

March 31, 1958

EXCHANGE MEMO # 36

SUBJECT: Specifications and Operation of the Manual  
Controls on the Exchange Maintenance Console.

I Features

1. Ability to reset and ready the Exchange with a Power On button.
2. Ability to reset the Exchange with a Machine Reset button.
3. Ability to clear control words in the Exchange Memory and reset the Exchange with a Clear and Reset button.
4. Ability to enter information into any address in the Exchange Memory.
5. Ability to step sequentially through the addresses in any 32 word group in the Exchange Memory either single cycle or continuously.
6. Ability to operate continuously with any selected I/O unit on a simulated Read, Write, Control or Locate instruction.
7. Ability to simulate any type cycle either single cycle or continuously.
8. Ability to turn on all service request and data word transfer triggers.
9. Ability to stop on occurrence of any control error or any data error.
10. Ability to ignore a cancel bit.
11. Ability to execute any type cycle format either single cycle or continuous.

12. Ability to execute continuously with Main Memory a data transfer operation either read or write.
13. Ability to activate the error recorder with a button.
14. Telephone system acceptable.

## II Manual Controls

### A Rotary Type Switches

#### 1. Type of Test - 6 Position

- a. Exchange Memory Test
- b. Type Cycle Test
- c. Main Memory Test
- d. Format Test
- e. Unit Test
- f. Scanner Test

#### 2. Type Cycle - 10 Position

- a. Byte Cycle
- b. Status Test Cycle
- c. Modification Cycle
- d. Deselect Cycle
- e. Control Word Transfer Cycle
- f. Data Word Transfer Cycle
- g. Data Word Set-Up Cycle
- h. Check Cycle
- i. Store Status Cycle
- j. Scanning Cycle

### B Toggle Type Switches

- |     |                               |      |
|-----|-------------------------------|------|
| 1.  | Operation Mode                | (1)  |
| 2.  | Data Error Stop               | (1)  |
| 3.  | Control Error Stop            | (1)  |
| 4.  | Main Memory Read - Write      | (1)  |
| 5.  | Service Request Simulation    | (33) |
| 6.  | Data Word Transfer Simulation | (33) |
| 7.  | Word Bit Simulation           | (75) |
| 8.  | Exchange Memory Address       | (9)  |
| 9.  | Advance                       | (1)  |
| 10. | Ignore Cancel Bit             | (1)  |
| 11. | Signal Simulation             | (9)  |
| 12. | Stop After Reset              | (1)  |

### C. Push-Buttons

1. Power ON
2. Power OFF
3. Start
4. Single Cycle
5. Stop
6. Machine Reset
7. Clear And Reset
8. Recorder Control
9. Unit Test Read
10. Unit Test Write
11. Unit Test Control
12. Unit Test Locate
13. Set SR and DWT Triggers

### III Functions of the Manual Controls

A The following triggers are used for the operation of the manual controls.

1. Block Clock - This trigger being on blocks the gate of the 10 time pulse to the clock.
2. Start 1 (700 mus Single Shot)
3. Start 2
4. Start 3

Triggers 2, 3 and 4 are used to control the turn off of the block clock trigger. This combination prevents sliver condition and insures a full 10 time pulse as the first clock output. The Start 1 Trigger allows a single cycle to be accomplished when desired. The Start 2 and Start 3 triggers synchronize the manual operation buttons to the exchange clock.

5. Power on Single Shot (200 mus)
6. Test Single Shot (200 mus)

Single shots 5 and 6 are used to control a re-set operation when the Power On, Machine Reset or Clear and Reset buttons are pushed.

7. Hold Start - Remembers that continuous operation is desired.
8. Delay

Triggers 7 and 8 are used to insure that the same address in the Exchange Memory is not used more frequently than once every 10 u sec under Exchange Memory Test or continuous operation in the type Cycle test.

9. Machine Reset - This trigger being on causes signals to be generated to reset the following triggers for each unit.
 

a. Deselect	e. "32" Bit
b. Channel Check	f. Select
c. Service Request	g. Channel Start
d. Data Word Transfer.	
10. Clear Memory - This trigger being on blocks the Exchange Memory sample gate. Trigger 9 or 10 being on blocks all normal type cycles and forces the Exchange to execute reset cycles.
11. Initial Load - This trigger being on allows a program to be loaded into the Computer:
12. Exchange Ready - This trigger being on indicates that the Exchange is ready for operation.

## B Toggle Switches

### 1. Operation

#### 1.1 Normal

Allows normal operation of the Exchange

#### 1.2 Test

- a. Condition "Type Test" rotary switch
- b. Condition the Ignore Cancel Bit switch.
- c. Blocks appropriate communications to and from the computer, the main memory and the I/O units.

2. Data Error Stop (1)

The block clock trigger is turned on upon discovery of a data error.

3. Control Error Stop (1)

The block clock trigger is turned on upon discovery of a control error.

4. Main Memory Read- Write (1)

Simulates either the Select Read or Select Write bits in Main Memory Test.

5. Service Request Simulation (33)

Any combination of service request triggers may be turned on in Format Test, Main Memory Test or Scanner Test.

6. Data Word Transfer Simulation (33)

Any combination of data word transfer triggers may be turned on in Format Test, Main Memory Test or Scanner Test.

7. Word Bit Simulation (75)

Information set on these switches may be entered into the Exchange Memory during various tests.

8. Exchange Memory Address (9)

These switches determine the test address which is set into EMA Storage Register 1.

9. Advance

Allows the sequential stepping in any 32 word group.

10. Ignore Cancel Bit (1)

Allows the Exchange to ignore the presence of a cancel bit in a control word.

11. Signal Simulation (9)

Allows signals normally gated to the Exchange by an I/O unit to be simulated.

Channel Check  
ECC  
Ready  
Cancel  
Unit Error  
EOF  
Unit Signal  
EOM  
Deselect

12. Stop After Reset (1)

Allows the Exchange clock to be blocked after a machine reset has been completed.

C. Rotary Type Switches

## 1. Type Test

## 1.1 Exchange Memory Test

- a. Conditions Advance switch
- b. Blocks all normal type cycles
- c. Conditions turn on of Delay Trigger
- d. Conditions turn on of EMAR 128 Bit Trigger.
- e. Conditions Word Bit Switches.
- f. Conditions Ex. Mem. Address Switches.
- g. Conditions the address setting into EMAR

## 1.2 Type Cycle Test

- a. Conditions Type Cycle switch
- b. Conditions turn on of Delay trigger
- c. Conditions Ex. Mem. Address switches.
- d. Blocks all normal types cycles.
- e. Conditions the address setting into EMAR.

## 1.3 Main Memory Test

- a. Condition SR and DWT switches
- b. Conditions Main Memory Read-Write switch.
- c. Inhibits control word modification.
- d. Condition Signal simulation switches.

## 1.4 Format Test

- a. Condition Signal simulation switches.
- b. Blocks Store Limit Bit
- c. Conditions turn on of Block Clock trigger.
- d. Conditions SR and DWT switches.

## 1.5 Unit Test

- a. Conditions Instruction simulating push buttons.
- b. Conditions Ex. Mem. Address switches.
- c. Conditions turn on of Instruction Request Trigger.
- d. Conditions inhibit of Instruction Triggers reset.
- e. Conditions Word Bit switches.
- f. Modifies Ex. Mem. Sample gates on some normal type cycles.

## 1.6 Scanner Test

- a. Condition SR and DWT switches.

## 2. Type Cycle

## 2.1 Byte Cycle

- a. Conditions Word Bit switches
- b. Holds Byte Cycle trigger on

## 2.2 Status Test Cycle

- a. Holds Status Test Cycle trigger on

## 2.3 Modification Cycle

- a. Conditions Signal Simulation switches.
- b. Holds Modification cycle trigger on.

## 2.4 Deselect Cycle

- a. Holds Deselect Cycle trigger on.

## 2.5 Control Word Transfer Cycle

- a. Holds Control Word transfer cycle trigger on.

## 2.6 Data word transfer cycle

- a. Holds Data word transfer cycle trigger on.

## 2.7 Data Word Set-Up Cycle

- a. Holds Data Word Set up cycle trigger on.

## 2.8 Check Cycles

- a. Holds Check cycle trigger on.

## 2.9 Store Status Cycle

- a. Holds Store Status Cycle trigger on.

## 2.10 Scanning Cycle

- a. Holds Scanning Cycle trigger on.
- b. Inhibits address advancing.

**D** Push Buttons

## 1. Power ON

- a. Initiates the turn on of all power supplies in the Exchange.



- b. When power is fully on an automatic reset operation is initiated which conditions the Exchange for normal or test mode operation.
2. Power Off
    - a. Removes all power from the Exchange
  3. Start
    - a. Initiates continuous operation of the Exchange.
  4. Single Cycle
    - a. Allows one complete cycle of the selected test operation to be completed.
  5. Machine Reset
    - a. An automatic operation is carried out which resets the control triggers in the Exchange and the triggers for each I/O unit as listed under Machine Reset trigger.
  6. Clear and Reset
    - a. The operation under 5a is duplicated.
    - b. All unit control words in Exchange Memory are cleared.
  7. Stop
    - a. Turns on Block Clock trigger
    - b. Resets Hold Start trigger.
  8. Recorder Control
    - a. Initiates a recorder cycle
  9. Unit Test Read
    - a. Turns on Instruction Request trigger.
    - b. Turns on Read Trigger.
  10. Unit Test Write
    - a. Turns on Instruction Request trigger.
    - b. Turns on Write trigger.

11. Unit Test Control
  - a. Turns on Instruction Request trigger.
  - b. Turns on Control trigger.
  
12. Unit Test Locate
  - a. Turns on Instruction Request trigger
  - b. Turns on Locate trigger
  
13. Set SR and DWT Triggers
  - a. Sets pattern of Service Request and Data Word transfer switches into the corresponding triggers on specified tests.

IV Procedure and description of functions as performed with manual controls.

A Power ON (Refer to Fig. 1)

1. Push Power ON button

1.1 Power on is initiated to Exchange

1.2 When power is fully on a line comes up from the power supply section which initiates a single shot reset of 200 mus.

1.3 The SS pulse resets the following triggers.

OFF

Delay  
 Hold Start  
 Start 2  
 Start 3  
 Initial Load  
 Exchange Ready  
 Clock Trigger 1  
 I/O Address Register  
 Status Interrupt Triggers  
 Instruction Response Register  
 Operation Format Triggers  
 Instruction Request Trigger  
 Instruction Waiting Trigger  
 EMA Storage Register I  
 EMA Storage Register II  
 Weight Count  
 Weight Count Check

ON

Block Clock  
 Machine Reset  
 Clear Memory  
 Clock Triggers -  
 2, 3, 4, 5, 6, 7, 8, 9 and  
 10

The SS pulse also inhibits all osc. pulse outputs and initiates the Start 1 SS of 700 mus.

- 1.4 The first BN oscillator pulse after the Start I SS comes on turns on the Start 2 trigger.
- 1.5 The next AN pulse turns on the Start 3 trigger which turns the Block Clock trigger off. The clock emits a 10 time pulse as its first output.
- 1.6 The Machine Reset and Clear Memory triggers being on blocks all type cycles and forces the Exchange to execute reset cycles during which control words are cleared.
- 1.7 The Machine Reset Trigger being on causes the following triggers for each I/O unit to be reset.
  1. Select
  2. Deselect
  3. Channel Check
  4. Service Request
  5. Data Word Transfer
  6. "32" Bit
  7. Channel Start
- 1.8 The Clear Memory trigger being on blocks the Exchange Memory Sample gates.
- 1.9 At the completion of the reset cycles the Initial Load and the Exchange Ready triggers are turned on which put the Exchange in condition to operate either in normal mode or in test mode.

## B Machine Reset

1. Push Machine Reset button
  - 1.1 The same sequence occurs as when the Power On button is pushed with the exception of the Clear Memory trigger coming on.
  - 1.2 Any information in the Exchange Memory will be retained.

## C Clear and Reset

1. Push Clear and Reset button
  - 1.1 The power on sequence is duplicated.

## D Entering information into any address in the Exchange Memory.

1. Set Type Test switch to Exchange Memory Test position.
2. Set Advance switch off.
3. Set desired address with Exchange Memory Address switches.
4. Set desired information with Word Bit switches.
5. Push Single Cycle or Start button.
  - 5.1 Each 10 time pulse sets address into EMA Storage Register 1.
  - 5.2 The address in EMA Storage Register 1 is gated into EMAR at (1 + 2) time.
  - 5.3 The information presently at the address is read out to the word register but is not gated through the gating circuits.
  - 5.4 The information on the Word Bit switches is written back into the selected address.
  - 5.5 If Single Cycle was pushed the operation is stopped at 9 time and can be repeated as desired.
  - 5.6 If Start was pushed the Delay trigger is turned on at 4 time of the first cycle. This causes the Hold 1 trigger to be turned on at 7 time and the Idle Cycle trigger at the next 1 time. The Idle Cycle trigger being on prevents Exchange Memory driving pulses.

- 5.7 The Delay trigger remains on until Hold 9 is reached. It goes off at 4 time of Hold 9. This allows the Idle Cycle trigger to go off for one cycle and another information transfer takes place. The complete cycle is then repeated. This scheme prevents the same address in the Exchange Memory from being selected more than once every 10 microseconds in continuous operation.

E Entering information sequentially in any 32 word group.

1. Set Type Test switch to Exchange Mem. Test position.
2. Set Advance switch ON.
3. Set initial starting point with Exchange Memory Address switches 32, 64, and 128.
4. Set desired information with Word Bit switches.
5. Push Single Cycle or Start button.
  - 5.1 Each 10 time pulse sets the starting point of the address into EMA Storage Register 1.
  - 5.2 The Advance switch being on causes the address to be advanced by one during each cycle until the advancing address equals 31 at which time it starts over from zero.
  - 5.3 The address in EMA Storage Register 1 is gated into EMAR at (1 + 2) time.
  - 5.4 The information presently at each address is read out to the word register but is not gated through the gating circuits.
  - 5.5 The information on the Word Bit switches is written back into each address sequentially.

**F Simulation of a type cycle**

1. Set Type Test switch to Type Cycle Test position.
2. Set Type Cycle switch to desired cycle.
3. Set desired address with Ex. Mem. Adr. switches.
4. Set information on Word Bit switches if Byte Cycle chosen.
5. Set Signal simulation switches as desired if Modification Cycle chosen.
6. Push Single Cycle or Start Button
  - 6.1 If Single Cycle is pushed the test may be repeated as desired.
  - 6.2 If Start is pushed the Delay trigger and Hold Ring are used in the same manner as with the Exchange Memory Test without advance.
  - 6.3 EMA Storage Register 1 is used to supply the address on each cycle.

**G Main Memory Test**

1. Prior to executing this test a control word containing a word address, word count of anything but one, ready bit and parity bit must be inserted in a pre-selected location.
2. A data word in a corresponding location must also be inserted if read is to be tested.
3. Set Type Test switch to Main Memory Test position.
4. Set Main Memory Read - Write switch to desired test.

5. Turn on data word transfer trigger at the address where the control word was initially placed.
6. Push Start button
  - 6.1 All addressing will operate normally on this operation due to a DWT trigger being on.
  - 6.2 A data transfer operation beginning with a modification cycle will be continuously executed.
  - 6.3 The normal gating circuits are conditioned on the DWT cycle if the read trigger is on.
  - 6.4 The control word modification is inhibited during this test.

#### H Format Test

1. Prior to executing this test a control word containing specified bits must be inserted in a pre-selected location.
2. Set Type Test switch to Format Test position.
3. The Signal Simulation switches are set according to the pre-selected operation chosen to be tested.
4. Turn on data word transfer trigger at the address where the control word was initially placed.
5. Push Single Cycle or Start button
  - 5.1 All addressing will operate normally on this test due to a DWT trigger being on.
  - 5.2 The pre-selected operation will be continuously executed.



- 5.3 The modification cycle proceeds normally with the exception that the limit bit is blocked from being inserted in the control word when the word count reaches one.
- 5.4 Any bits initially inserted in the control word to select a specific operation are forced to remain in the control word.

## I Unit Test

1. Prior to executing this test a control word containing information to govern the operation of the selected unit must be inserted in the units control word location.
2. Set Type Test switch to Unit Test position.
3. Set up Address of unit to be tested on the Exchange Memory Address switches.
4. If a Write instruction is to be tested the word to be written is set up on the word Bit switches.
5. If a Control or Locate instruction is to be tested the Control or Locate information is set up on the Word Bit switches.
6. Push the Read, Write, Control or Locate Unit button.
7. Push the Start button.
  - 7.1 Addressing in this type of test is normal in all cases with the exception that the selected units address is available in EMA Storage Register 1 at all times.
  - 7.2 The Word Bit switches are used in supply the information which normally comes from Main Memory on Data Word Transfer cycle and the information which normally comes from the computer on a Data Word Set-Up Cycle in the Control or Locate instruction.

- 7.3 The Exchange will continually execute this test until the unit stops it or a word count of one is reached.

J       Scanner Test

1.    Set Type Test switch to Scanner Test position.
2.    Set up desired SR and DWT switches.
3.    Push Set SR and DWT Triggers button.
4.    Push Single Cycle or Start Button
  - 4.1   Addressing in this test is completely normal due to SR and DWT triggers being on.
  - 4.2   As each request is serviced the requesting trigger is turned off and remains off until they are all serviced at which time the initial set-up is fully loaded again and the operation repeats.

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