MAGNETIC TAPE SYSTEM, 15 Kc
Technical Manual

SDS 900014A

TECHNICAL MANUAL

MAGNETIC TAPE SYSTEM, 15 Kc

SCIENTIFIC DATA SYSTEMS

1649 Seventeenth St., Santa Monica, Calif.

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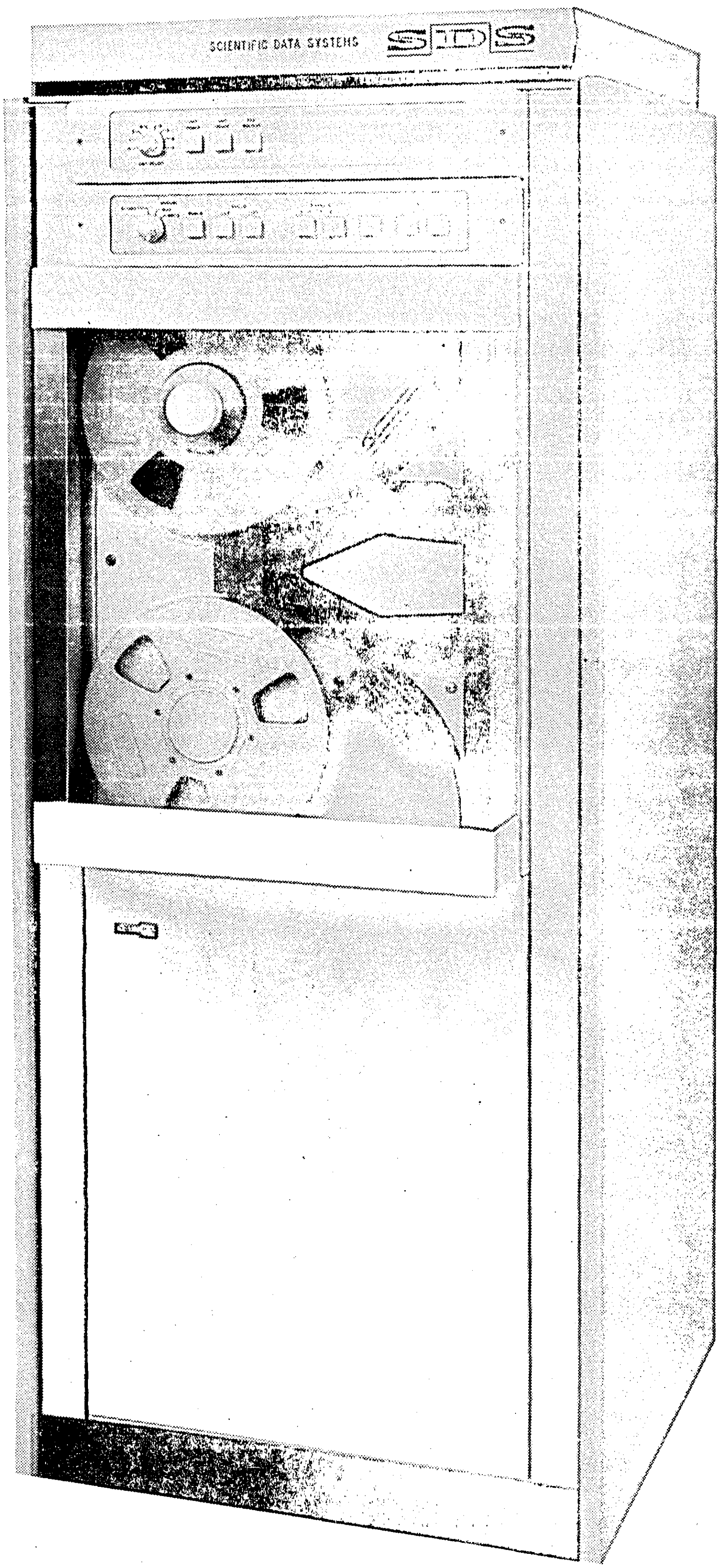

Magnetic Tape System, 15Kc

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I. INTRODUCTION AND DESCRIPTION

A. SCOPE

This manual describes the SDS Magnetic Tape System, 15Kc, Models 9146, 9145, and 9140 as used with the SDS 910 and 920 Computers. Its purpose is to aid in using, understanding, and maintaining the system. A basic knowledge of the computer logic and programming is assumed. Logic terms which are peculiar to magnetic tape operations are defined in Table 5-2 at the end of Section V. For detailed information on operation and maintenance procedures of the magnetic tape transport, reference is made to Ampex TM-4 Technical Manual.

B. PHYSICAL DESCRIPTION

Shown in the frontispiece, the magnetic tape system is contained within a cabinet constructed on a welded steel frame. The basic structure within the cabinet is a conventional RETMA rack providing standard 19-inch component mounting to facilitate system configuration flexibility. The side panels are completely removable, and large doors at the front and rear provide maximum access for installation and service operations to the components. Pushbutton controls on the manual and auxiliary control panels illuminate to indicate operational status of the system.

C. SYSTEM CONFIGURATIONS

Versatile design of SDS magnetic tape systems incorporate features which make them readily adaptable to various computer system application requirements. System configurations are designated by model numbers and have varying degrees of capability. Possible forms of system applications are illustrated in Figure 1-1 block diagram, and are described in the following paragraphs.

C-1. MAGNETIC TAPE UNIT, MODEL 9146

Two major subcomponents comprise the 9146 Magnetic Tape Unit (see Figure 1-1): (a) the tape transport with its own power supply and manual control unit, and (b) the tape electronics unit with the PX10 power supply and auxiliary control unit.

The 9146 Magnetic Tape Unit is the fundamental component of all SDS magnetic tape system configurations. One of these units may be operated in conjunction with a 9148 Tape Control Unit for input/output operations with the SDS 910 or 920 Computer, or as many as eight units may be connected in series and operated with one 9148 Tape Control Unit for computer-controlled applications. Up to 16 tape units may be operated simultaneously under computer control with the addition of the 9120 Y Buffer and another 9148 Tape Control Unit.

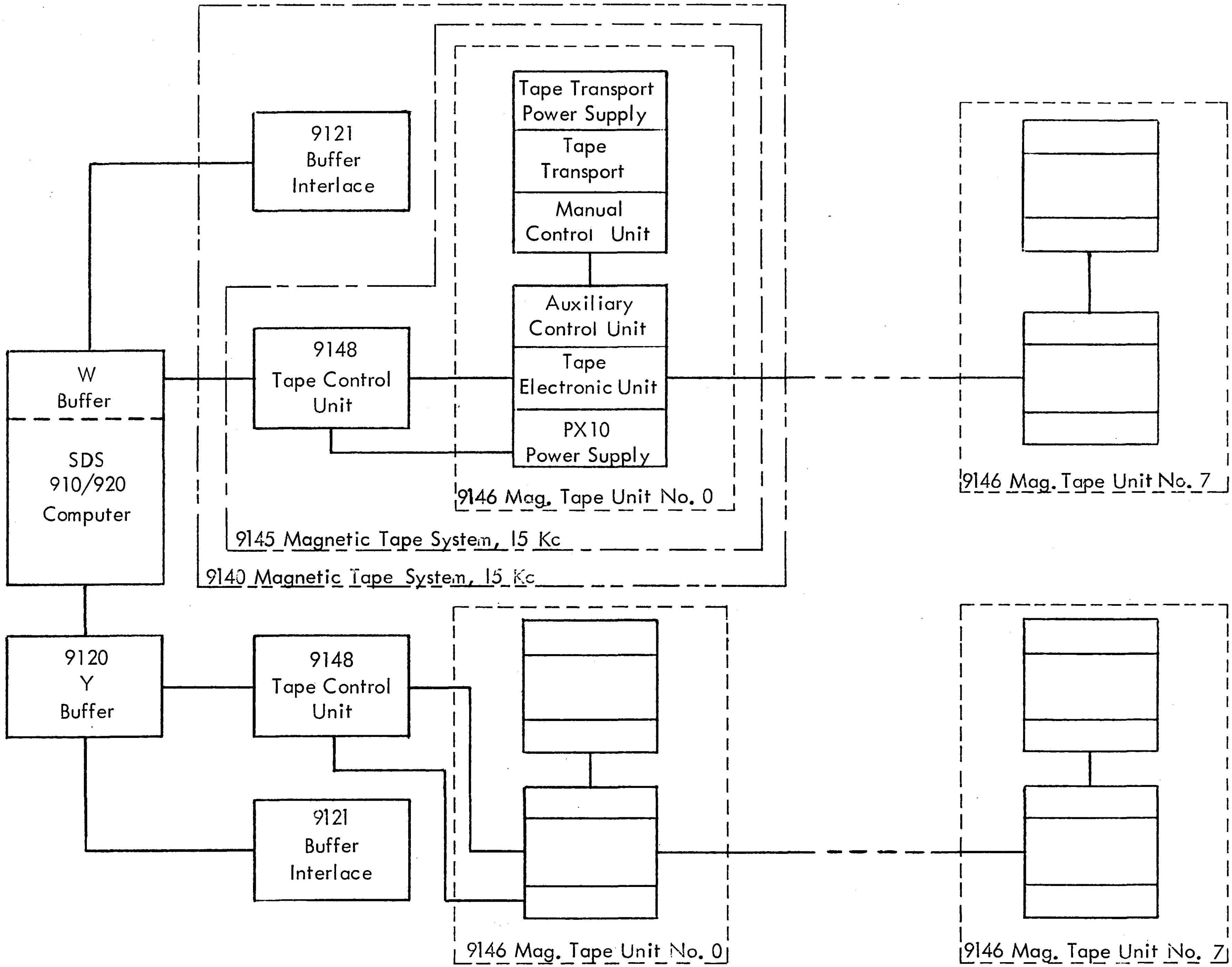


Figure 1-1. Magnetic Tape System Configurations

C-2. MAGNETIC TAPE SYSTEM, 15 Kc, MODEL 9145

The 9145 Magnetic Tape System comprises the 9146 Magnetic Tape Unit and the 9148 Magnetic Tape Control Unit (see Figure 1-1). These units are mounted in either the 9110 or 9210 rack. Up to seven additional 9146 Magnetic Tape Units may be operated in this system using the one control unit for input/output operations with the SDS 910 or 920 Computer.

C-3. MAGNETIC TAPE SYSTEM, 15 Kc, MODEL 9140

The 9140 Magnetic Tape System incorporates the optional 9121 Buffer Interlace into a conventional 9145 system to provide the increased capability of rapid input/output access to the computer memory without interfering with normal computer operations.

C-4. EXTENDED CAPABILITIES

As many as 16 magnetic tape units may be operated simultaneously with one SDS 910 or 920 Computer by installing a second 9145 system (or optional 9140 system) and the 9120 Y Buffer (see Figure 1-1).

D. SPECIFICATIONS

Tape Transport	Ampex TM-4
Tape Speed - Read/Write	75 ips
Tape Speed - Rewind	150 ips (3.25 minutes to rewind 2400 feet of tape)
Reels and Hubs	10-1/2 inch take-up reel; 10-1/2 inch file reel with file protect ring and IBM hub
Tape Drive	Capstan pinch roller drive with reel control servos and vacuum buffer storage chamber
Recording Method	NRZI (non-return-to-zero-change-on-ones)
Recording Format	7 channel, 6 bits and parity, self-clocking, BCD or binary
Inter-Record Gap	3/4-inch
Recording Density	200 characters per inch
Character Read/Write Rate	15,000 characters per second
Tape	1/2-inch wide x 2400 feet long with 1-1/2 mil thickness mylar tape

D. SPECIFICATIONS (continued)

End of Tape Sensing	Metallic leader
Head	7 channel, dual gap, IBM compatible
Operating Environment	Ambient temperature: 50° to 90°F
	Relative humidity: 40 % to 70 %
	Altitude: 0 to 7000 feet
Power Requirements	60 ± 3 cps, 117 volts ± 10 %, 12 amperes minimum

E. CONTROLS AND INDICATORS

E-1. MANUAL CONTROL PANEL

The controls and indicators on the manual control panel are described in the TM-4 Technical Manual. When the mode select switch is set to AUTOMATIC, all control of the tape transport is derived from the computer.

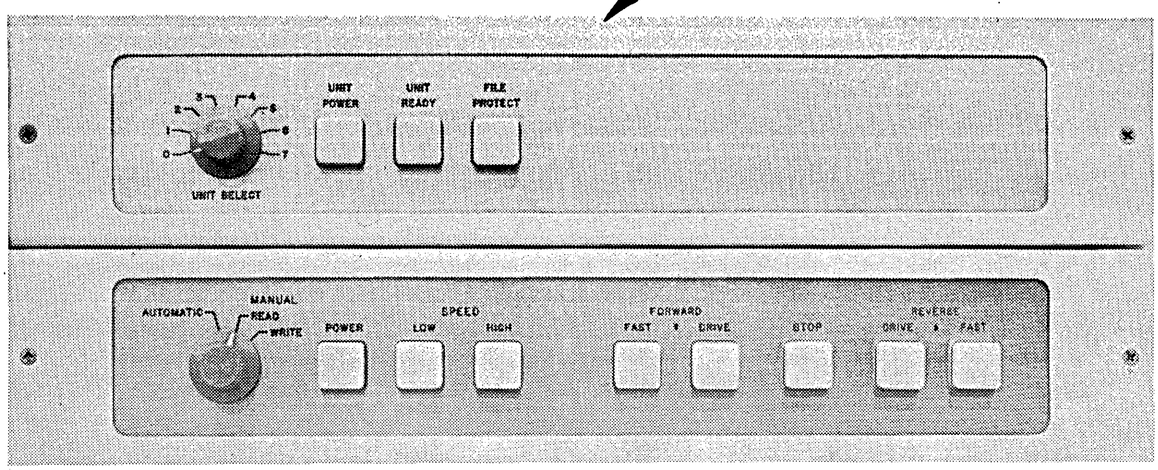


Figure 1-2. Controls and Indicators

E-2. AUXILIARY CONTROL PANEL

The tape UNIT SELECT switch permits designating numbers 0 through 7 to the tape units used in a system. When the system is in AUTOMATIC mode, a tape unit will respond only to computer commands whose address bits correspond to the tape UNIT SELECT switch setting.

The UNIT POWER indicator provides visual indication that dc power is applied to the tape unit.

The FILE PROTECT indicator provides visual indication of whether or not recording may be accomplished. A file protect ring is inserted into a reel of tape if that reel is to be recorded. If a reel is only to be read, then no ring is inserted in the reel, and the FILE PROTECT indicator will be on.

The UNIT READY indicator provides visual indication of the status of a tape unit. A lighted condition of the UNIT READY indicator denotes that a tape transport is available for use under computer control. When the tape transport is in use or when the tape handler interlocks are not properly set, the indicator is off. The UNIT READY indicator circuit is inhibited for approximately 90 seconds after initial power is applied to the unit.

II. OPERATION

A. CABLE INTERCONNECTIONS

Cable assemblies supplied with the magnetic tape system provide interconnection (a) between units within the system cabinet, (b) to source power, (c) for input/output with the SDS 910 or 920 Computer, and (d) between magnetic tape systems when more than one tape system is used with a computer installation.

Prior to operating the magnetic tape system, verify that the cable plug modules are connected as described in steps A-1 through A-7 for the particular type of system installation being used. Refer to Installation Drawing 102215, sheet 6 of 6 in Appendix II for physical location of cables and connectors.

A-1. CABLE PLUG MODULE, P21

This module always remains inserted into location 21W of the electronics Chassis (W).

A-2. CABLE PLUG MODULES, P22-P23

One P22-P23 cable is always used between control chassis Z and electronics chassis W respectively; with P22 inserted into location 22W of the W chassis, and P23 inserted into location 24Z of the Z chassis, If more than one 9146 unit is used from the same control chassis another P22-P23 cable is used, with P22 inserted into location 22W of the W chassis of the second 9146 unit, and P23 inserted into location 23W of the W chassis of the first unit. This procedure is followed for all additional units; P22 in the third unit, P23 in the second unit, and in sequence.

A-3. CABLE PLUG MODULES, P24-P25

One P24-P25 cable is always used between the Z and W chassis, with P24 inserted into location 24W of the W chassis, and P25 inserted into location 25Z of the Z chassis. If more than one 9146 unit is used from the same control chassis another P24-P25 cable is used, with P24 inserted into location 24W of the W chassis of the second 9146 unit, and P25 inserted in location 25W of the W chassis of the first unit. This procedure is followed for all additional units; P24 in the third unit, P25 in the second unit, and in sequence.

A-4. CABLE PLUG MODULES, P26-P27

Plug module P27 is always inserted into location 4Z of the Z chassis and P26 in location 11G of the SDS 910 or 920 Computer, or into 38X of the Y buffer.

A-5. TAPE TRANSPORT CONTROL CABLE, P3

This is the MS-type connector from the auxiliary control panel. It is inserted in location J3 of the Ampex power supply chassis.

A-6. READ HEAD CABLE, P1

Connector P1 of the read head cable from the head box is inserted into location J1 on the W chassis.

A-7. WRITE HEAD CABLE, P2

Connector P2 of the write head cable from the head box is inserted into location J2 on the W chassis.

B. POWER CONTROL

B-1. PRIMARY POWER CONNECTION

External connection to the 117-volt, 60-cycle primary power source is made at the bottom rear of the cabinet. The primary power source shall be capable of handling a load of 20 amperes for each tape unit connected.

B-2. POWER DISTRIBUTION PANEL OPERATION

The power distribution panel (lower front panel of console) permits flexible control of primary power application to the magnetic tape system. Primary power is routed from the cabinet a-c receptacle to a 30-ampere circuit breaker (see Power Distribution Schematic 102334). If the tape system is operated independent of computer operation, apply power by switching the circuit breaker and ON-REMOTE switches to ON. Application of power to the magnetic tape system may be controlled at the computer, however, by plugging the tape unit remote a-c power cord into the computer a-c plugmold, and setting the ON-REMOTE switch to the REMOTE position. The magnetic tape system then becomes energized simultaneously with power application to the computer.

Power application for more than one magnetic tape unit may be controlled at the computer power circuits by connecting the remote a-c power cord of each magnetic tape unit to J1 of the preceding tape unit power distribution panel. With the ON-REMOTE switches of all units set to REMOTE, power will be applied to all systems when computer power is turned on.

B-3. TYPICAL OPERATION MODE

The following steps are required to apply power for typical tape system operations:

a. Switch power distribution panel circuit breaker to ON, on set ON-REMOTE switch to REMOTE.

b. Set PX10 power supply ON-OFF switch to ON.

c. Depress POWER pushbutton switch on manual control panel.

C. OPERATION PROCEDURE

1. With system in MANUAL mode, load and thread reel of tape according to the procedure described in Ampex TM-4 Technical Manual. If file is to be protected, remove file-protect ring in tape reel hub.

2. Move tape forward until metallic leader has passed lower sense posts, and then reverse tape direction until tape automatically stops with metallic leader spanning lower sense posts.

3. Rotate UNIT SELECT switch to predetermined setting.

4. Rotate mode select switch to AUTOMATIC. The UNIT READY indicator on the auxiliary control panel should light indicating the tape unit is prepared to accept computer control.

III. PROGRAMMING

(Considerations for Magnetic Tape System Operation)

A. INTRODUCTION

A-1. GENERAL

The basic programming of writing and reading magnetic tape is essentially the same as for any other combination of input and output devices. Since tape is also used as an external storage device rather than strictly an input or output device, certain other functions are unique to programming for magnetic tape systems. These are discussed in detail in this section.

A-2. PROGRAM RESTRICTIONS

A-3. Without-Leader EOM Instructions

As a general rule, all EOM instructions to the tape units should specify start-without-leader. Since the tape unit generates gap on all write operations automatically, it is not necessary for the starting EOM to call for leader. A leader instruction should never be included in a magnetic tape program because the buffer will then attempt to generate leader, and an erroneous operation may occur.

A-4. Four-Character Mode

It is possible to write tape in a 1-, 2-, or 3-character-per-word mode if the program can keep the buffer supplied with characters. On reading, however, the tape unit uses the buffer character count to tell when it has read two characters and can look for gap. If a 1-character-per-word read were started, a single noise character would stop the tape. In reverse-read, or scan, a 1-character-per-word operation would cause the tape to stop after detecting the longitudinal check character at the end of the record. This means the tape would stop in the recorded information.

As a general rule, therefore, tape units should be programmed for four characters per word if possible. The write-tape-mark operation is an exception to this rule.

A-5. Timing Considerations

The tape unit specification allows repetitive commands to be given every 8.5 milliseconds. However, for short periods commands may be somewhat faster. If the user restricts his records to ten words (40 characters) in length or longer, there is effectively no timing restrictions on programming the tape unit. If, however, records of less than ten words are to be read or written repetitively, then a delay of 8.5 milliseconds must be programmed between the stopping of the tape after one record and the start-to-read or write the next record.

A-6. SIGNALS FROM THE TAPE UNIT

The tape unit sends four status signals to the computer which can be tested with SKS instructions. These may be tested before or after any tape operation to determine the status of the tape unit.

A-7. Tape-Unit-Ready Test

The tape-unit-ready test, TRT, (SKS 10410 for unit 0 on the W buffer) will skip if the tape unit is not ready. The TRT may be used with two BRU instructions to wait for the tape unit to become ready before starting an operation. The tape unit is not ready if there is no physical unit set to the logical unit number being tested, or if the selected unit is not in AUTOMATIC mode of operation. If the tape unit is in motion for any operation it will not be ready.

A-8. File-Protect Test

The tape file-protect test, FPT, (SKS 14010 for unit 0 on the W buffer) will skip if the file protect is not on. In other words, if the tape can be written, the FPT will skip; if it cannot be written, FPT will not skip. This instruction should be used before any write operation to ascertain if it is possible to perform the write.

A-9. Beginning-of-Tape Test

The load-point or beginning-of-tape test, BTT, (SKS 12010 for unit 0 on the W buffer) will skip if the tape is not positioned at the physical beginning of tape. This instruction can be used to determine when, or if, the tape is rewound.

A-10. End-of-Tape Test

The end-of-tape test, ETT, (SKS 11010 for unit 0 on the W buffer) will skip if the tape is not at the physical end of tape or end of reel. It should be used after every write operation to determine when the end of the tape is reached.

B. WRITE OPERATIONS

B-1. WRITING A TAPE RECORD

B-2. General

Writing on magnetic tape is essentially the same as outputting information to any other device. The program should first determine that the desired logical unit is ready and that the file protect is off. An EOM to write tape in either binary or decimal (BCD) will start the tape and write half a gap. The program should then supply words to the proper buffer at a sufficient rate to keep the transfer rate to the tape constant. The interrupt system may, or may not, be used as desired. At 15000 characters per second there are about 32 machine cycles between interrupts or buffer empty conditions. After the last word has been sent to the buffer, the program gives a terminate output, TOP, (EOM 14000 for the W buffer). When the last word has been written, the tape unit writes half a gap and stops. The tape control unit sends the computer an I2 (33 or 32) interrupt signal when the tape is stopped.

B-3. Write Errors

If the read-after-write check finds either a character parity or longitudinal parity error, the buffer error flip-flop is set and can be tested with a BET, (SKS 20010 for the W buffer). If there was an error detected on writing, the program may backspace the tape over the record and rewrite it. (See paragraph D for instructions to program a backspace). If the record is wrong on the second try, it is probable that a bad spot on the tape is causing the write error. To correct this, the program may backspace over the record and erase the section of tape on which the information was recorded. The program may then try to write on a new section of tape.

B-4. ERASING TAPE

B-5. General

The erase tape operation is essentially equivalent to writing information except that no flux changes are recorded on tape. The erase is timed like a write operation, in that, MIW instructions are used to supply dummy characters to the buffer and allow the tape unit to clock the desired number of character times for the length of tape to be erased.

B-6. Erasing a Record after a Write Error

If one or more write errors occur while trying to write a given record, the program may decide to consider the section of tape as bad and erase it. In this case, all that is necessary is to position the tape ahead of the bad record, and start the tape in an erase as though to write the record. After executing the same number of MIW instructions as was necessary to write the original record, a terminate-output is given to stop the operation. The tape is now in a position to write another record.

B-7. Erasing a Given Length of Tape

If one wishes to erase a fixed section of tape, it is only necessary to calculate the number of words that must be sent to the buffer to clock the erase operation over the desired length of tape. An allowance of about 0.45 inch should be made for gap that will be written by the tape control unit automatically. A write or erase operation stops when the read head finds the gap at the end of a record. Since the read head is always reading the gap in an erase operation, the tape stops 0.3 inch shorter after erase than after a write operation of the same length.

B-8. WRITING AT THE ENDS OF THE TAPE

B-9. Writing Near the Beginning of Tape

B-10. General

If the tape is situated at the beginning of the reel when a write operation is to begin, the program should first erase a section of tape before the first record. When a read operation starts from the beginning of tape, all information transfer from the tape is inhibited for one second after the tape starts. At 75 inches per second tape speed, this means that the first record must be at least 75 or 80 inches down the tape. An erase operation for 4000, 4-character words is sufficient to erase this section of tape.

B-11. Compatible Tapes

When the tape being written is to be read on a unit that has reflective strips for end-of-tape sensing with the load-point marker approximately 10 feet from the end of the tape, it is desirable to erase an 11-or 12-foot section of leader. This allows space for the conductive leader to be added to the very beginning of the tape and still have the tape readable on both systems. An erase operation for 7200 4-character words is sufficient to erase 12 feet of leader.

B-12. Writing Near the End of Tape

When the conductive leader at the end of the tape crosses the sensing post, there is still approximately 30 inches of usable tape left. This will normally be sufficient to complete the record being written, and/or to write an end of file after the last record. Thirty inches is sufficient to write 1500 4-character words.

B-13. WRITING AN END-OF-FILE RECORD

B-14. End-of-File Definition

An end-of-file record is traditionally defined as a gap 3.75 inches long followed by a tape-mark character (0001111) and its longitudinal check character. When read, the gap is ignored and the end-of-file is detected by reading the tape mark. Some tape systems, however, detect the long gap as the end of file. To maintain compatibility with these systems, the gap must be written. An end-of-file is used to indicate the end of a group of related records or the end of recorded information on a tape.

B-15. Writing the Long Gap

An erase operation for 150 4-character words will produce the long gap before the tape mark.

B-16. Writing the Tape Mark

The tape mark is a 1-character BCD record regardless of the parity of the previous information on the tape. To start the write process, an EOM instruction for one character per word in BCD should be given. This is followed by an MIW to load a word into the buffer which contains 17XXXXXX. (The 17 is the tape mark). The MIW should be followed by a terminate output. As in any write operation, when the buffer is ready or the I2 interrupt occurs, the operation is complete.

C. READ OPERATIONS

C-1. READING A TAPE RECORD

C-2. General

The reading of magnetic tape records is essentially equivalent to reading from paper tape. It is only necessary to first test the tape ready condition; and when the tape unit is ready, an EOM to read in either binary or decimal (RTBW, EOM 03612, to read binary from logical unit No. 2 on the W buffer; or RTDW, EOM 02617, to read BCD from logical unit No. 7 of the W buffer) will start the tape and prepare the buffer to receive information. When the buffer is filled with characters from the tape, an I1 (31 or 30) interrupt is generated; or, if the interrupt system is not used, the buffer is released and the information may be stored in memory. When the gap is reached the tape control unit reads the longitudinal check character and brings the tape to a stop in the middle of the inter-record gap. The program is then signaled with an I2 (33 or 32) interrupt. The buffer and the tape unit will be in the ready condition.

C-3. Read Errors

The error flip-flop in the buffer becomes set when either a character parity or a longitudinal parity error is detected on reading. After reading the record, the program may check the buffer error signal to determine if the record was read correctly. If it was in error, the program may then take corrective action. The tape should be backspaced over the erroneous record, and a second attempt made to read it. This process may be repeated several times if necessary to obtain a correct reading. As a rule of thumb, if the record is still read incorrectly after ten attempts, then it probably can be considered a bad or unreadable record.

C-4. READING AN END-OF-FILE

The end-of-file will be readily detected if the program starts the tape in a read operation and the next record is an end-of-file record. Whenever a record of less than four characters and greater than, or equal to, two characters is encountered, the program will receive an I2 (33 or 32) interrupt without ever receiving an I1 (31 or 30). A tape mark and its check character will be interpreted as a 2-character record by the tape unit. If the program receives the I2 interrupt and no I1, and this was caused by the tape mark, the word in the buffer will be 17170000 (four character per word read). If the buffer contains some other pattern then it was probably caused by noise on the tape, and should be ignored. A further check on the tape mark can be made by testing the error condition of the buffer. If the read instruction was in binary, there should be an error; if in decimal, there should not be an error.

C-5. READING AT THE ENDS OF THE TAPE

C-6. Reading Near the Beginning of Tape

When a read operation is started and the tape is at the beginning of the reel, all information transfer from the tape unit is inhibited for one second after the tape starts. This is to prevent noise from being read when the conductive leader splice crosses the sensing post. It is essential that the first record be at least 75 or 80 inches from the conductive leader otherwise it may be missed entirely or only partially read.

C-7. Reading Near the End of Tape

The end-of-tape signal is generated when the conductive leader at the end of the tape crosses the sensing post. This signal may be used to indicate that the last record has been read.

The end-of-file record may be used to indicate the end of recorded information on tape, and it might occur after the end of tape signal is set. The user may decide which condition, if not both, he wishes to accept as the end of information condition.

D. SCAN AND SEARCH OPERATIONS

D-1. SCAN TAPE

D-2. General

The scan tape operation is like the read operation except that only one I1 interrupt, or buffer full condition, occurs for each record. This occurs when the gap is first encountered and while the tape is still moving. The buffer at that time will contain the last four characters of the record. When scanning forward this means the last word of the record. When scanning reverse this means the first word of the record which will be in reverse order by characters. For example, if the first word contained the eight octal digits 01 23 45 67, when this is loaded into the buffer in the reverse scan it would appear as 67 45 23 01. The position of bits in the character are not modified; only the order of the characters are changed in the word.

D-3. Continued Scan

Since the I1 interrupt (33 or 32), or buffer full condition, occurs when the gap is reached (but while the tape is still moving), it is possible to give another scan instruction and have the tape continue to scan the next record without stopping. If no further instructions are given to the tape unit, it will bring the tape to a stop in the middle of the gap and generate an I2 interrupt. The tape unit and buffer will now be ready.

D-4. SCAN

D-5. Reverse Search

Searching for a given record that is identified by the first word, is a simple application of the repeated scan-reverse operation. First the identifier should be reversed by character. When the selected tape unit is ready, it is started in reverse scan, SRBW, (EOM07635 for unit No. 5 on the W buffer). The program may wait for the I1 interrupt, or may hang up on a WIM until the gap is reached and the buffer is filled with the first word of the record. This word is then compared with the reversed identifier for which the search is being made. If they are not equal, the program gives another scan-reverse EOM and waits to check the next record. If they are equal, the program does not give any further EOM instructions but merely waits for the I2 interrupt or for the buffer to be ready. It may then indicate a forward-read if desired.

D-6. Forward Search

A search-forward operation could be executed in the same manner as the reverse search if the identifier was recorded at the end of a record as well as at the beginning. Since this is somewhat awkward, provision has been made to search forward on the first word of a record and read the information when the desired record is found.

This is accomplished by starting the tape in a forward-read operation and waiting for the first I1 interrupt or buffer full condition. When this occurs the identifier word can be compared with the first word of the record. If they are not equal, an EOM instruction (02 14000 for tapes on the W buffer) is given to convert the read operation to scan. When the next I1 occurs, the tape is at the end of the record and the program may give another read EOM to keep the tape moving and check the next record. If the identifier and first word are equal, the program may go ahead and read the record since it is already in a read status.

D-7. SCANNING AN END OF FILE

D-8. Scanning a Short Record

There is no way to determine the length of a record scanned because the scan operation only gives one I1 interrupt, and then only when the gap is reached. This means that the gap after any two characters, even if they are noise, will cause the I1 interrupt. When the tape mark and its check character are detected in scan, the tape control generates the interrupt just the same as if many words or characters had been scanned.

D-9. Detecting the Tape Mark

The tape mark can be checked in scan operations by comparing the word in the buffer to the octal configuration XXXX1717. This is how an end of file record looks when it is scanned in either direction. The buffer error can also be checked to determine the parity of these two characters.

D-10. Using Read to Detect the Tape Mark

There is no problem in detecting the end-of-file character since the forward search starts in the read mode. It is possible to start the search-reverse operation in the read mode and convert to scan after the first I1 interrupt. In this mode, if the tape mark is encountered, the tape will stop and generate an I2 interrupt notifying the program that something unusual has happened. The tape mark will appear in the buffer as 17170000 just as in forward-read operations.

D-11. SCANNING AT THE ENDS OF THE TAPE

D-12. Scanning Near the Beginning of Tape

When scanning in reverse, the detection of the beginning of tape marker will cause the tape to be stopped and an I2 (33 or 32) interrupt, buffer ready condition, to occur. This is the only time in the scan mode of operation that an I2 interrupt occurs without prior occurrence of an I1.

D-13. Scanning Near the End of Tape

The end-of-tape detection causes no special action other than the setting of the end-of-tape signal. If the end of information is not indicated by an end-of-file record, the program should check the end-of-tape signal before scanning forward over each record.

E. SPACE AND REWIND

E-1. SPACING

E-2. Space Forward or Reverse, One Record

To space one record, the tape is started forward, or reverse as desired, in a scan mode, and the program waits for the buffer to be ready or for the I2 interrupt. The I1 interrupt should be ignored by executing a WIM to a dummy location and then executing the BRU indirect to clear the interrupt channel. When the I2 interrupt occurs, or when the buffer is ready, the tape will have been stopped in the gap following the record over which the space was executed.

E-3. Space More Than One Record

To space more than one record, another scan EOM should be executed when the I1 interrupt occurs indicating the detection of gap. This may be repeated until the desired number of records have been spaced over. The end of file, however, will require special consideration when spacing over a file of unknown length. The user may wish to program a check for tape mark characters or might start first in a read mode and convert to scan after the first word is read (refer to paragraph D-10).

E-4. REWINDING

A tape unit may be started in rewind at any time as long as the unit is ready. This operation does not use the buffer or the tape control unit. Any or all tape units may be rewound while any input/output operation, on tape units or other devices, is in progress. The rewind instruction, REWW, is an EOM (EOM 14016 for tape unit No. 6 on the W buffer). Once started the tape will continue in rewind until the beginning of tape is sensed. It will then stop. After it stops, one second is allowed for the drive capstans to return to normal speed before the unit ready signal is set.

F. SUMMARY OF TAPE OPERATION CODES

F-1. TEST CONDITIONS

Mnemonic	Description	Buffer	Coding
* TRTW n	Skip if tape unit n is not ready	W	SKS 1041n
* TRTY n		Y	SKS 1051n
* FPTW n	Skip if tape unit n not file protected	W	SKS 1401n
* FPTY n		Y	SKS 1411n
* BTTW n	Skip if tape unit n not at beginning of tape	W	SKS 1201n
* BTTY n		Y	SKS 1211n
* ETTW n	Skip if tape unit n not at end of tape	W	SKS 1101n
* ETTY n		Y	SKS 1111n

F-2. TAPE FUNCTIONS

Mnemonic	Description	Buffer	Coding
WTBW n,4	Write in binary on tape unit n	W	EOM 0365n
WTBY n,4	4-characters per word	Y	EOM 0375n
WTDW n,4	Write in decimal (BCD) on tape unit n	W	EOM 0265n
WTDY n,4	4-characters per word	Y	EOM 0275n
ETW n,4	Erase tape on tape unit n (Binary or BCD	W	EOM 0367n
* ETY n,4	has no effect on erase)	Y	EOM 0377n
RTBW n,4	Read in binary on tape unit n (For reverse	W	EOM 0361n
RTBY n,4	add 4000 octal)	Y	EOM 0371n
RTDW n,4	Read in decimal (BCD) on tape unit n	W	EOM 0261n
RTDY n,4	(For reverse add 4000 octal)	Y	EOM 0271n
SFBW n,4	Scan forward in binary on tape unit n	W	EOM 0363n
* SFBY n,4		Y	EOM 0373n
SRBW n,4	Scan reverse in binary on tape unit n	W	EOM 0763n
* SRBY n,4		Y	EOM 0773n
* SFDW n,4	Scan forward in decimal (BCD) on tape	W	EOM 0263n
* SFDY n,4	unit n	Y	EOM 0273n
* SRDW n,4	Scan reverse in decimal (BCD) on tape	W	EOM 0663n
* SRDY n,4	unit n	Y	EOM 0673n
REWW n	Rewind tape unit n	W	EOM 1401n
* REWY n		Y	EOM 1411n
* RTSW	Convert read to scan. (This is the same	W	EOM 14000
* RTSY	instruction as terminate output, TOPW or TOPY).	Y	EOM 14100

* These mnemonics are not defined in SYMBOL I.

IV. W BUFFER

(Considerations for Magnetic Tape System Operation)

This section describes the special input/output functions of the W buffer for magnetic tape system operation.

A. READ/SCAN FORWARD

A read/scan forward process is accomplished by executing an EOM0361X (i.e., read with 4 characters/word). After the first two characters are read, W0 is set.

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

After 4 characters have been read, (Ilw) is generated. (INTRUPT 1, W BUFFER)

$$(Ilw) = \overline{Wf}\ W0\ \overline{Wh}\ (En + (En))\ (\overline{Iw})\ (\overline{Ew})$$

This interrupt causes the computer to execute a WIM which sets Wf, W7, and W8.

$$sWf = - - - + Wx\ (T5 - T0)$$

Upon examination of the first word (4 characters), the program determines if this is the desired block. If it is, then the established command (EOM0361X) is permitted to continue. If it is determined that this is not the block being scanned for, then the program executes an EOM14000. This EOM sets W10 and resets W0 converting the read to a scan.

$$sW10 = - - - + Ioc\ C12\ \overline{W9}\ C17\ C20$$

$$rW0 = - - - + Ioc\ C12\ \overline{C17}\ \overline{C20}$$

Two characters later W0 is again set,

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

and W8 is locked on.

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + - - -$$

Flip-flop Wf can no longer be reset in the usual manner.

$$rWf = - - - + \overline{W7}\ \overline{W8}\ W4\ (T22 - T17)$$

Normal (Ilw) signals are no longer generated,

$$(Ilw) = \overline{Wf}\ W0\ \overline{Wh}\ (En + (En))\ (\overline{Iw})\ (\overline{Ew})$$

and the remainder of the block shuffles through the buffer. Upon detection of the gap, Wf is reset.

$$rWf = - - - + \overline{W9}\ W10\ W11\ W0\ \textcircled{Mtg}\ \overline{W7}\ (T22 - T17)$$

Upon detection of the gap, $\textcircled{Ilw}$ is generated.

$$\textcircled{Ilw} = \overline{Wf}\ W0\ \overline{Wh}\ (En + \textcircled{En})\ \textcircled{\overline{Iw}}\textcircled{\overline{Ew}}$$

The scan may be converted back to a read by executing an EOM0361X which sets the buffer back to a read status. (Note: Because the tape unit is already running, the EOM0361X is locked out from having adverse effects on the magnetic tape unit timing). By executing the EOM 0361X, W10 is reset, W0 is reset, and the character counter is unlocked. Wf is set and $\textcircled{Ilw}$ is released.

$$rW10 = Wc$$

$$rW0 = Wc + - - -$$

$$sW8 = - - - + \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh}$$

$$sWf = - - - + Wc\ \overline{Wh}$$

$$\textcircled{Ilw} = \overline{Wf}\ W0\ \overline{Wh}\ (En + \textcircled{En})\ \textcircled{\overline{Iw}}\ \textcircled{\overline{Ew}}$$

Because W0 is reset the tape unit cannot stop.

$$rMf = - - - + Dt\ \overline{D2}\ (W9 + W0)$$

To prevent the longitudinal check character from setting We due to the block just scanned, the $\textcircled{Wes}$ one shot in the tape control unit is gated by $\overline{Mf}\ \overline{Mr}$.

$$s\ \textcircled{Wes} = W11\ \overline{W9}\ (M1 + M2 + M3 + M4 + M5 + M6 + Mp)\ D3\ \overline{Mf}\ \overline{Mr} + - - -$$

The longitudinal check character is only permitted to set We if the tape unit is to be stopped.

B. SCAN FORWARD

A scan forward also may be accomplished by executing an EOM0363X (i.e., scan with 4 characters/word). After the first two characters are read W0 is set,

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

and W8 is locked on.

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + - - -$$

Flip-flop Wf cannot be reset in the usual manner,

$$rWf = - - - + \overline{W7}\ \overline{W8}\ W4\ (T22 - T17)$$

Normal (Ilw) signals are not generated,

$$(\text{Ilw}) = \overline{Wf}\ W0\ \overline{Wh}\ (En + (\text{En}))\ (\overline{\text{Iw}})(\overline{\text{Ew}})$$

and the data shuffles through the buffer (the last 4 characters remain in the buffer). Upon the detection of the gap Wf is reset.

$$rWf = - - - + \overline{W9}\ W10\ W11\ W0\ (\text{Mtg})\ \overline{W7}\ (T22 - T17)$$

Upon detection of the gap (Ilw) is generated.

$$(\text{Ilw}) = \overline{Wf}\ W0\ \overline{Wh}\ (End + (\text{En}))\ (\overline{\text{Iw}})(\overline{\text{Ew}})$$

The scan may be stopped (e.g., based on a block counting subroutine) by not resetting W0, however a WIM must be executed to release the (Ilw) interrupt.

$$sWf = Wx\ (T5 - T0) - - -$$

If the scan is to continue, executing an EOM0363X will reset W0, set Wf, and unlock W8.

$$rW0 = + - - - Wc$$

$$sWf = Wc\ \overline{Wh}$$

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh}$$

The scan process repeats, W0 setting after reading the first two characters of the next block.

C. FILE MARKER FUNCTIONS

On a read/scan forward (EOM0361X), a file marker will cause the following: both characters will be read, the gap between characters will not be recognized because W0 will not be set, and the program will not be interrupted

$$sW0 = + - - - + \overline{W9}\ W6\ \overline{W8}$$

$$(\text{Ilw}) = \overline{Wf}\ W0\ \overline{Wh}\ (En + (\text{En}))\ (\overline{\text{Iw}})(\overline{\text{Ew}})$$

The second character will set W0 as the character counter indicates W7 $\overline{W8}$. Because the character counter has not down counted to $\overline{W7}\ \overline{W8}$, Wf will remain set and (Ilw) will not interrupt. Because W0 is set the tape unit will halt and set Wh.

$$sWh = (\text{Whs})\ T24$$

This will permit the character counter to down count and cause Wf to reset.

$$sW4 = Wh\ T24 + - - -$$

$$rWf = - - - + \overline{W7}\ \overline{W8}\ W4\ (T22 - T17)$$

Interrupt signal $\bigcirc\!\text{I2w}$ will be generated.

$$\bigcirc\!\text{I2w} = \overline{Wf}\ Wh\ (En + \bigcirc\!\text{En})$$

The $\bigcirc\!\text{I2w}$ interrupt must be interpreted by the program to determine its cause

(i.e., no $\bigcirc\!\text{I1w}$ signals received).

In a scan forward mode (EOM0363X), a file marker will cause the following sequence: both characters will be read, the gap between characters will not be recognized because W0 will not have been set, nor will Wf be reset.

$$sW0 = + - - - \overline{W9}\ W6\ \overline{W8}$$

$$rWf = + - - - \overline{W9}\ W10\ W11\ W0\ \bigcirc\!\text{Mtg}\ \overline{W7}\ (T22 - T17)$$

The second character will set W0 as the character counter indicates W7 $\overline{W8}$. Because the character counter has not down counted to $\overline{W7}$ $\overline{W8}$, Wf will remain set. Because the second character converted the character count from W7 $\overline{W8}$ to $\overline{W7}$ W8, the character counter will lock up.

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + - - -$$

A gap after the second character will generate an $\bigcirc\!\text{I1w}$ because of resetting Wf.

$$rWf = - - - + \overline{W9}\ W10\ W11\ W0\ \bigcirc\!\text{Mtg}\ \overline{W7}\ (T22 - T17)$$

$$\bigcirc\!\text{I1w} = \overline{Wf}\ W0\ \overline{Wh}\ (En + \bigcirc\!\text{En})\ \bigcirc\!\overline{\text{Iw}}\ \bigcirc\!\overline{\text{Ew}}$$

The interrupt must be interpreted (i.e., counted as if a block had been read or the characters must be inspected for file marker uniqueness).

The scan may be continued by executing another EOM0363X which will reset W0. If the scan is to be ended, then a WIM must be executed to set Wf and release $\bigcirc\!\text{I1w}$. Because W0 is left set, the tape will halt and Wh will set.

$$sWf = Wx\ (T5 - T0) + - - -$$

$$sWh = \bigcirc\!\text{Whs}\ T24 + - - -$$

With Wh set, the character counter will start down counting, Wf will reset, $\bigcirc\!\text{I2w}$ will be generated, and the W buffer will clear.

$$sW4 = Wh\ T24 + - - -$$

$$rWf = \overline{W9}\ W10\ W11\ W0\ \textcircled{Mtg}\ \overline{W7}\ (T22 - T17) + - - -$$

$$\textcircled{I2w} = \overline{Wf}\ Wh\ (En + \textcircled{En})$$

D. SCAN REVERSE

A scan reverse process is accomplished by executing an EOM0763X. The first character may be the longitudinal check character but the gap following will have no effect as W0 has not been set. The second character received by the buffer sets W0 and locks W8.

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

$$sW8 = \overline{W7}\ W9\ W10\ W11\ \overline{Wh} + - - -$$

With W8 locked, $\textcircled{I1w}$ signals are not generated in the normal manner because Wf is not permitted to reset. The characters shuffle through the buffer.

$$rWf = - - - + \overline{W7}\ \overline{W8}\ W4\ (T22 - T17)$$

$$\textcircled{I1w} = \overline{Wf}\ W0\ \overline{Wh}\ (En + \textcircled{En})\ \textcircled{\overline{Iw}}\ \textcircled{\overline{Ew}}$$

Upon detection of the gap Wf is permitted to reset,

$$rWf = - - - + \overline{W9}\ W10\ W11\ W0\ \textcircled{Mtg}\ \overline{W7}\ (T22 - T17)$$

and an $\textcircled{I1w}$ is generated.

$$\textcircled{I1w} = \overline{Wf}\ W0\ Wh\ (En + \textcircled{En})\ \textcircled{\overline{Iw}}\ \textcircled{\overline{Ew}}$$

The $\textcircled{I1w}$ causes a program interrupt, and by execution of a WIM the last four characters read (actually the first word of the block) are inspected. If the scan is to halt, the program does not take any further action, leaving W0 set.

The WIM sets Wf to turn off the $\textcircled{I1w}$ interrupt.

$$sWf = Wx\ (T5 - T0) + - - -$$

$$\textcircled{I1w} = \overline{Wf}\ W0\ \overline{Wh}\ (En + \textcircled{En})\ \textcircled{\overline{Iw}}\ \textcircled{\overline{Ew}}$$

Because W0 is left set, the tape unit may halt. When $\textcircled{Whs}$ is generated Wh is set.

$$sWh = \textcircled{Whs}\ T24 + - - -$$

Flip-flop Wf is reset by down counting the character counter.

$$sW4 = Wf\ T24\ W5 + - - -$$

$$rWf = \overline{W7}\ \overline{W8}\ W4\ (T22 - T17)$$

With Wh set and Wf reset, (I2w) is generated.

$$(I2w) = \overline{Wf}\ Wh\ (En + (\overline{En}))$$

Interrupt signal (I2w) indicates that the tape has halted and the reverse scanned block located. If it is desired to continue the scan, the program executes an EOM0763X again causing W0 to be reset.

$$rW0 = Wc + - - -$$

With W0 reset, Wf cannot be reset by the gap.

$$rWf = - - - + \overline{W9}\ W10\ W11\ W0\ (Mtg)\ \overline{W7}\ (T22 - T17)$$

The EOM sets up the character count, W7 W8, and the scan continues. Reverse scan is the same as forward scan with respect to the file mark.

E. W BUFFER LOGIC

E-1. UNIT ADDRESS REGISTER

$$sW14 = Ws\ C23$$

$$rW14 = Wc$$

$$sW13 = Ws\ C22$$

$$rW13 = Wc$$

$$sW12 = Ws\ C21 + (Kf)$$

$$rW12 = Wc$$

$$sW11 = Ws\ C20$$

$$rW11 = Wc$$

$sW10 = Ws\ C19 + Ioc\ \overline{C17}\ \overline{W9}\ \overline{C20}\ C12$

$rW10 = Wc$

E-2. INPUT-OUTPUT

$sW9 = Ws\ C18$

$rW9 = Wc$

E-3. CHARACTER COUNTER

$sW8 = Ws\ C16 + W7\ \overline{W8}\ W4\ T0 + Wx\ T24\ Ww + \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + \textcircled{St}$

$rW8 = Wc\ (T22 - T17) + W8\ W4\ T0$

$sW7 = Ws\ C15 + Wx\ T24\ Wn + \textcircled{St}$

$rW7 = Wc\ (T22 - T17) + W7\ \overline{W8}\ W4\ T0$

E-4. CLOCK COUNTER

E-5. Clock Detector

$sW6 = \overline{W5}\ Ecw\ (T22 - T17)$

$rW6 = W5\ T0 + Wc$

E-6. Precess Detector

$sW5 = \overline{W5}\ W6\ \overline{Ecw}\ T0 + Ws\ C13\ C18$

$rW5 = W4\ T0 + Wc$

E-7. Precess W

$sW4 = W5\ Wf\ T24 + Ws\ T0 + Wh\ T24 + \textcircled{St}\ T0$

$rW4 = W4\ T0 + W\ 4\ T24$

E-8. COMPUTER INTERLOCK

$sWf = Wc\ \overline{Wh} + Wx\ (T5 - T0)$

$rWf = \overline{W8}\ \overline{W7}\ W4\ (T22 - T17) + Ws\ W9 + \overline{W9}\ W10\ W11\ W0\ \textcircled{Mtg}\ \overline{W7}\ (T22 - T17)$

E-9. INTERRUPT SIGNALS

$$I1w = \overline{Wf}\ W0\ \overline{Wh}\ (En + En)\ \overline{Iw}\ \ \overline{Ew}$$

$$I2w = \overline{Wf}\ Wh\ (En + En)$$

E-10. TIME SHARE CALLING SIGNAL

$$Tsw = \overline{Wf}\ W0\ \overline{Wh}\ Iw$$

E-11. HALT DETECTOR

$$sWh = Whs\ T24 + W9\ \overline{W11}\ \overline{W0}\ W5\ \overline{W6}\ T24$$

$$+ \overline{W9}\ \overline{W10}\ \overline{W11}\ W12\ \overline{W13}\ (\overline{R1}\ \overline{R2}\ \overline{R3}\ \overline{R4}\ \overline{R5}\ \overline{R6}\ \overline{Rp})\ W5\ T24$$

$$rWh = Wc$$

E-12. ERROR DETECTOR

$$sWe = \overline{W9}\ W4\ \overline{Rp}\ (T5 - T0)\ \overline{Wh}\ Np + W0\ \overline{W6}\ W5\ Ecw\ Tp + Wes$$

$$rWe = Wc\ \overline{Wh}$$

E-13. CHARACTER BUFFER

$$sR1 = W4\ Wn\ \overline{Wx}\ (\overline{Tp}\ \overline{T24}) + \overline{W9}\ W6\ \overline{W5}\ Zw1 + W4\ Wx\ C23$$

$$rR1 = W4\ \overline{Wn}\ \overline{Wx} + \overline{W9}\ \overline{W6}\ \overline{W5}\ \overline{W4} + W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11 + W4\ Wx\ \overline{C23}$$

$$sR2 = W4\ R1 + \overline{W9}\ W6\ \overline{W5}\ Zw2$$

$$rR2 = W4\ \overline{R1} + \overline{W9}\ \overline{W6}\ \overline{W5}\ \overline{W4} + W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11$$

$$sR3 = W4\ R2 + \overline{W9}\ W6\ \overline{W5}\ Zw3$$

$$rR3 = W4\ R2 + \overline{W9}\ \overline{W6}\ \overline{W5}\ W4 + W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11$$

$$sR4 = W4\ R3 + \overline{W9}\ W6\ \overline{W5}\ Zw4$$

$$rR4 = W4\ \overline{R3} + \overline{W9}\ \overline{W6}\ \overline{W5}\ \overline{W4} + W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11$$

$$sR5 = W4\ R4 + \overline{W9}\ W6\ \overline{W5}\ Zw5$$

$$rR5 + W4\ \overline{R4} + \overline{W9}\ \overline{W6}\ \overline{W5}\ \overline{W4} + W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11$$

$sR6 = W4\ R5 + \overline{W9}\ W6\ \overline{W5}\ Zw6$

$rR6 = W4\ \overline{R5} + \overline{W9}\ \overline{W6}\ \overline{W5}\ \overline{W4} + W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11$

$sRp = \overline{W9}\ W4\ \overline{Rp}\ Ww\ (T22\text{-}T17) + W9\ W4\ \overline{Rp}\ Wn\ (T5\text{-}T0)\ \overline{Wx} + \overline{W9}\ W6\ \overline{W5}\ Zwp$

$+ W9\ W4\ (T22\text{-}T17) + W9\ W4\ \overline{Rp}\ C23\ (T5\text{-}T0)\ Wx$

$rRp = \overline{W9}\ W4\ Rp\ Ww\ (T22\text{-}T17) + W9\ W4\ Rp\ Wn\ (T5\text{-}T0)\ \overline{Wx} + \overline{W9}\ \overline{W6}\ \overline{W5}\ \overline{W4}$

$+ W9\ \overline{W4}\ W5\ \overline{W6} + W9\ W10\ W11 + W9\ W4\ Rp\ C23\ (T5\text{-}T0)\ Wx$

E-14. LOAD W FROM C

$Wx = (\overline{01}\ 03\ \overline{04}\ 05\ \overline{06}\ F1\ \overline{F3})\ \overline{Ts} + Wp\ Ts$

E-15. CLOCK SIGNAL

$Ecw = \overline{(\overline{Ecw})}$

E-16. CHARACTER INPUTS

(Zw1) = (R1t) + (R1r) + (R1m) + - - -

(Zw2) = (R2t) + (R2r) + (R2m) + - - -

(Zw3) = (R3t) + (R3r) + (R3m) + - - -

(Zw4) = (R4t) + (R4r) + (R4m) + - - -

(Zw5) = (R5t) + (R5r) + (R5m) + - - -

(Zw6) = (R6t) + (R6r) + (R6m) + - - -

(Zwp) = (Rpt) + (Rpr) + (Rpm) + - - -

E-17. BUFFER REGISTER

$sWw = W4\ R6$

$+ W4\ Tp\ W8$

$+ W4\ T24\ W7$

$+ (\overline{T24}\ \overline{Tp})\ \overline{W4}\ Wx\ C23 + (T24 + Tp)\ \overline{W4}\ Wn$

$+ \overline{W4}\ Wn\ \overline{Wx}$

$rWw = (\overline{sWw})$

$sWn =$ Ww delayed by 24 pulse times

$rWn = \overline{Ww}$ delayed by 24 pulse times

E-18. CLEAR AND SET SIGNALS

$Wc = Buc\ \overline{C17}\ (T22 - T17) + Wh\ \overline{Wf}\ T0 + (St)\ (T5 - T0)$

$Ws = Buc\ \overline{C17}\ (T5 - T0)$

W Buffer Ready $= \overline{W9}\ \overline{W10}\ \overline{W11}\ \overline{W12}\ \overline{W13}\ \overline{W14}$

WIM and MIW interlock $= \overline{Wf}\ (W0 + \overline{W9})$

E-19. HALT INTERLOCK

$sW0 = \overline{W9}\ W6\ \overline{W8} + Ws\ W9$

$rW0 = Wc + Ioc\ C12\ \overline{C17}\ \overline{C20} + W9\ (Iwf)\ W5\ \overline{W8}\ \overline{W7}$

E-20. MAGNETIC TAPE CONTROL SIGNALS

Stop Read Interlock = W0

Output Character Interlock $= \overline{W5}$

V. LOGIC DESCRIPTION

A. GENERAL

A basic knowledge of the logic used in SDS 910 and 920 Computers is essential for comprehension of the logic used in implementing magnetic tape system functions. General description of the mechanization of magnetic tape unit commands and control signals, when operated in the AUTOMATIC mode, is contained in paragraphs B through K in sequence of normal application. For purposes of discussion and brevity, many logic equations are used showing only part of their gate mechanizations. A complete listing of the 9148 control unit logic and the 9146 electronics unit logic is contained in paragraphs L and M respectively, and a block diagram (Figure 5-14) illustrate their related functions.

Timing diagrams of the magnetic tape commands are included in Figures 5-1 through 5-13. These diagrams illustrate the timing sequence relationship of signals received from the computer and those generated in the magnetic tape logic and control circuits. Frequent reference to these diagrams enables the reader to more readily visualize actions that take place within the logic and control circuits at specific times.

Definitions of logic terms used in magnetic tape unit circuits are given in the glossary (Table 5-2) at the end of this section. Complete logic diagrams showing connector and pin locations of signals are included in Appendix I of this manual.

B. SELECTION AND STARTING

B-1. MAGNETIC TAPE COMMANDS

A magnetic tape process is selected and started by executing the appropriate EOM command indicated in the table below:

PROCESS	COMMAND
Read	EOM03X1X
Read/Forward Scan	EOM0361X
Forward Scan	EOM0363X
Reverse Scan	EOM0763X
Write	EOM03X5X
Erase	EOM03X7X
Rewind	EOM1401X

The commands all refer to magnetic tape systems as used with the W buffer and provide for binary handling of information. The commands may be suitably modified to accommodate Y buffer and/or BCD operation.

Refer to Figure 5-1 for timing sequence of the following processes.

B-2. STARTING

A generalized start command is generated for all processes except Rewind.

$$M\ start = Buc\ \overline{C17}\ C20$$

As rewind on one tape unit may occur concurrently with any process on another tape unit, a separate Rewind start command is generated.

$$Rewind = Ioc\ C12\ Q2$$

The D1 timer is triggered to provide a delay for starting any process except Rewind.

$$sD1 = (M\ start\ Q2)\ dc + - - -$$

$$rD1 = 5.8\ ms\ after\ sD1$$

B-3. FORWARD AND REVERSE CONTROLS

The reverse control flip-flop, Mr, is set for the reverse scan mode, and the forward control flip-flop, Mf, is set for all other commands.

$$sMf = (\underline{M\ start\ Q2})\ \overline{C12}\ \overline{Mf}\ \overline{Mr}$$

$$rMf = (\underline{M\ start\ Q2})\ Mf\ Mr + (\overline{W11}\ \overline{M\ start} + \ldots)\ dc$$

$$sMr = (\underline{M\ start\ Q2})\ C12\ \overline{Mf}\ \overline{Mr}$$

$$rMr = (\underline{M\ start\ Q2})\ Mf\ Mr + (\overline{W11}\ \overline{M\ start} + \ldots)\ dc$$

B-4. DATA MODE SELECT

A data mode select flip-flop, Me, is included to permit reading or recording in a BCD or binary mode.

$$sMe = (\underline{M\ start\ Q2})\ \overline{C14}\ \overline{Me}$$

$$rMe = (\overline{W11}\ \overline{M\ start})\ dc$$

B-5. TAPE UNIT SELECT

Each tape unit contains a tape unit select flip-flop, Ma, which is set at the beginning of a tape process and remains set until the process is completed.

$$sMa = (\underline{M\ start\ Q2})\ \overline{Mad}\ Ready\ (Unit\ Select)$$

$$rMa = (\overline{Mf}\ \overline{Mr}\ \overline{D1}\ \overline{Dt}\ \overline{D3})\ dc$$

A tape unit Addressed signal, Mad, guards against addressing of several tape units simultaneously.

$$Mad = Ma0 + Ma1 + Ma2 + Ma3 + Ma4 + Ma5 + Ma6 + Ma7$$

where: Ma0 is the tape unit select flip-flop, Ma, of the tape unit designated zero.

Setting of Ma is controlled by a Ready signal to permit selection only if the tape unit is in ready condition.

$$Ready = \overline{Ma}\ \overline{Mb}\ \overline{Db}\ \textcircled{Ready}$$

A tape unit is ready if it is not selected, $\overline{Ma}$; not in the process of rewind, $\overline{Mb}\ \overline{Db}$; and if the tape handler interlocks are properly set providing the signal $\textcircled{Ready}$.

$$\textcircled{Ready} = K8\ K1\ \overline{K9}$$

The Unit Select signal permits setting of Ma only if coincidence is established between the EOM unit address bits C21, C22, and C23 and the tape UNIT SELECT switch on the control panel. If the tape UNIT SELECT switch designates the tape unit as unit 5, the EOM command to set Ma5 must contain C21 $\overline{C22}$ C23.

$$Unit\ Select = \overline{C17}\ C20\ Kc21\ Kc22\ Kc23$$

where: Kc21, Kc22, and Kc23 are UNIT SELECT switch controlled combinations of the address bits C21, C22, and C23.

B-6. FORWARD AND REVERSE ACTUATE

Tape motion is achieved for the addressed tape handler by:

$$Forward\ actuate = Ma\ Mf$$

$$Reverse\ actuate = Ma\ Mr$$

B-7. READ AND WRITE ACTIVATE

Upon addressing a tape unit a Read Activate signal is generated, and if a write operation is required a Write Activate signal is generated.

Read activate = Ma ($\overline{\text{Bor}}$) $\overline{\text{Db}}$

Write activate = Ma W9 W11

Read activation is inhibited if the tape is on metallic leader, ($\overline{\text{Bor}}$). If on metallic leader, read activation is inhibited by $\overline{\text{Db}}$ for 1.0 second from the time of M start.

sDb = (Ma (Bor)) dc +---

rDb = 1.0 sec after sDb

Write amplifier voltage is interlocked with the file protect ring on the tape reel.

+25 volts Write = K1 energized

K1 set = $\overline{\text{File Protect}}$

B-8. REWIND

Each tape unit can be signalled to start a rewind by executing an EOM1401X

sMb = (Ioc C12 Q2) Ready (Unit Select)

rMb = (Ma + Db + ($\overline{\text{Ready}}$)) dc

K2 set = Mb

To permit capstan deceleration a Rewind Stop Delay, Db, inhibits Ready for 1.0 second upon detection of the beginning of the reel, (Bor), signal.

sDb = (Mb (Bor)) dc + - - -

rDb = 1.0 sec after sDb

Ready = $\overline{\text{Ma}}$ $\overline{\text{Mb}}$ $\overline{\text{Db}}$ (Ready)

C. TEST To (Sio)

Each tape unit can be tested for File Protect (SKS1401X), Ready (SKS1041X), Beginning of Reel, (Bor) (SKS1201X) and for End of Reel, Df, (SKS1101X).

($\overline{\text{Siot}}$) = C12 (Unit Select) File Protect
+ C13 (Unit Select) (Bor)
+ C14 (Unit Select) Df
+ C15 (Unit Select) Ready

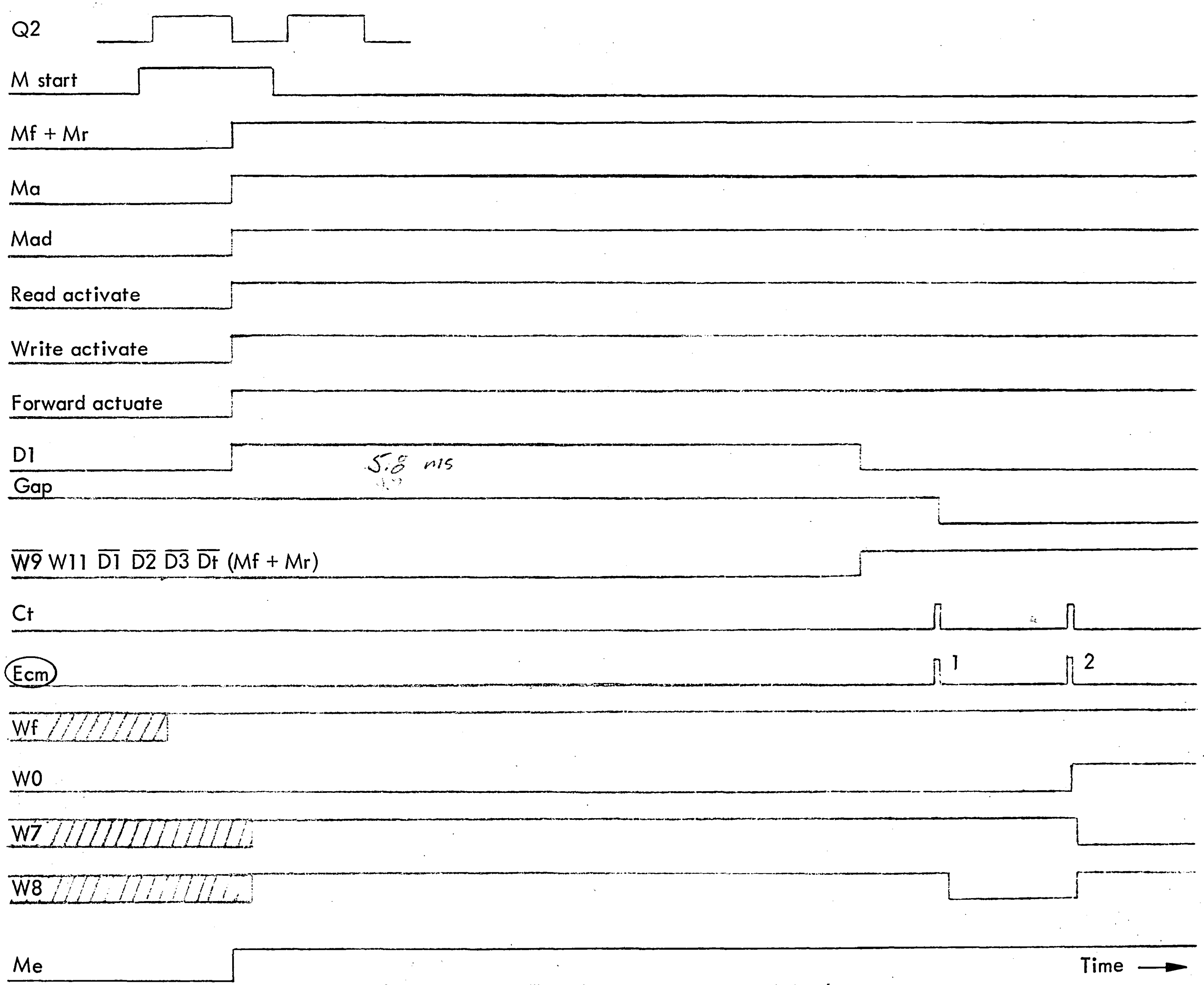


Figure 5-1. Magnetic Tape Input or Output - - Initial Start

Df is a timer which will set upon detection of the End of Reel.

$$sDf = (Eor)\ dc$$

$$rDf = 0.5\,sec \text{ after } sDf$$

The (Siot) signal from each tape unit is sent to the computer from the tape control unit as (Sio).

$$(Sio) = \overline{C17}\ C20\ (\ (Siot0)\ \cdot\ (Siot1)\ \cdot \cdot \cdot \cdot\ (Siot7)\ )$$

For each test made a skip will occur if the signal tested for is not present.

D. INPUT PROCESS TIMING

Refer to Figures 5-2 through 5-11 for timing sequence of the following processes.

D-1. READ

The input process, once started, must find data on the tape. If a four character per word input process had been programmed, then after two characters have been read, W0 in the W buffer is set.

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

$$rW0 = Wc + - - -$$

Once W0 has been set, detection of gap, Mtg, will commence a tape shut-down sequence. The D2 one-shot is triggered to delay stopping until the desired position is achieved within the gap. The forward flip-flop, Mf, is then reset and the D3 one-shot is triggered to provide a delayed halt signal, (Whs), after the tape has completely stopped.

and Above for LCC

$$sMtg = (\underline{\overline{Gap} + - - -})\ \overline{Mtg}$$

$$rMtg = \underline{Cr}\ Mtg + (\overline{W11}\ \overline{M\ start})\ dc$$

$$Gap = 150\,\mu s \text{ with no Ct signal}$$

$$sD2 = \overline{W9}\ W11\ W0\ \overline{Dt}\ (Mf + Mr)\ dc\ (Mtg)\ dc$$

$$rD2 = 0.8 \text{ ms after } sD2$$

$$sDt = D2\ \underline{Mc}\ \overline{Dt}$$

$$rDt = D3\ \underline{Mc}\ Dt + - - -$$

Will Mss

$$rMf = - - - + (\overline{D1}\ \overline{D2}\ Dt\ ([illegible] + W0) + - - -)\ dc$$

$$sD3 = (\overline{D1}\ \overline{D2}\ Dt\ \overline{Mf}\ \overline{Mr})$$

$$rD3 = 3 \text{ ms after } sD3$$

$$rMa = (\overline{Mf}\ \overline{Mr}\ \overline{Dt}\ \overline{D3}\ \overline{D1})\ dc$$

$$\text{(Whs)} = (\overline{M\ start})\ W11\ \overline{D1}\ \overline{D3}\ \overline{Dt}\ \overline{Mf}\ \overline{Mr} + - - -$$

$$Ready = \overline{Ma}\ \overline{Mb}\ \overline{Db}\ \text{(Ready)}$$

The input clock signal, (Ecm) , to the W buffer is gated by $\overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}$ to block transient signals and the longitudinal parity character

$$\text{(Ecm)} = \overline{W9}\ W11\ Ct\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ (Mf + Mr) + ---$$

Ct is the clock signal derived from the incoming data from the tape.

D-2. READ/FORWARD SCAN

A read/forward scan process is similar to a read process. Upon detection of the second character after gap, W0 in the W buffer is set.

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

$$rW0 = Wc + - - -$$

After the fourth character is read (i.e. first word) an (Ilw) interrupt in the W buffer is generated.

$$\text{(Ilw)} = \overline{Wf}\ W0\ \overline{Wh}\ (En + \text{(En)})\ \text{(}\overline{Iw}\text{)}\ \ \text{(}\overline{Ew}\text{)}$$

The interrupt pemits the program to evaluate the first word to detemine if the read should be converted to a scan or not. If this is the block being scanned for, then the normal read is pemitted to continue with the tape halting at the end of the block. If it is not the block being scanned for, the program must execute an EOM14000 to convert the read to a scan. This resets W0 and sets W10 in the W buffer.

$$rW0 = Ioc\ C12\ \overline{C17}\ \overline{C20} + - - -$$

$$sW10 = Ioc\ C12\ \overline{C17}\ \overline{C20}\ \overline{W9} + - - -$$

After two characters W0 is again set,

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

and W8 in the W buffer is locked on.

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + ---$$

This prevents Wf in the W buffer from resetting by normal character count down and thus inhibits further program interrupts.

$$sWf = Wc\ \overline{Wh} + Wx\ (T5 - T0)$$

$$rWf = \overline{W7}\ \overline{W8}\ W4\ (T22 - T17) + ---$$

$$Ilw = \overline{Wf}\ W0\ \overline{Wh}\ (En + En)\ \overline{Iw}\ \overline{Ew}$$

Upon detection of gap, Wf is permitted to reset and the D2 timer is triggered.

$$rWf = --- + \overline{W9}\ W10\ W11\ W0\ \ Mtg\ \ \overline{W7}\ (T22 - T17)$$

$$sD2 = \overline{W9}\ W11\ W0\ Mtg\ \overline{Dt}\ (Mf + Mr)\ dc + ---$$

$$rD2 = 0.8 \text{ ms after } sD2$$

A program interrupt is generated.

$$Ilw = \overline{Wf}\ Wo\ \overline{Wh}\ (En + En)\ \overline{Iw}\ \overline{Ew}$$

To return from a forward scan process to a read/forward scan, the program must execute a read instruction during the interval the D2 timer is set. The read instruction resets W10, resets W0, unlocks W8, and establishes the character count.

$$rW0 = Wc + ---$$

$$rW10 = Wc + ---$$

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + ---$$

To override extraneous signals in the gap, timers D1 and D3 are triggered. The D2 timer had been triggered upon gap detection thus setting Dt.

$$sDt = D2\ \underline{Mc}\ \overline{Dt}$$

$$rDt = D3\ \underline{Mc}\ Dt + ---$$

$$sD1 = (M \text{ start } Q2)\ dc + ---$$

$$rD1 = 5.8 \text{ ms after } sD1$$

$$sD3 = (\overline{D1}\ \overline{D2}\ Dt\ \overline{W9}\ W11\ (\overline{W0} + \overline{W11})\ dc + ---$$

$$rD3 = 0.8 \text{ ms after } sD3$$

$$Ecm = \overline{W9}\ W11\ Ct\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ (Mf + ---) + ---$$

Because W0 is reset, the tape is not permitted to halt.

$$rMf = - - - + (\overline{D1}\ \overline{D2}\ Dt\ (W0 + - - -) + \overline{W11}\ \overline{M\ start})\ dc$$

Since the W buffer is now in the read mode, the recognition of data characters will permit repeating of the read/forward scan sequence.

D-3. FORWARD SCAN

A forward scan process is similar to a read process. The scan is initiated by an EOM0363X. After the second character has been read, W0 is set.

$$sW0 = \overline{W9}\ W6\ \overline{W8} + - - -$$

Because W10 was set by the EOM command, W8 locks up and the data shuffles through the W buffer.

$$sW10 = C19\ Ws + - - -$$

$$sW8 = \overline{W7}\ \overline{W9}\ W10\ W11\ \overline{Wh} + - - -$$

Wf is not permitted to reset and normal program interrupts are inhibited.

$$rWf = - - - + \overline{W7}\ \overline{W8}\ W4\ (T22 - T17)$$

$$(\text{Ilw}) = \overline{Wf}\ W0\ \overline{Wh}\ (En + (\text{En}))\ (\overline{\text{Iw}})\ \ (\overline{\text{Ew}})$$

Upon detection of gap, Wf is reset and Ilw is generated.

$$rWf = \overline{W9}\ W10\ W11\ W0\ \ (\text{Mtg})\ \ \overline{W7}\ (T22 - T17) + - - -$$

The last four characters remain in the buffer. The computer program must determine whether the scan is to be continued or not. If the scan is to be concluded then executing a WIM instruction releases the (Ilw) interrupt by setting Wf.

$$sWf = Wx\ (T5 - T0) + - - -$$

Since W0 is still set, the tape unit will stop and a halt signal will be generated.

$$sD2 = (W0\ \overline{W9}\ W11\ \overline{Dt}\ (Mf + - - -)\ Mtg)\ dc + - - -$$

$$rD2 = 0.8 \text{ ms after } sD2$$

$$sDt = D2\ \underline{Mc}\ \overline{Dt}$$

$$rDt = D3\ \underline{Mc}\ Dt + - - -$$

$$rMf = + (\overline{D1}\ \overline{D2}\ Dt\ (W0 + - - -) + - - -$$

$$sD3 = \overline{D1}\ \overline{D2}\ Dt\ \overline{Mf}\ \overline{Mr}$$

$$(\text{Whs}) = \overline{M\ start}\ W11\ \overline{D1}\ \overline{D3}\ \overline{Dt}\ \overline{Mf}\ \overline{Mr} + - - -$$

If the scan is to be continued, the program must execute an EOM0363X. This instruction resets W0.

$$rW0 = Wc + - - -$$

To override extraneous signals in the tape gap, D1 is triggered.

$$sD1 = (M\ start\ Q2)\ dc + - - -$$

Mf cannot be reset so the scan continues,

$$rMf = \overline{D1}\ Dt\ \overline{D2}\ (W0 + - - -)\ dc + - - -$$

D-4. REVERSE SCAN

A reverse scan, EOM0763X, procedes in a similar manner as forward scan with minor differences.

The D1 timer is triggered after every block to insure that when the tape is stopped it will be properly positioned within the gap. Triggering D1 delays resetting Mr.

$$sD1 = - - - + (D2 \cdot Mr)\ dc$$

$$rMr = - - - + (\overline{D1}\ \overline{D2}\ Dt\ (- - - + W0\ )\ dc$$

E. OUTPUT PROCESS TIMING

E-1. WRITE

The write process, EOM03X5X, once started, proceeds until W0 in the W buffer is reset by the computer, the last output character has been completed (indicated by $\overline{W0}\ \overline{W6}\ W5$), and the gap signal is detected. The D2 timer is triggered to record a gap. The forward flip-flop, Mf, is then reset, and the D3 timer is triggered to continue recording the gap and generate a delayed halt signal, (Whs) , after the tape is stopped.

$$sW0 = - - - + Ws\ W9$$

$$rW0 = Wc + loc\ C12\ \overline{C17}\ \overline{C20} + - - -$$

W5 W9 W11 $\overline{W0}$ $\overline{W6}$ $\overline{DT}$ MF Mtg $\overline{M\ start}$

$$sD2 = - - - + (W5\ W9\ W11\ (\overline{W0} + \overline{W11})\ (\overline{W6} + \overline{W11})\ \overline{Dt}\ Mf\ Mtg\ \overline{M\ start})\ dc$$

$$rD2 = 0.8 \text{ ms after } sD2$$

$$sD3 = \overline{D1}\ \overline{D2}\ Dt\ (\overline{Mf}\ \overline{Mr} + - - -)\ dc + - - -$$

$$rD3 = 3.0 \text{ ms after } sD3$$

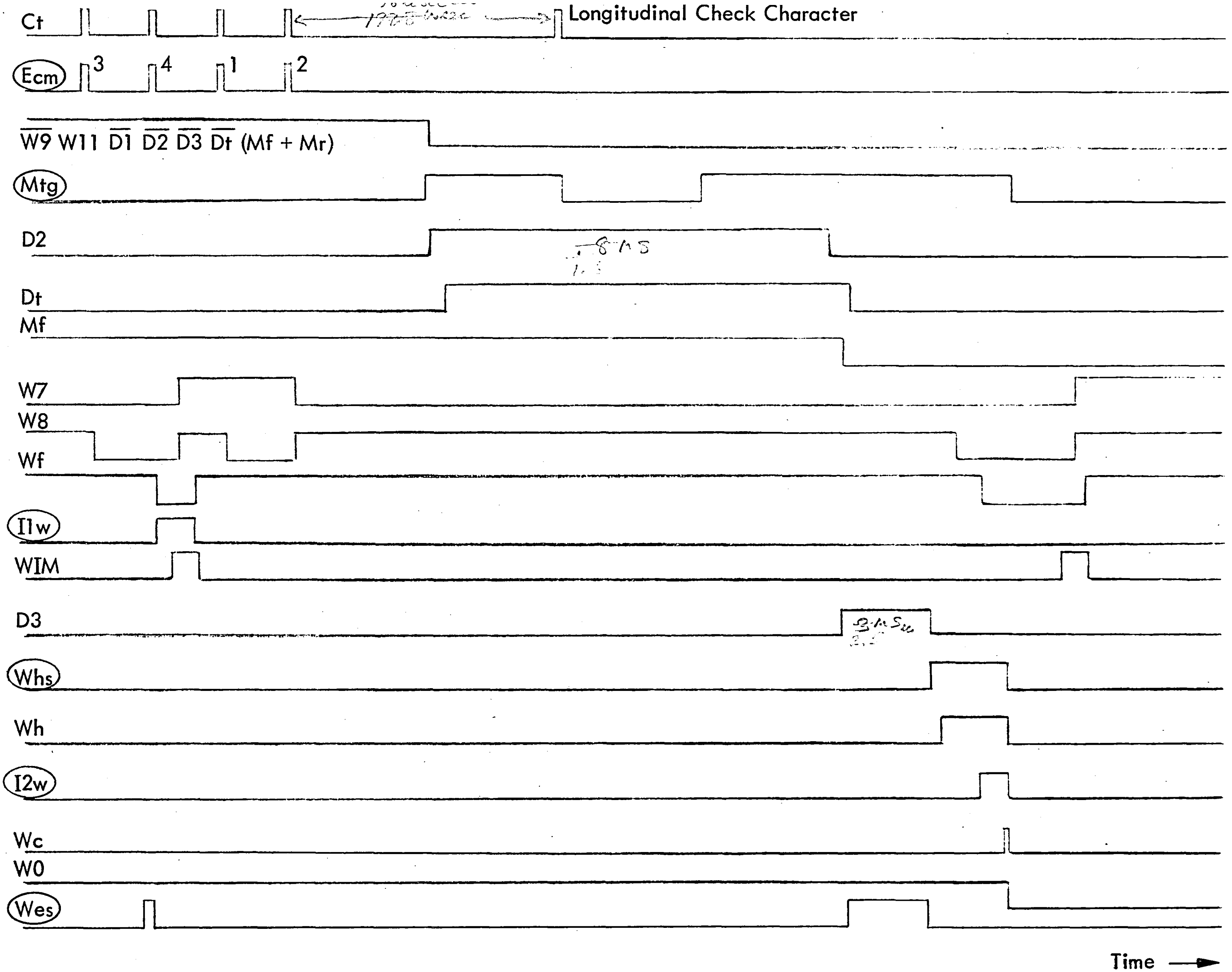


Figure 5-2. Magnetic Tape Read - - Termination

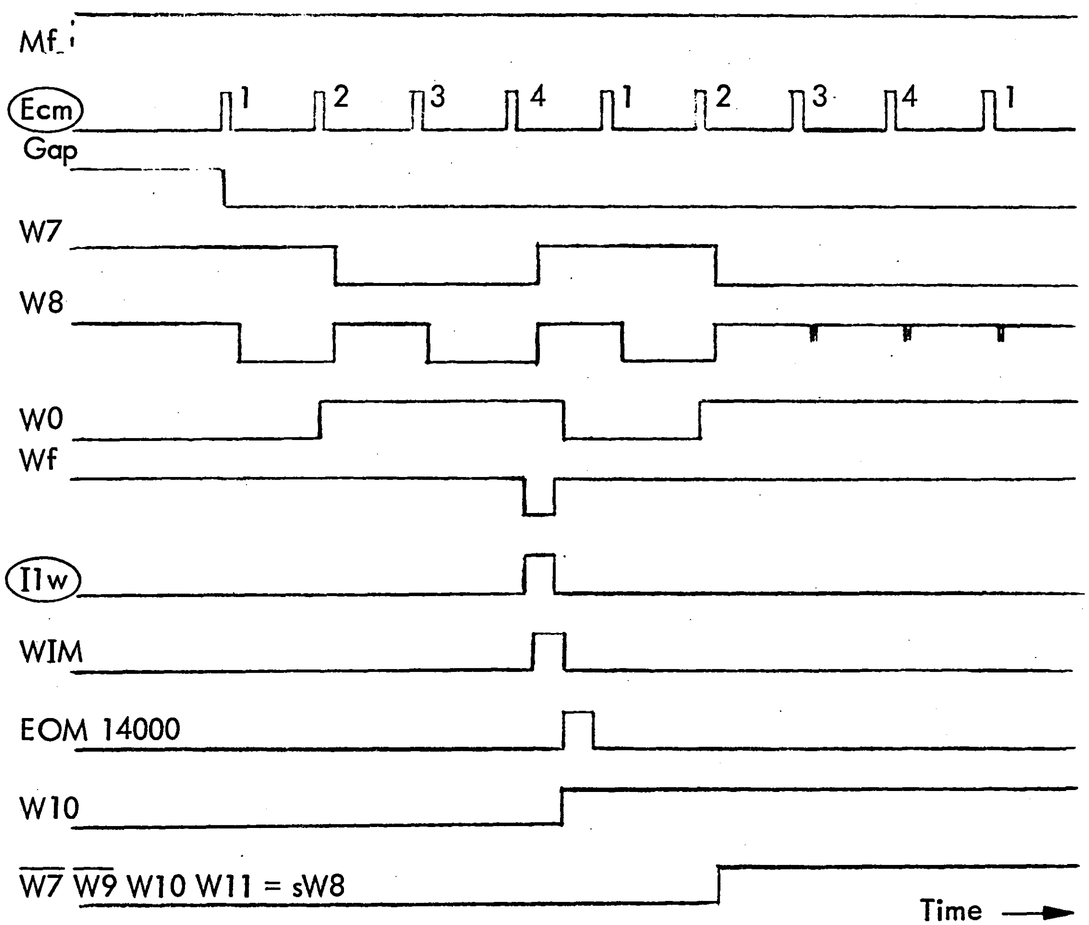


Figure 5-3. Magnetic Tape Read, Forward Scan - - Transition from Read to Scan

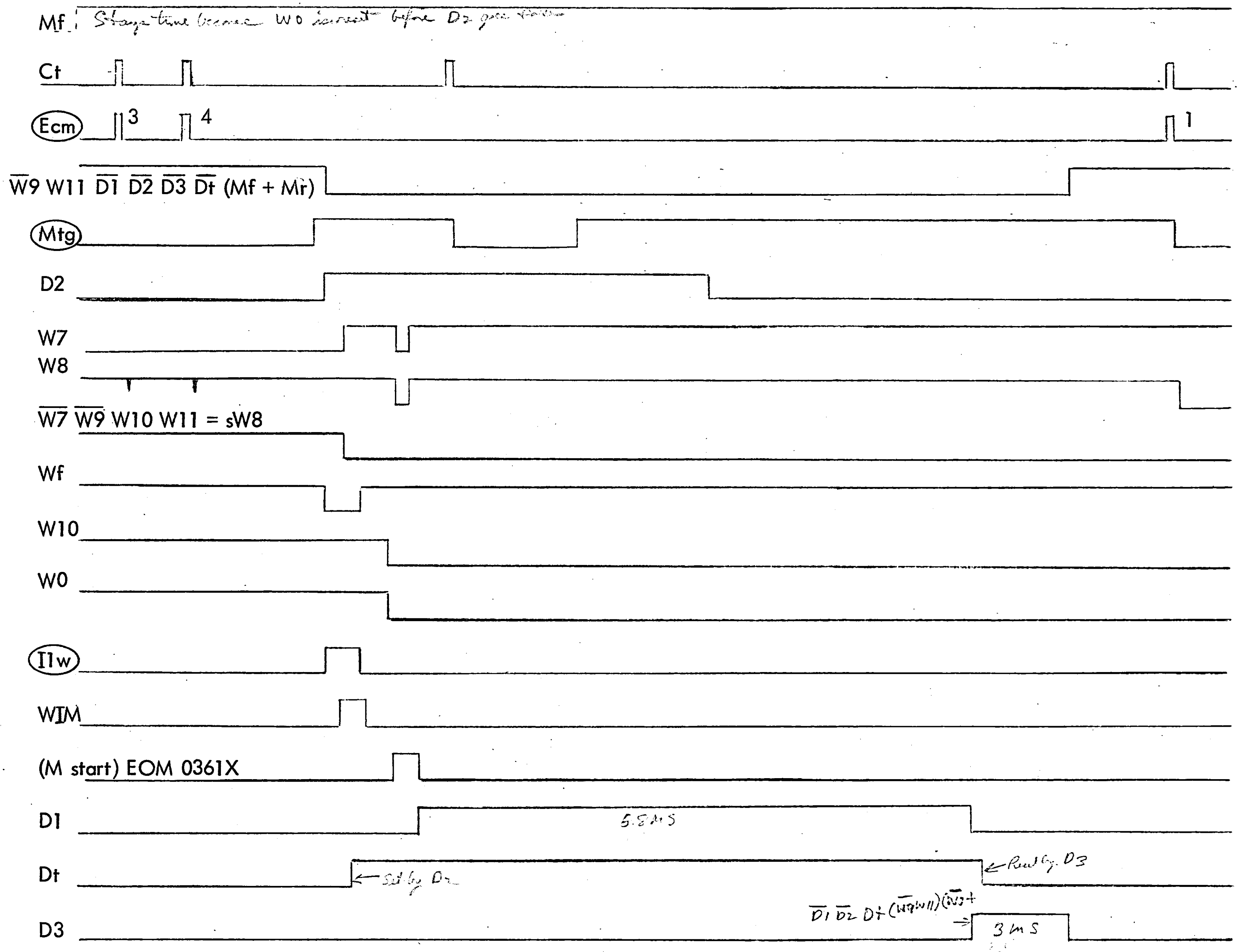


Figure 5-4. Magnetic Tape Read, Forward Scan - - Transition from Scan to Read

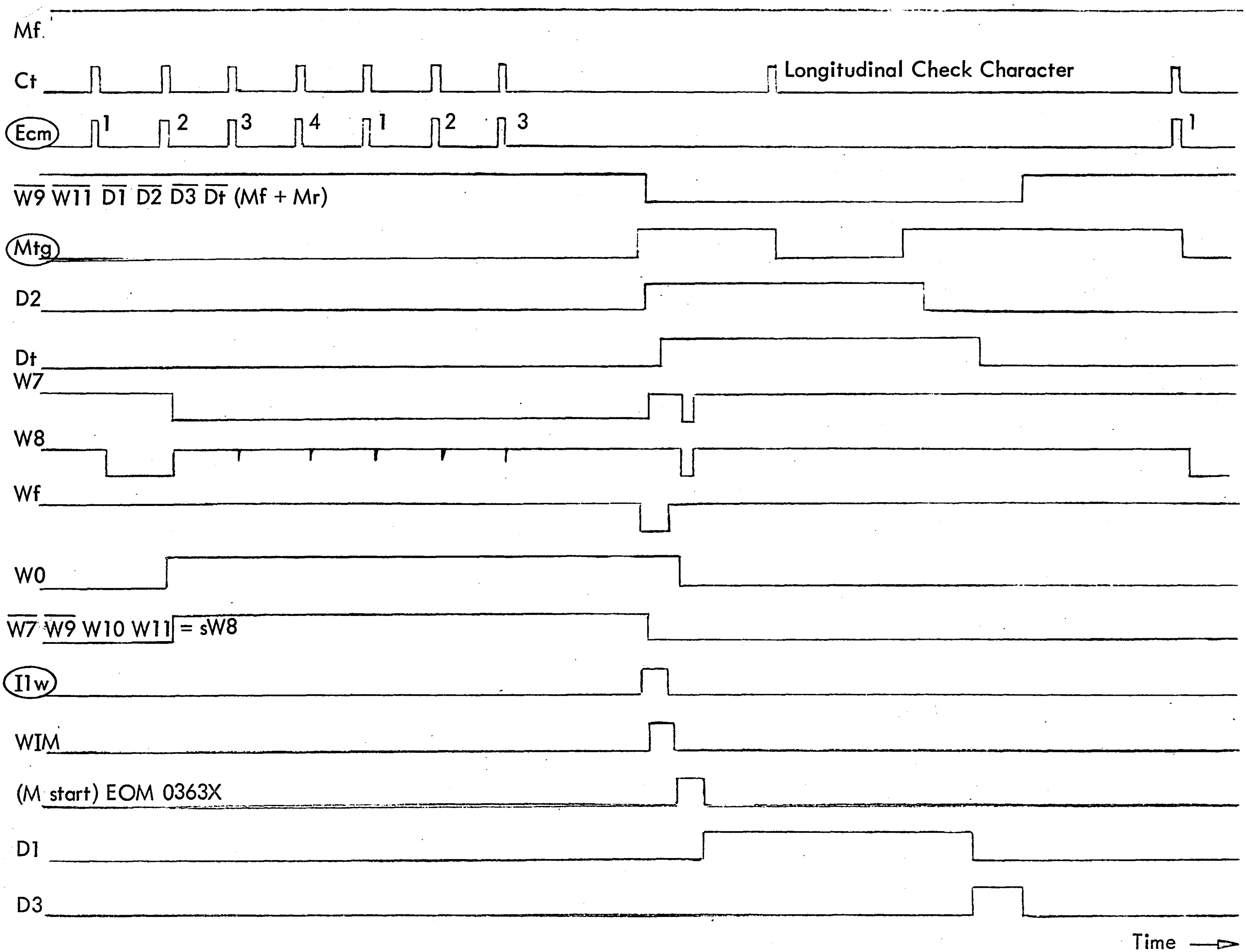


Figure 5-5. Magnetic Tape Forward Scan - - Scan Continued

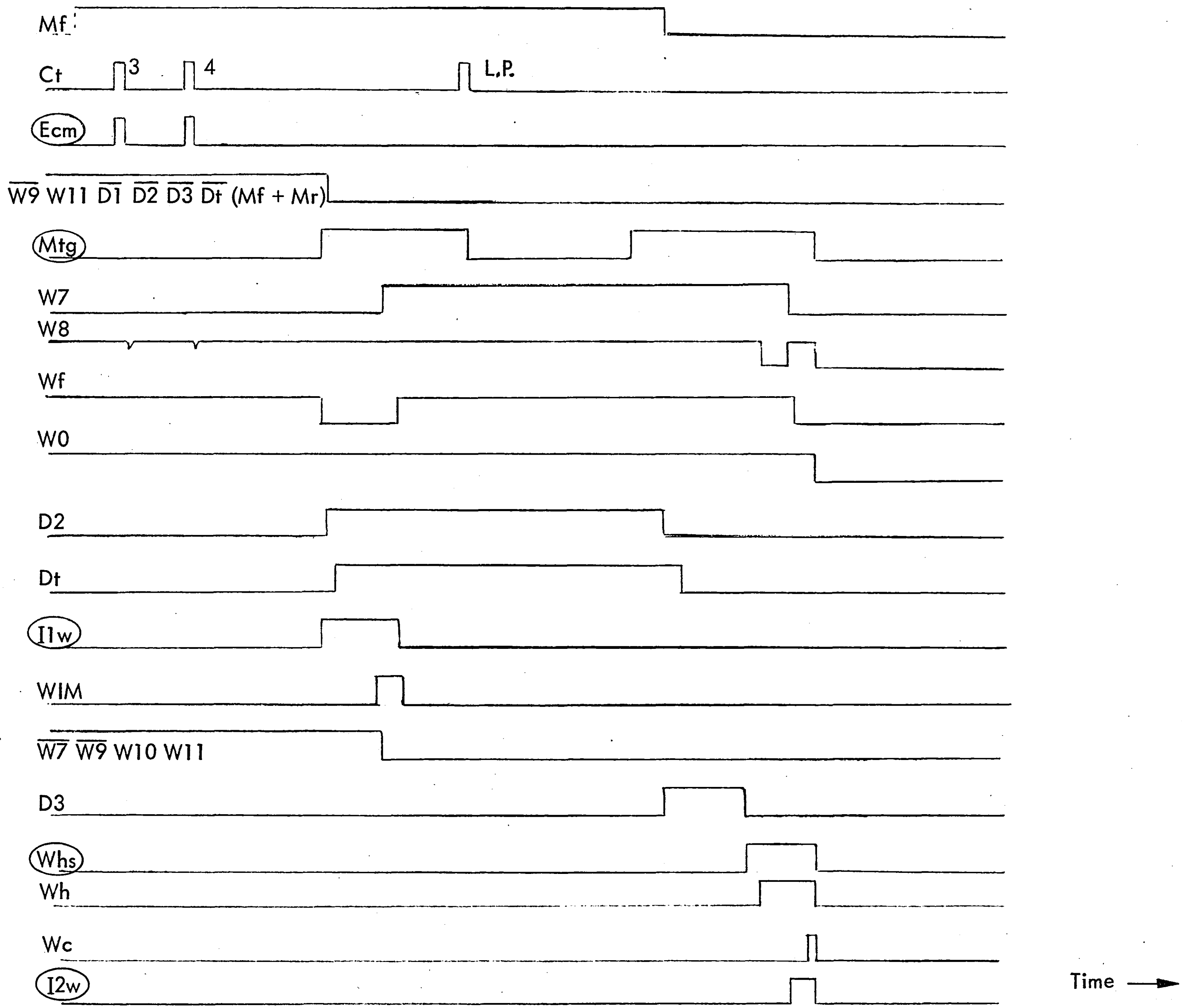


Figure 5-6. Magnetic Tape Forward Scan - - Termination

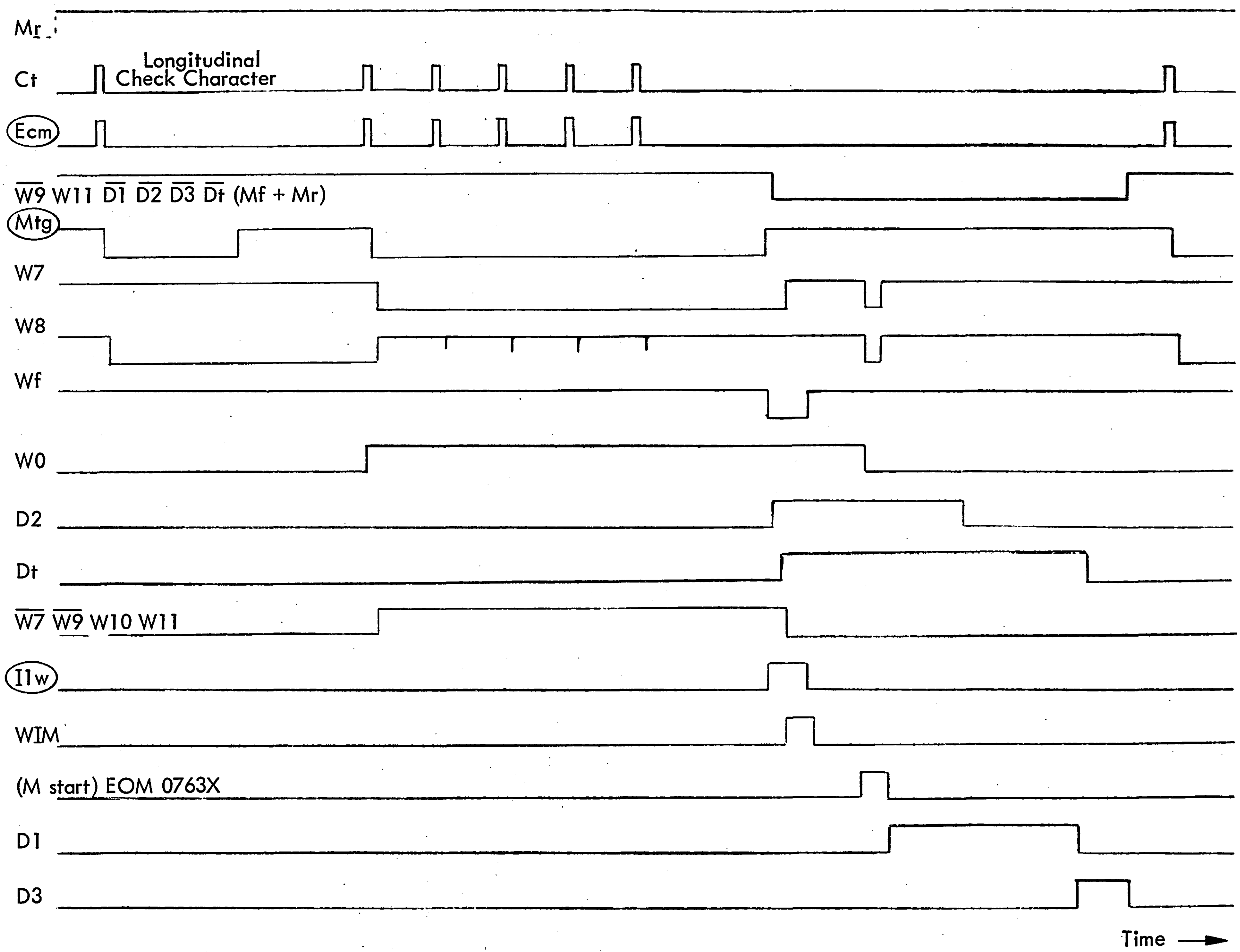


Figure 5-7. Magnetic Tape Reverse Scan - - Scan Continued

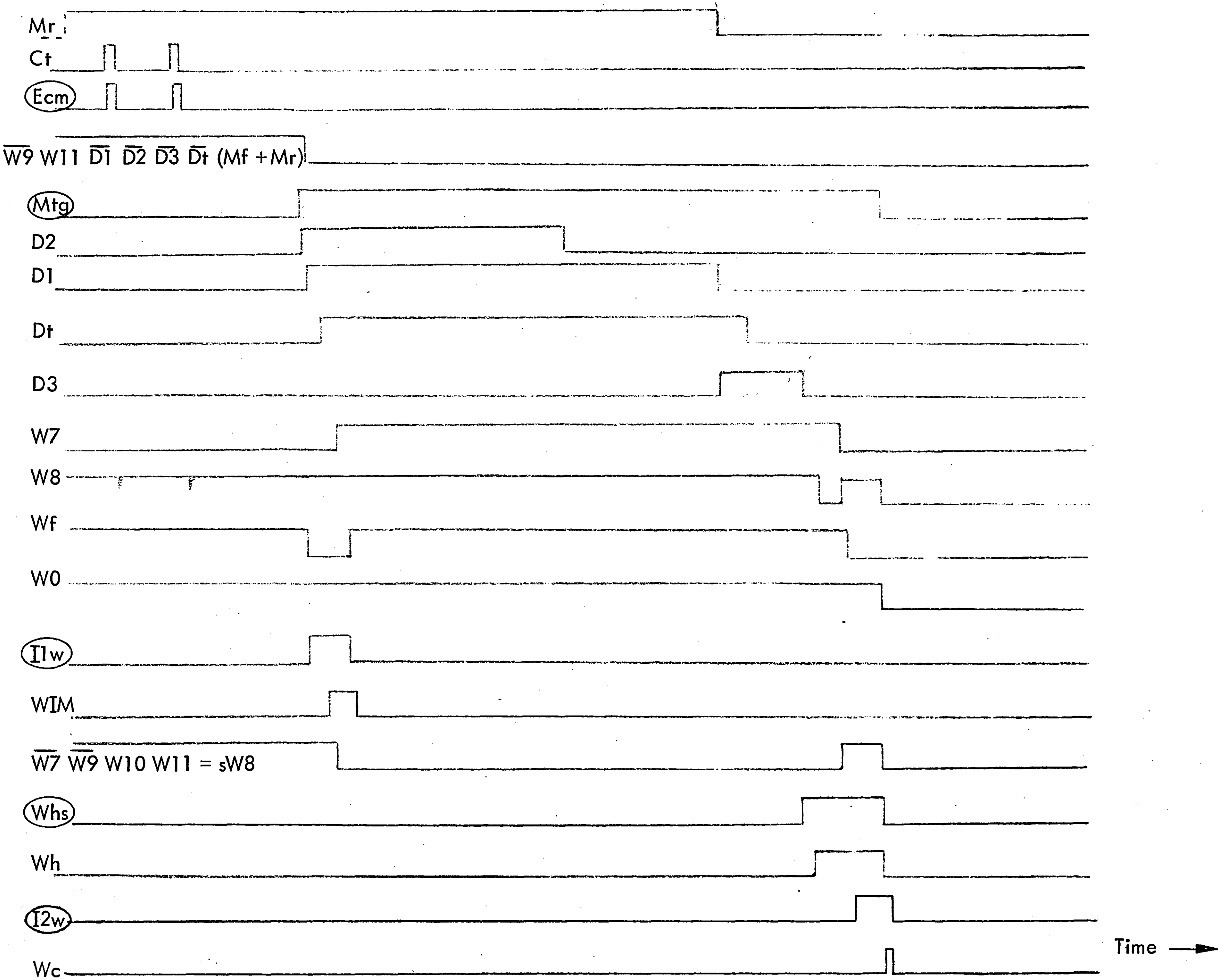


Figure 5-8. Magnetic Tape Reverse - - Scan Termination

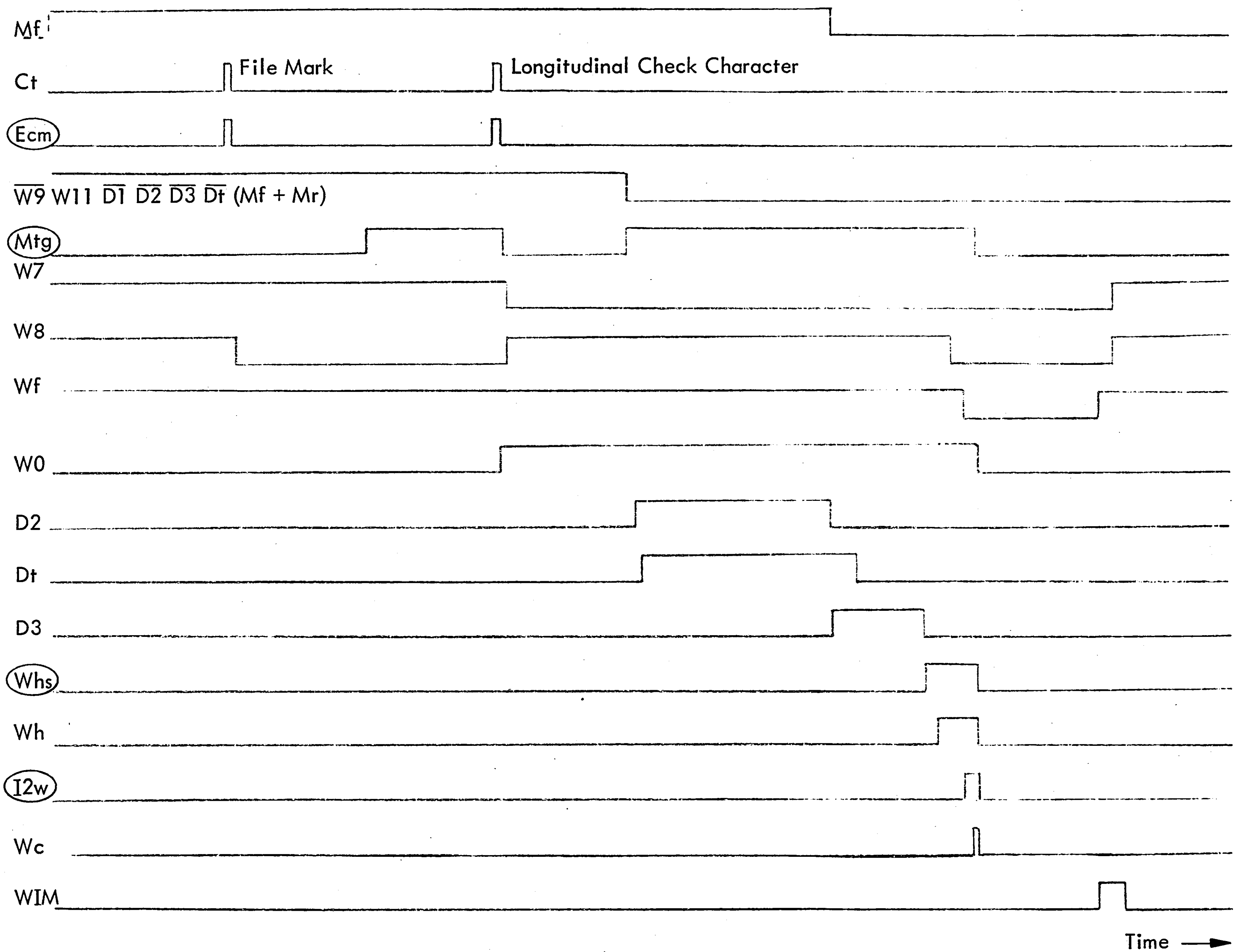


Figure 5-9. Magnetic Tape Read, or Read-Forward Scan - - File Mark Timing

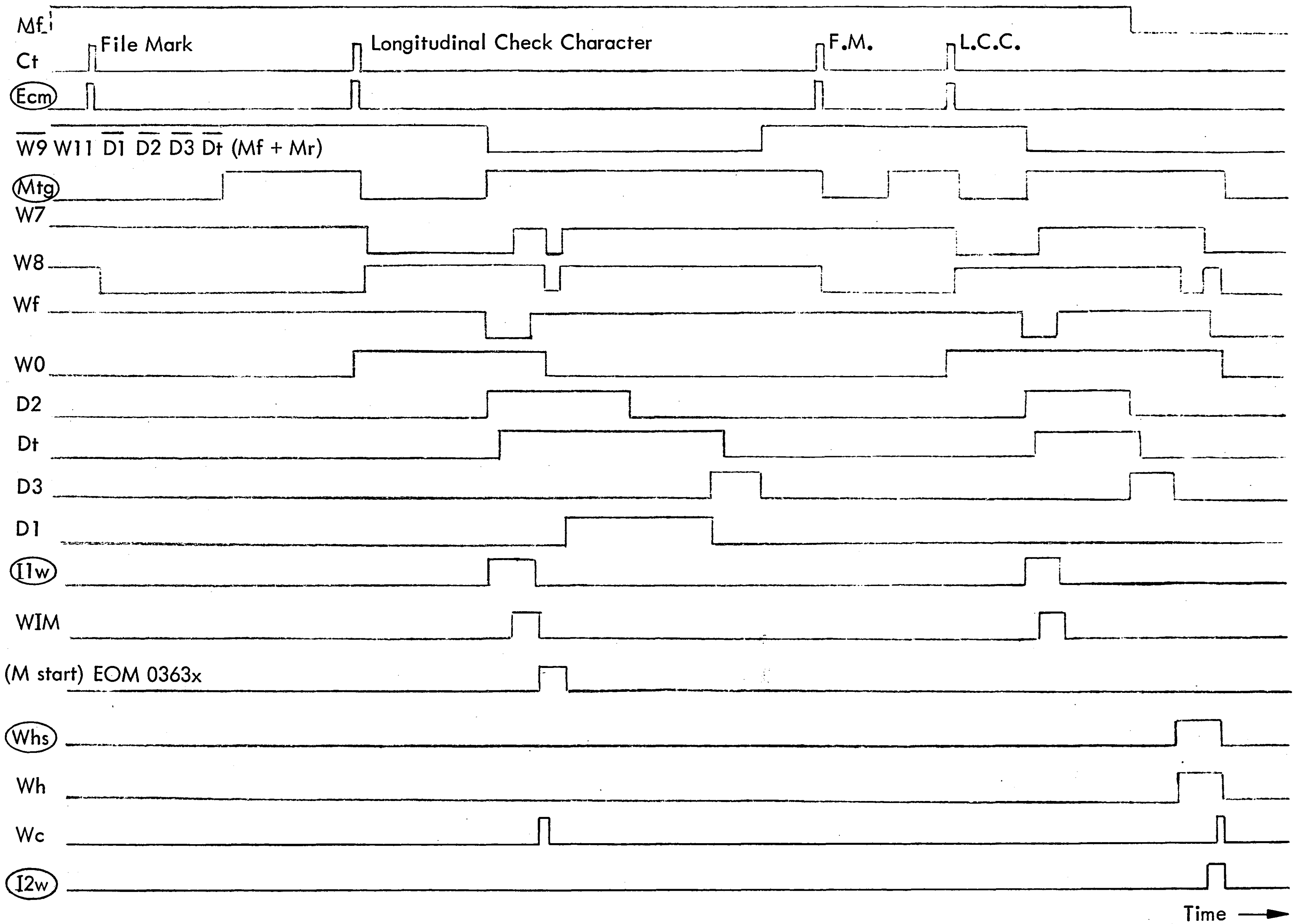


Figure 5-10. Magnetic Tape Forward Scan - - File Mark Continuation and Termination

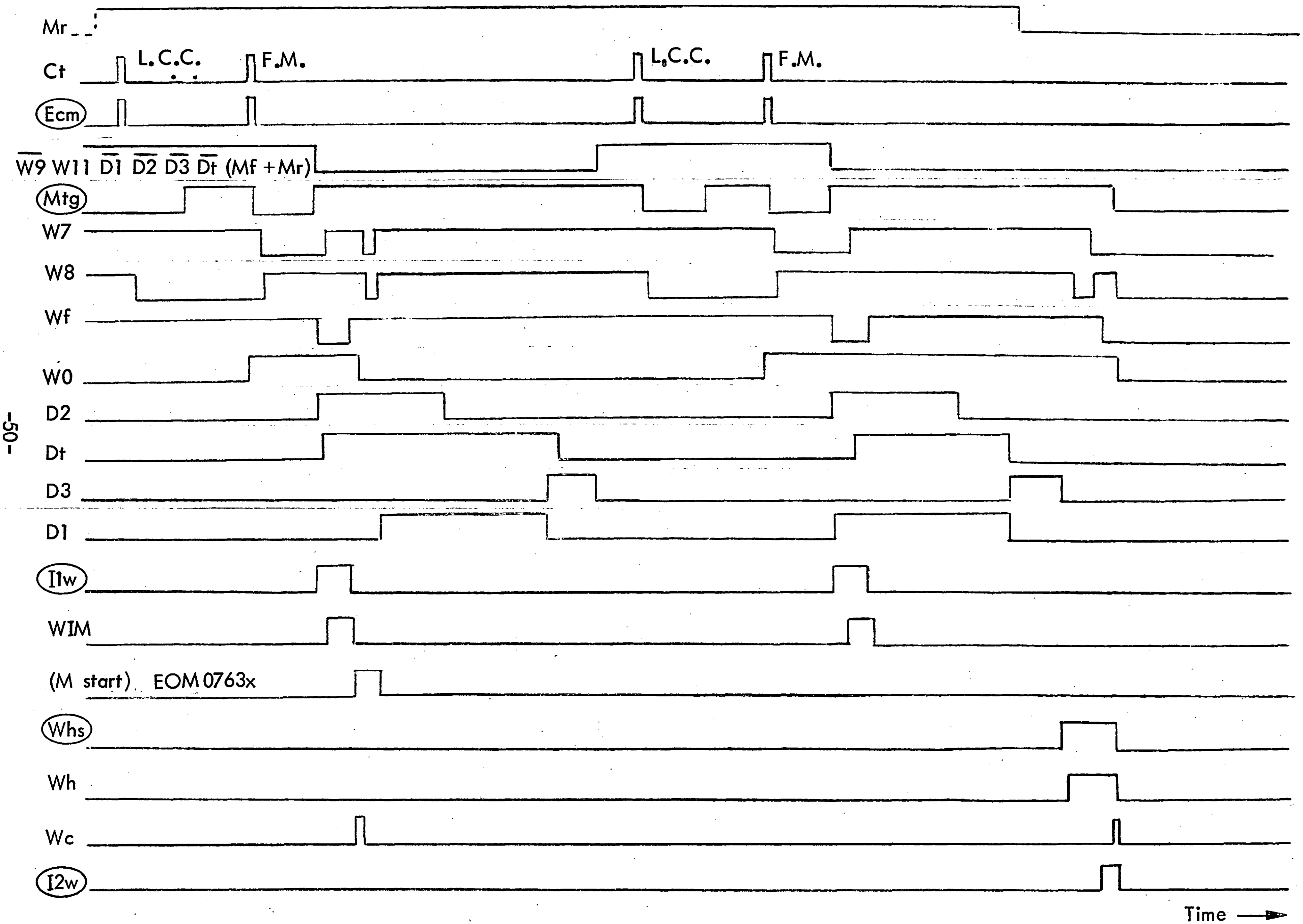


Figure 5-11. Magnetic Tape Reverse Scan - - File Mark Continuation and Termination

$sDt = D2\ \underline{Mc}\ \overline{Dt}$

$rDt = D3\ \underline{Mc}\ Dt + ---$

$rMf = --- + (\overline{D1}\ \overline{D2}\ Dt\ (W9\ W11 + ---) + ---)\ dc$

$Whs = W11\ \overline{Mf}\ \overline{Mr}\ \overline{D1}\ \overline{D3}\ \overline{Dt}\ \overline{M\ start} + ---$

The output clock, Ecm, for the W buffer is provided by oscillator Mc, gated by the clock enable flip-flop, Mca, to generate the starting gap.

$Ecm = --- + W9\ W11\ Mc\ Mf\ Mca$

$sMca = \overline{D1}\ (Ma0\ Bor0 + --- + Ma7\ Bor7)\ \underline{Mc}$

$rMca = (M\ start\ Q2 + ---)\ dc$

Flip-flop Mca is prevented from setting during start delay D1 and when the tape is on the metallic leader, (Ma0 Bor0 + -- + Ma7 Bor7).

E-2. ERASE

The erase process, EOM03X7X, has the same timing as write except that the Mtg signal is forced on as soon as $\overline{W0}\ \overline{W6}\ W5$ occurs, thus prematurely setting timer D2.

$sMtg = (\underline{--- + W10\ Mu})\ \overline{Mtg}$

$rMtg = --- + (\overline{W11}\ \overline{M\ start})\ dc$

$sD2 = --- + (W5\ W9\ W11\ (\overline{W0} + \overline{W11})\ (\overline{W6} + \overline{W11})\ \overline{Dt}\ Mf\ \overline{M\ start}\ Mtg)\ dc$

rD2 = 0.8 ms after sD2.

To obtain an erased length on tape equal to the recorded length, the number of output erase characters must be increased sufficiently to fill a space equal to the gap between the write and read heads.

F. CHARACTER SENSING AND RECORDING

Refer to Figures 5-12 and 5-13 for timing sequence of the following processes.

F-1. CHARACTER SENSING

Each read head amplifier receives alternate polarity pulses for recorded 1-bits in each channel. Signals from the various channels exhibit a time displacement for bits of the same character.

The presence of a character is indicated by a pulse in one or more of the seven channels. Each read amplifier generates a one-shot output signal for each of the alternate polarity input pulses. The one-shot output pulses from the read amplifiers set the read flip-flops.

$$sR1m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Df} + W11\ D2)\ \overline{R1m}\ \underline{Ra6}$$

$$rR1m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Df} + W11\ D2)\ R1m\ \underline{Ra6} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$\vdots$$

$$sRpm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Df} + W11\ D2)\ \overline{Rpm}\ \underline{Ra7}$$

$$rRpm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Df} + W11\ D2)\ Rpm\ \underline{Ra7} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

Signal terms Ra1 through Ra7 represent the one-shot output pulses from each of the read amplifiers. Control of R1m through Rpm is inhibited during the gap by $(W11\ \overline{D1}\ \overline{D3}\ \overline{Df} + - - -)$ to prevent extraneous signals in the gap from being sensed. The longitudinal check character, however, is permitted to pass (- - - + W11 D2). During write operations R1m through Rpm are permitted to toggle in order to register the longitudinal parity. During read operations R1m through Rpm are reset after each character is processed by $(\overline{W9}\ W11\ Ce + - - -)\ dc$.

Character present flip-flop Rcm is set upon detection of the first bit of an incoming character.

$$sRcm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Df} + W11\ D2)\ \overline{Rcm}\ \underline{Rac}$$

$$rRcm = \underline{Ct}\ Rcm + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

Term Rac is the one-shot output from the read amplifier detecting the presence of alternating pulses on any of the incoming channels. After the character is processed, Rcm is reset by $\underline{Ct}\ Rcm$.

A sequence of clock signal timers are triggered upon detection of the presence of a character.

$$sCr = \overline{Cr}\ \overline{Cs}\ Rcm$$

$$rCr = 20\ \mu s \text{ after } sCr$$

$$sCs = \underline{Cr}$$

$$rCs = 30\ \mu s \text{ after } sCs$$

$$sCt = \underline{Cr}$$

$$rCt = 10\ \mu s \text{ after } sCt$$

$sCe = \underline{Ct}$

$rCe = 2\ \mu s$ after sCe

Because of the inherent time displacement of the incoming data pulses, the duration of Cr permits acquisition of all bits related to the character before the character is processed. Timer Cs inhibits triggering a new clock sequence until the present character is processed. The effect is to smooth out instantaneous character rate variations. Timer Ct is used to clock the data from the read flip-flop into the computer. Timer Ce permits resetting of the read flip-flops, R1m through Rpm, in the read modes after the character has been processed.

Timer (Ecm) provides an input clock to the W buffer.

CT

$(Ecm) = \overline{W9}\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ (Mf + Mr) + - - -$

Reset terms $\overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}$ inhibit clocking of the W buffer during the traversing of the gap due to extraneous gap signals and the presence of the longitudinal check character.

F-2. CHARACTER RECORDING

Non-return-to-zero (NRZI) recording is accomplished by toggling each write flip-flop for each 1-bit to be recorded.

$sM6 = \underline{Mi}\ \overline{M6}\ (\ (R6m)\ \ W9\ W11 + - - -\ )$

$rM6 = \underline{Mi}\ M6\ (\ (R6m)\ \ W9\ W11 + - - -\ ) + (M\ start\ Q2 + Mu\ Mv\ Mc + - - -\ )\ dc$

|

$sMp = \underline{Mi}\ \overline{Mp}\ (\ (Rpm)\ \ W9\ W11 + - - -\ )$

$rMp = \underline{Mi}\ Mp\ (\ (Rpm)\ \ W9\ W11 + - - -\ ) + (M\ start\ Q2 + Mu\ Mv\ Mc + - - -\ )\ dc$

Read flip-flop outputs (R6m) through (Rpm) represent the signals to be recorded from the W buffer appropriately modified for BCD or binary data modes. The toggle clock, Mi, is inhibited by $\overline{W5}$ until each output character is established in the W buffer character register.

$Mi = W9\ W11\ (\overline{W10} + \overline{W11})\ (\overline{W5} + W11)\ Mca\ Mc + - - -$

Clock enable fip-flop, Mca, assures synchronous operation of Mi with Mc after the initial gap generation has completed and the tape has left the metallic leader.

$sMca = \overline{D1}\ \underline{Mc}\ (Ma0\ (\overline{Bor0}) - - - + Ma7\ (\overline{Bor7})\ )$

$rMca = (M\ start\ Q2 + - - -\ )\ dc$

Reset term $\overline{W10}$ permits Mi to toggle the write flip-flops during a write mode but inhibits the write flip-flops during the erase mode.

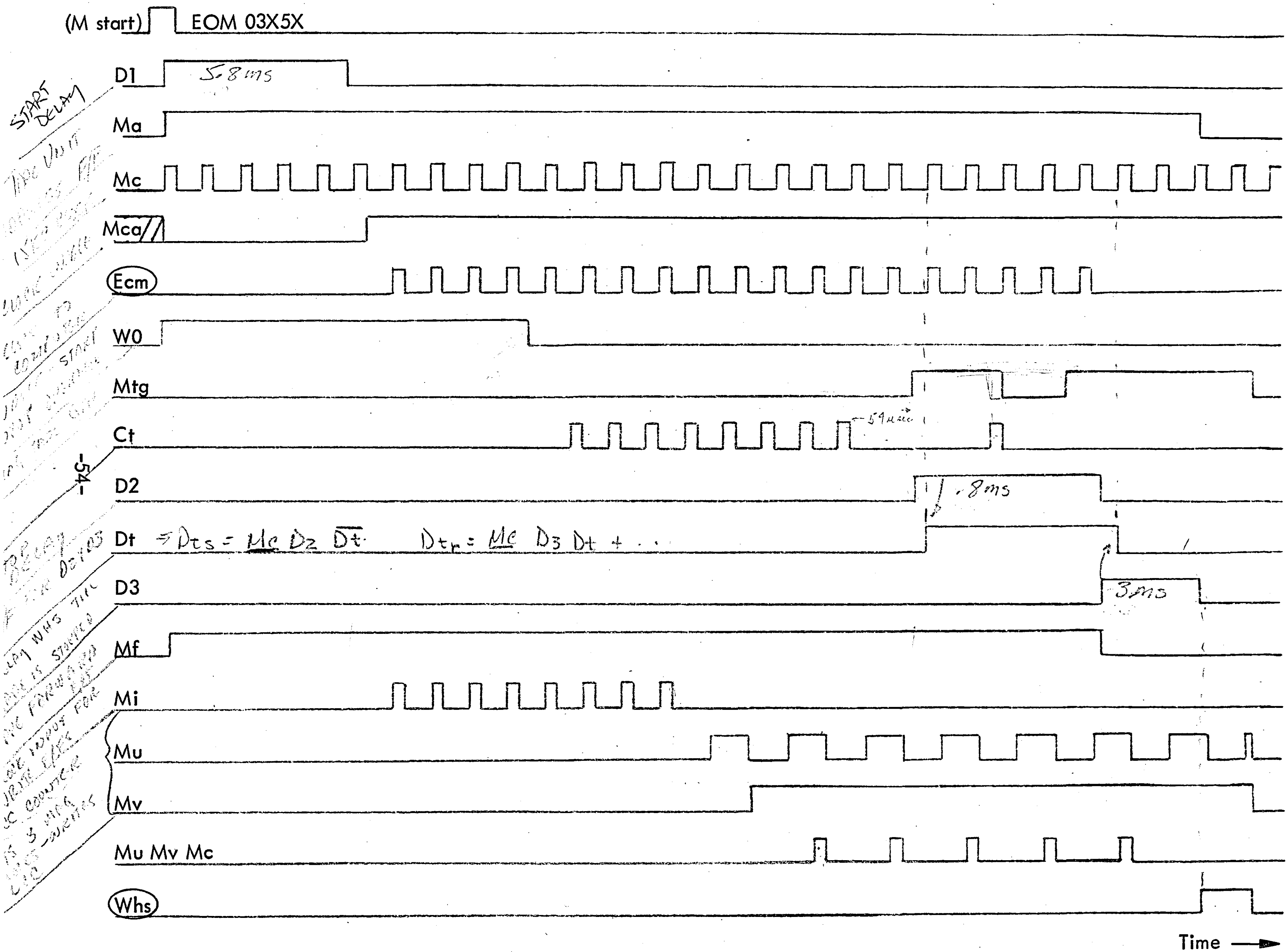


Figure 5-12. Magnetic Tape Write

The write flip-flops are reset by the longitudinal parity counter Mu and Mv after the last data character is recorded.

$$sMu = W5\ W9\ W11\ (\overline{W0} + \overline{W11})\ (\overline{W6} + \overline{W11})\ \overline{D1}\ \overline{Mu}\ \underline{Mc}$$

$$rMu = Mu\ \underline{Mc} + (\ - - - + \overline{W11}\ \overline{M\ start})\ dc$$

$$sMv = Mu\ \overline{Mv}\ \underline{Mc}$$

$$rMv = - - - + (\ - - - + \overline{W11}\ \overline{M\ start})\ dc$$

$$rM6 = - - - + (\ - - - + Mu\ Mv\ Mc)\ dc$$

|
|
|
|
|

$$rMp = - - - + (\ - - - + Mu\ Mv\ Mc)\ dc$$

The output clock, (Ecm), for the W buffer is provided by oscillator Mc which is gated by clock enable flip-flop Mca.

$$\text{(Ecm)} = - - - + W9\ W11\ Mca\ Mc\ Mf$$

G. CHARACTER SIGNALS

G-1. DATA MODE SELECT

Data mode select flip-flop, Me, permits reading or recording in a BCD or binary mode.

$$sMe = (\underline{M\ start\ Q2})\ \overline{C14}\ \overline{Me}$$

$$rMe = (\overline{W11}\ \overline{M\ start})\ dc$$

G-2. BCD OUTPUT

If Me is set during output, data from the computer in SDS internal code will be converted to IBM BCD interchange code for recording on magnetic tape (see Table 5-1).

$$\text{(R6m)} = W9\ W11\ R6 + - - -$$

$$\text{(R5m)} = W9\ W11\ (Rp\ \overline{R6}\ \overline{R5}\ \overline{R4}\ \overline{R3}\ \overline{R2}\ \overline{R1})\ Me + W9\ W11\ R5 + - - -$$

$$\text{(R4m)} = W9\ W11\ R4 + - - -$$

$$\text{(R3m)} = W9\ W11\ (Rp\ \overline{R6}\ \overline{R5}\ \overline{R4}\ \overline{R3}\ \overline{R2}\ \overline{R1})\ Me + W9\ W11\ R3 + - - -$$

$$\text{(R2m)} = W9\ W11\ R2 + - - -$$

Table 5-1. BCD Character Code Conversion Chart

BCD Character	Magnetic Tape Code	Memory Code	BCD Character	Magnetic Tape Code	Memory Code
Ø	12	00	–	40	40
1	01	01	J	41	41
2	02	02	K	42	42
3	03	03	L	43	43
4	04	04	M	44	44
5	05	05	N	45	45
6	06	06	O	46	46
7	07	07	P	47	47
8	10	10	Q	50	50
9	11	11	R	51	51
SPACE	12	12	CAR. RET.	52	52
#	13	13	$	53	53
@	14	14	*	54	54
:	15	15	]	55	55
>	16	16	;	56	56
	17	17	Δ	57	57
&	60	20	ƀ	20	60
A	61	21	/	21	61
B	62	22	S	22	62
C	63	23	T	23	63
D	64	24	U	24	64
E	65	25	V	25	65
F	66	26	W	26	66
G	67	27	X	27	67
H	70	30	Y	30	70
I	71	31	Z	31	71
BACK SPACE	72	32	TAB	32	72
.	73	33	,	33	73
⌑	74	34	%	34	74
[	75	35	m	35	75
<	76	36	\	36	76
ǂ	77	37	⧻	37	77

$$\text{(R1m)} = W9\ W11\ (\overline{R2} + \overline{W9} + \overline{W11})\ R1\ Me + W9\ W11\ (\overline{R1} + \overline{W9} + \overline{W11})\ R2\ Me + - - -$$

$$\text{(Rpm)} = W9\ W11\ (\overline{Rp} + \overline{W9} + \overline{W11})\ (\overline{R2} + \overline{W9} + \overline{W11})\ Me + W9\ W11\ Rp\ R2\ Me + - - -$$

G-3. BCD INPUT

If Me is set during input, data from the tape in IBM BCD interchange code will be converted to SDS internal code (see Table 5-1).

$$\text{(R6m)} = \overline{W9}\ W11\ Ct\ R6m + - - -$$

$$\text{(R5m)} = \overline{W9}\ W11\ Ct\ R5m\ (\overline{\overline{Rpm}\ \overline{R6m}\ R5m\ \overline{R4m}\ R3m\ \overline{R2m}\ \overline{R1m}})\ Me + - - -$$

$$\text{(R4m)} = \overline{W9}\ W11\ Ct\ R4m + - - -$$

$$\text{(R3m)} = \overline{W9}\ W11\ Ct\ R3m\ (\overline{\overline{Rpm}\ \overline{R6m}\ R5m\ \overline{R4m}\ R3m\ \overline{R2m}\ \overline{R1m}})\ Me + - - -$$

$$\text{(R2m)} = \overline{W9}\ W11\ Ct\ R2m$$

$$\text{(R1m)} = \overline{W9}\ W11\ Ct\ \overline{R2m}\ R1m\ Me + \overline{W9}\ W11\ Ct\ R2m\ \overline{R1m}\ Me + - - -$$

$$\text{(Rpm)} = \overline{W9}\ W11\ Ct\ \overline{Rpm}\ \overline{R2m}\ Me + \overline{W9}\ W11\ Ct\ Rpm\ R2m\ Me + - - -$$

G-4. BINARY OUTPUT

If Me is reset during output, binary data from the computer will be recorded on tape in binary code.

$$\text{(R6m)} = W9\ W11\ R6 + - - -$$

$$\text{(R5m)} = W9\ W11\ R5 + - - -$$

$$\text{(R4m)} = W9\ W11\ R4 + - - -$$

$$\text{(R3m)} = W9\ W11\ R3 + - - -$$

$$\text{(R2m)} = W9\ W11\ R2 + - - -$$

$$\text{(R1m)} = W9\ W11\ R1\ \overline{Me} + - - -$$

$$\text{(Rpm)} = W9\ W11\ Rp\ \overline{Me} + - - -$$

G-5. BINARY INPUT

If Me is reset during input, binary data from the tape will be input to the computer in binary code.

$\textcircled{R6m}$ $= \overline{W9}$ W11 Ct R6m + - - -

$\textcircled{R5m}$ $= \overline{W9}$ W11 Ct R5m $\overline{Me}$ + - - -

$\textcircled{R4m}$ $= \overline{W9}$ W11 Ct R4m + - - -

$\textcircled{R3m}$ $= \overline{W9}$ W11 Ct R3m $\overline{Me}$ + - - -

$\textcircled{R2m}$ $= \overline{W9}$ W11 Ct R2m + - - -

$\textcircled{R1m}$ $= \overline{W9}$ W11 Ct R1m $\overline{Me}$ + - - -

$\textcircled{Rpm}$ $= \overline{W9}$ W11 Ct Rpm $\overline{Me}$ + - - -

H. ERROR DETECTION

H-1. INPUT

The character parity is checked in the W buffer during magnetic tape input.

sWe = $\overline{W9}$ W4 $\overline{Rp}$ (T5 - T0) $\overline{Wh}$ $\textcircled{Np}$ + - - -

rWe = Wc $\overline{Wh}$

The longitudinal parity is checked with the write flip-flops during input.

sM6 = Mi $\overline{M6}$ (- - - + R6m $\overline{W9}$ W11)

rM6 = Mi M6 (- - - + R6m $\overline{W9}$ W11) + (M start Q2 + D3 (Mf + Mr) + - - -) dc

¦

sMp = Mi $\overline{Mp}$ (- - - + Rpm $\overline{W9}$ W11)

rMp = Mi Mp (- - - + Rpm $\overline{W9}$ W11) + (M start Q2 + D3 (Mf + Mr) + - - -) dc

Mi = $\overline{W9}$ W11 Ct + - - -

After the block has been read, all write flip-flops should be reset; if not, an error will be indicated.

s $\textcircled{Wes}$ = $\overline{W9}$ W11 (M1 + M2 + M3 + M4 + M5 + M6 + Mp) $\overline{Mf}$ $\overline{Mr}$ D3 + - - -

r $\textcircled{Wes}$ = 10 μs after s $\textcircled{Wes}$

sWe = $\textcircled{Wes}$

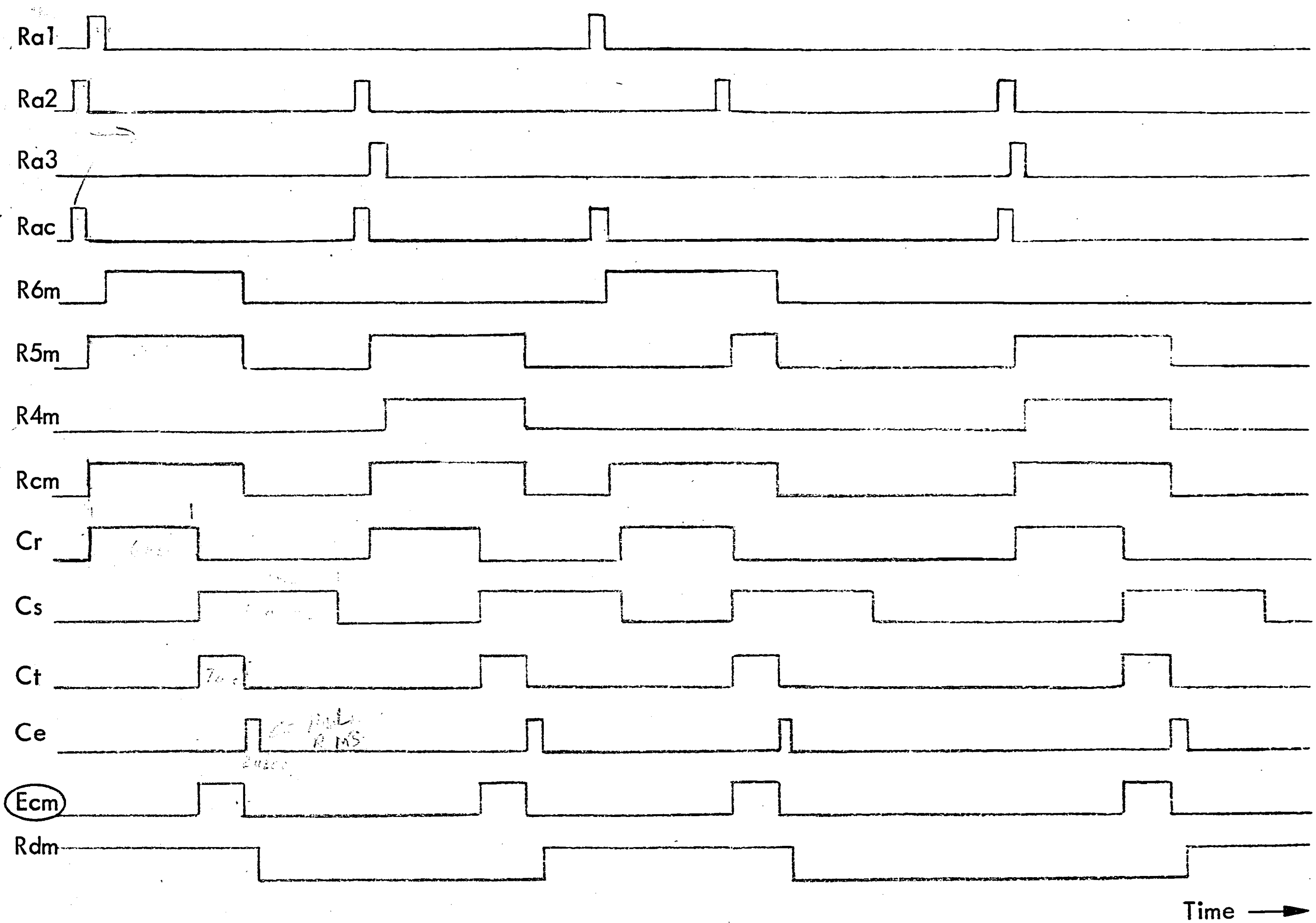


Figure 5-13. Magnetic Tape Read - - Character Timing

In the read/scan forward mode, a longitudinal check character parity error is not permitted to set (Wes) if the process has been converted to a scan. This insures that the We flip-flop in the W buffer will not be erroneously set from the scanned block's longitudinal check character's parity, but permitting it to be set if the read is not converted to a scan. The We flip-flop is reset when the scan is converted back to a read,

$$rWe = Wc\ \overline{Wh}$$

but there is no assurance that this occurs before, or after (Wes), hence scanning longitudinal check character parity errors are inhibited. During scan operation, M6 through Mp are reset by D3 (Mf + Mr) to insure that the write flip-flops are initially reset prior to the scan of a new block.

H-2. OUTPUT

For magnetic tape output, the character parity of the recorded information is checked with the read flip-flops plus a character counter flip-flop, Rdm.

$$sR1m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R1m}\ \underline{Ra6}$$

$$rR1m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R1m\ \underline{Ra6} + (- - - + \overline{W11})\ dc$$

$$\vdots$$

$$sRpm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{Rpm}\ \underline{Ra7}$$

$$rRpm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ Rpm\ \underline{Ra7} + (- - - + \overline{W11})\ dc$$

$$sRdm = W11\ \overline{Rdm}\ \underline{Ce}$$

$$rRdm = W11\ Rdm\ \underline{Ce} + \overline{W11}\ \overline{M\ start}$$

Flip-flops R1m through Rpm function as counters for the number of 1-bits in the seven channels. If Me is reset, each character should have an odd number of ones and the parity of R1m through Rpm should alternate odd and even for each character. Rdm should alternate odd and even for each character so that the parity of R1m through Rdm should always be odd. When this parity is even, an error is indicated.

$$(sWes) = W9\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ Ct\ (Mf + Mr)\ \overline{Me}\ Zp\ Rdm$$

$$+ W9\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ Ct\ (Mf + Mr)\ \overline{Me}\ \overline{Zp}\ \overline{Rdm} + - - -$$

where:

$$Zp = \overline{Yp}\ \overline{Rpm}\ R6m + \overline{Yp}\ Rpm\ \overline{R6m} + Yp\ \overline{Rpm}\ \overline{R6m} + Yp\ Rpm\ R6m$$

$$Yp = \overline{Xp}\ \overline{R5m}\ R4m + \overline{Xp}\ R5m\ \overline{R4m} + Xp\ \overline{R5m}\ \overline{R4m} + Xp\ R5m\ R4m$$

$$Xp = \overline{R3m}\ \overline{R2m}\ R1m + \overline{R3m}\ R2m\ \overline{R1m} + R3m\ \overline{R2m}\ \overline{R1m} + R3m\ R2m\ R1m$$

If Me is set, each character should have an even number of ones. Therefore when R1m through Rpm indicates an odd number of ones, an error indication is generated.

$$\text{sWes} = W9\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Df}\ Ct\ (Mf + Mr)\ Me\ Zp + - - -$$

After the longitudinal parity character is counted by R1m through Rpm these flip-flops should all be reset. If they are not all reset, an error is signalled.

$$\text{sWes} = W9\ W11\ (R1m + R2m + R3m + R4m + R5m + R6m + Rpm)\ D3 + - - -$$

I. GAP DETECTION

If, as data passes the read head, no clock signals are detected for 150 μs, a gap signal is generated.

Gap = 150 μs with no Ct signal   200 bpi
54 " " " " " "   556 bpi

The gap detector flip-flop, Mtg, is set only after data has been detected and then becomes absent.

$$sMtg = \underline{(\overline{Gap} + - - -)}\ \overline{Mtg}$$

$$rMtg = Cr\ Mtg + (\overline{W11}\ \ \overline{M\ start})\ dc$$

In the erase mode, the gap detector flip-flop is forced on at the time that the erase is terminated.

$$sMtg = (\underline{- - - + W10\ Mu})\ \overline{Mtg}$$

$$sMu = W9\ W11\ (\overline{W0} + \overline{W11})\ (\overline{W6} + \overline{W11})\ W5\ \overline{D1}\ \overline{Mu}\ \underline{Mc}$$

To obtain an erased length on tape equal to the recorded length, the number of output erase characters must be increased sufficiently to fill a space equal to the gap between the write and read heads.

J. CLOCK GENERATOR, 15 Kc

A 15 Kc oscillator provides the basic clock, Mc, for the tape system. It has a period of 67 μs and duration of 10 μs.

K. THRESHOLDING

Read amplifiers are capable of accepting a variable threshold. During write modes, W9 W11, the read amplifier thresholds are raised in order to detect poorly recorded signals at the time of recording. Thresholding for the various channel read amplifiers and for the clock read amplifier are independently controlled for the read and write modes.

L. CONTROL UNIT LOGIC, MODEL 9148

L-1. CONTROL COMMANDS

$$(\text{M start}) = \text{Buc}\ \overline{\text{C17}}\ \text{C20}$$

$$(\text{Rewind}) = \text{loc C12 Q2}$$

L-2. FORWARD REVERSE CONTROLS

$$\text{sMf} = (\underline{\text{M start Q2}})\ \overline{\text{C12}}\ \overline{\text{Mf}}\ \overline{\text{Mr}}$$

$$\text{rMf} = \text{Mf Mr}\ (\underline{\text{M start Q2}}) + (\overline{\text{D1}}\ \overline{\text{D2}}\ \text{Dt (W0 + W9 W11)} + \overline{\text{W11}}\ \overline{\text{M start}})\ \text{dc}$$

$$\text{sMr} = (\underline{\text{M start Q2}})\ \text{C12}\ \overline{\text{Mf}}\ \overline{\text{Mr}}$$

$$\text{rMr} = \text{Mf Mr}\ (\underline{\text{M start Q2}}) + (\overline{\text{D1}}\ \overline{\text{D2}}\ \text{Dt (W0 + W9 W11)} + \overline{\text{W11}}\ \overline{\text{M start}})\ \text{dc}$$

L-3. DATA MODE SELECT

$$\text{sMe} = (\underline{\text{M start Q2}})\ \overline{\text{C14}}\ \overline{\text{Me}}$$

$$\text{rMe} = (\overline{\text{W11}}\ \overline{\text{M start}})\ \text{dc}$$

L-4. TIMERS

$$\text{sD1} = (\text{M start Q2})\ \text{dc} + (\underline{\text{D2 Mr}})\ \text{dc}\ +$$ Ds Dr [illegible]

$$\text{rD1} = 5.8 \text{ ms after sD1}$$

$$\text{sD2} = (\text{W0}\ \overline{\text{W9}}\ \text{W11}\ \overline{\text{Dt}}\ (\text{Mf} + \text{Mr})\ \text{Mtg})\ \text{dc}$$
$$+ (\ [~~\text{W5 W9 W11 (W0 + W11) (W6 + W11)}~~]\ \overline{\text{Dt}}\ \text{Mf Mtg}\ \overline{\text{M start}})\ \text{dc}$$

W0 W5 W6 W9 W11 Dt Mtg M start

$$\text{rD2} = 0.8 \text{ ms after sD2}$$

$$\text{sD3} = (\ [\overline{\text{D1}}\ \overline{\text{D2}}\ \text{Dt}]\ \overline{\text{Mf}}\ \overline{\text{Mr}})\ \text{dc} + (\ [\overline{\text{D1}}\ \overline{\text{D2}}\ \text{Dt}]\ \overline{\text{W9}}\ \text{W11}\ (\overline{\text{W0}} + \overline{\text{W11}}))\ \text{dc}$$

$$\text{rD3} = 3 \text{ ms after sD3}$$

$$\text{sDt} = \text{D2}\ \underline{\text{Mc}}\ \overline{\text{Dt}}$$

$$\text{rDt} = \text{D3}\ \underline{\text{Mc}}\ \text{Dt} + (\overline{\text{W11}}\ \overline{\text{M start}})\ \text{dc} + \text{Ds}$$

L-5. HALT SIGNAL

$$(\text{Whs}) = (\overline{\text{M start}})\ \text{W11}\ \overline{\text{D1}}\ \overline{\text{D3}}\ \overline{\text{Dt}}\ \overline{\text{Mf}}\ \overline{\text{Mr}} + \text{Mr}\ (\text{Ma0}\ (\text{Bor0}) + \ldots \text{Ma 7}\ (\text{Bor 7})\ )$$

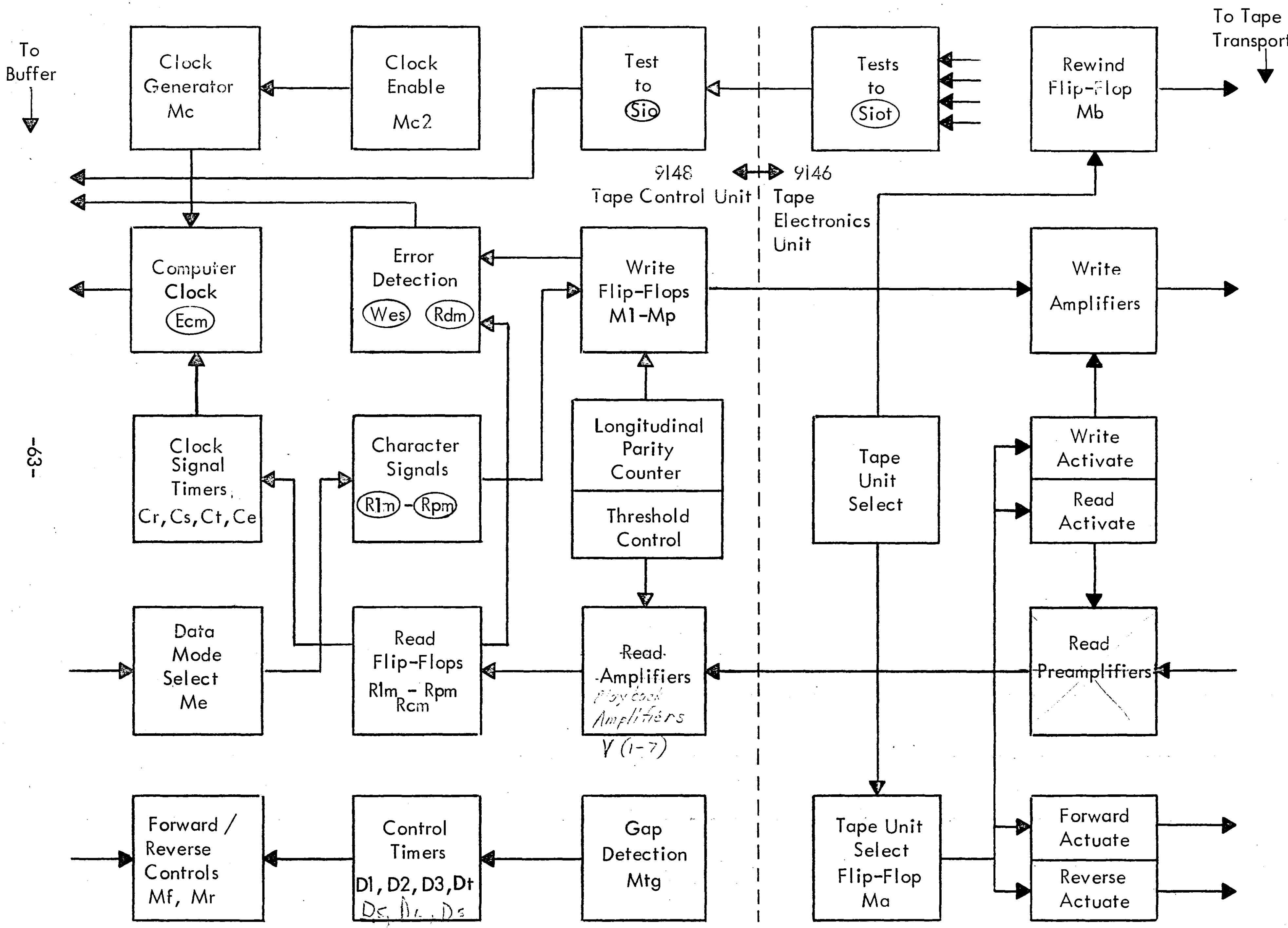


Figure 5-14. Magnetic Tape System, 15 Kc (Logic Block Diagram)

L-6. READ FLIP-FLOPS

$$sR1m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R1m}\ \underline{Ra6}$$

$$rR1m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R1m\ \underline{Ra6} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sR2m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R2m}\ \underline{Ra5}$$

$$rR2m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R2m\ \underline{Ra5} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sR3m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R3m}\ \underline{Ra4}$$

$$rR3m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R3m\ \underline{Ra4} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sR4m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R4m}\ \underline{Ra3}$$

$$rR4m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R4m\ \underline{Ra3} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sR5m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R5m}\ \underline{Ra2}$$

$$rR5m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R5m\ \underline{Ra2} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sR6m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{R6m}\ \underline{Ra1}$$

$$rR6m = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ R6m\ \underline{Ra1} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sRpm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{Rpm}\ \underline{Ra\,7}$$

$$rRpm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ Rpm\ \underline{Ra\,7} + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sRcm = (W11\ \overline{D1}\ \overline{D3}\ \overline{Dt} + W11\ D2)\ \overline{Rcm}\ \underline{Rac}$$

$$rRcm = \underline{Ct}\ Rcm + (\overline{W9}\ W11\ Ce + \overline{W11})\ dc$$

$$sRdm = W11\ \overline{Rdm}\ \underline{Ce}$$

$$rRdm = W11\ Rdm\ \underline{Ce} + (\overline{W11}\ \overline{M\ start})\ dc$$

L-7. ERROR DETECTOR

$$s\ \text{(Wes)}\ dc = \overline{W9}\ W11\ (M1 + M2 + M3 + M4 + M5 + M6 + Mp)\ \overline{Mf}\ \overline{Mr}\ D3$$

$$+ W9\ W11\ (R1m + R2m + R3m + R4m + R5m + R6m + Rpm)\ D3$$

$$+ W9\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ Ct\ (Mf + Mr)\ Me\ \underline{Zp}$$

$$+ W9\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ Ct\ (Mf + Mr)\ \overline{Me}\ Zp\ \underline{Rdm}$$

$$+ W9\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Dt}\ Ct\ (Mf + Mr)\ \overline{Me}\ \overline{Zp}\ \overline{Rdm}$$

r (Wes) = 10 μs after s (Wes)

$$Zp = \overline{Yp}\ \overline{Rpm}\ R6m + \overline{Yp}\ Rpm\ \overline{R6m} + Yp\ \overline{Rpm}\ \overline{R6m} + Yp\ Rpm\ R6m$$

$$Yp = \overline{Xp}\ \overline{R5m}\ R4m + \overline{Xp}\ R5m\ \overline{R4m} + Xp\ \overline{R5m}\ \overline{R4m} + Xp\ R5m\ R4m$$

$$Xp = \overline{R3m}\ \overline{R2m}\ R1m + \overline{R3m}\ R2m\ \overline{R1m} + R3m\ \overline{R2m}\ \overline{R1m} + R3m\ R2m\ R1m$$

L-8. READ AMPLIFIER THRESHOLD

Threshold High = $W11\ W9$

Threshold Normal = $W11\ \overline{W9}$

L-9. CHARACTER SIGNALS

(R6m) $= \overline{W9}\ W11\ Ct\ R6m + W9\ W11\ R6$

(R5m) $= [\overline{W9}\ W11\ \overline{Me}\ Ct]\ R5m$

$+ [\overline{W9}\ W11\ Me\ Ct]\ R5m\ \overline{(\overline{Rpm}\ \overline{R6m}\ R5m\ \overline{R4m}\ R3m\ \overline{R2m}\ \overline{R1m})}$

$+ W9\ W11\ R5 + Me\ [Rp\ \overline{R6}\ \overline{R5}\ \overline{R4}\ \overline{R3}\ \overline{R2}\ \overline{R1}\ W9\ W11]$

(R4m) $= \overline{W9}\ W11\ Ct\ R4m + W9\ W11\ R4$

(R3m) $= [\overline{W9}\ W11\ \overline{Me}\ Ct]\ R3m$

$+ \overline{W9}\ W11\ Me\ Ct\ [R3m\ \overline{(\overline{Rpm}\ \overline{R6m}\ R5m\ \overline{R4m}\ R3m\ \overline{R2m}\ \overline{R1m})}]$

$+ W9\ W11\ R3 + Me\ [Rp\ \overline{R6}\ \overline{R5}\ \overline{R4}\ \overline{R3}\ \overline{R2}\ \overline{R1}\ W9\ W11]$

(R2m) $= \overline{W9}\ W11\ Ct\ R2m + W9\ W11\ R2$

(R1m) $= [\overline{W9}\ W11\ \overline{Me}\ Ct]\ R1m + [\overline{W9}\ W11\ Me\ Ct]\ \overline{R2m}\ R1m$

$+ [\overline{W9}\ W11\ Me\ Ct]\ R2m\ \overline{R1m} + Me\ (\overline{R2} + \overline{W9} + \overline{W11})\ W9\ W11\ R1$

$+ Me\ (\overline{R1} + \overline{W9} + \overline{W11})\ W9\ W11\ R2 + \overline{Me}\ W9\ W11\ R1$

(Rpm) $= [\overline{W9}\ W11\ \overline{Me}\ Ct]\ Rpm + [\overline{W9}\ W11\ Me\ Ct]\ \overline{Rpm}\ \overline{R2m}$

$+ \overline{Me}\ W9\ W11\ Rp + W9\ W11\ Me\ (\overline{Rp} + \overline{W9} + \overline{W11})\ (\overline{R2} + \overline{W9} + \overline{W11})$

$+ [\overline{W9}\ W11\ Me\ Ct]\ Rpm\ R2m + [W9\ W11\ Me]\ (Rp)\ R2$

L-10. CLOCK SIGNALS

$sCr = (\overline{Cr}\ \overline{Cs}\ Rcm)\ dc$	$sCt = Cr$
$rCr = 20\ \mu s$ after sCr	$rCt = 10\ \mu s$ after sCt
$sCs = Cr$	$sCe = Ct$
$rCs = 30\ \mu s$ after sCs	$rCe = 2\ \mu s$ after sCe

$$\text{(Ecm)} = \overline{W9}\ W11\ \overline{D1}\ \overline{D2}\ \overline{D3}\ \overline{Df}\ Ct\ (Mf + Mr)$$

$$+ W9\ W11\ Mca\ Mc\ Mf$$

Mc = Clock Generator Output

L-11. CLOCK ENABLE

$$sMca = \overline{D1}\ \underline{Mc}\ (Ma0\ \text{(}\overline{Bor0}\text{)}\ + \ldots + Ma7\ \text{(}\overline{Bor\ 7}\text{)}\ )\ \overline{Mca}$$

$$rMca = (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr)\ )\ dc$$

L-12. WRITE FLIP-FLOPS

$$sM6 = \underline{Mi}\ \overline{M6}\ (\ \text{(R6m)}\ W9\ W11 + R6m\ \overline{W9}\ W11)$$

$$rM6 = \underline{Mi}\ M6\ (\ \text{(R6m)}\ W9\ W11 + R6m\ \overline{W9}\ W11) + (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr)\ )\ dc$$

$$sM5 = \underline{Mi}\ \overline{M5}\ (\ \text{(R5m)}\ W9\ W11 + R5m\ \overline{W9}\ W11)$$

$$rM5 = \underline{Mi}\ M5\ (\ \text{(R5m)}\ W9\ W11 + R5m\ \overline{W9}\ W11) + (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr)\ )\ dc$$

$$sM4 = \underline{Mi}\ \overline{M4}\ (\ \text{(R4m)}\ W9\ W11 + R4m\ \overline{W9}\ W11)$$

$$rM4 = \underline{Mi}\ M4\ (\ \text{(R4m)}\ W9\ W11 + R4m\ \overline{W9}\ W11) + (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr))\ dc$$

$$sM3 = \underline{Mi}\ \overline{M3}\ (\ \text{(R3m)}\ W9\ W11 + R3m\ \overline{W9}\ W11)$$

$$rM3 = \underline{Mi}\ M3\ (\ \text{(R3m)}\ W9\ W11 + R3m\ \overline{W9}\ W11) + (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr)\ )\ dc$$

$$sM2 = \underline{Mi}\ \overline{M2}\ (\ \text{(R2m)}\ W9\ W11 + R2m\ \overline{W9}\ W11)$$

$$rM2 = \underline{Mi}\ M2\ (\ \text{(R2m)}\ W9\ W11 + R2m\ \overline{W9}\ W11) + (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr))\ dc$$

$$sM1 = \underline{Mi}\ \overline{M1}\ (\ \text{(R1m)}\ W9\ W11 + R1m\ \overline{W9}\ W11)$$

$$rM1 = \underline{Mi}\ M1\ (\ \text{(R1m)}\ W9\ W11 + R1m\ \overline{W9}\ W11) + (M\ start\ Q2 + Mu\ Mv\ Mc + D3\ (Mf + Mr))dc$$

$$sMp = \underline{Mi}\,\overline{Mp}\,(\ Rpm\ \ W9\ W11 + Rpm\ \overline{W9}\ W11)$$

$$rMp = \underline{Mi}\ Mp\ (\ Rpm\ \ W9\ W11 + Rpm\ \overline{W9}\ W11) + (M\ start\ \ Q2 + Mu\ Mv\ \ Mc + D3\ (Mf + Mr))dc$$

$$Mi = [W9\ W11\ (\overline{W10} + \overline{W11})(\overline{W5} + \overline{W11})]\quad Mca\ Mc + \overline{W9}\ W11\ Ct$$

L-13. LONGITUDINAL PARITY COUNTER

$$sMu = [W9\ W11\ (\overline{W0} + \overline{W11})\ (\overline{W6} + \overline{W11})\ W5]\ \ \overline{D1}\ \overline{Mu}\ \underline{Mc}$$

$$rMu = Mu\ Mc + (\overline{D1}\ \overline{D2}\ \ Dt\ \ (W0 + W9\ W11) + \overline{W11}\ \ \overline{M\ start})\ dc$$

$$sMv = Mu\ \overline{Mv}\ \underline{Mc}$$

$$rMv = (\overline{D1}\ \ \overline{D2}\ Dt\ \ (W0 + W9\ W11) + \overline{W11}\ \overline{M\ start})\ dc$$

L-14. GAP DETECTOR

$$s\ Mtg = \underline{(\overline{Gap} + W10\ Mu)}\quad \overline{Mtg}$$

$$r\ Mtg = Cr\ Mtg + (\overline{W11}\ \ \overline{M\ start})\ dc$$

$$Gap = (150\,\mu s \text{ with no Ct signal})$$

L-15. TESTS TO Sio

$$Sio = \overline{C17}\ C20\ (\ Siot0\ \cdot\ Siot1\ \cdots\ Siot7\ )$$

M. ELECTRONICS UNIT, MODEL 9146

M-1. TAPE UNIT SELECT

$$sMa = (\underline{M\ start\ Q2})\ \overline{Mad}\ \text{Ready (Unit Select)}$$

$$rMa = (\overline{Mf}\ \overline{Mr}\ \overline{Dt}\ \ \overline{D3}\ \overline{D1})\ dc$$

M-2. TAPE UNIT ADDRESSED

$$Mad = Ma0 + Ma1 + Ma2 + Ma3 + Ma4 + Ma5 + Ma6 + Ma7$$

M-3. PINCH ROLLER ACTUATE

$$\text{Forward Actuate} = Ma\ Mf$$

$$\text{Reverse Actuate} = Ma\ Mr$$

M-4. TAPE UNIT READY

$$\text{Ready} = \overline{Ma}\ \overline{Mb}\ \overline{Db} \qquad (\text{Ready})$$

M-5. AMPEX TM-4 READY

$$(\text{Ready}) = K8\ K1\ \overline{K9}$$

M-6. TESTS To Sio

$$(\text{Siot}) = C12\ (\text{File Protect})\ (\text{Unit Select})$$

$$+\ C13\ (\text{Bor})\ (\text{Unit Select})$$

$$+\ C14\ Df\ (\text{Unit Select})$$

$$+\ C15\ \text{Ready}\ (\text{Unit Select})$$

M-7. READ ACTIVATE

$$\text{Read Activate} = Ma\ (\overline{\text{Bor}}) \cdot \overline{Db}$$

M-8. WRITE ACTIVATE

$$\text{Write Activate} = Ma\ W9\ W11$$

$$K1 \text{ set} = \overline{\text{File Protect}} \longrightarrow +25 \text{ v Write}$$

M-9. REWIND

$$sMb = (\underline{\text{Ioc } C12\ Q2})\ \text{Ready}\ (\text{Unit Select})$$

$$rMb = (Ma + Db + (\overline{\text{Ready}}))\ dc$$

$$K2 \text{ set} = Mb$$

M-10. REWIND STOP DELAY

$$sDb = (Mb\ (\text{Bor}))\ dc + (Ma\ (\text{Bor}))\ dc$$

$$rDb = 1.0 \text{ sec after } sDb$$

M-11. BEGINNING OF REEL INTERRUPT

$$sDbor = Db\ \overline{Ma} + (Ma\ (\text{Bor})\ Mr)\ dc$$

$$rDbor = 10\,\mu \text{ sec after } sDbor$$

M-12. END OF REEL INTERRUPT

sDeor = (Ma Mf (Eor)($\overline{\text{Bor}}$)) dc

rDeor = 10 μ sec after sDeor

M-13. END OF REEL DELAY

sDf = (Eor) dc

rDf = 0.5 sec after sDf

M-14. UNIT SELECT

Unit Select = Kc21 Kc22 Kc23 $\overline{\text{C17}}$ C20

Table 5-2. Glossary of Magnetic Tape System Logic Terms

TERM	DEFINITION
(Bor)	Beginning of reel
Buc	Buffer unit control signal that is high during Ø5 of an EOM OXXXX instruction
Cr, Cs, Ct, Ce	Clock signals generated by data on the tape
D1	Delay one shot used in starting or reverse-stopping the tape
D2	Delay one shot used in stopping the tape at the correct location in the gap
D3	Delay one shot used to delay halt signal Whs until the tape is at rest
Db	Delay one shot used for backing or rewind-stop and to inhibit Read when starting from leader
Dbor	Delay one shot used for beginning-of-reel interrupt
Deor	Delay one shot used for end-of-reel interrupt
Df	Delay one shot set by (Eor) and used for SKS11010 end-of-reel test
Dt	Flip-flop used with the D2 and D3 delay one shots
(Ecm)	External clock from the magnetic tape unit to the computer
(Eor)	End of reel
M1-M6	Write flip-flops. Also used for longitudinal parity check while reading
Ma	Tape unit address flip-flop (one for each transport)
Mad	Magnetic tape unit addressed (gate made up of all eight Ma flip-flops)
Mb	Rewind address flip-flop (one for each transport)
Mc	15-Kc clock generator
Mca	Clock enable flip-flop
Me	Parity select flip-flop
Mf	Forward direction flip-flop

Table 5-2. Glossary of Magnetic Tape System Logic Terms (Continued)

TERM	DEFINITION
Mi	Clock input for write flip-flops M1 - Mp
Mp	Parity channel write flip-flop
Mr	Reverse direction flip-flop
M start	Start signal
Mtg	Magnetic tape gap detect
Mu, Mv	Longitudinal parity counter (counts three magnetic clocks, then writes longitudinal parity)
Q2	Computer pulse counter flip-flop; high for T10-T23 pulse times
R1m-R6m	Read flip-flops for magnetic tape (read data during read-and-detect-errors during write)
(Ra1) - (Ra7)	Read preamp analog signal outputs
Ra1-Ra7	Read amplifier one shot outputs
Rac	Read amplifier one shot clock output (comes high when one or more of Ra1-Ra7 comes high)
Rcm	Read clock flip-flop for magnetic tape. Set by Rac and is set input to Cr
Rdm	Toggle flip-flop used in detecting errors while writing data with odd parity
Rpm	Read flip-flop for parity channel for magnetic tape
(Sio)	Signal for input/output used to qualify Sks which sets the skip flip-flop Sk for Sks test instructions
(Siot1) - (Siot7)	(Sio) from the tape units
W0	W buffer logic flip-flop used in starting input operations and stopping output operations
W5	W buffer flip-flop which detects that a precess should occur
W6	W buffer flip-flop that receives the input/output clocks from peripheral devices

Table 5-2. Glossary of Magnetic Tape System Logic Terms (Continued)

TERM	DEFINITION
W9	W buffer unit address flip-flop specifying output operations when true and input operations when false
W10	W buffer flip-flop which selects erase/scan operations when true and read/write operations when false if W11 is true
W11	W buffer flip-flop which designates magnetic tape operations
Wes	Error Detector
$\overline{Wes}$	Error signal
Whs	Signal from peripheral devices to set the W buffer halt flip-flop Wh
Xp, Yp, Zp	Parity detecting signals used to detect errors while writing

VI. ADJUSTMENT AND MAINTENANCE

A. SERVICING OF TAPE TRANSPORT UNIT

Adjustments, trouble shooting, and maintenance procedures pertaining to the magnetic tape transport are presented in detail in the Ampex TM-4 Technical Manual which is supplied with each SDS magnetic tape system. Refer to the TM-4 manual for servicing requirements and procedures of the tape transport.

B. MAGNETIC TAPE SYSTEM ADJUSTMENTS

Outlined below are the procedures for performing all adjustments for the SDS portion of the magnetic tape system.

B-1. OSCILLATOR, 15 Kc, Mc

a) With the magnetic tape unit operating in the MANUAL mode, observe Mc at 34Z24.

b) Adjust the tuning slug on the CK52 module located in 34Z for a 67-microsecond period.

c) Adjust the top potentiometer on the OK52 in 33Z for 10-microsecond pulse duration (high).

B-2. CLOCK SIGNAL TIMER, Cr

a) Operate magnetic tape unit in the MANUAL mode.

b) Remove the FC17 module located at 18Z.

c) Clip lead Rcm at 18Z9 to 8Z25 (M start Q2).

d) Sync scope on (M start Q2) at 8Z26.

e) Program the computer to execute the following commands:

Location	Command	Note
100	00000000	HLT
101	07100106	LDX
102	04100104	BRX
103	00100102	BRU
104	00200010	EOM
105	00100101	BRU
106	00037000	(constant)

(M start Q2) should occur approximately every 13 milliseconds.

f) Observe Cr at 3Z5, and adjust top potentiometer on the OK52 at 3Z for a 20-microsecond signal (high).

g) If steps B-3 through B-7 are not to be perfomed, then remove clip-lead and restore 18Z.

B-3. CLOCK SIGNAL TIMER, Cs

Using the same procedure described for Cr (paragraph B-2), observe Cs at 3Z15, and adjust the middle potentiometer on the OK52 at 3Z for a 30-microsecond signal (high) starting on the fall of Cr.

B-4. CLOCK SIGNAL TIMER, Ct

Using the same procedure described for Cr (paragraph B-2), observe Ct at 3Z39, and adjust the bottom potentiometer on the OK52 at 3Z for a 10-microsecond signal (high) starting on the fall of Cr.

B-5. CLOCK SIGNAL TIMER, Ce

Using the same procedure described for Cr (paragraph B-2), observe Ce at 33Z39, and adjust the bottom potentiometer on the OK52 at 33Z for a 2-microsecond signal (high) starting on the fall of Ct.

B-6. GAP DETECTOR, Gap

Using the same procedure described for Cr (paragraph B-2), observe Gap at 34Z36, and adjust potentiometer on 34Z for a false period (low) of 150 microseconds after Cr falls and before Gap goes true (high).

B-7. CONTROL TIMER, D1

Using the same procedure described for Cr (paragraph B-2), observe D1 at 13Z5, and adjust top potentiometer for a 5.8 millisecond signal (high) starting at (M start Q2) time.

B-8. THRESHOLD ADJUSTMENT, READ

With tape unit operating in the MANUAL mode, execute magnetic tape read command EOM 00010. Observe 20Z40 and adjust potentiometer on 21Z for +3 volts dc. Observe 22Z40 and adjust potentiometer on 23Z for +3 volts dc.

B-9. THRESHOLD ADJUSTMENT, WRITE

With tape unit operating in the MANUAL mode, execute magnetic tape write command EOM 00050. Observe 20Z40 and adjust potentiometer on 20Z for +4 volts dc. Observe 22Z40 and adjust potentiometer on 22Z for +5 volts dc.

Note

The following adjustments may be made with the 15 Kc Magnetic Tape Test Program, catalog No. 044003 (or equivalent), loaded in the computer. Refer to the Test Program for loading instructions.

B-10. READ PREAMPLIFIER GAIN ADJUSTMENTS

a) Load test program, catalog No. 044003.

b) Write continuous data, (77777777) in all channels.

c) Observe the read amplifier test points listed below, and adjust the corresponding read preamplifier gain potentiometers for an 18-volt peak-to-peak signal.

Read Amplifier Test Point	Preamplifier Potentiometer Adjustment
20Z30	11y top
21Z16	11y middle
21Z30	11y bottom
22Z16	12y top
22Z30	12y middle
23Z16	13y top
23Z30	13y middle

B-11. CONTROL TIMER, D2, ADJUSTMENT

a) Load test program, catalog No. 044003.

b) Write blocks of data repetitively; sync on, and observe D2 at 13Z15.

c) Adjust middle potentiometer on 13Z for 0.8 milliseconds (high).

B-12. CONTROL TIMER, D3, ADJUSTMENT

a) Load test program catalog No. 044003.

b) Write blocks of data repetitively, and observe D3 at 13Z39.

c) Adjust bottom potentiometer on 13Z for 3.0 milliseconds (high).

B-13. ERROR ONE-SHOT, Wes, ADJUSTMENT

a) Load test program catalog No. 044003.

b) Write blocks of data repetitively and use the error by-pass option.

c) Observe (Wes) at 33Z15 and connect 31Z2 to ground.

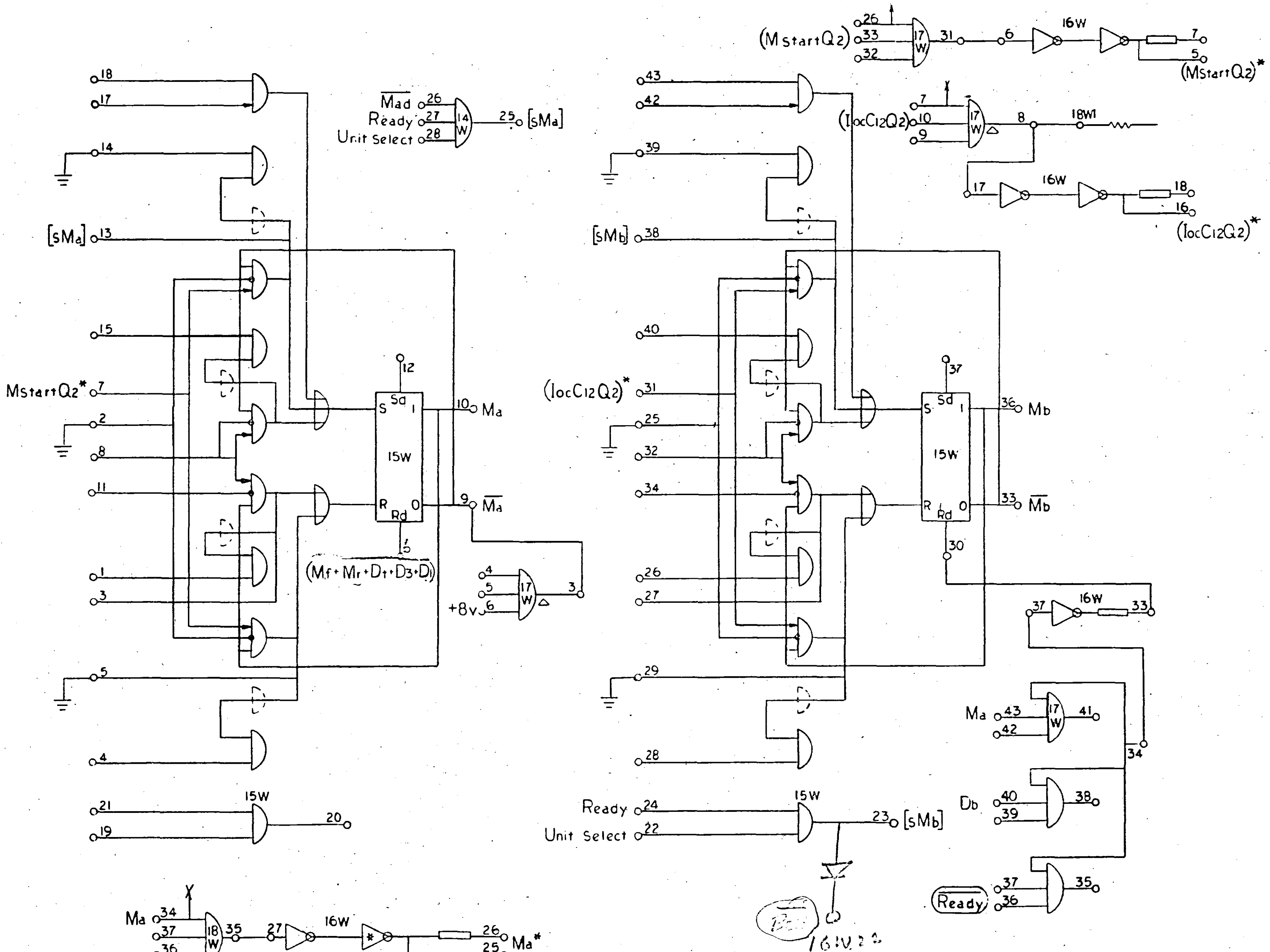
d) Adjust middle potentiometer on 33Z for 10 microseconds (high).

C. PERIODIC SYSTEM TESTING

At regular maintenance intervals the Magnetic Tape Exerciser test routine should be performed to determine the operational status of the magnetic tape system. Catalog No. 049001 test routine (or equivalent) may be used for this purpose.

APPENDIX I

LOGIC DIAGRAMS



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15 KC TAPE UNIT ELECTRONICS

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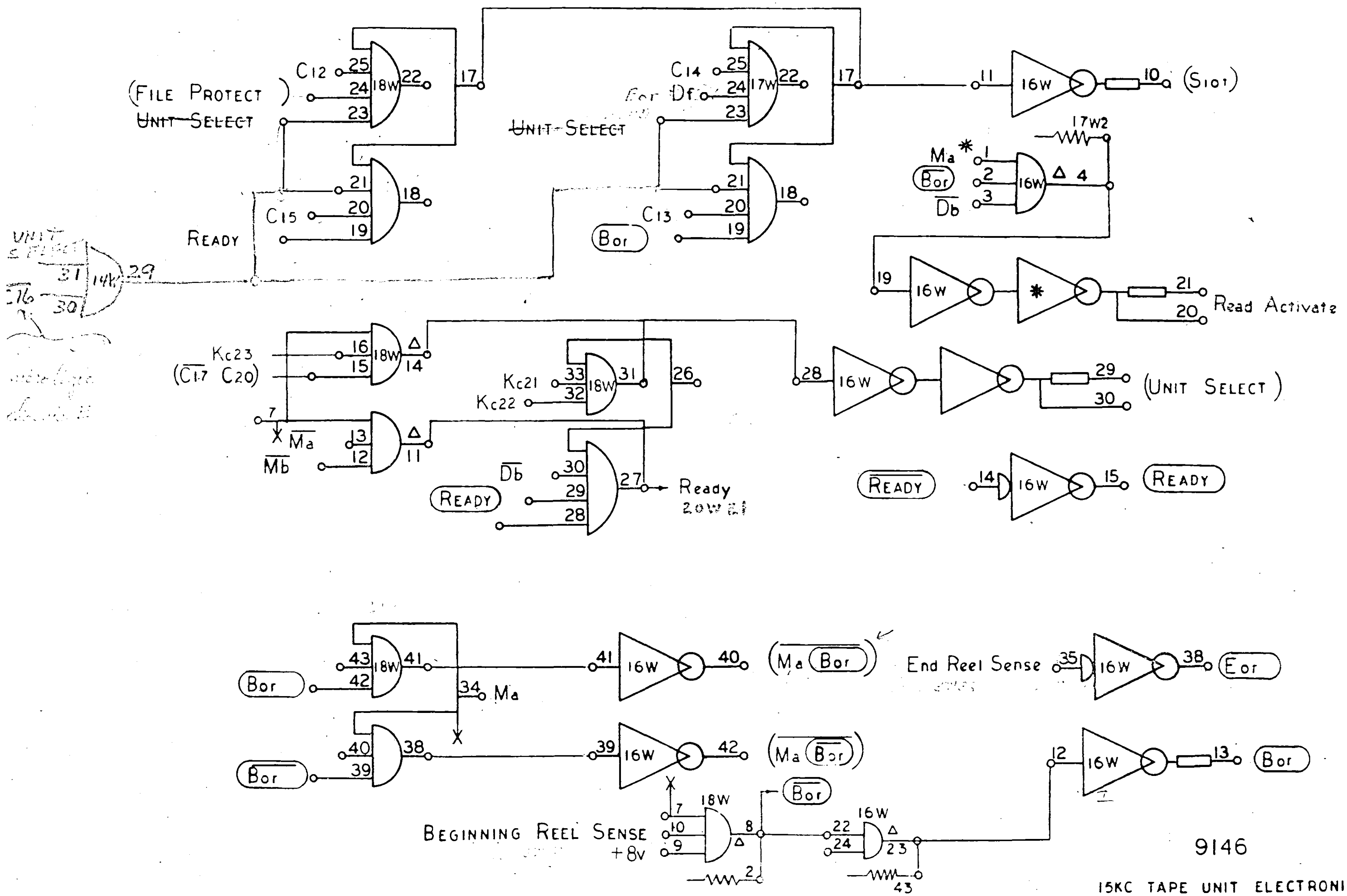

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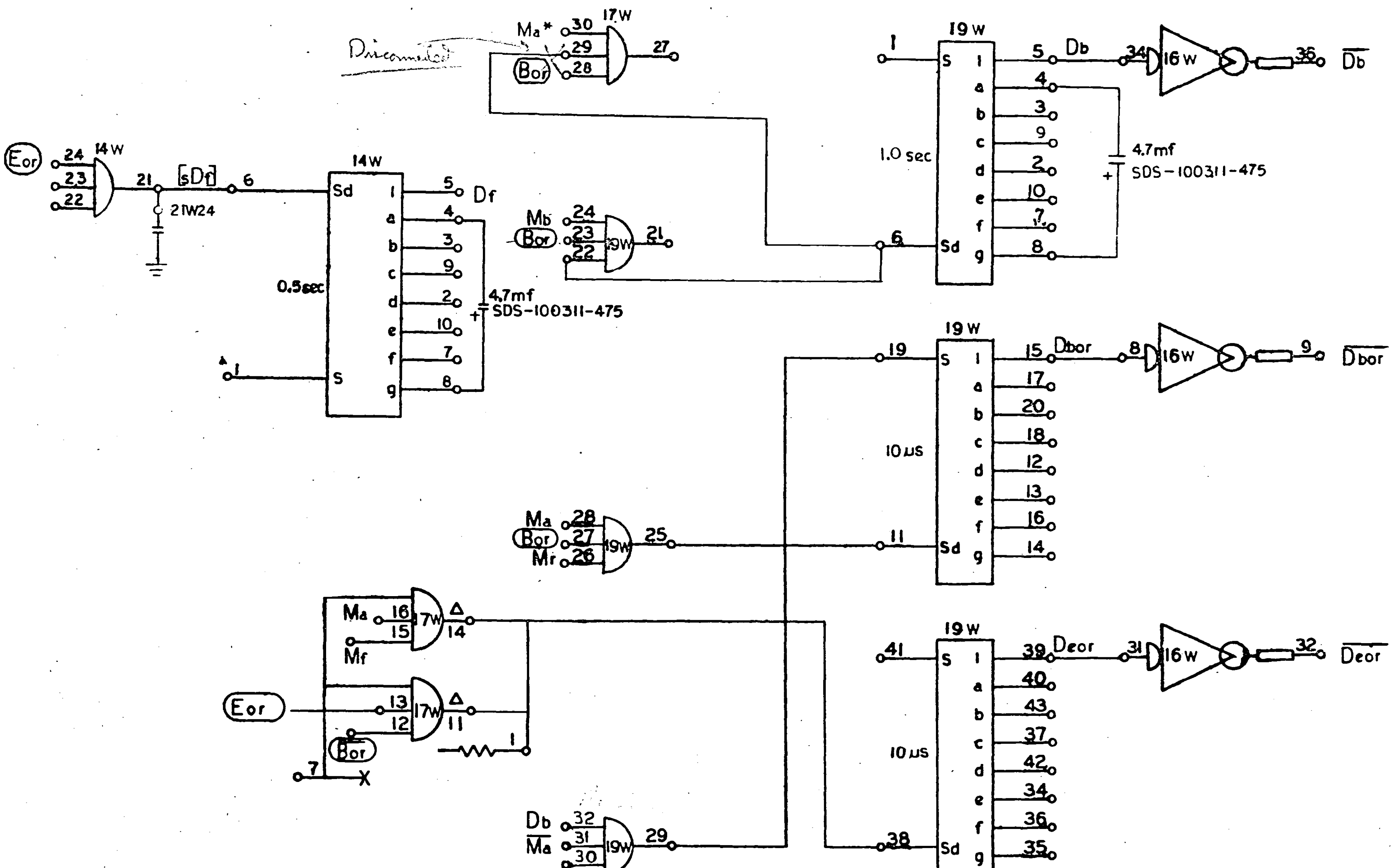

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15 KC TAPE UNIT ELECTRONICS

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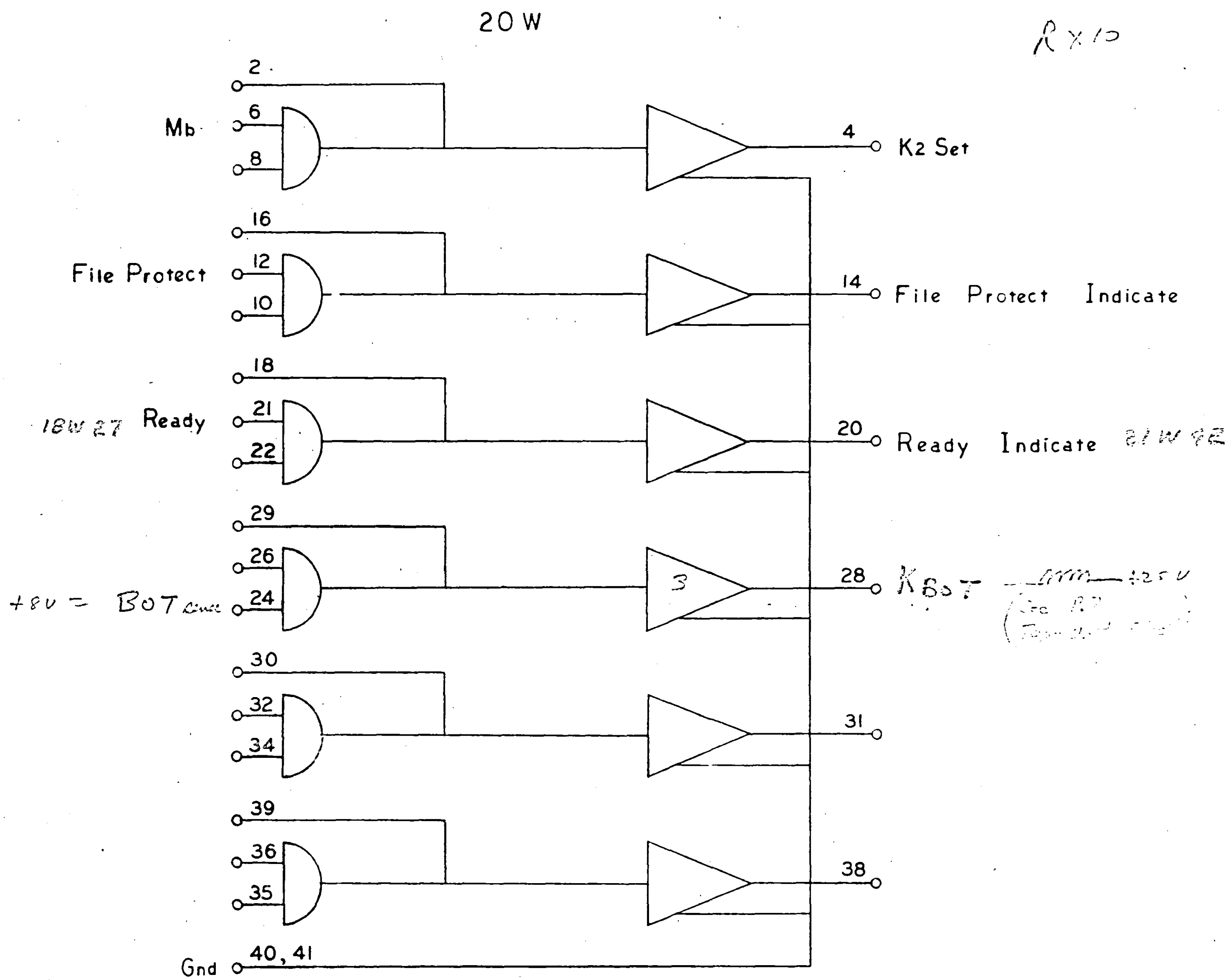

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15 KC TAPE UNIT ELECTRONICS

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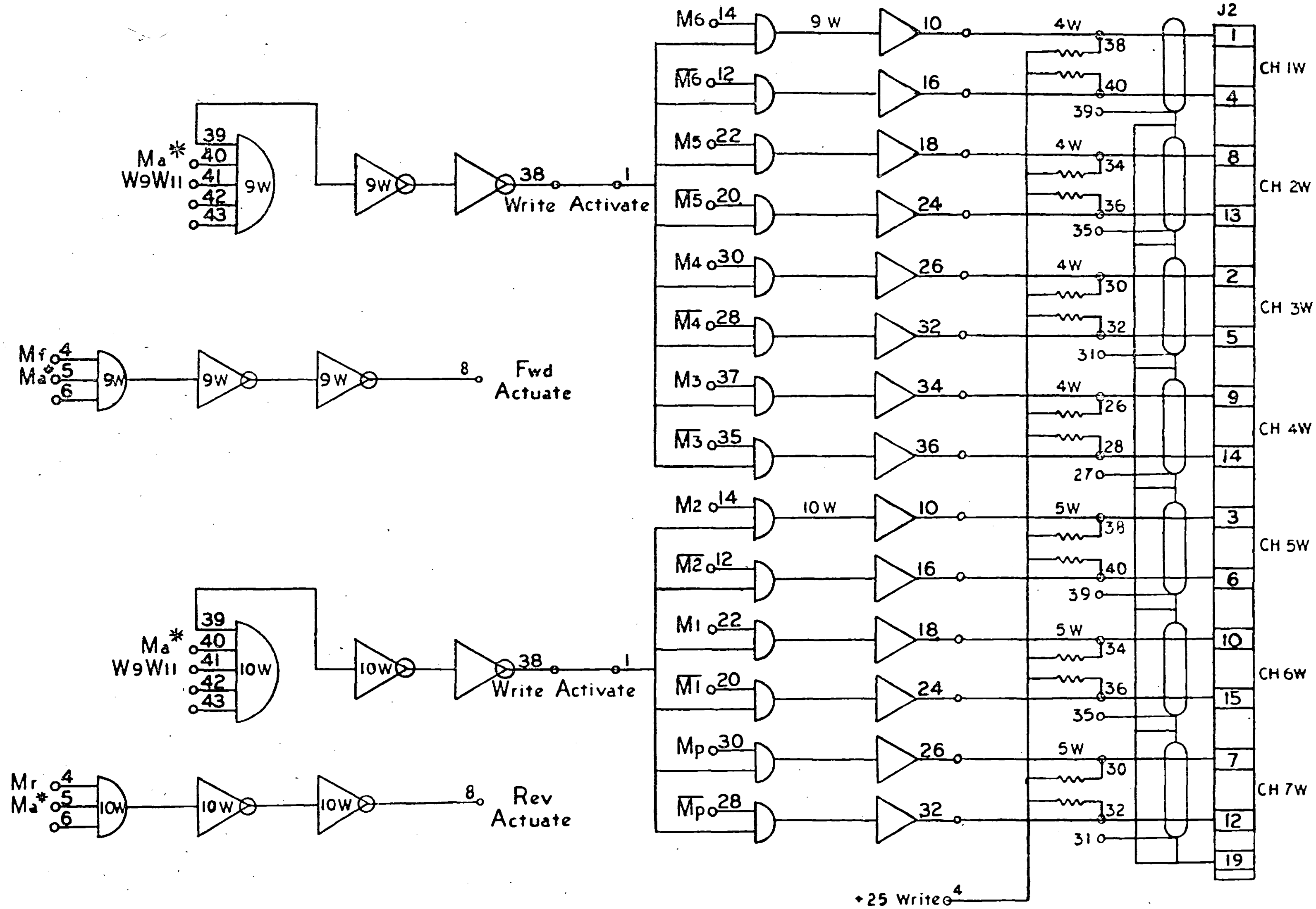

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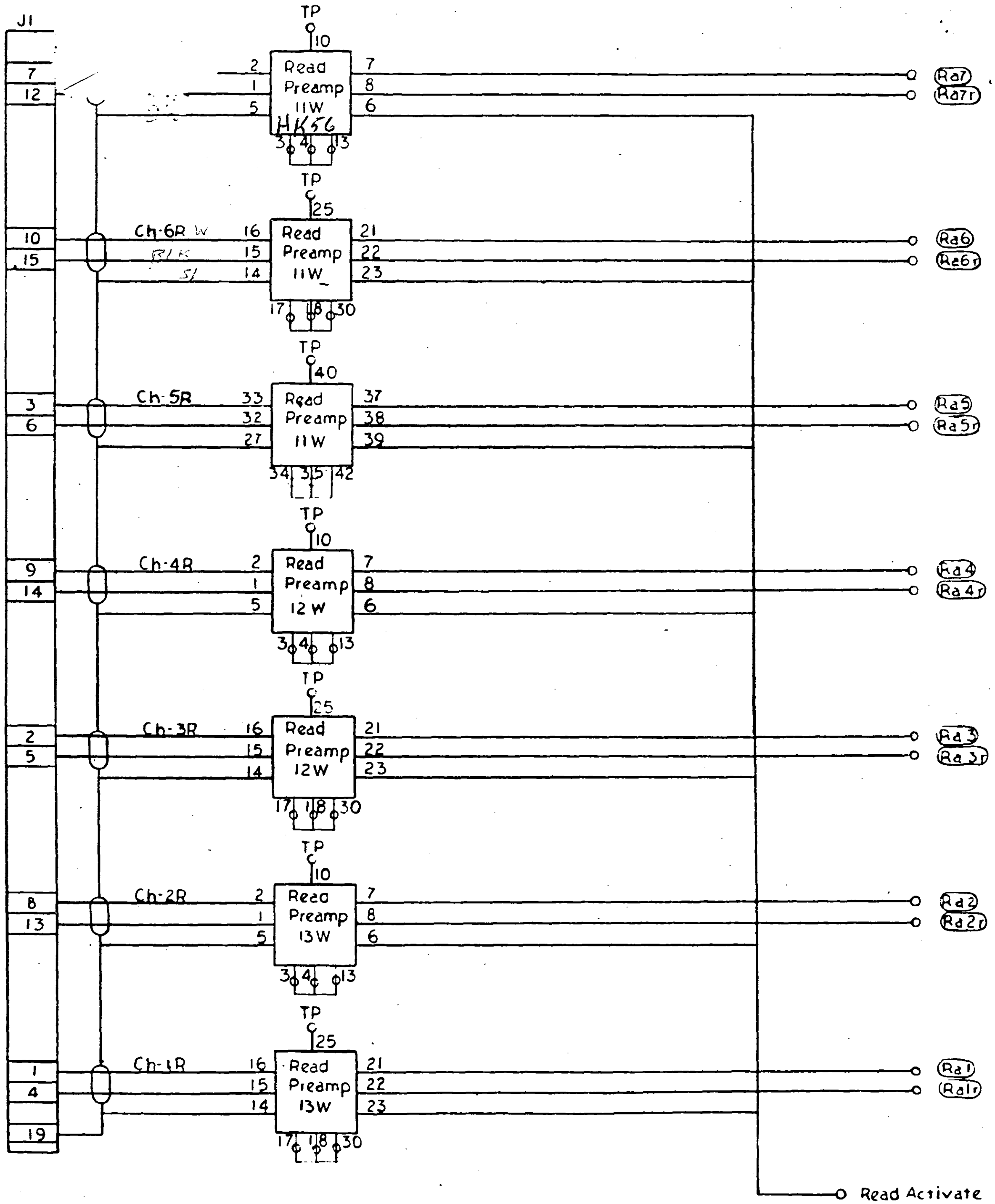

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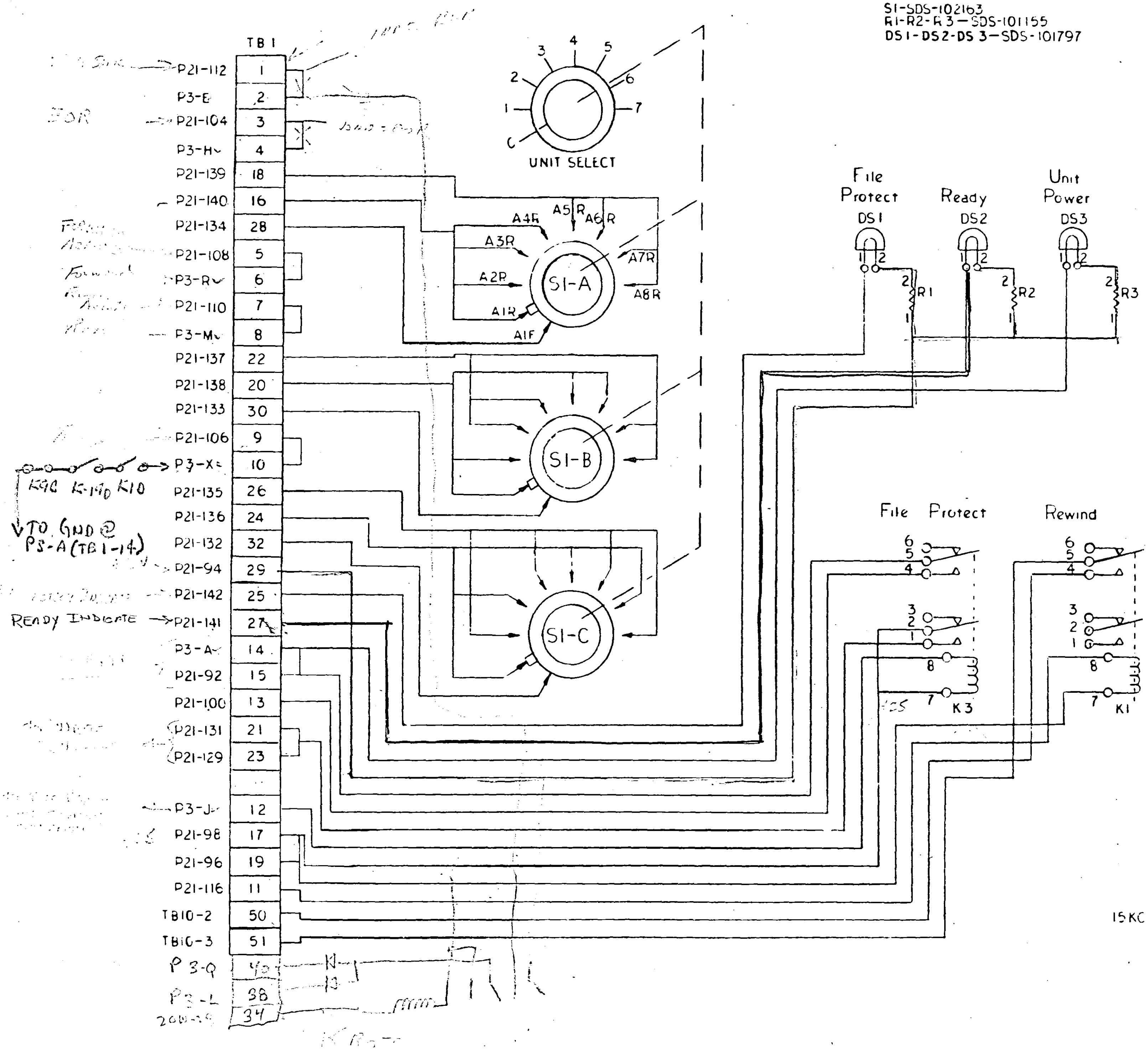

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CABLE PLUG MODULE

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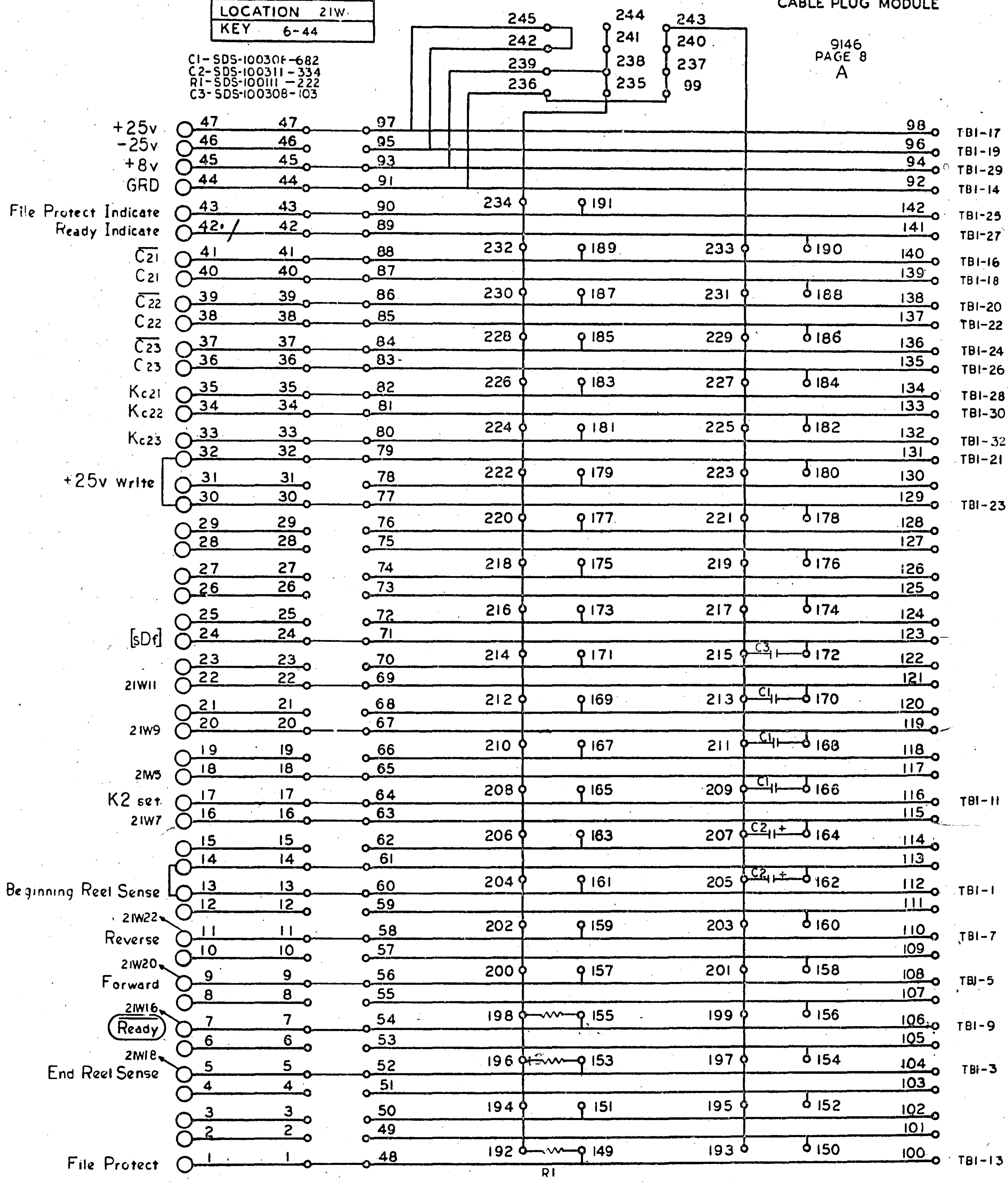
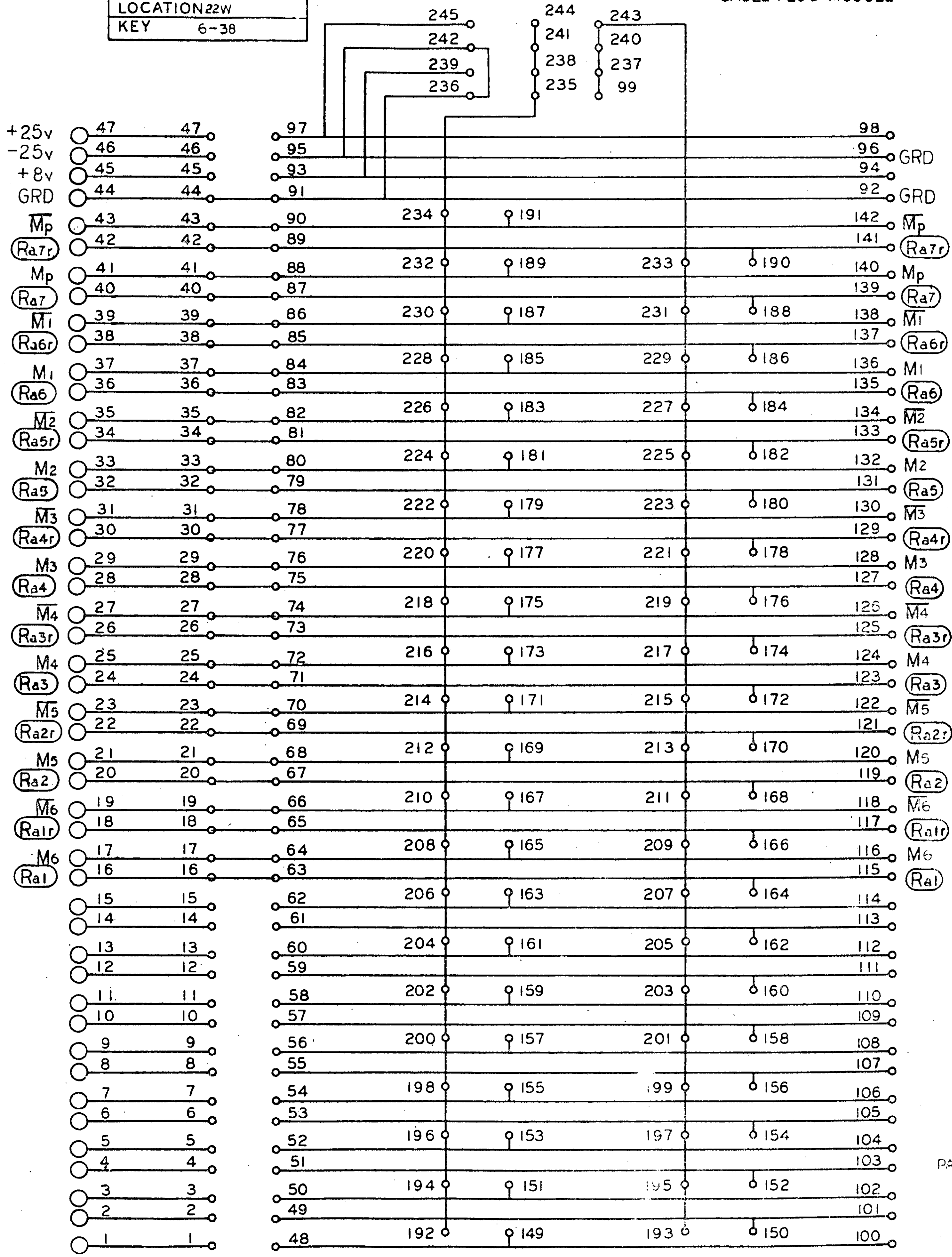
DESIGNATION	P21
LOCATION	21W
KEY	6-44

C1-SDS-100306-682
C2-SDS-100311-334
R1-SDS-100111-222
C3-SDS-100308-103



DESIGNATION	P22
LOCATION	22W
KEY	6-38

CABLE PLUG MODULE



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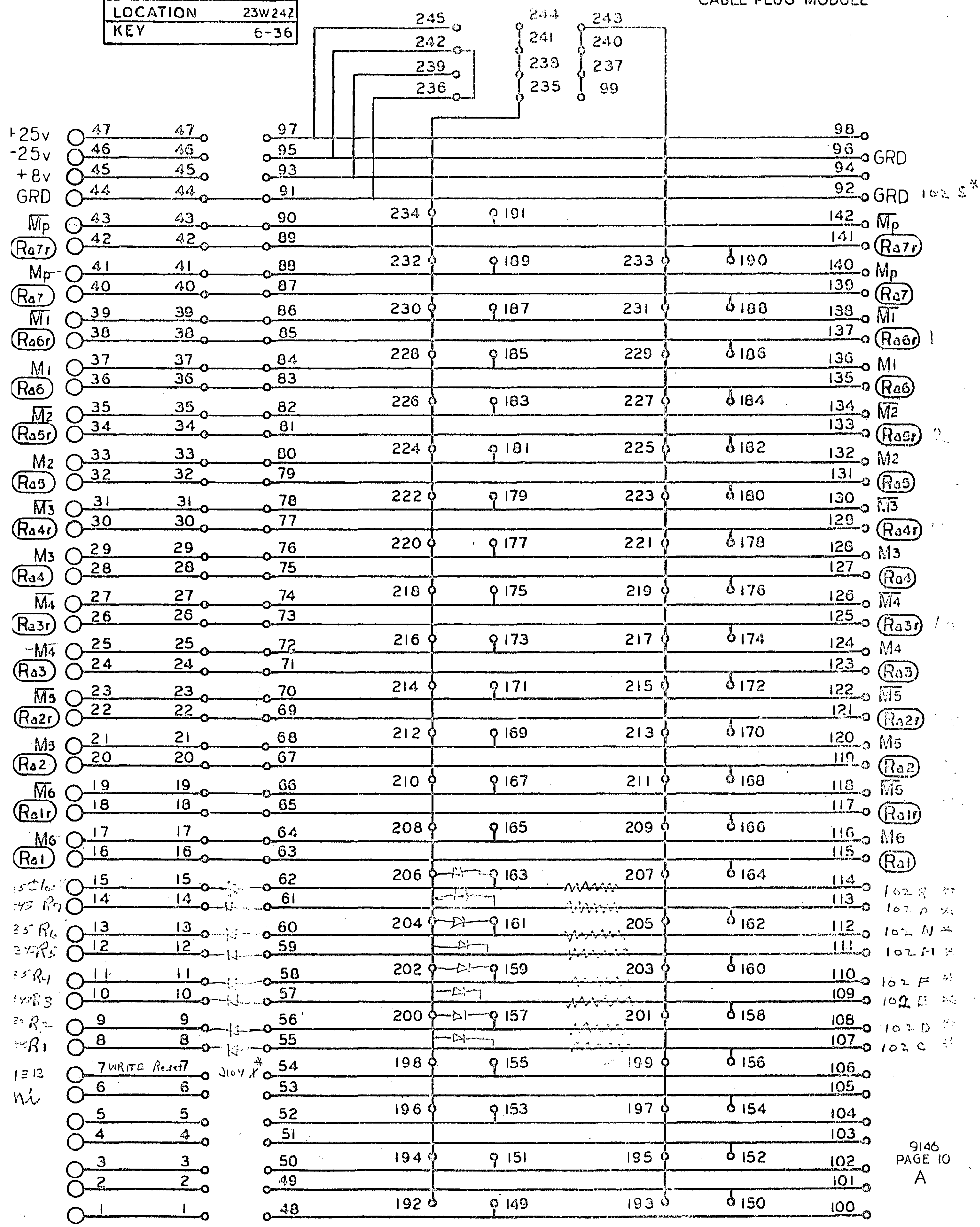
DESIGNATION	P23
LOCATION	23W242
KEY	6-36

CABLE PLUG MODULE



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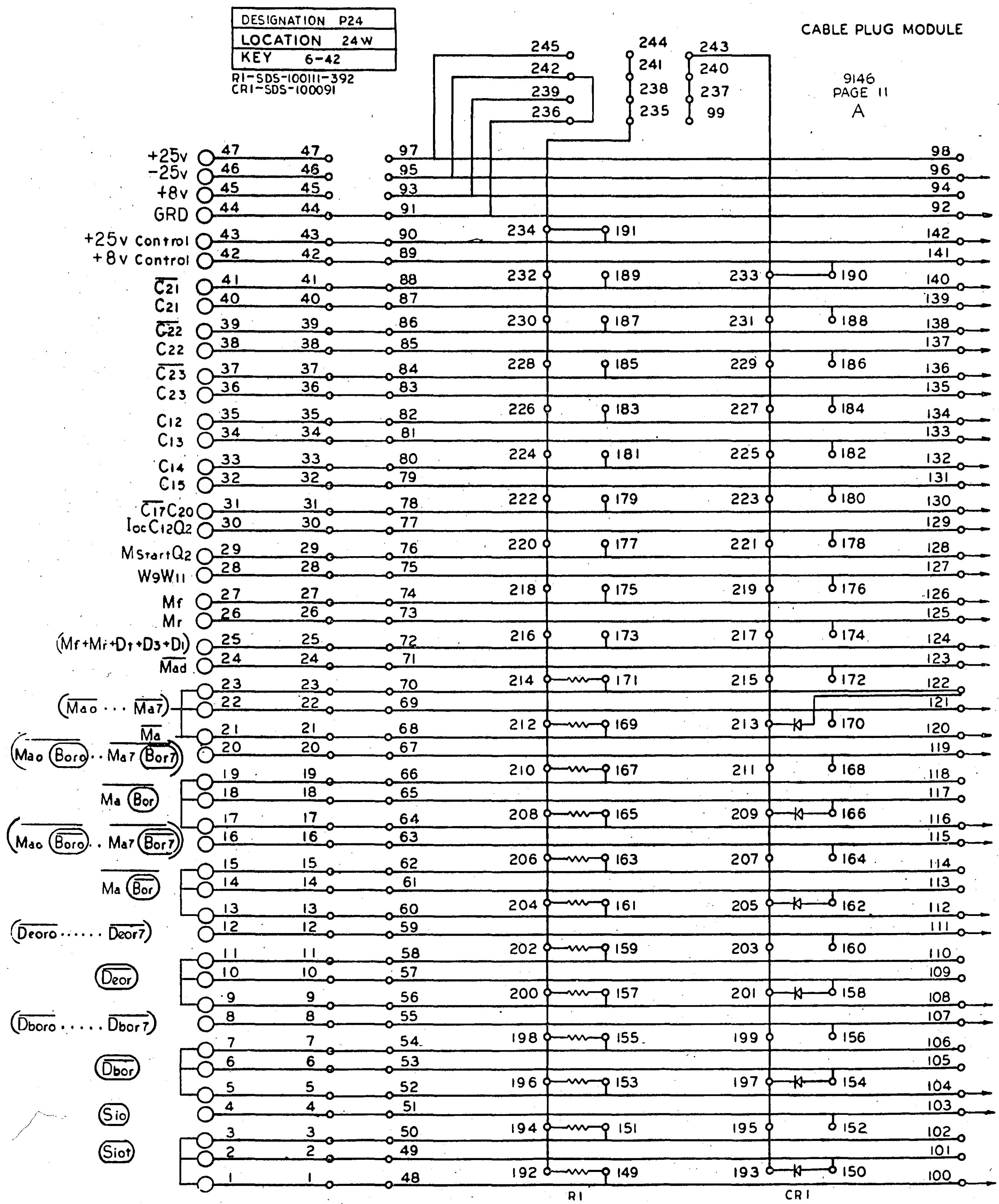
DESIGNATION P24
LOCATION 24W
KEY 6-42
R1-SDS-100111-392
CR1-SDS-100091
CABLE PLUG MODULE
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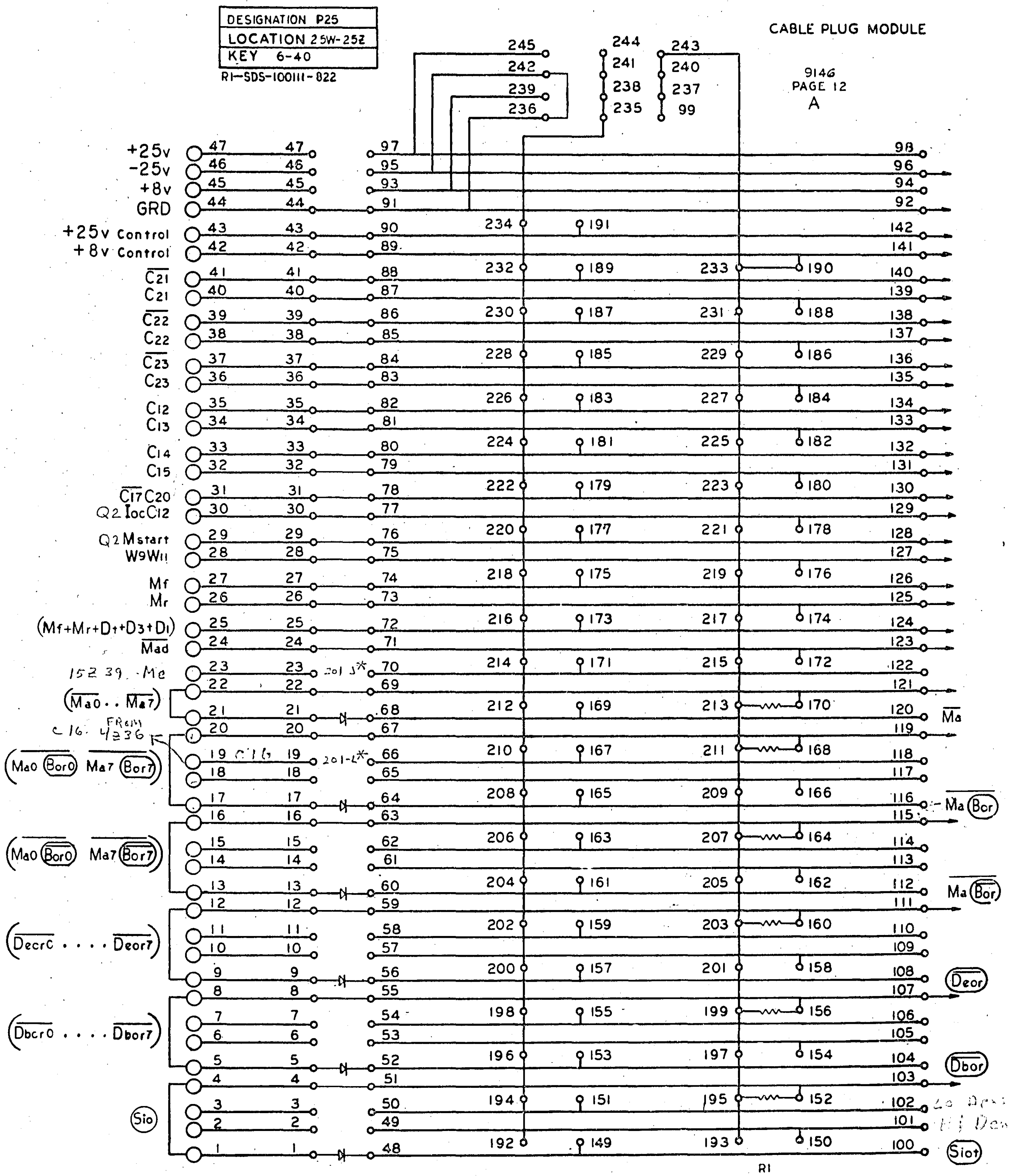
A
+25v
-25v
+8v
GRD
+25v Control
+8v Control
C21
C22
C23
C12
C13
C14
C15
Mf
Mr
R1
CR1


DESIGNATION P25
LOCATION 25W-25Z
KEY 6-40
R1-SDS-100111-822
CABLE PLUG MODULE
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PAGE 12
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+25v
-25v
+8v
GRD
+25v Control
+8v Control
$\overline{C21}$
C21
$\overline{C22}$
C22
$\overline{C23}$
C23
C12
C13
C14
C15
$\overline{C17}$C20
Q2 IocC12
Q2 Mstart
W9W11
Mf
Mr
(Mf+Mr+D1+D3+D1)
$\overline{Mad}$
($\overline{Ma0}$ . . $\overline{Ma7}$)
(Ma0 Bor0 Ma7 Bor7)
(Ma0 $\overline{Bor0}$ Ma7 $\overline{Bor7}$)
($\overline{Decr0}$ . . . . $\overline{Deor7}$)
($\overline{Dbcr0}$ . . . . $\overline{Dbor7}$)
Sio
$\overline{Ma}$
$\overline{Ma}$ (Bor)
Ma ($\overline{Bor}$)
Deor
Dbor
Siot
R1

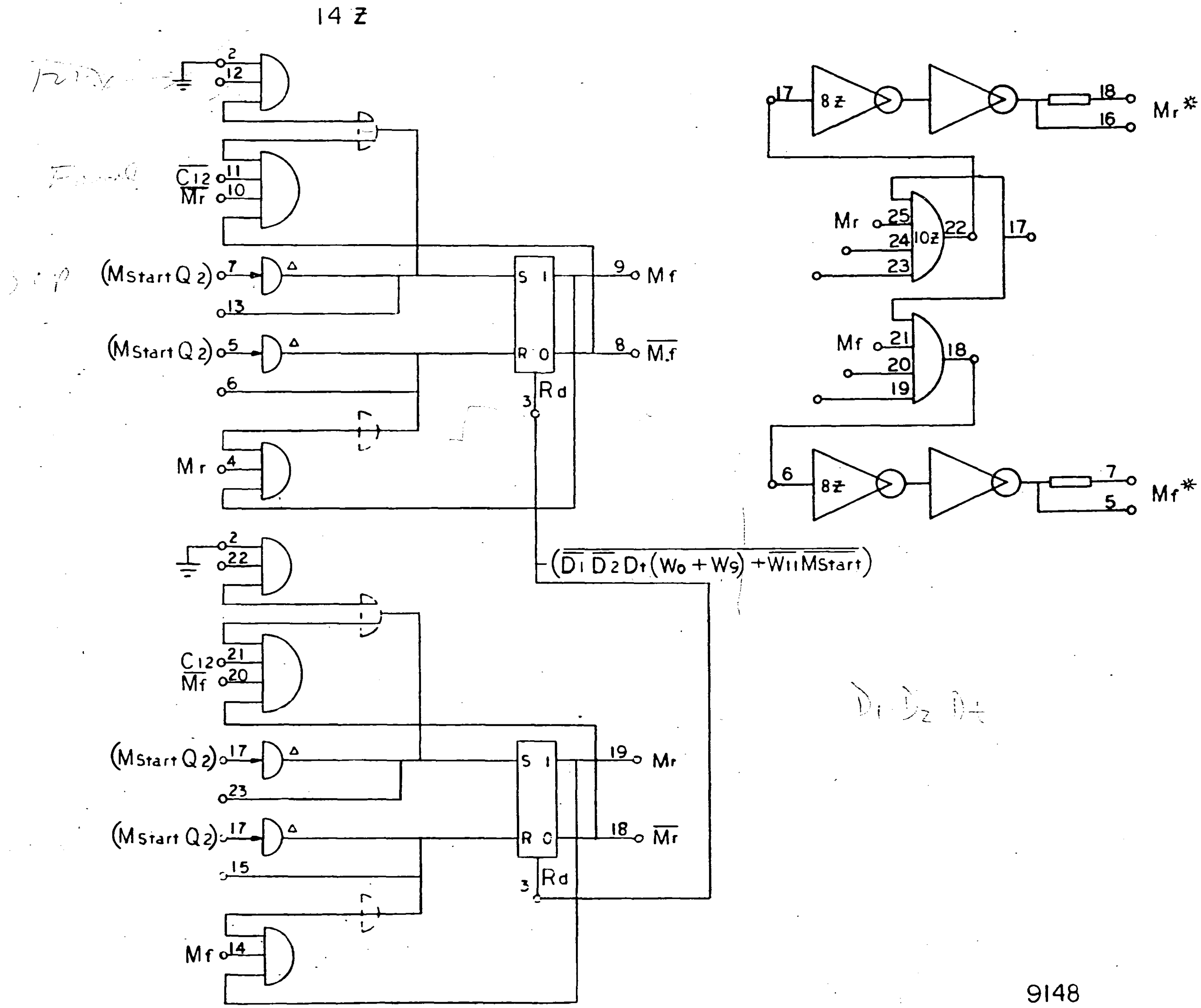
* TM4111 D ✓ 201

9146 DIRECTORY

PAGE	CHG	PAGE	CHG	PAGE	CHG	PAGE	CHG	PAGE	CHG
1	A								
2	A								
3	A								
4	A								
5	A								
6	A								
7	A								
8	A								
9	A								
10	A								
11	A								
12	A								
13	A								
14	A								

NOTES:

1. REV. LETTERS LISTED INDICATE STATUS OF EACH SHEET OF THIS MULTIPLE SHT. DWG.
2. CHECK INDIVIDUAL SHEETS FOR REV. LETTER AGAINST THIS SHT. BEFORE USING THIS DWG.



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15KC TAPE CONTROL UNIT

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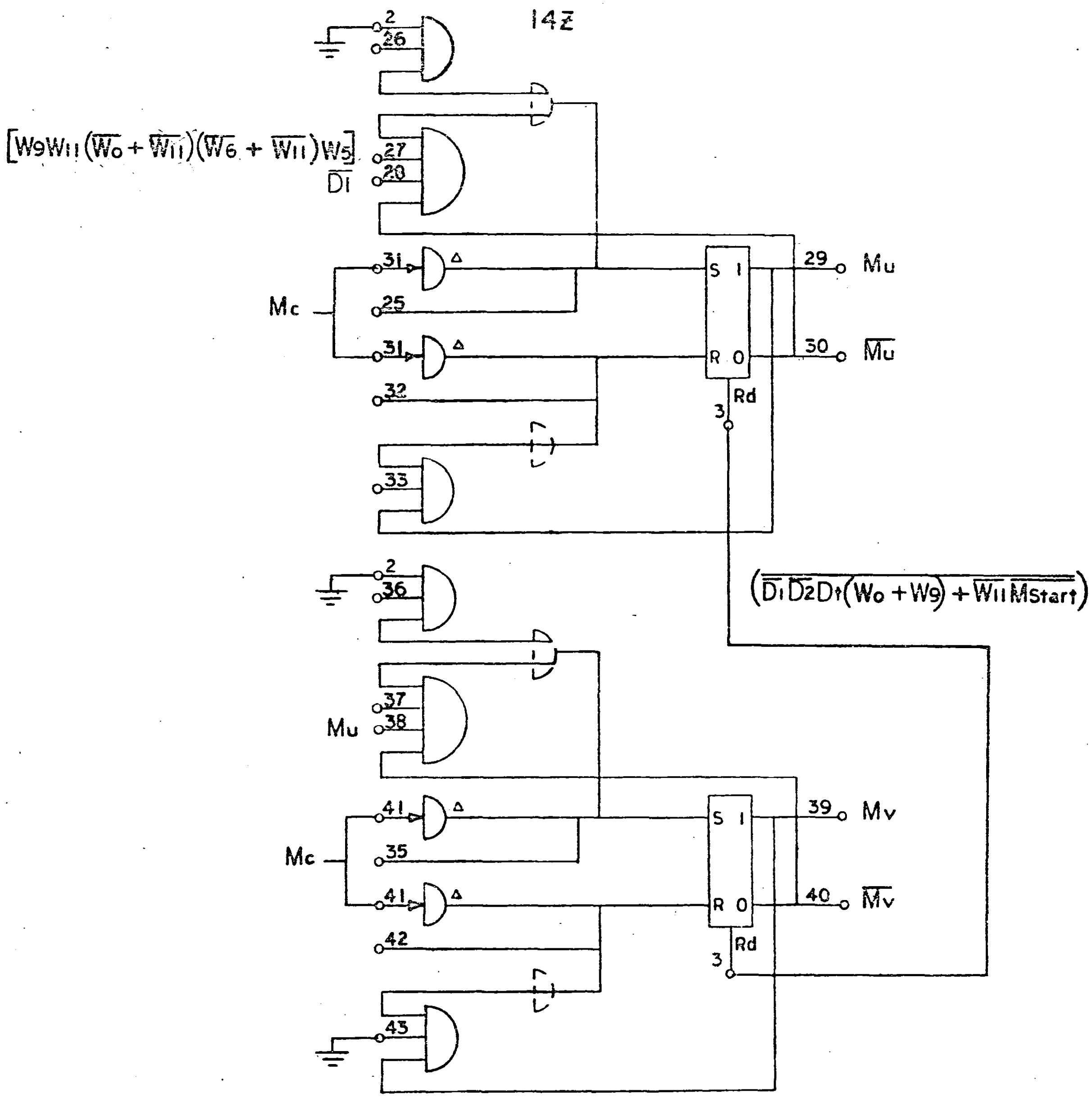

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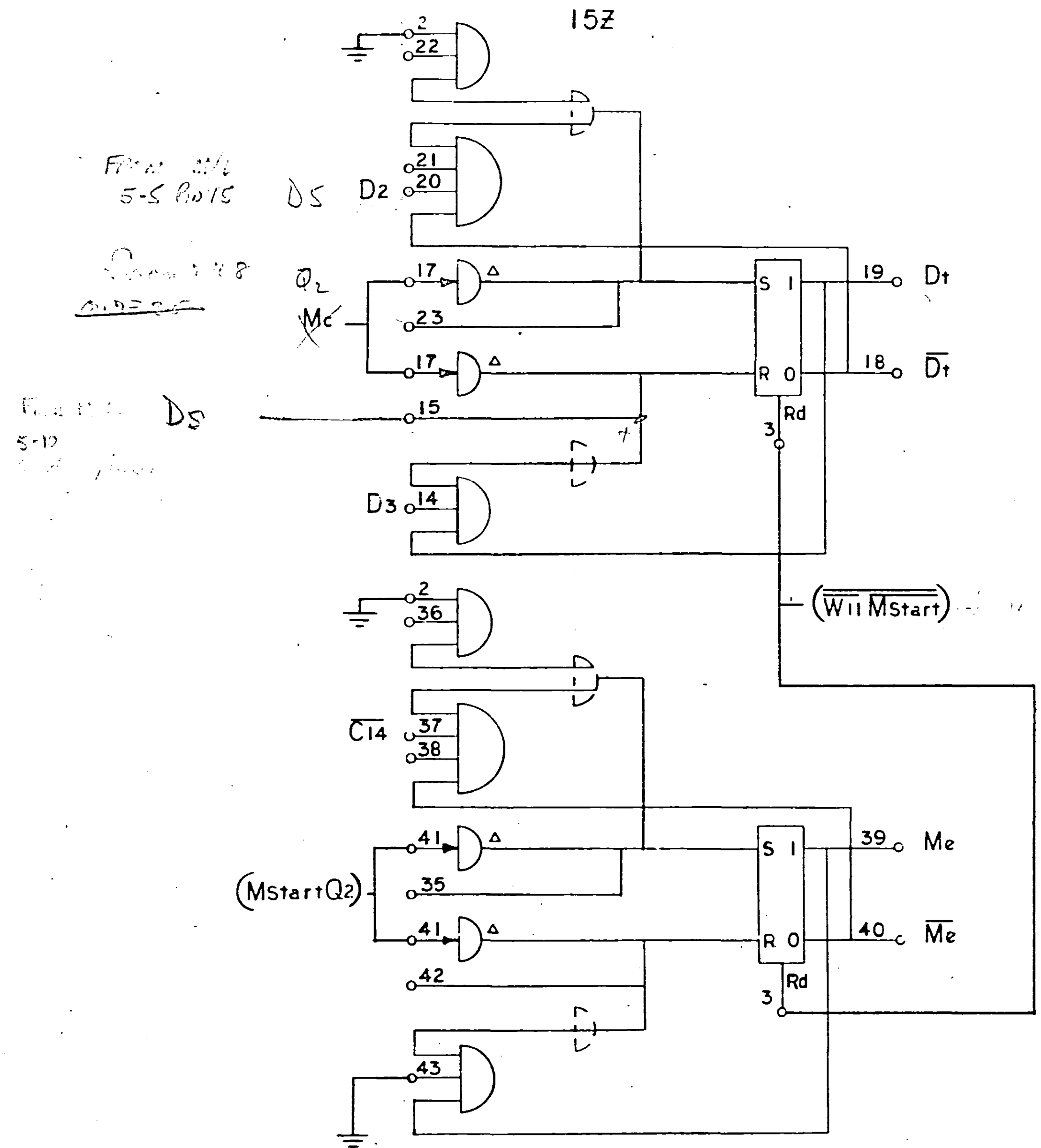

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15 KC TAPE CONTROL UNIT

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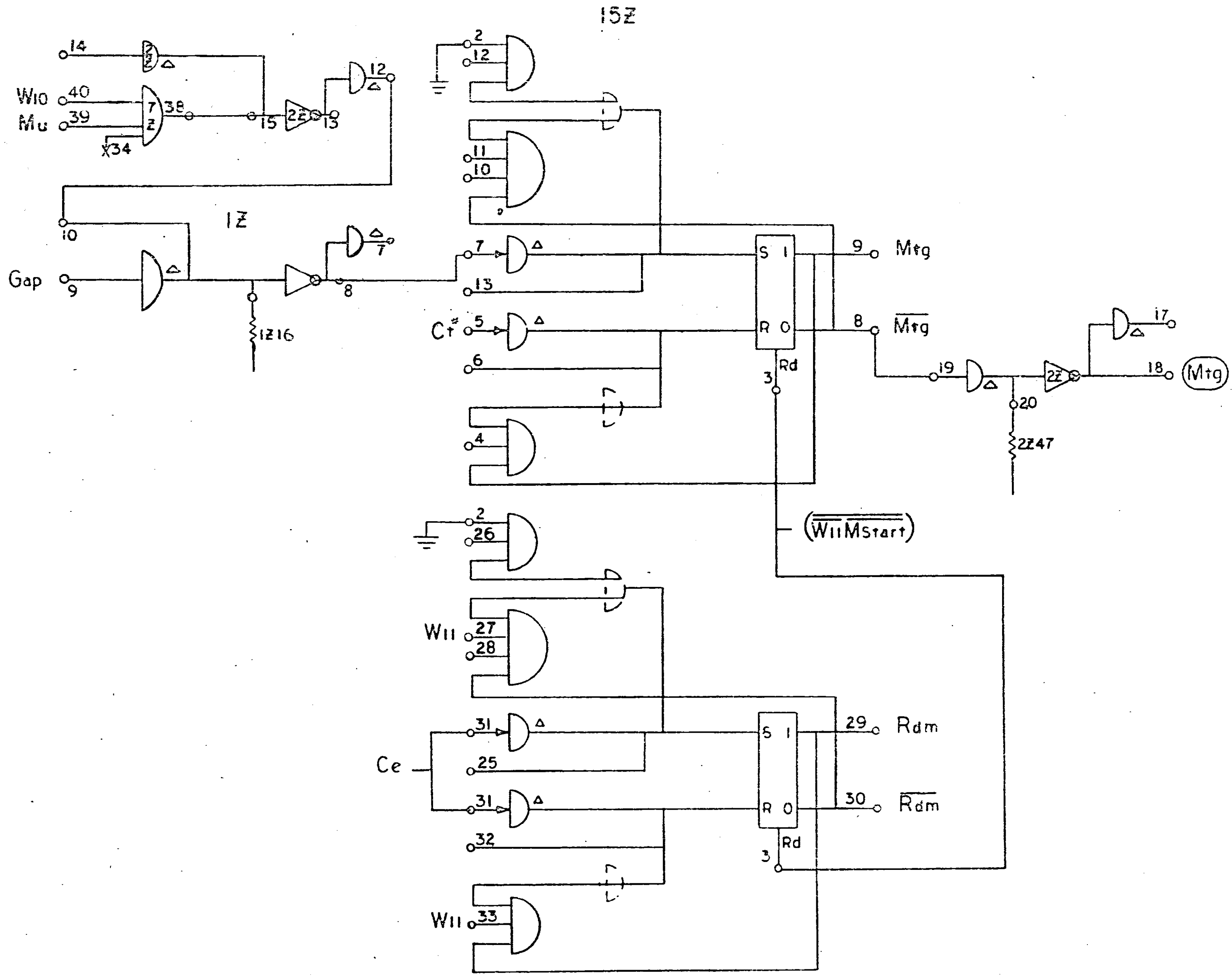

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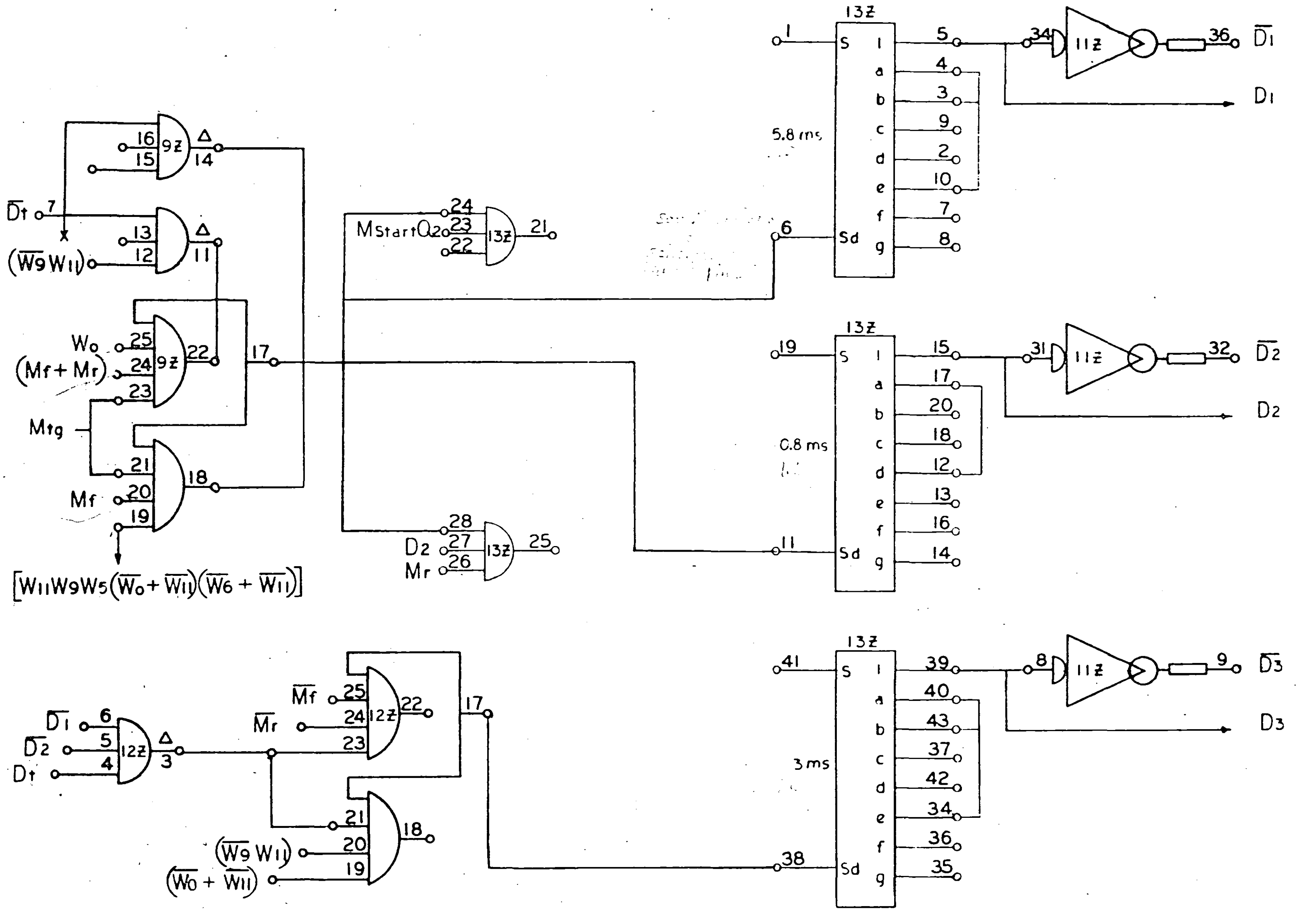

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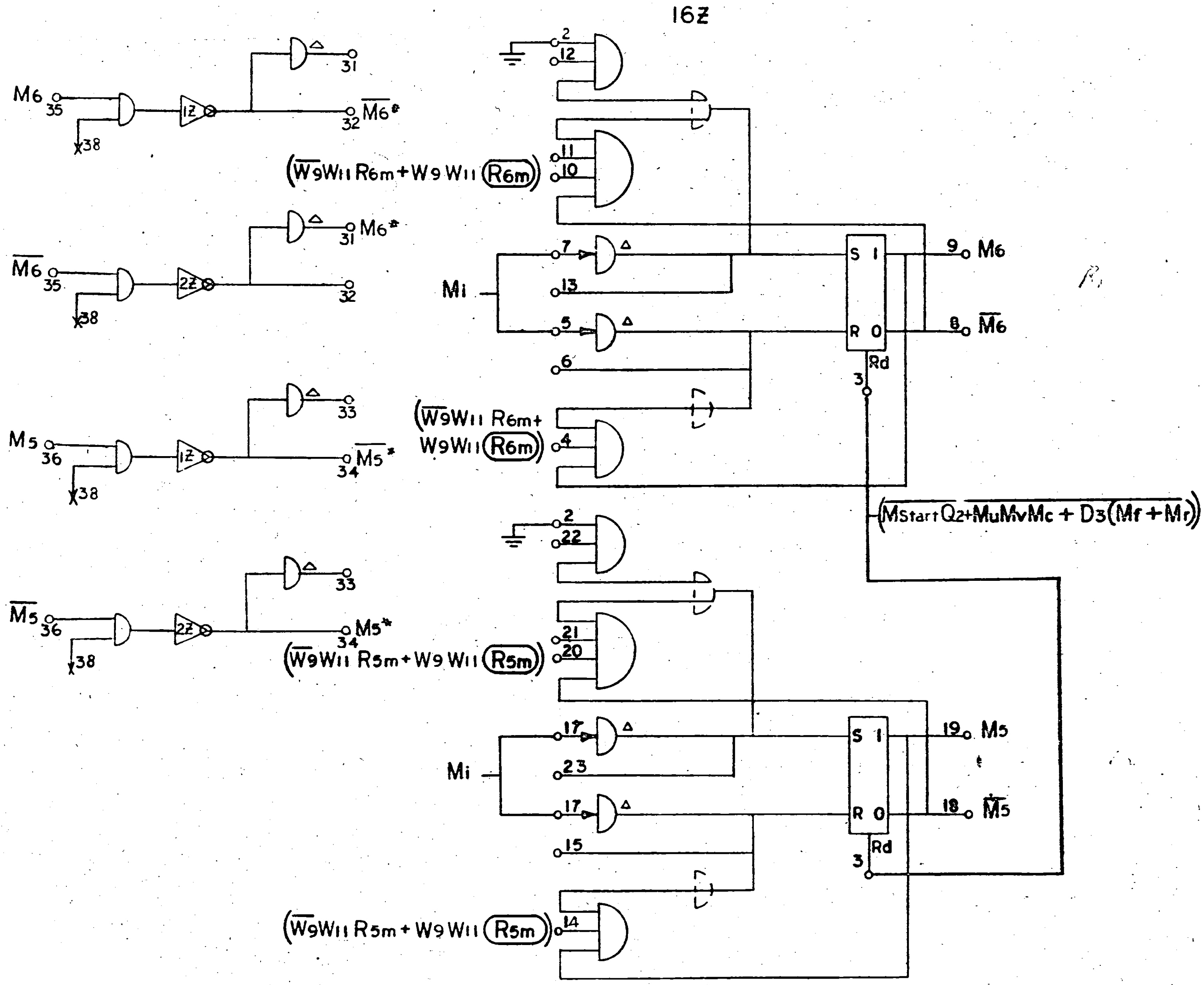

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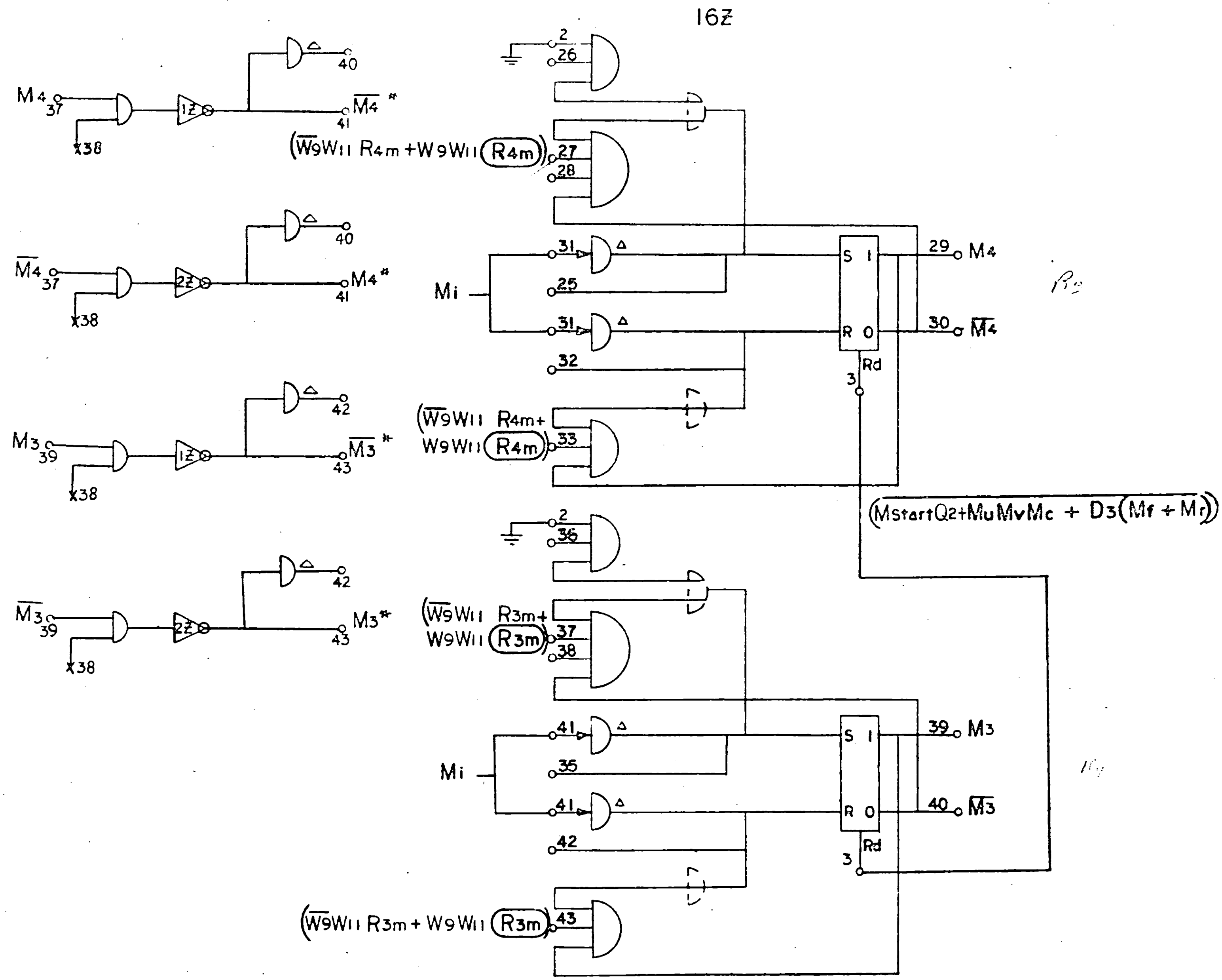

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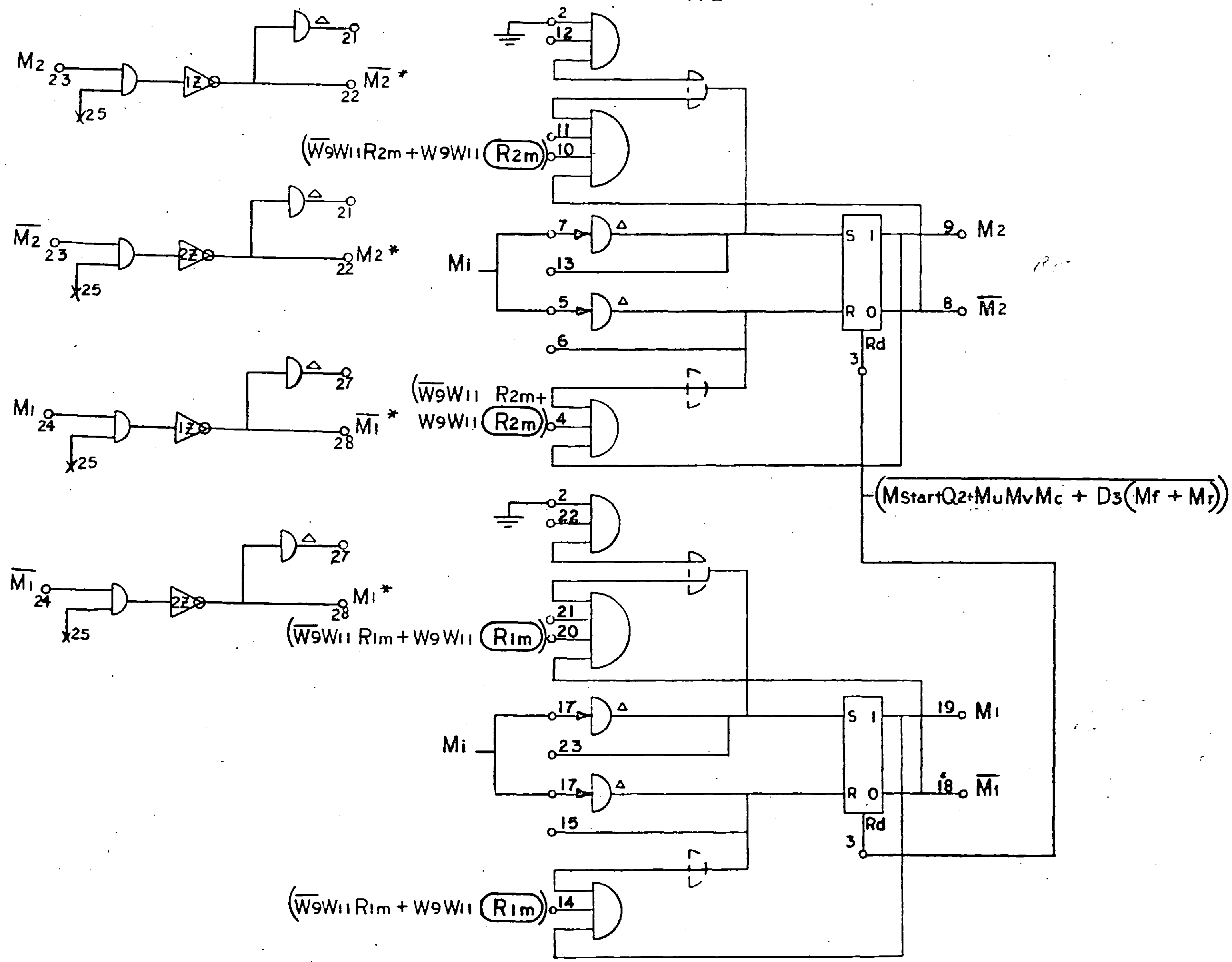

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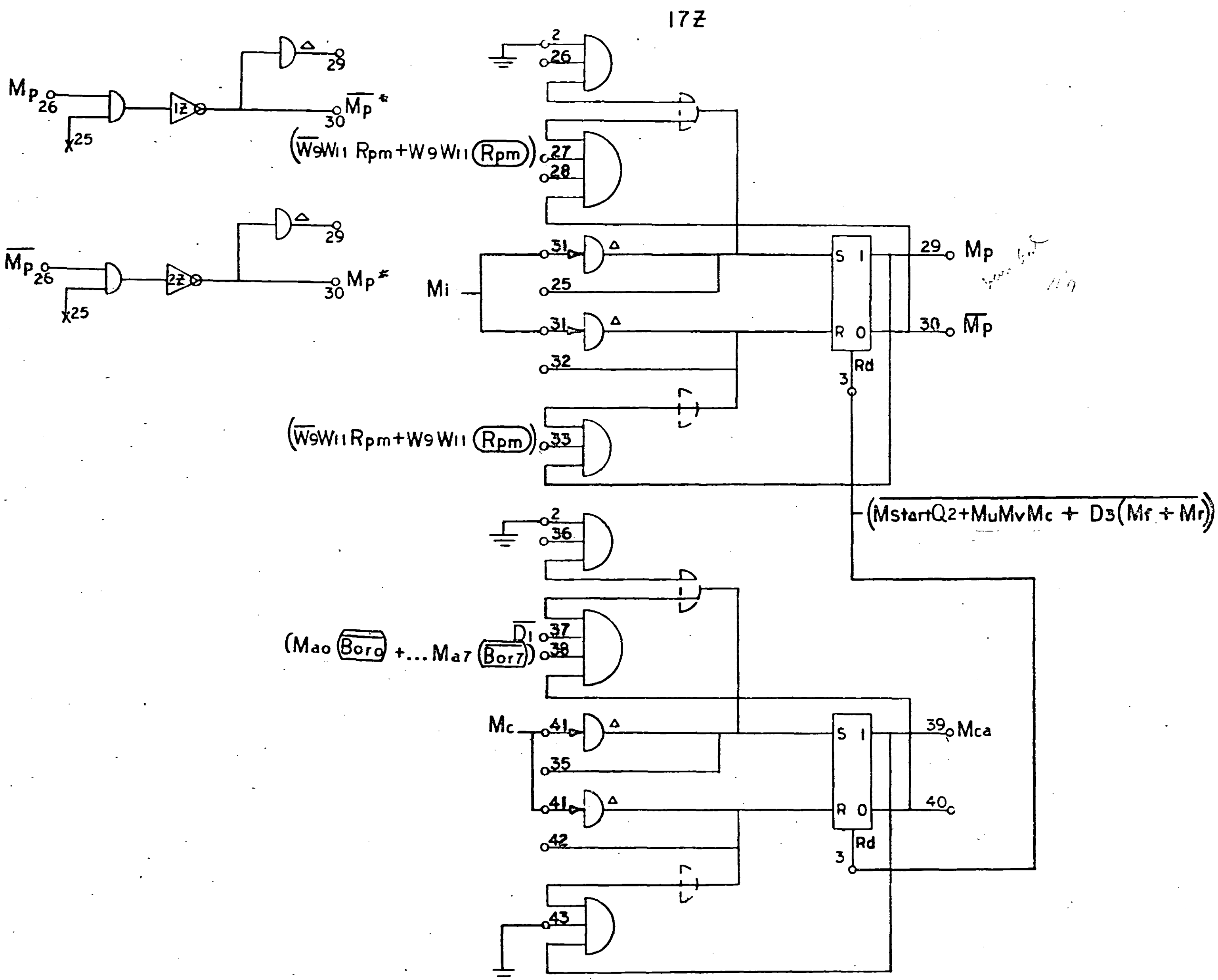

17Z
Mp
26
25
1Z
29
30
Mp*
(W9W11 Rpm+W9W11 (Rpm))
27
28
2
Mp
2Z
Mp≠
Mi
31
Mi
25
31
32
S 1
R 0
Rd
3
29 Mp
30 Mp
(W9W11 Rpm+W9W11 (Rpm))
33
(MstartQ2+MuMvMc + D3(Mf + Mr))
2
36
D1
37
38
(Ma0 (Bor0) +...Ma7 (Bor7))
Mc
41
35
41
42
43
39 Mca
40

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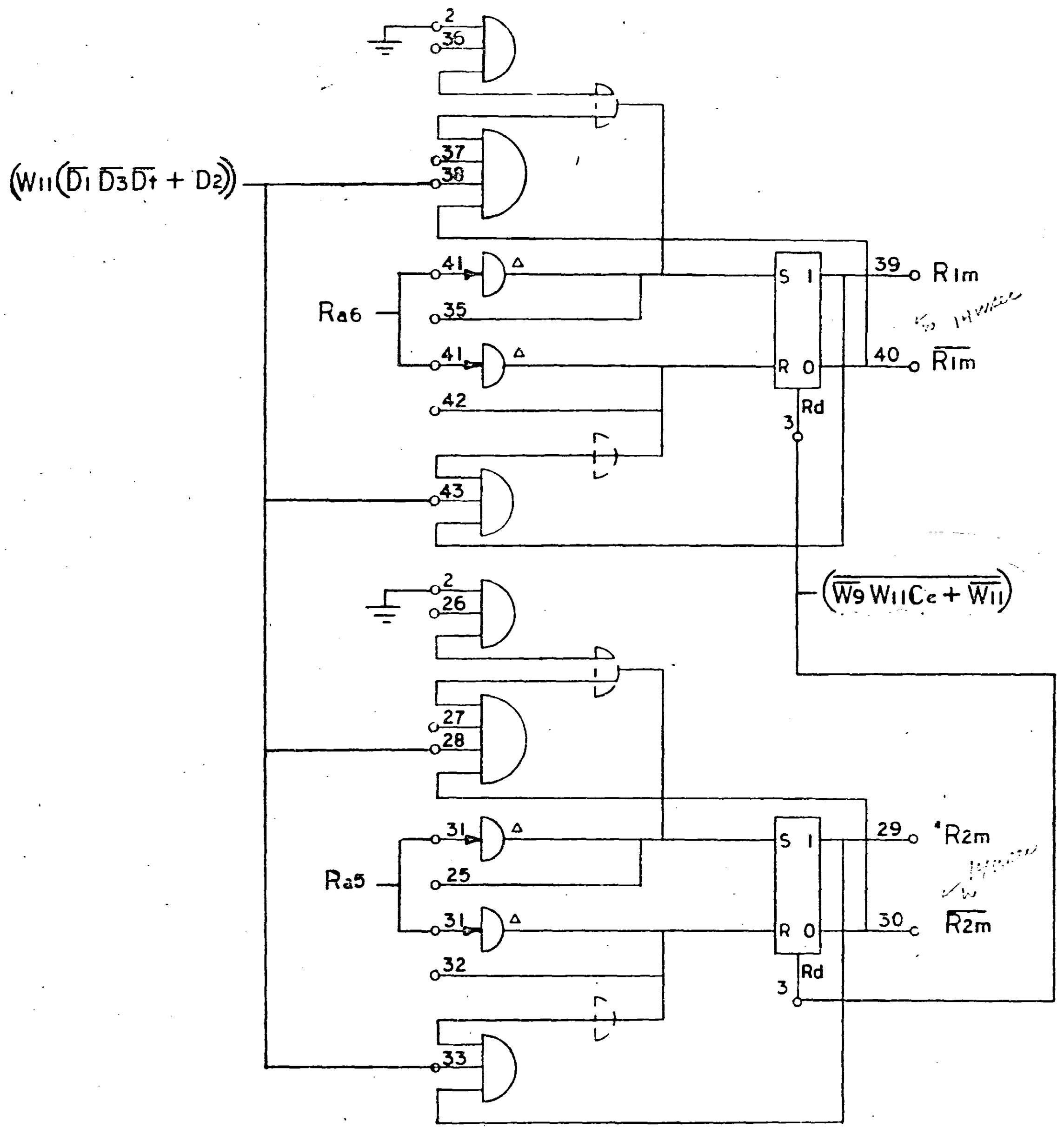

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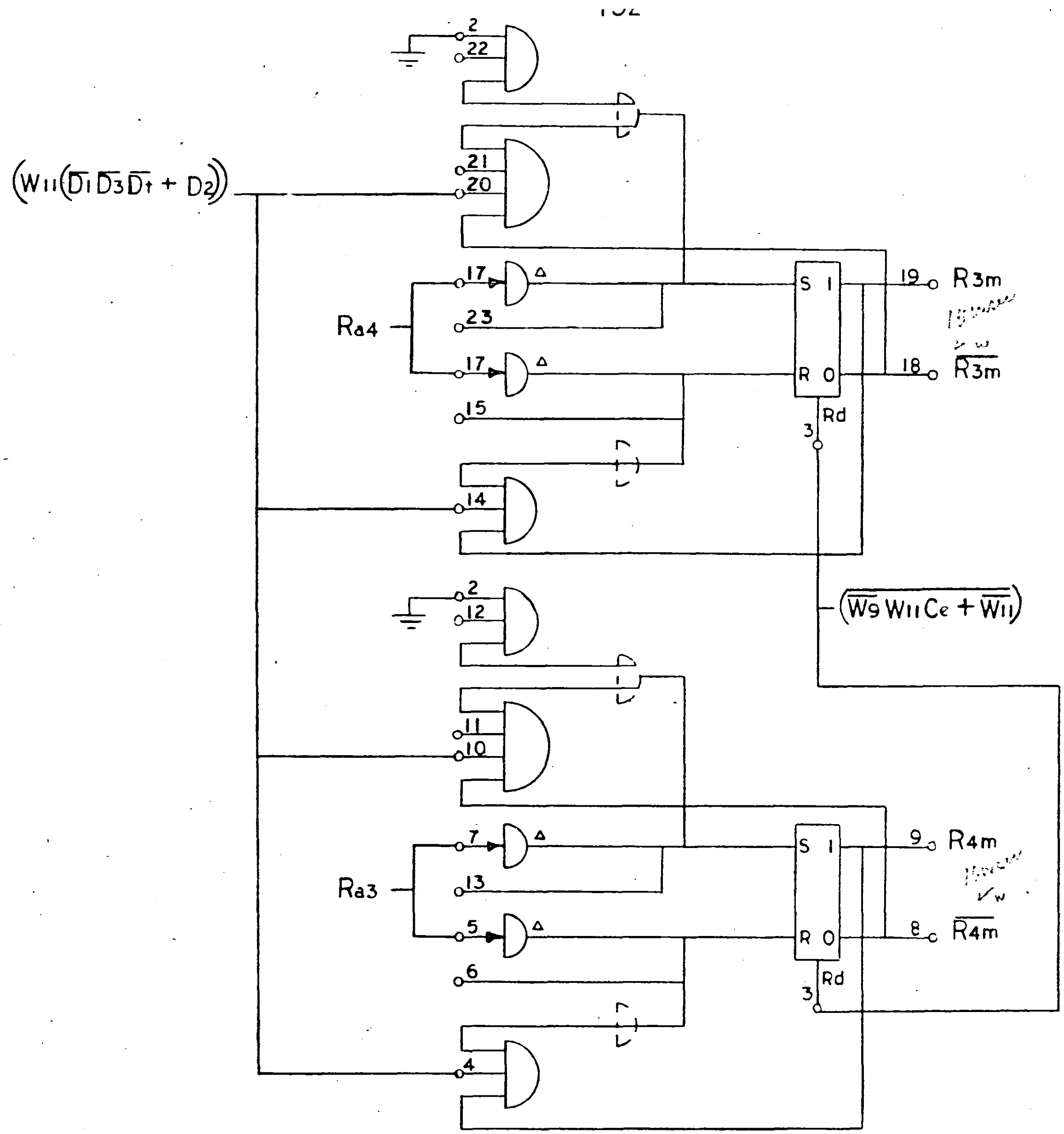

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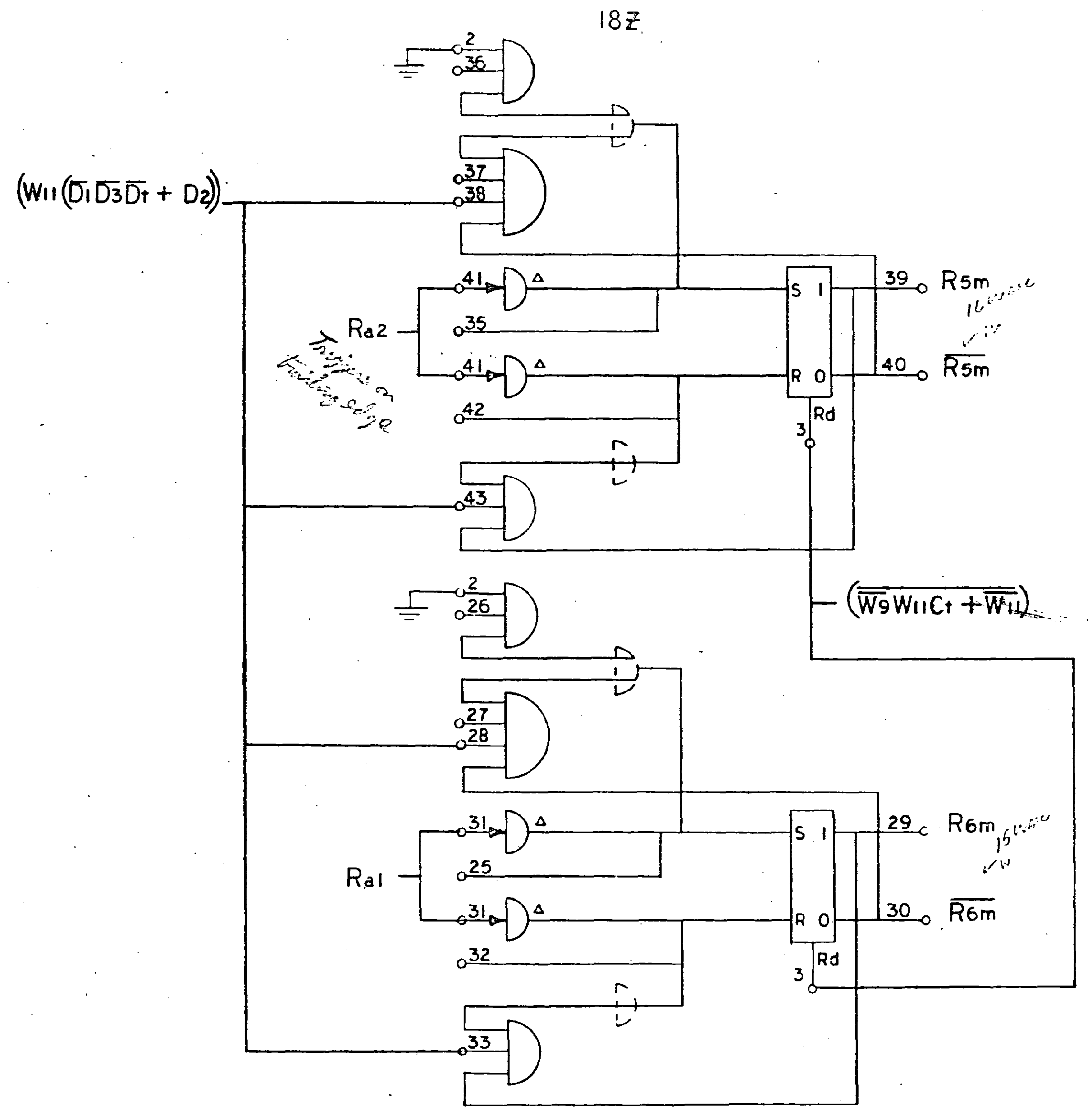

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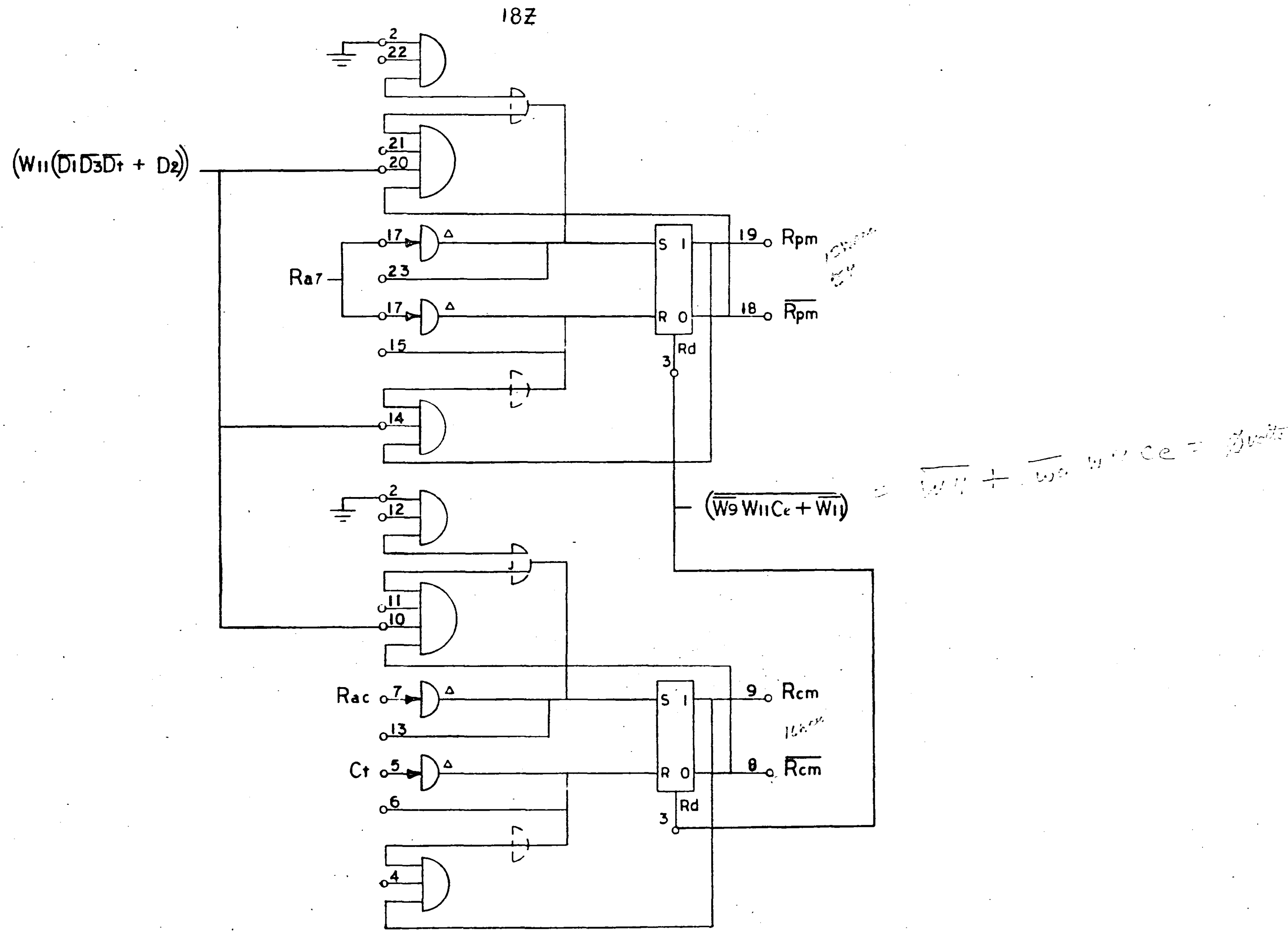

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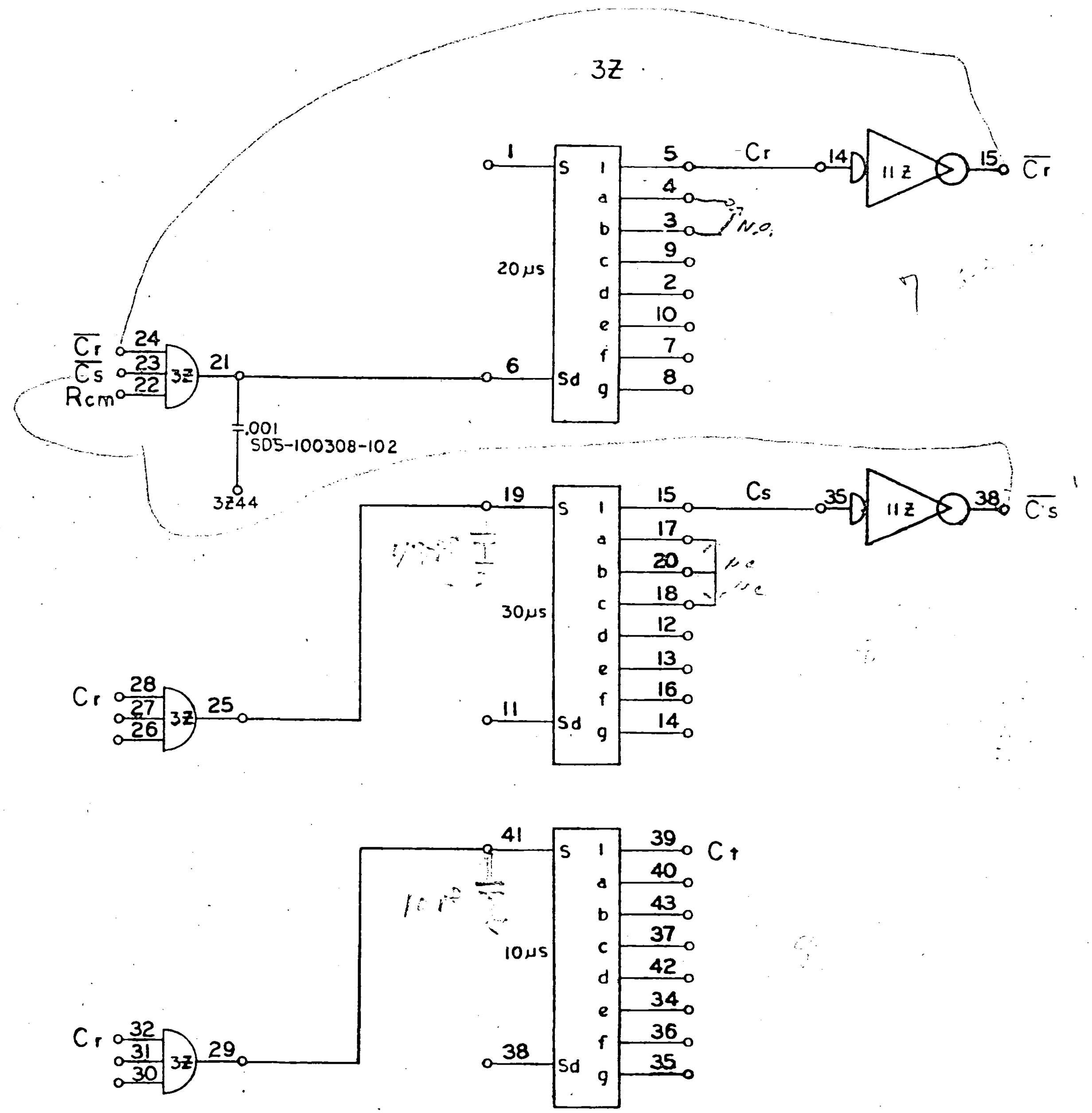

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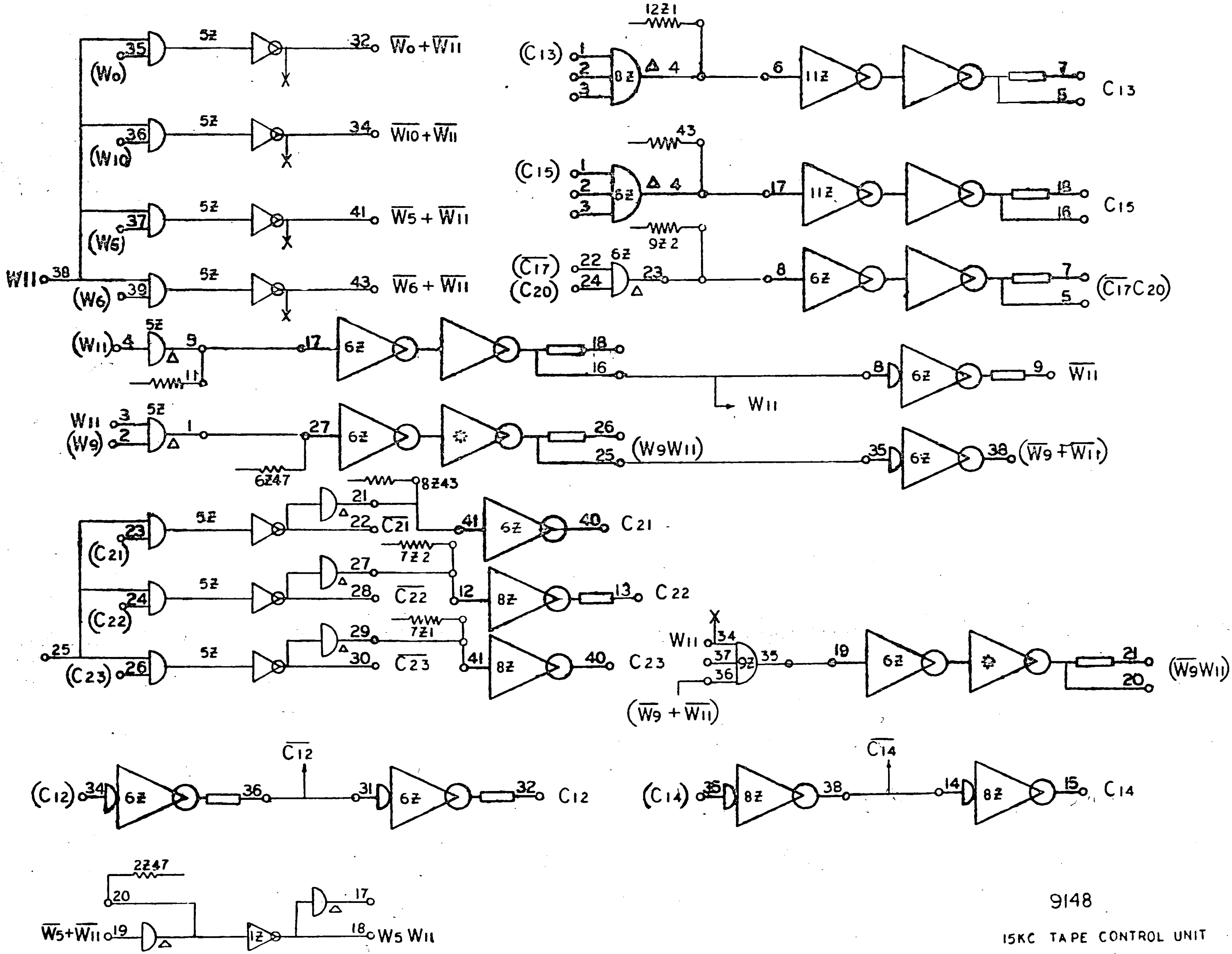

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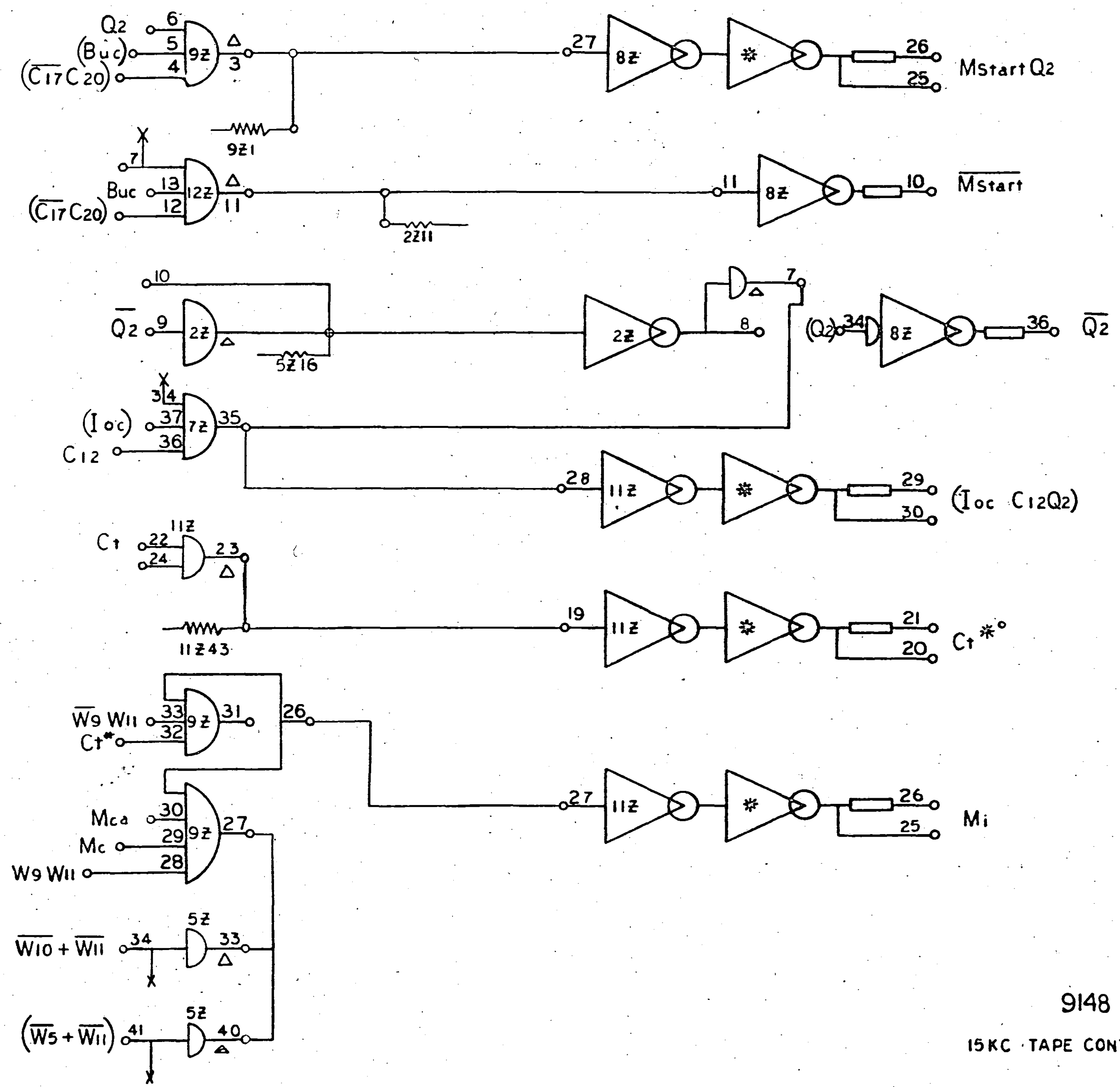

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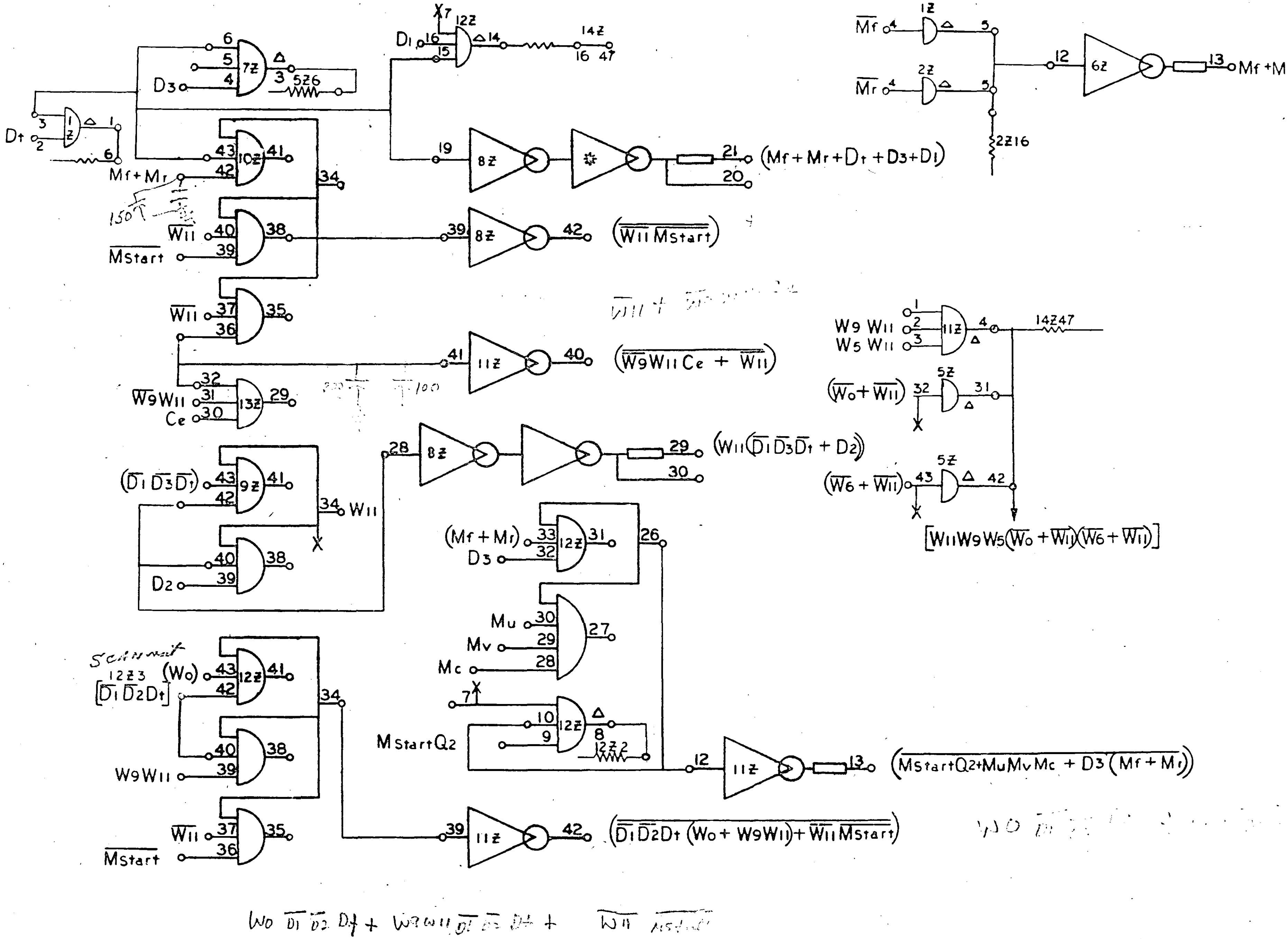

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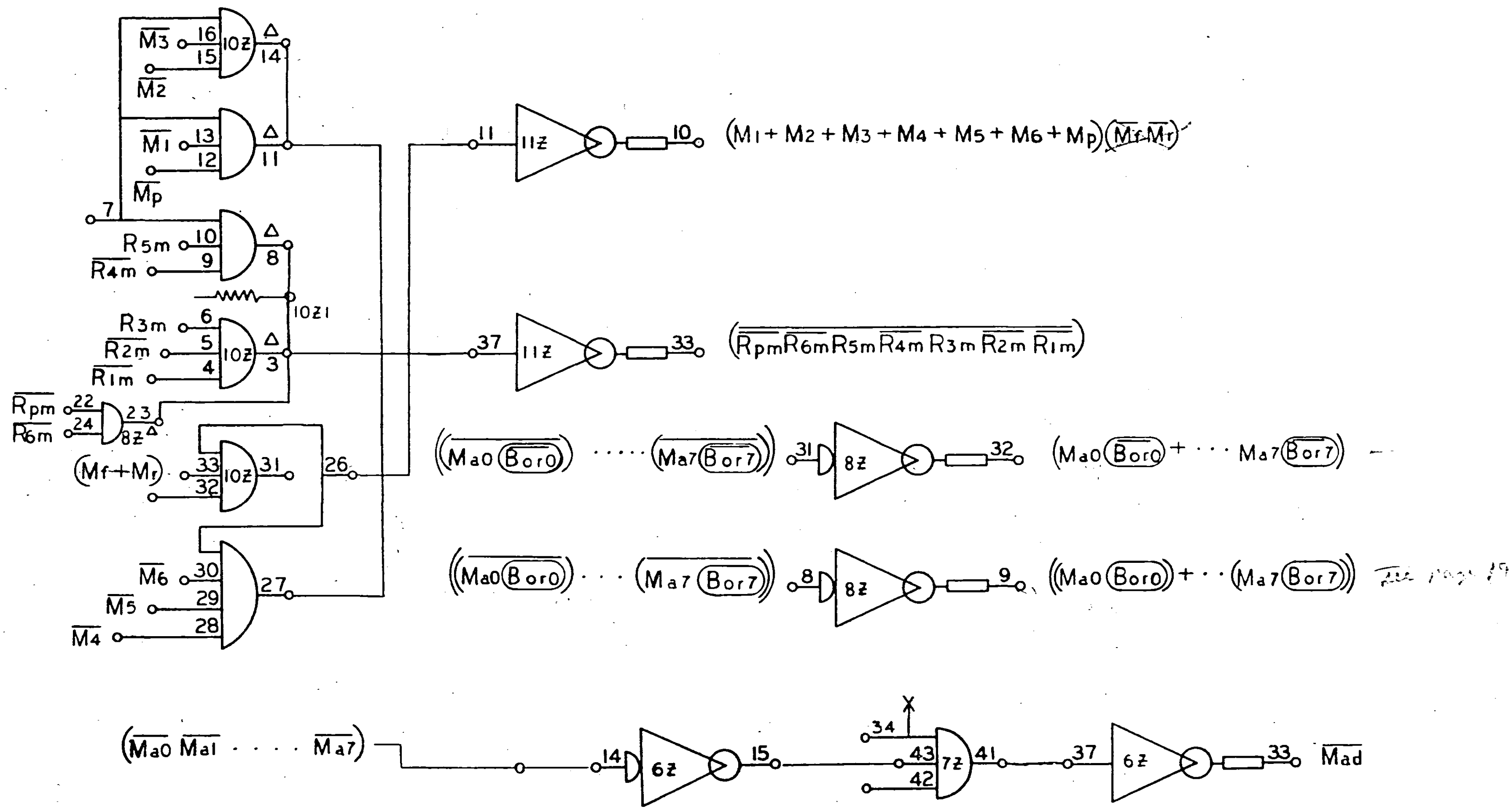

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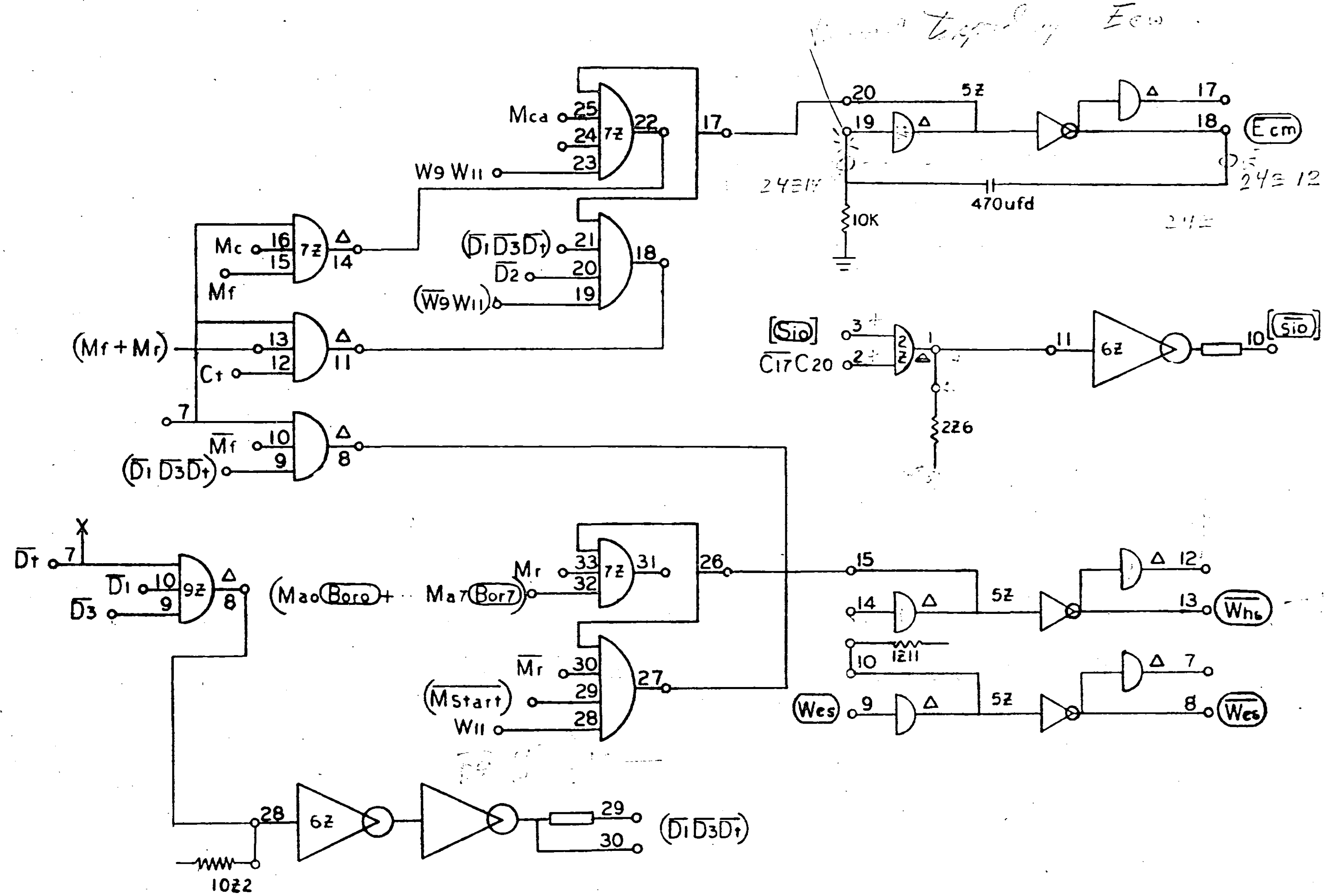

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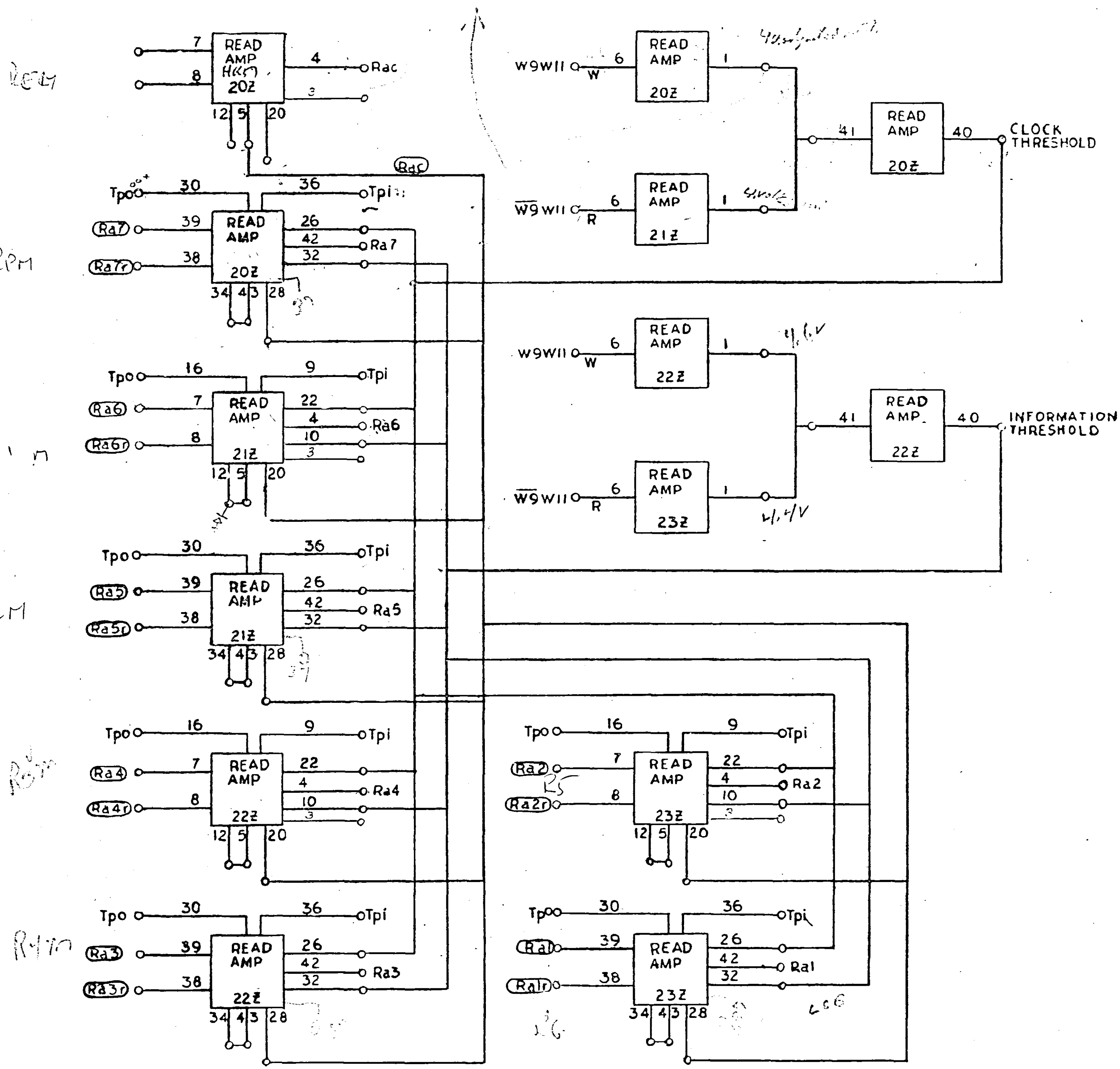

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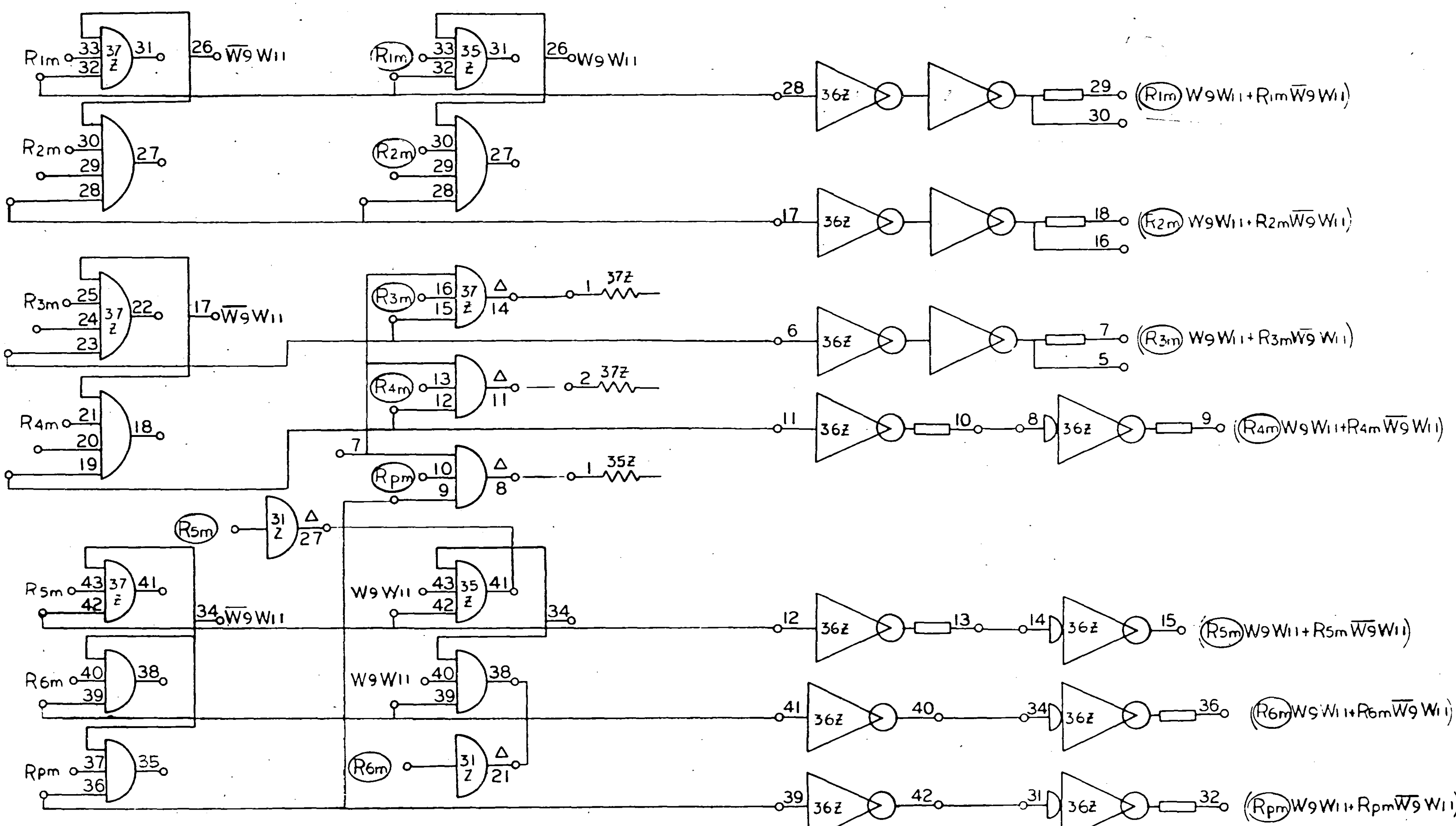

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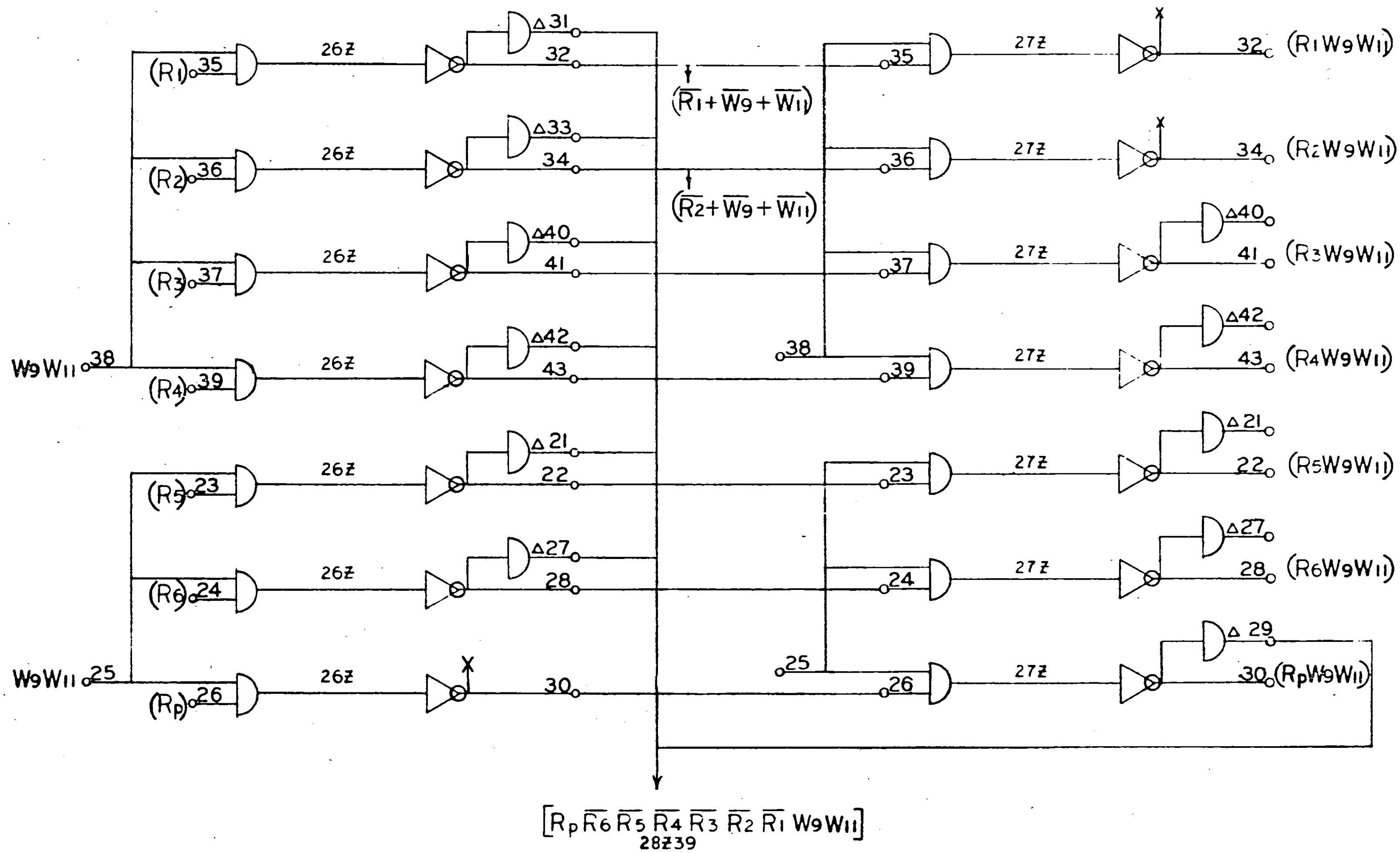
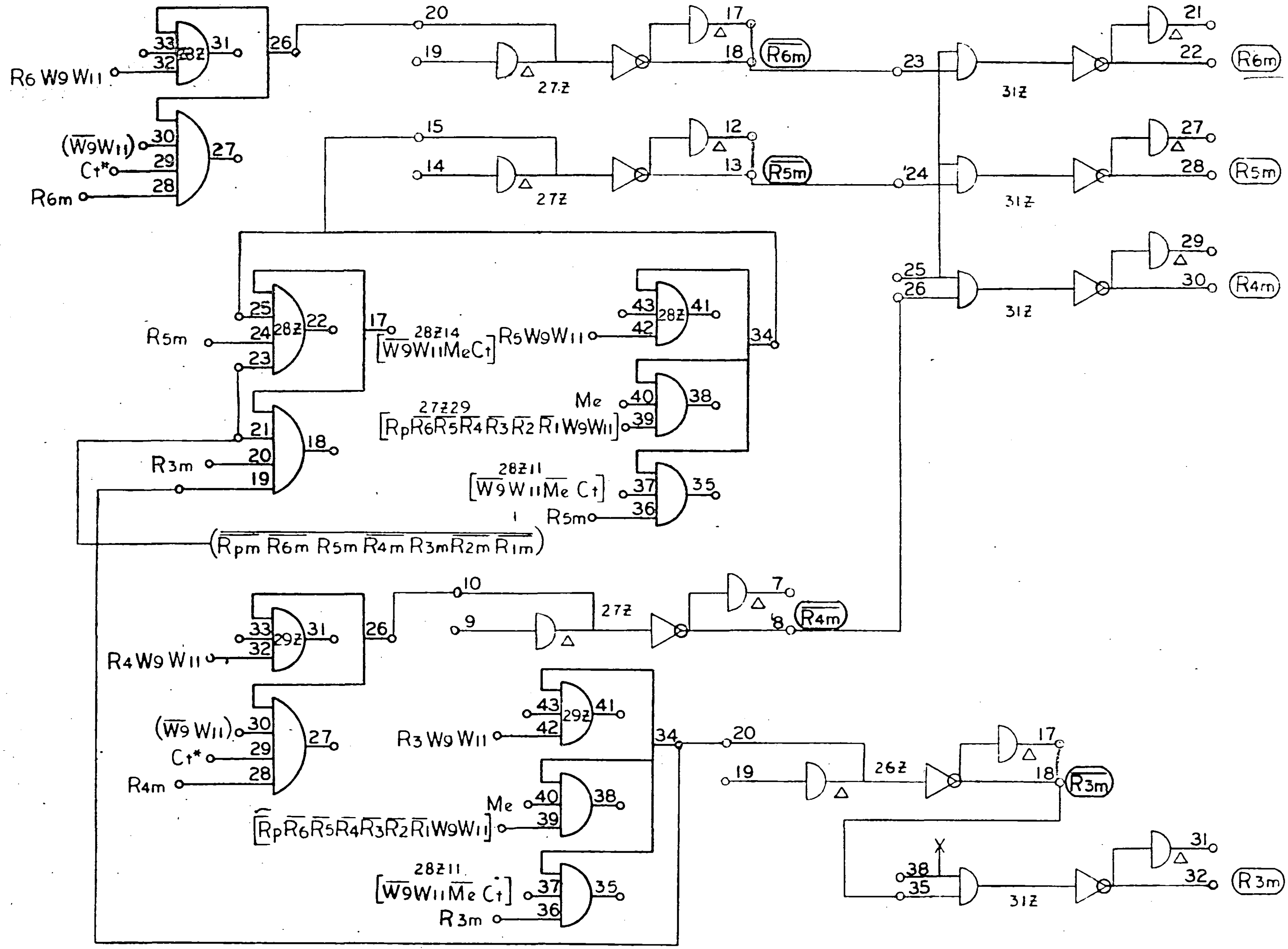


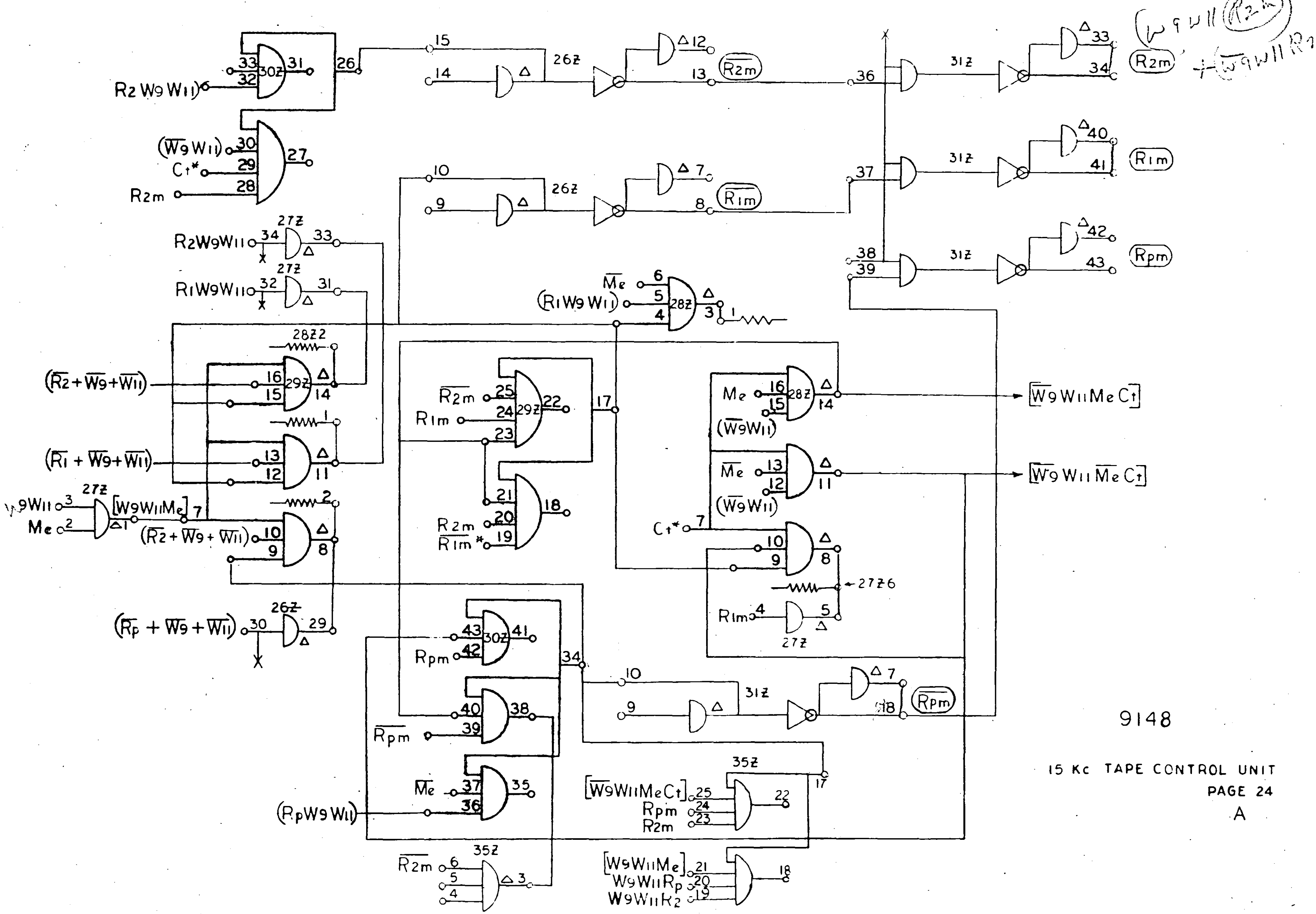
9148

15 Kc TAPE CONTROL UNIT



9148

15 KC TAPE CONTROL UNIT

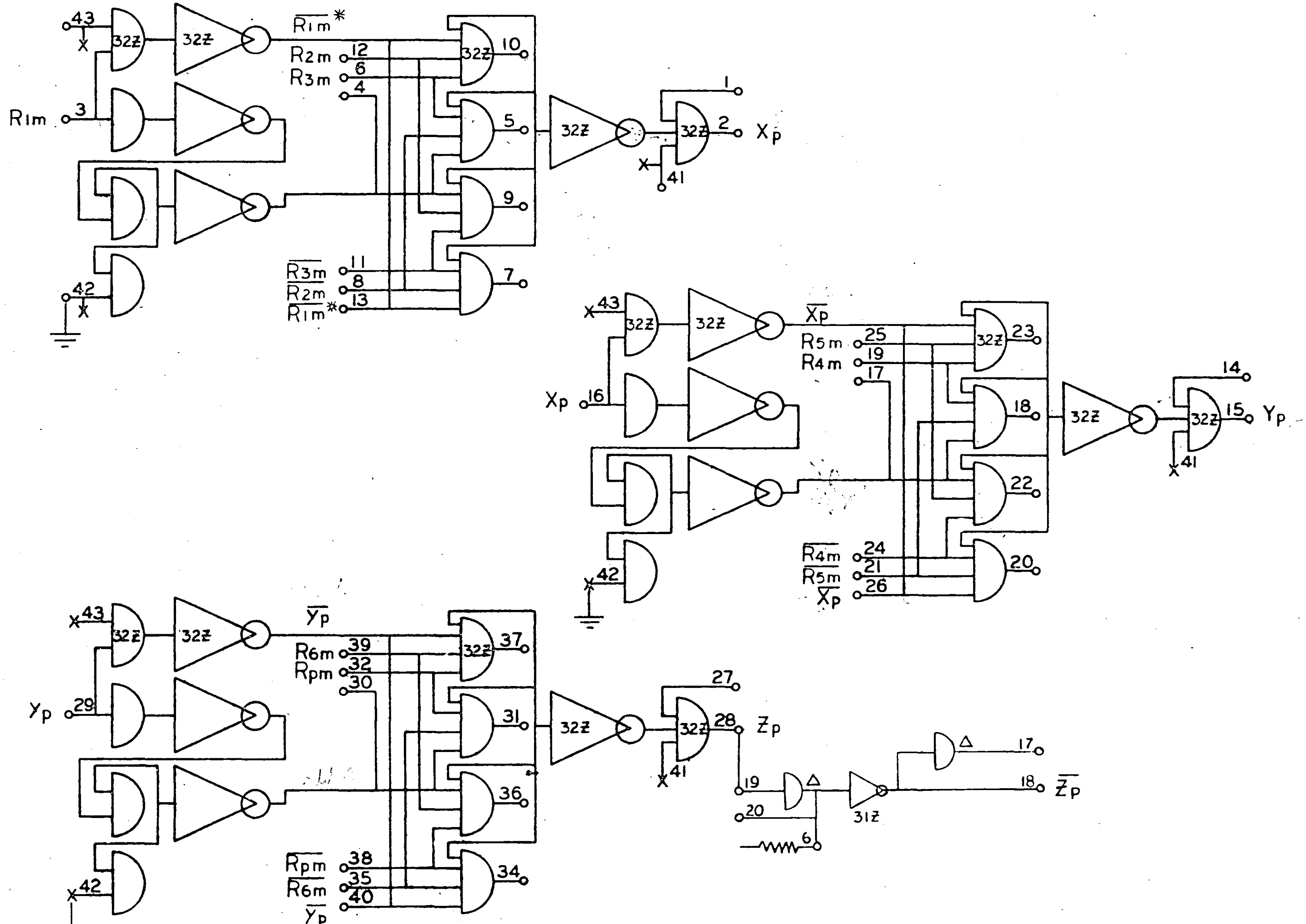


9148

15 Kc TAPE CONTROL UNIT

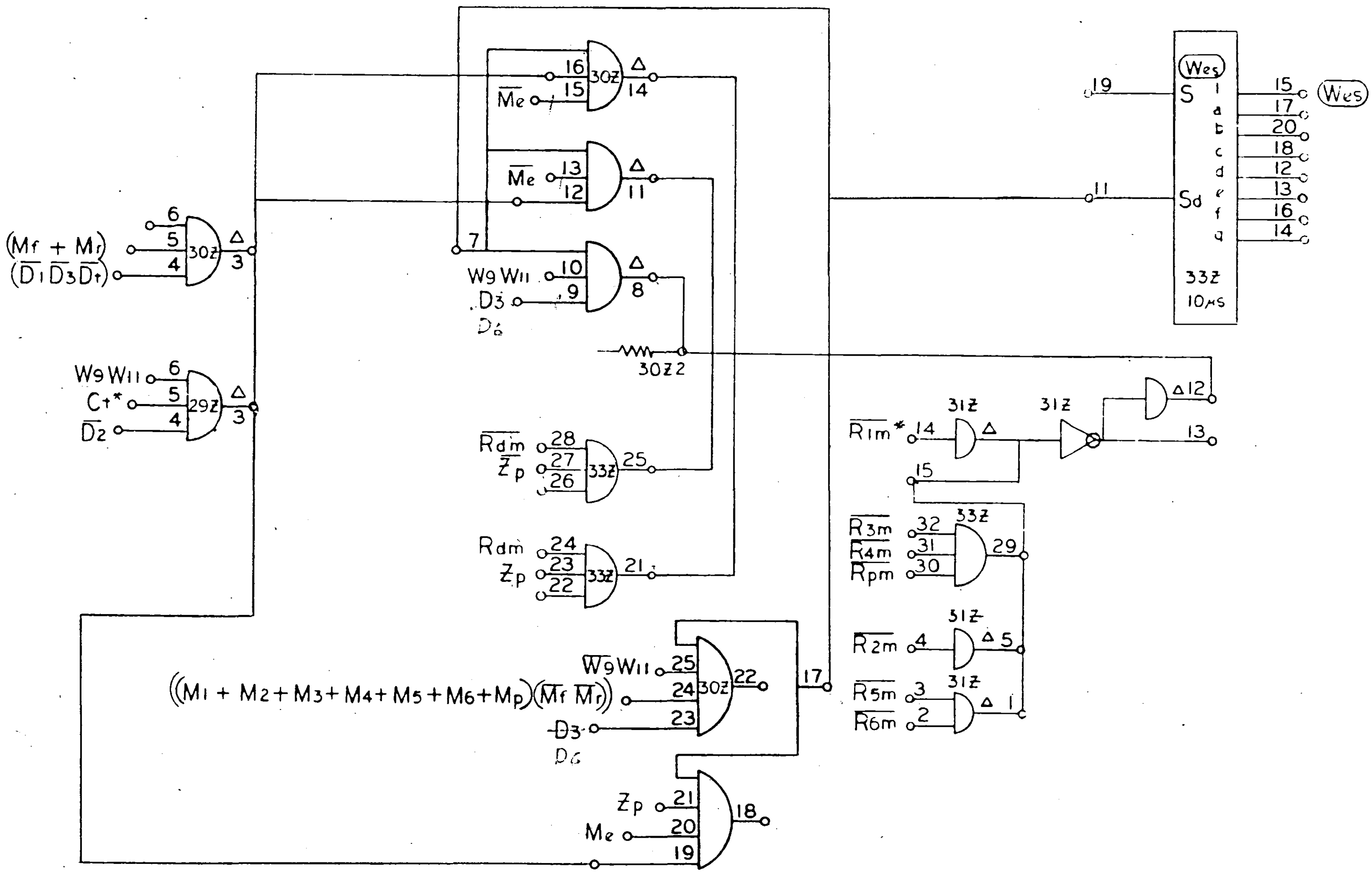
PAGE 24

A



9148

15 KC TAPE CONTROL UNIT

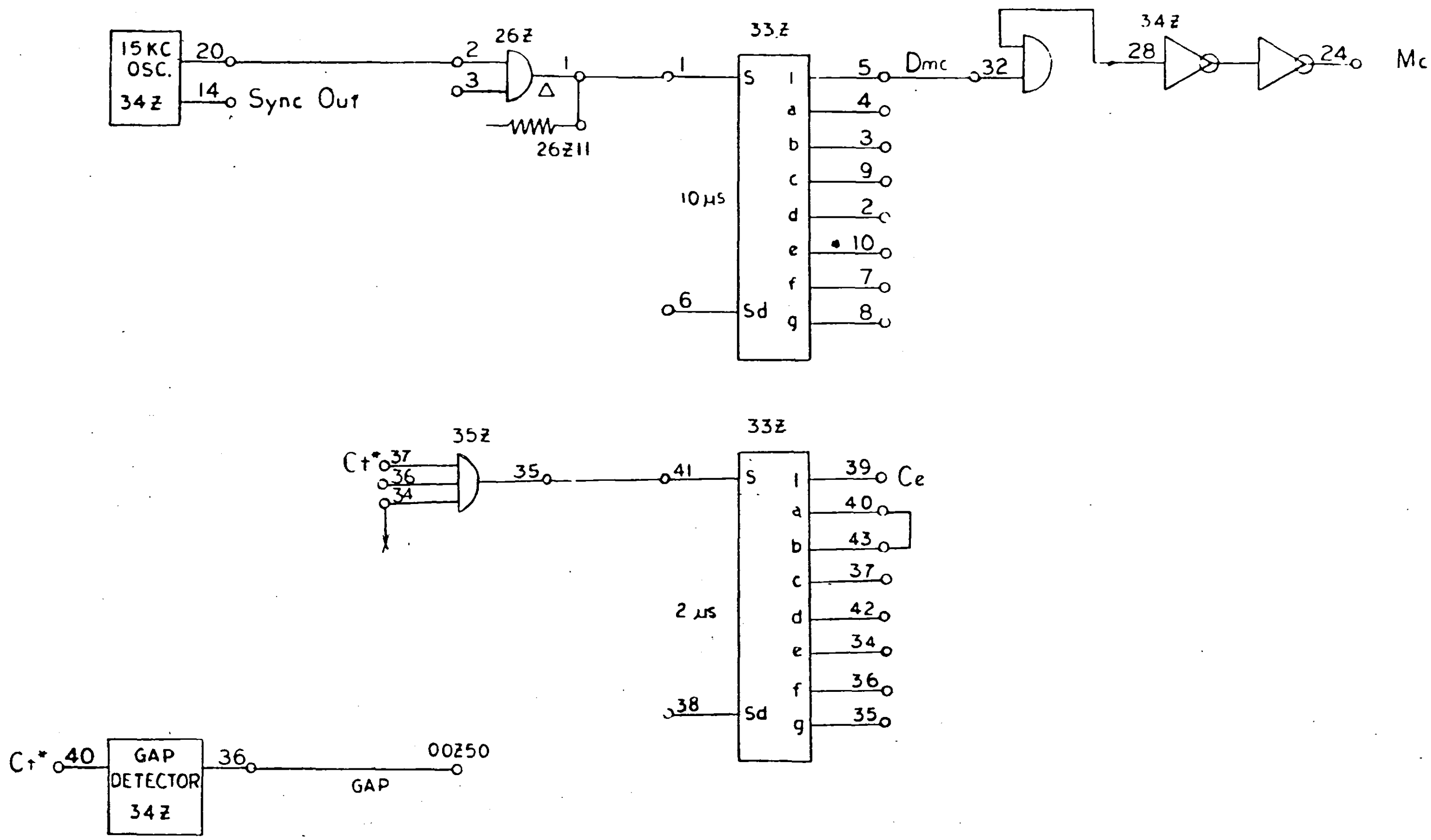


9148

15KC TAPE CONTROL UNIT

PAGE 26

A



9148
15KC TAPE CONTROL UNIT

PAGE	TERM
27	Ce
14	Cr
14	Cs
14	Ct
16	Ct*°
15	C12
15	$\overline{\text{C12}}$
15	C13
15	C14
15	$\overline{\text{C14}}$
15	C15
15	($\overline{\text{C17}}$ C20)
15	C21
15	$\overline{\text{C21}}$
15	C22
15	$\overline{\text{C22}}$
15	C23
15	$\overline{\text{C23}}$
5	D1
5	$\overline{\text{D1}}$
5	D2
5	$\overline{\text{D2}}$
5	D3
5	$\overline{\text{D3}}$
19	($\overline{\text{D1}}$ $\overline{\text{D3}}$ $\overline{\text{Dt}}$)
17	($\overline{\text{D1}}$ $\overline{\text{D2}}$ Dt (WØ + W9 W11) + $\overline{\text{W11}}$ $\overline{\text{M start}}$)
3	Dt
3	$\overline{\text{Dt}}$
19	Ecm
27	Gap
16	(Ioc C12 Q2)
18	$\overline{\text{Mad}}$
18	(MaØ BorØ + . . . Ma7 Bor7)
18	(MaØ $\overline{\text{BorØ}}$ + . . . Ma7 $\overline{\text{Bor7}}$)
27	Mc
9	Mca
3	Me
3	$\overline{\text{Me}}$
1	Mf
1	$\overline{\text{Mf}}$
1	Mf*
17	Mf + Mr
17	(Mf + Mr + Dt + D3 + D1)
16	Mi
9	Mp
9	$\overline{\text{Mp}}$
9	Mp*
1	Mr
1	$\overline{\text{Mr}}$
1	Mr*
16	M start Q2
16	$\overline{\text{M start}}$
17	$\overline{\text{(M start Q2 + Mu Mv Mc + D3 (Mf + Mr))}}$
4	Mtg
4	$\overline{\text{Mtg}}$

PAGE	TERM
4	Mtg
2	Mu
2	$\overline{\text{Mu}}$
2	Mv
2	$\overline{\text{Mv}}$
8	M1
8	$\overline{\text{M1}}$
8	M1*
8	$\overline{\text{M1}}$*
8	M2
8	$\overline{\text{M2}}$
8	M2*
8	$\overline{\text{M2}}$*
7	M3
7	$\overline{\text{M3}}$
7	M3*
7	$\overline{\text{M3}}$*
7	M4
7	$\overline{\text{M4}}$
7	M4*
7	$\overline{\text{M4}}$*
6	M5
6	$\overline{\text{M5}}$
6	M5*
6	$\overline{\text{M5}}$*
6	M6
6	$\overline{\text{M6}}$
6	M6*
6	$\overline{\text{M6}}$*
18	(M1 + M2 + M3 + M4 + M5 + M6 + Mp) ($\overline{\text{Mf}}$ $\overline{\text{Mr}}$)
16	$\overline{\text{Q2}}$
20	Rac
13	Rcm
13	$\overline{\text{Rcm}}$
4	Rdm
4	$\overline{\text{Rdm}}$
20	Read amp channels 1 thru 7
13	Rpm
13	$\overline{\text{Rpm}}$
24	Rpm
24	$\overline{\text{Rpm}}$
18	$\overline{(\overline{\text{Rpm}}\ \overline{\text{R6m}}\ \text{R5m}\ \overline{\text{R4m}}\ \text{R3m}}$ $\overline{\text{R2m}}$ $\overline{\text{R1m}}$)
22	[Rp $\overline{\text{R6}}$ $\overline{\text{R5}}$ $\overline{\text{R4}}$ $\overline{\text{R3}}$ $\overline{\text{R2}}$ $\overline{\text{R1}}$ W9 W11]
22	(Rp W9 W11)
21	(Rpm W9 W11 + Rpm $\overline{\text{W9}}$ W11)
10	R1m
10	$\overline{\text{R1m}}$
24	R1m
24	$\overline{\text{R1m}}$
22	(R1 W9 W11)
22	($\overline{\text{R1}}$ + $\overline{\text{W9}}$ + $\overline{\text{W11}}$)
21	(R1m W9 W11 + R1m $\overline{\text{W9}}$ W11)
10	R2m
10	$\overline{\text{R2m}}$
24	R2m
24	$\overline{\text{R2m}}$

PAGE	TERM
22	(R2 W9 W11)
22	($\overline{\text{R2}}$ + $\overline{\text{W9}}$ + $\overline{\text{W11}}$)
21	(R2m W9 W11 + R2m $\overline{\text{W9}}$ W11)
11	R3m
11	$\overline{\text{R3m}}$
23	R3m
23	$\overline{\text{R3m}}$
22	(R3 W9 W11)
21	(R3m W9 W11 + R3m $\overline{\text{W9}}$ W11)
11	R4m
11	$\overline{\text{R4m}}$
23	R4m
23	$\overline{\text{R4m}}$
22	(R4 W9 W11)
21	(R4m W9 W11 + R4m $\overline{\text{W9}}$ W11)
12	R5m
12	$\overline{\text{R5m}}$
23	R5m
23	$\overline{\text{R5m}}$
22	(R5 W9 W11)
21	(R5m W9 W11 + R5m $\overline{\text{W9}}$ W11)
12	R6m
12	$\overline{\text{R6m}}$
23	R6m
23	$\overline{\text{R6m}}$
22	(R6 W9 W11)
21	(R6m W9 W11 + R6m $\overline{\text{W9}}$ W11)
19	[$\overline{\text{Slo}}$]
20	Threshold, clock
20	Threshold, information
26	Wes
19	$\overline{\text{Wes}}$
19	Whs
15	$\overline{\text{WØ}}$ + $\overline{\text{W11}}$
15	$\overline{\text{W5}}$ + $\overline{\text{W11}}$
15	$\overline{\text{W6}}$ + $\overline{\text{W11}}$
15	(W9 W11)
15	($\overline{\text{W9}}$ W11)
15	($\overline{\text{W9}}$ + $\overline{\text{W11}}$)
17	($\overline{\text{W9}}$ W11 Ce + $\overline{\text{W11}}$)
24	[$\overline{\text{W9}}$ W11 Me Ct]
24	[$\overline{\text{W9}}$ W11 $\overline{\text{Me}}$ Ct]
15	$\overline{\text{W10}}$ + $\overline{\text{W11}}$
15	W11
15	$\overline{\text{W11}}$
17	$\overline{(\overline{\text{W11}}\ \overline{\text{M start}})}$
17	(W11 ($\overline{\text{D1}}$ $\overline{\text{D3}}$ $\overline{\text{Dt}}$ + D2))
17	[W11 W9 W5 ($\overline{\text{W0}}$ + $\overline{\text{W11}}$) ($\overline{\text{W6}}$ + $\overline{\text{W11}}$)]
25	Xp
25	Yp
25	Zp
25	$\overline{\text{Zp}}$

9146 9148 MAGNETIC TAPE SYSTEM

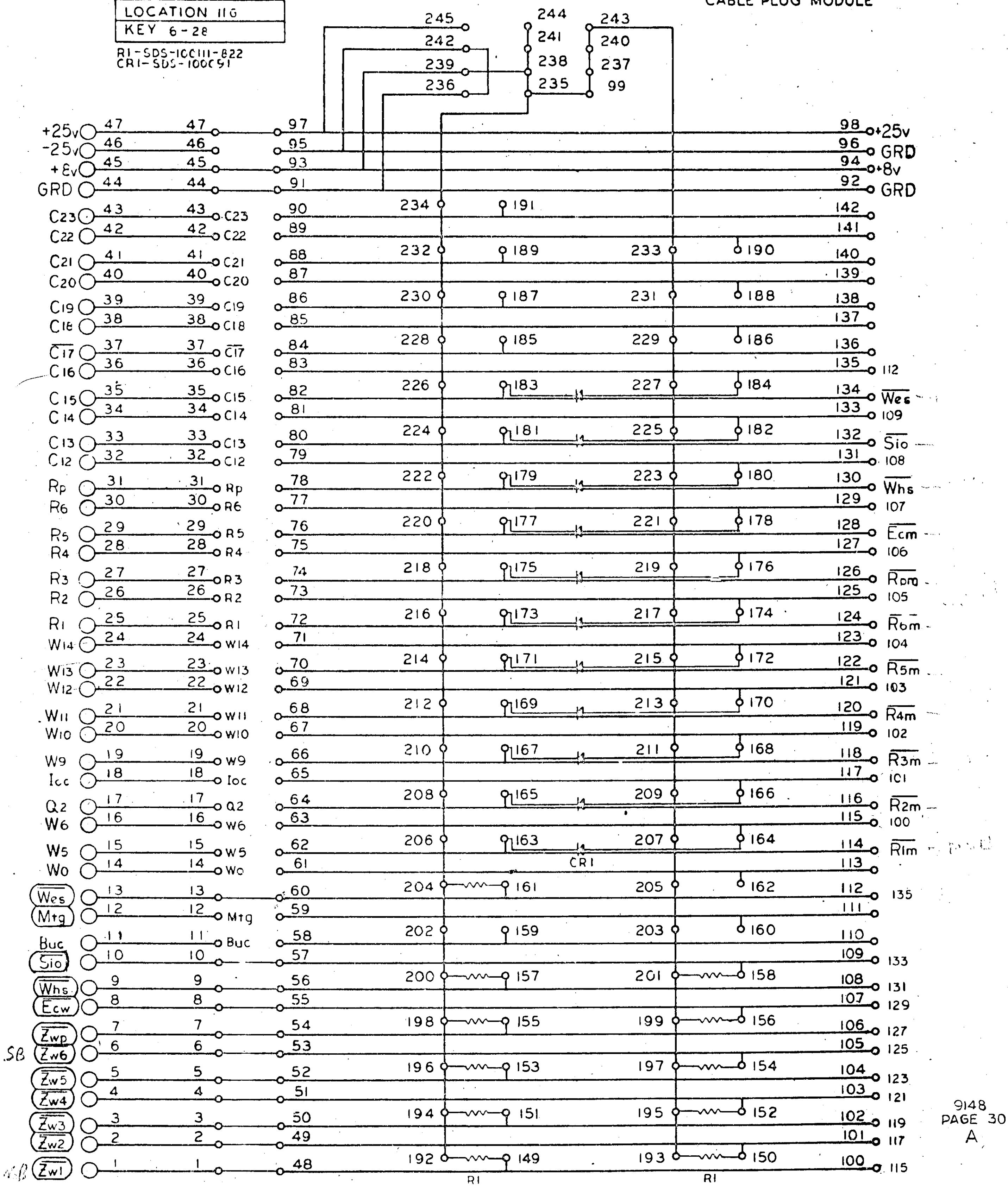
CONTROL UNIT ROW Z — TAPE ELECTRONICS ROW W

Z	1 IK53	2 IK53	3 OK52	4 CON. P27 MAG. TAPE 1 6-28	5 IK53	6 IK51	7 GK51	8 IK51	9 GK51	10 GK51	11 IK51	12 GK51	13 OK52	14 FC17	15 FC17	16 FC17	17 FC17	18 FC17	19 FC17	20 HK57	21 HK57	22 HK57	23 HK57	24 CON. P23 DATA 1 6-36	25 CON. P25 CONTROL 1 6-40	Z
Z						26 IK53	27 IK53	28 GK51	29 GK51	30 GK51	31 IK53	32 IK52	33 OK52	34 CK52	35 GK51	36 IK51	37 GK51	38	39	40	41	42				Z
W		2	3	4 ZK51	5 ZK51	6	7	8	9 AK52	10 AK52	11 HK56	12 HK56	13 HK56	14 OK52	15 FC18	16 IK51	17 GK51	18 GK51	19 OK52	20 RX10	21 CON P21 CONTROL PANEL 6-44	22 CON. P22 DATA 2 6-38	23 CON P23 DATA 1 6-36	24 CON P24 CONTROL 2 6-42	25 CON P25 CONTROL 1 6-40	W

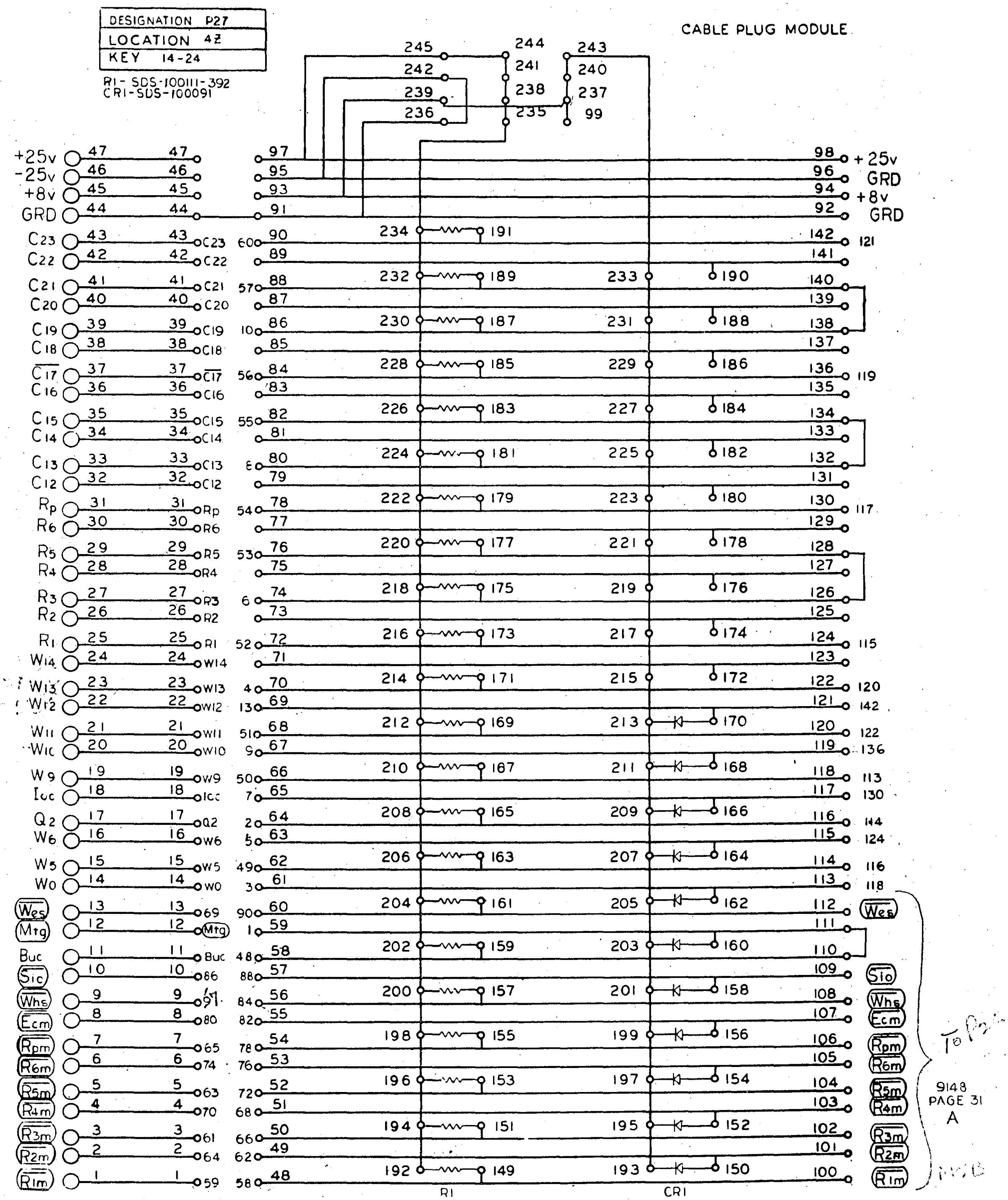
DESIGNATION P26	
LOCATION 11G	
KEY 6-28	

R1-SDS-100111-822
CR1-SDS-100C91

CABLE PLUG MODULE



9148
PAGE 30
A



DESIGNATION P27
LOCATION 4Z
KEY 14-24
R1- SDS-100111-392
CR1-SDS-100091
CABLE PLUG MODULE
+25v
-25v
+8v
GRD
C23
C22
C21
C20
C19
C18
C17
C16
C15
C14
C13
C12
Rp
R6
R5
R4
R3
R2
R1
W14
W13
W12
W11
W10
W9
Icc
Q2
W6
W5
W0
Wes
Mtg
Buc
Sic
Whs
Ecm
Rpm
R6m
R5m
R4m
R3m
R2m
R1m
+25v
GRD
+8v
GRD
Wes
Sio
Whs
Ecm
Rpm
R6m
R5m
R4m
R3m
R2m
R1m
R1
CR1
9148
PAGE 31
A

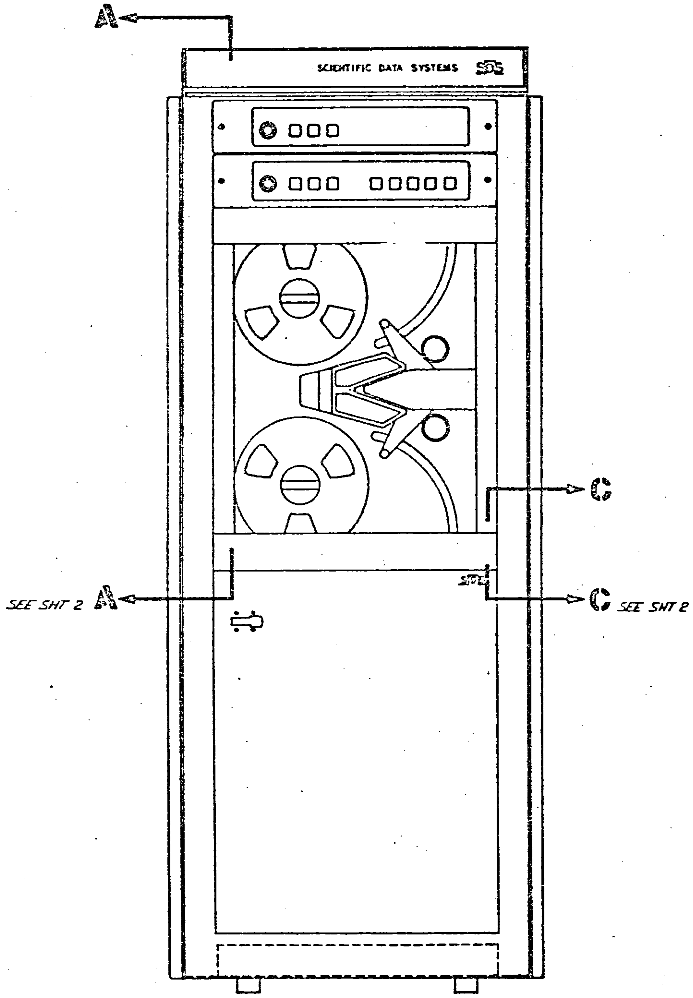
PAGE	CHG	PAGE	CHG	PAGE	CHG	PAGE	CHG	PAGE	CHG
1	A								
2	A								
3	A								
4	A								
5	A								
6	A								
7	A								
8	A								
9	A								
10	A								
11	A								
12	A								
13	A								
14	A								
15	A								
16	A								
17	A								
18	A								
19	A								
20	A								
21	A								
22	A								
23	A								
24	A								
25	A								
26	A								
27	A								
28	A								
29	A								
30	A								
31	A								
32	A								

NOTES:

1. REV. LETTERS LISTED INDICATE STATUS OF EACH SHEET OF THIS MULTIPLE SHT. DWG.
2. CHECK INDIVIDUAL SHEETS FOR REVISION LETTER AGAINST THIS SHEET BEFORE USING THIS DWG.

APPENDIX II

INSTALLATION DRAWINGS AND SCHEMATICS



FRONT VIEW
(10)(13) (INSTALLATION IN 9210 CABINET)

NOTES: UNLESS OTHERWISE SPECIFIED

(1) PART OF 9146 MAG. TAPE UNIT 101720

2. ALL HARDWARE USED IN MOUNTING 9146 MAG TAPE UNIT & 9148 MAG TAPE CONTROL UNIT IS FURNISHED WITH RESPECTIVE UNIT.

(3) MOUNT WITH #10-32 × 3/8 LG PAN HD SCREWS, #10 FLAT WASHERS & #10 LOCK WASHERS.

(4) MOUNT WITH #10-32 × 1/4 LG. PAN HD SCREWS, #10 FLAT WASHERS & #10 LOCK WASHERS.

(5) MOUNT WITH #1/4-20 × 3/4 LG HEX HD SCREWS & 1/4 LOCK WASHERS.

(6) MOUNT IN THIS LOCATION FOR SHIPPING ONLY. FOR INSTALLATION IN AN ASSOCIATED COMPUTER SEE 102219.

(7) REF MODULE LOCATION CHART 101779.

(8) REF MODULE LOCATION CHART 101791.

(9) INSTALL IN LOCATION 11G OF 910 OR 920 COMPUTER.

(10) REF INSTALLATION DWG 101941

(11) MOUNT WITH #10-32 × 1/2 LG HEX HD SCREWS, & #10 LOCK WASHERS.

(12) MOUNT WITH #10-32 × 1 1/2 LG PAN HD SCREWS, & 10 LOCK WASHERS.

(13) WHEN A 9146 MAG TAPE UNIT IS INSTALLED IN A 9210 CABINET THE FOLLOWING PARTS FURNISHED WITH 9146 ARE NOT USED:
(1) 101806-001 SPACER (1) 101806-002 SPACER
(1) 101875 BAR.

(14) CONNECT POWER CABLE FROM TB1 ON 9148 TO TB1 ON 9146 ELECTRONICS CHASSIS AS INDICATED ON TAGS.

(15) CONNECT POWER WIRES FROM TB1 ON 9143 ELECTRONICS CHASSIS TO BARRIER STRIP ON ASSOCIATED POWER SUPPLY AS FOLLOWS:
TB1-E-3 TO 0V
TB1-E-4 TO +8V
TB1-E-5 TO -25V
TB1-E-6 TO +25V
AFTER CONNECTING LACE WIRES TOGETHER WITH SUITABLE LACING CORD.

(16) REF INSTALLATION DWGS 101007 (9110) & 101006 (9119)

(17) ATTACH WITH #6-32 × 1/2 LG. PAN HD SCREWS.

(18) SPACER TO BE INVERTED FOR USE ON 9110 OR 9119 CABINETS.

(19) MOUNT WITH #8-32 × 3/8 LG. PAN HD SCREWS & #8 LOCK WASHERS; ALSO USE #8 FLAT WASHERS ON ALL SLOTS.

(20) REF INSTALLATION DWG NO. 100852.

(21) REF INSTALLATION DWG NO. 101612.

REVISIONS					102215	A
REV.	DESCRIPTION	CHK	DATE	APPROVED		
A	RELEASED TO MFG					

ITEM NO.	DRAWING NO.	DESCRIPTION	REFERENCE DESIGNATION	ITEM NO.
MATERIAL LIST				

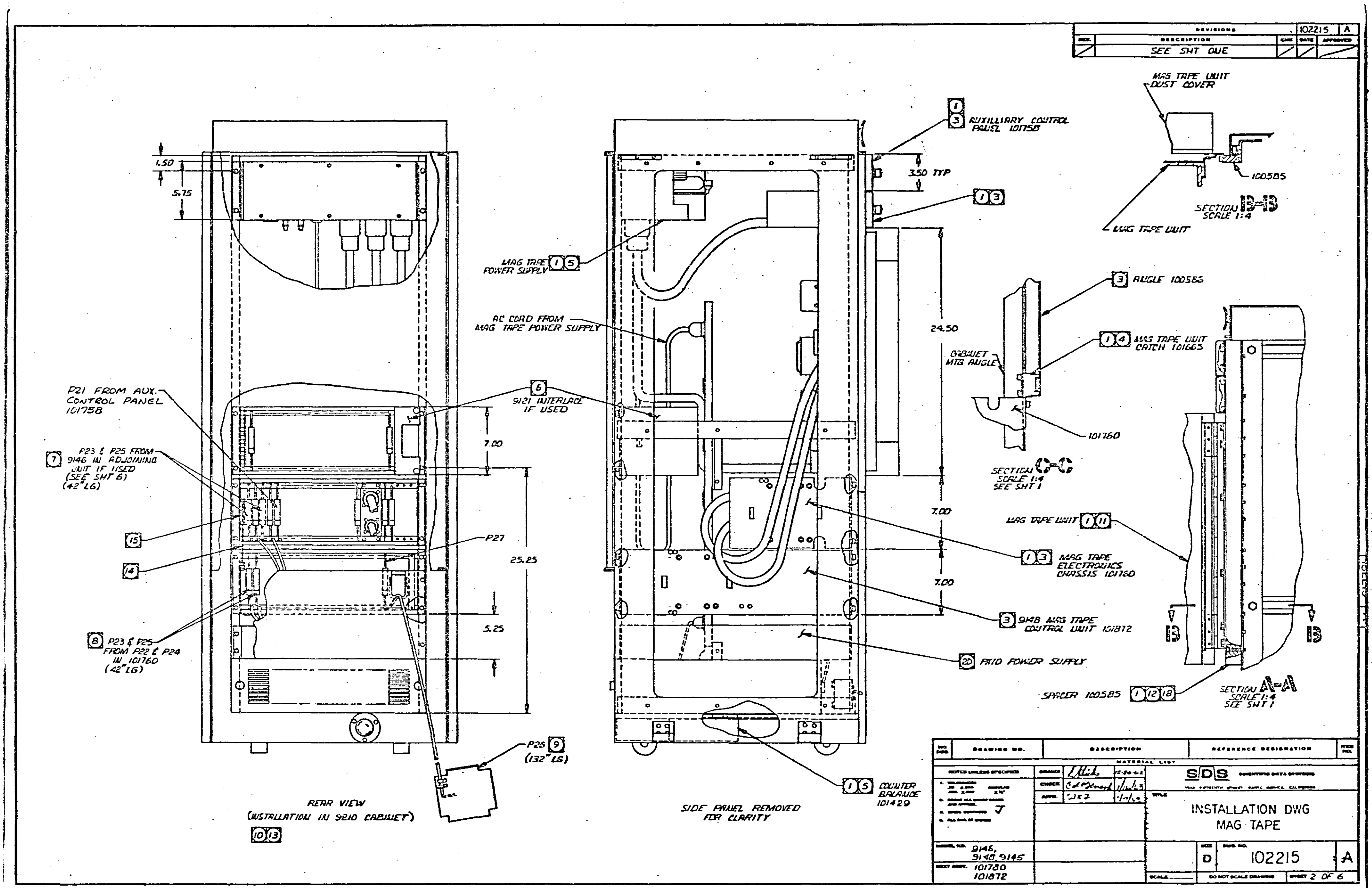
SDS SCIENTIFIC DATA SYSTEMS

INSTALLATION DWG
MAG TAPE

MODEL NO. 9146, 9148, 9145
NEXT ASSY. 101760, 101872

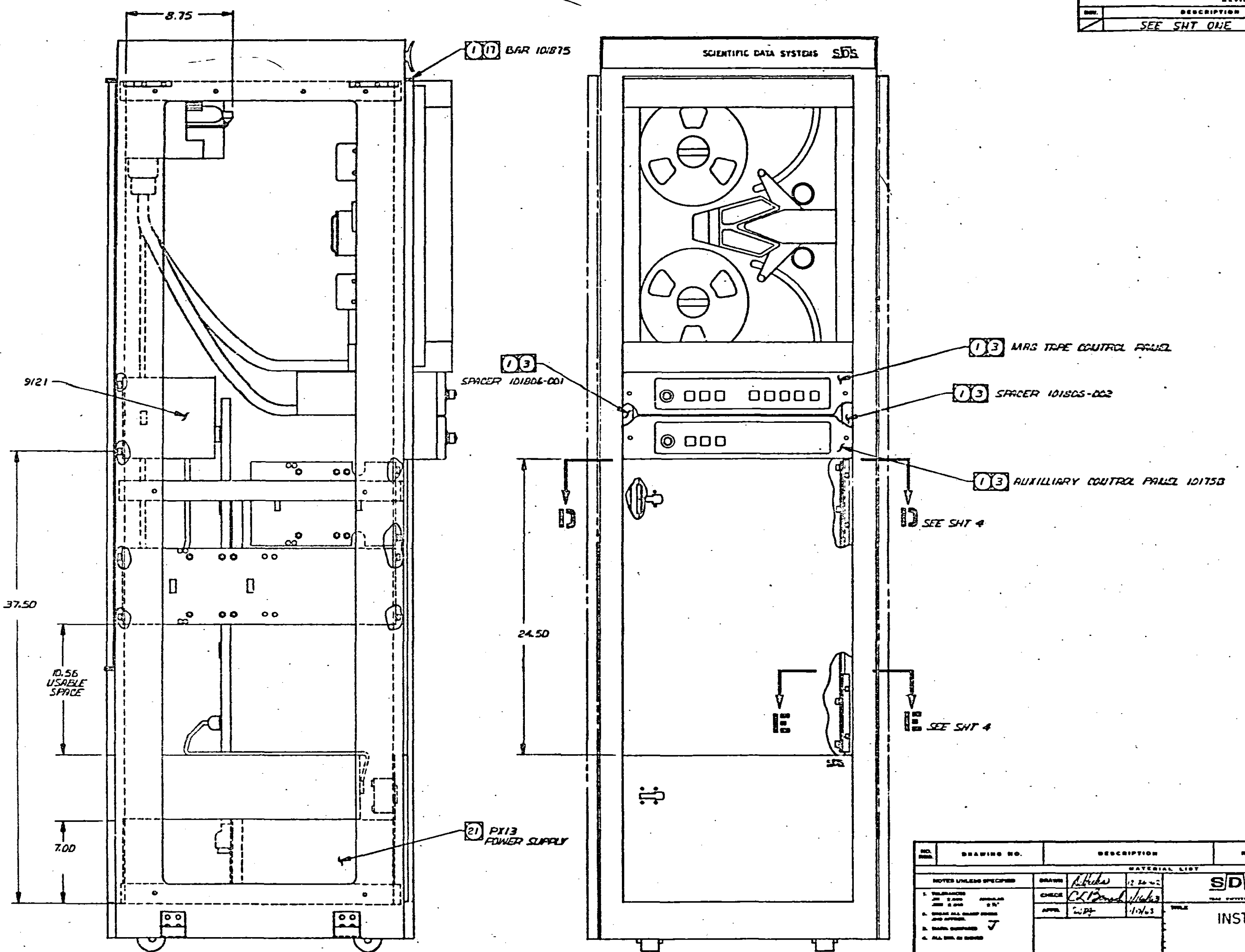
SIZE D DWG. NO. 102215 A

SHEET 1 OF 6



REVISIONS
102215 A
SEE SHT ONE
MAG TAPE UNIT DUST COVER
100585
SECTION B-B SCALE 1:4
MAG TAPE UNIT
AUXILLIARY CONTROL PANEL 101758
3.50 TYP
MAG TAPE POWER SUPPLY
AC CORD FROM MAG TAPE POWER SUPPLY
24.50
ANGLE 100566
CABINET MTG ANGLE
MAG TAPE UNIT CATCH 101665
101760
SECTION C-C SCALE 1:4 SEE SHT 1
1.50
5.75
P21 FROM AUX. CONTROL PANEL 101758
9121 INTERFACE IF USED
7.00
P23 & P25 FROM 9146 IN ADJOINING UNIT IF USED (SEE SHT 6) (42" LG)
MAG TAPE UNIT
MAG TAPE ELECTRONICS CHASSIS 101760
P27
25.25
9148 MAG TAPE CONTROL UNIT 101872
5.25
P23 & P25 FROM P22 & P24 IN 101760 (42" LG)
PX10 POWER SUPPLY
SPACER 100585
SECTION A-A SCALE 1:4 SEE SHT 1
P25 (132" LG)
COUNTER BALANCE 101429
REAR VIEW (INSTALLATION IN 9210 CABINET)
SIDE PANEL REMOVED FOR CLARITY
MATERIAL LIST
SDS SCIENTIFIC DATA SYSTEMS
INSTALLATION DWG MAG TAPE
9145, 9148, 9145
101780 101872
D 102215 A
DO NOT SCALE DRAWING
SHEET 2 OF 6

REVISIONS				102215	A
REV.	DESCRIPTION		CHK	DATE	APPROVED
	SEE SHT ONE				



FRONT VIEW
16 (INSTALLATION IN 9110 OR 9119 CABINET)
SEE SHT 2 FOR ANY DETAIL NOT SHOWN

NO. REQ.	DRAWING NO.	DESCRIPTION	REFERENCE DESIGNATION	ITEM NO.

MATERIAL LIST

SDS SCIENTIFIC DATA SYSTEMS

INSTALLATION DWG
MAG TAPE

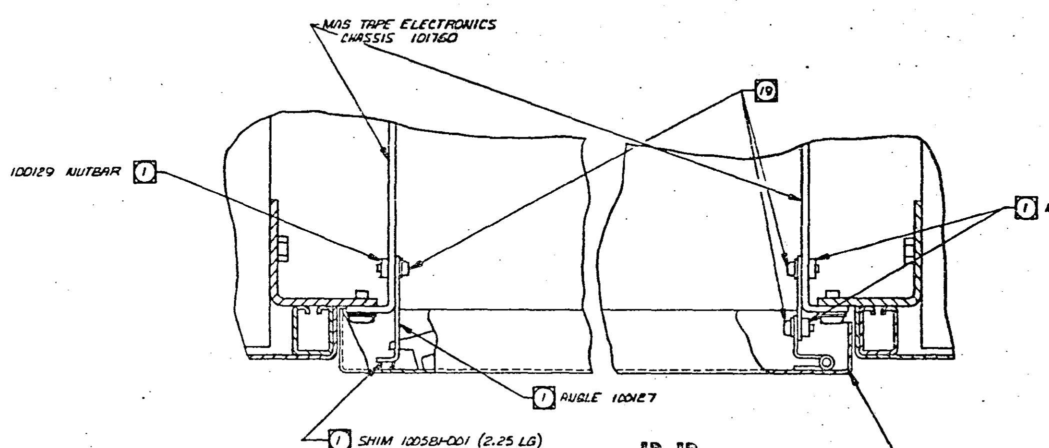
MODEL NO. 9146, 9148, 9145
NEXT ASSY. 101780, 101872

SIZE D — DWG. NO. 102215 — A

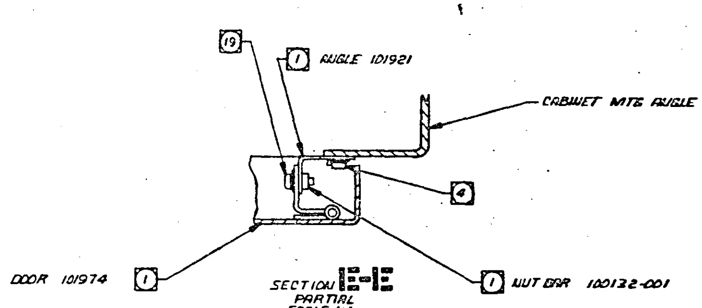
SHEET 3 OF 6

REV.	REVISIONS DESCRIPTION	CHK	DATE	APPROVED
/	SEE SHT ONE	/	/	/

102215 A



SECTION D-D
PARTIAL
SCALE 1:1
SEE SHT 2



SECTION E-E
PARTIAL
SCALE 1:1
SEE SHT 2

NO. REQ.	DRAWING NO.	DESCRIPTION	REFERENCE DESIGNATION	ITEM NO.

MATERIAL LIST

DRAWN	[signature]	[illegible]
CHECK	C. L. [signature]	1/16/63
APPR.	WKF	1/17/63

SDS SCIENTIFIC DATA SYSTEMS

TITLE: INSTALLATION DWG MAG TAPE

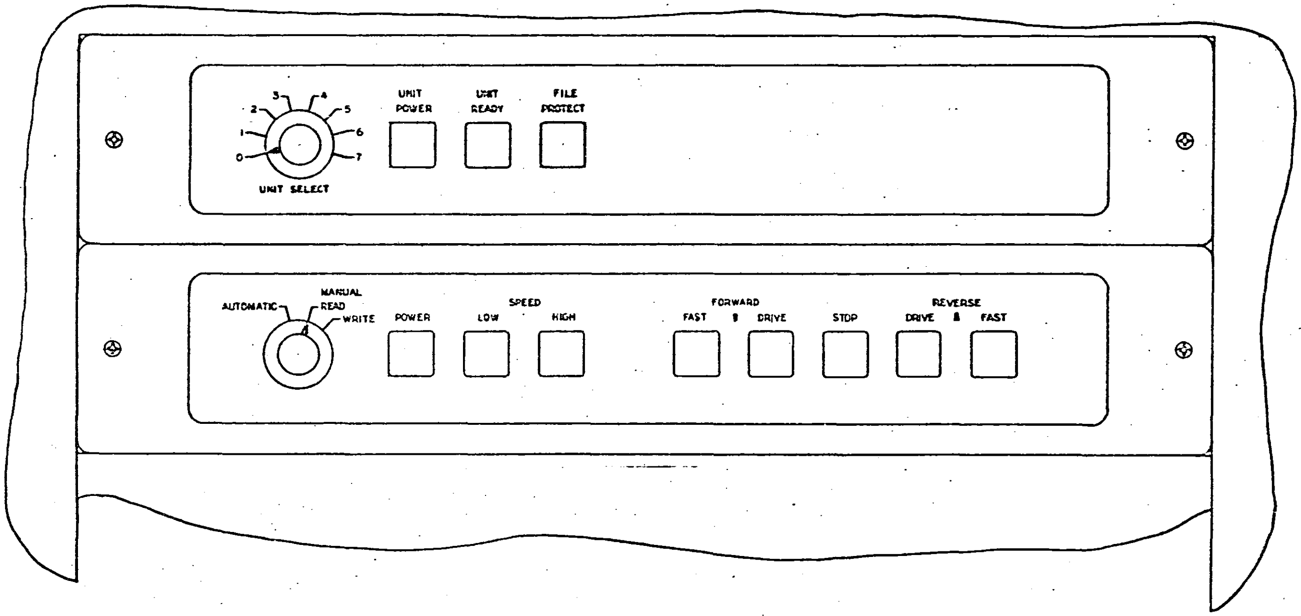
MODEL NO. 9146, 9148, 9145

NEXT ASSY. 101780, 101872

SIZE D DWG. NO. 102215 A

SCALE —— DO NOT SCALE DRAWING SHEET 4 OF 6

REVISIONS				102215 A
REV.	DESCRIPTION	CHK	DATE	APPROVED
/	SEE SHT ONE	/	/	/



DETAIL
SCALE 1:1
SEE SHT 2

NO. REQD	DRAWING NO.	DESCRIPTION	REFERENCE DESIGNATION	ITEM NO.
MATERIAL LIST				

DRAWN	[signature]	1/14/63
CHECK	C. [signature]	1/14/63
APPR.	[signature]	1/15/63

SDS SCIENTIFIC DATA SYSTEMS

TITLE: INSTALLATION DWG MAG TAPE

MODEL NO. 9196, 9148, 9145

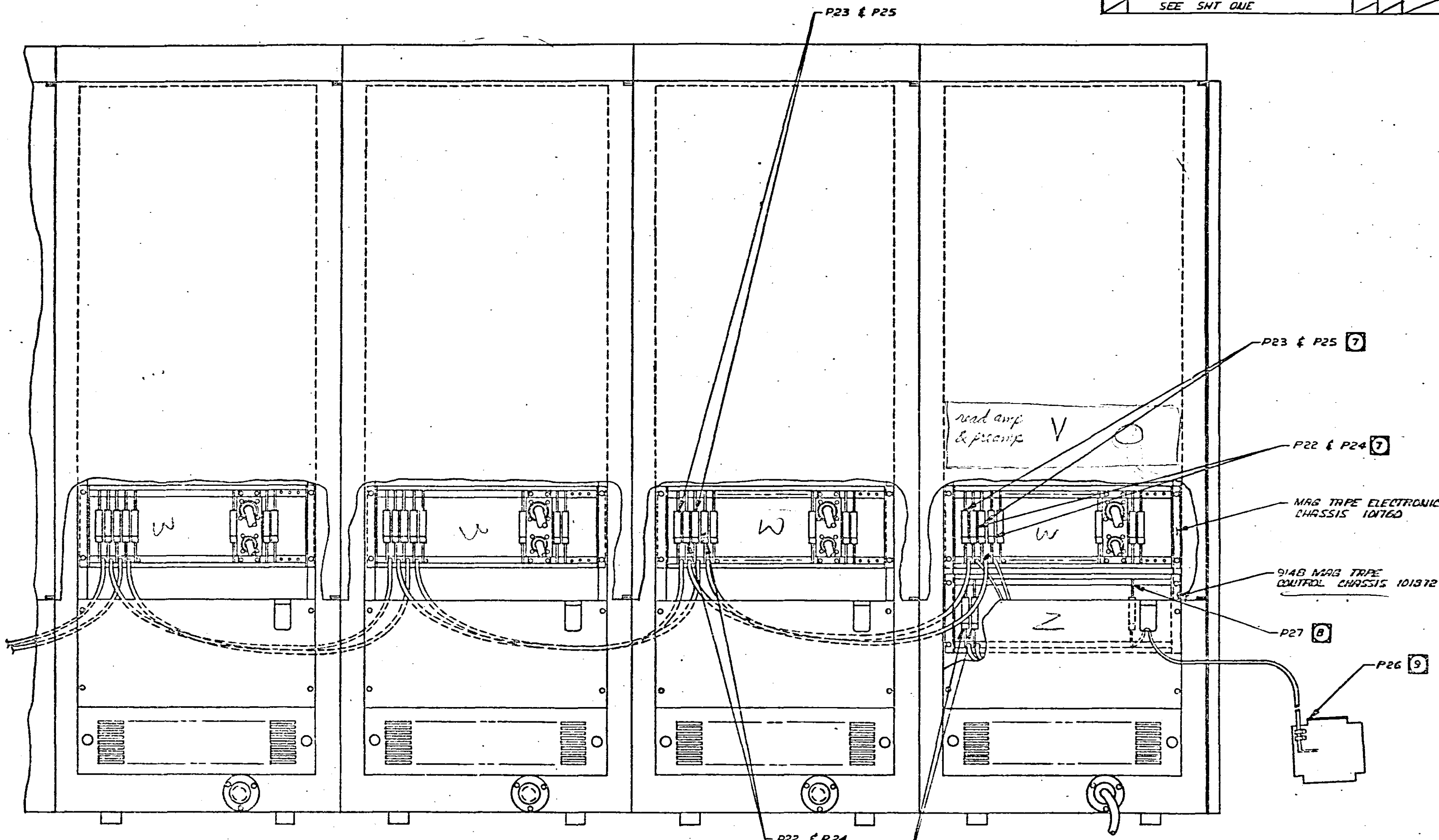
NEXT ASSY. 101780, 101872

SIZE D | DWG NO. 102215 | A

SCALE — | DO NOT SCALE DRAWING | SHEET 5 OF 6

REV.	DESCRIPTION	CHK	DATE	APPROVED
	SEE SHT ONE			

REVISIONS 102215 A



TYPICAL MULTIPLE CABINET INSTALLATION WITH SIDE PANELS REMOVED & CABINETS BOLTED TOGETHER

NO. REQ.	DRAWING NO.	DESCRIPTION	REFERENCE DESIGNATION	ITEM NO.

MATERIAL LIST

DRAWN			SDS SCIENTIFIC DATA SYSTEMS
CHECK	C.J.		
APPR.			TITLE: INSTALLATION DWG MAG TAPE

MODEL NO. 9146, 9148, 9145

NEXT ASSY. 101780, 101872

SIZE D DWG NO. 102215 A

SCALE — DO NOT SCALE DRAWING SHEET 6 OF 6

SDS SCIENTIFIC DATA SYSTEMS

SCHEMATIC DIODE GATE I

Size: D — Dwg No: C0244

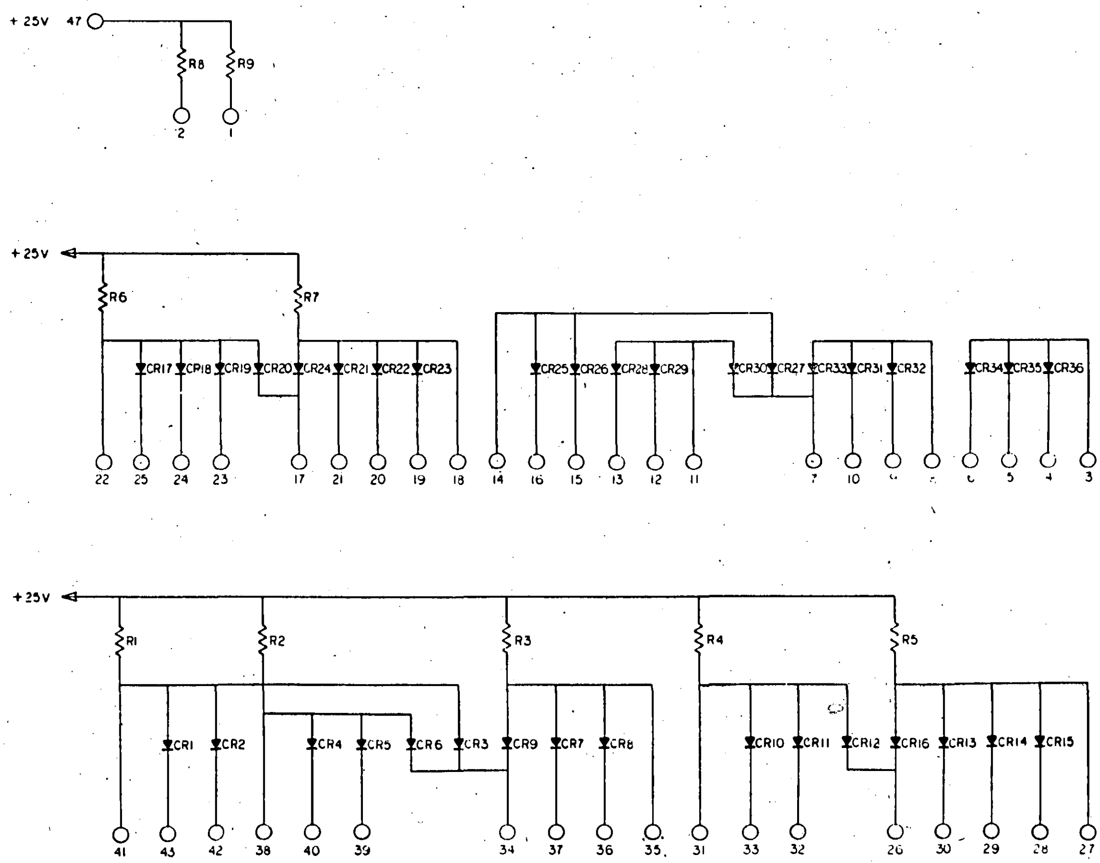
Model No: GK51

REVISIONS

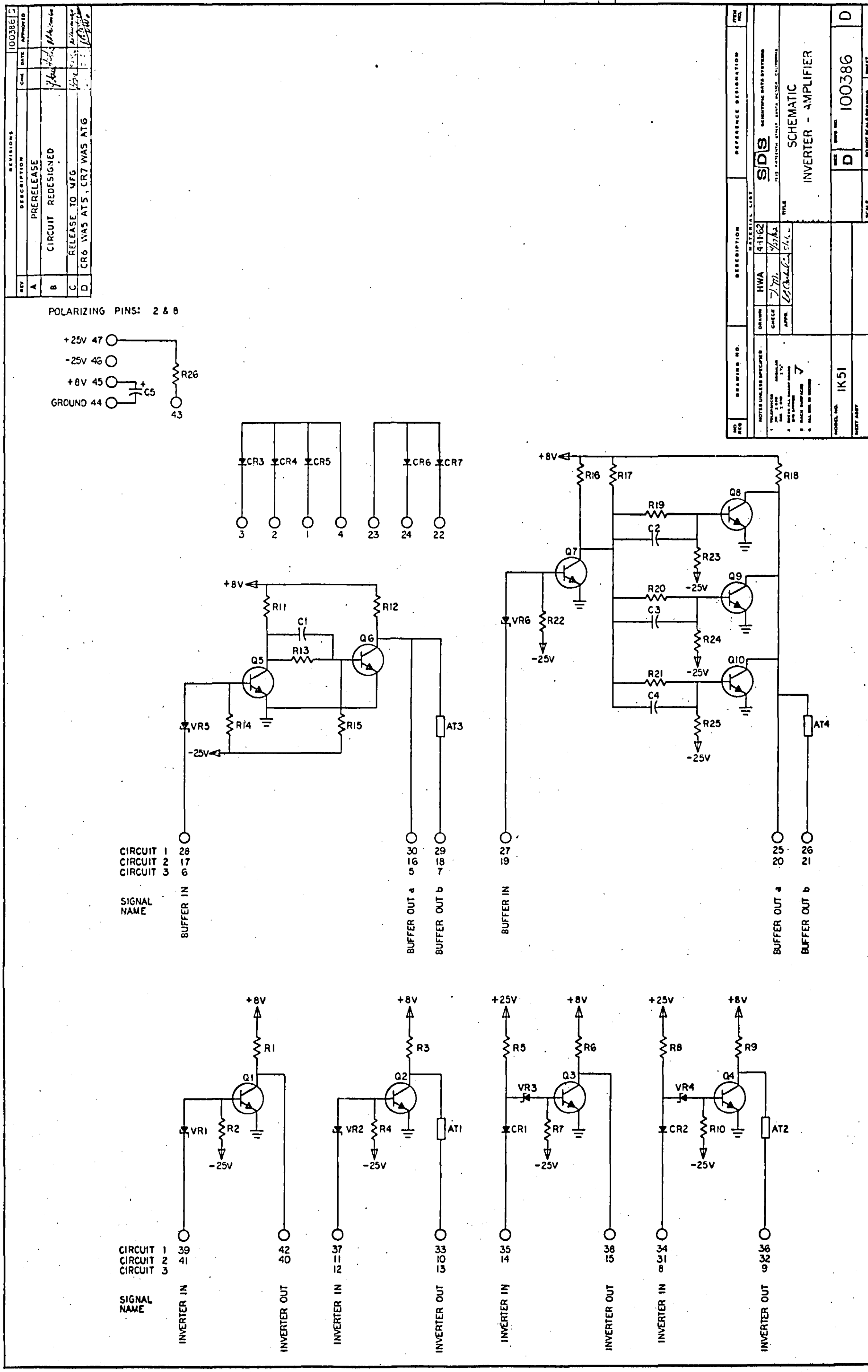
PRE-RELEASE

RELEASE TO MFG.

POLARIZING PINS: 2 & 22



100386 D

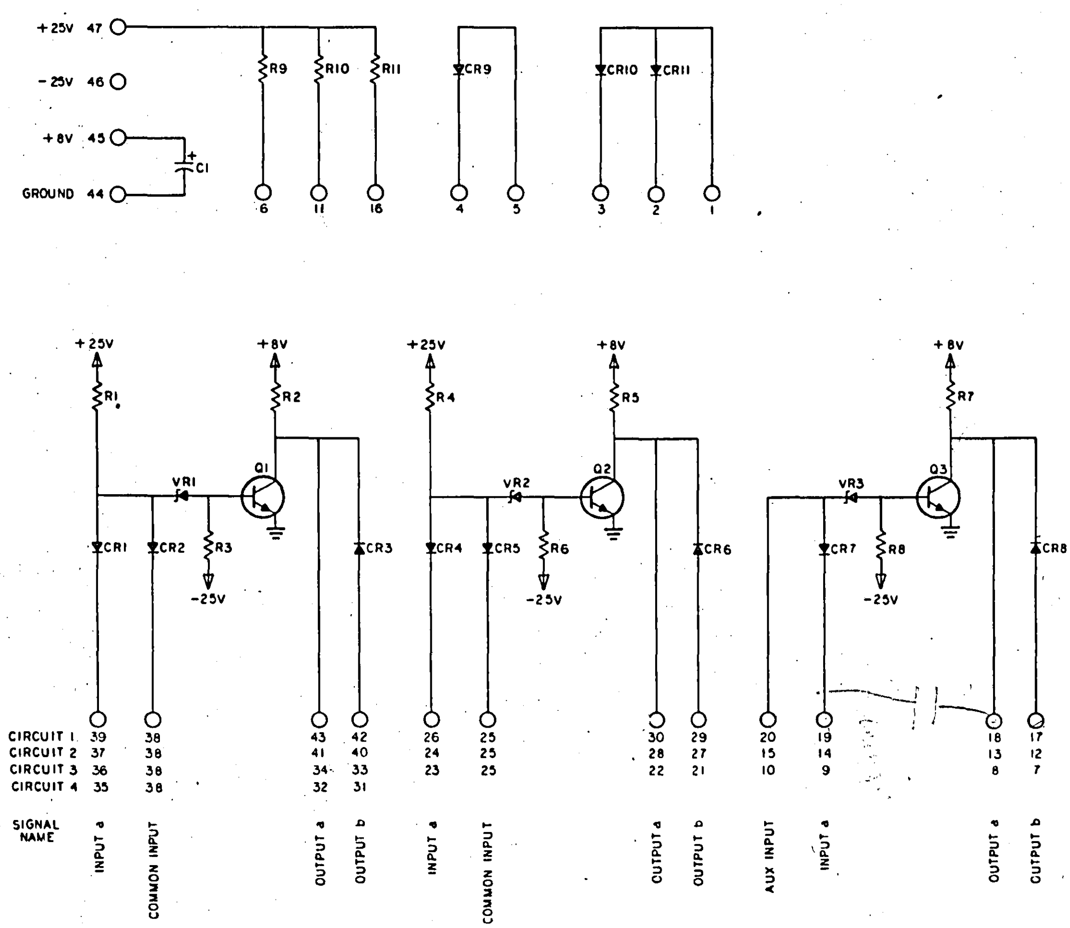


REVISIONS
100386 D
A PRERELEASE
B CIRCUIT REDESIGNED
C RELEASE TO MFG
D CR6 WAS AT5, CR7 WAS AT6
POLARIZING PINS: 2 & 8
+25V 47
-25V 46
+8V 45
GROUND 44
R26
C5
43
CR3 CR4 CR5 CR6 CR7
3 2 1 4 23 24 22
+8V
R11 R12 C1 R13 Q5 Q6 VR5 R14 R15 -25V AT3
R16 R17 R18 R19 Q8 C2 Q7 R23 -25V R20 Q9 C3 VR6 R22 R24 R21 Q10 C4 R25 AT4
CIRCUIT 1 28 30 29 27 25 26
CIRCUIT 2 17 16 18 19 20 21
CIRCUIT 3 6 5 7
SIGNAL NAME
BUFFER IN
BUFFER OUT a
BUFFER OUT b
BUFFER IN
BUFFER OUT a
BUFFER OUT b
+8V +8V +25V +8V +25V +8V
R1 Q1 VR1 R2 -25V
R3 Q2 VR2 R4 -25V AT1
R5 R6 VR3 Q3 CR1 R7 -25V
R8 R9 VR4 Q4 CR2 R10 -25V AT2
CIRCUIT 1 39 42 37 33 35 38 34 36
CIRCUIT 2 41 40 11 10 14 15 31 32
CIRCUIT 3 12 13 8 9
SIGNAL NAME
INVERTER IN
INVERTER OUT
INVERTER IN
INVERTER OUT
INVERTER IN
INVERTER OUT
INVERTER IN
INVERTER OUT
DRAWN HWA 4-11-62
SDS
SCHEMATIC
INVERTER - AMPLIFIER
D 100386
D
IK51

REV	DESCRIPTION
A	PRERELEASE
B	RELEASE TO MFG

100711

POLARIZING PINS: 4 & 36



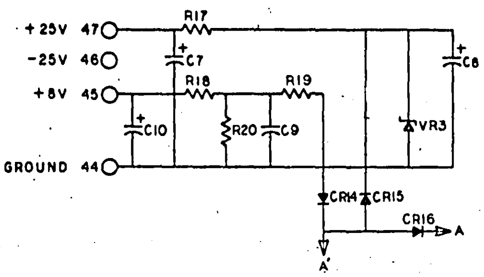
SDS SCIENTIFIC DATA SYSTEMS

SCHEMATIC
AND GATE INVERTER

SIZE D DWG NO 100711 B

MODEL NO. 1K53

POLARIZING PINS: 2 & 46



NOTES:

1. THE TABLE BELOW GIVES COARSE ADJUST PIN CONNECTIONS FOR TEN DIFFERENT DELAY RANGES. FINE ADJUST IS ACCOMPLISHED BY VARYING R10.

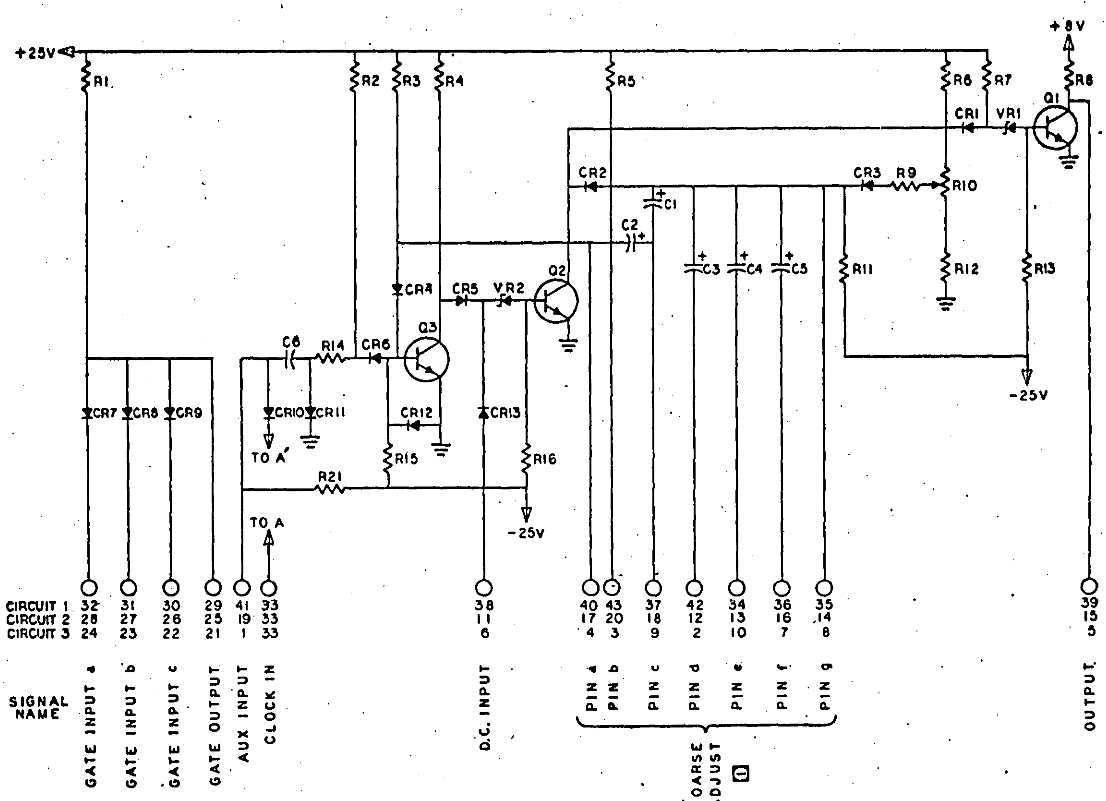
DELAY RANGE	COARSE ADJUST PIN CONNECTIONS					
	a	b	c	d	e	f
2 µSEC-6 µSEC	X	X				
6 µSEC-20 µSEC						
20 µSEC-60 µSEC	X	X	X			
60 µSEC-200 µSEC	X		X			
200 µSEC-600 µSEC	X	X		X		
600 µSEC-2 MSEC	X			X		
2 MSEC-6 MSEC	X	X			X	
6 MSEC-20 MSEC	X				X	
20 MSEC-60 MSEC	X	X				X
60 MSEC-200 MSEC	X					X

EXAMPLE:
TO OBTAIN 300 µSEC DELAY, JUMPER COARSE ADJUST PINS a, b AND d, AND VARY R10 FOR FINE ADJUSTMENT.

BY ADDING A CAPACITOR, C, EXTERNALLY, FURTHER DELAY RANGES CAN BE OBTAINED AS FOLLOWS:

(a) JUMPER PIN a TO b AND CONNECT CAPACITOR BETWEEN PINS a AND g; THE DELAY RANGE THEN IS 20 × C TO 60 × C MILLISECONDS. (C IS IN MICROFARADS)

(b) CONNECT CAPACITOR BETWEEN PINS a AND g; THE DELAY RANGE IS 60 × C TO 200 × C MILLISECONDS (C IS IN MICROFARADS)



REV	DESCRIPTION
A	RELEASE TO MFG.
B	ADDED R21

SDS

SCHEMATIC ONE SHOT MULTIVIBRATOR

D 101227 B

0K52

101500 A

REV.	DESCRIPTION
A	RELEASE TO MFG

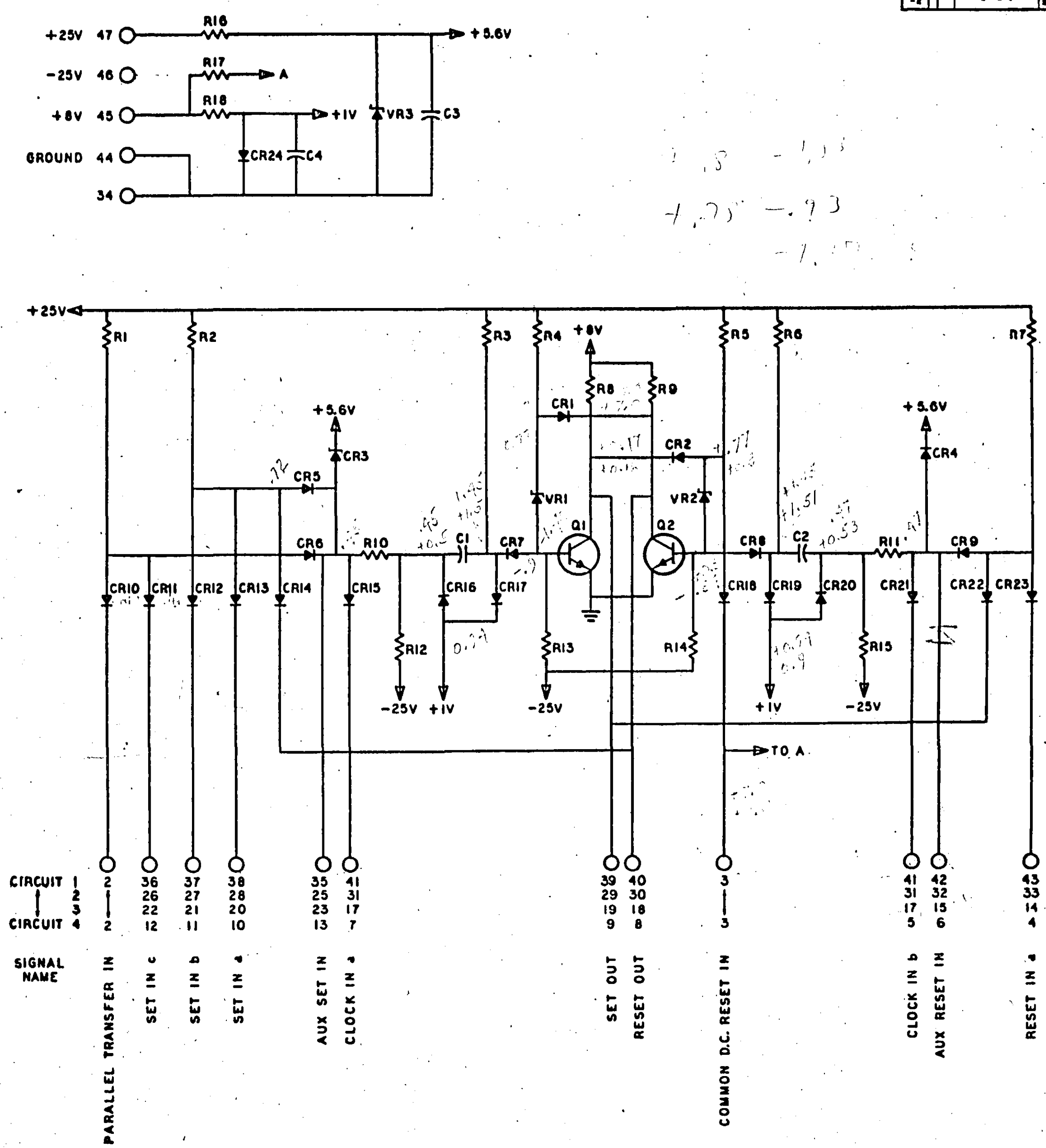
SDS

SCHEMATIC
UNIVERSAL FLIP-FLOP

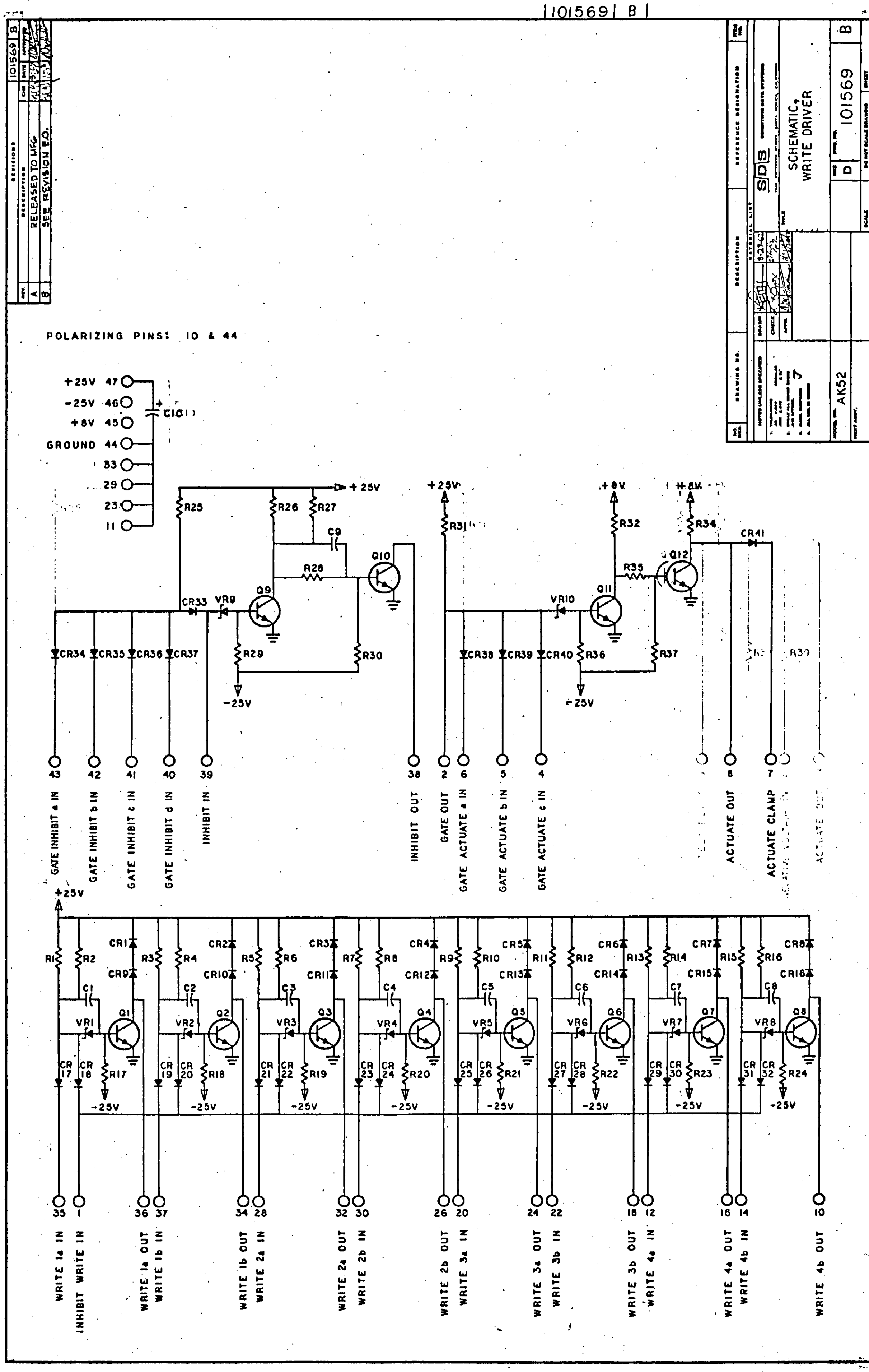
D 101500 A

FC17 FH17

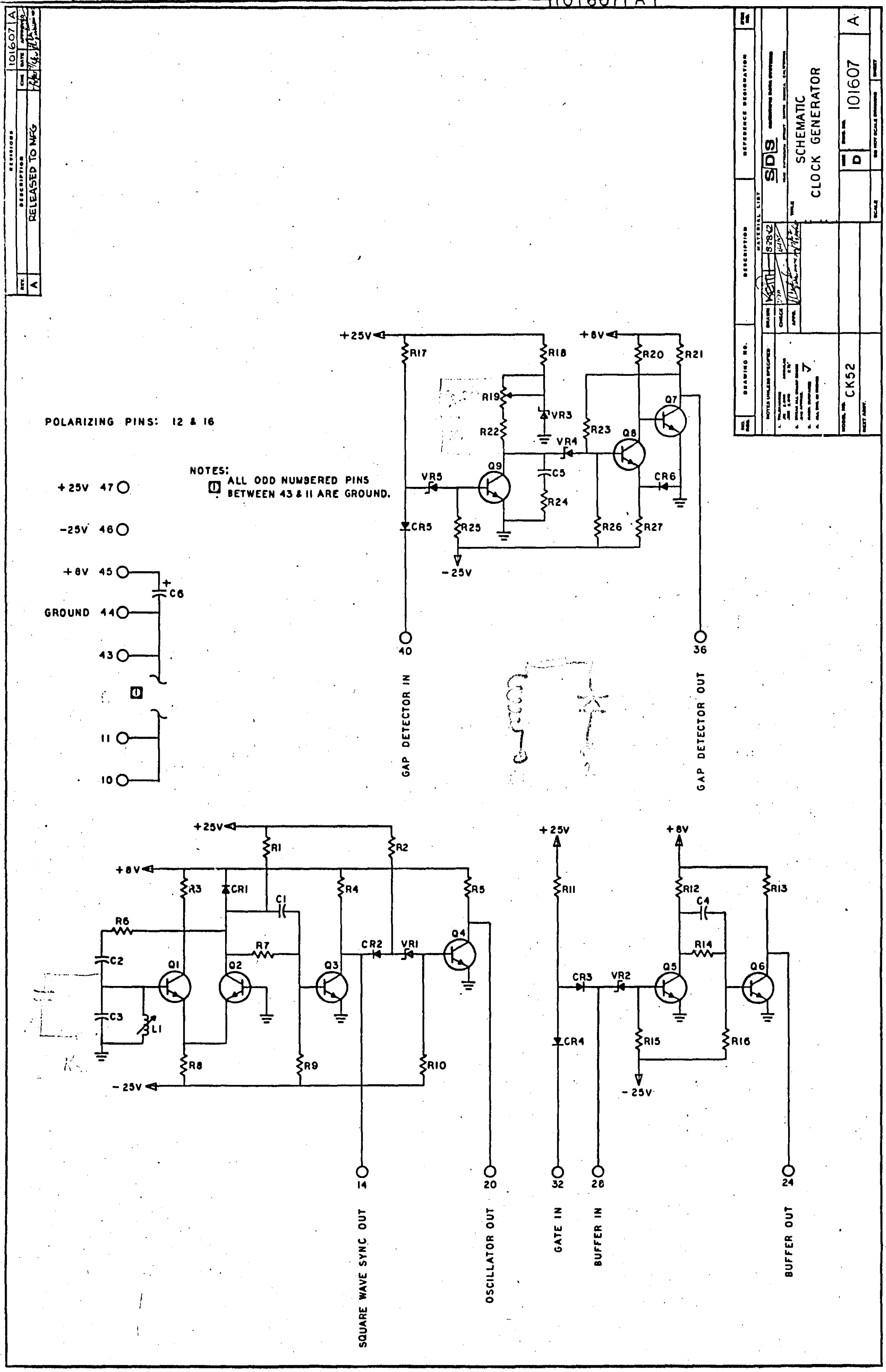
POLARIZING PINS: 2 & 32.



101569 B



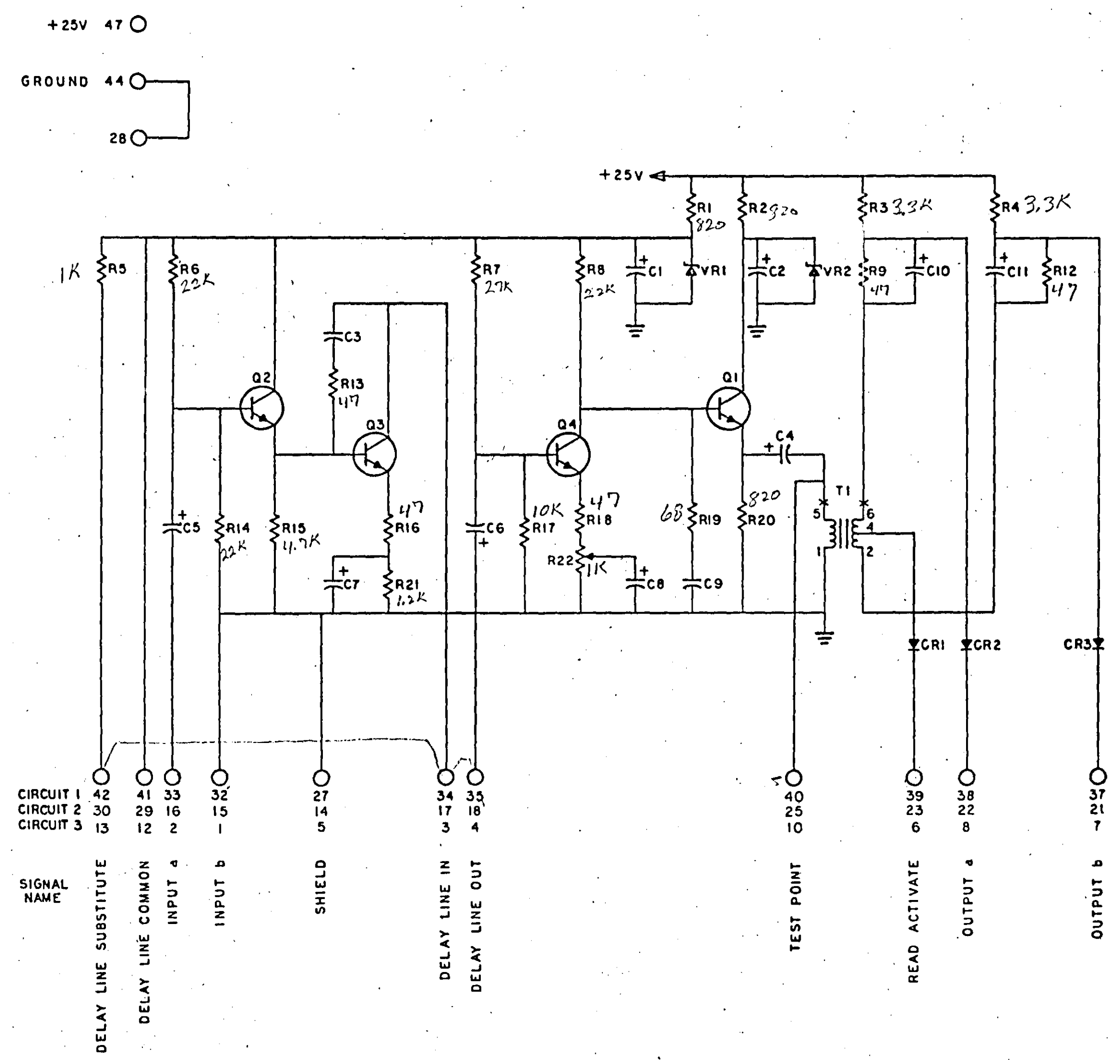
101569 B
REVISIONS
A RELEASED TO MFG
B SEE REVISION E.O.
POLARIZING PINS: 10 & 44
+25V 47
-25V 46
+8V 45
GROUND 44
33
29
23
11
C101
+25V
R25
R26
R27
C9
R28
Q9
Q10
CR33
VR9
CR34
CR35
CR36
CR37
R29
R30
-25V
R31
R32
R34
CR41
R35
Q11
Q12
VR10
CR38
CR39
CR40
R36
R37
+8V
43 GATE INHIBIT a IN
42 GATE INHIBIT b IN
41 GATE INHIBIT c IN
40 GATE INHIBIT d IN
39 INHIBIT IN
38 INHIBIT OUT
2 GATE OUT
6 GATE ACTUATE a IN
5 GATE ACTUATE b IN
4 GATE ACTUATE c IN
8 ACTUATE OUT
7 ACTUATE CLAMP
35 WRITE 1a IN
1 INHIBIT WRITE IN
36 WRITE 1a OUT
37 WRITE 1b IN
34 WRITE 1b OUT
28 WRITE 2a IN
32 WRITE 2a OUT
30 WRITE 2b IN
26 WRITE 2b OUT
20 WRITE 3a IN
24 WRITE 3a OUT
22 WRITE 3b IN
18 WRITE 3b OUT
12 WRITE 4a IN
16 WRITE 4a OUT
14 WRITE 4b IN
10 WRITE 4b OUT
SDS
SCHEMATIC, WRITE DRIVER
D 101569 B
AK52


SCHEMATIC
CLOCK GENERATOR
SDS
101607
A
D
CK52
REVISIONS
RELEASED TO MFG
POLARIZING PINS: 12 & 16
NOTES:
1 ALL ODD NUMBERED PINS BETWEEN 43 & 11 ARE GROUND.
+25V 47
-25V 46
+8V 45
GROUND 44
43
11
10
C6
GAP DETECTOR IN
GAP DETECTOR OUT
SQUARE WAVE SYNC OUT
OSCILLATOR OUT
GATE IN
BUFFER IN
BUFFER OUT
40
36
14
20
32
28
24
+25V
+8V
-25V
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
C1
C2
C3
C4
C5
L1
CR1
CR2
CR3
CR4
CR5
CR6
VR1
VR2
VR3
VR4
VR5
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9

REV.	DESCRIPTION
A	RELEASED TO MFG
B	SEE REV. E.O.

Q1 - Q4 Motorola 2N2501
VR1 - VR2 GE 1N968?

POLARIZING PINS: 12 & 18



SDS SCIENTIFIC DATA SYSTEMS, SANTA MONICA, CALIFORNIA

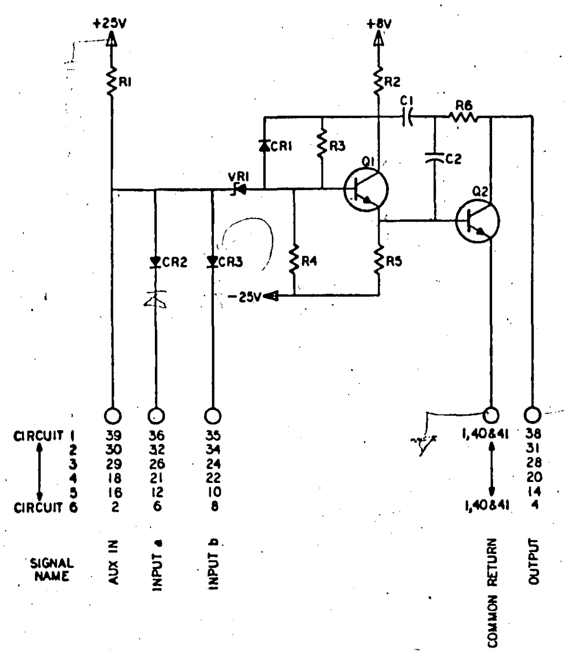
SCHEMATIC READ PREAMPLIFIER

SIZE D — DWG. NO. 101630 — B

MODEL NO. HK56

POLARIZING PINS: 4 & 28

+25V	47	O
−25V	46	O
+8V	45	O
GROUND	44	O
GROUND	43	O



REVISIONS		
REV.	DESCRIPTION	
A	PRERELEASE	
B	RELEASE TO MFG	
C	COMMON RETURN 1,40&41 WAS 40&41	

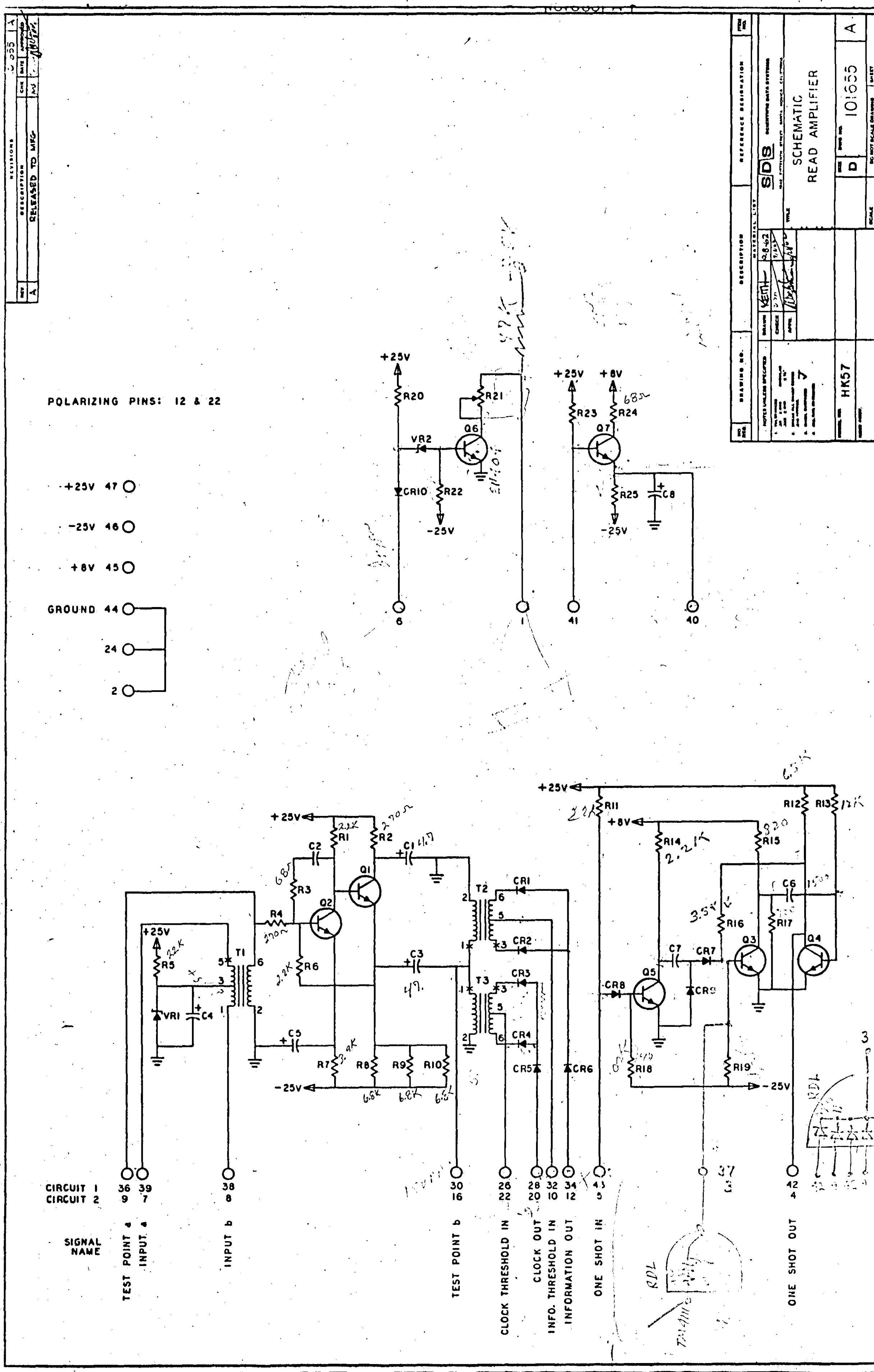
100650 C

SDS

SCHEMATIC
RELAY DRIVER

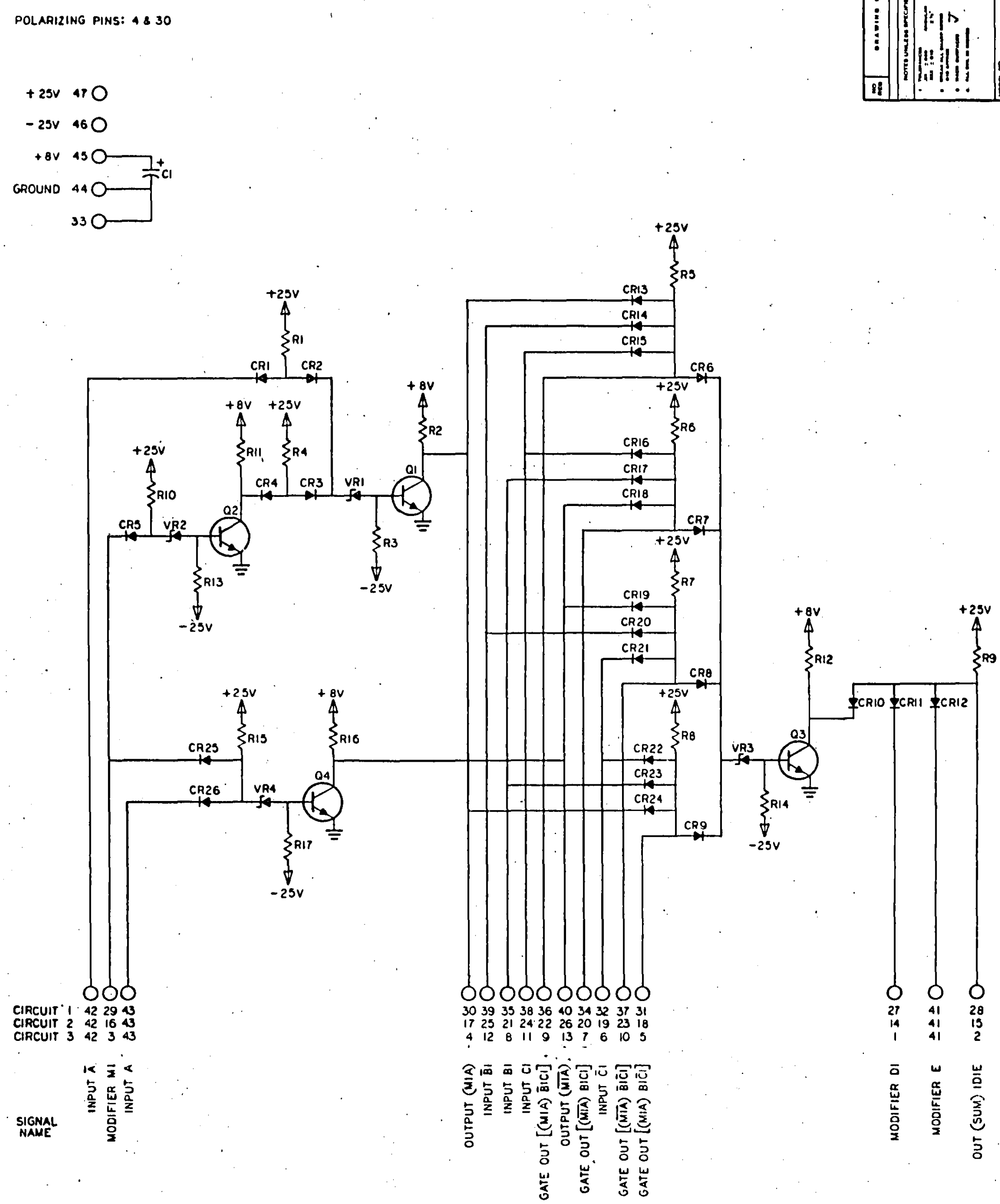
D 100650 C

MODEL NO. RX10


SCHEMATIC READ AMPLIFIER
SDS
101655
A
D
HK57
REVISIONS
RELEASED TO MFG
POLARIZING PINS: 12 & 22
+25V 47
-25V 46
+8V 45
GROUND 44
24
2
CIRCUIT 1
CIRCUIT 2
SIGNAL NAME
TEST POINT a
INPUT a
INPUT b
TEST POINT b
CLOCK THRESHOLD IN
CLOCK OUT
INFO. THRESHOLD IN
INFORMATION OUT
ONE SHOT IN
ONE SHOT OUT
See Playback Amp Schematic

100677 C

REV	DESCRIPTION
A	PRERELEASE
B	RELEASED TO MFG.
C	PIN 33 TO PIN 44 GND. WAS PIN 45 TO PIN 44 GND.



SDS SCIENTIFIC DATA SYSTEMS

SCHEMATIC
ADDER MODULE

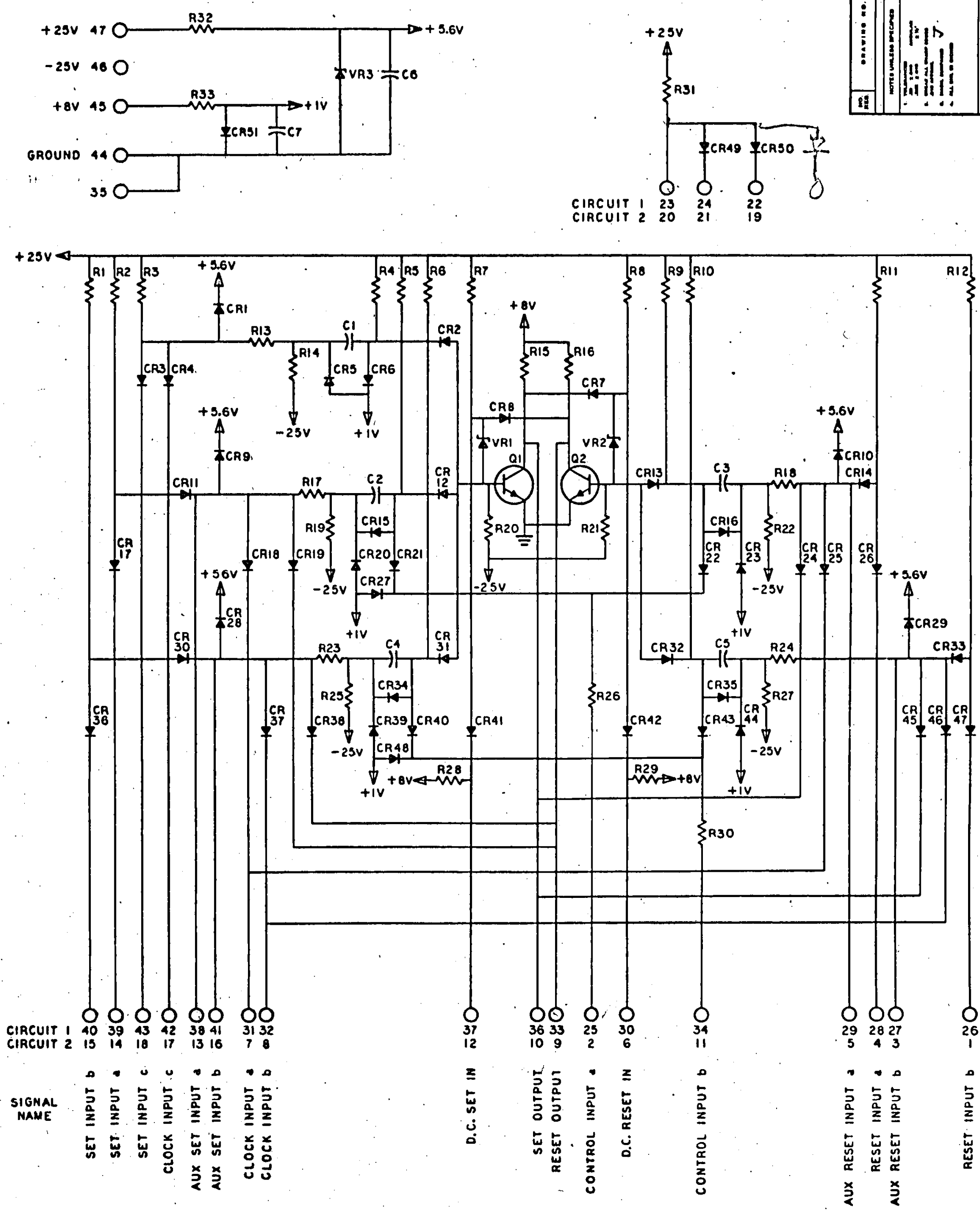
D 100677 C

MODEL NO. 1K52

101734 A

REV.	DESCRIPTION	CHK.	DATE	APPROVED
A	RELEASED TO MFG			

POLARIZING PINS: 16 & 22



SDS SCIENTIFIC DATA SYSTEMS

SCHEMATIC
REVERSIBLE COUNTER
FLIP-FLOP

D 101734 A

FC18 FH18

CONTROL UNIT, 9148, SPECTRASTRIP DESIGNATIONS

OZ or OOZ	LOGIC	OZ or OOZ	LOGIC
1	$\textcircled{\overline{R1m}}$	27	(R3)
2	$\textcircled{\overline{R2m}}$	28	(R4)
3	$\textcircled{\overline{R3m}}$	29	(R5)
4	$\textcircled{\overline{R4m}}$	30	(R6)
5	$\textcircled{\overline{R5m}}$	31	(Rp)
6	$\textcircled{\overline{R6m}}$	32	Ce
7	$\textcircled{\overline{Rpm}}$	33	Ct
8	$\textcircled{Wes}$	34	D3
9	W9 W11	35	$(\overline{D1}\ \overline{D3}\ \overline{Dt})$
10	$\overline{W9}$ W11	36	$\overline{D2}$
11	R1m	37	(M1 + M2 + M3 + M4 + M5
12	R2m		+ M6 + Mp) $\overline{Mf}\ \overline{Mr}$)
13	R3m	38	$\overline{(\overline{Rpm}\ \overline{R6m}\ R5m\ \overline{R4m}\ R3m\ \overline{R2m}\ \overline{R1m})}$
14	R4m	39	Me
15	R5m	40	$\overline{Me}$
16	R6m	41	($\textcircled{R1m}$ W9 W11 + R1m $\overline{W9}$ W11)
17	Rpm	42	($\textcircled{R2m}$ W9 W11 + R2m $\overline{W9}$ W11)
18	$\overline{R2m}$	43	($\textcircled{R3m}$ W9 W11 + R3m $\overline{W9}$ W11)
19	$\overline{R3m}$	44	($\textcircled{R4m}$ W9 W11 + R4m $\overline{W9}$ W11)
20	$\overline{R4m}$	45	($\textcircled{R5m}$ W9 W11 + R5m $\overline{W9}$ W11)
21	$\overline{R5m}$	46	($\textcircled{R6m}$ W9 W11 + R6m $\overline{W9}$ W11)
22	$\overline{R6m}$	47	($\textcircled{Rpm}$ W9 W11 + Rpm $\overline{W9}$ W11)
23	$\overline{Rpm}$	48	Rdm
24	Mf + Mr	49	$\overline{Rdm}$
25	(R1)	50	Gap
26	(R2)	51	Mc

APPENDIX III

SPARE PARTS LISTS

REV	A
DWG. NO.	102175
ML	

MATERIAL LIST
DWG. TITLE

SDS SCIENTIFIC DATA SYSTEMS

ML

DWG. NO.	REV
102175	A

ASSY.SPARE PARTS KIT, MAG.TAPE MOD # 9193 DATE 12-14 SHEET 1 OF 1

ITEM	DWG. TITLE	DWG. NO.	NO. REQ.	REMARKS OR CKT. DESIG.
1	Assy, P. W. Bd Write Driver	101571	1	AK52 DL 101572
2	Assy, P. W. Bd Dual Clock FF	100170	1	FC12 DL 100413
3	Assy, P. W. Bd Inverter Amp	100388	1	IK51 DL 100434
4	Assy, P. W. Bd Diode Gate 1	100246	1	GK51 DL 100424
5	Assy, P. W. Bd Read PreAmp	101632	1	HK56 DL 101633
6	Assy, P. W. Bd One Shot Multi.	101228	1	OK52 DL 101229
7	Assy, P. W. Bd Relay Driver	100652	1	RX10 DL 100473
8	Assy, P. W. Bd Resistor Mod.	101716	1	ZK51 DL 101717
9	Assy, P. W. Bd Extender	100253	1	ZX10 DL 100493
10	Assy, TM-4 Spare Parts	102205	1	
11	Assy, Spare Components	102176	1	
12				
13	Relay	101036	1	

REV	A
DWG. NO.	102176
ML	

MATERIAL LIST
DWG. TITLE

SDS SCIENTIFIC DATA SYSTEMS

ML	DWG. NO.	REV
	102176	A

ASSY, SPARE COMPONENTS MOD # 9193 DATE 12-14 SHEET 1 OF 2

ITEM	DWG. TITLE	DWG. NO.	NO. REQ	REMARKS OR CKT. DESIG.
1	Resistor, 1/2 watt	100111-470	3	
2	Resistor, 1/2 watt	100111-680	1	
3	Resistor, 1/2 watt	100111-101	1	
4	Resistor, 1/2 watt	100111-271	1	
5	Resistor, 1/2 watt	100111-331	1	
6	Resistor, 1/2 watt	100111-471	1	
7	Resistor, 1/2 watt	100111-561	2	
8	Resistor, 1/2 watt	100111-821	3	
9	Resistor, 1/2 watt	100111-102	2	
10	Resistor, 1/2 watt	100111-122	1	
11	Resistor, 1/2 watt	100111-222	2	
12	Resistor, 1/2 watt	100111-302	1	
13	Resistor, 1/2 watt	100111-332	2	
14	Resistor, 1/2 watt	100111-392	3	
15	Resistor, 1/2 watt	100111-472	1	
16	Resistor, 1/2 watt	100111-822	2	
17	Resistor, 1/2 watt	100111-103	2	
18	Resistor, 1/2 watt	100111-123	1	
19	Resistor, 1/2 watt	100111-153	1	
20	Resistor, 1/2 watt	100111-183	1	
21	Resistor, 1/2 watt	100111-223	2	
22	Resistor, 1/2 watt	100111-273	2	
23	Resistor, 1/2 watt	100111-393	1	
24	Resistor, 1/2 watt	100111-473	2	
25	Resistor, 1/2 watt	100111-224	1	
26	Resistor, 1/2 watt	100111-394	1	
27	Resistor, 1/2 watt	100111-474	1	
28	Resistor, 1/2 watt	100111-225	1	
29	Resistor, Metal Film	100680-101	1	
30	Resistor, Metal Film	100680-222	2	
31	Resistor, Wirewound	101155-251	1	
32	Potentiometer	100289-202	1	
33	Potentiometer	100289-103	1	
34	Pad, Transistor	100592	2	
35	Capacitor, Mica	100107-101	2	
36	Capacitor, Mica	100107-471	1	
37	Capacitor, Mica	100107-511	1	
38	Capacitor, Mica	100107-680	1	

REV	A
DWG. NO.	102176
ML	

MATERIAL LIST
DWG. TITLE

SDS SCIENTIFIC DATA SYSTEMS

ML	DWG. NO.	REV
	102176	A

ASSY, SPARE COMPONENTS MOD # 9193 DATE 12-14 SHEET 2 OF 2

ITEM	DWG. TITLE	DWG. NO.	NO. REQ	REMARKS OR CKT. DESIG.
40	Capacitor, Mylar	100308-102	1	
41	Capacitor, Mylar	100308-152	1	
42	Capacitor, Mylar	100308-332	1	
43	Capacitor, Mylar	100308-472	1	
44	Capacitor, Mylar	100308-103	2	
45	Capacitor, Tantalum	100311-104	1	
46	Capacitor, Tantalum	100311-684	1	
47	Capacitor, Tantalum	100311-105	1	
48	Capacitor, Tantalum	100311-475	1	
49	Capacitor, Tantalum	100312-156	2	
50	Capacitor, Tantalum	100313-476	2	
51	Diode, SDS 101	100025	5	
52	Diode, SDS 102	100090	10	
53	Diode, SDS 103	100091	10	
54	Diode, SDS 100	100019	3	
55	Diode, SDS 106	100323	1	
56	Diode, SDS 107	100324	3	
57	Diode, SDS 108	100325	3	
58	Transistor, SDS 201	100092	5	
59	Transistor, SDS 202	100093	5	
60	Transistor, SDS 203	100254	5	
61	Transistor, SDS 209	100697	1	
62	Lamp, Incandescent	101797	3	
63	Resistor, Wirewound	101155-100	1	

SDS-E-106

REV	A
DWG. NO.	102177

DL

DRAWING LIST
Spare Parts Kit
Mag. Tape Control Unit

SDS SCIENTIFIC DATA SYSTEMS

DL

DWG. NO.	REV
102177	A

MODEL NO. 9194 W. O. NO. ______ DATE 12-14-2 SHEET 2 OF 2

ITEM	DWG. TITLE	DWG. NO.	INDENTURING								REMARKS
1	Assy, Spare Parts Kit	102178	x								
2	Assy, P. W. Bd Univ. FF	101502		x							FC17
3	Assy, P. W. Bd Clock Gen.	101609		x							CK52
4	Assy, P. W. Bd Read Amp	101657		x							HK57
5	Assy, P. W. Bd One Shot Mult.	101228		x							OK52
6	Assy, P. W. Bd Diode Gate 1	100246		x							GK51
7	Assy, P. W. Bd Inverter Amp	100388		x							IK51
8	Assy, P. W. Bd Adder Module	100679		x							IK52
9	Assy, P. W. Bd And Gate Inv.	100713		x							IK53
10	Assy, Spare Components	102179		x							

SDS-E-108

REV A

DWG. NO. 102178

ML

MATERIAL LIST

DWG. TITLE

SDS SCIENTIFIC DATA SYSTEMS

ML

DWG. NO. 102178

REV A

ASSY, SPARE PARTS KIT MAG TAPE CONTROL MOD 9194 DATE 12-14 SHEET 1 OF 1

ITEM	DWG. TITLE	DWG. NO.	NO. REQ.	REMARKS OR CKT. DESIG.
1	Assy, P. W. Bd Univ. F. F.	101502	1	FC17 DL 101503
2	Assy, P. W. Bd Clock Gen.	101609	1	CK52 DL 101610
3	Assy, P. W. Bd Read Amp	101657	1	HK57 DL 101658
4	Assy, P. W. Bd One Shot Mult.	101228	1	OK 52 DL 101229
5	Assy, P. W. Bd Diode Gate 1	100246	1	GK51 DL 100424
6	Assy, P. W. Bd Inverter Amp	100388	1	IK51 DL 100434
7	Assy, P. W. Bd Adder Mod.	100679	1	IK52 DL 100743
8	Assy, P. WBd And Gate Inv.	100713	1	IK53 DL 100742
9				
10	Assy. Spare Components	102179	1	

SDS-E-106

REV	6	MATERIAL LIST DWG. TITLE	SDS	SCIENTIFIC DATA SYSTEMS	ML	DWG. NO. 102179	REV 6

DWG. NO. 102179 ML

ASSY. SPARE COMPONENTS MOD # 9194 DATE 12-14 SHEET 1 OF 2

ITEM	DWG. TITLE	DWG. NO.	NO. REQ	REMARKS OR CKT. DESIG.
1	Resistor, 1/2 watt	100111-470	1	
2	Resistor, 1/2 watt	100111-680	1	
3	Resistor, 1/2 watt	100111-101	4	
4	Resistor, 1/2 watt	100111-271	4	
5	Resistor, 1/2 watt	100111-391	1	
6	Resistor, 1/2 watt	100111-471	1	
7	Resistor, 1/2 watt	100111-561	3	
8	Resistor, 1/2 watt	100111-821	10	
9	Resistor, 1/2 watt	100111-102	1	
10	Resistor, 1/2 watt	100111-122	1	
11	Resistor, 1/2 watt	100111-182	1	
12	Resistor, 1/2 watt	100111-222	3	
13	Resistor, 1/2 watt	100111-332	1	
14	Resistor, 1/2 watt	100111-392	10	
15	Resistor, 1/2 watt	100111-562	1	
16	Resistor, 1/2 watt	100111-682	5	
17	Resistor, 1/2 watt	100111-822	5	
18	Resistor, 1/2 watt	100111-103	1	
19	Resistor, 1/2 watt	100111-123	1	
20	Resistor, 1/2 watt	100111-183	6	
21	Resistor, 1/2 watt	100111-223	2	
22	Resistor, 1/2 watt	100111-273	2	
23	Resistor, 1/2 watt	100111-153	4	
24	Resistor, 1/2 watt	100111-393	1	
25	Resistor, 1/2 watt	100111-473	3	
26	Resistor, 1/2 watt	100111-563	1	
27	Resistor, 1/2 watt	100111-104	3	
28	Resistor, 1/2 watt	100111-224	1	
29	Resistor, 1/2 watt	100111-394	1	
30	Resistor, 1/2 watt	100111-474	3	
31	Resistor, 1/2 watt	100111-225	2	
32	Potentiometer	100289-252	1	
33	Potentiometer	100289-502	1	
34	Potentiometer	100289-103	1	
35	Capacitor, Mica	100107-101	2	
36	Capacitor, Mica	100107-221	1	
37	Capacitor, Mica	100107-471	1	
38	Capacitor, Mica	100107-511	3	

MATERIAL LIST
DWG. TITLE

SDS SCIENTIFIC DATA SYSTEMS

ML DWG. NO. 102179 REV B

ASSY, SPARE COMPONENTS — MOD 9194 DATE 12-14 SHEET 2 OF 2

DWG. NO. 102179 ML

ITEM	DWG. TITLE	DWG. NO.	NO. REQ	REMARKS OR CKT. DESIG.
39	Capacitor, Mica	100107-680	2	
40	Capacitor, Mylar	100308-102	2	
41	Capacitor, Mylar	100308-152	1	
42	Capacitor, Mylar	100308-682	1	
43	Capacitor, Mylar	100308-103	2	
44	Capacitor, Mylar	100308-473	1	
45	Capacitor, Tantalum	100311-104	1	
46	Capacitor, Tantalum	100311-105	1	
47	Capacitor, Tantalum	100311-475	3	
48	Capacitor, Tantalum	100312-156	1	
49	Capacitor, Tantalum	100312-476	2	
50	Diode, SDS 101	100025	10	
51	Diode, SDS 102	100090	35	
52	Diode, SDS 103	100091	35	
53	Diode, SDS 100	100323	1	
54	Diode, SDS 106	100325	1	
55	Diode, SDS 107	101711	1	
56	Transistor, SDS 201	100092	10	
57	Transistor, SDS 202	100093	5	
58	Transistor, SDS 203	100254	2	
59	Inductor, Variable	100332-004	1	
60	Transformer	101662	1	
61	Transformer	101663	2	
62	Pad, Transistor	100592	1	
63	Resistor, 1/2 watt	100111-472	1	

SDS-E-106