

FILE MEMO

SUBJECT: Multiprogram Control - Signals from the Operator to the Supervisory Program

DATE: January 2, 1958

NOTE: The purpose of this memorandum is to describe the kind of signals which are envisaged, rather than present a complete list precise in every detail

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Signals between the operator and supervisory program (SP) can be classified according to the following purposes:

1. Control over the sequence in which problem programs (PP) are executed.
2. Informing the SP about machine conditions which it is unable to sense itself (for example, that a unit is being taken out of service).
3. Control over the handling of cards, tapes and forms.
4. Miscellaneous purposes (for example, supplying last-minute requirements for a debugging or production run.)

The signals described below refer to the first two of these purposes only, and also concern communication from the operator to the SP and not vice versa.

It is anticipated that messages between the operating staff and the SP will be handled by one or more inquiry stations reserved exclusively for the SP. Further, these messages will be expressed in a mnemonic code readily understandable by human beings, but a good deal more concise than plain language (compare the communication techniques used internally by airlines in current reservations procedures).

Although the use of a standard code for communication between the operator and the SP will yield many benefits, a programmer may desire to use any arbitrary code for communication between his PP and himself. The supervisory program will handle this as follows: when the time comes for I/O units to be assigned to this PP, the SP will, if possible, reserve an inquiry station for the exclusive use of this PP. During execution of the PP,

the SP will handle requests for reading and writing using this inquiry station in the same way as for any other I/O unit assigned to a PP. In other words, the SP will actually issue the READ and WRITE instructions but will remain unaware of what information is read or written and unconcerned about the areas of memory used except that these should lie within the bounds of the given PP. Sharing of inquiry stations by several PPs or by a PP and the SP will be discussed elsewhere.

The signals described below are accompanied in some cases by identification of a problem program, in others by identification of an I/O unit and in others by identification of some other message. The relevancy of these pieces of information will be apparent from the description of the signal.

Since signals will be in a fairly concisely coded form, several may be included in a single message.

#### DO PP NEXT

Examine available space vector: \*if enough available, bring PP into memory and execute. If not enough space available now, prevent introduction of any PP until sufficient is available for this one, and then bring this one in.

#### STOP PP NOW

Turn off Master Resume Bit. When turned off this bit prevents any of the instruction streams for the specified PP from being resumed.

#### BREAKPOINT STOP PP (specified level)

1. SP turns on the breakpoint bit
2. PP branches to SP at each breakpoint when this bit is on
3. When breakpoint is reached with specified character following the branch, PP is terminated.

#### RESUME PP

Turn on Master Resume Bit. When turned on, this bit allows resumption of the instruction streams belonging to the specified PP.

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\* The available space vector describes the availability of space in memory and disk storage and of I/O units by type.

## RELOCATE PP

Is destination area available? If yes, relocate at next relocation breakpoint. If no, send check signal to the operator.

## CANCEL PENDING PP

Sets select bit to zero. When turned off, this bit prevents the specified PP from being called into memory for execution.

## RESTORE PENDING PP

Sets select bit to one. When turned on, this bit allows the specified PP to be brought into memory for execution according to the scheduling arrangements. After the PP has been brought in, its select bit is turned off.

## UNLOAD PP

1. Releases any I/O units currently being used by the specified PP. Puts tapes for this PP in a rewind-unready status.
2. Issues unloading instructions to operators.
3. Adjusts available space vector.
4. Examines next code in operator's message to determine if the normal end-of-PP procedure is to be put into effect or an abnormal procedure specified by the supervisor.

## RE-SCHEDULE

Sets up new schedule in place of the existing specified one (several are assumed to exist)

(PPs in process or completed are not affected).

## SCHEDULE

Adds specified names of PP's to the existing specified schedule preserving sequence.

(PPs in process or completed are not affected).

**CANNOT COMPLY**

Indicates to the SP that it has issued a request to the operating staff which cannot be executed. The particular request is identified in this signal.

YES  
NO

Responses by operator to information requests from the SP. Must be accompanied by identification of signal from SP which is being answered.

**OUT-OF-SERVICE NOW**

1. Release any I/O activity for specified unit.
2. Change corresponding bit in the unit bit map to 0.
3. Turn off the Master Resume Bit for the affected PP.
4. If another unit of same kind is available, it is reserved. SP notifies operator of this, or that no unit is available. Subtract one from available space vector (corresponding component) and sign test. If negative, SP remembers to allocate first available unit of this type to given PP.

**BREAKPOINT OUT-OF-SERVICE**

1. Take affected PP to next breakpoint of specified level.
2. & 3. Same as out-of-service now, but executed at breakpoint.
4. Ditto but executed now.

**IN-SERVICE**

Change corresponding bit in the unit bit map to one.

**DUMP PP**

1. Dumps on a tape associated with the SP the whole PP in binary together with the lower bound currently in effect for this PP.

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2. Issues signal to operator regarding completion of dump.
3. Makes an entry in a directory of dumped programs.



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