60399900

CONTROL DATA CORPORATION

CONTROL DATA®
6671-3
DATA SET CONTROLLER

HARDWARE REFERENCE MANUAL

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PREFACE

This manual contains system application, descriptive, operational, and programming information on the CONTROL DATA® 6671-3 Data Set Controller. Customer engineering information is in separate manuals. Refer to the Literature Distribution Services Catalog for ordering information.

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FUNCTIONAL DESCRIPTION 1

INTRODUCTION

The CONTROL DATA® 6671-3 Data Set Controller (DSC) is a multiplexer which interfaces CONTROL DATA® CYBER 70 or 6000 Series Computer Systems with remote communications terminals. The DSC has a maximum transfer rate of 9600 baud to/from the modem. The DSC interfaces as many as 16 remote-terminal modems (AT&T 103 Teletype Data Sets, 201A/B Dataphone Data Sets, or any standard interface as defined by EIA RS232 specifications). The 16 modems can be arranged in any combination. Remote-terminal modems can be located several thousand miles away provided that voice-grade telephone lines or telephone data service is available. This results in immediate on-line access capabilities to a centrally located computing facility. The DSC with a software package permits users at remote terminal locations to write routines, debug programs, establish files, and modify existing data without being at the computer site. A typical CYBER 70 or 6000 Series computer interfaced with remote communications terminals is shown in Figure 1-1.

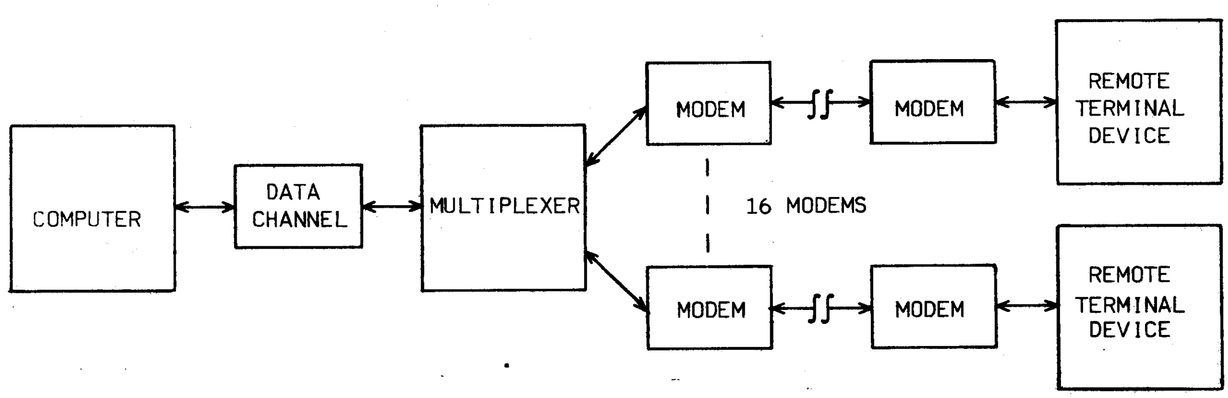


Figure 1-1. Typical Controller Application

DATA TRANSFER

RATE

The transfer rate of 12-bit data words between the data channel and the DSC is approximately 0.5 MHz. This permits the input of a 16-word block in approximately 32 microseconds. Transmission rates of 8-bit characters (plus data control pulses) between the DSC and remote-terminal equipment are determined by the modem as follows.

Typical Modems (Data Sets)	Baud (bits per second)	Mode
AT&T 103	110, 134.5, 150, 300	103
AT&T 202	600, 1200	103
AT&T 201A	2000	201
AT&T 201B	2400	201
Milgo 4400/48	4800	201
Milgo 5500/96	9600	201

At the above rates, with a terminal active, the DSC requires an input operation based on the character time of the baud rates being processed on the multiplex channels, or data may be lost. The character times per baud rates are:

Baud	Character Time (milliseconds)
110	100.0
134.5	66.92
150	66.67
300	33.33
600	16.67
1200	8.33
2000	4.00
2400	3.33
4800	1.67
9600	0.833

MODE

The DSC operates in both half- and full-duplex modes; the mode is determined by the type and configuration of the modem used. The 103 mode is related to asynchronous data transmission, and the 201 mode is related to synchronous data transmission. Data is transferred between the DSC and terminals in only one direction (either transmit or receive) at a time in half-duplex mode and in both directions simultaneously in full-duplex mode. The DSC is capable of full-duplex operation with 16 4800-baud data terminals in either line or consecutive data block mode. For 9600 baud data terminal operation, the 9600 baud terminals are used on only the lower eight multiplex channels (0 through 7) while the upper eight multiplex channels (8 through 15) are inactive (which means no data transmitted or received). The number of possible system configurations is dependent on the various modem speeds and the nature of the software operating system. The interconnecting transmission lines between the DSC, the data channel, and the major DSC circuits are shown in Figure 1-2.

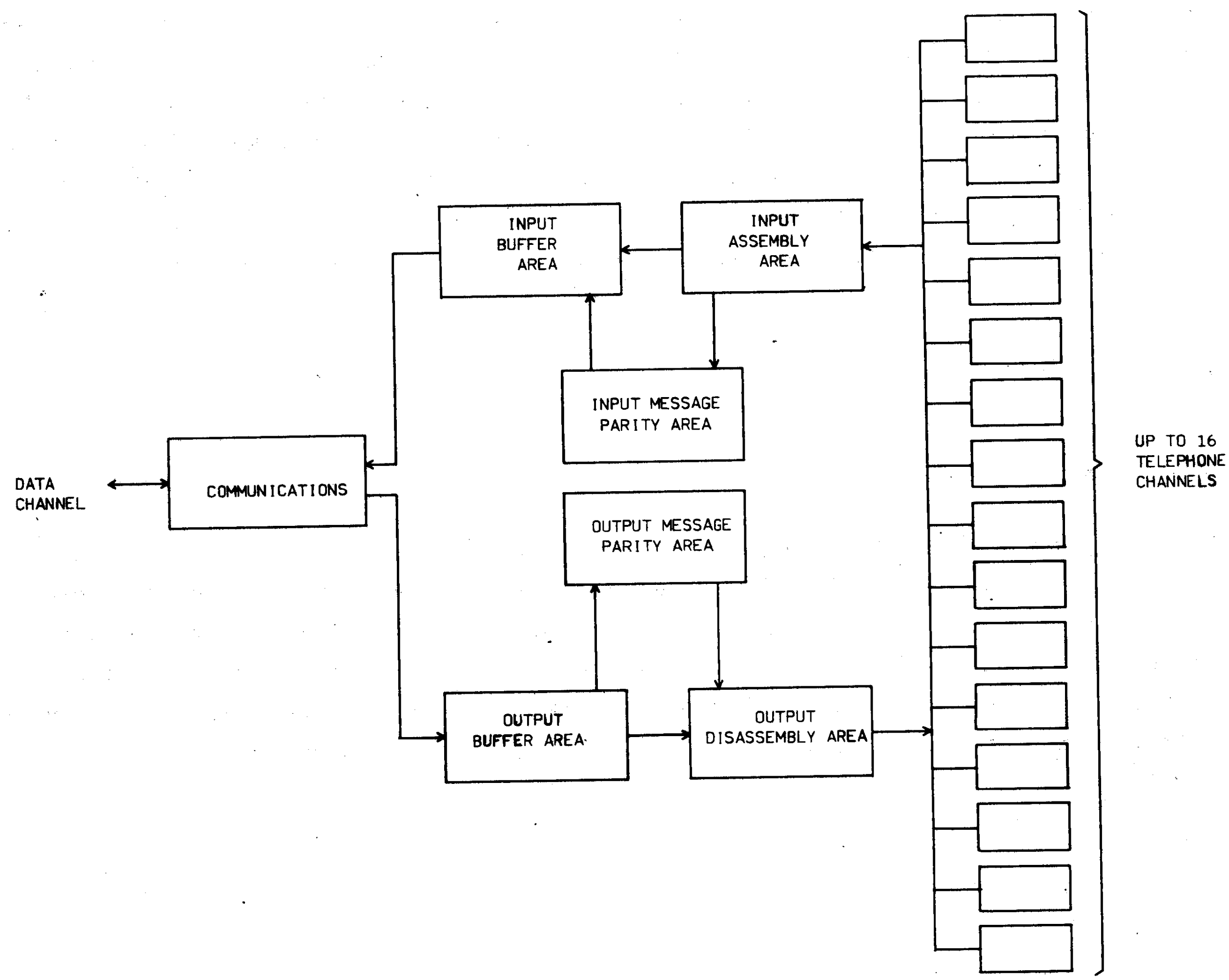


Figure 1-2. DSC Block Diagram

DATA EXCHANGE BETWEEN DATA CHANNEL AND CONTROLLER

The transfer of data between the data channel and the DSC is in blocks containing from one to sixteen 12-bit data words (for 9600 baud, one to eight 12-bit words). Each 12-bit data word uses the lower 8 bits to form a data character and the remaining 4 bits, as necessary, for I/O control. During output operations, I/O control bits must be generated by the programmer; during input operations, status bits are generated by the DSC.

DATA EXCHANGE BETWEEN CONTROLLER AND MODEM TERMINALS

The transfer of data between the DSC and the modem terminals is performed serially by means of 8-bit characters plus additional start/stop pulses, if required, for each character. The DSC then associates each data word in the data block with one of the sixteen terminals. It transfers data word 0 both to and from terminal 0 and transfers subsequently numbered data words to and from correspondingly numbered terminals. This format (order of operation) applies regardless of the number of terminals available or that require service. For 201 mode, the DSC attaches a message parity character (MPC) to the output data channel message (the MPC itself has odd character parity). Incoming data is checked for ASCII formated messages, and a message parity check character replaces the incoming MPC (MPC character parity not checked).

DATA STORAGE

LOCATIONS

The DSC uses a 64-word, 27-bit-per-word core memory to buffer data/control information to and from the modems. Sixteen core locations are used to store information received from or sent to the data channel. A second group of 16 memory locations stores information used to control the disassembly of output characters. A third group of 16 memory locations stores information used to control the assembly of input characters. The final 16 locations store the MPC for input/output data.

Four memory locations are assigned to a communications channel. For example, memory locations 0 through 3 are associated with channel zero, locations 4 through 7 with channel 1, etc. During an I/O operation with the computer, each word sent to the DSC is stored in one of the four locations associated with the channel for which it was intended. Words sent to the computer from the DSC are read from one of the four locations associated with the channel from which it was derived.

Each communication line operation requires that the three words (buffer, input, and output) be read for processing. The MPC word is read only when a character is completed and when a MPC must be updated or generated.

MEMORY WORDS

Core memory is partitioned according to line channels. Each line channel has an input information word, an output information word, a buffer word, and a message parity character associated with it (Figure 1-3).

The first word read from core memory during the processing of a telephone channel is the output information word which is read from location XXXX00. This word contains the following information.

Bits 0 through 7	Data in the process of being disassembled.
Bits 8 through 11	Clock count (used for 103 mode timing and synchronization).
Bits 12 through 15	Bit count to keep track of the disassembly process.
Bits 16	Indicates that an I/O instruction was in progress when this telephone channel was previously processed. The I/O operation will resume upon completion of this processing.
Bit 18	Used for synchronization of 103 mode data.
Bits 21 through 23	Used to convey carrier and phone-line connection information to the telephone channel such that data is not lost.

The second word read from memory is the buffer word which is contained in the output/input buffer registers and is read from location XXXX01. The output buffer holds information received from the data channel in bits 0 through 11. The input buffer holds information received from the terminal in bits 12 through 23.

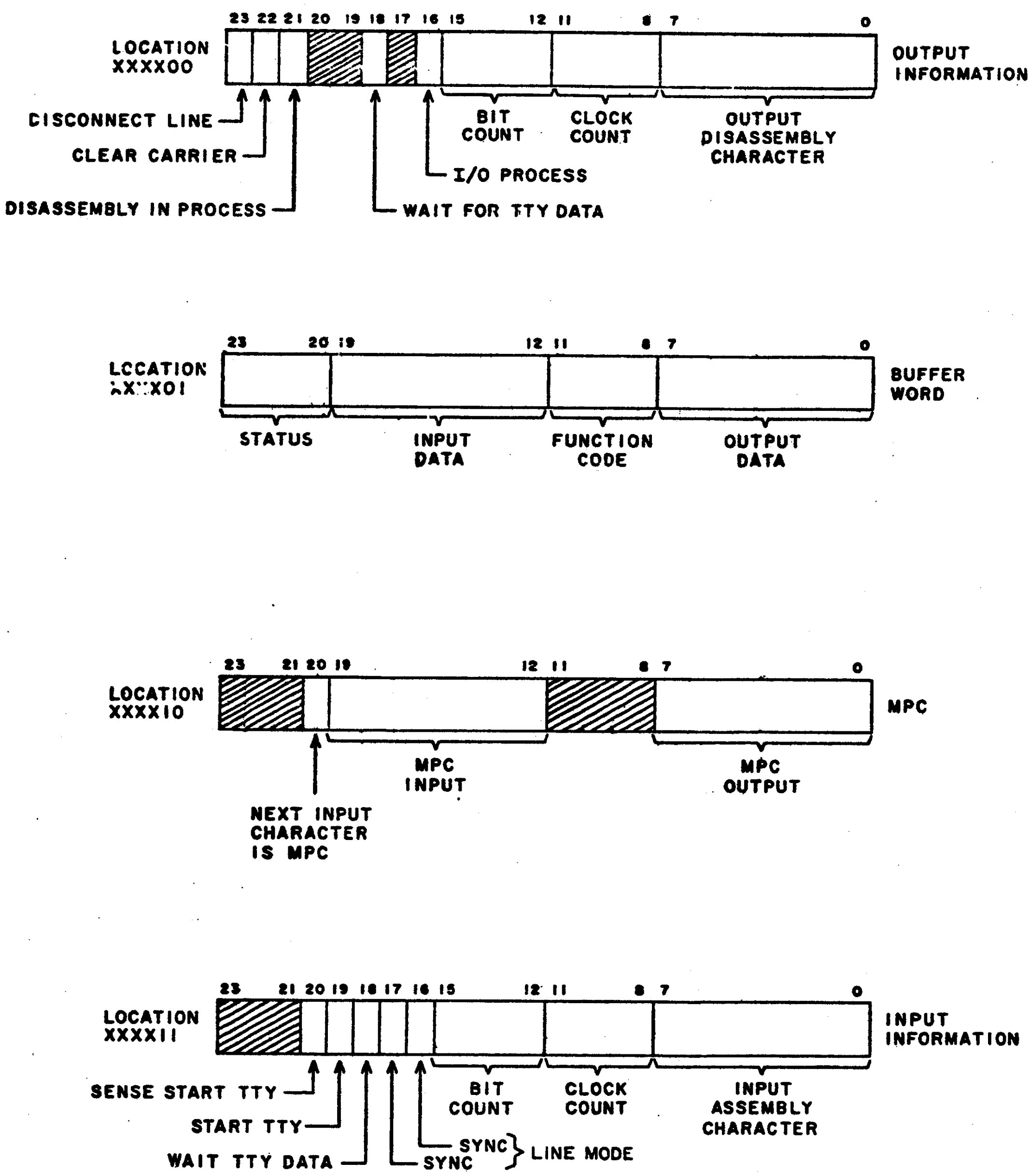


Figure 1-3. Memory Word Formats

Next the updated output information word is returned to memory. The input information word is then read from location XXXX11. This word contains the following information.

Bits 0 through 7	Data in the process of being assembled.
Bits 8 through 11	Clock count (used for 103 timing and synchronization).
Bits 12 through 15	Bit count to keep track of assembly process.
Bits 16 through 17	Synchronization indicators for 201 mode.
Bits 18 through 20	Synchronization indicators for 103 mode.

After the reading of the input information word, the MPC word is read from memory location XXXX10 if either the input or output portions of the telephone channel require MPC updating. This word contains the output MPC in bits 0 through 7 and the input MPC in bits 12 through 19. Bit 20 indicates the next input character will be an MPC. The MPC word is then returned to memory.

Regardless of whether the MPC processing is performed, the final events are the return of the updated buffer and input information words to memory (in that order).

DATA CONTROL

To initiate a data transfer to a remote terminal, the processor must select the DSC by means of a function select code. This code contains an equipment code and select bits which designate the DSC operating modes. Two basic methods of sending function select codes to the DSC exist. One selects operating modes for the entire DSC and includes data transfers to or from the data channel and the presentation of DSC status. The other selects an operating mode for a single communication channel and includes the information necessary for the control of the modem. This latter function select code is transmitted to the DSC as part of an output word.

The DSC must receive a function select code before it can generate an inactive and enable the requested operating mode. Nonacceptance of a code is indicated by no response from the DSC. The DSC is ready for an I/O operation when the processor has successfully selected the DSC and an operating mode by means of one of the codes in Table 2-1.

DATA OUTPUT

The processor, after selecting the output mode with a function select code, activates the DSC data channel and transfers a block of data words to the DSC. The data block is held in the DSC output buffer register. If the DSC receives a data word for a terminal when the output buffer register for that terminal is full, the DSC performs a pseudo-accept of the new data word and sets the character reject status bit. After completing the block storage, the DSC prepares the terminals which require an output for transmit operation. The DSC begins a data buffer transfer (if there is a valid character in the buffer) after receiving a signal indicating terminal readiness. The lower 8 bits (data character) for each terminal are transferred from the output buffer register to the output disassembly register if the disassembly section of the terminal is clear. If the output disassembly is not clear, the data transfer for that terminal must wait for the next data-transfer cycle. The DSC also transfers control information to the modem during the data transfer.

The bits are transferred to the modem according to the serial pattern set for 103 or 201 modes, and this transfer continues for each of the terminals. The DSC is ready for another data character following the transfer of the previous data character from the output buffer register to the output disassembly register. The DSC can store the next data character in the output buffer register while the preceding data character is in the output disassembly register.

DATA INPUT

The terminal data input consists of taking the serial data bits from the active terminals and reassembling them in the input assembly register. When a character has been reassembled, the DSC transfers its data portion to the lower 8 bits of the memory area for that terminal and sets bit 11 of the input buffer register of that terminal. The input assembly continues the reassembling and transferring of characters as long as serial data from the terminals is available.

After receiving an input function selection and a subsequent activate pulse, the DSC transfers up to 16 12-bit data words (contained in the input buffer) to the data channel. The data blocks may contain both completed data characters and words which contain zeros even though the I/O control bits may be set. The validity of data characters is detected by examining bit 11 of each data word.

If the DSC should complete the assembly of a data character when the input buffer of the terminal section is full, it writes the new data character into the buffer, destroying the previous character, and sets the lost data I/O control bit.

SIGNAL SYNCHRONIZATION

103 DATA SETS

The 103 data set is asynchronous in operation.

103 OUTPUT

If the valid character bit (bit 11) is set, the DSC accepts a 12-bit word from the processor and transfers bits 0 through 7 to the output disassembly register. To this 8-bit data character, the DSC appends a start bit and the appropriate number of stop bits to form an 11-bit asynchronous character for 110 baud and 10-bit asynchronous character for 150, 300, 600 and 1200 baud. For 134.5 baud, the DSC appends a start bit to bits 0 through 7 of the output word. The stop bit is bit 0 of the output word, and therefore, bit 0 must always be a 1 and part of the output word. By adding the start bit to bits 0 through 7 (bit 0 being the stop bit), the DSC forms the 9-bit asynchronous character for 134.5 baud. Refer to Table 2-3 for information on half-duplex operation when turning off the carrier.

103 INPUT

The start bit from the modem is initially issued to the DSC. This start bit is sampled several times to eliminate synchronization on a noise pulse. At one-tenth of a bit time after initiation, the DSC checks to determine if the start bit is present. If the bit is present, the DSC checks it again at the center of the start bit. If the start bit is still present, the DSC begins to time-out the next 10 bit times for 110 baud, 9 bit times for 150, 300, 600, and 1200 baud, and 8 bit times for 134.5 baud, sampling each of them. The DSC assembles this character, sends it to the input buffer register, and then waits for another start bit from the modem.

The sequence of start, data, and stop bits are shown in Tables 2-2 and 2-4.

201 DATA SETS

The DSC receives clock information from the modem (type based on baud rate) for data both received and transmitted. It does not supply clock pulses to the modem.

CLOCKED OUTPUT

After receiving a 4XXX data word on a telephone-channel output, the DSC places the modem in the proper condition, if required, for data transmission. The DSC presents the first data bit to the modem at the second clock pulse following confirmation of the modem condition.

The controlling computer program must generate synchronizing characters according to those required by the remote site along with the header, data, and end of message (EOM). The DSC appends the MPC with odd character parity immediately after the EOM character. MPC is calculated from the start of message (SOM) header character. Note that all characters are standard ASCII types.

Output data bits are transmitted at each clock pulse received from the modem. Any code needed for synchronization of receiving equipment must be supplied by the controlling computer program. (Refer to the appropriate equipment reference manual to determine the types of codes required.) The DSC sets the output failure status bit when a break in the flow of transmitted data occurs if the computer does not supply data characters fast enough.

CLOCKED INPUT

The processor initially sends an xx1XXX code to a specific telephone channel which returns bits under modem-clock regulation. The DSC monitors the incoming data until it detects an 8-bit 026 code (ASCII sync character). It then records the character and accepts another 8-bit byte. It examines this byte to determine if it is a 026 code. When two consecutive 026 codes are sensed, the DSC logic is synchronized with the data characters that follow. The DSC ignores any subsequent 026 codes after establishing synchronization. If a second 026 code is not found, the DSC logic considers it a non-synchronized condition and continues to check for two consecutive 026 codes.

The processor controlling the DSC must send an xx1XXX word to the DSC prior to the arrival of the first 026 code word, and any device supplying clocked information to the DSC must send a minimum of four 026 code words before each message to provide synchronizing reliability. Sync codes are not valid data.

Once synchronized, the DSC must be sent a function code to initiate a sync seeking sequence.

MESSAGE PARITY CHARACTER

MPC OUTPUT

The DSC begins computing a message parity character when it transmits an ASCII SOM character. Any ASCII sync codes contained in the message which follows are ignored. The DSC appends a MPC with odd character parity immediately after the EOM character is transmitted.

MPC INPUT

The DSC begins computing a MPC when it receives an ASCII SOM character. ASCII sync codes contained in the message are ignored. After receipt of an EOM, the DSC takes the logical difference between the lower 7 bits of the next assembled character (incoming MPC) and its calculated MPC and sends it to the input buffer register.

FUNCTION SELECT CODES

After being recognized, function select codes (Table 2-1) select the DSC and designate its normal operating mode. Function code selection does not prevent the DSC from transferring output data characters from the buffer to the terminals, nor does it prevent input data characters from being transferred from the terminals to the buffer registers.

TABLE 2-1. FUNCTION SELECT CODES

Octal Code	Description
X001†	Select output
X002	Select status request
X003	Select input

† The X portion must correspond to the setting of the equipment number switches.

NOTE

Additional codes are used for diagnostic test routines (refer to CE Manual).

SELECT OUTPUT (X001)

Receipt of this code enables the DSC which causes it to accept data blocks from the data channel. These blocks consist of as many as 16 data words. Figure 2-1 illustrates the output word format.

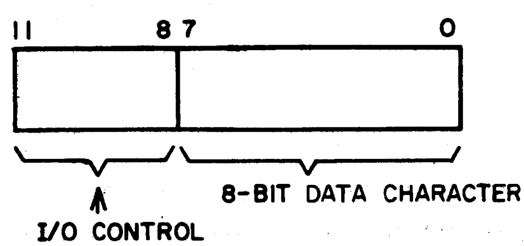


Figure 2-1. Output Word Format

SELECT STATUS REQUEST (X002)

The DSC transfers a 12-bit status word to the data channel input lines when it has received a X002 code. This code must be followed by a one word input operation in order to examine the status bits. Specific bit assignments are given in Figure 2-3.

SELECT INPUT (X003)

A select input code enables the DSC which causes it to transfer a data block to the data channel. As soon as it receives an active (activate channel instruction), the DSC transfers a data block of up to 16 words (Figure 2-2). For block lengths less than 16 words, refer to Input Block Length in this section.

After receiving a function select code, the DSC sends an inactive to the processor to indicate it has recognized and accepted the code (no response by the DSC indicates it has not accepted the code). An inactive is generated by the DSC when bits 9 through 11 of the function select code correspond to the code determined by the setting of the equipment number switches and a recognized operation select code has been received. These switches (located at J022A/B/C, respectively) are UP for a 1 and DOWN for a 0. After generating an inactive, the DSC enables the selected operating mode (output, status request, or input) when it receives an active from the data channel.

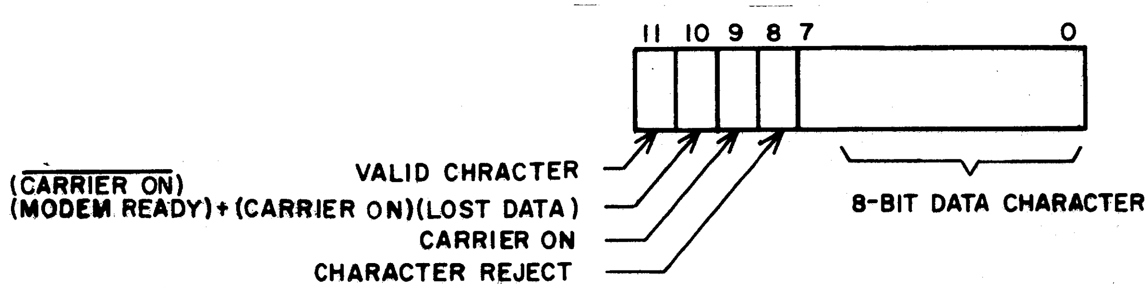


Figure 2-2. Input Word Format

DATA WORD

The DSC communicates with the processor by means of a 12-bit data word. The 12-bit data word is comprised of either an 8-bit character which the DSC receives from or transfers to the terminals together with 4 output-control bits, 4 input-status bits, or a 12-bit status character (status word). The position of a word in the data block determines the channel with which it is associated. For example, the first word in the block is associated with channel 0, the second with channel 1, etc.

OUTPUT WORD

The output word format required by the DSC during data transfers with the data channel is shown in Figure 2-1.

The lower 8 bits (0 through 7) of the output word form the data character. The DSC, when enabled, performs a serial transfer of the 8-bit data characters as shown in Table 2-2. Bit 0 of the output word must always be a 1 for 134.5 baud operation (stop bit) when recording data. Bit 0 of the output word is clear when a long space interrupt is transmitted.

TABLE 2-2. DATA CHARACTER SERIAL TRANSFER

Transfer Sequence	Bit	Data Character Bit Position			
		103 Mode (Asynchronous)			201 Mode (Synchronous)
		110 Baud	150, 300, 600 1200 Baud	134.5 Baud	
1	0	Start	Start	Start	0
2	1	1	1	1	1
3	2	2	2	2	2
4	3	3	3	3	3
5	4	4	4	4	4
6	5	5	5	5	5
7	6	6	6	6	6
8	7	7	7	7	7
9	8	0	0	0	
10	9	Stop	Stop		
11	10	Stop			

NOTE

For ASCII codes (110, 150, 300, 600, and 1200 baud), bit 0 is the character parity bit.

For correspondence codes (134.5 baud), bit 7 is the character parity bit.

For 134.5 baud, bit 0 of each data character is the stop bit and is set. Bit 0 is clear for each interrupt character.

The upper four bits (bits 8 through 11) of the output word provide I/O control and operate, in various combinations, either as a flag for data characters or as a control for the modem. Any data to be transmitted must be accompanied by either a 4XXX or 5XXX function code (refer to Table 2-3) which turns on the carrier. At least one character time should elapse before the processor sends out a 4XXX or 5XXX code if a 2XXX, 3XXX, or 6XXX function code was previously sent out to turn off the carrier.

TABLE 2-3. DSC DATA WORD FUNCTION CODES

Code	Description
0XXX	A do-nothing function; no data is transferred.
1XXX	Enables the receiver section of the DSC to resync.† Does not affect the carrier or the line connection. No data should be contained in this word.
2XXX	Turns off the carrier. No data should be contained in this word.
3XXX	Turns off the carrier and allows the receiver to resync. No data should be contained in this word. The valid data character preceding this function code is transmitted prior to carrier turn-off. Note that MPCs appended to a clocked-data modem message are considered to be valid data characters.
4XXX††	Turns on the carrier. Must be appended to all data words (refer to 5XXX code description).
5XXX	Turns on the carrier and resyncs the receiver. Can contain data to be transmitted; primarily a function for full-duplex operation. Should be used whenever it is desirable to resync the receiver and transmit data simultaneously.

† The resynchronization is immediate and does not wait for completion of the input character.

†† When outputing to the DSC, a 4XXX code should be sent after each MPC so that the 6XXX code does not cut off the last bit of the MPC.

TABLE 2-3. DSC DATA WORD FUNCTION CODES (Cont'd)

Code	Description
6XXX	Resyncs the receiver, turns off the carrier, and disconnects the telephone connection. No data should be contained in this word. Used primarily to disconnect the phone line. NOTE The 2XXX, 3XXX, and 6XXX codes await the disassembly of the previous valid character before they affect the carrier on multiplex channels performing synchronous (201 mode) transmission. For channels performing asynchronous (103 mode) transmission, a time-out of 5.0 milliseconds occurs after the last bit (stop bit) is placed on the line before the carrier is dropped. This time-out ensures that the last bit has been transmitted for 600 and 1200 baud. The 600 and 1200 baud rates also require that the transmit carrier be off before the DSC can receive data when half-duplex communication equipment is used. For 103 mode operation below 300 baud, dropping the carrier is not necessary, and if the processor does output a 6XXX code, the time-out may not be adequate to ensure that the last bit (stop bit) has been completely transmitted by the DSC. The 6XXX code (2XXX and 3XXX codes for 103 mode speeds below 300 baud) does not wait for completion of the last bit of the last output character before becoming active. Software timing for the use of the 6XXX code (2XXX and 3XXX codes for 103 mode speeds below 300 baud) is desirable. The 4XXX and 5XXX codes act immediately.
7XXX	Resyncs the receiver and enables the telephone connections for data transmissions. This word contains no information to be transmitted.
X(1xx)XX (Bit 8 set)	Used to disconnect a modem when output operation has failed in the middle of a character. Indicates that any valid character in the output buffer should be ignored, and that any data accompanying the function code should be transferred into the buffer memory. The DSC does not recognize that it is disassembling a character on this terminal, and it executes the incoming function.

INPUT WORD

The input word format used by the DSC during data transfer with the data channel is shown in Figure 2-2.

DATA CHARACTER (BITS 0 THROUGH 7)

The lower 8 bits (0 through 7) of the input word form the data character. The DSC forms this character serially from data received from the modem. An all-zeros data character is transferred to the data channel when a MPC is passed by the DSC and no error has occurred. A nonzero character is transferred to the data channel if an error has occurred. The order of data character assembly is shown in Table 2-4.

TABLE 2-4. DATA CHARACTER ASSEMBLY/DISASSEMBLY

103 Mode (Asynchronous)			201 Mode (Clocked Format)	
Modem Bit Order	Bit Use Assembly	Bit Use Disassembly	Modem Bit Order	Bit Use Input and Output
1	Discard	Start (0)	1	0
2	1	1	2	1
3	2	2	3	2
4	3	3	4	3
5	4	4	5	4
6	5	5	6	5
7	6	6	7	6
8	7	7	8	7
9†	0	0		
10	Discard	Stop (1)		
11††	Discard	Stop (1)		

† Modem bit 9 is the last bit (stop bit) of the character for 134.5 operation. The stop bit is bit 0 of the output word (character being disassembled) and becomes bit 0 of the assembled character and input word. The stop bit is not appended by the DSC (must be part of the output word), and it is not discarded by the DSC on input as is the case for 110, and 150 through 1200 baud rates. Bit 0 in 134.5 baud is a 1 for data characters and a 0 for interrupts.

†† Modem bit 11 (second stop bit) occurs only for 110 baud operation. Modem bit 10 is the final (stop) bit of the character for 150 through 1200 baud operation.

CHARACTER REJECT (BIT 8)

Bit 8 of the DSC input word sets if a data channel output word has been pseudo-accepted and then discarded (output buffer for that terminal was full). This control bit indicates that the DSC has not accepted a data output word. The DSC clears bit 8 after transferring the input word to the processor.

TERMINAL READY (BIT 9)

Bit 9 is set when the modem interlock signal is present and indicates that a connection exists between the terminal and the modem. Bit 9 clears as the interlock signal terminates.

LOST DATA (BIT 10)

When set, bit 10 of the DSC word indicates that the processor has failed to perform an input operation before the next character has been assembled. When a terminal is active, the processor must perform an input operation within one character time based on the baud rate of the terminal after input required sets (status bit 1). The DSC clears this control bit 10 after transferring the input word to the processor. Note that ASCII sync characters (026 code) are not considered to be data and do not cause a lost data condition.

VALID CHARACTER (BIT 11)

Bit 11 is set after the DSC assembles a complete data character from the active terminal. Bit 11 indicates that bits 0 through 7 contain a data character.

LONG SPACE INTERRUPT

For 134.5 baud, bit 0 is the character stop bit when set; for both input and output words, bit 0 is clear for interrupt characters. An interrupt (long space) can be sent in either direction. The processor can send an interrupt by sending at least three consecutive 4000 characters (a 200-millisecond space). The processor can detect an interrupt sent by a terminal if it receives at least three consecutive 5000 characters. Full-duplex lines are required to use interrupts. The long space interrupt can be used with 134.5 baud operation only.

STATUS WORDS

A status word provides the processor with a means of determining the condition of the DSC. The processor, to determine the status of the DSC, issues a status request code (X002) followed by an input operation. Figure 2-3 shows the format of the DSC status response word.

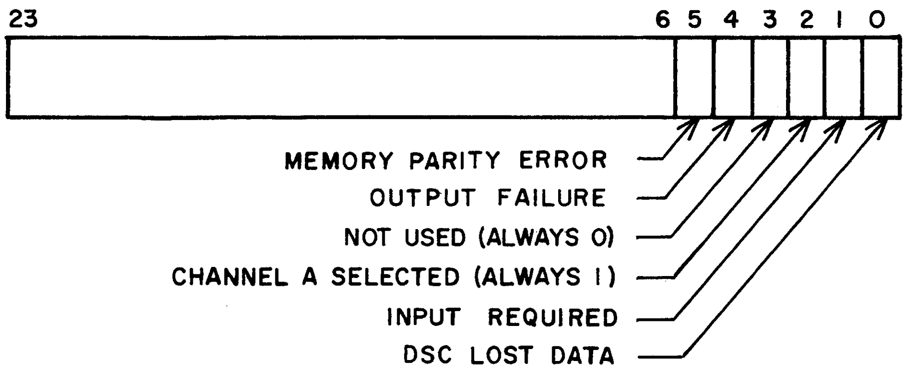


Figure 2-3. Status Response Word Format

DSC LOST DATA (0005)

Status bit 0 sets when the processor fails to perform an input operation before a telephone channel has assembled the next input character. This status bit indicates the presence of lost data in at least one telephone channel. The DSC clears status bit 0 after receiving a select input code.

NOTE

Use care when configuring the hardware and software driver for the DSC so that false lost data errors do not occur. Errors will occur if the software executes a status (X002 code) of the DSC and if the following conditions exist:

1. Modem Selection switches for unused ports in the DSC are set in the asynchronous (103) mode.
2. Software does not input from one or more of the 16 DSC ports (i, e, the word count during input/output operations is less than 20_8).
3. Input circuits on receiver (HA91) cards in the DSC are open (i, e., there is no cable between an unused port and a powered-on modem).

To prevent the potential lost data problem, set unused port switches to synchronous (201) mode.

INPUT REQUIRED (0006)

Status bit 1 sets when a character is available for input on any of the multiplex channels. Data may be lost if the input operation requested by the DSC does not follow within a time period of less than one character of the fastest baud terminal being used.

CHANNEL A SELECT (0004)

Bit 2 (always a 1) is required for 6676 Data Set Controller campatibility.

OUTPUT FAILURE (0024)

Status bit 4 sets when a clocked line or block mode (201 mode) output operation does not find a character to disassemble in the output buffer register. A XXX1 function code clears this bit (output).

MEMORY PARITY ERROR (0044)

Status bit 5 sets when a parity error is detected in a data transfer to or from the DSC memory. A XXX2 function code (status) clears this bit after it has been presented to the data channel.

PROGRAMMING CONSIDERATIONS

STATUS

The DSC has the following two types of status available.

Equipment status; consists of DSC lost data and input required; available by means of status request code.

Operation control status; consists of lost data and terminal ready indications (for input operations) and character reject indications (for output operations) for each channel.

OUTPUT STATUS CHECK

The output operation must be followed by an input operation to obtain complete status. The terminal for which an output character has been rejected has bit 8 set in the next input word for the terminal. For example, if an output character to terminal 10 (word 10 of the output block) is rejected, the next input block has bit 8 set in word 10.

DATA BLOCK LENGTH

The I/O data block length can be a function of the terminals available if the DSC controls less than 16 terminals. For example, the I/O data blocks need only be eight words if a DSC only controls eight terminals and the terminals are consecutively numbered starting with terminal 0. The DSC considers all data transfers to start at terminal 0. The output data block length can also be a function of the number of active terminals. The data block can be 10 words if only terminal 10 is active, that is, must service the highest numbered active channel. For 9600 baud operation, the block length must be eight words or less. The 9600 baud terminals must be on the lower eight multiplex channels, and the upper eight channels must be inactive.

INPUT BLOCK LENGTH

An input operation may be up to 16 words long. Blocks shorter than 16 words can be read, but they should contain at least as many words as the number of active data terminals. Due to the nature of the 6000 data channel, the DSC presents the data channel with one more word than requested. In most situations, this is of no consequence. In the DSC, however, the extra word presented corresponds to a data terminal one higher in number than the last word requested by the data channel. The DSC considers this word as having actually been transferred to the data channel and destroys any information that it may contain. It is possible, therefore, to lose data when a block of insufficient length is read.

To prevent loss of data on 16-word blocks, the DSC ceases to process data channel signals after 16 words or after the first word on an input which follows a status function. Abnormal program termination results if longer block inputs are attempted.

OUTPUT TIMING

The DSC accepts a 16-word block from the data channel in 32 microseconds (one word each 2 microseconds) in a block-output format. The complete output on communication lines (including disassembly and transfer) requires additional character time dependent on the baud rate of the terminals (refer to Rate in section 1).

If the DSC receives a new data word before the preceding word is in the output disassembly register, the new word is lost and character reject sets in the next input word. Because of these output-timing restrictions, each output block should be followed by an input block in which bit 8 (character reject) is checked.

INPUT TIMING

The DSC can transmit a 16-word data block to the data channel in 32 microseconds (one word each 2 microseconds). The time required by the DSC to assemble a complete input code from a terminal is the same as that required for data output. The DSC assembles the character and then transfers it to the input buffer register. With a word assembled and status bit 11 set, an input to the data channel must be activated within one character time (refer to Rate in section 1) or the word may be lost and result in lost data for the corresponding word.

GENERAL TIMING

When a number of high- and low-speed data terminals are used with the DSC, it is advisable to connect the higher-speed terminals to the low-numbered channels and the lower-speed terminals to the high-numbered channels. In this way, the controlling computer program need communicate with only those terminals which require frequent servicing at a high rate. The slower terminals can then be serviced at a lower rate. These arrangements provide a considerable shortening of programming time but should be used only after consideration of the input block length. If high-speed channels are serviced more frequently than low-speed channels, an unused channel between the high- and low-speed channels prevents lost data.

PROCESSOR RESTRICTIONS

INPUT

The processor must perform inputs that equal or exceed the input character rate to avoid lost data (refer to Rate in section 1).

OUTPUT

The processor must perform outputs that equal or exceed the character rate to avoid lost data when transmitting line-mode (clocked) information (refer to Rate in section 1).

CHARACTER FORMAT

During transmission, the DSC performs a serial transfer of the 11-bit synchronized data character. This serialized character stream is required for compatibility with the 6676 Data Set Controller. Refer to Table 2-2 for the 103/201 data sets character format and transfer sequence.

PROGRAMMING EXAMPLE

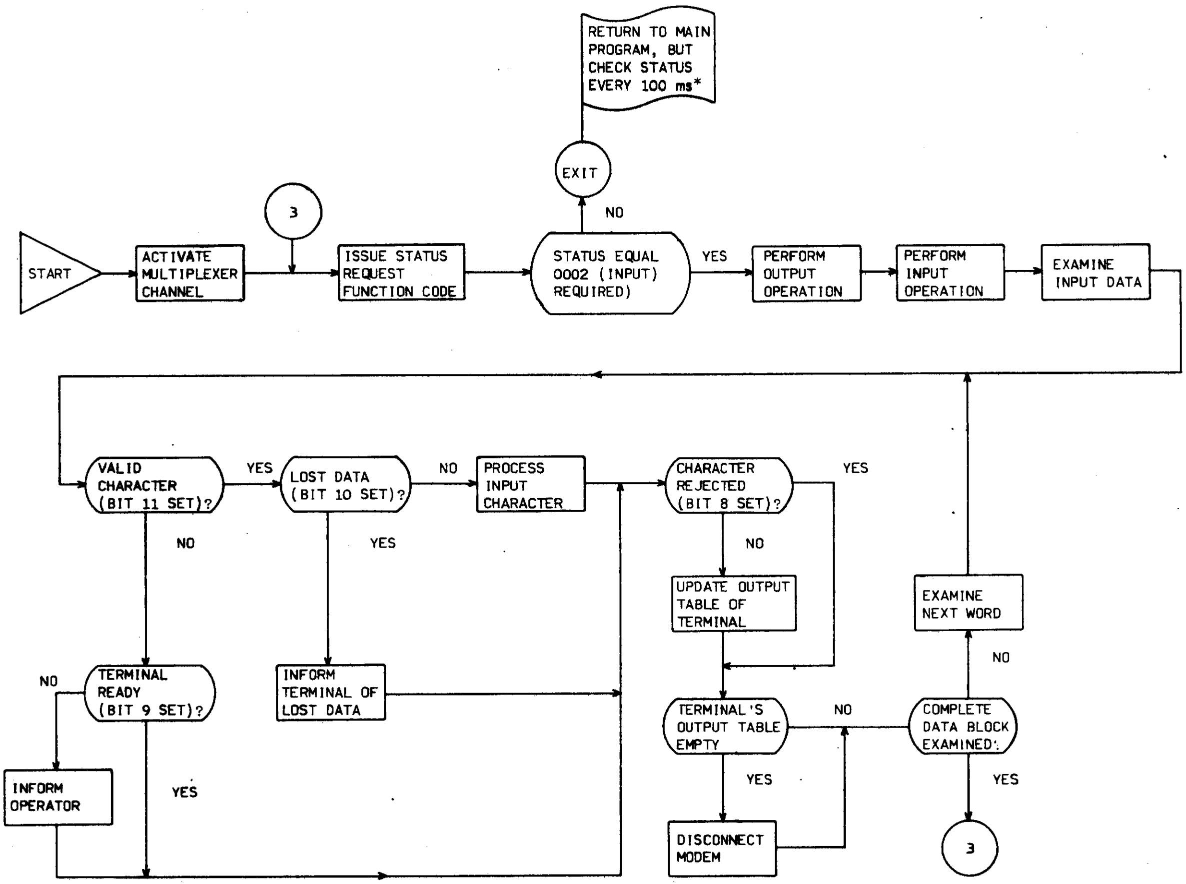
The flowchart (Figure 2-4) shows the DSC servicing routine and is useful in understanding the DSC operation. Programming the DSC is similar to programming other peripheral equipment. A typical ordering of programming steps is as follows:

1. Clear (deadstart)
2. Function select status
3. Input status (determine if DSC requires service)
4. Function select output
5. Output data to terminals
6. Function select input
7. Input data plus I/O control bits for terminals

NOTE

EXCEPTION TO COMPLIANCE WITH EIA STANDARD RS-232-C

The 6671-3 Data Set Controller does not comply with the following statement in EIA Standard RS-232-C. The data terminal equipment shall hold circuit BA (Transmitted Data) in marking condition during intervals between characters or words and at all times when no data is being transmitted. The Transmitted Data circuit in the 6671-3 is in a spacing condition when no data is being transmitted if a port is selected for synchronous (201) mode.



*100 ms (110 BAUD): THIS RATE VARIES ACCORDING TO THE SPECIFIC DATA SET EQUIPMENT BEING USED.

Figure 2-4. Sample Controller Servicing Routine

OPERATION

SWITCHES AND INDICATORS

ROTARY SELECTOR SWITCHES

There are 16 rotary selector switches mounted on a panel above the logic chassis. Each of the switches is individually assigned to one of the 16 channels, and it is used to select 201 or 103 mode for that channel. Switch S00 for channel 00, Figure 3-1, is typical of the other 15 switches. The SYNC position selects 201 mode, and the other six positions (110, 134.5, 150, 300, 600, and 1200) select 103 mode.

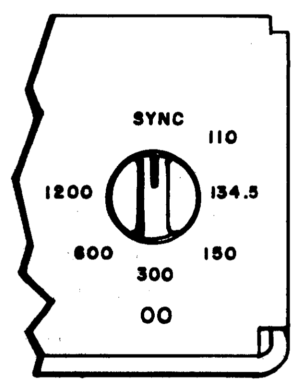


Figure 3-1. Rotary Selector Switch S00

In addition to designating 103 mode, the switches gate the proper asynchronous clock, specify the character format, and specify the bits per character. In the 1200 position, the switches change the clock count per bit from 10 to 5 clocks for the proper channel. The rotary selector switches for unused channels (channels not cabled to the data sets) should be set to the SYNC position.

MAINTENANCE, OPERATING MODE, AND UNIT EQUIPMENT SELECT SWITCHES

These switches are small toggle switches mounted on special modules in the logic chassis. Switch 1J003A, for example, refers to the switch at that location in the logic chassis which is the A part of the C60 card module. The use of these switches is described in Tables 3-1, 3-2, and 3-3.

CONTROL SWITCHES AND INDICATORS

Refer to Table 3-4 for a description of switches and indicators for controlling temperature, power, step mode, and master clear.

TABLE 3-1. MAINTENANCE SWITCHES

Switch	Position	Function
1J003A	Up	Normal
	Down	Allows the 201 simulator clock to generate a single transmit pulse and a single receive pulse each time the STEP switch is pressed. Mode is used by a utility routine and is useful in stepping up to a certain set of conditions (for example, sync) and to observe various logic translations.
1J003B	Up	Connects the internal Teletype clock pulses in the same manner as 201 simulator pulses. Thus, if the 201 simulator is in step mode, the 110 clock is also in step mode. Also, if the 201 simulator clock is synchronized with the DSC logic, the Teletype clock can be synchronized with it.
	Down	Normal - 110 Baud Clock

TABLE 3-1. MAINTENANCE SWITCHES (Cont'd)

Switch	Position	Function
1J003C	Up	Allows the 6000 data channel to perform an I/O operation between the processing of data terminals 00 and 01 only. This allows the observation of the DSC operation with the oscilloscope while performing I/O operations and with a minimum of synchronization difficulties.
	Down	Normal
1J003D	Up	Synchronizes the 201 simulator clock with the DSC data terminal 00 processing. Allows data I/O to be viewed on scope with minimum of synchronization difficulties.
	Down	Normal
1F044A	Up	Connects the internal Teletype clock pulses in the same manner as 201 simulator pulses. Thus, if the 201 simulator is in step mode, the 134.5 clock is also in step mode. Also, if the 201 simulator clock is synchronized with the DSC logic, the Teletype clock can be synchronized with it.
	Down	Normal - 134.5 Baud Clock
1F044B	Up	Connects the internal Teletype clock pulses in the same manner as 201 simulator pulses. Thus, if the 201 simulator is in step mode, the 150 clock is also in step mode. Also, if the 201 simulator clock is synchronized with the DSC logic, the Teletype clock can be synchronized with it.
	Down	Normal - 150 Baud Clock

TABLE 3-1. MAINTENANCE SWITCHES (Cont'd)

Switch	Position	Function
1F044C	Up	Connects the internal Teletype clock pulses in the same manner as 201 simulator pulses. Thus, if the 201 simulator is in step mode, the 300 clock is also in step mode. Also, if the 201 simulator clock is synchronized with the DSC logic, the Teletype clock can be synchronized with it.
	Down	Normal - 300 Baud Clock
1F044D	Up	Connects the internal Teletype clock pulses in the same manner as 201 simulator pulses. Thus, if the 201 simulator is in step mode, the 600 clock is also in step mode. Also, if the 201 simulator clock is synchronized with the DSC logic, the Teletype clock can be synchronized with it.
	Down	Normal - 600 Baud Clock (also used for 1200 baud operation)

TABLE 3-2. OPERATING MODE SWITCH

Switch	Position	Description
6676 MODE	J022D	The UP position forces a connect code (7XXX) to each MUX channel selected for asynchronous mode on a 6671 MC. The switch has no effect when DOWN or for those MUX channels selected for synchronous mode. The switch should normally be DOWN.

TABLE 3-3. UNIT EQUIPMENT SELECT SWITCHES

Switch	Location	Description
2^0 2^1 2^2	J022 A J022 B J022 C	These switches determine the logical unit-select number (for example, J022 A Up, J022 B Down, and J022 C Up provide the controller with a unit-select number of 5).

TABLE 3-4. CONTROL SWITCHES AND INDICATORS

Control/Indicator	Function
400 HZ, 50/60 HZ POWER DISCONNECT Toggle switch (S1)	Main power switch for the controller; turns on 400 Hz power for the power supply and 60 Hz power for the blowers.
DC POWER ON Indicator (DS1)	Lights when switch S1 is closed; indicates that dc power is available.
TEMP WARN Indicator (DS2)	Lights when the air temperature entering the cabinet rises above 80°F, when a blower fails, or when a blower provides insufficient air circulation. When the air temperature inside the cabinet rises above 110°F, power shutdown commences.
MASTER CLEAR Momentary push switch (S1)	Generates a clear pulse for the logic circuits and memory.
201 STEP Momentary push switch (S2)	Allows manual generation of single step pulses for observation of conditions during utility and maintenance routines. Switch is used for either 201 or 103 mode.
40 VDC TERM, PWR Toggle switch (S2)	Not used

SIMULATOR

For test purposes, a 201 data set simulator is built into the controller. A data set cable may be connected between one of the MUX channels (connectors T00 to T15) and the simulator connector (T16). Simulation of a 103 data set is also possible by using connector T17 which loops both control and data signals back to the MUX channel.

COMMENT SHEET

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Hardware Reference Manual

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