

# HP 3000 HARDWARE ARCHITECTURE



# BLOCK DIAGRAM

DIRECT I/O

START I/O

CHANNEL PROGRAMMING

SIO MULTIPLEXER

PORT CONTROLLER—

SELECTOR CHANNEL



# DIRECT I/O

The ability of the computer to communicate with an I/O device on a one word per instruction basis.

# START I/O

The ability of the computer to set up multi-word transfers between memory and I/O devices.

# CHANNEL PROGRAMMING

The program instructions used to control the transfers in the start I/O mode.



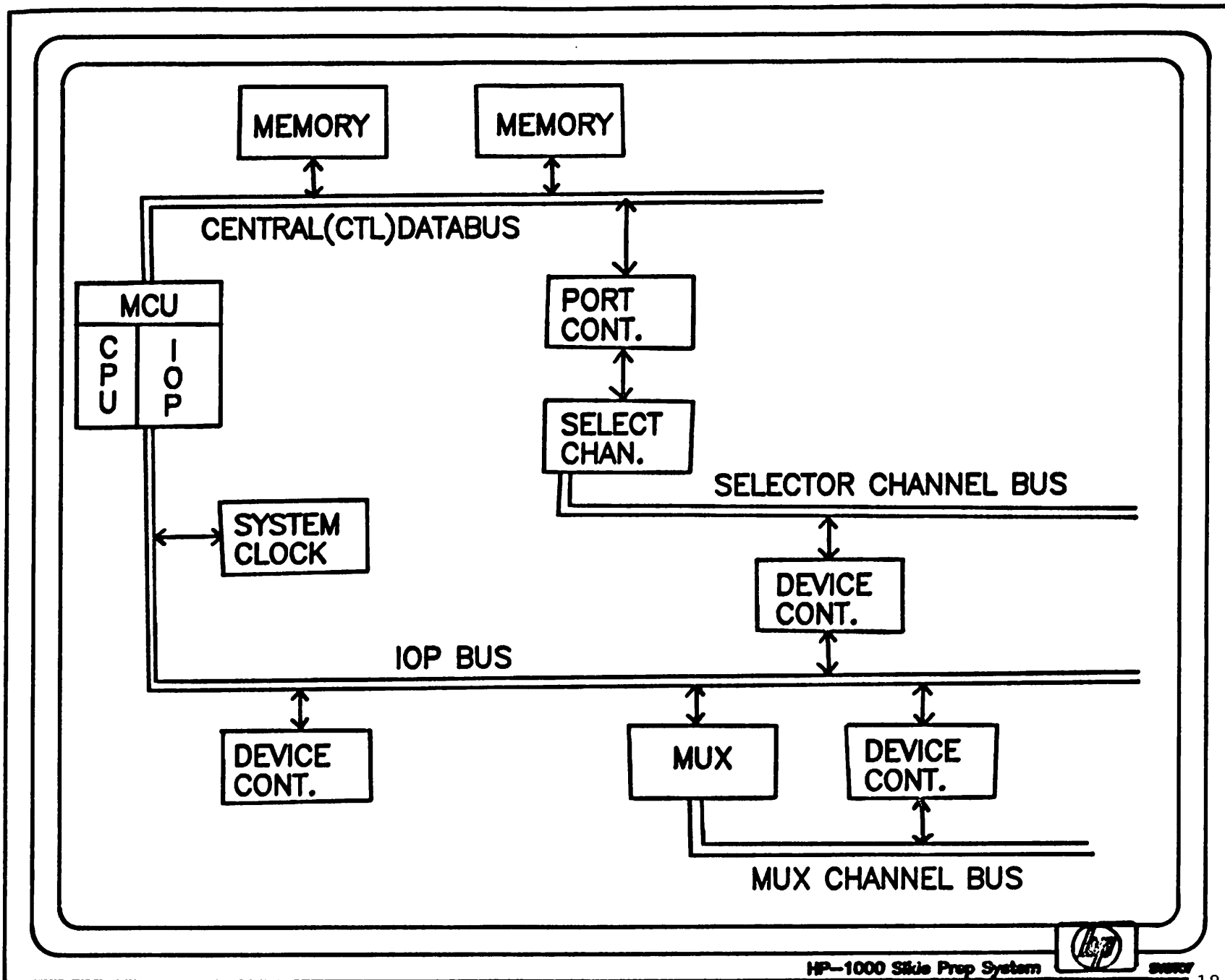
# SIO MULTIPLEXER

The hardware subsystem that controls the execution of the channel programs on up to 16 I/O devices at a time.

# PORT CONTROLLER- SELECTOR CHANNEL

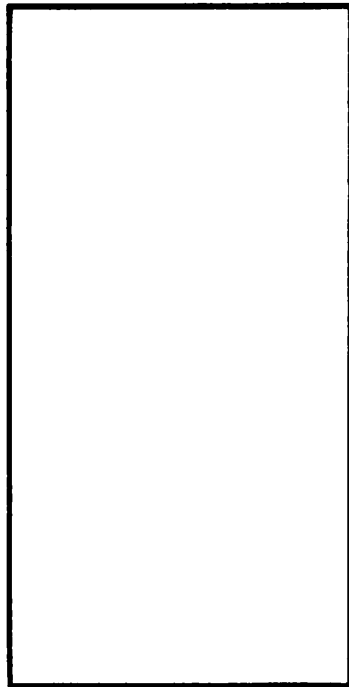
The hardware subsystem that controls the execution of the channel programs on high speed devices.



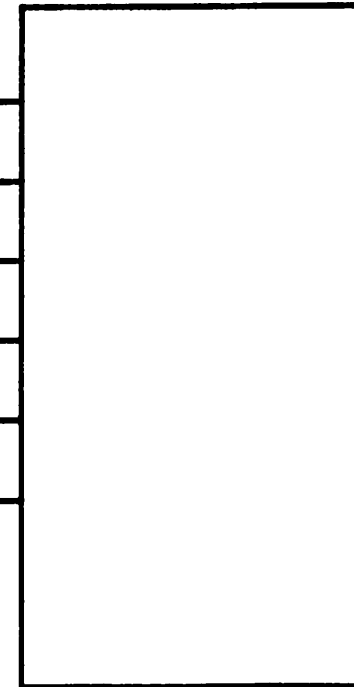


# CTL BUS

MCU



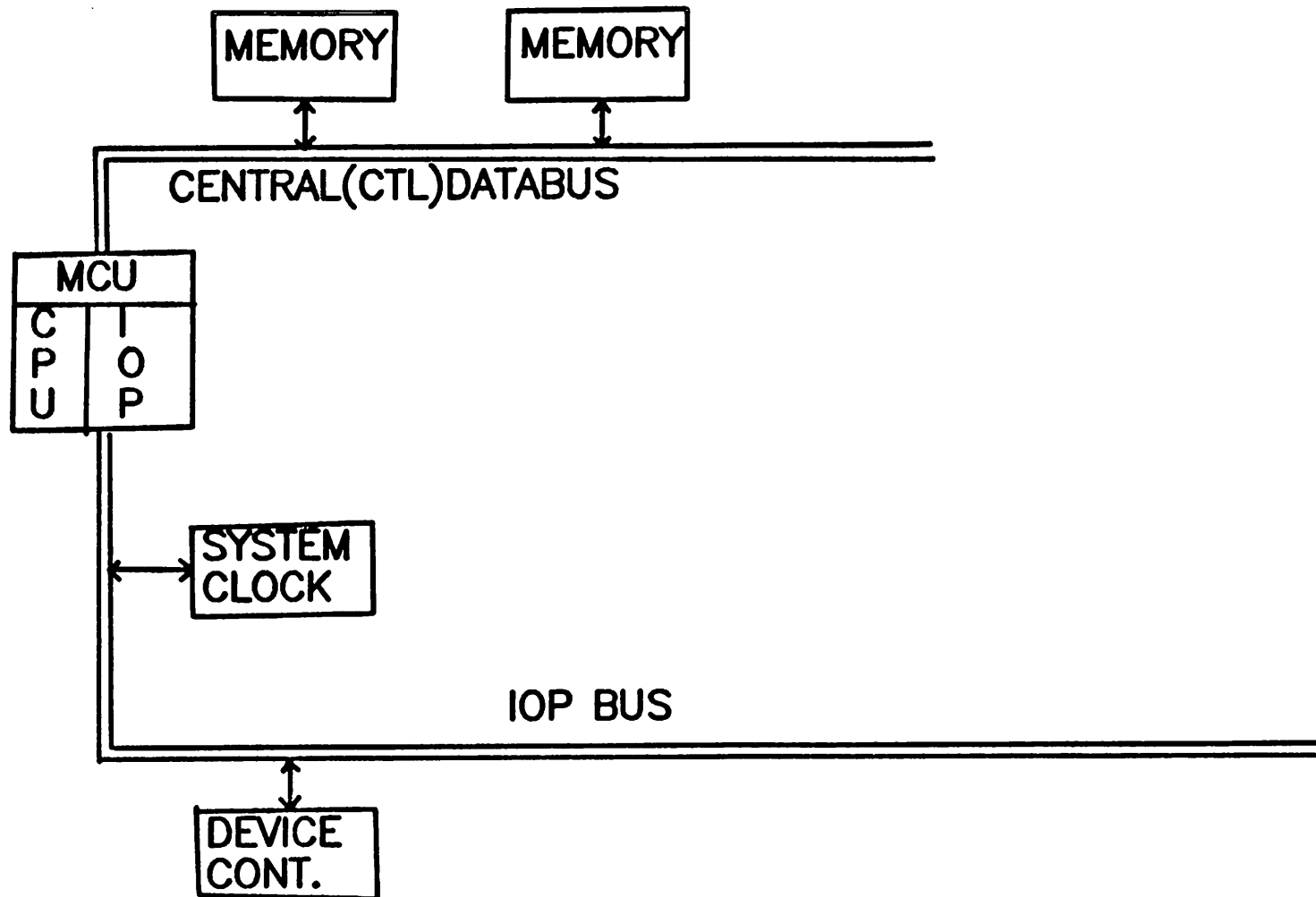
MEMORY



|        |    |
|--------|----|
| DATA   | 17 |
| TO     | 3  |
| FROM   | 3  |
| MOP    | 2  |
| READY  | 7  |
| ENABLE | 6  |



# DIRECT I/O



# DEVICE CONTROLLER

The hardware that interfaces the iop bus to an I/O device.

# IOP

The hardware that interfaces the cpu to the iop bus.

# DRT NUMBER

A number to which only one DC will respond.

# IOP BUS

A multi lined cable which connects the iop to all device controllers. It carries data, drt number and handsake signals

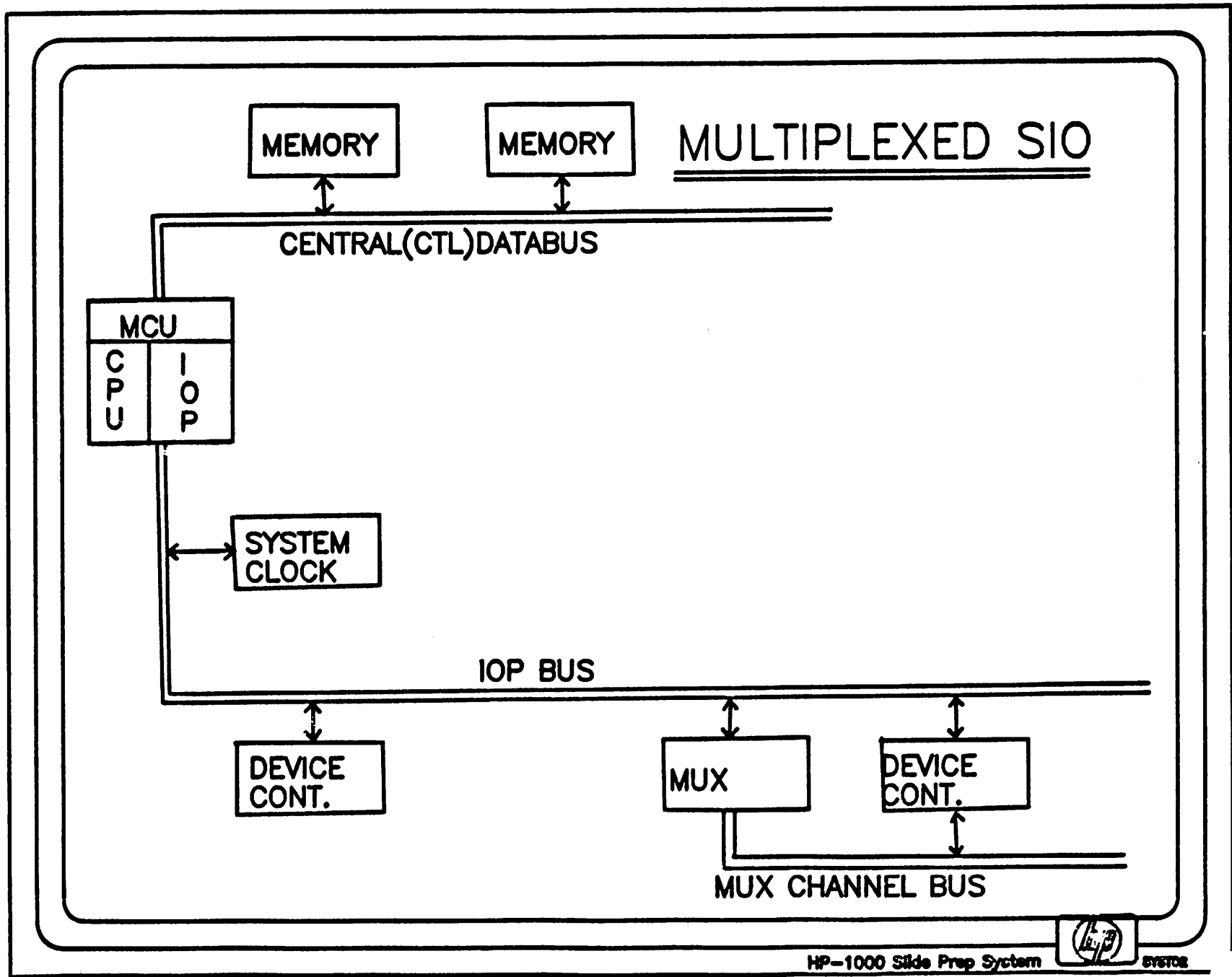




# COLD LOAD ON DRT 6

|    |        |                     |
|----|--------|---------------------|
| 30 | 000031 | PROG POINTER        |
| 31 | 014000 | SET BANK            |
| 32 | 000000 | BANK NUMBER         |
| 33 | 040000 | CONTROL             |
| 34 | 000006 | CONTROL WORD (READ) |
| 35 | 077740 | READ 32 WORDS       |
| 36 | 000037 | READ TARGET ADDRESS |
| 37 | 034000 | END—JUST IN CASE    |







0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|        |         |       |
|--------|---------|-------|
| D<br>C | ORDER   | COUNT |
|        | ADDRESS |       |

I O C W

I O A W



# READ

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|--------|---|---|---|---|---|---|---|---|---|---|---|
| D | 1 | 1 | 1 | -Count |   |   |   |   |   |   |   |   |   |   |   |
| C | . | . | . | .      | . | . | . | . | . | . | . | . | . | . | . |

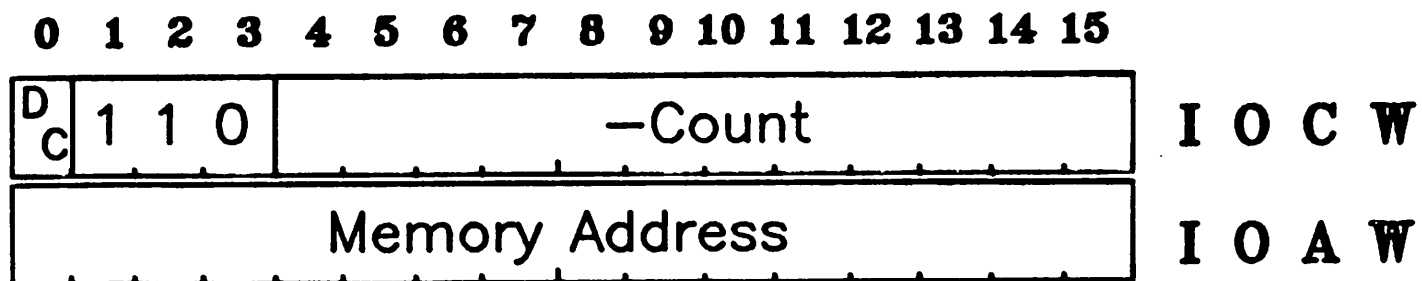
I O C W

|                |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Memory Address |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| .              | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . |

I O A W



# WRITE



# CONTROL

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|   |   |   |   |                    |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |
|---|---|---|---|--------------------|--|--|--|--|--|--|--|--|--|--|--|---|---|---|---|
| 0 | 1 | 0 | 0 | I/O Command Code 1 |  |  |  |  |  |  |  |  |  |  |  | I | O | C | W |
|   |   |   |   | I/O Command Code 2 |  |  |  |  |  |  |  |  |  |  |  | I | O | A | W |



# END

If Bit 4 Then Interrupt

| 0                      | 1 | 2 | 3 | 4 | 5        | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15      |         |
|------------------------|---|---|---|---|----------|---|---|---|---|----|----|----|----|----|---------|---------|
| 0                      | 0 | 1 | 1 | 1 | Not Used |   |   |   |   |    |    |    |    |    |         | I O C W |
| Returned Device Status |   |   |   |   |          |   |   |   |   |    |    |    |    |    | I O A W |         |



# SENSE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|   |   |   |   |          |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|----------|--|--|--|--|--|--|--|--|--|--|--|
| 0 | 1 | 0 | 1 | Not Used |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|----------|--|--|--|--|--|--|--|--|--|--|--|

I O C W

|                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Returned Device Status |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

I O A W



# INTERRUPT

| 0        | 1 | 2 | 3 | 4        | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |   |   |   |   |
|----------|---|---|---|----------|---|---|---|---|---|----|----|----|----|----|----|---|---|---|---|
| 0        | 0 | 1 | 0 | Not Used |   |   |   |   |   |    |    |    |    |    |    | I | O | C | W |
| Not Used |   |   |   |          |   |   |   |   |   |    |    |    |    |    |    | I | O | A | W |



# SET BANK

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|   |   |   |   |   |          |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|----------|--|--|--|--|--|--|--|--|--|--|
| 0 | 0 | 0 | 1 | 1 | Not Used |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|----------|--|--|--|--|--|--|--|--|--|--|

I O C W

|          |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |
|----------|--|--|--|--|--|--|--|--|--|--|--|--------|--|--|--|
| Not Used |  |  |  |  |  |  |  |  |  |  |  | Bank # |  |  |  |
|----------|--|--|--|--|--|--|--|--|--|--|--|--------|--|--|--|

I O A W



# RETURN RESIDUE

| 0                        | 1 | 2 | 3 | 4 | 5        | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |   |   |   |   |
|--------------------------|---|---|---|---|----------|---|---|---|---|----|----|----|----|----|----|---|---|---|---|
| 0                        | 0 | 0 | 1 | 0 | Not Used |   |   |   |   |    |    |    |    |    |    | I | O | C | W |
| Returned Count (Residue) |   |   |   |   |          |   |   |   |   |    |    |    |    |    | I  | O | A | W |   |

# JUMP

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|   |   |   |   |          |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|----------|--|--|--|--|--|--|--|--|--|--|--|
| 0 | 0 | 0 | 0 | Not Used |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|----------|--|--|--|--|--|--|--|--|--|--|--|

I O C W

|                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Jump Target Address |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

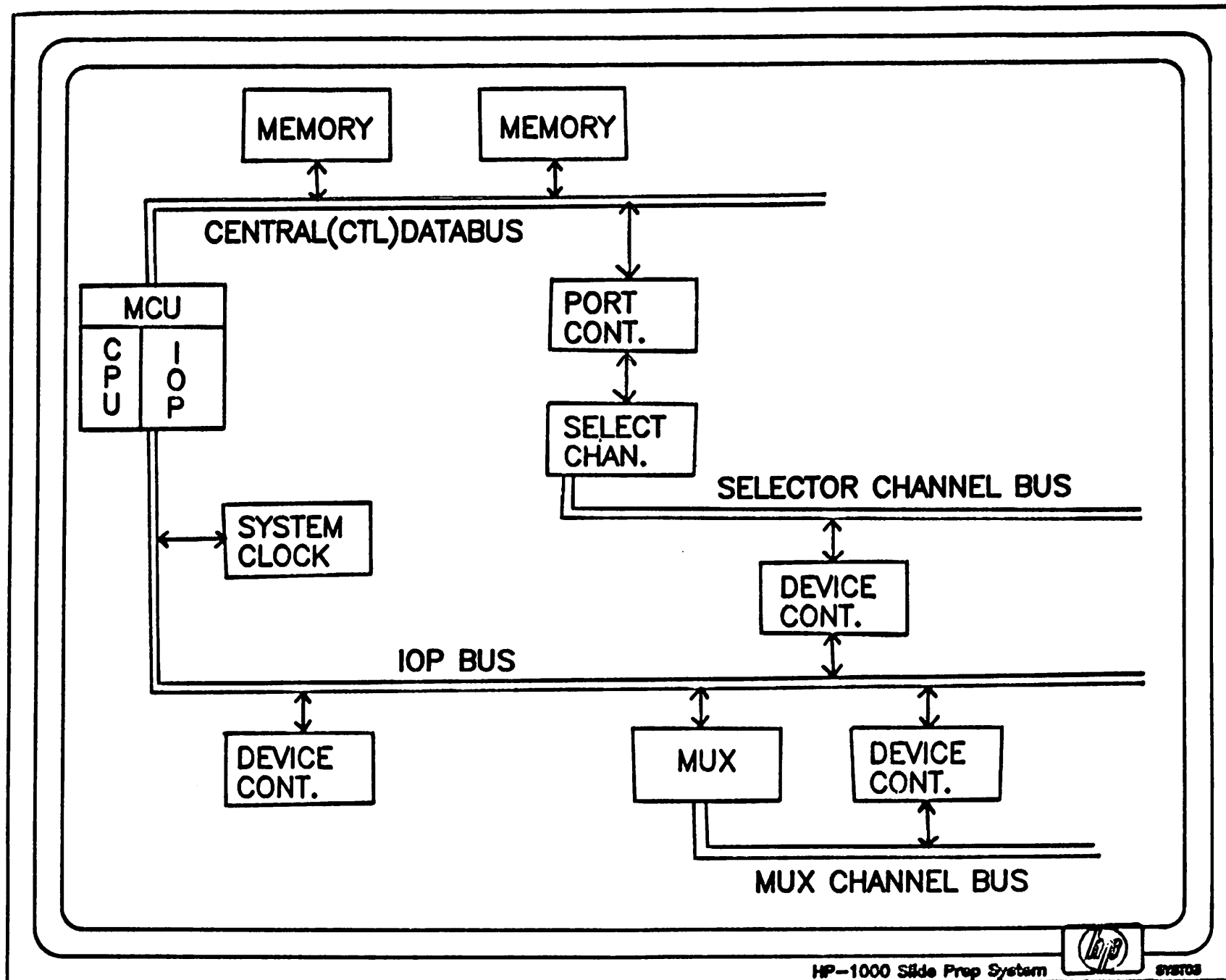
I O A W



## COLD LOAD ON DRT 6

|    |        |                      |
|----|--------|----------------------|
| 30 | 000031 | Prog Pointer         |
| 31 | 014000 | Set Bank             |
| 32 | 000000 | Bank number          |
| 33 | 040000 | Control              |
| 34 | 000006 | Control word(read)   |
| 35 | 077740 | Read 32 words        |
| 36 | 000037 | Reads target address |
| 37 | 034000 | End—Just in case     |





# DRT FETCH

Mux. tells the IOP. to read memory  
Mux. tells the DC to give its device #  
times 4 as the address to be read  
IOP reads memory and puts the returned  
word on the IOP BUS. It then updates  
the word by 2 and writes it back  
Mux stores this word and advances to the  
next state "IOCW FETCH"





## IOCW FETCH

Mux. tells the IOP to do a read and gives the word it just recieved as the address to be read

IOP reads memory and puts the returned word on the IOP BUS

Mux. stores this word and advances to the next state "IOAW FETCH"



# IOAW FETCH

Mux. tells the IOP to do a read and gives the  
(word read in the DRT FETCH STATE)+1 as the  
address to be read

IOP reads memory and puts the returned word  
on the IOP BUS.

Mux. stores this word and advances to the next  
state.

## DATA read

Mux. tells the IOP to do a write and gives its address register as the address to be written

Mux. tells the DC to give its data register as the word to be written

IOP writes the data into the given address

Mux. updates the address register by 1 and counts the word count by 1

If the word count rolls over then advance to the next state "DRT FETCH"  
else same state



# DATA write

Mux. tells the IOP to do a read and gives its address register as the address to be read

IOP reads memory and puts the returned word on the IOP BUS

Mux. tells the DC to store this word into its Data register

Mux. updates the address register by 1 and counts the word count by 1

If the word count rolls over then advance to the next state "DRT FETCH" else same state