

COMPANY CONFIDENTIAL

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Exchange Memo No. 20

**SUBJECT:** General Performance Characteristics  
of the Basic Exchange

**REFERENCE:** Exchange Memos 15, 16, 18 and  
Stretch File Memo #61

**BY:** R. P. Fletcher  
H. K. Wild

This memo is being issued to supply interested parties with the performance characteristics of the Basic Exchange prior to issuance of the full description of the Exchange Machine Specifications.

1. CAPACITY OF EXCHANGE

- a) The Exchange will provide for direct connection of 32 input-output unit adapters. To each adapter will be connected one I/O device except for 729 type magnetic tapes. The adapters for 729 type tapes will provide for connection of two tape drivers to the adapter, only one of which may operate at any time.
- b) The maximum data rate for the units in (a) above is 15 usecs per 8 bit byte.
- c) The Exchange will provide one channel in addition to (a) above for the connection of low speed units. These units will be connected through a second level multiplexing unit to this channel. The maximum number of low speed units connected in this manner will be 64.
- d) The maximum data rate for the units in (c) above is 8 milliseconds per 8 bit byte if all 64 units run simultaneously. For

lesser numbers of low speed units higher byte rates can be accommodated accordingly.

## 2. SIMULTANEOUS OPERATION OF INPUT/OUTPUT UNITS

- a) I/O units connected to the 32 I/O terminals of the Exchange in (1a) are divided into 3 speed classes and are physically connected to the Exchange I/O scanner in descending order of speed. That is, the highest speed units are scanned first by the I/O scanner, those in the next class of speed are scanned next and the lowest speed units last which gives a priority in servicing to the higher speed units. A weighting factor is given to the units according to their speed to allow the Exchange to determine the total number of units which can operate simultaneously. Units operating with Speed range of 15 to 30 usecs per byte have a weighting factor of 4. Units operating in the speed range of 30 to 60 usecs per byte have a weighting factor of 2. Units slower than 60 usecs per byte have a weighting factor of 1. The total allowable weight count the Exchange can accommodate is 32. This means that the total weights of the units in operation can add up to no greater than 32 excluding the low speed channel. Thus 8 729 III Tape drives (4 times 727 speed) or Direct Access Disks can be run simultaneously; 16 729 II, 32 729 I Tape Drives can be run simultaneously; Tape Drives, Card Readers, Punches or 720 Printers can be run simultaneously. Any combination of the above units will operate simultaneously to the limit that the weights add to no greater than 32. For example, 4 729 III Tape Drives, 8 729 I Tape Drives, 4 Card Readers and 4 720 Printers can be run simultaneously.
- b) In addition to 2(a) 64 low speed units can be run simultaneously.

## 3. STORAGE OF INSTRUCTIONS

If the maximum number of units are operating simultaneously and an instruction is received for a non-operating unit, the Exchange will store the instruction and execute it at a later time. (An instruction is rejected only if the unit is not ready to operate or if it is still selected as the result of a previous instruction.)

The Exchange starts units by scanning their respective Control Words in the Exchange memory under control of the Exchange Memory Address Counter and will start a unit if the select flag is present and if the weight count indicates that the maximum weight count will not be exceeded by the operation of this unit. If the weight count would be exceeded by selection of the unit, the Memory Address Counter does not step until the number of units operating simultaneously decreases to allow selection of the unit and the unit is selected.

#### 4. EXECUTION OF INSTRUCTIONS INDEPENDENTLY OF THE COMPUTER

These Instructions are:

- a) Read- Transfers data from the Input Unit to main memory.
- b) Write- Transfers data from the main memory to the Output unit.
- c) Control- Transfers up to 20 Control bits from the Computer to the I/O unit.
- d) Locate- Transfers up to 20 Locate bits from the Computer to the I/O unit. This is used for units with addressable storage such as the Disk or for selecting one of the two tape drives on a common adapter.
- e) Transmit- Transfers the I/O unit's Control Word from the Exchange to the main memory.
- f) Disconnect- Disconnects (deselects) the I/O unit, thereby stopping the transfer of data between the I/O unit and the main memory.

#### 5. GROUPING/DISTRIBUTION

The Exchange has the facility for grouping various sections of data contained in main memory into one record at the I/O unit;

it can distribute successive sections of a record read from and input unit to various areas in main memory.

#### 6. STORAGE OF I/O STATUS INDICATIONS

The Exchange stores the status of an input-output unit until the computer is able to accept it on program interrupt. Status includes such things as cancel, data error, end of file, etc.

#### 7. SINGLE ERROR CORRECTION AND DOUBLE ERROR DETECTION

Provision will be made to correct single bit errors and detect double bit errors when reading from I/O devices that have error correcting code bits (ECC) recorded with each data word.

#### 8. ERROR RECORDING

Error detected in the Exchange are recorded. Because of the limited speed of the recording device only a sampling of the detected errors will be recorded when errors occur in close time intervals.

#### NOTE I

With reference to 729 III tape speed it is understood that the goal is from 4 times to 6 times 727 character rate. If 6 times speed is realized the Exchange will still service the units on a byte basis with a corresponding reduction in the number of units operating simultaneously.

#### NOTE II

No provision is made in the Basic Exchange to accommodate tape units faster than 4 to 6 times tape. There are no characteristics of such tape units available upon which the Basic Exchange design can be postulated, i. e., byte rate and number of tracks.

#### NOTE III

The simultaneous operation described has been calculated from the information contained in Stretch File Memo #61 using the bus times which do not include the Error Correcting stations on the memory bus.

NOTE IV

Low Speed Units can either be connected to the Low Speed channel multiplexing unit or to one of the 32 byte channels in 1 (a) where it would fall into the class 3 speed classification.

The complete specifications for the Basic Exchange will be completed after this general specifications for the Exchange as outlined in this memo have been evaluated and approved and after other pertinent decisions are reached.

Comments from interested parties concerning the subject of this memo are requested.