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9250 Magnetic Tape Drive Maintenance Manual

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## CAUTION

THE 9250 TAPE UNIT CONTAINS COMPONENTS THAT MAY BE DAMAGED BY ELECTROSTATIC DISCHARGE (ESD). THE TAPE UNIT IS MANUFACTURED, TESTED, AND SHIPPED UNDER RIGOROUSLY CONTROLLED CONDITIONS DESIGNED TO PREVENT COMPONENT DAMAGE BY ESD.INSTALLATION, OPERATION, AND MAINTENANCE OF 9250 UNITS SHOULD CONFORM TO APPROPRIATE AND ACCEPTED INDUSTRY STANDARDS* OF ESD PROTECTION AND PREVENTION.

---All semiconductors are static sensitive and are to be handled as such.

---When removed from the tape unit all PC Boards, sub-assemblies, and modules containing semiconductor devices must be packaged in static shielding containers. These containers should not be opened in areas that are not equipped to provide ESD protection required for the device.

---Contact with connector pins of semiconductors is to be avoided when possible. The devices should be handled by the plastic case or body material.

---Compressed air must not be blown onto or into areas containing semiconductors unless the air supply is equipped with ionizing nozzles.

---The chassis of all test equipment must be grounded. DC power supplies in test equipment must have an earth ground reference.

---The tape unit chassis must be grounded before technical personnel contact circuit boards or backplane pins. An external ground wire is not necessary if the Tape Unit input AC power cable is connected to a properly grounded outlet.

*See: ESD Protective Material and Equipment: A Critical Review. Reliability Analysis Center. RADC/RBRAC. Griffiss AFB, NY 13441. Ordering No. SOAR-1.

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# SECTION 1 - GENERAL DESCRIPTION AND CHARACTERISTICS

## 1.1 PHYSICAL DESCRIPTION

The 9250 Series Tape Subsystem is a high-performance, digital, vacuum-buffered tape unit manufactured by Telex Computer Products, Tulsa, Oklahoma. (See Figure 1-1.) It may be vertically mounted in a standard 19-inch RETMA rack using two hinges on one mounting rail and a latch on the other. Hinge/latch sets may be ordered separately. When mounted, the unit swings out and is serviced from the front. The unit is hinged on the right.

Size and Weight (Approx.)

Weight: 140 pounds
Height: 24 1/2 inches
Width: 19 inches
Depth: 12 inches to the rear from the mounting rail; 5 inches in front of the rack mounting rail.

NOTE: Depending upon the hinge offset, the rear and front depth dimensions will change. (See Section 2, Installation.)

## 1.2 FUNCTIONAL DESCRIPTION

The 9250 handles 1/2-inch magnetic tape at 50 IPS while autoloading standard 10 1/2-inch open reels. For smaller reels, autothreading is accomplished by manually placing the tip of tape in the thread chute. Vacuum column technology is utilized to provide 0.6 and 0.3 inch IBG performance, PE and GCR respectively, thereby maximizing storage capacity.

9250 Series tape units are available in either dual- or tri-density models. Model number suffix -2 indicates dual-density and -3 tri-density. NRZI functions and characteristics are discussed in this manual.

Multiple microprocessors are used to implement functions normally associated with hardware and provide the basic intelligence to implement the fault finding diagnostics.

### EMBEDDED FORMATTER

The 9250 tape unit is capable of housing an embedded formatter within the tape unit cabinet. The embedded formatter is compatible with the 6850 Telex Standard Interface. The formatter provides all data encoding and decoding, tape gapping, and error detection/correction functions. The unit housing the formatter with Telex interface (the master unit) is designated as the 9253-200 or -300. Add-on tape units (slaves) are designated as the 9250-200 or -300. Up to three slaves may be connected to a master unit.

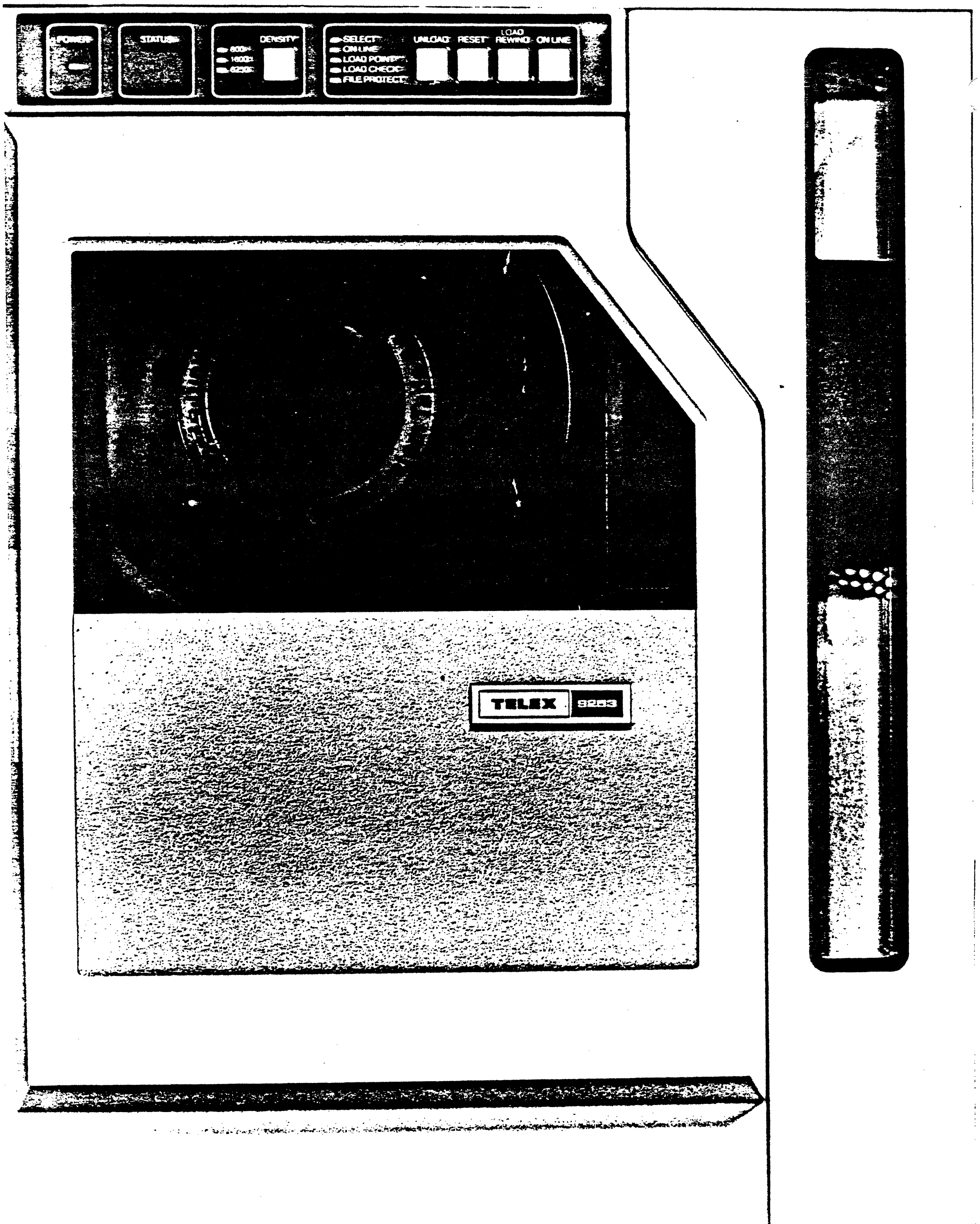



Figure 1-1. Series 9250 Tape Subsystem

## 1.3 PERFORMANCE CHARACTERISTICS

The performance specifications listed below are based on a properly aligned tape unit using certified tape. When magnetic tapes of different types and various conditions are used, or when operating in field environments with extended or non-standard maintenance procedures, different performance parameters may result.

---Tape Speed: 50 ips
---Data Rate:

| Density (Bytes/Inch) | Transfer Rate (K Bytes/Sec) |
|---|---|
| 6250 | 312.5 |
| 1600 | 80.0 |
| 800 | 40.0 |

---Rewind Time: Two minutes, nominal

Rewind time from EOT to BOT for a 2400 foot tape is nominally 2.0 minutes.

---Inter-Block Gap

The tape unit will read interblock gaps as defined by the appropriate ANSI standard and generate the following nominal gaps:

| Density (BPI) | Nominal (Inches) |
|---|---|
| 6250 | 0.30 |
| 1600 | 0.60 |
| 800 | 0.60 |

Note: Rewrites, which are under control of the Host, may extend the gap to a maximum of 15 feet for 6250, and up to 25 feet for 1600 and 800 bpi, and still conform to the appropriate ANSI standard.

---Start/Stop Characteristics

| | | |
|---|---|---|
| Start Time | 2.4±0.4 | ms |
| Start Distance | .060±.010 | in |
| Stop Time | 2.4±0.6 | ms |
| Stop Distance | .060±.015 | in |

TU Access

| | | | |
|---|---|---|---|
| Write | | 3.0±0.4 | ms |
| Read | (6250 bpi) | 3.4±0.4 | ms |
| | (1600/800 bpi) | 5.0±0.4 | ms |

## 1.4 EMBEDDED CAPABILITIES AND OPTIONS

Embedded capabilities in the standard unit include:

Seismic Option
Forced Read
Dynamic Status
Manual Density Select
Address Select

These capabilities are enabled or disabled via the Diagnostic Keyboard.

Feature Codes

The following features are separate sales order options that can be installed or reinstalled in the field.

9253 Telex Interface
Emulates the Telex 6850/6253 Tri-Density tape subsystem.

9251 Pertec Interface
Emulates the industry standard Pertec interface for Tri-Density tape subsystems.

9252 STC Interface
Emulates the STC 1935/1953 Tri-Density or 2920 Dual Density tape subsystem.

2301 Horizontal Mount
The 9250 Tape Unit (TU) may be mounted horizontally in a suitable cabinet (back down, in a drawer type mount).

# SECTION 2 - INSTALLATION

## 2.1 GENERAL

The unit is shipped in a reuseable carton that will provide a self supporting stand for checking the unit on a table top, and allow the unit to be repackaged for subsequent shipping or storage.

SAFETY NOTICE

Personal safety is a vital part of any installation. Guard your own safety as well as the safety of those around you. Practice the following precautions:

1. Only qualified Customer Engineers should work on internal components of the Tape Unit.
2. Customer Engineers should not work alone with power applied to the unit. At least two people should be present whenever work is done with machine power on.
3. Remove watches, rings, bracelets, etc.
4. Power down and unplug the tape unit before moving it or removing any components. In some areas, dangerous voltages are present EVEN WHEN POWER IS OFF. If it is necessary to work near live power connectors or inside power supplies, use extreme caution.
5. Make sure all test equipment is grounded.
6. Maintain good housekeeping in the machine area and customer engineer's room. This can be a major factor in fire and accident prevention.

## 2.2 UNPACKING, INSPECTION, AND REPACKING

To Unpack The Tape Unit:

1. Check the outer carton for damage; if it appears that a damage claim should be filed, be sure to make photographs or sketches to support the claim.

CAUTION

IF THE TAPE UNIT HAS BEEN EXPOSED TO LOW TEMPERATURES LONG ENOUGH TO BECOME SUBSTANTIALLY COLDER THAN ROOM TEMPERATURE, ALLOW THE UNIT TO WARM UP BEFORE UNPACKING. THIS WILL MINIMIZE CONDENSATION OF ATMOSPHERIC MOISTURE ON AND INSIDE THE UNIT.

2. Cut the outer straps and lift off the corrugated outer cover.

3. Very carefully open the anti-static bag and fold down around outer edges of base.

4. Gripping the tubular shipping stand, carefully lift the unit out of its shipping base and place upright as shown in Figure 2-1.

5. The tape unit can now be powered up for a preinstallation performance check. See Subsection 2.6.

To Repack The Tape Unit:

1. Place the tape unit into container base, electrical component side up.

2. Pull anti-static bag up over tape unit and seal.

3. Replace shipping materials and corrugated cover.

4. Restrap shipping container. (Straps not provided.)

## 2.3 PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

The 9250 Series will operate to the performance parameters described in this manual when used within the operating environment defined below, unless otherwise stated in this manual. A non-operating unit will exhibit no damage when placed within the storage environment as defined below, and will meet the described operating parameters once placed within the operating environment for the minimum specified time.

TEMPERATURE AND HUMIDITY

Temperature and humidity limits for the tape media are the limiting factors in tape unit performance. Exclusive of media limits, the following specifications apply to the unit.

---Operating Temperature: 40 deg. F (5 deg. C) to 110 deg. F (43 deg. C), including temperature rise in cabinet, after the unit has been within the operating environment for 4 hours, and with a maximum rate of change of 0.5 deg. F per minute.

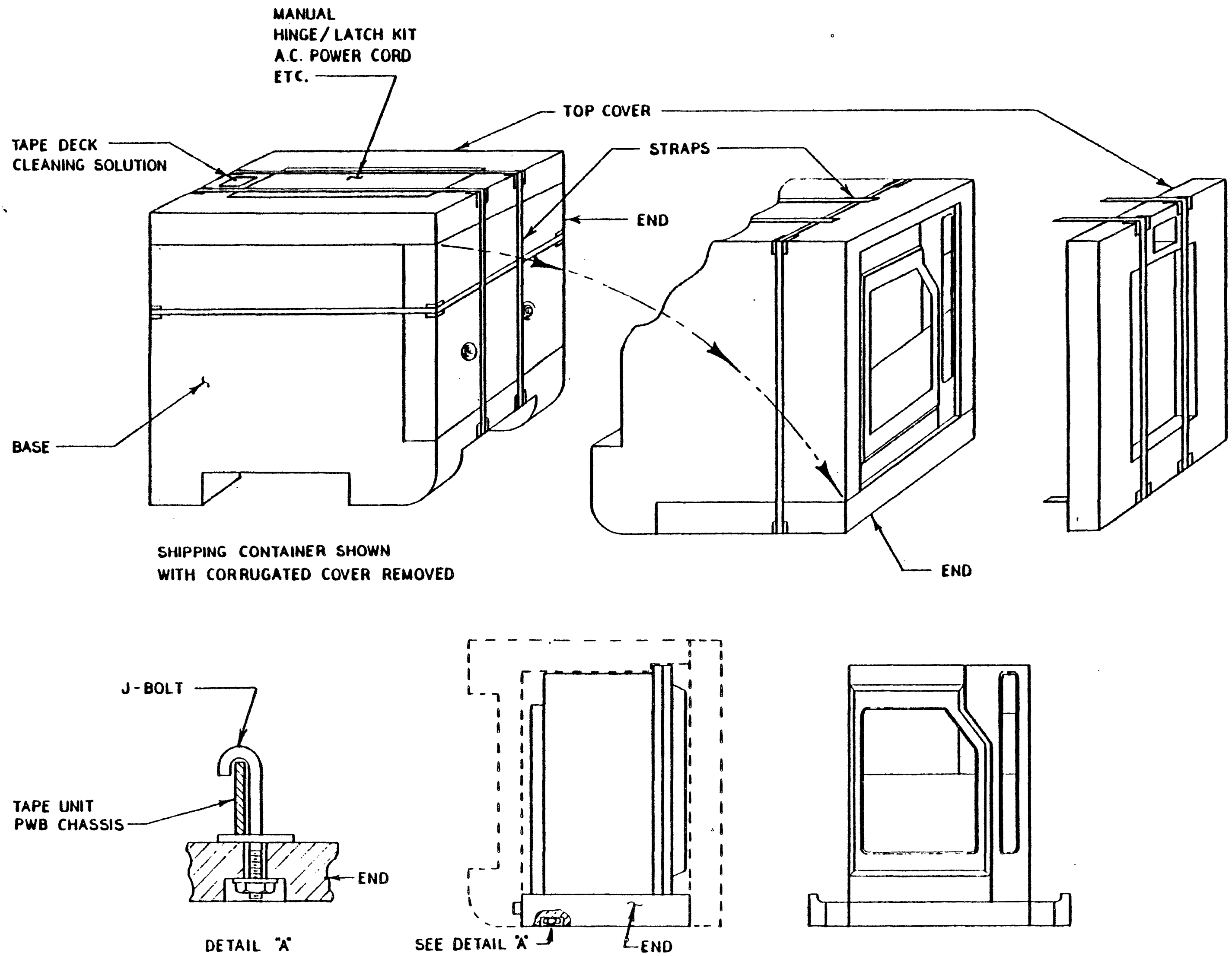



Figure 2-1. 9250 Shipping Container

---Storage Temperature: -50 deg. F (-45 deg. C) to 160 deg. F (70 deg. C), with a maximum rate of change of 60 deg. F per hour.

---Operating Relative Humidity: 30 to 80%, without condensation.

---Preferred Temperature/Relative Humidity Limits per ANSI Standard X3.40:

Temperature: 65 to 75 deg. F
Relative Humidity: 40 to 60%

---Altitude

Operating: Sea Level to 8,000 feet.
Storage: Sea Level to 50,000 feet.

## 2.4 PRE-INSTALLATION REQUIREMENTS

Before installation the Tape Unit should be examined for shipping damage. On-site power and environment should meet the criteria in this section.

## 2.5 POWER CONNECTION

PRIMARY POWER

The main AC receptacle provides for 3-wire service (black line hot, white line neutral, and green line safety ground).

Primary power circuits and components are protected by one fuse at the AC input. This fuse must be changed following the AC selection of either 115 VAC or 230 VAC.

The power supply is capable of operating at voltages and frequencies as follows:

Line Voltages - 115 and 230 VAC, plus or minus 10%
Phase - Single
Frequency - 47 to 63 Hz
Input Currents - 5.0 Amps (max) @ 115 VAC and 2.5 Amps (max) @ 230 VAC

OPERATIONAL VOLTAGE SELECTION (The unit will be wired for 115 VAC at the factory.)

Voltage is selected by using the following procedure:

1. Change power supply AC input fuse (next to line cord socket) for appropriate voltage, 4 amps for 230V and 8 amps for 115V

2. Remove the small (about an inch square) PC board from its slot in the AC line filter (next to the input fuse) and reinsert the PC board so the selected voltage can be read from the top.

3. Open hinged cover on top of power supply by unfastening the knurled screws. Find the black voltage selection jumper wire (in the upper left corner as you face the back of the power supply).

4. Pull the voltage selection jumper female connector off the vertical pin on the circuit board and push it over the pin labeled with the selected voltage.

The 9250 will operate within specifications for line voltage variations of plus or minus 10% and will operate within specifications to a brown-out level of 15%, except for rewind time.

Power Consumption (Nominal):

| | |
|---|---|
| Standby | 250 watts |
| Tape Loaded | 360 watts |
| Operating | 440 watts |
| Power Factor | .78 |

Grounding

The frame casting is connected to the safety ground (3rd wire) of the main AC input receptacle. AC ground (line neutral) is isolated from the equipment frame casting. DC ground (circuit ground) is also isolated from the frame casting. The AC ground is the return current path for the AC source input of the AC Power Module.

Circuit grounds are common with the ground side of the output of the DC power supply. Reference to other equipment (Host and attached TUs) is by the ground wires in the signal interface cables.

## 2.6 INITIAL CHECKOUT

Tape unit controls are described in Section 3. Before installing the tape unit do the following:

1. Connect power cord.

2. Clean tape path as directed in paragraph 3.9.

3. Mount a test tape.

4. Power up the tape unit.

5. Load the tape by following the procedure in paragraph 3.4.

6. If using Pertec interface verify conditions in Pertec configuration check list at the end of this section.

7. Operate all Operator Control Panel (OCP) controls according to the function descriptions in paragraph 3.3 and make sure tape unit and appropriate indicator lights operate as described.

8. Set door override by entering Diagnostic Keyboard (DKB) Cmd 04.

9. Activate desired tape motion commands on the DKB (see Section 7) and check to see if tape motion and tape tracking are satisfactory---commands 23 through 28 may be used for these checks.

10. Push RESET on the OCP, power down and disconnect tape unit.

## 2.7 RACK MOUNTING

The 9250 series can be mounted in a standard 19-inch RETMA cabinet using two hinges on the right mounting rail and a latch on the opposite rail. All components are mounted on the main casting.

WARNING

THE TAPE UNIT MUST BE MOUNTED IN A SECURELY ANCHORED FRAME OR CABINET BEFORE THE HINGED DECKPLATE IS SWUNG OUT. SWINGING OUT THE DECKPLATE WILL ALTER THE TAPE UNIT'S CENTER OF GRAVITY AND MAY CAUSE AN UNSECURED UNIT TO TIP OVER.

See Figures 2-2 and 2-3.

To install the tape unit in a cabinet, mount two hinge assemblies to the mounting rail before installing the deckplate assembly. The vacuum column door assembly may be removed from the tape unit for ease of deckplate installation. See Figures 2-4 and 2-5 for details of hinge and latch mounting locations. The figures show hinge mounts for three typical spacings: 2.50, 3.00, and 3.50 inches from hinge mounting surface on the deckplate to the mounting rail surface. Holes coded "C" on main view of figure 2-2 are mounting hole locations.

## 2.8 INTERFACE CONNECTIONS

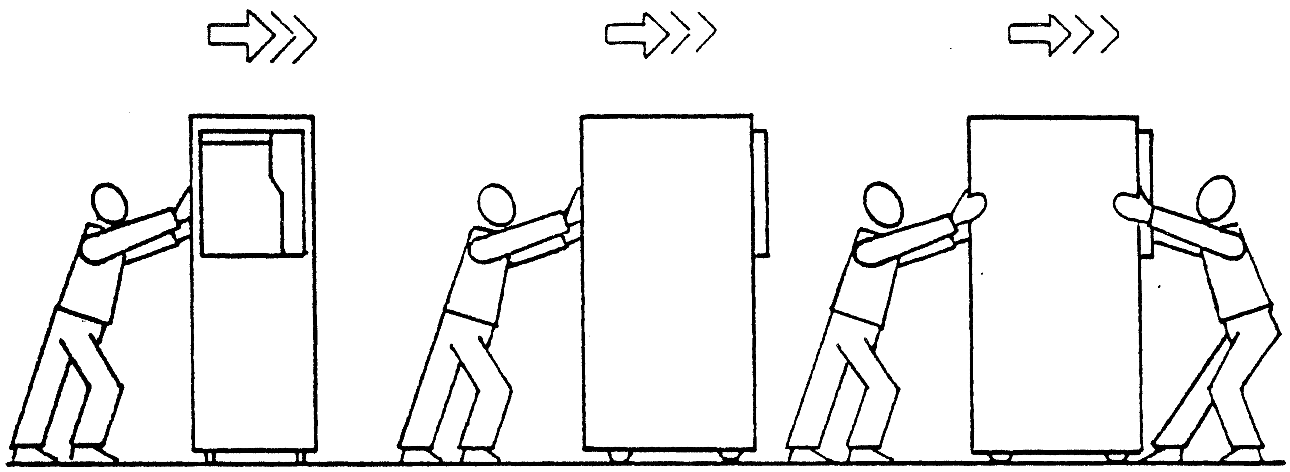
I/O Cables, Host Interface

The host I/O cables are applicable to the master unit only (unit with Interface Feature installed) and depend upon the type of interface feature installed.

Telex Interface Feature

Three 50-conductor I/O cables are required to attach the 9253 to the host. The mating connector TPN A55X01610-01 (3M 3425-6050, or equivalent) can be ordered separately. Three are required, maximum length 20 feet.

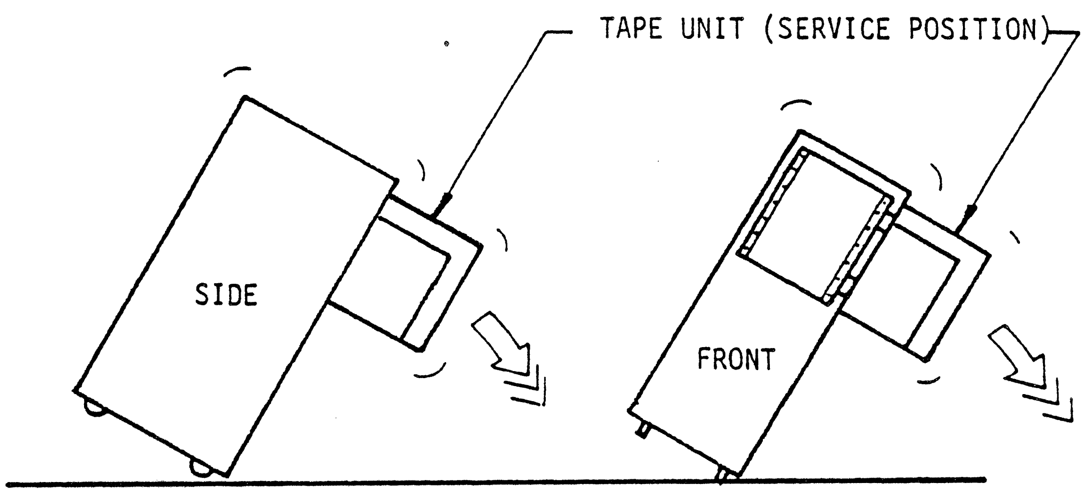
For those installations requiring connector plug-in compatibility with a host configured for a Telex 6850 Formatter, one connector-to-connector kit (includes three cables) is required (TPN A90X21028-01) and should be ordered separately. The mating connector is TPN A55X01445-01 (Amp P/N 552390-1, or equivalent). Use strain relief TPN A55X01450-01 (Amp P/N 2-552008-1, or equivalent).



NOT RECOMMENDED NOT RECOMMENDED RECOMMENDED

TAPE UNIT/CABINET TRANSIT

RECOMMENDATIONS




TAPE UNIT/CABINET
SERVICE WARNINGS

WARNING:

WHEN TAPE UNIT IS IN SERVICE POSITION, ENSURE THAT SUFFICIENT CABINET STABILITY IS MAINTAINED TO MEET UL/CSA REQUIREMENTS. (REF UL478 38.2, CSA C22.2 154) SEVERAL FACTORS SUCH AS CABINET DESIGN, TAPE UNIT LOCATION, AND COUNTERBALANCES WILL AFFECT STABILITY.

FIGURE 2-2 CABINET STABILITY REQUIREMENTS

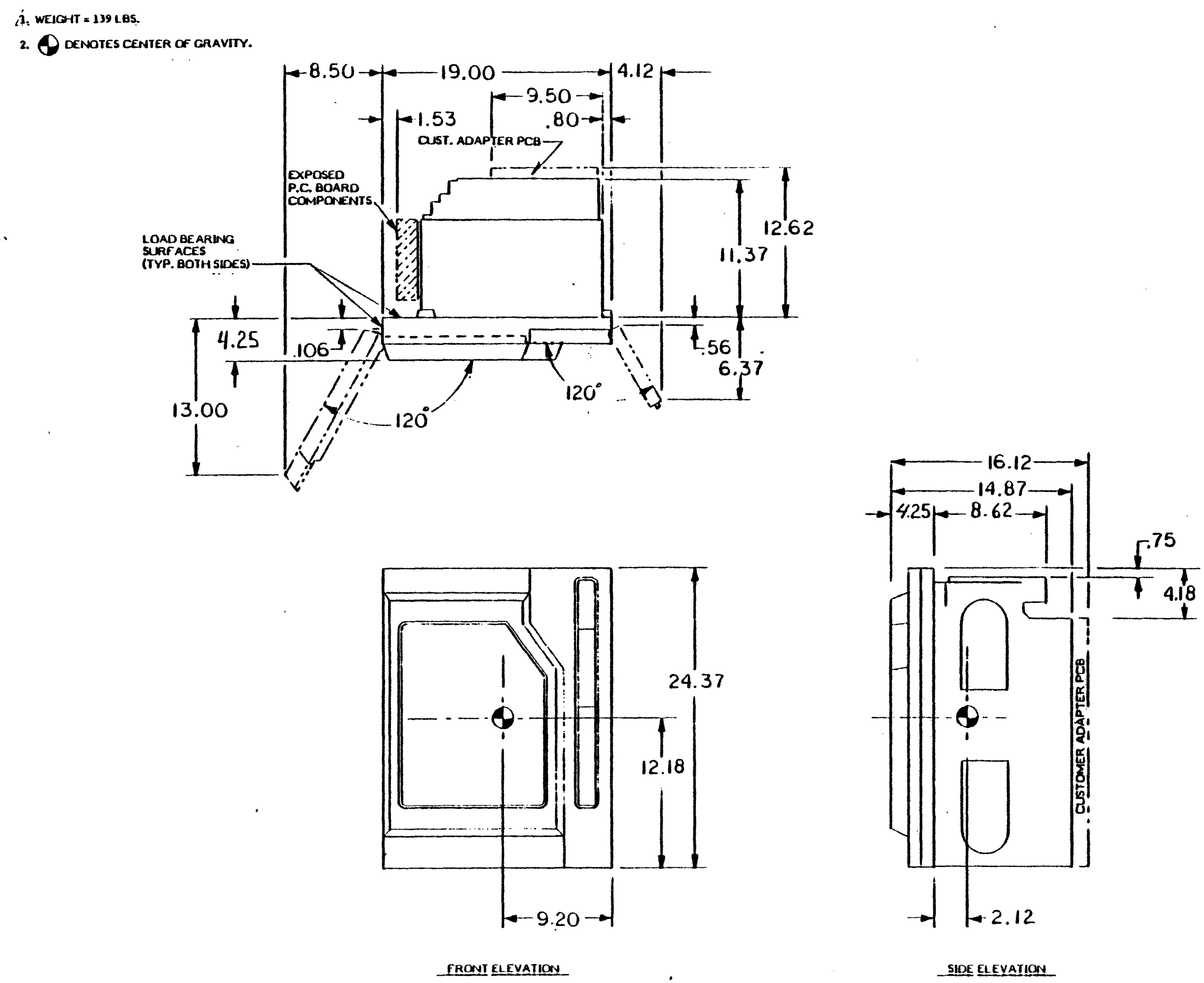



Figure 2-3. 9250 Outline Dimensions

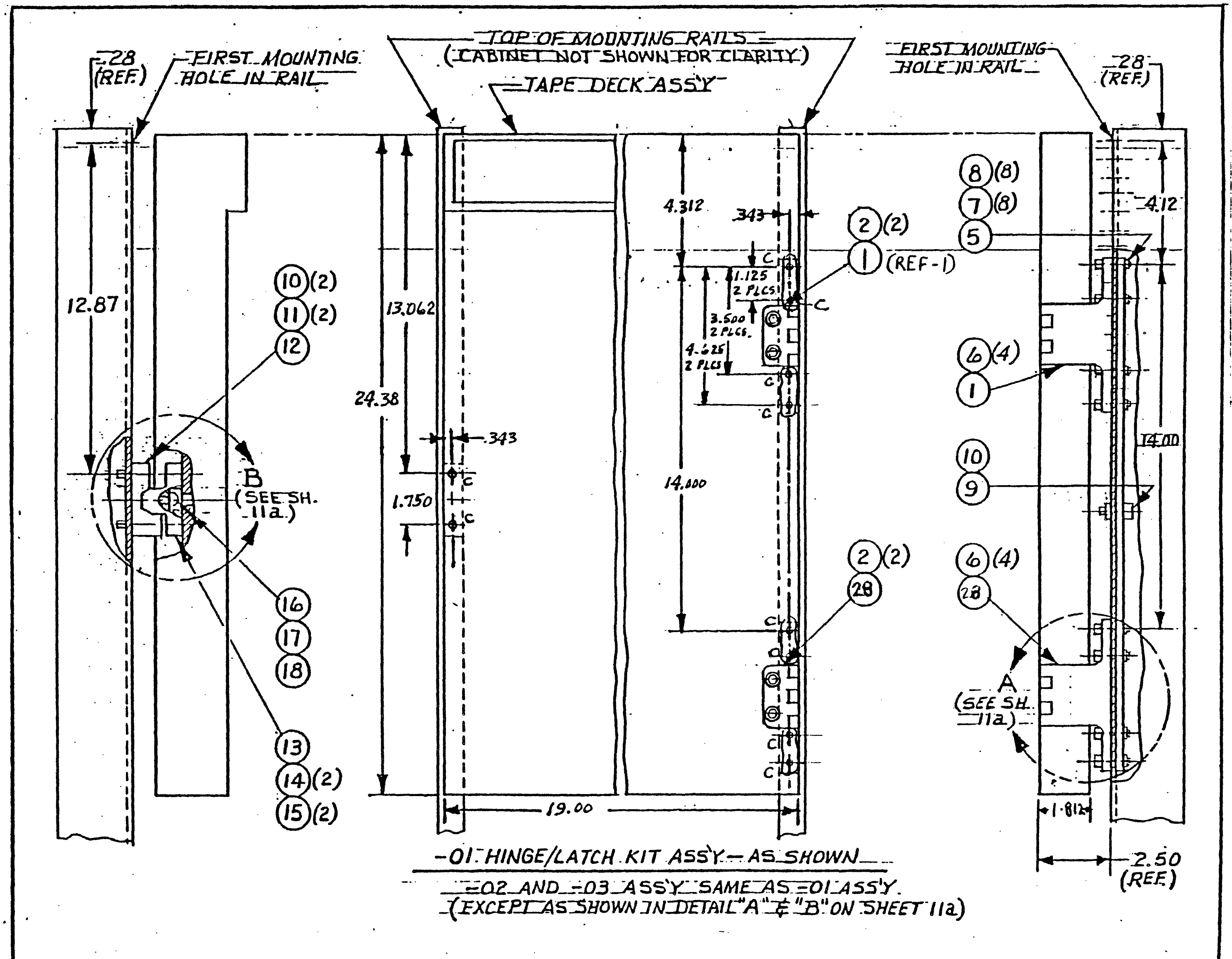



Figure 2-4. Mounting Hardware Orientation, 1 of 2

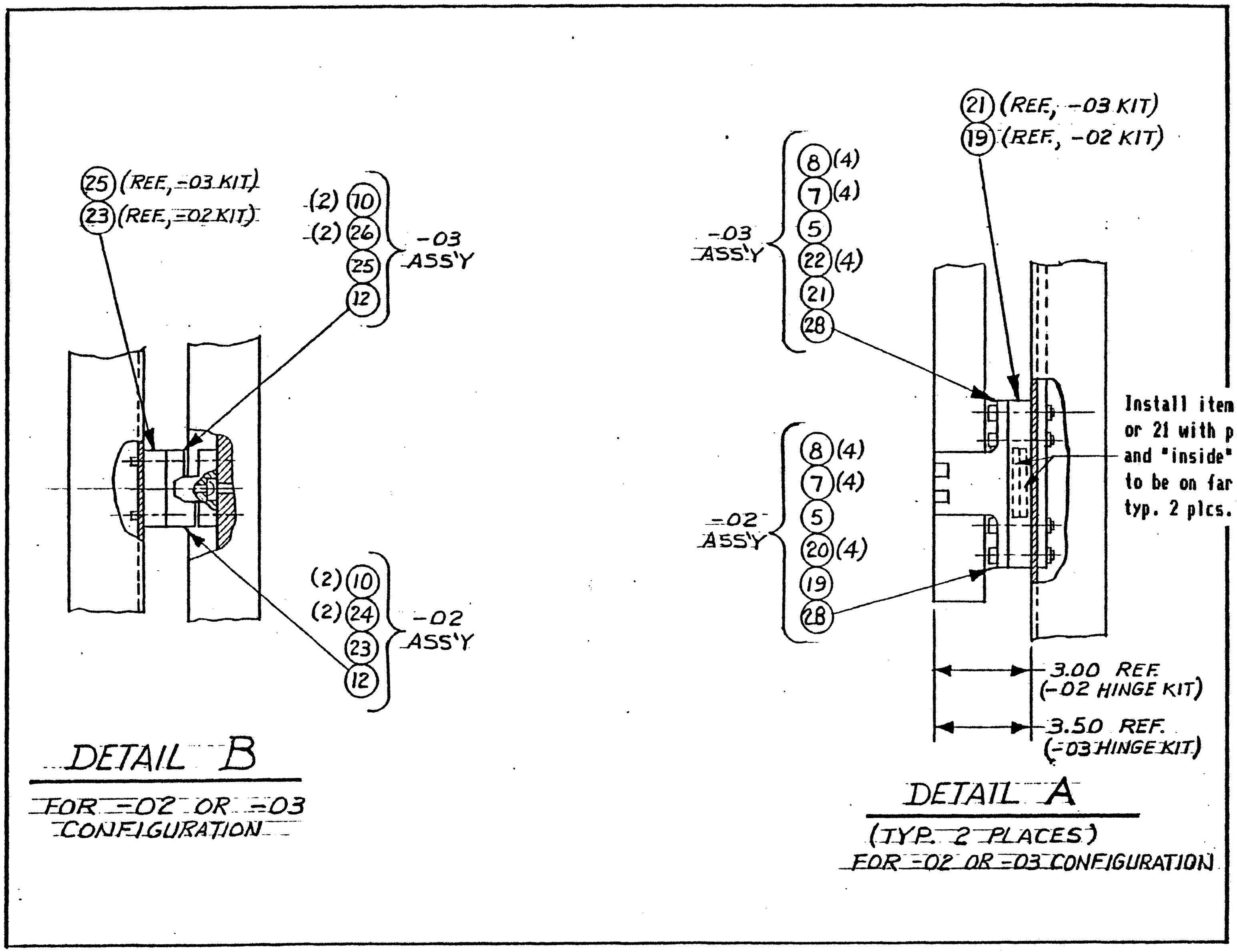



Figure 2-4. Mounting Hardware Orientation, 2 of 2

Kit: Hinge/Latch Set
90A21026-01 (2.50-inch hinge with no spacers)
90A21026-02 (2.50-inch hinge with .50-inch spacer)
90A21026-03 (2.50-inch hinge with with 1.00-inch spacer)

| Ref. No. | Nomenclature | Part No. | Quantity -01 | -02 | -03 |
|---|---|---|---|---|---|
| 1 | Hinge Assy., Deckplate Mtg. | 91B22935-01 | 1 | 1 | 1 |
| 2 | Hinge, Deckplate mtg. | A73C20139-02 | 1 | 1 | 1 |
| 5 | Bar, Deckplate Support | A78B20688-01 | 1 | 1 | 1 |
| 6 | Screw, Soc. Hd. Cap, #10-32 x 1.00 Lg. | A61X00175-01 | 8 | - | - |
| 7 | Washer, Flat, #10 | A63X00425-01 | 8 | 8 | 8 |
| 8 | Nut, Kep, #10-32 | A62X00032-01 | 8 | 8 | 8 |
| 9 | Screw, Soc. Hd. Cap, #10-32 x .50 Lg. | A61X00180-01 | 1 | 1 | 1 |
| 10 | Lockwasher, Split, #10 | A63X00086-01 | 3 | 3 | 3 |
| 11 | Screw, Soc. Hd. Cap, #10-32 x .62 Lg. | A61X00173-01 | 2 | - | - |
| 12 | Latch, Frame to Transport | A78B20679-01 | 1 | 1 | 1 |
| 13 | Latch, Transport to Frame | A78B20678-01 | 1 | 1 | 1 |
| 14 | Screw, Soc. Hd. Cap, #8-32 x .62 Lg. | A61X00160-01 | 2 | 2 | 2 |
| 15 | Lockwasher, Split, #8 | A63X00085-01 | 2 | 2 | 2 |
| 16 | Screw, Pan Hd., #1/4-20 x 1.50 Lg. | A61X02318-01 | 1 | 1 | 1 |
| 17 | Washer, Flat, .25 I.D. x .50 O.D. | A63X00112-01 | 1 | 1 | 1 |
| 18 | Lockwasher, Ext. Tooth, #1/4 | A63X00162-01 | 1 | 1 | 1 |
| 19 | Spacer, Hinge/Deckplate - 1/2" Spacing | A78C20703-01 | - | 2 | - |
| 20 | Screw, Soc. Hd. Cap, #10-32 x 1.50 Lg. | A61X02062-01 | - | 8 | - |
| 21 | Spacer, Hinge/Deckplate - 1" Spacing | A78C20703-02 | - | - | 2 |
| 22 | Screw, Soc. Hd. Cap, #10-32 x 2.00 Lg. | A61X01251-01 | - | - | 8 |
| 23 | Spacer, Latch/Deckplate - 1/2" Spacing | A78C20704-01 | - | 2 | - |
| 24 | Screw, Soc. Hd. Cap, #10-32 x 1.12 Lg. | A61X01240-01 | - | 2 | - |
| 25 | Spacer, Latch/Deckplate - 1" Spacing | A78C20704-02 | - | - | 1 |
| 26 | Screw, Soc. Hd. Cap, #10-32 x 1.75 Lg. | A61X02349-01 | - | - | 2 |
| 27 | Kit, Hinge/Latch Set | 90A21026 | REF | REF | REF |
| 28 | Hinge Assembly, Dkplte. Mtg. | 91B22935-02 | 1 | 1 | 1 |

Figure 2-5. Hinge/Latch Set

I/O Cables, TU Interface, Single Tape Unit

One 50-conductor twisted pair is used to connect add-on tape units to the master. This TU cable is internal for the 1x1 master unit. (See Section 4 for pin assignments.)

## 2.9 MULTIPLE TRANSPORT OPERATION

Add-On Tape Units

The Add-On (slave) Tape Units are the same as a master unit less the formatter. Each unit is stand-alone and individually featured. Up to three add-ons may be attached to the formatter in the master unit, for a total of four drives per formatter. Formatters are radially connected to the Host.

For each add-on TU, order one 28 gauge wire cable TPN A91C22840-XX, (XX specifies cable length in feet), including the long retainer clips for strain relief. The total cable length is limited to 50 feet from the formatter to the last TU. The mating connector on the cable is TPN A55X01610-01 (3M 3425-6050, or equivalent) including strain relief. The mating connector on the PWBs is TPN A55X01609-01 (3M 3433-5302, or equivalent), including strain relief.

When add-on tape units are attached, the terminator must be moved to the last tape unit in the daisy chain. The terminator assembly, TPN 91C72377-01, is supplied with the formatter.

## 2.10 Tape Drive Configuration Check List For Pertec Interface

| | | | |
|---|---|---|---|
| AC Power | | 110v | |
| Manual Density Select | | | |
| | 9251 | on | |
| | 9252 | on | |
| | 9253 | off | |
| Seismic Operation | | off | |
| Software Density Select | | | |
| | 9251 | off | |
| | 9252 | off | |
| | 9253 | off | |
| Formatter Address | 9251 | 0 | |
| Data Burst Rate | 9251 | 400 kbs write<br>334 kbs read | DS and RS jumpers set at 2 and DH jumper at 0 |

Command 85 Feature 9251 set to 08, Kennedy and check parity

Feature 2330 set to 00, CDC 92185 and check parity

Feature 2331 set to 08, Kennedy and check parity

Bits 3, 4, and 5 in sense byte 5 can be set to configure the interface for the particular controller in use, except for FC 2330.

bit 3 set will disable reporting correctable errors in GCR.
bit 4 set will enable Kennedy 9400 interface
bit 5 set will disable checking parity on the interface.

# SECTION 3---OPERATION

## 3.0 GENERAL

This section provides specific instructions for tape handling, operator control functions, and cleaning and maintenance procedures to be performed by the operator.

## 3.1 TAPE MARKERS

Magnetic tape must have some leader at the beginning of the reel to allow threading of the tape unit. The manufacturer places two reflective markers on the tape, which the TU senses as the beginning and end of the usable portion of the tape. These markers are small strips of aluminized plastic, which are affixed to the mylar side of the tape. See Figure 3-1.

1. Beginning-of-Tape marker (BOT) should be approximately 16 feet from the end of the tape. It must be on the mylar side of the tape and parallel to the edge of the tape nearest the operator when the reel is mounted. The marker must be within 1/32 inch of the edge but must not overlap it.

2. End-of-Tape marker (EOT) is between 25 and 30 feet from the hub end of the tape. It must be parallel to the edge of the tape away from the operator. The marker must be within 1/32 inch of the edge but must not overlap it.

## 3.2 FILE PROTECTION

Because a write operation erases any previous information on the tape, a file protection device is provided to prevent unintentional erasure. A plastic write-enable ring fits into a circular groove on the tape reel. Without the ring, only reading is possible; the tape file is protected from unintentional erasure. The File Protect indicator on the Operator Control Panel (OCP) lights to indicate this condition.

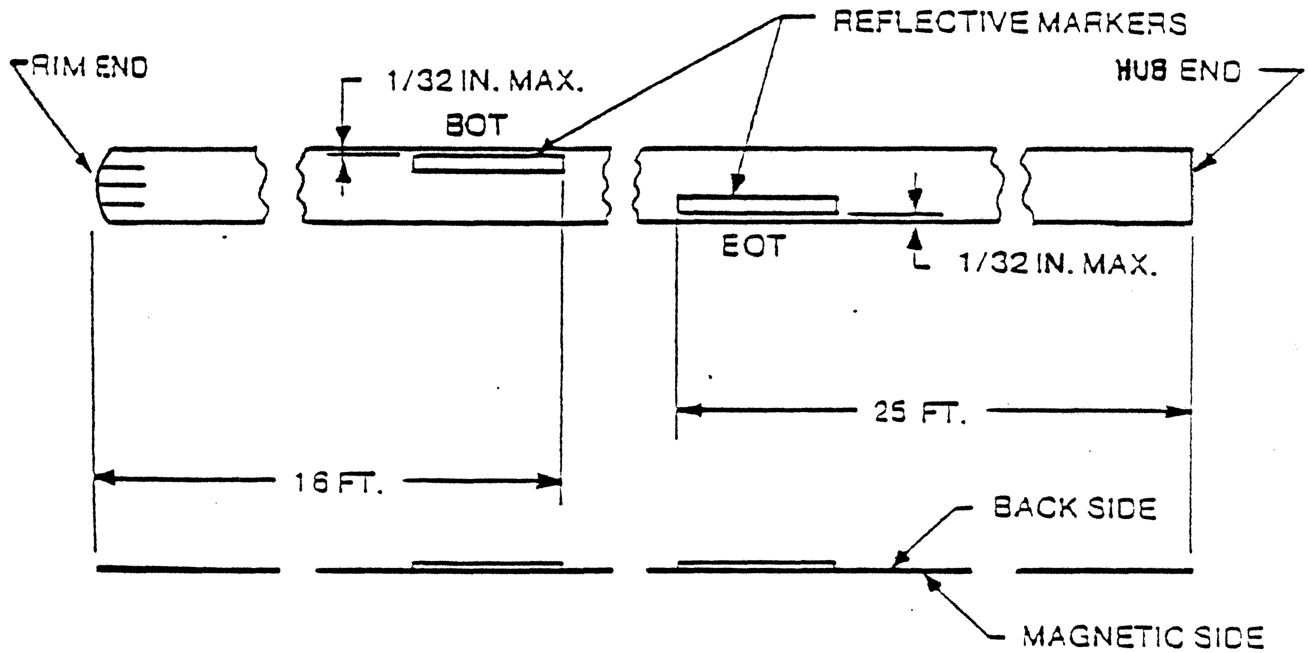



Figure 3-1. ANSI Standard Tape Markers

## 3.3 CONTROLS AND INDICATORS

---Operator Control Panel (OCP)

The OCP incorporates membrane switches, LED indicators, and a seven-segment LED display.

| NAME | TYPE | FUNCTION |
|---|---|---|
| POWER | LED (red) | Illuminated when power is ON. |
| STATUS | XXY 7-Segment, 3-Digit Display | A two-digit code indicating the general status of the subsystem (XX), with the third digit (Y) indicating the device address. |
| DENSITY | 3 LED's (yellow) | One indicator for each density - 6250, 1600, 800. The one illuminated is the current selection. Note: Some features alter normal operation. Refer to the respective feature. |
| | Switch | Pressing the switch selects the next density. |
| SELECT | LED (yellow) | Illuminated when the tape unit has been selected by the formatter. |
| ON-LINE | LED (green) | Illuminated when the tape unit is under remote control for On-Line operation. (Ready) |
| LOAD POINT | LED (yellow) | ON when the tape is stopped in response to sensing the BOT marker. |
| LOAD CHECK | LED (red) | Indicates a thread failure (after the one automatic retry) or the failure of a mid-tape load operation. |
| FILE PROTECT | LED (red) | Indicates that the mounted tape is protected from erasing or writing. Note: This indicator will be ON before a tape is mounted. |

| | | |
|---|---|---|
| UNLOAD | Switch | If loaded and Off-Line, the tape is rewound to BOT and spooled onto the File Reel by depressing this switch. |
| RESET | Switch | If tape is loaded and On-Line, depressing will set Off-Line mode to enable manual operation. If in high speed rewind, depressing will change the rewind speed to normal speed and then stop. If in normal speed, depressing will stop tape. Depressing will reset a LOAD CHECK condition. |
| LOAD REWIND | Switch | If the tape unit is not loaded, one depression will cause the File Reel to back-wrap, tape to move forward to thread, then dump into the vacuum columns, position to BOT, and stop. One press of this switch also initiates a mid-tape load. If the switch is depressed twice within one second, tape will load as described above except the back-wrap operation will be inhibited. This mode is used for autothread of tape on a mini reel.<br><br>If tape is loaded and Off-Line, depressing will initiate a rewind of tape and stop at BOT. |
| ON-LINE | Switch | This will set the tape unit to remote control for On-Line operation. Tape must be loaded and door must be closed to set On-Line status. |

---Diagnostic Keyboard (DKB)

One 12-Key panel (located behind the reel door) is used to invoke various functions and features for normal operation, and to control operation for diagnostic purposes. A series of access level sequences is incorporated as a guard against inadvertent operation.

DKB enable and control sequences needed to perform operations described in this section are given in the instructions for those particular operations. Diagnostic control sequences are covered in Section 7.

---Power On/Off

This switch is used to turn main power ON or OFF to the AC Power Module.

### 3.4 LOADING TAPE ON FULL SIZE REELS

If write capability is required, insert a write enable ring into the groove in the back of the file reel. File reels must conform to ANSI standard X3.40

NOTE: Remove the tape collar (manual or autoload). The 9250 accepts only plain reels.

1. Open the reel door and press the POWER ON switch if the unit is off; make certain the POWER ON indicator lights. Press the RESET switch.

2. Mount the file reel on the hub with the write enable groove facing the tape unit. Engage the reel latch. Close the reel door.

3. Press the LOAD REWIND switch. The tape unit will load the tape and stop with the BOT reflective marker at load point. The LOAD POINT indicator will light. FILE PROTECT will then indicate the presence or absence of a write enable ring.

   NOTE: If this load follows a power on sequence or an unusual operation, a column and capstan self-calibrate sequence will be performed prior to positioning of the tape to load point.

If the load operation is unsuccessful the drive will attempt to load a second time, unless the failure was due to insufficient tape leader. If the second attempt fails, the loading sequence stops and the LOAD CHECK indicator lights. (Insufficient leader will cause the drive to stop when the tape pulls off the machine reel hub before the marker reaches load point.)
If a load error should occur see Section 7.11.

LOADING TAPE ON MINI REELS

Loading tape from reels smaller than 10 1/2 inches in diameter requires operator assistance. After mounting the reel and engaging the reel latch, use the following procedure:

1. Rotate the reel and place about one inch of tape into the entrance of the thread channel. Close the reel door.

2. Press the LOAD REWIND switch twice within one second. The tape unit will load the tape and stop with the BOT reflective marker at load point. The LOAD POINT indicator will light. FILE PROTECT will then indicate the presence or absence of a write enable ring.

   (If the mini-reel load attempt fails, the LOAD CHECK indicator will light and the operator assisted load must be repeated.)

MID-TAPE LOAD

If power is lost while the tape unit is running, operator assistance will be needed to recover. When power is restored, use the following procedure:

1. Press the POWER ON switch.

2. Open the reel door and hand tension the slack tape into the thread path, shut door, press RESET then LOAD REWIND switch. (The columns will load, complete a column and capstan autocal and move tape forward.)

3. When the load sequence halts, press LOAD REWIND again to return to load point. Then press the ON LINE pushbutton to return to on-line status.

ON-LINE OPERATION

The On-Line (Ready) mode is initiated by pressing the ON LINE switch at any time after initiating the load sequence with the LOAD REWIND pushbutton. The tape unit will enter on-line status after completing the load sequence.

When the tape unit enters on-line status, the ON LINE indicator lights. This signals the operator that the tape unit is ready to execute commands when selected by the formatter. When the tape unit is selected to execute, the SELECT indicator will light indicating that the formatter is addressing the tape unit.

The Tape Unit write density is automatically set by the Formatter in response to a two bit code sent by the Host. The DENSITY switch is disabled. Density will be displayed by the DENSITY indicator.

## 3.5 UNLOADING TAPE

1. Press the UNLOAD switch. Tape will be rewound to beginning of tape, the columns unloaded and the tape spooled onto the file reel.

2. Disengage the file reel latch and remove the file reel. Replace the protective collar on the file reel.

## 3.6 MANUAL WRITE DENSITY CONTROL

By transferring a special code the Host can relinquish density control, in which case the density is established from the OCP.

WRITE DENSITY PROTOCOLS AND OPTIONS

The following comments apply when writing from load point. The density cannot be changed once the tape leaves load point.

IBM Interface--The host controls the write density.

TELEX Interface--The host controls write density except when the host issues the "one one" density code thus relinquishing control to the TU front panel.

STC and PERTEC Interfaces--The TU controls (via front panel density selection) the write density, except when the "Software Select" option is enabled through the diagnostic keyboard.

Manual (Write) Density Select option--This option causes the density selected by the operator to be displayed when the TU is Online at load point. The default density indication is 1600 BPI when the TU is online at load point. The default density is indicated if the manual density option is not active and the TU is online at load point. The operator may make a density selection only when the TU is offline.

Software Density Select option--This option allows the front panel to relinquish write density control to the host. Appropriate for STC and Pertec interfaces only.

The following procedure is used to set write density manually.

1. Follow the tape loading procedure to position tape at LOAD POINT.

2. Set the desired density on the OCP by using the DENSITY switch.

3. Set Manual Density Select with CMD 02.

4. Push the ON-LINE switch.

5. Transmit a 1, 1 code (DS0, DS1 bits) from the Host to the Formatter.

The Tape Unit will now perform write operations at the density set on the OCP.

NOTE: Density can be changed only while the tape is at load point.

## 3.7 FORCED READ DENSITY

Normally the read density is established upon reading the ID Burst when the tape leaves Load Point. If for some reason, such as a damaged tape, the tape unit cannot identify the density in which a tape was written the forced read density feature can be invoked via the Diagnostic Keyboard (DKB). Forced read density will be deactivated automatically once the tape has left Load point.

### READ DENSITY PROTOCOL AND OPTION

For normal operation on any interface the density in a read operation is determined by the tape subsystem by reading the ID Burst.

Force Read Option--When this option is enabled the tape subsystem reads the tape in the density selected by the operator via the front panel. The ID Burst is ignored. This option is automatically disabled when the tape leaves Load Point.

Use the following procedure to activate Forced Read Density:

1. Execute the Forced Read enable command on the DKB: CMD 06.

2. With the TU at Load Point and Off-Line, set the read density using the DENSITY switch on the OCP. The DENSITY indicator will show the density set.

With forced read density enabled, the TU will activate the forced read density status bit indicating to the formatter that read operations will be forced to the density as defined by the density status bits. CMD 07 resets the forced read option. See Section 7 for instructions on DKB operation.

## 3.8 ADDRESS SELECT

Tape units are attached by a daisy chain cable to the formatter, and the device address is controlled in each TU. Valid addresses are 0, 1, 2, and 3. Any TU can be set to any address. In normal operation the three digit STATUS display on the OCP indicates the device address: letter A in the first digit position, blank in the second, and the TU address in the third. The unit is shipped with the address set at zero. To change the address enter the address execute command, CMD 01, on the DKB.

CAUTION

DO NOT ASSIGN THE SAME ADDRESS TO MORE THAN ONE TU ATTACHED TO THE SAME FORMATTER.

## 3.9 OPERATOR MAINTENANCE

Operator maintenance is limited to cleaning the tape path and reel hubs.

CLEANING THE TAPE PATH

The tape path must be kept free of oxide, dust, and foreign matter that could cause data dropouts or excessive wear of tape path components. The tape path should be cleaned once every eight hour shift. Use only cleaning agents specified below, since substitute cleaners may damage tape path components.

1. Unload the tape and remove the file reel. Power off.

2. Open the vacuum column door.

3. Moisten a lint-free cloth pledget, Texwipe TX 325 or equivalent, with TELEX Tape Transport Cleaner, 98C01723-01 and wipe clean all the following tape path components:

   ---Vacuum column glass covers (upper and lower)
   ---Vacuum columns (upper and lower)
   ---Threading path

---Capstan wheel
---Tape Lifter

4. Clean the tape cleaner, magnetic head, and corners at the guides and bearings with a foam swab TPN 98X01834-01 or equivalent, moistened with tape transport cleaner.

5. Close the vacuum column door.

6. Clean the reel hubs and surrounding deck plate with a damp cloth. Do not use Tape Transport Cleaner or other solvents on the reel flanges or the reel and vacuum column doors.

7. Allow about two minutes for the tape transport cleaner to evaporate before loading a tape.

Once a week, or more often if the environment is unusually dirty, clean the rubber ring on the file reel hub. Use a foam swab sparingly moistened with Telex Tape Transport Cleaner. Avoid spilling cleaner inside the hub.

CAUTION

The tape unit door interlock is designed to stop reel motion when the reel door is opened. This interlock can be defeated by either the plastic door interlock override tool (Telex PN 66X01797-01) provided by Telex for service purposes or by the override code entered on the diagnostic keyboard. The operator or service person should be aware of the hazard involved in coming in contact with moving parts if the reel door interlock is defeated.

# SECTION 4 - THEORY OF OPERATION

## 4.1 TAPE SUBSYSTEM

The 9250 Tape Subsystem consists of the Tape Unit (TU) itself and, as an option, an embedded Formatter. This section describes the main functions and relationships of major areas of the tape unit and the formatter. See Figure 4-1.

This discussion assumes a single, vertically mounted tape drive with embedded formatter and Telex interface.

## 4.2 TAPE UNIT

Each tape unit contains nonvolatile RAM memory to retain key, up-to-the-minute information in case of power failure. Information includes calibration constants (read/write), enable/disable of embedded features, pack count information for rewind control, and other control data needed to preserve operational integrity and tape control following a loss of power. (Read or write data is not retained in nonvolatile RAM).

Information retained can be displayed by using the Diagnostic Keyboard (DKB). See Section 7 for details on use of the DKB.

Multiple microprocessors (MPUs) are used in the tape unit to control and monitor tape operations, and to execute the layered diagnostics to identify failing Field Replaceable Units (FRUs).

Specifically the MPUs:

- Control the TU interface to the formatter
- Control reel servos
- Control ramp to the capstan
- Control off-line operations
- Monitor power fail to provide a controlled shut-down and start-up
- AutoCal routines to automatically:
  calibrate the column sensors
  optimize the write currents to the head
  establish the read gain
- Provide diagnostic links within the TU and to and from the formatter
- Execute diagnostics for fault identification

The Tape Unit is discussed in terms of five major areas:

1. Operator/Tape Unit Interface, which consists of the Operator Control Panel (OCP) and the Diagnostic Keyboard (DKB)

2. Tape Handling (electromechanical) consisting of various motors, pneumatic pumps, sensors, and associated electronics to control tape motion.

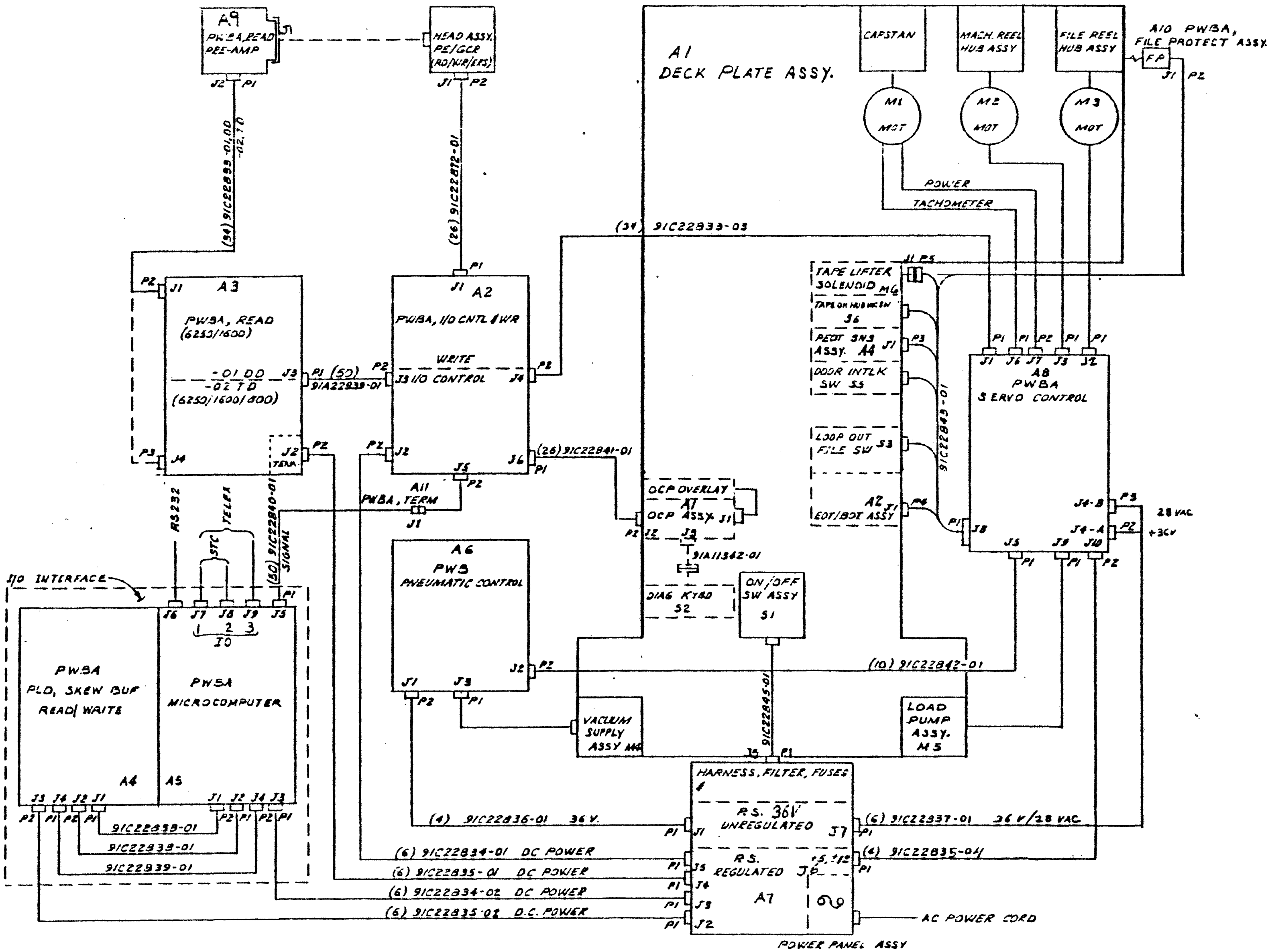



Figure 4-1. Subsystem Block Diagram

3. Data Electronics, including a. Write Circuits, which receive formatted data from the formatter, apply write compensation, and provide write current to the head, and b. Read Circuits, which shape, filter, and digitize the raw signal from the read head; encoded data is then transferred from the tape unit to the formatter.

4. Control Network, consisting of three interconnected microprocessors that sense and control communications with the formatter, operation of the tape handling system, and the write and read electronics. Two of the microprocessors in the control network are for the specific functions of capstan control and reel control. The third microprocessor maintains overall control of the tape unit and the interface with the formatter.

5. Power Supply, which supplies regulated and unregulated power to the tape unit and embedded formatter. The AC input filter and provisions for 115/230 VAC selection are part of this module.

### 4.2.1 OPERATOR/TAPE UNIT INTERFACE

The OCP and DKB are discussed in Section 3. Specific diagnostic use of the DKB is discussed in Section 7.

### 4.2.2 TAPE HANDLING

PNEUMATIC SYSTEM

The tape path requires positive air flow at several points to perform the AutoLoad and thread functions. It also needs vacuum on the machine reel hub during loading and on the columns during normal operation. The pneumatic system provides both air pressure and vacuum for these requirements by means of two motor-blower assemblies: 1. The load pump, which provides vacuum and pressure for tape loading operations and 2. The vacuum blower, a variable speed, servo driven motor-pump assembly that provides constant column vacuum during tape drive operation. See Figure 4-2.

LOAD PUMP

During the initial tape loading sequence the load pump 1. provides positive air pressure through file reel jets to keep the tape tightly wrapped on the reel, 2. directs air over the tape at the entrance of the thread channel to guide the tape through the channel to the machine reel, 3. produces vacuum at the machine reel hub to secure the end of the tape and allow it to be wrapped on the machine reel hub.

VACUUM PUMP

After the tape is wrapped around the machine reel hub, the load pump is disengaged and the vacuum pump is engaged to produce a vacuum in the column plenum. (The control input to the column vacuum system is a Vacuum-On (VAC-ON) signal from the reel control microprocessor). The resulting drop in pressure in the column plenum produces a pressure drop in the upper and lower columns, which in turn forms the tape loops in each column.

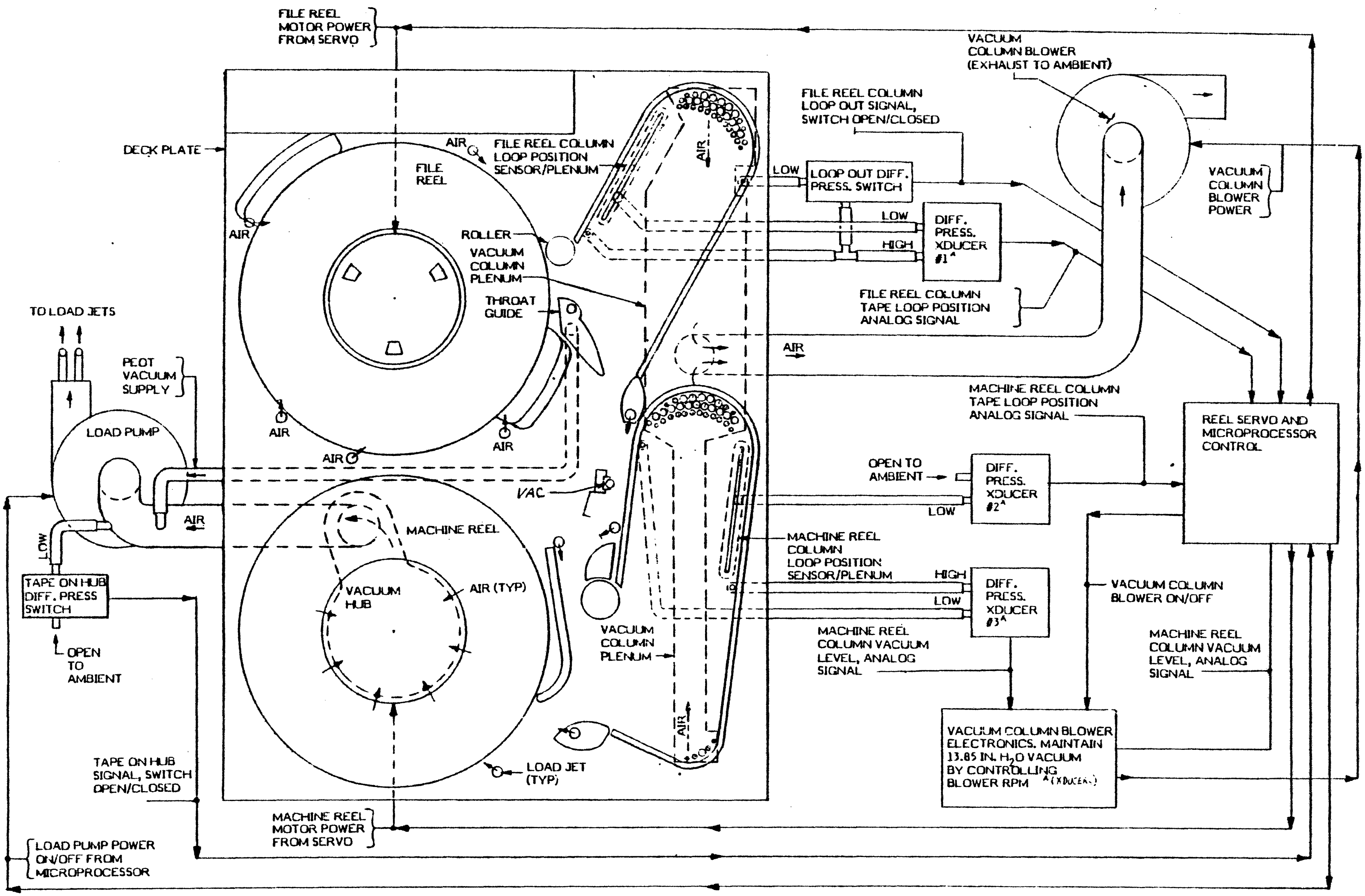



Figure 4-2. Pneumatic System Block Diagram

Two ports in the lower tape column connect to a differential pressure transducer inside the tape unit. These ports are positioned at the extremes of the normal tape loop position. Tape motion beyond these limits constitutes tape bottom or tape loop-out.

When a tape loop has been formed in the usable region of the column, there will be a pressure difference across the tape and hence between the two ports. An analog signal representing the pressure difference between these two ports is passed to the vacuum pump servo electronics.

The vacuum servo electronics, located on the Pneumatic PWB, control the speed of the vacuum pump to maintain a pressure difference of 13.85 inches of water across the ports. This analog signal is also available to the reel servo system.

The column vacuum system acts in the tape dump sequence described below. Tape Dump refers to the operation of placing tape in the column and using the partial vacuum to create a tape loop.

TAPE DUMP SEQUENCE

1. Start vacuum pump
2. Reel system drops tape into the column
3. When a tape loop is formed (columns loaded) the vacuum servo enters a mode to maintain a pressure difference across the tape loop
4. The vacuum pump is shut off when the VAC-ON signal is negated, if the differential pressure transducer indicates loss of pressure difference, or if the lower loop-out sensor indicates loss of vacuum.

CAPSTAN DRIVE SYSTEM

The purpose of the capstan drive is to control tape motion across the read-write-erase head. This control is effective in both directions.

The capstan motor assembly consists of a DC motor, a dual channel digital encoder, and the capstan wheel itself. The encoder outputs are made available to the capstan control microprocessor on the servo PWB for speed control and to the formatter for tape positioning control.

The capstan servo receives inputs from the microprocessor to control acceleration and deceleration, speed and direction, and servo enable-disable functions. It receives inputs from the encoder, conditions the encoder inputs for the capstan microprocessor, and compares them to the reference frequency provided by the capstan microprocessor. The output from the servo is the current required to maintain the tach frequency at the reference frequency. The capstan servo PWB maintains communication with the tape unit I/O PWB microprocessor, which receives, decodes and sequences all commands for the capstan servo.

The signal lines used to interface the capstan microprocessor and I/O PWB are:

GO

Low Level signal telling the Capstan to move tape

FWD/REV

Telling the capstan which direction to move the tape

HIGH SPEED REWIND

High level signal telling the capstan to move tape in reverse at high speed

SERIAL TRANSMIT

Serial transmit line used for communicating status to tape unit I/O PWB

SERIAL RECEIVE

Serial receive line used for receiving commands from the I/O PWB

PWR FAIL

Low level signal indicating power loss

RESET

Low level signal that resets the servo PWB

CAP ATN

High Level signal to I/O PWB indicating that capstan circuit is requesting communications

CLK1

5.0 MHz Clock frequency, used to operate the microprocessor

TACH-01

Digital waveform giving position, velocity, and direction information

TACH-02

Digital waveform with 90 degrees difference from Tach-01, giving position, velocity, and direction information

The read/write capstan speed is 50 ips plus or minus 1.5 ips. For a GCR read operation, capstan access time is 3.4 ms nominal, 4.0 ms maximum. For a GCR write operation, the access time is 3.0 ms nominal, 3.6 ms maximum. The capstan can decelerate from 50 ips to a stop, then accelerate from rest to 50 ips in .15 inches of tape.

REEL DRIVE SYSTEM

The 9250 Reel Drive System consists of:

1. Two permanent magnet DC Motors
2. Two FET (field effect transistor) power switching amplifiers
3. One 6803 microprocessor chip
4. One 2764 PROM containing system firmware
5. One 8 bit, 8 channel A/D (Analog to Digital) IC
6. One loop position sensor
7. One emergency power off relay
8. One load pump motor relay
9. Digital input and output ports
10. One 6840 digital pulse width modulator

The loading sequence of the reel servo system is shown in Figure 4-3 and Figure 4-4 is a block diagram of the system.

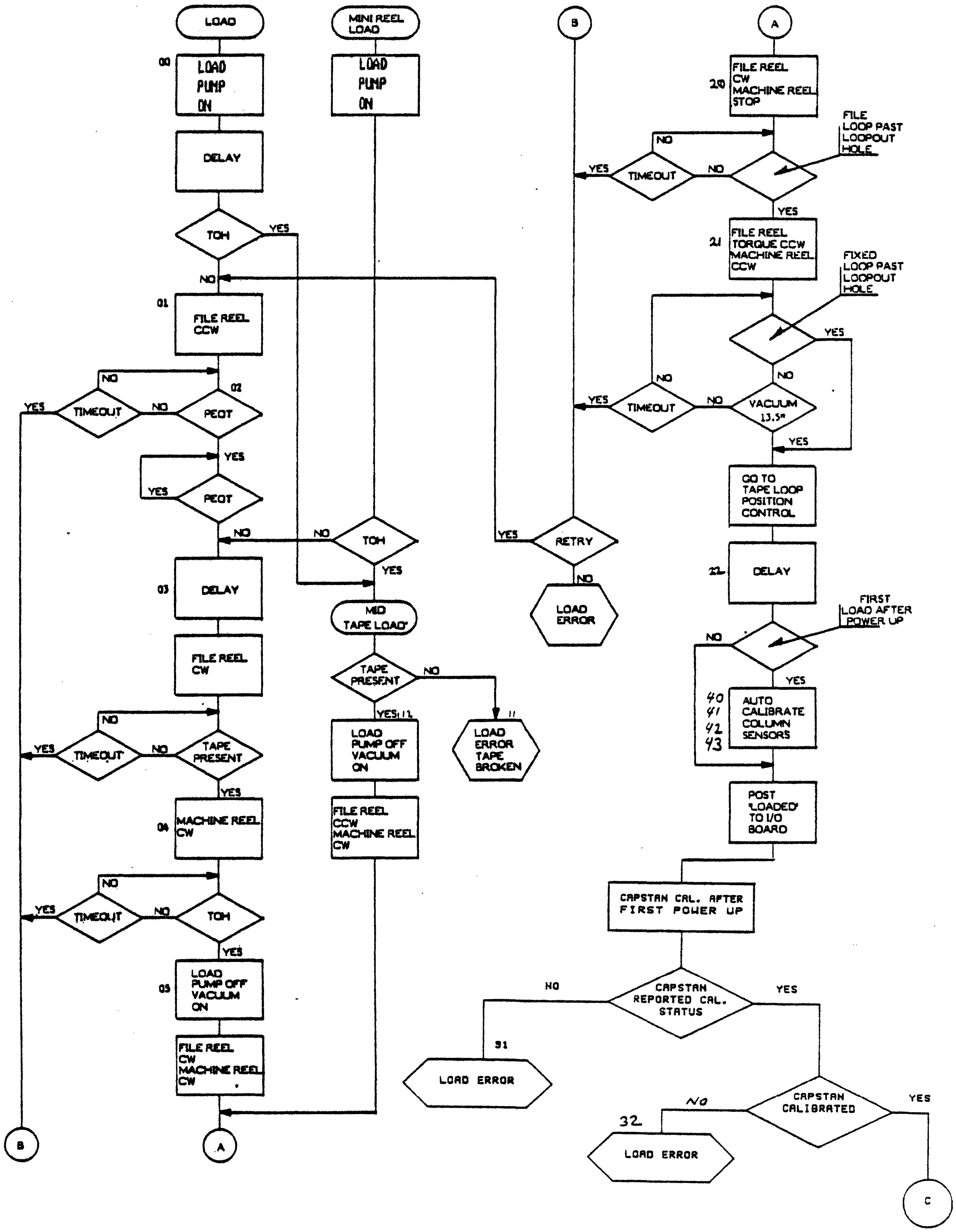



Figure 4-3. Tape Loading Sequence, 1 of 2

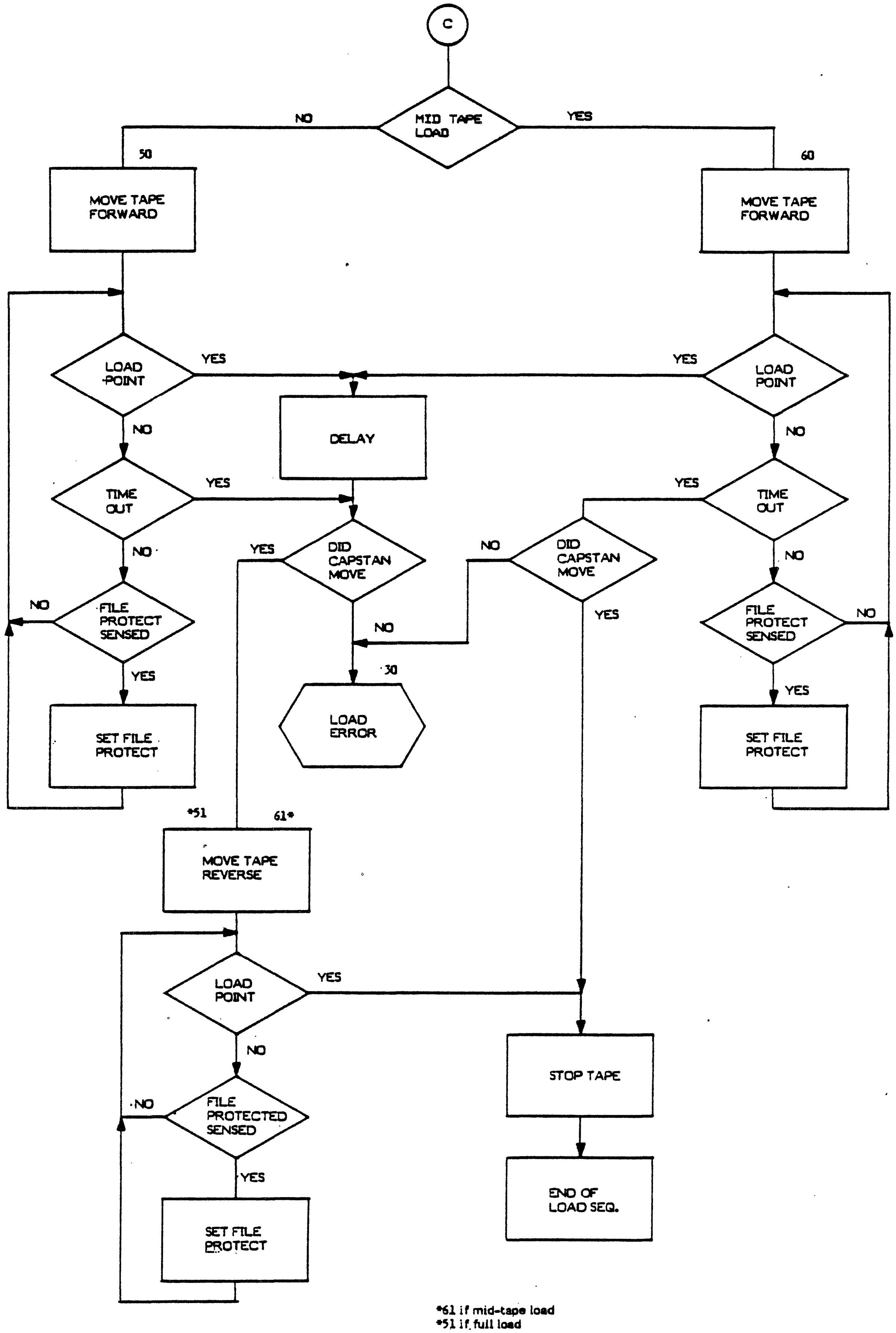



Figure 4-3. Tape Loading Sequence, 2 of 2

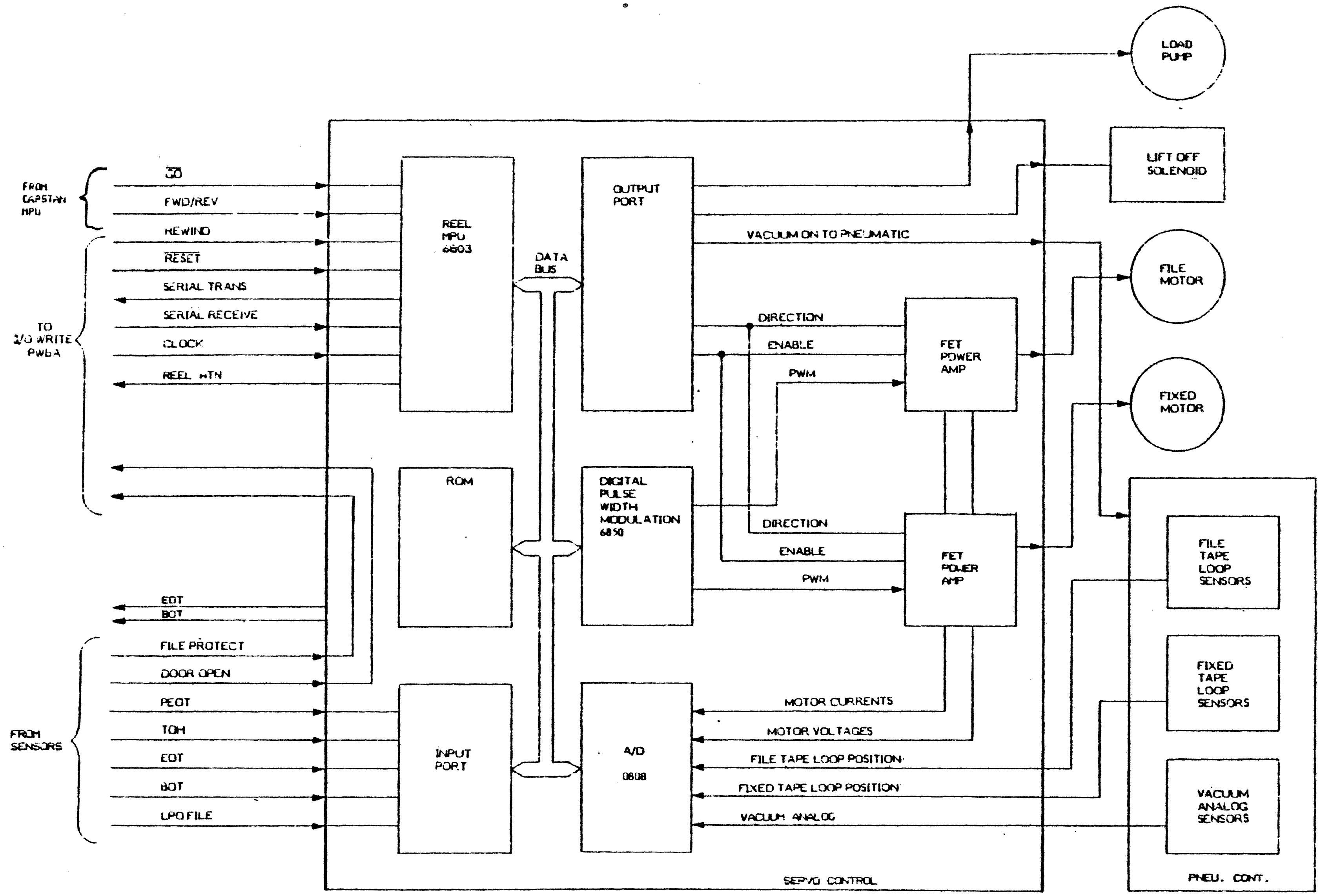



Figure 4-4. Reel Servo Block Diagram

## Loading Step Counts Visible on Status Display

| STEP COUNT | DESCRIPTION |
|---|---|
| L00 | Load pump on<br>Check if tape on hub |
| L01 | Backwrapping, looking for PEOT -1 |
| L02 | Looking for PEOT-0 |
| L03 | File Reel FWD, looking for tape present |
| L04 | Fixed and File Reels Forward<br>Look for tape on hub |
| L05 | Delay while wrapping |
| L10 | Load Pump off, vac off, File Reel wrapping<br>(Mid tape load only) |
| L11 | Check for tape broken<br>(Mid tape load only) |
| L12 | Vac-on delay while pressure is reaced<br>(Mid tape load only) |
| L20 | File Reel FWD<br>Look for file column trigger |
| L21 | Fix Reel BKWD<br>Look for fixed column trigger |
| L22 | Lock in column<br>Delay |
| L30 | Capstan failed to move after tape in column |
| L31 | Waiting Capstan calibration status |
| L32 | Capstan failed to calibrate |
| L40 | Look for File Reel Low limit ** |
| L41 | Look for File Reel upper limit ** |
| L42 | Look for Machine Reel low limit ** |
| L43 | Look for Machine Reel upper limit ** |
| L50 | Moving tape forward searching for Load Point<br>(Full load only) |
| L51 | Moving tape reverse searching for Load Point<br>(Full load only) |
| L60 | Moving tape forward<br>(Mid tape load only) |
| L61 | Moving tape reverse searching for Load Point<br>(Mid tape load only) * |

* Happens only if Load Point is detected during L60

** Auto-Cal of Column Sensors

TAPE LOOP POSITION CONTROL

The control microprocessor has two control loops, a motor current minor loop and a tape loop position major loop. The microprocessor also continuously monitors the serial and parallel commands from the tape unit I/O, and monitors the column pressure and loop out switch.

COLUMN AUTO-CAL

The microprocessor control provides an automatic calibration of each linear column sensor output relative to its loop-out port. This Auto-Cal occurs during the first tape load following power on and following other abnormal conditions, such as loop-out.

During capstan acceleration the tape loop reference position is offset to minimize reel servo motor current and to provide maximum column storage in case the capstan is ordered to reverse direction.

During rewind and fast forward the tape loops are held in the center of their respective columns and the tape lift off solenoid is energized to keep tape off the head.

The following information signals are available to the reel servo PWB:

GO & FWD/REV

Used to set tape loop reference position and to change closed loop gain

HIGH SPEED REWIND

Signals reel servo to position tape loop in middle of columns. Used to set tape loop reference position and to activate Liftoff Foot

RESET

Low level signal used to reset servo PWB

SERIAL TRANSMIT & RECEIVE

Serial communication lines with I/O PWB for receiving commands and transmitting status

CLK 1

5.0 MHz clock received from I/O used to operate microprocessor system

REEL ATN

Signals tape unit I/O that reel is requesting communication

DOOR INTERLOCK

This signal is routed through the sensor harness and Servo Control PWB to the tape unit I/O PWB

FILE PROTECT

If the file reel has a write enable ring a pulse will occur as the file reel is rotated during a load. This signal is received from an optical sensor and amplified and transmitted to the tape unit Write-I/O PWB.

VACUUM ON

This output line turns on vacuum power amplifier

BOT and EOT

Beginning of Tape (BOT) and End of Tape (EOT) are sensed if either the BOT or EOT reflective marker installed on the tape is positioned over the BOT/EOT sensor assembly. This signal is amplified and transmitted to the tape unit Write-I/O PWB. It is also used by the reel servo to signal tape present during load and unload operations. BOT and EOT are simultaneously sensed if there is no tape in the tape path. This will not affect the operation of the tape unit.

PEOT

Physical End of Tape signal is used during the tape load operation to stop the backwrap of the file reel and to begin the thread sequence.

TOH

The pneumatic Tape on Hub signal is used to sense that the tape is wrapped on the machine reel hub.

LPO FILE

The pneumatic Loop Out File senses that the file reel tape loop is not between the loop out holes and not in a controllable position in the vacuum column. (The machine reel loop out is indicated by reading the vacuum transducer that is connected across the machine reel loop out holes)

### 4.2.3 TU DATA ELECTRONICS

WRITE

The 9250 Write System is capable of writing data formatted in GCR, PE, and (optionally) NRZI, 6250, 1600 amd 800 bpi respectively. The system incorporates advanced digital design. It is microprocessor controlled and has no manual adjustments. The microprocessor corrects for head wear by adjusting the write system when a reference tape is mounted and the built in Auto-Cal feature is executed. The gain constants are stored in nonvolatile RAM. The Telex Read/Write Auto-Cal (patent applied for) automatically optimizes the write current level, write compensation factors and establishes the optimum read gain during the calibrate operation for all three densities. Read/Write Auto-Cal is operator executable from the diagnostic keyboard.

Figure 4-5 describes the operation of the write circuitry as follows: The data for each track is received by a register (block 1). The register contents are examined by a PROM (block 2) where decisions are made affecting the write current according to the present data pattern. The write current is also affected by the compensation counter (block 3). The overall write current magnitude is determined by the MPU-controlled power supply (block 4). The voltage mode driver (block 5) provides current to block information on the tape. Blocks 6, 7, and 8 connect the functions in blocks 1 through 5.

Block 9 determines if the MPU-controlled supply (block 4) is on or off.

Block 10 produces current to erase the tape.

The power supply filter (block 11) attenuates noise signals entering or leaving the write circuitry.

READ

The 9250 Tape Unit is capable of reading data from tapes recorded in GCR (6250 bpi), PE (1600 bpi),and (optionally) NRZI (800 bpi) formats. In addition, the tape unit incorporates a unique Read/Write Auto-Cal System, which eliminates the need for manual calibration and adjustment. Gain constants are established automatically and stored in non-volatile RAM.

The PE/GCR and NRZI read systems reside on the Read PWB assembly (a -01 PWB for Dual Density and a -02 PWB for tri-density, NRZI added). The PE/GCR read system accepts low-level analog data from the read preamplifier and control logic levels from the tape unit I/O PWB.

The Read PWB processes and digitizes both PE and GCR formats at a tape speed of 50 ips. Digitized data is then delivered to the I/O PWB. See Figure 4-6

The NRZI portion of the read system accepts analog data from the read preamplifier PWB, processes it, and delivers data to the tape unit I/O PWB. See Figure 4-7.

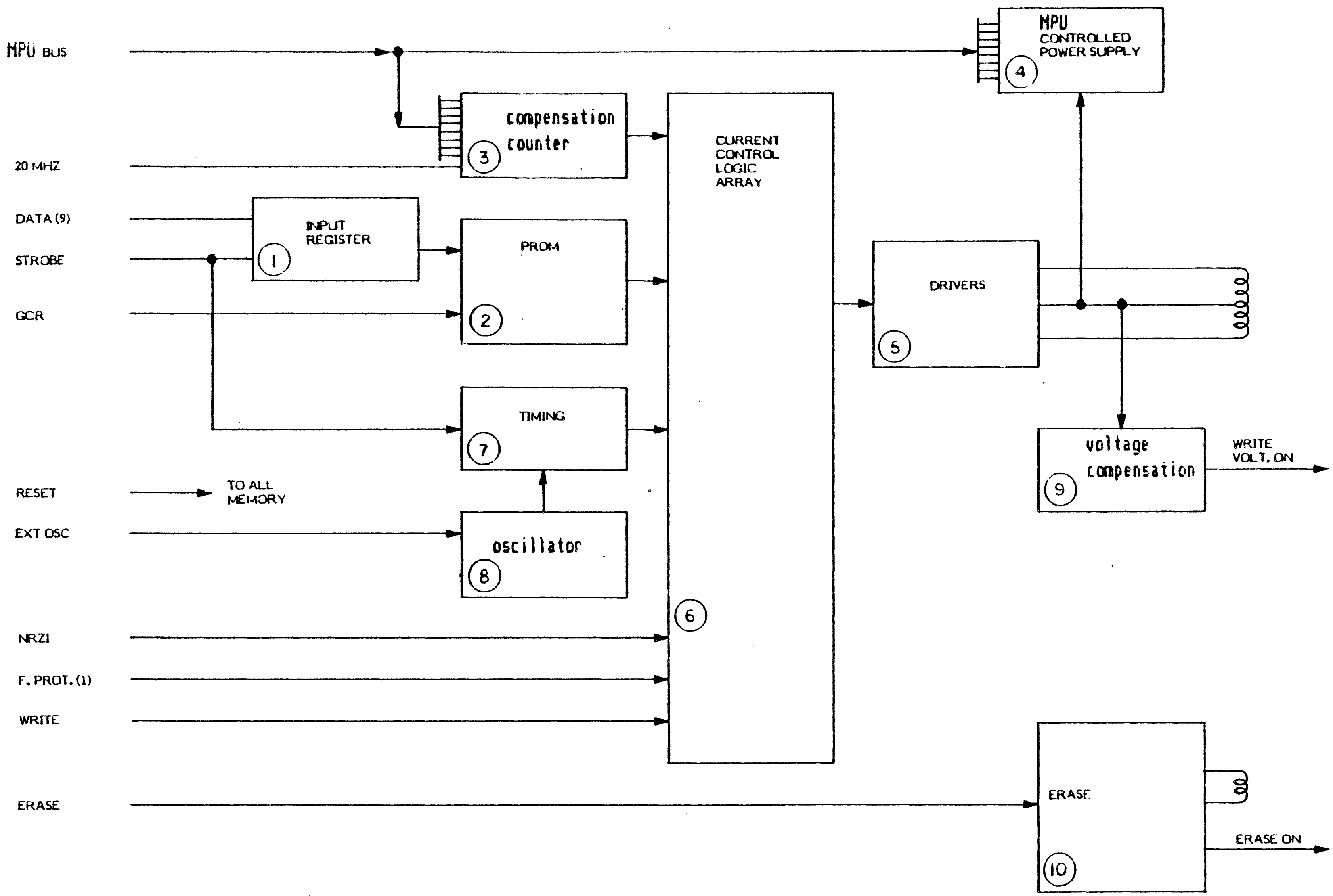



Figure 4-5. Write Logic Block Diagram

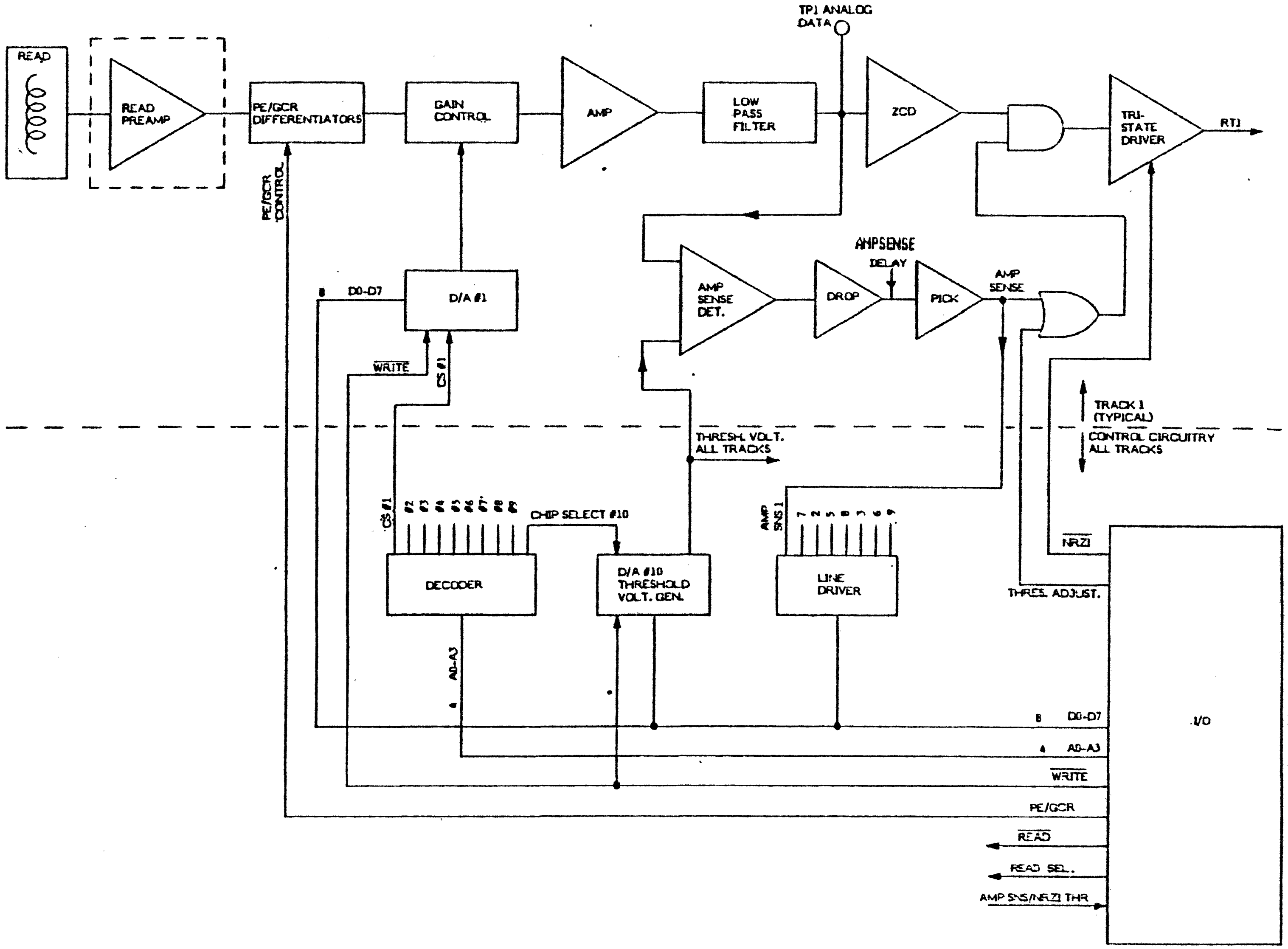



Figure 4-6. PE/GCR Read Block Diagram

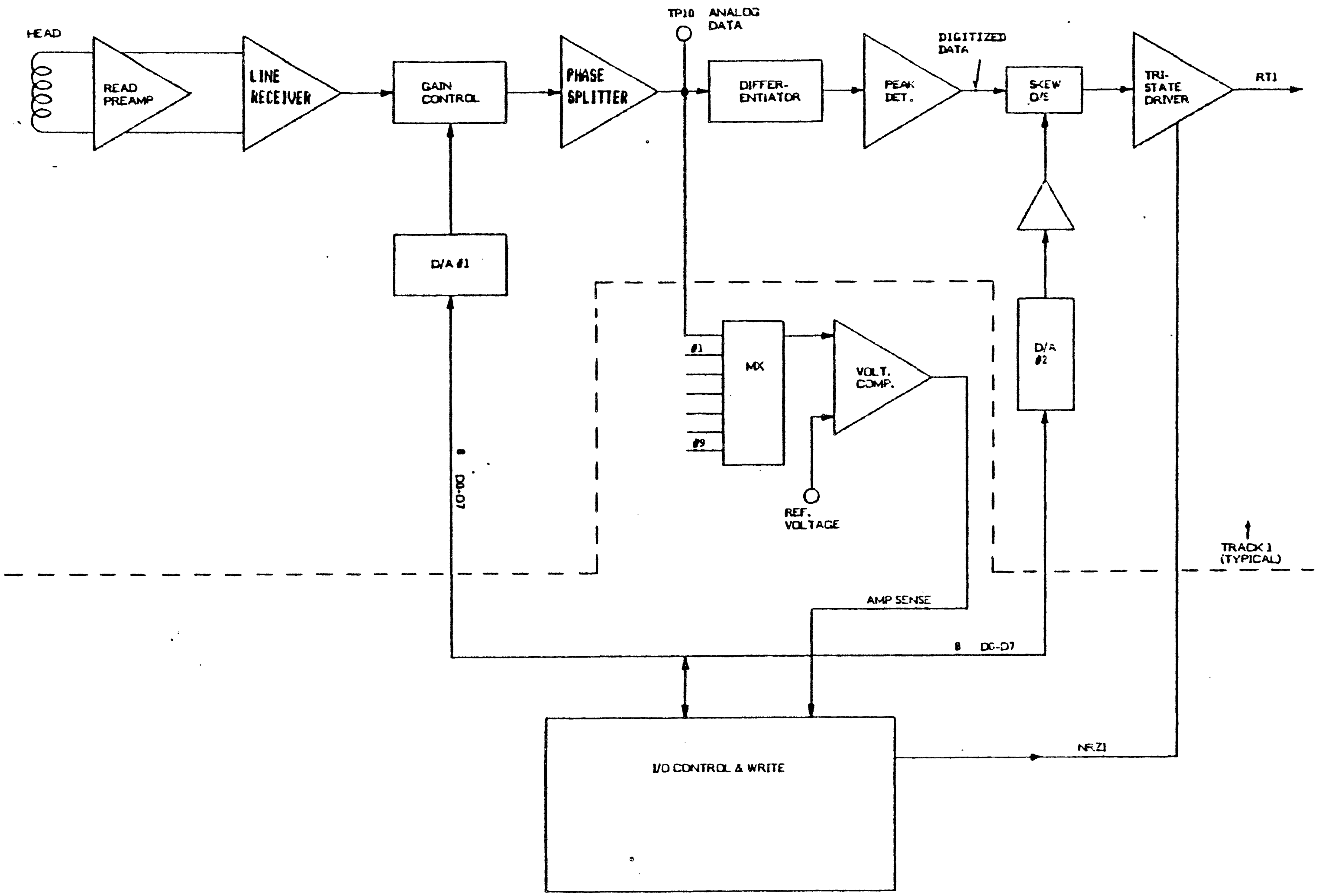



Figure 4-7. NRZI Read Block Diagram

## 4.2.4 CONTROL NETWORK

### 4.2.4.1 TU CONTROL LOGIC

TU Control logic functions are located on the tape unit Write-I/O PWB. Control logic is handled by a gate array chip in combination with a 6803-1 MPU.

The gate array includes functions normally found on several boards using conventional TTL logic chips. It functions analogously to a peripheral in relation to the MPU. When the TU is on line, the gate array acts as an interface between the formatter and the tape unit.

The tape unit I/O MPU is used in the "expanded multiplexed configuration (mode 2)." The serial communication interface (SCI) portion of the 6803 is used as a general communication line to the microprocessors for the capstan and reel servo controls.

During on-line operations the main control function of the MPU is to update status in the gate array. When the TU is off-line, the I/O MPU controls the load and unload operations, and those functions ordinarily handled by the Host during on-line operation.

The I/O MPU communicates with the reel MPU by the serial bus, through which it transfers commands to and receives status information from the pneumatic system vacuum pump and load pump. The I/O MPU also controls the acceleration to and from high speed rewind while monitoring the loop position in each column to guarantee a smooth speed. The high speed rewind is slowed to 50 ips near the end of the tape based on pack count information from the capstan MPU.

If power is lost the pack count is stored in nonvolatile RAM. When the tape unit is powered up the pack count is transferred to the tach count control and the rewind can be resumed at high speed. The 256 bytes of I/O MPU nonvolatile RAM also save information such as write compensation, read gain, and TU address in case of power failure.

### 4.2.4.2 TAPE UNIT I/O INTERFACE

A gate array serves as the main interface component between the tape unit and the formatter; it is responsible for:

1. detecting selection of TU
2. command decode and execution (if command is valid)
3. returning status to the formatter

TU CONTROL AND I/O INTERFACE CABLE CONNECTIONS

The following interface cable connections to the Write-I/O PWB show the function of this PWB in relation to other areas of the Tape Unit. See Figure 4-1.

1. Write-Erase Head Interface Cable J1

   This cable connects the write-erase head to the write drivers. Data from the Formatter is sent over cable J5 through the tape unit I/O circuit to the write driver circuit and onto cable J1.

2. Power Interface Cable J2

   This cable supplies DC power for the Write-I/O PWB. Power is supplied at +5, -12, and +12 VDC.

3. Read Interface Cable J3

   This cable allows the I/O MPU to set up the proper read gains and skew data on the Read PWB for read operations. It also supplies data read by the read head.

4. Servo Interface Cable J4

   This cable carries commands and receives status from the Servo PWB. It also carries a Power Fail signal from the regulated power supply. Command signal line types are: GO (move tape), FWD/REV (tape direction), REWIND (initiates high-speed rewind), RESET (initializes servo PWB). In addition, a serial transmit communication line is provided to tell the Servo PWB to load tape, unload tape, run diagnostic commands and command pneumatic operations. There is also a serial receive communication line, which is used to receive status from the servo unit. Other signals provided are File Protect, Door Interlock, Failure Lines, and Tach Lines. The Power-Fail signal warns of any power failure, thus giving the tape unit I/O MPU time to save setup information in nonvolatile RAM.

5. Formatter Interface Cable J5

   This cable carries communications to the Formatter PWB. It handles Formatter commands for the tape unit, data, tape unit status information for the formatter, and general communication between the formatter and tape unit.

6. OCP Interface Cable J6

   This cable is used to drive the display on the OCP and to scan the OCP and DKB for commands.

### 4.2.5 POWER SUPPLY

The power supply section of the tape unit consists of an unregulated DC supply, a regulated, switching DC supply, and the main AC input providing a line filter, 6.25A SB fuse, and capability for selecting 115 VAC or 230 VAC.

UNREGULATED SUPPLY

The DC output of the unregulated supply is nominally 36 VDC at full load. This supplies power to the reel motors, capstan motor, vacuum pump, and load pump.

REGULATED SUPPLY

The DC outputs of the regulated DC supply are +5, +12 and -12 volts at full load. The outputs supply power to the tape unit and the formatter. See Figure 4-1.

### 4.2.6 TU TO FORMATTER SENSE BYTES

Sense information is available to the formatter from the selected TU and is transferred upon command from the formatter. This information provides status, error conditions and results of special operations for normal control and diagnostic purposes.

The sense bytes match those described for the formatter under "TUSA" in Subsection 4.6.

## 4.3 FORMATTER

The formatter provides all data encoding and decoding, tape gapping and formatting, error detection and correction, And interface with the host computer. In 6250 bpi (GCR) read operation, two tracks in error are corrected on the fly. In 1600 (PE) bpi read operation, one track in error is corrected on the fly. In 800 bpi (NRZI)read operation, the formatter can automatically detect and correct a single track error during a retry operation.

The formatter consists of two circuit boards, the MCU board and the PLO board. These boards reside in the tape unit card cage in the master tape unit.

A 68000 MPU is the intelligence for the formatter. It controls all operations and is the "Kernel" for the layered diagnostics. The diagnostic routines expand from the Kernel and, following the functional partitioning, can identify the failing FRU. An RS232 port is available for remote analysis.

CMOS gate array technology is used extensively to reduce formatter component count and improve reliability. The Telex patented PLOs provide one PLO per track and are adjustment-free.

## 4.4 HOST INTERFACES

TELEX INTERFACE

The Telex interface between the formatter and the Host provides 59 lines of digital information in the form of data, status, commands, and addressing. A 512 byte buffer is used for data transfers. Burst rates may be as high as 1 MB/S between the host computer and the buffer. Access to these lines is by three 50-conductor flat cables connected to the formatter Microcomputer PWB. Host adapters designed for the Telex 6850/6253 subsystem may be used for the 9250, and cables, adapters, and system software are capable of operating the Telex 9250 as a plug equivalent for the Telex 6850/6253 tape subsystem. Figure 4-8 shows formatter interface signals.

The architecture and packaging of the 9250 is designed such that other industry standard interfaces can be supported as optional features.

### 4.4.1 I/O CABLES

The Host I/O cables are applicable to the master unit only and depend upon the type of interface feature installed.

For the Telex Interface three 50-conductor I/O cables are required to attach the 9250 to the Host. The mating connector TPN A55X01610-01 can be ordered separately. Three are required. A cable kit is available to adapt existing 6850 cables. The kit part number is 90A21028-01.

Figure 4-8 Formatter/Telex Interface Signals

---Pertec Interface

See subsection 4.15 for information on the Pertec interface.

---STC Interface

See subsection 4.27 for information on the STC interface.

### 4.4.2 TAPE UNIT ADDRESSING

Tape Unit Address 0,1,2 (TA0, TA1, TA2).

These three lines select the particular tape unit to be used for operations.

| | TA0 | TA1 | TA2 |
|---|---|---|---|
| TU0 | 0 | 0 | 0 |
| TU1 | 0 | 0 | 1 |
| TU2 | 0 | 1 | 0 |
| TU3 | 0 | 1 | 1 |

## 4.5 COMMANDS AND COMMAND CLOCK

The following five (5) command lines and single command clock line are used to initiate any of 22 commands described below. Assertion of the command clock enables command execution. Command execution is acknowledged by the assertion of FUBUSY by the formatter. For all the commands, except NOP command, the formatter will clear the previous status and errors before responding with FUBUSY. Decode of the five command lines is shown in the following table.

Table # - Command Decode

| Description | Cmd | Cmd0 | Cmd1 | Cmd2 | Cmd3 | Cmd4 | HEX Code |
|---|---|---|---|---|---|---|---|
| No Op | NOP | 0 | 0 | 0 | 0 | 0 | 00 |
| Write | WRT | 0 | 0 | 0 | 0 | 1 | 01 |
| Read Forward | RDF | 0 | 0 | 0 | 1 | 0 | 02 |
| Reject | REJ | 0 | 0 | 0 | 1 | 1 | 03 |
| Fwd Space Block | FSB | 0 | 0 | 1 | 0 | 0 | 04 |
| Reverse Space Block | RSB | 0 | 0 | 1 | 0 | 1 | 05 |
| Reverse Space File | RSF | 0 | 0 | 1 | 1 | 0 | 06 |
| Rewind | RWD | 0 | 0 | 1 | 1 | 1 | 07 |
| Fwd Space File | FSF | 0 | 1 | 0 | 0 | 0 | 08 |
| Loop Write to Read #2 | LWR2 | 0 | 1 | 0 | 0 | 1 | 09 |
| Track In Error | TIE | 0 | 1 | 0 | 1 | 0 | 0A |
| Diag Mode | DIA | 0 | 1 | 0 | 1 | 1 | 0B |
| Read Reverse | RDR | 0 | 1 | 1 | 0 | 0 | 0C |
| Loop Write to Read #1 | LWR1 | 0 | 1 | 1 | 0 | 1 | 0D |
| Unload | UNL | 0 | 1 | 1 | 1 | 1 | 0F |
| Clear | CLR | 1 | 0 | 0 | 1 | 1 | 13 |
| Sense | SNS | 1 | 0 | 1 | 0 | 0 | 14 |
| Tape Unit Sense | TUS | 1 | 0 | 1 | 0 | 1 | 15 |
| Erase Variable Gap | EVG | 1 | 0 | 1 | 1 | 0 | 16 |
| Erase Gap | ERG | 1 | 0 | 1 | 1 | 1 | 17 |
| Tape Unit Sense A | TUSA | 1 | 1 | 0 | 0 | 0 | 18 |
| Write File Mark | WFM | 1 | 1 | 1 | 1 | 1 | 1F |

Commands are described as follows:

No Operation (NOP)

This command can be used to test the command handshake between the Formatter and the Host. The TU is not accessed by this command. Previous status and errors will not be cleared by this command.

Write (WRT)

This command causes the selected TU, if not file protected, to write data on tape at the density selected. Write command to a file protected TU will be rejected. A write operation will occur in the forward direction only. During write the data is read and verified in the formatter; however, no data is returned to the Host. Applicable TU status and errors will be reported.

If the formatter software Diagnostic Flag has been set by use of the DIA command then the operation of the WRT command is modified. Data sent from the host is not written to tape but is interpreted as diagnostic commands.

Read Forward (RDF)

This command causes the selected TU to read the tape forward and transfer data to the interface. Applicable TU status and errors will be reported.

If the formatter software Diagnostic Flag has been set by use of the DIA command then the operation of the RDF command is modified. Instead of reading data from tape the formatter sends diagnostic response messages to the host adapter.

Reject (REJ)

This command causes REJECT status to be set.

Forward Space Block (FSB)

This command causes the selected TU to move forward one block and stop in the interblock gap. No data is transferred.

Reverse Space Block (RSB)

This command causes the selected TU to move in reverse one block and stop in the interblock gap. If BOT is sensed, tape motion stops. A reverse space command at BOT or into BOT will be rejected. No data is transferred.

Reverse Space File (RSF)

This command causes the selected TU to move in reverse and stop in front of the next file mark (i.e. stop on the BOT side of the file mark). File mark status is reported. When BOT is sensed, motion stops. No data is transferred.

Rewind (RWD)

This command causes the selected TU to rewind to the Load Point (BOT) marker. The TU status indicates rewinding until BOT is sensed. The tape unit will not accept commands while rewinding.

Forward Space File (FSF)

This command causes the selected TU to move forward past the next file mark and stop (i.e. stop on the EOT side of the file mark). File mark status is reported. No data is transferred.

Loop Write to Read #2 (LWR2)

This command causes write data to be transferred through the formatter to the selected TU and back through the read data path. The selected TU must be on line and ready but tape moves during this command sequence. This command is terminated by the Last Byte signal.

Track in Error (TIE)

This command causes two bytes of Track-In-Error information to be transferred from the Host to the formatter for use in a subsequent NRZI read operation. These two bytes will normally contain the same TIE information contained in Error Bytes 2 and 3 at the conclusion of a previous read of the same data block. The first byte transferred will be the TIE byte. The second byte transferred will have the TIE parity bit in the least significant position. Transfer of the second byte is optional. If the first byte is all zeros and the second byte is not transferred, the formatter will assume the parity track is in error.

Enable Diagnostic Mode (DIA)

This command causes the tape subsystem to operate under diagnostic mode with diagnostic routines stored in the microprogram. For a detailed description of the diagnostics, refer to Section 7.

This command is issued via the I/O interface as any other command. This command transfers diagnostic data from the computer adapter interface in the same manner as data is transferred in a standard write operation. (At least one diagnostic data byte must be transferred. Any number of data bytes may be transferred but only the first 16 will be saved by the formatter.)! Any data bytes beyond the first which are not sent are assumed to have values of zero. The drive address associated with the DIA command is saved by the formatter along with the diagnostic data. Subsequent commands to the addressed drive will be modified in accordance with the diagnostic data. The diagnostic mode can be enabled for only one drive at a time. The diagostic mode is disabled at power up, System Reset, by issuing a Clear command, or by a DIA command whose data bytes have value of zero.

The functions of the various Diagnostic data fields are described below:

Byte 0, Bit 0 - Dead Track Pattern, Bit P

The parity track is not written during a write operation if this Dead Track Pattern Bit is set.

Byte 0, Bit 1 - Diagnostic Mode Flag

The operation of Stack Write/Read mode is modified so that Write data is interpreted as diagnostic messages from the host and Read data is diagnostic response to the host. The Stack Write/Read bit must also be set.

Byte 0, Bit 2 - Enable Error Correction

Byte 0, Bit 3 - Stack Write/Read

Byte 0, bit 4 - Ignore Multitrack

Causes Multitrack errors to be ignored while writing PE or GCR records. This bit is not used in NRZI.

Byte 0, bit 5 - Inhibit Postamble

a) PE and GCR: causes the postamble not to be written.
b) NRZI: causes the LRC character not to be written.

Byte 0, bit 6 - Reserved

Byte 0, bit 7 - Inhibit Preamble
a) PE and GCR: causes the preamble not to be written.
b) NRZI: causes the CRC character not to be written.

Byte 1, Bits 0..7 - Dead Track Pattern

The data tracks indicated by the Dead Track Pattern are not written during a write operation.

Byte 2, Bits 0..7 - Go-Down-Timer

Causes a delay to occur between the time the drive has been commanded to stop and time Busy is cleared. The delay occurs in 0.5 millisecond increments. The number of increments is determined by the count in this byte. The maximum delay is 127.5 milliseconds.

Read Reverse (RDR)

This command causes the selected TU to read the tape in reverse and transfer data to the interface. Applicable TU status and errors will be reported. A Read Reverse command at BOT or into BOT will be rejected.

Loop Write to Read #1 (LWR1)

This command causes data to be transferred through the formatter write and read circuits without going to the TU. The selected TU must be on line and ready, but no tape motion occurs during this command sequence. This command is terminated by the Last Byte signal. If this command is issued with both density lines DS0 and DS1 in '1' state, the formatter will default to PE mode and perform the LWR operation. This command can be executed without a TU attached to the formatter. No TU status is reported by this operation.

Unload (UNL)

This command causes the selected TU to rewind to the Load Point (BOT) marker and then perform an unload sequence winding all tape onto the file reel. The TU status indicates NOT ON LINE and will remain so until operator invention.

Clear (CLR)

This command causes all status to be cleared prior to setting FUBUSY. After setting FUBUSY, the formatter issues a sense reset command to the selected TU, then updates TU status before dropping FUBUSY.

The CLR command also clears any Diagnostic mode setup information which may have been transmitted with a DIA (DMS) command.

Sense (SNS)

This command causes the formatter to access the selected TU to update the TU status. No tape motion results from this command. Previous formatter status is reset by this command.

Tape Unit Sense (TUS)

This command functions the same as a Read command (RDF) except TU status is transferred instead of data. No tape motion occurs. These TU sense bytes correspond with those of the Telex 6850/6253 subsystem.

Bit Position

| Sense Bytes | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| 0 | Load Point Status | Not File Protect | Bkward Status | Write Status | EOT | Lo Density | Ready | Command Reject |
| 1 | * | Equip Fail | Model Bit 0 | Model Bit 1 | Model Bit 2 | 6250 Capable | LWR | * |
| 2 | IBG Overflow | IBG Bit 0 | IBG Bit 1 | IBG Bit 2 | IBG Bit 3 | IBG Bit 4 | IBG Bit 5 | IBG Bit 6 |
| 3 | Load Check | Force Read Density | Dual Density | * | Erase Fail | * | Loopout | * |
| 4 | Alternate Density Request | Tri-Density | .1 in. Head | -2XX | Write Current Fail | Erase Status | SAGC Check | * |

Erase Variable Gap (EVG)

This command causes the selected TU to erase the tape in the forward direction, provided the TU is not file protected. Handshaking and data transfer occur between the Host and Formatter as in a standard write operation except that the data transferred is ignored and not written on tape. The length of the erased gap is given by the formula:

Erased gap length = Standard IBG + N/density

where N is the number of simulated data byte transfers. This operation is terminated by sending Last Byte to the formatter.

Erase Gap (ERG)

This command causes the selected TU to erase 3.5 inches (nominal) of tape in the forward direction provided the TU is not file protected. No data is transferred. Applicable TU status and errors will be reported.

Tape Unit Sense A (TUSA)

This command functions the same as Tape Unit Sense (TUS) except that eight TU sense bytes are transferred. Additional sense information is available at the Host Interface.

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

BLANK

Bit Position (TUSA)

| Sense Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| 0 | Command Reject | Not File Protect | EOT | Write | Reverse | Rewinding | Ready | Load Point |
| 1 | Load Check | EC Fail | WC Fail | SAG Check | Loopout Machine Reel | Loopout File Reel | IBG Overflow | Equipment Fail |
| 2 | IBG Bit 0 | IBG Bit 1 | IBG Bit 2 | IBG Bit 3 | IBG Bit 4 | IBG Bit 5 | IBG Bit 6 | IBG Bit 7 |
| 3 | Force Read Density | Seismic Option | Erase Status | GCR Request | NRZI Request | LWR | GCR | NRZI |
| 4 | Mod 0 | Mod 1 | Mod 2 | * | * | .10 Head | Soft Density Select | NRZI Capable |
| 5 | * | Buff Avail | * | Config Bit 1 | Config Bit 0 | Parity Disable | Command Overflow | Command Overflow |
| 6 | * | * | * | * | * | * | * | * |
| 7 | Get Buffer Empty | Put Buffer Full | * | * | * | Get Underrun | Put Overflow | Overrun |

Write File Mark (WFM)

This command causes the selected TU to perform an ERG (Erase 3.5 inch gap) then write an ANSI compatible file mark at the density selected. Successful completion of this operation is verified by the formatter and status reported to the Host. Other applicable TU status and errors will be reported.

Command Clock (Cmd CLK)

This single line is used to clock commands into the formatter. This signal must remain active until FUBUSY line is asserted.

Data Density (DS0, DS1)

These two lines control the density (format) to be used for a write operation from load point.

| | DS 0 | DS 1 |
|---|---|---|
| 800 bpi | 0 | 1 |
| 1600 bpi | 0 | 0 |
| 6250 bpi | 1 | 0 |
| by drive | 1 | 1 |

If both DS0 and DS1 are set, the density used for a write from load point is that set on the drive operator control panel, as described under Manual Density Select.

For a read operation from load point, the density is set automatically according to the ID burst read from the tape. This automatic selection can be overridden by enabling Forced Read Density as described under Embedded Functions. The density select lines from the host are always ignored for a read operation.

For any operation away from load point the density select lines from the host are ignored, and the density used is that established for the drive at load point.

## 4.6 STATUS LINES FROM THE TAPE SUBSYSTEM

Status is valid when BSY and Cmd CLK are inactive. All status indications reflect the results of the previous operation with the exception of Rewinding or Not Ready, Online, Ready, Rewinding, EOT, BOT, and File Protect, which dynamically indicate the status of the selected tape unit. The following 21 status lines are available at the Host interface.

Data Density (DCS0, DDS1)

These two lines indicate the density of the last operation.

| | DDS0 | DDS1 |
|---|---|---|
| 800 bpi NRZI | 0 | 1 |
| 1600 bpi PE | 0 | 0 |
| 6250 bpi GCR | 1 | 0 |

Write Mode (WRM)

This line when asserted indicates that the selected TU is performing or has completed a write or write file mark operation.

Read Mode (RDM)

This line when asserted indicates that the selected TU is performing or has completed a read forward, read reverse, space forward, or space reverse operation.

Erase Mode (ERM)

This line when asserted indicates that the selected TU is performing or has completed and erase operation.

Ready (RDY)

This line when asserted indicates that the selected TU has tape loaded, is ON LINE and is not rewinding.

Load Point (BOT)

This line when asserted indicates that the selected TU has the tape stopped with the BOT marker over the BOT sensor.

End of Tape (EOT)

This line when asserted indicates that the end of tape marker has been sensed on the selected TU.

File Protect (FPT)

This line when asserted indicates that there is no write ring installed in the file reel on the selected TU thus preventing a write or erase operation.

Rewinding (RWG)

This line when asserted indicates that the selected TU is in the process of rewinding to BOT. The TU indicates not ready during this operation.

Formatter Busy (BSY)

This line when asserted indicates that the formatter is in the process of executing a command. The formatter will not accept commands when Formatter Busy is asserted. This line is negated when the command is complete, provided the Host has negated Command Clock. When Formatter Busy is negated the formatter will accept commands.

On Line (ONL)

This line when asserted indicates the selected TU has been placed On Line by the operator.

ID Burst (IDB)

This line when asserted indicates the selected TU has read an ID Burst in either the 1600 or 6250 bpi format. Based on the ID Burst information, the formatter selects the density of operation of the tape subsystem.

Corrected Error Status (COR)

This line when asserted indicates the formatter has corrected a single track error in a 1600 bpi read operation, or a single or dual track error in a 6250 bpi read operation.

Reject Status (REJ)

This line when asserted indicates the command given to the formatter cannot be executed and will be aborted by dropping Formatter Busy without executing the command. Following are examples of reject status.

--- TU Sense Bit `Cmd REJ' is set

--- An invalid command or Reject command is issued to the formatter

--- Read Reverse or Reverse Space Block is issued at Load Point

--- Any write operation is issued to a file protected TU

--- Any command except CLEAR, LWR1, NOP, or DIAGNOSE is issued to a NOT READY or OFFLINE TU

--- A TIE command is issued to a TU not in NRZI mode

--- Any tape motion command except Rewind or Unload with an IBG overflow condition indicated

--- A LWR1 or LWR2 command is issued in NRZI mode.

Error Status (ERR)

This line when asserted indicates one or more errors indicated by '*' in the paragraph entitled "Error Bytes" has been detected. Those indicated by '**' will be reported in write only. ERR is also set for Data Parity Error (DPE) and for Overrun (OVR) while doing LWR.

Overrun (OVR)

This line when asserted indicates the Host did not respond to a data request in sufficient time to allow proper transfer of data.

ROM Parity Error (RPE)

This line when asserted indicates a parity error condition exists in the microprocessor read only memory.

File Mark (FMK)

This line when asserted indicates that the selected TU has read a file mark.

Reverse (REV)

This line when asserted indicates that the selected TU is moving tape in reverse or has completed a reverse operation.

Data Parity Error (DPE)

This line when asserted indicates that a VRC, LRC, or CRC error has occurred.

Rewinding or Not-Ready (RNR)

This line when asserted indicates that the selected TU is Rewinding or Not-Ready.

## 4.7 ERROR BYTES

Four bytes of error information are presented at the Host Interface as selected by the Error Status select lines. The most significant error conditions are presented in Byte Zero. A bit being asserted indicates an error condition.

Error Status Control (ESC 0, 1)

These two lines select one of four error bytes to be presented to the Host Interface.

| Byte # | ESC #1 (MSB) | ESC #0 (LSB) |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 2 | 1 | 0 |
| 3 | 1 | 1 |

**Table #. Error Bytes**

BIT POSITION

| ERROR BYTE | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| 0 | NOT CMPT | VRC | MULTI TRACK | SAGC CHECK | FILE MK ERR | NOISE | EQ FAIL (FU) | EQ FAIL (TD) |
| 1 | LRC | ENV CK | PRE ERR | POST ERR | PART REC | LOST BOB | SKEW | CRC |
| 2 | ID CK | VEL CK | TACH FAIL | E/W FAIL | LOOP OUT | NO DATA | IBG OVER | DEAD TRACK P |
| 3 | DEAD TRACK 0 | DEAD TRACK 1 | DEAD TRACK 2 | DEAD TRACK 3 | DEAD TRACK 4 | DEAD TRACK 5 | DEAD TRACK 6 | DEAD TRACK 7 |

ERROR BYTE DESCRIPTION

Byte Zero

| Bit | Description |
|---|---|
| 0 | Not compatible - indicates an 800 bpi tape is installed to be read on a 6250/1600 bpi TU or the TU is not capable of writing in the commanded density. |
| 1 | I/O BUS VRC - Vertical Redundancy Check - indicates a parity error on data bytes transferred on the data bus during read and write operation. |
| 2 | Multi-Track Error - indicates the number of tracks in error exceeds the error correction capability. This is set by 1 or more dead tracks in 1600 bpi write, 2 or more dead tracks in 6250 bpi write and 1600 bpi read, and 3 or more dead tracks in 6250 bpi read operation. |
| 3 | SAGC Check (Set Auto Gain Control) - indicates that the read circuits have been unable to set the read gain to the proper level while reading the ARA burst. |
| 4 | File Mark Error - During write file mark operation, this indicates that the file mark was not written properly. During read, space block, and space file operations, this indicates that no data was encountered and tape motion was stopped after moving 25 ft. of tape during PE and NRZI modes, or 15 ft. of tape in GCR mode. (Note: This is not active if the Seismic Option is active). |
| 5 | Noise - indicates data is detected during an erase operation or data is detected during the erase portion of a write file mark. |
| 6 | Equipment Fail Formatter - indicates the formatter has failed or is malfunctioning. This is set if a microprogram parity error occurs or if various parity errors in the data path occur out of sequence. |
| 7 | Equipment Fail Tape Unit - indicates the TU has failed or is malfunctioning. This is set by IBG overflow or tape unit fail. File mark check or velocity check in a write operation will also set this bit. This is also set if tape positioning errors are detected (for example, IBG not detected, beginning of block not detected in write).<br><br>If an ID burst error occurs at ID burst time, this bit will be set. If an ID burst error occurs at ARA or ARA ID time, this bit will not be set. |

Byte One

| Bit | Description |
|---|---|
| 0 | LRC - Longitudinal Redundancy Check - indicates LRC error has been detected in NRZI operation. |
| 1 | Envelope Check - indicates that one or more tracks have fallen below a pre-set level. During a 1600 bpi write operation, this will also set error status. |
| 2 | Preamble Error - indicates that there is a preamble error in 1600 or 6250 bpi operation. The error is either too few bytes or the ones marker is missing. |
| 3 | Postamble Error - indicates that there is a postamble error in 1600 or 6250 bpi operation. The error is either too many bytes or the ones marker is missing. |
| 4 | Partial block - indicates that an IBG is detected before the end of data. |
| 5 | Lost Beginning of Block (BOB) - indicates that BOB is lost during the block time in 1600 or 6250 bpi operation. |
| 6 | Skew - indicates excessive skew is detected on a 6250/1600 bpi write or read operation. |
| 7 | CRC - Cyclical Redundancy Check - indicates a CRC error was detected in 6250 or 800 bpi for read and write operations, or for write operations in 1600 bpi. |

Byte Two

| Bit | Description |
|---|---|
| 0 | ID Burst Check - indicates the 6250 or 1600 ID Burst is not written correctly, or in 6250 mode the ARA burst or its ID is not written correctly. |
| 1 | Velocity Check - indicates that speed variation during write is beyond the pre-set maximum and minimum allowed. |
| 2 | Tach Fail - indicates that tach pulses have not been received from the TU within a pre-set time. |
| 3 | Erase/Write Current Failure - indicates that one of these currents is not present when it should be or is present during a read operation. |
| 4 | Loopout - indicates the tape loop has crossed the loopout sensor in the vacuum column. |

| | |
|---|---|
| 5 | No Data Read/Word Count Zero - indicates that no data was detected in read, or that no data was transferred from the Host during a write operation. |
| 6 | IBG Overflow - indicates that an excessive IBG count was detected. |
| 7 | Dead Track/Track in Error Status Track P. |

Byte Three

| Bit | Description |
|---|---|
| 0 | Dead Track/Track in Error Status Track 0 |
| 1 | Dead Track/Track in Error Status Track 1 |
| 2 | Dead Track/Track in Error Status Track 2 |
| 3 | Dead Track/Track in Error Status Track 3 |
| 4 | Dead Track/Track in Error Status Track 4 |
| 5 | Dead Track/Track in Error Status Track 5 |
| 6 | Dead Track/Track in Error Status Track 6 |
| 7 | Dead Track/Track in Error Status Track 7 |

This error status is latched and will not be cleared even if the dead track was reset at resync time in GCR. The dead track error status is reset at the start of the command.

## 4.8 DATA TRANSFER

The following signals define the 17 lines associated with a data transfer between the Host and the Formatter. The Formatter includes a 512 byte data buffer. The maximum data transfer rate is 1 megabyte per second (MB/S).

Data Request (DRQ)

This signal is generated by the formatter. In a write operation, it indicates that the formatter is requesting a data byte from the Host. In a read operation, it indicates to the Host that a byte of data is ready to be transferred from the formatter.

Data Lines(D0-7,P)

These nine bi-directional lines are used to transfer write data and read data between the Host and the formatter. The formatter checks parity on write data. These lines should always have odd parity during write and read.

Data Acknowledge (DAK)

This signal originates at the Host and is used to transfer data across the interface in conjunction with the data request signal. DAK in response to DRQ during a write operation indicates that the requested data byte has been placed on the data bus by the Host. DAK in response to DRQ during a read operation signals that the Host has sampled the data byte available at data bus.

Data Busy (DBZ)

This formatter-generated signal indicates that the data is actually being transferred across the interface. The transition from logic '1' to logic '0' signifies the end of data transfer. This signal is set by the first data request signal and cleared by last byte or the end of operation.

Last Byte (LBY)

This signal is generated by the Host in response to data request in a write operation indicating the presence of the last data byte on the data bus. During a read operation, it signals the formatter to discontinue any further data transfer across the interface. The formatter performs error checks on any remaining data bytes in the block.

Odd Byte (OBY)

This formatter-generated signal is asserted for the first byte transferred and toggles to the opposite state for each byte transferred across the interface to allow 16 bit computer words to be easily packed or unpacked by the Host.

Input Bus Enable (IBEN)

This formatter-generated signal conditions the bi-directional data bus for Host to formatter data transfers.

System Reset (SYS RST)

This signal will abort any formatter operation in progress, reset all status and error signals and return the formatter to a ready state. System reset should be asserted for 6 microseconds minimum.

## 4.9 PIN ASSIGNMENTS

The following chart lists the pin assignments for the three Host I/O Interface Connectors: I/01, I/02, and I/03.

PIN NUMBER

| SIGNAL | GROUND | SIGNAL NAME |
|---|---|---|
| I/01-01 | I/01-26 | TU ADDRESS 0 (MSB) |
| I/01-02 | I/01-27 | TU ADDRESS 1 |
| I/01-03 | I/01-28 | TU ADDRESS 2 (LSB) |
| I/01-04 | I/01-29 | COMMAND 0 (MSB) |
| I/01-05 | I/01-30 | COMMAND 1 |
| I/01-06 | I/01-31 | COMMAND 2 |
| I/01-07 | I/01-32 | COMMAND 3 |
| I/01-08 | I/01-33 | COMMAND 4 (LSB) |
| I/01-09 | I/01-34 | DENSITY 0 (MSB) |
| I/01-10 | I/01-35 | DENSITY 1 (LSB) |
| I/01-11 | I/01-36 | |
| I/01-12 | I/01-37 | FORMATTER BUSY |
| I/01-13 | I/01-38 | COMMAND CLOCK |
| I/01-14 | I/01-39 | REJECT STATUS |
| I/01-15 | I/01-40 | LOAD POINT (BOT) |
| I/01-16 | I/01-41 | END OF TAPE |
| I/01-17 | I/01-42 | ON LINE |
| I/01-18 | I/01-43 | READY |
| I/01-19 | I/01-44 | FILE PROTECT |
| I/01-20 | I/01-45 | ROM PARITY ERROR |
| I/01-21 | I/01-46 | REVERSE |
| I/01-22 | I/01-47 | READ MODE |
| I/01-23 | I/01-48 | WRITE MODE |
| I/01-24 | I/01-49 | REWINDING |
| I/01-25 | I/01-50 | ERASE MODE |
| I/02-01 | I/02-26 | DATA 0 (MSB) |
| I/02-02 | I/02-27 | DATA 1 |
| I/02-03 | I/02-28 | DATA 2 |
| I/02-04 | I/02-29 | DATA 3 |
| I/02-05 | I/02-30 | DATA 4 |
| I/02-06 | I/02-31 | DATA 5 |
| I/02-07 | I/02-32 | DATA 6 |
| I/02-08 | I/02-33 | DATA 7 (LSB) |
| I/02-09 | I/02-34 | DATA P |
| I/02-10 | I/02-35 | INPUT BUS ENABLE |

| PIN NUMBER | | |
|---|---|---|
| SIGNAL | GROUND | SIGNAL NAME |
| I/02-11 | I/02-36 | DATA BUSY |
| I/02-12 | I/02-37 | DATA REQUEST |
| I/02-13 | I/02-38 | DATA ACKNOWLEDGE |
| I/02-14 | I/02-39 | LAST BYTE |
| I/02-15 | I/02-40 | REWINDING OR NOT READY |
| I/02-16 | I/02-41 | OVERRUN |
| I/02-17 | I/02-42 | ERROR |
| I/02-18 | I/02-43 | CORRECTED ERROR |
| I/02-19 | I/02-44 | ID BURST |
| I/02-20 | I/02-45 | DATA DENSITY 0 (MSB) |
| I/02-21 | I/02-46 | DATA DENSITY 1 (LSB) |
| I/02-22 | I/02-47 | FILE MARK (TAPE MARK) |
| I/02-23 | I/02-48 | SYSTEM RESET |
| I/02-24 | I/02-49 | DATA PARITY ERROR |
| I/02-25 | I/02-50 | ODD BYTE |
| I/03-01 | I/03-26 | |
| I/03-02 | I/03-27 | ERROR 0 |
| I/03-03 | I/03-28 | ERROR 1 |
| I/03-04 | I/03-29 | ERROR 2 |
| I/03-05 | I/03-30 | ERROR 3 |
| I/03-06 | I/03-31 | ERROR 4 |
| I/03-07 | I/03-32 | ERROR 5 |
| I/03-08 | I/03-33 | ERROR 6 |
| I/03-09 | I/03-34 | ERROR 7 |
| I/03-10 | I/03-35 | ERROR STATUS CONTROL 0 (LSB) |
| I/03-11 | I/03-36 | ERROR STATUS CONTROL 1 (MSB) |
| I/03-12 | I/03-37 | |
| I/03-13 | I/03-38 | |
| I/03-14 | I/03-39 | |
| I/03-15 | I/03-40 | |
| I/03-16 | I/03-41 | |
| I/03-17 | I/03-42 | |
| I/03-18 | I/03-43 | |
| I/03-19 | I/03-44 | |
| I/03-20 | I/03-45 | |
| I/03-21 | I/03-46 | |
| I/03-22 | I/03-47 | |
| I/03-23 | I/03-48 | |
| I/03-24 | I/03-49 | |
| I/03-25 | I/03-50 | |

## 4.10 FORMATTER DATA PATHS

## 4.11 READ DATA PATH

PHASE LOCKED OSCILLATOR (PLO)

The PLO defines bit-cell boundaries in data read from tape recorded in PE or GCR mode.

The unique, Telex implementation is adjustment free. The digital techniques employed compensate for component variations.

There are nine independent phase-locked oscillators (one for each data track). The primary purpose of the PLO is to generate a clock synchronized to the data in GCR and PE offsetting the speed variation from the tape. This data clock (PLOCLK) is used to clock data into the skew buffer.

Each PLO consists of the following loop components:

1. Voltage controlled oscillator (VCO)
2. Synchronous N/2 counter
3. Asynchronous N counter
4. Phase detector
5. Low-pass filter

When the loop is in lock there is little phase error generated and the VCO continues to run at the same frequency. However, if incoming data undergoes a frequency or phase shift (speed change), a phase error will be generated and the VCO will change its frequency to stay phase locked to data.

The VCO clocks both the N and N/2 counters, which provide the reference frequency and variable input to the phase detector, respectively. The phase detector generates an output pulse equal to the difference in phase between the two counters. This phase pulse is filtered and amplified to produce a voltage proportional to the phase error. The sign of the voltage indicates whether the variable input leads or lags the reference. The low-pass filter determines the loop operating characteristics of bandwidth, step, and frequency response. Different loop filters and values of N are selected according to the density.

SKEW BUFFER (deskewing)

The primary purpose of the skew buffer is to store data coming from the individual detection logic of each track, reassemble the byte, and release the data as a parallel, nine bit byte. There is one skew buffer for each data track. Each skew buffer operates independently of the other eight tracks since the bits that pertain to each byte are accurately defined for each bit period. The skew buffer is organized as a 32 x 2-bit, first in-first out (FIFO) file. Two types of information are stored in the skew buffer: actual data (DETONES, detect ones) and phase error/track down information (PHASERR/TRKDOWN).

Skew buffer operation is initiated at the end of the preamble (RICMRK) and is terminated at the end of data. Each track contains a Read In Counter (RIC), which operates independently of the other tracks. When all skew buffers have received at least one bit of data, the first complete byte of data has been accumulated. A Read Out Counter (ROC) cycle is initiated and the complete data byte is transferred to the 5:4 buffer (GCR only).

The read in counter is incremented and decremented with each bit stored and read from the FIFO. The output of each counter reflects the skew of each track continuously during GCR and PE operations.

Skew limitations are 28 bytes in GCR (14 on read after write) and 14 bits in PE (4 on read after write). If these limits are exceeded a skew error flag is set.

## 4.12 ERROR DETECTION/CORRECTION, READ

The formatter contains logic to correct erroneous data in GCR, PE, and nine-track NRZI operation. The basic areas of read logic to detect errors and correct detected errors are described below. These operations are transparent to the Host for PE and GCR.

### POINTER SYSTEM

Pointers are indicators of wrong data such as low amplitude, phase error, or invalid data. The pointer system receives inputs from Data Detectors (AMPSENSOR), the 5:4 Decoder (GCR, Invalid Format), and ECC (GCR, Last Track Corrected). If a track is consistently bad, that track will be dead-tracked until the RESYNC burst. The pointer information is used by error correction circuitry.

### DEAD TRACK REGISTER

The Dead Track Register (DTR) uses one latch for each track. Once the track is dead tracked, the data on that track is ignored until the DTR is reset at RESYNC time or at sense reset. An active dead track latch forces that skew buffer output to zero and inhibits the Skew Counter for that track. Dead track information is reported to the computer in error bytes 2 and 3.

### GCR ERROR DETECTION/CORRECTION

Error correction is based upon a modified cyclic code. An error in any single track, on a data group basis, can be corrected without any additional information. With track pointers available, two tracks can be corrected. The error correction logic inserts one check character (ECC) for every seven data characters. All data and ECC characters have odd parity. Two overall check characters (CRC and auxiliary CRC) are used for detection of errors that lie outside the range of the correction process. An auxiliary CRC is computed on data characters only. The CRC is computed on the data characters, fill in residual data group, and the auxiliary CRC character.

The error correction and detection is performed "on the fly." In GCR write operation single track correction is accomplished, while in read operation two tracks can be corrected. The ECC logic is located on the PLO board.

PE ERROR CORRECTION

PE error correction circuits are capable of correcting one track at a time "on the fly" during a read operation.

If the parity of the data byte in the ECC register is correct no correction is performed. However, if the ECC register has bad parity, then INVERT ECC is enabled. This signal enables inverting any bit in the ECC register (for which the corresponding POINTER or DTR is set) as the data byte is transferred to the buffer register.

NRZI ERROR CORRECTION

NRZI error correction is attempted automatically by the formatter if a faulty read forward operation is followed by a reverse space block command and then by a read forward command.

At the end of a read operation the formatter checks for a mismatch. If a mismatch is indicated, a routine is executed to determine the track in error. Zeros are shifted until the shift pattern matches the error pattern register. The number of shifts required for match correlates with the track number of the track in error, and an appropriate bit is set on the MPWRTx bus to give track in error information. This in turn is saved in working storage.

NRZI error correction is also initiated when the host issues a TIE command followed by a reverse space block and then a read command. The TIE command causes the microprocessor to load the MPWRTx bus with the TIE byte from working storage. This enables the error correction logic to replace the track in question on the basis of byte parity at the primary parity check. The secondary parity check verifies that error correction has taken place.

## 4.13 FORMATTER WRITE LOGIC

The Polynomial Generator gate array accepts input data from the FIFO and generates ECC, ACRC, and CRC polynomial characters appropriate for the data density mode (PE, NRZI, or GCR) currently in operation. Either data or a polynomial character is transmitted to the Write Data Path gate array as commanded by the Write Control gate array.

The Write Data Path gate array accepts the data or polynomial character from the Polynomial Generator. This will normally be encoded by a 4 to 5 encoder if the operation is in GCR. The Write Data Path will also insert all ones or all zeros characters or other special characters into the data stream as commanded by the Write Control. Finally, the character is passed on to the tape unit to be written on tape.

The Write Control gate array generates control signals at the appropriate times to cause the Polynomial Generator and the Write Trigger to perform their functions. The Write Control is controlled by the 68000 microprocessor firmware. Once the Write Control is properly set up and the operation is initiated, the write operation will be completed by the write gate arrays with no further intervention from the firmware. Exceptions to this are in the event of a diagnostic write and in the event of an early termination of the write operation.

After receipt of a write command from the host computer the 68000 microprocessor firmware interrogates the tape unit for status. If the status is clean, the formatter raises FUBUSY and proceeds with the write operation. If the tape is at load point, the formatter erases the tape near load point and writes the appropriate ID burst and gap prior to writing the first block. For midtape operation, the formatter positions the tape so that a gap is written before writing the data block in the appropriate density. In addition, the host interface and the FIFO are set up by the firmware to transfer data from the host to the FIFO, and a velocity check is also performed to insure the tape drive is up to speed prior to writing the block.

The firmware then sets up the Write Control gate array to do a write operation in the desired density. The write operation may actually be a Write Tape Mark or Erase Gap operation as well as a write data operation. The firmware may also cause the write logic gate arrays to be set up to perform in a diagnostic mode such as 'write dead track.' After verifying the velocity, setting up the write logic gate arrays, and verifying that data is available, the firmware commands the write logic gate arrays to begin operation.

During write operation the formatter reads back the block written on the tape and checks for data errors. When the formatter detects the end of block during the echo read, the write operation is terminated. The firmware issues a stop command to the tape unit and again obtains tape unit status.

The heart of the write logic consists of three gate arrays: the Polynomial Generator, Write Data Path, and Write Control. See Figures 4-9 and 4-10, block diagrams of overall formatter operation.

## 4.14 EMBEDDED FUNCTIONS, 9250 TAPE SUBSYSTEM (See 7.9 for DKB commands.)

The 9250 Tape Subsystem incorporates several embedded functions, which are discussed below. <u>NOTE: Settings are in nonvolatile ram and must be reset if the I/O Control Write PWB is replaced.</u>

---- MANUAL DENSITY SELECTION

Manual Density Selection affects only the manner in which density is indicated while the Tape Unit is Online at Load Point.

Write Density Selection is accomplished in the following fashion. There are several factors considered by the Formatter in deciding which density to use in writing a tape:

(A) Host density signals (DDS0 and DDS1)
(B) Tape Unit Density Status (GCR, NRZI, or neither (PE))
(C) Tape Unit Density Request (GCR Request, NRZI Request or neither)
(D) Tape position (Load Point or midtape)

Two bits in the TU status (GCR Request and NRZI Request) indicate the last density selected by the operator while the TU is offline. These status bits may be changed while the TU is offline either unloaded, at Load Point, or in midtape.

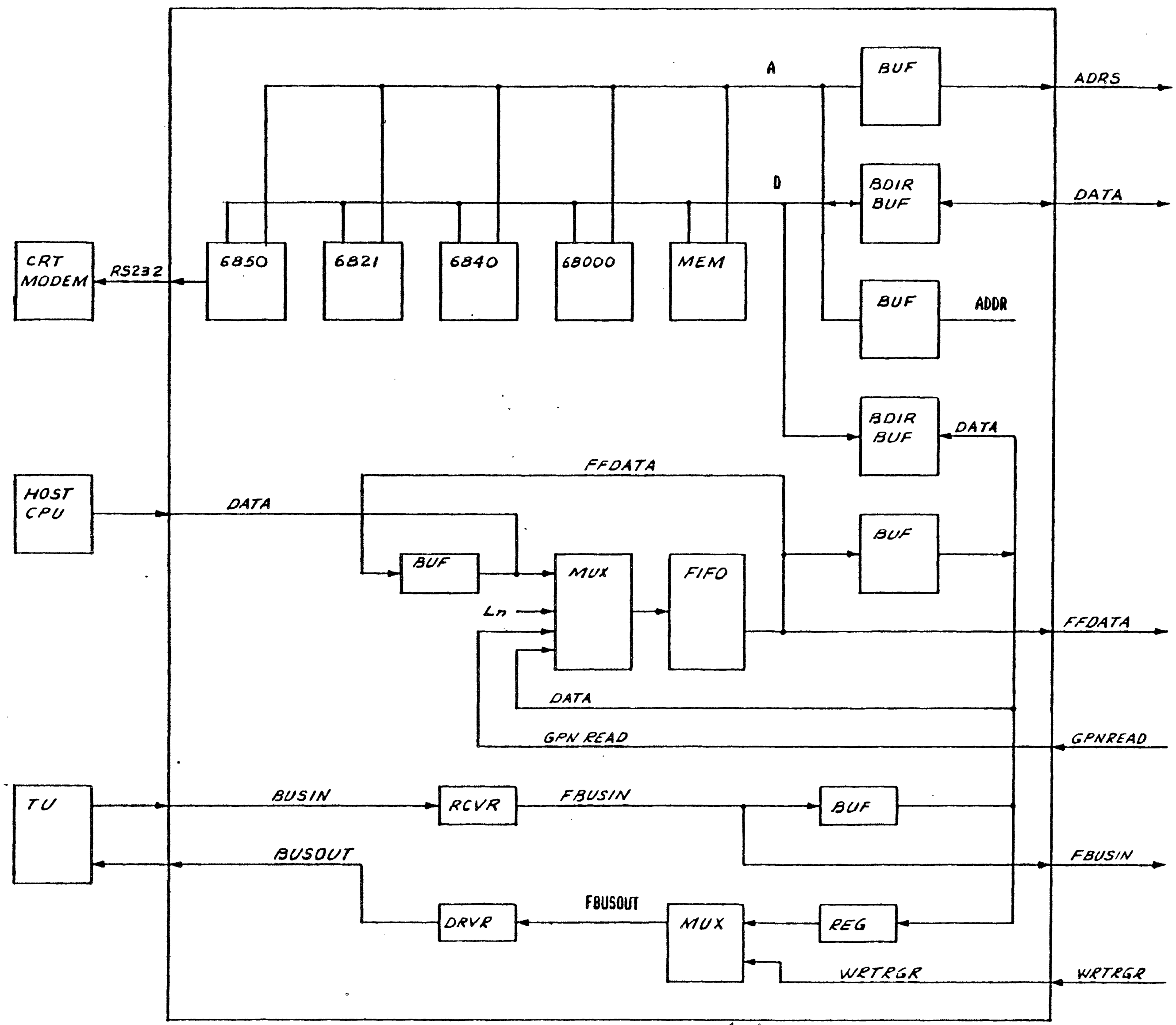



Figure 4-9. Formatter MPU and I/O Block Diagram

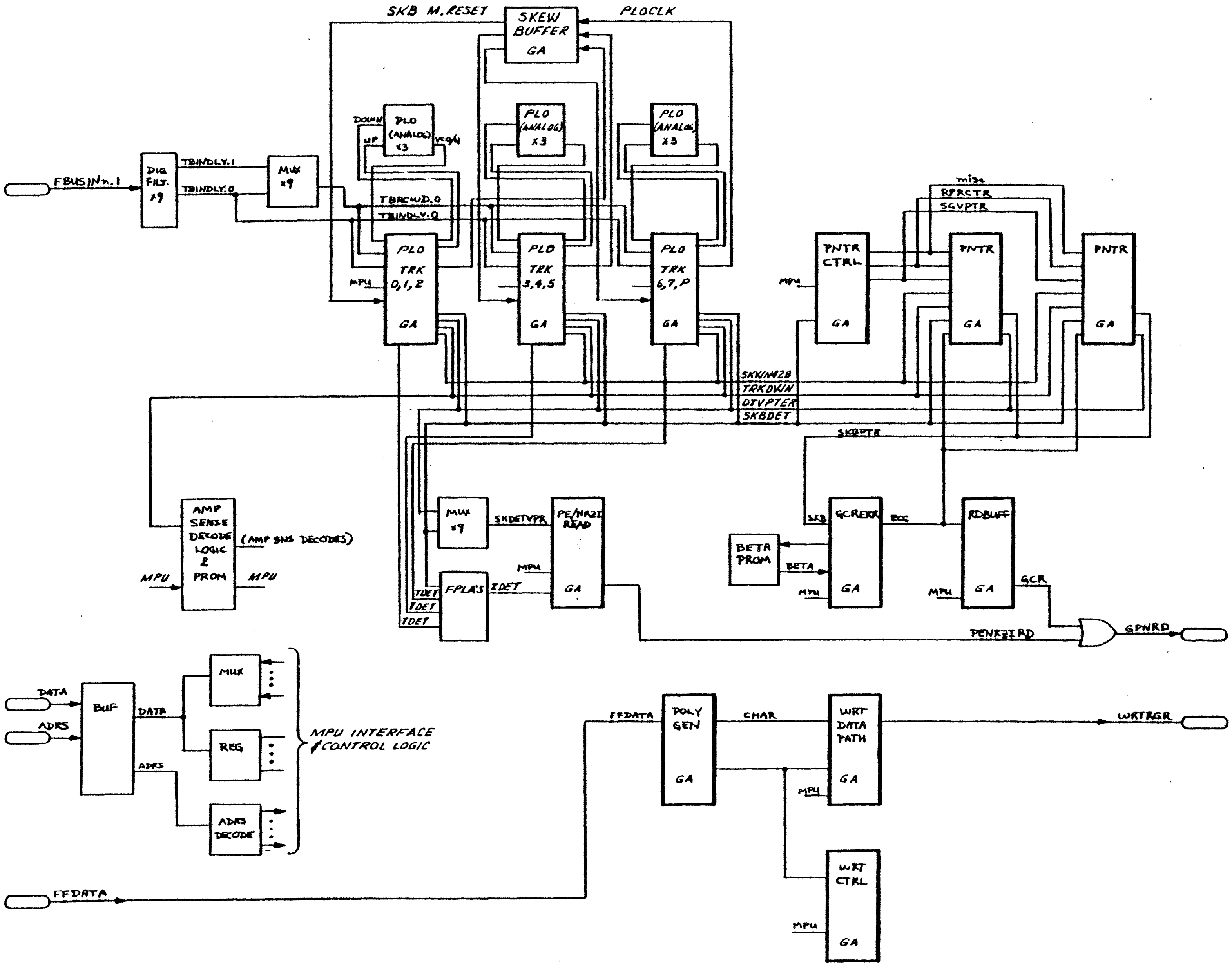



Figure 4-10. Formatter Read/Write Block Diagram

Two hardwired signals from the Host to the Formatter (DDS0 and DDS1) indicate the host's density selection. They are coded in the following fashion:

| DDS0 | DDS1 | Function |
|---|---|---|
| 0 | 0 | PE |
| 0 | 1 | NRZI |
| 1 | 0 | GCR |
| 1 | 1 | Defer to TU Requested Density |

A midtape write operation is always performed in the same density used for the ID Burst.

A write operation at Load Point is performed in the density selected by the host with the exception that if DDS0 and DDS1 are coded as (1,1) then the host is giving permission to the Formatter to write the tape in the density selected by the Tape Unit density request status bits (GCR Request and NRZI Request).

The density indicators on the front panel operate as follows:

Offline:
Indicate density selected by the operator. Operator selects density by pressing Density pushbutton.

Online - Midtape:
Indicate operational density in accordance with state of TU density status bits.

Online at Load Point:
If Manual Density Select is in effect then the Density Status Display shows the state of the Tape Unit Density Request status bits.
If Manual Density Select is not in effect then the Density Status Display shows the state of the TU Density operational Status bits.

---FORCED READ DENSITY

For normal read operations, the density is established upon reading the ID Burst when the tape leaves Load Point (BOT). With Forced Read Density activated, the operator can preset and control the read density. Forced Read Density is deactivated automatically once the tape has left Load Point.

The Operator activates or de-activates Forced Read Density by using the Diagnostic Keyboard. With the TU at Load Point and off-line, the Operator presets the read density using the Density pushbutton on the OCP. The preset density will be illuminated.

With Forced Read Density activated, the TU activates the Forced Read Density Status bit indicating to the formatter that read operations are forced to the density as defined by the density bits. Forced Read enable is reported in TU Sense Byte 3, bit 0.

---SEISMIC OPTION

The Seismic Option changes the criteria of the read-after-write check for GCR and PE (6250 and 1600 bpi). The write operation is completed and the data is recorded on the tape regardless of tracks in error. Standard write errors will be reported. It is the responsibility of the host to rewrite the block, or leave the block as written. The option also disables FMK error, which normally indicates tape runaway condition during read.

The Operator activates or deactivates the Seismic Option by using the Diagnostic Keyboard. (This option is deactivated when the tape unit is shipped.)

---ADDRESS SELECT

Tape units are attached by a daisy chain cable to the formatter, and the device address is controlled in each TU. Valid addresses are 0,1,2, and 3. Any TU can be set to any address. For normal operation the last digit in the three-digit STATUS display on the OCP indicates the device address. The address can be changed by using the Diagnostic Keyboard.

---RS232 PORT

An RS232 Port is provided on the microprocessor card (A4) of the formatter. Diagnostics may be activated and executed from this port. The 9250 must be logically off-line from the host for such operation.

The port is configured as data communications equipment (DCE), allowing most terminals (DTE) to be directly connected. If a modem is connected, a crossover ("no-modem") cable should be used.

MICROCOMPUTER BOARD CONTROLS

The microcomputer board contains two four-position DIP switches, a toggle switch, and a pushbutton switch. One of the DIP switches and the pushbutton switch control reset of the tape subsystem. The other DIP switch and the toggle switch control operation through the RS-232 port.

RESET CONTROLS

The pushbutton switch, S1, is provided as an auxiliary RESET for the subsystem. It provides the same function as a normal power-on reset; formatter diagnostic settings are cleared, initial conditions are established, and RESET commands are sent to all tape units in the subsystem. Tape unit configuration and calibration settings that are saved during power off conditions are not affected. This switch will not be used during normal operation.

Provisions have been made for a maximum of four pairs of program EPROMS. Switch S3 determines the pair that is initially selected during reset. The normal configuration includes three pairs of EPROMS: U4 & U5, U6 & U7, and U8 and U9. With this configuration U8 & U9 should be selected for RESET selection by setting section 3 of S3 to ON (closed) and sections 1, 2, and 4 to OFF (open). One and only one section of S3 should be ON during RESET. This switch should not be changed during normal operation.

S3 SETTINGS

| SECTION 1 | 2 | 3 | 4 | RESET PAIR SELECTED | REMARKS |
|---|---|---|---|---|---|
| ON | OFF | OFF | OFF | U4 & U5 | SPECIAL DIAGNOSTICS ONLY |
| OFF | ON | OFF | OFF | U6 & U7 | HOST OPERATION ONLY |
| OFF | OFF | ON | OFF | U8 & U9 | NORMAL OPERATION |
| OFF | OFF | OFF | ON | U10 & U11 | RESERVED FOR EXPANSION |

MICROCOMPUTER STATUS INDICATORS

Eight LEDs are provided on the microcomputer board to indicate status of the subsystem. Under normal idle conditions, while the subsystem is not executing a tape operation, the green RUN LED will be on, and all other LEDs will be off.

During RESET, the yellow RESET, red HALT, and yellow LOAD LEDs should be on, and all other LEDs off. This occurs while the system reset signal from the host is active, while RESET pushbutton S1 is depressed, and for approximately a second after power is turned on.

Under non-reset conditions, the red HALT LED indicates failure of the formatter (A4 or A5). If the yellow LOAD LED is on also, the microcomputer (A5) has failed.

The other four LEDs, CR5, CR6, CR7, and CR8, are provided for future diagnostic use.

MICROCOMPUTER STATUS INDICATORS

| RESET yellow | HALT red | LOAD yellow | RUN green | REMARKS |
|---|---|---|---|---|
| ON | ON | ON | XX | RESET Active |
| OFF | OFF | OFF | ON | Normal idle condition |
| OFF | OFF | OFF | OFF | Normal active condition |
| OFF | ON | OFF | XX | FAILURE of A4 or A5 (formatter) |
| OFF | ON | ON | XX | FAILURE of A5 (microcomputer) |

RESET (C] (Yellow LED)
HALT (C] (Red LED)
LOAD (C] (Yellow LED)
RUN (C] (Green LED)

```
CR8       <[]  (Red LED)
CR7       <[]  (Red LED)
CR6       <[]  (Red LED)
CR5       <[]  (Red LED)

RESET     +[]  (Pushbutton S1)
          -[]  (Toggle S2)
```

RS-232 PORT CONTROLS

The toggle switch, S2, is provided to activate the RS-232 port for diagnostic execution. Prior to actuation of this switch, a terminal, modem, or other RS-232 device should be connected to A4J6 of the microcomputer board. The baud rate is set with DIP switch S4, as indicated in the table below.

For information on operation of the diagnostics from the RS-232 port see Section 7.

SPEED SETTINGS FOR THE RS-232 PORT (S4)

| BAUD | SWITCH SECTION | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 50 | ON | ON | ON | ON |
| 75 | OFF | ON | ON | ON |
| 110 | ON | OFF | ON | ON |
| 134 | OFF | OFF | ON | ON |
| 150 | ON | ON | OFF | ON |
| 300 | OFF | ON | OFF | ON |
| 600 | ON | OFF | OFF | ON |
| 1200 | OFF | OFF | OFF | ON |
| 1800 | ON | ON | ON | OFF |
| 2000 | OFF | ON | ON | OFF |
| 2400 | ON | OFF | ON | OFF |
| 3600 | OFF | OFF | ON | OFF |
| 4800 | ON | ON | OFF | OFF |
| 7200 | OFF | ON | OFF | OFF |
| 9600 | ON | OFF | OFF | OFF |
| 19200 | OFF | OFF | OFF | OFF |

----RS-232 PORT CONFIGURATION

| ITEM | OPTION |
|---|---|
| Speed | Switch selectable (see table above) |
| Data Bits | 8 bits |
| Stop bits | 1 bit transmitted |
| Parity | None |
| Line feed | Sent with Carriage Return |

----RS-232 PORT CONFIGURATION (continued)

| ITEM | OPTION |
|---|---|
| Flow Control | XON/XOFF not supported |
| | Incoming XOFF not supported |
| | RTS-CTS handshake not supported |
| Mode | Full duplex |

----RS-232 PORT PINOUT

| PIN | CIRCUIT | DIRECTION | DESCRIPTION |
|---|---|---|---|
| 1 | AA | Protective ground | |
| 2 | BA/TXD | To FU | Transmitted Data |
| 3 | BB/RXD | From FU | Received Data |
| 4 | CA/RTS | To FU | Request To Send |
| 5 | CB/CTS | From FU | Clear To Send |
| 6 | CC/DSR | From FU | Data Set Ready |
| 7 | AB | | Signal Ground |
| 8 | CF/DCD | From FU | Received Line Signal Detector |
| 20 | CD/DTR | To FU | Data Terminal Ready |

## 4.15 PERTEC INTERFACE

This section defines the interface between the host adapter and the Telex formatter/tape unit(s). This interface is based on the industry standard interface for one-half (1/2) inch tape units. This interface is sometimes referred to as the "Pertec" interface. Presently Telex supports three different versions of the interface.

### SIGNAL CLASSIFICATION AND GROUPING

The interface signals can be separated into four classes: address, status, command, and data exchange. No class is autonomous.

### ADDRESS SIGNALS

The signals that make up the address class can be divided into two groups: formatter address and tape unit address. These signals are all generated by the host adapter. They are responsible for the selection of a formatter and an attached tape unit. In themselves, they cause no action to take place. These signals should remain fixed (not change logic state) from the time a command is issued until it has completed execution. This is because status information returned by the formatter is pulsed and may be undetected by the host adapter if other formatter or tape unit status is addressed.

The formatter address selects between two possible formatters on a host adapter channel (or cable set). The formatter address is composed of the following signal: FFAD.

The tape unit address selects one of four possible tape units attached to a selected formatter. The tape unit address is composed of the following signals: FTAD0 and FTAD1.

There may be as many as two (2) formatters on a cable set and there may be as many as four (4) tape units attached to each formatter.

### STATUS SIGNALS

The signals that makeup the status class can be divided into two groups: formatter status and tape unit status. These signals are all generated by the formatter. They are responsible for the conveyance of status information to the host adapter. The selection of a formatter and tape unit (by the address signals) immediately makes these signals available to the host adapter via the cable set.

The formatter status signals change frequently as a result of command execution and under certain circumstances are pulsed. These signals are relatively dynamic in nature. The formatter status signals are: FFBY, FDBY, FFMK, FID, FCCG, FCER, and FHER.

The tape unit status signals do not change frequently. These signals are relatively static in nature. The tape unit status signals are: FRDY, FONL, FRWD, FEOT, FFPT, FLDP, FHSPD, FGCR, and FNRZI.

COMMAND SIGNALS

The command class of signals can be divided into two groups: strobed and encoded. These signals are all generated by the host adapter. They are responsible for entering a command into a formatter (as selected by the formatter address ). The host adapter must observe the status signals to determine when it is permissible to enter a command, the status of command execution, and the terms of command completion.

The strobed signals specify explicit commands to be executed by the formatter when one is pulsed. The commands invoked by these signals are the less frequently used requests. The strobed signals are: FREW, FLOL, and FOFL.

The encoded signals are used to select from a variety of commands, some of which are unique to a manufacturer's host adapter. One of the signal lines is a strobe to latch the remaining signals of this group. That strobe causes the formatter to decode the latched data and execute the specified command. The commands which are invoked by the encoded signals are the most frequently used requests. The encoded signals are: FGO (the strobe), FREV, FWRT, FEDIT, FWFM, FERASE, FHISP, FTHR, and FLGAP.

DATA EXCHANGE SIGNALS

The signals that makeup the data exchange class can be divided into two groups: write data and read data . These signals are generated by either the host adapter or the formatter. The formatter, however, controls the data transfers in and out of the host adapter. These signals are responsible for the conveyance of information between the host adapter and the formatter. Data exchanges are generated during the execution of certain commands.

The write data signals are used to transfer data from the host adapter to the formatter. This transfer is done during the execution of certain commands to obtain data for the tape unit and to terminate execution. One signal is a strobe to acknowledge that the data presented to the formatter has been accepted. It is generated by the formatter. Another signal (from the host adapter) informs the formatter that the data being accepted is the last word (byte) to be transferred. This last word signal is used by some commands that ignore the data completely, just to tell when to terminate execution. The other signals of the write data group convey the word (byte) data and its parity. The write data signals are: FDWDS (the strobe), FLWD (the last word flag), FWD0 through FWD7, and FWDP (the parity bit).

The read data signals are used to transfer information from the formatter to the host during the execution of certain commands. All signals are generated by the formatter. One signal is a strobe to inform the host adapter that the data on the read data signal lines is valid and must be accepted. The other signals convey the word (byte) data and its parity. The read data signals are: FRSTR (the strobe), FRD0 through FRD7 (the date), and FRDP (the data parity bit).

Table 4-1 a chart of signals arranged by class and group. Figure 4-11 depicts the interface cable set with the signals arranged by group.

Table 4-1. Signal Classification Chart

| Class | Group | Signal | Description |
|---|---|---|---|
| Address | | | |
| | Formatter | | |
| | | FFAD | Formatter address bit |
| | Tape Unit | | |
| | | FTAD0 | Tape unit address bit 0 |
| | | FTAD1 | Tape unit address bit 1 |
| Status | | | |
| | Formatter | | |
| | | FFBY | Formatter busy |
| | | FDBY | Data busy |
| | | FFMK | File mark encountered |
| | | FID/FCCG | IDB encountered/NRZI check character gate |
| | | FCER | corrected error |
| | | FHER | hard error |
| | Tape Unit | | |
| | | FRDY | Tape unit ready |
| | | FONL | Tape unit on-line |
| | | FRWD | Tape unit in rewind |
| | | FEOT | Tape unit tape at EOT |
| | | FFPT | Tape unit tape write protect |
| | | FLDP | Tape unit tape at BOT |
| | | FHSPD/ FGCR | Tape unit high speed mode/ GCR mode |
| | | FGCR/ FNRZI | Tape unit in GCR mode/ NRZI mode |
| Command | | | |
| | Strobed | | |
| | | FREW | Rewind tape unit tape |
| | | FLOL | Load tape and go on-line |
| | | FOFL | Rewind, unload tape and go off-line |
| | | FFEN | Reset formatter |
| | Encoded | | |
| | | FGO | Execute encoded command |
| | | FREV | Reverse - encoded bit 0 |
| | | FWRT | Write - encoded bit 1 |
| | | FEDIT | Edit - encoded bit 2 |
| | | FWFM | Write filemark - encoded bit 3 |
| | | FERASE | Erase - encoded bit 4 |
| | | FHISP | High speed - encoded bit 5 |
| | | FTHR | Threshold - encoded bit 6 |
| | | FLGAP | Long gap - encoded bit 7 |

Table 4-1. Signal Classification Chart (continued)

| Class | Group | Signal | Description |
|---|---|---|---|
| Exchange | | | |
| | Write | | |
| | | FDWDS | Demand write strobe |
| | | FLWD | Last word flag |
| | | FWD0-FWD7 | Write data |
| | | FWDP | Write data parity bit |
| | Read | | |
| | | FRSTR | Read strobe |
| | | FRD0-FRD7 | Read data |
| | | FRDP | Read data parity |

```
****************                   ******************
* HOST ADAPTER *                   * FORMATTER/T.U. *
*   SIGNALS    *                   *    SIGNALS     *
****************                   ******************

FFEN------------------------------1->

FFAD------------------------------1->

FTAD0,FTAD1-----------------------2->

               <-6-----------------FFBY,FDBY,FFMK,
                                   FID,FCER,FHER

               <-8-----------------FRDY,FONL,FRWD,FEOT,
                                   FFPT,FLDP,FHSPD/FGCR,
                                   FGCR/FNRZI

FREW,FLOL,FOFL,-------------------3->

FGO,FREV,FWRT,FEDIT,FWFM,---------9->
FERASE,FHISP,FTHR,FLGAP

              <-1/11---------------FDWDS

FLWD,FWD0-FWD7,FWDP----------10/11->

              <-10-----------------FRSTR,FRD0-FRD7,FRDP

SPARE-------------------1----------SPARE

SIGNAL GROUNDS---------48----------SIGNAL GROUNDS
```

Figure 4-11. Interface Cable Signal Grouping

DATA TRANSFER RATE

The data transfer rate differs from nominal during the initial phase of commands which transfer data due to "data bursting". The data burst rate is user programmable. The data burst rate MUST always exceed the maximum nominal transfer rate.

The nominal data transfer rate (for both read and write operations) is primarily dependant on both the tape speed and the data format. The tape format versus the nominal transfer rate is shown in Table 4-2. Due to bit crowding, signal drop-out correction, and tape speed variation, the host adapter must be able to tolerate variations of 0.75 to 1.25 times the nominal data rate (+/- 25.%).

**Table 4-2. Nominal Data Transfer Rates**

| Tape Format | Nominal Data Rate* |
|---|---|
| NRZI | 40,000. |
| PE | 80,000. |
| GCR | 312,500. |

* Words (bytes) per second (BPS), at 50. IPS.

## 4.16 SYSTEM CONFIGURATION AND CABLING

The host interface is connected to the Telex formatter with two flat cables of fifty conductors each (the cable set). Two Telex formatters are permited per cable set: via daisy-chaining. When two formatters are resident in a system, factory installed line terminators are allowed on the formatter ONLY at the end of the cable set. Line terminators on the formatter midway along the cable set (between the host interface and the last formatter of a two formatter arrangement) MUST be removed. If two formatters are resident on the same cable set and both have their factory installed line terminators, damage to the host interface adapter is likely.

Normally, there will be only one formatter per host interface adapter. This is the minimum system configuration. This situation is shown in Figure 4-12.

When additional tape units are attached to a formatter (as many as four), a system configuration as shown in Figure 4-13 results.

There may be two formatters on a cable set. This configuration REQUIRES the removal of factory installed line terminators on the "midway" located formatter. This situation is shown in Figure 4-14.

```
 ______________                                    ________________
|              |                                  |                |
|<HOST  SYSTEM>|                                  |<--FORMATTER 0-->|
|              |                                  |                |
| HOST ADAPTER <--------CABLE SET------->(LINE TERMINATOR)|
|              |                                  |                |
|______________|         +-T.U. CABLE--->________________|
                         |
                         |
                         |
                         |                         ________________
                         |                        |                |
                         |                        |<--TAPE UNIT 0-->|
                         |                        |                |
                         +------------->(LINE TERMINATOR)|
                                                  |________________|
```

Figure 4-12  Minimum System Configuration

```
 _______________                           __________________
|               |                         |                  |
|<HOST   SYSTEM>|                         |<--FORMATTER 0-->|
|               |                         |                  |
| HOST ADAPTER <--------CABLE SET------->(LINE TERMINATOR)|
|               |                         |                  |
|_______________|          +-T.U. CABLE--->                  |
                           |              |                  |
                           |              |__________________|
                           |
                           |               _______________
                           |              |               |
                           |              |<-TAPE UNIT 0->|
                           |              |               |
                           +------------+->               |
                                        | |_______________|
                                        |  _______________
                                        | |               |
                                        | |<-TAPE UNIT 1->|
                                        | |               |
                                        +->               |
                                        | |_______________|
                                        |  _______________
                                        | |               |
                                        | |<-TAPE UNIT 2->|
                                        | |               |
                                        +->               |
                                        | |_______________|
                                        |  __________________
                                        | |                  |
                                        | |<--TAPE UNIT 3-->|
                                        | |                  |
                                        +->(LINE TERMINATOR)|
                                          |__________________|
```

Figure 4-13 Single Formatter and Multiple Tape Units

```
 ______________                          _________________
|              |                        |                 |
|<HOST  SYSTEM>|                        |<--FORMATTER 0-->|
|              |                        |                 |
| HOST ADAPTER <--------CABLE SET-----+->                 |
|              |                      | |                 |
|              |    +-----------------+ |                 |
|              |    |                   |                 |
|______________|    |    +-T.U. CABLE--->                 |
                    |    |              |                 |
                    |    |              |_________________|
                    |    |
                    |    |               _________________
                    |    |              |                 |
                    |    |              |<--TAPE UNIT 0-->|
                    |    |              |                 |
                    |    +-------------->(LINE TERMINATOR)|
                    |                   |_________________|
                    |
                    |                    _________________
                    |                   |                 |
                    |                   |<--FORMATTER 1-->|
                    |                   |                 |
                    +------------------->(LINE TERMINATOR)|
                                        |                 |
                         +-T.U. CABLE--->                 |
                         |              |                 |
                         |              |_________________|
                         |
                         |               _________________
                         |              |                 |
                         |              |<--TAPE UNIT 0-->|
                         |              |                 |
                         +-------------->(LINE TERMINATOR)|
                                        |_________________|
```

Figure 4-14 Two Formatters With A Single Tape Unit System

When two formatters are on a single host cable set and multiple tape units (as many as four per formatter) reside on each formatter, the configuration is considered to be at maximum. The maximum system configuration is shown in Figure 4-15.

## 4.17 FORMATTER ADDRESSING

Each host adapter cable set may have as many as two (2) resident formatters. A formatter can be selected either by a low or a high logic state of the cable set formatter address (FFAD) signal line. The formatter has a jumper block for setting which level will select it. The three pin formatter address jumper block is set by positioning the jumper body ("shoring" device) such that the center pin is connected ("shorted") to one of the outer pins. The outer pins are labeled "FFAD.0" and "FFAD.1", for formatter zero (0) and formatter one (1) respectively. The normal, single formatter, factory installed jumper is set in position FFAD.0 (high state, negative true logic, in the cable set). In two formatter systems one formater MUST be set for FFAD.0 only and the other FFAD.1 only. Otherwise, cable set bus conflict will result.

## 4.18 TAPE UNIT ADDRESSING

Each formatter may have as many as four (4) tape units attached to it. An individual tape unit is selected by the cable set tape unit address signals (FTAD0 and FTAD1, tape unit address bits 0 and 1). Tape unit 0 (of 0 through 3) is selected when both cable set signals FTAD0 and FTAD1 are logically zero (high state, negative true logic, in the cable set).

## 4.19 TAPE DENSITY/FORMAT CAPABILITIES

The Telex formatter and tape units (of this model) will operate in three formats: NRZI, PE, and GCR. The tape unit densities are 800., 1600., and 6250. bits per inch (BPI) each, respectively. Please note that these are not literal tape bit densities but, are representations of host data bit densities.

FGO COMMAND STROBE (encoded command)

The FGO strobe from the host latches eight other signal lines from the host: FREV, FWRT, FEDIT, FWFM, FERASE, FHISP, FTHR, and FLGAP. These eight signals encode several commands:

---Write Command:

This command causes the tape unit to record data from the host. The data is transferred to the formatter on the FWD0 through FWD7 signal lines. The host adapter word (byte) transfers are clocked by the formatter demand write data strobe (FDWDS signal line). The data transfer will continue until the host indicates that the last word (byte) has been sent to the formatter. The host indicates the last data transfer by asserting the FLWD signal line (last word flag) with the last transfer.

```
 _______________                           __________________
|               |                         |                  |
|<HOST   SYSTEM>|                         |<--FORMATTER 0--> |
|               |                         |                  |
| HOST ADAPTER <--------CABLE SET-----+-> |                  |
|               |    +-----------------+  |                  |
|_______________|    |    +-T.U. CABLE--->|__________________|
                     |    |                ________________
                     |    |               |                |
                     |    +-----------+-><-TAPE UNIT 0->   |
                     |                |   |________________|
                     |                |    ________________
                     |                |   |                |
                     |                +-><-TAPE UNIT 1->   |
                     |                |   |________________|
                     |                |    ________________
                     |                |   |                |
                     |                +-><-TAPE UNIT 2->   |
                     |                |   |________________|
                     |                |    __________________
                     |                |   |                  |
                     |                |   |<--TAPE UNIT 3--> |
                     |                +->(LINE TERMINATOR)   |
                     |                    |__________________|
                     |                     __________________
                     |                    |                  |
                     |                    |<--FORMATTER 1--> |
                     |                    |                  |
                     +------------------>(LINE TERMINATOR)   |
                                          |                  |
                          +-T.U. CABLE--->|__________________|
                          |                ________________
                          |               |                |
                          +-----------+-><-TAPE UNIT 0->   |
                                      |   |________________|
                                      |    ________________
                                      |   |                |
                                      +-><-TAPE UNIT 1->   |
                                      |   |________________|
                                      |    ________________
                                      |   |                |
                                      +-><-TAPE UNIT 2->   |
                                      |   |________________|
                                      |    __________________
                                      |   |                  |
                                      |   |<--TAPE UNIT 3--> |
                                      +->(LINE TERMINATOR)   |
                                          |__________________|
```

The maximum cable set length is twenty feet. This length is measured from the host interface adapter PWB to the end formatter.

Figure 4-15 Maximum System Configuration

---Write File Mark Command:

This command causes the formatter to write the proper file mark on the tape.

---Erase Commands:

All erase commands will cause the identification burst (IDB) to be written on tape when an erase command is given while the beginning of tape sensor is active (BOT).

1) Fixed Erase: This command causes the inter-record gap (IBG) to be extended by three inches (3. IN).

2) Controlled Erase: This command will cause the formatter to erase the tape continuously and issue generated demand write data strobes (FDWDS signal line) to the host adapter. This action continues until the host adapter responds with a last word flag (FLWD signal line) to the formatter demand write strobes are generated by the formatter to determine how many data positions to erase on tape. No data words (bytes) are actually transferred.

3) Data Security Erase: This command causes the tape unit to erase the tape from its present position (an IBG) to a position about ten feet (10. FT) past the end of tape marker, EOT.

---Read Forward Command:

This command causes the tape unit to read the tape, in the forward direction, until the first data block encountered has been transferred. The data is transmitted, at the nominal rate, to the host adapter via the FRD0 through FRD7 and FRDP signal lines. The data is clocked into the host adapter by the formatter generated read data strobe (FRSTR signal line).

If blank tape is encountered during the execution of this command the operation is terminated with uncorrectable (hard) error status (FHER signal line). Blank tape is defined as no data having been detected in fifteen feet (15.FT) of tape when in GCR tape format or twenty-five feet (25.FT) of tape when in PE or NRZI tape format.

---Read Reverse Command:

This command causes the tape unit to read the tape in the reverse direction until the first data block encountered has been transferred. The data is transferred in the same manner as the read forward command. If this command is issued while the tape is at BOT, it will be rejected.

---Space Forward Command:

This command causes the tape unit to position the tape in the next IBG.

---Space Reverse Command:

This command causes the tape unit to position the tape in the next IBG, in reverse.

---File Mark Search Forward With Data Transfer:

This command causes the tape unit to search, in the forward direction, until a file mark is read. Data encountered IS transferred, at the nominal rate, to the host adapter as in a read forward command.

If blank tape is encountered during the execution of this command the operation is terminated with uncorrectable (hard) error status (FHER signal line). Blank tape is defined as no data having been detected in fifteen feet (15.FT) of tape when in GCR tape format or twenty-five feet (25.FT) of tape when in PE or NRZI tape format.

---File Mark Search Reverse:

File Mark Search Reverse With Data Transfer:

This command causes the tape unit to search, in the reverse direction, until a file mark is read or load point is reached. Data encountered IS transferred, at the nominal rate, to the host adapter as in a read reverse command.

If blank tape is encountered during the execution of this command the operation is terminated with uncorrectable (hard) error status (FHER signal line). Blank tape is defined as no data having been detected in fifteen feet (15.FT) of tape when in GCR tape format or twenty-five feet (25.FT) of tape when in PE or NRZI tape format.

File Mark Search Reverse (Without Data Transfer):

This command causes the tape unit to search, in the reverse direction, until a file mark is read or load point is reached. Data encountered is NOT transferred to the host adapter.

---Select NRZI Density:

This command causes the formatter to put the tape unit status to show NRZI density. This command will be accepted ONLY when the tape is at load point (FLDP signal line active). Tape unit commands which follow will be performed in NRZI density if possible, that is, unless a read is issued to a tape of a different density or software density select is reset in the tape unit.

---Select PE Density:

This command causes the formatter to put the tape unit status to show PE density format mode. This command will be accepted only when the tape is at load point (FLDP signal line active). Tape unit commands which follow will be performed in PE density if possible, that is, unless a read is issued to a tape of a different density or software density select is reset in the tape unit.

---Select GCR Density:

This command causes the formatter to set tape unit status to show GCR density. This command will be accepted only when the tape is at load point (FLDP signal line active). Tape unit commands which follow will be performed in GCR density if possible, that is, unless a read is issued to a tape of a different density or software density select is reset in the tape unit.

---Read Sense Data Command:

This command transfers formatter sense information to the host adapter via the FRD0 through FRD7 and FRDP signal lines. This data is sent to the host adapter by the formatter as in a read command except the data transfer rate will be controlled by the read strobe timing (read data burst rate). Eight (8) bytes are transferred.

---Read Extended Sense Data Command:

This command transfers the formatter extended sense information to the host adapter in the same manner as the normal sense information. Two hundred fifty-six (256) bytes are transferred.

---Update Sense Command:

This command causes the formatter to access the selected tape unit to update the tape unit status. No tape motion results from this command. Tape unit status is automatically updated by the formatter without this command.

---Reset Sense Command:

This command causes the formatter to issue a reset command to the selected tape unit and then updates the tape unit status.

---Channel Loop Write to Read Command:

This command causes the formatter to operate just as if a write command was received except the tape unit does NOT operate. The data received from the host is routed through the write logic, to the tape unit interface, and then back through the read logic but, NOT to the host adapter. This command is used as a diagnostic to insure correct formatter functioning for read and write operations. This command does NOT function as many "Pertec" host adapters would expect, that is as a simple cable test. Data is not returned to the host.

---Channel Loop Write to Read External Command:

This command functions just as the normal loop write-to-read command except the data is transferred through the write logic, to this selected tape unit, and then back through the read logic. Data is not returned to the host.

## 4.20 STATUS AND SENSE INFORMATION

Status and sense information is sent from the formatter to the host adapter.

STATUS AND SENSE INFORMATION

Status and sense information is sent from the formatter to the host adapter.

STATUS INFORMATION

Status information is made available to the host adapter on individual signal lines. A low state, positive logic, on a cable set status line indicates conditions for setting the status have been met. The status lines are:

Formatter Busy (FBSY):

The formatter acknowledges receipt of an FGO strobed (encoded) command. Another command cannot be issued by the host adapter while this signal is active.

Data Busy (FDBY):

The formatter has received an FGO strobed (encoded) command. All associated data transfers and status posting occurs while this signal is active.

File Mark (FFMK):

Pulsed signal indicating that a file mark has been encountered by the tape unit during execution of a command.

ID Burst/Check Character Gate (FID/FCCG):

In PE or GCR tape density a pulsed signal indicating that an identification burst has been encountered by the tape unit during the execution of a command. In NRZI tape density a signal indicating the read data strobe (FRSTR signal line) is clocking check character information to the host adapter. Two zero characters are transferred during a read or write operation. One zero character is transferred during a write file mark operation.

Corrected Error (FCER): Pulsed signal indicating that a correctable error has been encountered by the tape unit.

Corrected Error (FCER):

Pulsed signal indicating that a correctable error has been encountered by the tape unit during the execution of a command.

Hard Error (FHER):

Pulsed signal indicating that an uncorrectable error has been encountered. Hard error status indicates that one or more of the following errors occured:

1) vertical parity error without drop-out,
2) single track corrected during write execution,
3) false preamble or postamble found,
4) excessive track skew,
5) multi-drop (multi-track) error,
6) parity error on host data transmission,
7) read-after-write error found,
8) excessive noise error,
9) equipment check,
10) read timeout,
11) equipment sense error,
12) loop write to read error,
13) illegal command,
14) command overflow,
15) reverse into load-point,
16) formatter/tape density mismatch.

Ready (FRDY): Indicates that the selected tape unit is loaded and ready to accept on-line or sense commands.

On-line (FONL): Indicates that the selected tape unit has been placed on-line.

Rewind (FRWD): Indicates that the selected tape unit is actively in rewind.

EOT (FEOT): Indicates that the selected tape unit tape is at or past the EOT marker in the tape unit.

File Protect (FFPT): Indicates that the selected tape unit tape is write protected.

Load point (FLDP):

Indicates that the selected tape unit tape is at the load point (logical beginning of tape, BOT).

High Speed Mode/GCR Density (FHSPD/FGCR):

If the tape unit has been "set" to a type one (1) "Pertec" interface: this signal line is never active - not used. If the tape unit has been "set" to a type two (2) or three (3) "Pertec" interface: this signal line is active when the tape unit is in GCR tape density.

GCR Mode (FGCR): Indicates that the formatter is in the GCR format mode.

SENSE INFORMATION

The formatter issues sense information to the host adapter, via the read data path, when read sense data commands are executed. Eight (8) bytes are transferred with the following meaning:

Sense byte 0:

Bit 0: command rejected,
Bit 1: not file protect,
Bit 2: EOT,
Bit 3: write condition,

Bit 4: reverse condition,
Bit 5: rewinding,
Bit 6: ready,
Bit 7: LDP.

Sense byte 1:

Bit 0: load check,
Bit 1: EC fail,
Bit 2: WC fail,
Bit 3: SAG check,

Bit 4: loopout machine reel,
Bit 5: loopout file reel,
Bit 6: IBG overflow,
Bit 7: equipment fail.

Sense byte 2:

Bit 0: IBG Bit 0,
Bit 1: IBG Bit 1,
Bit 2: IBG Bit 2,
Bit 3: IBG Bit 3,

Bit 4: IBG Bit 4,
Bit 5: IBG Bit 5,
Bit 6: IBG Bit 6,

Sense byte 2: (continued)

Bit 7: IBG Bit 7.

Sense byte 3:

Bit 0: force read density,
Bit 1: seismic option,
Bit 2: erase status,
Bit 3: GCR request,

Bit 4: NRZI request,
Bit 5: LWR condition,
Bit 6: GCR flag,
Bit 7: NRZI flag.

Sense byte 4:

Bit 0: Model Bit 0,
Bit 1: Model Bit 1,
Bit 2: Model Bit 2,
Bit 3: this bit not used,

Bit 4: this bit not used,
Bit 5: one-tenth head,
Bit 6: software density selection,
Bit 7: tape unit NRZI capable.

Sense byte 5:

Bit 0: This bit not used,
Bit 1: Pertec buffer option,
Bit 2: this bit not used,
Bit 3: Pertec type Bit 0,

Bit 4: Pertec type Bit 1,
Bit 5: Pertec host adapter parity disable option,
Bit 6: command overflow,
Bit 7: command overflow.

Sense byte 6:

Bit 0 through 7: Not used.

Sense byte 7:

Bit 0: Get buffer empty,
Bit 1: Put buffer full,
Bit 2: this bit not used,
Bit 3: this bit not used,

Bit 4: this bit not used,
Bit 5: Get overflow,
Bit 6: Put overflow,
Bit 7: Overrun

READ EXTENDED SENSE INFORMATION

Two-hundred fifty-six (256) bytes are transferred. The exact definition of those bytes has not been determined.

## 4.21 SIGNAL DESCRIPTION

The signals on the host adapter/formatter cable set are low state true on the cable set.

HOST ADAPTER GENERATED SIGNALS DESCRIPTION

FFEN:

Formatter ENable bit. This signal, when inactive, puts all attached formatters in an initialized state and the tape units are reset. It must be active for ANY operations. It is totally asynchronous and is NOT gated with the formatter select bit (FFAD signal line). This signal is used to halt errant operations (by re-initializing the formatter). This signal, when inactive, will halt all operations on all attached formatters and tape units. A formatter disable (formatter enable inactive, FFEN signal line) Table 3 - FGO Commands vs Latched Signal Lines State should be at least one microsecond (1. uS) in duration.

FFAD:

Formatter ADdress bit. This bit selects one of two possible formatters on the cable set. FFAD polarity selection for a formatter is done with.a jumper. Normally there is only one formatter per cable set and the jumper will be set for FFAD high state, on the cable set (FFAD.0, the factory installed jumper position).

FTAD0 and FTAD1:

Tape unit ADdress bits 0 and 1. These two signal lines select one of four (4) possible tape units attached to a selected formatter. When both signal lines are high state, on the cable set, tape unit 0 (of 0 through 3) is selected on the selected formatter. FTAD0 is the most significant bit. FTAD1 is the least significant bit.

FGO:

GO command strobe. This signal latches the following eight (8) signal lines to encode a command: FREV, FWRT, FEDIT, FWFM, FERASE, FHISP, FTHR, and FLGAP. This is not the only command strobe but, it is the only one which latches other signal lines to encode a command. It is the only command strobe which will cause the formatter to set the formatter busy flag (FBSY signal line). Table 3 shows the commands which are encoded by the FGO strobe and the latched state of the signal lines.

Table 4-3 - FGO Commands vs Latched Signal Lines State

| COMMAND | FREV__ | FWRT__ | FEDIT_ | FWFM__ | FERASE | FHISP_ | FTHR__ | FLGAP_ |
|---|---|---|---|---|---|---|---|---|
| Write | H | L | H | H | H | X | X | H |
| Write w/L.Gap * | H | L | H | H | H | X | X | L |
| Write F.Mrk | H | L | H | L | H | X | X | H |
| Write F.Mrk w/L.Gap * | H | L | H | L | H | X | X | L |
| Erase Fixed | H | L | H | L | L | X | X | H |
| Erase Fixed w/L.Gap * | H | L | H | L | L | X | X | L |
| Erase Cntrl'd | H | L | H | H | L | X | X | H |
| Erase Cntrl'd w/L.Gap * | H | L | H | H | L | X | X | L |
| Erase Secure | H | L | L | L | L | X | X | H |
| Read Fwd. | H | H | H | H | H | X | X | H |
| Read Rev. | L | H | H | H | H | X | X | H |
| Space Fwd. | H | H | H | H | L | X | X | H |
| Space Rev. | L | H | H | H | L | X | X | H |
| F.Mrk Sch.Fwd. w/ Data Xfer | H | H | H | L | H | X | X | H |
| F.Mrk Sch.Fwd. wo/ Data Xfer | H | H | H | L | L | X | X | H |
| F.Mrk Sch.Rev. w/ Data Xfer | L | H | H | L | H | X | X | H |
| F.Mrk Sch.Rev. wo/ Data Xfer | L | H | H | L | L | X | X | H |
| Sel. NRZI | H | H | L | L | L | X | X | L |
| Sel. PE | H | H | L | L | L | X | X | H |
| Sel. GCR | L | H | L | L | L | X | X | H |
| Read Sens | L | H | L | H | L | X | X | H |
| Read Ex.Sens | L | L | L | H | L | X | X | H |
| Update Sens | L | H | L | H | H | X | X | L |
| Reset Sens | H | L | L | H | H | X | X | H |

Table 4-3 - FGO Commands vs Latched Signal Lines State
(Continued from previous page)

| COMMAND | FREV__ | FWRT__ | FEDIT_ | FWFM__ | FERASE | FHISP_ | FTHR__ | FLGAP_ |
|---|---|---|---|---|---|---|---|---|
| Loop WR-to-Rd (Int) | L | L | L | L | L | X | X | H |
| Loop WR-t0-Rd (Ext) | L | L | L | L | L | X | X | L |
| Diag. Mode | L | L | H | H | H | X | X | H |
| Reject | L | H | H | H | H | X | X | L |
| No Operation | H | H | H | H | H | X | X | L |
| Rewind | H | H | L | H | H | X | X | H |
| Unload 1 (Always) | L | H | L | H | L | X | X | L |
| Unload 2 (Telex) | H | H | L | H | H | X | X | L |
| Load Go ONL | H | H | L | H | L | X | X | H |

L = low level = true, H = high level = false, x = don't care, on the cable set. (*) Long gaps are performed as short gaps!

FREV:

REVerse tape direction for command. Latched by FGO strobe, this signal is used to encode a command. Further information is contained in the FGO signal description.

FWRT:

WRiTe operation, else read, performed by command. Latched by FGO strobe, this signal is used to encode a command. Further information is contained in the FGO signal description.

FEDIT:

EDIT during command. Latched by FGO strobe, this signal is used to encode a command. Further information is contained in the FGO signal description.

FWFM:

Write File Mark during command. Latched by FGO strobe, this signal is used to encode a command. Further information is contained in the FGO signal description.

FERASE:

ERASE during command. Latched by FGO strobe, this signal is used to encode a command. Further information is contained in the FGO signal description.

FHISP:

HIgh SPeed tape operation during command. Latched by FGO strobe, this signal requests that the command be executed at a second, higher tape speed (if a tape operation is involved). Further information is contained in the FGO signal description. This signal is ignored.

FTHR:

THReshold high during command. Latched by FGO strobe, this signal requests that the command be executed with a second, higher head (analog circuitry) threshold (if a read tape operation is involved). Further information is contained in the FGO signal description. This signal is ignored.

FLGAP:

Long GAP used during command. Latched by FGO strobe, this signal is used to encode a command. Further information is contained in the FGO signal description. Long gaps are NOT generated.

FREW:

REWind command strobe. This strobe causes the formatter to rewind the selected tape unit to load point (BOT). Following this command strobe, no other commands may be issued to a formatter until after the associated tape unit has posted rewinding status.

FLOL:

Load tape and go On-Line command strobe. This strobe causes the formatter to load the tape on the selected tape unit and place the tape unit on-line. Allow at least thirty (30) seconds for on-line status to occur on the associated tape unit.

FOFL:

OFf-Line command strobe. This strobe causes the formatter to rewind the tape on the selected tape unit, go not ready, go off-line and unload the tape.

FWD0 through FWD7:

Write Data signal lines 0 through 7. These signal lines are used to transfer data from the host adapter to the formatter.

FWDP:

Write Data Parity. This signal line has the parity of the FWD0-FWD7 data lines.

FLWD:

Last WorD flag bit. This signal line will indicate that the data on the FWD0-FWD7 signal lines is the last word (byte) to be transferred to the formatter. This signal line is also used to halt certain commands. Further information is contained in Section 1.2.1.

DESCRIPTION OF FORMATTER GENERATED SIGNALS

FFBY:

Formatter BusY status bit. This signal is activated by the formatter as an acknowledgement of an FGO strobed (encoded) command reception. This signal will remain active during the command execution.

FDBY:

Data BusY bit. This signal is activated when an FGO strobed (encoded) command begins execution and the formatter can not accept another command. Once activated it remains active during command execution. After formatter busy (FFBY signal line) has been activated, the formatter will accept an overriding command and abort the former command as long as data busy (FDBY signal line) has not become active. If data busy (FDBY) had been activated and another command is issued, the formatter will execute the second command at completion of the first.

FFMK:

File MarK detected status strobe. This strobe is pulsed when the tape unit detects a file mark pattern during a file mark search, read or write command.

FID/FCCG:

In PE or GCR tape density this signal is the IDentification burst detected status strobe. This strobe is pulsed when an identification burst is detected during a tape operation. In NRZI tape density this signal is the Check Character Gate status strobe. This strobe is active while check characters are being sent to the host adapter.

FCER:

Corrected ERror performed status strobe. This strobe is pulsed whenever data has been successfully corrected during a tape operation.

FHER:

Hard ERror encountered status strobe or bit. This signal line will be pulsed if an uncorrectable error is encountered during the execution of a command. Further information on the causes of hard errors is contained in Section 4.1.

FRDY:

ReaDY tape unit status bit. This signal line, when active, indicates that the selected tape unit is loaded, on-line, and ready to accept commands.

FONL:

ON-Line tape unit status bit. This signal line, when active, indicates that the selected tape unit is on-line.

FRWD:

ReWinD underway status bit. This signal line, when active, indicates that the selected tape unit is being rewound.

FEOT:

End-Of-Tape status bit. This signal, when active, indicates that the selected tape unit is at or past the EOT marker on the tape.

FFPT:

File Protected Tape status bit. This signal, when active, indicates that the tape on the selected tape unit is write protected (that is, the write enable ring is not in place on the tape spool). Write operations may not be performed on a write protected tape unit.

FLDP:

LoaD Point tape position status bit. This signal, when active, indicates that the tape on the selected tape unit is at load point (BOT).

FHSPD/FGCR:

For tape units set to type one (1) "Pertec" interface this signal is the High SPeeD mode selected status bit. This signal is never activated as there is no high speed mode. The present Telex tape unit operates at fifty inches per second (50.IPS) singularly. For tape units set to type two (2) or three (3) "Pertec" interface this signal is the Group Coded Recording mode status bit. This signal, when active, indicates that the selected tape unit is in the GCR format mode for operation.

FGCR/FNRZI:

For tape units set to type one (1) "Pertec" interface this signal is the Group Coded Recording mode status bit. This signal, when active, indicates that the selected tape unit is in the GCR format mode for operation. For tape units et to type two (2) or three (3) "Pertec" interface this signal is the Non-Return-to-Zero inverted mode status bit. This signal, when active, indicates that the selected tape unit is in the NRZI format mode for operation.

FRD0 through FRD7:

Read Data signal lines 0 through 7. These data lines are used to transfer data from the formatter to the host adapter.

FRDP:

Read Data Parity bit. This signal line has the odd parity of the FRD0-FRD7 signal lines.

FRSTR:

Read data STRobe. This strobe is used to enter information from the read data and parity signal lines into the host adapter.

The setup and hold times for the read data/parity and the read data strobe pulse length are user selectable (to match the host adapter characteristics). Jumpers are provided on the formatter for this purpose. There are three groups, of four (4) jumpers each, provided for setting the time interval of interest to one of fifteen steps in increments of two-hundred fifty nanoseconds (250 NS) each. The read data burst rate is controlled by adjusting the data setup, strobe, and hold times. Figure 4-16 is a nomograph to assist in making adjustments to the data burst transfer rate. The factory pre-set rate is 400.KB/S in write mode and 334.KB/S in read mode (which is the lowest rate which can support GCR tape formats).

FDWDS:

Demand Write Data Strobe. This signal strobe is used to capture data from the host adapter on the write data, parity, and last word flag signal lines. It is also used to determine when to terminate certain commands.

The pulse duration is user selectable (to match the host adapter characteristics) in the same manner as the FRSTR signal. The data burst rate is controlled by adjusting the strobe width. Data burst occurs during the initial loading of the formatter data buffer (512. words). After the buffer is filled, the data rate becomes nominal (the tape data rate). Figure 6 is a nomograph to assist in making adjustments to the data burst transfer rate. The factory pre-set rate is 400.KB/S in write mode and 334.KB/S in read mode (which is the lowest rate which can support GCR tape formats).

Telex "Pertec" Interface Feature (FC9251)

| RS Block Jumper No. (1) 0 1 2 3 | Data Burst Transfer Rate (2) (Kilobytes/Second) Write/Read | DS Block Jumper No. (1) 0 1 2 3 |
|---|---|---|
| J 0 0 0 | 1000/667 | J 0 0 0 |
| | 800/572 | |
| 0 J 0 0 | 667/500 | 0 J 0 0 |
| | 572/445 | |
| J J 0 0 | 500/400 | J J 0 0 |
| | 445/364 | |
| 0 0 J 0(3) | 400/334 | 0 0 J 0(3) |
| | 363/308 | |
| J 0 J 0 | 334/286 | J 0 J 0 |
| | 308/267 | |
| 0 J J 0 | 286/250 | 0 J J 0 |
| | 267/236 | |
| J J J 0 | 250/223 | J J J 0 |
| | 236/211 | |
| 0 0 0 J | 222/200 | 0 0 0 J |
| | 211/191 | |
| J 0 0 J | 200/182 | J 0 0 J |
| | 191/174 | |
| 0 J 0 J | 182/167 | 0 J 0 J |
| | 174/160 | |
| J J 0 J | 167/154 | J J 0 J |
| | 160/149 | |
| 0 0 J J | 154/142 | 0 0 J J |
| | 149/138 | |
| J 0 J J | 142/134 | J 0 J J |
| | 138/130 | |
| 0 J J J | 134/125 | 0 J J J |
| | 130/122 | |
| J J J J | 125/118 | J J J J |

FIGURE 4-16 - Data Transfer Timing Nomograph

1) Jumper Key: J = jumper installed, 0 = jumper NOT installed.

2) These data burst rates assume the DH jumper block has position number "0" jumpered only.

3) Factory installed jumpers.

Note: There must always be at least one jumper installed in each jumper block.

4.22 TIMING DIAGRAMS

Seven timing diagrams are provided for the user to observe the relationships of signals during command entry, read data transfers, and write data transfers. Figure 4-17 depicts the FGO (encoded) command entry sequence and timing. Figure 4-18 depicts the read data transfer timing. Figure 4-19 depicts the write data transfer timing. Figure 4-20 depicts the rewind timing. Figure 4-21 depicts the unload timing. Figure 4-22 depicts the load and go on-line timing.

```
COMMAND BYTE (1)        +++++++++++<-VALID->+++++++++++++++++
                                  |<t1>|<t2>|
COMMAND STROBE (FGO)    -----+_________+---------------------
                             |<--t3--->|<t4>|
FORMATTER BUSY (FFBY)   --------------------+______________+--
                                            |<t5>|<t6>|<t7>|
DATA BUSY (FDBY)        -------------------------+____+-------
```

| Time Interval | Description | Time Min | Time Max | Units |
|---|---|---|---|---|
| t1 | command setup time | 20. | | NS |
| t2 | command hold time | 20. | | NS |
| t3 | command pulse width (2) | 13. | | NS |
| t4 | cmd stb to fmt busy | 20. | 80. | NS |
| t5 | fmt bsy to dat bsy | | | N/A |
| t6 | dat bsy (cmd exec) | | | N/A |
| t7 | dat n/bsy to fmt n/bsy | 0.0 | | NS |

(1) Command byte: FREV, FWRT, FEDIT, FWFM, FERASE, FHISP, FTHR, FLGAP (bits 0 to 7).

(2) No other command strobe (FREW,FOFL, or FLOL) may be active at same time.

Figure 4-17 FGO Command Entry Timing

```
DATA (FRD0-FRD7,FRDP)        +++++<-VALID DATA->++++
                                   |<t1>|<t3>|<t2>|<-t4->|
READ DATA STROBE (FRSTR) ---------+____+-------//--+___
```

| Time Interval | Description | Time Min | Time Max | Units |
|---|---|---|---|---|
| t1 | data setup time (1)(4) | 0.25 | 3.75 | US |
| t2 | data hold time (2) | 0.25 | 3.75 | US |
| t3 | data stb pulse width (3)(4) | 0.25 | 3.75 | US |
| t4 | data stb inactive time | 0.48 | 0.50 | US |

(1) Adjustable from minimum to maximum with DS jumper block.
Note: factory preset to 1.0 microsecond.
(2) Adjustable with DH jumper block.
Note: factory preset to 250. nanoseconds.
(3) Adjustable with RS jumper block.
Note: factory preset to 1.0 microsecond.
(4) Affects write transfer timing.

Figure 4-18 Read Transfer Timing

```
DATA (FWD0-FWD7,FWDP)     +++++++++++<-VALID->++++
                                     ¦         ¦
LAST WORD FLAG (FLWD)     +++++++++++<-VALID_>++++
                                     ¦<t1>¦<t2>¦
DEMAND WRITE STB (FDWDS) -----+_________+------//--+___
                              ¦<--t3--->¦<---t4--->¦
```

| Time Interval | Description | Time Min | Max | Units |
|---|---|---|---|---|
| t1 | data setup time | 20. | | NS |
| t2 | data hold time | 20. | | NS |
| t3 | data stb pulse width (1)(3) | 0.25 | 3.75 | US |
| t4 | data stb inactive time (2)(3) | 0.48 | 4.25 | US |

(1) Adjustable from minimum to maximum with RS jumper block.
    Note: factory preset to 1.0 microsecond.
(2) Adjustable with DS jumper block.
    Note: factory preset to 1.0 microsecond.
(3) Affects read transfer timing.

Figure 4-19 Write Transfer Timing

```
REWIND STROBE (FREW)        ---+____+------------//-----------
                               |<t1>|<t2>|<----t3---->|
REWINDING STATUS (FRWD)     -------------+_______//___+-------
                                         |            |
TAPE UNIT READY (FRDY)      _____________+-------//---+_______
                                                      |
LOAD POINT (FLDP)           ------------------//----+_______
```

| Time Interval | Description | Time Min | Time Max | Units |
|---|---|---|---|---|
| t1 | rewind cmd stb width (1) | 20. | | NS |
| t2 | rew cmd stb to rwd sts (2) | | 60. | US |
| t3 | rwd status to load point | | | N/A |

(1) No other command strobe (FGO,FOFL, or FLOL) may be active at the same time.
(2) If no formatter or tape unit command is being executed.

Figure 4-20 Rewind Command Timing

```
UNLOAD STROBE (FOFL)         ---+____+------------//----------
                                |<t1>|<t2>|<----t3---->|
REWINDING STATUS (FRWD)      -------------+_______//___+------
                                          |
TAPE UNIT READY (FRDY)       _____________+-------//----------
                                          |
TAPE UNIT ON-LINE (FONL)     _____________+-------//----------
```

| Time Interval | Description | Time Min | Time Max | Units |
|---|---|---|---|---|
| t1 | unload cmd stb width (1) | 20. | | NS |
| t2 | unl cmd stb to rwd sts (2) | | 60. | US |
| t3 | unl status to rwd done | | | N/A |

(1) No other command strobe (FGO,FREW, or FLOL) may be active at the same time.
(2) If no formatter tape unit command is being executed.

Figure 4-21 Unload Command Timing

```
REWIND STROBE  (FREW)       ---+____+-----------------------------
                               |<t1>|<t2>|
REWINDING STATUS (FRWD)     ------------+____________//____+------
                                        |<-------t3------->|
TAPE UNIT READY (FRDY)      ____________+-------------------------
                                        |<t4>|
UNLOAD STROBE (FOFL)        -----------------+____+---------------
                                             |<t5>|<-t6->|
TAPE UNIT ON-LINE (FONL)    _____________________________+--------
```

| Time Interval | Description | Time Min | Time Max | Units |
|---|---|---|---|---|
| t1 | rewind cmd stb width (1) | 20. | | NS |
| t2 | rew cmd stb to rwd sts (2) | | 60. | US |
| t3 | rwd sts to rwd done | | | N/A |
| t4 | rwd sts to un/cmd stb | 0.0 | 20. | US |
| t5 | unl cmd stb width (1) | 0.02 | 1.2 | US |
| t6 | unl cmd to ofl sts (2) | | 60. | US |

(1) No other command strobe (FGO,FREW, or FLOL) may be active at the same time.
(2) If no formatter tape unit command is being executed.

Figure 4-22 Alternate Unload Command Timing

```
LOAD/ON-LINE STROBE (FLOL) ----+____+------------------------
                               |<t1>|<-------t2------->|
TAPE UNIT READY (FRDY)     ----------------------//---+______
                                                       |
TAPE UNIT ON-LINE (FONL)   ----------------------//---+______
```

| Time Intervals | Description | Time Min | Time Max | Units |
|---|---|---|---|---|
| t1 | load/on-line cmd stb width (1) | 20. | | NS |
| t2 | load/onl cmd stb to rdy sts (2) | | 30. | S |

(1) No other command strobes (FGO,FREW, or FOFL) maybe active at the same time.
(2) If no formatter or tape unit commands are being executed.

Figure 4-23 Load And Go On-Line Command Timing

SEQUENCE DIAGRAMS

Six sequence diagrams are provided for the user to observe the sequence of signal transitions during FGO (encoded) command entry and execution. See Figures 4-24 through 4-29.

```
FFBY              --+_________________________________________+--
                    |a|                                       |
FLDP (1)          ____+------------------------------------------
                      |bbb|                                   |
FGCR, FNRZI (1,2) <stable>x<-------valid-------------------------
                          |c|d|                               |
FID/FCCG (1,3)    ----------+_+----------------------------------
                              |e|                           |f|
FDBY              --------------+___________________________+----
                                |g|                         |
FRSTR (3)        -----------------+_xx_+-------------------------
                                  |                         |
FRSTR (4)        -----------------+_xx_+---+_++_+----------------
                                       |h|i|jj| |k|         |
FID/FCCG (4)     ------------------------+________+--------------
                                                    |l|mmmmm|
FFMK,FCER,       -----------------------------------+_+----------
FHER (5)                                                    |
                                                     |nnnnnn|
FEOT (6)         ------------------------------------+___________
```

(1) If Load Point was valid.
(2) If true tape format different from requested or manual.
(3) PE or GCR tape format valid and data encountered.
(4) NRZI tape format valid and data encountered.
(5) If detected.
(6) If End of Tape becomes valid.

Key: - = logical high (false), _ = logical low (true),
+ = transition to high or low logic state,
x = transition or transitions will occur as necessary.

Figure 4-24 Read Forward

```
-----------------------------------------------------------------

FFBY             --+_________________________________________+--
                   |a|                                      |b|
FDBY             ----+______________________________________+-----
                     |c|                                    |
FRSTR (1)        ------+_xx_+-------------------------------------
                       |                                    |
FID/FCCG (2)     ------+________+---------------------------------
                       |d|ee| |f|g|                         |
FRSTR (2)        --------+_++_+---+_xx_+------------------------
                                      |h|i|jjjjjjjjjjjjjjjj|
FMK, FCER, (3)   -------------------------+_+---------------------
FHER                                                        |
                                         |k|lllllllllllllll|
FLDP (4)         -------------------------+_______________________
                                          |
FEOT (5)         _________________________+-----------------------
-----------------------------------------------------------------
```

(1) PE or GCR tape format valid.
(2) NRZI tape format valid.
(3) If detected.
(4) If Load Point becomes valid.
(5) If End of Tape becomes not valid.

Key: - = logical high (false), _ = logical low (true),
+ = transition to high or low logic state,
x = transition or transitions will occur as necessary.

Figure 4-25 - Read Reverse

---

```
FFBY             --+______________________________________+--
                   |a|                                    |
FLDP (1)         ____+---------------------------------------
                     |b|                                  |
FID/FCCG (1,2)   ------+_+-----------------------------------
                         |c|                            |d|
FDBY             ----------+____________________________+----
                           |e|                          |
FDWDS            ------------+_xx_+--------------------------
                             |    |f|                   |
FID/FCCG (3)     -------------------+________+---------------
                             |      |g|hh| |i|          |
FRSTR (3)        ---------------------+_++_+-----------------
                             |                  |j|kkkkk|
FCER, FHER (4)   -------------------------------+_+----------
                             |                  |1111111|
FEOT (5)         ------------xxxxxxxxxxxxxxxxxxx+____________
```

---

(1) If Load Point was valid.
(2) PE or GCR tape format valid.
(3) NRZI tape format valid.
(4) If detected.
(5) If End of Tape becomes valid.

Key: - = logical high (false), _ = logical low (true),
+ = transition to high or low logic state,
x = transition or transitions will occur as necessary.

---

Figure 4-26 - Write

```
FFBY              --+________________________________________+--
                    |a|                                      |
FLDP (1)          ____+-----------------------------------------
                      |b|c|                                  |
FID/FCCG (1,2)    ------+_+-------------------------------------
                          |d|                              |e|
FDBY              ----------+______________________________+----
                            |f|                            |
FID/FCCG (3)      ------------+_____+-----------------------------
                              |g| |h|                      |
FRSTR (3)         --------------+_+-----------------------------
                              |                        |i|j|
FFMK              --------------------------------------+_+------
                              |                        |  |  |
FCER, FHER (4)    --------------------------------------+_+------
                              |                         |kk|
FEOT (5)          ------------xxxxxxxxxxxxxxxxxxxxxxxxxx+_______
```

(1) If Load Point was valid.
(2) PE or GCR tape format valid.
(3) NRZI tape format valid.
(4) If detected.
(5) If End of Tape becomes valid.

Key: - = logical high (false), _ = logical low (true),
+ = transition to high or low logic state,
x = transition or transitions will occur as necessary.

Figure 4-27 - Write Tape Mark

```
------------------------------------------------------------------
FFBY              --+_______________________________________+--
                    |a|                                     |
FLDP (1)          ____+----------------------------------------
                      |b|c|                                 |
FID/FCCG (1,2)    ------+_+------------------------------------
                          |d|                             |e|
FDBY              ----------+_____________________________+----
                            |f|                             |
FDWDS             ------------+_xx_+---------------------------
                              |                     |g|h|
FCER, FHER (3)    ------------------------------------+_+------
                              |                     |i|
FEOT (4)          ------------xxxxxxxxxxxxxxxxxxxxxxxxx+_______
------------------------------------------------------------------
```

(1) If Load Point was valid.
(2) PE or GCR tape format valid.
(3) If detected.
(4) If End of Tape becomes valid.

```
Key:  - = logical high (false), _ = logical low (true),
      + = transition to high or low logic state,
      x = transition or transitions will occur as necessary.
```

---

Figure 4-28 - Erase Variable Gap

```
-----------------------------------------------------------------
FFBY             --+________________________________________+--
                   |a|                                      |
FLDP (1)         ____+-----------------------------------------
                     |b|c|                                  |
FID/FCCG (1,2)   ------+_+-------------------------------------
                         |d|                              |e|
FDBY             ----------+______________________________+----
                           |                          |f|g|
FCER, FHER (3)   -------------------------------------+_+------
                           |h|
FEOT (4)         ------------+_________________________________
-----------------------------------------------------------------

(1)  If Load Point was valid.
(2)  PE or GCR tape format valid.
(3)  If detected.
(4)  When End of Tape becomes valid.

Key:  - = logical high (false), _ = logical low (true),
      + = transition to high or low logic state.
-----------------------------------------------------------------
```

Figure 4-29 - Data Security Erase

## 4.23 PHYSICAL INTERFACE

The physical interface consists of the electrical hardware and the mechanical devices (wire and connectors) which conduct the signals between the host adapter and the formatter. Additionally, the placement of those signal lines at the formatter cable set interface (connector) is included as part of the physical interface.

## 4.24 ELECTRICAL INTERFACE

The signal lines are driven by open-collector devices (7438s). The receiving devices are Schmitt-triggered (74LS14s) and are front-ended by TTL pulse squaring, resistive voltage dividers.

Transmitted low voltages must be at or between zero (0.) and four-tenths (0.4) volts. Received low voltages must be at or between zero (0.) and eight-tenths (0.8) volts.

Transmitted high voltages must be at or between two (2.) and five (5.) volts. Received high voltages must be at or between two and four-tenths (2.4) and five (5.) volts.

Figure 4-30 depicts a partial signal transfer schematic diagram.

## 4.25 MECHANICAL INTERFACE

The mechanical interface consists of two fifty (50) pin connectors and their cables.

The connectors should be 3M #3415-0002 or their equivalent. The strain relief for the connector is 3M #3448-20.

The cable set shall be two signal cables of fifty (50) conductors each and no more than twenty feet (20. FT) in length.

## 4.26 CONNECTOR SIGNAL PIN ASSIGNMENT

Table 4-4 provides a list of the connector set pins and the signal assignment associated with each.

```
   HOST ADAPTER                          FORMATTER

****************                    ****************
*              *                    *              *
*     +--+     *                    *              *
*  --i¦  ¦     *                    *     +--+     *
*     ¦&/¦o---->>------------------>>--X-i¦/ ¦o--  *
*  --i¦  ¦  GND>>------------------>>GND  +--+     *
*     +--+     *                    *              *
*  7438 (1/4)  *                    * 74LS14 (1/6) *
*              *                    *     +--+     *
*     +--+     *                    *     ¦  ¦i--  *
*  --o¦/ ¦i-X--<<------------------<<----o¦&/¦     *
*     +--+  GND<<------------------<<GND  ¦  ¦i--  *
*              *                    *     +--+     *
* 74LS14 (1/6) *                    *  7438 (1/4)) *
*              *                    *              *
****************                    ****************
```

```
i = input, o = output, & = AND, and / = invert.
X = 220. ohm pullup to Vcc, and 330. ohm pulldown to GND.
```

Figure 4-30 - Interface Driver/Receiver Circuits

Table 4-4. Connector Signal Pin Assignment

| Connector Number | Signal Name | Signal Pin | Return Pin |
|---|---|---|---|
| I/O 1 | FFBY | 2 | 1 |
| - | FLWD | 4 | 3 |
| - | FWD4 | 6 | 5 |
| - | FGO | 8 | 7 |
| - | FWD0 | 10 | 9 |
| - | FWD1 | 12 | 11 |
| - | SPARE | 14 | 13 |
| - | FLOL | 16 | 15 |
| - | FREV | 18 | 17 |
| - | FREW | 20 | 19 |
| - | FWDP | 22 | 21 |
| - | FWD7 | 24 | 23 |
| - | FWD3 | 26 | 25 |
| - | FWD6 | 28 | 27 |
| - | FWD2 | 30 | 29 |
| - | FWD5 | 32 | 31 |
| - | FWRT | 34 | 33 |
| - | FLGAP | 36 | 35 |
| - | FEDIT | 38 | 37 |
| - | FERASE | 40 | 39 |
| - | FWFM | 42 | 41 |
| - | FTHR | 44 | 43 |
| - | FTAD0 | 46 | 45 |
| - | FRD2 | 48 | 47 |
| - | FRD3 | 50 | 49 |

Table 4-4. Connector Signal Pin Assignment (Continued)

| Connector Number | Signal Name | Signal Pin | Return Pin |
|---|---|---|---|
| I/O 2 | FRDP | 1 | 5 |
| - | FRD0 | 2 | 5 |
| - | FRD1 | 3 | 5 |
| - .......... | FLDP ...... | 4 ....... | 5 |
| - | FRD4 | 6 | 5 |
| - | FRD7 | 8 | 7 |
| - | FRD6 | 10 | 9 |
| - .......... | FHER ...... | 12 ...... | 11 |
| - | FFMK | 14 | 13 |
| - | FID/FCCG | 16 | 15 |
| - | FFEN | 18 | 17 |
| - .......... | FRD5 ...... | 20 ...... | 19 |
| - | FEOT | 22 | 21 |
| - | FOFL | 24 | 23 |
| - | FGCR/FNRZI | 26 | 25 |
| - .......... | FRDY ...... | 28 ...... | 27 |
| - | FRWD | 30 | 29 |
| - | FFPT | 32 | 31 |
| - | FRSTR | 34 | 33 |
| - .......... | FDWDS ..... | 36 ...... | 35 |
| - | FDBY | 38 | 37 |
| - | FHSPD/FGCR | 40 | 39 |
| - | FCER | 42 | 41 |
| - .......... | FONL ...... | 44 ...... | 43 |
| - | FTAD1 | 46 | 45 |
| - | FFAD | 48 | 47 |
| - | FHISP | 50 | 49 |

## 4.27 STC INTERFACE

The STC Interface between the formatter (FCU) and the Host consists of 59 lines. Access to these lines is by two 60-conductor flat cables on the formatter interface PWB card.

The interface provides digital information in the form of data, status, errors, controls, and addressing. The STC Interface Feature allows the Telex 9250 Subsystem to be interchangeable with the STC 1935/1953 and 2920 Subsystems. The Telex 9250 Subsystem must be pre-selected to operate in the 1935/1953 or 2920 mode.

## 4.28 ADDRESSING

Tape Unit Address 1,0 (AD1, AD0)

These two lines select the particular tape unit to be used for operations.

| | AD1 | AD0 |
|---|---|---|
| TU 0 | 0 | 0 |
| TU 1 | 0 | 1 |
| TU 2 | 1 | 0 |
| TU 3 | 1 | 1 |

A one (1) indicates a selected line that corresponds to a low voltage level.

## 4.29 DENSITY SELECT 0, 1, (DS0, DS1)

These two lines select the density at which the formatter/tape unit system is to operate. Code selection is defined below:

| | | DS0 | DS1 |
|---|---|---|---|
| NRZI | 800 bpi | 1 | 1 |
| NRZI | 800 bpi | 0 | 1 |
| PE | 1600 bpi | 0 | 0 |
| GCR | 6250 bpi | 1 | 0 |

A density switch exists on the TU to select NRZI, PE, GCR, or the diagnostic keyboard can be used to select a Software Selected recording density. With the switch in the NRZI, PE, or GCR position, and tape positioned at BOT, the tapes will be written in the selected density. With 'Software Select' selected and tape positioned at BOT, the TU will write tapes in the density indicated by the ID BURST of the tape in use.

## 4.30 COMMAND LINES AND START

The following four (4) command lines and single START line are used to initiate any of 16 commands described below. Assertion of START enables command execution. Command execution is acknowledged by the assertion of BUSY by the formatter. For all the commands, except NOP command, the formatter will clear the previous status and errors before responding with BUSY. Decode of the four command lines is shown in Table 4-6.

**Table 4-6. Command Decode**

| Description | CMD | Cmd0 | Cmd1 | Cmd2 | Cmd3 |
|---|---|---|---|---|---|
| No Operation | NOP | 0 | 0 | 0 | 0 |
| Drive Clear | CLR | 0 | 0 | 0 | 1 |
| Diag Mode Set | DMS | 0 | 0 | 1 | 0 |
| Sense Drive Status | SNS | 0 | 0 | 1 | 1 |
| Read Forward | RDF | 0 | 1 | 0 | 0 |
| Read Backward | RDB | 0 | 1 | 0 | 1 |
| Write | WRT | 0 | 1 | 1 | 0 |
| Loop Write to Read | LWR | 0 | 1 | 1 | 1 |
| Backward Space File | BSF | 1 | 0 | 0 | 0 |
| Backspace Block | BSB | 1 | 0 | 0 | 1 |
| Space File | FSF | 1 | 0 | 1 | 0 |
| Space Block | FSB | 1 | 0 | 1 | 1 |
| Write Tape Mark | WTM | 1 | 1 | 0 | 0 |
| Erase Gap | ERG | 1 | 1 | 0 | 1 |
| Rewind | REW | 1 | 1 | 1 | 0 |
| Unload | UNL | 1 | 1 | 1 | 1 |

Commands are discussed in the following paragraphs:

No Operation (NOP)

This command can be used to test the command handshake between the formatter and the Host. The TU is not accessed by this command. Previous Status and Errors will not be cleared by this command.

Clear (CLR)

This command is used to reset associated error indicators to initial conditions. The following status bits will be reset: CRERR, ID BURST, ROMPS, BUPER, ERRMX, DATA CHK, and OVRNS. The formatter remains busy until the reset is completed.

The CLR command also clears any Diagnostic mode setup information which may have been transmitted with a DIA (DMS) command.

Enable Diagnostic Mode (DMS)

This command causes the tape subsystem to operate under diagnostic mode in conjunction with diagnostic routines stored in the microprogram. Diagnostic Mode to Functional Mode transfer is accomplished by the Host issuing a RESET input or when the formatter automatically transfers mode after a diagnostic mode command sequence.

This command is issued via the I/O interface as any other command. This command transfers diagnostic data from the computer adapter interface in the same manner as data is transferred in a standard write operation. (At least one diagnostic data byte must be transferred. Any number of data bytes may be transferred but only the first 16 will be saved by the formatter.)! Any data bytes beyond the first which are not sent are assumed to have values of zero. The drive address associated with the DIA command is saved by the formatter along with the diagnostic data. Subsequent commands to the addressed drive will be modified in accordance with the diagnostic data. The diagnostic mode can be enabled for only one drive at a time. The diagostic mode is disabled at power up, System Reset, by issuing a Clear command, or by a DIA command whose data bytes have value of zero.

The functions of the various Diagnostic data fields are described below:

Byte 0, Bit 0 - Dead Track Pattern, Bit P

The parity track is not written during a write operation if this Dead Track Pattern Bit is set.

Byte 0, Bit 1 - Diagnostic Mode Flag

The operation of Stack Write/Read mode is modified so that Write data is interpreted as diagnostic messages from the host and Read data is diagnostic response to the host. The Stack Write/Read bit must also be set.

Byte 0, Bit 2 - Enable Error Correction

Byte 0, Bit 3 - Stack Write/Read

Byte 0, bit 4 - Ignore Multitrack

Causes Multitrack errors to be ignored while writing PE or GCR records. This bit is not used in NRZI.

Byte 0, bit 5 - Inhibit Postamble

a) PE and GCR: causes the postamble not to be written.
b) NRZI: causes the LRC character not to be written.

Byte 0, bit 6 - Reserved

Byte 0, bit 7 - Inhibit Preamble
a) PE and GCR: causes the preamble not to be written.
b) NRZI: causes the CRC character not to be written.

Byte 1, Bits 0..7 - Dead Track Pattern

The data tracks indicated by the Dead Track Pattern are not written during a write operation.

Byte 2, Bits 0..7 - Go-Down-Timer

Causes a delay to occur between the time the drive has been commanded to stop and time Busy is cleared. The delay occurs in 0.5 millisecond increments. The number of increments is determined by the count in this byte. The maximum delay is 127.5 milliseconds.

Sense Drive Status (SNS)

This command initiates the transfer of the various TU Status Bytes through the formatter and across the error multiplex bus to the Host. Upon receiving a SNS command the formatter will signal the TU and request that the next TU Sense Byte be placed on the interface. This TU Sense Byte will remain valid until the formatter is issued a NOP command. At this point, the formatter may be issued a CLR command or RESET may be asserted to place TU Sense Byte 0 on the error multiplex bus and return the formatter to the idle mode or the formatter may be issued a SNS command to request the next TU Sense Byte. Each SNS command must be followed by a NOP command, which in turn must be followed by a SNS or a CLR command. The assertion of the RESET line at any time during this sequence will place TU Sense Byte 0 on the error multiplex bus and return the formatter to the idle mode.

Read Forward (RDF)

This command causes the selected TU to read the tape in the forward direction transferring data to the interface. Applicable TU status and errors will be reported.

If the formatter software Diagnostic Flag has been set by use of the DIA command then the operation of the RDF command is modified. Instead of reading data from tape the formatter sends diagnostic response messages to the host adapter.

Read Backward (RDB)

This command causes the selected TU to read the tape in the reverse direction transferring data to the interface. Applicable TU status and errors will be reported. A Read Backward command at BOT or into BOT will be rejected.

Write (WRT)

This command causes the selected TU, if not file protected, to write data on tape at the density selected. A Write command to a file protected TU will be rejected. A Write operation will only occur in the forward direction. During write, the data is read and verified in the formatter. However, no data is returned back to the Host. Applicable TU status and errors will be reported.

If the formatter software Diagnostic Flag has been set by use of the DIA command then the operation of the WRT command is modified. Data sent from the host is not written to tape but is interpreted as diagnostic commands.

Loop Write to Read (LWR)

This command causes data to be transferred through the formatter write and read circuits without going to the TU. No tape motion occurs during this command sequence. This command is terminated by the STOP signal. This command can be performed without a TU attached to the formatter. No TU status is reported by this operation.

BacKspace File (BSF)

This command causes the selected TU to move backward and stop in front of the next tape mark. No data is transferred, however, tape mark status is reported. When BOT is sensed, motion stops and BOT and DATA CHK are asserted in the ending status. A BacKspace command at BOT will be rejected.

BacKspace Block (BSB)

The BSB command causes tape to move backward passing over data blocks until signalled to STOP by the Host interface. No data is transferred across the interface or checked for validity.

After the command initiation, the formatter will signal the addressed TU to begin backward tape motion. If a data block is detected, the formatter will assert BLOCK at the formatter interface. If data block spacing is to be terminated, the Host interface must assert STOP. The assertion must occur within 2 microseconds. If data block spacing is not to be terminated STOP must not be asserted. Tape motion will continue. BLOCK will be reset and then reasserted when and if the next data block detected. When STOP is asserted tape motion will be halted with tape positioned in the preceding IBG, BUSY will be reset and the operation is completed.

If BOT is reached before STOP is asserted or before a data block is detected the operation will be terminated. Tape will be positioned at BOT. DATA CHK and BOTS will be asserted in the ending status. If BSB is initiated with tape positioned at BOT, the command is invalid, REJECT will be asserted and the operation will be terminated.

If a tape mark block is encountered during the operation, tape motion will halt with tape positioned in the IBG preceding the tape mark block. TMS will be included in the ending status.

Forward Space File (FSF)

This command causes the selected TU to move forward past the next file mark and stop. No data is transferred, however, tape mark status is reported.

Forward Space Block (FSB)

This command causes tape to move forward passing over data blocks until signalled to STOP by the host interface. Tape is positioned in the IBG following the data block. No data is transferred across the interface or checked for validity.

Write Tape Mark (WTM)

This command causes the selected TU to write an ANSI compatible tape mark at the density selected. Successful completion of this operation is verified by the formatter and status reported to the Host. Other applicable TU and error status will be reported.

Erase (ERG)

This command causes the selected TU to erase 3.0 inch nominal (plus the normal IBG) section of tape in the forward direction and then stop provided the TU is not file protected. No data is transferred, however, applicable TU status and errors will be reported.

Rewind (REW)

This command causes the selected TU to rewind to the Load Point (BOT) marker. The TU status indicates rewinding until BOT is sensed. BUSY is asserted only until the TU accepts the REW command. Any command issued to a TU that is rewinding will be rejected.

Unload (UNL)

This command causes the selected TU to rewind to the Load Point (BOT) marker and to then perform an unload sequence causing all tape to be wound onto the file reel. BUSY is asserted only until the TU accepts the UNL command. The TU status indicates NOT ON LINE and will remain so until operator action.

START

This single line is used to clock commands into the formatter. This signal should remain active until the BUSY line is asserted. START may be asserted to initiate a command whenever BUSY is not asserted. START assertions while BUSY is asserted will have no effect.

**4.31 FORMATTER CONTROL UNIT STATUS**

The formatter status lines carry status information from the formatter to the Host. Status is valid when BUSY and START are inactive. The following 10 status lines are available at the STC Interface.

High Density Status (HDNS)

This line is asserted when the TU is set to GCR density.

NRZI Status (NRZI)

These lines are asserted by the formatter to indicate the recording format (density) at which the formatter is presently operating.

| HDENS | NRZI | MODE |
|---|---|---|
| 0 | 0 | PE |
| 0 | 1 | NRZI |
| 1 | 0 | GCR |
| 1 | 1 | GCR |

On read or space commands initiated at BOT, the formatter first sets the TU to PE mode, reads the ID BURST, and then sets the TU to the format indicated.

On write operations initiated at BOT the formatter sets the TU to the density selected by the Host. Once positioned away from BOT; the Tape Subsystem reads and writes in the density previously determined by reading the ID BURST of the tape in use. The TU is set to PE mode whenever it is loaded, unloaded, or powered up.

Formatter Busy (BSY)

This line when asserted indicates that the formatter is in the process of executing a command. The formatter will not accept commands when BUSY is asserted. This line is negated when the command is complete. When BUSY is negated, the formatter will accept commands. To have continuous 'on the fly' operation, the next command should be given immediately after BUSY is negated.

Identification Burst (ID BURST)

This line is asserted by the formatter to indicate that an identification burst procedure is being performed by the formatter. It will be asserted on read or write command from BOT. ID BURST is a real time signal when BUSY is asserted; it is asserted only while the identification burst is being sensed. On Write type commands the procedure includes the writing of the ID BURST and a reverse and forward read only mode check of the written burst. On read type commands, the procedure includes the determination of the nature (PE, GCR, or NRZI) of the burst. All of these procedures are automatic within the formatter.

Reject (REJECT)

This line is asserted by the formatter whenever conditions within the formatter or TU are inappropriate to the command operation in progress or just initiated. The conditions that caused the REJECT and the octal codes are given under the Error Multiplex Bus definitions. After the assertion of REJECT and the reset of BUSY, REJECT CODES for the conditions causing the REJECT are the octal contents of the Diagnostic Aids register, addressable on the Error Multiplex Bus as Mux Byte 2. Read or write commands given after a REJECT is received may result in mispositioning and/or creation of an unreadable portion of tape.

Overrun Status (OVRNS)

This line when asserted indicates the Host did not respond to the transfer request in sufficient time to allow proper transfer of data. If asserted, DATA CHK will also be asserted following the read validity checking.

ROM Parity Error (ROMPS)

This line when asserted indicates a parity error condition exists in the microprocessor read only memory.

Tape Mark Status (TMS)

This line when asserted indicates that the selected TU has detected a Tape Mark. This line will be asserted following a Write Tape Mark command and on any read or space command when a tape mark block is detected. TMS will be reset by the next command issued, unless that command is a NOP, SNS, or CLR.

Slave Status Change (SSC)

This line is asserted by the formatter to indicate that one or more TU's have either gone ONLINE, gone OFF-LINE or gone from Not Ready to Ready. SSC will be reset after the TU's that had one of these three status changes has been issued any command except NOP.

Operation Incomplete (OPINC)

This line is asserted by the formatter in conjunction with all REJECT codes except numbers 1, 5, 13, 23, and 30 (octal). OPINC indicates that the given command was initiated but was not completed. REJECT includes those commands that were not able to be initiated as well as those not completed.

**4.32 ERROR STATUS**

The Error Status lines from the formatter to the Host convey information dealing with error conditions in the formatter. Error conditions in a tape unit or in the formatter itself can be discerned by the Host depending on the state of the Error Status lines and the Error MUX lines.

Data Check (DATA CHK)

This line is asserted by the formatter to indicate when any of the following error conditions occur:

Cyclic Redundancy Check

Occurs when internal checks of data character CRC registers do not contain matching patterns. This error may occur during NRZI, PE, or GCR read and write commands. CRC ERR, Error Multiplex Bus Byte 1 Bit P, is also set.

Write Tape Mark Check

The formatter has been unable to cause a tape mark to be written correctly.

In PE or GCR mode REJECT will also be asserted when neither Zone 1 nor Zone 2 meet tape mark requirements in conjunction with Zone 3.

In NRZI mode, whenever a tape mark is written incorrectly, REJECT will also be asserted when no data is detected on tape. WTM CHK, Error Multiplex Bus Byte 1 Bit 7, is also set.

Uncorrectable Error

An uncorrectable error has been detected. This error may occur during

PE or GCR read or write commands. UCE, Error Multiplex Bus Byte 1 Bit 6 is set.

An uncorrectable error during NRZI mode operation is indicated by the assertion of Bits P, 6, and 7 of the dead track register.

During NRZI mode operation UCE is asserted during write commands to indicate excess skew in the record just written.

Partial Record

When an IBG is detected before detecting any interpretable end of data characters. This error may occur during PE or GCR read or write commands. PART REC, Error Multiplex Bus Byte 1 Bit 5, is also set.

Multiple Track Error

Two or more tracks are detected in error. This error may occur during PE or GCR read or write commands. During NRZI read or write operations this line indicated an LRC error. Error Multiplex Bus Byte 1, Bit 4, is also set.

End of Data Check

The end of data characters are not detected, or the preamble and postamble do not meet format requirements. This error may occur during PE or GCR read or write commands. During NRZI operation this line indicates a VRC error. END DATA CHK, Error Multiplex Bus Byte 1 Bit 2, is also set.

Velocity Error

The TU speed indication is outside acceptable limits. This error may occur during PE, GCR, or NRZI write commands. VEL ERR, Error Multiplex Bus Byte 1 Bit 1, is also set.

BOT Reached

Indicated when a backward command is initiated with tape positioned off BOT and tape reaches BOT before the end of the command. ID BURST and BOT are also set.

No Data Detected

Indicated if a block is detected but the nature of the written information precludes identifying any of it as data characters.

Overrun

Indicated if an overrun occurs during a WRT command or a RDF or RDB command.

Corrected Error (CRERR)

This line when asserted indicates the formatter has corrected a single track error in a 1600 bpi (PE) read operation, or single track error in a 6250 bpi (GCR) read operation, or that a reread of a NRZI record has been performed in order to correct a bad record.

Bi-Directional Bus Parity Error (BUPER)

This line is asserted by the formatter indicating that the Bi-Directional Bus has even parity during a TREQ/TRAK data transfer. On WRT operations, assertion of this line indicates that the data written on tape is incorrect. On RDF or RDB operations, assertion of this line indicates either an uncorrectable read error or an internal malfunction of the formatter read data processing system. Data transmission is not halted in either write or read operations.

Select Multiplex (SLX1, SLX0)

These lines are decoded in the formatter and determine which of four 9 bit registers is multiplexed to the Error Multiplex Bus (ERRMX) output lines. The ERRMX lines are valid only as part of 'ending status' (i.e. after busy has been negated). The delay time between the selection of a Multiplex Error code and the stabilization of the selected MUX BYTE is 150 ns max. Select Multiplex decode is defined below:

| SLX1 | SLX0 | BYTE | MUX DESCRIPTION |
|---|---|---|---|
| 0 | 0 | 0 | DEAD TRACKS |
| 0 | 1 | 1 | READ/WRITE ERRORS |
| 1 | 0 | 2 | DIAGNOSTIC AIDS |
| 1 | 1 | 3 | DRIVE SENSE BYTE |

Error Multiplex Bus (ERRMX,P,7,6,5,4,3,2,1,0)

These lines are asserted by the formatter to allow transfer of additional error and reject status information. The lines are valid only as a part of ending status of the just completed command after BUSY is reset. There are three registers multiplexed to the ERRMX BUS. The decode of SLX0 and SLX1 indicates which register is being monitored. Figure 4-31 gives the ERRMX decode for functional mode operation.

---

| MUX BYTE | P | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | DTP | DT7 | DT6 | DT5 | DT4 | DT3 | DT2 | DT1 | DT0 | DEAD TRACKS |
| 1 | CRC ERR | WTM CHK | UCE | PART REC | MTE | NOT USED | END DATA CHK | VEL ERR | DIAG MODE LTCH | READ/WRITE ERRORS |
| 2 | TACH | DA7 | DA6 | DA5 | DA4 | DA3 | DA2 | DA1 | DA0 | DIAGNOSTIC AID BITS |
| 3 | WRT STAT | EOT STAT | BOT STAT | WRT INHB | FILE PROT | BKWD STAT | HI DEN | RDY STAT | ON LINE STAT | DRIVE SENSE BYTE 0 |

Figure 4-31  Error Multiplex Bit

MUX BYTE 0

ERRMX Bits P thru 0 are asserted upon detecting a dead track during a read or a write operation. A dead track is caused by the inability to detect correct data on a specific track on tape. These bits are reset at the start of each new command.

MUX BYTE 1

The following bits of MUX BYTE 1 are asserted when the conditions defining the bit occur:

1. CRC Error (Cyclic Redundancy Character Error)
The internal checks of the CRC registers indicate a loss of data integrity. This error may occur during read or write commands during PE, GCR, or NRZI operations. DATA CHK is also asserted.

2. WTM CHK (Write Tape Mark Check)

The Formatter has been unable to cause a tape mark to be written correctly.

In PE or GCR mode, DATA CHK will also be asserted when Zone 1 and Zone 2 in conjunction with Zone 3 do not meet tape mark requirements. REJECT will also be asserted when neither Zone 1 nor Zone 2 in conjunction with Zone 3 meets tape mark requirements.

In NRZI mode, DATA CHK will also be asserted whenever a tape mark is written incorrectly.

REJECT will also be asserted when no data is detected on tape.

3. UCE (Uncorrectable Error)

An uncorrectable error has been detected. This error may occur during PE or GCR read or write commands. DATA CHK is also asserted.

An uncorrectable error during NRZI mode operation is indicated by the assertion of DATA CHK and Bits P, 6, and 7 of the dead track register.

During NRZI mode operation UCE is asserted during write commands to indicate excess skew in the record just written.

4. PART REC (Partial Record)

An IBG is detected before detecting end of data characters. This error may occur during PE or GCR read or write commands. DATA CHK is also asserted.

5. MTE (Multiple Track Error)

Two or more tracks are detected in error. This error may occur during PE or GCR read or write commands. DATA CHK may also be asserted. During NRZI read or write operations this line indicates an LRC error.

6. END DATA CHK (End of Data Check)

The end of data characters are not detected, or the preamble and postamble do not meet format requirements. This error may occur during PE or GCR read or write command. During NRZI read or write operations, this line indicates a VRC (parity) error has occurred. DATA CHK is also asserted.

7. VEL ERR (Velocity Error)

The TU speed indication was outside acceptable limits. This error may occur during PE, GCR, or NRZI write commands. DATA CHK is also asserted.

8. DIAG MODE LTCH (Diagnostic Mode Latch)

The Diagnostic Mode of operation has been set in the Formatter.

MUX BYTE 2

ERRMX Bit P is the digital tachometer (TACH) from the drive and contains information concerning tape speed and distance. This line is used in certain diagnostic routines and is valid during commands as well as after the command is completed.

REJECT CODES are asserted on Bits 7 through 0 under their defining conditions. The REJECT code is the octal equivalent of Bits DA7 through DA0 with Bit DA7 being most significant and Bit DA0 being least significant. Figure 4-32 gives the REJECT CODES and descriptions. Those codes setting Operation Incomplete (OP INC) are also indicated.

| REJECT CODE (octal) | DESCRIPTION |
|---|---|
| 1 | The addressed TU is not in Ready Status. |
| *2 | The FCU has detected one of its internal microprogram words having wrong parity. |
| *3 | The TRAK responses to initiating TREQs were not received within 75 milliseconds on a write type command. |
| *4 | The FCU has detected an unimplemented word in its internal microprogram. |
| 5 | The addressed TU is in File Protect Status when a write type command is attempted. |
| *6 | The addressed TU did not go to Erase Status only. |
| *10 | The addressed TU did not go to Read Status. |
| *11 | The Tape subsystem does not have NRZI capability and attempted to read a NRZI tape.<br><br>The Tape Subsystem does not have NRZI capability and was unable to read a PE or GCR ID BURST during either a read operation or during a read check after writing the ID BURST.<br><br>The Tape Subsystem does have NRZI capability and was unable to read a PE or GCR ID BURST during a read check after writing the ID BURST. |
| *12 | The addressed TU did not drop Write Inhibit Status. |
| 13 | The addressed TU is not in Online Status. |
| *14 | The addressed TU did not go to Write Status after a write type command was initiated. |
| *15 | During a backward motion after writing the ID BURST, BOT was not reached in the distance expected. |
| *16 | The addressed TU did not go to Backward Status. |

* OP INC is also set

Figure 4-32. Reject Codes (1 of 2)

| REJECT CODE (octal) | DESCRIPTION |
| --- | --- |
| *17 | Noise (possible data) was detected during an Erase Gap command or during a write command following a read type command. |
| *21 | The addressed TU reset Ready Status. |
| *22 | When the PE or GCR ID BURST just written was rechecked on a read, the ID BURST was on the wrong track. |
| 23 | A backward type command (except a rewind or an unload command) was given, but tape was already positioned at BOT. |
| *24 | The ARA BURST portion of the GCR ID BURST just written did not have all 9 tracks active. |
| *25 | An IBG longer than 25 feet in PE or NRZI mode or longer than 15 feet in GCR mode was detected on a read or space type command. |
| *27 | The addressed TU failed to reset Ready Status during a rewind operation. |
| *30 | The addressed TU does not indicate being in the density requested by the FCU. |
| *32 | The addressed TU failed to initiate tape motion. |
| *33 | During the read back check of a write operation, data was detected in the IBG area. |
| *34 | There was no IBG detected following the ARA BURST. |
| *35 | Drive attempted to backspace over a bad record just written but was unable to detect the record. |
| *36 | The ARA BURST was unreadable during a GCR read or write command. |
| *37 | During the read back check of a write or write tape mark command, no data was detected. |

* OP INC is also set

Figure 4-32. Reject Codes (2 of 2)

## 4.33 UNIT STATUS

The tape unit status is monitored by the formatter and is available to the CPU. A description of status lines follows. Figure 4-33 describes tape unit status bytes.

Write Status (WRTS)

This line when asserted indicates that the selected TU is in write status.

Ready Status (RDYS)

This line when asserted indicates that the selected TU has tape loaded, is ONLINE, and is not rewinding.

Beginning of Tape Status (BOTS)

This line when asserted indicates that the selected TU has the tape stopped with the BOT marker over the BOT sensor.

End of Tape Status (EOTS)

This line when asserted indicates that the end of tape marker has been sensed on the selected TU.

File Protect Status (PROTS)

This line when asserted indicates that there is no write ring installed in the file reel on the selected and loaded TU, thus precluding a write or erase operation.

Rewinding Status (REWS)

This line when asserted indicates that the selected TU is in the process of rewinding tape to BOT. The selected drive is ONLINE and Not Ready.

ONLINE Status (ONLS)

This line when asserted indicates the selected TU has been placed ONLINE by the operator. A TU may be ONLINE when it is not READY.

## 4.34 DATA OPERATION

The following signals define the lines associated with a data transfer between the host and the formatter. The formatter includes a 512 byte data buffer. The maximum data transfer rate is 1 megabyte per second (MB/S).

Transfer Request (TREQ)

This signal is generated by the formatter. In a write operation, it indicates that the formatter is requesting a data byte from the host. In a read operation, it indicates to the host that a byte of data is ready to be transferred from the formatter.

| TU STATUS BYTES | TU STATUS BITS 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| SB 0 | EOTS | BOTS | WNHB | PROS | BWDS | HDNS | RDYS | ONLS |
| SB 1 | 1 | 1 | D1 | D0 | 0 | M2 | M1 | M0 |
| SB 2* | 0 | 0 | S1 | S0 | 0 | 0 | 0 | 0 |

* TU STATUS BYTES NUMBERED 3 AND ABOVE ARE USED FOR DIAGNOSTIC INFORMATION TRANSFER. ONLY BYTES 0, 1, AND 2 ARE USED IN FUNCTIONAL MODE OPERATION.

'D' Bit Decode of TU Status Byte 1

| D1 | D0 | TU MODE |
|---|---|---|
| 0 | 0 | NRZI |
| 0 | 1 | NRZI |
| 1 | 0 | PE |
| 1 | 1 | GCR |

'M' Bit Decode of Drive Status Byte 1

| M2 | M1 | M0 | TU CAPABILITY |
|---|---|---|---|
| 0 | 0 | 0 | 50 IPS - PE/GCR |
| 0 | 0 | 1 | 50 IPS - PE/GCR/NRZI |

Figure 4-33. Tape Unit Status Decode

Expecting Data (RECV)

This signal is generated by the formatter to indicate the Bi-Directional Bus is under control of the Host and that the formatter will soon request data character transfers. This line is asserted on WRT or LWR command operations only. It will remain asserted until a new command is initiated.

End of Data Pulse (ENDATP)

This line is asserted by the formatter to indicate that the last data character has been transferred across the interface. If the Host TREQ and TRAK timing have been within the specified limits, the Host should have received all data bytes by the time ENDATP is asserted. Upon assertion of ENDATP all data transfer is halted and untransferred bytes are lost. ENDATP is asserted on read type command operations (RDF or RDB) only, and is a 400 nanosecond pulse (nominal duration).

Bi-Directional Bus (Data-P,0,1,2,3,4,5,6,7)

These lines are used to transfer write data and read data between the Host and the formatter. The formatter checks parity on write data. These lines should always have odd parity during read and write.

Block Sensed (BLOCK)

This line is asserted by the formatter to indicate that a data block has been detected. This line is asserted during BSB and FSB commands only. BLOCK is a pulse of 400 nanoseconds nominal duration.

Transfer Acknowledge (TRAK)

This signal originates at the Host and is used to transfer data across the interface in conjunction with the transfer request signal. TRAK in response to TREQ during a write operation indicates that the requested data byte has been placed on the data bus by the Host. TRAK in response to TREQ during a read operation signals that the Host has sampled the data byte available at the data bus.

Terminate Command (STOP)

This signal is generated by the Host in response to TREQ in a write operation indicating the presence of the last data byte on the data bus. During a read operation it signals the formatter to discontinue any further data transfer across the interface. During these operations STOP replaces TRAK as the Host response to TREQ. During a BSB or FSB operation in response to BLOCK, it signals the formatter to terminate spacing over blocks. In response to STOP, the formatter will terminate the command in progress and reset BUSY, but only after the formatter has completed the necessary tape formatting, deformatting and positioning according to the nature of the command in progress.

System Reset (RESET)

This signal, when asserted, will abort any formatter operation in progress, reset all status and error signals and return the formatter to a ready state.

If the system is in Diagnostic Mode it will be set to Functional Mode. Duration of the system reset is 1 microsecond minimum.

Oscillator (OSC)

This line is derived from the formatter internal crystal oscillator. This frequency will be 2.27 MHz (440 nanosecond period) at 50 IPS; and a 2.40 MHz (416 nanosecond period) for PE or NRZI operations. The frequency is stable within 0.01 percent and the half cycle periods will be symmetrical within five percent. The oscillator frequency reflects the density mode in effect in the formatter and not the TU. It will shift frequency as the requirements of the command sequence dictate (such as ID BURST identification).

## 4.35 TIMING DIAGRAMS

The timing diagrams applicable to the Host Interface will be included in a later edition of this manual.

## 4.36 ELECTRICAL

The asserted level is a voltage of 0.0 to +.4 volts and the negated level, +2.4 to +5.0 volts.

Driver/Receiver Circuits

Line driver and receiver circuits are 7416 or equivalent for the unidirectional output lines, 7414 or equivalent for the unidirectional input lines, and DM8838 or equivalent for the bi-directional data bus.

Termination

Standard termination for all lines consists of a 180 (±5%) ohm resistor to +5V and a 390 (±5%) ohm resistor to ground. Inputs to the formatter are terminated at the formatter and outputs from the formatter are terminated at the Host. The bi-directional data bus should be terminated at both ends.

Grounds

The DC logic grounds in the flat cables establish the reference level between the Host and the formatter. Alternate ground wires should be connected to the ground bus on the I/O card.

## 4.37 MECHANICAL

Signal Cables

The interface cables should be no longer than 40 feet. Two 60-conductor flat cables are required. These are supplied by the user. It is recommended that the cables be 28 gauge (3M or equivalent).

Mating Connector

The mating connector is a 60-pin TPN A55X01631-01 including strain relief.

**4.38 PIN ASSIGNMENTS**

Pin assignments for the two Host I/O Interface Connectors are listed in Figure 4-34.

| | PIN NUMBER | | | |
|---|---|---|---|---|
| CONN. | SIGNAL | GROUND | SIGNAL NAME | MNEMONIC |
| A4 | A01 | B01 | TU Address 0 | AD0 |
| A4 | A02 | B02 | TU Address 1 | AD1 |
| A4 | A03 | B03 | Command Select 0 | CMD0 |
| A4 | A04 | B04 | Command Select 1 | CMD1 |
| A4 | A05 | B05 | Command Select 2 | CMD2 |
| A4 | A06 | B06 | Command Select 3 | CMD3 |
| A4 | A07 | B07 | Density Select 0 | DS0 |
| A4 | A08 | B08 | Initiate Command | START |
| A4 | A09 | B09 | Terminate Command | STOP |
| A4 | A10 | B10 | Transfer Acknowledge | TRAK |
| A4 | A11 | B11 | Bi-Directional Data P | DATA-P |
| A4 | A12 | B12 | Bi-Directional Data 0 | DATA-0 |
| A4 | A13 | B13 | Bi-Directional Data 1 | DATA-1 |
| A4 | A14 | B14 | Bi-Directional Data 2 | DATA-2 |
| A4 | A15 | B15 | Bi-Directional Data 3 | DATA-3 |
| A4 | A16 | B16 | Bi-Directional Data 4 | DATA-4 |
| A4 | A17 | B17 | Bi-Directional Data 5 | DATA-5 |
| A4 | A18 | B18 | Bi-Directional Data 6 | DATA-6 |
| A4 | A19 | B19 | Bi-Directional Data 7 | DATA-7 |
| A4 | A20 | B20 | System Reset | RESET |
| A4 | A21 | B21 | Multiplex Select 1 | SLX1 |
| A4 | A22 | B22 | Multiplex Select 0 | SLX0 |
| A4 | A23 | B23 | Density Select 1 | DS1 |
| A4 | A24 | B24 | Multiplex Select 2 | SLX2 |
| A4 | A25 | B25 | Slave Status Change | SSC |
| A4 | A26 | B26 | Oscillator | OSC |
| A4 | A27 | B27 | End of Tape Status | EOTS |
| A4 | A28 | B28 | Begin. of Tape Status | BOTS |
| A4 | A29 | B29 | File Protect Status | FPTS |
| A4 | A30 | B30 | Rewinding Status | REWS |
| B4 | A1 | B1 | Error Multiplex-P | ERRMX-P |
| B4 | A2 | B2 | Error Multiplex-0 | ERRMX-0 |
| B4 | A3 | B3 | Error Multiplex-1 | ERRMX-1 |
| B4 | A4 | B4 | Error Multiplex-2 | ERRMX-2 |

Figure 4-34. STC Pin Assignments (1 of 2)

| | PIN NUMBER | | | |
|---|---|---|---|---|
| CONN. | SIGNAL | GROUND | SIGNAL NAME | MNEMONIC |
| B4 | A5 | B5 | Error Multiplex-3 | ERRMX-3 |
| B4 | A6 | B6 | Error Multiplex-4 | ERRMX-4 |
| B4 | A7 | B7 | Error Multiplex-5 | ERRMX-5 |
| B4 | A8 | B8 | Error Multiplex-6 | ERRMX-6 |
| B4 | A9 | B9 | Error Multiplex-7 | ERRMX-7 |
| B4 | A10 | B10 | Formatter Busy | BUSY |
| B4 | A11 | B11 | Transfer Request | TREQ |
| B4 | A12 | B12 | Expecting Data | RECV |
| B4 | A13 | B13 | Identification Burst | ID BURST |
| B4 | A14 | B14 | Operation Incomplete | OP INC |
| B4 | A15 | B15 | End of Data Pulse | ENDATP |
| B4 | A16 | B16 | Tape Mark Status | TMS |
| B4 | A17 | B17 | Command Reject | REJECT |
| B4 | A18 | B18 | Overrun Status | OVRNS |
| B4 | A19 | B19 | Data Check | DATA CHK |
| B4 | A20 | B20 | Rom Parity Error | ROMPS |
| B4 | A21 | B21 | Corrected Error | CRERR |
| B4 | A22 | B22 | Block Sensed | BLOCK |
| B4 | A23 | B23 | NRZI Status | NRZI |
| B4 | A24 | B24 | Data Bus Parity Error | BUPER |
| B4 | A25 | B25 | On Line Status | ONLS |
| B4 | A26 | B26 | High Density Status | HDENS |
| B4 | A27 | B27 | Ready Status | RDYS |
| B4 | A28 | B28 | Write Status | WRTS |
| B4 | A29 | B29 | Reserved | |
| B4 | A30 | B30 | Reserved | |

Figure 4-34. STC Pin Assignments (2 of 2)

# SECTION 5 - MAINTENANCE

## 5.1 GENERAL

The 9250 contains microprocessor-controlled diagnostics that are capable of evaluating operational areas of the TU/formatter combination and identifying defective components at the Field Replaceable Unit (FRU) level. Maintenance procedures for removal, replacement, and checkout of FRUs are described later in this section. (See Section 6 for a list of FRUs.)

SERVICE LIFE

The 9250 is designed to provide a useful life of 40,000 power-on hours or 5 years, whichever occurs first, before the unit requires a major overhaul or replacement.

MAINTAINABILITY

The 9250 requires no special tools for maintenance. An IBM Multi-system tape (or equivalent) of known quality is required to verify head and read/write performance. A skew tape is required for NRZI skew adjustment.

SERVICE ACCESS

All Service can be performed from the front of the Tape Unit. FRUs are readily accessible when the unit is opened for service. The logic boards are packaged as a "book" with two "pages" for the TU and two "pages" for the formatter. Servo and pneumatic control power circuits are on separate boards. See Section 6 for FRU locations and orientation.

## 5.2 PREVENTIVE MAINTENANCE (PM)

No PM is required other than cleaning performed by the operator. See Section 3 for prescribed operator cleaning procedures.

## 5.3 READ, WRITE, AND SKEW CALIBRATION

The 9250 allows compensation of the read-write circuits to insure optimum performance for differences in tape and heads, or for special conditions. The read and write calibration routines are invoked at the Diagnostic Keyboard. Before being shipped, the unit is calibrated while reading and writing an IBM Multi-System Tape. Refer to paragraph 3.7 for the read/write Auto Cal procedure.

In addition, NRZI operation will require occasional skew calibration as determined by diagnostic procedures.

--- Read/Write Calibration Procedure*

The purpose of this procedure is to calibrate read gains in all densities or just PE and GCR if the unit is not equipped for NRZI operation. This procedure will also calibrate write current for the three densities.

To Calibrate:

1. Load a non-write-protected IBM Multi-system tape (or equivalent).

2. Make sure the tape is at load point.

3. Make sure that the correct write compensation time for PE and GCR is in the system. The compensation times for PE and GCR are located on the head base plate. Compensation time for PE can be modified by Cmd 97 on the DKB. Compensation time for GCR can be modified by Cmd 98 . See the command dictionary in Section 7 for details.

4. Enable access level II by entering Cmd 92 on the DKB.

5. Start calibration procedure by entering Cmd 31 on the DKB.

6. After tape has stopped, unload tape.

NOTE: If error codes appear on the status display, see Section 7 Cmd 31.

--- Skew Calibration Procedure*

NRZI Read Skew Adjustment is accomplished after the head azimuth and capstan alignments have been performed. Test points (TP) are located on the Read PWB. The steps required are:

1. Load an 800 bpi master skew tape.

2. Set an oscilloscope to two channel, chop, 2V/cm (both channels), DC coupled, negative DC trigger on channel one and 1us/cm sweep.

3. Put the channel one scope probe on TP 23 track 5 and the channel two scope probe on TP 19 track 1. TP 28 is ground.

4. Select 800 bpi density on the OCP.

5. Enter Cmd 4 (door interlock override), Cmd 23 (move forward), Cmd 92 (set access level II), and Cmd 9D (NRZI skew forward).

6. Press the up stroke button on the DKB once, then press 8 on the DKB to increment and 9 to decrement. Adjust the rising edge of channel two such that it is within 1us of channel one. Enter execute on the DKB when adjustments are satisfactory.

*<u>NOTE: Settings are in nonvolatile ram and must be reset if the I/O Control Write PWB is replaced.</u>

7. Repeat step 6 for each of the other seven tracks. (Channel one scope probe remains on TP 23 (track 5) while channel two scope probe is used for all other tracks: TPs 20-22 and 24-27)

8. Enter Cmd 24 (move backward), Cmd 92, and Cmd 9E.

9. Repeat steps 6 and 7 above.

10. Enter Cmd 5 to reset door override.

NOTE: After each track is adjusted the calibration routine automatically goes to the next track. The track being adjusted is displayed in the left-hand segment of the OCP display. For example [1.h h], where one is the track being adjusted and "h h" represents hex values. Be sure not to adjust track 5 when it comes up in the adjustment sequence, since this is the reference track. See Section 7 for details on diagnostic commands.

## 5.4 MECHANICAL ADJUSTMENTS

Most FRUs are preset at the subassembly level and require no further adjustment during operation or after component replacement. The read- write head is adjusted for azimuth at the factory for PE and GCR operation. If the NRZI option is installed, an azimuth adjustment may be required after replacing the head or capstan motor.

--- Azimuth Adjustment

The Azimuth adjustment procedure is as follows:

1. Load a skew tape.

2. Verify that capstan alignment is correct before proceeding. Refer to capstan alignment procedure below.

3. Attach scope probes to test points TP-1 and TP-9 on the read PWB. Set scope for chopped mode and sync on TP-1.

4. Swing open head cover. Unlock 3/8 hex head azimuth-adjust screw. (Locking screw located in edge of skew plate.) Torque mounting screw (located in center of hex) down until spring is totally collapsed ,and back screw out one turn.

   With a 3/8 socket driver, turn azimuth adjust screw back and forth ,and at same time torque locking screw until azimuth adjust screw runs smooth under semi-locked mode.

   NOTE: Mounting Screw located in center of azimuth screw is not a functional part of adjustment mechanism and should remain as is.

5. From the DKB enter Cmd 4 (door interlock override) then enter Cmd 26 to start tape motion.

6. Begin reading the tape in the Cmd 26 mode and observe the dual traces.

7. With a 3/8 socket driver, turn azimuth screw until scope traces are coincident or two microseconds or less apart during both forward and reverse tape motion. Check coincidence of several other tracks to insure that the azimuth is not skewed by one byte or more.

8. Lock Azimuth adjust screw.

9. Unload skew tape.

10. Close head cover.

--- Capstan Tracking Adjustment (NRZI option only)

This is a factory adjustment not normally performed in the field, but may be required after replacement of capstan wheel or capstan motor.

1. Install the vacuum column cover (Telex Part #89D20784) on the unit.

2. Load a scratch tape.

3. On the DKB enter Cmd 23, which will move tape forward. Allow enough tape to move forward past the BOT marker to permit forward/reverse reel motion.

4. Enter Cmd 26 on the DKB to start forward/reverse tape movement.

5. Using a flashlight or high intensity work light, observe the capstan tape guide. Visualize the tape running on the capstan wheel as a flat belt runs on a flat pulley. The idea is to align the motor precisely so that the tape runs on the capstan wheel and so that tape is not guided by the capstan wheel. These are minute changes within confines of the vacuum column. Good lighting is essential to observe them.

6. Adjust the capstan alignment screws as necessary to eliminate:

   a. Change in horizontal position of the tape on the capstan wheel with the direction of tape motion. Observe the hairline spacing between the tape edge and the vacuum column edge;

   b. Buckling of the tape on either ceramic edge guide on the capstan bearing assembly, and buckling of the tape edge against the vacuum column surface next to the capstan wheel;

   c. Spacing between the tape edge and the outer ceramic tape guide on the guide block assembly. The tape should run flush with the outer guide without buckling.

7. Loosen the outer ceramic tape guide on the capstan bearing and pull it clear of the tape edge.

8. Depress the rear, spring loaded ceramic guide. It should clear the tape edge.

9. With both ceramic guides out of contact with the tape edge, fine tune the capstan alignment so that the tape maintains precisely the same path as with the guides in place and all of the conditions in step 6 are met.

10. Unload the scratch tape and load a skew tape. Refer to head azimuth alignment procedure above and set up oscilloscope.

11. Adjust the capstan alignment screws to remove the phase jitter between tracks.

12. Tighten the outer ceramic tape guide.

13. Observe to make sure the conditions established in steps 6 and 9 have been maintained.

## 5.5 FRU REMOVAL/REPLACEMENT PROCEDURES

The following procedures offer step by step guidance in the removal and replacement of FRUs for the 9250 Tape Unit. Procedures are covered under the following subheadings:

| | |
|---|---|
| Doors | Power Supplies |
| Tape Path Components | Sensors and Switches |
| Reel Hubs | PWBs |
| Controls | Motors and Blowers |

Refer to Section 6 for FRU illustrations and parts lists.

***** DOORS *****

### 5.5.1 REEL DOOR ASSEMBLY REMOVAL/REPLACEMENT

--- To Remove Reel Door Assembly:

1. Remove the two door stop retainer screws from the deck plate.

2. At the bottom hinge remove the two button head hex socket screws from the deckplate.

3. Grip the reel door firmly and remove the top two hinge screws from the deck plate.

--- To Replace Reel Door Assembly:

1. Fit a hinge screw onto an allen driver.

2. Holding the reel door in your left hand, screw in the topmost screw in order to fasten the top hinge.

3. Replace the other three screws.

## 5.5.2 VACUUM COLUMN COVER ASSEMBLY REMOVAL/REPLACEMENT

--- To Remove Vacuum Column Cover Assembly:

1. Remove the two door stop retainer screws from the deckplate.

2. At the bottom hinge remove the two button head hex socket screws from the deckplate.

3. Grip the column cover firmly and remove the top two hinge screws from the deck plate.

--- To Replace Column Cover Assembly:

1. Fit a hinge screw onto an allen driver.

2. Holding the column cover, screw in the topmost screw in order to fasten the top hinge.

3. Replace the other three screws.

## 5.5.3 HEAD COVER ASSEMBLY REMOVAL/REPLACEMENT

---To remove Head Cover Assembly:

1. Power down and disconnect the tape unit.

2. Open the reel door and vacuum column door.

3. Open the head cover.

4. Remove three phillips head screws from cover mounting block.

5. Disconnect the quick disconnect electrical fasteners from the door interlock switch. (Note connections.)

6. Remove the door interlock switch from the cover assembly.

--- To Replace Head Cover Assembly:

1. Install interlock switch in assembly and connect wires.

2. Install the first cover assembly mounting screw in the round hole in the mounting block.

3. Install the remaining two screws in the slotted holes.

4. Tighten all screws.

***** TAPE PATH FRUs *****

### 5.5.4 CAPSTAN WHEEL REMOVAL/REPLACEMENT

--- To Remove Capstan Wheel:

1. Power down and unplug the tape unit.

2. Open the reel door, vacuum column cover and head cover.

CAUTION

DO NOT TOUCH THE TAPE CONTACT SURFACE OF THE CAPSTAN WHEEL WITH BARE FINGERS AS SKIN OILS WILL CONTAMINATE THE SURFACE AND REDUCE CAPSTAN EFFICIENCY.

3. Using a clean, lint-free cloth pledget (Telex TX 325 or equivalent) gently brace the capstan shaft (wrench flats are provided on the motor shaft extension of the motor) and use a 9/64" hex driver to remove the center hex socket screw.

4. Slip the capstan wheel off the capstan motor shaft.

--- To Replace Capstan Wheel:

Reverse procedure above (Use 10 to 14 in. lb torque). For NRZI equipped tape unit align capstan wheel using procedure described in paragraph 5.4.

### 5.5.5 READ/WRITE HEAD ASSEMBLY REMOVAL/REPLACEMENT

--- To remove Head Assembly:

1. Power down and unplug tape unit.

2. Open reel door.

3. Open head cover by gently pulling right edge. Cover is hinged on left and spring loaded. Be sure that cover is opened all the way so it does not snap back hard against the deck plate.

CAUTION

DO NOT TOUCH SURFACE OF HEAD OR LET IT CONTACT THE DECK PLATE. HEAD DAMAGE MAY RESULT. PROTECT SURFACE OF HEAD WITH SOFT, CLEAN, LINT-FREE CLOTH PLEDGET (TELEX TEXWIPE TX 325 OR EQUIVALENT.)

4. Gently grasp head cables and unplug from behind deck plate.

5. Disconnect green ground wire from preamp PWBA assembly, leaving it attached to the head assembly.

6. Remove three phillips screws from head assembly.

7. Pull head assembly straight out from deck plate.

--- To Replace Head Assembly:

1. Slip assembly over locator pins in deck plate.

2. Fasten the bottom two phillips screws.

3. Reconnect head cables and ground wire.

4. Perform calibration procedures in paragraphs 5.3 and 5.4.

### 5.5.6 ROLLER TAPE GUIDE REMOVAL/REPLACEMENT

--- To remove roller tape guide:

1. Remove power supply assembly (5.5.15).

2. Remove retainer screw from front of deckplate.

CAUTION

DO NOT ATTEMPT TO REMOVE THE ROLLER TAPE GUIDE BY REMOVING THE C-CLIP FROM THE FRONT OF THE DECK.

--- To Replace Roller Tape Guide:

Reverse the procedure above.

### 5.5.7 LIFTER FOOT AND ROTARY SOLENOID REMOVAL/REPLACEMENT

--- To remove Lifter Foot and Rotary Solenoid:

1. Power down and unplug unit.

2. Open reel door, head cover, and vacuum column cover.

CAUTION

LIFTER FOOT IS A PRECISION, POLISHED SURFACE. UTMOST CARE SHOULD BE TAKEN TO AVOID DAMAGING THE TAPE BEARING SURFACE. THE SURFACE MAY BE CLEANED WITH FOAM SWABS AND TELEX TAPE TRANSPORT CLEANER 98X01723-01.

3. Apply a protective covering such as a lint-free cloth secured with adhesive tape to the lifter foot.

4. Swing tape unit open.

5. Swing out PWBs for access.

6. Remove solenoid mounting screw and nut.

7. remove lifter foot mounting screw and nut.

8. Carefully pull solenoid back until lifter foot can be removed.

--- To replace Lifter Foot and Rotary Solenoid:

1. Start lifter foot mounting screw in threaded hole in lifter.

2. Place lifter foot in position and push solenoid forward until shaft enters hole in lifter foot.

3. Orient lifter so mounting screw can pass through hole in shaft.

4. Tighten screw firmly.

5. Replace solenoid mounting screws.

6. Install nut on end of lifter mounting screw and tighten until lifter foot clamps firmly onto shaft (approximately 4-6 in. lb torque.)

7. Plug in solenoid connector.

8. Remove protective covering from lifter.

9. Power up tape unit and mount scratch tape.

10. Run tape forward for a minute then perform high speed rewind to ensure solenoid and lifter foot are operating properly.

**5.5.8 TAPE CLEANER ASSEMBLY REMOVAL/REPLACEMENT**

--- To remove Tape Cleaner Assembly:

1. Remove head (5.5.5).

2. Apply protective covering to tape lifter foot, such as a lint-free cloth secured by tape, and remove lifter foot (5.5.7).

3. Remove tape cleaner mounting screw.

--- To Replace Tape Cleaner Assembly:

1. Replace tape cleaner and install mounting screw.

2. Remount lifter foot (5.5.7).

3. Install and align head (5.5.5).

4. Remove protective covering from lifter foot.

5. Check operation.

### 5.5.9 TAPE BEARING ASSEMBLIES REMOVAL/REPLACEMENT

--- To remove Tape Bearing Assembly:

1. Remove tape and power down unit.

2. Open head cover.

CAUTION

BEARINGS ARE PRECISION, POLISHED COMPONENTS. UTMOST CARE SHOULD BE TAKEN TO AVOID DAMAGE. DO NOT TOUCH, RUB OR DROP BEARINGS. THEY MAY BE CLEANED WITH A FOAM SWAB MOISTENED WITH TELEX TAPE TRANSPORT CLEANER 98X01723-01.

3. Apply protective covering to bearing, such as a lint free cloth secured by adhesive tape.

4. Remove mounting screw to remove bearing.

CAUTION

A RUBBER "O" RING IS LOCATED UNDER THE UPPER BEARING ASSEMBLY. SPECIAL CARE SHOULD BE TAKEN TO INSURE IT IS IN POSITION WHEN UPPER BEARING ASSEMBLY IS REPLACED.

--- To Replace Bearing Assembly:

1. Replace mounting screw on bearing.

2. Remove protective covering and close head cover.

### 5.5.10 LOAD JET REMOVAL/REPLACEMENT

Load jets are removed from the back of the deck plate. Removal procedure is essentially the same for all jets. However, gaining access to some jets will require more shifting of components than for others. Also, some jets will mount in only one position, while others need to be specifically oriented when they are replaced. A list of jets and specific removal/replacement requirements follows these general procedures.

--- To remove a Load Jet:

1. Power down and unplug tape unit.

2. Pull the supply tee or elbow and coupling hose from the jet.

3. Remove the jet mounting screw.

4. Pull jet from deck.

--- To replace a Load Jet:

1. Position jet in deck. Flange will be flush with machined surface when pin is in locating hole.

2. Replace mounting screw and washer.

3. Push coupling hose over barb on jet.

4. Push tee (or elbow) into coupling hose with bore of tee over pipe on jet. Make sure that coupling hose covers both the barb on the jet and the barb on the tee.

Information on removal/replacement of specific jets follows:

1. 66C20129-01---Load Jet, Hand Well: Remove load pump for easier access. Only one jet position is possible.

2. 66C20129-02---Load Jet, Hand Well: Only one jet position is possible.

3. 86C20342-01---Load Jet, Covered: Only one jet position is possible.

4. 86C20342-01---Load Jet, Covered: Only one jet position is possible.

5. 86C20342-02---Load Jet, Covered: Remove vacuum column pump for easier access.

   Vertical Models: Position Jet in counterclockwise position as viewed from back of tape unit.

   Horizontal Models: Position Jet in Clockwise position as viewed from back of tape unit.

6. 86C20342-02---Load Jet, Covered: Remove load pump for easier access. Only one position possible.

7. 86C20342-03---Load Jet, Covered: Use position with threaded hole closest to power switch (air stream parallel to deck edge).

8. 86C20342-03---Load Jet, Covered: Remove power supply for easier access. Only one position possible.

9. 86C20342-04---Load Jet, Covered: Remove vacuum column pump for easier access.

***** REEL HUBS *****

### 5.5.11 FILE REEL HUB ASSEMBLY REMOVAL/REPLACEMENT

--- To remove File Reel Hub Assy:

1. Power down the tape unit.

2. Remove tape reel from file reel hub.

3. Remove three phillips screws from front of file reel hub. Be careful not to let the hub drop after removing last screw.

--- To replace File Reel Hub Assy:

1. Insert single screw part way into hole in hub.

2. Fasten screw loosely into topmost hole in motor shaft plate.

3. Fasten other two screws.

4. Firmly tighten all three screws.

**5.5.12 MACHINE REEL HUB ASSEMBLY REMOVAL/REPLACEMENT**

--- To remove Machine Reel Hub Assy:

1. Power down the tape unit.

2. Remove the 1/4 inch hex head screws. Be careful not to let the hub cover drop after removing last screw.

3. Remove three phillips screws located under hub cover.

--- To replace Machine Reel Hub Assy: Reverse procedure above.

***** CONTROLS *****

**5.5.13 OCP ASSEMBLY REMOVAL/REPLACEMENT**

--- To remove OCP:

1. Power down and unplug tape unit.

2. Remove the power supply subassembly (5.5.15).

3. Remove OCP retainer nuts from behind deckplate.

4. Push OCP out.

5. Disconnect cable.

--- To replace OCP: Reverse above procedure

**5.5.14 DIAGNOSTIC KEYBOARD ASSEMBLY REMOVAL/REPLACEMENT**

--- To remove Diagnostic Keyboard:

1. Power down and unplug tape unit.

2. Remove power supply.

3. Remove connector from back of DKB.

4. Remove two screws that retain DKB mounting bracket.

--- To replace Diagnostic Keyboard: Reverse the procedure above.

**** POWER SUPPLIES *****

**5.5.15 POWER SUPPLY SUBASSEMBLY REMOVAL/REPLACEMENT**

--- To remove the power supply subassembly:

1. Power down and unplug tape unit.

2. Swing tape unit open.

3. Disconnect all cables from power supply. Note location of connections.

4. Remove four hex nuts from top of power supply chassis.

5. Lift out power supply assembly.

--- To replace power supply subassembly: Reverse the procedure above. Be sure to route cables as before.

**5.5.16 POWER SUPPLY MODULE REMOVAL/REPLACEMENT** (Old PS only, see Sec. 8)

--- To remove regulated power supply module:

1. Power down and unplug tape unit.

2. Remove power supply subassembly (5.5.15).

3. Place power supply subassembly on stable work surface with the hinged door on top.

4. Open the hinged door by releasing knurled captive screws.

5. Disconnect 12-pin connector and other wires. Note location of wires.

6. Rotate power supply subassembly so the side of the chassis that normally faces the tape unit deck plate lies flat on the work surface.

7. Remove the eight phillips head screws and take off the back of the chassis.

8. Remove one green and two white wires from TB-1 at the inside lower left corner of the chassis. Note location of wires.

9. Remove wires from TB-2. Note location of wires.

10. Remove the four screws that secure the regulated power supply to the chassis. Save the screw standoffs and the harness assembly for use on the replacement power supply.

--- To replace the regulated power supply: Reverse the procedure above.

--- To remove the unregulated power supply:

1. Power down and unplug tape unit.

2. Remove the power supply subassembly and the regulated power supply (5.5.15 and above).

3. Disconnect all wires. Note location of wires.

4. Remove four 3/8 inch nuts from the deckplate side of the power supply chassis.

--- To replace the unregulated power supply: Reverse the procedure above.

***** SENSORS AND SWITCHES *****

**5.5.17 ON-OFF SWITCH REMOVAL/REPLACEMENT**

--- To remove On-Off Switch:

1. Power down and unplug tape unit.

2. Remove power supply (5.5.16).

3. Disconnect switch wires.

4. Pull switch out from behind deckplate.

--- To replace On-Off Switch: Reverse the procedure above.

**5.5.18 DIFFERENTIAL SWITCHES REMOVAL/REPLACEMENT**

The tape unit uses two identical pneumatically actuated differential switches, one for tape on hub sensing and one for file column loopout.

Both switches are removed by disconnecting fast-on electrical connectors and pneumatic tubing. The power supply assembly must be removed for access to the file column loopout switch.

Electrical connectors may be replaced without regard to position. However, tubing must be connected to the correct switch ports for proper switch operation.

For the tape on hub switch, tubing must be connected to the low port. The low port is located nearest the metal screw head on one side of the switch. No tubing is connected to the high port.

For the file column loopout switch, the low port must be connected to the tube running to the loopout fitting. The high port must be connected to the tee that connects the other loopout fitting and pressure transducer.

### 5.5.19 DOOR INTERLOCK SWITCH REMOVAL/REPLACEMENT

See Head Cover Removal/Replacement, paragraph 5.5.3.

***** PWBs *****

### 5.5.20 PEOT ASSEMBLY REMOVAL/REPLACEMENT

--- To remove PEOT Assy.:

1. Power down and unplug unit.

2. Remove power supply subassembly (5.5.15).

3. Remove pressure hose.

4. Remove cable connector.

5. Remove screw from behind deckplate.

--- To replace PEOT Assy: Reverse procedure above.
Note: Maximum protrusion of item 8 above item 43 to be 0.01 in. See pp. 6.8 & 6.9.

### 5.5.21 EOT/BOT SENSOR PWB REMOVAL/REPLACEMENT

--- To remove EOT/BOT PWB:

1. Power down unit.

2. Using needlenose pliers, gently pull out sensor from front of tape unit.

--- To replace EOT/BOT PWB: Reverse the procedure above.

### 5.5.22 PRINTED WIRE BOARDS (CARD CAGE) REMOVAL/REPLACEMENT

The card cage of the tape unit holds a maximum of four PWBs, two for the formatter and two for the tape unit. From back to front the PWBs are inserted in this order: 1. Formatter Microcomputer PWB, 2. Formatter PLO SKBUF, RD/WRT PWB, 3. Tape Unit Read PWB, 4. Tape Unit Write PWB. (Slots one and two will be empty on units not equipped with a Formatter.)

--- To remove any PWB from the card cage:

1. Power down and unplug tape unit.

2. Swing the tape unit open.

3. Unfasten nylon button latch at top and bottom of outer board.

4. Swing out appropriate PWBs to allow access.

5. Disconnect cables from PWBs you wish to remove, taking note of connections.

6. Firmly grip the PWB you wish to remove by its metal stiffening frame.

7. While gripping the board with one hand, use your other hand to lift the spring-loaded retainer at the upper pivot corner of the PWB.

8. Gently tilt and lift the PWB to free its bottom pivot pin from the chassis.

---To replace PWBs in the swing out card cage: Reverse the procedure above.

**NOTE: After replacing the Write PWB perform autocal and NRZI skew procedures. After replacing the Read PWB perform autocal procedures in 5.3 & 5.4.**

Two PWBs are mounted on either side of the tape unit chassis: the Pneumatic Control PWB (mounted inside the chassis on the left as you face the back of the tape unit) and the Servo Control PWB (mounted outside the chassis on the right as you face the back of the tape unit).

### 5.5.23 SERVO CONTROL PWB REMOVAL/REPLACEMENT

--- To remove Servo Control PWB:

1. Power down and unplug the tape unit.

2. Disconnect all cables; note location of connections.

3. Remove PWB from nylon retaining studs.

--- To replace Servo PWB: Reverse procedure above.

### 5.5.24 PNEUMATIC CONTROL PWB REMOVAL/REPLACEMENT

1. Disconnect all cables. Note location of connections.

2. Disconnect appropriate pneumatic hoses to allow clear access to PWB. Note location of hose connections.

3. Unfasten PWB from chassis by removing nylon standoffs.

--- To replace the Pneumatic Control PWB: Reverse the procedure above.

## 5.5.25 FILE PROTECT PWB REMOVAL/REPLACEMENT

--- To remove File Protect PWB:

1. Power down and disconnect unit.

2. Remove power supply assembly.

3. Disconnect cable.

4. Remove phillips screw to free PWB.

--- To replace File Protect PWB: Reverse the procedure above.

***** MOTORS AND PUMPS *****

## 5.5.26 FILE REEL MOTOR REMOVAL/REPLACEMENT

--- To remove File Reel Motor:

1. Power down and unplug tape unit.

2. Swing the unit open.

3. Swing out PWBs.

4. Remove power supply (5.5.15).

5. Disconnect motor cable and unthread from cable path. Note cable routing for motor replacement.

6. Remove file reel hub assy. (5.5.11).

7. Remove lower three 5/32 inch hex socket motor mounting screws from front of deckplate.

CAUTION

MAKE SURE THE MOTOR IS COOL ENOUGH TO HANDLE

8. Grip the motor firmly and remove the fourth screw. The motor is now free.

--- To replace File Reel Motor:

1. Holding motor firmly against back of deckplate, replace the top mounting screw.

2. Align motor mounting holes and replace other three screws.

3. Tighten motor mounting screws.

4. Reroute and plug in motor cable.

5. Replace file reel hub assembly.

### 5.5.27 MACHINE REEL MOTOR REMOVAL/REPLACEMENT

--- To remove Machine Reel Motor:

1. Power down and unplug tape unit.

2. Remove nylon standoff on rear deck of motor housing by unthreading center screw.

3. Retain standoff for replacement on new motor

4. Disconnect motor cable.

5. Remove machine reel hub assembly (5.5.12).

6. Remove six, 1/4 inch hex head screws on metal air-seal retainer ring and remove ring and seal.

7. Remove lower three 5/32 hex socket mount screws from front of deckplate.

CAUTION
MAKE SURE THE MOTOR IS COOL ENOUGH TO HANDLE

8. Grip motor firmly with one hand and remove last motor mount screw. Motor is now free.

--- To replace Machine Reel Motor:

1. Follow procedure outlined for file reel motor (5.5.26).

2. Replace nylon standoff by threading into existing motor casing hole.

### 5.5.28 CAPSTAN MOTOR REMOVAL/REPLACEMENT

1. Power down and unplug tape unit.

2. Remove capstan wheel from motor (5.5.4).

3. Unplug capstan motor power cord and encoder cords from servo board (note cable routing).

4. Disconnect large vacuum supply hose that passes behind motor.

5. Disconnect hoses and fittings from two load jets that partially extend behind capstan motor mounting ring.

CAUTION
MAKE SURE THE MOTOR IS COOL ENOUGH TO HANDLE

6. Remove two bottom slot head shoulder screws from mounting ring.

7. Grip motor firmly and remove the top shoulder screw. Motor is now free.

8. Note orientation of mounting ring on motor.

9. Remove mounting ring from motor by removing four screws.

--- To replace Capstan Motor:

1. Install mounting ring on new motor.

2. Position motor assembly on deck.

3. Start three mounting ring shoulder screws and springs.

4. Tighten three mounting ring screws making sure screw shoulder passes through hole in mounting ring.

5. Connect encoder and power cables.

6. Connect load jets (5.5.10).

7. Connect vacuum supply hose.

8. Install capstan wheel on new motor (5.5.4).

9. On NRZI equipped tape units adjust capstan tracking.

### 5.5.29 LOAD PUMP REMOVAL/REPLACEMENT

--- To remove Load Pump:

1. Power down and unplug tape unit.

2. Swing open tape unit.

3. Unlatch large (12 x 9 inch) PWBs and swing open to expose the pump assembly.

4. Disconnect the twisted pair connector from J9 on the inboard edge of the 6 x 22 inch servo control PWB.

5. Loosen the hose clamps from both inlet and exhaust ports.

6. Remove the exhaust port adapter from the pump and place out of the way. Do not remove the small plastic tubes that are fastened to the adapter.

7. Loosen the deck mounting screws and slide the pump assembly to the left.

CAUTION

DO NOT DAMAGE THE FRAGILE READ PRE-AMP ASSEMBLY ADJACENT TO THE PUMP ON THE LEFT.

8. The pump may now be removed through the back of the unit.

--- To replace Load Pump: Reverse procedure above.

Follow the procedures above in reverse order to replace the pump assembly.

### 5.5.30 VACUUM SUPPLY ASSEMBLY REMOVAL/REPLACEMENT

--- To remove Vacuum Supply Assembly:

1. Power down and unplug tape unit.
2. Swing open tape unit to expose the back of the unit.
3. Unlatch large (12 x 19-inch) printed wiring boards and swing open to expose the pump assembly, centrally located at the bottom of the unit.
4. Disconnect the flat cable from the 6 x 11-inch pneumatic PWB.
5. Disconnect flex hose by loosening the hose clamp at the top of the assembly.
6. Remove the blower stabilizer mounting screws (#8-32 x 3/16-inch long) located between the pump assembly and the chassis. Do not remove the stabilizer bracket from the chassis assembly.
7. Open the cable clamp on the left side of the assembly and remove the capstan ribbon cable.
8. Pump assembly may now be removed by loosening the deck mounting screws and lifting the front of the assembly until it has cleared the head of the mounting screws.

--- To replace Vacuum Supply Pump Assembly: Reverse the procedures above.

# SECTION 6 - FIELD REPLACEABLE UNITS PARTS LIST

## 6.1 GENERAL

This section contains the parts list for the Telex 9250 Series tape unit whose serial number appears on the front cover. All parts listed reflect the latest available revisions made by Telex Engineering Department as part of a continuing product improvement. Parts numbers and other information in this manual may not be accurate for earlier or later Model 9250 Series tape units.

The parts list contains a list of Field Replaceable Units, along with reference drawings showing location of FRUs. FRUs can be located on the appropriate drawing by using the parts list column titled Ref Number.

## 6.2 NUMBERING SYSTEM

Complete identification of parts and drawings requires two types of numbers.

Drawing Number

Part and Assembly Number

6.2.1 **The Drawing Number**, consisting of eight characters, identifies and controls all documentation created by the Engineering Department for production purposes.

6.2.2 **Part and Assembly Numbers** are identical in makeup and use, and are defined as follows.

The part number consists of the Drawing Number with a prefix letter and suffix dash number added.

The prefix letter is used to determine interchangeability of a given part. The prefix 'A' identifies the initial release of a part. When a change is made to the initial configuration that affects the physical or functional characteristics, and thus prevents exchange of the old part with the next without alteration of the part itself or adjoining items, the new part number prefix becomes 'B'. The letters 'A' through 'W' with the exception of I,O, and Q are used for prefix identification. If revision is required after the use of letter 'W', a new part number is assigned.

NOTE: There is no relationship between interchangeability prefix letter and the revision letter of the drawing on which a part is described.

The suffix dash number is used to identify a given part on a drawing. When only one part is described on a drawing, the part number always carries a -01 suffix. When more than one part of a similar design is described on a drawing, the part number carries a suffix of -02, -03, -04 , etc.

Part Number Example: B73DXXXXX-02

| Interchangeability Control | Drawing Category | Size | Sequence Number | Variation Suffix |
|---|---|---|---|---|
| B | 73 | D | XXXXX | -02 |

| Prefix Letter | Category | Purchased PN Drawing | Sequence Number | Suffix Dash Number |
|---|---|---|---|---|
| A | 66 | X | 00462 | -01 |

## CONTENTS

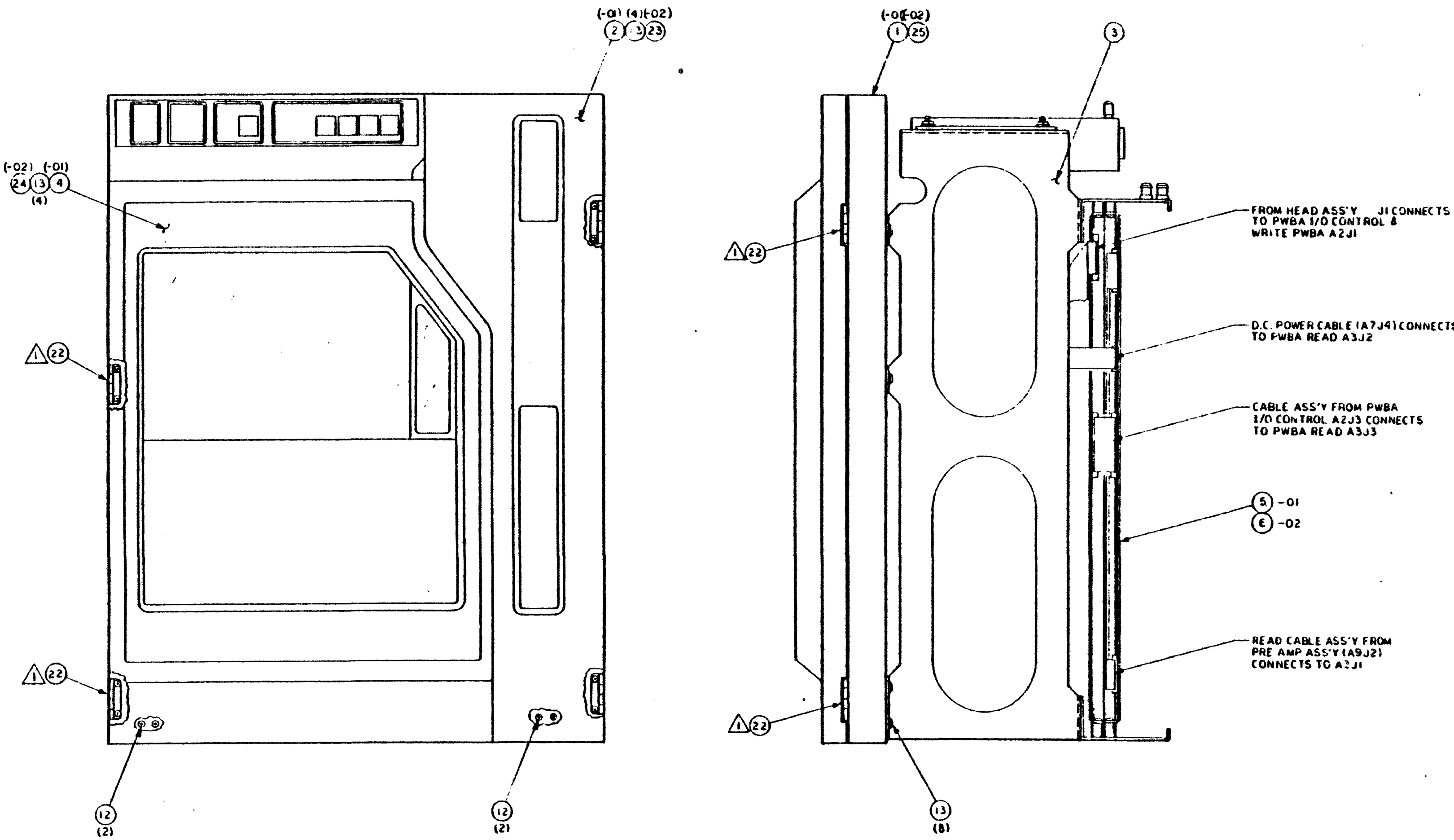


**Note: Your tape unit has one of two models of Power One power supply. These units are interchangeable, however the old supply uses regulated and unregulated internal modules that may be removed and replaced whereas the new linear type power supply is a single field replaceable unit. Please note which power supply you have before beginning removal replacement procedures. The old supply is in a gold anodized case; the new supply is in a silver anodized case.

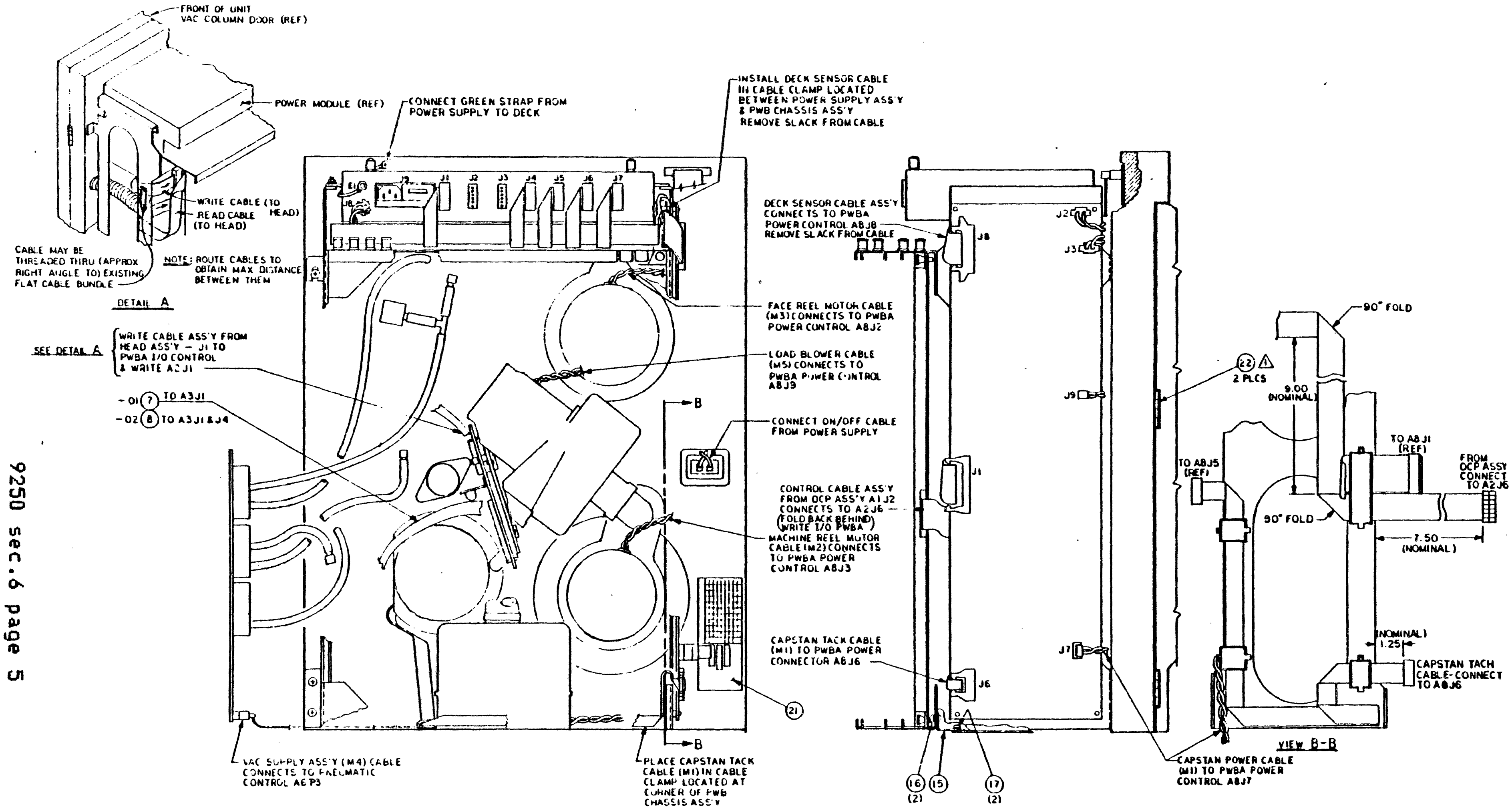
# FRU PARTS LIST, 9250 TAPE UNIT

## TAPE SUBSYSTEM
## 95D20585

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 2 | Door,Vac.Col.Cover Assy. | C91D22800-01 | 1 |
| | (Pearl White) | B91D22800-02 | 1 |
| | (Beige) | A91D22800-02 | 1 |
| 4 | Door, Reel Cover Assy. | A91D22812-01 | 1 |
| | (Pearl White) | B91D22800-01 | 1 |
| | (Beige) | A91D22812-02 | 1 |
| 5 | PWBA,Read,Dual Density (-01) | G91D72399-01 | 1 |
| 6 | PWBA,Read,Tri-Density (-02) | E91D72399-02 | 1 |
| 12 | Screw,"SEMS"6-32 x .32 Lg. | A61A02335-05 | 4 |
| 13 | Screw,"SEMS"10-32 x .50 Lg. | A61A02337-08 | 8 |
| 14 | Screw,Button Hd.,Sock.6-32 x .31 Lg. | A61X02338-01 | 8 |
| 15 | Bracket,Blower Support | A71C21364-01 | 1 |
| 16 | Screw,"SEMS" 8-32 x .25 Lg.(Pan Hd.) | A61A02336-04 | 2 |
| 17 | Screw,"SEMS" 8-32 x .19 Lg.(Pan Hd.) | A61A02336-03 | 2 |
| 20 | AC Power Cord Assy.(Not Shown) | A91B22888-01 | 1 |




95D20585 Tape Subsystem (1 of 2)




95D20585 Tape Subsystem (2 of 2)

# FRU PARTS LIST, 9250 TAPE UNIT

## TAPE DECK SUB-ASSY.
## 91D22791

| Ref Number | Nomenclature | | Part Number | Qty |
|---|---|---|---|---|
| 2 | O.C.P. Assy. | | A91C22859-01 | 1 |
| 8 | Peot Assy. | | A91C22861-01 | 1 |
| 12 | Tape Cleaner Assy. | | D91D22799-01 | 1 |
| 13 | Hub Assy.,File Reel | | D91D22802-01 | 1 |
| 14 | Hub Assy.,Machine Reel | | B91C22803-01 | 1 |
| 15 | Roller, Tape Guide Assy. | | A91C22828-01 | 1 |
| 16 | Upper Bearing Assy. | | A91B22881-01 | 1 |
| 17 | Capstan Bearing Assy. | | A91B22882-01 | 1 |
| 18 | Lower Bearing Assy. | | A91B22883-01 | 1 |
| 19 | Head Cover Assy. | C91C22868-01 | **A91C22918-01 | 1 |
| 23 | Cable Assy.,26 Cond. | | A91C22841-01 | 1 |
| 24 | Cable Assy., Sensors | | B91D22843-01 | 1 |
| 27 | PWBA,EOT/BOT Sensor | | B91C72391-01 | 1 |
| 28 | PWBA, File Protect | | A91B72378-01 | 1 |
| 29 | PWBA, Read Pre-amp | | D91C72397-01 | 1 |
| 30 | D.C. Motor, Reel | | A35D20067-01 | 2 |
| 31 | Solenoid Rotary | | B35C20070-01 | 1 |
| 32 | Capstan Motor Assy. | | B35D20072-01 | 1 |
| 33 | Head Assy., Magnetic Tape | | G36D20017-01 | 1 |
| 38 | Lifter Foot | | A78C20682-01 | 1 |
| 40 | Capstan | | C86D20326-01 | 1 |
| 45 | Load Jet, Covered | | A86C20342-01 | 3 |
| 46 | Load Jet, Covered | | A86C20342-02 | 1 |
| 47 | Load Jet, Covered | | A86C20342-03 | 2 |
| 48 | Load Jet, Covered | | A86C20342-04 | 1 |
| 50 | Load Jet, Hand Well | | A86C20364-02 | 1 |
| 58 | Load Jet, Hand Well | | A86C20364-01 | 1 |
| 83 | EOT/BOT Block & Ref. Assy. | | A91C22911-01 | 1 |
| 84 | Screw,Sems 6-32 x .25 Lg. | | A61A02335-04 | 10 (** 8) |
| 85 | Screw,Sems 6-32 x .31 Lg. | | A61A02335-05 | 4 |
| 86 | Screw,Sems 6-32 x .38 Lg. | | A61A02335-06 | 31 (**33) |
| 87 | Screw,Sems 6-32 x .50 Lg. | | A61A02335-08 | 18 |
| 88 | Screw,Sems 6-32 x .62 Lg. | | A61A02335-10 | 9 |
| 89 | Screw,Sems 8-32 x .31 Lg. | | A61A02336-05 | 2 |
| 90 | Screw,Sems 8-32 x .38 Lg. | | A61A02336-06 | 2 |
| 92 | Screw,Sems 10-32 x .50 Lg. | | A61A02337-08 | 4 |
| 93 | Screw,Sems 10-32 x .38 Lg. | | A61A02337-06 | 1 |
| 96 | Clamp,Hose,1.06 to 2 | | A66X00912-01 | 5 |
| 105 | Screw,Fil Hd.6-32 x .75 Lg. | | A61X01877-01 | 1 |
| 106 | Screw,Button Hd.4-40 x .50 Lg.(Black) | | A61X00990-01 | 1 |
| 107 | Screw,Set,8-32 x .75 Lg.Flat Pt.(SST) | | A61X01798-01 | 3 |
| 109 | Screw,Pan Hd.10-32 x 1.62 Lg. | | A61X02328-01 | 6 |
| 110 | Screw,Cap 10-32 x .62 Lg.(SST) | | A61X00173-01 | 4 |
| 111 | Screw,Cap 10-32 x .87 Lg.(SST) | | A61X00174-01 | 4 |
| 112 | Screw,Cap 4-40 x .50 Lg. | | A61X00051-01 | 4 |

**as of CLC 44 on tape unit configuration level decal.

# FRU PARTS LIST, 9250 TAPE UNIT

## TAPE DECK SUB-ASSY.
## 91D22791

| | | | |
|---|---|---|---|
| 113 | Screw,Cap 4-40 x .62 Lg. | A62X00147-01 | 2 |
| 114 | Screw,Cap 8-32 x .50 Lg. | A61X00166-01 | 5 |
| 115 | Screw,Sems 6-32 x .25 Lg.(Blk Zinc) | A61X02341-01 | 6 |
| 116 | Lockwasher,#4 | A63X00090-01 | 5 |
| 117 | Washer,Flat,#6 | A63X00230-01 | 12 |
| 118 | Lockwasher,#6 | A63X00237-01 | 1 |
| 119 | Washer,Flat,#4 | A63X00627-01 | 2 |
| 120 | Lockwasher,#8 Split | A63X00085-01 | 4 |
| 121 | Washer,Flat,#8 | A63X00740-01 | 1 |
| 122 | Lockwasher,#10 Split | A63X00086-01 | 8 |
| 123 | Nut,Kep 4-40 | A62X00029-01 | 4 |
| 124 | Screw,Shoulder,Slotted Hd. .250-20 x .44 Lg. | A65X00222-01 | 3 |
| 125 | Screw,Shoulder,Slotted Hd.6-32 x .87 Lg. | A65X00240-01 | 1 |
| 129 | Screw,Sems 6-20 x .75 Lg. Type 25 | A61X02345-01 | 3 |
| 131 | Lockwasher #10 Ext. | A63X00108-01 | 3 |
| 135 | Cable Clamp 2 in wide, Scr. Mtg. | A66X01793-01 | 3 |
| 136 | Screw,Button Hd.(Soc.).312-18 x .63 Lg. | A61X02343-01 | 3 |
| 146 | Decal,Non-Reflective,BOT/EOT | A96B20574-01 | 1 |
| 148 | Screw, #6-32 x .75 Lg. Fill.Hd. | A61X02350-01 | 1 |
| 149 | Spring,Azimuth Adj. | A77B20076-01 | 1 |
| 153 | Standoff, Reel Motor | A66B20138-01 | 1 |
| 154 | Screw, #10-16 x 5/8 | A61X02340-01 | 1 |

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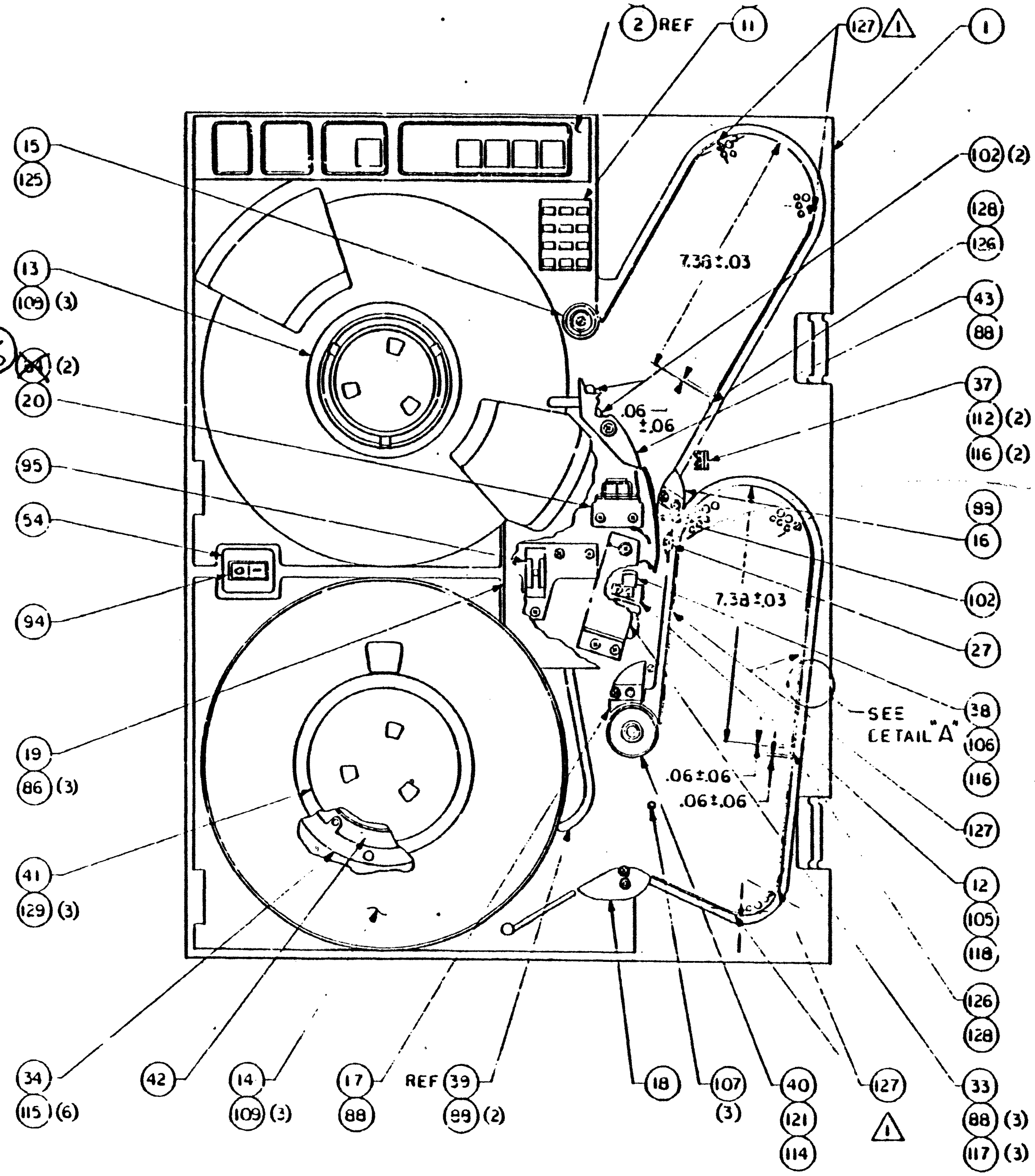


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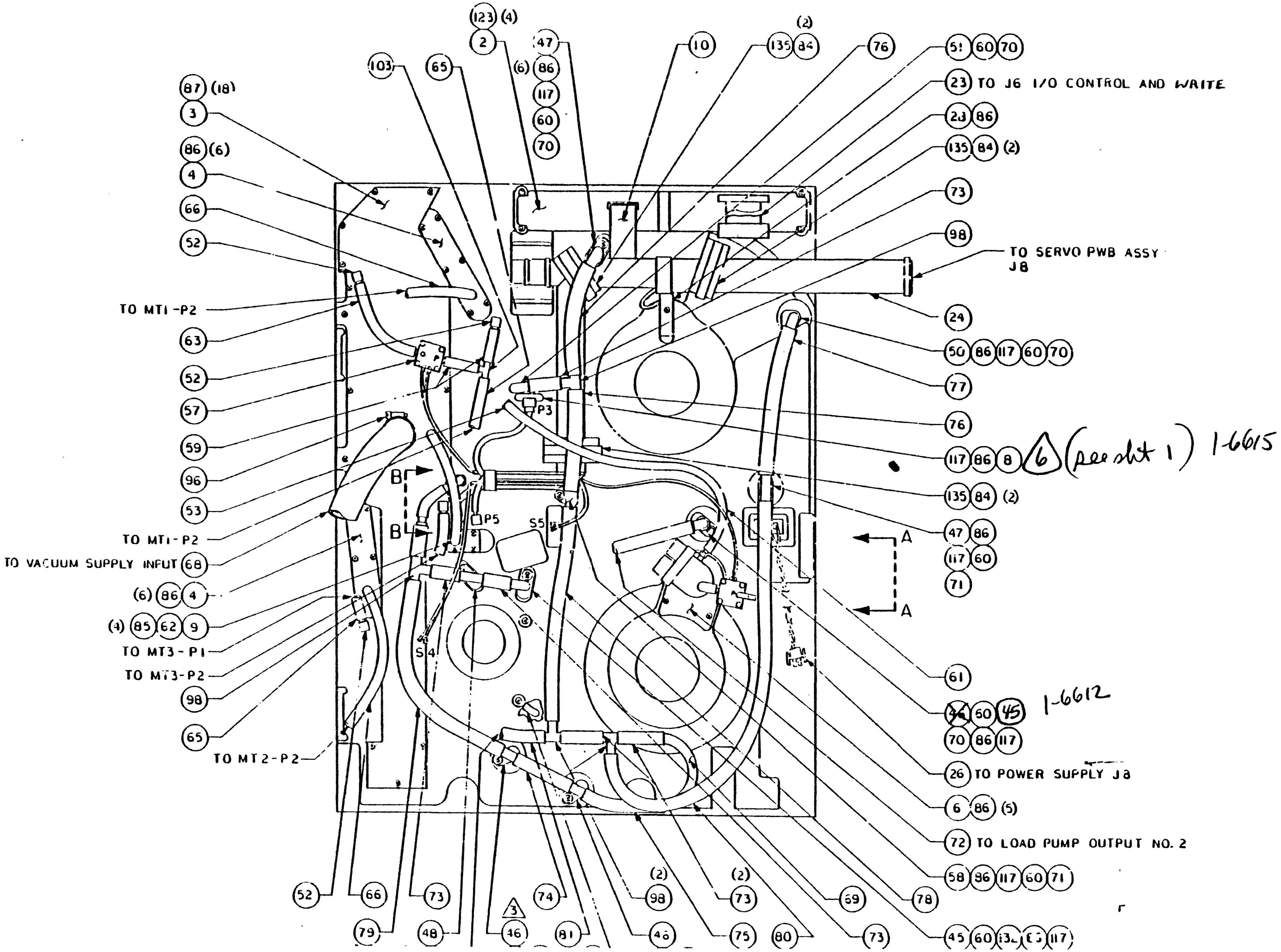
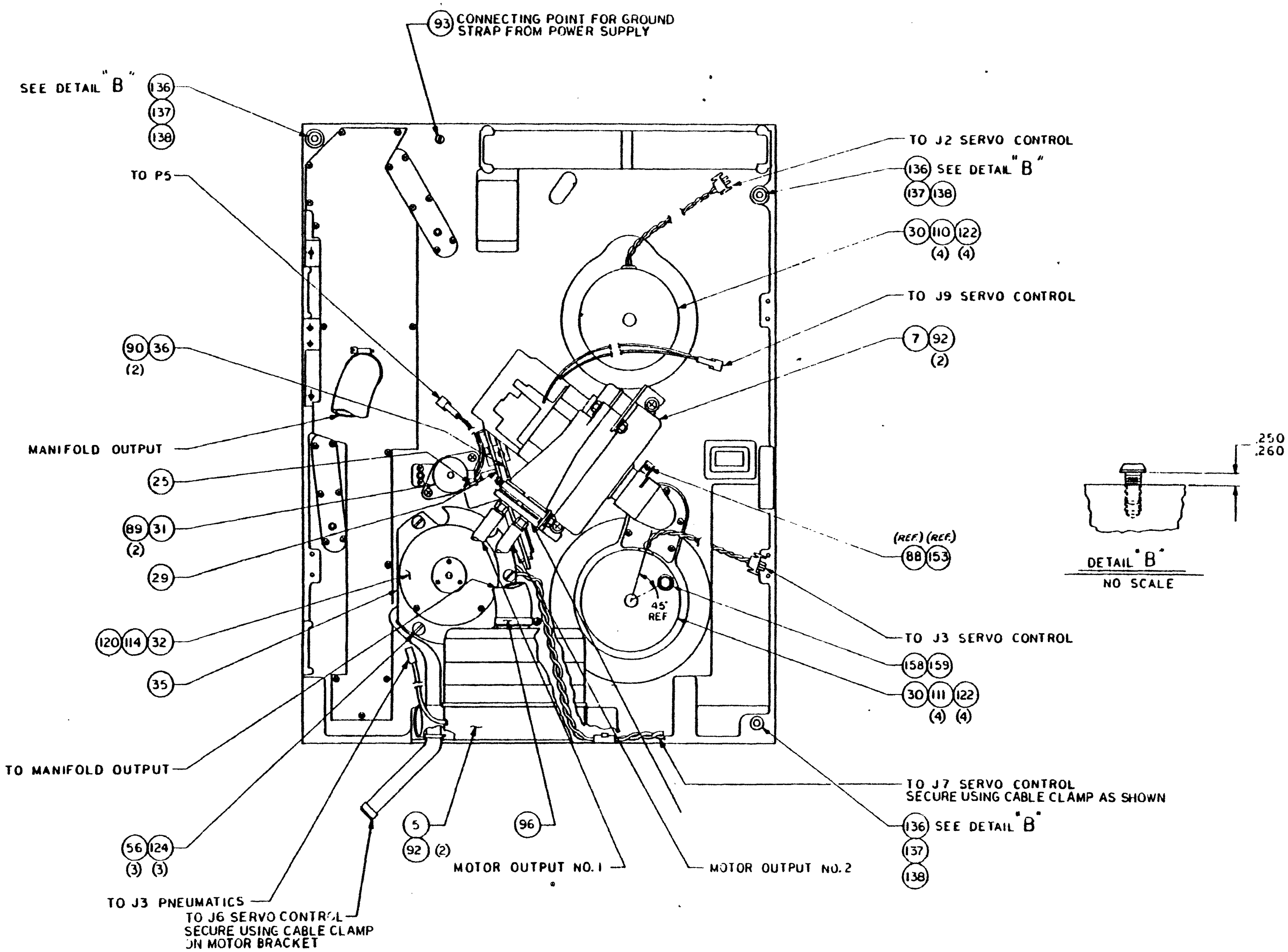
91D22791 Tape Deck Sub-Assy. (1 of 3)




91D22791 Tape Deck Sub-Assy. (2 of 3)



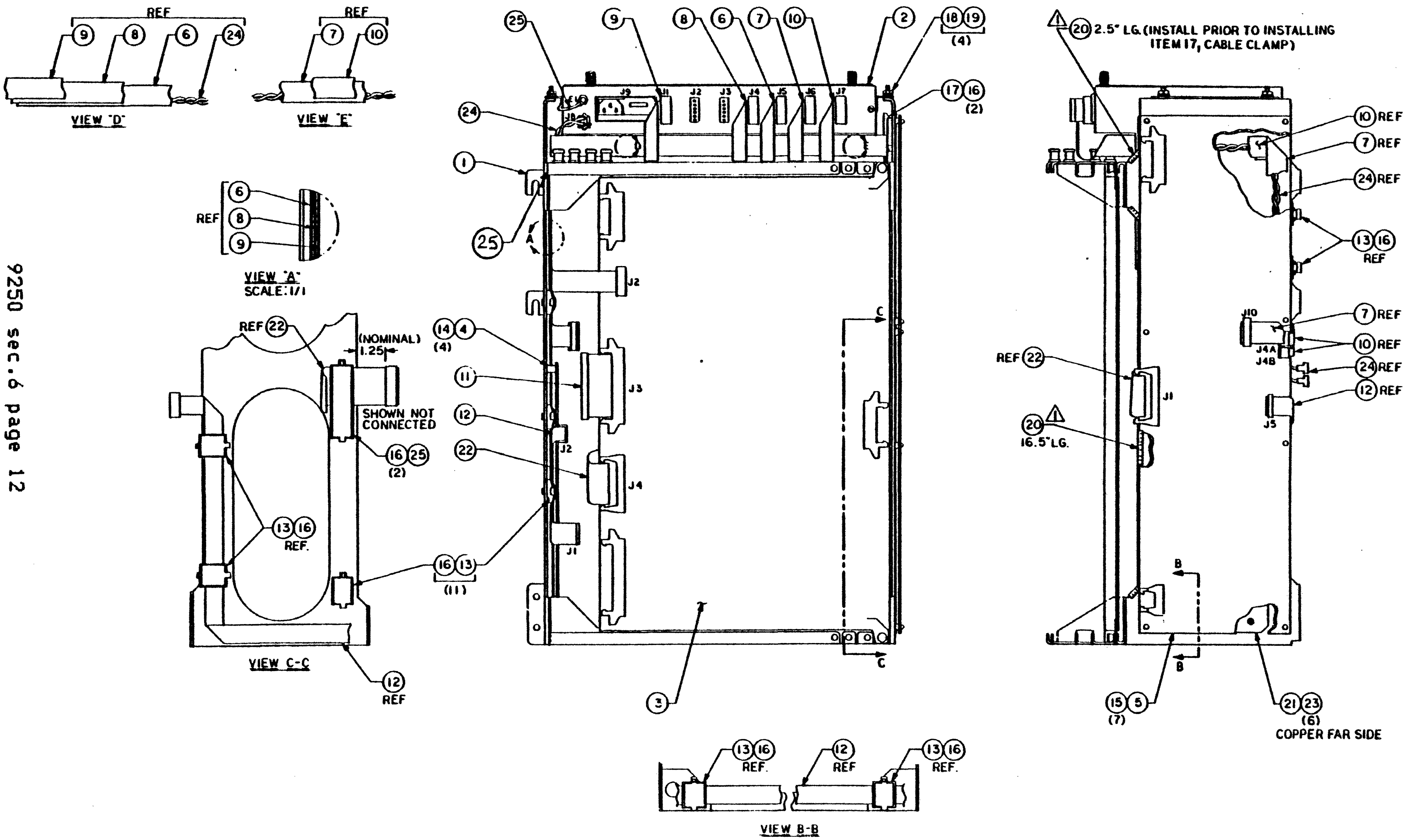

91D22791 Tape Deck Sub-Assy. (3 of 3)

# FRU PARTS LIST, 9250 TAPE UNIT

## PWB CHASSIS ASSY
## 91D22879

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 2 | Power Supply (linear type) | C39D20066-01 | 1 |
| 3 | PWBA,I/O Control & Write (Pertec) | ***A91D72426-01 | 1 |
| 3 | PWBA,I/O Control & Write | **J91D72406-01 | 1 |
| 4 | PWBA,Pneumatic Control | D91C72375-01 | 1 |
| 5 | PWBA,Servo Control | N91D72389-01 | 1 |
| 6 | Cable Assy.,Power,Write | A91D22904-02 | 1 |
| 7 | Cable Assy.,Power,Servo | A91D22906-01 | 1 |
| 8 | Cable Assy.,Power,Read | A91D22904-03 | 1 |
| 9 | Cable Assy.,Power,Pneumatic | A91D22903-01 | 1 |
| 10 | Cable Assy.,Power,Motor | B91C22837-01 | 1 |
| 11 | Cable Assy.,50 Conductor Ribbon | A91C22839-01 | 1 |
| 12 | Cable Assy.,Signal,Vacuum/Servo | A91C22842-01 | 1 |
| 13 | Cable Clamp | A66X01792-01 | 11 |
| 16 | Screw,"SEMS",6-32 x .25 Lg. | A61A02335-04 | 15 |
| 17 | Cable Clamp | A66X01793-01 | 1 |
| 18 | Nut,Kep,#8-32 | A62X00026-01 | 4 |
| 19 | Washer,Flat #8 | A63X00696-01 | 4 |
| 22 | Cable Assy.,Read Preamp to Read | B91C22833-03 | 1 |
| 23 | Screw,Pan Hd.,6-32 x .25 Lg.(Nylon) | A61X02322-01 | 6 |
| 24 | Cable Clamp, 3-inch | A66XC1799-01 | 1 |
| 25 | 1" Modified Cable Clamp | A66B20140-01 | 1 |

**as of CLC 51 on tape unit configuration level decal.
***as of CLC 50 on tape unit configuration level decal.

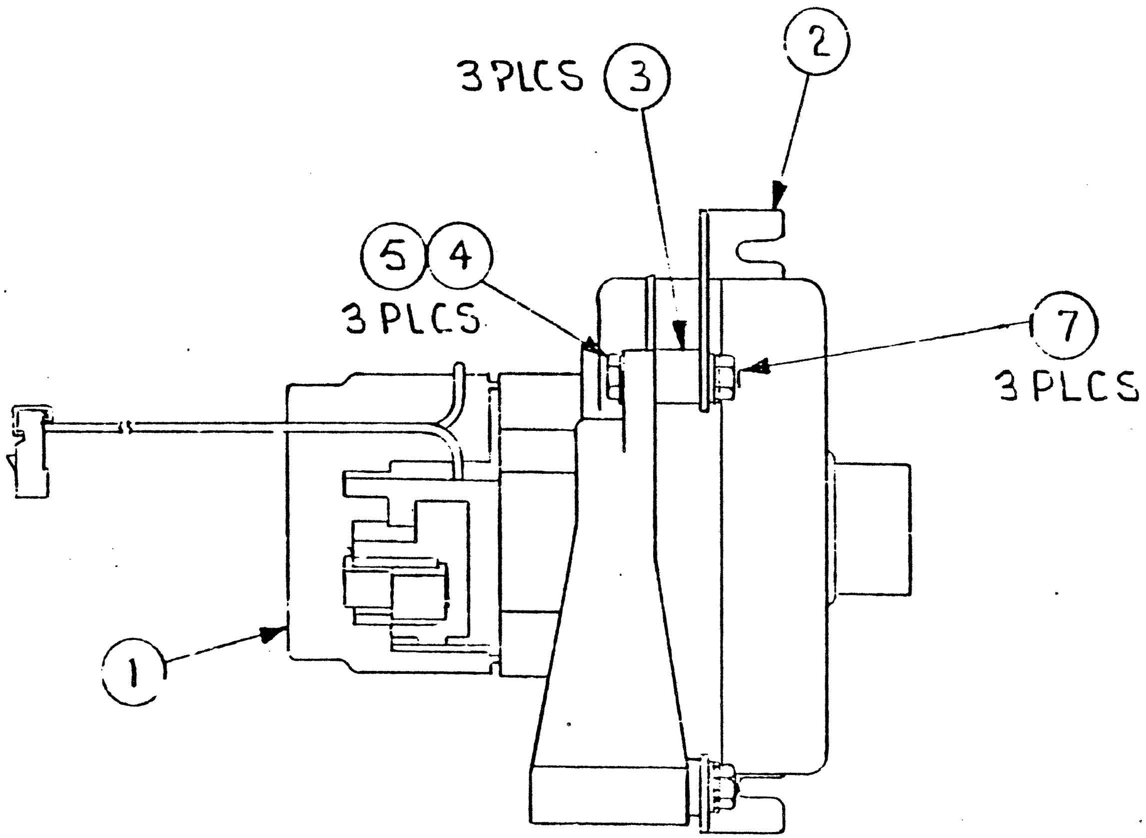



91D22879 PWB Chassis Assy.

FRU PARTS LIST, 9250 TAPE UNIT

LOAD PUMP ASSY.
91C22858

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 1 | Load Pump | B35D20069-01 | 1 |
| 4 | Screw,Hex Hd., .250-20 x .62 Lg. | A61X02084-01 | 3 |
| 5 | Lockwasher,.250 Ext. Tooth | A63X00162-01 | 3 |
| 7 | Nut,Kep, .250-20 | A62X00393-01 | 3 |

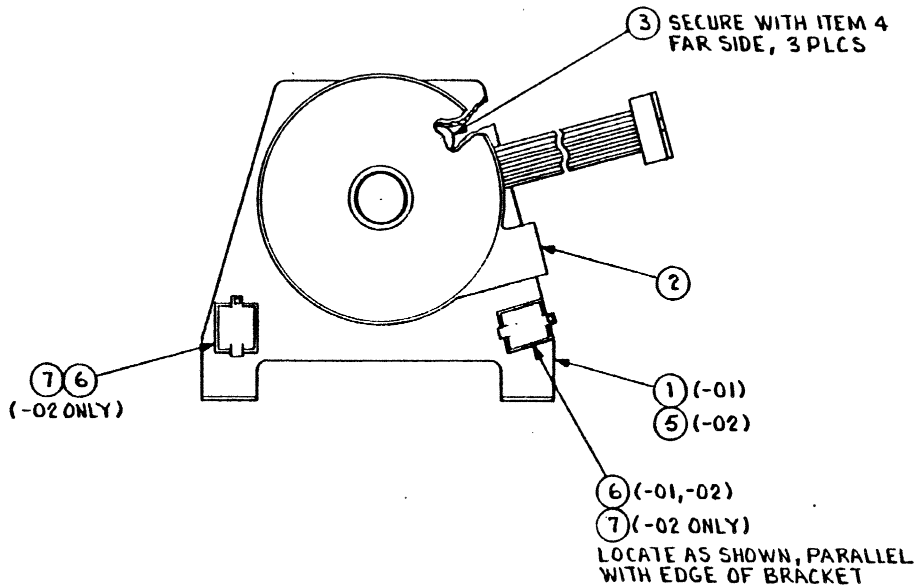



91C22858 Load Pump Assy.

# FRU PARTS LIST, 9250 TAPE UNIT

## VACUUM SUPPLY ASSY.
## 91C22793

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 2 | Pneumatic Pump Assy. | A35C20068-01 | 1 |
| 3 | Screw,Flat Hd., 1/4 - 20 x .44 Lg. | A61X02333-01 | 3 |
| 6 | Clamp; Cable, 1" Flat | A66X01792-01 | 2 |
| 7 | Screw,Sems #6-32 x .19 Lg. Pan Hd. | A61A02335-03 | 2 |

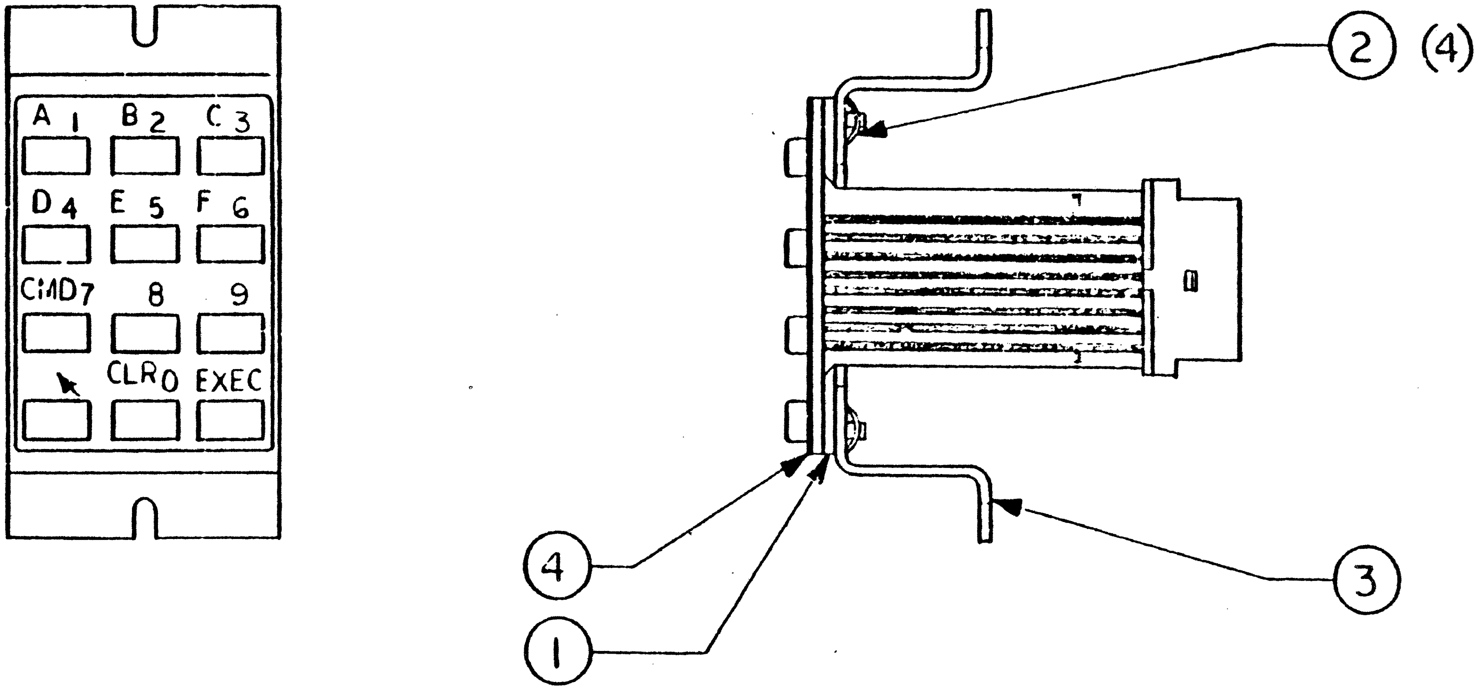



91C22793 Vacuum Supply Assy.

FRU PARTS LIST, 9250 TAPE UNIT

DIAGNOSTIC PANEL ASSY.
91B22820

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 1 | Diagnostic Keyboard | A39C20065-01 | 1 |
| 2 | Fastener, Push On, .093 Dia. | A67X00469-01 | 4 |
| 3 | Support, Keyboard Mtg. | B71C21337-01 | 1 |



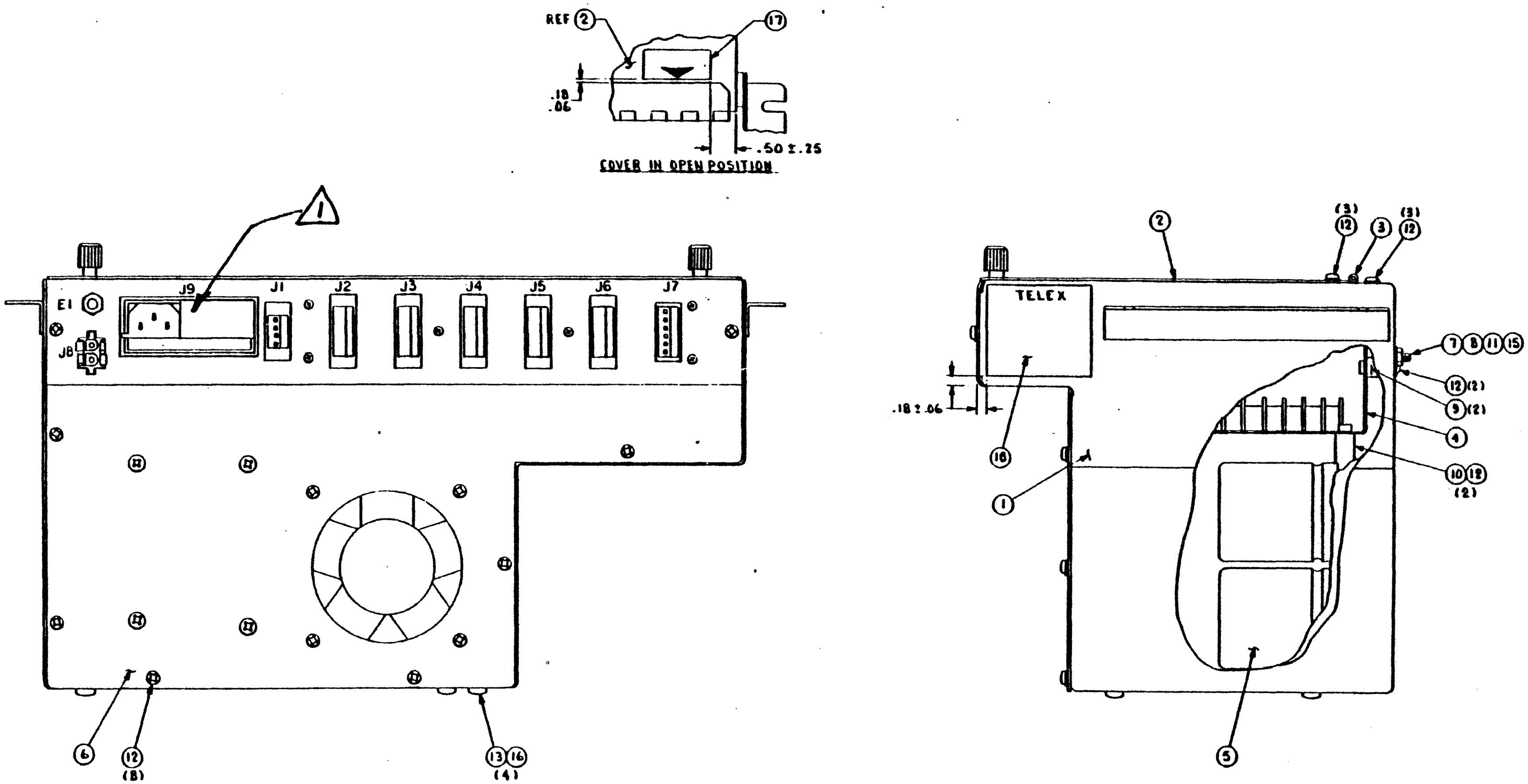

91B22820 Diagnostic Panel Assy.

FRU PARTS LIST, 9250 TAPE UNIT

POWER SUPPLY SUB-ASSY.
~~91D22895~~

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 4 | Power Supply, Regulated | B39D20064-01 | 1 |
| 5 | Power Supply, Unregulated | C39C20063-01 | 1 |
| 9 | Standoff, Hex #6-32 x .50 Lg. M-F | A66X01795-01 | 2 |
| 10 | Standoff, Hex #6-32 x .75 Lg. M-F | A66X01794-01 | 2 |
| 11 | Screw,Pan Hd.,#6-32 x .37 Lg. | A61X00987-01 | 1 |
| 12 | Screw,Pan Hd.,#6-32 x .37 Lg. W/ Lockwasher | A61A02335-06 | 18 |
| 13 | Screw,Pan Hd., #10-32 x .37 Lg. | A61X01367-01 | 4 |
| 14 | Cable Strap, Plastic, 0- 3/4 Bundle | A66X01003-01 | 6 |
| 15 | Nut,Kep,#6-32 | A62X00010-01 | 1 |
| 16 | Nut,Kep,#10-32 | A62X00032-01 | 4 |
| 20 | Edge Trim, Nylon | A86X00720-01 | .27ft |

⚠1 INPUT VOLTAGE SELECTION CARD TO BE PLUGGED FOR 120V.

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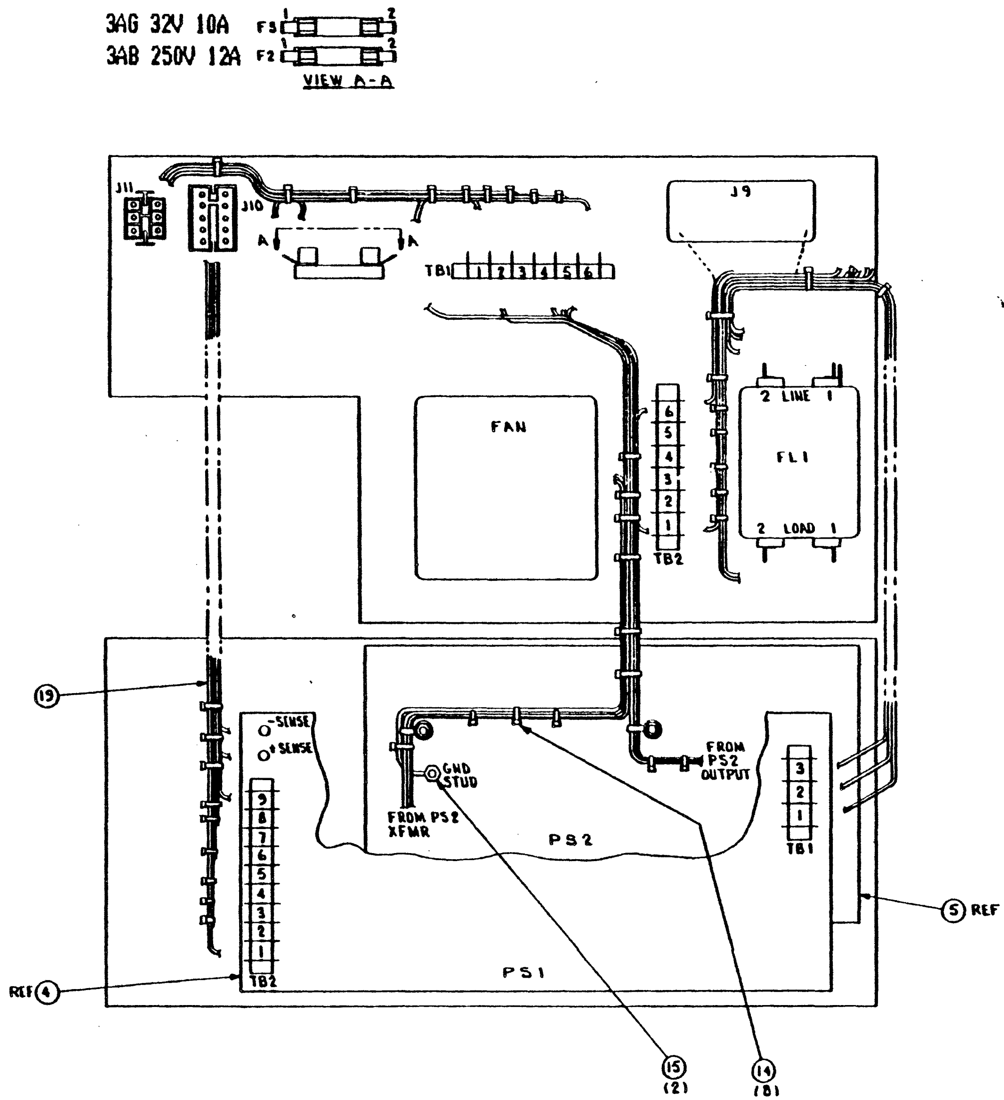
91D22895 Power Supply Sub-Assy. (1 of 2)




91D22895 Power Supply Sub-Assy. (2 of 2)

FRU PARTS LIST, 9250 TAPE UNIT

INTERFACE, FC 9253
J95D20593 (Telex)
INTERFACE, FC 2303~
B95D20615 (Telex)~

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 1 | PWBA, Microcomputer | W91D72373-01 | 1 |
| 1 | PWBA, Microcomputer | D91D72373-02~ | 1 |
| 2 | PWBA, PLO, SKBUF, RD/WRT | A91D72388-02 | 1 |
| 4 | Cable Assy., Power, PLO | A91C22904-01 | 1 |
| 5 | Cable Assy., 60 Cond. Ribbon | A91C22838-01 | 2 |
| 6 | Cable Assy., 50 Cond. Ribbon | A91C22839-01 | 1 |
| 7 | Cable Assy., Power, Microprocessor | A91C22904-04 | 1 |
| 8 | Cable Assy., 50 Cond./Ribbon/Term. | C91C22840-01 | 1 |
| 11 | PWBA, Terminator | C91B72377-01 | 1 |

~Same as FC9253 but has 2 byte buffer instead of 512 K-Byte.

---

INTERFACE, FC 9251
K95D20601 (Pertec)

INTERFACE, FC 2330
B95D20616 (Pertec Dateline)++

INTERFACE, FC 2331
B95D20621 (Pertec Dylon)~~

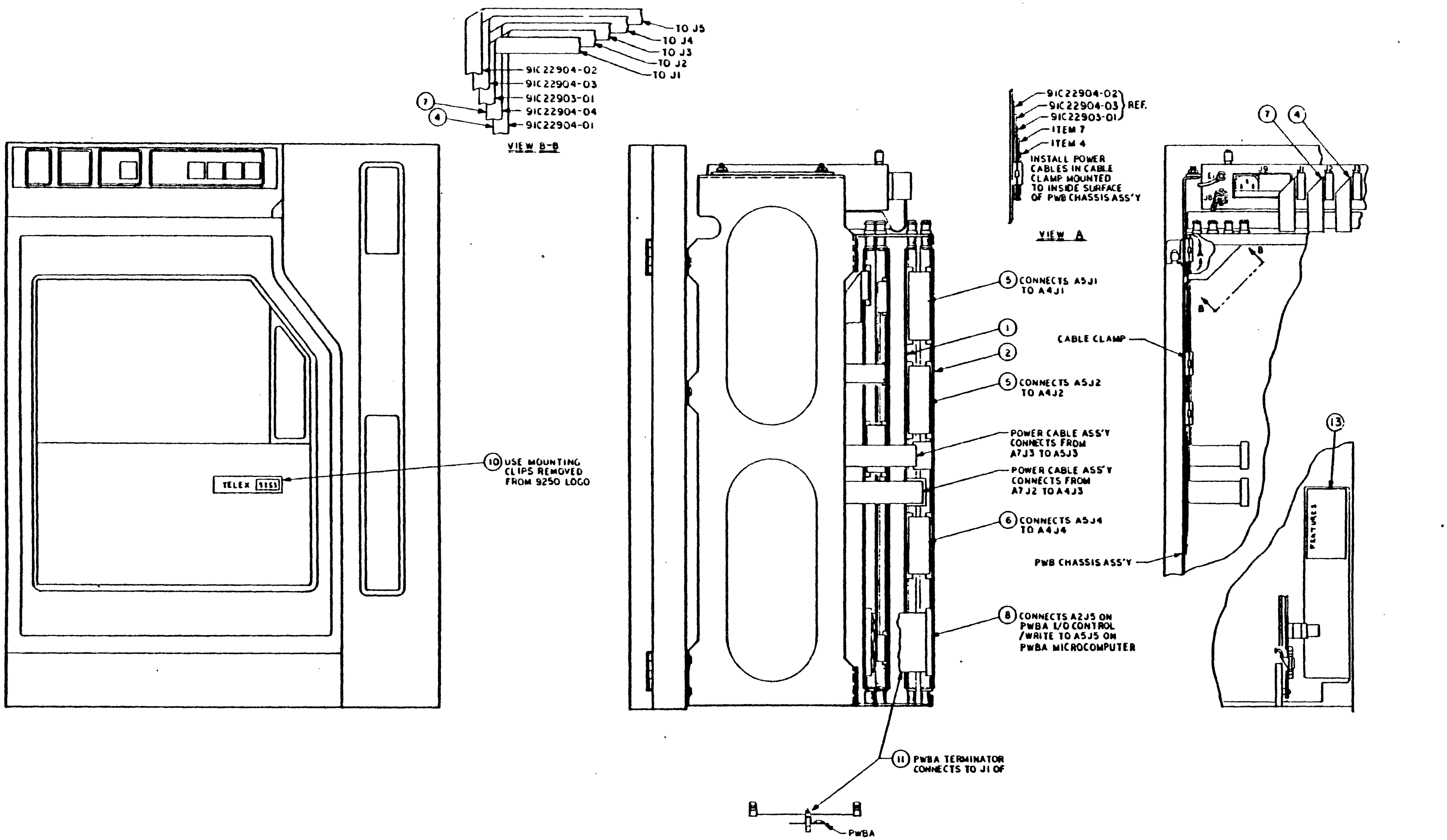
| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 1 | PWBA, Microcomputer | C91D72416-01 | 1 |
| 1 | PWBA, Microcomputer | B91D72424-01~~ | 1 |
| 1 | PWBA, Microcomputer | K91D72387-01++ | 1 |
| 2 | PWBA, PLO, SKBUF, RD/WRT | A91D72388-02 | 1 |
| 4 | Cable Assy., Power ,PLO | A91C22904-01 | 1 |
| 5 | Cable Assy., 60 Cond. Ribbon | A91C22838-01 | 2 |
| 6 | Cable Assy., 50 Cond. Ribbon | A91C22839-01 | 1 |
| 7 | Cable Assy., Power, Microprocessor | A91C22904-04 | 1 |
| 8 | Cable Assy., 50 Cond./Ribbon/Term. | C91C22840-01 | 1 |
| 11 | PWBA, Terminator | B91B72377-01 | 1 |

~~Dylon only Pertec feature code.
++Dateline only Pertec feature code.

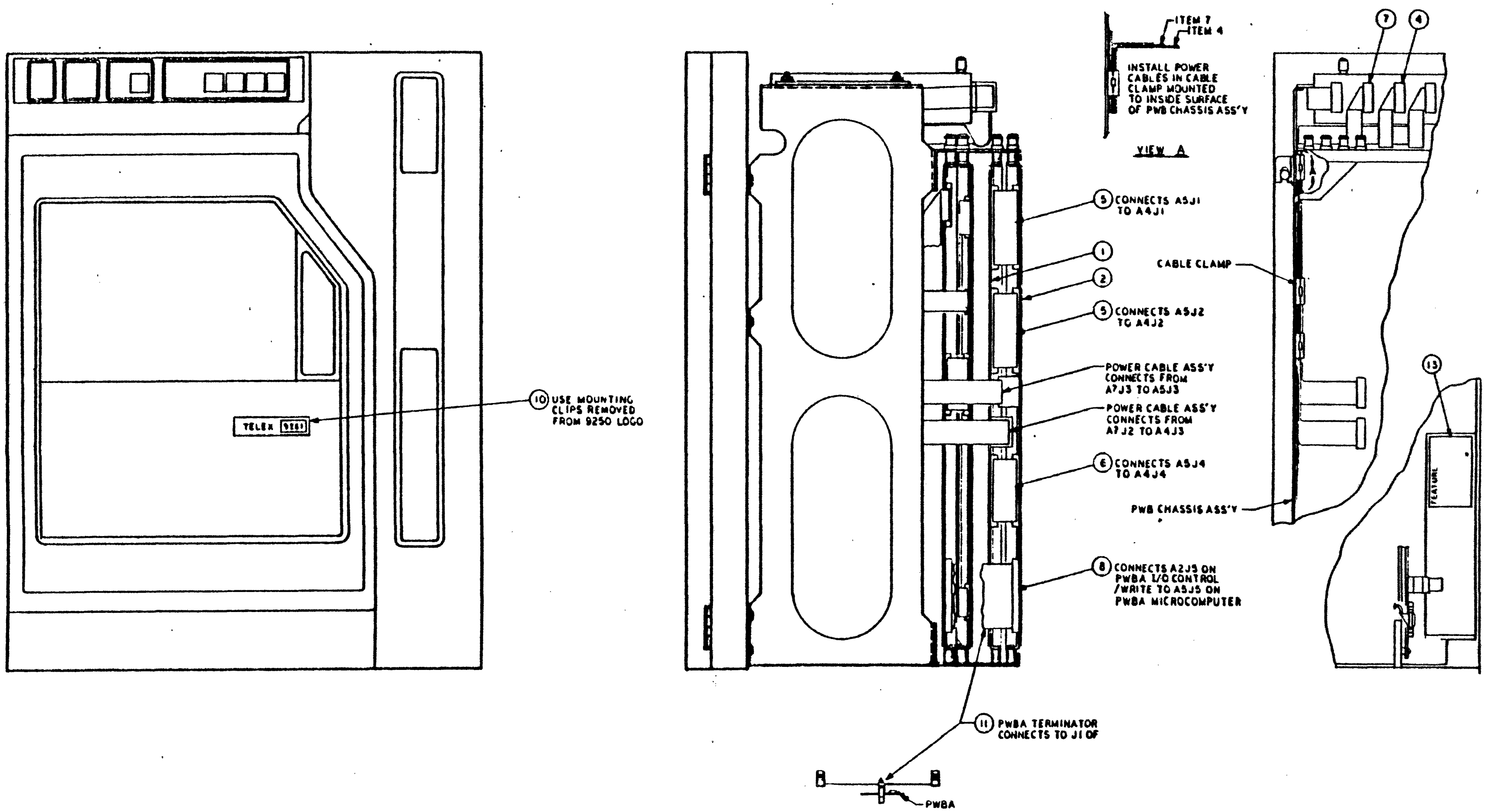
---

INTERFACE, FC 9252
E95D20600 (STC)

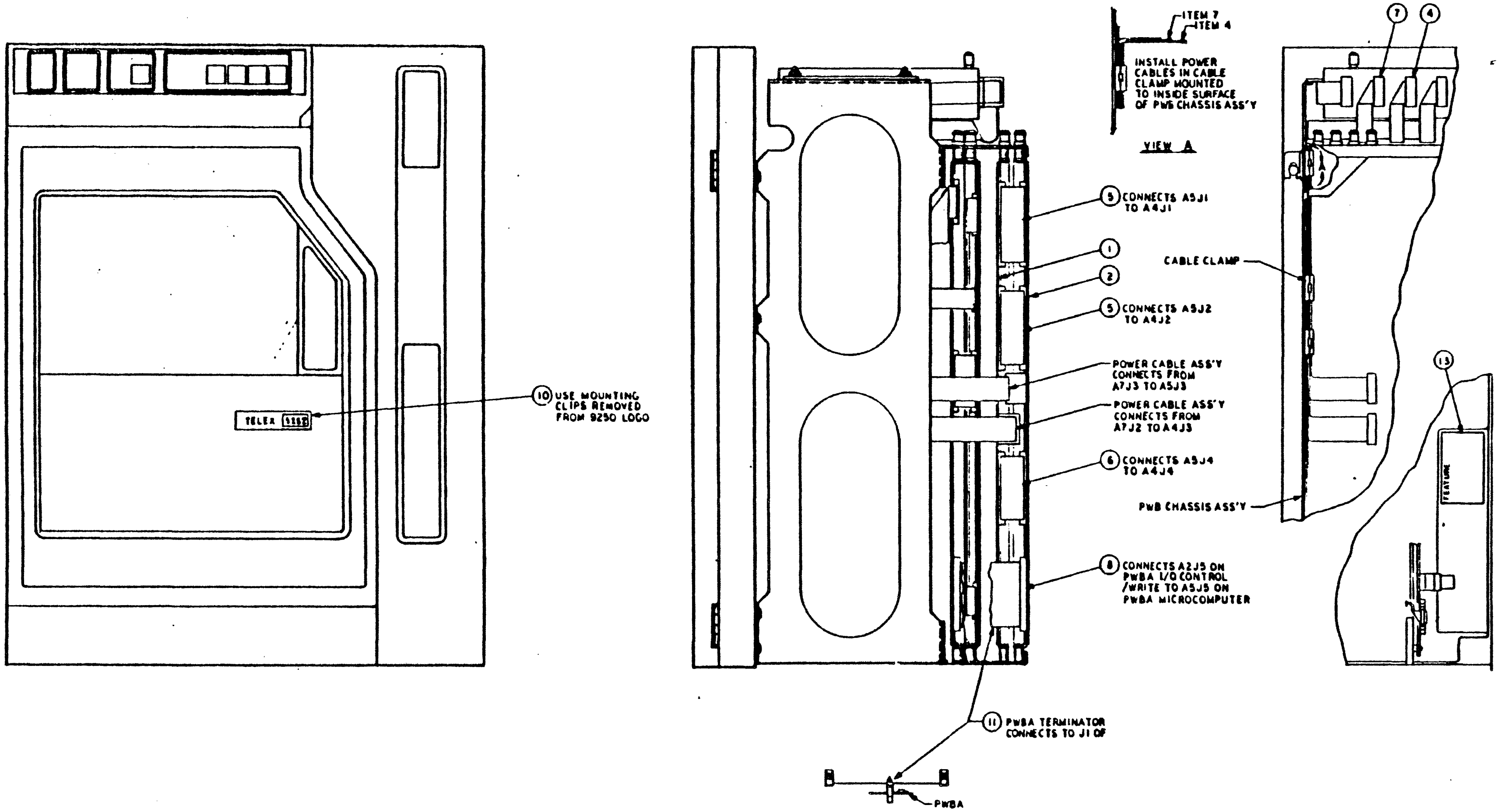
| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 1 | PWBA, Microcomputer | K91D72385-01 | 1 |
| 2 | PWBA, PLO, SKBUF, RD/WRT | A91D72388-02 | 1 |
| 4 | Cable Assy., Power, PLO | A91C22904-01 | 1 |
| 5 | Cable Assy., 60 Cond. Ribbon | A91C22838-01 | 2 |
| 6 | Cable Assy., 50 Cond. Ribbon | A91C22839-01 | 1 |
| 7 | Cable Assy., Power, Microprocessor | A91C22904-04 | 1 |
| 8 | Cable Assy., 50 Cond./Ribbon/Term. | C91C22840-01 | 1 |
| 11 | PWBA, Terminator | B91B72377-01 | 1 |




95D20593 Interface, FC 9253




95D20601 Interface, FC 9251




95D20600 Interface, FC 9252

INTERFACE, FC 2328
A95D20628 (Telex, Perkin Elmer)

| Ref Number | Nomenclature | Part Number | Qty |
|---|---|---|---|
| 1 | PWBA, Microcomputer | A91D72427-01 | 1 |
| 2 | PWBA, PLO, SKBUF, RD/WRT | A91D72388-02 | 1 |
| 4 | Cable Assy., Power, PLO | A91C22904-01 | 1 |
| 5 | Cable Assy., 60 Cond. Ribbon | A91C22838-01 | 2 |
| 6 | Cable Assy., 50 Cond. Ribbon | A91C22839-01 | 1 |
| 7 | Cable Assy., Power, Microprocessor | A91C22904-04 | 1 |
| 8 | Cable Assy., 50 Cond./Ribbon/Term. | C91C22840-01 | 1 |
| 11 | PWBA, Terminator | B91B72377-01 | 1 |

# SECTION 7 - DIAGNOSTICS

CONTENTS PAGE

## 7.1 DIAGNOSTIC PROCEDURES

The 9250 Tape Subsystem provides built-in diagnostic capabilities for the following purposes:

-- To perform confidence testing as requested by operator.

-- To perform idle and power-up self testing.

-- To identify malfunctioning Field Replaceable Units with minimum user skills, time and equipment.

-- To aid in setting up or calibrating system.

The procedures are provided in a series of levels requiring a progression of skills and tools. The procedures are designed to coach the user in problem detection and correction. If the user is not able to correct a problem he is guided to the next maintenance level where greater skills and tools are available.

At the operator level some diagnostics will be called into action when the equipment is powered up and when the operator loads tape. In the event of a failure at either of these times the Status display on the OCP will coach the user to corrective action or to the use of additional diagnostic tests. The Status display is to be used with either an Error Code Matrix or a FAST Chart (Fault Analysis Structured Technique), which will point to the next corrective action to be done.

## 7.2 USING DIAGNOSTICS

LOAD OPERATIONS

During normal tape loading operations the Status display will show load step numbers as the operation progresses. If a load malfunction occurs then either an error code or load step number will be displayed. Refer to the Load Operation section of this chapter for an Error Code Matrix. The Error Code Matrix will suggest one or more possible remedies.

OPERATOR REQUESTED OPERATIONS

The operator may refer to the Diagnostic Command Dictionary in this chapter to select options or maintenance operations. A short list also appears in the Table of Diagnostic Commands.

For assistance in the use of the Diagnostic Keyboard and the Status Display refer to Diagnostic Keyboard and Status Display Description and the sections on Entering a Command and Executing a Command.

The section on Error Code Matrix and FAST Charts will assist in the selection of appropriate procedures and interpretation of resulting Status displays.

## 7.3 USE OF ERROR CODE MATRIX

The upper left quadrant of an Error Code Matrix contains a list of possible error codes that might be displayed in the Status Display as a result of executing a diagnostic command or a standard operation such as loading tape. The lower right quadrant contains possible remedies. The lower left quadrant connects error codes with possible remedies in a suggested order of use.

As an example, suppose that error code 56 is displayed as a result of running the capstan test. In the sample ECM below find the column that contains error code 56. Going down this column, observe that the first suggested remedy is to "Replace Servo PWB." The second suggested remedy is to "Replace Capstan Assembly" and the third suggested remedy is to "Replace Power Supply."

ERROR CODE MATRIX for CAPSTAN TEST

| ERROR CODE | | | | | | | | | | | CMD A3 CAPSTAN VERIFICATION TEST |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | E | E | E | E | E | E | E | E | E | E | ACTION ITEMS |
| 40 | 57 | 58 | 59 | 5A | 5C | 5E | 5F | 60 | 61 | 62 | (First check all cable connections) |
| 2 | 3 | 3 | 3 | . | 2 | 3 | 2 | 1 | 1 | 1 | Replace SERVO CONTROL PWBA |
| . | . | . | . | . | . | . | . | 2 | . | 2 | Replace CAPSTAN MOTOR ASSY |
| 1 | 2 | 2 | . | . | . | 2 | . | . | . | . | Replace IO CNTRL & WRT to SERVO CABLE |
| 3 | 4 | 4 | 2 | . | . | 4 | . | . | . | . | Replace IO CNTRL & WRT PWBA |
| . | . | . | . | . | . | . | . | 3 | . | . | Replace Power Supply |
| . | 1 | 1 | 1 | 1 | 1 | 1 | 1 | . | . | . | Cycle power off/on - repeat test |

## 7.4 ACCESS LEVELS

Access to diagnostic functions is controlled at four levels to preserve system integrity. Access commands are provided to enable access to each level. These are commands 91, 92, 93, and 94.

The Level I commands are the least restricted. They are intended for use by the tape unit operator and require the minimum intervention. The operator must be able to perform the usual operator functions such as mounting a reel of tape and in addition must be able to operate the Diagnostic Keyboard. This level is always available for normal operations and subsystem confidence tests.

The Level II commands are intended for use by a trained key operator or for use by the operator with the guidance of a Customer Engineer. The Level II commands are used for some calibration purposes and for finding faulty FRUs (Field Replaceable Units).

The Level III and Level IV commands are intended for use by Customer Engineers.

Some diagnostic commands may be entered under two access levels. For example, command <85> (EX/MOD SENSE BYTE 5) can be entered under access level I to only EXAM the contents of Sense Byte 5, but under access level IV both EXAM and MODIFY procedures can be performed.

## 7.5 DIAGNOSTIC KEYBOARD AND OPERATOR CONTROL PANEL OPERATION

### 7.5.1 DIAGNOSTIC KEYBOARD AND STATUS DISPLAY DESCRIPTION

OPERATOR CONTROL PANEL STATUS DISPLAY

The STATUS display on the Operator Control Panel is the primary means of conveying diagnostic and status information to the operator. The most common STATUS display function is to display the Tape Unit address. Other functions include display of step numbers during a tape load operation, error number display, diagnostic command entry, and data display.

The STATUS display consists of three 7-segment characters with decimal points. These displays are capable of displaying the 16 hexadecimal characters and most of the alphabet in a mixture of upper and lower case characters. The first character is usually a function indicator or an index number. A typical use of an index number is to indicate data track numbers. The other two characters are usually used to display a value.

The OCP STATUS display is indicated in this manual by square brackets. For example:

```
[8.8.8.]  All display segments lighted
```

The following are typical STATUS displays:

```
[A   0 ]  Tape Unit address 0
[c 1 2 ]  Command 12
[E 4 2 ]  Error 42
[L 5 0 ]  Load Step 50
[0.3 4 ]  Parameter display - Index = 0, Value = 34
[1.A 7 ]  Parameter display - Index = 1, Value = A7
```

DIAGNOSTIC KEYBOARD

```
+-------+-------+-------+
|   A   |   B   |   C   |
|   1   |   2   |   3   |
+-------+-------+-------+
|   D   |   E   |   F   |
|   4   |   5   |   6   |
+-------+-------+-------+
|  CMD  |<decr> |<incr> |
|   7   |   8   |   9   |
+-------+-------+-------+
|       |  CLR  |       |
|   ↖   |   0   |  EXE  |
+-------+-------+-------+
```

DIAGNOSTIC KEYBOARD LAYOUT

The Diagnostic Keyboard (DKB) is a 12 key keyboard similar to a telephone keyboard. The numerals 0 thru 9, the hexadecimal numerals A thru F, and several special functions can be entered through the DKB. The Reel Door must be opened to gain access to the DKB, which is located in the upper corner of the area covered by the Reel Door.

DKB and OCP keystrokes are indicated by angle brackets in the following descriptions. For example:

| | |
|---|---|
| <A/1> | Press "A/1" key on DKB |
| <1> | Press "A/1" key while in basic key mode |
| <A> | Press "A/1" key while in alternate key mode |
| <exe> | Press "execute" key on DKB |
| <unload> | Press "unload" key on OCP |

Most of the DKB keys have an alternate function. The center and right hand periods of the STATUS display will be lighted to prompt the operator when an alternate key function is expected. This alternate function prompt is toggled by the <^> key.

The two groups of DKB key functions are listed below:

| | | |
|---|---|---|
| Basic: | Decimal number entry | <0>,<1>..<9> |
| | Execute or Step/Stop | <exe> |
| | Begin alternate function | <^> |
| Alternate: | Hex number entry | <A>,<B>..<F> |
| | Decrement | <decr/8> or <decr> |
| | Increment | <incr/9> or <incr> |
| | Clear or restore | <clr/0> or <clr> |
| | Exit alternate function | <^> |
| | Chain command | <cmd/7> or <cmd> |

### 7.5.2 ENTERING A DKB COMMAND

Press the <cmd> key to begin the command entry mode. While in the command entry mode the Status display will show [c ] indicating its readiness to accept a command. Press the number keys to enter the desired command code. If a hexadecimal number (A..F) is desired then press the <^> key to enter the shift operation followed by the desired hex key. When the desired command has been entered then press the <execute> key to begin execution of the command. The following examples show typical key stroke and status display sequences while entering and executing commands.

| KEY STROKE | STATUS DISPLAY | |
|---|---|---|
| | [A 0 ] | Typical Tape Unit address display |
| <cmd> | [c ] | Initial command mode prompt |
| <4> | [c 0 4 ] | Enter command number 4 |
| <exe> | | Begin execution of command 4 |

The following example shows the entry of command 35:

```
          [A   0 ]  Typical Tape Unit address display
<cmd>     [c     ]  Initial command entry prompt
<3>       [c 0 3 ]  Enter command 35
<5>       [c 3 5 ]
<exe>               Begin execution of command 35
```

The following example shows how corrections may be made by scrolling in additional numerals:

```
          [c     ]  Initial command mode prompt
<6>       [c 0 6 ]  Enter command 6
<1>       [c 6 1 ]  Enter command 61 (scroll in 1)
<4>       [c 1 4 ]  Enter command 14 (scroll in 4)
```

The following example illustrates the entry of a hexadecimal numeral:

```
          [c     ]  Initial command entry prompt
<3>       [c 0 3 ]  Enter command 3F
<^>       [c 0.3.]  Shift prompt appears
<F>       [c 3 F ]  Hex numeral appears & shift prompt disappears
```

The following example illustrates chaining of commands:

```
          [c     ]  Initial command entry prompt
<4>       [c 0 4 ]  Enter command 04
<^>       [c 0.4.]  Shift prompt appears
<cmd>     [c _ _ ]  Command chain prompt appears
<2>       [c 0 2 ]  Enter command 23
<3>       [c 2 3 ]
<exe>               Begin execution of the command chain 04/23
```

### 7.5.3 EXECUTING A COMMAND

After entering the command in the command entry mode then press <exec> to begin the command execution.

The Status Display may have several different responses depending upon the type of command being executed. Some commands, such as Write/Read Calibration (Cmd 31), will display step counts while others may display their command number briefly, [C ? ? ], then return to the Tape Unit address display.

At times it may be desirable to re-execute a command. If a command has been executed and the Tape Unit address Status display has returned then the command may be re-executed by using the following two key sequence: <cmd>, <exec>.

The following example illustrates the entry and execution of command 1 to change the Tape Unit address:

| | | |
|---|---|---|
| | [A 0 ] | Typical TU address display |
| <cmd> | [c ] | Begin command entry mode (note small "c" prompt) |
| <1> | [c 0 1 ] | Enter command number one |
| <exe> | [A. 0 ] | Begin execution of command 1 (note "A." prompt) |
| <3> | [A. 3 ] | Change to address 3 |
| <exe> | [A 3 ] | Terminate execution of command. Note that TU address is 3. |

The following example shows the entry and execution of command 92 to enable command Access Level II:

| | | |
|---|---|---|
| | [A 0 ] | TU address display |
| <cmd> | [c ] | Begin command entry mode |
| <9> | [c 0 9 ] | Enter command "92" |
| <2> | [c 9 2 ] | |
| <exe> | [A 0 ] | Execute command 92 then return to TU address display. |

The following example shows the entry and execution of command 97 which displays PE write compensation and write current and allows the modification of those values. This example shows the use of the alternate key functions: <increment> <9>, <decrement> <8>, and <clear>:

| | | |
|---|---|---|
| | [A 0 ] | TU Address display |
| <cmd> | [c ] | Begin command entry mode |
| <9> | [c 0 9 ] | Enter command 97 |
| <7> | [c 9 7 ] | |
| <exe> | [0.5 8 ] | Begin execution of command 97. Displays PE write compensation value. |
| <4> | [0.8 4 ] | Change value to 45 |
| <5> | [0.4 5 ] | |
| <^> | [0.4.5.] | Begin alternate key function |
| <9> | [0.4.6.] | Increment value to 46 |
| <9> | [0.4.7.] | Increment value to 47 |
| <8> | [0.4.6.] | Decrement value to 46 |
| <^> | [0.4 6 ] | Exit alternate key function |
| <5> | [0.6 5 ] | Change value to 5D |
| <^> | [0.6.5.] | Begin alternate key function |
| <D> | [0.5 D ] | Enter "D" |
| <^> | [0.5.D.] | Exit alternate key function |
| <clr> | [0.5 8 ] | Clear (restores original value of "58") |
| <exe> | [1.E 4 ] | Step to display second value (PE write current = "E4") |
| <exe> | [A 0 ] | Step / terminate command 97 and return to address display |

## 7.6 RS232 SERIAL PORT OPERATIONS

--WARNING--

In order to prevent inadvertent interference with system operation by improper use of diagnostics thru the RS232 port it is recommended that Diagnostics normally be disabled in the formatter.

Some users may chose to enable formatter diagnostics and to leave them enabled during normal operations. This is quite feasible provided the user is aware of the possible danger of improper diagnostic usage. Some users may desire to use this set up to facilitate diagnostic operations. The primary danger is that a terminal might be left attached to the RS232 port and that an operator may inadvertantly engage diagnostics during normal system operation.

Switch S3, Position 3 should be selected on the Shamrock formatter MPU board to enable formatter diagnostic functions. Switch S3, Position 2 should be selected to disable formatter diagnostic functions.

ATTACHING TO THE RS232 SERIAL PORT

Refer to Section 4 for instructions on configuring the RS-232 port and attaching a modem or terminal cable..

ENTERING SERIAL DIAGNOSTIC MODE

The serial diagnostic mode announces its presence by displaying a command entry prompt of the form 'n>' where n is a number from 0 thru 3. This prompt indicates the tape unit to be tested and readiness to accept a command or commands. The prompt will appear as one of the following:

```
0>
1>
2>
3>
```

If the prompt does not appear then press the '>' Key. If the prompt still does not appear then verify the cable connections and the setup as described in Section 4.

ENTERING AND EXECUTING COMMANDS

A single command is entered by typing '>', the command number, and then '/' to begin execution as shown here:

```
0>>80/
```

The '0>' is the prompt from the formatter and the '>80/' is typed by the operator..

A chain of commands may be entered by typing the command numbers using a space to separate each pair of commands:

```
0>>80 04 9B/
```

Other entries after the 'n>' prompt include:

| | |
|---|---|
| 0>>/ | Execute the previous command or command chain again. |
| 0>/ or 0>! | Cancel a tape motion operation. (A few commands involving tape motion continue to move tape after they have indicated completion. |
| 0># | Reset. Stop any operations that may be active and clear the command chain memory. |

Once command execution has begun the formatter may display the following kinds of responses:

| | |
|---|---|
| (80) | Shows that command 80 has begun execution. |
| (E.15) | Shows that error 15 has occured. |
| [3.84] | Value number 3 is 84. |
| [3.84]? | Value number 3 is 84 and may be modified by the operator. Valid operator responses include: |

- 8A Typing a new value.
- + Typing '+' to increment the value.
- - Typing '-' to decrement the value.
- ? Typing '?' to reshow the value.
- = Typing '=' to restore the original value.
- / Typing '/' to continue to the next value of a series..
- ! Typing '!' to cancel the remainder of the commanded operation.
- # Typing '#' to abort the commanded operation , to stop any tape motion, and to clear the command chain.

## 7.7 HOST INTERFACE OPERATIONS

Operation of diagnostics through the host interface varies from one interface type to another. Refer to the section of the manual describing the specific interface.

In most cases the Diagnostic Mode Set command is used to modifiy operation of standard Write and Read commands. The Clear command or a reset is used to restore normal operation.

**--WARNING--**

**After diagnostic operations are completed the user must be careful to ensure that normal operation is restored. If this is not done then data will not be transferred to and from tape by Write and Read operations as expected.**

After initiation of the diagnostic mode, the host sends diagnostic command chains and instructions to the formatter by use of the Write command whose data is not written to tape but is interpreted by the formatter. The messages sent from the host are similar to the messages sent from a terminal through the RS232 serial port. For example the first message, a command, would appear as follows:

>80/

Responses from the formatter to the host are transferred by use of Read commands. The data transferred via the Read command is not data read from tape but consists of diagnostic messages.

The formatter response to executing command 80 might be:

<80>[0.40].

where <80> indicates command 80 began execution,

[0.40] indicates sense byte 0 has a value of 40,
. indicates the completion of the command.

A series of Write and Read operation continues until the command chain is completed (or cancelled or aborted).

## 7.8 DIAGNOSTIC COMMAND DICTIONARY

Note that some of the command descriptions indicate Access Levels II, III, or IV are required. Use commands 92, 93, or 94 to enable these access levels.

Many of the commands are described as "Ex/Mod". These commands enable the operator to EXamine and MODify one or more parameters. The Status Display index number represents a function or count. For example, the index may indicate track numbers. The other two display characters represent the corresponding value. These values may be modified, incremented, decremented, or cleared to their original value.

**DKB Cmd 01 - Change Tape Unit Address (Access Level I)**

This command allows the user to change the Tape Unit Address within the range from 0 to 3.

**DKB Cmd 02 - Set Manual Density Select (Access Level I)**

This command enables the Manual Density Select option. This option causes the density selected by the operator while the Tape Unit was Off-Line to be displayed when the tape is positioned at Load Point and the Tape Unit is On-Line. The state of this option is maintained in Real Time Memory during power down. The Manual Density Select option status can be determined by referring to Flag byte 3 when executing Cmd 89.

**DKB Cmd 03 - Reset Manual Density Select (Access Level I)**

This command reset the Manual Density Select option which was set by Cmd 02.

**DKB Cmd 04 - Set Door Override (Access Level I)**

This command enables certain operations to be performed with the door open which would otherwise require that the door be closed. The door override remains in effect until one of the following occurs:

1) DKB Cmd 05 is executed which resets the door override
2) The <reset> key is pressed on the Operator Panel
3) The door is closed then opened.

**DKB Cmd 05 - Reset Door Override (Access Level I)**

This command resets the door override which was set by Cmd 04.

**DKB Cmd 06 - Set Force Read Option (Access Level I)**

This command sets a TU Status bit (Force Read), which instructs the Formatter to read a tape in the density selected at the Operator Control Panel. The operator selects the density with the <density> push button while the unit is Offline and tape is positioned at Load Point. The Force Read option remains in effect until either:

1) Tape is moved away from Load Point
2) DKB Cmd 07 is executed
3) DKB Cmd B2 is executed

The Force Read Option status can be determined by using Cmd 83 to look at sense byte 3.

**DKB Cmd 07 - Reset Force Read Option (Access Level I)**

This command resets the option set by Cmd 06

**DKB Cmd 08 - Set Seismic Option (Access Level I)**

This command sets the Seismic Option into effect. The Seismic Option remains in effect until reset by Cmd 09 or Cmd B2. The state of this option is maintained in Real Time Memory during power down. The Seismic Option causes a write operation to proceed even though multitrack errors occur that would normally cause the write operation to be terminated early. The Seismic Option status can be determined by using Cmd 83 to look at sense byte 3.

**DKB Cmd 09 - Reset Seismic Option (Access Level I)**

This command resets the seismic option set by Cmd 08.

**DKB Cmd 10 - Set Software Density Select (Access Level I)**

This command is not used by Telex or Telex type interfaces but may be used by the Shamrock Formatter with the STC or Pertec interface option installed. Software Density Select allows the density of write operations from load point to have density controlled by the host computer software. The state of the Software Density Select option is stored in Real Time Memory. Software Density Select option status can be determined by looking at Sense Byte 4 using Cmd 84.

**DKB Cmd 11 - Reset Software Density Select (Access Level I)**

This command is used to reset the Software Density Select option set by Cmd 10.

**DIAG. Cmd 14 - Real Time Memory (NVRAM) Test (Access Level I)**

This command performs a check sum test of the nonvolatile RAM and displays 'PAS' if no errors and 'FAL' if there are errors. This command is only valid before any other command is executed after power up. If 'FAL' does occur the calibration data for the read and write circuits may be invalid.

If command was executed by the host or RS-232 then Error 35 will be displayed for a checksum error and Error 00 will be display for no errors. If a failure should occur it may be necessary to re-calibrate the tape unit using Cmd 31.

**DIAG. Cmd 20 - Write All Ones (Access Level II)**

This command causes an All Ones pattern to be written on tape in the density selected on the OCP. This command is terminated by <reset>, <exec> or EOT. If Cmd 20 is executed via RS-232 or host the tape unit will appear non-existant to the formatter until EOT is detected or if tape motion is terminated via DKB.

**DIAG. Cmd 21 - Write Preset Pattern (Access Level II)**

This command causes a preset pattern to be written on tape in the density selected on the OCP. This command is terminated by <reset>, <exec> or EOT. If Cmd 21 is executed via RS-232 or host the tape unit will appear non-existant to the formatter until EOT is detected or if tape motion is terminated via DKB.

**DKB Cmd 22 - Write/Read Reverse/Repeat (Access Level II)**

This command will increment the density on OCP to next level then write data on tape for a short distance then the tape unit will read data in the reverse direction for a shorter distance than written forward. This process is repeated until EOT is detected. Once EOT is reached tape will rewind to BOT and the sequence will repeat. This command is terminated by <reset> or <exec>.

This command will increment through all three densities even though the system may be a dual-density machine.

**DKB Cmd 23 - Move tape forward (Access Level I)**

This command moves tape forward until <reset> or <exec> is pressed or EOT is reached.

**DKB Cmd 24 - Move Tape Reverse (Access Level I)**

This command moves tape in the reverse direction until <reset> or <exec> is pressed or BOT is reached.

**DKB Cmd 25 - Go-Stop Until EOT (Access Level I)**

This command moves tape forward and stops repeatedly until EOT is reached. The tape then rewinds and begins the Go-Stop motion again. The operation is terminated by pressing the <reset> or <exec> key.

**DKB Cmd 26 - Shoeshine (Access Level I)**

This command moves tape forward and reverse over a local area of tape. The operation is terminated by pressing the <reset> or <exec> key.

**DKB Cmd 27 - BOT/EOT Shoeshine (Access Level I)**

This command moves tape back and forth between the two tape markers. The operation is terminated by pressing the <reset> or <exec> key.

**DKB Cmd 28 - Shuffle to EOT (Access Level I)**

This command moves tape forward and backward with more forward motion than backward motion so that the result is a shuffle toward the EOT marker. When EOT is reached the tape rewinds and the shuffle begins again. This operation is terminated by pressing the <reset> or <exec> key.

**DKB Cmd 29 - Fast Forward (Access Level III)**

This command moves tape fast forward.

**WARNING**

**THIS OPERATION MUST BE STOPPED MANUALLY BY PRESSING THE <reset>, <exec> or <#> TO AVOID UNSPOOLING TAPE FROM THE FILE REEL AT EOT.**

**DKB Cmd 2A - Fast Reverse (Access Level III)**

This command moves tape fast reverse.

**WARNING**

**THIS OPERATION MUST BE STOPPED MANUALLY BY PRESSING THE <reset>, <exec> or <#> TO AVOID UNSPOOLING TAPE FROM THE FILE REEL AT EOT.**

**DKB Cmd 31 - Write/Read Calibration (Access Level II)**

This command determines the correct write current and read gains for each of the densities. The calibration requires about a minute to perform. If the tape is not at BOT the Tape Unit will rewind to BOT before calibrating. During the operation the density display on the OCP will change to show the density being calibrated and step numbers will be displayed on the STATUS display showing the progress of the operation. At the completion of the calibration the new write current values will be stored in the nonvolatile RAM. The operation may be terminated by opening the door or pressing the <reset> or <exec> key. If the operation is terminated by one of the three methods or EOT is encountered, [E.3 3] will be displayed indicating that the calibration was incomplete and the write currents and read gains for each density may be incorrect.

If this command is executed from the HOST or RS-232 the tape unit would immediately report the calibration is complete even though it is not. It is up to the operator to execute CMD 8A after the tape unit has actually finished calibrating to determine if any errors were encountered during the calibration

Write calibration will normally need to be done only after replacing the read/write head, Read PWB, or I/O Write PWB.

A reel of write enabled tape of good quality must be mounted on the tape unit and positioned at Load Point prior to performing the calibration.

Insure that the COMPENSATION values for both PE and GCR are set to the proper level. Use **Cmd 97** and **Cmd 98** respectively for this operation.

The following table lists the actions to be taken if any errors are displayed during **Cmd 31**.

If an error should appear make sure that all cables are seated properly. Repeat test if cables were not properly seated. If an error still persists after reseating cables perform the action described in the following table for the appropriate error code.

CMD 31 ERROR TABLE

| E 05 | E 14 | E 15 | E 30 | E 31 | E 32 | E 33 | E 34 | E 36 | CMD 31 ACTION ITEMS (First check all cable connections for proper contact.) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | . | . | . | . | . | . | . | . | Close door |
| . | 1 | . | . | . | . | . | . | . | Install write enable ring |
| . | . | 1 | . | . | . | . | . | . | Set proper access level |
| . | . | . | 1 | 1 | 2 | . | 1 | 2 | Run test A4 |
| . | . | . | . | . | 1 | . | . | 1 | Ensure GCR COMP. time is set |
| . | . | . | . | . | . | 1 | . | . | Door was opened or <RESET> key |
| . | . | . | . | . | . | 2 | . | . | EOT detected before calibrated |
| . | . | . | . | . | 3 | . | 2 | 3 | Replace IO CNTRL & WRITE PWBA |
| . | . | . | . | . | 4 | . | 3 | 4 | Replace READ PWBA |
| . | . | . | . | . | . | . | 4 | . | Replace READ Pre-Amp PWBA |

| E 4C | E 4E | E 4F | CMD 31 ACTION ITEMS (First check all cable connections) |
|---|---|---|---|
| 1 | 1 | . | Ensure COMP. times are set properly |
| 2 | 2 | 1 | Run Cmd A4 - IO CONTROL & WRITE PWBA TEST |
| 3 | 3 | 2 | Replace READ PWBA |
| 4 | 4 | 3 | Replace IO CONTROL & WRITE PWBA |
| 5 | 5 | 4 | Replace READ Pre-Amp PWBA |

**DKB Cmd 32 - Calibrate PE Read Gain (Access Level II)**

This command calibrates the read gain for PE from a prerecorded, all 1's PE tape.

An all 1's PE recording can be created by using **Cmd 20. Make sure to execute Cmd 32 over the same area of tape that the all 1's PE recording was created.**

The operation may be terminated by opening the door or pressing the <reset> or <exec> key. If the operation is terminated by one of the three methods or EOT is encountered, [E.3 3] will be displayed indicating that the calibration was incomplete and the read gains may be incorrect.

Refer to the following table for any status codes that may occur during calibration.

ERROR CODE MATRIX for **Cmd 32, Cmd 33, Cmd 34**

| ERROR CODES E 02 | E 03 | E 05 | E 07 | E 15 | E 33 | E 34 | CMD 32, 33, 34 (First check all cable connections.) ACTION OR COMMENTS |
|---|---|---|---|---|---|---|---|
| . | . | . | 1 | . | . | . | Illegal operation while On-Line |
| 1 | . | . | . | . | . | . | Rewind tape |
| . | 1 | . | . | . | . | . | Load tape |
| . | . | 1 | . | . | . | . | Close door |
| . | . | . | . | 1 | . | . | Execute **Cmd 92** |
| . | . | . | . | . | 1 | . | Reset key was pressed during cal. |
| . | . | . | . | . | 2 | . | Door was opened during cal. |
| . | . | . | . | . | 3 | . | EOT detected before end of cal. |
| . | . | . | . | . | . | 1 | Ensure GCR 1's or ARA Burst present |
| . | . | . | . | . | . | 2 | Run test A4 - IO CNTRL & WRT test |

If one or several tracks were not able to calibrate in the requested density then one of the following error codes would be displayed.

| ERROR CODES E 4C | E 4E | E 4F | CMD 32,33,34 ACTION ITEMS |
|---|---|---|---|
| .1 | . | . | Ensure all 1's PE data is on tape |
| . | 1 | . | Ensure all 1's GCR or ARA BURST is on tape |
| . | . | 1 | Ensure all 1's NRZI data is on tape |
| 2 | 2 | 2 | Run Cmd 31 - Write/Read calibration |

**DKB Cmd 34 - Calibrate NRZI Read Gain (Access Level II)**

This command calibrates the read gain for NRZI from a prerecorded all 1's NRZI tape.

An all 1's NRZI recording can be created by using **Cmd 20.Make sure to execute Cmd 34 over the same area of tape that the all 1's NRZI recording was created.**

The operation may be terminated by opening the door or pressing the <reset> or <exec> key. If the operation is terminated by one of the three methods or EOT is encountered, [E.3 3] will be displayed indicating that the calibration was incomplete and the read gains may be incorrect.

Refer to the table in **Cmd 32** for any status codes that may occur during calibration.

## DKB Cmd 35 - Display PROM version (Access Level I)

This command displays PROM "header" information for the two IO CONTROL & WRITE PROMs, SERVO reel PROM and SERVO capstan PROM. Five bytes of information are displayed in the STATUS display for each PROM. The index character tells which byte is being displayed while the byte of header information is displayed in the center and right characters. The <execute> key is pressed to step through the five bytes. This sequence is repeated for each PROM.

The following is an example of what the display will show for the following PROM part numbers. (Note underlined segments of first part number.)

| | |
|---|---|
| IO CONTROL & WRITE PROM #1 | N42D20279-01 |
| IO CONTROL & WRITE PROM #2 | L42D20279-02 |
| SERVO REEL PROM | G42D20282-01 |
| SERVO CAPSTAN PROM | C42D20283-02 |

| KEY | DISPLAY | |
|---|---|---|
| <cmd> | [c    ] | |
| <3> | [c 0 3] | |
| <5> | [c 3 5] | |
| <exec> | [0.0 1] | Prompt for IO CONTROL PROM #1 |
| <exec> | * [1.0 D] | Prefix 'N' of PROM #1 |
| <exec> | [2.0 2] | Last four digits |
| <exec> | [3.7 9] | Last four digits cont. |
| <exec> | [4.0 1] | Dash number of PROM #1 |
| <exec> | [0.0 2] | Prompt for IO CONTROL PROM #2 |
| <exec> | * [1.0 B] | Prefix 'L' of PROM #2 |
| <exec> | [2.0 2] | Last four digits |
| <exec> | [3.7 9] | Last four digits cont. |
| <exec> | [4.0 2] | Dash number of PROM #2 |
| <exec> | [0.0 3] | Prompt for REEL PROM |
| <exec> | * [1.0 7] | Prefix 'G' of REEL PROM |
| <exec> | [2.0 2] | Last four digits |
| <exec> | [3.8 2] | Last four digits cont. |
| <exec> | [4.0 1] | Dash number of CAPSTAN PROM |
| <exec> | [0.0 4] | Prompt for CAPSTAN PROM |
| <exec> | * [1.0 3] | Prefix 'C' for CAPSTAN PROM |
| <exec> | [2.0 2] | Last four digits |
| <exec> | [3.8 3] | Last four digits cont. |
| <exec> | [4.0 2] | Dash number for CAPSTAN PROM |
| <exec> | [A   0] | End of command |

* The following table describes the HEX code for the PREFIX of the PROM part number.

| HEX CODE | PREFIX LETTER | HEX CODE | PREFIX LETTER |
|---|---|---|---|
| 01 | A | 10 | P |
| 02 | B | 11 | Q |
| 03 | C | 12 | R |
| 04 | D | 13 | S |
| 05 | E | 14 | T |
| 06 | F | 15 | U |
| 07 | G | 16 | V |
| 08 | H | 17 | W |
| 09 | I | 18 | X |
| 0A | J | 19 | Y |
| 0B | K | 1A | Z |
| 0C | L | 1B | AA |
| 0D | M | 1C | AB |
| 0E | N | | |
| 0F | O | | |

**DKB Cmd 60 - Calibrate Capstan Circuit (Access Level III)**

This command will cause the Capstan circuit on the SERVO PWBA to calibrate. This command requires that the SERVO PWBA have the supporting software installed. If this software is not installed then [E.2 1] will be displayed.

**DKB Cmd 80 - Display Sense Byte 0 (Access Level I)**

This command displays sense byte 0. The display is dynamic so that if the sense byte changes while the command is active the display will change accordingly. The operation is terminated by pressing either the <exe> or <reset> key. Refer to section 4.5 under Tape Unit Sense A (TUSA) for description of sense bytes.

**DKB Cmd 81 thru 84, 86, 87 - Display Sense Byte n (Access Level I)**

These commands are similar to Cmd 80 in that each command causes one sense byte to be displayed. The number of the displayed sense byte is determined by the second digit of the command number. Refer to section 4.5 under Tape Unit Sense A (TUSA) for description of sense bytes.

**DKB Cmd 85 - Ex/Mod Sense Byte 5 (Access Level I/II)**

This command allows Sense Byte 5 to be displayed while in access level I. If access level II is set then the PERTEC formatter configuration in Sense Byte 5 can be modified. To set the PERTEC formatter configuration one may enter a value from the following table, which describes settings for the PERTEC interface option. Refer to section 4.5 under Tape Unit Sense A (TUSA) for description of sense bytes.

| Sense Byte 5 Value | PERTEC Option | Write Data Buss Parity |
|---|---|---|
| 00 | CDC 185 | Enabled |
| 04 | CDC 185 | Disabled |
| 08 | Kennedy/ 9400 | Enabled |
| 0C | Kennedy/ 9400 | Disabled |

**DKB Cmd 88 - Display sense bytes 0 thru 7 (Access Level I)**

This command sequentially displays sense bytes 0 thru 7. The STATUS display index indicates the sense byte number. The operation is terminated by pressing <exec> key while displaying the last sense byte or by pressing <reset>. Refer to section 4.5 under Tape Unit Sense A (TUSA) for description of sense bytes.

**DKB Cmd 89 - Display Software Flag Bytes 1 thru 4 (Access Level I)**

This command sequentially displays Software Flag bytes 1 thru 4. The operation is terminated by pressing <exe> key while displaying the last flag byte or by pressing <reset>. The following is a description of each Software Flag byte.

**Bit location description.**

```
+-------+-------+-------+-------+-------+-------+-------+-------+
|       |       |       |       |       |       |       |       |
| MSB   |       |       |       |       |       |       | LSB   |
|       |       |       |       |       |       |       |       |
+-------+-------+-------+-------+-------+-------+-------+-------+
```

```
FLAG 1: MSB -
            -
            - Tape is loaded in the Tape Unit.
            - Reset program waiting to be executed
            - Unload routine waiting to be executed
            - Online routine waiting to be executed
            - Door is open
        LSB -


FLAG 2: MSB - Formatter Reset command received
            -
            -
            -
            -
            -
            - Tape in process of loading
        LSB - Skip OCP indicator update
```

FLAG 3: MSB - Door Override set
-
- Manual Density Select
- Ignore Tape Marker Interrupts
- Allow Select Indicator to Blink During Dynamic Status
- Tape Moving
-
LSB -

FLAG 4: MSB - Serial Data Received from Servo PWB
- Serial Receive Framing Error
- Capstan Communication Error
- Reel Communication Error
- Command Rejected from Servo PWB
-
- Capstan Communication Busy
LSB - Reel Communication Busy

**DKB Cmd 8A - Examine errors status of previous command. (Access level I)**

This command will display the error status of any previous command. If any previous errors were recorded then the display will first show [c.X X], where X X is the command number. By pressing <EXEC> the display will show the first recorded error for that particular command. If the LSD decimal is activated then more error codes follow. Press <EXEC> until all errors have been displayed.

**DKB Cmd 8C - Examine/Modify Loop Chain Count (Access level I)**

This command will allow one to examine and/or modify two HEX bytes that represent the number of times the following commands have been executed.

CMD F3 - Loop on command chain
CMD F6 - Loop until BOT
CMD F7 - Loop until EOT

**DKB Cmd 91 - Enable Access Level I**

This command enables Access Level I so that only commands at Access Level I may be executed. This is the default Access Level. Use of the <reset> key also causes a return to Access Level I.

**DKB Cmd 92 - Enable Access Level II**

This command enables Access Level II so that only commands at Access Levels I and II may be executed.

**DKB Cmd 93 - Enable Access Level III** (Level II required)

This command enables Access Level III so that commands at Access Levels I, II, and III may be executed.

**DKB Cmd 94 - Enable Access Level IV** (Level III required)

This command enables Access Level IV so that commands at Access Level IV and below may be executed.

**DKB Cmd 95 - Ex/Mod Selected Density Write Compensation/Current (Access Level I/II)**

This command allows write compensation and write current of the density indicated on the OCP to be displayed while in access level I and modified if in access level II. Modified values are put into effect immediately and stored in the Real Time Memory when the operation is completed. A STATUS display index of 0 indicates that write compensation is being displayed. A STATUS display index of 1 indicates that write current is being displayed.

**DKB Cmd 96 - Ex/Mod Selected Density Read Gain (Access Level I/II)**

This command allows the read gains of the density indicated on the OCP to be displayed while in access level I and modified if in access level II. The STATUS display index indicates the physical track number whose gain is being displayed.

**DKB Cmd 97 - Ex/Mod PE Write Compensation/Current (Access Level I/II)**

This command allows the PE write compensation and write current to be displayed while in access level I and modified if in access level II. Otherwise the command is the same as Cmd 95.

**DKB Cmd 98 - Ex/Mod GCR Write Compensation/Current (Access Level I/II)**

This command allows the GCR write compensation and write current to be displayed while in access level I and modified if in access level II. Otherwise the command is the same as Cmd 95.

**DKB Cmd 99 - Ex/Mod NRZI Write Current (Access Level I/II)**

This command allows the NRZI write current to be displayed while in access level I and modified if in access level II. A STATUS display index 1 indicates that write current is being displayed.

**DKB Cmd 9A - Ex/Mod PE Read Gain (Access Level I/II)**

This command allows the PE read gains to be displayed while in access level I and modified if in access level II. The STATUS display index indicates the physical track number whose gain is being displayed. Modified values are put into effect immediately and stored in the Real Time Memory when the operation is completed.

**DKB Cmd 9B - Ex/Mod GCR Read Gain (Access Level I/II)**

This command allows the GCR read gains to be displayed while in access level I and modified if in access level II. The STATUS display index indicates the physical track number whose gain is being displayed. Since the GCR read gain is normally adjusted each time an ARA Burst is read the values

1.90
2.77
3.78
4.6b
5.6A
6.71
7.89
8.7d
9.85

displayed here are those most recently determined by reading an ARA Burst. Modified values are put into effect immediately and stored in the Real Time Memory when the operation is completed.

**DKB Cmd 9C - Ex/Mod NRZI Read Gain (Access Level I/II)**

This command allows the NRZI read gains to be displayed while in access level I and modified if in access level II. The STATUS display index indicates the physical track number whose gain is being displayed. Modified values are put into effect immediately and stored in the Real Time Memory when the operation is completed.

**DKB Cmd 9D - Ex/Mod NRZI Forward Skew (Access Level I/II)**

This command allows the NRZI forward skew values to be displayed while in access level I and modified if in access level II. The STATUS display index indicates the physical track number whose skew is being displayed. Modified values are put into effect immediately and stored in the Real Time Memory when the operation is completed.

**DKB Cmd 9E - Ex/Mod NRZI Reverse Skew (Access Level I/II)**

This command allows the NRZI reverse skew values to be displayed while in access level I and modified if in access level II. The STATUS display index indicates the physical track number whose skew is being displayed. Modified values are put into effect immediately and stored in the Real Time Memory when the operation is completed.

**DIAG. Cmd A0 - DKB and OCP Keyboard Test (Access level I)**

This command can only be executed from the DKB panel. The purpose of this test is to verify the operation of the key switches on the OCP and DIAGNOSTIC keyboards. The keys are to be activated in a set sequence to insure all switches have been tested. While the switches are being depressed a corresponding character will be displayed. If any key is pressed out of sequence [E.1 9] will be displayed. If a key switch is bad the processor will not detect it so the corresponding character will not be displayed and when the next key in sequence is pressed [E.1 9] will be displayed.

When the test is executed the most significant digit (MSD) will have a lower case 'c' in the upper left corner of the segments with the other two digits blank. The following table below shows the sequence in which the keys must be pressed. If the keys are pressed out of sequence and [E.1 9] is displayed. the test can be entered again by starting the key sequence at (1). To exit the test at anytime press <RESET> twice or close and open the reel door.

Keyboard Test Key Sequence

| KEY SEQUENCE | CHARACTER DISPLAYED |
|---|---|
| 1 | 01 |
| 2 | 02 |
| 3 | 03 |
| 4 | 04 |
| 5 | 05 |
| 6 | 06 |
| 7 | 07 |
| 8 | 08 |
| 9 | 09 |
| UPSTROKE | 0A |
| 0 | 0b |
| EXEC | 0C |
| DENSITY | 0d |
| UNLOAD | 0E |
| LOAD/REWIND | 0F |
| ON LINE | 10 |
| RESET | TAPE UNIT ADDRESS |

ERROR CONDITION: If [E.1 9] is displayed when the key sequence was properly executed then perform the following actions in sequence and repeat the test each time until no fault occurs.

(1) Ensure all cables are seated properly.
(2) Replace the diagnostic keyboard if the error occurred during key sequence (1) thru <DENSITY>.
Replace the OCP panel if the error occurred during the key sequence <UNLOAD> thru <RESET>
(3) Replace the WRITE & IO CONTROL PCB.

**DKB Cmd A1 - Display and OCP indicator test (Access Level I)**

The purpose of this test is to verify that all the segments on the display digits and each indicator on the OCP panel operate properly. This is done by activating each display segment and OCP indicator. Operator assistance is required to visually inspect the displays and indicators. Test may be terminated by <RESET> OR <EXEC> at any time.

a. Upon entry all display segments and OCP indicators will deactivate.

b. The MSD display segments will activate individually in a clockwise direction until the number '8' appears along with a decimal point. All segments will stay activated for a set time then they will be deactivated.

c. The middle display segments will activate individually in a clockwise direction until the number '8' appears along with a decimal point. All segments will stay activated for a set time then they will be deactivated.

d. The LSD display segments will activate individually in a clockwise direction until the number '8' appears along with a decimal point. All segments will stay activated for a set time then they will be deactivated.

e. The OCP indicators will activate individually starting with the SELECT indicator and ending with the 6250 indicator. All indicators will stay activated for a set time.

f. All segments and indicators are activated for 2 seconds.

h. Tape unit address is displayed.
END OF TEST

ERROR CONDITION: If any of the segments or indicators does not activate then perform the following actions. Repeat test after each action until no fault appears.

(1) Ensure all cables are seated properly.

(2) Replace OCP assy.

(3) Replace IO CONTROL & WRITE PWBA.

**DKB Cmd A2 - Tape Unit Sensor Test (Access level III)**

This command can only be executed from the DKB. The purpose of this test is to verify the operation of the following: PEOT (Physical End of Tape) sensor, File Protect sensor, Door Interlock switch, EOT (End of Tape) sensor, BOT (Beginning of Tape) sensor, Tape on Hub sensor, Load Pump and Vacuum motor. Operator assistance is required to activate and deactivate each sensor and to thread tape on the fixed reel.
The tape unit display is used to show the activation and deactivation of the sensors, load pump and vacuum motor.

Some early version SERVO PWBs will not support this command. This is revealed when [E.2 1] is displayed momentarily. By displaying this message the tape unit indicates that the PEOT sensor and the TAPE on HUB sensor will not be tested during this command.

Once the test is entered the MSD (most significant digit) will have a lower case 'c' in the upper left corner of the digit along with its decimal. The last two digits will display '88'. The displays will stay in this mode for approximately 2 seconds. This is to test the displays to ensure segments are working properly. Refer to ERROR CONDITION section if '88' is not displayed.

After '88' is displayed the last two digits will have specific segments activated when each sensor is sensing a true signal. Figure #1 shows which segment is assigned to each sensor.

The bottom segment of the LSD will go blank indicating that the load pump should be off. The bottom segment of the middle display will go blank indicating that the vacuum motor should be off.

To activate the load pump press <EXEC> once. The bottom segment of the LSD will be activated showing that the load pump should be on. This allows the Tape on Hub sensor to be tested. To activate the vacuum motor and deactivate the load pump press <EXEC> once more. The bottom segment of the middle display will be activated showing that the vacuum motor should be on.

To exit from the test press <RESET> or press <EXEC> until the Tape Unit address is displayed.

Perform the following steps to test the sensors, load pump and vacuum motor.

A. PEOT SENSOR TESTING
When the PEOT sensor is blocked segment 1 will activate.
When the PEOT sensor is not blocked segment 1 will deactivate.
Refer to ERROR CONDITION section if segment 1 fails to toggle.

B. EOT SENSOR TESTING
When no tape is in tape path segment 2 will activate.
To deactivate the EOT segment 2 block the EOT sensor from the reflector.
Refer to ERROR CONDITION section if segment 2 fails to toggle.

C. DOOR INTERLOCK TESTING
When the door is closed segment 3 will activate.
When the door is opened segment 3 will deactivate.
Refer to ERROR CONDITION section if segment 3 fails to toggle.

D. FILE PROTECT TESTING
When the plunger of the File Protect sensor on the file reel is out, segment 4 will not blink when the file reel is rotated.
When the plunger is held in, segment 4 will blink

when the file reel is rotated.
Refer to ERROR CONDITION section if segment 4 fails to toggle.

E. BOT SENSOR TESTING
When no tape is in tape path segment 5 will activate.
To deactivate the BOT segment 5 block the sensor from the reflector.
Refer to ERROR CONDITION section if segment 5 fails to toggle.

F. TAPE ON HUB SENSOR TEST and LOAD PUMP TEST.
Turn on the load pump by pressing <EXEC> once after entering test. The bottom segment of the LSD display will activate indicating that load pump should be on. The load pump makes an audible blowing noise. If this noise is not heard then refer to the ERROR CONDITION section for instructions.

When the Load Pump is either on or off and no tape is fully wrapped on the FIXED reel, segment 6 should be off. Refer to ERROR CONDITION section if segment 6 is on during this phase.

When the Load Pump is on and tape is fully wrapped on the FIXED reel segment 6 should be on indicating Tape On Hub. Refer to ERROR CONDITION section if segment 6 is off during this phase.

G. VACUUM MOTOR TEST
Press <EXEC> once more to turn on the vacuum motor. The load pump will be turned off along with LSD bottom segment. After 1 second has passed the bottom segment of the middle display will activate and the vacuum motor will come on. The vacuum motor will create an audible blowing noise as the load pump but at a different pitch. Refer to ERROR CONDITION section if no audible blowing noise is heard.
See SENSOR SEGMENTS following.

SENSOR SEGMENTS

```
 MSD                      LSD

 ---        ---         ---
|          1   |       4   |
 ---         2           5
           |   3       |   6
     .       VAC         LPO
```

LPO - Indicates Load Pump On
VAC - Indicates Vacuum Motor On

| SEGMENT | SENSOR |
|---|---|
| 1 | PEOT |
| 2 | EOT |
| 3 | DOOR INTERLOCK |
| 4 | FILE PROTECT |
| 5 | BOT |
| 6 | TAPE ON HUB |

ERROR CONDITION: If the tape unit display fails to display the number '88' then execute test A1.

<u>SECTION A THRU E</u>.
If any of the segments fail to toggle after performing TEST OPERATION A thru E, reseat all sensor cables and repeat test. If failure still occurs then refer to the the following Field Replaceable Unit (FRU) table.

FRU TABLE

| ERROR CODE E 57 | E 59 | E 5A | E 5E | E 5F | E 21 | CMD A2 ACTION ITEMS (First check all cable connections for proper contact.) |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | . | Cycle power off/on repeat test |
| 3 | 3 | . | 3 | 2 | . | Replace SERVO PWBA |
| 2 | . | . | 2 | . | . | Replace IO CNTRL & WRT to SERVO CABLE |
| 4 | 2 | . | 4 | . | . | Replace IO CNTRL & WRT PWBA |
| . | . | . | . | . | 1 | SERVO code does not support cmd |

FRU TABLE (continued)

| A PEOT | B EOT | C DOOR SWITCH | D FILE PROTECT | E BOT | SENSOR TEST SECTION A THRU E ACTION ITEMS (First check all cable connections for proper contact.) |
|---|---|---|---|---|---|
| 1 | 2 | . | 1 | 2 | Replace SERVO PWBA |
| . | . | 2 | . | . | Replace DOOR INTERLOCK SWITCH |
| . | 1 | . | . | 1 | Replace EOT/BOT PWBA |
| . | . | . | 4 | . | Replace FILE PROTECT PWBA |
| 2 | . | . | . | . | Replace PEOT SENSOR ASSY. |
| . | 4 | 1 | 3 | 4 | Replace IO CNTRL & WRT to SERVO CABLE |
| . | 3 | . | 2 | 3 | Replace IO CNTRL & WRT PWBA |

<u>SECTION F - TAPE ON HUB SENSOR AND LOAD PUMP</u>

If the LSD bottom segment is activated and no audible blowing noise is heard then perform each of the following actions repeating the test after each action.

(a) Reseat all cables leading to SERVO PWB.
(b) Replace the SERVO PWBA.
(c) Replace the LOAD PUMP.

If the LSD bottom segment is activated and an audible blowing noise is heard and if no tape is on the FIXED reel but segment 6 is on <u>OR</u> if the LSD bottom segment is activated and an audible blowing noise is heard and if tape is fully wrapped on the FIXED reel but segment 6 is not activated then perform the following actions and repeat the test after each action.

(a) Reseat all cables leading to SERVO PWB.
(b) Replace Tape on Hub sensor.
(d) Replace SERVO PWBA

<u>SECTION G - VACUUM MOTOR</u>

When the bottom segment of the middle display is activated and no audible blowing noise is heard perform the following action and repeat the test after each action.

(a) Reseat all cables leading to the PNEUMATIC CONTROL PWB and SERVO CONTROL PWB.
(b) Replace PNEUMATIC CONTROL PWBA.
(c) Replace the VACUUM COLUMN PUMP ASSEMBLY

## DKB Cmd A3 - Capstan Verification Test (Access Level III)

This diagnostic test will verify the following functions of the CAPSTAN control circuit for either 50ips or 75ips machines.

(1) Serial communication between the IO CONTROL & WRITE and SERVO PWBs
(2) CAPSTAN internal circuitry.
(3) CAPSTAN calibration.
(4) Control lines from the IO CONTROL & WRITE to SERVO PWB.
(5) CAPSTAN performance in forward direction at 50/75ips and high speed.
(6) CAPSTAN performance in reverse direction at rewind speed and 50/75ips.

Test may be terminated by <RESET> OR <EXEC> at any time.

ERROR CONDITION: If an error should appear check if all cables are seated properly. Repeat test if cables were not properly seated.
If an error still persists after reseating cables perform the action described below for the appropriate error code.

If the test was conducted while tape was loaded and tape loop out of the columns, run this same test (CMD A3) with no tape loaded.

| ERROR CODE E 05 | E 07 | E 15 | E 21 | CMD A3 CAPSTAN VERIFICATION TEST ACTION ITEMS (First check all cable connections.) |
|---|---|---|---|---|
| 1 | . | . | . | Close door |
| . | 1 | . | . | Take Tape Unit Off-Line |
| . | . | . | . | Press <RESET> |
| . | . | 1 | . | Set access level III. |
| . | . | . | 1 | Update SERVO software to latest code |

| ERROR CODE E 40 | E 57 | E 58 | E 59 | E 5A | E 5C | E 5E | E 5F | E 60 | E 61 | E 62 | CMD A3 CAPSTAN VERIFICATION TEST ACTION ITEMS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | 3 | 3 | . | 2 | 3 | 2 | 1 | 1 | 1 | Replace SERVO CONTROL PWBA |
| . | . | . | . | . | . | . | . | 2 | . | 2 | Replace CAPSTAN MOTOR ASSY |
| 1 | 2 | 2 | . | . | . | 2 | . | . | . | . | Replace IO CNTRL & WRT to SERVO CABLE |
| 3 | 4 | 4 | 2 | . | . | 4 | . | . | . | . | Replace IO CNTRL & WRT PWBA |
| . | . | . | . | . | . | . | . | 3 | . | . | Replace Power Supply |
| . | 1 | 1 | 1 | 1 | 1 | 1 | 1 | . | . | . | Cycle power off/on - repeat test |

(continued)

CMD A3 ERROR CONDITION TABLE
(continued)

| E 63 | E 64 | E 65 | E 66 | E 80 | E 81 | E 82 | E 83 | CMD A3 CAPSTAN VERIFICATION TEST ACTION ITEMS (First check all cable connections.) |
|---|---|---|---|---|---|---|---|---|
| . | 1 | 1 | 1 | 3 | 1 | 3 | 2 | Replace SERVO CONTROL PWBA |
| . | . | . | . | . | . | . | . | Replace CAPSTAN MOTOR ASSY |
| . | . | . | . | 1 | 2 | 1 | 1 | Replace IO CNTRL & WRT to SERVO CABLE |
| . | . | . | . | 2 | 3 | 2 | 3 | Replace IO CNTRL & WRT PWBA |
| 1 | . | . | 2 | . | . | . | . | Replace Power Supply |
| . | . | . | . | . | . | . | . | Cycle power off/on on tape unit |

## DKB Cmd A4 - IO CONTROL & WRITE PWBA Test (Access Level III)

Circuitry on the I/O CONTROL & WRITE PWB is exercised and checked for proper operation. The test will terminate with the tape unit address displayed if no error has occurred. If an failure should occur a error code will be displayed. If more than one error has occurred the LSD decimal on the display will be activated. To examine the next error code press <EXEC>.

If this command is executed from the HOST or RS-232 the tape unit will immediately report that the test is complete even though it is not. It is up to the operator to execute CMD 8A after one minute to determine if any errors were encountered during the test.

The Tape Unit will appear nonexistent to the Formatter during this test.

If a write track error is detected the OCP indicators will indicate which density the track error occurred and the display will show ERROR code [E.4 1] thru [E.4 9] indicating which physical track failed. If an error is displayed, press <EXEC> to test the next physical track until all tracks have been tested.

If any other error should appear check if all cables are seated properly. Repeat test if cables were not properly seated. If an error still persists after reseating cables perform the action described below for the appropriate error code.

For the following error codes replace the IO CONTROL & WRITE PWB: 30,37,38,39,3A,3C,3E,3F,41,42,43,44,45,46,47,48,49,4A,4C,4E,and.

Refer to the following tables for other error codes displayed.

| ERROR CODES E 07 | E 15 | E 17 | E 21 | CMD A4 ACTION ITEMS (First check all cable connections for proper contact.) |
|---|---|---|---|---|
| 1 | . | . | . | Take system off-line |
| . | 1 | . | . | Set for access level III |
| . | . | 1 | . | Remove tape from tape path |
| . | . | 2 | . | Run CMD A2 |
| . | . | . | 1 | Update Servo Software |

(continued)

CMD A4 Error Condition Table (continued)

| ERROR CODES E 31 | E 35 | E 57 | E 58 | E 59 | E 5A | E 5C | E 5E | E 5F | CMD A4 ACTION ITEMS (First check all cable connections for proper contact.) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | . | . | . | . | . | . | . | . | Ensure write head cable connected |
| 2 | . | . | . | . | . | . | . | . | Replace IO CONTROL & WRITE PWBA |
| . | 1 | . | . | . | . | . | . | . | Recalibrate tape unit |
| . | . | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Cycle power off/on & retry test |
| . | . | . | . | . | . | 2 | . | 2 | Replace SERVO CONTROL PWBA |
| . | . | 1 | 1 | 2 | 2 | . | 1 | . | Run CMD A3 for SERVO communication chk |

| ERROR CODES E 80 | E 81 | E 82 | E F8 | CMD A4 ACTION ITEMS (First check all cable connections |
|---|---|---|---|---|
| 1 | 2 | 1 | . | Replace IO CNTRL & WRT to SERVO CABLE |
| 2 | 3 | 2 | 2 | Replace IO CNTRL & WRT PWBA |
| 3 | 1 | 3 | . | Replace SERVO PWBA |
| . | . | . | 1 | Cycle power - repeat test |

**DKB Cmd A5 - IO CONTROL & WRITE PWBA Test (Power up access only)**

This command is entered automatically upon power up conditions, Watch Dog interruption ,or Brown Out conditions. This command cannot be entered by the DKB. Circuitry on the I/O CONTROL & WRITE PWB is exercised and checked for proper operation. The test will terminate with the tape unit address displayed if no error has occurred. If a failure should occur an error code will be displayed. If more than one error has occurred the LSD decimal on the display will be activated. To examine the next error code press <EXEC>.

The Tape Unit will appear nonexistent to the Formatter during this test.

If an error should appear check if all cables are seated properly. Repeat test if cables were not properly seated. If an error still persists after reseating cables perform the action described below for the appropriate error code.

For the following error codes replace the IO CONTROL & WRITE PWB: 30,37,38,39,3A,3C,3E,3F,FA and FE.

Refer to the following tables for other error codes displayed.

CMD A5 Error Condition Table

| E 31 | E 35 | E 57 | E 58 | E 59 | E 5A | E 5C | E 5E | E 5F | CMD A5 ACTION ITEMS (First check all cable connections for proper contact.) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | . | . | . | . | . | . | . | . | Ensure write head cable connected |
| 2 | . | . | 4 | . | . | . | . | . | Replace IO CONTROL & WRITE PWBA |
| . | . | . | 2 | . | . | . | . | . | Replace IO CNTRL & WRT to SERVO CABLE |
| . | 1 | . | . | . | . | . | . | . | Recalibrate tape unit |
| . | . | . | . | 1 | 1 | 1 | . | 1 | Cycle power off/on & retry test |
| . | . | . | 3 | . | . | 2 | . | 2 | Replace SERVO CONTROL PWBA |
| . | . | 1 | 1 | 2 | 2 | . | 1 | . | Run CMD A3 for Servo Communication Chk |

| E F8 | E F9 | E FC | E FF | CMD A5 ACTION ITEMS (First check all cable connections) |
|---|---|---|---|---|
| 1 | 1 | . | 1 | Cycle power - repeat test |
| 2 | . | 2 | . | Replace IO CNTRL & WRT PWBA |
| . | . | 1 | . | Are IO & WRT PWBA EPROMs in right sockets? |
| . | . | . | . | Replace Power Supply |

**DKB Cmd B0 - Disable SELECT indicator during dynamic status. (Access Level II)**

The Select option status can be determined by looking at FLAG byte 3 by use of CMD 89.

**DKB Cmd B1 - Enable SELECT indicator during dynamic status. (Access Level II)**

**DKB Cmd B2 - Factory Configuration (Access Level IV)**

This command sets the Tape Unit in a specific configuration as described below:

a. Force Read option - RESET
b. Seismic option - RESET
c. Software density select - RESET
d. PERTEC formatter configuration - Kennedy 9400
e. Clears Parity Disable bit of Sense Byte 5
f. Manual Density Select - RESET
g. If NRZI capable line is low from the READ PWB, the NRZI capable bit in Sense Byte 4 is set.
h. Set tape unit address to [A 0]
i. Set Access level to level I
j. Set Density Request bits in Sense Byte 3 to PE.

**DKB Cmd B5 - Reset (Access level I)**

This command performs the same function as the OCP <reset> key.

**DKB Cmd B6 - Density (Access level I)**

This command performs the same function as the OCP <density> key.

**DKB Cmd B7 - On-Line (Access level I)**

This command performs the same function as the OCP <online> key.

**DKB Cmd B8 - Unload (Access level I)**

This command performs the same function as the OCP <unload> key.

**DKB Cmd B9 - Rewind (Access level I)**

This command will rewind tape to BOT if tape is loaded.

**DKB Cmd BA - Load tape (Access level I)**

This command is used to load a 2400 foot reel of tape or to execute a mid-tape load sequence. This command is not used for a load assist.

Refer to section 7.11 LOAD OPERATION if a load failure should occur.

**DKB Cmd BC - Load Assist Tape (Access Level I)**

This command is used to load assist a reel of tape or to execute a mid-tape load sequence.

The following is the procedure for using the LOAD ASSIST TAPE command.

1) Rotate the file reel and place about one-inch of tape into the entrance of the thread channel.

2) Enter command BC and close door.

Refer to section 7.11 LOAD OPERATION if a load failure should occur.

**DIAG. Cmd C1 - Formatter Microprocessor test**

This self test is nonexhaustive operational verification of the 68000 microprocessor of the formatter. Refer to tables below if any errors should occur.

**ERROR CODE TABLE IF COMMAND WAS EXECUTED FROM DKB**

| ERROR CODES E 50 | E 51 | ACTIONS OR COMMENTS |
|---|---|---|
| 1 | . | Press <reset> and try again. |
| . | 1 | Ensure cable from MPU (A5J5) is |
| . | . | connected to IO/WRT (A2J5) |
| . | 2 | Ensure MPU has updated |
| . | . | diagnostic EPROM's |
| . | 3 | Ensure that EPROM select switch |
| . | . | position 3 is on, on the MPU |

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## FORMATTER DIAGNOSTIC SELF TEST ERROR CODES

| SELF TEST: CMD CODE | SELF TEST: DESCRIPTION | ERROR CODE | PROBABLE FAILURE: PLO (A4) | PROBABLE FAILURE: MPU (A5) | REMARKS (First check all cable connections) |
|---|---|---|---|---|---|
| C1 | MPU TEST | 1 | | XXX | CHECK SUM MISMATCH |
| C2 | RAM TEST | 1 | | XXX | DATA MISMATCH |
| C3 | FIFO TEST | 1 | | XXX | FIFO EMPTY FLAG NOT RESET |
| | | 2 | | XXX | FIFO FULL FLAG SET EARLY |
| | | 3 | XXX | XXX | FIFO EMPTY FLAG NOT CLEARED |
| | | 4 | | XXX | FIFO FULL FLAG NEVER SET |
| | | 5 | | XXX | FIFO EMPTY FLAG SET EARLY |
| | | 6 | | XXX | FIFO FULL FLAG NOT CLEARED |
| | | 7 | | XXX | DATA MISMATCH |
| C4 | SET PE | 0 | | | ALWAYS PASSES |
| C5 | SET NRZI | 0 | | | ALWAYS PASSES |
| C6 | SET GCR | 0 | | | ALWAYS PASSES |

(continued)

## FORMATTER DIAGNOSTIC SELF TEST ERROR CODES
(continued)

| SELF TEST CMD CODE | SELF TEST DESCRIPTION | ERROR CODE | PROBABLE FAILURE PLO (A4) | PROBABLE FAILURE MPU (A5) | REMARKS (First check all cable connections) |
|---|---|---|---|---|---|
| C7 | I/F LWR | 1 | | XXX | DATA MISMATCH |
| | | 2 | | XXX | CONTROL SET UP FAILURE |
| CC | A5 MCU REG | 1 | | XXX | DATA MISMATCH |
| CD | A4 PLO REG | 1 | XXX | | DATA MISMATCH |
| D0 | FU LWR | 1 | | XXX | SETUP ERROR |
| | | 2 | XXX | | SETUP ERROR |
| | | 3 | XXX | XXX | DATA ERROR |
| | | 7 | | XXX | TAPE UNIT I/F SETUP ERROR |
| | | 8 | XXX | XXX | SETUP ERROR |
| | | 9 | | | NRZI NOT IMPLEMENTED |
| D1 | FU LWR, 1 DT | 1 | | XXX | SETUP ERROR |
| | | 2 | XXX | | SETUP ERROR |
| | | 3 | XXX | XXX | DATA ERROR |
| | | 9 | | | NRZI NOT IMPLEMENTED |
| D2 | FU LWR, 2 DTS | 1 | | XXX | SETUP ERROR |
| | | 2 | XXX | | SETUP ERROR |
| | | 3 | XXX | XXX | DATA ERROR |
| | | 8 | | XXX | TAPE UNIT I/F SETUP ERROR |
| | | 9 | | | NRZI NOT IMPLEMENTED |
| D3 | FU LWR, 3 DTS | 1 | | XXX | SETUP ERROR |
| | | 2 | XXX | | SETUP ERROR |
| | | 3 | XXX | XXX | DATA ERROR |
| | | 8 | | XXX | TAPE UNIT I/F SETUP ERROR |
| | | 9 | | | NRZI NOT IMPLEMENTED |

**DIAG. Cmd C2 - Formatter Memory test**

This self test verifies operation of the random access memory (RAM) of the formatter. RAM contents are left intact. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd C3 - Formatter FIFO Data Rate Buffer test.**

This self test verifies the operation of the formatter FIFO, which acts as a data rate buffer between the host and the read or write logic of the formatter. The FIFO, which is 512 words deep and 9 bits wide, is filled with a binary count of 511 to 0; the count is then read out and checked. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd C4 - Formatter set PE mode.**

This self test establishes PE as the format to be used for other self tests that operate in a specific format. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd C5 - Formatter set NRZI mode.**

This self test establishes NRZI as the format to be used for other self tests that operate in a specific format. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd C6 - Formatter set GCR mode.**

This self test establishes GCR as the format to be used for other self tests that operate in a specific format. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd C7 - Formatter interface LWR test.**

This self test verifies operation of the tape unit interface on the microcomputer card (A5). Data patterns are written to the tape unit interface, looped back and read from it, and compared. No tape unit is involved in this test, and no encoding format (PE, NRZI, or GCR) is used. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd CC - Formatter MPU HW register test.**

The microcomputer hardware register self test exercises the available registers of the A5 board which are both read and write accessible. It does this by writing a binary count pattern to each register, reading back and comparing after each write.

Eight bit registers are tested with a count of 255 to 0; sixteen bit registers are tested with a count of 65535 to 0. Unavailable bits within the registers are masked, and not considered for the comparison.

The registers tested include the Tape Unit Interface Control register, the Formatter Status register, the Formatter Error register, the Dynamic Status register, and the Tape Unit Error Status registers.

For interfaces other than Telex, this test exercises the registers available on that interface.

During the running of the test, erroneous dynamic status and error status will be reported to the host. Correct status will be restored at the completion of the test. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd CD - Formatter PLO HW Register test.**

The PLO hardware register self test exercises the available registers of the A4 formatter board which are both read and write accessible. It does this by writing a binary count pattern to each register, reading back and comparing after each write.

Eight bit registers are tested with a count of 255 to 0; nine bit registers are tested with a count of 511 to 0. Unavailable bits within the registers are masked, and not considered for the comparison.

The registers tested include the Amp Sense Control register, the PLO Timing Control register, the GCR ECC Control register, the PE/NRZI Read Control register, the Microprocessor Track-In-Error register, the PLO/Skew Buffer Control register, the PLO Divisor registers, the Pointer Control register, the Read Buffer Control register, the Write Control register, the Write Inhibit register, the Write Dead Track Control register, the Write Data Path Control register, and the two Write Dead Track registers. Refer to Formatter Error table in CMD C1 for status codes that may appear.

**DIAG. Cmd D0 - Formatter LWR test**

This self test involves the FIFO, the write encoding logic, the tape unit interface, and the read decoding logic. A preset pattern of 65 characters is written into the FIFO, encoded to PE or GCR format, looped back through the tape unit interface portion of the MPU PWBA, and decoded. Both the read encoding logic and write decoding logic are checked for proper response. Refer to Formatter Error table in CMD C1 for status codes that may appear.

Cmd C4 or Cmd C6 should be executed before Cmd C8 in order to select either PE or GCR format. Formatter LWR is not implemented for NRZI format.

**DIAG. Cmd D1 - Formatter LWR with 1 dead track.**

This self test is similar to Cmd D0, except that it is run with one track dead. Nine LWRs are run, with each track dead in turn. This test checks for proper operation of error detection and correction in the read decoding logic. Refer to Formatter Error table in CMD C1 for status codes that may appear.

Cmd C4 or Cmd C6 should be executed before Cmd D1 to select either PE or GCR format. Formatter LWR is not implemented for NRZI format.

**DIAG. Cmd D2 - Formatter LWR with 2 dead tracks test.**

This self test is similar to CMD D0, except that it is run with two tracks dead. Thirty six LWRs are run, with each pair of tracks dead in turn. This test checks for proper operation of error detection and correction in the read decoding logic. Refer to Formatter Error table in CMD C1 for status codes that may appear.

Cmd C4 or Cmd C6 should be executed before Cmd D2, to select either PE or GCR format. Formatter LWR is not implemented for NRZI format.

**DIAG. Cmd D3 - Formatter LWR with 3 dead tracks test.**

This self test is similar to Cmd D0, except that it is run with three tracks dead. Eighty four LWRs are run, with each triplet of tracks dead in turn. This test checks for proper operation of error detection in the read decoding logic. Refer to Formatter Error table in CMD C1 for status codes that may appear.

Cmd C4 or Cmd C6 should be executed before Cmd D3, to select either PE or GCR format. Formatter LWR is not implemented for NRZI format.

**DIAG. Cmd E0 - Set Formatter for Tape Unit 0 diagnostics.**

This command will set the formatter to communicate with Tape Unit 0.

**DIAG. Cmd E1 - Set Formatter for Tape Unit 1 diagnostics.**

This command will set the formatter to communicate with Tape Unit 1.

**DIAG. Cmd E2 - Set Formatter for Tape Unit 2 diagnostics.**

This command will set the formatter to communicate with Tape Unit 2.

**DIAG. Cmd E3 - Set Formatter for Tape Unit 3 diagnostics.**

This command will set the formatter to communicate with Tape Unit 3.

**DIAG. Cmd F3 - Loop On Cmd Chain (Access level I)**

The Loop command is used to cause a loop of one or more commands to execute repeatedly. A Mark command (Cmd FE) is entered to mark the beginning of the command loop to be repeated and the Loop command is the last command in the loop to be repeated. If a Mark command is not in the chain then all of the commands in the chain prior to the Loop command will be repeated. Execution of the command loop is terminated by pressing <RESET>.

**DIAG. Cmd F6 - Loop Until BOT (Access level I)**

The Loop Until BOT command is used to cause a loop of one or more commands to repeat until BOT is observed. Execution of the command loop is terminated when BOT is observed or by pressing <RESET>. Refer to description of Mark and Loop commands for description of command loops.

**DIAG. Cmd F7 - Loop Until EOT (Access Level I)**

The Loop Until EOT command is used to cause a loop of one or more commands to repeat until EOT is observed. Execution of the command loop is terminated when EOT is observed or by pressing <RESET>. Refer to description of Mark and Loop commands for description of command loops.

**DIAG. Cmd FE - Mark (Access Level I)**

The Mark command is used with a Loop command (or conditional loop command such as Loop Until BOT or Loop Until EOT). The Mark command marks the beginning of a loop of commands to be executed repeatedly while the Loop command indicates the last command of the loop to be executed. Commands in the chain before the Mark command and after the Loop command will not be repeated.

## 7.9 TABLE OF DIAGNOSTIC COMMANDS

| ACCESS LEVEL | CMD CODE | FUNCTION |
|---|---|---|
| I | 01 | Change Tape Unit Address |
| I | 02 | Set Manual Density Select |
| I | 03 | Reset Manual Density Select |
| I | 04 | Set Door Override |
| I | 05 | Reset Door Override |
| I | 06 | Set Force Read Option |
| I | 07 | Reset Force Read Option |
| I | 08 | Set Seismic Option |
| I | 09 | Reset Seismic Option |
| I | 10 | Set Software Density Select (STC and Pertec---reset otherwise) |
| I | 11 | Reset Software Density Select |
| I | 14 | Real Time Memory (NVRAM) Test |
| II | 20 | Write All Ones in selected density |
| II | 21 | Write Preset Pattern in selected density |
| II | 22 | Write/Read Reverse/Repeat |
| I | 23 | Read forward in selected density |
| I | 24 | Read reverse in selected density |
| I | 25 | Go-Stop until EOT |
| I | 26 | Shoeshine |
| I | 27 | BOT/EOT Shine |
| I | 28 | Shuffle to EOT |
| III | 29 | Fast Forward |
| III | 2A | Fast Reverse |
| II | 31 | Calibrate Write Current & Read Gains |
| II | 32 | Calibrate PE Read Gain |
| II | 33 | Calibrate GCR Read Gain |
| II | 34 | Calibrate NRZI Read Gain |
| I | 35 | Display PROM Version |
| III | 60 | Calibrate Capstan** |
| I | 80 | Display Sense Byte 0 |
| I | 81 | Display Sense Byte 1 |
| I | 82 | Display Sense Byte 2 |
| I | 83 | Display Sense Byte 3 |
| I | 84 | Display Sense Byte 4 |
| I/II | 85 | EX/MOD Sense Byte 5 |
| I | 86 | Display Sense Byte 6 |
| I | 87 | Display Sense Byte 7 |
| I | 88 | Display Sense Bytes 0 thru 7 |

**Not applicable to Pertec interface.

(continued on next page)

TABLE 7.9 (continued)

| ACCESS LEVEL | CMD CODE | FUNCTION |
|---|---|---|
| I | 89 | Display Software Flags 1 thru 4 |
| I | 8A | Examine error status of previous command** |
| I | 8C | Examine/Modify loop count** |
| I | 91 | Enable Access Level I |
| I | 92 | Enable Access Level II |
| II | 93 | Enable Access Level III |
| III | 94 | Enable Access Level IV |
| I/II | 95 | Ex/Mod Selected Density Write Compensation/Current |
| I/II | 96 | Ex/Mod Selected Density Read Gain |
| I/II | 97 | Ex/Mod PE Write Compensation/Current |
| I/II | 98 | Ex/Mod GCR Write Compensation/Current |
| I/II | 99 | Ex/Mod NRZI Write Current |
| I/II | 9A | Ex/Mod PE Read Gain |
| I/II | 9B | Ex/Mod GCR Read Gain |
| I/II | 9C | Ex/Mod NRZI Read Gain |
| I/II | 9D | Ex/Mod NRZI Forward Skew |
| I/II | 9E | Ex/Mod NRZI Reverse Skew |
| I | A0 | Keyboard Operation test** |
| I | A1 | Display Operation test** |
| III | A2 | Sensor Operation test** |
| III | A3 | Capstan Operation test** |
| III | A4 | IO CONTROL & WRITE PWBA test** |
| * | A5 | Power Up diagnostic test* |
| II | B0 | Disable Select Indicator Blinking |
| II | B1 | Enable Select Indicator Blinking |
| IV | B2 | Set Tape Unit to Factory Configuration |
| I | B5 | Reset tape unit** |
| I | B6 | Increment density** |
| I | B7 | Put tape unit On-Line** |
| I | B8 | Unload tape** |
| I | B9 | Rewind tape to BOT** |
| I | BA | Load tape** |
| I | BC | Load Assist tape** |

TABLE 7.9 (continued)

| ACCESS LEVEL | CMD CODE | FUNCTION |
|---|---|---|
| I | C1 | Formatter Microprocessor test |
| I | C2 | Formatter Memory test |
| I | C3 | Formatter FIFO Data Rate Buffer test |
| I | C4 | Formatter Set PE mode |
| I | C5 | Formatter Set NRZI mode |
| I | C6 | Formatter Set GCR mode |
| I | C7 | Formatter interface LWR test |
| I | CC | Formatter MPU HW register test |
| I | CD | Formatter PLO HW register test |
| I | D0 | Formatter LWR test |
| I | D1 | Formatter LWR with 1 dead track test |
| I | D2 | Formatter LWR with 2 dead tracks test |
| I | D3 | Formatter LWR with 3 dead tracks test |
| I | E0 | Set Formatter for Tape Unit 0 diagnostics |
| I | E1 | Set Formatter for Tape Unit 1 diagnostics |
| I | E2 | Set Formatter for Tape Unit 2 diagnostics |
| I | E3 | Set Formatter for Tape Unit 3 diagnostics |
| I | F3 | Loop on Cmd chain** |
| I | F6 | Loop if not BOT** |
| I | F7 | Loop if not EOT** |
| I | FE | Mark Loop** |

* Command not accessible by DKB.
** Not applicable to Pertec interface.

NOTE: See Section 7.4 for description of CMDs with more than one access level.

## 7.10 ERROR CODES DISPLAYED ON STATUS DISPLAY

The column marked Diag. Cmd will indicate which command to refer to in order to trouble shoot a tape unit problem. When a '*' is indicated then the error may have been generated by inappropriate or incomplete operator actions. For instance drive door not closed. Check operator control procedure before performing further diagnostics.

| Error Code | Diag. Cmd | Condition |
|---|---|---|
| 0 | - | No error |
| 2 | *,A2 | Tape beyond EOT |
| 3 | *,A2 | Tape not loaded |
| 4 | *,A2 | Tape at or behind load point |
| 5 | *,A2 | Door open |
| 6 | *,A2 | Tape not at Load Point |
| 7 | * | Tape Unit is On Line |
| 8 | * | Unimplemented command |
| 9 | * | Another program is busy |
| 10 | * | Command can only be executed from DKB |
| 11 | * | Load Failure |
| 12 | * | Load check indicator active |
| 13 | * | Not NRZI capable |
| 14 | *,A2 | Tape is File Protected |
| 15 | * | Proper Access Level is not enabled |
| 16 | * | Load operation interrupted by door open or <reset> |
| 17 | *,A2 | Operation requires no tape in tape path |
| 18 | * | Illegal operation while tape is loaded |
| 19 | * | Illegal key sequence |
| 20 | *,A3 | Capstan is not calibrated |
| 21 | * | SERVO does not support all or portion of command |
| 30 | A4 | Write current error detected |
| 31 | A4 | Erase current error detected |
| 32 | 31 | Write current calibraton error |
| 33 | * | Calibration interrupted |
| 34 | 31 | SAG error during GCR calibration |
| 35 | A5 | NVRAM check sum error |
| 36 | 31 | Track 5 Read CAL error during Write Calibration |
| 37 | A4 | Marker interrupt circuit failure |
| 38 | A4 | BOT Latch circuit failure |
| 39 | A4 | EOT Latch circuit failure |
| 3A | A4 | Write DAC should not be comming on. |
| 3C | A4 | Write DAC is not comming on. |
| 3E | A4 | Watch Dog circuit Failure |
| 3F | A4 | IO CONTROL & WRITE PWBA Gate Array failure |
| 40 | A3 | IO CONTROL & WRITE PWBA direction detection failure |
| 41 | A4 | Physical Track 1 failure in selected density. |
| 42 | A4 | Physical Track 2 failure in selected density. |
| 43 | A4 | Physical Track 3 failure in selected density. |

(Continued on next page)

TABLE 7.10 (Continued)

| Error Code | Diag. Code | Condition |
|---|---|---|
| 44 | A4 | Physical Track 4 failure in selected density. |
| 45 | A4 | Physical Track 5 failure in selected density. |
| 46 | A4 | Physical Track 6 failure in selected density. |
| 47 | A4 | Physical Track 7 failure in selected density. |
| 48 | A4 | Physical Track 8 failure in selected density. |
| 49 | A4 | Physical Track 9 failure in selected density. |
| 4A | A4 | Noise on tracks or bad track gating. |
| 4C | A4,31 | Track error in PE. |
| 4E | A4,31 | Track error in GCR. |
| 4F | A4,31 | Track error in NRZI. |
| 50 | *,C1 | Diagnostic communication failure with formatter |
| 51 | *,C1 | Unable to communicate with formatter |
| 55 | A3 | Write protected SERVO memory |
| 56 | A3 | Invalid SERVO address |
| 57 | A3 | REEL processor failed to reply to communication |
| 58 | A3 | CAPSTAN failed to reply to communication |
| 59 | A3 | IO CONTROL processor detected framing error |
| 5A | A3 | Serial command sent to SERVO PCB was rejected. |
| 5C | A3 | Only CAPSTAN failed to serial communicate. |
| 5E | A3 | Both REEL and CAPSTAN failed the communication test |
| 5F | A3 | Only REEL processor failed to serial communicate. |
| 60 | A3 | Capstan failed to calibrate. |
| 61 | A3 | Capstan sync error on Go. |
| 62 | A3 | Capstan low speed velocity error. |
| 63 | A3 | Capstan high speed velocity error. |
| 64 | A3 | Capstan deceleration error. |
| 65 | A3 | Capstan failed to stop. |
| 66 | A3 | Capstan failed to move on GO command. |
| 80 | A3 | Go control line from IO CONTROL & WRITE PWBA to SERVO failure |
| 81 | A3 | Rewind line from IO CONTROL & WRITE PWBA to SERVO failure. |
| 82 | A3 | Fwd/rev line from IO CONTROL & WRITE PWBA to SERVO failure. |
| 83 | A3 | IO CONTROL & WRITE PWBA not receiving TACH from SERVO PWBA. |
| 90 | * | Privilege violation |
| 97 | * | Program overflow |
| 98 | * | Illegal operation |
| 99 | * | Unimplemented |
| A0 | * | Time out error (Reset, try cmd again) |
| A1 | * | Non-hexadecimal character |
| A2 | * | Bad Syntax |
| A3 | * | Stack overflow (Reset, try cmd again) |
| C0 | * | CMDST Bus Handshake Failure (Reset, try cmd again) |
| C1 | * | Illegal TU command |
| C3 | * | Unexpected response from tape unit (Reset, try cmd again) |
| C8 | * | Echo response failure (Reset, try cmd again) |
| C9 | * | DATST Bus Handshake Failure (Reset, try cmd again) |
| CA | * | Data Disappeared (Reset, try cmd again) |

TABLE 7.10 (Continued)

| | | |
|---|---|---|
| CB | * | DATST Bus Handshake Failure (Reset, try cmd again) |
| CC | * | Data re-appeared (Reset, try cmd again) |
| F8 | A4 | IO CNTRL & WRT PWBA Watch dog interrupted processor |
| F9 | A5 | Power Fail line failure |
| FA | A5 | IO CNTRL & WRT PWBA Processor failure |
| FC | A5 | IO CONTROL EROM placement failure or EPROM failure |
| FE | A5 | IO CONTROL NVRAM failure |
| FF | A5 | BROWN out detected |

## 7.11 LOAD OPERATION

The following tables represent possible error codes that may be encountered during a load operation and suggests possible remedies.

Ensure the following items are checked before using error tables.

a) Make sure column and reel doors are securely closed.
b) Ensure that the file reel hub is latched.
c) Ensure tape path and column is clean.
d) Check all cable connections for proper contact.

| ERROR CODES E 05 | E 07 | E 11 | E 12 | E 16 | E 30 | E 31 | E 57 | E 58 | E 5A | E 59 | ACTIONS OR COMMENTS (First check all cable connections) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| . | . | 1 | . | . | . | . | . | . | . | . | Exam load failure code that followed |
| . | . | . | 1 | . | . | . | . | . | . | . | Reset tape unit |
| . | . | . | . | . | 1 | 1 | . | . | . | . | Run Cmd A4 |
| 1 | . | . | . | . | . | . | . | . | . | . | Close door |
| 2 | . | . | . | . | . | . | . | . | . | . | Run test A2 - test for door |
| . | 1 | . | . | . | . | . | . | . | . | . | Illegal Cmd while On-Line |
| . | . | . | . | 1 | . | . | . | . | . | . | Door was opened while loading |
| . | . | . | . | 2 | . | . | . | . | . | . | Reset while loading |
| . | . | . | . | . | . | . | . | . | 1 | 1 | Press <reset> repeat command |
| . | . | . | . | . | . | . | 1 | 1 | 2 | 2 | Run test A3 for comm. test |

| ERROR LOAD STEPS L 00 | L 01 | L 02 | L 03 | L 04 | L 05 | ACTIONS OR COMMENTS (First check all cable connections) |
|---|---|---|---|---|---|---|
| . | 1 | . | . | . | . | Static or keeper on tape |
| . | 2 | . | 1 | . | . | Damaged tape tip |
| . | . | . | 2 | . | . | Upper tape path blocked |
| . | . | . | . | 1 | . | Lower tape path blocked |
| . | . | . | 3 | . | . | Run test A2 - test EOT/BOT |
| . | 5 | 1 | . | . | . | Run test A2 - test for PEOT |
| . | . | . | . | 2 | . | Run test A2 - test Tape on Hub |
| 1 | 6 | 2 | 4 | 3 | 1 | Replace SERVO PWBA |
| . | 3 | . | . | . | . | If File reel did not move replace SERVO PWB |
| . | 4 | . | . | . | . | If File reel did not move replace File Reel Motor |

7.11 LOAD OPERATION (continued)

Ensure the following items are checked before using error tables.

a) Make sure column and reel doors are securely closed.
b) Ensure that the file reel hub is latched.
c) Ensure tape path and column is clean.
d) Check all cable connections for proper contact.

| ERROR LOAD STEPS L 10 | L 11 | L 12 | L 20 | L 21 | L 22 | L 30 | L 31 | L 32 | ACTIONS OR COMMENTS (First check all cable connections) |
|---|---|---|---|---|---|---|---|---|---|
| . | 1 | . | . | . | . | . | . | . | Broken tape on Fix Reel |
| . | . | . | 3 | . | . | . | . | . | Check if upper column is blocked |
| . | . | . | . | 1 | 1 | . | . | . | Check if lower column is blocked |
| . | . | . | 4 | 2 | . | . | . | . | Run cmd A2 - test vacuum |
| . | 2 | . | . | . | . | . | . | . | Run cmd A2 - test EOT/BOT |
| . | . | . | 6 | 4 | 2 | . | . | . | Replace Pneumatic PWBA |
| 1 | . | 1 | 5 | 3 | 3 | . | . | . | Replace SERVO PWBA |
| . | . | . | . | . | . | 1 | 1 | 1 | Run cmd A3 - Capstan check |
| . | . | . | . | 5 | . | . | . | . | Replace Fix Reel motor |
| . | . | . | 1 | . | . | . | . | . | If File Reel did not move replace SERVO PWB |
| . | . | . | 2 | . | . | . | . | . | If File Reel did not move replace File Reel motor |

| ERROR LOAD STEPS L 40 | L 41 | L 42 | L 43 | L 50 | L 51 | L 60 | L 61 | ACTIONS OR COMMENTS (Check all cable connections) |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 1 | 2 | 5 | 2 | 2 | Replace SERVO PWBA |
| 2 | 3 | 2 | 2 | 3 | 6 | 3 | 3 | Replace Pneumatic PWBA |
| 3 | 1 | 3 | 3 | . | . | . | . | Replace differential switch |
| . | . | . | . | . | 1 | . | . | Leader too long or no BOT? |
| . | . | . | . | . | 2 | . | . | Leader too short? |
| . | . | . | . | . | 4 | . | . | Run CMD A2 - test EOT/BOT |
| . | . | . | . | 1 | 3 | 1 | 1 | Run CMD A3 - Capstan test |

## 7.12 Power Supply Voltage Level Tests

In order to measure power supply output voltages at the Servo Control PWB do the following:

1. Make all appropriate power supply cable connections.
2. Power up the tape unit.
3. Measure voltages on the Servo Control PWB, which is mounted on the right side of the card chassis as viewed from the rear of the tape unit. See Figure 7-1.
4. Verify that the voltages are within the limits of Part A of the following table.
5. Load tape into the vacuum columns.
6. Measure voltages at points indicated in Figure 7-1.
7. Verify that these voltages are within the limits given in part B of the following table.

Table #

| Designated Voltage | Part A Actual Voltage | Part B Actual Voltage |
|---|---|---|
| +5.0 VDC | +5 + .05 VDC<br>- .12 VDC | +5 + .05 VDC<br>- .12 VDC |
| +12.0 VDC | +12 + .7 VDC<br>- .7 VDC | +12 + .7 VDC<br>- .7 VDC |
| -12.0 VDC | -12 + .7 VDC<br>- .7 VDC | -12 + .7 VDC<br>- .7 VDC |
| +36.0 VDC | +42 +2.0 VDC<br>-2.0 VDC | +37 +2.0 VDC<br>-2.0 VDC |
| +28.0 VDC | 30 +2.0 VAC<br>-2.0 VAC | 30 +2.0 VAC<br>-2.0 VAC |

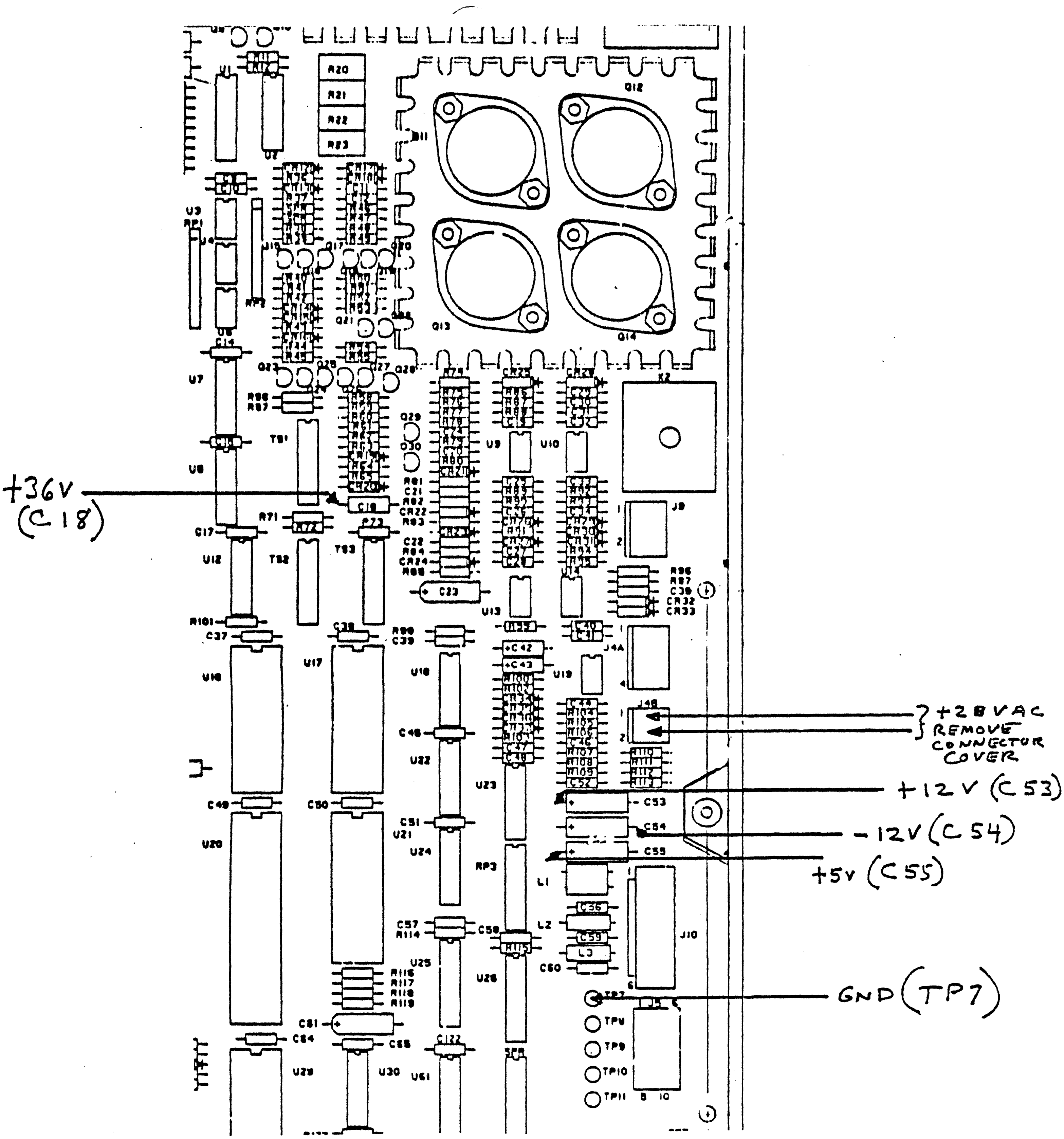



Figure 7-1. Voltage Measurement Points on Servo Control PWB

# SECTION 8 - LOGICS AND SCHEMATICS

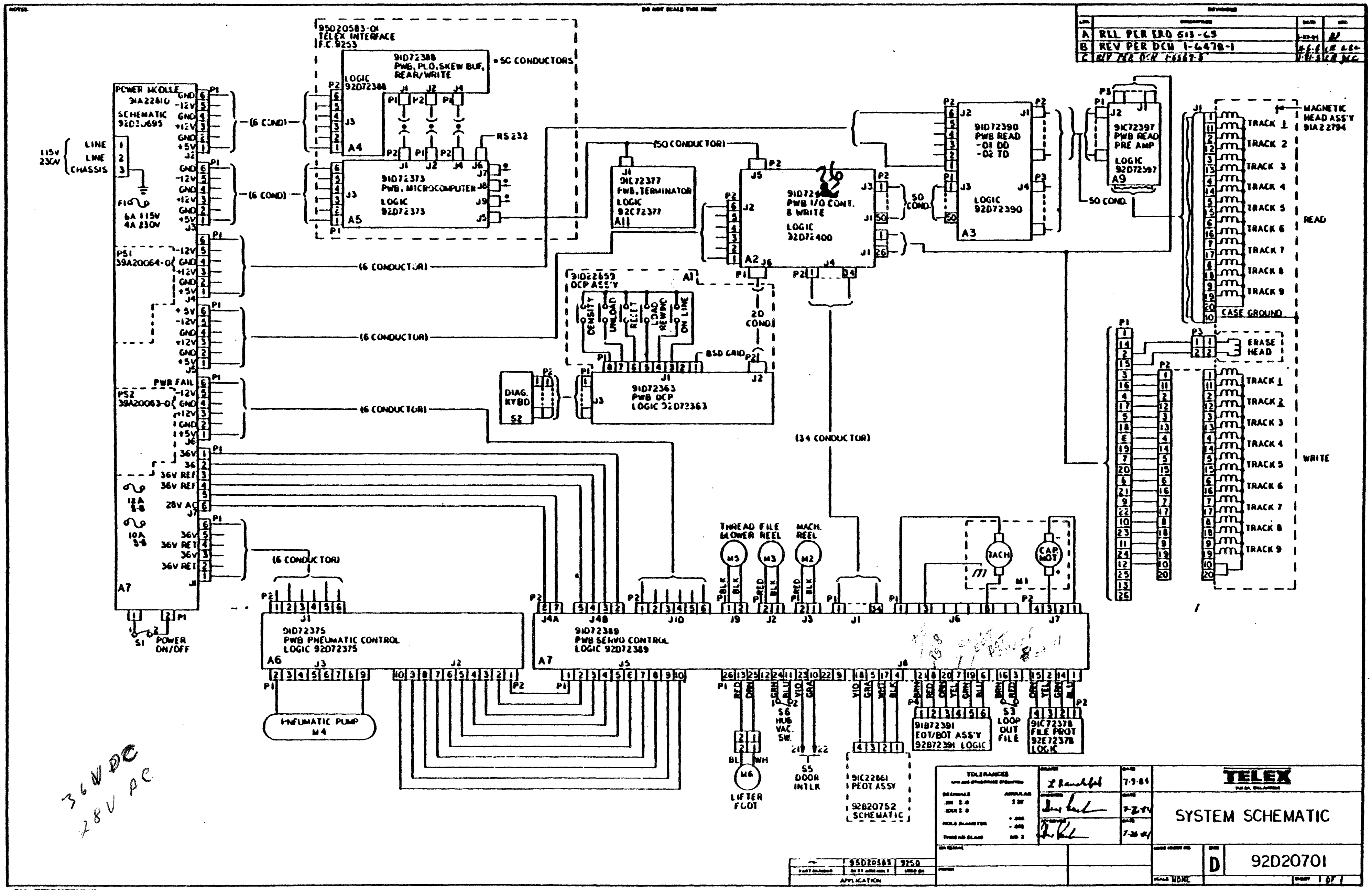
## 8.1 INDEX OF LOGIC & SCHEMATIC DRAWINGS (ENGINEERING DOCUMENTATION)

| Drawing No. | Sheets | Title - PWBA Description |
|---|---|---|
| 92D20701 | 1 | System Schematic |
| 92B20752 | 1 | Schematic Diagram PEOT ASSY |
| 92D20753~~ | 1 | Schematic, Power Supply (Power One) |
| 92D20754~~ | 1 | Schematic, Power Supply (Linear) |
| 92D72363 | 1 | OCP |
| 92D72373 (FC 9253)* | 14 | PWBA Microcomputer |
| 92D72375 | 2 | Pneumatic Control |
| 92D72377 | 1 | Terminator |
| 92B72378 | 1 | File Protect |
| 92D72385 (FC 9252)** | 14 | PWBA Microcomputer |
| 92D72387 (FC 2330)++ | 14 | PWBA Microcomputer |
| 92D72388 (FC 925X) | 18 | PWBA PLO, SKBUF, RD/WRT |
| 92D72389 | 11 | PWBA Servo Control |
| 92C72391 | 1 | EOT/BOT |
| 92D72397 | 1 | Read Preamp |
| 92D72399 | 13 | PWBA Read |
| 92D72406 | 23 | PWBA I/O Control & Write |
| 92D72416 (FC 9251)*** | 16 | PWBA Microcomputer |
| 92D72424 | 18 | PWBA Microcomputer |
| 91D72426 | 23 | PWBA,I/O Control & Write |
| 92D72427 (FC 2328)+++ | 14 | PWBA Microcomputer |

~~Note: Your tape unit has one of two models of Power One power supply. These units are interchangeable, however the old supply uses regulated and unregulated internal modules that may be removed and replaced whereas the new linear type power supply is a single field replaceable unit. Please note which power supply you have before beginning removal replacement procedures. The old supply is in a gold anodized case; the new supply is in a silver anodized case.

---

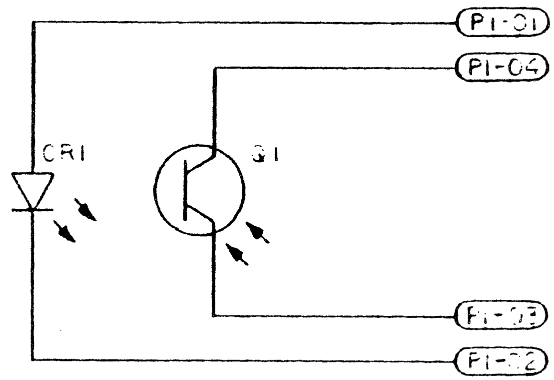
*Telex, **STC, ***Pertec ,++Pertec Dateline, +++Telex Perkin Elmer


DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 613-65
B REV PER DCN 1-6478-1
95D20583-01
TELEX INTERFACE
F.C. 9253
91D72388
PWB, PLO, SKEW BUF, READ/WRITE
LOGIC 92D72388
50 CONDUCTORS
91D72373
PWB, MICROCOMPUTER
LOGIC 92D72373
RS 232
POWER MODULE
91A22810
SCHEMATIC 92D20695
115V 230V
LINE
LINE
CHASSIS
6A 115V
4A 230V
PS1
39A20064-0
PS2
39A20063-0
PWR FAIL
(6 COND)
(6 CONDUCTOR)
(50 CONDUCTOR)
91C72377
PWB, TERMINATOR
LOGIC 92C72377
PWB I/O CONT. & WRITE
LOGIC 92D72400
50 COND.
91D72390
PWB READ
-01 DD
-02 TD
LOGIC 92D72390
91C72397
PWB READ PRE AMP
LOGIC 92D72397
MAGNETIC HEAD ASS'Y 91A22794
TRACK 1
TRACK 2
TRACK 3
TRACK 4
TRACK 5
TRACK 6
TRACK 7
TRACK 8
TRACK 9
CASE GROUND
READ
ERASE HEAD
WRITE
91D22659
OCP ASS'Y
DENSITY
UNLOAD
RESET
LOAD REWIND
ON LINE
20 COND
BSD GRID
91D72363
PWB OCP
LOGIC 92D72363
DIAG. KYBD
(34 CONDUCTOR)
36V
36V REF
28V AC
36V RET
12A S-B
10A S-B
POWER ON/OFF
THREAD BLOWER
FILE REEL
MACH. REEL
TACH
CAP. MOT
91D72375
PWB PNEUMATIC CONTROL
LOGIC 92D72375
91D72389
PWB SERVO CONTROL
LOGIC 92D72389
PNEUMATIC PUMP M4
LIFTER FOOT
S6 HUB VAC. SW.
S5 DOOR INTLK
91C22861
PEOT ASSY
92B20752 SCHEMATIC
91B72391
EOT/BOT ASS'Y
92B72391 LOGIC
S3 LOOP OUT FILE
91C72378
FILE PROT
92E72378
LOGIC
36VDC
28V AC
TOLERANCES
7-9-84
TELEX
SYSTEM SCHEMATIC
D
92D20701
95D20583
9250
APPLICATION
SCALE NONE
1 OF 1

NOTES

DO NOT SCALE THIS PRINT

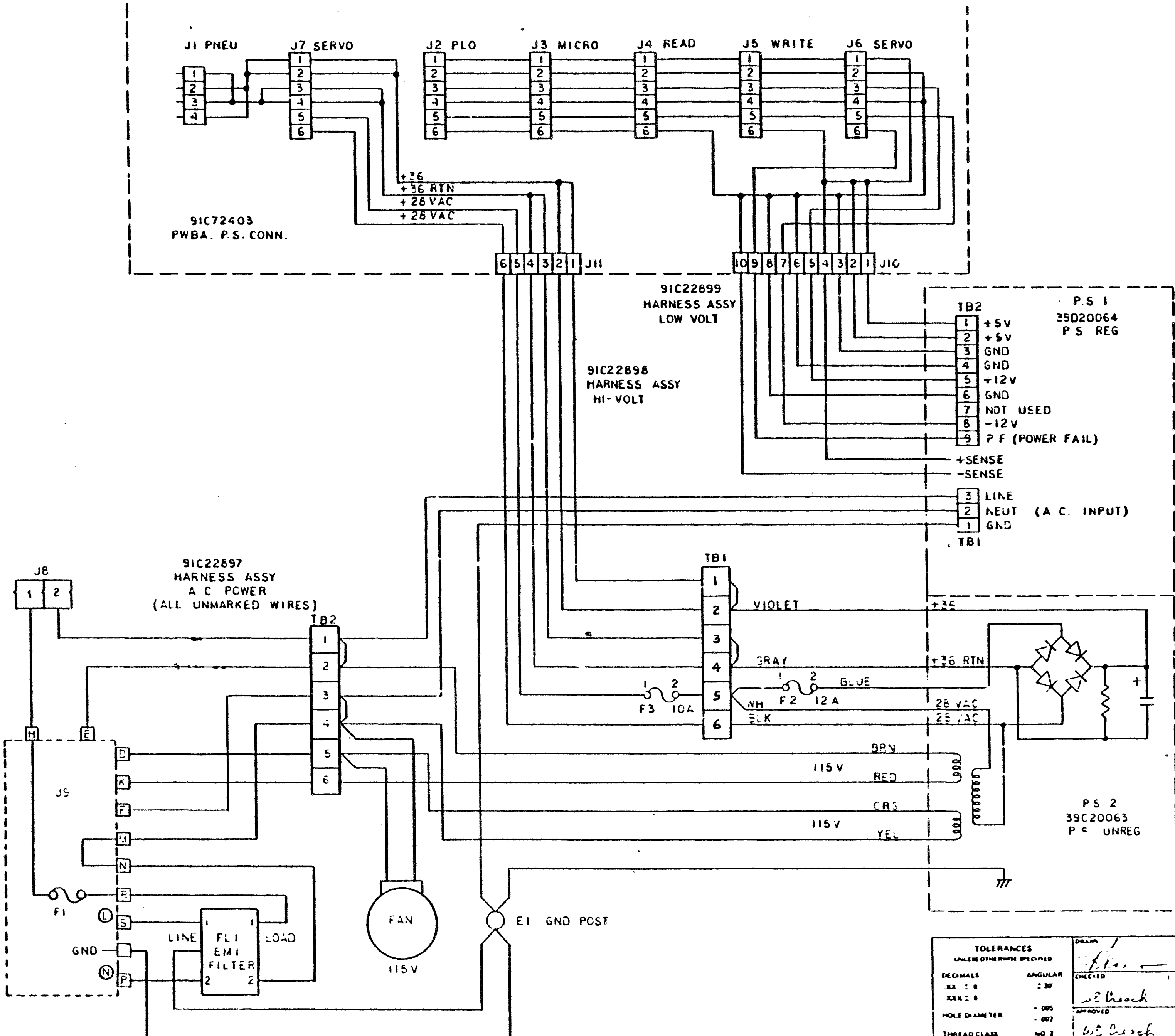
| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| A | REL PER ERC 513-93 | 11-6-4 | LR LEC |




| | | | |
|---|---|---|---|
| TOLERANCES<br>UNLESS OTHERWISE SPECIFIED<br>DECIMALS .XX ± .0 / .XXX ± .0 — ANGULAR ± 30'<br>HOLE DIAMETER +.005 −.002<br>THREAD CLASS NO. 2 | DRAWN | DATE 11-6-84 | TELEX<br>TULSA, OKLAHOMA<br>MAR 01 1985 |
| | CHECKED LR | DATE 11-8-4 | SCHEMATIC DIAGRAM<br>PEOT ASSY |
| | APPROVED W.E. Creech | DATE 11-8-4 | |

| PART NUMBER | NEXT ASSEMBLY | USED ON | MATERIAL | CODE IDENT NO | SIZE | |
|---|---|---|---|---|---|---|
| | [illegible] | [illegible] | FINISH | | B | 92E207[illegible]2 |
| APPLICATION | | | | SCALE ~ | | SHEET OF 1 |

11-8-17 PRINTED ON RIDGWAY B 1020




| LTR. | DESCRIPTION | DATE | APP. |
|---|---|---|---|
| A | REL PER ERO 513-97 | 12-7-84 | LK WEC |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0

ANGULAR ± 30'

HOLE DIAMETER + .005 - .002

THREAD CLASS NO 2

MATERIAL

FINISH

DRAWN

CHECKED W.E. Creach 11-30-84

APPROVED W.E. Creach 11-30-84

TELEX

TULSA OKLAHOMA

SCHEMATIC, P.S.

CODE IDENT NO

SIZE D 92D20753

SCALE —

SHEET

| PART NUMBER | NEXT ASSEMBLY | USED ON |
|---|---|---|
| | 91C22428 | |

APPLICATION

| LTR | DESCRIPTION | DATE | APP |
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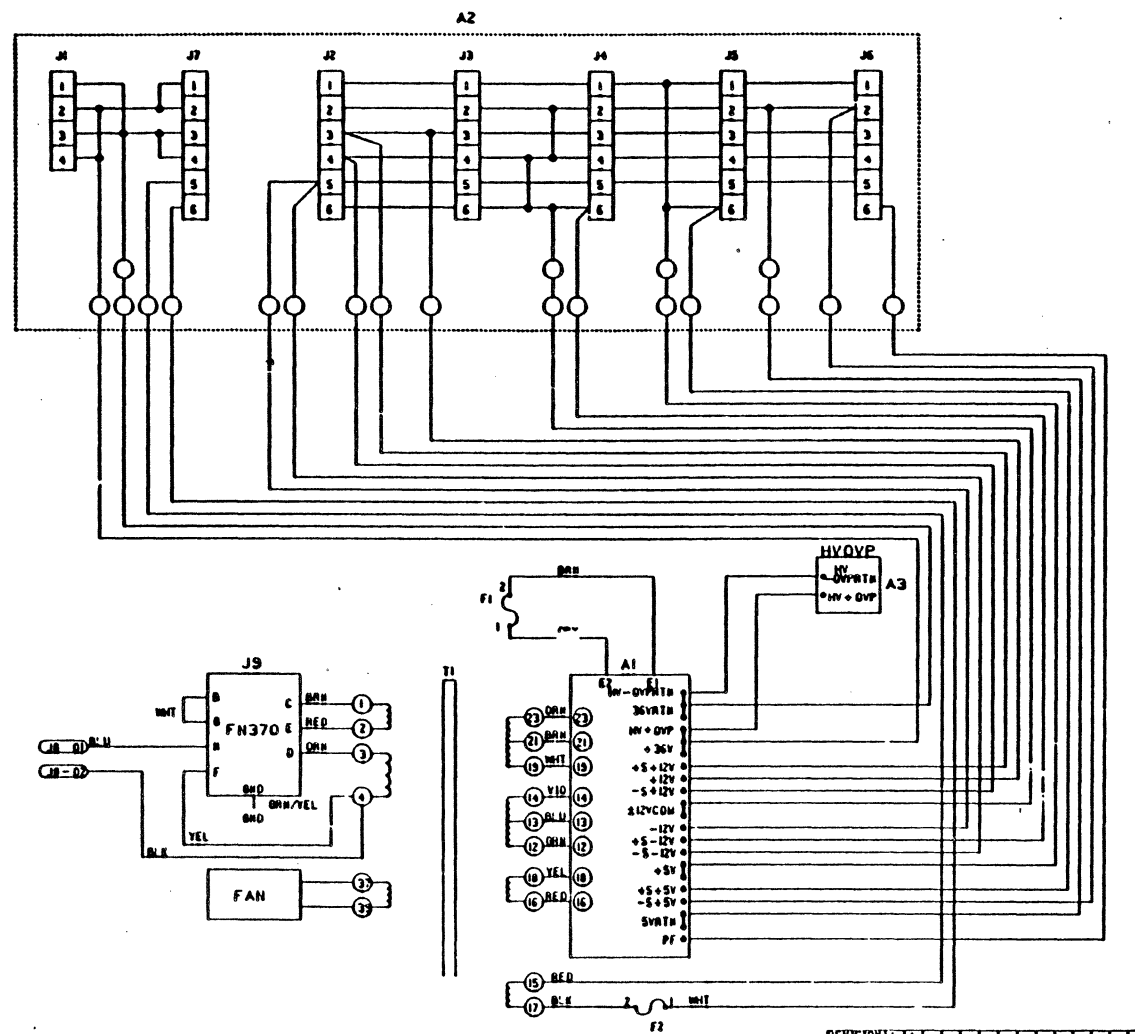



TOLERANCES

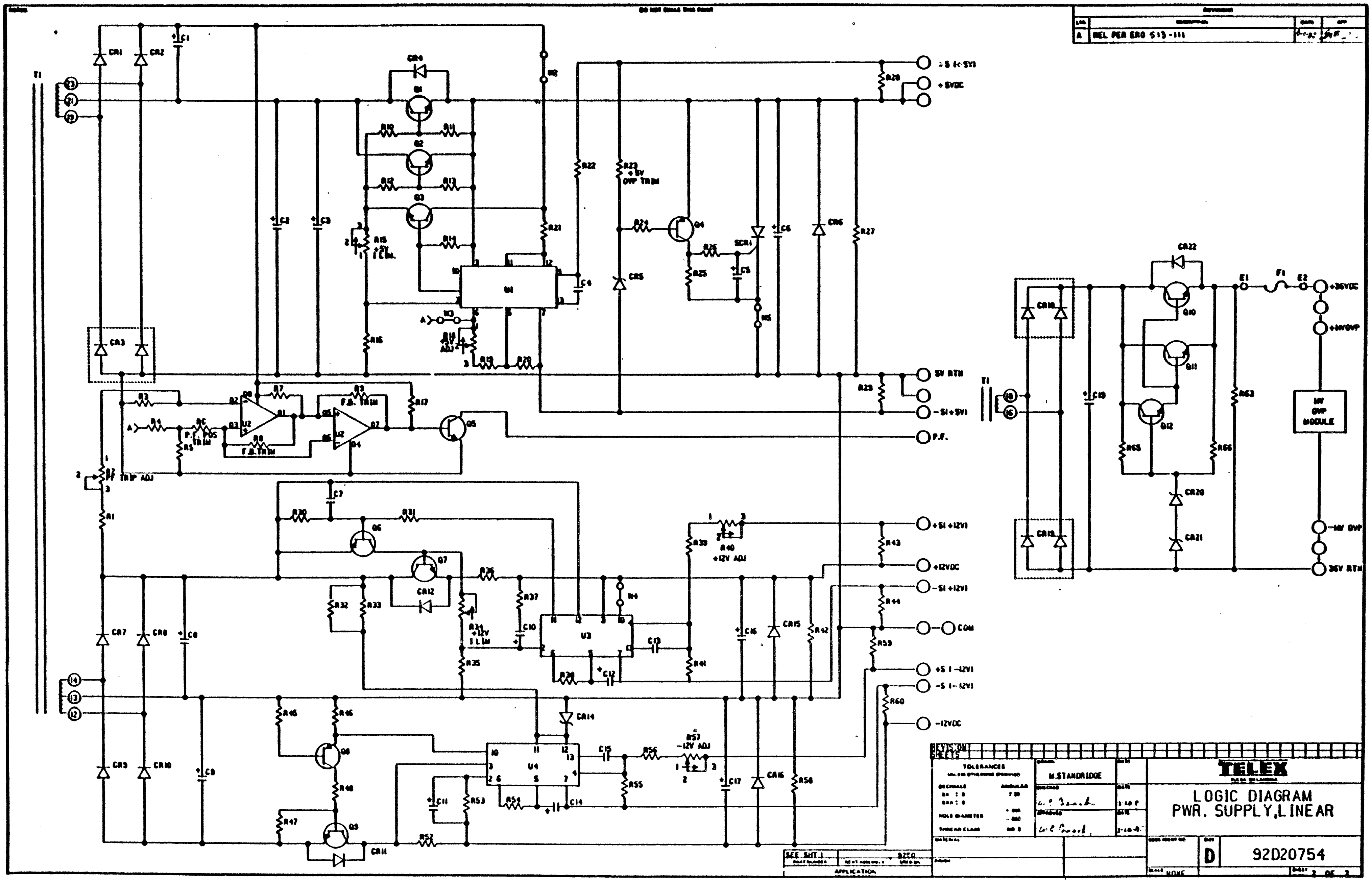
M.STANDRIDGE

TELEX

LOGIC DIAGRAM
PWR.SUPPLY,LINEAR

D 92D20754

APPLICATION




TELEX

# LOGIC DIAGRAM PWR. SUPPLY, LINEAR

M.STANDRIDGE

SEE SHT.1

APPLICATION

D

92D20754

SCALE NONE

SHEET 2 OF 2

NOTES:

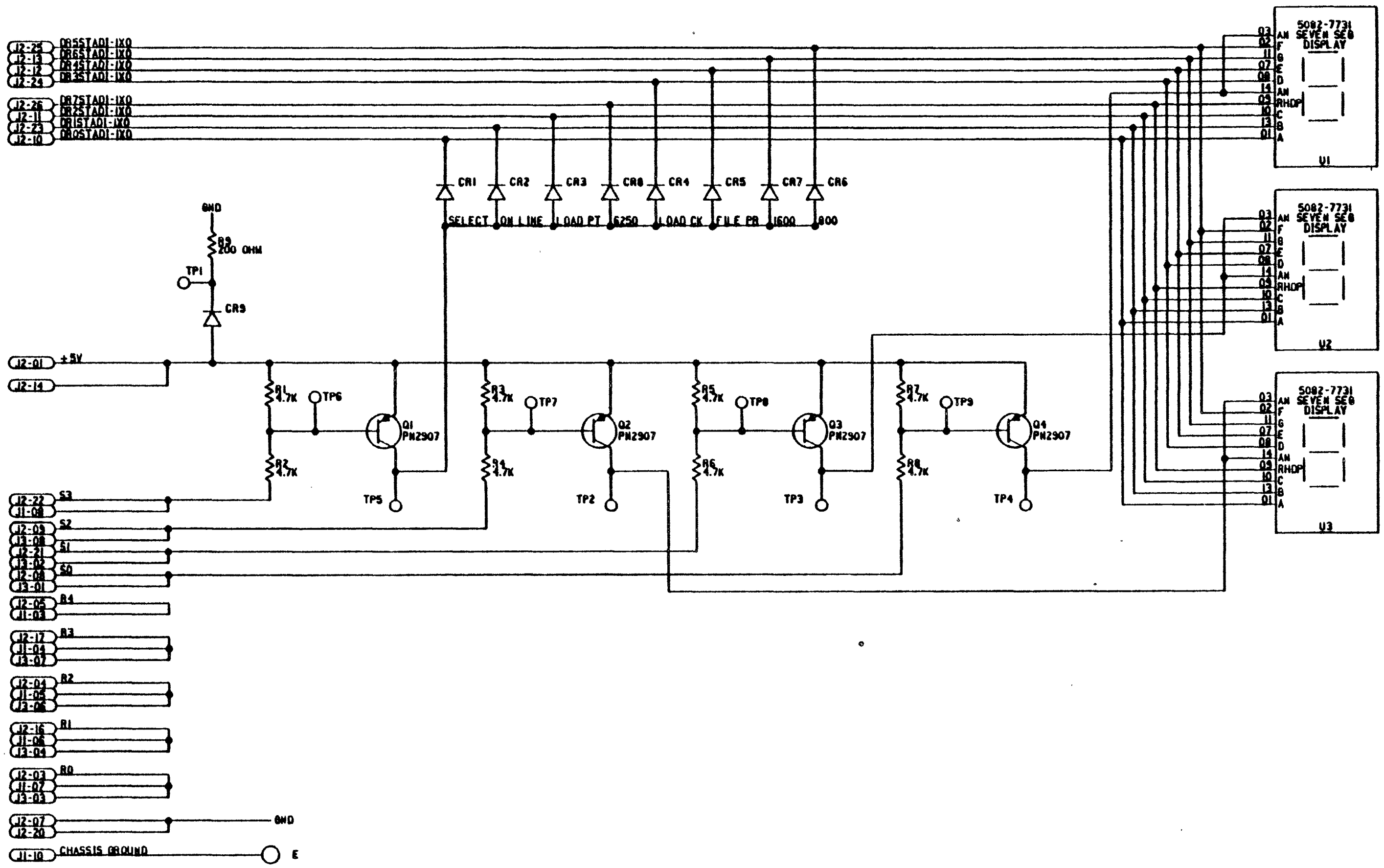
UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT.

DO NOT SCALE THIS PRINT

REVISIONS

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| E | REV PER DCN 1-6311 | | |




| | | |
|---|---|---|
| ASIC72363-0 | | 9250 |
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DRAWN C.V 5-15-4

CHECKED LR 5-16-4

TELEX

TULSA, OKLAHOMA

LOGIC DIAGRAM
OPER CONTROL PANEL

E 1-6311

SIZE D 92D72363

SCALE NONE

SHEET 1 OF 1

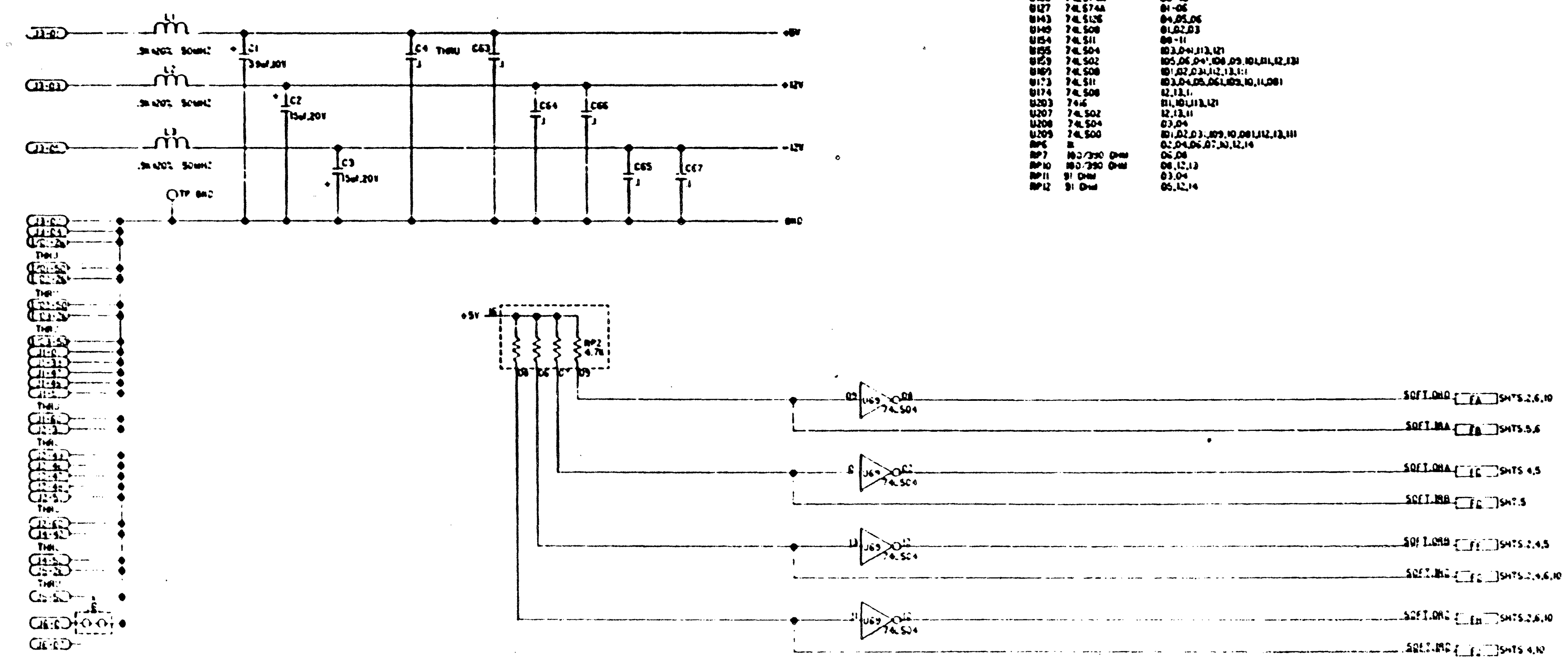
UNLESS OTHERWISE SPECIFIED

1. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
2. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
3. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED ⓐ ARE 1/8 WATT.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED ⓒ ARE 100 VOLTS.
6. JUMPERS ARE MADE IN ETCH ON THE CIRCUIT BOARD.
   (THESE ARE NOT COMPONENTS TO BE INSTALLED).
7. LOCATIONS SHOWN HAVE 24 PIN DIP INSTALLED INTO PINS 03-26 OF A 28 PIN SOCKET.

8. BOARDS BUILT ON "D-90" A/W HAVE PINS ON U162 AND U161-166 TIED TO +5V AND GND INSTEAD OF SOFT HIGH AND LOW.

9. -02 ASSY. (FC2303) WILL HAVE U07-11 DISCONNECTED FROM FFULL.0 AND CONNECTED TO FIFOUT.1 SEE SHEET 7

| REF DESIG | | SPARE |
|---|---|---|
| U10 | MC1489 | 09,10,08 |
| U31 | 7416 | 103,04,105,061,109,081 |
| U65 | 74LS32 | 01,02,03 |
| U71 | 74AS00 | 109,10,081,112,13,111 |
| U78 | 7416 | 101,021,103,041,011,101 |
| U86 | 74LS04 | 103,041,111,101 |
| U88 | 74LS08 | 12,13,11 |
| U89 | 74LS27 | 01,02,13,12 |
| U91 | 74LS10 | 01,02,13,12 |
| U94 | 7414 | 03,08 |
| U103 | 74LS32 | 104,05,061,109,10,081 |
| U105 | 74LS74A | 08-13 |
| U106 | 74LS74A | 08-13 |
| U127 | 74LS74A | 01-06 |
| U143 | 74LS126 | 04,05,06 |
| U149 | 74LS08 | 01,02,03 |
| U154 | 74LS11 | 08-11 |
| U155 | 74LS04 | 103,041,113,121 |
| U159 | 74LS02 | 105,06,041,108,09,101,111,12,131 |
| U169 | 74LS08 | 101,02,031,112,13,111 |
| U173 | 74LS11 | 103,04,05,061,109,10,11,081 |
| U174 | 74LS08 | 12,13,11 |
| U203 | 7416 | 111,101,113,121 |
| U207 | 74LS02 | 12,13,11 |
| U208 | 74LS04 | 03,04 |
| U209 | 74LS00 | 101,02,03,109,10,081,112,13,111 |
| RP6 | 1K | 02,04,06,07,10,12,14 |
| RP7 | 180/390 OHM | 06,08 |
| RP10 | 180/390 OHM | 08,12,13 |
| RP11 | 91 OHM | 03,04 |
| RP12 | 91 OHM | 05,12,14 |




REFERENCE DESIGNATION

| NOT USED | LAST USED |
|---|---|
| U20,46,80,97,101,102,124, 112,117,118,120,139,141,144, 171,172,177-199,212. | U214 |
| C66-89 | C93 |
| RP9 | R4 |
| | CR4 |
| | L3 |
| | S4 |
| | J16 |
| | RP12 |

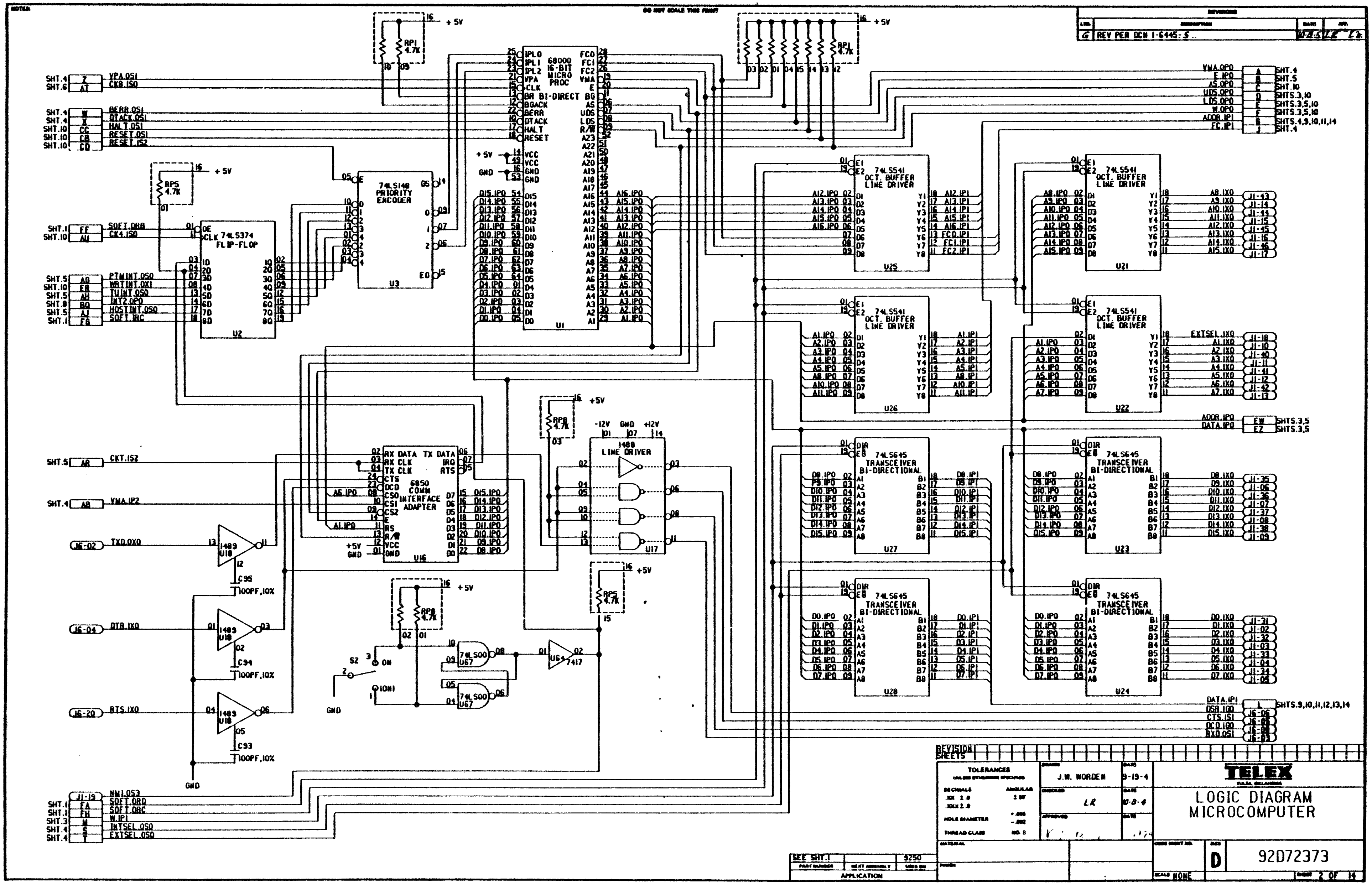
W910 72373-01
D910 72373-02

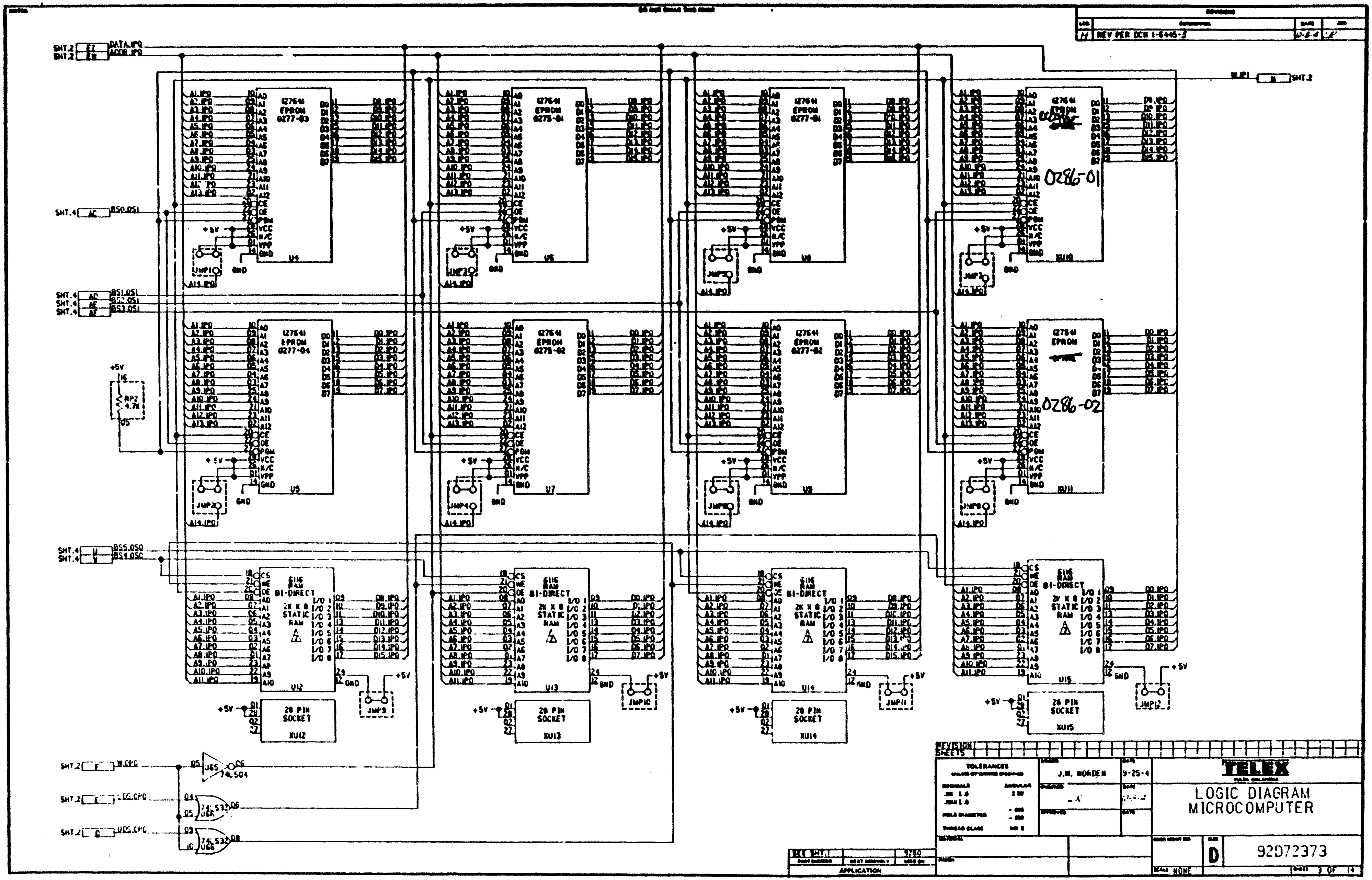
TELEX

J.W. WONDER

LOGIC DIAGRAM
MICROCOMPUTER

D 93D72373


DO NOT SCALE THIS PRINT
REVISIONS
G REV PER DCN 1-6445
68000 16-BIT MICRO PROC
74LS148 PRIORITY ENCODER
74LS374 FLIP-FLOP
6850 COMM INTERFACE ADAPTER
1488 LINE DRIVER
74LS541 OCT. BUFFER LINE DRIVER
74LS645 TRANSCEIVER BI-DIRECTIONAL
TELEX
J.W. WORDEN
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
9250
APPLICATION
D
92D72373
SCALE NONE
SHEET 2 OF 14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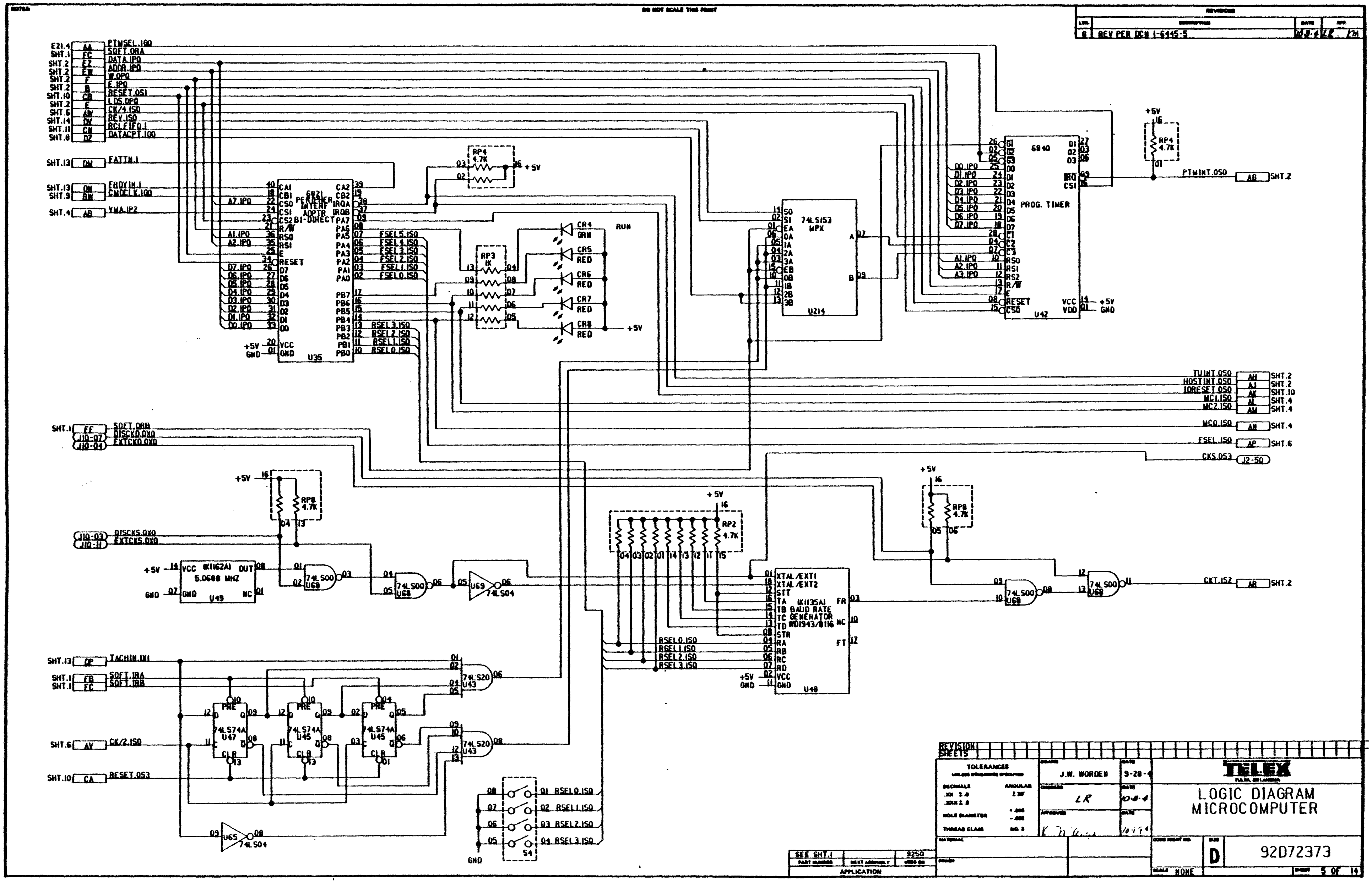
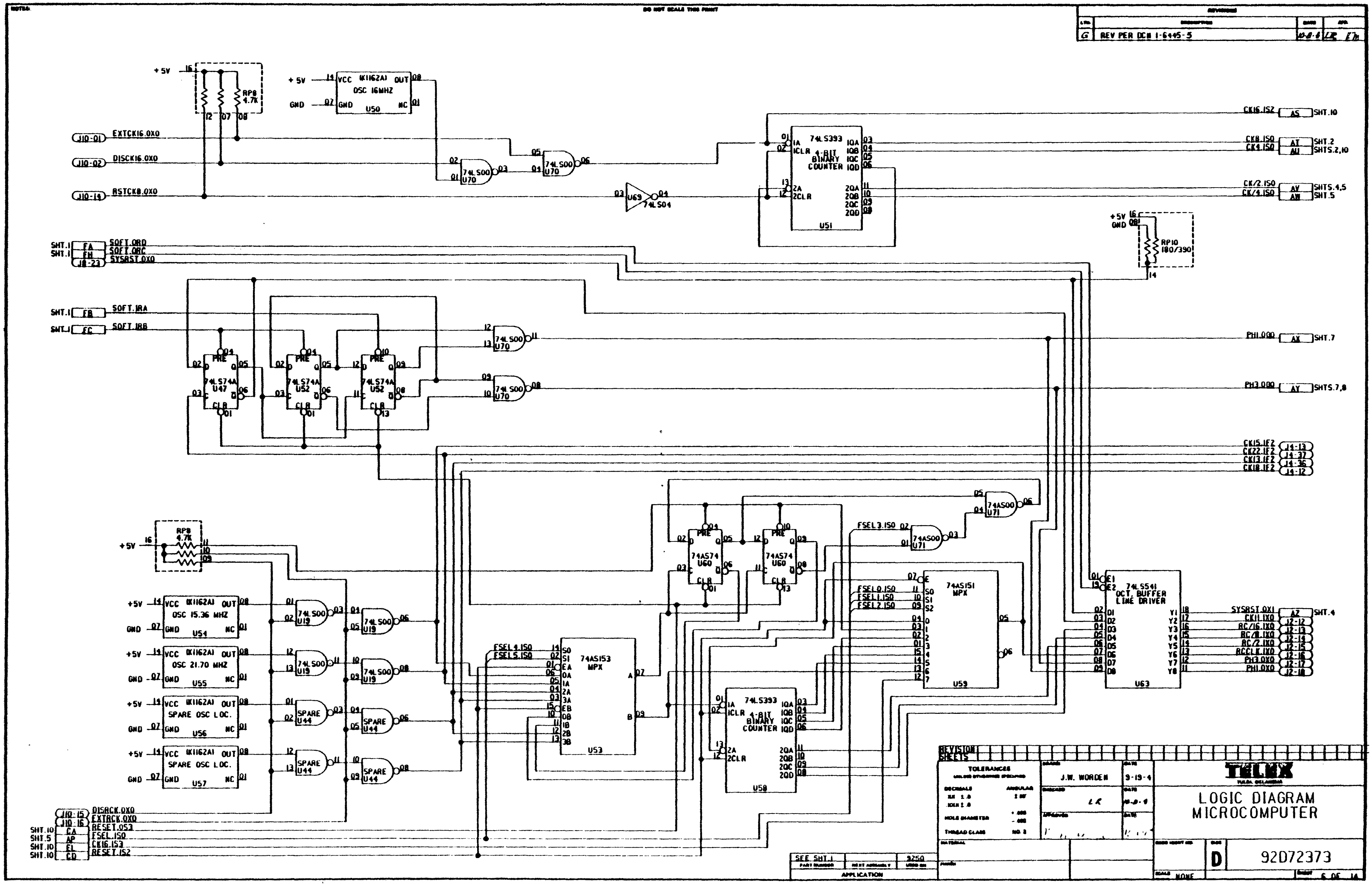
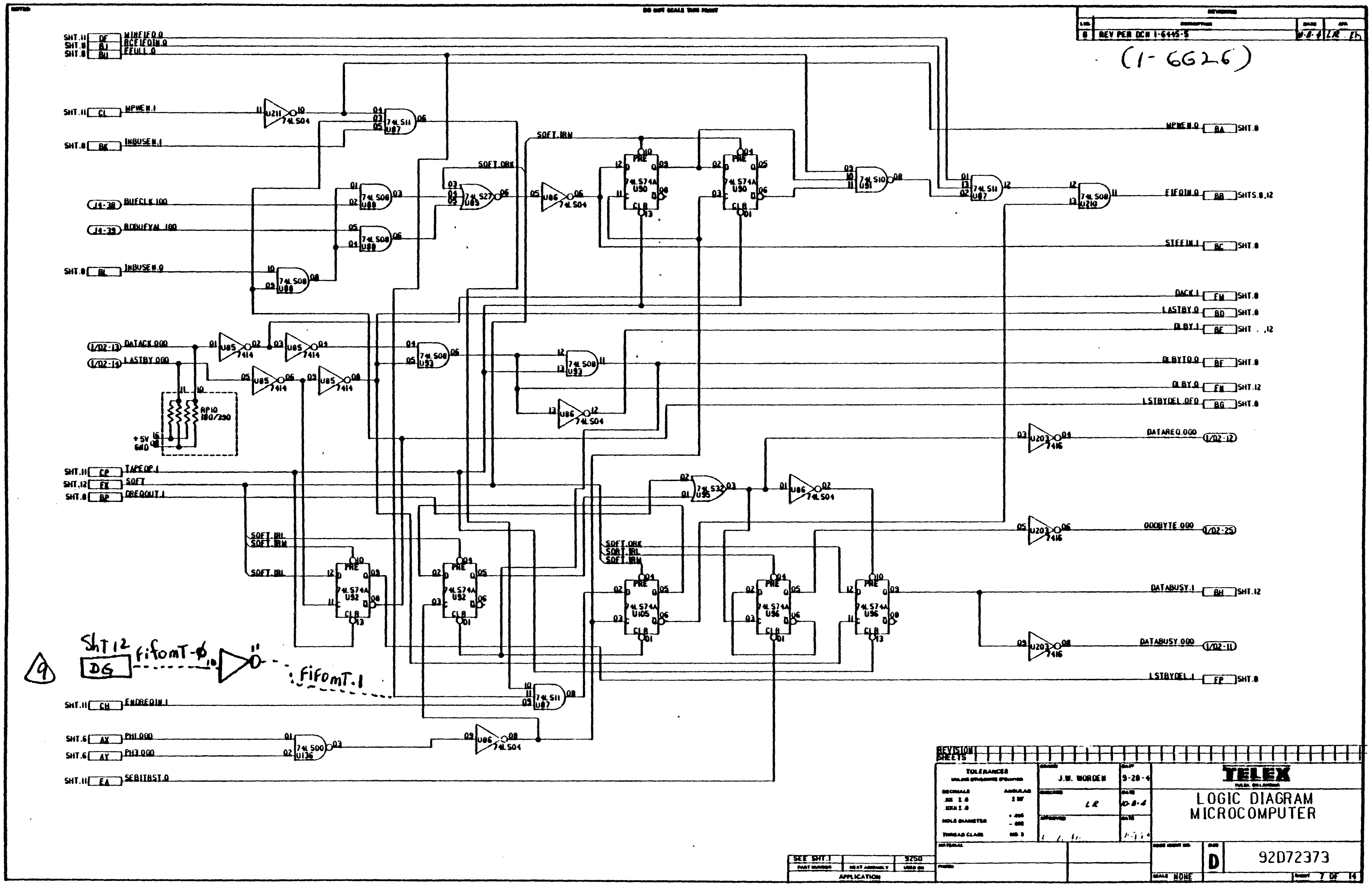
27641 EPROM 0275-01
27641 EPROM 0277-01
0286-01
27641 EPROM 0277-04
27641 EPROM 0275-02
27641 EPROM 0277-02
0286-02
6116 RAM BI-DIRECT 2K X 8 STATIC RAM
28 PIN SOCKET
74LS04
74LS32
J.W. WORDEN
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
92072373
SHEET 3 OF 14
SCALE NONE


DO NOT SCALE THIS PRINT
REVISIONS
G REV PER DCN 1-6445-5
PTMSEL.IGO
SOFT.ORA
DATA.IPO
ADDR.IPO
W.OPO
E.IPO
RESET.OSI
LDS.OPO
CK/4.ISO
REV.ISO
RCLFIFO.I
DATACPT.IGO
FATTN.I
FRDYIN.I
CMDCLK.IGO
VMA.IP2
6821 PERIPHERAL INTERF ADPTR BI-DIRECT
U35
74LS153 MPX
U214
6840 PROG. TIMER
U42
PTMINT.OSO
RP4 4.7K
RP3 1K
CR4 GRN
CR5 RED
CR6 RED
CR7 RED
CR8 RED
RUN
FSEL5.ISO
FSEL4.ISO
FSEL3.ISO
FSEL2.ISO
FSEL1.ISO
FSEL0.ISO
RSEL3.ISO
RSEL2.ISO
RSEL1.ISO
RSEL0.ISO
TUINT.OSO
HOSTINT.OSO
IORESET.OSO
MC1.ISO
MC2.ISO
MCO.ISO
FSEL.ISO
CKS.OS3
SOFT.ORB
DISCKD.OXO
EXTCKD.OXO
DISCKS.OXO
EXTCKS.OXO
RP8 4.7K
RP2 4.7K
8K1162A1 5.0688 MHZ
U49
74LS00 U68
74LS04 U69
8K1135A1 BAUD RATE GENERATOR WD1943/8116
U48
CKT.IS2
TACHIN.IXI
SOFT.IRA
SOFT.IRB
CK/2.ISO
RESET.OS3
74LS74A U47
74LS74A U45
74LS20 U43
74LS04 U65
S4
GND
+5V
TOLERANCES
J.W. WORDEN
9-28-4
LR
10-8-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
9250
APPLICATION
D
92D72373
NONE
5 OF 14


DO NOT SCALE THIS PRINT
G REV PER DC# 1-6445-5
+5V RP8 4.7K
+5V VCC (K1162A) OUT OSC 16MHZ GND NC U50
J10-01 EXTCK16.0X0
J10-02 DISCK16.0X0
J10-14 ASTCK8.0X0
74LS00 U70
74LS04 U69
74LS393 4-BIT BINARY COUNTER U51
CK16.1S2 AS SHT.10
CK8.1S0 AT SHT.2
CK4.1S0 AU SHTS.2,10
CK/2.1S0 AV SHTS.4,5
CK/4.1S0 AW SHT.5
+5V GND RP10 180/390
SHT.1 FA SOFT.ORD
SHT.1 FH SOFT.ORC
J8-23 SYSRST.0X0
SHT.1 FB SOFT.IRA
SHT.1 FC SOFT.IRB
74LS74A U47
74LS74A U52
PH1.000 AX SHT.7
PH3.000 AY SHTS.7,8
CK15.1F2 J4-13
CK22.1F2 J4-37
CK13.1F2 J4-36
CK18.1F2 J4-12
74AS00 U71
74AS74 U60
FSEL3.1S0
+5V RP8 4.7K
+5V VCC (K1162A) OUT OSC 15.36 MHZ GND NC U54
+5V VCC (K1162A) OUT OSC 21.70 MHZ GND NC U55
+5V VCC (K1162A) OUT SPARE OSC LOC. GND NC U56
+5V VCC (K1162A) OUT SPARE OSC LOC. GND NC U57
74LS00 U19
SPARE U44
FSEL4.1S0
FSEL5.1S0
74AS153 MPX U53
FSEL0.1S0
FSEL1.1S0
FSEL2.1S0
74AS151 MPX U59
74LS393 4-BIT BINARY COUNTER U58
74LS541 OCT. BUFFER LINE DRIVER U63
SYSRST.0X1 AZ SHT.4
CK11.1X0 J2-12
RC/16.1X0 J2-13
RC/8.1X0 J2-14
RC/2.1X0 J2-15
RCCLK.1X0 J2-16
PH3.0X0 J2-17
PH1.0X0 J2-18
J10-15 DISACK.0X0
J10-16 EXTACK.0X0
SHT.10 CA RESET.0S3
SHT.5 AP FSEL.1S0
SHT.10 E1 CK16.1S3
SHT.10 CD RESET.1S2
REVISION SHEETS
TOLERANCES
J.W. WORDEN 9-19-4
LR
TELEX
LOGIC DIAGRAM MICROCOMPUTER
SEE SHT.1 9250
PART NUMBER NEXT ASSEMBLY USED ON
APPLICATION
D 92D72373
SCALE NONE
SHEET 6 OF 14




TELEX

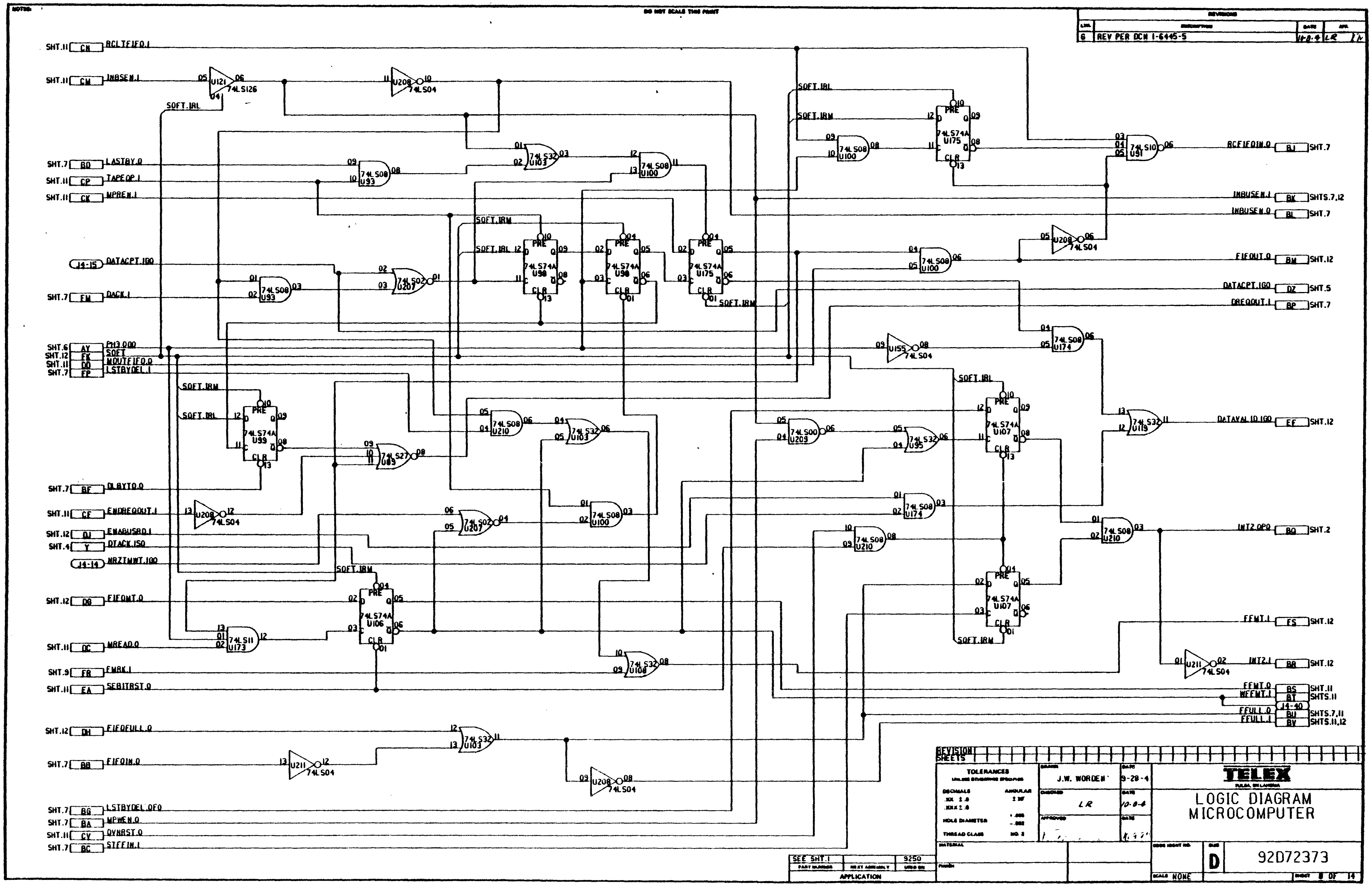
LOGIC DIAGRAM
MICROCOMPUTER

J.W. WORDEN

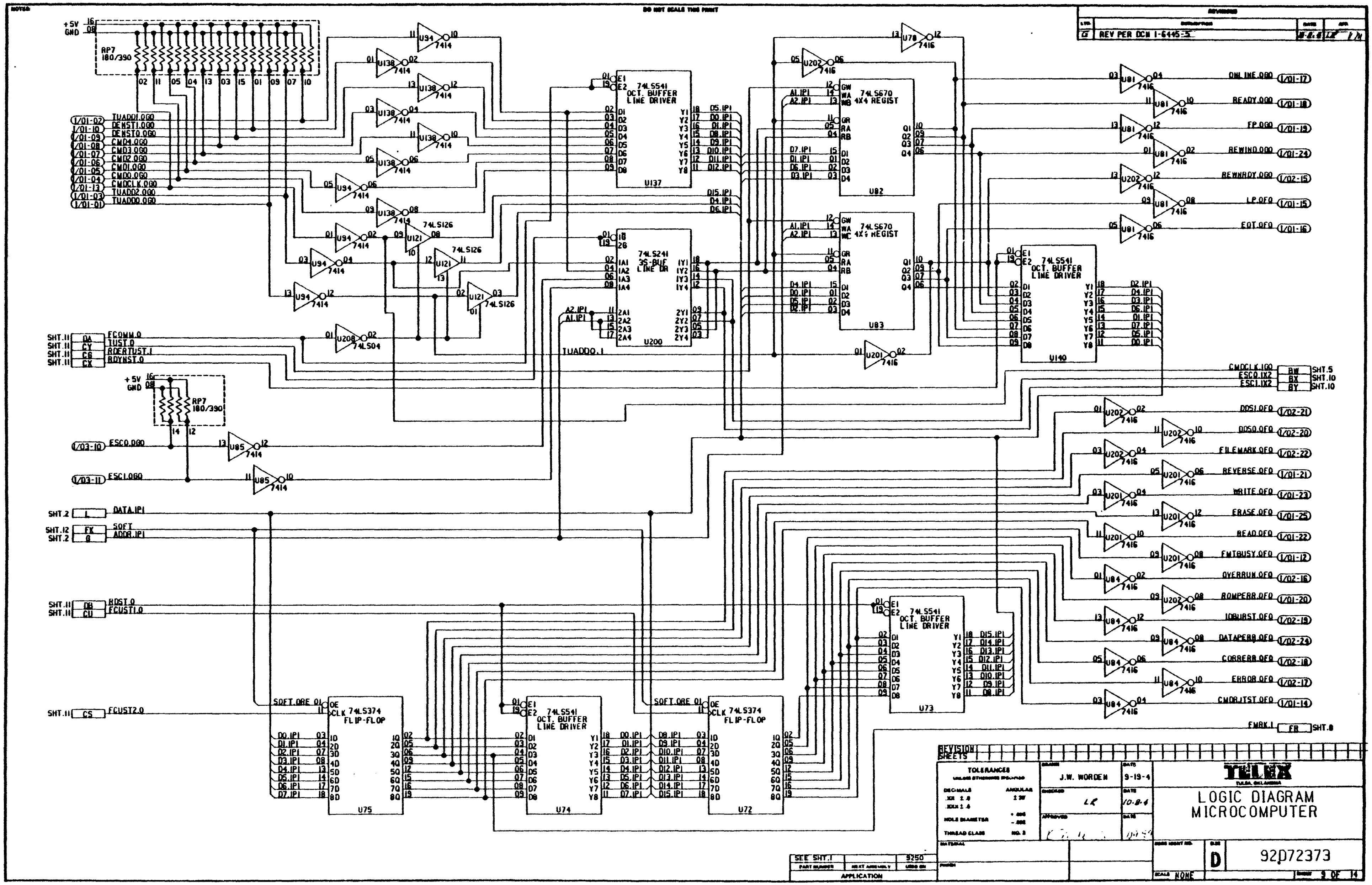
D 92D72373

SHEET 7 OF 14

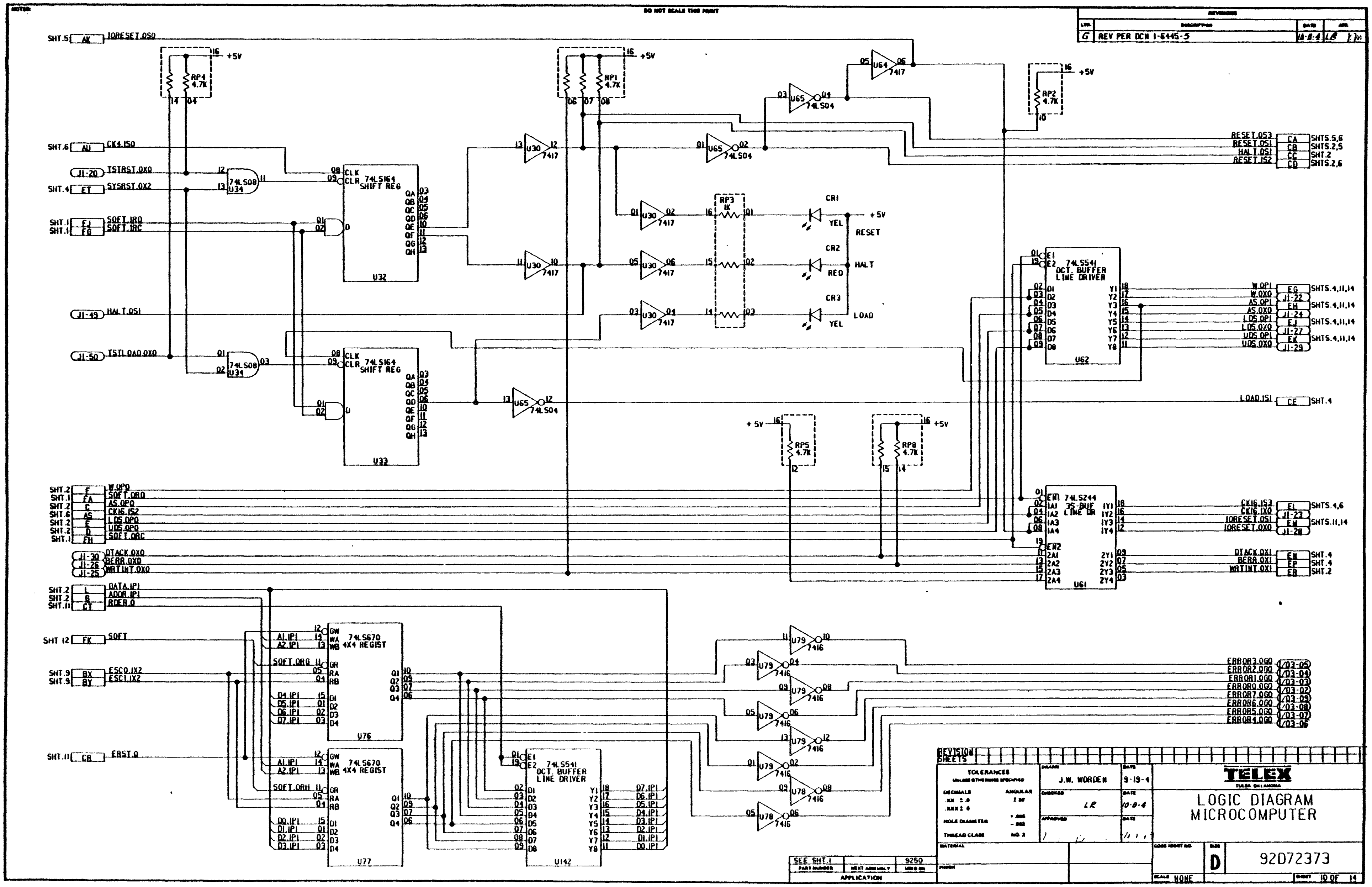
SCALE NONE

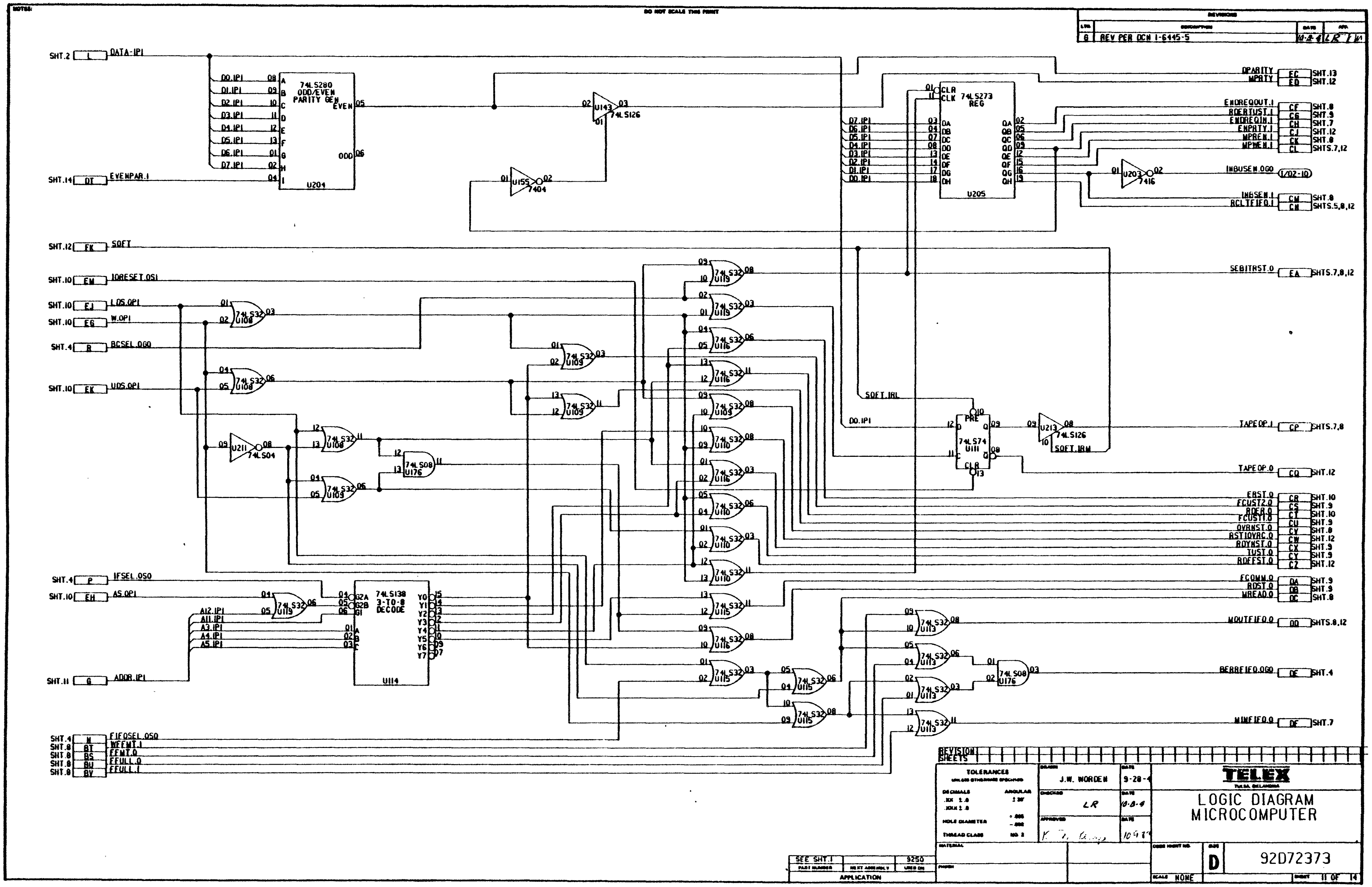


DO NOT SCALE THIS PRINT
REVISIONS
6 REV PER DCN 1-6445-5
RCLTFIFO.I
INBSEN.I
SOFT.IRL
SOFT.IRM
LASTBY.0
TAPEOP.I
MPREN.I
DATACPT.I00
DACK.I
PH3.000
SOFT
MOUTFIFO.0
LSTBYDEL.I
DLBYTO.0
ENDREQOUT.I
ENABUSRD.I
DTACK.IS0
NRZIMWT.I00
FIFOMT.0
MREAD.0
FMRK.I
SEBITRST.0
FIFOFULL.0
FIFOIN.0
LSTBYDEL.OF0
MPWEN.0
OVNRST.0
STFFIN.I
RCFIFOIN.0
INBUSEN.I
INBUSEN.0
FIFOUT.0
DATACPT.I00
DREQOUT.I
DATAVAL.ID.I00
INT2.OP0
FFMT.I
INT2.I
FFMT.0
WFFMT.I
FFULL.0
FFULL.I
TOLERANCES
J.W. WORDEN
9-29-4
LR
10-8-4
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
9250
APPLICATION
D
92D72373
NONE
8 OF 14



DO NOT SCALE THIS PRINT
REV PER DCN 1-6445-5
74LS541 OCT. BUFFER LINE DRIVER
U137
74LS670 4X4 REGIST
U82
U83
74LS241 3S-BUF LINE DR
U200
U140
U73
74LS374 FLIP-FLOP
U75
U74
U72
SEE SHT.1
9250
APPLICATION
TOLERANCES
J.W. WORDEN
9-19-4
10-8-4
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72373
SCALE NONE
SHEET 3 OF 14


DO NOT SCALE THIS PRINT
REVISIONS
G REV PER DCN 1-6445-5
74LS164 SHIFT REG U32
74LS164 SHIFT REG U33
74LS08 U34
U30 7417
U65 74LS04
U64 7417
RP1 4.7K
RP2 4.7K
RP3 1K
RP4 4.7K
RP5 4.7K
RP8 4.7K
CR1 YEL RESET
CR2 RED HALT
CR3 YEL LOAD
+5V
74LS541 OCT. BUFFER LINE DRIVER U62
74LS244 3S-BUF LINE DR U61
74LS670 4X4 REGIST U76
74LS670 4X4 REGIST U77
74LS541 OCT. BUFFER LINE DRIVER U142
U78 7416
U79 7416
IORESET.0S0
CK4.1S0
TSTRST.0X0
SYSRST.0X2
SOFT.1RD
SOFT.1RC
HALT.0S1
TSTLOAD.0X0
RESET.0S3
RESET.0S1
HALT.0S1
RESET.1S2
LOAD.1S1
W.OP1
W.0X0
AS.OP1
AS.0X0
LDS.OP1
LDS.0X0
UDS.OP1
UDS.0X0
CK16.1S3
CK16.1X0
IORESET.0S1
IORESET.0X0
DTACK.0X1
BERR.0X1
WRTINT.0X1
W.OP0
SOFT.ORD
AS.OP0
CK16.1S2
LDS.OP0
UDS.OP0
SOFT.ORC
DTACK.0X0
BERR.0X0
WRTINT.0X0
DATA.1P1
ADDR.1P1
RDER.0
SOFT
ESC0.1X2
ESC1.1X2
ERST.0
ERROR3.0G0
ERROR2.0G0
ERROR1.0G0
ERROR0.0G0
ERROR7.0G0
ERROR6.0G0
ERROR5.0G0
ERROR4.0G0
TOLERANCES
J.W. WORDEN
9-19-4
LR
10-8-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
9250
APPLICATION
D
92D72373
NONE
10 OF 14

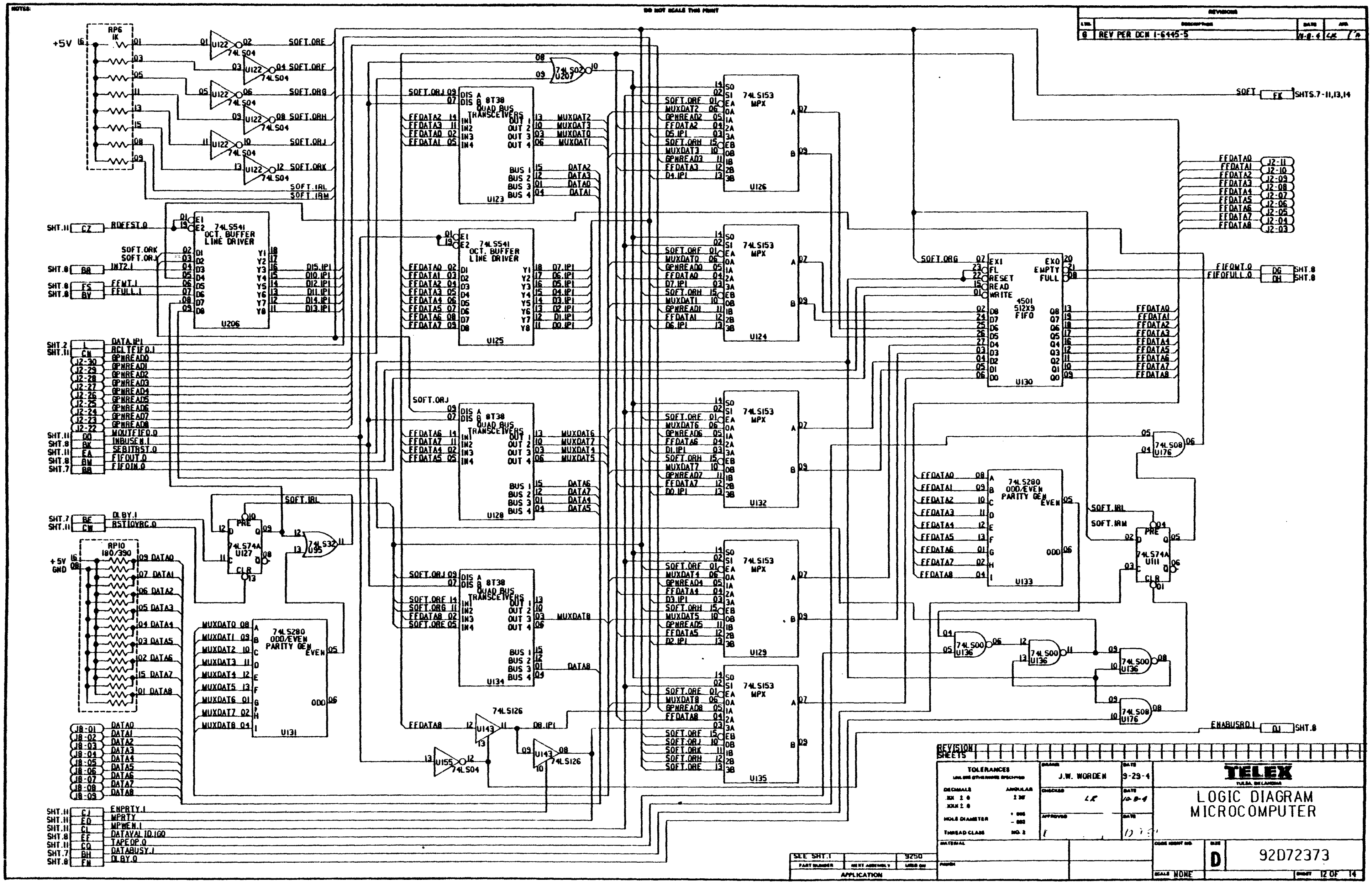



REVISION
SHEETS

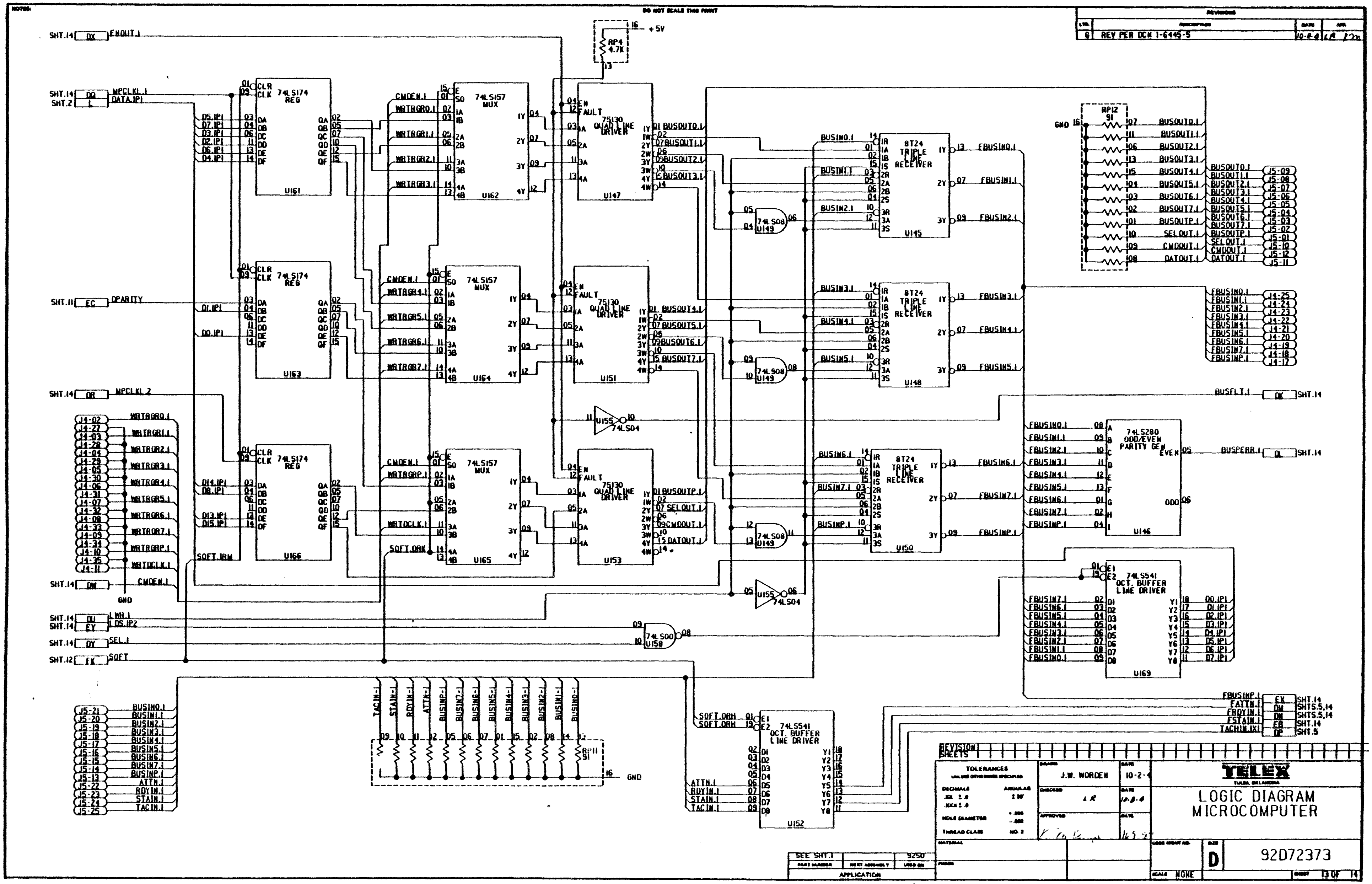
| | | | |
|---|---|---|---|
| TOLERANCES | DRAWN J.W. WORDEN | 9-28-4 | TELEX TULSA, OKLAHOMA |
| | CHECKED LR | 10-8-4 | LOGIC DIAGRAM MICROCOMPUTER |
| | APPROVED | | |

SEE SHT.1 — 9250
PART NUMBER — NEXT ASSEMBLY — USED ON
APPLICATION

SIZE D — 92D72373
SCALE NONE — SHEET 11 OF 14



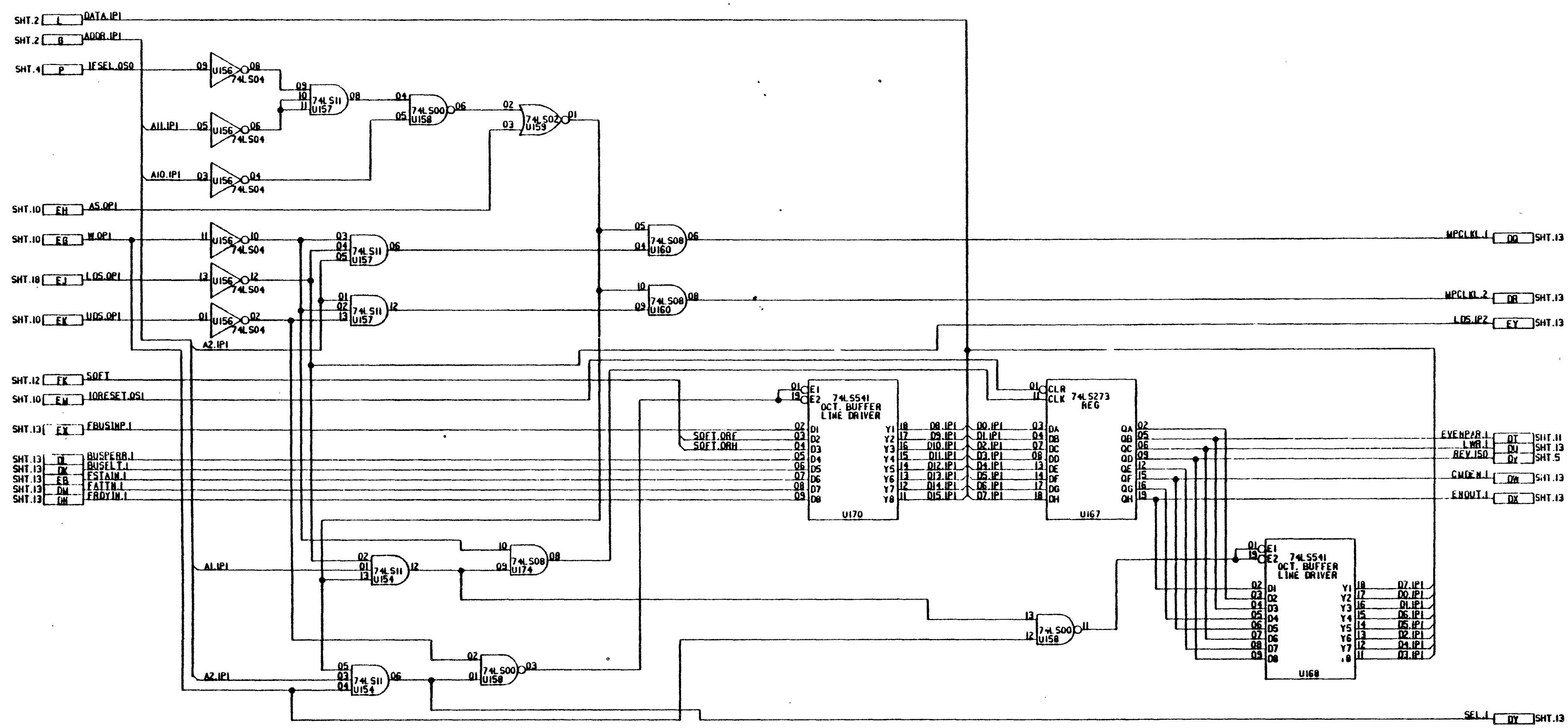
LOGIC DIAGRAM
MICROCOMPUTER
TELEX
J.W. WORDEN
9-29-4
92D72373
D
SHEET 12 OF 14
REV PER DCN 1-6445-5
DO NOT SCALE THIS PRINT


DO NOT SCALE THIS PRINT
REVISIONS
G REV PER DCN 1-6445-5
TOLERANCES
J.W. WORDEN
10-2-
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72373
SEE SHT.1
9250
APPLICATION
NONE
13 OF 14

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR. | DESCRIPTION | DATE | APP. |
| G | REV PER DCN 1-6445-5 | 10-8-4 | LR |




| REVISION | |
|---|---|
| SHEETS | |

| TOLERANCES UNLESS OTHERWISE SPECIFIED | | DRAWN | DATE |
|---|---|---|---|
| DECIMALS XX ± .X XXX ± .0 | ANGULAR ± 30' | J.W. WORDEN | 10-2-4 |
| HOLE DIAMETER | + .005 - .003 | CHECKED LR | 10-8-4 |
| THREAD CLASS | NO. 2 | APPROVED | |

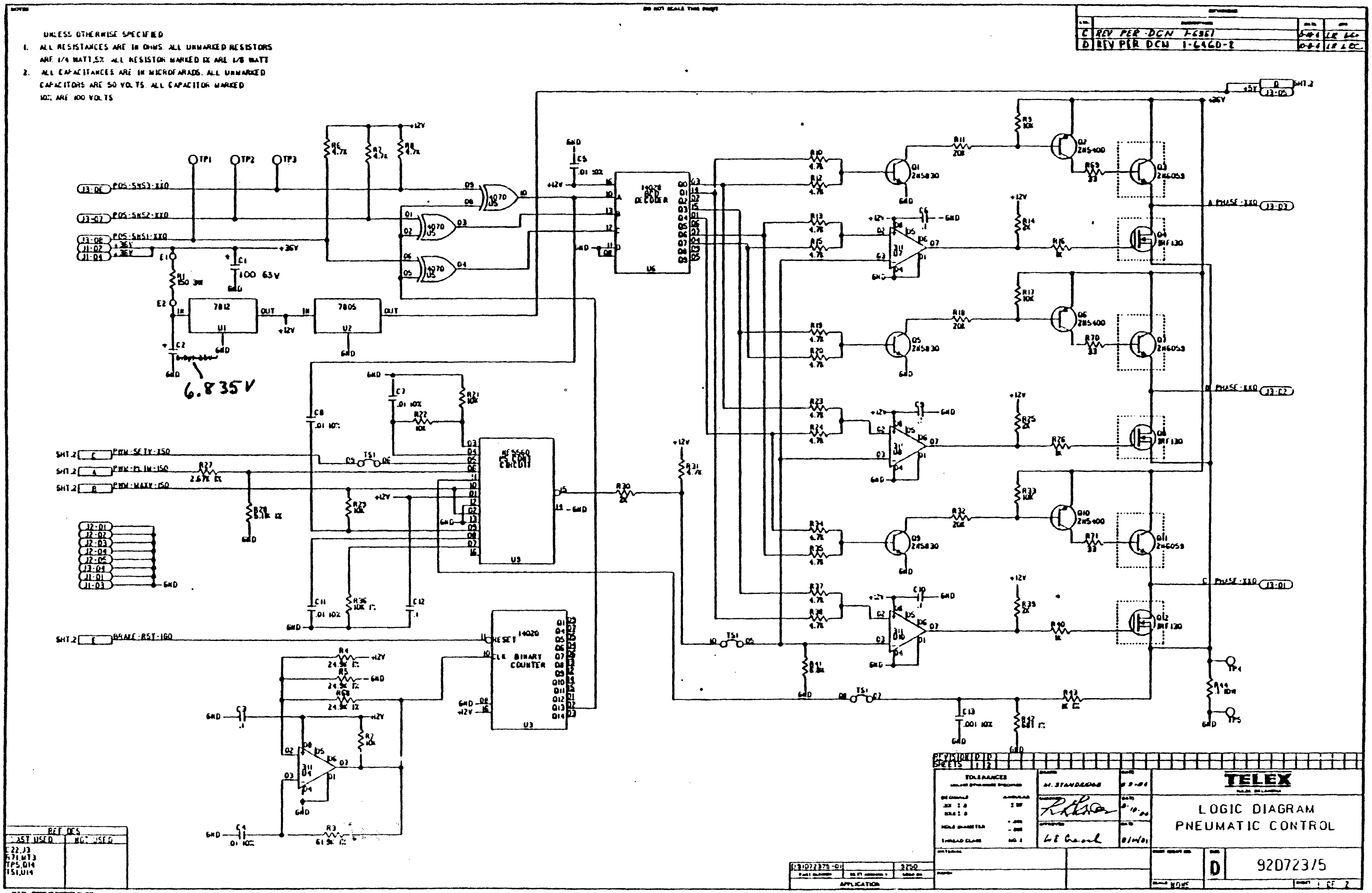
TELEX
TULSA, OKLAHOMA

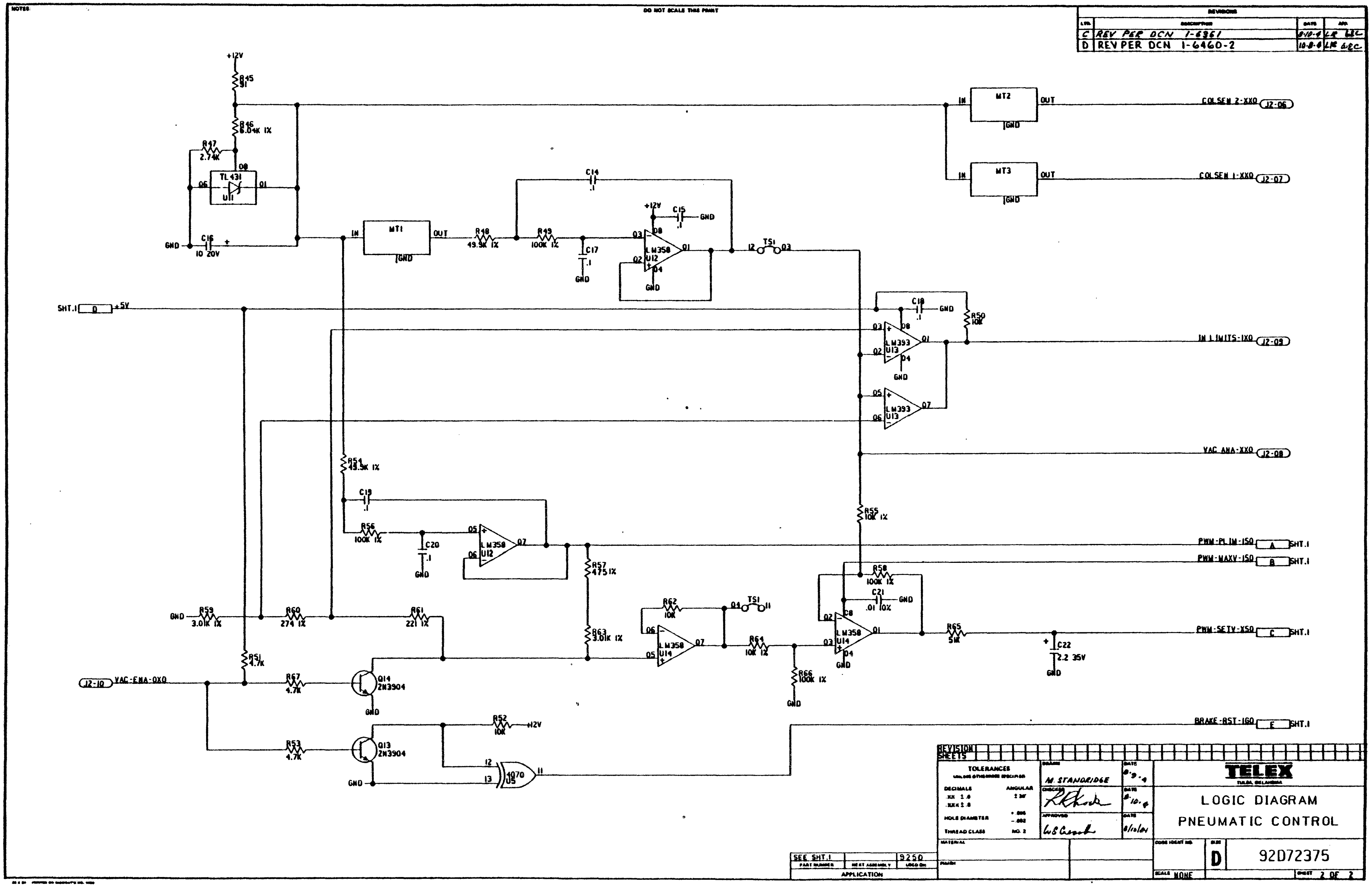
# LOGIC DIAGRAM MICROCOMPUTER

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

SIZE D — 92D72373

SCALE NONE — SHEET 14 OF 14


UNLESS OTHERWISE SPECIFIED
1. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT,5%. ALL RESISTOR MARKED 1% ARE 1/8 WATT
2. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS. ALL CAPACITOR MARKED 10% ARE 100 VOLTS
C REV PER DCN F-6961
D REV PER DCN I-6460-E
POS-SNS3-XX0
POS-SNS2-XX0
POS-SNS1-XX0
14028 BCD DECODER
7812
7805
6.835V
PWM-SETX-150
PWM-MLIM-150
PWM-MAXV-150
BRAKE-RST-160
14020 BINARY COUNTER
A PHASE-XX0
B PHASE-XX0
C PHASE-XX0
REF DES
LAST USED
NOT USED
C22,J3
R71,MT3
TP5,Q14
TS1,U14
TELEX
LOGIC DIAGRAM
PNEUMATIC CONTROL
D
92D72375
APPLICATION



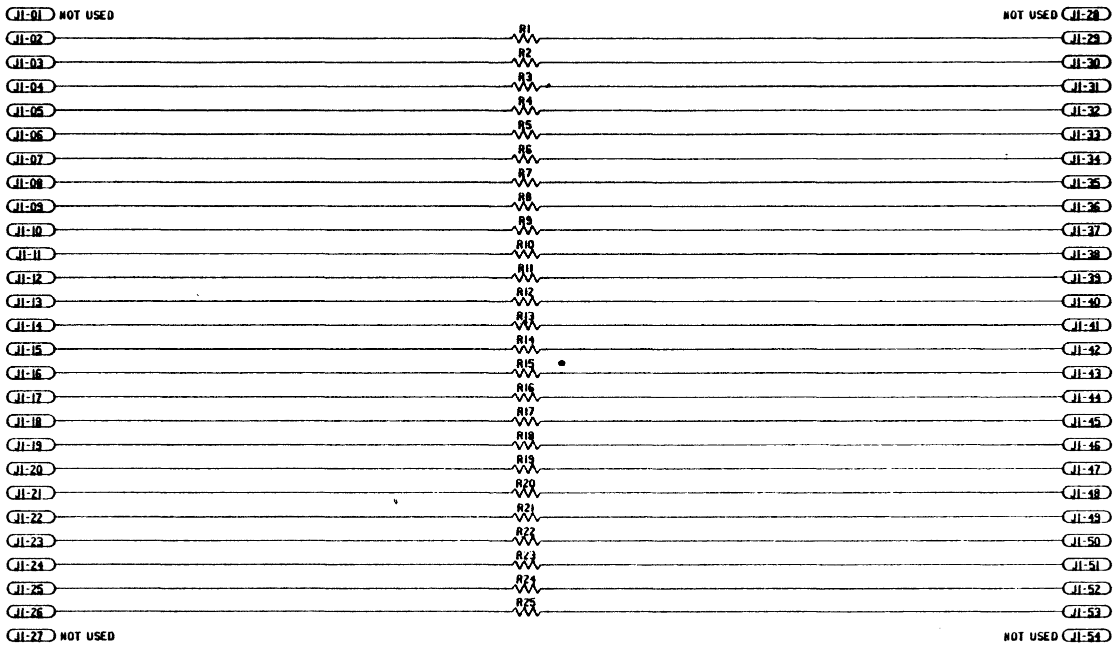
NOTES:
DO NOT SCALE THIS PRINT
REVISIONS
C REV PER DCN 1-6361
D REV PER DCN 1-6460-2
+12V
R45 91
R46 6.04K 1%
R47 2.74K
TL431 U11
C16 10 20V
GND
MT1
MT2
MT3
IN
OUT
COLSEN 2-XXO
J2-06
COLSEN 1-XXO
J2-07
C14 .1
R48 49.9K 1%
R49 100K 1%
C15 .1
C17 .1
LM358 U12
TS1
SHT.1 D +5V
C18 .1
R50 10K
LM393 U13
IN LIMITS-IXO
J2-09
VAC ANA-XXO
J2-08
R54 49.9K 1%
C19 .1
R56 100K 1%
C20 .1
R55 10K 1%
PWM-PLIM-ISO A SHT.1
PWM-MAXV-ISO B SHT.1
R57 475 1%
R58 100K 1%
C21 .01 10%
R59 3.01K 1%
R60 274 1%
R61 221 1%
R62 10K
R63 3.01K 1%
R64 10K 1%
LM358 U14
R65 5K
C22 2.2 35V
PWM-SETV-XSO C SHT.1
R66 100K 1%
R51 4.7K
J2-10 VAC-ENA-OXO
R67 4.7K
Q14 2N3904
R52 10K
R53 4.7K
Q13 2N3904
4070 U5
BRAKE-RST-IGO E SHT.1
TOLERANCES
M. STANDRIDGE
TELEX
LOGIC DIAGRAM
PNEUMATIC CONTROL
SEE SHT.1
9250
APPLICATION
D
92D72375
SCALE NONE
SHEET 2 OF 2

NOTES:

DO NOT SCALE THIS PRINT

1. RESISTORS ARE 91 OHMS, .25W + OR - 5%.

| REVISIONS | | | |
|---|---|---|---|
| LTR. | DESCRIPTION | DATE | APP. |
| C | REV PER DCN 1-6316 | 5-2? | |
| D | REV PER DCN 1-6577 | 2-2-5 | LR |




REVISION D
SHEETS 1

| | | |
|---|---|---|
| 891B72377-01 | 2 | 9250 |
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30'
HOLE DIAMETER +.005 -.002
THREAD CLASS NO. 2

DRAWN M. STANDRIDGE DATE 5-25-?
CHECKED DATE 5-29-?
APPROVED DATE 5-29-84

MATERIAL

FINISH

TELEX
TULSA, OKLAHOMA

LOGIC DIAGRAM
TERMINATOR

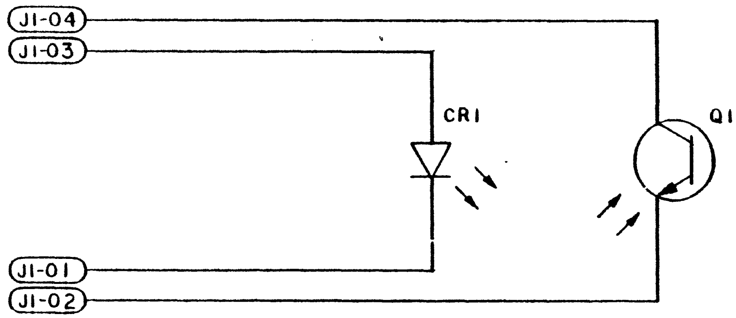
CODE IDENT NO. SIZE D 92D72377

SCALE NONE SHEET 1 OF 1

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR. | DESCRIPTION | DATE | APP. |
| A | REV PER SPCN P1-5018<br>REL PER ERO 513-9 | 2-16-84 | WEC |
| B | REV PER DCN 1-6478-1 | 11-6-4 | LR WEC |




| TOLERANCES UNLESS OTHERWISE SPECIFIED | | DRAWN | DATE |
|---|---|---|---|
| DECIMALS | ANGULAR | KKholer | 2-16-4 |
| .XX ±.0 | ± 30' | CHECKED | DATE |
| .XXX ±.0 | | WEC | 2-16-4 |
| HOLE DIAMETER | +.005 −.002 | APPROVED | DATE |
| THREAD CLASS | NO. 2 | WE Creach | 2-16-84 |

**TELEX**
TULSA, OKLAHOMA

# LOGIC DIAGRAM, FILE PROTECT

| PART NUMBER | NEXT ASSEMBLY | USED ON |
|---|---|---|
| A91B72378-01 | ~ | 9250 |

APPLICATION

MATERIAL

FINISH

CODE IDENT NO.

SIZE B

92B72378

SCALE —

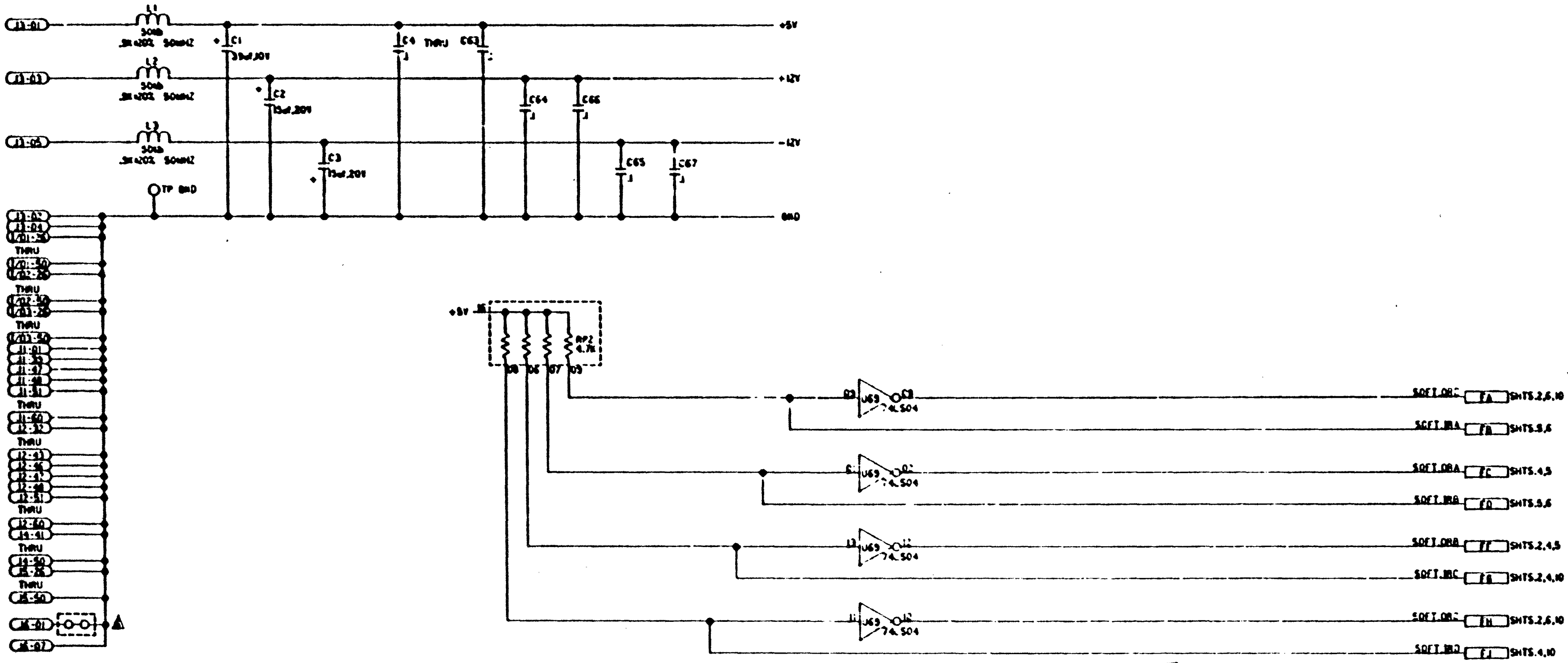
SHEET 1 OF 1

11 X 17 PRINTED ON RIDGWAY'S 1020

| REV | DESCRIPTION | DATE | APP |
|---|---|---|---|
| B | REV PER DCN 1-6623-2 | | |
| J | REV PER DCN 1-6701-3 | 7/10 | RP |

UNLESS OTHERWISE SPECIFIED

1. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
2. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
3. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED (X) ARE 1/8 WATT.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED (X) ARE 100 VOLTS.
6. JUMPERS ARE MADE IN ETCH ON THE CIRCUIT BOARD.
   (THESE ARE NOT COMPONENTS TO BE INSTALLED).
7. LOCATIONS SHOWN HAVE 24 PIN DIPS INSERTED IN PINS 03-26 OF A 28 PIN SOCKET.




REFERENCE DESIGNATION

| NOT USED | LAST USED |
|---|---|
| U38,46,72,75,80,97,101,102 104,112,117,118,120,139,141, 144,171,172,177-190,212,215, 216 | U221 |
| | C95 |
| | R2 |
| C60-63 | CR8 |
| | L3 |
| RP9 | S4 |
| J7-9 | J10 |
| | RP12 |

TELEX

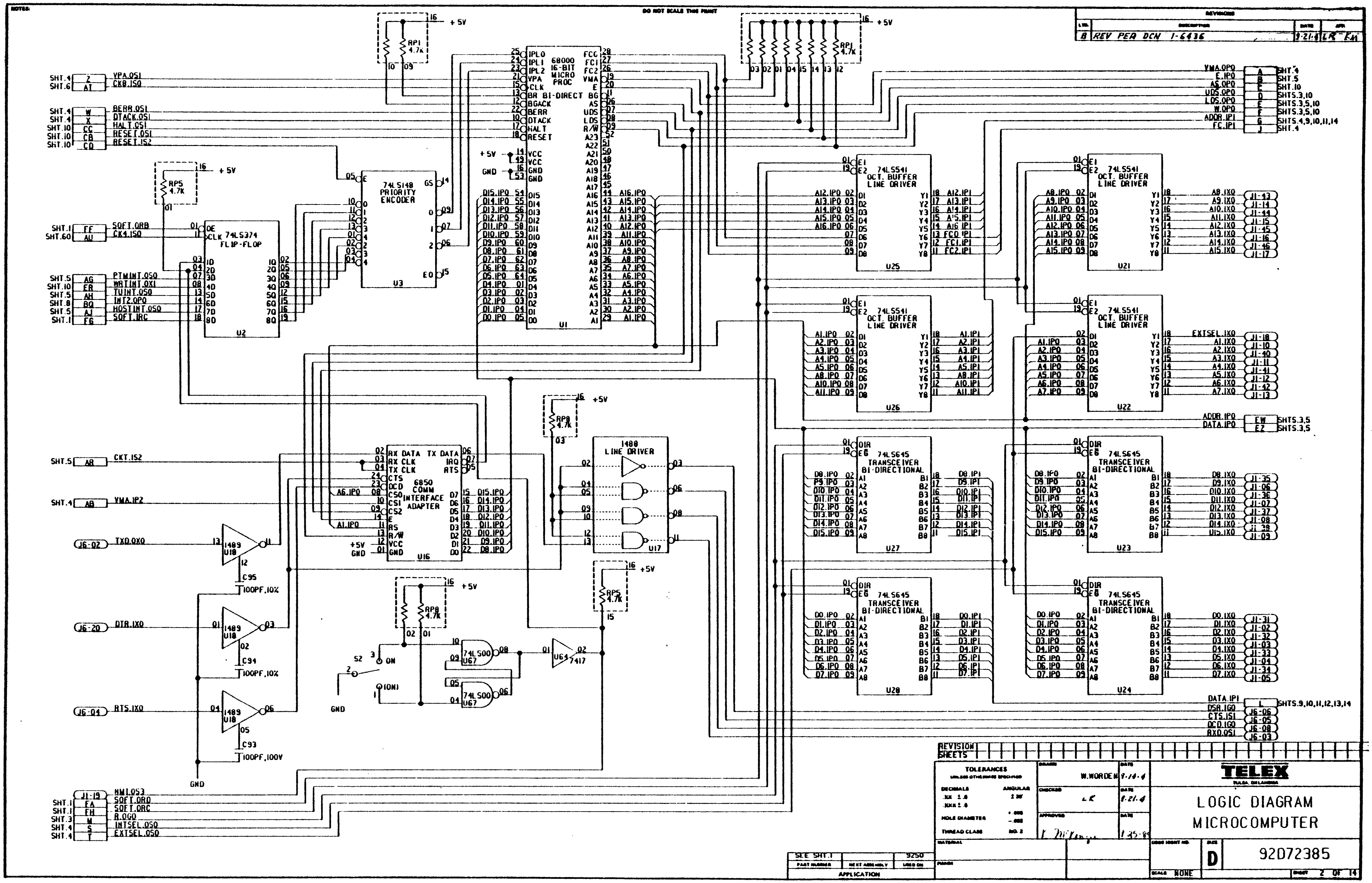
DRAWN: B.WORDEN

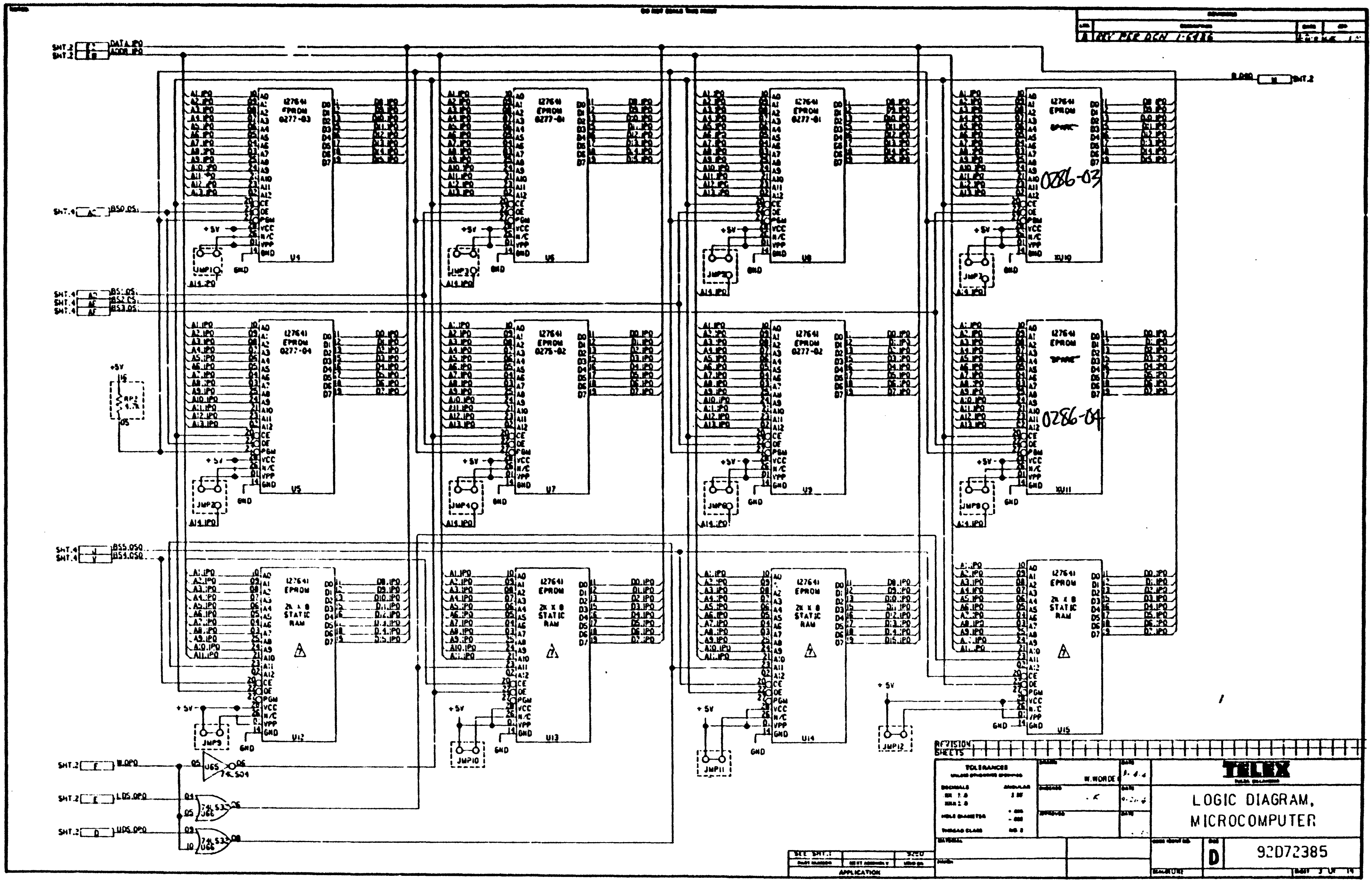
LOGIC DIAGRAM
MICROCOMPUTER

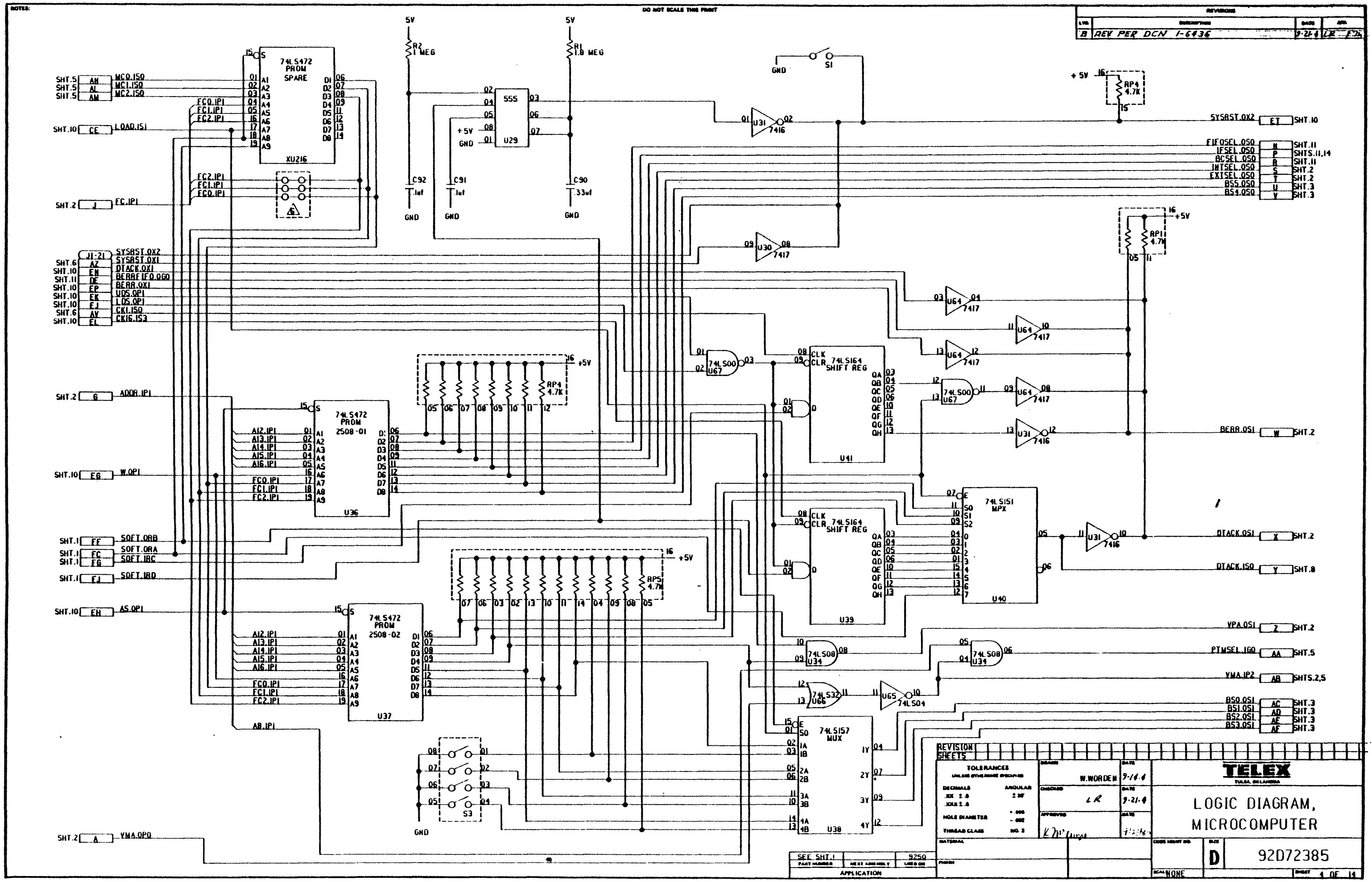
SIZE: D

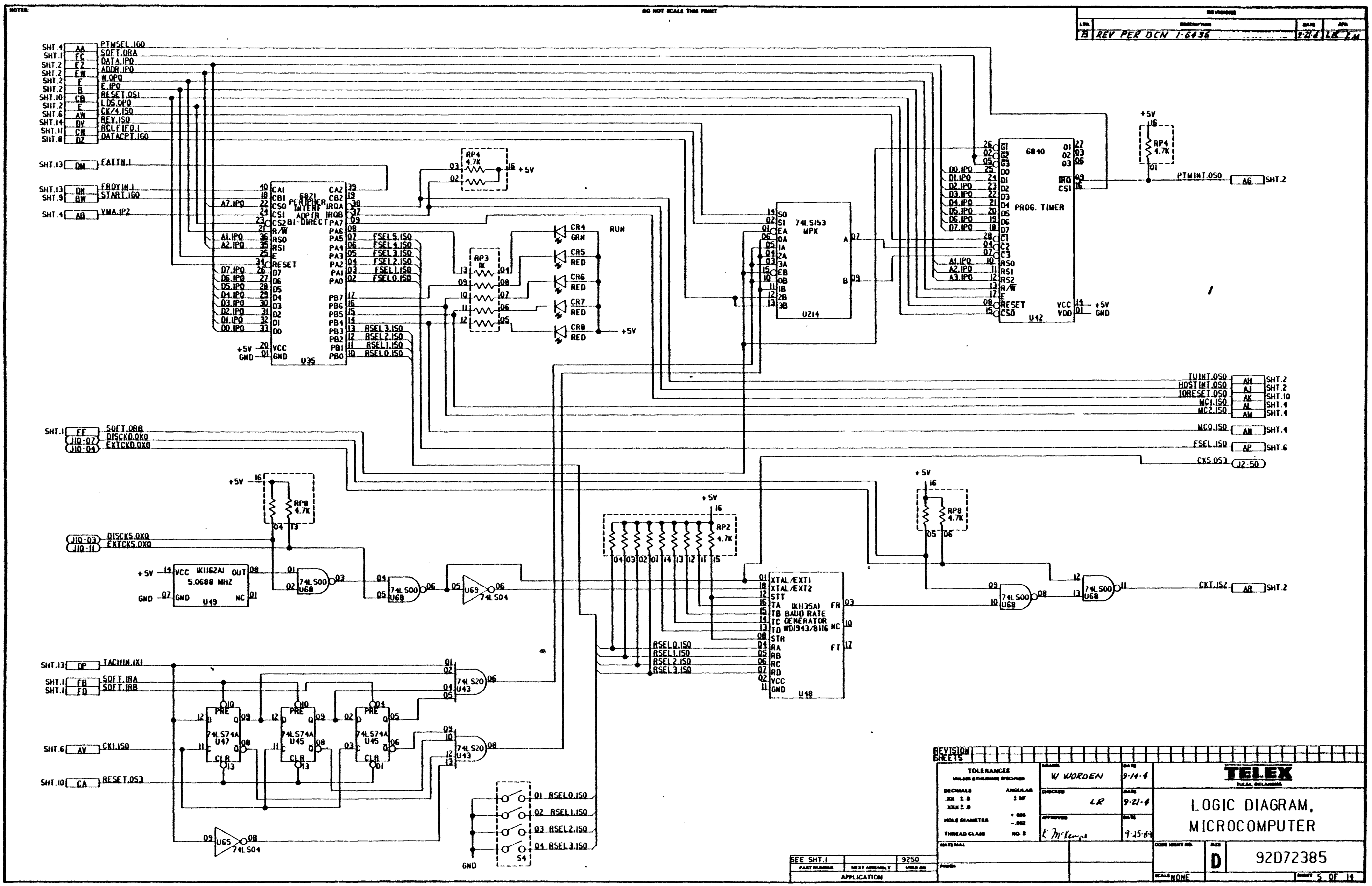
92D72385

APPLICATION: 91D72385-01


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6436
68000 16-BIT MICRO PROC
74LS148 PRIORITY ENCODER
74LS374 FLIP-FLOP
74LS541 OCT. BUFFER LINE DRIVER
74LS645 TRANSCEIVER BI-DIRECTIONAL
6850 COMM INTERFACE ADAPTER
1488 LINE DRIVER
1489
74LS00
7417
RP1 4.7K
RP5 4.7K
RP8 4.7K
+5V
GND
S2
ON
(ON)
C95 100PF,10%
C94 100PF,10%
C93 100PF,100V
VMA.OPO
E.IPO
AS.OPO
UDS.OPO
LDS.OPO
W.OPO
ADDR.IPI
FC.IPI
ADDR.IPO
DATA.IPO
DATA.IPI
DSR.IGO
CTS.IS1
DCD.IGO
RXD.OSI
VPA.OSI
CK8.ISO
BERR.OSI
DTACK.OSI
HALT.OSI
RESET.OSI
RESET.IS2
SOFT.ORB
CK4.ISO
PTMINT.OSO
WRTINT.OXI
TUINT.OSO
INT2.OPO
HOSTINT.OSO
SOFT.IRC
CKT.IS2
VMA.IP2
TXD.OXO
DTR.IXO
RTS.IXO
NMI.OS3
SOFT.ORO
SOFT.ORC
R.OGO
INTSEL.OSO
EXTSEL.OSO
TOLERANCES
DRAWN W.WORDEN
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
9250
APPLICATION
D
92D72385
SCALE NONE
SHEET 2 OF 14


LOGIC DIAGRAM,
MICROCOMPUTER
TELEX
D
92D72385
W.WORDE
TOLERANCES
REVISION
SHEETS
SEE SHT.1
APPLICATION
REV PER DCN 1-6486
0286-03
0286-04
27641 EPROM 0277-03
27641 EPROM 0277-01
27641 EPROM 0277-04
27641 EPROM 0275-02
27641 EPROM 0277-02
2K X 8 STATIC RAM
DATA IPO
ADDR IPO
BS0.0S
BS1.0S
BS2.0S
BS3.0S
BS5.0S0
BS4.0S0
R.0S0
W.0P0
LDS.0P0
UDS.0P0
U4
U5
U6
U7
U8
U9
XU10
XU11
U12
U13
U14
U15
U65
U66
74LS04
74LS32
JMP1
JMP2
JMP3
JMP4
JMP5
JMP6
JMP7
JMP8
JMP9
JMP10
JMP11
JMP12
+5V
GND
RP2 4.7K


DO NOT SCALE THIS PRINT
B REV PER DCN 1-6436
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM,
MICROCOMPUTER
W.WORDEN
D
92D72385
NONE
4 OF 14
SEE SHT.1
9250
APPLICATION




| | |
|---|---|
| DRAWN | W WORDEN 9-14-4 |
| CHECKED | LR 9-21-4 |
| APPROVED | 9-25-84 |

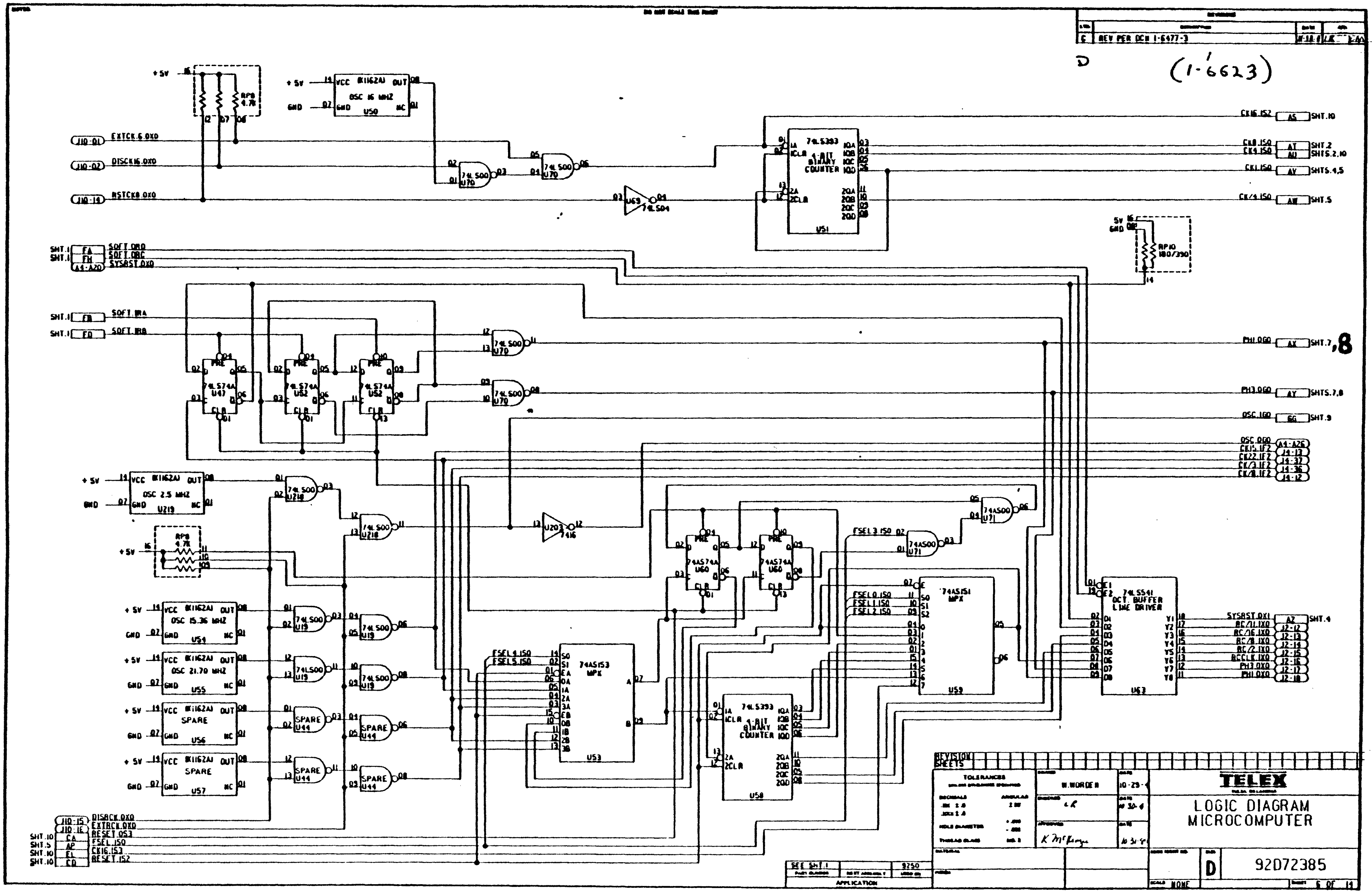
**TELEX** TULSA, OKLAHOMA

LOGIC DIAGRAM, MICROCOMPUTER

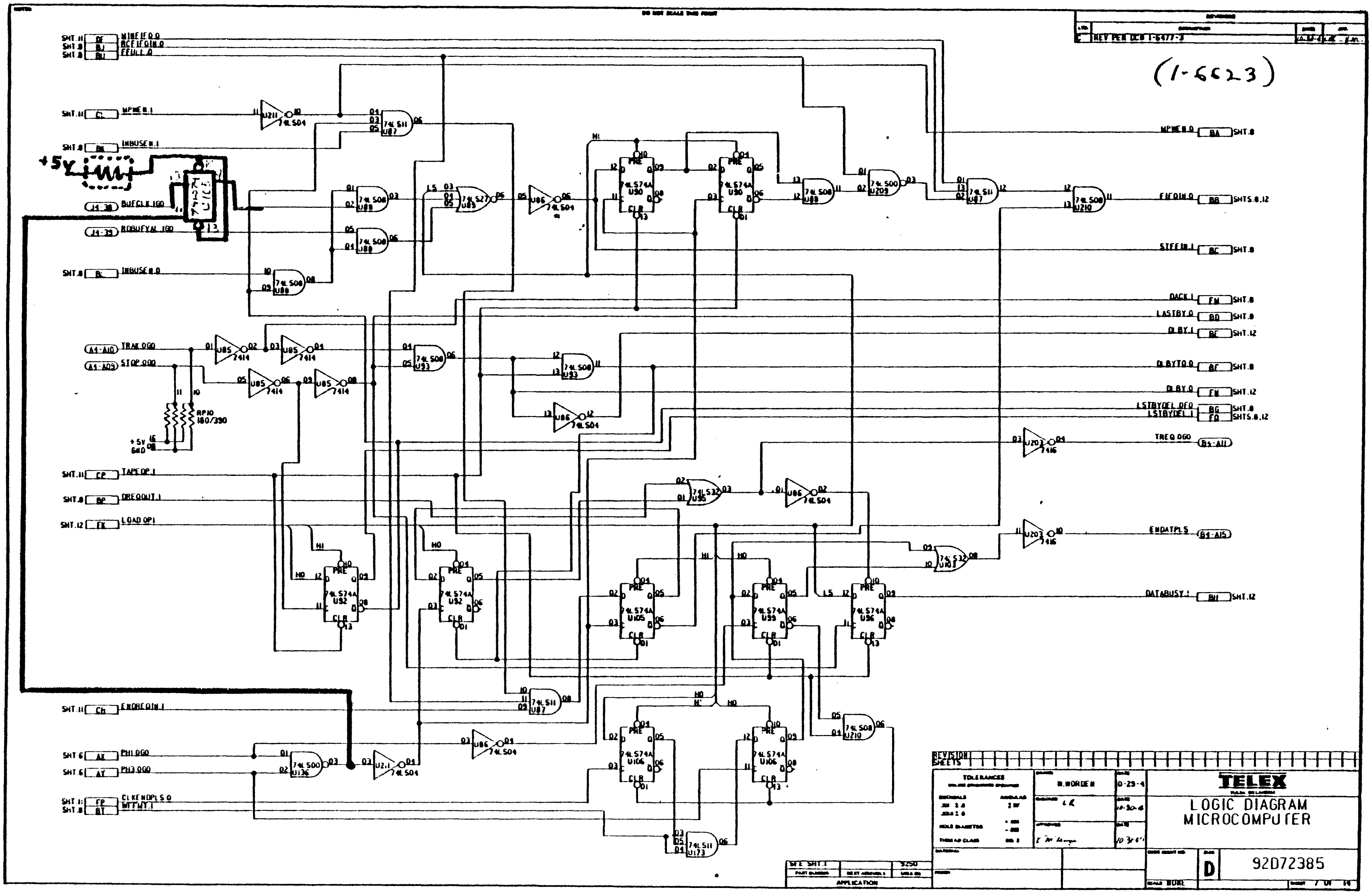
SIZE D 92D72385

SCALE NONE SHEET 5 OF 14

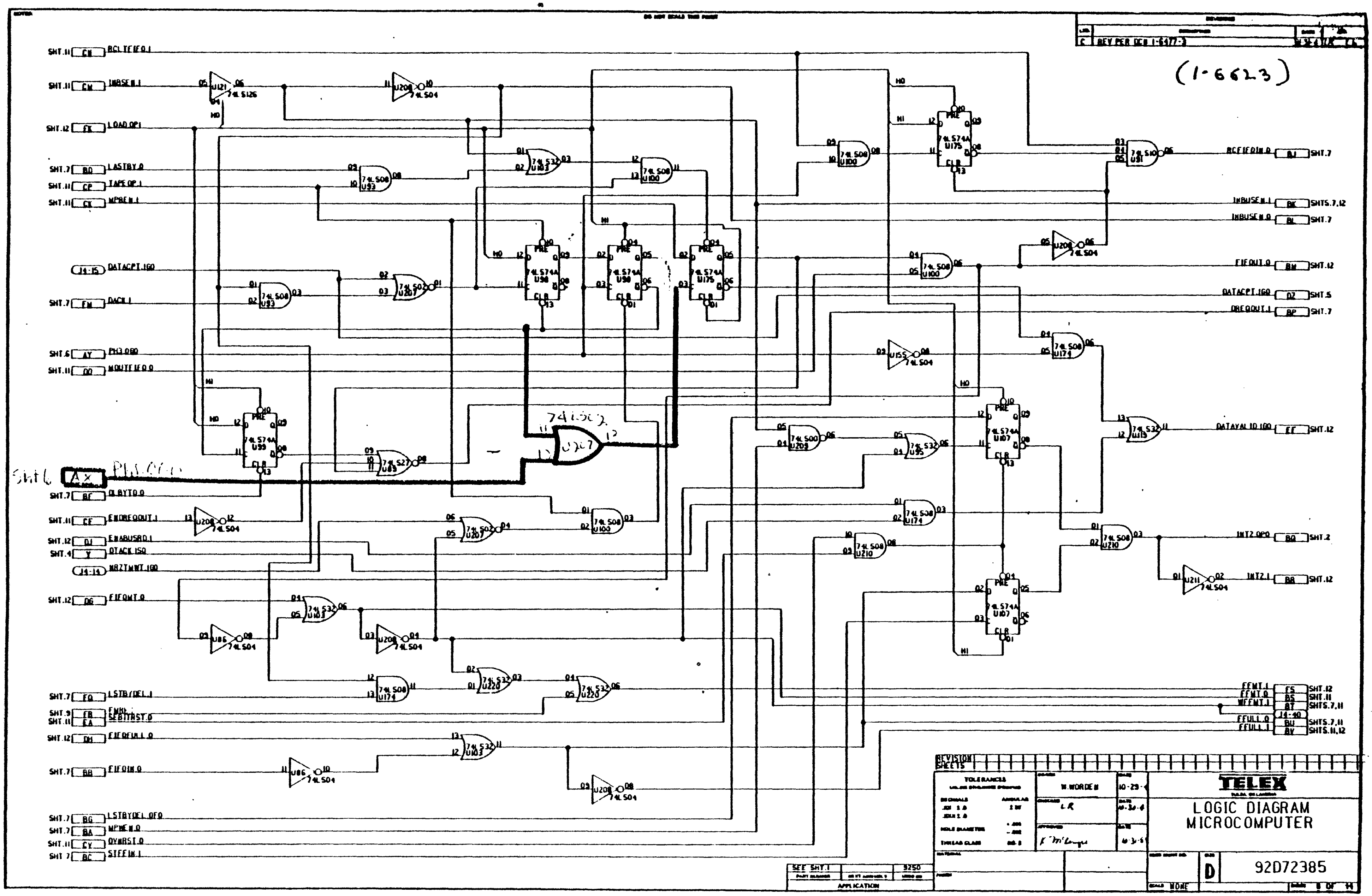
SEE SHT.1 9250
APPLICATION

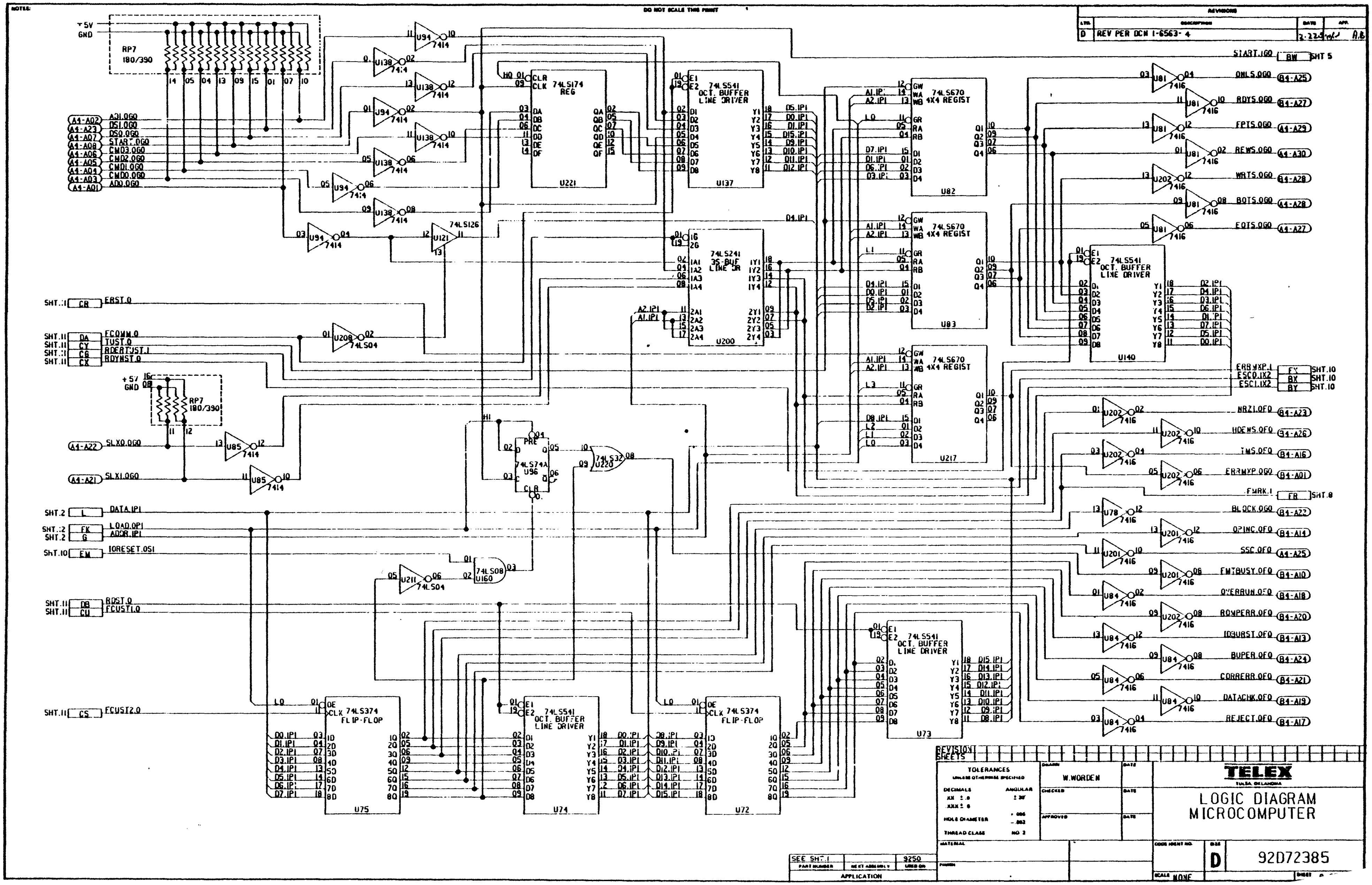


REV PER DCN 1-6477-3
D
(1-6623)
74LS393
4-BIT BINARY COUNTER
74LS00
74LS74A
74AS153 MPX
74AS151 MPX
74LS541 OCT. BUFFER LINE DRIVER
OSC 16 MHZ
OSC 2.5 MHZ
OSC 15.36 MHZ
OSC 21.70 MHZ
SPARE
EXTCK.6.0X0
DISCK16.0X0
RSTCK8.0X0
SOFT.0R0
SOFT.0RC
SYSRST.0X0
SOFT.IRA
SOFT.IRB
PH1.0G0
PH3.0G0
OSC.1G0
OSC.0G0
DISACK.0X0
EXTRCK.0X0
RESET.0S3
FSEL.1S0
CK16.1S3
RESET.1S2
SYSRST.0X1
TOLERANCES
W.WORDEN
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
9750
APPLICATION
D
92D72385
NONE
6 OF 14



(1-6523)
REV PER DCN 1-6477-3
SHT.11 DF MINEIFO.0
SHT.8 BJ RCFIFOIN.0
SHT.8 BU FFULL.0
SHT.11 CL MPWEN.1
SHT.8 BN INBUSEN.1
+5V
74LS74 U100
J4-38 BUFCLK.1G0
J4-39 RDBUFVAL.1G0
SHT.8 BL INBUSEN.0
A1-A10 TRAK.0G0
A1-A09 STOP.0G0
RP10 180/390
+5V
GND
SHT.11 CP TAPEOP.1
SHT.8 BP DREQOUT.1
SHT.12 FK LOADOP.1
SHT.11 CH ENDREQIN.1
SHT.6 AX PH1.0G0
SHT.6 AY PH3.0G0
SHT.11 FP CLKENDPLS.0
SHT.8 BT WTFWT.1
74LS04
74LS11
74LS08
74LS27
74LS00
74LS74A
74LS32
7414
7416
MPWEN.0 BA SHT.8
FIFOIN.0 BB SHTS.8,12
STFFIN.1 BC SHT.8
DACK.1 FM SHT.8
LASTBY.0 BD SHT.8
DLBY.1 BF SHT.12
DLBYTO.0 BE SHT.8
DLBY.0 FN SHT.12
LSTBYDEL.0F0 BG SHT.8
LSTBYDEL.1 FQ SHTS.8,12
TREQ.0G0 B4-A11
ENDATPLS B4-A15
DATABUSY.1 BH SHT.12
REVISION
SHEETS
TOLERANCES
M.WORDEN
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
SEE SHT.1
D
92D72385


(1-6623)
REV PER DCN 1-6477-3
BCLTFIFO.1
INBSEN.1
LOAD OP1
LASTBY.0
TAPE OP.1
MPREN.1
DATACPT.IGO
DACK.1
PH3.0B0
NOUTFIFO.0
PH1.0F0
DLBYTO.0
ENDREQOUT.1
ENABUSRD.1
DTACK ISO
NRZTMNT.IGO
FIFOMT.0
LSTB/DEL.1
SEBTRST.0
FIFOFULL.0
FIFOIN.0
LSTBYDEL.0FO
MPWEN.0
DYNRST.0
STFFIN.1
BCFIFOIN.0
INBUSEN.1
INBUSEN.0
FIFOUT.0
DATACPT.IGO
DREQOUT.1
DATAVALID.IGO
INT2.0PO
INT2.1
FFMT.1
FFMT.0
WFFMT.1
FFULL.0
FFULL.1
74LS126
74LS04
74LS08
74LS32
74LS02
74LS74A
74LS27
74LS00
74LS10
74LS02
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
W. WORDEN
SEE SHT.1
APPLICATION
D
92D72385
NONE


DO NOT SCALE THIS PRINT
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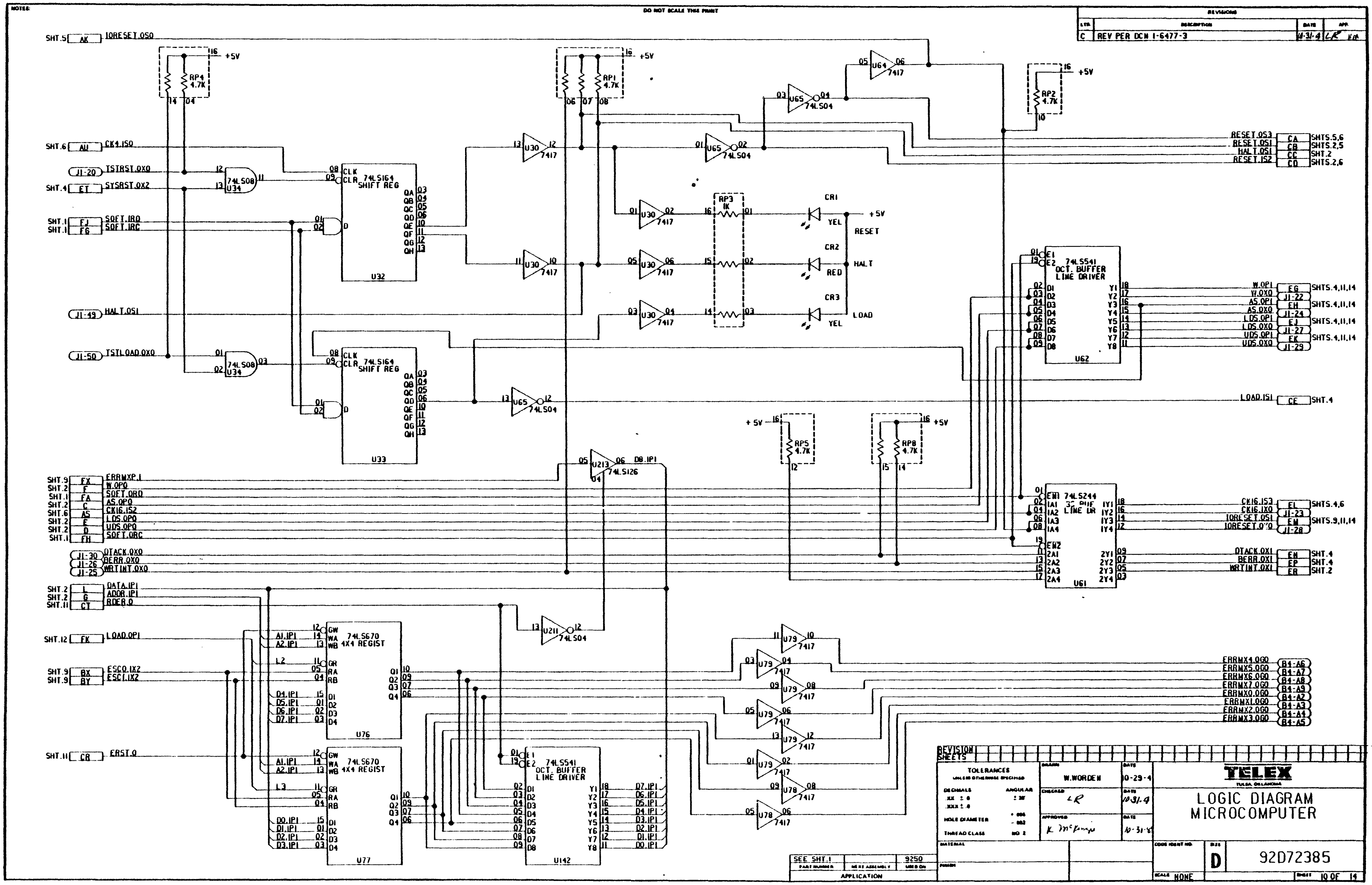
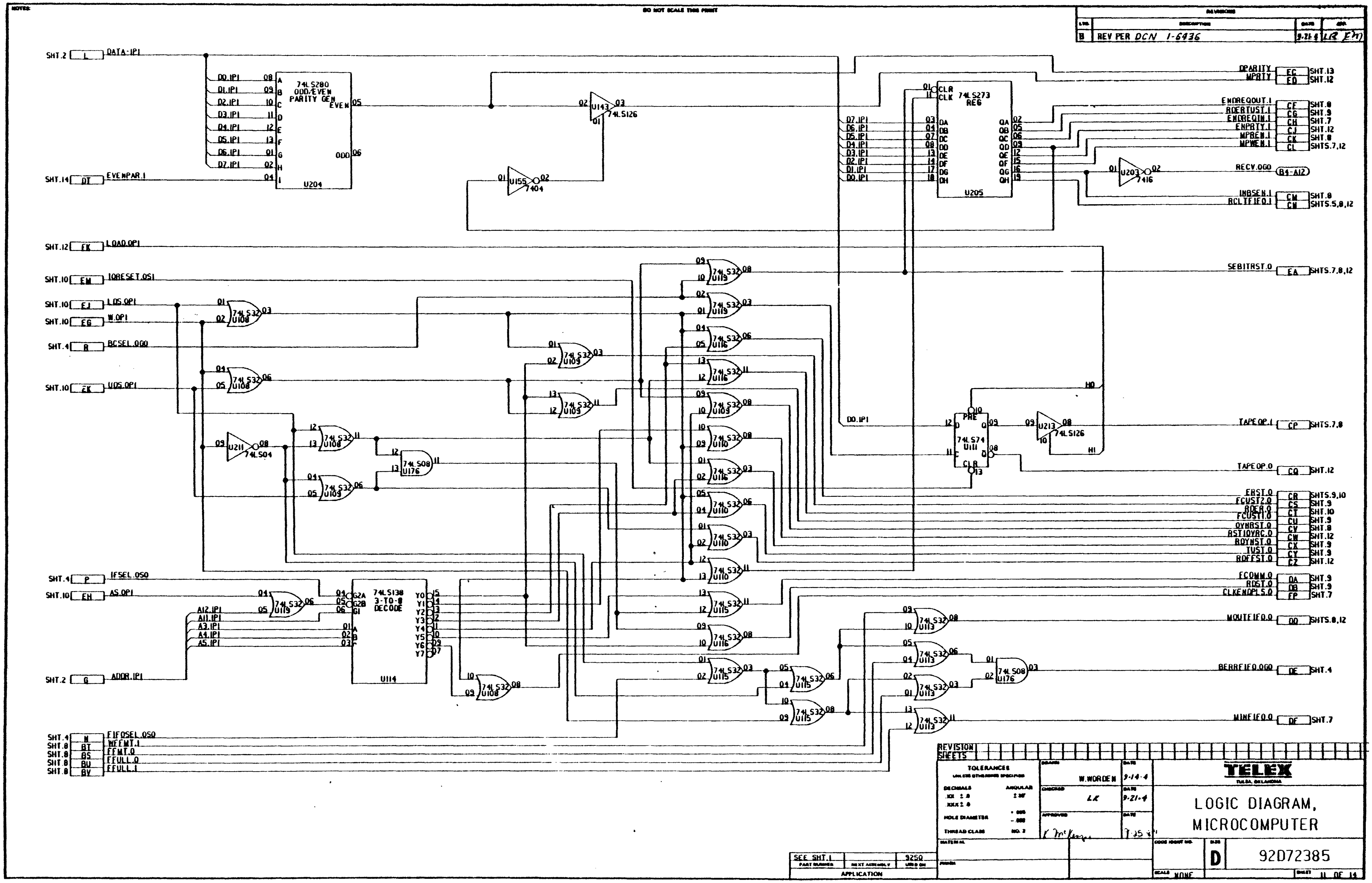
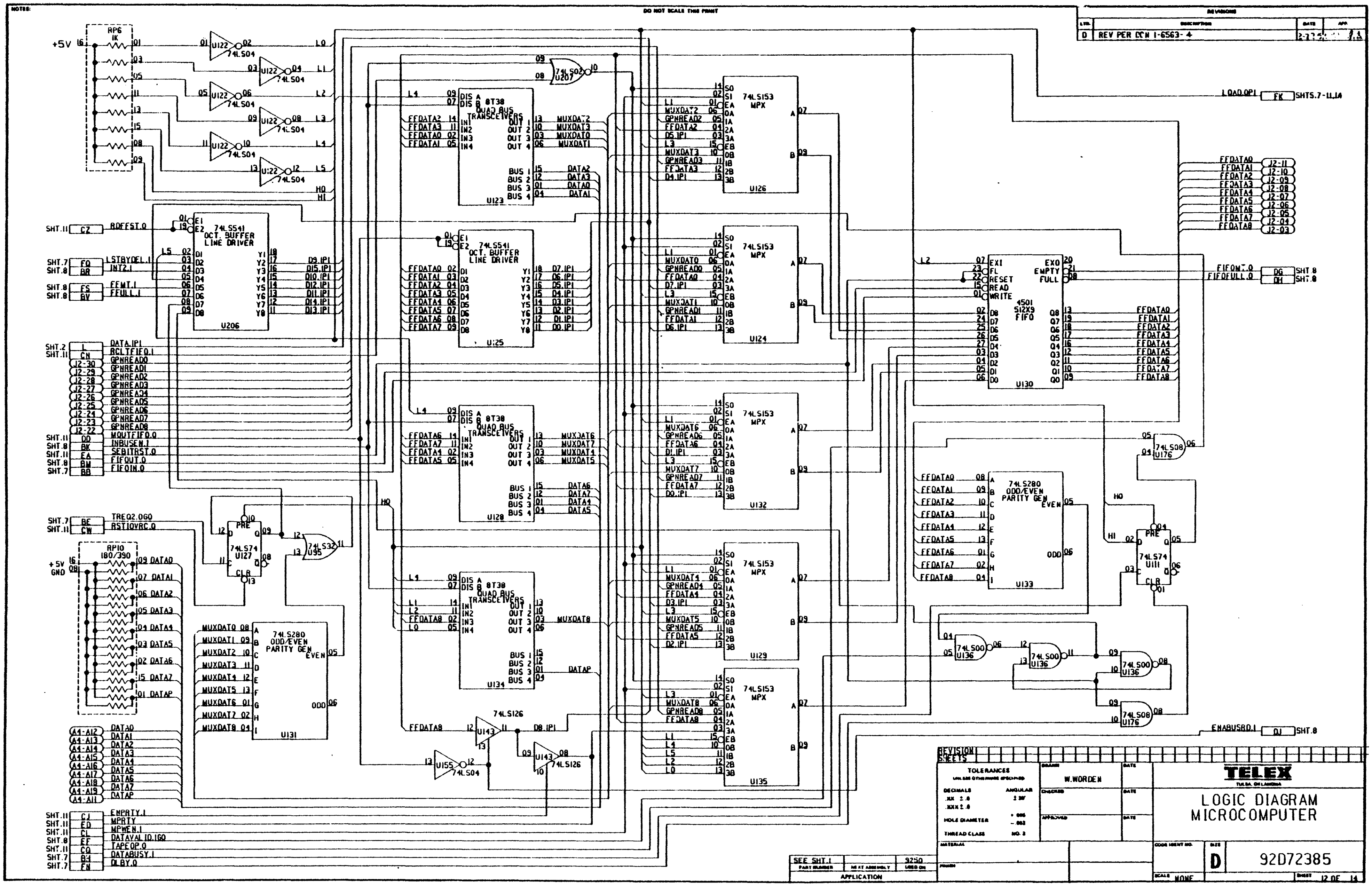
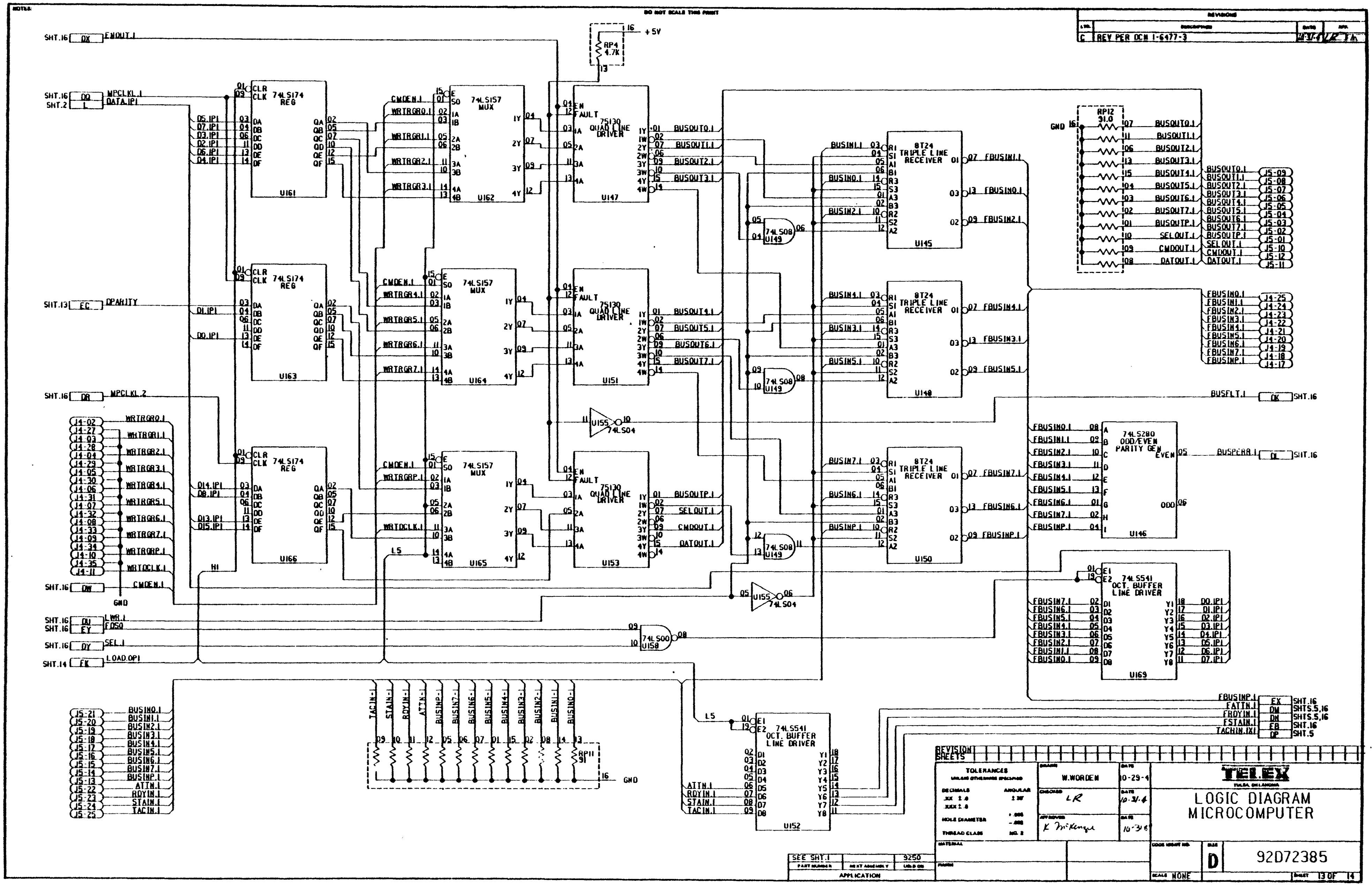
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
W.WORDEN
D
92D72385
SEE SHT.1
9250
APPLICATION
NONE


DO NOT SCALE THIS PRINT
REVISIONS
C REV PER DCN 1-6477-3
74LS164 SHIFT REG
U32
U33
74LS08
U34
7417
74LS04
74LS541 OCT. BUFFER LINE DRIVER
U62
U142
74LS244
U61
74LS670 4X4 REGIST
U76
U77
74LS126
U213
RP1 4.7K
RP2 4.7K
RP3 1K
RP4 4.7K
RP5 4.7K
RP8 4.7K
CR1 YEL RESET
CR2 RED HALT
CR3 YEL LOAD
+5V
IORESET.0S0
CK4.1S0
TSTRST.0X0
SYSRST.0X2
SOFT.IRQ
SOFT.IRC
HALT.0S1
TSTLOAD.0X0
RESET.0S3
RESET.0S1
HALT.0S1
RESET.1S2
LOAD.1S1
W.0P1
W.0X0
AS.0P1
AS.0X0
LDS.0P1
LDS.0X0
UDS.0P1
UDS.0X0
CK16.1S3
CK16.1X0
IORESET.0S1
DTACK.0X1
BERR.0X1
WRTINT.0X1
ERRMXP.1
W.0P0
SOFT.0RQ
AS.0P0
CK16.1S2
LDS.0P0
UDS.0P0
SOFT.0RC
DTACK.0X0
BERR.0X0
WRTINT.0X0
DATA.1P1
ADDR.1P1
RDER.0
LOAD.0P1
ESC0.1X2
ESC1.1X2
ERST.0
D8.1P1
ERRMX4.0G0
ERRMX5.0G0
ERRMX6.0G0
ERRMX7.0G0
ERRMX0.0G0
ERRMX1.0G0
ERRMX2.0G0
ERRMX3.0G0
SEE SHT.1
9250
APPLICATION
TOLERANCES
W.WORDEN
10-29-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72385
SCALE NONE
SHEET 10 OF 14


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6436
SHT.2 L DATA·IP1
D0.IP1
D1.IP1
D2.IP1
D3.IP1
D4.IP1
D5.IP1
D6.IP1
D7.IP1
SHT.14 DT EVENPAR.1
74LS280 ODD/EVEN PARITY GEN
EVEN
ODD
U204
U143 74LS126
U155 7404
74LS273 REG
CLR
CLK
U205
DPARITY EC SHT.13
MPRTY ED SHT.12
ENDREQOUT.1 CF SHT.8
RDERTUST.1 CG SHT.9
ENDREQIN.1 CH SHT.7
ENPRTY.1 CJ SHT.12
MPREN.1 CK SHT.8
MPWEN.1 CL SHTS.7,12
U203 7416
RECV.0G0 (B1-A12)
INBSEN.1 CM SHT.8
RCLTFIFO.1 CN SHTS.5,8,12
SHT.12 FK LOAD.0P1
SHT.10 EM IORESET.0S1
SEBITRST.0 EA SHTS.7,8,12
SHT.10 EJ LDS.0P1
SHT.10 EG W.0P1
SHT.4 R BCSEL.0G0
SHT.10 EK UDS.0P1
74LS32 U108
74LS32 U109
74LS32 U119
74LS32 U116
74LS32 U110
74LS32 U115
74LS32 U113
U211 74LS04
74LS08 U176
D0.IP1
74LS74 U111
PRE
CLR
U213 74LS126
TAPEOP.1 CP SHTS.7,8
TAPEOP.0 CQ SHT.12
ERST.0 CR SHTS.9,10
FCUST2.0 CS SHT.9
RDER.0 CT SHT.10
FCUST1.0 CU SHT.9
DYNRST.0 CV SHT.8
RSTIOYRC.0 CW SHT.12
RDYNST.0 CX SHT.9
TUST.0 CY SHT.9
RDFFST.0 CZ SHT.12
SHT.4 P IFSEL.0S0
SHT.10 EH AS.0P1
A12.IP1
A11.IP1
A3.IP1
A4.IP1
A5.IP1
SHT.2 G ADDR.IP1
74LS138 3-TO-8 DECODE
U114
FCOMM.0 DA SHT.9
RDST.0 DB SHT.9
CLKENOPLS.0 FP SHT.7
MOUTFIFO.0 DD SHTS.8,12
BERRFIFO.0G0 DE SHT.4
MINFIFO.0 DF SHT.7
SHT.4 N FIFOSEL.0S0
SHT.8 BT WFEMT.1
SHT.8 BS FEMT.0
SHT.8 BU FFULL.0
SHT.8 BV FFULL.1
REVISION SHEETS
TOLERANCES
W.WORDEN 9-14-4
LR 9-21-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM, MICROCOMPUTER
SEE SHT.1
9250
APPLICATION
D
92D72385
SCALE NONE
SHEET 11 OF 14

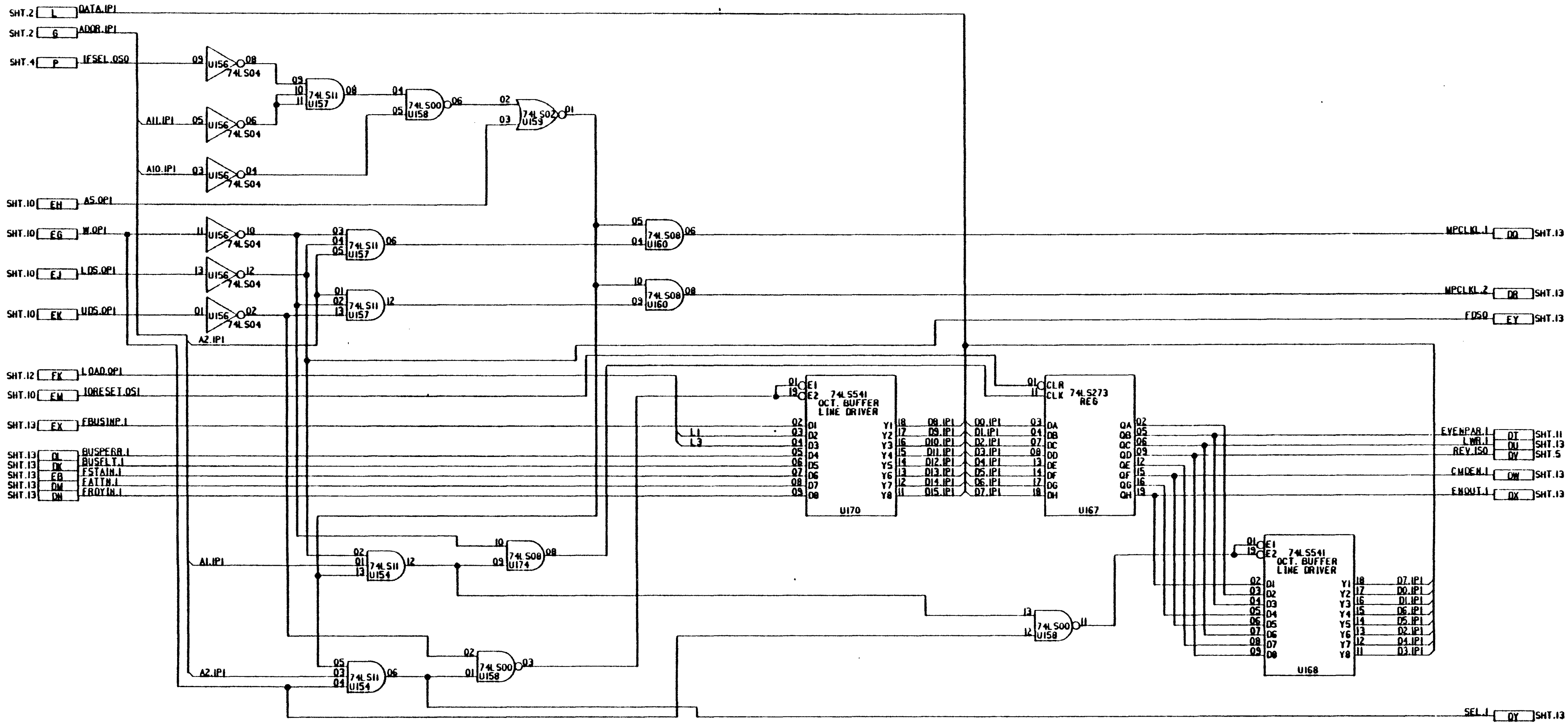

DO NOT SCALE THIS PRINT
REV PER DCN 1-6563-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
W.WORDEN
TOLERANCES
D
92D72385
NONE
12 OF 14
SEE SHT.1
9250
APPLICATION


DO NOT SCALE THIS PRINT
REVISIONS
C REV PER DCN 1-6477-3
TOLERANCES
W.WORDEN
10-29-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72385
SEE SHT.1
9250
APPLICATION
SCALE NONE
SHEET 13 OF 14

DO NOT SCALE THIS PRINT

REVISIONS

| LTR | DESCRIPTION | DATE | APR |
|---|---|---|---|
| B | REV PER DCN 1-6436 | | |




| REVISION | |
|---|---|
| SHEETS | |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30'

HOLE DIAMETER + .000 − .002

THREAD CLASS NO. 2

MATERIAL

FINISH

| DRAWN | DATE |
|---|---|
| W. WORDEN | 9-14-4 |
| CHECKED LR | 9-21-4 |
| APPROVED | 9-25-4 |

TELEX

TULSA, OKLAHOMA

LOGIC DIAGRAM, MICROCOMPUTER

SIZE D — 92D72385

SCALE NONE — SHEET 14 OF 14

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |

APPLICATION

NOTES

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| G | REV PER DCN 1-6605-2 | 5-31-5 | LR RCP |

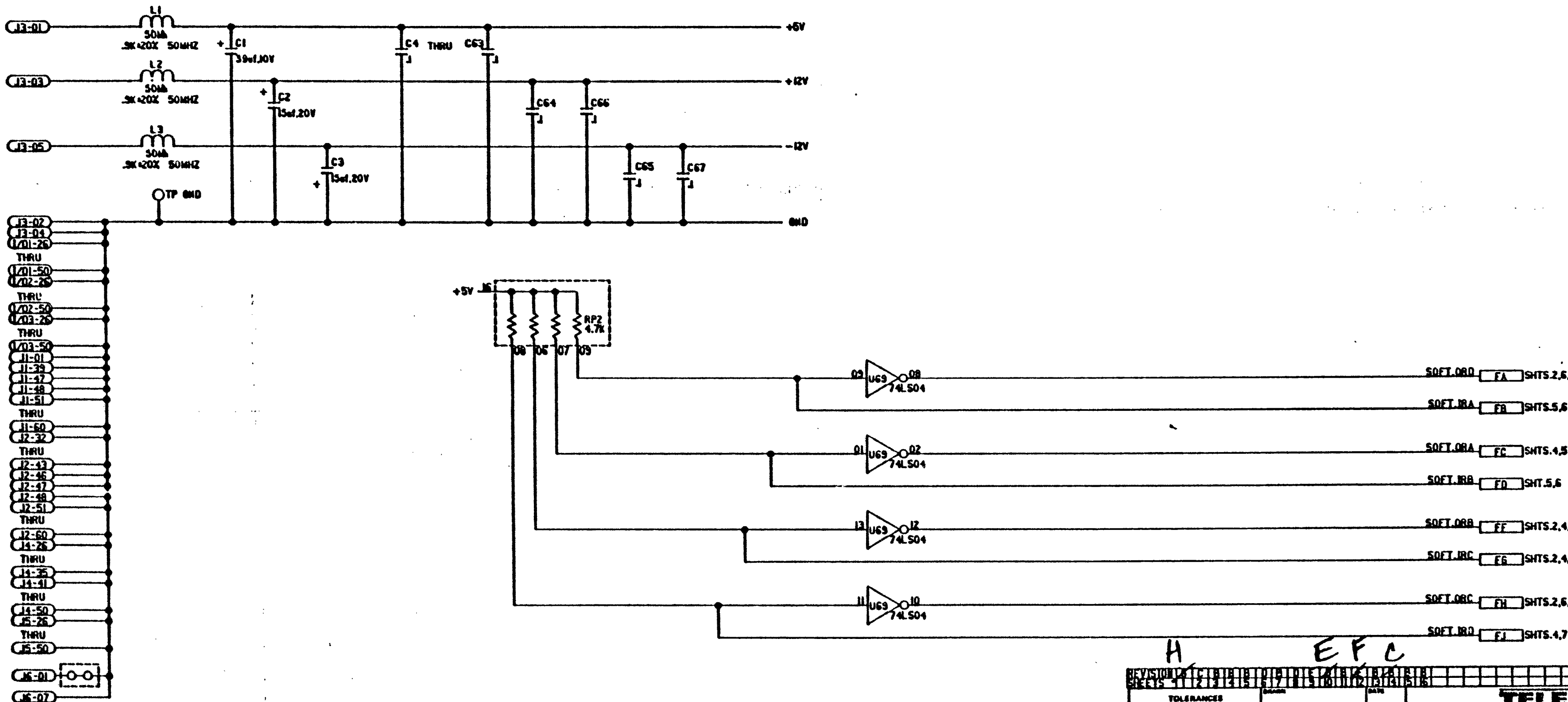
H

UNLESS OTHERWISE SPECIFIED

1. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
2. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
3. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED (X ARE 1/8 WATT.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED 10X ARE 100 VOLTS.

6. JUMPERS ARE MADE IN ETCH ON THE CIRCUIT BOARD.
   (THESE ARE NOT COMPONENTS TO BE INSTALLED).

7. LOCATIONS SHOWN HAVE 24 PIN DIPS INSTALLED IN
   PINS 03-26 OF THE 28 PIN SOCKET.




H E F C

REVISION / SHEETS 1–16

TOLERANCES
UNLESS OTHERWISE SPECIFIED

DRAWN W.WORDEN 5-29-5

CHECKED LR 5-31-5

APPROVED R. Pondexter 5-31-5

TELEX
TULSA, OKLAHOMA

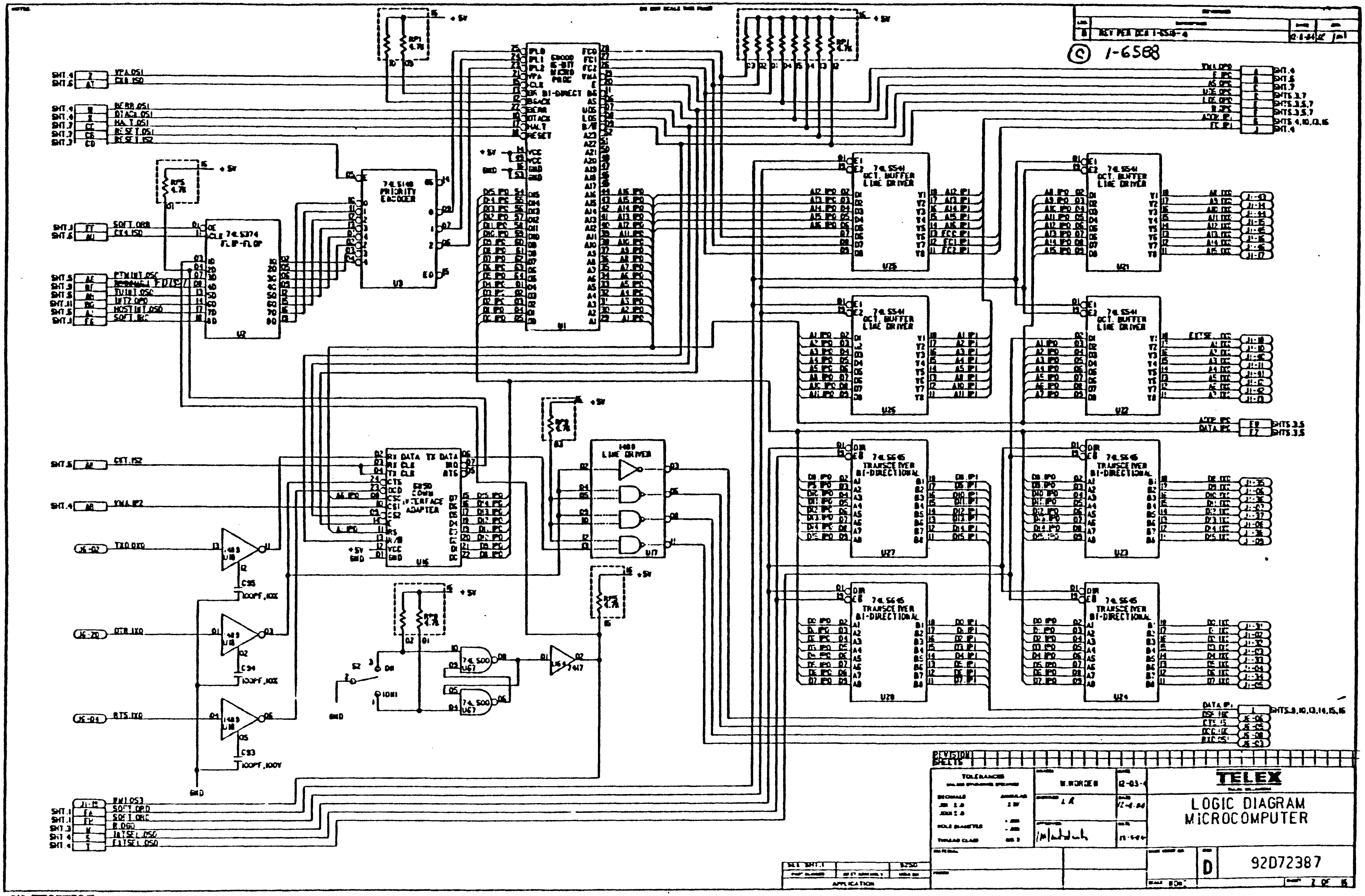
LOGIC DIAGRAM
MICROCOMPUTER

SIZE D 92D72387

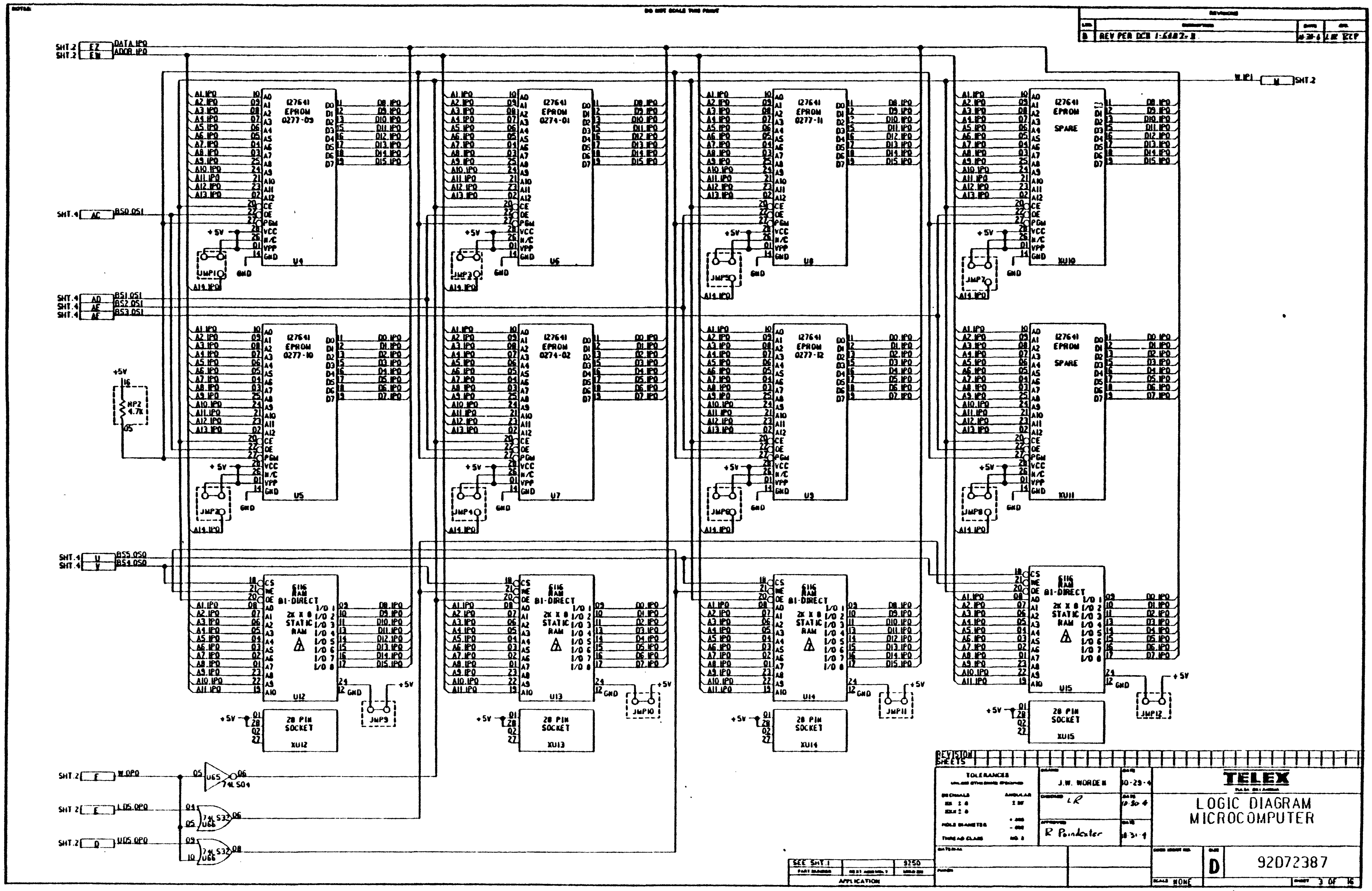
SCALE NONE SHEET 1 OF 16

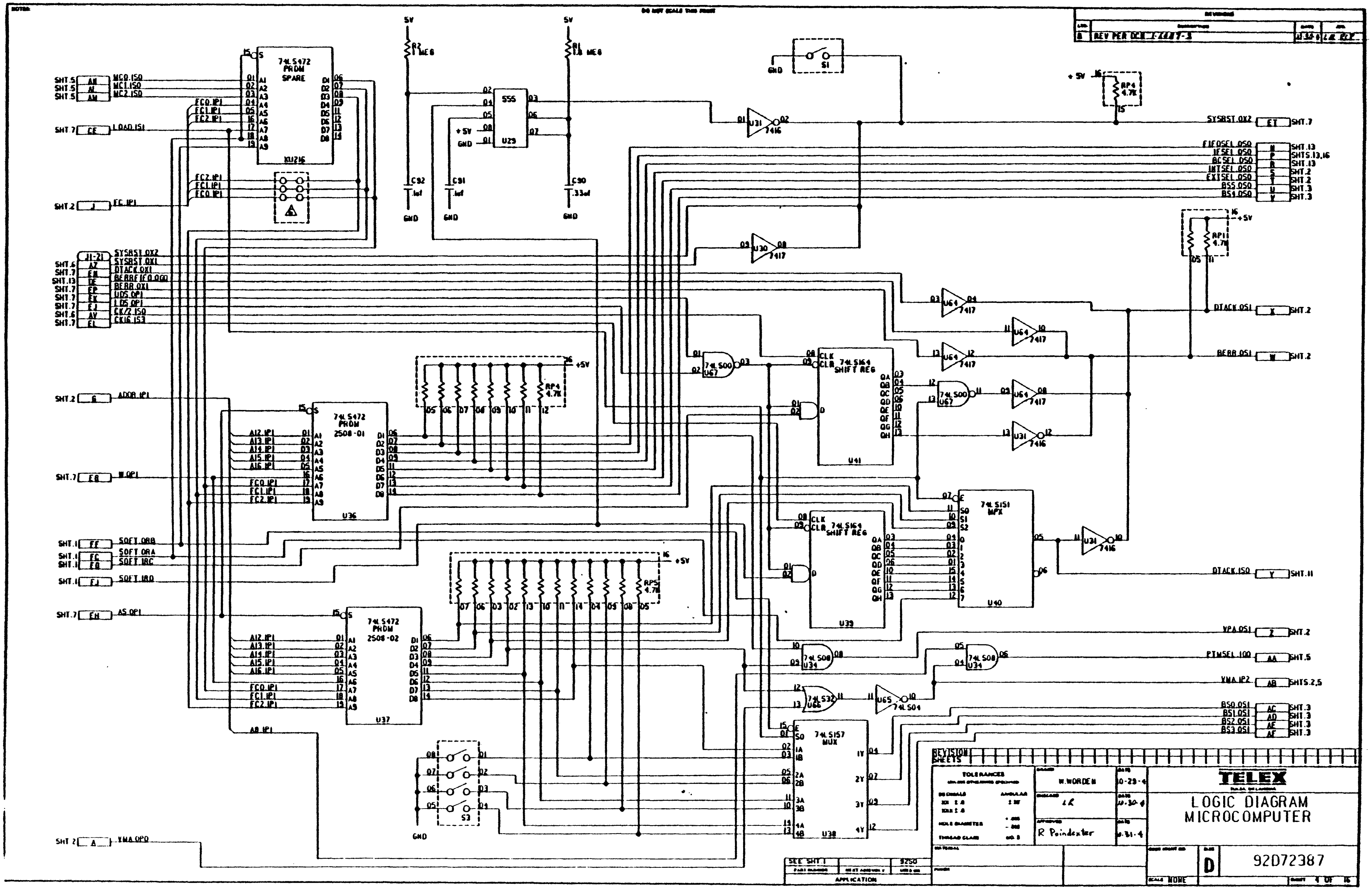
| 19107238 / -01 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

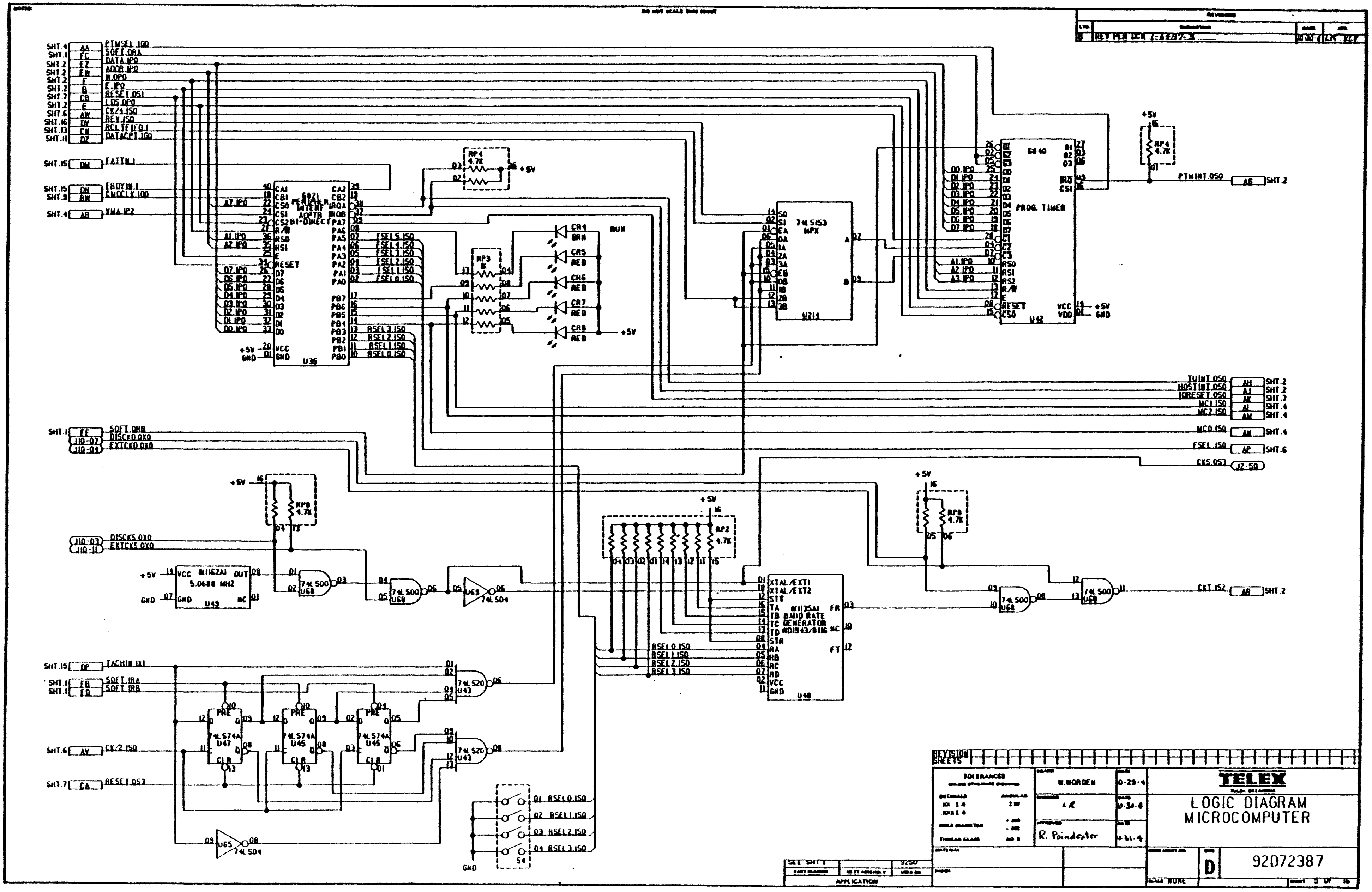
SUB 9



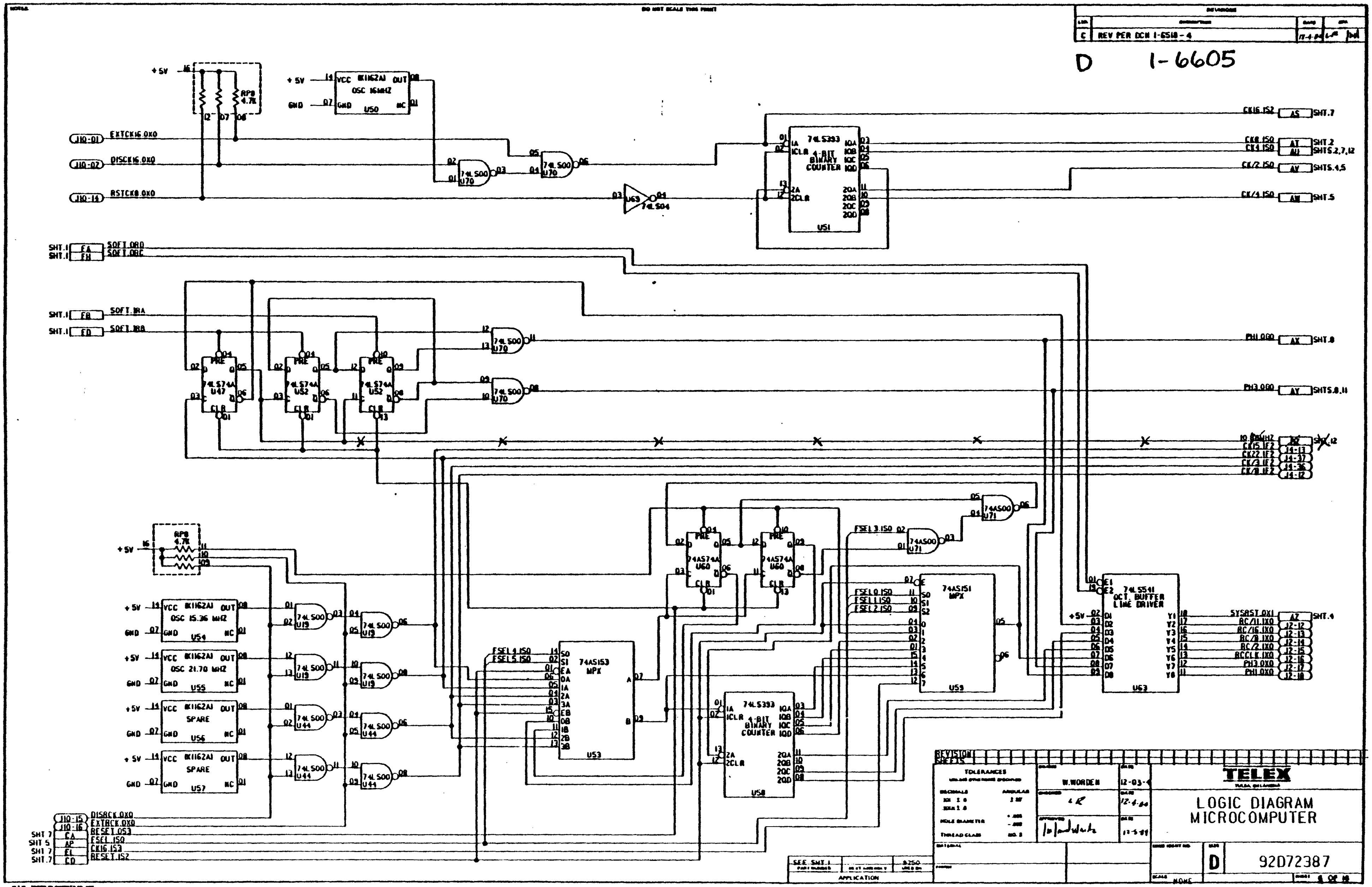
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72387
TOLERANCES
REVISION
SHEETS
(C) 1-6588
68000 16-BIT MICRO PROC
74LS148 PRIORITY ENCODER
74LS374 FLIP-FLOP
6850 COMM INTERFACE ADAPTER
1488 LINE DRIVER
74LS541 OCT. BUFFER LINE DRIVER
74LS645 TRANSCEIVER BI-DIRECTIONAL


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
92D72387
D
J.W. WORDEN
R Poindexter
SCALE NONE
SHEET 3 OF 16
REV PER DCN
TOLERANCES
APPLICATION
SEE SHT.1
9250
(27641) EPROM 0277-09
(27641) EPROM 0274-01
(27641) EPROM 0277-11
(27641) EPROM SPARE
(27641) EPROM 0277-10
(27641) EPROM 0274-02
(27641) EPROM 0277-12
6116 RAM BI-DIRECT 2K X 8 STATIC RAM
28 PIN SOCKET
U4
U5
U6
U7
U8
U9
XU10
XU11
U12
U13
U14
U15
XU12
XU13
XU14
XU15
74LS04
74LS32
DATA IPO
ADDR IPO
BS0 0S1
BS1 0S1
BS2 0S1
BS3 0S1
BS5 0S0
BS4 0S0
W 0P0
LDS 0P0
UDS 0P0
W IP1
RP2 4.7k

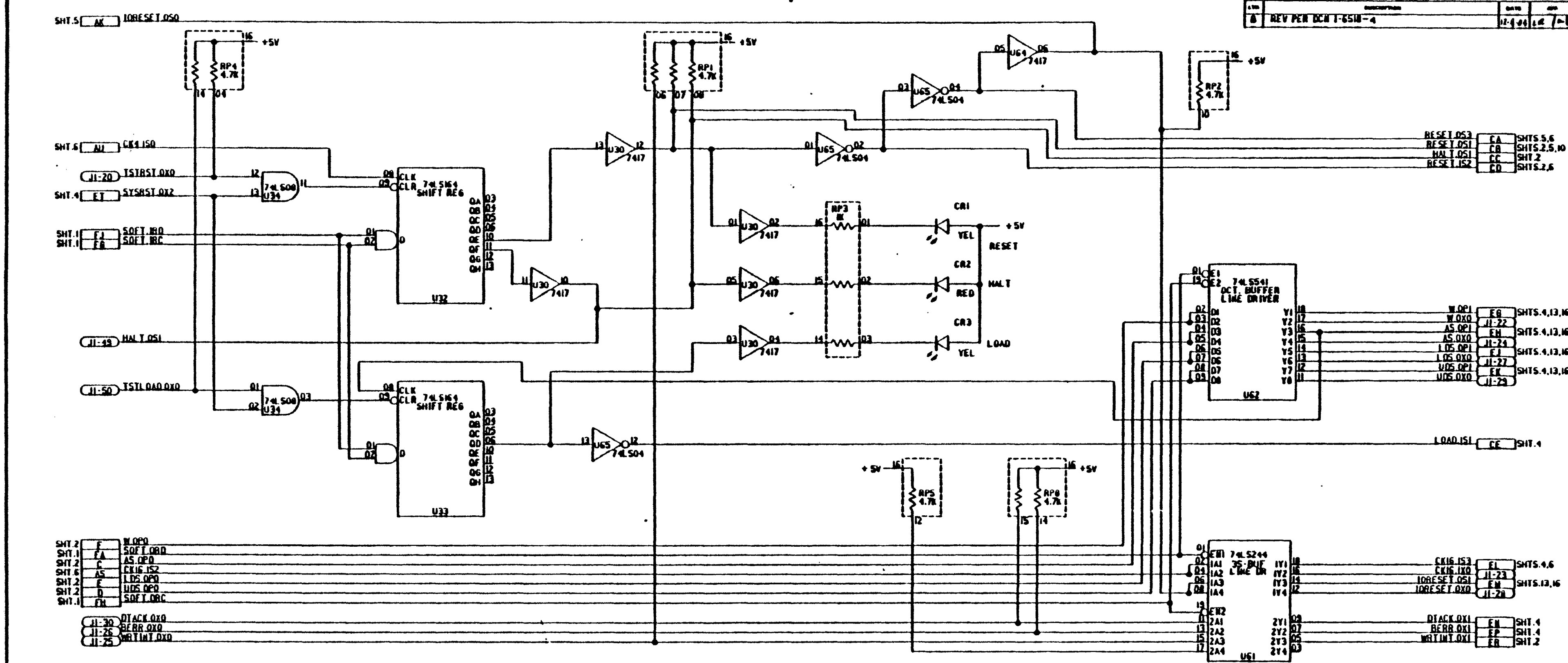

TELEX
LOGIC DIAGRAM
MICROCOMPUTER
92D72387
D
W. WORDEN
R Poindexter
REV PER DCN
SCALE NONE
74LS472 PROM SPARE
74LS472 PROM 2508-01
74LS472 PROM 2508-02
74LS164 SHIFT REG
74LS151 MPX
74LS157 MUX
555



PTMSEL.IGO
SOFT.ORA
DATA.IPO
ADDR.IPO
W.OPO
E.IPO
RESET.OSI
LDS.OPO
CK/4.ISO
REV.ISO
RCLTFIFO.I
DATACPT.IGO
FATTN.I
FRDYIN.I
FMDCLK.IGO
VMA.IP2
6821 PERIPHERAL INTERF ADPTR BI-DIRECT
U35
6840 PROG. TIMER
U42
74LS153 MPX
U214
PTMINT.OSO
RUN
GRN
RED
TVINT.OSO
HOSTINT.OSO
IORESET.OSO
MC1.ISO
MC2.ISO
MCO.ISO
FSEL.ISO
CKS.OS3
SOFT.ORB
DISCKO.OXO
EXTCKO.OXO
DISCKS.OXO
EXTCKS.OXO
MXO1162AI 5.0688 MHZ
U49
74LS00
74LS04
MXO1135AI TB BAUD RATE GENERATOR WD1943/8116
U48
CKT.IS2
TACHIN.IXI
SOFT.IRA
SOFT.IRB
CK/2.ISO
RESET.OS3
74LS74A
U47
U45
74LS20
U43
U65
BSEL0.ISO
BSEL1.ISO
BSEL2.ISO
BSEL3.ISO
S4
GND
+5V
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
W.WORDEN
R. Poindexter
D
92D72387
SHEET 5 OF 16



DO NOT SCALE THIS PRINT
C REV PER DCN 1-6518-4
D 1-6605
EXTCK16.0X0
DISCK16.0X0
RSTCK8.0X0
SOFT.0BD
SOFT.0BC
SOFT.1BA
SOFT.1BB
74LS393 4-BIT BINARY COUNTER U51
CK16.IS2 AS SHT.7
CK8.IS0 AT SHT.2
CK4.IS0 AU SHTS.2,7,12
CK/2.IS0 AV SHTS.4,5
CK/4.IS0 AW SHT.5
PH1.0G0 AX SHT.8
PH3.0G0 AY SHTS.8,11
CK15.IF2 J4-13
CK22.IF2 J4-37
CK/3.IF2 J4-36
CK/8.IF2 J4-12
74LS74A U47
74LS74A U52
74AS74A U60
74AS151 MPX U59
74AS153 MPX U53
74LS393 4-BIT BINARY COUNTER U58
74LS541 OCT. BUFFER LINE DRIVER U63
OSC 16MHZ U50
OSC 15.36 MHZ U54
OSC 21.70 MHZ U55
SPARE U56
SPARE U57
FSEL3.IS0
FSEL0.IS0
FSEL1.IS0
FSEL2.IS0
FSEL4.IS0
FSEL5.IS0
SYSAST.0X1 AZ SHT.4
RC/11.IX0 J2-12
RC/16.IX0 J2-13
RC/8.IX0 J2-14
RC/2.IX0 J2-15
RCCLK.IX0 J2-16
PH3.0X0 J2-17
PH1.0X0 J2-18
DISRCK.0X0
EXTRCK.0X0
RESET.0S3
FSEL.IS0
CK16.IS3
RESET.IS2
SEE SHT.1
APPLICATION
W.WORDEN
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D 92D72387




| | | |
|---|---|---|
| DRAWN | W.WORDEN | 12-03-4 |
| CHECKED | | |
| APPROVED | | |

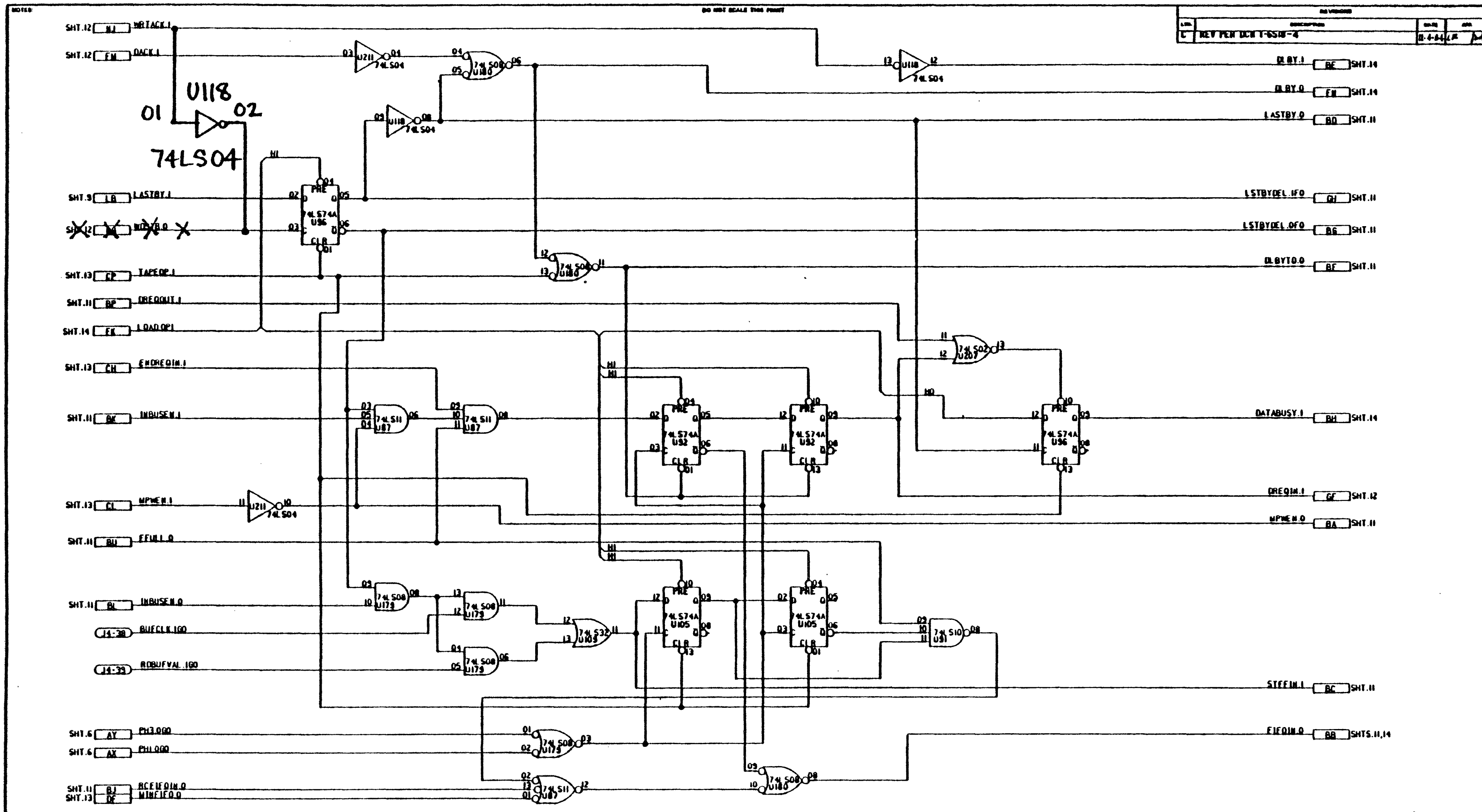
**TELEX**

# LOGIC DIAGRAM MICROCOMPUTER

SIZE D — 92D72387

SCALE NONE — SHEET 2 OF 16

SEE SHT 1 — 9250 — APPLICATION

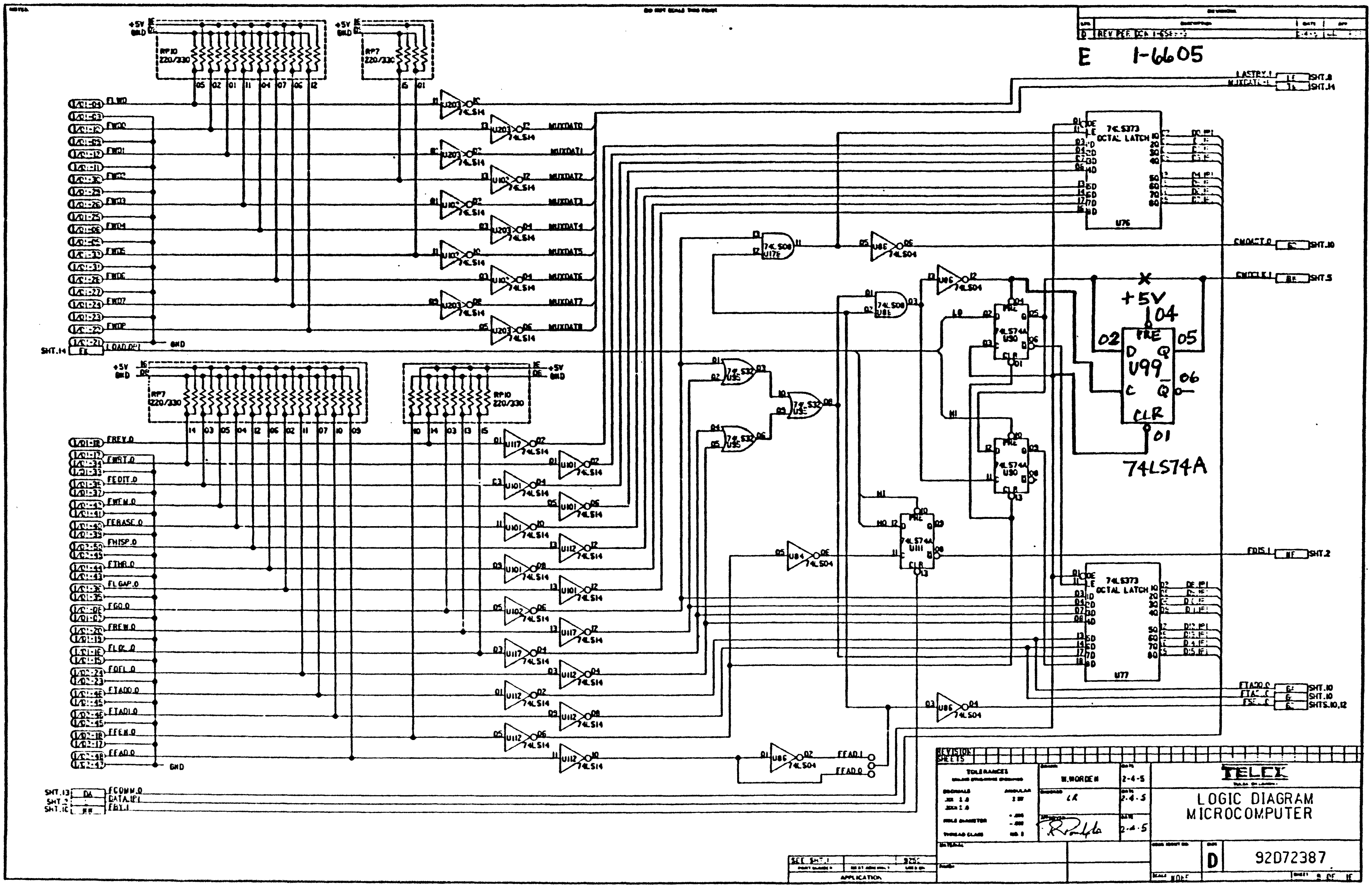


| | |
|---|---|
| DRAWN | W. WORDEN |
| DATE | 2-03-4 |
| CHECKED | LR |
| APPROVED | |

**TELEX**

LOGIC DIAGRAM
MICROCOMPUTER

D 92D72387


E 1-6605
+5V
U99
74LS74A
74LS373 OCTAL LATCH
U76
U77
74LS14
74LS04
74LS08
74LS32
RP10 220/330
RP7 220/330
MUXDAT0
MUXDAT1
MUXDAT2
MUXDAT3
MUXDAT4
MUXDAT5
MUXDAT6
MUXDAT7
MUXDAT8
GND
W. WORDEN
2-4-5
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72387

REVISIONS

| LTR | DESCRIPTION | DATE | APP |
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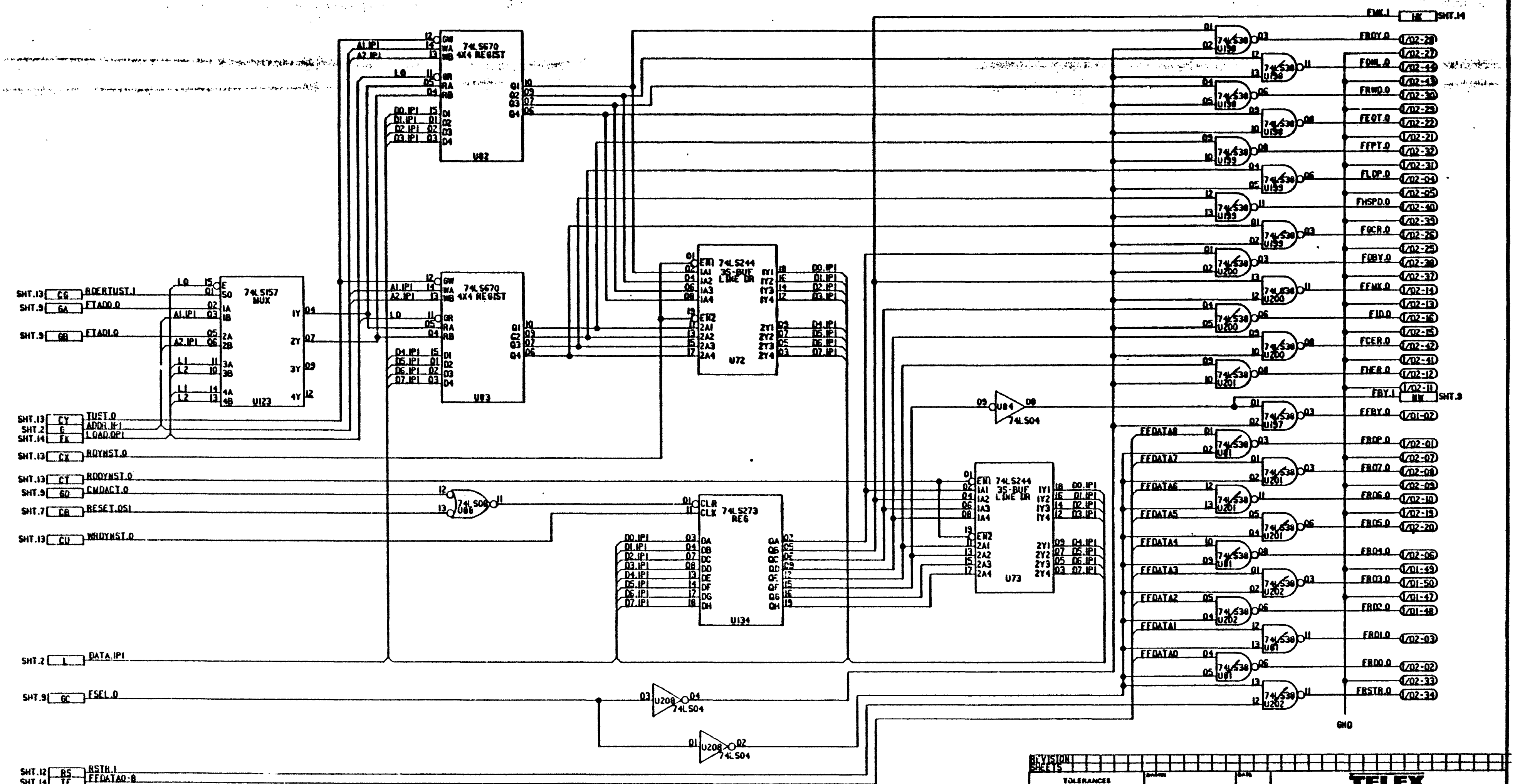
| E | REV PER DCN 1-6580-3 | 2-4-5 | RCP |




| TOLERANCES | | DRAWN | DATE |
|---|---|---|---|
| DECIMALS | ANGULAR | W.WORDEN | 2-4-5 |
| HOLE DIAMETER | | CHECKED LK | 2-4-6 |
| THREAD CLASS | NO. 2 | | 2-4-5 |

SEE SHT.1 | 9750

APPLICATION

**TELEX**

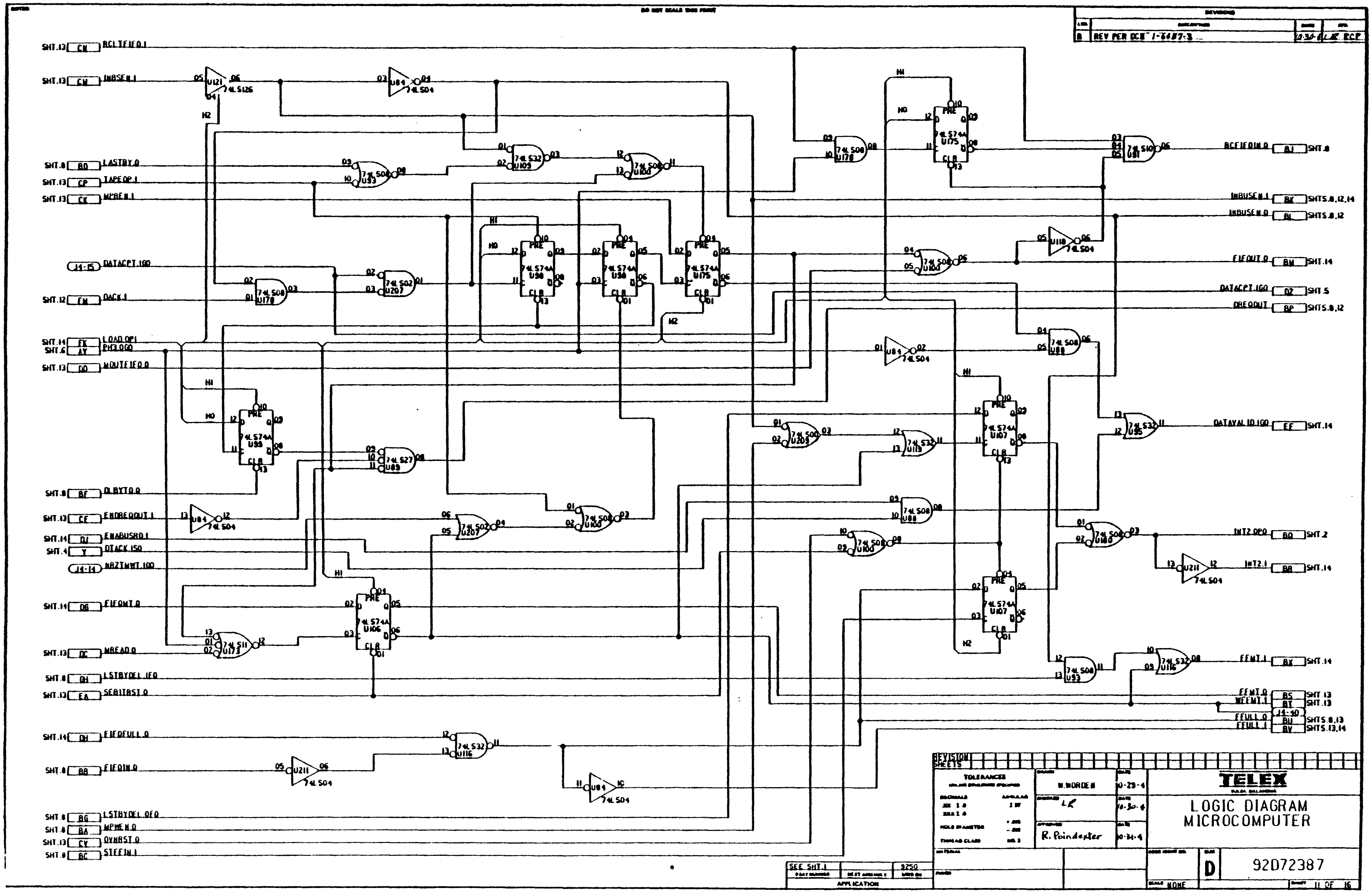
TULSA, OKLAHOMA

LOGIC DIAGRAM
MICROCOMPUTER

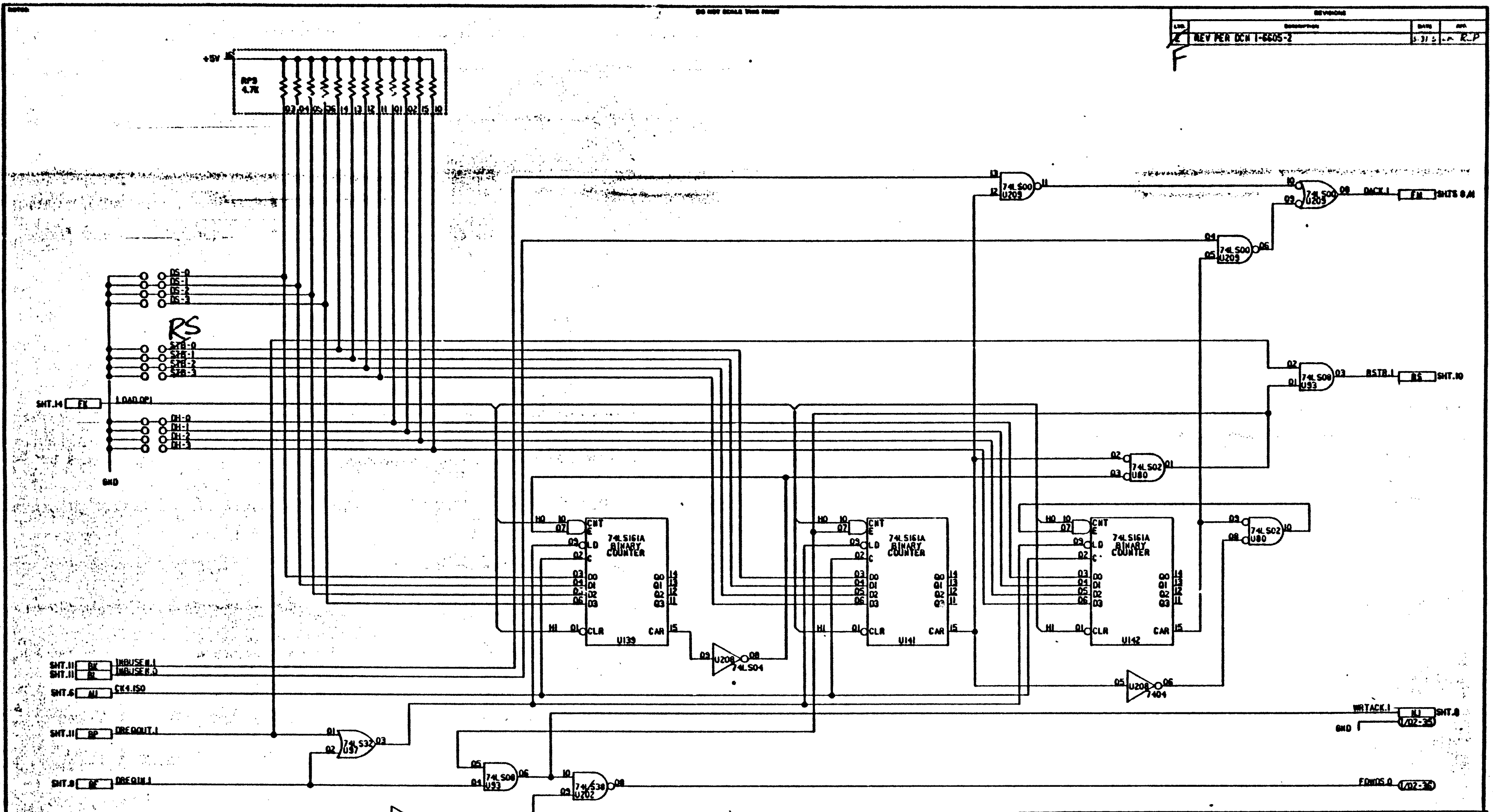
D 92D72387

SCALE NONE

SHEET 10 OF 16



REV PER DCN 1-6487-3
SHT.13 CN RCLTFIFO.1
SHT.13 CM INBSEN.1
SHT.8 BD LASTBY.0
SHT.13 CP TAPEOP.1
SHT.13 CK MPREN.1
J4-15 DATACPT.100
SHT.12 FM DACK.1
SHT.14 FK LOAD.OP1
SHT.6 AY PH3.0G0
SHT.13 DD MOUTFIFO.0
SHT.8 BF DLBYTO.0
SHT.13 CF ENDREQOUT.1
SHT.14 DJ ENABUSRQ.1
SHT.4 Y DTACK.150
J4-14 MAZTMWT.100
SHT.14 DG FIFOMT.0
SHT.13 DC MREAD.0
SHT.8 BH LSTBYDEL.IFO
SHT.13 EA SEBITRST.0
SHT.14 DH FIFOFULL.0
SHT.8 BB FIFOIN.0
SHT.8 BG LSTBYDEL.OFO
SHT.8 BA MPWEN.0
SHT.13 CY DYNRST.0
SHT.8 BC STFFIN.1
RCFIFOIN.0 BJ SHT.8
INBUSEN.1 BK SHTS.8,12,14
INBUSEN.0 BL SHTS.8,12
FIFOUT.0 BM SHT.14
DATACPT.100 DZ SHT.5
DREQOUT BP SHTS.8,12
DATAVALID.100 EF SHT.14
INT2.0PO BQ SHT.2
INT2.1 BR SHT.14
FFMT.1 BX SHT.14
FFMT.0 BS SHT.13
MFEMT.1 BT SHT.13
J4-10
FFULL.0 BU SHTS.8,13
FFULL.1 BV SHTS.13,14
74LS126 74LS04 74LS08 74LS32 74LS02 74LS10 74LS27 74LS11 74LS74A
TOLERANCES
W.WORDEN 10-29-4
LR 10-30-4
R. Poindexter 10-31-4
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72387
SCALE NONE
SHEET 11 OF 16
SEE SHT.1
9250
APPLICATION




| | |
|---|---|
| DRAWN | W.WORDEN |
| CHECKED | 5-31-5 |

TELEX

TULSA, OKLAHOMA

LOGIC DIAGRAM
MICROCOMPUTER

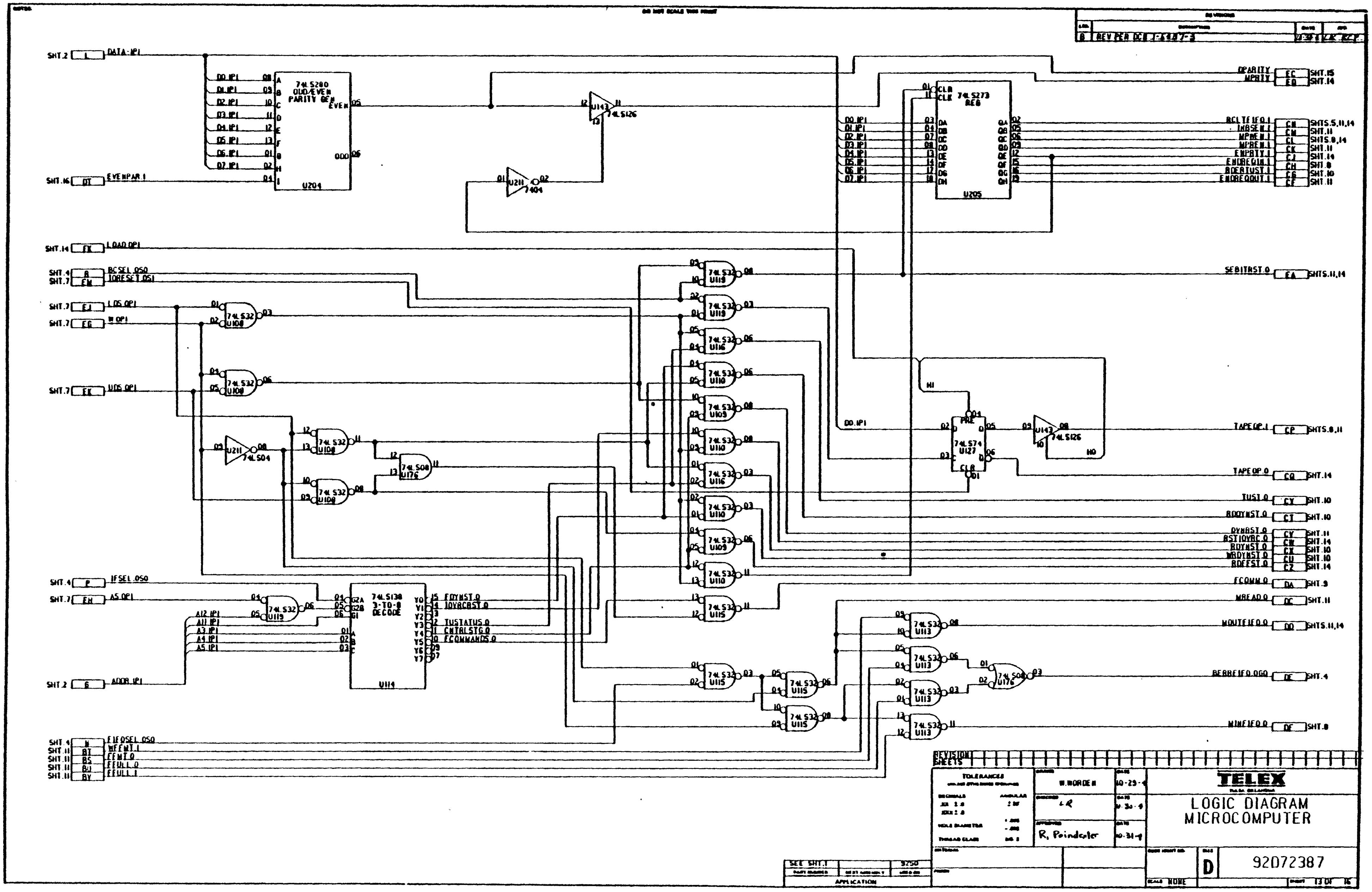
D 92D72387

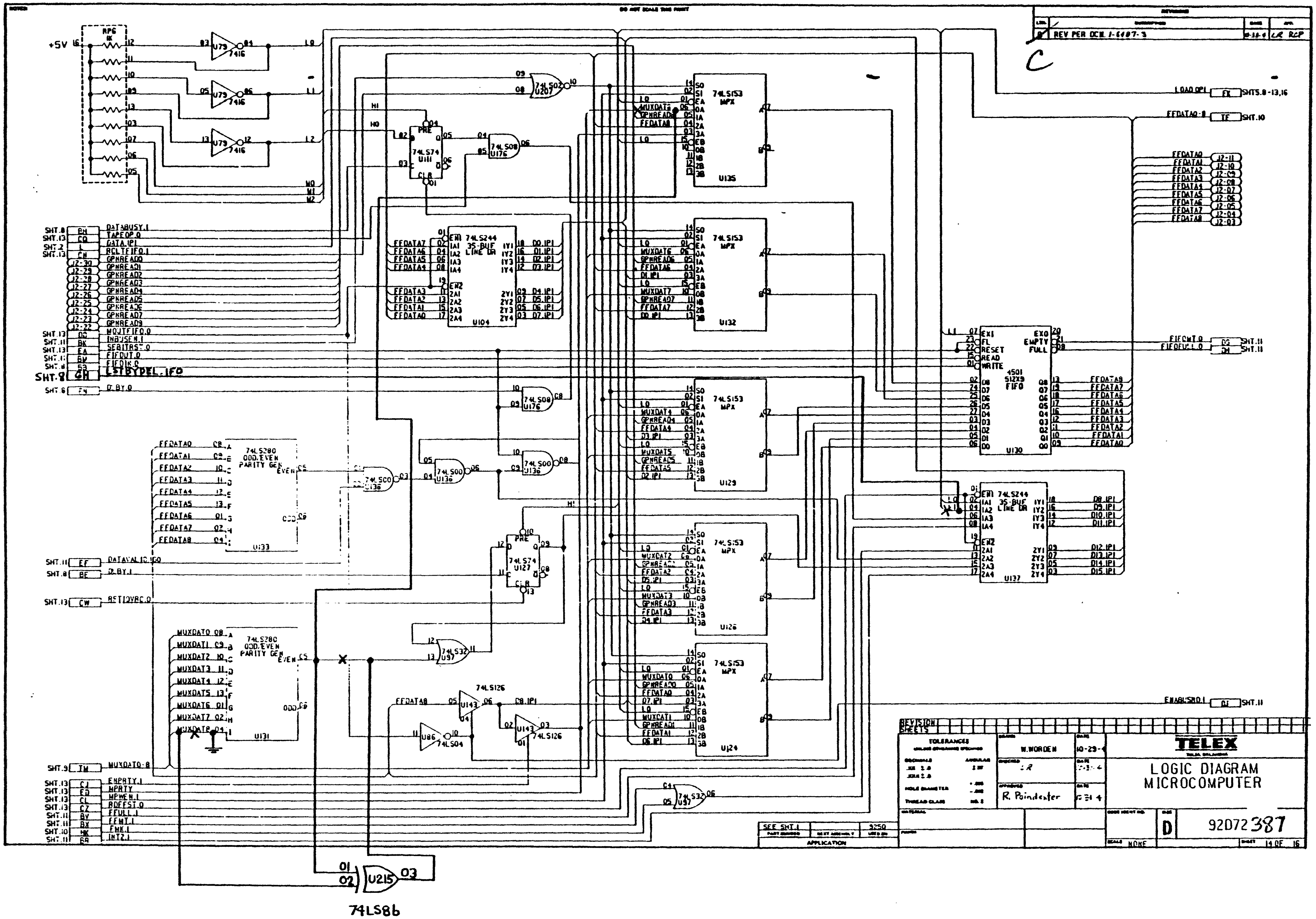
SCALE NONE

SHEET 12 OF 16

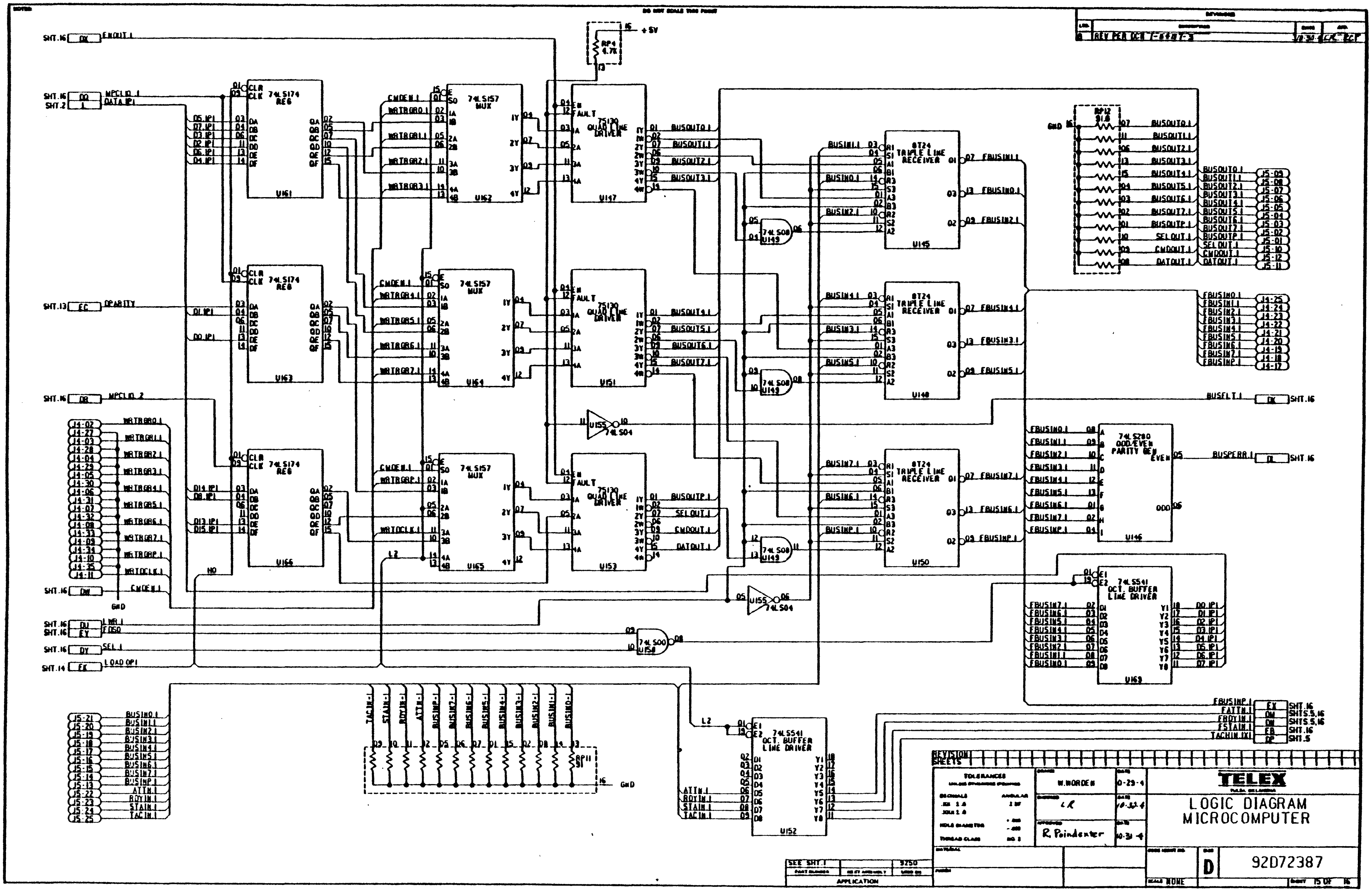
SEE SHT.1 9250

APPLICATION


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCO 1-6407-8
SHT.2 L DATA-IP1
D0.IP1
D1.IP1
D2.IP1
D3.IP1
D4.IP1
D5.IP1
D6.IP1
D7.IP1
74LS280 ODD/EVEN PARITY GEN
EVEN
ODD
U204
SHT.16 DT EVENPAR.1
U143 74LS126
U211 7404
74LS273 REG
U205
CLR
CLK
OPARITY
MPRTY
EC SHT.15
EQ SHT.14
BCLTFIFO.1
INBSEN.1
MPREN.1
MPREN.1
ENPRTY.1
ENDREGIN.1
BOERTUST.1
ENDREQOUT.1
CN SHTS.5,11,14
CM SHT.11
CL SHTS.8,14
CK SHT.11
CJ SHT.14
CH SHT.11
CG SHT.10
CF SHT.11
SHT.14 FK LOAD.OP1
SHT.4 R BCSEL.0S0
SHT.7 FM IORESET.0S1
SHT.7 FJ LDS.OP1
SHT.7 FG W.OP1
SHT.7 FK UDS.OP1
SEBITRST.0
EA SHTS.11,14
74LS32
U108
U119
U116
U110
U109
U115
U113
74LS04
74LS08
U176
74LS74
U127
PRE
HI
HO
D0.IP1
TAPEOP.1
CP SHTS.8,11
TAPEOP.0
CQ SHT.14
TUST.0
CY SHT.10
RDDYNST.0
CT SHT.10
DYNRST.0
RSTIOYRC.0
RDYNST.0
WRDYNST.0
RDFEST.0
CV SHT.11
CW SHT.14
CX SHT.10
CU SHT.10
CZ SHT.14
SHT.4 P IFSEL.0S0
SHT.7 FH AS.OP1
A12.IP1
A11.IP1
A3.IP1
A4.IP1
A5.IP1
SHT.2 G ADDR.IP1
74LS138 3-TO-8 DECODE
U114
FDYNST.0
IOYRCRST.0
TUSTATUS.0
CNTRLSTG.0
FCOMMANDS.0
FCOMM.0
DA SHT.9
MREAD.0
DC SHT.11
MOUTFIFO.0
DD SHTS.11,14
BERRFIFO.0S0
DE SHT.4
MINFIFO.0
DF SHT.8
SHT.4 N FIFOSEL.0S0
SHT.11 BT WFEMT.1
SHT.11 BS FEMT.0
SHT.11 BU FFULL.0
SHT.11 BY FFULL.1
REVISION
SHEETS
TOLERANCES
W.NORDEN
R. Poindexter
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72387
SCALE NONE
SHEET 13 OF 16
SEE SHT.1
APPLICATION



REV PER DCN 1-6487-3
C
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
W. WORDEN
R. Poindexter
D
92D72387
SEE SHT. 1
APPLICATION
NONE
14 OF 16
74LS153 MPX
74LS244 3S-BUF LINE DR
4501 512X9 FIFO
74LS280 ODD/EVEN PARITY GEN
74LS74
U215
74LS86


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
W. WORDEN
R. Poindexter
D
92D72387
SCALE NONE
SHEET 15 OF 16
REV PER DCN
74LS174 REG
74LS157 MUX
75130 QUAD LINE DRIVER
8T24 TRIPLE LINE RECEIVER
74LS280 ODD/EVEN PARITY GEN
74LS541 OCT. BUFFER LINE DRIVER
74LS08
74LS04
74LS00
U161
U162
U147
U145
U163
U164
U151
U148
U166
U165
U153
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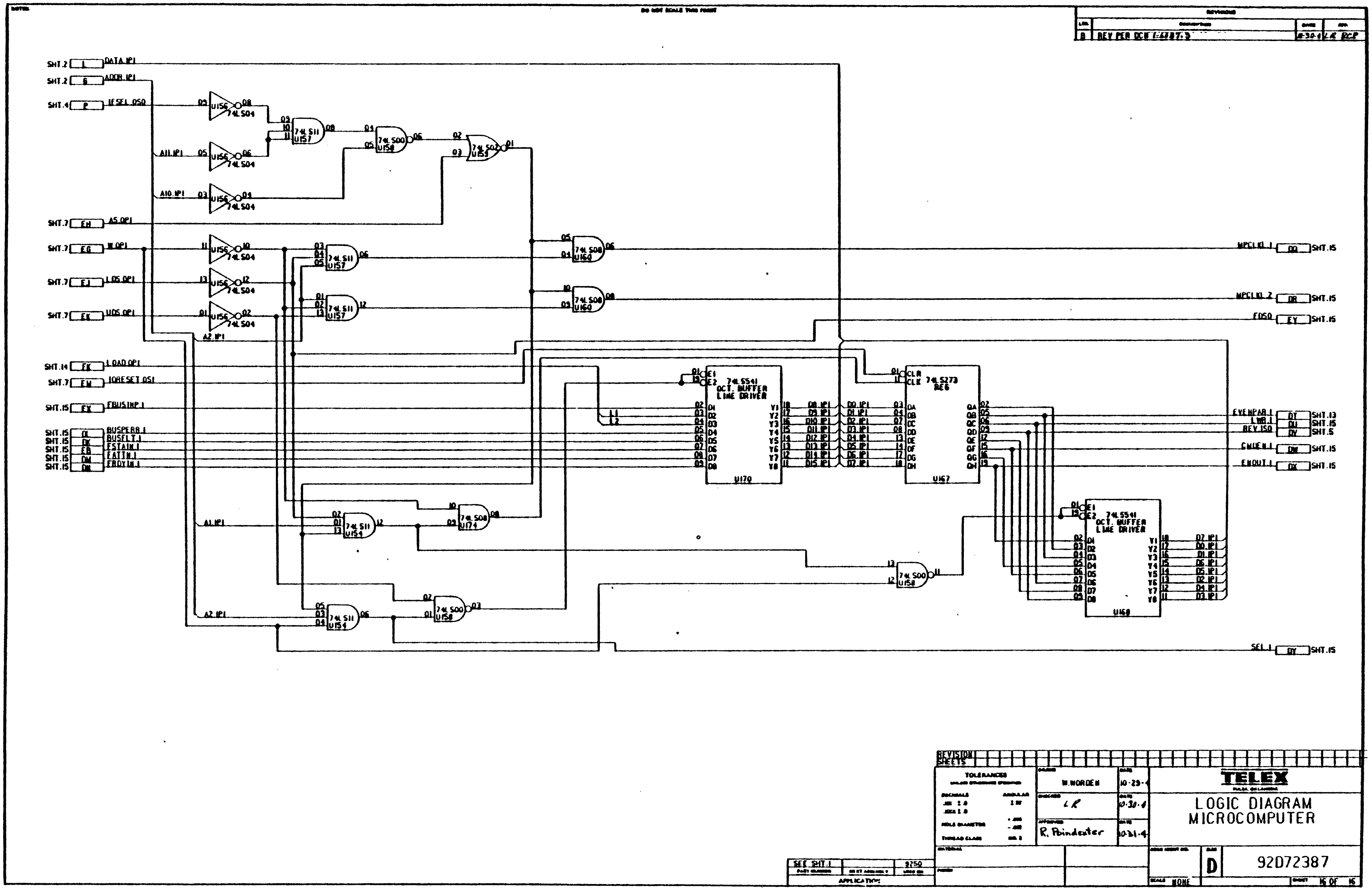
U152
U149
U155
U158




TELEX

LOGIC DIAGRAM
MICROCOMPUTER

W.WORDEN

R. Poindexter

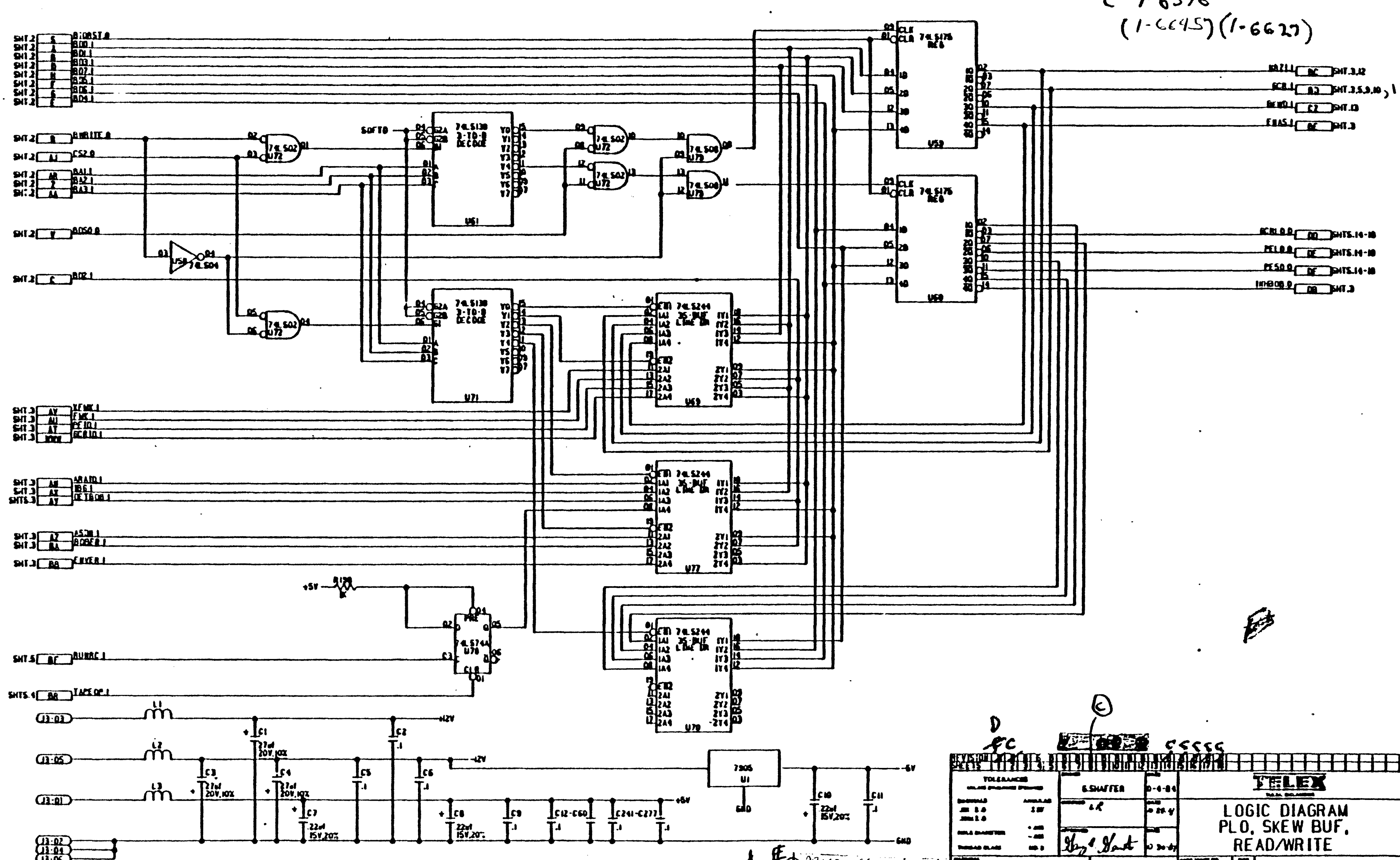
D 92D72387

SCALE NONE

SHEET 16 OF 16

UNLESS OTHERWISE SPECIFIED (CONT'D ON SHT.10)

1. GATE ARRAYS ARE POWERED BY VDD (+5V) AND GROUNDED BY VSS (GND)




TELEX

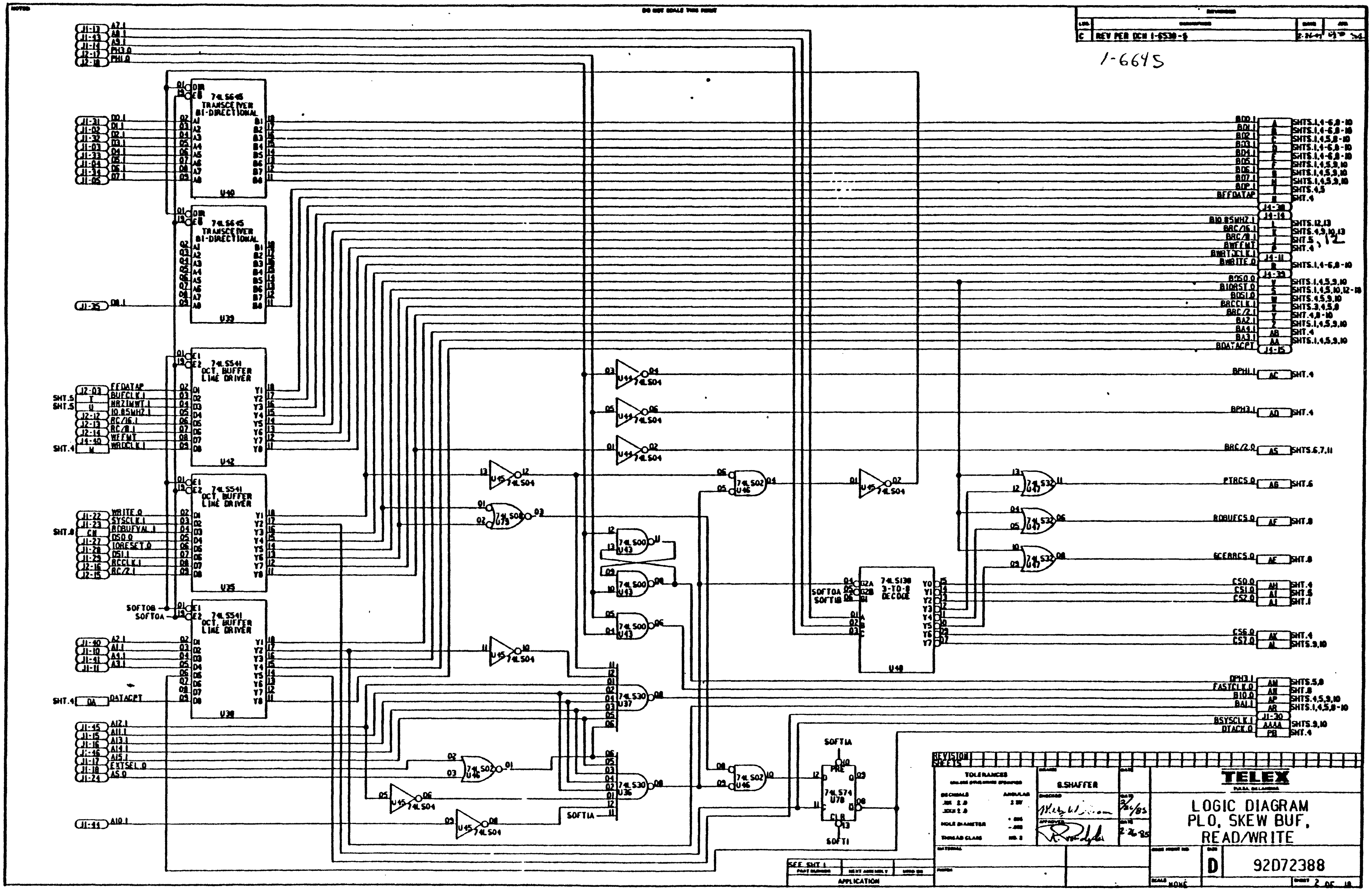
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE

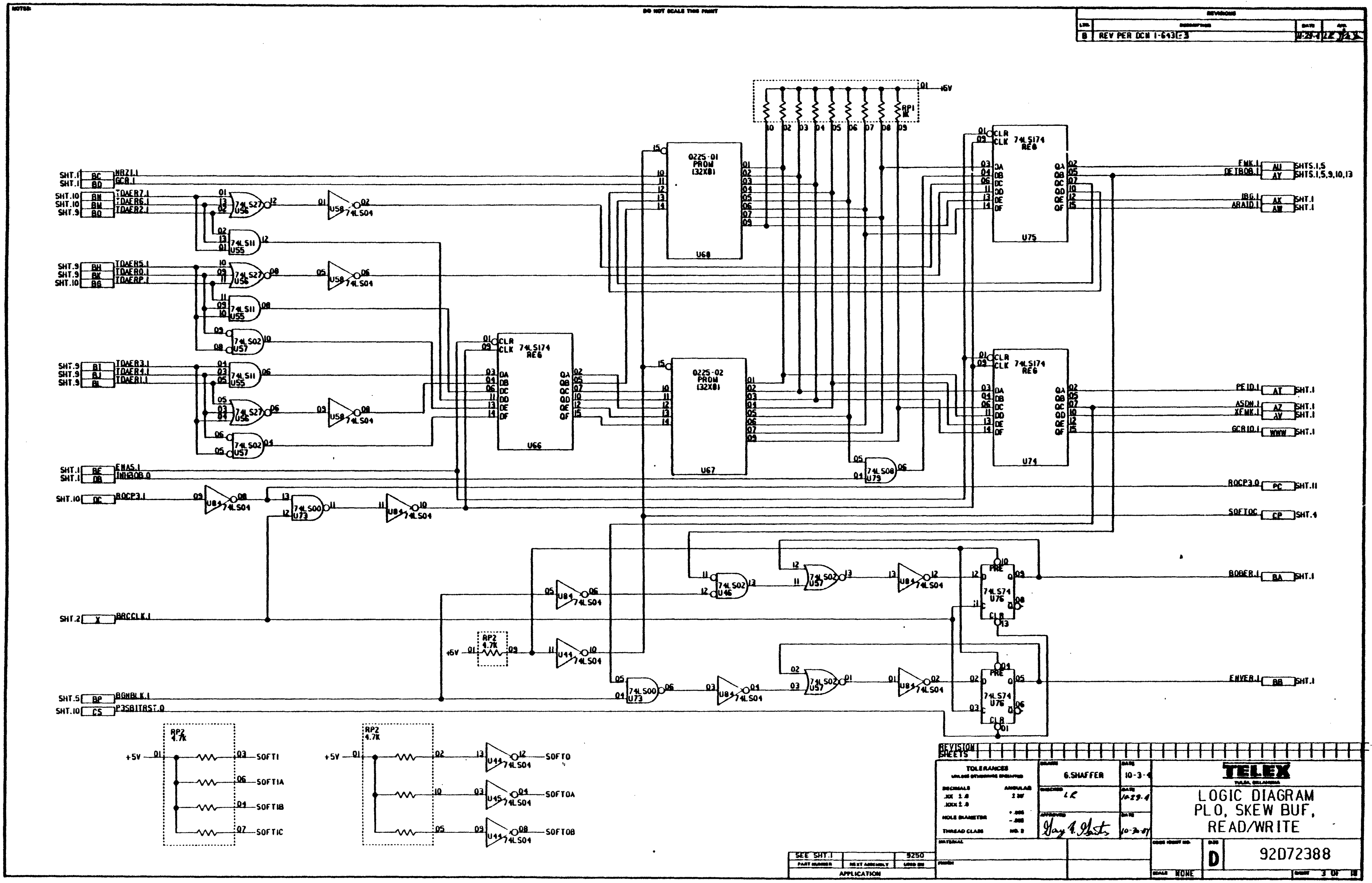
G.SHAFFER

D 92D72388

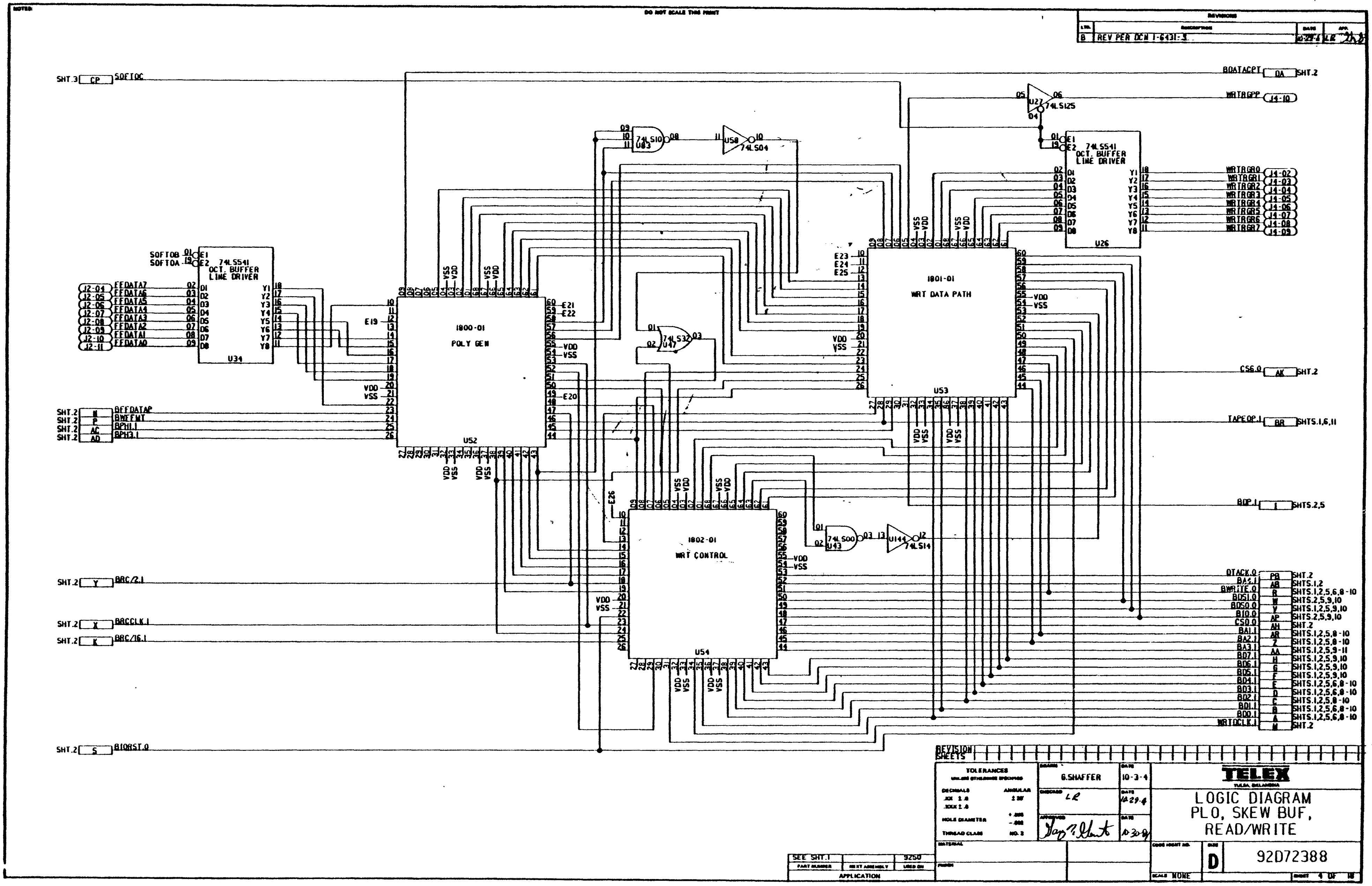
SCALE NONE

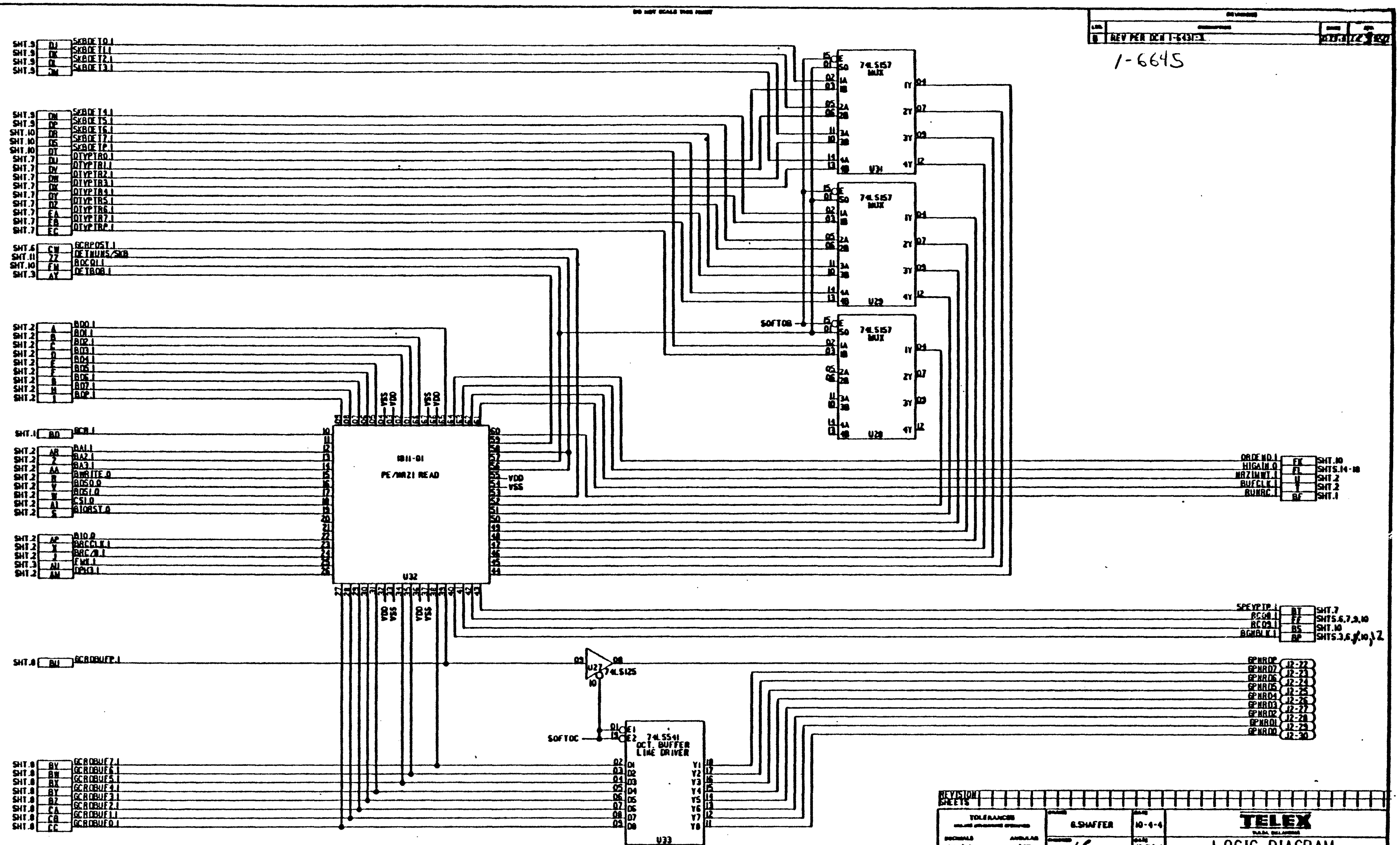
SHEET 1 OF 18


DO NOT SCALE THIS PRINT
C REV PER DCN 1-6530-S
1-6645
74LS645 TRANSCEIVER BI-DIRECTIONAL
74LS541 OCT. BUFFER LINE DRIVER
74LS138 3-TO-8 DECODE
74LS74
TOLERANCES
B.SHAFFER
TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
D
92D72388
SCALE NONE
SHEET 2 OF 18
APPLICATION



DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6431-3
RP1 1K
0225-01 PROM (32X8)
U68
0225-02 PROM (32X8)
U67
74LS174 REG
U75
U74
U66
74LS27
74LS11
74LS02
74LS04
74LS00
74LS08
74LS74
U76
RP2 4.7K
SHT.1 BC NRZI.I
SHT.1 BD GCR.I
SHT.10 BN TDAER7.I
SHT.10 BM TDAER6.I
SHT.9 BO TDAER2.I
SHT.9 BH TDAER5.I
SHT.9 BK TDAER0.I
SHT.10 BG TDAERP.I
SHT.9 BI TDAER3.I
SHT.9 BJ TDAER4.I
SHT.9 BL TDAER1.I
SHT.1 BE ENAS.I
SHT.1 DB INHBOB.0
SHT.10 DC ROCP3.I
SHT.2 X BRCCLK.I
SHT.5 BP BGNBLK.I
SHT.10 CS P3SBITRST.0
FMK.I AU SHTS.1,5
DETBOB.I AY SHTS.1,5,9,10,13
IBG.I AX SHT.1
ARAID.I AW SHT.1
PEID.I AT SHT.1
ASDN.I AZ SHT.1
XFMK.I AV SHT.1
GCRID.I WWW SHT.1
ROCP3.0 PC SHT.11
SOFTOC CP SHT.4
BOBER.I BA SHT.1
ENVER.I BB SHT.1
+5V
SOFTI
SOFTIA
SOFTIB
SOFTIC
SOFTO
SOFTOA
SOFTOB
REVISION SHEETS
TOLERANCES
G.SHAFFER
TELEX
LOGIC DIAGRAM PLO, SKEW BUF, READ/WRITE
SEE SHT.1
9250
APPLICATION
D
92D72388
SCALE NONE
SHEET 3 OF 18


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6431-3
SHT.3 CP SOFTOC
BDATACPT DA SHT.2
WRTRGPP J4-10
74LS125
74LS541 OCT. BUFFER LINE DRIVER
74LS10 U83
U58 74LS04
1800-01 POLY GEN
U52
1801-01 WRT DATA PATH
U53
1802-01 WRT CONTROL
U54
74LS32 U47
74LS00 U43
U144 74LS14
U34
U26
SOFTOB
SOFTOA
FFDATA7
FFDATA6
FFDATA5
FFDATA4
FFDATA3
FFDATA2
FFDATA1
FFDATA0
SHT.2 N BFFDATAP
SHT.2 P BWFFMT
SHT.2 AC BPH1.1
SHT.2 AD BPH3.1
SHT.2 Y BRC/2.1
SHT.2 X BRCCLK.1
SHT.2 K BRC/16.1
SHT.2 S BIORST.0
WRTRGR0 J4-02
WRTRGR1 J4-03
WRTRGR2 J4-04
WRTRGR3 J4-05
WRTRGR4 J4-06
WRTRGR5 J4-07
WRTRGR6 J4-08
WRTRGR7 J4-09
CS6.0 AK SHT.2
TAPEOP.1 BR SHTS.1,6,11
BOP.1 I SHTS.2,5
DTACK.0 PB SHT.2
BA4.1 AB SHTS.1,2
BWRITE.0 R SHTS.1,2,5,6,8-10
BDS1.0 W SHTS.2,5,9,10
BDS0.0 V SHTS.1,2,5,9,10
BI0.0 AP SHTS.2,5,9,10
CS0.0 AH SHT.2
BA1.1 AR SHTS.1,2,5,8-10
BA2.1 Z SHTS.1,2,5,8-10
BA3.1 AA SHTS.1,2,5,9-11
BD7.1 H SHTS.1,2,5,9,10
BD6.1 G SHTS.1,2,5,9,10
BD5.1 F SHTS.1,2,5,9,10
BD4.1 E SHTS.1,2,5,6,8-10
BD3.1 D SHTS.1,2,5,6,8-10
BD2.1 C SHTS.1,2,5,8-10
BD1.1 B SHTS.1,2,5,6,8-10
BD0.1 A SHTS.1,2,5,6,8-10
WRTOCLK.1 M SHT.2
TOLERANCES
G.SHAFFER 10-3-4
TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
SEE SHT.1 9250
APPLICATION
D 92D72388
SCALE NONE
SHEET 4 OF 18




REV PER DCN 1-6431-3

1-6645

REVISION SHEETS

TOLERANCES

B.SHAFFER 10-4-4

TELEX

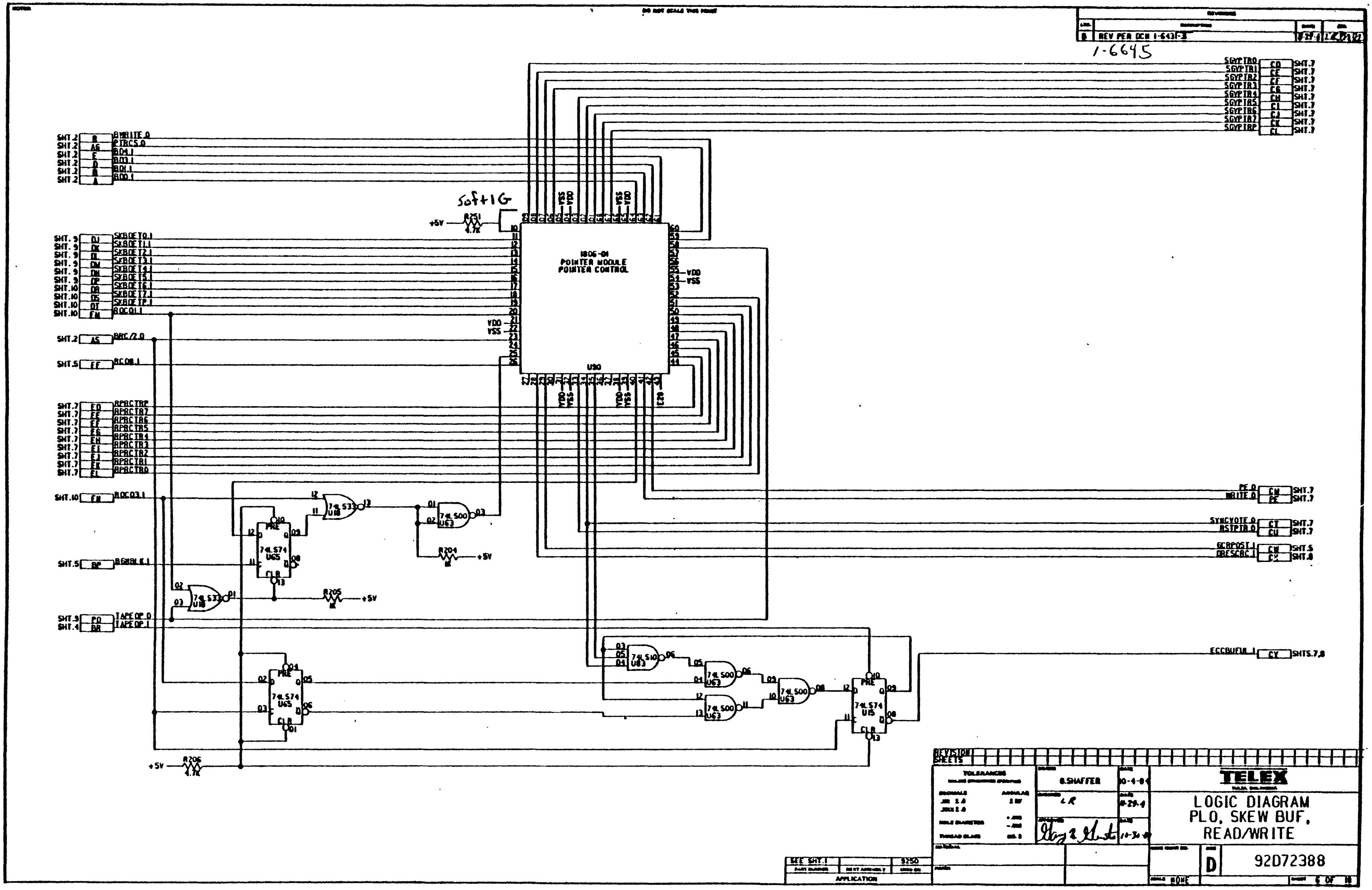
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE

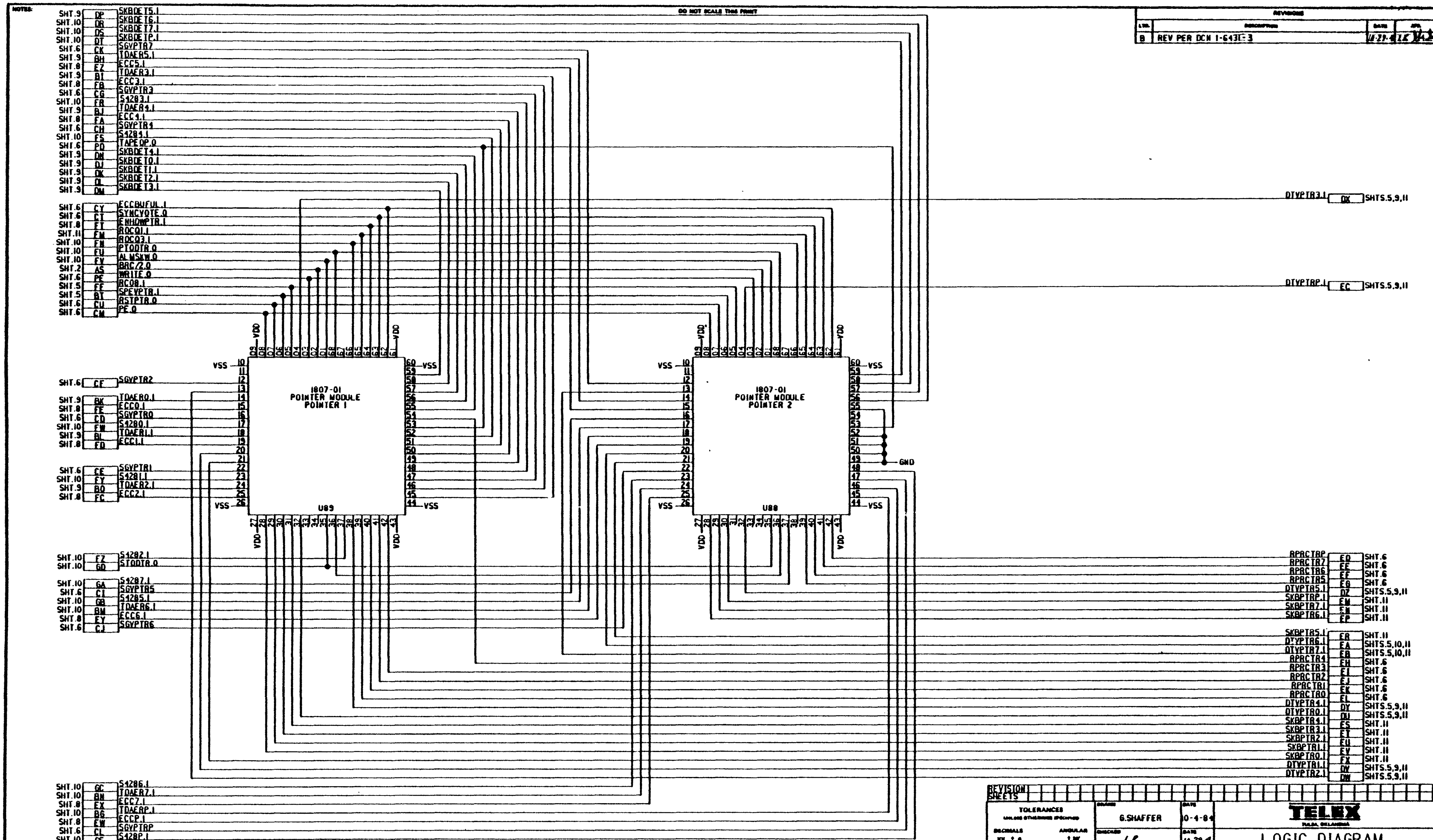
SEE SHT.1 | 9250

APPLICATION

D | 92D72388

SCALE NONE | SHEET 5 OF 18


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6431-3
1-6645
Soft 1G
1806-01
POINTER MODULE
POINTER CONTROL
U30
+5V
R251
4.7K
BWRITE.0
PTRCS.0
BD4.1
BD3.1
BD2.1
BD1.1
BD0.1
SKBDET0.1
SKBDET1.1
SKBDET2.1
SKBDET3.1
SKBDET4.1
SKBDET5.1
SKBDET6.1
SKBDET7.1
SKBDETP.1
BOCO1.1
BRC/2.0
RCO8.1
RPRCTRP
RPRCTR7
RPRCTR6
RPRCTR5
RPRCTR4
RPRCTR3
RPRCTR2
RPRCTR1
RPRCTR0
ROCO3.1
RGNBLK.1
TAPEOP.0
TAPEOP.1
SGYPTR0
SGYPTR1
SGYPTR2
SGYPTR3
SGYPTR4
SGYPTR5
SGYPTR6
SGYPTR7
SGYPTRP
PE.0
WRITE.0
SYNCYOTF.0
RSTPTR.0
SCRPOST.1
DRESCRC.1
ECCBUFUL.1
SHTS.7,8
74LS32 U18
74LS00 U63
74LS74 U65
74LS10 U83
74LS74 U15
R204
R205
R206
4.7K
VDD
VSS
TELEX
B.SHAFFER
10-4-84
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
D
92D72388
SEE SHT.1
9250
APPLICATION
NONE
5 OF 10




REVISIONS

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| B | REV PER DCN 1-6431-3 | 11-29-84 | |

| | |
|---|---|
| DRAWN | G.SHAFFER 10-4-84 |
| CHECKED | LR 10-29-84 |
| APPROVED | 10-30-84 |

TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE

SIZE D 92D72388
SCALE NONE
SHEET 7 OF 11

SEE SHT.1 | 9250
APPLICATION

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
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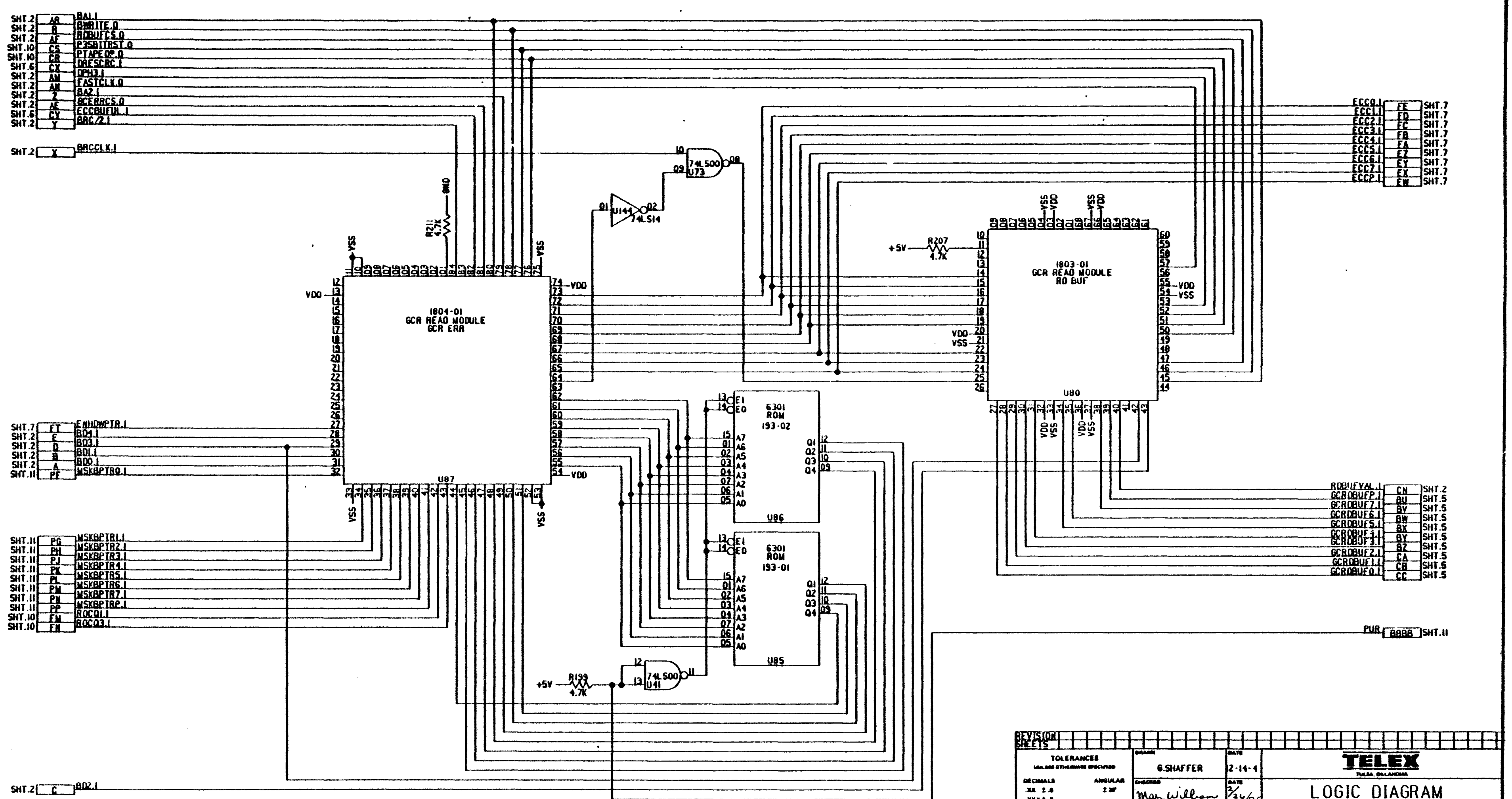


| REVISION | |
|---|---|
| SHEETS | |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30'

HOLE DIAMETER + .005 − .002

THREAD CLASS NO. 2

DRAWN G.SHAFFER — DATE 12-14-4

CHECKED Mary William — DATE 3/24/85

APPROVED R. Pendyke — DATE 2-26-85

TELEX
TULSA, OKLAHOMA

# LOGIC DIAGRAM PLO, SKEW BUF, READ/WRITE

SEE SHT.1 — 9250

PART NUMBER — NEXT ASSEMBLY — USED ON

APPLICATION

MATERIAL

FINISH

CODE IDENT NO. — SIZE D — 92D72388

SCALE NONE — SHEET 8 OF 18

NOTE – RESERVED PINS FOR INPUTS.

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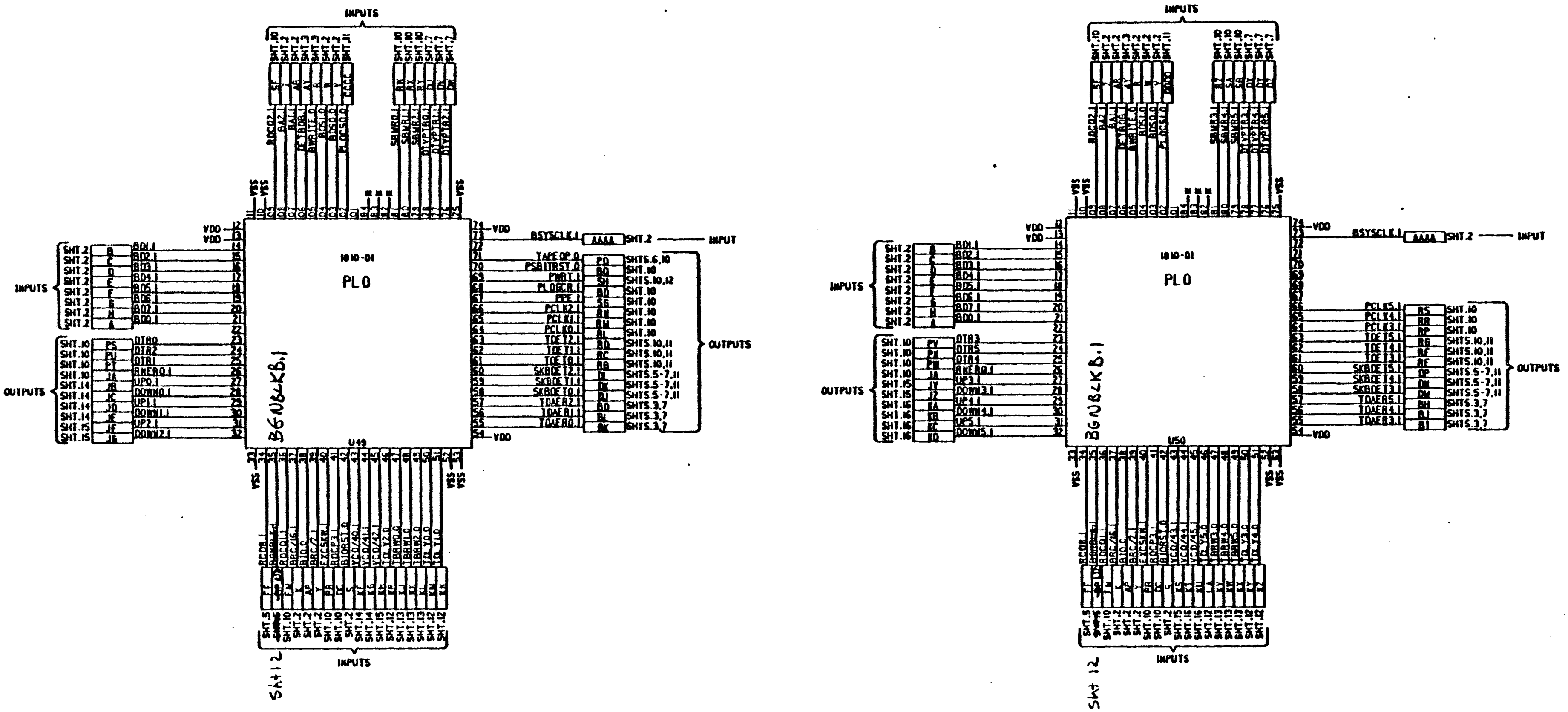
| | | | |
|---|---|---|---|
| B | REV PER DCN 1-6431-3 | | |

1-6645




TELEX

LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE

G.SHAFFER 10-4-84

SEE SHT.1 | 9250

APPLICATION

D 92D72388

SCALE NONE

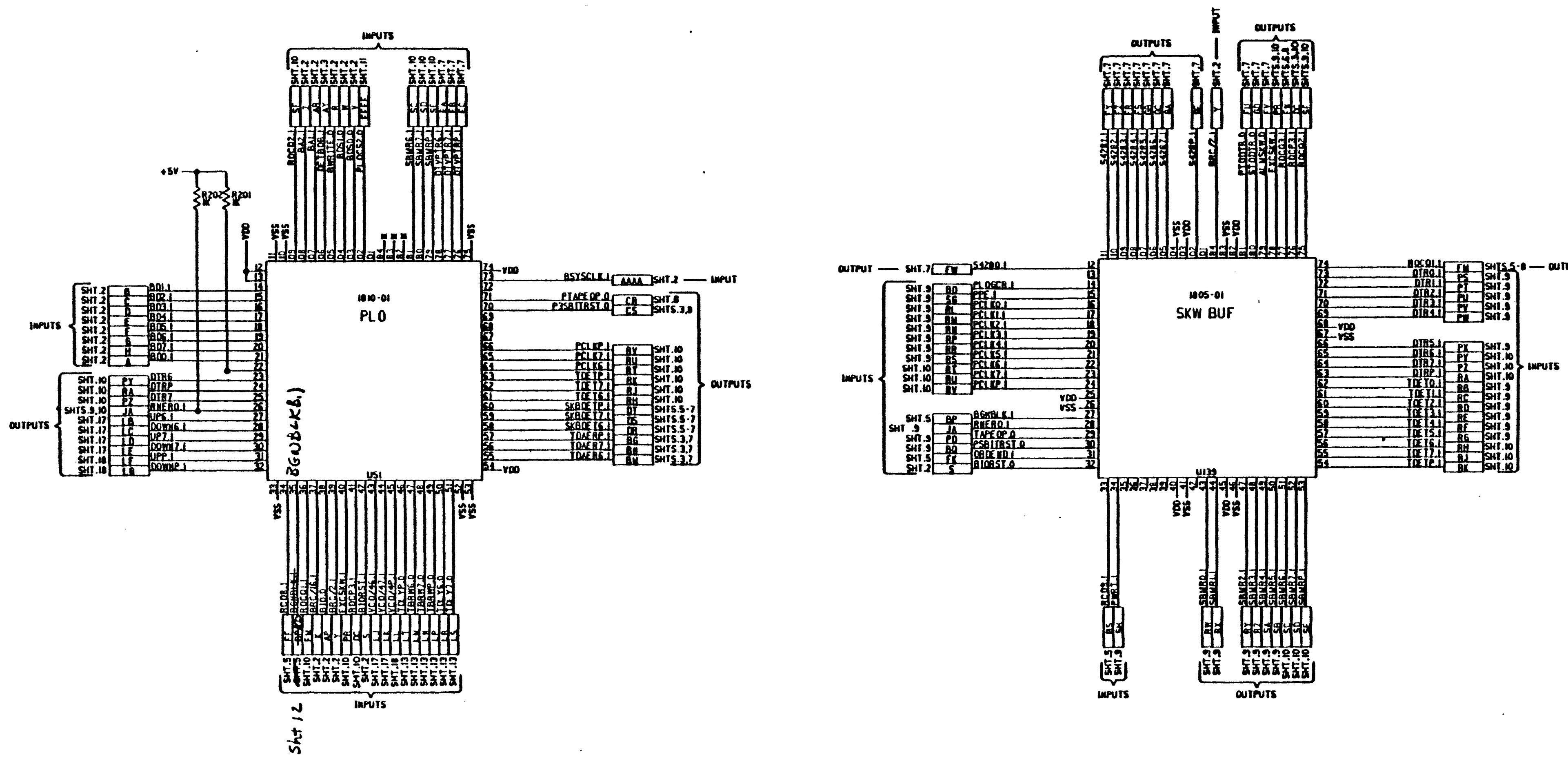
SHEET 9 OF 10

NOTES- RESERVED PINS FOR INPUTS

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APPD |
|---|---|---|---|
| B | REV PER DCN 1-6431-3 | | |

1-6645




| TOLERANCES | DRAWN G.SHAFFER | 10-4-84 |
|---|---|---|
| | CHECKED LR | |
| | APPROVED | |

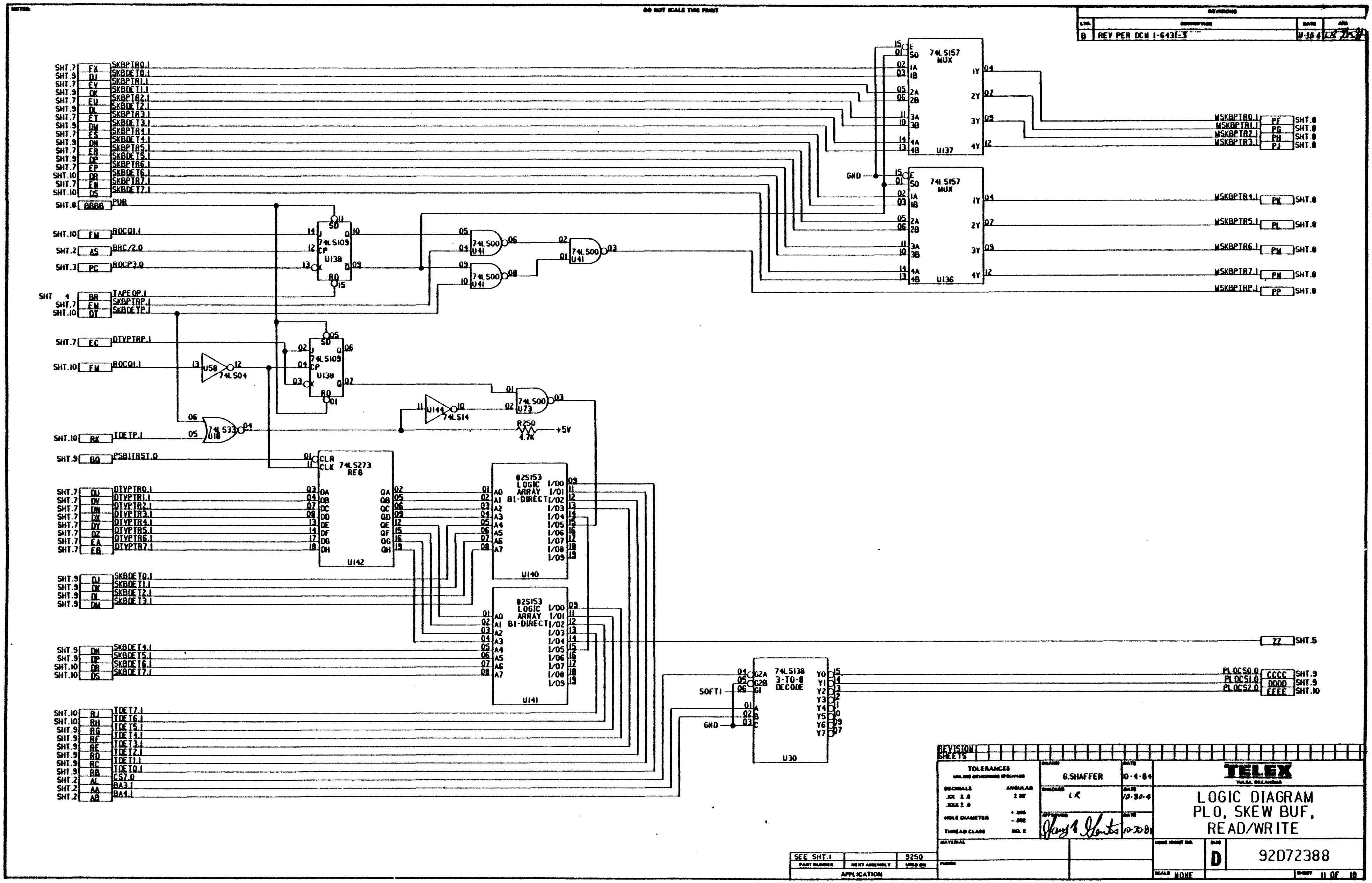
TELEX

LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE

SEE SHT.1 | 9250 | APPLICATION

SIZE D | 92D72388

SCALE NONE | SHEET 10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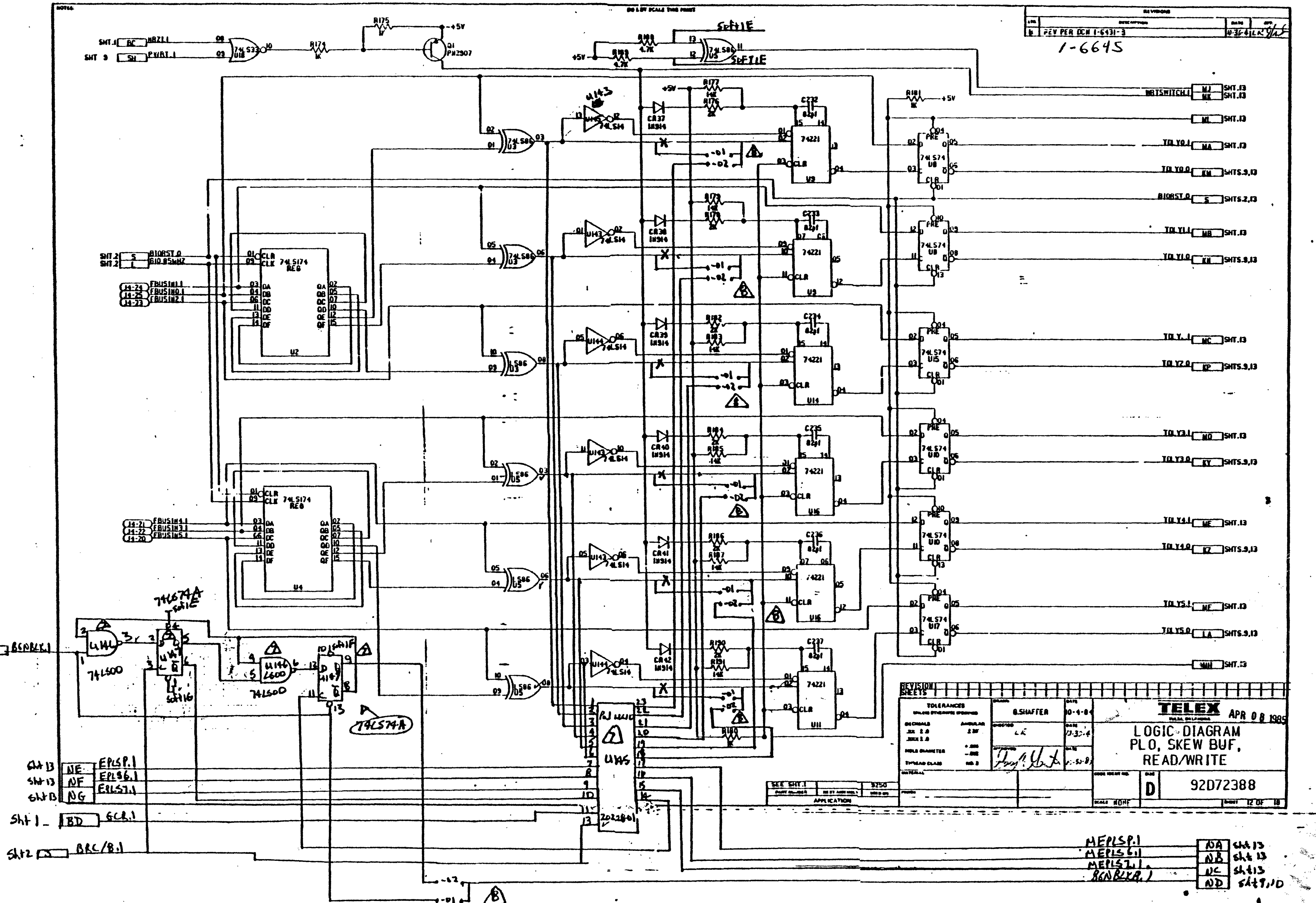
74LS157 MUX
74LS109
74LS00
74LS04
74LS14
74LS32
74LS273 REG
82S153 LOGIC ARRAY BI-DIRECT
74LS138 3-TO-8 DECODE
TOLERANCES
G.SHAFFER
10-4-84
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
D
92D72388
SEE SHT.1
9250
APPLICATION
NONE
11 OF 18



REV PER DCN 1-6431-3
1-6645
TELEX
APR 08 1985
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
D
92D72388
G.SHAFFER
SEE SHT.1
APPLICATION
74LS174 REG
74221
74LS74
74LS86
74LS14
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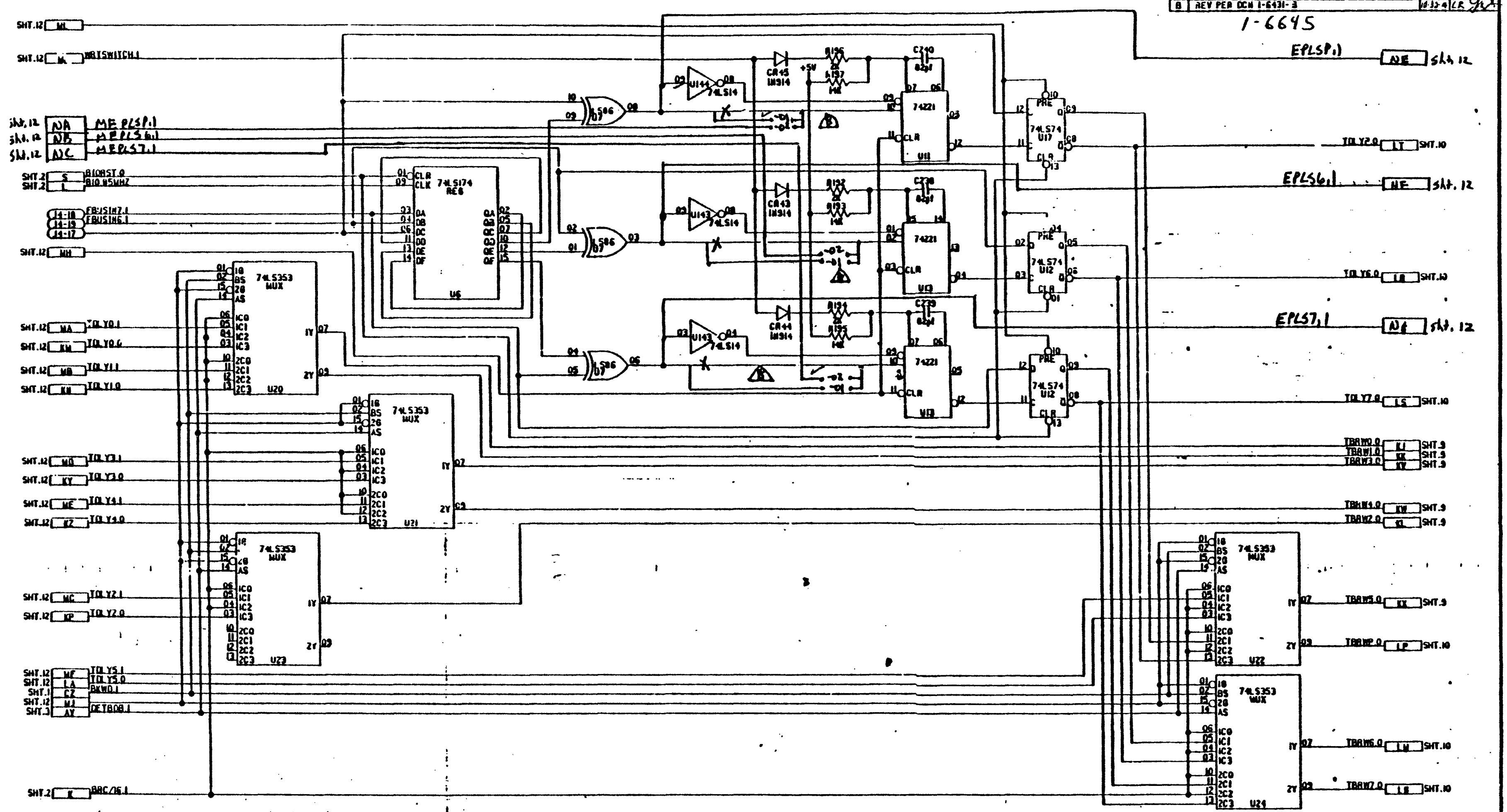
MEPLS6.1
MEPLS7.1
BGNBLKB.1


Sub 8

REV PER DCN 1-6431-3

1-6645




TELEX APR 08 1985

G.SHAFFER 10-4-8

LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE

D 92D72388

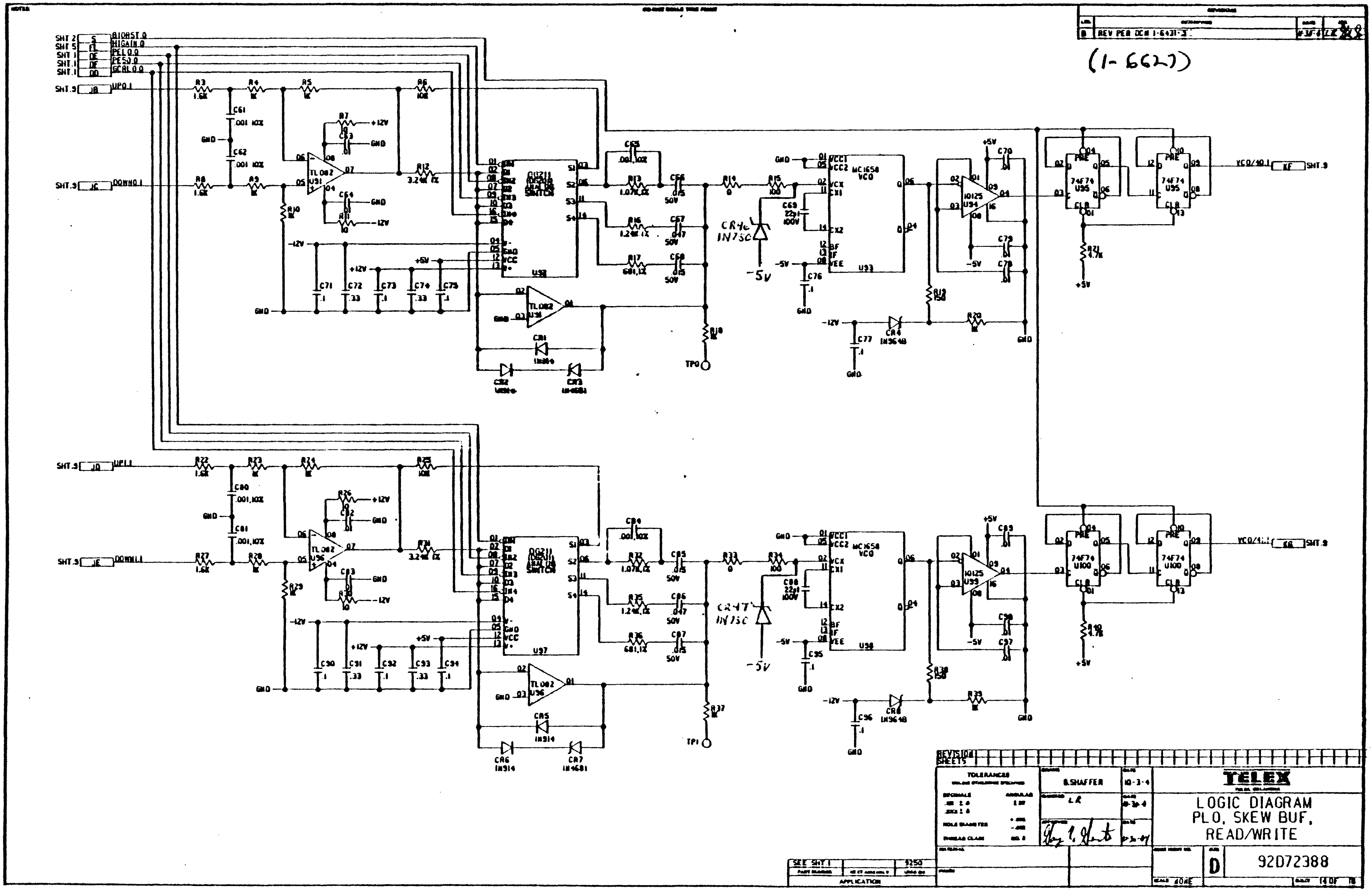
SCALE NONE SHEET 13 OF 18

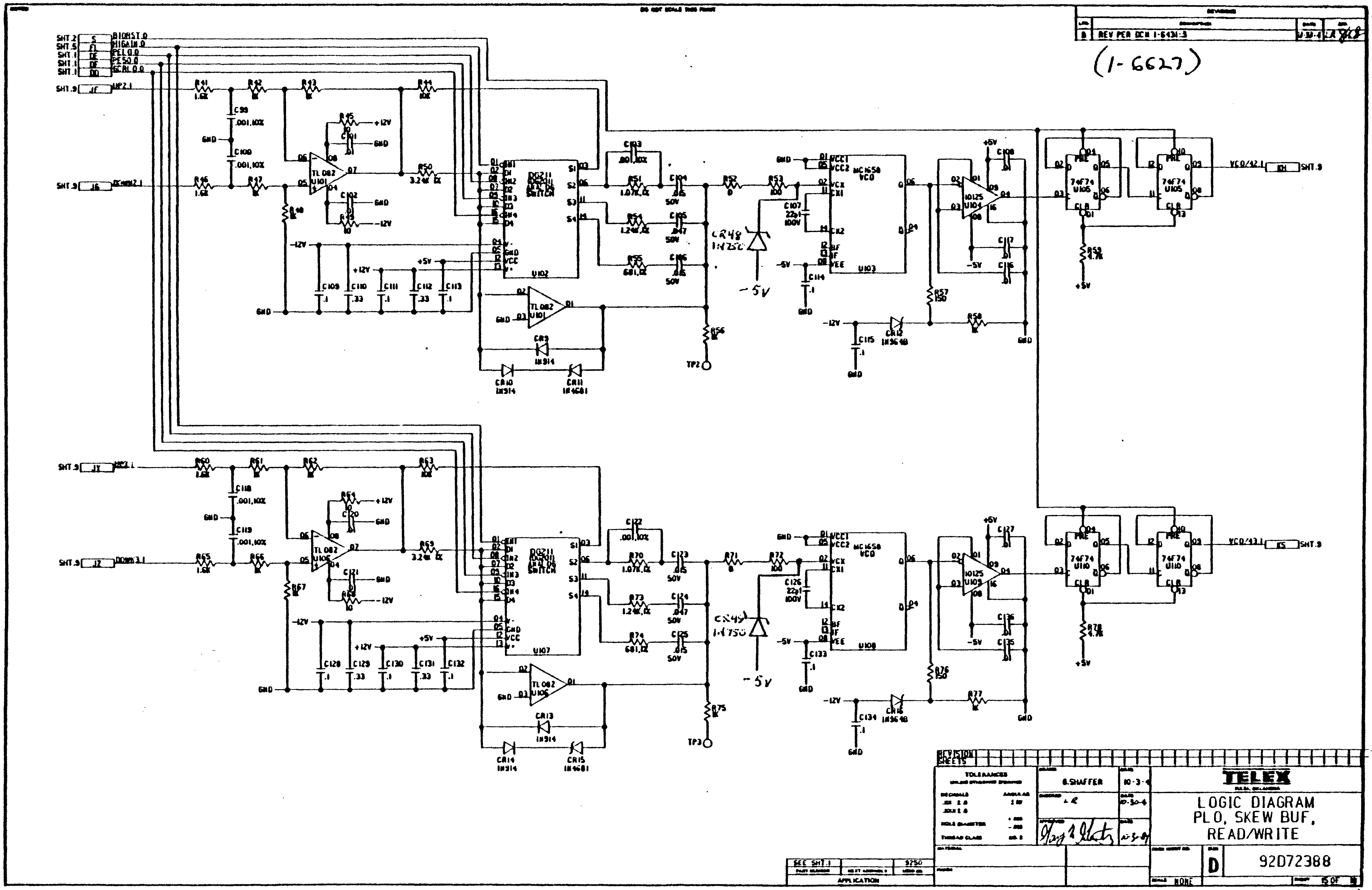
SEE SHT.1

APPLICATION

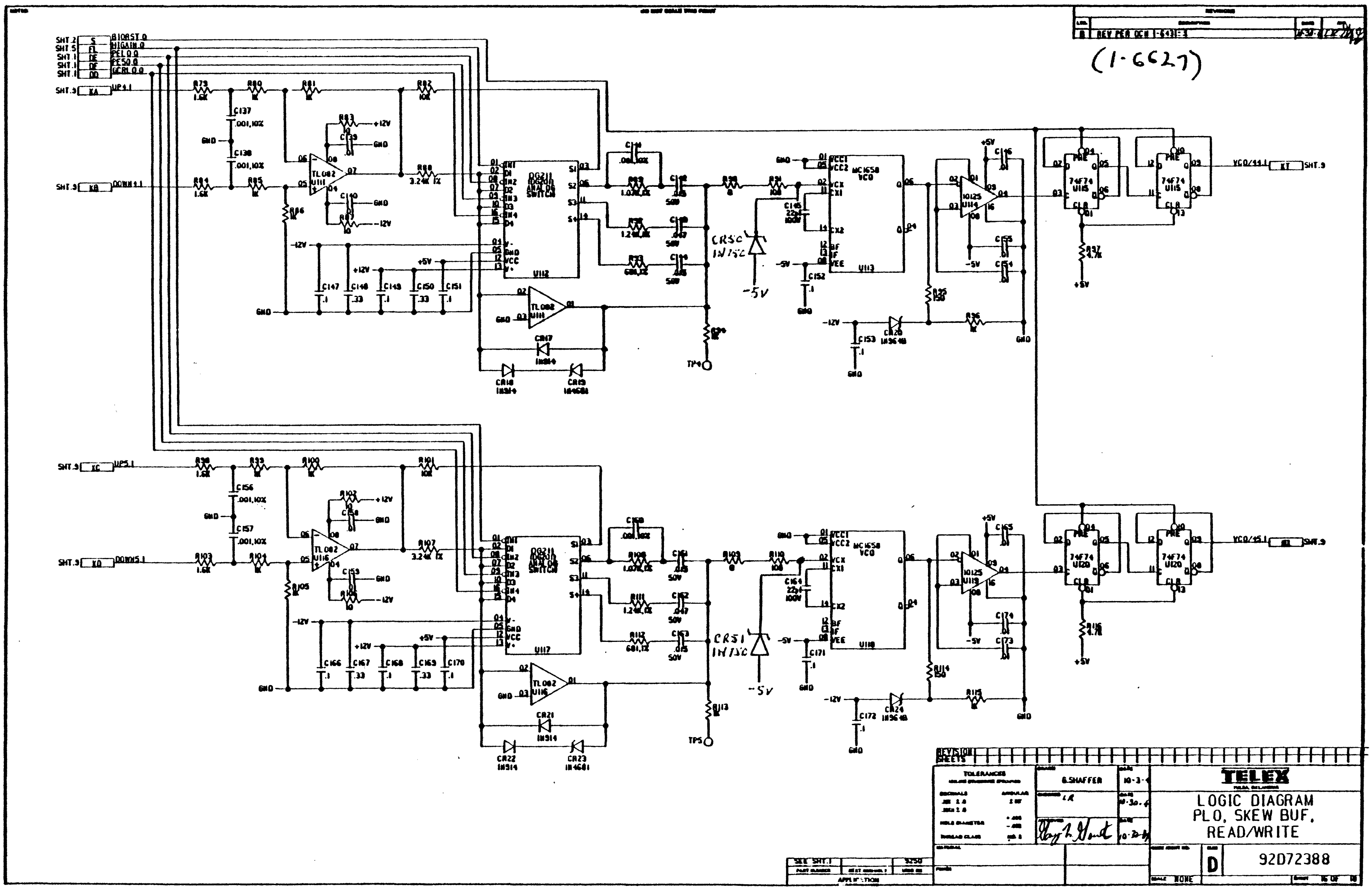
9250

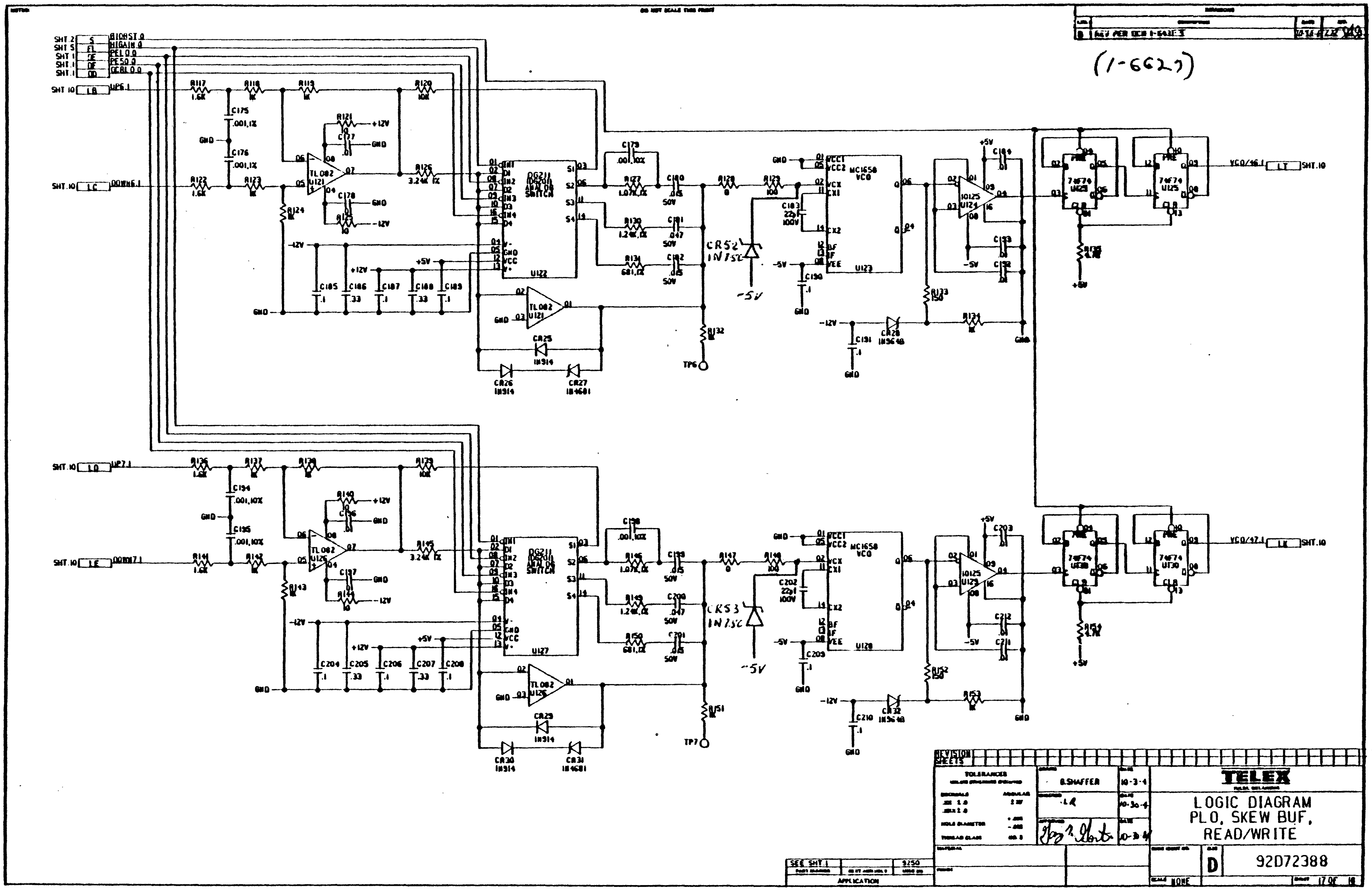
(619)


(1-6627)
REV PER DCN 1-6431-3
SHT 2 S BIOBST 0
SHT 5 FL HIGAIN 0
SHT 1 DE PEL0 0
SHT 1 DF PESJ 0
SHT 1 DD GCRL0 0
SHT 9 JB UP0 1
SHT 9 JC DOWN0 1
SHT 9 JD UP1 1
SHT 9 JE DOWN1 1
TL082 U91
DG211 ANALOG SWITCH U92
TL082 U96
DG211 ANALOG SWITCH U97
MC1658 VCO U93
MC1658 VCO U98
10125 U94
10125 U99
74F74 U95
74F74 U100
CR46 1N750
CR47 1N750
-5V
TP0
TP1
VCO/40 1 KF SHT 9
VCO/41 1 KG SHT 9
TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
B.SHAFFER
D
92D72388
SEE SHT 1
APPLICATION



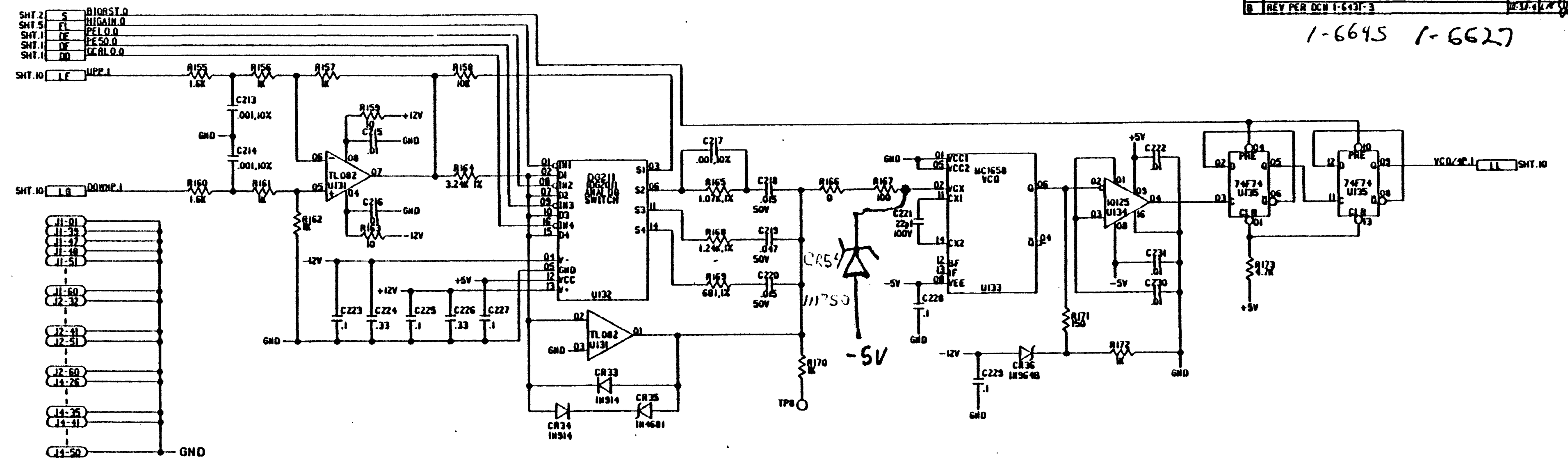
REV PER DCN 1-6431-3
(1-6627)
DG211
TL082
MC1658 VCO
10125
74F74
VCO/42.1
VCO/43.1
TOLERANCES
B.SHAFFER
TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
SEE SHT.1
9250
APPLICATION
D
92D72388
NONE


(1-6627)
REV PER OCN 1-6431-3
SHT.2 S BIORST 0
SHT.5 FL HIGAIN 0
SHT.1 DE PEL0 0
SHT.1 DF PE50 0
SHT.1 DD GCRL0 0
SHT.9 KA UP4 1
SHT.9 KB DOWN4 1
SHT.9 KC UP5 1
SHT.9 KD DOWN5 1
TL082 U111
DG211 ANALOG SWITCH U112
TL082 U116
DG211 ANALOG SWITCH U117
MC1658 VCO U113
MC1658 VCO U118
10125 U114
10125 U119
74F74 U115
74F74 U120
VCO/44 1 KT SHT.9
VCO/45 1 SHT.9
CR50 1N752
CR51 1N752
-5V
+12V
-12V
+5V
GND
TP4
TP5
CR17 1N914
CR18 1N914
CR19 1N4681
CR20 1N5648
CR21 1N914
CR22 1N914
CR23 1N4681
CR24 1N5648
TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
G.SHAFFER
D
92D72388
SCALE NONE
SEE SHT.1
9250


(1-6627)
TELEX
LOGIC DIAGRAM
PLO, SKEW BUF,
READ/WRITE
92D72388
D
B.SHAFFER
TOLERANCES
SEE SHT 1
APPLICATION
SCALE NONE
DG211 ANALOG SWITCH
TL082
MC1658 VCO
10125
74F74
CR52 1N752
CR53 1N752
-5V
VCO/46.1
VCO/47.1
TP6
TP7

| LTR | DESCRIPTION | DATE | APP |
| --- | --- | --- | --- |
| B | REV PER DCN 1-6431-3 | | |

1-6645 1-6627

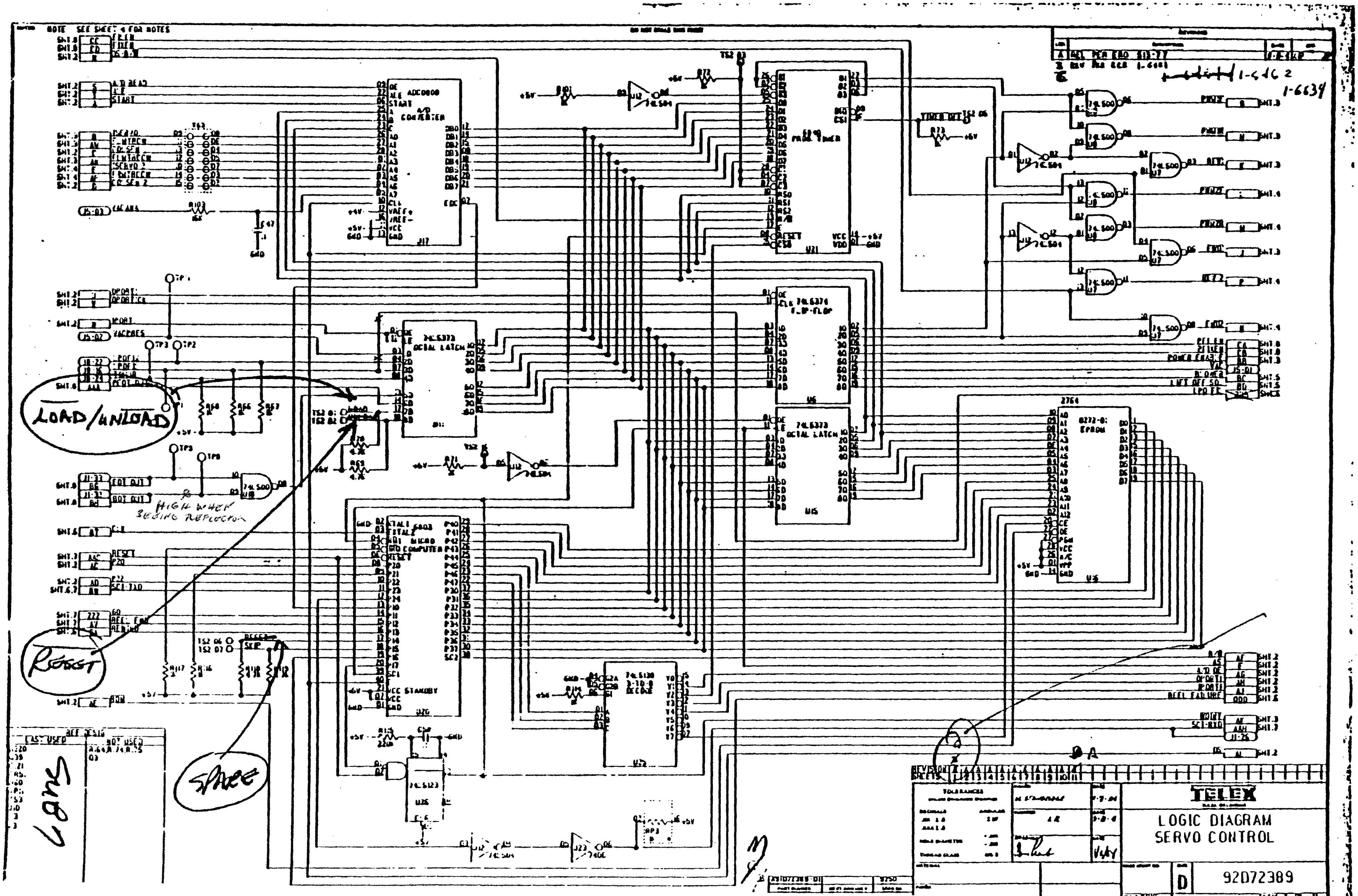



NOTES(CONT'D)

2. 14 PIN I.C. - CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC
3. 16 PIN I.C. - CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC
4. 20 PIN I.C. - CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC
5. ALL RESISTORS ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT,5%. ALL RESISTORS MARKED 1% ARE 1/8 WATT.
6. ALL CAPACITANCES ARE IN MICRO-FARADS. ALL UNMARKED CAPACITORS ARE 50V. ALL CAPACITORS MARKED 10% ARE 100V.
7. U145, U146 and U147 are present only on 91D72388-02 boards.
8. -01 stands for a wire or etch jumper installed for 91D72388-01
   -02 stands for a wire or etch jumper installed for 91D72388-02

| | | |
| --- | --- | --- |
| SEE SHT.1 | | 9250 |
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

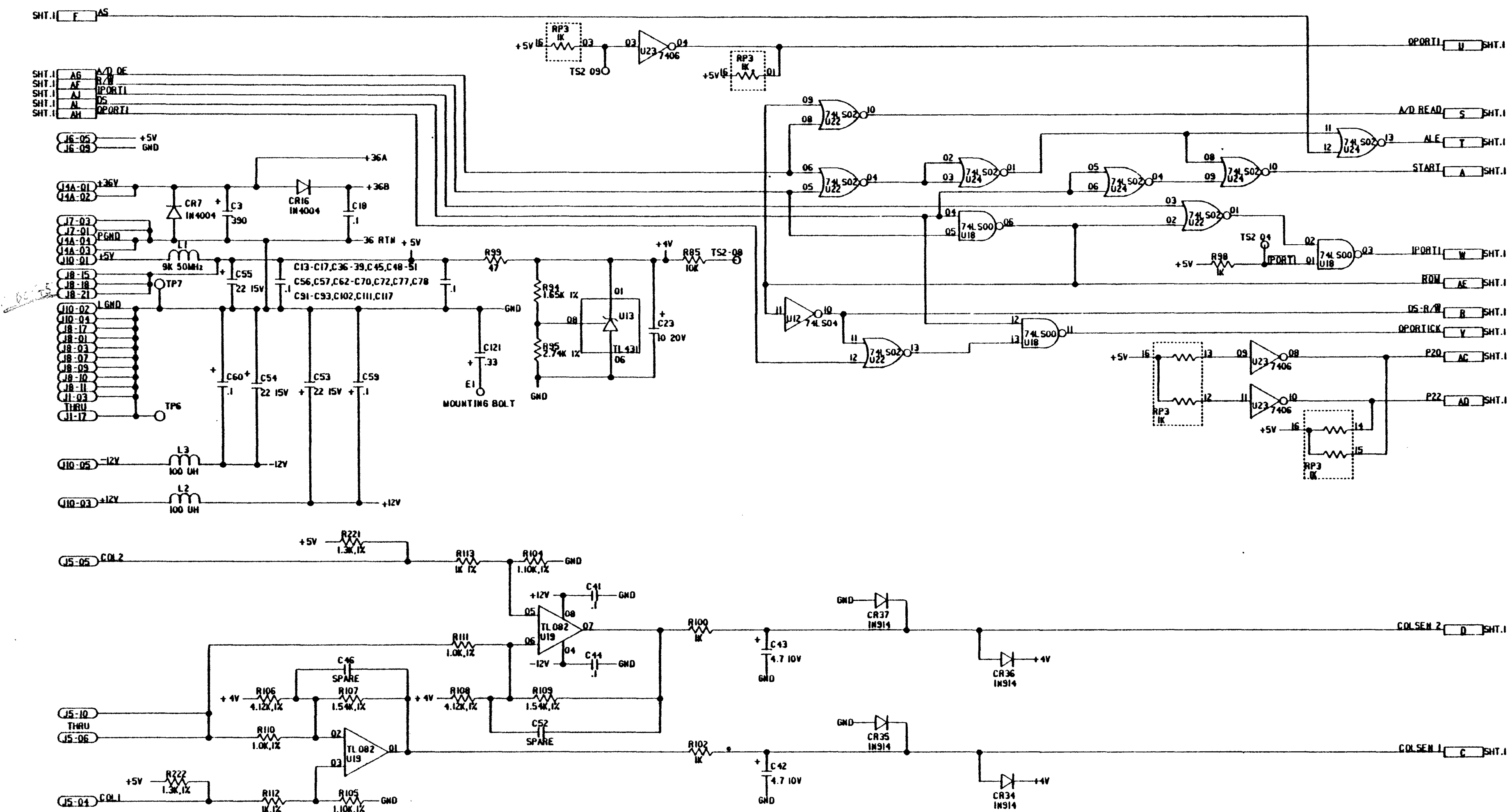
| | | | |
| --- | --- | --- | --- |
| TOLERANCES | DRAWN B.SHAFFER | DATE 10-4-4 | TELEX |
| | CHECKED LR | DATE 10-30-4 | LOGIC DIAGRAM PLO, SKEW BUF, READ/WRITE |
| | APPROVED | DATE 10-30-81 | |
| MATERIAL | | | SIZE D 92D72388 |
| | | | SCALE NONE SHEET 18 OF 18 |


NOTE SEE SHEET 4 FOR NOTES
ADC0808 A/D CONVERTER
6840 PROG TIMER
74LS374 FLIP-FLOP
74LS373 OCTAL LATCH
2764 EPROM
6803 MICRO COMPUTER
74LS138 3:10:8 DECODE
74LS123
74LS00
74LS04
LOAD/UNLOAD
HIGH WHEN SEEING REFLECTOR
RESET
SPARE
TELEX
LOGIC DIAGRAM
SERVO CONTROL
D
92D72389

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| C | REV PER DCN 1-6569-2 | 1-28-5 | [illegible] |




REVISION SHEETS

| TOLERANCES UNLESS OTHERWISE SPECIFIED | | DRAWN | DATE |
|---|---|---|---|
| DECIMALS XX ± .0 XXX ± .0 | ANGULAR ± 30' | M.STANDRIDGE | 1-30-5 |
| HOLE DIAMETER | +.005 -.002 | CHECKED LK | 1-24-5 |
| THREAD CLASS | NO. 2 | APPROVED L. McKenzie | 1-25-85 |

MATERIAL

FINISH

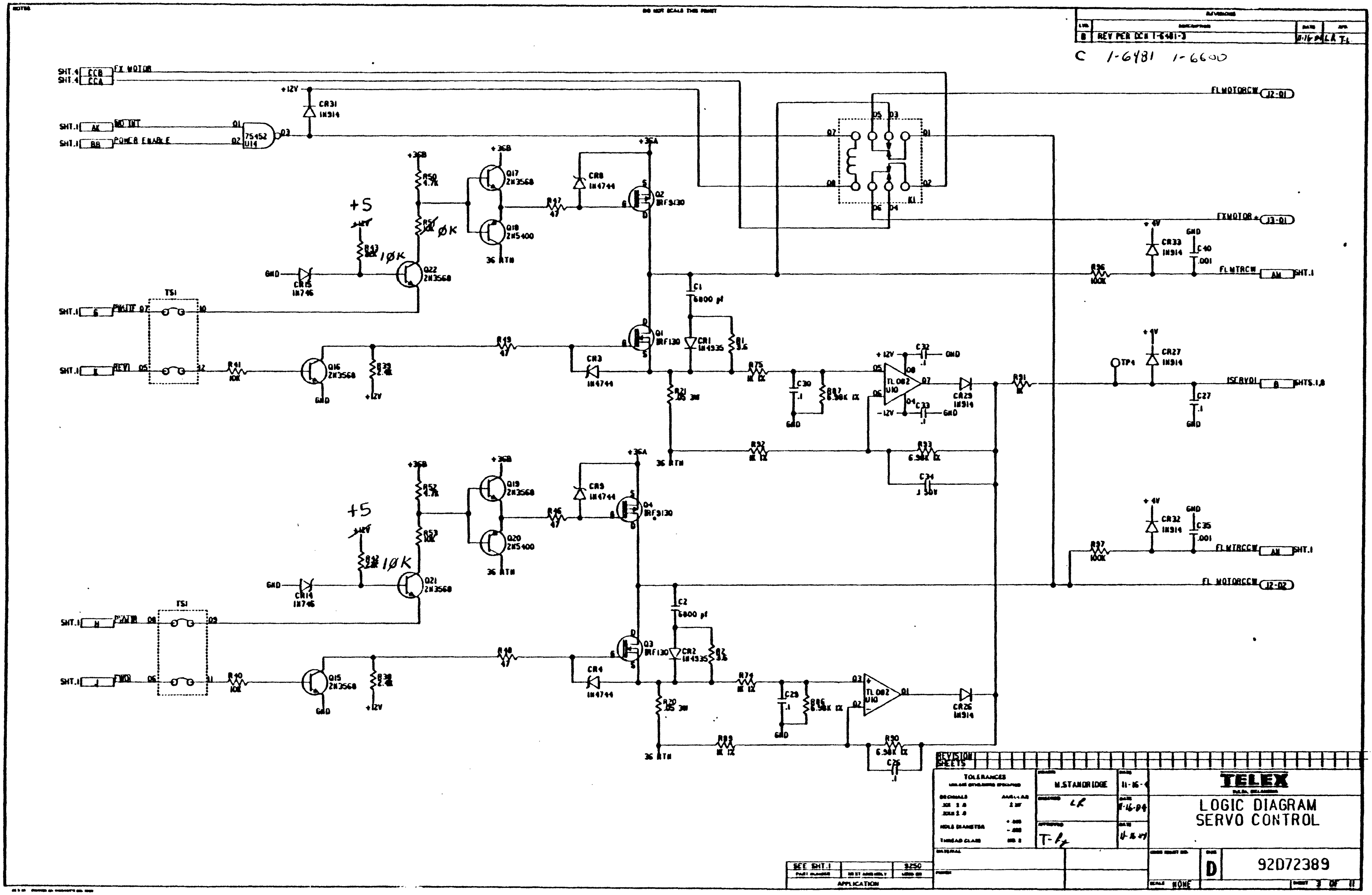
| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

TELEX
TULSA, OKLAHOMA

# LOGIC DIAGRAM SERVO CONTROL

CODE IDENT NO. | SIZE D | 92D72389

SCALE NONE | SHEET 2 OF 11


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6481-3
C 1-6481 1-6600
SHT.4 CCB
SHT.4 CCA
FX MOTOR
SHT.1 AK
SHT.1 BB
POWER ENABLE
75452 U14
CR31 1N914
+12V
+36A
+36B
R50 4.7K
Q17 2N3568
Q18 2N5400
36 RTN
R47 47
CR8 1N4744
Q2 IRF9130
+5
R51
ØK
R43
10K
Q22 2N3568
GND
CR15 1N746
TS1
SHT.1 G
SHT.1 K
REV
R41 10K
Q16 2N3568
R39 2.4K
+12V
R49 47
CR3 1N4744
Q1 IRF130
C1 6800 pf
CR1 1N4935
R1 3.6
R21 .05 3W
R75 1K 1%
C30 .1
R87 6.98K 1%
TL082 U10
C32 .1
C33 .1
-12V
CR29 1N914
R91 1K
R92 1K 1%
R93 6.98K 1%
C34 .1 50V
K1
FLMOTORCW J2-01
FXMOTOR+ J3-01
+4V
CR33 1N914
C40 .001
R96 100K
FLMTRCW AM SHT.1
CR27 1N914
TP4
ISERVO1 B SHTS.1,8
C27 .1
R52 4.7K
Q19 2N3568
Q20 2N5400
R46 47
CR9 1N4744
Q4 IRF9130
R53 10K
R42
Q21 2N3568
CR14 1N746
SHT.1 H
SHT.1 J
FWD
R40 10K
Q15 2N3568
R38 2.4K
R48 47
CR4 1N4744
Q3 IRF130
C2 6800 pf
CR2 1N4935
R2 3.6
R20 .05 3W
R74 1K 1%
C29 .1
R86 6.98K 1%
TL082 U10
CR26 1N914
R89 1K 1%
R90 6.98K 1%
C26 .1
CR32 1N914
C35 .001
R97 100K
FLMTRCCW AN SHT.1
FL MOTORCCW J2-02
REVISION
SHEETS
TOLERANCES
M.STANDRIDGE
11-16-
TELEX
LOGIC DIAGRAM
SERVO CONTROL
SEE SHT.1
APPLICATION
D
92D72389
NONE
3 OF 11

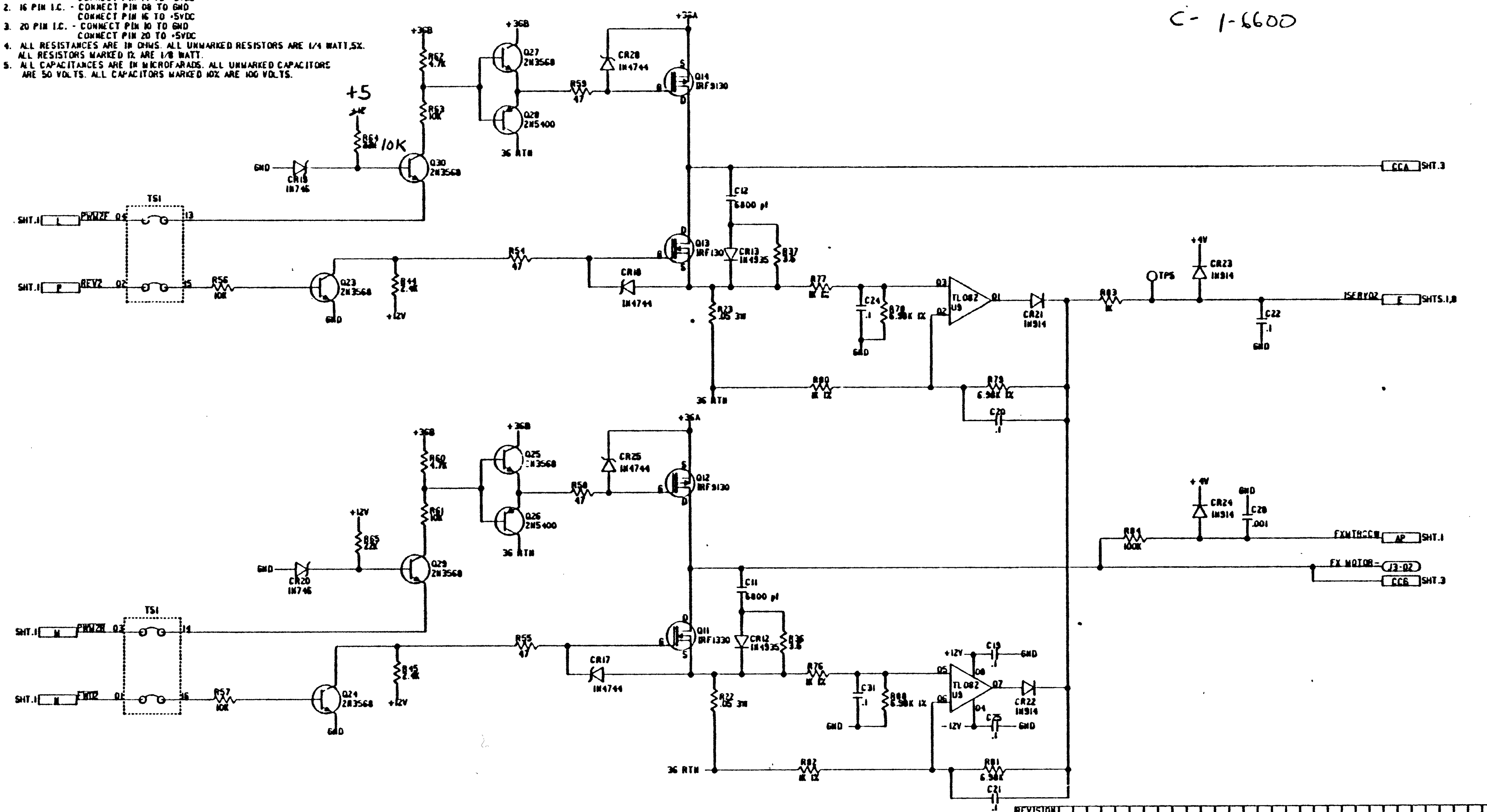
NOTES

DO NOT SCALE THIS PRINT

UNLESS OTHERWISE SPECIFIED
1. 14 PIN I.C. - CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC
2. 16 PIN I.C. - CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC
3. 20 PIN I.C. - CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT,5%.
   ALL RESISTORS MARKED 1% ARE 1/8 WATT.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS
   ARE 50 VOLTS. ALL CAPACITORS MARKED 10% ARE 100 VOLTS.

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| B | REV PER DCN 1-6481-3 | | |

C- 1-6600




| SEE SHT.1 | | 8250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

| TOLERANCES | DRAWN | DATE |
|---|---|---|
| | M.STANDRIDGE | 11-16- |
| | CHECKED LR | 11-16-86 |
| | APPROVED T. P. | 11-16-86 |

TELEX

LOGIC DIAGRAM
SERVO CONTROL

SIZE D 92D72389

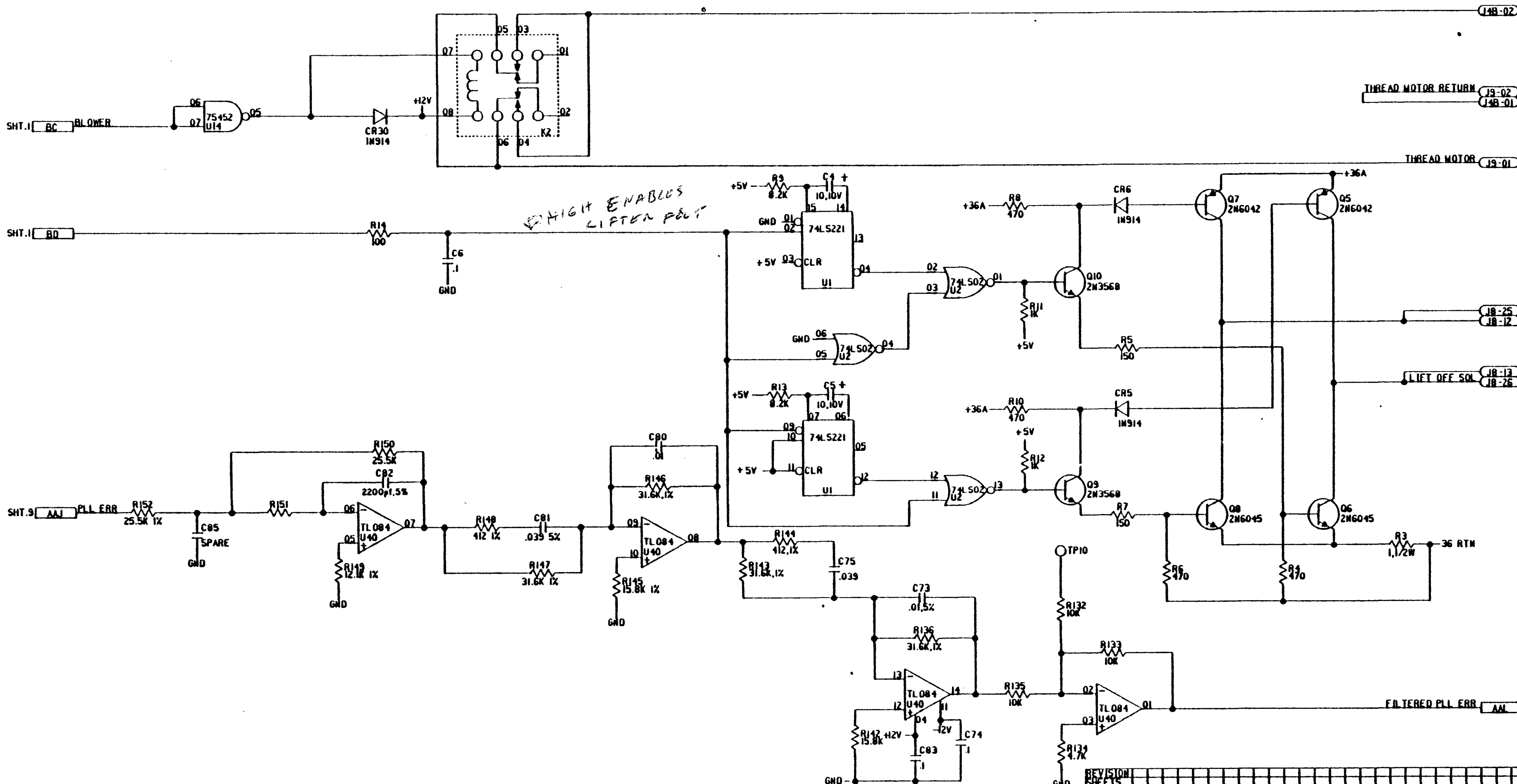
SCALE NONE

SHEET 4 OF 11

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| B | REV PER DCN 1-6481-3 | 11-16-84 | LR T.L |
| C | REV PER DCN 1-6540-3 | 12-17-4 | LR |




| REVISION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHEETS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30'

HOLE DIAMETER + .005 − .002

THREAD CLASS NO. 2

DRAWN M.STANDRIDGE — DATE 11-16-4

CHECKED LR — DATE 11-16-84

APPROVED T. L — DATE 11-16-84

MATERIAL

FINISH

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSY | USED ON |
| APPLICATION | | |

**TELEX**

TULSA, OKLAHOMA

# LOGIC DIAGRAM SERVO CONTROL

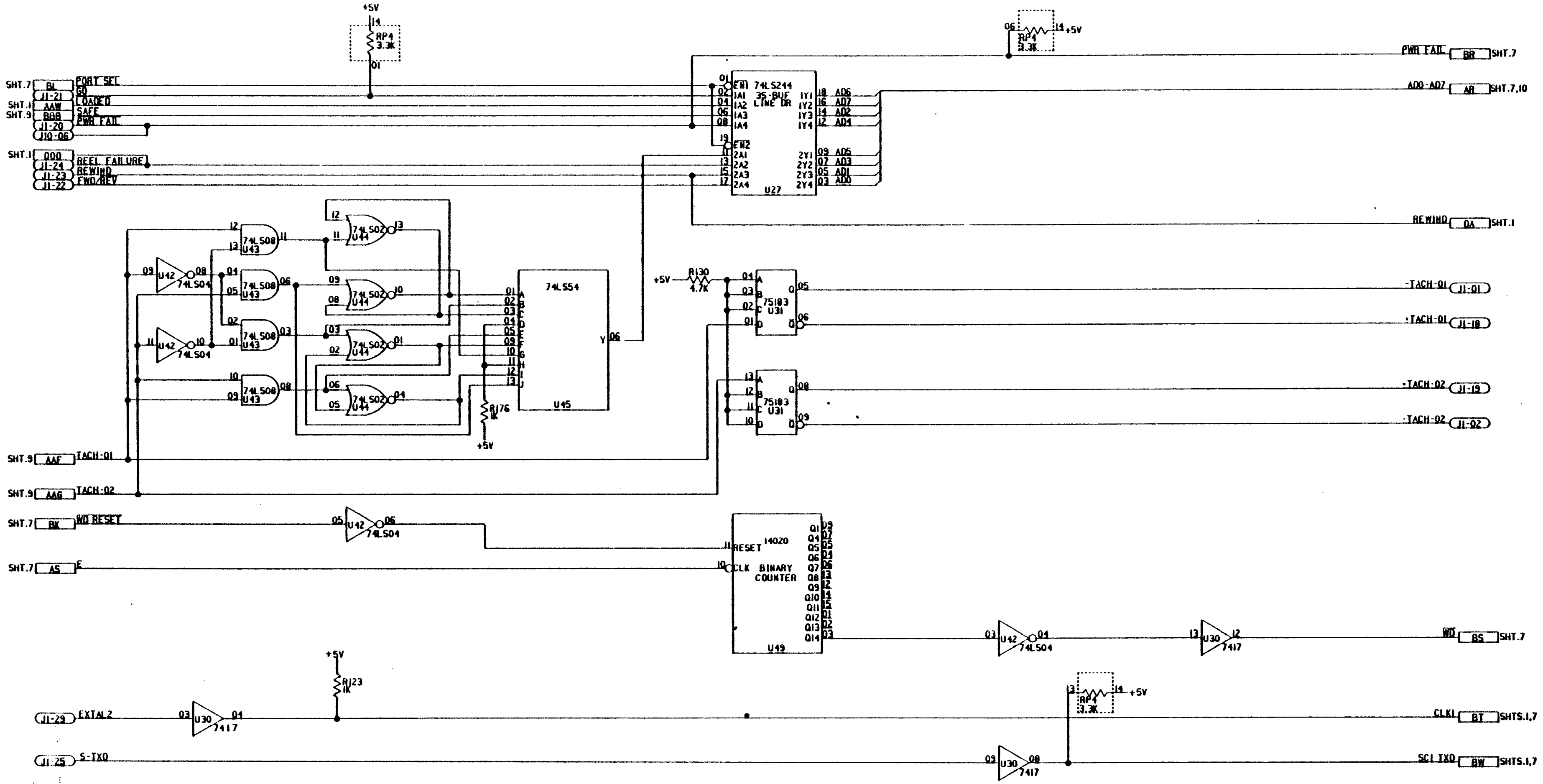
CODE IDENT NO. — SIZE D — 92D72389

SCALE NONE — SHEET 5 OF 11

NOTES:

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP. |
|---|---|---|---|
| B | REV PER DCN 1-6481-3 | 11-16-4 | LR T.L. |




| TOLERANCES UNLESS OTHERWISE SPECIFIED | |
|---|---|
| DECIMALS .XX ± .0 .XXX ± .0 | ANGULAR ± 30' |
| HOLE DIAMETER | + .006 - .002 |
| THREAD CLASS | NO 2 |

DRAWN M.STANDRIDGE DATE 11-16-4

CHECKED LR DATE 4-16-84

APPROVED T.L. DATE 11-16-84

TELEX TULSA, OKLAHOMA

# LOGIC DIAGRAM SERVO CONTROL

SIZE D 92D72389

SCALE NONE SHEET 6 OF 11

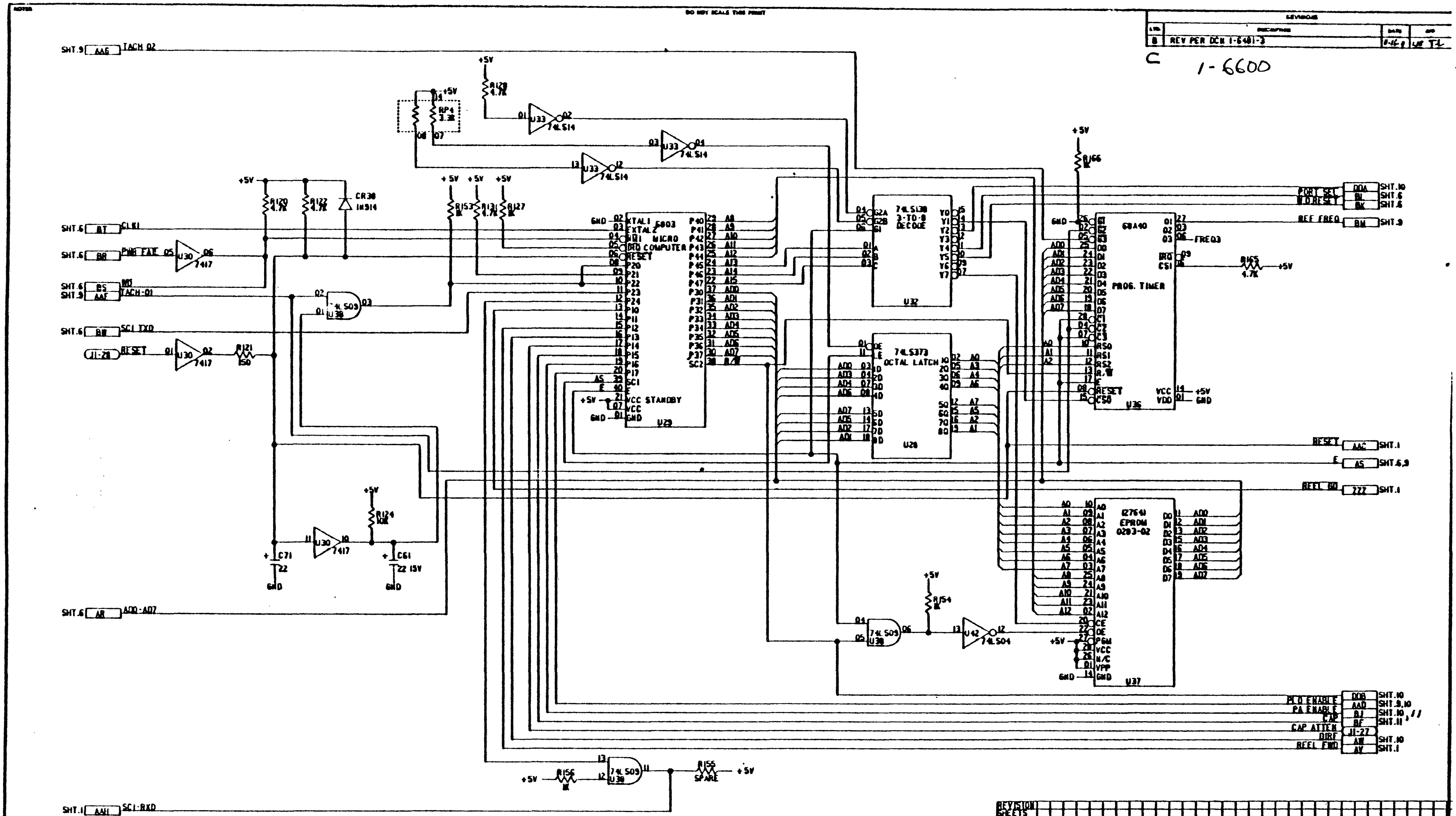
SEE SHT.1 PART NUMBER | NEXT ASSEMBLY | 9250 USED ON

APPLICATION

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| B | REV PER DCN 1-6481-3 | 11-16-84 | T.L. |

C 1-6600




| TOLERANCES | DRAWN | DATE |
|---|---|---|
| UNLESS OTHERWISE SPECIFIED | W.STANDRIDGE | 11-16-84 |
| | CHECKED: LK | 11-16-84 |
| | APPROVED: T.L. | 11-16-84 |

TELEX

LOGIC DIAGRAM
SERVO CONTROL

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |

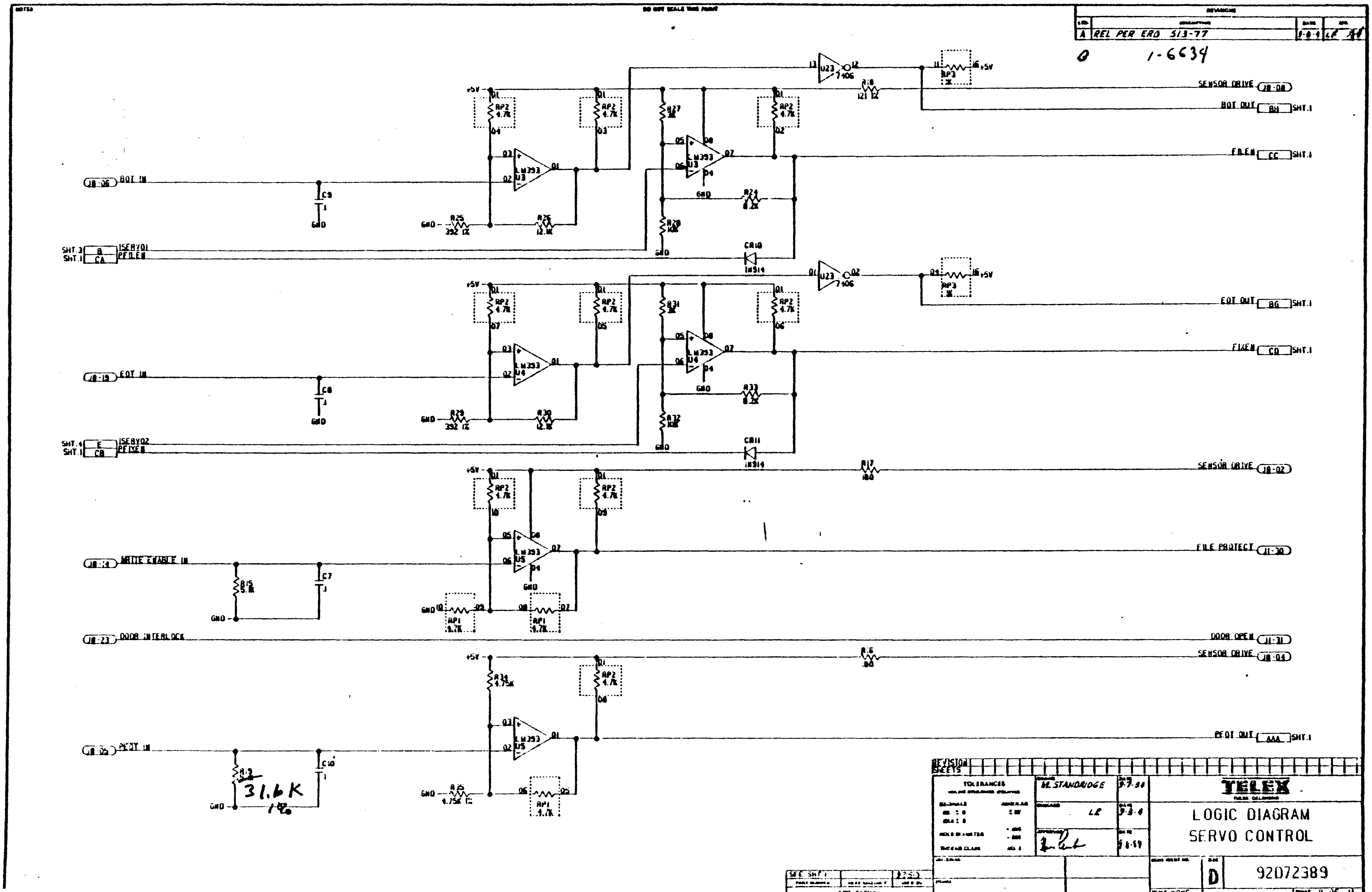
APPLICATION

SIZE D | 92D72389

SCALE NONE | SHEET 7 OF 11

From manual

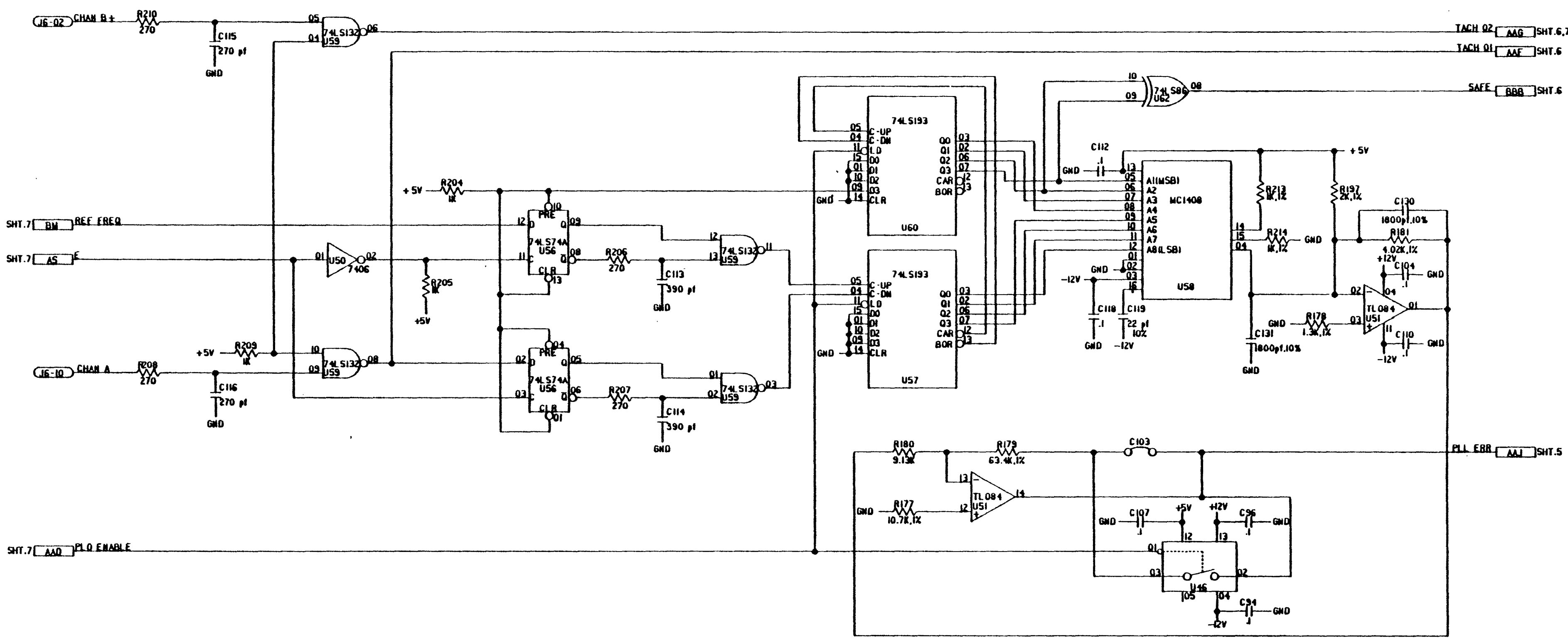
INFO FOR MANUAL



NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APR |
| D | REV PER DCN 1-6569-2 | 1-24-5 | |




| REVISION SHEETS | |
|---|---|

TOLERANCES UNLESS OTHERWISE SPECIFIED

DRAWN M.STANDRIDGE DATE 1-30-5

CHECKED LK DATE 1-24-5

APPROVED L. McKenzie DATE 1-25-85

TELEX

LOGIC DIAGRAM
SERVO CONTROL

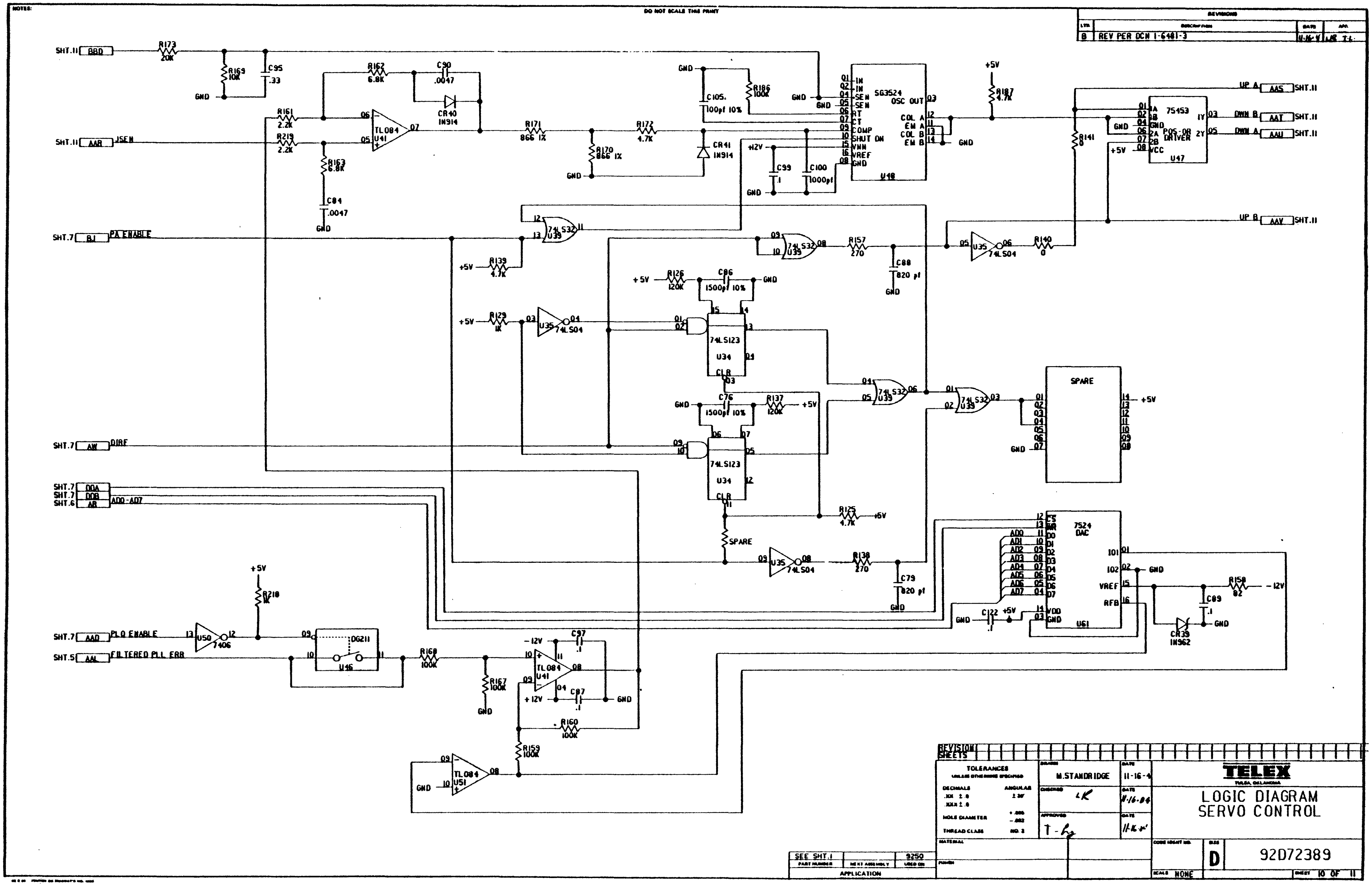
SIZE D 92D72389

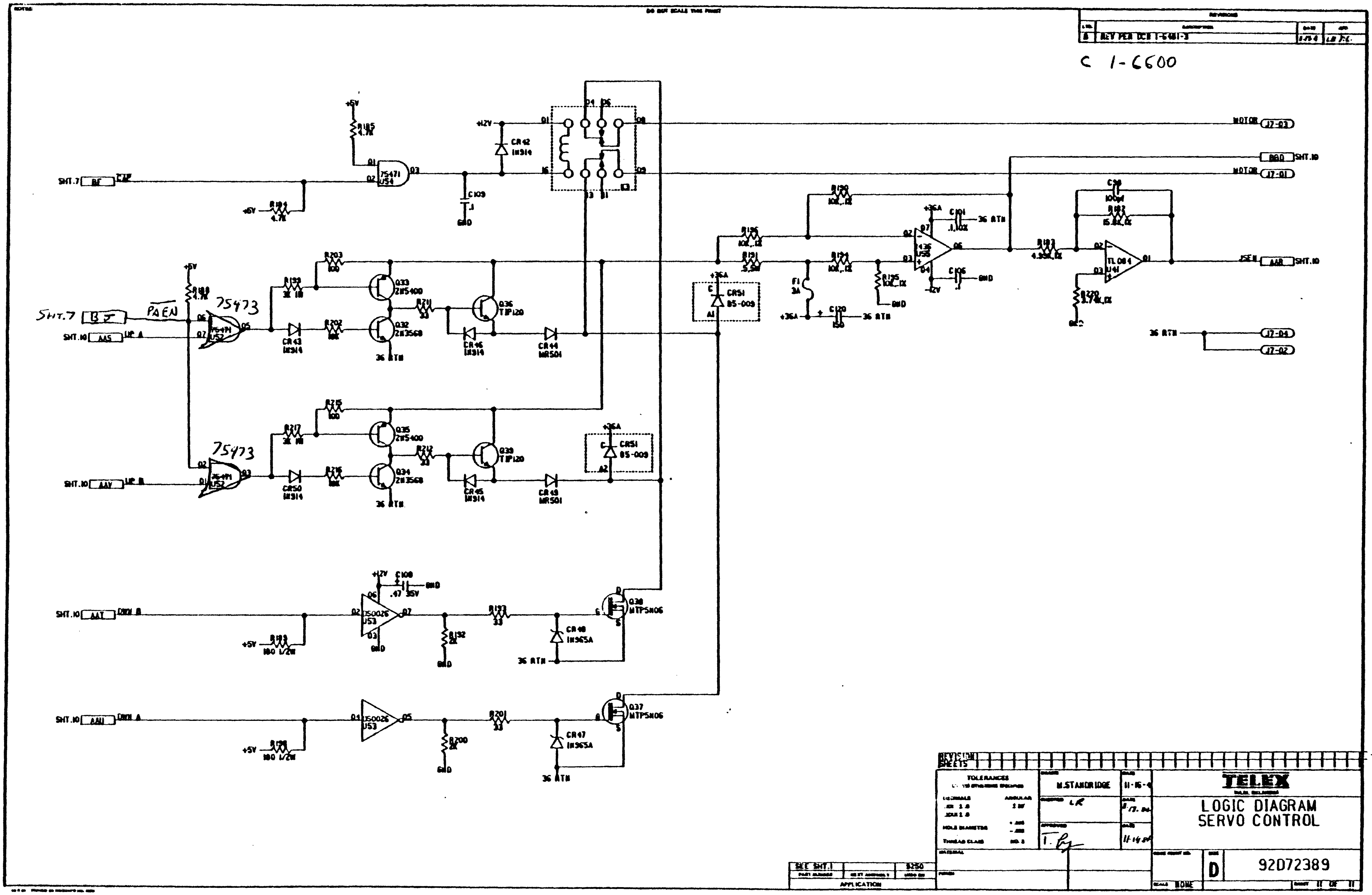
SCALE NONE SHEET 9 OF 11

SEE SHT.1 | 9250

PART NUMBER | NEXT ASSEMBLY | USED ON

APPLICATION


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6481-3
SHT.11 BBD
SHT.11 AAR JSEN
SHT.7 BJ PA ENABLE
SHT.7 AW DIRF
SHT.7 DDA
SHT.7 DDB
SHT.6 AB ADO-AD7
SHT.7 AAD PLO ENABLE
SHT.5 AAL FILTERED PLL ERR
SG3524
U48
75453
POS-OR DRIVER
U47
UP A AAS SHT.11
DWN B AAT SHT.11
DWN A AAU SHT.11
UP B AAV SHT.11
74LS32
74LS04
74LS123
U34
SPARE
7524 DAC
U61
TL084
U41
U51
DG211
U46
7406
U50
TOLERANCES
M.STANDRIDGE
11-16-84
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
SERVO CONTROL
D
92D72389
SCALE NONE
SHEET 10 OF 11
SEE SHT.1
9250
APPLICATION

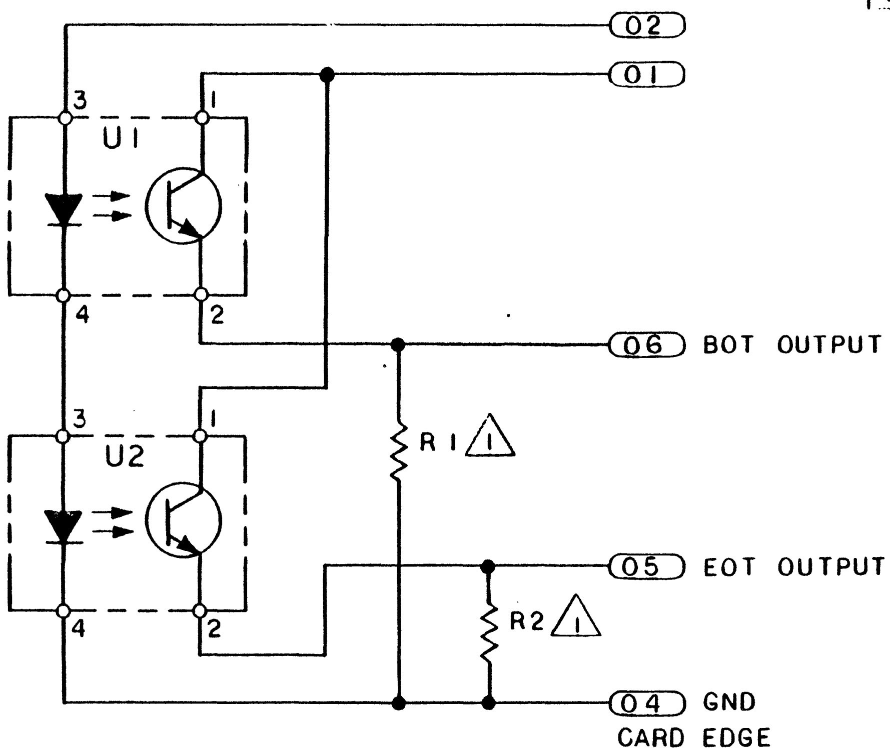

DO NOT SCALE THIS PRINT
REVISIONS
B REV PER ECN 1-6481-3
C 1-6600
SHT.7 BF CTP
+5V R185 4.7K
75471 U54
+6V R184 4.7K
+12V CR42 1N914
C109 .1 GND
K3
MOTOR J7-03
BBD SHT.10
MOTOR J7-01
SHT.7 BJ PAEN
75473
SHT.10 AAS UP A
SHT.10 AAV UP B
+5V R188 4.7K
R199 3K 1W
R203 100
Q33 2N5400
Q32 2N3568
R211 33
R202 10K
CR43 1N914
Q36 TIP120
CR46 1N914
CR44 MR501
36 RTN
R217 3K 1W
R215 100
Q35 2N5400
Q34 2N3568
R212 33
R216 10K
CR50 1N914
Q39 TIP120
CR45 1N914
CR49 MR501
+36A CR51 85-009 A1
+36A CR51 85-009 A2
R196 10K,1%
R191 .5,3W
R190 10K,1%
R194 10K,1%
R195 10K,1%
F1 3A
+36A C120 150 36 RTN
+36A C101 .1,10% 36 RTN
1436 U55
C106 GND
-12V
R193 4.99K,1%
C38 100pf
R192 15.8K,1%
TL084 U41
R220 3.74K,1%
ISEN AAR SHT.10
36 RTN J7-04 J7-02
SHT.10 AAT DWN B
+12V C108 .47 35V GND
DS0026 U53
R193 33
R192 2K
CR48 1N965A
Q38 MTP5N06
+5V R197 180 1/2W
SHT.10 AAU DWN A
DS0026 U53
R201 33
R200 2K
CR47 1N965A
Q37 MTP5N06
+5V R198 180 1/2W
36 RTN
GND
REVISION SHEETS
TOLERANCES
M.STANDRIDGE 11-16-
TELEX
LOGIC DIAGRAM
SERVO CONTROL
SEE SHT.1 8250
APPLICATION
D 92D72389
SCALE NONE
SHEET 11 OF 11

NOTES:

1. REF TO ENGRG SPEC 91B72391-S FOR TYPE AND VALUE

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR. | DESCRIPTION | DATE | APP. |
| A | REL PER ERO 513-57 | 7-5-4 | LR WEC |
| B | REV PER DCN 1-6417 | 8-23-4 | LR WEC |




| TOLERANCES UNLESS OTHERWISE SPECIFIED | | DRAWN | DATE |
|---|---|---|---|
| DECIMALS | ANGULAR | P. Porterous | 7-5-84 |
| .XX ± .0 | ± 30' | CHECKED LR | 7-5-84 |
| .XXX ± .0 | | APPROVED W E Crouch | 7-5-84 |
| HOLE DIAMETER | +.005 −.002 | | |
| THREAD CLASS | NO. 2 | | |

**TELEX**

TULSA, OKLAHOMA

# EOT/BOT SENSOR, LOGIC DIAGRAM

| PART NUMBER | NEXT ASSEMBLY | USED ON |
|---|---|---|
| B91B72391-01 | | 9250 |
| APPLICATION | | |

MATERIAL

FINISH

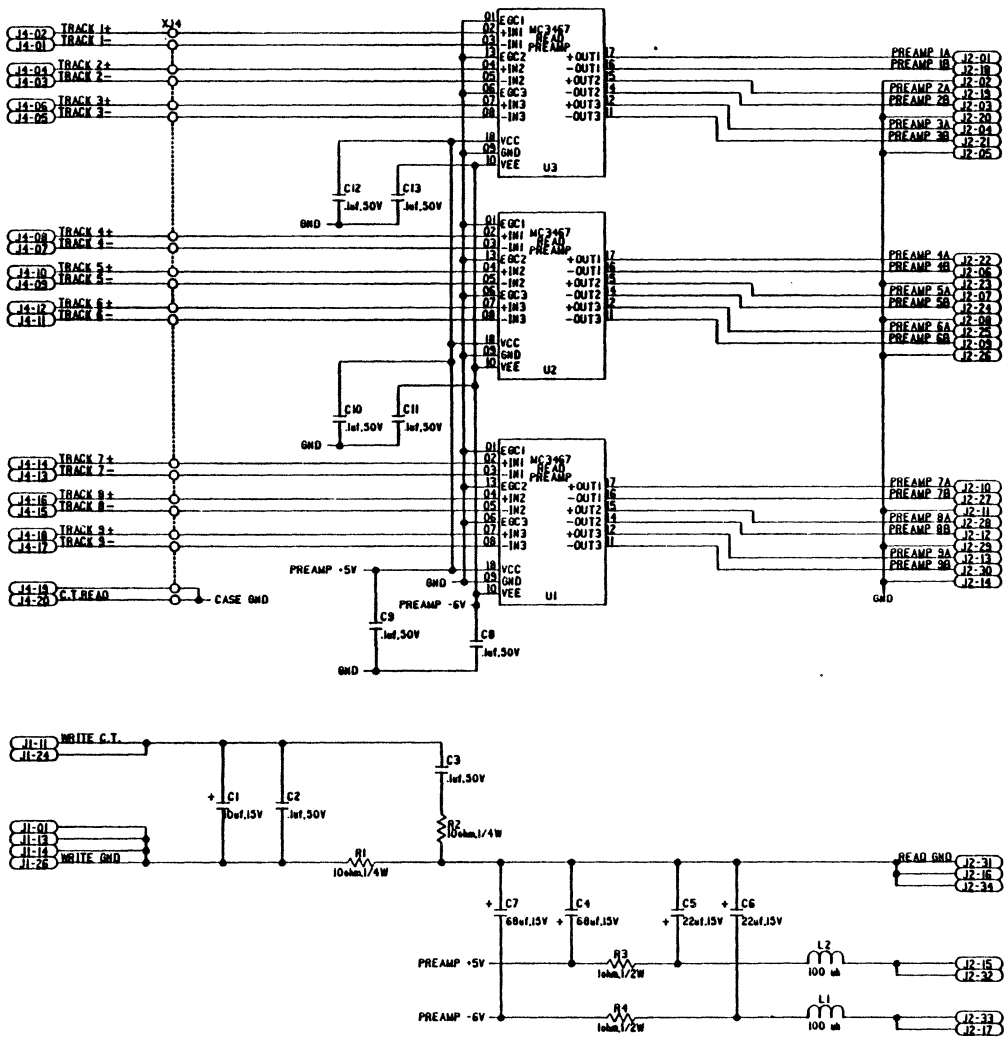
| CODE IDENT NO. | SIZE | |
|---|---|---|
| | B | 92B72391 |
| SCALE NONE | | SHEET 1 OF 1 |

11 X 17 PRINTED ON RIDGWAY'S 1020

NOTES:

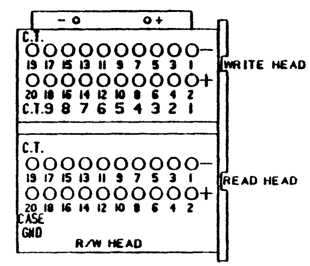
DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APR |
|---|---|---|---|
| D | REV PER DCN 1-6567-4 | 1-23-5 | LR JEC |




TRACK LOCATIONS ON UNIT

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | PHYSICAL |
| 4 | 6 | 0 | 1 | 2 | P | 3 | 7 | 5 | LOGICAL |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | TAPE MARK |
| INSIDE | | | GCR I.D. BURST | | PE I.D. BURST | | | OUTSIDE | |




| REF DES | |
|---|---|
| NOT USED | LAST USED |
| | C13 |
| | R4 |
| J3 | J4 |
| | U3 |

| D91C72397-01 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

REVISION SHEETS

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ± .0 .XXX ± .0 ANGULAR ± 30'
HOLE DIAMETER + .005 − .002
THREAD CLASS NO. 2

DRAWN M.STANDRIDGE DATE 1-25-5
CHECKED LR DATE 1-23-5
APPROVED JE Gill DATE 1-24-5

MATERIAL

FINISH

TELEX
TULSA, OKLAHOMA

# LOGIC DIAGRAM READ PREAMPLIFER

CODE IDENT NO. SIZE D 92D72397

SCALE NONE SHEET 1 OF 1

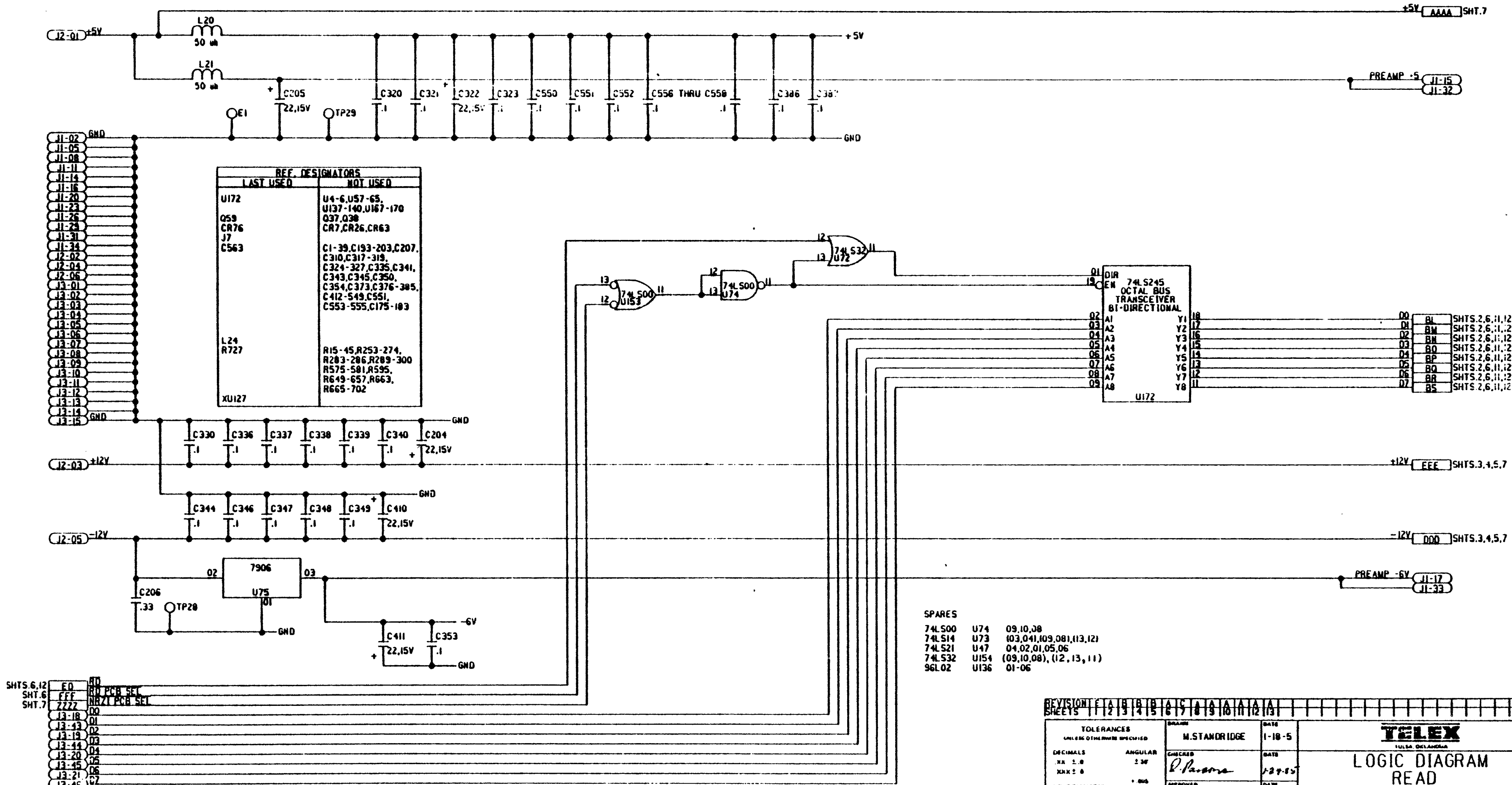
NOTES:

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP. |
|---|---|---|---|
| D | REV PER DCN 1-6570-2 | 1-19-85 | LK [illegible] |
| E | REV PER DCN 1-6576-3 | 1-30-5 | LK [illegible] |

UNLESS OTHERWISE SPECIFIED

1. 14 PIN I.C. - CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC
2. 16 PIN I.C. - CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC
3. 20 PIN I.C. - CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4W,5%.
   ALL RESISTORS MARKED 1% ARE 1/8W.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED 10% ARE 100 VOLTS.




| REF. DESIGNATORS | |
|---|---|
| LAST USED | NOT USED |
| U172 | U4-6,U57-65, U137-140,U167-170 |
| Q59 | Q37,Q38 |
| CR76 | CR7,CR26,CR63 |
| J7 | |
| C563 | C1-39,C193-203,C207, C310,C317-319, C324-327,C335,C341, C343,C345,C350, C354,C373,C376-385, C412-549,C551, C553-555,C175-183 |
| L24 | |
| R727 | R15-45,R253-274, R283-286,R289-300 R575-581,R595, R649-657,R663, R665-702 |
| XU127 | |

SPARES

| | | |
|---|---|---|
| 74LS00 | U74 | 09,10,08 |
| 74LS14 | U73 | (03,04),(09,08),(13,12) |
| 74LS21 | U47 | 04,02,01,05,06 |
| 74LS32 | U154 | (09,10,08),(12,13,11) |
| 96L02 | U136 | 01-06 |

| REVISION | E | A | B | B | B | A | C | A | A | A | A | A | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHEETS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DRAWN M.STANDRIDGE DATE 1-18-5
CHECKED D. Parsons DATE 1-24-85
APPROVED D. Parsons DATE 1-24-85

TELEX TULSA, OKLAHOMA

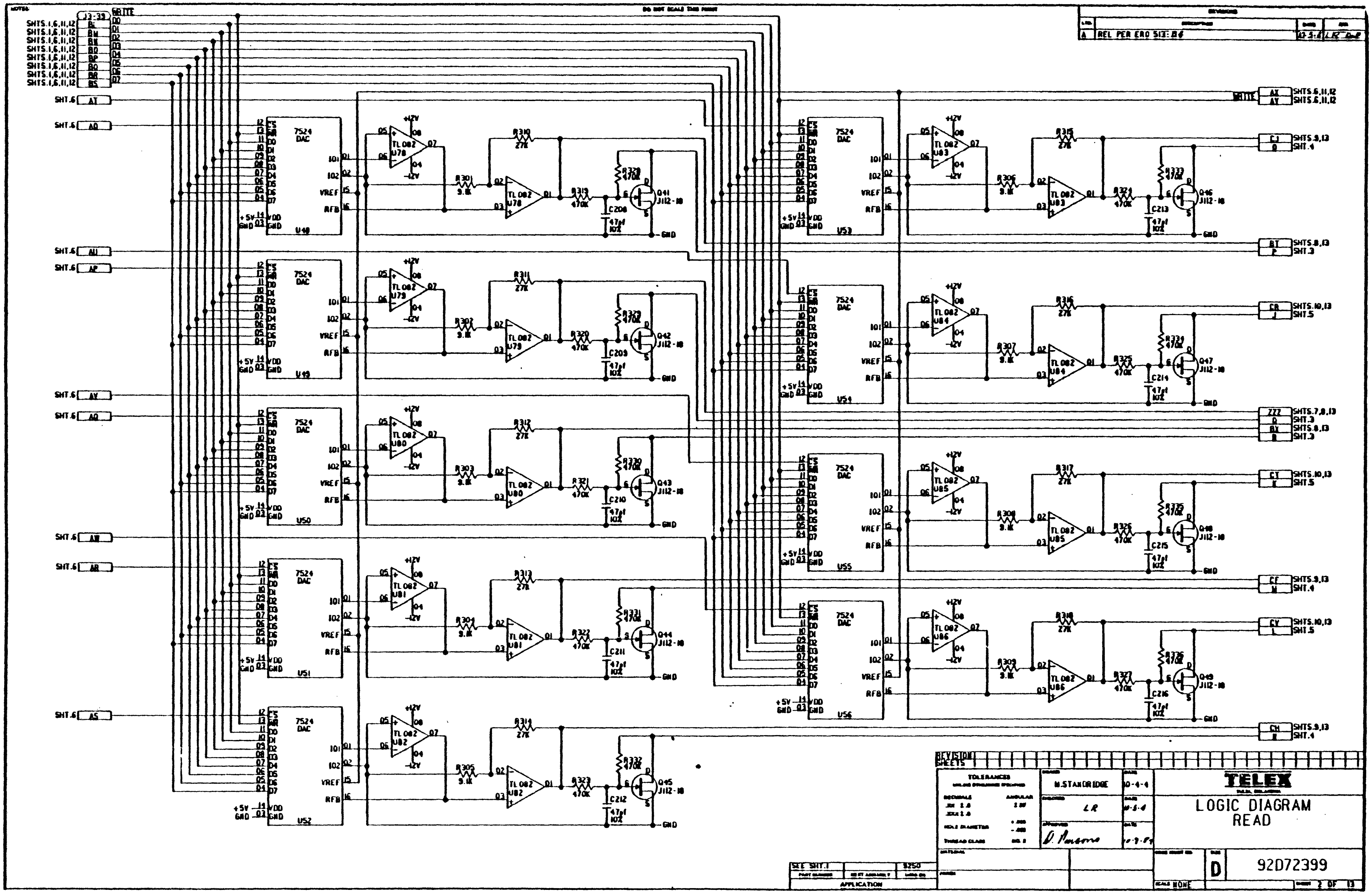
LOGIC DIAGRAM
READ

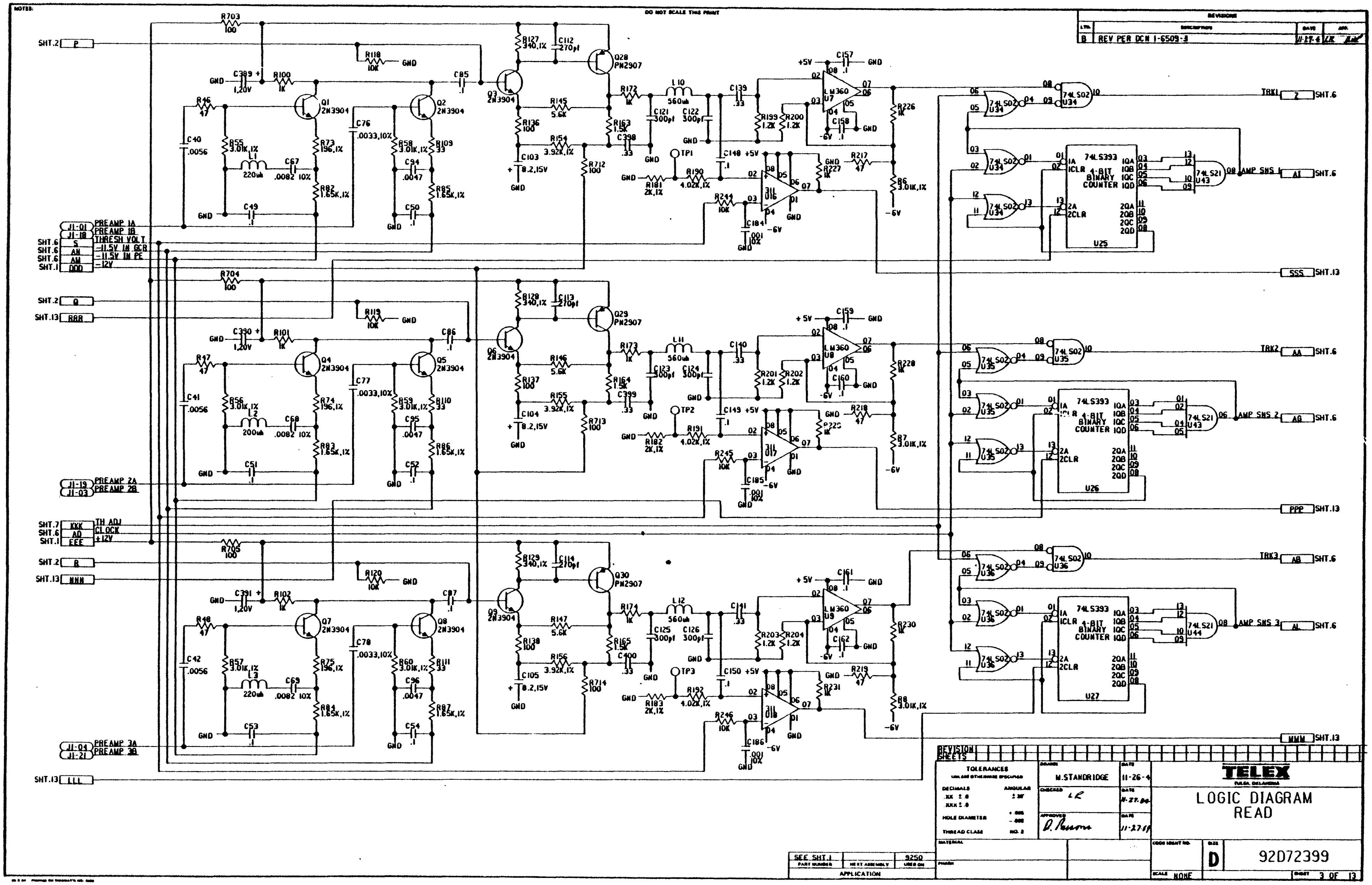
SIZE D 92D72399

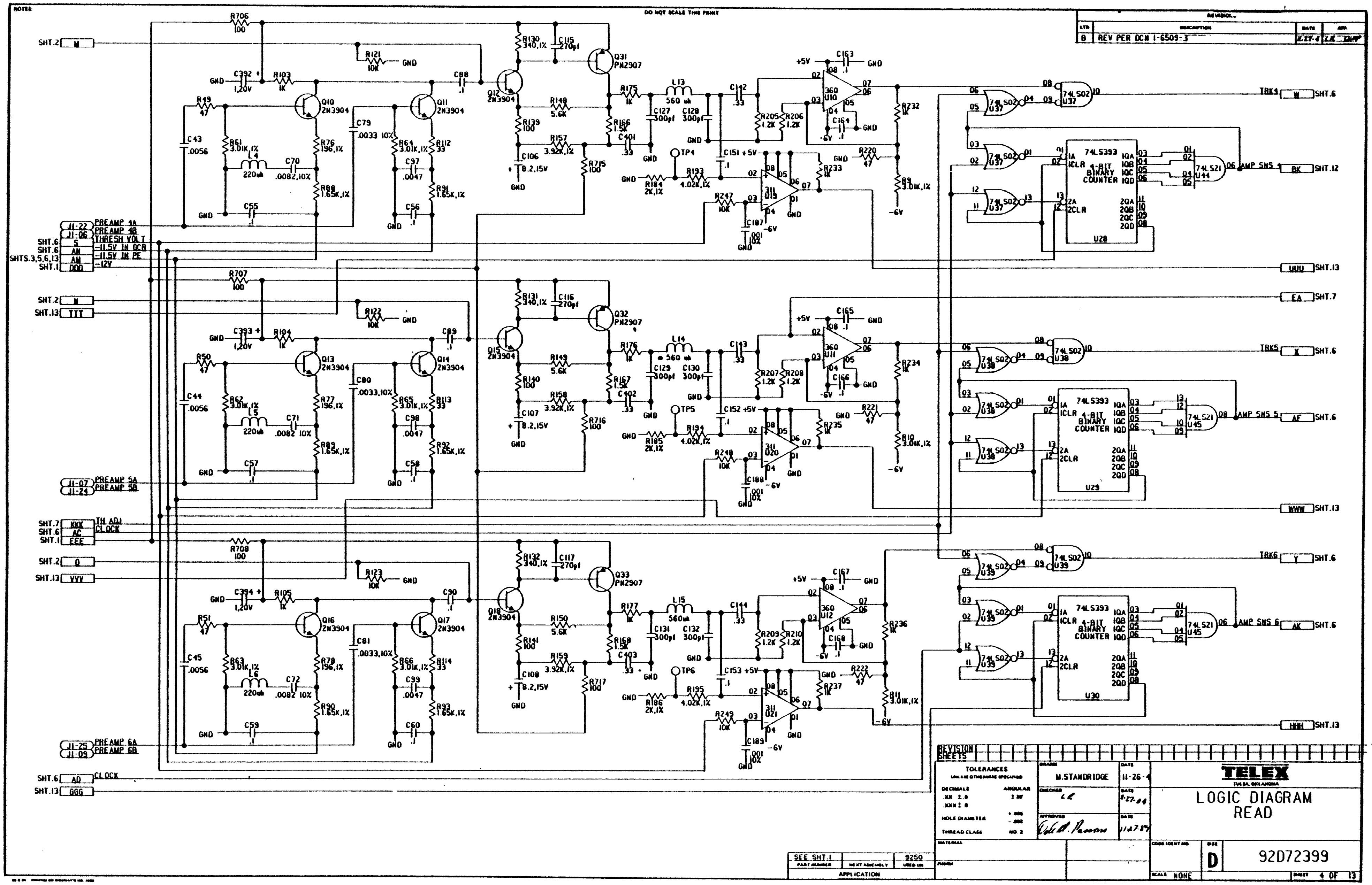
SCALE NONE SHEET 1 OF 13

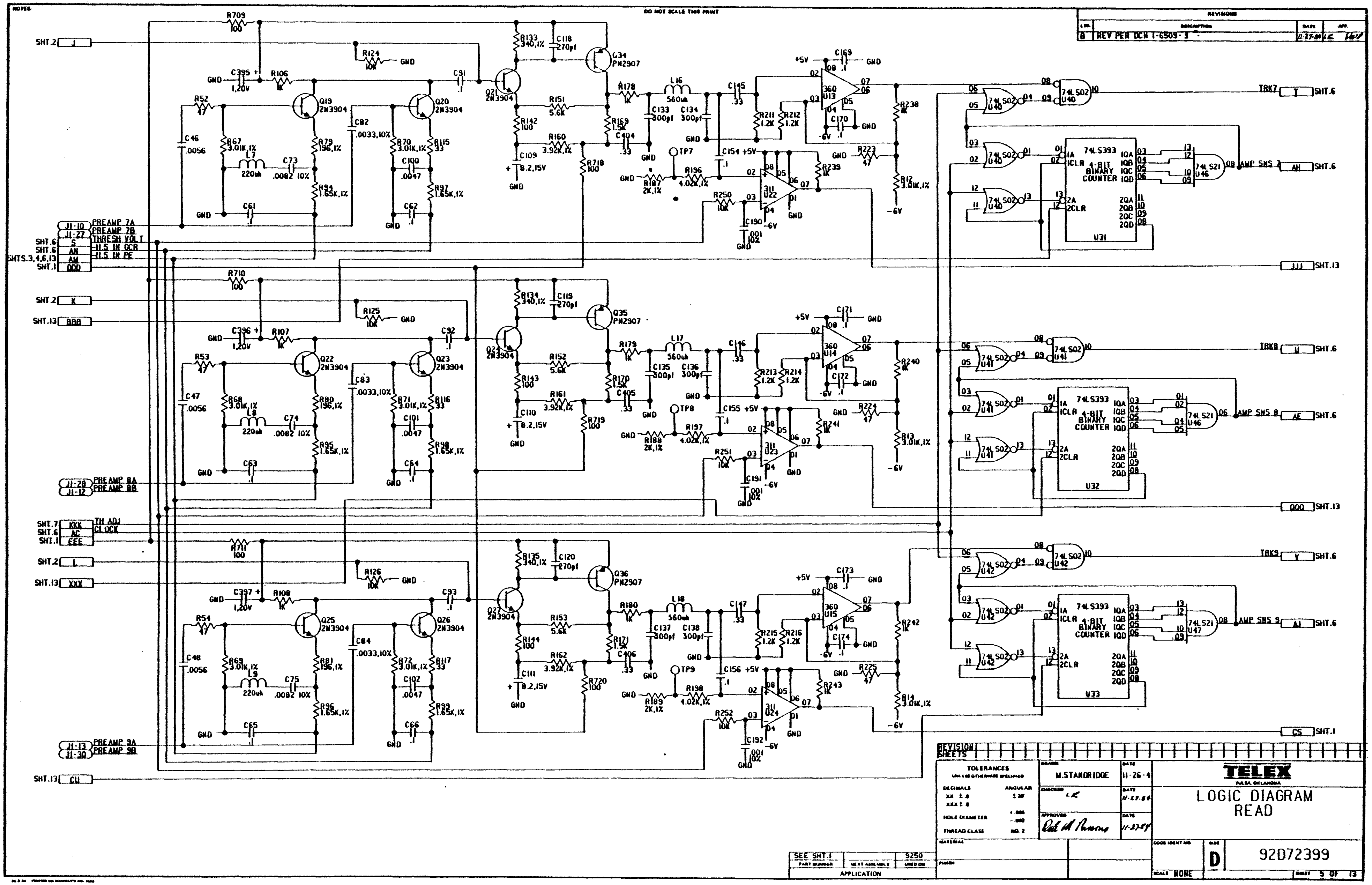
| PART NUMBER | NEXT ASSEMBLY | USED ON |
|---|---|---|
| F91D72399-02 | | 9250 |
| F91D72399-01 | | |

APPLICATION

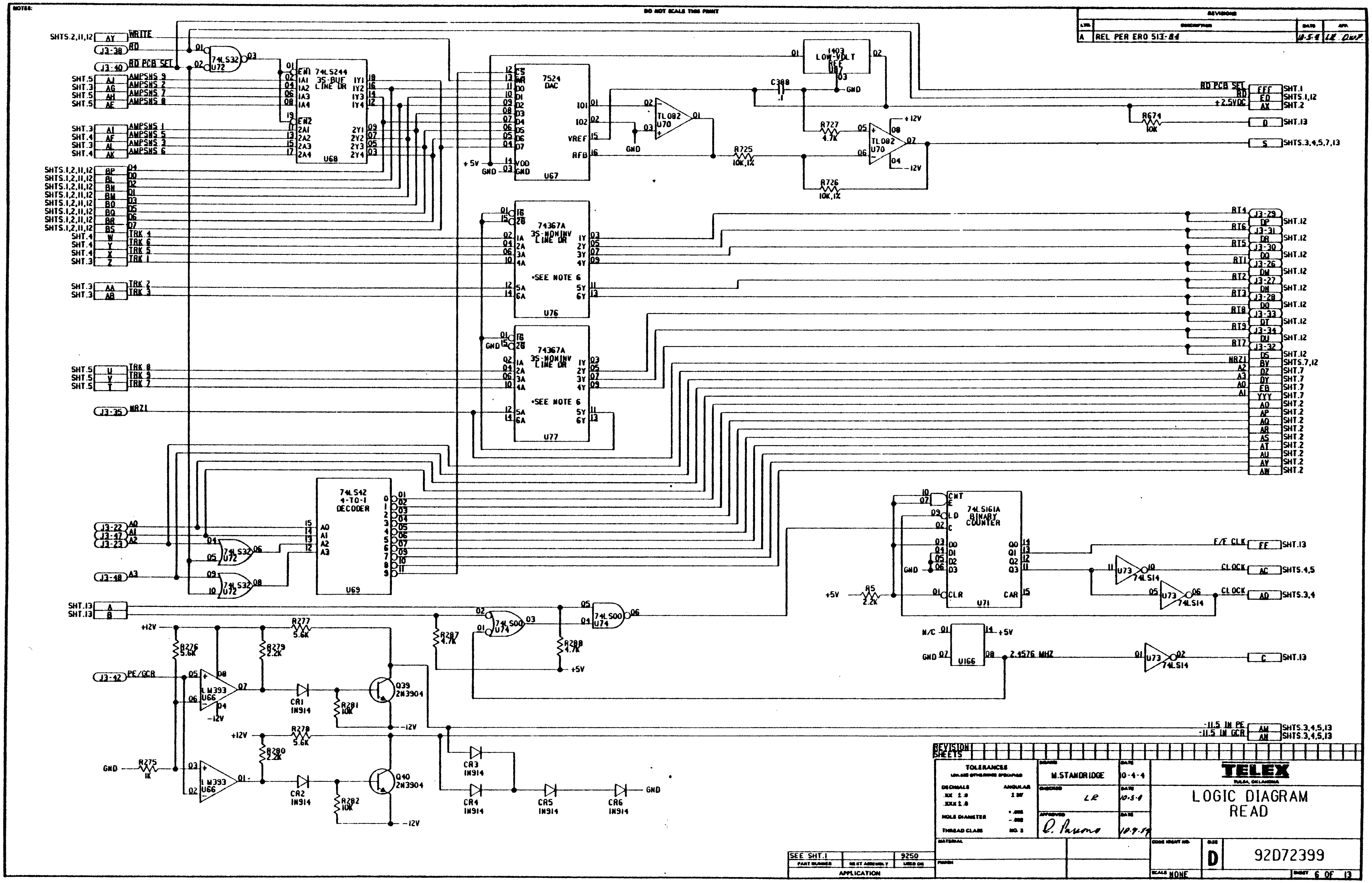

DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513: 86
J3-39
WRITE
SHTS.1,6,11,12
SHT.6
7524 DAC
TL 082
J112-18
GND
+5V
+12V
-12V
U48
U49
U50
U51
U52
U53
U54
U55
U56
SHTS.6,11,12
SHTS.9,13
SHT.4
SHTS.8,13
SHT.3
SHTS.10,13
SHT.5
SHTS.7,8,13
REVISION SHEETS
TOLERANCES
M.STANDRIDGE
LR
D. Parsons
TELEX
LOGIC DIAGRAM
READ
SEE SHT.1
9250
APPLICATION
D
92D72399
NONE
2 OF 13


DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6509-3
TOLERANCES
M.STANDRIDGE
11-26-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
READ
D
92D72399
SCALE NONE
SHEET 3 OF 13
SEE SHT.1
9250
APPLICATION


DO NOT SCALE THIS PRINT
REVISION
B REV PER DCN 1-6509-3
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
READ
M.STANDRIDGE
11-26-
92D72399
D
SCALE NONE
SHEET 4 OF 13
SEE SHT.1
9250
APPLICATION
TOLERANCES
PREAMP 4A
PREAMP 4B
THRESH VOLT
-11.5V IN GCR
-11.5V IN PE
-12V
PREAMP 5A
PREAMP 5B
TH ADJ
CLOCK
PREAMP 6A
PREAMP 6B
TRK4
TRK5
TRK6
AMP SNS 4
AMP SNS 5
AMP SNS 6
74LS393
4-BIT BINARY COUNTER



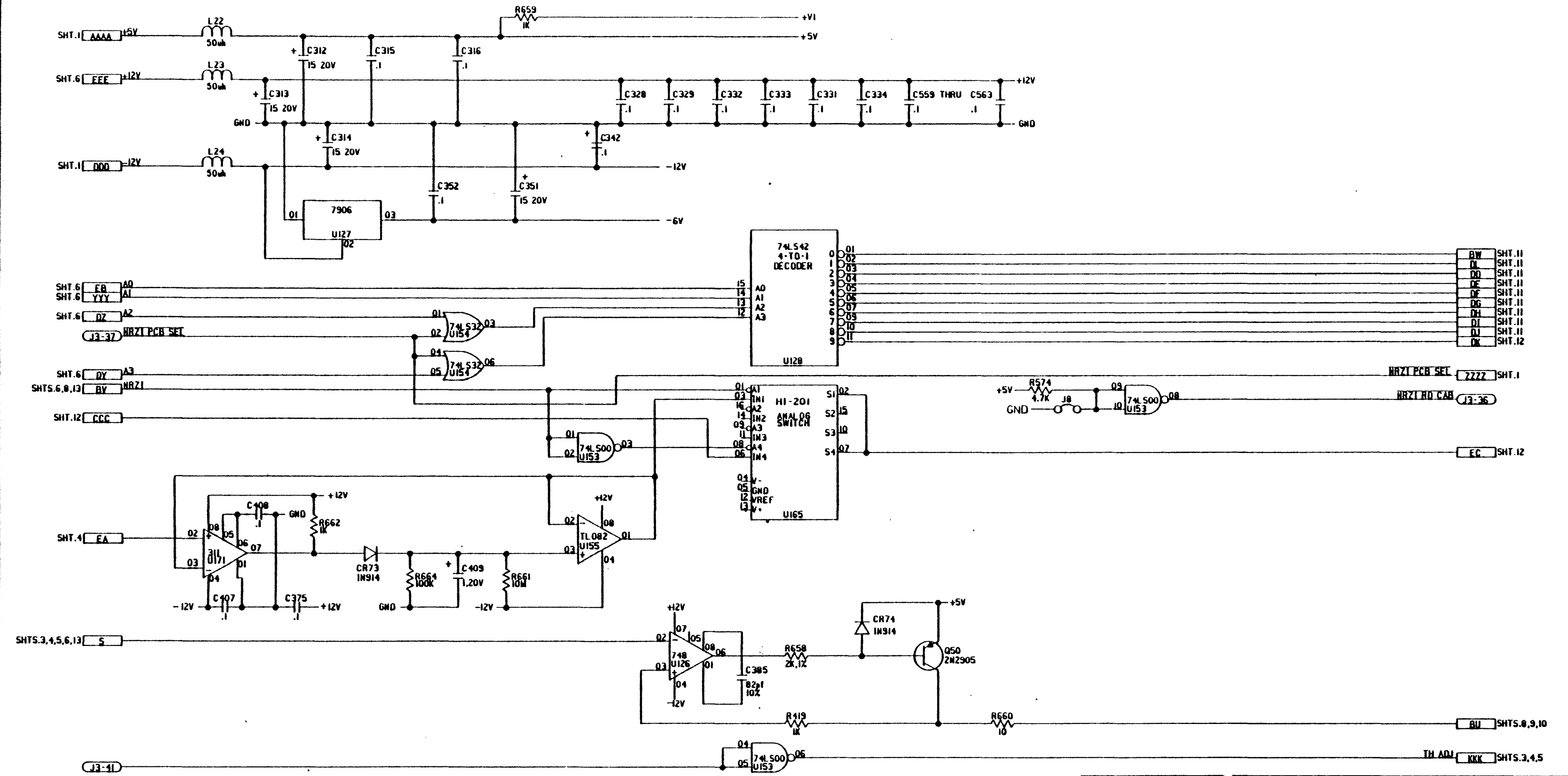
NOTES:
DO NOT SCALE THIS PRINT
REVISIONS
B REV PER DCN 1-6509-3
SHT.2 J
SHT.13 BBB
SHT.2 K
SHT.2 L
SHT.13 XXX
SHT.13 CU
PREAMP 7A
PREAMP 7B
THRESH VOLT
11.5 IN GCR
11.5 IN PE
PREAMP 8A
PREAMP 8B
TH ADJ
CLOCK
PREAMP 9A
PREAMP 9B
TRK7 T SHT.6
AMP SNS 7 AH SHT.6
JJJ SHT.13
TRK8 U SHT.6
AMP SNS 8 AE SHT.6
QQQ SHT.13
TRK9 V SHT.6
AMP SNS 9 AJ SHT.6
CS SHT.1
74LS393 4-BIT BINARY COUNTER
REVISION SHEETS
TOLERANCES
DECIMALS
ANGULAR
HOLE DIAMETER
THREAD CLASS
M.STANDRIDGE
11-26-4
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
READ
MATERIAL
FINISH
SEE SHT.1
9250
APPLICATION
D
92D72399
SCALE NONE
SHEET 5 OF 13


DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-84
7524 DAC
74LS244 3S-BUF LINE DR
74367A 3S-NONINV LINE DR
•SEE NOTE 6
74LS42 4-TO-1 DECODER
74LS161A BINARY COUNTER
1403 LOW-VOLT REF
TL082
LM393
2N3904
IN914
2.4576 MHZ
-11.5 IN PE
-11.5 IN GCR
TELEX
TULSA, OKLAHOMA
M.STANDRIDGE
10-4-4
LOGIC DIAGRAM
READ
D
92D72399
SCALE NONE
6 OF 13
SEE SHT.1
9250
APPLICATION

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| C | REV PER DCN 1-6537-3 | 12-11-84 | LR |




| REVISION SHEETS | | | |
|---|---|---|---|

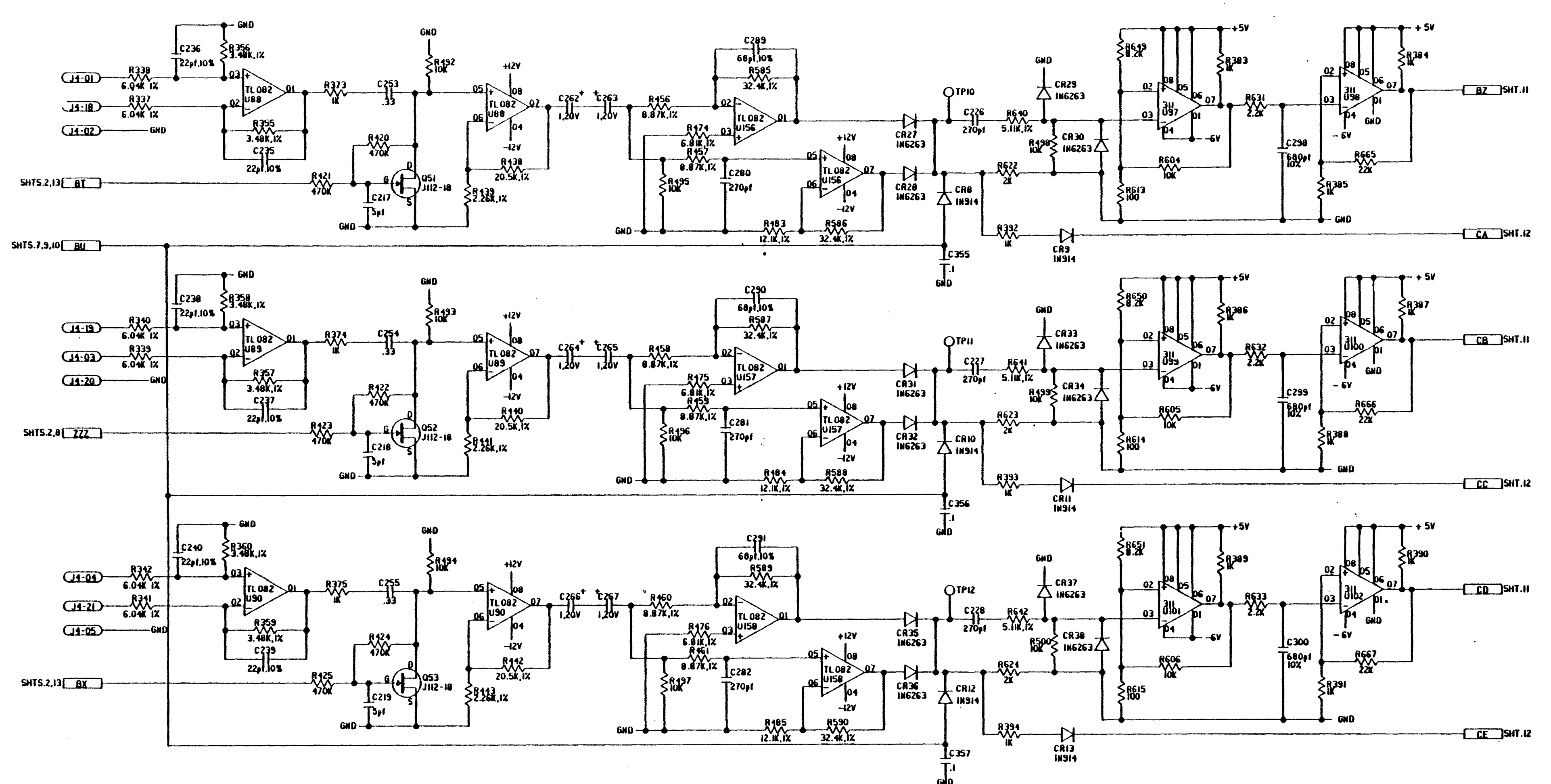
| TOLERANCES UNLESS OTHERWISE SPECIFIED | DRAWN M.STANDRIDGE | DATE 12-10-4 | TELEX TULSA, OKLAHOMA |
|---|---|---|---|
| DECIMALS .XX ±.0 .XXX ±.0 ANGULAR ±30' | CHECKED LR | DATE 12-11-4 | LOGIC DIAGRAM READ |
| HOLE DIAMETER +.005 -.000 | APPROVED R. Parsons | DATE 12-11-84 | |
| THREAD CLASS NO. 2 | | | |
| MATERIAL | | | CODE IDENT NO. SIZE D 92D72399 |
| FINISH | | | SCALE NONE SHEET 7 OF 13 |

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| A | REL PER ERO 513-84 | 10-5-84 | LR |




| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

REVISION
SHEETS

TOLERANCES
UNLESS OTHERWISE SPECIFIED

| DECIMALS | ANGULAR |
|---|---|
| .XX ± | ± |
| .XXX ± | |
| HOLE DIAMETER | |
| THREAD CLASS | NO. 2 |

MATERIAL

FINISH

| DRAWN | M.STANDRIDGE | DATE | 10-4-4 |
|---|---|---|---|
| CHECKED | LR | DATE | 10-5-4 |
| APPROVED | R. Parsons | DATE | 10-9-84 |

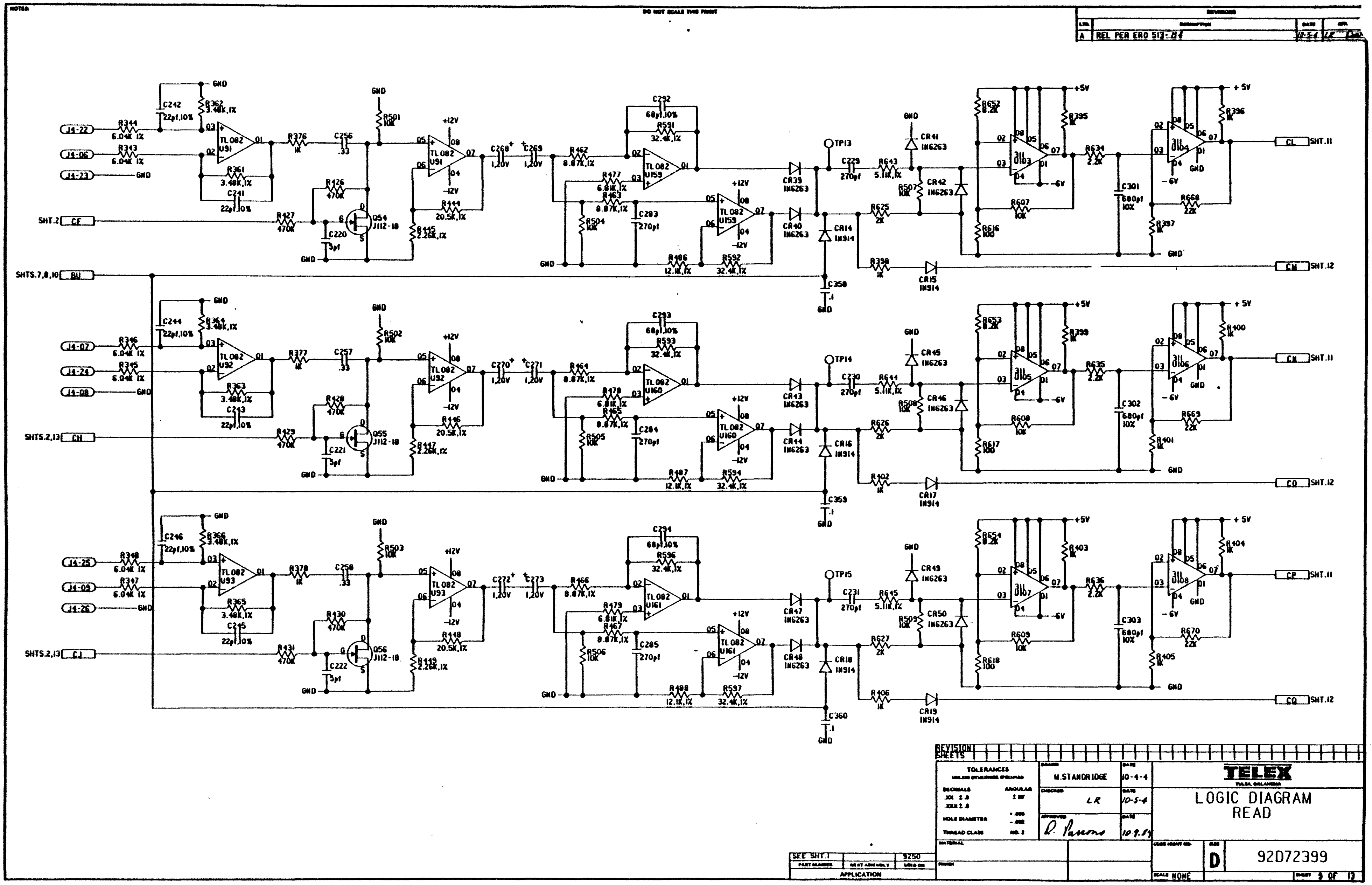
TELEX

TULSA, OKLAHOMA

LOGIC DIAGRAM
READ

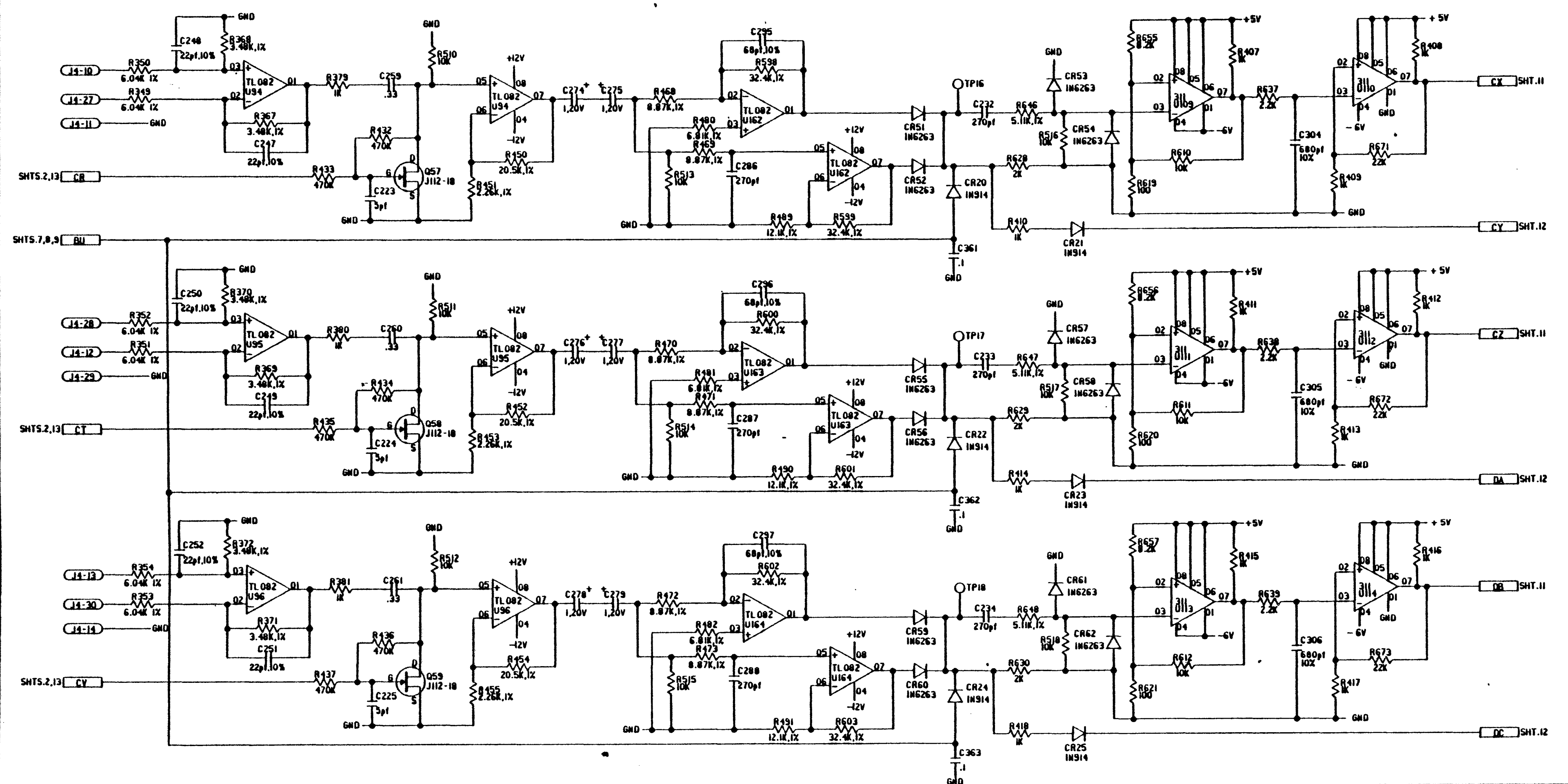
CODE IDENT NO. | SIZE D | 92D72399

SCALE NONE | SHEET 8 OF 13


DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-84
J4-22
J4-06
J4-23
GND
SHT.2 CF
SHTS.7,8,10 BU
J4-07
J4-24
J4-08
SHTS.2,13 CH
J4-25
J4-09
J4-26
SHTS.2,13 CJ
R344 6.04K 1%
R343 6.04K 1%
C242 22pf,10%
R362 3.48K,1%
TL082 U91
R361 3.48K,1%
C241 22pf,10%
R376 1K
C256 .33
R501 10K
R426 470K
Q54 J112-18
C220 5pf
R427 470K
+12V
-12V
R444 20.5K,1%
R445 2.26K,1%
C268 1,20V
C269 1,20V
R462 8.87K,1%
C292 68pf,10%
R591 32.4K,1%
R477 6.81K,1%
R463 8.87K,1%
TL082 U159
R504 10K
C283 270pf
R486 12.1K,1%
R592 32.4K,1%
CR39 1N6263
CR40 1N6263
TP13
C229 270pf
CR14 1N914
C358 .1
R643 5.11K,1%
CR41 1N6263
R507 10K
CR42 1N6263
R625 2K
R398 1K
CR15 1N914
R652 8.2K
311 U103
R395 1K
+5V
-6V
R607 10K
R616 100
R634 2.2K
C301 680pf 10%
R397 1K
R668 22K
311 U104
R396 1K
CL SHT.11
CM SHT.12
TELEX
TULSA, OKLAHOMA
TOLERANCES
M.STANDRIDGE
LR
LOGIC DIAGRAM
READ
SEE SHT.1
9250
APPLICATION
D
92D72399
SCALE NONE
9 OF 13

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP. |
| | REL PER ERO 513-84 | | |




REVISION SHEETS

TOLERANCES UNLESS OTHERWISE SPECIFIED

DRAWN M.STANDRIDGE 10-4-4

CHECKED LR 10-5-4

APPROVED 10-9-84

TELEX

TULSA, OKLAHOMA

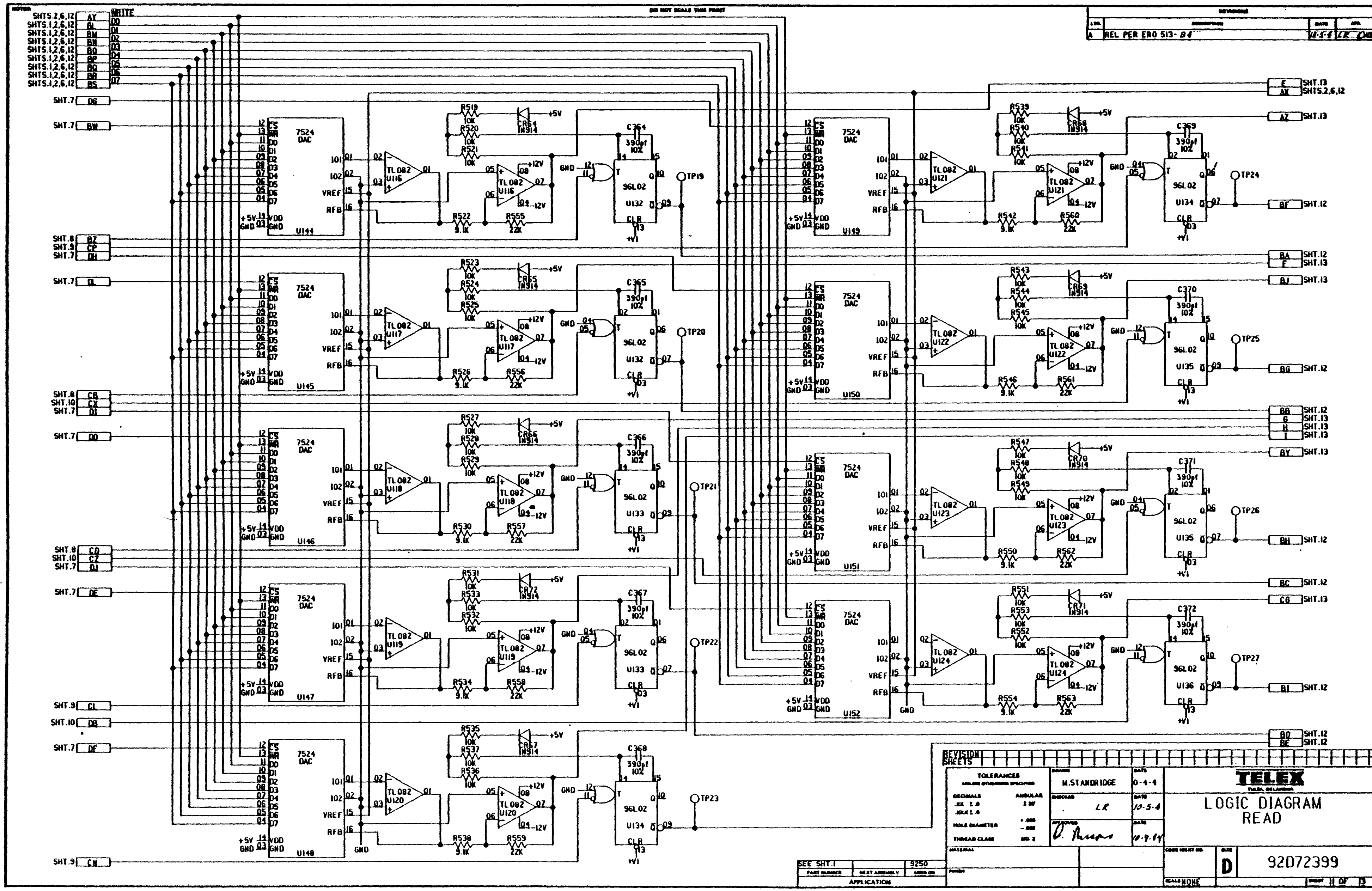
LOGIC DIAGRAM
READ

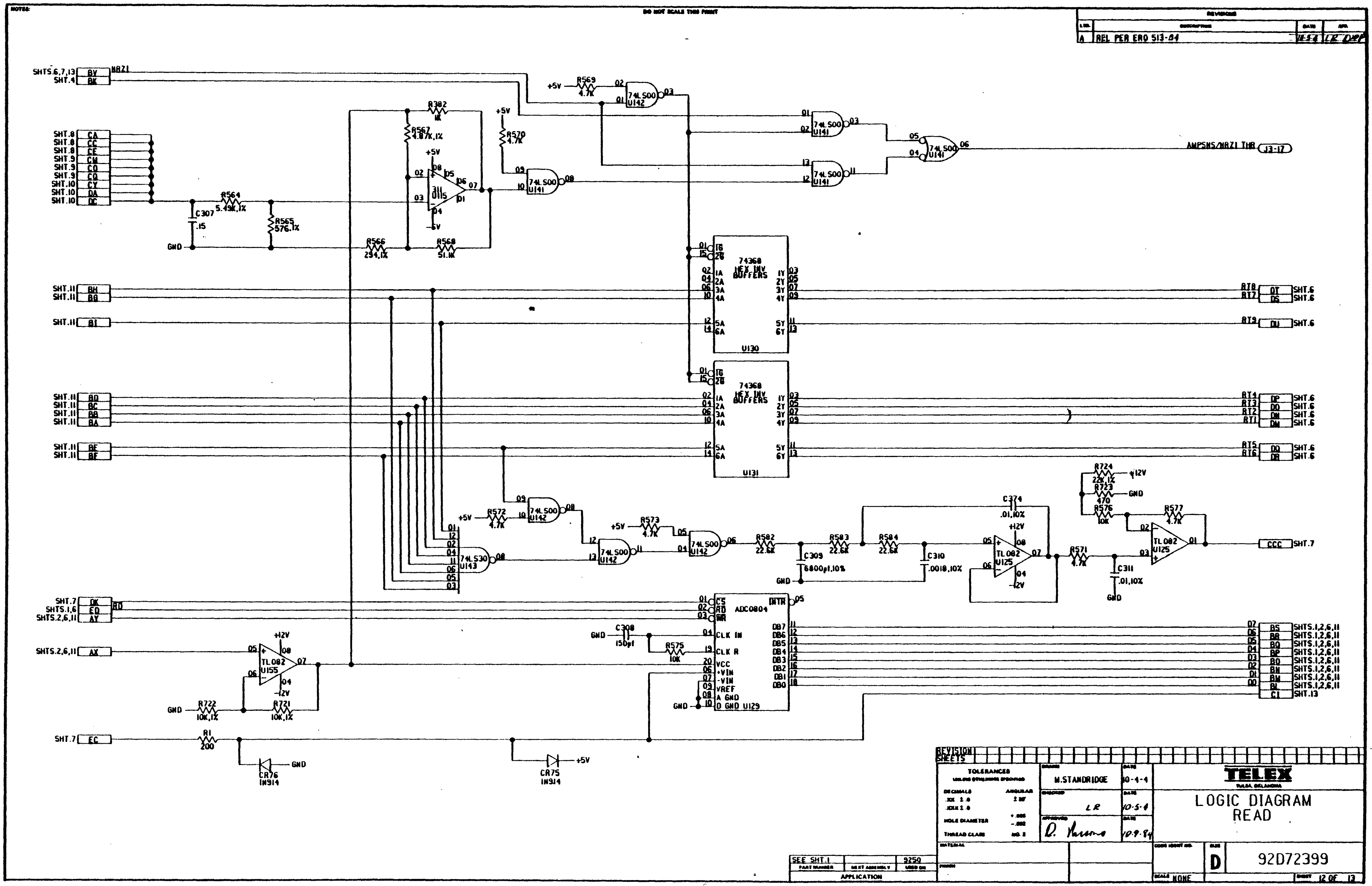
SIZE D 92D72399

SCALE NONE SHEET 10 OF 13

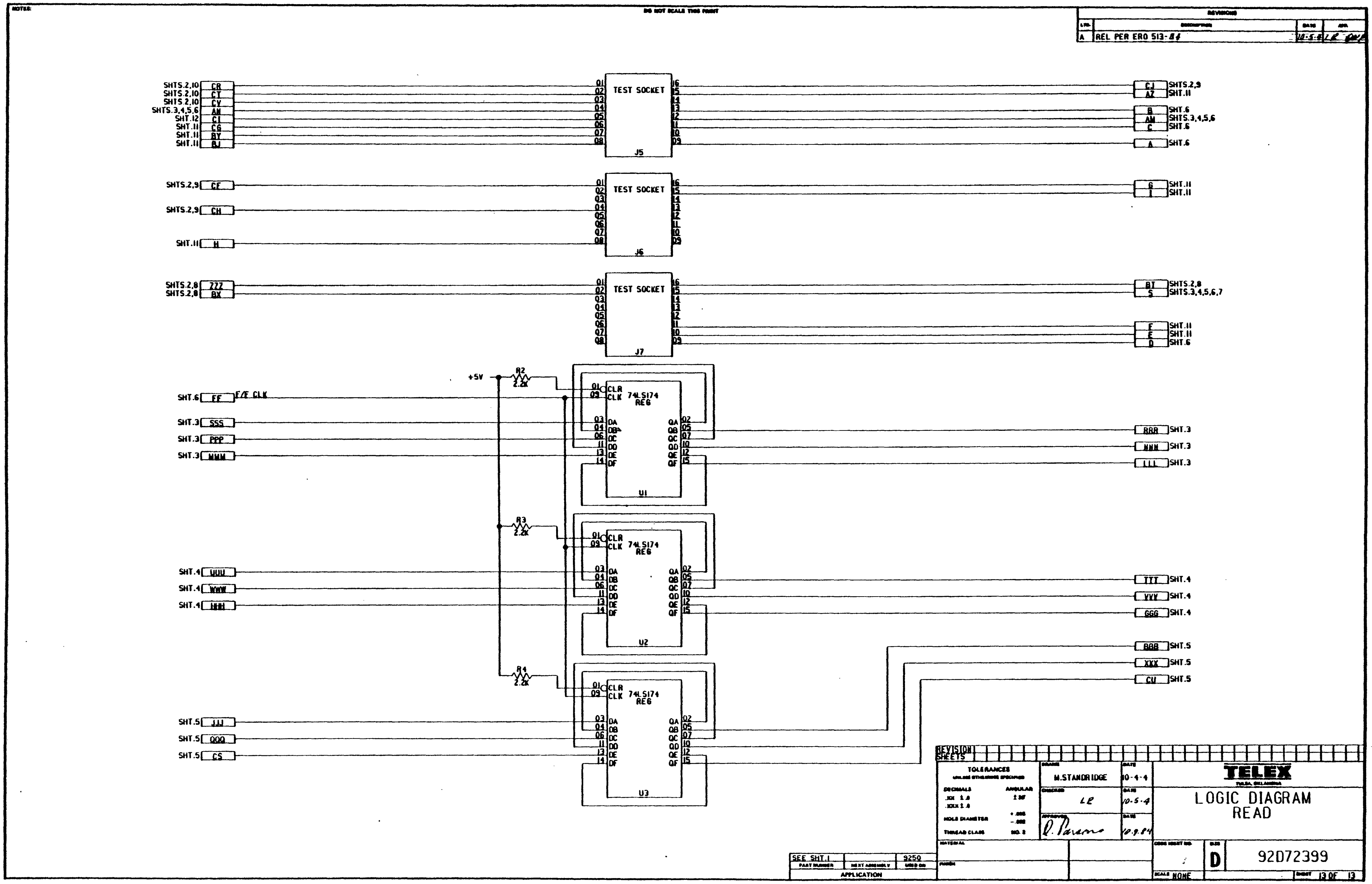
SEE SHT.1 9250

APPLICATION


DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-
7524 DAC
TL082
96L02
WRITE
TP19
TP20
TP21
TP22
TP23
TP24
TP25
TP26
TP27
U144
U145
U146
U147
U148
U149
U150
U151
U152
SHT.7
SHT.8
SHT.9
SHT.10
SHT.12
SHT.13
SHTS.1,2,6,12
SHTS.2,6,12
390pf 10%
+5V
+12V
-12V
GND
+VI
1N914
SEE SHT.1
9250
APPLICATION
TOLERANCES
M.STANDRIDGE
LR
TELEX
LOGIC DIAGRAM
READ
D
92D72399
NONE
11 OF 13

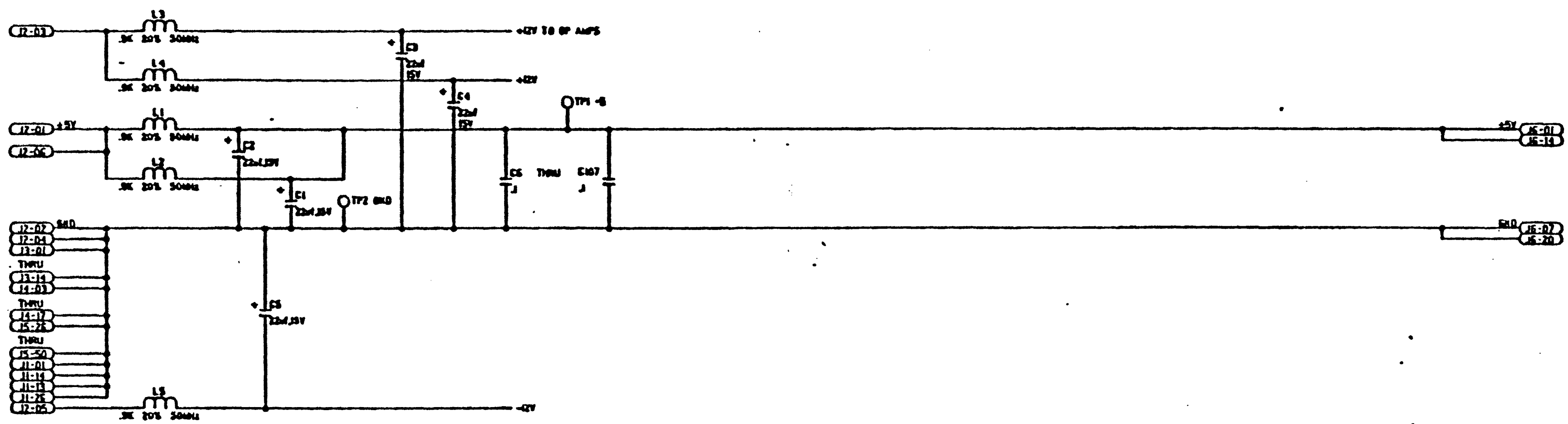


NOTES:
DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-04
AMPSNS/NRZI THR
J3-17
74368 HEX INV BUFFERS
U130
U131
ADC0804
U129
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
READ
M.STANDRIDGE
10-4-4
LR
10-5-4
10-9-84
D
92D72399
SCALE NONE
SHEET 12 OF 13
SEE SHT.1
9250
APPLICATION


DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-84
TEST SOCKET
J5
J6
J7
74LS174
REG
U1
U2
U3
+5V
R2
R3
R4
2.2K
F/F CLK
CLR
CLK
SHTS.2,10 CR
SHTS.2,10 CT
SHTS.2,10 CV
SHTS.3,4,5,6 AN
SHT.12 CI
SHT.11 CG
SHT.11 BY
SHT.11 BJ
SHTS.2,9 CF
SHTS.2,9 CH
SHT.11 H
SHTS.2,8 ZZZ
SHTS.2,8 BX
SHT.6 FF
SHT.3 SSS
SHT.3 PPP
SHT.3 MMM
SHT.4 UUU
SHT.4 WWW
SHT.4 HHH
SHT.5 JJJ
SHT.5 QQQ
SHT.5 CS
CJ SHTS.2,9
AZ SHT.11
B SHT.6
AN SHTS.3,4,5,6
C SHT.6
A SHT.6
G SHT.11
I SHT.11
BT SHTS.2,8
S SHTS.3,4,5,6,7
F SHT.11
E SHT.11
D SHT.6
RRR SHT.3
NNN SHT.3
LLL SHT.3
TTT SHT.4
VVV SHT.4
GGG SHT.4
BBB SHT.5
XXX SHT.5
CU SHT.5
REVISION SHEETS
TOLERANCES
M.STANDRIDGE
10-4-4
LE
10-5-4
D. Parsons
10-9-84
TELEX
LOGIC DIAGRAM
READ
SEE SHT.1
9250
APPLICATION
D
92D72399
NONE
13 OF 13

C 1-6620. CCC 99
D 1-6662. CCC 99

UNLESS OTHERWISE SPECIFIED
1. 8 PIN I.C. CONNECT PIN 04 TO GND
   CONNECT PIN 08 TO +5VC
2. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
3. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
4. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
5. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED E ARE 1/8 WATT.
6. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED XXX ARE 100 VOLTS.
7. CAP C140 IS TO BE GROUNDED ACROSS PIN 10 OF U50.




| REF DESIG | |
|---|---|
| NOT USED | LAST USED |
| U12,13,44,53,85,91 | U1000 |
| U100-199,200-299,300-399 | |
| U400-499,500-599,600-699 | |
| U700-799,800-899,900-999 | |
| C115-125,130-132 | C145 |
| R3,10,13,18,27-30,33,37 | |
| 40,43,53,54,58-60,81 | |
| 84,85,96-104,112,113,117 | R129 |
| | RP30 |
| | J6 |
| | JP1 |
| | TP11 |
| | L5 |
| Q2 | Q4 |
| CR2,4 | CR8 |

| REF DESIG. | | SPARES |
|---|---|---|
| 7417 | U2 | I05,O6I,I03,O8I,I11,I01 |
| 74LS04 | U10 | I1I,I01 |
| 74LS86 | U43 | I2,I3,I1 |
| 74LS08 | U58 | I2,I3,I1 |
| 74LS32 | U65 | I1,I2,I3 |
| 75452 | U69 | I01,02,03I,I06,07,05I |
| 74LS86 | U72 | I2,I3,I1 |
| 74LS279 | U73 | I01,02,03,04I,I10,I1,I2,09I |
| 74125 | U99 | I01,02,03I,I12,I3,I11 |
| 74LS14 | U1000 | I05,O6I,I03,O8I,I11I,I01,I13,I21 |
| 74LS04 | U35 | I1,I0 |

B C B B B B B B B B

TOLERANCES

M. STANBRIDGE

JEC

TELEX

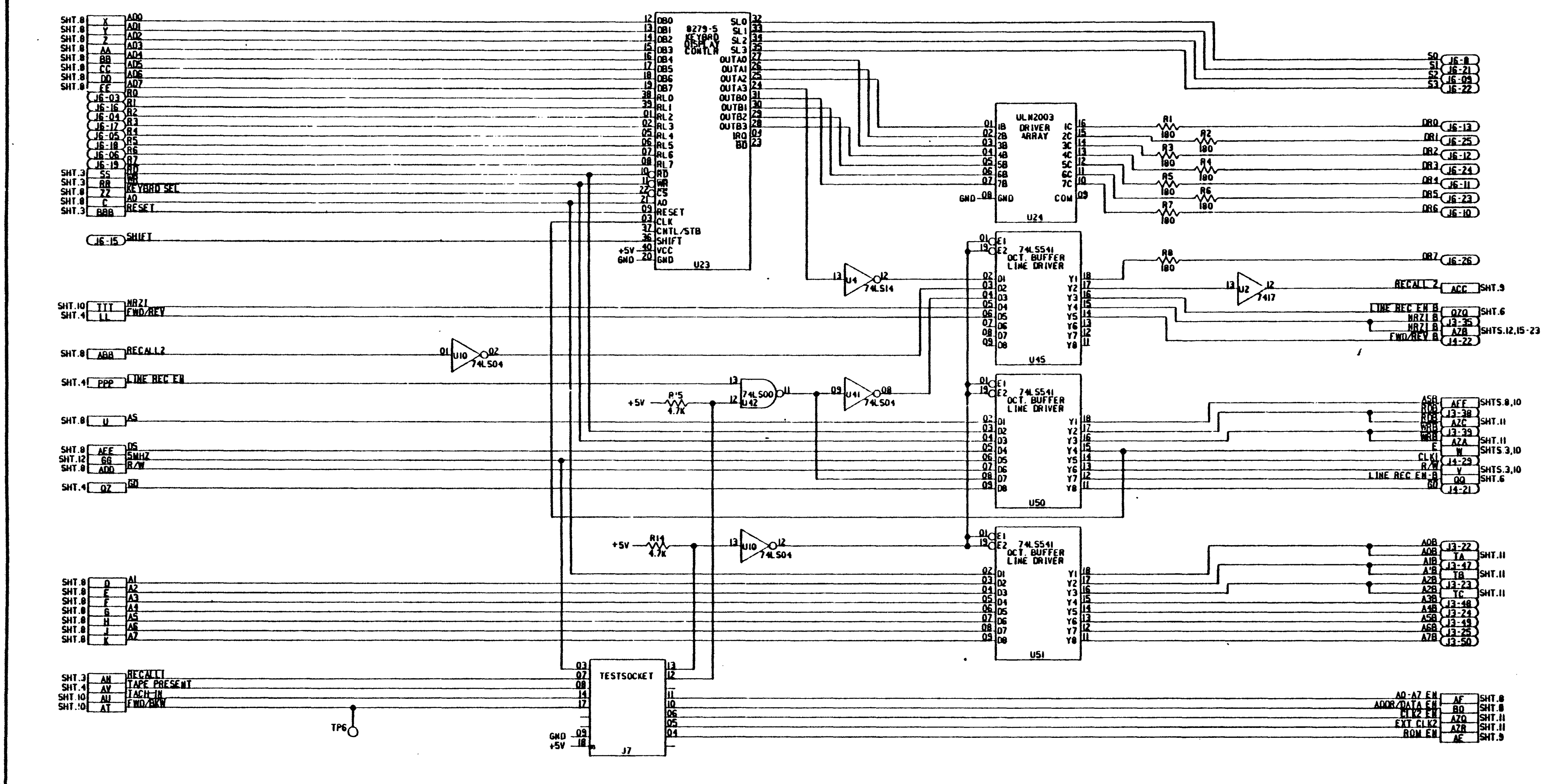
LOGIC DIAGRAM
I/O CONTROL & WRITE

D 92D72406

1 OF 23

DO NOT SCALE THIS PRINT

| LTR | REVISIONS | DATE | APP |
| --- | --- | --- | --- |
| A | REL PER ERO 513-105 | 2-14-5 | JFC |




| TOLERANCES | DRAWN | DATE |
| --- | --- | --- |
| DECIMALS .XX ± .0 / .XXX ± .0 — ANGULAR ± 30' | M.STANDRIDGE | 1-18-5 |
| HOLE DIAMETER | CHECKED JFC | 2-14-5 |
| THREAD CLASS NO. 3 | APPROVED James E. Gibb | 2-14-5 |

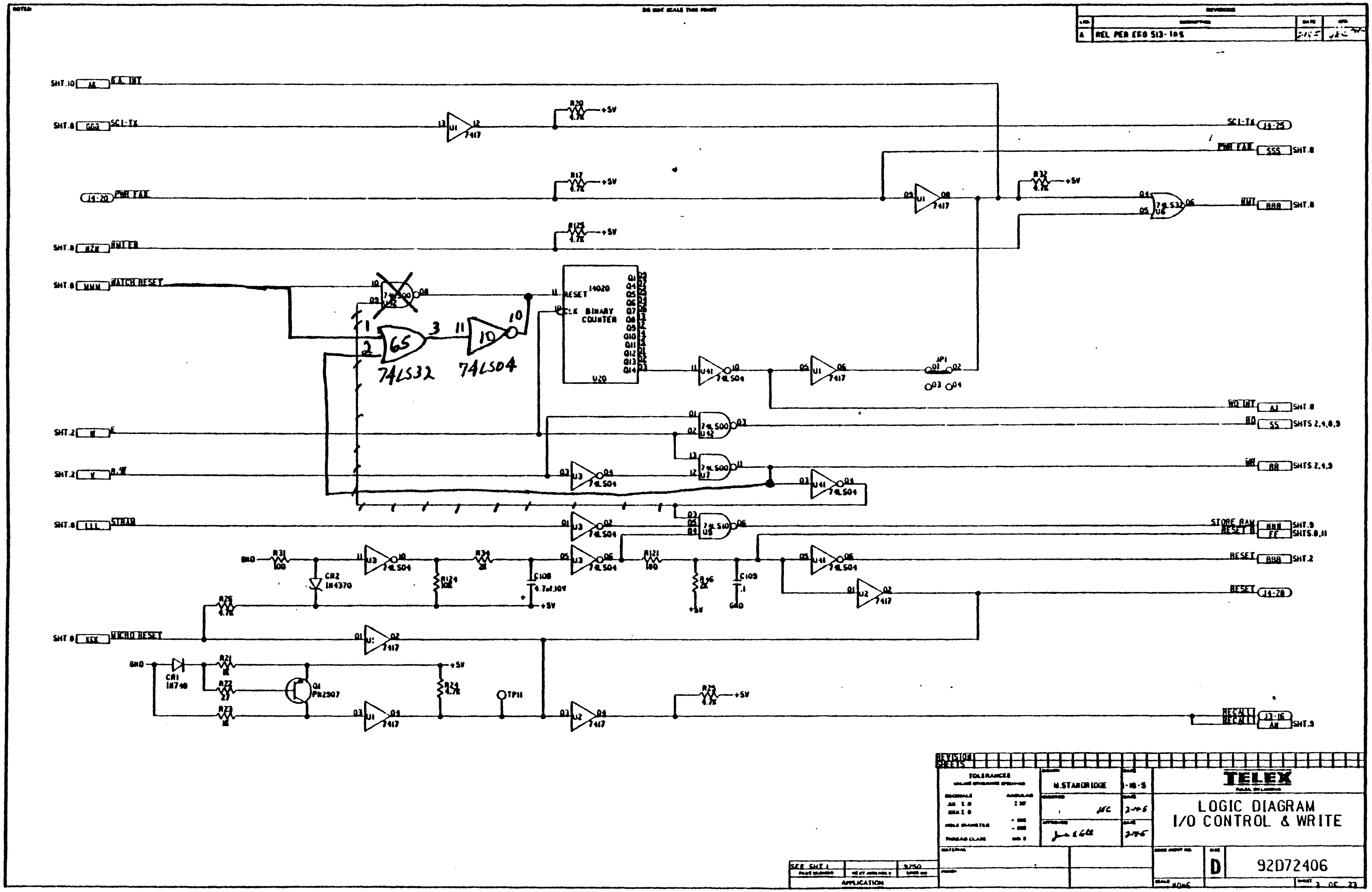
**TELEX**
TULSA, OKLAHOMA

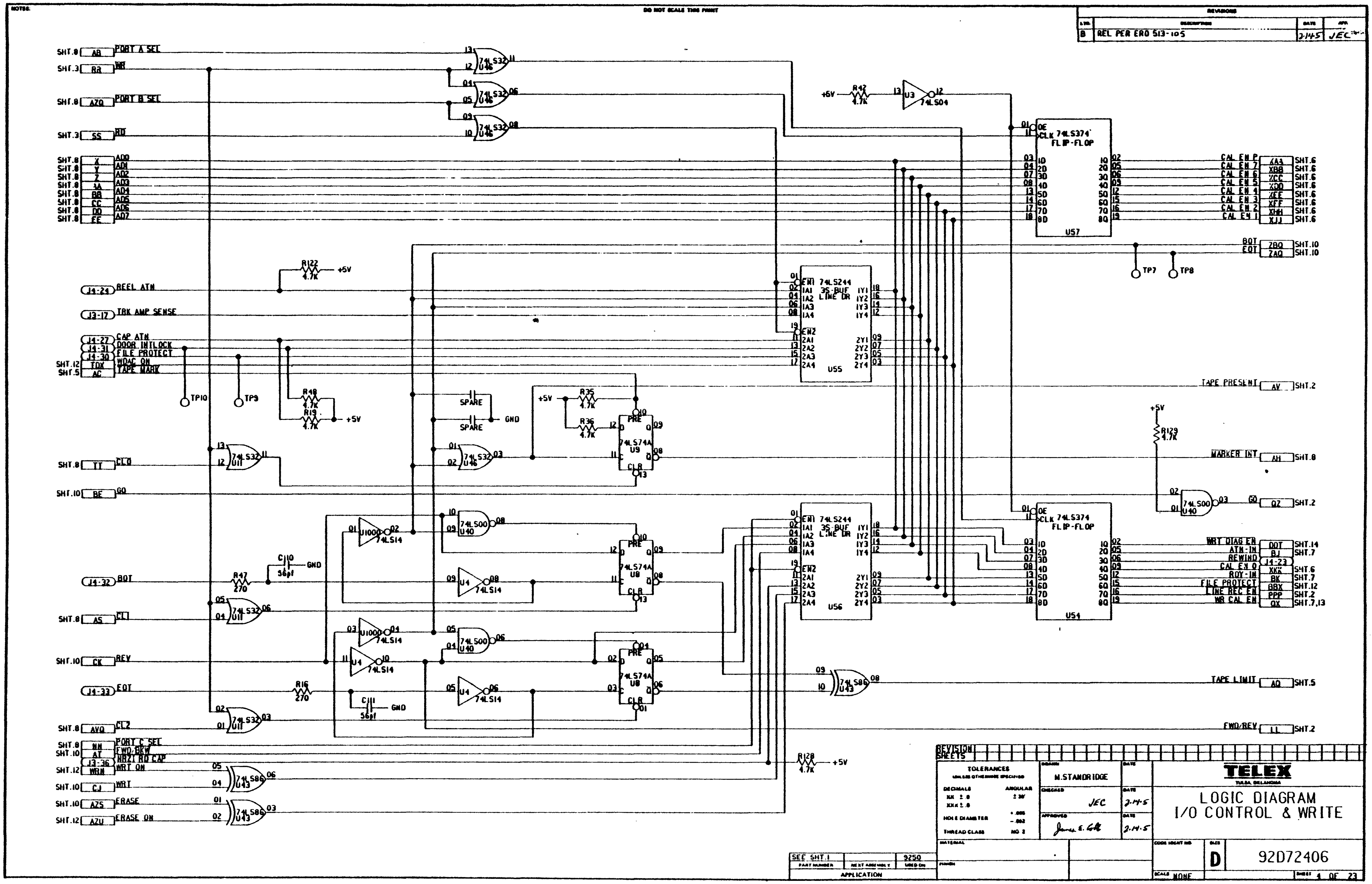
# LOGIC DIAGRAM I/O CONTROL & WRITE

SIZE D 92D72406

SCALE NONE — SHEET 2 OF 23

SEE SHT.1 — 9250 — APPLICATION

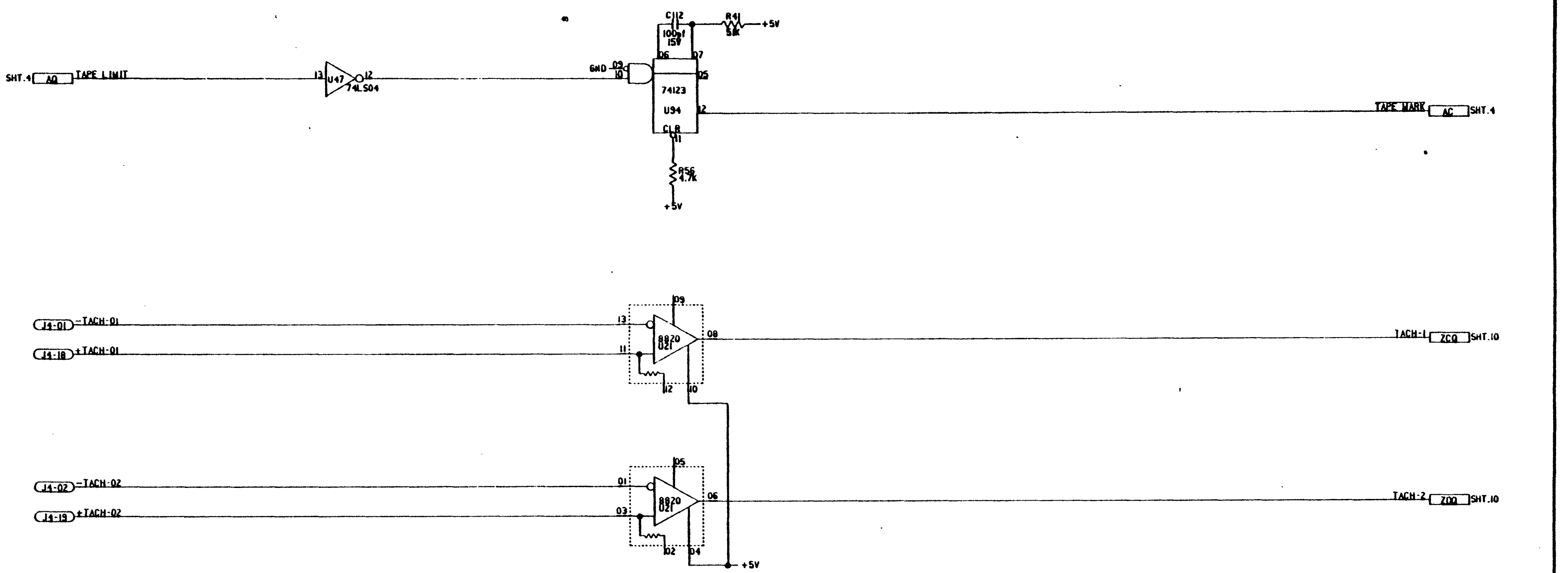

DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-105
SHT.10 AK BA INT
SHT.8 GGG SCI-TX
SCI-TX J3-25
PWR FAIL SSS SHT.8
J4-20 PWR FAIL
NMI BBB SHT.8
SHT.8 NZN NMI EN
SHT.8 MMM WATCH RESET
74LS32
74LS04
14020 BINARY COUNTER U20
WD INT AJ SHT.8
SHT.2 W E
SHT.2 V R/W
RD SS SHTS 2,4,8,9
WR RR SHTS 2,4,9
SHT.8 LLL STRAB
STORE RAM HHH SHT.9
RESET B FF SHTS.8,11
RESET BBB SHT.2
RESET J4-28
SHT.8 KKK MICRO RESET
RECALL J3-16
RECALL AN SHT.9
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
I/O CONTROL & WRITE
M.STANDRIDGE
D
92D72406
APPLICATION


DO NOT SCALE THIS PRINT
REVISIONS
B REL PER ERO 513-105 2-14-5 JEC
PORT A SEL
WR
PORT B SEL
RD
AD0 AD1 AD2 AD3 AD4 AD5 AD6 AD7
74LS374 FLIP-FLOP U57
CAL EN P
CAL EN 7
CAL EN 6
CAL EN 5
CAL EN 4
CAL EN 3
CAL EN 2
CAL EN 1
BOT
EOT
TP7
TP8
REEL ATN
TRK AMP SENSE
CAP ATN
DOOR INTLOCK
FILE PROTECT
WDAC ON
TAPE MARK
74LS244 3S-BUF LINE DR U55
TAPE PRESENT
TP10
TP9
SPARE
GND
74LS74A U9
CLO
GO
MARKER INT
74LS00 U40
74LS14
74LS374 FLIP-FLOP U54
74LS244 3S-BUF LINE DR U56
WRT DIAG EN
ATN-IN
REWIND
CAL EN 0
RDY-IN
FILE PROTECT
LINE REC EN
WR CAL EN
74LS74A U8
CL1
REV
EOT
TAPE LIMIT
CL2
FWD/REV
PORT C SEL
FWD/BKW
NRZI RD CAP
WRT ON
WRT
ERASE
ERASE ON
74LS86 U43
TOLERANCES
DRAWN M.STANDRIDGE
CHECKED JEC 2-14-5
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
I/O CONTROL & WRITE
SEE SHT.1
9250
APPLICATION
D
92D72406
SCALE NONE
SHEET 4 OF 23

NOTES:

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP. |
|---|---|---|---|
| A | REL PER ERO 513-105 | 2-14-5 | JEC |




REVISION
SHEETS

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ± .0 .XXX ± .0 ANGULAR ± 30'
HOLE DIAMETER + .005 − .002
THREAD CLASS NO. 2

DRAWN M.STANDRIDGE DATE 1-18-5
CHECKED JEC DATE 2-14-5
APPROVED James L. Gill DATE 2-14-5

MATERIAL

FINISH

TELEX
TULSA, OKLAHOMA

LOGIC DIAGRAM
I/O CONTROL & WRITE

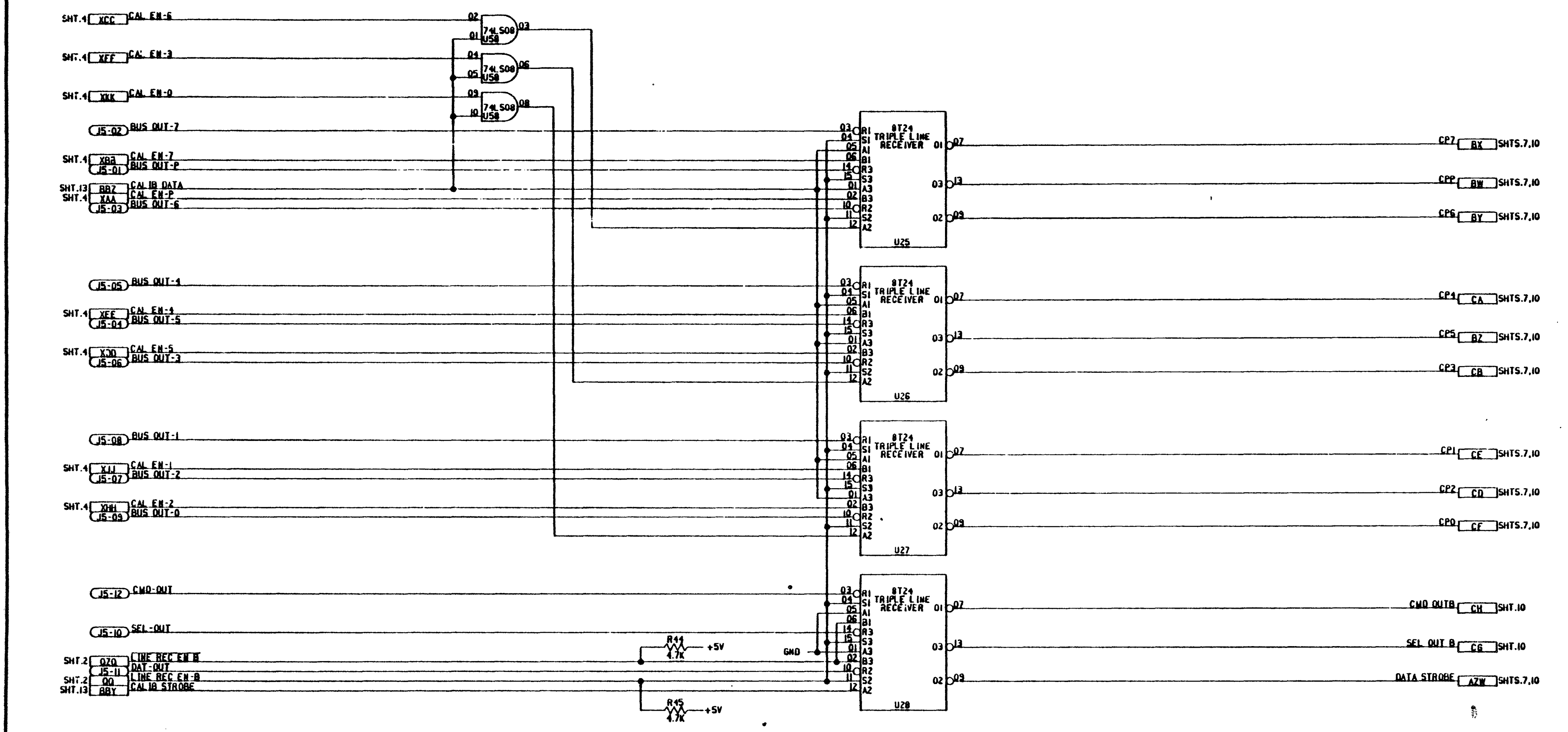
CODE IDENT NO. SIZE D 92D72406

SCALE NONE SHEET 5 OF 23

| SEE SHT 1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| A | REL PER ERO 513-105 | 2-14-5 | JEC |




TOLERANCES UNLESS OTHERWISE SPECIFIED

DRAWN: M.STANDRIDGE — DATE: 1-18-5

CHECKED: JEC — DATE: 2-14-5

APPROVED: James E Cobb — DATE: 2-14-5

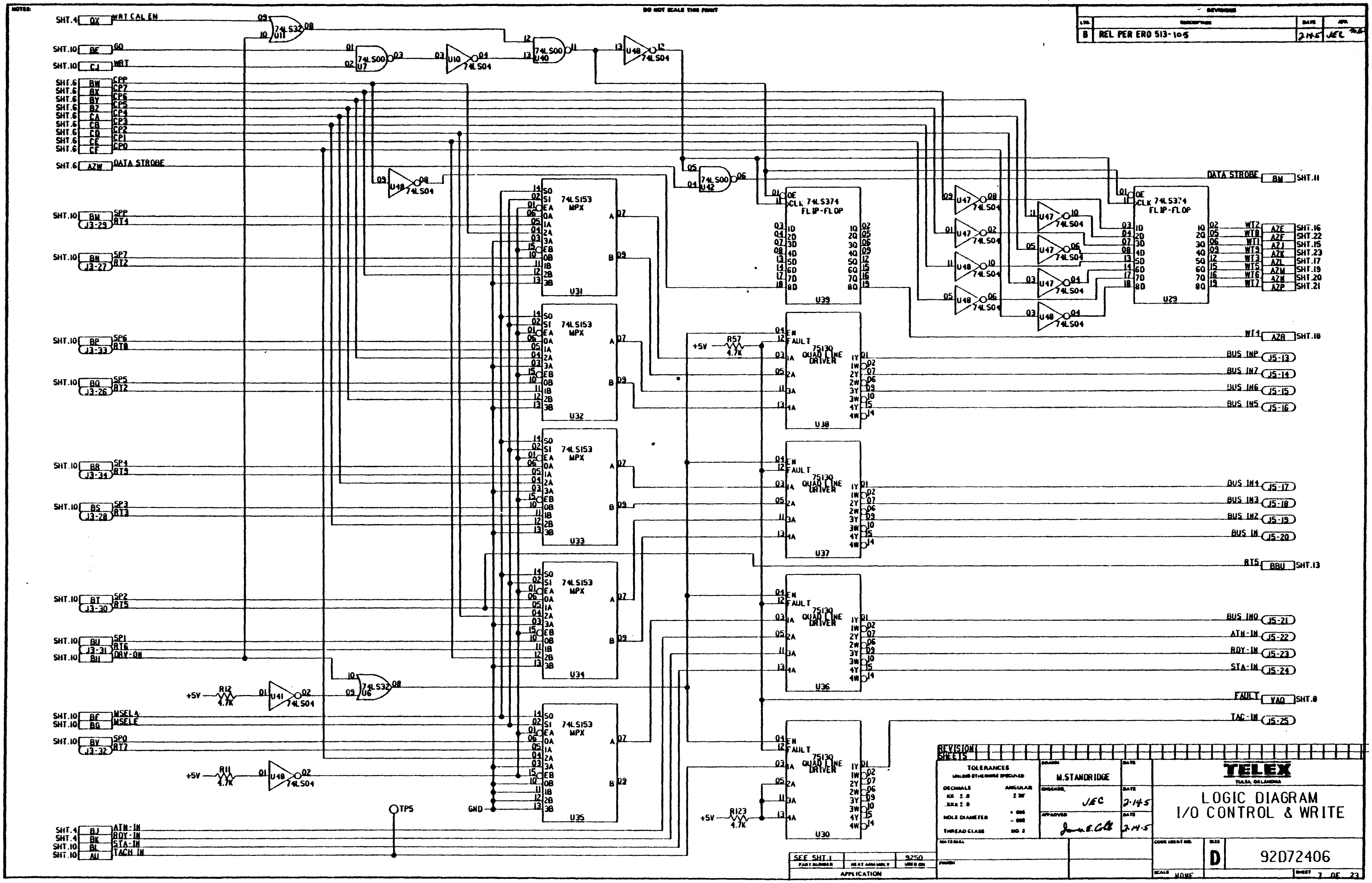
TELEX — TULSA, OKLAHOMA

# LOGIC DIAGRAM I/O CONTROL & WRITE

SIZE: D — 92D72406

SCALE: NONE — SHEET 6 OF 23

SEE SHT 1 — 9250 — APPLICATION

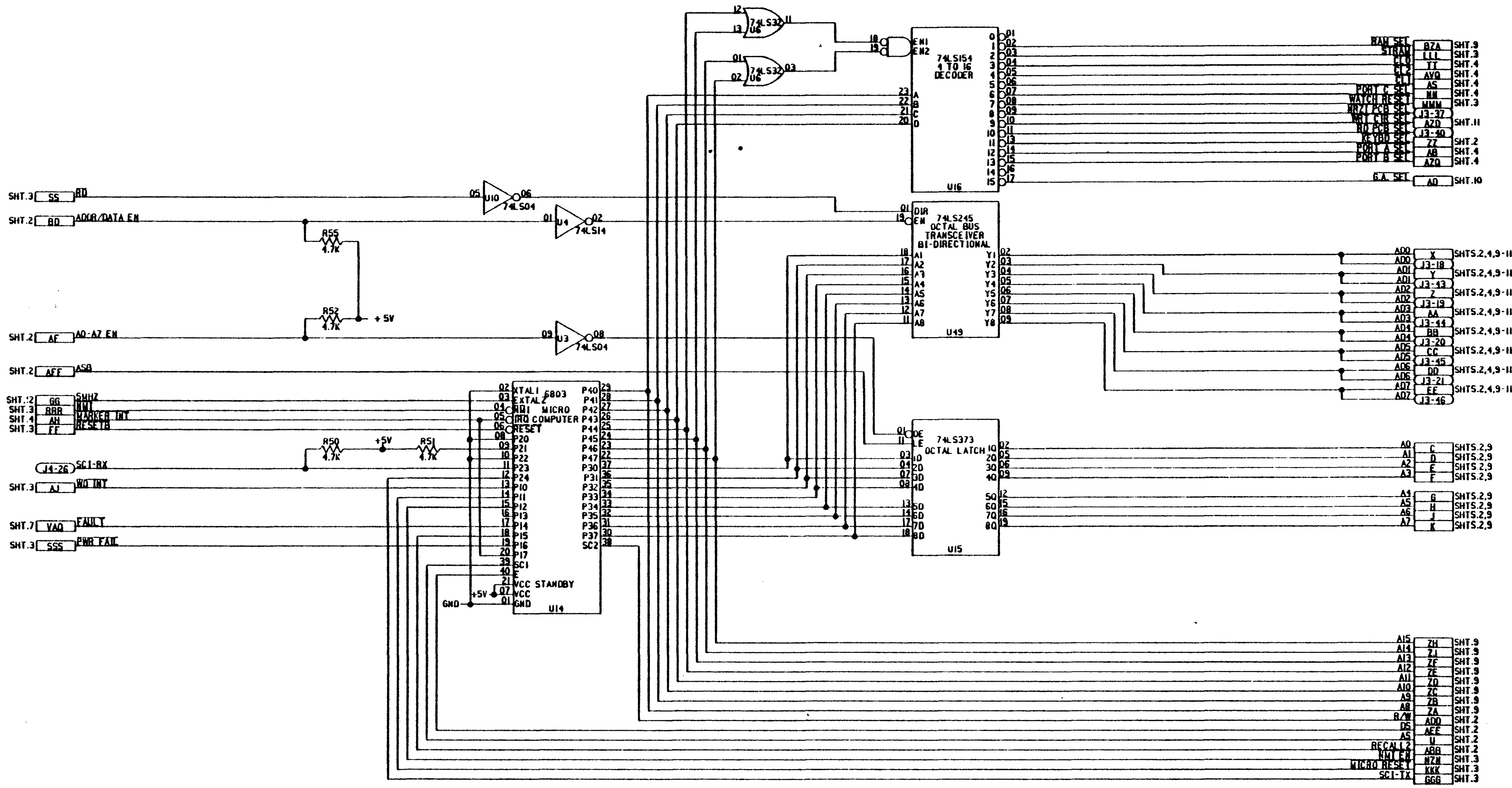


DO NOT SCALE THIS PRINT
REVISIONS
B REL PER ERO 513-105 2-14-5 JEC
SHT.4 QX WRT CAL EN
SHT.10 BE GO
SHT.10 CJ WRT
SHT.6 BW CPP
SHT.6 BX CP7
SHT.6 BY CP6
SHT.6 BZ CP5
SHT.6 CA CP4
SHT.6 CB CP3
SHT.6 CD CP2
SHT.6 CE CP1
SHT.6 CF CP0
SHT.6 AZW DATA STROBE
SHT.10 BM J3-29 SPP RT4
SHT.10 BN J3-27 SP7 RT2
SHT.10 BP J3-33 SP6 RT8
SHT.10 BQ J3-26 SP5 RT2
SHT.10 BR J3-34 SP4 RT9
SHT.10 BS J3-28 SP3 RT3
SHT.10 BT J3-30 SP2 RT5
SHT.10 BU J3-31 SP1 RT6
SHT.10 BH DRV-ON
SHT.10 BF MSELA
SHT.10 BG MSELE
SHT.10 BV J3-32 SP0 RT7
SHT.4 BJ ATN-IN
SHT.4 BK RDY-IN
SHT.10 BL STA-IN
SHT.10 AU TACH IN
74LS32 U11
74LS00 U7
U10 74LS04
74LS00 U40
U48 74LS04
74LS00 U42
74LS153 MPX U31
74LS153 MPX U32
74LS153 MPX U33
74LS153 MPX U34
74LS153 MPX U35
74LS374 FLIP-FLOP U39
74LS374 FLIP-FLOP U29
75130 QUAD LINE DRIVER U38
75130 QUAD LINE DRIVER U37
75130 QUAD LINE DRIVER U36
75130 QUAD LINE DRIVER U30
U47 74LS04
74LS32 U6
U41 74LS04
+5V R12 4.7K
+5V R11 4.7K
+5V R57 4.7K
+5V R123 4.7K
TP5
GND
DATA STROBE BM SHT.11
WT2 AZE SHT.16
WT8 AZF SHT.22
WT1 AZJ SHT.15
WT9 AZK SHT.23
WT3 AZL SHT.17
WT5 AZM SHT.19
WT6 AZN SHT.20
WT7 AZP SHT.21
WT4 AZR SHT.18
BUS INP J5-13
BUS IN7 J5-14
BUS IN6 J5-15
BUS IN5 J5-16
BUS IN4 J5-17
BUS IN3 J5-18
BUS IN2 J5-19
BUS IN J5-20
RT5 BBU SHT.13
BUS IN0 J5-21
ATN-IN J5-22
RDY-IN J5-23
STA-IN J5-24
FAULT VAQ SHT.8
TAC-IN J5-25
REVISION SHEETS
TOLERANCES
M.STANDRIDGE
JEC 2-14-5
2-14-5
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
I/O CONTROL & WRITE
SEE SHT.1
9250
APPLICATION
D
92D72406
SCALE NONE
SHEET 7 OF 23

NOTES:

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APR |
| A | REL PER ERO 513-105 | 2-14-5 | JEC |




| REVISION | |
|---|---|
| SHEETS | |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30'

HOLE DIAMETER + .005 - .002

THREAD CLASS NO. 2

MATERIAL

FINISH

DRAWN M.STANDRIDGE DATE 1-18-5

CHECKED JEC DATE 2-14-5

APPROVED James E. Gill DATE 2-14-5

**TELEX**

TULSA, OKLAHOMA

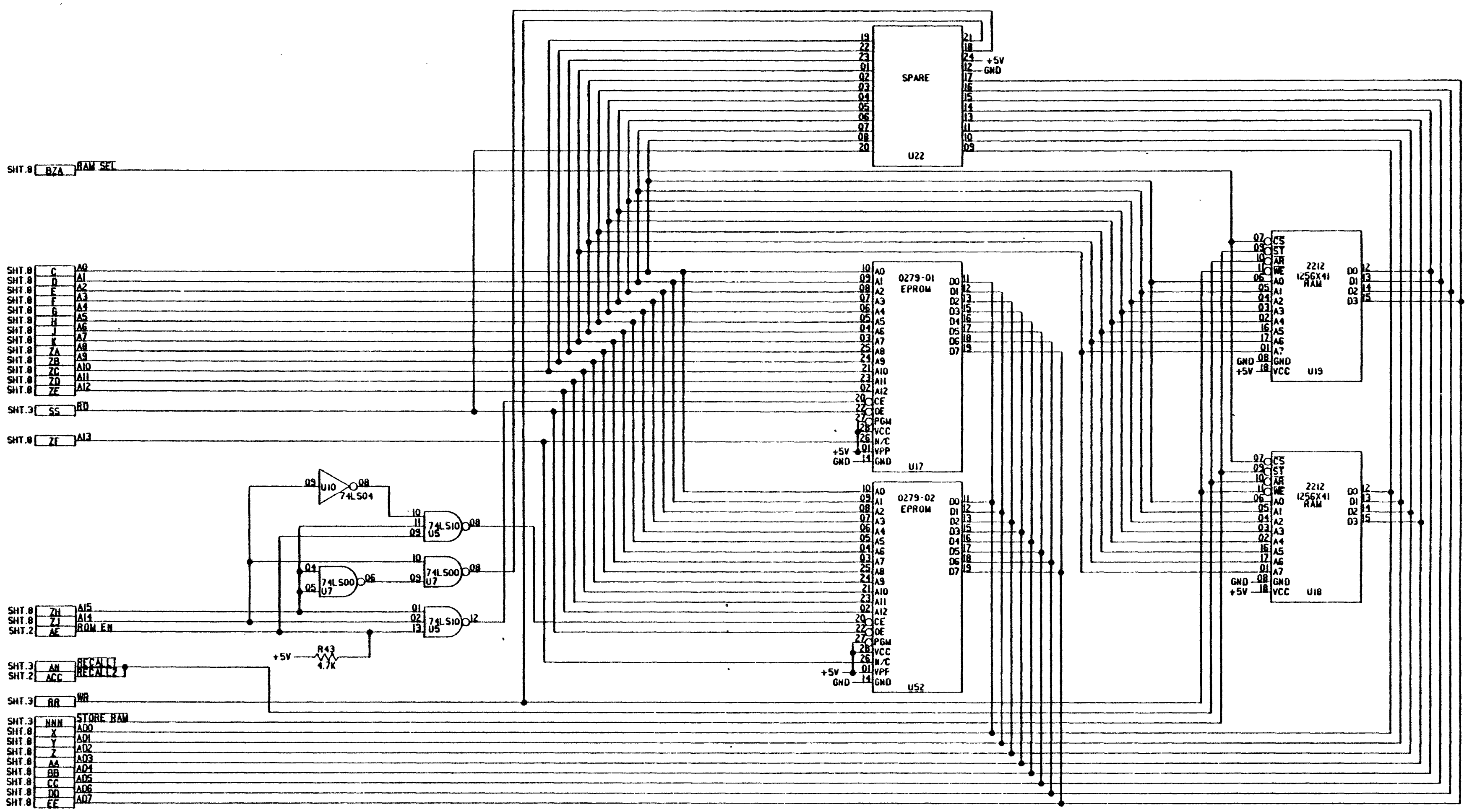
# LOGIC DIAGRAM I/O CONTROL & WRITE

SIZE D — 92D72406

SCALE NONE

SHEET 8 OF 23

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |




DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| A | REL PER ERC 513-105 | 2-14-5 | JEC |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DRAWN M.STANDRIDGE 1-18-5
CHECKED JEC 2-14-5
APPROVED 2-14-5

TELEX
TULSA, OKLAHOMA

LOGIC DIAGRAM
I/O CONTROL & WRITE

SIZE D 92D72406

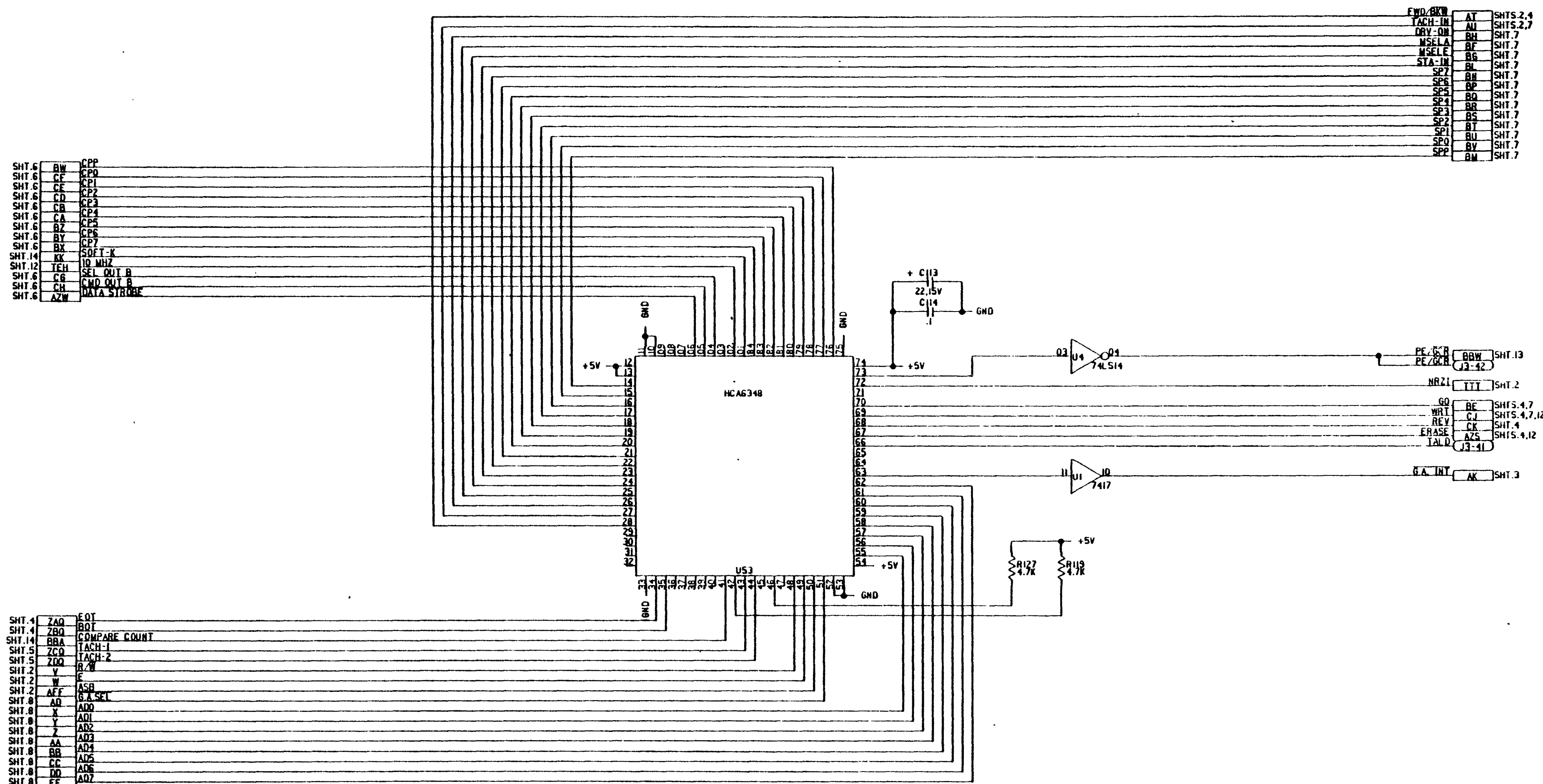
SCALE NONE SHEET 9 OF 23

SEE SHT.1 9250
APPLICATION

NOTES:

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| A | REL PER ERO 513-105 | 2-15 | JEC |




REVISION
SHEETS

| TOLERANCES UNLESS OTHERWISE SPECIFIED | | DRAWN | DATE |
|---|---|---|---|
| DECIMALS | ANGULAR | M.STANDRIDGE | 1-18-5 |
| .XX ± .0 / .XXX ± .0 | ± 30' | CHECKED JEC | 2-14-5 |
| HOLE DIAMETER | + .005 − .002 | APPROVED James E. Gill | 2-14-5 |
| THREAD CLASS | NO 2 | | |

MATERIAL

FINISH

| SEE SHT.1 | | 9250 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

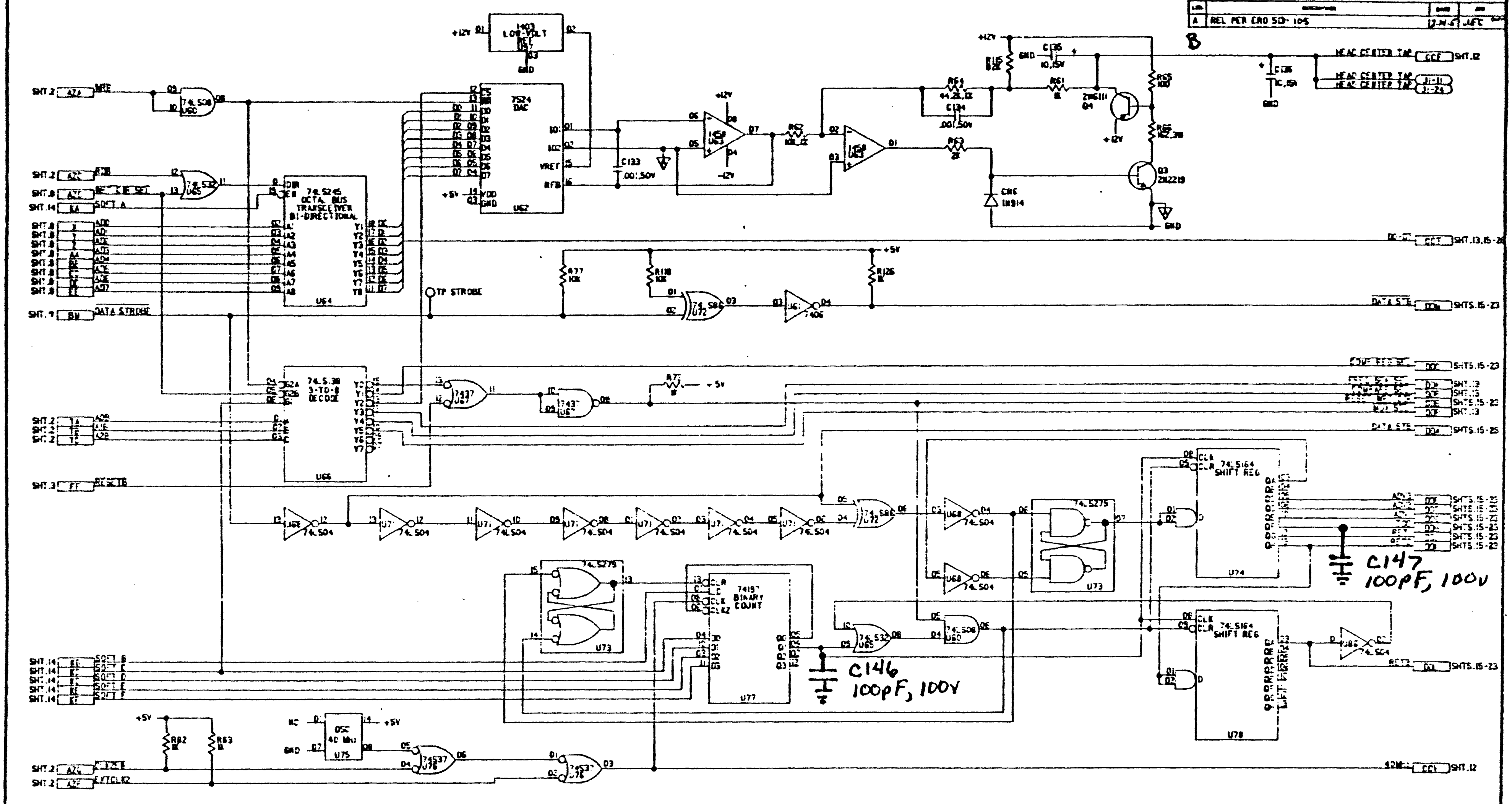
**TELEX**
TULSA, OKLAHOMA

# LOGIC DIAGRAM
# I/O CONTROL & WRITE

CODE IDENT NO. | SIZE D | 92D72406

SCALE NONE | SHEET 10 OF 23

(1-6620, CLC 44)




| REV | DESCRIPTION | DATE | APP |
|---|---|---|---|
| A | REL PER ERO 5[illegible]-105 | 12-14-[illegible] | JFC |

TELEX

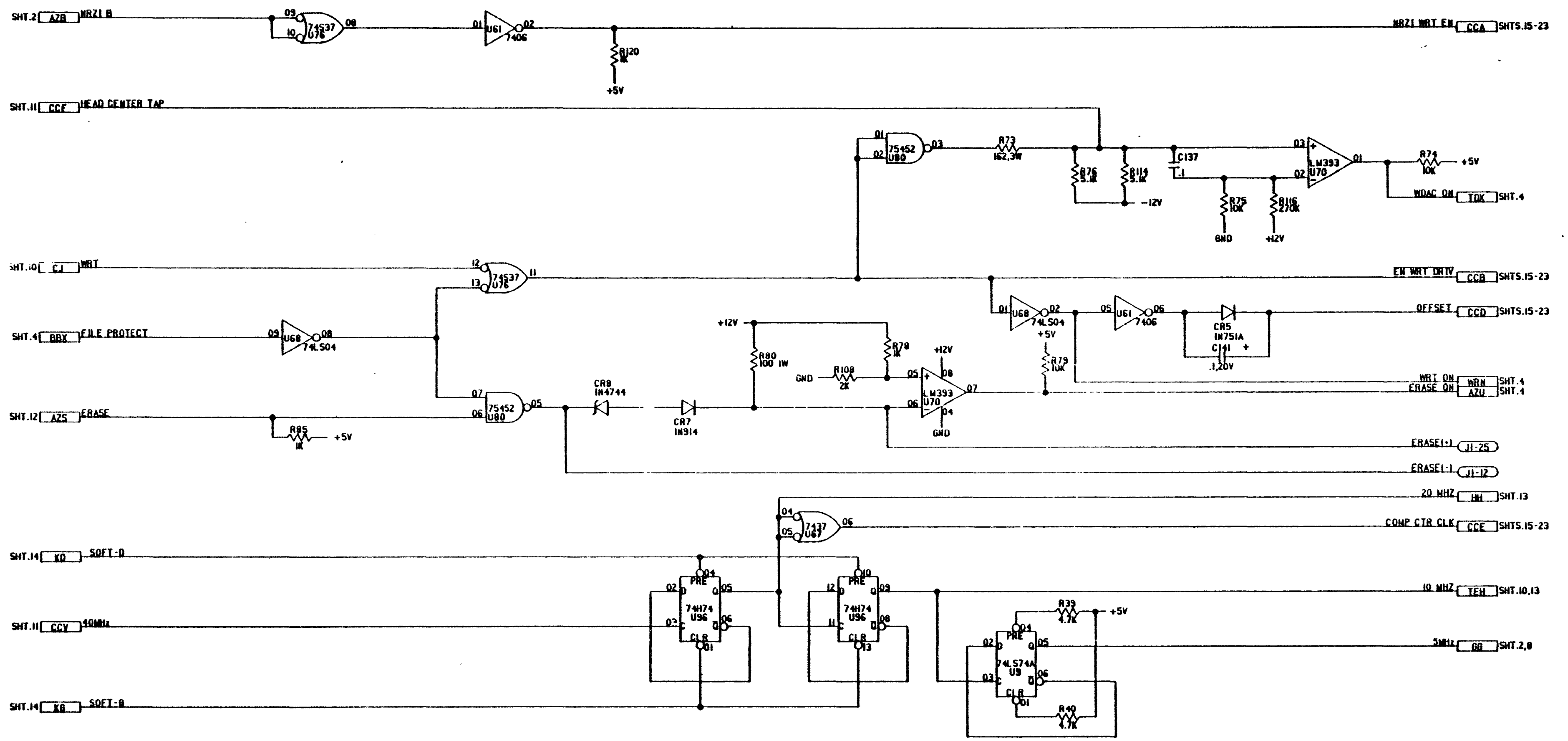
LOGIC DIAGRAM
I/O CONTROL & WRITE

M.STANDRIDGE 1-18-5
JFC 2-14-5

D 92D72406

NOTES: DO NOT SCALE THIS PRINT

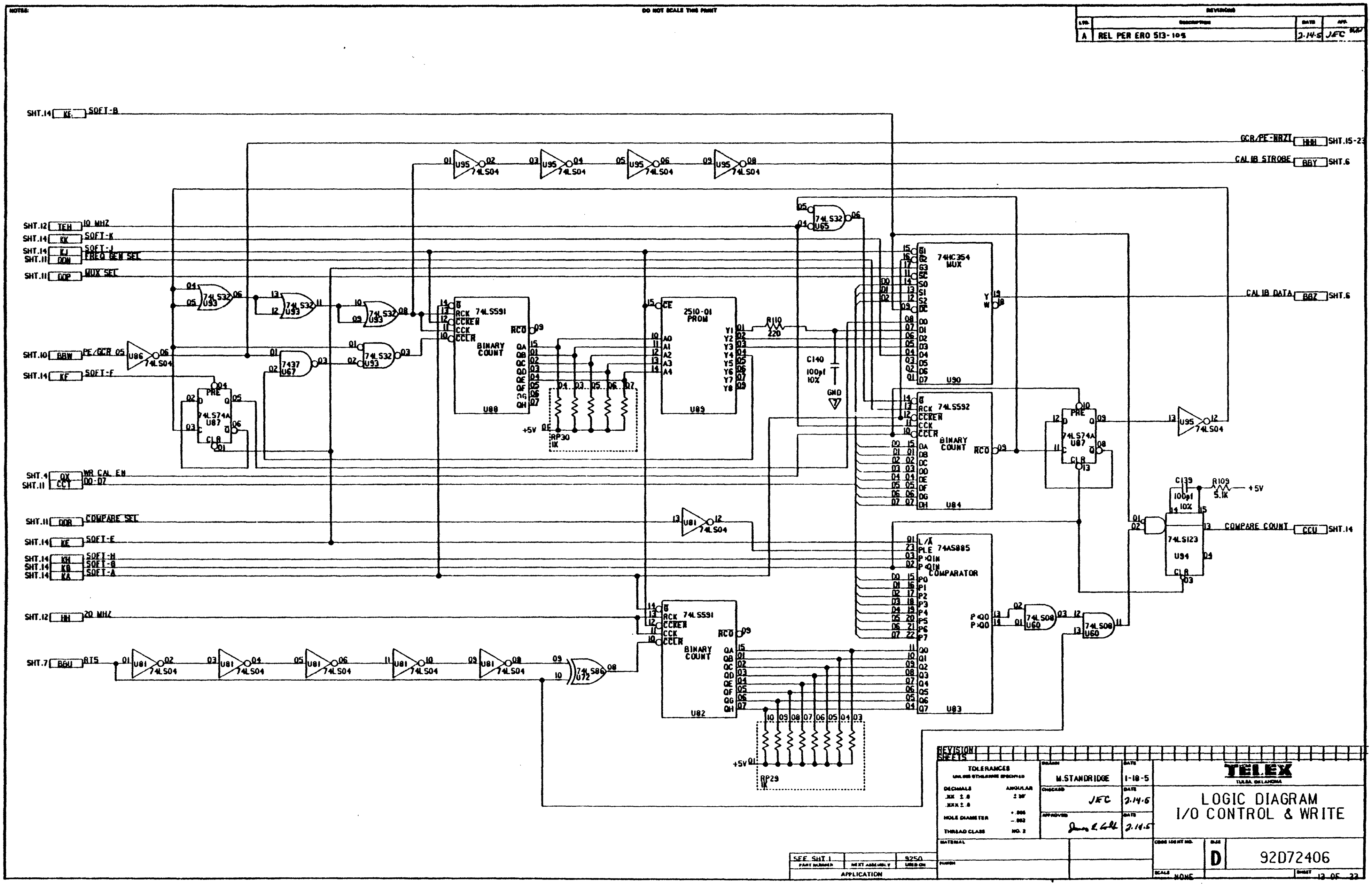
| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| A | REL PER ERO 513-105 | 2-14-5 | |



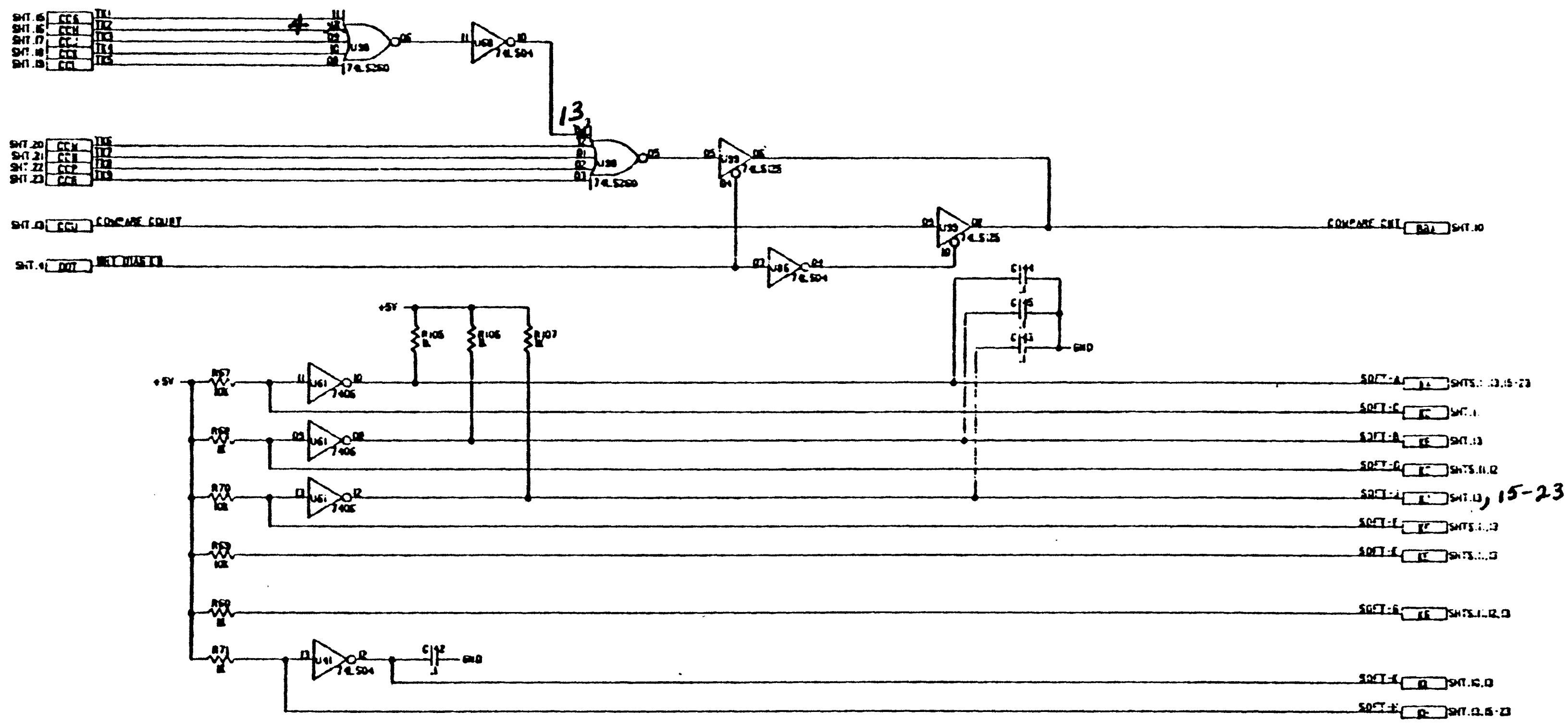

REVISION SHEETS

| TOLERANCES UNLESS OTHERWISE SPECIFIED | | DRAWN M.STANDRIDGE | DATE 1-18-5 | TELEX TULSA, OKLAHOMA |
|---|---|---|---|---|
| DECIMALS .XX ±.0 .XXX ±.0 | ANGULAR ±30' | CHECKED JEC | DATE 2-14-5 | LOGIC DIAGRAM I/O CONTROL & WRITE |
| HOLE DIAMETER | +.005 -.002 | APPROVED James E. Gill | DATE 2-14-5 | |
| THREAD CLASS | NO. 2 | | | |
| MATERIAL | | | CODE IDENT NO. | SIZE D — 92D/2406 |
| FINISH | | | SCALE NONE | SHEET 12 OF 23 |

| PART NUMBER | NEXT ASSEMBLY | USED ON |
|---|---|---|
| SEE SHT 1 | | 9250 |
| APPLICATION | | |


DO NOT SCALE THIS PRINT
REVISIONS
A REL PER ERO 513-105 2-14-5 JFC
SHT.14 KF SOFT-B
GCR/PE-NRZI HHH SHT.15-23
CALIB STROBE BBY SHT.6
SHT.12 TEH 10 MHZ
SHT.14 KK SOFT-K
SHT.14 KJ SOFT-J
SHT.11 DDN FREQ GEN SEL
SHT.11 DDP MUX SEL
CALIB DATA BBZ SHT.6
SHT.10 BBW PE/GCR
SHT.14 KF SOFT-F
SHT.4 QX WR CAL EN
SHT.11 CCT D0-D7
SHT.11 DDR COMPARE SEL
COMPARE COUNT CCU SHT.14
SHT.14 KE SOFT-E
SHT.14 KH SOFT-H
SHT.14 KB SOFT-G
SHT.14 KA SOFT-A
SHT.12 HH 20 MHZ
SHT.7 BGU BT5
74LS04
74LS32
7437
74LS74A
74LS591 BINARY COUNT
2510-01 PROM
74HC354 MUX
74LS592 BINARY COUNT
74AS885 COMPARATOR
74LS123
74LS08
74LS86
RP30 1K
RP29 1K
R110 220
C140 100pf 10%
C139 100pf 10%
R109 5.1K +5V
TOLERANCES
M.STANDRIDGE 1-18-5
JFC 2-14-5
2-14-5
TELEX
TULSA, OKLAHOMA
LOGIC DIAGRAM
I/O CONTROL & WRITE
D 92D72406
SEE SHT.1 9250
APPLICATION
NONE
13 OF 33

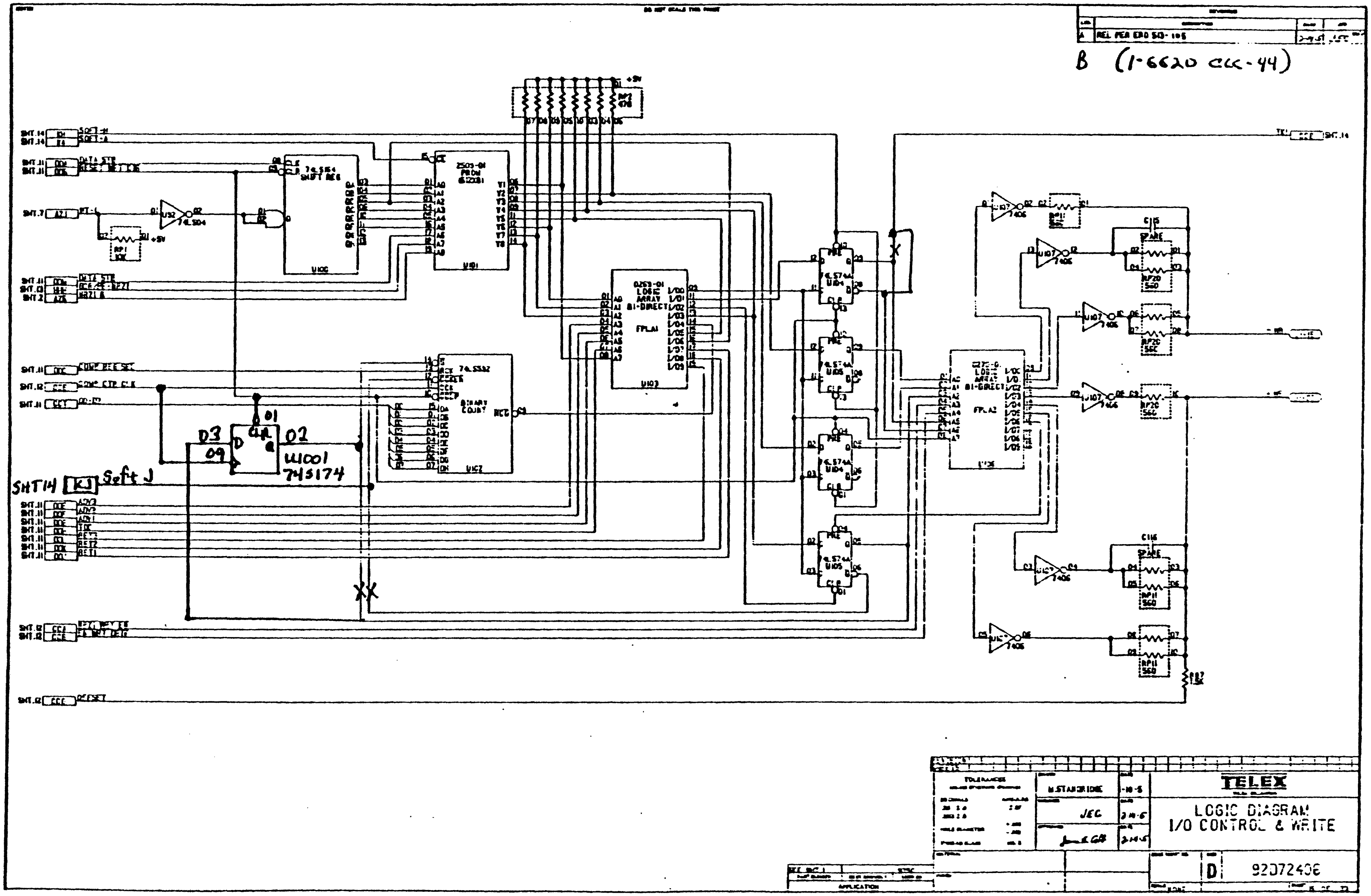
B (1-6620, CCC 44)




TELEX

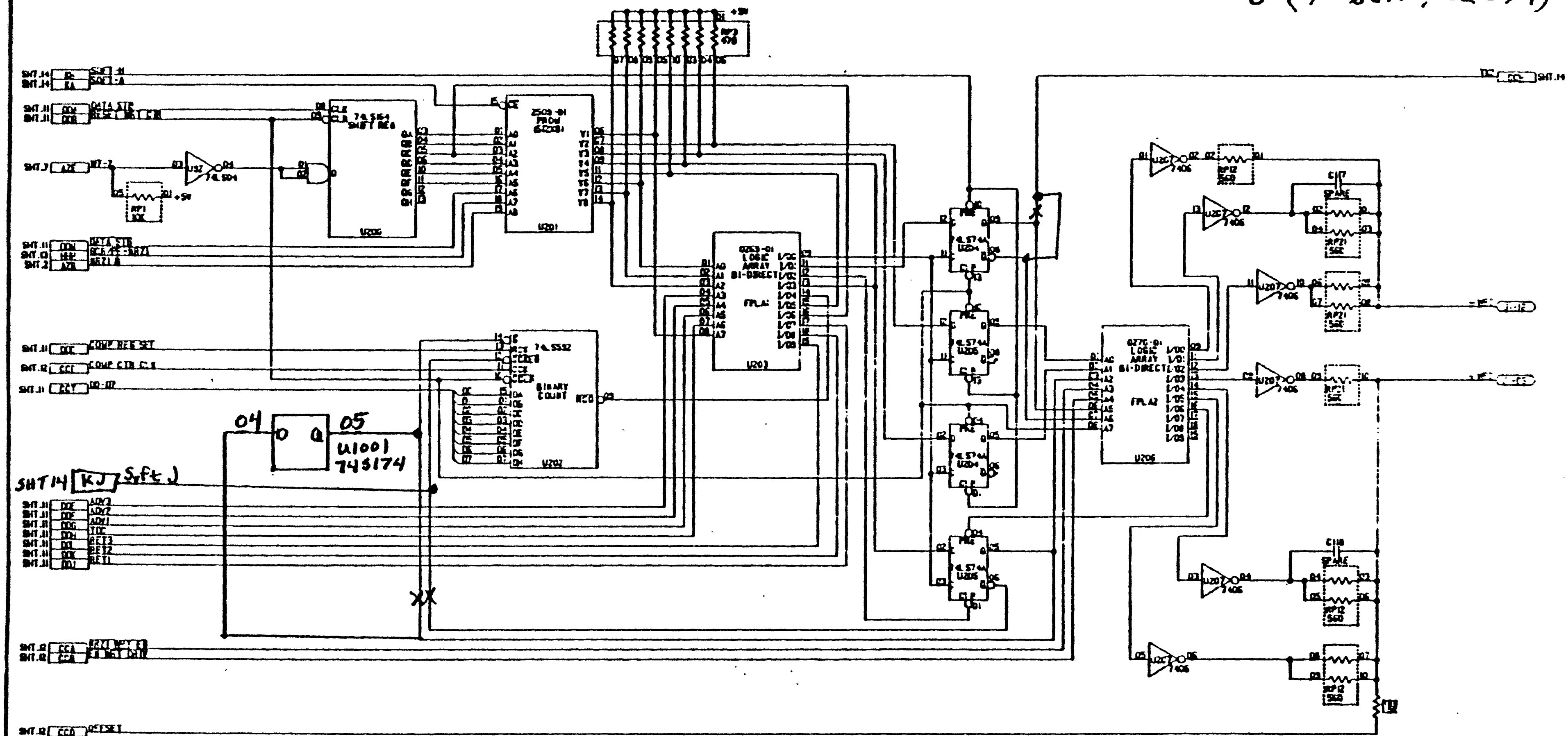
LOGIC DIAGRAM
I/O CONTROL & WRITE

D 92D72406



REL PER ERO SD-105
B (1-6620 CCK-44)
SHT14 KJ Soft J
D3
09
01
02
U1001
74S174
74LS164 SHIFT REG
2503-01 PROM
U101
U102
FPLA1
FPLA2
74LS74A
74LS393 BINARY COUNT
7406
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
JEC
D
92072406

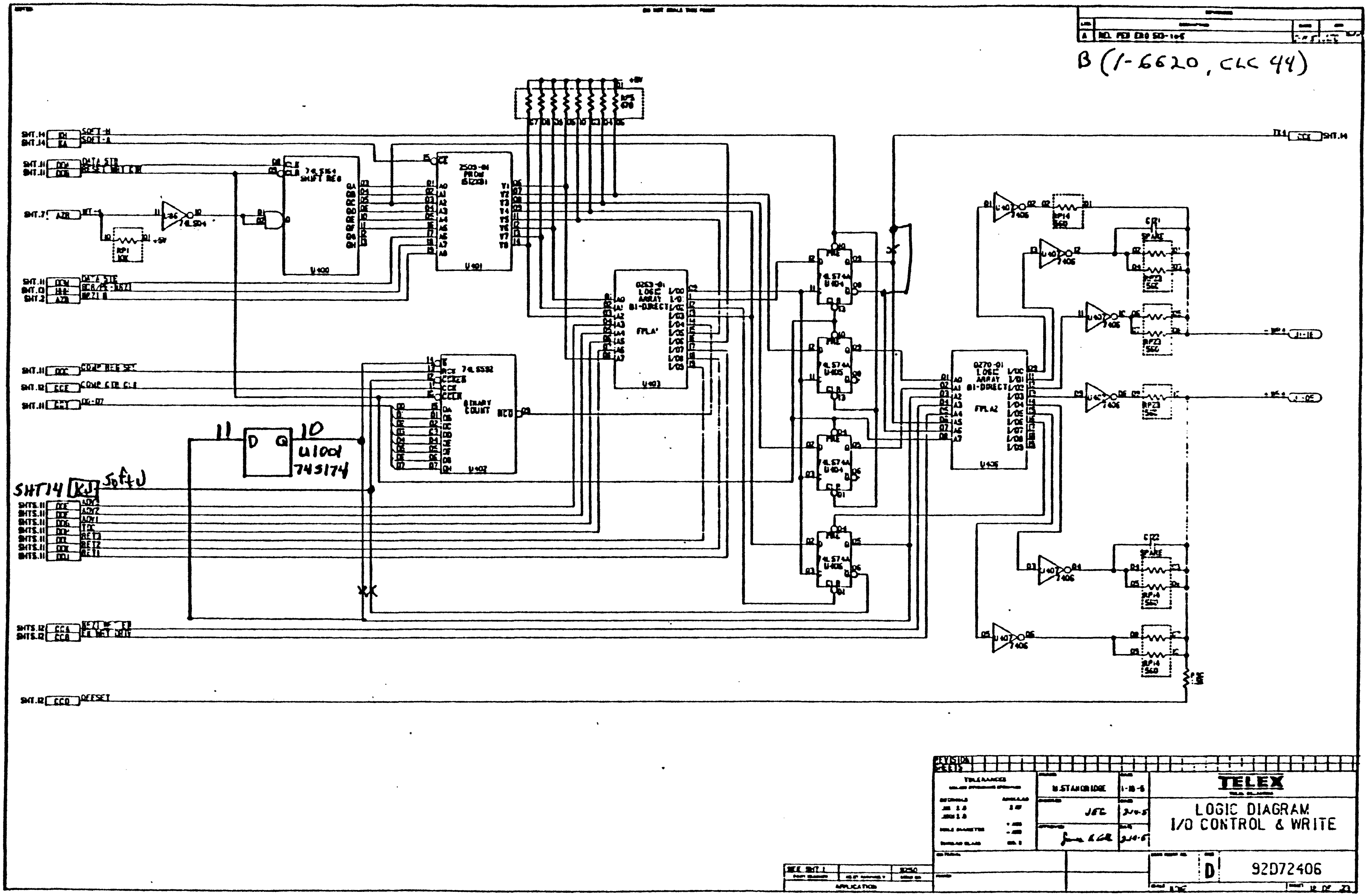
B (1-6620, CLC44)

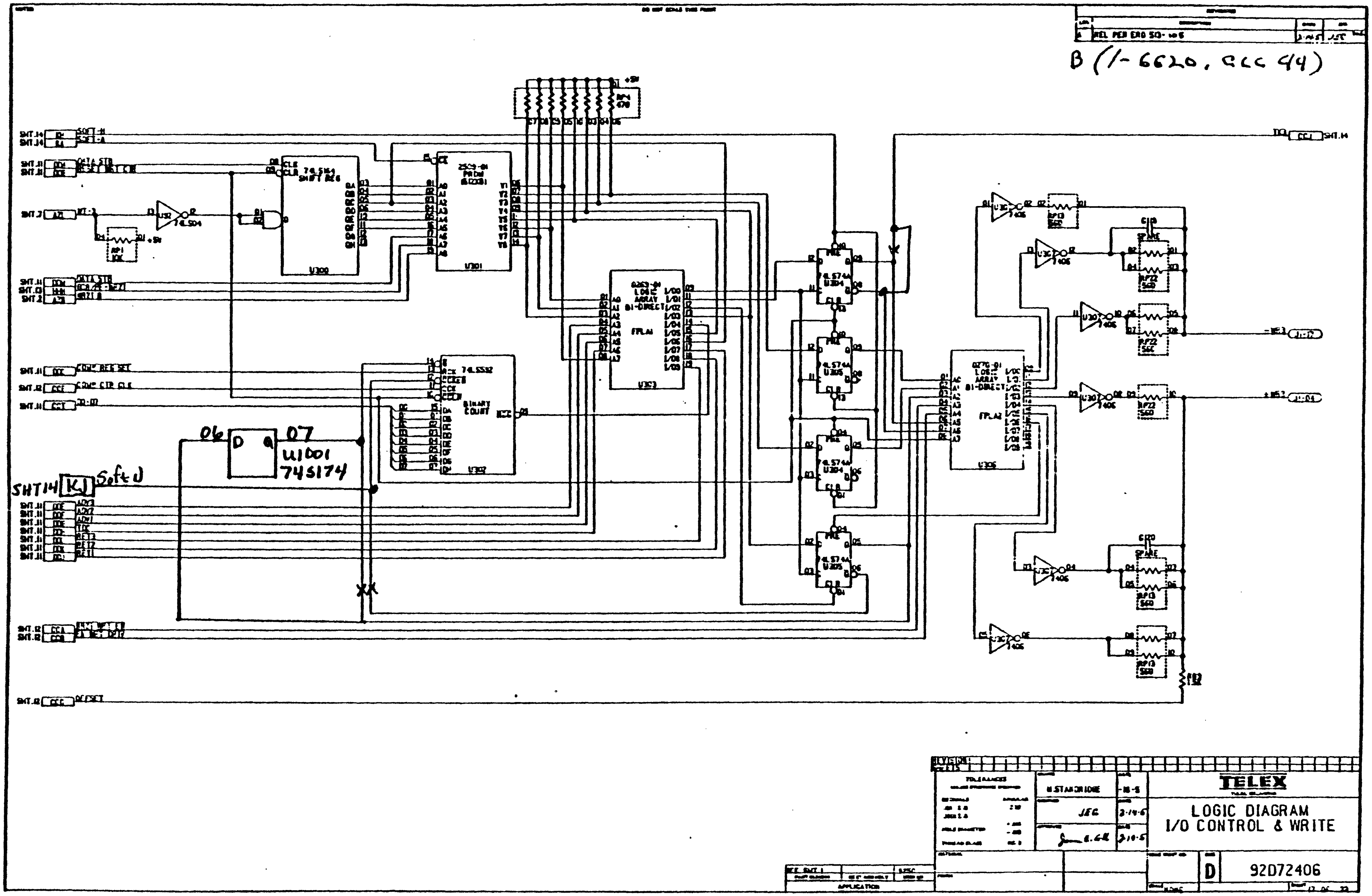


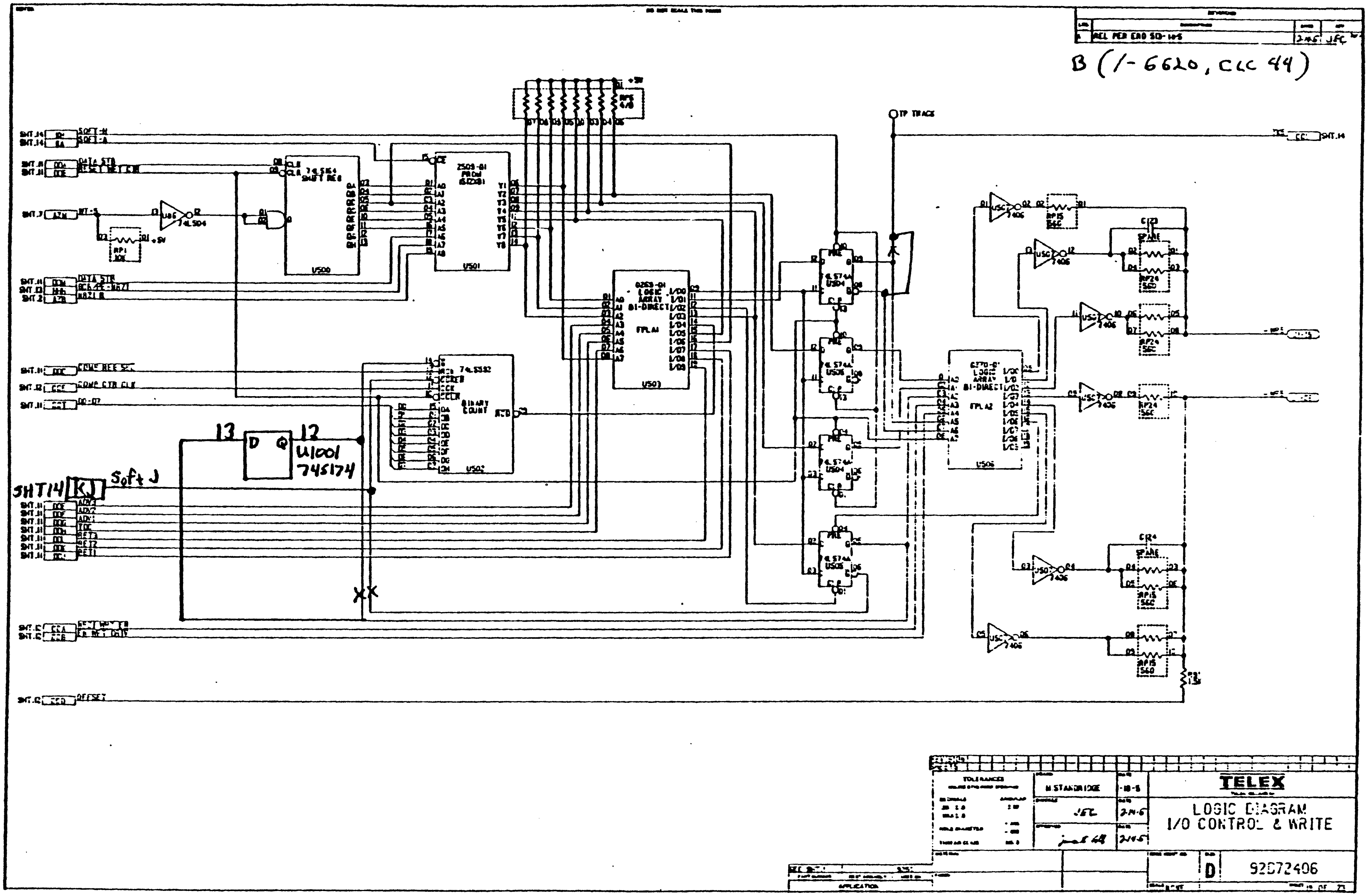
TELEX

LOGIC DIAGRAM
I/O CONTROL & WRITE

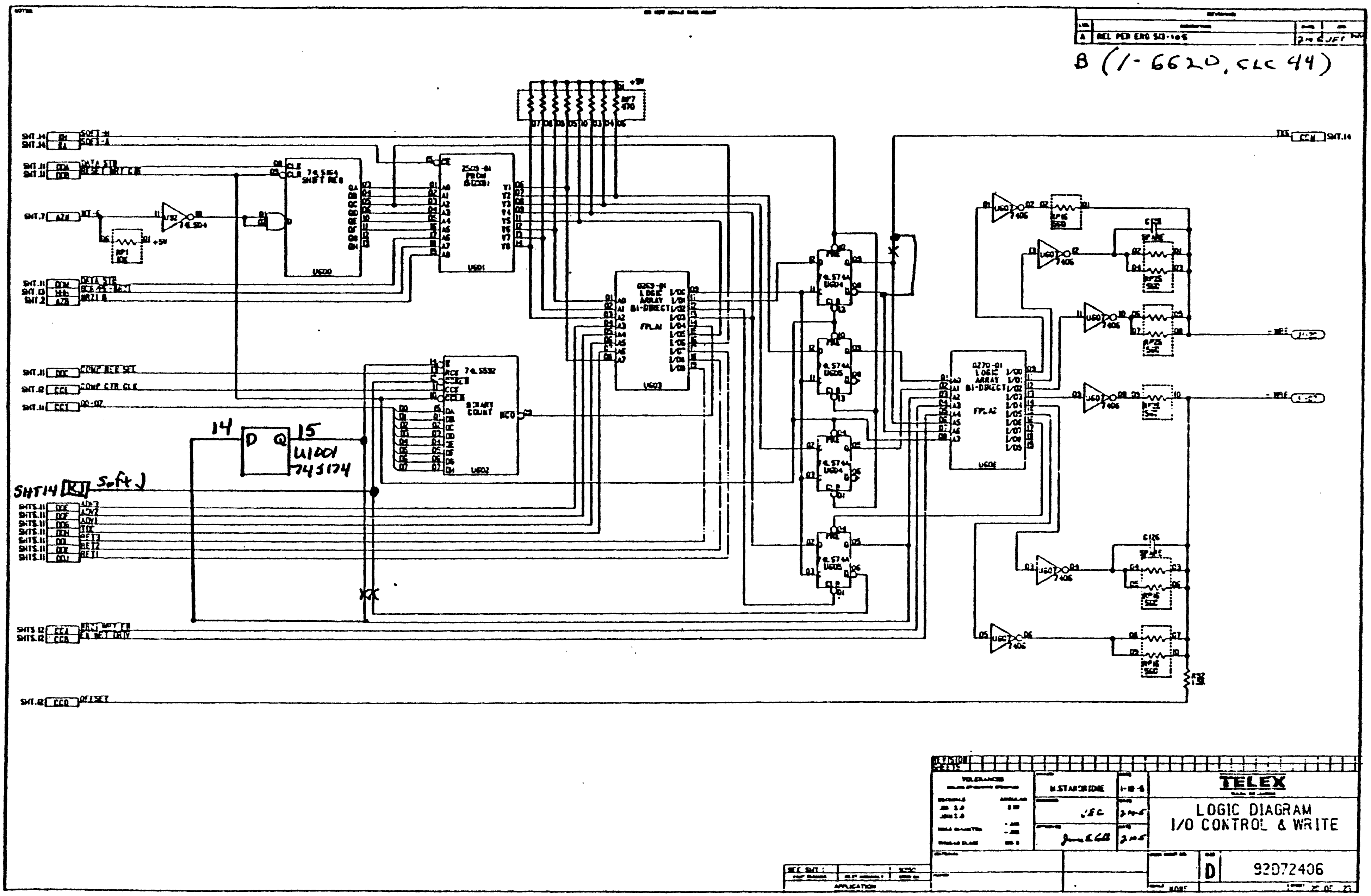
D 92D72406


B (1-6620, CLC 44)
74LS164 SHIFT REG
U400
U401
74LS04
U402
U403
U405
SHT14 KJ Soft U
D Q
11
10
U1001
74S174
BINARY COUNT
LOGIC ARRAY BI-DIRECT FPLA
SOFT-A
DATA STB
COMP REG SET
OFFSET
SPARE
7406
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72406

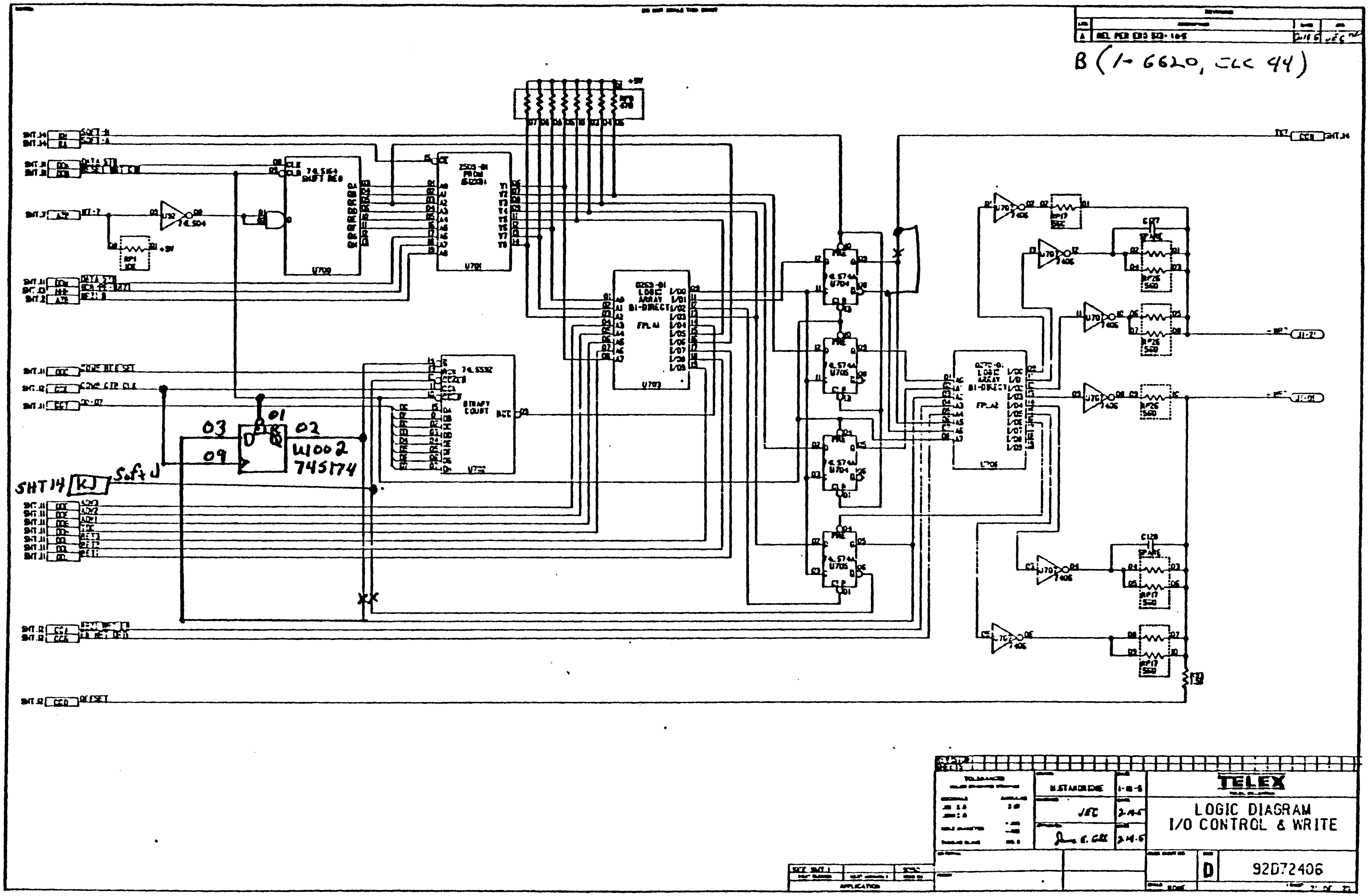

B (1-6620, ecc 44)
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72406
U1001
74S174
SHT14 KJ Soft d

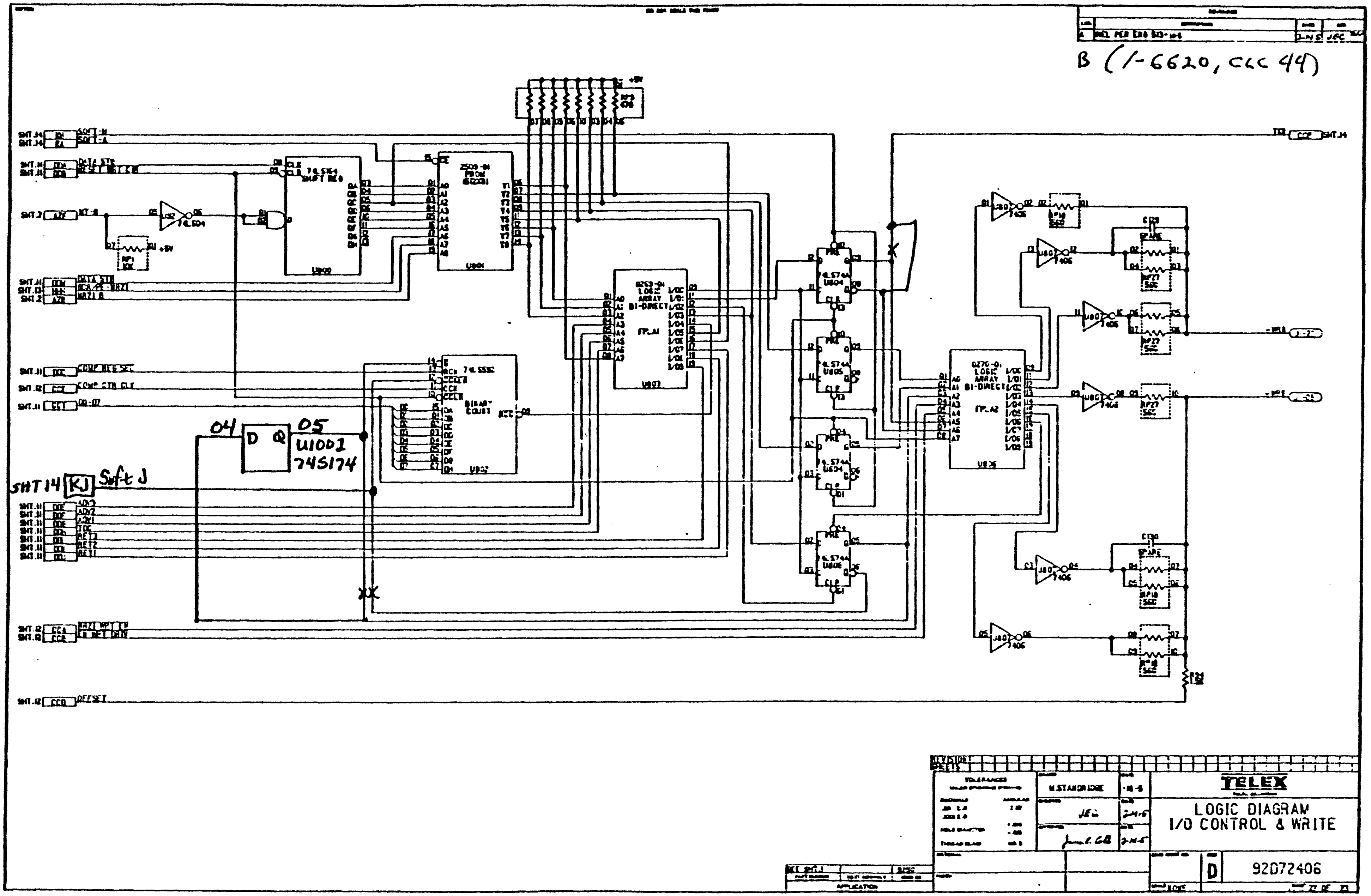


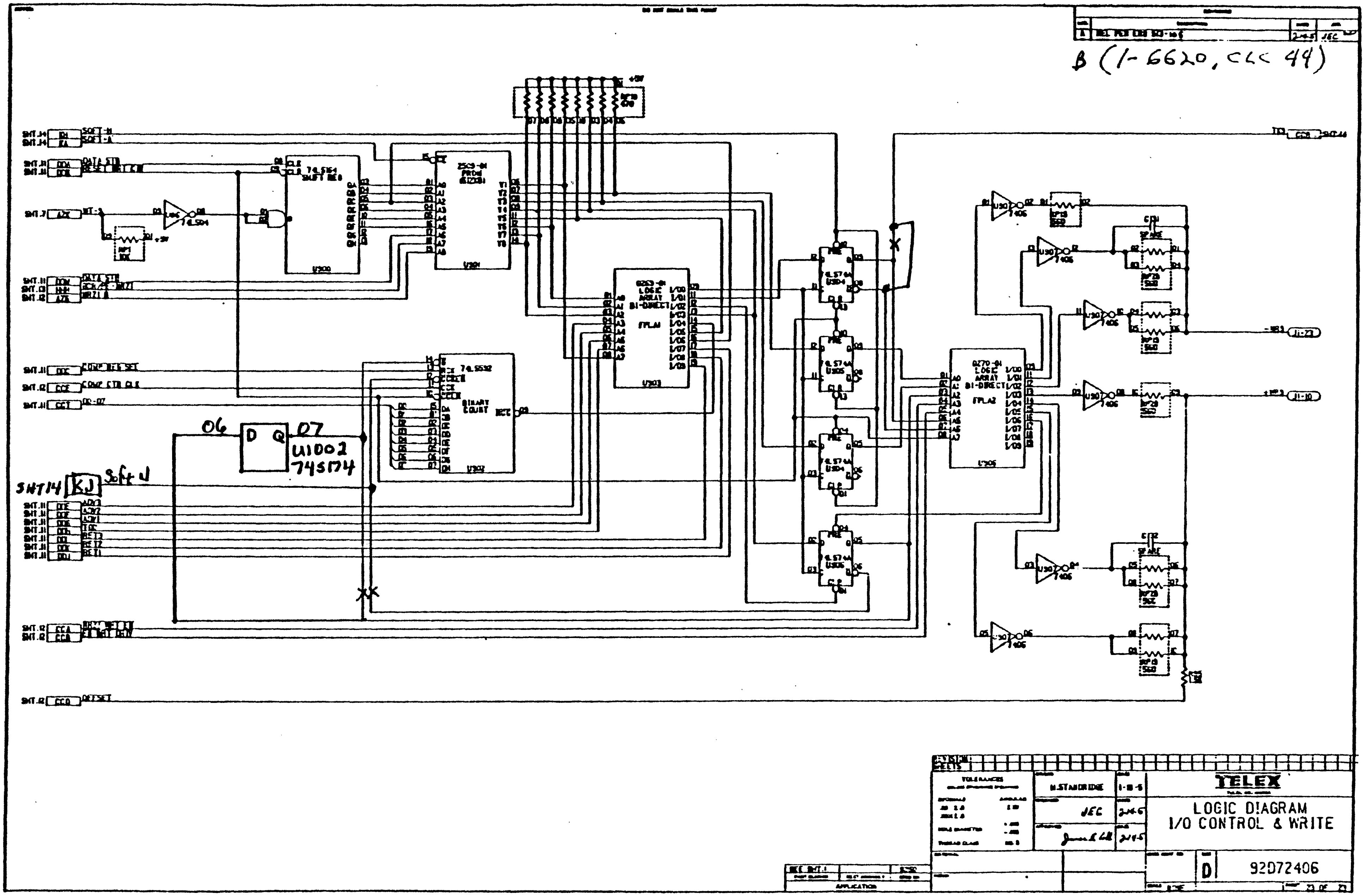
B (1-6620, CLC 44)
TP TRACK
SOFT-H
SOFT-A
DATA STB
74LS164
SHIFT REG
U500
2509-01
PROM
U501
74LS04
U503
FPLA1
74LS592
BINARY COUNT
U502
13
D
Q
12
U1001
74S174
SHT14
KJ
Soft J
OFFSET
FPLA2
U506
74S74
7406
SPARE
TELEX
M STANDRIDGE
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72406
APPLICATION



B (1-6620, CLC 44)
14
D
Q
15
U1001
74S174
SHT14 R1 Soft J
74LS164
SHIFT REG
U600
U601
74LS32
U602
U603
FPLA1
FPLA2
U606
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92072406


B (1-6620, ECC 44)
SHT14 KJ Soft J
03
01
02
09
U1002
74S174
U700
U701
U703
U704
U705
U706
U702
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72406


B (1-6620, CLC 44)
74LS164
SHIFT REG
2509-01
PROM
U800
U801
82S3-01
LOGIC
ARRAY
BI-DIRECT
FPLA1
U803
74LS74A
U804
U805
U806
8276-01
LOGIC
ARRAY
BI-DIRECT
FPLA2
U836
74LS592
BINARY
COUNT
7406
74LS04
04
D
Q
05
U1001
74S174
SHT 14
KJ
Soft J
SOFT-N
SOFT-A
DATA STB
COMP REF SEL
COMP CTR CLK
OFFSET
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
M. STANDRIDGE
D
92D72406


B (1-6620, CLC 44)
LOGIC DIAGRAM
I/O CONTROL & WRITE
TELEX
92D72406
D
06
07
U1002
74S174
SHT14
KJ
Soft J
74LS164
SHIFT REG
74LS04
U300
U301
U302
U303
U304
U305
U306
7406
74LS74A
DATA STB
RESET WRT CK
COMP REG SET
COMP CTR CLR
OFFSET
SOFT-H
SOFT-A
BINARY COUNT
FPLA1
FPLA2
LOGIC ARRAY BI-DIRECT
N.STANDRIDGE
JEC

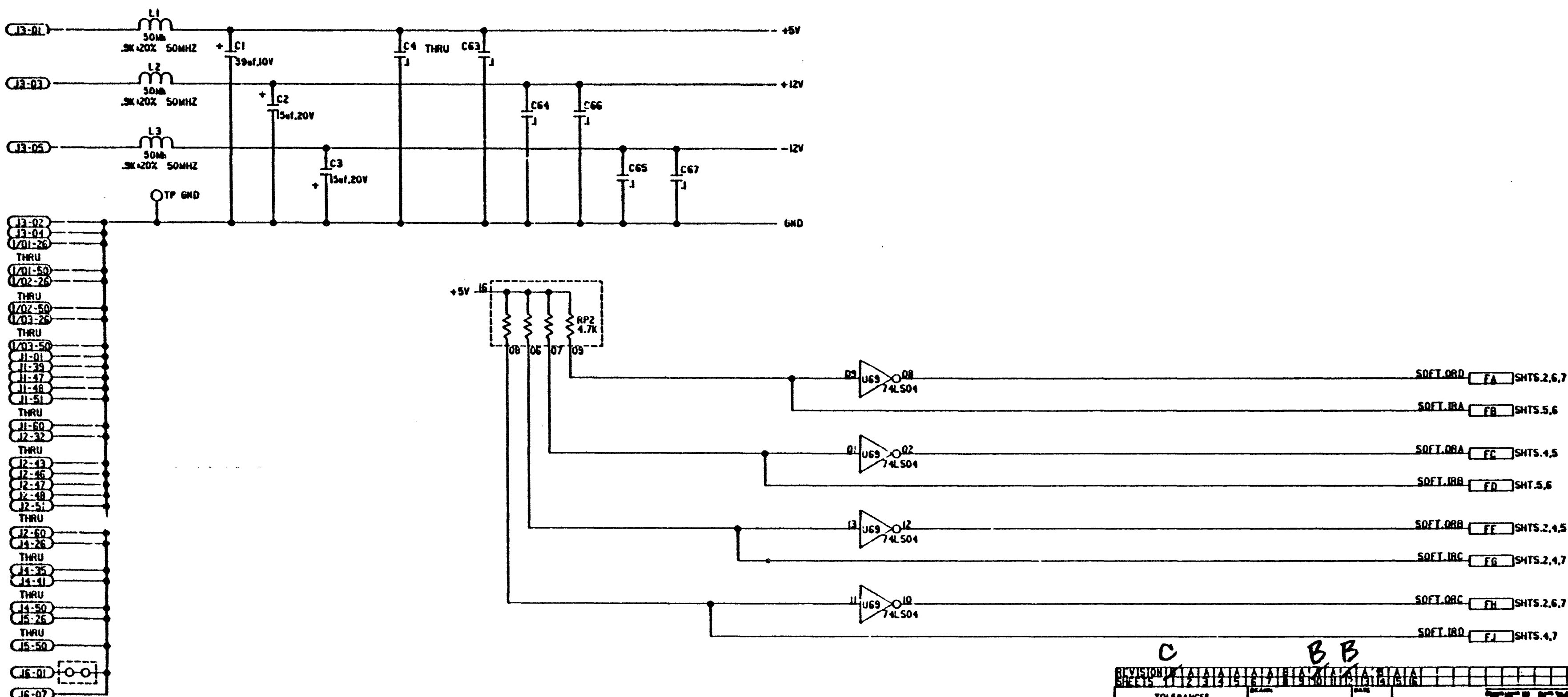
DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| B | REV PER DCN 1-6690-2 | 7-16-5 | RCP |

C

UNLESS OTHERWISE SPECIFIED

1. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
2. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
3. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED 1% ARE 1/8 WATT.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED 10% ARE 100 VOLTS.
6. JUMPERS ARE MADE IN ETCH ON THE CIRCUIT BOARD.
   (THESE ARE NOT COMPONENTS TO BE INSTALLED).
7. LOCATIONS SHOWN HAVE 24 PIN DIPS INSTALLED IN
   PINS 03-26 OF THE 28 PIN SOCKET.




C B B

| REVISION | B | A | A | A | A | A | A | B | A | B | A | B | A | A | A | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHEETS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30'

HOLE DIAMETER + .005 - .002

THREAD CLASS NO. 2

DRAWN M.STANDRIDGE — DATE 7-12-5

CHECKED LK — DATE 7-15-5

APPROVED RPL — DATE 7-16-5

MATERIAL

FINISH

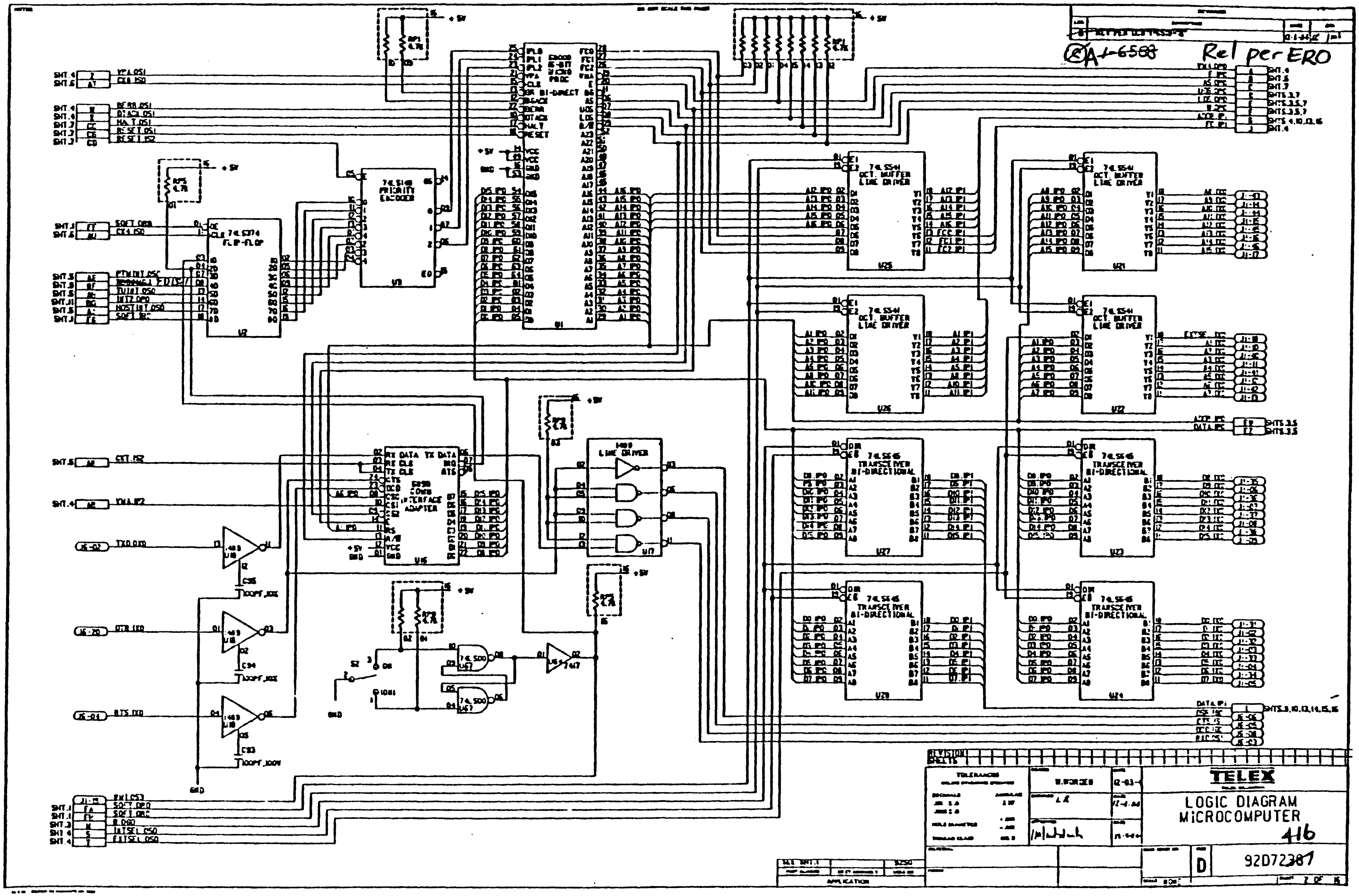
| 891072416-01 | | 925 |
|---|---|---|
| PART NUMBER | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |

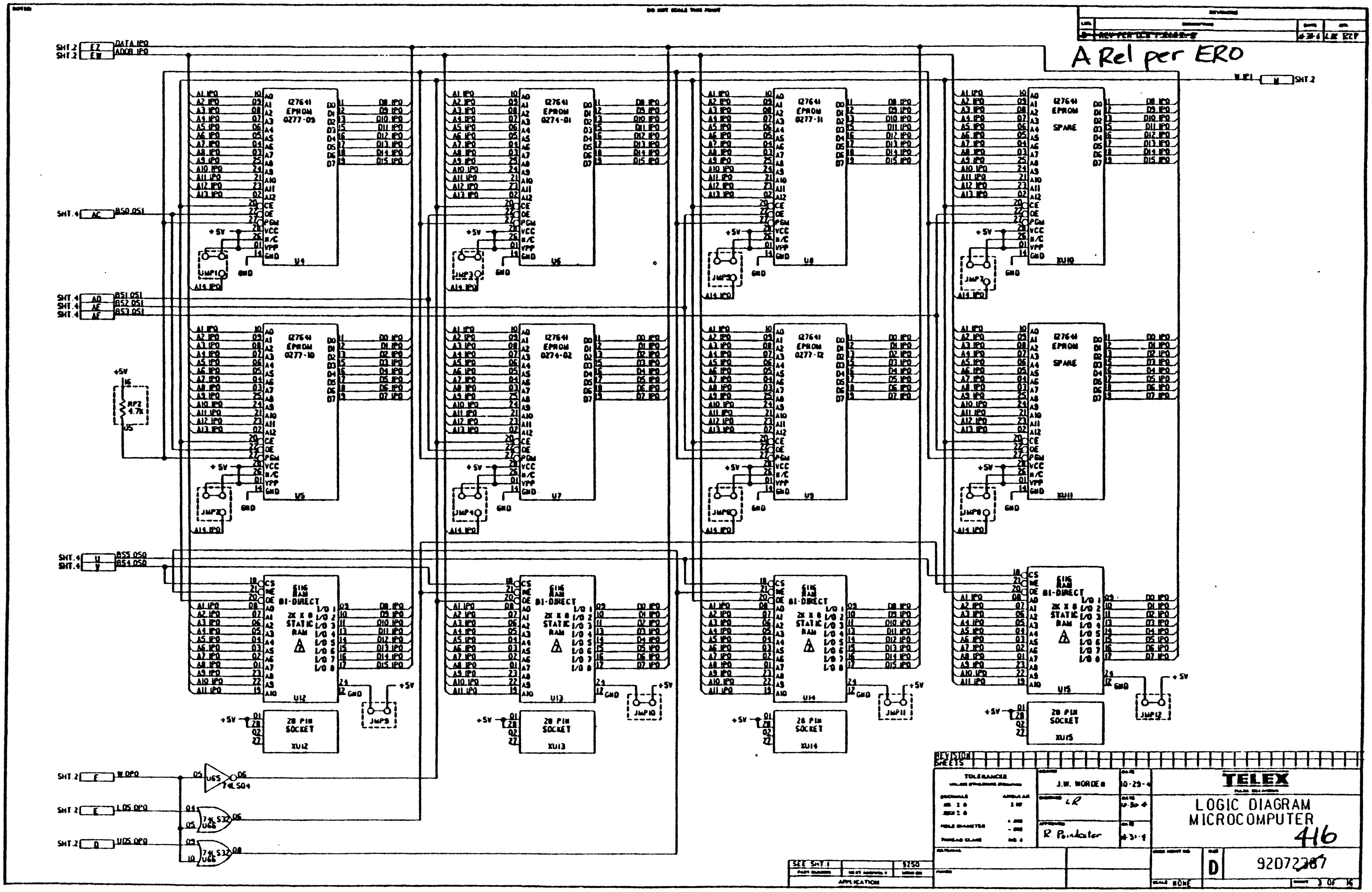
**TELEX**
TULSA, OKLAHOMA

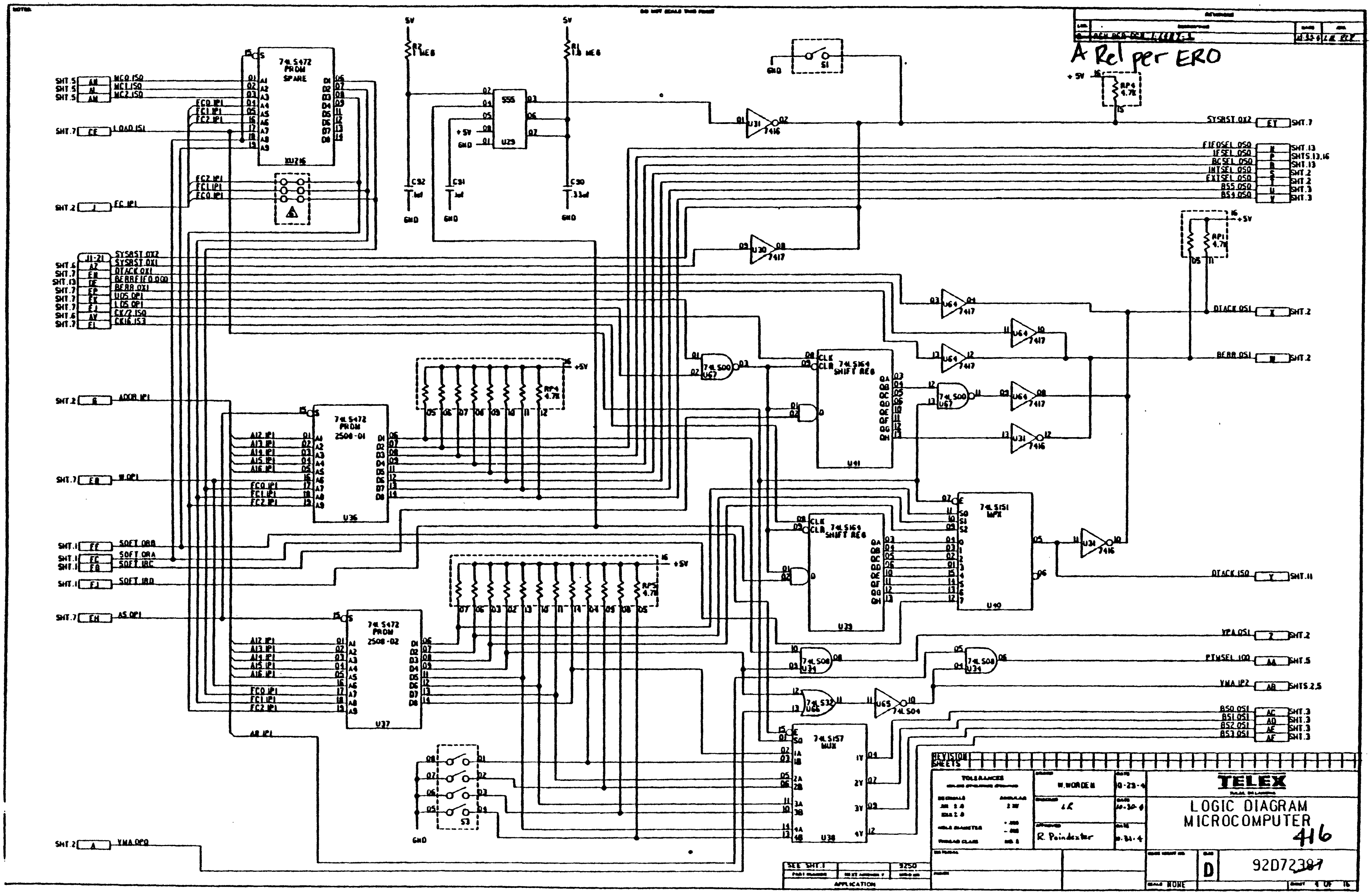
# LOGIC DIAGRAM MICROCOMPUTER

CODE IDENT NO. — SIZE D — 92D72416

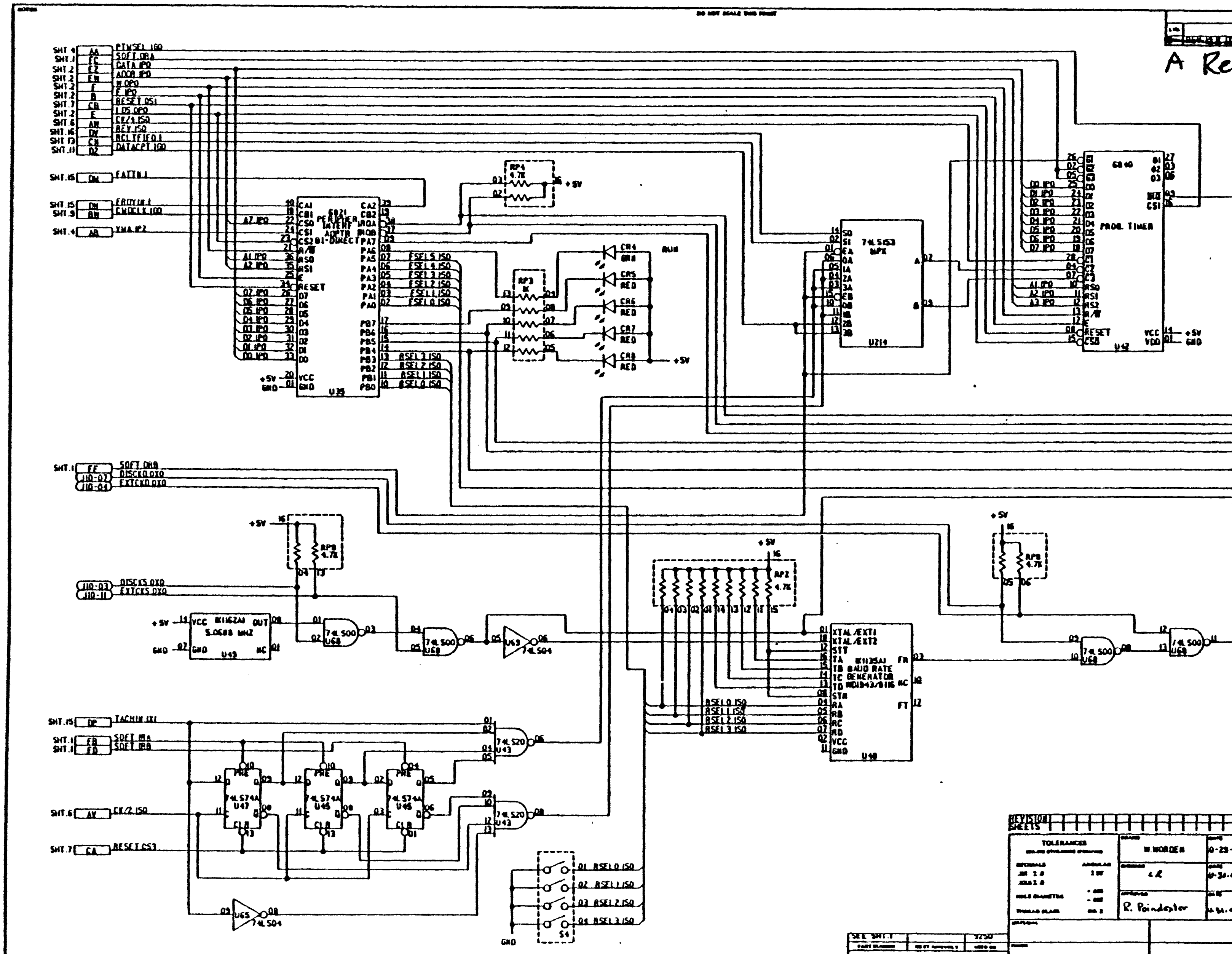
SCALE NONE — SHEET 1 OF 16


Rel per ERO
A-6588
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
D
92D72387


A Rel per ERO
2764I EPROM
SPARE
6116 RAM BI-DIRECT 2K X 8 STATIC RAM
28 PIN SOCKET
74LS04
74LS32
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
J.W. WORDEN
R Poindexter



A Rel per ERO
74LS472 PROM SPARE
XU216
555
U29
74LS472 PROM 2508-01
U36
74LS472 PROM 2508-02
U37
74LS164 SHIFT REG
U41
U39
74LS151 MPX
U40
74LS157 MUX
U38
S1
S3
SYSRST OX2
FIFOSEL OSO
IFSEL OSO
BCSEL OSO
INTSEL OSO
EXTSEL OSO
BS5 OSO
BS4 OSO
DTACK OSI
BERR OSI
DTACK ISO
VPA OSI
PTMSEL IOO
VMA IP2
BS0 OSI
BS1 OSI
BS2 OSI
BS3 OSI
SOFT 0RB
SOFT 0RA
SOFT IRC
SOFT IRD
AS OPI
ADDR IPI
W OPI
LOAD ISI
VMA OPO
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
W. WORDEN
R. Poindexter
92D72387
D
SCALE NONE
SHEET 4 OF 16



A Rel per ERO

TELEX

LOGIC DIAGRAM MICROCOMPUTER

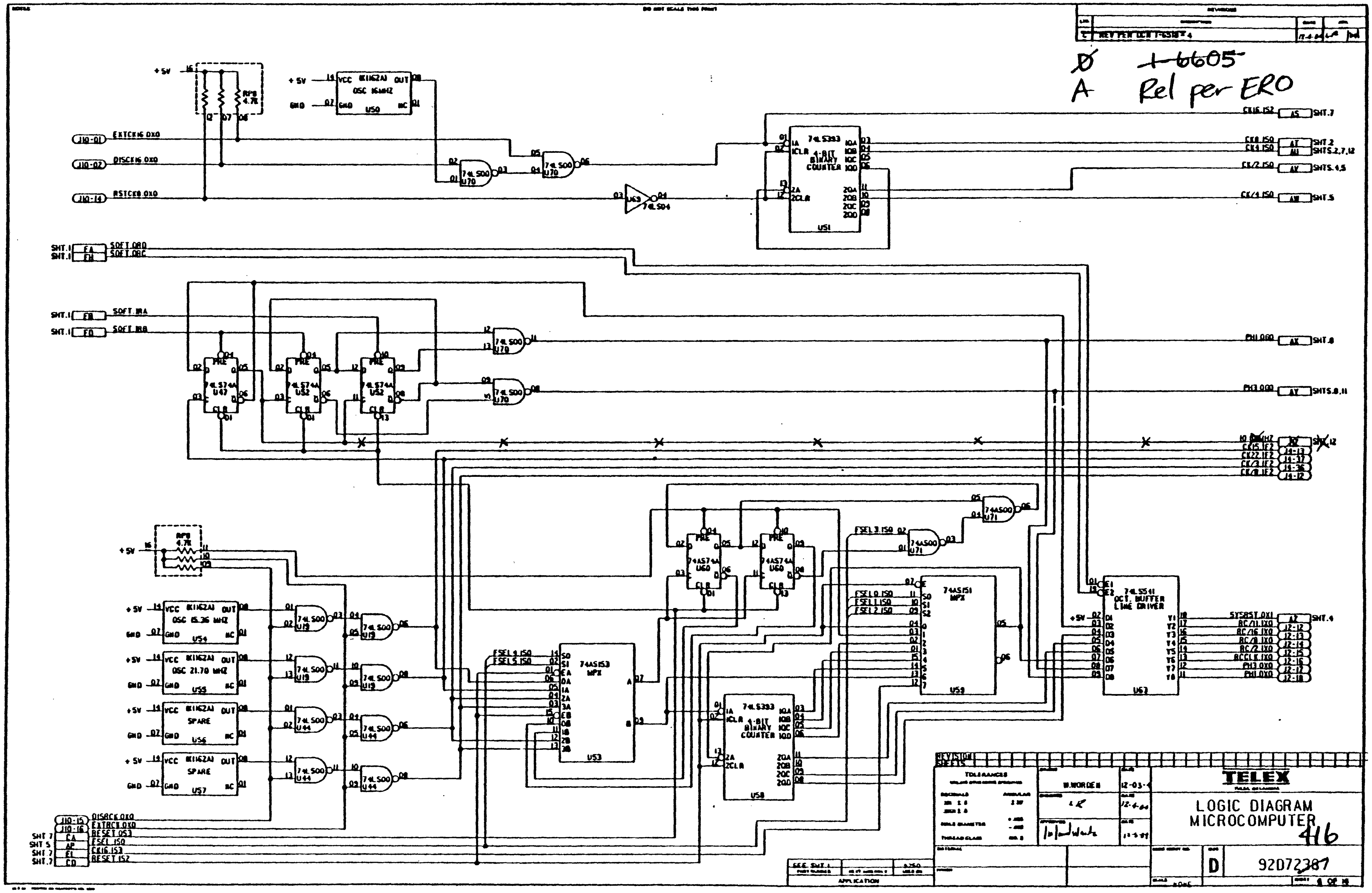
416

W. WORDEN

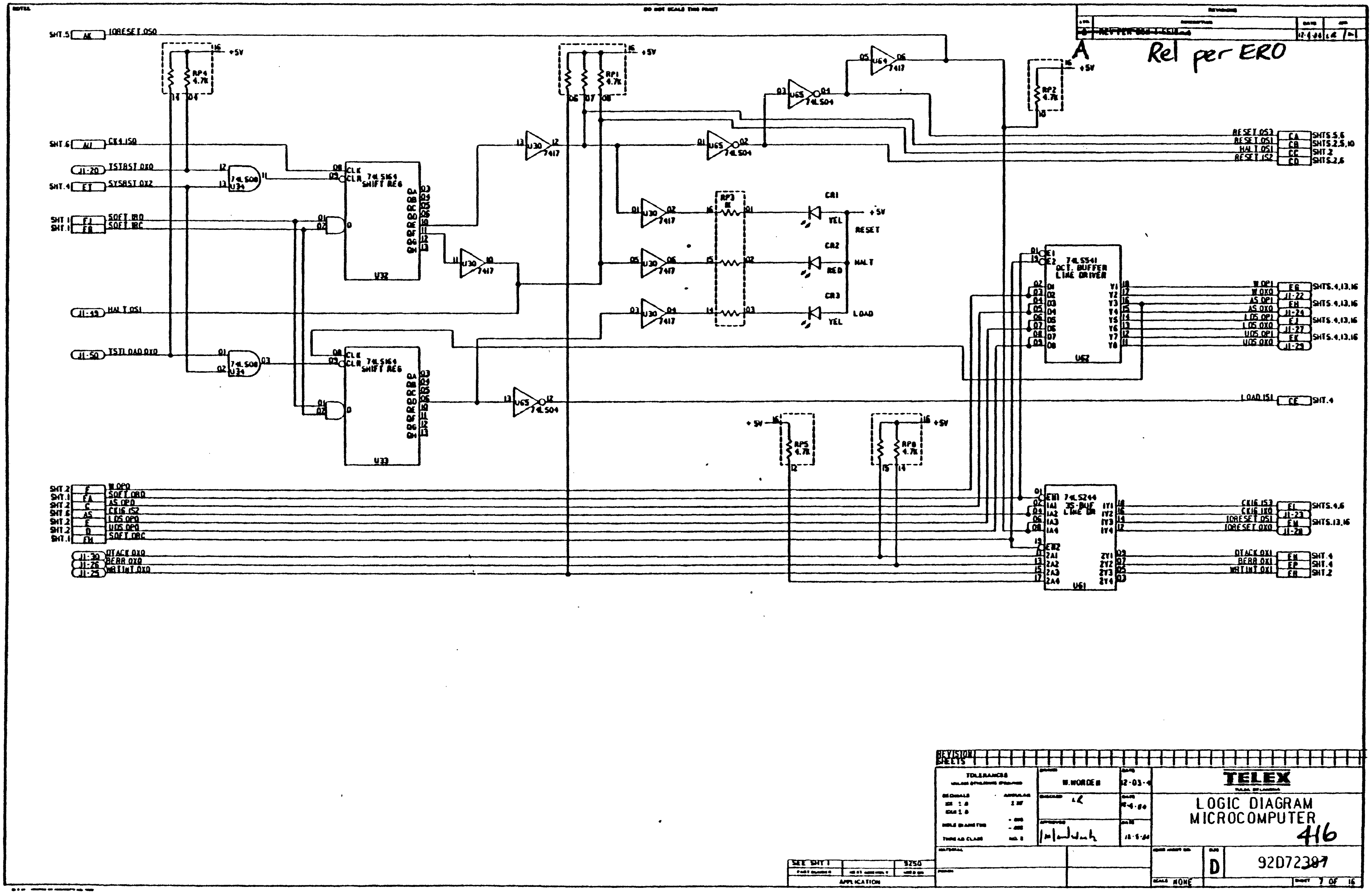
R. Poindexter

D 92D72387

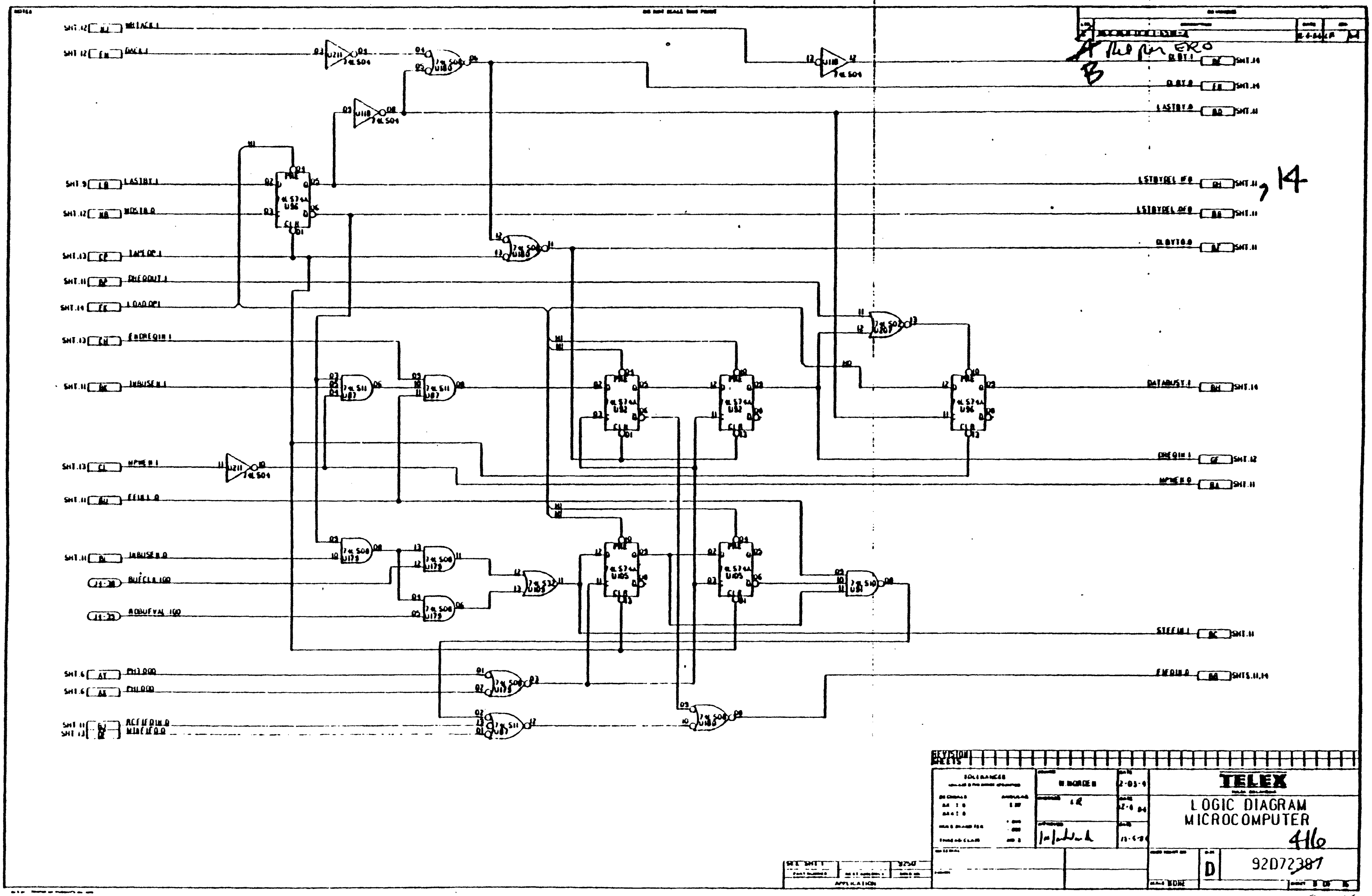
SCALE NONE

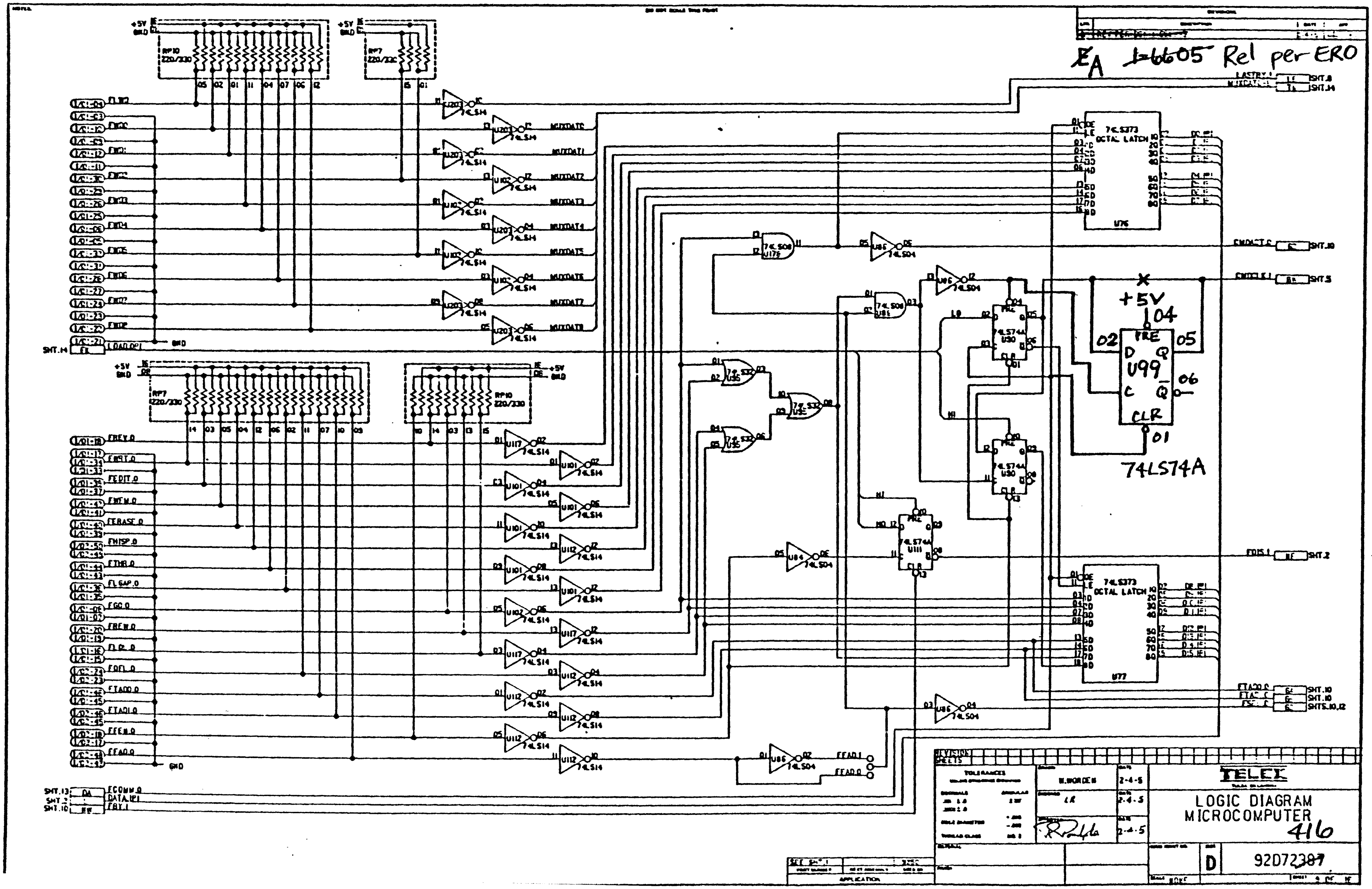


D 1-6605
A Rel per ERO
74LS393
4-BIT BINARY COUNTER
OSC 16MHZ
OSC 15.36 MHZ
OSC 21.70 MHZ
SPARE
74AS153 MPX
74AS151 MPX
74LS541 OCT. BUFFER LINE DRIVER
EXTCK16 0X0
DISCK16 0X0
RSTCK8 0X0
SOFT 0RD
SOFT 0RC
SOFT IRA
SOFT IRB
CK16 IS2
CK8 IS0
CK4 IS0
CK/2 IS0
CK/4 IS0
PH1 0X0
PH3 0X0
SYSRST 0X1
FSEL 3 IS0
FSEL 0 IS0
FSEL 1 IS0
FSEL 2 IS0
FSEL 4 IS0
FSEL 5 IS0
DISBCK 0X0
EXTRCB 0X0
RESET 0S3
FSEL IS0
CK16 IS3
RESET IS2
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
W.WORDEN
12-03-84
D
92D72387



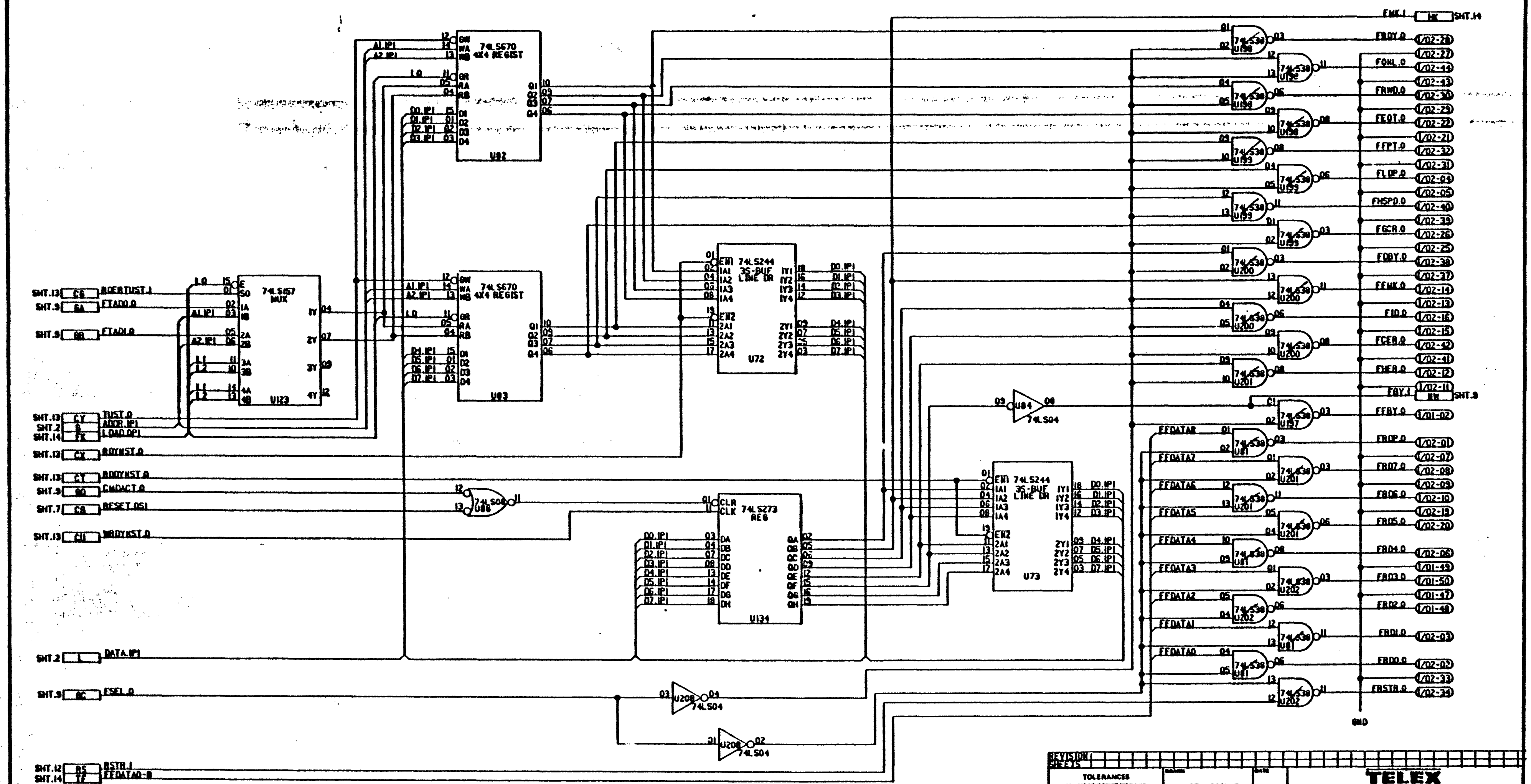
DO NOT SCALE THIS PRINT
Rel per ERO
A
IORESET 0S0
CK4 IS0
TSTRST 0X0
SYSRST 0X2
SOFT IR0
SOFT IRC
HALT 0S1
TSTLOAD 0X0
74LS08
74LS164 SHIFT REG
U32
U33
U34
7417
74LS04
RP1 4.7K
RP2 4.7K
RP3
RP4 4.7K
RP5 4.7K
RP8 4.7K
+5V
CR1
CR2
CR3
YEL
RED
RESET
HALT
LOAD
RESET 0S3
RESET 0S1
HALT 0S1
RESET IS2
SHTS.5,6
SHTS.2,5,10
SHT.2
SHTS.2,6
74LS541 OCT. BUFFER LINE DRIVER
U62
W 0P1
W 0X0
AS 0P1
AS 0X0
LDS 0P1
LDS 0X0
UDS 0P1
UDS 0X0
SHTS.4,13,16
LOAD IS1
SHT.4
74LS244 3S-BUF LINE DR
U61
W 0P0
SOFT 0R0
AS 0P0
CK16 IS2
LDS 0P0
UDS 0P0
SOFT 0RC
DTACK 0X0
BERR 0X0
WRTINT 0X0
CK16 IS3
CK16 IX0
IORESET 0S1
IORESET 0X0
SHTS.4,6
SHTS.13,16
DTACK 0X1
BERR 0X1
WRTINT 0X1
TOLERANCES
W.WORDEN
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
D
92D72397
SCALE NONE
SHEET 7 OF 16
SEE SHT 1
5250
APPLICATION


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
D
92D72387
74LS74A
74LS04
74LS08
74LS11
74LS10
74LS32


EA 1-6605 Rel per ERO
74LS373 OCTAL LATCH
U76
U77
74LS74A
U99
+5V
74LS14
74LS04
74LS08
74LS32
MUXDAT0
MUXDAT1
MUXDAT2
MUXDAT3
MUXDAT4
MUXDAT5
MUXDAT6
MUXDAT7
MUXDAT8
RP10 220/330
RP7 220/330
LOGIC DIAGRAM
MICROCOMPUTER
416
TELEX
D
92D72387

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APR |
|---|---|---|---|
| B | REL PER ERO 513-140 | 6-26-5 | LR RCP |




TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMALS .XX ± .0 .XXX ± .0 — ANGULAR ± 30

HOLE DIAMETER +.005 −.002

THREAD CLASS NO. 2

DRAWN M.STANDRIDGE 6-26-5

CHECKED LR 6-26-5

APPROVED 6-26-5

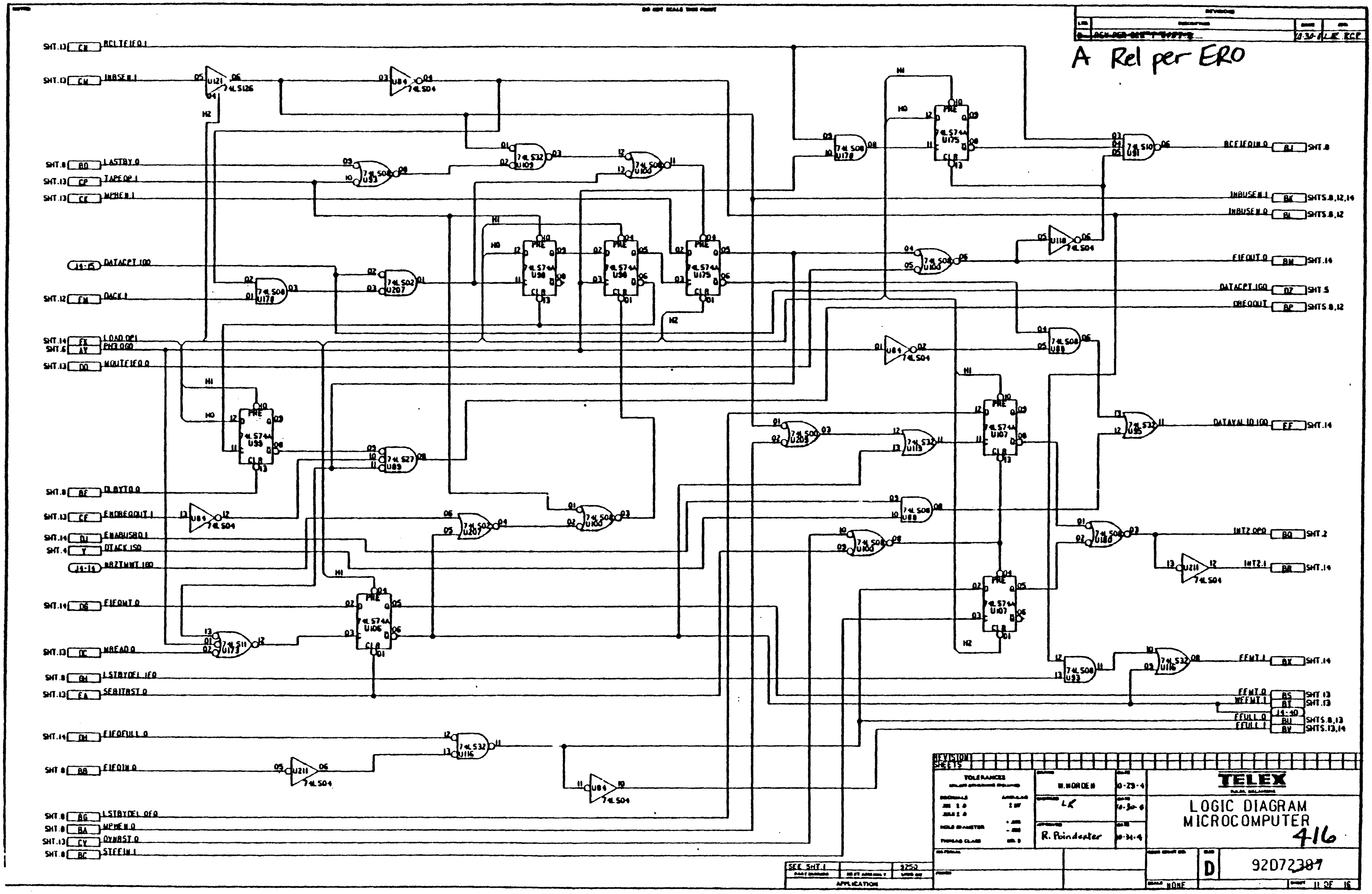
TELEX TULSA, OKLAHOMA

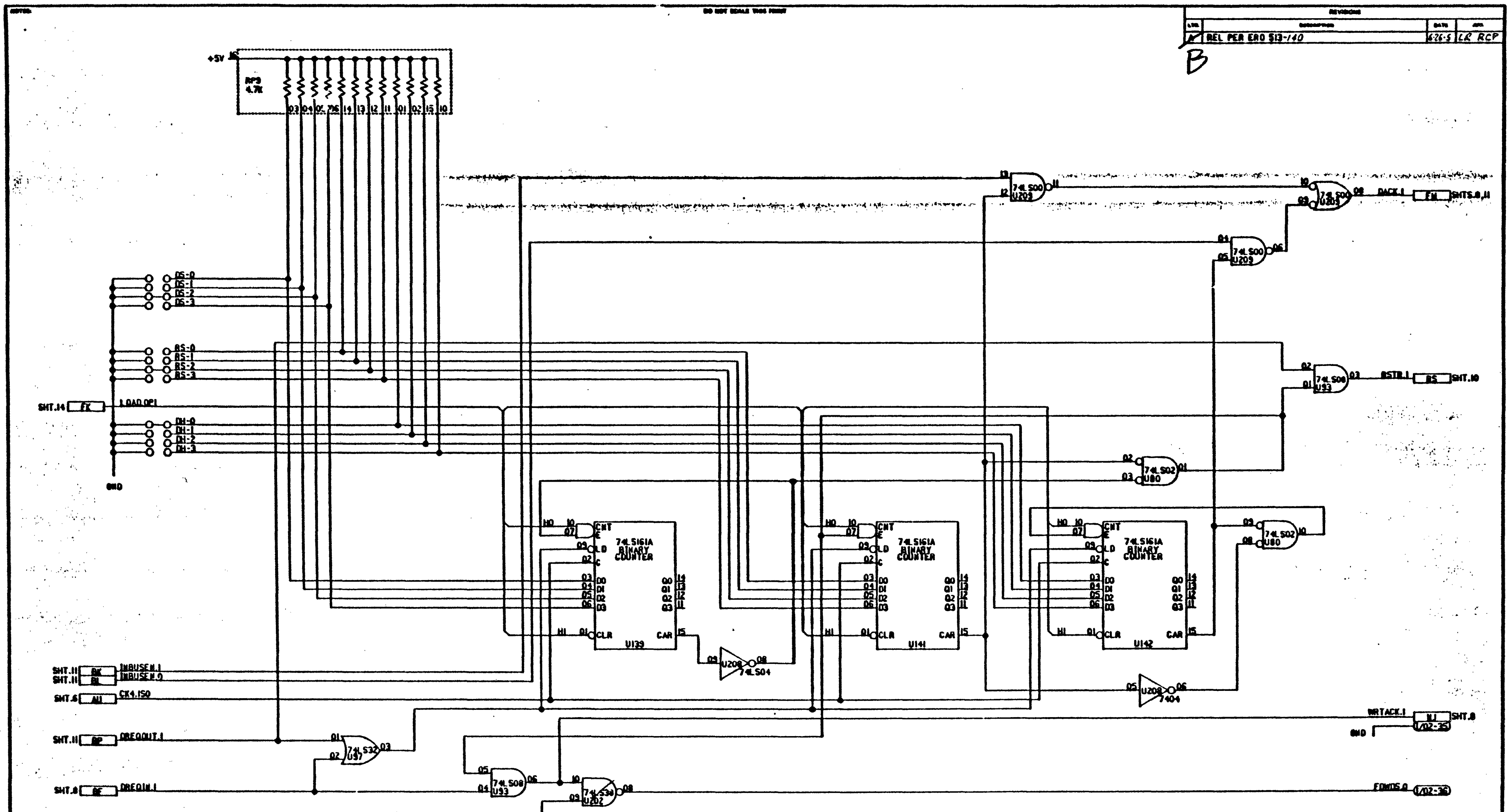
LOGIC DIAGRAM MICROCOMPUTER

SIZE D 92D72416

SCALE NONE SHEET 10 OF 16

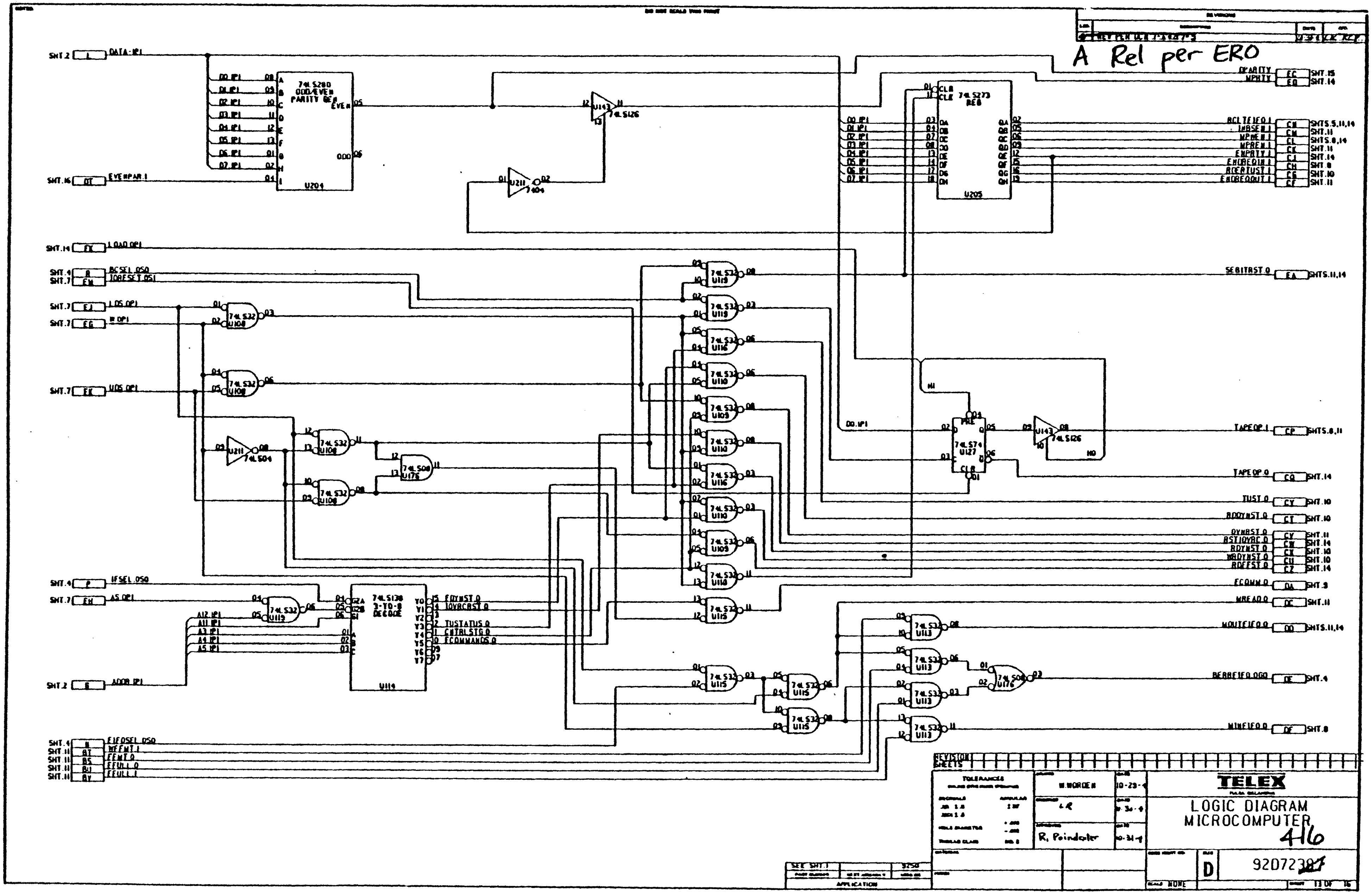
APPLICATION: SEE SHT. 9251

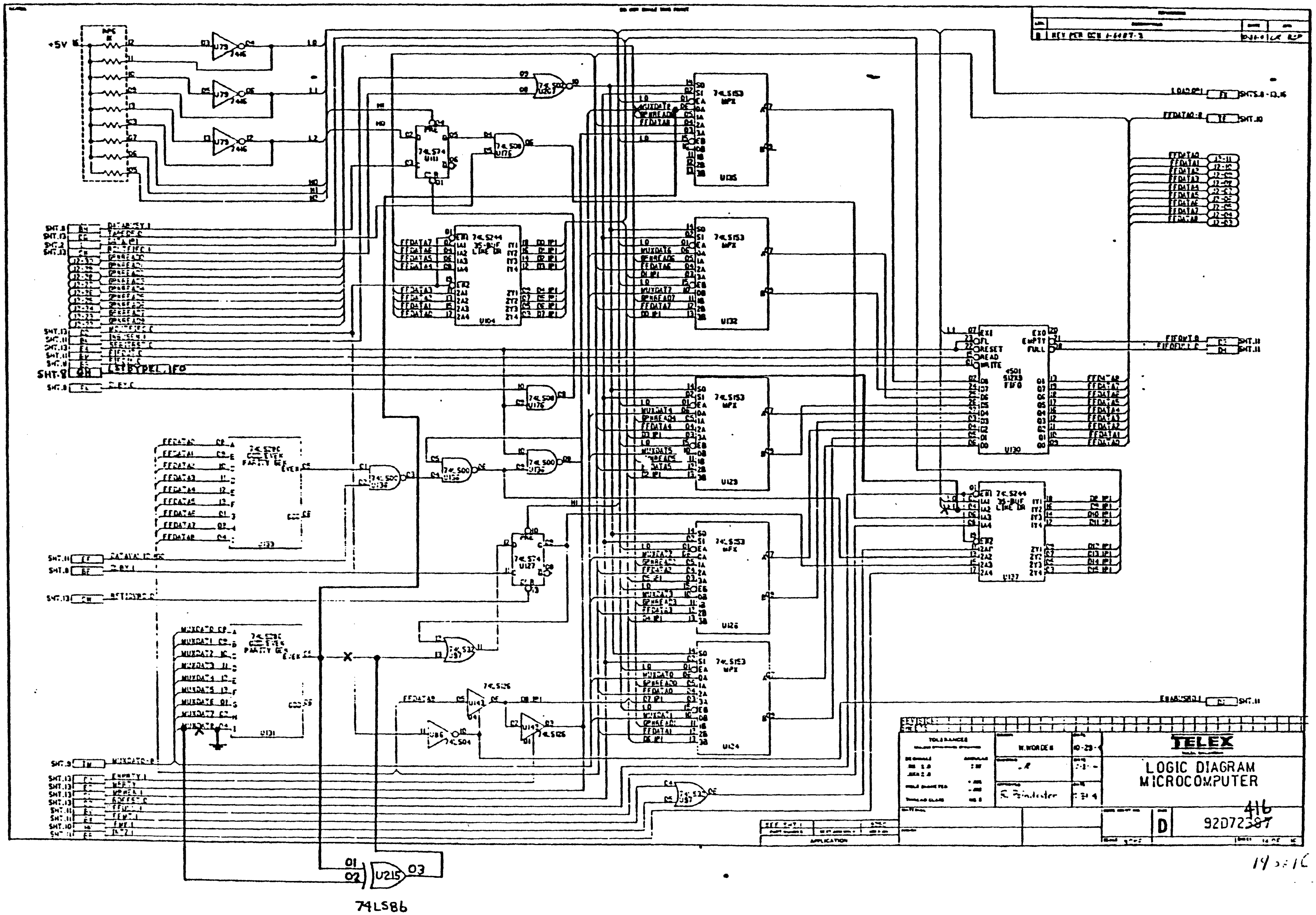

A Rel per ERO
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
W. WORDEN
R. Poindexter
D
92D72387
NONE
11 OF 16
SEE SHT. 1
APPLICATION
74LS74A
74LS00
74LS04
74LS32
74LS02
74LS10
74LS11
74LS27
74LS126
RCLTFIFO I
INBSEN I
LASTBY 0
TAPEOP I
MPHEN I
DATACPT I00
DACK I
LOAD OPI
PH3 0G0
MOUTFIFO 0
DLBYT0 0
ENDBEQOUT I
ENABUSBO I
DTACK IS0
EIFOWT 0
MREAD 0
LSTBYDEL IF0
SEBITRST 0
FIFOFULL 0
FIFOIN 0
LSTBYDEL OF0
MPHEN 0
DYNRST 0
STFFIN I
RCFIFOIN 0
INBUSEN I
INBUSEN 0
FIFOUT 0
DATACPT IG0
OREQOUT
DATAVAL IO IG0
INT2 OP0
INT2 I
FEMT I
FFMT 0
WFFMT I
FFULL 0
FFULL I

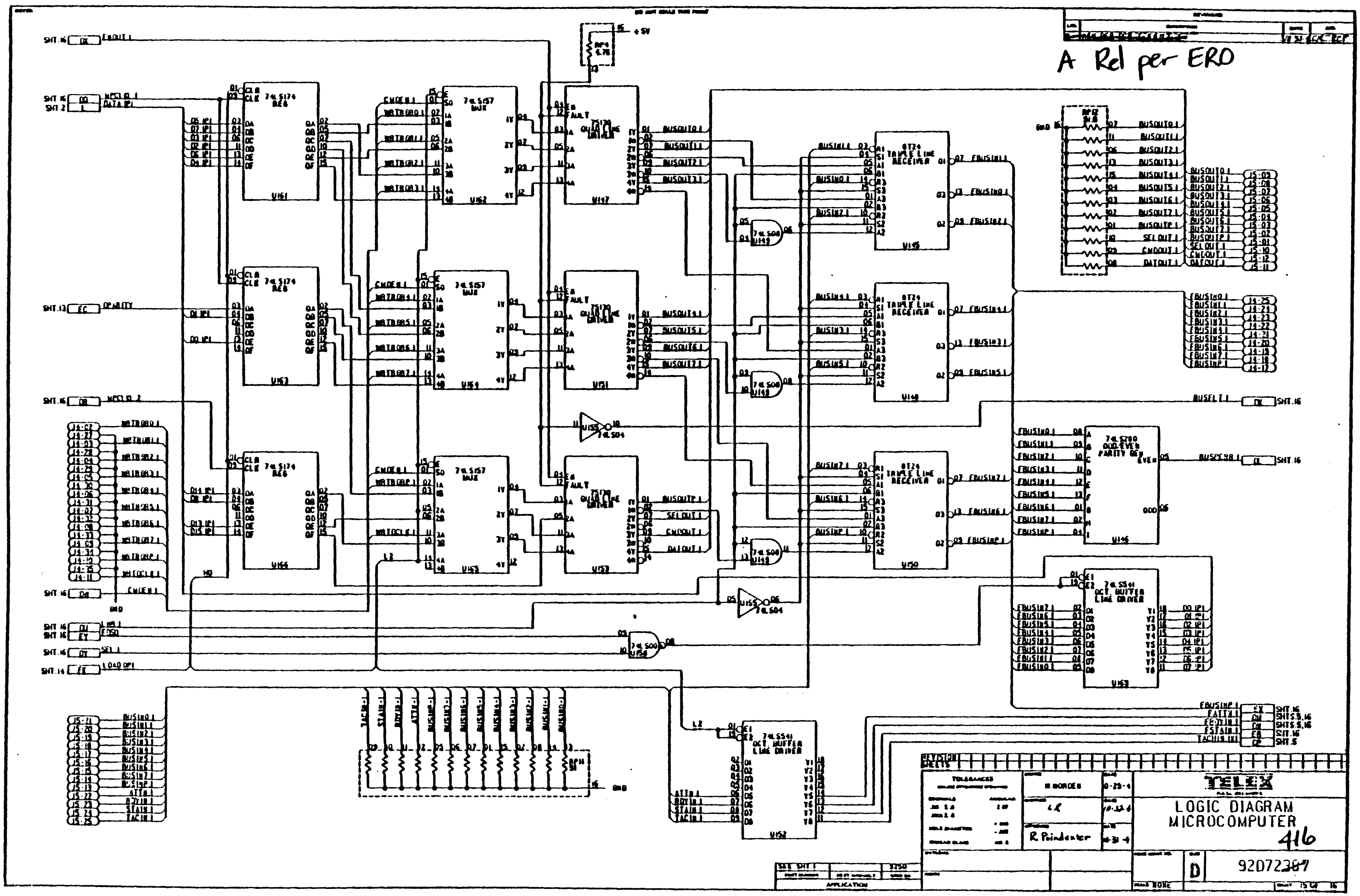



| | | | | | |
|---|---|---|---|---|---|
| TOLERANCES | DRAWN M.STANDRIDGE | 6·26·5 | TELEX | | |
| DECIMALS .XX ±.0 .XXX ±.0 ANGULAR | CHECKED LR | 6·26·5 | LOGIC DIAGRAM MICROCOMPUTER | | |
| HOLE DIAMETER THREAD CLASS NO. 2 | APPROVED | 6·26·5 | | | |
| MATERIAL | | | | SIZE D | 92D72416 |
| FINISH | | | SCALE NONE | | SHEET 12 OF 16 |

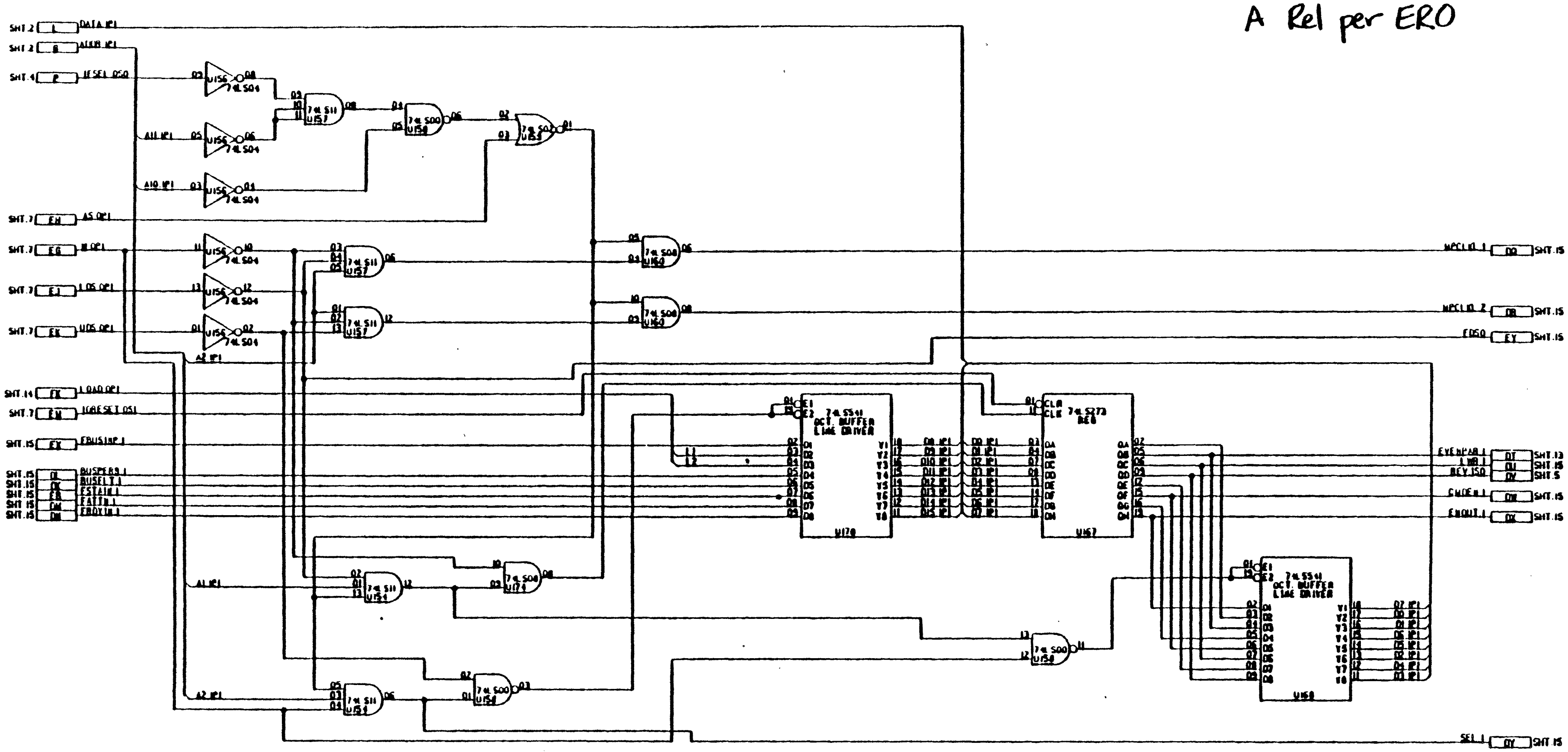
| SEE SHT.1 | | 9251 |
|---|---|---|
| PART NO. | NEXT ASSEMBLY | USED ON |
| APPLICATION | | |


A Rel per ERO
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
W. WORDEN
R. Poindexter
D
92D72387
SCALE NONE
13 OF 16


LOGIC DIAGRAM
MICROCOMPUTER
TELEX
D
92D72416
U215
01
02
03
74LS86
14 of 16


A Rel per ERO
74LS174 REG
U161
U163
U166
74LS157 MUX
U162
U164
U165
75130 QUAD LINE DRIVER
U157
U151
U153
8T24 TRIPLE LINE RECEIVER
U145
U148
U150
74LS280 ODD/EVEN PARITY GEN
U146
74LS541 OCT. BUFFER LINE DRIVER
U152
U163
74LS04
74LS00
BUSOUT0 I
BUSOUT1 I
BUSOUT2 I
BUSOUT3 I
BUSOUT4 I
BUSOUT5 I
BUSOUT6 I
BUSOUT7 I
BUSOUTP I
SELOUT I
CMDOUT I
DATOUT I
FBUSIN0 I
FBUSIN1 I
FBUSIN2 I
FBUSIN3 I
FBUSIN4 I
FBUSIN5 I
FBUSIN6 I
FBUSIN7 I
FBUSINP I
BUSFLT I
BUSPE98 I
+5V
GND
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
416
R. Poindexter
D
92D72387

A Rel per ERO




TELEX

LOGIC DIAGRAM
MICROCOMPUTER
416

R. Poindexter

SEE SHT.1

APPLICATION

D

92D72387

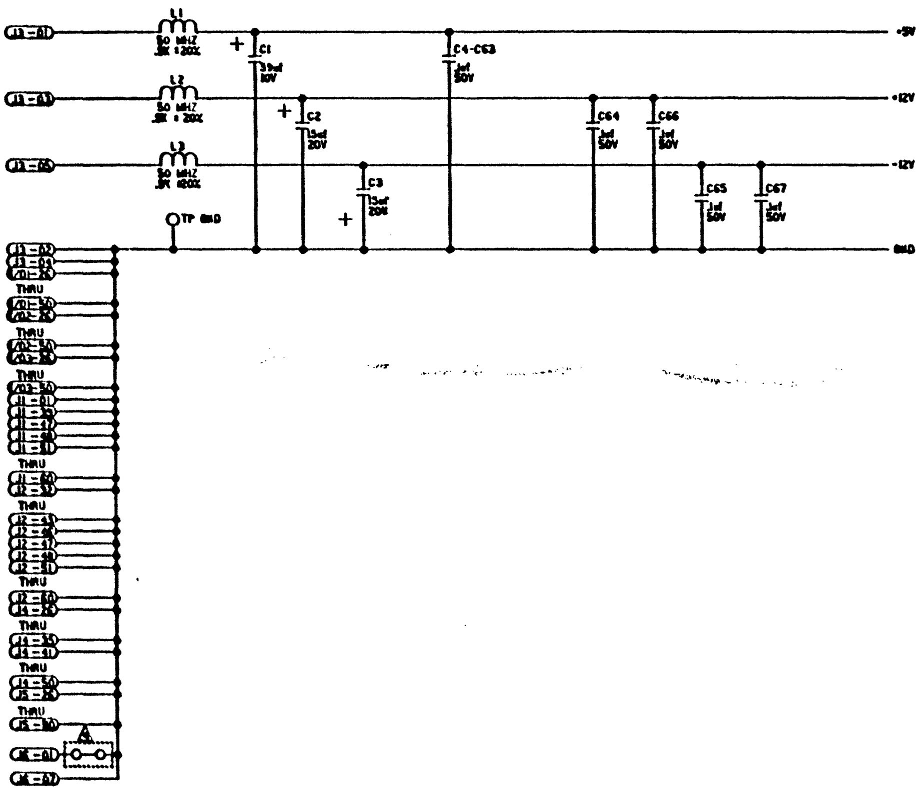
SHEET 16 OF 16

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| A | REL PER ERO 513-157 | 4-18-85 | MS ECP |

UNLESS OTHERWISE SPECIFIED

1. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
2. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
3. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
4. JUMPERS ARE MADE IN ETCH ON THE CIRCUIT BOARD. (THESE ARE NOT COMPONENTS TO BE INSTALLED).
5. LOCATIONS SHOWN HAVE 24 PIN DIP INSTALLED INTO PINS 03-26 OF A 28 PIN SOCKET.




| REF DESIG | | SPARE |
|---|---|---|
| 74AS00 | U71 | (03,10,08),(12,13,11) |
| 74LS00 | U136 | (04,05,06),(08,09,10),(11,12,13) |
| 74LS00 | U209 | 11,12,13 |
| 74LS02 | U159 | (05,06,04),(08,09,10),(11,12,13) |
| 74LS02 | U207 | (01,02,03),(12,13,11) |
| 74LS04 | U86 | (01,02),(03,04) |
| 74LS04 | U155 | (03,04),(08,09),(13,12) |
| 74LS04 | U208 | 03,04 |
| 74LS08 | U93 | 01,02,03 |
| 74LS08 | U149 | 01,02,03 |
| 74LS08 | U160 | (01,02,03),(12,13,11) |
| 74LS08 | U174 | (01,02,03),(04,05,06),(12,13,11) |
| 74LS10 | U91 | 01,02,13,12 |
| 74LS11 | U154 | 08-11 |
| 74LS11 | U173 | (03,04,05,06),(09,10,11,08) |
| 7414 | U94 | 09,08 |
| 7416 | U31 | (03,04),(05,06),(09,08) |
| 7416 | U78 | (01,02),(03,04),(11,10) |
| 7416 | U203 | (11,10),(13,12) |
| 74LS32 | U66 | 01,02,03 |
| 74LS74A | U98 | 01,02,03,04,05,06 |
| 74LS74A | U105 | 08-13 |
| 74LS74A | U106 | 08-13 |
| 74LS74A | U127 | 01-06 |
| 74LS126 | U143 | 04,05,06 |
| MC1489 | U18 | 09,10,08 |
| RP6 | 1K | 02,04,06,07,10,12,14 |
| RP7 | 180/390 OHM | 06,08 |
| RP10 | 180/390OHM | 08,12,13 |
| RP11 | 91 OHM | 03,04 |
| RP12 | 91 OHM | 05,12,14 |

REFERENCE DESIGNATION

| NOT USED | LAST USED |
|---|---|
| U20,44,46,80,97,101,102<br>104,105,112,117,118,120,139,<br>141,144,171,172,177-199,212 | U214 |
| | C96 |
| | R2 |
| C68-89 | CR8 |
| | L3 |
| RP9 | S4 |
| | J8 |
| | RP12<br>82-SHT.INCON |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | | | | | | | | | | | | | | | B | B | | |
| REVISION | ~~A~~ | A | A | A | A | A | A | A | A | A | A | A | A | A | A | ~~A~~ | ~~A~~ | | |
| SHEETS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ± .0 / .XXX ± .0 — ANGULAR ± 30'
HOLE DIAMETER + .005 / - .002
THREAD CLASS NO. 2

DRAWN M.STANDRIDGE — DATE 8-2-5
CHECKED ES — DATE 8-12-5
APPROVED R. [signature] — DATE 8-12-5

MATERIAL

FINISH

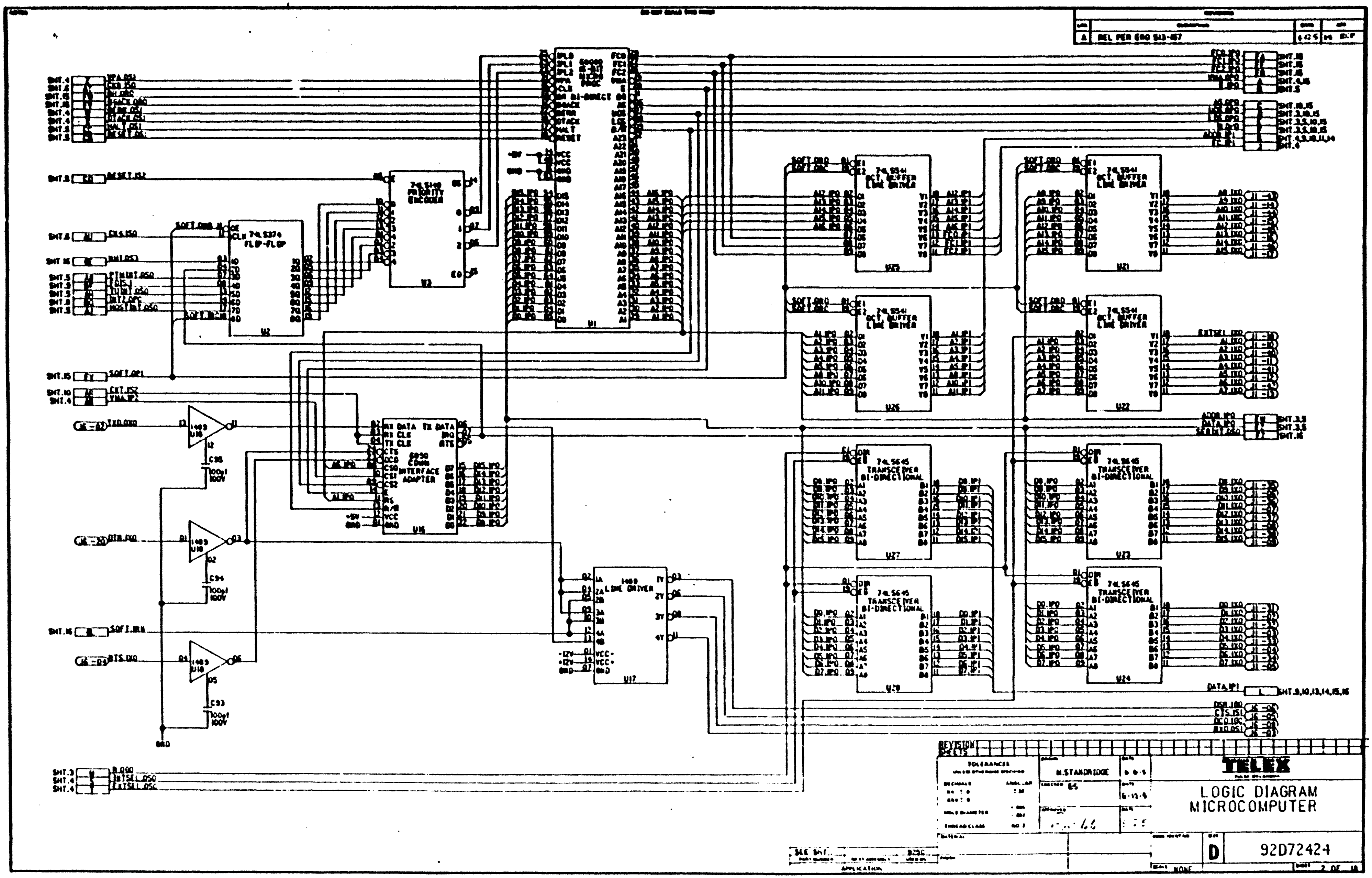
B ~~9~~1D72424-01 — PART NO. — NEXT ASSEMBLY — 9250 — USED ON
APPLICATION

**TELEX**
TULSA, OKLAHOMA

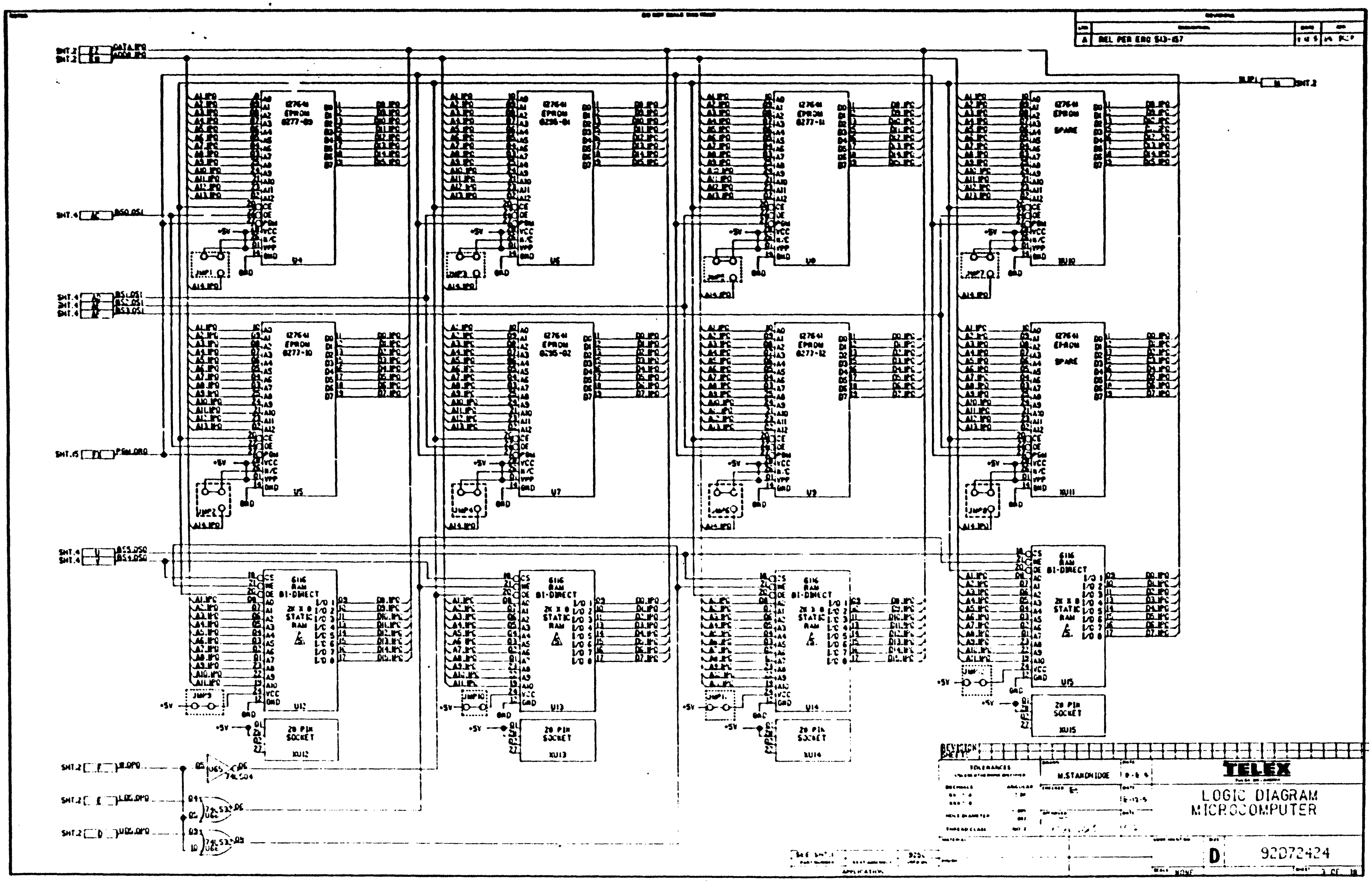
# LOGIC DIAGRAM MICROCOMPUTER

CODE IDENT NO. — SIZE D — 92D72424
SCALE NONE — SHEET 1 OF 18

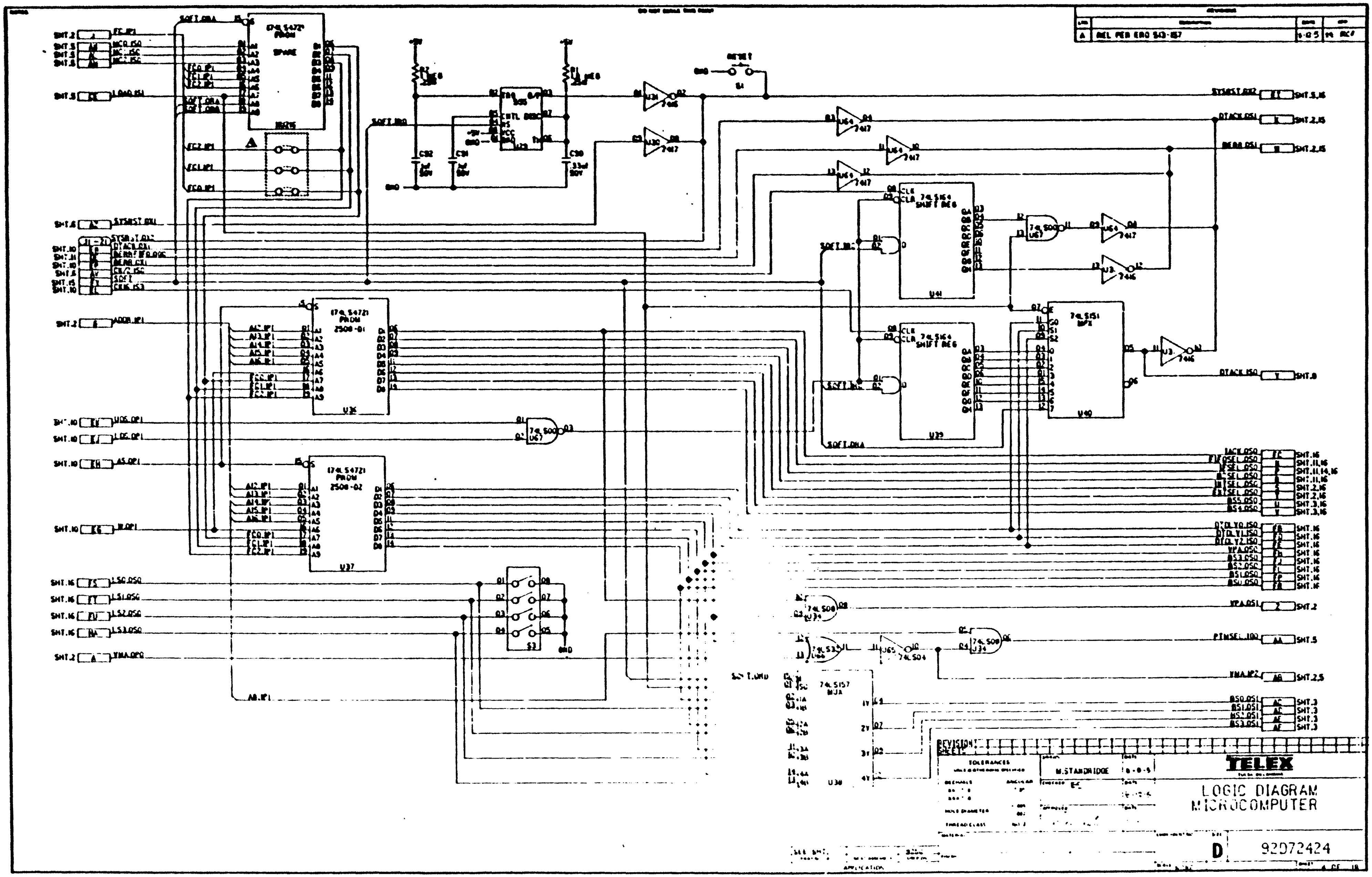
SUB 9

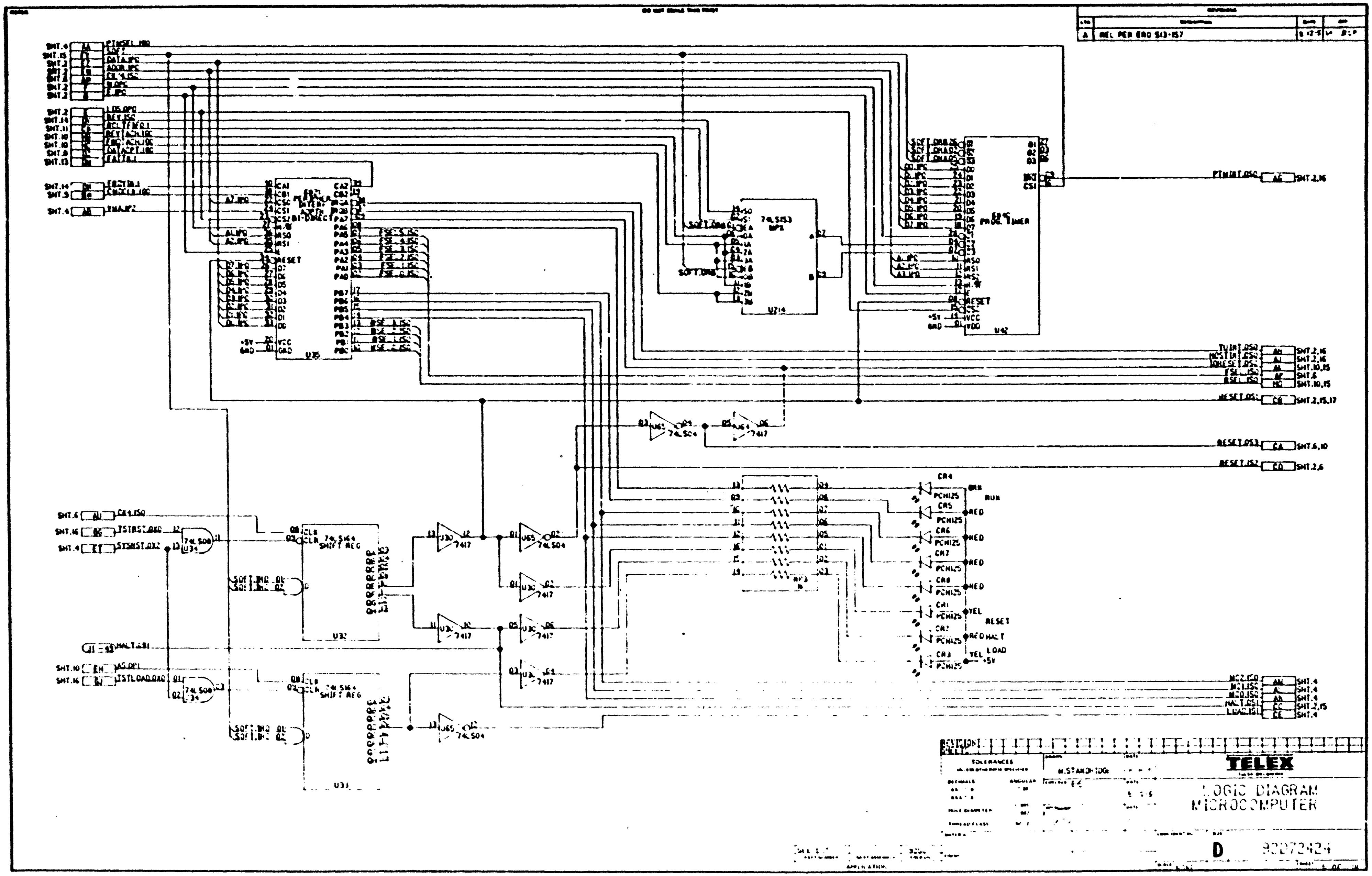


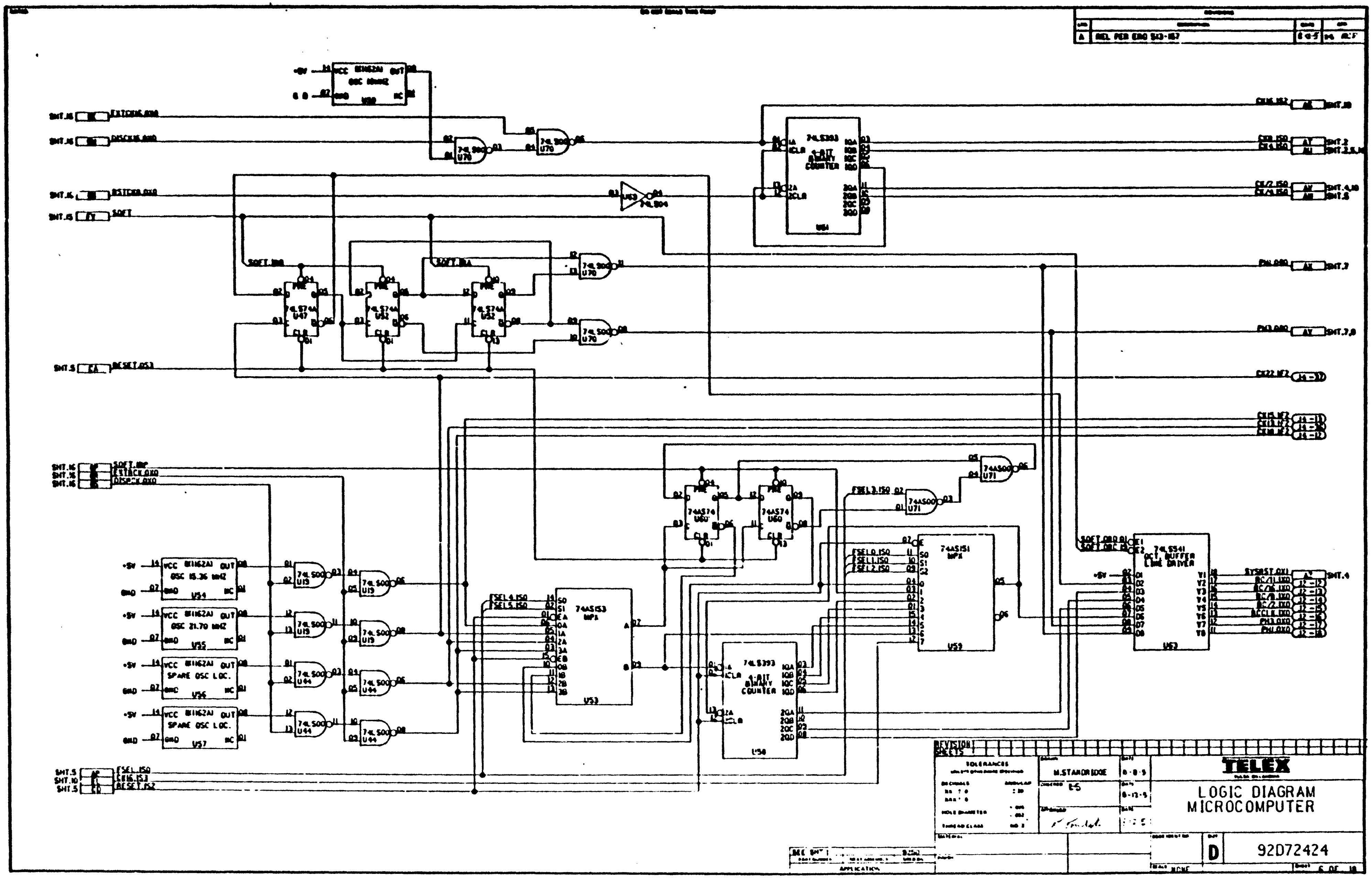
REL PER ENG 513-187
68000 16-BIT MICRO PROC
74LS148 PRIORITY ENCODER
74LS374 FLIP-FLOP
6850 COMM INTERFACE ADAPTER
1489 LINE DRIVER
74LS541 OCT. BUFFER LINE DRIVER
74LS645 TRANSCEIVER BI-DIRECTIONAL
TOLERANCES
M.STANDRIDGE
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72424
NONE
2 OF 18
APPLICATION



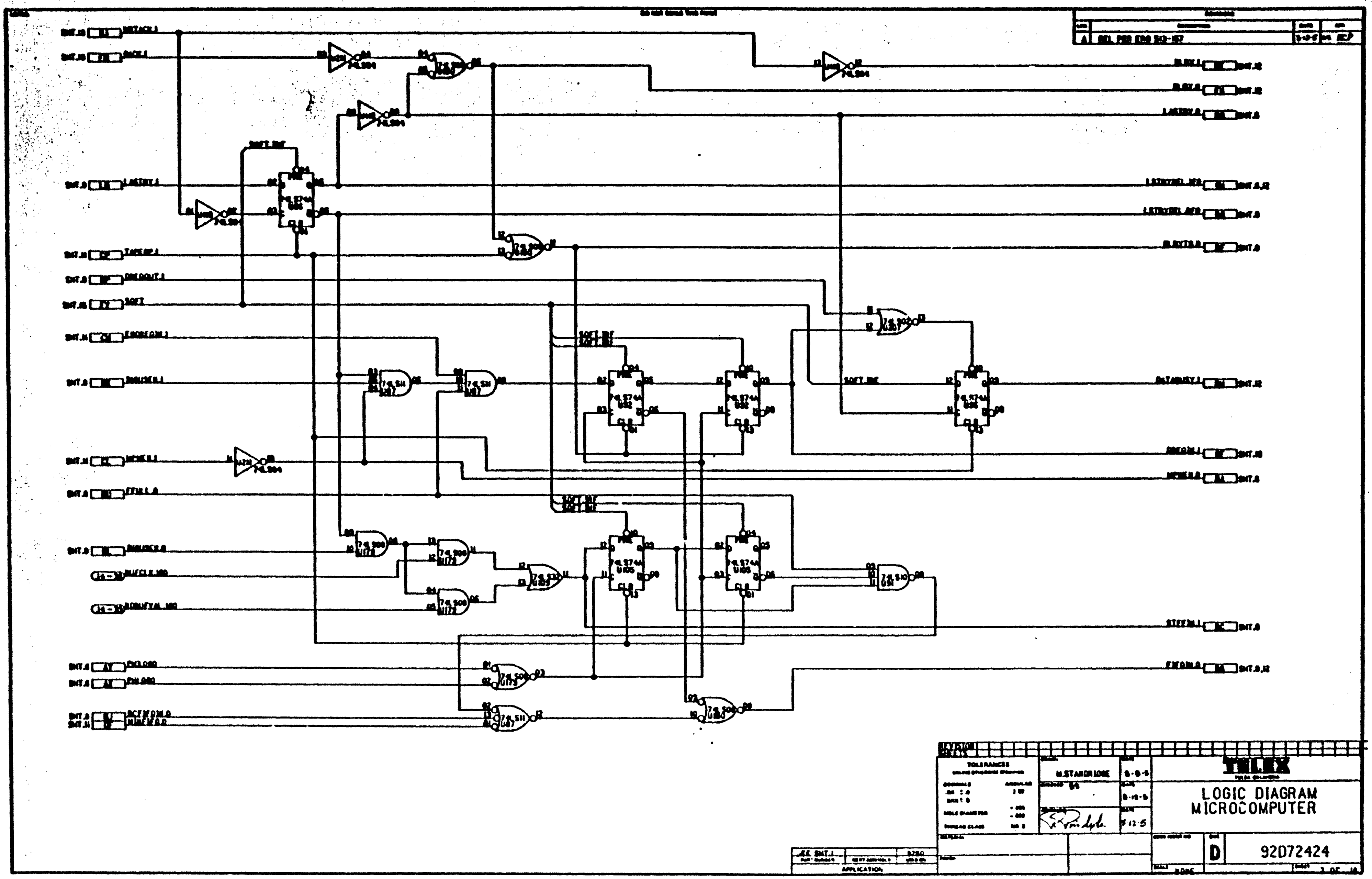
REL PER ERO 513-157
12764I EPROM 8277-09
12764I EPROM 8295-01
12764I EPROM 8277-11
12764I EPROM SPARE
12764I EPROM 8277-10
12764I EPROM 8295-02
12764I EPROM 8277-12
6116 RAM BI-DIRECT 2K X 8 STATIC RAM
20 PIN SOCKET
TELEX
M.STANDHIDGE
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72424
NONE

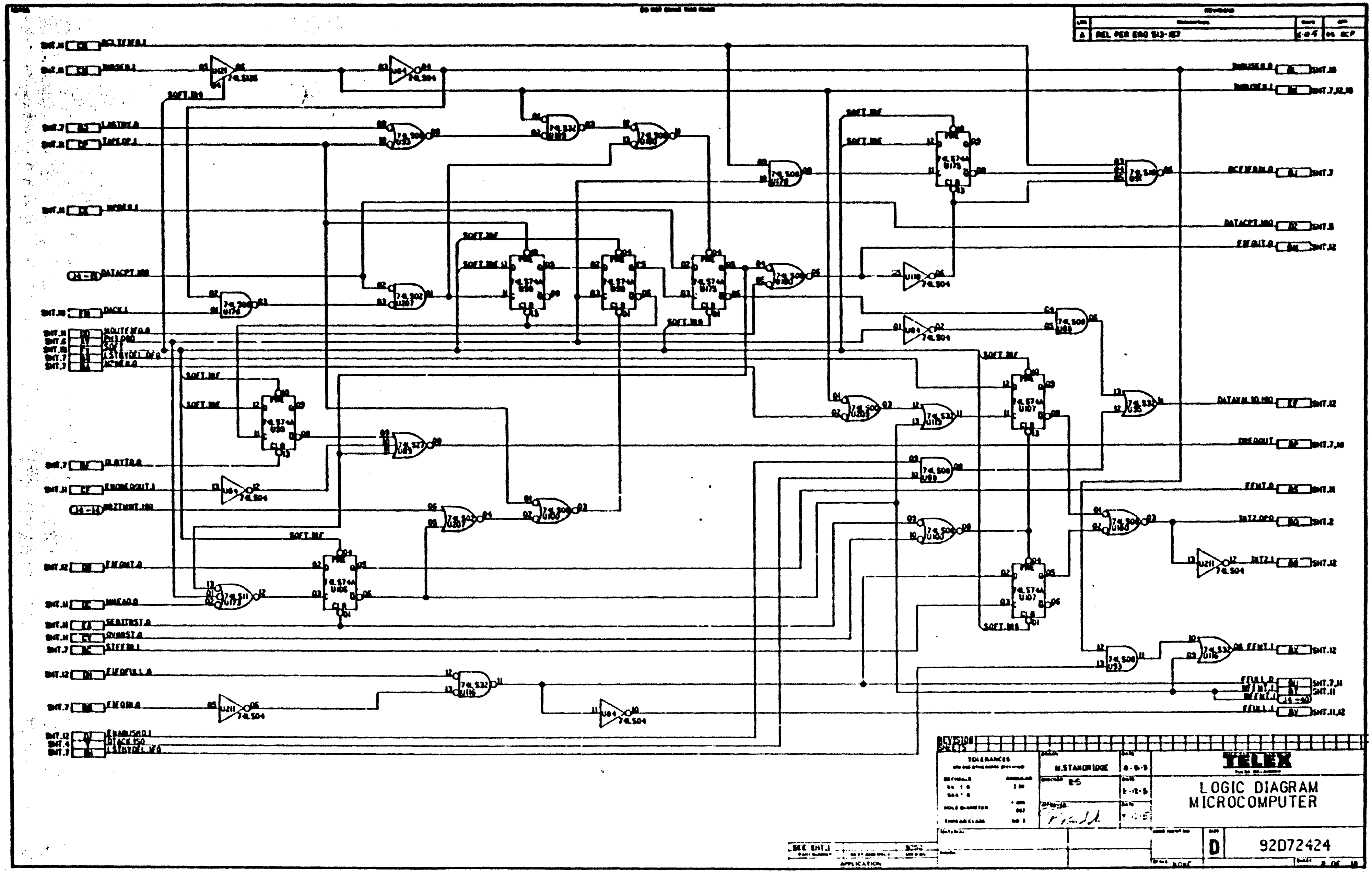

TELEX
LOGIC DIAGRAM
MICROCOMPUTER
M.STANDRIDGE
D
92D72424
RESET
SOFT DBA
SYSRST 0I2
DTACK 0SI
BERR 0SI
DTACK 1S0
PTMSEL 100
VMA 0PO
74LS151
MPX
74LS164
SHIFT REG
74LS157
MUX
U36
U37
U38
U39
U40
U41

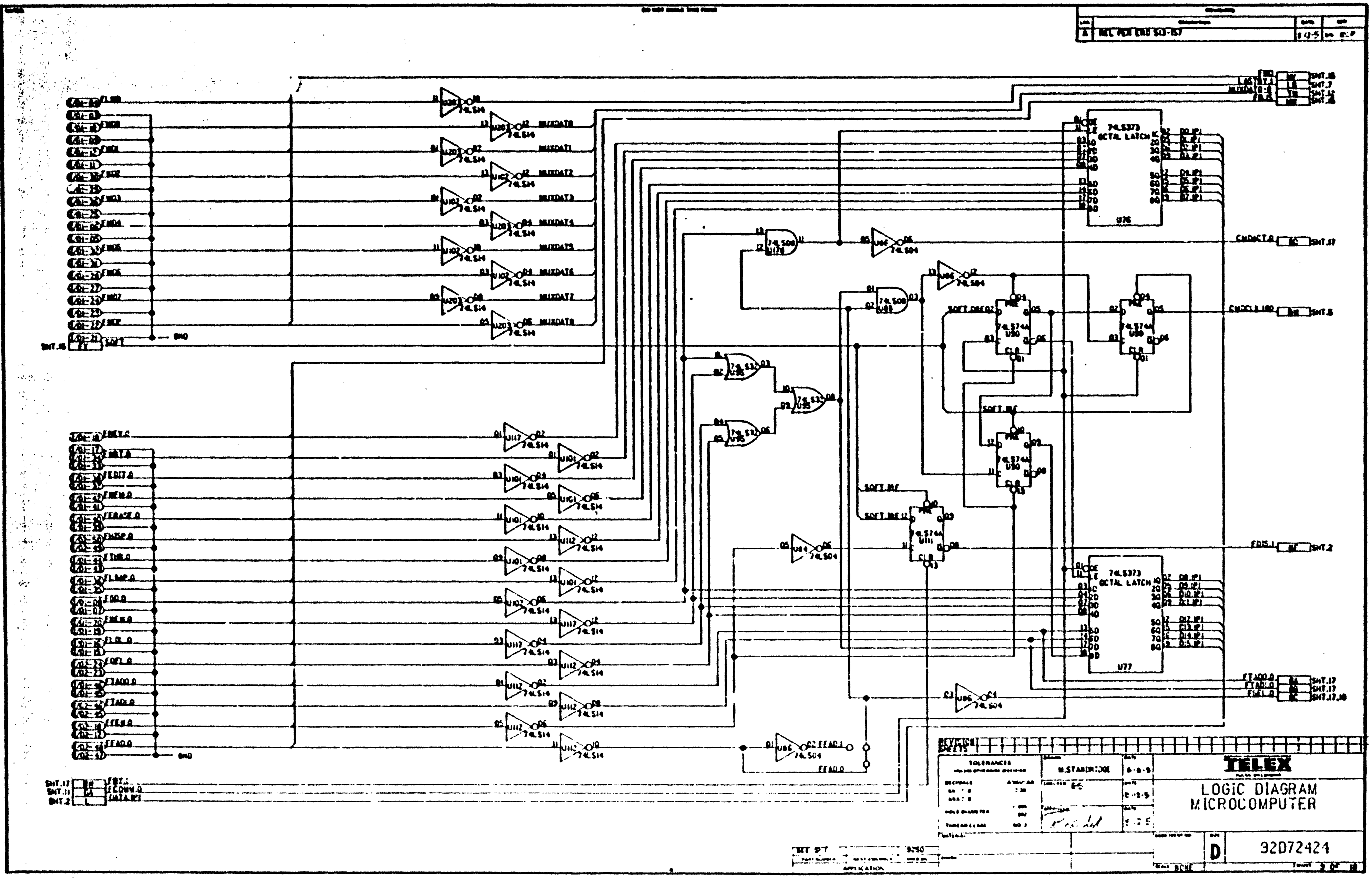

TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
82072424
74LS153
74LS164
SHIFT REG
74LS00
74LS04
7417
PROG. TIMER
RESET
HALT
LOAD
RUN



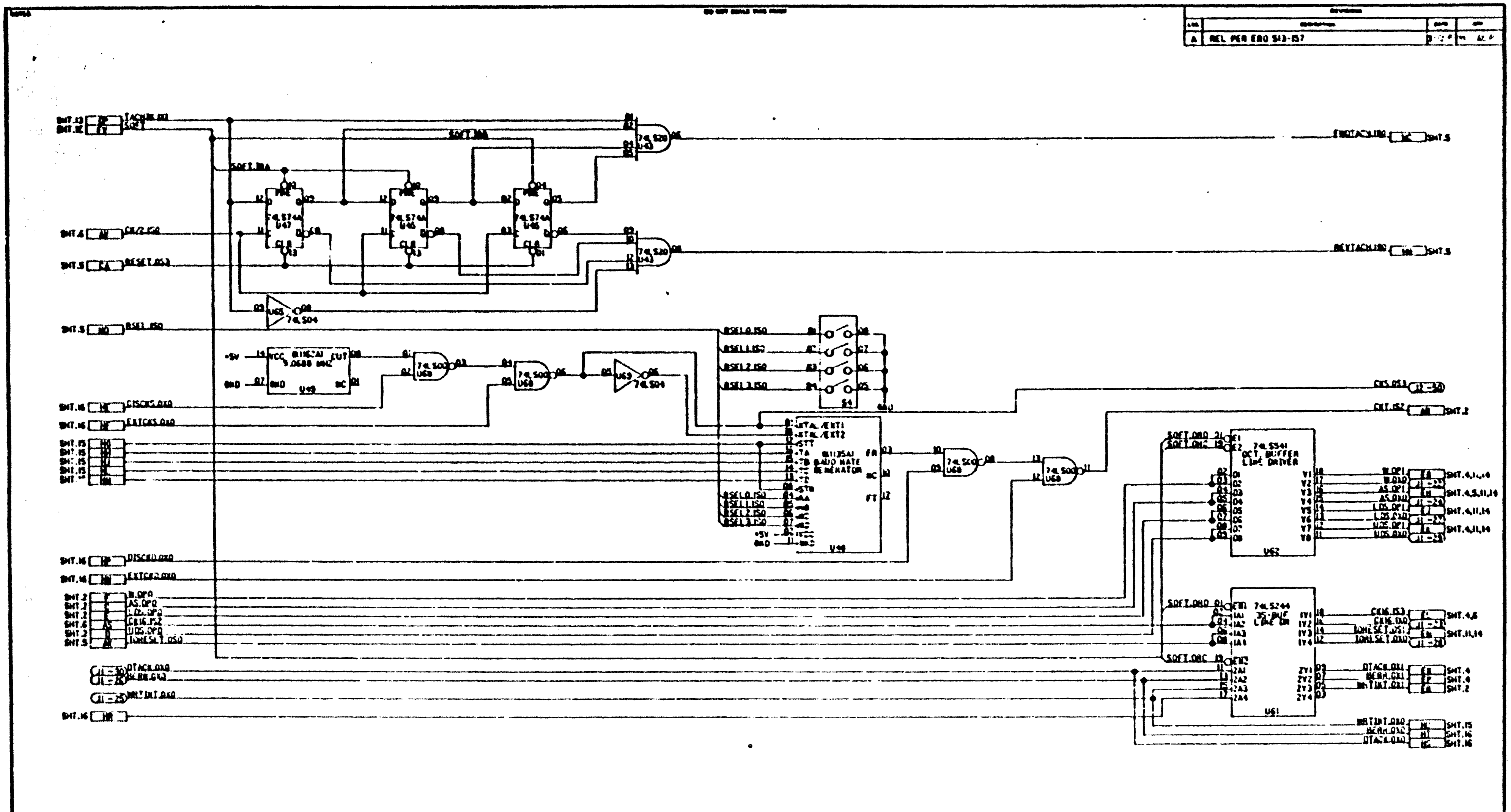
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
92D72424
D
M.STANDRIDGE
74LS393
4-BIT BINARY COUNTER
74AS153 MPX
74AS151 MPX
74LS541 OCT. BUFFER LINE DRIVER
OSC 15.36 MHZ
OSC 21.70 MHZ
SPARE OSC LOC.
SOFT
RESET.0S1
SYSRST.0X1


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72424


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72424
M.STANDRIDGE



TELEX
LOGIC DIAGRAM
MICROCOMPUTER
M.STANDRIDGE
D
32D72424
74LS373
OCTAL LATCH
U76
U77
74LS74A
74LS14
74LS04
74LS08
74LS32
SOFT.INF
SOFT.OREQ
CMDACT.0
CMDCLK.100
FDIS.1
MUXDAT0
MUXDAT1
MUXDAT2
MUXDAT3
MUXDAT4
MUXDAT5
MUXDAT6
MUXDAT7
MUXDAT8
FKEY.C
FEDIT.0
FERASE.0
FTADD.0
FTADI.0
FSEL.0
FEAD.0
FEAD.1
GND

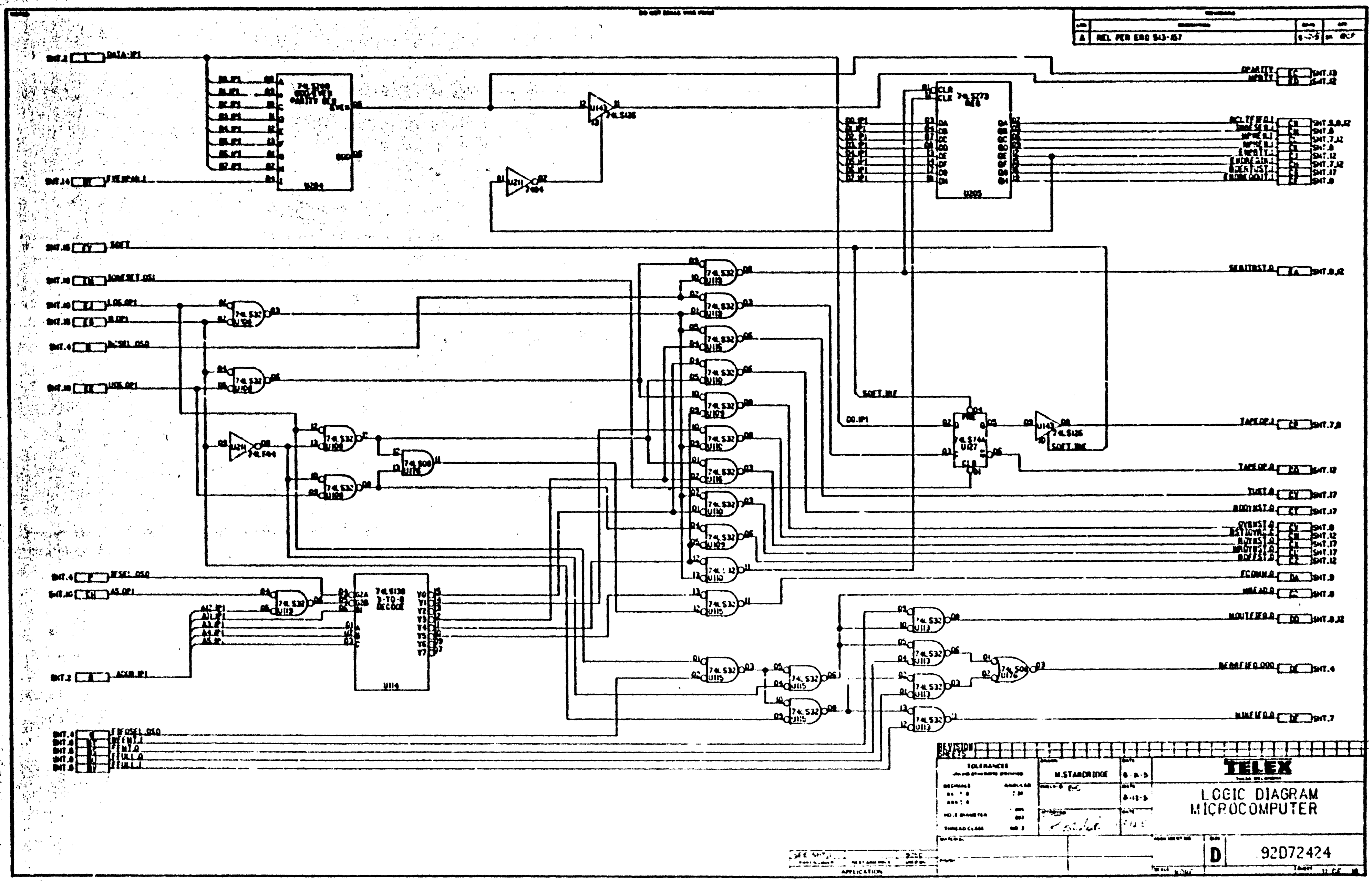



TELEX

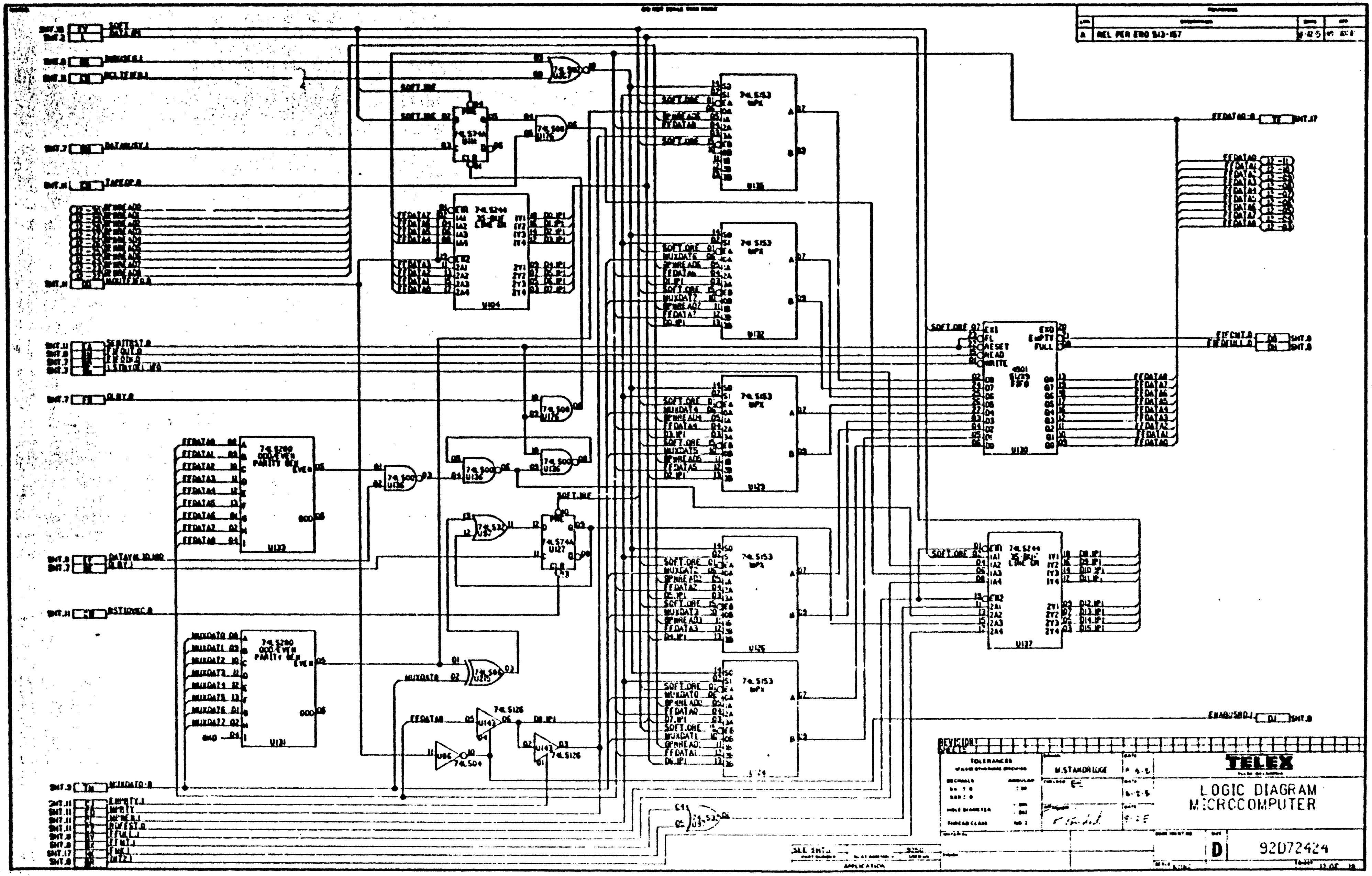
LOGIC DIAGRAM
MICROCOMPUTER

D

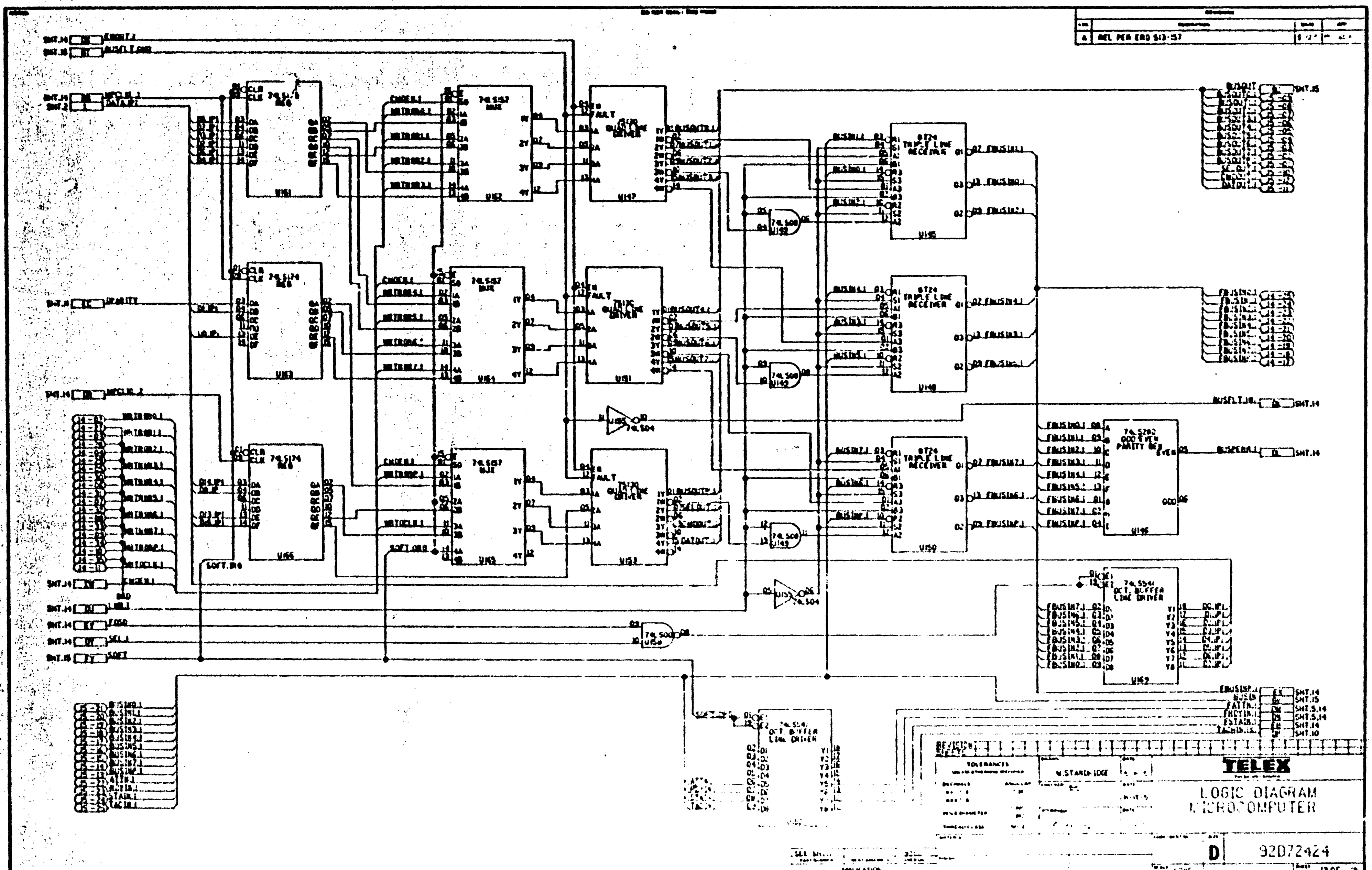
92D72424

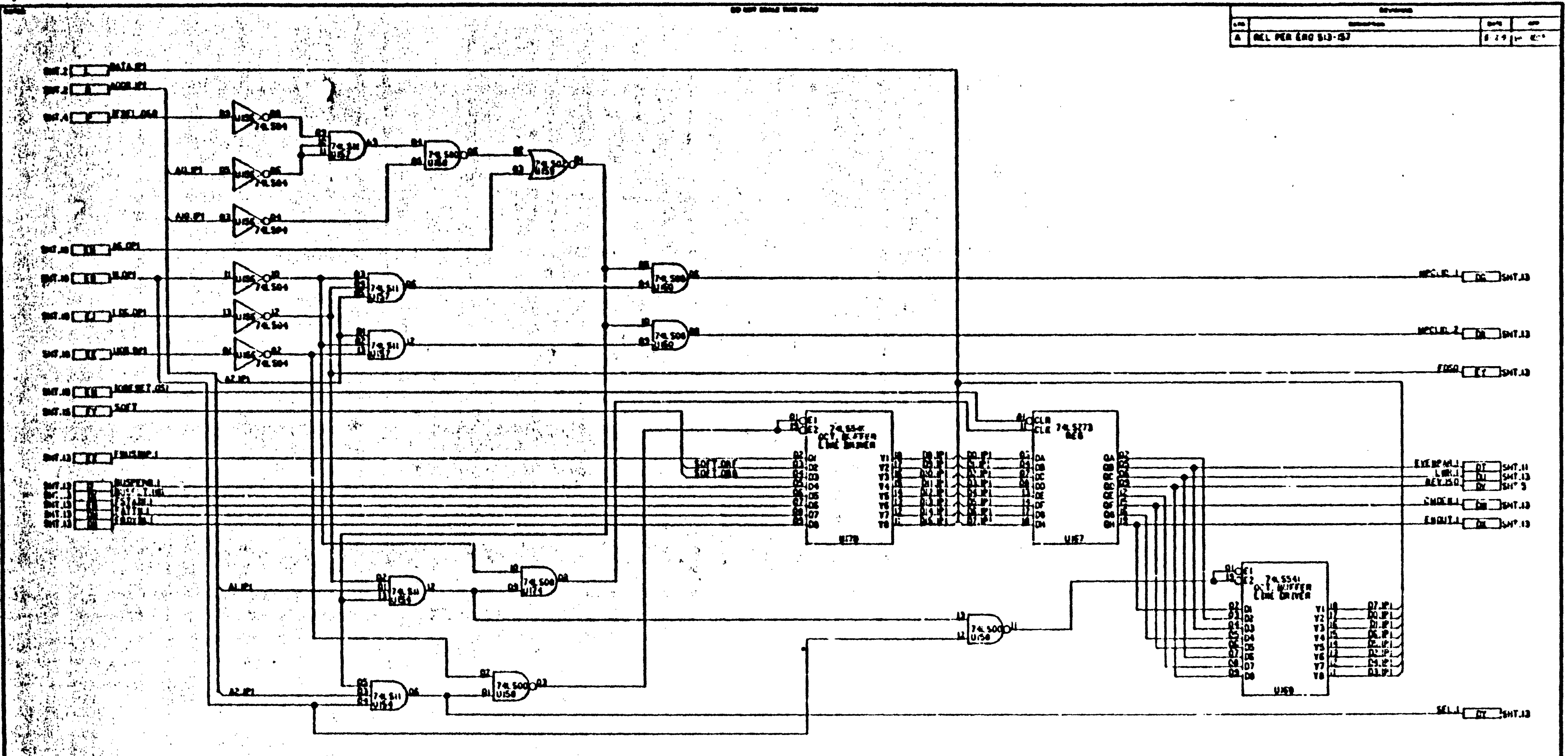


LOGIC DIAGRAM
MICROCOMPUTER
TELEX
M.STANDRIDGE
D
92D72424
REL PER ERO 943-157
74LS280
74LS273
74LS74A
74LS138
3-TO-8
DECODE
74LS32
74LS126
74LS04
74LS08
U204
U205
U127
U114
DATA-IP1
SOFT
SOFT.INF
SOFT.INE
D0.IP1
TAPEOP.I
TAPEOP.A
ADDR.IP1



74LS153 MPX
74LS244 3S-BUF LINE DR
74LS280 ODD/EVEN PARITY GEN
74LS74A
74LS00
74LS126
74LS04
SOFT ORE
FFDATA0
MUXDATA0
TELEX
M.STANDRIDGE
TOLERANCES
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72424


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
M. STANDRIDGE
D
92D72424




REVISION
SHEET

TOLERANCES

HOLE DIAMETER

THREAD CLASS

M.STANCHIDGE

**TELEX**

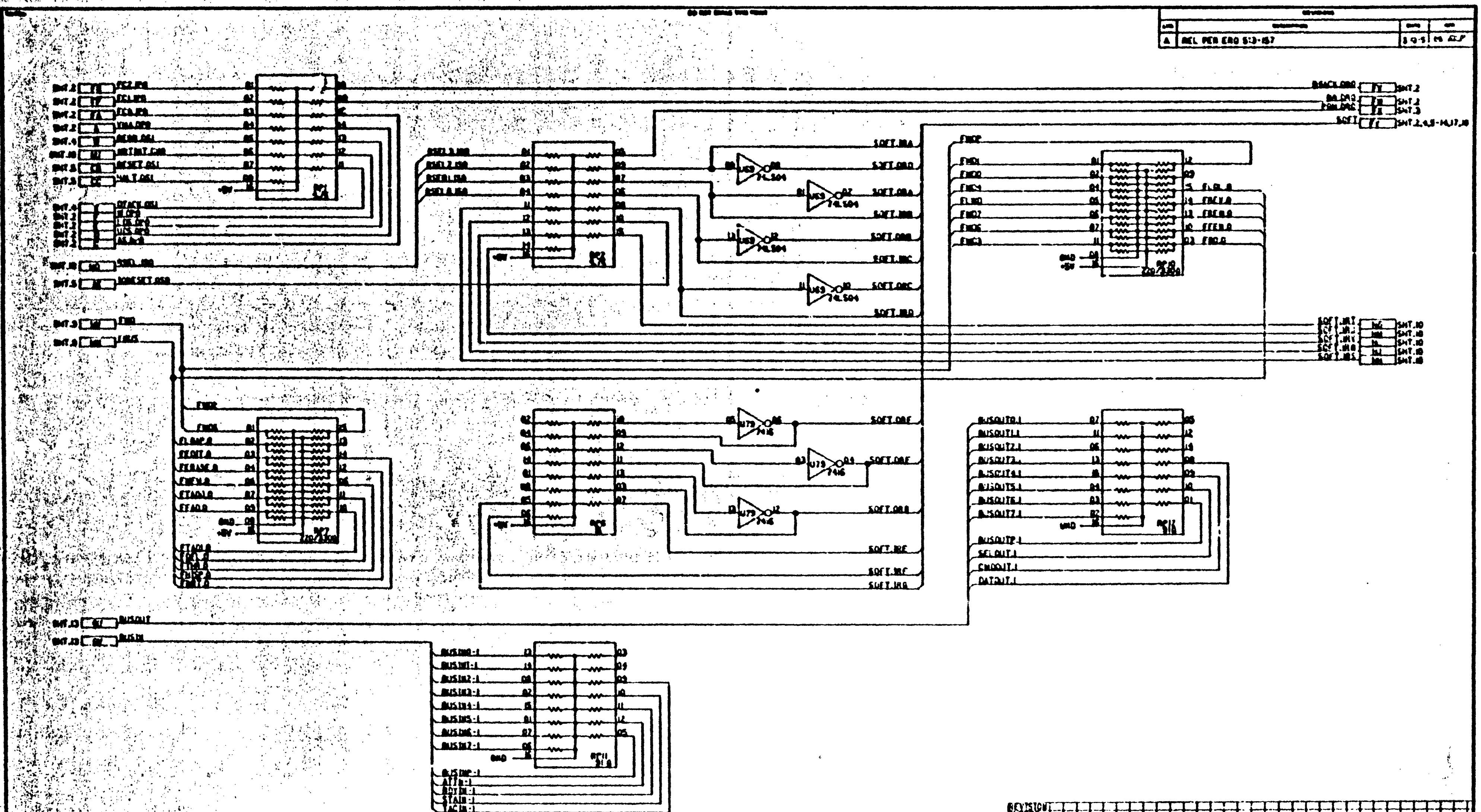
LOGIC DIAGRAM
MICROCOMPUTER

D

92D72424

SCALE NONE

SHEET 15 OF 18




TOLERANCES

M. STANDRIDGE

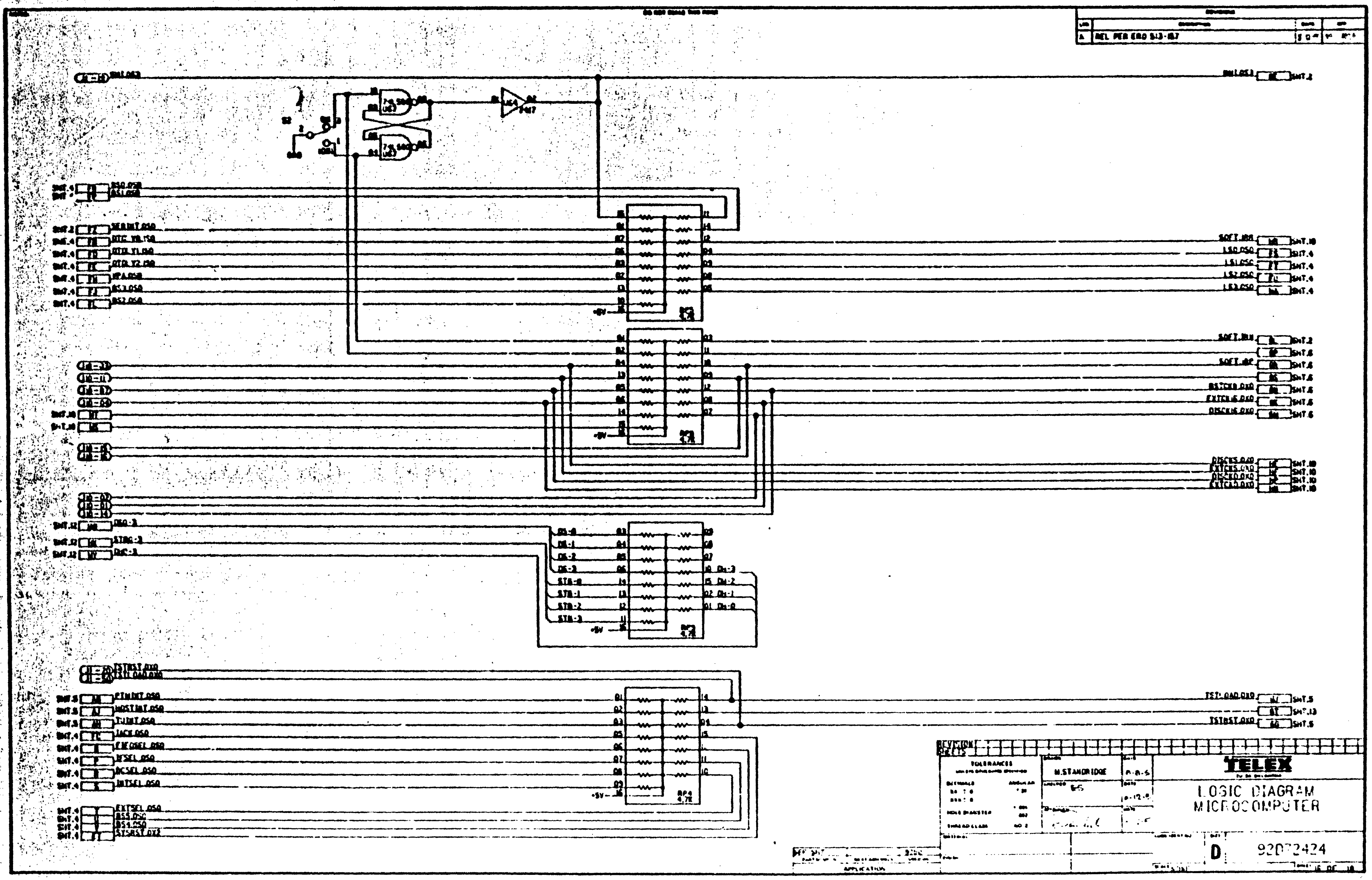
TELEX

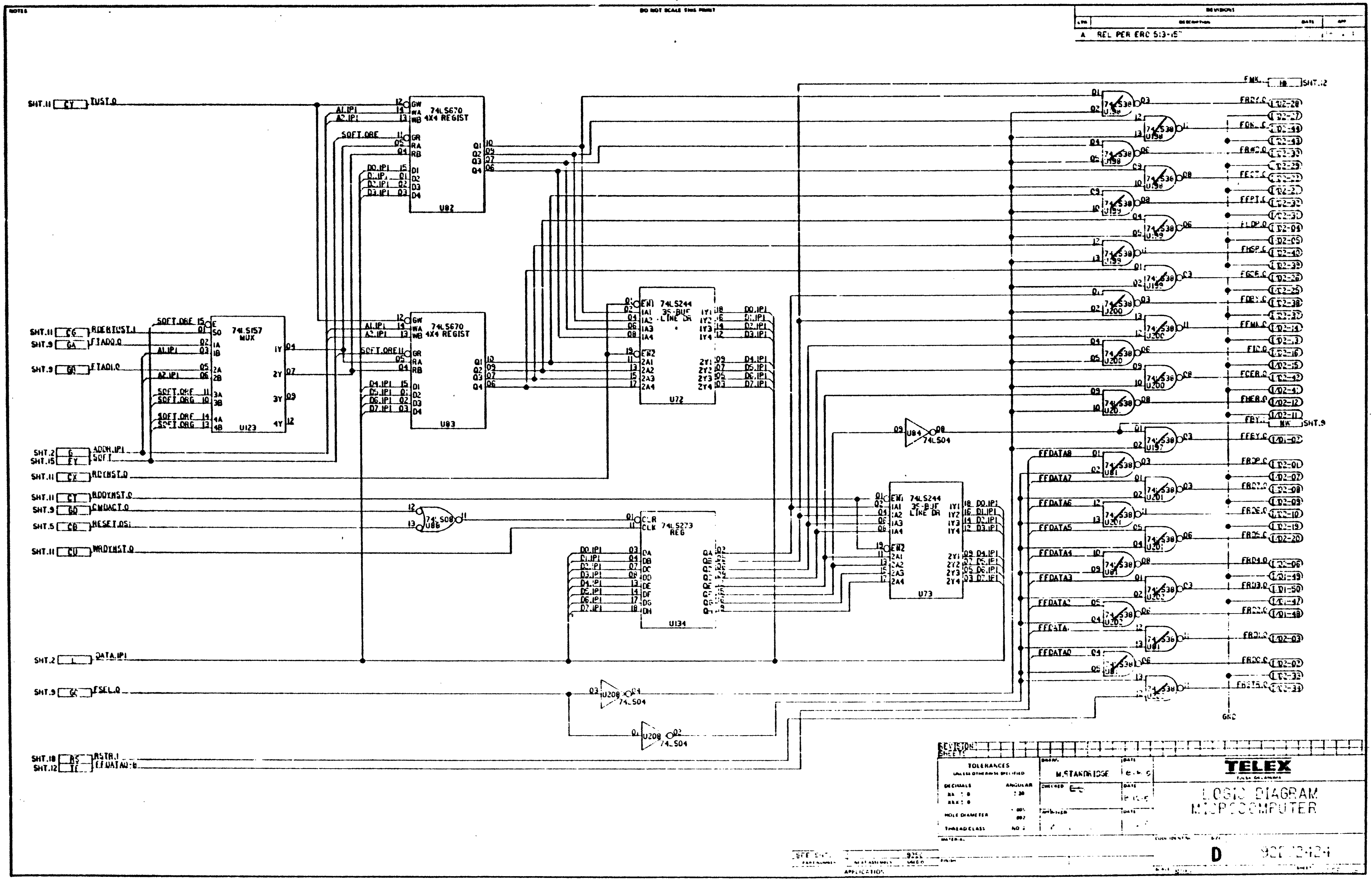
LOGIC DIAGRAM
MICROCOMPUTER

D 92D72424

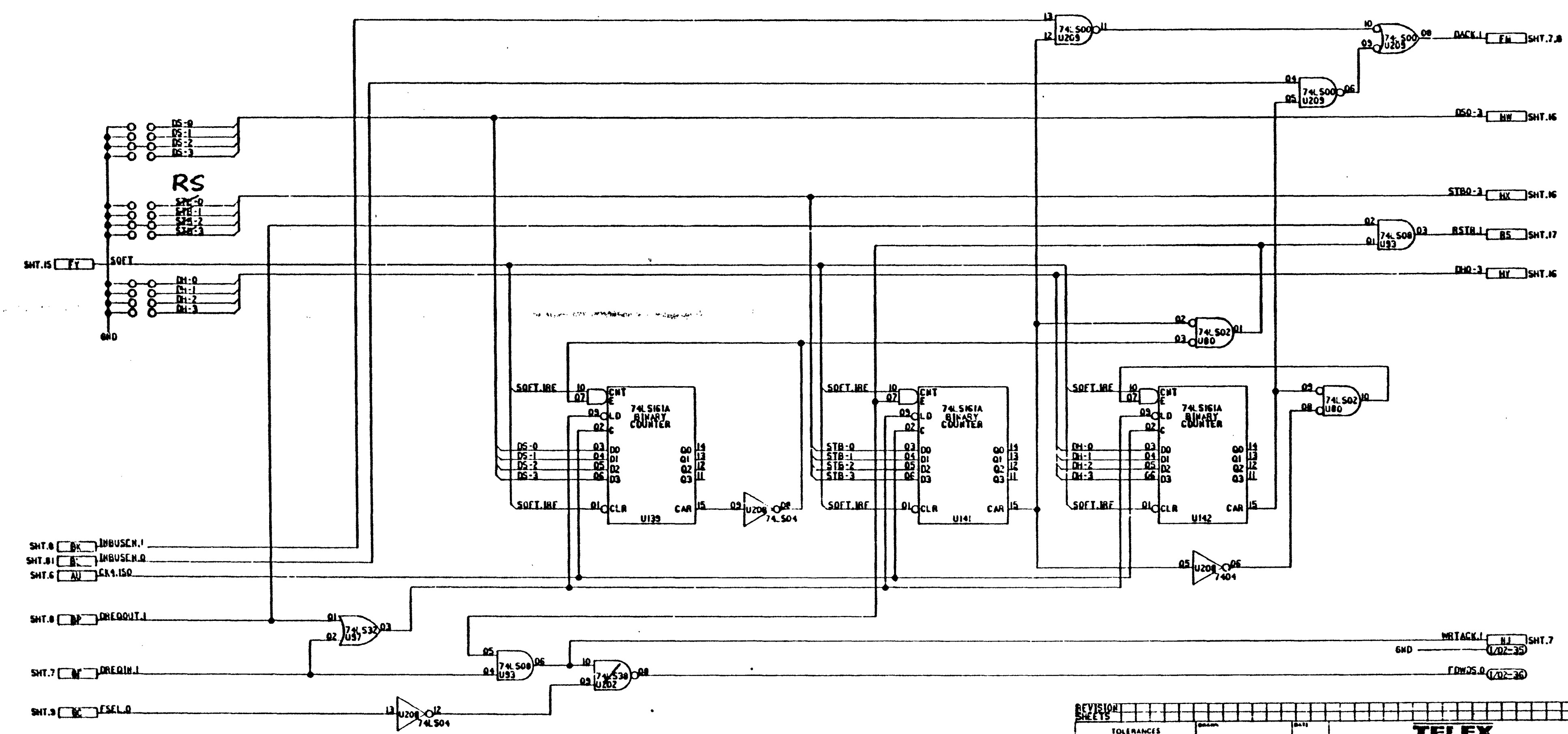
SEE SHT.1

APPLICATION


REL PER ERO 513-187
SOFT.IRQ
LS0.050
LS1.050
LS2.050
LS3.050
BS0.050
BS1.050
BS2.050
BS3.050
SERINT.050
DISCES.0X0
EXTCES.0X0
DISCE0.0X0
EXTCE0.0X0
DSG-3
STRG-3
TSTRST.0X0
TST.OAD.0X0
PTININT.050
HOSTINT.050
T-INT.050
JACK.050
EXTSEL.050
BS5.050
BS4.050
SYSRST.0X2
RP4
4.7K
+5V
TELEX
M.STANDRIDGE
LOGIC DIAGRAM
MICROCOMPUTER
D
TOLERANCES
APPLICATION


DO NOT SCALE THIS PRINT
74LS670 4X4 REGIST
74LS157 MUX
74LS244 3S-BUF LINE DR
74LS273 REG
74LS04
TELEX
M.STANDRIDGE
LOGIC DIAGRAM
D

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| A | REL PER ERO 513-157 | | |




REVISION SHEETS

TOLERANCES

DRAWN M.STANDRIDGE

TELEX

LOGIC DIAGRAM MICROCOMPUTER

SIZE D

92D72424

SCALE NONE

SHEET 18 OF 18

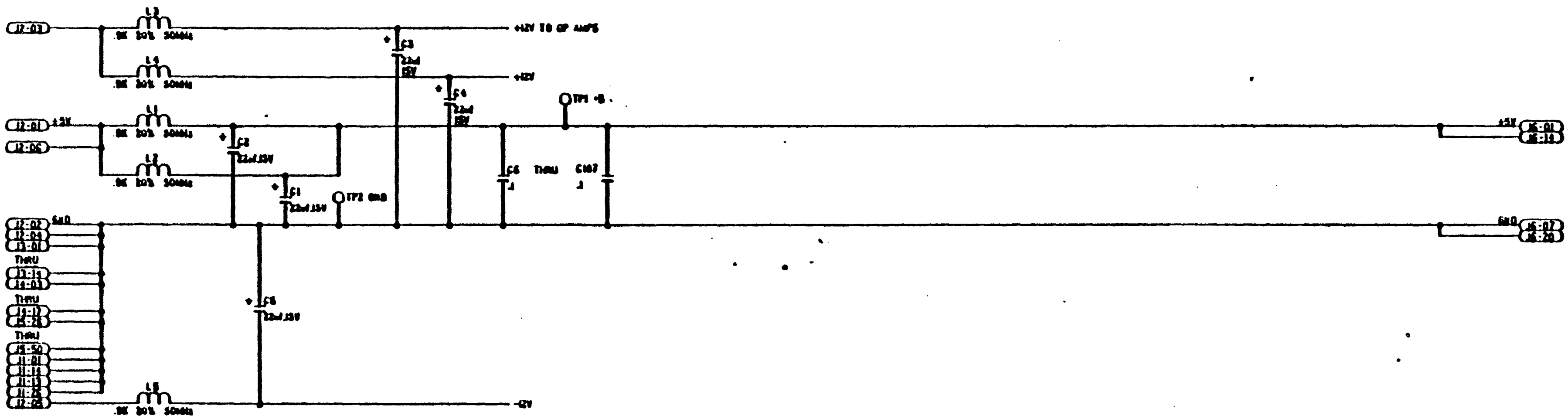
| | | |
|---|---|---|
| B | REL PER ERO 515-1-5 | 2-14-5 |

C 1-6620, CCC 49
D ~~1-6662~~ CCC 49
1-6700

UNLESS OTHERWISE SPECIFIED

1. 8 PIN I.C. CONNECT PIN 04 TO GND
   CONNECT PIN 08 TO +5VC
2. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
3. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
4. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
5. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED G ARE 1/8 WATT.
6. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED 10% ARE 100 VOLTS.

⚠ CAP C140 IS TO BE GROUNDED ACROSS PIN 10 OF U98.




| REF DESIG | |
|---|---|
| NOT USED | LAST USED |
| U12,13,44,53,85,91 | U1000 |
| U109-133,208-233,308-333 | |
| U408-433,508-533,608-633 | |
| U708-733,808-833,908-933 | |
| C115-126,130-132 | C146 |
| R3,10,13,18,27-30,33,37 | |
| 40,43,53,54,58-60,81 | |
| 84,86,96-104,112,113,117 | R129 |
| | RP30 |
| | J6 |
| | JP1 |
| | TP11 |
| | L5 |
| Q2 | Q4 |
| CR2,4 | CR8 |

| REF DESIG. | | SPARES |
|---|---|---|
| 7417 | U2 | 105,061,103,081,111,101 |
| 74LS04 | U16 | 111,101 |
| 74LS86 | U43 | 12,13,11 |
| 74LS08 | U58 | 12,13,11 |
| 74LS32 | U65 | 01,02,03 |
| 75452 | U68 | 101,02,031,106,07,061 |
| 74LS86 | U72 | 12,13,11 |
| 74LS273 | U73 | 101,02,03,041,110,11,12,091 |
| 74125 | U30 | 104,02,031,112,13,111 |
| 74LS14 | U1000 | 105,061,103,081,111,101,113,121 |
| 74LS04 | U36 | 11,10 |

D
B C B B B B B B B B

A91D7242601

REVISION
SHEETS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

TOLERANCES

M. STANBRIDGE

JFE

TELEX

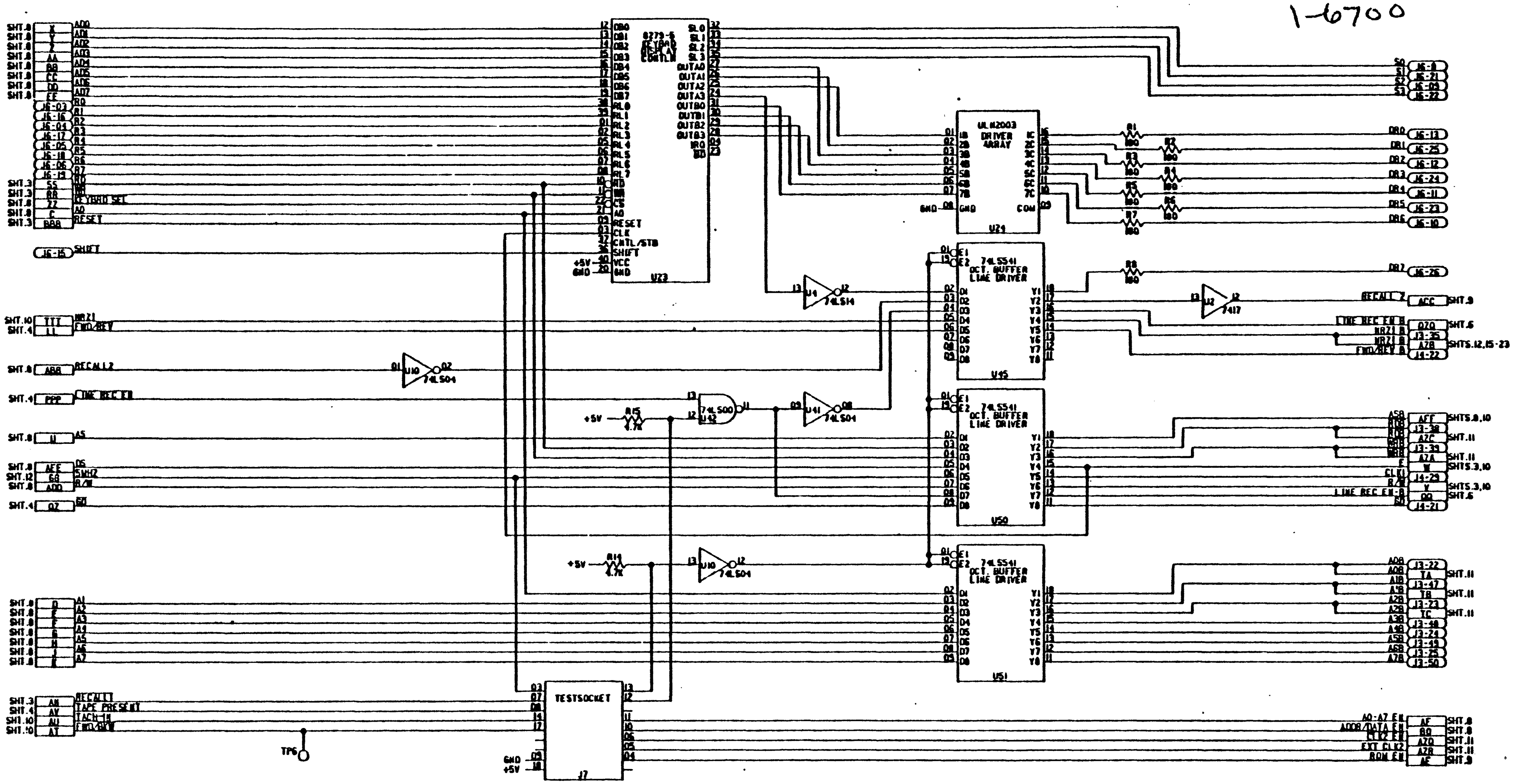
LOGIC DIAGRAM
I/O CONTROL & WRITE

E91D72406-01
9250
APPLICATION

D | 92D72406

NONE
1 OF 23

1-6700




| A | REL PER ERO 512-105 | 2-14-5 |
|---|---|---|

TOLERANCES

M.STANDRIDGE 1-10-5

TELEX

LOGIC DIAGRAM
I/O CONTROL & WRITE

SEE SHT 1 | 9250

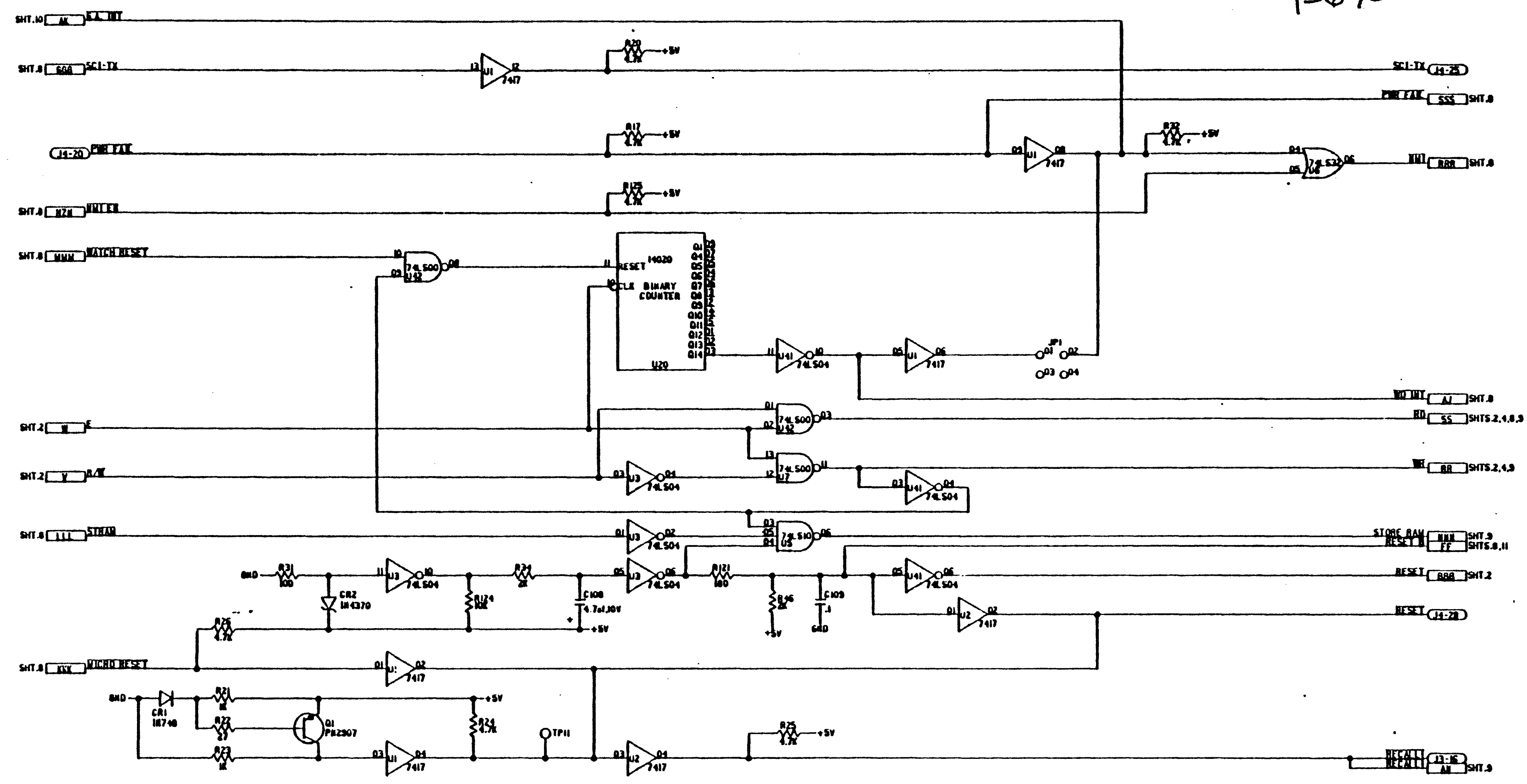
APPLICATION

D | 92D72406

SCALE NONE | SHEET 2 OF 23

| LTR | DESCRIPTION | DATE | APP. |
|---|---|---|---|
| A | REL PER ECO 513-105 | 2-14-5 | JEC |

1-6700




| TOLERANCES | DRAWN | DATE |
|---|---|---|
| | M.STANDRIDGE | 1-18-5 |
| | CHECKED JEC | 2-14-5 |
| | APPROVED | 2-14-5 |

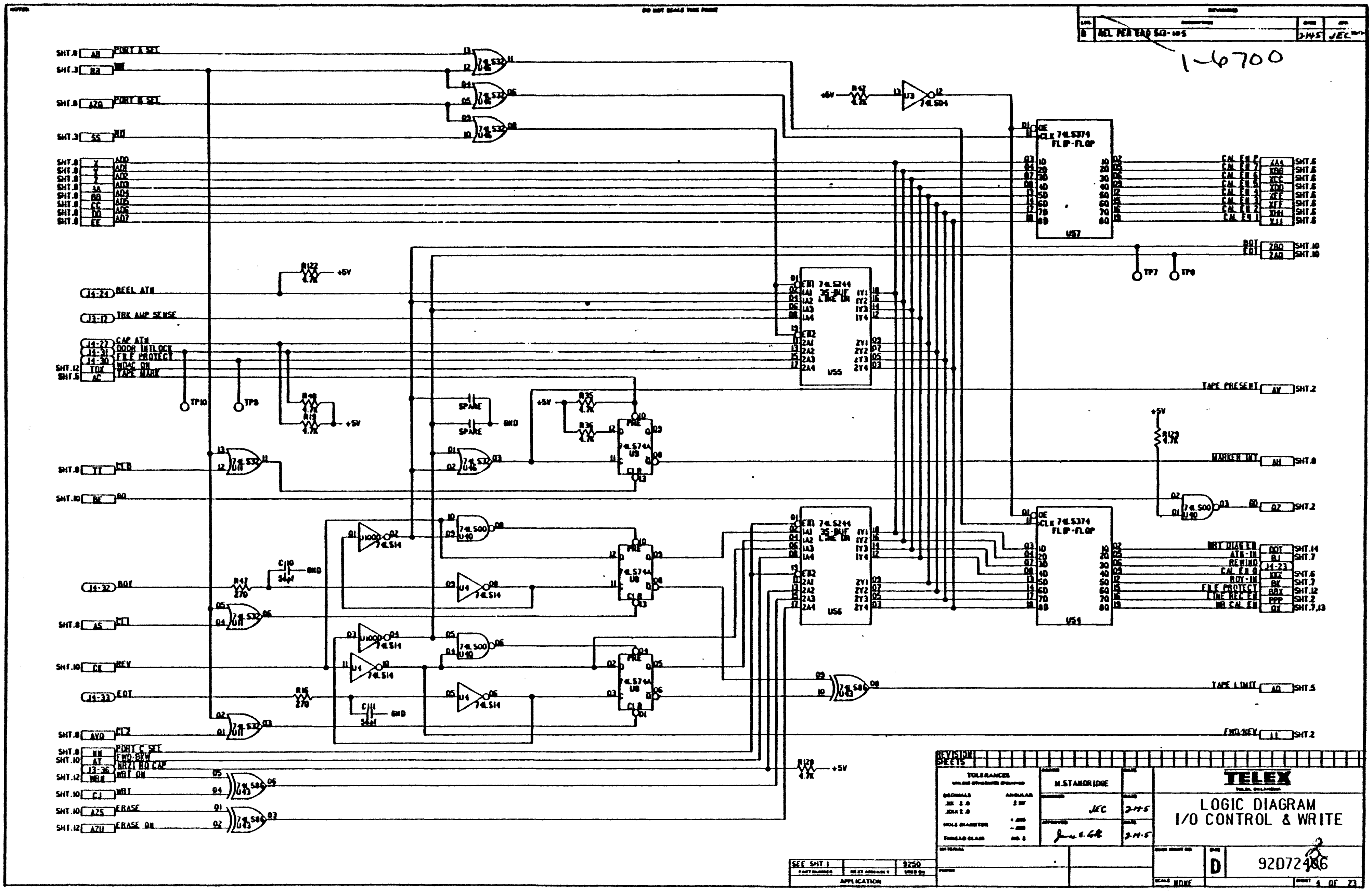
SEE SHT.1 | 9250
APPLICATION

**TELEX**

# LOGIC DIAGRAM I/O CONTROL & WRITE

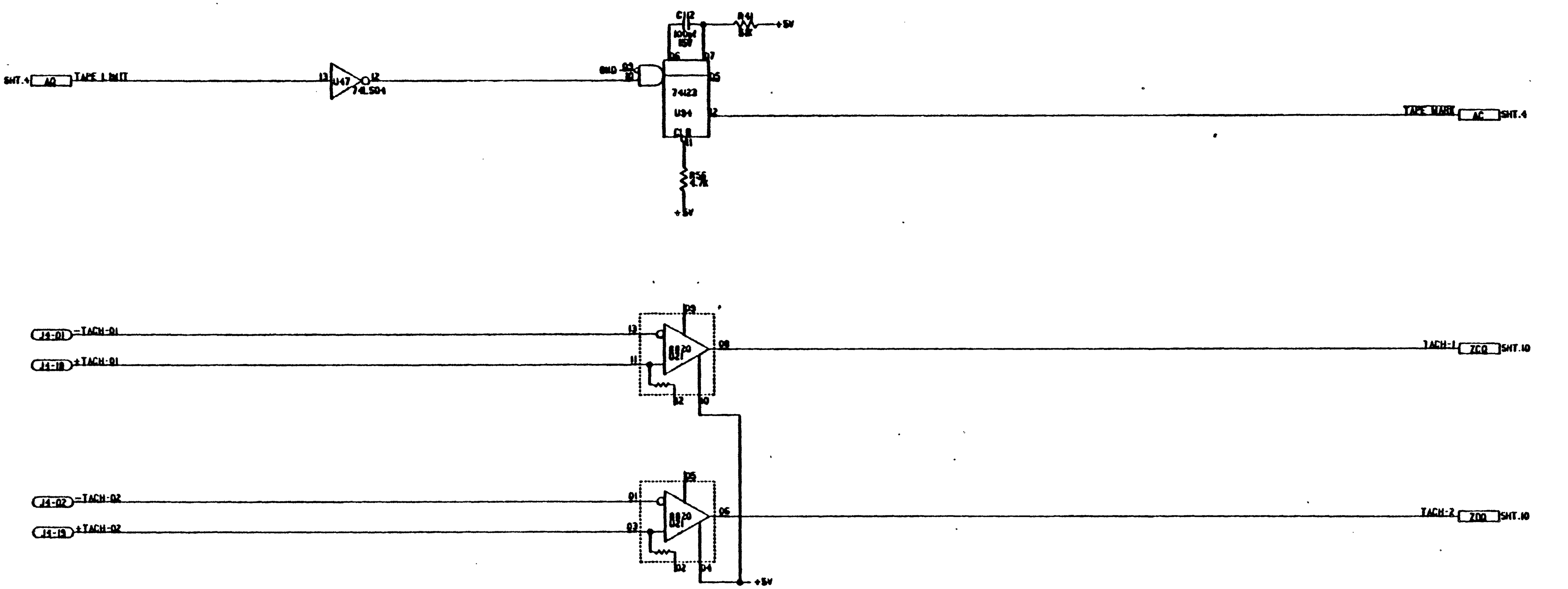
SIZE D | 92D72406

SCALE NONE | SHEET 2 OF 23


1-6700
PORT A SEL
PORT B SEL
REEL ATN
TRK AMP SENSE
CAP ATN
DOOR INTLOCK
FILE PROTECT
WDAC ON
TAPE MARK
BOT
EOT
REV
PORT C SEL
FWD-REW
WRT ON
WRT
ERASE
ERASE ON
74LS374 FLIP-FLOP
74LS244 3S-BUF LINE DR
74LS74A
74LS32
74LS00
74LS14
74LS86
74LS04
U57
U55
U56
U54
TP7
TP8
TP9
TP10
TAPE PRESENT
MARKER INT
TAPE LIMIT
FWD/REV
WRT DIAGEN
ATN-IN
REWIND
RDY-IN
LINE REC EN
WR CAL EN
SPARE
GND
+5V
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
M.STANDRIDGE
TOLERANCES
SEE SHT 1
9250
APPLICATION
D
92D72406
NONE
4 OF 23

| LTR | DESCRIPTION | DATE | APP |
|---|---|---|---|
| A | REL PER ERO 513-106 | 2-14-5 | JEC |

1-6700




REVISION
SHEETS

TOLERANCES

M.STANDRIDGE 1-18-5

JEC 2-14-5

2-14-5

TELEX

# LOGIC DIAGRAM
# I/O CONTROL & WRITE

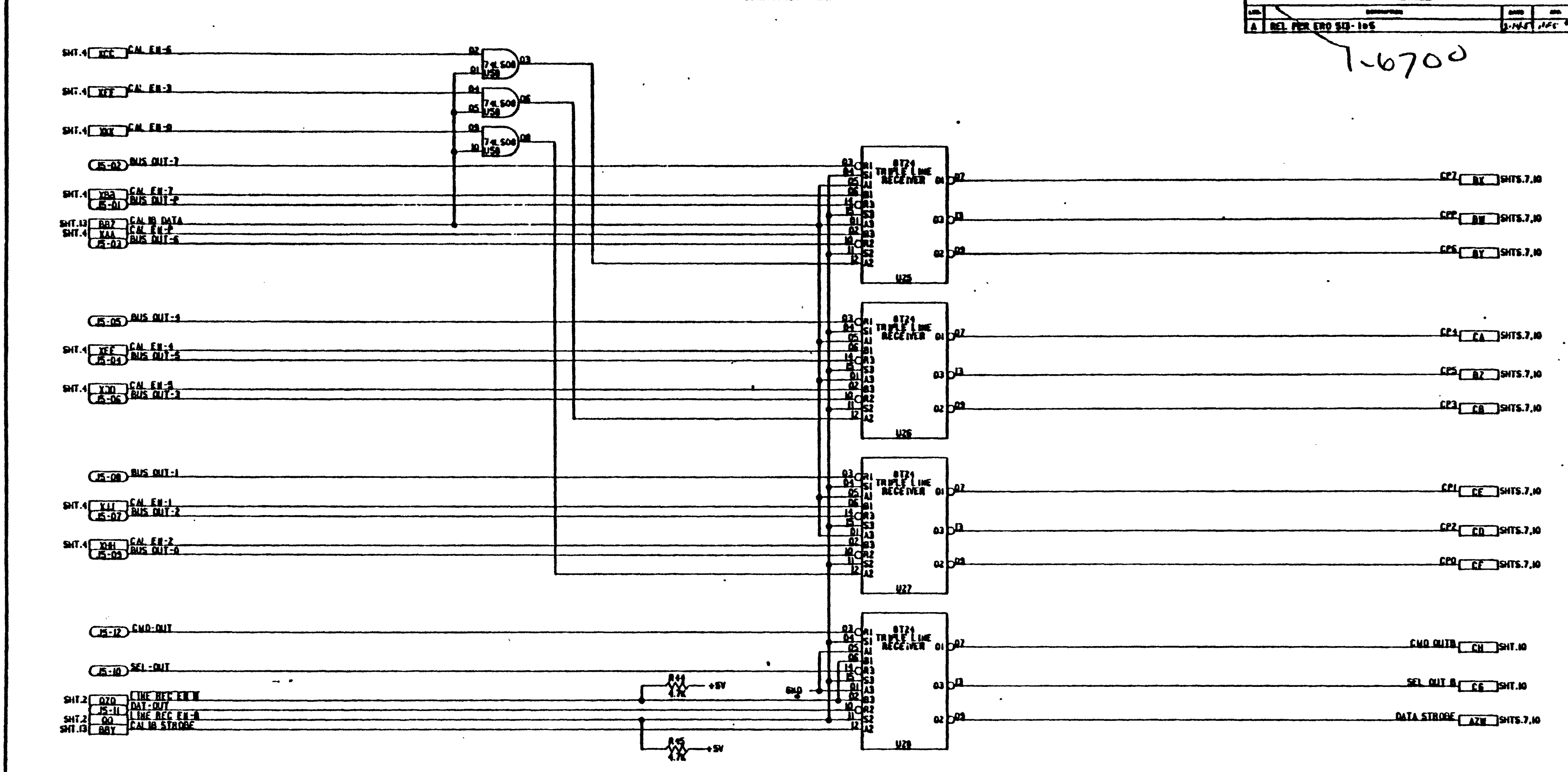
SEE SHT 1 | 8250

APPLICATION

D 92D724R6

SCALE NONE

SHEET 5 OF 23




1-6700

M.STANDRIDGE 1-10-5

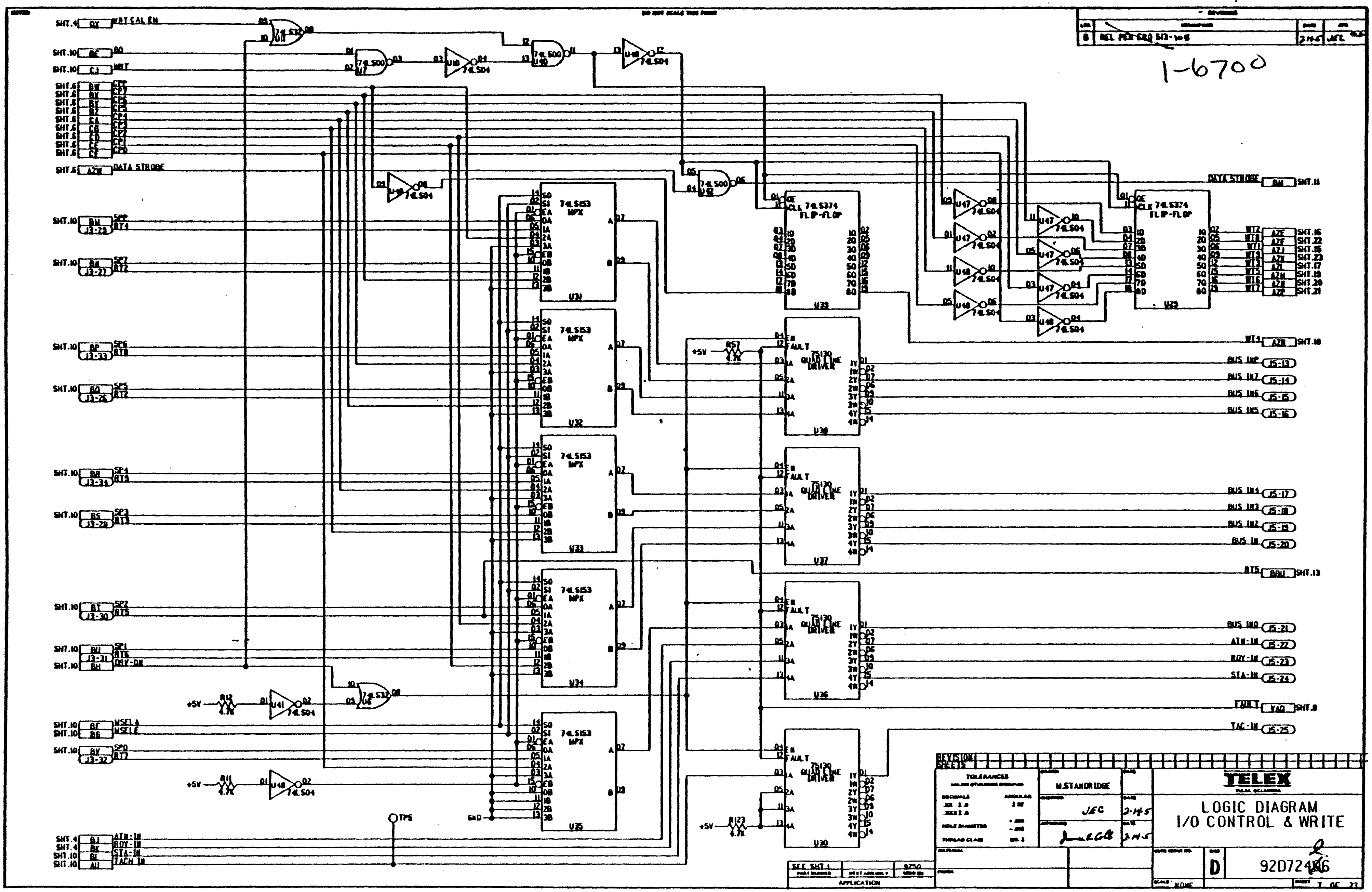
JEC 2-14-5

TELEX

LOGIC DIAGRAM
I/O CONTROL & WRITE

D 92D72406

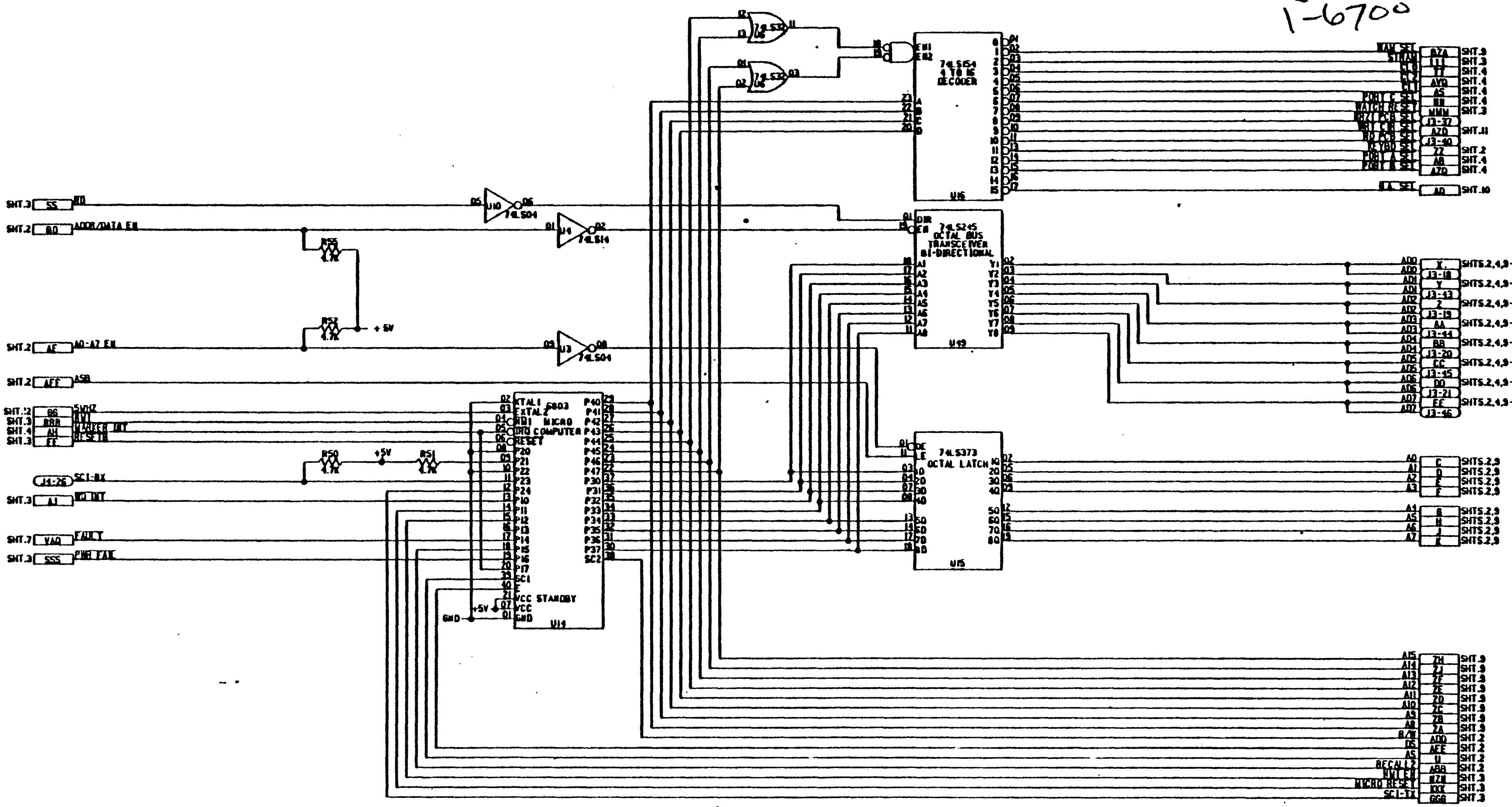
SHEET 6 OF 23


1-6700
LOGIC DIAGRAM
I/O CONTROL & WRITE
TELEX
M. STANDRIDGE
92D72416
D
NONE
7 OF 23
SEE SHT 1
APPLICATION
DATA STROBE
74LS153 MPX
74LS374 FLIP-FLOP
75130 QUAD LINE DRIVER
74LS04
74LS00
74LS32
BUS IN7
BUS IN6
BUS IN5
BUS IN4
BUS IN3
BUS IN2
BUS IN1
BUS IN0
ATN-IN
RDY-IN
STA-IN
TAC-IN
FAULT
WRT CAL EN
MSELA
MSELB
TACH IN
TP5
GND

DO NOT SCALE THIS PRINT

| LTR | DESCRIPTION | DATE | APR |
| --- | --- | --- | --- |
| A | REL PER ERO 513-105 | 2-14-5 | JEC |

1-6700




TOLERANCES

| M.STANDRIDGE | 1-18-5 |
| --- | --- |
| JEC | 2-14-5 |
| James E. Gill | 2-14-5 |

TELEX

# LOGIC DIAGRAM I/O CONTROL & WRITE

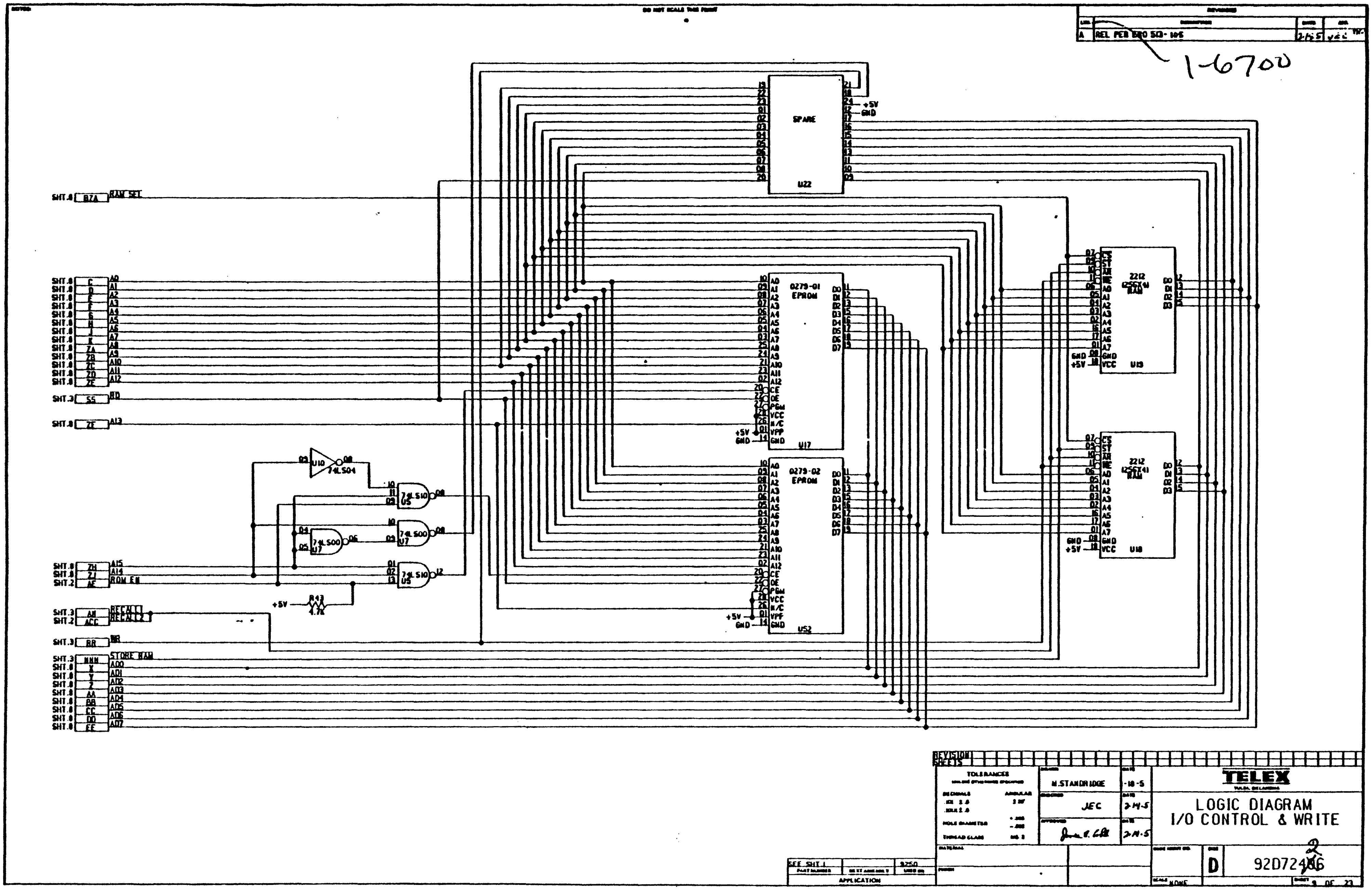
D 92D72416

SEE SHT 1 | 9250

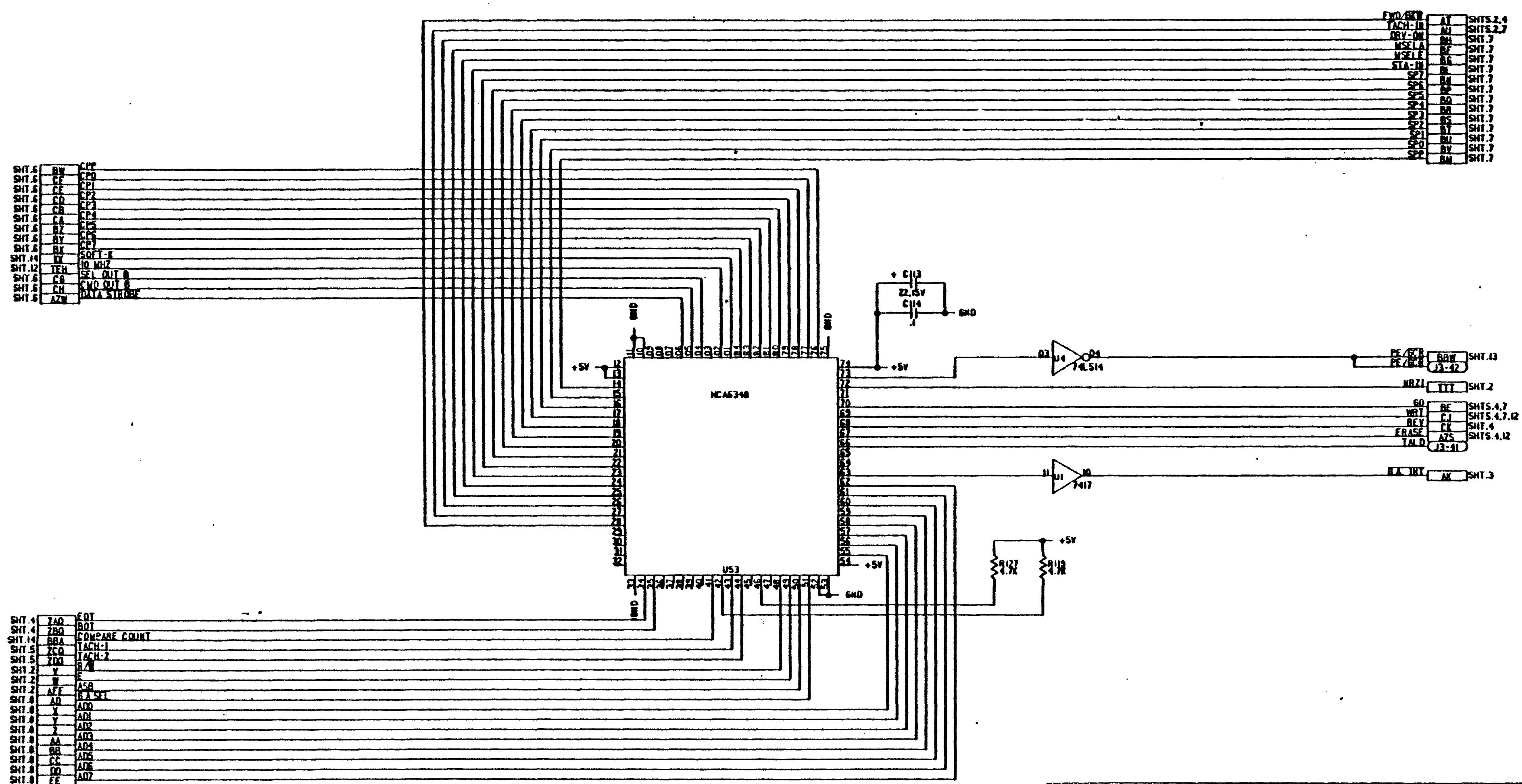
APPLICATION

SCALE NONE

SHEET 8 OF 23



DO NOT SCALE THIS PRINT
REL PER ERO SCI-106
1-6700
SPARE
U22
0279-01
EPROM
U17
0279-02
EPROM
U52
2212
(2567-4)
RAM
U19
U18
74LS04
74LS10
74LS00
R43
4.7K
+5V
GND
SHT.8 B7A RAM SET
SHT.3 S5 RD
SHT.8 ZF A13
SHT.8 ZH A15
SHT.8 ZJ A14
SHT.2 AF ROM EN
SHT.3 AH RECALL1
SHT.2 ACC RECALL2
SHT.3 RR WR
SHT.3 NNN STORE RAM
TOLERANCES
M.STANDRIDGE
JEC
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72416 2
SEE SHT 1
9250
APPLICATION
SCALE NONE
SHEET 9 OF 23




| TOLERANCES | DRAWN: M.STANDRIDGE | DATE: 1-18-5 |
|---|---|---|
| | CHECKED: JEC | 2-14-5 |
| | APPROVED | 2-14-5 |

**TELEX**

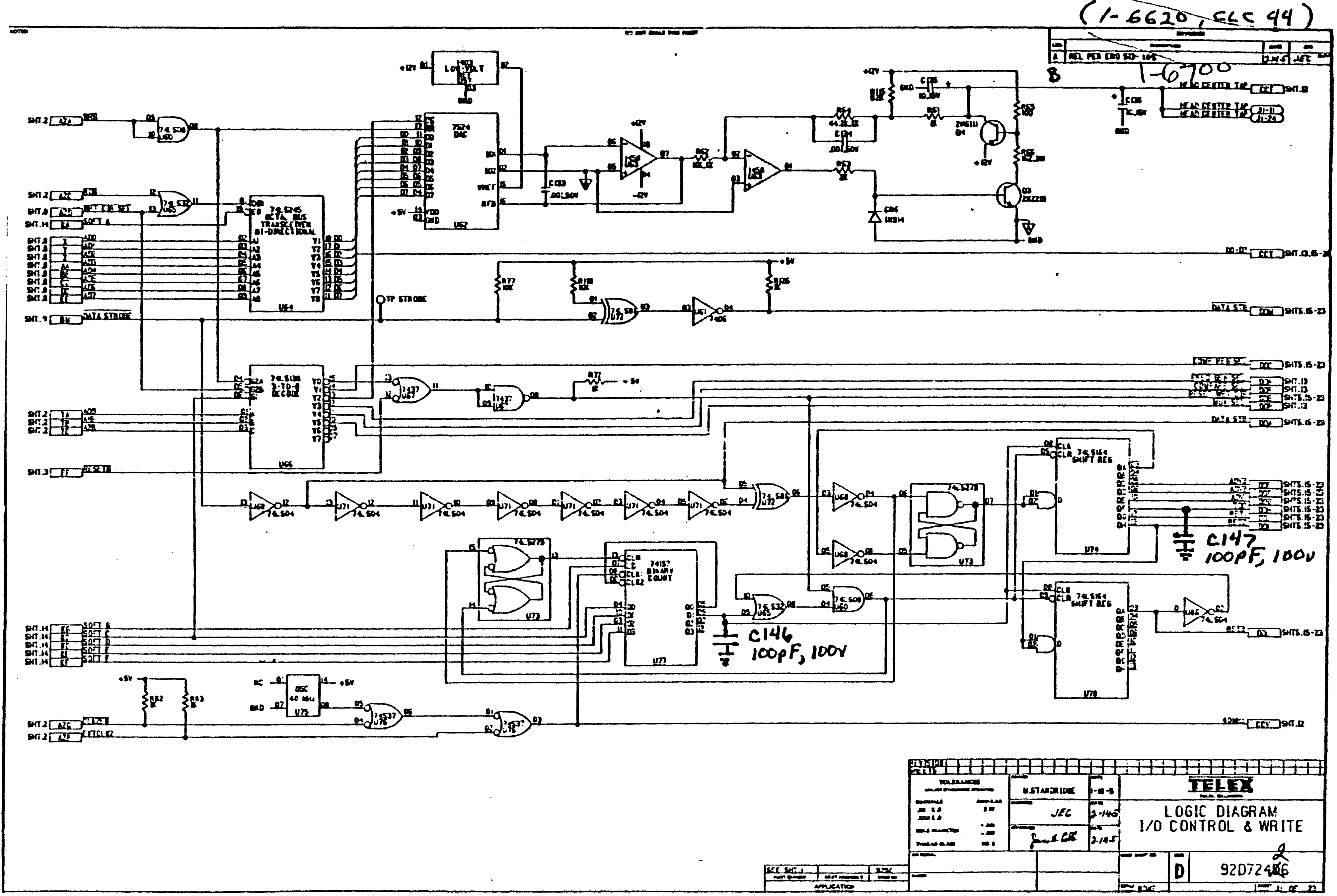
LOGIC DIAGRAM
I/O CONTROL & WRITE

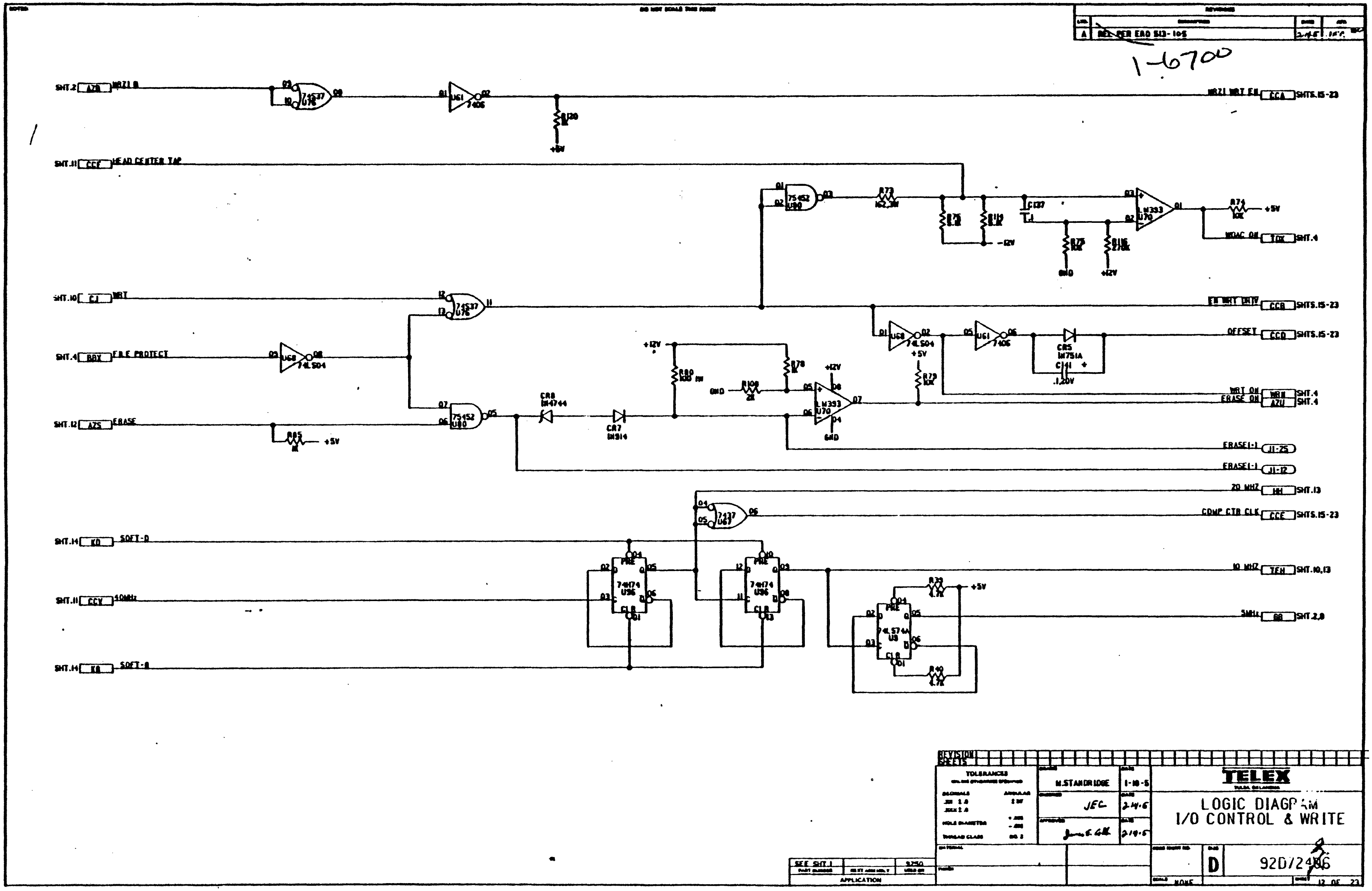
SIZE D 92D72406

SCALE NONE SHEET 10 OF 23

SEE SHT 1 | 3250

APPLICATION

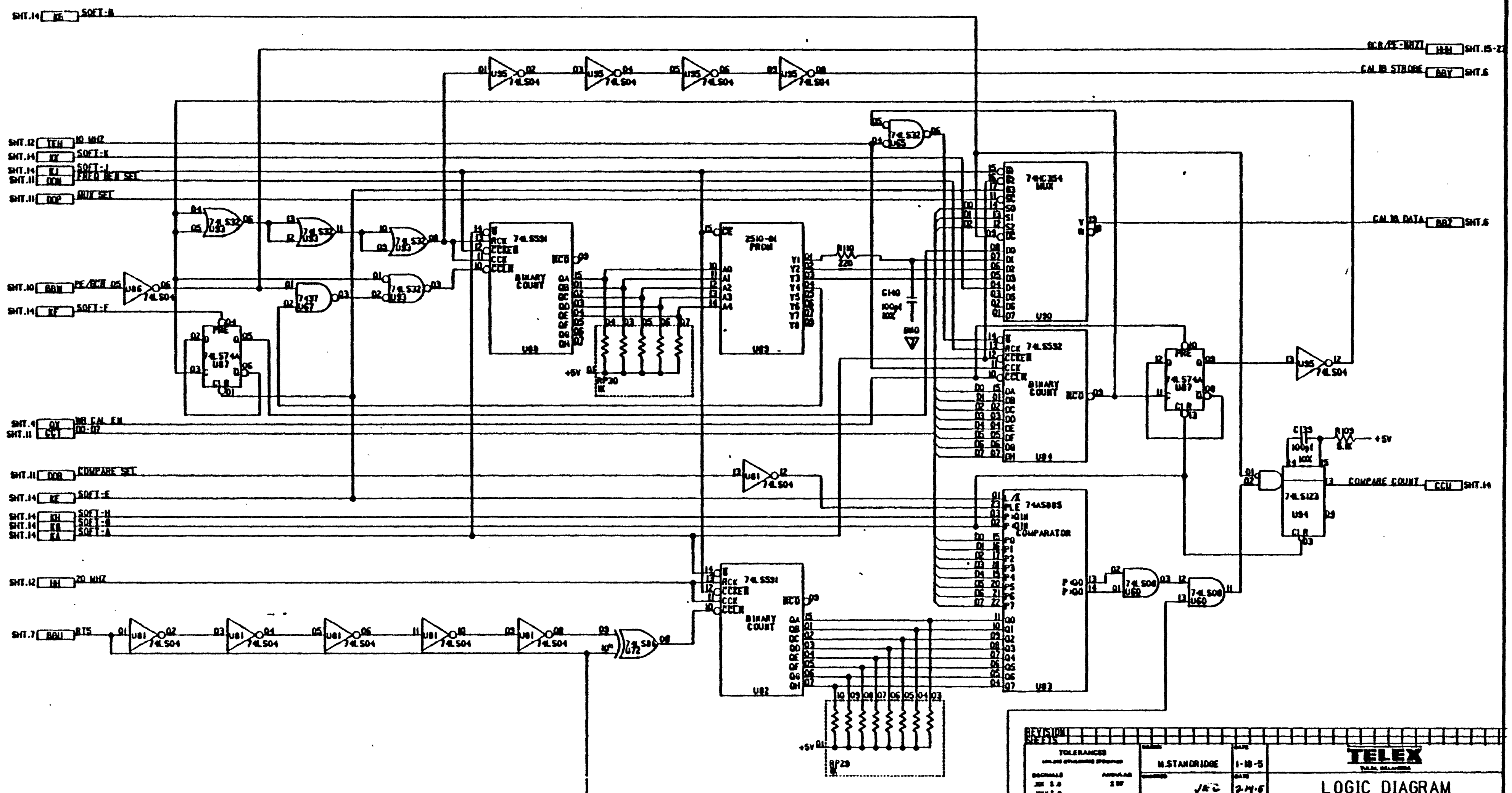

(1-6620, ELC 44)
1-6700
REL PER ERO
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D7242
M.STANDRIDGE
JEC
C146
100pF, 100V
C147
100pF, 100V
74LS245 OCTAL BUS TRANSCEIVER BI-DIRECTIONAL
7524 DAC
74LS138 3-TO-8 DECODE
74LS164 SHIFT REG
74193 BINARY COUNT
OSC 40 MHz
LOW VOLT
DATA STROBE
TP STROBE
HEAD CENTER TAP
SOFT A
SOFT B
SOFT C
SOFT D
SOFT E
SOFT F
RESET
EXTCLK2
+5V
+12V
-12V
GND



DO NOT SCALE THIS PRINT
A REL PER EAO 513-105
1-6700
SHT.2 AZB NRZI B
74S37 U76
U61 7406
R120 1K
+5V
NRZI WRT EN CCA SHTS.15-23
SHT.11 CCF HEAD CENTER TAP
75452 U80
R73 162.3H
R76
R115
-12V
C137
LM393 U70
R74 10K
+5V
WDAC ON TDX SHT.4
R75 10K
R116 270K
GND
+12V
SHT.10 CJ WRT
74S37 U76
EN WRT DRIV CCB SHTS.15-23
SHT.4 BBX FILE PROTECT
U68 74LS04
U61 7406
CR5 1N751A
C141 .1,20V
OFFSET CCD SHTS.15-23
R80 100 1W
R78 1K
R108 2K
R79 10K
WRT ON WRN SHT.4
ERASE ON AZU SHT.4
SHT.12 AZS ERASE
75452 U80
CR8 1N4744
CR7 1N914
R85 1K
ERASE(-) J1-25
ERASE(-) J1-12
20 MHZ HH SHT.13
7437 U67
COMP CTR CLK CCE SHTS.15-23
SHT.14 KD SOFT-D
PRE
74H74 U96
CLR
10 MHZ TEH SHT.10,13
SHT.11 CCY 40MHz
R39 4.7K
74LS74A U8
5MHz GB SHT.2,8
R40 4.7K
SHT.14 KB SOFT-B
REVISION SHEETS
TOLERANCES
M.STANDRIDGE 1-10-5
JEC 2-4-5
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
SEE SHT 1
9250
APPLICATION
D
92D/2486
NONE
12 OF 23

1-6700

| LTR | DESCRIPTION | DATE | APP |
| --- | --- | --- | --- |
| A | REL PER ERO 513-106 | 2-14-6 | JFC |




TELEX

M.STANDRIDGE 1-18-5

LOGIC DIAGRAM
I/O CONTROL & WRITE

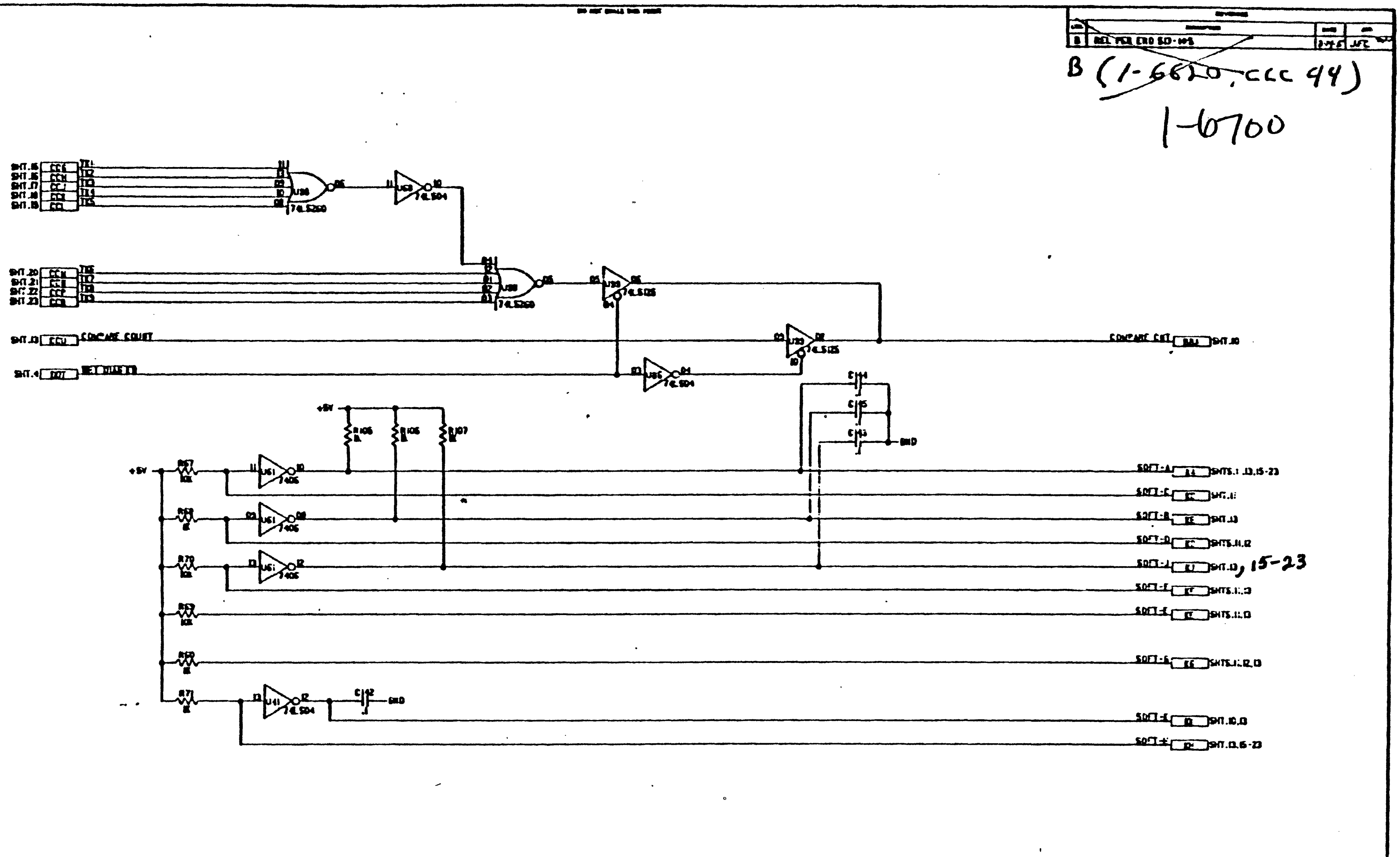
SEE SHT 1

APPLICATION

D 92D72406

SCALE NONE

SHEET 12 OF 22

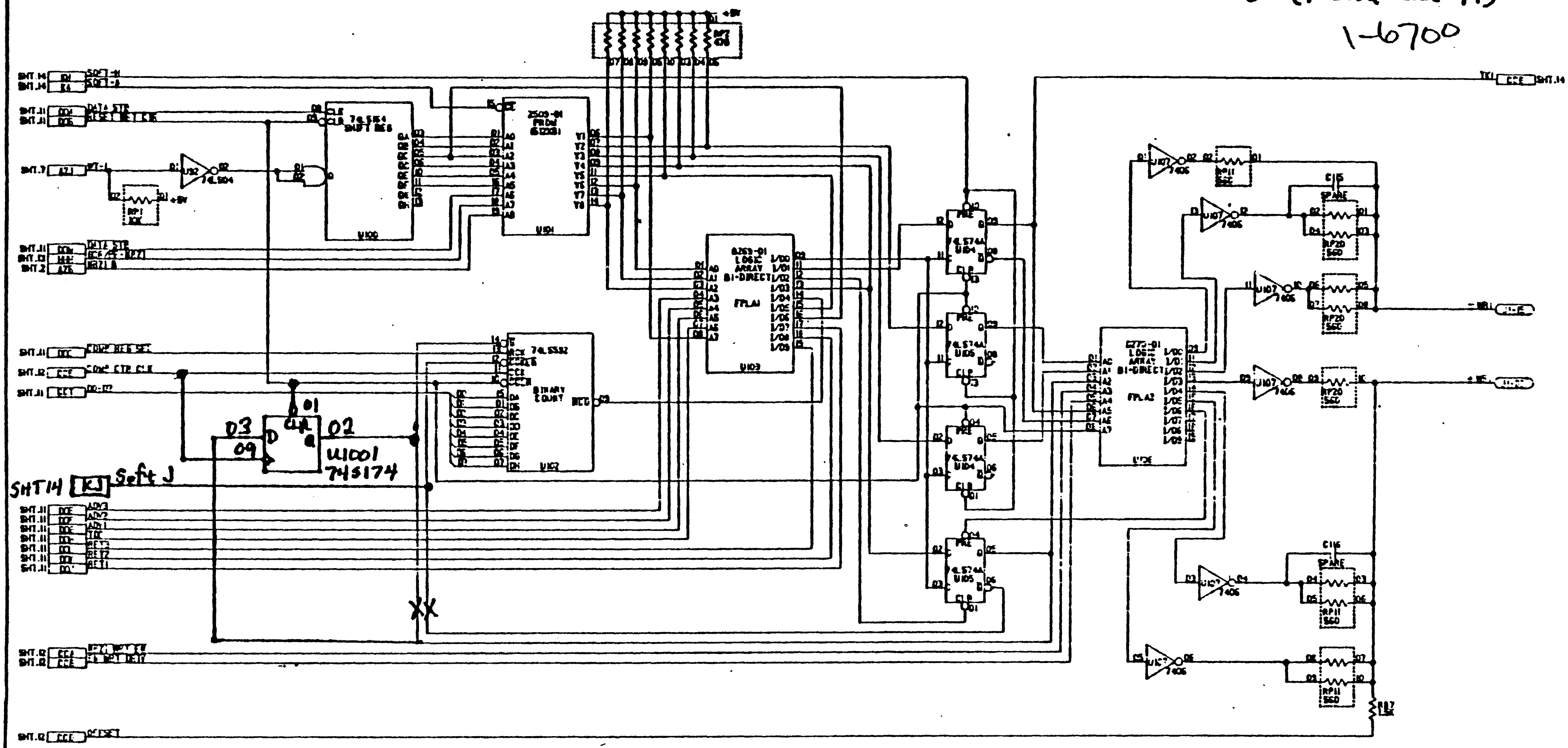



TELEX

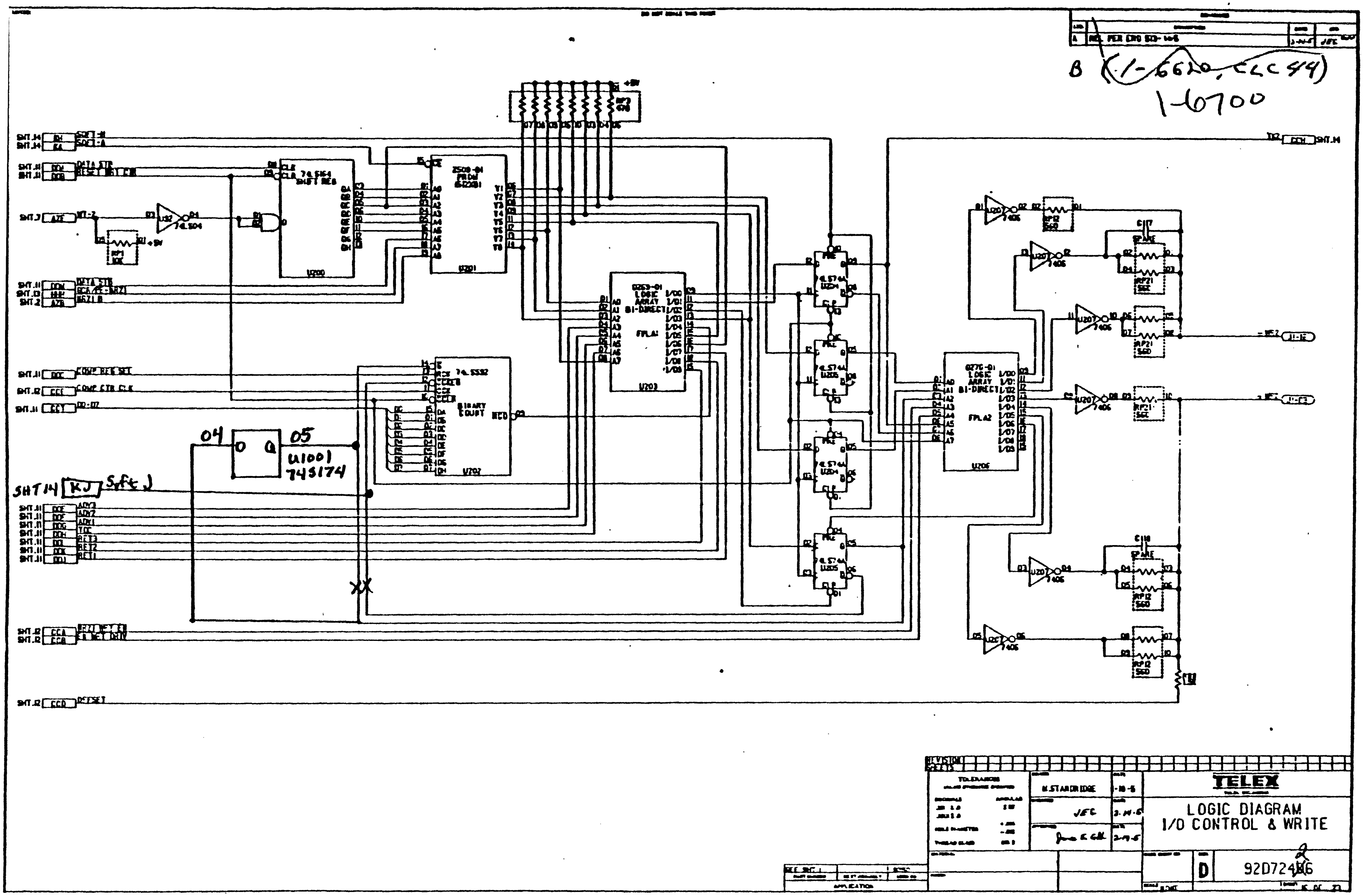
LOGIC DIAGRAM
I/O CONTROL & WRITE

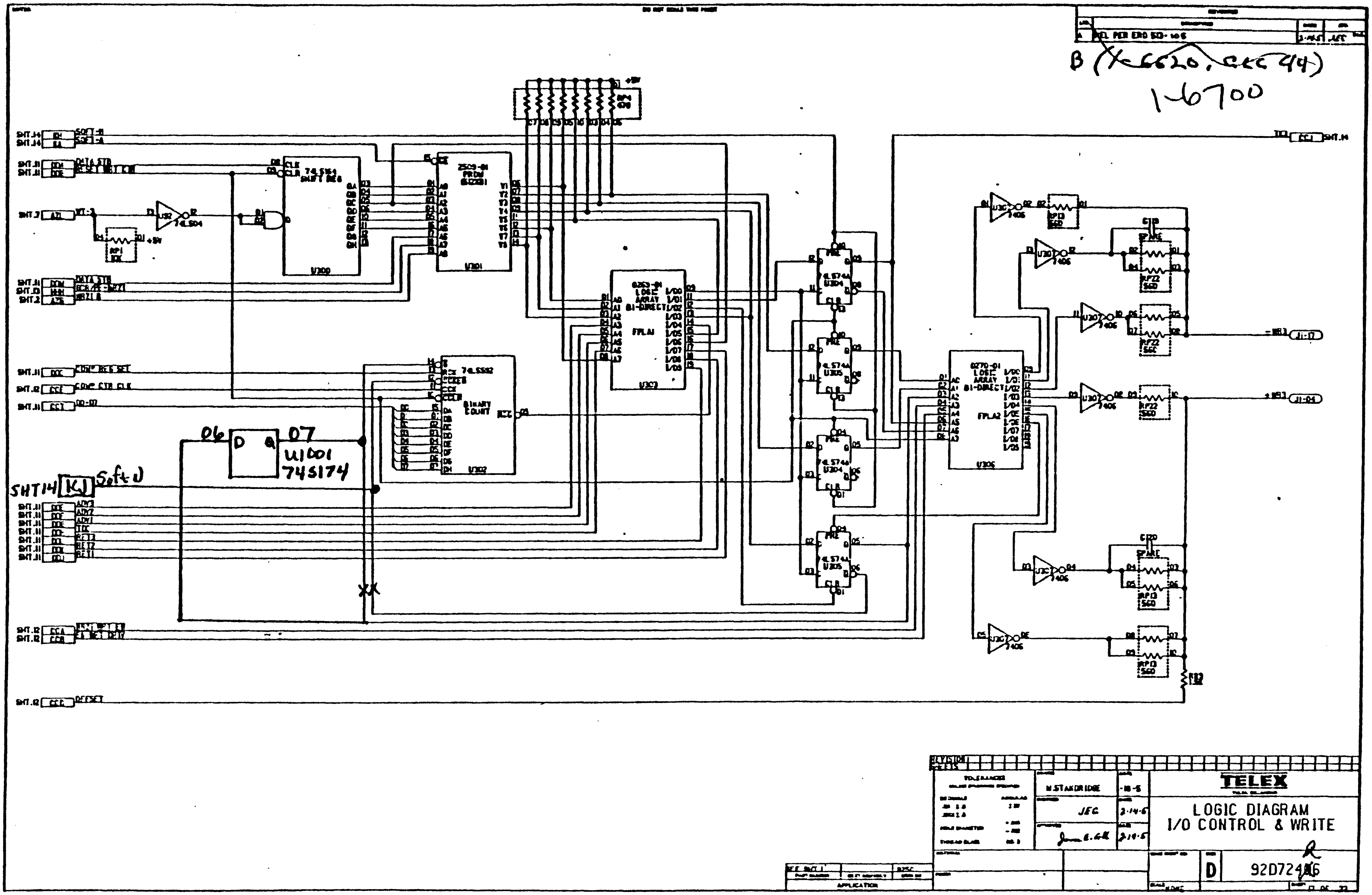
D 92D7246

B (1-6620 CLK-44)
1-6700

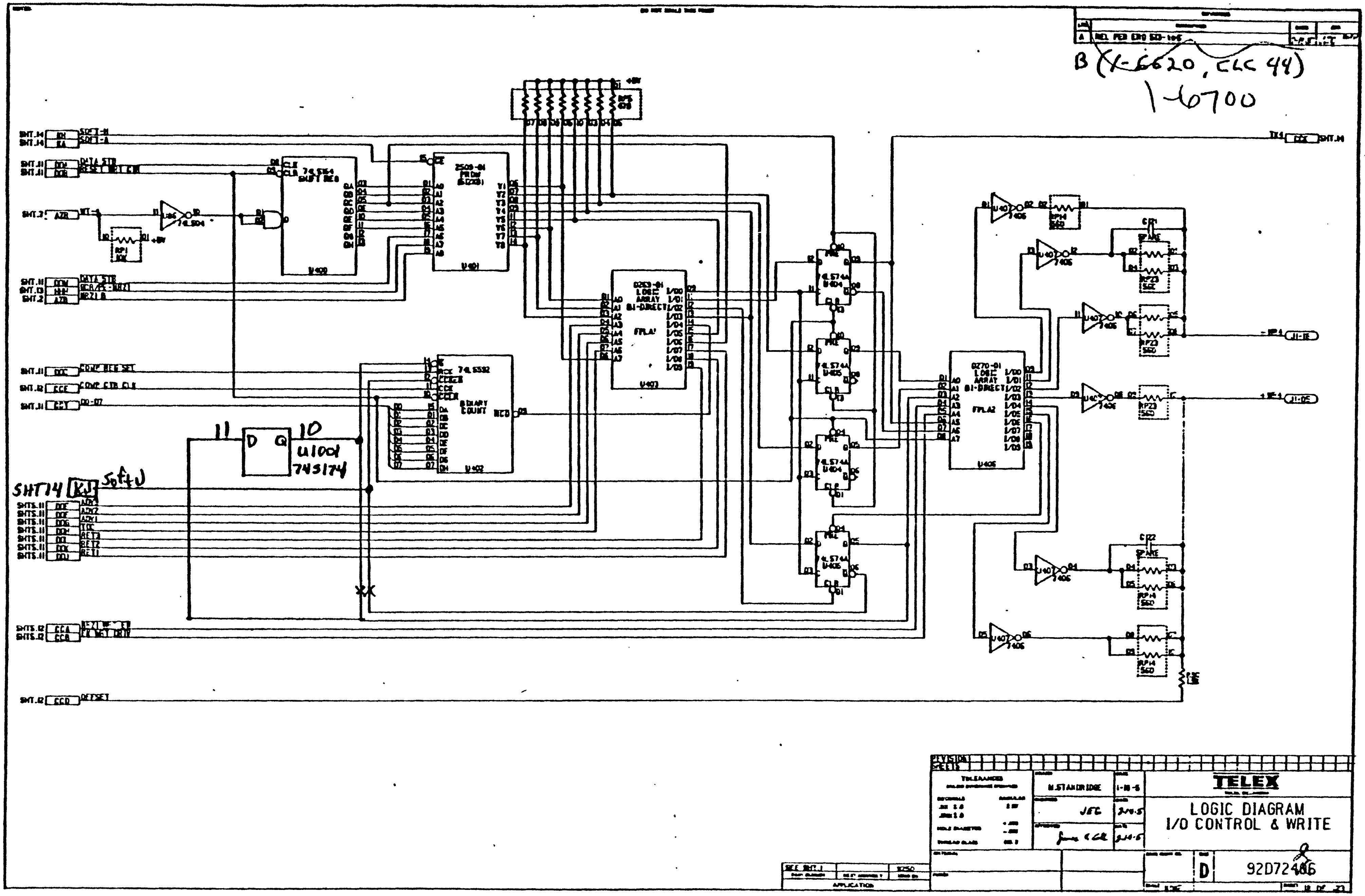


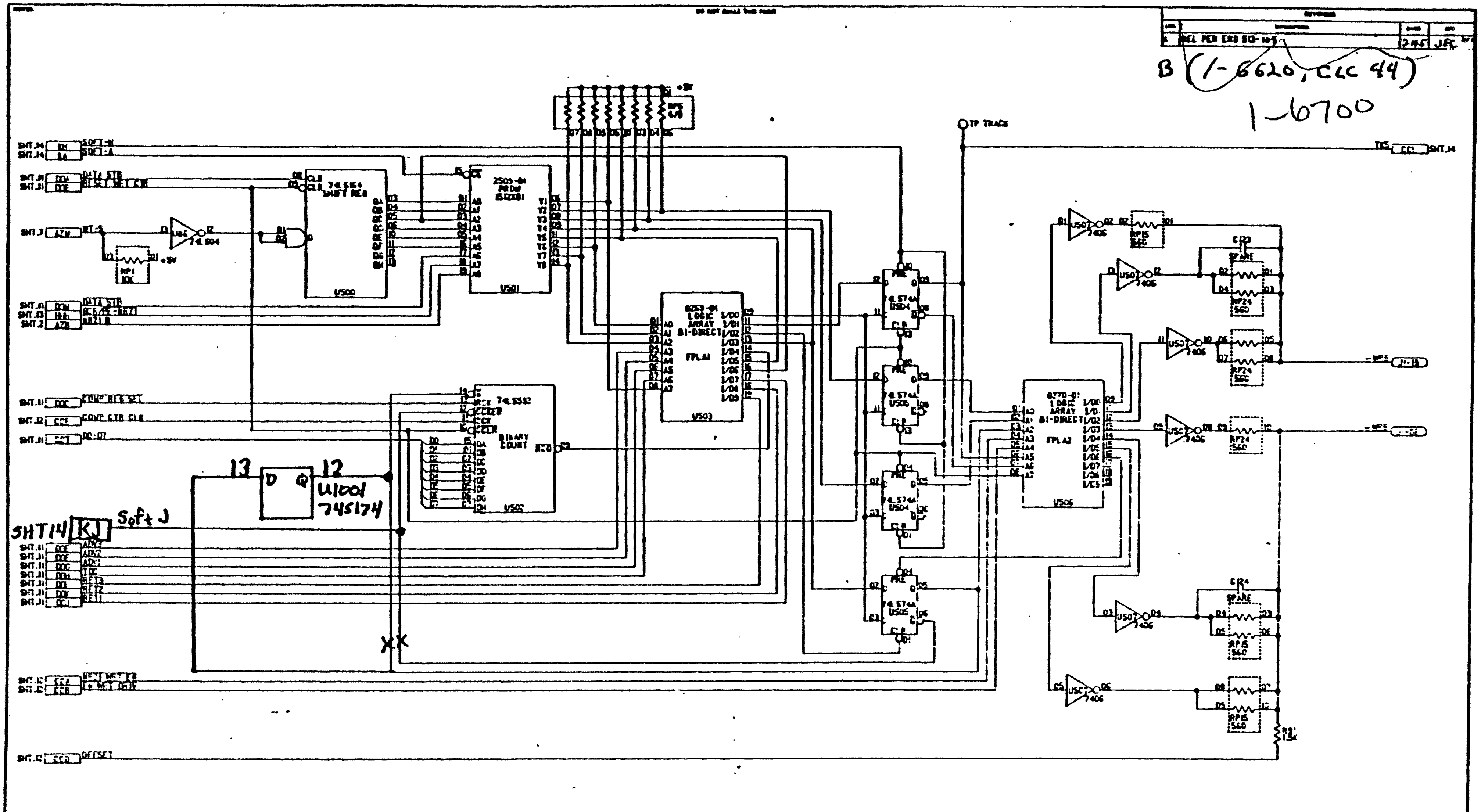

| TELEX |
|---|
| LOGIC DIAGRAM I/O CONTROL & WRITE |
| M.STANDRIDGE |
| JEC |
| D 92D72496 |


B (1-6620, CLC 44)
1-6700
74LS164
SHFT REG
U200
2508-01
PROM
U201
8253-01
LOGIC
ARRAY
BI-DIRECT
FPLA1
U203
74LS393
BINARY
COUNT
U202
8276-01
LOGIC
ARRAY
BI-DIRECT
FPLA2
U206
74LS74
7406
04
05
U1001
74S174
SHT14
KJ
Soft J
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D724



B (X-6620, ECC 44)
I-6700
SOFT-B
SOFT-A
DATA STB
RESET WRT CLR
DATA STB
COMP RES SET
COMP CTR CLK
SHT14 KJ Soft-U
D6
D7
D Q
U1001
74S174
74LS164 SHIFT REG
U300
2509-01 PROM
U301
74LS02 BINARY COUNT
U302
8263-01 LOGIC ARRAY BI-DIRECT FPLA1
U303
74LS74A
U304
U305
8270-01 LOGIC ARRAY BI-DIRECT FPLA2
U306
SPARE
OFFSET
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
M.STAKDRIDGE
JEC
D
92D7246


B (1-6620, CLC 44)
1-6700
74LS164 SHFT REG
U400
2509-01 PROM
U401
74LS592
BINARY COUNT
U402
FPLA1
U403
74LS74A
U404
U405
U406
FPLA2
U405
D Q
11
10
U1001
74S174
SHT14
KJ
Soft J
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72486
M.STANDRIDGE




TELEX

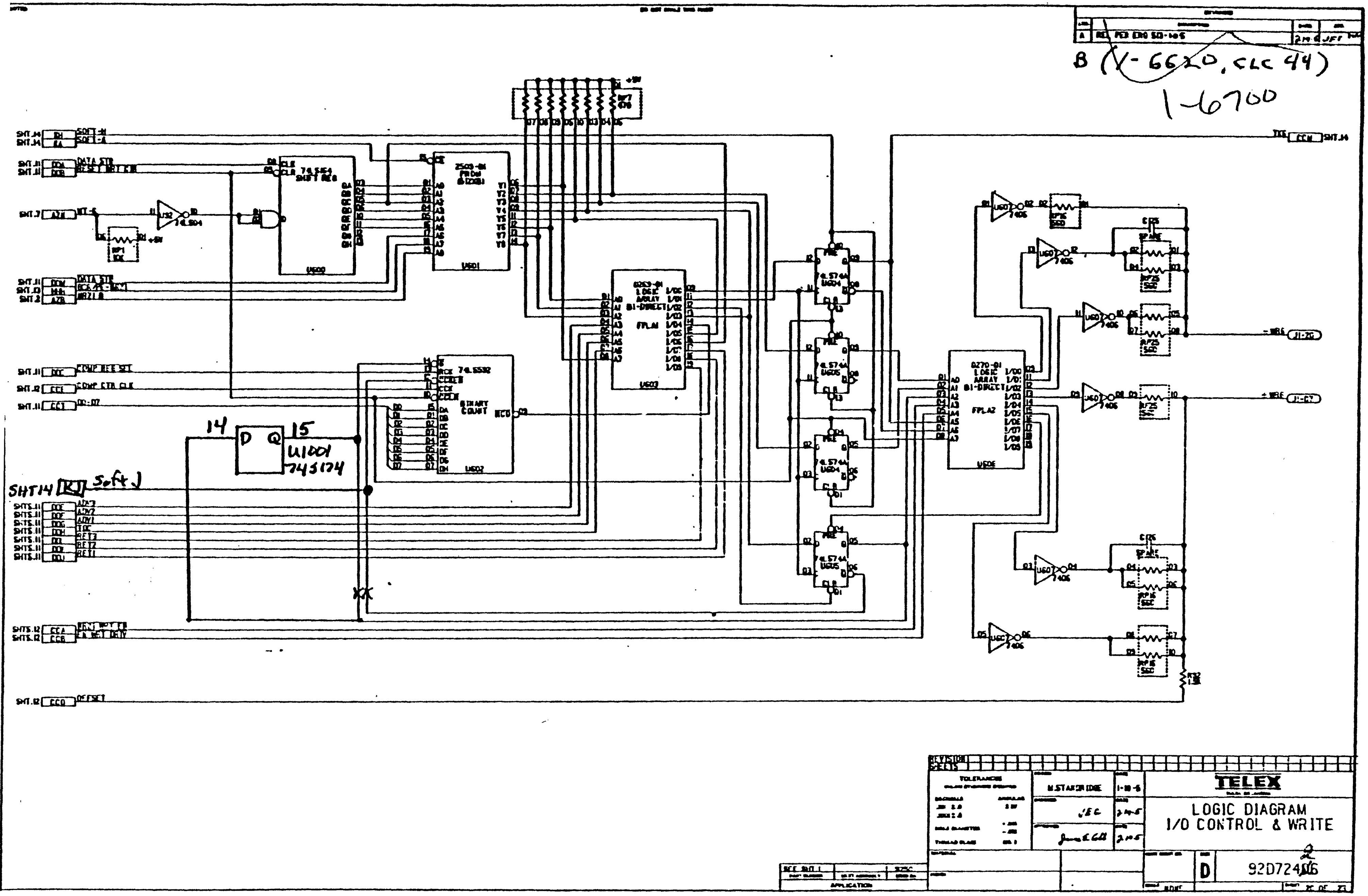
LOGIC DIAGRAM
I/O CONTROL & WRITE

M. STANDRIDGE

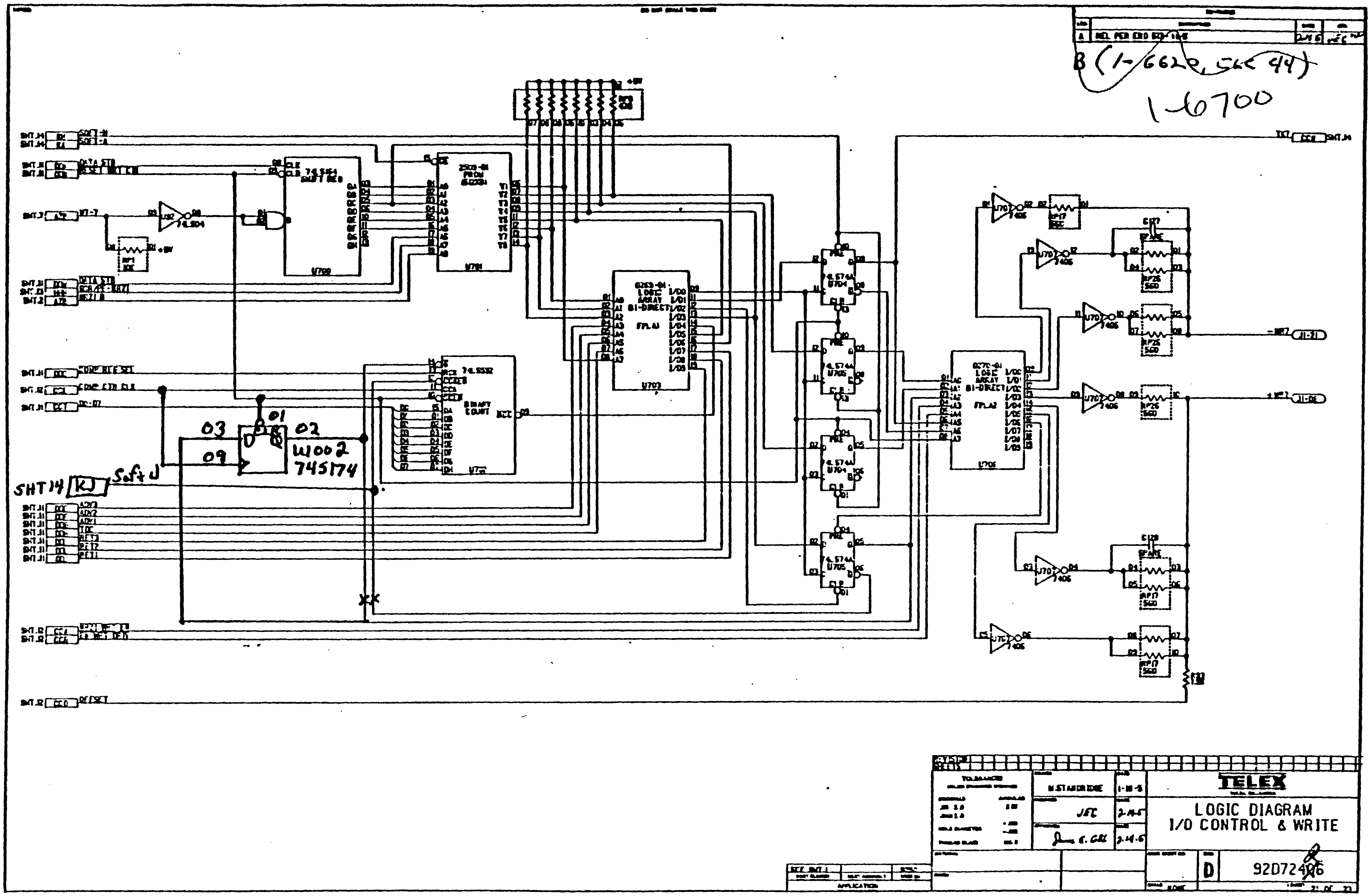
JEC

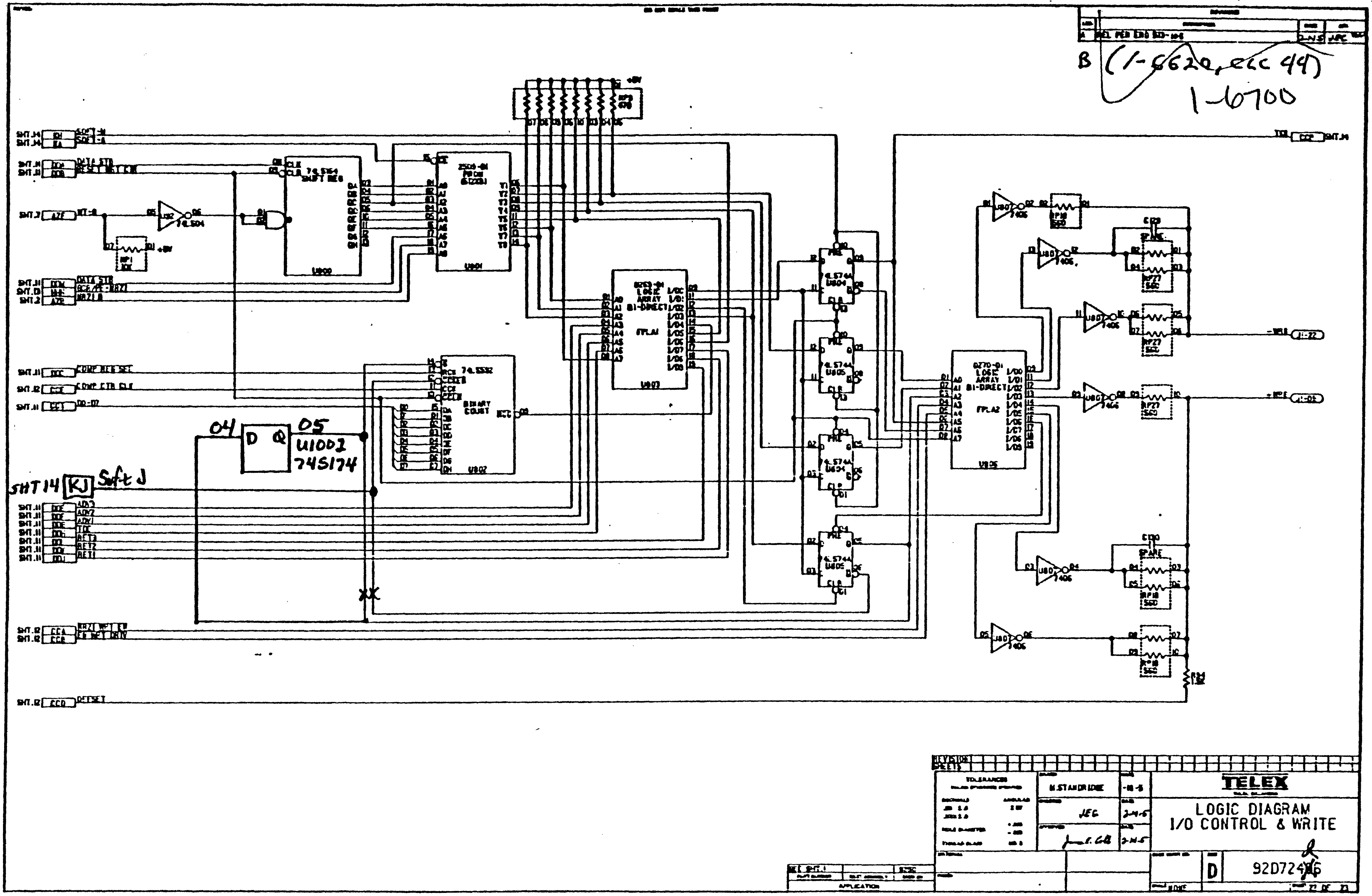
D

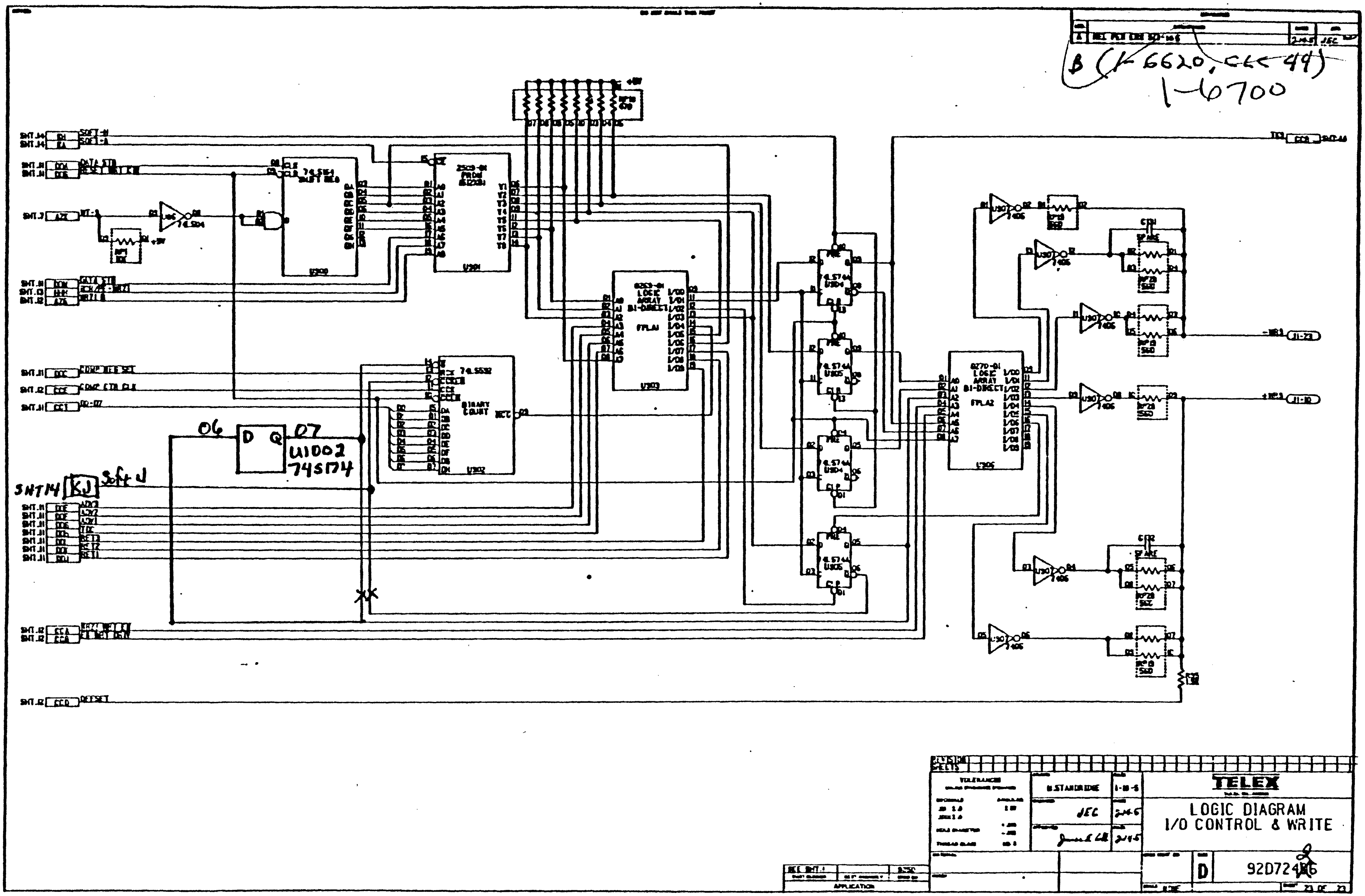
92D72406



B (1-6620, CLC 44)
1-6700
14
D Q
15
U1001
74S174
SHT14
Soft J
74LS164
SHIFT REG
U600
U601
U602
U603
74LS74A
U604
U605
7406
U607
FPLA1
FPLA2
LOGIC ARRAY BI-DIRECT
BINARY COUNT
DATA STB
COMP REF SET
OFFSET
+5V
J1-7G
J1-C7
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D7240


B (1-6620, SEE 44)
1-6700
74LS164 SHIFT REG
U700
2508-01 PROM
U701
8263-01 LOGIC ARRAY BI-DIRECT FPLA
U703
74LS74A
U704
U705
74LS592 8 BIT BINARY COUNT
827C-01 LOGIC ARRAY BI-DIRECT FPLA
U706
74LS04
7406
RP17
RP26
560
+5V
03
01
02
09
D
W002
74S174
SHT14
KJ
Soft J
-WRT
+WRT
OFFSET
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72406


B (1-5620, ecc 49)
1-6700
74LS164
SHIFT REG
U800
U801
U802
U803
U804
U805
74LS04
74LS393
BINARY COUNT
82S153
LOGIC ARRAY
BI-DIRECT
FPLA1
FPLA2
74LS74
7406
RP18
RP27
560
D
Q
04
05
U1002
74S174
SHT 14
KJ
Soft J
DATA STB
COMP REG SET
COMP CTR CLR
+5V
+WDE
J1-22
J1-02
TELEX
M. STANDRIDGE
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D724?6



B (I-6620, CLC 44)
I-6700
06
D Q
07
U1002
74S174
SHT14 KJ Soft J
74LS74A
U304
U305
8270-01 LOGIC ARRAY BI-DIRECT FPLA2
8269-01 LOGIC ARRAY BI-DIRECT FPLA1
U303
U306
74LS164 SHIFT REG
U300
U301
74LS592 BINARY COUNT
U302
TELEX
LOGIC DIAGRAM
I/O CONTROL & WRITE
D
92D72486
B.STANBRIDGE
JEC
APPLICATION

UNLESS OTHERWISE SPECIFIED

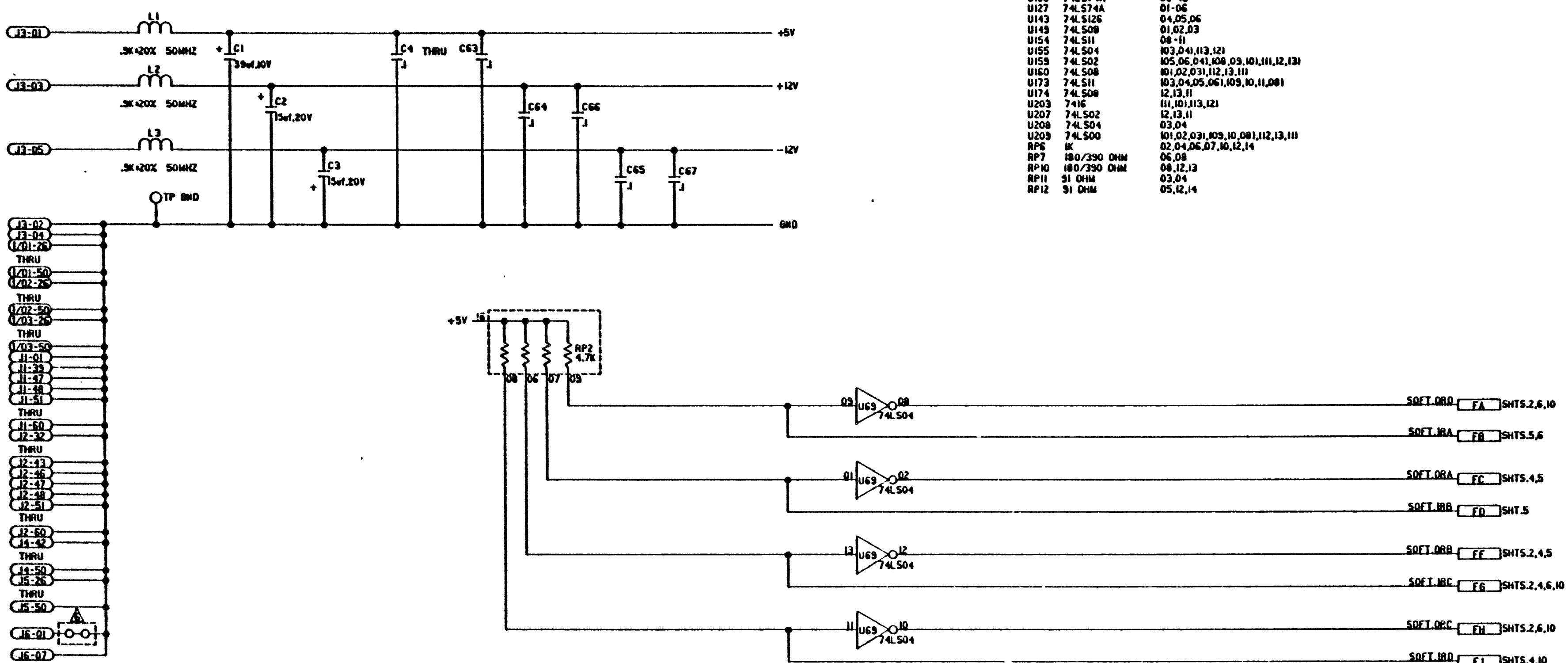
1. 14 PIN I.C. CONNECT PIN 07 TO GND
   CONNECT PIN 14 TO +5VDC.
2. 16 PIN I.C. CONNECT PIN 08 TO GND
   CONNECT PIN 16 TO +5VDC.
3. 20 PIN I.C. CONNECT PIN 10 TO GND
   CONNECT PIN 20 TO +5VDC.
4. ALL RESISTANCES ARE IN OHMS. ALL UNMARKED RESISTORS ARE 1/4 WATT, 5%.
   ALL RESISTORS MARKED 1% ARE 1/8 WATT.
5. ALL CAPACITANCES ARE IN MICROFARADS. ALL UNMARKED CAPACITORS ARE 50 VOLTS.
   ALL CAPACITORS MARKED 10% ARE 100 VOLTS.
6. JUMPERS ARE MADE IN ETCH ON THE CIRCUIT BOARD. (THESE ARE NOT COMPONENTS TO BE INSTALLED).
7. LOCATIONS SHOWN HAVE 24 PIN DIP INSTALLED INTO PINS 03-26 OF A 28 PIN SOCKET.
8. BOARDS BUILT ON "B-50" A/W HAVE PINS ON U152 AND U161-166 TIED TO +5V AND GND INSTEAD OF SOFT HIGH AND LOW.
9. -02 ASSY. (FC2303) WILL HAVE U87-11 DISCONNECTED FROM FFULL.0 AND CONNECTED TO FIFOMT.1 SEE SHEET 7

DO NOT SCALE THIS PRINT

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APP |
| P | REV PER DCN 1-6626-1 | 4-15-85 | |
| ~~B~~ | ~~REV PER DCN 1-6701-3~~ | 7-15-85 | RCF |

A Rel per ERO

| REF DESIG | | SPARE |
|---|---|---|
| U18 | MC1489 | 09,10,08 |
| U31 | 7416 | (03,04),(05,06),(09,08) |
| U66 | 74LS32 | 01,02,03 |
| U71 | 74AS00 | (09,10,08),(12,13,11) |
| U78 | 7416 | (01,02),(03,04),(11,10) |
| U86 | 74LS04 | (03,04),(11,10) |
| U88 | 74LS08 | 12,13,11 |
| U89 | 74LS27 | 01,02,13,12 |
| U91 | 74LS10 | 01,02,13,12 |
| U94 | 7414 | 09,08 |
| U103 | 74LS32 | (04,05,06),(09,10,08) |
| U105 | 74LS74A | 08-13 |
| U106 | 74LS74A | 08-13 |
| U127 | 74LS74A | 01-06 |
| U143 | 74LS126 | 04,05,06 |
| U149 | 74LS08 | 01,02,03 |
| U154 | 74LS11 | 08-11 |
| U155 | 74LS04 | (03,04),(13,12) |
| U159 | 74LS02 | (05,06,04),(08,09,10),(11,12,13) |
| U160 | 74LS08 | (01,02,03),(12,13,11) |
| U173 | 74LS11 | (03,04,05,06),(09,10,11,08) |
| U174 | 74LS08 | 12,13,11 |
| U203 | 7416 | (11,10),(13,12) |
| U207 | 74LS02 | 12,13,11 |
| U208 | 74LS04 | 03,04 |
| U209 | 74LS00 | (01,02,03),(09,10,08),(12,13,11) |
| RP6 | 1K | 02,04,06,07,10,12,14 |
| RP7 | 180/390 OHM | 06,08 |
| RP10 | 180/390 OHM | 08,12,13 |
| RP11 | 91 OHM | 03,04 |
| RP12 | 91 OHM | 05,12,14 |




REFERENCE DESIGNATION

| NOT USED | LAST USED |
|---|---|
| U20,46,80,97,101,102,104 112,117,118,120,139,141,144, 171,172,177-199,212. | U214 |
| | C95 |
| | R3 |
| C68-93 | CR8 |
| | L3 |
| RP9 | S4 |
| | J10 |
| | RP12 |

A A A A A A A A A A A A A A

| REVISION | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHEETS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

A91D72427-01

| PART NUMBER | NEXT ASSEMBLY | USED ON |
|---|---|---|
| ~~91D72373-02~~ | | |
| ~~91D72373-01~~ | | |
| ~~91D72373-02~~ | | |
| ~~91D72373-01~~ | | 9250 |

APPLICATION

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ±.0 .XXX ±.0 ANGULAR ±30
HOLE DIAMETER +.005 -.002
THREAD CLASS NO. 2

DRAWN J.W. WORDEN

CHECKED

APPROVED

MATERIAL

FINISH

TELEX
TULSA OKLAHOMA

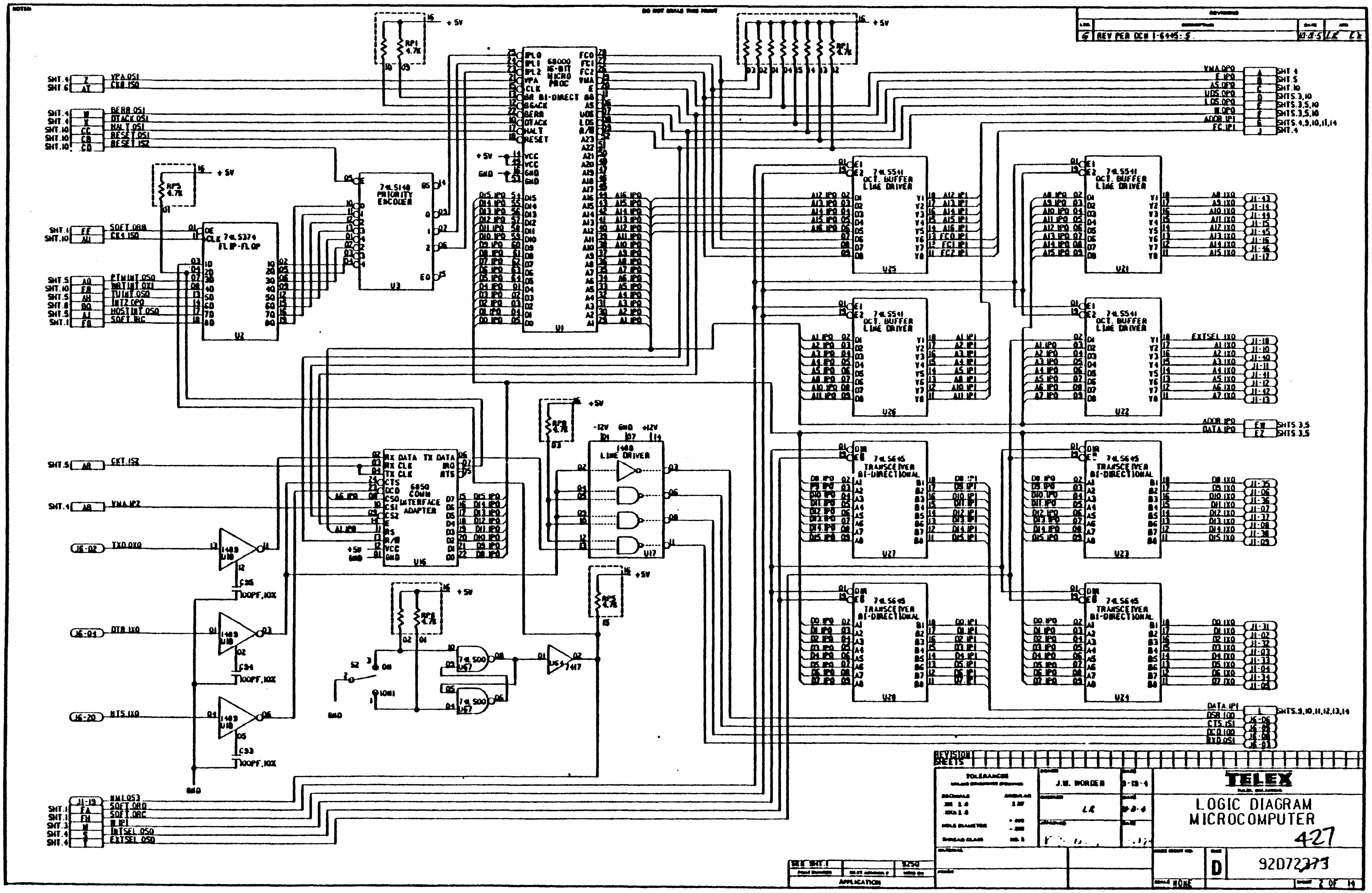
LOGIC DIAGRAM
MICROCOMPUTER

SIZE D

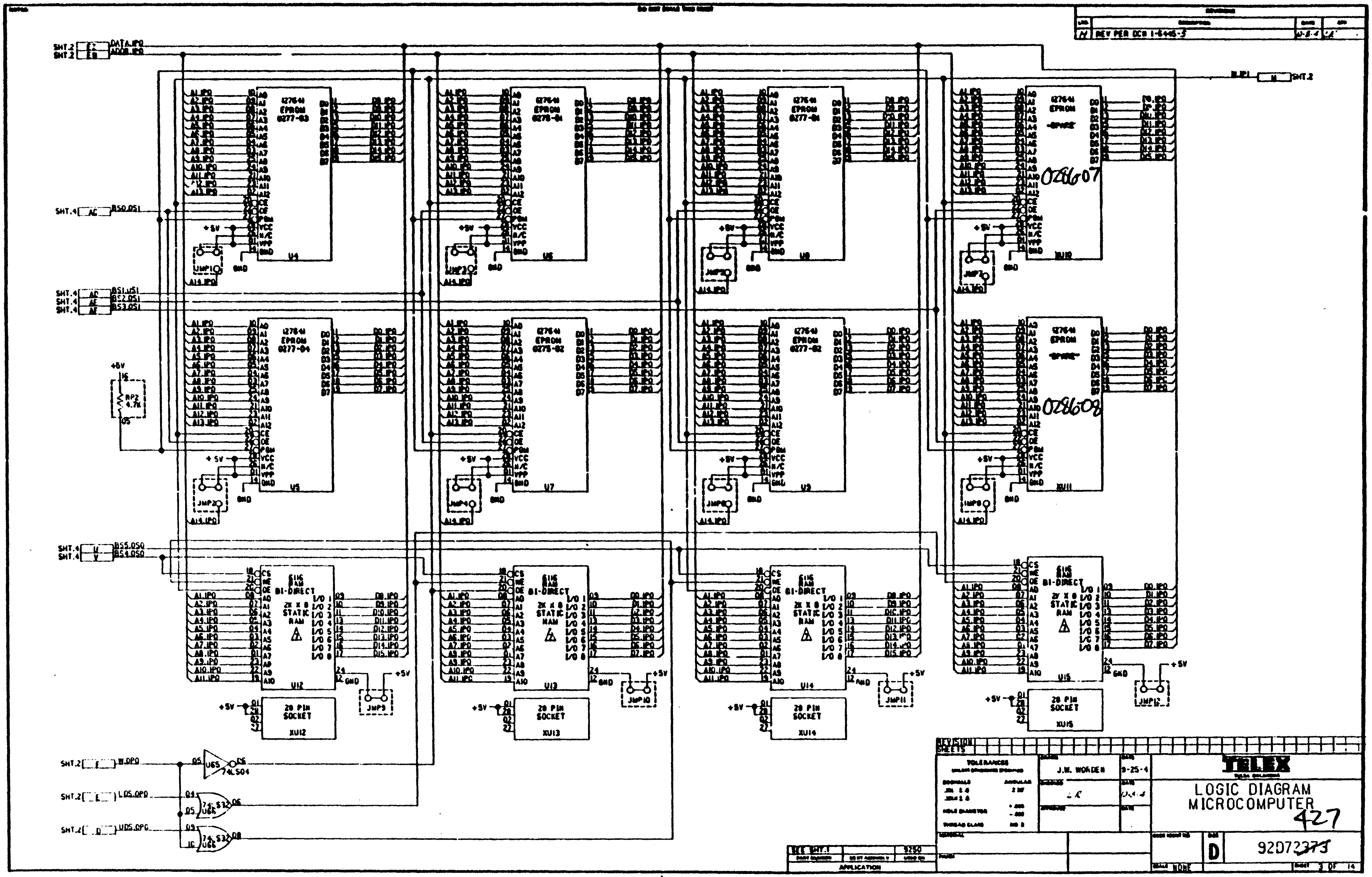
92D72~~373~~ 427

SCALE NONE

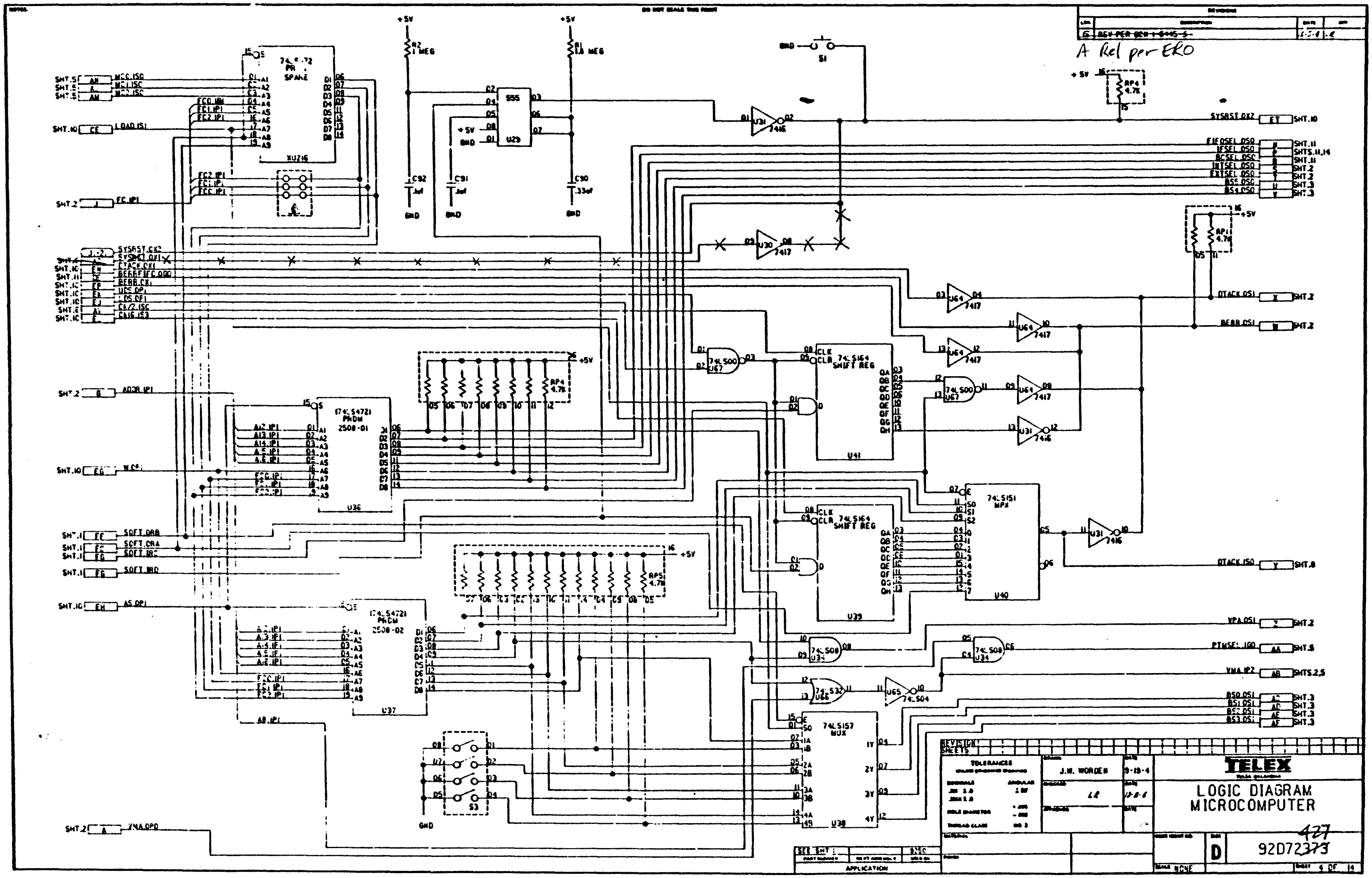
SHEET 1 OF 14



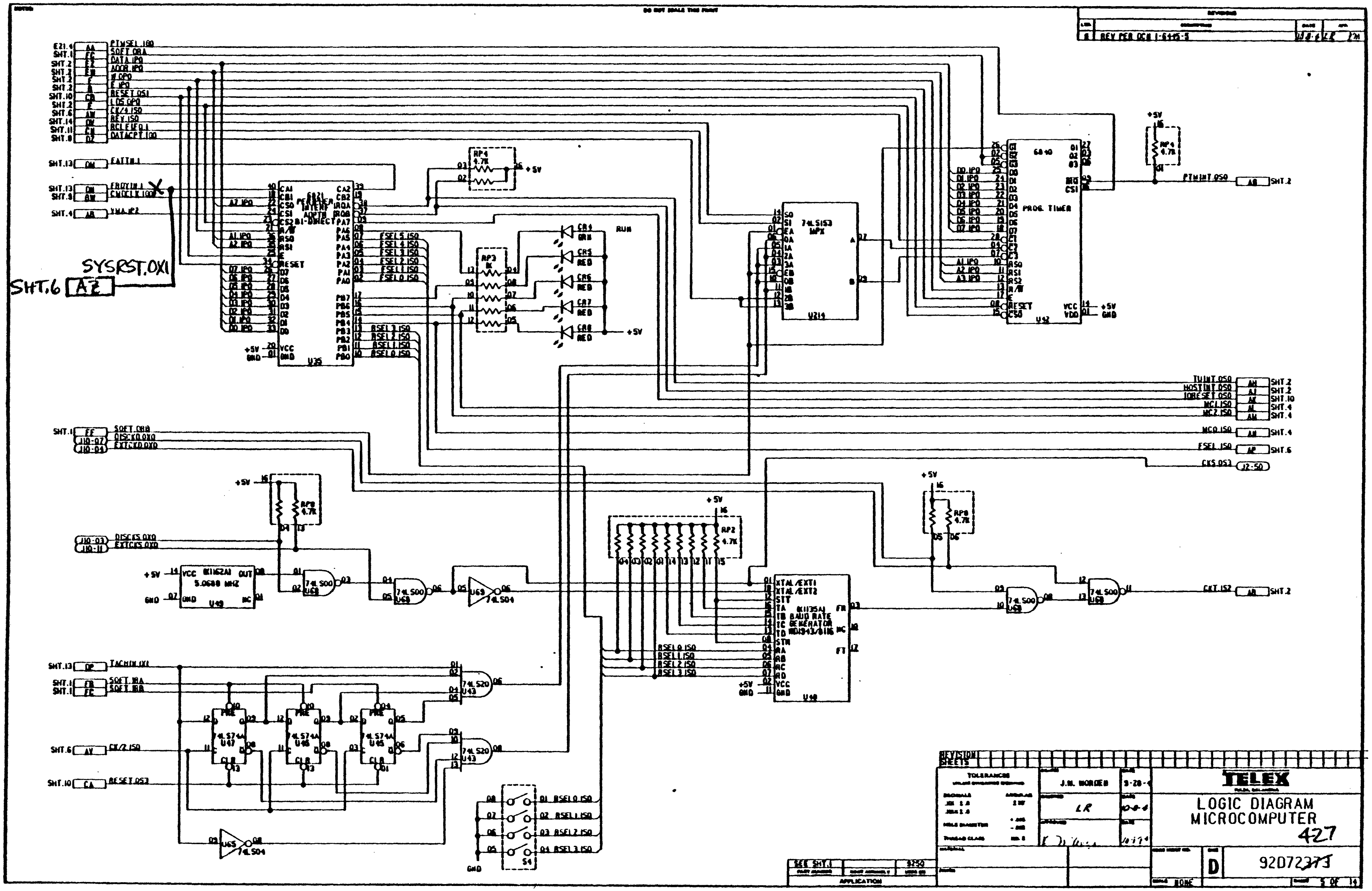
DO NOT SCALE THIS PRINT
REV PER DCN 1-6445-5
68000 16-BIT MICRO PROC
74LS148 PRIORITY ENCODER
74LS374 FLIP-FLOP
6850 COMM INTERFACE ADAPTER
1488 LINE DRIVER
1489
74LS00
74LS541 OCT. BUFFER LINE DRIVER
74LS645 TRANSCEIVER BI-DIRECTIONAL
U1
U2
U3
U16
U17
U18
U21
U22
U23
U24
U25
U26
U27
U28
+5V
GND
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
427
J.W. WORDER
D
92D72373
NONE
2 OF 14
APPLICATION



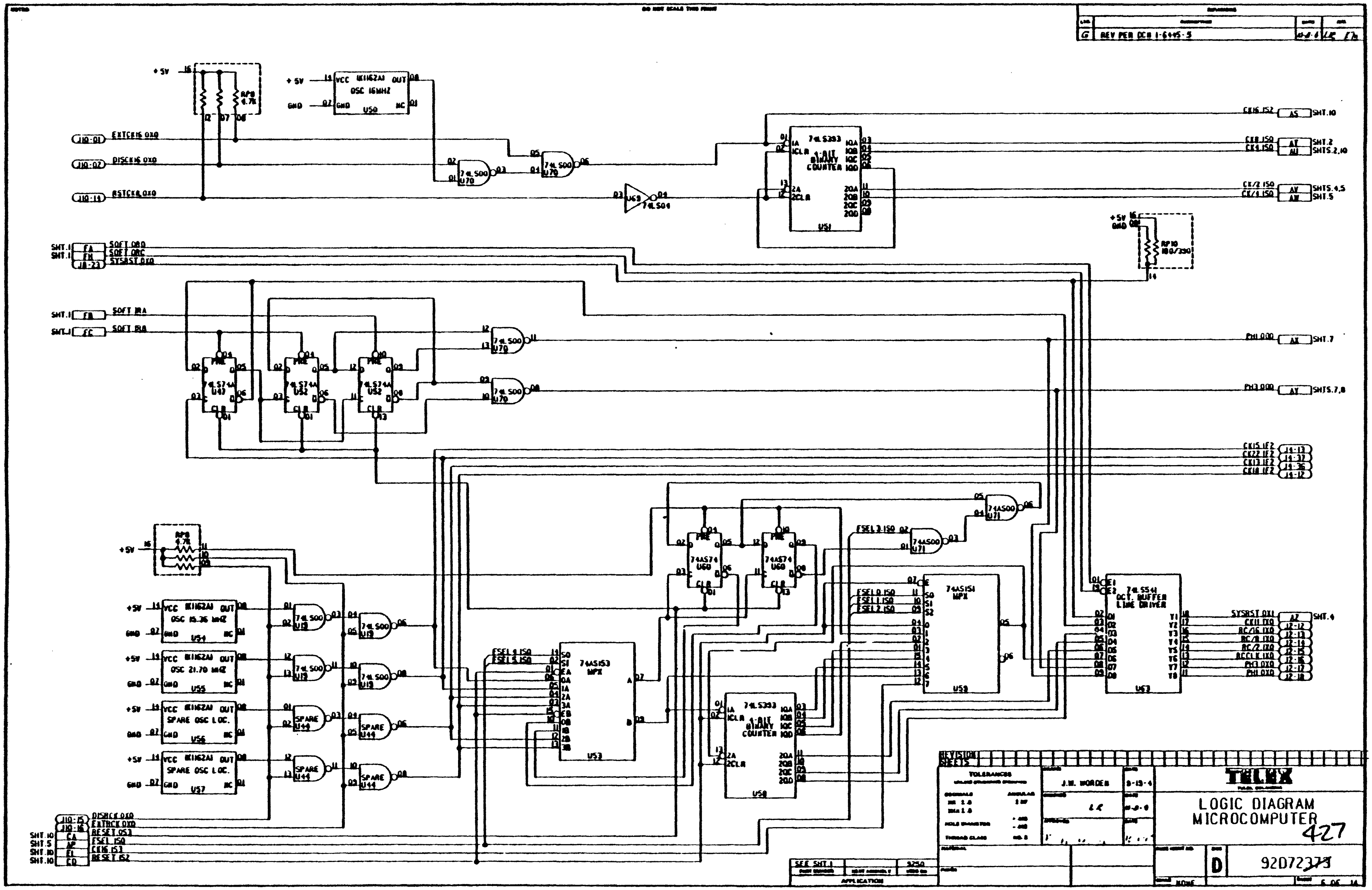
DATA.IPO
ADDR.IPO
SHT.2
SHT.4
BS0.0S1
BS1.0S1
BS2.0S1
BS3.0S1
BS5.0S0
BS4.0S0
W.OPO
LDS.OPO
UDS.OPO
2764
EPROM
0277-03
0275-01
0277-01
0277-04
0275-02
0277-02
SPARE
028607
028608
U4
U5
U6
U7
U8
U9
XU10
XU11
6116
RAM
BI-DIRECT
2K X 8
STATIC
RAM
U12
U13
U14
U15
28 PIN
SOCKET
XU12
XU13
XU14
XU15
JMP1
JMP2
JMP3
JMP4
JMP5
JMP6
JMP7
JMP8
JMP9
JMP10
JMP11
JMP12
RP2
4.7K
+5V
GND
U65
74LS04
74LS32
U66
REV PER DCN 1-6445-3
TELEX
J.W. WORDEN
9-25-4
LOGIC DIAGRAM
MICROCOMPUTER
427
D
92D72373
NONE
3 OF 14
SEE SHT.1
9250
APPLICATION


A Rel per ERO
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
J.W. WORDEN
D
92D72373
427
4 OF 14
APPLICATION

SUR 10



DO NOT SCALE THIS PRINT
REV PER DCN 1-6115-5
SYSRST.0X1
SHT.6 A2
6821 PERIPHERAL INTERF ADPTR BI-DIRECT
U35
RUN
74LS153 MPX
U214
6840 PROG. TIMER
U42
PTMINT 0S0
TUINT 0S0
HOSTINT 0S0
IORESET 0S0
MCO 1S0
FSEL 1S0
CXS 0S3
5.0688 MHZ
U49
74LS00
U68
74LS04
U69
8116 BAUD RATE GENERATOR
U48
74LS74A
U47
U46
U45
74LS20
U43
U65
S4
CKT 1S2
J.M. WORDEN
LR
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
427
D
92D72373
NONE
5 OF 14
SEE SHT.1
APPLICATION




REVISION
SHEETS

TOLERANCES

J.W. WORDEN 8-13-4

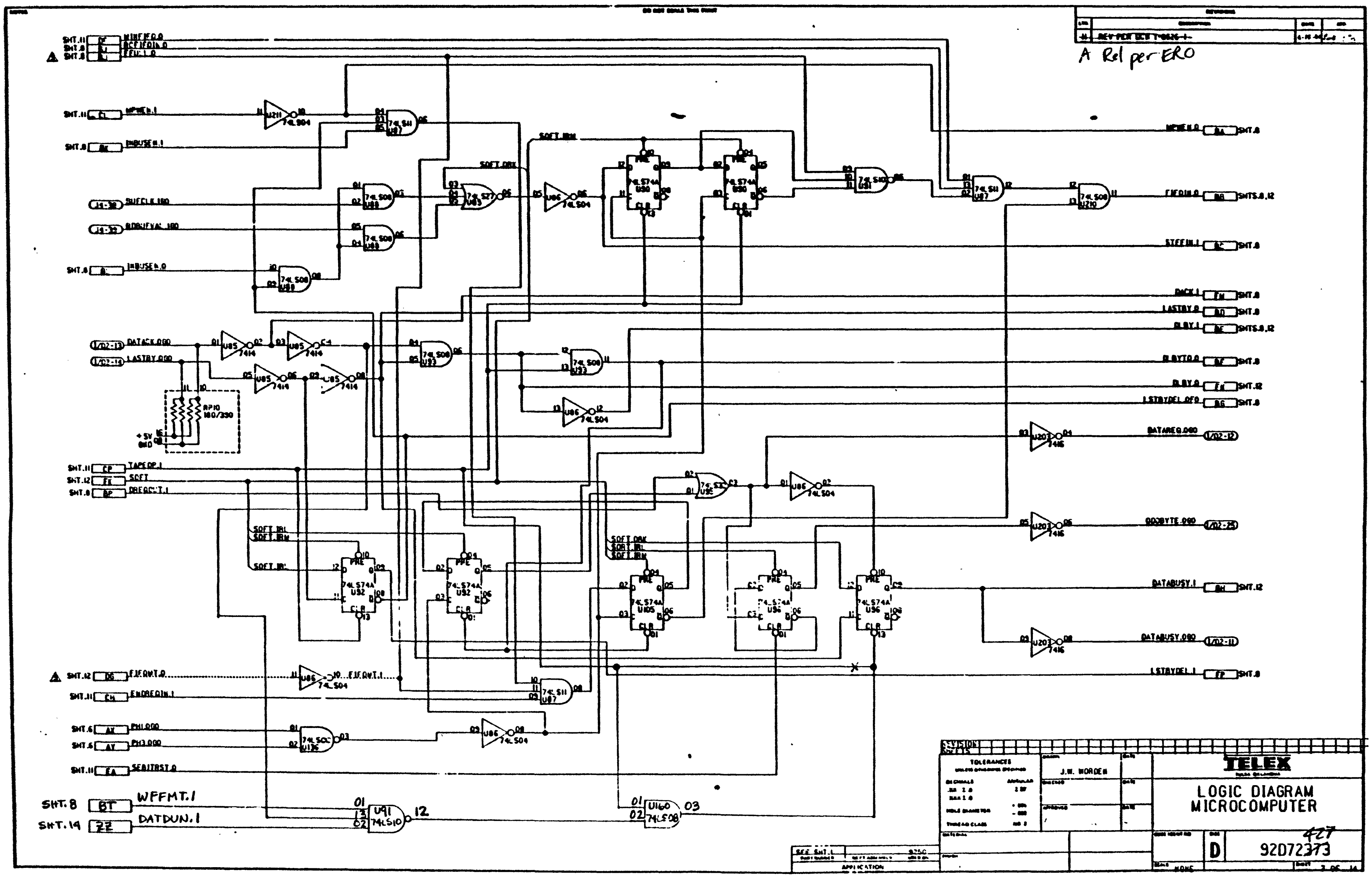
TELEX

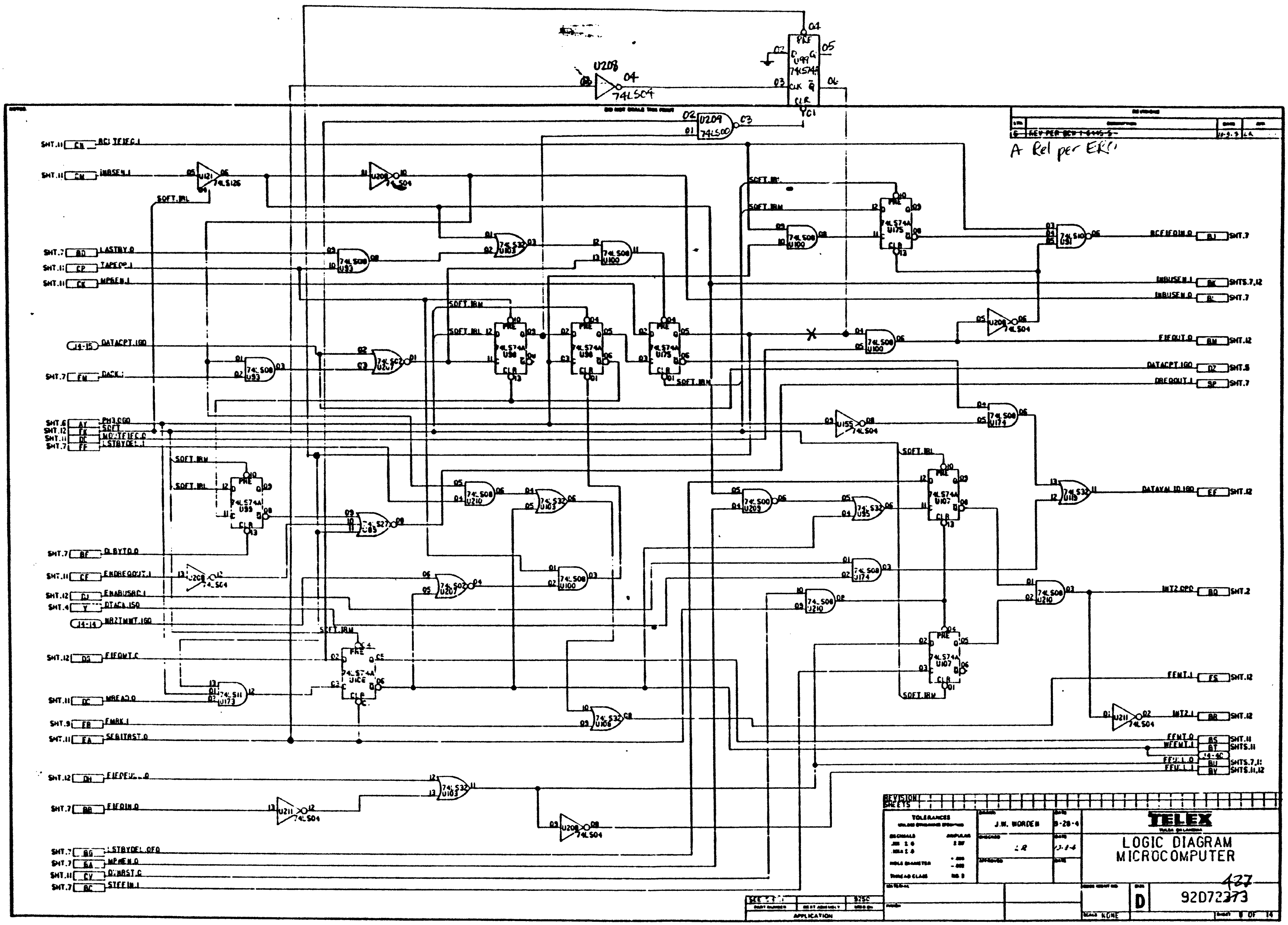
LOGIC DIAGRAM
MICROCOMPUTER
427

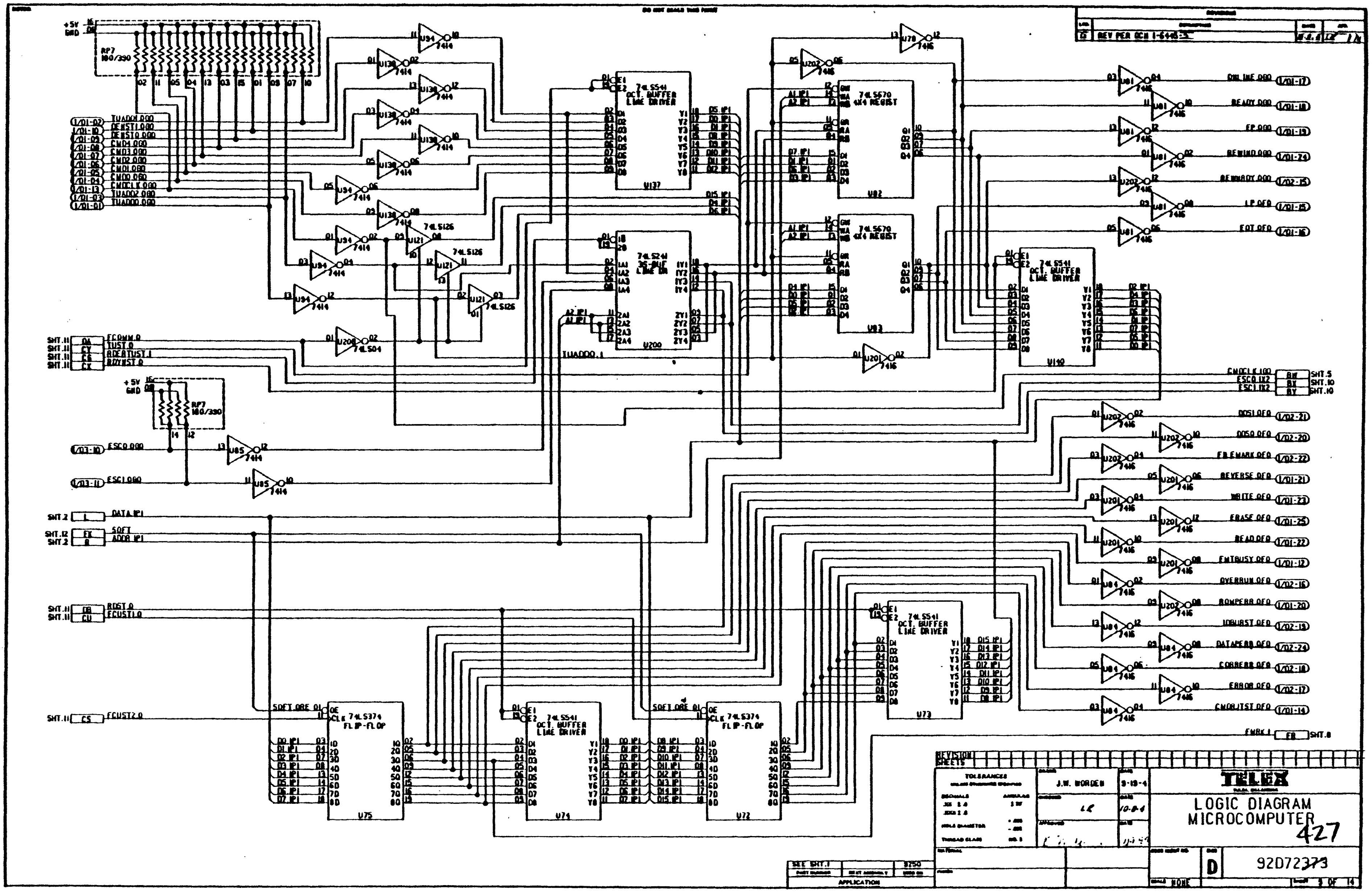
SEE SHT 1
APPLICATION
9250

D 92D72373

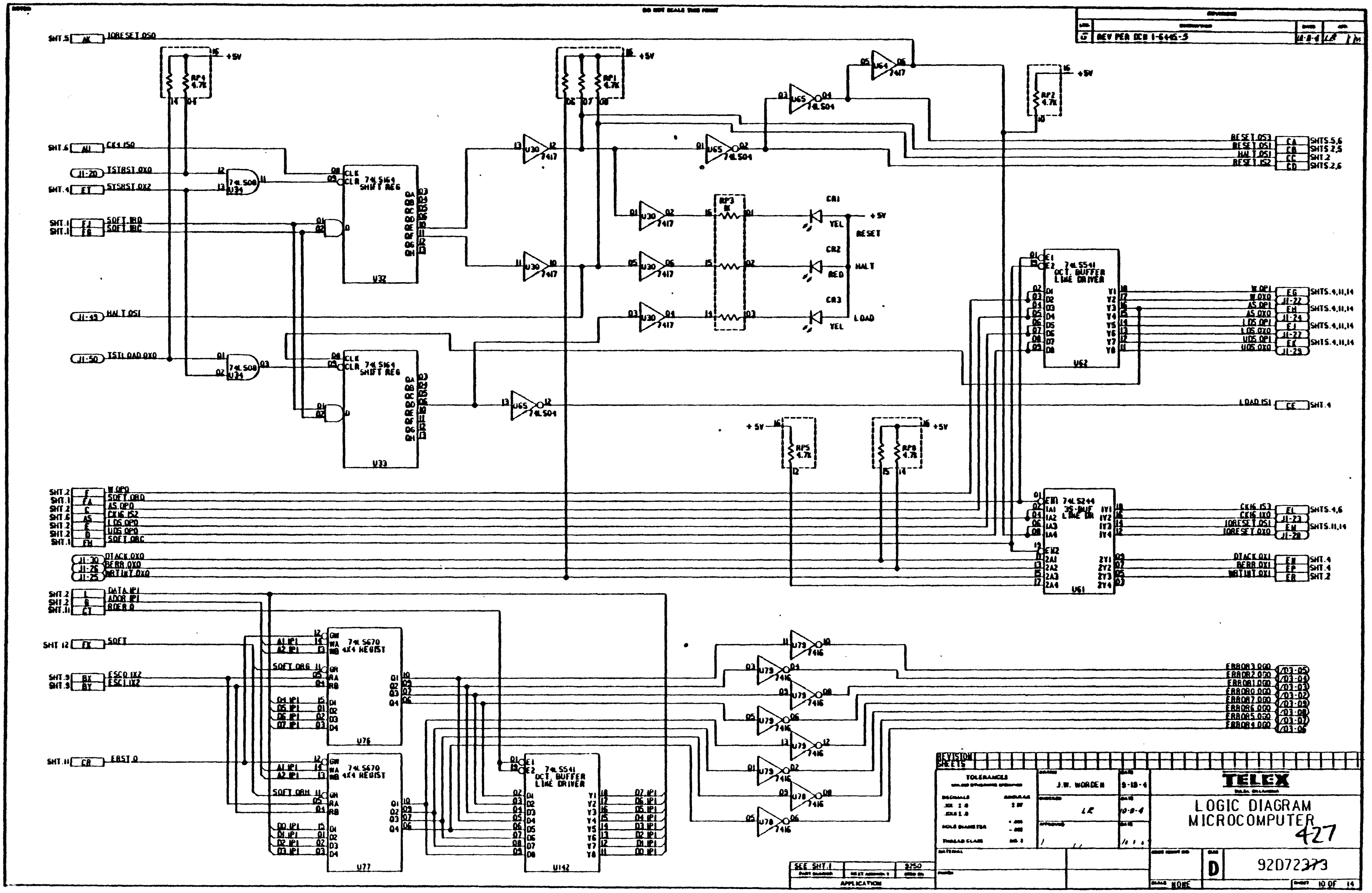
NONE


A Rel per ERO
SHT.11 CL MPWEN.1
SHT.8 BK INBUSEN.1
SUFCLK.180
RDBUFVAL.180
SHT.8 BL INBUSEN.0
DATACK.090
LASTBY.090
RP10 180/330
+5V
GND
SHT.11 CP TAPEOP.1
SHT.12 FX SOFT
SHT.8 BP DREQCUT.1
SOFT IRL
SOFT IRN
SOFT DRK
SHT.12 DG FIFOWT.0
SHT.11 CM ENDREQIN.1
SHT.6 AX PH1.090
SHT.6 AY PH3.090
SHT.11 EA SERITEST.0
SHT.8 BT WFFMT.1
SHT.14 ZZ DATDUN.1
74LS04
74LS11
74LS08
74LS27
74LS74A
74LS10
74LS32
7414
7416
MPWEN.0 BA SHT.8
FIFOIN.0 BB SHTS.8,12
STFFUL.1 BC SHT.8
DACK.1 EM SHT.8
LASTBY.0 BD SHT.8
RLBY.1 BE SHTS.8,12
RLBYTO.0 BF SHT.8
RLBY.0 EN SHT.12
LSTBYDEL.OFD BG SHT.8
DATAREQ.090
ODDBYTE.090
DATABUSY.1 BH SHT.12
DATABUSY.090
LSTBYDEL.1 FP SHT.8
TELEX
J.W. WORDEN
LOGIC DIAGRAM
MICROCOMPUTER
D
92D72373
427
APPLICATION

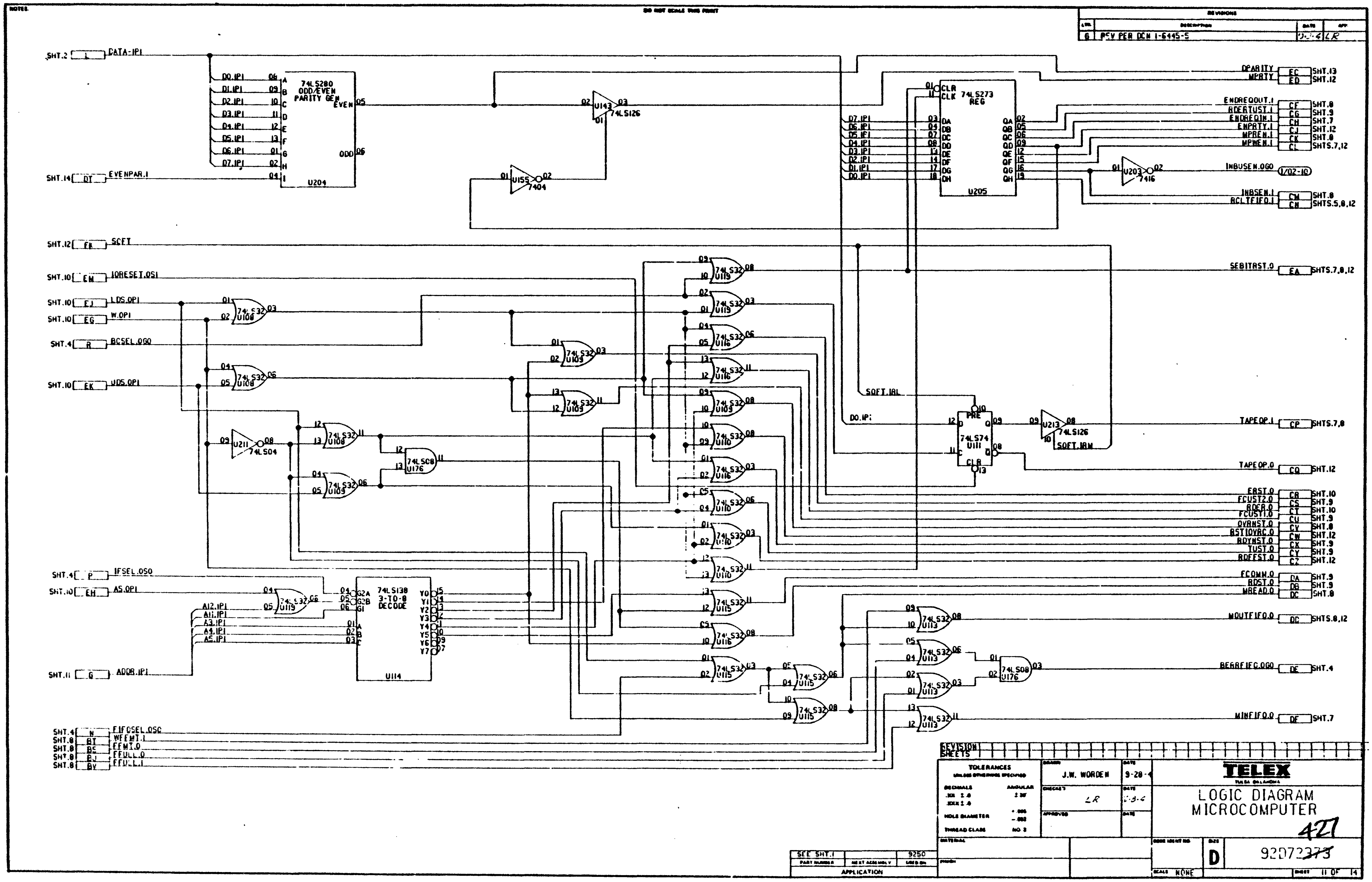

TELEX
LOGIC DIAGRAM
MICROCOMPUTER
J.W. WORDEN
92D72373
427
D
NONE
APPLICATION



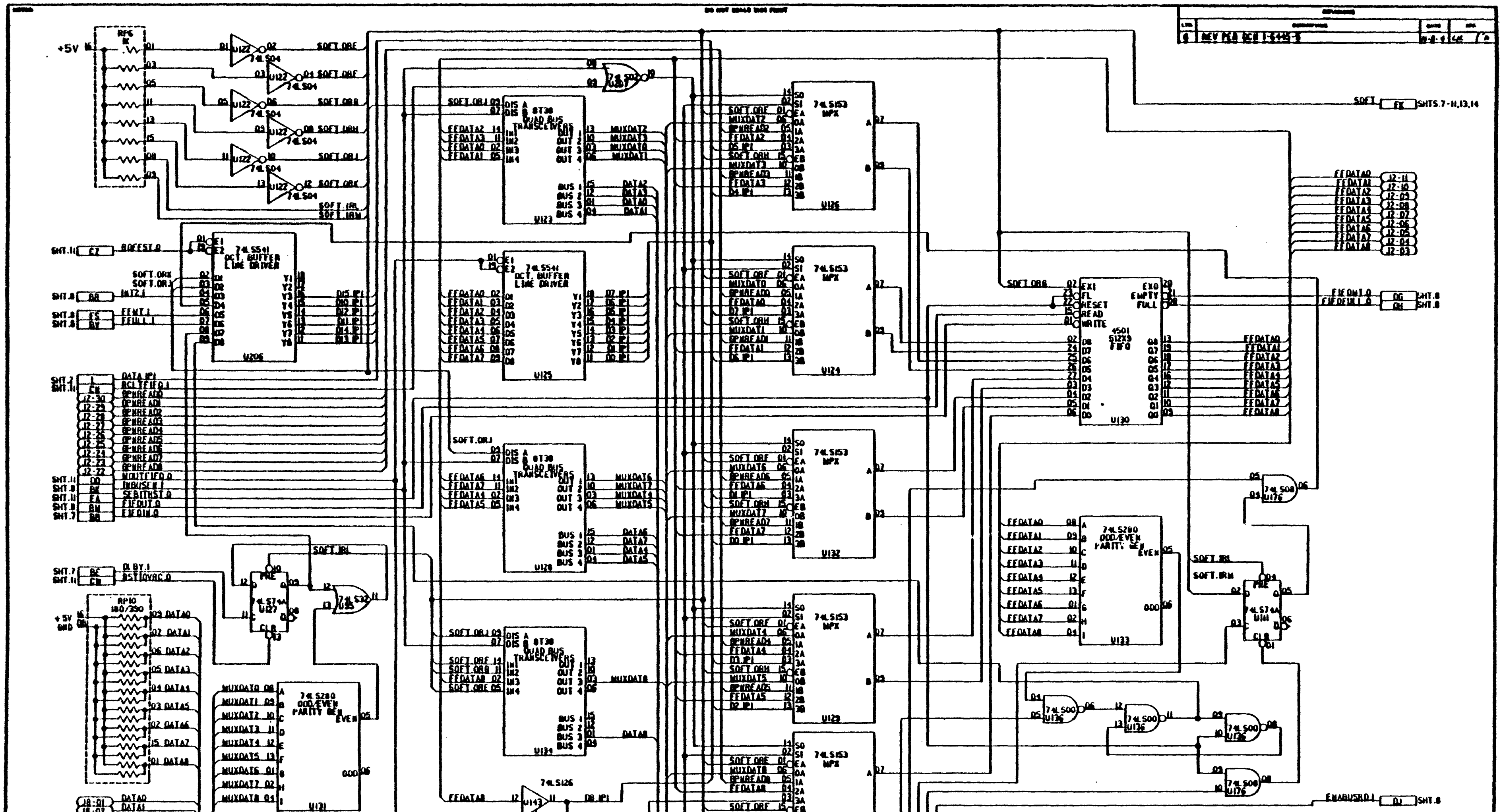
REV PER ECN I-6465.5
J.W. WORDEN
TELEX
LOGIC DIAGRAM
MICROCOMPUTER
427
D
92D72373
SEE SHT.1
APPLICATION
SCALE NONE
SHEET 5 OF 14



IORESET 0S0
CK4 IS0
TSTRST 0X0
SYSRST 0X2
SOFT IRQ
SOFT IRC
HALT 0SI
TSTLOAD 0X0
74LS164 SHIFT REG
U32
U33
74LS08
74LS04
7417
RP1 4.7K
RP2 4.7K
RP3 1K
RP4 4.7K
RP5 4.7K
RP8 4.7K
+5V
CR1 YEL RESET
CR2 RED HALT
CR3 YEL LOAD
RESET 0S3
RESET 0S1
HALT 0SI
RESET IS2
74LS541 OCT. BUFFER LINE DRIVER
U62
U61
U142
74LS244 3S BUF LINE DR
LOAD IS1
W 0P0
SOFT 0RD
AS 0P0
CK16 IS2
LDS 0P0
UDS 0P0
SOFT 0RC
DTACK 0X0
BERR 0X0
DATA IP1
ADDR IP1
RDER 0
SOFT
ESC0 IX2
ESC1 IX2
ERST 0
74LS670 4X4 REGIST
U76
U77
7416
ERROR3 0Q0
ERROR2 0Q0
ERROR1 0Q0
ERROR0 0Q0
ERROR7 0Q0
ERROR6 0Q0
ERROR5 0Q0
ERROR4 0Q0
REV PER ECN 1-6445-5
TELEX
J.W. WORDEN
LOGIC DIAGRAM
MICROCOMPUTER
427
D
92D72373
NONE
10 OF 14
SEE SHT.1
APPLICATION



DATA-IPI
EVENPAR.I
SCFT
IORESET.OSI
LDS.OPI
W.OPI
BCSEL.OGO
UDS.OPI
IFSEL.OSO
AS.OPI
ADDR.IPI
FIFOSEL.OSC
WFEMT.I
FEMT.O
FFULL.O
FFULL.I
74LS280
ODD/EVEN
PARITY GEN
U204
74LS273
REG
U205
74LS138
3-TO-8
DECODE
U114
74LS74
U111
SOFT.IAL
SOFT.IAM
DPARITY
MPRTY
ENDREQOUT.I
ADERTUST.I
ENDREQIN.I
ENPRTY.I
MPREN.I
MPWEN.I
INBUSEN.OGO
INBSEN.I
RCLTFIFO.I
SEBITRST.O
TAPEOP.I
TAPEOP.O
EAST.O
FCUST2.O
ADER.O
FCUST1.O
OVRNST.O
BSTIOVRC.O
RDYNST.O
TUST.O
RDFFST.O
FCOMM.O
RDST.O
MREAD.O
MOUTFIFO.O
BERRFIFO.OGO
MINFIFO.O
REV PER DCN 1-6445-5
TELEX
TULSA OKLAHOMA
LOGIC DIAGRAM
MICROCOMPUTER
J.W. WORDEN
LR
D
92D72373
427
SCALE NONE
SHEET 11 OF 14
SEE SHT.1
9250
APPLICATION
TOLERANCES




REVISION 6 REV PER DCN 1-6445-5

TOLERANCES

J.W. NORDEN 9-29-

TELEX

LOGIC DIAGRAM MICROCOMPUTER

427

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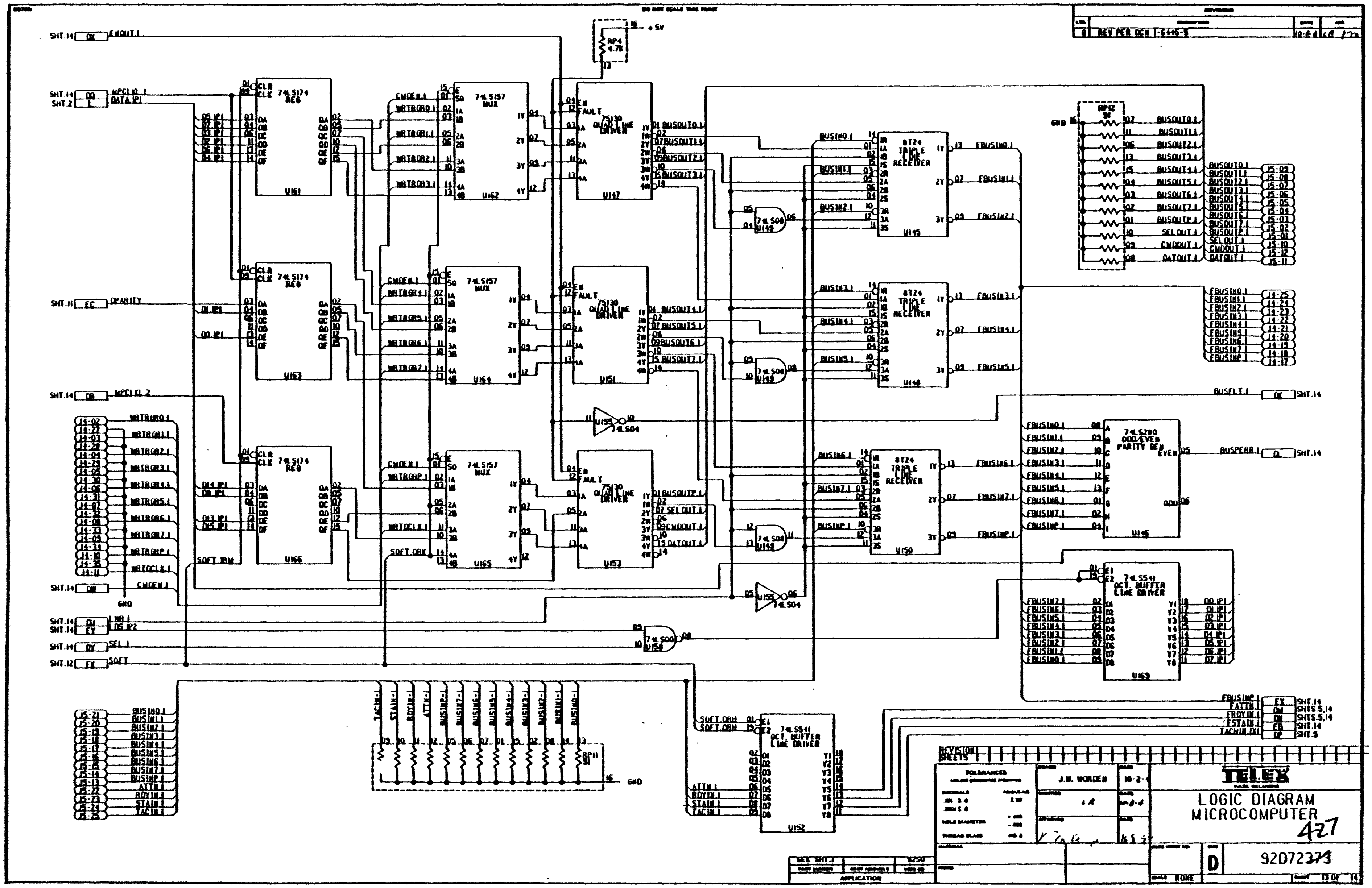
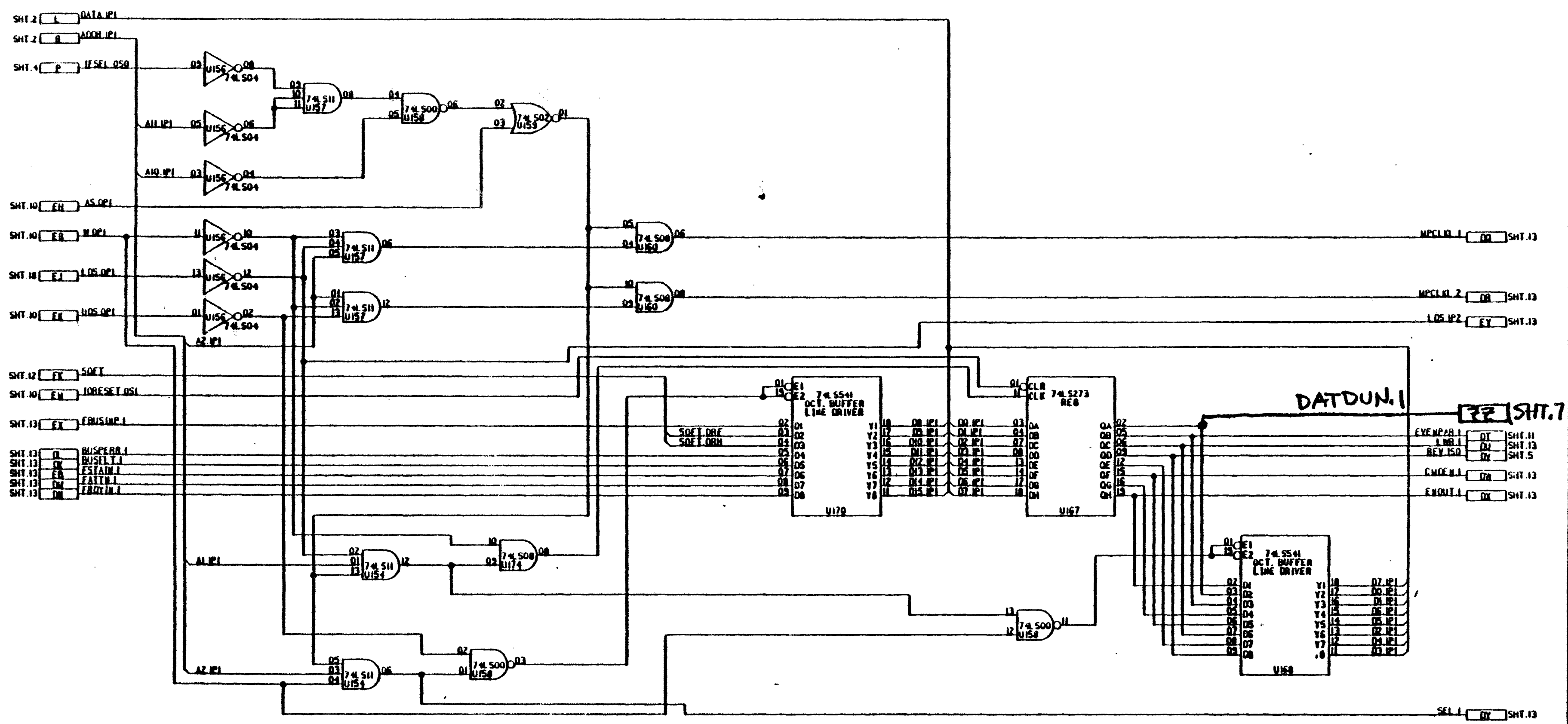
SCALE NONE SHEET 12 OF 14

SEE SHT.1

APPLICATION


TELEX
LOGIC DIAGRAM
MICROCOMPUTER
427
J.W. WORDEN
92D72373
SCALE NONE
13 OF 14

REV PER DCN 1-6445-5




TELEX

LOGIC DIAGRAM
MICROCOMPUTER

J.M. WORDEN 10-2-?

427

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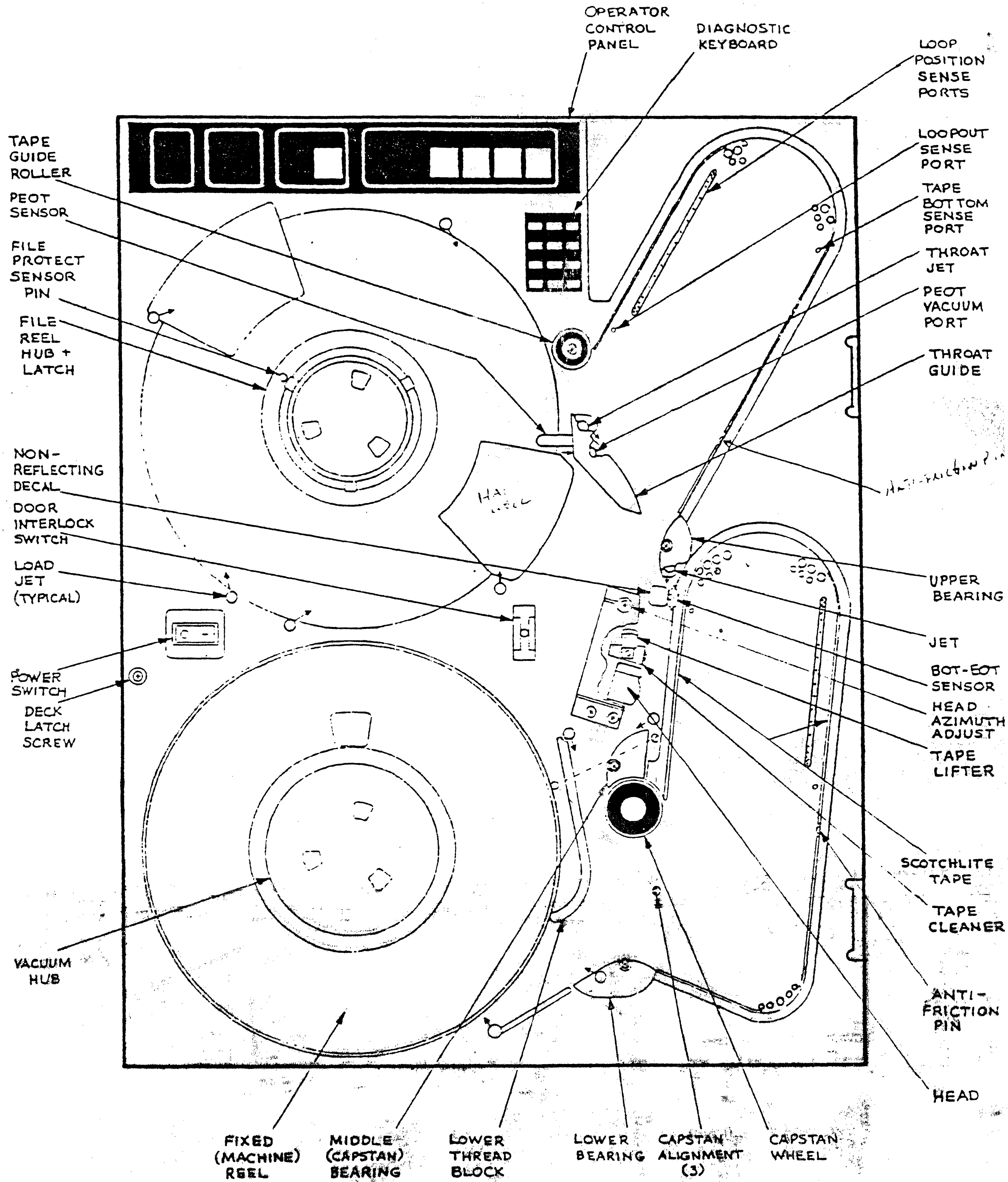
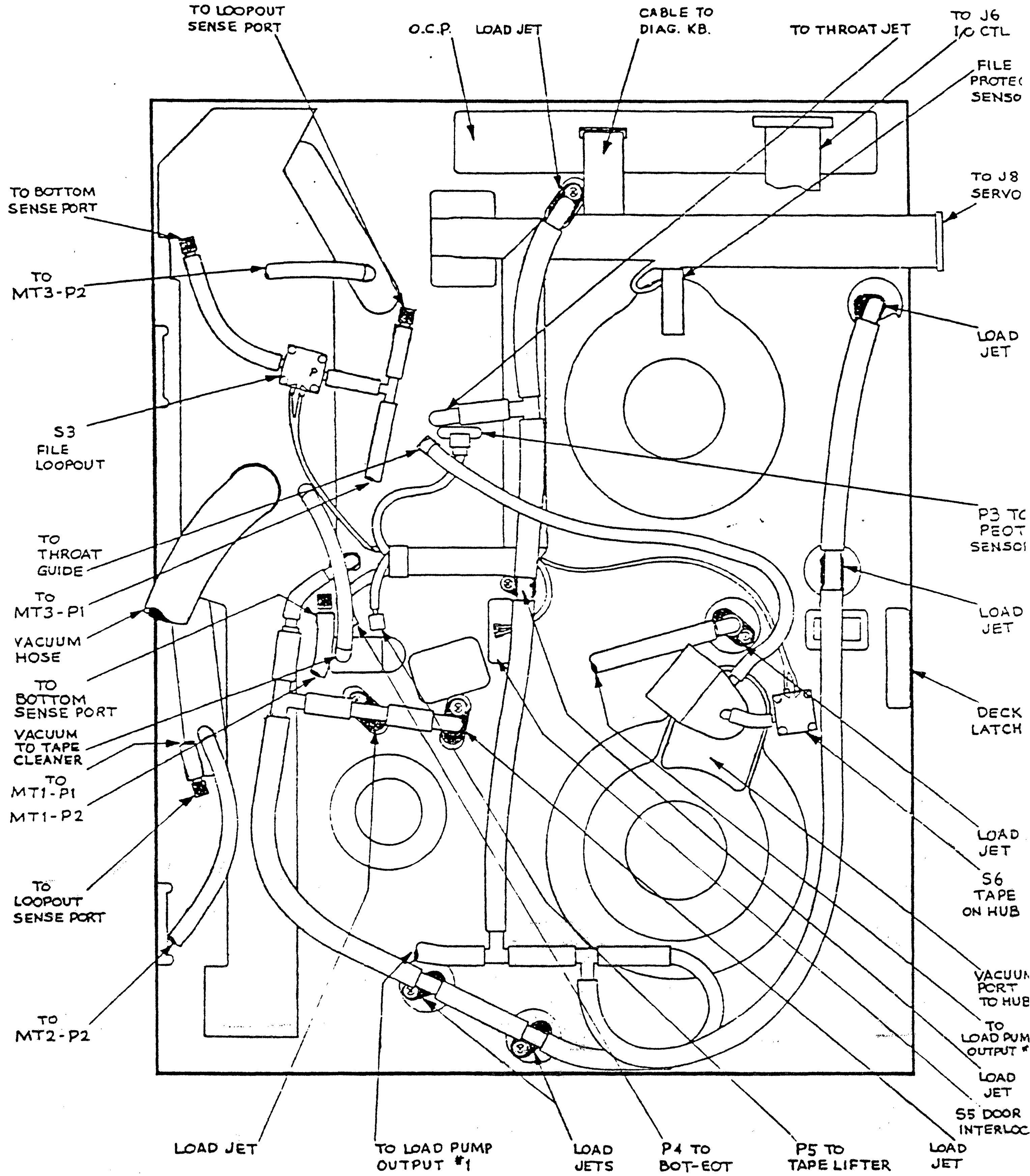
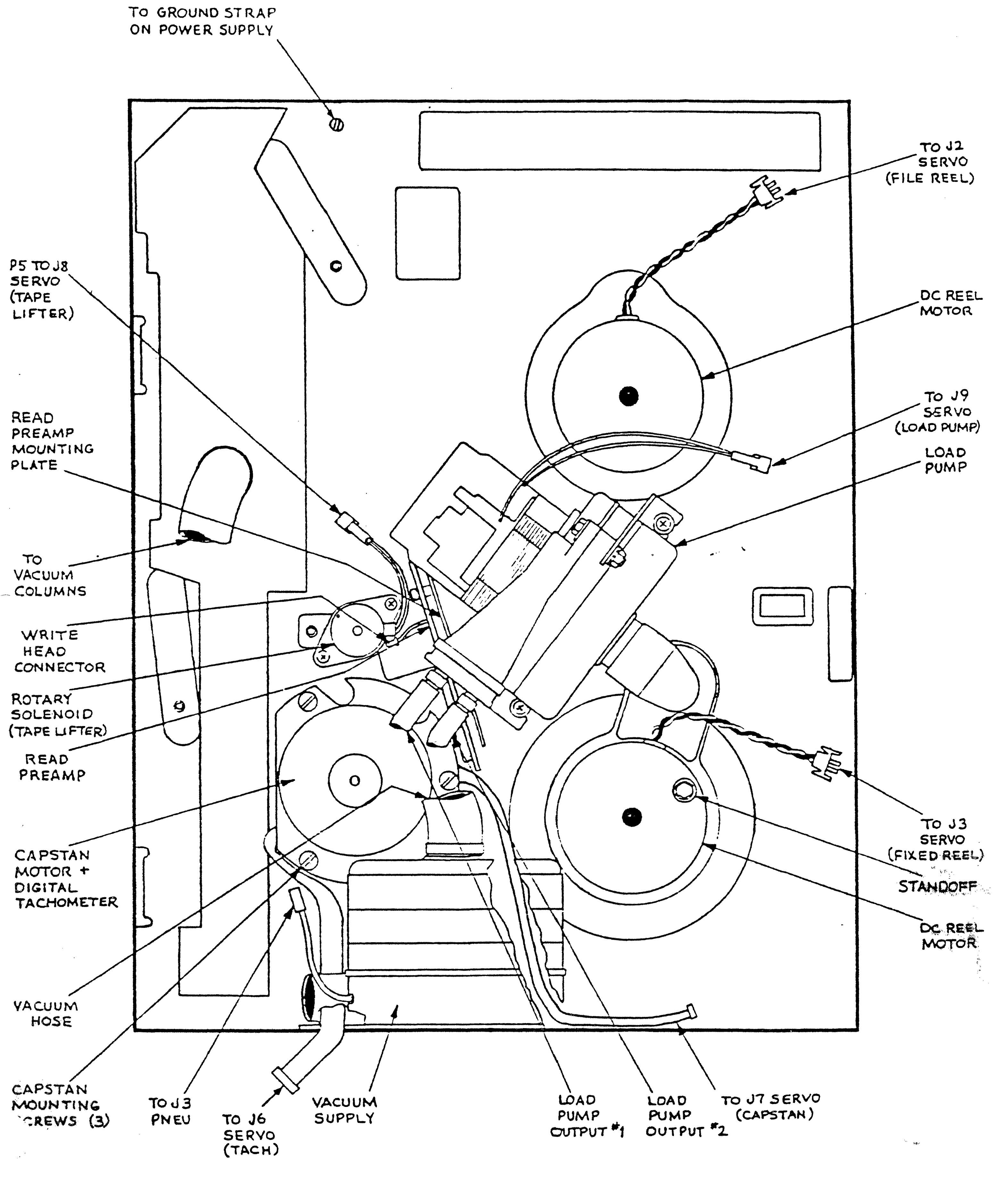
SEE SHT.1

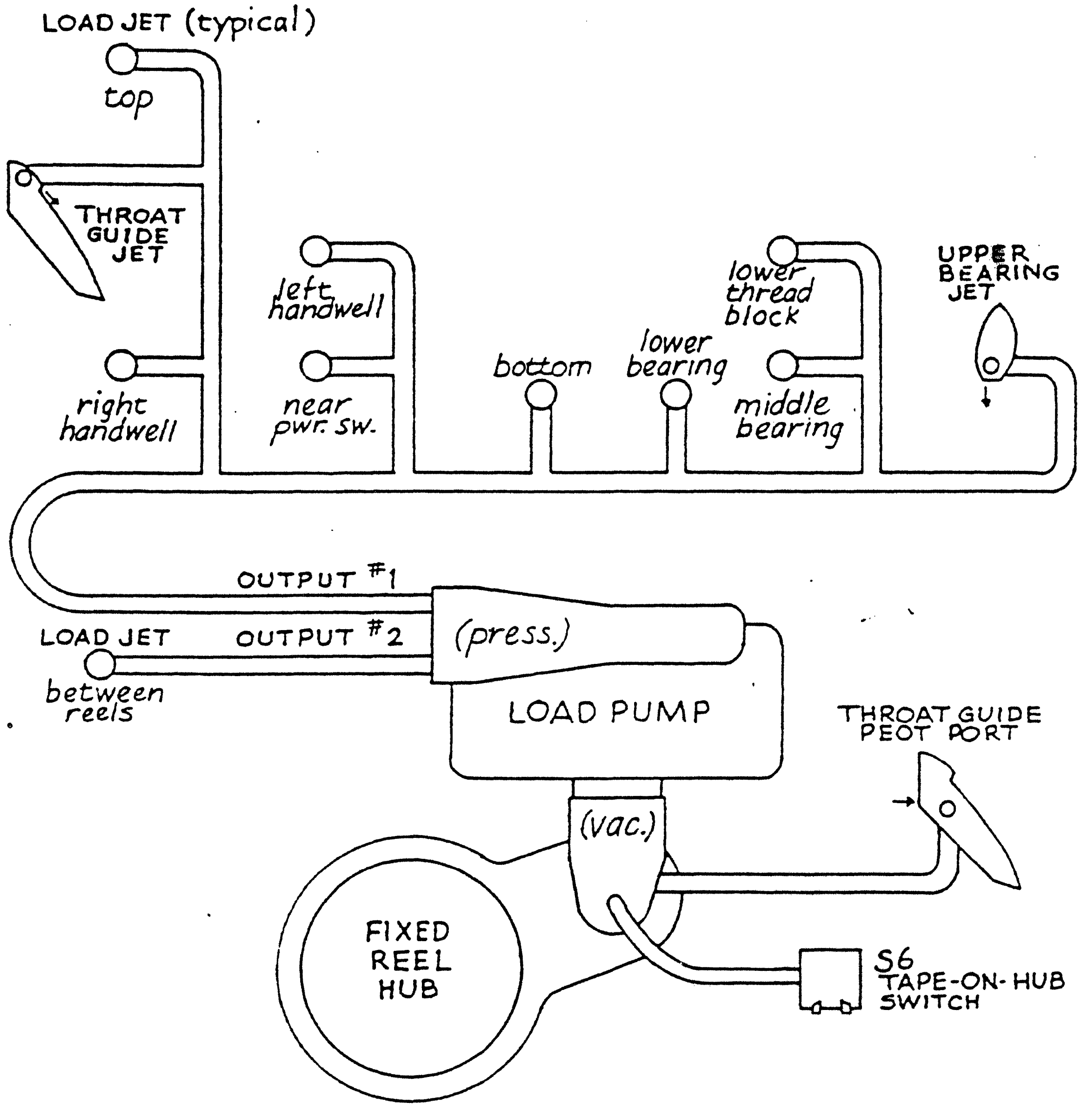
APPLICATION




TELEX SHAMROCK 9253 Tape Drive

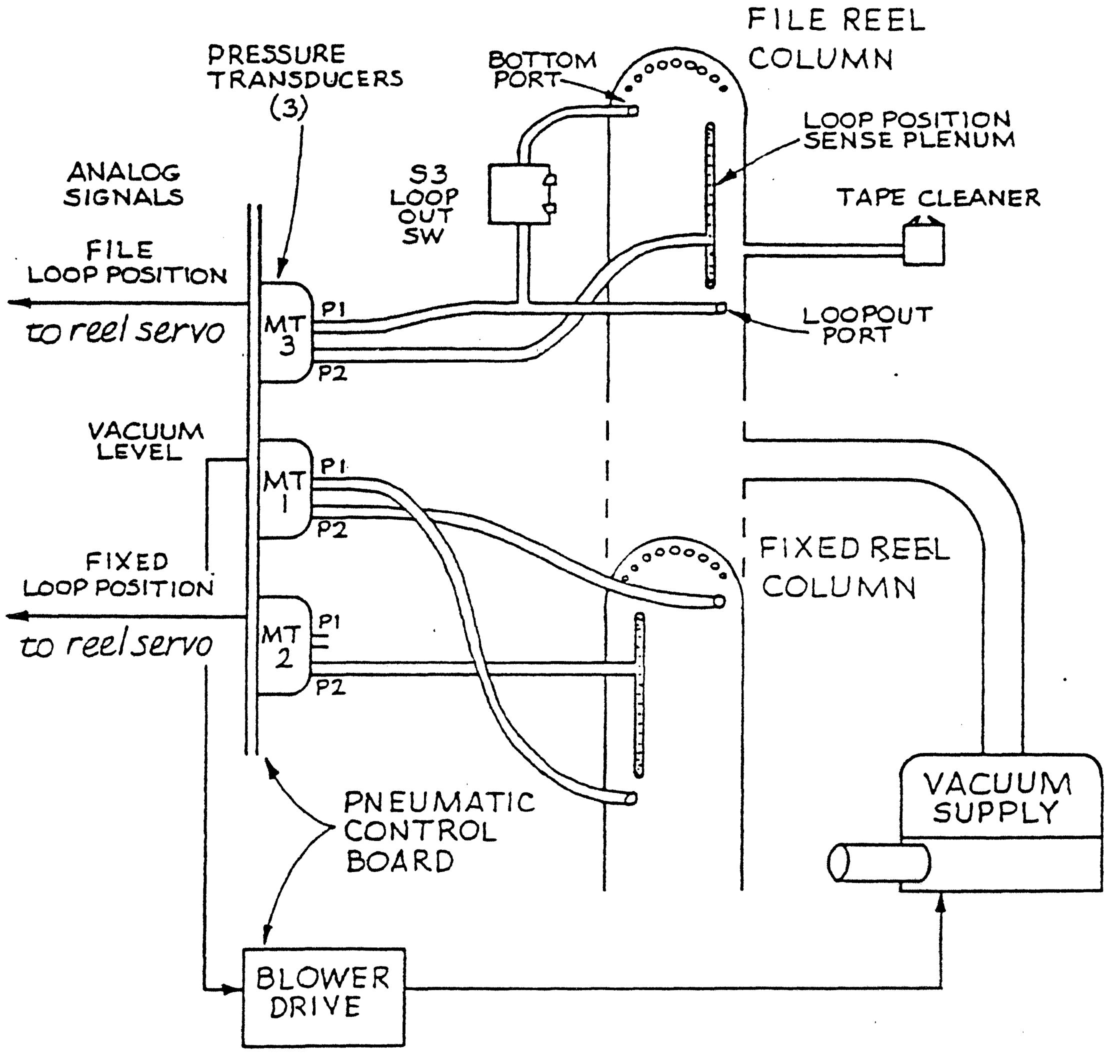

TO LOOPOUT SENSE PORT
O.C.P.
LOAD JET
CABLE TO DIAG. KB.
TO THROAT JET
TO J6 I/O CTL
FILE PROTE SENSO
TO J8 SERVO
TO BOTTOM SENSE PORT
TO MT3-P2
LOAD JET
S3 FILE LOOPOUT
P3 TO PEOT SENSO
TO THROAT GUIDE
TO MT3-P1
LOAD JET
VACUUM HOSE
TO BOTTOM SENSE PORT
DECK LATCH
VACUUM TO TAPE CLEANER
TO MT1-P1
MT1-P2
LOAD JET
S6 TAPE ON HUB
TO LOOPOUT SENSE PORT
VACUUM PORT TO HUB
TO MT2-P2
TO LOAD PUMP OUTPUT
LOAD JET
S5 DOOR INTERLOC
LOAD JET
TO LOAD PUMP OUTPUT #1
LOAD JETS
P4 TO BOT-EOT
P5 TO TAPE LIFTER
LOAD JET


TO GROUND STRAP ON POWER SUPPLY
TO J2 SERVO (FILE REEL)
P5 TO J8 SERVO (TAPE LIFTER)
DC REEL MOTOR
READ PREAMP MOUNTING PLATE
TO J9 SERVO (LOAD PUMP)
LOAD PUMP
TO VACUUM COLUMNS
WRITE HEAD CONNECTOR
ROTARY SOLENOID (TAPE LIFTER)
READ PREAMP
CAPSTAN MOTOR + DIGITAL TACHOMETER
TO J3 SERVO (FIXED REEL)
STANDOFF
DC REEL MOTOR
VACUUM HOSE
CAPSTAN MOUNTING SCREWS (3)
TO J3 PNEU
TO J6 SERVO (TACH)
VACUUM SUPPLY
LOAD PUMP OUTPUT #1
LOAD PUMP OUTPUT #2
TO J7 SERVO (CAPSTAN)




# LOAD PUMP Functional Diagram
Telex Shamrock

P.T. 3-85




*VACUUM SUPPLY Functional Diagram*
*Telex Shamrock*

P.T. 3·85