



**LASER MAGNETIC STORAGE  
INTERNATIONAL COMPANY  
TAPE STORAGE DIVISION**

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**49769000**

**STREAMING TAPE UNIT  
92181 - VERTICAL MOUNT  
HARDWARE MAINTENANCE MANUAL**

**THEORY OF OPERATION  
DIAGRAMS  
MAINTENANCE  
PARTS IDENTIFICATION**

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A PHILIPS AND CONTROL DATA JOINT VENTURE



REVISION RECORD

REVISION	DESCRIPTION
<p>A (09-30-84) Series Code 15</p>	<p>Released. This manual along with the Hardware Reference/Maintenance Manual Pub. No. 49768900 supersedes Field Service Manual 49761800, Technical Reference Manual 49761500 and Parts Identification Manual 49762000 for Vertical Mounted STU's.</p>
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<p>PUB. NO. 49769000</p>	<p>Revision letters I, O, Q, S, X, and Z are not used.</p>



## PREFACE

The purpose of this manual is to furnish to the customer engineer information needed to maintain the 92181 STU. It is assumed that the customer engineer has had training and/or experience on the 92181 or similar tape units. Under no circumstances should maintenance be attempted by any one without the prerequisite skills and experience.

Hardware reference/maintenance information is separated into two publications on a task-oriented basis. This manual, publication number 49769000 presents technical maintenance information in the following sections:

- 4 - THEORY OF OPERATION
- 5 - DIAGRAMS
- 6 - MAINTENANCE
- 7 - PARTS IDENTIFICATION

The other manual, publication number 49768900, presents routine operation, maintenance, and installation instructions in the following sections:

- 1 - GENERAL INFORMATION
- 2 - OPERATION
- 3 - INSTALLATION AND CHECKOUT

The manuals identified above are available through Laser Magnetic Storage International Company Tape Storage Division.

The revision level of each page is indicated by an alpha character located adjacent to the publication number at the bottom of each page. The revision level of a page will change when the content of the page has been affected by deletions or additions to the page. A bar in the margin indicates where the change has occurred. A dot near the page number indicates the entire page is affected, and a bar adjacent to the page number indicates pagination rather than content has changed.

WARNING

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A peripheral computing device pursuant to Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case, the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

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## GENERAL DESCRIPTION

This section of the manual discusses the principles of operation of the Streaming Tape Unit (STU). Descriptions are provided for all functions of the STU on a major component basis. Major areas of discussion are as follows:

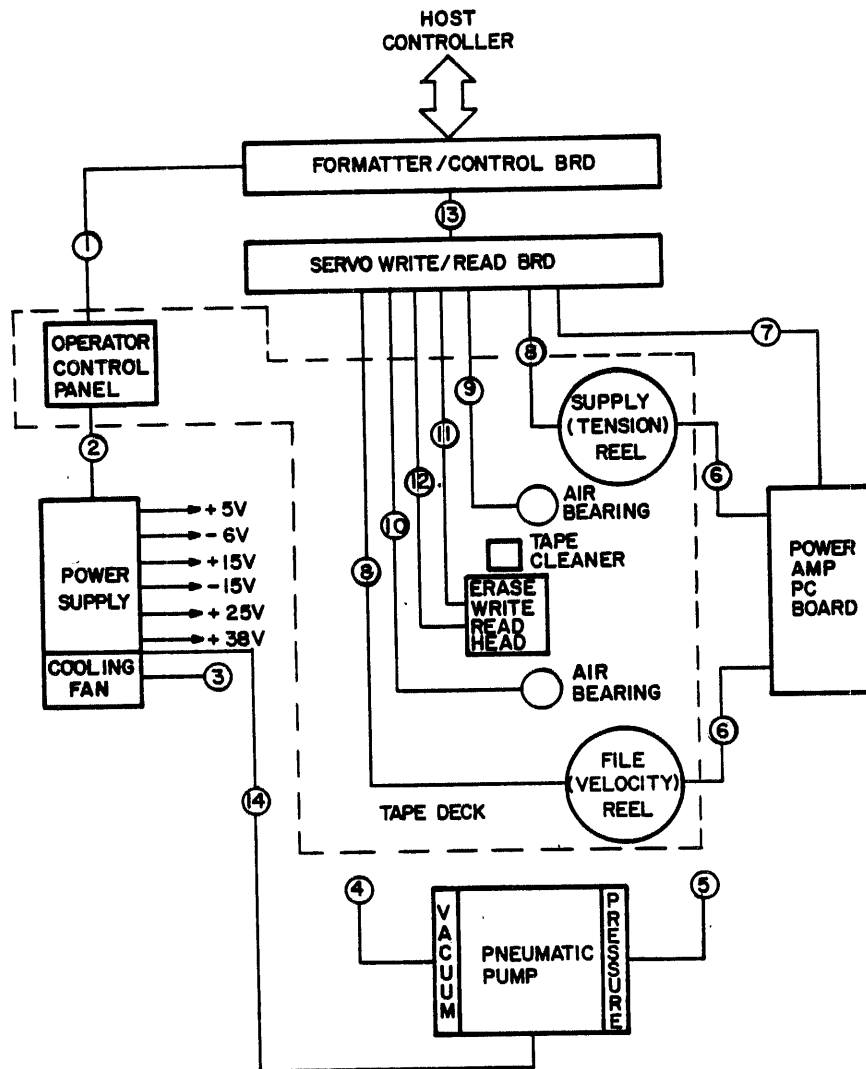
- o Power Generation and Distribution
- o Pneumatic System
- o Servo-Read/Write Board Functions
- o Formatter/Control Functions
- o Power Amplifier Operation
- o Head Operation/Recording
- o Interface and Timing Considerations

Text is supported by diagrams, flowcharts and timing charts, where required, to simplify understanding of the description. Diagrams contained herein are condensed and simplified and, in no way, should they be used for STU troubleshooting. Logic diagrams and schematics contained in the Field Service Manual take preference over any diagrams contained in the theory of operation. Refer to Figure 4-1 for a block diagram of the Streaming Tape Unit (STU).

A brief functional description of major areas of the STU is given in succeeding paragraphs. A more detailed circuit description is then discussed with accompanying block diagrams and flowcharts.

## PHYSICAL DESCRIPTION

The STU is a manual load, reel-to-reel tape drive unit requiring no capstan drive, tension arms or vacuum columns. Tape is transported directly under electronic control, with no tape buffers required. Tension is sensed electronically by tension sensors built directly into the tape path. The five major equipment components or subsystems are Formatter/Control logic, Servo circuits, Read/Write Head assembly and circuits, Pneumatics/Cooling systems, and the Power Supply and Distribution circuitry. The following paragraphs give a brief description of the overall STU functions.



- |   |                                      |
|---|--------------------------------------|
| ①. OPERATOR/DIAGNOSTIC COMMANDS                 | ⑧. TACH INFO TO SERVO CIRCUITS       |
| ②. ON/OFF SWITCHES AND PANEL INDICATOR VOLTAGES | ⑨. BEARING TRANSDUCER TENSION INFO   |
| ③. COOLING AIR TO ALL ASSEMBLIES                | ⑩. BEARING TRANSDUCER TENSION INFO   |
| ④. VACUUM SUPPLY TO TAPE CLEANER                | ⑪. WRITE DATA TO TAPE                |
| ⑤. PRESSURE TO AIR BEARINGS                     | ⑫. READ DATA FROM TAPE               |
| ⑥. DRIVE CURRENT TO REEL MOTORS                 | ⑬. LOGIC CONTROL AND FORMATTING INFO |
| ⑦. SPEED/TENSION CONTROL                        | ⑭. POWER TO PUMP MOTOR               |

Figure 4-1. FUNCTIONAL BLOCK DIAGRAM

## POWER SUPPLY

The power supply is partially activated when the main circuit breaker is in the ON position. This allows the LOGIC OFF indicator on the control panel to illuminate, and also supplies the AC power to operate the cooling fan motor.

Pressing the LOGIC ON switch generates all the necessary DC voltages used throughout the STU logic circuits, as well as initiating a MASTER CLEAR pulse. This pulse is used to steer the control logic functions to a starting or known state prior to starting a Load operation.

## TENSION/SPEED CONTROL

The Load function is initiated by the LOAD switch on the control panel. The compressor is activated at this time, causing air pressure to be gated to the upper and lower air bearings. Air pressure gated through holes in the bearings actually senses the tension of the tape through transducers physically located on the air bearings. The transducer output signals are applied to a tension servo circuit, whereby, the supply (file) reel is directed to drive so that a constant tension of approximately 8 ounces is maintained across the tape path at all times.

Tape speed is maintained through the use of a 1000 line tach and a 1 line tach located on the rear of the reel motors. Tach information is applied to an electronically controlled servo, whereby, a calculation is made of the linear velocity (inches per second) and the radius of the take-up reel. Because the radius of tape on the reel is always a known factor, then the linear velocity can be compensated for without the use of a capstan drive circuit.

## MAGNETIC HEAD

The magnetic head fulfills the objective of the STU; ie., read from or write to the magnetic tape. This assembly consists of a sectionalized read/write head and an erase head. Selection of the read or write modes of operation is made by the host controller through the control logic circuits. Data is transferred from or to the host controller via data lines that are gated to the individual read heads by the read/write circuits. Read recovery circuits convert the readback data to a digital format compatible with the control and formatter logic. Write driver circuits convert the logic-compatible write data to current levels required to drive the write head coils.

## FORMAT CONTROL

The STU performs all data formatting functions internal in the formatter logic circuits. Functions controlled by the transport include PE ID Burst, Preamble, Postamble, File Mark, and Skew Compensation.

## INTERFACE

The STU interface is based upon the Industry Standard Interface for 1/2 inch tape products. Modifications to this standard interface are required to accommodate the STU. The modifications are in the form of expansion to accommodate streaming mode operations and increased functionality, as well as deletions of unused functions. More specifically, the following additional capability is provided:

### Streaming Mode Operations

Speed Select Command and Status Lines are required for setting start/stop or streaming modes and identifying motion states.

### Gap Length Controls

Establish normal (0.6 inch nominal) or long (1.2 inch nominal) Inter-block Gap (IBG). Optional gap lengths in the short and long gap are selectable via change to printed circuit board: The short gap is fixed at 0.6 inch or variable 0.6 to 0.9 inch. The long gap is fixed at 1.2 inches or variable 0.6 to 1.2 inches. The STU is shipped with the gaps selected in the fixed modes.

### Sense Transfer

Allows for the transfer of sense information.

### Interface Loopback

Allows for the looping of write-to-read lines on the STU Interface.

The deletions consist of removing the functions of density selection (NRZI/PE), Edit Command (not supported), and clip level threshold selection (performed automatically in the transport).



## POWER SUPPLY

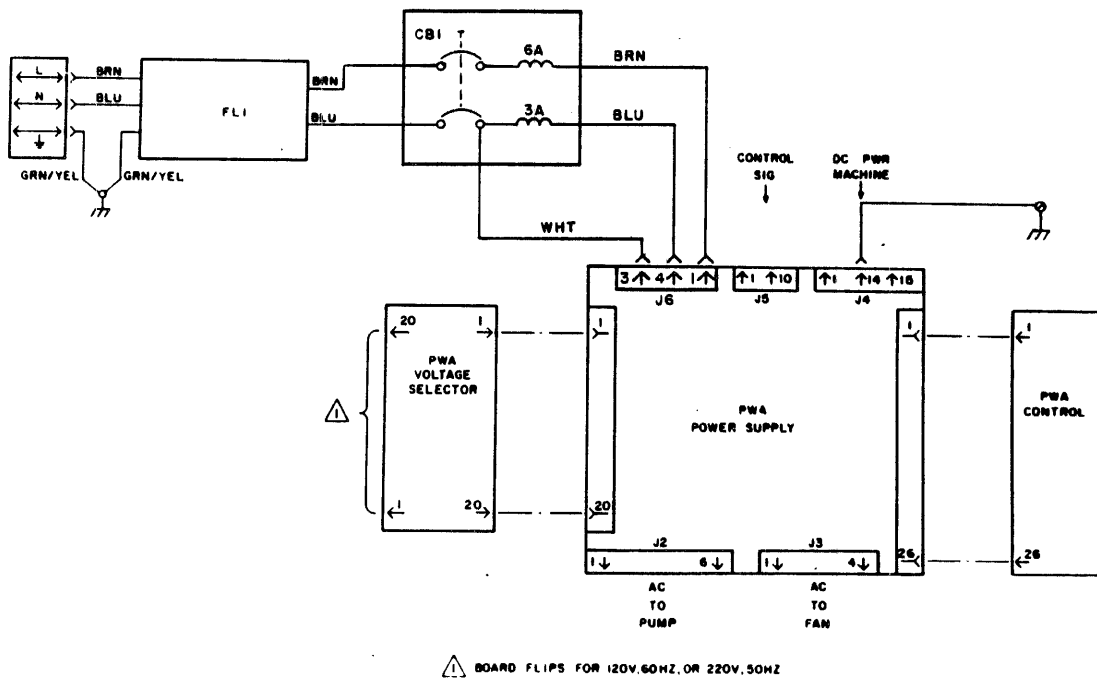
### GENERAL DESCRIPTION

The power supply located at the top rear of the transport provides all power from a single AC appliance input. A circuit breaker or similar protective device rated at 15 amps is required at the customer power source.

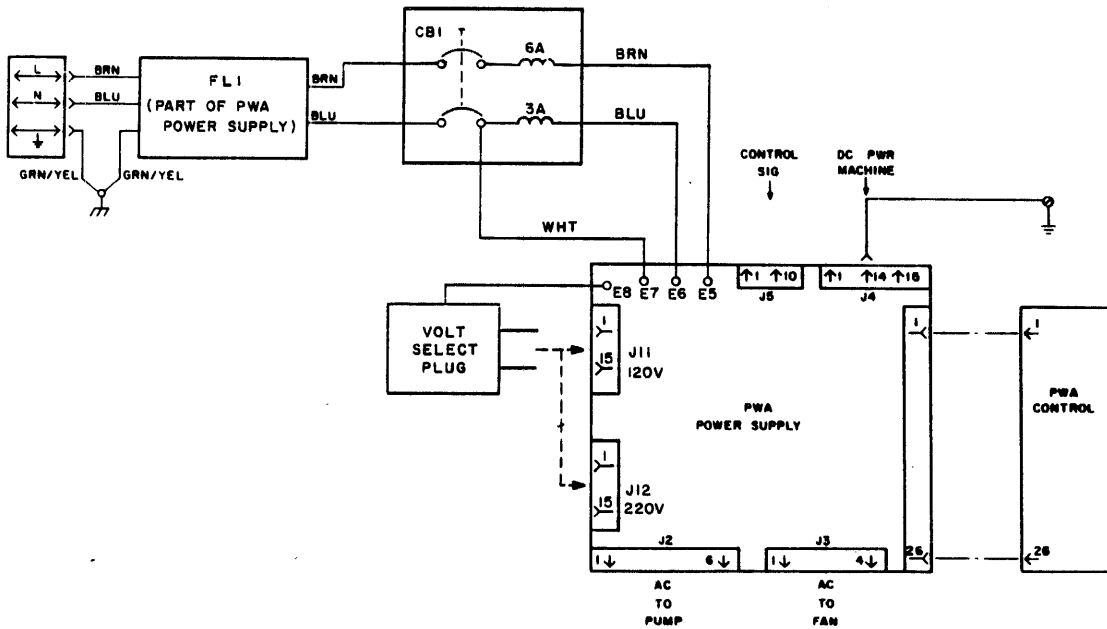
The power supply accepts regulated inputs of 120V or 220-240V power, with the only change in configuration being the positioning of the voltage select PWA on (P/N 7700993X) power supplies or positioning of the voltage select plug on (P/N 7702934X) power supplies. A functional description of this change is discussed in succeeding paragraphs. The major function of the power supply is to provide ac power to the cooling fan and compressor, generate dc voltages used throughout the transport, and provide shut-down capabilities in the event of abnormal voltage conditions.

### PHYSICAL DESCRIPTION

Power supply (P/N 7700993X) components consist of the ac input receptacle, line filter, circuit breaker (mounted on the top front of tape deck), voltage select PWA, main power supply PWA, and power supply control PWA. Power supply (P/N 7702934X) components are the same as power supply (P/N 7700993X) components except a voltage select plug is used in place of a voltage select PWA. A simplified block diagram of major power components is shown in figure 4-2. A brief functional description of the three power supply PWA's is as follows:



A. Power Supply P/N 7700993X



B. Power Supply P/N 7702934X

Figure 4-2. MAJOR POWER SUPPLY COMPONENTS

### Voltage Select PWA (Power Supply P/N 7700993X)

This PWA consists of two connectors labeled J1A and J1B and two fuses. One fuse is used in the input ac lines to a standby voltage supply, and the remaining fuse is used for protection of components in the board is such that the input transformer in a configuration compatible with either 120V or 220-240V. Connector J1A is inserted into the main PWA if 120V is provided; connector J1B is used for the 220-240V requirement. Connector keys are provided on the board edge connectors to reduce the possibility of incorrect insertion. The voltage select PWA is mounted vertically into power supply main PWA at connector J6.

### Voltage Select PWA (Power Supply P/N 7700993X)

The voltage select plug consists of a 15-pin connector with a cable strain relief mounted on top. The plug is hard-wired to point E8 on the main power supply PWA. When 120V input is provided, the voltage select plug is inserted in the 120V receptacle (J11) on the main power supply PWA. When 220-240V input is provided, the voltage select plug is inserted in the 200V receptacle (J12) on the main power supply PWA.

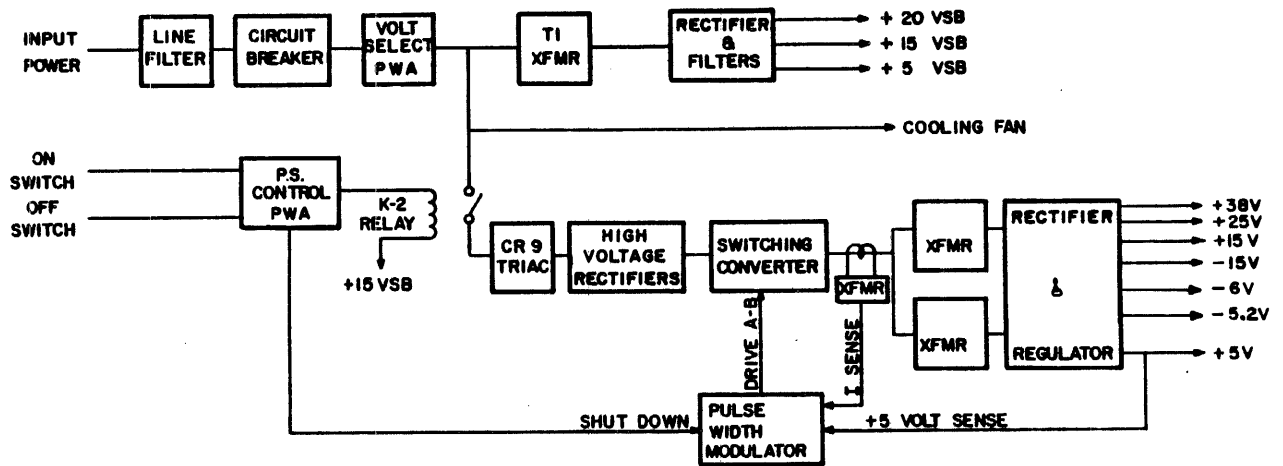
### Power Supply Control PWA

The Control PWA consists of the low voltage and over-voltage detect circuits, LOGIC ON switch and LOGIC OFF switch input circuits, LOGIC ON/OFF control panel indicator circuits, master clear circuit and power-on latching circuit. Like the Voltage Select PWA, the Control PWA is mounted vertically into the Main PWA at connector J8.

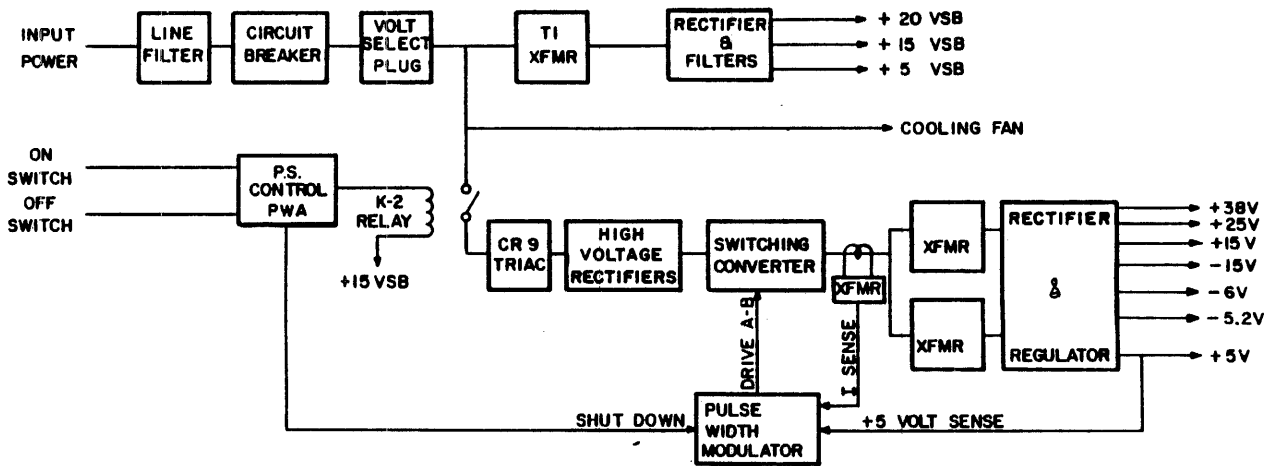
## Power Supply Main PWA

The main PWA is responsible for the function of the power supply; i.e., generating dc voltages for all functions in the STU. A brief description of the circuits, comprising the main PWA, is as follows:

- o Standby Voltage Circuit - Standby voltages of +20, +15 and +5 volts are developed to provide a separate supply voltage for all other control circuits associated with the power supply. The standby voltages are used only within the power supply.
- o Pulse Width Modulator - This circuit monitors the +5 volt output logic level and develops a pulse train to drive the half bridge switching converter. The pulse width modulator also provides the means by which abnormal conditions cause the shut-down of the output voltages.
- o Half-Bridge Switching Converter - This circuit contains the pulse width modulator, totem-pole driver circuits, high voltage rectifier, and transformers coupling the converted primary energy to the regulated dc voltage output circuits.
- o Regulated DC Voltages - The regulated DC voltages generated on the main PC board include +5V, -5.2V, -6V, +15V, +25V and +38V. The circuits consist of output transformers, full wave rectifiers, filtering networks and regulators.



A. Power Supply P/N 7700993X



B. Power Supply P/N 7702934X

Figure 4-3. POWER SUPPLY BLOCK DIAGRAM

## POWER SUPPLY FUNCTIONAL DESCRIPTION

### GENERAL

The following discussion of circuit operation is presented in the sequence in which the power supply is activated. Reference should be made to the accompanying block diagrams or to the Power Supply Schematics contained in the Diagram section of the manual.

### INPUT POWER SELECTION

Input power (120V or 220-240V) is applied from the power line cord connected to the power supply receptacle and into a line filter for noise suppression. Power is then supplied to the transport power switch (circuit breaker) located on the tape deck. The switch portion of the circuit breaker is labeled 1 (ON) and 0 (OFF). With the circuit breaker placed in the 1 position, input power is routed through connectors and into the voltage select PWA on 7700993X series power supplies or voltage select plug on 7702934X series power supplies. It is, at this point, that circuit selection is made for either 120V or 220-240V ac. Refer to figure 4-4 for circuit differences.

### Power Supply P/N 7700993X

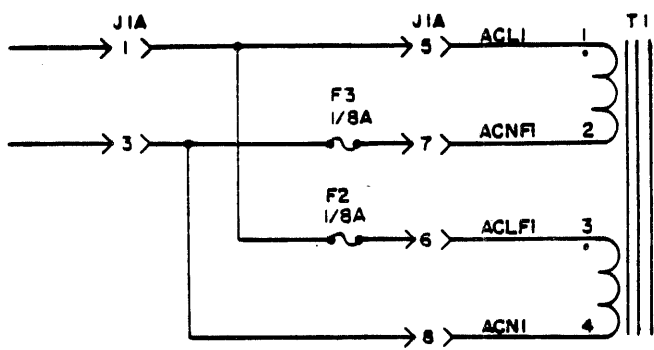
If 120V input power is being applied, the voltage select PWA is positioned such that connector J1A is plugged into the main PWA. If an overload condition is present at transformer T1, the F3 and/or the F2, 1/8A fuses would blow. The fuses are situated so that any external taps of the primary (i.e., compressor operation) do not affect the fuses, which are used only for detection of an overload condition at transformer T1.

If 220-240V input power is being applied, then the voltage select PWA is positioned such that connector J1B is plugged into the main PWA. With this configuration, the two primaries of transformer T1 are wired in series, with only the F3 fuse applicable to the circuit.

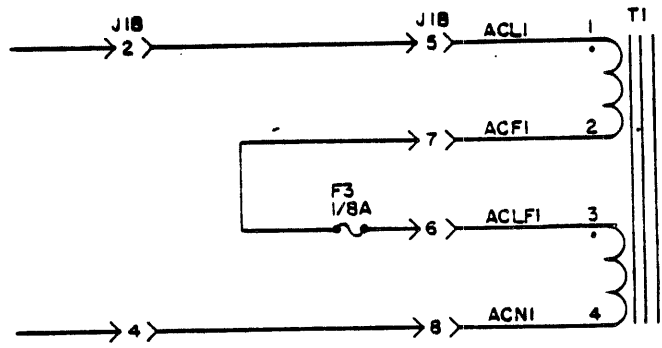
Power Supply P/N 7702934X

If 120V input power is being applied, the voltage select plug is inserted in the 120V receptacle (J11) on the main power supply PWA. If an overload condition is present at transformer T1, the F1 and/or the F2, 1/8A fuses will blow. The fuses are situated so that any external taps of the primary (i.e., compressor operation) do not affect the fuses, which are used only for detection of an overload condition at transformer T1.

If 220-240V input power is being applied, then the voltage select plug is inserted in the 220V receptacle on the main power supply PWA. With this configuration, the two primaries of transformer T1 are wired in series, with the F1 and F2 fuses in series to the circuit.

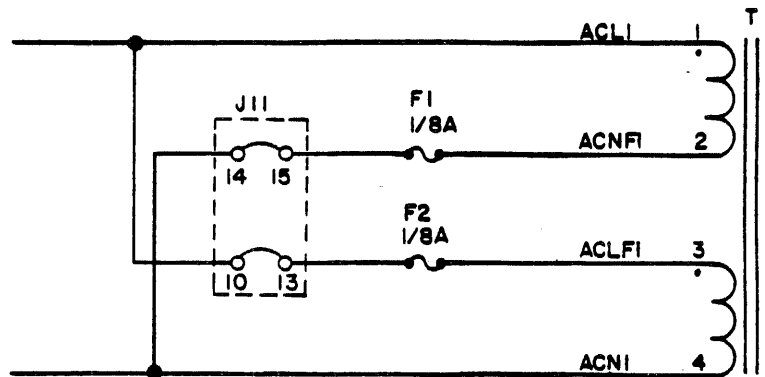


A. 120V Power Input

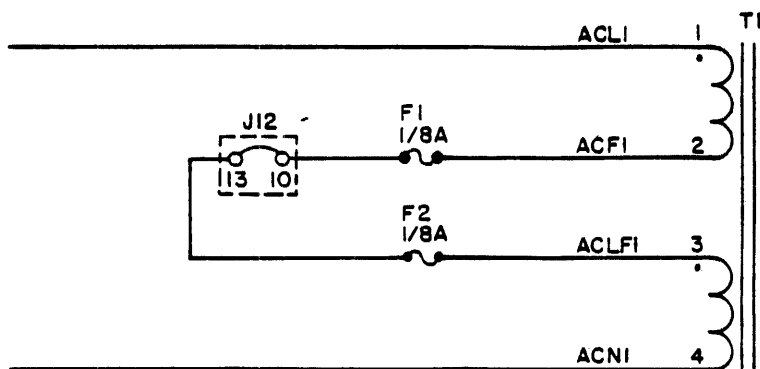


B. 220-240V Power Input

Figure 4-4A. Voltage Select PWA  
(Power Supply P/N 7700993X)



A. 120V Power Input



B. 220-240V Power Input

Figure 4-4B. Voltage Select PWA  
(Power Supply P/N 7702934X)



Also, note that, at this point (power applied, circuit breaker ON), the AC line is applied to the cooling fan motor. The cooling blower has a three-line input and is configured as shown for either 120 or 220-240 volt application. Wiring to the neutral line is determined in the Voltager Select PWA.

#### STANDBY VOLTAGE GENERATION

Standby voltages of +20, +15 and +5 volts are developed to provide a separate supply voltage for all control circuits associated with the power supply. These voltages are present when input power is applied and the circuit breaker is placed in the ON position. Development of the standby voltage is as follows:

Input power is applied to the T1 standby transformer and converted to a +20 standby voltage via a full wave rectifier and filter network. The +20 VSB is used as a control voltage for the half-bridge switching converter and control panel OFF indicator, and is also used to develop the +15 standby voltage.

The +15 standby voltage is developed by a LM317 voltage regulator. The resistor divider network R3/R4 determines the required output of this regulator. Plus 15 volts is used as a supply voltage for the K-1 pump enable relay, K-2 current-on relay, pulse width modulator, over and under voltage detect circuits and master clear circuits, and is used as the source voltage to develop +5 standby voltage.

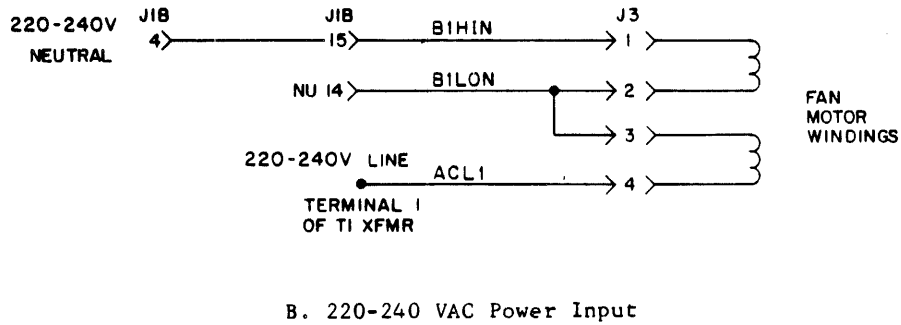
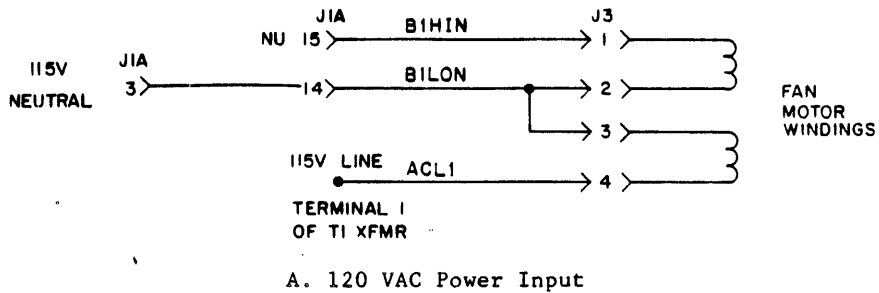


Figure 4-5A. Cooling Fan Wiring  
(Power Supply P/N 7700993X)

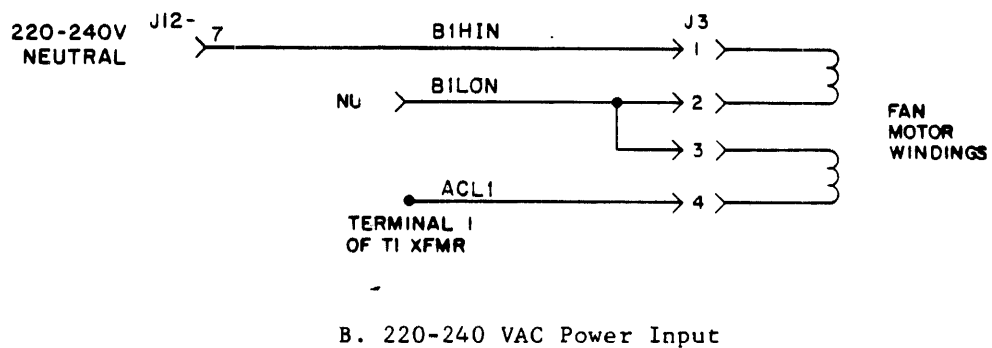
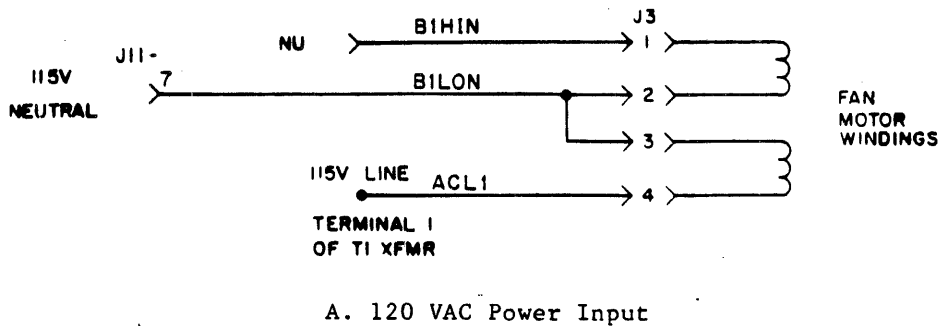


Figure 4-5B. Cooling Fan Wiring  
(Power Supply P/N 7702934X)

The +5 standby voltage is developed by a LM317 voltage regulator circuit similar to that used on the +15 VSB line. Plus 5 VSB is used as the supply voltage to operate all of the TTL chips used throughout the power supply. The Q3 transistor located between the +5 and +15 volt circuits is used in the event of the +15V supply being shorted to the +5 volt supply. If the +5V supply increases above 6.2 volts, diode CR36 would forward bias transistor Q3, causing a +5V potential at the resistor divider network of the +15 VSB voltage regulator. The +15 VSB regulator would then be regulated to approximately 6.2 volts, eliminating any damage that would otherwise occur to the TTL circuits fed by the +5V supply.

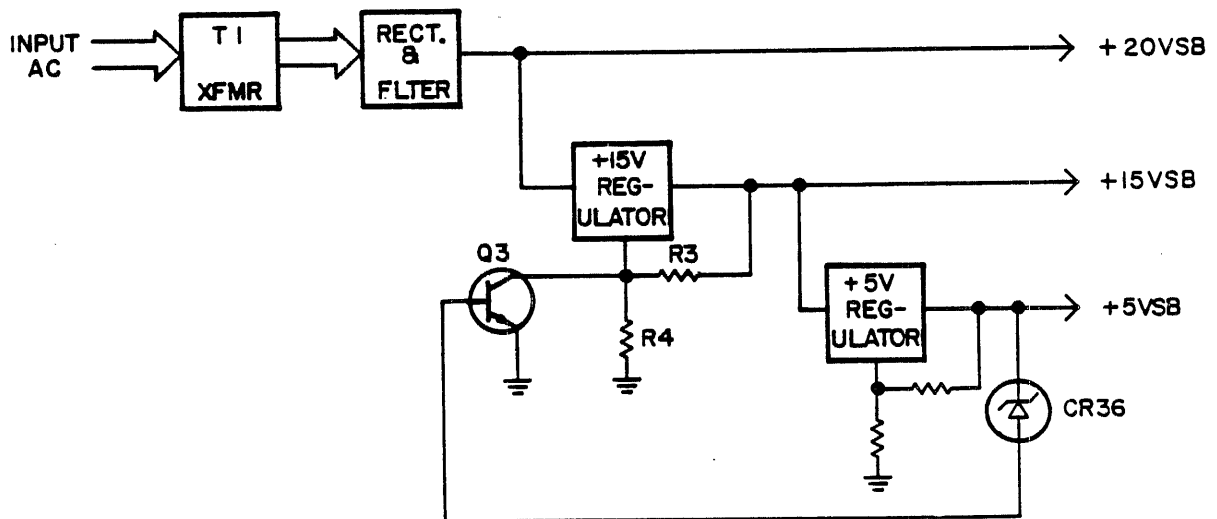


Figure 4-6. STAND-BY VOLTAGE GENERATION

The only effect of the standby voltage outside the power supply is the OFF indicator on the control panel. The Power-On flip-flop (reset at this time) turns on the OFF LED transistor and supplies current limited (20 ma) +20 VSB to the OFF indicator.

While in the standby mode, the ION signal is a logic 1 (High), keeping the pulse width modulator in a shut-down condition.

## POWER-ON SEQUENCE (Refer to Figure 4-7, Power-On Flowchart)

The purpose of the power-on function is to provide the required regulated DC voltages to the transport's control, formatter and servo circuits. The power-on sequence also enables the abnormal (low/over) voltage detect circuits within the power supply.

Power-On is initiated by pressing the ON switch on the control panel. This action causes a momentary turn on of the power-on transistor which triggers the POWER-ON flip-flop to the set state. The reset output of the flip-flop removes the ION (low) signal from the pulse width modulator, enabling a 25 KHz pulse train output (DRIVE A/DRIVE B). These outputs are the control signals to develop the +5, -6, +15, +25 and +38 volt logic levels used throughout the transport. An explanation of the pulse width modulator and DC circuits are discussed in succeeding paragraphs.

Concurrent with the development of the DC voltages, the POWER-ON flip-flop also initiates a power-on delay, which is used to inhibit detection of low voltage until the DC voltages are expected to attain their nominal voltage level. The reset output of the POWER-ON flip-flop initiates a RC time delay of approximately 300 ms. This delay prevents the ON DLY flip-flop from setting which, in turn, forces the LVCHECK flip-flop to remain reset. At the conclusion of the 300 ms delay, a comparator triggers the ON DLY flip-flop. The LVCHECK flip-flop is now primed to receive a Low Voltage signal, if that condition is detected. Low voltage detection is discussed in succeeding paragraphs.

The ON DLY flip-flop also removes one of three inhibits from the Master Clear circuit.

The Master Clear (MCLR) circuit is provided to the transport logic to "steer" the control functions to a starting or known state during ON/OFF and other detected abnormal conditions. The MCLR circuit contains a time delay circuit of approximately 150 ms, which is used to assure output voltage stability prior to inactivating Master Clear. Three inputs are used to control MCLR: PON (Power On flip-flop), LOWV (Low Voltage), and ONDLY (On Delay flip-flop). The output of the MCLR is held low active during transitional periods, and is allowed to de-activate to a high level after all three controlling inputs are logic high.

At the conclusion of Master Clear, the ON LED transistor is turned on which applies +5V to the LOGIC ON indicator on the control panel.

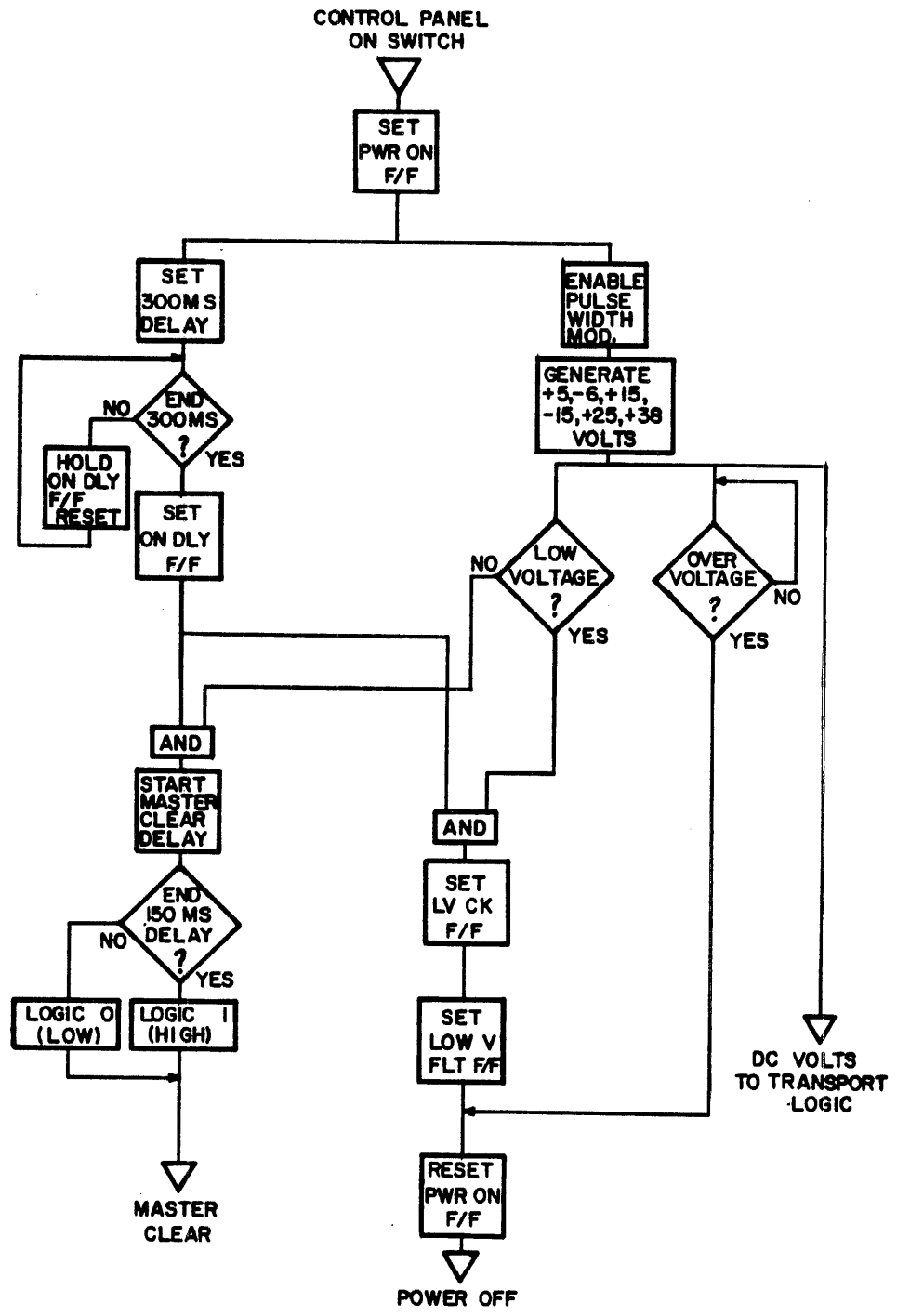


Figure 4-7. POWER-ON SEQUENCE FLOWCHART

## SWITCHING CONVERTER (Ref. Figures 4-8 and 4-9)

The high voltage supply for the switching converter consists of two electrolytic capacitors charged through a diode bridge network. The output capacitors are configured such that during 120V operation, the circuit functions as a voltage doubler, with the output capacitors connected in series. During 220-240V operation, the output capacitors are connected in parallel, and the input line is full-wave rectified. The resulting effect is that an output voltage of approximately 300V is supplied to the switching converter, regardless of whether 120V or 220-240 VAC is supplied. A simplified diagram of output capacitors and bridge configuration is shown in the figures below.

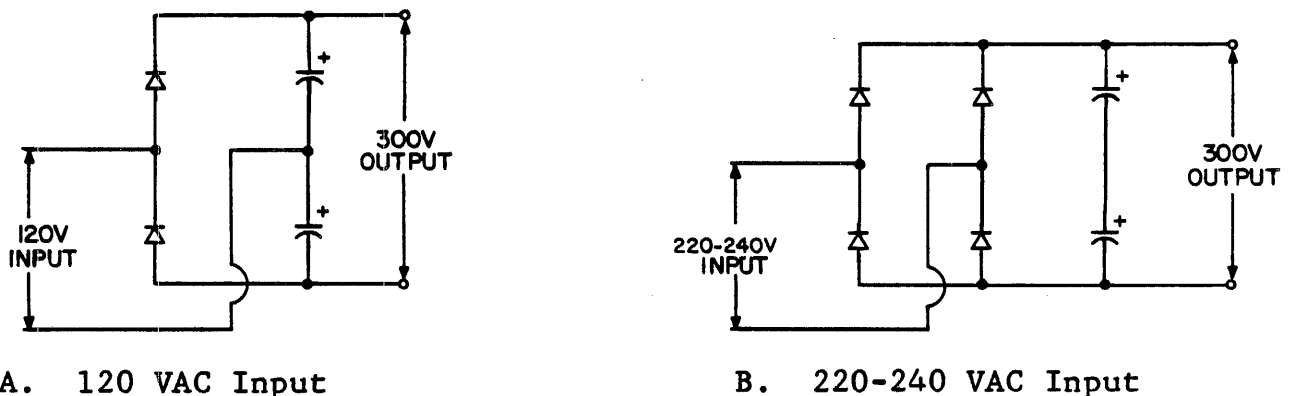


Figure 4-8. HIGH VOLTAGE GENERATION

DRIVE A and DRIVE B (from the pulse width modulator) appear at the input of two 75452 peripheral drives. These drivers, in the on state, positive input, provide a ground output. In the off state, the output is an open collector circuit. An example of circuit operation is as follows: As the signal level of DRIVE B goes negative, driver pin 5 becomes an open collector. This provides a circuit from R12, +20 VSB, through the primary of transformer T2, pin 12, to ground of the peripheral driver pin 3. With terminal 2 of T2 at a positive potential, an induced positive voltage is also present at terminal 10 of the secondary of T2, causing transistor Q1 to turn on. With Q1 turned on, a current path is now provided via Q1, T2 windings 5 and 6, and through the primaries of transformers T4 and T5. The induced voltage in the secondary of T4 and T5 is rectified, as described in the DC Voltage paragraph.

During conduction of Q1, the current flow through T2 terminals 5 and 6 applies a "load proportional" drive current to base of Q1.

DRIVE B peripheral driver is turned on (ground output) when the DRIVE B signal returns to the high level. With both DRIVE A and DRIVE B in the on state, the primary of T2 is essentially shorted, causing Q1 to turn off. The charge stored in capacitor C10, during conduction of Q1, is applied as a back bias to Q1 when T2 is shorted. This ensures an immediate turn off of Q1 to produce the resultant waveform shown in Figure 4-9.

When DRIVE A signal goes negative, the peripheral driver pin 3 outputs an open collector, and a current path is provided in the opposite direction through transformer T2 primary winding. Terminal 7 of T2 secondary now has a positive reference and Q2 is turned on. Current flow through T4 and T5 is now in the opposite direction via Q2 and T2 windings 5 and 6.

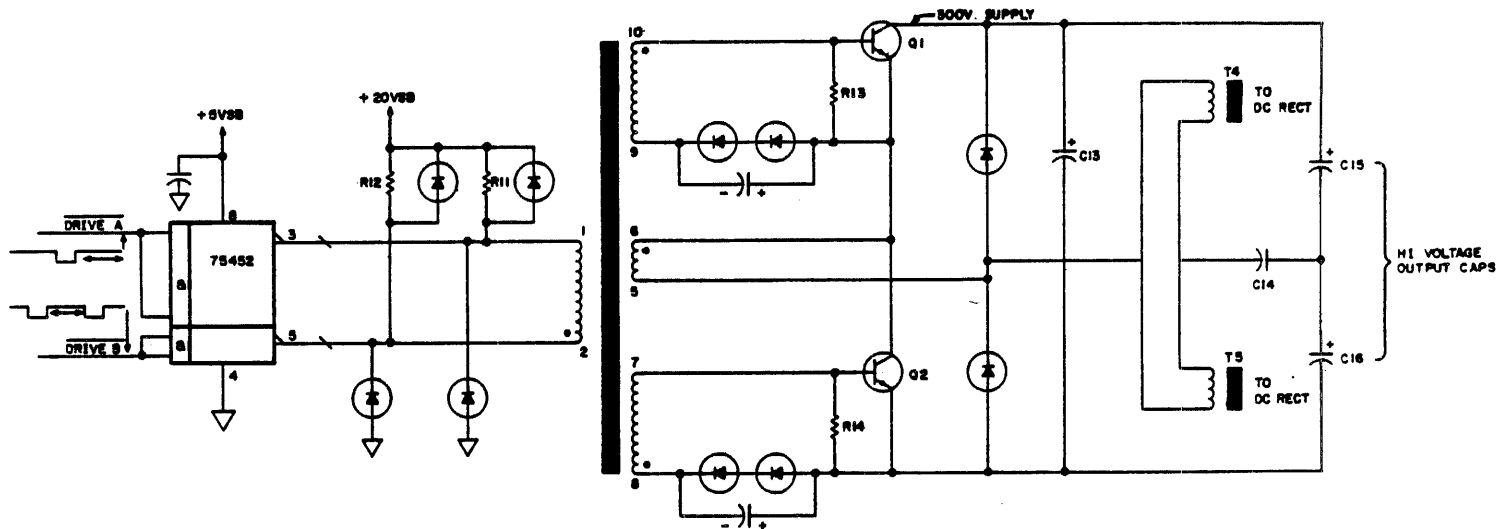


Figure 4-9. SWITCHING CONVERTER CIRCUIT

#### DC VOLTAGES

The DC voltages generated by the power supply, for use throughout the STU, are as follows:

<u>VOLTAGE</u>	<u>USED ON</u>
+5V	All PC Boards as a supply voltage for TTL circuits
-6V	Read Amplifier Circuits
+15V	Servos, Power Amplifier and Read Recovery VFO
-15V	Servos and Power Amplifier
+25V	Write Driver Circuits
+38V	Power Amplifier

All DC voltages are generated and regulated in a similar manner. The output of the secondary windings of the Switching Converter transformers T4 and T5 are inputted to a full wave rectifier and filtered by a choke/capacitor filter network. Negative 6 volts and + 15 volts are regulated by LM317 and LM337 voltage regulators, with resistor divider networks providing the required regulator programming. Plus 5 volts circuit does not require a voltage regulator due to the compensation circuit supplied by the pulse width generator discussed previously.

## LOW VOLTAGE/OVER-VOLTAGE DETECTION

The detector circuits are comprised of the various DC input voltages, voltage divider resistor networks, +2.5 reference voltage and LM339 voltage comparators. If any of the input DC voltages exceed the circuit threshold set up by the resistor networks and reference voltage, the comparator outputs a ground potential. This output then initiates a shut-down of the transport power supply. If the voltages are within the parameters listed below, the comparators will have open outputs.

<u>NOMINAL VOLTAGE</u>	<u>LOW VOLTAGE THRESHOLD</u>	<u>OVER-VOLTAGE DETECTION</u>
+5V	+4.53	+6.0
-6V	-5.0	-6.96
+15V	+12.58	+17.25
-15V	-12.58	-17.25
+25V	+21.25	+28.13
+38V	+25.25	+50.3

## POWER SUPPLY SHUT-DOWN

There are three circuits which cause the STU to power-down. They are an over-voltage condition, low voltage condition, and control panel LOGIC OFF switch being pressed.

- o Over-Voltage - When an over-voltage condition occurs, the voltage comparators of the detection circuit output a ground potential. This ground signal (labeled OFF) resets the POWER-ON flip-flop. Signal ION becomes a logic 1 (high), causing the pulse width modulator to shut down. With no output from the modulator, all DC voltages to the transport are dropped. Concurrent with the shut-down of the pulse width modulator, the Master Clear signal goes to a logic 0 (low), thereby resetting affected circuits in the transport logic. The LOGIC OFF indicator on the control panel is illuminated by the shut-down condition.
- o Low Voltage - When a low voltage condition occurs, the voltage comparators of the detection circuit output a ground potential. This ground signal (labeled LOWV) sets the Low Voltage Check flip-flop, if the ON DLY FF is set, causing LV FAULT FF to set which results in the POWER-ON flip-flop going reset. With POWER-ON flip-flop in the reset state, the power supply is shut down in the same manner as described in the Over-Voltage discussion above.
- o Control Panel LOGIC OFF Switch - Pressing the LOGIC OFF switch causes a logic 0 (low) to exist at the reset input of the POWER-ON flip-flop. When the POWER-ON flip-flop is in the reset state, the shut-down of the power supply occurs in the same manner as described in Over-Voltage and Low Voltage discussed in previous paragraphs.



## PNEUMATIC SYSTEM FUNCTIONAL DESCRIPTION

The pneumatic system generates and distributes the air pressure and vacuum requirements of the transport. The pneumatic system consists of a carbon-vane centrifugal pump, tape cleaner intake port, filter/regulator assembly, and pressure ports of the air bearings.

The compressor is enabled by the microprocessor during the load sequence. A PUMPEN signal from the logic energizes K-1 relay located in the power supply. The contacts of K-1 relay triggers a triac which gates the single phase input power to the compressor. Motor wiring is configured for 120 or 220-240 volt input via the Voltage Select PWA in the power supply.

With the compressor operating, the air intake (vacuum) side of the compressor is from the tape cleaner assembly. Refer to Figure 4-10 for a block diagram of vacuum and pressure distribution. In addition to the tape cleaner intake, a small bleeder hole exists on the elbow fitting between the compressor and plastic hose from the tape cleaner. The vacuum affect at the tape cleaner is approximately 8.0 inches H<sub>2</sub>O.

There are two configurations for pressure distribution from the compressor. One configuration uses the rear of the tape deck as an air plenum between the air bearings and filter/regulator assembly. This configuration uses the cylindrical filter can and is shown in Figure 4-10A. The other configuration uses a rectangular filter box as an air plenum rather than the tape deck. This configuration is shown in Figure 4-10B.

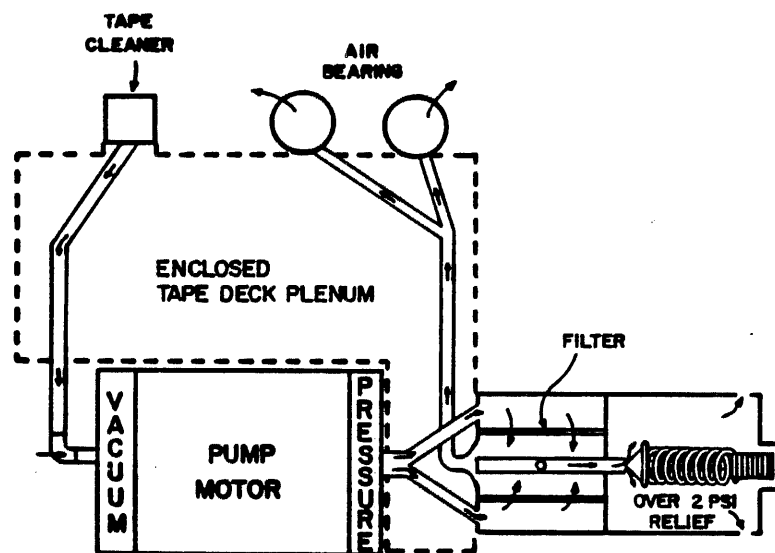


Figure 4-10A. Vacuum and Pressure Distribution

The regulator portion of this assembly is a spring-controlled valve that causes any pressure above 2.0 PSI to be bled out of the system. The air pressure is filtered by a high efficiency particle accumulator filter to clean the air prior to application to the air bearings. Air is forced through the filter and a hollow shaft. One end of the shaft is open and contacts the bleeder valve so that pressure in excess of 2.0 PSI is removed. The inside area of the filter (now regulated to 2.0 PSI) is applied to the deck plenum which directs the air pressure to the air bearings.

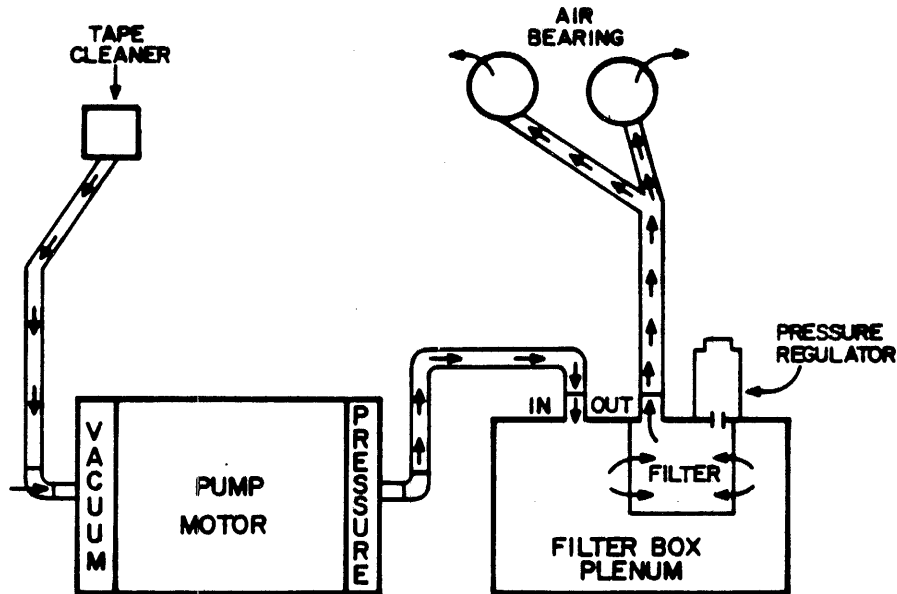


Figure 4-10B. VACUUM AND PRESSURE DISTRIBUTION

#### PNEUMATIC SYSTEM OPERATIONAL DESCRIPTION

Operation of the pneumatic system is obtained via the power supply by the presence of 15 VSB and low active -PUMP signals. Together, these signals energize K-1 relay and trigger triac CR8. The output of triac CR8 provides the pump with the single phase operating voltage.

The following figures illustrate motor wiring configurations for 120 or 220-240 volt inputs via the Voltage Select PC board in the power supply.

In the 120V mode of operation, single phase input power is applied to the motor via pins 2 and 6 of connector P2. During initial motor start-up, an external 5 uF capacitor is utilized to create a phase difference. In this configuration, the capacitor is connected in series with the start motor winding.

V.S.B 120V APPLICATION (J1A)

COMPRESSOR

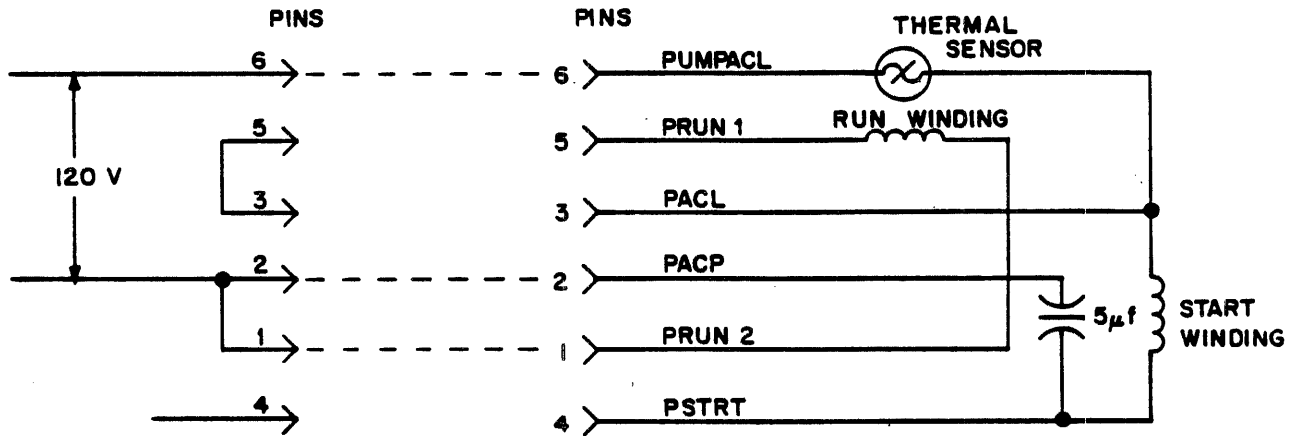


Figure 4-11A. Compressor Wiring, 120 Vac Configuration

In the 220V and 220-240V modes of operation, single phase input power is applied to the motor via pins 5 and 6 of connector P2. During initial motor start-up, an external 5 uF capacitor is utilized to create a phase difference. In this configuration, the capacitor is connected in parallel with the start motor winding. For both configurations, the compressor contains a self-recovering thermal sensor.

V.S.B. 220-240V APPLICATION (J1B)

COMPRESSOR

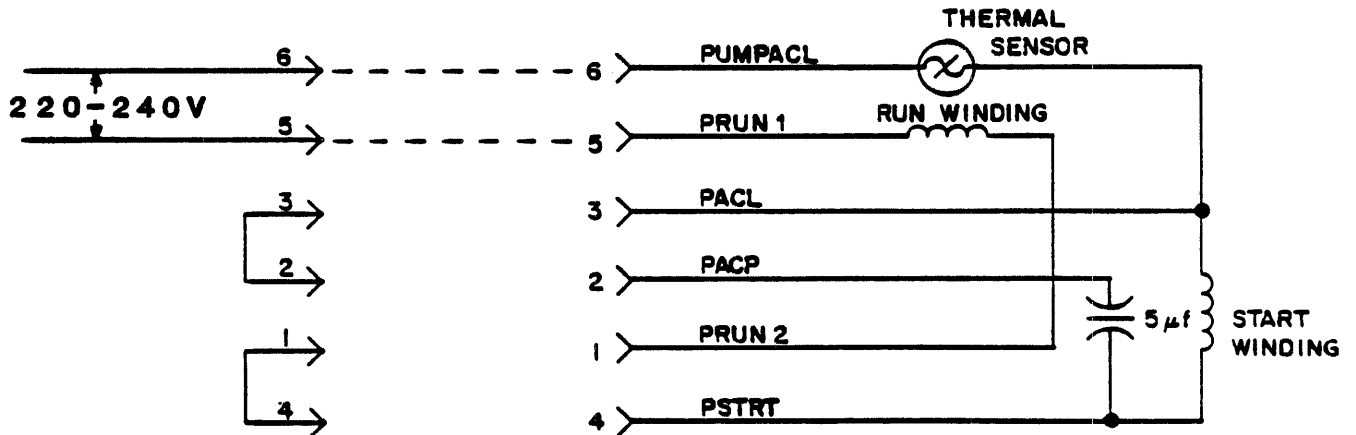


Figure 4-11B. Compressor Wiring, 220 Vac and 220-240 Vac Configuration

## READ/WRITE/SERVO PWA FUNCTIONAL DESCRIPTION

### INTRODUCTION

The Read/Write/Servo Board used in the Phase Encoded (PE) Keystone Streaming Tape Unit (STU) has a multiple of distinct functions resident on one board. In order to simplify the functional description, each section will be described separately. The basic functions are as follows:

- o Microprocessor and Associated Hardware
- o Servo For Both Take-up (Velocity) and Supply (Tension) Reels
- o Head Write Drivers and Write Current Programmable Regulator
- o Head Read Amplifiers with Envelope Detection and Clip Voltage Generation Circuits

### MICROPROCESSOR

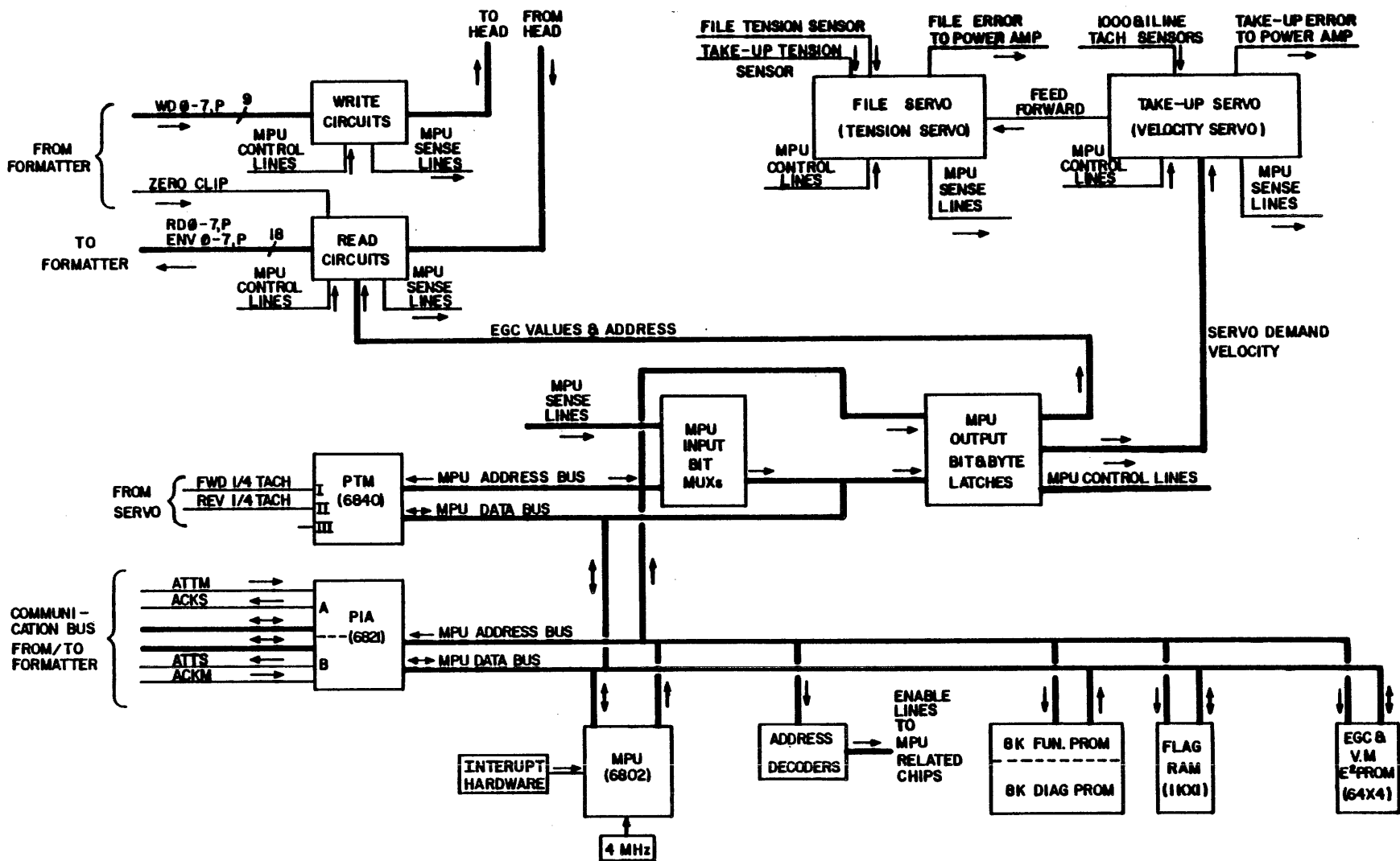
Refer to Logic Diagrams located in the applicable Field Service Manual (See PREFACE) and Block Diagrams for circuit identification. The microprocessor (uP) for the board is constructed with the 6802 uP chip being the basis. The 6802 uP (sheet 2) has two 8-bit accumulators, an 8-bit Condition Code Register and a 16-bit Stack Pointer, Program Counter and Index Register. In addition, the device contains 128 bytes of internal RAM and an internal clock which is operated off of a 4 MHz crystal. All inputs and outputs of the 6802, and all other devices on the processor bus, are TTL compatible. Output devices connected to the processor data bus have tri-state drivers, with some being bi-directional.

The input, output and control lines radiate out to the various peripheral and memory devices on the board from the uP. The desired peripheral or memory device is selected by decoding a portion of the processor address bus, and gating it with the Valid Memory Address (VMA).

A Peripheral Interface Adapter (PIA, 6821) (sheet 3) on the board is used to communicate between the Read/Write/Servo PWA uP and Formatter PWA uP. The PIA's sixteen bi-directional peripheral data lines (Ports A and B), two interrupt inputs (CA1 and CB1), and two peripheral controls (CA2 and CB2) are used to establish a hand-shake communication between the two boards.

In essence, the communication between the two processors is established with Ports A and B (of the PIA) interfacing the processors data and CA1, CB1, CA2 and CB2 acting as the attention and acknowledgement lines to the processors (through the Interrupt Request (IRQ) line to the processor).

Figure 4-12. READ/WRITE/SERVO PWA BLOCK DIAGRAM



In order for the processor to count servo tachs (forward and reverse), and provide a real time clock for the processor, a Programmable Timer Module (PTM, 6840) (sheet 3) is attached to the processor data bus and related control lines. The PTM contains three 16-bit counters, each independently programmed by the processor through the PTM's control registers. The counters decrement on each subsequent clock period which may be an external clock or processor clock. The source of the clock and desired mode of operation is defined by the contents of the PTM's three control registers. Separate enable lines are provided to gate on or off the clock to each counter. The PTM IRQ to the processor is activated as a result of an interrupt condition from one of the three counters if enabled.

The functional and diagnostic program for the processor reside in two Read-Only Memory (ROM) chips. Each contains 8K x 8 bits and connects directly to the processor address and data bus. When the ROM is enabled by the processor (through the address decoder), the data relative to the current processor address is conveyed to the data bus by the ROM within one processor cycle time. Sockets are provided for both ROM's providing for easy processor code updates.

Various Medium Scale Integration (MSI) devices are attached to the processor data and address bus to allow the processor to interface with the servo, read and write hardware. MSI devices consist of bit input multiplexers, bit output latches, byte output latches, and related address decoding devices (sheet 4).

Single input data bits are passed through the bit input multiplexers, to the processor on data bit 7 (the most significant bit - MSb), upon selection of one of the various bit input multiplexers. The selection of a given data bit and multiplexer (to the processor) is dependent on the address conveyed by the processor to the multiplexer and address decoding devices.

Bit output latches are used to convey individual bits from the processor to the hardware. No connection to the processor data bus is made. Bit output latches are set by the processor writing to the related odd address, and reset by the processor writing to the related even address. The selection of a given bit and bit output latch is dependent on the address conveyed by the processor to the latch and address decoding devices. All latches will be reset by the master reset line.

Byte output latches are used to pass bytes of data from the processor to the hardware. Output data is derived from the processor data bus upon a write operation (by the processor) to the byte output latch address. The selection of a given byte output latch is dependent on the address conveyed by the processor to the address decoding devices. All byte latches will be reset by the master reset line.

A 1K x 1 bit Random Access Memory (RAM, 2102) (sheet 3) device provides the processor with storage for flag bits representing the transport status. The flag RAM is written at both the output bit latch address and flag RAM address; therefore, it contains the flag status bits defined by the processor code, and also reflects the state of all the bit output latches. Flag RAM bits are set by the processor writing to the related odd address, and reset by the processor writing to the related even address. The selection of a given flag bit (in a processor read or write operation) is dependent on the address conveyed by the processor to the flag RAM and address decoding devices. Data can only be read from the flag RAM at the flag RAM address, and not the bit latch address.

A nonvolatile 64 x 4 bit static RAM (2210) (sheet 12) is also attached to the processor to provide a means of storing the read amplifiers gain values and velocity servo offset multipliers. The 64 x 4 bit static RAM front end is overlaid bit-for-bit with a nonvolatile 64 x 4 bit electrically erasable PROM (E<sup>2</sup> PROM). Data is transferred back and forth between the RAM and E<sup>2</sup> PROM by an array store and array recall signals. The selection of the RAM/E<sup>2</sup> PROM and of a given (4-bit) RAM/E<sup>2</sup> PROM byte (in a processor read or write operation) is dependent on the address conveyed by the processor to the RAM/E<sup>2</sup> PROM and address decoding devices. Data is transferred between the processor and RAM/E<sup>2</sup> PROM over the processor data bus upon device selection. A two-position jumper is provided to prevent unintentional changes to the data contained in the E<sup>2</sup> PROM. Data can only be transferred to the E<sup>2</sup> PROM with the jumper in the "STORE" position.

## TENSION SERVO

Refer to Logic Diagrams located in Section 5 and block diagrams for circuit identification.

The tension servo system is comprised of two tension servo transducers, input operational amplifiers, reference voltage inputs, take-up motor error input, summing circuit, analog switch circuit for mode selection, and above/below tension level comparators for servo shut-down in the event of component failure.

The two tension sensors are located on either side of the magnetic head. One sensor is located between the velocity servo motor (take-up reel) and the magnetic head, and the second is located between the tension servo motor (supply reel) and magnetic head.

During a load sequence, prior to starting the pump motor, the microprocessor sweeps TTENOFF and FTENOFF levels from their maximum voltage to the minimum voltage. At the point at which the TTENOFF and FTENOFF zero their respective operational amps, the TTENZERO and FTENZERO signals toggle causing the microprocessor to stop the changing sweep levels. The effect of this action is to determine the point at which both tension transducers have a zero offset. The microprocessor maintains the TTENOFF and FTENOFF levels at the determined offset until the next load sequence.

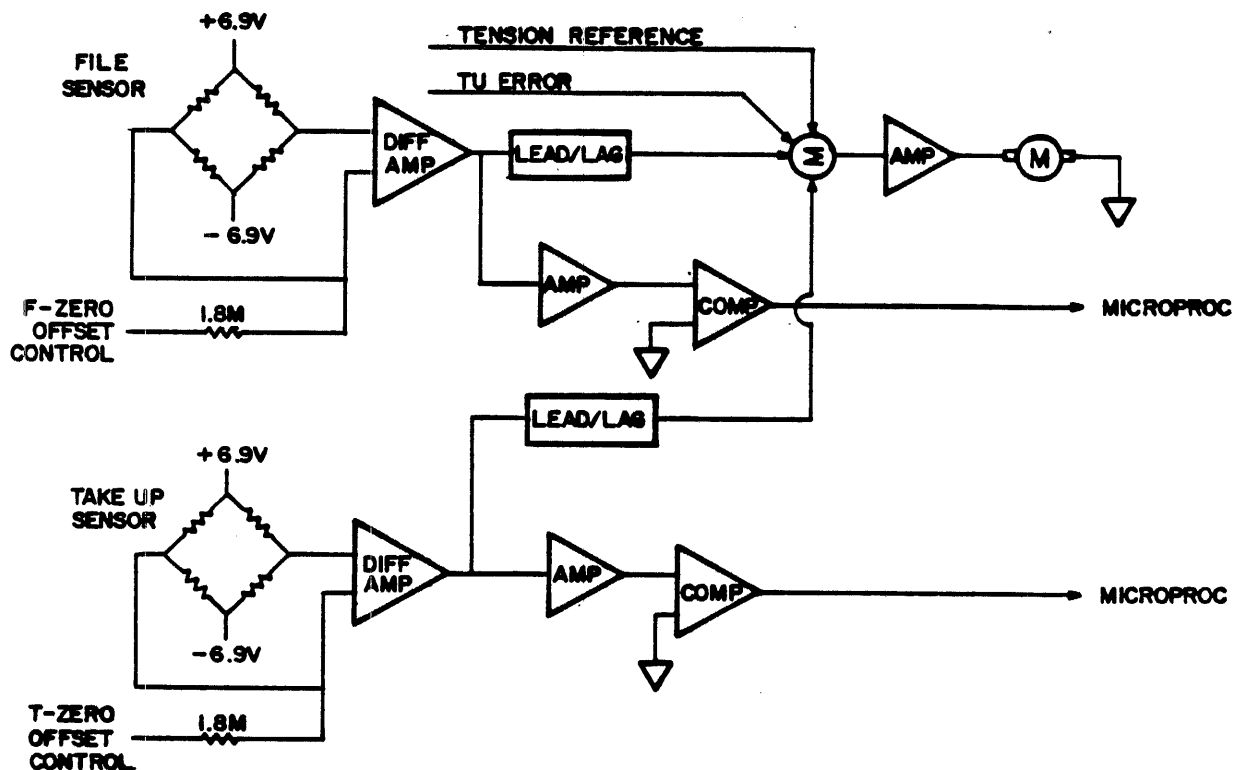


Figure 4-13. TENSION SERVO - SIMPLIFIED



The inputs to the tension servo circuit are TTENTRANS, FTENTRANS, + REF and TUER. The TTENTRANS and FTENTRANS signals come directly from the tension transducers with a signal input proportional to the variance of tension felt by the transducer. The tension reference is derived from a 6.9 volt supply and a 1.78M ohm resistor. This reference voltage is equivalent to 16 ounces of tape tension, and is used to bias the circuit so that 8 ounces of tension is developed. The fourth input is the TUER signal and is proportional to the current in the take-up motor at any given time.

At an optimum condition, where both sensors are sensing 8 ounces of tension, the 16 ounce (+ REF) reference is effectively neutralized. The only dynamic effect on the circuit, at this time, would be the action of the take-up reel motor. With the TUER being summed with the neutralized tension/reference voltage inputs, the tension motor (supply) reacts proportionally to the current in the take-up motor, as indicated by TUER.

Any variance in tape tension would cause a change in the transducer op amps' outputs. This voltage output is subtracted from the tension reference, with the result summed with TUER. The difference of all these signals is multiplied by a high gain amplifier when tape is in motion.

The PRKD input term to the tension servo is active during a Parked or No Tape Motion condition. With PRKD active, the operational amplifier used as a high gain multiplier, after the summing network, is switched to a low gain amplifier.

The above/below tension limit protection circuits consist of a series of comparators, with inputs referenced to predetermined voltage levels corresponding to high or low tension levels. If above or below tension levels are sensed on either of the tension transducers, the microprocessor is notified via signals TAUTL, TBLTL, FAUTL or FBLTL and a shut-down of the servo is initiated. Refer to Figure 4-12 for a simplified presentation of this circuit.

#### VELOCITY SERVO

The velocity servo consists of a digital-to-analog converter (DAC), decode flip-flops connected to a digital tachometer, operational amplifiers, and three presettable counters. The DAC converts 8 bits of information labeled "Demand Velocity" (DMDVEL) into a signal proportional to the desired velocity. The demand velocity can vary from 0 to 255 with complete control at any speed. The DAC output at 12.5 ips is 1.0 volt per radian per second; at 25 ips, the DAC output is 1/2 volt per radian per second. A radian per second is derived from the linear tape velocity (ips) divided by the radius of the take-up reel.

At the beginning of tape (BOT), the radius is 2.56 inches. At the end of tape (EOT), the radius is approximately 4.9 inches when using a 2400 foot reel of tape. The voltage at the output of the DAC is approximately 4.88 volts at 12.5 ips or 9.76 volts at 25 ips (speed divided by 2.56 inches) at BOT and 2.5 or 5.0 volts at EOT. The voltage at the DAC output will not change when 100 ips is selected, however, the rotational speed will change accordingly. The signal FWD determines the polarity of the analog demand velocity signal for rotation of the take-up motor in each direction.

Rotational velocity is generated and referred to as "analog tachometer" (ANALOG TACH). The analog tach (TP9) is also proportional to 1.0 volt per radian per second in the 12.5 ips mode, and 1/2 volt in the 25 ips mode. In the 100 ips or rewind mode, the analog tach is less (i.e., 8 or 15 times) than the rotational speed. The analog tach is derived from the 2-phase, 1000-line tachometer physically mounted on the rear of the velocity motor. The output signals, phase A and phase B, are decoded into direction and divided down (depending on the speed selected). The divided tach triggers a 128 microsecond one-shot. The decoded direction is logically Anded with the 128 microsecond one-shot and then filtered to become the analog tach.

The analog tach is subtracted from the demand velocity at operational amplifier C8A pin 6 and compensated with a lag-lead filter. This signal is then multiplied by 1 or 8, depending on speed and becomes the take-up error (TUER). The take-up error is proportional to the desired current in the velocity motor and is equivalent to 1.0 volt per amp.

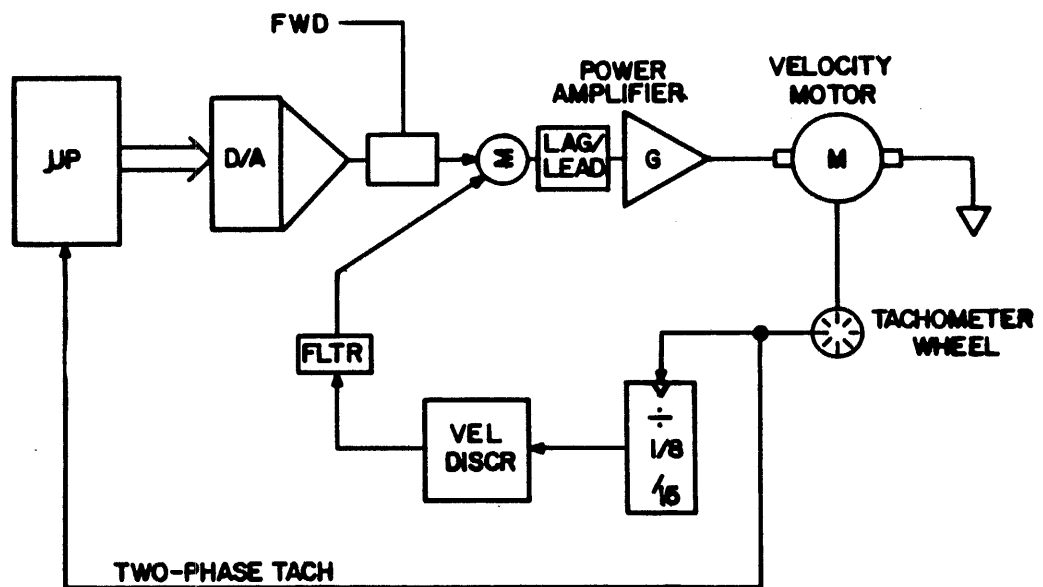


Figure 4-14. VELOCITY SERVO - SIMPLIFIED

## WRITE CIRCUITS

(Reference Write/Erase Block Diagram and Logic Schematics located in Section 5.

### Write Drivers

The write drivers and control circuits consist of 18 write drivers (2 per track), write and erase head voltage control, degauss, and erase sense circuits. Write data is gated via the TWDO-7,P input data lines through the write drivers by the presence of WRITE ENABLE and the absence of FILE PROTECT signals (the write ring is installed in supply reel).

The write drivers are arranged so that two opposite drivers are servicing one input line. A true signal (logic 1) on the input line causes one driver to assume an open output while the complimentary driver assumes a ground output. Thus, current flows through the head coil in one direction only. If the input line is false (logic 0), then the write drivers' outputs are reversed and the head current flow is in the opposite direction.

Write head voltage to the head coils is developed as follows: Q2 transistor is switched on by the absence of FILE PROTECT and REWIND signals. As Q2 is turned on, +24 volts is applied to pin 3 of the voltage regulator. Pin 1 input of the regulator is determined by the output of OP AMP C16 and the status of Speed Select. Selection of either H SELECT 0 or L SELECT 0 introduce a Select-By-Test resistor which is matched to the impedance of the head. This signal is applied to the voltage regulator circuit as WRITE CUR along with resistor R126, and determines the voltage to the individual head coils.

### Degauss

During the course of a write operation, a condition of residual magnetism is built up around the write coils. If the residual magnetism is not neutralized, the possibility of partial tape erasure is possible during succeeding tape operations.

In order to prevent this unwanted magnetism, the STU performs a degauss operation at the conclusion of a write function. The degauss capacitor C71 is charged and remains charged as long as a write operation is in progress. At the conclusion of a WRITE command, the DEGAUSS signal effectively cancels out the positive voltage charging capacitor C71 and the capacitor begins to discharge through resistor R124. Thus, pin 5 input to OP AMP C16 sees a decreasing positive voltage, the affect of which results in an exponential decay of write current. Concurrent with the discharge of the degauss capacitor and decaying write current, the write data input lines are switched at a 10 KHz rate. As the write current is switched at 10 KHz, the exponential decay of the current waveforms causes any residual magnetism to be neutralized.

## Erase

The erase circuit is enabled by the presence of ERASE ENABLE and the absence of REWIND signals, and uses an open collector driver circuit to provide ground return for erase current. Erase voltage is supplied by the same +24 volts used to develop the write voltage. An integral part of the erase circuit is an OP AMP configured to detect the level of erase current, and provide an ERASE SENSE signal to the sense multiplexers.

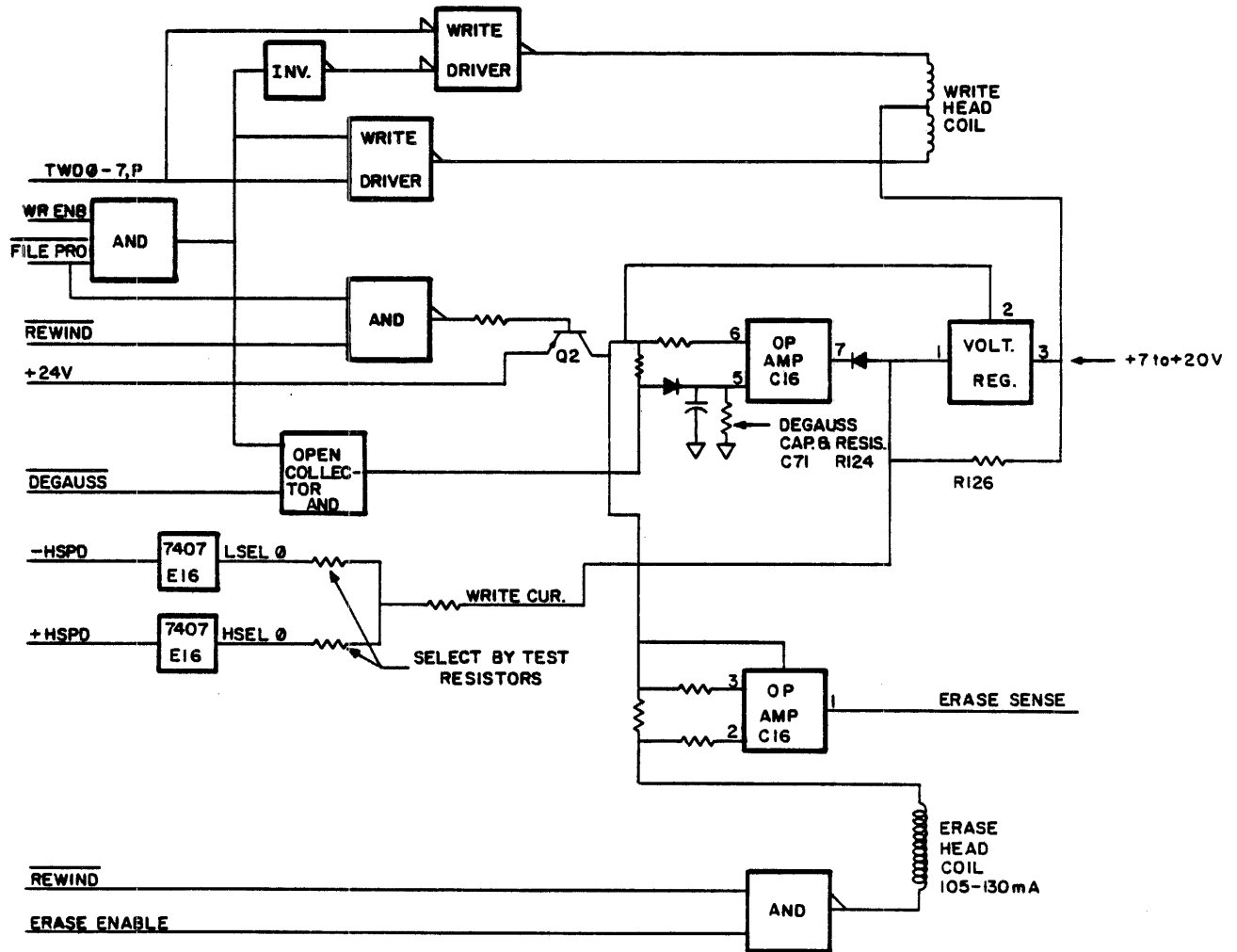


Figure 4-15. WRITE/ERASE BLOCK DIAGRAM

## READ CIRCUITS

(Reference Read Timing/Block Diagram or subsequent pages and Logic Schematics located in Section 5.

A read operation is initiated from the host controller during any read or write operation. As tape motion is initiated and tape passes across the read head coils, recorded data on the tape induces a voltage in the head coils. This voltage has to be amplified and circuit selection made depending on tape speed. The entire read chain is responsible for detection of data, amplification of weak readback signals, and conversion of the analog signal to a digital TTL logic level for use in the control and formatter portion of the STU.

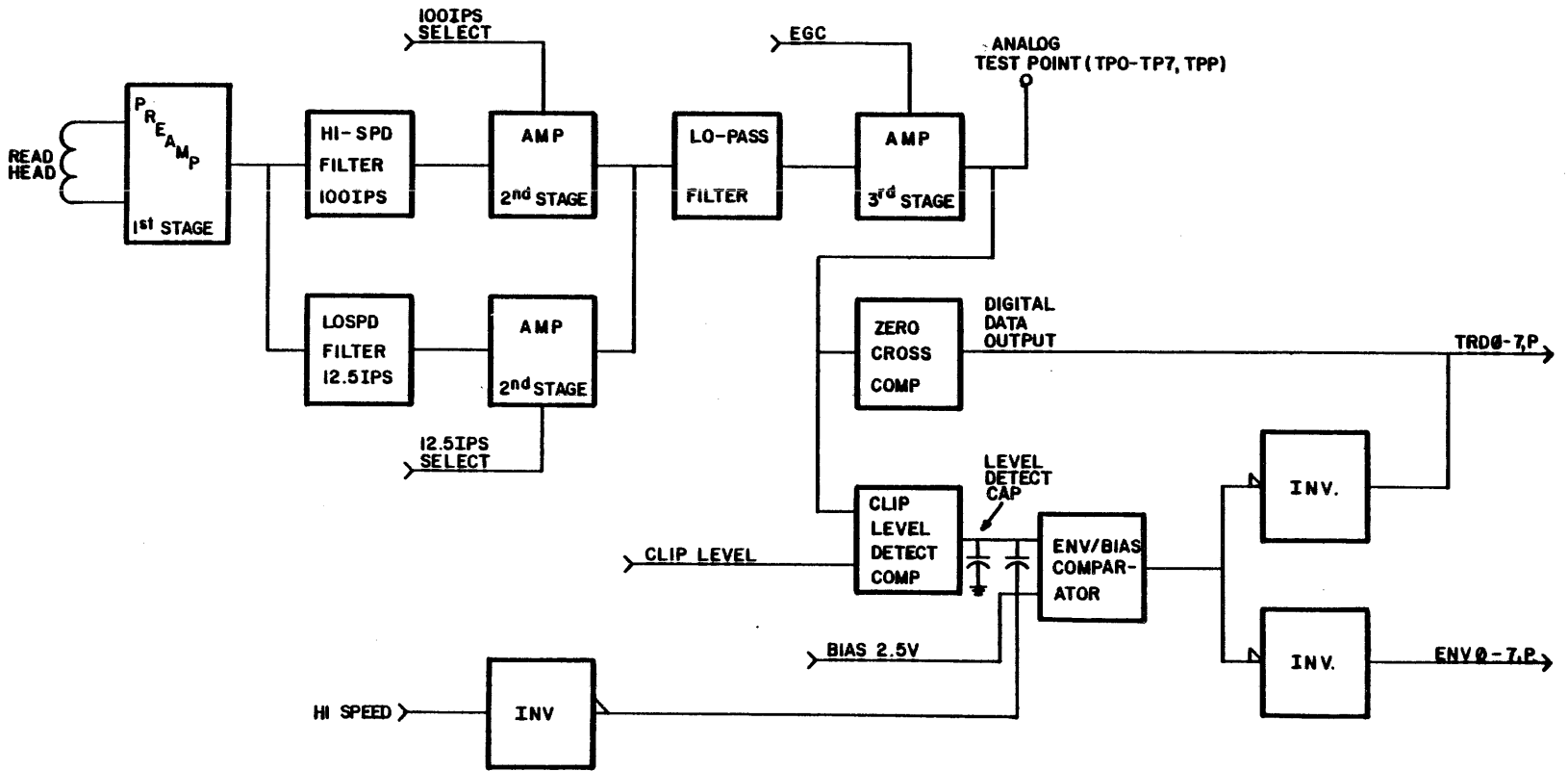
As data is detected when tape passes the read head, the induced voltage in the range of 2.0 to 4.2 MVp-p (12.5 ips), 4.0 to 8.4 MVp-p (25 ips), or 10.0 to 22.0 MVp-p (100 ips) is differentially coupled to a preamplifier. This preamplifier provides a gain of 100 to the relatively low signal from the head coils. After amplification, the READ signal is routed to two separate filter and differentiator circuits, which also tend to normalize different voltage amplitudes prior to the second stage of amplification.

The second amplifier stage is selected by the presence of either the low or high speed input signal. If low speed is active, then that amplifier provides further amplification of the READ signal from the low speed filter and differentiator circuit. The 100 ips amplifier will have no output at this time due to the absence of the 100 ips input signal. The amplified READ signal is then routed through isolation resistors and a low-pass filter and attenuator. The low-pass filter eliminates any high frequencies above the data frequency. Because of the isolation resistors and attenuation of the low-pass filter, the signal is subjected to a third stage of amplification. This stage utilizes an Electronic Gain Control (EGC) circuit to determine the gain. Refer to the EGC discussion in succeeding paragraphs. The EGC level to the amplifier ensures that the output of the third stage is approximately 1.5 volts peak-to-peak as seen at the analog test points (TP1 thru TP9).

The third stage amplifier output is connected to a comparator used as a zero cross detector. If the differential input signal is positive, the zero cross detector output switches to a positive voltage. If the differential input signal is negative, the zero cross detector output switches to a ground potential.

A second comparator is also connected to the third stage output. This circuit compares the single-ended output voltage of the third stage with a clip level voltage. The clip levels, as follows, are a percentage of the nominal input voltage and are predetermined by the microprocessor, depending on the type

Figure 4-16. READ CIRCUITS BLOCK DIAGRAM



of operation being performed. Because a maximum readback amplitude is expected during a read-after-write operation, the clip level is relatively high (25%) to ensure that a strong signal has been written.

During a normal read operation, the microprocessor sets the clip level to 0.3% after recognizing the beginning of the preamble. This 0.3% clip is maintained throughout the data record until the postamble is detected. The clip level is then set to 16% while the read head is traversing the inter-record gap. This insures that any noise in the gap will not be detected as data.

Referring to the waveform figure, it can be seen that the greater the amplitude of the analog signal, the wider the output pulse of the clip level detector. The pulse width should always be greater than 30% of the analog waveform.

The output of the level detector is coupled directly to a bias comparator which establishes the validity of the detected data. As the analog input to the level detector exceeds the clip level, the level detector assumes an open collector output. This allows +5 volts to charge capacitor C110. As C110 charges above the bias voltage, the bias comparator output goes to ground potential. As long as valid data is being received, the

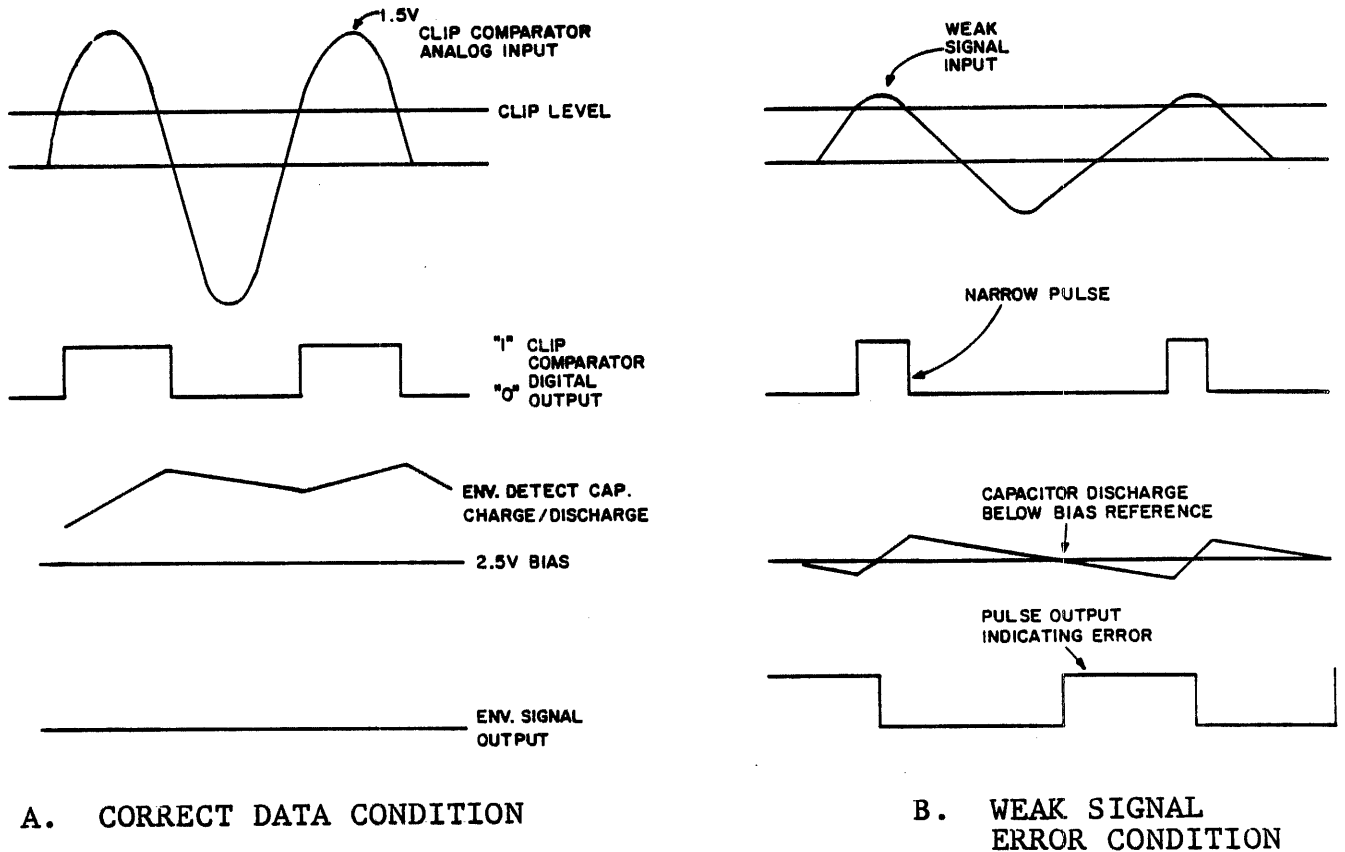


Figure 4-17. READ CHAIN WAVEFORMS

pulse width of the level detector should be of sufficient duration (30%) so that capacitor C110 does not discharge below the 2.5 bias voltage. If the analog signal is of such small amplitude that the level detector outputs a pulse of less than 30% of the waveform, then capacitor C110 is allowed to discharge below 2.5 volts and the bias detector outputs a positive pulse. This condition is recognized by the formatter as an error, and the data is inhibited from appearing on the output lines.

#### ELECTRONIC GAIN CONTROL (EGC)

EGC is designed to replace the potentiometer that would normally be used to determine the readback amplitude of recorded data. The circuit is activated through the use of customer engineer diagnostics when the Read/Write/Servo PWA or magnetic head is replaced, or if reported errors are such that the customer engineer determines the need to activate EGC.

The EGC lines during normal operation are constant, and provide the appropriate input to the third stage amplifiers to set a nominal output of 1.5 volts at the analog test point. This output voltage may vary slightly due to magnetic head wear or the type of magnetic tape being used.

Operation of the EGC circuit during the customer engineer diagnostics is as follows: A write function is initiated and the readback signals are sampled through the ENV outputs of the read chain, with an EGC clip level set at 96%. The test is initiated with a binary bit count of 128 (80 Hex) applied to the Digital-to-Analog Converter (DAC). The output voltage of the DAC is then applied to an analog multiplexer. The microprocessor provides the input gating to the multiplexer so that the voltage conversion of the 128 count is applied to each of the nine read circuits on an individual basis.

Using one read channel for discussion purposes, EGC voltages are set up as follows: The voltage equivalent of the binary 128 count is gated through the analog multiplexer and charges a 0.1 uF capacitor to the value whereby, the read amplifiers have a mid-point gain. As data is read from tape, the output of the read amplifier is sampled by the envelope comparator. If the ENV signal is low, the microprocessor uses a successive approximation method of the binary count to the DAC so that an optimum EGC voltage is applied to the read amplifiers. If the ENV signal is low or inactive, the microprocessor lowers the binary count by half (64) to the DAC. The DAC then outputs a voltage equivalent to the 64 count to the EGC capacitors. The read amplifier gain is increased and the ENV signal is again sampled by the microprocessor. The microprocessor adjusts the binary count either up or down by half of the previous count,



depending on whether the ENV signal is active or inactive. This method of successive approximation is continued until the microprocessor determines, via the ENV signal, that the read gain is optimum. In this manner, the count "zeros in" on the point at which the ENV signal is active except for extraneous pulses going inactive. At this point, it can be assumed that, if the ENV signal is mostly active at the 96% EGC clip level, then when the normal clip of 25% (WRITE) is used, then ENV signal will be a solid active level.

The binary count for each read channel is stored in memory. During normal on-line operations, the microprocessor will access memory every 11 milliseconds and the EGC voltage charges the 0.1 uF refresher capacitor to maintain a constant gain of the third stage read amplifier.

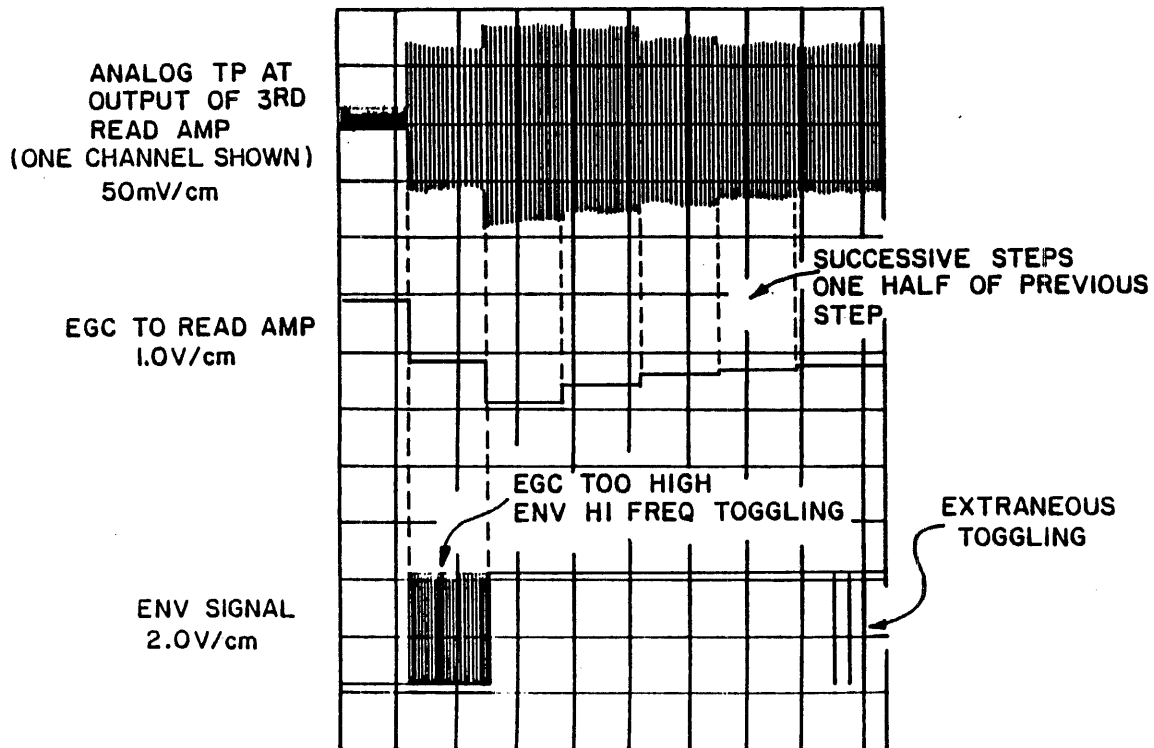


Figure 4-18. ELECTRONIC GAIN CONTROL WAVEFORMS

## FORMATTER/CONTROL PWA FUNCTIONAL DESCRIPTION

### MICROPROCESSOR

The formatter microprocessor (up) for the PWA is constructed with the 6802 up chip being the basis. The 6802 up has two 8-bit accumulators, an 8-bit Condition Code Register and a 16-bit Stack Pointer, Program Counter and Index Register. In addition, the device contains 128 bytes of internal RAM, and an internal clock which is operated off of a 3.84 MHz crystal. All inputs and outputs of the 6802 and all other devices on the processor bus are TTL compatible. Output devices connected to the processor data bus must have tri-state drivers. The timing diagrams for the processor read and write operations are located in Figures 4-21 and 4-22 respectively, with actual operating timing constraints listed in Table 4-1. The processor is operated at 0.96 MHz rate.

The input, output and control lines radiate out to the various peripheral and memory devices on the board from the top. All of the attached peripheral and memory devices are able to function at the processor rates as listed and illustrated in Table 4-1 and Figures 4-21 and 4-22. The desired peripheral or memory device is selected by decoding a portion of the processor address bus and gating it with the Valid Memory Address (VMA).

The MC6821 Peripheral Interface Adapter (PIA) is a programmable device and interfaces the 6802 up to the read/write control logic. It has sixteen bi-directional peripheral data lines (Ports A and B), two interrupt inputs (CA1 and CB1), and two peripheral control lines (CA2 and CB2). Four control registers (within the PIA) are used to define the data direction of each bit in Ports A and B, the active transition for CA1 and CB1, and the active or response transition of CA2 and CB2.

Table 4-1. PROCESSOR READ/WRITE TIMING CONSTRAINTS

CHARACTERISTIC	SYMBOL	MIN	TYP	MAX	UNIT
Address Delay	$t_{AD}$	--	--	270	ns
Peripheral Read Access Time	$t_{acc}$	--	--	530	ns
$t_{acc} = t_{ut} -$ ( $t_{AD} + t_{DSR}$ ) ( $t_{ut} = t_{cyc} - t_0$ )					
Data Set-Up Time (Read)	$t_{DSR}$	100	--	--	ns

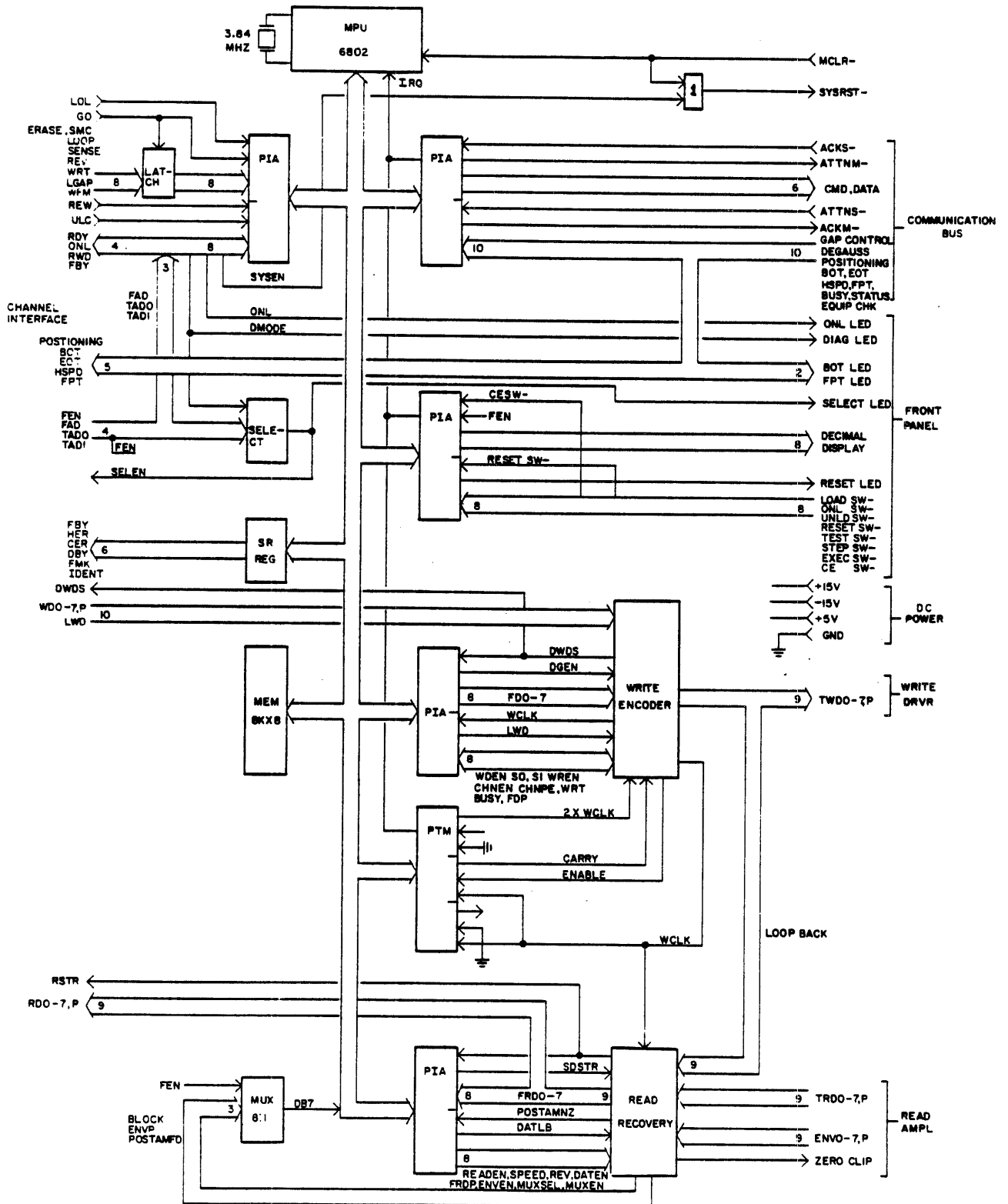


Figure 4-19. FORMATTER/CONTROL BLOCK DIAGRAM

Table 4-1. PROCESSOR READ/WRITE TIMING CONSTRAINTS (Cont'd)

CHARACTERISTIC	SYMBOL	MIN	TYP	MAX	UNIT
Input Data Hold Time	$t_H$	10	--	--	ns
Output Data Hold Time	$t_H$	30	--	--	ns
Address Hold Time (Address, R/W, VMA)	$t_{AH}$	20	--	--	ns
Data Delay Time (Write)	$t_{DDW}$	--	165	225	ns

Five PIA's are used on the board. PIA 0 is used to communicate between the read/write/servo board up and formatter board up. The communication between the two processors is established with Ports A and B (of the PIA) interfacing the processor's data and CA1, CB1, CA2 and CB2 acting as attention and acknowledgement lines to the processors (through the Interrupt Request (IRQ) line to the processor). Figure 4-20 indicates the basic interface protocol across the PIA between the processors.

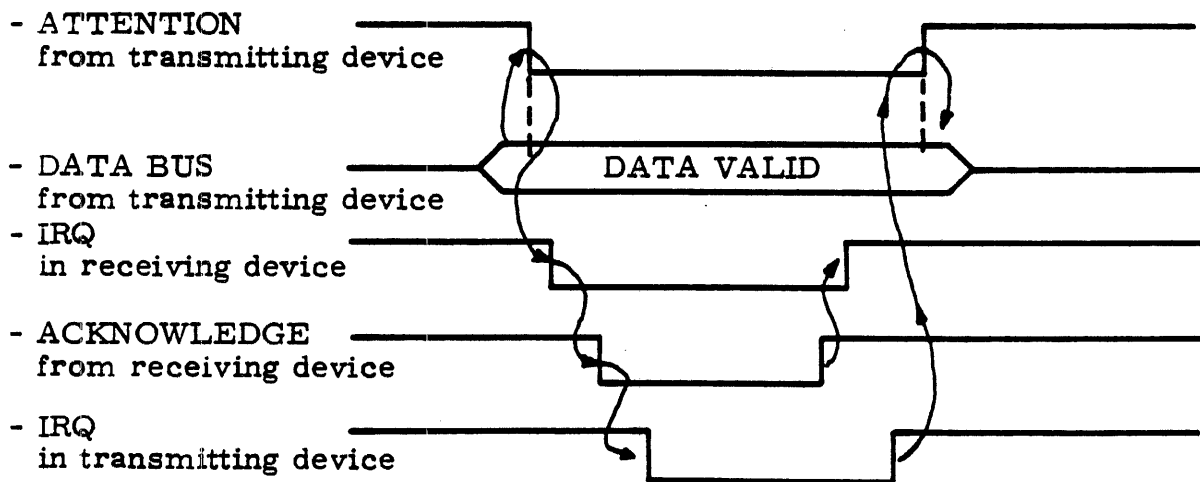


Figure 4-20. PIA COMMUNICATION PROTOCOL

PIA 1 is used to interface the up to the operator panel. Part A is connected to the eight switches on the control panel and Part B is connected to the display drivers. The PIA could be programmed to cause an interrupt on pressing of the Reset or CE switch, or on transition of the FEN line. PIA 2, along with other logic, is used to interface the up to the user controller/adaptor. PIA 3 is used to control the read logic and PIA 4 is used to control the write logic on the board.

A Programmable Timer Module (PTM 6840) is attached to the processor data bus and related control lines. It generates proper write clocks, a control line (Carry) at preamble and postamble time in the write operations, and it helps the up generate a various amount of delays during the read/write operations. The PTM contains three 16-bit counters, each individually programmed by the processor through the PTM's control registers. The counters are highly versatile in that each can be programmed by the processor to operate for squarewave generation, the gated delaying of signals, generation of single pulses with controlled duration, the pulse width modulation. The counters decrement on subsequent clock periods which may be an external clock or processor clock. The source of the clock and desired mode of operation is defined by the contents of the PTM's three control registers. Separate enable lines are provided to gate on or off the clock to each counter. The PTM IRQ to the processor is activated as a result of an interrupt condition from one of the three counters if enabled.

The source of the IRQ (from the PTM) is located by reading the single PTM status register, and is then cleared by reading the respective interrupting counter's 16-bit contents. A Reset bit in Control Register 1 of the PTM can be used to hold all counters inactive.

The functional and diagnostic programs for the processor reside in a Read-Only Memory (ROM) chip. It contains 8K x 8 bits and connects directly to the processor address and data bus. When the ROM is enabled by the processor (through address decoder), the data relative to the current processor address is conveyed to the data bus by the ROM within one processor cycle time.

An 8-bit addressable latch and an 8-bit input multiplexer are used to increase I/O capability of the processor. Single input data bits are passed through the bit input multiplexer to the processor on data bit 7 (the most significant bit [MSB]), upon selection of the bit input multiplexer. The selection of a given data bit and the bit input multiplexer (to the processor) is dependent on the address conveyed by the processor to the multiplexer and address decoding device. The bit output latch is used to convey individual bits from the processor to the hardware. No connection to the processor data bus is made. The bit output latch is set by the processor writing to the related "Cx" address, and reset by the processor by writing to the related "8x" address. The selection of a given bit and bit output latch is dependent on the address conveyed by the processor to the latch and address decoding devices.

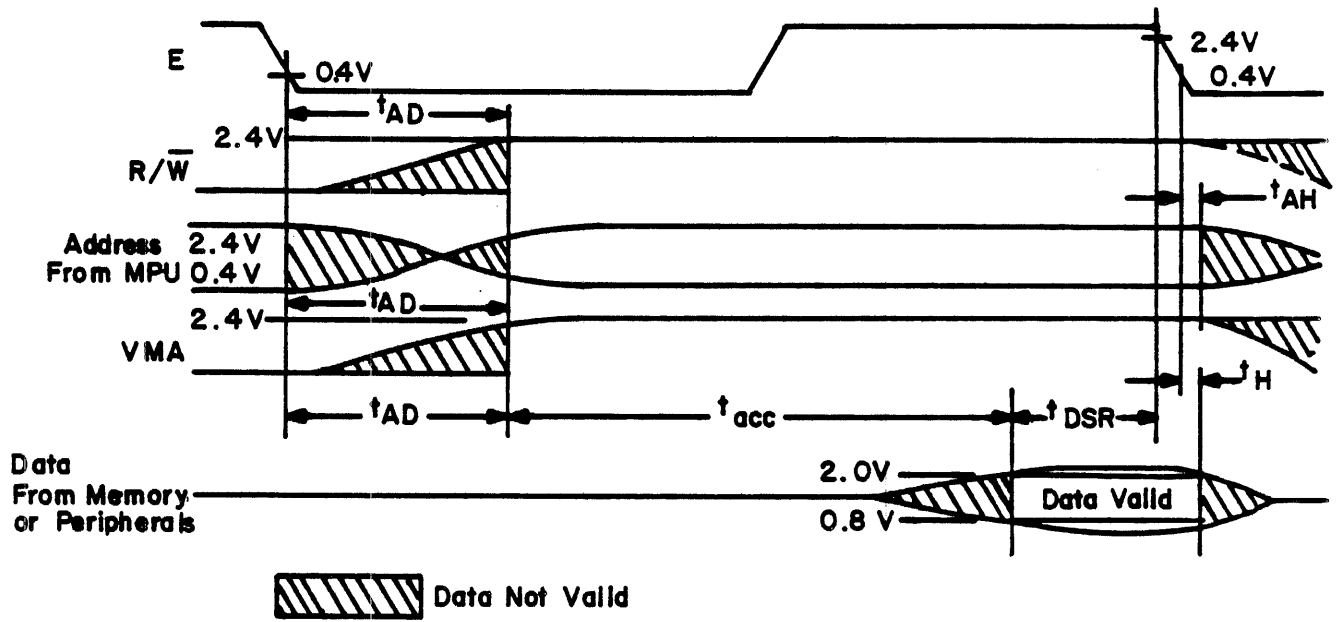


Figure 4-21. PROCESSOR READ OPERATION

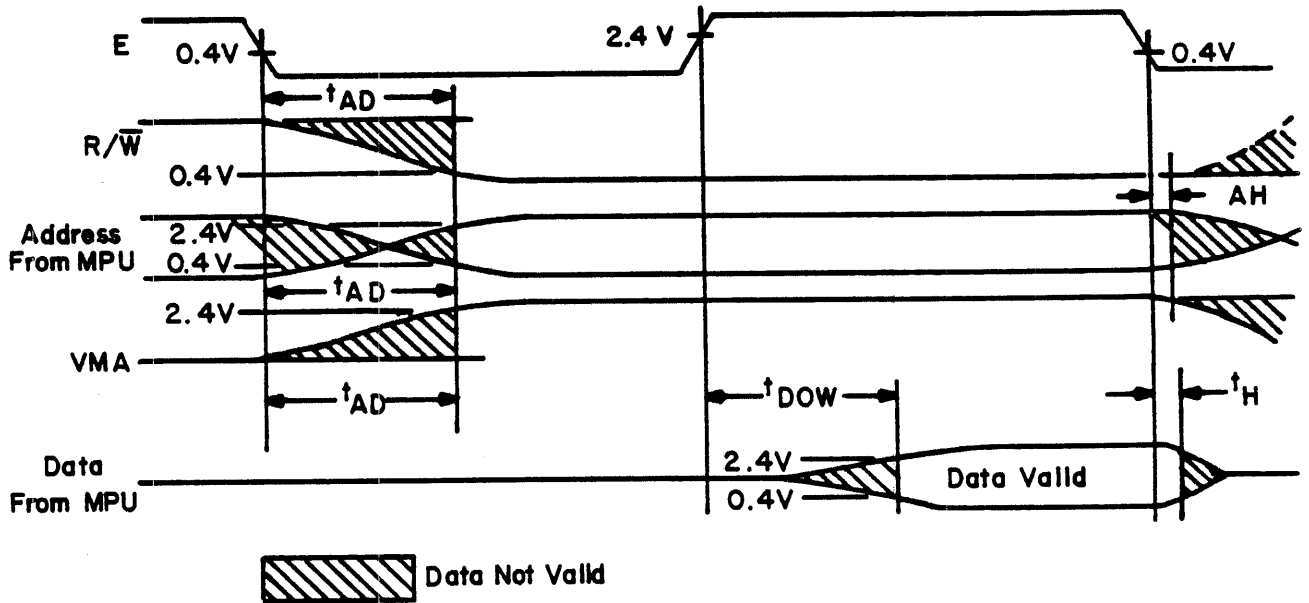


Figure 4-22. PROCESSOR WRITE OPERATION

## WRITE CIRCUITS

The write operation is controlled by PIA 4, PTM and write circuits. The PTM is programmed by the microprocessor to generate write clock, depending upon speed and function to be performed. The PTM is also programmed to generate the control signal "CARRY" at preamble and postamble time during the write operation. The Timer 3 on the PTM is used as a variable timer to control a various amount of time delays during the read/write operation. A brief description of the signals controlling the write operation follows:

<u>Signal</u>	<u>Description</u>
WCLK	Write Data Frequency programmable by microprocessor.
CARRY	Controls Preamble and Postamble in Write.
WRT BUSY	Write operation is in progress.
CHNPE	Channel is in Parity Error.
CHNEN	Enables Channel side for interface data.
WDEN	Enables Write Data to device.
WREN	Enables Write operation.
S1,S0	Selects ID, File Mark, Channel Data or Processor-generated Data.
FDO-FDP	Processor-generated Data.
LWD	Processor-generated Last Word signal.
DGEN	Enables Degauss operation.

A PROM (82S123) is used in the write circuits. It controls writing of preamble, data and postamble and it also controls the ID, file mark, data and format write operations, and generates the Demand Write Data Strobe (FDWDS). The write operation is explained with the timing diagram in Figure 4-23.

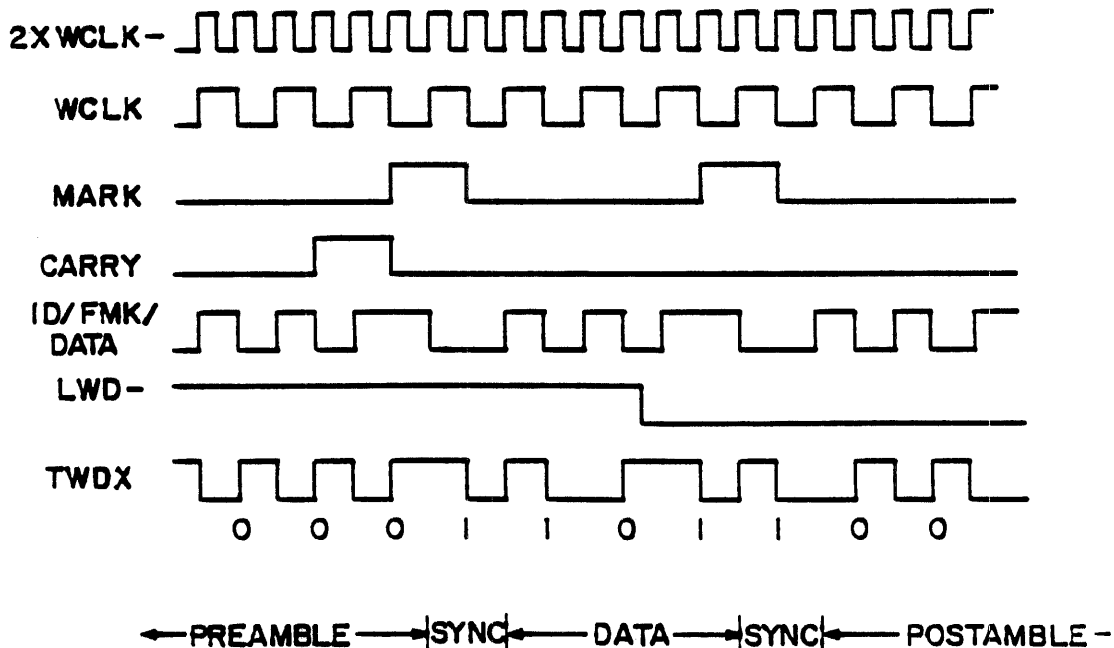


Figure 4-23. FORMATTER WRITE OPERATION

## READ CIRCUITS

The read circuits consist of a Variable Frequency Oscillator (VFO), deskew buffer circuits for each track and error correction circuits. PE read signals from the tape transport are applied to read circuits, one for each channel.

On the tape, bits on the various recording tracks belonging to the same byte cannot be expected to lie on a straight line across the tracks or, upon reading, to be received by the formatter at the same time. This is due to head and tape path imperfections. The data is said to have skew and, for PE data, the formatter must deskew the data such that the bits belonging to the same byte, upon being transferred to the CPU, are all transmitted at the same time. This is accomplished in the formatter by storing and delaying the first arrived bits until all the bits belonging to the same byte have arrived, and then transferring them collectively to the CPU.

The read data from the device comes on lines TRDO-TRDP. In the formatter, it goes through deskew process. The deskew circuits consist of a PROM and a FIFO along with some other logic. The PROM generates a Data Strobe (DSTR-) when a new data bit comes in; it generates Data Ready (DRDY) when the bit is deskewed and ready for loading into FIFO; it recognizes the first one transition as a SYNC and generates a SYNC pulse; and it also generates a Drop-Out (DROP) upon indication of Drop-Out or Drop-In. The FIFO allows for deskew in the read data. Once the SYNC is recognized, it starts saving further data until all other tracks are ready with the data. It generates Bit Ready (BRDY) when the bit is ready for error detection, and then outputs to the host system. A counter is used to create a window for data and phase transitions. The data strobe initiates the window, and the counter counts the clocks and generates a pulse (CARRY) to reset the window (DGATE). The timings in the deskew buffer operation is shown in Figures 4-24 and 4-25.

Single track "on-the-fly" error correction is performed on the data. The error correction circuit uses a PROM and other logic circuits. The PROM, called "DROP PROM", generates signals NO DROP, MLT DROP and SGL DROP/CER when there is no Drop-Out in the block, more than two tracks dropped out in the block, and only one track dropped out in the block respectively. A parity checker checks the parity of the read data and generates PE (Parity Error) on even parity data. Single track error is corrected by using the PE and DROP signals for each track. If there is a PE without any track Drop-Out, a NO TRK PTR (No Track Pointer) is generated which then generates UNCORRDATA (Uncorrected Data). When there is a multi-track Drop-Out, no correction is performed.



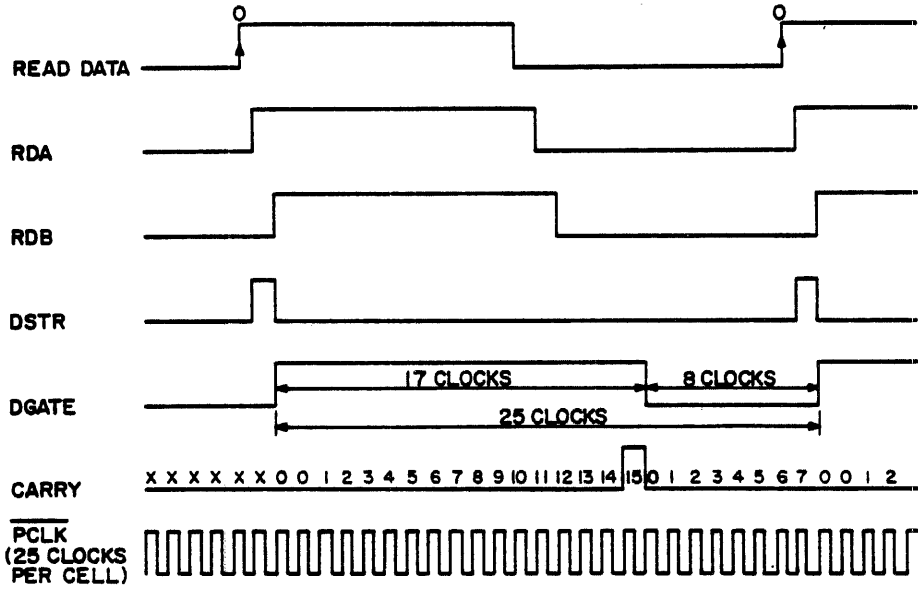


Figure 4-24. PE RECOVERY - DATA CELL TIMING

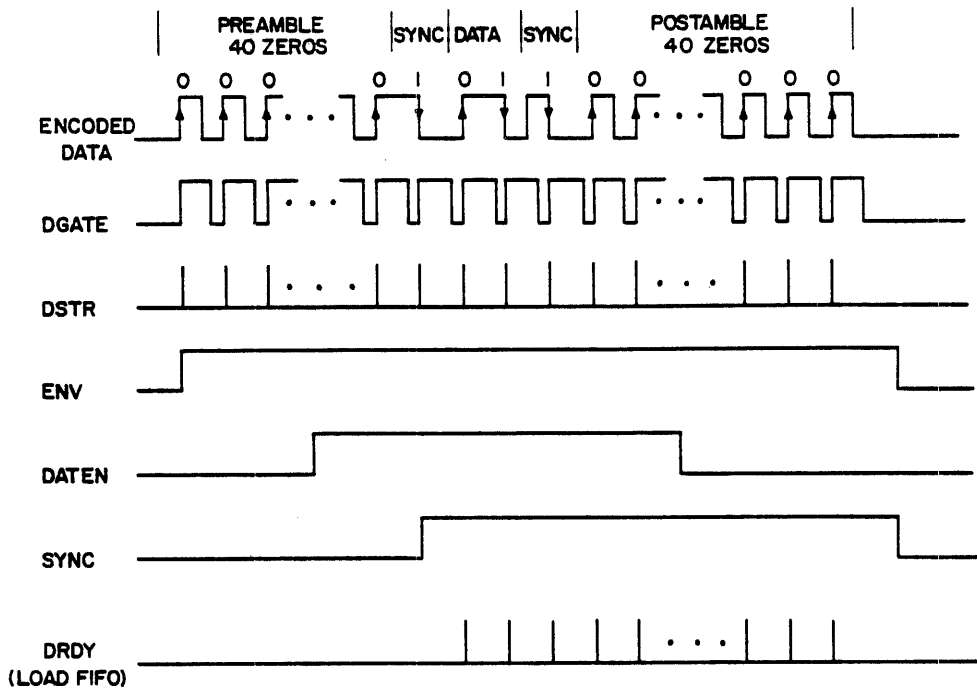


Figure 4-25. PE READ RECOVERY TIMING

POWER DRIVER PWA FUNCTIONAL DESCRIPTION

The Power Driver PWA is an electronic assembly consisting of two identical amplifiers capable of converting voltage error signals from the Servo Control Assembly PWA to proportional currents passing through two motors (TAKE-UP and FILE). The torques created provide the acceleration and tension to the connecting tape between the two motors. The operation of one amplifier is as follows:

The amplifier has an H-bridge voltage switcher driven by a Pulse Width Modulation (PWM) converter contained within a current feed-back loop. The resulting current is uninterrupted, but varying with an average value proportional to the input voltage, with a gain factor of 1 amp per volt. A soft dead-band of + 300 MV exists where the gain factor quickly approaches zero within this region of input.

An overall block diagram is shown in Figure 4-26. The signal flow proceeds from the differential error input through A with Unity Gain Summing, with the current feed-back voltage from B. The resulting difference is multiplied by five through C and compared to two triangle voltages by comparators D and E. The resulting difference is multiplied by five through C and compared to two triangle voltages by comparators D and E.

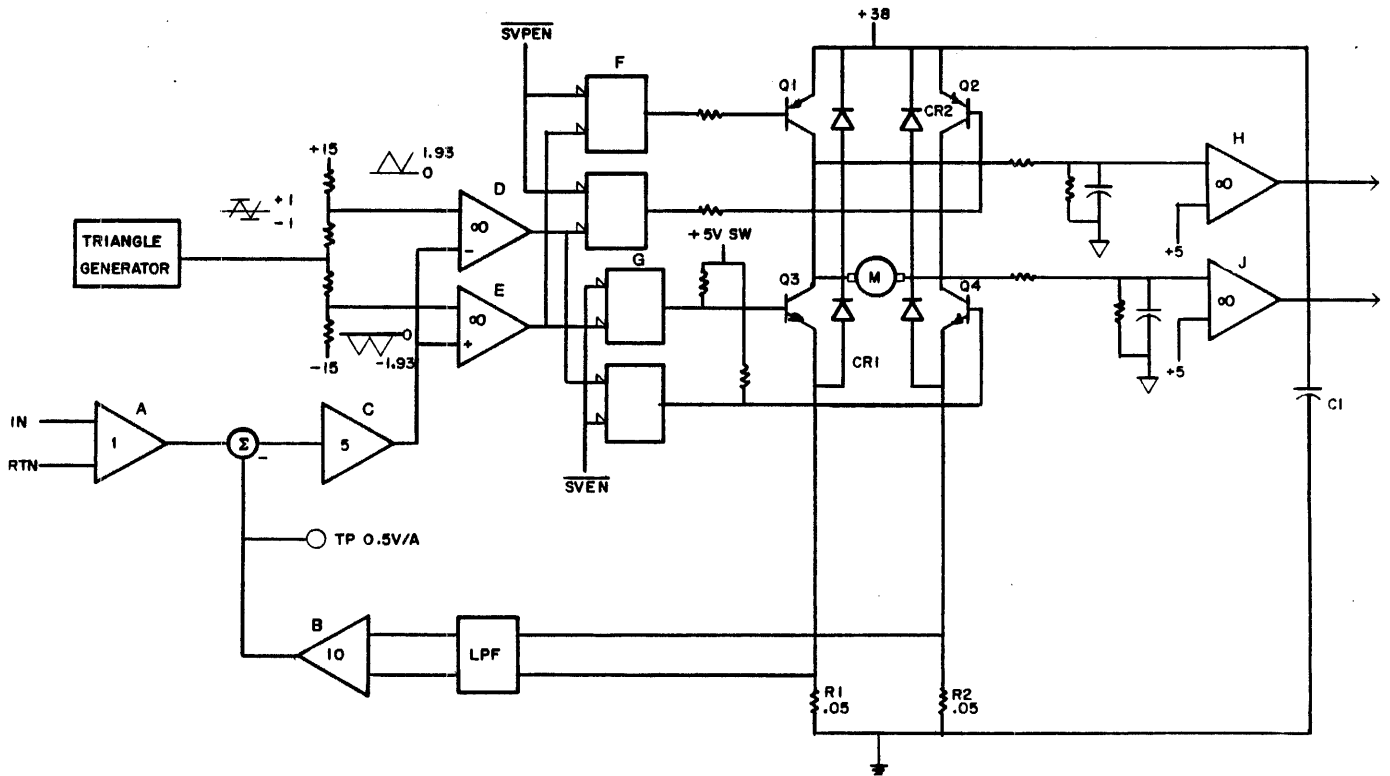


Figure 4-26 POWER DRIVER BLOCK DIAGRAM

These waveforms are shown in Figure 4-27. Two quadrants of input are shown to point out that only one of the negative-active outputs from D and E exists at any given time. The peripheral drivers F and G connect the PWM outputs from the comparators to the appropriate transistors Q1 through Q4. At this point, it can be seen how the enabling to the H-bridge is performed. The gating of SVPEN and SVEN allow diagnostic control. The SW5 signal (Switched +5 Volts) is applied as the source of drive to the lower bridge. It can be quickly removed during Power On and Off sequencing or during a high over-current condition.

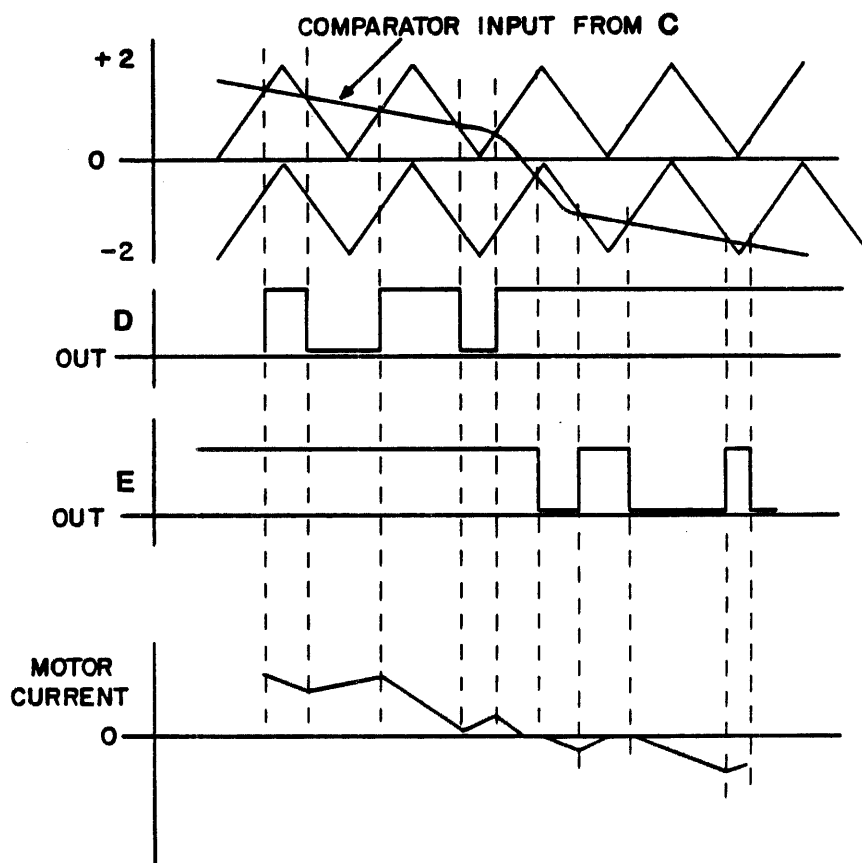


Figure 4-27. POWER DRIVER WAVEFORMS

Figure 4-28 shows a quadrant of the H-bridge and the states of current flow for a given DC input. In State 1, current is flowing in Q1 and Q4, 'charging' the motor. In State 2, the motor is 'discharging' through CR1 and CR2 and through CR3, thus charging C1. It should be noticed that the capacitor C1 is discharging during State 1. The capacitor is also charged by the power supply during State 2.

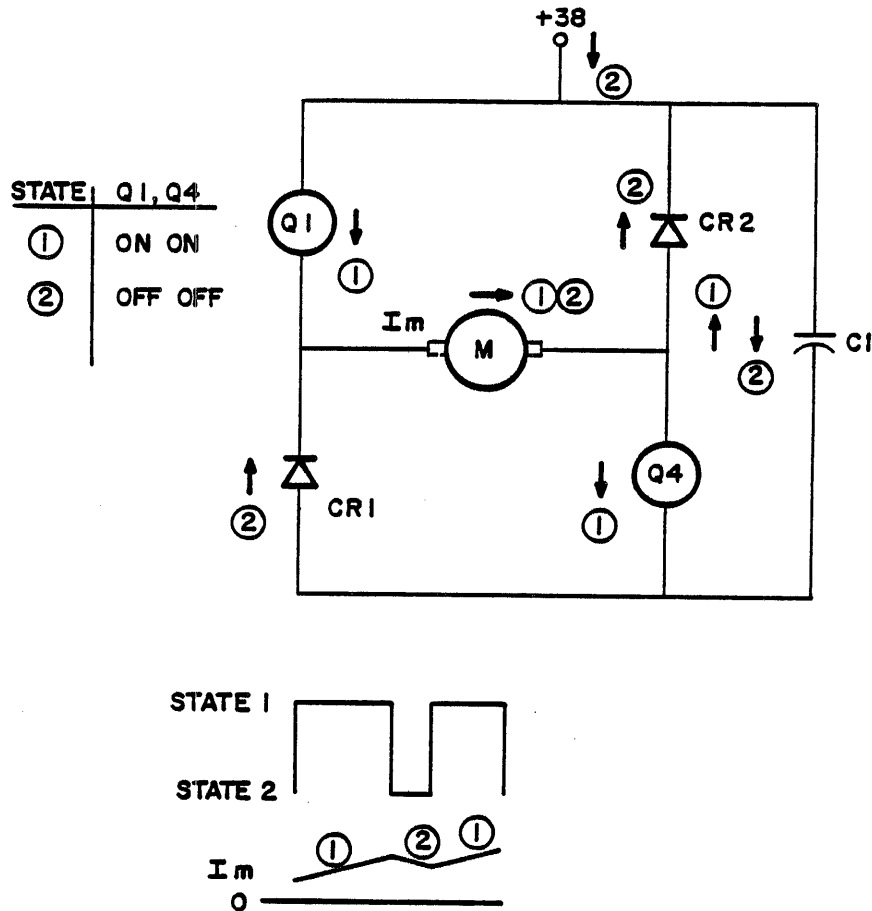


Figure 4-28. H-BRIDGE SWITCHING

A block diagram of the Switched 5-Volt line for biasing the lower stages of the H-bridge, and also the peripheral drivers for biasing the upper stage, is shown in Figure 4-29. The 5-volt shut-down is needed because the peripheral drivers become uncontrolled below 4 volts, thereby turning on both sides of the bridge in the presence of 38 volts. The Master Clear signal from the power supply and the 4.2 volt reference make use of comparator K for shut-down.

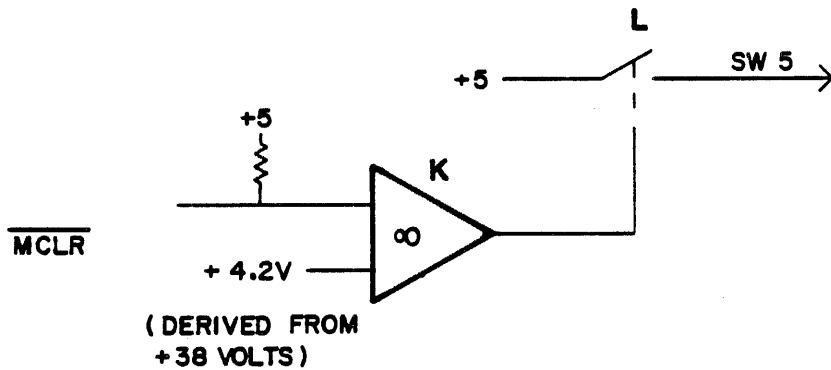


Figure 4-29. SWITCHED +5 VOLTS

## HEAD ASSEMBLY OPERATION

Figure 1-2 in section 1 of the Hardware Reference/Maintenance Manual 49768900 shows the location of the head assembly with respect to other tape components. The read/write subsections of the head consist of nine individual write heads and nine individual read heads. The two sections are mounted in tandem in such a way that, when in forward motion, tape passes first under the write heads and then under the read heads. The width of a write is slightly wider than its corresponding read head, thus asserting that a read head will always scan within the track of its write head.

Individual read and write heads are configured of a wire-wound core placed to influence the magnetic field of an associated read or write gap cut into the assembly. During a write operation, the direction of current flow through a winding is established by the nature of the data pattern to be transcribed onto the tape. As current flows through the windings in a write head, a magnetic field is induced across the write gap. As tape passes into the influence of this field, the magnetic particles on the tape are aligned by the lines of flux across the write gap. When current flow through the coil windings is reversed due to data change, the magnetic particles on the tape are realigned in the opposite direction. As the tape passes under the read head, the direction in which the magnetic particles on the tape are aligned, is detected by the read head core. This electrical signal is amplified by the preamplifiers and is then transmitted to the formatter for processing.

An erase head is also included in the head mechanism. The erase head is energized by a current (DC) during a write operation. This action aligns all tape particles in the same direction prior to passing under the write head. Thus, all information is erased from a tape before new information is written. During a read operation, the erase head is turned off in order to preserve pre-recorded data.

A tape cleaner contacts the tape and removes all foreign particles from the tape prior to reaching the head assembly. Cleaner blades dislodge any foreign material on the tape, which is then removed from the tape path area by vacuum.

## RECORDING TECHNIQUES AND FORMATS

Streaming tape transports read or transcribe data in the PE (phase) recording schemes. The following paragraphs provide a brief review of techniques and associated tape formats.

### Tape Composition

Magnetic tape is constructed of a plastic base material that is coated on the recording side with a substance containing minute

iron oxide particles mixed with a binding agent. The recording surface thus is sensitive to the influence of electrically generated magnetic fields.

The magnetic recording technique employs a data-dependent current switching scheme to set the polarization pattern of individual write heads. Discrete segments of the magnetically sensitized tape, when passed through the magnetic field of an associated write head, are forced to assume a corresponding polarization pattern. During a read operation, the data-descriptive polarization patterns carried by the previously recorded tape influence the polarity of the electrical signals induced into the read head coils.

### Phase Modulation - Technique and Format

The phase modulation method records "1" and "0" bits on tape by changing the direction of current through the write head. A change in current direction results in a corresponding change in direction of the magnetic flux in the write head. As tape passes under the write head, magnetic particles in the tape align with the direction of magnetic flux. Particles aligned in one direction represent a "1" bit, while particles aligned in the opposite direction represent a "0" bit.

When the erase head flux is positive, a change in write head flux from negative to positive records a "1" bit on tape (Figure 4-30). A flux change from positive to negative represents a "0" bit. When two "1's" are written in succession, the magnetic flux must return to the negative before the second "1" can be written. The flux must return to the positive state between two "0" bits. This flux transition (phase bit) between two identical data bits contains no information. The phase bit establishes the proper polarity if two identical bits ("1's" or "0's") are written in succession.

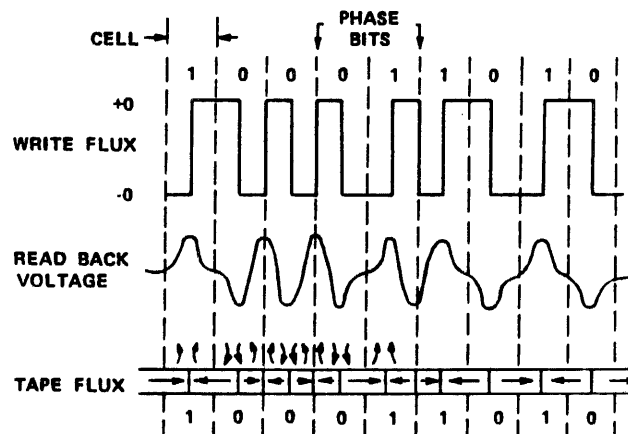


Figure 4-30. PE MODULATION RECORDING

A cell is the time needed to transfer one data bit of information. The TCU maintains a cell timing during encoding. Each data bit and phase bit requires one magnetic flux change. One inch of phase recorded tape contains 1600 data bits per track. The total number of flux changes per inch varies between 1600 and 3200, and depends on the pattern written.

The following characteristics describe the readback signal during phase modulation recording:

1. A positive pulse in the middle of a cell indicates a "1"; a negative pulse indicates a "0".
2. A positive pulse at the junction of two cells indicates that both cells contain "0". Conversely, a negative pulse at the junction indicates that both cells contain "1's".
3. The absence of a pulse at the junction of two cells indicates that the cell contains opposite binary bit values.

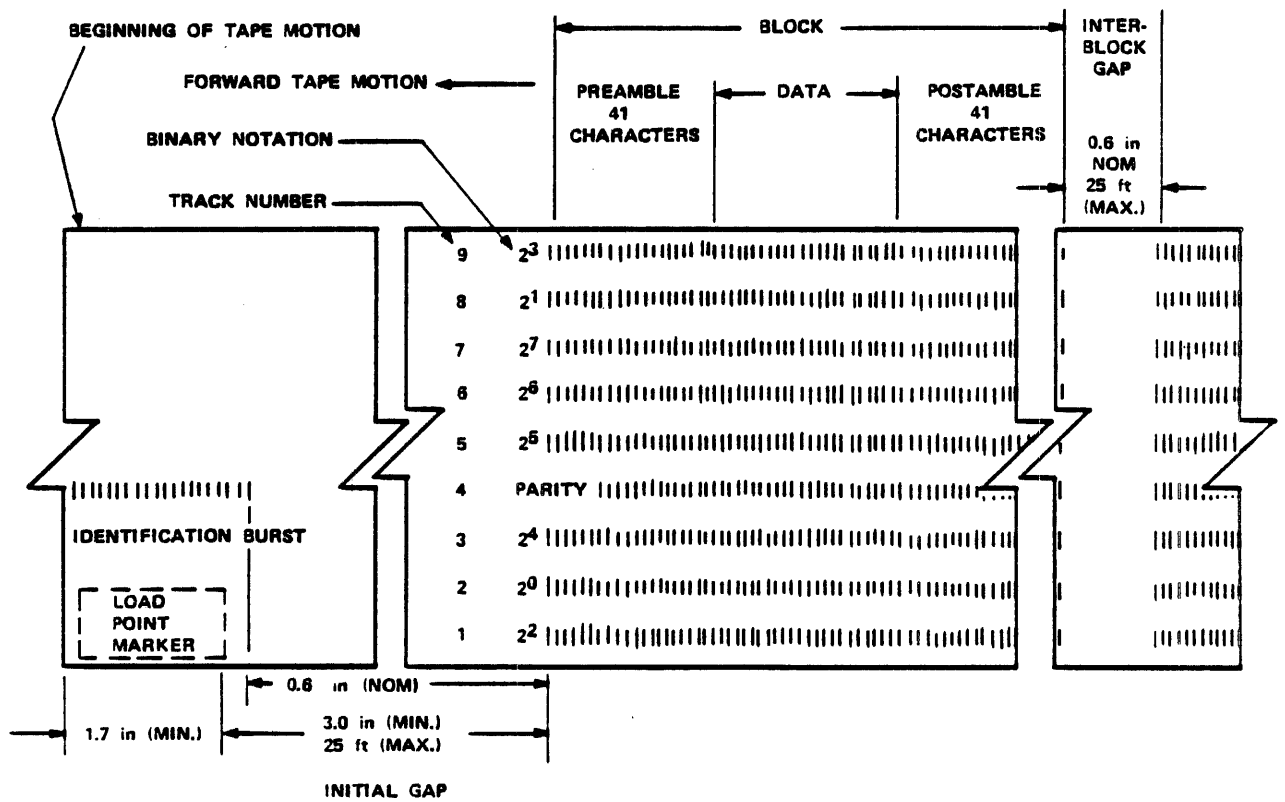
The identification burst shown in Figure 4-31 identifies the phase modulation method of recording information. The burst consists of alternate "1's" and "0's" (1600 flux changes per inch) written on track 4 only. During the burst, all other tracks are erased. A minimum gap of 0.5 inch must exist between the burst and the first block of data.

#### Phase Modulation Character Configuration

Data is recorded on the 9 tracks in Figure 4-31. Track 1 is the track closest to the operator; the remaining 8 tracks are numbered consecutively from 2 to 9. Track 4 is used to check character parity on information in the other 8 tracks. If an even number of "1's" is written in the 8 information tracks, a "1" will be written in track 4 to give an odd parity check. If an odd number of "1's" is written in the 8 information tracks, a "0" will be written in track 4.



A data block consists of a preamble, data and a postamble as shown in Figure 4-31. The preamble identifies the beginning of a block and consists of 41 characters. The first 40 characters are "0's" in all tracks and the last character is a "1" in all tracks. The postamble identifies the end of a data block. It consists of 41 characters which are a mirror image of the preamble; that is, the first character is a "1" in all tracks and the last 40 characters are "0's" in all tracks. The postamble also identifies the data block when performing a Reverse Read operation.



NOTE:  
1. OXIDE SIDE UP ON DIAGRAM RECORDING HEAD ON SAME SIDE AS OXIDE.

Figure 4-31. PHASE ENCODED TAPE FORMAT

## STU/ADAPTER INTERFACE

### ELECTRICAL INTERFACE

All lines are low true and driven by 2-state devices, type SN7438. These lines are received by the circuit shown in Figure 4-32. The following voltage levels apply:

	<u>Transmitted</u>	<u>Received</u>
True = 0	0.0V - 0.4V	0.0V - 0.8V
False = 1	2.4V - 5.0V	2.0V - 5.0V

### MECHANICAL INTERFACE

#### Connector Requirements

The connectors for this interface are two 50-pin printed circuit edge connectors:

- o 50-Pin Connector CDC P/N 95966510 (AMP 88373-1 or equivalent)
- o Keying Plug CDC P/N 95966560 (AMP 88113-1 or equivalent)

#### I/O Cabling Requirement

Two 50-pin flat signal cables are used to interface the STU with the controller/adapter.

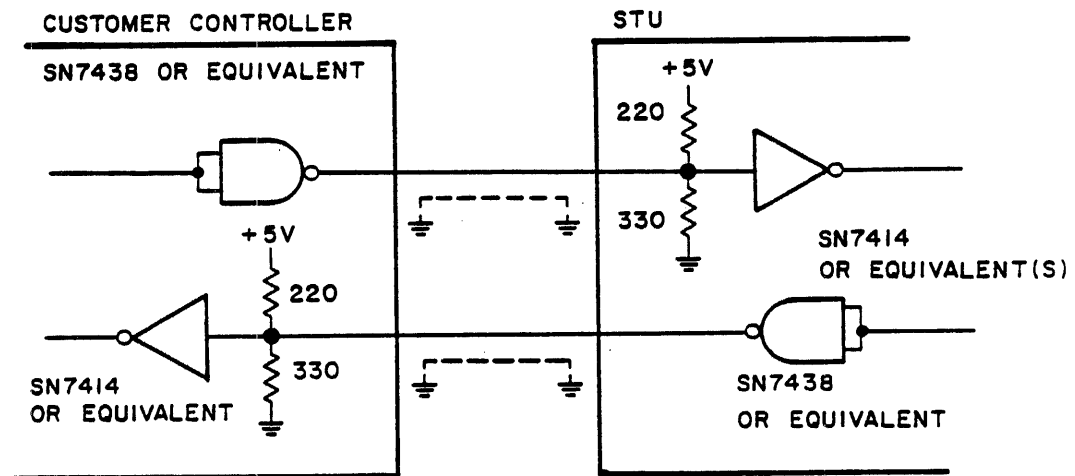


Figure 4-32. INTERFACE CONFIGURATION

# CONNECTOR PIN CONFIGURATION

CONNECTOR	SIGNAL PIN	RETURN PIN	SIGNAL
J4	2	1	-FFBY
	4	3	-FLWD
	6	5	-FWD4
	8	7	-FGO
	10	9	-FWD0
	12	11	-FWD1
	14	13	Spare
	16	15	-FLOL
	18	17	-FREV
	20	19	-FREW
	22	21	-FWDP
	24	23	-FWD7
	26	25	-FWD3
	28	27	-FWD6
	30	29	-FWD2
	32	31	-FWD5
	34	33	-FWRT
	36	35	-FLGAP
	38	37	-FEDIT
	40	39	-FERASE
42	41	-FWFM	
44	43	Spare	
46	45	-FTADO	
48	47	-FRD2	
J4	50	49	-FRD3

The prefix "F" denotes Formatter Interface Signals.

CONNECTOR PIN CONFIGURATION (Cont'd)

CONNECTOR	SIGNAL PIN	RETURN PIN	SIGNAL
J5	1	5	-FRDP
	2	5	-FRD0
	3	5	-FRD1
	4	5	-FLDP
	6	5	-FRD4
	8	7	-FRD7
	10	9	-FRD6
	12	11	-FHER
	14	13	-FFMK
	16	15	-FID
	18	17	-FFEN
	20	19	-FRD5
	22	21	-FEOT
	24	23	-FOFL
	26	25	Spare
	28	27	-FRDY
	30	29	-FRWD
	32	31	-FFPT
	34	33	-FRSTR
	36	35	-FDWDS
38	37	-FDBY	
40	39	-FHSPD	
42	41	-FCER	
44	43	-FONL	
46	45	-FTAD1	
48	47	-FFAD	
J5	50	49	-FHISP

The prefix "F" denotes Formatter Interface Signals.

## INTERFACE REQUIREMENTS

The STU Interface is designed to accommodate the subsystem configurations shown in Figure 4-33. The STU Interface is based upon the Industry Standard Interface for 1/2 inch tape products. Modifications to this standard interface are required to accommodate the STU. The modifications are in the form of expansion to accommodate streaming mode operations and increased functionality, as well as deletions of unused functions. More specifically, the following additional capability is provided:

- o Streaming Mode Operations

High Speed Select and Status Lines required for setting start/stop or streaming modes and identifying motion states.

- o Gap Length Controls

Establish normal (0.6 inch nominal) or long (1.2 inch nominal) Interblock Gap (IBG). Optional gap lengths in the short and long gap are selectable via change to printed circuit board. The short gap is fixed at 0.6 inch or variable 0.6 to 0.9 inch. The long gap is fixed at 1.2 inches or variable 0.6 to 1.2 inches. The STU is shipped with the gaps selected in the fixed modes.

- o Sense Transfer

Allows for the transfer of STU sense information.

- o STU Interface Loopback

Allows for the looping of write to read lines on the STU Interface.

The deletions consist of removing the functions of density selection (NRZI/PE) and clip level threshold selection (performed automatically in the STU).

### Minimum System Configuration

The minimum system configuration, as shown in Figure 4-33, provides for a single tape unit. Terminators for the Channel I/O are installed on the formatter board. The maximum cable length to the controller is 20 feet.

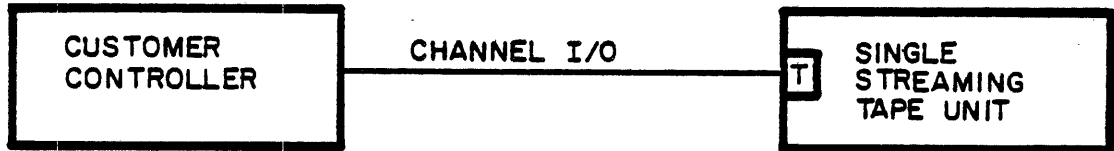


Figure 4-33. MINIMUM SYSTEM CONFIGURATION

### Maximum System Configuration

Figure 4-34 shows the maximum system configuration consisting of four tape units daisy-chained together. Only the last tape unit will have terminators installed in the formatter board and intermediate units should have their factory installed terminators removed. The maximum total cable length to the controller is 20 feet.

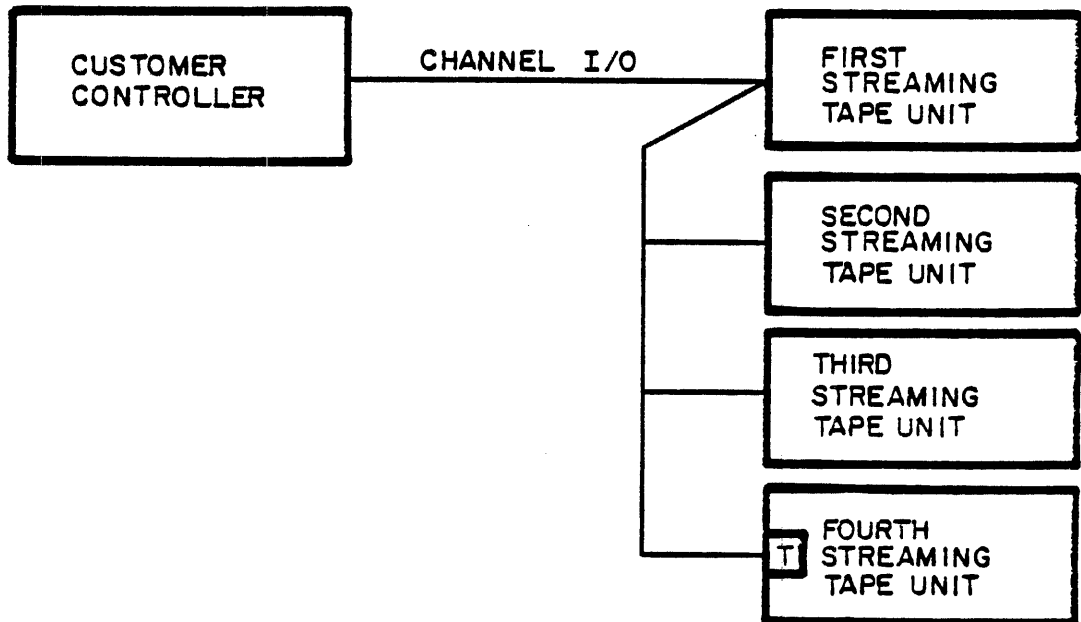


Figure 4-34. MAXIMUM SYSTEM CONFIGURATION

## INTERFACE DESCRIPTION

### Addressing

The STU monitors the interface signals -FFAD, -FTAD0 and -FTAD1 and compares them to levels predetermined by switch settings on the unit(s) PWA. Hence, one of the four STU's daisy-chained on the STU interface may be selected. The appropriate levels must be maintained for the duration of an operation.

### Mode of Operation

The STU operates in either start/stop mode or streaming mode.

#### o Start/Stop Mode

The STU operates similar to conventional tape transports. It accelerates the tape when a command is received and stops the tape within the Interblock Gap (IBG).

#### o Streaming Mode

Tape motion continues without loss of time due to starting and stopping, if the next command is received during the command reinstruct time. The STU maintains 100 ips speed through the IBG, anticipating the next command. If a command is received within the reinstruct time, there is no loss of time due to starting and stopping. If commands arrive after command reinstruct time or are discontinued, the tape unit will go through a recovery cycle.

### Command Set

#### o Write Command

This command causes the STU to accelerate tape and start transferring data. The data transfer continues until the Last Word command is given from the controller. The STU continues to move tape to perform read-after-write check.

In the start/stop mode, the STU decelerates tape after each block. The next command will not be executed until the STU has completed its stop.

In the streaming mode, if the following Write command is received during reinstruct time (see Table 4-4), the STU will continue the tape motion and write the next block. Otherwise, the STU will decelerate the tape. If the Write command is received after reinstruct time, the command will not be executed until STU has completed its recovery cycle.

- o Write File Mark Command

This command causes the STU to start the tape and write the proper file mark pattern on the tape.

- o Erase Commands

1. Fixed Erase - This command causes a 3.6 inch length of tape to be erased. The ID burst will be written when an Erase command is given from BOT.
2. Controlled Erase - This command causes the STU to accelerate the tape and erase tape continuously until the "Last Word" signal from the controller is set true. This terminates the erase operation. The ID burst will be written when an Erase command is given from BOT.
3. Data Security Erase - This command causes the STU to erase tape at 100 IPS from its present position to a position approximately 10 feet past End of Tape marker. The ID burst will be written when command is given from BOT.

- o Read Forward Command

This command causes tape to be accelerated to normal operating speed. The STU reads the next logical record of data encountered.

If the STU has not detected data after 25 feet of tape motion, it will terminate the operation by decelerating the tape and resetting Formatter Busy status. An error condition will be set as a result of the time-out. File Mark testing is performed during read operation.

In start/stop mode, the STU decelerates tape after each block. The next command will not be executed until the stop is completed.

In streaming mode, if the following Read command is received during the reinstruct time, the STU will continue tape motion and read the next block of data. Otherwise, the STU will decelerate the tape. If the Read command is received after the reinstruct time, the command will not be executed until the recovery cycle is completed.

- o Read Reverse Command

Similar to Read Forward, but with tape motion in the reverse direction. Consecutive records may be read in reverse "on-the-fly". The STU will stop tape motion and set low speed mode when the BOT signal is present during any reverse operation.



- o Space Forward Command

This operation is similar to a Read Forward except that no read strobe signals are generated and no read data is supplied to the controller. Error checking is not performed on the read data. However, File Mark testing is performed.

- o Space Reverse Command

This operation is similar to the Space Forward operation except that the STU moves tape in the reverse direction.

- o File Mark Search Commands

These commands cause the STU to continuously Read Forward or Read Reverse in "on-the-fly" mode. Tape motion ceases when a File Mark is read with the head correctly positioned. When combined with a Space command, data transfer and error detection is inhibited.

- o Rewind Command

This command causes the selected STU to rewind to BOT. The tape unit defaults to start/stop mode after Rewind. The command is ignored if the unit is already at BOT.

- o Off-Line Command

This command causes the selected STU to go Off-Line, Rewind and Unload tape.

- o On-Line Command

This command causes the selected STU to go On-Line if tape is loaded.

- o High Speed Select Command

When received with a Read or Write-type command, this command causes STU to change from start/stop to streaming mode before executing Read or Write-type command. This command may delay first Read or Write command by 640 milliseconds.

- o Long Gap Command

When received with a Write-type command, this command causes the STU to be set for Long Gap (see Table 4-4) in streaming mode. In start/stop mode, the gap will be 1.2 inches. When received with a Read command in start/stop mode, the Long Gap command will be ignored.

- o Channel Loopback Command

This is a diagnostic command used to loopback the STU Interface write data lines to read data lines. The STU generates Demand Write Data Strokes and loops back the write data from the STU Interface to the read data lines until the Last Word signal is received. The Formatter Busy and Data Busy signals are reset when the last data byte is transmitted. The data transfer rate is at the present transport speed.

- o Sense Read Command

This command transfers STU sense information to the controller. The sense transfer is similar to a read operation at low speed of a fixed length record except that no tape motion is involved. The STU generates a read strobe for every sense byte transferred. Eight (8) bytes of sense information are transferred (refer to Table 4-2). The STU need not be on-line (but must be selected) to execute a Sense Read command.

- o Controlled Backspace Command

This command causes the STU to accelerate the tape in the reverse direction and start issuing Demand Write Data Strokes. The STU has no maximum restrictions on the space length. The Demand Write Data Strokes continue at the data rate until the Last Word command is given from the controller. Tape motion will continue until an IBG is detected. This will terminate the operation. No read data is sent to the controller and no error checking is performed. File Mark testing is not performed for this operation. This operation is similar to a write operation except that no data is recorded on tape.

## STATUS AND SENSE INFORMATION

### Status Information

The status bits are set when their respective setting condition occurs. The setting conditions are detailed as follows in this section. The STU need not be on-line (but must be selected) to transfer the sense bits.

- o Formatter Busy

When a command is transferred to the Formatter, this signal goes active on the trailing edge of FGO and is reset when the Formatter has completed the last Go command.

o ID Burst Detect

This line is pulsed if the identification burst on the tape is detected when the tape operation is a read or a read-after-write from BOT.

o Hard Error

1. This line is set as the result of one of the following conditions being detected during execution of a command:

- Vertical Parity Error without associated drop-out
- False Preamble Detection
- False Postamble Detection
- Excess Skew
- Multi-track Error
- Parity Error on channel interface
- Identification Error on read-after-write
- Noise Error
- Equipment Check
- Read Time-out
- Device Sense Error
- Loop Write-to-Read Error
- Illegal Command
- Reverse into Load Point
- Single Track Correction on Write Command

2. Should the error condition be detected while FDBY is set, then FHER is pulsed with a minimum pulse of 10 us. If FDBY is not set, then FHER is set and will be reset on receipt of the next GO command or when Formatter Enable is reset.

o Corrected Error

This line is pulsed while FDBY is set when single track error correction is performed during execution of a Read command.

o File Mark

1. This line is pulsed during any Read/Write type command when a File Mark pattern is detected.

o On-Line

1. Set when the selected transport is placed On-Line by the operator or On-Line command and tape is loaded.

2. Reset at the successful initiation of the Off-Line command or any time that the transport goes Off-Line.

o Rewind

1. Set when a Rewind or Off-Line command is issued to the selected transport.
2. Reset when the transport has completed the operation.

o File Protect

A signal which, when true, indicates that a tape without a write enable ring is mounted on the selected transport.

o Load Point

1. Set when the tape is located with its Load Point over the BOT sensor in the start/stop mode.
2. When in streaming mode at Load Point, the BOT marker will not be under the sensor, but Load Point status will still be set.
3. Reset when the Load Point marker moves off the BOT sensor in the forward direction.
4. The streaming mode recovery cycle will not effect the status of Load Point.

o End-of-Tape

1. Set and latched when the selected transport has detected the End-of-Tape marker in the forward direction.
2. The streaming mode recovery cycle will not affect the status of the EOT.
3. Reset when passing over trailing edge of EOT in reverse direction, other than a streaming mode recovery cycle.

o High Speed

Set to indicate that the selected transport is in high speed streaming mode.

o Data Busy

True during the active execution of all commands initiated by FGO. No new command may be given while Data Busy is true.

o Ready

STU is loaded and ready to accept On-Line or Sense commands.

## Sense Data

The STU has 8 bytes of sense data available to the system upon command request (Sense Data Transfer). Table 4-2 presents a summary of STU sense byte definition. A more detailed description of STU sense data is as follows:

### o Sense Byte 0

- 7 - Unit Exception - Set when single track error correction is performed during read operation.
- 6 - Unit Check - Set when Bit 0, 1, 2, 3, 4 or 5 of this sense byte is set.
- 5 - Command Overrun - Set if command is received while Data Data is true (also sets sense byte 0 bit 0).
- 4 - Data Check
  - Set when Postamble Error is detected.
  - Excessive skew is detected.
  - When PE ID Burst is not correctly recorded while writing from BOT.
  - When PE ID Burst is not detected while reading from BOT.
  - When noise is detected during read-after-write check on Erase command.
  - When Multi-drop is detected.
  - When no data is detected (Read Time-out Error).
  - When readback data does not occur when expected on Write Tape Mark command, or tape mark is not written correctly during Write Tape Mark command.
  - Uncorrectable parity errors are detected.
  - One track in error during write operation.
- 3 - Equipment Check
  - Set when internal hardware malfunctions are detected.
  - Write Transfer Check.
  - Parity error is detected on channel in data.
  - Gap Control is not detected within defined window.
  - Positioning is not detected within defined window.
- 2 - 0
- 1 - Intervention Required - Set when STU is not Ready.

o Sense Byte 1 (Last Command Issued)

- 7 - Long Gap
- 6 - Undefined
- 5 - High Speed Select
- 4 - Erase
- 3 - Write File Mark
- 2 - Edit
- 1 - Write
- 0 - Reverse

o Sense Byte 2 (Tape Status)

- 7 - EOT
- 6 - BOT
- 5 - High Speed
- 4 - Positioning/Ramp
- 3 - File Protected
- 2 - Rewinding
- 1 - On-Line
- 0 - Ready

o Sense Byte 3

- 7 - Gap Control - Set when there is a Hardware Failure. This condition also sets sense byte 0 bit 3 (Equipment Check).
- 6 - Write Hardware Check - Set when there is a Hardware Failure. This condition also sets sense byte 0 bit 3 (Equipment Check).
- 5 - Channel In PE - Set when parity error is detected on data received from channel. This condition also sets sense byte 0 bit 3 (Equipment Check). Addition of a jumper negates this status and causes correct parity to be generated. However, if STU generates parity, there will not be any integrity checking of data lines from channel, any channel data error will be written onto tape as an undetected write error.
- 4 - Position Check - Set when there is a Hardware Failure. This condition also sets sense byte 0 bit 3 (Equipment Check).
- 3 - Device Response Check - Set when communication error has occurred between the two STU microprocessors.

- 2 - 0
- 1 - Illegal Command
  - Set when Illegal Command Sequence is detected, for example: a Read Reverse command is decoded with tape unit at BOT or decoded command has Write and Reverse bits set. This condition also sets sense byte 0 bit 7 (Command Reject).
- 0 - File Mark Detected
  - Set when a tape mark is detected during a Read or Space command.
- o Sense Byte 4
  - 7 - TIE 4
    - Track In Error 4.
  - 6 - No Track Pointer
    - Set when parity error is detected with no pointer set. This condition also sets sense byte 0 bit 4 (Data Check).
  - 5 - Multi-drop
    - Set when a Multi-drop (more than one pointer) is detected. Data is not correctable. This condition also sets sense byte 0 bit 4 (Data Check).
  - 4 - Postamble Error
    - Set when Postamble error is detected. This condition also sets sense byte 0 bit 4 (Data Check).
  - 3 - Uncorrectable Data
    - Parity error that cannot be corrected. Error has no pointer or more than one pointer.
  - 2 - PE ID Check
    - Set when PE ID is not correctly recorded while writing from BOT, or PE ID is not detected while reading from BOT. This condition also sets sense byte 0 bit 4 (Data Check).
  - 1 - Noise
    - Set when noise is detected during read-after-write check on Erase command, or IBG is not detected at End of Record. These conditions also set sense byte 0 bit 4 (Data Check).
  - 0 - Time-out
    - Set when no data is detected within 25 feet of tape. This condition also sets sense byte 0 bit 4 (Data Check).

o Sense Byte 5

These bits indicate the tracks for which pointers are on at the end of the last operation.

7 - TIE 2	- Track In Error	2
6 - TIE 8		8
5 - TIE 1		1
4 - TIE 9		9
3 - TIE 3		3
2 - TIE 5		5
1 - TIE 6		6
0 - TIE 7	- Track In Error	7

o Sense Byte 6

- Fault Symptom Code      - Fault Code Representation for internally detected failure mode

o Sense Byte 7 - Marginal Device Indication

	<u>12.5 ips</u>	<u>25 ips</u>	
7 - 0		Low Speed Slow Down Ramp Fault	Support Level Interpretation Only
6 - 0		Low Speed Slow Up Ramp Fault	
5 - Low Speed			
4 - High Speed			
3 - Low Speed Down Ramp			
2 - High Speed Down Ramp			
1 - Low Speed Up Ramp			
0 - High Speed Up Ramp			Support Level Interpretation Only



Table 4-2. STU SENSE BYTE SUMMARY

SENSE BYTE	MSB				LSB			
	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7
0	Command Reject	Inter- vention Required	0	Equipment Check	Data Check	Over- run	Unit Check	Unit Exception
1	Reverse	Write	Edit	Write File Mark	Erase	Hi Speed Select		Long Gap
2	Ready	On-Line	Rewind	File Protect	Position- ing Ramp	High Speed	BOT	EOT
3	File Mark Detect	Illegal Command	12.5 ips 0 ----- 25 ips Checksum Check	Device Response Check	Position- ing Check,	Channel In Parity Error	Write Hardware Check	Gap Control Check
4	Read Time-out	Noise Check	PE ID Check	Uncorrec- table Data	Postamble Error	Multi- drop	No Track Pointer	TIE 4
5	TIE 7	TIE 6	TIE 5	TIE 3	TIE 9	TIE 1	TIE 8	TIE 2
6	FAULT SYMPTOM CODE							
7	High Speed Up Ramp MDI	Low Speed Fast Up Ramp MDI	High Speed Down Ramp MDI	Low Speed Fast Down Ramp MDI	High Speed MDI	Low Speed MDI	Low Speed Slow Up Ramp Fault	Low Speed Slow Down Ramp Fault

## SIGNAL DESCRIPTION

All STU interface lines are defined low-true.

### Lines To The STU

- o -FFAD: Formatter Address

This line must correspond to the address switch setting.

- o -FTAD0, -FTAD1: Transport Address

These lines must correspond to the address switch setting.

- o -FGO: Initiate Command

This signal is used to strobe the following command lines on the trailing edge:

- |           |          |
|-----------|----------|
| 1. FREV   | 5. FEDIT |
| 2. FWRT   | 6. FLGAP |
| 3. FWFM   | 7. FHISP |
| 4. FERASE |          |

- o -FREV: Reverse/Forward

This signal is used to encode Go commands. See Table 4.3.

- o -FWRT: Write/Read

This signal is used to encode Go commands. See Table 4.3.

- o -FWFM: Write File Mark

This signal is used to encode Go commands. See Table 4.3.

- o -FERASE: Erase

This signal is used to encode Go commands. See Table 4.3

- o -FEDIT: Edit

This signal is used to encode Go commands. See Table 4.3  
(Note: Edit commands are not supported by the STU.).

- o -FLGAP: Long Gap

When true, this line causes the STU to be set up for 1.2 inch gap. When false, will select the normal 0.6 inch gap.

- o -FHISP: High Speed Select

If this line is true when Read or Write command is issued, the STU will read or write at high speed. If the line is false, the STU will read or write low speed. Should unit be in opposite speed mode when command is issued, the STU will first change speed with a delay of up to 640 milliseconds and then execute the command at the desired speed.

- o -FREW: Rewind

This signal (minimum 1.0 microsecond pulse) causes the selected transport to rewind to BOT. The -FRWD signal is asserted during the Rewind operation. Formatter Busy is not set during a Rewind.

- o -FOFL: Off-Line and Rewind

This line must be held true for a minimum of 1.0 microsecond. It causes the STU to go Off-Line, Rewind and Unload the tape. Formatter Busy is not set.

- o -FLOL: On-Line

This signal causes the selected STU to go On-Line. It must be held true for a minimum of 1.0 microsecond. Formatter Busy is not set.

- o -FWDO-7, -FWDP

These lines transmit data to the STU. -FWDO is the most significant.

- o -FFEN: Formatter Enable

This signal, when false, causes the formatter to be held in an initialized state. It is independent of -FFAD. Resetting Formatter Enable may be used to terminate run-away operations caused by missing last word.

- o -FLWD: Last Word

During Write and Controlled Erase, this line, when true with -FWDO-7, -FWDP, indicates that the character being strobed into the Formatter is the last of the record.

Table 4-3 presents a correspondence between the signal lines strobed by the -FGO line and the command to be executed.

Table 4-3. STU INTERFACE COMMANDS

COMMAND	EDIT	REV	WRT	WFM	ERASE
Read Forward *	L	L	L	L	L
Read Reverse *	L	H	L	L	L
Write *	L	L	H	L	L
Write File Mark	L	L	H	H	L
Erase (Variable)	L	L	H	L	H
Erase (Fixed)	L	L	H	H	H
Data Security Erase	H	L	H	H	H
Space Forward	L	L	L	L	H
Space Reverse	L	H	L	L	H
Controlled Backspace	L	H	H	L	H
File Search Forward	L	L	L	H	L
File Search Reverse	L	H	L	H	L
File Search Forward (Ignore Data)	L	L	L	H	H
File Search Reverse (Ignore Data)	L	H	L	H	H
Read Sense	H	H	L	L	H
Data Loopback	H	H	H	H	H

L = Low = False

H = High = True

\* FLGAP is also strobed during these command transfers, indicating the setting of a Long or Normal Gap Length (1.2 inch or 0.6 inch IBG nominal respectively). See Table 4-4.

## Lines From The STU

- o -FFBY: Formatter Busy

Only goes true when -FGO command is received. Remains true until completion of command execution.

- o -FDBY: Data Busy

Goes true during active execution of all commands initiated by -FGO. When searching file marks, Data Busy will go true during each record. A new command may be given when Data Busy goes false for an "on-the-fly" operation. "On-the-fly" commands must be the same read/write mode and same tape direction. All other commands are accepted by the STU after Data Busy goes false, but will not be executed until the previous command is completed.

- o -FID: PE Identification Burst Detected

- o -FHER: Hard Error

This line is set low if any error has been detected. Should the error be detected while FDBY is set, then FHER is pulsed with a minimum pulse of 10 us. If FDBY is not set, then FHER is set and will be reset on receipt of the next Go command or when Formatter Enable is reset.

- o -FCER: Corrected Error

This line is pulsed while FDBY is set when single track error correction is performed during the execution of a Read command. Minimum pulse width is 10 us.

- o -FFMK: File Mark Detected

This line is pulsed while FDBY is set during any Read/Write type command when a File Mark pattern is detected.

- o -FRDY: STU Ready

This line, when true, indicates that unit is loaded. The Ready line will go false during a Rewind.

- o -FONL: STU On-Line

- o -FRWD: Rewind

This line, when true, indicates that a Rewind is being executed.

- o -FEOT: End-of-Tape
- o -FFPT: File Protect
- o -FLDP: Load Point
- o -FHSPD: High Speed

When true, indicates selected STU is in the streaming mode, high speed. When false, it indicates start/stop mode, low speed.

- o -FDWDS: Demand Write Data Strobe

This line consists of a pulse for each character to be written onto tape. The pulse width of signal -FDWDS is equal to 1/2 of the data rate. The first data character should be available on the write data input lines within 40 character periods after the -FDBY signal has been set true, and remain true until the trailing edge of the first -FDWDS signal.

Succeeding characters must then be placed on these lines within one-half of a character period after the trailing edge of each -FDWDS signal. During a Write File Mark command, the required File Mark pattern is generated internally by the Formatter and the -FDWDS signal is not used. During erase operation (variable length), this line will also be used. However, no data are transferred or written onto tape. The controller may use this line to determine the length of tape to be erased.

o -FRSTR: Read Data Strobe

This line consists of a pulse for each character of read information to be transmitted to the customer controller interface and should be used to sample the read data lines -FRDO-7, -FRDP. The pulse width of this signal is a minimum of 1 usec. The average time between pulses on the -FRSTR line is given by:

$$\frac{1}{S \times D} \quad \text{Where } S = \text{Tape Speed (ips) and } D = 1600 \text{ bpi}$$

The customer controller interface must be able to accept the whole block of data at the specified data rate.

Due to bit crowding, tape speed variation and signal drop-out correction (PE), the customer controller interface must be able to receive characters at a rate which can vary between twice the nominal rate and half the nominal rate.

o -FRDO-7, -FRDP: Read Data

These 9 lines transmit read data from the Formatter to the customer controller. Each character read from tape is available by sampling these lines in parallel with the -FRSTR. Data will be placed on the read data lines at least 0.5 usec prior to the leading edge of the -FRSTR pulse. The data remains on the read data lines for at least 0.5 usec after the trailing edge of the -FRSTR pulse. Sense data is also transmitted on this bus analogous to the read data rate at low speed.

## SYSTEM AND TIMING CONSIDERATIONS

### MOTION CHARACTERISTICS

The transport has two operational modes: start/stop and streaming modes. Selection of either mode is made at the transport interface with start/stop being the default mode. Also, following a rewind operation, the transport automatically reverts to the start/stop mode.

In the ensuing discussions, read operations represent all read-type operations such as read, space and search. Similarly, write operations represent all write-type operations such as write data, erase and write file mark.

At 100 ips, all models perform only in the streaming mode. The 25 ips model performs in start/stop and streaming modes at 25 ips.

## Start/Stop Mode

In the start/stop mode, the transport operates similar to a conventional 1/2 inch tape unit. It accelerates the tape when a command is received and stops tape within the IBG. A long IBG of 1.2 inch nominal may be commanded as well as the normal or 0.6 inch nominal IBG. Figure 4-35 illustrates start/stop mode motion characteristics. The figure is drawn so that points A thru E represent the position of the read head for read operations and the write head for write operations.

- o Read Operations - 25 ips Unit Only

After a block has been successfully traversed, the tape will be brought to a complete stop to await the next command. The microprocessor will delay the subsequent start if the time, since the last start, is less than 80 ms.

- o Write Operations - 25 IPS Unit Only

Tape control is exactly the same as in the read; the 80 ms restriction also applies. Note that the normal IBG written in this mode is 0.8 inch.



o Other Start/Stop Motion Characteristics

whenever a change from read-to-write mode is experienced (forward direction), a "jog" operation is performed to position the erase head within the IBG. When changing from write to read reverse or rewind, a forward jog to erase a full gap is inserted by the transport. This insures that there is no glitch in the initial gap when the write head is turned off.

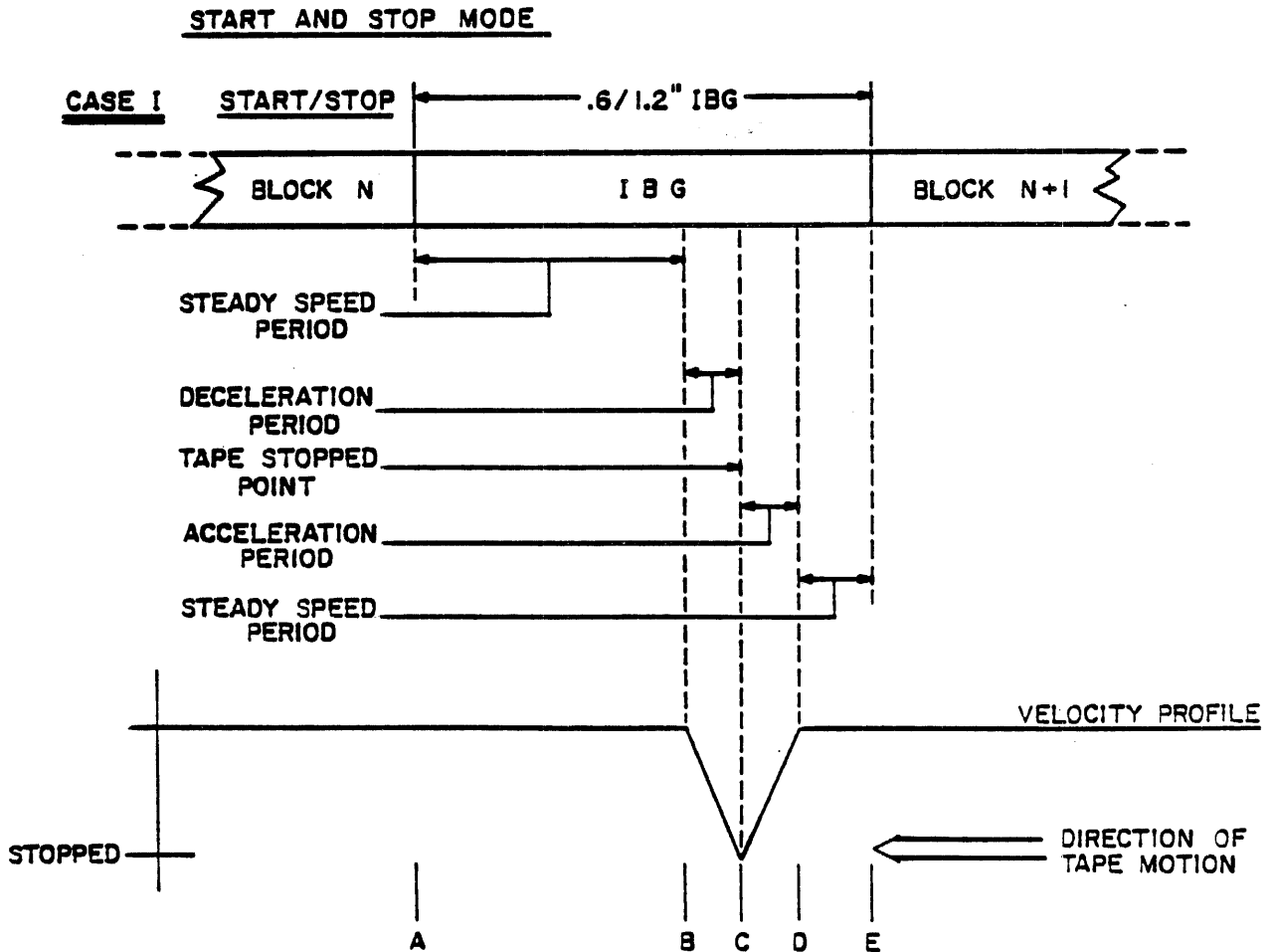


Figure 4-35. START/STOP TAPE MOTION CONTROL

## Streaming Mode

The streaming modes are high performance operating modes designed to accommodate continuous transfers of many data blocks to or from tape. Unlike the start/stop mode, tape acceleration and deceleration cannot be accomplished within the interblock gap (IBG). In order to efficiently utilize the streaming mode, tape motion must be sustained by commanding successive data operations. This is accomplished by issuing subsequent commands to the transport during the time the transport is traversing the IBG. (This command window is referred to as command reinstruct time.) If a follow-up command is not received during the reinstruction interval, a repositioning cycle is required. (A Reverse command can be received during the initial down ramp and will be executed without going through a complete repositioning cycle.) For example, assume that the transport has just completed a write data operation. If the normal IBG length of 0.6 inch is commanded by the system, then the system has 3.5 milliseconds (0.6 inch/100 inches per second) to respond with a subsequent write command in order for streaming mode to be sustained. If the subsequent write command is not received by the end of the reinstruction interval, the transport repositions itself in anticipation of the next streaming mode command.

Three sequences of events, which generally describe the motion characteristics of the transport in streaming mode, are:

- o Case 1 - Command Received During Reinstruction Interval
- o Case 2 - Command Received During Repositioning Cycle
- o Case 3 - Command Received Following Repositioning Cycle

These three sequences are applicable to both forward and reverse operations and are described on the following pages individually. First, a more general discussion of streaming mode motion characteristics is presented.

Refer to Figure 4-36. In order for the transport to perform a data operation on Block N + 1 from a stopped position (point E), it must first accelerate and be up to speed at point F as referenced to the read head in the case of a read operation, or erase head in the case of a write operation. For the case where the transport has just completed a data operation on Block N and a repositioning cycle is required, the transport begins the repositioning cycle at point B and traverses path BCDE. The transport then positions itself at point E in anticipation of the next operation. The transport presumes the next operation to be a streaming mode operation on Block N + 1. A sequence chart is presented in Table 4-4 which identifies transport streaming mode motion sequences for combinations of previous and present command issuances. In all cases, the next command is received during the reinstruct time. This chart refers to the diagram of Figure 4-36.

Table 4-4. Streaming Mode Motion Sequence Chart

PREVIOUS COMMAND	FORWARD READ	REVERSE READ	WRITE
Forward Read	Path ABF	Paths ABC, CHDG	Path ABCDEF
Reverse Read	Paths HDE, EABF	Path HDG	Paths HDE, EABF
Write	Not Recommended	Paths ABC, CHDG	Path ABF

The above mentioned three streaming mode sequences designated Cases 1, 2 and 3 apply to both read and write operations.

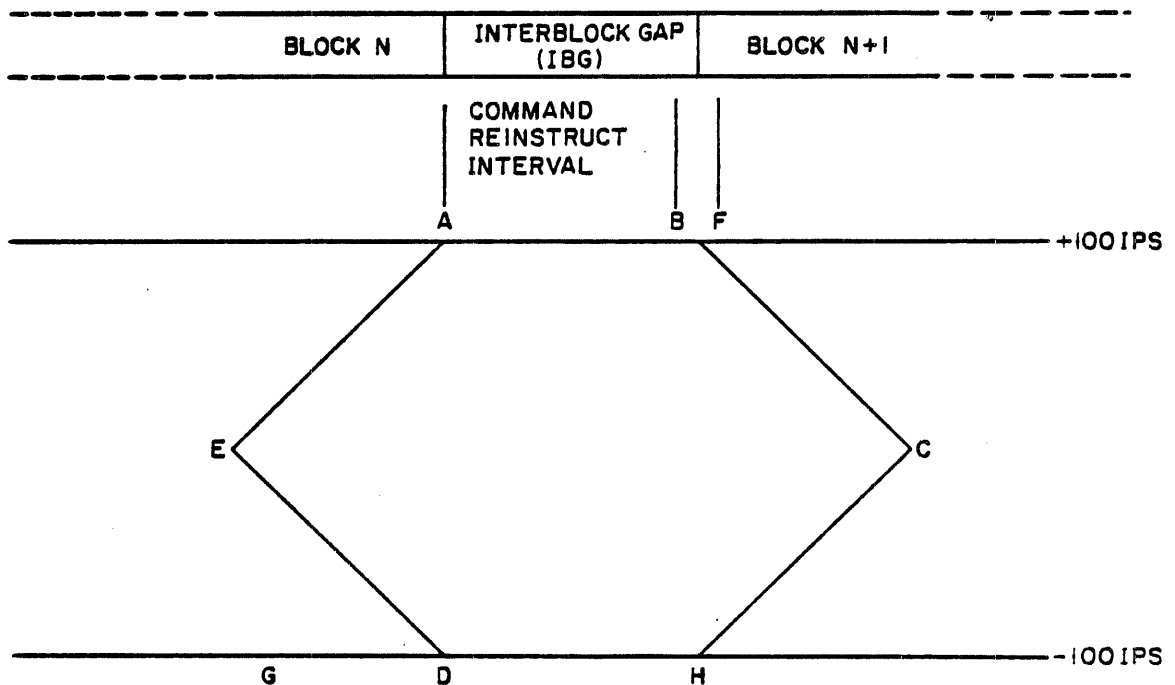


Figure 4-36. STREAMING MODE VELOCITY DIAGRAM

- o Case 1 - (Non-Stop) Command Received During Reinstruction Interval

A command is received sometime during the command reinstruction period following the data operation on Block N. Note that the velocity profile at the bottom of the figure indicates that 100 ips velocity is maintained without interruption through the processing of Block N and N + 1.

**CASE 1 - NON-STOP**

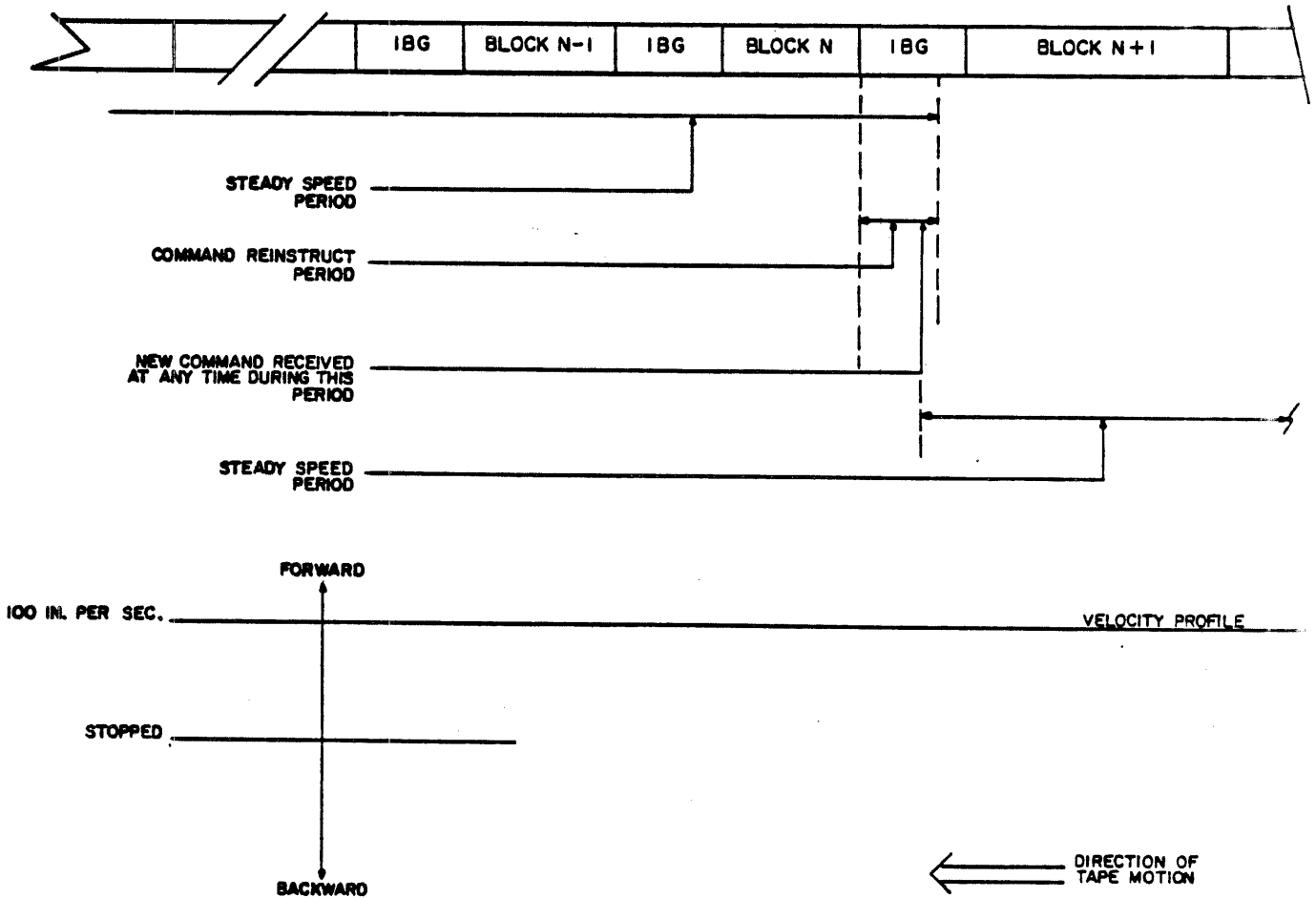


Figure 4-37. TAPE MOTION CONTROL - CASE 1

- o Case 2 - (Momentary Stop) Command Received During Repositioning Cycle

A command is not received during the command re-instruct period, but is received during the repositioning cycle. Figure 4-38 illustrates the sequence of events with respect to transport motion and command transfer.

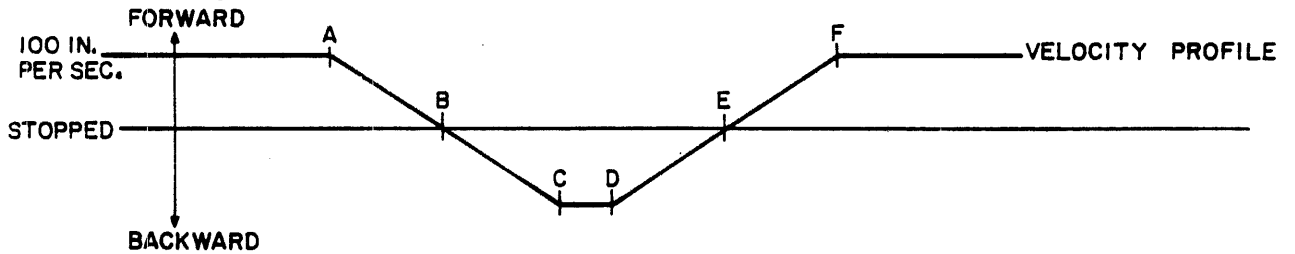


Figure 4-38. TAPE MOTION CONTROL - CASE 2

The velocity profile illustrates tape velocity characteristics. Looking at the diagram of Figure 4-39, it shows that tape stops only momentarily to change direction. The velocity profile identifies the time sequence of events. The correspondence between the time and distance portrayals in sequence is as follows:

<u>EVENT</u>	<u>VELOCITY PROFILE POSITION</u>
Steady Speed Period	Up to Point A
Forward Motion Deceleration	A-B
Tape Motion Stopped Momentarily	B
Reverse Motion Acceleration	B-C
Full Speed Reverse Motion	C-D
Reverse Motion Deceleration	D-E
Tape Motion Stopped Momentarily	E
Forward Motion Acceleration	E-F
Steady Speed Forward Through Data Block N + 1	Point F and On

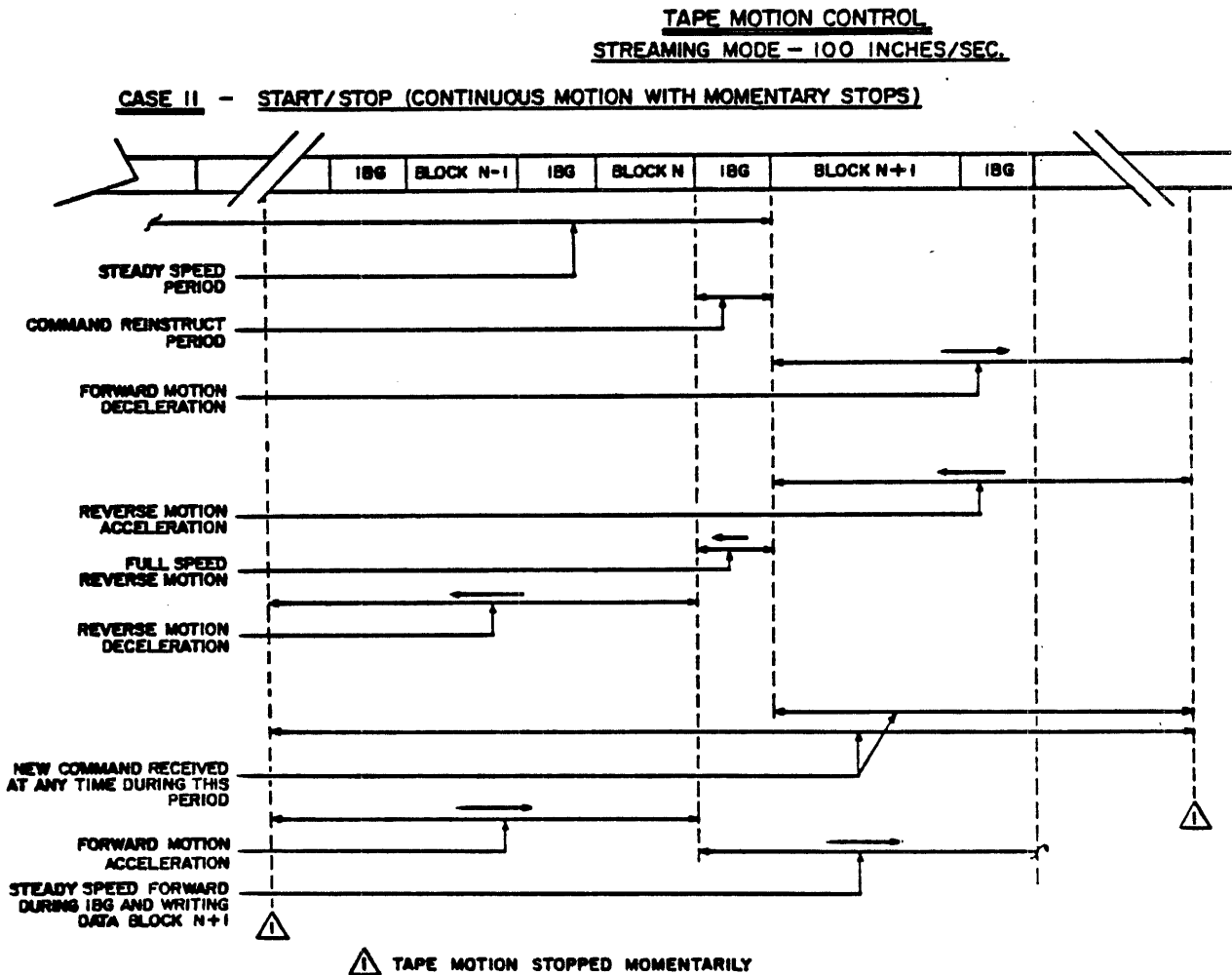


Figure 4-39. TAPE MOTION CONTROL - CASE 2 (Cont'd)

- o Case 3 - (Wait For Command) Command Received Following Repositioning Cycle

Case 3 is very similar to Case 2 except that the subsequent command is not received until the tape has come to rest at point E1. The tape is not accelerated until time E2 when the new command is received. Other than for this delay in receiving the next command, the correspondence between time and distance portrayals is the same for Cases 2 and 3. Refer to Figure 4-40.

<u>EVENT</u>	<u>VELOCITY PROFILE POSITION</u>
Steady Speed Period	Up to Point A
Forward Motion Deceleration	A-B
Tape Motion Stopped Momentarily	B
Reverse Motion Acceleration	B-C
Full Speed Reverse Motion	C-D
Reverse Motion Deceleration	D-E1
Tape Motion Stopped While Awaiting New Command	E1-E2
Forward Motion Acceleration	E2-F
Steady Speed Forward Through Data Block N + 1	Point F and On

Important to note is that the transport performs all repositioning without system or controller intervention.

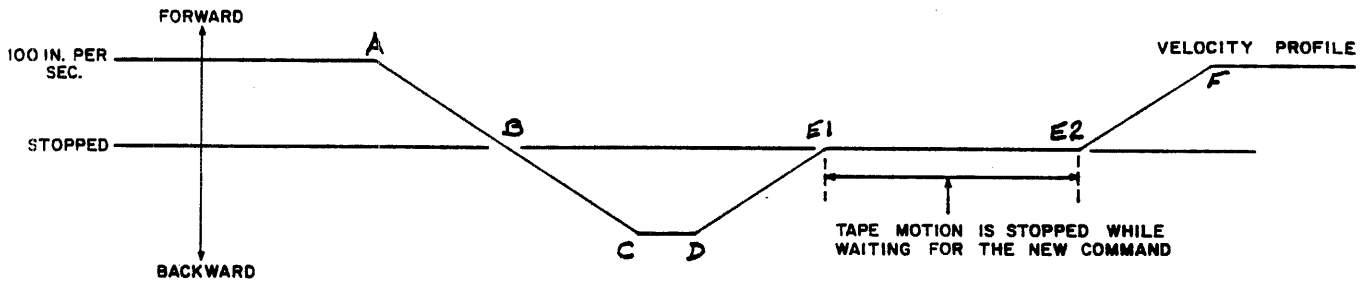


Figure 4-40. TAPE MOTION CONTROL - CASE 3

TAPE MOTION CONTROL

STREAMING MODE - 100 INCHES/SEC

CASE III - START/STOP (TAPE MOTION IS STOPPED FOR PERIODS LONGER THAN REQUIRED TO CHANGE DIRECTION)

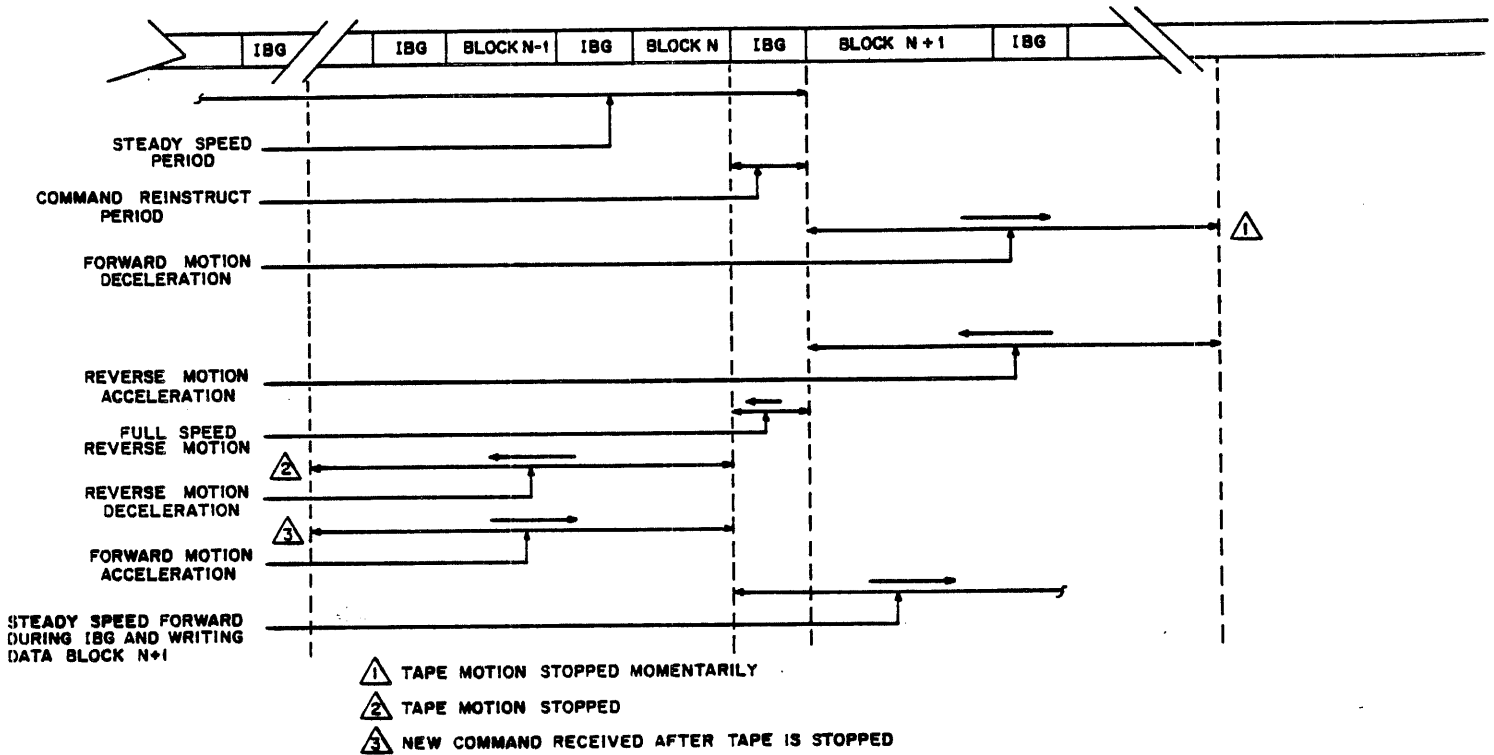


Figure 4-41. TAPE MOTION CONTROL - CASE 3 (Cont'd)

25 ips Mode Control (25 IPS Unit Only)

The transport will automatically switch between 25 ips streaming mode and 25 ips start/stop mode in response to system usage. Essentially, when repositioning becomes excessive in streaming mode, rather than continue to 'thrash', the transport will switch to start/stop mode.

The transport will switch back to streaming mode when the command Reinstruct Time consistently reduces to a value that would allow streaming.

#### NOTE

As to avoid 'jog' delays, mode switching is done at 25 ips rather than when stationary. In essence, a mode switch takes effect at the end of the block in process.

#### Optional Adaptive Velocity Control (AVC) (25 ips Units Only)

When this option is invoked, rather than selecting 25 ips mode when low speed is commanded, the transport will enter a mode, whereby the most optimum speed will be chosen to match system requirements. If 100 ips mode gives the best throughput, then this mode will be used; the same applies to 25 ips streaming and 25 ips start/stop modes. This choice of operating mode will be done automatically by the STU and does not require any involvement by the system. This option allows the transport to be interfaced to a standard adapter and to run under standard 1/2 inch tape software, and yet offer the advantage of streaming.

#### NOTES

1. With this option enabled, unit will respond to a Set 100 ips command in the normal manner.
2. This option is enabled by relocating a pluggable jumper on one of the two main printed circuit boards.



## COMMAND CLASSIFICATION

The transport command set is categorized into five categories dealing with the type of command being executed. They are as follows:

- o Motion Control: Rewind, Speed Mode Change
- o Mode Control: On-Line, Off-Line/Rewind
- o Data Operations: Read, Write
- o Read Sense: Sense Data Transfer
- o Data Loopback: Write-to-Read Data Channel Loopback

Command Categories 1 and 2 are associated with transport control; i.e., Rewind and On-Line/Off-Line are primarily transport related. These commands are transferred by the controller by pulsing the associated interface line. Command categories 3 thru 5 are associated with the formatting/data transfer function of the transport. These commands are transferred via the -FGO strobe sampling of the interface lines identified in the Interface Section of this manual. Speed Mode Change is also strobed by -FGO, but is classified as a Motion Control command.

### Interface States

There are several states within which the transport may reside during execution of data operations. These states are described in this section with respect to command transfer and interface signal conditions. Refer to Figures 4-42 thru 4-46 for an illustration of time representation of States B thru H discussed below.

#### o State A

In this state, the transport is Off-Line (-FONL = False) and Selected (-FTAD0, -FTAD1); the formatter is selected (-FFAD) and enabled (-FFEN). On-Line, Data Loopback, and Sense Read commands may be issued. A Sense Read can be performed, but transport status is not available.

In each of the following states, the transport is On-Line, Selected and Ready (-FRDY); the formatter is Selected and Enabled.

o State B

In this state, a Command Type 1, 2, 3, 4 or 5 may be issued. Refer to Command Classification for description of command categories. Figures 4-42 thru 4-46 illustrate the transfer of a Type 3 command. For both streaming and start/stop modes, this state and its next state are the same following receipt of the FGO command.

o State C

In this state, a Type 3 command has been received. This state is identical in both the streaming and start/stop modes and is identified by the conditions of signal lines -FFBY and -FDBY. This state is entered upon receipt of the -FGO command and exited when the transport is up to speed or positioned at the beginning of the data block. No new commands should be issued while in this state.

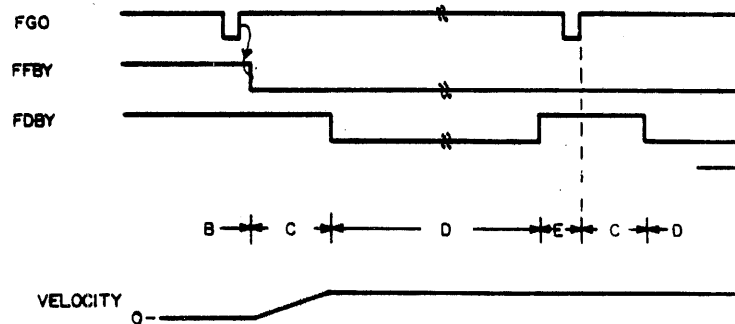


Figure 4-42. START/STOP - NEW COMMAND RECEIVED DURING REINSTRUCT

o State D

This state represents the data transfer cycle. This state is entered upon assertion of the -FDBY signal and exited upon negation of -FDBY. -FDBY is only asserted while -FFBY is asserted. No new commands should be issued while in this state. This state is identical in both streaming and start/stop modes.

o State E

This state is the reinstruct interval. Receipt of a follow-up command identical to the previous -FGO command continues tape motion at either low or high speed in streaming mode. Refer to Figures 4-42 and 4-46.

o State F

This state is unique to the start/stop mode. In this state, a new command was not received during the reinstruction interval (State E) and, consequently, tape is being decelerated to a stop. Any command issued during this time is not acted upon until State B is re-entered following the stopping of tape.

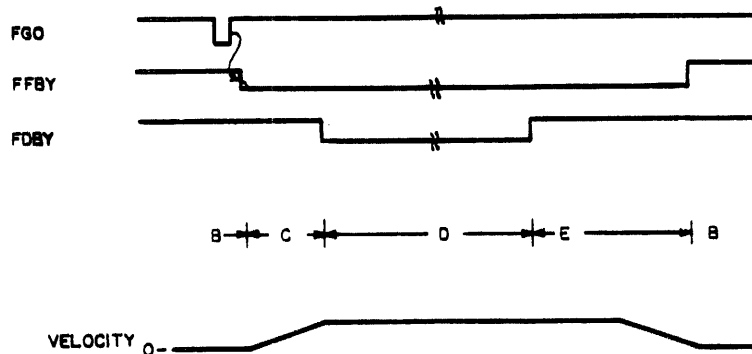


Figure 4-43. START/STOP - NO NEW COMMAND RECEIVED

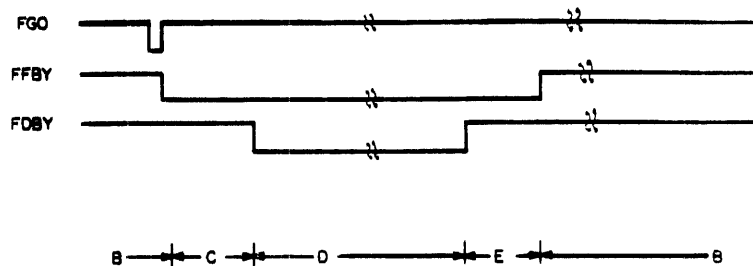


Figure 4-44. STREAMING - NO NEW COMMAND RECEIVED

o State G

This state is unique to the streaming mode. This state is entered at the expiration of the reinstruct interval (State E) and represents the repositioning cycle. State G is exited either upon receipt of a Type 3 command or upon completion of repositioning cycle. Refer to Figures 4-45 and 4-46.

o State H

This state is unique to the streaming mode. It is entered upon receipt of a follow-up command which continues streaming mode. In State H, -FFBY remains asserted. This state is exited upon assertion of -FDBY, indicating the beginning of the next data block.

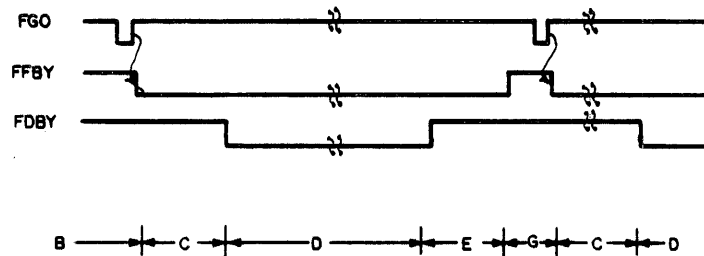


Figure 4-45. STREAMING - NEW COMMAND RECEIVED DURING REPOSITIONING

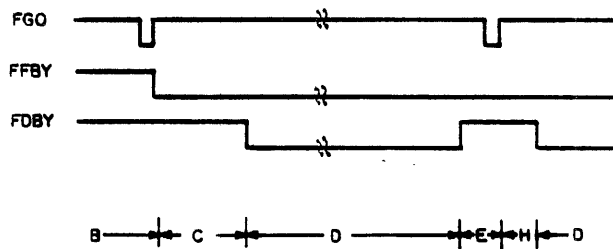


Figure 4-46. STREAMING - NEW COMMAND RECEIVED DURING REINSTRUCT



o State D

This state represents the data transfer cycle. This state is entered upon assertion of the -FDBY signal and exited upon negation of -FDBY. -FDBY is only asserted while -FFBY is asserted. No new commands should be issued while in this state. This state is identical in both streaming and start/stop modes.

o State E

This state is the reinstruct interval. Receipt of a follow-up command identical to the previous -FGO command continues tape motion at either low or high speed in streaming mode. Refer to Figures 4-42 and 4-46.

o State F

This state is unique to the start/stop mode. In this state, a new command was not received during the reinstruction interval (State E) and, consequently, tape is being decelerated to a stop. Any command issued during this time is not acted upon until State B is re-entered following the stopping of tape.

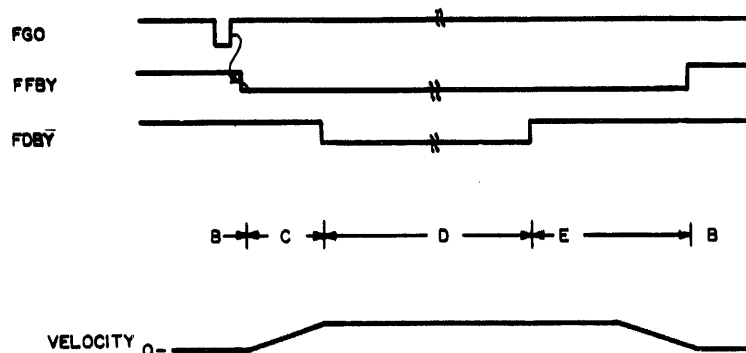


Figure 4-43. START/STOP - NO NEW COMMAND RECEIVED

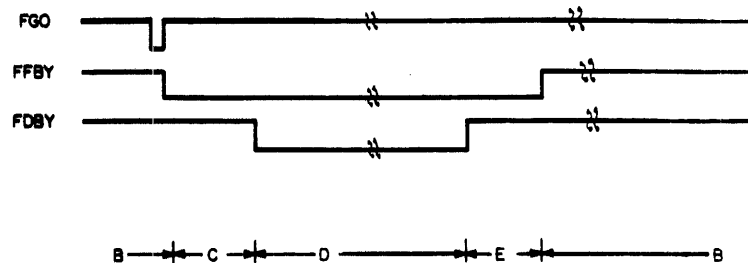


Figure 4-44. STREAMING - NO NEW COMMAND RECEIVED

o State G

This state is unique to the streaming mode. This state is entered at the expiration of the reinspect interval (State E) and represents the repositioning cycle. State G is exited either upon receipt of a Type 3 command or upon completion of repositioning cycle. Refer to Figures 4-45 and 4-46.

o State H

This state is unique to the streaming mode. It is entered upon receipt of a follow-up command which continues streaming mode. In State H, -FFBY remains asserted. This state is exited upon assertion of -FDBY, indicating the beginning of the next data block.

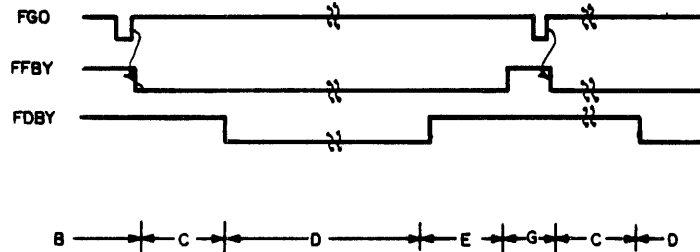


Figure 4-45. STREAMING - NEW COMMAND RECEIVED DURING REPOSITIONING

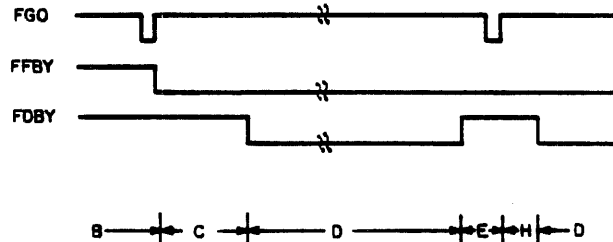


Figure 4-46. STREAMING - NEW COMMAND RECEIVED DURING REINSTRUCT

GENERAL

This section of the manual contains the schematics and logic diagrams for all PWA's contained in the transport. A complete list of boards is shown in the table below and is arranged in sets numerically by the 8-digit control number. The board assembly layouts are for reference only in locating components. Do not attempt to order new PWA's by the 8-digit drawing number on these drawings, instead, use the Parts Section of the manual to order the appropriate replacement assembly.

Preceding the schematics is the Main Electrical Cable Diagram. This diagram shows all cables and their respective connectors routed to the various transport assemblies.

Table 5-1. SCHEMATIC INDEX

TITLE	SCHEMATIC NO.	ASSEMBLY NO.	PAGE NO.
Cable Diagram	77012280		5-5
Control Panel	77005910	7700591X	5-6
Read/Write/Servo	77041120	7704112X	5-7
Formatter/Control	77041130	7704113X	5-33
Formatter/Control	77042070	7704207X	5-57
Power Supply	77040450	7704045X	5-82
Power Supply Control	77040460	7704046X	5-86
Power Amp	77043090	7704119X	5-90
Voltage Select	77040590	7704059X	5-96

A Glossary of Terms follows the logic diagrams. Terms are listed in alphabetical order for each of the PWA logic sets.



## SIGNAL TRACING (OFF-BOARD)

When it becomes necessary to trace a specific signal(s) or cable/wiring, refer to the cabling diagrams located at the rear of the logic diagrams.

In using the cable diagrams, you must first reference a specific signal such as the Formatter Control PWA signal -MCLR (Master Clear) as shown in Figure 5-1. This signal (-MCLR) at P6-pin 8 and P2-pin 38 (referring to cable/wiring diagrams sheet 1) comes from J5-pin 8 of the power supply (Figure 5-2). The same signal (-MCLR) is also at J2-pin 38 of the Read/Write Servo PWA as indicated by sheet 4 (Figure 5-3) of the diagrams via P2-pin 38.

## ON-BOARD TRACING

In many instances, a signal(s) is confined to a specific board, only to be interconnected to other board components. When this occurs, the signal may be traced to another location by referencing the signal name, line identifier, and sheet number as illustrated in Figure 5-1.

## CABLE BUNDLING

In some instances, cable bundling exists between logic circuits as shown below. When this occurs, the internal wiring of the bundle remains unchanged; i.e., 1 to 1, 2 to 2, 12 to 12, etc.

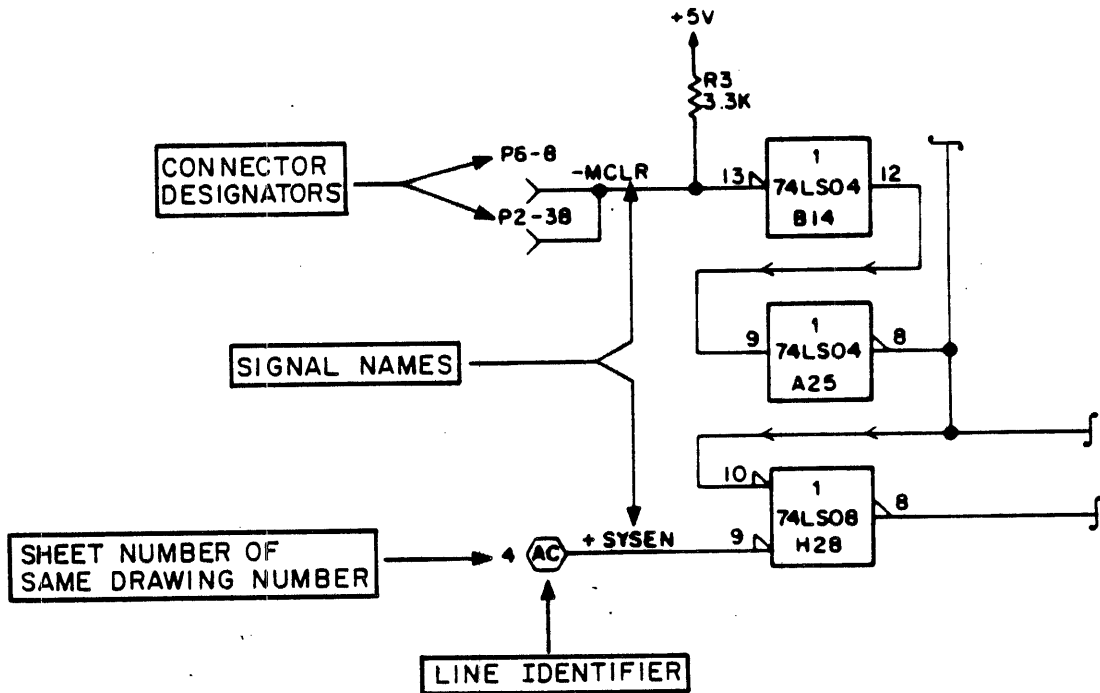


Figure 5-1. FORMATTER CONTROL PWA

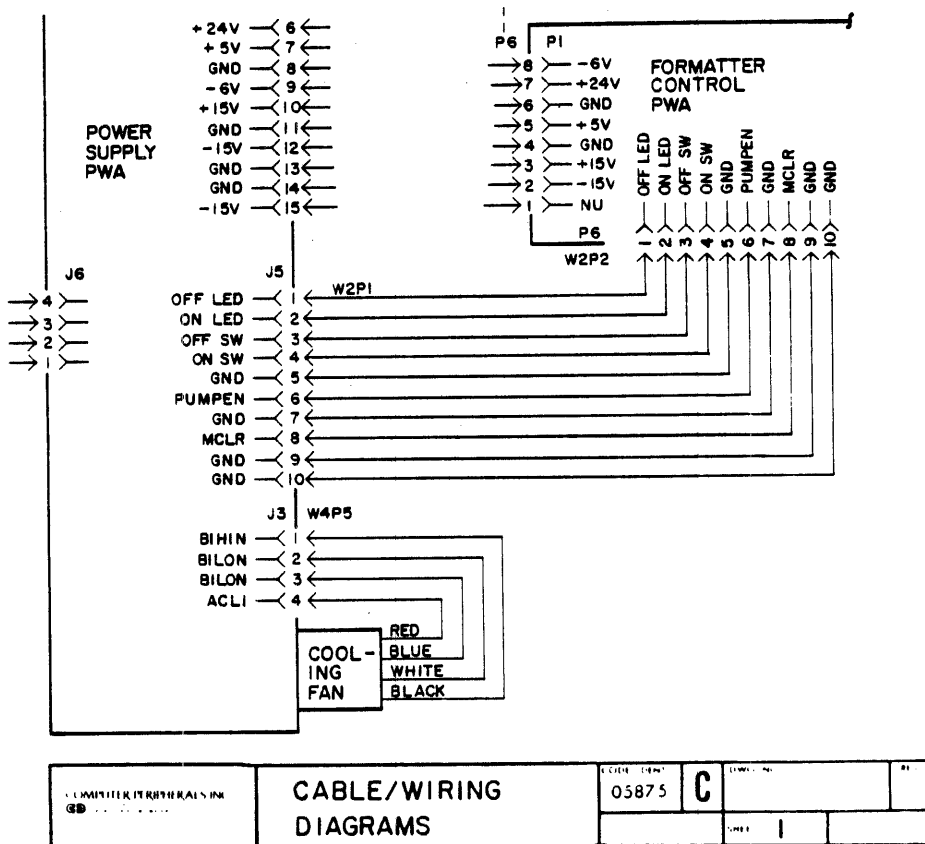
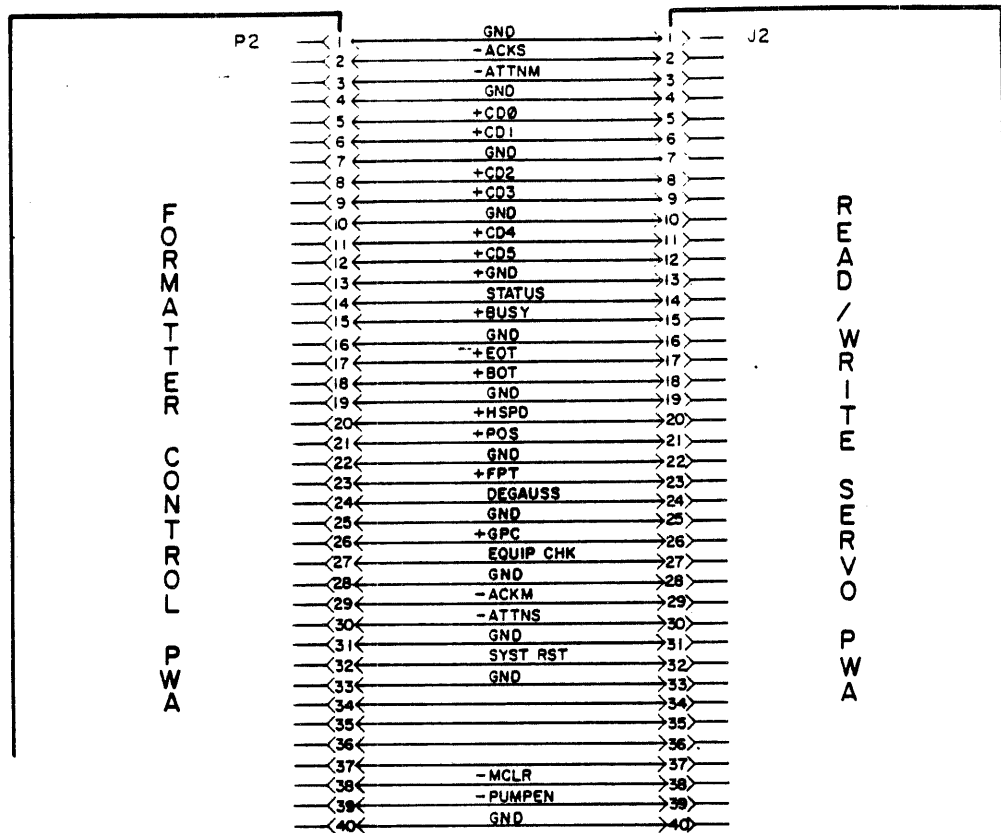


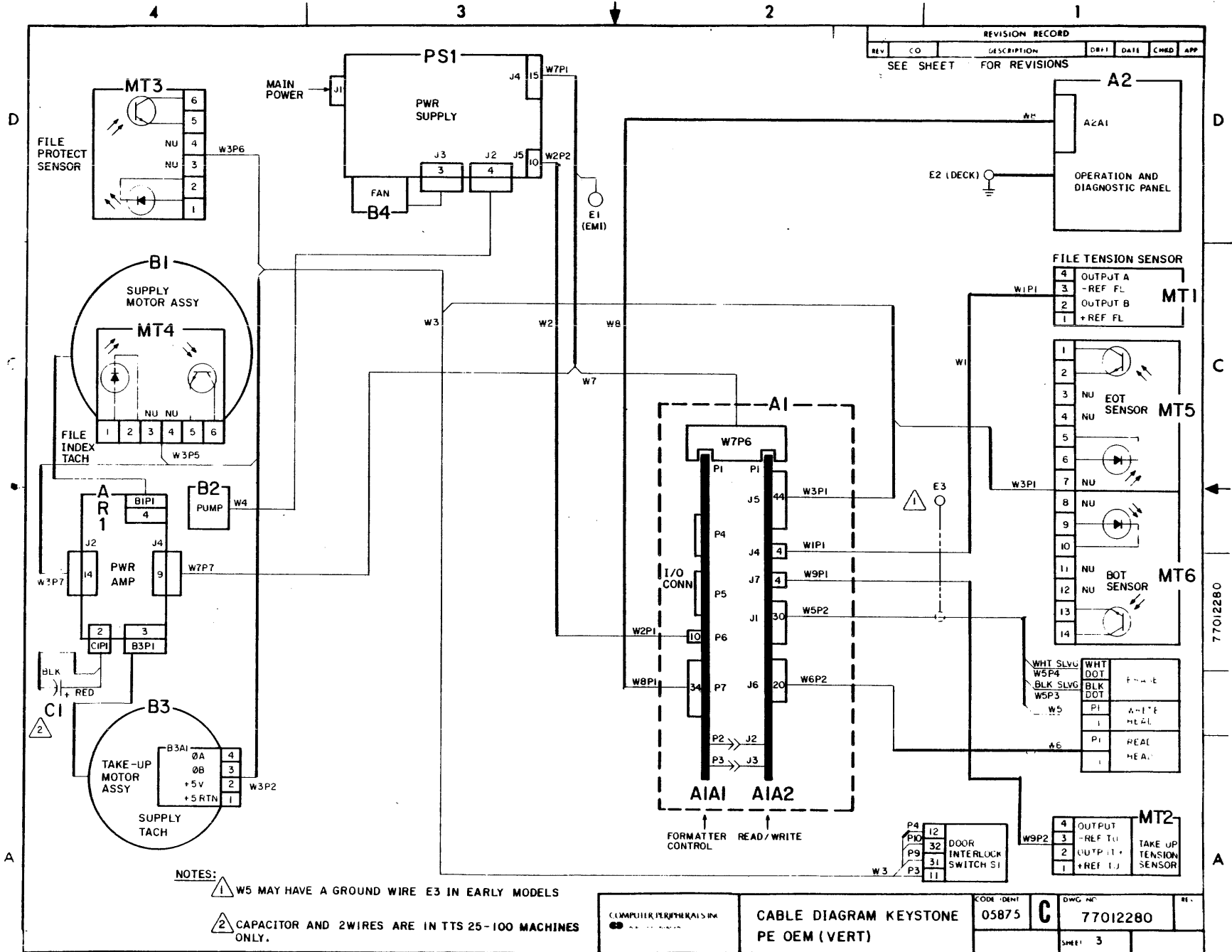
Figure 5-2. POWER SUPPLY



COMPUTER PERIPHERALS INC.	CABLE/WIRING DIAGRAMS	05875	C	DWG. NO.	REV.

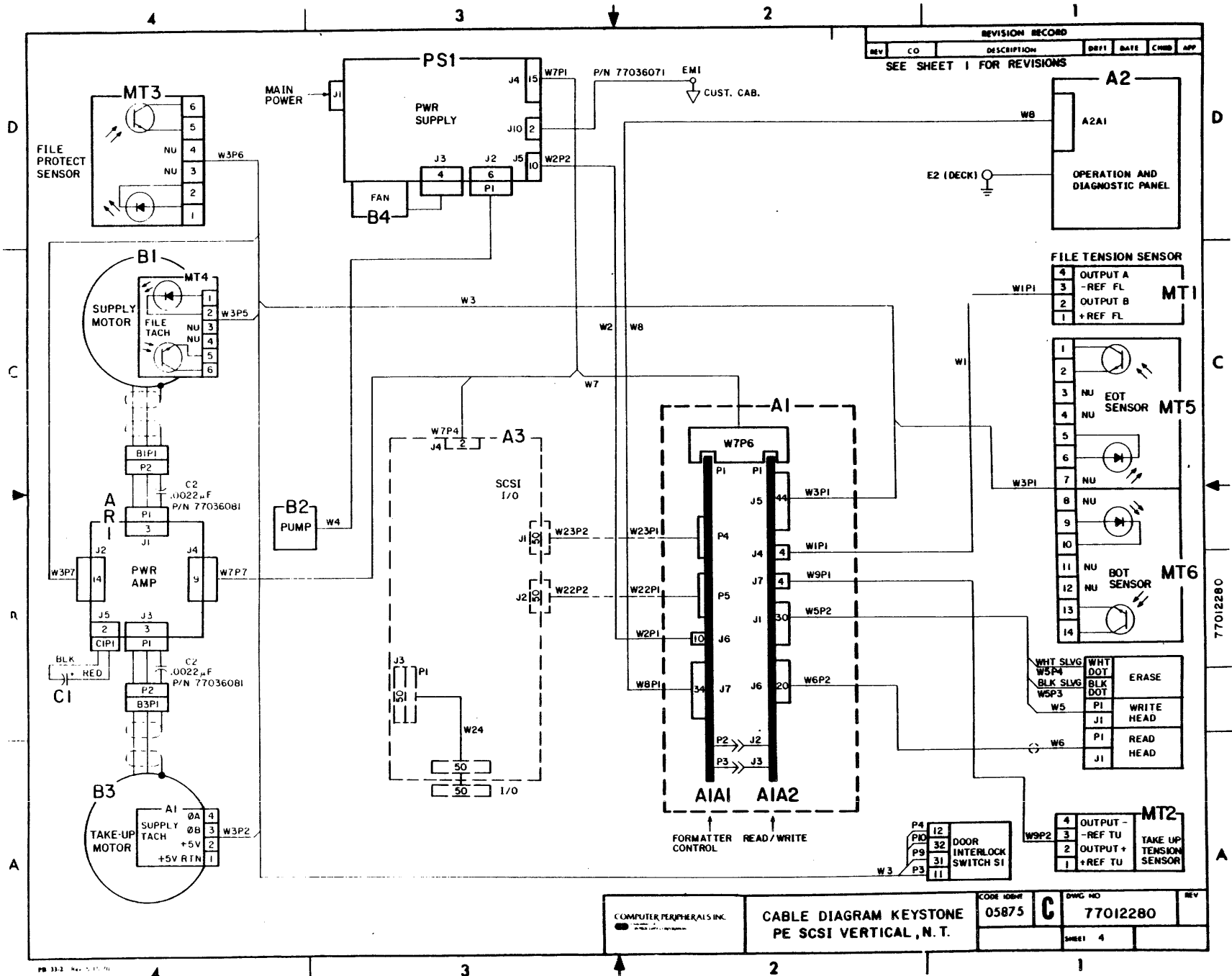
Figure 5-3. READ/WRITE SERVO PWA

49769000

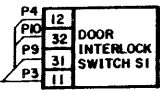
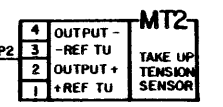
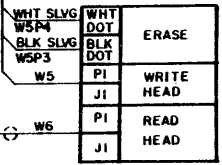
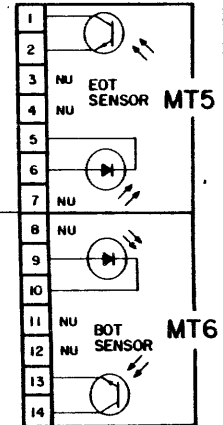
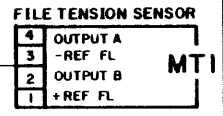
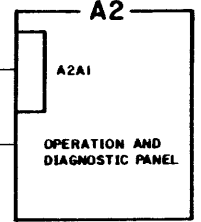


COMPUTER PERIPHERALS INC.	<b>CABLE DIAGRAM KEYSTONE</b>	CODE IDENT 05875	DWG NO <b>C</b>	77012280	REV.
	PE OEM (VERT)		SHEET 3		

5-5



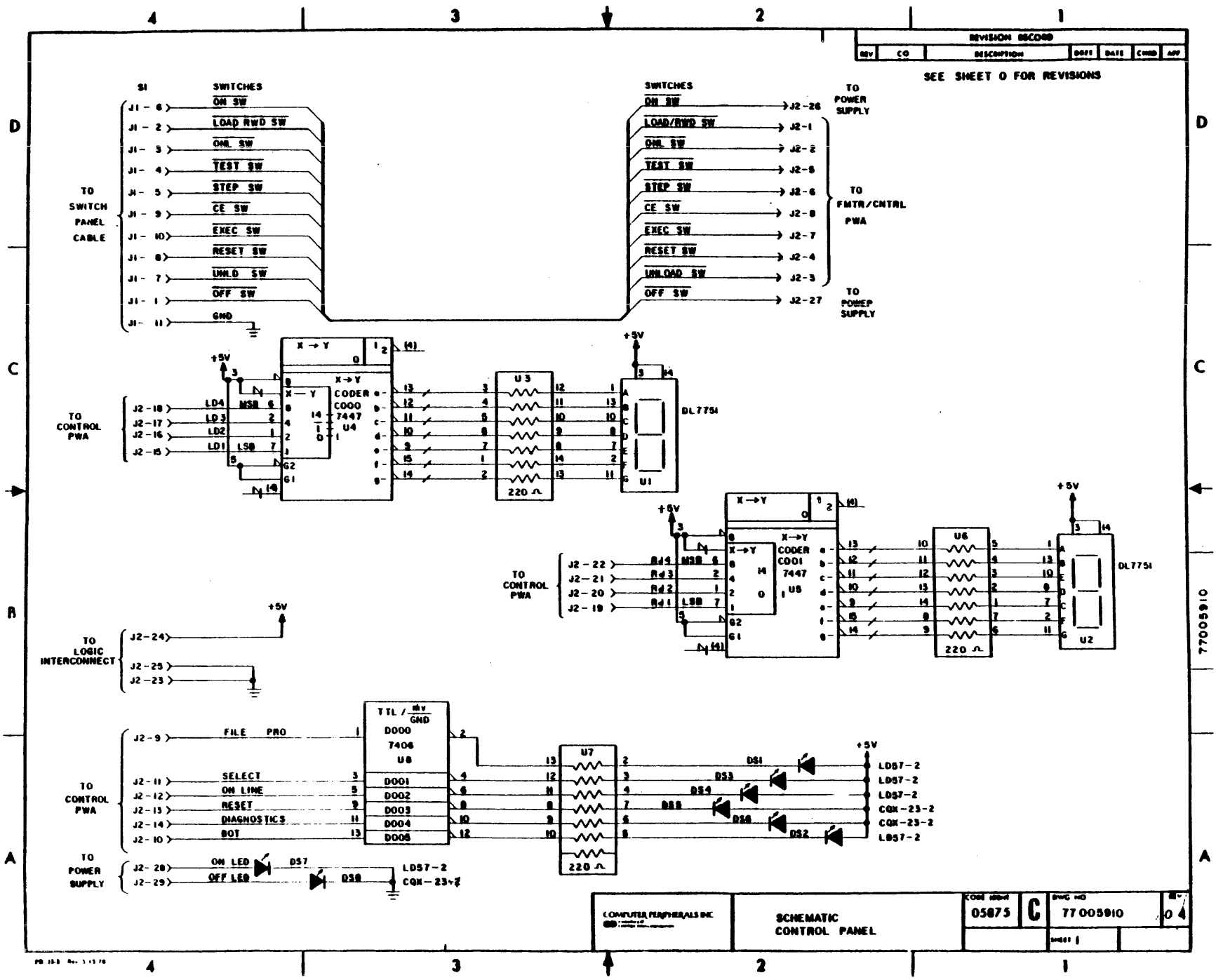
REVISION RECORD						
REV	CO	DESCRIPTION	BY	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS						



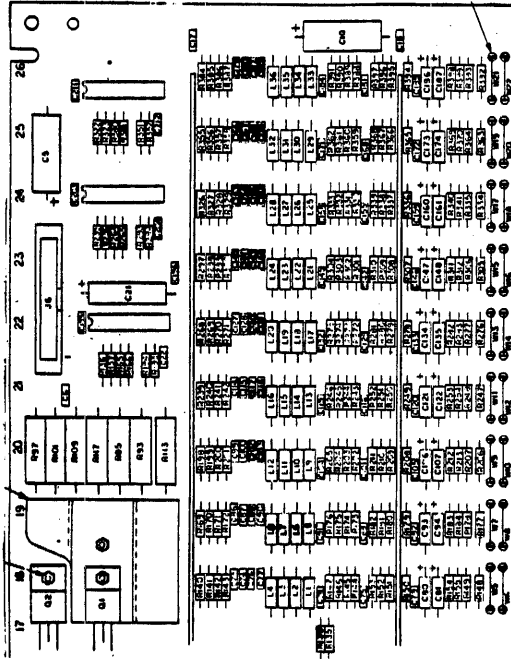
COMPUTER PERIPHERALS INC.	CABLE DIAGRAM KEYSTONE PE SCSI VERTICAL, N. T.	CODE 05875	DWG NO 77012280	REV
			SHEET 4	

49769000 L.1

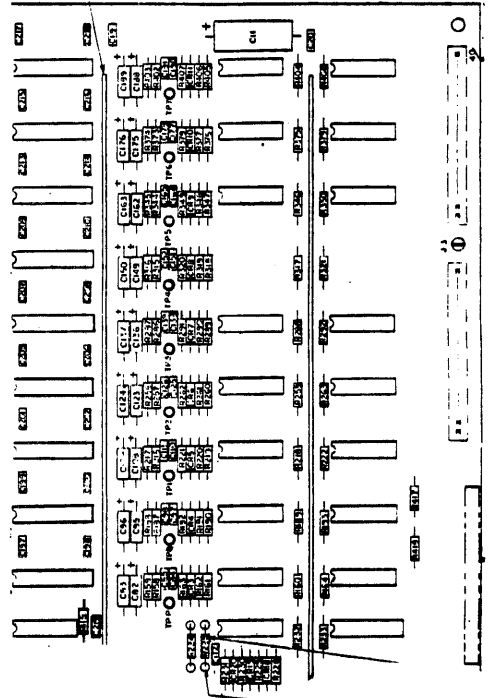
5-6A/B



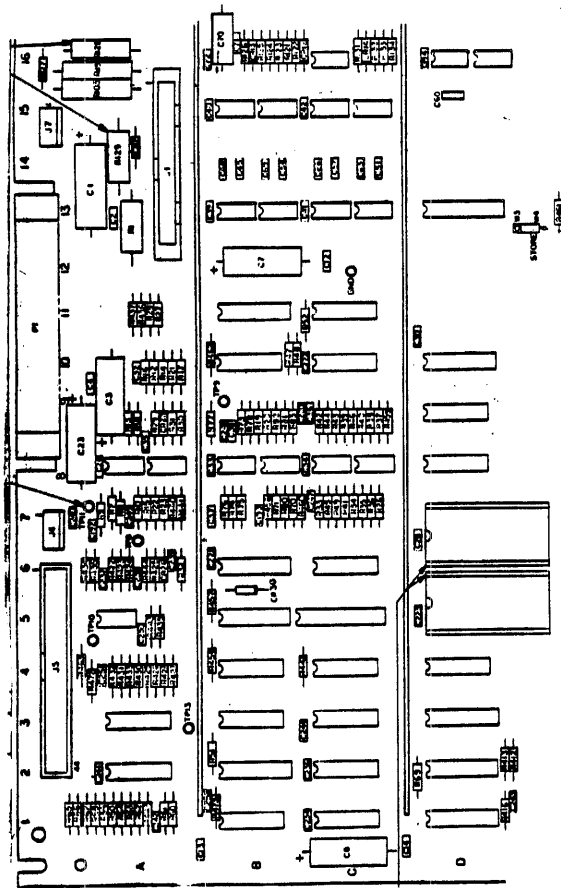
77005910



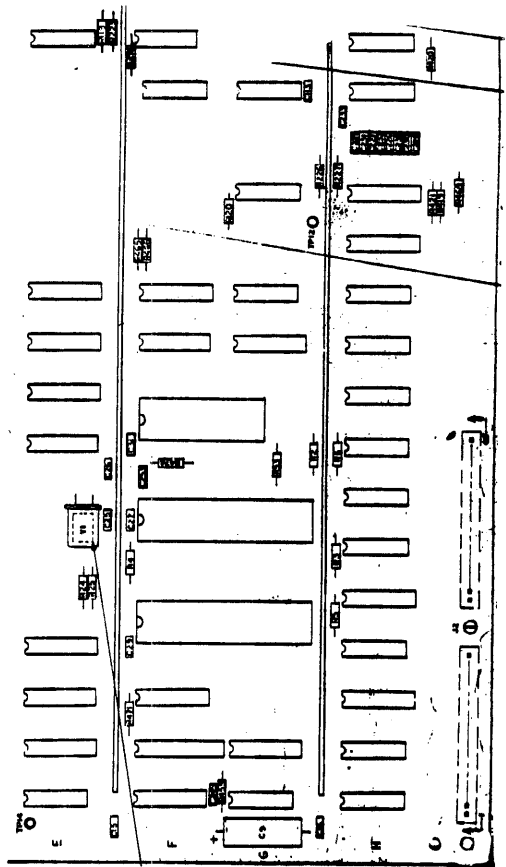
REFERENCE SHEET 1A



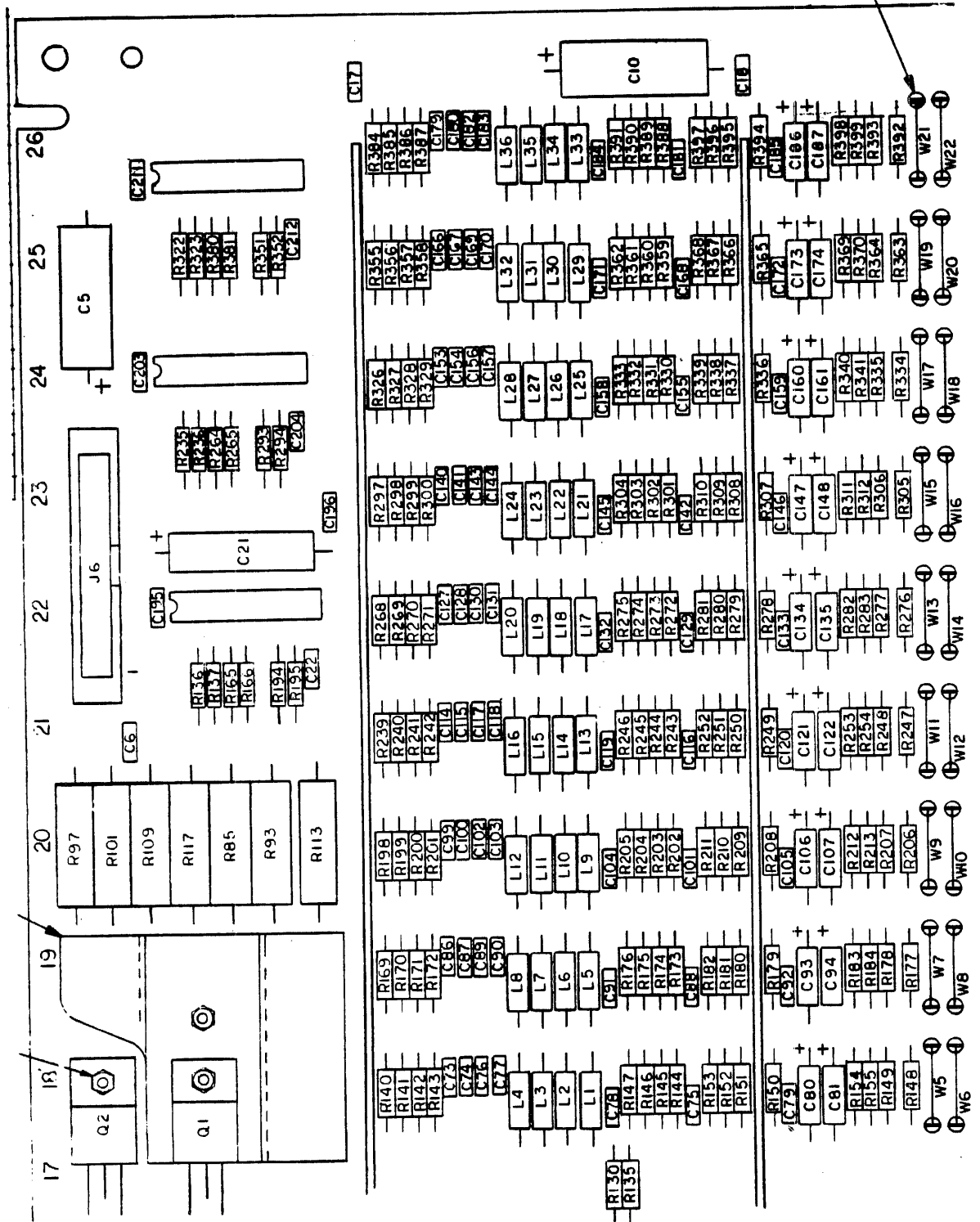
REFERENCE SHEET 1B



REFERENCE SHEET 1C

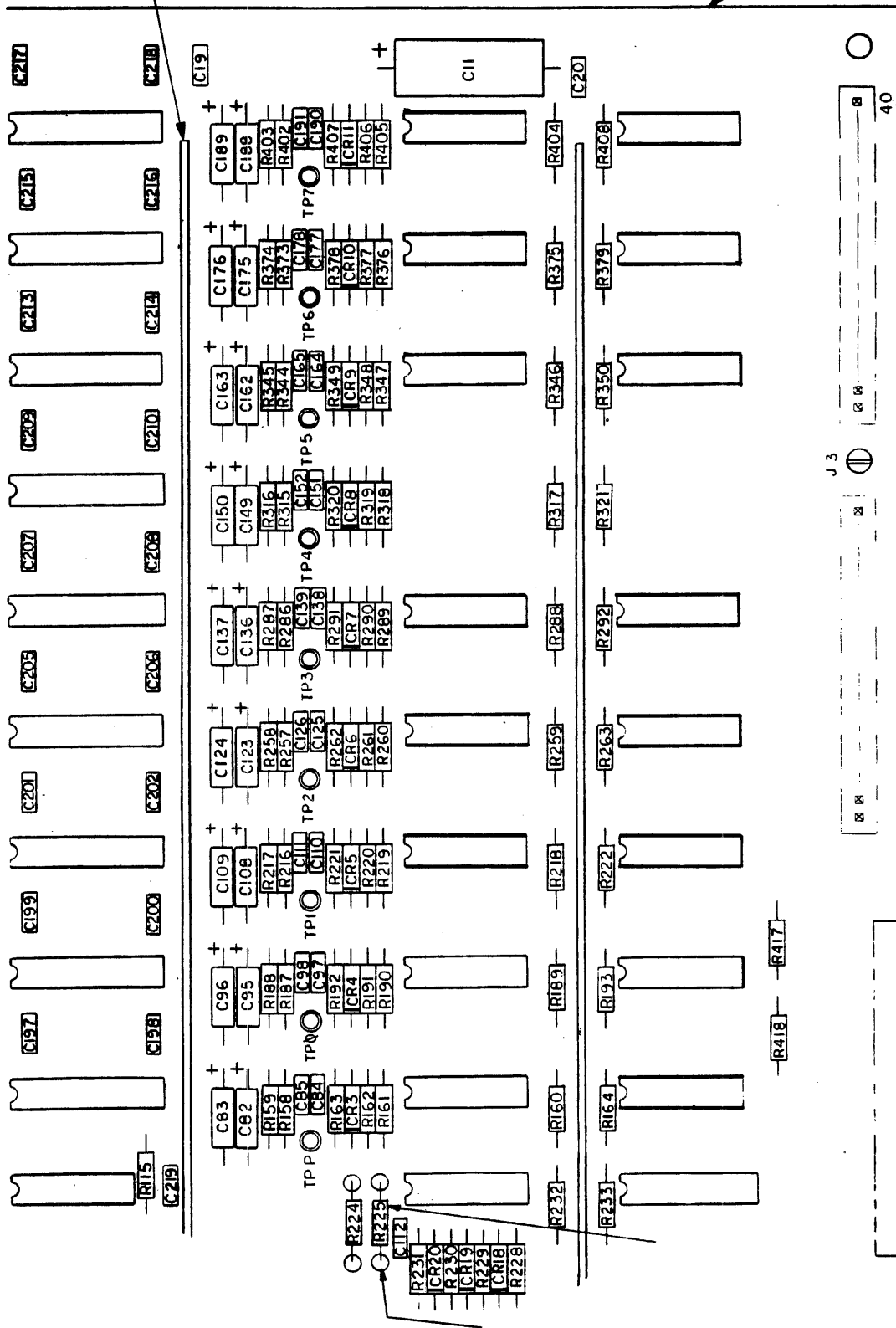


REFERENCE SHEET 1D

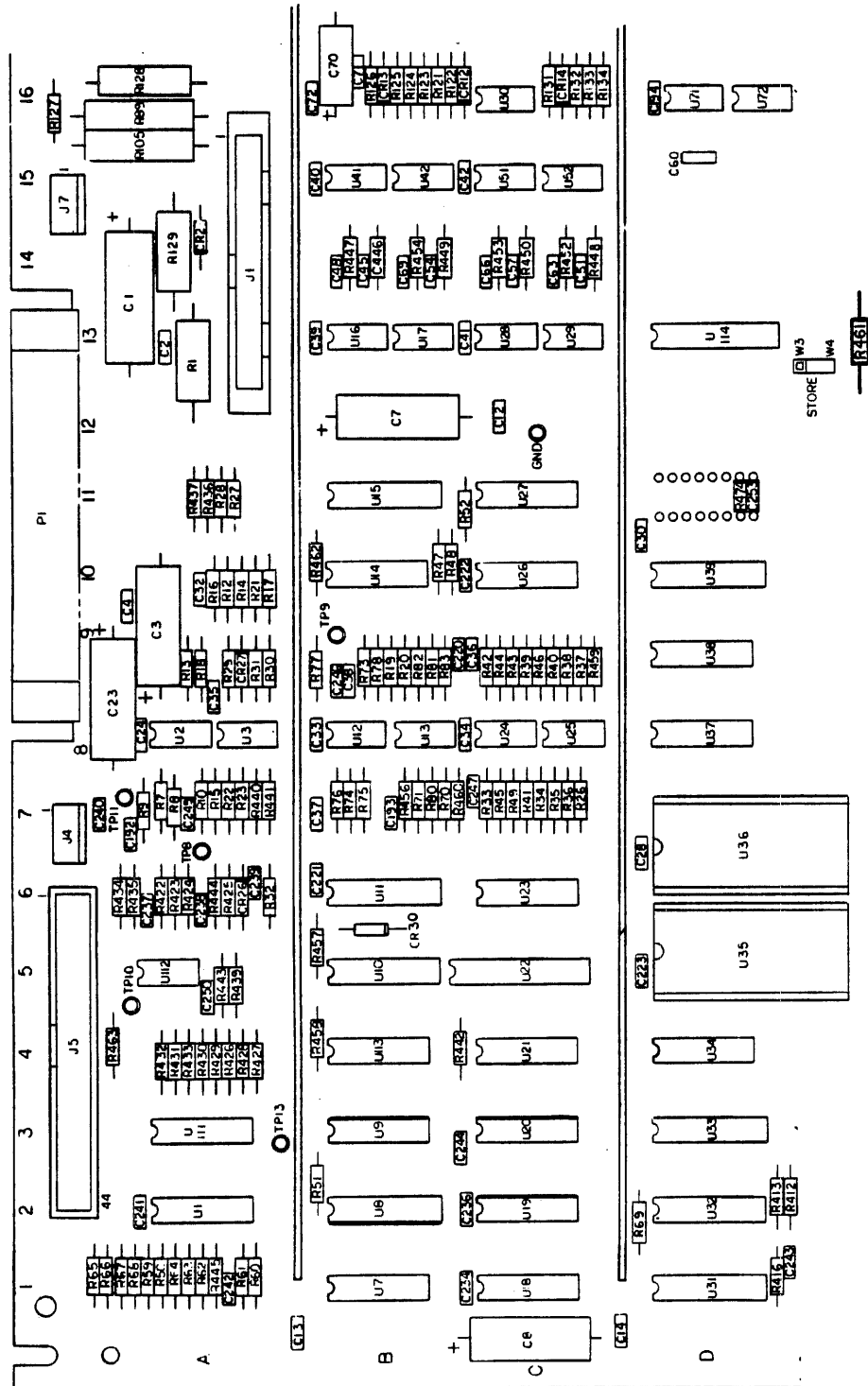


READ-WRITE-SERVO PWA LAYOUT (SHEET 1A)

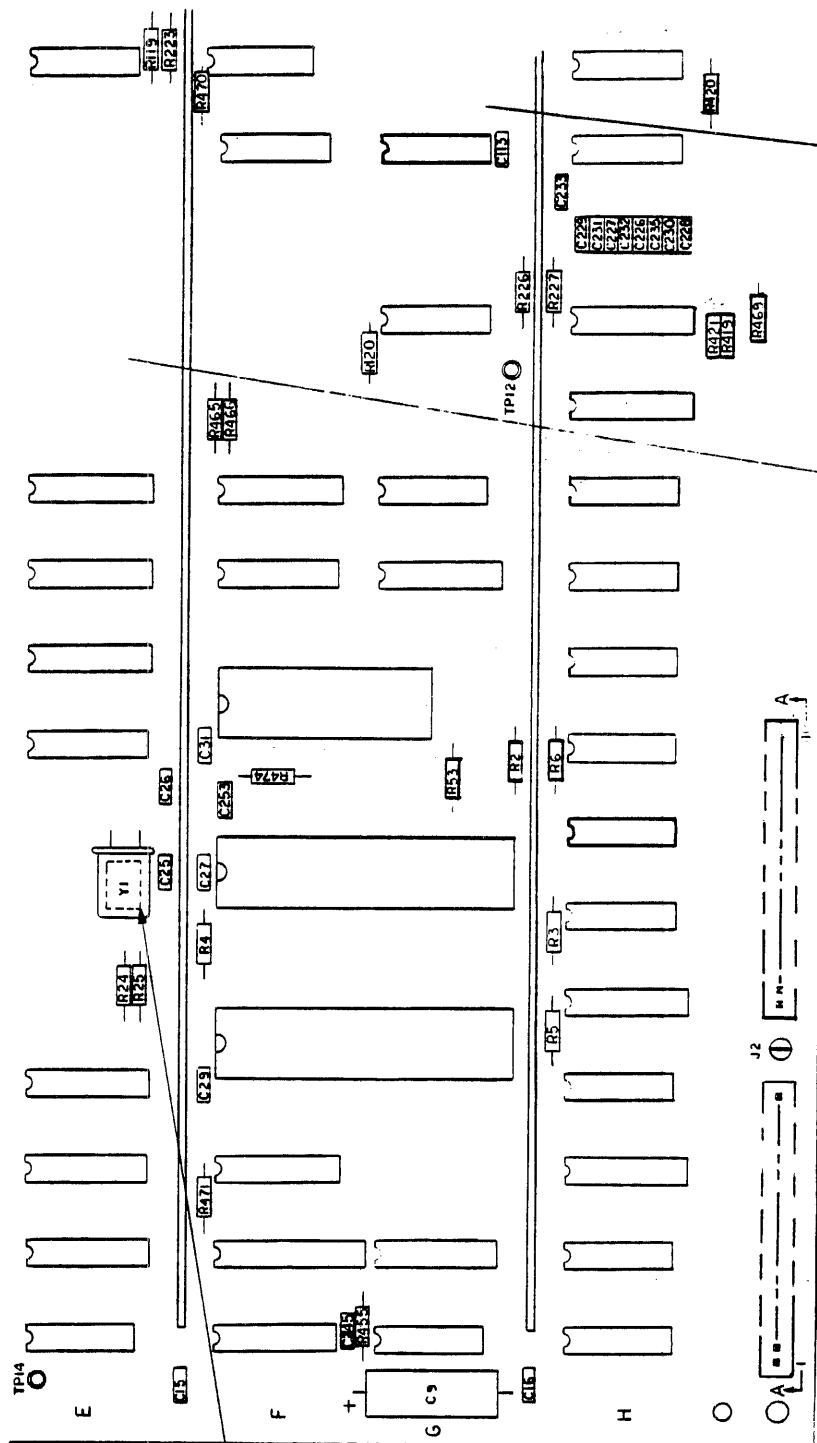




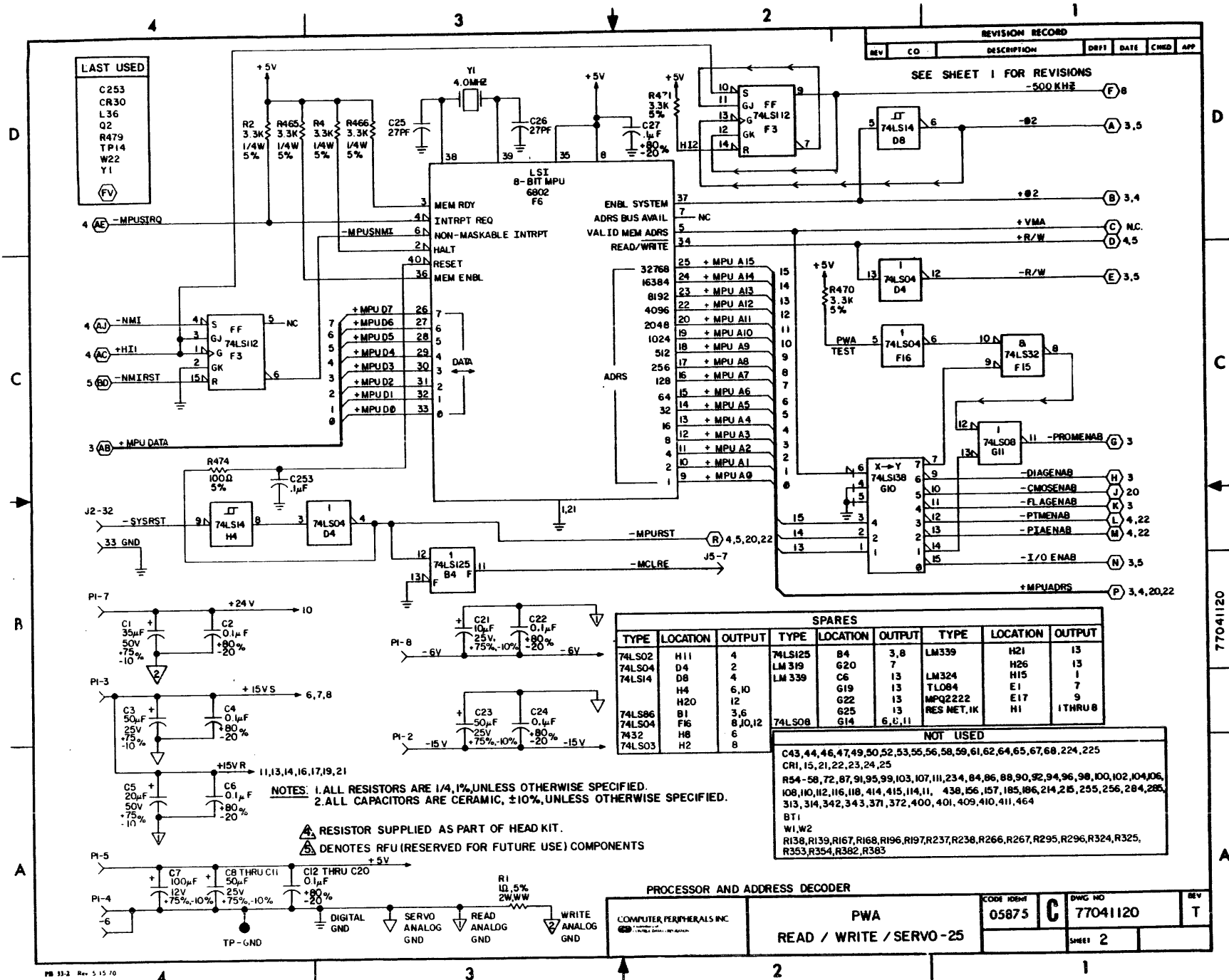
READ-WRITE-SERVO PWA LAYOUT (SHEET 1B)



READ-WRITE-SERVO PWA LAYOUT (SHEET 1C)



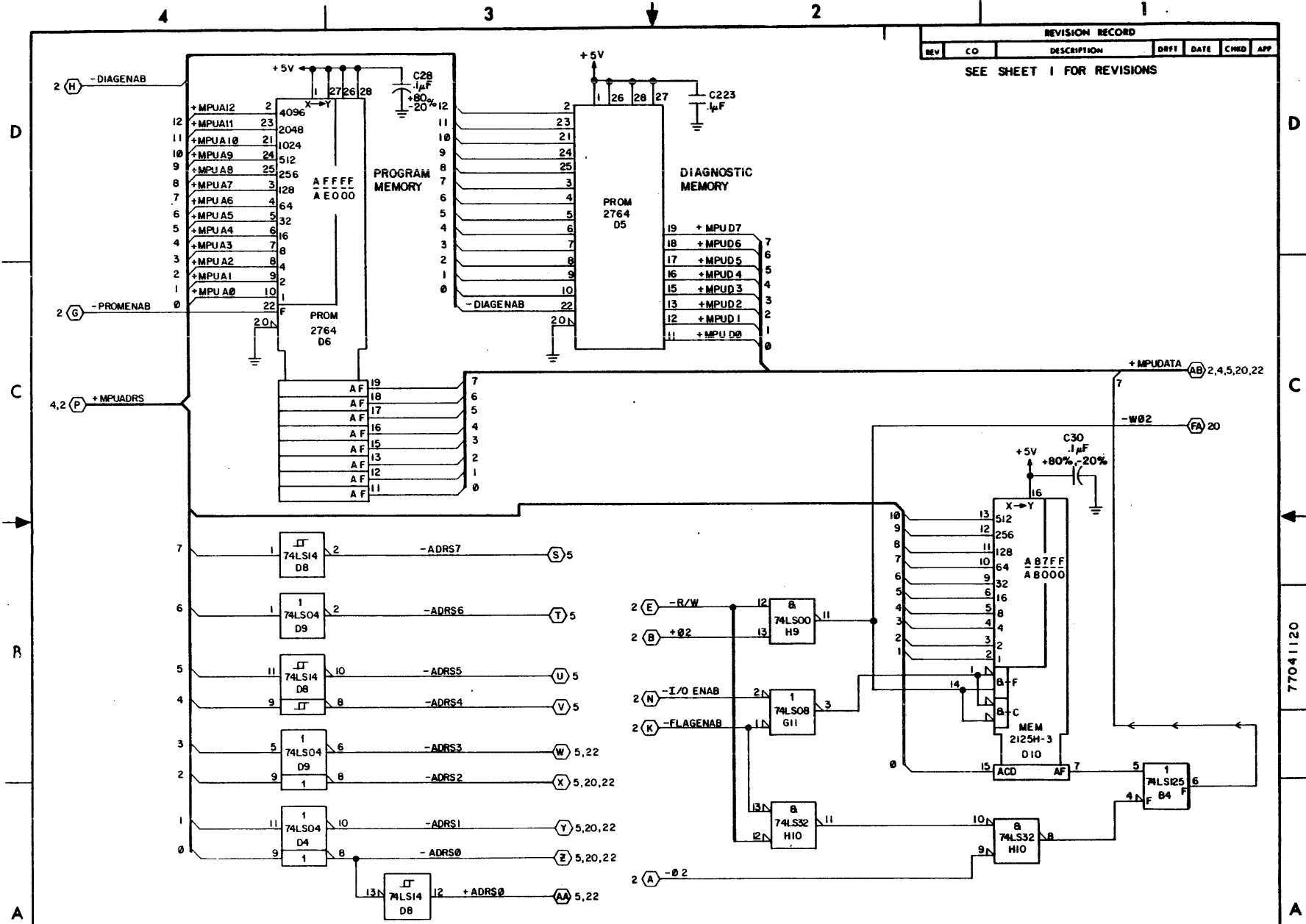
READ-WRITE-SERVO PWA LAYOUT (SHEET 1D)



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5-13

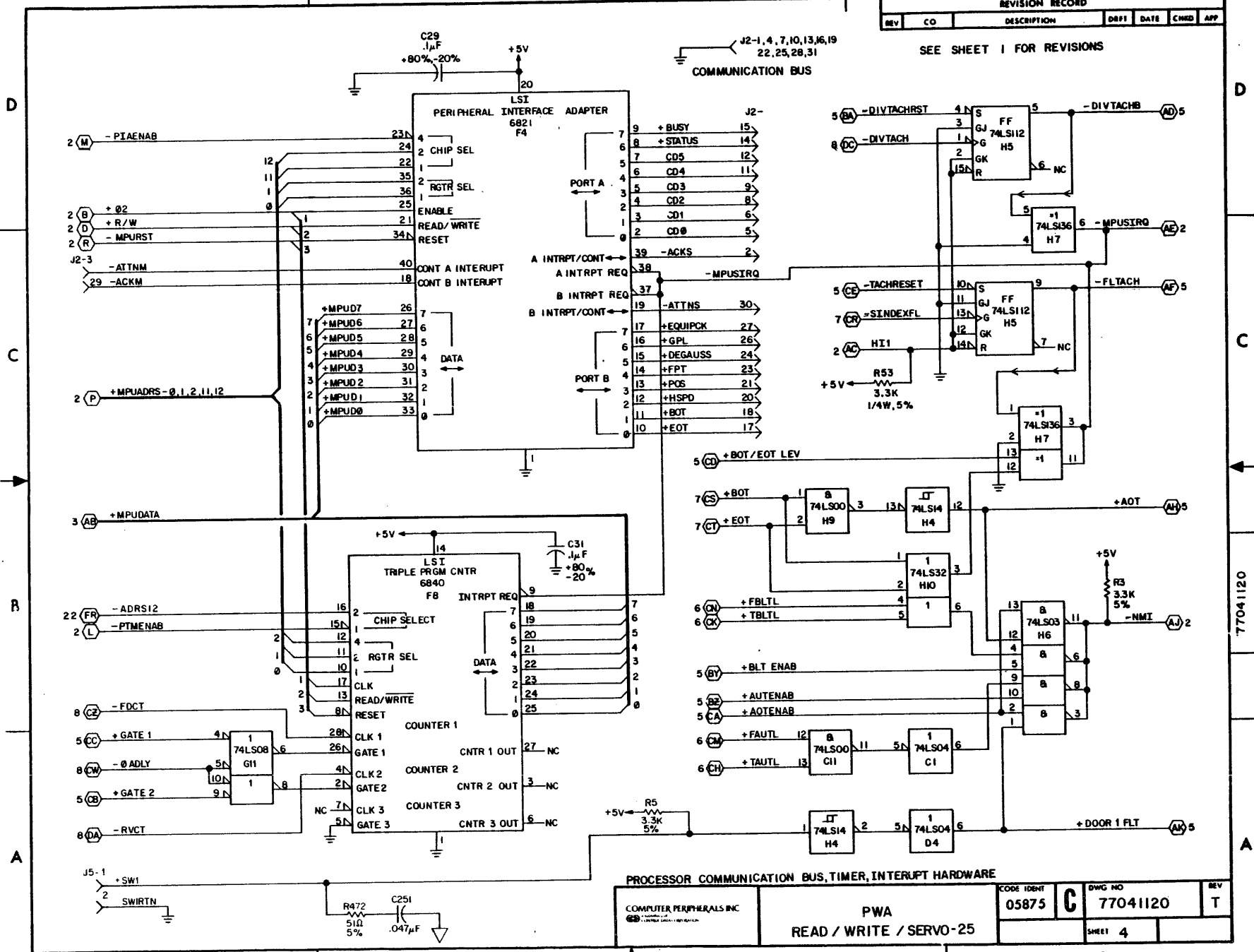
REVISION RECORD						
REV	CD	DESCRIPTION	DRFT	DATE	CHGD	APP
SEE SHEET 1 FOR REVISIONS						



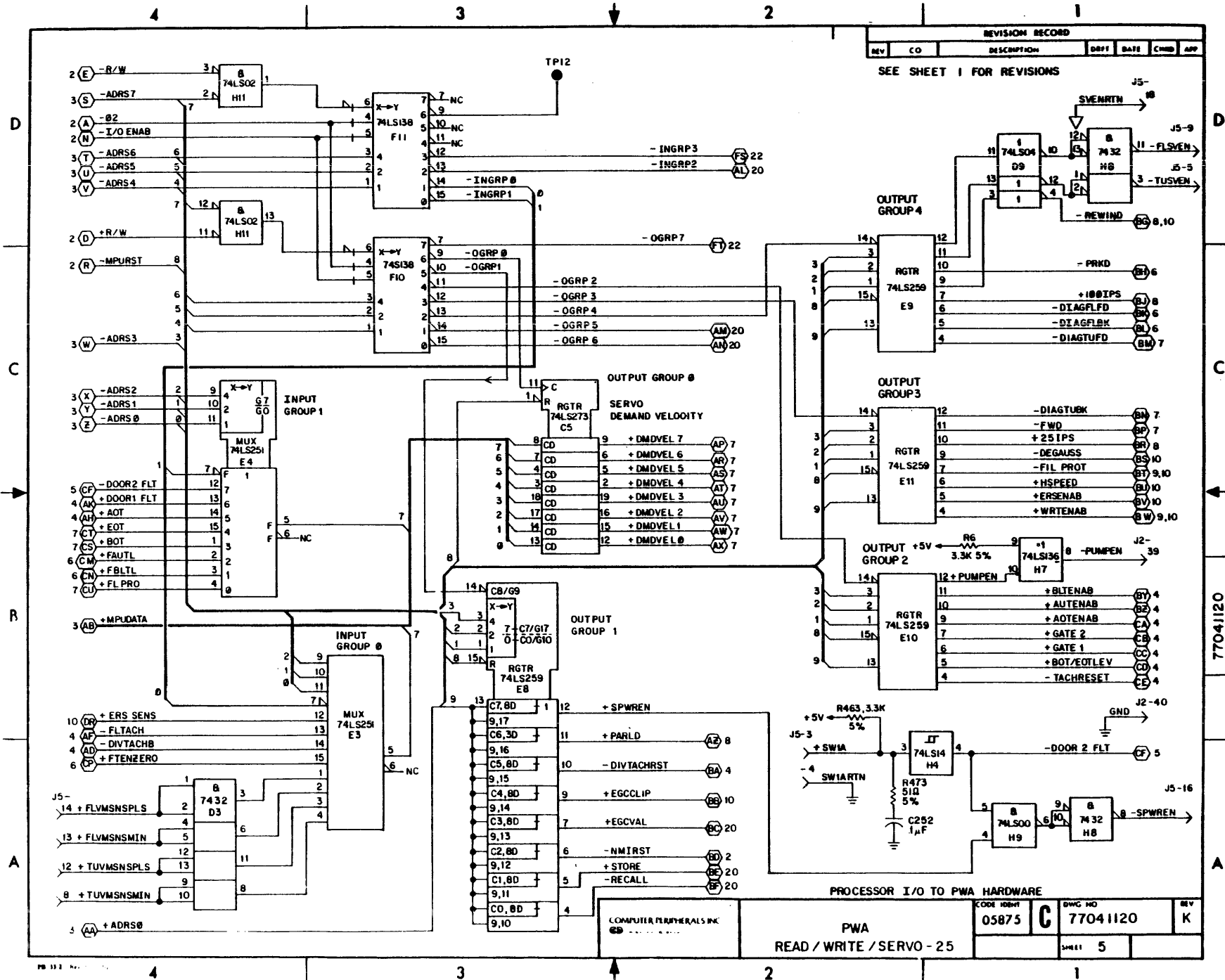
PROCESSOR MEMORY			
COMPUTER PERIPHERALS INC.	PWA	CODE IDENT	REV
77041120	READ / WRITE / SERVO - 25	05875	T
		DWG NO	DWG NO
		77041120	77041120
		SHEET	SHEET
		3	3

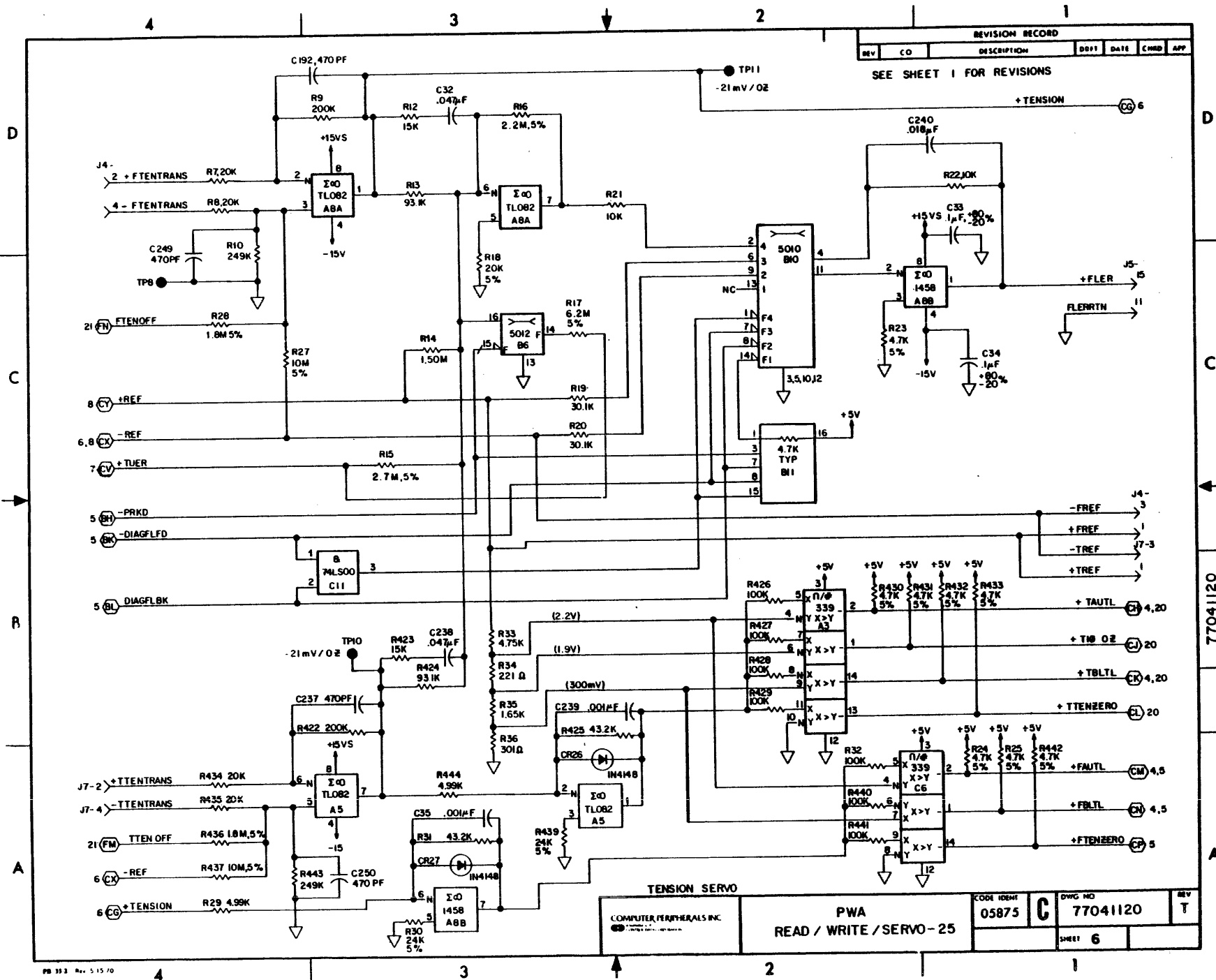
REVISION RECORD						
REV	CO	DESCRIPTION	DRAFT	DATE	CHKD	APP

SEE SHEET 1 FOR REVISIONS



COMPUTER PERIPHERALS INC.		PWA		CODE IDENT	DWG NO	REV
READ / WRITE / SERVO-25		05875		C 77041120		T
				SHEET 4		

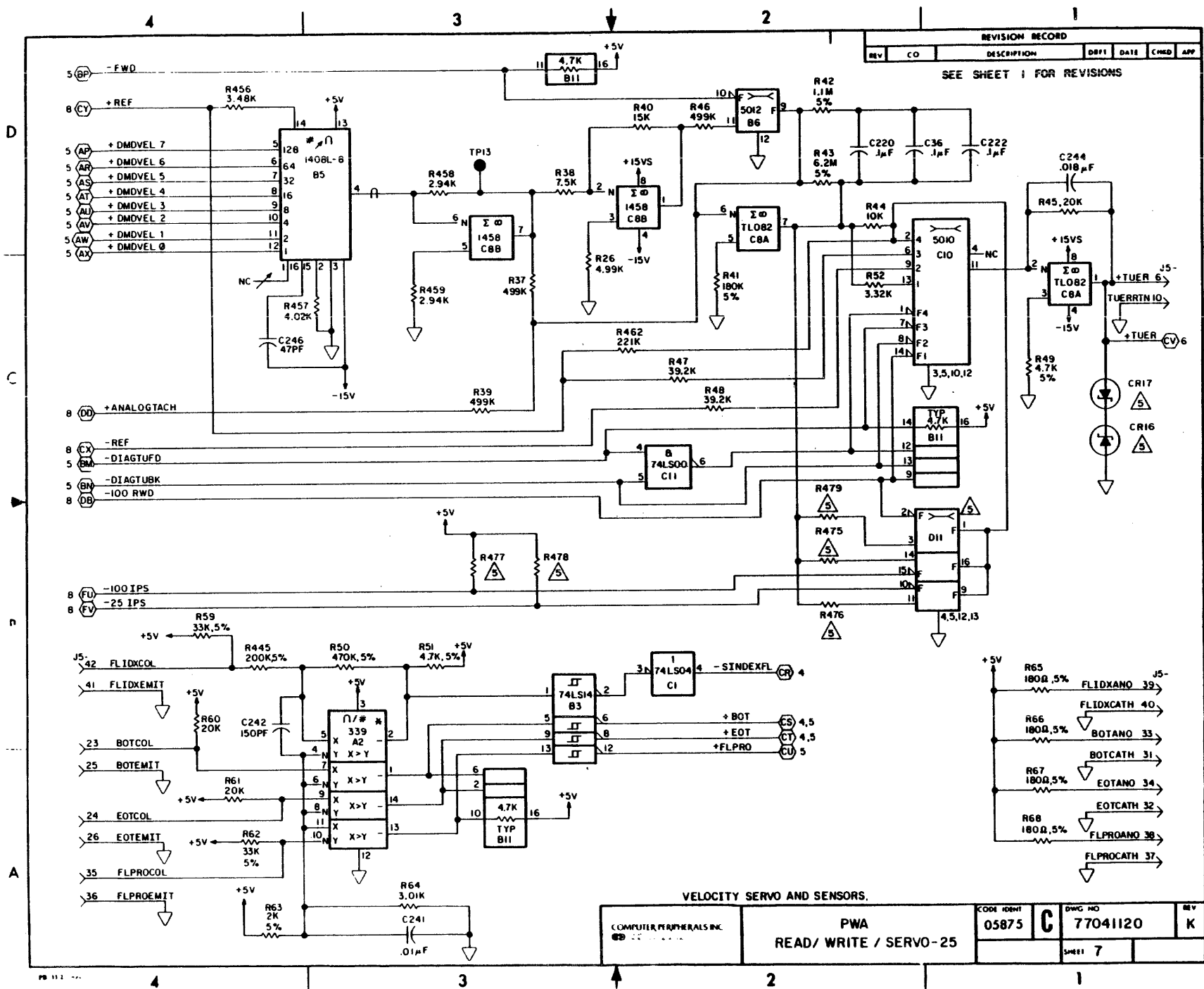




REVISION RECORD					
REV	CO	DESCRIPTION	BY	DATE	CHKD
SEE SHEET 1 FOR REVISIONS					

TENSION SERVO		PWA		CODE IDENT	DWG NO	REV
COMPUTER PERIPHERALS INC.		READ / WRITE / SERVO-25		05875	77041120	T
				SHEET	6	





REVISION RECORD						
REV	CO	DESCRIPTION	DRFT	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS						

VELOCITY SERVO AND SENSORS.		CODE IDENT	DWG NO	REV
COMPUTER PERIPHERALS INC.		05875	77041120	K
PWA		READ / WRITE / SERVO-25		
		SHEET	7	

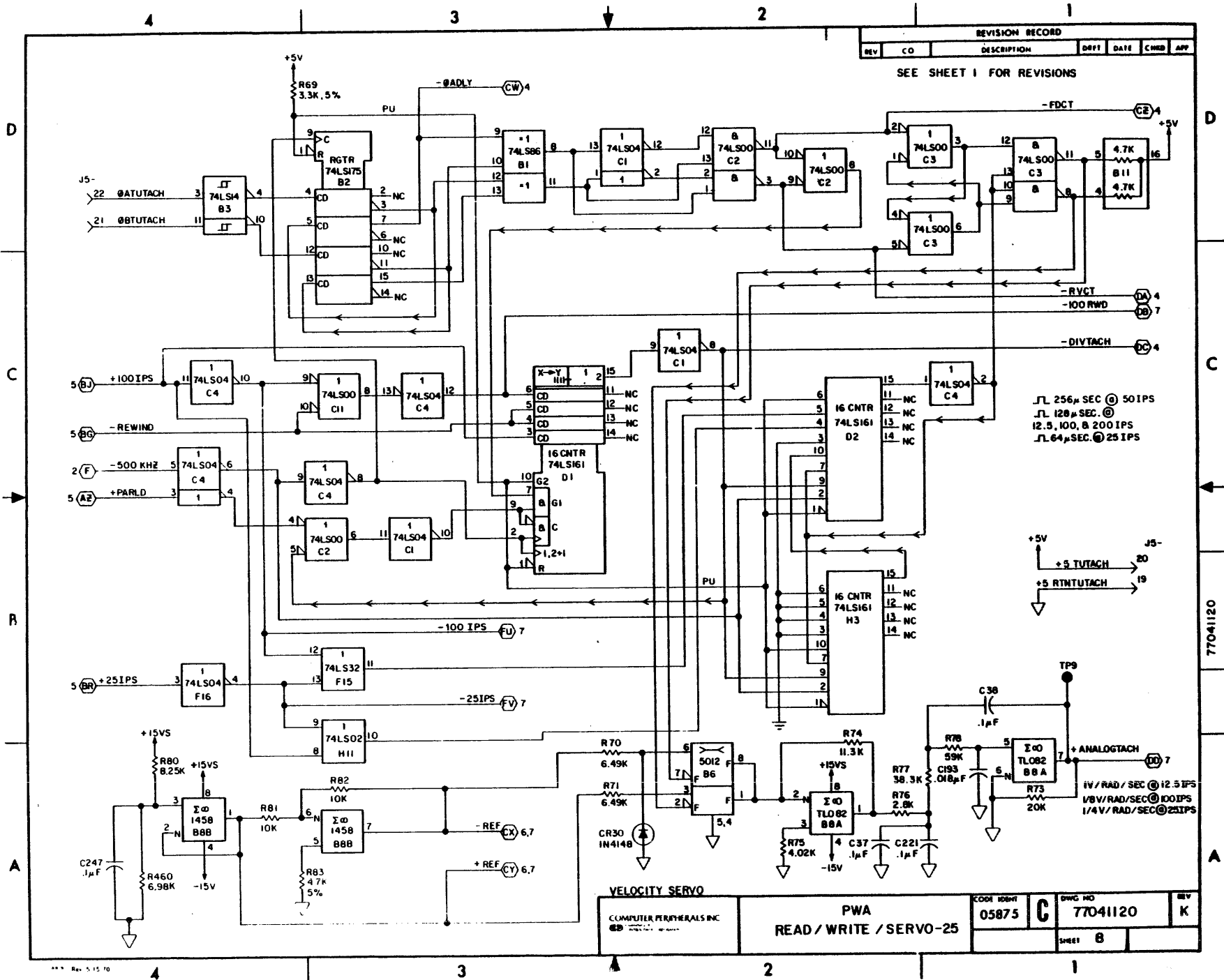
D

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B

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77041120



REVISION RECORD						
REV	CO	DESCRIPTION	DRFT	DATE	CHNG	APP
SEE SHEET 1 FOR REVISIONS						

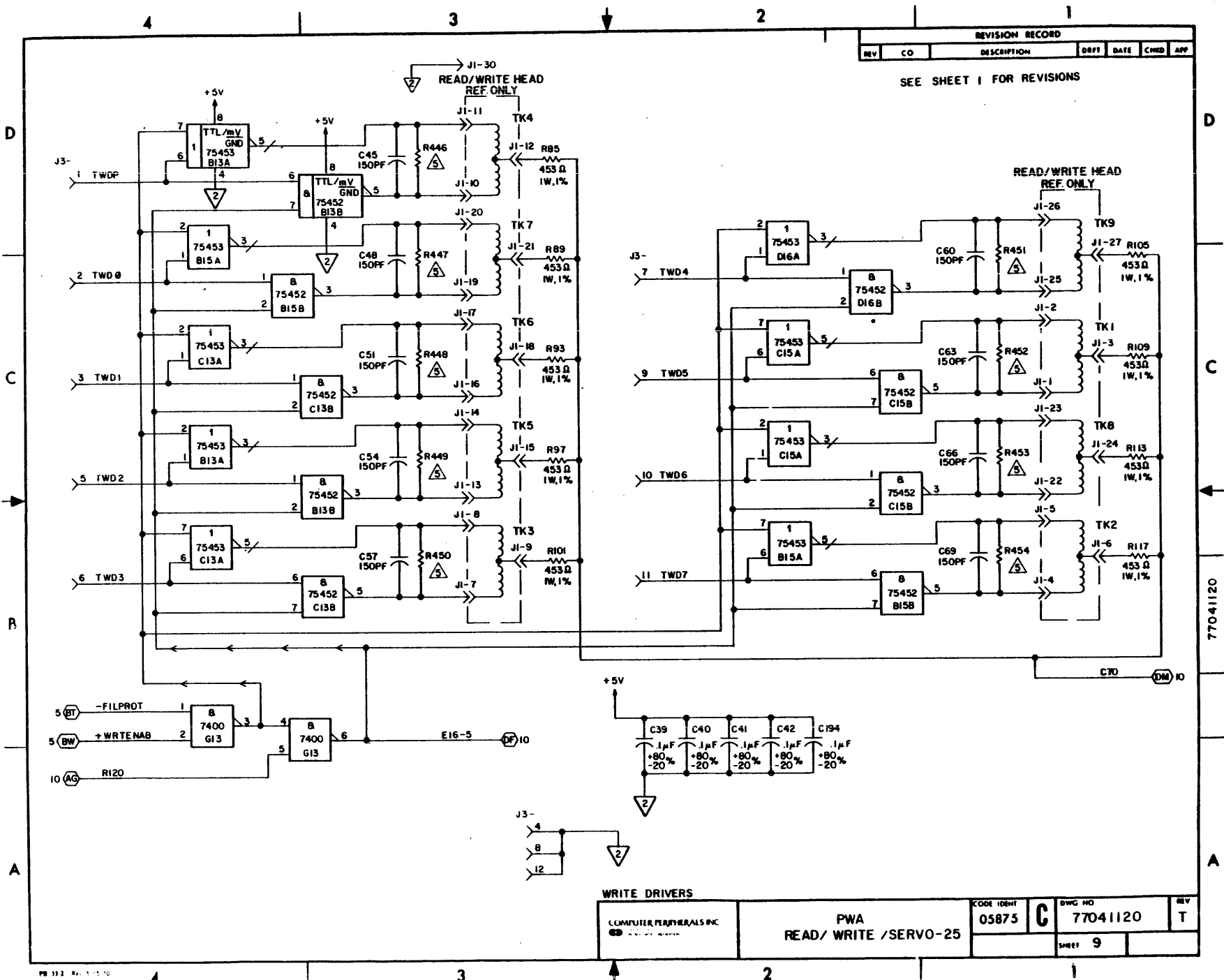
.JL 256 μ SEC @ 50 IPS  
 .JL 128 μ SEC @  
 12.5, 100, & 200 IPS  
 .JL 64 μ SEC @ 25 IPS

VELOCITY SERVO		PWA		CODE 05875	DWG NO 77041120	REV K
COMPUTER PERIPHERALS INC		READ / WRITE / SERVO-25		05875	77041120	K
				SHEET 8		

\*\*\* Rev. 5-15-70

49769000

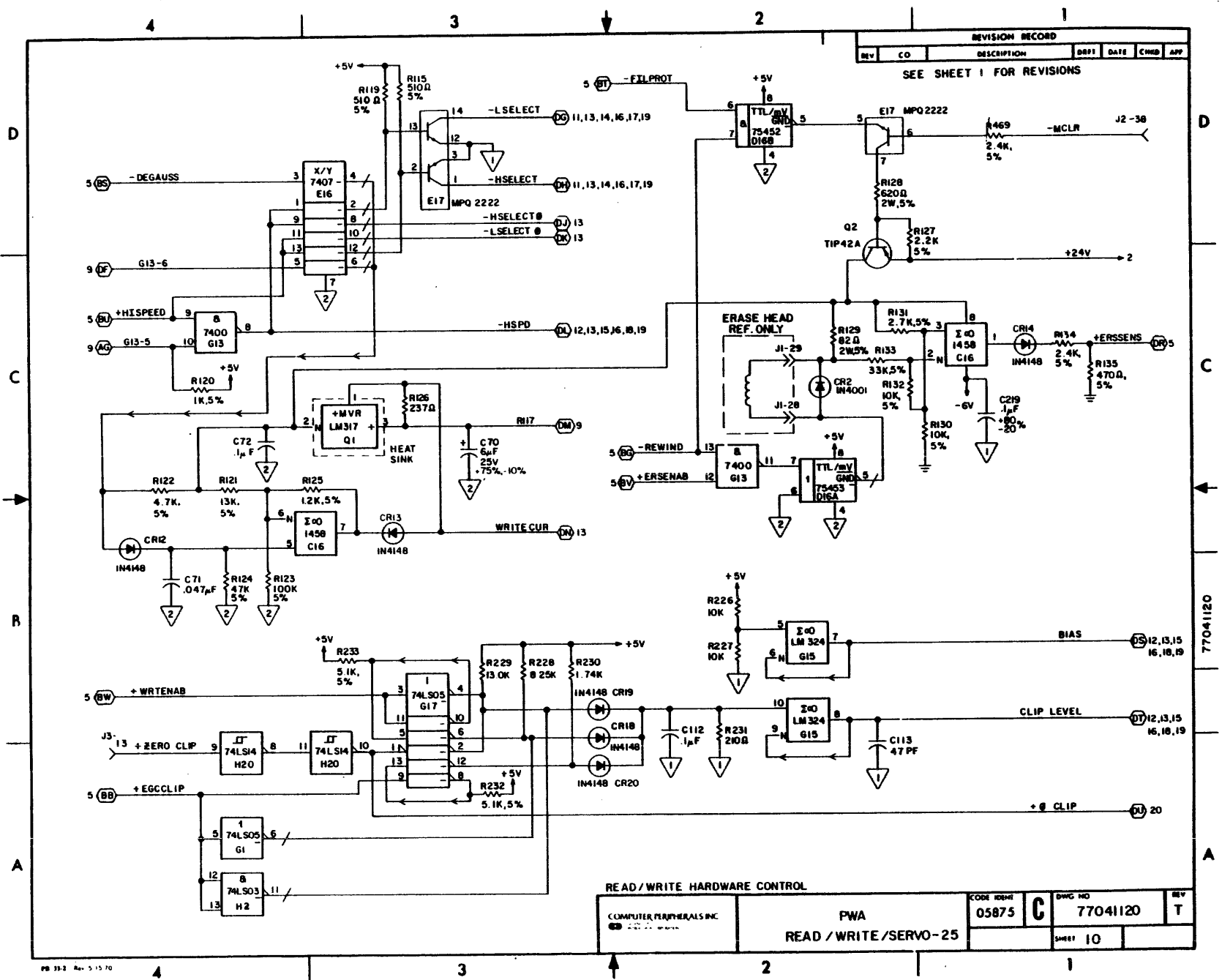
5-19



REVISION RECORD						
REV	CO	DESCRIPTION	DRFT	DATE	CHNG	APP

SEE SHEET 1 FOR REVISIONS

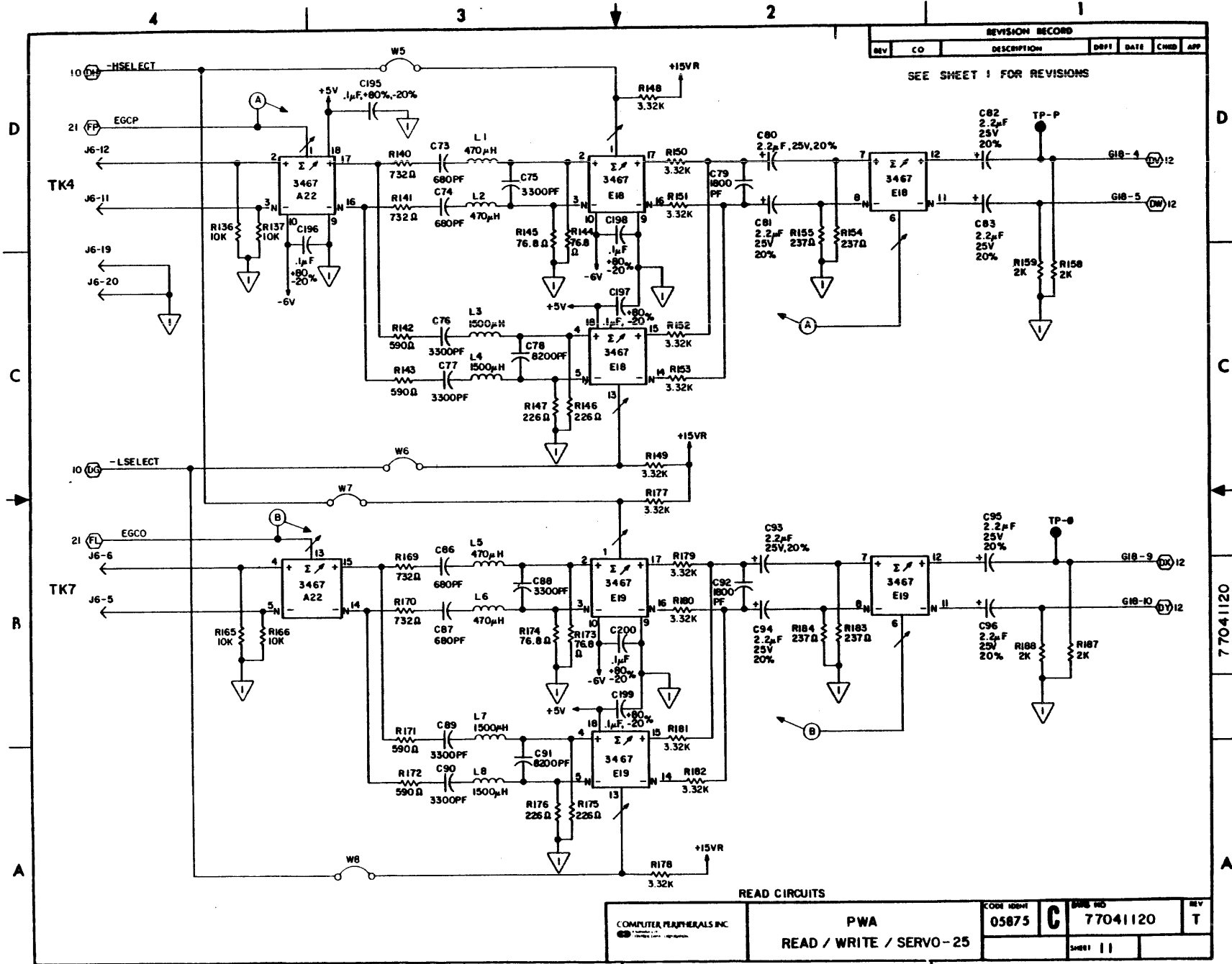
WRITE DRIVERS		CODE IDENT	DWG NO	REV
COMPUTER PERIPHERALS INC		05875	77041120	T
PWA READ/WRITE/SERVO-25		SHEET 9		



REVISION RECORD						
REV	CO	DESCRIPTION	DRFT	DATE	CHNG	APP
SEE SHEET 1 FOR REVISIONS						

READ / WRITE HARDWARE CONTROL			
COMPUTER PERIPHERALS INC.	PWA	CODE IDENT	REV
	READ / WRITE / SERVO-25	05875 C	T
		DWG NO	
		77041120	
		SHEET	
		10	

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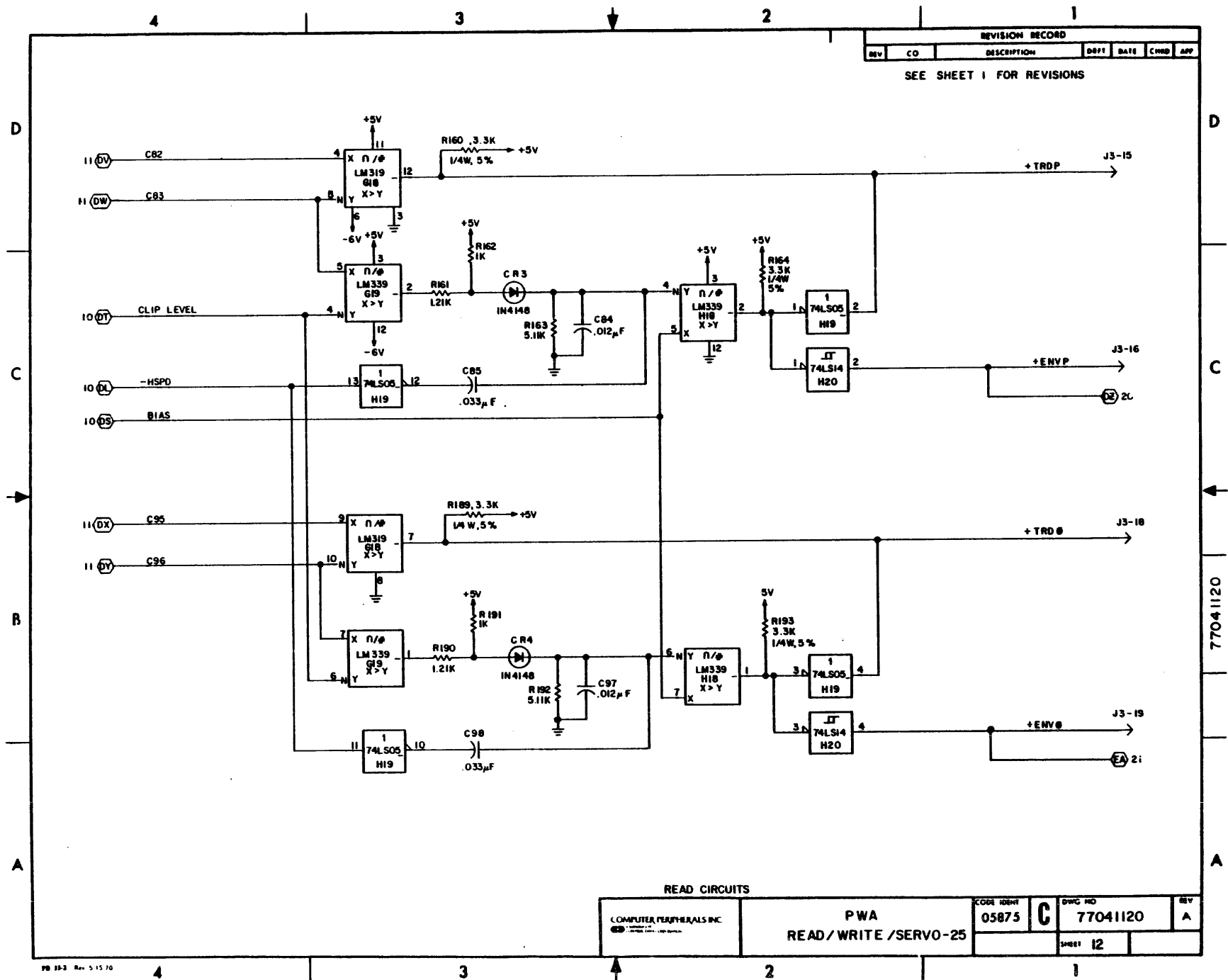


REVISION RECORD					
REV	CO	DESCRIPTION	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS					

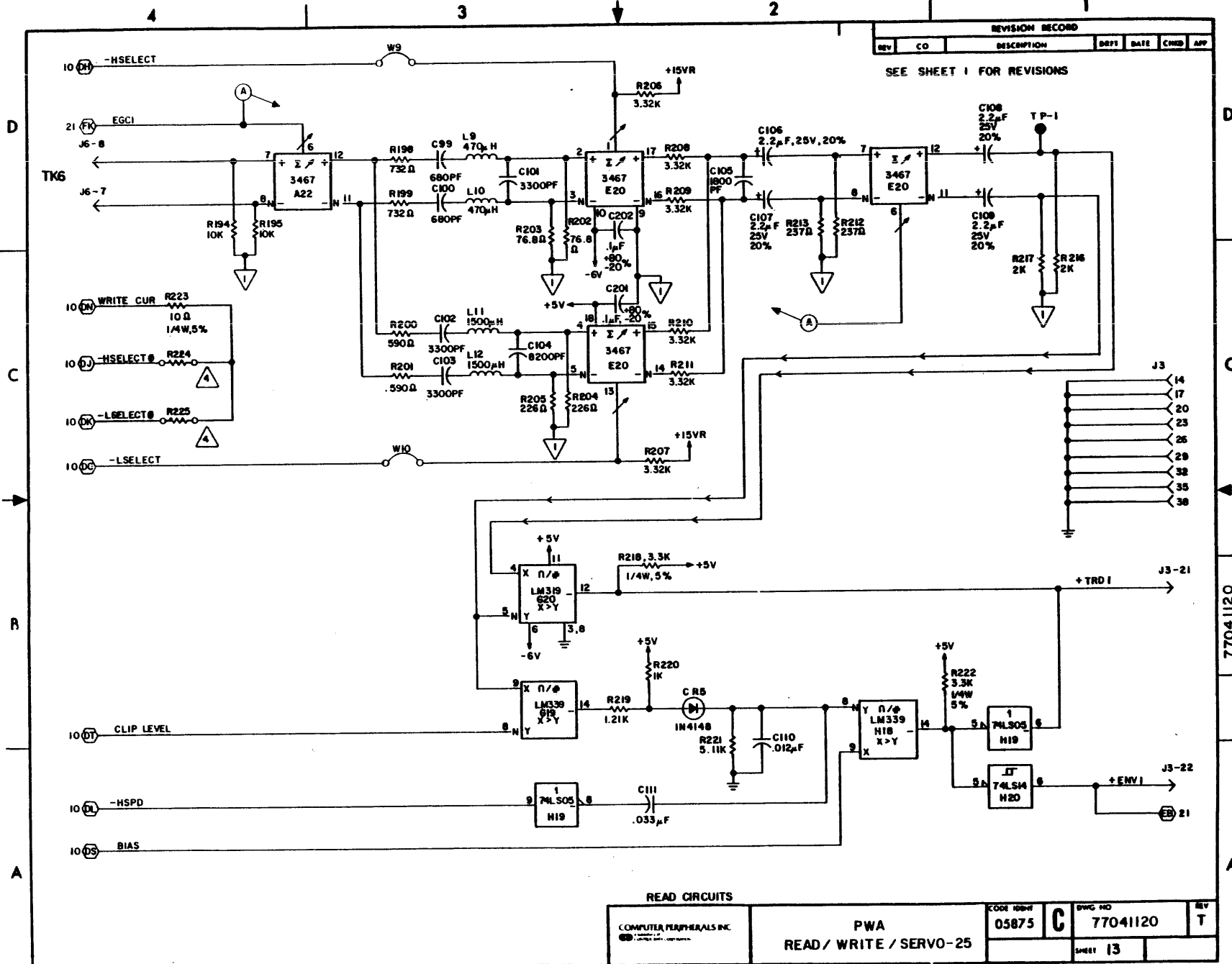
READ CIRCUITS

COMPUTER PERIPHERALS INC.	PWA		CODE IDENT	DATE	REV
	READ / WRITE / SERVO-25		05875	77041120	T

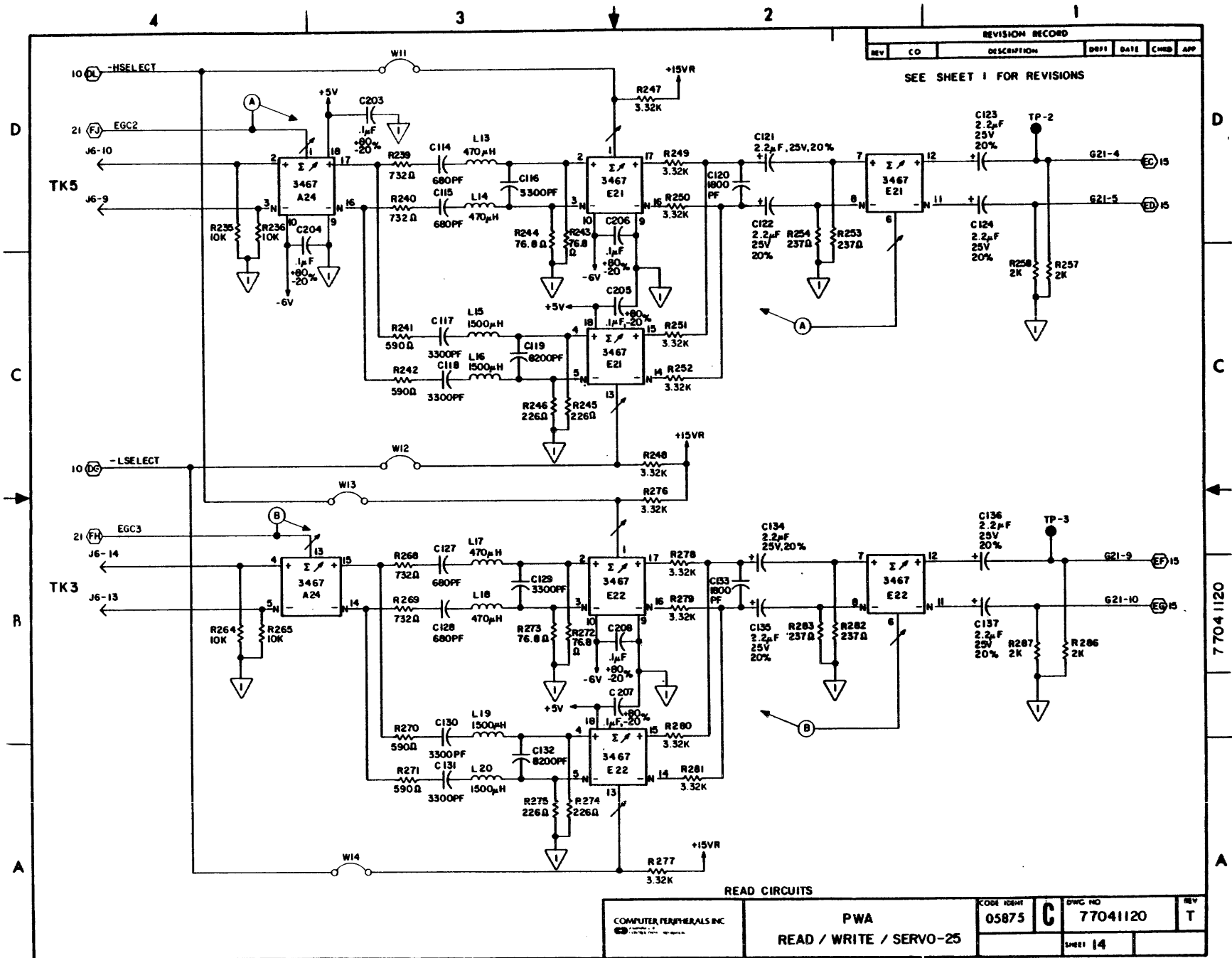
5-21



77041120



COMPUTER PERIPHERALS INC.		PWA		CODE 05875	QWC NO 77041120	REV T
		READ / WRITE / SERVO-25			SHEET 13	

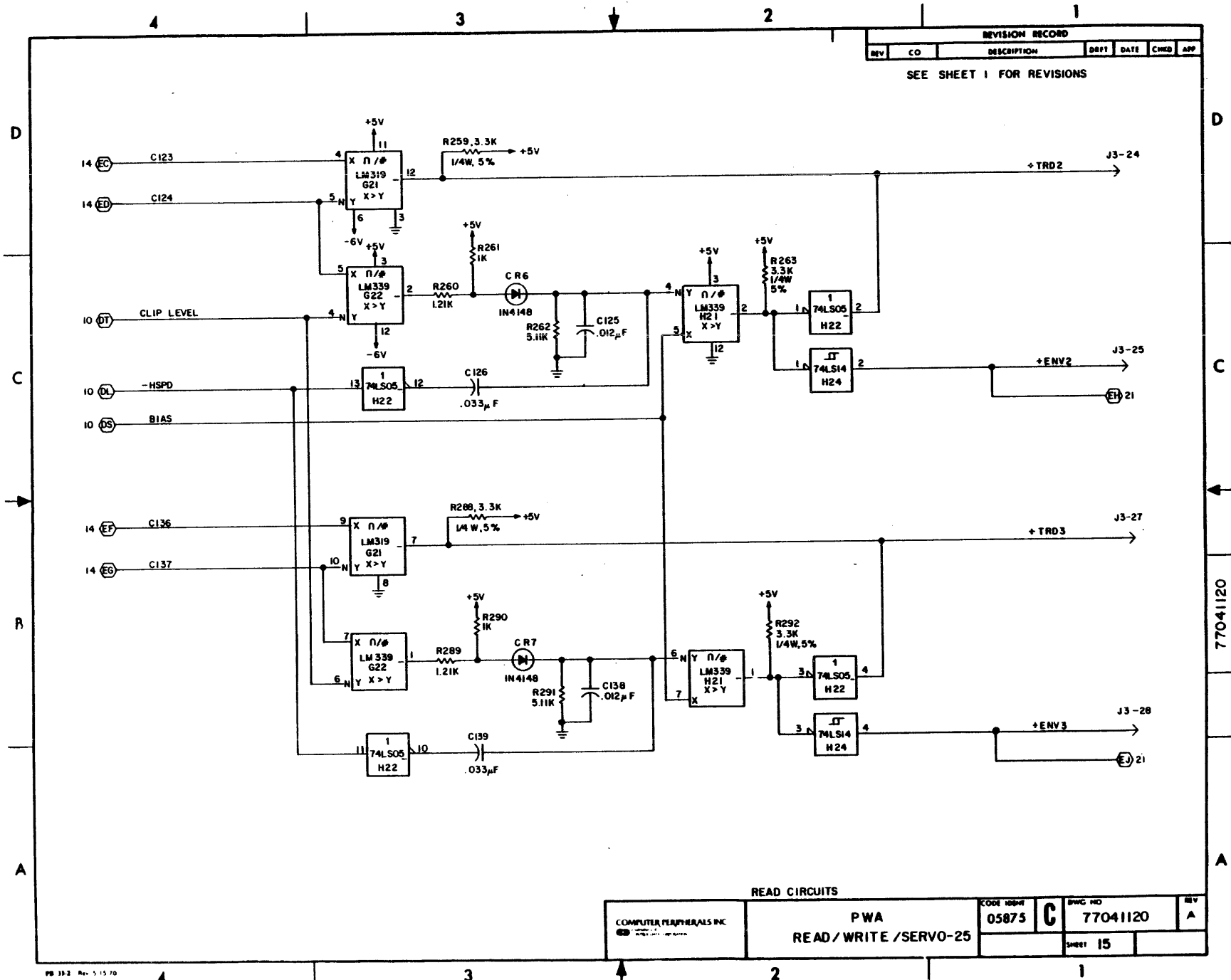


77041120

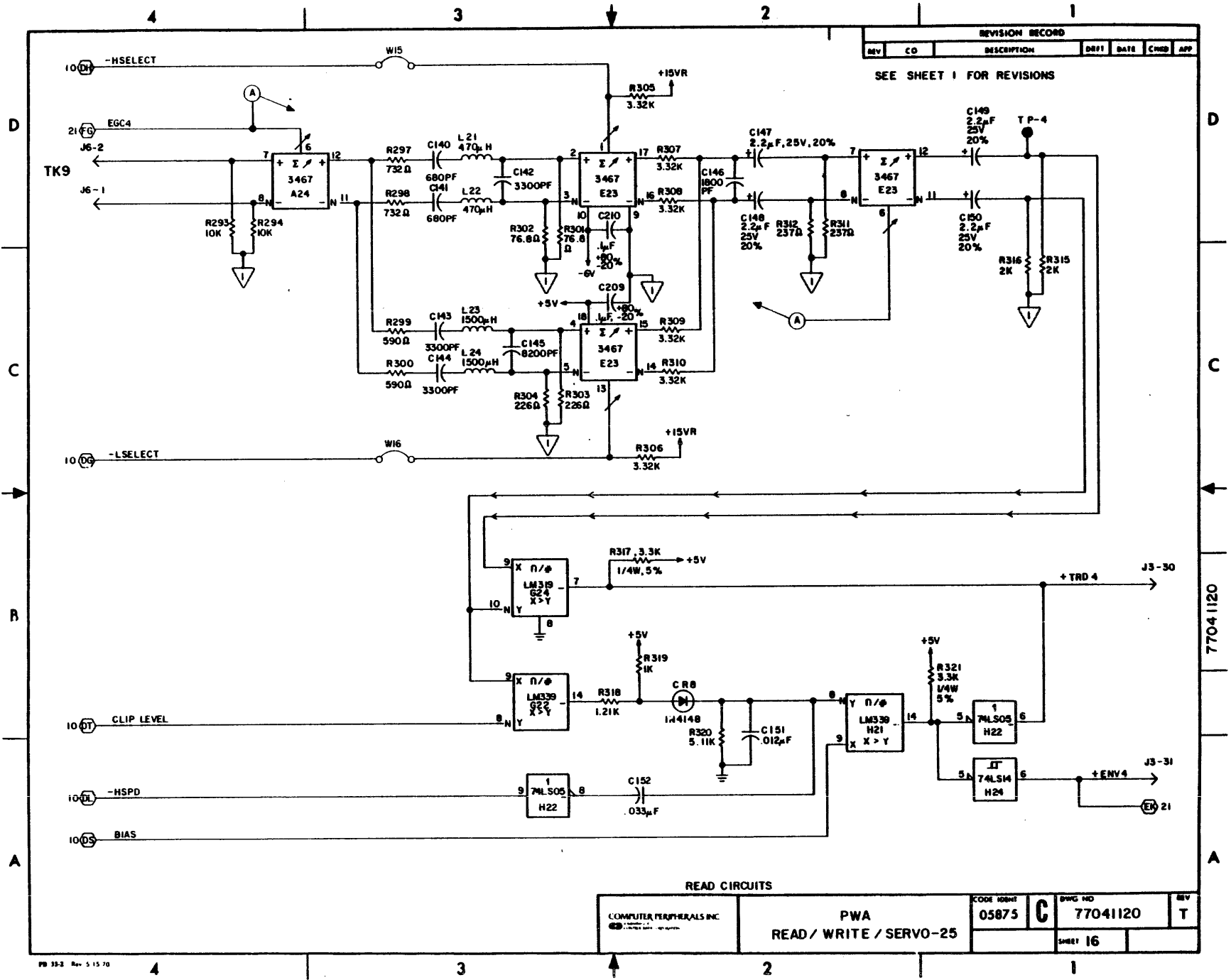


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5-25



77041120



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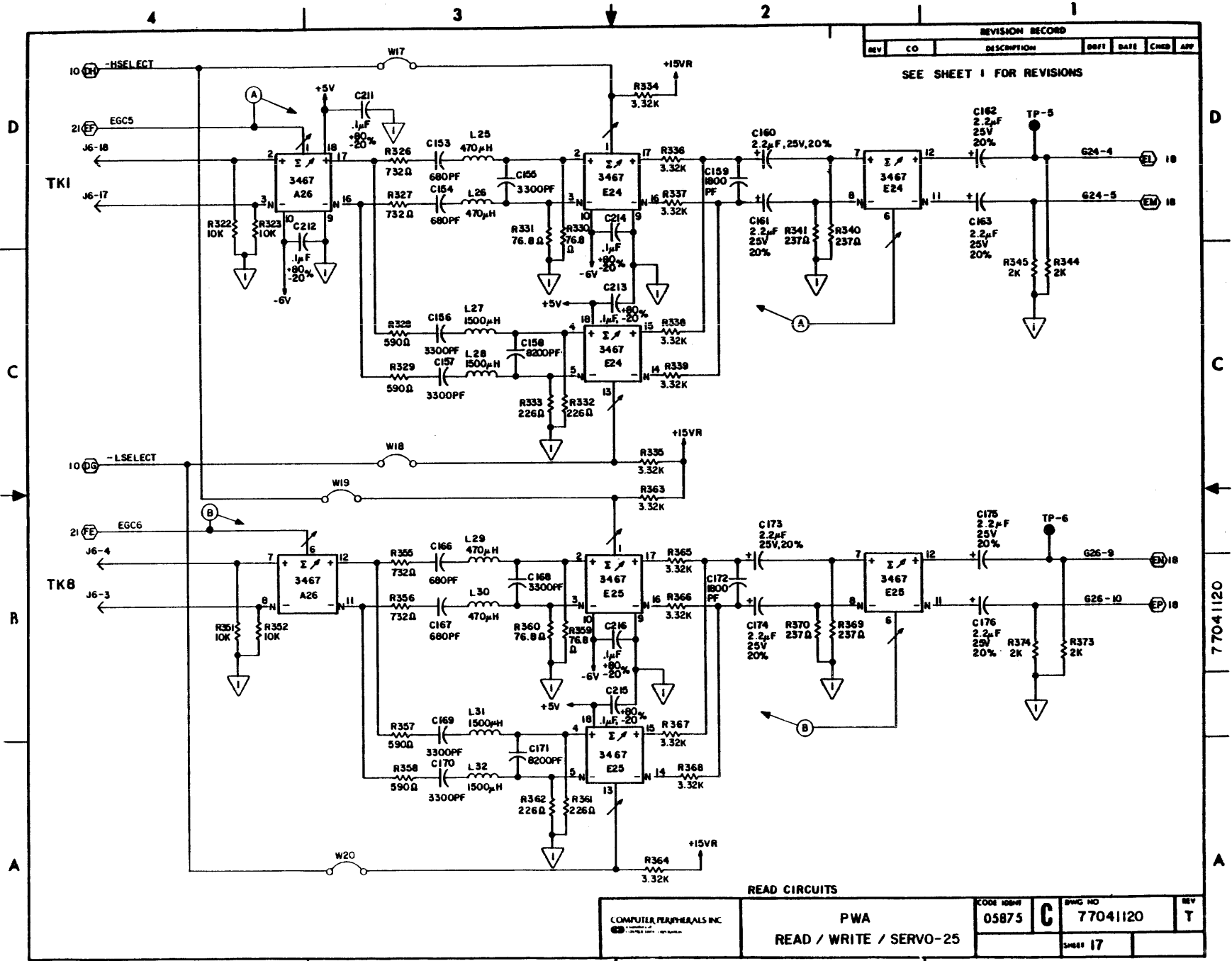
C

B

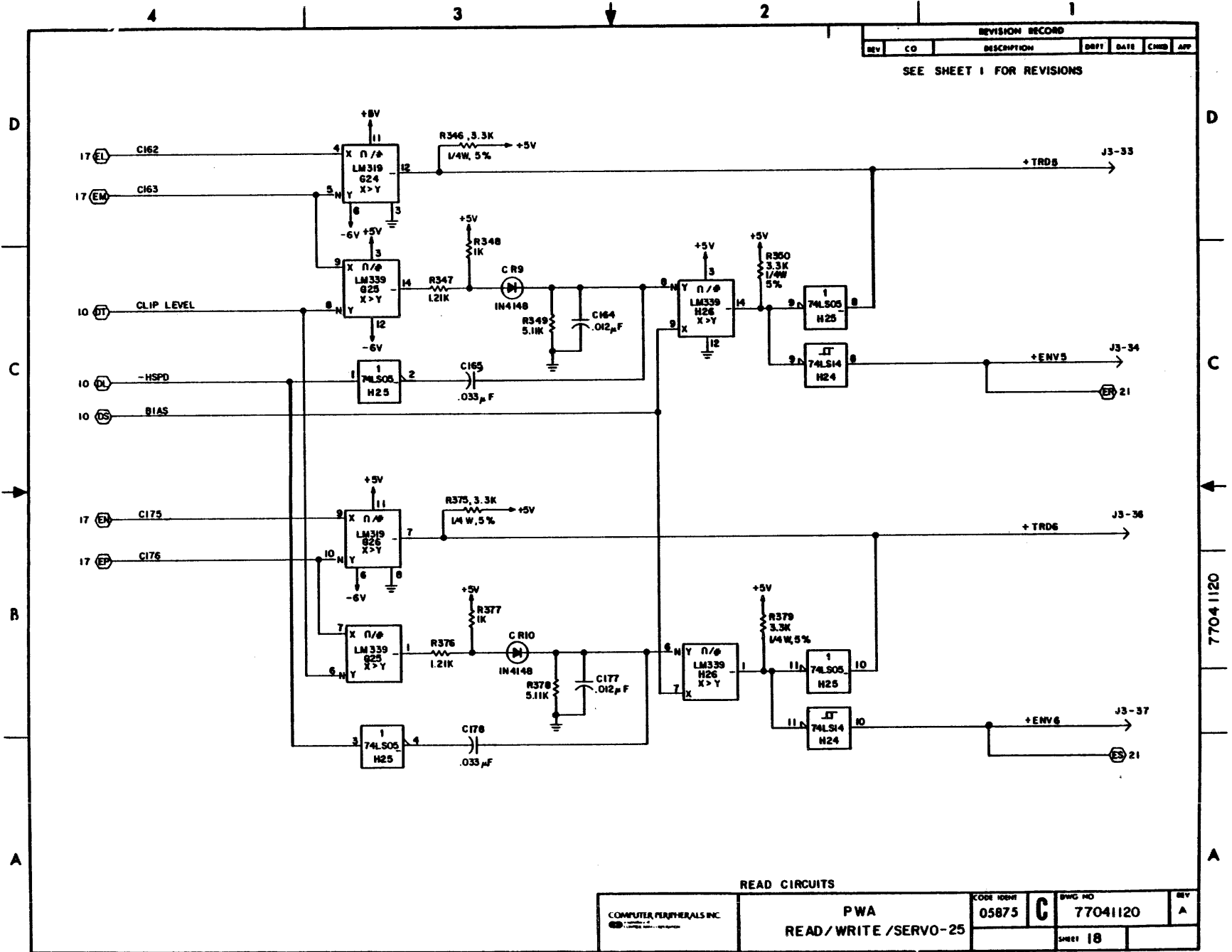
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77041120

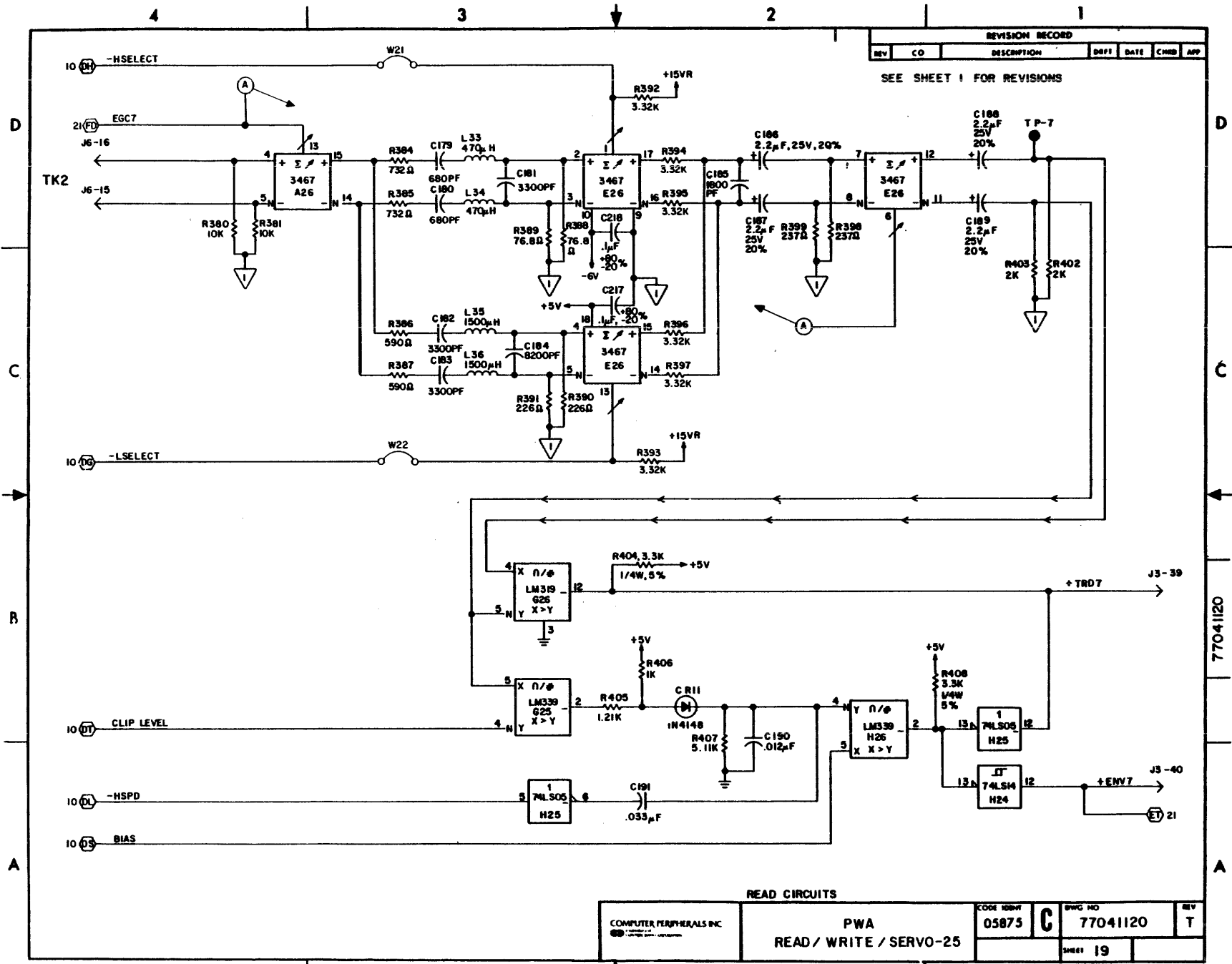
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5-27



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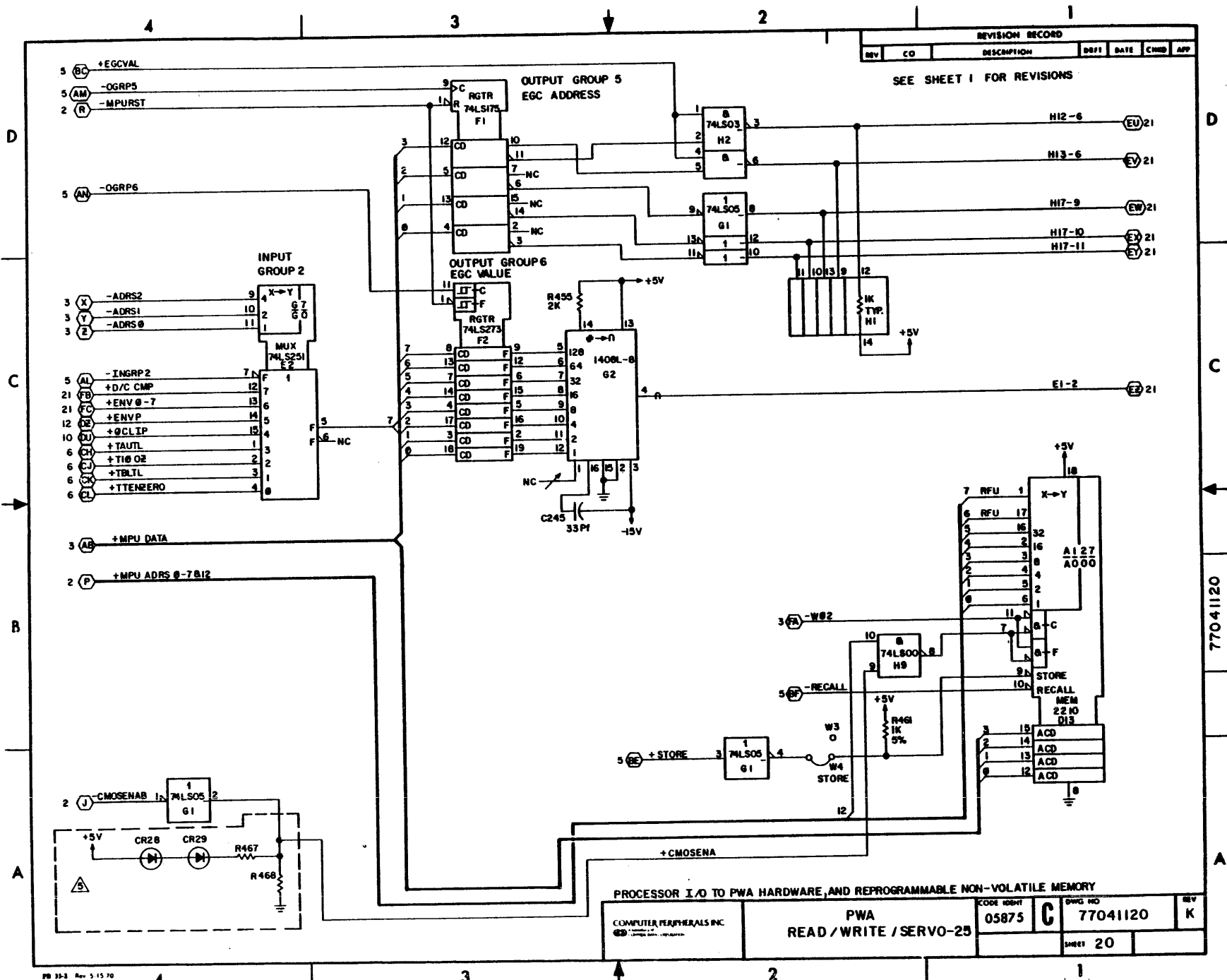


REVISION RECORD					
REV	CO	DESCRIPTION	DRFI	DATE	CHKD APP
SEE SHEET 1 FOR REVISIONS					

COMPUTER PERIPHERALS INC		PWA		CODE 05875	REV T
READ CIRCUITS		READ / WRITE / SERVO-25		QWC NO 77041120	REV T
				SHEET 19	

PH 35-2 Rev. 5-15-70

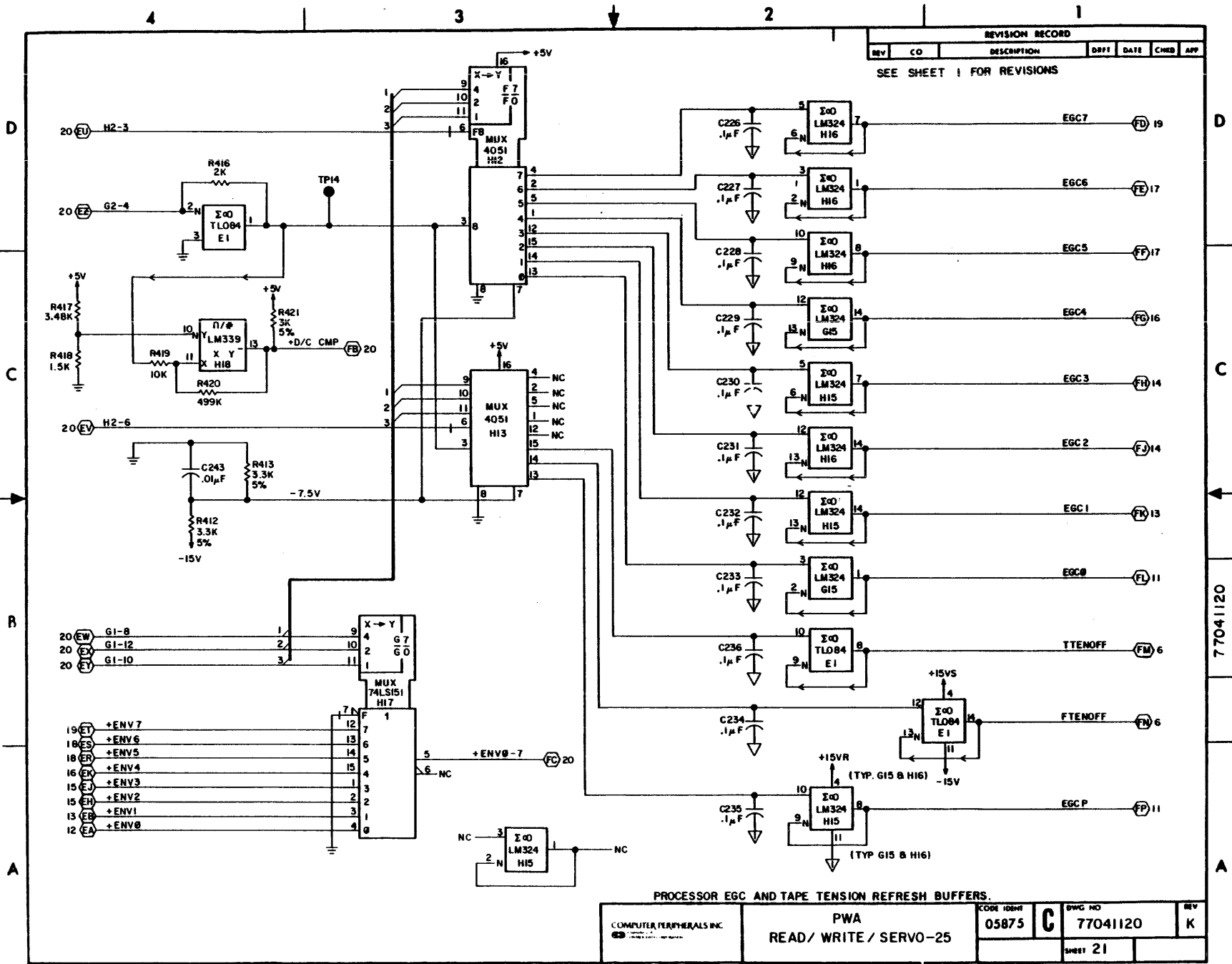
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REVISION RECORD						
REV	CO	DESCRIPTION	DESI	DATE	CHG	APP
SEE SHEET 1 FOR REVISIONS						

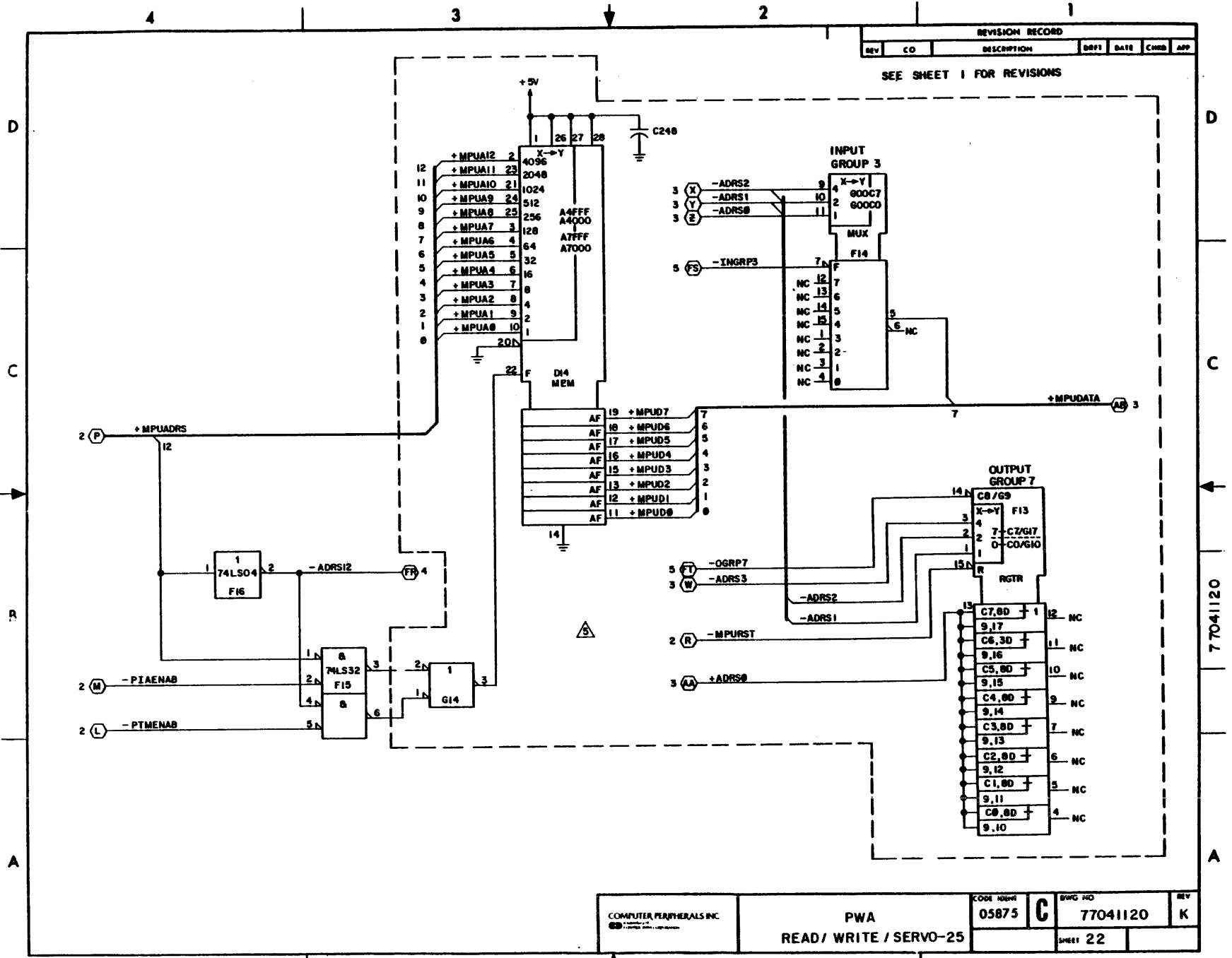
PROCESSOR I/O TO PWA HARDWARE, AND REPROGRAMMABLE NON-VOLATILE MEMORY			
COMPUTER PERIPHERALS INC.	PWA READ / WRITE / SERVO-25	CODE IDENT 05875	DRWG NO 77041120
		SHEET 20	REV K

49769000



COMPUTER PERIPHERALS INC.	<b>PWA</b> READ / WRITE / SERVO-25	CODE IDENT <b>05875</b>	<b>C</b>	DWG NO <b>77041120</b>	REV <b>K</b>
				SHEET 21	

5-31



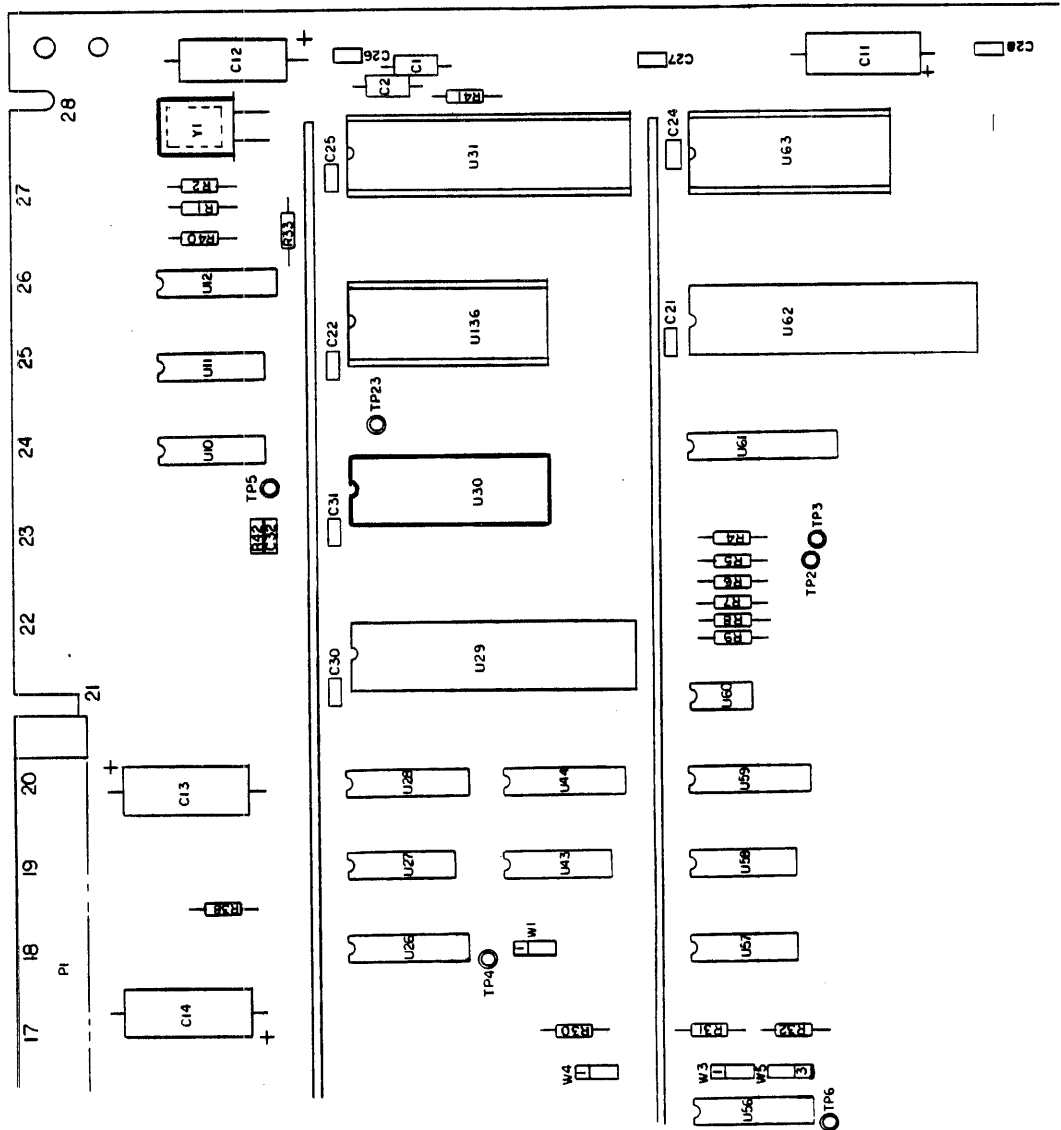
REVISION RECORD						
REV	CO	DESCRIPTION	DESI	DATE	CHKD	APP

SEE SHEET 1 FOR REVISIONS

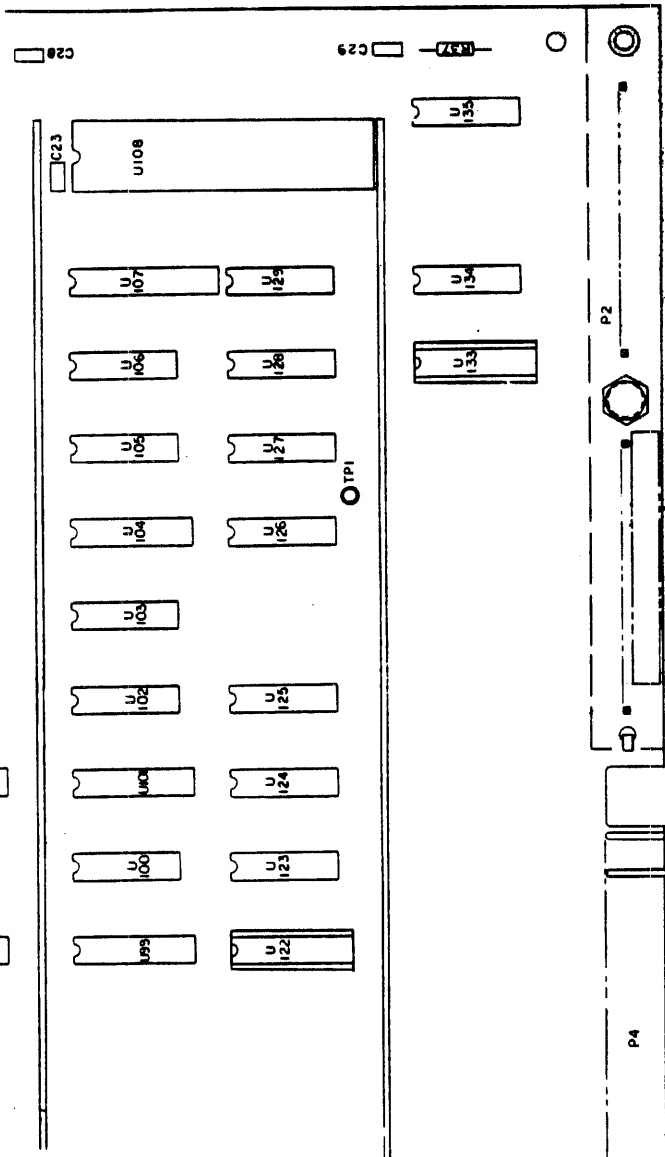
77041120

COMPUTER PERIPHERALS INC.	PWA	CODE 05875	DWG NO. C	77041120	REV K
	READ / WRITE / SERVO-25			SHEET 22	

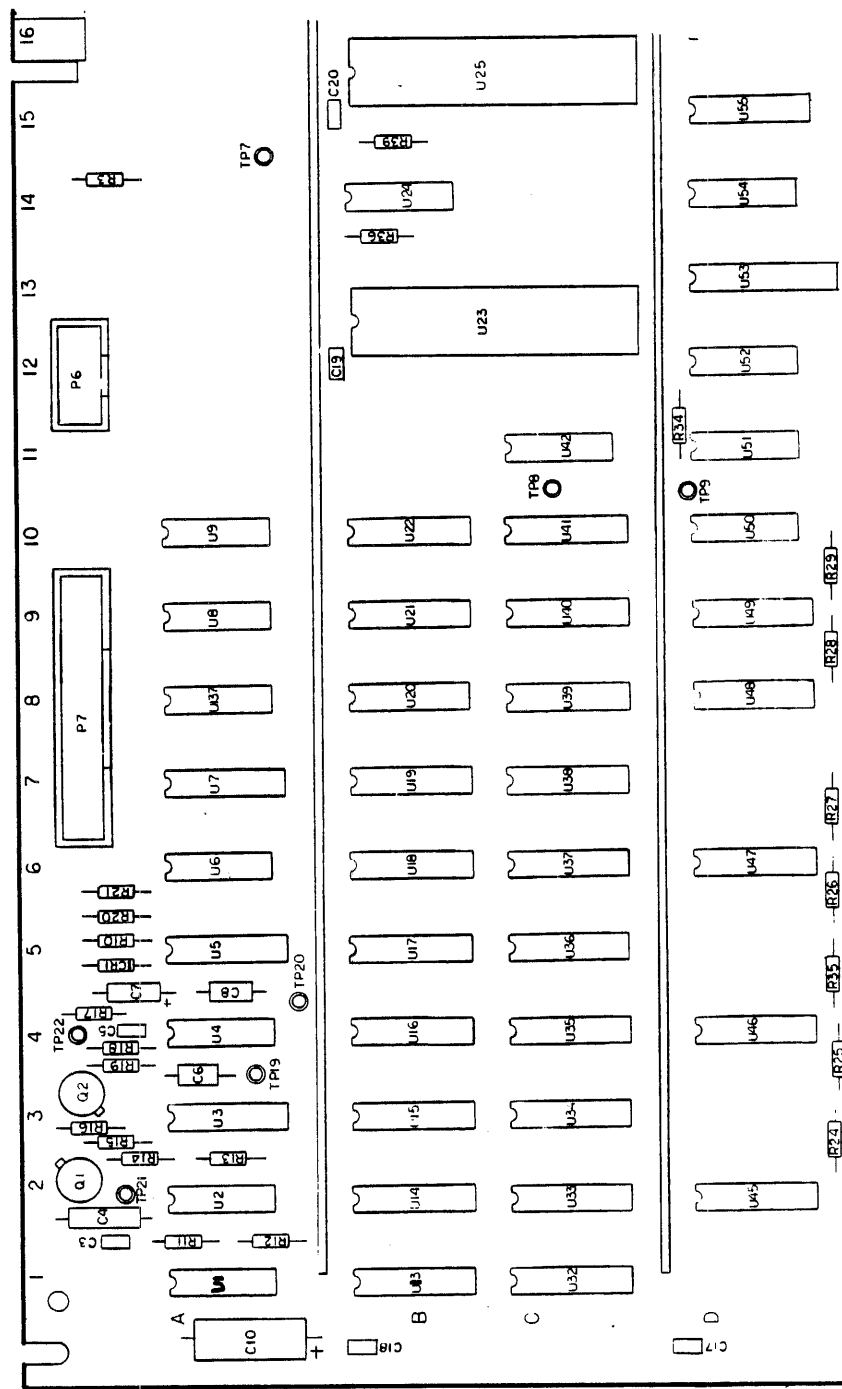




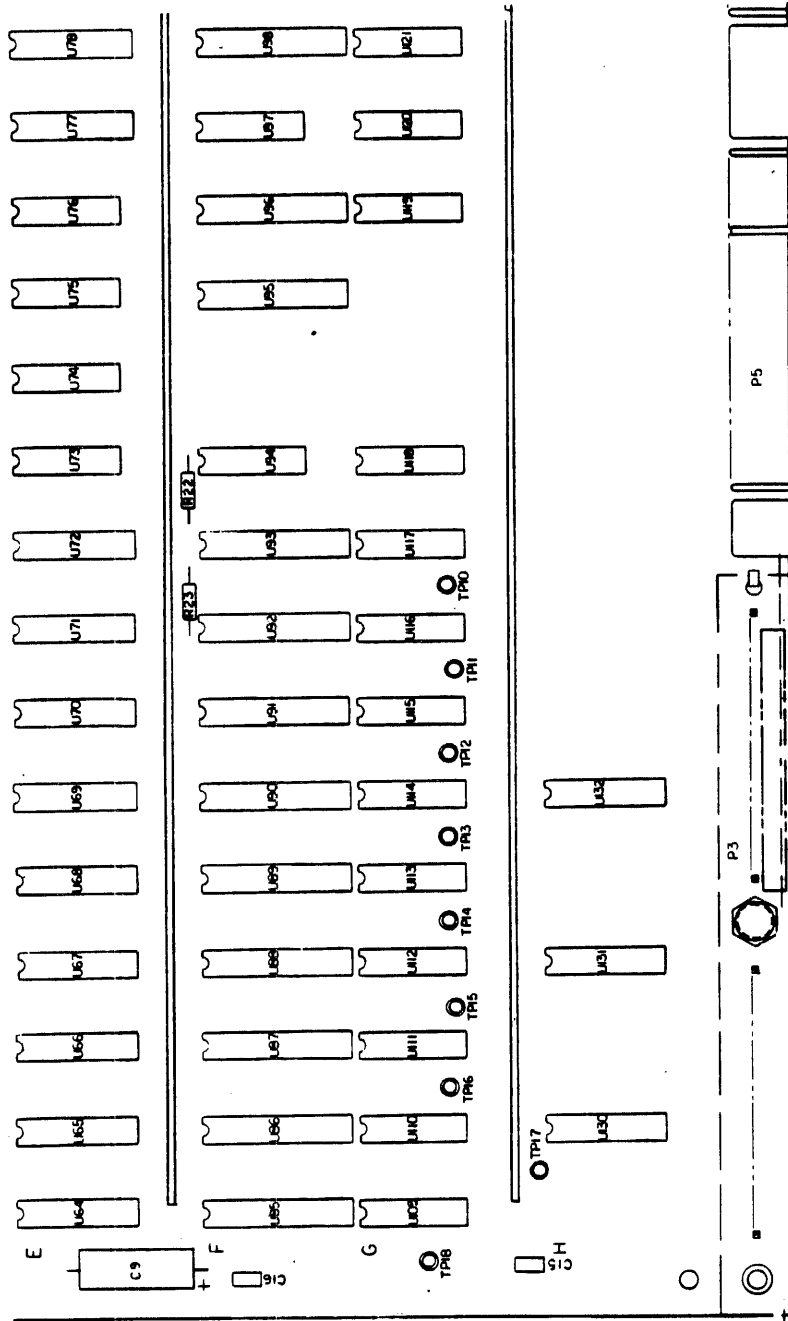
FORMATTER-CONTROL PWA LAYOUT (SHEET 1A)



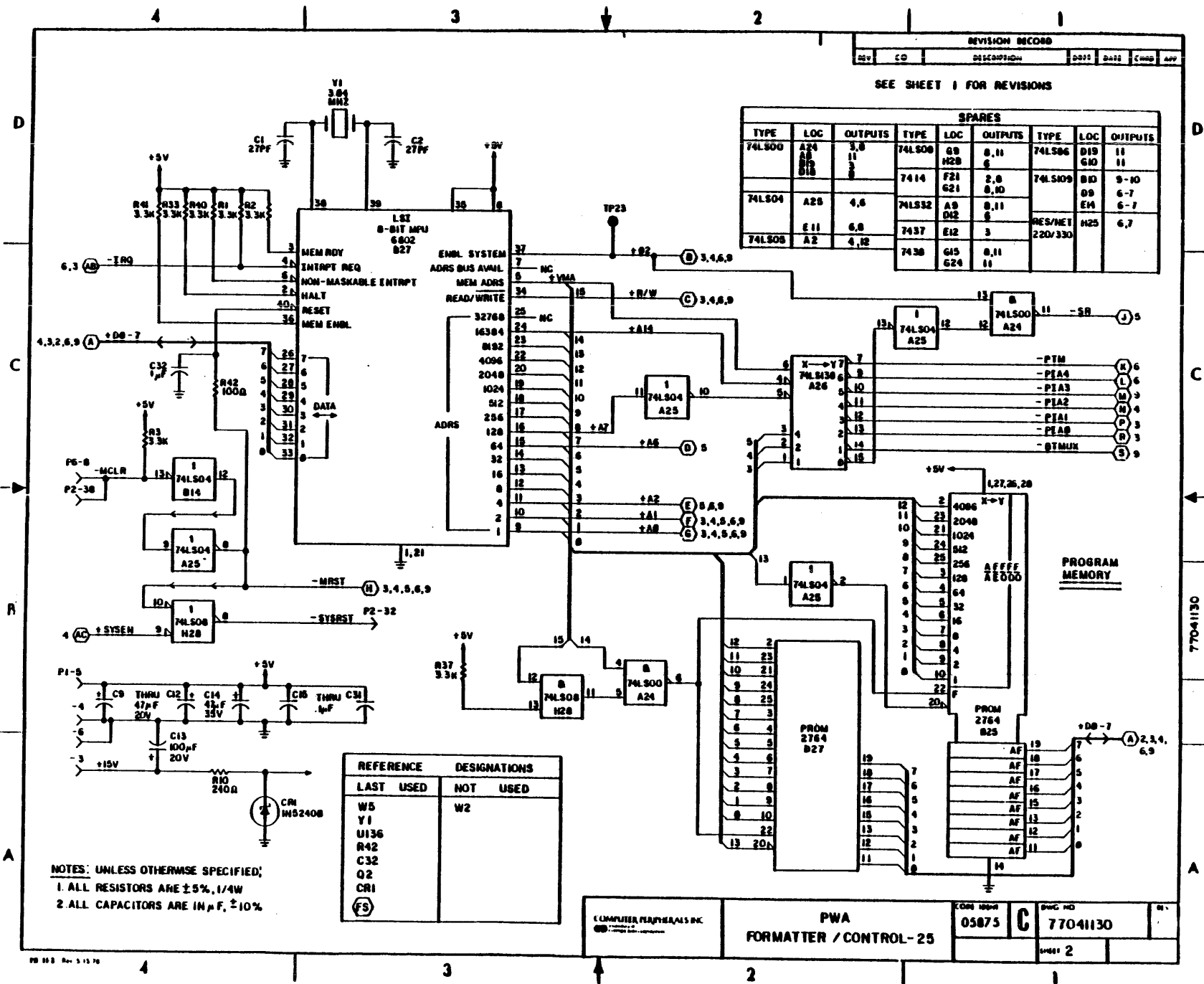
FORMATTER-CONTROL PWA LAYOUT (SHEET 1B)



FORMATTER-CONTROL PWA LAYOUT (SHEET 1C)



FORMATTER-CONTROL PWA LAYOUT (SHEET 1D)



REVISION RECORD						
REV	CD	DESCRIPTION	DATE	CHKD	APP	

SEE SHEET 1 FOR REVISIONS

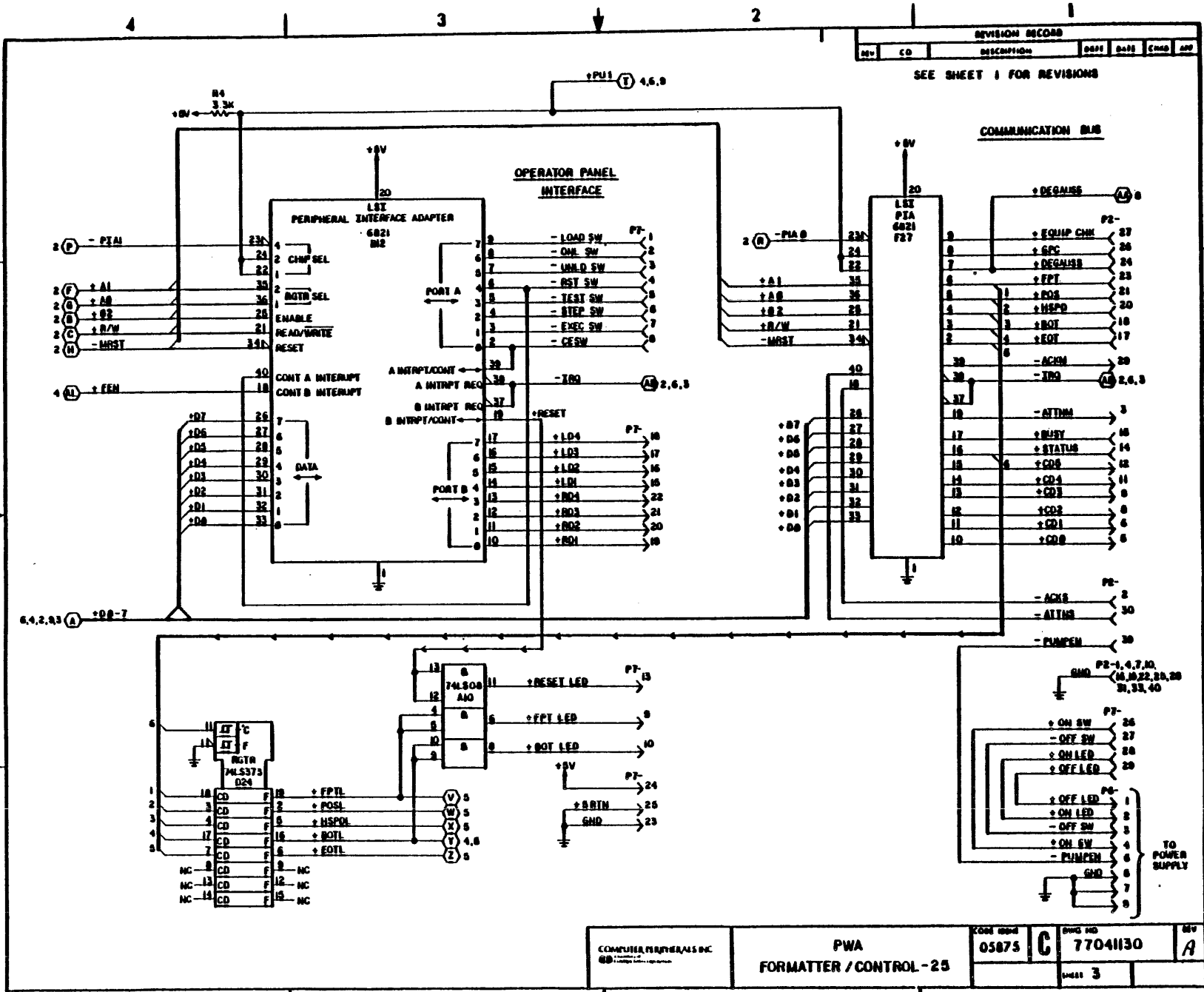
SPARES								
TYPE	LOC	OUTPUTS	TYPE	LOC	OUTPUTS	TYPE	LOC	OUTPUTS
74LS00	A24	3,8	74LS00	G8	8,11	74LS06	D19	11
	B8	11		H28	6		G10	11
	B18	3	7414	F21	2,8	74LS09	B10	9-10
				G21	8,10		09	6-7
74LS04	A25	4,6	74LS32	A9	8,11		EM	6-7
	E11	6,8		G12	6	RES/NET	H25	6,7
74LS08	A2	4,12	7437	G12	3			
			7438	G15	8,11			
				G24	11			

REFERENCE DESIGNATIONS	
LAST USED	NOT USED
W5	W2
Y1	
U136	
R42	
C32	
Q2	
CRI	
(FS)	

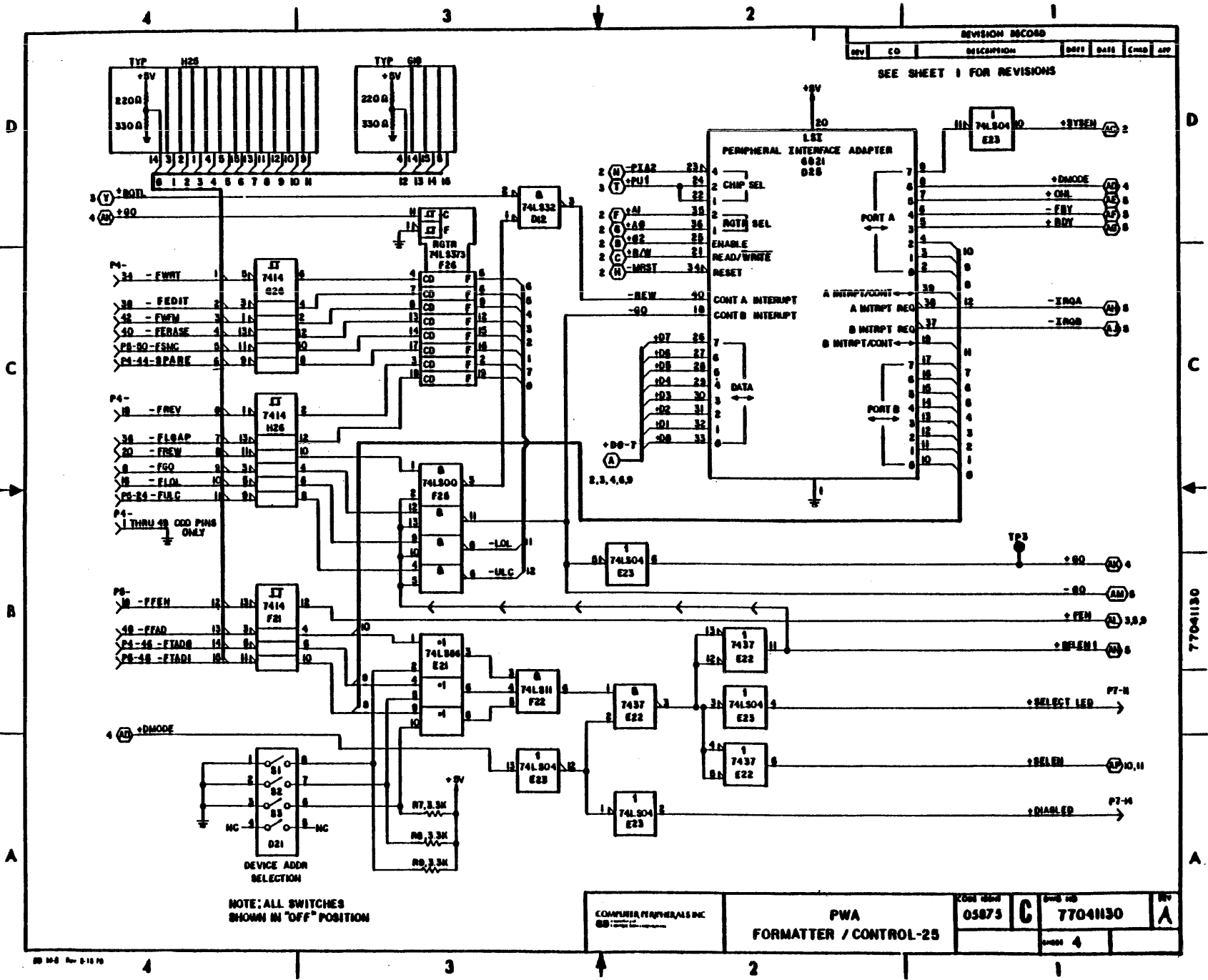
NOTES: UNLESS OTHERWISE SPECIFIED;  
 1. ALL RESISTORS ARE ±5%, 1/4W  
 2. ALL CAPACITORS ARE IN μF, ±10%

COMPUTER PERIPHERALS INC.	PWA	FORM 1004	05875	FORM 100	77041130	REV
	FORMATTER / CONTROL-25				2	

77041130

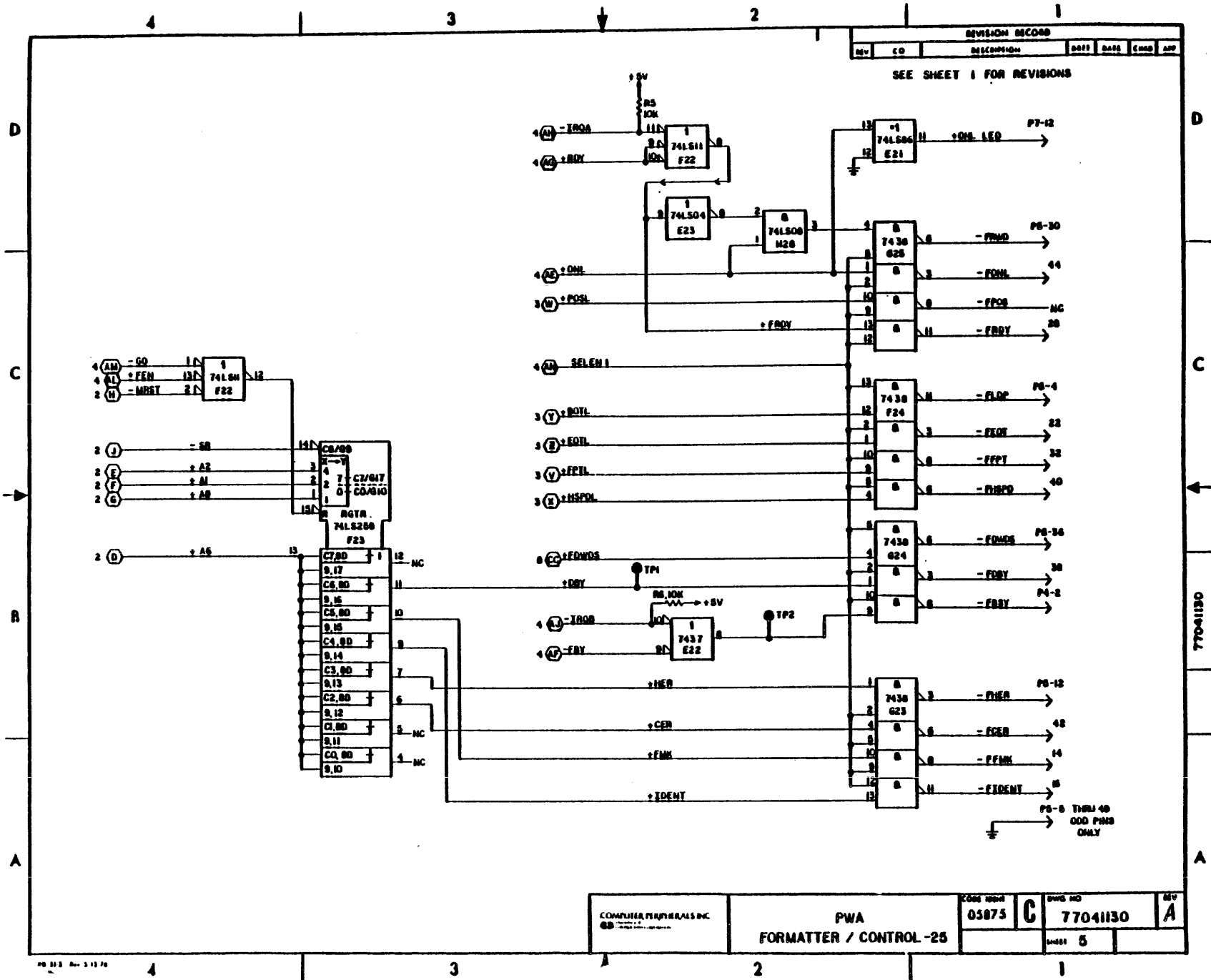


COMPUTER PERIPHERALS INC. 800	PWA FORMATTER / CONTROL - 25	CODE 05875 G	HWG NO 77041130	REV A
			REV 3	

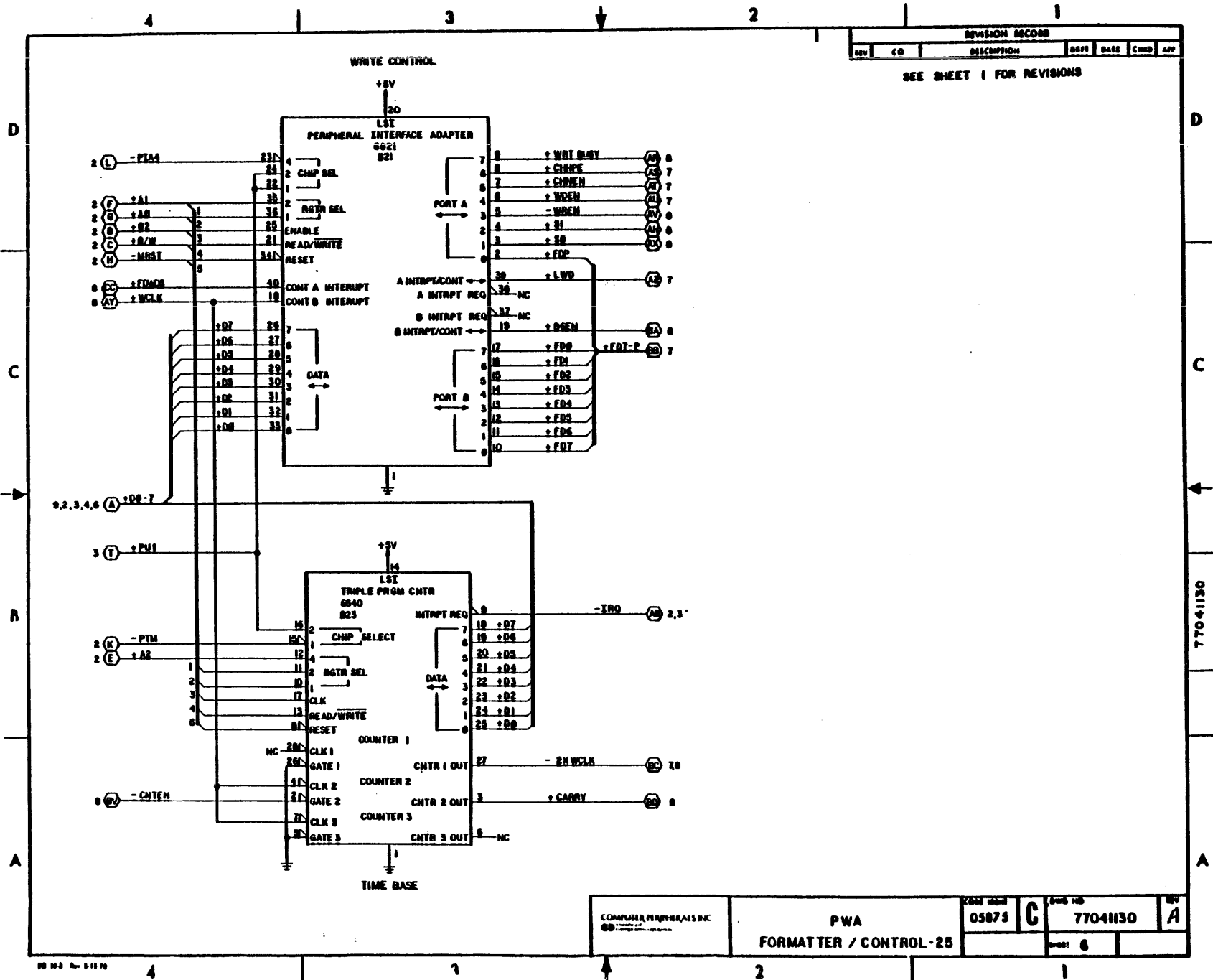


NOTE: ALL SWITCHES SHOWN IN "OFF" POSITION

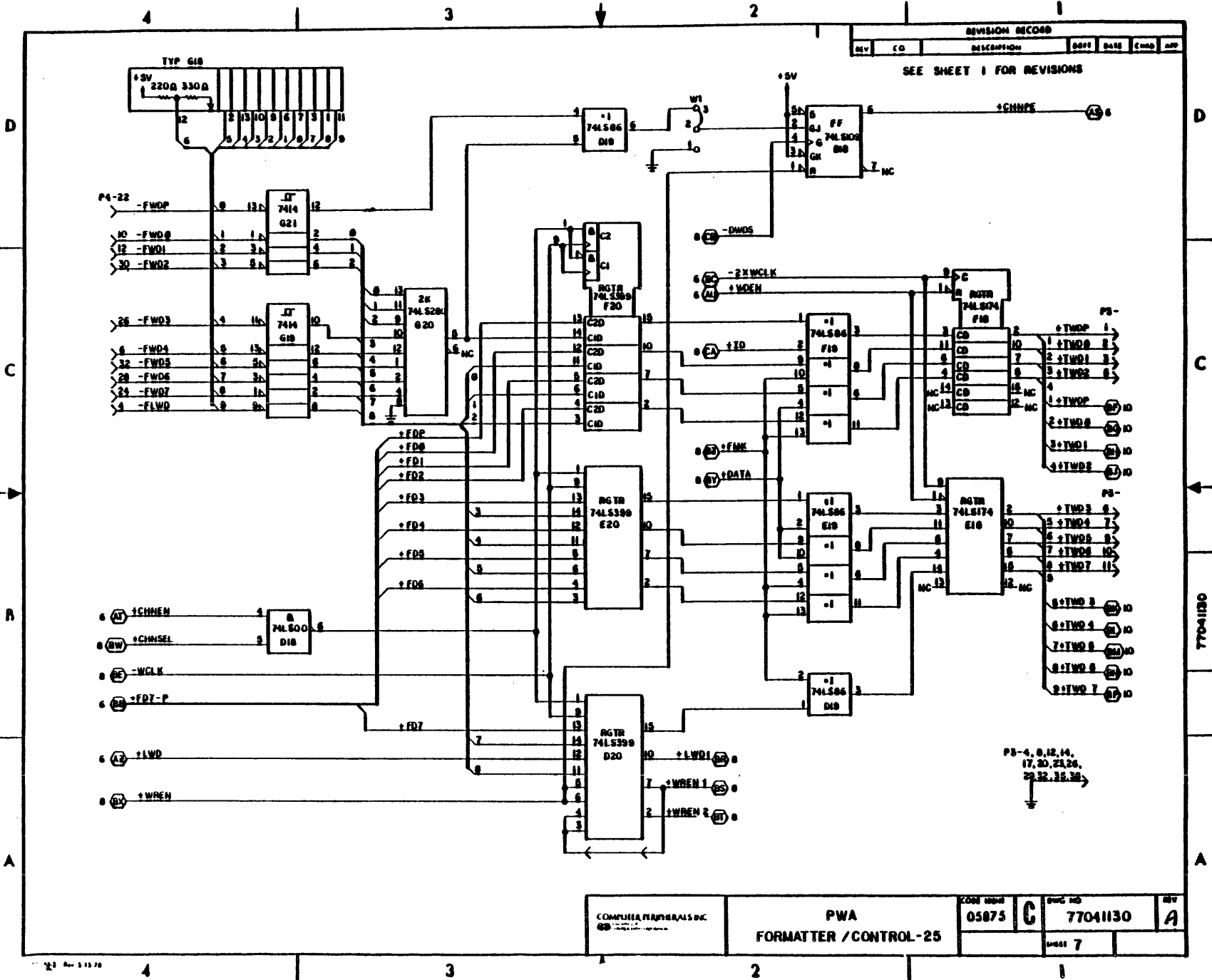
COMPUSA PERIPHERALS INC	PWA	05873	77041130	REV A
	FORMATTER / CONTROL-25			

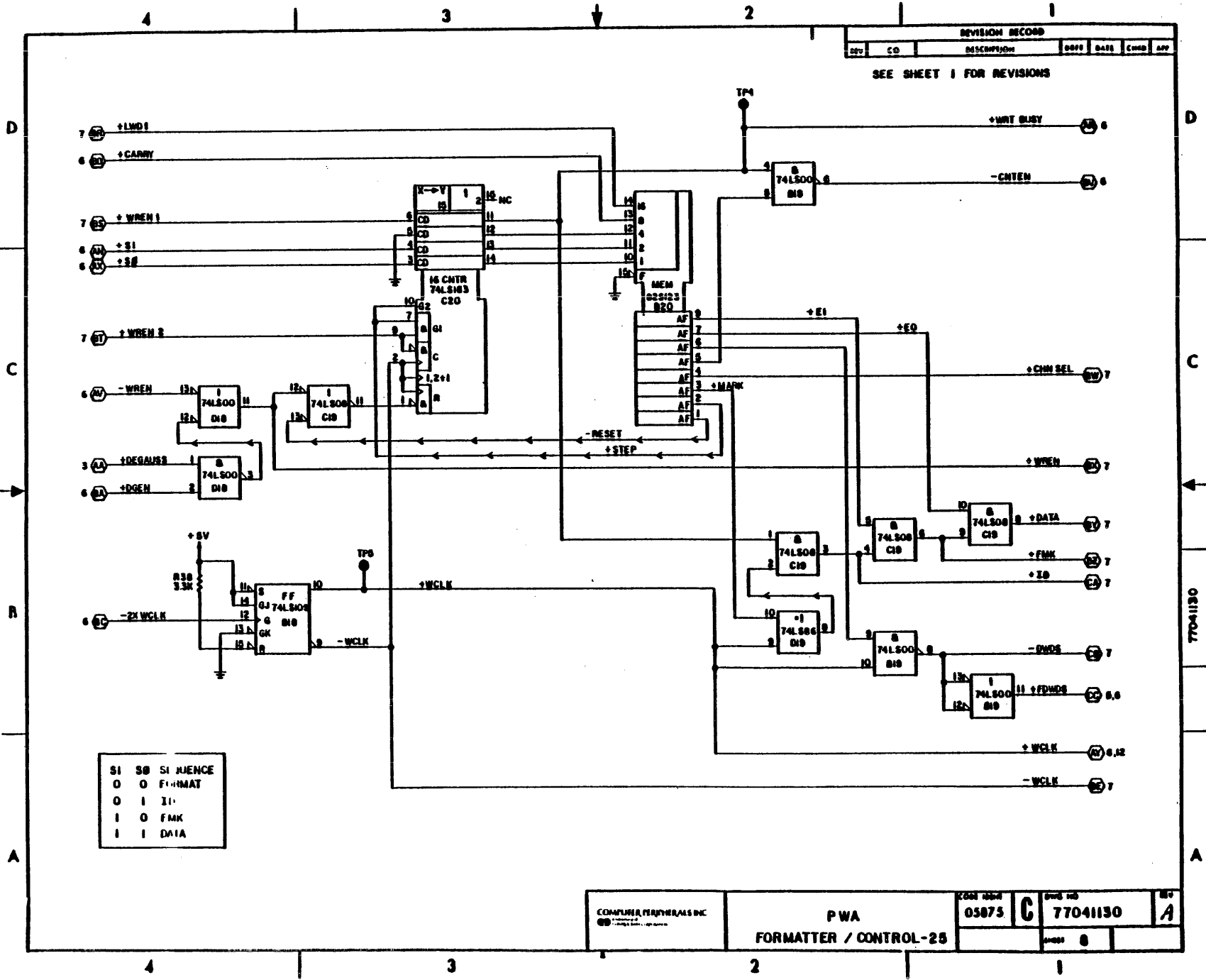




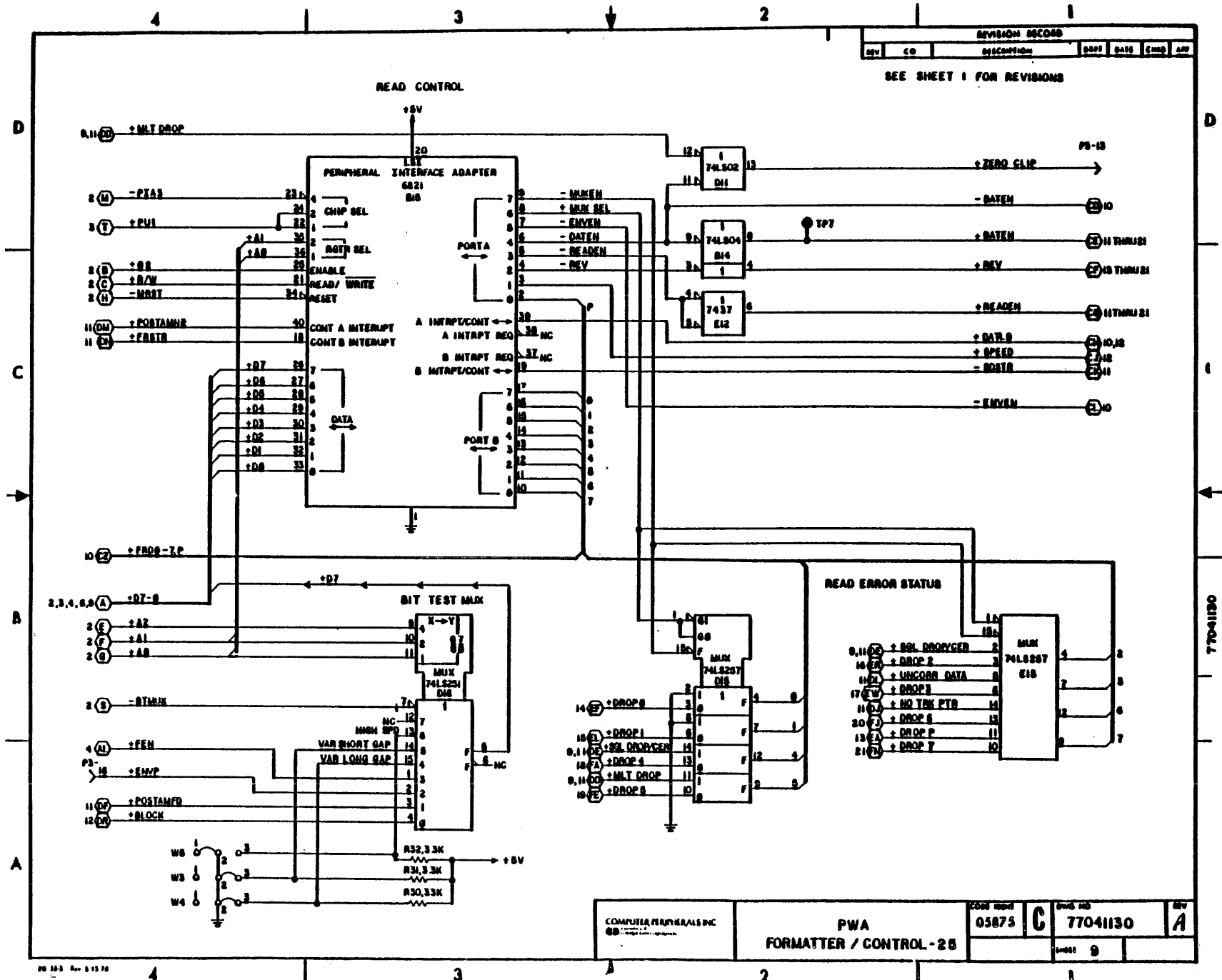


COMPUTER PERIPHERALS INC	PWA	05975	C	77041130	A
	FORMATTER / CONTROL - 25				

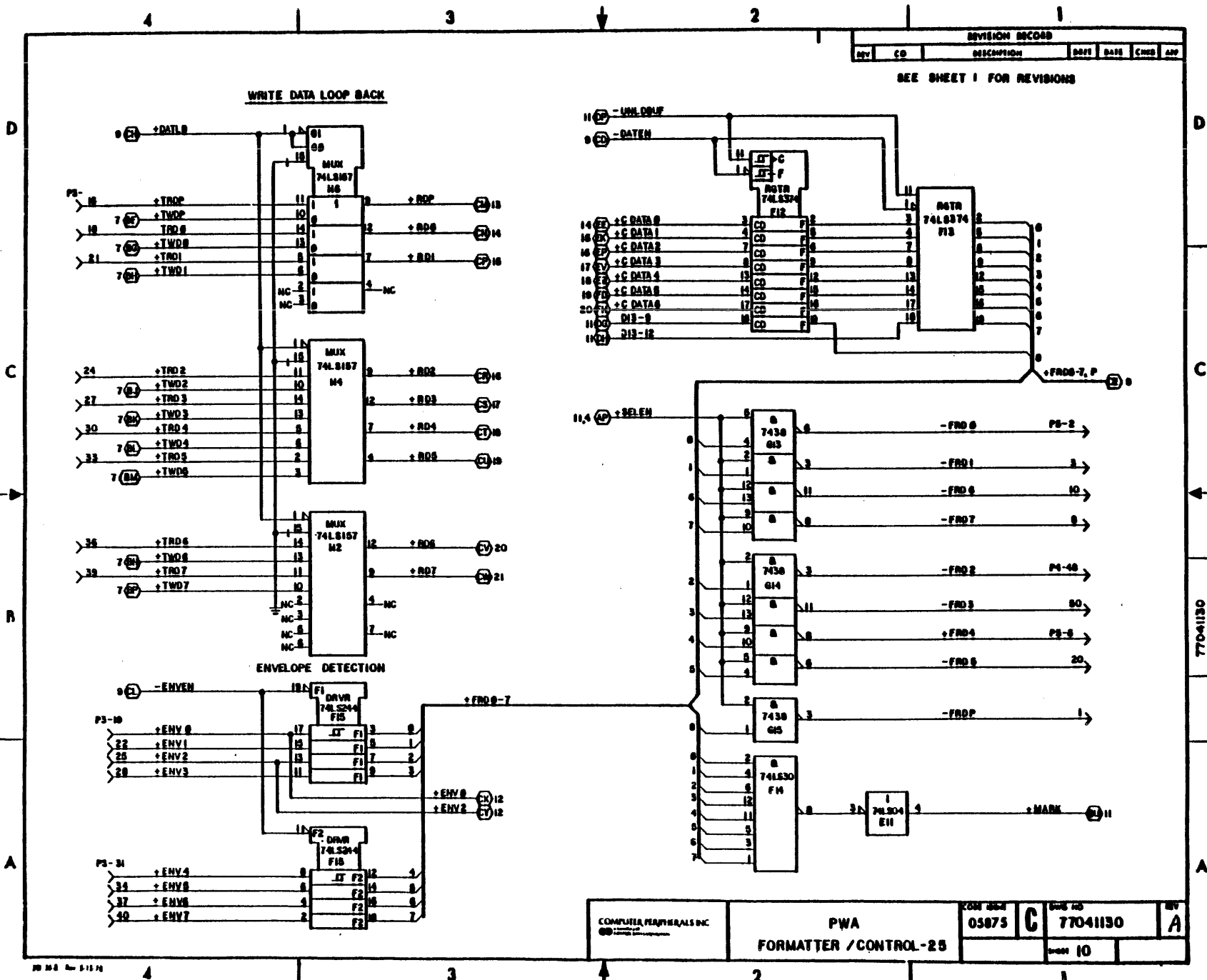




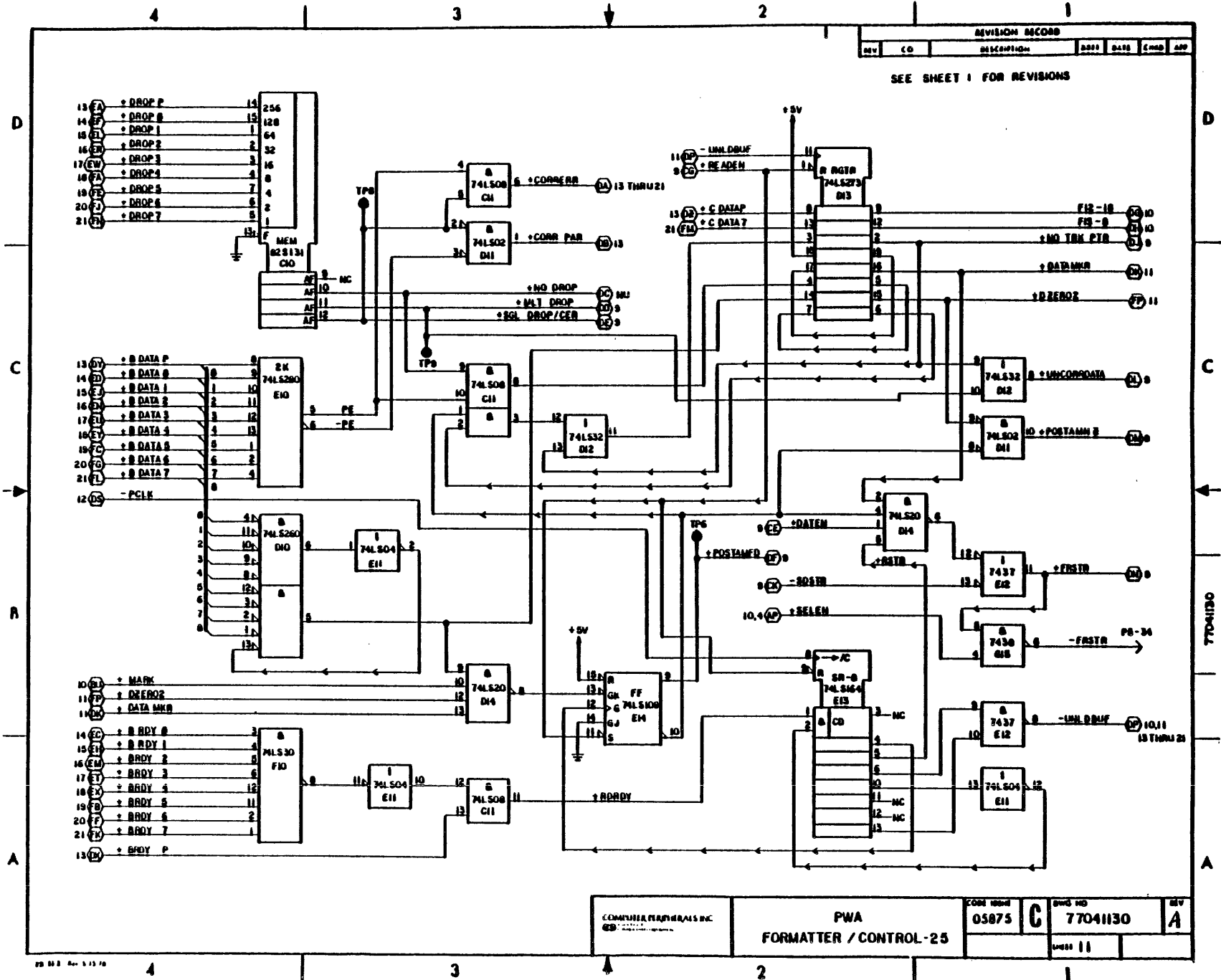
COMPUTER PERIPHERALS INC.	PWA	05875	77041130	A
	FORMATTER / CONTROL-25			



COMPUTER MATERIALS INC.	PWA FORMATTER / CONTROL - 25	Rev. No. 05875	C	Part No. 77041130	Rev. A
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77041130

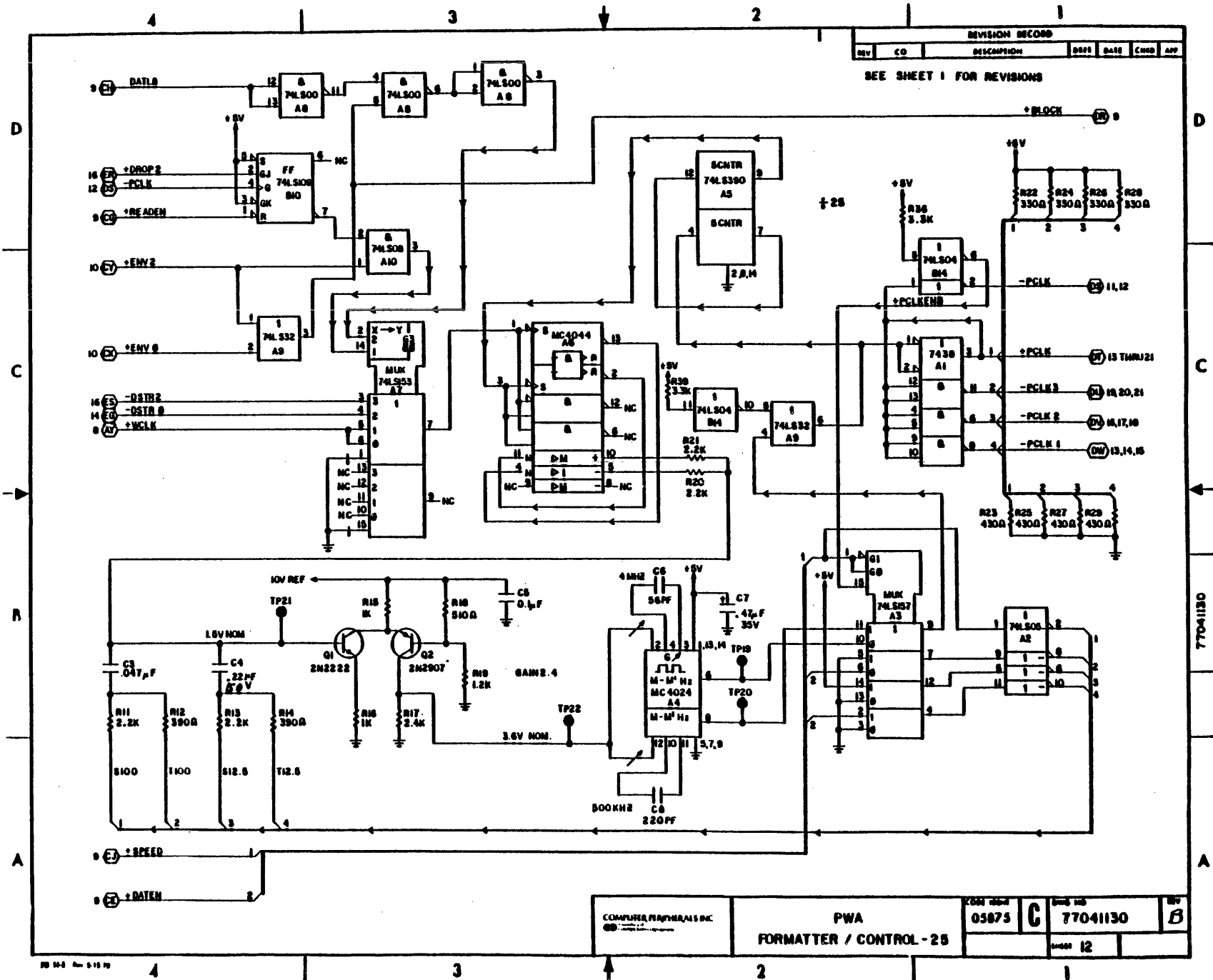


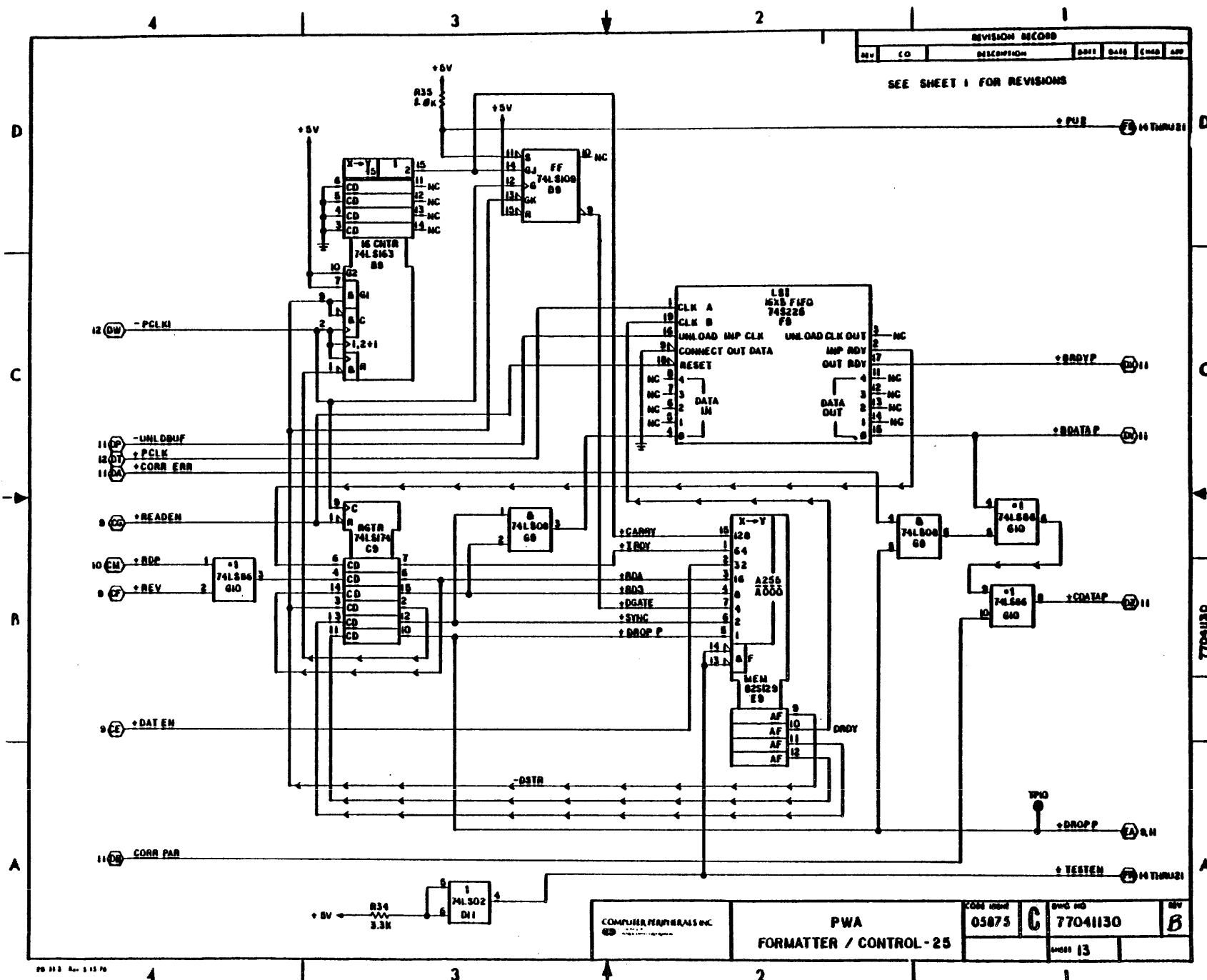
D  
C  
A

D  
C  
A

4 3 2 1

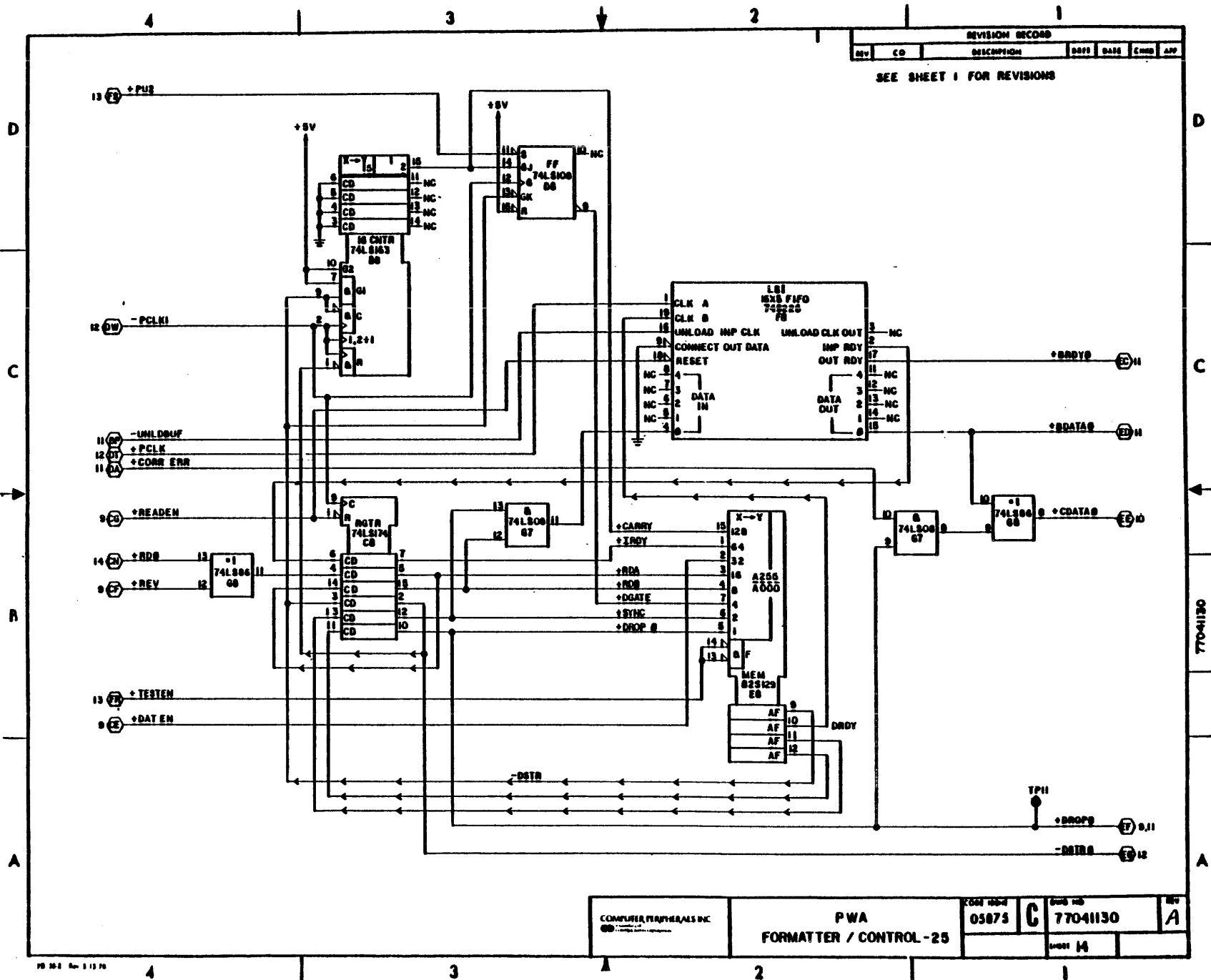
4 3 2 1





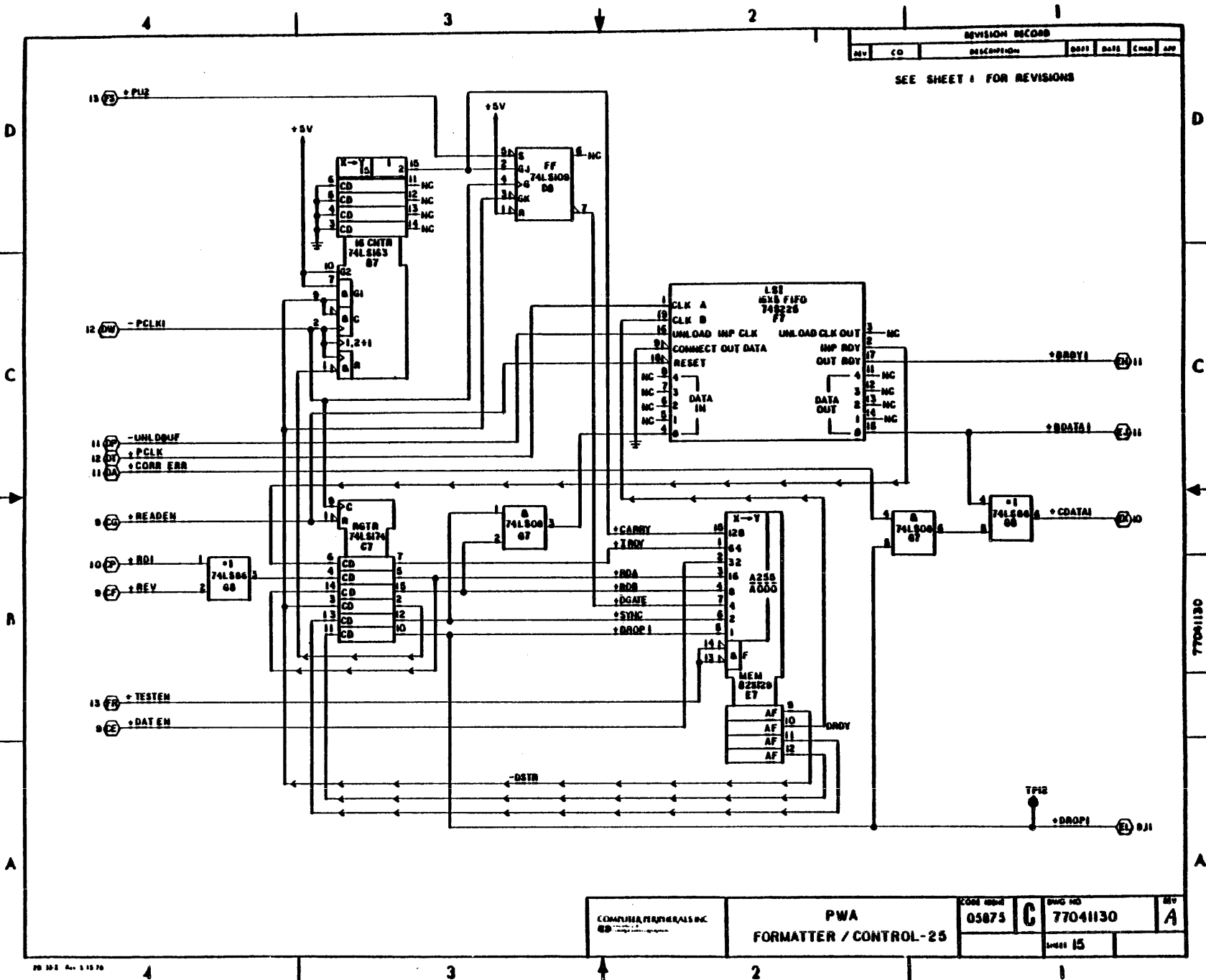
COMPTON ELECTRONICS INC 6050 ...	PWA FORMATTER / CONTROL - 25		FORM ID 05875	CD	DOC NO 77041130	REV B
			ISSUE 13			



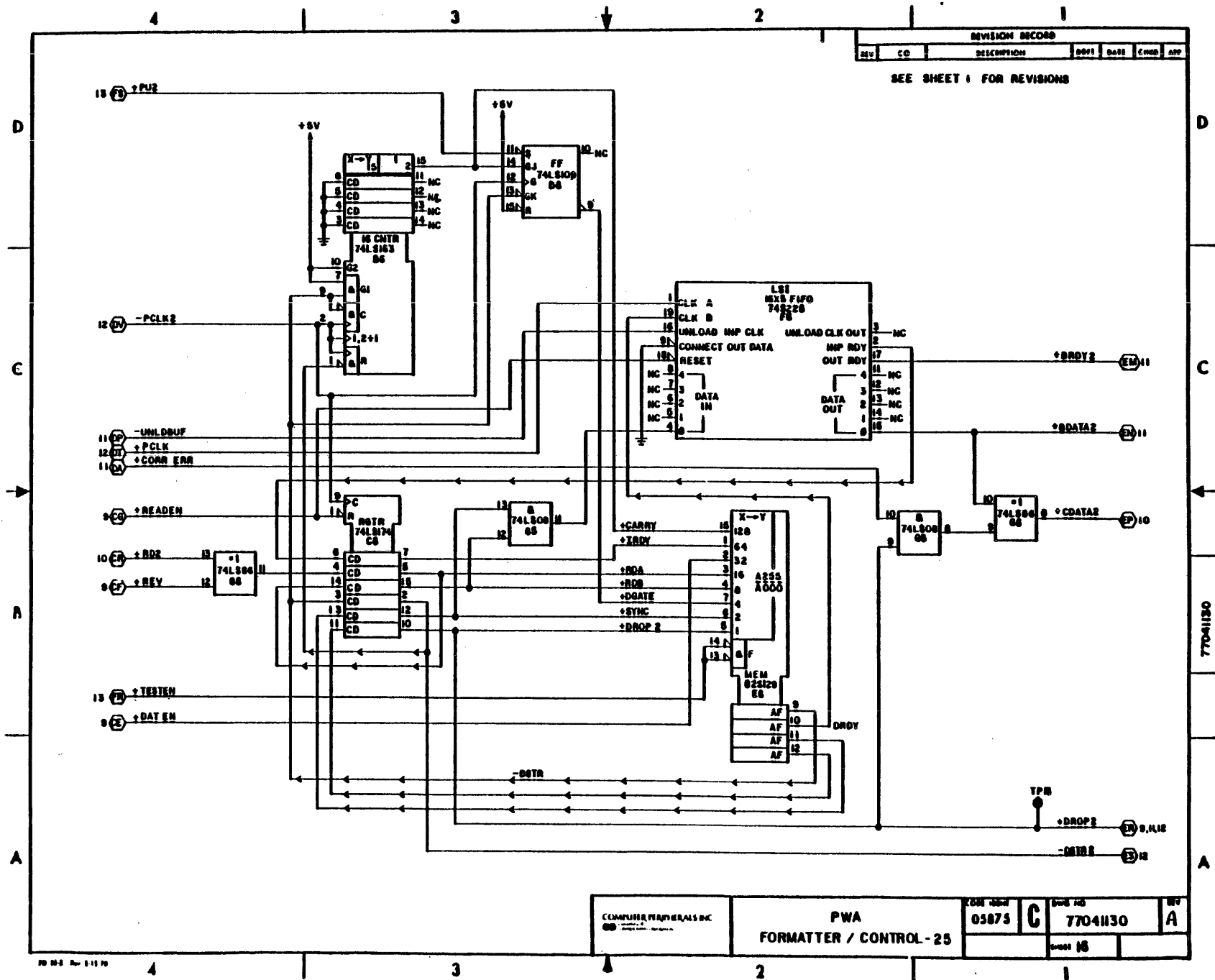


REVISION RECORD						
REV	CD	DESCRIPTION	DIFF	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS						

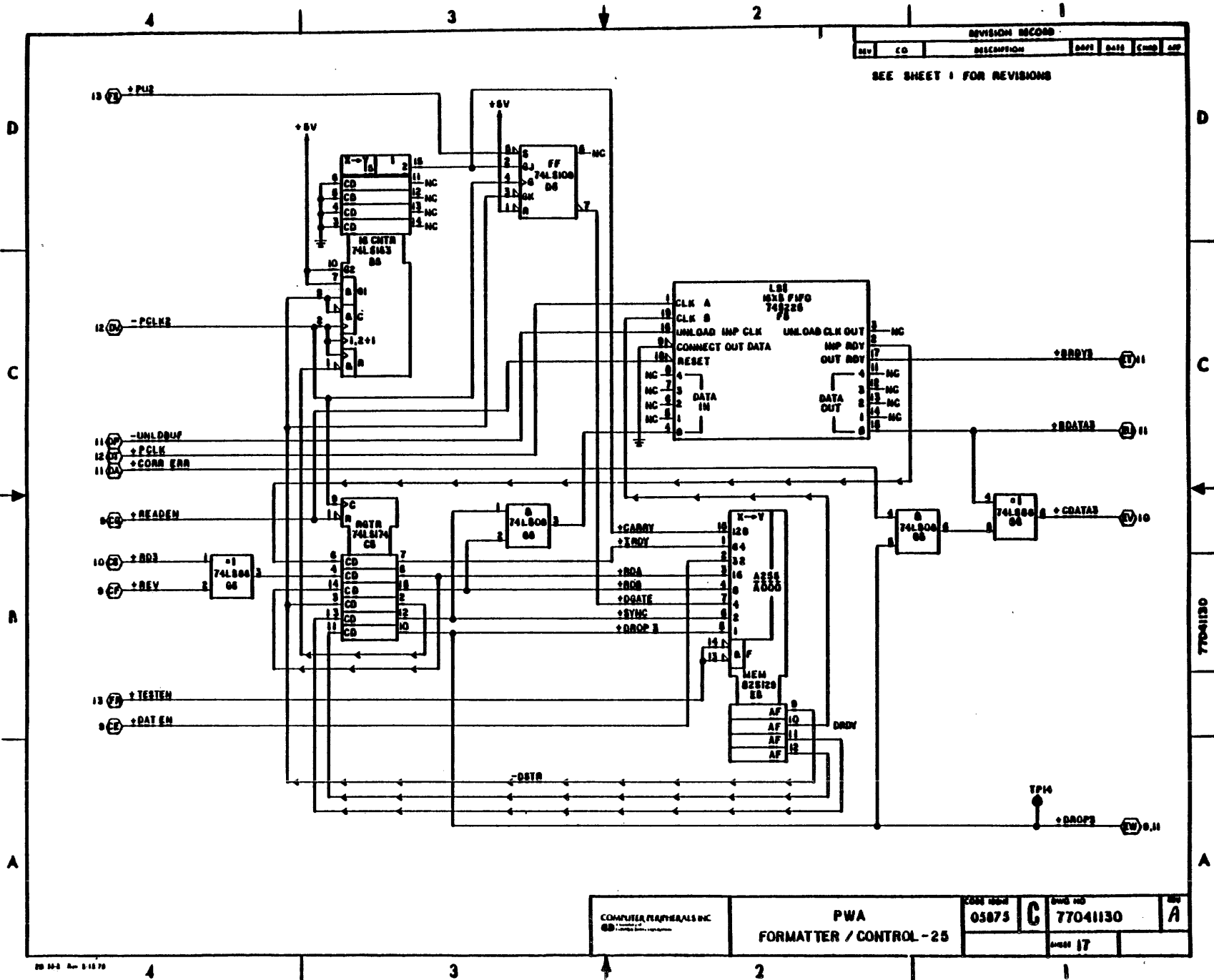
COMPUTER PRODUCTS INC.	PWA	FORM 1004	05875	DATE 103	77041130	REV	A
	FORMATTER / CONTROL - 25				POST 14		

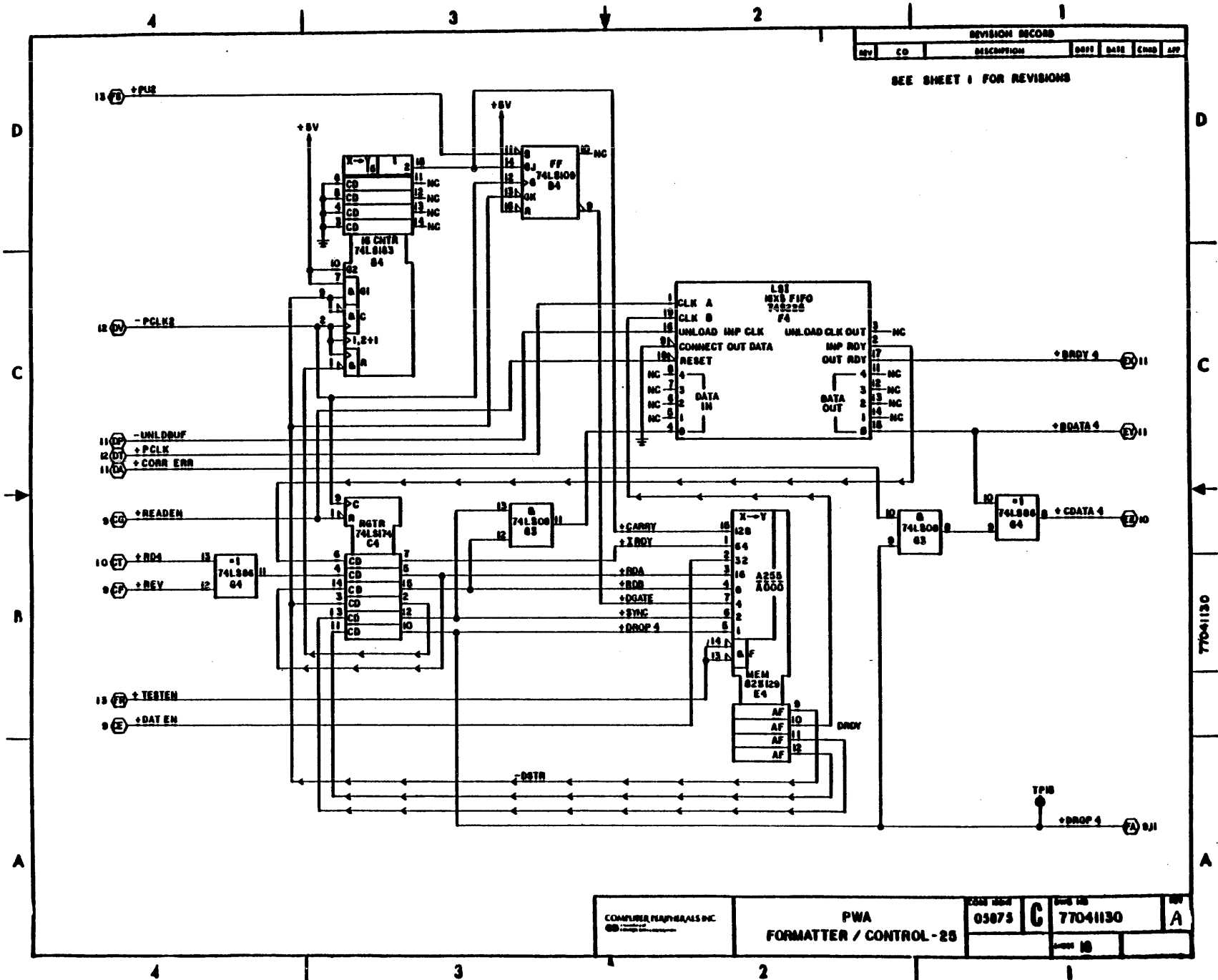


COMPUTER MATERIALS INC <small>8000 ...</small>	<b>PWA</b> <b>FORMATTER / CONTROL-25</b>	CODE 05875	<b>C</b> DWG NO <b>77041130</b>	SHEET 15 OF <b>A</b>
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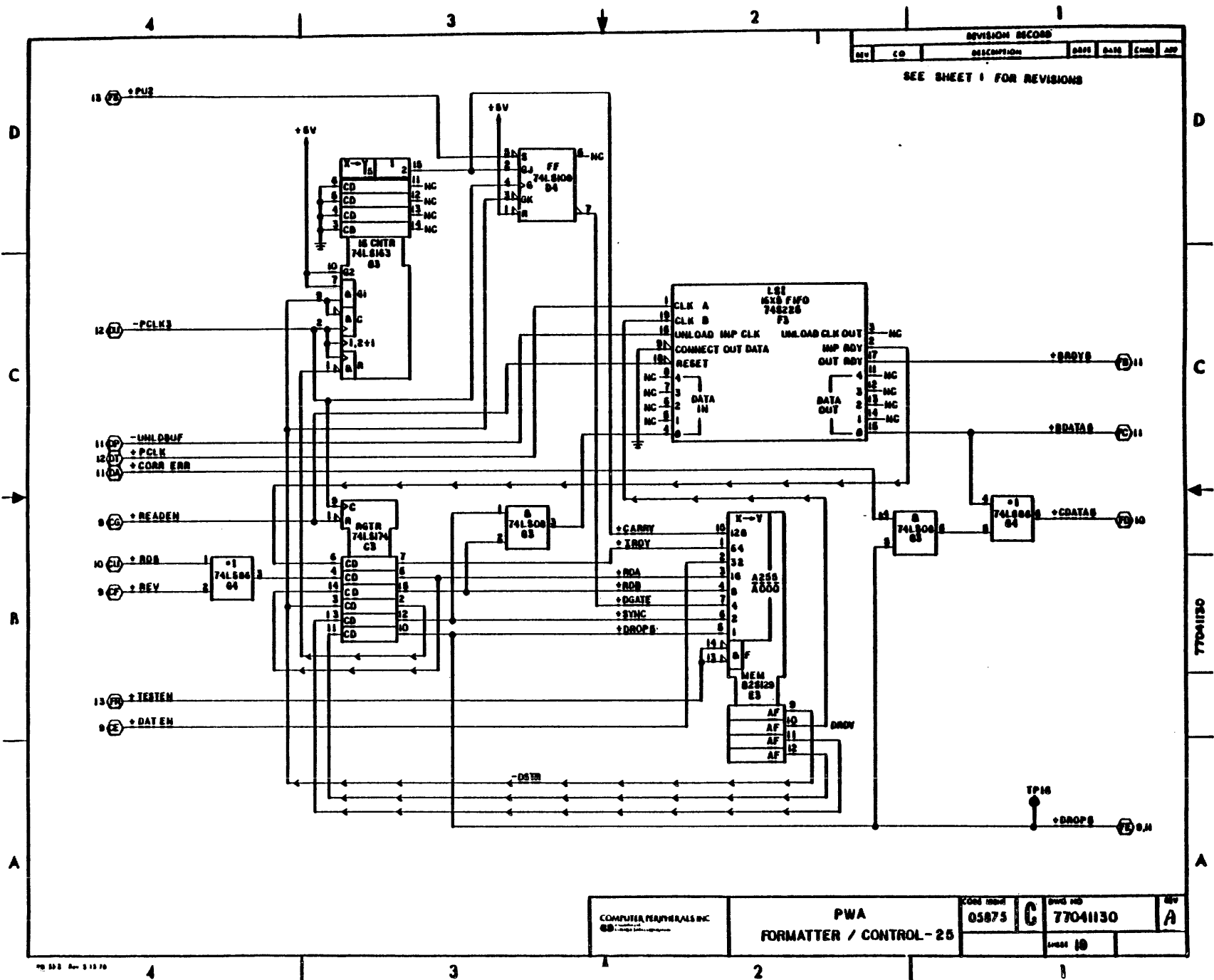


7704H30





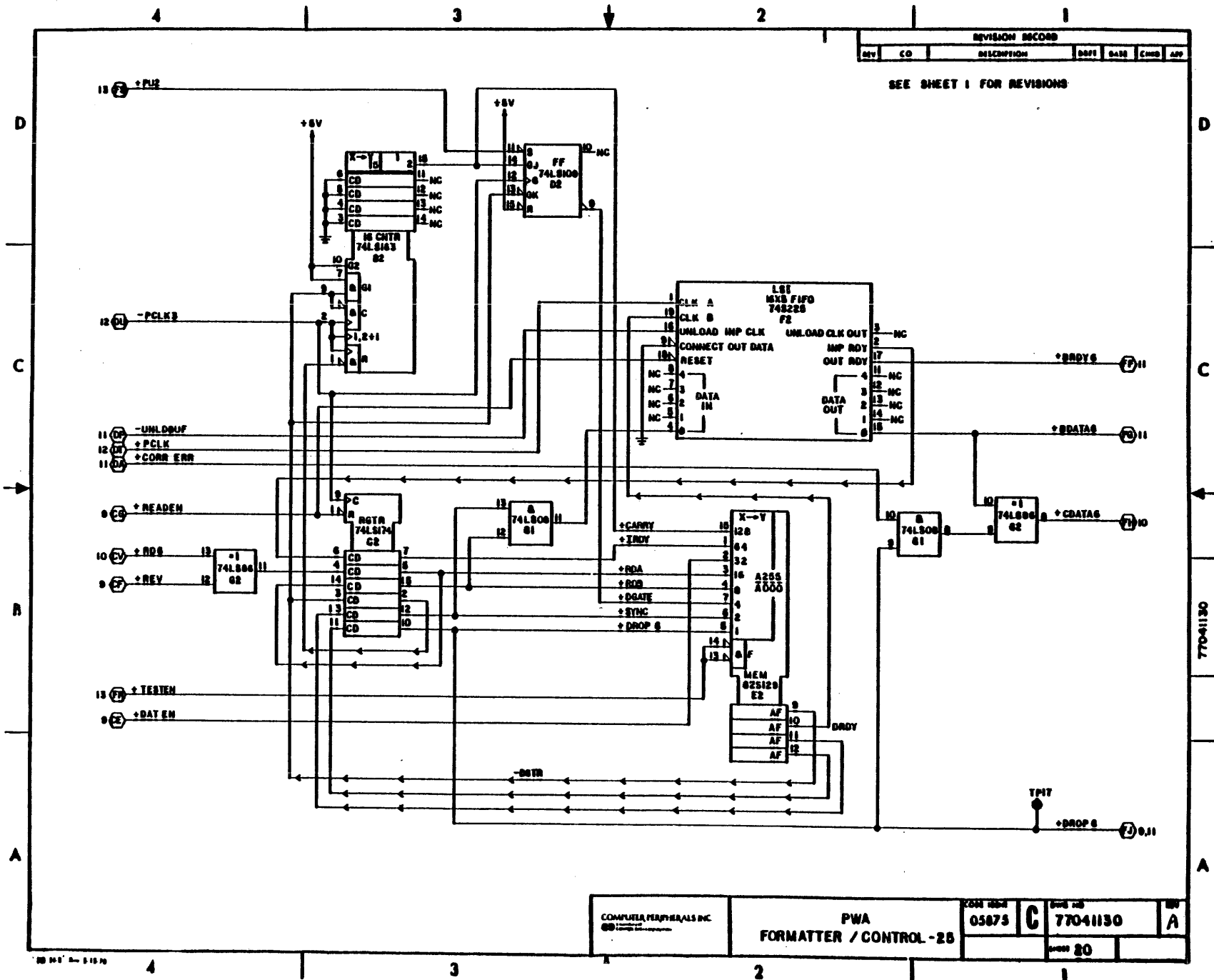
77041130



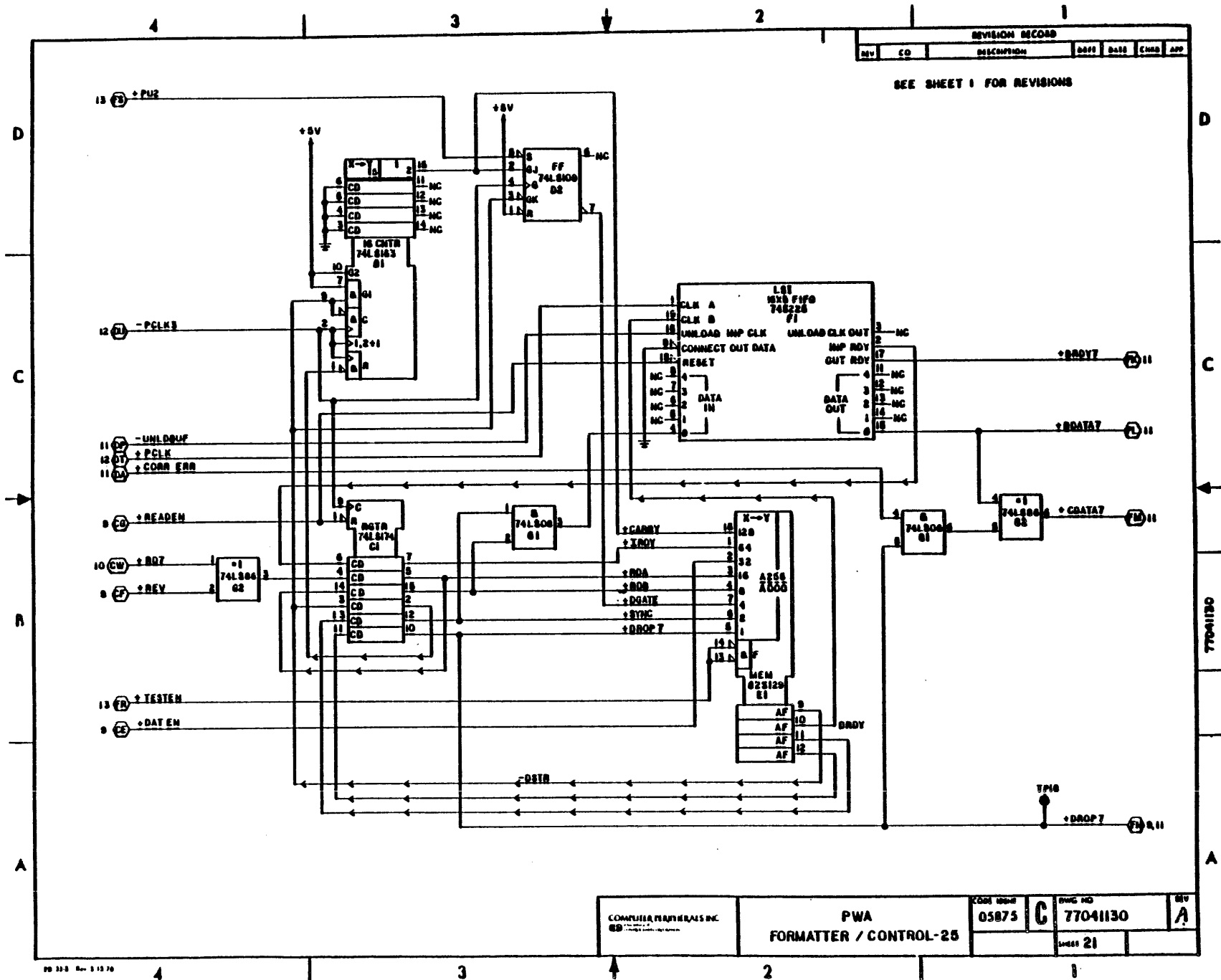
REVISION RECORD						
REV	CD	DESCRIPTION	DATE	BY	CHKD	APP
SEE SHEET 1 FOR REVISIONS						

COMPUTER PERIPHERALS INC. 68	PWA FORMATTER / CONTROL-25	CODE 05875	DESG 77041130	REV A
		G	10	10

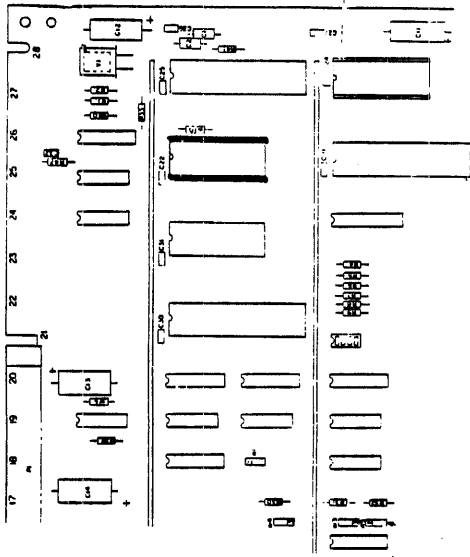
49769000



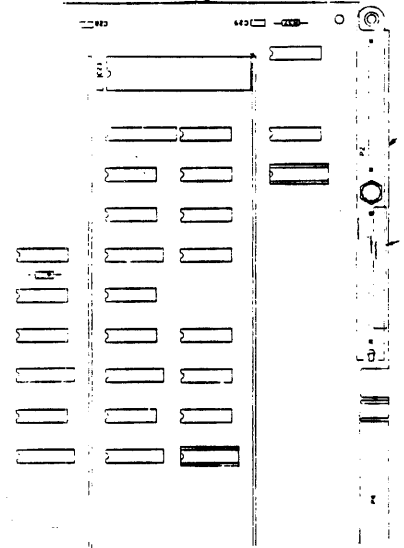
5-55



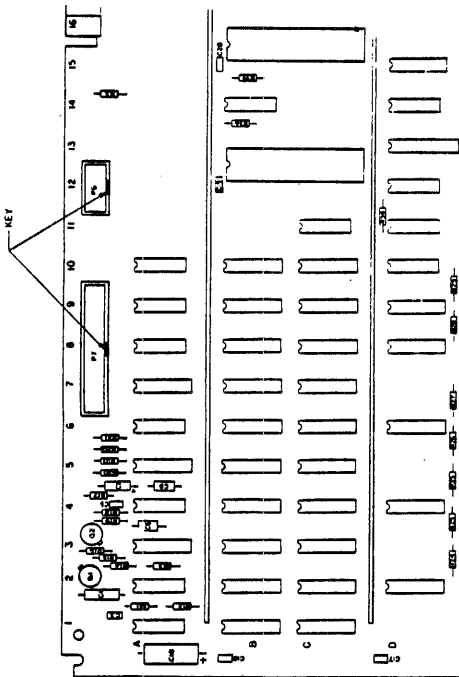




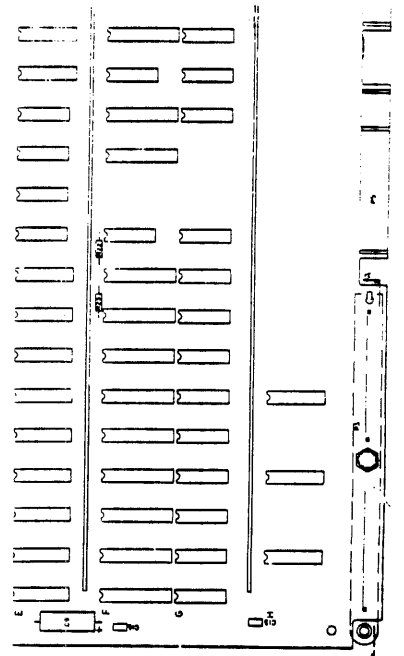
REFERENCE SHEET 1A



REFERENCE SHEET 1B

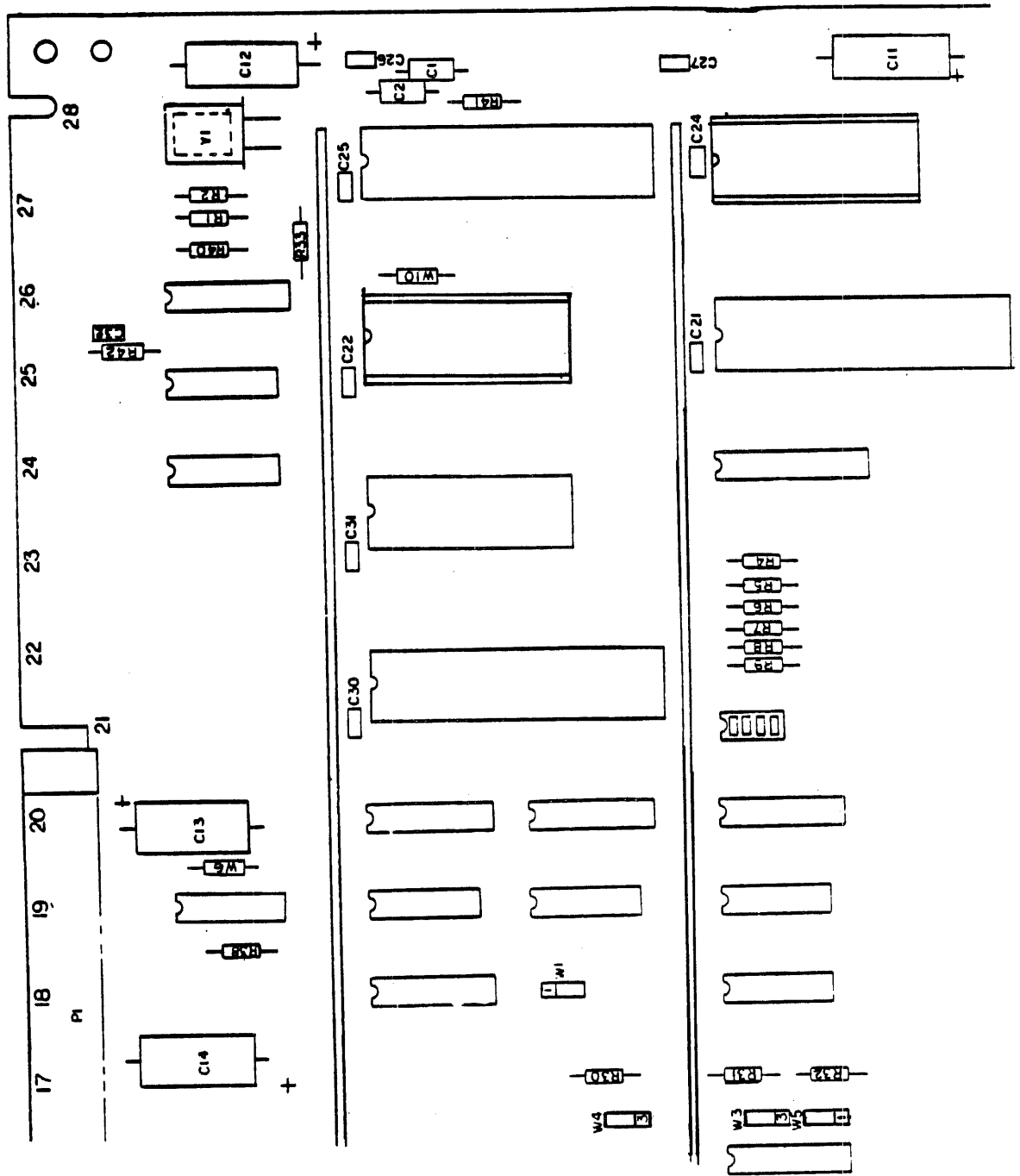


REFERENCE SHEET 1C

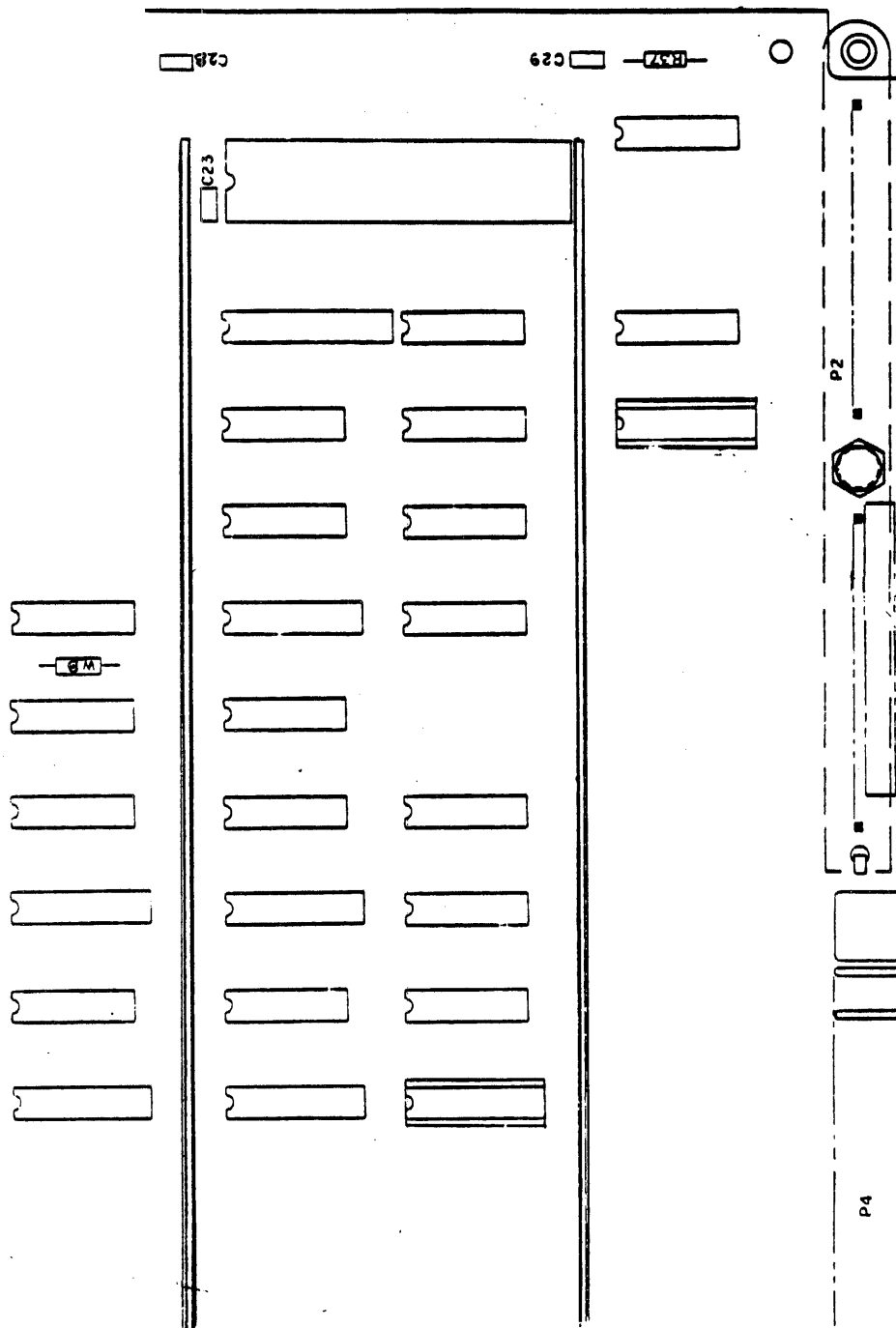


REFERENCE SHEET 1D

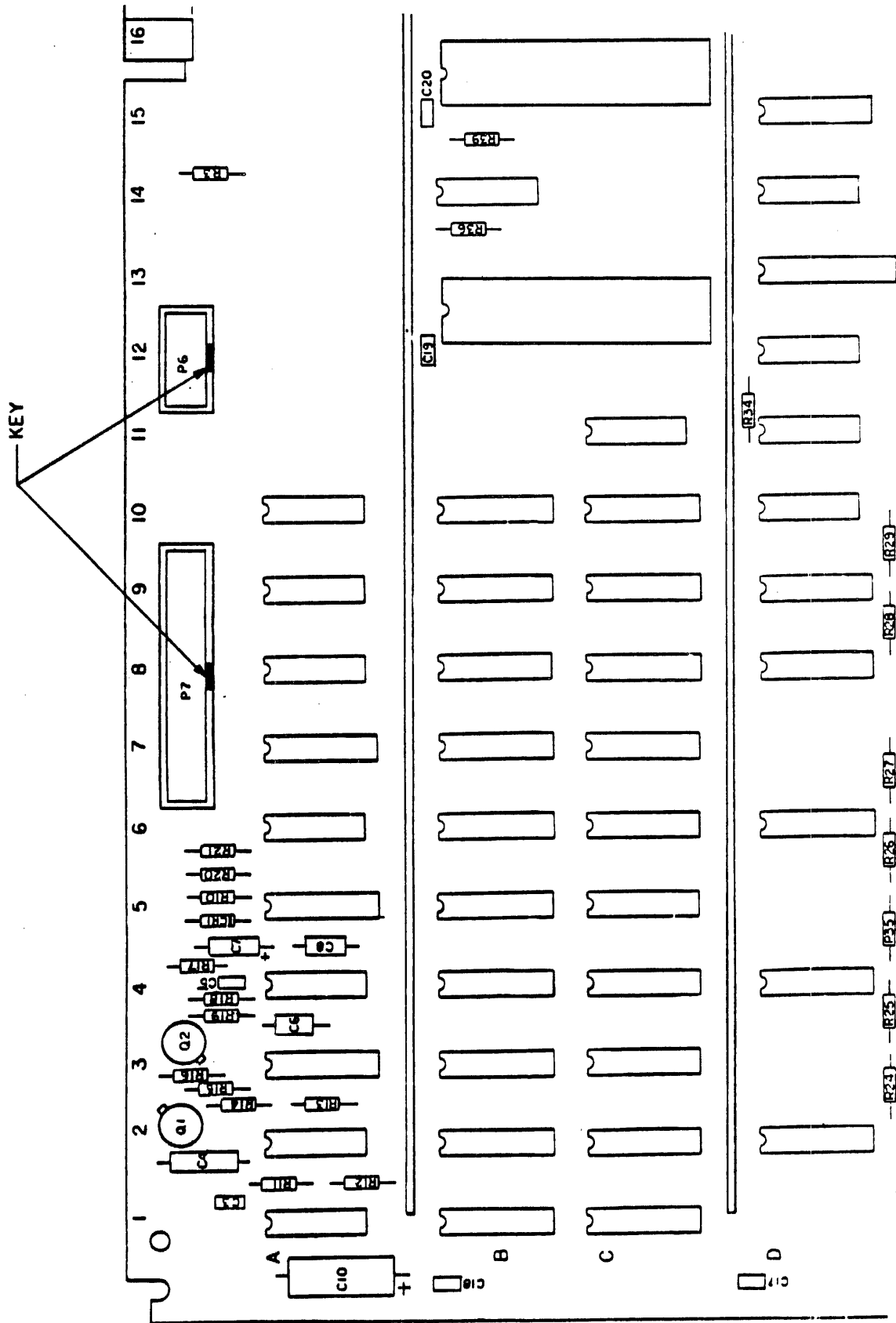
FORMATTER - CONTROL PWA P/N 77042070 LAYOUT (SHEET 1)



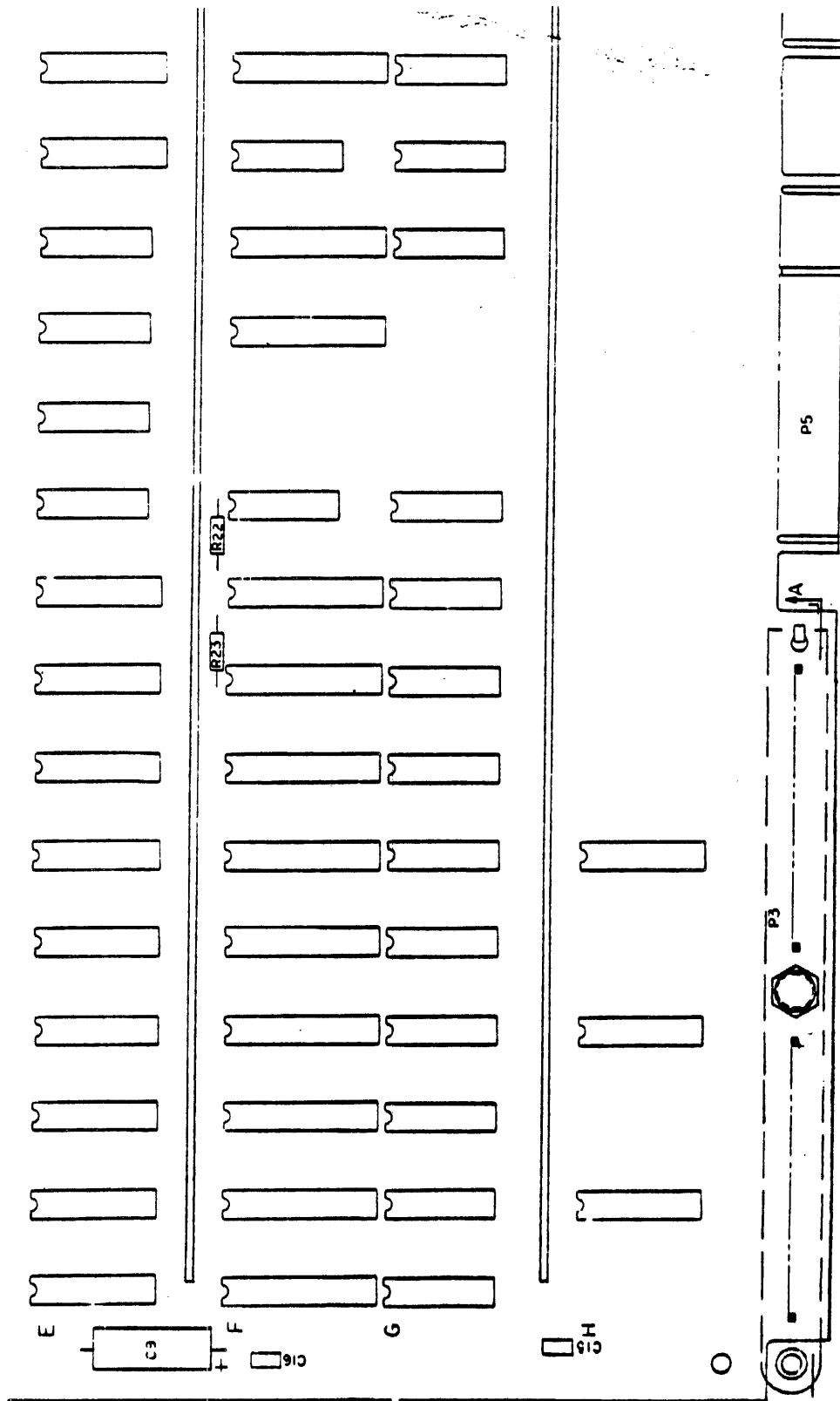
FORMATTER - CONTROL PWA P/N 77042070 LAYOUT (SHEET 1A)



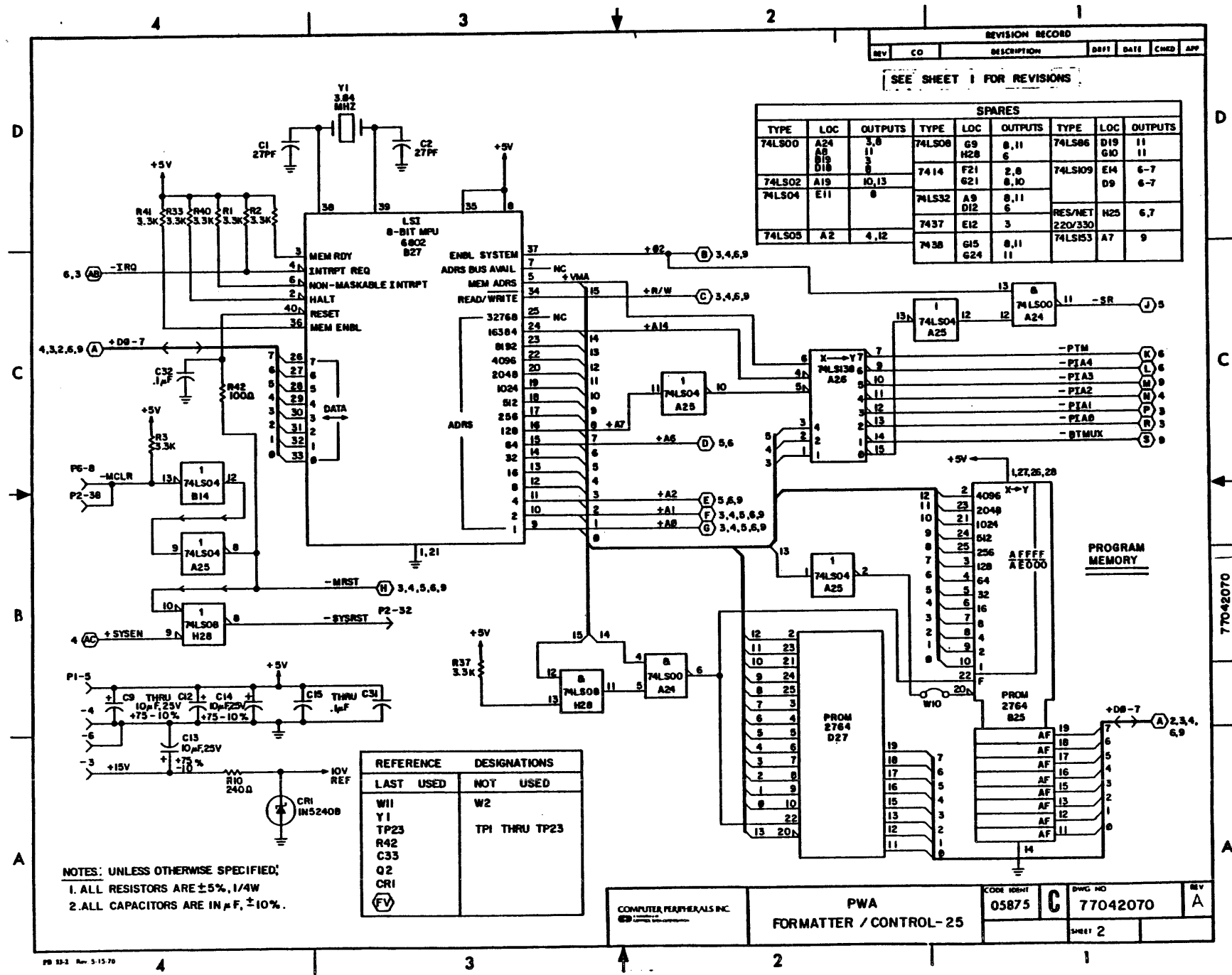
FORMATTER - CONTROL PWA LAYOUT P/N 77042070 (SHEET 1B)



FORMATTER - CONTROL PWA P/N 77042070 LAYOUT (SHEET 1C)



FORMATTER - CONTROL PWA P/N 77042070 LAYOUT (SHEET 1D)



REVISION RECORD					
REV	CO	DESCRIPTION	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS					

SPARES									
TYPE	LOC	OUTPUTS	TYPE	LOC	OUTPUTS	TYPE	LOC	OUTPUTS	
74LS00	A24	3,8	74LS08	G9	8,11	74LS86	D19	11	
	A8	11		H28	6		G10	11	
	B19	3		F21	2,8		E14	6-7	
	D18	8		G21	8,10		D9	6-7	
74LS02	A19	10,13		A9	8,11	RES/MET	H25	6,7	
74LS04	E11	8		D12	3	220/330			
				7437	E12	6			
				7438	G15	8,11	74LS153	A7	9
					G24	11			

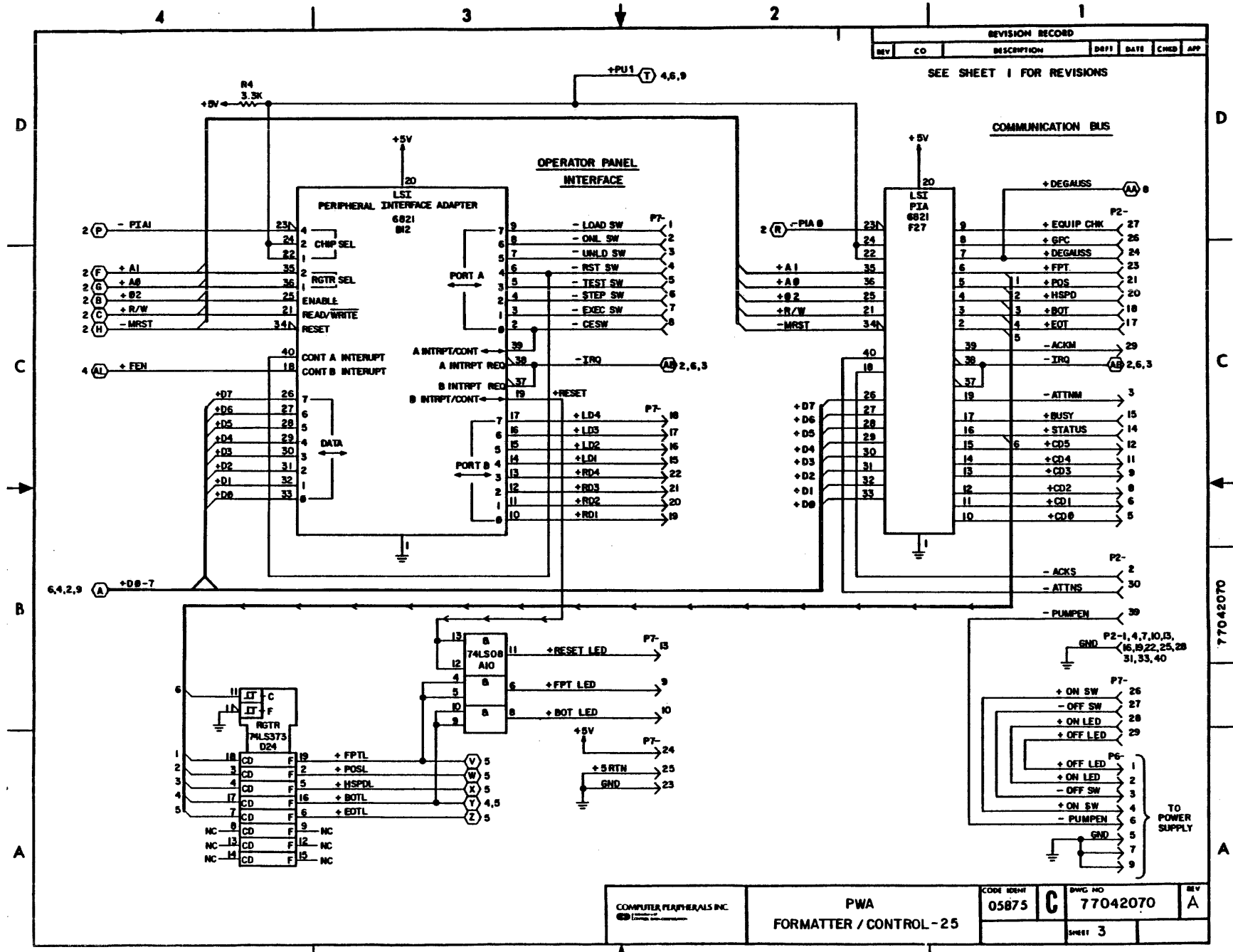
REFERENCE DESIGNATIONS	
LAST USED	NOT USED
W11	W2
Y1	TP1 THRU TP23
TP23	
R42	
C33	
Q2	
CRI	
FV	

NOTES: UNLESS OTHERWISE SPECIFIED;  
 1. ALL RESISTORS ARE ±5%, 1/4W  
 2. ALL CAPACITORS ARE IN μF, ±10%.

COMPUTER PERIPHERALS INC.	PWA	CODE 05875	DWG NO	REV
	FORMATTER / CONTROL- 25	G	77042070	A
			SHEET 2	

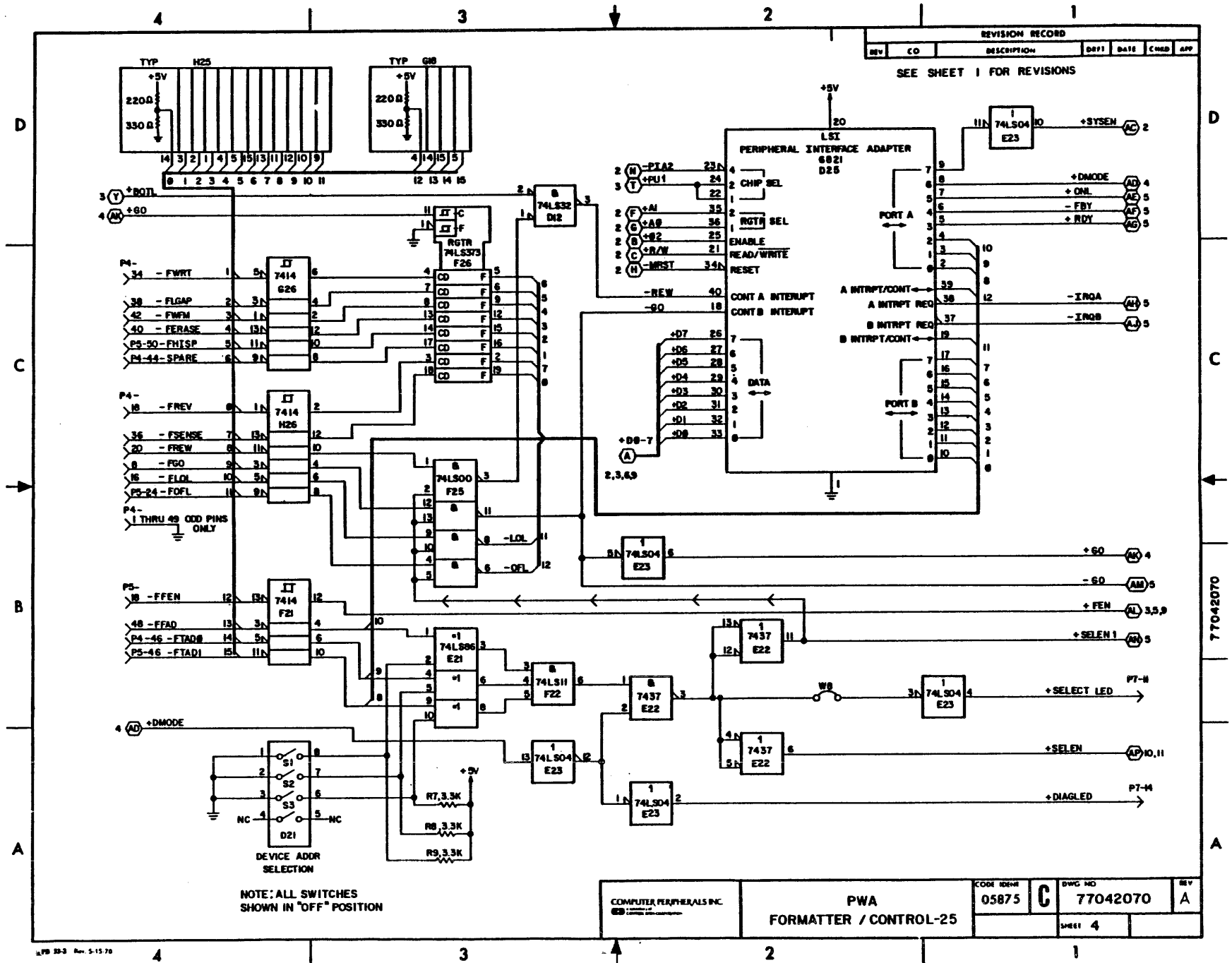
49769000

5-63



77042070

A

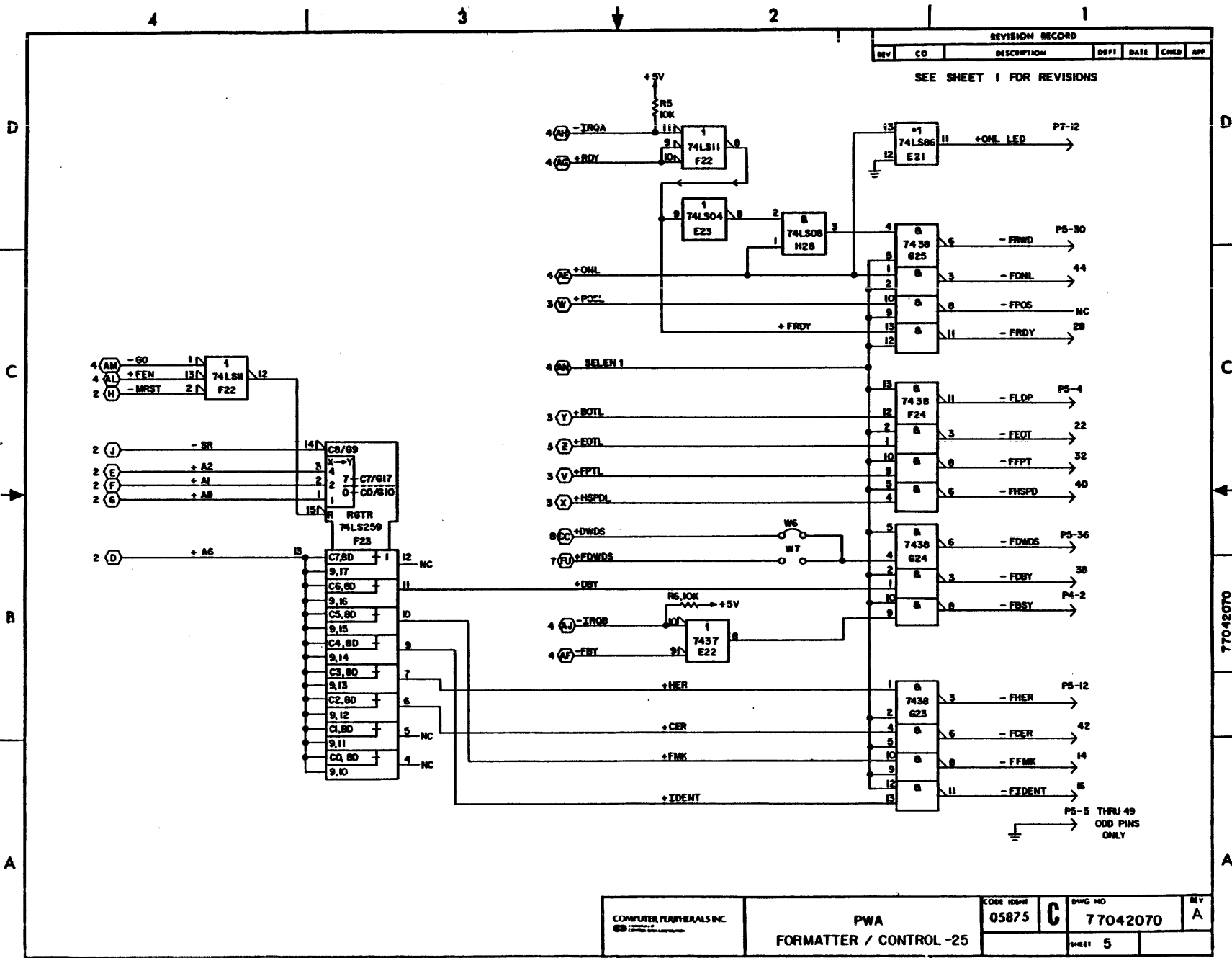


77042070



49769000

5-65



COMPUTER PERIPHERALS INC. PWA	05875	G	77042070	REV A
	FORMATER / CONTROL -25			5

D  
C  
B  
A

D  
C  
B  
A

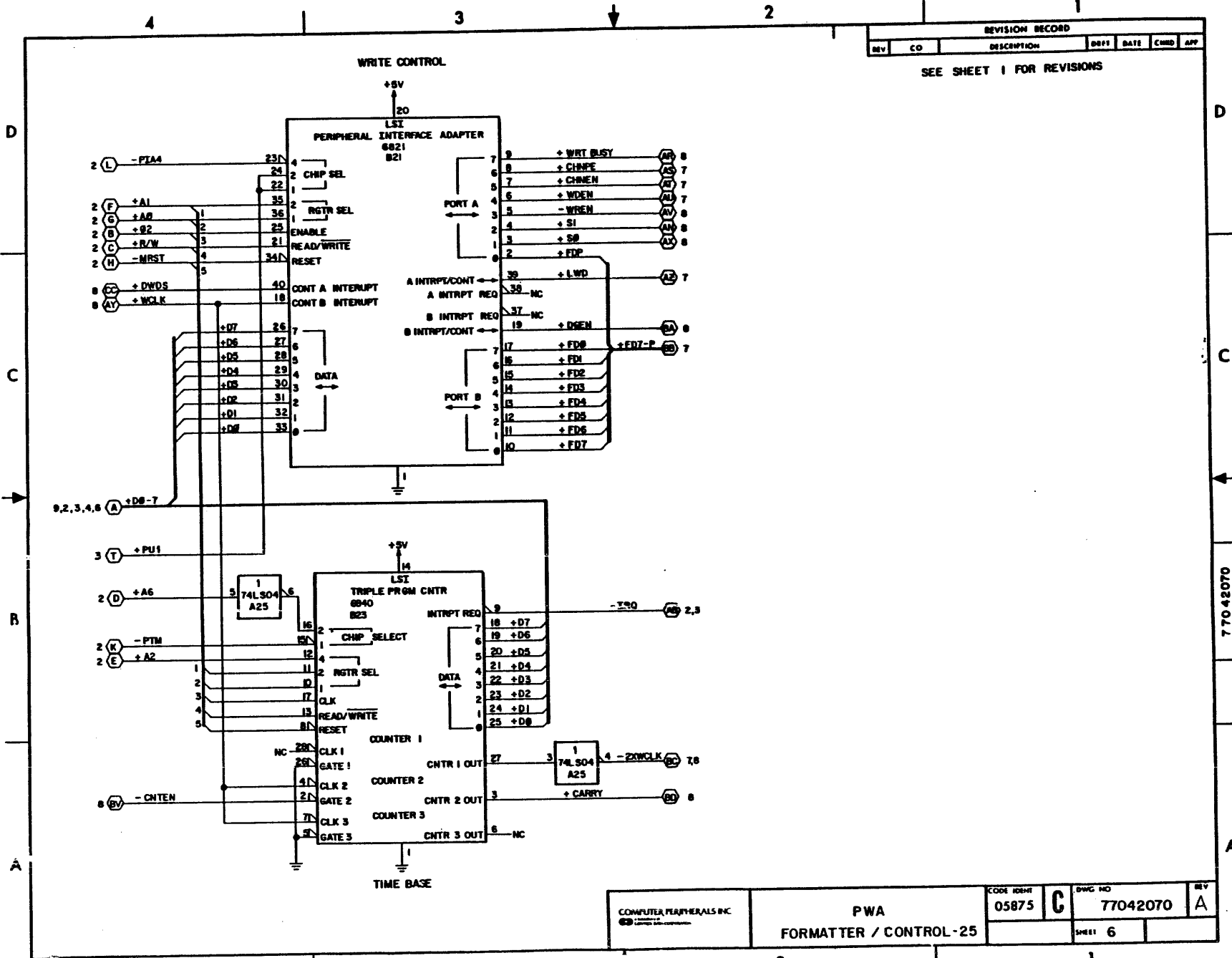
4 3 2 1

4 3 2 1

77042070

P5-5 THRU 49  
ODD PINS  
ONLY

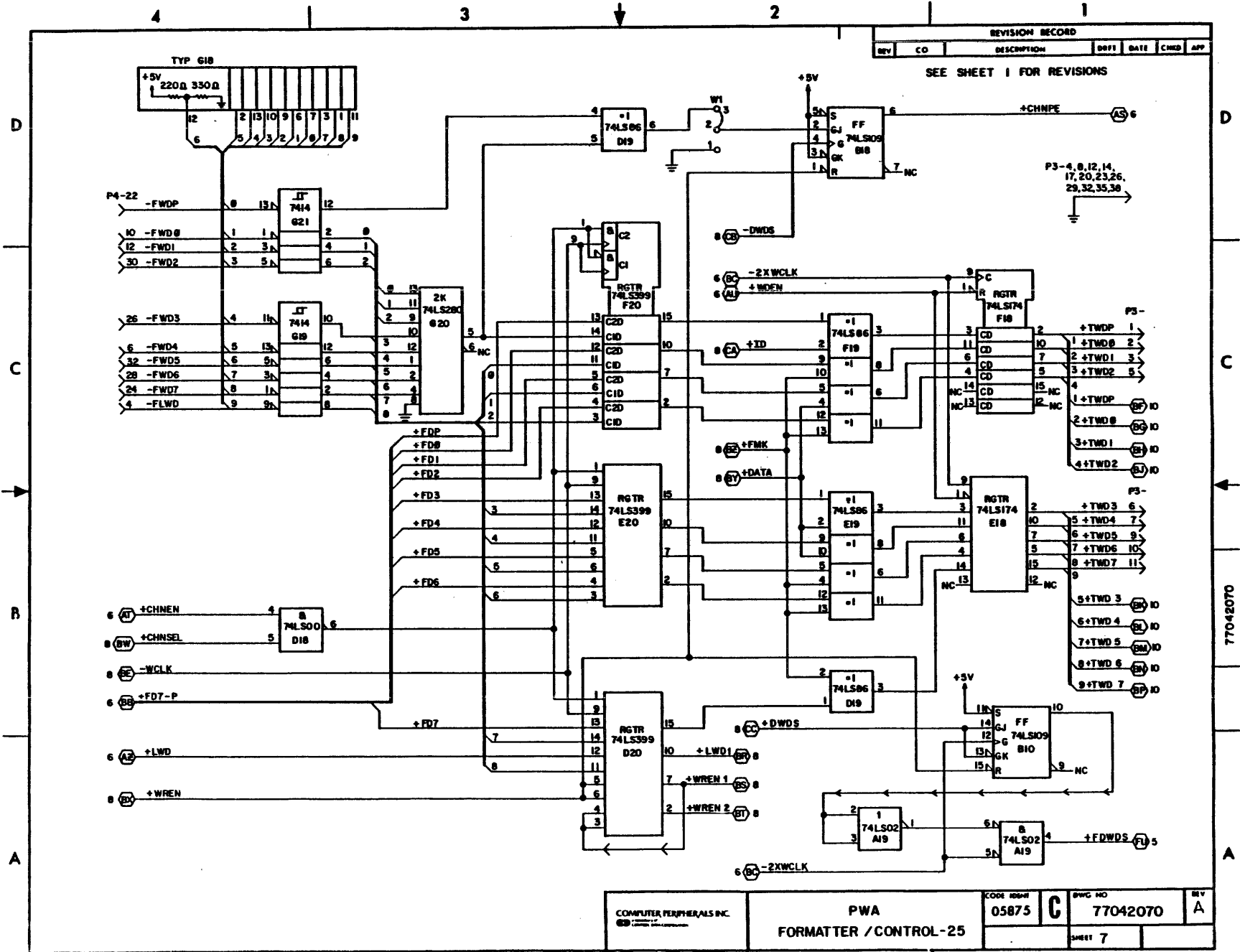
REVISION RECORD						
REV	CO	DESCRIPTION	BY	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS						



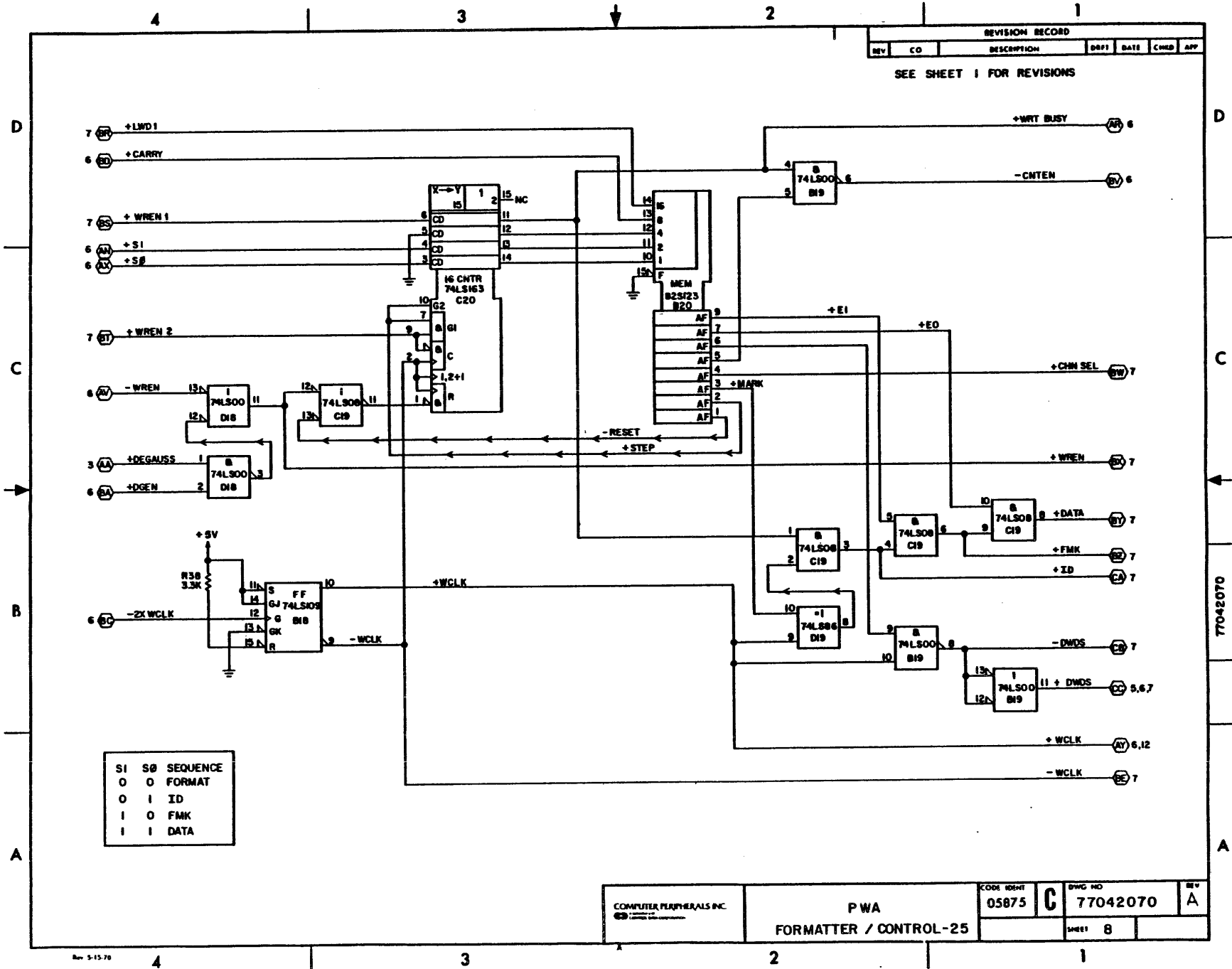
COMPUTER PERIPHERALS INC.	PWA	CODE IDENT	DWG NO	REV
		05875 C	77042070	A
FORMATTER / CONTROL-25			SHEET 6	

49769000

5-67



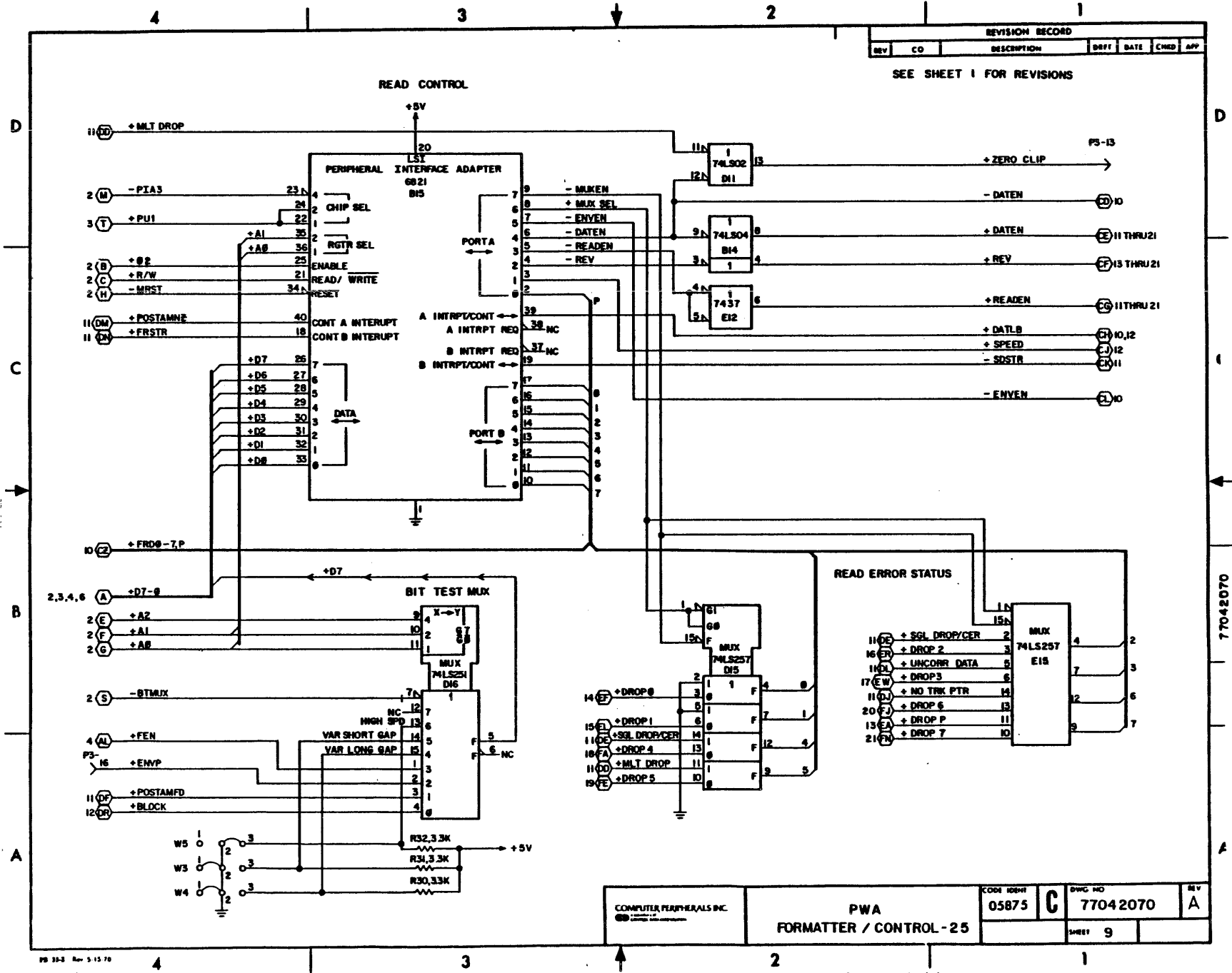
77042070



77042070

49769000

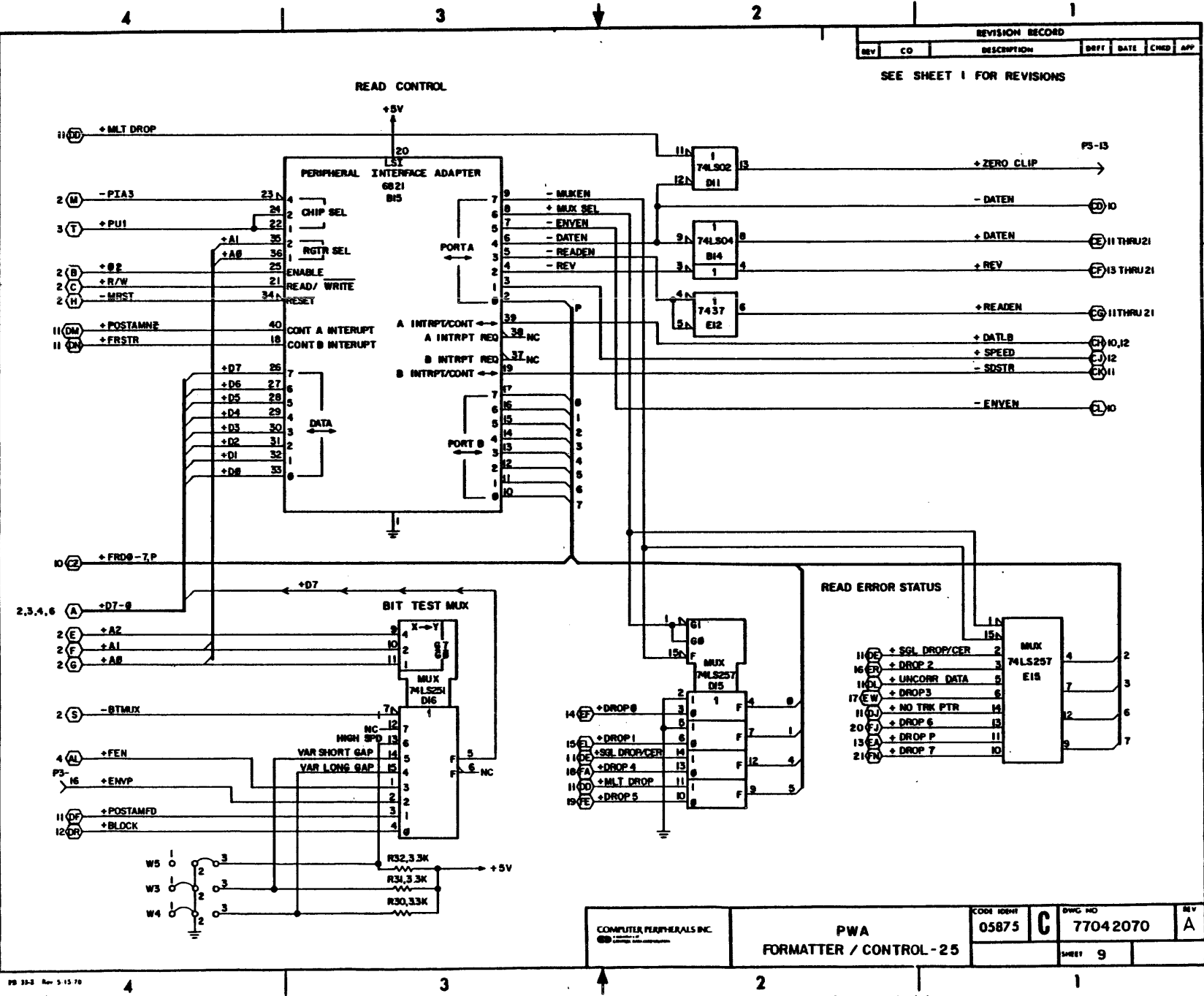
5-69



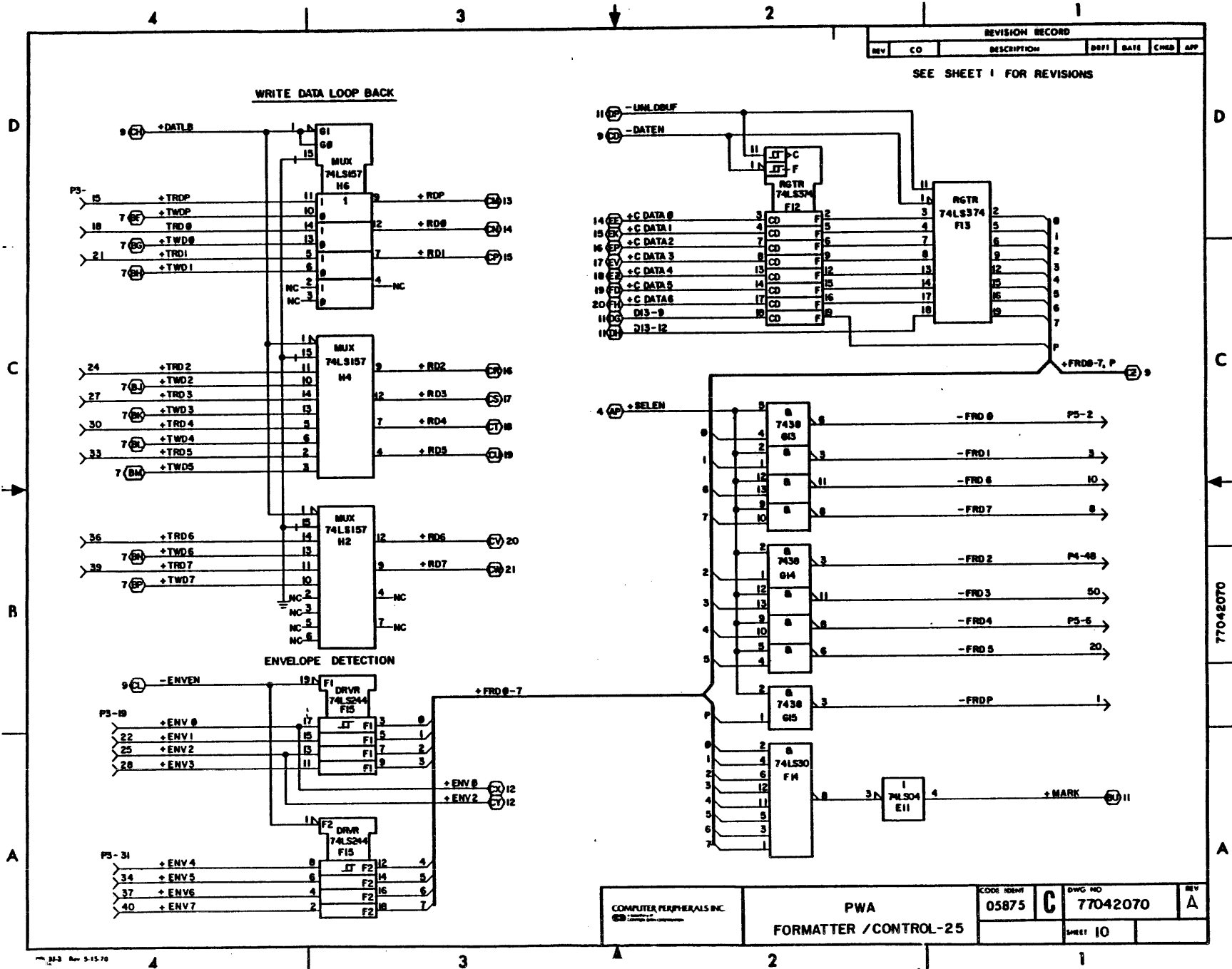
REVISION RECORD					
REV	CO	DESCRIPTION	DIFF	DATE	CHKD APP
SEE SHEET 1 FOR REVISIONS					

D  
C  
B  
A

D  
C  
B  
A



77042070



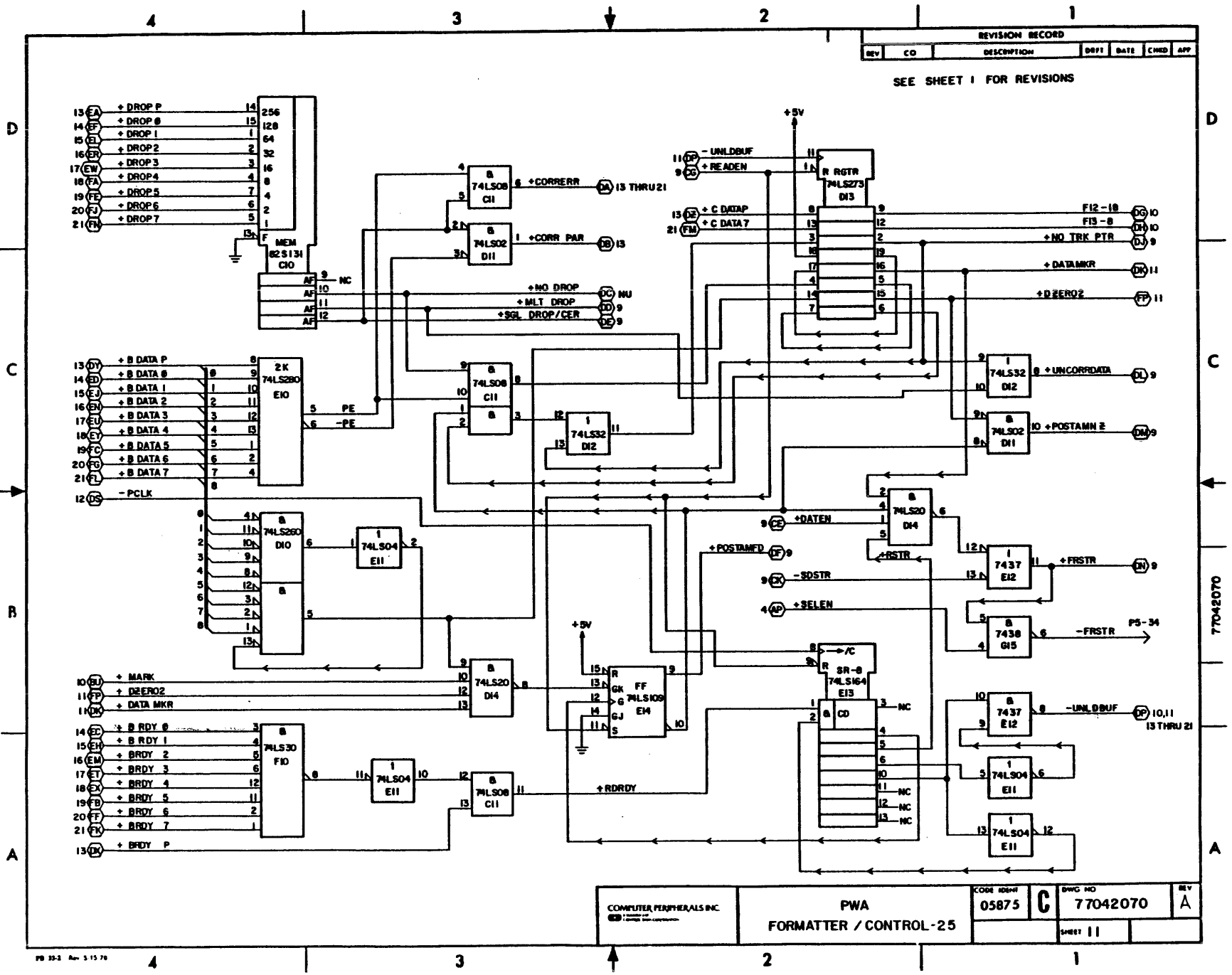
REVISION RECORD						
REV	CO	DESCRIPTION	DRN	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS						

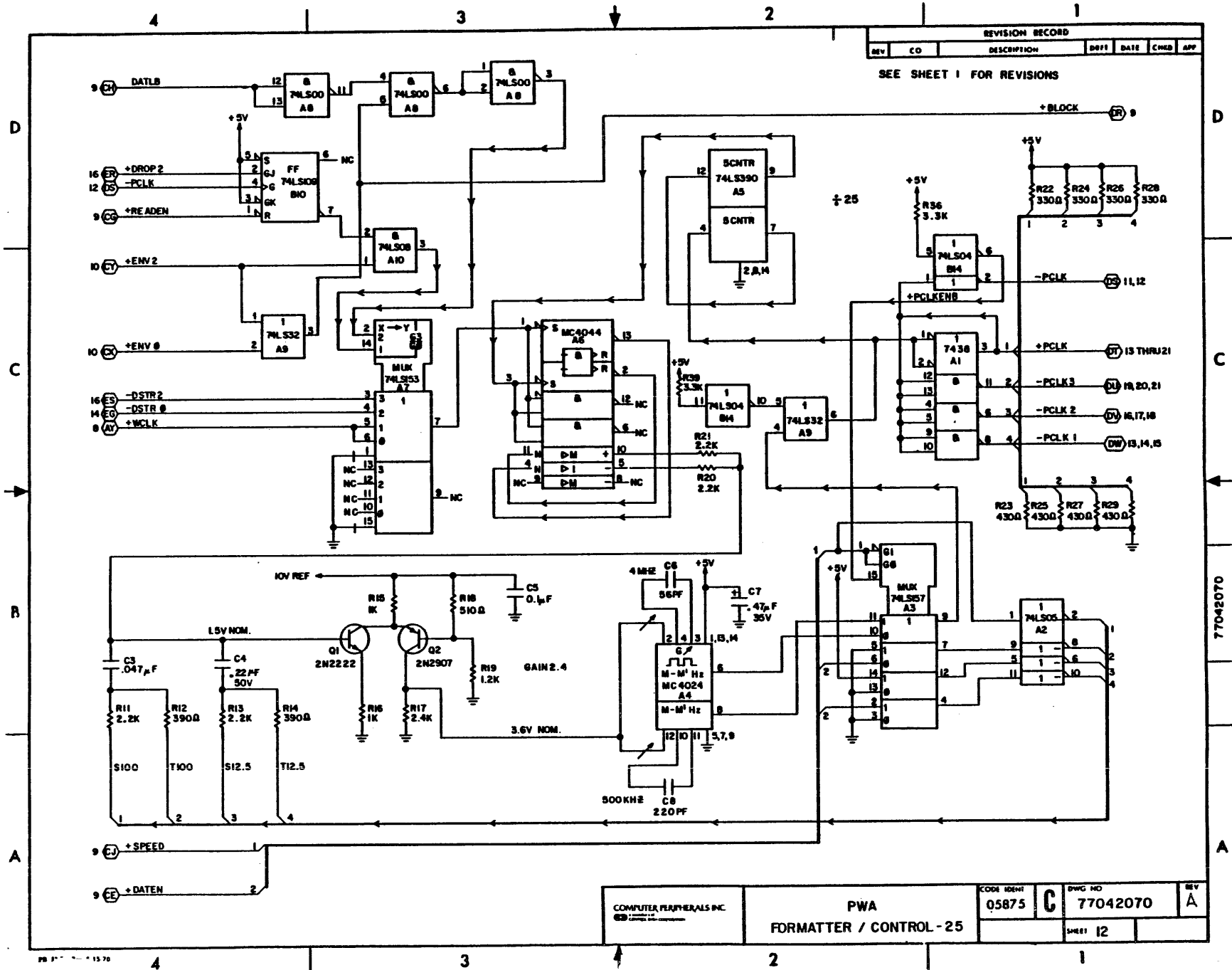
COMPUTER PERIPHERALS INC.	PWA	CODE 05875	DWG NO 77042070	REV A
FORMATTER / CONTROL-25		C	SHEET 10	

77042070

4-9769000

5-71



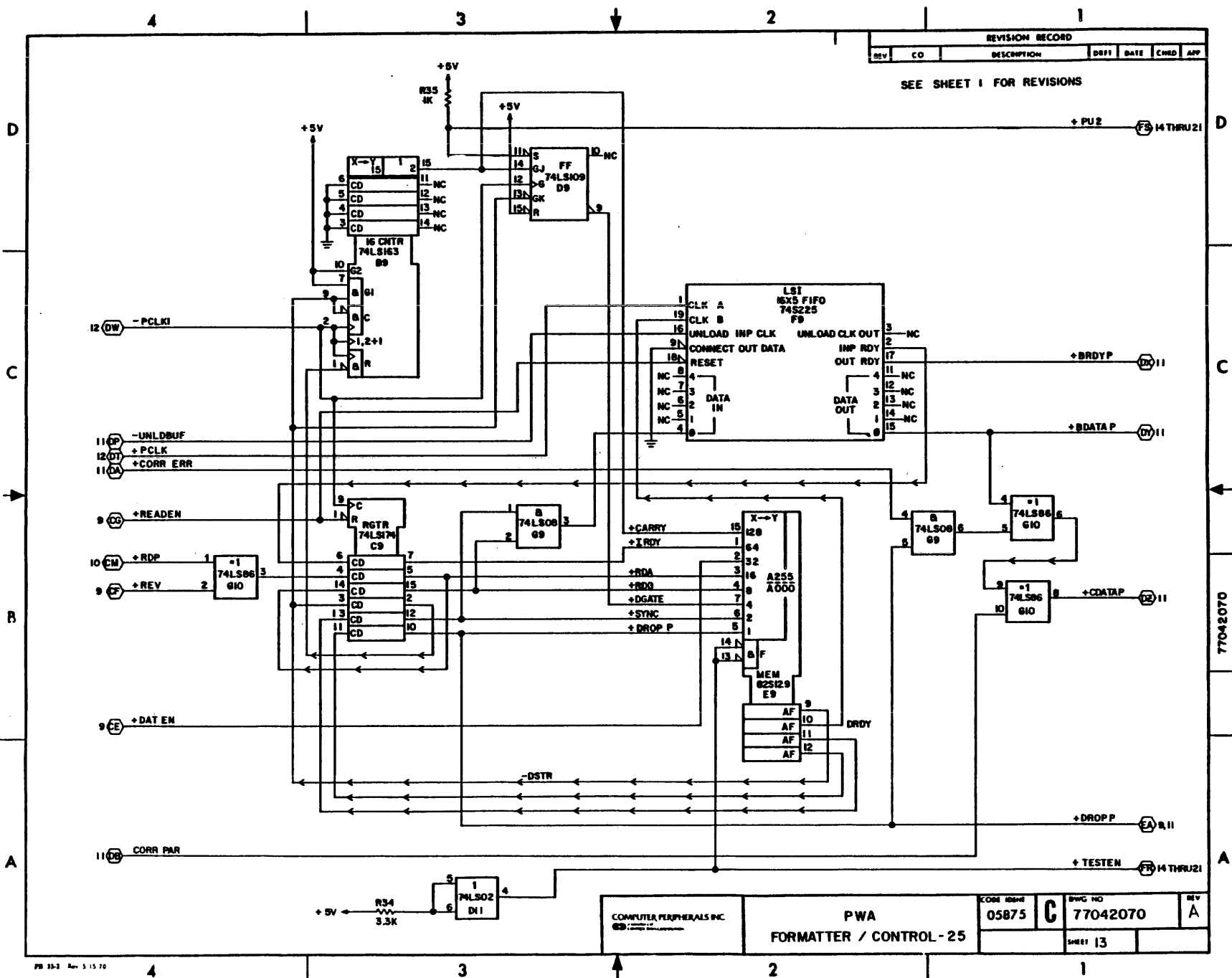


77042070



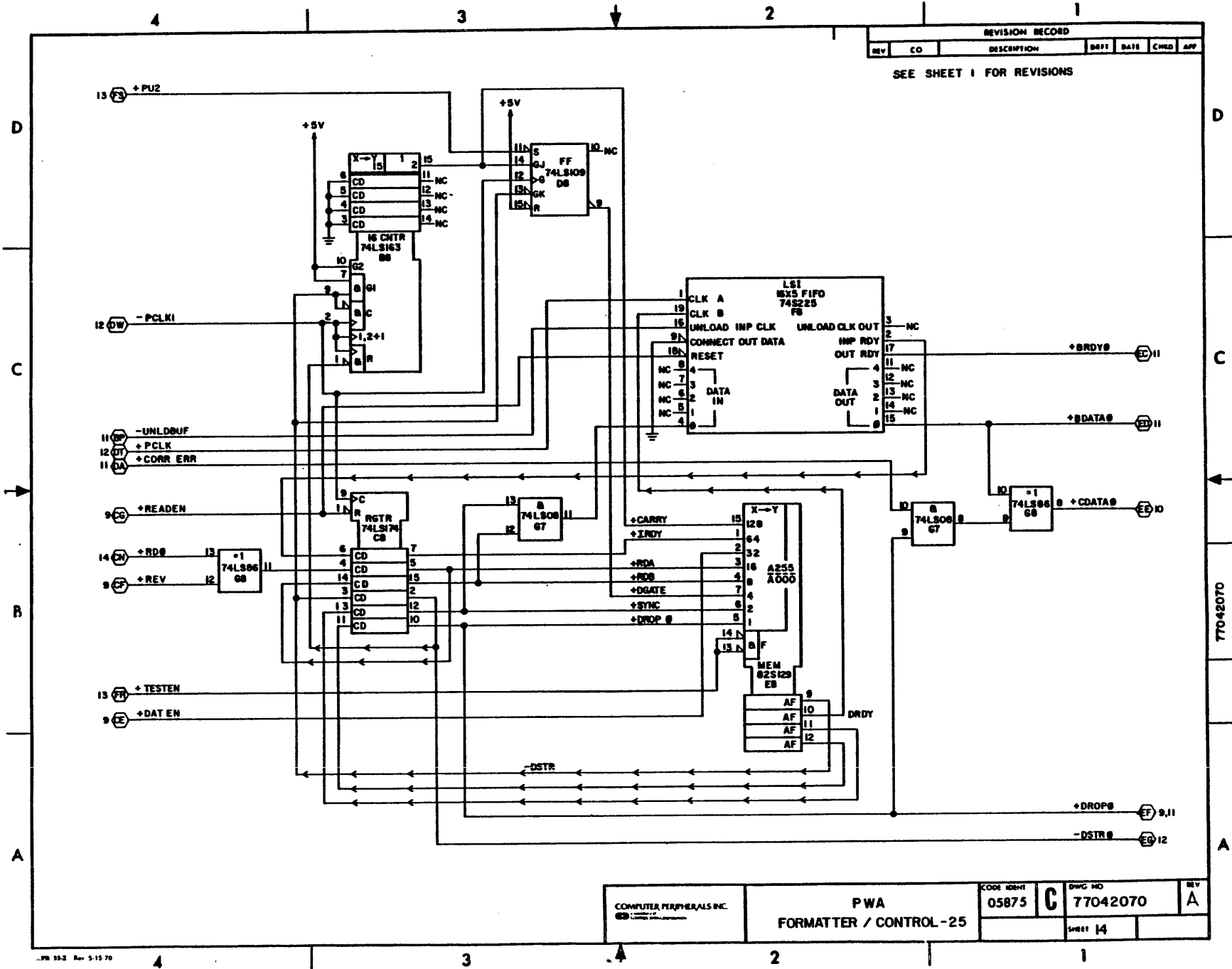
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5-73



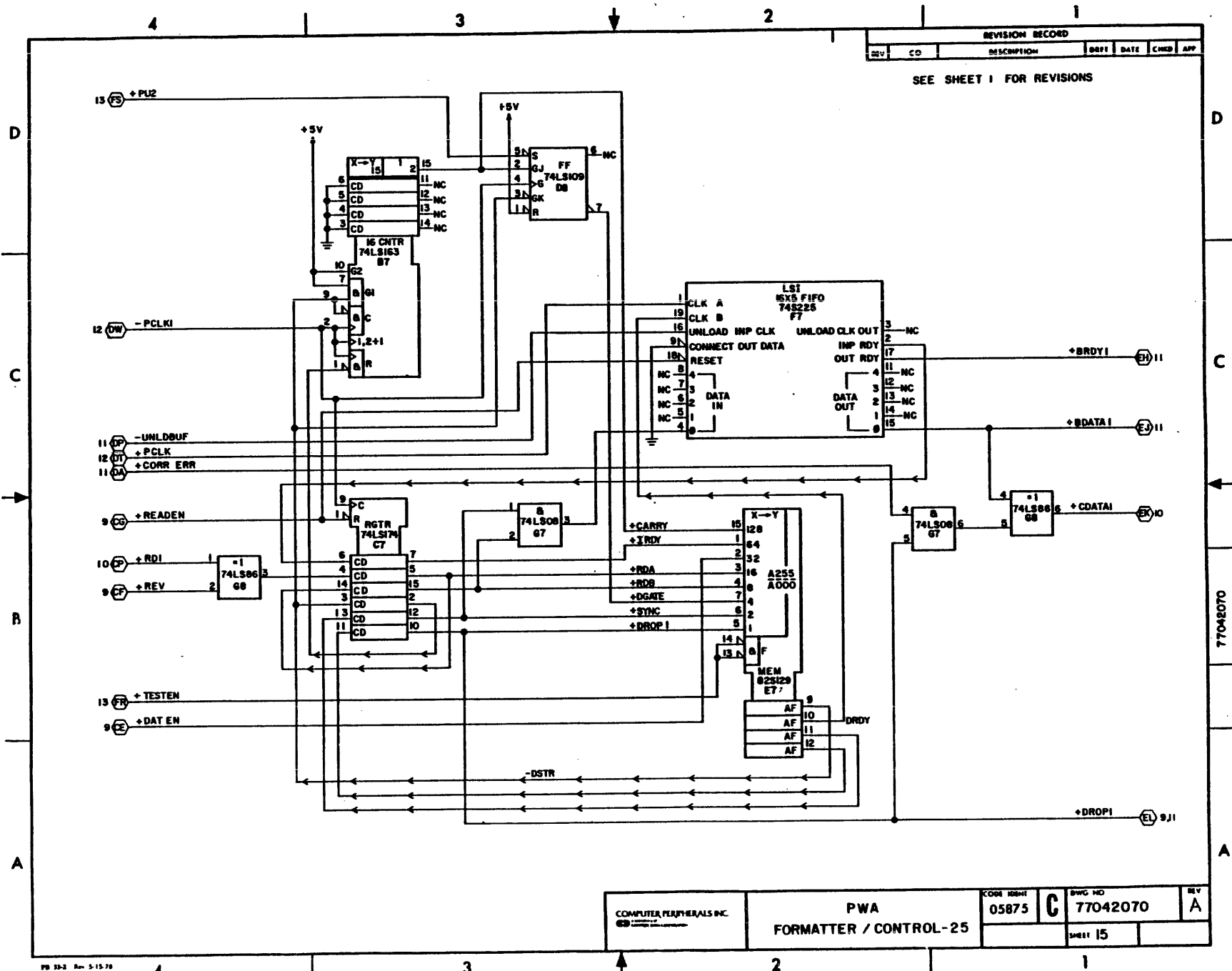
REVISION RECORD					
REV	CO	DESCRIPTION	DRFT	DATE	CHKD APP
SEE SHEET 1 FOR REVISIONS					

COMPUTER PERIPHERALS INC.	PWA		CORE ID#	DRWG NO	REV
	FORMATTER / CONTROL - 25		05875	C 77042070	A
			SHEET 13		



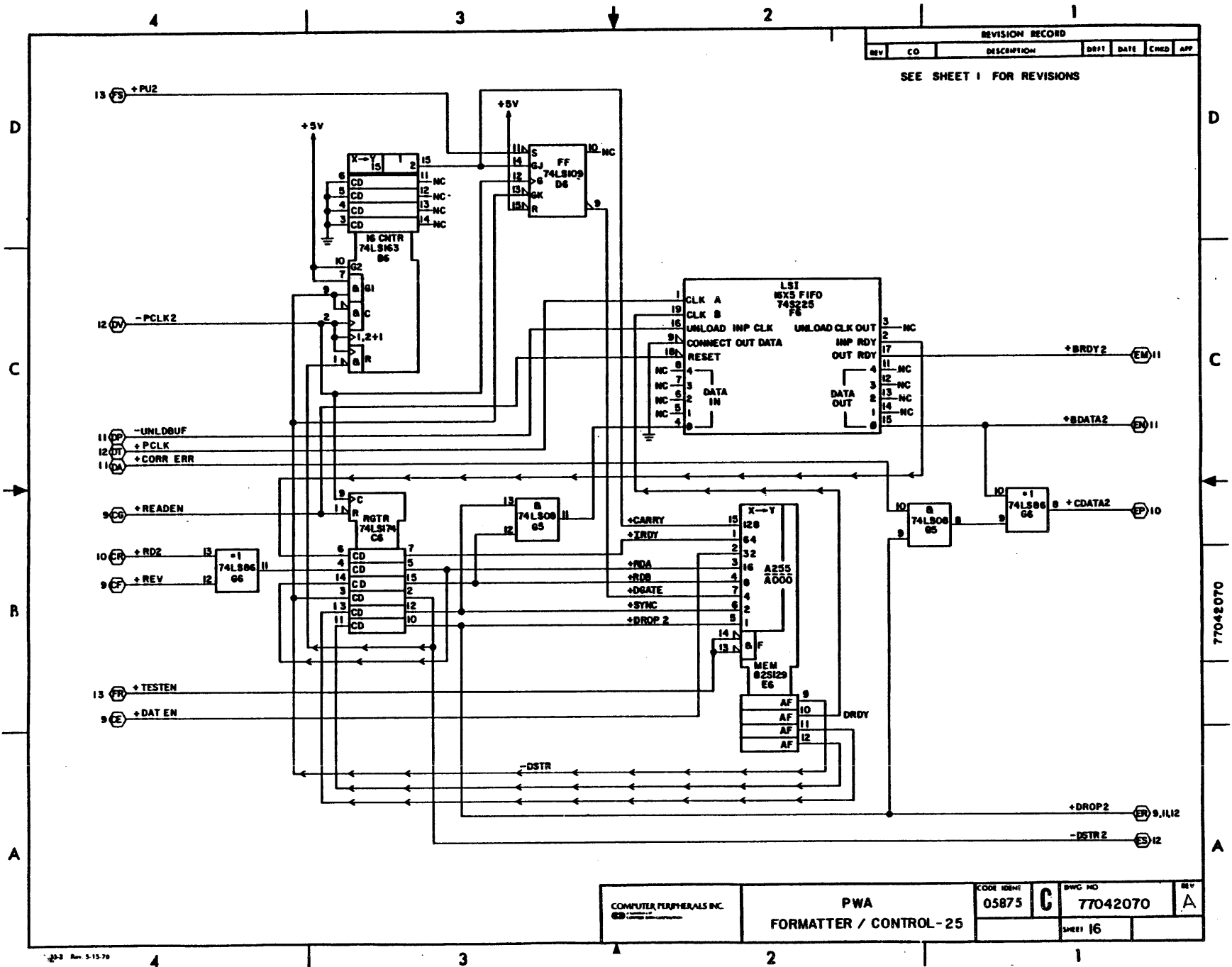
49769000

5-75



COMPUTER PERIPHERALS INC.	PWA		CODE IDENT	DWG NO	REV
	FORMATTER / CONTROL-25		05875	C 77042070	A
			SHEET 15		

77042070

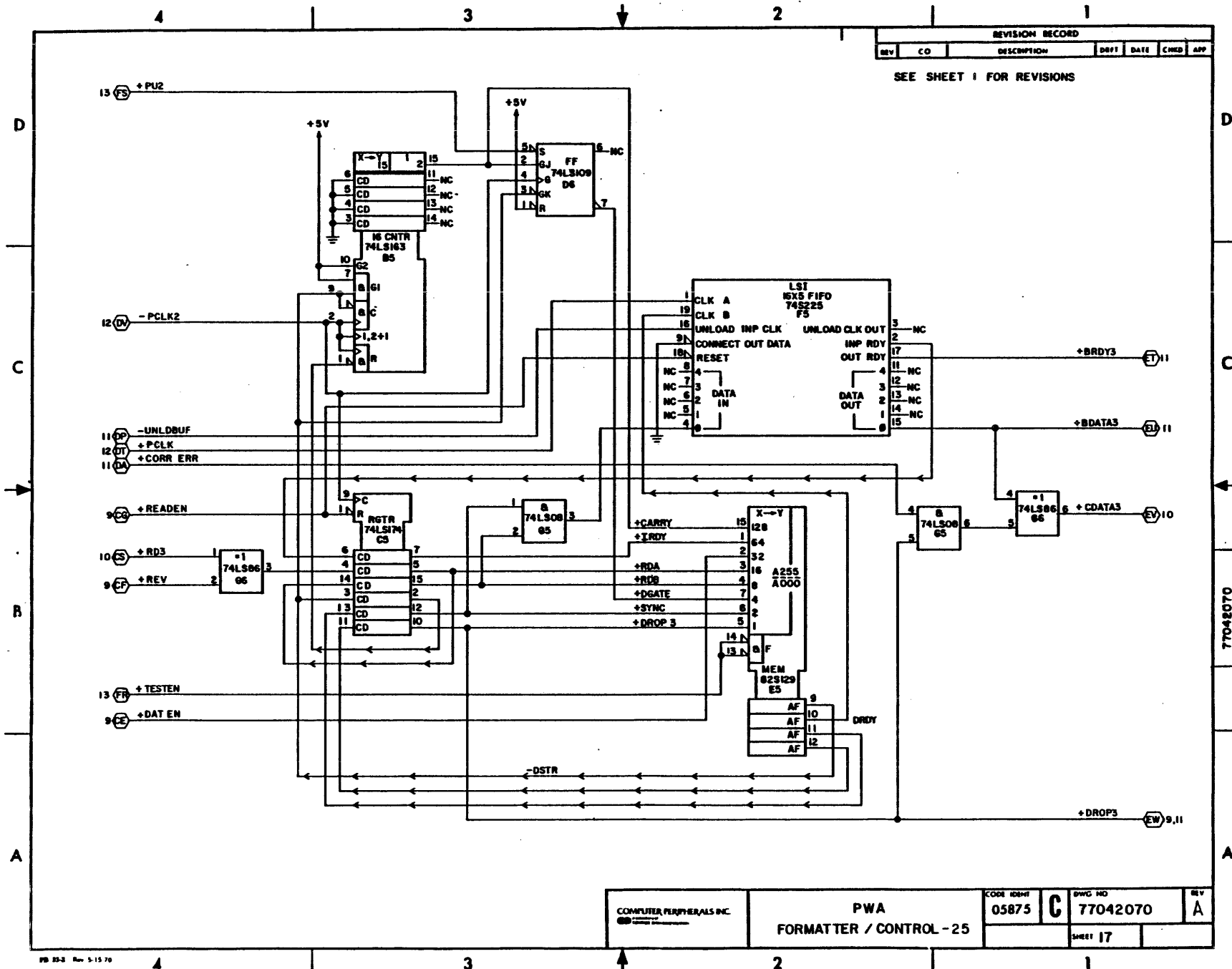


20-2 Rev. 5-15-70

77042070

49769000

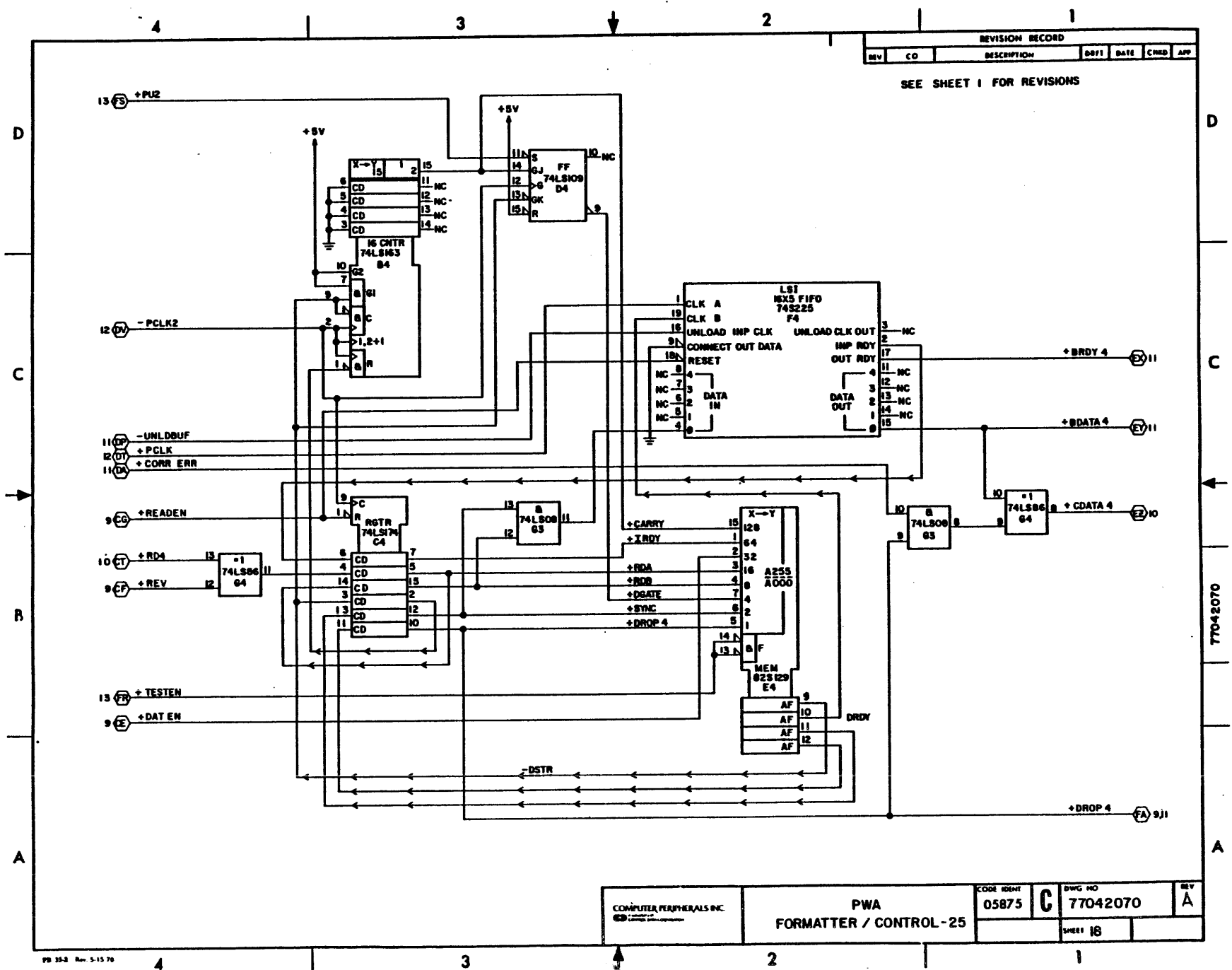
5-77



REVISION RECORD						
REV	CO	DESCRIPTION	DATE	CHKD	APP	
SEE SHEET 1 FOR REVISIONS						

COMPUTER PERIPHERALS INC.	PWA	CODE IDENT	05875	DWG NO	77042070	REV	A
		FORMATTER / CONTROL - 25		SHEET 17			

77042070

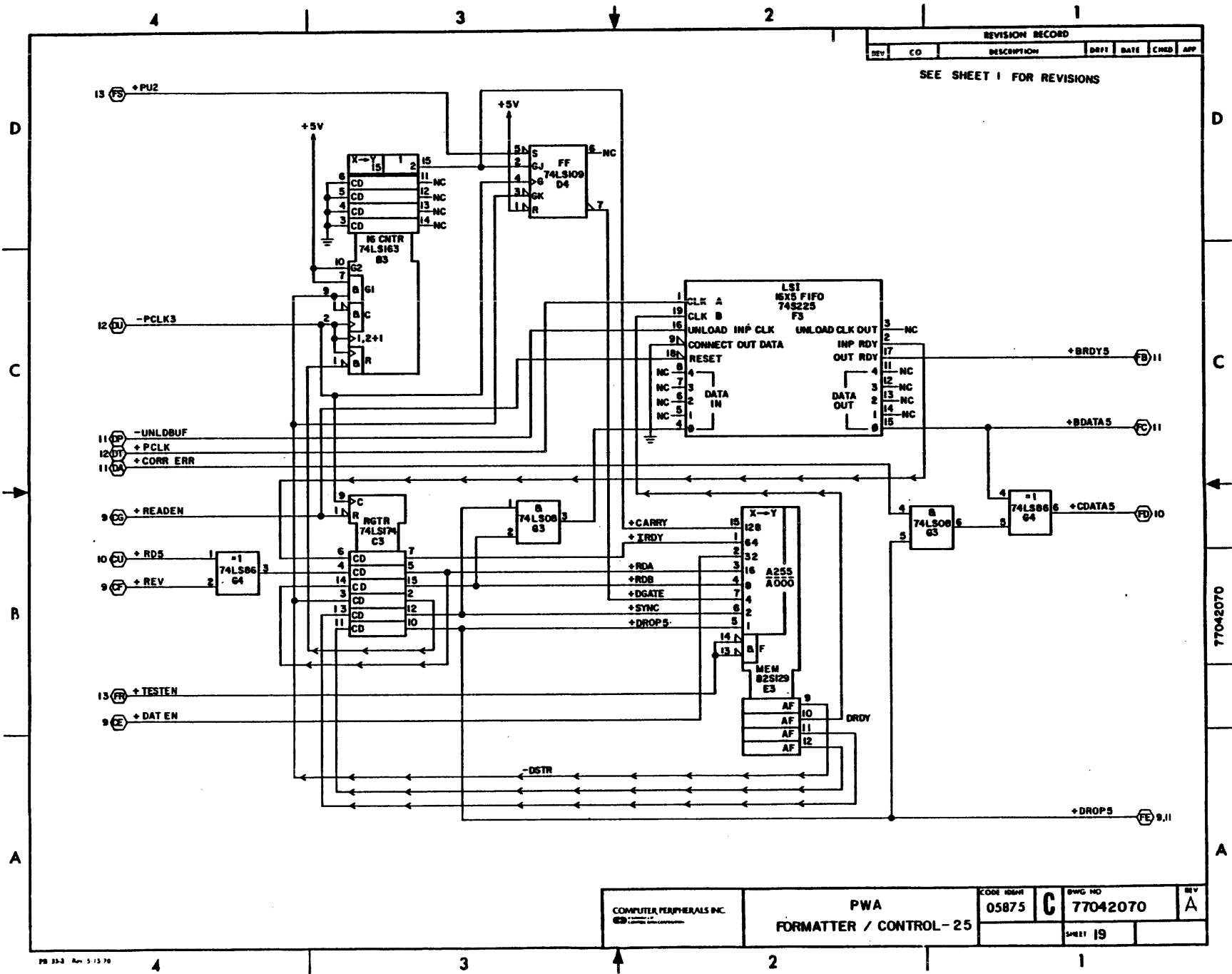


REVISION RECORD						
REV	CO	DESCRIPTION	DRFT	DATE	CRND	APP

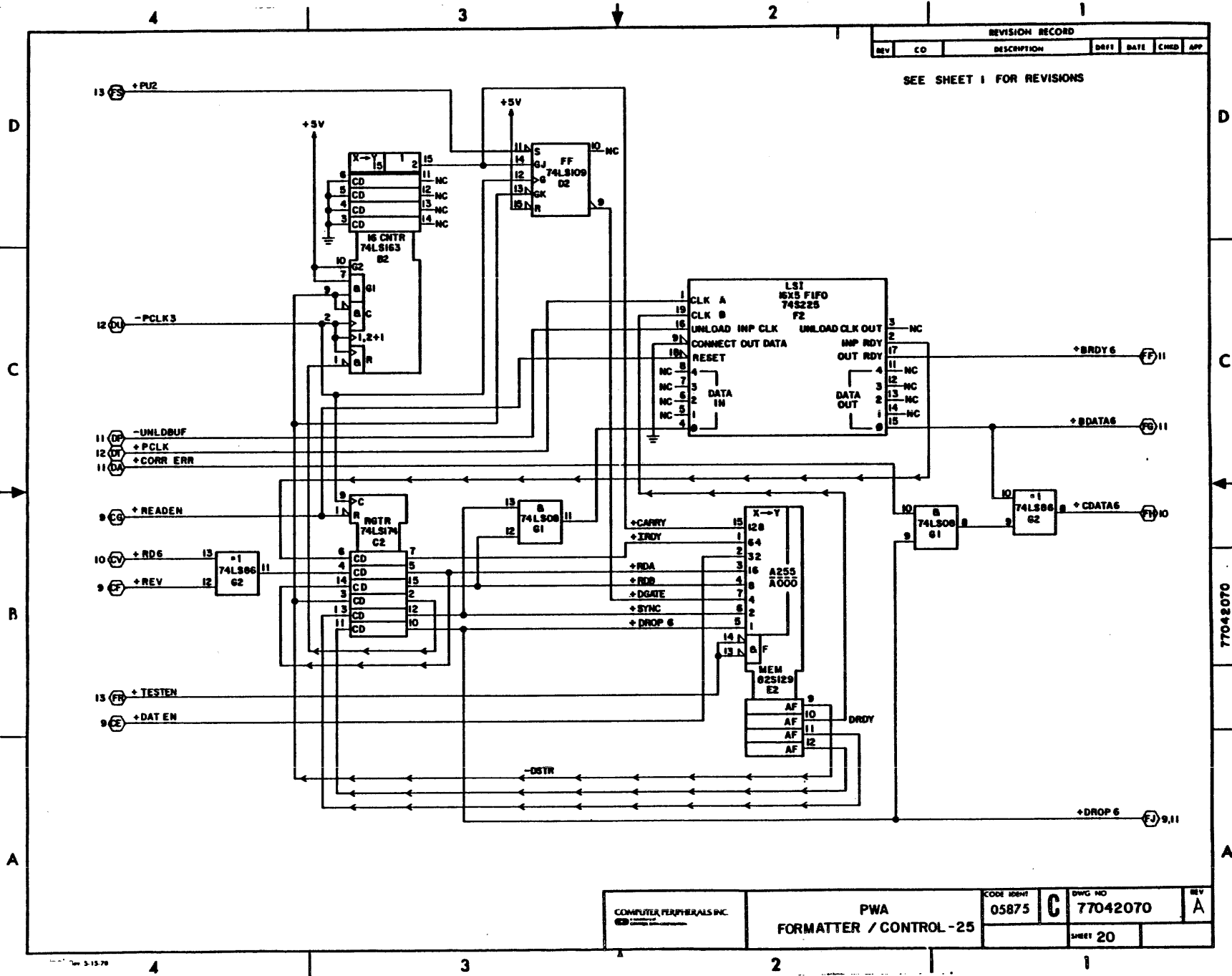
SEE SHEET 1 FOR REVISIONS

77042070

COMPUTER PERIPHERALS INC. 5000 ...	PWA FORMATTER / CONTROL - 25	CODE IDENT 05875	C	DRWG NO 77042070	REV A
				SHEET 18	



COMPUTER PERIPHERALS INC.	PWA FORMATTER / CONTROL-25	CODE 05875	C	DWG NO 77042070	REV A



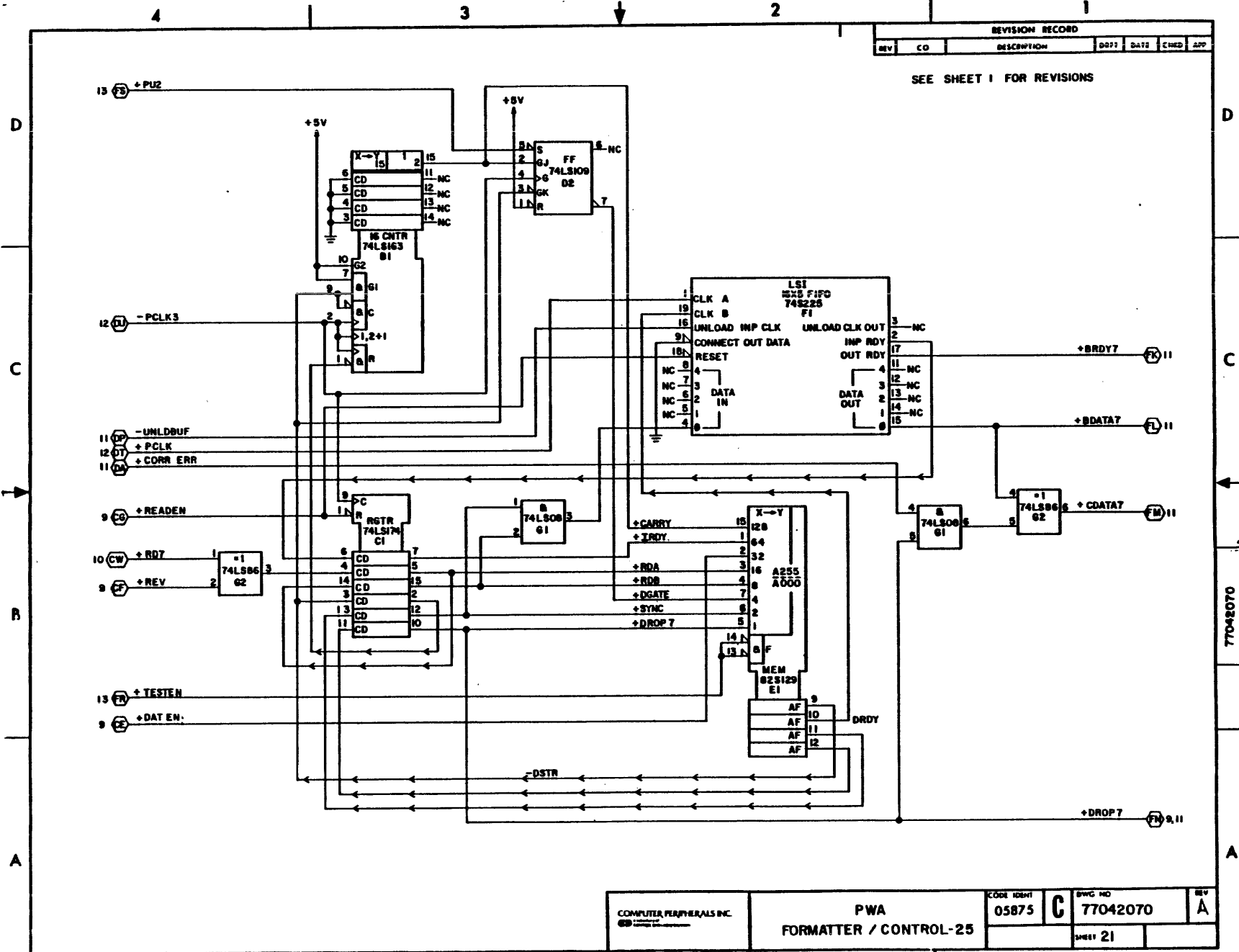
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				SHEET	20		

77042070



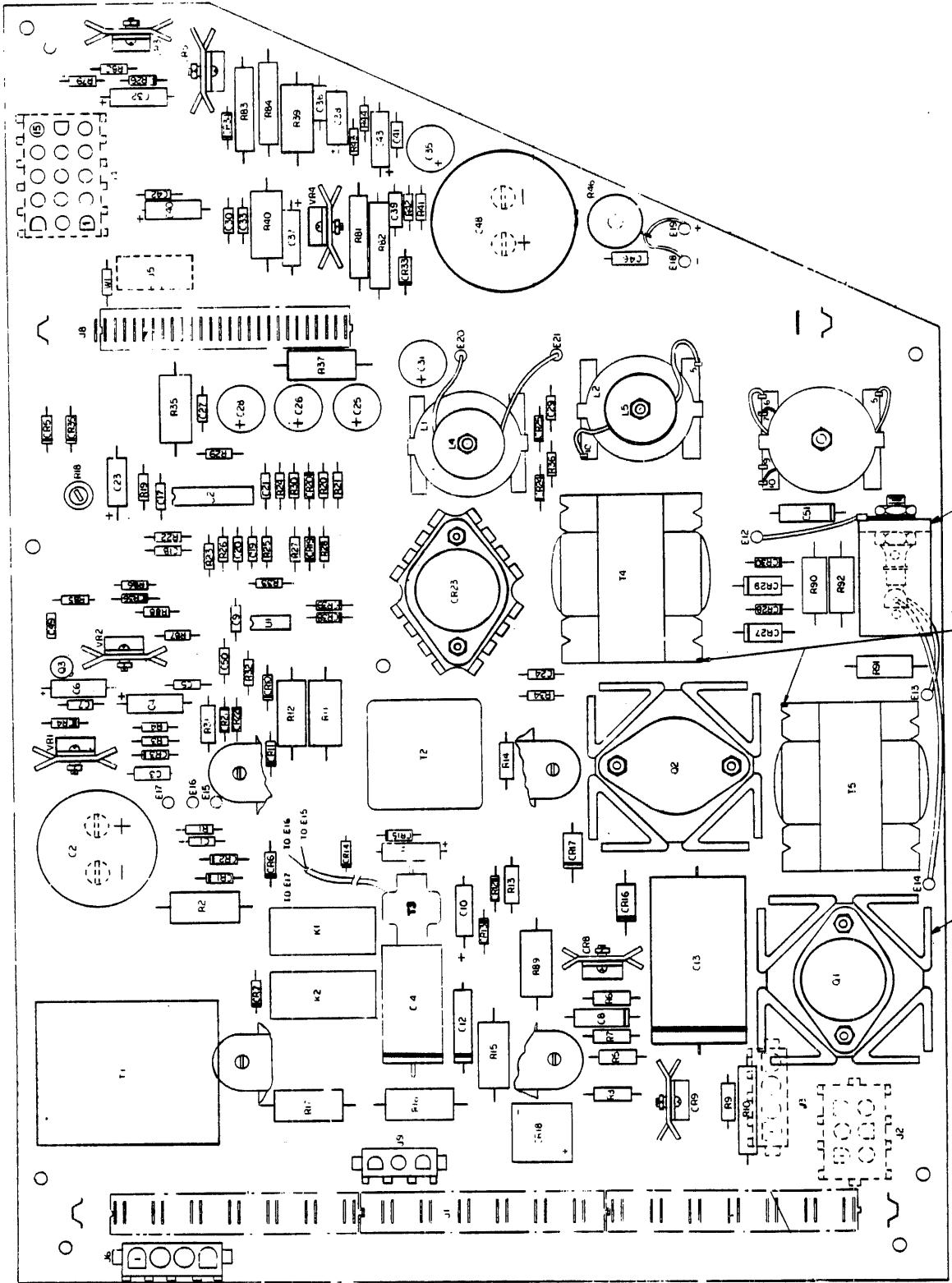
49769000

REVISION RECORD						
REV	CD	DESCRIPTION	DRPT	DATE	CHKD	APP
SEE SHEET 1 FOR REVISIONS						



COMPUTER PERIPHERALS INC. 600 ...	PWA FORMATTER / CONTROL-25	CODE IDENT	05875	C	SWG NO	77042070	REV	A
		SHEET	21					

77048070

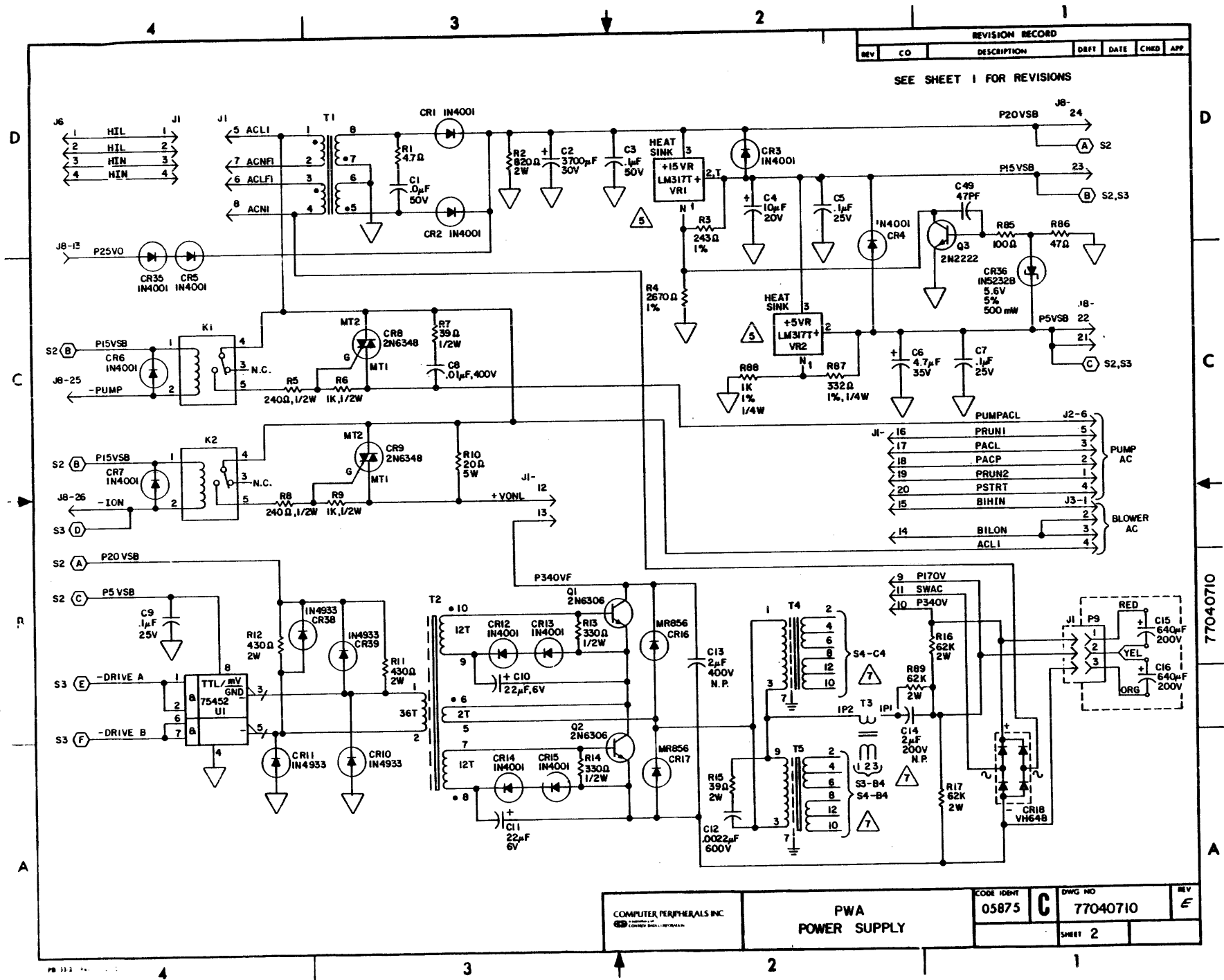


POWER SUPPLY PWA P/N 77040710  
 (Does not apply to Model 370B)

49769000 N

(Does not apply to model 370B)

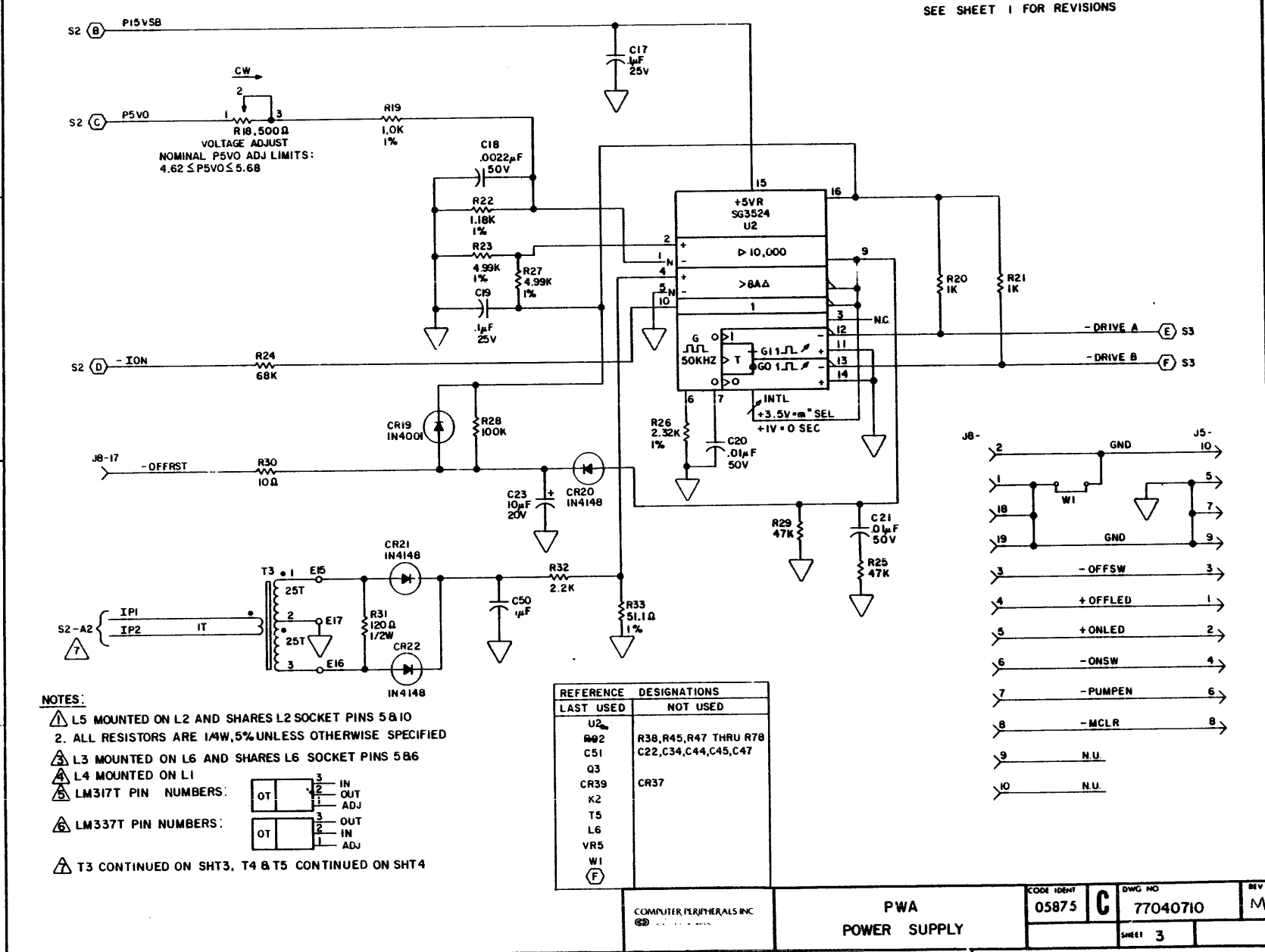
5-83



COMPUTER PERIPHERALS INC. A Division of General Electric Company	PWA POWER SUPPLY	CODE IDENT	DWG NO	REV
		05875	77040710	E
		SHEET 2		

(Does not apply to model 370B)

REVISION RECORD					
REV	CO	DESCRIPTION	DRFT	DATE	CHKD APP
SEE SHEET 1 FOR REVISIONS					

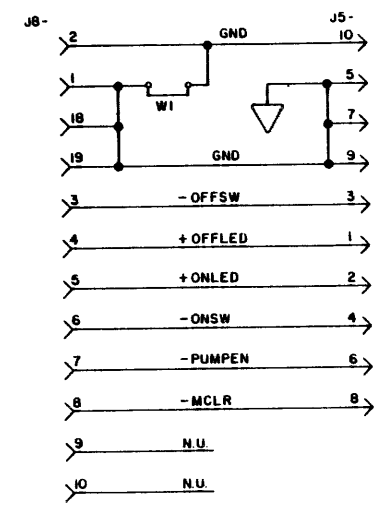


- NOTES:**
- ⚠ L5 MOUNTED ON L2 AND SHARES L2 SOCKET PINS 5 & 10
  - 2. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE SPECIFIED
  - ⚠ L3 MOUNTED ON L6 AND SHARES L6 SOCKET PINS 5 & 6
  - ⚠ L4 MOUNTED ON L1
  - ⚠ LM317T PIN NUMBERS:
 

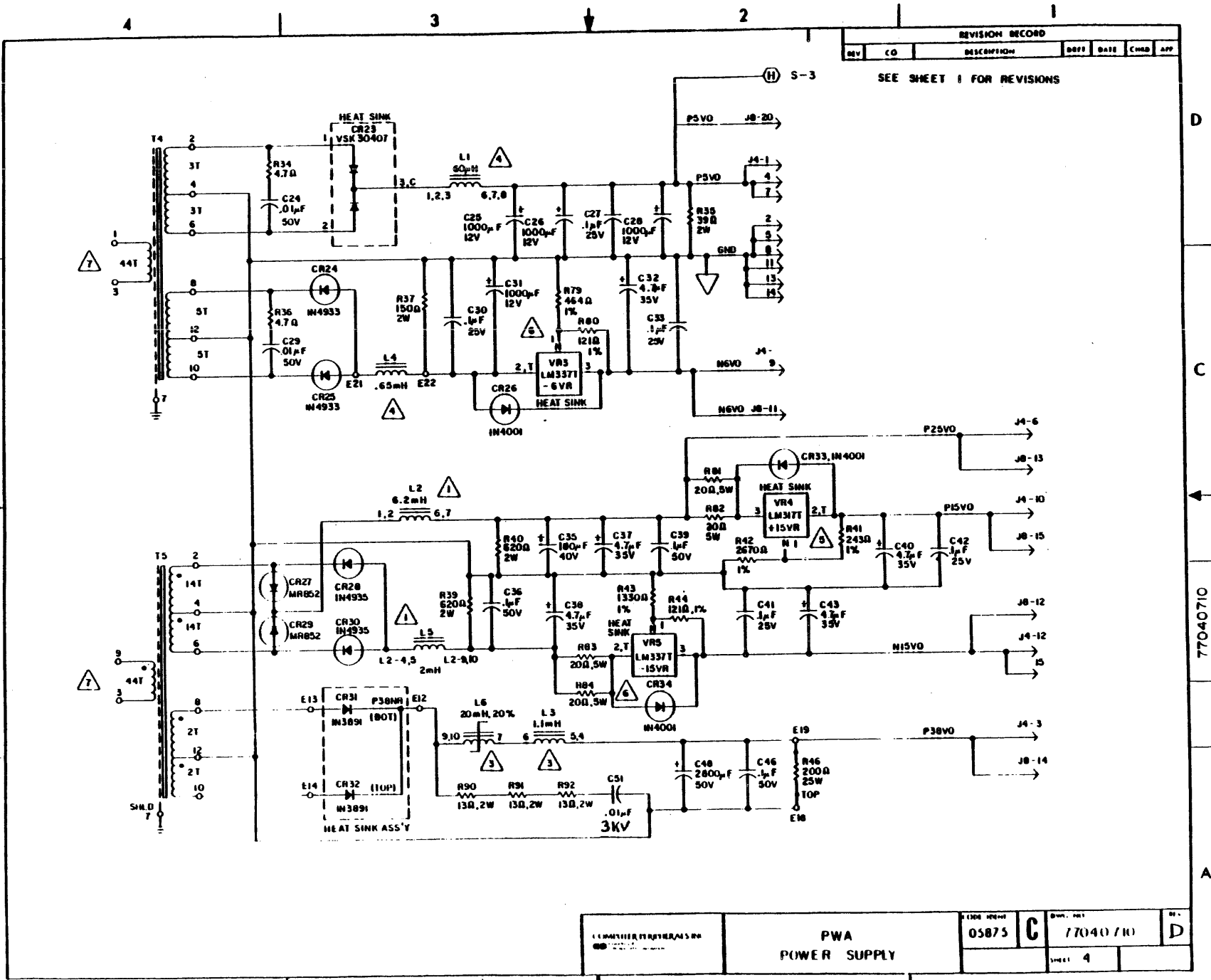
3	IN
2	OUT
1	ADJ
  - ⚠ LM337T PIN NUMBERS:
 

3	OUT
2	IN
1	ADJ
  - ⚠ T3 CONTINUED ON SHT3. T4 & T5 CONTINUED ON SHT4

REFERENCE DESIGNATIONS	
LAST USED	NOT USED
U2	
R92	R38, R45, R47 THRU R78
C51	C22, C34, C44, C45, C47
Q3	
CR39	CR37
K2	
T5	
L6	
VR5	
W1	
Ⓣ	

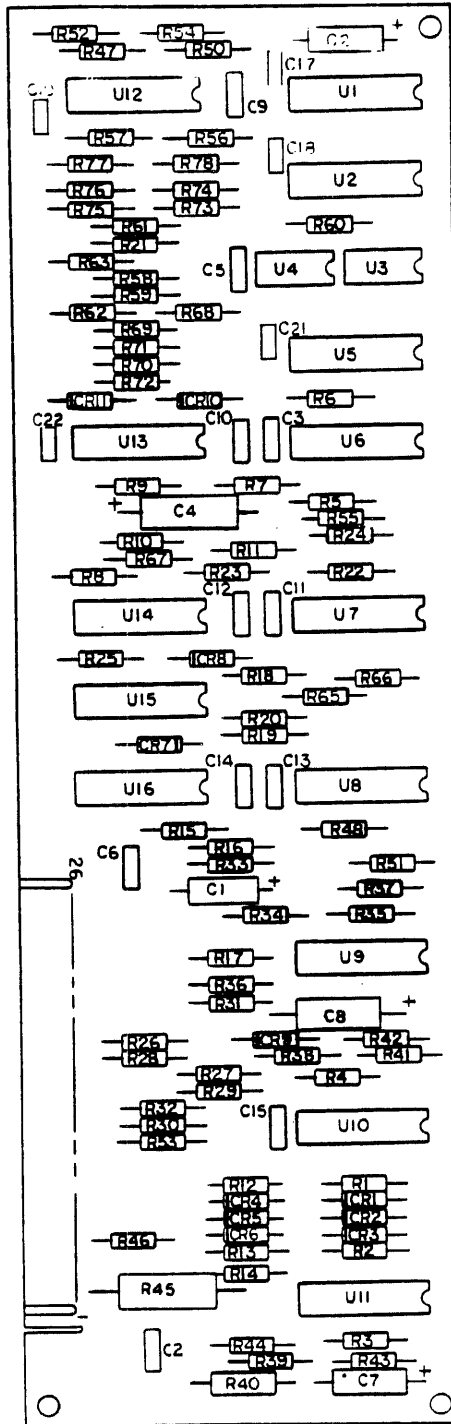


(Does not apply to model 370B)



REVISION RECORD						
REV	CO	DESCRIPTION	DIFF	DATE	CHNG	APP
SEE SHEET 1 FOR REVISIONS						

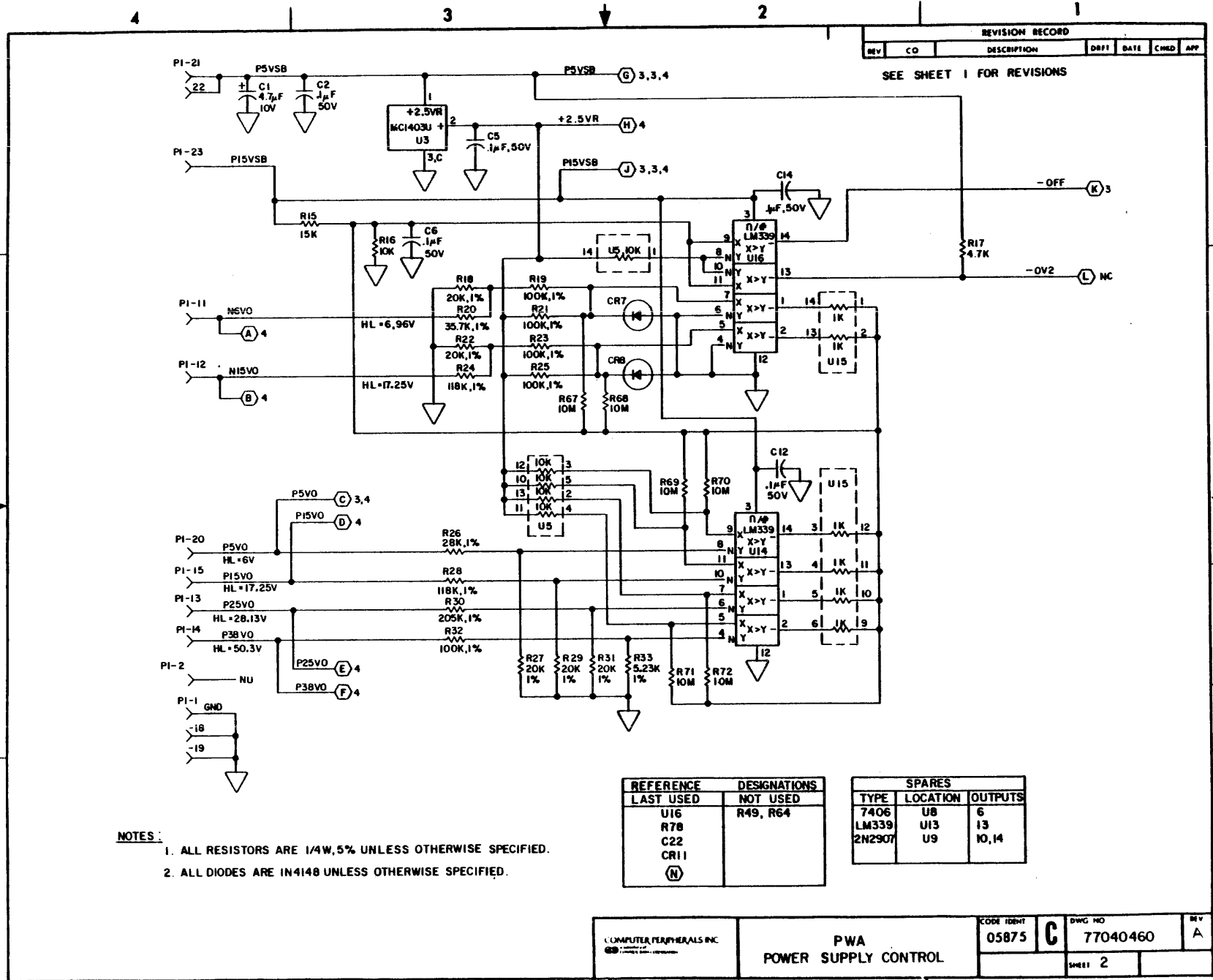
COMPUTER PROGRAMS INC 1000 ...	<b>PWA</b> POWER SUPPLY	05875	<b>C</b>	77040710	<b>D</b>
		SHEET 4			



POWER SUPPLY CONTROL PWA P/N 77040460  
 (Does not apply to model 370B)

49769000 N

(Does not apply to model 370B)



REVISION RECORD						
REV	CD	DESCRIPTION	DRFT	DATE	CHGD	APP
SEE SHEET 1 FOR REVISIONS						

- NOTES:
1. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
  2. ALL DIODES ARE IN4148 UNLESS OTHERWISE SPECIFIED.

REFERENCE	DESIGNATIONS
LAST USED	NOT USED
U16	R49, R64
R78	
C22	
CR11	
(N)	

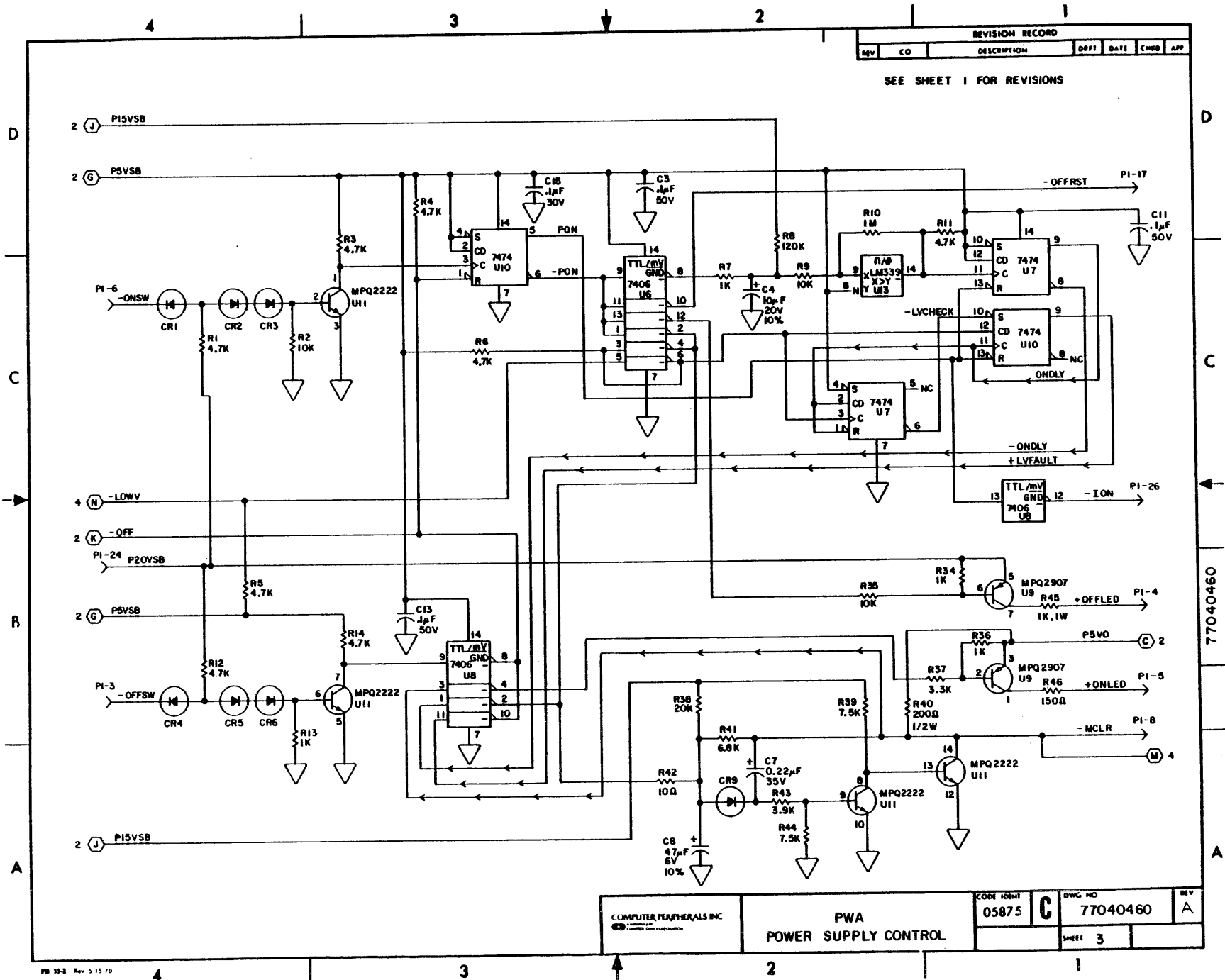
SPARES		
TYPE	LOCATION	OUTPUTS
7406	U8	6
LM339	U13	13
2N2907	U9	10, 14

COMPUTER PERIPHERALS INC.	PWA POWER SUPPLY CONTROL	CODE IDENT	05875	DWG NO	77040460	REV	A
		SHEET	2				

5-87

77040460

(Does not apply to model 370B)



REVISION RECORD						
REV	CO	DESCRIPTION	DEF1	DATE	CHSD	APP
SEE SHEET 1 FOR REVISIONS						

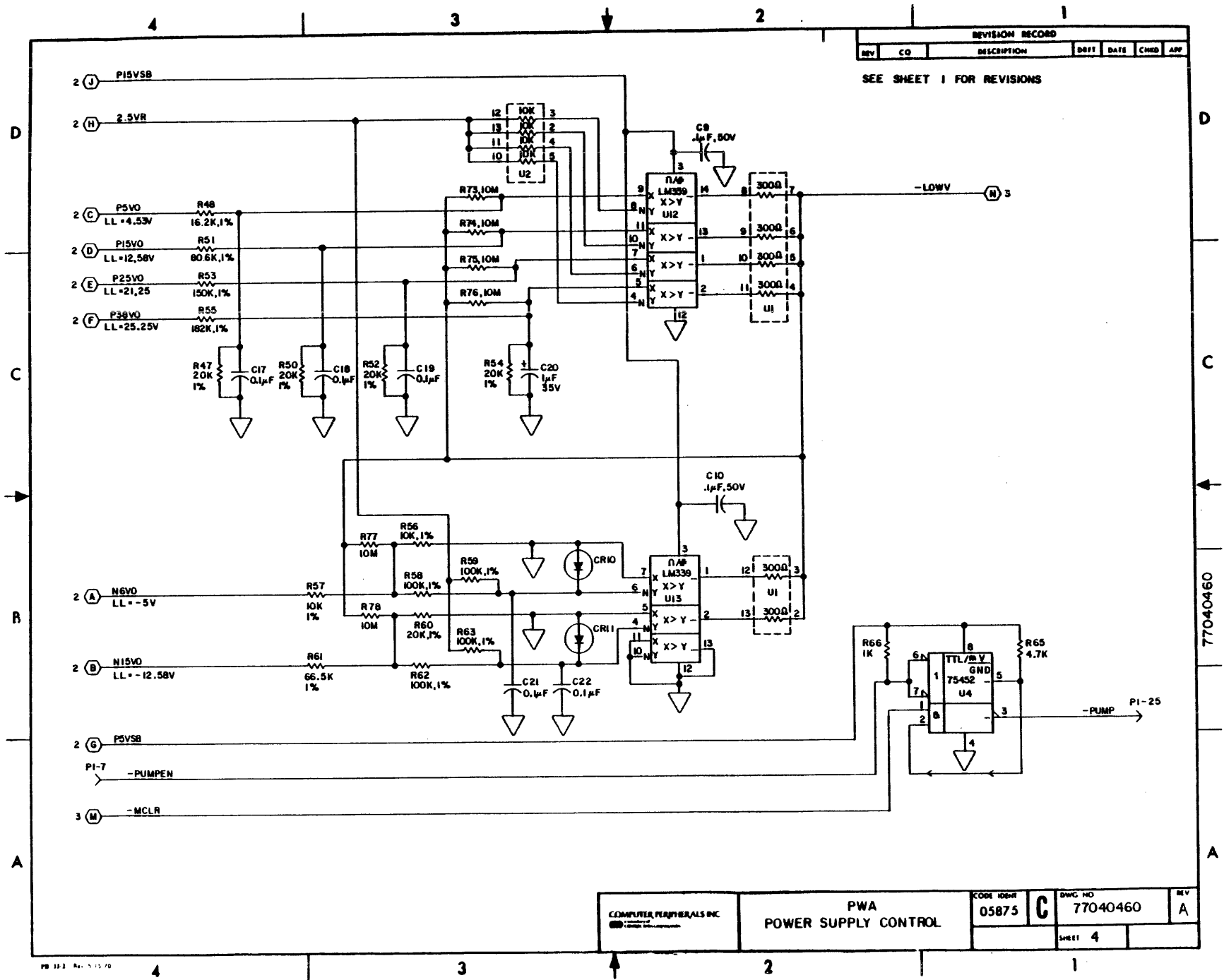
COMPUTER PERIPHERALS INC.	PWA	CODE IDENT	DWG NO	REV
	POWER SUPPLY CONTROL	05875	C 77040460	A
			SHEET 3	



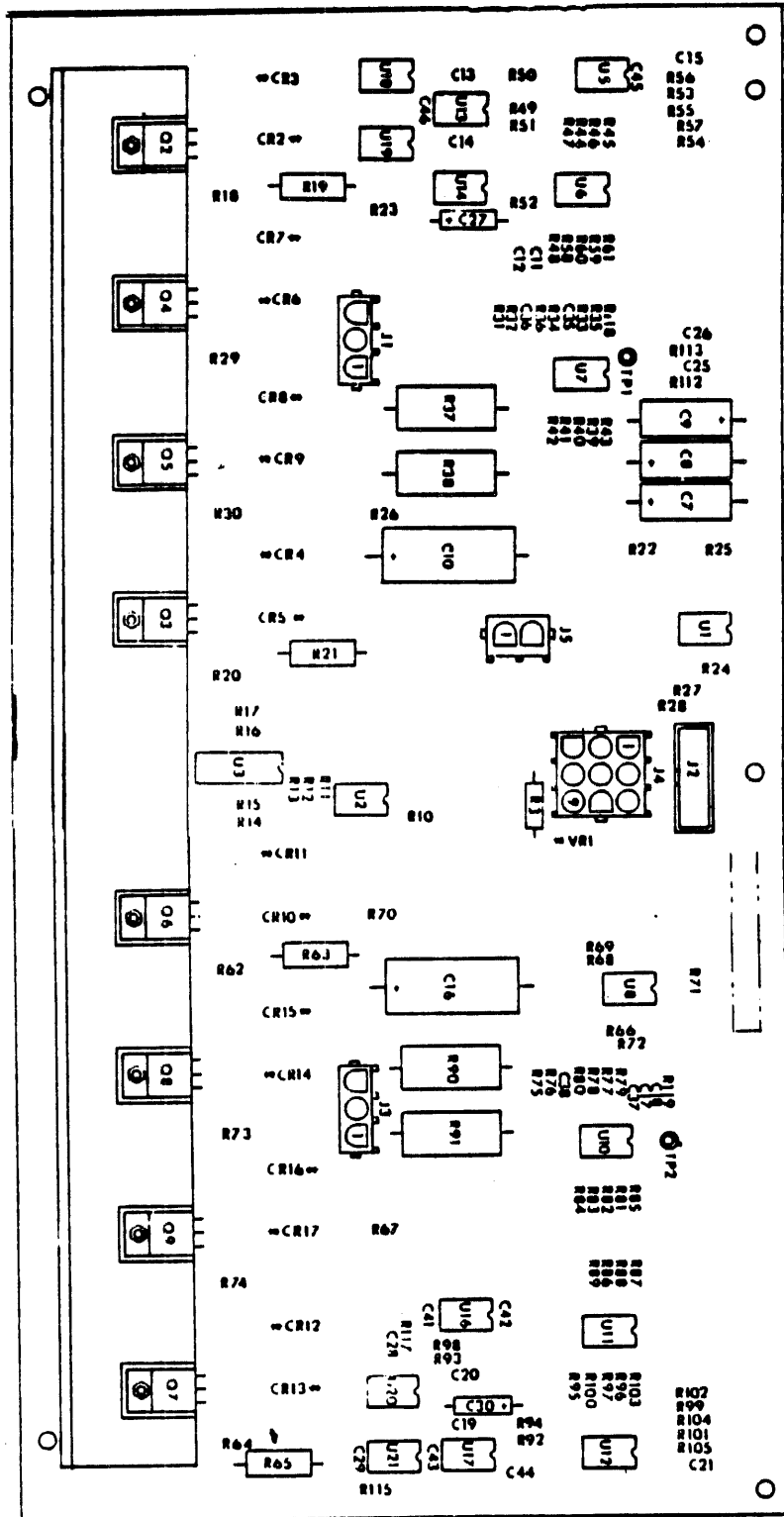
49769000 N

(Does not apply to model 370B)

5-89

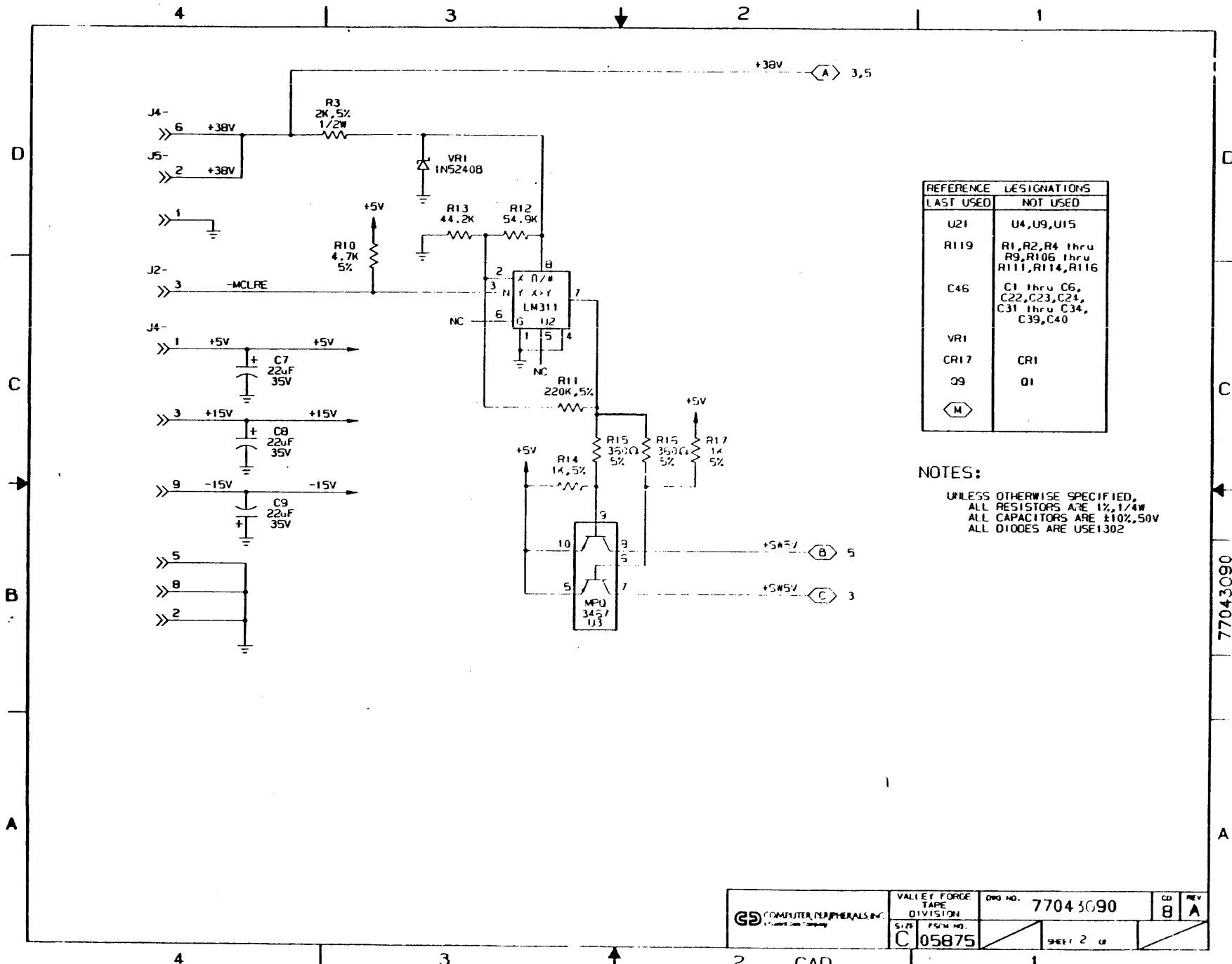


COMPUTER PERIPHERALS INC.	PWA	CODE 108M	DWG NO	REV
	POWER SUPPLY CONTROL	05875	77040460	A
			SHEET 4	



49769000 K

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REFERENCE	DESIGNATIONS
LAST USED	NOT USED
U21	U4, U9, U15
R119	R1, R2, R4 thru R9, R106 thru R111, R114, R116
C46	C1 thru C6, C22, C23, C24, C31 thru C34, C39, C40
VR1	
CR17	CR1
Q9	Q1
(M)	

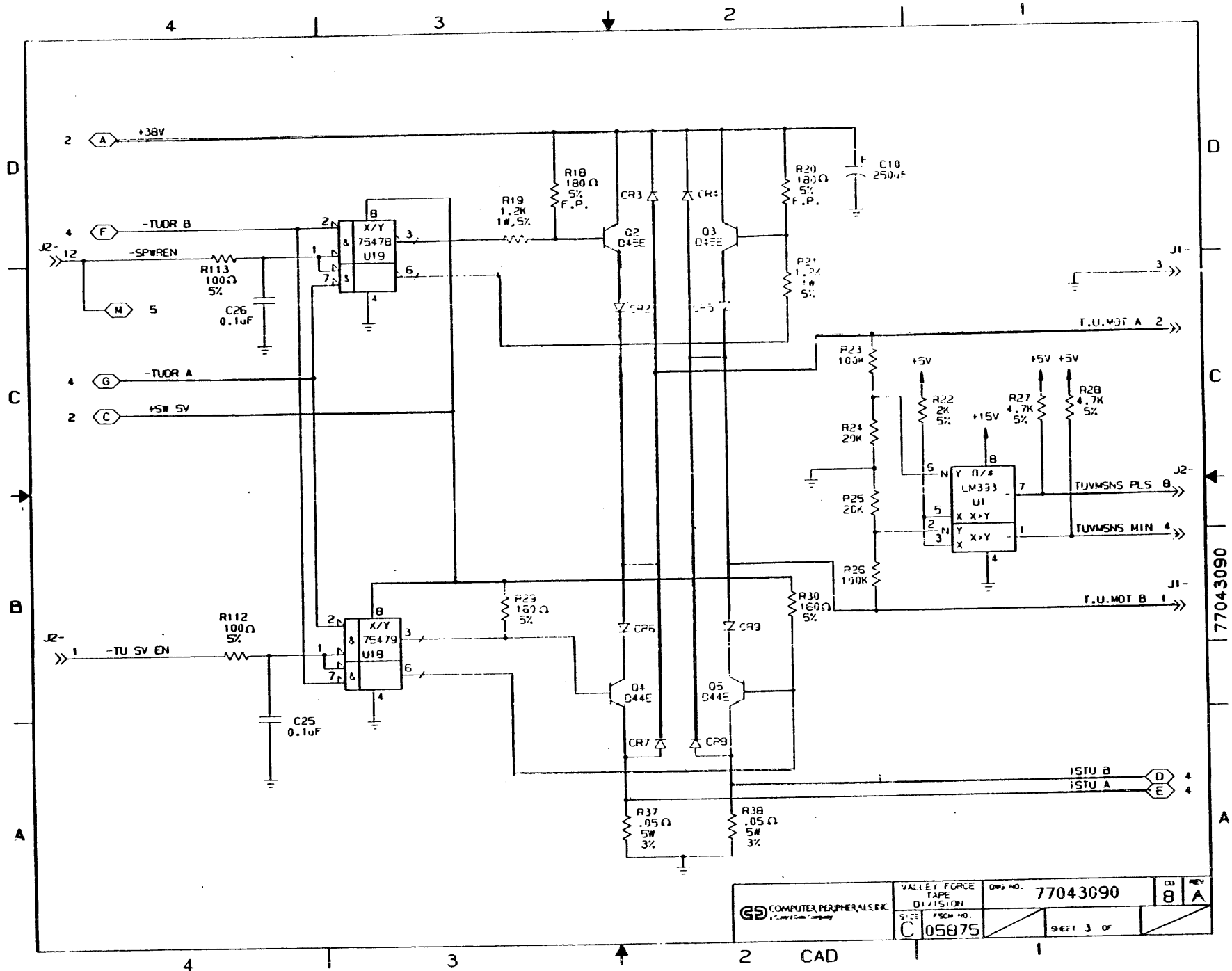
NOTES:  
 UNLESS OTHERWISE SPECIFIED,  
 ALL RESISTORS ARE 1%, 1/4W  
 ALL CAPACITORS ARE ±10%, 50V  
 ALL DIODES ARE USE1302

VALLEY FORGE TAPE DIVISION COMPUTER PERIPHERALS INC.	Dwg. No. 77043090	CD 8 REV A
	SIZE C PSM NO. 05875	SHEET 2 OF

77043090

2 CAD

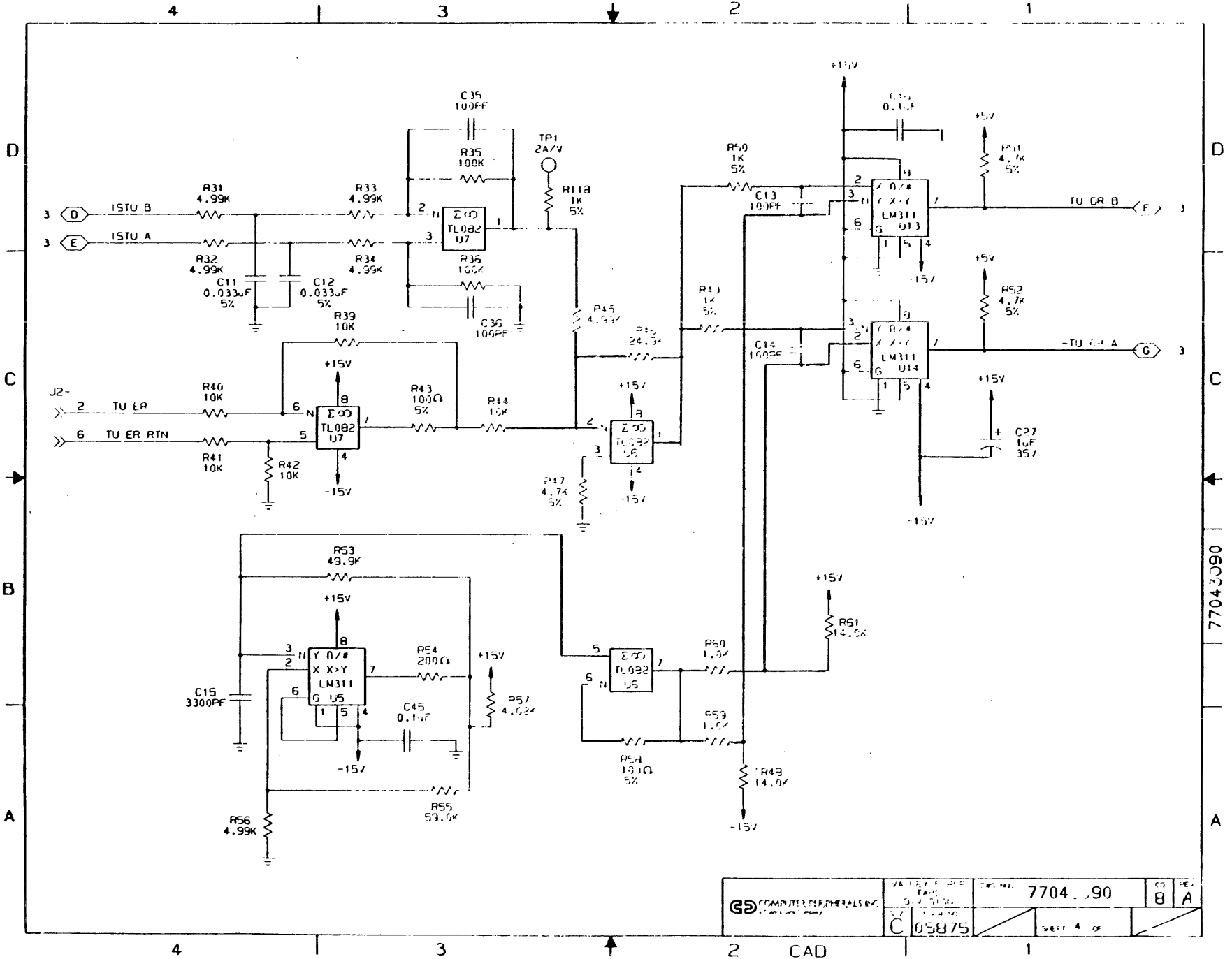
1



COMPUTER PERIPHERALS INC. <small>A General Electric Company</small>	VALLEY FORCE TAPE DIVISION	DES. NO. <b>77043090</b>	CD <b>8</b>	REV <b>A</b>
	SIZE <b>C</b>	PSCM NO. <b>05875</b>	SHEET 3 OF	

77043090

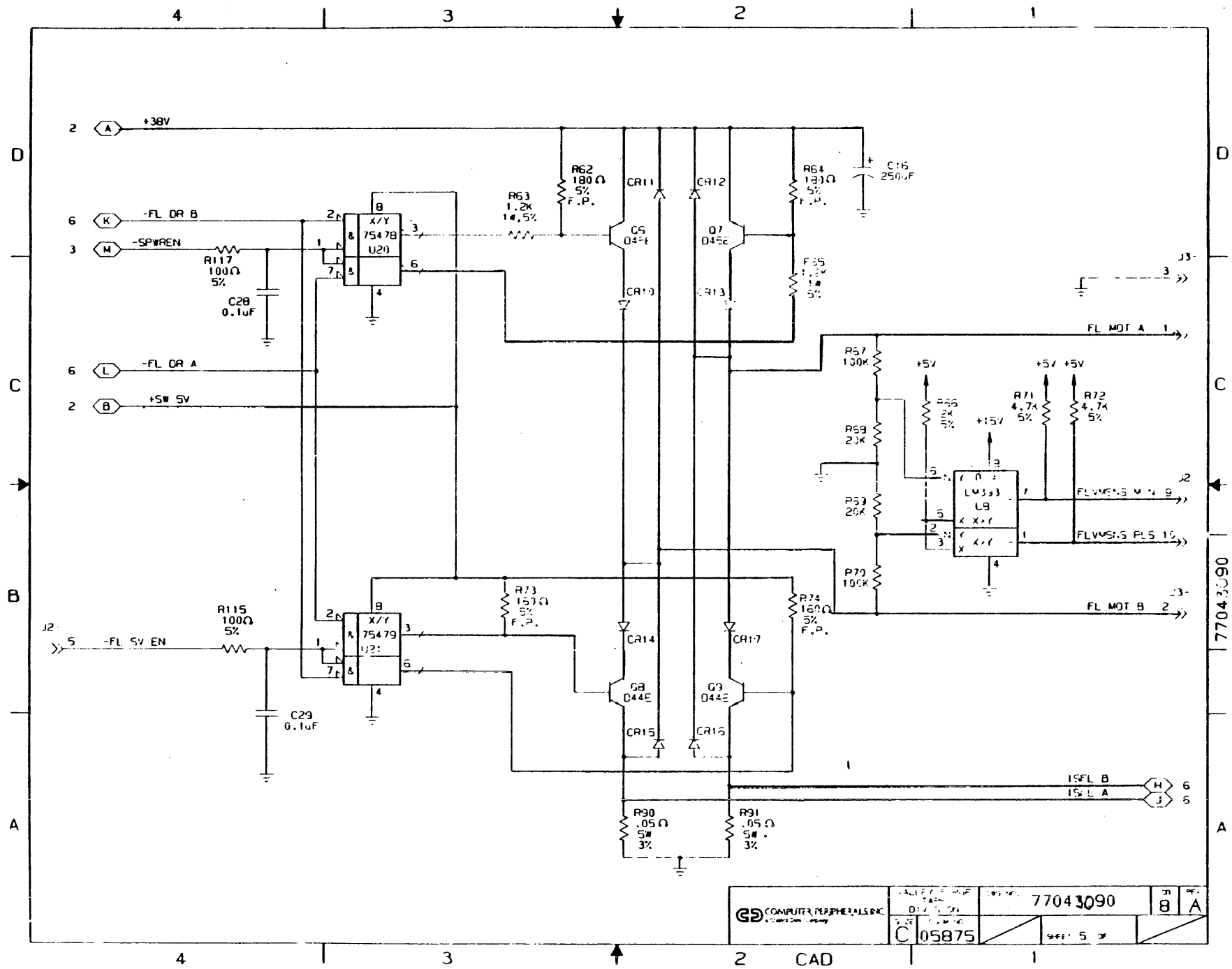
CAD



COMPUTER PERIPHERALS INC. <small>Computer Peripherals</small>	VA 15V 100PF TAPE DATE 5/87	DES. NO. 7704-90	CO. B	REV. A
	C 05875	SHEET 4 OF		

7704-3090

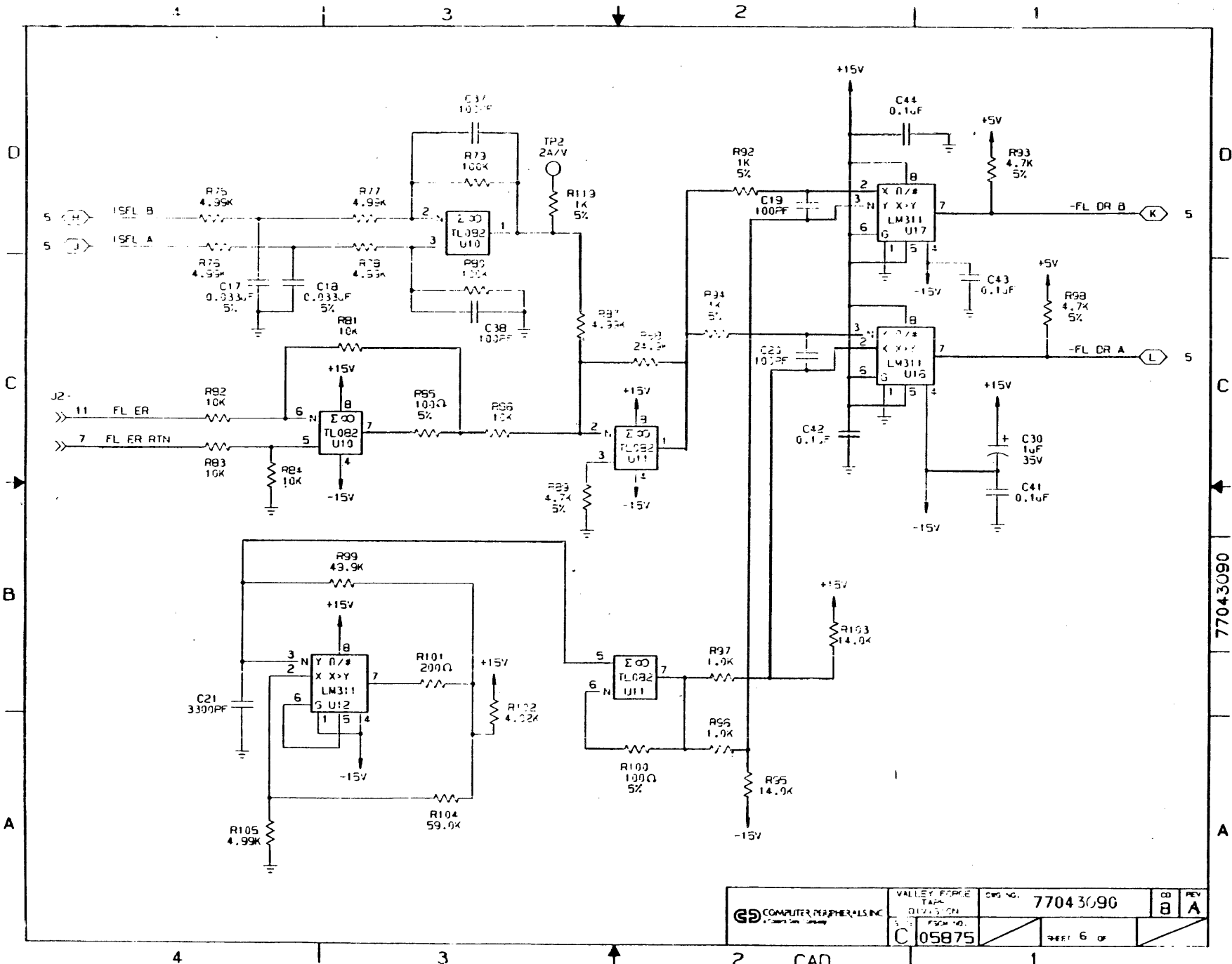
5-94



COMPUTER PERIPHERALS INC. <small>A General Electric Company</small>	DATE: 10/21/75 DRAWN BY: C 05875	QTY: 50 PART NO.: 77043090	IN: B REF: A
	C 05875		50

49769000 K

49769000 K

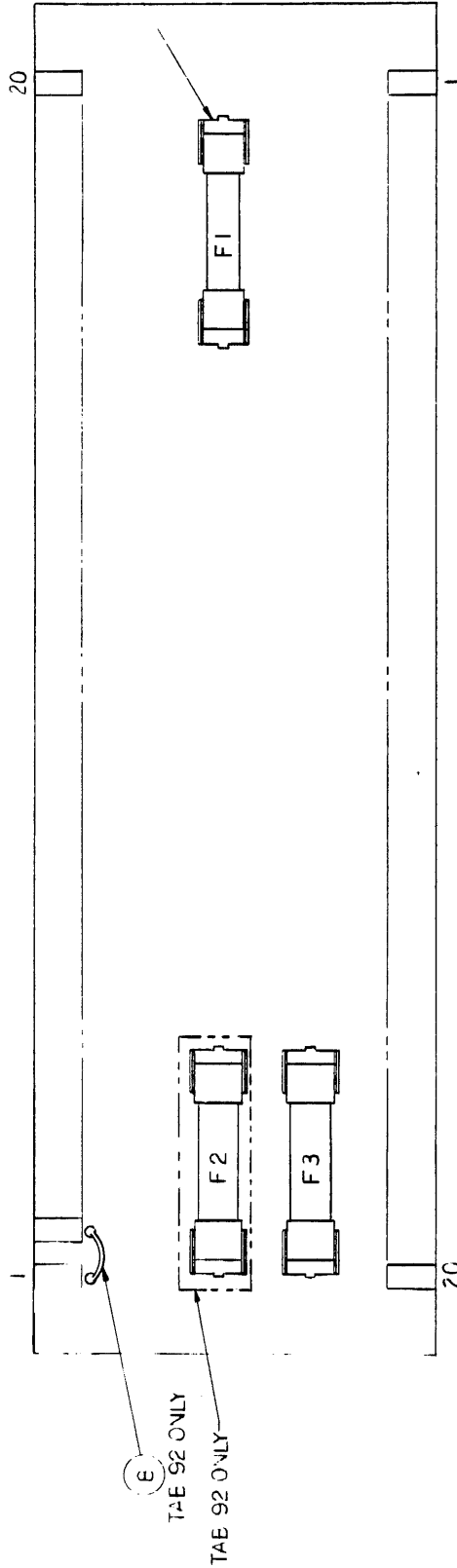


77043090

COMPUTER PERIPHERALS INC. <small>10000 Valley Forge Road, Valley Forge, PA 19381</small>	VALLEY FORGE TAP DIVISION DESIGNED BY <b>C 05875</b>	DWG NO. <b>77043090</b>	CD <b>8</b>	REV <b>A</b>
	SHEET 6 OF			

5-95

CAD



POWER SUPPLY VOLTAGE SELECT PWA P/N 77040590



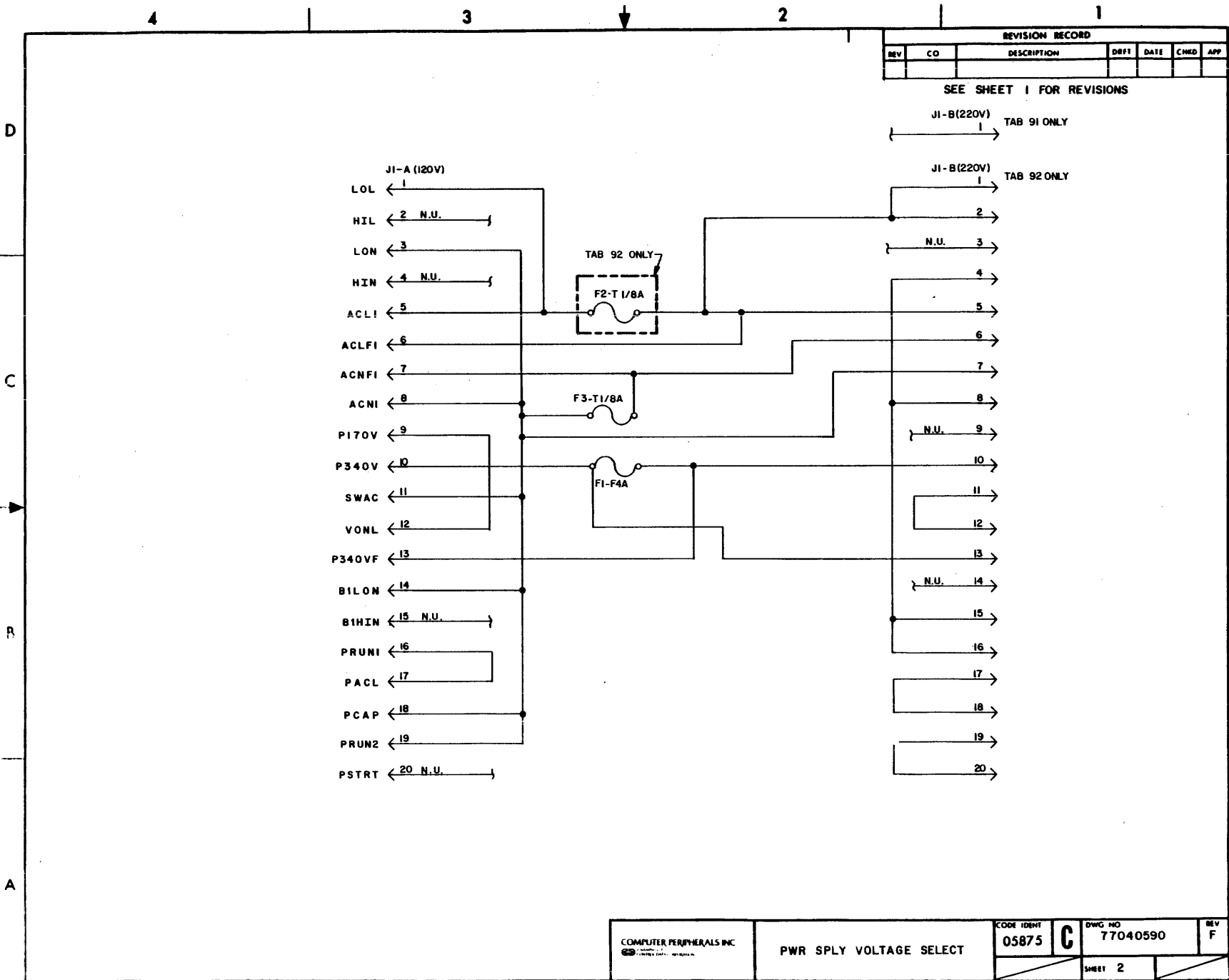
49769000

5-97/5-98

77040590

REVISION RECORD						
REV	CO	DESCRIPTION	DRFT	DATE	CHKD	APP

SEE SHEET 1 FOR REVISIONS



COMPUTER PERIPHERALS INC 77040590	PWR SPLY VOLTAGE SELECT	CODE IDENT	DWG NO	REV
		05875	C 77040590	F
		SHEET 2		



## GLOSSARY OF TERMS

### Read/Write/Servo PWA

ACKM	Acknowledge Master
ADRS	Address
AOT	Absence of Tape
AOT ENAB	Absence of Tape Enable
ATTNM	Attention Master
AUTENAB	Above Upper Tension Enable
BLTENAB	Below Lower Tension Enable
BOT	Beginning of Tape
BOT ANO	Beginning of Tape Anode
BOT CATH	Beginning of Tape Cathode
BOT COL	Beginning of Tape Collector
BOT EMIT	Beginning of Tape Emitter
BOT/EOT LEV	BOT/EOT Level
CLIP LEVEL	Clip Level
+CMOSENAB	+CMOS RAM Enable
-CMOSENAB	-CMOS RAM Enable
D/C CMP	Digital to Analog Converter Compare
DEGAUSS	Degauss
DIAG FLBK	Diagnostic File Backward
DIAG FLFD	Diagnostic File Forward
DIAG TUBK	Diagnostic Take Up Backward
DIAG TUFDF	Diagnostic Take Up Forward
DIVTACHB	Divided Tach (Latched)
DIVTACH RST	Divide Tach Reset
DMDVEL	Demand Velocity
DOOR1FLT	Door Fault (Switch 1)
DOOR2FLT	Door Fault (Switch 2)
EGC ADRS	Electronic Gain Control Address
EGC CLIP	Electronic Gain Control Clip
EGC VAL	Electronic Gain Control Valid
ENV	Envelope
EOT	End of Tape
EOT ANO	End of Tape Anode
EOT CATH	End of Tape Cathode
EOT COL	End of Tape Collector
EOT EMIT	End of Tape Emitter
ERSENAB	Erase Enable
ERSENS	Erase Sense
FAULT	Fault
FBLTL	File Below Lower Tension Limit
FDCT	Forward Count Tach
-FILPRO	Negative File Protect
+FILPRO	Positive File Protect
FLIDXANO	File Index Anode
FLIDXCATH	File Index Cathode

Read/Write/Servo PWA (Cont'd)

FLIDXCOL	File Index Collector
FLIDXEMIT	File Index Emitter
FLPROANO	File Protect Anode
FLPROCATH	File Protect Cathode
FLSVEN	File Servo Enable
FLTACH	File Tach (Latched)
FLVMSNSMIN-	File Voltage Motor Sense Minus
FLVMSNSPLS+	File Voltage Motor Sense Plus
-FREF	Negative File Reference
+FREF	Positive File Reference
FTENOFF	File Tension Offset
FTENZERO	File Tension Sensor Zeroed
FWD	Forward
GATE1	Gate 1
GATE2	Gate 2
HSELECT	High Select
HSPEED	High Speed
INGRP	Input Group
LSELECT	Low Select
MCLR	Master Clear
MPUADRS	MPU Address
MPUDATA	MPU Data
MPURST	MPU Reset
NMI	Non-Maskable Interrupt
NMIRST	Non-Maskable Interrupt Reset
OGRP	Output Group
PARLD	Parallel Load
oATUTACH	Phase A Take Up Tach
oBTUTACH	Phase B Take Up Tach
PTMENAB	Programmable Timer Enable
PRKD	Parked
PUMPEN+	Pump Enable Positive
PUMPEN-	Pump Enable Negative
RECALL	E2 PROM Recall
REWIND	Rewind
RVCT	Reverse Count Tach
R/W	Read/Write
R/W LOOP	NU (Not Used)
SINDEXFL	Index Tach (File)
SPWREN+	Servo Power Enable Positive
SPWREN-	Servo Power Enable Negative
STORE	E2 PROM Store
SW1A	Switch 1A

Read/Write/Servo PWA (Cont'd)

SWIARTN	Switch 1A Return
SYSRST	System Reset
TACHRST-	Tach Reset Negative
TAUTL	Take Up Above Upper Tension Limit
TBLTL	Take Up Below Lower Tension Limit
TRD	Transport Read Data
TREF-	Take Up Reference Negative
TREF+	Take Up Reference Positive
TTENOFF	Take Up Tension Offset
TTENZERO	Take Up Tension Sensor Zeroed
TUER	Take Up Error
TUERTN	Take Up Error Return
TUSVEN	Take Up Servo Enable
TUVMSNSMIN-	Take Up Voltage Motor Sense Negative
TUVMSNSPLS+	Take Up Voltage Motor Sense Positive
TWD	Transport Write Data
T10Z	Take Up Tension at 10 Ounces
WRTCUR	Write Current
WRTENAB	Write Enable
OCLIP	Zero Clip
100IPS	One Hundred Inches Per Second

Formatter/Control PWA

A0-2	Address 0-2
ACKM	Acknowledge Master
ACKS	Acknowledge Slave
ATTM	Attention Master
ATTMS	Attention Slave
BLOCK	Data Block
BOTL	Beginning of Tape Level
BTMUX	Bit Test Mux
CARRY	Carry
CDATA0-7, P	Corrected Data 0-7, P
CHNEN	Channel Enable
CHNPE	Channel Parity Error
CHNSEL	Channel Select
CNTEN	Count Enable
CORRERR	Correct Error
CORRPAR	Correct Parity
D0-7	Data 0-7
DATAMKR	Data Marker
DATLB	Data Loopback
DGEN	Degauss Enable
DIAGLED	Diagnostic LED
DMODE	Diagnostic Mode

Formatter/Control PWA (Cont'd)

DROP0-7	Drop 0-7
DZERO2	Data Zero 2
ENVEN	Envelope Enable
ENVP	Envelope Parity
EOTL	End of Tape Level
FBY	Formatter Busy
FBSY	Formatter Busy
FCER	Formatter Correctable Error
FDO-7	Formatter Data 0-7
FDBY	Formatter Data Busy
FDP	Formatter Data Parity
FDWDS	Formatter Demand Write Data Strobe
FEN	Formatter Enable
FERASE	Formatter Erase
FFAD	Formatter Address
FFEN	Formatter Enable
FFMK	Formatter File Mark
FGO	Formatter Go
FHER	Formatter Hard Error
FIDENT	Formatter Ident. Burst
FLGAP	Formatter Long Gap
FLOL	Formatter Load On-Line
FLOOP	Formatter Loop Read-to-Write
FPTL	File Protect Level
FREV	Formatter Reverse
FREW	Formatter Rewind
FRSTR	Formatter Restore
FRWD	Formatter Rewind Status
FSENSE	Formatter Sense
FTADO	Formatter Transport Address 0
FTAD1	Formatter Transport Address 1
FULC	Formatter Unload Command
FWRT	Formatter Write
GO	Go
GPC	Gap Count
HSPDL	High Speed Level
ID	Ident. Control
IRQ	Interrupt Request
IRQA	Interrupt Request A
IRQB	Interrupt Request B
LD1-4	Left Digit 1-4
LWD	Last Word
MARK	Mark (All 1's Cont. Signal)
MCLR	Master Clear
MRST	Master Reset
MUXEN	Multiplexer Enable
MLTDROP	Multiple Drop

## Formatter/Control PWA (Cont'd)

NO TRK PTR	No Track Pointer
ONL	On-Line
PCLK	Phase Clock (25 x Data Rate)
PCLK1-3	Phase Clock 1-3
PIAO-4	Peripheral Interface Adapter 0-4
POSL	Position Level
POSTAMFD	Postamble Found
POSTAMNZ	Postamble Not Zero
PTM	Programmable Timer Module
PUMPEN	Pump Enable
RDP, 0-7	Read Data P, 0-7
RDY	Ready
R/W	Read/Write
S0, S1	Sequence 0, 1
SDSTR	Sense Data Strobe
SELEN1	Select Enable 1
SR	Set/Reset
SYSEN	System Enable
SYSRST	System Reset
UNLDBUF	Unload Buffer
WCLK	Write Clock
WDEN	Write Data Enable
WREN	Write Enable
WRT BSY	Write Busy
2XWCLK	2 x Write Clock

## Power Amplifier PWA

FLER	File Error
FLER RTN	File Error Return
FLSVEN	File Servo Enable
ICCW	Current Counterclockwise
ICW	Current Clockwise
MCLR	Master Clear
SPWREN	Servo Power Enable
TRIANGLE	Triangle Generator
TRISYPLS	Triangle Sync Pulse
TUER	Take Up Error
TUER RTN	Take Up Error Return
TUSVEN	Take Up Servo Enable





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## GENERAL DESCRIPTION

The maintenance section of this manual provides information for trouble analysis, removal and replacement of Streaming Tape Unit (STU) assemblies, and verification tests to determine the transports operability. All diagnostic tests are designed for off-line use and are independent of the host controller. The removal/replacement procedures follow a concept of modular (assembly) replacement only. Individual circuit troubleshooting or assembly repair are not recommended and are, therefore, not within the scope of this manual.

The maintenance information is divided into two major areas: Trouble Analysis and Removal/Replacement Procedures.

## TROUBLE ANALYSIS

The principles involved in trouble analysis of the STU consist of interpreting fault codes, which appear on the diagnostic display on the operator control panel, in the event of failure. The trouble analysis section provides information on the operation of the diagnostic portion of the control panel; interpretation of fault codes, description of diagnostic tests, and lists the corrective action to restore the STU to an operable condition.

The trouble analysis information is presented in the following order:

1. CE Procedures before arriving at the customer's location (pre-site) and after arrival (on-site).
2. Use of Correction Action tables.
3. Diagnostic Test information.
4. Structured Analysis Method (SAM) tables.
5. Functional Description of CE tests.

## REMOVAL/REPLACEMENT PROCEDURES

This portion of the maintenance section contains instructions on how to remove and replace all field replaceable parts or assemblies of the STU. Location and identification of assemblies can be referenced to Section 7 - PARTS IDENTIFICATION.

Reference into the Removal/Replacement Procedures is primarily via the Structured Analysis Method (SAM) Tables contained in the Trouble Analysis portion of this section. Verification tests follow each of the replacement procedures so that the integrity of the replaced assembly can be insured, prior to returning the transport to an on-line status.

Table 6-1. REFERENCED MAINTENANCE AIDS

AID	USED ON
Digital Voltmeter 3M777 Tape (or equivalent)	Voltage Checks Magnetic Head Replacement Verification Check and Read/Write/Servo PWA Replacement

# TROUBLE ANALYSIS

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## GENERAL DESCRIPTION

This section of the manual contains diagnostic test procedures, Structured Analysis Method (SAM) Tables, and a description of the diagnostic tests.

## NOTES

1. The procedures contained in this section of the manual are intended for use by a qualified customer engineer, familiar with the operation of the Streaming Tape Unit (STU). Under no circumstances should these procedures be performed by persons other than fully qualified maintenance personnel.
2. The operator diagnostic procedures referenced in this section of the manual are expanded for maintenance personnel use. Diagnostics for use by the operator are contained in the OPERATION section of the Reference Manual.

The diagnostic tests designed into the STU are an off-line function initiated through the operator control panel. There are no on-line diagnostics, however, the host controller is capable of monitoring STU status through the Status Transfer command. A Channel Loopback command is also provided to exercise the formatter logic of the STU.

Although on-line diagnostics are not part of the STU, the microprocessor tests for many operational fault conditions while operating on-line. These conditions are indicated as fault codes, appearing on the control panel display. The fault condition is indicated by illumination of the Reset indicator and the appropriate fault code being displayed. Faults, which occur while tape is loaded, may initiate a controlled removal by the microprocessor of servo and write circuitry power to prevent tape damage.

## CUSTOMER ENGINEER PROCEDURES

Trouble analysis procedures by the customer engineer consist of a pre-site determination of the reported problem, and an on-site procedure to isolate and correct verified faults.

### PRE-SITE PROCEDURES

When the trouble call is received from the site, the customer engineer should proceed as follows:

1. Consult Tables 6-2 and 6-3, Corrective Action Matrices, to determine if operator action is required. Specific STU malfunctions or fault codes indicate the need for operator action in the form of visual checks, cleaning, or performing Operator Diagnostic Test 01. It should also be verified that Operator Diagnostic Test 01 has been performed after the operator corrective actions have been completed.
2. After verifying that the fault still occurs following completion of all operator actions, consult Table 6-2 or Table 6-3 for a list of assemblies related to the reported malfunction or fault code. As many of these assemblies, as are available, should be taken to the site to prevent unnecessary call-backs.

### Corrective Action Matrices

The Malfunction and Fault Code Matrices (Tables 6-2 and 6-3) list all malfunctions or fault codes and possible assemblies which may cause the fault condition. The purpose of this table is to provide a list of related assemblies prior to reporting to the customer site. Assemblies listed under the individual malfunction or fault codes are arranged in a "most probable fault" order. In addition to the assemblies listed, the table may direct the customer engineer to request the operator to perform Diagnostic Test 02 or Test 03. Test 02 is required if Fault Codes 22, 24, 26, 30, 31 or 36 terminate Operator Diagnostic Test 01. Tables 6-4 thru 6-7 list possible failing assemblies for fault codes which terminate Test 02.

Test 03 is required if Fault Codes 04, 06, 22, 25, 26, 30, 31, 32, 33, 35, 36, 48 or 52 terminate Operator Diagnostic Test 01. Tables 6-8 and 6-9 list possible failing assemblies for fault codes which terminate Test 03.

Also contained on the matrices in Tables 6-2 and 6-3 are those actions (A, B, C) which should be performed by the operator. These actions should be verified prior to any on-site call by the customer engineer.

Table 6-2. MALFUNCTION MATRIX

MALFUNCTION	FOLLOWING THE DEPRESSION OF POWER SWITCH (CIRCUIT BREAKER) TO THE '1' POSITION, THE "LOGIC OFF" LED DOES NOT ILLUMINATE.											
	FOLLOWING THE DEPRESSION OF THE "LOGIC ON" SWITCH, THE "LOGIC ON" LED DOES NOT ILLUMINATE.											
	STU DISPLAYS 00 ON POWER UP.											
	STU POWERS DOWN WHILE IN USE.											
	OPERATOR PANEL SWITCH DOES NOT OPERATE.											
	STU OPERATES WITH OPERATOR DOOR OPEN.											
	FILE PROT. LED DOES NOT ILLUMINATE WHEN A WRITE PROTECTED TAPE IS LOADED.											
	TAKE UP REEL DOES NOT TURN FREELY.											
	SUPPLY REEL DOES NOT TURN FREELY.											
	SUPPLY REEL HUB CANNOT BE LATCHED.											
CORRECTIVE ACTION	EXCESSIVE PNEUMATIC NOISE.											
ENSURE STU IS PLUGGED INTO A LIVE SUPPLY	A											
ENSURE OPERATION IS LEGAL					A							
CHANGE TAPE										A		
READ/WRITE/SERVO		4		3		2	2					
FORMATTER/CONTROL		5	1		2		5					
POWER SUPPLY	1	1	2	1								
POWER AMPLIFIER		3		2								
OPERATOR PANEL	3	2			1		3					
PNEUMATIC PUMP												1
PRESSURE REGULATOR												2
SUPPLY MOTOR/TACH				5					1			
SUPPLY HUB						4		2	1			
TAKE-UP MOTOR/TACH				4				1				
TAKE UP HUB								2				
DOOR SWITCH						1						
FILE PROTECT SENSOR							1					
COOLING FAN	2											

Table 6-3. FAULT CODE MATRIX (OPERATOR TEST 01)

FAILING ASSEMBLY	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Test Successful	X																														
Latch Hub Correctly													A										A			A					
Thread Tape Correctly											A		A					A												A	
Clean Head/Tape Path		A	A	A	A	A	A	A	A				C										B			B					
Change Tape		B	B	B	B	B	B	B	B				B		A		A	B					C			C				B	
Close Door										A																					
Run Test 02 (See NOTE)																							X		X		X				
Run Test 03 (See NOTE)					X		X																X			X	X				
Read/Write/Servo		2	2	2	1	1	1	1	1		2	2	1	3	2	2	2	1	2			2	2	4	1	2	2	4	1	1	2
Formatter/Control		3	3	1	2	2	2	2	2							3	3	2	1												
Power Supply													2																		
Power Amplifier					4		4																5		3	4	5				
Operator Panel																1															
Pneumatic Pump														1																	
Filter													4																		
Upper Air Bearing Sensor																							1								
Lower Air Bearing Sensor																								1							
Head (Amplitude Error)		1	1																												
Head (Data Reliability)					3	3	3	3	3	3		3																			
Supply Motor/Tach													3										3		1		3	2			
Supply Hub												2					4						1			1					
Take-Up Motor/Tach					5		5																2			3	1				
EOT/BOT Sensor												1			1															1	
Door Switch										1																		2			
File Protect Sensor																	1														
Pressure Regulator														5																	

NOTE: Tests 02 and 03 should not be used unless Test 01 directs their use. Test 02 will fail if run Stand-alone.

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Table 6-3. FAULT CODE MATRIX (Cont'd)

FAILING ASSEMBLY	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61		
Test Successful																																		
Latch Hub Correctly																																		
Thread Tape Correctly																																		
Clean Head/Tape Path	A	A																	A															
Change Tape																			B															
Close Door																																		
Run Test 02 (See NOTE)	X	X					X																											
Run Test 03 (See NOTE)	X	X	X	X		X	X											X				X												
Read/Write/Servo	1	1	2	1	1	1	1											1	1			1	1	2	1	1	1	1	1					
Formatter/Control																					2							2	2	1	1	2	2	
Power Supply																																		
Power Amplifier	2	2	1					2																										
Operator Panel																																1	1	
Pneumatic Pump	4	4	4					4																										
Filter	5	5	5					5																										
Upper Air Bearing Sensor	7	7						7																										
Lower Air Bearing Sensor	8	8						8																										
Head (Amplitude Error)																																		
Head (Data Reliability)																																		
Supply Motor/Tach																			2					3										
Supply Hub																									4									
Take-Up Motor/Tach	3	3	3	2			2	3											3					1										
EOT/BOT Sensor	9	9																																
Door Switch																																		
File Protect Sensor																																		
Pressure Regulator	6	6	6					6																										

NOTE: Tests 02 and 03 should not be used unless Test 01 directs their use. Test 02 will fail if run Stand-alone.

6-7

Test 02 Follow-up

Refer to Table 6-4 if, after running Operator Test 01, Fault Code 22 appears on the display. Table 6-3 indicates that Test 02 is required if operator actions A, B and C did not resolve the problem. If Test 02 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-4. TEST 02 TERMINATION CODES FOLLOWING TEST 01 FAULT CODE 22

FAILING ASSEMBLY	7 1	7 2	7 3	7 4	7 5	8 0	8 1	8 2	8 3	8 4	8 5	8 6	8 7	8 8	8 9	9 0	9 1	9 2	9 7	9 8	0 0	
Ensure Tape is Thd'd	A																					
Repeat Test	B																					A
Read/Write/Servo	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
Power Amplifier		2	2	2	2	2	2	2	2		2	2	2	2	2	2			2	2	2	2
Pneumatic Pump																						
Filter																						
Upper Air Brg Sensor																						
Lower Air Brg Sensor																						
Supply Motor/Tach																		1				
Supply Hub		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Take-Up Motor/Tach		4	4	4	4	4	4	4	4	2	4	4	4	4	4	4			4	4	4	4
Pressure Regulator																						

Refer to Table 6-5 if, after running Operator Test 01, Fault Code 24 appears on the display. Table 6-3 indicates that Test 02 is required. If Test 02 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-5. TEST 02 TERMINATION CODES FOLLOWING TEST 01 FAULT CODE 24

FAILING ASSEMBLY	7 1	7 2	7 3	7 4	7 5	8 0	8 1	8 2	8 3	8 4	8 5	8 6	8 7	8 8	8 9	9 0	9 1	9 2	9 7	9 8	0 0	
Ensure Tape is Thd'd	A																					
Repeat Test	B																					A
Read/Write/Servo	1	1	3	1	3	1			1	1	1	1	1	1	1	1	1	3	1	3	1	1
Power Amplifier		2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pneumatic Pump																						
Filter																						
Upper Air Brg Sensor																						
Lower Air Brg Sensor																						
Supply Motor/Tach			1		1													1		1		
Supply Hub																						
Take-Up Motor/Tach																						
Pressure Regulator																						



Refer to Table 6-6 if, after running Operator Test 01, Fault Code 26 appears on the display. Table 6-3 indicates that Test 02 is required. If Test 02 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-6. TEST 02 TERMINATION CODES FOLLOWING TEST 01 FAULT CODE 26

FAILING ASSEMBLY	7 1	7 2	7 3	7 4	7 5	8 0	8 1	8 2	8 3	8 4	8 5	8 6	8 7	8 9	9 0	9 1	9 2	9 7	9 8	0 0
Ensure Tape is Thd'd	A																			
Repeat TEST	B																			A
Read/Write/Servo	1	1	1	1	1	1	3	3	1	2	1	1	1	1	1	1	1	1	1	1
Power Amplifier							1	1												
Pneumatic Pump																				
Filter																				
Upper Air Bearing																				
Lower Air Bearing																				
Supply Motor/Tach							2													
Supply Hub																				
Take-Up Motor/Tach		2	2	2	2	2		2	2	1	2	2	2	2	2	2	2	2	2	2
Pressure Regulator																				

Refer to Table 6-7 if, after running Operator Test 01, Fault Code 30, 31 or 36 appears on the display. Table 6-3 indicates that Test 02 is required if operator action "A" did not resolve the problem. If Test 02 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-7. TEST 02 TERMINATION CODES FOLLOWING TEST 01 FAULT CODES 30, 31, OR 36

FAILING ASSEMBLY	7 1	7 2	7 3	7 4	7 5	8 0	8 1	8 2	8 3	8 4	8 6	8 7	8 9	9 0	9 1	9 2	9 7	9 8	0 0	
Ensure Tape is Thd'd	A																			
Repeat Test	B																			A
Read/Write/Servo	1		2		2	3	3	3	3	2	3	3			3			3	3	3
Power Amplifier						1	1	1	1		1	1						1	1	1
Pneumatic Pump		3	4	3	4										2	2				
Filter		2		2												1				
Upper Air Bearing				1	1								1							
Lower Air Bearing		1	1											1						
Supply Motor/Tach																				
Supply Hub																				
Take-Up Motor/Tach						2	2	2	2	1	2	2						2	2	2
Pressure Regulator		4	3	4	3										1	3				

Test 03 Follow-Up

Refer to Table 6-8 if, after executing Operator Test 01, Fault Code 04 or 06 appears on the display. Table 6-3 indicates that Test 03 is required if operator actions A or B did not resolve the problem. If Test 03 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-8. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 04 OR 06

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			A
FAILING ASSEMBLY							
Read/Write/Servo		2	1	1	2	1	1
Power Amplifier	1						
Read-Write Head							3
Take-Up Motor/Tach		1			1	2	
Formatter Control				2			2

Refer to Table 6-9 if, after executing Operator Test 01, Fault Code 26 or 32 appears on the display. Table 6-3 indicates that Test 03 is required. If Test 03 is unsuccessful, refer the fault code to this table for probable failing assemblies.

Table 6-9. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 26 OR 32

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			A
FAILING ASSEMBLY							
Read/Write/Servo		2	1	1		2	1
Power Amplifier	1				2		2
Read-Write Head							
Take-Up Motor/Tach		1			1		3
Pneumatic Pump							4
Filter							5
Pressure Regulator							6

Refer to Table 6-10 if, after executing Operator Test 01, Fault Code 22 appears on the display. Table 6-3 indicates that Test 03 is required if operator actions A or B did not resolve the problem. If Test 03 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-10. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 22

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			A
FAILING ASSEMBLY							
Read/Write/Servo	2	1	1	1	2	2	1
Power Amplifier	1	2					2
Read-Write Head							
Take-Up Motor/Tach					1	1	

Refer to Table 6-11 if, after executing Operator Test 01, Fault Code 25 appears on the display. Table 6-3 indicates that Test 03 is required. If Test 03 is unsuccessful, refer the fault code to this table for probable failing assemblies.

Table 6-11. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 25

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			A
FAILING ASSEMBLY							
Read/Write/Servo	2	2	1	1	2	2	2
Power Amplifier	1	1			1		1
Read-Write Head							
Take-Up Motor/Tach						1	

Refer to Table 6-12 if, after executing Operator Test 01, Fault Code 33 or 35 appears on the display. Table 6-3 indicates that Test 03 is required if operator actions A or B did not resolve the problem. If Test 03 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-12. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 33 OR 35

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			A
FAILING ASSEMBLY							
Read/Write/Servo	1	1	1	1	1		1
Power Amplifier	2						
Read-Write Head							
Take-Up Motor/Tach						1	

Refer to Table 6-13 if, after executing Operator Test 01, Fault Code 48 appears on the display. Table 6-3 indicates that Test 03 is required. If Test 03 is unsuccessful, refer the fault code to this table for probable failing assemblies.

Table 6-13. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 48

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			
FAILING ASSEMBLY							
Read/Write/Servo	1	1	1	1	2		1
Power Amplifier							
Read-Write Head							2
Take-Up Motor/Tach					1	1	
Supply Motor	2	2					
EOT/BOT Assembly	2						

Refer to Table 6-14 if, after executing Operator Test 01, Fault Code 52 appears on the display. Table 6-3 indicates that Test 03 is required if operator actions A or B did not resolve the problem. If Test 03 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-14. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 52

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			A
FAILING ASSEMBLY							
Read/Write/Servo	1	1	1	1	2		1
Power Amplifier							
Read-write Head							
Take-Up Motor/Tach					1	1	
Supply Motor Assy	2	2					2
Supply Reel Hub Assy	3	3					3

Refer to Table 6-15 if, after executing Operator Test 01, Fault Code 30 or 31 appears on the display. Table 6-3 indicates that Test 03 is required. If Test 03 is unsuccessful, refer the fault code to this table for probable failing assemblies.

Table 6-15. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 30 OR 31

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			
FAILING ASSEMBLY							
Read/Write/Servo	2	2	1	1	2		3
Power Amplifier	1						1
Read-Write Head							
Take-Up Motor/Tach		1			1	1	2
Pneumatic Pump							
Filter							
Pressure Regulator							
EOT/BOT Sensor							4

Refer to Table 6-16 if, after executing Operator Test 01, Fault Code 36 appears on the display. Table 6-3 indicates that Test 03 is required if operator actions A or B did not resolve the problem. If Test 03 is unsuccessful, refer the fault code displayed to this table for probable failing assemblies.

Table 6-16. TEST 03 TERMINATION CODES FOLLOWING TEST 01  
FAULT CODE 36

	8 2	8 4	9 4	9 5	9 6	9 8	0 0
OPERATOR ACTION							
Ensure Tape is Not Thd'd			A				
Repeat Test			B	A			
FAILING ASSEMBLY							
Read/Write/Servo	2	2	1	1	2		3
Power Amplifier	1						1
Read-Write Head							
Take-Up Motor/Tach		1			1	1	2

#### ON-SITE PROCEDURES

Prior to initiating any diagnostic test, make a thorough visual inspection of the STU. Inspection of the head recording surface, cleaner blades, write enable reflective ring, hub assemblies, and proper seating of electrical connectors is always the first step in an organized troubleshooting procedure.

After the visual inspection, perform a functional check of the STU as follows (see Figure 6-1):

1. Perform SAM 1001. This procedure checks out the functional operation of the transport, including ancillary sensors, which the microprocessor cannot fault detect, without manual operation and visual feedback.
2. Refer to specific SAM fault code.
3. Perform any corrective action as directed by the SAM.
4. Verify operation of the transport by again performing Operator Diagnostic 01 or other verification tests, as directed by the SAM.

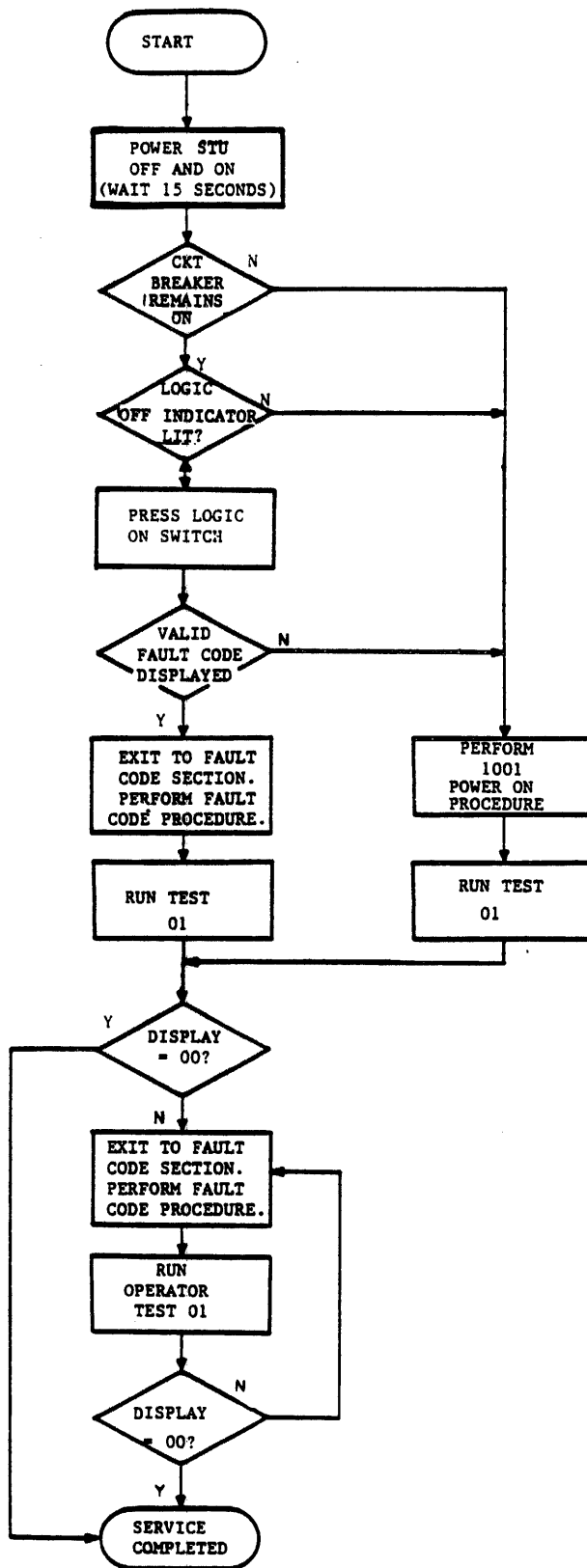


Figure 6-1. FLOWCHART OF ON-SITE TROUBLE ANALYSIS

## Diagnostic Tests

The maintenance philosophy for trouble analysis of the STU is to minimize the time it takes to restore the STU to an on-line status, after a reported fault condition occurs. This is accomplished by providing two types of diagnostics as follows:

1. An operator test which is initiated prior to reporting the fault condition to the CE.
2. Customer engineer tests to be performed when you report to the site for corrective action.

## Operator Diagnostics

The operator diagnostic is a functional test which directs the operator actions after a fault code appears. The operator test, procedure, and a fault code/corrective action table are contained in Volume I, 49768900. The fault code may indicate any one or more of the following types of fault conditions:

### o Environment or Media Problems

This type of problem requires that the operator clean the tape path area and/or use another known good quality tape.

### o Operator Error Problem

This type of problem is caused by conditions such as door open, write enable ring not present, or tape threaded incorrectly.

### o Transport Circuit Problems

These are fault conditions which require service by a customer engineer.

It is your responsibility to ensure that the operator performs Test 01, and to determine from the operator the fault code which appears, after running the operator diagnostic.

Because the operator diagnostics are an integral part of the trouble analysis procedures, subsequent paragraphs contain the procedure to initiate this diagnostic. The only difference between the procedure contained in the OPERATION section of Volume I, 49768900 and the following procedure, is an expanded feature to display a Sub-Fault Code for maintenance purposes.



## Diagnostic Test Procedure

The operator diagnostic consists of one selectable test which runs for approximately 10 minutes, when a 2400 foot tape is used. Faults encountered during the test terminate the diagnostics and display a numerical code on the display panel. Any fault code should be logged by the operator and reported to you, if operator corrective actions do not resolve the problem. The operator diagnostic is initiated as follows:

### o Transport Status

1. Transport powered on (LOGIC ON indicator lit).
2. Tape threaded through tape path and onto take-up reel, but not loaded (untensioned).

### o Test Procedure

1. Press TEST switch.
  - a. DIAGNOSTIC indicator lights.
  - b. Display panel indicates 01.
2. Press EXECUTE switch.
  - a. Test starts with display panel incrementing from 00, 11, 22 thru 99. Verify that all segments of the numerical display are functioning.
  - b. Concurrent with step a. above, the following indicators are illuminated: FILE PROTECT, LOGIC ON, ON-LINE, RESET and DIAGNOSTICS.
  - c. Test continues with various motion and read/write exercises for approximately 10 minutes.

The transport performs a REWIND/UNLOAD operation and 00 is indicated on the display panel, if the test runs to completion. If the test is unsuccessful, the test terminates and a fault code appears on the display panel. If the problem cannot be resolved through operator actions, as indicated in Table 6-3, the fault code is referenced directly to the corresponding SAM Table for corrective action.

When the SAM Tables are referenced for corrective action, a Sub-Fault Code interrogation may be required. With the fault code still indicated on the display panel, press and hold the CE switch. This action will cause the Sub-Fault Code to appear on the display.

If a SAM action item indicates Test 02 or Test 03 is to be performed, select test as follows:

#### NOTE

Tests 02 and 03 should not be used unless Test 01 directs their use. Tests 02 and 03 may fail if run without first running Test 01, and Fault Code 70 or 71 will appear.

1. Press RESET switch (resets fault code from Test 01 if still displayed).
2. Press TEST switch (01 is indicated on display).
3. Press STEP switch one time (numerical display steps from 01 to 02). If Test 03 is required, press STEP a second time to increment display from 02 to 03.
4. Press EXECUTE switch (test starts).

Tests 02 and 03 are very short tension and servo tests. Display 00 is indicated if test is successful. If test is not successful, refer the fault code to the original SAM table.

#### Customer Engineer Diagnostics

Perform the customer engineer diagnostics in conjunction with the requirements of the Structured Analysis Method (SAM) tables. When reporting to the site, obtain as much information from the operator and operating system as you can. Fault codes, the frequency at which they occur and, if possible, the operation in progress at that time, are all things which should be considered prior to execution of the diagnostics. If the fault is intermittent, the information received from the operator and operating system may be instrumental in directing you to the appropriate test to duplicate the condition under which the fault occurs.

If the fault condition is a hard error, or one which occurs frequently, start the troubleshooting procedure by executing Operator Diagnostic Test 01. This test is a lead-in to all fault codes and subsequent SAM Tables.

Initiate customer engineer tests as follows:

o Transport Status

Status requirements of the transport are listed in the individual SAM troubleshooting tables.

o Test Procedure

1. While pressing CE switch, press TEST switch.

- a. DIAGNOSTICS indicator lights.
- b. Display panel indicates 00.

2. Press STEP switch.

- a. Display number increments each time STEP is pressed, or increments automatically if STEP is held pressed.
- b. To facilitate test number selection, use the following procedure. Example: Test 39 selection required.
  - Press STEP switch until 03 appears on display panel.
  - Press TEST switch and the 3-digit transfers to the left.
  - Display now indicates 30.
  - Press STEP switch again until display increments from 30 to 39.
- c. If test options (see test description subsection) are desired, press and hold CE switch, then press EXEC while CE is held pressed. Display will indicate 00. STEP switch is then pressed to select the desired option.

3. Press EXECUTE switch.

- a. Test is initiated.

If the test runs to completion, the display panel indicates 00. If test fails, the display panel indicates the fault code.

#### Customer Engineer Special Load/Unload Procedures

While performing specific fault code procedures, you may be directed to perform a Test Load or Untensioned Unload procedure. A description of these special procedures follows.

##### o Test Load

Follow this procedure if a reel of tape is suspected of not being wrapped properly and a tape re-wrap is necessary.

1. Press TEST switch. DIAGNOSTIC LED lights and display indicates 01.
2. Press LOAD switch. Forward tape motion is initiated to EOT. The take-up reel motor moves tape while the supply reel motor is completely untensioned. When EOT is detected, a normal rewind function is initiated (with tape tension) to BOT.

##### o Untensioned Unload

Use this procedure to unwrap tape from the take-up reel onto the supply reel following a servo fault. The velocity servo (take-up reel motor) is completely untensioned while the supply reel moves tape in the reverse direction. Press UNLOAD switch while tape is untensioned (not loaded).

#### Sub-Fault Codes

The SAM tables may direct you to display the sub-fault code associated with the primary fault code. The sub-fault code is displayed by pressing the CE switch after the primary fault code appears on the digital indicators. The sub-fault code is displayed as long as the CE switch is held pressed.

STRUCTURED ANALYSIS METHOD (SAM) TABLES

After a fault code appears on the display panel, refer the fault code number directly to the corresponding number of the SAM which are listed numerically on subsequent pages. The basic SAM format (Figure 6-2) uses YES (Y) or NO (N) responses to sequential conditions to lead the customer engineer to appropriate corrective action.

When a fault can be caused by any one of several factors, the separate actions to correct each of these factors are numbered according to priority level with the action, having the highest probability of success, being listed as number 1. If several actions have the same probability of correcting the fault, the one that is easiest to perform (takes the least time) is listed as the first action.

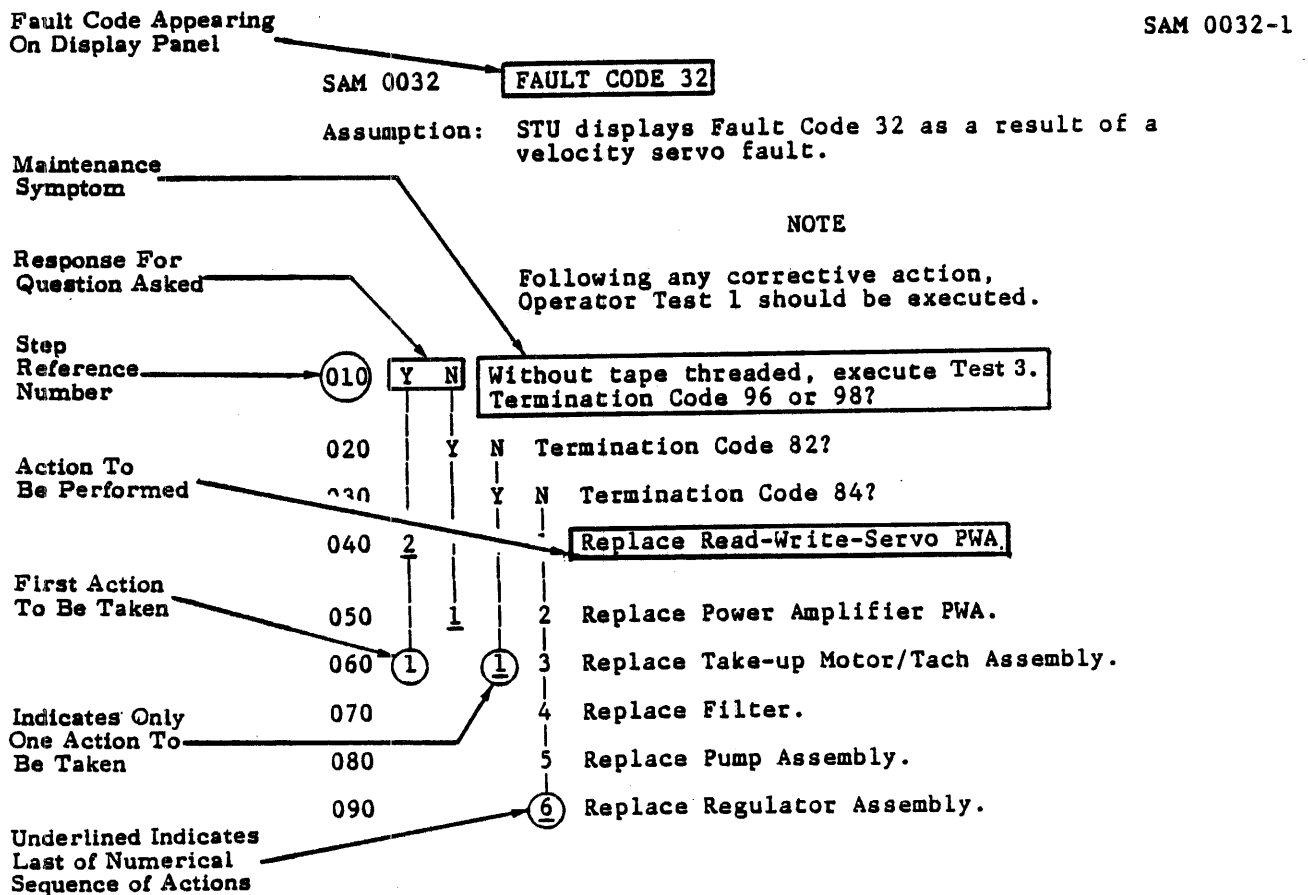


Figure 6-2. EXAMPLE OF STRUCTURED ANALYSIS METHOD (SAM) TABLE

## SUB-FAULT CODE INTERPRETATION

The sub-fault code is displayed by pressing the CE switch after the primary fault code is indicated. Sub-fault codes are listed after the associated fault code.

Interpretation of the sub-fault numerical display is as follows:

1. Example 1 - Fault Code 25, Sub-Fault Code 64 (Figure 6-3)
    - a. 40 - Take-Up sensor saw fault first
    - b. 20 - Fault occurred on up ramp
    - c. 04 - Fault occurred in reverse direction
    - d. 00 - Fault occurred with 25 ips demanded
    - e. 00 - Fault occurred while drive was moving at constant velocity, on ramp, on in stoplock for less than 1 second
    - f. 00 - Fault occurred with pneumatic pump enabled
- 64

### STU FAULT CODE 25 - LOW TENSION FAULT

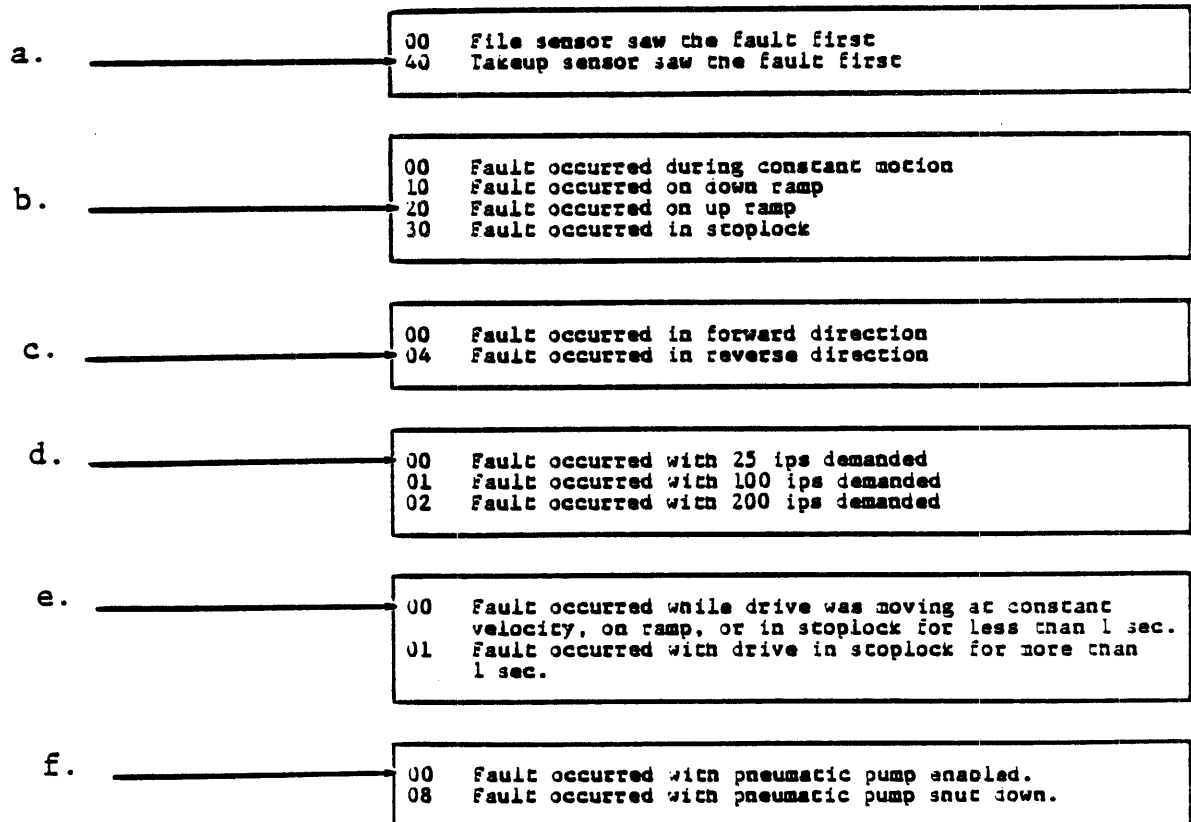


Figure 6-3. SUB-FAULT CODE INTERPRETATION - EXAMPLE 1

2. Example 2 - Fault Code 25, Sub-Fault Code 19 (Figure 6-4)
- a. 00 - File sensor saw fault first
  - b. 10 - Fault occurred on down ramp
  - c. 00 - Fault occurred in forward direction
  - d. 01 - Fault occurred with 100 ips demanded
  - e. 00 - Fault occurred while drive was moving at constant velocity, on ramp, or in stoplock for less than 1 second
  - f. 08 - Fault occurred with pneumatic pump shut down
- 19

STU FAULT CODE 25 - LOW TENSION FAULT

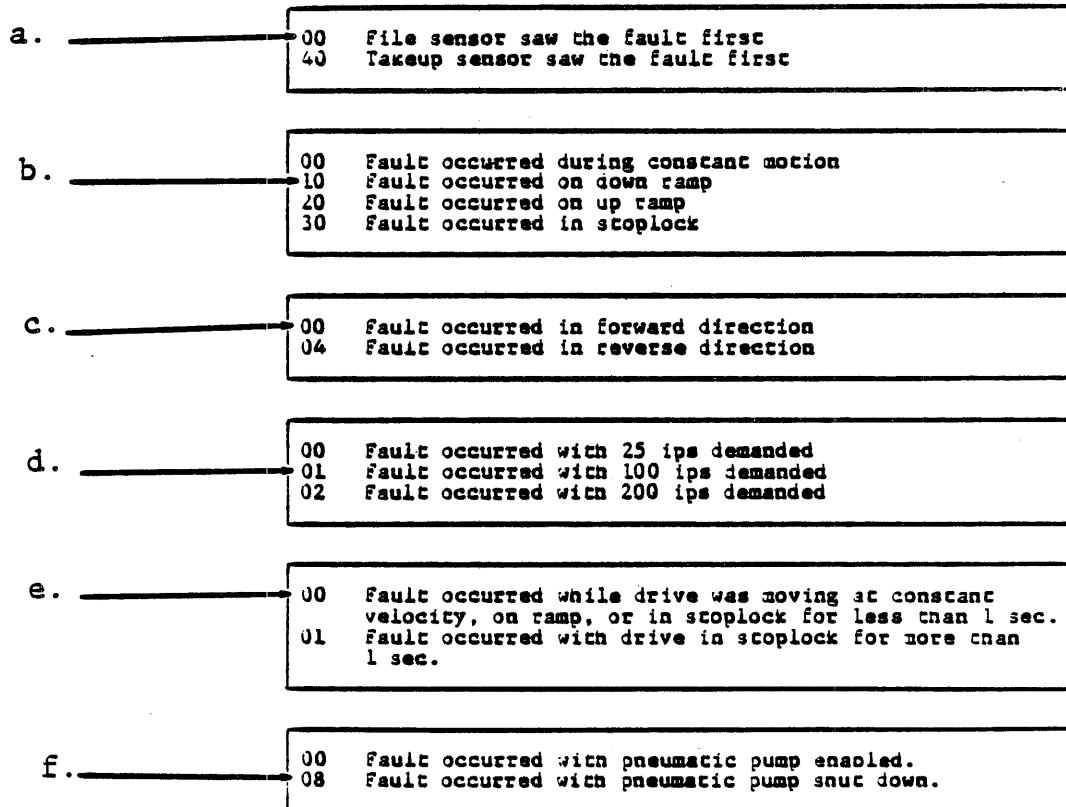


Figure 6-4. SUB-FAULT CODE INTERPRETATION - EXAMPLE 2

<u>SAM CHECKOUT</u>	<u>DESCRIPTION</u>
1001	Power-On 1
1002	Power-On 2
1003	Power-On 3

<u>SAM FAULT CODE</u>	<u>DESCRIPTION</u>
01	Read envelope fault
02	Read amplitude tolerance fault
03	ID fault
04	Low speed write errors
05	Low speed read errors
06	High speed write errors
07	High speed read errors
08	Noise in IBG
09	Reserved for future use
10	Operator door open
11	Absence of tape
12	Load fault
13	Tape threaded incorrectly
14	BOT location fault
15	Load/Unload aborted by operator
16	Diagnostic tape is write protected
17	Ran off end of tape
18	Tape already loaded
19	Reserved for future use
20	File tension sensor fault
21	Take-up tension sensor fault
22	Unable to tension tape
23	Unable to re-establish tension
24	High tension fault
25	Low tension fault
26	Servo fault
27	No coarse tachs
28	Tension recovery problem
29	Absence of tape



<u>SAM</u> <u>FAULT CODE</u>	<u>DESCRIPTION</u>
30	Up ramp fault
31	Down ramp fault
32	Stoplock over-run
33	Tape positioning fault
34	BOT positioning fault
35	Positioning fault
36	Speed fault
37	Pump power-up
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	Velocity correction fault
48	Unload fault
49	
50	Irrecoverable device health check fault
51	Recoverable device health check fault
52	Speed calculation fault
53	Arithmetic error
54	Erase/Write current fault
55	Load/Rewind timeout fault
56	Processor communication fault
57	Device illogical fault
58	Recoverable formatter health check fault
59	Irrecoverable formatter health check fault
60	Irrecoverable operator panel fault
61	Recoverable operator panel fault

This Power-On/Installation SAM is for the isolation of AC power faults.

Assumption: The STU's AC circuit breaker is turned off and the STU is plugged into a "live" AC supply of the correct voltage.

NOTE

Following any corrective action, reconnect any assemblies that may have been disconnected and restart this SAM with circuit breaker turned off.

010	Y	N		Turn circuit breaker ON. Does circuit breaker remain on?
020		Y	N	Disconnect cooling fan cable from power supply. Turn circuit breaker ON. Does circuit breaker remain on?
030		<u>2</u>	<u>1</u>	Replace Power Supply Assembly.
040		1		Replace Cooling Fan Assembly.
050	Y	N		Is the LOGIC OFF LED on operator panel illuminated?
060		Y	N	Is the LOGIC ON LED on operator panel illuminated?
070			Y	N Press LOGIC ON switch. Does LOGIC ON LED illuminate and stay illuminated?
080			Y	N Is cooling fan operating?
090				1 Ensure AC supply cable is plugged into Power Supply Assembly.
100				2 Ensure that AC supplied to STU is "live" and the correct voltage for the unit.
110		1	<u>2</u>	<u>3</u> Replace Power Supply Assembly.
120				1 Ensure operator panel cable is plugged into Formatter-Control PWA.
	2	2	2	2
	A	B	C	D

	A	B	C	D	
	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	
130					2 Ensure logic cable between power supply and Formatter-Control PWA firmly connected at each end.
140		<u>2</u>	1	<u>4</u>	Replace Operator Panel Assembly.
150	Y	N			Is cooling fan operating?
160			1		Replace Cooling Fan Assembly.
170		<u>2</u>			Replace Power Supply Assembly.
180	<u>1</u>				Go to SAM 1002.

This Power-On SAM is for the isolation of DC power faults.

Assumption: The STU's AC circuit breaker is turned on, the OFF LED is illuminated and the cooling fan is operating.

NOTE

Following any corrective action, reconnect any assemblies that may have been disconnected and restart this SAM.

010	Y	N	Press LOGIC ON switch of operator panel. Does LOGIC ON LED illuminate and stay illuminated?
015		1	Ensure DC cable harness is firmly connected to the underside of the Power Supply.
020	Y	N	Disconnect DC supply cable from Power Amplifier PWA. Press LOGIC ON switch. Does LOGIC ON LED illuminate and stay illuminated?
030		Y	N Reconnect DC supply cable to Power Amplifier PWA. Disconnect DC supply cable from Formatter-Control PWA and Read-Write-Servo PWA. Press LOGIC ON switch. Does LOGIC ON LED illuminate and stay illuminated?
040			1 Replace Power Supply Assembly.
050			<u>2</u> Replace Operator Panel Assembly.
060		Y	N Remove Read-Write-Servo PWA and reconnect DC supply cable to Formatter-Control PWA. Press LOGIC ON switch. Does LOGIC ON LED illuminate and stay illuminated?
070			1 Replace Formatter-Control PWA.
080		<u>2</u>	<u>2</u> <u>2</u> Replace Power Supply Assembly.
090			1 Replace Read-Write-Servo PWA.
100			1 Replace Power Amplifier PWA.
110	Y	N	Is the OFF LED illuminated?
	2	2	
	A	B	

	A	B	
	1	1	
120	Y	N	Is the two-digit display blank and FILE PROT LED illuminated, and RESET, ON-LINE and DIAGNOSTICS LEDs all extinguished?
130	Y	N	Are the RESET, ON-LINE and DIAGNOSTICS LEDs all illuminated?
140		Y	N Is the display blank?
150		Y	N Wait for 15 seconds. Is RESET LED extinguished?
160		Y	N Is Fault Code 50 or 51 or 56 or 58 or 59 or 60 or 61 displayed?
170		<u>1</u>	<u>1</u> Replace Formatter-Control PWA.
180		<u>1</u>	<u>1</u> Go to the SAM for the displayed fault code.
190		Y	N Is FILE PROT LED illuminated?
200	<u>2</u>		<u>1</u> Replace Operator Panel Assembly.
210			<u>2</u> Replace Read-Write-Servo PWA.
220		<u>1</u>	<u>1</u> <u>3</u> Replace Formatter-Control PWA.
230	1	<u>2</u>	<u>2</u> Replace Power Supply Assembly.
240		<u>1</u>	<u>1</u> Go to SAM 1003.

This SAM is for the detection/isolation of operational faults.

Assumption: The STU is powered on with the LOGIC OFF LED extinguished, the LOGIC ON LED illuminated, the FILE PROT LED illuminated and the display blank.

NOTE

Following any corrective action, this SAM should be restarted.

010	Y	N	Thread a write enabled tape and close operator door. Press TEST switch. Does DIAGNOSTICS LED illuminate?
020		1	Replace Operator Panel Assembly.
030		<u>2</u>	Replace Formatter-Control PWA.
040	Y	N	Is 01 displayed?
050		1	Replace Operator Panel Assembly.
060		<u>2</u>	Replace Formatter-Control PWA.
070	Y	N	Press EXECUTE switch and observe LEDs and display of operator panel. Does display sequence from 00 to 11 to 22 to 99 without any missing segments? And while display is sequencing, are ON-LINE and RESET LEDs both illuminated?
080		1	Replace Operator Panel Assembly.
090		<u>2</u>	Replace Formatter-Control PWA.
100	Y	N	Does Operator Test 1 terminate displaying 00?
110		<u>1</u>	Go to the SAM for the displayed fault code.
120	Y	N	Is the BOT LED extinguished?
130		1	Replace Formatter-Control PWA.
140		<u>2</u>	Replace Operator Panel Assembly.
150	Y	N	Press the RESET switch. Is the display blank?
		<u>2</u>	
	A	B	

	A	B	
	1	1	
160		1	Replace Operator Panel Assembly.
170		<u>2</u>	Replace Formatter-Control PWA.
180	Y	N	Thread tape and close operator door. Press LOAD switch. Does STU load tape?
190		Y	N Fault Code displayed?
200		1	Replace Operator Panel Assembly.
210		<u>2</u>	Replace Formatter-Control PWA.
220		<u>1</u>	Go to the SAM for displayed fault code.
230	Y	N	Is BOT LED illuminated?
240		1	Replace Operator Panel Assembly.
250		<u>2</u>	Replace Formatter-Control PWA.
260	Y	N	Is FILE PROT LED extinguished?
270		1	Replace Operator Panel Assembly
280		<u>2</u>	Replace Formatter-Control PWA.
290	Y	N	Press ON-LINE switch. Does ON-LINE LED illuminate?
300		1	Replace Operator Panel Assembly.
310		<u>2</u>	Replace Formatter-Control PWA.
320	Y	N	Press RESET switch followed by UNLOAD switch. Does STU unload tape?
330		Y	N Fault Code displayed?
340		1	Replace Operator Panel Assembly.
350		<u>2</u>	Replace Formatter-Control PWA.
360		<u>1</u>	Go to the SAM for the displayed fault code.
	3		
	A		

	A		
	2		
370	Y	N	While pressing CE switch, press TEST switch. Is 00 displayed?
380		1	Replace Operator Panel Assembly.
390		<u>2</u>	Replace Formatter-Control PWA.
400	Y	N	Press STEP switch. Is 01 displayed?
410		1	Replace Operator Panel Assembly.
420		<u>2</u>	Replace Formatter-Control PWA.
430	Y	N	Press RESET switch. Remove write permit ring from reel and rethread tape. With operator door open, press LOAD switch. Is Fault Code 10 displayed?
440		1	Replace Door Switch Assembly.
450		<u>2</u>	Replace Read-Write-Servo PWA.
460	Y	N	Press RESET switch and close operator door. Press LOAD switch. Does the STU load tape successfully?
470		<u>1</u>	Go to the SAM for the displayed fault.
480	Y	N	Is FILE PROT LED illuminated?
490		1	Replace File Protect Sensor Assembly.
500		2	Replace Read-Write-Servo PWA.
510		<u>3</u>	Replace Supply Hub Assembly.
520	<u>1</u>		Unload tape; the SAM is completed without finding any faults.



Assumption: STU displays Fault Code 01 as a result of failing to detect a read signal during a read amplitude checking diagnostic test.

The most probable cause of this fault is a dirty read-write head. Another possible cause is damaged tape.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Ensure that cables between read-write head and Read-Write-Servo PWA are correctly connected.
- 040 4 Ensure that write current selection resistors (R224 and R225) are correctly installed in Read-Write-Servo PWA.
- 050 5 Replace Read-Write Head Assembly.
- 060 6 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 070 7 Replace Formatter-Control PWA.

STU FAULT CODE 01 - READ ENVELOPE FAULT

---

00 Envelope not detected during read amplitude check  
(EGC test)

---

Assumption: STU displays Fault Code 02 as a result of detecting a read amplitude out of range during a read amplitude checking diagnostic test.

The most probable cause of this fault is a dirty read-write head. Another possible cause is damaged tape.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Ensure that cables between read-write head and Read-Write-Servo PWA are correctly connected.
- 040 4 Ensure that write current selection resistors (R224 and R225) are correctly installed in Read-Write-Servo PWA.
- 050 5 Replace Read-Write Head Assembly.
- 060 6 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 070 7 Replace Formatter-Control PWA.

STU FAULT CODE 02 - READ AMPLITUDE TOLERANCE FAULT

---

00 Read amplitude outside range 1.5 volts  $\pm$  0.8 volts (i.e. difference between EGC gain and gain in backup memory would cause an amplitude difference greater than 0.8 volts)

---

Assumption: STU displays Fault Code 03 during Operator Test 1 due to a failure to read or write the PE identification burst at load point.

The probable cause of this fault is damaged tape. The tape should be free of defects within the first six inches of tape after the BOT reflective marker.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Ensure that Formatter-Control PWA and Read-Write-Servo PWA are firmly connected.
- 040 4 Replace Formatter-Control PWA.
- 060 5 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 070 6 Replace Read-Write Head.

STU FAULT CODE 03 - ID FAULT

---

00 Unable to read or write PE Identification Burst

---

Assumption: STU displays Fault Code 04 during Operator Test 1 due to a failure to write a block within five attempts at low speed.

The probable causes of this fault are dirty head and damaged tape.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Ensure that Formatter-Control PWA and Read-Write-Servo PWA are firmly connected.
- 040 Y N Without tape threaded, execute Test 3.  
Termination Code 98?
- 050 Y N Termination Code 96?
- 060 Y N Termination Code 82?
- 070 Y N Termination Code 84?
- 080 1 2 2 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 090 2 1 2 2 Replace Formatter-Control PWA.
- 100 2 1 3 3 Replace Read-Write Head Assembly.
- 110 2 1 1 1 Replace Take-Up Motor/Tach Assembly.
- 120 2 1 1 1 Replace Power Amplifier PWA.

STU FAULT CODE 04 - LOW SPEED WRITE ERRORS

- 
- 00    Unable to write a block at low speed within 5 attempts
  - 37    Filemark detection error
  - 38    More than 16 write error recoveries performed while  
      writing to EOT at low speed during CE test 21
-

Assumption: STU displays Fault Code 05 during Operator Test 1 due to a failure to read a block in forward or reverse direction at low speed.

The probable causes of this fault are dirty head and damaged tape.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 040 4 Replace Formatter-Control PWA.
- 050 5 Replace Read-Write Head.

STU FAULT CODE 05 - LOW SPEED READ ERROR

- 
- 00 Data error detected while reading at low speed  
(No error recovery performed)
  - 36 Short IBG detected
  - 37 Filemark detection error
-

Assumption: STU displays Fault Code 06 during Operator Test 1 due to a failure to write a block within 5 attempts at high speed, or due to too many write errors while writing to EOT.

The probable causes of this fault are dirty head and damaged tape.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

010	1				Clean read-write head, tape cleaner and tape guides.
020	2				Change tape to a known good write enabled tape.
030	3				Ensure that Formatter-Control PWA and Read-Write-Servo PWA are firmly connected.
040	Y	N			Without tape threaded, execute Test 3. Termination Code 98?
050		Y	N		Termination Code 96?
060			Y	N	Termination Code 82?
070				Y	N Termination Code 84?
080	1	2		2	1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
090					2 Replace Formatter-Control PWA.
100					3 Replace Read-Write Head Assembly.
110	2	1		1	1 Replace Take-Up Motor/Tach Assembly.
120				1	1 Replace Power Amplifier Assembly.

STU FAULT CODE 06 - HIGH SPEED WRITE ERROR

---

00	Unable to write a block at high speed within 5 attempts
37	File mark detection error
38	More than 16 write error recoveries performed while writing to EOT at high speed during operator test 1 or CE test 23

---

SAM 0007      FAULT CODE 07

SAM 0007-1

Assumption: STU displays Fault Code 07 during Operator Test 1 due to a failure to read a block at high speed.

The probable causes of this fault are dirty head and damaged tape.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 040 4 Replace Formatter-Control PWA.
- 050 5 Replace Read-Write Head.

STU FAULT CODE 07 - HIGH SPEED READ ERROR

- 
- 00 Data error detected while reading at high speed (No error recovery performed)
  - 36 Short IBG detected
  - 37 File mark detection error
-



SAM 0008      FAULT CODE 08

SAM 0008-1

Assumption: STU displays Fault Code 08 during Operator Test 1 due to detection of noise during IBG.

The probable causes of this fault are dirty head and damaged tape.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Clean read-write head, tape cleaner and tape guides.
- 020 2 Change tape to a known good write enabled tape.
- 030 3 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 040 4 Replace Formatter-Control PWA.
- 050 5 Replace Read-Write Head.

STU FAULT CODE 08 - NOISE IN IBG

---

00 Noise detected during IBG or while erasing

---

Assumption: STU displays Fault Code 10 as a result of detecting an open operator door condition.

The most probable cause of this fault is the operator door being open. During any normal operation, including execution of diagnostic tests that require reel motion, the door must be closed.

## NOTE

Following any corrective action, the door should be closed and Operator Test 1 should be executed.

- |     |          |          |   |
|-----|----------|----------|---|
| 010 | 1        |          | Ensure that all interlock switch leads are unbroken and are firmly connected to the door switch assembly.   |
| 020 | 2        |          | Ensure that all cables are firmly connected to the Read-Write-Servo PWA.  |
| 030 | Y        | N        | Using a DVM with negative terminal connected to TP8 of Read-Write-Servo PWA, measure voltages on outermost terminals of door switch while the operator door is closed. Is voltage difference greater than 0.2 volt? |
| 040 |          | Y        | N Repeat previous operation for innermost terminals. Is voltage difference greater than 0.2 volt?   |
| 050 |          |          | <u>1</u> Replace Read-Write-Servo PWA (See Note 3 on page 6-130).   |
| 060 | 1        | 1        | Ensure Door Switch Plunger on operator door lines up with door switch and will depress switch when door is closed.  |
| 070 | <u>2</u> | <u>2</u> | Replace Door Switch Assembly.   |

STU FAULT CODE 10 - OPERATOR DOOR OPEN

- 
- 01 Door open on load
  - 02 Door open after tensioning
  - 03 Door opened during unload
  - 04 Door open on untensioned unload
  - 05 Door opened during untensioned unload
  - 06 Door opened during retensioned load unload
  - 07 Door open on diagnostic test
-

Assumption: STU displays Fault Code 11 as a result of detecting an absence of tape condition during a load operation, or a diagnostic test that requires tape threaded.

The most probable cause of this fault is that tape is not threaded. Another possible cause is that tape is threaded with tape that has oxide removed.

## NOTE

Following any corrective action, a tape load operation should be performed.

- |     |          |          |  |
|-----|----------|----------|--|
| 010 | Y        | N        | Disconnect cable from BOT/EOT Sensor Assembly. With operator door closed, press Load/Rewind switch. Is Fault Code 11 reported? |
| 020 |          | 1        | Replace BOT/EOT Sensor Assembly.   |
| 030 | <u>1</u> | <u>2</u> | Replace Read-Write-Servo PWA (See Note 3, page 6-130).   |

STU FAULT CODE 11 - ABSENCE OF TAPE

- 
- |    |                                    |
|----|------------------------------------|
| 01 | Absence of tape on load            |
| 02 | Absence of tape on operator test 2 |
-

Assumption: STU displays Fault Code 12 as a result of detecting a hub unlatched condition.

The most probable cause of this fault is that supply hub was not latched after mounting a new reel of tape.

A possible cause is that tape being loaded has been subjected to extreme temperature or humidity changes. These tapes can sometimes be recognized by shaking the full reel and hearing tape pack move relative to reel. Also, while loading tape, it will be seen that hub and reel rotate counterclockwise while pack of tape rotates clockwise. To continue using these tapes, the pack requires to be rewrapped at correct tension. This is achieved by performing a test load operation which wraps all tape onto take-up reel, and then returns tape, correctly tensioned, to the supply reel.

Other possible causes of Fault Code 12 are:

1. Loading a tape while in tape trailer.
2. Loading a tape with a short leader or a missing BOT marker.
3. Loading a tape with EOT/BOT sensor cable disconnected.

#### NOTE

Following any corrective action, a tape load operation should be performed.

010	1	Remove supply reel from supply hub and clean hub pads.
020	Y	N Remount reel and latch hub. While holding hub, can reel be easily rotated in either direction?
030	1	Replace Read-Write-Servo PWA (See Note 3, page 6-130).
040	2	Replace BOT/EOT Sensor Assembly.
	<u>3</u>	Replace Supply Motor Assembly
050	<u>1</u>	Replace Supply Reel Hub Assembly.

SAM 0012      FAULT CODE 12

SAM 0012-1

STU FAULT CODE 12 - LOAD FAULT

---

01    Tension fault while loading

---

Assumption: STU displays Fault Code 13 during a load operation as a result of not establishing tension within 10 seconds.

The most probable cause of this fault is that tape has been threaded with a long loop, or tape has not been tightly wrapped on take-up hub.

## NOTE

Following any corrective action, a tape load operation should be performed.

010	Y	N	Execute CE Test 43. Does pump fail to start?
020		Y	N Does air pressure lift tape off air bearings?
030			1 Replace Filter.
040	1		2 Replace Pump Assembly.
050			<u>3</u> Replace Regulator Assembly.
060	Y	N	Unthread tape. Push LOAD switch. Fault Code 11 is displayed?
070	1		Replace BOT/EOT assembly.
080	2	<u>1</u>	Replace Read-Write-Servo PWA. (See Note 3, page 6-130)
090		<u>3</u>	Replace Power Supply Assembly.

STU FAULT CODE 13 - TAPE THREADED INCORRECTLY

---

01	Tension not detected on both sensors within 10 secs.
02	Second course tach not detected within 10 secs.

---

Assumption: The most probable cause of this fault is that tape leader is too long. ANSI Standard X3.39 specifies that BOT reflective marker should be placed from 14 feet to 18 feet from physical beginning of tape.

## NOTE

Following any corrective action, a tape load operation followed by an unload operation should be performed.

- 010 1 Mount a new reel of tape and retry load/unload sequence.
- 020 2 Replace BOT/EOT Sensor Assembly.
- 030 3 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 14 - BOT LOCATION FAULT

- 
- 01 BLTL.loading.not seen BOT
  - 02 AOT.loading.not seen BOT
  - 03 Did not get BLTL within prescribed period during unload
-



Assumption: STU displays Fault Code 15 as a result of load or unload operation being aborted.

The most probable cause of this fault is that operator pressed Reset Switch during load or unload operation.

NOTE

Following any corrective action, a tape load operation followed by an unload operation should be performed.

- 010 1 Replace Operator Panel Assembly.
- 020 2 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 030 3 Replace Formatter-Control PWA.

STU FAULT CODE 15 - LOAD/UNLOAD ABORTED BY OPERATOR

- 
- 01 Reset pressed during load
  - 02 Reset pressed during unload
-

Assumption: STU displays Fault Code 16 on execution of a Read/Write Diagnostic Test with a write protected scratch tape.

The most probable cause of this fault is that the scratch tape in use does not have a write permit ring installed.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

- |     |          |          |  |
|-----|----------|----------|--|
| 010 | 1        |          | Remove write enable sensor cover plate and ensure connector is correctly connected to sensor.                  |
| 020 | Y        | N        | Does write permit ring push reflective ring part of Supply Reel Hub Assembly in line with write enable sensor? |
| 030 |          | <u>1</u> | Replace Supply Reel Hub Assembly.  |
| 040 | 1        |          | Replace Write Enable Sensor Assembly.  |
| 050 | 2        |          | Replace Read-Write-Servo PWA (See Note 3 on page 6-130).   |
| 060 | <u>3</u> |          | Replace Formatter Control PWA.   |

STU FAULT CODE 16 - DIAGNOSTIC TAPE IS WRITE PROTECTED

---

00    Attempted to execute a read/write diagnostic with write protected tape

---

Assumption: STU displays Fault Code 17 as a result of running off the physical end of tape.

The most probable cause of this fault is that the system continued issuing Forward Read/Write commands after EOT has been sensed. A possible cause is that trailer is too short (ANSI Standard X3.39 specifies trailer should be longer than 25 feet.).

#### NOTE

Following any corrective action, Operator Test 1 should be executed.

010	Y	N	Load tape and execute CE Test 44. Does tape stop within trailer?
020	<u>2</u>	1	Replace Read-Write-Servo PWA (See Note 3, page 6-130).
030	1	<u>2</u>	Replace Formatter-Control PWA.

#### STU FAULT CODE 17 - RAN OFF END OF TAPE

---

01	AOT.trailer.forward
02	BLTL.trailer.forward
03	BOT.trailer.reverse

---

Assumption: STU displays Fault Code 18 as a result of attempting to execute a Diagnostic Test which requires tape to be untensioned.

The most probable cause of this fault is that tape is already loaded while attempting to execute test that requires tape to be untensioned.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Replace Formatter-Control PWA.
- 020 2 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 18 - TAPE ALREADY LOADED

---

00 Attempted to execute Operator Test 1 with tape already loaded

---

Assumption: STU displays Fault Code 20 as a result of a file tension fault.

## NOTE

Following any corrective action, a tape load operation or Operator Test 1 should be executed.

010	1			Ensure that cable between Upper Air Bearing Sensor Read-Write-Servo PWA is correctly connected.	
020	Y	N		Sub-Fault Code 05?	
030		Y	N	Sub-Fault Code 02 or 04?	
040			Y	N	Disconnect cable between Upper Air Bearing Sensor and Read-Write-Servo PWA at Read-Write-Servo PWA Assembly. Try to load a tape. Fault Code 20, Sub-Fault Code 05?
050	1		1		Replace Upper Air Bearing Sensor. Reconnect cable.
060	<u>2</u>	<u>1</u>	<u>2</u>	<u>1</u>	Replace Read-Write-Servo PWA (See Note 3 on page 6-130). Reconnect cable.

STU FAULT CODE 20 - FILE TENSION SENSOR FAULT

---

00	Offset comparator is low with min. offset
01	Offset comparator is high with max. offset
02	2 oz. detected with no tension
04	Upper tension detected with no tension
05	Did not reach 2 oz. within 100 ms of takeup sensor detecting 2 oz. during load.

---

Assumption: STU displays Fault Code 21 as a result of a take-up tension fault.

## NOTE

Following any corrective action, a tape load operation or Operator Test 1 should be executed.

010	1			Ensure that cable between Lower Air Bearing Sensor Read-Write-Servo PWA is correctly connected.	
020	Y	N		Sub-Fault Code 05?	
030		Y	N	Sub-Fault Code 02 or 03 or 04?	
040			Y	N	Disconnect cable between Lower Air Bearing Sensor and Read-Write-Servo PWA at Read-Write-Servo PWA Assembly. Try to load a tape. Fault Code 21, Sub-Fault Code 05?
050	1		1		Replace Lower Air Bearing Assembly. Reconnect cable.
060	<u>2</u>	<u>1</u>	<u>2</u>	<u>1</u>	Replace Read-Write-Servo PWA (See Note 3 on page 6-130). Reconnect cable.

STU FAULT CODE 21 - TAKEUP TENSION SENSOR FAULT

---

00	Offset comparator is low with min. offset
01	Offset comparator is high with max. offset
02	2 oz detected with no tension
03	9 oz. detected with no tension
04	Upper tension detected with no tension
05	Did not reach 2 oz. within 100 ms of file sensor detecting 2 oz during load

---

Assumption: STU displays Fault Code 22 as a result of being unable to maintain tape tension during a tape load operation.

The most probable cause of this fault is that the tape being loaded has been subjected to extreme temperature or humidity changes. These tapes can sometimes be recognized by shaking the full reel and hearing the tape pack move relative to the reel. To continue using these tapes, the pack requires to be re-wrapped at the correct tension. At the time of reporting the fault, the tape may have been removed from the supply reel. Recovery for this case will be to re-wrap the tape onto the file reel (to the BOT side of the EOT marker) and perform a normal load operation. If tape was not removed from the supply reel, a test load operation should be performed to remove the tape.

NOTE

A tape load operation should be performed following any corrective action. During load operation, file reel should be observed for pack slip.

- 010 1 Clean read-write head, tape cleaner and tape guides.
  - 020 2 Unload reel using Untensioned Unload command. Remove reel and clean hub pads.
  - 030 Y N Mount reel and latch the hub. While holding hub, can reel be easily rotated in either direction?
  - 040 Y N Sub-Fault Code 03 or 04 or 05?
  - 050 Y N Execute Test 2 with tape threaded. Termination Code 70?
  - 060 1 Invalid operator sequence (Refer to CE Test 02, page 6-106).
  - 070 Y N Termination Code 84?
  - 080 Y N Termination Code 92?
- 2 2 2 2 2  
 A B C D E

	A	B	C	D	E	
	1	1	1	1	1	
090					Y N	Execute Test 3 without tape threaded. Termination Code 96 or 98?
100		<u>1</u>	1	<u>2</u>	<u>2</u>	1 Replace Read-Write-Servo PWA (See Note on page 6-130).
110					<u>2</u>	2 Replace Power Amplifier PWA.
120				1		Replace Supply Motor/Tach Assembly.
130			<u>2</u>		1	Replace Take-Up Motor/Tach Assembly.
140	<u>1</u>					Replace Supply Hub Assembly.

STU FAULT CODE 22 - UNABLE TO TENSION TAPE

- 
- 01 Unable to successfully maintain tension during load  
(Fault is reported after tape is unloaded off EOT).
  - 02 Unable to successfully maintain tension during load  
(Fault is reported with tape still in the tape path  
after failing to find AOT within 30 seconds)
  - 03 Tape slipping on file reel while accelerating during  
tension recovery
  - 04 Tape slipping on file reel while decelerating during  
tension recovery
  - 05 Tape slipping on file reel while decelerating during  
tension recovery/test load
-



Assumption: STU displays Fault Code 23 as a result of being unable to re-establish tape tension during a tape load operation.

The most probable cause of this fault is that the tape being loaded has been subjected to extreme temperature or humidity changes. These tapes can sometimes be recognized by shaking the full reel and hearing the tape pack move relative to the reel. To continue using these tapes, the pack requires to be re-wrapped at the correct tension. At the time of reporting the fault, all the tape may have been removed from the supply reel. Recovery for this case will be to re-wrap the tape onto the file reel (to the BOT side of the EOT label) and perform a normal load operation. If tape was not removed from supply reel, a test load operation should be performed to remove the tape.

#### NOTE

A tape load operation should be performed following any corrective action. During load operation, file reel should be observed for pack slip.

- 010 1 Ensure that the cable is correctly connected to BOT/EOT Sensor Assembly.
- 020 2 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 030 3 Replace Supply Motor Assembly.

#### STU FAULT CODE 23 - UNABLE TO RE-ESTABLISH TENSION

- 
- 01 Unable to establish tension during test load
  - 02 Unable to maintain tension after stopping tape following a test load
-

SAM 0024

FAULT CODE 24

SAM 0024-1

Assumption: STU displays Fault Code 24 as a result of a high tension detected on both air bearings.

NOTE

Following any corrective action, Operator Test 1 should be executed.

010	Y	N	Execute Test 2 with tape threaded. Termination Code 70?
020	<u>1</u>		Invalid operator sequence (Refer to CE Test 02 on page 6-106).
030		Y	N Termination Code 81 or 82?
040		Y	N Termination Code 73 or 74 or 92 or 98?
050		<u>3</u>	<u>1</u> Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
060	<u>1</u>	<u>2</u>	<u>2</u> Replace Power Amplifier PWA.
070		1	Replace Supply Motor/Tach Assembly.

STU FAULT CODE 24 - HIGH TENSION FAULT

---

00	Fault occurred during constant velocity motion
10	Fault occurred on down ramp
20	Fault occurred on up ramp
30	Fault occurred in stoplock

---

---

00	Fault occurred in forward direction
04	Fault occurred in reverse direction

---

STU FAULT CODE 24 (Cont'd)

---

00    Fault occurred with 25 ips demanded  
01    Fault occurred with 100 ips demanded  
02    Fault occurred with 200 ips demanded

---

---

00    Fault occurred while drive was moving at constant  
      velocity, on ramp, or in stoplock for less than 1 sec.  
01    Fault occurred with drive in stoplock for more than  
      1 sec.

---

---

00    Fault occurred with pneumatic pump enabled.  
08    Fault occurred with pneumatic pump shut down.

---

Assumption: STU displays Fault Code 25 as a result of a low tension condition being detected on one of the air bearings.

The most probable cause of this fault is damaged tape. Should tape be torn, then the fault can occur as tape passes over air bearing. Another cause, with stiction tapes, is when tape sticks to read-write head.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

- |     |   |   |   |
|-----|---|---|---|
| 010 | 1 |   | Clean read-write head, tape cleaner and tape guides.                                    |
| 020 | 2 |   | Change tape to a known good, write enabled scratch tape.                                |
| 030 | 3 |   | Unload reel using Untensioned Unload command. Remove reel and clean hub pads.           |
| 040 | Y | N | Remount reel and latch hub. While holding hub, can reel be rotated in either direction? |
| 050 |   | Y | N Execute Operator Test 3 without tape threaded. Termination Code 98?                   |
| 060 |   |   | 1 Replace Power Amplifier PWA.  |
| 070 |   |   | 2 <u>2</u> Replace Read-Write-Servo PWA. (See Note 3 on page 6-130)                     |
| 080 |   |   | 1 Replace Take-Up Motor/Tach Assembly.  |
| 090 |   |   | <u>1</u> Replace Supply Hub Assembly.   |

STU FAULT CODE 25 - LOW TENSION FAULT

---

00 File sensor saw the fault first  
40 Takeup sensor saw the fault first

---

---

00 Fault occurred during constant motion  
10 Fault occurred on down ramp  
20 Fault occurred on up ramp  
30 Fault occurred in stoplock

---

---

00 Fault occurred in forward direction  
04 Fault occurred in reverse direction

---

---

00 Fault occurred with 25 ips demanded  
01 Fault occurred with 100 ips demanded  
02 Fault occurred with 200 ips demanded

---

---

00 Fault occurred while drive was moving at constant velocity, on ramp, or in stoplock for less than 1 sec.  
01 Fault occurred with drive in stoplock for more than 1 sec.

---

---

00 Fault occurred with pneumatic pump enabled.  
08 Fault occurred with pneumatic pump shut down.

---

Assumption: STU displays Fault Code 26 as a result of a servo fault.

NOTE

Following any corrective action for Sub-Fault Codes 01 to 06, tape should be threaded onto take-up, wound on by hand for approximately 50 turns, and then perform an Untensioned Unload. For all other Sub-Fault Codes, tape should be loaded and then unloaded.

- 010 1 Ensure all cables to Power Amplifier Assembly are correctly connected.
  - 020 2 Ensure all leads to door switch are unbroken and correctly connected.
  - 030 Y N Sub-Fault Code 09?
  - 040 Y N With tape threaded, execute Test 2. Termination Code 70?
  - 050 1 Invalid operator sequence (Refer to CE Test 02 on page 6-106).
  - 060 Y N Termination Code 81?
  - 070 Y N Termination Code 82?
  - 080 Y N Termination Code 84?
  - 090 3 3 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
  - 100 2 1 Replace Take-Up Motor/Tach Assembly.
  - 110 1 1 Replace Power Amplifier Assembly.
  - 120 2 Replace Supply Motor Assembly.
  - 130 Y N Without tape threaded, execute Test 3. Termination Code 84?
- 2 2  
A B

	A	B	
	<u>1</u>	<u>1</u>	
140	Y	N	Termination Code 96?
150		Y	N Does take-up reel move during execution of Test 3?
160	<u>1</u>	<u>1</u>	Ensure cable is correctly connected to take-up tach.
170		<u>1</u>	Replace Take-up Motor/Tach Assembly.
180		<u>2</u>	<u>2</u> Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
190		<u>3</u>	Replace door switch (interlock).
200	Y	N	Does take-up reel move during execution of Test 3?
210		<u>1</u>	Replace door switch (interlock).
220	<u>1</u>	<u>2</u>	Replace Take-Up Motor/Tach Assembly.
230	<u>2</u>	<u>3</u>	Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
240		<u>2</u>	Replace Power Amplifier Assembly.

STU FAULT CODE 26 - SERVO FAULT

- 
- 01    Takeup reel moving in wrong direction during untensioned unload
  - 02    Takeup reel not moving during untensioned unload
  - 03    Takeup reel too fast during untensioned unload
  - 04    Takeup reel too slow during untensioned unload
  - 05    Voltage sensed in wrong half of file reel amplifier bridge while pulsing file reel
  - 06    Timeout to get unwind speed during untensioned unload
  - 07    Voltage sense fault in file reel amplifier bridge during load
  - 08    Voltage sense fault in takeup reel amplifier bridge during load
  - 09    Fine line tach fault on load
-



Assumption: STU displays Fault Code 27 as a result of not detecting any single line tachs from the supply reel.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Ensure that cable is correctly connected to Supply Motor Tach.
- 020 2 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 030 3 Replace Supply Motor Assembly.

STU FAULT CODE 27 - NO COARSE TACHS

- 
- 01 No coarse tachs during load
  - 02 No coarse tachs during tension recovery section of load
-

SAM 0028 FAULT CODE 28

SAM 0028-1

Assumption: STU displays Fault Code 28 as a result of a tension recovery timeout.

NOTE

Following any corrective action,  
Operator Test 1 should be executed.

010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 28 - TENSION RECOVERY PROBLEM

---

01 Tension recovery lasting longer than 0.5 second

---

Assumption: STU displays Fault Code 29 as a result of detecting absence of tape. This fault can be caused by the use of a damaged tape that has oxide missing, such that the BOT and EOT sensors detect light passing through the tape.

Unloading of tape with a short leader may also result in Fault Code 29.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

010	Y	N	Disconnect cable from the EOT/BOT Sensor Assembly. Remove the reel of tape, close operator door, and press the LOAD switch. Fault Code 11?
020	1		Replace BOT/EOT Sensor Assembly.
030	<u>2</u>	<u>1</u>	Replace Read-Write-Servo PWA Assembly (See Note 3 on page 6-130).

STU FAULT CODE 29 - ABSENCE OF TAPE

---

01    Absence of tape

---

Assumption: STU displays Fault Code 30 as a result of a detected fault on an Up ramp. A possible cause of this fault, with stiction tapes, is when tape sticks to the read-write head. Another possible cause is a tape with damaged BOT marker.

NOTE

Following any corrective action, Operator Test 1 should be executed.

010	1	Clean read-write head, tape cleaner and tape guides.												
020	Y	N	With tape threaded, execute Test 2. Termination Code 70?											
030	<u>1</u>	Invalid operator sequence (Refer to CE Test 02 on page 6-106).												
040	Y	N	Termination Code 89?											
050		Y	N	Termination Code 72?										
060			Y	N	Termination Code 73?									
070				Y	N	Termination Code 74?								
080					Y	N	Termination Code 75?							
090						Y	N	Termination Code 84?						
100							Y	N	Termination Code 90?					
110								Y	N	Termination Code 91?				
120									Y	N	Termination Code 92?			
130										Y	N	Without tape threaded, execute Operator Test 3. Termination Code 98?		
140											Y	N	Termination Code 96?	
150												Y	N	Termination Code 82?
		2	2	2	2	2	2	2	2	2	2	2	2	
		A	B	C	D	E	F	G	H	I	J	K	L	M

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
160	1	1	1	1	1	1	1	1	1	1	1	1	1	Y	Termination Code 84?
170												1		1	Replace Power Amplifier PWA.
180						1				<u>1</u>	1		1	2	Replace Take-Up Motor/Tach Assembly.
190			2		2	<u>2</u>		3			<u>2</u>	<u>2</u>	<u>2</u>	3	Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
														<u>4</u>	BOT/EOT Sensor.
200		2		2					1						Replace Filter.
210		<u>4</u>	3	<u>4</u>	3			1	<u>3</u>						Replace Regulator Assembly.
220		3	<u>4</u>	3	<u>4</u>			2	2						Replace Pump Assembly.
230	<u>1</u>			1	1										Replace Upper Air Bearing Sensor.
240		1	1				<u>1</u>								Replace Lower Air Bearing Sensor.

STU FAULT CODE 30 - UP RAMP FAULT

- 
- |    |  |
|----|--|
| 01 | Failed to move 4 quarter tachs in reverse direction within deadman time                        |
| 02 | Failed to move 4 quarter tachs in forward within deadman time                                  |
| 03 | Failed to move 0.08 inch in forward direction within deadman time (detected by stiction test)  |
| 04 | Failed to move 0.125 inch in forward direction within deadman time (detected by stiction test) |
| 05 | Failed to reach top of ramp within deadman time  |
| 06 | Ramp time time nominal - 50% (i.e. too fast)   |
| 07 | Ramp time time nominal + 50% (i.e. too slow)   |
- 

- 
- |    |                                |
|----|--------------------------------|
| 00 | Fault occurred on forward ramp |
| 20 | Fault occurred on reverse ramp |
- 

- 
- |    |   |
|----|---|
| 00 | Fault occurred on 25 ips start/stopramp |
| 40 | Fault occurred on 100 ips ramp          |
| 80 | Fault occurred on 25 ips streaming ramp |
-



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
160	1	1	1	1	1	1	1	1	1	1	1	1	1	Y	Termination Code 84?
170	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Replace Power Amplifier PWA.
180	1	1	1	1	1	1	1	1	1	1	1	1	1	2	Replace Take-Up Motor/Tach Assembly.
190	1	1	2	2	2	2	3	3	3	2	2	2	2	3	Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
														4	BOT/EOT Sensor.
200	1	2	2	2	2	2	3	3	1	1	1	1	1	1	Replace Filter.
210	1	4	3	4	3	3	3	1	3	3	3	3	3	3	Replace Regulator Assembly.
220	1	3	4	3	4	4	4	2	2	2	2	2	2	2	Replace Pump Assembly.
230	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Replace Upper Air Bearing Sensor.
240	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Replace Lower Air Bearing Sensor.



STU FAULT CODE 31 - DOWN RAMP FAULT

- 
- 01 Failed to detect any quarter tachs in forward direction
  - 02 Failed to detect any quarter tachs in reverse direction
  - 03 Failed to detect change of direction (forward to reverse) on forward 100 ips down ramp
  - 04 Failed to detect change of direction (reverse to forward) on reverse 100 ips down ramp
  - 05 Failed to reach end of forward 25 ips ramp within deadman time
  - 06 Failed to reach end of reverse 25 ips ramp within deadman time
  - 07 25 ips ramp time less than nominal -50% (ie. too fast)
  - 08 25 ips ramp time greater than nominal +50% (ie. too slow)
  - 11 100 ips ramp time less than nominal -50% (ie. too fast)
  - 12 100 ips ramp time greater than nominal +50% (ie. too slow)
- 

- 
- 00 Fault occurred on forward ramp
  - 20 Fault occurred on reverse ramp
- 

- 
- 00 Fault occurred on 25 ips start/stop ramp
  - 40 Fault occurred on 100 ips ramp
  - 80 Fault occurred on 25 ips streaming ramp
-

Assumption: STU displays Fault Code 32 as a result of a velocity servo fault.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

010	Y	N		Without tape threaded, execute Operator Test 3. Termination Code 96 or 98?
020		Y	N	Termination Code 82?
030			Y	N Termination Code 84?
040	<u>2</u>			1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
050		<u>1</u>		2 Replace Power Amplifier PWA.
060	1		<u>1</u>	3 Replace Take-up Motor/Tach Assembly.
070				4 Replace Filter.
080				5 Replace Pump Assembly.
090				<u>6</u> Replace Regulator Assembly.

STU FAULT CODE 32 - STOPLOCK OVER-RUN

- 
- |    |  |
|----|--|
| 01 | TU Reel position is 32 quarter tachs reverse of correct stoplock position. |
| 02 | TU Reel position is 32 quarter tachs forward of correct stoplock position. |
-

STU FAULT CODE 32 (Cont'd)

---

00 Fault occurred with drive in stoplock less than 1 sec.

04 Fault occurred with drive in stoplock more than 1 sec.

---

---

00 Fault occurred with pneumatic pump enabled

10 Fault occurred with pneumatic pump shut down

---

SAM 0033      FAULT CODE 33

SAM 0033-1

Assumption: STU displays Fault Code 33 as a result of a tape positioning fault when about to write.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- |     |          |          |   |
|-----|----------|----------|---|
| 010 | Y        | N        | Remove reel of tape and execute Test 3.<br>Termination Code 98? |
| 020 |          | <u>1</u> | Replace Read-Write-Servo PWA (See Note 3, page 6-130).          |
| 030 | <u>1</u> |          | Replace Take-up Motor/Tach Assembly.                            |

STU FAULT CODE 33 - TAPE POSITIONING FAULT

- 
- |    |  |
|----|--|
| 01 | Passed erase head turn-on point when about to write<br>at low speed  |
| 02 | Passed erase head turn-on point when about to write<br>at high speed |
-

SAM 0034 FAULT CODE 34

SAM 0034-1

Assumption: STU displays Fault Code 34 as a result of the STU losing positioning control at Load Point.

NOTE

Following any corrective action,  
Operator Test 1 should be executed.

010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 34 - BOT POSITIONING FAULT

- 
- 01 Timed out waiting for BOT in forward direction during a Load point "reposition"
  - 02 Time out waiting for BOT in reverse direction during a Load point "reposition"
-

SAM 0035      FAULT CODE 35

SAM 0035-1

Assumption: STU displays Fault Code 35 as a result of the STU losing positioning control.

NOTE

Following any corrective action, Operator Test 1 should be executed.

- |     |          |          |   |
|-----|----------|----------|---|
| 010 | Y        | N        | Remove reel of tape and execute Test 3.<br>Termination Code 98? |
| 020 |          | <u>1</u> | Replace a Read-Write-Servo PWA. (See Note 3 on page 6-130.)     |
| 030 | <u>1</u> |          | Replace Take-up Motor/Tach Assembly.                            |

STU FAULT 35 - POSITIONING FAULT

---

00    Failed to reach target at 25 ips.

02    Failed to reach target at 100 ips

---

00    Failed to reach target in forward direction

01    Failed to reach target in reverse direction

---

Assumption: STU displays Fault Code 36 as a result of a speed fault.

NOTE

Following any corrective action, Operator Test 1 should be executed.

010	Y	N	With tape threaded, execute Test 2. Termination Code 70?													
020	<u>1</u>		Invalid operator sequence (Refer to CE Test 02 on page 6-106).													
030	Y	N	Termination Code 89?													
040		Y	N	Termination Code 72?												
050			Y	N	Termination Code 73?											
060				Y	N	Termination Code 74?										
070					Y	N	Termination Code 75?									
080						Y	N	Termination Code 84?								
090							Y	N	Termination Code 90?							
100								Y	N	Termination Code 91?						
110									Y	N	Termination Code 92?					
120										Y	N	Without tape threaded, execute Test 3. Termination Code 98?				
130											Y	N	Termination Code 96?			
140												Y	N	Termination Code 82?		
150													Y	N	Termination Code 84?	
160														1	1	Replace Power Amplifier PWA.
														2	2	
														A	B	
														C	D	
														E	F	
														G	H	
														I	J	
														K	L	
														M	N	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
170	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Replace Take-Up Motor Assembly.
180			2		2	2		3			2	2	2	3	Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
190		2		2					1						Replace Air Filter.
200		4	3	4	3			1	3						Replace Regulator Assembly.
210		3	4	3	4			2	2						Replace Pump Assembly.
220	1			1	1										Replace Supply Air Bearing Sensor.
230		1	1				1								Replace Take-Up Air Bearing Sensor.

STU FAULT CODE 36 - SPEED FAULT

---

00	Speed fault at 25 ips
04	Speed fault at 100 ips

---

00	Speed fault occurred in forward direction
----	---

---

00	Speed less than nominal -12.5% (i.e. too slow)
01	Speed greater than nominal +12.5% (i.e. too fast)

---



Assumption: STU displays Fault Code 37 as a result of not being able to re-establish tension within 5 seconds of pump power-up.

## NOTE

Following any corrective action, Operator Diagnostic Test 01 should be executed.

- 010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 020 2 Replace Power Amplifier PWA.
- 030 3 Replace Supply Motor/Tach Assembly.

STU FAULT CODE 37 - PUMP POWER-UP FAULT

---

01 Unable to re-establish tension within 5 seconds

---

SAM 0047

FAULT CODE 47

SAM 0047-1

Assumption: STU displays Fault Code 47 resulting from a velocity correction calculation fault.

This fault can be caused by the velocity correction factor in the back-up memory being corrupted. Should this be the case, the power-on health check should fault, displaying Fault Code 51. To overcome this problem, CE Test 37 could be executed. However, if all precautions are taken, the back-up memory should never be corrupted.

NOTE

Following any corrective action, Operator Test 1 should be executed.

010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 47 - VELOCITY CORRECTION FAULT

---

01 Speed correction multiplier in the backup memory is out of range

---

Assumption: STU displays Fault Code 48 resulting from an unload fault. This fault can be caused by a damaged tape leader.

NOTE

Following any corrective action, tape should be loaded and unloaded again.

- 010 1 Clear Read-Write Head, tape cleaner and tape guides.
- 020 2 Change tape to a known good tape.
- 030 Y N Without tape threaded, execute Test 3.  
Termination Code 98?
- 040 Y N Termination Code 96?
- 050 2 1 Replace Read-Write-Servo PWA (See Note 3 on  
page 6-130).
- 060 2 Replace Supply Motor Assembly.
- 065 3 Replace EOT/BOT Assembly.
- 0070 1 1 Replace Take-up Motor/Tach Assembly.

STU FAULT CODE 48 - UNLOAD FAULT

- 
- 01 Did not find AOT within 6 seconds of losing tension on  
unload
-

Assumption: STU displays Fault Code 50 as a result of a Read-Write-Servo PWA health check fault.

NOTE

Following any corrective action, the unit should be powered off and on again.

010 Y N Sub-Fault Code 06 or 07?  
020 1 1 Replace Read-Write-Servo PWA (See Note 3, page 6-130).  
030 2 Replace Formatter-Control PWA.

STU FAULT CODE 50 - IRRECOVERABLE DEVICE HEALTHCHECK FAULT

---

01 Read-write-servo diagnostic PROM checksum fault  
02 Read-write-servo flag memory fault  
03 Read-write-servo PTM fault  
06 Read-write-servo healthcheck did not complete  
07 Read-write-servo initialization did not complete  
08 Read-write-servo functional PROM checksum fault

---

SAM 0051      FAULT CODE 51

SAM 0051-1

Assumption: STU displays Fault Code 51 during Power-On Health Check.

A possible cause of this fault is that the write enable jumper on the Read-Write-Servo PWA, which protects the contents of the back-up memory, has been left in the "STORE" position. Should this have occurred, the back-up memory should be re-initialized as described in Appendix A.

NOTE

Following any corrective action, the unit should be powered off and powered on again.

010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 51 - RECOVERABLE DEVICE HEALTHCHECK FAULT

- 
- |    |                        |
|----|------------------------|
| 11 | EE PROM checksum fault |
| 12 | EE PROM defective      |
| 14 | EGC DAC fault          |
-

Assumption: STU displays Fault Code 52 as a result of a radius calculation fault.

A possible cause of this fault is that BOT reflective marker is not positioned correctly. ANSI Standard X3.39 specifies that the BOT marker should be placed from 14 feet to 18 feet from the physical beginning of tape.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

010	Y	N	Without tape threaded, execute Test 3. Termination Code 98?
020		Y	N Termination Code 96?
030		2	1 Remove tape reel and clean hub pads. 2 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
040			3 Replace Supply Motor Assembly. 4 Replace Supply Reel Hub Assembly.
050	<u>1</u>	1	Replace Take-up Motor/Tach Assembly.

STU FAULT CODE 52 - SPEED CALCULATION FAULT

---

10	A previous fault caused by modulus being too large
20	A previous fault caused by modulus change inconsistent with direction of tape
40	A previous fault caused by modulus being outside expected range
80	Unable to obtain consistent harvest counts in determining the file reel radius
90	Unable to obtain harvest counts in determining file reel radius within 5 seconds during load

---

STU FAULT CODE 52 (Cont'd)

- 
- 01    This fault caused by modulus being too large
  - 02    This fault caused by modulus change inconsistent  
      with direction of tape
  - 04    This fault caused by modulus being outside expected  
      range
  - 08    This fault caused by harvest count greater than 8000
-

Assumption: STU displays Fault Code 53 as a result of a radius calculation arithmetic error.

NOTE

Following any corrective action,  
Operator Test 1 should be executed.

010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 53 - ARITHMETIC ERROR

- 
- 01 Attempt to divide by 0
  - 02 Integer overflow on floating point to integer conversion
  - 03 Negative result on floating point subtraction
-



Assumption: STU displays Fault Code 54 as a result of an erase current fault.

## NOTE

Following any corrective action,  
Operator Test 1 should be executed.

- |     |          |          |  |
|-----|----------|----------|--|
| 010 | Y        | N        | Sub-Fault Code 10?   |
| 020 | 2        | <u>1</u> | Replace Read-Write-Servo PWA Assembly (See Note 3 on page 6-130).  |
| 030 | 1        |          | Ensure leads are correctly connected to the erase head with black lead to the back and white to the front. |
| 040 | <u>3</u> |          | Replace Read-Write Head Assembly.  |

STU FAULT CODE 54 - ERASE CURRENT FAULT

- 
- |    |  |
|----|--|
| 01 | Erase current present after degauss    |
| 02 | Erase Current present when reading     |
| 10 | Erase Current not present when writing |
-

SAM 0055      FAULT CODE 55

SAM 0055-1

Assumption: STU displays Fault Code 55 as a result of the Read-Write-Servo microprocessor timing out during a Rewind or Load-Rewind operation.

NOTE

Following any corrective action,  
Operator Test 1 should be executed.

010 1 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).

STU FAULT CODE 55 - LOAD/REWIND TIMEOUT FAULT

- 
- |    |   |
|----|---|
| 01 | Failed to reach BOT within specified time during load   |
| 02 | Failed to reach BOT within specified time during rewind |
-

Assumption: STU displays Fault Code 56 as a result of a communication problem between the two STU microprocessors.

## NOTE

Following any corrective action, device DC power should be turned off and then turned on, followed by the execution of Operator Test 1.

- 010 1 Ensure that Formatter Control PWA and Read-Write-Servo PWA are firmly connected.
- 020 2 Ensure that the DC power connector is firmly connected to Read-Write-Servo PWA.
- 030 3 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 040 4 Replace Formatter Control PWA.

STU FAULT CODE 56 - PROCESSOR COMMUNICATION FAULT

- 
- 04 Read-write-servo did not respond to system enable
  - 05 Bus integrity test fault
  - 20 Read-write-servo did not go busy in response to command from formatter
  - 21 Read-write servo rejected command from formatter
  - 22 Read-write-servo did not acknowledge command from formatter
  - 32 Read-write servo did not respond to sense command from formatter
-

Assumption: STU displays Fault Code 57 as a result of the Formatter-Control Microprocessor not detecting the correct response from the Read-Write-Servo Microprocessor.

## NOTE

Following any corrective action, Operator Test 1 should be executed.

- 010 1 Ensure that Formatter-Control PWA and Read-Write-Servo PWA are firmly connected.
- 020 2 Replace Read-Write-Servo PWA (See Note 3 on page 6-130).
- 030 3 Replace Formatter Control PWA.

STU FAULT CODE 57 - ILLOGICAL FAULT

- 
- 30 Device did not stop after stop commanded
  - 31 Device did not stop after reset
  - 33 Device not at BOT after load
  - 34 Device not at BOT after rewind
  - 39 Device did not reset busy on reverse into BOT
-

SAM 0058

FAULT CODE 58

SAM 0058-1

Assumption: STU displays Fault Code 58 during Power-On due to a failure in the functional operation of Formatter-Control PWA.

NOTE

Following any corrective action, the STU should be powered off and on again.

010 1 Replace Formatter-Control PWA.

STU FAULT CODE 58 - RECOVERABLE FORMATTER HEALTHCHECK FAULT

Second byte defines formatting logic fault.

SAM 0059      FAULT CODE 59

SAM 0059-1

Assumption: STU displays Fault Code 59 as the result of a  
Formatter-Control PROM Checksum Error being  
detected during Power-On Health Check.

NOTE

Following any corrective action, the  
STU should be powered off and powered  
on again.

020 1 Replace Formatter-Control PWA.

STU FAULT CODE 59 - IRRECOVERABLE FORMATTER HEALTHCHECK FAULT

---

00    Formatter PROM checksum fault

---

SAM 0060      FAULT CODE 60

SAM 0060-1

Assumption: STU displays Fault Code 60 as the result of a functional operator panel switch being closed during Power-On Health Check.

This fault can also be generated if any of the Load/Rewind, Unload, On-Line or Reset switches are depressed for 15 seconds during the Power-On Health Check.

NOTE

Following any corrective action, the STU should be powered off and powered on again.

- 010 1 Replace Operator Panel Assembly.
- 020 2 Replace Formatter-Control PWA.

STU FAULT CODE 60 - IRRECOVERABLE OPERATOR PANEL FAULT

---

00    LOAD/REWIND or UNLOAD or ONLINE or RESET switch  
      permanently pressed

---

SAM 0061      FAULT CODE 61

SAM 0061-1

Assumption: STU displays Fault Code 61 as the result of a diagnostic operator panel switch being closed during Power-On Health Check.

This fault can also be generated if any of the Test, Step, CE or Execute switches are depressed for 15 seconds during the Power-On Health Check. Should this fault occur, normal on-line operation of the STU is available after pressing the Reset switch. However, the use of STU diagnostics will not be made available.

NOTE

Following any corrective action, the STU should be powered off and powered on again.

- 010 1 Replace Operator Panel Assembly.
- 020 2 Replace Formatter Control Assembly.

STU FAULT CODE 61 - RECOVERABLE OPERATOR PANEL FAULT

---

00 TEST or STEP or CE or EXEC switch permanently pressed

---



# TEST DESCRIPTIONS

---

## GENERAL INFORMATION

The diagnostic test information is presented under the following headings:

- o Test Requirement - Conditions which must be met before execution of the test.
- o Test Description - A brief explanation of what the test is all about.
- o Test Options - A list of the options and the option code applicable to the test.
- o Test Sequence - A step-by-step breakdown of what happens during execution of the test. The test sequence is performed automatically when the EXECUTE switch is pressed.
- o Possible Termination Codes - A list of termination codes associated with the test.

Those tests referenced by the structured analysis methods (SAMs) and in the removal/replacement procedures can be used by all levels of maintenance personnel. Tests which are not referenced in the maintenance section of this manual are to be used only by technical specialists who have been instructed in the use and limitations of these tests.

## INITIATING A DIAGNOSTIC TEST AND SELECTING OPTIONS

After ensuring that the test requirements are met, follow the steps below to initiate a diagnostic test.

1. While pressing the CE switch, press the TEST switch.
  - a. The DIAGNOSTIC indicator lights.
  - b. The display panel indicates 00.
2. Press the STEP switch.
  - a. The display number increments each time the STEP switch is pressed, or increments automatically if the STEP switch is held pressed.
  - b. To facilitate test number selection, use the following procedure. Example: Test 39 selection required.
    - Press the STEP switch until 03 appears on the display panel.
    - Press the TEST switch and the 3-digit transfers to the left.
    - The display now indicates 30.
    - Press the STEP switch again until the display increments from 30 to 39.
  - c. If test options (see test descriptions) are available and desired, press and hold the CE switch, and then press the EXECUTE switch while the CE switch is held pressed. The display will indicate 00. The STEP switch is then pressed to select the desired option.
3. Press the EXECUTE switch.
  - a. The test is initiated.

If the test runs to completion, the display panel indicates 00. If the test fails, the display panel indicates the fault code.

## LIST OF DIAGNOSTIC TESTS

The diagnostic tests are listed below in numerical order with the options available for each test.

### OPERATOR TESTS

<u>TEST NO.</u>	<u>DESCRIPTION</u>
01	Functional Fault Detection Diagnostic

### CE TESTS

<u>TEST NO.</u>	<u>DESCRIPTION</u>	<u>OPTION*</u>
02	Tension Fault Isolation Diagnostic	
03	Velocity Fault Isolation Diagnostic	
04-09	Reserved	
10	25 ips Forward to EOT	L
11	25 ips Reverse to BOT	L
12	25 ips Forward Ramps to EOT	L
13	25 ips Reverse Ramps to BOT	L
14	25 ips Repositioning	L
15	100 ips Forward Ramps to EOT	L
16	100 ips Reverse Ramps to BOT	L
17	100 ips Repositioning	L
18	100 ips Forward to EOT	L
19	100 ips Reverse to BOT	L
20	Formatter Internal Fault Detection Diagnostic	B
21	Write 2K Byte Records at 25 ips to EOT (At EOT, Rewind to BOT.)	B
22	Read at 25 ips to EOT (At EOT, Rewind to BOT.)	B
23	Write 256 Byte Records at 100 ips to EOT (At EOT, Rewind to BOT.)	B
24	Read at 100 ips to EOT (At EOT, Rewind to BOT.)	B
25-27	Reserved	
28	Perform Command Stack entered by Diagnostic 97 at 25 IPS Start/Stop	B

\* See key at end of test list.

CE TESTS (Cont'd)

<u>TEST NO.</u>	<u>DESCRIPTION</u>	<u>OPTION*</u>
29	Perform Command Stack entered by Diagnostic 97 at 100 IPS Thrashing	B
30	Check Read Amplitudes at 25 and 100 ips to be within tolerance of 0.8 volt.	B
31	Determine EGC Gains at 25 and 100 ips and store gains in Backup Memory. Then check read amplitudes at 25 and 100 ips to be within tolerance of 0.1 volt.	X
32	Check Read Amplitudes at 25 and 100 ips with pre-recorded all 1's tape with tolerance of 0.3 volt.	B
33	Determine EGC Gains at 25 ips and store gains in Backup Memory.	X
34	Determine EGC Gains at 100 ips and store gains in Backup Memory.	X
37	Determine Velocity Servo Correction Multiplier and store multiplier in Backup Memory.	X
38	Apply approximately 8 ounce tension by pulsing supply reel with take-up reel in Stoplock.	X
39	Write all 1's to EOT at 25 ips (At EOT, Rewind to BOT.)	B
40	Write all 1's to EOT at 100 ips (At EOT, Rewind to BOT.)	B
41	Stoplock Take-up Reel	X
42	Enable Tension Servo	X
43	Turn-on Pump	X
44	Fast Search Forward For EOT	X
45	EGC DAC Scope Loop	X
46	Velocity DAC Scope Loop	X
47	R/W/S Microprocessor Outputs Scope Loop	X
48	Set Up Pump Power-Down Timer	X
49	Reserved	

\* See key at end of test list.

CE TESTS (Cont'd)

<u>TEST NO.</u>	<u>DESCRIPTION</u>	<u>OPTION*</u>
50	25 IPS Forward Streaming Ramps to EOT	L
51	25 IPS Reverse Streaming Ramps to BOT	L
52-60	Reserved	
61	Take-up Motor and Power Amp Marginal Fault Detection	X
62	Take-Up Fine-Line Tach Fault Detection	X
63-90	Reserved	
91	Functional Fault Detection (Same as Operator Test 01 except: a) Will start in Loaded or Unloaded condition, b) Will not unload upon completion, and c) bypass EGC test.)	B
92-96	Reserved	
97	Read/Write Command Stack Generation Diagnostic	X

OPTION KEY

X = Do not use any options.

L = Test will loop. Do not use any options.

B = CE may use options.

00 = Halt if read or write errors exceed limits specified,  
halt on completion of test (Default option).

01 = Loop on test, halt if read or write errors exceed  
limit specified on any given pass.

02 = Loop on test, bypass read or write error halts.

NOTE

Option of halting or bypassing errors  
only exists for read/write type errors;  
all other errors will cause test to  
halt, with the appropriate fault code  
displayed, regardless of the option  
selected.



TEST 01: FUNCTIONAL FAULT DETECTION TEST (FOR OPERATOR)

TEST REQUIREMENT: A write enabled scratch tape should be threaded, but NOT loaded (untensioned).

DESCRIPTION: Test 01 performs various functions normally performed during functional operations. Unit halts with appropriate fault code if a functional fault occurs (approximately seven minutes is required to perform this test).

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Illuminate ONLINE and RESET LEDs. Increment display from 00 to 99. Extinguish ONLINE and RESET LEDs. Display 01.
- b. Load tape.
- c. Check read amplitudes at low and high speeds. Rewind.
- d. Write 100 blocks at 25 IPS start/stop (see NOTE 1).
- e. Space reverse, erase, and write file mark (check for file mark detect). Space reverse and check for file mark detect. Read forward and again check for file mark detect.
- f. Read reverse 100 blocks previously written at 25 IPS start/stop mode.
- g. Read forward 2 blocks at 25 IPS start/stop.
- h. Check gap lengths twice.
- i. Read forward 94 blocks at 25 IPS start/stop.
- j. Repeat steps d to i at 25 IPS continuous mode.
- k. Repeat steps d to i at 100 IPS streaming mode.
- l. Change speed from high to low and then low to high.
- m. Write 10 blocks at 100 IPS "thrashing" (see NOTE 2).
- n. Space reverse 10 blocks at 100 IPS "thrashing".
- o. Read forward 10 blocks at 100 IPS "thrashing".
- p. Rewind.
- q. Speed mode change.

TEST 01: (Cont'd)

- r. Read forward 200 blocks at 100 IPS streaming. (Check for file mark detect.)
- s. Write to EOT at 100 IPS streaming (see NOTE 2).
- t. Space reverse 200 blocks at 100 IPS streaming.
- u. Read forward 10 blocks at 100 IPS "thrashing".
- v. Read forward 20 blocks at 25 IPS start/stop.
- w. Read reverse 20 blocks at 25 IPS start/stop
- x. Rewind/Unload.

NOTE 1: Data blocks written at 25 IPS are 2K bytes with first 256 bytes "random" and remaining bytes of fixed pattern.

NOTE 2: Data block written at 100 IPS are 256 bytes of all zeros.

POSSIBLE TERMINATION CODES:

- 00 - Test Successful
- 01 - Read Envelope Fault
- 02 - Read Amplitude Range Fault
- 03 - ID Check
- 04 - Low Speed Write Error
- 05 - Low Speed Read Error
- 06 - High Speed Write Error
- 07 - High Speed Read Error
- 08 - Noise In IBG
- 10 to 69 - Refer to Fault SAM's.



TEST 02: TENSION FAULT ISOLATION

TEST REQUIREMENT: Tape should be threaded, but NOT loaded (untensioned).

Valid fault code displayed in operator panel.

NOTE: Test 2 will run only if, during execution of Test 1, one of the following codes appear in the operator panel display: 22, 24, 26, 30, 31, 36.

TEST DESCRIPTION: Test 2 is an extension of Test 1. Test 2 isolates servo faults by checking various assemblies of the STU.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Verify operator door is closed and tape is not loaded.
- b. Verify EGC DAC of Read/Write/Servo PWA is operational. If not, display Termination Code 80.
- c. Verify file reel power amp is operational. If not, display Termination Code 81.
- d. Verify take-up reel power amp is operational. If not, display Termination Code 82.
- e. Verify Demand Velocity DAC of Read/Write/Servo PWA is operational. If not, display Termination Code 83.
- f. Move take-up reel slightly in forward direction. Check for correct count of quarter-tach pulses. If incorrect, display Termination Code 84.
- g. Repeat step f in the reverse direction. Display Termination Code 84 if tach count is incorrect.
- h. Verify velocity feedback loop of Read/Write/Servo PWA is operational by putting take-up motor in stoplock mode, and monitoring forward and reverse quarter-tachs. Display Termination Code 85 if any fault is detected.
- i. Verify that tension comparators on Read/Write/Servo PWA are operational. Vary tension offsets and monitor status of tension level status lines. If any fault is detected, display Termination Code 87.

TEST 02: (Cont'd)

- j. With compressor off, zero tension offsets. If fault occurs, display Termination Code 97.
- k. Turn on compressor. If take-up sensor detects at least 2.0 ounces of tension, display Termination Code 90. If file sensor detects at least 2.0 ounces of tension, display Termination Code 89.
- l. Enable take-up servo. Move take-up reel from 0 IPS to 6 IPS in forward direction.
- m. If both sensors do not detect at least 2.0 ounces of tension within 15 seconds, display Termination Code 91.
- n. If, during this 15 seconds, the file sensor does not detect 2.0 ounces of tension within 100 milliseconds after take-up sensor, display Termination Code 74. If take-up sensor does not detect 2.0 ounces within 100 milliseconds after file sensor, display Termination Code 72.
- p. Move file reel slowly in reverse direction while take-up reel is moving forward at 6 IPS. If neither sensor detects at least 16 ounces of tension within 500 milliseconds, display Termination Code 92.
- q. If, during this 500 milliseconds, the file sensor does not detect 16 ounces of tension within 100 milliseconds after take-up sensor, display Termination Code 75. If take-up sensor does not detect 16 ounces of tension within 100 milliseconds after file sensor, display Termination Code 73.
- r. Stop moving file reel in reverse direction. If tension detected on both sensors is not within limits in 100 milliseconds, display Termination Code 98.
- s. Stop reel motion. Display Fault Code 00 to indicate test is successful.

TEST 02: (Cont'd)

POSSIBLE TERMINATION CODES:

- 00 - Test Successful
- 10 to 69 - Refer to Fault SAM
- 70 - Test Requirements Not Met, See Test 02
- 71 - Tape Loaded Fault
- 72 - TU Sensor Fault 1
- 73 - TU Sensor Fault 2
- 74 - File Sensor Fault 1
- 75 - File Sensor Fault 2
- 80 - EGC DAC Fault
- 81 - File Power Amp Fault
- 82 - TU Power Amp Fault
- 83 - Demand Velocity DAC Fault
- 84 - TU Motor/Tach Fault
- 85 - Velocity Feedback Loop Fault
- 86 - TU Comparator Fault
- 87 - File Comparator Fault
- 89 - File Sensor - 0 Fault
- 90 - TU Sensor - 0 Fault
- 91 - Compressor Failure Fault
- 92 - Filter/Regulator, Compressor, R/W/S PWA Fault
- 97 - R/W/S PWA, Sensor Intermittent Fault
- 98 - R/W/S PWA, Power Amp Fault

TEST 03: VELOCITY FAULT ISOLATION

TEST REQUIREMENT: Tape should not be threaded.

Test 03 should not be used unless Test 01 directs its use. This test may fail if run Stand-alone.

TEST DESCRIPTION: Test 03 isolates velocity servo faults by checking the take-up motor/tach assembly and the velocity servo loop.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is absent.
- b. Ramp up to 4 IPS.
- c. Check if distance between two consecutive quarter tachs is within tolerable limits.
- d. If, after five tries, at least once, the distance between two consecutive quarter tachs is within limits, go to step f.
- e. Display Termination Code 96.
- f. Check that the distance between all consecutive quarter tachs is within tolerable limits.
- g. If distance between any two consecutive quarter tachs is not within limits, report fault, otherwise, go to step i.
- h. Repeat steps e and f. If the error is detected five times, display Termination Code 98.
- i. Apply diagnostic lines to move take-up motor in forward direction from 0 to 100 IPS, and measure time it requires to ramp-up. Stop take-up motor.
- j. Calculate motor constant from this data.
- k. If motor constant is within range, go to step e. If motor constant is out of range the first time, repeat steps i and j. Otherwise, display Termination Code 84.
- l. Apply full current to move take-up motor in forward direction from 0 to 100 IPS, and measure time it requires to ramp-up. Stop take-up motor.

TEST 03: (Cont'd)

- m. If power amp is not capable of delivering full current in forward direction, flag a fault, otherwise, go to step o.
- n. If fault is the first time, repeat steps l and m, otherwise, display Termination Code 82.
- o. Apply full current to move take-up motor in reverse direction from 0 to 100 IPS, and measure time it requires to ramp-up. Stop take-up motor.
- p. If power amp is not capable of delivering full current in reverse direction, flag a fault, otherwise, go to step r.
- q. If fault is the first time, repeat steps o and p, otherwise, display Termination Code 82.
- r. Display Termination Code 00 to indicate successful completion of test.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to Fault SAM.
- 82 - Take-Up Power Amp Fault
- 84 - Take-Up Motor/Tach Fault
- 94 - Tape Present Fault
- 95 - Formatter Interrupt received while test in progress.
- 96 - Servo Loop Fault
- 98 - Take-up Motor/Tach Fault

CE TEST 10: FORWARD 25 IPS CONTINUOUS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 10 exercises the transport in a continuous mode at 25 IPS in the forward direction. When EOT is detected, tape is stopped and 25 IPS continuous mode is executed in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run forward continuously 25 IPS until EOT is detected.
- c. Stop and run reverse continuously at 25 IPS until BOT is detected.
- d. Stop motion and go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 11: REVERSE 25 IPS CONTINUOUS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 11 exercises the transport in a continuous mode at 25 IPS in the reverse direction. When BOT is detected, tape is stopped and 25 IPS continuous mode is executed in the forward direction. When EOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run reverse continuously 25 IPS until BOT is detected.
- c. Stop and run forward continuously at 25 IPS until EOT is detected.
- d. Stop motion and go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 12: FORWARD 25 IPS RAMPS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 12 exercises the transport in a start/stop mode at 25 IPS in the forward direction. When EOT is detected, the same 25 IPS start/stop mode is executed in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run forward at 25 IPS for 120 ms.
- c. Stop and pause for 120 ms.
- d. Repeat steps b and c until EOT is detected.
- e. Run reverse at 25 IPS for 120 ms.
- f. Stop and pause for 120 ms.
- g. Repeat steps e and f until BOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault



CE TEST 13:            REVERSE 25 IPS RAMPS

TEST REQUIREMENT:    Tape should be loaded.

TEST DESCRIPTION:    Test 13 exercises the transport in a start/stop mode at 25 IPS in the reverse direction. When BOT is detected, the same 25 IPS start/stop mode is executed in the forward direction. When EOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run reverse at 25 IPS for 120 ms.
- c. Stop and pause for 120 ms.
- d. Repeat steps b and c until BOT is detected.
- e. Run forward at 25 IPS for 120 ms.
- f. Stop and pause for 120 ms.
- g. Repeat steps e and f until EOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
70 - Tape Not Loaded Fault

CE TEST 14:            25 IPS REPOSITIONING

TEST REQUIREMENT:    Tape should be loaded.

TEST DESCRIPTION:    Test 14 is a repositioning routine at 25 IPS. It repositions the tape in the forward direction. When EOT is detected, it repositions the tape in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run forward at 25 IPS for 100 ms.
- c. Run reverse at 25 IPS for 30 ms.
- d. Repeat steps b and c until EOT is detected.
- e. Run forward at 25 IPS for 30 ms.
- f. Run reverse at 25 IPS for 100 ms.
- g. Repeat steps e and f until BOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
70 - Tape Not Loaded Fault

CE TEST 15:            FORWARD 100 IPS RAMPS

TEST REQUIREMENT:    Tape should be loaded.

TEST DESCRIPTION:    Test 15 exercises the transport in a start/stop mode at 100 IPS in the forward direction. When EOT is detected, the same 100 IPS start/stop mode is executed in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run forward at 100 IPS for 500 ms.
- c. Stop and Pause for 500 ms.
- d. Repeat steps b and c until EOT is detected.
- e. Run reverse at 100 IPS for 500 ms.
- f. Stop and pause for 500 ms.
- g. Repeat steps e and f until BOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
70 - Tape Not Loaded Fault

CE TEST 16: REVERSE 100 IPS RAMPS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 16 exercises the transport in a start/stop mode at 100 IPS in the reverse direction. When BOT is detected, the same 100 IPS start/stop mode is executed in the forward direction. When EOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run reverse at 100 IPS for 500 ms.
- c. Stop and Pause for 500 ms.
- d. Repeat steps b and c until BOT is detected.
- e. Run reverse at 100 IPS for 500 ms.
- f. Stop and pause for 500 ms.
- g. Repeat steps e and f until EOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
70 - Tape Not Loaded Fault

CE TEST 17: 100 IPS REPOSITIONING

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 17 is a repositioning routine at 100 IPS. It repositions the tape in the forward direction. When EOT is detected, it repositions the tape in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run forward at 100 IPS for 1 second.
- c. Run reverse at 100 IPS for 30 ms.
- d. Repeat steps b and c until EOT is detected.
- e. Run forward at 100 IPS for 30 ms.
- f. Run reverse at 100 IPS for 1 second.
- g. Repeat steps e and f until BOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
70 - Tape Not Loaded Fault

CE TEST 18: FORWARD 100 IPS CONTINUOUS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 18 exercises the transport in a continuous mode at 100 IPS in the forward direction. When EOT is detected, tape is stopped and 100 IPS continuous mode is executed in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run forward continuously 100 IPS until EOT is detected.
- c. Stop and run reverse continuously at 100 IPS until BOT is detected.
- d. Stop motion and go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
70 - Tape Not Loaded Fault

CE TEST 19: REVERSE 100 IPS CONTINUOUS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 19 exercises the transport in a continuous mode at 100 IPS in the reverse direction. When BOT is detected, tape is stopped and 100 IPS continuous mode is executed in the forward direction. When EOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Run reverse continuously 100 IPS until BOT is detected.
- c. Stop and run forward continuously at 100 IPS until EOT is detected.
- d. Stop motion and go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 20: FORMATTER INTERNAL DIAGNOSTICS

TEST REQUIREMENT: None.

TEST DESCRIPTION: Test 20 checks out the internal hardware of the formatter. It does not check host interface or device interface hardware.

TEST OPTIONS: 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).  
01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.  
02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Check out programmable timer hardware.
- b. Check out hardware used to write ID or file mark.
- c. Check out hardware used to write or read a block of data.
- d. Check out hardware used to detect dead tracks and correct errors.
- e. Check out hardware used for high speed and reverse operations.

POSSIBLE TERMINATION CODES:

- 00 - Test is Successful
- 58 - Formatter Internal Diagnostic Failure



CE TEST 21:            25 IPS WRITE TO EOT

TEST REQUIREMENT:    A write enabled scratch tape should be loaded.

TEST DESCRIPTION:    Test 21 writes 2K byte records, first 256 bytes of random data and then the remaining bytes of fixed data, from the present position of the tape to EOT at 25 IPS. On detection of EOT, it rewinds and positions at BOT. If a write error occurs, the unit performs Backspace, Erase, and attempts to write again. If more than five consecutive erases are required, the test terminates with a write fault. If 16 erases are required in one complete pass, the test terminates with a write fault. All functional checks are active throughout the test.

TEST OPTIONS:        00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).  
                      01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.  
                      02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Write 2K byte records at 25 IPS continuous to EOT.
- b. Rewind to BOT.

POSSIBLE TERMINATION CODES:

- 00 - Test is successful
- 03 - ID Check
- 04 - Low Speed Write Error
- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 22:           25 IPS READ TO EOT

TEST REQUIREMENT:    A pre-written tape should be loaded.

TEST DESCRIPTION:    Test 22 reads any pre-written tape from present tape position to EOT at 25 IPS. Any read error halts the test with a fault code. All functional checks are active. On detection of EOT, it rewinds and positions at BOT.

TEST OPTIONS:        00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).  
                      01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.  
                      02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Read records at 25 IPS continuous to EOT.
- b. Rewind to BOT.

POSSIBLE TERMINATION CODES:

- 00 - Test is Successful
- 03 - ID Check
- 05 - Low Speed Read Error
- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 23: 100 IPS STREAMING WRITE TO EOT

TEST REQUIREMENT: A write enabled scratch tape should be loaded.

TEST DESCRIPTION: Test 23 writes 256 byte records, all zeros patterns, from present position of tape to EOT at 100 IPS in streaming mode. On detection of EOT, it rewinds and positions at BOT. If a write error occurs, the unit performs Backspace, Erase, and attempts to write again. If more than five consecutive erases are required, the test terminates with a write fault. If 16 erases are required in one complete pass, the test terminates with a write fault. All functional checks are active throughout the test.

TEST OPTIONS:

- 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).
- 01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.
- 02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Write 256 byte records at 100 IPS streaming to EOT.
- b. Rewind to BOT.

POSSIBLE TERMINATION CODES:

- 00 - Test is successful
- 03 - ID Check
- 06 - High Speed Write Error
- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 24: 100 IPS READ TO EOT

TEST REQUIREMENT: A pre-written tape should be loaded.

TEST DESCRIPTION: Test 24 reads any pre-written tape from present tape position to EOT at 100 IPS. Any read error halts the test with a fault code. All functional checks are active. On detection of EOT, it rewinds and positions at BOT.

TEST OPTIONS:

- 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).
- 01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.
- 02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Read records at 100 IPS streaming to EOT.
- b. Rewind to BOT.

POSSIBLE TERMINATION CODES:

- 00 - Test is Successful
- 03 - ID Check
- 07 - High Speed Read Error
- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 28: PERFORM COMMAND STACK AT 25 IPS START/STOP

TEST REQUIREMENT: a. If a write-type operation is desired, a write enabled scratch tape should be loaded.

b. If a read-type operation is desired, a pre-recorded tape should be loaded.

TEST DESCRIPTION: Test 28 performs the three-level command stack entered by Test 97. If option 01 is entered, the stack will be repeated until EOT or BOT is detected. If write operation is being performed upon an error, a Backspace, Erase, and Rewrite is performed. If read operation is being performed, any uncorrectable read error will cause the test to fail with a read fault. All functional checks are active throughout the test.

TEST OPTIONS: 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).

01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.

02 = Loop on test, bypass read or write error halts.

POSSIBLE TERMINATION CODES:

00 - Test is Successful  
03 - ID Check  
04 - Low Speed Write Error  
05 - Low Speed Read Error  
10 to 69 - Refer to Fault SAM  
70 - Tape Not Loaded Fault

CE TEST 29: PERFORM COMMAND STACK AT 100 IPS THRASHING

- TEST REQUIREMENT:
- a. If a write-type operation is desired, a write enabled scratch tape should be loaded.
  - b. If read-type operation is desired, a pre-recorded tape should be loaded.

TEST DESCRIPTION: Test 29 performs the three-level command stack entered by Test 97. If option 01 is entered, the stack will be repeated until EOT or BOT is detected. If write operation is being performed upon an error, a Backspace, Erase, and Rewrite is performed. If read operation is being performed, any uncorrectable read error will cause the test to fail with a read fault. All functional checks are active throughout the test.

- TEST OPTIONS:
- 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).
  - 01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.
  - 02 = Loop on test, bypass read or write error halts.

POSSIBLE TERMINATION CODES:

- 00 - Test is Successful
- 03 - ID Check
- 06 - High Speed Write Error
- 07 - High Speed Read Error
- 10 to 69 - Refer to Fault SAM
- 70 - Tape Not Loaded Fault

CE TEST 30: CHECK READ AMPLITUDES AT 25 AND 100 IPS WITH TOLERANCE OF + 0.8 VOLTS

TEST REQUIREMENT: Tape should be loaded and not write protected, and should not be near EOT.

TEST DESCRIPTION: Test 30 checks that read amplitudes at 25 AND 100 IPS are  $1.5 \pm 0.8$  volts. For 25 IPS, the minimum read amplifier gain value is determined for each track, such that the peak-to-peak voltage at the analog test point is 1.5 volts. This generates an envelope signal for that track. If, at the end of the test, an envelope is not detected for any track, a fault is reported. The gain determined for each track is compared to corresponding gain value stored in the back-up memory (determined by Test 31). If the difference for any track is such, that it causes an amplitude difference of 0.8 volts, a fault is reported. All CE options are available for the test.

The same operation is carried out for 100 IPS.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed, tape is not write protected, tape is loaded and not at EOT.
- b. Calculate the minimum read gain values for all tracks for 25 IPS as described.
- c. Display Fault Code 01 if an envelope is not detected in track at the end of the test.
- d. Display Fault Code 02 if the difference in gain, between that determined and the corresponding value stored in the back-up memory for any track, is such that it causes an amplitude difference of 0.8 volts.
- e. Execute steps b, c, and d for 100 IPS.
- f. Display Termination Code 00 if complete test is successful.

CE TEST 30: (Cont'd)

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 01 - EGC Envelope Fault
- 02 - EGC Wear Tolerance Fault
- 10 to 69 - Refer to Fault SAM
- 70 - Tape Not Loaded Fault
- 72 - Tape Write Protected Fault
- 77 - EOT On EGC Fault

NOTE: CE Test 30 is a part of Operator Test 1.



CE TEST 31: SET UP AND CHECK READ AMPLITUDES AT 25 AND 100 IPS

TEST REQUIREMENT: Execute this test with a (3M 777) or equivalent tape. Tape should be loaded and not write protected, and should not be near EOT. Jumper to the back-up memory should be in W4 ("STORE") position.

TEST DESCRIPTION: Test 31 sets up and checks the read amplitudes at 25 and 100 IPS. For 25 IPS, it determines the minimum gain value for each track, in the same manner as described in Test 30, and stores them in the back-up memory. It again determines the minimum gain value for each track and compares it to the previously stored value. If the difference in gain between the two values for any track is such that it causes an amplitude difference of 0.1 volts, the test is repeated. Also, if any fault is detected while determining the minimum gain values, the test is repeated. If, after 5 attempts, the operation is not successful, a fault is reported.

The same operation is carried out for 100 IPS.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed, tape is not write protected, tape is loaded, and tape is not at EOT.
- b. Determine the minimum gain values for 25 IPS and store them in the back-up memory. Report a fault if the jumper on the back-up memory is not in the W4 ("STORE") position.
- c. Determine the minimum gain values for 25 ips and compare them with the previously stored values. If, for any track, the difference is such that it causes an amplitude difference greater than 0.1 volts, the test is repeated.
- d. If, while determining the minimum gain values in steps b and c, a fault is detected, the test is repeated.
- e. If, after five tries, the test is still not successful, terminate the test with Termination Code 78.

CE TEST 31: (Cont'd)

- f. Execute steps b, c, and d for 100 IPS. If test is not successful after five tries, display Termination Code 79.
- g. Display Termination Code 00 if complete test is successful.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to Fault SAM
- 70 - Tape Not Loaded Fault
- 72 - Tape Write Protected Fault
- 78 - EGC Low Speed Set-Up Failure
- 79 - EGC High Speed Set-Up Failure
- 99 - Attempt to Loop on Test

NOTE 1: After completing the test, replace the jumper to the back-up memory from the W4 ("STORE") position to the W3 position before powering down the STU.

NOTE 2: Loop on test option is not permitted with this test.

NOTE 3: Make certain resistors R224 and R225 are moved from old PWA to replacement PWA. Move jumper plug at location 13E on Read-Write-Servo PWA from normal W3 to Test W4 - Store position. With tape not threaded, execute Field Service Tests 37 and 48. Load known good quality write enabled tape. Execute Field Service Test 18 to move tape away from BOT. Press RESET to stop tape motion. Execute Field Service Test 31. After test is complete (display 00), return jumper plug to W3 position. With tape threaded, but not loaded, execute Operator Test 01.

CE TEST 32:            CHECK READ AMPLITUDES AT 25 AND 100 IPS

TEST REQUIREMENT:    Tape should be loaded and pre-written with all 1's, and should not be near EOT.

TEST DESCRIPTION:    Test 32 checks that read amplitudes at 25 and 100 IPS are  $1.5 \pm 0.3$  volts, with pre-written tape of all 1's. This test is similar to Test 30 except that it requires pre-written tape and the tolerance value is  $\pm 0.3$  volts instead of 0.8 volts.

TEST OPTIONS:        00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).  
                      01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.  
                      02 = Loop on test, bypass read or write error halts.

POSSIBLE TERMINATION CODES:

00 - Test Is Successful  
01 - EGC Envelope Fault  
02 - EGC Wear Tolerance Fault  
10 to 69 - Refer to Fault SAM  
70 - Tape Not Loaded Fault  
77 - EOT On EGC Fault

CE TEST 33:            SET UP READ AMPLITUDES AT 25 IPS

TEST REQUIREMENT:    Tape should be loaded and not write protected, and should not be near EOT. Jumper to the back-up memory should be in the W4 ("STORE") position.

TEST DESCRIPTION:    Test 33 determines and stores the read gains at 25 IPS. This test is similar to Test 31 except it is done only at 25 IPS, and whenever a fault is detected, the test is terminated and the fault is reported.

TEST OPTIONS:        None.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 01 - EGC Envelope Fault
- 10 to 69 - Refer to Fault SAM
- 70 - Tape Not Loaded Fault
- 72 - Tape Write Protected Fault
- 73, 74 - Back Up Memory Not Write Enabled
- 75, 76 - Bad Back Up Memory
- 77 - EOT On EGC Fault
- 99 - Attempt to Loop on Test

NOTE 1: After completing the test, replace the jumper to the back-up memory from the W4 ("STORE") position to the W3 position before powering down the STU.

NOTE 2: Loop on test option is not permitted with this test.

CE TEST 34:            SET UP READ AMPLITUDES AT 100 IPS

TEST REQUIREMENT:    Tape should be loaded and not write protected, and should not be near EOT. Jumper on the back-up memory should be in the W4 ("STORE") position.

TEST DESCRIPTION:    Test 34 determines and stores the read gains at 100 IPS. This test is similar to Test 31 except it is done only at 100 IPS, and whenever a fault is detected, the test is terminated and the fault is reported.

TEST OPTIONS:        None.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 01 - EGC Envelope Fault
- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault
- 72 - Tape Write Protected Fault
- 73, 74 - Back Up Memory Not Write Enabled
- 75, 76 - Bad Back Up Memory
- 77 - EOT On EGC Fault
- 99 - Attempt to Loop on Test

NOTE 1: After completing the test, replace the jumper to the back-up memory from the W4 ("STORE") position to the W3 position before powering down the STU.

NOTE 2: Loop on test is not permitted with this test.

TEST 37: SET UP VELOCITY CORRECTION MULTIPLIER

TEST REQUIREMENT: Tape should not be threaded. Jumper to the back-up memory (on Read-Write-Servo Module) should be in the W4 ("STORE") position.

TEST DESCRIPTION: Test 37 sets up the velocity correction multiplier for the velocity DAC.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the top cover door is closed and tape is absent.
- b. Move take-up reel forward at about 19 IPS velocity (for BOT radius).
- c. Calculate velocity correction multiplier for velocity DAC.
- d. Display Termination Code 93 if velocity correction multiplier is out of range.
- e. Stop take-up reel and store velocity correction multiplier in back-up memory.
- f. Display Termination Code 00 if complete test is successful.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to respective Troubleshooting Procedure
- 73, 74 - Back Up Memory Not Write Enabled
- 75, 76 - Bad Back Up Memory
- 93 - Velocity Correction Multiplier Factor Out of Range
- 94 - Tape Present Fault
- 99 - Attempt to Loop on Test

NOTE 1: Upon successful completion of this test, CE Test 48 should be initiated to set up pump power-down timer.

NOTE 2: After completing the test, replace the jumper to the back-up memory from the W4 ("STORE") position to the W3 operating position before powering down the transport.

CE TEST 38: PULSE FILE REEL AT 8 OUNCES

TEST REQUIREMENT: Tape (10.5 inch reel) should be threaded close to BOT without any loop.

TEST DESCRIPTION: This test puts the take-up reel in Stoplock. It pulses the file reel in the reverse direction to maintain approximately 8 ounces of tension. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is present.
- b. Put take-up reel in Stoplock.
- c. Turn on pump.
- d. Pulse the file reel.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 71 - Tape Loaded Fault

CE TEST 39: WRITE ALL 1'S TO EOT AT 25 IPS

TEST REQUIRMENT: Tape should be loaded and not write protected.

TEST DESCRIPTION: Test 39 writes tape with all 1's at 25 IPS to EOT. At EOT, tape is rewound to BOT. All CE options are available for the test.

TEST OPTIONS: 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).  
01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.  
02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Check if the operator door is closed.
- b. Check if tape is loaded and not write protected.
- c. Write all 1's to EOT at 25 IPS.
- d. Rewind to BOT.
- e. Display Termination Code 00 if test is successful.

POSSIBLE TERMINATION CODES:

00 - Test Is Successful  
10 to 69 - Refer to Fault SAM  
70 - Tape Not Loaded Fault  
72 - Tape Write Protected Fault



CE TEST 40: WRITE ALL 1'S TO EOT AT 100 IPS

TEST REQUIREMENT: Tape should be loaded and not write protected.

TEST DESCRIPTION: Test 40 writes tape with all 1's at 100 IPS to EOT. First, it checks if tape is not write protected. It then writes all 1's at 100 IPS to EOT. At EOT, it is rewound to BOT.

TEST OPTIONS:

- 00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).
- 01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.
- 02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. Check if the operator door is closed.
- b. Check if tape is loaded and not write protected.
- c. Write all 1's to EOT at 100 IPS.
- d. Rewind to BOT.
- e. Display Fault Code 00 if test is successful.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to Fault SAM
- 70 - Tape Not Loaded Fault
- 72 - Tape Write Protected Fault

CE TEST 41:            STOPLOCK TAKE-UP REEL

TEST REQUIREMENT:    Tape should not be loaded.

TEST DESCRIPTION:    Test 41 checks the stoplock mode of the  
take-up reel servo. Manual intervention is  
required to terminate the test.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed.
- b. Put take-up reel servo in stoplock mode.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
71 - Tape Loaded Fault

CE TEST 42:            ENABLE TENSION SERVO

TEST REQUIREMENT:    Tape should be threaded.

Tape slack should be removed to allow File Servo to be enabled.

TEST DESCRIPTION:    Test 42 allows tape tension to be checked via the tension servo. It produces 8 ounces of tension by enabling tension servo.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed. If tape is absent, go to step d.
- b. Take up slack in tape by slowly moving take-up reel in reverse direction until tension is reached.
- c. Enable tension servo operation at 8 ounces.
- d. If tape is pulled out of tape path, display Termination Code 00.

POSSIBLE TERMINATION CODES:

00 - Test Is Successful  
10 to 69 - Refer to Fault SAM.  
71 - Tape Loaded Fault

CE TEST 43: TURN ON PUMP

TEST REQUIREMENT: Tape should not be loaded.

TEST DESCRIPTION: Test 43 turns on the pump. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is not loaded.
- b. Turn on pump.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM.  
71 - Tape Loaded Fault

CE TEST 44: FAST FORWARD TO EOT

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 44 moves tape forward at rewind speed to EOT.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Gradually increase speed and then maintain rewind speed.
- c. Wait until EOT is detected.
- d. Stop motion and display Termination Code 00.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to Fault SAM.
- 70 - Tape Not Loaded Fault

CE TEST 45: EGC DAC SCOPE LOOP

TEST REQUIREMENT: Tape should not be loaded.

TEST DESCRIPTION: Test 45 exercises the EGC DAC on the Read/Write/Servo PWA. Use TP 12 as a sync point and observe output at TP 14. If EGC DAC is operational, a triangle waveform of 35 ms period will be observed on the scope. Manual termination is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed.
- b. Issue a trigger signal at TP 12.
- c. Output zero voltage at TP 14 through EGC DAC, and increase it by 20 mv at every 60 microseconds (approximate) until it reaches 5 volts.
- d. Decrease output at TP 14 through EGC DAC by 20 mv at every 60 microseconds (approximate) until it reaches 0 volt.
- e. Go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 71 - Tape Loaded Fault

CE TEST 46:            VELOCITY DAC SCOPE LOOP

TEST REQUIREMENT:    Tape should not be loaded.

TEST DESCRIPTION:    Test 46 exercises the Velocity DAC on the Read/Write/Servo PWA. Use TP 12 as a sync point and observe output at TP 13 on the scope. If Velocity DAC is operational, a triangle waveform of 35 ms period will be observed on the scope. Manual termination is required to terminate the test.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed.
- b. Issue a trigger signal at TP 12.
- c. Output zero voltage at TP 13 through Velocity DAC, and increase it by 20 mv at every 60 microseconds (approximate) until it reaches 6.9 volts.
- d. Decrease output at TP 13 through Velocity DAC by 20 mv at every 60 microseconds (approximate) until it reaches 0 volt.
- e. Go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 71 - Tape Loaded Fault

CE TEST 47: READ/WRITE/SERVO MICROPROCESSOR OUTPUTS SCOPE LOOP

TEST REQUIREMENT: Tape should not be loaded.

TEST DESCRIPTION: Test 47 generates a pulse of 50 microseconds every 5 ms on each of the addressable outputs of the Read/Write/Servo PWA. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is not present.
- b. Generate a 50 microsecond pulse every 5 ms on each of the addressable outputs of Read/Write/Servo microprocessor.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM.
- 94 - Tape Present Fault



CE TEST 48:            SET UP PUMP POWER-DOWN TIMER

TEST REQUIREMENT:    Tape should not be threaded. Jumper to the backup memory (on the Read-Write-Servo module) should be in the W4 ("STORE") position.

TEST DESCRIPTION:    Test 48 sets up the pump power-down timer for one minute if no tape motion has occurred.

TEST OPTIONS:        None.

POSSIBLE TERMINATION CODES:

- 00 - Test is successful
- 73, 74 - Backup memory is not write enabled.
- 75, 76 - Bad backup memory
- 94 - Tape Present Fault

NOTE 1:    After completing the test, replace the jumper to the back-up memory from the W4 ("STORE") position to the W3 operating position before powering down the transport.

NOTE 2:    To disable the pump power-down timer, run CE Test 37.

CE TEST 50: 25 IPS FORWARD STREAMING RAMPS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 50 exercises the transport in a start/stop mode at 25 ips using the streaming ramps in the forward direction. When EOT is detected, the same 25 ips mode is executed in the reverse direction. When BOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Ramp up to 25 ips using streaming ramp and run for 250 ms.
- c. Stop using streaming ramp and pause for 250 ms.
- d. Repeat steps b and c until EOT is detected.
- e. Ramp up to 25 ips in reverse direction and run for 250 ms.
- f. Stop and pause for 250 ms.
- g. Repeat steps e and f until BOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

- 10 to 69 - Refer to Fault SAM
- 70 - Tape Not Loaded Fault

CE TEST 51:

25 IPS REVERSE STREAMING RAMPS

TEST REQUIREMENT: Tape should be loaded.

TEST DESCRIPTION: Test 51 exercises the transport in a start/stop mode at 25 ips using the streaming ramps in the reverse direction. When BOT is detected, the same 25 ips mode is executed in the forward direction. When EOT is detected, the routine starts again. Manual intervention is required to terminate the test.

TEST OPTIONS: None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is loaded.
- b. Ramp up to 25 ips using streaming ramp and run for 250 ms.
- c. Stop using streaming ramp and pause for 250 ms.
- d. Repeat steps b and c until BOT is detected.
- e. Ramp up to 25 ips in forward direction and run for 250 ms.
- f. Stop and pause for 250 ms.
- g. Repeat steps e and f until EOT is detected.
- h. Go to step b.

POSSIBLE TERMINATION CODES:

10 to 69 - Refer to Fault SAM  
70 - Tape Not Loaded Fault

CE TEST 61:            TAKE-UP MOTOR AND POWER AMP FULL CAPABILITY  
DETECTION TEST

TEST REQUIREMENT: Tape should not be threaded.

TEST DESCRIPTION: Test 61 checks out whether take-up motor performance is within range or not. It also checks out whether take-up section of the power amp is capable of delivering full current or not.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is absent.
- b. Apply diagnostic lines to move take-up motor in forward direction from 0 to 100 IPS, and measure time it requires to ramp-up. Stop take-up motor.
- c. Calculate motor constant from this data.
- d. If motor constant is within range, go to step e. If motor constant is out of range the first time, repeat steps b and c. Otherwise, display Termination Code 84.
- e. Apply full current to move take-up motor in forward direction from 0 to 100 IPS, and measure time it requires to ramp-up. Stop take-up motor.
- f. If power amp is not capable of delivering full current in forward direction, flag a fault, otherwise, go to step h.
- g. If fault is the first time, repeat steps e and f, otherwise, display Termination Code 82.
- h. Apply full current to move take-up motor in reverse direction from 0 to 100 IPS, and measure time it requires to ramp-up. Stop take-up motor.
- i. If power amp is not capable of delivering full current in reverse direction, flag a fault, otherwise, go to step k.
- j. If fault is the first time, repeat steps h and i, otherwise, display Termination Code 82.
- k. Display Termination Code 00 to indicate successful completion of test.

CE TEST 61: (Cont'd)

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to Fault SAM.
- 82 - Take-Up Power Amp Fault
- 84 - Take-Up Motor/Tach Fault
- 94 - Tape Present Fault

CE TEST 62:            TAKE-UP FINE TACH FAULT DETECTION

TEST REQUIREMENT:    Tape should not be threaded.

TEST DESCRIPTION:    Test 62 checks that the distance between two consecutive quarter tachs (derived from fine line tachs at the take-up motor) is within tolerable limits.

TEST OPTIONS:        None.

TEST SEQUENCE:

- a. Check if the operator door is closed and tape is absent.
- b. Ramp up to 4 IPS.
- c. Check if distance between two consecutive quarter tachs is within tolerable limits.
- d. If, after five tries, at least once, the distance between two consecutive quarter tachs is within limits, go to step f.
- e. Display Termination Code 96.
- f. Check that the distance between all consecutive quarter tachs is within tolerable limits.
- g. If distance between any two consecutive quarter tachs is not within limits, report fault, otherwise, go to step i.
- h. Repeat steps e and f. If the error is detected five times, display Termination Code 84.
- i. Display Termination Code 00 to indicate successful completion of test.

POSSIBLE TERMINATION CODES:

- 00 - Test Is Successful
- 10 to 69 - Refer to Fault SAM.
- 84 - Take-Up Motor/Tach Fault
- 94 - Tape Present Fault
- 95 - Formatter Interrupt received while test in progress.
- 96 - Servo Loop Fault

CE TEST 91:            FUNCTIONAL FAULT DETECTION TEST

TEST REQUIRMENT:    A write enabled scratch tape should be loaded.

TEST DESCRIPTION:    Test 91 performs those functions that the STU would normally perform during functional operations. Unit halts with the appropriate error code, if a functional fault occurs.

TEST OPTIONS:        00 = Halt if read or write errors exceed limits specified, halt on completion of test (Default option).  
                      01 = Loop on test, halt if read or write errors exceed limit specified on any given pass.  
                      02 = Loop on test, bypass read or write error halts.

TEST SEQUENCE:

- a. If tape is unloaded then load tape, otherwise, rewind tape.
- b. Write 100 blocks at 25 IPS start/stop (NOTE 1).
- c. Space Reverse, Erase, Write File Mark (check for File Mark Detect), Space Reverse (check for File Mark Detect), Read Forward, Read Reverse (check for File Mark Detect).
- d. Read reverse 100 blocks previously written at 25 IPS start/stop mode.
- e. Read forward 2 blocks at 25 IPS start/stop mode.
- f. Check gap lengths twice.
- g. Read forward 94 blocks at 25 IPS start/stop mode.
- h. Repeat steps d to i at 25 IPS continuous mode.
- i. Repeat steps d to i at 100 IPS start/stop mode.
- j. Change speed from high to low and then low to high.
- k. Write 100 blocks at 100 IPS "thrashing" (NOTE 2).
- l. Space reverse 10 blocks at 100 IPS "thrashing".
- m. Read forward 10 blocks at 100 IPS "thrashing".
- n. Rewind.

CE TEST 91: (Cont'd)

- o. Speed mode change.
- p. Read forward 200 blocks at 100 IPS streaming (check for File Mark Detect).
- q. Write to EOT at 100 IPS streaming (NOTE 2).
- r. Space reverse 200 blocks at 100 IPS streaming.
- s. Read forward 10 blocks at 100 IPS "thrasning".
- t. Read forward 20 blocks at 25 IPS start/stop mode.
- u. Read reverse 20 blocks at 25 IPS start/stop mode.
- v. Rewind.

NOTE 1: Data blocks written at 25 IPS are 2K bytes with the first 256 bytes "random" and remaining bytes of fixed pattern.

NOTE 2: Data blocks written at 100 IPS are 256 bytes of all zeros.

POSSIBLE TERMINATION CODES:

- 00 - Test is Successful
- 01 - Read Envelope Fault
- 02 - Read Amplitude Range Fault
- 03 - ID Check
- 04 - Low Speed Write Error
- 05 - Low Speed Read Error
- 06 - High Speed Write Error
- 07 - High Speed Read Error
- 08 - Noise In IBG
- 10 to 69 - Refer to Fault SAM.







# REMOVAL/REPLACEMENT PROCEDURES

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## GENERAL

This section of the manual provides information for the removal and replacement of all parts or assemblies as defined in the spare parts list. In addition, a verification test follows each of the replacement procedures. The reader should be thoroughly familiar with the operation of the STU and with the diagnostic test procedures.

It is assumed that any part or assembly being replaced has been determined to be defective. If an adjustment procedure is included as part of the procedure, then the adjustment must be attempted before a part or assembly is replaced. In addition, the adjustment must also be performed following the replacement procedure.

Parts, assemblies, and locations are referenced by the STU Component Location, sheets 1 through 3.

Unless otherwise specified, all procedures assume that tape has been unloaded, the transport is powered down, and the input power cord is disconnected.

Table 6-17. REMOVAL/REPLACEMENT INDEX

TITLE	PAGE	TITLE	PAGE
Tape Cleaner Assembly Platform Blade and Housing	6-160	Pressure Regulator Filter	6-179
Door Interlock Switch	6-161	Magnetic Head Assembly	6-181
File Protect Sensor	6-162	Operator Panel Assembly	6-185
EOT/BOT Sensor Assembly	6-163	Cooling Fan Assembly	6-186
Takeup Reel Assembly		Power Supply Assembly	6-187
Hub Assembly	6-165	Printed Wire Assemblies	
Motor Assembly	6-166	Read-Write-Servo	6-189
		Formatter/Control	6-191
		Power Amplifier	6-192
Supply Reel Assembly		Capacitor Assembly	6-193
Hub Assembly	6-167	Acoustic Shield Assembly	6-195
Motor Assembly	6-169	Drive Cover Assembly	6-197
Supply Motor Tach and Sensor	6-172	Drive Cover With SCSI	6-198
Air Bearing Sensors	6-173	SCSI Interface PWA	6-200
Air Bearing Spring Guides	6-175	Capacitor	6-202
Compressor Assembly	6-177		

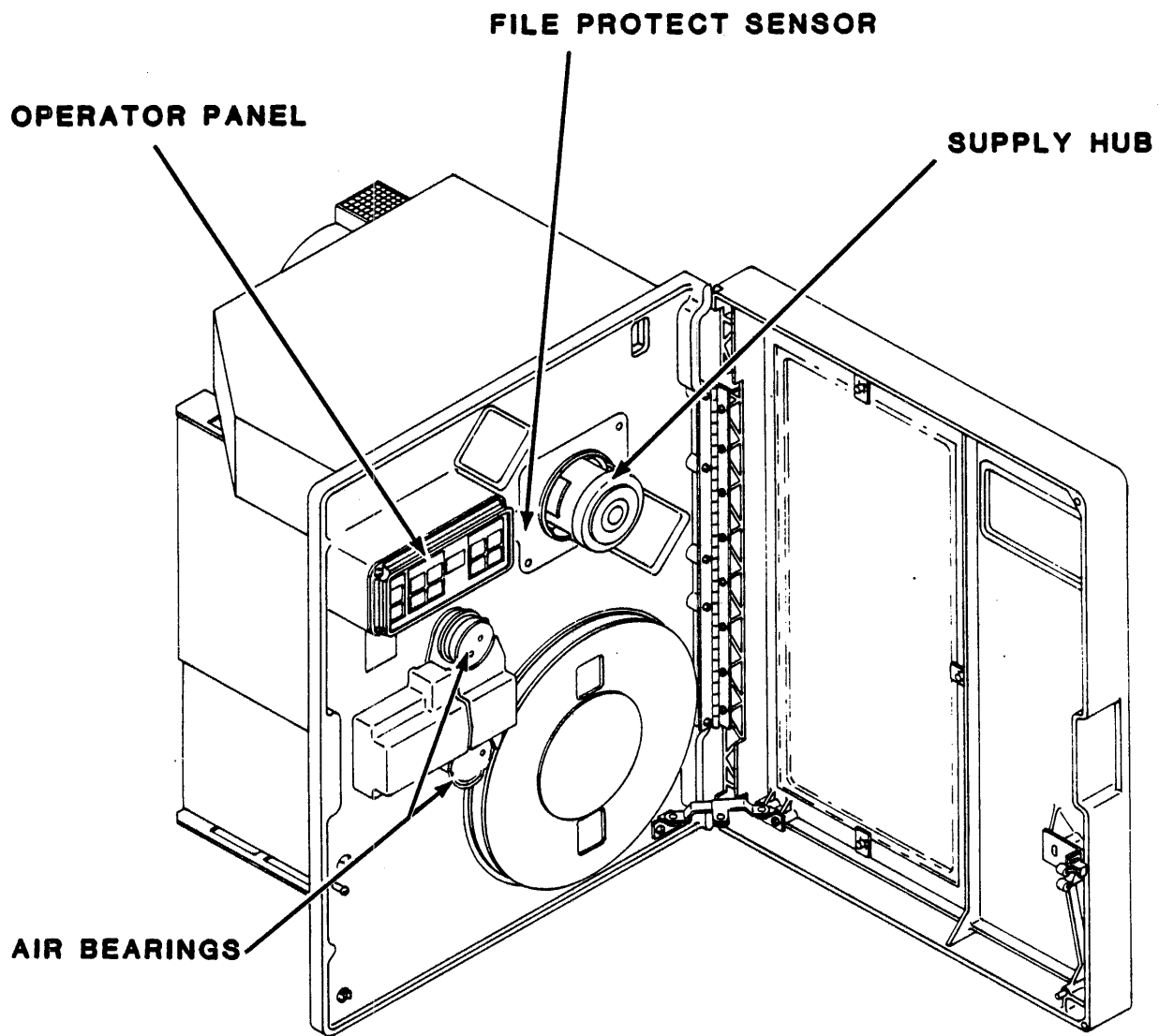


Figure 6-5. STU COMPONENT LOCATION (Sheet 1 of 3)

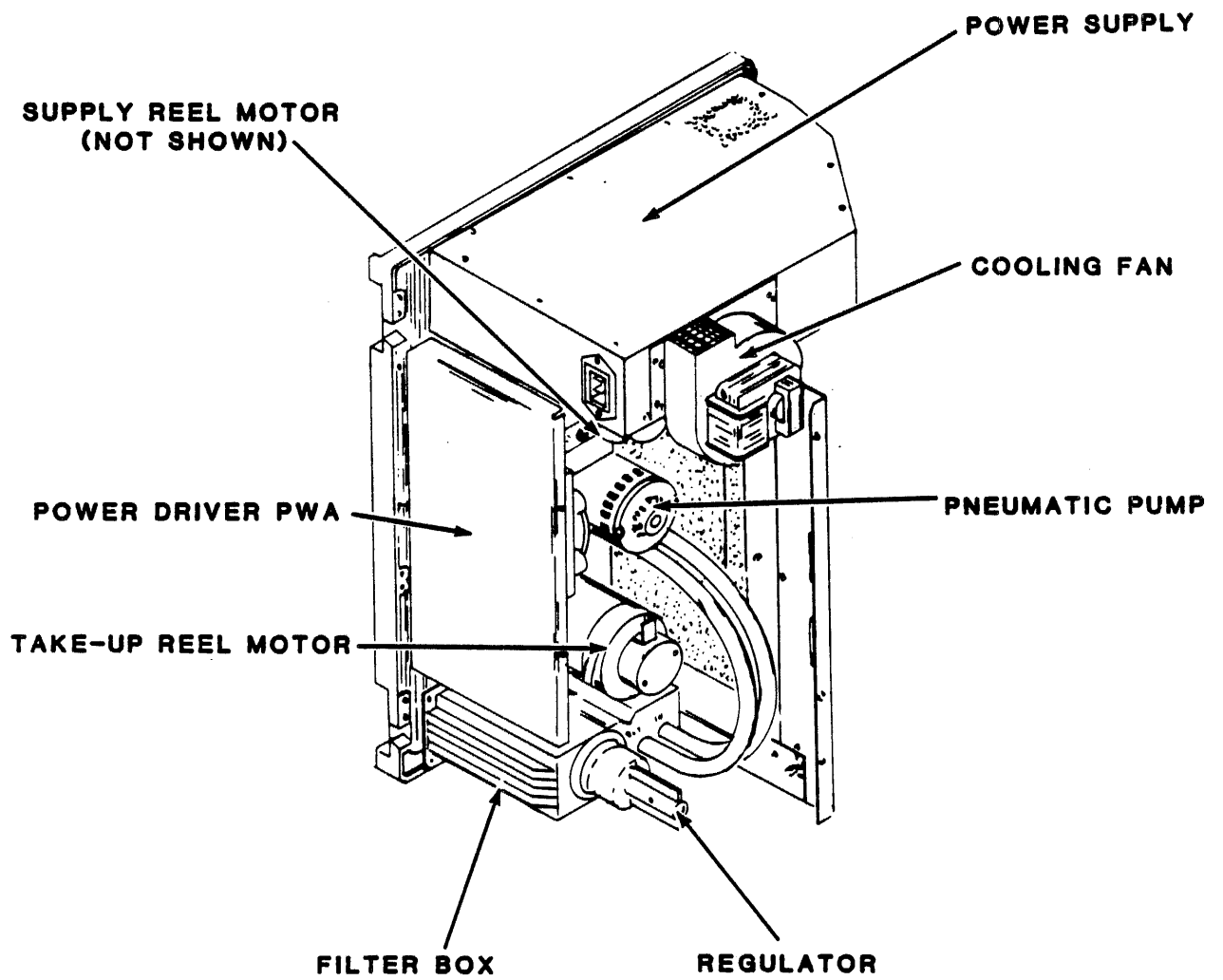


Figure 6-5. STU COMPONENT LOCATION (Sheet 2 of 3)

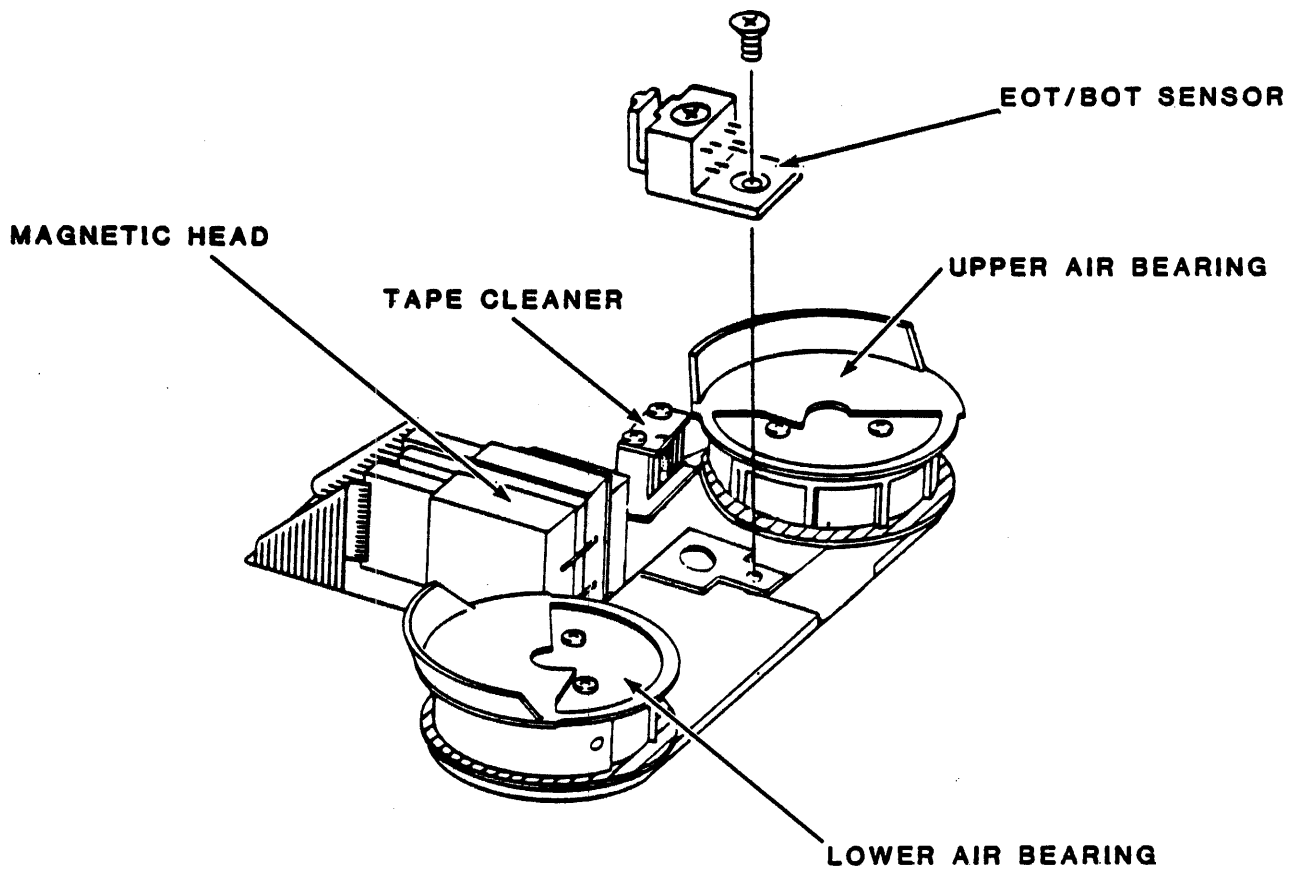


Figure 6-5. STU COMPONENT LOCATION (Sheet 3 of 3)

## TAPE CLEANER ASSEMBLY

### Removal

1. Remove head cover from tape deck.
2. Loosen two pan head screws and remove cleaner assembly from tape deck.
3. Remove screws, lockwashers, and cover plate from blade housing.
4. Slide platform assembly out from tape cleaner assembly.

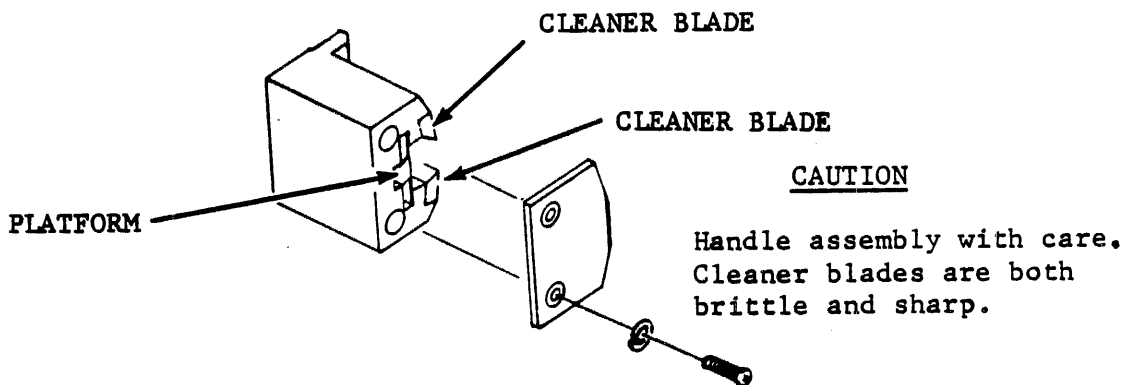


Figure 6-6. TAPE CLEANER

### NOTE

Defective tape cleaner must be replaced as a complete assembly.

### Replacement

6. Inspect cleaner blades for damage. If blades are chipped or damaged, replace entire assembly.
2. If blades are not damaged, clean platform and reinstall. When installing platform, ensure flanges are such that platform fits firmly inside cleaner assembly.
3. Install cover plate, two washers and mounting screws.
4. Position assembly onto guide pins on tape deck and secure screws.
5. Reinstall head cover.

### Verification Check

1. No functional checks are necessary.



## DOOR INTERLOCK SWITCH

### Removal

1. At the rear of the tape deck, remove four labeled slip-on connectors from interlock switch connectors. (If any wires are not labeled, identify and mark each wire for reassembly.)
2. Remove two hex head screws securing switch plate to tape deck. Remove switch and switch plate.
3. Depress top and bottom release tabs on switch to separate switch from switch plate.

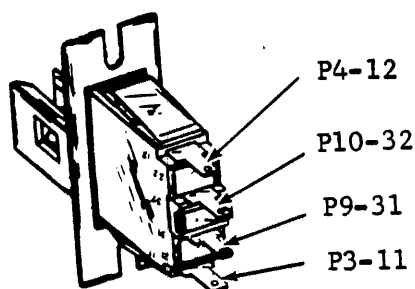


Figure 6-7. DOOR INTERLOCK SWITCH (REAR VIEW)

### Replacement

1. Assemble switch to switch plate.
2. Position switch assembly on the rear of the tape deck so that connector numbers on switch correspond to numbers stencilled on tape deck.
3. Insert two hex mounting screws. Position front dust cover door so that interlock switch can be aligned with actuating stud on door. Tighten switch mounting screws when center of switch front is aligned with actuating stud.
4. Attach slip-on connectors to appropriate studs of interlock switch. Refer to figure for wire and connector positions.

### Verification Check

1. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to corresponding Fault SAM.

## FILE PROTECT SENSOR

### Removal

1. Remove tape reel from supply hub.
2. Remove four mounting screws and file protect sensor cover plate from tape deck.
3. Remove mounting screw and washer securing file protect sensor to tape deck.
4. Detach connector W3P6 from sensor and discard sensor.

### Replacement

#### NOTE

Refer to Figure 6-8 for sensor alignment and cable plug connection.

1. Place sensor on tape deck and secure with mounting screw and washer.
2. Attach cable plug W3P6 to sensor pins.
3. Reinstall sensor cover plate and secure to tape deck with four mounting screws.

### Verification Check

1. Perform SAM 1003 to verify operation of file protect sensor circuit.

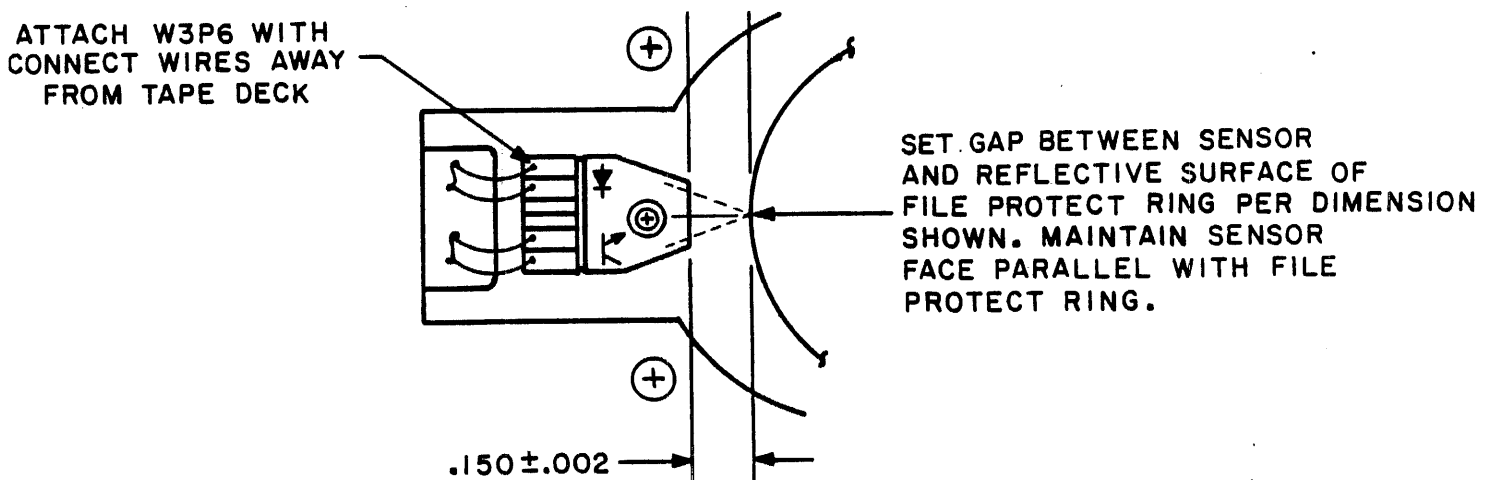


Figure 6-8. FILE PROTECT SENSOR ALIGNMENT

## EOT/BOT SENSOR ASSEMBLY

### Removal

1. Remove tape path and magnetic head covers from tape deck.
2. Disconnect W3P1 plug from EOT/BOT assembly.
3. Remove black flat head phillips mounting screw from assembly base-mount and remove assembly from tape deck.

### NOTE

Defective sensor must be replaced as a complete assembly.

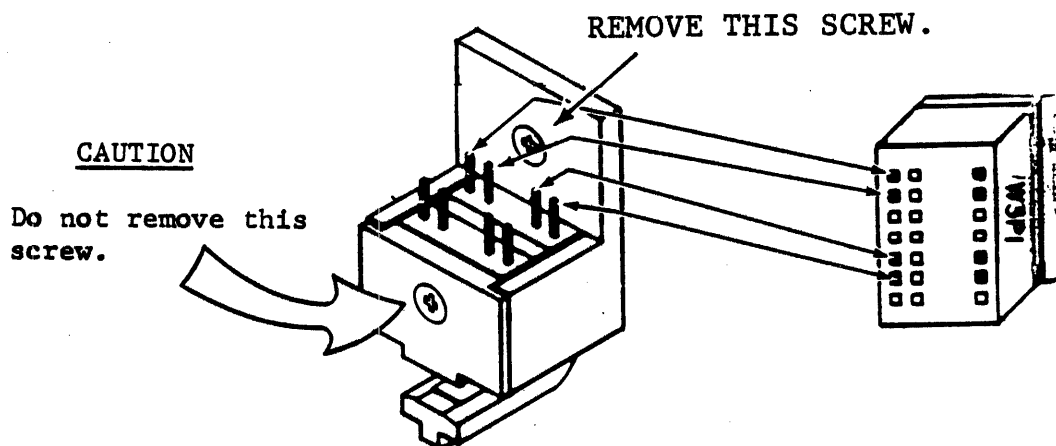


Figure 6-9. EOT/BOT SENSOR

### Replacement

1. Position EOT/BOT assembly onto tape deck and install flat head mounting screw.
2. Thread tape onto take-up reel and adjust EOT/BOT assembly so that assembly is aligned perpendicular to tape.
3. Tighten flat head mounting screw.
4. Reattach W3P1 plug to assembly connector as shown. If excess cable exists, position cable so that excess is at the rear of tape deck.
5. Install tape path and magnetic head covers.

## Verification Check

### NOTE

If available, use a 600 foot reel of tape with properly installed EOT/BOT markers to reduce test time.

1. Load a reel of tape onto supply hub and thread tape so that BOT marker is located before EOT/BOT assembly.
2. Perform a load operation and observe that tape loads and positions itself at BOT marker (BOT indicator illuminates).
3. Execute CE Test 44 to verify operation of EOT sensor. If tape does not stop when EOT is reached, refer to TROUBLE ANALYSIS Section for test procedures.

## HUB ASSEMBLY - TAKE-UP REEL

### Removal

1. Remove four mounting screws from take-up reel hub cover and remove cover from hub assembly.
2. Remove three allen screws, lockwashers, and plain washers securing reel to motor shaft assembly.
3. Remove take-up reel from transport.

### Replacement

#### CAUTION

If a new reel is being installed, inspect reel edges for burrs or cracks that could cause tape damage.

1. Perform Removal procedure in reverse order.

### Verification Check

1. Manually rotate tape reel to ensure reel does not contact tape deck.
2. Load a known good reel of tape and observe reel during tape motion. Tape should not contact reel flanges.

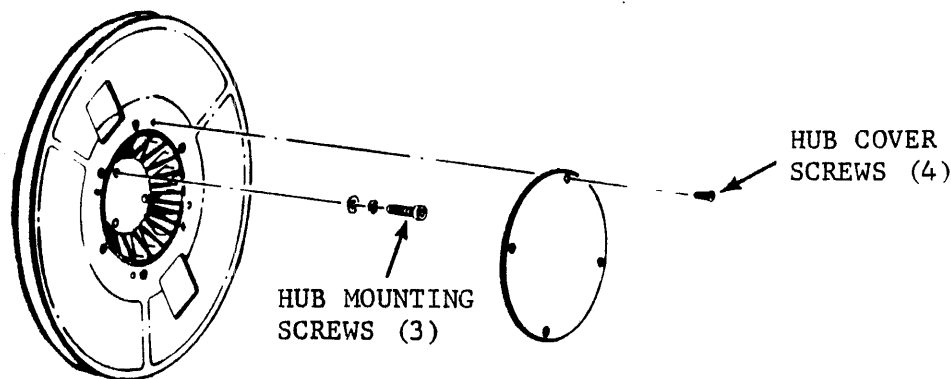


Figure 6-10. TAKE-UP REEL

## MOTOR ASSEMBLY - TAKEUP REEL

### Removal

1. Perform Removal procedure for Hub Assembly - Take-up Reel.
2. Perform Removal procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.
3. Detach connector W4P2 from tach assembly on rear of take-up motor.
4. Detach B3P1 connector from servo power amplifier board (connector J1 on power amplifier).
5. Remove four mounting screws securing motor to rear of tape deck. Remove motor from transport.

### Replacement

#### NOTE

Reel motor and tach must be replaced as an assembly.

#### CAUTION

When installing motor, make sure there are no loose wires between motor mounting plate and tape deck.

1. Position motor on rear of tape deck so that B3P1 cable extends from upper left of motor assembly if STU is mounted vertically, or lower right if STU is mounted horizontally. Secure with four mounting screws.
2. Connect B3P1 to J1 on servo power amplifier board.
3. Connect W4P2 to tach assembly on rear of motor.
4. Perform Replacement procedure for Hub Assembly - Take-up Reel.
5. Perform Replacement procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.

MOTOR ASSEMBLY - TAKEUP REEL (Cont'd)

Verification Check

1. Execute CE Test 37 and if test is successful (display 00), proceed with step 2. If Test 37 is unsuccessful, refer Fault Code display to CE Test 37 termination codes.
2. Thread tape (not loaded) and execute Operator Test 01. If test is successful, test will terminate with display 00. If test is not successful, refer display number to the corresponding Fault SAM.

## HUB ASSEMBLY - SUPPLY REEL

### Removal

1. Press center button on hub to put hub into the unlatched position.
2. Locate slot opening on periphery of cover. Insert small blade screwdriver into slot and twist to unsnap cover from hub assembly.
3. Place hub assembly in the latched position by depressing cam carrier.

### CAUTION

Ensure hub is latched before proceeding with further removal. If hub is unlatched, piece parts may disassemble.

4. Remove three large shoulder screws from cam carrier. Hub assembly can then be removed from tape deck.

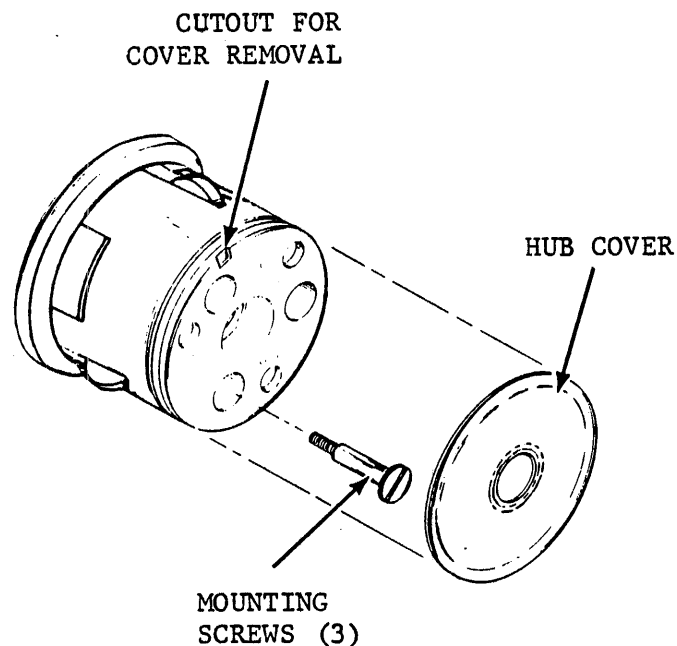


Figure 6-11. SUPPLY REEL HUB ASSEMBLY



## HUB ASSEMBLY - SUPPLY REEL (Cont'd)

### Replacement

1. Position hub assembly onto motor shaft assembly and secure with three large shoulder screws.
2. Install cover on face of hub assembly.

### Verification Check

1. Mount tape reel onto hub assembly. Reel should mount easily onto hub and against rear flange.
2. Latch reel onto hub. Ensure reel is securely fastened.
3. Load a known good quality tape and observe reel during tape motion. Tape should not contact reel flanges.
4. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is not successful, refer display number to corresponding Fault SAM.

## MOTOR ASSEMBLY - SUPPLY REEL

### IMPORTANT

The supply reel motor assembly is not supplied as part of spare parts list; the spared take-up reel motor assembly must be disassembled and the motor used as a replacement for the supply motor.

### Removal

1. Perform Removal procedure for Supply Reel Hub Assembly.
2. Perform Removal procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.
3. Detach B1P1 connector from J3 on Servo Power Amplifier PWA.
4. Remove 4 mounting screws and tach cover from rear of motor.
5. Detach W3P5 connector from tach assembly at rear of motor.

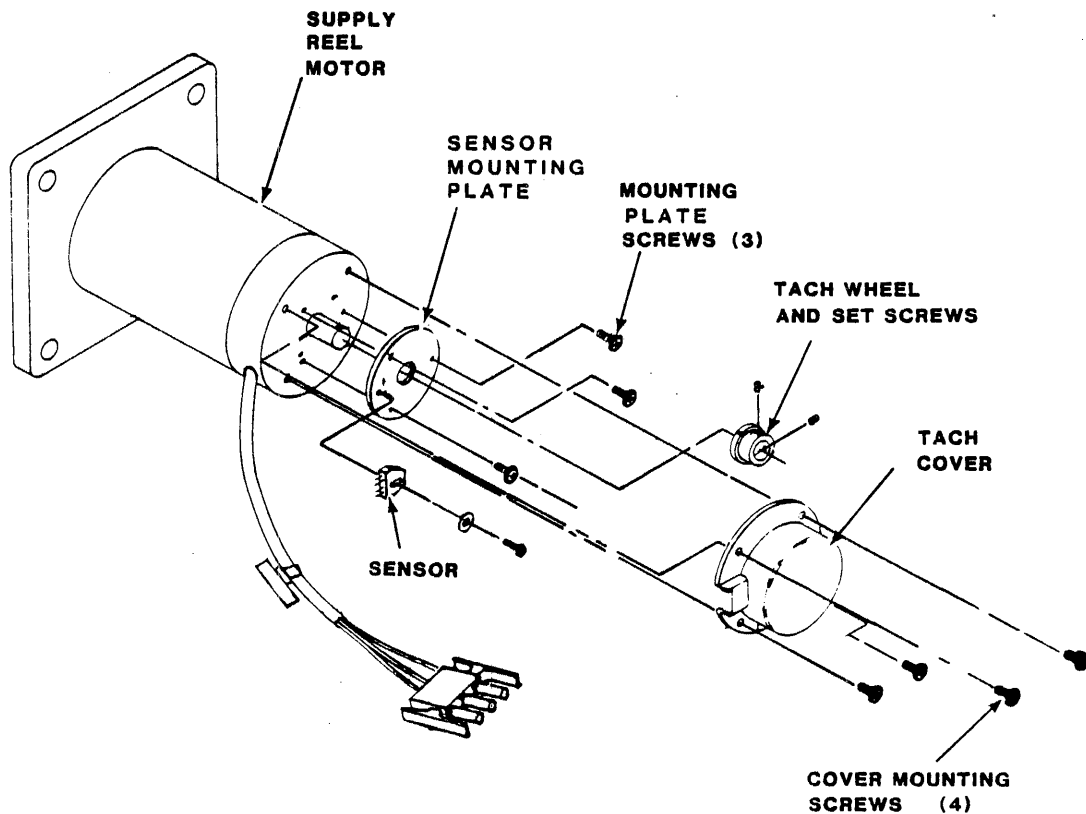


Figure 6-12. SUPPLY REEL ASSEMBLY

## MOTOR ASSEMBLY - SUPPLY REEL

### Removal (Cont'd)

6. Remove four mounting screws securing motor to rear of tape deck. Remove motor from transport.
7. Remove mounting screw and sensor from mounting plate at rear of supply reel motor. Retain for reuse.
8. Loosen two set screws securing tach to motor shaft and remove tach from shaft. Retain for reuse.
9. Remove four screws securing mounting plate and remove plate from supply reel motor. Retain for reuse.
10. Disassemble spared Take-Up Reel Motor Assembly as follows:
  - a. Remove two mounting screws and tach cover from rear of motor assembly.
  - b. Remove two mounting screws securing tach sensor to reel motor. Remove tach sensor from reel shaft and tach wheel.

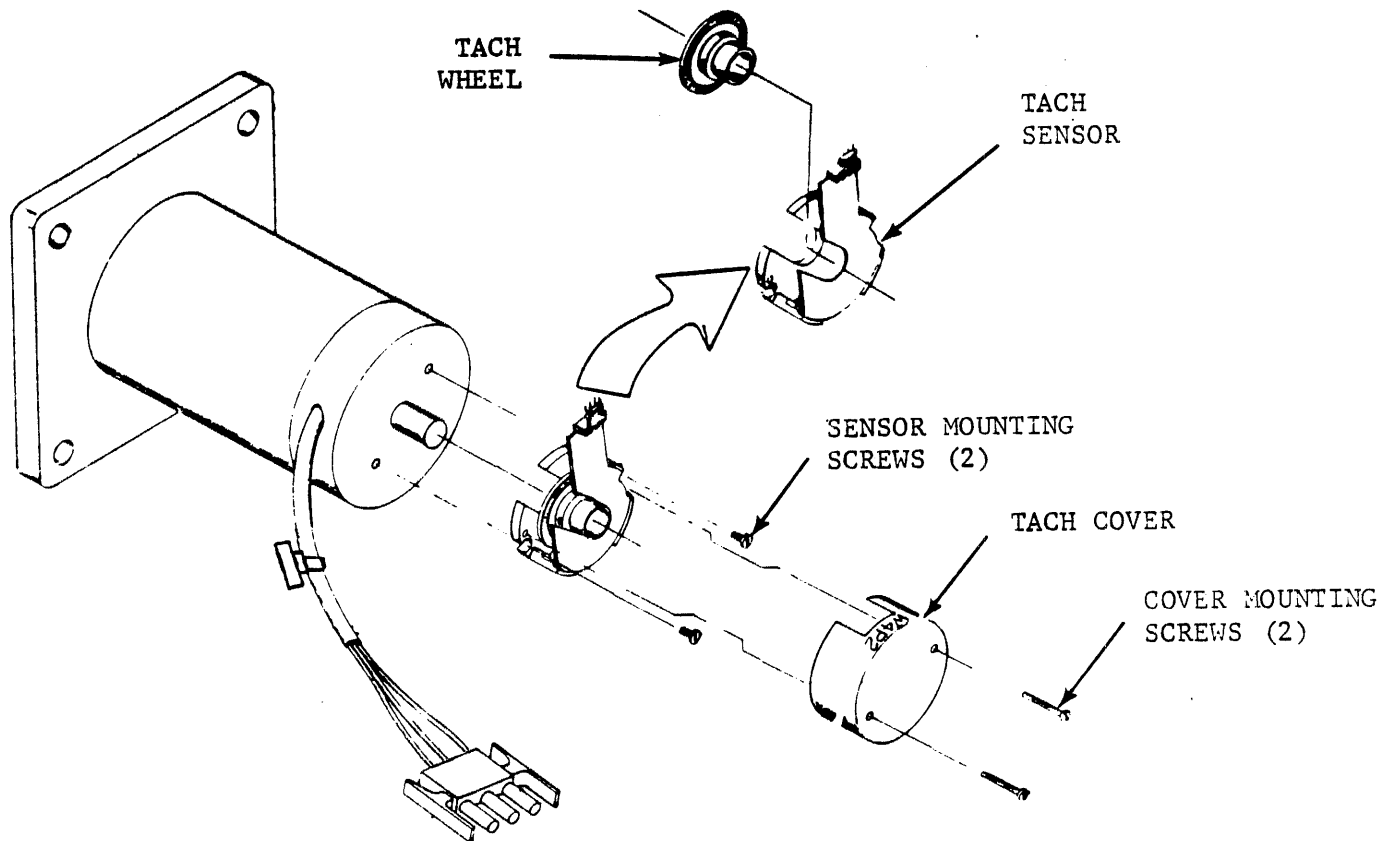


Figure 6-13. TAKE-UP REEL MOTOR ASSEMBLY

## MOTOR ASSEMBLY - SUPPLY REEL

### Removal (Cont'd)

- c. Loosen set screw securing tach wheel and remove from motor shaft.

### NOTE

Do Not attempt to reuse the removed tach assembly.

### Replacement

1. Place mounting plate (from step 8 of Removal) onto rear of new motor and secure with four mounting screws.
2. Assemble sensor and tach wheel (from steps 6 and 7 of Removal) onto rear of motor mounting plate and shaft as shown in Figure 6-14 and adjust per tolerance requirements listed in the Supply Motor Tach and Sensor Procedures.

### CAUTION

When installing motor, ensure there are no loose wires between motor mounting plate and tape deck.

3. Position motor on rear of tape deck so that B1P1 cable extends from left of motor if STU is mounted vertically, or from the right. Secure motor with four mounting screws.
4. Connect B1P1 cable to J3 on Servo Power Amplifier PWA.
5. Attach W3P5 connector to tach sensor pins (Figure 6-14).
6. Install tach cover and secure with four mounting screws.
7. Perform Replacement procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.
8. Perform Replacement procedure for Hub Assembly - Supply Reel.

### Verification Check

1. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is not successful, refer display number to appropriate SAM Table.

## TACH AND SENSOR - SUPPLY MOTOR

### Removal

1. Perform Removal procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.
2. Remove four mounting screws and tach cover from rear of motor.
3. Detach W3P5 connector from sensor pins.
4. Remove mounting screw and sensor from mounting plate.
5. Loosen two set screws securing tach to motor shaft and remove tach from shaft.

### Replacement (Refer to Figure 6-14)

1. Insert tach wheel on motor shaft. Position tach for  $0.030 \pm 0.005$  inch clearance between tach and sensor mounting plate.
2. Install sensor on mounting plate and position for a clearance of  $0.150 \pm 0.002$  inch between sensor and tach. Tighten sensor mounting screw.
3. Attach W3P5 connector to sensor pins.
4. Install tach cover and secure with four mounting screws.
5. Perform Replacement procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.

TACH AND SENSOR - SUPPLY MOTOR (Cont'd)

Verification Check

1. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is not successful, refer display number to corresponding Fault SAM.

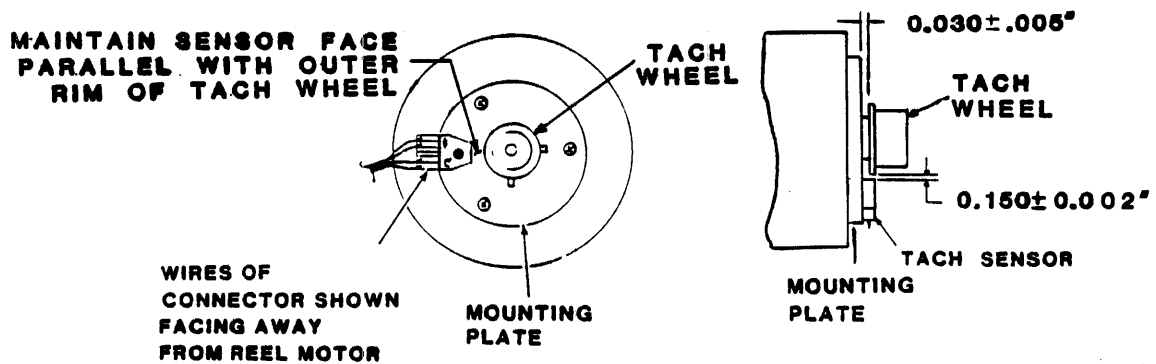


Figure 6-14. TACH/SENSOR ASSEMBLY/ADJUSTMENTS

## AIR BEARING SENSOR - UPPER AND LOWER

### Removal

#### NOTE

Replacement parts for the air bearing assembly are contained in refurbishment kit P/N 77015691. This kit contains an upper and lower spring guide, a sensor, and small 'O' ring. If sensor is being replaced, it is recommended that upper and lower spring guides and small 'O' ring also be replaced.

1. From rear of tape deck, remove P1 connector from sensor pins.
2. Remove the two socket head screws and washers securing the sensor to the rear of the air bearing. Remove the sensor and the small 'O' ring from the bearing housing.

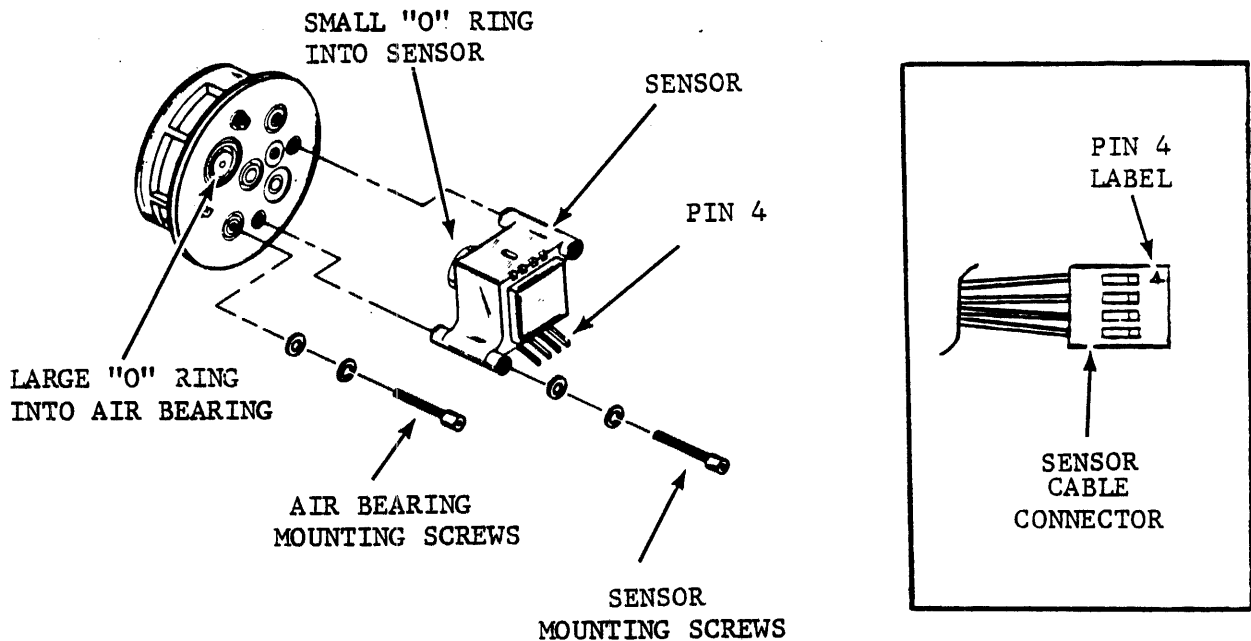


Figure 6-15. AIR BEARING SENSORS

## AIR BEARING SENSORS (Cont'd)

### Replacement

1. Insert a new small "O" ring in the aperture at the rear of the air bearing housing.
2. Position the sensor on the air bearing so that connector pins are positioned towards the outside of the air bearing. Secure the sensor with mounting screws and washers.
3. Reattach P1 connector to the transducer pins. Refer to Figure 6-15 for pin orientation.

### Verification Check

1. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is not successful, refer display number to corresponding Fault SAM.



## AIR BEARING SPRING GUIDE - UPPER AND LOWER

### Removal

#### NOTE

Replacement parts for the air bearing assembly are contained in refurbishment kit P/N 77015691. This kit contains an upper and lower spring guide, a sensor, and small 'O' ring. If a spring guide is being replaced, it is recommended that both upper and lower guides be replaced.

1. Remove head covers from tape deck.
2. Remove two phillips head screws securing upper spring guide and guard to bearing housing.
3. Remove spring guard and guide from housing.
4. Repeat steps 2 and 3 to remove lower spring guide.

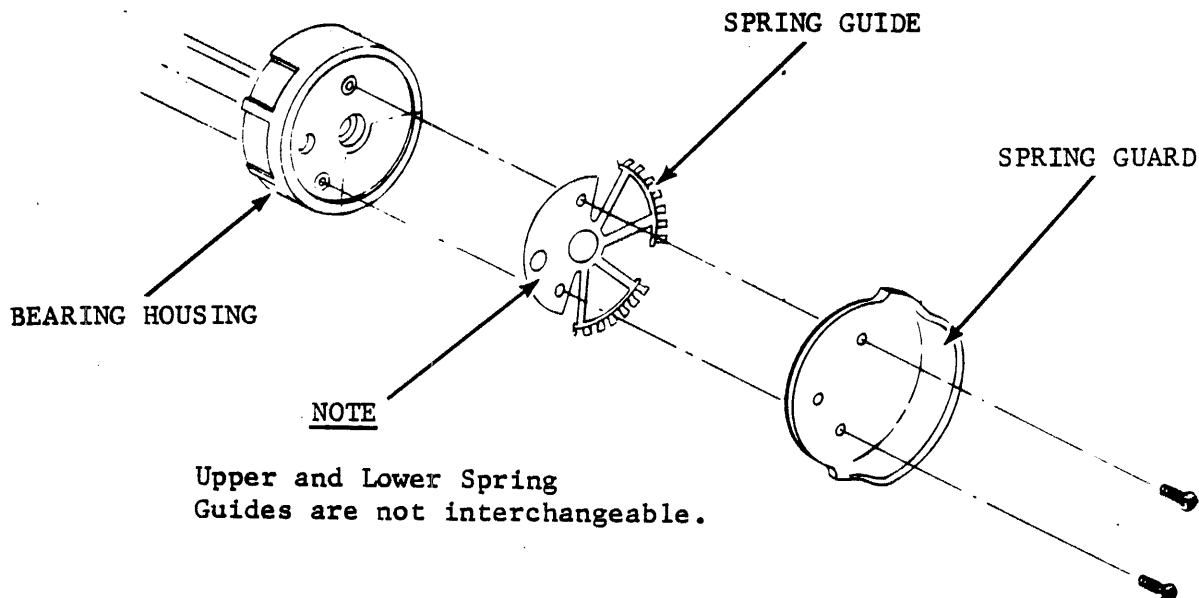


Figure 6-16. AIR BEARING SPRING GUIDE

## AIR BEARING SPRING GUIDE (Cont'd)

### Replacement

1. Place new upper spring guide (P/N 77004255) and guard into bearing housing. Holes for mounting screws provide positive alignment of both piece parts to housing.
2. Secure with two phillips head screws.
3. Repeat steps 1 and 2 using spring guide (P/N 77004254) to replace lower spring guide.
4. Reinstall head covers on tape deck.

### Verification Check

1. With tape threaded, but no loaded, execute Operator Diagnostic Test 01. If test is successful, test terminates with display 00. If test is unsuccessful, refer display number to corresponding Fault SAM.
2. Visually observe tape for no tape edge damage.

## COMPRESSOR ASSEMBLY

### Removal

1. Perform Removal procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.
2. Detach connectors B2P1 from power supply.
3. Remove pneumatic tubing (vacuum and pressure lines) from nipples on rear of tape deck.

### NOTE

Detach any wiring that may interfere with removal of compressor assembly.

4. Remove 4 mounting screws securing compressor assembly to rear of tape deck. Carefully withdraw assembly from transport.

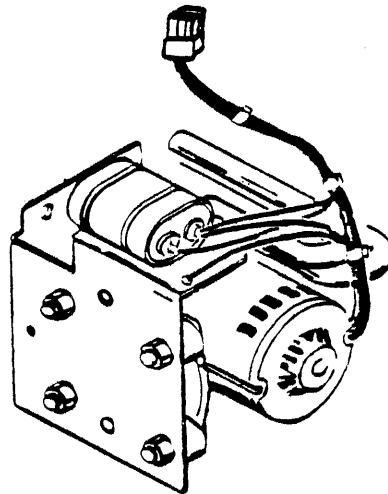


Figure 6-17. COMPRESSOR

## COMPRESSOR ASSEMBLY (Cont'd)

### Replacement

1. Position compressor assembly to rear of tape deck and secure with washers and mounting screws.
2. Attach pneumatic tubing to nipples on tape deck.
3. Attach connector B2P1 to power supply.
4. Perform Replacement procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.

### NOTE

Reattach any wiring that was disconnected prior to Removal procedure.

## PRESSURE REGULATOR AND FILTER ASSEMBLY

### NOTE

If only the pressure regulator is being replaced, perform Removal step 1, Replacement step 3, and Verification Check. If filter is being replaced, perform the entire Removal/Replacement and Verification Check procedures.

### General

There are two types of pressure regulator/filter assemblies, each requiring separate removal/replacement procedures. Careful attention must be given to ensure that the proper procedures are applied to the proper assembly. This can be accomplished by comparing the unit serial number (S/N) with the following procedures and illustrations.

### Removal (S/N 838 and Below)

1. Remove power amp PWA shield where applicable.
2. Remove pressure regulator by unscrewing regulator from filter can and shaft.
3. Remove filter can by pulling straight out from tape deck.
4. Remove filter from filter base assembly.

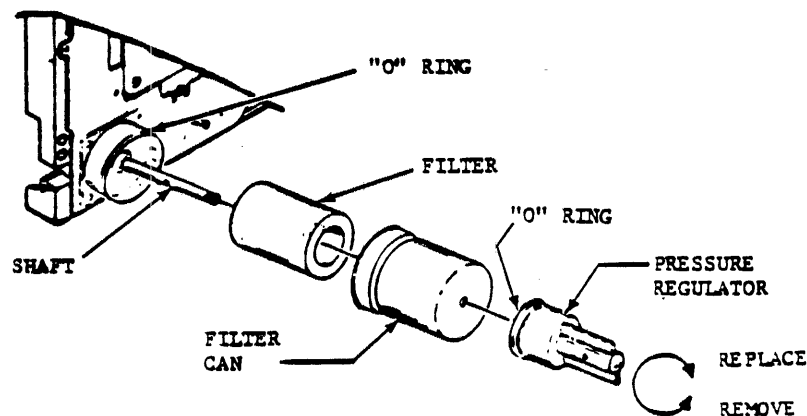


Figure 6-18. REGULATOR & FILTER REMOVAL  
(S/N 838 and Below)

## PRESSURE REGULATOR AND FILTER ASSEMBLY (Cont'd)

### Replacement (S/N 838 and Below)

1. Position filter into filter base.
2. Place filter can over filter and shaft and press onto filter base assembly. Ensure "O" ring is in place on filter base so that a seal is maintained between base and filter can.
3. Screw pressure regulator clockwise onto shaft protruding from filter can. Ensure "O" ring is in place on base of pressure regulator.
4. Replace power amp PWA shield where applicable.

### Removal (S/N 839 and Above)

1. Remove Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA per Removal instructions.
2. To assure proper replacement and unit operation, label the regulator/filter hoses IN-OUT, and then detach from assembly (see figures below).
3. Remove four mounting screws and pull assembly away from tape deck.
4. The regulator, inner filter, and/or gasket may now be independently removed from the assembly.

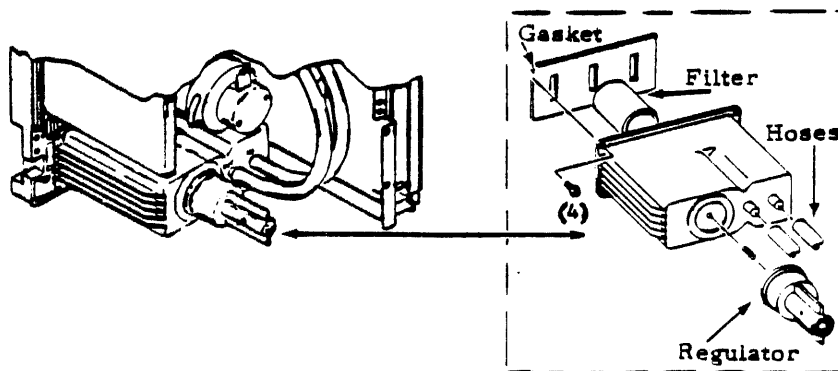


Figure 6-18A. REGULATOR & FILTER REMOVAL  
(S/N 839 and Above)

## PRESSURE REGULATOR AND FILTER ASSEMBLY (Cont'd)

### Replacement (S/N 839 and Above)

1. Once the individual piece parts of pressure regulator and filter assembly have been replaced, mount entire assembly to tape deck by installing the four screws and tighten.
2. Ensure proper replacement of regulator/filter hoses.
3. Replace Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA per Replacement procedures.

### Verification Check

1. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to corresponding Fault SAM.

## MAGNETIC HEAD ASSEMBLY

### CAUTION

The magnetic head and two write resistors (R224/R225) are matched components. If head is being replaced, write resistors must be replaced also. Resistors are supplied with new head and are labeled with head serial number, resistor "r" number (R224 or R225), resistor value, equivalent write current and DC voltage.

### NOTE

When magnetic head replacement is indicated, it is recommended that tape cleaner assembly also be replaced.

### Removal

1. Remove tape path and magnetic head covers from tape deck.
2. From front of transport, detach read head connector W6P1, write head connector W5P1, and erase head wires P3/P4 from magnetic head.

### NOTE

Before removing head, tape a piece of soft material across recording surface.

3. From rear of tape deck, remove read, write and erase connectors away from magnetic head.

### CAUTION

Refer to figure for location of head mounting screws. DO NOT loosen head alignment screws, otherwise, entire head must be replaced by a new assembly.

4. Loosen four head mounting screws. Hold head against tape deck while removing four mounting screws, lockwashers, and flatwashers.
5. Carefully withdraw head from tape deck.



## MAGNETIC HEAD ASSEMBLY

### Removal (Cont'd)

6. Remove write resistors R224 and R225 from Read/Write/Servo PWA at location F17. Resistors can be removed without removing board from logic cage.

#### NOTE

Keep magnetic head and write resistors together as a package, if head is being returned to factory.

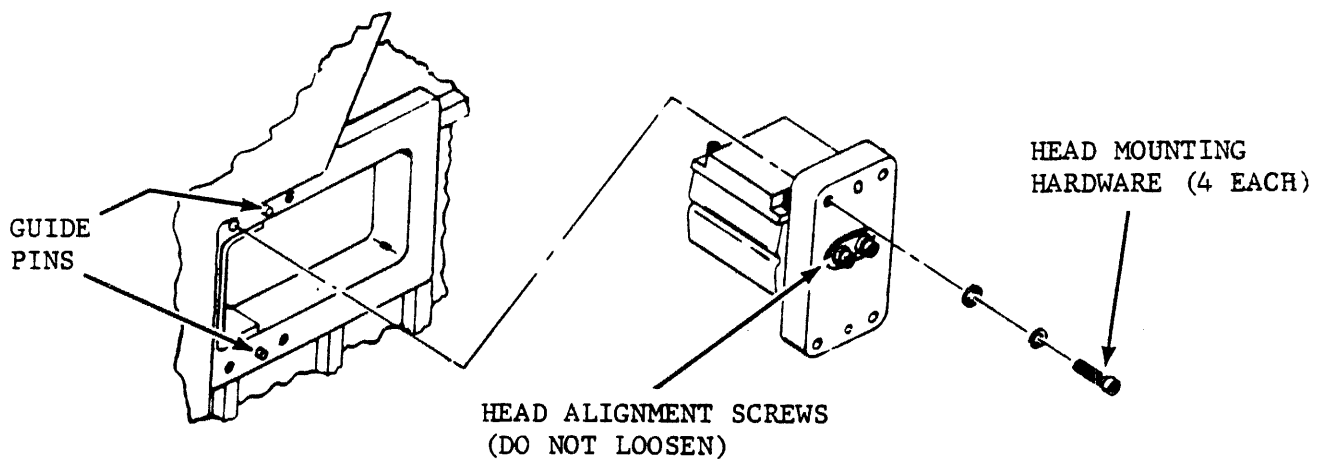


Figure 6-19. MAGNETIC HEAD ASSEMBLY

### Replacement

1. Install new write resistors R224 and R225 onto Read/Write/Servo PWA. Refer to accompanying figure for resistor locations.

#### NOTE

Before installing magnetic head, insure that recording surface is protected with soft material.

If a new magnetic head is installed, a new tape scraper (P/N 77031270) must be installed.

2. Install magnetic head through tape deck and position mounting surface onto guide pins.

## MAGNETIC HEAD ASSEMBLY

### Replacement (Cont'd)

3. While holding head in place, insert flatwashers, lockwashers, and mounting screws. Tighten 4 mounting screws.
4. Place read and write/erase cables through tape deck.
5. From front of tape deck, attach read, write and erase connectors to magnetic head (see Figure 6-20). Remove recording surface covering.
6. Install tape path and magnetic head covers on tape deck.

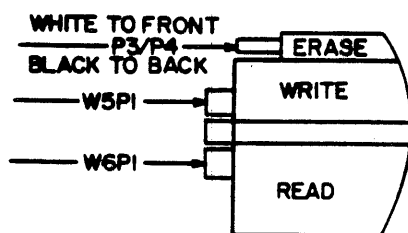


Figure 6-20. MAGNETIC HEAD CONNECTORS

### Verification Check

1. Clean magnetic head recording surface with a soft lint-free cloth moistened with tape transport cleaner. Wipe recording surface in same direction as tape motion.
2. Load a 3M777, or equivalent, write enabled scratch tape and execute CE Test 18 to move tape away from BOT. Press RESET to stop tape after approximately 5 seconds.
3. Move jumper plug at location 13E on Read/Write/Servo PWA from W3 to W4 (STORE) position.
4. Execute CE Test 31.
5. After test is complete (display 00), return jumper plug from W4 (STORE) to W3 position before unit is powered down.
6. With tape still threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to corresponding Fault SAM.

MAGNETIC HEAD ASSEMBLY (Cont'd)

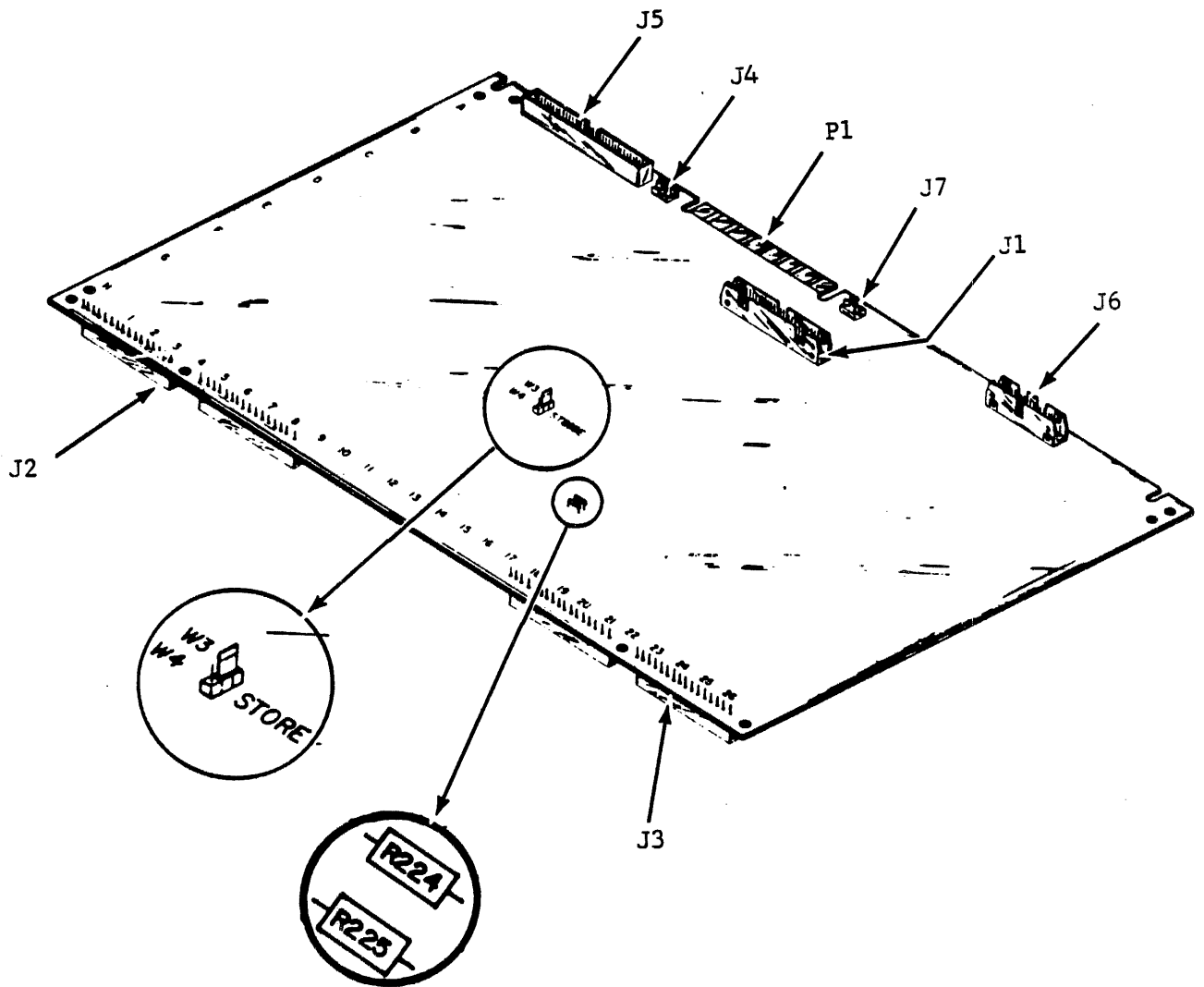


Figure 6-21. READ-WRITE-SERVO PWA

## OPERATOR PANEL ASSEMBLY

### Removal

1. From rear of transport, remove screw securing ground strap to tape deck (E2).
2. Release thumb screws securing PWA's to logic cage and swing PWA's to access component side of Servo-Control PWA.
3. Detach operator panel cable connector W8P1 from connector J7 on Formatter-Control PWA.
4. From front of transport, slip a small blade screwdriver between operator panel and operator panel housing and pry the operator panel up.
5. Remove operator panel and cable.

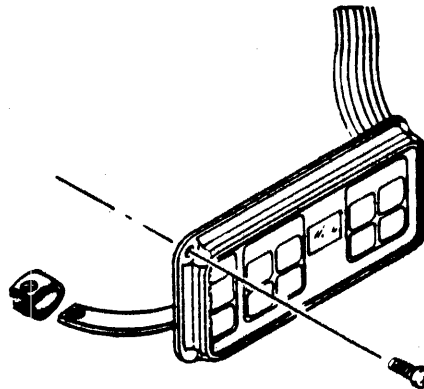


Figure 6-22. OPERATOR PANEL ASSEMBLY

### Replacement

1. Insert ground strap, W8 cable and control panel through tape deck and control panel housing and secure with four push-in clips.
2. Attach ground strap to E2 position on tape deck and connect W8P1 to J7 position on Formatter-Control PWA.
3. Place PWA's in normal operating position and secure to logic cage bracket with top and bottom thumb screws. (Align screws with screw holes before attempting to tighten.)

### Verification Check

1. Perform functional SAM's 1001 thru 1003.

## COOLING FAN ASSEMBLY

### Removal

1. Detach W4P5 connector from power supply.
2. Remove four hex nuts and washers and withdraw fan assembly from mounting studs.

### Replacement

1. Perform Removal procedure in reverse order.

### Verification Check

1. Power transport on and check for air flow from fan.

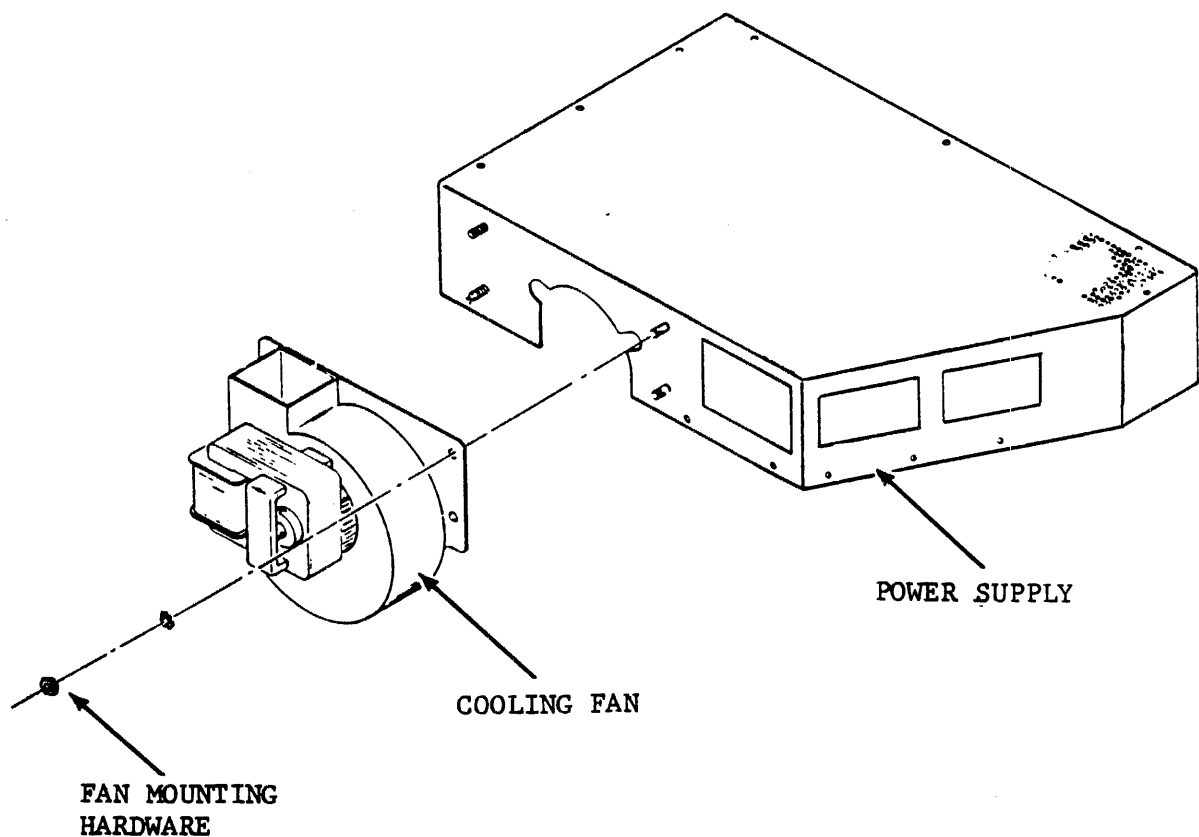


Figure 6-23. COOLING FAN ASSEMBLY

## POWER SUPPLY

### Removal

1. Disconnect power cord from power supply.
2. Perform Cooling Fan Assembly Removal.
3. Detach W4P4, W2P1 and W7P1 connectors from power supply.

### CAUTION

A power supply weighs approx. 6.8 Kg (15 lbs).

4. While holding power supply in position, remove four mounting screws. Lift power supply away from transport.

### Replacement

1. With power supply held in position, insert washers and mounting screws and tighten.
2. Attach W4P4, W2P1 and W7P1 connectors to power supply.
3. Reinstall cooling fan per Cooling Fan Assembly Replacement procedure.
4. Connect power cord to power supply.

### Verification Check

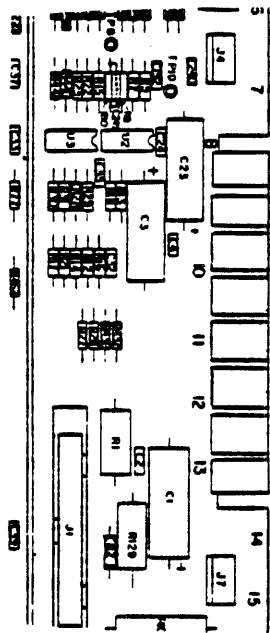
1. DC Voltage Checks - Using a digital voltmeter for all DC voltage measurements, connect ground lead of meter to either pin 4 or 6 of power connector on Read/Write/Servo PWA (labeled P1 on board). Connect other meter lead to points listed to test all DC voltages.

### DC VOLTAGES AND TOLERANCES

<u>LOCATION</u>	<u>VOLTAGE</u>	<u>TOLERANCE</u>
P1-5*	+ 5V	+ 2% (4.90 to 5.10)
P1-2*	- 15V	± 10% (-13.5 to -16.5)
P1-3*	+ 15V	± 10% (+13.5 to +16.5)
P1-7*	+ 25V	± 10% (21.6 to +26.4)
P1-8*	- 6V	± 10% (-5.4 to -6.6)
J4-6**	+ 38V	± 10% (+34.2 to +41.8)
J10-2***	- 5.2V	± 10% (-4.7 to -5.7)

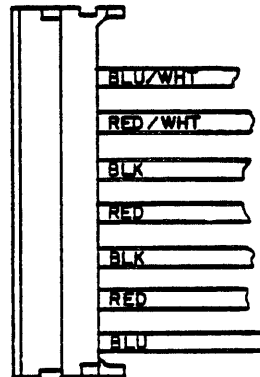
\*P1 is the power connector on Read/Write/Servo PWA.  
\*\*J4 is the power connector on Power Amplifier.  
\*\*\*J10 is the 2-pin power connector on power supply.

RD/WR/SERVO PWA



- 1 (NC)\*
- 2 (-15)
- 3 (+15)
- 4 (GND)
- 5 (+5)
- 6 (GND)
- 7 (+25)
- 8 (-6)

W7P1

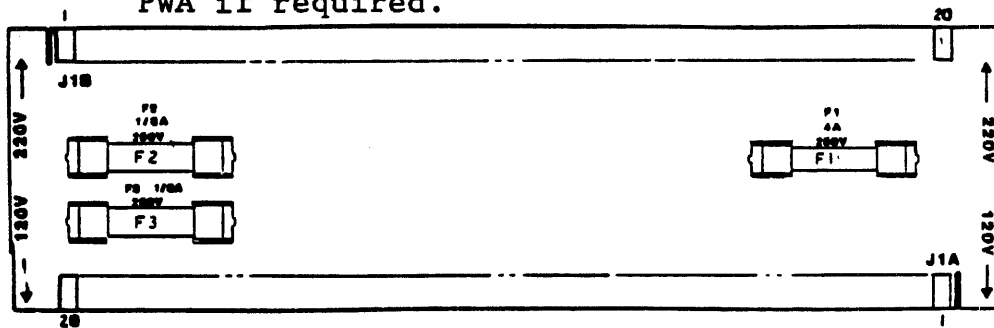


\* No Connection

NOTE

If a new power supply is being installed, remove top cover of new power supply and observe position of voltage select PWA. The position of this PWA must correspond to input voltage as defined on equipment identification plate. The ends of the PWA are stencilled with "120V" and "220V" and indicating arrows. Ensure PWA is connected to match input voltage.

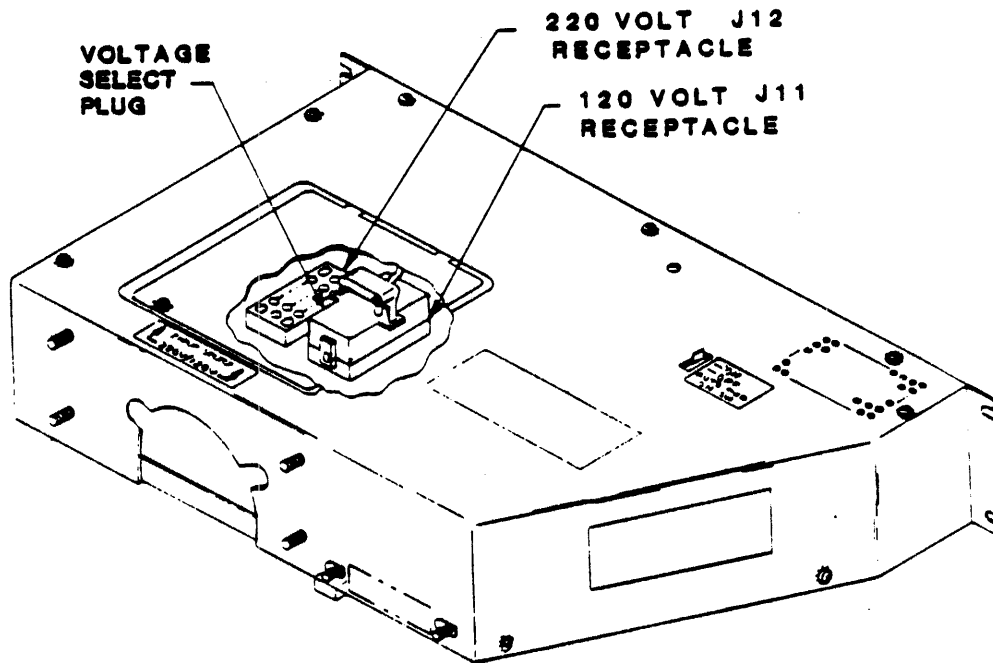
The PWA can be disconnected, turned upside down, and reconnected to main power supply PWA if required.



VOLTAGE SELECT PWA (Power Supply P/N 7700993X)

**NOTE**

If a new power supply is being installed, remove voltage select access panel from new power supply and observe position of voltage select plug. The position of this plug must correspond to input voltage as defined on equipment identification plate. Make sure plug is inserted in correct voltage receptacle, that is, J11 for 120V operation or J12 for 220-240V operation. Secure voltage select access panel with two screws. Check position of AUTO POWER-ON SWITCH. Make sure it is in "OFF" position.



**Voltage Select Plug**

**VOLTAGE SELECT PLUG (Power Supply P/N 7702934X)**





READ/WRITE/SERVO PWA

Verification Check (Cont'd)

3. Load a 3M777, or equivalent, write enabled tape.
4. Execute CE Test 18 to move tape away from BOT. Press RESET to stop tape motion after approximately 5 seconds.
5. Execute CE Test 31. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to test description for Test 31.
6. After test is complete (display 00), return jumper plug from W4 (STORE) to W3 position before unit is powered down.
7. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to corresponding Fault SAM.

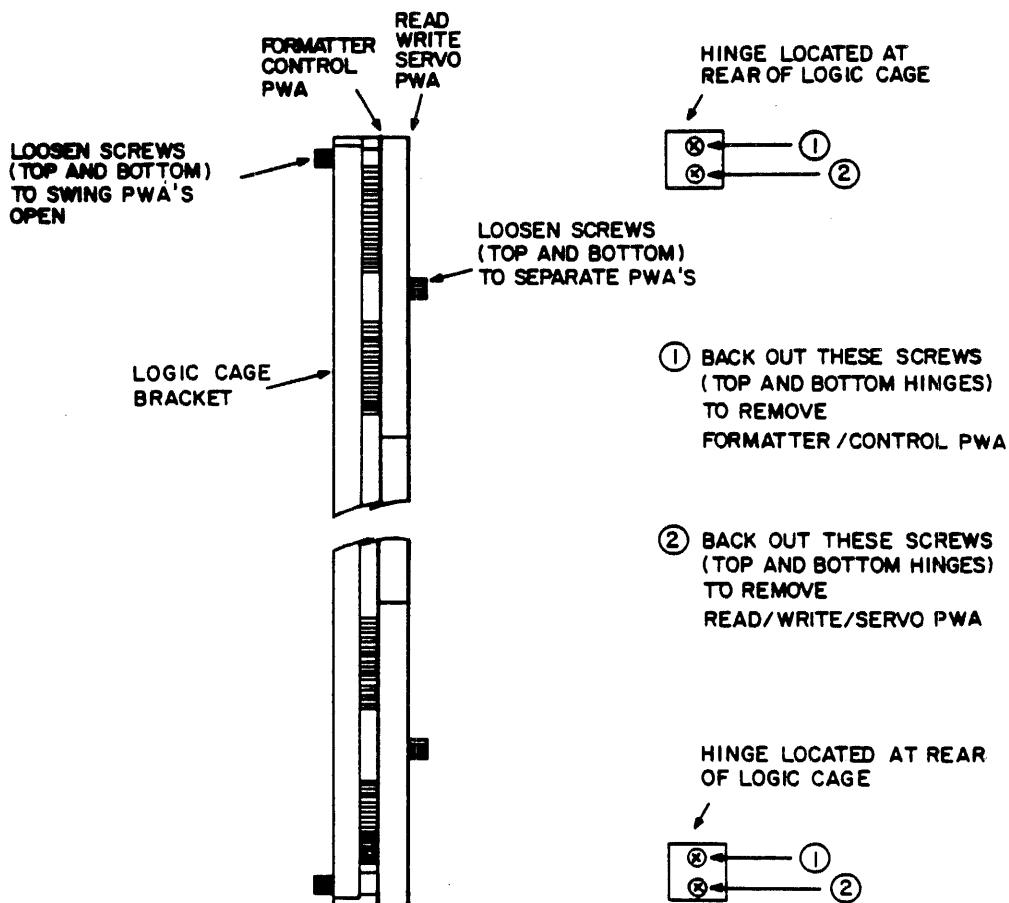


Figure 6-24. LOGIC CAGE ASSEMBLY

## FORMATTER/CONTROL PWA

### Removal

1. Remove I/O cables from connectors P4 and P5 of Formatter/Control PWA.
2. Loosen two thumb screws securing PWA to logic cage bracket (see Figure 2-21) and swing PWA's open to access component side of Formatter/Control PWA's.
3. Remove cable connectors from P6 and P7 of PWA.
4. Loosen two thumb screws and separate Read/Write/Servo and Formatter/Control PWA's. Avoid undue stress on PWA's by loosening thumb screws alternately and separating PWA's as screws are loosened.
5. Loosen and back out (do not remove) the top screw of top and bottom hinges. Hold Formatter/Control PWA while loosening hinge screws.
6. Remove Formatter/Control PWA from logic cage.

### NOTE

Prior to installing new PWA, place 4-segment DIP switch at location D21 to same address as set in removed PWA. Also ensure that jumpers at location 16E are in same position as in removed PWA.

### Replacement

1. Insert PWA into top and bottom hinge slots of logic cage. Ensure PWA is fully inserted into hinge slot.
2. Attach outside connectors P2 and P3 of Formatter PWA to J2 and J3 of Read/Write/Servo PWA and secure with two thumb screws.
3. Reattach W2P1 cable to P6 and W8P1 cable to P7 of Formatter PWA.
4. Place PWA's in closed position and align thumb screws with screw slots. Secure with two thumb screws.
5. Insert top screw of top and bottom hinges to lock PWA in position.

### Verification Check

1. Perform functional SAM's 1001 thru 1003.

## POWER AMPLIFIER PWA

### Removal

1. Perform Removal procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.
2. Detach the following connectors from Power Amp PWA:
  - J1 - B3P1
  - J2 - W3P7
  - J3 - B1P1
  - J4 - W7P2
3. If the unit has a power amplifier assembly cover, it must be removed. If the unit does not have a power amplifier assembly, ignore this step and perform step 4.
4. Remove three screws along outside edge of PWA to release PWA from mounting assembly. Remove PWA.

### Replacement

1. Insert Power Amp PWA into mounting assembly. The inside of mounting assembly has metal slots to receive PWA.
2. Secure PWA by installing three screws along outside edge.
3. If the unit previously had a power amplifier assembly cover, re-install the cover assembly and secure with two pan head phillips locking screws.
4. Install connectors as follows:
  - J1 - B3P1
  - J2 - W3P7
  - J3 - B1P1
  - J4 - W7P2
5. Perform Replacement procedure for Acoustic Shield, Drive Cover, or Drive Cover with SCSI Interface PWA.

### Verification Check

1. With tape threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to corresponding fault SAM.

## CAPACITOR ASSEMBLY

### Removal

1. Perform Removal procedure for Acoustic Shield Assembly where applicable.
2. Detach capacitor connector from J5 of the Power Amp PWA.

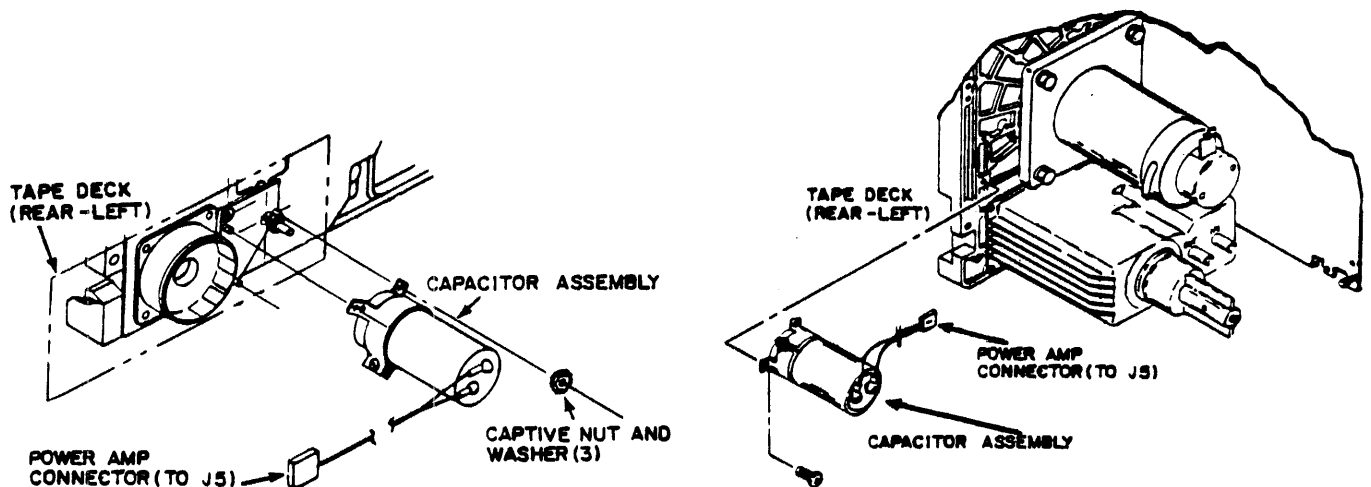
### CAUTION

DO NOT remove protective terminal caps located on top of capacitor during removal or replacement procedures.

3. At the rear of the tape deck (shown below), remove three captive nut and washer assemblies from the capacitor mounting assembly. Remove capacitor assembly.

### Replacement

1. Mount replacement capacitor assembly as shown above and install three captive nut and washer assemblies. Tighten securely.
2. Install capacitor connector to J5 of the Power Amp PWA.
3. Perform Replacement procedure for Acoustic Shield Assembly where applicable.



S/N 838 and below

S/N 839 and above

Figure 6-25. CAPACITOR ASSEMBLY

CAPACITOR ASSEMBLY (Cont'd)

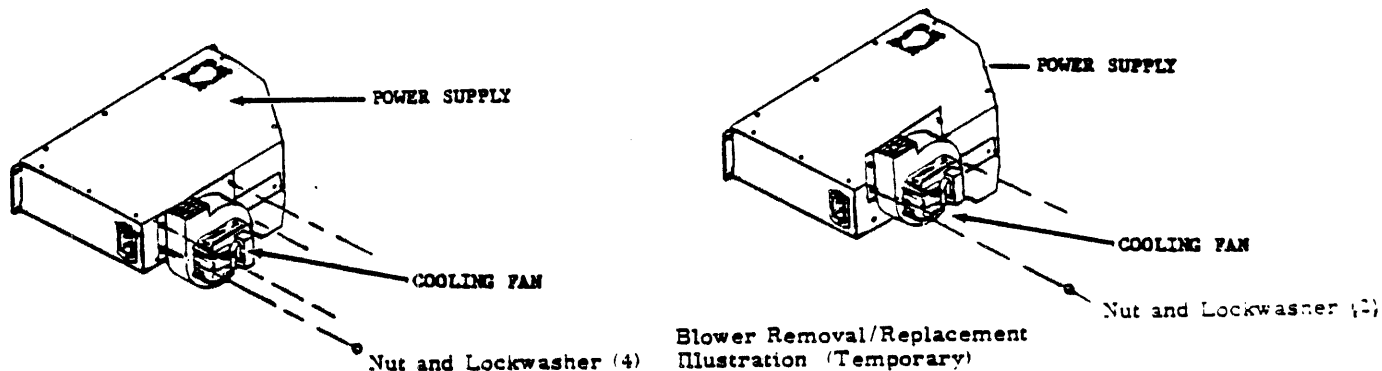
Verification Check

1. Thread tape (not loaded) and run Operator Tests 01 and 02.

# ACOUSTIC SHIELD ASSEMBLY

## Removal

1. The cooling fan assembly must be temporarily remounted (as shown below) before attempting removal of acoustic shield.



2. Remove two pan head screws and lockwashers from power amp PWA bracket.
3. Remove three nuts and lockwashers from logic card bracket.
4. Disconnect both hoses from filter assembly (Figure 6-26A). To prevent incorrect replacement, temporarily label hoses IN or OUT.
5. Remove acoustic shield.

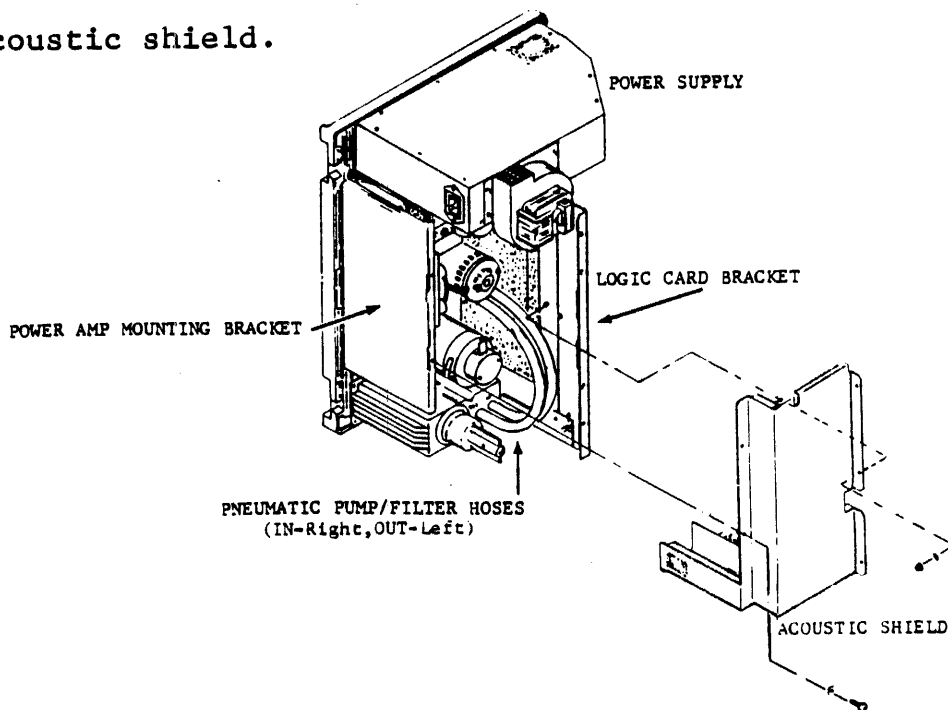


Figure 6-26A. ACOUSTIC SHIELD ASSEMBLY (UNMOUNTED)

## ACOUSTIC SHIELD ASSEMBLY

### Replacement (Cont'd)

1. Route filter hoses through cut-out on right side of acoustic shield (Figure 6-26B). Insure correct replacement of hoses to filter.
2. Install acoustic shield to the rear of tape deck and align with logic card bracket and power amp PWA brackets as shown.

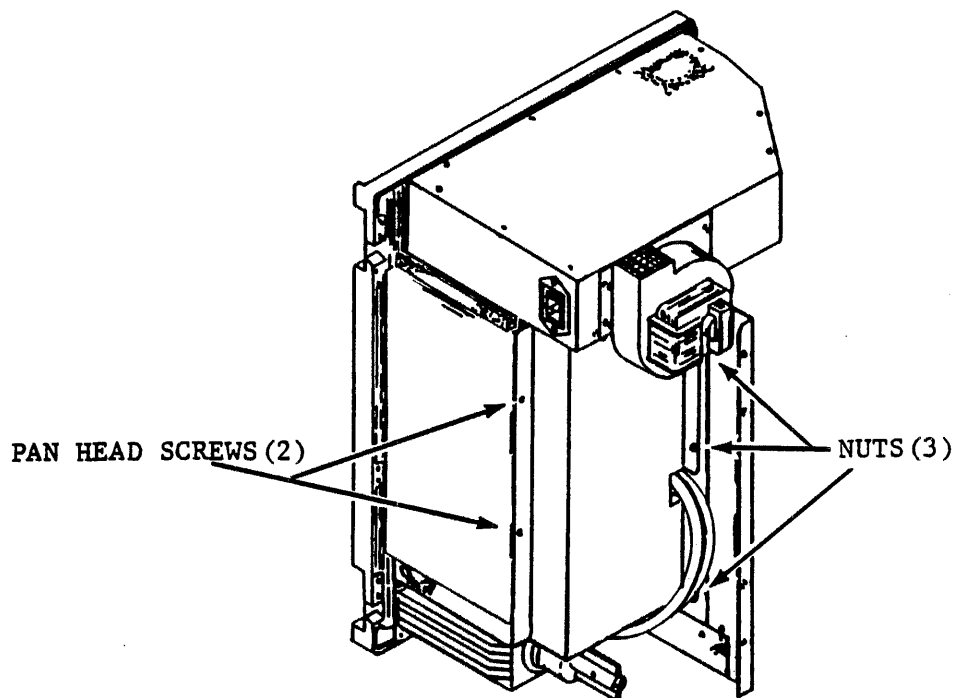


Figure 6-26B. ACOUSTIC SHIELD ASSEMBLY (MOUNTED)

3. Install two pan head screws and lockwashers to acoustic shield and power amp PWA bracket and tighten.
4. Install three nuts and lockwashers to acoustic shield and logic card bracket and tighten.
5. Remount cooling fan assembly to original position.

### Verification Check

When tape is threaded, but not loaded, execute Operator Test 01. If test is successful, test will terminate with display 00. If test is unsuccessful, refer display number to the corresponding Fault SAM.



## DRIVE COVER ASSEMBLY

### Removal

1. Loosen wing nuts and screws securing drive cover assembly and remove cover (Figure 6-27). The drive cover assembly consists of drive cover with attached foam strips and grommet.

### Replacement

1. Place drive cover assembly in position so that cooling fan wires are placed in feed-thru hole.
2. Secure cover with wing nuts and screws.

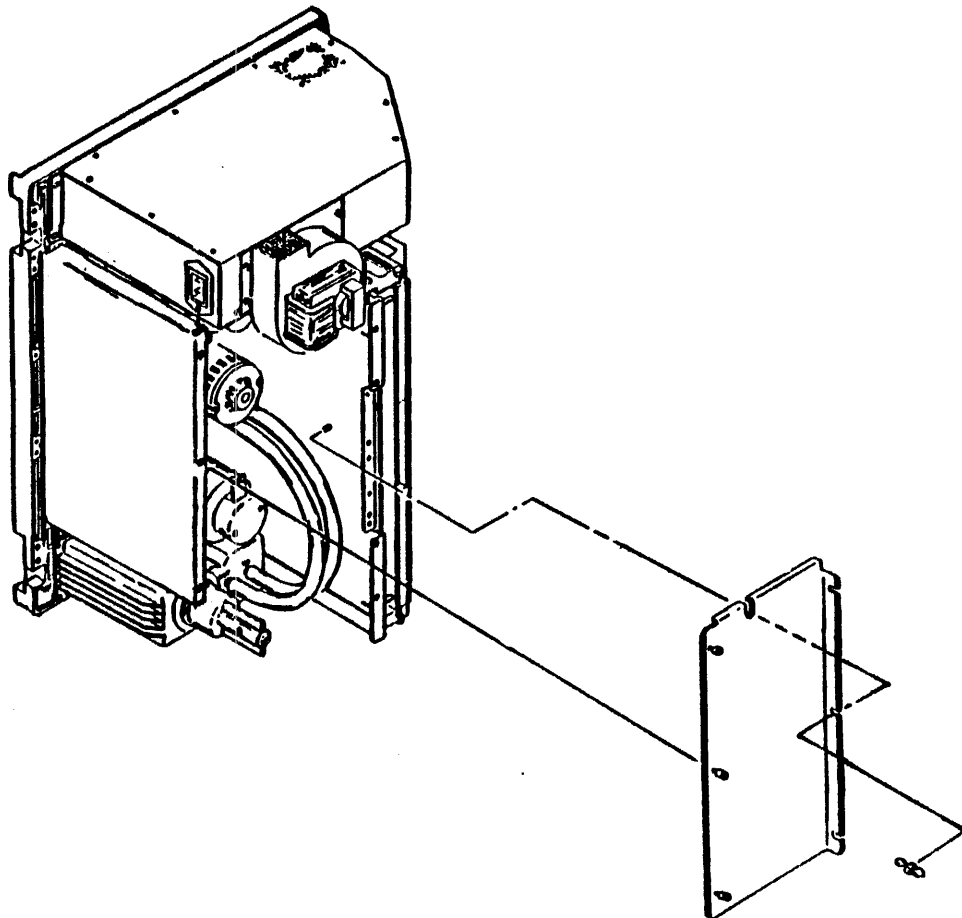


Figure 6-27. DRIVE COVER ASSEMBLY

## DRIVE COVER WITH SCSI

### Removal

1. Disconnect the I/O cables from I/O cable bracket (units with Alternative I or Alternative II connectors). Disconnect the I/O cable from J3 on the SCSI interface PWA (units without Alternative I or Alternative II connectors).
2. Remove two screws securing I/O cable under strip clamp on cable bracket (units without Alternative I or Alternative II connectors).
3. Detach the following connectors from the SCSI PWA:
  - J1 - W23P2
  - J2 - W22P2
  - J4 - W7P4
4. Loosen wing nuts and screws securing drive cover with SCSI PWA and remove drive cover assembly (Figure 6-28).

### Replacement

1. Place drive cover with SCSI PWA in position so that cooling fan wires are placed in feed-thru hole.
2. Secure drive cover with wing nut and screws.
3. Install connectors as follows:
  - J1 - W23P2
  - J2 - W22P2
  - J4 - W7P4
4. Reconnect the I/O cables to I/O cable bracket (units with Alternative I or Alternative II connectors). Reconnect the I/O cable to J3 on the SCSI interface PWA (units without Alternative I or Alternative II connectors).
5. Secure I/O cable under strip clamp with two screws (units without Alternative I or Alternative II connectors).

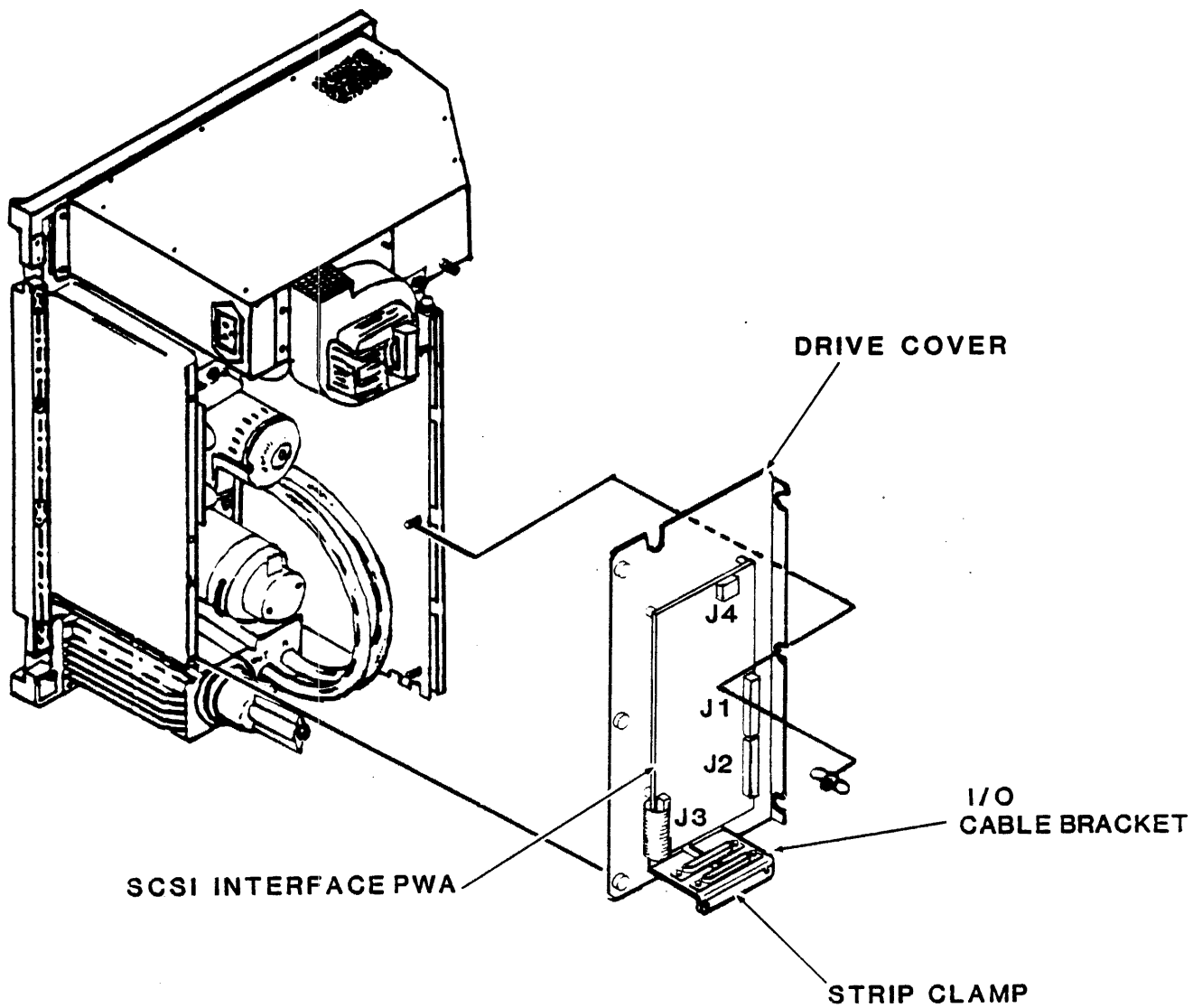


Figure 6-28. Drive Cover With SCSI Interface PWA

## SCSI INTERFACE PWA

### Removal

1. Disconnect the following cables from SCSI interface PWA:

- J1 - W23P2
- J2 - W22P2
- J3 - W24P1
- J4 - W7P4

2. Remove two screws securing SCSI interface PWA to Drive Cover Assembly (Figure 6-29) and remove SCSI interface PWA.

### Replacement

1. Position SCSI interface PWA under mounting clips and secure with two screws.

2. Install connectors as follows:

- J1 - W23P2
- J2 - W22P2
- J3 - W24P1
- J4 - W7P4

### Verification Check

1. Thread tape. Do not load. Execute operator diagnostic test 01.

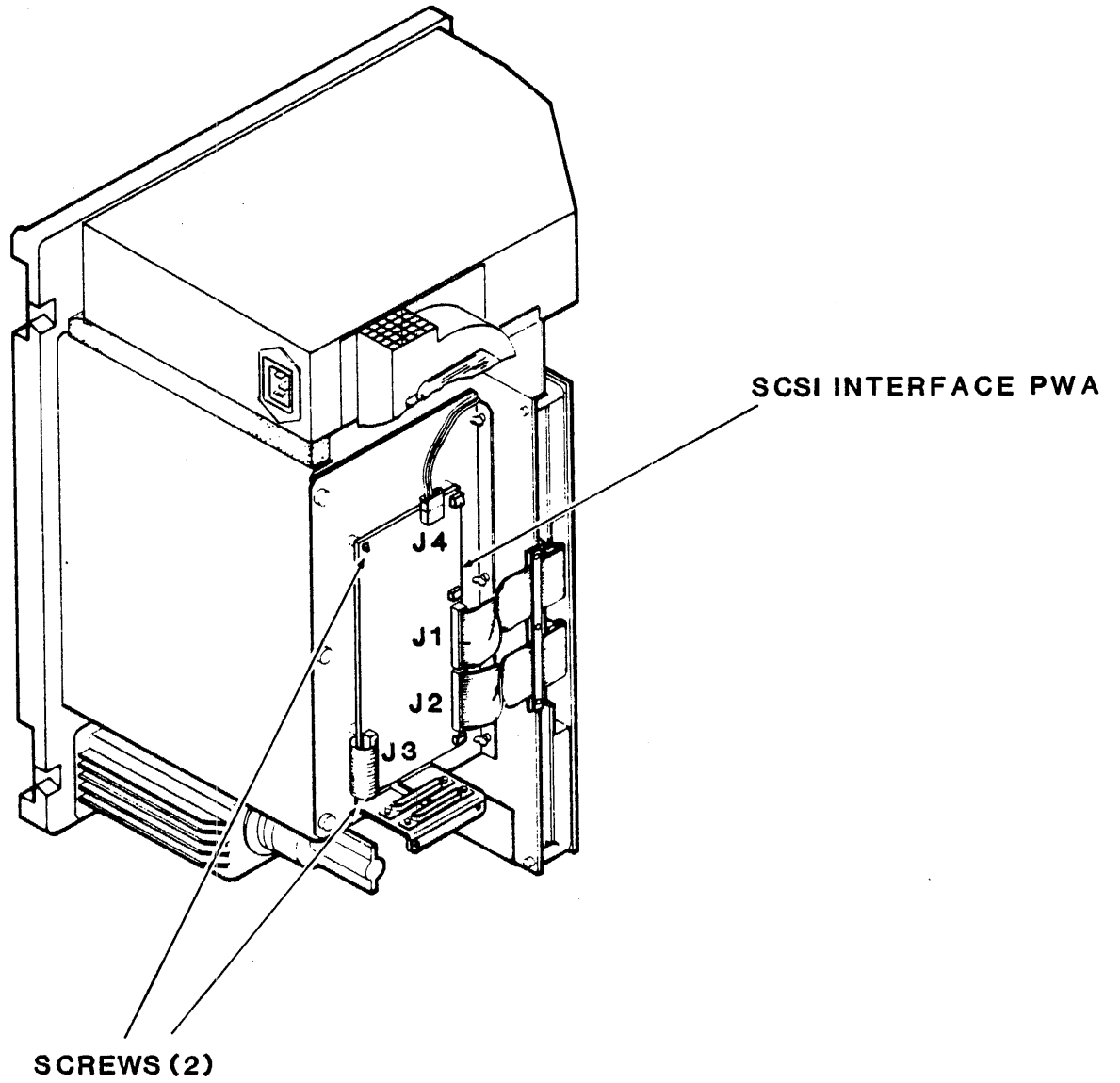


Figure 6-29. SCSI Interface PWA

## CAPACITOR

### Removal

1. Remove drive cover or drive cover with SCSI interface.
2. Remove capacitor connector from J5 of Power Drive PWA.
3. Insert a screwdriver through access hole and loosen screw holding capacitor in retainer. Remove capacitor from retainer.

### NOTE

The capacitor loses its charge within four seconds after transport power is removed.

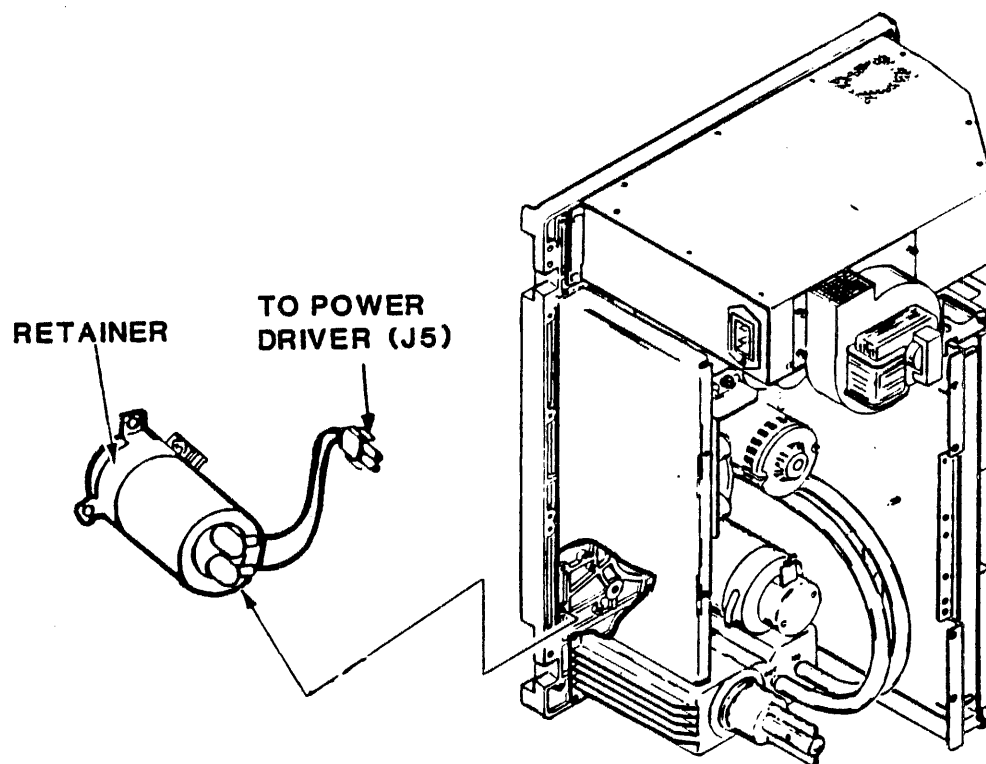


Figure 6-30. Capacitor

## CAPACITOR (Cont'd)

### Replacement

1. Install connector wires to the same capacitor terminal locations as the original. Slide protective caps over terminals.
2. Place capacitor in retainer. Insert a screwdriver through access hole and tighten retainer screw until capacitor is secured.
3. Install capacitor connector into J5 of Power Driver PWA.
4. Replace drive cover or drive cover with SCSI interface.

### Verification Check

1. Thread tape. Do not load. Execute Operator Diagnostic Test 01.





## PARTS DATA

A. FORMAT - A general understanding of this manual is necessary for efficient use in identifying parts and obtaining part numbers.

1. Locators are provided to aid in the location of an assembly and the figure in which it is illustrated. Isometric illustrations are provided for every major assembly and subassembly of the tape transport.

B. EXPLANATION OF TERMS AS USED IN THE PARTS LIST (See Example)

1. The number before the hyphen is the figure to which it applies. The number after the hyphen is the callout number on the figure.
2. The 8-digit number is the identifying number used in ordering replaceable parts.
3. INDENTURES - This indicates the relationship of parts to the next higher assembly.

Example: Guard, Spring Guide, Upper, Item -1, 1 dot, is part of the Air Bearing Assembly, Item 4-.

4. ATTACHING PARTS - The attaching parts for a particular part or assembly.
5. The part code refers to the ordering of parts and is to be read as follows:

\* = Authorized Field Replacement Part. Item is available on a routine order or an emergency order if justified.

CNS = Cataloged Not Stocked. Item is in stock only at original manufacturing division or outside vendor.

In an emergency:

- a. Order next higher assembly that contains item from Laser Magnetic Storage International Company, Spares Marketing; that assembly must be coded with an asterisk(\*).
- b. Do not order any CNS items on an emergency order.

In routine cases:

- a. Order the item on a routine order from Laser Magnetic Storage International Company, Spares Marketing.

NC = Not Cataloged. Item is only available as follows:

For assembly-type items (routine or emergency):

- a. Always order the next higher assembly that contains the item; that assembly must be coded with an asterisk (\*).

All parts must be ordered from:

Laser Magnetic Storage International Company  
Tape Storage Division  
2621 Van Buren Avenue  
Norristown, PA 19403  
Attn: Spares Marketing

Phone: (215) 666-4779  
Fax: (215) 666-4691

EXAMPLE

<u>INDEX</u> <u>NO.</u>	<u>PART</u> <u>CODE</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>					
			1	2	3	4	5	6
8-	CNS	77004215	AIR BEARING ASSEMBLY - UPPER					
-1	NC	77005020	. GUARD, SPRING GUIDE UPPER					
-2	NOTE	77004255	. GUARD, - TAPE, SPRING AIR BEARING					
			-attaching parts-					
-3	NC	92748082	. SCREW, MACH PAN HD PHL, 4-40 x .250					
			-----*					
-4	NC	77004241	. FOIL & HOUSING ASSEMBLY, UPPER AIR BEARING					
-5	NOTE	95870205	. 'O' RING, SILICON					
			-----*					
-6	NOTE	95967710	. TRANSDUCER PRESS, SOLID STATE					
			-attaching parts-					
-7	NC	92815107	. SCREW, CAP SOC HD, 4-40 x 1.0					
-8	NC	10125603	. WASHER, PLAIN 4					
-9	NC	10125801	. WASHER, SPRING LOCK 4					
-10	NC	77025281	. ISOLATOR, SPRING GUIDE					

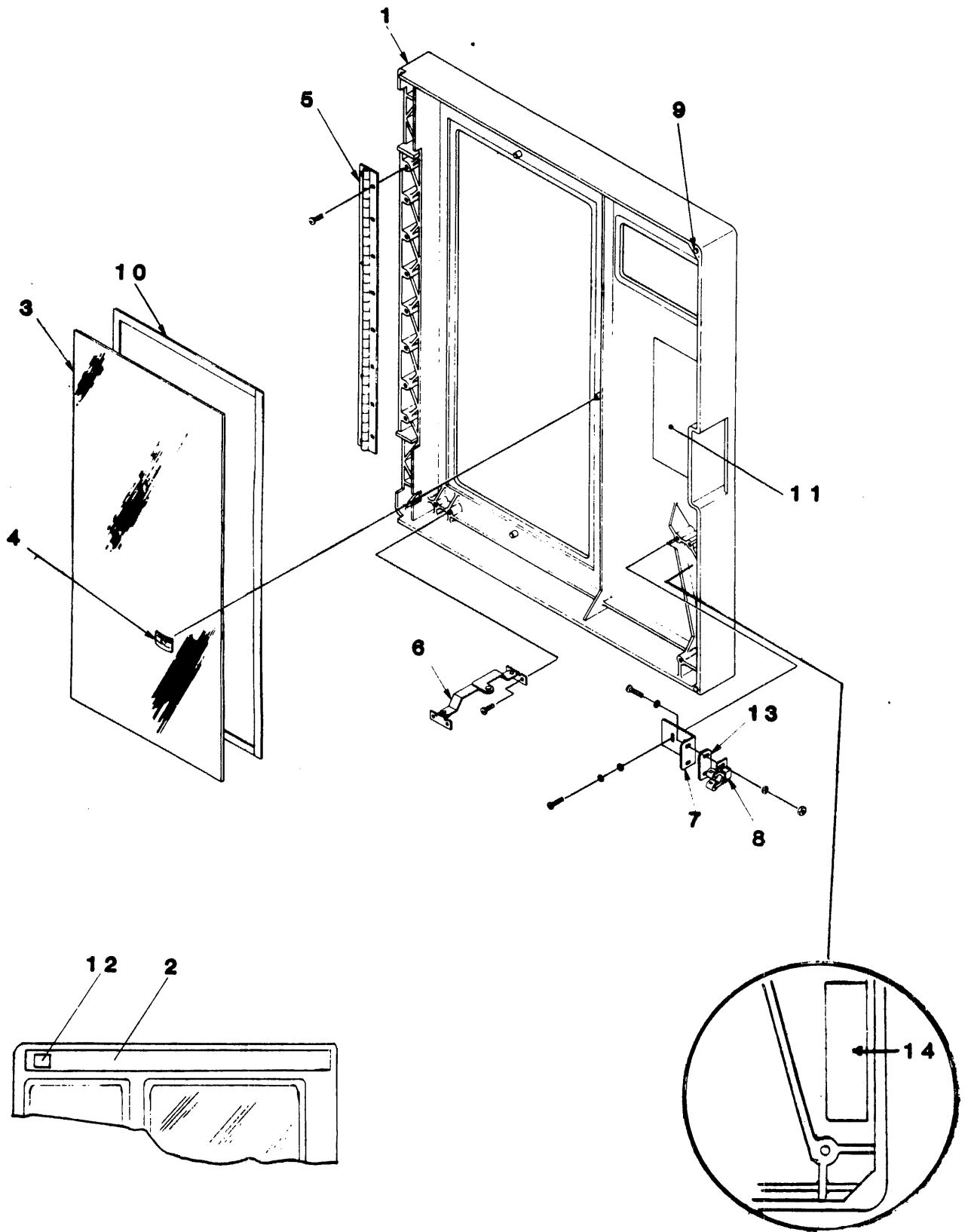


Figure 7-1. Door and Trim Assembly

INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
2-	CNS	7701835X	DOOR + TRIM ASSEMBLY					
-1	CNS	77013951	. DOOR, VERTICAL - SEAFOAM WHITE					
-1	CNS	77013952	. DOOR, VERTICAL - LT. GRAY					
-1	CNS	77013953	. DOOR, VERTICAL - IVORY					
-1	CNS	77013955	. DOOR, VERTICAL - BLACK					
-1	CNS	77013956	. DOOR, VERTICAL - WHITE					
-1	CNS	77013957	. DOOR, VERTICAL - BEIGE					
-1	CNS	77013961	. DOOR, VERTICAL - GRAY					
-1	CNS	77013963	. DOOR, VERTICAL - BROWN					
-2	NC	77006631	. DECORATIVE TRIM - IMPERIAL BLUE (TAB 52 ONLY)					
-2	NC	77006632	. DECORATIVE TRIM - BLACK (TAB 53 ONLY)					
-2	NC	77006633	. DECORATIVE TRIM - BROWN (TAB 51 ONLY)					
-3	NC	77005081	. WINDOW, DOOR					
-4	NC	93864267	. FASTENER, PUSH-IN					
-5	NC	77005090	. HINGE-CONTINUOUS					
-6	NC	49984642	. MECH. ASSY - HING STAY UPPER					
-7	NC	77013910	. BRACKET, LATCH					
-8	NC	92574001	. CATCH, ROLLER FRICTION					
-9	NC	77016320	. PAD, SELF-ADHESIVE					
-10	NC	95968381	. TAPE-FOAM, DBLF ADH .031 x .19					
-11	NC	77015730	. LABEL, FAULT RECOVERY					
-12	NC	77005514	. PRODUCT IDENT EMBLEM (TAB 52 ONLY)					
-13	NC	77015660	. SPACER (ALL EXCEPT TABS 56 & 57)					
-14	NC	21987646	. LABEL - FCC, RFI, CLASS A, METRIC					

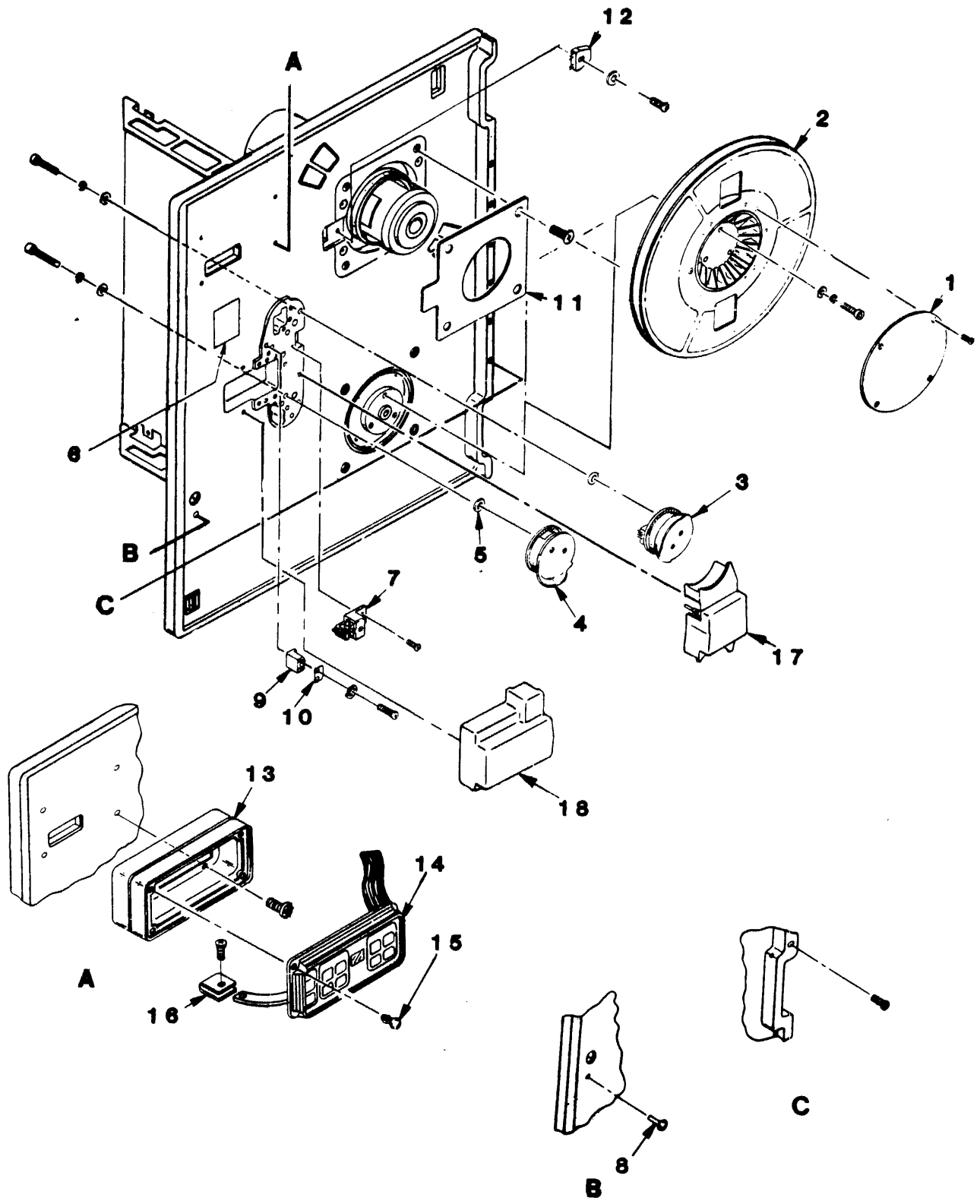


Figure 7-2. Equipment Assembly, Front

INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
2-	NC	7702105X	EQUIPMENT ASSEMBLY, FRONT VIEW (50/60 HZ)					
-1	*	77003790	. COVER-HUB TAKE UP REEL					
-2	*	77003091	. HUB ASSEMBLY-TAKE UP REEL					
-3	CNS	77004215	. AIR BEARING ASSEMBLY-UPPER (See FIGURE 7-10) **					
-4	CNS	77004335	. AIR BEARING ASSEMBLY-LOWER (See FIGURE 7-9) **					
-5	*	95870206	. 'O'-RING, SILICON (See FIGURE 7-9 or 7-10)					
-6	NC	77006990	. LABEL-TAPE PATH					
-7	*	77004613	. EOT/BOT ASSEMBLY					
-8	NC	77014130	. DOOR CATCH STRIKE, BALL END					
-9	*	77010492	. TAPE CLEANER ASSEMBLY					
-10	CNS	77004720	. PLATE, TAPE CLEANER					
-11	CNS	77014981	. COVER-FILE PROTECT (BLK)					
-12	*	95969991	. SENSOR ASSY, FILE PROTECT					
-13	NC	77014220	. HOUSING-OPERATOR PANEL					
-14	NC	77010432	. OPERATOR PANEL ASSEMBLY					
-15	NC	95968770	. CLIP, PUSH-IN					
-16	NC	77009840	. TERMINAL-FOIL GROUNDING					
-17	NC	77011561	. COVER ASSEMBLY, TAPE PATH					
-18	CNS	77011571	. COVER ASSEMBLY, MAGNETIC HEAD					

\*\* DO NOT REPLACE AIR BEARING ASSEMBLY IN THE FIELD.

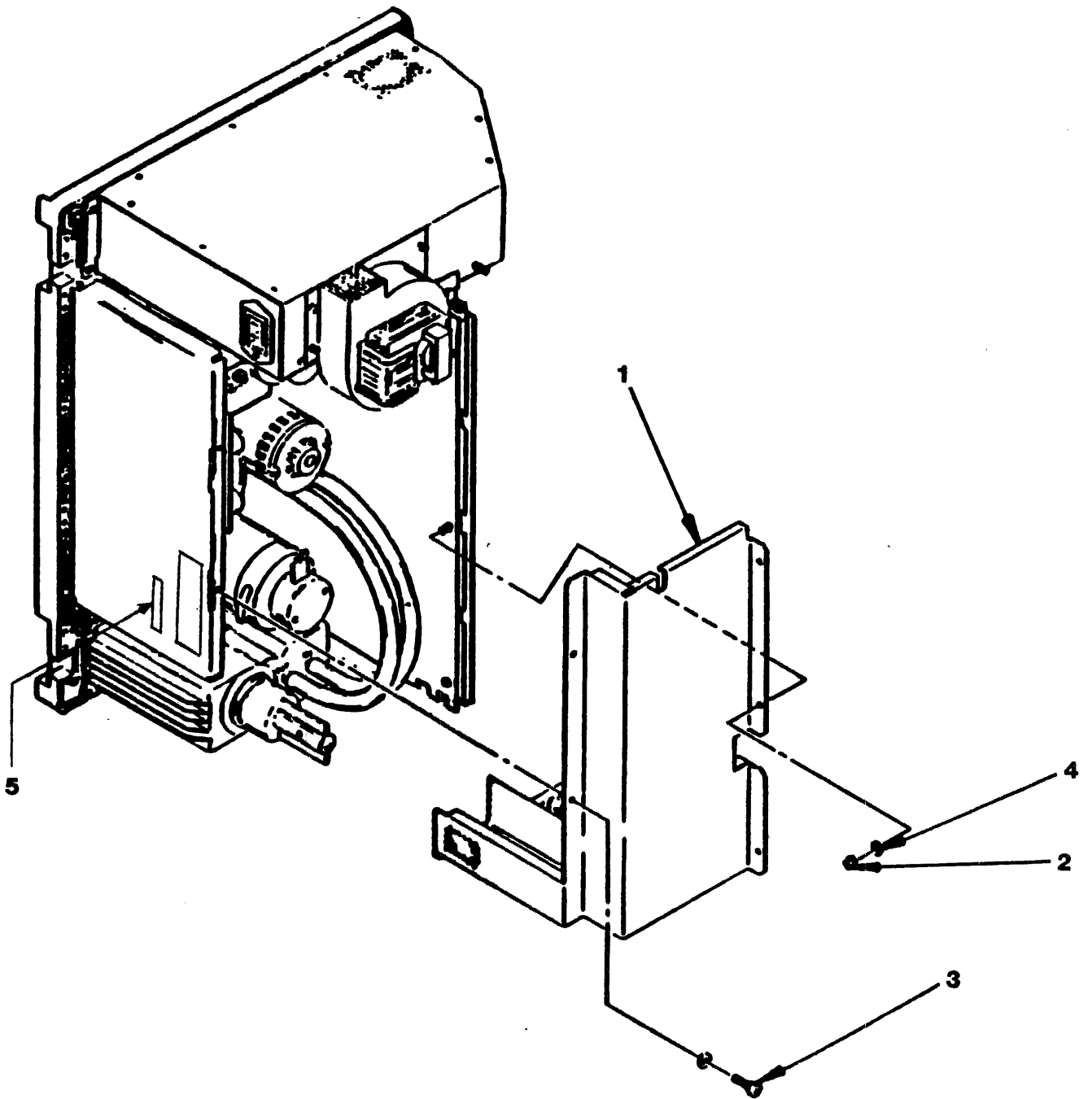


Figure 7-3. Equipment Assembly, Rear View



<u>INDEX</u> <u>NO.</u>	<u>PART</u> <u>CODE</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>					
			1	2	3	4	5	6
3-	NC	7701147X	EQUIPMENT ASSEMBLY, REAR (50/60 HZ)					
-1	CNS	77016771	. PANEL ASSEMBLY - ACOUSTICAL					
-2	NC	53777902	. NUT & LOCKWSHR, 6-32 .14H .312 HEX					
-3	NC	95959725	. SCREW - PAN HD/EXT T LW 6-32 x .375					
-4	NC	10125605	. WASHER, FLAT #6					
-5	NC	21987646	. LABEL - FCC, RFI, CLASS A, METRIC					

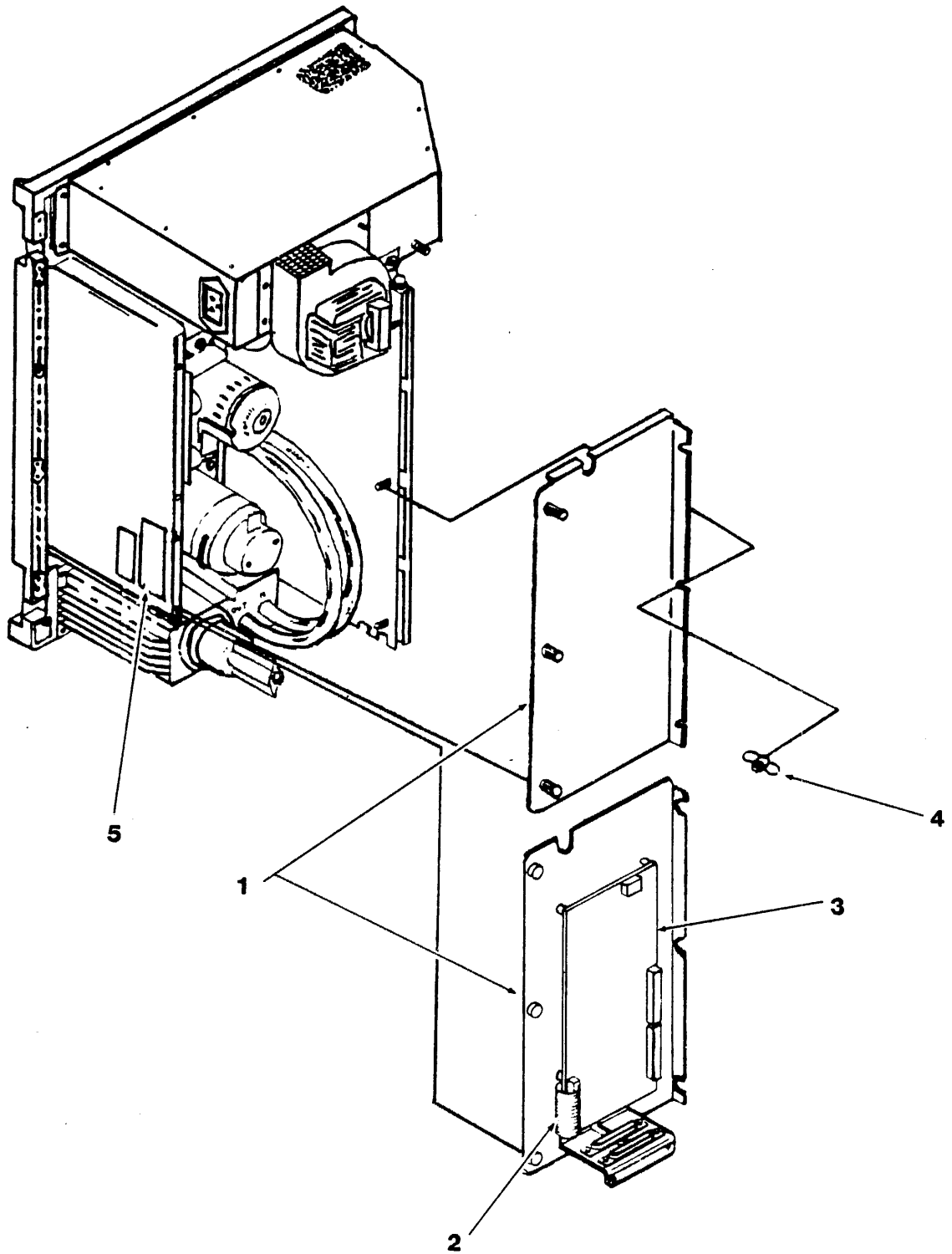


Figure 7-4. Equipment Assembly, Rear View

<u>INDEX</u> <u>NO.</u>	<u>PART</u> <u>CODE</u>	<u>PART</u> <u>NUMBER</u>	<u>DESCRIPTION</u>					
			1	2	3	4	5	6
4-	NC	7702105X	EQUIPMENT ASSY, REAR (50/60 HZ)					
-1	NC	77023611	. DRIVE COVER ASSY					
-1	NC	77023612	. DRIVE COVER ASSY - SCSI ALT I, SE					
-2	CNS	77033291	. . BRKT/CA ASSY ALT I (PE SCSI)					
-3	*	77043010	. . PWA SCSI SE					
-1	NC	77023613	. DRIVE COVER ASSY - SCSI ALT II, SE					
-2	CNS	77033311	. . BRKT/CA ASSY ALT I (PE SCSI)					
-3	*	77043010	. . PWA SCSI SE					
-1	NC	77023614	. DRIVE COVER SCSI SE					
-2	CNS	77031690	. . BRKT - I/O MTG					
-3	*	77043151	. . PWA SCSI SE					
-1	NC	77023615	. DRIVE COVER ASSY - SCSI ALT I, DIFF					
-2	CNS	77033291	. . BRKT/CA ASSY ALT I (PE SCSI)					
-3	*	77043030	. . PWA SCSI DIFF					
-1	NC	77023616	. DRIVE COVER ASSY - SCSI ALT II, DIFF					
-2	CNS	77033311	. . BRKT/CA ASSY ALT II (PE SCSI)					
-3	*	77043030	. . PWA SCSI DIFF					
-1	NC	77023617	. DRIVE COVER SCSI DIFF					
-2	CNS	77031690	. . BRKT - I/O MTG					
-3	*	77043171	. . PWA SCSI DIFF					
-4	NC	93031001	. NUT - WING (NC) 6-32					
-5	NC	21987646	. LABEL - FCC, RFI, CLASS A, METRIC					

S/N 838 and below

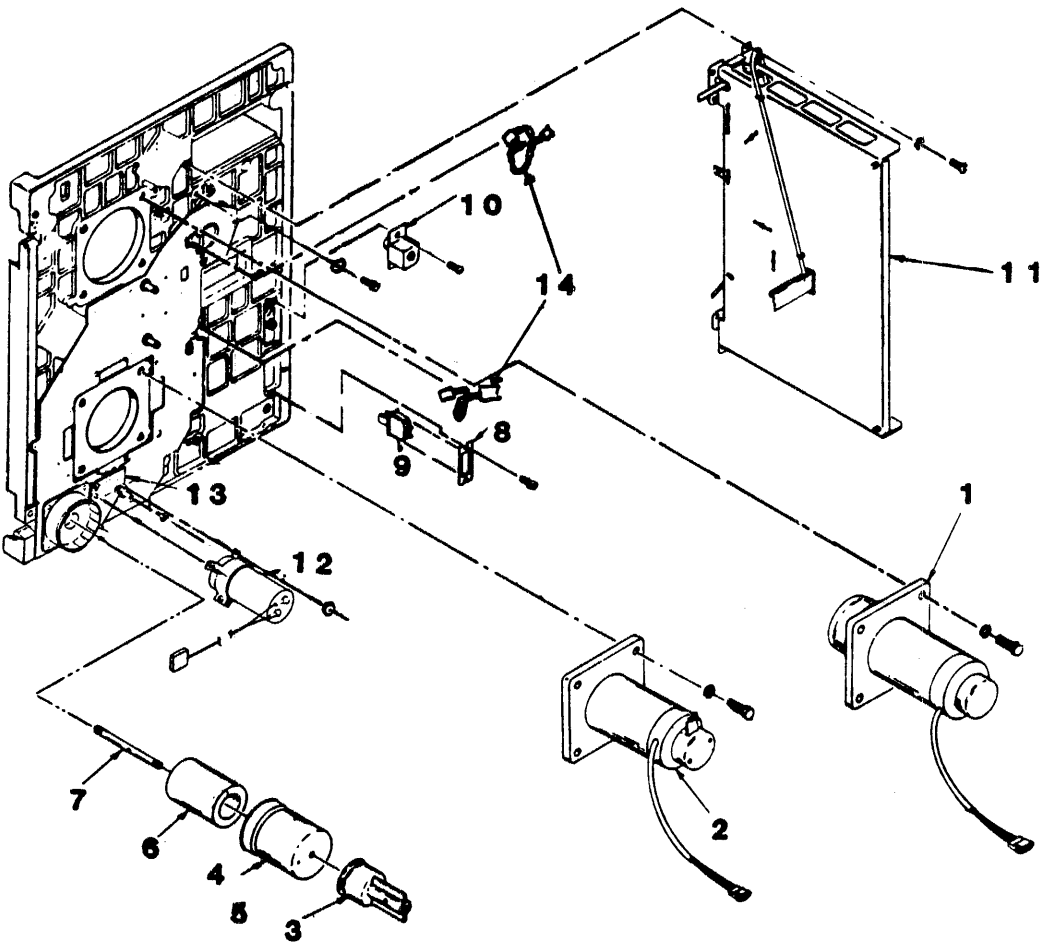


Figure 7-5. Equipment Assembly, Rear View

<u>INDEX NO.</u>	<u>PART CODE</u>	<u>PART NUMBER</u>	DESCRIPTION					
			1	2	3	4	5	6
5-	NC	7701147X	EQUIPMENT ASSEMBLY, REAR VIEW (50/60 HZ)					
-1	*	77006579	. MOTOR ASSEMBLY - SUPPLY REEL					
-2	*	77006162	. MOTOR ASSEMBLY - TAKEUP REEL					
-3	CNS	77011551	. PRESSURE REGULATOR ASSEMBLY					
-4	CNS	77006533	. FILTER CAN ASSEMBLY					
-5	NC	94671590	. SLIC SILICONE LUBRICANT					
-6	*	95966090	. FILTER					
-7	CNS	77007240	. SHAFT, FILTER					
-8	NC	77003191	. PLATE, SWITCH					
-9	*	92014800	. SWITCH-BASIC					
-10	NC	94802306	. FASTENER-ADJUSTABLE PAWL					
-11	NC	77011522	. CARD CAGE ASSEMBLY, 2 BD, 11 x 17					
-12	NC	77015911	. CAP-CA, 13-17K MF/2 POSN CONN					
-13	NC	77015210	. PLATE-ADAPTER CAPACITOR MTG					
-14	CNS	77010862	. CABLE ASSEMBLY, PWA TO XDUCER (2 BD) W1 + W9					

S/N 839 and above

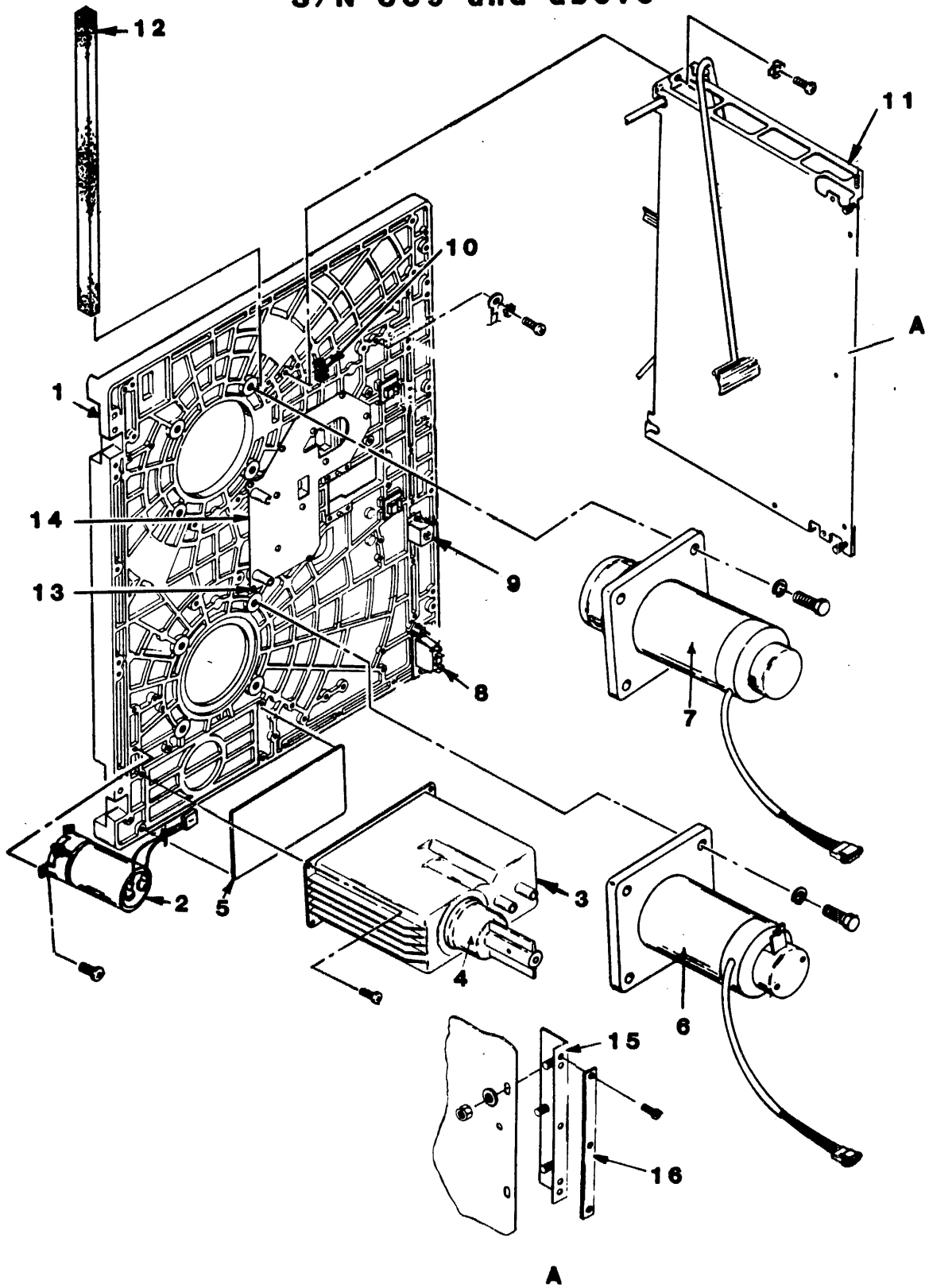


Figure 7-6. Equipment Assembly, Rear

INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
6-	NC	7702105X	EQUIPMENT ASSEMBLY, REAR (50/60 HZ) (V)					
-1		77014361	. TAPE DECK MACH (BLK)					
-2	NC	77015912	. CAP-CA, 13-17K, MF/2, SKT/09 LG					
-3	NC	77025191	. AIR CHAMBER ASSEMBLY					
-4	CNS	77011551	. . PRESSURE REGULATOR ASSEMBLY					
-	CNS	95966090	. . FILTER					
-	NC	77015431	. . GASKET-FILTER					
-5	CNS	77024250	. GASKET-AIR CHAMBER					
-6	*	77006162	. MOTOR ASSEMBLY, TAKE-UP REEL					
-7	*	77035311	. MOTOR ASSEMBLY, SUPPLY REEL					
-8	*	95966651	. INTERLOCK SWITCH					
-9	NC	94802306	. FASTENER-ADJUSTABLE PAWL					
-10	NC	95862300	. ANCHOR-STRAP, CA, SCR HOLE, .170D					
-11	NC	77011523	. CARD CAGE ASSEMBLY, 25 IPS					
-12	NC	77016921	. FOAM STRIP, ADHESIVE					
-13	NC	77014392	. GASKET-PLENUM					
-14	NC	77025261	. PLENUM COVER ASSEMBLY					
-15	NC	77022850	. BRACKET-I/O, CA					
-16	NC	77017190	. STRIP-CLAMP, CA					

S/N 838 and below

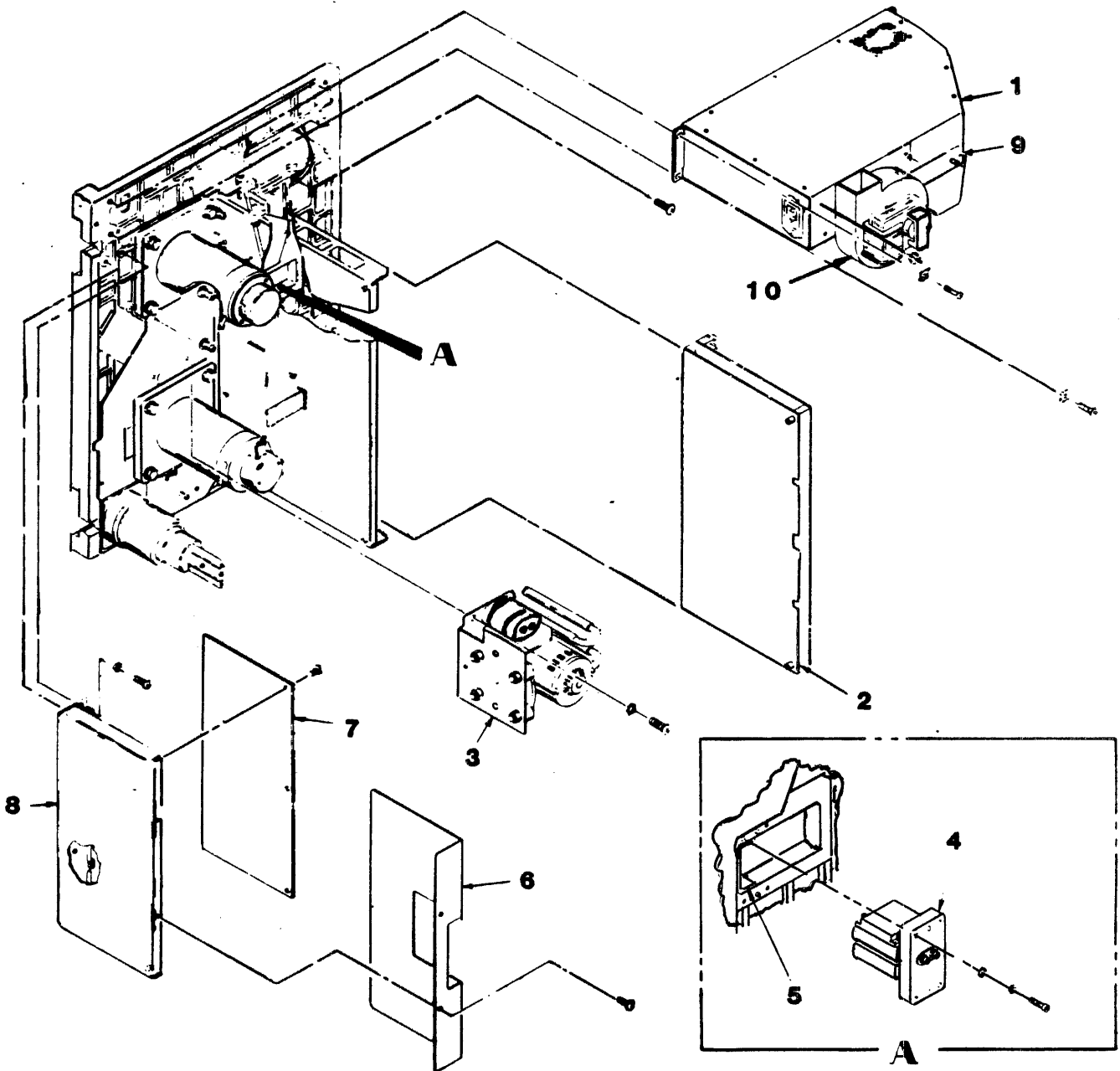


Figure 7-7. Equipment Assembly, Rear



INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
7-	NC	7701147X	EQUIPMENT ASSEMBLY, REAR VIEW (50/60 HZ)					
-1	*	77009931	. POWER SUPPLY (60 HZ)					
-1	*	77009932	. POWER SUPPLY (50 HZ)					
-1	*	77029343	. POWER SUPPLY (BY3C6G)					
-2	NC	7701151X	. CARD SET ASSEMBLY					
-	CNS	77011860	. . PIVOT - LOGIC CARD CAGE					
-	CNS	77015857	. . R/W/S PWA, READ AMP CAL. SPEC					
-	CNS	77041137	. . PWA - FORMATTER/CONTROL					
-3	*	77011532	. COMPRESSOR ASSEMBLY, BRACKET & CAP (50/60 HZ)					
-4	*	77015881	. MAG HEAD INSTALLATION & INSTRUCTION KIT					
-5	NC	77007090	. LINER, SILICON FOAM RUBBER					
-6	NC	77011950	. COVER, POWER AMP					
-7	*	77043091	. PWA - POWER DRIVER, 10-AMP					
-8	NC	77011960	. BRACKET - POWER AMP PWA MOUNTING					
-9	NC	77014410	. BRACKET - SUPPORT, CARD CAGE					
-10	NC	95968433	. BLOWER, 30/CFM, 220/120V, 50/60 HZ					

S/N 839 and above

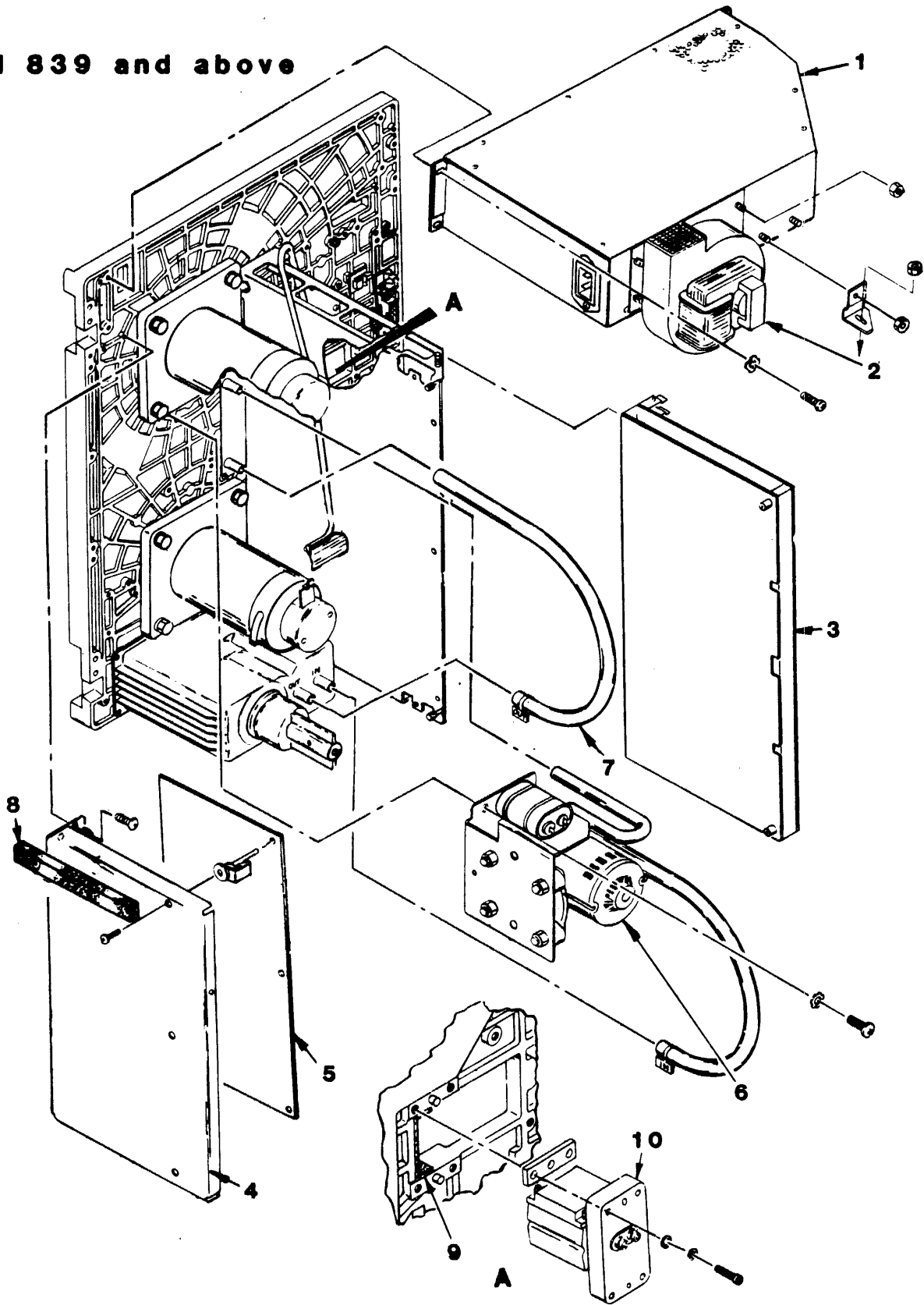


Figure 7-8. Equipment Assembly, Rear

INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
8-	NC	7702105X	EQUIPMENT ASSEMBLY, REAR (50/60 HZ) (V)					
-1	*	77009935	. POWER SUPPLY ASSEMBLY (60 HZ)					
-1	*	77009936	. POWER SUPPLY ASSEMBLY (50 HZ)					
-1	*	77029341	. POWER SUPPLY ASSEMBLY (60 HZ)					
-1	*	77029342	. POWER SUPPLY ASSEMBLY (50 HZ)					
			-----*					
-2	*	95968433	. BLOWER, 30/CFM, 220/120V, 50/60 HZ					
-3	NC	77011512	. CARD SET ASSEMBLY, 25 IPS					
-	*	7704207X	. . PWA-FORMATTER CONTROL					
-	*	7704112X	. . PWA-READ/WRITE/SERVO					
-4	NC	77023560	. BRACKET-POWER AMP					
-5	*	77043091	. PWA-POWER DRIVER					
-6	*	77011537	. COMPRESSOR ASSEMBLY, BKRT + CAP					
-7	NC	77011937	. TUBING-MODIFICATION					
-8	NC	77016938	. FOAM STRIP, ADHESIVE					
-9	NC	77019544	. FOAM-STRIP, ADH, .12T, .50WI, .50L					
-10	*	77019544	. MAG HD INSTAL & INSTRUC KIT					
-11		94275200	. CLAMP HOSE					

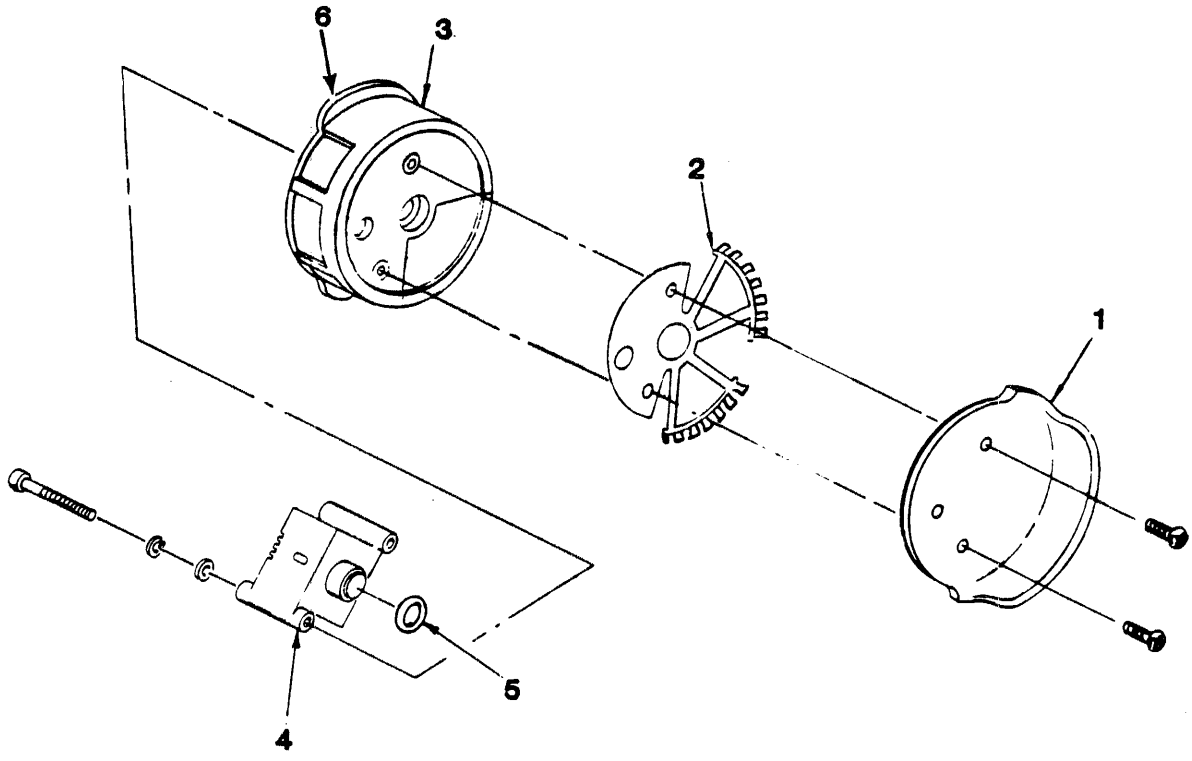


Figure 7-9. Air Bearing Assembly, Lower

INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
9-	CNS	77004335	AIR BEARING ASSY, LOWER **					
-1	NC	77005030	. GUARD SPRING GUIDE, LOWER					
-2	NC	77004254	. GUIDE-TAPE, SPRING *					
			-----*-----					
-3	NC	77004361	. HOUSING ASSY, LOWER *					
			-----*-----					
-4	NC	95967710	. SENSOR PRESS, SOLID-STATE					
-5	NC	95870205	. 'O' RING, SILICON *					
-6	NC	77031490	. TAPE GUIDE					

\* NOTE: KIT AIR BEARING P/N 77015691 HAS PARTS 2, 3 & 5.  
 \*\* DO NOT REPLACE AIR BEARING ASSY IN FIELD

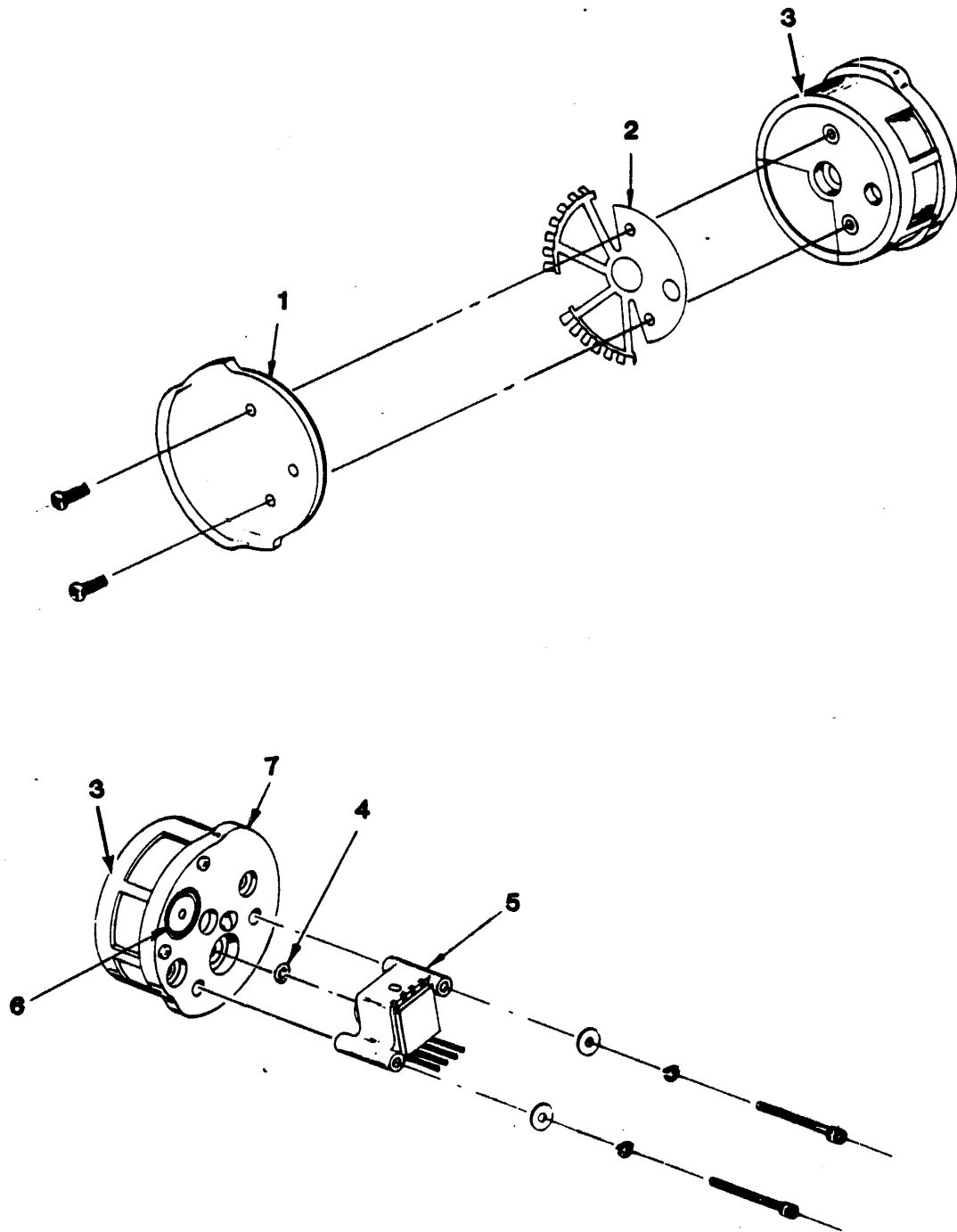


Figure 7-10. Air Bearing Assembly, Upper

<u>INDEX</u> <u>NO.</u>	<u>PART</u> <u>CODE</u>	<u>PART</u> <u>NUMBER</u>	1	2	3	4	5	6	DESCRIPTION
10-	CNS	77004215							AIR BEARING ASSY, UPPER **
-1	NC	77005020							. GUARD SPRING GUIDE, UPPER
-2	NC	77004255							. GUIDE-TAPE, SPRING *
									-----*
-3	NC	77004241							. HOUSING ASSY, UPPER *
-4	NC	95870205							. 'O' RING, SILICON
									-----*
-5	NC	95967710							. SENSOR PRESS, SOLID-STATE *
-6	NC	95870206							. 'O' RING, SILICON
-7	NC	77031480							. TAPE GUIDE

\* NOTE: KIT AIR BEARING P/N 77015691 HAS PARTS 2, 3 & 5.  
 \*\* DO NOT REPLACE AIR BEARING ASSY IN FIELD.

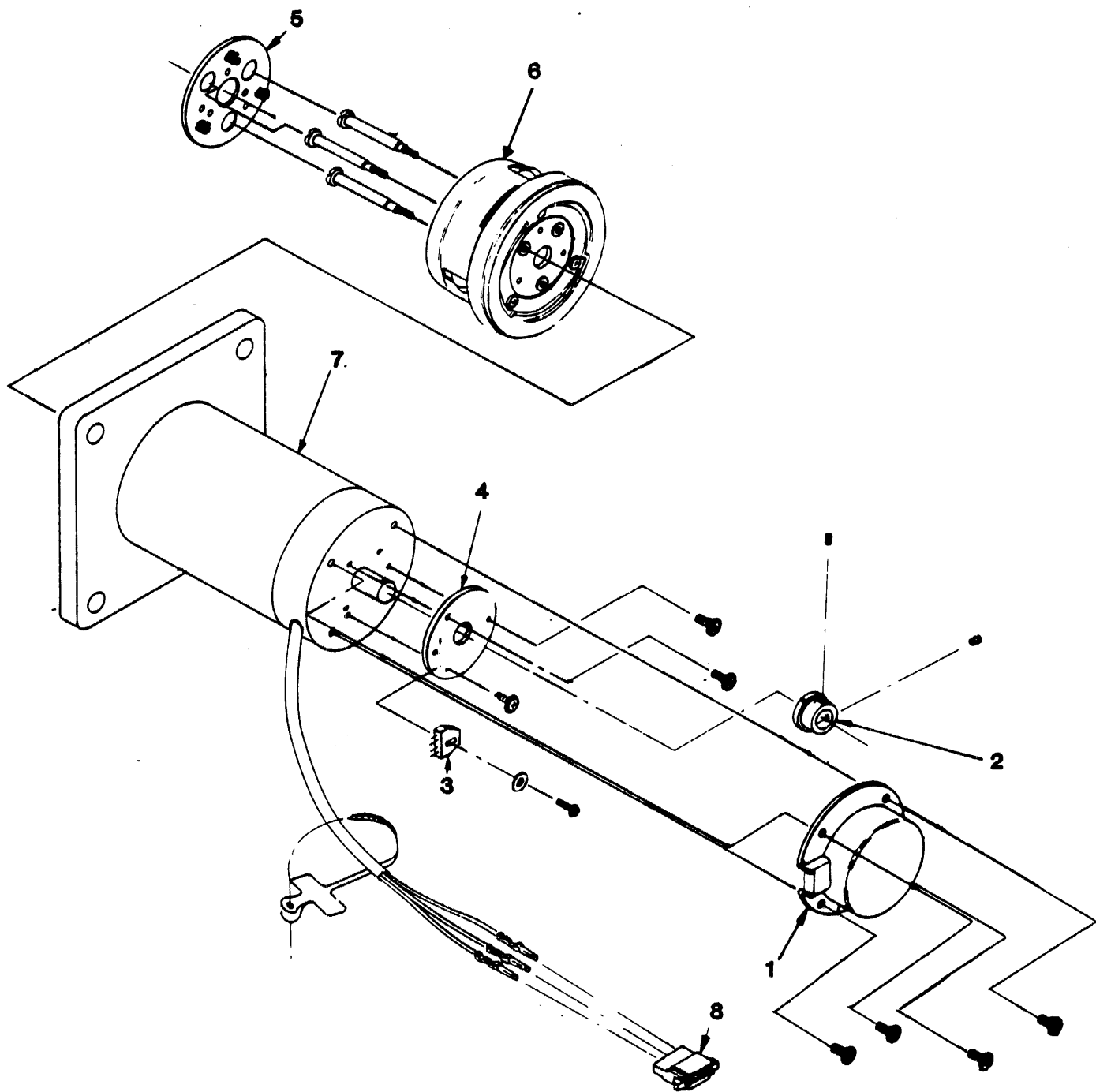


Figure 7-11. Motor Assembly, Supply Reel



<u>INDEX</u> <u>NO.</u>	<u>PART</u> <u>CODE</u>	<u>PART</u> <u>NUMBER</u>	1	2	3	4	5	6	DESCRIPTION
11-	*	77035311							MOTOR ASSEMBLY, SUPPLY REEL
-1	NC	77002240							. COVER, TACHOMETER
									-----*-----
-2	*	77007560							. HUB ASSEMBLY - TACHOMETER
-3		95969993							. SENSOR ASSEMBLY, INDEX TACH
-4		77002230							. PLATE, MOUNTING, SENSOR
									-----*-----
-5		77029241							. COVER - SUPPLY REEL HUB
-6	*	77003917							. HUB ASSEMBLY - SUPPLY REEL
-7	NC	77015532							. MOTOR ASSEMBLY, REEL
-8	NC	95929001							. CONNECTOR, HSG, PIN/SKT

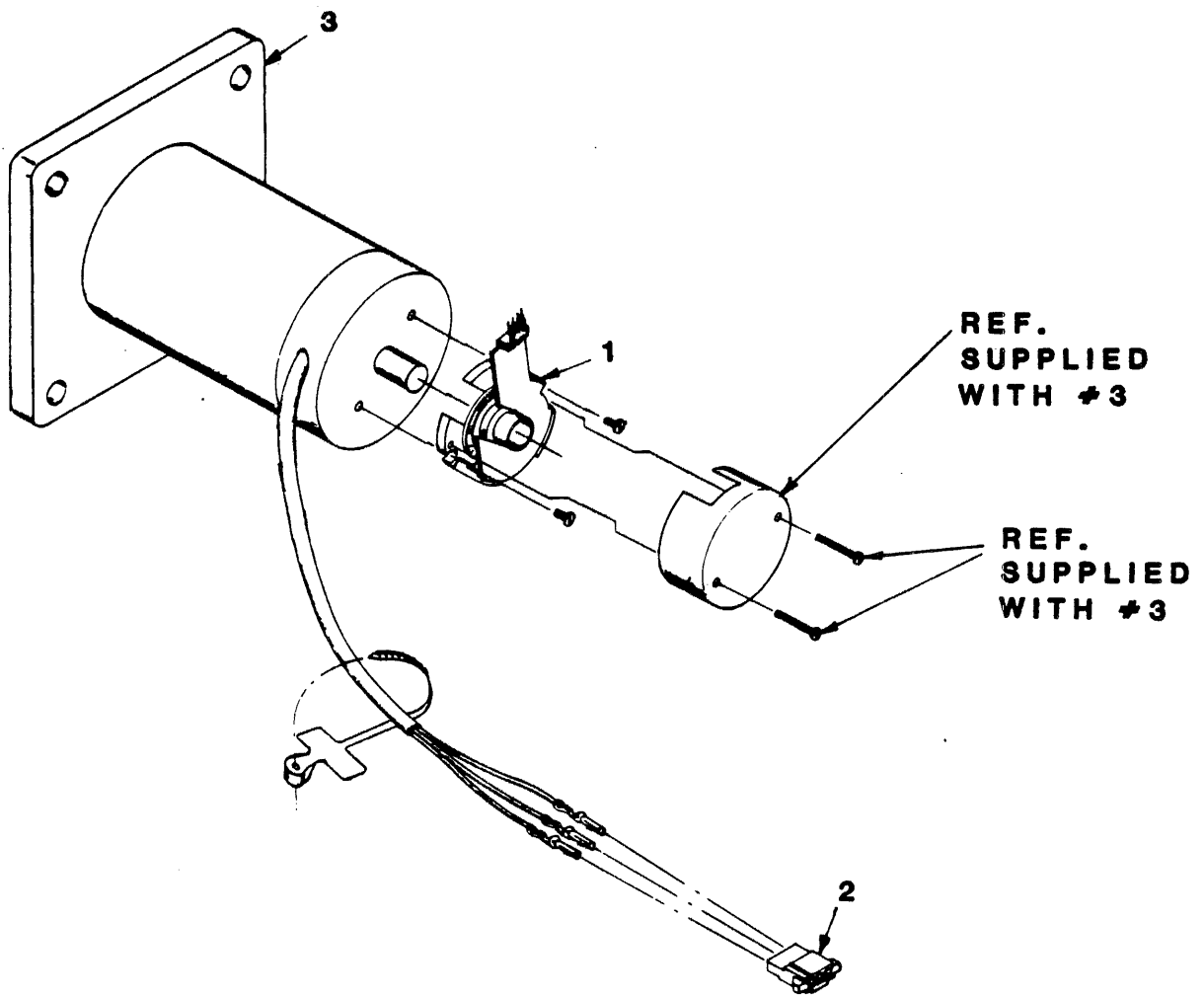


Figure 7-12. Motor Assembly, Take-Up Reel

INDEX NO.	PART CODE	PART NUMBER	DESCRIPTION					
			1	2	3	4	5	6
12-	*	77006162	MOTOR ASSEMBLY, TAKE-UP REEL					
-1	NC	95966061	. TACHOMETER, 1000 LINE					
			-----*-----					
-2		95929001	. CONNECTOR, HSG, PIN/SKT					
-3	NC	77015532	. MOTOR ASSEMBLY, REEL					

PWA COMPLEMENT

<u>PART CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
*	77043091	POWER DRIVER
*	7704112X	READ/WRITE/SERVO
*	7704113X	FORMATTER/CONTROL
*	7704207X	FORMATTER/CONTROL

Pictorials are shown in Section 5 (DIAGRAMS)

HARNESS AND CABLE ASSEMBLIES

<u>PART CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
CNS	77010291	HARNESS ASSEMBLY - CAPACITOR
CNS	77010862	CABLE ASSEMBLY W1 & W9
CNS	77011622	CABLE ASSEMBLY W3
CNS	77015562	CABLE ASSEMBLY W5
CNS	77006552	CABLE ASSEMBLY W6
CNS	77011591	CABLE ASSEMBLY W7
CNS	77011581	CABLE ASSEMBLY - SIG, FC PWA/PS-W2
CNS	77014171	CABLE ASSEMBLY - AC PWR, CB1/PS PWA
CNS	77008281	CABLE ASSEMBLY - 34 COND OPER. PNL
CNS	77036071	CABLE ASSEMBLY - EMI, LOGIC GROUND (BY3C6G)
CNS	77036081	CABLE ASSEMBLY - EMI, REEL MOTOR (BY3C6G)

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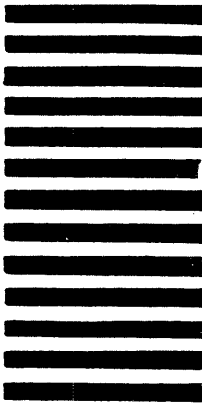


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