TO: Distribution

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SUBJECT: Use of the Bulk Store

This MOSN is intended to define how to set up the various
switches on the bulk store, how to alter the configuration ceck
to use the bulk store, and how to read any error messages that
might be printed by BOS or Multics relative to the bulk store.
Note: there is also included in this document a bulk store
configuration check list for service and development to be used
as a simple guide by operations for setting the switches on the
bulk store and memories. These check lists are in appendicies A
and B.

Port Select Switches

The first column of switches to be discussed are to be found in
the bulk store maintenance panel box labeled PORT SELECT. These
switches are called the PORT ENABLE switches and they are to be
set in either the ON or OFF position. As the name implies, these
switches are used to enable a path from the various memories to
the bulk store. Currently, memory A goes to bulk store port A,
memory B to port B, and memory C to port C.

The next column of switches in the PORT SELECT panel box are the
INITIALIZE ENABLE switches. These allow the receipt of an
initialize signal from the memory if they are enabled. They
should all be in the OFF position. Next is the column of
switches labeled ASSIGNMENT. In the case where several memories
are to be made available to the bulk store, it must know which
memory contains lower order addresses and which the higher. Thus
if memory A (bulk store port A) and memory B (port B) are hooked
up to the bulk store and memory A is the low memory, port A
assignment switches should be 000 and the port B assignment
switches should be 001.

The next column of switches are the ADDRESS RANGE switches and
these are used in the case where only half of a memory is on line
to the bulk store. Normally, all of these switches should be in
the FULL position. The next column of switches are the PORT GROUP
switches. It is possible to have several (up to 4) independent
computer systems attached to the bulk store. Since this will not
normally be done, a discussion of how this is possible is
deferred until later in this MOSN. The normal setting of these
switches will be 00 (port group 00) for the entire column. The

last column is labeled INTERLACE. These switches are used to
specify if a pair of memories attached to the bulk store are to
be accessed by the bulk store using none, 2-word, or 4-word
interlace.

BSU Select Switches

The next maintenance panel box is to the right of the PORT SELECT
box and it is labeled BSU SELECT. The main function of the
switches in this section is to subdivide the bulk store among
several independent computer systems in a variety of ways. The
leftmost column of switches in the BSU SELECT area is labeled
LOGICAL BSU. There are 8 logical Bulk Store Unit (BSU) channels
labeled A thru H. There are hardware patches associated with
these logical BSU channels which specify what the size of the
bulk store is for each logical BSU channel. These patches are on
logic boards, not on the maintenance panel. Currently, logical
BSU channels A and B are patched to a BSU size of 256K words. C
and D are patched to 512K words. E and F to 1M words, and G and H
to 2M words. Consequently, if one were to try to access the bulk
store thru logical channel A or B, one could only read 256K
words. Since the bulk store currently has 2M words, one could
use logical BSU channels G or H to access all 2M words. However,
since the normal mode of use for the bulk store for now will be
to share it between the development and service machines, we must
use several logical BSU channels to break the addressing
capabilities into small units. We will use the logical BSU
channel E to access the first 1M words, channel C to access the
next 512K words, and channels B and A to access the last two
groups of 256K words. The way in which one uses a logical BSU
channel is to enable it via the column of switches labeled PORT
GROUP ASSIGNMENT. It was mentioned previously that up to 4
computer systems could access the bulk store. These computer
systems are called PORT GROUPS in bulk store terminology. Service
will be designated as PORT GROUP 00; and development, as PORT
GROUP 01.

To give all 2M words to service, set the PORT GROUP ASSIGNMENT
switches labelled 00 opposite logical BSU channels A, B, C, and E
to the YES position. All other PORT GROUP ASSIGNMENT switches
should be in the down (NO) position. To give 1-3/4M words to
service, set the PORT GROUP ASSIGNMENT switches labeled 00 and
opposite logical BSU channels B, C, and E to YES. To give the
last 1/4M words to development, set the PORT GROUP ASSIGNMENT
switch labeled 01 and opposite logical BSU channel A to YES.

The column of WRITE INHIBIT switches should all be in the OFF
position. These switches may be used to prevent the writing of
certain portions of the bulk store.

Once the logical BSU channels have been selected, we must specify, via the ASSIGNMENT switches, how the logical BSU channels are to access physical bulk store memory. These switches are used the same way that the ASSIGNMENT switches are used for the memory ports. We will use logical BSU channel E to access the first 1M words so its ASSIGNMENT switches should be 000. Logical BSU channel C will be used to access the first half of the second 1M. Its ASSIGNMENT switches will be 010. (That means: take the logical BSU size, 512K, and multiply by the value in the ASSIGNMENT switches, 2, to get the first address to be accessed by that logical BSU channel). The value for logical BSU channel B will be 110, and 111 for A.

The next set of switches are labeled PHYSICAL BSU. These switches tell for each logical BSU channel what PHYSICAL BSU they refer to. Currently, we have two PHYSICAL BSU's numbered 4 and 5. Each has 1M words. We will let logical BSU channel E (1M words) access physical BSU 4. All other logical BSU channels (C, B, and A) whose sizes total 1M words will access physical BSU 5.

The final set of switches are labeled PHYSICAL BSU CONTROL. Switches 4 and 5 in this column should be in the up (or ON) position to enable the full 2M words (1M in physical BSU's 4 and 5).

Control Base Switches

This takes care of most of the configuration switches on the bulk store. The only remaining configuration switches to discuss are in the maintenance panel box labeled CONTROL BASE. There are two sets of switches in this box. One set is labeled PORT GROUP 00 and the other set is labeled PORT GROUP 01. These switches are used to set up the mailbox addresses on the first two independent computer systems. The mailbox addresses for the third and fourth computer systems (PORT GROUP 10 and 11) can be set up by hardware patches on logic boards if needed. Since the bulk store will probably only be accessed by two port groups, only the PORT GROUP 00 and 01 (service and development) switches need be set. The switches should be set to 1100 octal which is the address of the bulk store mailbox.

Miscellaneous Switches

The last switches to set are the following: the TEST/NORMAL switch should be set to TEST. The SYSTEM CONTROL & MONITOR switches should all be in the OFF position. The OPERATION RETRY switch should be in the DISABLE position. Finally, the ALARM DISABLE switch should be in the NORMAL position.

Configuration Cards

This takes care of all of the switches needed to configure the bulk store. A brief discussion of the configuration cards follows, but these cards are discussed further in MOSN-4.3 which will soon be reissued in which all Multics configuration cards are described. To configure the bulk store in a configuration card sense, one must have a BULK card. The format of the BULK card is as follows:

        BULK frec nrec port int_cell

where frec is the number of the first usable 1024 word record (usually 0), nrec is the number of 1024 word pages which may be used, port is the memory port to which the bulk store is attached, and int_cell is the interrupt cell assigned to the bulk store. Currently, nrec is 2048 (there are two million words of storage on the bulk store at this time), port is 2, and int_cell is 2.

If one wishes to use the bulk store as a paging device (the normal way in which it will be used), one must provide the following card:

        PAGE BULK frec nrec

where frec is the number of the first 1024 word record to be on the paging device and nrec is the number of 1024 word pages to be used for a paging device. Normally, 256 1024 word pages will be used in a development configuration while the entire 2048 pages will be used for a paging device in the service configuration.

In addition, one must specify a partition card such as the following:

        PART PAGE 0 4000 0 0 0 0 0 0 0 0   for service
                  or
        PART PAGE 3400 400 0 0 0 0 0 0 0 0   for development

As can be seen from this card, the device id assigned to the bulk store is 1. Consequently, if one were ever to run the bulk store as a normal device in the secondary storage heirarchy, one would produce a card such as the following:

        PART MULT 0 2048. 0 6000. 0 0 0 0 0 0

This card assigns the DSU-190s and the bulk store as secondary storage.

This completes the discussion of how to configure the bulk store. Figure 1 which follows defines the possible error messages that

can be received on the operator's console. In addition, a discussion follows which describes a way in which the bulk store will be shared between the service and development systems. Finally, it should be noted that the bulk store can be tested by BOS using the TEST command in exactly the same ways in which the bulk store or disks are currently tested (i.e., TEST PART PAGE ... where the bulk store is the paging device or TEST BULK DEVICE ... etc.).

Bulk_Store_Error_Message_Format

The bulk store error message is of the following format:

BULK STORE ERR, STATUS = x x x
CSB STATUS = 0, ADDR = z

If a non-zero CSB status is ever printed, a member of the Multics programming staff should be contacted immediately. DCB status consists of three 36-bit words. The first word is in the following format:
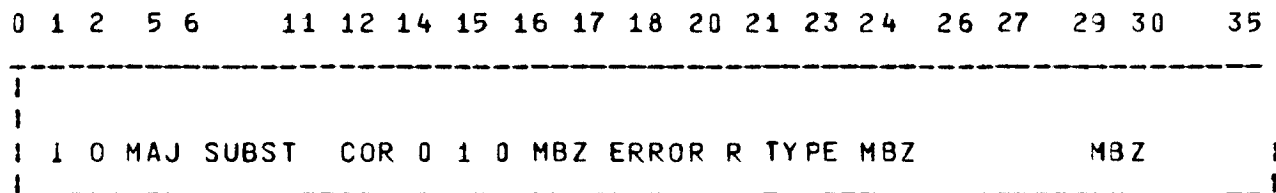
```
0 1 2   5 6      11 12 14 15 16 17 18 20 21 23 24  26 27  29 30    35
---------------------------------------------------------------------
!
!
! 1 0 MAJ SUBST   COR 0 1 0 MBZ ERROR R TYPE MBZ        MBZ        !
!_____!
```

Figure 1 Major_and_Minor_Status_Codes

Listed below are the various possible major and minor status conditions.

MAJOR STATUS CODE	CONDITION	SUBSTATUS CODE
0000	Subsystem Ready	000000
0010	Subsystem Attention	
	BSU Address Not Present	000000
	No Response From BSU	000010
	Error Detected in BSU	000100
	Hardware Write Inhibited	000001
0011	Data Alert	
	EDAC Detected Non-Correctable Data Error	000001
	Hardware Detected Data Error	00X010
	Hardware Detected Control Error	0010X0
	Failed to Compare	100000
	Write Verification Failed	010000
	Write Conditional Inhibited	000100
0100	End of File	000000
0101	DCB Commamand Reject	
	Invalid Instruction Code	000001
	Invalid BSU Address	000100
	Hardware Detected Control Error	00X010
1101	DCW Reject	
	Hardware Detected Control Error	0010X0
	Hardware Detected Data Error	00X010
	DCW Out of Bounds	000100
	Invalid DCW	000001
	Hardware Detected Data Error	00X010

The second word and the third word of the status codes are for use of FED (Site Engineers) in further analyzing bulk store errors. "z" is the bulk store address.

APPENDIX A

CHECKLIST_FOR_CONFIGURING_THE_BULK_STORE_FOR_SERVICE_ONLY

1) Enable the port to which the bulk store is attached at each memory controller being used on service.

2) At the bulk store, set the PORT ENABLE switches for each memory being used on service to the ON position All other FORT ENABLE switches should be in the OFF position.

3) Make sure all INITIALIZE ENABLE switches are in the OFF position.

4) Set the ASSIGNMENT switches for the bulk store port attached to the low order service memory to 000. If there are three memories on service, set the ASSIGNMENT switches for the bulk store port attached to the middle order service memory to 001. Set the ASSIGNMENT switches for the high order memory to 010.

5) Set all ADDRESS RANGE switches to the FULL position.

6) Set the PORT GROUP switches for the three service memories to 00.

7) Set all INTERLACE switches to to the appropriate values.

8) Set the PORT GROUP ASSIGNMENT switch labeled 00 opposite LOGICAL BSU CHANNELS E,C,B, and A to the YES position. All other PORT GROUP ASSIGNMENT switches should be in the NO position.

9) Set the ASSIGNMENT switches for LOGICAL BSU A to 7 and the PHYSICAL BSU switches for LOGICAL BSU A to 5. For LOGICAL BSU B, they should be 6 and 5; for LOGICAL BSU C, they should be 2 and 5; and for LOGICAL BSU E, they should be 0 and 4. 10) Set all WRITE INHIBIT switches to the OFF position.

11) Set the PHYSICAL BSU CONTROL switches labeled 4 and 5 to the ON position. All other PHYSICAL BSU CONTROL switches should be in the OFF position.

12) Set the CONTROL BASE switches for PORT GROUP 00 to 1100 octal.

13) Set the TEST/NORMAL switch to TEST, the OPERATION RETRY switch to the DISABLE position, the ALARM DISABLE switch to the NORMAL position, and all the SYSTEM CONTROL & MCNITOR switches to the OFF position.

In addition, the following service and development configuration cards should be in the service and development config decks:

```
PART PAGE 0 4000 0 0 0 0 0 0 0 0
PAGE BULK 0 4000
BULK 0 4000 2 2
```

APPENDIX B

CHECKLIST FOR CONFIGURING THE BULK STORE FOR SERVICE AND DEVELOPMENT

1) Enable the port to which the bulk store is attached at each memory controller being used on development and service.

2) At the bulk store, set the PORT ENABLE switches for the memories being used to the ON position. All other PORT ENABLE switches should be in the OFF position.

3) Make sure all INITIALIZE ENABLE switches are in the OFF position.

4) Set the ASSIGNMENT switches for the bulk store port attached to the development memory to 000. Set the ASSIGNMENT switches for service memories as described in APPENDIX A, part 4.

5) Set all ADDRESS RANGE switches to the FULL position.

6) Set the PORT GROUP switches for the two service memories to 00. Set the PORT GROUP switch for the development memory to 01.

7) Set all INTERLACE switches to to the appropriate values.

8) Set the PORT GROUP ASSIGNMENT switch labeled 00 opposite LOGICAL BSU channels E, C, and B to the YES position. Set the PORT GROUP ASSIGNMENT switch labeled 01 opposite LOGICAL BSU channel A to the YES position. All other PORT GROUP ASSIGNMENT switches should be in the NO position.

9) Set the ASSIGNMENT switches for LOGICAL BSU A to 7 and the PHYSICAL BSU switches for LOGICAL BSU A to 5. For LOGICAL BSU B, they should be 6 and 5; for LOGICAL BSU C, 2 and 5; and for LOGICAL BSU E, 0 and 4.

10) Set all WRITE INHIBIT switches to the OFF position.

11) Set the PHYSICAL BSU CONTROL switches labeled 4 and 5 to the ON position. All other PHYSICAL BSU CONTROL switches should be in the OFF position.

12) Set the CONTROL BASE switches for PORT GROUP 00 and 01 to 1100 octal.

13) Set the TEST/NORMAL switch to NORMAL, the OPERATION RETRY switch to the DISABLE position, the ALARM DISABLE switch to the NORMAL position, and all the SYSTEM CONTROL & MONITOR switches to the OFF position.

In addition, the following configuration cards should be in the service and development config decks:

Service

```
PART PAGE 0 3400 0 0 0 0 0 0 0 0
PAGE BULK 0 4000 3400 400
BULK 0 4000 2 2
```

Development

```
PART PAGE 3400 400 0 0 0 0 0 0 0 0
PAGE BULK 3400 400
BULK 0 4000 2 2
```