CIRCUITS

This chapter is organized in sections, one for each functional part of the equipment. Each section is identified by an index label placed in the same position on the right hand side of the pages as the corresponding label on the index page. The colour along the sides of the pages indicate the type of circuit information according to the following guidelines:

Explanation of signals	White
Block diagrams	Brown
Circuit diagrams Circuit descriptions Component location drawings Timing diagrams Electrical parts list	Red

Page identification:
circuits
white
brown
red

CONTENTS

Continued next page

TDC 3000
Publ. No. 1381 - 2 - 77

TDC 3000
Publ. No. 1381 - 2 - 7

Index to circuit description

TDC 3000
Publ. No. 1381 - 2 - 77

Signal definitions

A mnemonic is an abbreviation for the signal name, for example FST = Fast

The signal name (mnemonic) states the purpose or function of the signal.

The signal is said to be **true** or **false** whether the statement in the signal name is true or false.

In this manual the following convention is used:

A signal is defined to be **true when High (H)** when the mnemonic is written **without an inversion bar:** FST

A signal is defined to be **true when Low (L)** when the mnemonic is written **with an inversion bar:** $\overline{\text{FST}}$

Example:

Signal		
FST	$\overline{\text{FST}}$	Signal state
H	L	True
L	H	False

The signal voltage levels are:

H (high) = + 2.5 V to + 5.0 V
L (low) = 0 V to + 0.7 V

TDC 3000
Publ. No. 1381 - 2 - 77

Mnemonic List

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
BOT	Beginning of Tape (not a signal)				Derived from holes in the tape, denoting the physical beginning of the tape, sensed optically by two phototransistors on the Sensor Board.
CEX	Capstan Encoder Zero Crossings	Servo Board U10-3	Capstan motor rotating	Servo Board U4-5 U6-3 U8-5 Motion Control Board: U10-2 U27-11 U16-12 U3-4	The frequency of this signal is proportional to the capstan motor speed, and is 18 kHz at 90 ips. The distance between two pulses corresponds to 8 data-bits on the tape.
CEXS	Capstan Encoder Zero Crossings Status	Motion Control Board U16-11	The Motion Control must be selected, SLT = true (high)	External Controller via Device Bus	Same as above.
CIX	Cartridge Inserted Switch	Sensor Board	When the cartridge is inserted CIX goes true	Servo Board U11-2-13 via the LOCK signal from the Motion Control Board	When no cartridge is inserted CIX will command the locking mechanism to the open state via the LOCK signal from the Motion Control Board. (CIX = LOCK = false).
CLR (1-3)	Clear (1-3) at Power On	Motion Control Board U20-8-10-12	Logic supply voltage below specified limit	Motion Control Board	These are used to set the logic circuits to the initial state at the moment the power is switched on. When CLR1 has gone low and after two different delays, (C15 and R29) and (C7 and R18) CLR2 and CLR3 go high and stay high for normal operation. See "Power Turn-On, Pulse Diagram".
COM	Common	Motion Control Board. From U7 via the Unit Address Selector or the jumpers JP3	COM is true when the output of the "Unit Address Decoder" (U7) corresponds to the selected unit number	Motion Control Board U19-1	If COM is made true by the Unit Address Decoder either via the jumpers JP3 or by the Unit Select Switch on the Front Panel, the Select line (SLT) will go high and the unit will be enabled.
DATA	Data	Read/Write Board U1-10		Read/Write Board U4-11 U6-5-9 U7-5-9	When the circuit is selected (SLT = true) and the tape is in slow motion (FST = false) the write data (WD) is gated through U1. The output U1-10 is the DATA signal. This signal is used as the input to the write head drivers.
DAV	Data Valid	Read/Write Board U9-4	DAV is set true after a single read-bit. If no more bits arrive within 150 µs DAV again goes false	Read/Write Board U9-5 U18-1	When DAV goes true the 10-bit counter, U18, is enabled and when DAV is false the Parking Oscillator is activated.
DD	Data Detect	Read/Write Board U18-15	DD is set true after 9 good bits to the 10-bit counter, U18.	Read/Write Board: U16-3 U9-13 U19-11 U19-9 U21-12	DD is the "carry"-output of the 10-bit counter U18. When DD is false both the Read Clock Generator and the one-shot U16 (PX) are disabled; also U17-8 ($\overline{\text{PHASE}}$) is forced high, thus enabling all NX pulses to trigger the one-shot U19-1 independent of timing conditions.
DDS	Data Detect Status	Read/Write Board U21-11	When the unit is selected, SLT is true and DD is true	External Controller via Device Bus	
DIFF	Differentiator Output	Read/Write Board U13-6		Read/Write Board R69	DIFF is the output of the Differentiator. This signal is 90° displaced from the preamp. signal, thus the zero-crossings correspond to the peak of the preamp signal and the flux changes on the tape.
ENABLE	Enable	Read/Write U9-2	When the unit is selected (SLT = true) and the tape is not in the fast mode, (FST = false)	Read/Write Board U21-5	ENABLE will enable the RD (Read Data) and RCLK (Read Clock) signals to be transmitted on the Device Bus.
ENC	Encoder	Servo Board U10-11		Servo Board U11-4	ENC is one of the amplified signals from the encoder mounted on the capstan motor.
EOT	End of Tape (not a signal)				Derived from a hole in the tape denoting the physical end of the tape and sensed optically by a photo-transistor on the Sensor Board.
FST	Fast	Motion Control Board	When FSTFWD or FSTREV is true, FST is set true	Read/Write Board U2-13	FST is derived from the output 4 or 6 of the Tape Motion Command Decoder via the diodes CR7 and CR8. When true it is used to disable the WD, WENC, RD and RCLK signals on the Read/Write Board.

TDC 3000
Publ. No. 1381 - 2 - 77

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
FSTC	Fast Command	External Controller via Device Bus		Motion Control Circuit U6-2	
FSTFWD	Fast Forward	Motion Control Board U7-6	The input of U7 must be in the following condition: A = low (fast) B = high (REVRS = false) EN = low	Servo Board U9-1	FSTFWD is an output signal from the Tape Motion Command Decoder U7. It is used as a fast forward command signal to the Velocity Command Circuit in the Servo Board.
FSTREV	Fast Reverse	Motion Control Board U7-4	The input of U7 must be in the following condition: A = low (fast) B = low (REVRS = true) EN = low	Servo Board U9-13	FSTREV is an output signal from the Tape Motion Command Decoder U7. It is used as a fast reverse command signal to the Velocity Command Circuit in the Servo Board.
FWD	Forward	Motion Control Board U7-7	The input of U7 must be in the following condition: A = high (slow) B = high (REVRS = false) EN = low	Servo Board U9-3	FWD is an output signal from the Tape Motion Command Decoder U7. It is used as a slow forward command signal to the Velocity Command Circuit in the Servo Board.
GND	Signal Ground (not a signal)				Physically different from the Servo Ground, but they are connected together on the Power Supply. The GND can be connected to the chassis by a jumper wire.
LDET	Lock Detected	Servo Board U11-8	When the cartrigde is locked in the machine	Motion Control Board U26-1-13 U15-8	The LDET signal is generated in the "Lock Logic" on the Servo Board. The RST signal in the Motion Control Board is derived from the LDET. LDET is also used as the drive to the lock indicator (LDI) via two inverter drivers U26. A negative transition of $\overline{\text{LDET}}$ resets flip-flop U27 making LRUN true which starts a load sequence.
LDI	Lock Detect Indicator	Motion Control Board U26-2-12	LDET is true	The LOADED indicator on the Front Panel	LDI is the lampdrive to the LOADED indicator lamp on the front panel. When it is true the lamp will light.
LFST	Local Fast	Motion Control Board U5-6		Motion Control Board U6-3 U4-2 U22-13	LFST (and LREV) are used to select the inputs of the Local Motion Sequencer U4. It also goes to input 1B on the Tape Motion Command Multiplexer U6.
LLOCK	Light at Lock	Lock Mechanism	When the cartridge is locked in the machine	Servo Board Q4	LLOCK is a signal from a phototransistor on the lock mechanism, and is used as the basedrive to Q4.
LOCK	Lock	Motion Control Board U17-3 CIX, +5 V (R12)	LOCK is set true when a cartridge is inserted and the Cartridge Inserted Switch (CIX) is activated	Servo Board U11-2-13	LOCK is a lock/unlock command from the Motion Control Board to the Servo Lock Logic. When a cartridge is inserted LOCK is set true and the lock/unlock motor will start and lock the cartridge in the machine. When the cartridge is locked and an unload command is completed, LOCK is set false starting the lock/unlock motor which unlocks the cartridge after the tape has been rewound to BOT.
LP	Load Point (not a signal)				LP is an upper tape mark, a single hole near the beginning of the tape and denotes the start of the recording area. This hole is sensed optically by the phototransistor on the Sensor Board.
LPDR	Lamp Drive	Motion Control Board	LPDR is true when the lamp-current is not interrupted	Sensor Board	LPDR is the supply to the lamp on the Sensor Board via R10. When the lamp-current is interrupted, Q1 is cut-off and LPF is pulled high by R11, making UNSF high which stops all tape motion.
LPF	Lamp Fail	Motion Control Board Q1, R11	When the lamp-current to the Sensor Board is interrupted	Motion Control Board U12-1	The Lamp Fail signal, LPF, is used to generate the UNSF signal in the Drive Unsafe Detector. When Q1 is cut off because of a lamp failure, LPF goes true, making UNSF true, which stops all tape motion.
LREV	Local Reverse	Motion Control Board U5-9		Motion Control Board U6-6 U4-14 U22-1	LREV (and LFST) are used to select the inputs of the Local Motion Sequencer U4. It also goes to the 2B input of the Tape Motion Command Multiplexer U6.
LRUN	Local Run	Motion Control Board U27-6 U27-5		Motion Control Board U6-1 U21-9-12 U17-1	LRUN are the outputs of U27 in the Local Motion Sequencer. When LRUN is true it selects the B-inputs of the Tape Motion Command Multiplexer, and it selects the A-inputs when LRUN is false. LRUN is true when a rewind to LP or Unload Command is executed.

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
LSTOP	Local Stop	Motion Control Board U8-5		Motion Control Board U27-4	LSTOP is used to set the local run flip-flop U27 making LRUN false.
LTM	Lower Tape Marker	Motion Control Board U25-6		Motion Control Board U18-4 U1-15	LTM is generated in the Tape Marker Detector and is normally false. When a lower hole in the tape is passing in front of the photo-transistor on the Sensor Board, a pulse is generated on LTM.
LTMD	Lower Tape Marker Hole Detected	Sensor Board	The lower tape marker hole is passing in front of the photo-transistor on the Sensor Board	Motion Control Board U25-2	When LTMD is true it will generate a negative pulse on the output of U25 (LTM).
LULOCK	Light at Unlock	Lock Mechanism	LULOCK is true when the cartridge is unlocked	Servo Board Q5	LULOCK is a signal from the Lock/Unlock Detector on the lock mechanism, and is used as the base drive for Q5.
MRUN	Lock Motor Run	Servo Board U10-8	MRUN is true when a lock or an unlock command is given and the lock/unlock operation is not completed	Servo Board U9-9-11	MRUN is the run command to the lock/unlock motor.
NT	Negative Transition	Read/Write Board U12-8	The negative peaks of the preamp exceed the the negative threshold (– TH)	Read/Write Board U15-12 CR6 to the Peak Detector	The NT (and PT) signal are used to enable the triggering of the Zero Crossing Enable flip-flop, and as signals to the Peak Detector. When a single bit (NT or PT) is detected, DAV is set true.
NX	Negative Crossing	Read/Write Board U16-5	A negative going edge of the ZXE signal will trigger the one-shot U16, thus generating the NX pulse	Read/Write Board U17-1	When the PHASE signal is false, the NX signal will be gated through U17. The Read Data (RD) is derived from the NX (and PX) signal via U15/U2.
OFLC	Off-line Command	External Controller via Device Bus		Motion Control Board U12-9	Normally, UNLC will be used instead. The On-Line Status is set by a pulse from the ON-LINE push-button on the front panel, and reset by a second pulse from the front panel, by UNLC, or by OFLC. OFLC can be added to the Device Bus by a jumper on the Mother Board.
OFLCG	Off-Line Command Gated	Motion Control Board U12-8	When the unit is selected (SLT = true) and OFLC is true, OFLCG is made true.	Motion Control Board U1-12	See OFLC.
ONL	On-Line	Motion Control Board U3-10	ONL is true when a a cartridge is inserted and power is switched on, and the on-line flip-flop U3 is set	Motion Control Board U26-5-9 U1-3 U7-15	ONL is used to enable the Unit Address Decoder U7. Via the amplifier U26 it is also used as drive for the ON-LINE Indicator lamp. When ON-LINE, remote control via the Device Bus is made possible. When ONL, the Front Panel "REWIND" push-button is inhibited.
ONLI	On-Line Indicator	Motion Control Board U26-6-8	ONLI is true when the cartridge is inserted and the on-line flip-flop U3 is set.	Indicator Lamp on the Front Panel	The ONLI signal is used as drive for the ON-LINE Indicator Lamp on the Front Panel.
ONLS	On-Line Status	Motion Control Board U13-6	ONLS is ONL gated to the Device Bus by SLT	External Controller via Device Bus	ONLS indicates that the drive is connected to the Device Bus.
ONLX	On-Line Switch	Front Panel	The ON-LINE button is depressed	Motion Control Board U1-11-12	ONLX will toggle the On-Line flip-flop U3.
OSC	Oscillator	Read/Write Board U2-8	When DAV is false (no data valid), the Parking Oscillator will start	Read/Write Board U19-2	OSC is the signal from the Parking Oscillator and it triggers the one-shot U19. The frequency of OSC is about 48 kHz.
PHASE	Phase Transition Inhibit	Read/Write Board U17-8		Read/Write Board U17-2-5	PHASE is a pulse which prevents the phase-transitions of the encoded signal to be decoded into read data. The pulse length is adjusted by the "phase" pot.meter to 75% of the bit time. At any other speed the pulse length is automatically corrected.
PREAMP	Preamplifier	Read/Write Board Q5		Read/Write Board Amplitude Comparator	The correct preamp level is required for the signal verification to be correct. At 30 ips the level should be 5.0 V peak-peak when reading a Reference Cartridge.

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
PT	Positive Transition	Read/Write Board U12-1	The positive peaks of the preamplifier signal are compared with the positive threshold (+TH) and when they are more positive than +TH, the PT signal is made true	Read/Write Board U23-14 CR5 to the Peak Detector. U18-2. Testpoint	The PT (and NT) signals are used to enable the triggering of the Zero-Crossing Enable flip-flop and as signals to the Peak Detector. When a signal bit PT (or NT) is detected, DAV is set true. The PT pulses are also counted in the 10-bit counter U18 in the Data Detect circuit.
PU	Pull Up	Motion Control Board	+5 V via R8	Motion Control Board	PU is a high signal (+5 V) via R8 used to terminate unused TTL-inputs.
PWRAMP	Power Amplifier	Servo Board Q1 and 2		Servo Board and the capstan motor	PWRAMP is the capstan motor power from the darlington transistors Q1 and Q2
PX	Positive Crossing	Read/Write Board U16-13	The positive going edge of the ZXE signal will trigger the one-shot U16 when DD is set high. Then PX is set true	Read/Write Board U17-4	When the PHASE signal is false, the PX signal will be gated through U17. The Read Data and Read Clock pulses are derived from PX (and NX).
RAMP	Ramp Generator Voltage	Servo Board U2-1		Servo Board U1-5 and U2-6 via R17	Generates the velocity command to the servo with controlled rise and fall times.
RCLK	Read Clock	Read/Write Board U21-8	The Read Clock pulses are derived from the trigger-pulses (PX and NX), but is disabled until DD goes true after 9 good bits	External Controller via Device Bus	The decoded Read Clock pulses are delayed 3 µs after the Read Data (RD) line is valid. Thus RD is valid on both edges of the clock. The clock pulse is 3µs min.
RD	Read Data	Read/Write Board U21-6		External Controller via Device Bus	The Read Data (RD) is the decoded read data where the true level equals a "ONE", and the false level equals a "ZERO".
RDY	Ready	Motion Control Board U6-12	RDY is true when the Q_A output of the Tape Position Register is high and the A-inputs of U6 are selected	Motion Control Board U17-12	When RDY is enabled by SLT it becomes the Ready Status, RDYS
RDYS	Ready Status	Motion Control Board U17-11	RDYS is true when the Q_A output of the Tape Position Register is high, the A-inputs of U6 are selected, and the unit is selected, SLT is true	External Controller via Device Bus	The Ready Status, RDYS, is the information signal to the Formatter and the Input/Output Controller that the Motion Control Board is ready for commands via the Device Bus. RDYS goes false when LRUN is true.
REV	Reverse	Motion Control Board U7-5	REV is true when the A-input is high and the B-input of U7 is low and tape motion is permitted, RUN is true	Servo Board U9-5	REV is an output signal from the Tape Motion Command Decoder U7 and is used as a command signal to the Velocity Command Circuit in the Servo. When REV is true a synchronous reverse command is given.
REVC	Reverse Command	External Controller via Device Bus	Reverse Command is given from the Formatter	Motion Control Board U6-2	
REVD	Reverse Detected	Servo Board U6-6	When the capstan is running in reverse	Servo Board, Motion Control Board U6-6 Read/Write U1-2 via jumper JP5, and to U8-13	When REVD is true, the write mode is disabled in the Read/Write Board. REVD is also used to invert the data polarity in the Polarity Switch in the Read/Write circuit when the tape is read in reverse.
REVRS	Reverse	Motion Control Board U6-7	When a reverse command is given	Motion Control Board U7-3, U16-10, U19-13, U23-1	

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
REVS	Reverse Status	Motion Control Board U16-3		External Controller via Device Bus	REVS is derived from the true direction of the Capstan encoder (CEX and REVD). It is used as the reverse status signal to the Formatter and Input/Output Controller.
REWC	Rewind Command	External Controller via Device Bus		Motion Control Board U12-5	REWC sets Rewind mode and resets the Ready Status (RDYS). The Tape will rewind automatically to the Load Point (LP) and stop.
REWCG	Rewind Command Gated	Motion Control Board U12-6	REWC and SLT are true	Motion Control Board U22-11	REWCG is the gated REWC signal.
RST	Reset	Motion Control Board U15-10, U20-4	CLR1 true or LDET false	Motion Control Board	The RST signal is used to reset circuits in the Motion Control Board.
RUN	Run	Motion Control Board U14-11	RUN is true when RUNINH is false and a run command is given, RUNCG or LRUN is true	Motion Control Board U7-1	RUN is the enabling signal for the Tape Motion Command Decoder U7.
RUNC	Run Command	External Controller via Device Bus		Motion Control Board U21-5	RUNC is a run command signal to the Tape Motion Command Multiplexer and Decoder, and is thus used to enable the simultaneously selected $\overline{\text{REVC}}$/REVC and $\overline{\text{FSTC}}$/FSTC commands.
RUNCG	Run Command Gated	Motion Control U21-4	RUNC and SLT are true	Motion Control Board U6-11	RUNCG is the gated RUNC signal.
RUNINH	Run Inhibit	Motion Control Board U16-6 U16-8 or Q4	RUNINH is set true when the tape has run off the hub, the BOT is sensed in the reverse direction or EOT is sensed in the forward direction	Motion Control Board	When RUNINH is true the Tape Motion Command Decoder U7 is disabled via U14.
RUNPULSE	Run Pulse	Motion Control Board U10-13	RUNPULSE is true if the time between two positive CEX edges is less than 6.2 ms, indicating that the edge is running	Motion Control Board U27-12-14	RUNPULSE is used to generate the run status (RUNS) signal.
RUNS	Run Status	Motion Control Board U13-3	RUNS is true when TRUN is true and the unit is selected	External Controller via Device Bus	RUNS is a status line to the Formatter.
RVD	Reverse Detect	Motion Control Board U18-3	RVD is true when the tape is running, TRUN is true, and in reverse direction. REVD = true	Motion Control Board U20-5 U23-12, U14-1	RVD controls the shift direction of the Tape Position Register in the Motion Control Board; when RVD is true, shift left is commanded, and when RVD is false, shift right is commanded.
SLAC	Unit Select Line "A" Command	External Controller via Device Bus		Motion Control Board U17-13	The drive select lines A and B permit up to 4 drives on one Formatter. SLAC and SLBC are used in the Unit Address Decoder.
SLBC	Unit Select Line "B" Command	External Controller via Device Bus		Motion Control Board U17-14	SLAC / SLBC / Drive: False / False / 1; False / True / 2; True / False / 3; True / True / 4
SLT	Select	Motion Control U19	SLT is true when the unit is selected: COM goes true either via the Unit Address Selector on the Front Panel or via the jumper JP3. (Selected Address coinsides with assigned device address)	Motion Control and Read/Write	The SLT signal is used to gate the device bus input signals into the Motion Control Board and Read/Write Board. It is also used to gate the output signals from the same circuits to the device bus.
SLTM	Stored Lower Tape Marker Hole	Motion Control Board U1-13	SLTM is true when a lower tape marker hole has been detected	Motion Control Board U19-5 U4-4-5	SLTM (and SUTM) are used as parallel inputs to the Tape Position Register, TPR. They are also used as inputs to the 4-1 multiplexer U4, which controls the local motion flip-flop U5.

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
SUTM	Stored Upper Tape Marker Hole	Motion Control Board U1-7	SUTM is true when an upper tape marker hole has been detected	Motion Control Board U19-9 U23-10, U4-12 U22-5	Same as SLTM
STRB	Strobe Pulse	Motion Control Board U18-8	STRB is generated on the trailing edge of the UTM and LTM signals	Motion Control Board	STRB is a negative strobe pulse which is used to clock the Tape Position Register (TPR) and the Sequence State Decoder. The STRB pulse is 0.4 µs nominal.
TACHO	Tachometer Voltage	Servo Board U7-1		Servo Board CR14 and 15, R67	The TACHO-meter voltage is generated in the Frequency to Voltage Converter and the following Polarity Switch in the Servo. It is compared with the command voltage, to control the motorspeed.
+ TH	Positive Threshold Voltage	Read/Write Board		Read/Write Board	+ TH is a positive voltage derived from the tacho-meter voltage, VTACH. + TH is propotional to the tape speeds. The positive peaks of the preamplifier are compared with the + TH.
– TH	Negative Threshold Voltage	Read/Write Board U11-1		Read/Write Board	– TH is a negative voltage generated by the inverting amplifier U11. The negative peaks of the preamplifier are compared with – TH.
T1-4EN	Track Enable 1-4	Read/Write Board U3	T1-4EN is true if the selected track is not write protected (T1-4PX are false)	Read/Write Board	The T1-4EN are used to enable the head drivers, permitting the DATA signal to drive the head, and also connecting the erase current. T1-4EN are also used to enable the WPX signal. (WRITE PERMIT is set true.)
T1-4PX	Track Protect Switch 1-4	Front Panel		Read/Write Board U4 and U5	T1-4PX are the Track Write Protect Switches on the Front Panel.
TPAS	Tape Position "A" Status	Motion Control Board U13-8	TPAS is set when the first forward command after the LP marker has been sensed when going forward or when the EOT is sensed going in reverse	External Controller via Device Bus	When TPAS is true the tape is positioned between LP and EOT.
TPBS	Tape Position "B" Status	Motion Control Board U13-11	TPBS is set when the Early Warning (EW) marker is sensed going forward and reset when the marker is detected going in reverse	External Controller via Device Bus	TPBS is generated directly from the Q_B output of the TPR (Tape Position Register). TPBS stays true after the EW-marker and flags the Formatter that writing of the current file must be terminated.
TRAC	Track Select "A" Command	External Controller via Device Bus		Read/Write Board U23-2 U10-10	The track select lines A and B permit one of four tracks to be used for writing or reading.
TRBC	Track Select "B" Command	External Controller via Device Bus		Read/Write Board U23-3 U10-9	
TRUN	Tape Running	Motion Control Board U27-9	When the tape is running TRUN is set true	Motion Control Board U13-2 U18-1	The TRUN signal is derived from CEX in the Tape Motion Status Circuit. At power switch on, TRUN goes false making RVD false, which sets the TPR control inputs to the shift right state.
U1-4	Unit Address 1-4	Motion Control Board U7		Unit Address Selector on the Front Panel	One of the outputs, U1, U2, U3, or U4 of U7 can be connected to COM in two ways, either by jumpers (h, j, k, or l) or by the Unit Address Selector on the Front Panel. When the unit address specified by SLAC and SLBC via U7 is compared with the address given from the Front Panel and found identical, SLT is set true.

INPUTS			TRACK
TRAC	TRBC		
False	False	1	
False	True	2	
True	False	3	
True	True	4	

INPUTS			OUTPUTS			
EN	SELECT					
	B	A	Y_0	Y_1	Y_2	Y_3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
ULDI	Unload Indicator	Motion Control Board U26-4-10	ULDI is true when an unload command is given. UNL is true	Unload Indicator Lamp on the Front Panel	The UNLOAD indicator lamp on the front panel will light when an unload command is given.
ULDPULSE	Unload Pulse	Motion Control Board U10-12	When the UNLOAD button is pressed.	Motion Control Board U8-11	ULDPULSE is used as the clockpulse to the unload flip-flop U8, and is approx. 0.4 second.
ULDSW	Unload Switch	Motion Control Board U1-4	Unload button on the front panel is depressed	Motion Control Board U10-9 U21-8, U22-10	Buffered signal from the ULDX.
ULDX	Rewind/Unload Switch	Front Panel	Is true when the button is pushed	Motion Control Board U1-1-2	A short (less than 1 second) push initiates the REWIND sequence; a push till the Unload Indicator lamp lights initiates the UNLOAD sequence.
UNL	Unload	Motion Control Board U8-8-9		Motion Control Board U17-2, U15-3, U18-13 U22-3, U26-3-11	See above.
UNLC	Unload Command	External Controller via Device Bus		Motion Control Board U12-12	Unload command from the Formatter will also set the recorder Off-Line.
UNLCG	Unload Command Gated	Motion Control Board U12-11	Is true when UNLC is true and SLT is true.	Motion Control Board U22-9, U8-10	UNLCG is the gated UNLC.
UNSF	Drive Unsafe	Motion Control Board U12-3	UNSF is true when Write Circuit Fault (WCF) is true, RST is true or Lamp Fail (LPF) is true	Motion Control Board U16-15	When false the run inhibit signal, UNSF, will enable the tape motion command multiplexer. When UNSF is true all tape motion is inihibted.
UTM	Upper Tape Marker	Motion Control Board U24-6		Motion Control Board U1-6 U18-5	UTM is generated in the Tape Marker Detector and is normally false. When an upper hole in the tape is passing in front of the photo-transistor on the Sensor Board, a pulse is generated on the UTM-signal wire.
UTMD	Upper Tape Marker Hole Detected	Sensor Board	UTMD is true when an upper tape marker hole is passing in front of the photo-transistor on the Sensor Board	Motion Control Board U24-2	When UTMD is true it will generate a negative pulse on the output of U24 (UTM)
VTACH	Tachometer Voltage	Servo Board U7-7		Read/Write Board	VTACH is a voltage generated in the Frequency to Voltage Converter and is proportional to the absolute value of the tachometer frequency (CEX) (Positive signal for both directions). The threshold voltage is derived from VTACH.
WCF	Write Circuit Fault	Read/Write Board U8-6	WEN and WV are compared and if they are different WCF is set true	Motion Control Board U17-10	WCF is used in the Drive Unsafe Detector. When WCF is true UNSF goes true, and all tape motion is stopped.
WCT	Write Circuit Test	Read/Write Board		Read/Write Board U8-2	By forcing WCT true the WCF can be set true for testing purposes.
WD	Write Data	External Controller via Device Bus		Read/Write Board U1-8	Encoded write data, the true polarity magnetizing the tape in the direction of the gap.
WEN	Write Enable	Read/Write Board U1-1	WEN is true when WENC is true, FST is false, REVD is false, SLT is true, and WRITE PERMIT is true	Read/Write Board U22-1 U8-1	WEN turns on the Write Voltage.
WENC	Write Enable Command	External Controller via Device Bus		Read/Write Board U1-12	The WENC signal will turn on the write voltage (WV) when the unit is selected, not in fast mode and the wanted track is not write protected.

MNEMONIC	Signal Name	Origin	Condition for signal to be true	Goes to	Effect of signal and further details
WPI	Write Permit Indicator	Read/Write Board Q2	When writing is permitted WPI goes true	Write Permit Lamp on the Front Panel via Motion Control Board	If a protected track is addressed (drive is On-Line) WPI will go false. Also.
WPS	Write Permit Status	Read/Write Board U21-3	When writing is permitted WPS goes true	External Controller via Device Bus	
WPX	Write Permit Switch	Sensor Board	True if the Write Protect Plug on the inserted Cartridge is in the Unsafe position	Read/Write Board U1-6 via Motion Control Board	If the Write Protect Plug on the cartridge is rotated to the SAFE position, the Write Permit switch will not be activated.
WRITE PERMIT	Write Permit	Read/Write Board	WRITE PERMIT is true when WPX is true and the addressed track is not write protected	Read/Write Board	WRITE PERMIT is used to enable the Write Enable Command (WENC) and Write Permit Indicator (WPI) signals.
WV	Write Voltage	Read/Write Board Q1	The Write Voltage (WV) is turned on when WEN is true	Read/Write Board Head Drivers	WV is the voltage supply to the write and erase heads.
ZX	Zero Crossing	Read/Write Board U14-9	The ZX comparator U14 is activated by the DIFF signal. It has no hysteresis and is therefore also activated by the noise if the signal is not present	Read/Write Board U15-13 U23-15	ZX sets and resets the Zero Crossing Enable flip-flop U15. When the ZX goes negative and at the same time PT is high, the flip-flop is set. When ZX goes positive and NT is high, the flip-flop is reset.
ZXE	Zero Crossing Enabled	Read/Write Board U8-11		Read/Write Board U16-2-9	ZXE is the output of the Polarity Switch and consists of both data-transitions and phase-transitions. ZXE triggers the one-shots U16 in the Data Decoder.

A1 MOTHER BOARD

AC POWER 48 - 62 ~ SINGLE PHASE

A6 Power Supply Assembly

Power ON/OFF switch
230 V/115 V switch
Transformer, +10 V, +20 V, and -20 V
Fuses

115 V

A12 Fan Assembly

SERVO POWER ±20 V SERVO GROUND

±20 V
+10 V
REG. GND.

A5 Regulator Board

Three regulated voltages +5 V, +12 V, and -12 V with current limitation.
Overvoltage protection of +5 V

+5 V
±12 V REG. GND.

A4 Servo Board

Velocity Command.
Ramp Generator.
Compensation Velocity Loop.
Compensation Current Feedback Loop.
Power Amplifier.
Reference Voltage Regulator.
Voltage Feedback.
Encoder Preamplifier and Direction Sense.
Lock Logic and Driver.
Frequency to Voltage Converter and Filter.
Polarity Switch.

A7A1 Capstan Motor

MOTOR ENCODER

A 400 lines optical encoder is mounted on the motor shaft. The spacing between each pulse corresponds to 8 data-bits on the tape.

Capstan Encoder

LULOCK LLOCK

Lock/Unlock Detector

Shutter

Lock Motor

V_{TACH}

+5V
±12 V
GND

LDET
REVD
CEX

FSTREV
REV
FSTFWD
FWD
LOCK

±12 V +5 V GND

REVD

A2 Read/Write Board

Write Enable and Data Line
Write Permit.
Track Address and Protect Comparison, and Track Decoder.
Write and Erase Drivers.
Write Circuit Fault.
Write Permit Status and Indicator.
Track Selector, Read and Write Preamplifier
Differentiator.
Zero Crossing Detector.
Threshold Voltage.
Amplitude Comparator.
Zero Crossing Enable.
Polarity Switch.
Peak Detector.
Parking Oscillator.
Read Clock Generator.
Data Decoder.
Data Detect Converter
Output Gating

To WRITE and ERASE HEAD

From READ HEAD

A8 Head Assembly

WCF WPI

WPX WPX FST

SLT

Device Bus

A3 Motion Control Board

Tape Marker Detector.
Tape Position Register.
Tape Position Status.
Tape Motion Command Multiplexer.
Tape Motion Command Decoder.
Tape Motion Status.
Tape End Motion Inhibitor.
Unit Address Decoder.
Local Motion Sequencer.
Front Panel Communication Circuit.
Load/Unload and Lock/Unlock Circuit.
Logic Supply Voltage Monitor
Reset Circuit.
Drive Unsafe Detector.

FSTC SLAC SLBC
REVC OFLC REWC
UNLC RUNC

TPAS TPBS ONLS
REVS RUNS
CEXS RDYS

WD RD WPS DDS RCLK

TRAC TRBC WENC

UTMD
LTMD
WPX
WPX
CIX

LPDR

ONLI
ONLX
ULDI
ULDX
ULDX
WPI
LDI

U1
U2
U3
U4
COM

T1PX
T2PX
T3PX
T4PX

Input/ Output Controller

Formatter

Status Lines

Input/output Control Lines

Input Lines, Data and Commands

Data Output Lines

Address Lines
SLAC SLBC
TRAC TRBC

Command Lines
FSTC REWC REVC
OFLC UNLC RUNC

Staus Lines
TPAS TPBS ONLS
REVS RUNS CEXS
RDYS WPS

Write Data Lines
WD WENC

Read Data Lines
RD RCLK DDS

A7A2 Sensor Assembly

Cartidge Inserted Switch (CIX)
Write Permit Switch (WPX)
Optical Tape Marker Detectors

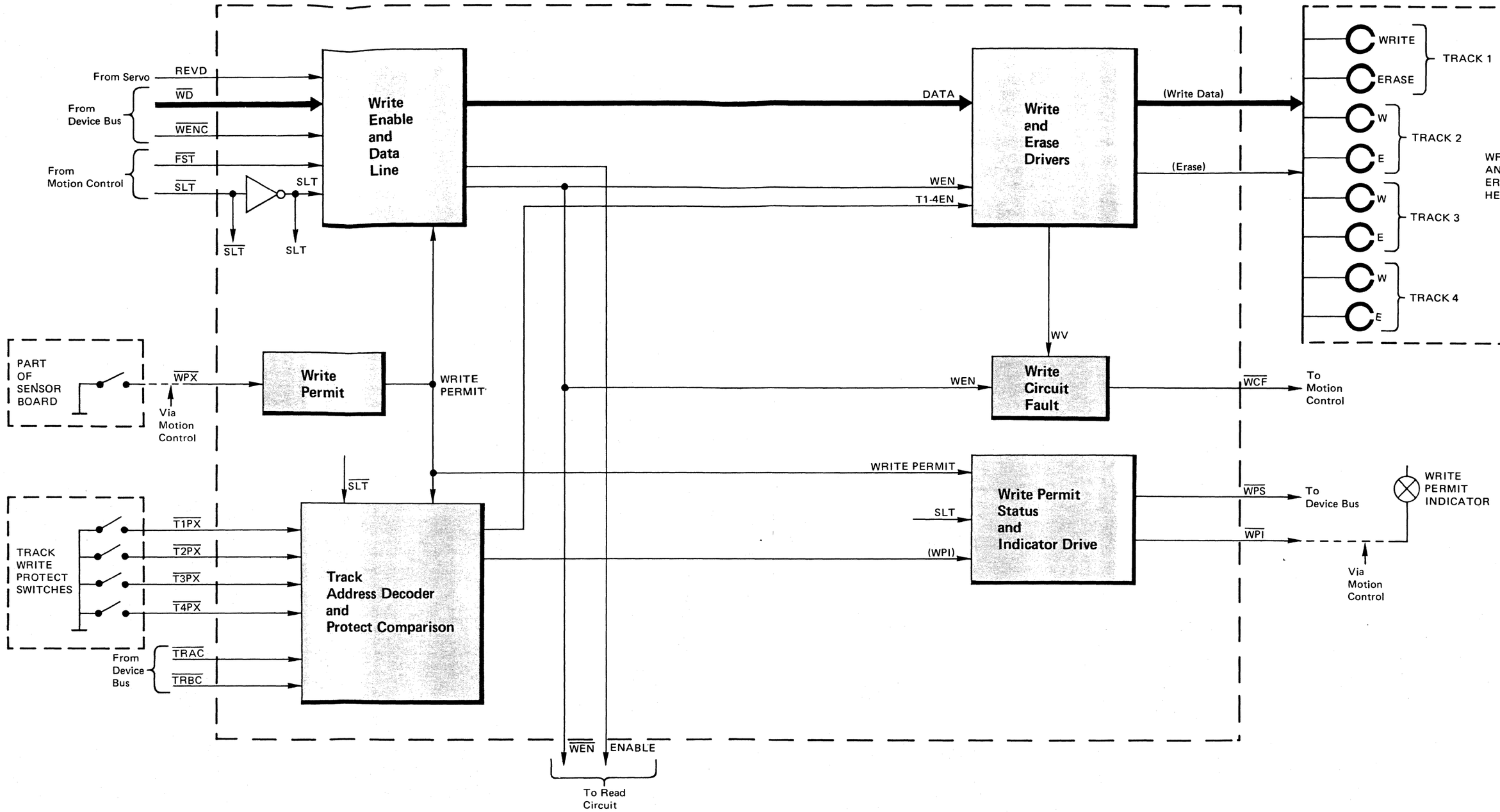
A9 Front Panel Board

CONTROLS and INDICATORS
ONLINE push button and indicator
REWIND/UNLOAD push button and indicator
WRITE PERMIT indicator
LOADED indicator

UNIT ADDRESS SELECTOR
U1, U2, U3, and U4

TRACK WRITE PROTECT SWITCHES
No. 1, 2, 3, and 4.

MAIN BLOCK DIAGRAM

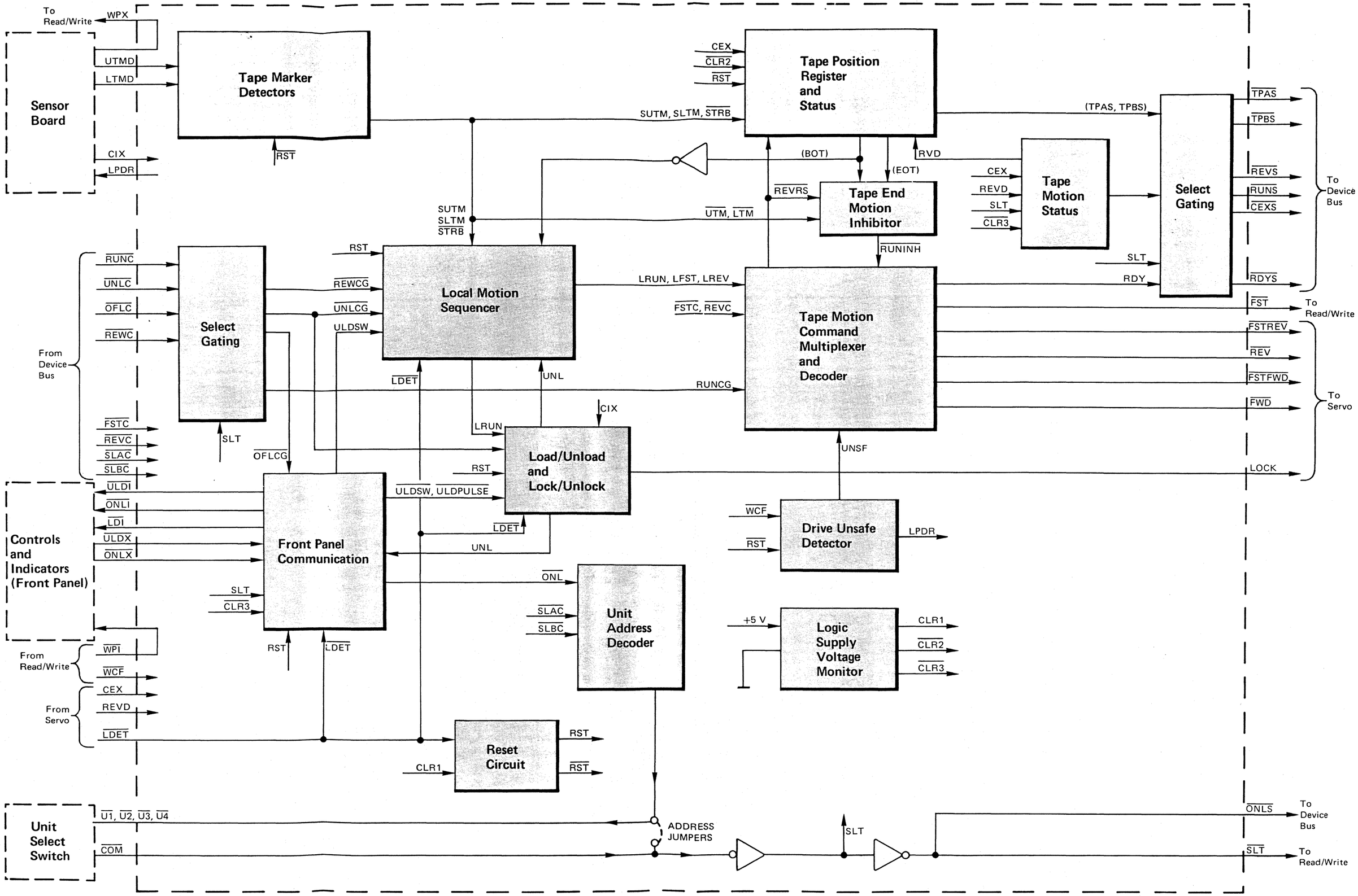


A2 WRITE CIRCUIT
PART OF READ/WRITE BOARD
Block Diagram

TDC 3000
Publ. No. 1381 - 2 - 77

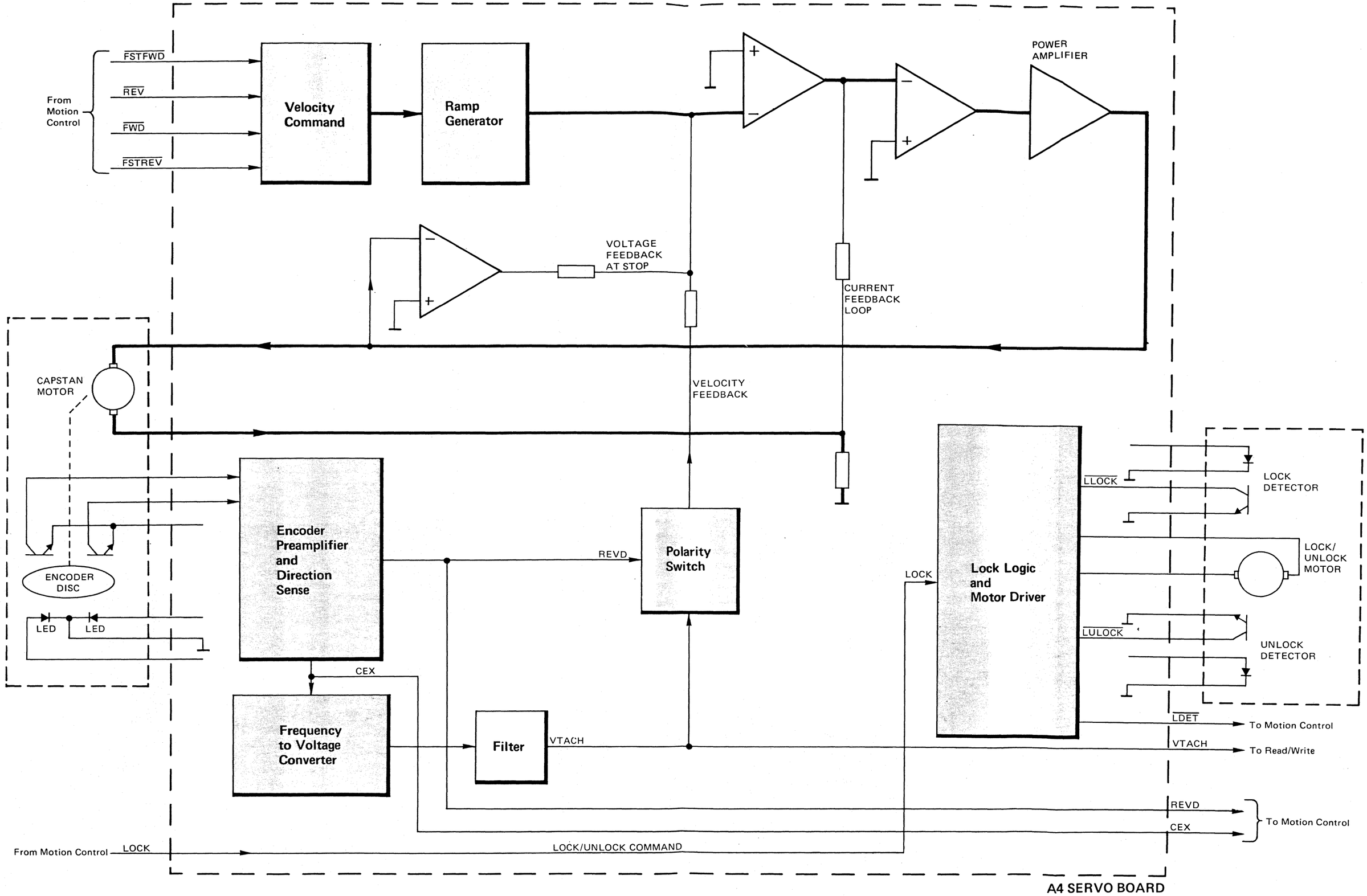
From Write Circuit
ENABLE
WEN
Threshold Voltage
+TH
−TH
PREAMP
Amplitude Comparator
PT
NT
Peak Detector
DAV
DAV
Data Detect (10 Bit Counter)
DD
SLT
DDS
DD
PT
From Servo
VTACH
REVD
From Device Bus
TRAC
TRBC
TRACK 1
TRACK 2
TRACK 3
TRACK 4
READ HEAD
Track Selector Read
Differential Preamplifier
PREAMP
"Gain"
Differentiator
DIFF
Zero Crossing Detector
PT
NT
ZX
Zero Crossing Enable Flip-Flop
REVD
Polarity Switch
ZXE
(Read Data)
To Device Bus
Data Flip-Flop
RD
Parking Oscillator
DAV
Data-Rate Tracking One-Shot
Current Controlled One-Shot
Filter
Amp
"Phase"
DD
One-Shot
One-Shot
Clock Generator
DD
ENABLE
(SLT · FST)
RCLK
PHASE

A2 READ CIRCUIT
PART OF READ/WRITE BOARD
Block Diagram



A3 MOTION CONTROL BOARD
Block diagram

TDC 3000
Publ. No. 1381 - 2 - 77



A4 SERVO BOARD
Block Diagram

Component notation

The component notation is based on the USA-Standard USAS-Y32.16-1968.

Each assembly is assigned an A-number (A1, A2, etc.) which defines the position of the assembly in the equipment (see section: DRIVE DESCRIPTION). This A-number is used as a prefix to form the notation of a component when it is necessary to avoid ambigiuties.

Example: A3R13 = R13 on the board in position A3.

In each circuit diagram the A-number is clearly indicated once, but is omitted from the notation of each component. Instead a second part is added to the component notation to indicate where the component is located on the board.

Example: R13-1M. 1M denotes the component coordinates on the Component Location Drawing and on the printed circuit board.

The component notation is not printed on the printed circuit boards.

Connector notation

Connector notations may include the following letters:

P: Plug, male or female - the moveable part of a mating pair of connectors, or a plug affixed to or being an integral part of an assembly.

J: Socket, male of female – the stationary part of a mating pair of connectors.

JP: Jumper.

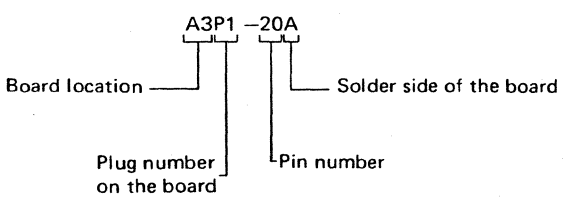
X: Socket, male or female – mating with a plug being affixed to or being an integral part of an assembly.

W: Cable.

A: Connector pin on the solder side of a board.

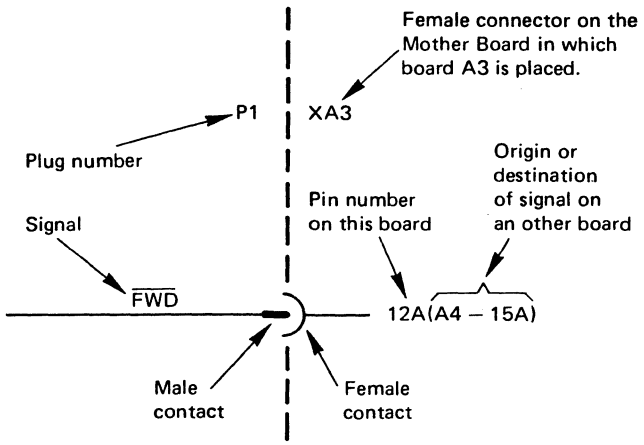
B: Connector pin on the component side of a board.

Examples:



XA3-20: Pin 20 on the socket that board A3 is plugged into.

Example of a connector notation in use on a circuit diagram.



Other connection details

To avoid the circuit diagram being crowded with lines or when there are two or more diagrams of one printed circuit board, many interconnections are merely indicated by the signal mnemonic and an arrow.

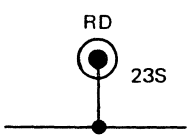
Example: DAV → To another place on the same diagram.

DAV → From another place on the same diagram.

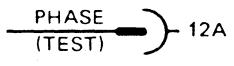
→ To or from another diagram of the same board.

There are also some testpoints on the printed boards. Some of them are pins on the board and some are brought out to the edge connector.

Example:



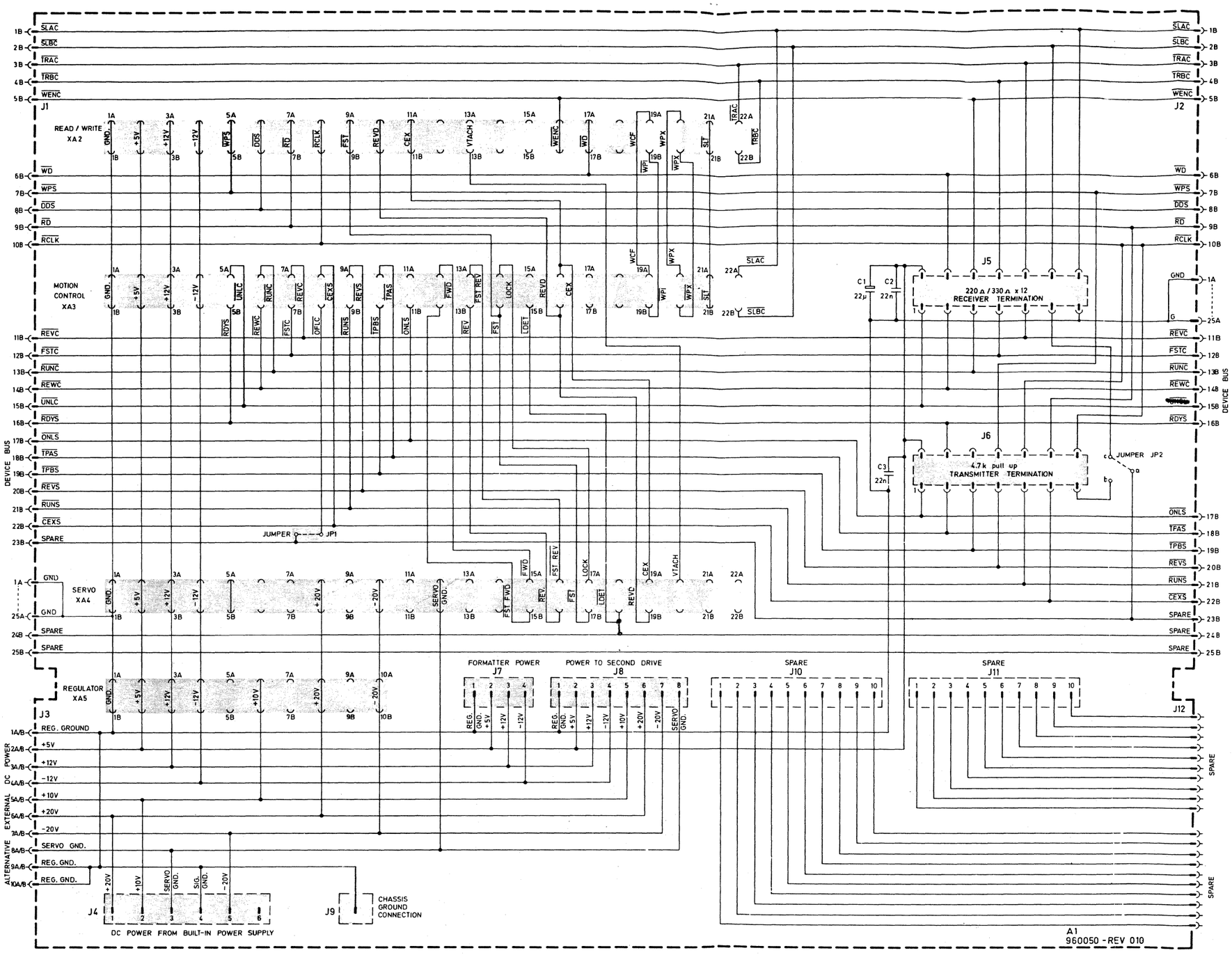
Test pin on the board at co-ordinate 23S.



This testpoint is only used with printed board test equipment.

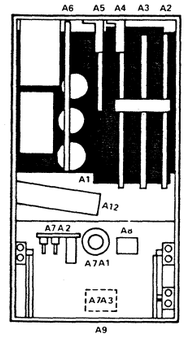
TDC 3000
Publ. No. 1381 - 2 - 77

see also next page



UNLC

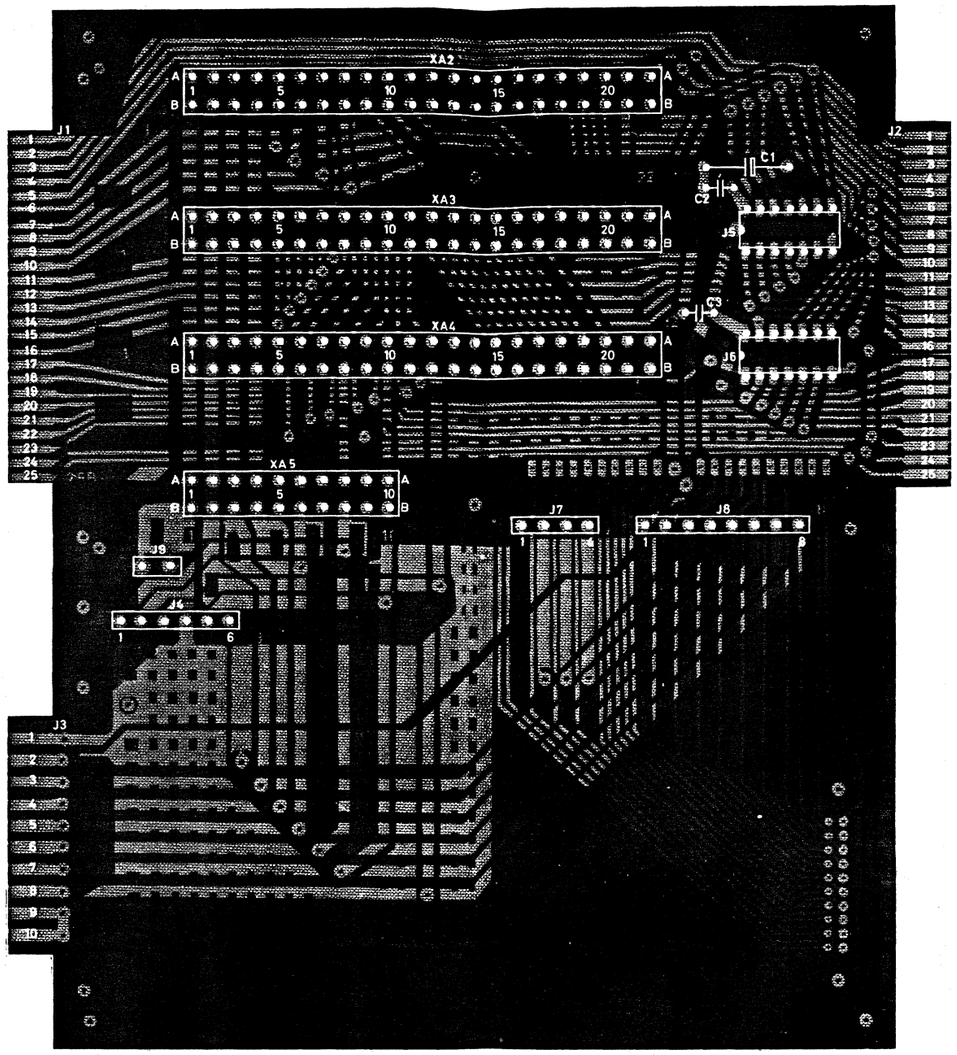
Component Location Drawing and Electrical Parts List see next page.



BACKDATING:

If the revision number (Rev. No.) on the printed circuit board is lower than the revision number on the circuit diagram, see paragraph Backdating Information in the chapter UPDATING.

Position	Name	Part No.	Rev. No.
A1	Mother Board	960050	010



A1 MOTHER BOARD
Component Location

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A1 Mother Board 960050/Rev. 010

Circuit reference No.	Part No.	Description			
Capacitors					
C1	292610	22 uF	-20/+50%	25 V	Electrolytic
C2/C3	252841	0.022 uF	20/100%	40 V	Ceramic 2
If the Mother Board is the last on the bus, then the resistor network should be plugged into J5 and J6 as follows:					
J5	309384	Receiver termination 12 x 220/330 Circuit 899-5-R			Beckman
J6	345942	Transmitter termination 13 x 4.7 kohm Circuit 899-1			Beckman

Part No.	Description		Quantity
342737	IC socket J5 and J6 14 pin	Cambion	2
343916	Spacer, plastic		3
341408	Edge connector 10 pin 3.96 mm	Burndy	1
343441	Edge connector 22 pin 3.96 mm	Burndy	3
308321	Keying	Burndy	3
341056	Connector, male J8 8 pin 3.96 mm	Molex	1
343089	Connector, male J6 6 pin 3.96 mm	Molex	1
344770	Connector, male J7 4 pin 3.96 mm	Molex	1
285346	Faston J9	AMP	1

TDC 3000
Publ. No. 1381 - 2 - 77

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A2 Read/Write Board 960053/Rev. 015

Circuit reference No.	Part No.	Description			
Diodes					
CR1	267488	1N 5234B	Zener	6,2 V	Motorola
CR2–CR12	231203	BA 130			Fairchild
Capacitors					
C1	262374	0.1 uF	20/80%	12 V	Ceramic 2
C2	252841	0.022 uF	20/100%	40 V	Ceramic 2
C3	256676	4.7 uF	-20/+50%	25 V	Tantalum
C4	265390	2.2 uF	-20/+50%	35 V	Tantalum
C5	278759	22 pF	2%	100 V	Ceramic 1
C6	265390	2.2 uF	-20/+50%	35 V	Tantalum
C7	278759	22 pF	2%	100 V	Ceramic 1
C8/C9	252841	0.022 uF	20/100%	40 V	Ceramic 2
C10/C11	252955	100 pF	10%	400 V	Ceramic 2
C12/C13	256676	4.7 uF	-20/+50%	25 V	Tantalum
C14/C15	265390	2.2 uF	-20/+50%	35 V	Tantalum
C16/C17	252841	0.022 uF	20/100%	40 V	Ceramic 2
C18	260779	0.01 uF	10%	250 V	Polyester
C19	251512	1000 pF	10%	50 V	Ceramic 2
C20	354921	270 pF	2%	63 V	Ceramic 1
C21	287782	470 pF	10%	50 V	Ceramic 2
C22	323341	47 pF	2%	63 V	Ceramic 1
C23	354921	270 pF	2%	63 V	Ceramic 1
C24	252841	0.022 uF	20/100%	40 V	Ceramic 2
C25/C26	251512	1000 pF	10%	50 V	Ceramic 2
C27/C28	286101	330 pF	10%	50 V	Ceramic 2
C29	258121	0.047 uF	10%	250 V	Polyester
C30	287078	4700 pF	10%	50 V	Ceramic 2
C31	307422	2700 pF	10%	100 V	Ceramic 2
C32	260779	0.01 uF	10%	250 V	Polyester
C33	255542	0.022 uF	10%	250 V	Polyester
C34	250463	0.033 uF	10%	250 V	Polyester
C35-C38	292610	22 uF	-10/+50%	25 V	Electrolytic
C39-C51	252841	0.022 uF	20/100%	40 V	Ceramic 2
Resistors					
R1-R13 (U24)	345942	13 x 4.7 kohm	Circuit 899-1		Beckman
R14	285102	4.7 kohm	5%	0.33 W	Carbon film
R15	289168	2.2 kohm	5%	0.33 W	Carbon film
R16/R17	287839	820 ohm	5%	0.33 W	Carbon film
R19	285102	4.7 kohm	5%	0.33 W	Carbon film
R20/R21	287839	820 ohm	5%	0.33 W	Carbon film
R23	285102	4.7 kohm	5%	0.33 W	Carbon film
R24/R25	287839	820 ohm	5%	0.33 W	Carbon film

TDC 3000
Publ. No. 1381 - 2 - 77

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A2 Read/Write Board 960053/Rev. 015

Circuit reference No.	Part No.	Description				
R27	285102	4.7 kohm	5%	0.33 W		Carbon film
R28/R29	287839	820 ohm	5%	0.33 W		Carbon film
R31	285102	4.7 kohm	5%	0.33 W		Carbon film
R32	289520	1 kohm	5%	0.33 W		Carbon film
R33	289872	470 ohm	5%	0.33 W		Carbon film
R34	319160	21.5 kohm	1%	0.125 W	± 100 ppm	Metal film
R35	315094	31.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R36	312229	1 kohm	1%	0.125 W	± 100 ppm	Metal film
R37	315094	31.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R38	319160	21.5 kohm	1%	0.125 W	± 100 ppm	Metal film
R39	315094	31.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R40	312229	1 kohm	1%	0.125 W	± 100 ppm	Metal film
R41	315094	31.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R42	289872	470 ohm	5%	0.33 W		Carbon film
R43	285454	2.7 kohm	5%	0.33 W		Carbon film
R44	289520	1 kohm	5%	0.33 W		Carbon film
R45	288112	12 kohm	5%	0.33 W		Carbon film
R46	284513	1 kohm	3006P lin cermet variable			Bourns
R47	288191	330 ohm	5%	0.33 W		Carbon film
R48	286431	10 kohm	5%	0.33 W		Carbon film
R49	289168	2.2 kohm	5%	0.33 W		Carbon film
R50	312229	1 kohm	1%	0.125 W	± 100 ppm	Metal film
R51	315331	2.61 kohm	1%	0.125 W	± 100 ppm	Metal film
R52	319239	681 ohm	1%	0.125 W	± 100 ppm	Metal film
R53	317012	2.87 kohm	1%	0.125 W	± 100 ppm	Metal film
R54	316660	3.48 kohm	1%	0.125 W	± 100 ppm	Metal film
R55/R56	319828	1.62 kohm	1%	0.125 W	± 100 ppm	Metal film
R57-R59	317989	4.64 kohm	1%	0.125 W	± 100 ppm	Metal film
R60/R61	317048	133 kohm	1%	0.125 W	± 100 ppm	Metal film
R62	280944	100 kohm	5%	0.33 W		Carbon film
R63	286079	22 kohm	5%	0.33 W		Carbon film
R64	280944	100 kohm	5%	0.33 W		Carbon film
R66	315525	750 ohm	1%	0.125 W	± 100 ppm	Metal film
R67/R68	318693	3.16 kohm	1%	0.125 W	± 100 ppm	Metal film
R69/R70	289520	1 kohm	5%	0.33 W		Carbon film
R71	285102	4.7 kohm	5%	0.33 W		Carbon film
R72/R73	285181	100 ohm	5%	0.33 W		Carbon film
R74	318262	348 ohm	1%	0.125 W	± 100 ppm	Metal film
R75	316897	42.2 ohm	1%	0.125 W	± 100 ppm	Metal film
R76	286431	10 kohm	5%	0.33 W		Carbon film
R77	280944	100 kohm	5%	0.33 W		Carbon film
R78	289520	1 kohm	5%	0.33 W		Carbon film
R79	313558	10 kohm	1%	0.125 W	± 100 ppm	Metal film
R80	278982	100 kohm	1%	0.125 W	± 100 ppm	Metal film
R81	317127	26.1 kohm	1%	0.125 W	± 100 ppm	Metal film
R82/R83	317989	4.64 kohm	1%	0.125 W	± 100 ppm	Metal film
R84	280799	10 kohm	3006P lin cermet variable			Bourns
R85	287135	3.3 kohm	5%	0.33 W		Carbon film
R86	288191	330 ohm	5%	0.33 W		Carbon film
R87	289872	470 ohm	5%	0.33 W		Carbon film
R88/R89	286431	10 kohm	5%	0.33 W		Carbon film

SPECIFY THIS WHEN ORDERING:

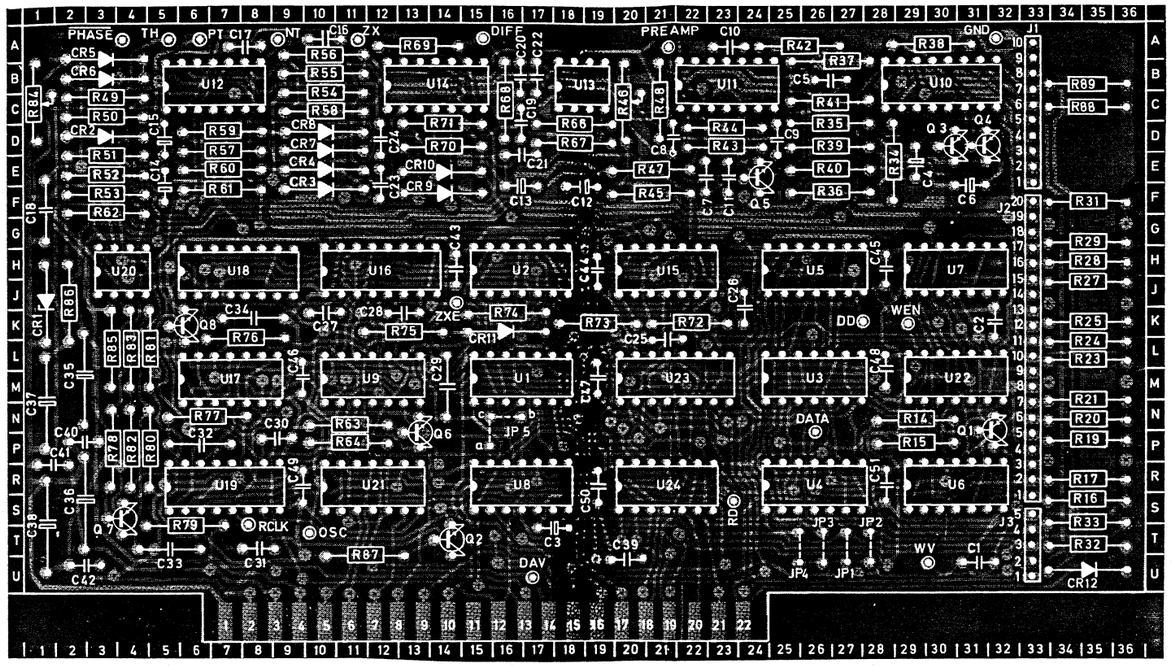
1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A2 Read/Write Board 960053/Rev. 015

Circuit reference No.	Part No.	Description		
Transistors				
Q1	263552	2N 4126 PNP		Motorola
Q2	257438	MPS 6531 NPN		Motorola
Q3/Q4	298170	2N 5087 PNP		Motorola
Q5	260463	2N 5089 NPN		Motorola
Q6	263200	2N 4124 NPN		Motorola
Q7	263552	2N 4126 PNP		Motorola
Q8	263200	2N 4124 NPN		Motorola
Circuits				
U1	293112	SN 7402N		Texas Instr.
U2	299843	SN 74132N		Texas Instr.
U3	293112	SN 7402N		Texas Instr.
U4	286712	SN 7404N		Texas Instr.
U5	305949	SN 7425N		Texas Instr.
U6/U7	291115	SN 7438AN		Texas Instr.
U8	292681	SN 7486N		Texas Instr.
U9	286712	SN 7404N		Texas Instr
U10	341150	CD 4052AE		RCA
U11	273220	TBA 231		SGS
U12	314154	MC 1414L		Motorola
U13	342170	NE 531V		Signetics
U14	287494	MC 1710CL		Motorola
U15	288745	SN 7400N		Texas Instr.
U16	283960	SN 74123N		Texas Instr.
U17	288745	SN 7400N		Texas Instr.
U18	291625	SN 74160N		Texas Instr.
U19	283960	SN 74123N		Texas Instr.
U20	307709	741 TC		Fairchild
U21	291115	SN 7438AN		Texas Instr.
U22	294793	SN 7406N		Texas Instr.
U23	340000	9321		Fairchild
U24 (R1-R13)	345942	13 x 4.7 kohm	899-1	Beckman

Part No.	Description			Quantity
341710	Testpoint		Oxley	17
340352	Connector J3	5 pin 2.50 mm	Molex	1
343132	Connector J1 and J2	10 pin 2.50 mm	Molex	2



A2 READ/WRITE BOARD
Component Location

TDC 3000
Publ. No. 1381 - 2 - 77

WRITE ENABLE AND DATA LINE

The primary input lines to this circuit are WD (Write Data) and WENC (Write Enable Command). The data on the WD line must be phase-encoded. A low voltage on $\overline{WD}$ line causes the tape to be magnetized in the direction of the gap (as prescribed by the interchange standard). The conditions for writing are:

a) SLT is true.

b) The WENC signal (on U1-12) from the Device Bus must be true.

c) The FST signal (U2-13) from the Motion Control must be false, the drive is not at high speed.

d) Input 2 of U1 must be low either via a jumper to ground or via a jumper to REVD. If REVD is connected it must be false, that is the drive is in the forward condition, and write-in-reverse is disabled.

e) WRITE PERMIT is true (high) on U2-1.

When these conditions are fulfilled, WEN (Write Enable) is set true (high), turning on the Write Voltage via U22 by supplying base drive to transistor Q1.

The condition SLT * $\overline{FST}$ (output of U9-2) is used to enable Read Data (RD) and Read Clock (RCLK) when not in Fast mode.

TRACK ADDRESS AND PROTECT COMPARISON

In this circuit the decoded track address lines are compared with the Track Protect lines from the Front Panel, to check whether the addressed track is write protected or not.

On the Front Panel there is one individual Write Protect switch for each of the 4 tracks. On the Read/Write board the tracks can be permanently write protected by jumpers.

When for example track 1 is not protected (T1PX = false and U3-5 is low) the output U3-4 (T1EN) is high, enabling track 1. If track 1 is write protected (T1PX = true and U3-5 = high) the output U3-4 is set low and track 1 is not enabled. The Track Enable 1-4 signals are used to enable the head drivers, permitting the DATA signal to drive the head with the correct polarity and also turning on the erase current. T1-4EN are also used to enable the WPX signal via gates U5, U8, and U1 if the addressed track is not protected.

TRACK DECODER

The encoded track select lines TRAC and TRBC are decoded in the Track Decoder, U23, and one of the outputs will be low when a track is selected. See function table 9321. When for example track 1 is selected (TRAC = TRBC = false) the output $1Y_3$ goes low.

WRITE PERMIT

WRITE PERMIT is true (high) when WPX is true and one of the tracks is enabled (T1EN, T2EN, T3EN, T4EN). WPX is derived from the switch on the Sensor Board, and is true when the WRITE PROTECT plug on the cartridge is in the Unsafe position and the cartridge is inserted. See simplified cartridge drawing.

The WRITE PERMIT signal enables the WENC signal via U2 in the Write Enable and Data Line circuit. It is also used to enable gate U5 in the Track Address and Protect Comparison circuit, which controls the WRITE PERMIT indicator drive Q2.

WRITE PERMIT STATUS (WPS) is derived from WRITE PERMIT via U21 in the Write Permit Status and indicator Circuit.

WRITE AND ERASE DRIVERS

The writing is accomplished in this way: the write voltage (WV) is turned on when WEN is true; Q1 will saturate, forcing the WV to approx. 11.9 V. If for example track 1 is enabled and the DATA signal is high, the outputs of the head lead drivers will be respectively high and low, U6-3 will be high and U6-6 will be low.

When the DATA signal is low, the drivers are reversed and the head current is changed. In addition an optional erase head may be used. This is driven by a separate driver in order to obtain the correct erase current.

If a center-tapped head is used, a single resistor is connected to the center tap. The two other head leads are then in turn driven to ground.

Current will then flow through R17, and the head winding to U6-6. At the same time an "un-used" current will flow through R16.

WRITE CIRCUIT FAULT

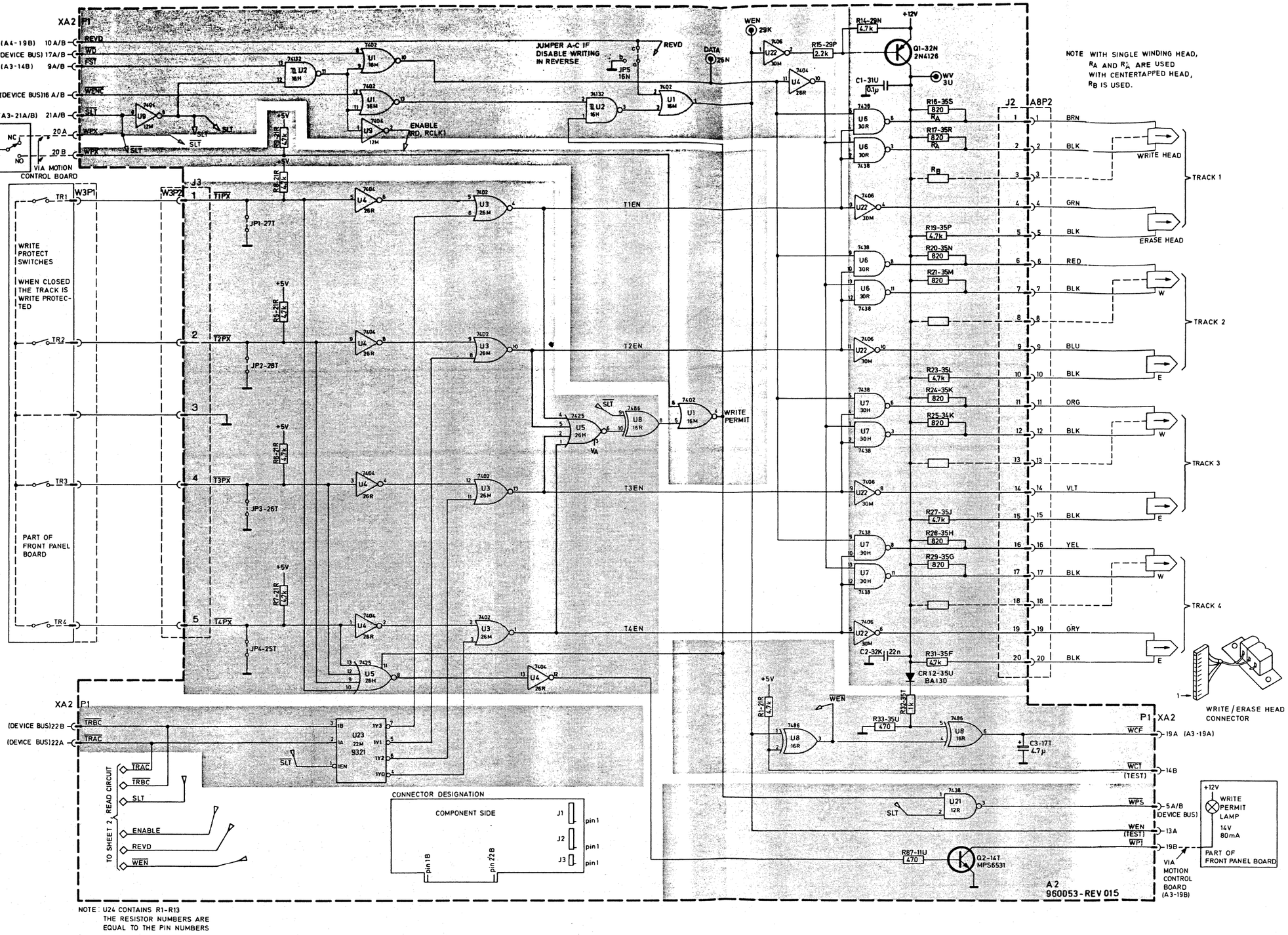
To detect short-and open circuit of the drive transistor Q1, an exclusive-or gate (U8) compares WEN and WV (Write Voltage). If different, WCF (Write Circuit Fault) goes high (true). U8 works as an inverter and the output is the inverted WEN, but for testing purposes, the WCF can be made true by forcing WCT (Write Circuit Test) low.

WRITE PERMIT STATUS AND INDICATOR

When write is permitted, U21 will make WPS (Write Permit Status) true if selected and the driver Q2 will light the write permit indicator on the front panel. If all 4 tracks are individually protected, WPI will not go on even if the drive is not selected.

A2 WRITE CIRCUIT
Part of Read/Write Board

TDC 3000
Publ. No. 1381 - 2 - 77



Component Location Drawing and Electrical Parts List, see page red 2–0 to 2.

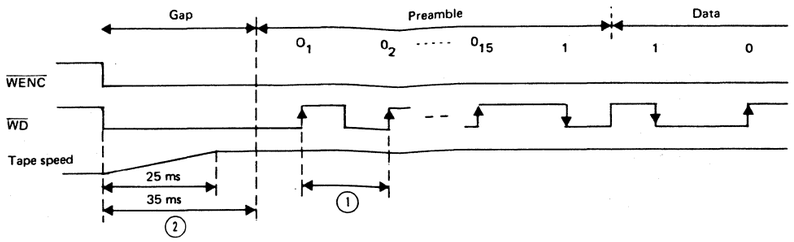
2

BACKDATING:

If the revision number on the printed circuit board is different from the revision number on the circuit diagram, see paragraph Backdating Information in the chapter UPDATING.

See also timing diagrams on page red 2–5.

Position	Name	Part No.	Rev. No.
A2	Write Circuit Part of Read/Write Board	960053	015



Notes:

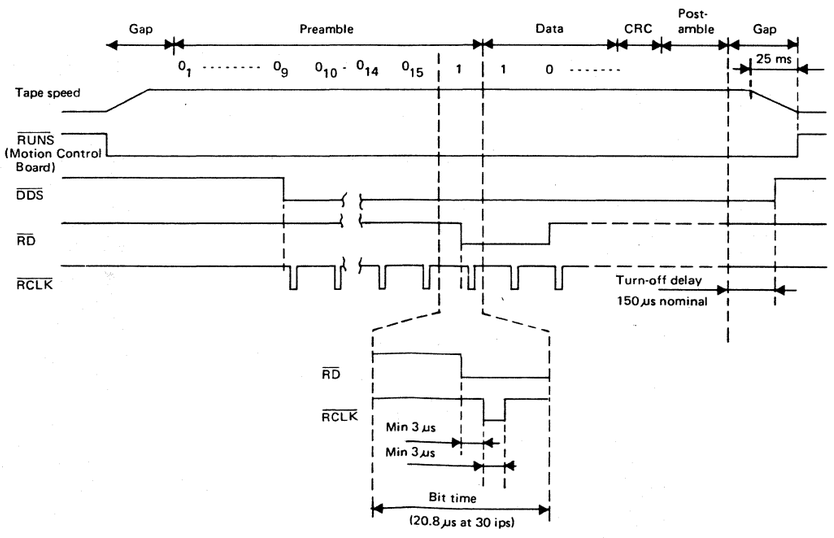
1 Bit time = $\frac{625}{V}$ [µs] where V = tape speed in ips.

At 30 ips the bit time is: $\frac{625}{30} \approx 20.8$ µs.

2 The built-in formatter does not use timing, but the travelled distance of ≅0.65" before initiating the preamble.

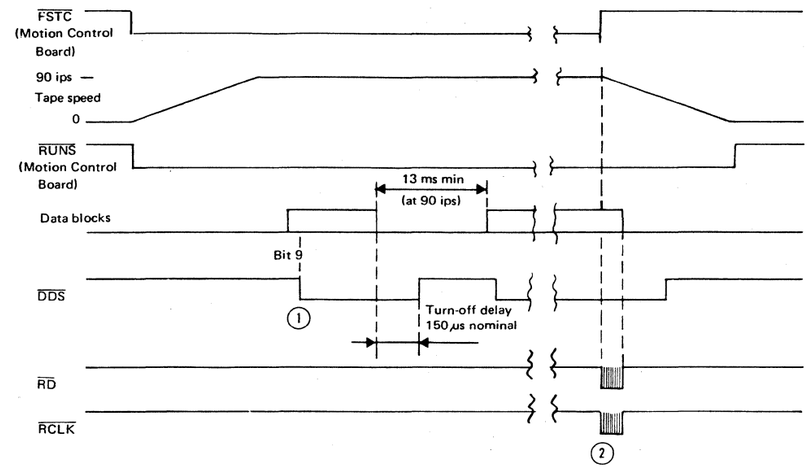
Write Timing, Device Bus

See the circuit diagram and the text blocks for the Write Circuit on page red 2–3 and 4.



Read Timing at Synchronous Speed, Device Bus

See the circuit diagram and the text blocks for the Read Circuit on page red 2–7 and 8.



Notes:

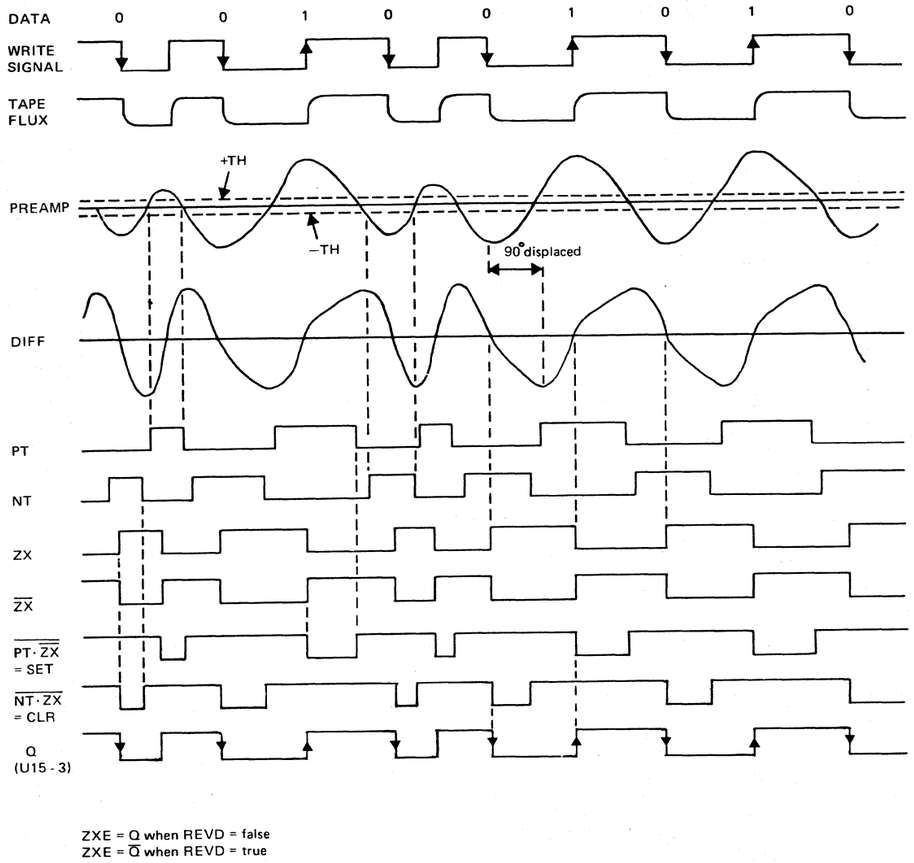
1 DDS goes true on the 9th. bit in the block (if the signal also satisfies the requirements for amplitude and energy).
DDS goes false 150 µs (nominal) after the end of the block.

2 If search is discontinued in the middle of a block, the RD and RCLK lines will be activated.
The signals must then be considered as noise.

Read Timing at Search Speed, Device Bus

See the circuit diagram and the text blocks for the Read Circuit on page red 2–7 and 8.

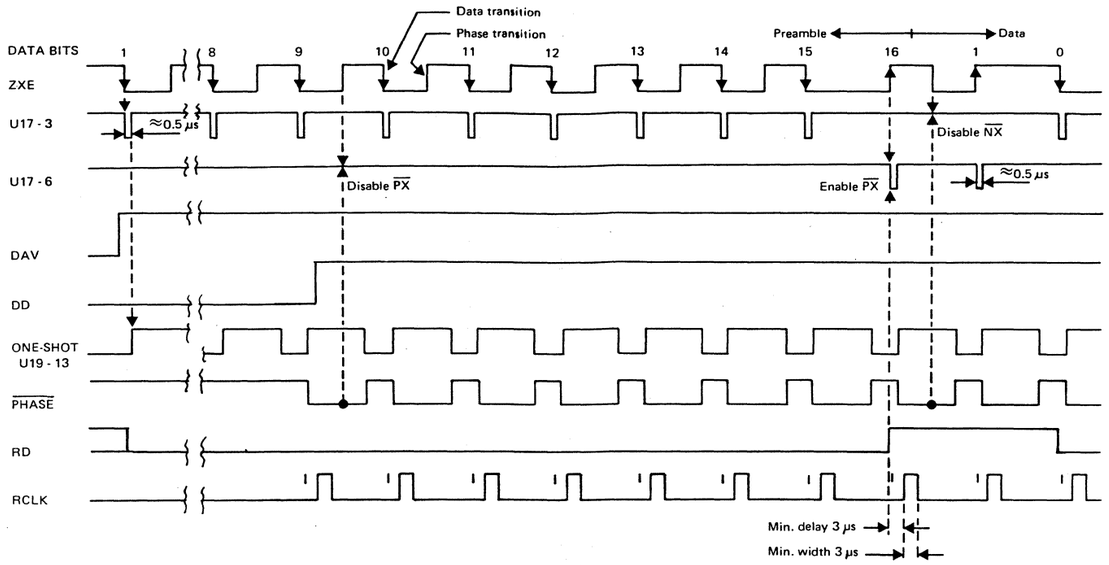
TDC 3000
Publ. No. 1381 - 2 - 77



ZXE = Q when REVD = false
ZXE = $\overline{Q}$ when REVD = true

See the circuit diagram and the text blocks for the Read Circuit on page red 2–7 and 8.

Read Amplifier, Timing Diagram



See the circuit diagram and the text blocks for the Read Circuit on page red 2–7 and 8.

Data Decoder, Timing Diagram

TRACK SELECTOR, READ

The two track select signals, TRAC and TRBC are decoded in the differential 4-channel MOS multiplexer U10. Care must be taken to avoid an input voltage greater than ±5 V.

The decoding is symbolized by a 2 pole, 4 position switch on the schematic.

Function Table

INPUT		TRACK
A	B	
H	H	1
H	L	2
L	H	3
L	L	4

POWER CONNECTIONS

PREAMPLIFIER

The preamplifier consists of the emitter followers Q3 and Q4, the operational amplifier U11, and the output emitter follower Q5. Q3 and Q4 isolate the read heads from the feedback network. U11 provide gain, and Q5 buffers low impedance loads. The gain is adjustable ±5 dB from a nominal gain of 54 dB by means of potentiometer R46. The nominal bandwidth is 130 kHz, high enough to amplify the head signals at the search speed with moderate frequency loss. The amplifier is capable of an input voltage 3 times the standard reference level at 126 ftpmm (flux transitions per mm) (3200 ftpi). This is true for all settings of the gain adjust potentiometer. The nominal output voltage is 5 Vpp at 126 ftpmm and 30 ips (48 kHz).

The circuit ground is isolated from the chassis ground so that the grounding point may be in the drive or in the external device. However, there is capacitive coupling between these two grounds in the heads, and thus the best grounding point is normally in the drive.

DATA DECODER

The purpose of this circuit is to decode the phase-encoded signal processed and validated by the preceding electronics. The phase-encoded signal contains data-transitions and phase-transitions which must be removed before the data is sent to the formatter as Level Data with clockpulses.

The phase-transitions are removed by an inhibit signal (PHASE) that lasts approx. 75% of the bit time. This signal is generated by a one-shot U19-13. The one-shot is current controlled and automatically tracks the data rate from 10 to 30 ips.

The one-shot U19 is triggered from the positive or negative-going data transitions of the ZXE signal. The preamble consists of 15 "zero" bits plus a "one" bit. During the first 9 bits the Data Detect Counter is not full. The DD signal (low) is thus used to reset the positive trigger-one-shot on U16-3. Also, U17-8 is kept high thus enabling gate U17-3. Trigger pulses (0.5 µs) generated (from negative-going transitions in the ZXE signals) by the one-shot U16-5 are or-gated through U17-11 to trigger the main one-shot U19. Thus during the first part of the preamble the circuit is guaranted to be triggered only from the correct transitions of the "zero"-bits.

After DD goes high, the reset to U16-3 is removed, and PX pulses are allowed to be generated. Also, U17-9 (DD) will now enable the U19-13 pulses to generate PHASE at U17-8. PHASE is used to stop the PX or NX trigger pulses (generated from phase-transitions of the ZXE signal) by forcing U17-2 and 5 low during 75% of the bit time.

If a phase-transition does not arrive (for example before the "one"-bit of the preamble), the PHASE signal again goes high and the subsequent PX signal is then enabled to trigger the main one-shot U19.

The Data flip-flop U15-8, U2-6 is triggered by the validated PX and NX pulses in a set-reset mode. In gaps and at power-on the state may be undetermined, but this is of no consequence as the clock pulses are not generated until DD goes true.

THRESHOLD VOLTAGE

The threshold voltage is derived from the tachometer voltage coming from the Servo Board. The tachometer voltage is proportional to the tape speed, and the circuit generates the correct threshold voltage as a percentage of the signal at all speeds.
When WEN (Write Enable) is false the threshold voltage is attenuated by U22. When writing, the output of U22-12 is high, thus the voltage at the TH testpoint is about doubled.

The positive threshold voltage is generated from the tachometer voltage directly. The negative voltage is generated by the inverting amplifier U11.

In stop, the threshold voltage has a hold off of about 80 mV generated by R49, R50, and CR2, so that the comparators are not activated by noise.

DIFFERENTIATOR

This consists of U13 with the differentiating capacitor C19. The high frequency response is controlled so that the two complex poles determined by C20, C21, R66, R67, R68, and the single pole in the preamplifier creates a 3-pole Bessel-type low-pass filter for constant group delay for the two frequencies of the phase encoded signals (See the Read Amplifier, Timing Diagram). Nominal output voltage is 9 Vpp at 48 kHz (30 ips). The output is DIFF.

AMPLITUDE COMPARATOR

This circuit consists of two comparators, U12. The positive and negative peaks of the preamplifier signal are compared against a threshold voltage derived from the tachometer voltage. See Read Amplifier, Timing Diagram. When the positive peaks of the preamplifier signal are above the positive threshold, + TH, the PT output signal of U12 goes high (true). The NT output of U12 is derived in the same way. When the negative peaks of the signal are more negative than the negative threshold voltage, − TH, the NT signal goes high (true).

The PT and NT signals are used to enable triggering of the Zero Crossing Enable flip-flop, and as signals to the Peak Detector. PT is also used as a clockpulse in the 10-bit counter, U18 in the Data Detect Counter.

The comparators have input level protection consisting of diodes CR3 and 4, CR7 and 8, and about 50 mV hysteresis.

ZERO CROSSING DETECTOR

The signal DIFF from the differentiator is limited by CR9 and CR10 to avoid overdriving the comparator U14. The series impedance is kept low (1 kohm) to minimize offset errors. The comparator detects when the signal DIFF crosses through zero. See Read Amplifier, Timing Diagram.

The output, ZX, clocks the Zero Crossing Enable flip-flop U15. When there is no signal from the tape, the comparator is activated by noise.

PEAK DETECTOR

The circuit peak detects the PT and NT signals and DAV (Data Valid) is set true after a single bit. If no more bits arrive within 150 µs (nominal) the DAV signal again goes false, and the Parking Oscillator is activated. DAV is also used to enable the Data Valid Counter U18 in the Data Detect Counter.

ZERO CROSSING ENABLE

This is a Set-Reset flip-flop, U15. When the ZX When PT is high and ZX goes neg, then the flip-flop is set. When ZX goes positive and NT is high, the flip-flop is reset.

This circuit has a high immunity against noise. The signal from the tape must have the correct level and polarity to cause a change in the flip-flop. The output, Q, does not change until both ZX and PT/NT have changed. A noise spike on ZX does not affect the output as long as either PT or NT stays true. See Read Amplifier, Timing Diagram.

POLARITY SWITCH

When the tape is read in reverse, the time-dependant flux-changes have reverse polarity. Since the data decoder is interpreting a given direction of the flux-changes as a 1-bit, the signal polarity must be inverted when in reverse. This is done with an exclusive-or gate U8, controlled by the REVD signal. When REVD is false (low) the output of U8 will follow the output of the Zero Crossing Enable flipflop U15. When REVD is true (high) the signal is inverted.

PARKING OSCILLATOR

When the one-shot, U19 is not triggered, the d.c. level of the amplifier U20 will stabilize at zero, then requiring a long time to achieve correct level when a data block arrives. To avoid this, the parking oscillator is triggering the one-shot when DAV is false (no data valid). The oscillator has a frequency of about 48 kHz (nominal).

DATA DETECT COUNTER

The Data Detect circuit has to detect if the signal is present on the tape. When DAV from the Peak Detector stays true the 10-bits counter starts to count the PT signals. After 9 good bits, the counter is full and latches with the carry-output high. This output is the Data Detect (DD) line. The counter is reset when DAV goes false.

READ CLOCK GENERATOR

The clock pulses (derived from the trigger pulses U17-11) are delayed 3 µs min. (nom. 4 µs) by Q8 and C30, before triggering the one-shot U19. The clock pulses have a pulse width of minimum 3 µs (nom. 4µs) and the data a line RD is stable for at least that time.

The clock generator is disabled until DD goes true after 9 bits, thus ignoring the initial state of the data flip-flop at power turn-on or in gaps.

The read clock is generated by the one-shot U19-5 in the Read Clock Generator. The trigger is delayed by Q8 allowing C30 to charge slowly through R13. The timing (set by C31,R2) is 4 µs nom. (3 µs min.) with a delay of 4 µs nom. (3 µs min.) after the Data flip-flop is set. Thus both transitions of the clock are valid, and this can be used by the formatter.

The automatic adjustment of the pulse length of the PHASE signal to the actual data rate takes place as follows: If the pulse is longer than nominal, the filtered (R82, C34) average d.c. voltage will be higher than the ref. voltage (adjustable by R84). The op-amp U20 amplifies the difference and causes the voltage on the base and emitter of the current source Q7 to change from + 12 V. The current through R79 and thus into the one-shot timing node will then increase. As a result, the timing will end earlier, and the output pulse resume its correct and shorter length.

OUTPUT GATING

The Read Data (RD) and the Read Clock (RCLK) output lines are enabled (ENABLE = true) only when the drive is selected (SLT = true) and in synchronous speed (FST = false).

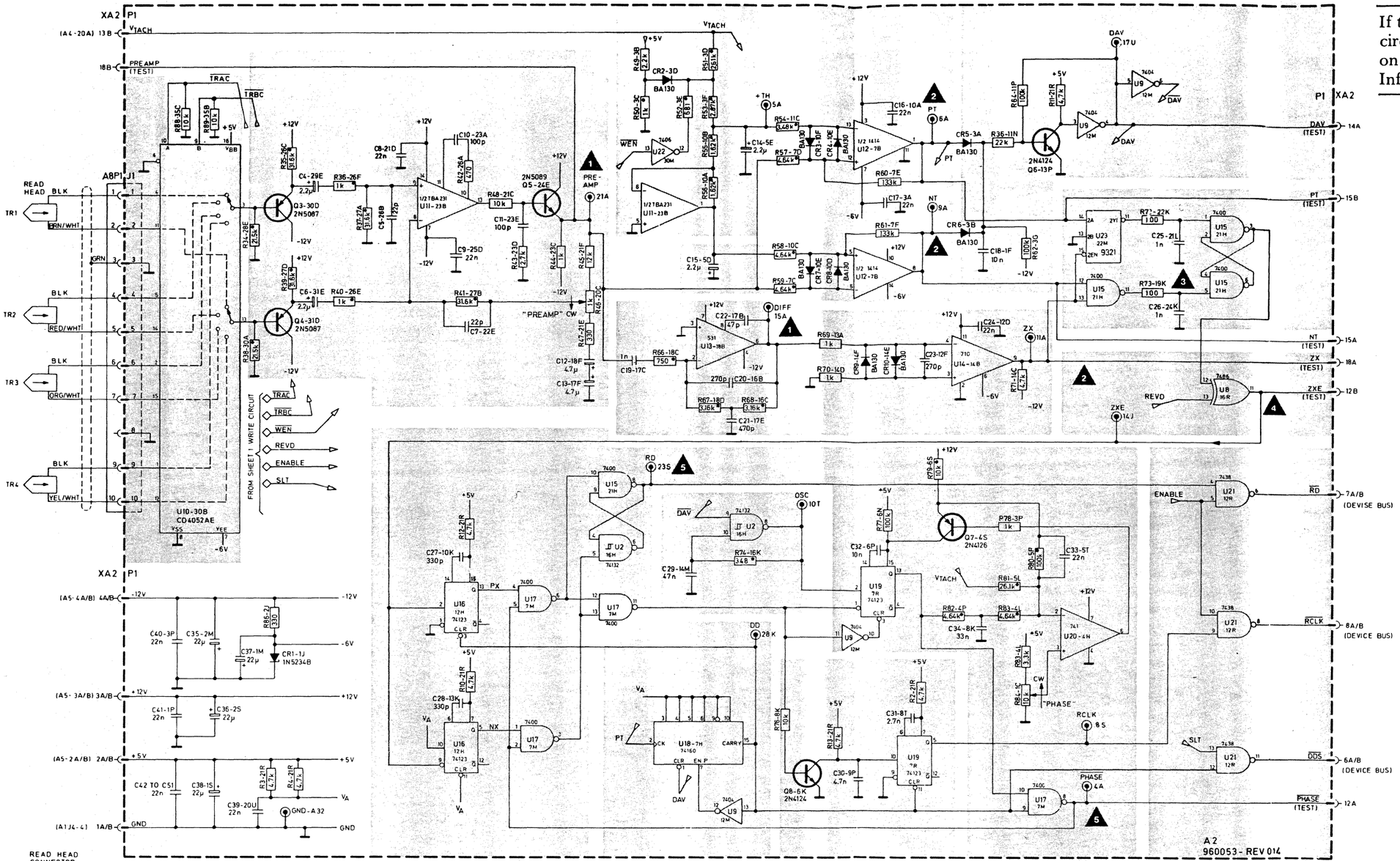
The Data Detect (DD) signal is gated by Select (SLT) and is active at all speeds. DDS (Data Detect Status) is the line output.

A2 READ CIRCUIT
Part of Read/Write Board

TDC 3000
Publ. No. 1381 - 2 - 77

BACKDATING:

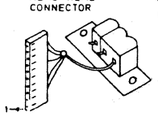
If the revision number (Rev. No.) on the printed circuit board is lower than the revision number on the circuit diagram, see paragraph Backdating Information in the chapter UPDATING.

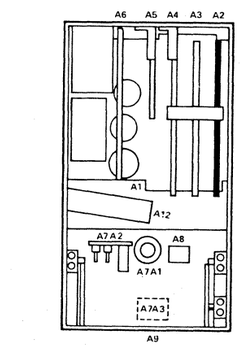


NOTE 1: U24 CONTAINS R1-R13 THE RESISTOR NUMBERS ARE EQUAL TO THE PIN NUMBERS

NOTE 2: ALL RESISTORS ARE CARBON FILM 5% 1/4 W, EXCEPT THOSE MARKED ▭ WHICH ARE METAL FILM 1%, 1/8W, 100 p.p.m.

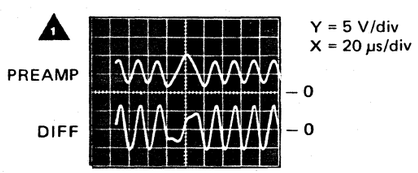
READ HEAD CONNECTOR



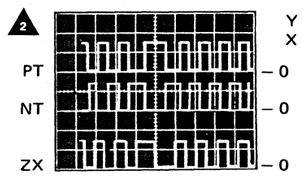


Component Location Drawing and Electrical Parts List, see red 2–0 to 2.

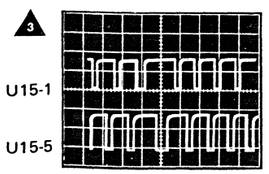
See also timing diagrams on page red 2–5 and 6.



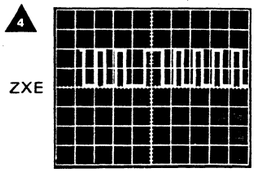
Y = 5 V/div
X = 20 µs/div



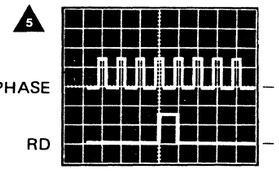
Y = 2 V/div
X = 20 µs/div



Y = 2 V/div
X = 20 µs/div



Y = 2 V/div
X = 20 µs/div



Y = 2 V/div
X = 20 µs/div

Position	Name	Part No.	Rev. No.
A2	Read Circuit Part of Read/Write Board	960053	014

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A3 Motion Control Board 960052/Rev. 012

Circuit reference No.	Part No.	Description			
Diodes					
CR1	342033	1N 5228B	Zener 3.9 V		Motorola
CR2/CR3	231203	BA 130			Fairchild
CR4	350833	AA 135			Telefunken
CR5/CR6	231203	BA 130			Fairchild
CR7/CR8	350833	AA 135			Telefunken
Capacitors					
C1	258493	0.01 uF	-20/+100%	40 V	Ceramic 2
C2	287782	470 pF	10%	50 V	Ceramic 2
C3	275757	47 uF	-20/+50%	6.3 V	Tantalum
C4	252913	2200 pF	10%	50 V	Ceramic 2
C5	254830	0.47 uF	20%	100 V	Polyester
C6	308564	6.8 uF	± 20%	20/25 V	Tantalum
C7	251512	1000 pF	10%	50 V	Ceramic 2
C8/C9	292610	22 uF	-20/+50%	25 V	Electrolytic
C10/C11	279672	680 pF	10%	50 V	Ceramic 2
C12	270447	1 uF	-20/+50%	35 V	Tantalum
C13/C14	262374	0.1 uF	20/80%	12 V	Ceramic 2
C15	287782	470 pF	10%	50 V	Ceramic 2
C16-C29	252841	0.022 uF	20/100%	40 V	Ceramic 2
C30	292610	22 uF	-20/+50%	25 V	Electrolytic
Resistors					
R1	295626	390 ohm	5%	0.33 W	Carbon film
R2	287135	3.3 kohm	5%	0.33 W	Carbon film
R3	289168	2.2 kohm	5%	0.33 W	Carbon film
R4/R5	285102	4.7 kohm	5%	0.33 W	Carbon film
R6	288543	220 ohm	5%	0.33 W	Carbon film
R7	286079	22 kohm	5%	0.33 W	Carbon film
R8/R9	289520	1 kohm	5%	0.33 W	Carbon film
R10	291424	15 ohm	5%	0.33 W	Carbon film
R11/R12	285102	4.7 kohm	5%	0.33 W	Carbon film
R13	289441	47 kohm	5%	0.33 W	Carbon film
R14	294786	47 ohm	5%	0.33 W	Carbon film
R15	288543	220 ohm	5%	0.33 W	Carbon film
R16	289872	470 ohm	5%	0.33 W	Carbon film
R17	286431	10 kohm	5%	0.33 W	Carbon film
R18	295626	390 ohm	5%	0.33 W	Carbon film
R19-R22	289441	47 kohm	5%	0.33 W	Carbon film
R23	294434	8.2 kohm	5%	0.33 W	Carbon film
R24	289872	470 ohm	5%	0.33 W	Carbon film

3

Electrical Parts List
A3 Motion Control Board
see next page.

TDC 3000
Publ. No. 1381 - 2 - 77

SPECIFY THIS WHEN ORDERING:

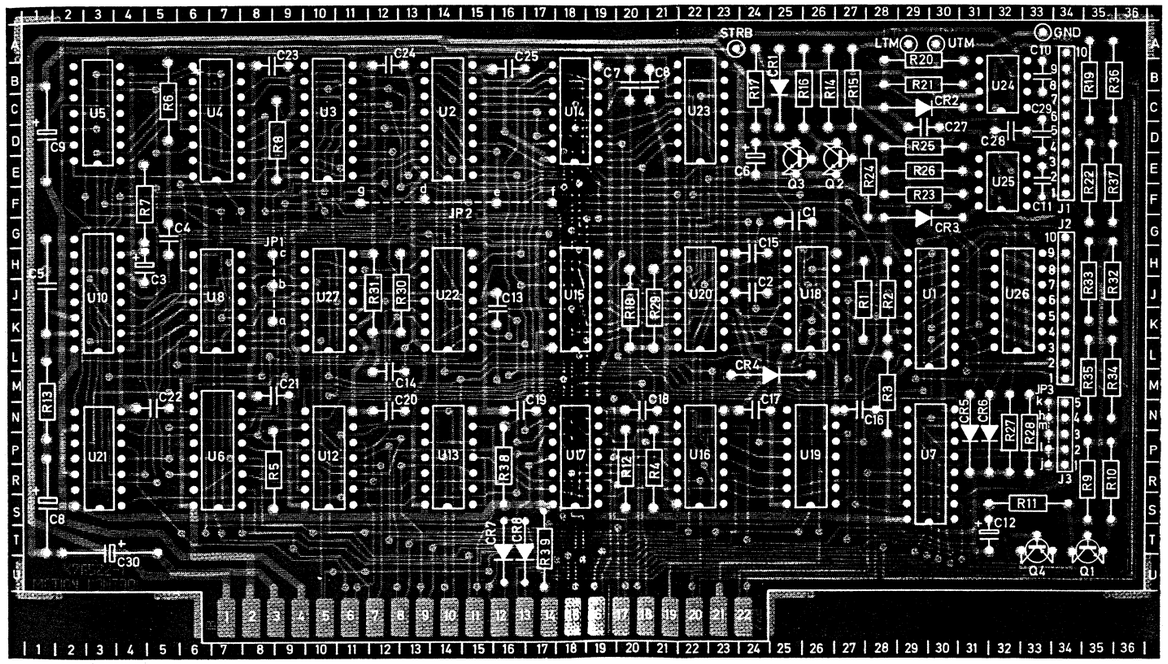
1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A3 Motion Control Board 960052/Rev. 012

Circuit reference No.	Part No.	Description
R25/R26	289441	47 kohm 5% 0.33 W Carbon film
R27	280944	100 kohm 5% 0.33 W Carbon film
R28	285102	4.7 kohm 5% 0.33 W Carbon film
R29	295626	390 ohm 5% 0.33 W Carbon film
R30	289168	2.2 kohm 5% 0.33 W Carbon film
R31	287135	3.3 kohm 5% 0.33 W Carbon film
R32	285102	4.7 kohm 5% 0.33 W Carbon film
R33	289520	1 kohm 5% 0.33 W Carbon film
R34/R35	285102	4.7 kohm 5% 0.33 W Carbon film
R36	294434	8.2 kohm 5% 0.33 W Carbon film
R37	289872	470 ohm 5% 0.33 W Carbon film
R38	285102	4.7 kohm 5% 0.33 W Carbon film
R39	294434	8.2 kohm 5% 0.33 W Carbon film
Transistors		
Q1/Q2	263200	2N 4124 NPN Motorola
Q3	257438	MPS 6531 NPN Motorola
Q4	263552	2N 4126 PNP Motorola
Circuits		
U1	315526	SN 74279N Texas Instr.
U2	343714	SN 74194N Texas Instr.
U3	332278	SN 74109N Texas Instr.
U4	314887	SN 74153N Texas Instr.
U5	291352	SN 7474N Texas Instr.
U6	292711	SN 74157N Texas Instr.
U7	340000	9321 AMD
U8	291352	SN 7474N Texas Instr.
U10	283960	SN 74123N Texas Instr.
U12	292056	SN 7432N Texas Instr.
U13	291115	SN 7438AN Texas Instr.
U14	288745	SN 7400N Texas Instr.
U15	293112	SN 7402N Texas Instr.
U16/U17	291115	SN 7438AN Texas Instr.
U18	299843	SN 74132N Texas Instr.
U19	286712	SN 7404N Texas Instr.
U20	299060	SN 7414N Texas Instr.
U21	293112	SN 7402N Texas Instr.
U22	292760	SN 7410N Texas Instr.
U23	291079	SN 7408N Texas Instr.
U24/U25	298249	UA 301A/U9T Fairchild
U26	288393	SN 7417N Texas Instr.
U27	291352	SN 7474N Texas Instr.

Part No.	Description	Quantity
341710	Testpoint Oxley	4
340352	Connector J3 5 pin 2.50 mm Molex	1
343132	Connector J1 and J2 10 pin 2.50 mm Molex	2



A3 MOTION CONTROL BOARD
Component Location

TAPE MOTION STATUS

Online status (ONLS) is derived from SLT via gate U13. When the unit is addressed and online, SLT will be made true, making ONLS true, indicating online. The Reverse Status (REVS) signal is derived from REVD, (from the Servo) and Tape Running (TRUN) via gate U18. When REVD is true, indicating reverse motion, and TRUN is true, indicating tape running, the REVS signal will be made true, which indicates reverse tape motion. When REVD is false, indicating forward motion, and TRUN is true indicating tape running, REVS will be made false, indicating forward tape motion. The Run Status (RUNS) signal indicates that the tape is moving. RUNS is generated in this way: the monostable U10 and the D-flip-flop U27 are used to determine the time between the positive CEX edges. R13 and C5 determine the pulse width of U10 at 6.2 ms. The positive edge of CEX is used to trigger U10 and to clock U27. U10 is retriggable and the output (RUNPULSE) will stay true if the time till the next positive CEX edge is less than 6.2 ms, which is equivalent to a tape speed of 0.02 m/s (0.8 ips), and the TRUN will go true making RUNS true. See Run Status Detector, Pulse Diagram. The capstan encoder zero crossing status (CEXS) is derived from CEX via U16.

TAPE MARKER DETECTOR

This circuit detects signals UTMD and LTMD from the photo-transistors on the Sensor Board, and the signals must be above a threshold of 300 mV to be detected. UTM and LTM are normally false, and at BOT (Beginning of Tape), UTMD and LTMD will make UTM and LTM true. When EOT (End of Tape) is detected, the LTM is true, and when LP (Load Point) and EW (Early Warning) is detected, the UTM is true. Two R-S latches, U1, store the last detected hole configuration. When RST is true, (Power turn on) and on the leading edge of UTM and LTM, the latches are reset. See Tape Marker Detector Pulse Diagram. UTM and LTM will then set the latches if the tape marker holes are present. A negative strobe pulse (STRB) is generated on the trailing edge of the UTM and LTM signals, and is used to clock the Tape Position Register (TPR) and STRB is also used to clock U5 and U8 in the Local Motion Sequencer. The STRB pulse is 0.4 µs.

TAPE POSITION REGISTER

The tape position register (TPR) is a 4-bit bidirectional shift register U2. S_0 and S_1 are the control inputs of TPR. STRB and CLR2 clock TPR via U23. RST resets TPR. If no cartridge is inserted the RST signal will stay true and the TPR will be reset to 0000. If a cartridge is inserted, the RST signal will only be set true by CLR1. The control inputs (S_0 and S_1) are controlled by REVD and TRUN via RVD, and by LTM via U14. When the tape moves forward, shift right is commanded, S_0 = high, S_1 = low. Reverse tape motion shift left is commanded, S_0 = low, S_1 = high. These commands are cancelled if a lower tape mark is detected, making LTM true. LTM makes $S_0 = S_1$ = high, which commands TPR for a parallel load at the next STRB pulse. The parallel data inputs are derived from the detected tape marker (SUTM and SLTM) and the detected tape motion direction via gate U23. The parallel load takes place when the BOT or EOT tape markers are detected. TPR is now "synchronised" on BOT or EOT marker. If the content of the TPR is different from the actual tape position, this will be corrected when the first BOT or EOT is detected. The "high" signal on the TPR shift right serial input (DR) will be clocked into the register on the positive going edge of the CLR2 pulse. The TPR now contains 1000 which indicates the "on tape" status. See Tape Position Register, State Diagram and Tape Position Status, Sequence Diagram. The Ready Status (RDY) is true when the Q_A output of the TPR is high and the A-input is selected in The Tape Motion Command Multiplexer.

LOGIC SUPPLY VOLTAGE MONITOR

See Power turn-on, Pulse Diagram. This circuit generates the three power turn-on signals: CLR1, CLR2, and CLR3. These signals are used to set the rest of the logic circuits to the initial state. The logic supply voltage level is monitored and if this voltage falls below 4.6 V, nominal, the logic circuits are set to the initial state and will be held in this state until the logic voltage is within the normal limits. In normal operation CLR1, 2, and 3 are false.

POWER CONNECTIONS

LOCAL MOTION SEQUENCER

The input signals to the 4-1 multiplexer, U4, are derived from UTM and LTM in the "Tape Marker Detector", and from UNL coming from the "Load/Unload" circuit U8. The output signals control the "local" fast (LFST) via U5, output 6, and the "local" reverse (LREV) via U5 output 9. By "local" is meant locally generated command in the Motion Control. The "local" stop (LSTOP) is derived from the tape markers, the load/unload commands (UNL), and the state of the local commands LFST and LREV via gates U14, U22, and flip-flop U8. The "local" run (LRUN) flip-flop U27 is set by LSTOP and reset by lock detected (LDET). The clock pulse to U27 is derived from REWC, UNLC, or ULDSW. U5 and U8 are clocked on the trailing edge of the strobe pulse (STRB) derived from UTM and LTM. A strobe pulse will be generated every time a hole configuration is detected (see Tape Marker Detector, Pulse Diagram). The outputs, LFST and LREV are used to select one of the inputs, 1D0-1D3 and 2D0-2D3 of U4. See Rewind, Load/Unload Sequence Diagram and Rewind, Load/Unload, State Diagram.

TAPE MOTION COMMAND MULTIPLEXER

This circuit has two sets of inputs, A and B, four of each. The Device Bus commands FSTC, REVC, and RUNCG are the A-input signals to U6. The local commands in the Motion Control LFST and LREV are the B-input signals. LRUN is used to select the A- or B-inputs. When LRUN is true, the B-inputs are selected. When LRUN is false, the A-inputs are selected. The enabling input is derived from UNSF from the Drive Unsafe Detector. The RDY output signal is gated through U17 in the Tape Position Status and is the information to the Formatter and Input/Output Controller that the Motion Control is ready for commands via the Device Bus. RDYS goes false when LRUN is true.

TAPE END MOTION INHIBITOR

The tape motion inhibit signal, RUNINH, is generated if the photo transistors are continously illuminated (tape has run off the hub The outputs, U16-6-8 and the emitter of Q4 are connected together in a "wired OR" gate, i.e. whenever one of the three outputs is low, RUNINH will be true. The output, RUN on U14-11 in the Tape Motion Command Decoder, will then be false. When the BOT marker is sensed in reverse tape motion, Q_D on U2-12 in the Tape Position Register is set high. The false REVRS is inverted by U19, and RUNINH will be forced true via U16, output 6. When the EOT marker is sensed in forward tape motion, Q_C of the TPR is set high. The REVRS signal is false in forward tape motion, and RUNINH will then be true via U16, output 8. When a pulse on the base of Q4 is longer than the normal UTM and LTM signal pulses, Q4 will conduct after a delay, depending on C12 and R27.

TAPE POSITION STATUS

The flip-flop U3 generates the "at LP" status. When no cartridge is inserted and power is turned on, U3 is reset by the low Q_A output of TPR. If the cartridge is in place when power is turned on, U3 is set by CLR3, and TPAS is true via the gates U21 and U13, indicating the "on tape" status. This means that the tape is between LP and EW.
CEX clocks U3 and when a forward command is detected by U23 and U3 clear input is high, U3 will be clocked, making output U21-1 low. U3 will be held in this state. TPAS stays true until the TPR output Q_C goes high (EOT) or the output Q_A goes low (LP). TPBS is set when the Early Warning (EW) marker is sensed going forward, and reset when the EW marker is sensed going in reverse. The TPBS signal is generated directly from the Q_B output of TPR. See Tape Position Status, Sequence Diagram.

TAPE MOTION COMMAND DECODER

This is a two-line to four-line decoder. When RUN is false no tape motion is permitted, and all the outputs are set false. When RUN is true, only one of the outputs is true depending on the inputs.

FRONT PANEL COMMUNICATION CIRCUIT

The front panel consists of the ONLINE and the REWIND/UNLOAD push buttons, and the indicator lamps: LOADED, WRITE PERMIT, ON-LINE, and UNLOAD. When the ONLINE button is pushed, it makes ONLX true, and the output U1-9 is set high and stays high as long as the button is pushed. The positive edge of the output U1-9 clocks the ONLINE/OFFLINE flip-flop U3. If the J-input U3-14 is set high, the flip-flop will toggle when clocked. The J-input of U3 is either held high (jumper b-c from PU), or it is controlled by the SLT signal via jumper a-c. If the jumper a-c is used it is not possible to set the recorder off-line from the front panel when the unit is selected. UNL and RST will set U3 via U15. The recorder will be forced off-line (ONL false) when U8 is set, or when RST is true. The clear input of U3 can be connected in three ways, JP2 with connection d-g, e-g, or f-g. d-g connects it to the logical "one" state (+ 5 V via PU) and has no effect, giving off-line at power turn on. Jumper e-g from CLR3 resets U3 at power turn on, making ONL = true = online. Jumper f-g connects LDET which clears U3 and the recorder goes online, when a cartridge is inserted. When the cartridge is removed U3, and ONL is set false by RST via U15. When jumper f-g is used, the ONLINE push button has no effect. When the REWIND/UNLOAD button is pushed, ULDX is made true. If ONL is true at the set input U1-3, ULDSW is made false, and the ONL inhibits the REWIND/UNLOAD button from generating a ULDSW pulse. If ONL is false, the push-button is enabled, and ULDSW is made true and stays true as long as the button is pushed. The leading edge of ULDSW triggers monostable U10. R7 and C3 set U10 to approx. 0.3 second.
At the monostable timeout, the trailing edge of ULDPULSE clocks the Unload flip-flop U8, and if the REWIND/UNLOAD button remains pushed and LRUN is true, U8 is set. This indicates that an unload operation is wanted. If the button is not pushed at the monostable time-out, the D-input of U8 is low, and U8 remains reset, indicating that a rewind operation is wanted.

RESET CIRCUIT

When no cartridge is inserted, LDET is false, making RST true. When the cartridge is inserted, the RST will only be pulsed by CLR1. The RST signal is used to reset circuits on this board.

LOAD/UNLOAD AND LOCK/UNLOCK

This circuit generates the UNL and LOCK signals. The Unload flip-flop U8 is always cleared by the leading edge of ULDPULSE via the network R6, C4, and U15 when the REWIND/UNLOAD button is pushed, cancelling any possible Unload command. Then it might be set or not, depending on how long the button remains pushed. When an unload operation is wanted, U8 is either set by the UNLCG from U12, or by the monostable timeout in U10 if an unload command is given from the front panel, making UNL true. When UNL is true and LRUN is false the LOCK signal will be made false via U17 and an unlock command is given to the Servo. When a cartridge is inserted the Cartridge Inserted Switch (CIX) signal goes high making LOCK true, and a lock command is given.

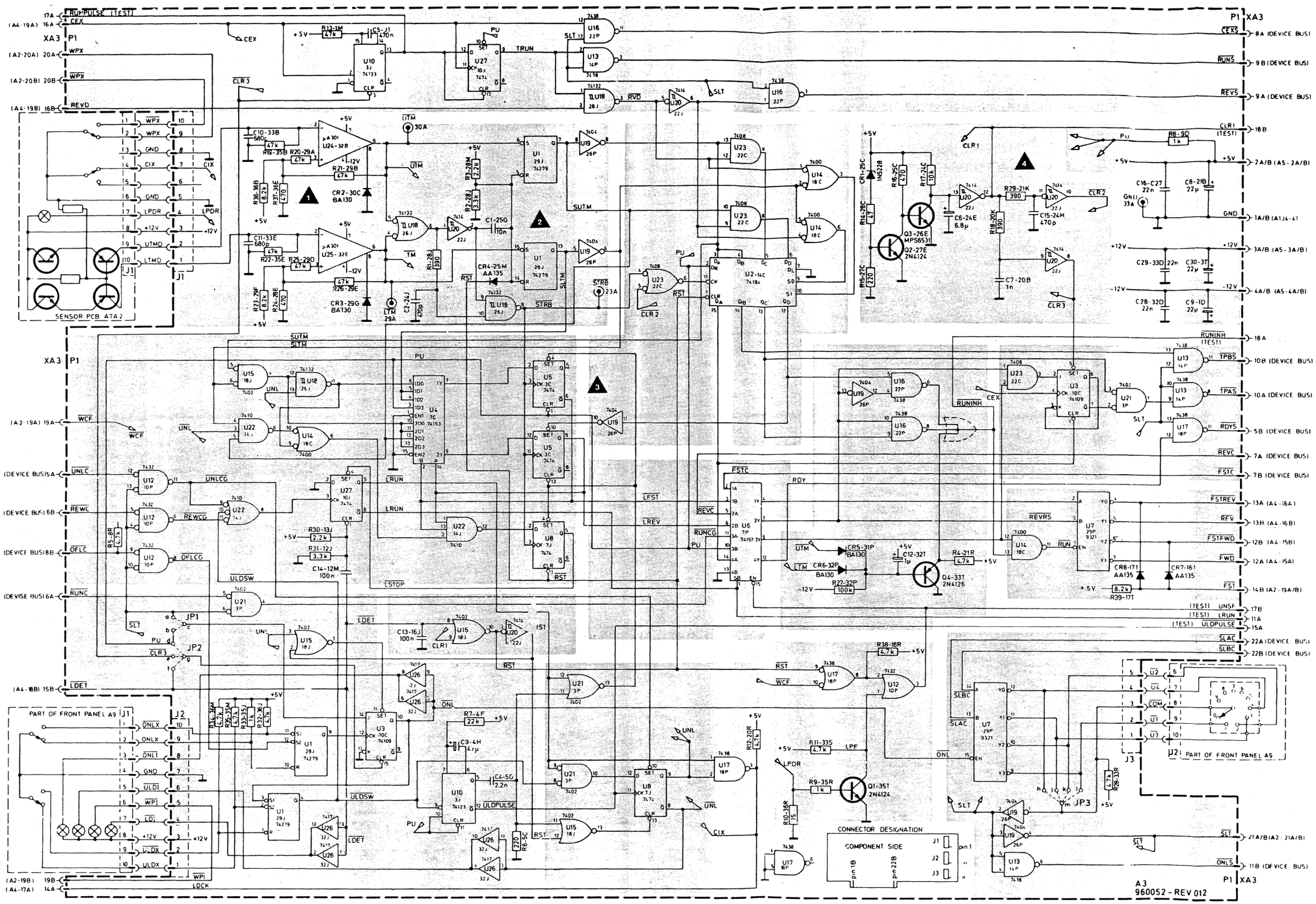
DRIVE UNSAFE DETECTOR

The run inhibit signal, drive unsafe (UNSF), is applied to the enable input (EN) of the Tape Motion Command Multiplexer (U6 pin 15). When UNSF is true, all outputs of U6 are forced low, making RUN false which inhibits all tape motion. Also RDYS is made false. UNSF will be true when the Write Circuit Fault (WCF) is true, RST is true, or Lamp Fail (LPF) is true. LPF is derived from the current in the tape marker detector lamp on the Sensor Board. This current produces a voltage drop across R10 giving base drive to Q1, and LPF is made false. If the lamp current is interrupted, Q1 is cut off and LPF is pulled high (true) making UNSF true, which stops all tape motion.

UNIT ADDRESS DECODER

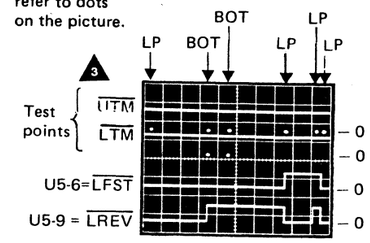
The input signals to the Decoder are Unit Select Line A (SLAC) and unit Select Line B (SLBC) command lines. The address specified by these signals is decoded and compared with the address given from the Unit Address Selector on the front panel. If one of the outputs is low and it is connected to COM, SLT will be true and the unit will be selected. One of the outputs of U7 can be connected to COM in two ways, either one of jumpers JP3 or by the unit address selector on the front panel. The SLT signals are used to gate the device bus input signals into the selected recorder and to connect the output drivers to the device bus.

TDC 3000
Publ. No. 1381 - 2 - 77
76709



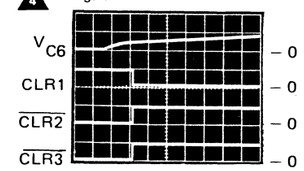
BOT and LP refer to dots on the picture.

Rewind Sequence

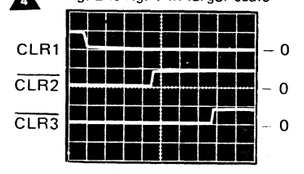


Power Turn-On

▲4 fig. 1

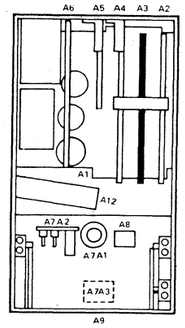


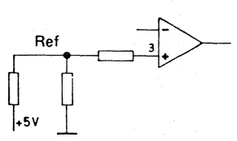
▲4 fig. 2 is fig. 1 in larger scale



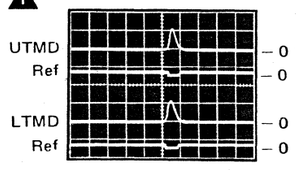
BACKDATING:

If the revision number(Rev.No.) on the printed circuit board is lower than the revision number on the circuit diagram, see paragraph Backdating Information in the chapter UPDATING.

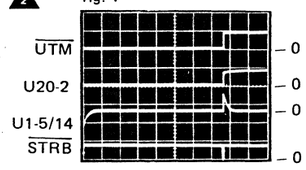




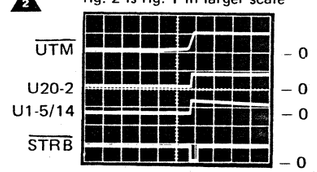
▲1



▲2 fig. 1

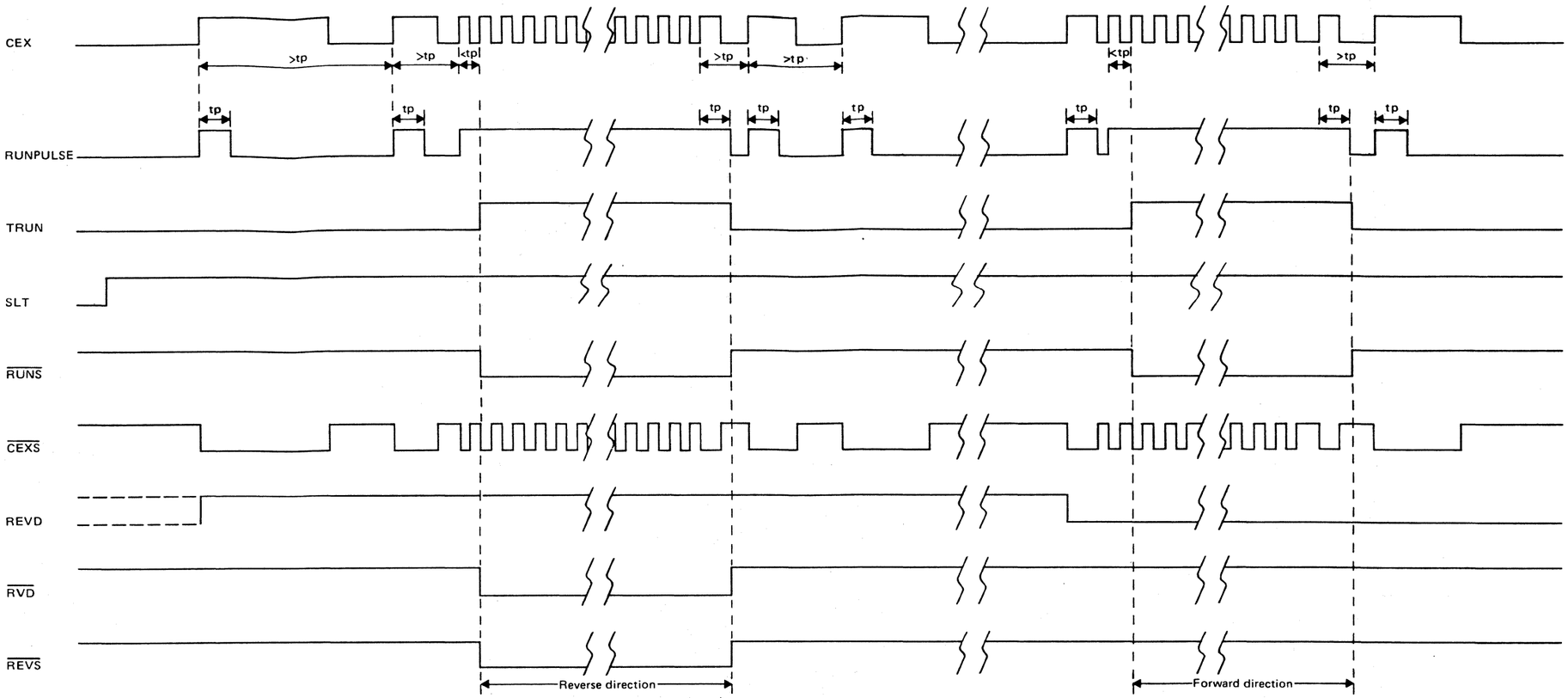


▲2 fig. 2 is fig. 1 in larger scale



Component Location Drawing and Electrical Parts List see page red 3–0 and 1.

Position	Name	Part No.	Rev. No.
A3	Motion Control Board	960052	012

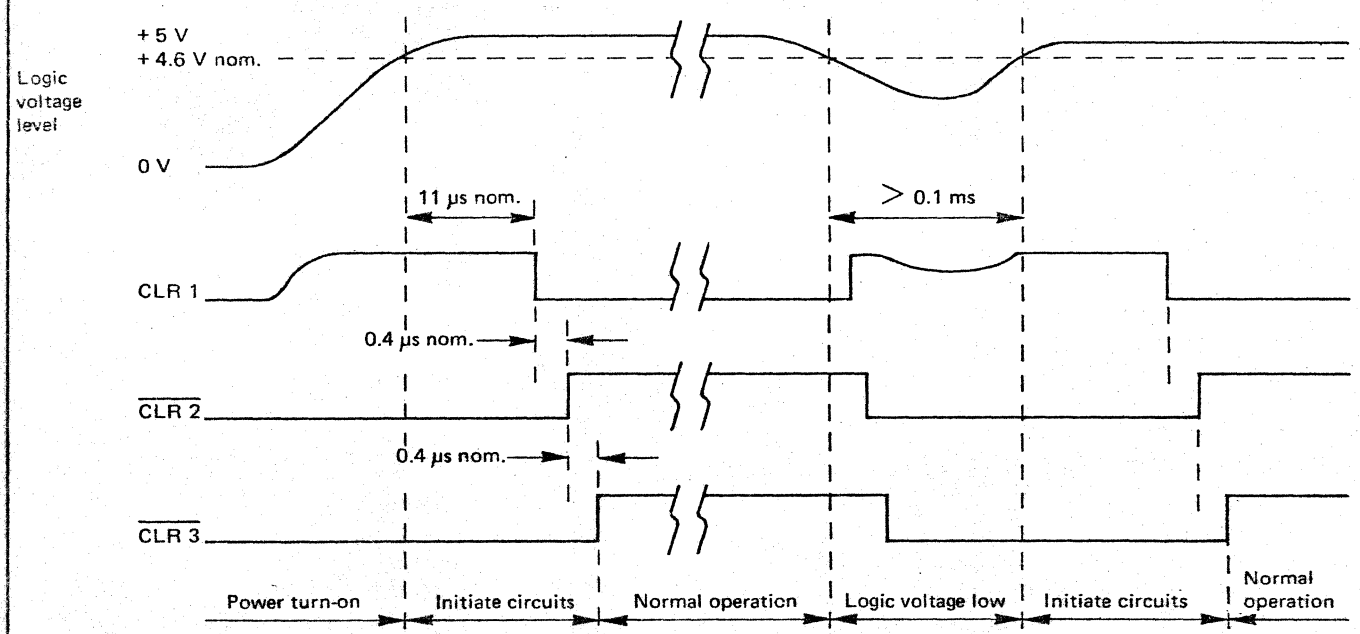


tp = Monostable pulse-width: 6.2 ms

See text block for the Tape Motion Status in the Motion Control Board on page red 3–2.

Run Status Detector, Pulse Diagram

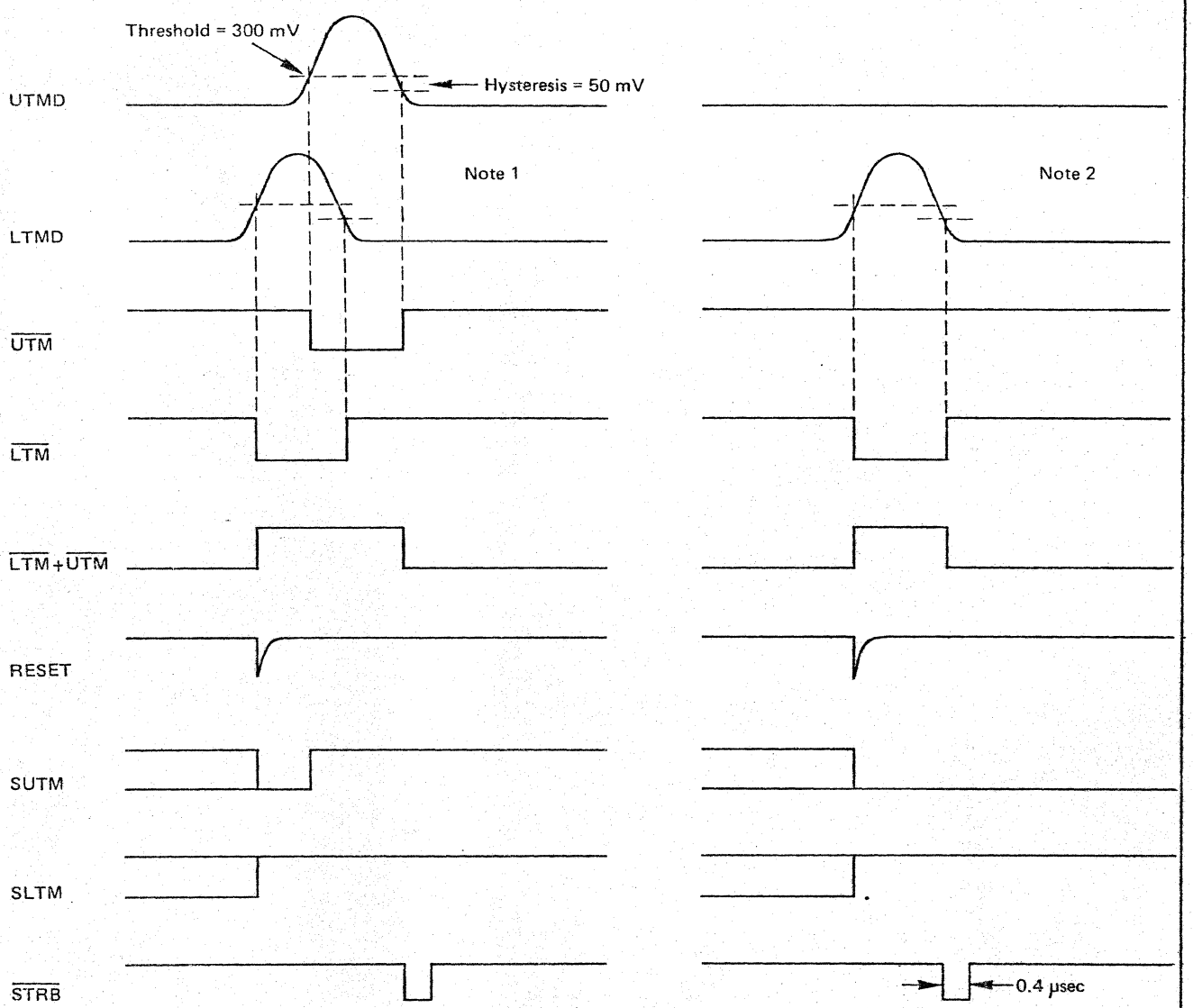
TDC 3000
Publ. No. 1381 - 2 - 77



See text block for the
Logic Supply Voltage Monitor
in the Motion Control Board
on page red 3–2

Power Turn-On, Pulse Diagram

TDC 3000
Publ. No. 1381 - 2 - 77



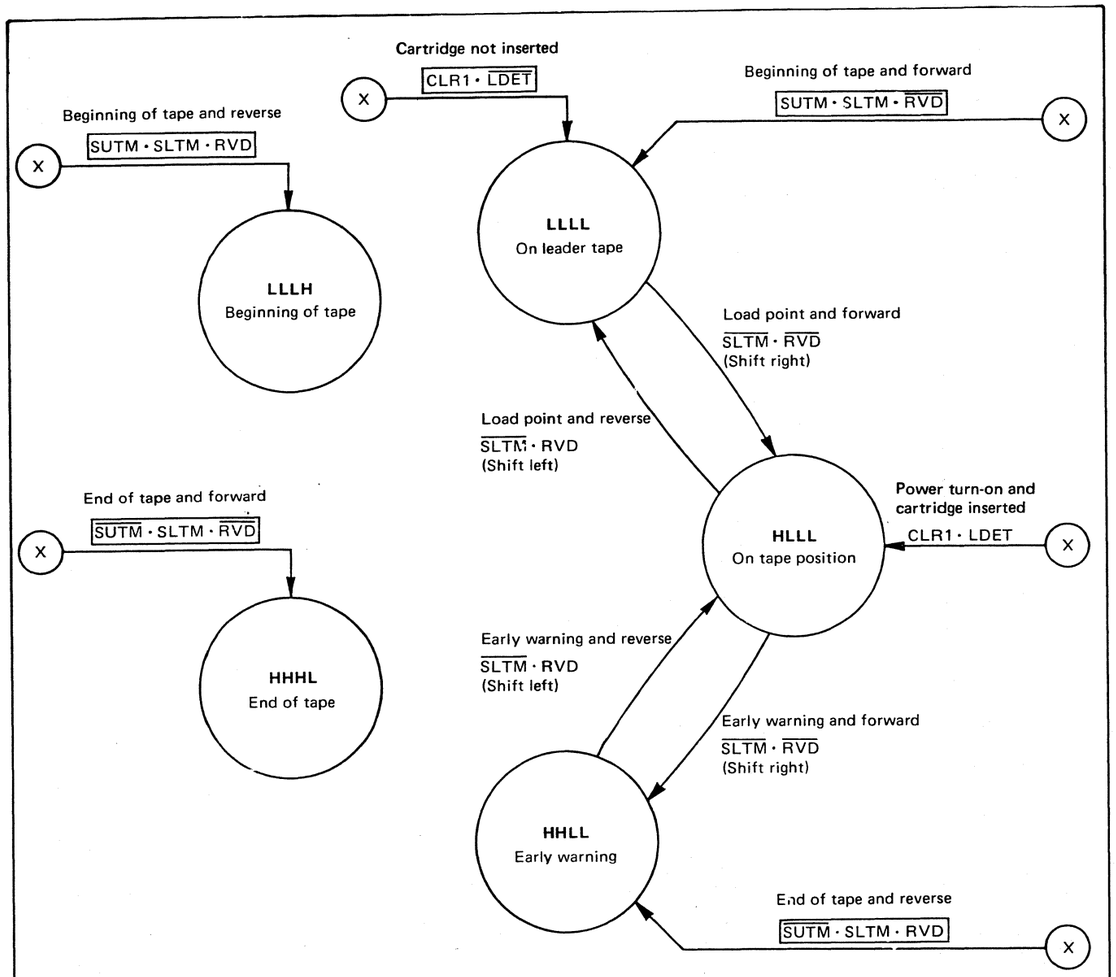
Notes:

1. Hole and detected skew indicated at BOT exaggerated.
2. LP and EW is the same as EOT except UTMD and LTMD signals are changed and UTMD pulse is shorter.

See text block for the Tape Marker Detector in the Motion Control Board on page red 3–2

Tape Marker Detector, Pulse Diagram

TDC 3000
Publ. No. 1381 - 2 - 77



Notes:

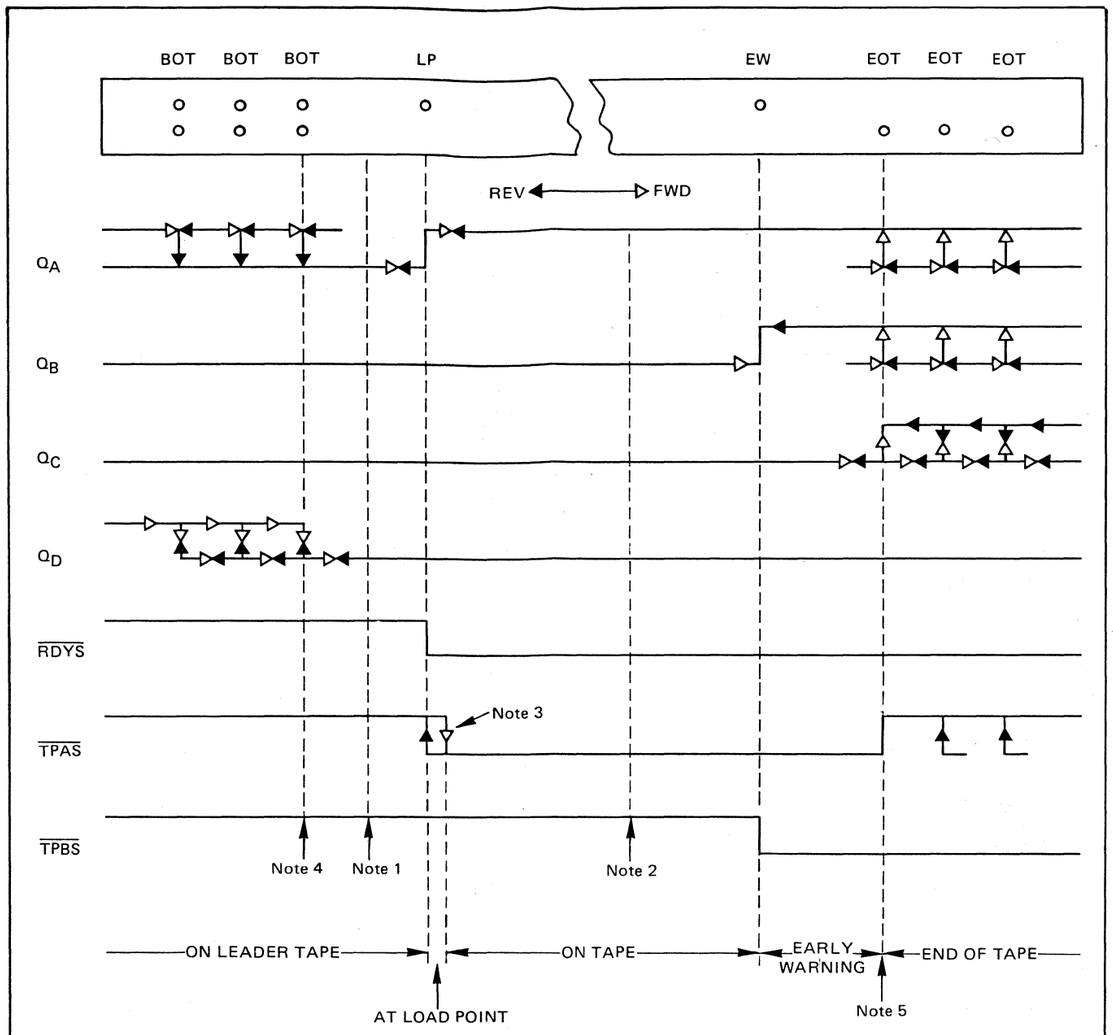
1. Register content $Q_A\ Q_B\ Q_C\ Q_D$

2. FRAMED TRANSITIONS are executed by parallel loading of the register

3. X — Any register state

See text block for the Tape Position Register in the Motion Control Board on page red 3–2

Tape Position Register, State Diagram



Notes:

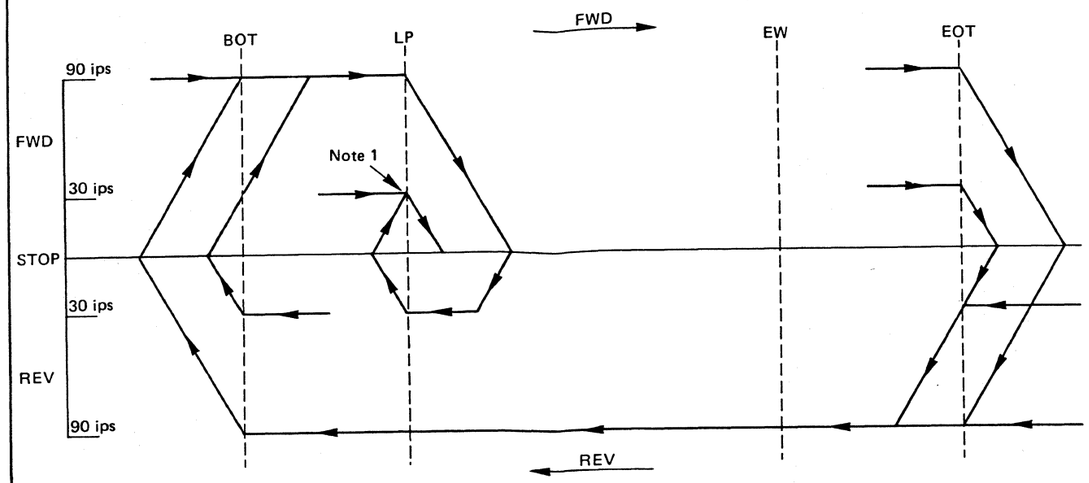
1. Set to this state at power turn-on and cartridge not inserted.
2. Set to this state at power turn-on and cartridge inserted.
3. Set true (low) by 1st. forward tape motion.
4. Further reverse tape motion inhibited.
5. Further forward tape motion inhibited.

RDYS	TPAS	TPBS	Position
H	H	H	On leader tape
L	H	H	At load point
L	L	H	On tape
L	L	L	On early warning tape
L	H	L	End of tape

See text blocks for the Tape Position Status and Tape Position Ragister on page red 3–2.

Tape Position Status, Sequence Diagram

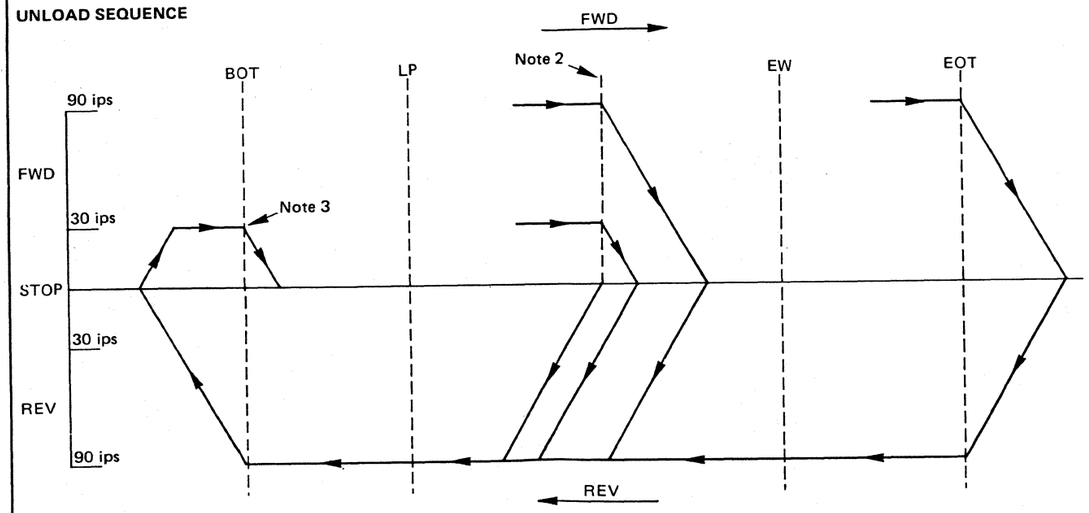
LOAD AND REWIND TO LP SEQUENCE



Note:

1. RDYS set at this time

UNLOAD SEQUENCE



Notes:

2. Unload command given

3. Motion stopped, cartridge unlocked and ejected

See text block for the Local Motion Sequencer in the Motion Control Board on page red 3–2.

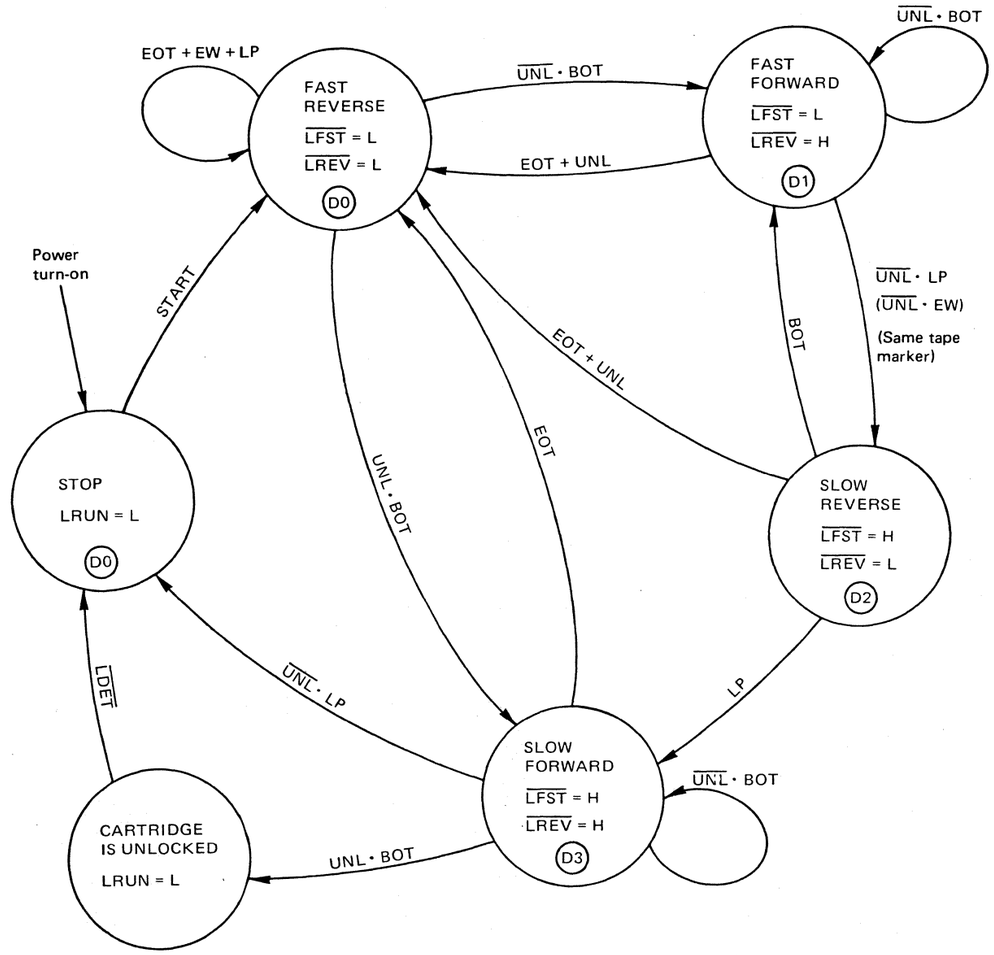
Rewind, Load/Unload, Sequence Diagram

Start:

Cartridge inserted and locked
or
Cartridge is in place and REWIND/UNLOAD button is pushed
or
Cartridge is in place and REWIND commanded
or
Cartridge is in place and UNLOAD commanded

Stop:

In state "STOP", LSTOP is true, sets local run f.f. U27, making LRUN false. LRUN forces LFST and LREV true, and LSTOP false via U21.
LRUN also selects the A-input of the "Tape Motion Command Multiplexer" U6, which now is ready for command instruction from the Device Bus.



Example:

1. The tape is in the state FAST FORWARD (D1)
   No unload command is given and the BOT hole-configuration is detected (UNL · BOT). The tape will still go FAST FORWARD.
2. The tape is still in (D1). Then the LP (Loadpoint) hole-configuration is detected. (UNL · LP). The tape will then go in SLOW REVERSE (D2)

(DX) Indicates the selected State Decoder inputs D0 - D3

See text block for the Local Motion Sequencer in the Motion Control Board on page red 3–2.

Rewind, Load/Unload, State Diagram

TDC 3000
Publ. No. 1381 - 2 - 77

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A4 Servo Board 960051/Rev. 011

Circuit reference No.	Part No.	Description			
Diodes					
CR1-CR15	231203	BA 130		Fairchild	
CR16	297545	1N 5231B	Zener 5.1 V	Motorola	
CR17	231203	BA 130		Fairchild	
CR18	297545	1N 5231B	Zener 5.1 V	Motorola	
CR19	231203	BA 130		Fairchild	
Capacitors					
C1	285397	3300 pF	10%	50 V	Ceramic 2
C2	289952	1 uF	10%	63 V	Polyester
C3	233523	0.22 uF	10%	100 V	Polyester
C4	260779	0.01 uF	10%	250 V	Polyester
C5	250463	0.033 uF	10%	250 V	Polyester
C6	305324	100 pF	2%	100 V	Ceramic 1
C7	233523	0.22 uF	10%	100 V	Polyester
C8/C9	272997	100 uF	-20/+50%	3 V	Tantalum
C10	275599	2.7 pF	±0.25 pF	100 V	Ceramic 1
C11	292610	22 uF	-20/+50%	25 V	Electrolytic
C12	332910	4700 pF	2.5%	63 V	Polysterene
C13	350438	0.47 uF	±20%	35 V	Tantalum
C15-C20	252841	0.022 uF	20/100%	40 V	Ceramic 2
C21/C22	292610	22 uF	-20/+50%	25 V	Electrolytic
C23	252841	0.022 uF	20/100%	40 V	Ceramic 2
C24	275599	2.7 pF	±0.25 pF	100 V	Ceramic 1
C25-C27	263710	22 uF	-20/+50%	16 V	Tantalum
C28/C29	255542	0.022 uF	10%	250 V	Polyester
C30/C31	252841	0.022 uF	20/100%	40 V	Ceramic 2
Resistors					
R1	316502	9.09 kohm	1%	0.125 W	± 100 ppm Metal film
R2	317127	26.1 kohm	1%	0.125 W	± 100 ppm Metal film
R3	317364	2.15 kohm	1%	0.125 W	± 100 ppm Metal film
R4	286086	100 kohm	3006P Lin. Cermet. Variable		Bourns
R5	317127	26.1 kohm	1%	0.125 W	± 100 ppm Metal film
R6	286086	100 kohm	3006P Lin. Cermet. Variable		Bourns
R7	313558	10 kohm	1%	0.125 W	± 100 ppm Metal film
R8	319045	2.37 kohm	1%	0.125 W	± 100 ppm Metal film
R9	286431	10 kohm	5%	0.33 W	Carbon film
R10	239816	180 ohm	5%	0.33 W	Carbon film
R11	287839	820 ohm	5%	0.33 W	Carbon film
R12	315446	23.7 kohm	1%	0.125 W	± 100 ppm Metal film
R13	319045	2.37 kohm	1%	0.125 W	± 100 ppm Metal film

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A4 Servo Board 960051/Rev. 011

Circuit reference No.	Part No.	Description				
R14	319785	51.1 kohm	1%	0.125 W	± 100 ppm	Metal film
R15	289520	1 kohm	5%	0.33 W		Carbon film
R16	318693	3.16 kohm	1%	0.125 W	± 100 ppm	Metal film
R17	317637	6.19 kohm	1%	0.125 W	± 100 ppm	Metal film
R18	289441	47 kohm	5%	0.33 W		Carbon film
R19/R20	280944	100 kohm	5%	0.33 W		Carbon film
R21	317127	26.1 kohm	1%	0.125 W	± 100 ppm	Metal film
R22	287760	33 kohm	5%	0.33 W		Carbon film
R23	289793	15 kohm	5%	0.33 W		Carbon film
R24	305633	180 kohm	5%	0.33 W		Carbon film
R25	288543	220 ohm	5%	0.33 W		Carbon film
R26	285533	10 ohm	5%	0.33 W		Carbon film
R27	288543	220 ohm	5%	0.33 W		Carbon film
R28	286079	22 kohm	5%	0.33 W		Carbon film
R29	239816	180 ohm	5%	0.33 W		Carbon film
R30	280944	100 kohm	5%	0.33 W		Carbon film
R31	289520	1 kohm	5%	0.33 W		Carbon film
R32	289168	2.2 kohm	5%	0.33 W		Carbon film
R33	280799	10 kohm	3006P Lin. Cermet. Variable			Bourns
R34	292753	1.8 kohm	5%	0.33 W		Carbon film
R35	285727	56 kohm	5%	0.33 W		Carbon film
R36	288543	220 ohm	5%	0.33 W		Carbon film
R37	294958	1 ohm	10%	4 W		Wirewound
R38	285727	56 kohm	5%	0.33 W		Carbon film
R39	292753	1.8 kohm	5%	0.33 W		Carbon film
R40	286079	22 kohm	5%	0.33 W		Carbon film
R41	316308	4.22 kohm	1%	0.125 W	± 100 ppm	Metal film
R42	286431	10 kohm	5%	0.33 W		Carbon film
R43	289520	1 kohm	5%	0.33 W		Carbon film
R44	288543	220 ohm	5%	0.33 W		Carbon film
R45	289520	1 kohm	5%	0.33 W		Carbon film
R46	313558	10 kohm	1%	0.125 W	± 100 ppm	Metal film
R48	284306	680 kohm	5%	0.33 W		Carbon film
R49/R50	286158	680 ohm	5%	0.33 W		Carbon film
R52	289520	1 kohm	5%	0.33 W		Carbon film
R53	319160	21.5 kohm	1%	0.125 W	± 100 ppm	Metal film
R54	317479	19.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R55	317127	26.1 kohm	1%	0.125 W	± 100 ppm	Metal film
R56	319864	12.1 kohm	1%	0.125 W	± 100 ppm	Metal film
R57	317479	19.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R58	313558	10 kohm	1%	0.125 W	± 100 ppm	Metal film
R59	288464	6.8 kohm	5%	0.33 W		Carbon film
R60	294082	18 kohm	5%	0.33 W		Carbon film
R61	289520	1 kohm	5%	0.33 W		Carbon film
R62	315446	23.7 kohm	1%	0.125 W	± 100 ppm	Metal film
R63	315094	31.6 kohm	1%	0.125 W	± 100 ppm	Metal film
R64	319512	56.2 kohm	1%	0.125 W	± 100 ppm	Metal film
R65	316071	61.9 kohm	1%	0.125 W	± 100 ppm	Metal film
R66	315446	23.7 kohm	1%	0.125 W	± 100 ppm	Metal film
R67	278982	100 kohm	1%	0.125 W	± 100 ppm	Metal film

TDC 3000
Publ. No. 1381 - 2 - 77

SPECIFY THIS WHEN ORDERING:

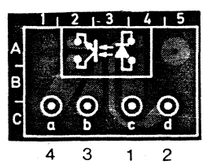
1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

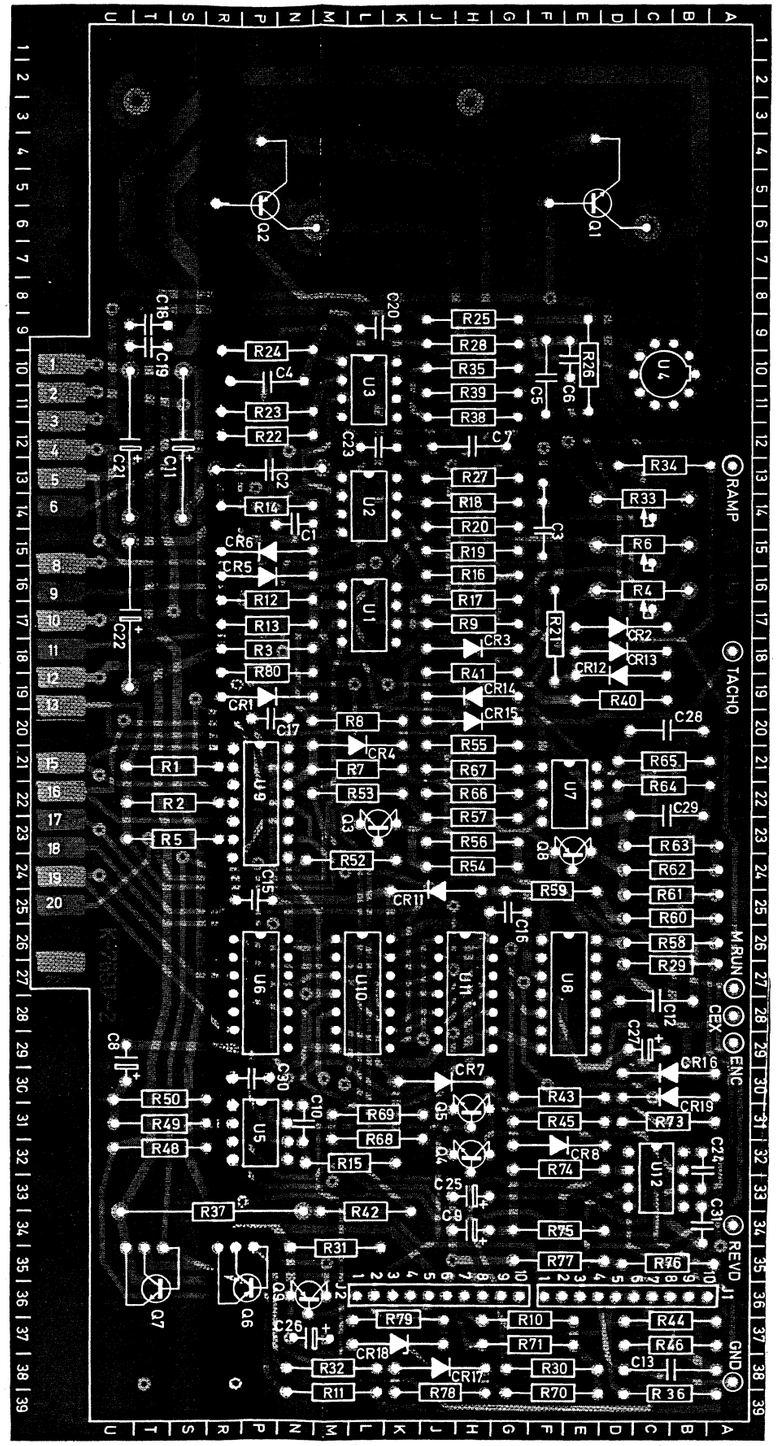
If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A4 Servo Board 960051/Rev. 011

Circuit reference No.	Part No.	Description				
R68/R69	289168	2.2 kohm	5%	0.33 W		Carbon film
R70	280944	100 kohm	5%	0.33 W		Carbon film
R71	239816	180 ohm	5%	0.33 W		Carbon film
R73	284306	680 kohm	5%	0.33 W		Carbon film
R74/R75	286158	680 ohm	5%	0.33 W		Carbon film
R76	318341	3.83 kohm	1%	0.125 W	± 100 ppm	Metal film
R77	318535	1.33 kohm	1%	0.125 W	± 100 ppm	Metal film
R78/R79	305633	180 kohm	5%	0.33 W		Carbon film
R80	315525	750 ohm	1%	0.125 W	± 100 ppm	Metal film
Transistors						
Q1	338262	MJ 3001 NPN		Darlington	Motorola	
Q2	336581	MJ 2501 PNP		Darlington	Motorola	
Q3	276180	2N 4401 NPN			Motorola	
Q4/Q5	260463	2N 5089 NPN			Motorola	
Q6	333399	BD 698AS PNP		Darlington	Motorola	
Q7	333751	BD 697AS NPN		Darlington	Motorola	
Q8	263552	2N 4126 PNP			Motorola	
Q9	298170	2N 5087 PNP			Motorola	
Circuits						
U1-U3	340489	MC 1458		Motorola		
U4	344066	NE 540		Signetics		
U5	342170	NE 531V		Signetics		
U6	291352	SN 7474N		Texas Instr.		
U7	340489	MC 1458		Motorola		
U8	290296	SN 74121N		Texas Instr.		
U9	299843	SN 74132N		Texas Instr.		
U10	292681	SN 7486N		Texas Instr.		
U11	352285	SN 7406N		Texas Instr.		
U12	342170	NE 531V		Signetics		

Part No.	Description		Quantity
347960	Heatsink TO5	Wakefield	1
341710	Testpoint	Oxley	7
343132	Connector J1 and J2 10 pin 2.50 mm	Molex	2
343987	Heatsink bracket, Servo	Tandberg	1





A7A1 LOCK/UNLOCK DETECTOR BOARD
Component Location

See Mechanical Parts List on page parts–8.

A4 SERVO BOARD
Component Location

VELOCITY COMMAND

The digital command signals (FSTFWD, FWD, FSTREV, and REV) from the Motion Control board are transformed to voltage levels which are proptional to the wanted tape speeds. The FWD and REV tape speeds can be adjusted from 10 to 30 ips by means of R4 and R6.

RAMP GENERATOR

This circuit works as an amplifier with a controlled slew-rate. The output swing of U2 is controlled by the potentiometer R33, resistor R14, and the capacitor C2.

COMPENSATION VELOCITY LOOP

The command signal and the feedback signal are summed in U2.

COMPENSATION CURRENT FEEDBACK LOOP

The output from the Compensation Velocity Loop and the feedback voltage across R 37 are added in U3.

POWER AMPLIFIER

U4 is a power driver and Q1 and Q2 are two Darlington transistors. The motor current is measured as a voltage level across R37 and this voltage is the feedback signal of the current feedback loop.

REFERENCE VOLTAGE REGULATOR

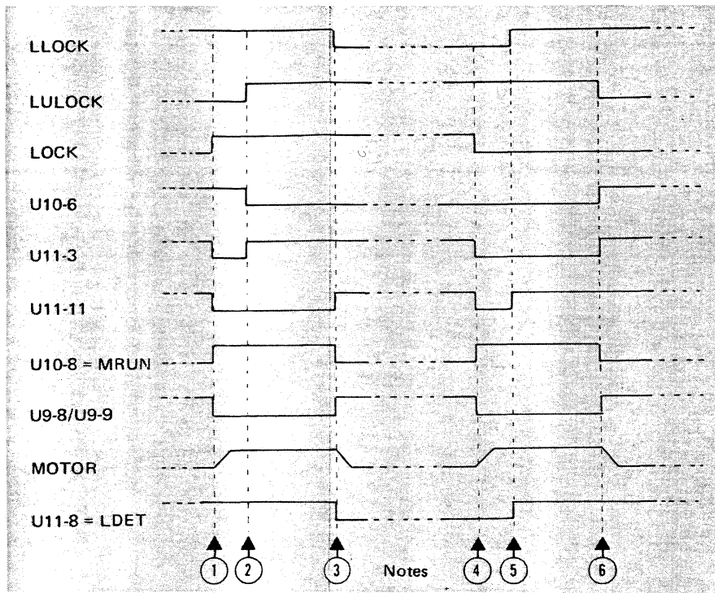
The zener stabilized reference voltage VR is generated in this circuit, by means of R29, CR16 and C27.

VOLTAGE FEEDBACK

This circuit will normally work between 5 ips and the stop mode.
A voltage from the Power Amplifier is inverted and then added to the command and tacho-feedback voltage.

ENCODER PREAMPLIFIER

See special diagram, Capstan-Encoder Signal Processor on page red 4—5.



LOCK LOGIC

A run command is given to the lock motor in two events:

1. When the LOCK command from the Motion Control Board is given and the unlock-detector detects that the mechanism is not locked.

or

2. When the LOCK command disappears and the lock-detector detects that the mechanism is locked.

To protect the motor if a fault occurs in the mechanism and the motor is stalled, the basedrive to Q6 will be cut off by means of Q9 in this way: after aproximately 0.7 second, determined by C26, R78 and CR18, the transistor Q9 will saturate and remove the base drive from Q6 and the drive to the motor.

Notes:

1. LOCK = true: Lock command given from the Motion Control Board.
2. LULOCK = false: The phototransistor cut off, but the cartridge is not locked.
3. LLOCK = true: Cartridge locked.
4. LOCK = false: Unlock command given from the Motion Control Board.
5. LLOCK = false: The phototransistor cut off, but the cartridge is still locked.
6. LULOCK = true: Cartridge unlocked.

FREQUENCY-TO-VOLTAGE CONVERTER AND FILTER

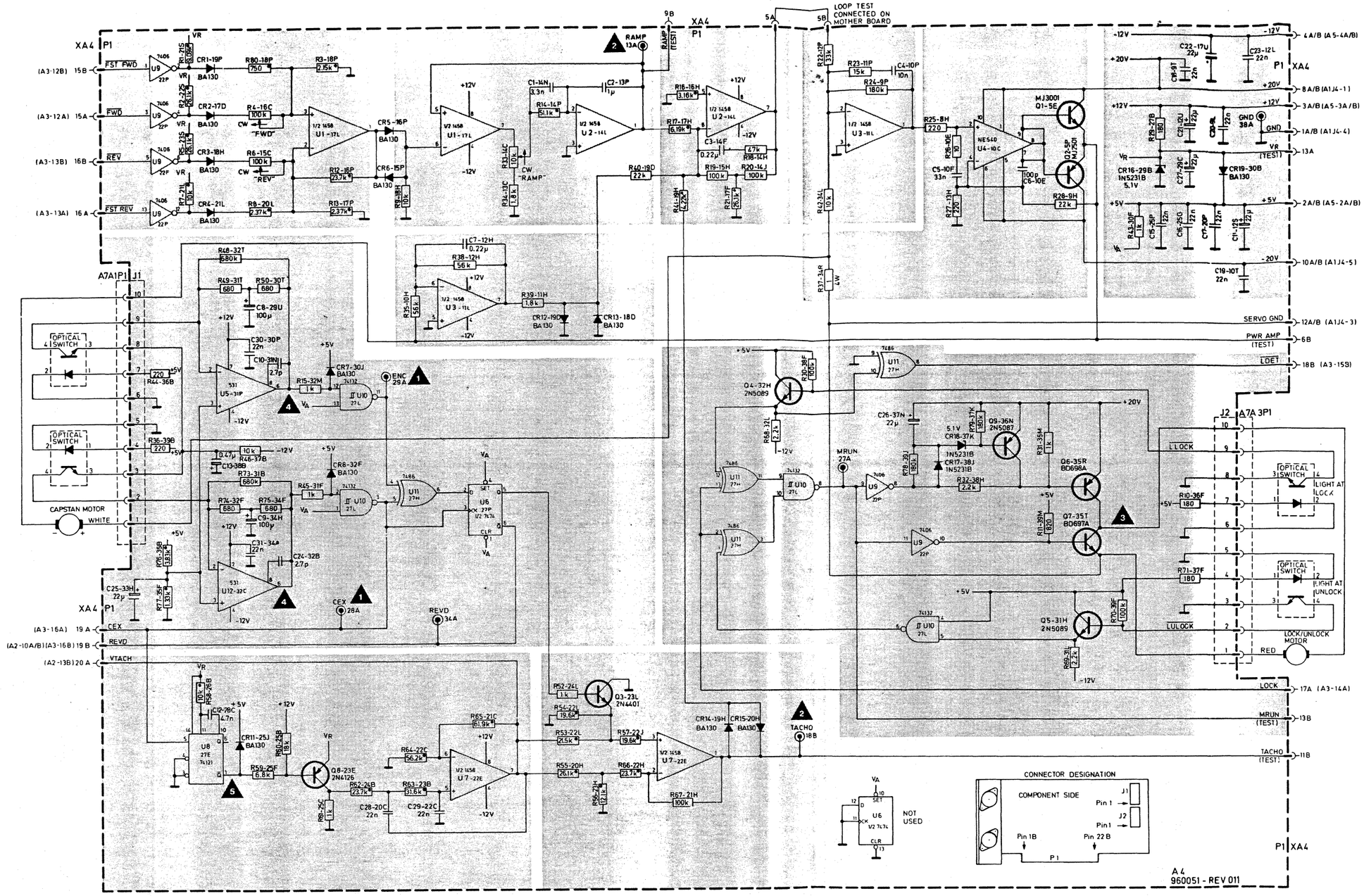
The tachometer frequency (CEX) is transfered to a propotional voltage, which only has information of the tape speed, not the direction.

POLARITY SWITCH

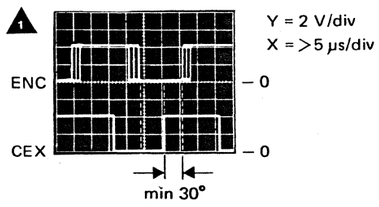
The feedback voltage supplies both inputs, U7-2-3. If the Q-output, U6-5 is high, Q3 will conduct and the feedback voltage to the non inverting input will be short-circuited. The amplifier will now have an amplification, —A. When Q from U6 is low, Q3 is cut off and the amplification is 2A—A = A. The tape direction information is thus added. The voltage on the output of U7-1 is compared via CR14 and CR15 with the command voltage in the Compensation Velocity Loop. When the tachometer frequency is low, (below 5 ips), the diodes CR14 and CR15 will open the feedback loop from the Polarity switch to the Compensation Velocity Loop and the Voltage Feedback circuit will control the motor speed.

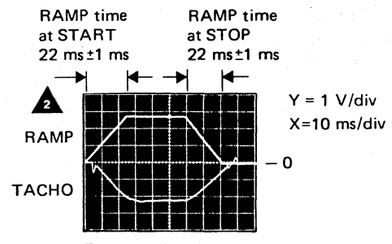
A4 SERVO BOARD

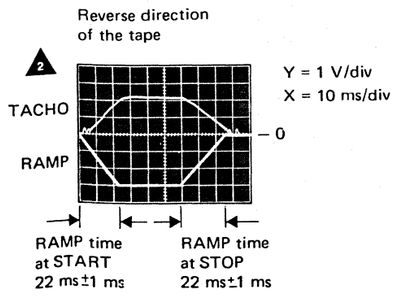
TDC 3000
Publ. No. 1381 - 2 - 77



NOTE: ALL RESISTORS ARE CARBON FILM 5%, 1/4 W, EXCEPT THOSE MARKED ▭ WHICH ARE METAL FILM 1%, 1/8 W, ±100 ppm

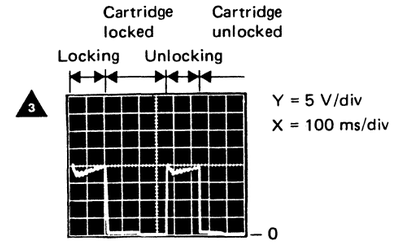


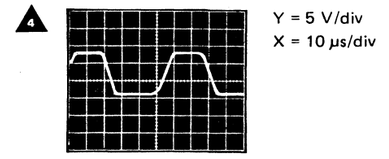


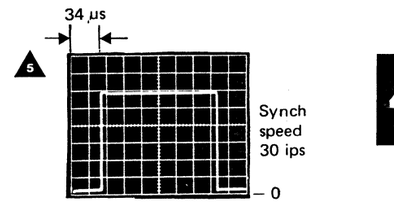


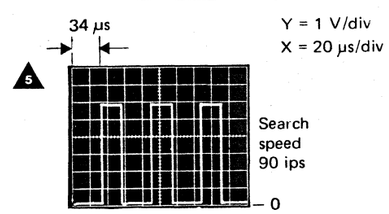
BACKDATING:

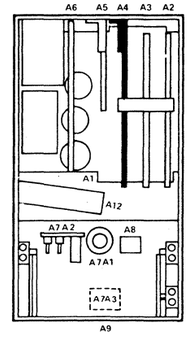
If the revision number (Rev. No.) on the printed circuit board is lower than the revision number on the circuit diagram, see paragraph Backdating Information in the chapter UPDATING.



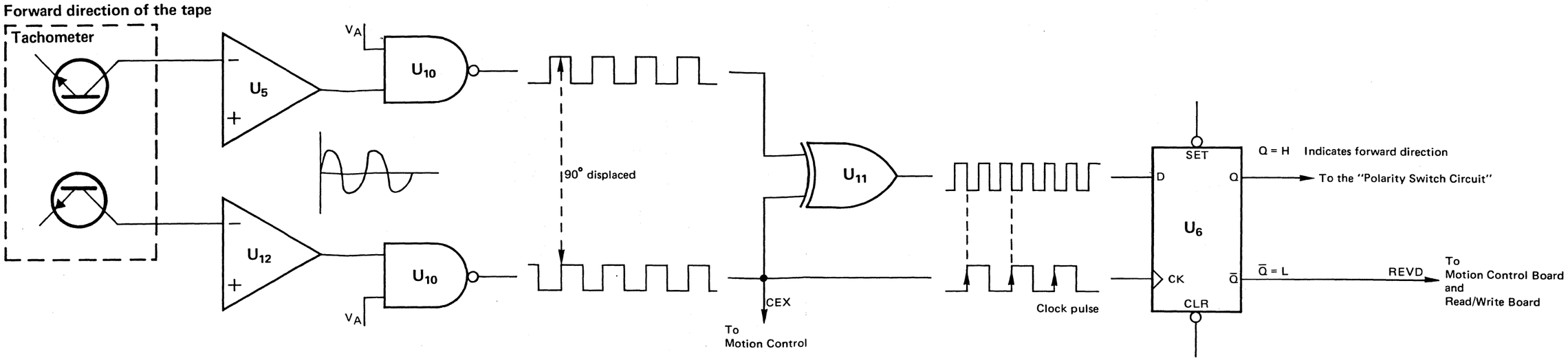


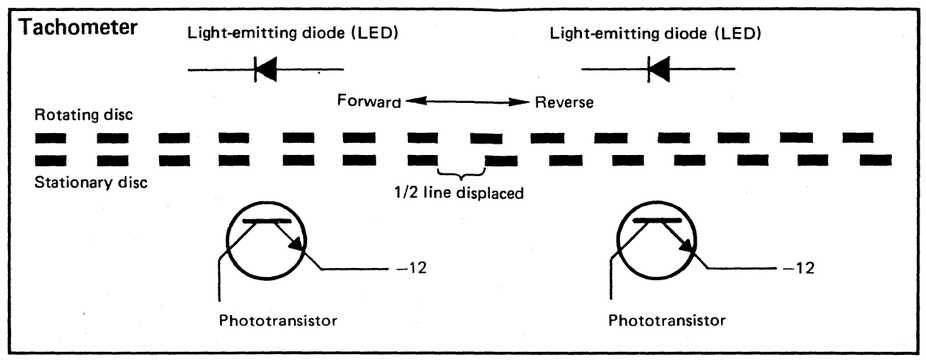






Position	Name	Part No.	Rev. No.
A4	Servo Board	960051	011





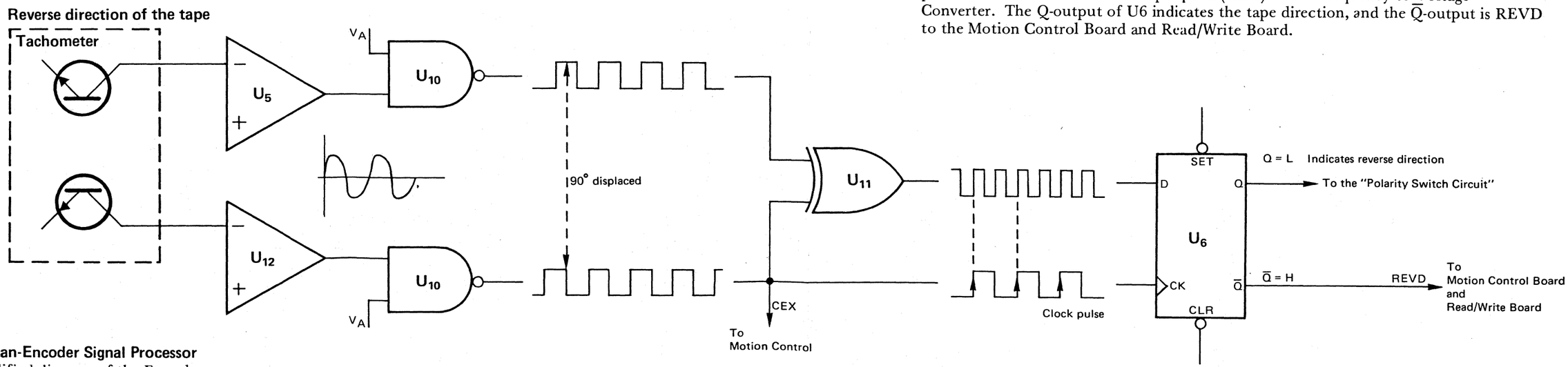
Exclusive OR-gate

Input	Input	Output
L	L	L
L	H	H
H	L	H
H	H	L

The Encoder Preamplifier detects the tape speed and the direction of the capstan motor by means of a tachometer. The tachometer consists of a rotating film disc and a stationary film disc. The rotating disc is mounted on the capstan motor shaft and has 400 lines. The stationary disc has only a few lines (a segment). These discs are situated between two light-emitting diodes and two phototransistors.

On the stationary disc two line areas are displaced by 1/2 line width. Consequently the signals from the two phototransistors are displaced by 90°.
These signals are amplified in U5 and U12 and gated through U10 and U11. One of the signals is used to clock the flip-flop U6.

Because of the delay in U11, the high level (FWD) or the low level (REV) will be clocked into U6 on the positive edge of the clock pulse. The same signal as the clock pulse is also used to detect the tape speed (CEX) in the Frequency to Voltage Converter. The Q-output of U6 indicates the tape direction, and the $\overline{Q}$-output is REVD to the Motion Control Board and Read/Write Board.



Capstan-Encoder Signal Processor
Simplified diagram of the Encoder Preamplifier in the Servo Board.

TDC 3000
Publ. No. 1381 - 2 - 77

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A5 Regulator Board 960054/Rev. 010

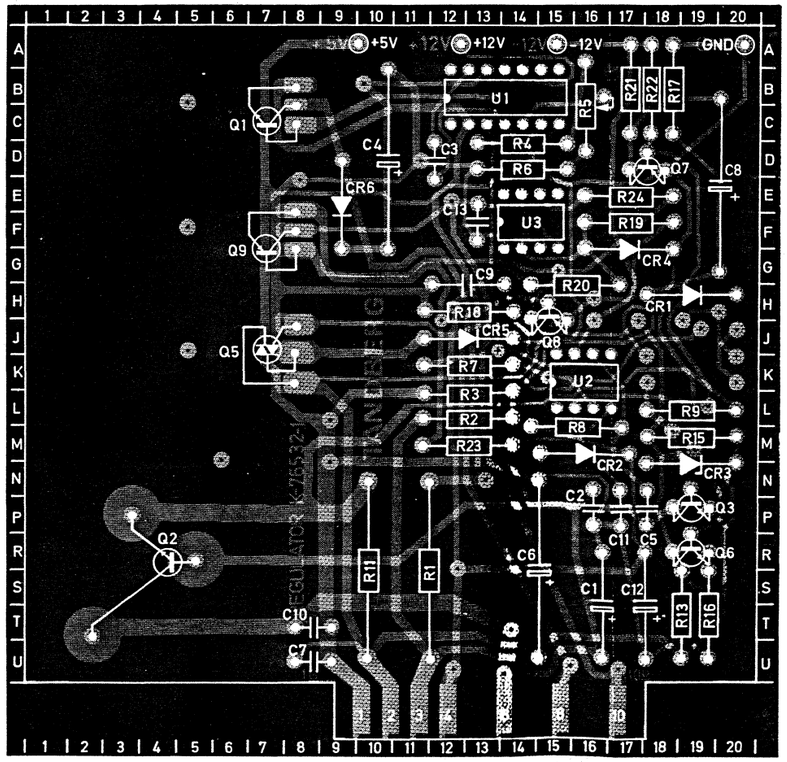
Circuit reference No.	Part No.	Description			
Diodes					
CR1/CR2	231203	BA 130			Fairchild
CR3	297545	1N 5231B	Zener 5.1 V		Motorola
CR4-CR6	231203	BA 130			Fairchild
Capacitors					
C1	292610	22 uF	-20/+50%	25 V	Electrolytic
C2	252841	0.022 uF	20/100%	40 V	Ceramic 2
C3	252955	100 pF	10%	400 V	Ceramic 2
C4	274026	100 uF	-10/+50%	25 V	Electrolytic
C5	252841	0.022 uF	20/100%	40 V	Ceramic 2
C6	274026	100 uF	-10/+50%	25 V	Electrolytic
C7	252841	0.022 uF	20/100%	40 V	Ceramic 2
C8	274026	100 uF	-10/+50%	25 V	Electrolytic
C9	283120	0.1 uF	10%	100 V	Folie
C10/C11	252841	0.022 uF	20/100%	40 V	Ceramic 2
C12	292610	22 uF	-20/+50%	25 V	Electrolytic
C13	252841	0.022 uF	20/100%	40 V	Ceramic 2
Resistors					
R1	339713	0.56 ohm	10%	4 W	Wirewound
R2/R3	315798	17.8 kohm	1%	0.125 W ± 100 ppm	Metal film
R4	319670	5.11 kohm	1%	0.125 W ± 100 ppm	Metal film
R5	280799	10 kohm	3006P	Lin. Cermet. Variable	Bourns
R6	318103	46.4 kohm	1%	0.125 W ± 100 ppm	Metal film
R7	319160	21.5 kohm	1%	0.125 W ± 100 ppm	Metal film
R8	288543	220 ohm	5%	0.33 W	Carbon film
R9	289520	1 kohm	5%	0.33 W	Carbon film
R11	342831	0.1 ohm	10%	4 W	Wirewound
R13	313558	10 kohm	1%	0.125 W ± 100 ppm	Metal film
R15	289520	1 kohm	5%	0.33 W	Carbon film
R16	285533	10 ohm	5%	0.33 W	Carbon film
R17	288112	12 kohm	5%	0.33 W	Carbon film
R18	306129	16.2 kohm	1%	0.125 W ± 100 ppm	Metal film
R19/R20	313558	10 kohm	1%	0.125 W ± 100 ppm	Metal film
R21	289520	1 kohm	5%	0.33 W	Carbon film
R22	286431	10 kohm	5%	0.33 W	Carbon film
R23	348406	1.5 ohm	5%	0.33 W	Carbon film
R24	289520	1 kohm	5%	0.33 W	Carbon film

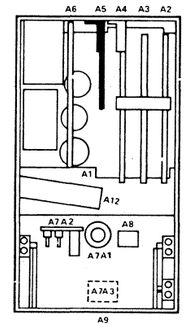
If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A5 Regulator Board 960054/Rev. 010

Circuit reference No.	Part No.	Description		
Transistors				
Q1	333751	BD 697AS NPN	Darlington	Motorola
Q2	342385	2N 6055 NPN	Darlington	Motorola
Q3	260463	2N 5089 NPN		Motorola
Q5	293695	2N 6152 Triac		Motorola
Q6	263200	2N 4124 NPN		Motorola
Q7/Q8	263552	2N 4126 PNP		Motorola
Q9	333399	BD 698AS PNP	Darlington	Motorola
Circuits				
U1	308723	MC1723	Regulator	Motorola
U2/U3	307709	741 TC		Fairchild

Part No.	Description		Quantity
341710	Testpoint	Oxley	4
342306	Heatsink bracket, Regulator	Tandberg	1





A5 REGULATOR BOARD
Component Location

5

Three different voltages, + 20 V, — 20 V, + 10 V and ground are supplied from the Power Supply or an external power source (A1J3). The regulated voltages are + 12 V, — 12 V, and + 5 V. An overvoltage protector, triac Q5, is also included in this circuit.

REGULATED + 12 V AND CURRENT LIMITATION

MC1723 (U1) is a monolithic voltage regulator. A part of the constant reference voltage from pin 6 is supplied to the non-inverting input (pin 5) via potentiometer R5. The feedback is established by attenuating the + 12 V and connecting it to the inverting input, pin 4. The difference between these two voltages (pin 4 and pin 5) will control the basedrive to Q1.

The current limitation takes place when the voltage drop across R1 (pin 2) reaches a definite level, which again reduces the drive to Q1 and thus keeps the current constant.

REGULATED + 5 V AND CURRENT LIMITATION

The regulation of + 5 V takes place in the same manner. A part of the regulated + 12 V is used as a reference voltage (U2, pin 3). Feedback from the + 5 V line is connected through R13 to pin 2. The basedrive to Q2 is controlled by the difference between these two voltages (on pin 2 and 3).
The current limitation takes place when the voltage drop across R11 is high enough to turn on Q3, thus reducing the drive to Q2.

OVERVOLTAGE PROTECTOR

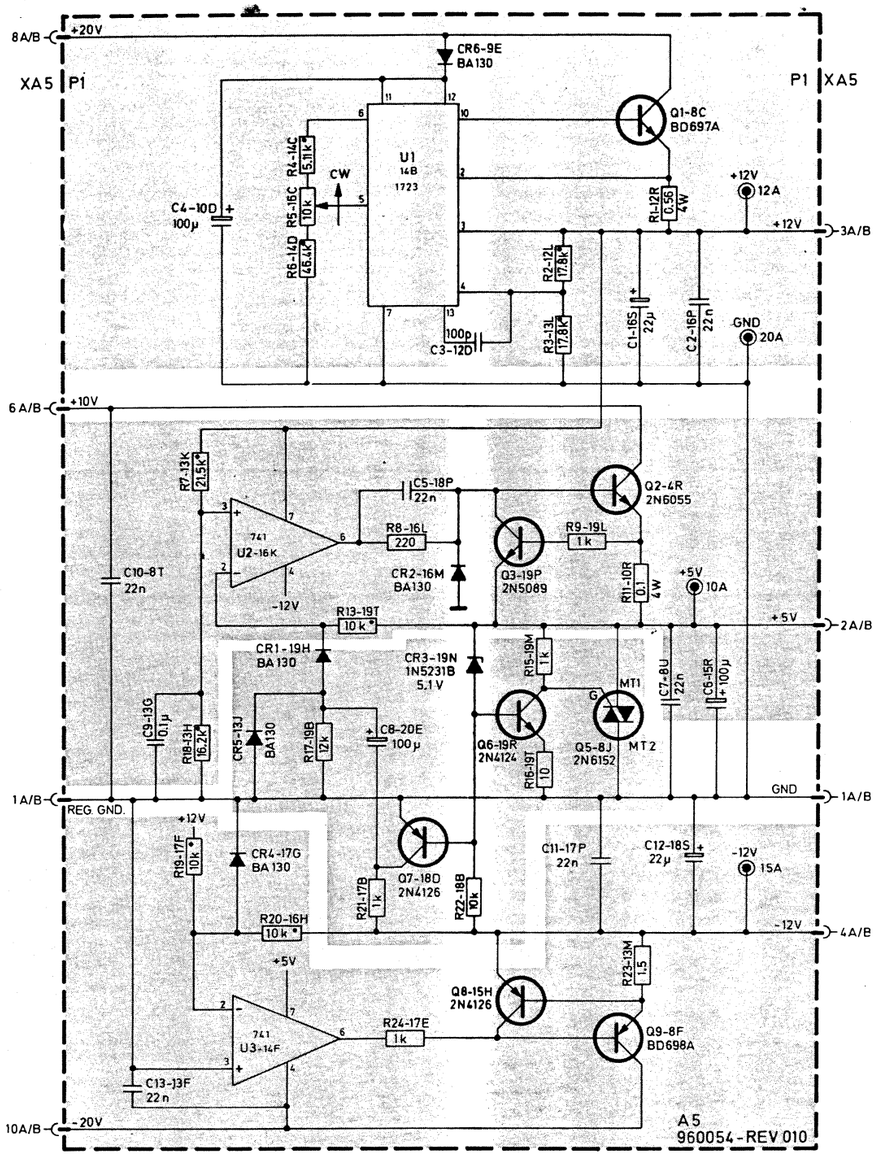
As soon as the voltage exceeds 5.1 V the overvoltage protector will be switced on in this way: Q6 will conduct and trigger the triac Q5. This will clamp the + 5 V line to ≅ 0.8 V. When the + 5 V line is forced low, Q7 will conduct and drive the inverting input (pin 2) of U2 high via C8 and CR1. The overvoltage protection resets itself automatically if the overvoltage is temporary. The time constant depends on C8, R17, and R13. The output of U2 (pin 6) will be driven to ground-potential, turning off Q2 and then also the triac Q5. CR2 will prevent the output from being more negative than ground. After a time of about 1 second, the voltage on pin 2 will again go low, and the output of the regulator will try to go high.

If the overvoltage is removed within the time of 1 second, the regulator will again function normally. However, if the over-voltage condition lasts for more than 1 second, the main power must be turned off to reset the circuit.

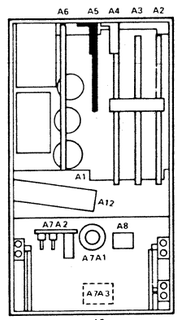
REGULATED — 12 V AND CURRENT LIMITATION

The regulation of the voltage and the current limitation of the — 12 V is done in the same way as the + 12 V and + 5 V.

A5 REGULATOR BOARD

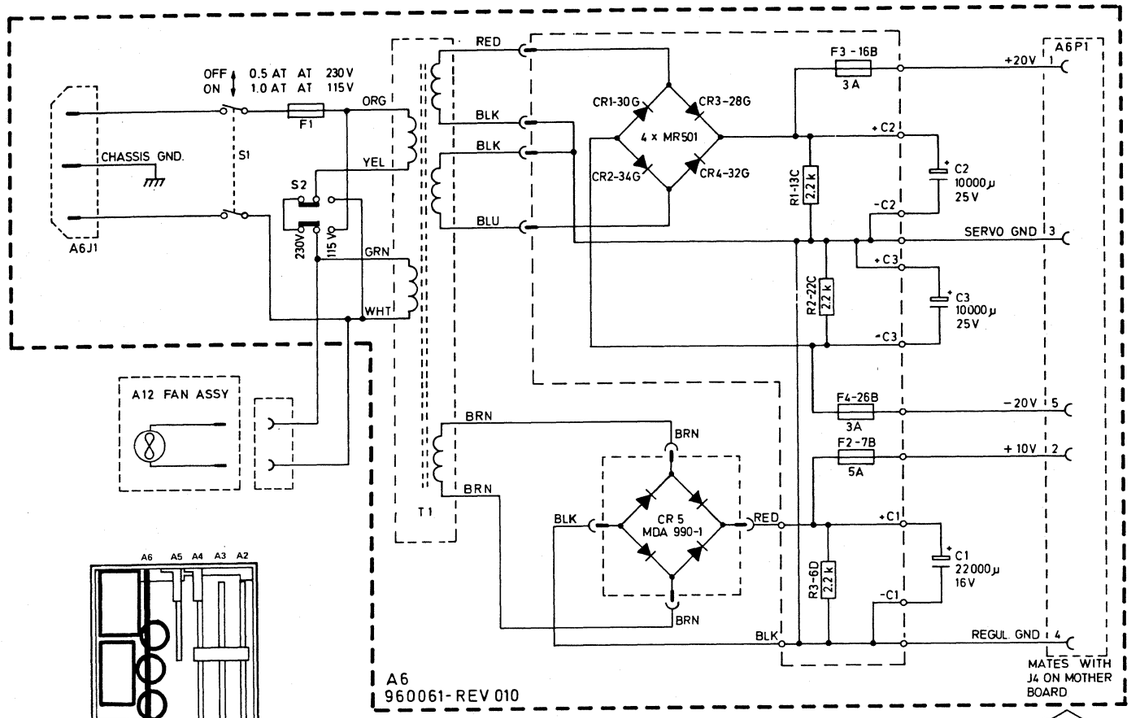


NOTE: ALL RESISTORS ARE CARBON FILM 5%, 1/4 W, EXCEPT THOSE MARKED ▭• WHICH ARE METAL FILM 1%, 1/8W, 100 p. p. m.



Position	Name	Part No.	Rev. No.
A5	Regulator Board	960054	010

TDC 3000
Publ. No. 1381 - 2 - 77
76711



Component Location Drawing,
see next page, red 7–1.

Position	Name	Part No.	Rev. No.
A6	Power Supply	960061	010

SPECIFY THIS WHEN ORDERING:

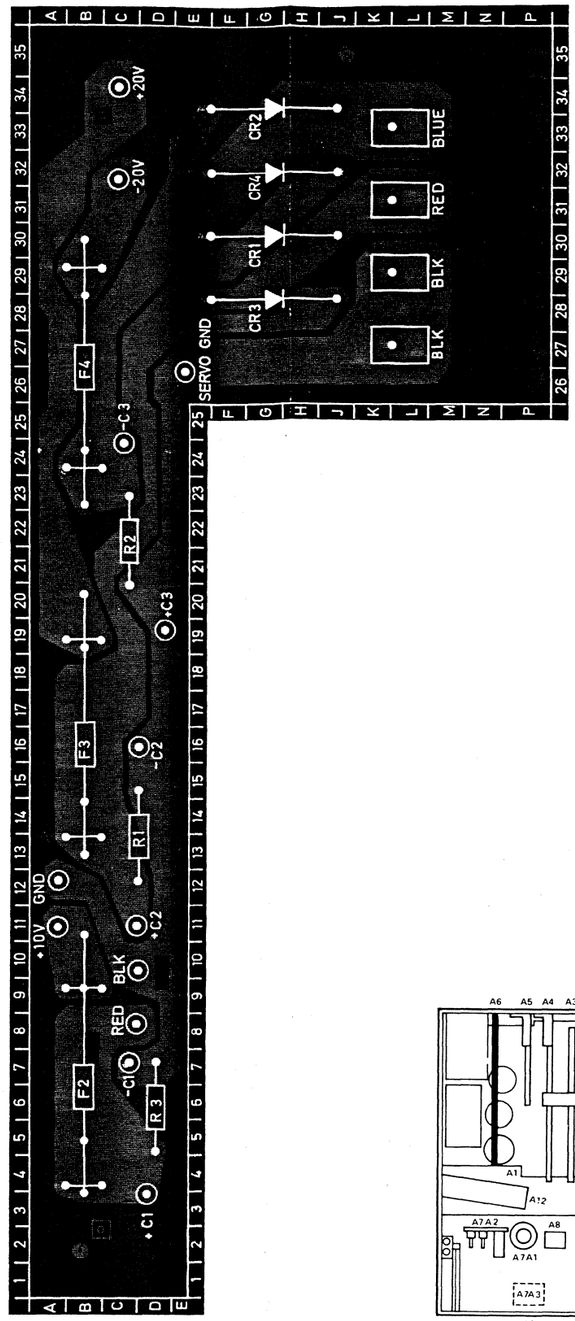
1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description. → Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

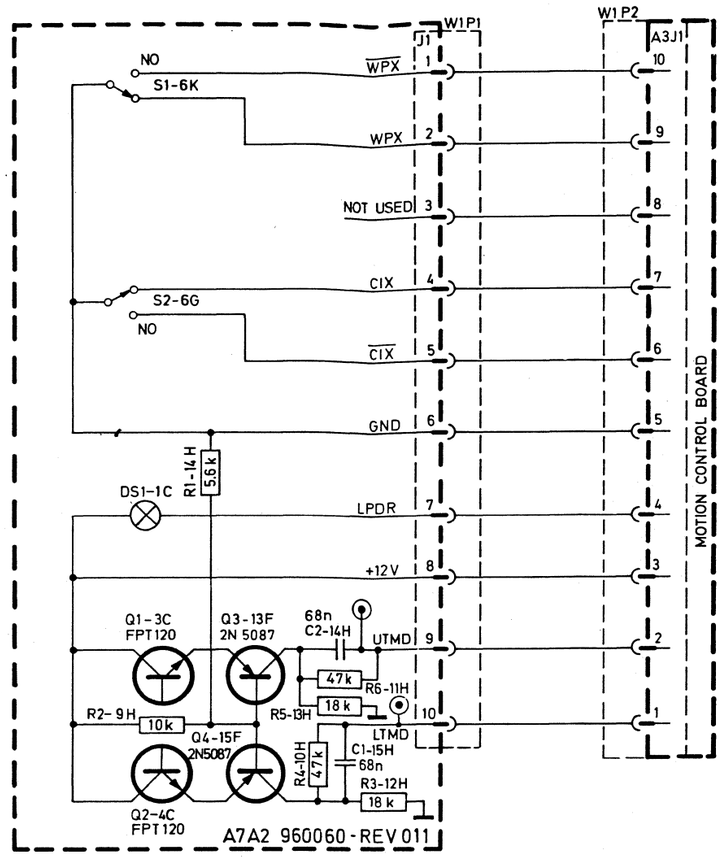
Power Supply Board, Part of Power Supply 960061/Rev. 010

Circuit reference No.	Part No.	Description
Diodes		
CR1-CR4	340798	MR 501 Motorola
Resistors		
R1/R2	289168	2.2 kohm 5% 0.33 W Carbon film
R3	289520	1 kohm 5% 0.33 W Carbon film

See also Mechanical Parts List on page parts–5

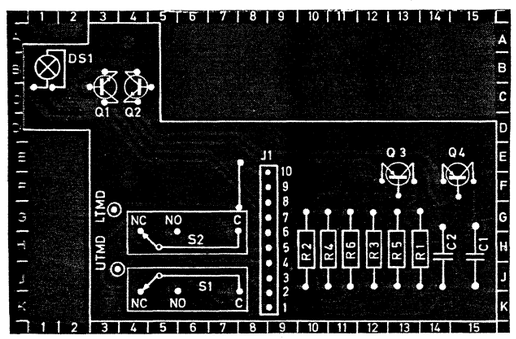


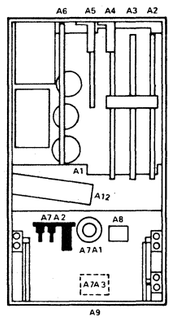
POWER SUPPLY BOARD
Component Location



BACKDATING:

If the revision number (Rev. No.) on the printed **c**ircuit board is lower than the revision number **o**n the circuit diagram, see paragraph Backdating **I**nformation in the chapter UPDATING.





Position	Name	Part No.	Rev. No.
A7A2	Sensor Board	960060	011

SPECIFY THIS WHEN ORDERING:

1. Board part No. / Revision No. → Stamped on the printed circuit board.
2. Circuit reference No.
3. Component part No.
4. Description.

→ Found in the electrical parts list.

If the revision number on the printed circuit board is different from the revision number in the electrical parts list, see paragraph Backdating Information in the chapter UPDATING.

A7A2 Sensor Board 960060/Rev. 011

see also Mechanical Parts List on page parts–10

Circuit reference No.	Part No.	Description			
Capacitors					
C1/C2	259140	0.068 uF	20%	250 V	Polyester
Resistors					
R1	286783	5.6 kohm	5%	0.33 W	Carbon film
R2	286431	10 kohm	5%	0.33 W	Carbon film
R3	294082	18 kohm	5%	0.33 W	Carbon film
R4	289441	47 kohm	5%	0.33 W	Carbon film
R5	294082	18 kohm	5%	0.33 W	Carbon film
R6	289441	47 kohm	5%	0.33 W	Carbon film
Transistors					
Q1/Q2	340496	FPT 120		Phototransistor	Fairchild
Q3/Q4	298170	2N 5087 PNP			Motorola

Part No.	Description	Quantity
341710	Testpoint Oxley	2
343132	Connector J1 10 pin 2.50 mm Molex	1

TDC 3000
Publ. No. 1381 - 2 - 77
76713

A8 HEAD ASSEMBLY

1. GENERAL INFORMATION

The head assembly is a transducer for creating a magnetic flux dependent upon the digital information, and for reading back the recorded magnetization on the tape.

The head is very critical in the magnetic recording process. In the TDC 3000 the shortest wavelength recorded on the tape is approximately 16μm. Intimate phycical contact between the head and the tape is therefore a requirement for reliable operation. For this reason the head assembly is manufactured with close tolerances under stringent quality control.

2. FUNCTIONAL DESCRIPTION

Erase Head

The erase head is designed to erase all previously recorded information down to a very low level. Because the erase field is quite strong the tape wrap across the head may be maintained at a low value, here approximately 2 degrees.
Since the cartridge has 4 individual tracks the erase head also has individual erase gaps. The erase head is optional and is therefore mounted on the side of the write head.

The need for the erase head is dependent upon the application. If the recorded data is to be updated, the erase head is recommended. Overall data reliability will also improve with the use of the erase head.

Write Head

The write head is optimized for the actual recording of data. The write current is selected to be 1.5 times the saturation current at the highest bit density (shortest wavelength), i.e. 1.5 times the current required to produce an output voltage of 95% of the maximum on that track.
The write head inductance is selected to give (together with the series resistor) a controlled risetime of the write current, thus reducing possible crossfeed from the write to the read head. The inductance is 650 μH nominal.

The tape wrap on the write head is approximately 5 degrees. Since the write field is higher than the value for maximum output voltage, the effect of partial loss of tape contact is less prominent than on the read head.

Read Head

The read head is optimized for reading the recorded flux on the tape. Because head-to-tape contact is most critical the tape wrap is 7 degrees. The read gap is 2.5 μm and the head inductance is 14 mH nominal.

TDC 3000
Publ. No. 1381 - 2 - 77

3. TRACK DIMENSIONS AND POSITIONING

Track width:

Erase: 1.37 ± 0.05 mm (0.054 ± 0.002")
Write: 1.22 ± 0.05 mm (0.048 ± 0.002")
Read: 0.66 ± 0.05 mm (0.026 ± 0.002")

Track Spacing

1.65 ± 0.05 mm (0.064 ± 0.002")
center-to-center with a non-accumulative tolerance.

Track Numbering (relative location in the head)

Track 3 Opposite mounting surface
Track 2
Track 1 Reference track
Track 4 Next to mounting surface

Track location

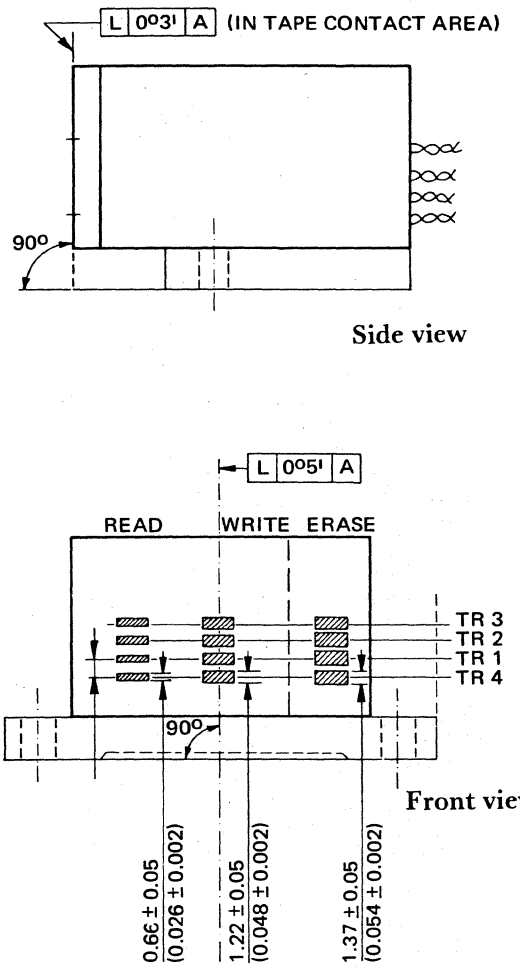
The head assembly is machined so that the reference track always has a certain elevation above the mounting surface:

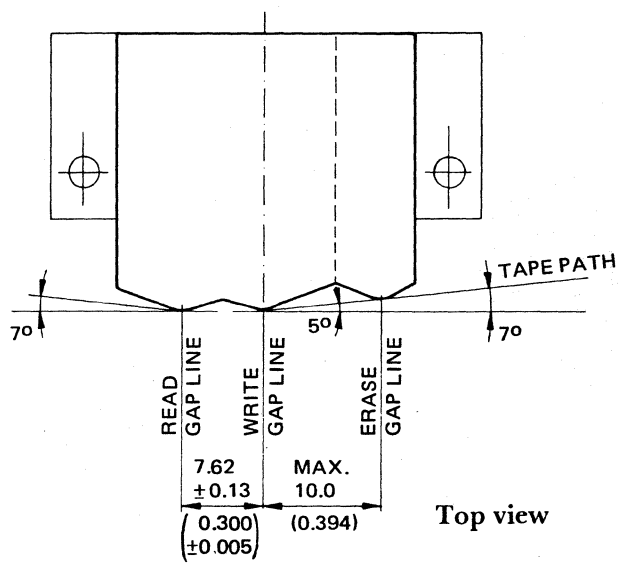
8.712 ± 0.025 mm (0.343 ± 0.001")

from the center of track 1 to the bottom surface.

Head positioning

The head is designed with no provision for adjustments. It is therefore possible to mount the head directly on the TDC 3000 casting and still have full interchange capability. This is due to the high tolerances used in both the head and the casting and the fact that the write track is wider than the read track. With the track widths used, the read head may be displaced ± (1.22 – 0.66)/2 = ± 0.28 mm (0.009") before the read level is reduced.





NOTE!
All dimensions in mm (inches).

Mechanical outline of the Head Assembly

4. HEAD CLEANING

For reliable performance, the head must at all times be free from contaminants such as dust from the environment or oxide particles shredded from the tape surface or edges. If contaminants are permitted to build up, poor head-to-tape contact will result. This in turn will cause an abnormal high number of re-writes or loss of previously written and accepted data.

The head should be cleaned using the solvent recommended in the list of preventive maintenance in the chapter SERVICING.

The cleaning interval is applications dependent. However, as a general guideline before a specific requirement is documented, the following intervals are recommended:

Occational use, but tape loaded	monthly
Medium use	weekly
Heavy use (over 10% motion duty cycle)	daily

5. HEAD DEMAGNETIZATION

The head may become magnetized from excessive currents in a fault situation or from high external fields such as magnetized tools, etc.

If a read head is magnetized, some reduction in signal level is expected. In addition, the general noise level increases. With high magnetization a partial erasure of the signal will occure, and this effect is strongest and also most damaging at the highest flux density.

The head should therefore be de-magnetized after replacement or before accurate analog measurements are to be made.

To de-magnetize, use the tool specified in the chapter SERVICING.

6. HEAD AND TAPE WEAR

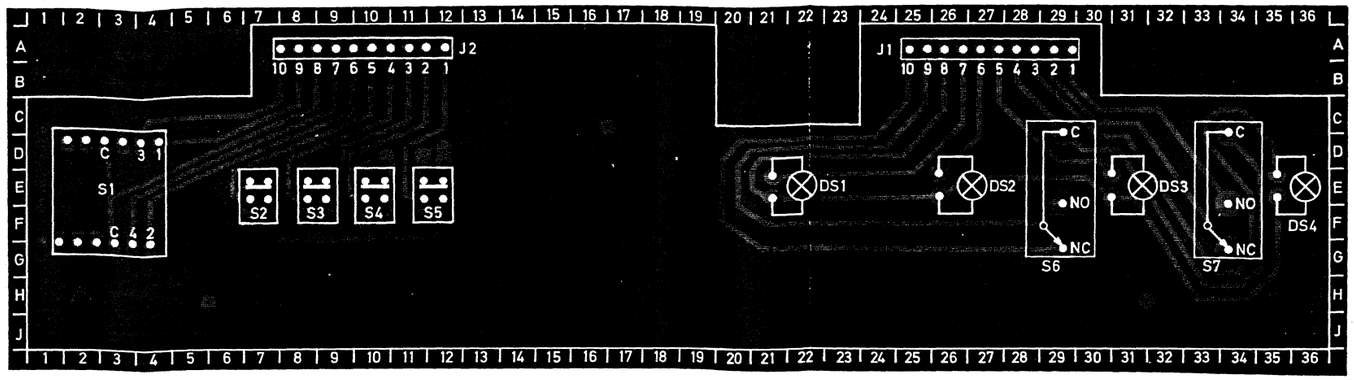
Head wear is dependent upon the smoothness of the tape surface, the tape contact force, and the environmental factors. At simultaneous high humidity and temperature the wear rate is many times that of the normal operating conditions. Wear is also tape speed dependent, but over a certain speed the tape moves away from the head surface because of the air film. Head wear at 90 ips is thus lower than at 30 ips.

If oxide particles start to deposit on the head surface, these particles will wear the tape at an accellerating rate. The head itself will then wear rapidly due to the rough tape surface. For reliable operation and low head wear it is therefore imperative that the head is maintained free from contamination.

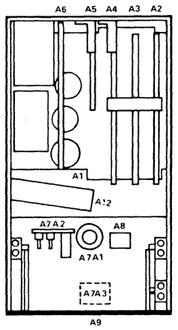
7. LIST OF HEAD VERSIONS

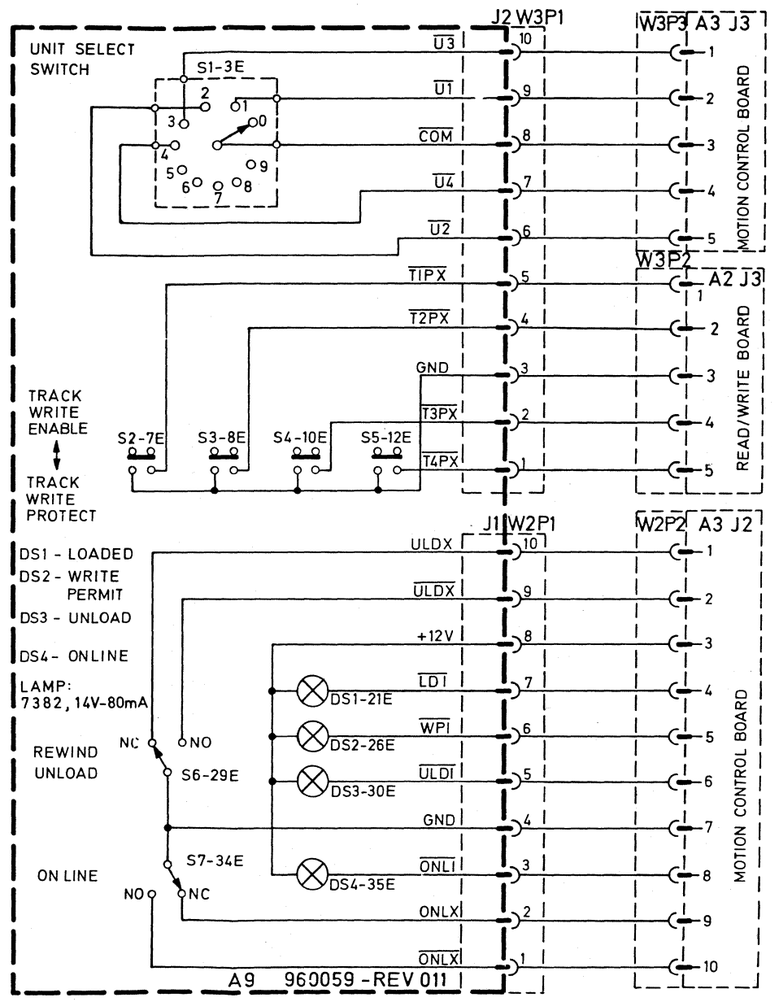
	Service ordering number
1 track Read-After-Write	960074
2 track Read-After-Write	960075
4 track Read-After-Write	960076
1 track Read-After-Write + Erase	960077
2 track Read-After-Write + Erase	960078
4 track Read-After-Write + Erase	960079

TDC 3000
Publ. No. 1381 - 2 - 77



A9 Front Panel Board,
see Mechanical Parts List
on page parts–4.





BACKDATING:

If the revision number (Rev. No.) on the printed circuit board is lower than the revision number on the circuit diagram, see paragraph Backdating Information in the chapter UPDATING.

Position	Name	Part No.	Rev. No.
A9	Front Panel Board	960059	010