REFERENCE MANUAL

FOR THE

SDS 930 TELETYPE INTERFACE

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I. Introduction

The teletype interface permits the transfer of 11-unit, 10-character-per-second teletype information between any SDS 900 series computer and 16 Model 33 or Model 35 Teletype printer keyboards. Each of the 16 lines is full duplex, and all of the lines can be active simultaneously. The interface operates through the parallel I/O connector of the computer and uses two of its interrupt locations.

Each of the 16 teletypes has a transmit and a receive character buffer which perform all necessary serial-to-parallel and parallel-to-serial operations and provide the necessary control timing. Flags associated with each transmit and receive buffer indicate when a character has been transmitted or received. The flags are continuously scanned by a scanning unit within the interface. Upon encountering a transmit (receive) flag, the scanner is stopped and an interrupt unique to the transmit (receive) operation is issued. At this time the scanner register contains the 4-bit address of the raised flag. The scanner is subsequently restarted when the computer reads the character into (out of) the corresponding buffer.

A program option is provided to allow for the suppression from the scan of a particular transmit flag, thus prohibiting an interrupt at the completion of the transmit operation. Also, a skip instruction is provided for testing for raised transmit flags.

II. Instructions

The following is a list of the instructions which pertain to the teletype interface:

1. Select Teletype Interface, EOM

0	0 2	3	0 0 0 1

    0   3   9   12

    This instruction selects the teletype interface; i.e., the execu-

    tion of this instruction causes the interface to be electrically

    connected to the I/O connector. The interface will remain selected

    until another EOM instruction is executed.

2. Output Character and Set Interrupt Control, POT. (The format of
    this instruction is given on Page 74 of the SDS 930 Reference
    Manual.)

    This instruction transfers a word from the specified memory location

    to the teletype interface. The transferred word contains a TTY

    address, an interrupt specification and, in appropriate cases, a

    character to be transmitted. The format of this word is as follows:

Bits

0 - 7   The character to be transmitted

           1 if the character (Bits 0 - 7) is not to be transferred
           to the transmit buffer
8
           0 if the character is to be transferred

           1 if an interrupt is to occur at the completion of the
           transmission
9
           0 if the interrupt is not to occur

           1 if the input and output interrupts are to be enabled
           (See the Operation Section for details.)
10
           0 otherwise

11 - 18   Not interpreted

19 - 23   TTY address

It should be noted that if Bit 8 of the outputted word is one, this instruction can be executed at any time without affecting the specified transmit buffer.

3. Read Teletype Address and Data, PIN. (The format for this instruction is given on Page 74 of the SDS 930 Reference Manual.)

    This instruction transfers a word from the teletype interface into the memory location specified. When this instruction is executed in response to a teletype input or output interrupt, the word transferred into memory will contain the address of the teletype causing the interrupt and, in the case of an input interrupt, it will also contain the inputted character. The format of this word is as follows:

<u>Bits</u>

0 - 7   The inputted character when responding to an input interrupt and zero when responding to an output interrupt

8 - 18   Zero

19 - 23 The address of the teletype causing the interrupt

4. Skip if Transmitter Not Busy, SKS.

	0	40	3	0	TTY address	0		01
0		3 9	12	13		16	17 18	23
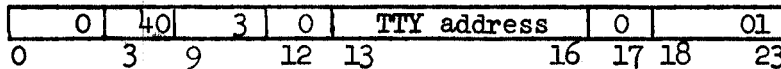
This instruction causes the next instruction in sequence to be skipped if the teletype transmit buffer specified by the instruction is not busy, i.e., the transmit flag is raised.

III. Operation

    As a result of pressing the start button on the CPU, the teletype interface is initially in a state such that it <u>will</u> <u>not</u> send interrupt

requests to the CPU. The normal operating state is effected by output-
ting a word with Bit 10 equal to one. This word may also contain fur-
ther information such as a character to be transmitted. When in the
normal operating state, the interface will issue a receive interrupt
request each time the scanner encounters a receive flag (indicating a
character is in the receive buffer) and will issue a transmit interrupt
request each time a transmit flag, together with its interrupt control
flag, is encountered (indicating that the transmit buffer is clear and
that the interrupt specification requested an interrupt at the completion
of transmission).

When responding to a receive interrupt, it is necessary only to sup-
plement the normal interrupt servicing routine with an EOM-PIN combination
to effect the input operation.

When responding to a transmit interrupt, it is first necessary to
input the teletype address with an EOM-PIN combination and then to output
the interrupt specification and the character to be transmitted with an
EOM-POT combination.

When transmitting a character at an arbitrary time (not in response
to an interrupt), the EOM-POT combination should be preceded by a skip
instruction to assure that the transmit buffer is not busy. If only the
interrupt specification is to be set (Bit 8 of the outputted word is one),
then the EOM-POT combination can be executed at any time since the inter-
rupt specification is independent of the transmit buffer.

IV. Interrupt Procedure

The scanner is halted every time that a receive flag or a transmit flag, together with its interrupt control flag, is encountered and will remain halted until the flag is cleared by the execution of a PIN instruction in the case of a receive flag, or by a POT instruction in the case of a transmit flag. During the time that the scanner is stopped, an interrupt request corresponding to the type of flag encountered (transmit or receive) will be sent to the CPU.

As a result of this scanning procedure and of the priority interrupt system of the CPU, the following facts hold:

1. The receive interrupt routine will not be interrupted by either a TTY transmit or receive interrupt.

2. The transmit interrupt routine will not be interrupted by a transmit interrupt and can be interrupted by a receive interrupt only after the transmit flag causing the interrupt has been cleared.

V. Timing

A receive or transmit interrupt must be serviced within approximately 600 usec. after it occurs to assure that no information will be lost. This results from the fact that a receive buffer allows approximately 18 msec. for servicing and the scan procedure is such that the case could occur in which all 16 transmitters and 15 of the receivers would have to be serviced before a given receive flag would be encountered.