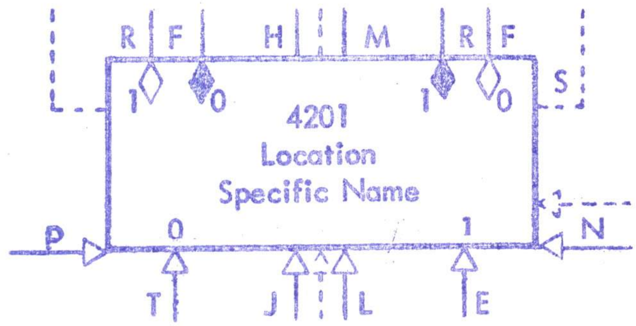
Input on opposite side from output.

Pulse transformer output terminals always shown with lower one grounded.



If external pushbutton switch used to trigger unit, draw as shown.

Jumpers on bottom.



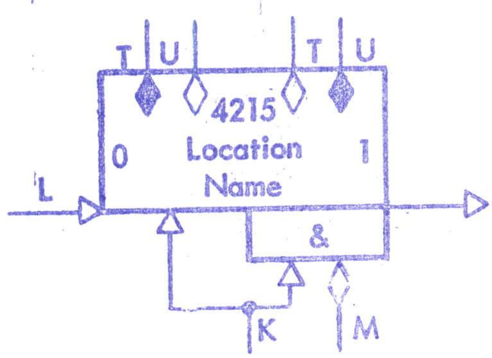
Engineering Drawings will use the double-output terminal flip-flop. A representative type is shown here. Unused terminals need not be shown. Ground terminals should be on the outside to facilitate setting via the output terminals, even though the additional notation on state is needed.

P - direct clear (sets to ZERO)
T - direct ZERO set input
J - complement input (C_1)
L - complement input (C_2)
E - direct ONE set input
N - direct set (sets to ONE)

F - 0 output (buffered)
R - 1 output (buffered)
M - propagate output (P_2)
H - propagate output (P_1)
S - indicator resistor output (never shown except in an indicator table)

Single complement would be between J and L. Single propagate would be between H and M.

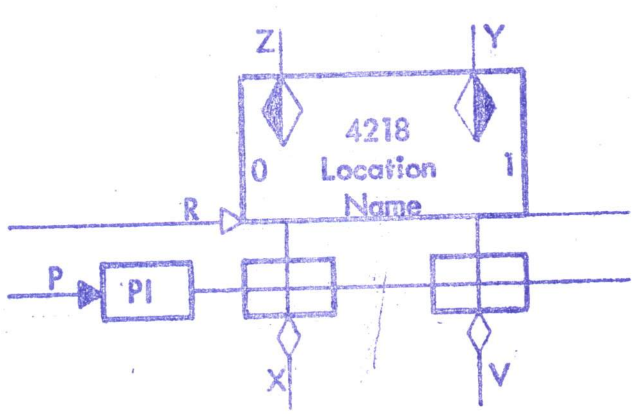
Unbuffered 0 output in addition to buffered outputs shown on 0 side as a dotted line (see Type 4204)



If the ground terminals are shown inside, then only one number per side is needed to identify the states.

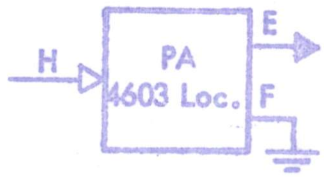
A common clear buss is illustrated here.

This shows the inhibit Flip-flop in the Type 4219. Instead of a negative inhibit level, a positive enable level to an AND gate is applied with the complement input to the 1 side

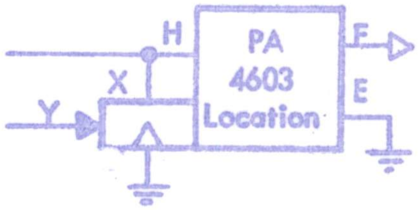


If single-output terminal flip-flops are used (as in application notes), a split diamond would provide quick identification of the circuit as a flip-flop as well as indicating the level of the output according to the state.

This example shows a common clear buss and a common load buss from a pulse inverter.

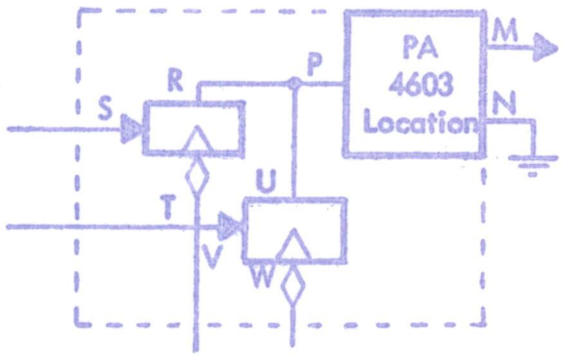


Pulse Amplifiers will use the letters PA. A single PA will be shown as above. If a single inverter on the same module drives the PA, it will be shown as at the left.



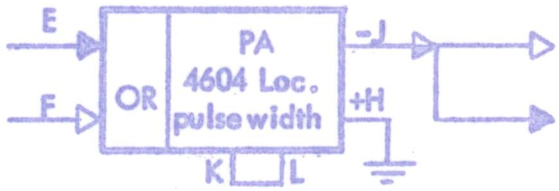
If more than one inverter on the same module drives the PA, it will be shown as on the left, with a dotted line.

Both pulse transformer output terminals will be shown, on the opposite side as the input(s). The lower on will always be grounded. Exception to this will occur when only one output is available, with the ground internally connected.

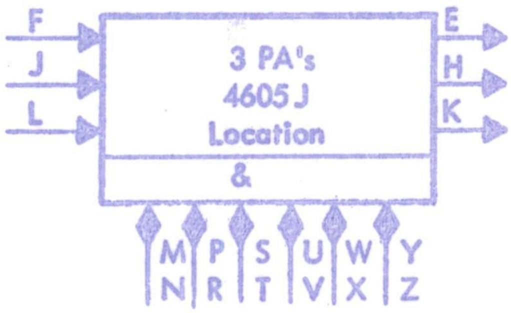


Jumpers and gating levels will always be on the bottom, along with external components.

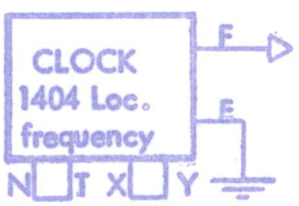
If both the leading edge and trailing edge is used, a split arrow will be shown. In this case, the polarity of the output terminals must also be shown.



If the pulse width is a different value from the standard for the series, it will be given internally.



Only the one AND input will be shown according to the internal jumpers.



Clocks will be shown as on the left. Frequency will always be given.

Jumpers and external components on bottom.

Pulse Inverters should normally be standard inverters with nonstandard clamped loads. However, this symbol may be used where the output drives capacitor-diode gates on the same module if a distinction is made.

dec INTEROFFICE MEMORANDUM

DATE April 17, 1963

SUBJECT Output from Accumulator bits in PDP-1 and coordinate system for display.

TO Computer Guidance Committee FROM Bob Savell

1. Sometime ago a memo was written to the committee requesting that the voltage output levels from the Accumulator bits in PDP-1 be complemented so that the output levels agree with the IO output levels and therefore with PDP-4 output levels. The fact that they at present do not agree is a source of much bother whenever any display system is designed to work with both PDP-1 and PDP-4. It requires the addition of inverter modules and results in other awkward items of design.

To the best of my knowledge, no one other than display systems uses these bits except for bits 15, 16, and 17 which are used by Mag. Tape. These three bits already produce the desired levels and so do not have to be changed.

2. At present, the PDP-1 uses a coordinate system with 00 in the center while PDP-4 uses one with 00 at the lower left-hand corner. In addition, plus 0 and minus 0 are adjusted to be equal in the PDP-1 system whereas the two center points in the PDP-4 system, naturally, are separated by one increment. Having these differences also results in awkwardness in design and makes it difficult to design equipment which is truly compatible with both PDP-1 and PDP-4. It is requested that a single system be decided upon which will be used for all display systems.

INTEROFFICE MEMORANDUM

DATE April 16, 1963

SUBJECT

TO Nick Mazzarese
CC: Harlan Anderson
Bob Beckman

FROM H. R. Morse

I propose the following be the extent of DEC's written commitment to furnish "software" to our customers. I hope that in the future any contracts which exceed these limits be re-examined to determine if we really wish to commit ourselves contractually.

The programming aids referred to are only those programs which comprise our software, not maintenace programs or other programming aids (such as instruction and hardware description).

With each PDP-1 DEC agrees to furnish:

One binary tape of:

Digital-1-1-S	Macro Assembly Program
2-S	Macro Symbol Package
3-S	DDT
4-S	Expensive Typewriter
5a-S	DO
6-S	Punchout
7a-S	Duplicator
18-S	Expensive Desk Calculator

One Symbolic tape of:

Digital-1-8-S	Extended Operations and Macros
9-A	Multiply Subroutine
10-A	Divide Subroutine
11-A	Random Number Generators
17-A	Single DEC

Upon request symbolic tapes and a listing of the following will be supplied:

Digital-1-1-S	Macro Assembly Program
2-S	Macro Symbol Package
3-S	DDT
4-S	Expensive Typewriter
5a-S	DO
6-S	Punchout
7a-S	Duplicator

With each PDP-4 DEC agrees to furnish:

One binary tape of:

Digital-4-10-S	Assembler
11-U	RIM Puncher
13-U	Tape Reproducer
16-U	Master Tape Duplicator
22-S	DDT (Debugging Tape)
32-S	Edmund the Editor

One symbolic tape of:

Digital-4-7-0	Teletype Output Package
8-0	Octal Print Subroutine
17-0	Decimal Integer Print
23-PA	Double Precision Integer Package
28-A	Multiply Subroutine
29-A	Double Precision Floating Point Routines
30-U	CAL Handler Type II
31-U	CAL Handler Type III
33-A	Divide Subroutine

Symbolic tapes and listings upon request for:

Digital-4-1-I	Funny Format Loader
10-S	Assembler
11-U	RIM Puncher
13-U	Tape Reproducer
16-U	Master Tape Duplicator
22-S	DDT (Debugging Tape)
32-S	Edmund the Editor

In addition, we will agree to supply a "user's manual" for each of the above programs but will supply "internal descip-tions" only if they already exist. At present Macro - PDP-1 is the only program for which both internal description and a user's manual exist.

Specifically, we will not offer (contractually) any materials which are non-existent (such as flow charts, modifi-cations for user's equipment) without first ascertaining whether, indeed, such can reasonably be offered.

Such "extensions of our software policy" should probably be channeled through the Computer Guidance Committee.

The above list is obviously a dynamic one. We should be able to offer DECAL (PDP-1) as part of our contractual software as of August 1st (if BBN sells their work to us), and FORTRAN (PDP-4) as of May 20th (when it will be announced at SJCC).

INTEROFFICE MEMORANDUM

DATE April 16, 1963

SUBJECT FORTRAN Programming System

TO Those concerned

FROM Dit Morse

A FORTRAN seminar is scheduled for April 26, at 1:00 p.m. in the 4th floor classroom of Building 5. The purpose of the seminar is to acquaint interested DEC personnel with the FORTRAN system for the PDP-4. Some of the areas to be discussed will be:

a. the FORTRAN II language

b. the machine code produced by the PDP-4 FORTRAN compiler

c. the FORTRAN operating system

d. differences between PDP-4 FORTRAN and the FORTRANS produced by "the other manufacturer"

e. FORTRAN documentation aims

f. the PDP-4 relocatable assembler

The primary objective of this seminar is the internal dissemination of information about a system which will eventually be offered as part of the PDP-4 Software.

dec INTEROFFICE MEMORANDUM

DATE April 16, 1963

SUBJECT Burroughs Card Reader Installation at Jet Propulsion Laboratory

TO Ken Olsen
Harlan Anderson
Stan Olsen
Nick Mazzarese
Bob Beckman

FROM Bob Savell

It has come to my attention through Bob Beckman that Jet Propulsion Laboratory has been given, I assume by our West Coast Office, all the logic drawings and mechanical information about our Burroughs Card Reader and Control so that they can purchase only the modules and mounting panels from us and interface the Burroughs Card Reader to the PDP-4 themselves. I know nothing of the background surrounding this transfer of information so the following comments may be way out in left field.

I assume that what happened in this case was that we simply gave JPL this information without receiving any financial compensation in return. If such is the case the Computer Sales Manager, I suggest, should see to it that this practice is stopped immediately for reasons I assume are fairly obvious. If we are to give out engineering information freely then we are no longer in the business of selling computers and systems but only in the business of selling modules and providing applications assistance.

RECEIVED

1963 APR 16 AM 11: 34

DIGITAL EQUIPMENT CORP.
SALES DEPARTMENT

DIGITAL MAYNAD

DIGITAL WA

TO HARLAN ANDERSON

FROM BARBARA WHALEN

WAYNE BROBECK CALLED THIS MORNING AND REQUESTED THAT I ASK YOU IF YOU KNEW THE NAME OR OFFICE OF G.S.A. THAT IS INTERESTED IN TWX PROGRAMMING. END OR GA PLS⊕

⊕

DIGITAL MAYNAD

ENDO

DIGITAL WA

V

TO BARBARA WHALEN

FROM NANCY SURVILAS

REGARDING YOUR MSG FOR WAYNE BROBECK

HARLAN ANDERSON IS ON VACATION

HAVE CHECKED WITH STAN AND KEN OLSEN AND NO ONE

SEEMS TO KNOW WHO WAYNE COULD SPEAK WITH AT THE GSA

SORRY

END GA

RECEIVED
1963 APR 17 AM 8:17
DIGITAL EQUIPMENT CORP.
SALES DEPARTMENT

INTEROFFICE MEMORANDUM

DATE April 15, 1963

SUBJECT ANALOG TO DIGITAL CONVERSION USING COMBINED PARALLEL-FEEDBACK TECHNIQUES WITH SELF-CORRECTION FEATURES

TO See Distribution List Below

FROM B Stephenson

Attached is a description of a general method for performing high speed A to D conversion. This is the method being used for the NSA system and I hope we will soon have some definite specifications and prices for standard units. In the meantime, we can quote on special units - depending on the customers' requirements. If you know of any customers interested in this area - I would be happy to give them more detailed information.

Distribution:

Sales Personnel
R Beckman
District Sales Office Personnel
Engineering Projects Comm Members
D Chin
J Atwood
S Grover
R A Cesari, Blair and Buckles
R Hughes

MEMO FROM B STEPHENSON April 10, 1963

SUBJECT: ANALOG TO DIGITAL CONVERSION USING COMBINED PARALLEL-FEEDBACK TECHNIQUES WITH SELF-CORRECTION FEATURES.

INTRODUCTION:

A parallel converter performs an entire conversion in one step. Generally, a separate comparator is used for each level of information, i.e., 2^n comparators are used in an N bit converter. The comparators are biased at increasing voltages. The value of the input voltage is determined by the transition point, where one comparator is on and the adjacent comparator is off.

A feedback converter is one where a digital number is converted to analog, compared with the input signal, and the resulting information used to correct the digital number until the appropriate digital representation is reached. Most feedback converters use the counter method, the continuous conversion method or the successive approximation method.

The parallel method is fast, but impractical for large numbers of bits. A ten bit system, requiring 1024 comparators, would be quite uneconomical. All 1024 comparators would have to be matched in terms of the effects of drift, power supply variation, temperature, etc. Any current drawn by a comparator would be multiplied by 1024.

A feedback converter can be implemented at considerably less cost. Also, since there is only one comparator, variations in this comparator tend to affect only the linearity, and not the monotonicity, of the system.

By combining these two techniques, it is possible to build converters which are considerably faster than the standard feedback techniques and also more practical and economical than a simple parallel converter. For example, with a combined parallel-successive approximation method, the total conversion time would be $\frac{NT}{M}$: where N is the number of bits in the total word, M is the number of bits determined by a single step and T is the time per step. This is compared with the time for a standard successive approximation conversion which would be NT. Only 2^m comparators would be required in a combined system while 2^n would be required for a parallel converter.

Figure 1 illustrates how a parallel-approximation converter might be implemented. This converter uses two D to A networks. During the first step of the approximation, the upper converter is at full scale and the lower converter is at zero. During the second step, the voltage corresponding to the results of the first step is applied to both converters. An additional voltage corresponding to the full scale voltage divided by 2^m is applied to the upper converter. The resistors between the two converters divide the voltage difference into 2^m equal parts. The resistance shown with dotted lines is the output resistance of the D to A network.

SELF-CORRECTION

Self-correction is the ability to change bits which have already been decided upon. This feature is automatically included in a continuous converter, though normally the maximum correction is ± one least significant bit. By combining the continuous converter and the parallel converter, the maximum correction is ± (M-1) bits.

The maximum frequency signal which the converter can follow is then multiplied by $2^{(M-1)}$. In either case, the aperture time would equal the time per step. At first, this method may not appear useful due to the fact that the aperture time is not changed. Thus, if the signal is moving fast enough to require a change between steps of more than one LSB, then the value of the input signal, in time, is not really known to the full number of N bits. However, in the case where the input signal is moving more slowly, the full accuracy of the converter is available. In the case where the input signal is moving faster, it is possible to catch peaks in the signal which would otherwise be lost. Although the accuracy at high speed is limited, it is more accurate than would be the case if the converter simply was not able to follow the input.

A continuous-parallel converter can be implemented by using two D to A networks, similar to the method shown in Figure 1, or using a method such as shown in Figure 2.

Self-correction may also be applied to the successive approximation converter. Since this correction feature requires additional information, the required number of steps may be increased. In the standard successive approximation system, the time per step, (T), is the same for all steps. T increases with the desired accuracy, since all the circuits must settle to within a certain percentage of their final value. When correction bits are used at various intervals in the conversion, it is not necessary for all steps to be as accurate. Thus the total time may actually be decreased.

Self-correction may also be used to reduce the aperture of a successive approximation converter. For example, if the input signal will not change more than one part in 2^5 during five step times, then a correction of one part of 2^5 inserted after the fifth step time would reduce the converter aperture by five step times.

When a parallel-approximation converter is used, self-correction may often be employed without increasing the number of steps. For example, with a ten bit converter, where three or four bit decisions are made per step, then there would be two bits of information which normally would not be used. These may be employed as correction bits to reduce the total conversion time, the aperture time, or some combination of the two.

It is also possible to bias the converter so that the correction would always be implemented by adding a bit to the system (never subtracting). This reduces the amount of circuitry required for the correction.

GENERAL INFORMATION

The amount of information determined by the parallel portion of the converter need not be restricted to an integer number of binary bits. If the final output were to be decimal, for example, it would be most convenient to determine ten pieces of information from the parallel portion.

The required number of comparators is much less in a combined system than in a strictly parallel system. However, some of the same limitations are still imposed. Any change in one comparator relative to another will affect not only the linearity of the system but also the monotonicity of the system. The input current required will be multiplied by the number of comparators used. The current drawn by the comparators through the resistive network must be taken into account in the calculation of the accuracy. (If this current is fairly well known it may be compensated for.) To avoid these limitations, the combined method may be used for determining the most significant bits and a standard feedback method may be used for determining the least significant bits. In this case an error correction would definitely be required when shifting from one mode of operation to the other. The shift may be made by transferring from the combined converter to a separate feedback converter or by using only one of the comparator circuits in the combined converter. The former method would be desirable when a different set of higher accuracy, lower speed circuitry is needed for the final bits. For example, the resistors in the combined method could be metal film while wire would resistors could be used in the feedback converter for determining the least significant bits.

AN EXAMPLE

A ten bit combined parallel-approximation system with self-correction has been constructed and operates quite well. The general logic employed is similar to that shown in Figure 1, i.e., there are two D to A converters connected by a series of resistors with a comparator at each node point. This particular converter gives sixteen pieces of information (or four binary bits) per step. The most significant bit in each of the second two steps is used for correction. The first two steps are offset by one-half of the LSB of that step so that the correction factor in the next step will always be positive. The D to A networks are designed so that the correction bits may be applied directly. This eliminates the problem of transients due to changes in more significant bits when a bit of lesser significance is added in. The results of the conversion are summed in external counter and the results appear in parallel at the end of the conversion.

A problem exists if the comparators do not switch in sequence. The resistor configuration was chosen to minimize this problem. The comparators require approximately equal times to switch on a given input difference. Thus, by tying the comparators to points which are in series, no more than one comparator should be in transition at a given time. The latter possibility is unavoidable unless the comparator is locked by some mechanism. This difficulty is avoided by converting the sixteen bits of information into a four bit gray code. This is stored in four flip flops in the gray code. A DC gray to binary code converter on the flip flop outputs produces a weighted code which drives the D to A networks. The system uses three sets of four bit registers with code converters; one set for the results of each step. The outputs of the first two code converters, gated by the timing signals when necessary, drive the D to A networks.

A block diagram of the system is shown in Figure 3.

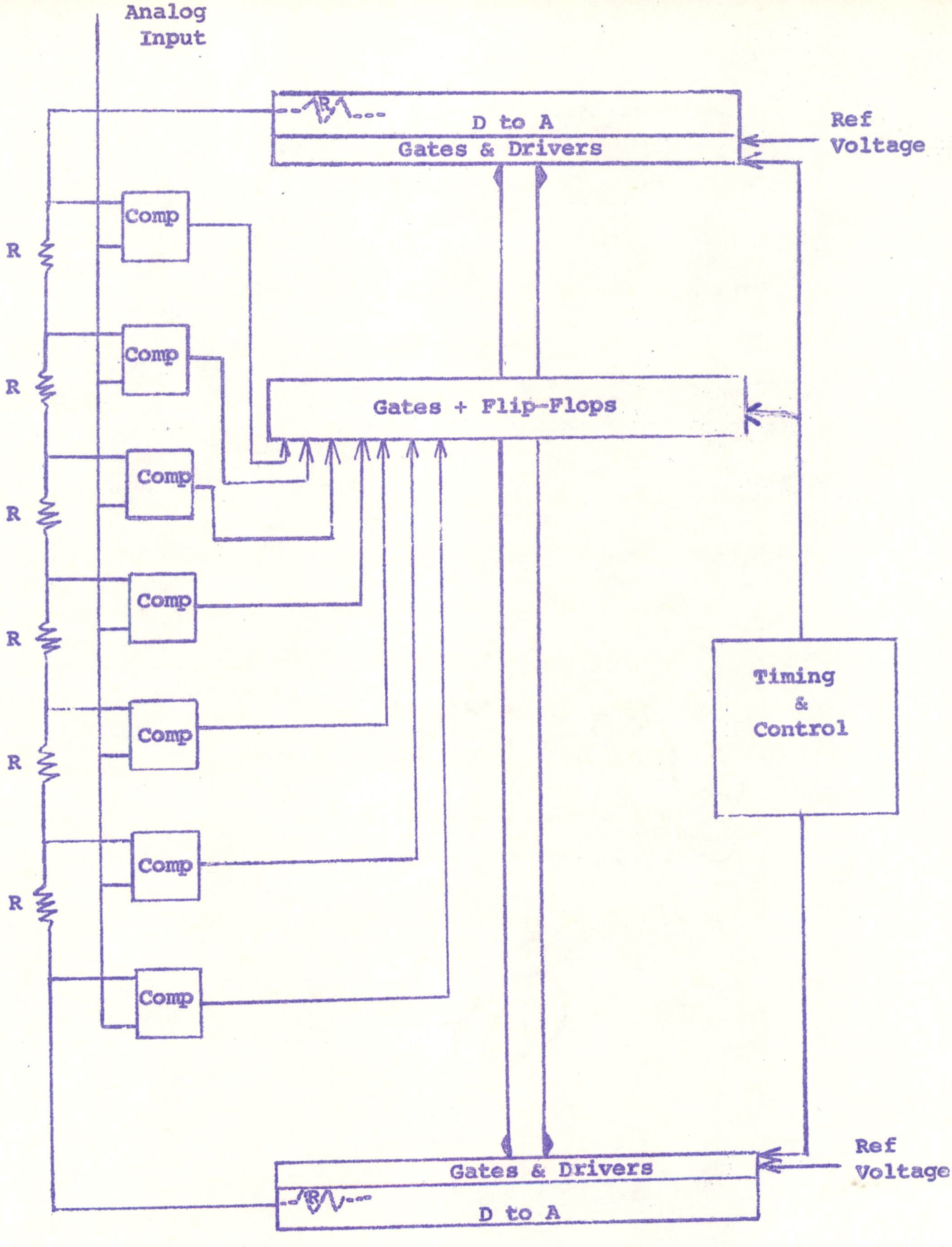
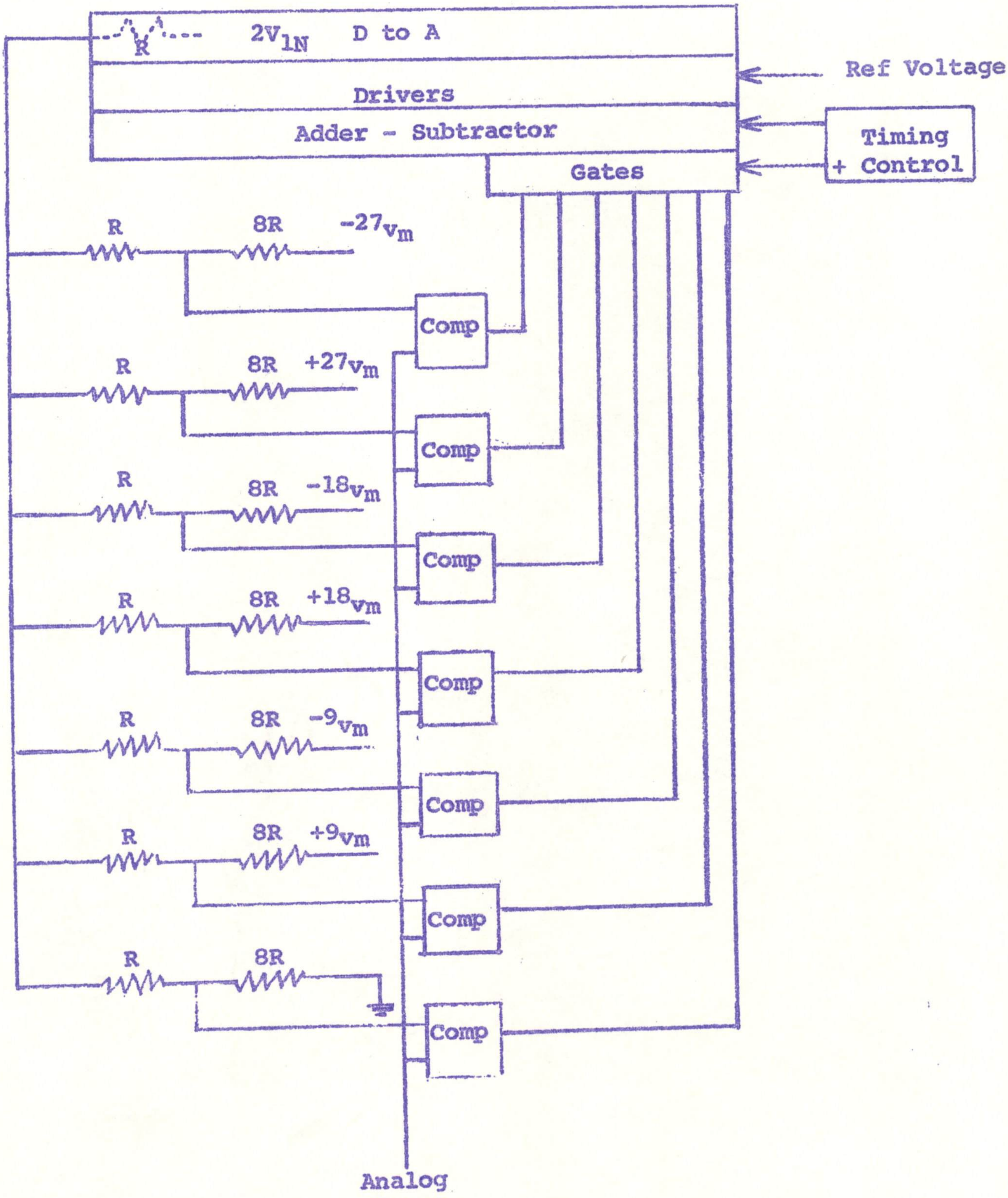


Figure 1

TYPICAL PARALLEL - APPROXIMATION CONVERTER



$v_m = V/2^m$

$0 \leq$ Input Voltage $(V_{1N}) \leq V$

Figure 2

TYPICAL CONTINUOUS - PARALLEL CONVERTE

Step	V_{max}	V_{min}
1	$V(1+2^{-5})$	$V(2^{-5})$
2	$V'+V(2^{-3}+2^{-8})$	$V'+V(2^{-8})$
3	$V'+V''+V(2^{-6})$	$V' + V''$

$V' = V$(Weighted Contents Reg A)
$V'' = V$(Weighted Contents Reg B)
$0 \leq$ Input Voltage $\leq V$

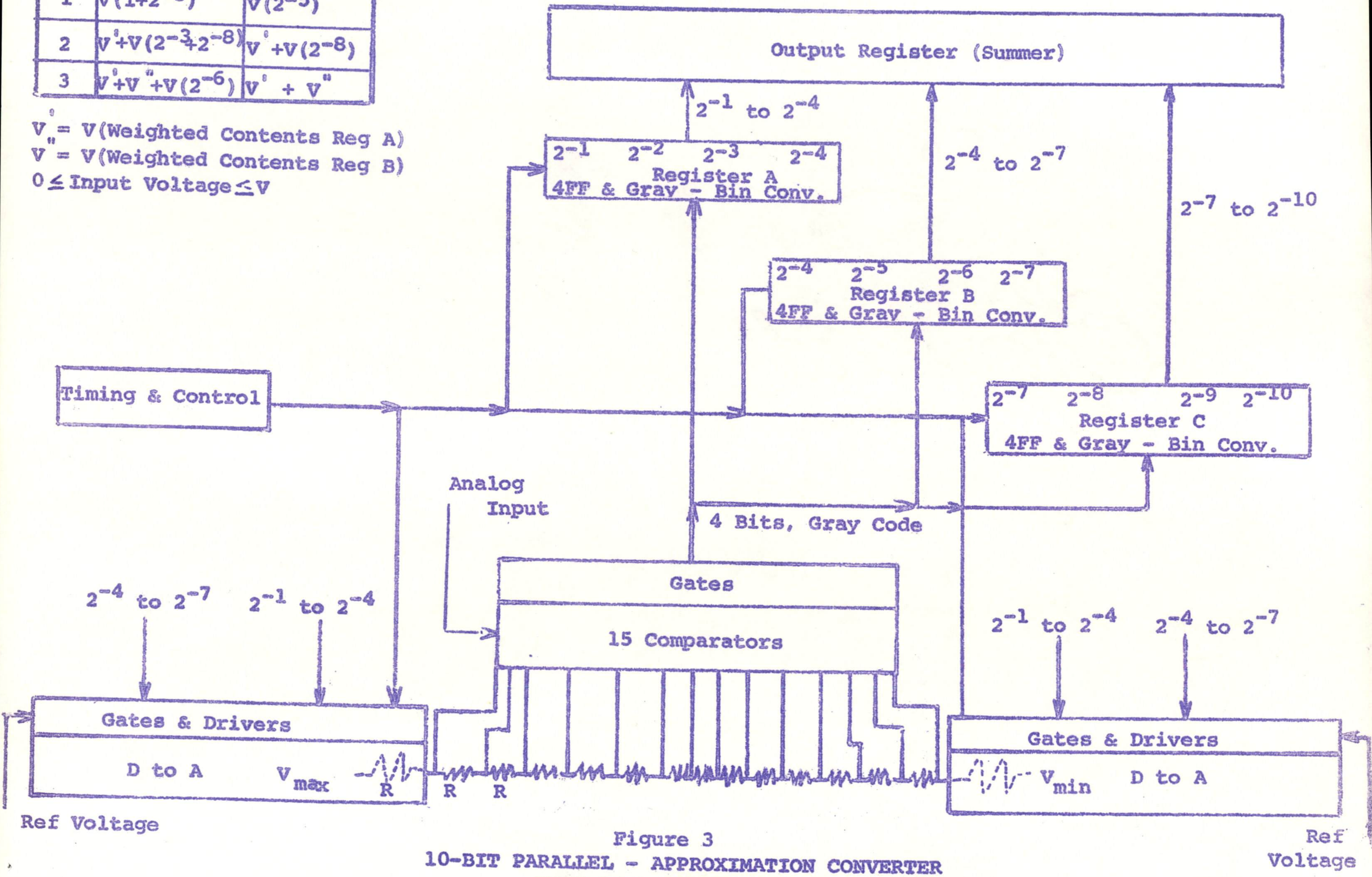


Figure 3
10-BIT PARALLEL - APPROXIMATION CONVERTER
WITH SELF-CORRECTION

INTEROFFICE MEMORANDUM

DATE April 12, 1963

SUBJECT

TO Stan Olsen

FROM Jon Fadiman

c.c.: Ken Olsen
Harlan Anderson ✓
Guenter Huewe

On Wednesday, March 19, 1963, I attended a conference on "The European Electronics Market" under the auspices of the Electronic Industries Association Symposium at the Statler Hilton Hotel in Washington, D. C. The particular session that I attended was the Industrial Electronics Division session.

The first speaker was Mr. John Griswold of Arthur D. Little in Cambridge. He spoke on "Trends and Opportunities in Industrial Electronics". He indicated that the biggest market for electronic components are in Germany, Italy, France and Sweden. For communications work, one must deal with the governments, otherwise, deal with the private industries. The market for Computers, both business and industrial, is becoming much greater because of increased labor shortages in Europe. The same is true for the market for industrial instrumentation and control, and automation of factories. In Germany in particular, there is increased military opportunities. In European electronics business in general, the financial ties are of much greater importance than in the United States. Most of the financing is through bank loans, not through public held stock, or at least the banks hold the stock. Large companies have no difficulty in getting large loans from banks, but small companies have great difficulty in obtaining any money whatsoever. Thus, America is in a good position to fill the gap in the market demand for the components which smaller companies can better provide. The rise in labor costs and labor shortages in Europe also contribute to the increase in markets for automatic control equipment. United States has great technilogical advances which can materially reduce the competitive advantage that Europe has because of slightly lower labor costs. There is only very limited government research and development money available in Europe and no large government grants, as we have in the United States. United Kingdom is most advanced in this respect. In general, Europe wants to buy U. S. technology and the price differential is becoming less important.

The second speaker was Mr. Dodigton of the ITT Corporation in Nutley, New Jersey. He spoke on "The European Avionics Market". Avionics comprises the electronic equipment in an airplane and that used for ground support and also used for test equipment. The scheduled airlines specify their equipment according to performance, not according to price. There is great conservatism in the buying of equipment. The equipment is specified for European airlines by the Engineering Electronics Committee in Brussels and in general, adopts U. S. standards and buys U. S. equipment. It is very important to offer good after-sales services and a guarantee to stay in business. Source of spare parts within their own European country must be provided. In the specification of test and check-out equipment, what is looked for is the most performance for the dollar and price becomes more important here. Airports and airport equipment is entirely government controlled. The international Civil Aviation Organization specifies performance but not equipment. In general, the equipment is manufactured in Europe after ideas from the United States. Most usually test and checkout equipment is built into the equipment that is to be tested and not sold as separate equipment.

The third speaker was Mr. Robert K. Gess of I. B. M. World Trade Corporation in New York. He talked on "Computers, Data Processing and Industrial Controls". His only point was that in the development of European trade, the most important thing is the people which do it, i.e. the hiring, training and development of people. There must be a continual education of the European personnel. The most important factor effecting sale of American equipment in Europe is the "sensitivity of the few Americans involved and the competance of the Europeans involved".

The fourth speaker was Mr. Clifford W. Slaybaugh of the International Division of RCA in New York. He spoke on "Communications Case Study". This was a case study of the marketing of the RCA TR22 video tape recorder in Europe. This is a $62,000. piece of equipment used mostly by broadcasting and TV stations. The important thing is to have the right product and incorporate it into the European requirements. The sales campaign was conducted by personal demonstrations in a particular lab in Zurich. The demonstration of the equipment was held at the time of an electronics festival at nearby Montreux. Consequently, many of the Engineers would be in Switzerland anyway, and this was a good time to get them to see the equipment. In order to sell equipment, the Engineers must have the chance to work with the product, and demonstrations must be provided with time for the Engineers to do this. Advertising campaign in selected media where rates are low, was coordinated with the demonstration. Invitations and literature were sent out in English, French and German. Fourteen pieces of equipment were sold on the spot at this demonstration and later 37 more pieces were sold as a result of it. Europe is not an easy market because of the "do it yourself" attitude and because of the prejedice of Europeans to buy European. The case study indicates the importance of personal demonstrations of equipment in which the equipment is not only demonstrated but actually allowed to be used by the people who are interested in buying it.

The fifth speaker was Mr. William P. Doolittle, Vice President of International Operations of Hewlitt-Packard in Palo Alto, Calif. Hewlitt-Packard is a considerably larger company than ours doing about $100,000,000. gross business per year with 6,000 people. They have two factories in Europe. They started an Export department in 1955. In 1957 they set up a sales representative organization in Europe. In 1959 they set up a corporate marketing office in Geneva, Switzerland. They started with a 10 day technical sales program with busses traveling all through Europe for demonstration of their equipment, plus a large advertising campaign. They used the technical exhibitions considerably and participated in all of them. They felt that these exhibitions were a great help in marketing their equipment in Europe. Later they saw the need for local manufacture in Europe of particularly their less sophisticated products. They set up manufacturing in Germany for their meters, etc. In 1962 they opened a manufacturing plant in England for the more sophisticated devices. They set up their own sales organization, staffed entirely with nationals of the country involved, first in Germany and then in Brussels. In Brussels it was a joint venture with another Belgium company. The third place was the United Kingdom; soon will come France and Sweden. In 1958, International Sales accounted for 10% of the total sales of Hewlitt-Packard. In 1962, International Sales accounted for 18% of the sales of Hewlitt-Packard. Of this 18%, 71% is in Europe. For the equipment that is made in the United States, they warehouse it in Basle, all shipment are made Air Freight. Hewlitt-Packard has 350 employees overseas of which only four are Americans.

It was difficult to draw any particular conclusions from this meeting, although there was much interesting information given by the speakers. The European market is definitely expanding for the type of equipment which we at DEC wish to market there. However, it is a more difficult market in which to sell than the United States. An acceptance of our product will not be as quick as in the United States. An important thing is to have flexibility of our products so that we may meet the European demands. Demonstration of our equipment, participation in trade shows and allowing the Engineer to actually see and use our equipment in operation will be very important in getting our equipment sold in Europe. We must talk with the Engineers and show them about our equipment in their own languages. I feel that particular attention must be paid to making it easy for companies to import from the United States and to simplify the paper work required by a company to get the import certificate. We must attack the problem that the European Engineers thinks that it is "easier" to buy European equipment than to buy our DEC equipment. Incidentally, Computer Control Company is getting into the European market with their plug-in units too. The Manager of International Marketing is Mr. Stanley A. Radler.

# # # # #

bbn

dec INTEROFFICE MEMORANDUM

DATE April 12, 1963

SUBJECT DECAL, AFCRC, BBN, and DEC

TO H. Anderson
D. Morse
N. Mazzarese
R. Beckman

FROM Gordon Bell

Computer Guidance Committee

I've just ordered one DECAL system from BBN for $14,000 for delivery in two parts in 90 and 120 days. This, hopefully, should be the end of DECAL, and with the system, (especially it's description), a formal offering of DECAL should be made to our customers.

Someone from DEC should be liaison in regard to the actual delivery, and:

1. See that every detail of our contract is fulfilled.
2. Handle rough draft descriptions and get them into print.
3. Incorporate DECAL with Program Library.
4. Perhaps institute DECAL as a standard DEC offered program.

There are several possibilities of people, and the Computer Guidance Committee should recommend or allocate personnel.

I also talked with Charleton Walters at AFCRC regarding DECAL. The AF has given BBN many contracts for research, and to his knowledge has gotten nothing in return. He would like to discuss this with BBN (jointly with DEC) at the slightest provocation. For the good of our present liaison with BBN, we should not do this now, but at some time. This might do BBN a great deal of good to hear the DECAL Story again from a large discontented united front.

dec INTEROFFICE MEMORANDUM

DATE April 12, 1963

SUBJECT ABSENCE NOTIFICATIONS

TO K. H. Olsen

FROM Jack Atwood

CC: H. E. Anderson
S. C. Olsen

Even a year ago, the word usually got around to the interested parties whenever one of our key people was going to be away on vacation or a trip. At least this held true for extended absences.

This year, however, these people seem to be getting away on a much more discreet basis. Sometimes their own staff personnel do not know they are gone until a day or two after the fact. In some instances, they have not even known where the person was or why he was absent.

I am particularly concerned because this plays havoc with our operation. Since virtually everything we do involves one or more approvals - sometimes many, many more approvals - it means that we lose time we cannot afford to lose. We usually wind up paying a premium in overtime, lost production and higher prices or else the job doesn't get done.

Certainly it would be most helpful to us to arrange a system for notifying cost center managers (or a selected list of managers) in advance when key people in the company will be away. I feel sure some of the other managers would consider such a service equally worthwhile.

If you think the idea has merit, I would be glad to do whatever I can to help establish the system.

SALES CALL REPORT

Ashley

FIRM M. I. T.	DATE April 11, 1963
DIVISION E. E. Dept.	SALESMAN K. Olsen, G. Bell, P. Bonner
STREET	OFFICE
CITY Cambridge STATE Mass.	NATURE OF CALL Our Visit
PHONE NUMBER AREA CODE	FOLLOW-UP DATE

CONTACTED

Prof. Marvin Minski
Prof. Jack Dennis
Mr. John Ward
Mr. Dick Mills (2511)

SUBJECT

REMARKS (CONTINUE ON BACK OF SHEET)

This meeting was a general discussion regarding MIT's desire to acquire another PDP-1 system.

Since the need of a PDP-1 and type 30 display is rather crucial it was decided to loan the above equipment on April 25 pending MIT's placing of a purchase order through A. R. P. A. When a purchase order will be placed and what exactly it will contain are at this point somewhat uncertain. The ultimate configuration being considered embodies a 7090 working with a PDP-1 which is servicing approximately 100 scope consoles. MIT hopes that this system will become a reality within the next two years.

Right now things are in a quandary as to whether to add extra core storage or drum storage. Also being considered is a Micro Tape tape system.

The above gentlemen intend to finalize their system equipment needs and it is set up that we'll be again getting together in the near future.

PROMISED

HOW TO LOCATE PLANT

dec INTEROFFICE MEMORANDUM

DATE April 10, 1963

SUBJECT Pricing

TO K. Olsen
H. Anderson
W. Hindle
R. Best
S. Olsen
N. Mazzarese
D. Morse
S. Grover
S. Lambert
R. Boisvert
R. Savell
All Sales Personnel

FROM R. F. Maxcy

The Micro Tape 555 transport is composed of a pair of micro tape drives, each with a density of 350 Bits/Inch and a storage capacity of 4 million bits per reel. The 555 transport sells for $7,400. Our regular quantity discount applies to this item in the following manner:

1 pair	0%
2 pairs	6%
3 pairs	12%
4 pairs	18%
5 pairs	24%

The Micro Tape Control type 550 controls 4 Micro Tape Transports. The selling price is $9,400. No quantity discount has been established at this time.

INTEROFFICE MEMORANDUM

DATE April 10, 1963

SUBJECT Fast, but small printer for PDP-6

TO R. Savell

FROM Gordon Bell

cc: K. Olsen
H. Anderson
D. Morse

We are purchasing an inexpensive ($2900) - 300 line per minute, 20 columns printer from Monroe for module testing. This seems to have possibilities for the PDP-6 console.

The PDP-6 consoles now consists:

1. Teleprinter - keyboard
2. 2 Microtape units
3. Display (optional)
4. Line printer (optional)
5. A few program intervention switches

attn: Gordon Bell
N. Mazzarese

SALES CALL REPORT

FIRM JPL

DIVISION ~~XXX~~ 331

STREET 4800 Oak Grove Drive

CITY Pasadena, STATE Calif.

PHONE NUMBER SY 0-6811 AREA CODE

DATE 4-9-63

SALESMAN R. Oakley

OFFICE WCO

NATURE OF CALL visit

FOLLOW-UP DATE

CONTACTED

Bob Stiver, X2583
Harold Baugh, X 2387

SUBJECT PDP-4, Computers-SDS 920 Modules

REMARKS (CONTINUE ON BACK OF SHEET)

This group will have an application in the near future for which a PDP-4 computer looks very desirable to them. The exact application is not readily known to me, however, it basically a machine which will be used for arranging equipment. It will be used principally off-line to real time systems.

These people also use, in conjunction with the group 332, Carl Johnson's group, the SDS 910-920 system at the Goldstone Tracking Station. At this time, the Goldstone system is not being used. It is reported that the IBM 1620 is being used 24 hours a day at the Goldstone site and that the 910-920 system very seldom even has the power on. This group, 332, has also leased an SDS 920 computer, which is at JPL in Pasadena for programming usage, assembling, compiling for the Goldstone site. It is my understanding that they have found the programming to be very awkward at the Goldstone site, therefore resulting in the leasing of a 920 for the on lab usage. I observed the SDS 920 at JPL which is being leased. This machine has the new packaging which is has not been seen in the past in the SDS literature. It was pointed out to me that the 920 has two possible configurations. The first being a single 6 ft. equipment rack and as an alternative, the second being a dual 4½ ft. rack, which seems to be very attractive. Both of these configurations have a very high module packing density and 3 layers of mounting panels, 2 of which are on doors are used in the configuration. Because of this, there is a great deal of heat generated as observed by Bob Stiver that the gate drive is approximately 6 mils per input, which in itself is approximately 6 times greater than ours. Therefore,

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HOW TO LOCATE PLANT

DIGITAL EQUIPMENT CORPORATION · MAYNARD, MASSACHUSETTS

SALES CALL REPORT

FIRM JPL

DATE 4-9-63

DIVISION

Sheet 2

SALESMAN

STREET

OFFICE

CITY

STATE

NATURE OF CALL

PHONE NUMBER

AREA CODE

FOLLOW-UP DATE

CONTACTED

SUBJECT

REMARKS (CONTINUE ON BACK OF SHEET)

even though an all silicon machine operates at a higher temperature it generates much more heat and with the SDS machine with this very high packing density, becomes x somewhat of a furnace. I also observed SDS uses the new xxxx IBM type -the ball type. It uses a Ream photo electric paper tape reader, Amperex indicator lamps and high velocity blowers for cooling in the equipment racks. It was also noted that in the single 6 ft. equipment rack there is no space for extensive input output channel hardware. Therefore, an additional rack must be added for I/O flexibility. The general opinion is, as far as the machine is concerned, that the PDP-4 ,because of its more attractive appearance, has a little more sophistication behind it to the outside world. However, the general feeling xxx is that the SDS machine id much more refined in the internal hardware packaging.

In addition to the computer discussion a little was discussed pertaining to the new digital modules for which there is probably an application for of which will not be of too much significance but will for the first time possibly get some DEC modules into this group. There is a particular interest for D to A converter equipment with counters and shift registers as incidentXX registers.

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HOW TO LOCATE PLANT

Arthur Hall
April 8, 1963

REQUIREMENT FOR AN ENGINEERING COMPUTER

The attached B-size sheet depicts the computer time requirements for Engineering (excepting programming).

Engineering is unlikely to find the necessary time on any other in-house computer.

The proposed requirements of Programming and Accounting alone are sufficient to require the use of one more computer than they now have. (See A-size sheet)

The Production test computer will not be available for Engineering use.

The Sales computer will be away a great deal of the time. It will, for instance, not be in the plant at any time during the five months following August 16, 1963.

Computers in Checkout may be available from time to time as they have been in the past. Except in the case where equipment under development is to be sold to the customer and can be tested on that customer's computer, the practice of using a computer in Checkout is inefficient. Wiring installed to check equipment must be put in and removed at the expense not only of the wiring time but of time lost for computer checkout. The fact that two pieces of equipment are being checked out on the same computer, both under a deadline, will likely cause compromises to be made in the checkout of both.

Considering the workload and the factors listed above it is important that the Engineering Department have a PDP-4 computer for full-time use on engineering development projects.

Arthur Hall
April 8, 1963

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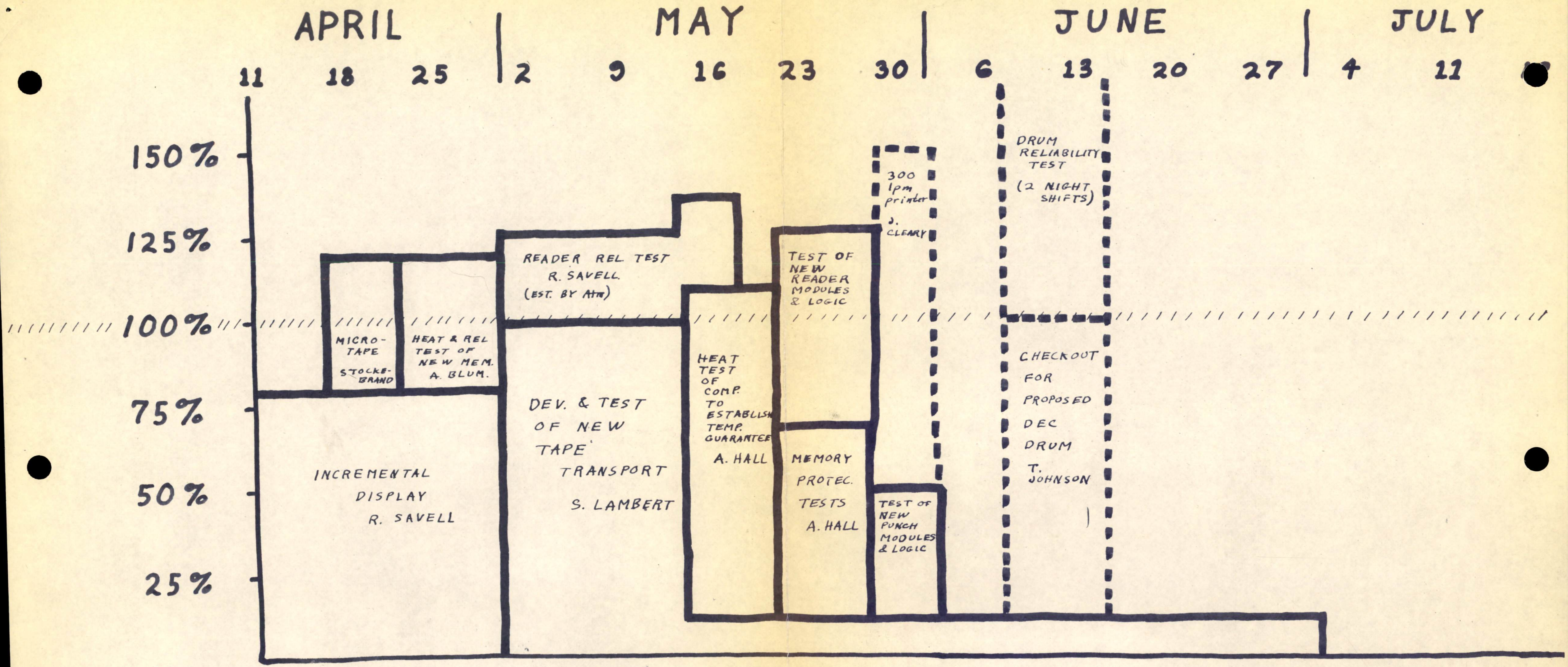
PDP-4 STEADY-STATE MACHINE TIME REQIREMENTS

1) PROGRAMMING GROUP	* 80 %
2) ACCOUNTING	50 %
3) ENGIN. PROGRAMMING	20 %
4) ADVERTISING	10 %
5) CUSTOMER RELATIONS	
CLASSROOM DEMON.	20 %
TAPE REPRODUCTION	15 %
FIELD SER. REPORT ANALYSIS	5 %
6) DOWNTIME	? %
	200 % + ?

* REQUIREMENTS ARE EXPRESSED AS A % OF AN AVERAGE 40 HR WEEK

A. HALL
4/8/63



NOT INCLUDED: 1) COMPUTER DOWNTIME
2) PROJECTS NOT YET DEFINED
3) PROJECTS GENERATED BECAUSE A COMPUTER IS AVAILABLE

PDP-4

AVERAGE % COMP. TIME
(OF AN 8 HOUR DAY)
REQ. FOR ENGIN. PROJECTS

A. HALL 4/8/63

Harlan Anderson

dec INTEROFFICE MEMORANDUM

DATE April 5, 1963

SUBJECT

TO Ken Olsen
Harlan Anderson
Stan Olsen
Nick Mazzarese
Jack Atwood

FROM Howie Painter

There will be a meeting at 9:00 AM on Tuesday, April 9 in Ken's Office to discuss the following:

1. Spring Joint Computer Conference
   a. Review booth backwall sketches.
   b. Decide on which equipment and programs for the show.

2. Review the exhibit schedule for the balance of 1963.

DIGITAL MAYNAD

DIGITAL WA

H.E.C.

TO HAL ANDERSON FROM JIM BURLEY APRIL 4

RECD A PHOE CALL FROM WAYNE BROBECK RELATING THAT GORDON KINGSLEY HAD RECD A CALL FROM THE GENERAL ACCOUNTING OFFICE FOR SETTING UP APPT FOR REVIEWING HI-VOLTAGES BOOKS.

WAYNE SAYS THAT THE DEPUTY GENERAL COUNSEL OF THE GAO IS A PERSONAL FRIEND OF HIS AND THAT WAYNE WOULD LIKE TO OFFER HIS KNOWLEDGE OF GAO ACTIVITIES TO YOU AND KEN SHOULD YOU GET A SIMILAR PHONE CALL.

AM PASSING THIS ON AT WAYNE RECCOM.

END OR GA

DIGITAL MAYNAD

ED

END

dec INTEROFFICE MEMORANDUM

DATE April 2, 1963

SUBJECT Incorporating Digital Equipment G.m.b.H.

TO Jon Fadiman

FROM George O'Dea

cc: Harlan Anderson
Stan Olsen
Dick Mills
Guenter Huewe

In accordance with our conversation of this morning I will arrange to arrive in Frankfurt Sunday, May 5th.

The following timetable has yet to be confirmed with the German parties involved but I propose it as a starting point:

Monday, May 6th – You and I to meet with:

Mr. R. A. Holterman
Resident Partner
Coopers and Lybrand
Wohlerstrasse 8 - Frankfurt

This gentleman was referred to us by the New York Office of Lybrand, Ross Brothers and Montgomery as a party especially familiar with the problems American Businessmen are likely to encounter on their first ventures into Germany. I wouldn't think it would be worth Guenter's time to join us.

Tuesday, May 7th – You, Guenter, and I to meet with:

Mr. Reidar Gundersen
Vice President
Morgan Guaranty Trust Co. Representative
Zurich-Haus am Opernplatz - Frankfurt

This gentleman was referred to us by the Morgan people in New York as highly knowledgeable in matters of import and customs procedures. The point you made this morning about how best to ease the customers' import pains can be discussed here. He is the gentleman who recommended Schenker and Co., G.m.b.H. as our broker. I would imagine he will arrange to have a gentleman from Schenker present.

Guenter has suggested we move on to Munich that evening.

Wednesday, May 8th – You, Guenter and I to meet with:

Dr. Jakob Strobl
8 Munchen 2
Brienner Strasse 15/II

This is the attorney who will represent us during the incorporation process. Hopefully this will take just one day.

Thursday, May 9th and Friday, May 19th – You, Guenter, Miss Siebert, and I to meet at the DEC office with the Munich Branch of Coopers and Lybrand to open a set of books which serves the requirements of the Federal Government of Germany and the Digital Equipment Corporation, Maynard, Mass. and to establish such routines as seem appropriate.

Guenter has volunteered to make reservations for us in Frankfurt and in Munich.

If you find these dates reasonable I will proceed to contact the other parties involved.

George O'Dea

GO'D:ncs

INTEROFFICE MEMORANDUM

SUBJECT 27th Meeting of the Test Equipment Committee

DATE April 2, 1963

TO Richard L. Best

FROM Russell Doane

Members of the Committee:

Robert Hughes, Chairman
Russell Doane, Secretary
Donald White
George Gerelds
Dave Dubay
Dick Tringale
Jim Cudmore
Larry White
Ken Wakeen
Steve Lambert

1. All four of the new Hewlett Packard type 175A oscilloscopes have been received but we are still awaiting two plug-in units.

2. The standards subcommittee has met for discussions, and Dave Dubay has completed graphical profiles of tolerance required vs. parameter value on which we can base planning.

3. The Ballantine AC VTVM has been ordered.

4. The Dynatran 100 megacycle F_t tester has been ordered and is now in operation.

5. Al Kotok requested that a type 564 Tektronix storage oscilloscope be purchased in order to facilitate investigations of the possibility of a storage tube computer display and also for use as a general purpose test instrument. We obtained a demonstration of this scope and discovered that its writing rate for storage is extremely restricted, being adequate only for the storage of 500 kc levels and inadequate to record the direction of transition between ones and zeros. Further discussions will take place between Al Kotok and Bob Savell on whether this device is still a good choice.

6. We discussed Al Blumenthal's need for XY plotting. A 561 Tektronix oscilloscope can be used as an XY scope at frequencies to 10 megacycles if two dual trace plug-ins are purchased for it. (The 561 oscilloscope was originally designed as an XY plotter according to our Tektronix representative.) Another possibility is a type 536 oscilloscope which also was designed as an XY plotter and which has a bandwidth of 11 megacycles. Its price is $1085 without plug-in units. It would require a time-base generator unit type "T" at $240 to adapt it for ordinary general purpose use.

7. There was considerable discussion about the speed with which probes are broken or lost. Dave Dubay has consistently found non-operative oscilloscope probes in wastebaskets and tool boxes. These probes are expensive and can be repaired. The total investment in probes is approximately $800 and consequently careless destruction of probes by letting them lie on the floor to be stepped on or by letting them be thrown out with the trash is expensive. Such treatment of current probes, because of their higher cost, is still more expensive. Please return any defective probes to Test Equipment Service.

The next meeting of the Test Equipment Committee will be on Tuesday, April 9, at 1:30 P.M. in Bob Hughes' office.

cc: H. Anderson
B. Beckman
W. Hindle
N. Mazzarese
R. Mills
J. O'Connell
G. O'Dea
K. Olsen
S. Olsen
H. Painter
G. Rice
M. Sandler
All Engineers
All Technicians

dec INTEROFFICE MEMORANDUM

DATE April 2, 1963

SUBJECT FORTRAN NEWSLETTER II

TO

FROM H. R. Morse

Present status:

The basic FORTRAN II Compiler for PDP-4 is in the final phase of checkout. The following features have been debugged:

- arithmetic statements (including subscripts)
- DO statements
- GOTO (regular, computed, assigned)
- Statement numbers
- DIMENSION
- COMMON
- END
- CONTINUE
- Floating point input

Included but not debugged as yet are:

- IF
- CALL
- RETURN
- FUNCTION
- SUBROUTINE
- STOP
- PAUSE

Also running (as far as can be checked out at this stage) is the "operating system;" i.e., the floating point routines and interpreter, the subscript calculator, and the subroutine caller.

Schedule for future work:

I expect the above mentioned items to be debugged by the end of the week (April 5th).

For the present time a very simple I/O facility will be defined, probably consisting of the two statements READ A and WRITE A. At a later date more sophisticated I/O commands will be made available, but the I/O needs of people using FORTRAN on PDP-4 have not yet been determined.

The largest job remaining is the generation of a relocatable and linking assembly system, which is essential if PDP-4 FORTRAN is to be a useful system. The quickest way to achieve this will be to modify the present PDP-4 Assembler. This job will be started shortly, and should be completed before April 30th.

Ron Coleman, WCO, is continuing work on a method for generating the basic arithmetic, trigonometric, and transcendental functions. His schedule presently calls for about two weeks' work on the West Coast, followed by a week or two here to incorporate his work into the system. A by-product of his work will be a verification of the PDP-4 Floating Point routines which will be part of the system.

Barring unforeseen disasters, we will have no trouble meeting the April 30th delivery date with a FORTRAN Compiler which will satisfy our obligation to Foxboro. In addition it appears that we will have operational and useable about that time a complete FORTRAN system, including a relocatable Assembler and loader, the operating system, and the basic function generators.

Documentation:

As I now see it, four pieces of literature will be necessary and useful to describe FORTRAN:

(1) Propaganda piece

(2) Basic User's Manual

(3) Detailed User's Manual

(4) Internal (or Infernal) Workings Manual

Both (1) and (2) will be available by the SJCC (May 20th). (3) should be available in final form by the middle of June. It is not clear when (4) should be available, or how detailed it should be, so I have no schedule at this time.

A note of the purpose of the documentation:

(1) is merely to say "DEC offers FORTRAN"

(2) should be sufficiently explicit to permit a person to use the system (at least the simple features of it.) However, it is an "abridged version" of

(3) which contains all the "dirty details" that are confusing to the beginner but necessary to the experienced programmer.

(4) will permit a programmer to understand the system enough to modify it.

Also, in two weeks (April 19th) a programming seminar explaining the system will be presented.

Specifications:

To date, we have been talking about FORTRAN, which, admittedly, is an ill-defined term. The FORTRAN for the PDP-4 will compile almost any statement that 709 FORTRAN II will, and a good number it will not.

It will not handle:

EQUIVALENCE

FREQUENCY

However, it will handle:

Mixed expression

n-dimensional arrays

arbitrary expressions as subscripts (including subscripted expressions)

variables as the arguments of DO's

The coding compiled is fairly efficient; however, we do not take advantage of such things as common subexpressions and indexing by 1 (maybe next month).

Harlan Anderson

#36

dec INTEROFFICE MEMORANDUM

DATE April 2, 1963

SUBJECT Personnel Policy Proposals

TO Works Committee

FROM Personnel Committee

PROPOSED COMPANY JURY DUTY PAY POLICY

The company will pay the difference between the employee's base rate of pay and his jury duty pay for the time he is absent from his job while serving jury duty.

The cost center manager, immediately upon receiving notice from an employee who has been assigned to jury duty, will notify the Personnel Office with respect to the starting date of the jury duty assignment, the daily jury duty pay, and the date the employee will return to work. The Personnel Office will advise the Accounting Department accordingly. The Personnel Office will explain the Jury Duty Pay Policy to the employee before he starts his jury assignment.

This policy will be kept in the Personnel Department's policy manual and will not be published elsewhere.

COMPANY PAID HOLIDAY WHICH FALLS ON A SATURDAY

In keeping with the company policy of $9\frac{1}{2}$ paid holidays during the calendar year, it is proposed that in the event a company paid holiday falls on a Saturday an additional assignable day will be included in the holiday schedule as a substitute. This will arise in 1964 when May 30 and July 4 both fall on a Saturday.

CONTINUATION OF HOSPITAL AND MEDICAL COVERAGE AFTER TERMINATION OF EMPLOYMENT

When an employee terminates his employment, his Life Insurance Coverage under the group plan continues for 31 days after the date of his termination while his hospital and medical coverage ceases at midnight on the day of his termination.

Because this is an abrupt discontinuation of hospital and medical coverage and allows the terminating employee little time to arrange for new coverage, it is proposed that we officially contact John Hancock for the purpose of amending our group insurance contract to continue a terminating employee's hospital and medical coverage for 31 days after the date of his termination. The continuation of this coverage would be at the option of the employee, and he would pay his proportionate share of the cost.

####

CC. HEA,

dec

INTEROFFICE MEMORANDUM

DATE April 2, 1963

SUBJECT New Computer for LRL

TO Gordon Bell

FROM Ken Larsen

I have spoken to George Michaels at LRL, Livermore, again regarding the large computer, (a machine not unlike the "PDP-6"), and they are enthused about the prospect of getting a new machine from us. The computer would be used for research in the areas of automatic film reading. They would remove the precision scope and the eyeball equipment from their PDP-1 and use it strictly as a processor.

The new computer would be used solely as an engineering tool in conjunction with the existing eyeball equipment and the image dissector that they have on order from Westinghouse.

George would very much like to have you, and possibly Dit Morse, visit them to discuss their ideas for this machine. He suggested sometime during the last two weeks in April, which would be the weeks of April 22nd and April 29th.

Norm Hardy is the fellow with the really good ideas, and I think we should take advantage of his creativity as much as possible. Since we enjoy such excellent rapport with the people at LRL, they are anxious to express their ideas to the DEC people who are able to carry them out. Hopefully, this could result in a machine that more closely fits their needs.

I would like to hear from you soon to find out if the memos I have been writing you regarding the conversations with them have been of any help to you, and I would like to see any copies of the notes that you have been using in describing the machine so that I might have a better idea what the specs of the machine would look like, when they are released.

Sincerely,

Ken Larsen (jw)

Ken Larsen

INTEROFFICE MEMORANDUM

DATE April 1, 1963

SUBJECT Module Testing, the SJCC, etc.

TO Ken Wakeen/Len Hantman

FROM Gordon Bell

cc: K. Olsen
H. Anderson
N. Mazzarese

The Computer Guidance Committee recommended that the PDP-4/Module Testing System be shown at the SJCC in Detroit, May 20, 1963. People have been marketing small ($10,000 - $100,000) gadgets to do automatic component testing, etc.

The brochure explaining the testing system at the show could also serve to handle the sales/application literature for marketing the device to manufacturers of other complex equipments requiring similar measurements. Computer Controls Corporation probably won't buy, but IBM or a group at Raytheon might.

Since the character generating scope might be on the same computer, a demonstration of the system could include a labelled schematic of the module, when a fault appeared. We seem to be in a position to provide:

1. Computer for controlling stimulus and response at selected terminals.

2. Design of special terminal equipment.

3. Programming (compiler) for generally testing devices of many classes.

The market areas then maybe:

1. Module testing.

2. Special system checkout requiring a stimulus-response action.

3. Back Panel Wiring Checkout (Enclosed is a brochure from Hughes -- on a gadget for back panel checkout) DIT-MCO (of Kansas City) also sells a similar device.

4. Component tests.

5. Unit checkers for computer equipment. Readers/Punches/Tyepwriters/Mag Tape Units/Line Printers/DISC files/ DRUMS/etc.

The module testing appears to be going quite well, and provides an impressive display of equipment. It would now be nice to apply the same techniques to other areas outside DEC.

Harlan Anderson

dec INTEROFFICE MEMORANDUM

DATE April 1, 1963

SUBJECT

TO W. Hindle

FROM J. Smith

Below you will find a list of topics I would like to discuss at the Thursday morning meeting.

1. Computer Production Finished Goods Inventory
2. Work In Process Inventory
3. Present Production Schedule
4. Computer Major Component Policy
5. Field Service Major Component Policy
6. Display Inventory Policy
7. Mag Tape Inventory Policy
8. Elimination of Wiring Diagrams

Review on Monday 1 April.

PREPARATION OF PRICING FORMULA SHEET

1. Fill in ________ name, type, class, tech ref. of item being priced.

ENGINEERING COST ESTIMATE

2. Major Materials - these are any special materials, not part of the completed item, that were needed for development (ie special scope for checkout). Enter total of purchase prices in column A.

3. Engineering Labor - insert number of hours worked on project (actual or estimated) by class of work. Multiply by the given rates. Enter total in column B.

4. Engineering Overhead - multiply column B by 1.5 enter product as column C. Add B to C enter total in column D.

PRODUCTION COST ESTIMATE

Lot size usually 1 unless item is a module.

5. Materials

   1. DEC Catalog Items - these are modules, power supplies, mounting panels, items on spare parts list etc. Enter total in column E. Attach separate list of these parts to pricing formula.

   2. Other Parts - these are assembled units available to anyone purchased outside. The list price of these items is arrived at in the following manner:

      (A) Parts purchased outside
      List price = purchase price marked up

0 to .99	- 100%	markup
1.00 to 4.99	- 50%	markup
5.00 to 999.99	- 40%	markup
1,000 - over	- 30%	markup

      (B) Standard parts manufactured by DEC from Components

      List price = production cost (available from Cliff Fuller) x 3.

      Enter totals in column F. Attach separate list of these parts to pricing formula. Add E to F, enter total in column G.

R. F. Maxcy
3/15/63

6. Labor - includes all assembly and rework done by production. Insert number of hours worked on project (estimated or actual) by class of work. Multiply by given rates. Enter total in column H.

7. Production overhead - Multiply column H by 2.6. Enter product in column I. Add H to I, enter total in column J.

SPECIAL INSTALLATION COSTS

8. Labor - Insert number of hours worked on special installation (actual or estimated) by class of work. Multiply by given rates. Enter total in column K.

9. Overhead - Multiply column K by 1.5. Enter product in column L. Add K to L and enter total in column M.

10. Travel - Enter actual cost of travel (.08/mi etc.) in column N.

MARKETING FACTORS

Estimate unit sales. The total of all three (3) years is the number that will be used in the formula. Call this number P. Complete rest of marketing factors.

FORMULA

$$\text{List Price} = 2.3\left(\frac{D}{P} + J + M\right) + \frac{A}{P} + G + N$$

R. F. Maxcy
3/15/63

COMPANY CONFIDENTIAL

DEC PRICING FORMULA

1. NAME ______________________ TYPE ______________

Item to be: _ Standard product _ Special job _ Combination <------Indicate Class

Customer Reference: If "SPECIAL" or "COMBINATION" indicate customer

Technical Description Reference: Any general drawing nos., manuals etc.

ENGINEERING COST ESTIMATE

2. MAJOR MATERIALS

		Cost	Total
1.	Manuals		
2.			
3.			
4.			
	Subtotal		A

3. LABOR

		Hours	Avg. Rate	Cost	Total
1.	Circuit design		4.50		
2.	Logic design		4.50		
3.	Mechanical design		4.50		
4.	Checkout		2.50		
5.	Technical writing		4.50		
6.	Technician		2.50		
7.	Drafting		2.50		
8.	Other				
9.	Programming	Subtotal		B	B

4. ENGINEERING OVERHEAD 1.5 x "B" — C

TOTAL ENGINEERING COST — D

PRODUCTION COST ESTIMATE

(Lot size assumed ____)

5. MATERIALS

		Cost	Total
1.	DEC Catalog Items (attach list)	E	
2.	Other Parts (attach list)	F	
	Subtotal		G

6. LABOR

		Hours	Avg. Rate	Cost	Total
1.	Assembly		2.00		
2.	Shop		2.50		
3.	Testing		2.50		
4.	Other				
	Subtotal			H	H

7. PRODUCTION OVERHEAD 2.6 x "H" — I

TOTAL PRODUCTION COST — J

R. F. Maxcy
3/15/63

COMPANY CONFIDENTIAL

SPECIAL INSTALLATION COSTS

8. LABOR

	Hours	Avg. Rate	Cost	Total
1. Engineer		4.50		
2. Technician		2.50		
Subtotal			K	K

9. OVERHEAD 1.5 x "K" — L

TRAVEL (actual cost) — N

TOTAL INSTALLATION COST — M

MARKETING FACTORS

Estimated Unit Sales: P 1st Year________ 2nd Year________ 3rd Year________

Product to be similar to following DEC product(s)________________

Competitive considerations________________

FORMULA PRICES

MODULE FORMULA

List Price = 3 X Production Cost ________

ALTERNATE FORMULA

List Price = Install. Cost + Prod. Cost + $\frac{\text{Eng. Cost Est.}}{\text{Est. Unit Sales}}$ + SG&A + Profit ________

AGREED PRICE

Date________ Limited: _ Yes _ No Price________

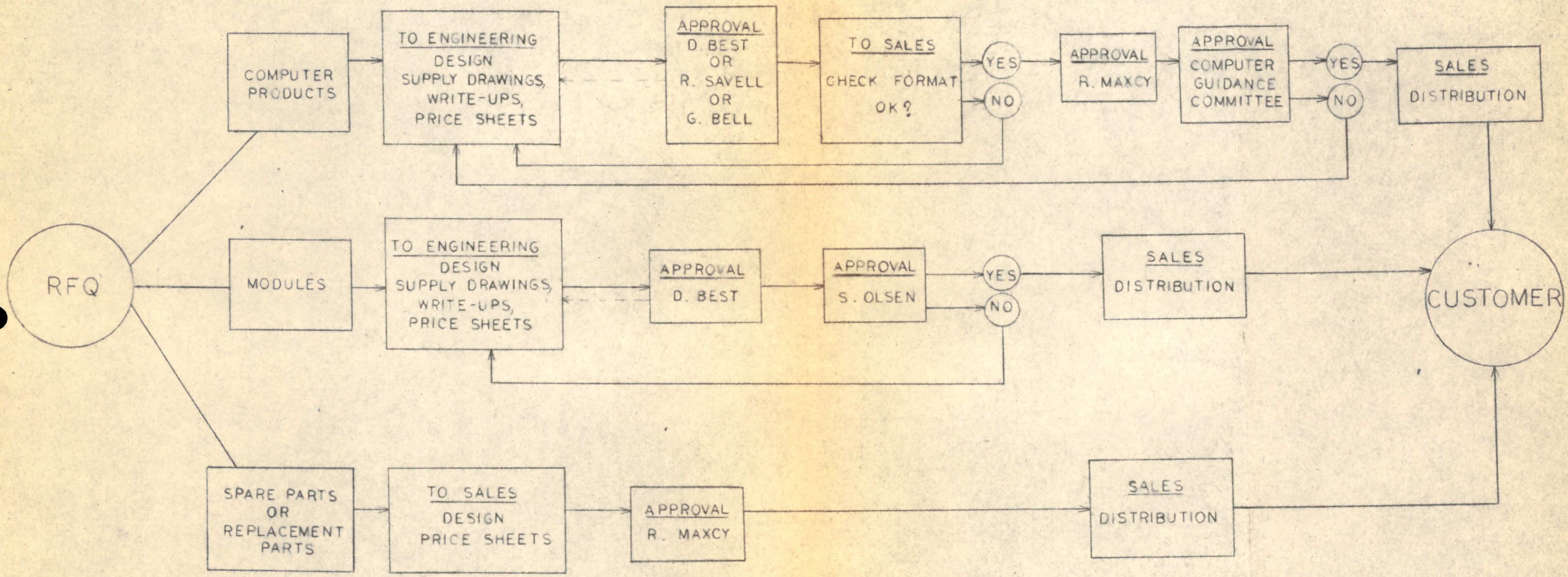
APPROVED BY

	Signed	Date		Signed	Date
1.			5.		
2.			6.		
3.			7.		
4.			8.		

$$\text{List Price} = 2.3\left(\frac{D}{P} + J + M\right) + \frac{A}{P} + G + N$$

PRICING PROCEDURE

COMPUTER PRODUCTS
MODULES
SPARE PARTS AND
REPLACEMENT ITEMS



R. MAXCY
3/15/63

A. Kotok
Rough Draft
April 1, 1963

INSTRUCTION CATEGORIES

1. Arithmetic
   - A. Fixed Point
   - B. Floating Point
2. Logical
3. Word Moving
4. Indexing and Counting
5. Comparison and Testing
6. Branching and Subroutine Calling
7. Bit Manipulations
8. Shift/Rotate
9. In-Out
10. Character Manipulation
11. Stack/P.D.L.

Instruction Format

7	2	2	3	3	1	18
OP. Code		M	O	X	I	A
0 6	7 8	9 10	11 13	14 16	17	18 35

A	Address
I	Indirect
X	Index
O	Operand
M	Modifier

Operand and Index Registers

Registers 0 thru 7 serve three functions:

1. Accumulators and operand registers. This use is specified in the "O" field of the instruction.

2. Index registers. This use is specified in the "X" field of the instruction. For purposes of indexing, register 0 will always be considered to contain 0.

3. Addressable locations. The CPU may use these registers as it would any core memory location.

   These registers are not part of the normal core memory and may not be addressed by other than the central processor.

Effective Address Computation

Let Y be the location of the instruction in question.

Then if $C(Y)_I = O$, the effective address [E] = $C(Y)_A + C(C(Y)x)_A$ ‡ unless $C(Y)x=O$; in which case the E = $C(Y)_A$.

Otherwise, [the $C(Y)_I=1$] , perform the calculation as above, replace Y by E, and return to the above procedure.

‡ Exception: In the "left halt index exchange" instruction, this expression reads:

$E=C(Y)_a + C(C(Y)x)$ 0-17

This holds only on the first time thru, in case $C(Y)_I$ is 1.

Instructions

1. Arithmetic Instructions:

The chart below gives locations of operands and results [Brackets denote second word when necessary]

M			
00	C(O) [C(O+1)];	C(E)	C(O) [C(O+1)]
01	C(O) [C(O+1)];	C(E)	C(E) [C(E+1)]
10	C(O) [C(O+1)];	C(E)	C(O) [C(O+1)] and C(E) [C(E+1)]
11	C(O) [C(O+1)];	E	C(O) [C(O+1)]

A Fixed Point

ADD $AC + V \rightarrow R$; Addition is done in 2's complement. If $AC_o = Vo \neq Ro$, then the Overflow flip-flop is set on. If AC + V considered as unassigned numbers $\geq 2^{36}$ the carry flip-flop will be complemented.

SUB $AC - V \rightarrow R$; Subtraction is done in 2's complement. If $ACo \neq Vo$ and $ACo \neq Ro$ then the overflow flip-flop is set on. If $NAC + V$, considered as unsigned numbers is $\geq 2^{36}$, the carry flip-flop will be complemented [N indicates 1's complement]

LDN $-V \rightarrow R$; Load negative

The 2's complement of V replaces R.

MPY AC X V → R [R]; Multiplication is a signed operation on 2's complement numbers. R will contain the high order part of the result and [R] will contain the low order part of the result. No overflow is possible.

IMPY AC X V → R Integer multiply is a signed operation on 2's complement numbers. R will contain the low order part of the result. If $|R| > 2^{35}$ the overflow flip-flop will be set.

DIV AC [AC] / V → R, [R] Divide is a signed operation on 2's complement numbers. AC is the high order part of the divident and [AC] is the low order part. [R] is the quotient and R is the remainder. The sign of the remainder is the same as the sign of AC. If $|AC| > |V|$ division will not take place and the overflow flip-flop will be set.

IDIV AC /V → R Integer divide is a signed operation on 2's complement numbers. AC is equivelent to the low order part of a full dividend. The high order part is considered to be zero. R is the quotient. If V=O, overflow will be set.

Branching and Subroutine Calling

JSX Jump and set index

M=00 $C(PC) \rightarrow C(O)_A$; $E \rightarrow C(PC) \rightarrow C(O)$ 0-17

M=01 $C(O) \rightarrow C(E)$; $C(PC) \rightarrow C(O)_A$; $E \rightarrow C(O)$ 0-17; $E+1 \rightarrow C(PC)$

M=10 $C(O) \rightarrow C(20)$; $C(PC) \rightarrow C(O)A$; $E \rightarrow C(O)$ 0-17; $21 \rightarrow C(PC)$

M=11 $E \rightarrow C(PC)$; $C(C(O)$ 0-17$) \rightarrow C(O)$

JAC Jump on accumulator condition. If C(O) meets the condition presecribed by M (see IXJ) $E \rightarrow C(PC)$

JMP

M=00 $E \rightarrow C(PC)$

M=01 $E \rightarrow C(PC)$ iff overflow is on. overflow is reset

M=10

M=11

Word Moving Instructions

The chart below gives locations of operands before and after a word moving operation.

M	Before AC	Before V	After AC	After V	
00	-	C(E)	C(E)	C(E)	
01	C(O)	-	C(O)	C(O)	
10	C(O)	C(E)	C(E)	C(O)	
11	-	E	E	E	[high order bits will be unchanged]

FWX AC ↔ V Full word exchange

LHX AC0-17 ↔ V0-17 Left half exchange [when M=11, E → AC0-17]

RHX AC_{18-35} ↔ V 18-35 Right half exchange

LIX AC ↔ V Left index exchange

This instruction is unique in that in the computation of E on the top level (ie in the LHX instruction itself) the C(X) 0-17 are used in place of the C(X) 18-35.

ARX AC_i ↔ V_i Arithmetic Registers exchange.

This instruction "exchange" registers 0 thru O with E thru E+O.

Indexing and Counting

On the following instructions, the table of operands and results under arithmetic instructions applies

ADO $V+1 \rightarrow R$ Add one. One is added to V in 2's complement

SBO $V-1 \rightarrow R$ Subtract one. One is subtracted from V in 2's complement.

CNT $V-1 \rightarrow R$; if R=0, skip next instruction. Count. Subtract one from V in 2's complement, and skip if the reset is 0.

On the following instructions the M field has the effect shown below

M=00	if	=0
M=01	if	$\neq 0$
M=10	if	≥ 0
M=11	if	<0

IXJ $C(O)+1 \rightarrow C(O)$. Increment index and jump. If result meets conditions as above, $E \rightarrow C(PC)$. Addition is 1's complement.

DXJ $C(O) -1 \rightarrow C(O)$. Decrement index and jump. Same as IXJ but −1 instead of +1

Comparison and Testing

SMC Skip on memory condition. If C(E) meets the condition as determined by M (same as IXJ conditions), the next instruction will be skipped.

SEQ Skip on equal

- M = 00 skip if C(E) = C (O)
- M = 01 skip if C(E) $\neq$ C (O)
- M = 10 skip if E = C (O)
- M = 11 skip if E $\neq$ C (O)

=>	don't	do
	=	$\neq$
	>	$\leq$
	$\geq$	<

SAC Skip on arithmetic comparison

- M=00 skip if C (E) > C (O)
- M=01 skip if C (E) $\leq$ C (O)
- M=10 skip if E > C (O)
- M=11 skip if E $\leq$ C (O)

SAE Skip on addresses equal

- M=00 skip if C (E)A = C (O)A
- M=01 skip if C (E)A $\neq$ C (O)A
- M=10 skip if EA = C (O)A
- M=11 skip if EA $\neq$ C (O)A

Logical Instructions

The chart for arithmetic instruction operands and results also applies to logical instructions.

Each bit of R as a function of the corresponding bit of AC and V is shown in the tables below:

		AC	V	R
AND	$AC \wedge V \rightarrow R$	0	0	0
		0	1	0
		1	0	0
		1	1	1
IOR	$AC \vee V \rightarrow R$	0	0	0
		0	1	1
		1	0	1
		1	1	1
XOR	$AC \oplus V \rightarrow R$	0	0	0
		0	1	1
		1	0	1
		1	1	0
ZRO	Ø R			

Bit Manipulations

SBC Skip on bit condition

M=00	Skip if all bits in C(O) which have corresponding 1 bits in C(E) are ones
M=01	Same as 00 but "E" instead of C(E)
M=10	Same as 00 but bits selected must all be zero
M=11	Same as 10 but "E" instead of C(E)

Character/bit OPS

XR	S	N	P

Want to have a number refer to a given "N" bit byte somewhere.

if A is table origin

and P is reference number

and N is number of bytes per word

and S is byte size

want to refer to C(A + $\left[\frac{P}{N}\right]$ Q) $\left[\frac{P}{N}\right]_R * S$ ... $\left[\frac{P}{N}\right]_R * S + S - 1$

what happens when this crosses word boundries?

		ZRO	,1	N=5		NA	R
Size	Byte	LAC	Z,P	P=0	A0-6	0	0
N	Size	Div	1,N	1	A7-13	0	1
1	36	LAC	0,A,1	2	A14-20	0	2
2	18	IMPY	Z,S	3	A21-27	0	3
3	12	ALS	0,2	4	A28-34	0	4
4	9	SUB	2,36,3	5	(A+1) 0-6	1	0
5	7	ALS*	0,S,2	6		1	1
6	6			7		1	2
7	5			8		1	3
8	4			9		1	4
9	4			10		2	
10	3			11		2	
11	3			12		2	
12	3						
13							
'							
18							
19							
'							
36							

Character Handling
(possibly optional)

A character may be any size $\leq$ 36 bits

A character is specified by :1) a number $\leq 2^{24}$. This number is sufficient to locate any bit in the machine. 2) A character size; 3) The number of characters per word. These are packed in one word as follows:

If E is the effective address of a character operation computed normally, except that no indexing will be done on the top level and the C(X) is of the above format, then the bits dealt with are:

$$C\left(E + \left[\frac{P}{N}\right]_{\text{integer}}\right)_{S\left[\frac{P}{N}\right]_{\text{remainder}} \cdots S\left[\frac{P}{N}\right]_{\text{remainder}} + S-1}$$

CHR Character operation

M=00 Deposit the S low-order bits of C(O) in the sepcified position. C(O) will be unchanged as will be the remainder of the $C\left(E + \frac{P}{N}\right.$ int