

UniPak 2™

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NOTE

Before using the UniPak 2™, read section 1.2 for programmer mainframe compatibility information.

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SECTION 1

INTRODUCTION

1.1 OVERVIEW

Data I/O's UniPak 2™ reliably programs over 600 popular MOS and bipolar devices. Values for programming variables, including pinouts, voltage levels and timing, are stored in firmware tables. When you choose the family and pinout codes for a particular device, the programmer uses information in these tables to assemble a specialized programming routine in scratch RAM. This method allows high-speed operation with minimum firmware overhead. The UniPak 2™ is designed to adapt to the programming requirements of many different devices. Pinout variations are handled by seven device sockets on the UniPak 2™ and, in some cases, by adapters which connect to socket 1 or 2. Specially designed electronic switches allow programming of both bipolar and MOS devices.

To maximize control speed during programming, the UniPak 2™ makes extensive use of addressable latches for control signals. For flexibility in waveform generation, digital-to-analog converters (DACs) control all major power supplies, with several rise and fall times selected by firmware.

1.2 PROGRAMMER COMPATIBILITY

To be compatible with the UniPak 2™, your programmer may require a hardware and/or firmware update, depending on the model, configuration, and age. The information that follows will help you determine whether your programmer requires updating. If you find that your programmer does require updating, contact your nearest Data I/O Service Center.

- System 17—The System 17 must be converted into a System 19 with the latest firmware installed and latest hardware modifications.
- System 19—Check to determine whether your System 19 contains a 702-1520 or 702-1980 controller board by performing the following steps:
 1. Remove the programming pak (section 2.3).
 2. Remove the metal shield (if any) shown in figure 2-1.
 3. Count the number of EPROM firmware sockets located just behind the pak interface connector. If there are four sockets, it is a 702-1520 board. If there are eight sockets, it is a 702-1980 board.

MODIFICATION STATUS					
1	2	3	4	5	6
●	0	0	0	0	0

Figure 1-1. Example of a "Modification Status" Sticker

If your System 19 contains a 702-1520 controller board, check the modification status sticker (figure 1-1) on the bottom of the programmer. If the sticker is not there or if only "1" is marked off, your System 19 requires hardware and firmware updating; contact the nearest Data I/O Service Center. If "2" is marked, your System 19 is compatible with the UniPak 2™. If your System 19 contains a 702-1980 controller board, it may require a firmware update. To display the configuration number of the firmware in your programmer, key in "SELECT-B2-START". If the configuration number displayed matches the number listed below, your firmware needs updating.

Model	Configuration Number
• 990-1902	3599
• 990-1903	CC8B

- 29A Universal Programmer—To be compatible with the UniPak 2™, the 29A programmers must have Rev C or later firmware. To determine the configuration of the firmware in your 29A, key in "SELECT-B2-START" and observe the display. If the hex number matches one listed in table 1-1, your firmware needs to be updated.
- 29B Universal Programmer—The UniPak 2™ is compatible with Rev A or later software.
- 100A Production Programmer—To be compatible with the UniPak 2™, the 100A programmers must have Rev E or later firmware. To determine the configuration of the firmware in your 100A, key in "SELECT-10" and observe the display. If the hex number displayed matches one listed in table 1-1, your firmware needs to be updated.

Table 1-1. Programmer Compatibility

Model	Rev	Configuration Number
29A	A	1ECA
	B	20A4
29A (with computer remote control)	A	BB41
	B	C00B
100A	A	917F
	B	9405
	C	9DEE
	D	9BED

1.3 APPLICATIONS

Table A-1 (in appendix A) lists all the devices that could be programmed with the UniPak 2™ when this manual was published. In many cases when a new device with industry-standard pinout is introduced within a manufacturer's family, the UniPak 2™ WILL NOT require a revision to program it. For some new applications, such as to accommodate a new device family, a firmware update of the UniPak 2™ may be required. The revision number is stamped after the part number (950-0059) along the underside of the top edge of the UniPak 2™ socket assembly.

1.4 SPECIFICATIONS

The UniPak 2™ receives its power from the programmer mainframe. Programming waveforms are generated from raw programmer supplies using regulators controlled by the programmer's microprocessor. The controlling firmware is located on a circuit card within the UniPak 2™.

The physical and environmental specifications are:

- Altitude: Sea level to 3 km (10,000 ft.)
- Dimensions: 20.9 x 17.0 x 10.5 cm (8.2 x 6.7 x 4.2 in.)
- Humidity (operating): 90% maximum (noncondensing)
- Humidity (storage): 95% maximum (noncondensing)
- Temperature (operating): 0 to 40°C (32 to 104°F)
- Temperature (storage): -40 to 55°C (-40 to 131°F)
- Weight: 1.38 kg (3 lb. 0.5 oz.)

1.5 FIELD APPLICATION SUPPORT

Data I/O has field applications engineers (FAE's) throughout the world. They can provide additional information about interfacing Data I/O products with other equipment and answer questions about equipment. FAE's are located within the United States at the addresses listed in the back of this manual. For international applications support, contact your nearest Data I/O representative.

1.6 WARRANTY

Data I/O equipment is warranted against defects in materials and workmanship. The warranty period of one year, unless specified otherwise, begins when you receive the equipment. The warranty card inside the back cover of this manual explains the length and conditions of the warranty. For warranty service, contact your nearest Data I/O service center.

1.7 SERVICE

Data I/O maintains service centers throughout the world, each staffed with factory-trained technicians to provide prompt, quality service. This includes not only repairs, but also calibration of all Data I/O products. A list of all Data I/O service centers is located in the back of this manual.

1.8 ORDERING

To order equipment, contact your Data I/O sales representative. Orders must contain the following information:

- Description of the equipment (see the latest Data I/O price list or contact your sales representative for equipment and part numbers)
- Quantity of each item ordered
- Shipping and billing address of firm, including ZIP code
- Name of person ordering equipment
- Purchase order number
- Desired method of shipment

SECTION 2

INSTALLATION

2.1 INSPECTION

Your UniPak 2™ was tested both electrically and mechanically before it was shipped, and was carefully packaged to prevent shipping damage. It should, therefore, arrive free of any defect, without marks or scratches, and in perfect operating condition. However, carefully inspect the instrument for any damage that may have occurred in transit. If you note any damage, file a claim with the carrier and notify Data I/O.

2.2 UniPak 2™ INSTALLATION

The UniPak 2™ may be installed and removed with the programmer's power on; this feature allows you to retain data in RAM during module changes. If the programmer power is turned on before the UniPak 2™ is installed, you will hear a beep until the UniPak 2™ is installed.

NOTE

Voltage transients can cause device damage. Thus, be sure that all sockets are empty when:

- *switching power on or off*
or
- *installing or removing the UniPak 2™*

To install the UniPak 2™, do the following:

1. Slide the UniPak 2™ into the opening in the programmer (figure 2-1).
2. Tilt the UniPak 2™ up and gently push it back to hook the flange of the UniPak 2™ over the back edge of the programmer opening (figure 2-1, a).
3. Lower the UniPak 2™ into position as shown in figure 2-1, b.
4. Press gently on the front edge of the UniPak 2™ to ensure a good connection (figure 2-1, c).

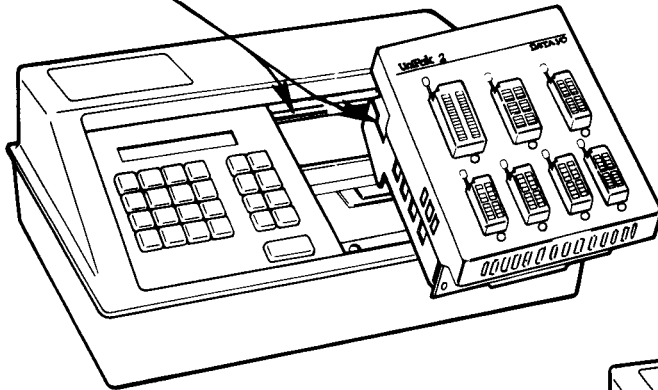
2.3 UniPak 2™ REMOVAL

1. Check to make sure the programmer is not in the process of an operation. If it is, wait until the operation is complete (the action symbol on the display disappears).
2. Check to make sure a device is not in a socket. If one is in a socket, remove it as described in section 3.7.
3. Tilt the UniPak 2™ up and gently remove it from the programmer.

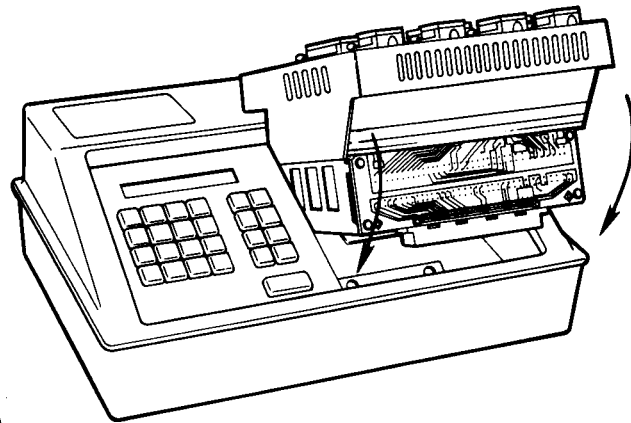
2.4 REPACKING FOR SHIPMENT

If the UniPak 2™ is to be shipped to Data I/O for service or repair, attach a tag to it describing the work required and identifying the owner. In correspondence, identify the unit by part number, revision level, and name. If the original shipping container is to be used, place the UniPak 2™ in the container with the appropriate packing material and seal the container with strong tape. If another container is used, be sure that it is a heavy carton, wrapped with heavy paper or plastic; use appropriate packing material and seal well with strong tape. Mark the container "DELICATE INSTRUMENT" or "FRAGILE."

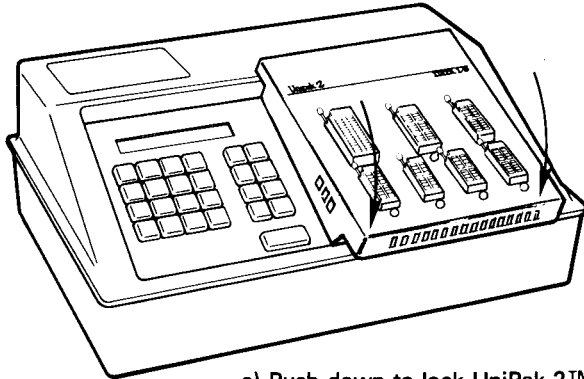
FLANGE



a) Tip the UniPak 2™ up and back to lock flanges.



b) Lower the UniPak 2™ into position.



c) Push down to lock UniPak 2™ into place.

NOTE: Although the System 29A is shown here, the insertion procedure is the same for all systems.

Figure 2-1. UniPak 2™ Installation

SECTION 3 OPERATION

3.1 OVERVIEW

The UniPak 2™ can be used in 29A, 29B, System 19, or 100A programmers of any configuration; see section 1.2 for firmware revision levels required. The typical programming operation with a 29A programmer and a UniPak 2™ is illustrated in figure 3-1. As can be seen from this figure, the UniPak 2™ can obtain data from three sources (a master device, a serial port, or the keyboard). Because the serial port and keyboard operations are unique for each type of programmer, you will be referred to your 29A, 29B, System 19, or 100A programmer manual for details on how to program using these mainframes.

When using a master device as the data source to program a blank device, you must first instruct the programmer to copy the device data into programmer RAM (shown as COPY in figure 3-1 and described in section 3.4).

Then enter the family code and pinout code as described in section 3.6. The data in the device will have been copied to the RAM of your 29A when you press START, as shown in figure 3-1. You must then remove the master device and instruct the programmer to copy the information just stored in its RAM to a blank device. This completes the basic programming operation.

The procedures to perform basic operations with your UniPak 2™ are described in this section. You should follow these procedures to properly operate your UniPak 2™. Wherever possible, key sequences have been included for using your UniPak 2™ with a 29A Universal Programmer with Rev C firmware (read section 1.2 carefully to determine your programmer's firmware revision level). Refer to your programmer manual for key sequences for the System 19, 29B, and 100A programmers.

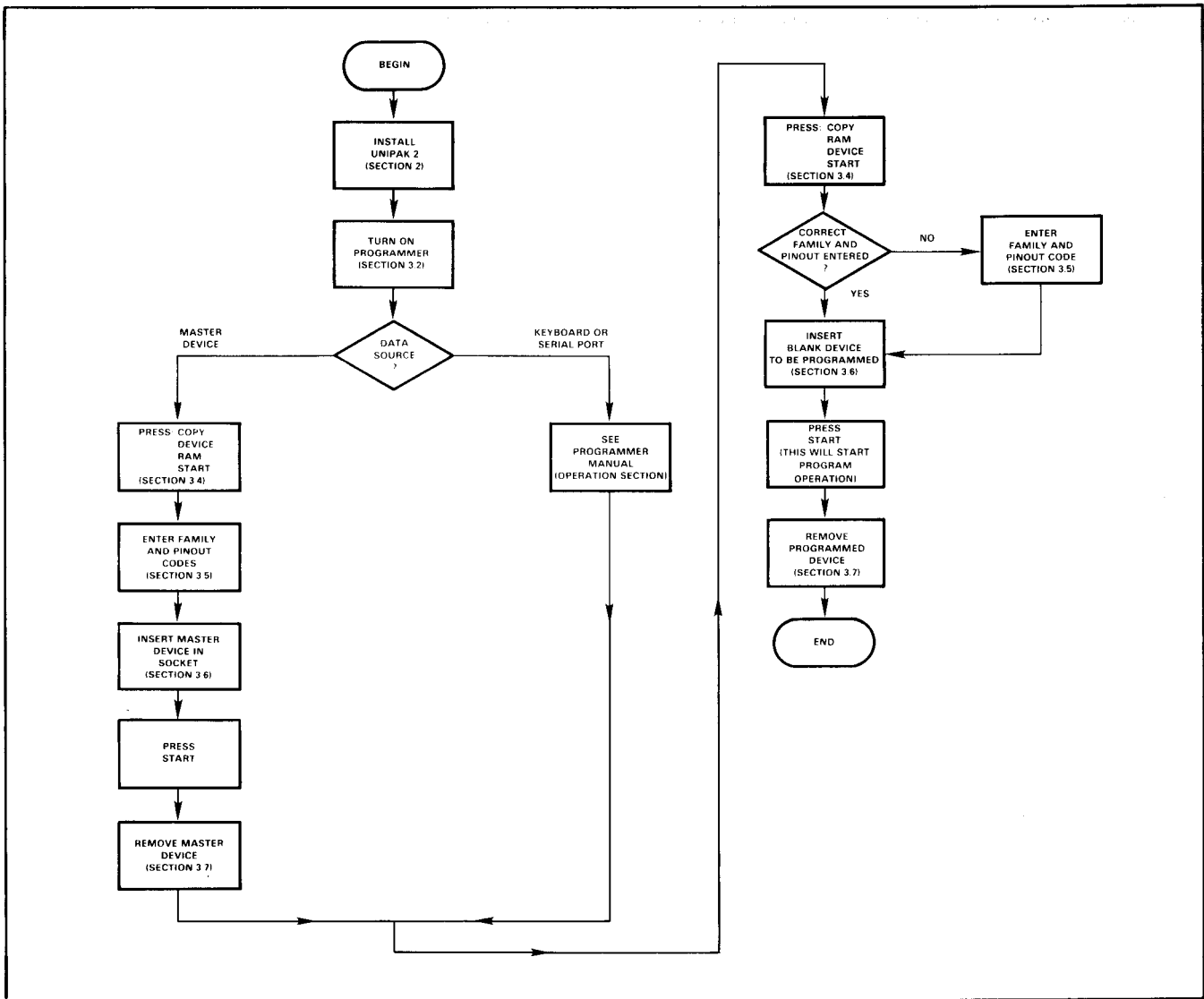


Figure 3-1. Typical 29A Programmer Operation

3.2 POWER UP

NOTE

If the UniPak 2™ is not installed in the programmer before power is turned on, you will hear a beep until the UniPak 2™ is installed.

When turned on, the programmer will perform an automatic self-test routine. When the self-test routine is complete, the programmer will signal its readiness.

To turn the programmer on, do the following:

1. Check to make sure a device is not in a socket. If a device is in a socket, lift up the lever (located on the upper left of the socket; see section 3.8), then gently lift the device out of the socket.
2. Plug the AC power cord into the power outlet.
3. Flip the power switch up to the "ON" position (see figure 3-2).

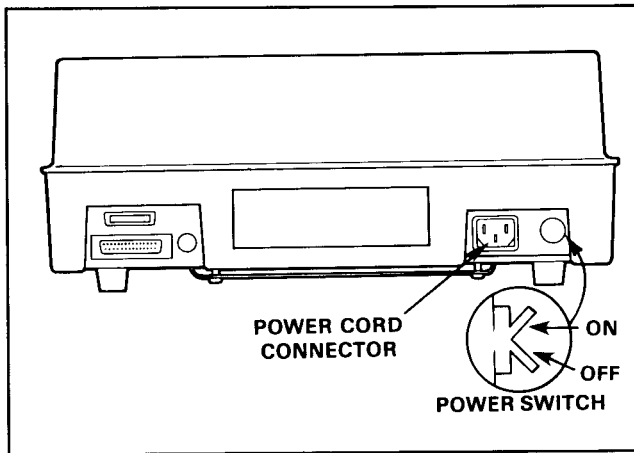


Figure 3-2. Programmer Power Switch Location

3.3 POWER DOWN

CAUTION

Do not turn the power off while the programmer is doing an operation or when a device is in a socket; voltage transients may damage the device.

To turn the programmer power off, do the following procedure:

1. Check to make sure that the programmer is not in the middle of an operation. If it is, wait until that operation is through.
2. Check to make sure a device is not in a socket. If a device is in a socket, remove it as described in section 3.8.
3. Flip the power switch down to the "OFF" position (figure 3-2).

3.4 BASIC OPERATION

All data transfer or verification operations take place between the programmer's internal RAM and the device or between the RAM and serial port in your programmer. Because the procedure to transfer data via a serial port varies from programmer to programmer, this manual describes only data transfer with the 29A. For other programmers, refer to your programmer operation manual.

The basic data transfer operations that can be performed with the UniPak 2™ and the 29A Universal Programmer are:

- Load RAM with data from a master device (described in section 3.4.1).
- Verify RAM data against the device data (described in section 3.4.2).
- Program a device with RAM data (described in section 3.4.3).

3.4.1 Load RAM With Data From Master Device

To load the 29A RAM with data from a master device, follow the steps listed below.

1. Press COPY; 29A displays COPY DATA FROM
2. Press DEVICE; 29A displays DEV ^ ADDR/SIZE TO

NOTE

The device is the source of data.

3. Press RAM; 29A displays CO DEV > RAM ^ ADDR

NOTE

The RAM is the destination of the data from the master device.

4. Press START; 29A displays FAM ^ 00 PIN 00
5. Enter the family code and pinout code (see section 3.6).
6. Insert the master device into the UniPak 2™ (see section 3.7).
7. Press START; 29A displays LOADING DEVICE
LOAD DONE XXXX

NOTE

XXXX is the sumcheck of the device.

8. Remove the master device from the UniPak 2™ (see section 3.8).

During source destination operations (copy and verify), ADDR and SIZE appear in the 29A prompts. These correspond to starting address and block size, respectively. For more detail on these parameters, see your programmer operation manual. When reading a device, the UniPak 2™ applies a nominal V_{CC} level. To simulate loading on device outputs, each output is driven by a 1.6 mA current source.

3.4.2 Verify RAM Data Against Master Device Data

The two-pass verify consists of comparing the device data to RAM data and is performed at two V_{CC} levels; these levels, plus the output-sink currents and the output-level-sense voltages, vary according to each manufacturer's requirements.

To verify that data entered in the 29A RAM duplicate the master device data, follow these steps:

1. Press VERIFY; 29A displays VERIFY DATA FROM
2. Press DEVICE; 29A displays DEV ^ ADDR/SIZE TO

NOTE

The device is the source of data.

3. Press RAM; 29A displays VE DEV > RAM ^ ADDR

NOTE

The RAM is the destination of the data from the master device.

4. Press START; 29A displays FAM 00 PIN 00
5. Enter the family code and pinout code (see section 3.6).
6. Insert the master device into the UniPak 2™ (see section 3.7).
7. Press START; 29A displays VERIFY DEVICE
VE DEV DONE XXXX

NOTE

XXXX is the sumcheck of the device.

8. Remove the master device from the UniPak 2™ (see section 3-8).

3.4.3 Program Device With RAM Data

When programming a device, the system performs illegal-bit tests and blank checks at nominal V_{CC} and with nominal output loading.

To program a blank device with the data in the 29A RAM, follow these steps:

1. Press COPY; 29A displays COPY DATA FROM
2. Press RAM; 29A displays RAM ^ ADDR/SIZE TO
3. Press DEVICE; 29A displays CO RAM > DEV ^ ADDR
4. Press START; 29A displays FAM ^ 00 PIN 00
5. Enter the family code and pinout code (see section 3-6).
6. Insert the blank device into the UniPak 2™ (see section 3-7).
7. Press START; 29A displays TEST DEVICE
PROGRAM DEVICE
VERIFY DEVICE
PRG DONE 01 XXXX
8. Remove the device from the UniPak 2™ (see section 3.8).

NOTE

XXXX represents the sumcheck of the device.

3.4.4 Extended Select Functions

In addition to the three basic source-destination functions (copy, verify and edit) and the select functions described in the Operation section of your programmer manual, the UniPak 2™ offers eight extended select functions (BC, BD, C3, CC, CD, CE, CF and EF). These functions are not required for normal operation of the UniPak 2™.

Functions BC and BD are used to disable and enable the electronic identifier function for device families listed in section 3.5, with the exception of family FF.

To disable the electronic identifier test (BC), follow the procedure below.

1. Press SELECT; 29A displays SELECT CODE ^
2. Press BC START; 29A displays SELECT CODE **

To enable the electronic identifier test (BD), follow the procedure below.

1. Press SELECT; 29A displays SELECT CODE ^
2. Press BD START; 29A displays SELECT CODE **

Function C3 gives access to options for specific family/pinout code combinations. If the UniPak 2™ is being used in a Model 19, this select code will work only from terminal remote.

To enter the options, follow the procedure below.

1. Press SELECT; 29A displays SELECT CODE ^
2. Press C3 START; 29A displays FXX PYY OPTIONS
3. Press START; 29A displays "NAME OF FIRST OPTION"

To select different options, press the REVIEW key. To execute an option, press START (in terminal remote, the RETURN key is used for the START key, and the space bar is used for the REVIEW key). If the option has subheadings under it, once the START key has been pressed, the REVIEW key can select the desired subheading. The START key is then pressed to execute the subheading. Once an option has been completely executed, an asterisk will be displayed after the option name. Complete execution may require doing a number of subheadings. Pressing the START key a second time after an option is completely executed will exit the options file, and the 29A will display OPTIONS DONE **.

NOTE

For the 8751H, the option "PROG SECTY ONLY" will program the security fuse as soon as the option is selected and executed.

Functions CC and CD are used in conjunction with electronic identifiers and may be used from the keyboard or from remote control.

Function CC displays the family and pinout codes of the last algorithm moved to RAM, usually the algorithm for the last device programmed or read. This function helps determine the family and pinout codes used by the programmer when in the automatic electronic identifier mode.

Function CD displays in hexadecimal 16 bytes of the device's electronic identifier. Byte 0 identifies the manufacturer; byte 1 identifies the device. For information on the purpose of the remaining bytes, consult the device data sheets.

To display the family and pinout codes of the last algorithm moved to RAM, follow the procedure below.

1. Press SELECT; 29A displays SELECT CODE ^
2. Press CC START; 29 A displays XXYY **

NOTE

XX represents the family code; YY represents the pinout code.

To display the electronic identifier, proceed as follows:

1. Press SELECT; 29A displays SELECT CODE ^
2. Press CD START; 29A displays 0000 YY
3. To display additional bytes of electronic identifier, press START; 29A displays 000X YY. To back up through previously displayed identifiers, press REVIEW; 29A displays 000X YY

NOTE

000X represents the byte number of the identifier displayed (i.e., 0001 represents byte 1 of the electronic identifier which is the device code). YY represents the identifier byte in hexadecimal.

Functions CE and CF are used to set the reject count (the number of programming pulses applied to a fuse or cell before it is rejected); CE sets the reject count back to the commercial specification (this is the default value) and CF sets the single-pulse reject count. This feature was accomplished in older UniPak™ models by adding 50 to the family code).

To select the commercial (default) reject count (CE), follow the procedure below.

1. Press SELECT; 29A displays SELECT CODE ^
2. Press CE START; 29A displays SELECT CODE **

To select the single-pulse reject count (CF), take the following steps:

1. Press SELECT; 29A displays SELECT CODE ^
2. Press CF START; 29A displays SELECT CODE **

Function EF calls up a four-digit hexadecimal configuration number and a two-digit decimal version number that correspond to the revision level and version number of the UniPak 2™ firmware. This function can be useful to identify firmware revision levels when communicating with Data I/O regarding field bulletins and updates.

To display the UniPak 2™ firmware configuration and version number, do the following:

1. Press SELECT; 29A displays SELECT CODE ^
2. Press EF START; 29A displays XXXX YY **

NOTE

XXXX represents the UniPak 2™ firmware configuration number, and YY represents the version number.

3.5 ELECTRONIC IDENTIFIERS

This version of the UniPak 2™ can read and use electronic identifiers in two modes.

The first mode occurs when family code 79, 93, 27, A5, BF, C5, AB, AF, C1, DD, or 45 is selected. The identifier is read and used to prohibit programming a device using the wrong family and pinout codes. The new low Vpp devices are protected from the old high Vpp algorithms which might destroy them. Older devices without signatures are permitted to program. An error will occur if you attempt to program using the wrong family or pinout codes.

The second mode is automatic. It is selected by entering family and pinout codes FF/FF. In this mode the operator need not look up any family or pinout codes; the electronic identifier is read and the correct algorithm is used for each device. An error will occur if you attempt to program on older devices without electronic identifiers or on newer devices whose identifiers are not yet supported.

3.6 FAMILY CODE AND PINOUT CODE SELECTION

Any device that can be programmed with the UniPak 2™ is specified by a unique combination of a two-digit family code and a two-digit pinout code (table A-1). Once the codes for a particular device are entered, the UniPak 2™ remains set up for any operation with that device until new codes are entered.

Your programmer manual will tell you where in the key sequence the family and pinout codes should be entered. If invalid family and pinout codes are entered, a beep will sound as either START or ENTER is pressed, or Err 30 (error 30) will be displayed and the operation will be aborted.

To select the family and pinout codes, do the following procedure:

1. Locate the manufacturer name and part number stamped on the device.

2. Turn to table A-1, Family and Pinout Codes, in appendix A, and find the same manufacturer name.
3. Then, in the first column (Device Part Number), find the number which corresponds to the part number stamped on the device.
4. Move to columns two and three, entitled Family and Pinout Codes, to find the numbers on the same line as the particular device number.
5. Enter these selected family and pinout code numbers.
6. Press "START."

NOTE

An LED (light-emitting diode) will light under one of the sockets.

Valid family and pinout codes must be in effect to use the System 19 DEVICE DATA key. When you press the DEVICE DATA key, either nominal, first-pass, or second-pass verify level is applied to the device. The level applied depends on the System 19's position in executing the selected mode. If the KEYBD light is on, the nominal verify level is applied.

3.7 DEVICE INSERTION

Once you have chosen the appropriate family and pinout codes, the UniPak 2™ is ready to accept a device in the socket located above the lighted LED.

NOTE

In the automatic electronic identifier mode, no LED is lighted unless UniPak 2™ is performing an operation on a device. An empty socket will always be unlighted. In this mode, disregard any reference to lighted LEDs; use the socket with the correct number of pins.

A good electrical connection between the device and the socket is essential. To ensure a good connection, do the following:

1. Check to make sure the programmer is not doing an operation. If it is, wait until the operation is complete.
2. Lift up the lever on the upper left side of the socket above the lighted LED; see figure 3-3. (The lever will stay locked into the upright position.)
3. Gently insert the device in the socket above the lighted LED. Make sure pin 1 of the device is aligned with pin 1 of the socket, as shown in figure 3-3.
4. Push the lever down to lock the device in the socket.

Once the family and pinout codes have been entered, the UniPak 2™ is ready for device-related operations. The key sequence to load, program, and verify are described in the Operation section of your programmer manual.

3.8 DEVICE REMOVAL

1. Check to make sure the programmer is not doing an operation. If it is, wait until the operation is complete.
2. Lift up the lever on the left side of the socket; see figure 3-3. (The lever will lock into the upright position.)
3. Lift the device out of the socket; the LED will remain illuminated.

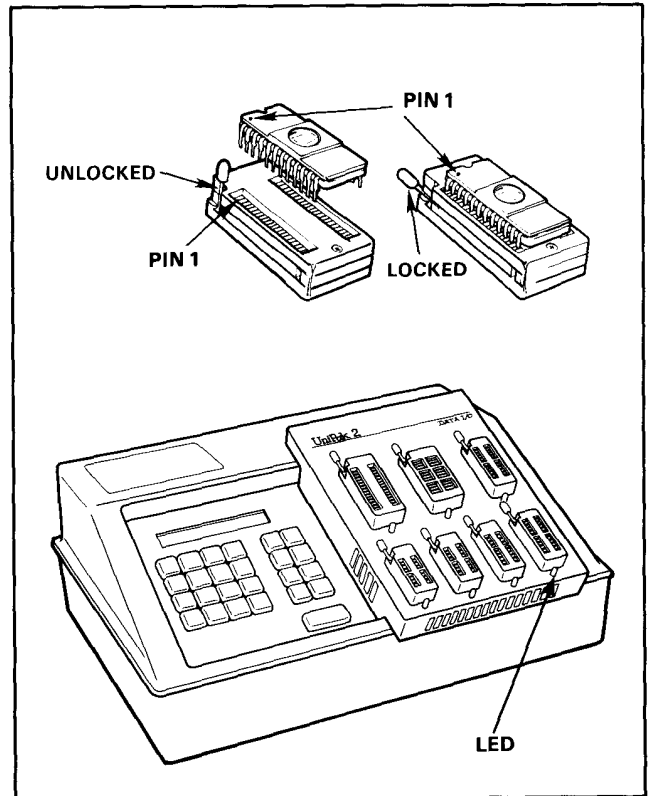


Figure 3-3. UniPak 2™ Sockets and Device Installation

SECTION 4

MAINTENANCE/TROUBLESHOOTING/CALIBRATION

4.1 OVERVIEW

The support material in this section has been provided to help you keep your UniPak 2™ in good operating condition. General maintenance practices are discussed in section 4.2, while the basic troubleshooting steps are listed in section 4.3. For those UniPak 2™ users who prefer to do their own calibration, detailed procedures, including measurement charts and timing diagrams, are provided in section 4.4.

4.2 MAINTENANCE

Before the UniPak 2™ can be cleaned (section 4.2.2) and/or inspected (section 4.2.3), it must be disassembled as described below.

4.2.1 UniPak 2™ Disassembly

To disassemble the UniPak 2™, refer to figure 4-1 and follow the procedure outlined below.

1. Remove the UniPak 2™ from the programmer; see section 2.3 for details.
2. Place the UniPak 2™ face down on a flat surface.
3. Unscrew the captive fasteners (figure 4-1a) until they hang loosely; the screws will not separate from their standoffs.
4. Lift the card cage up slightly, then pull out (as shown in figure 4-1b) to unlock the flanges.

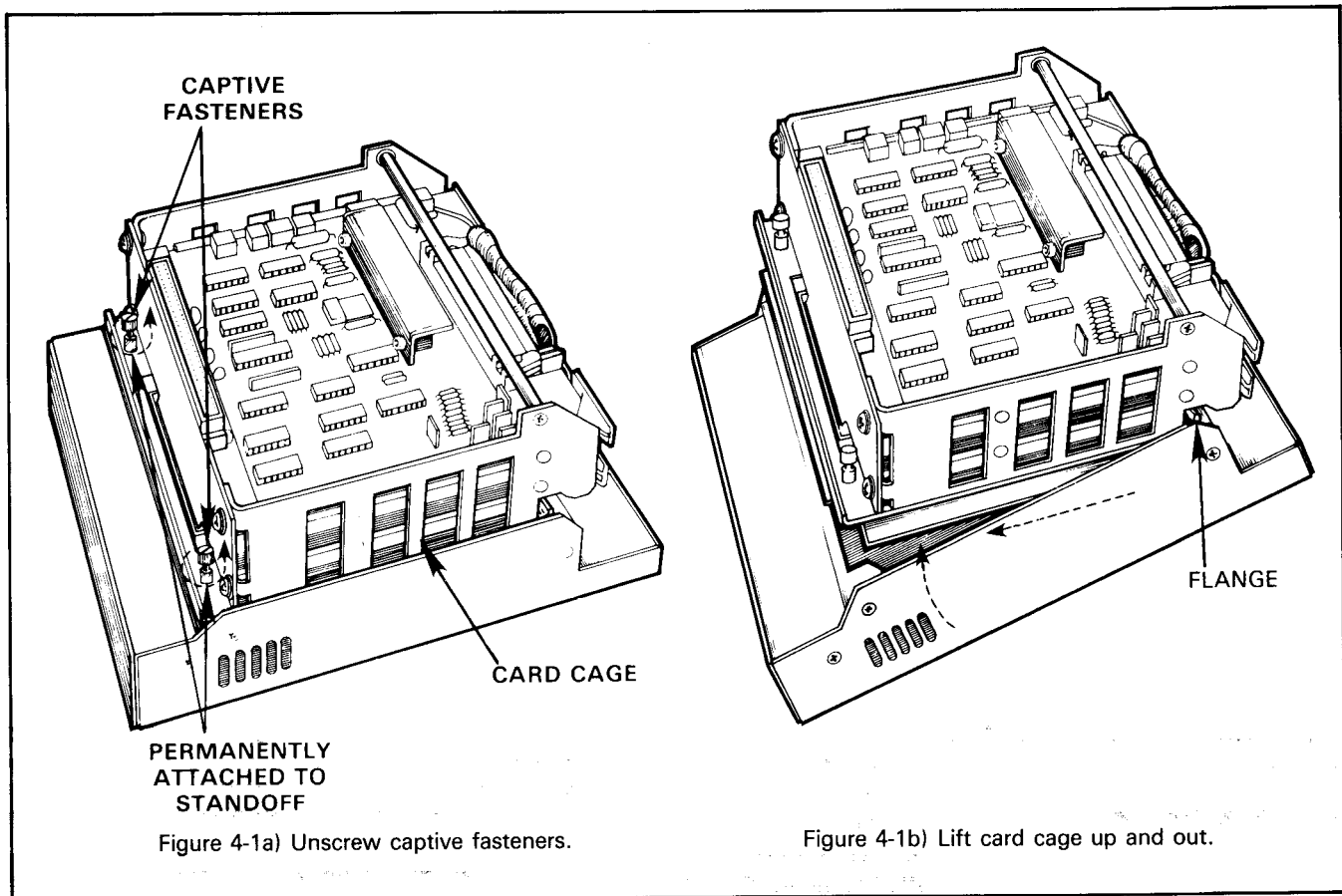


Figure 4-1. UniPak 2™ Disassembly

5. Lift the card cage up until you can see the socketboard interconnect cable and its connector (figure 4-2).
6. Flip the extraction tabs out on each side of the connector (figure 4-2).
7. Pull the cable out of the connector.
8. Disconnect the ground wire from the socketboard (see figure 4-2).
9. Flip the extraction tabs out on the top card (waveform generator card) and unplug the interconnect cable from its connector (figure 4-3).
10. Flip the extraction tabs out on the top card (waveform generator card).
11. Pull the waveform generator card out along the guides (figure 4-3).
12. Repeat steps 9, 10, and 11 for the extraction tabs on the address card.
13. Remove the two screws and the shield, and pull the memory card down to unplug it from the edge connector (as shown in figure 4-4).

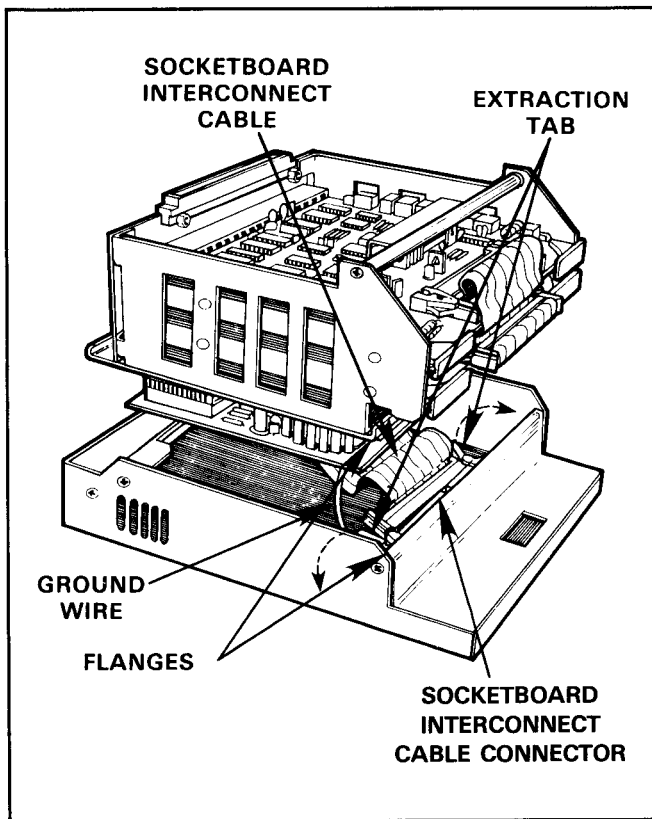


Figure 4-2. Socketboard Interconnect Cable Disconnect

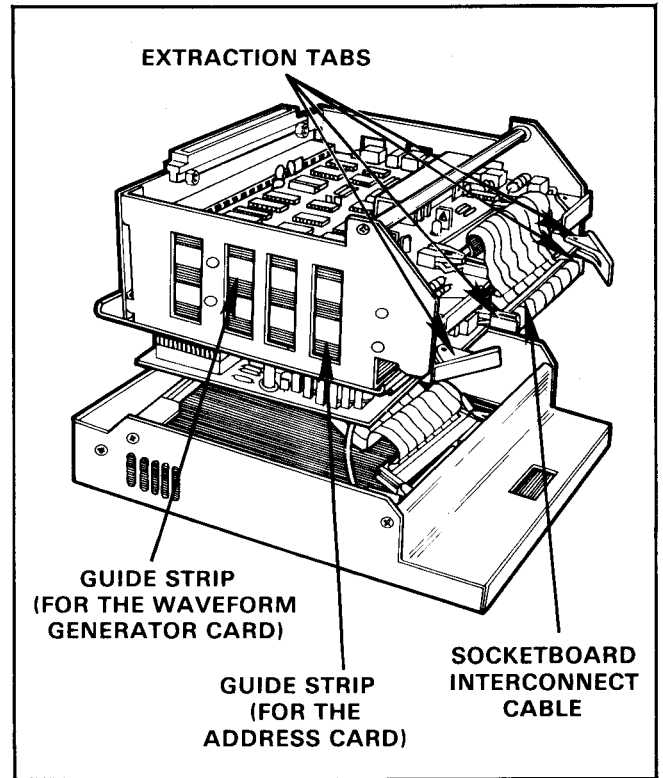


Figure 4-3. Circuit Board Removal

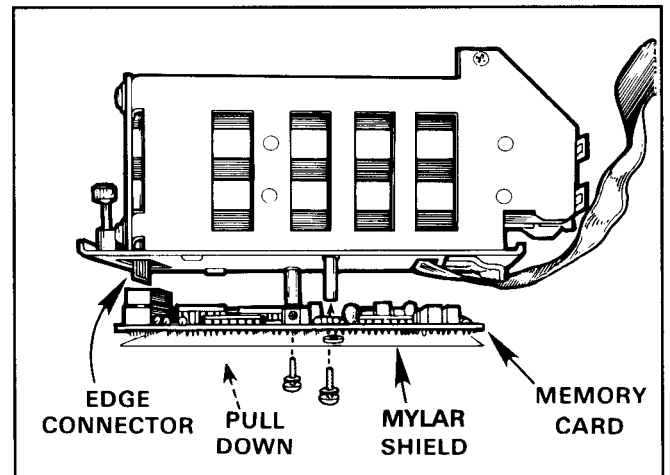


Figure 4-4. Memory Card Removal

4.2.2 Cleaning

Inspect the UniPak 2™ inside and out for accumulated dirt or dust. To clean the UniPak 2™, follow the procedure below.

1. Wipe any dust and/or dirt off the outside of the UniPak 2™ with a clean, damp cloth.

NOTE

Do not use abrasive cleaners or solvents. They will etch the paint.

2. Remove dust from the circuit boards with a blast of dry, compressed air or a clean, soft-bristled brush.

4.2.3 Inspection

You can help prevent malfunctions by periodically inspecting your UniPak 2™. Check cable connections, card seating, mounting of socketed components, etc., for shorts, opens or unstable continuity.

If you find heat-damaged components, be particularly careful to find and correct the cause of the overheating. This will prevent further damage.

4.2.4 UniPak 2™ Assembly

1. Plug the memory card onto its edge connector, as shown in figure 4-4.
2. Replace the shield, washers, and the two screws.
3. Flip the two extraction tabs down on the address card.
4. Using the flat surfaces of the extraction tabs, gently push the address card along the guides into its connector.
5. Make sure the extraction tabs on the interconnect cable connector are flipped open.
6. Firmly, but gently, push the socketboard interconnect cable into the connector. Notice that the extraction tabs will move back to their locked positions when the cable is locked into the connector.
7. Repeat steps 3 through 6 to replace the waveform generator card.
8. Reconnect the ground wire to the socketboard.
9. Plug the socketboard interconnect cable into its connector on the socketboard (figure 4-2).
10. Replace the card cage by tilting it up to lock the flanges, as shown in figure 4-1, then gently setting it down. Make sure the captive fasteners line up with the fastener holes on the UniPak 2™ frame.
11. Tighten the captive fasteners finger tight.

4.3 TROUBLESHOOTING

This section will help you interpret and isolate failures in the UniPak 2™. Use it in conjunction with section 5 (Circuit Description) and the schematics provided in the back of this manual.

There are three major classes of failures that can occur in a system comprised of a programmer and a UniPak 2™. The first is no system operation, the second is poor yields, and the third is UniPak 2™ failure.

After successfully troubleshooting the UniPak 2™, you must calibrate it according to the instructions in section 4.4. It is very important that the programmer be calibrated before the UniPak 2™ is calibrated.

4.3.1 No System Operation

You should perform the following steps if the system will not initialize with the UniPak 2™ installed. After completing each step, determine whether the problem still exists.

1. Check to be sure the UniPak 2™ is properly installed in your programmer.
2. Check the UniPak 2™ programmer mating connector (J1) for bent or broken pins. (Pin HH is intentionally shorter.)
3. Check the UniPak 2™ cards to be sure they are correctly installed in their connectors (section 4.2).
4. Check the ribbon cable to be sure it is properly inserted in the connectors (section 4.2).
5. Check the programmer power supplies for proper voltage output levels (see programmer manual).
6. If steps 1 through 5 fail to isolate the problem, contact your local Data I/O Service Center.

4.3.2 Poor Yields

Perform the following steps if the yield rate begins to decrease. After completing each step, determine whether the problem still exists.

1. Do a complete calibration; be sure that the programmer has been calibrated first.
2. Perform waveform observations (section 4.4) for the family of the device being programmed, being careful to note any discrepancies. You may find the circuit description (section 5) and the schematics at the end of this manual useful in isolating the problem.

3. Perform calibration steps 27 and 28 on the measurement chart for the device family that is giving problems. The circuit description (section 5), schematics, and suspected components in tests 1 through 4 of table 4-1 may be helpful in isolating the problem.
4. If steps 1 through 3 fail to resolve the problem, contact your local Data I/O Service Center.

4.3.3 UniPak 2™ Failure

Perform the following steps if a device will not program at all or if error messages are displayed. After completing each step, determine whether the problem still exists.

1. Check that the family and pinout codes are correct for the device, and that the device is being inserted in the correct socket.
2. If possible, try a known-good device to determine whether there is a hardware problem.
3. Check to be sure the UniPak 2™ is properly installed.
4. Check the UniPak 2™ programmer mating (J1) connector for bent or broken pins. (Pin HH is intentionally shorter.)
5. Check the UniPak 2™ cards to be sure they are correctly installed in their connectors (section 4.2).
6. Check to be sure the ribbon cable is correctly oriented and properly inserted in the connectors.
7. Perform a complete calibration, noting any measurements falling outside the indicated limits. Refer to the corresponding test number in table 4-1 for suspected boards and components, as well as the circuit description (section 5) and the schematics, to attempt to isolate the problem.
8. Perform waveform observations and note any discrepancies. Referring to the circuit description and the schematics may be helpful in isolating the problem.
9. If steps 1 through 8 fail to resolve the problem, contact your local Data I/O Service Center.

Table 4-1. Troubleshooting Chart

TEST NUMBER	SUSPECT CARDS	SUSPECT COMPONENTS
1	701-1655	VR1, U17, U25
2	701-1655	VR1, U16, U25, Q2, Q3
3	701-1655	VR1, U16, U25, Q2
4	701-1690 702-1659	U15, U7, U12, Q21, R52, CR15, CR16, VR1, Q15 CR18, U10
5	701-1690 702-1659	U14, U7, U3, Q3, R15, CR4, CR3, U10, U9, U11, Q24, Q25, Q19, CR14, Q16, U18, U17, VR1, Q15 C5, R11, CR9
6	701-1690 701-1655	U13, U7, U6, Q9, R31, CR10, CR11, Q2, CR19, VR1, Q15 U23, R1, Q15, Q17, RP8, RP3, RP4, RP2, Q4, U24, U11, CR6
7	702-1650 702-1659 701-1655	U23, U22, VR2, CR3, Q2, R28 CR24, Q10, U20 U4, U14
8	701-1655	VR1, U17, U25
9	701-1655	VR1, U16, U25, Q2
10	701-1655	VR1, U17, U25
11	702-1650 701-1655	U17, Q3, R3, VR1, U2, Q1, CR1, CR2 U23, R1, Q15, Q17, RP8, RP3, RP4, RP2, Q4, CR6, U24, U11
12	702-1650 701-1655	U17, Q3, R3, VR1, U2, Q1, CR1, CR2, VR3, U5, U22, U11 U23, R1, Q15, Q17, RP8, RP3, RP4, RP2, Q4, U24, U11, CR6
13	701-1690 701-1655	U17, U18, U11, Q22, Q25, Q2, CR19 U23, R1, RP8, Q16, RP3, Q14, RP4, RP2, Q12, U19, U24, CR9
14	701-1690 702-1659	U15, U7, U12, Q21, U16 CR18, U10
15	701-1690	U16, U13, U7, U6, Q9
16	701-1690	U16, U14, U7, U3, Q3
17	701-1655	U26, U17, U25, VR1
18	701-1655	U26, U16, U25, VR1, Q2
19	702-1650 701-1655	U5, U22, U17, U11, Q3, U2, CR1, CR2, Q1 U23, R1, RP8, Q15, RP3, Q17, RP4, RP2, Q4, CR6, U11, U24
20	701-1690, 701-1655, 702-1659	
21	702-1659 701-1655	U4, DS2 U18
22	701-1690 702-1659	U15, U7, U12, Q21, CR15, CR14, U16 CR18, U10
23	702-1659 701-1690 702-1650	CR26, Q6, Q7, Q5 U16, U13, U7, U6, Q9, CR10, CR11 U16, U3, U10, U12, U11, U7
24	701-1690 702-1659	U16, U14, U7, U3, Q3, U9, U10, U11, Q24, Q25, Q19, CR14, Q16, CR4, CR3 C5, R11

Table 4-1. Troubleshooting Chart (Continued)

TEST NUMBER	SUSPECT CARDS	SUSPECT COMPONENTS
25	701-1690	U16, U14, U7, U3, Q3, U9, U10, U11, Q24, Q25, U5, Q6, Q8, CR8, CR4, CR3
	702-1659	C5, R11
26	701-1690	U16, U14, U7, U3, Q3, U9, U10, U11, Q24, Q25, U5, Q13, CR9, Q4, Q10, Q12, Q5, Q7, CR4, CR3
	702-1659	C5, R11
27	701-1690	U16, U13, U7, U6, Q9, CR10, CR11, Q2, CR19
	701-1655	U23, R1, Q16, RP3, Q17, RP4, RP2, Q8, CR9, U19, U24
28	701-1690	U16, U13, U7, U6, Q9, Q2, Q18, U17, Q11, CR2, Q14, U5
29	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	CR18, U10
30	701-1690	U16, U14, U7, U3, Q3, CR4, CR3, U9, U10, U11, Q24, Q25, U5, Q6, Q8, CR8
	702-1659	C5, R11
31	702-1650	U23, U22, VR2, CR3, Q2, R28
	702-1659	CR24, Q10, U20
	701-1655	U4, U14
32	701-1690	U18, U10, U5, U7, Q20, Q7, Q5, Q12, U9, CR9, Q13, U11, Q24
	702-1659	CR8, C5, R11
33	701-1690	U11, CR17, VR2, U18, Q19, Q16, U9, Q24, U10
	702-1659	CR9, R11, C5
34	701-1690	U16, U13, U7, U6, Q9, CR10, CR11
	702-1659	CR4, CR3, CR2, U22, CR5, Q1, CR32, CR31, CR28, C3, C13
	702-1650	U5, VR3, U22, U17, U11, Q3, U2, Q1, CR1, CR2, VR1
	701-1655	U19, U24, U23, R1, Q16, RP3, Q17, RP4, RP2, Q8, CR9
35	702-1650	U5, VR3, U22, U17, U11, Q3, U2, Q1, CR1, CR2, VR1
	701-1655	U19, U24, U23, R1, Q16, RP3, Q17, RP4, RP2, Q8, CR9
36	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	CR18, U10
37	701-1690	U16, U14, U7, U3, Q3, CR4, CR3, U9, U10, U11, Q24, Q25, U5, Q13, CR9, Q7, Q5, Q12, Q20, U7
	702-1659	C5, R11
38	701-1690	U16, U13, U7, U6, Q9, CR10, CR11
	702-1659	CR4, CR3, CR2, U22, CR5, Q1, CR32, CR31, CR28, C3, C13
	702-1650	U5, VR3, U22, U17, U11, Q3, U2, Q1, CR1, CR2, VR1
	701-1655	U24, U11, U23, R1, RP8, Q15, RP3, Q17, RP4, RP2, Q4, CR9
39	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	CR18, U10
40	701-1655	VR1, U16, U25, Q2, RP5, U28, U22, CR9, CR6, U24, U11, U19, CR4, CR7
	702-1659	Q2, CR29, R30, CR28, CR31, CR32
41	701-1655	VR1, U16, U25, Q2, RP5, U28, U22, CR9, U24, U11, U19, CR4
	702-1659	Q2, CR29, R30, CR28, CR31, CR32
42	701-1655	VR1, U16, U25, Q2, RP5, U28, U22, CR9, U24, U11, U19, CR4
	702-1659	Q2, CR29, R30, CR28, CR31, CR32
43	701-1655	VR1, U16, U25, Q2, RP5, U28, U22, CR9, CR6, U24, U11, U19, CR4, CR7
	702-1659	Q2, CR29, R30, CR28, CR31, CR32

Table 4-1. Troubleshooting Chart (Continued)

TEST NUMBER	SUSPECT CARDS	SUSPECT COMPONENTS
44	702-1659	DS1, U4
	701-1655	U18
45	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	CR7, U10
46	701-1655	U2, U3, U4, U14
	702-1650	U23, U22, VR2, CR3, Q2
	702-1659	CR24, Q10, U20, U21, U13
47	701-1655	U2, U3, U4, U14
	702-1650	U23, U22, VR2, CR3, Q2
	702-1659	CR24, Q10, U20, U21, U13
48	701-1655	U2, U3, U4, U14
	702-1650	U23, U22, VR2, CR3, Q2
	702-1659	CR24, Q10, U20, U21, U13
49	701-1655	U2, U3, U4, U14
	702-1650	U23, U22, VR2, CR3, Q2
	702-1659	CR24, Q10, U20, U21, U13
50	701-1655	Q4, Q8, Q12, Q5, Q14-17, U23
51	701-1655	Q6, Q11, Q9, Q7, Q14-Q17, U23
52	701-1655	Q4, Q8, Q12, Q5, Q14-17, U23
53	701-1655	Q6, Q11, Q9, Q7, Q14-17, U23
54	702-1659	DS3, U4
	701-1655	U18
55	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	CR22, U10
56	702-1659	DS4, U4
	701-1655	U18
57	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	U10, CR1
58	702-1659	DS5, U4
	701-1655	U18
59	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	U10, CR11
60	702-1659	DS6, U4
	701-1655	U18
61	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	U10, CR19
62	702-1659	DS7, U4
	701-1655	U18
63	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	702-1659	U10, CR23
64	702-1659	Q3, CR14, RP1, R10, CR17, U10
	701-1655	U18, U22
65	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	701-1655	VR1, U16, U17, U25, Q2, Q3, Q1
	702-1659	CR17, CR1, CR11, CR19, CR23, CR22, CR7, CR18, U10
66	701-1690	U16, U15, U7, U12, Q21, CR15, CR16
	701-1655	VR1, U16, U17, U25, Q2, Q3, Q1
	702-1659	CR17, CR1, CR11, CR19, CR23, CR22, CR7, CR18, U10

4.4 CALIBRATION

The need for calibration varies with the amount of use your UniPak 2™ receives. Generally, we suggest calibration whenever: 1) programming yields fall below the manufacturer's recommended minimums, or 2) troubleshooting has been completed, or 3) the user's company policy requires periodic calibration certification.

NOTE

If calibration or repair is required but you lack the facilities to accomplish it, contact the nearest Data I/O Service Center.

Because of differences in programmer mainframes, this manual does not attempt to cover all areas of programmer calibration. Instead, it lists the steps necessary to calibrate only the UniPak 2™.

Calibration of the UniPak 2™ consists of three parts:

1. Power Supply Calibration—measures the DC supply voltages of the programmer. All other voltages depend on these supplies; therefore, this part of the calibration procedure must be done first. Refer to your programmer manual.
2. DC Calibration—consists of measuring and adjusting critical DC voltage levels generated by the UniPak 2™.
3. Waveform Observation—enables observation of waveforms on an oscilloscope to ensure compliance with the device manufacturers' critical voltage and timing specifications.

The first part of the calibration procedure (power supply calibration) varies with the type of programmer you have. Therefore, this manual refers you to your programmer manual for details on power supply calibration. DC calibration is discussed in section 4.4.1, the optional verify voltage checks are described in 4.4.2, and waveform observation is detailed in section 4.4.3. For information on how to carry out these steps on various programmers, consult your programmer manual.

The following equipment is necessary to calibrate the UniPak 2™:

- Data I/O calibration extender (part number 910-1521)
- Three and a half-digit digital voltmeter (DVM)
- Dual-trace oscilloscope (Tektronix 465 or equivalent)

Check the appropriate programmer manual for any additional equipment that you may need to calibrate the programmer.

To prepare your UniPak 2™ for calibration, follow the procedures outlined below.

1. Turn the programmer power off; see section 3.3 for details.
2. Remove the UniPak 2™ from the programmer; see section 2.3 for details.
3. Insert the calibration extender into the programmer the same way you insert the UniPak 2™ (section 2.2).
4. Unscrew the two thumb screws (captive fasteners) located on the underside of the top cover of the UniPak 2™ (figure 4-1); they connect the card cage to the socket assembly. Separate the two parts of the assembly.

CAUTION

Do not let the fasteners short to the motherboard.

5. Insert the 64-pin connector of the card cage into the mating connector on the calibration extender (figure 4-5, detail B).
6. Lean the top portion of the UniPak 2™ against its bottom portion at a 45-degree angle; see figure 4-5.

NOTE

Be sure the socket assembly flange locks into the card cage flange (see figure 4-5, detail A).

Do not allow the frame of the socket assembly to short to the memory board.

Be careful not to strain the cable or scratch the top of the programmer.

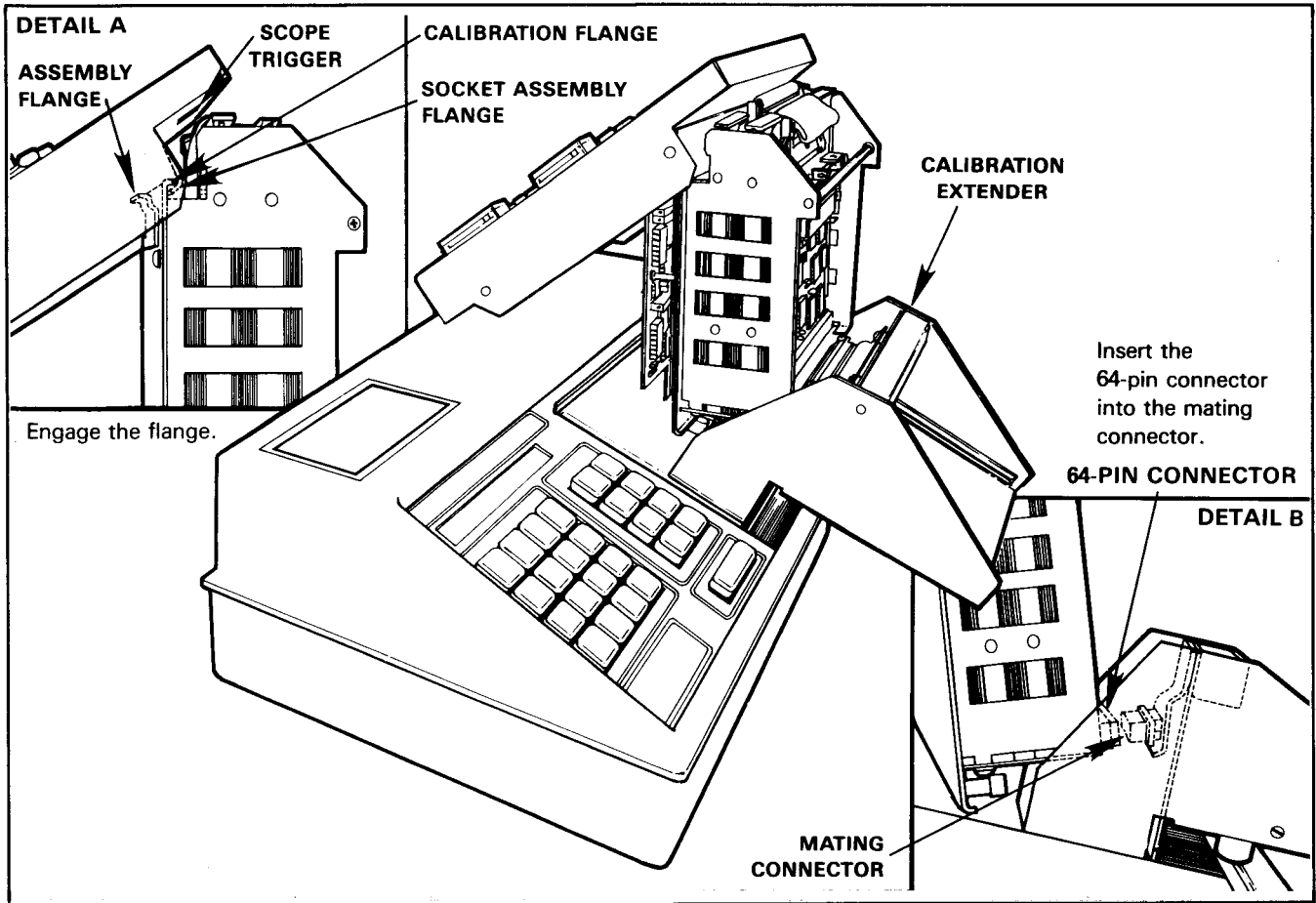


Figure 4-5. Calibration Setup

4.4.1 DC Calibration

The DC calibration procedure described in this section enables you to adjust critical DC voltage levels generated by the UniPak 2™. To follow this procedure, use the measurement chart at the end of this section. This measurement chart contains the information needed for all DC calibration tests. This information is included on the measurement chart in columns with the following headings:

- Step No.—tells which step to use for each test. Step numbers are set at the programmer keyboard and reflected in the display.
- Test No.—identifies individual tests.
- Test Description—identifies the functions being tested.
- Measurement Test Location—tells which socket pins, circuit boards, or test points to probe for measuring voltages.
- Measurement—specifies allowable measurement ranges. If a reading falls outside the range and you cannot adjust it to within the range, do not use the UniPak 2™ until the problem is corrected.
- Adjustment Location—tells which potentiometer to adjust if a measurement is out of range.
- Comments—gives special instructions for particular tests.

The DC calibration procedure is as follows:

CAUTION

Remove all devices from the sockets before entering the calibration mode (see section 3.8 for details).

Waveform generation may damage any device in the UniPak 2™ sockets.

1. Turn the programmer power on (section 3.2).
2. Put the programmer into the calibration mode by following the key sequences in table 4-2.
3. Perform the general calibration steps (steps 1 through 24) on the measurement chart. For steps 5, 6, and 7, refer to the figures at the end of the measurement chart to observe the bit switch rise waveform the DAC step waveforms, and the current DAC step waveform.

Table 4-2. Key Sequence To Access the Calibration Mode

Programmer System	Key Sequence To Enter Calibration Mode	To Increment Step No.	To Decrement Step No.
19	Press SELECT Press C2 Press ENTER Enter Step Number* Press START	Press ENTER	Press REVIEW
29A/ 29B	Press SELECT Press C1 Press START Enter Step Number* Press START	Press START	Press REVIEW
100A	Press SELECT Press 12 Enter Step Number* Press START	Press START	Press BACK-SPACE

*Optional

For each general calibration step on the measurement chart do the following:

- Take measurement readings at the device sockets or test points indicated on the measurement chart; figure 4-6 shows the pin numbers for the sockets; figure 4-7 shows test points.
- Ground the digital voltmeter to socket 7, pin 10 on the front panel of UniPak 2™.
- The adjustment pots on the waveform generator, memory board, and the address card enable you to make adjustments when your measurements do not match the measurement chart; figure 4-7 shows the location of these adjustment points.

- Access each new step by pressing the START (or ENTER) key. The new step number will appear in the display when the UniPak 2™ is ready for the next step. To go back to a previous test, press the REVIEW (or BACKSPACE) key.

NOTE

The remaining steps on the measurement chart (steps 25 through 28) are family specific. These steps are optional and have been included for your convenience.

4. For each family-specific calibration step on the measurement chart, do the following to enter the family and pinout codes:
 - Perform a **load operation**; refer to your programmer manual for details.
 - Enter the family and pinout codes when prompted by the programmer; refer to your programmer manual for further information.
 - Fill RAM with data specified on the timing diagram.
 - Put the programmer back into the calibration mode; see figures 4-8, 4-9, and 4-10 for the key sequence.
 - Enter the step number from the measurement chart.
 - Press START.

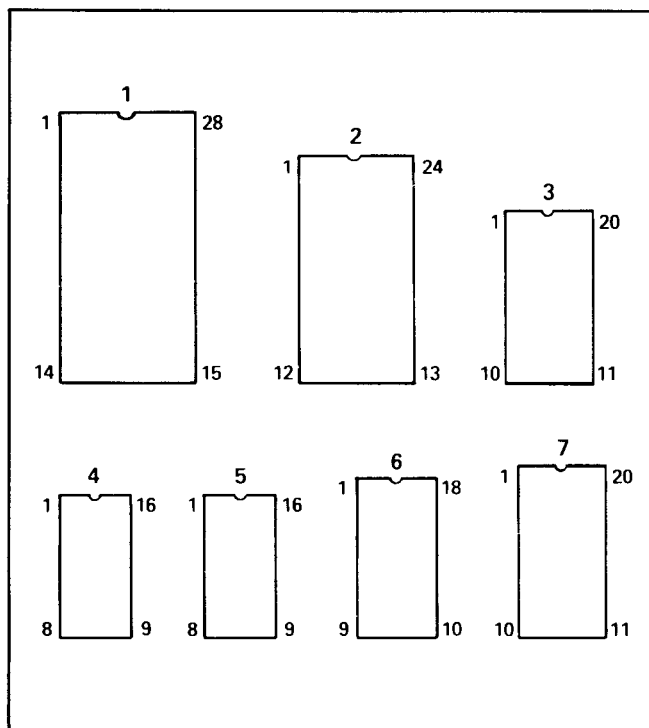


Figure 4-6. Pin Numbers of Device Sockets

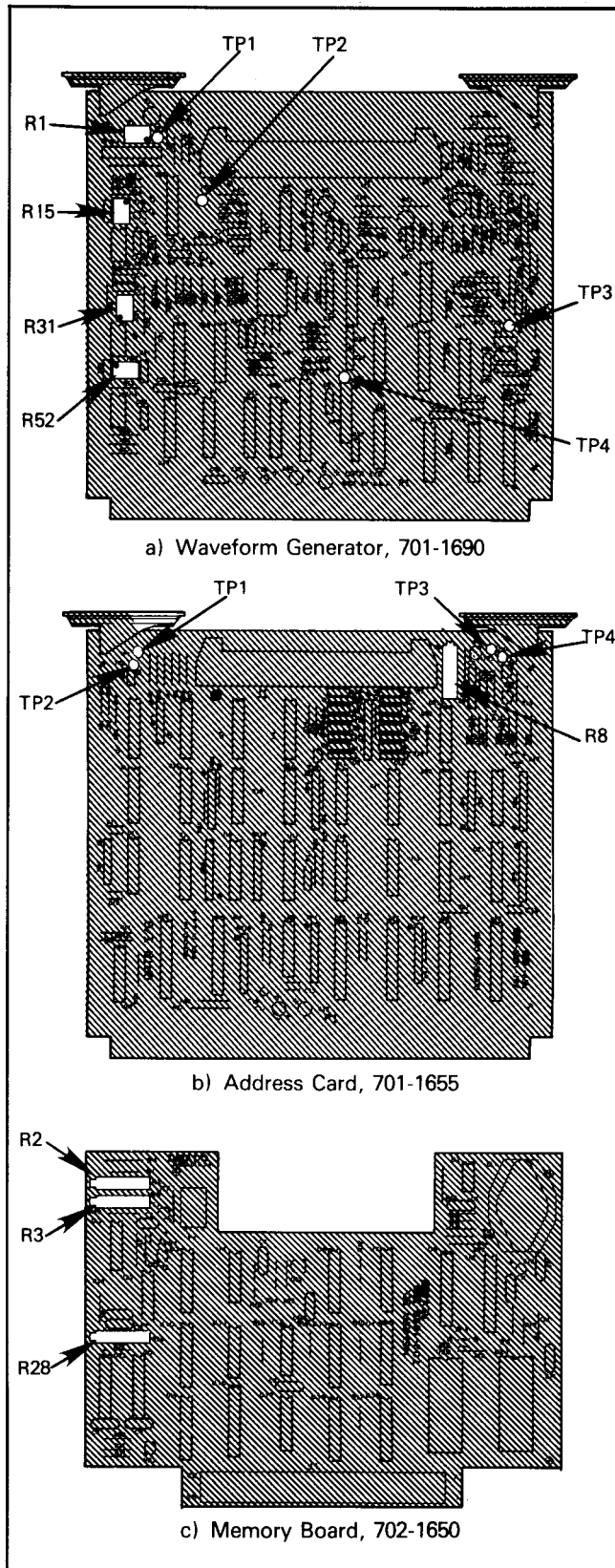


Figure 4-7. Adjustment Locations

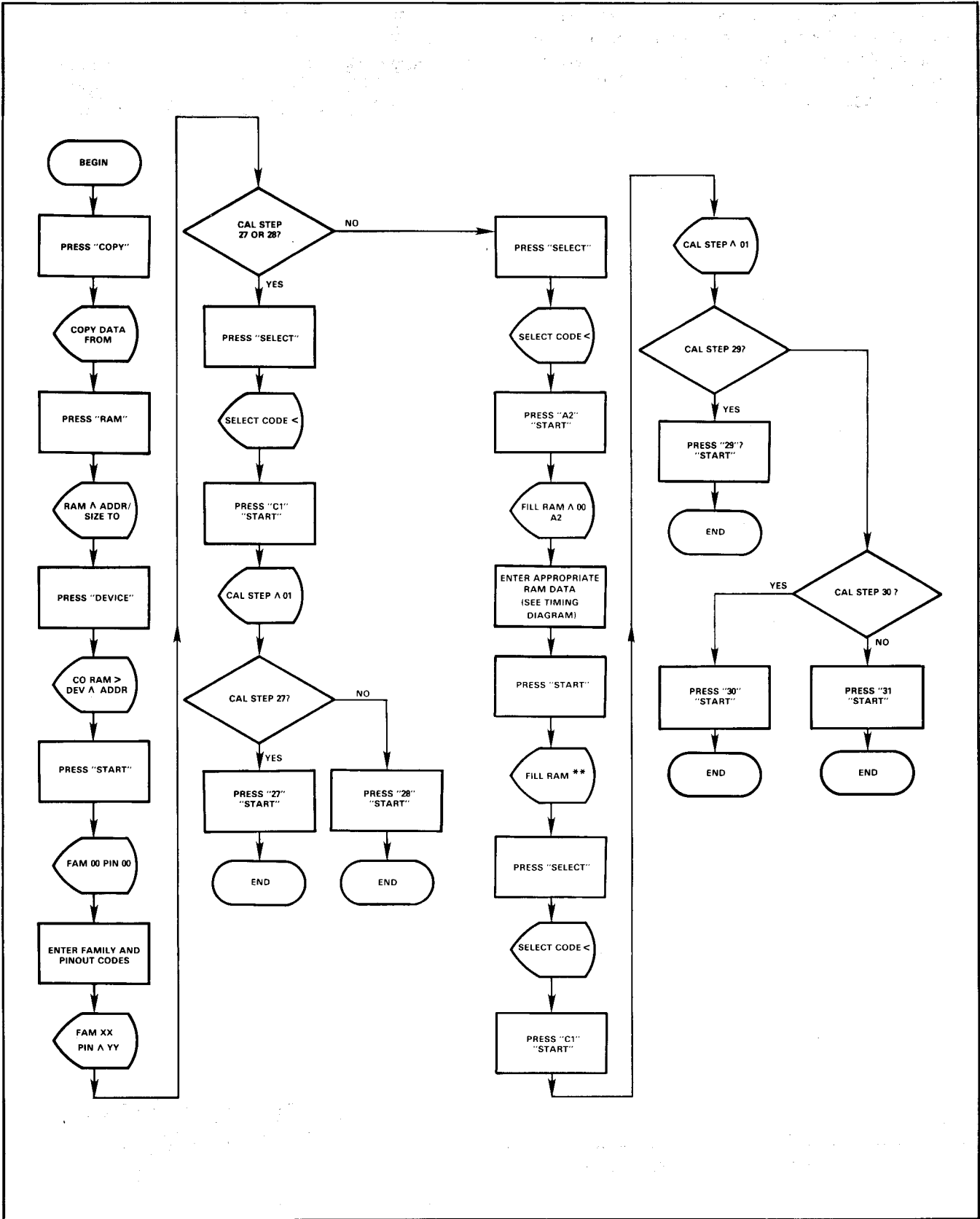


Figure 4-8. Accessing Calibration Steps 27, 28, 29, 30, 31 (29A Universal Programmer)

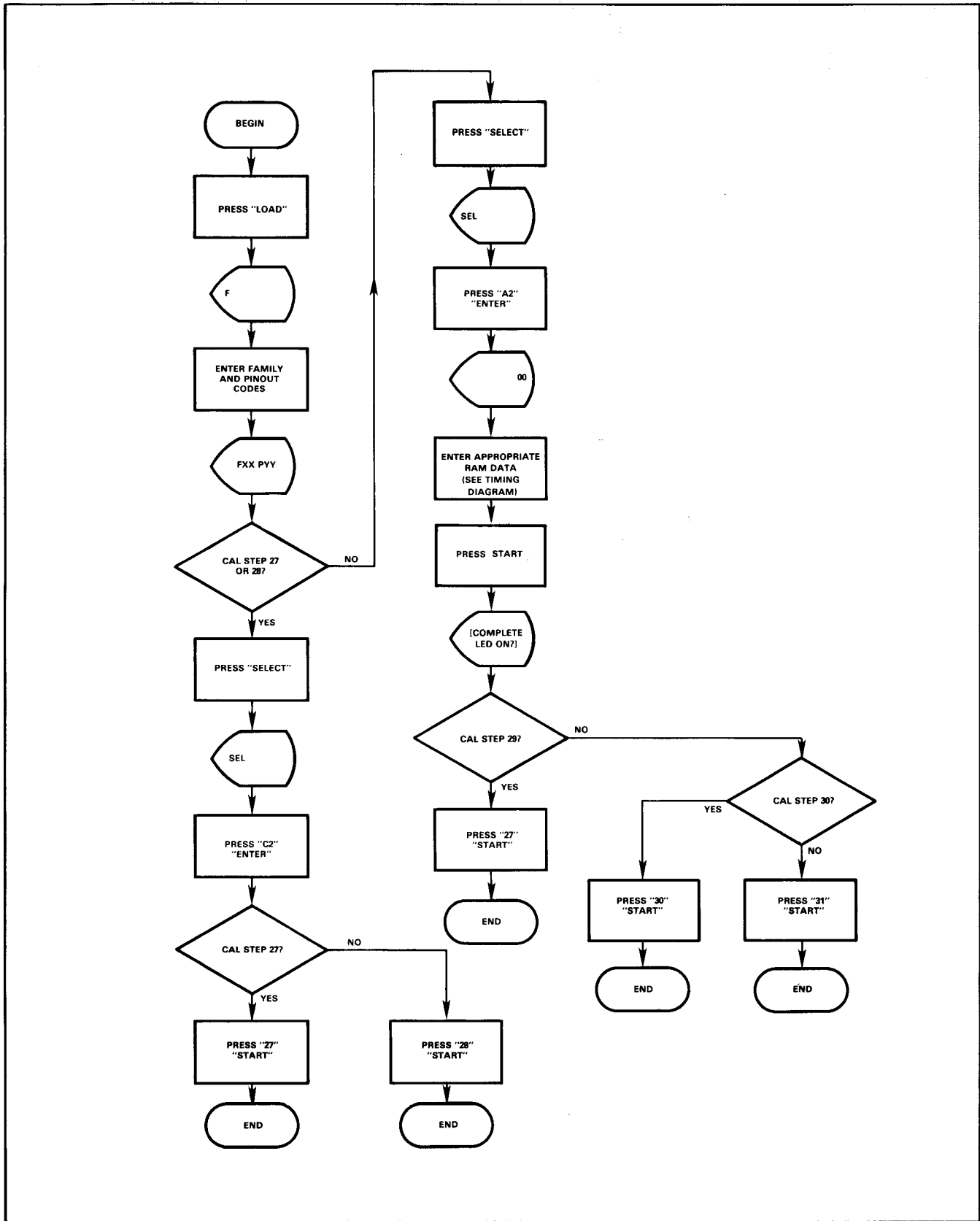


Figure 4-9. Accessing Calibration Steps 27, 28, 29, 30, and 31 (System 19)

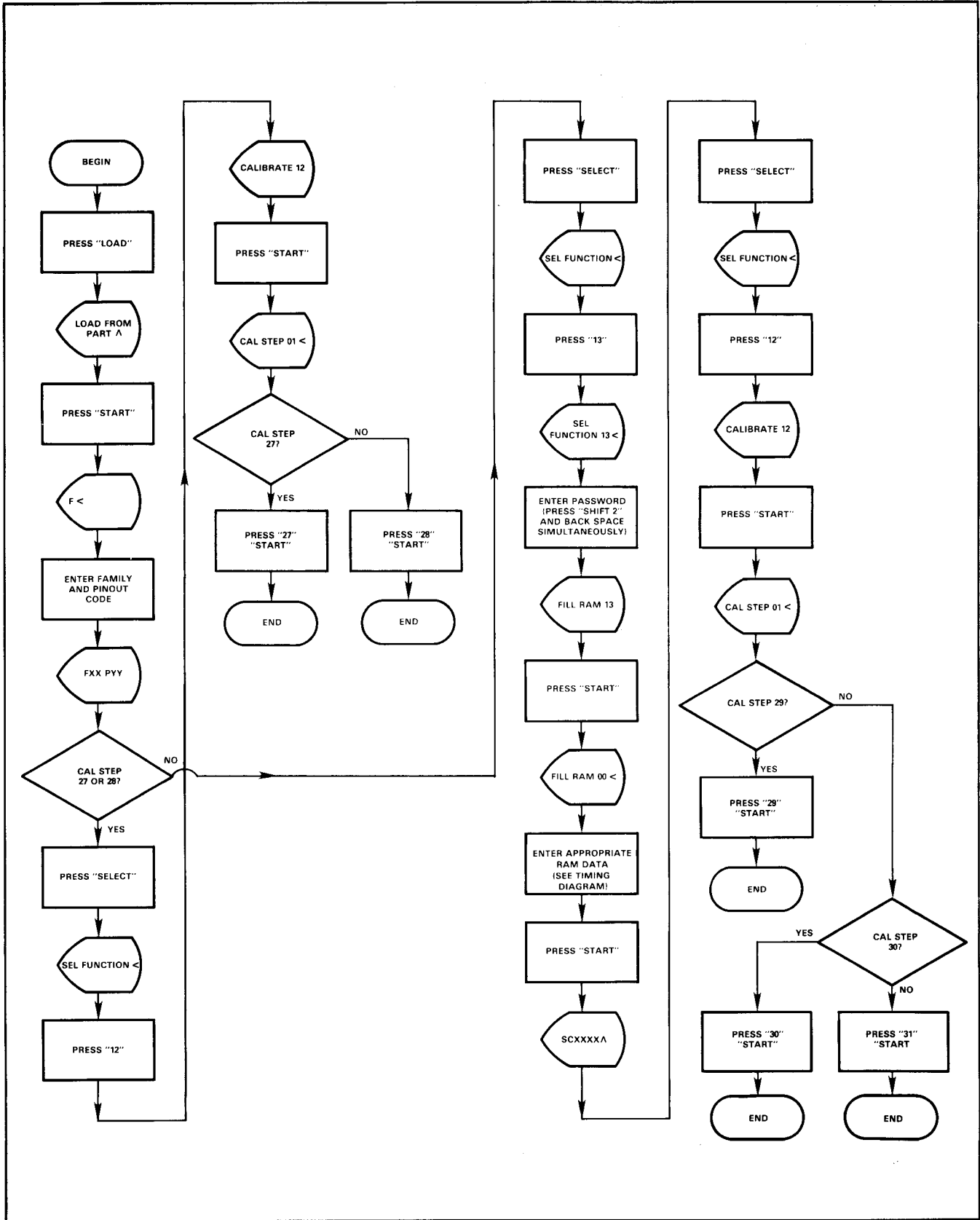


Figure 4-10. Accessing Calibration Steps 27, 28, 29, 30, 31 (Model 100A)

4.4.2 Optional Verify-Voltage Checks

Two calibration steps (27 and 28) have been provided for the measurement of first- and second-pass verify voltages. The family characteristics table in the applicable family timing diagram defines the levels for first- and second-pass verifications for each family. These are provided for the investigation of yield problems; no adjustments are available. Under normal circumstances, these steps can be eliminated from a routine calibration.

4.4.3 Waveform Observation

Programming waveforms of your UniPak 2™ can be observed with an oscilloscope and compared with the timing diagrams that are provided in appendix B. In this way, timing and magnitude relationships can be measured against known specifications to confirm that the UniPak 2™ is performing to the device manufacturer's specifications. Since the UniPak 2™ generates a large number of waveforms and all calibration adjustments are accomplished in DC calibration, it is necessary only to observe waveforms for commonly used devices or those that are presenting yield problems.

During the waveform observation phase of the calibration procedure, your UniPak 2™ uses a firmware routine that generates programming waveforms for the data stored in system RAM. An oscilloscope trigger pulse is generated for every address increment. This occurs after the reject pulse count has been reached for all the bits being programmed in the previous data word. The address is automatically reset to 0 when the maximum PROM address is reached, and incrementing continues. Waveform observation can be done with the UniPak 2™ either on the calibration extender or plugged into the programmer.

The waveform observation procedure described below calls for filling RAM with data so that it is possible to observe bit-to-program waveforms. The procedure takes into account the device type (VOL or VOH) so that for either type of PROM a bit-to-program will appear on the same socket contact.

When used with a timing diagram, this procedure allows you to compare waveforms on the oscilloscope with the waveform photographs on the timing diagram for any type of device; a detailed explanation of the timing diagrams is provided in section 4.4.4. The waveform observation procedure is as follows:

1. Refer to table A-1 to determine the family and pinout codes, polarity, and technology of the selected device.

NOTE

Polarity is indicated in the family code. Odd-numbered families are VOL and even-numbered families are VOH.

2. Initiate a load operation; refer to section 3.4 for details.
3. Key in the family and pinout codes when prompted by the programmer; see section 3.5.

4. Fill your programmer's RAM with programming data listed in the timing diagram for the family code entered: the correct data depends on the polarity and technology of the device. Refer to table 4-3 for the "Fill RAM" key sequence.

CAUTION

Remove all devices before entering the calibration mode. Waveform generation may damage any device in the UniPak 2™ sockets.

Table 4-3. Key Sequence To Fill RAM With Data

System	Key Sequence
19	Press SELECT A 2 Press ENTER Enter data Press START
29A/29B	Press SELECT A2 Press START Enter data Press START
100A	Press SELECT 1 3 Enter Password (SHIFT 2/ BACKSPACE) Enter data Press START

5. Enter the waveform generation mode at step 27 on the measurement chart by following the key sequences listed in figure 4-8, 4-9, or 4-10, depending on your programmer.
6. Erase waveforms for EEPROMs are observable at step 30 or 31 of the measurement chart by following the key sequences listed in figure 4-8, 4-9 or 4-10, depending on your programmer.
7. Trigger your oscilloscope by connecting to the test point under the top edge of the socket assembly (see figure 4-11).
8. Ground the scope to the GND contact of the socket with its LED illuminated; the GND contacts are shown in figure 4-12.
9. To observe individual waveforms, refer to figure 4-13 under the pinout code number entered in step 3. The individual socket illustrations give the numbers of the socket contacts to probe when observing the waveforms on the timing diagram.

NOTE

Considerations helpful in setting up and interpreting the waveform displays are explained in section 4.4.4.

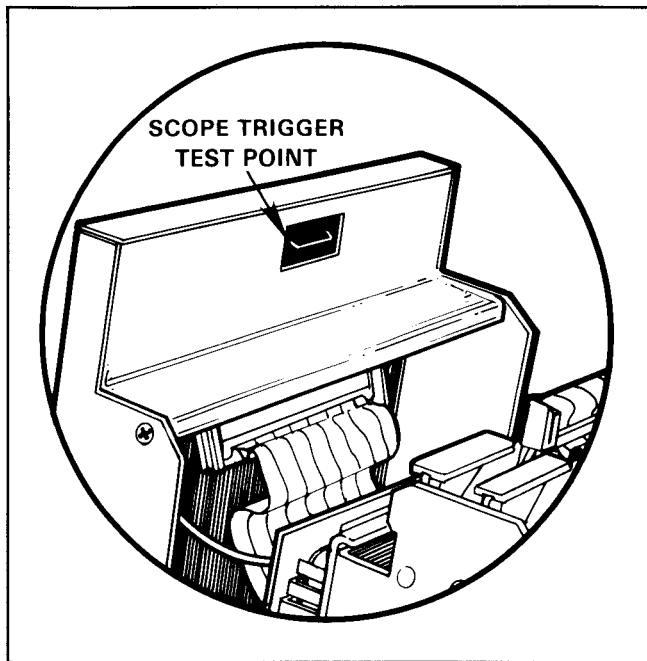


Figure 4-11. UniPak 2™ Scope Trigger Test Point

4.4.4 Detailed Explanation of the Timing Diagrams

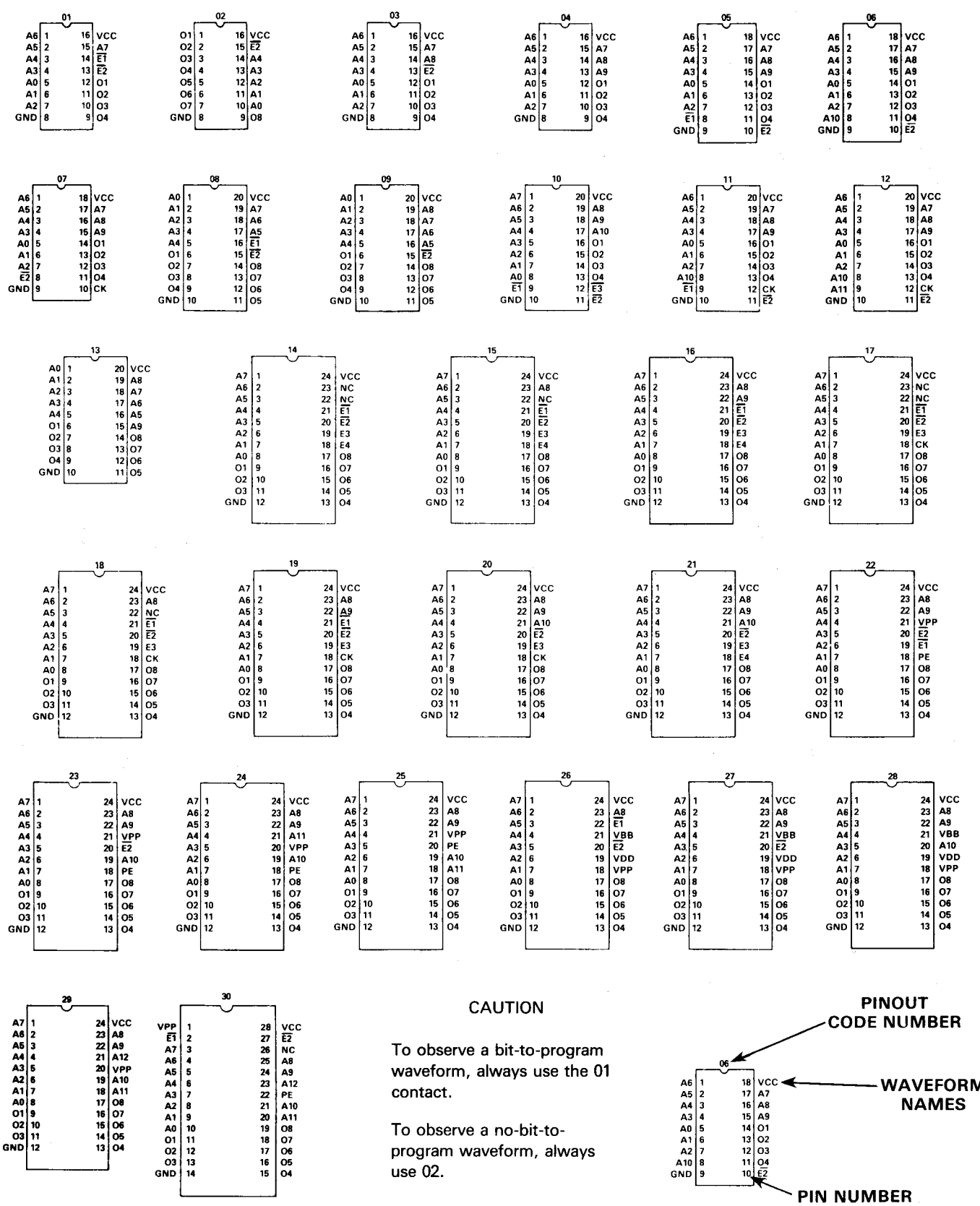
This manual contains a timing diagram for each device family that can be programmed by the UniPak 2™. Each timing diagram contains a set of waveform photographs that show critical programming parameters. To use these diagrams and photographs, read the information provided below and refer to the sample timing diagram (figure 4-13).

1. **FAMILY CODE NUMBER**—corresponds to the family code number of the device (refer to table A-1).
2. **FAMILY CHARACTERISTICS TABLE**—lists the minimum and maximum parameter values; voltage and timing parameters other than those listed in this table are to be considered noncritical with a $\pm 10\%$ tolerance.
3. **NOTES**—important information pertaining to a timing diagram.

4. **WAVEFORM NAMES**—correspond to the pin names on the pinout chart (figure 4-12); the pinout chart tells you which socket pins to probe when you are observing the waveforms for a particular device pinout within a family. (The pinout is indicated by the number above each socket on figure 4-12 which corresponds to the pinout code on table A-1.)

We recommend that you use the oscilloscope's single-sweep mode for address observation, since one trigger pulse is generated for each address change.

- **BIT NO PROG**—Always use the 02 (bit 2) contact (shown in figure 4-12).
 - **BIT TO PROG**—always use the 01 (bit 1) contact (shown in figure 4-12).
5. **LAYOUT SEQUENCE NUMBER**—used as a reference point within each diagram.
 6. **DELAY TIME POSITION**—indicates the time from the start of the main sweep to the start of the delay time.
 7. **OSCILLOSCOPE GROUND REFERENCE**—ground contact on the socket with its LED illuminated.
 8. **TIME-BASE AND VOLTS-PER-DIVISION SETTINGS**—Horizontal positioning of the waveforms is not critical and may vary slightly from the photographs. The important observation is the timing relationship between the waveforms in the photographs. You can adjust this timing relationship on your oscilloscope to set convenient reference points. By taking into account any time-base variance, you can also make time comparisons between photographs. The time base is always the same for different waveforms in the same photograph.
 9. **EXPANDED PHOTOGRAPH NUMBER**—corresponds to the photograph number. These detailed photographs are included to magnify rapid voltage changes or particular pulses in a pulse train.
 10. **VOLTAGE**—indicates volts per division. The one in the upper left corner is for the top trace, and that in the lower left corner is for the bottom trace.



CAUTION

To observe a bit-to-program waveform, always use the 01 contact.

To observe a no-bit-to-program waveform, always use 02.

PINOUT CODE NUMBER

WAVEFORM NAMES

PIN NUMBER

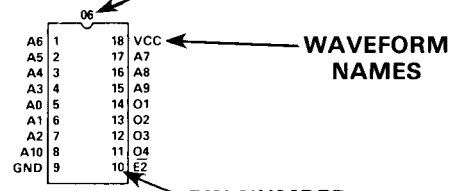


Figure 4-12. Pin Names by Pinout Code Numbers

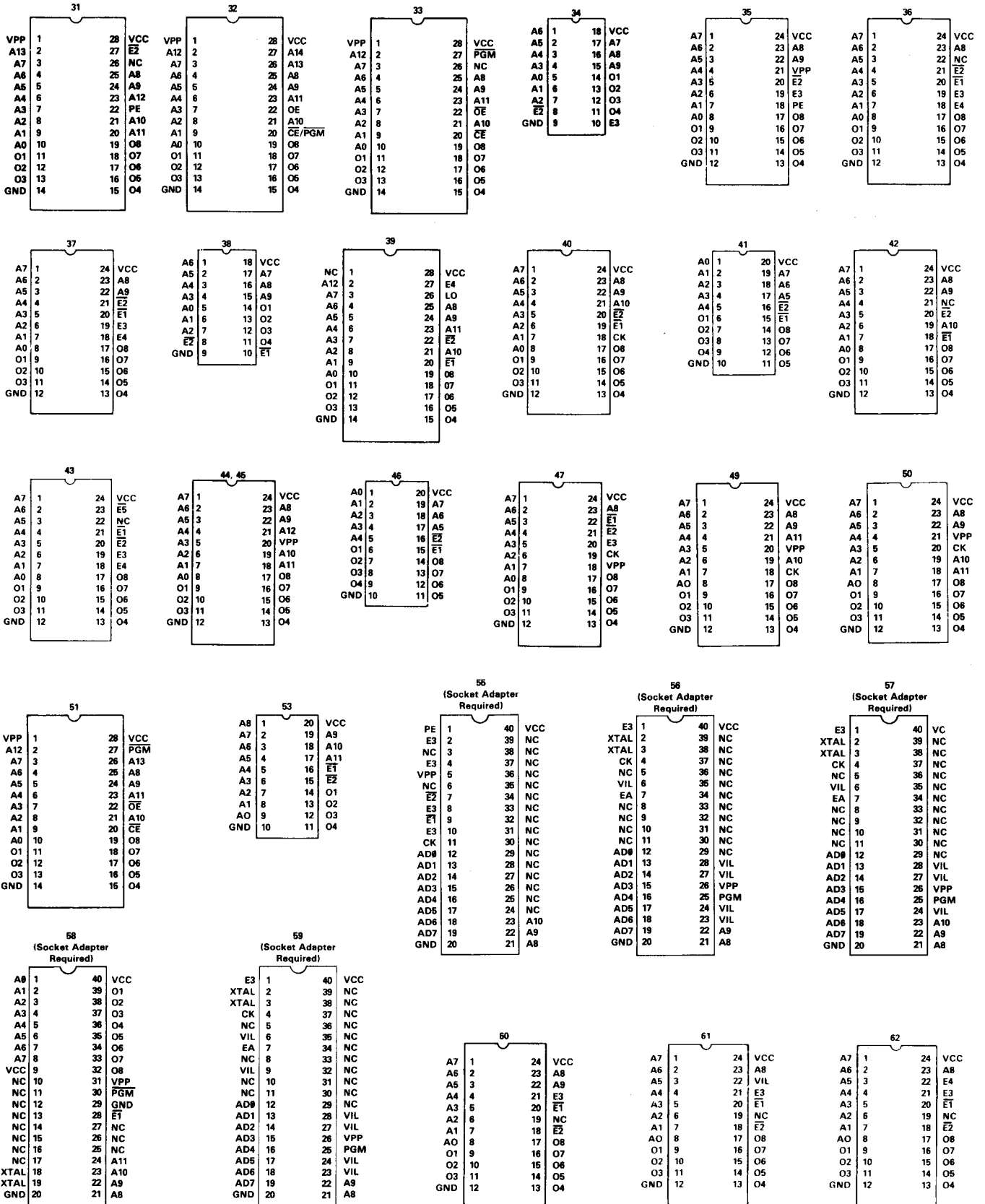


Figure 4-12. Pin Names by Pinout Code Numbers (Continued)

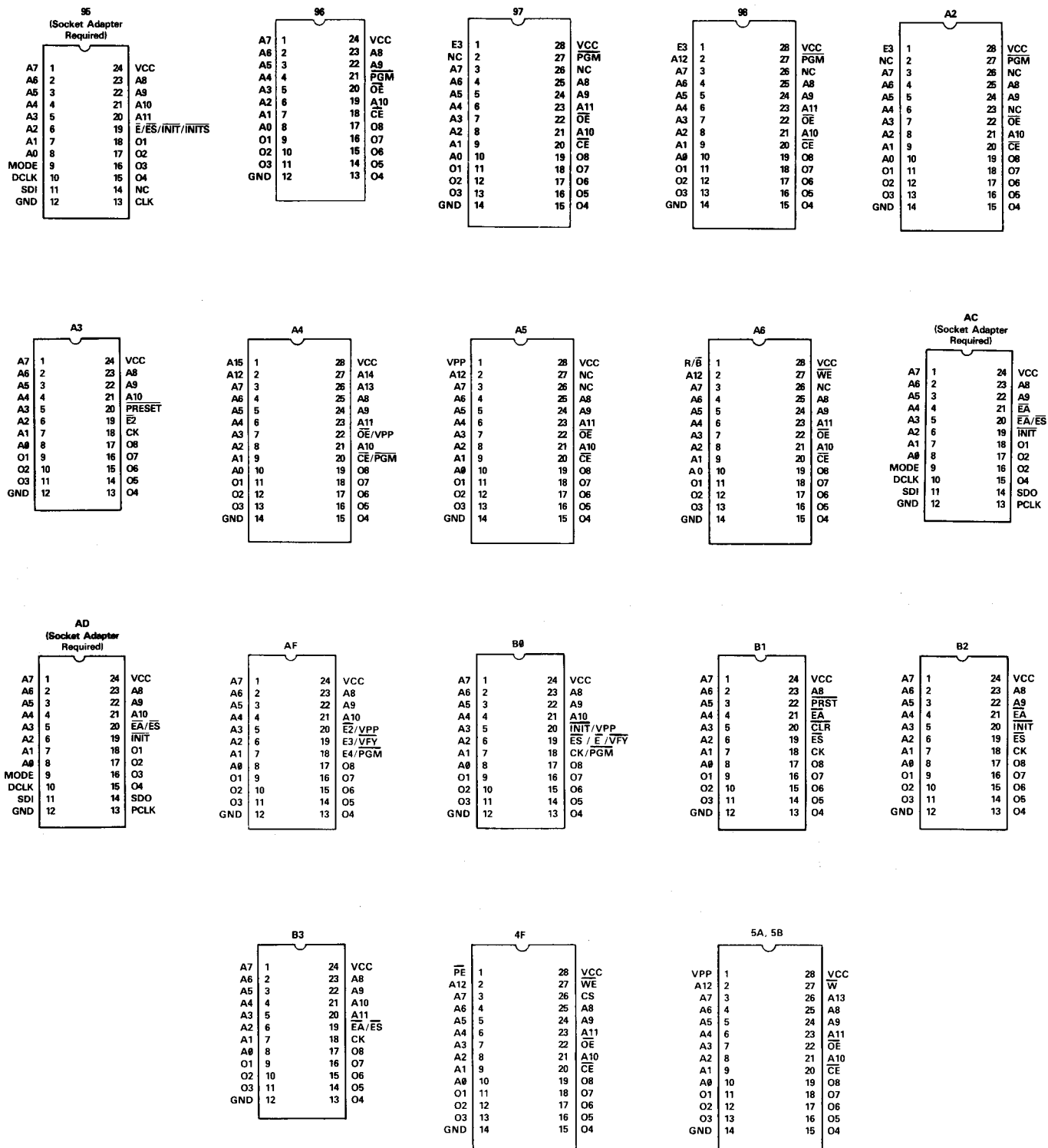


Figure 4-12. Pin Names by Pinout Code Numbers (Continued)

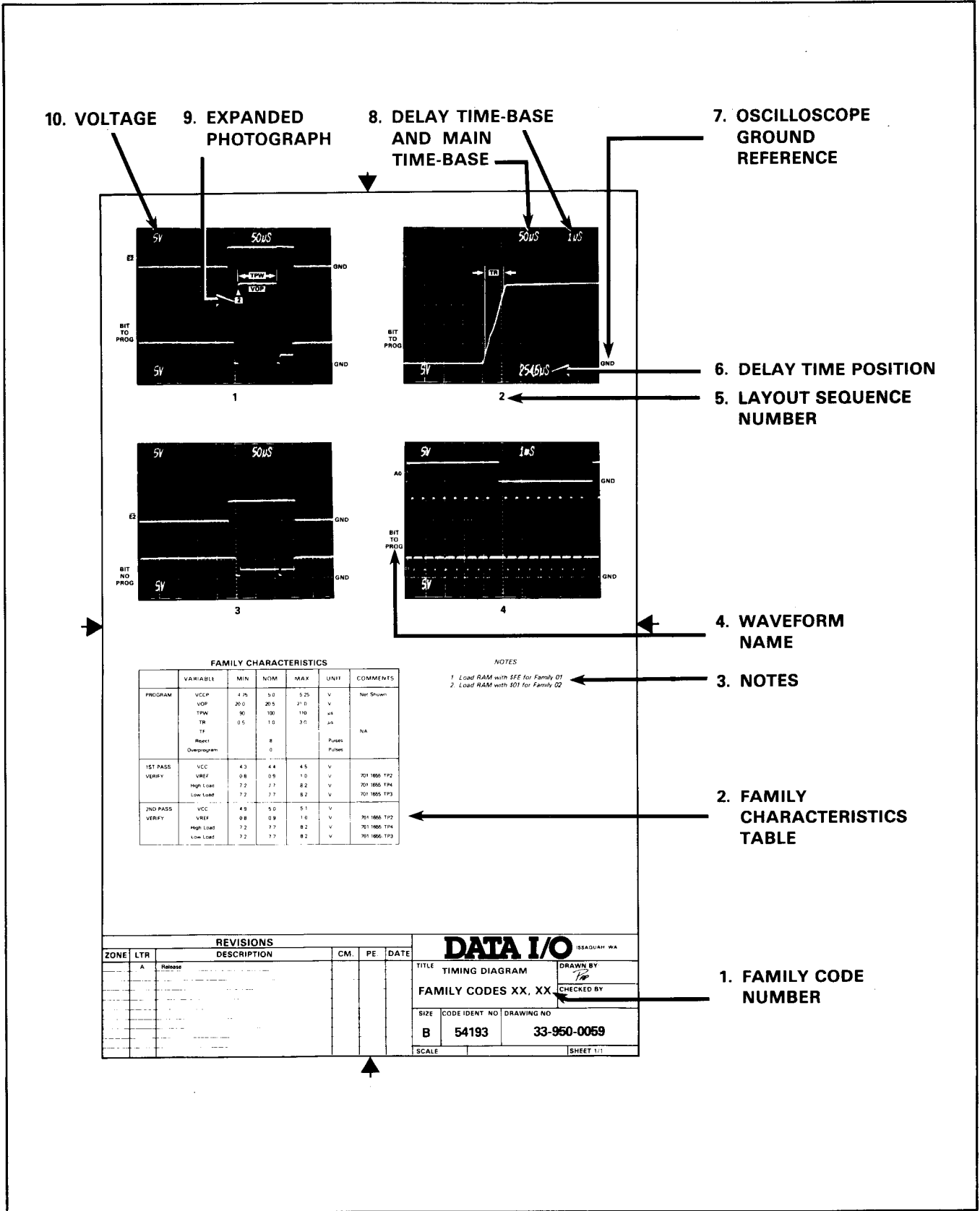


Figure 4-13. Sample Timing Diagram

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Measurement Chart

Table 4-4. Measurement Chart (Continued)

STEP	TEST NO.	TEST DESCRIPTION	Socket/Pin	MEASUREMENT LOCATION	MEASUREMENT			ADJUSTMENT LOCATION	COMMENTS	
					MIN	NOM	MAX			
REVISIONS										
		DESCRIPTION	P.E.	DATE	UniPak 2 tm Measurement Chart					
A				10/82						
C		ECN 4831		5/83						
D		ECN 5023		2/84						
1	1	V reference supply	2	24	701-1655/TP2	14.4V	14.5V	14.6V	R8,701-1655	Ground DMM to socket 7, pin 10
2	2	Load supply (high range)	2	20	701-1655/TP4	25.0V	26.0V	26.0V		
3	3	Load supply (low range)	2	20	701-1655/TP3	25.0V	26.0V	26.0V		
4	4	V _{CC} supply	2	24		11.9V	12.0V	12.1V	R52,701-1690	
5	5	CE supply	2	20		32.7V	33.0V	33.2V	R15,701-1690	
6	6	Bit supply	2	9		25.7V	26.0V	26.2V	R31,701-1690	
7	7	Address supply	2	8		14.8V	15.0V	15.2V	R28,702-1650	
2	8	V reference supply			701-1655/TP2	6.70V		6.90V		
9	9	Load supply			701-1655/TP3	10.3V		11.7V		
3	10	V reference supply			701-1655/TP2	3.30V		3.50V		
11	11	Current source 20 mA	2	9		19.5 mA	20.0 mA	20.5 mA	R3,702-1650	Use a 100-ohm, 2W carbon comp resistor in series with the current meter.
4	12	Current source supply	2	9		118 mA	120 mA	122 mA	R2,702-1650	Use a 100-ohm, 2W carbon comp resistor in series with the current meter.

Table 4-4. Measurement Chart

REVISIONS		UniPak 2 Measurement Chart	
LTR	DESCRIPTION	P.E.	DATE
A			10/82
C	ECN 4831		5/83
D	ECN 5023		2/84
STEP	TEST DESCRIPTION	MEASUREMENT LOCATION	MEASUREMENT LOCATION
		Socket/Pin	
		2 14	
5	Bit switch rise waveform		R1, 701-1690
6	DAC step waveforms		
14	V _{CC}	2 24	
15	Bit supply		701-1690/TP2
16	CE supply		701-1690/TP1
17	V _{REF} supply		701-1655/TP2
18	Load supply		701-1655/TP3
		The following tests are performed with the UniPak 2 ^m installed in its normal operating position.	
		Socket/Pin	
7	Current DAC step waveform	2 9	
			Place a 200-ohm, 5W resistor between pins 9 and 12, socket 2. See waveform photo (page 29).
8	All voltages off	All All	
9	Socket 2 LED		Confirm that socket 2 LED is on.
22	V _{CC} supply load	2 24	
			Place a 20-ohm, 2W resistor between pins 24 and 12, socket 2. Same as above; no LEDs on.
10	Fast V _{CC} supply load	2 24	
			13.0V
			12.0V
			11.8V
			0.4V
			-0.1V

Table 4-4. Measurement Chart (Continued)

REVISIONS		Unipak 2 ^m Measurement Chart					
LTR	DESCRIPTION	P.E.	DATE				
A			10/82				
C	ECN 4831		5/83				
D	ECN 5023	<i>CP</i>	2/84				
STEP	TEST DESCRIPTION	MEASUREMENT LOCATION		MEASUREMENT		ADJUSTMENT LOCATION	COMMENTS
11	24 CE supply load	2	20	MIN	NOM	MAX	Ground DMM to socket 7, pin 10
				32.3V		33.2V	Place a 100-ohm, 10W resistor between pins 20 and 12, socket 2.
25	Pin 18 voltage switch	2	18	32.7V		33.2V	
26	Pin 21 voltage switch	2	21	32.7V		33.2V	
12	27 Bit supply load	2	11	25.2V		26.0V	Place a 100-ohm, 5W resistor between pins 11 and 12, socket 2.
28	Pin 19 voltage switch	2	19	25.6V		26.2V	
13	29 V _{CC} voltage linearity	2	24	3.90V		4.10V	
	30 CE supply linearity	2	18	23.0V		23.5V	Place a 2.2K-ohm, 1/2W resistor between pin 12 and 18, socket 2.
31	Address supply	2	8	4.70V		5.30V	
32	-5V supply	2	21	-5.2V		-4.8V	
33	12-volt supply	2	20	11.4V		12.6V	
34	Clamp supply	2	11	20.5V		21.5V	
35	Current source linearity	2	11	88 mA		92 mA	Use a 100-ohm, 2W carbon comp resistor in series with the current meter.
14	36 V _{CC} voltage linearity	2	24	4.90V		5.10V	

Table 4-4. Measurement Chart (Continued)

STEP	TEST NO.	TEST DESCRIPTION	MEASUREMENT LOCATION	MEASUREMENT			ADJUSTMENT LOCATION	COMMENTS
				MIN	NOM	MAX		
		UniPak 2™ Measurement Chart						
LTR		DESCRIPTION	P.E.	DATE				
A				10/83				
C		ECN 4831		5/83				
D		ECN 5023	<i>Dg</i>	2/84				
15	37	CE supply linearity	2	21	11.4V		12.0V	Ground DMM to socket 7, pin 10
	38	Clamp supply linearity	2	9	6.7V		7.3V	
	39	V _{CC} voltage linearity	2	24	5.90V		6.10V	
	40	I source and pull-downs	2	9,11,14,16	2.0V		2.6V	
	41	I source and pull-downs	2	10,13,15,17	0.0V		1.0V	
	42	I source and pull-downs	2	10,13,15,17	2.0V		2.6V	
	43	I source and pull-downs	2	9, 11, 14, 16	0.0V		1.0V	
17	44	Socket 1 LED						Confirm that socket 1 LED is on.
	45	V _{CC} voltage supply	1	28	4.90V		5.10V	
	46	Odd address and data	1	2,3,5,7,9,11,13,16,18, 20,22,24,26	3.5V		6.0V	
	47	Even address and data	1	1,4,6,8,10,12,15,17,19,21, 23,25,27	-0.1V		0.4V	
	48	Odd address and data	1	2,3,5,7,9,11,13,16,18, 20,22,24,26	-0.1V		0.4V	
	49	Even address and data	1	1,4,6,8,10,12,15,17,19,21, 23,25,27	3.5V		6.0V	
19	50	Odd data lines high	1	11,13,16,18	25.5V		26.5V	
	51	Even data lines pullups	1	12,15,17,19	4.5V		5.5V	

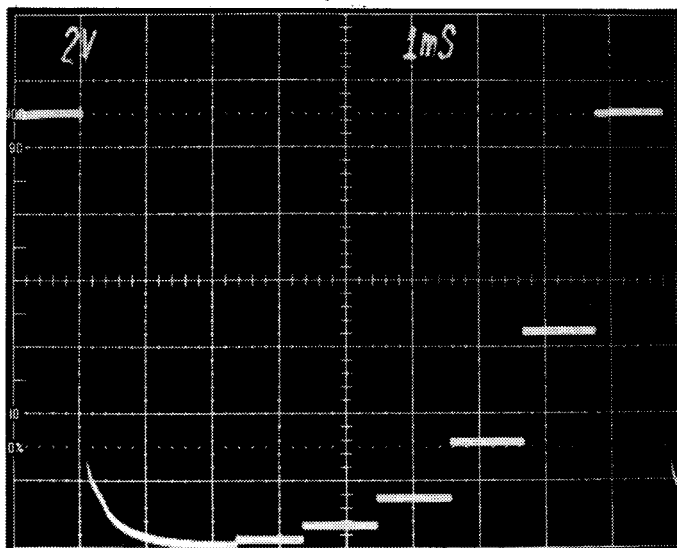
Table 4-4. Measurement Chart (Continued)

LTR		DESCRIPTION		P.E.	DATE			
A					10/82			
C		ECN 4831			5/83			
D		ECN 5023		<i>CS</i>	2/84			
Unipak 2™ Measurement Chart								
STEP	TEST NO.	TEST DESCRIPTION	MEASUREMENT LOCATION	MEASUREMENT			ADJUSTMENT LOCATION	COMMENTS
				MIN	NOM	MAX		
20	52	Odd data lines pullups	1 11,13,16,18	4.5V		5.5V		Ground DMM to socket 7, pin 10
	53	Even data lines high	1 12,15,17,19	25.5V		26.5V		
21	54	Socket 3 LED						Confirm that socket 3 LED is on.
	55	V _{CC} voltage supply	3 20	4.90V		5.10V		
22	56	Socket 4 LED						Confirm that socket 4 LED is on.
	57	V _{CC} voltage supply	4 16	4.90V		5.10V		
23	58	Socket 5 LED						Confirm that socket 5 LED is on.
	59	V _{CC} voltage supply	5 16	4.90V		5.10V		
24	60	Socket 6 LED						Confirm that socket 6 LED is on.
	61	V _{CC} voltage supply	6 18	4.90V		5.10V		
25	62	Socket 7 LED						Confirm that socket 7 LED is on.
	63	V _{CC} voltage supply	7 20	4.90V		5.10V		
26	64	V _{CC} pullup 1 on	1 28	4.0V		5.2V		
		V _{CC} pullup 2 on	2 24	4.0V		5.2V		
		V _{CC} pullup 3 on	3 20	4.0V		5.2V		
		V _{CC} pullup 4 on	4 16	4.0V		5.2V		
		V _{CC} pullup 5 on	5 16	4.0V		5.2V		
		V _{CC} pullup 6 on	6 18	4.0V		5.2V		
		V _{CC} pullup 7 on	7 20	4.0V		5.2V		

Measurement Chart

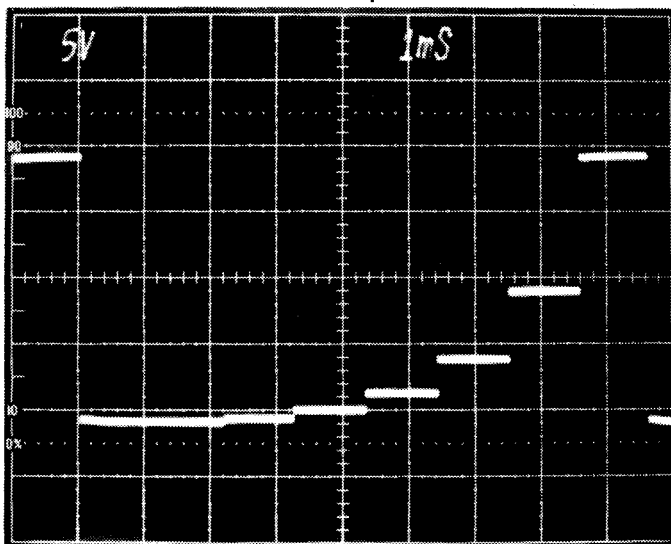
PROGRAM ELECTRONICS _____ UNIPAK 2™ _____

DAC Step Waveform



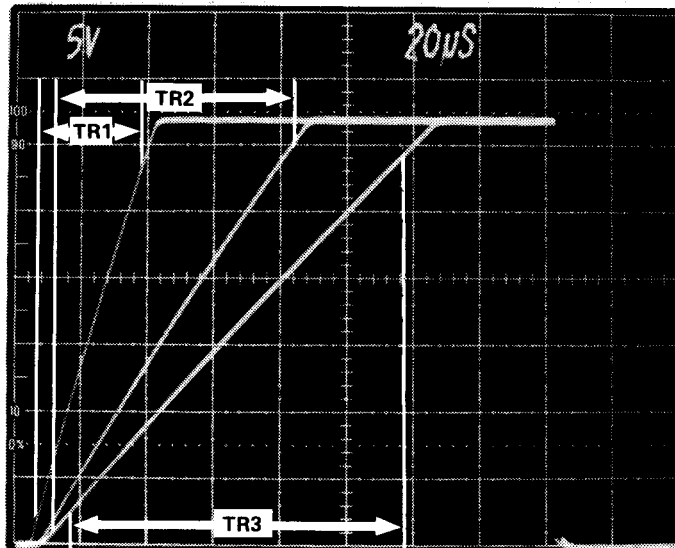
LOAD SUPPLY DAC

Current DAC Step Waveform



DATE	REV	REVISION RECORD	DR	CK
10-82				e.t.z.
3-84				e.t.z.

Bit Switch Rise-Time Waveform



	VARIABLE	MIN	NOM	MAX	UNIT	COMMENTS
PROGRAM	TR1	29	33	37	μ s	Adjust R1, 701-1690.
	TR2	62	66	70	μ s	
	TR3	90	100	110	μ s	

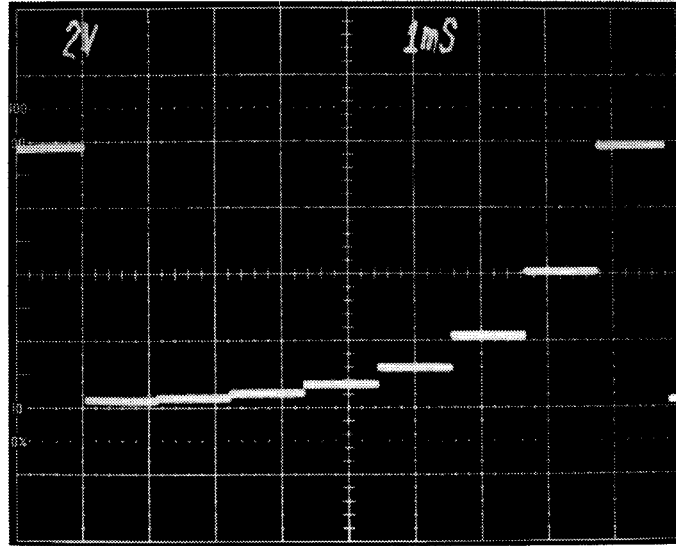
NOTE: All TR's are measured from 10% to 90%.

Measurement Chart

PROGRAM ELECTRONICS

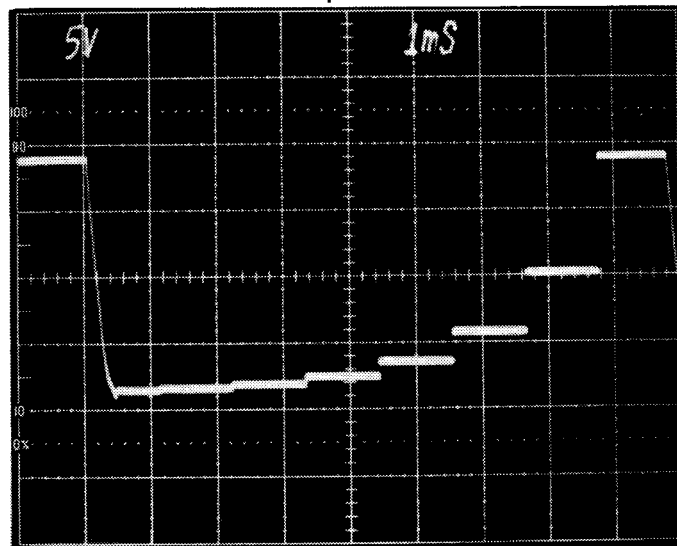
UNIPAK 2™

DAC Step Waveform



VCC DAC

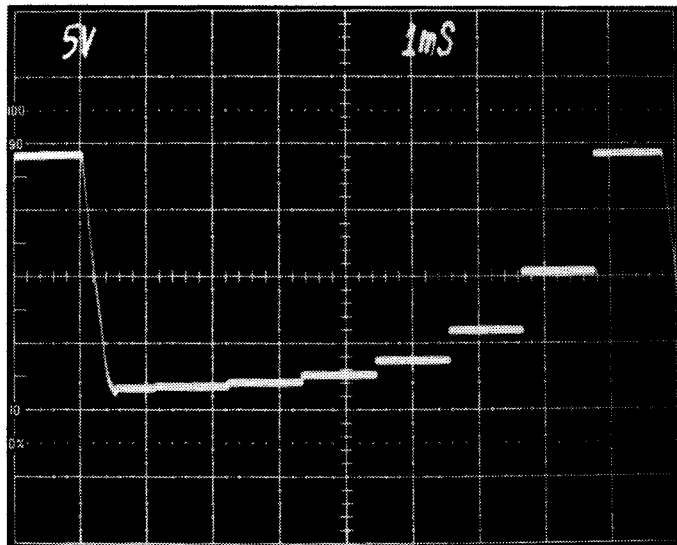
DAC Step Waveform



CE SUPPLY DAC

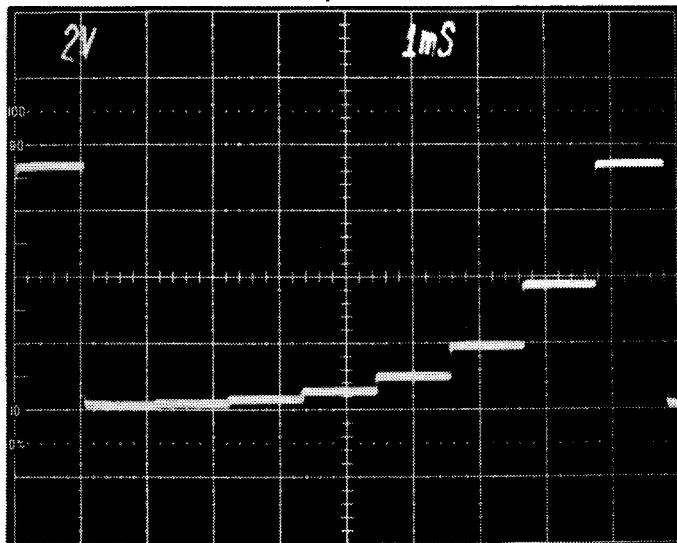
DATE	REV	REVISION RECORD	DR	CK
10-82				C72
3-84				C72

DAC Step Waveform



BIT SUPPLY DAC

DAC Step Waveform



V_{REF} SUPPLY DAC

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SECTION 5 CIRCUIT DESCRIPTION

5.1 OVERVIEW

This section defines the functions of UniPak 2™ principal hardware components. Each circuit-card assembly is depicted by a block diagram accompanied by a written description.

5.2 GENERAL ARCHITECTURE

5.2.1 The Link Between the UniPak 2™ and the Programmer

The UniPak 2™ is controlled by the programmer's extended processor bus through the UniPak 2™ mating connector (J1). The control software for the UniPak 2™ is located in EPROM on the memory card (702-1650).

5.2.2 The Buses

The programmer's address bus, data bus, R/W line and V_{02} line access the software on the memory card and control the gates and registers on the waveform generator (701-1690) and address cards (701-1655). The UniPak 2™'s device bus gathers the programming waveforms produced

by these cards and transmits them to the socket card (702-1659). Figure 5-1 shows the relationships between the buses.

5.3 COMPONENT LAYOUT

The principal components of the UniPak 2™ are the motherboard, the waveform generator, the address card, the socket card, and the memory card. The component layout of the UniPak 2™ is shown in figure 5-2 and described in the following subsections.

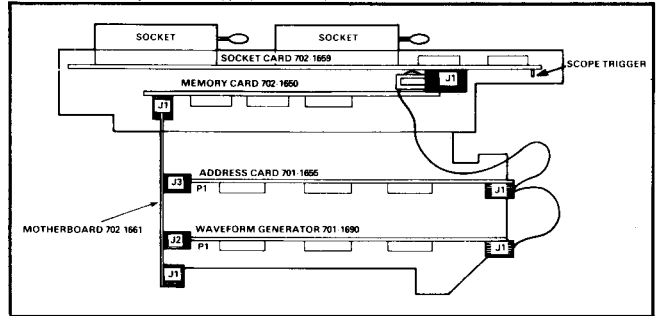


Figure 5-2. Principal Components

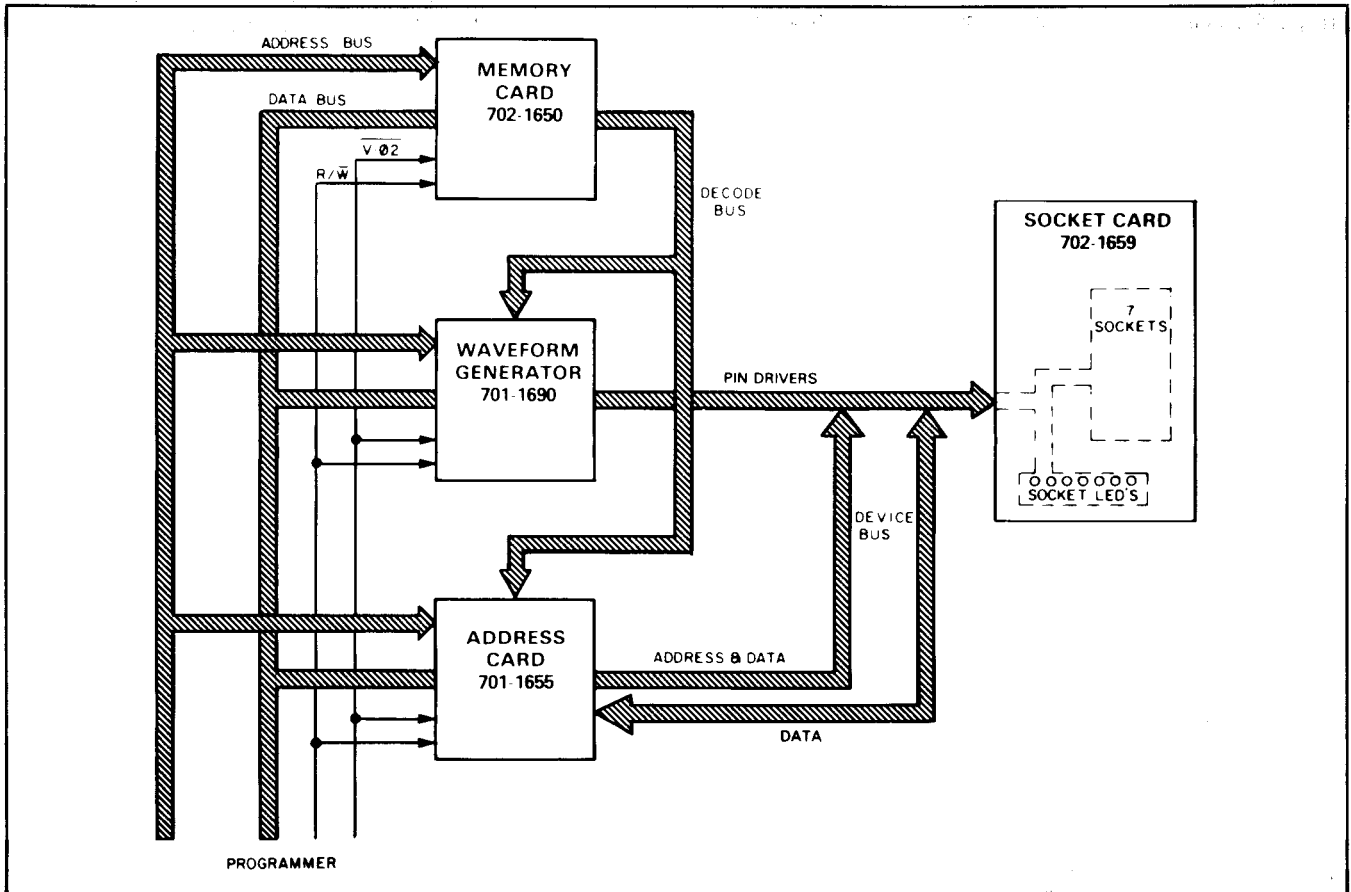


Figure 5-1. Block Diagram, UniPak 2™ Electronics

5.3.1 Motherboard

The motherboard accepts the signals and power supplies from the J6 of the programmer and transmits them to two identical 72-pin edge connectors and a 50-pin edge connector (see figure 5-3 and schematic 30-702-1661).

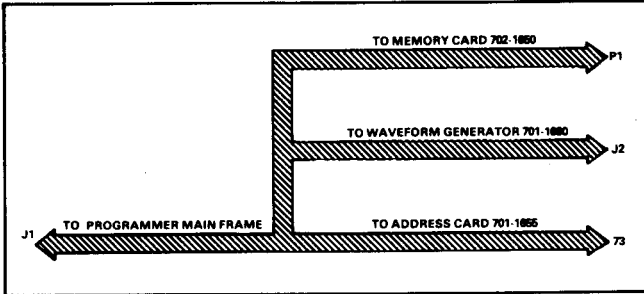


Figure 5-3. Block Diagram, Motherboard

5.3.2 Waveform Generator

The waveform generator provides signals required for programming devices. These signals are generated by the blocks shown in figure 5-4.

Three major supplies are the V_{CC} supply, the \overline{CE} supply and the bit supply, which are used to generate the respective signals. Each supply is software-controlled via a D/A converter. All DACs obtain their reference voltage from the DAC reference.

The V_{CC} waveforms are generated by writing appropriate DAC values from the firmware. The rise and fall times are fixed by the slewing rate of the op amp. Two overcurrent detectors are included, one for low currents and one for high currents (above 1 amp). If a detector is activated, the control latch is reset; the DAC-reference kill output then causes the DAC reference to go to zero, in turn causing all supplies to return to zero.

The V_{CC} supply senses the V_{CC} voltage at the PROM socket via the V_{CC} sense line. This remote sensing compensates for all cable drops between the supply and the socket.

The \overline{CE} waveforms are generated by using the \overline{CE} supply in conjunction with one of the pin switches. The voltage level is selected by writing the appropriate value to the \overline{CE} DAC. One of two rise times is selected by the control latch and rise-time control circuitry. Either the pin 18, 20 or 21 switch can be enabled by the switch-control latch to output the high-level \overline{CS} voltage. Switches that are not enabled can output TTL levels.

Each pin switch consists of an emitter follower with the collector tied to the \overline{CE} supply. A current source is provided for the base of each switch to charge the common rise-time capacitor. When the base is released, a linear ramp is generated which is truncated at the \overline{CE} supply level. An NPN-transistor pulldown is included in the switch to provide a $20V/\mu s$ controlled fall time. Logic circuitry prevents the pulldown and pullup circuits from being active simultaneously.

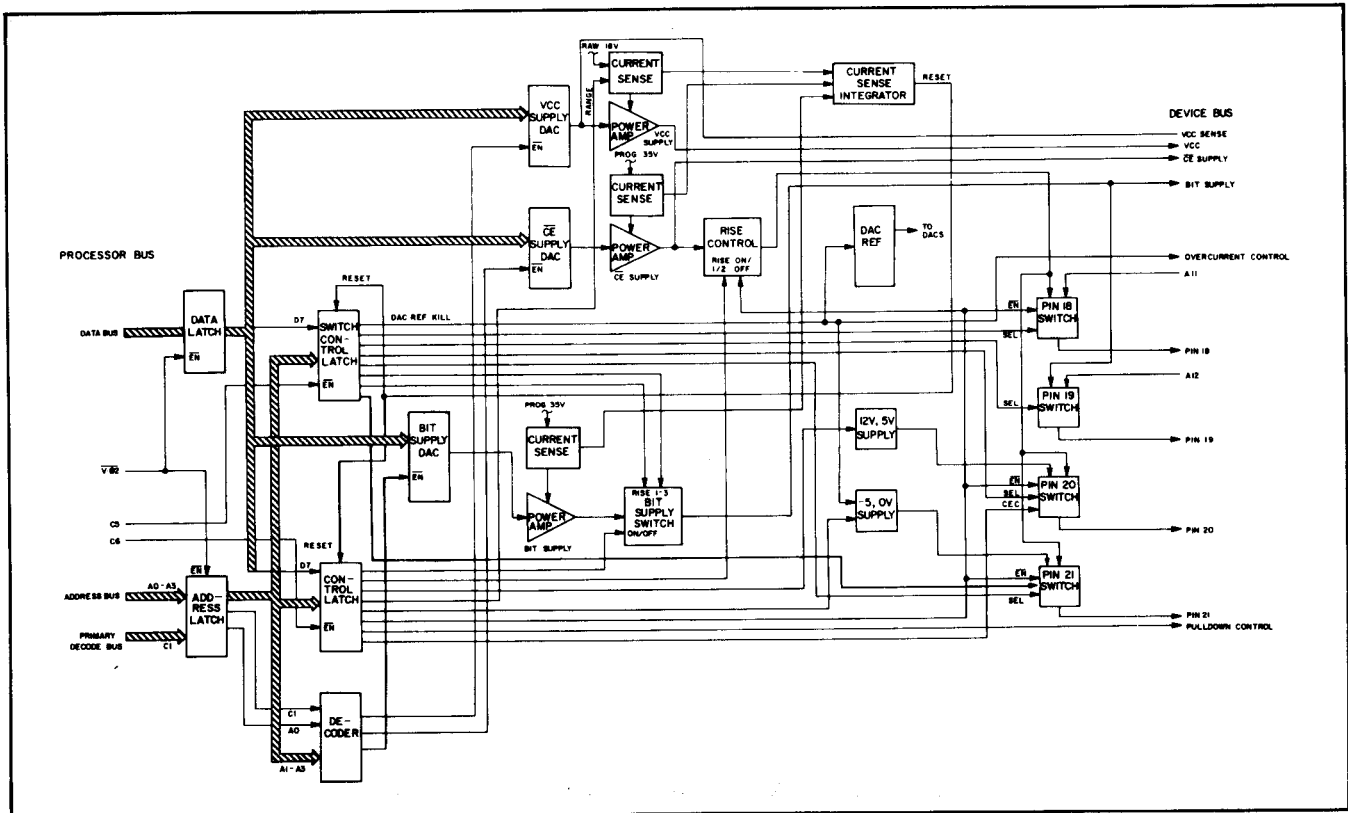


Figure 5-4. Block Diagram, Waveform Generator

The pin 21 switch uses the same principles as the pin 18 and pin 20 switches. However, a power amplifier output (0/-5V supply) provides the ground reference for the switch. For certain programming algorithms this amplifier output is brought to -5V.

The pin 20 switch includes a pullup that is connected to the +12/+5V supply, thus allowing the switch in the TTL mode to switch from 0 to 12V as well as from 0 to 5V. The +12/+5V supply consists of a monolithic regulator and a 5.1V zener diode controlled by the switch-control latch.

Signals to be applied to the data lines of a device are generated with the bit-supply signals and controlled by the bit-supply switch. The bit supply is nearly identical to the CE supply, but has one less diode in the feedback path, compensating for one less drop in the switch paths. The bit-supply switch consists of an emitter follower, a current source, and three rise-time control capacitors. The collector of the emitter follower is connected to the bit supply; the base is connected to the current source and timing capacitor. The control latch can select the timing capacitor and also control the base of the switch. When the base is released, the output ramps linearly to the bit-supply level. The output on the bit-supply switch is sent to the address card and to the pin 19 switch; unlike the pin 20, 21 and 18 switches, the pin 19 switch consists of a simple PNP-saturating switch controlled by the switch-control latch.

The current-sense integrator smoothes the transient overcurrent pulses occurring from charging supply capacitors. When an overcurrent condition from the VCC, CE, bit or (0/-5V) supply exists for sufficient time, the control latch is reset, in turn causing the DAC reference and the supplies to go to zero. The state of the overcurrent-control line can be read by the address card and used by the programmer to detect shorted devices.

Table 5-1 lists the functions of the device-bus pins. The data latch buffers the data bus and holds data to satisfy the long DAC data-hold requirement. The address latch buffers the lower-order address lines and the primary decode bus. These buffered lines are then sent to the decoder and the address latches. The decoder provides decode signals to the DACs for the VCC, CE and bit supplies. The switch-control latch and the control latch receive their clocks from a decoder on the address card.

Table 5-1. Pin Functions, Device Bus (at J1)

Pin	Function	Pin	Function
1	PA ₈	26	PA ₇
2	PA ₉	27	PA ₆
3	PA ₁₀	28	PA ₅
4	PA ₁₁	29	PA ₄
5	PA ₁₂	30	PA ₃
6	PA ₁₃	31	PA ₂
7	PA ₁₄	32	PA ₁
8	PA ₁₅	33	PA ₀
9	GND	34	Vcc
10	Vcc Sense	35	GND
11	CE Supply	36	GND
12	Bit Switch	37	Bit Supply
13	Pin 20	38	Pin 18
14	Pin 21	39	Pin 19
15	Scope Trigger	40	PD ₁
16	-9V	41	PD ₂
17	+24V	42	PD ₄
18	Overcurrent	43	PD ₄
19	Pull-Down Control	44	S1
20	Vcc Pull-Up Control	45	S2
21	Address Supply +5V Select	46	S3
22	PD ₈	47	Vcc Pulse
23	PD ₇	48	Address DAC
24	PD ₆	49	+5V
25	PD ₅	50	Bit Switch Control

5.3.3 Address Card

The address card, illustrated in figure 5-5, provides the device address, device data, data loads and supply measurement capability of the UniPak 2™.

The address drivers consist of addressable latches driving the device address bus. The addressable latches receive data from the most-significant-bit line of the data bus.

The data switch register drives PNP data switches which direct the output of the bit switch to the appropriate device-data line. The PNP switches are driven by current sources to provide a constant-base drive at all bit-switch voltages.

The data sink register is used to shunt programming currents to ground. Device data is read via the data comparators and strobed to the processor bus via the data gate. The comparators receive their reference voltage from the VREF amplifier, which is controlled by the VREF DAC. Loading the device data bus is controlled by the load DAC, the load amplifier and the high/low-range load switch. This supply develops a voltage that is applied to either the low-range or high- and low-range load resistor banks. These

resistors are fed through isolation diodes, which are connected to the device data pins. The load sink register enables the UniPak 2™ to select which device data pins will have loads applied to them. The diode clamps limit the voltage applied by the load resistors to the data bus to approximately 5V when the load clamp switch is closed.

The supply comparators read the VCC-sense line, the CE supply and the bit-switch line. The comparator gate/multiplexer strobes the data from the supply comparators and the overcurrent-read line to the most significant-bit line of the data bus.

The socket-select latch provides a control line for the high-/low-range switch and control lines for the socket card.

The data latch buffers the data bus and holds data to satisfy the DAC requirements.

The current source latch will supply a 4-mA current to a device provided there is a 15V zener diode inside the device on pin 18, 19 or 20. The address supply 5V select determines whether the address supply DAC or a fixed 5V will be applied to PA0-PA3.

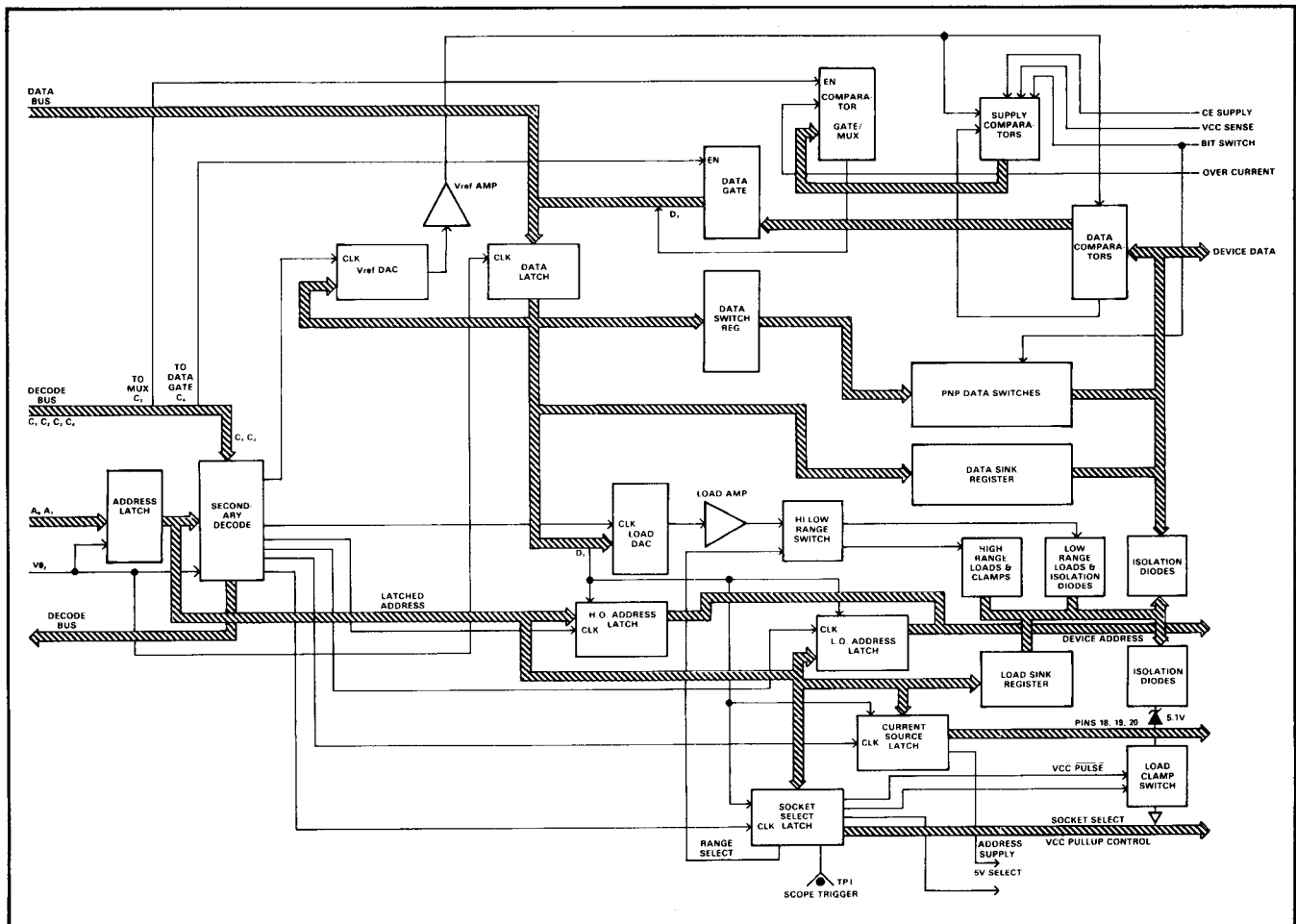


Figure 5-5. Block Diagram, Address Card

The address latch buffers low-order addresses for the secondary decoder. The secondary decoder provides the appropriate signals for the DACs and registers, as well as the latches on this card and on the waveform generator. The $\overline{V_{0_2}}$ signal controls the timing of the various clock signals developed by the decoder.

5.3.4 UniPak 2™ Socket Card

The socket card distributes to the device sockets the signals developed on the address card and the waveform generator (refer to figure 5-6).

The device address bus (PA0-PA15) is generated on the address card and fed to the socket card via the ribbon cable. On the socket card, the bus is fed into CMOS buffers. The address supply DAC connects to the VDD supply on these buffers. This allows the VOH level to be under DAC control. The address supply 5V select line allows PA0-PA3 to switch at TTL levels while all other address lines switch between "0" and the address supply

level. The address clamps provide overvoltage protection and are connected to a comparator that senses overvoltage, shutting down all the supplies when excessive voltage is detected.

The device-data bus connects directly to all sockets. Four-bit devices are connected to PD1-PD4. The data pulldowns consist of 1K-ohm resistors and a diode network. The data clamp has two modes of operation controlled by the bit switch control line.

When voltage pulses are being applied to a device, the pass element of the data clamp is switched out of the circuit. The op amp and 2.2K-ohm resistor precharge the 0.1 μF capacitors to the level set by the bit supply so that the network does not absorb energy from the actual data-line programming pulses.

When current pulses are being applied to a device, the pass element is switched into the circuit. The data clamp will be set to a voltage level by the bit supply and will sink all unnecessary current.

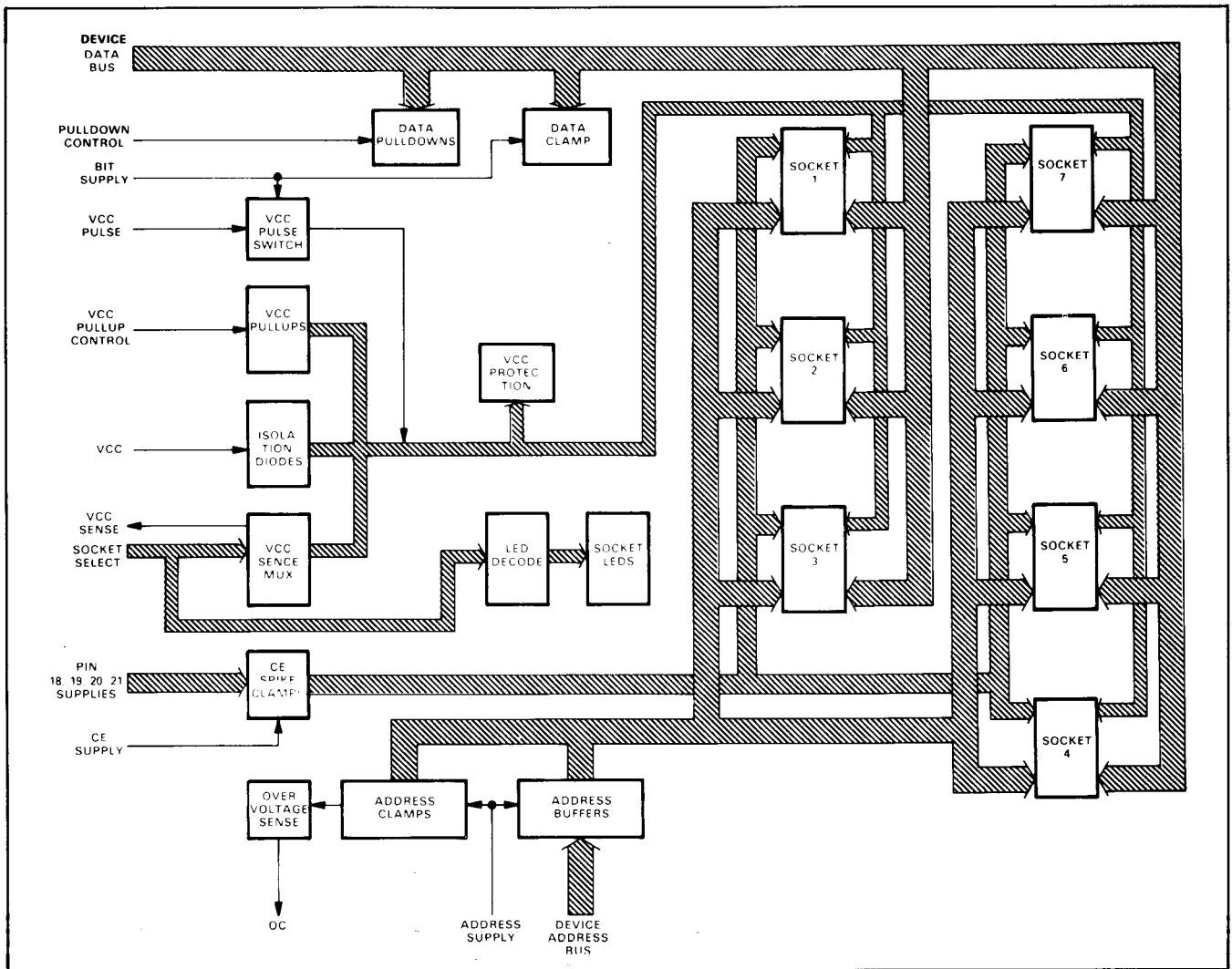


Figure 5-6. Block Diagram, Socket Card

Pins 18, 19, 20 and 21 of the 24-pin device socket receive signals directly from the waveform generator via the corresponding pin switches. A spike-suppression network is provided where the \overline{CE} supply charges the RC network. V_{CC} is applied to all sockets through seven diodes. Remote sensing of the voltage at the selected socket is provided by the analog switch of the V_{CC} -sense multiplexer. When V_{CC} is brought to zero, the device's V_{CC} lines can be pulled up by the V_{CC} pullups. The V_{CC} sense-multiplexer and a comparator on the address card are then used to read the V_{CC} voltage. If a device is properly inserted in a socket, the V_{CC} voltage will be above 2V. If it is in backwards it will be below 1V, and if no device is in the socket, the voltage will approach 4V.

The V_{CC} pulse switch is used to switch from a level set by the V_{CC} supply to a level set by the bit supply. The switch uses a HEX JFET with an RC network to control

the rise and fall times. When the HEX FET is switched on, the V_{CC} isolation diode is reversed biased and the V_{CC} sense line sees a dummy load. The V_{CC} pulse switch is applied only to the 24-pin socket. When the switch is on, the .01 μ F decoupling capacitor for the 24-pin socket is switched off.

The LED decoder is used to light the LEDs below the selected socket.

5.3.5 Memory Card

The UniPak 2™ memory card is shown in figure 5-7. EPROMs which store the UniPak 2™ firmware are contained on the memory card. These EPROMs connect to the address bus directly and to the data bus through data buffers.

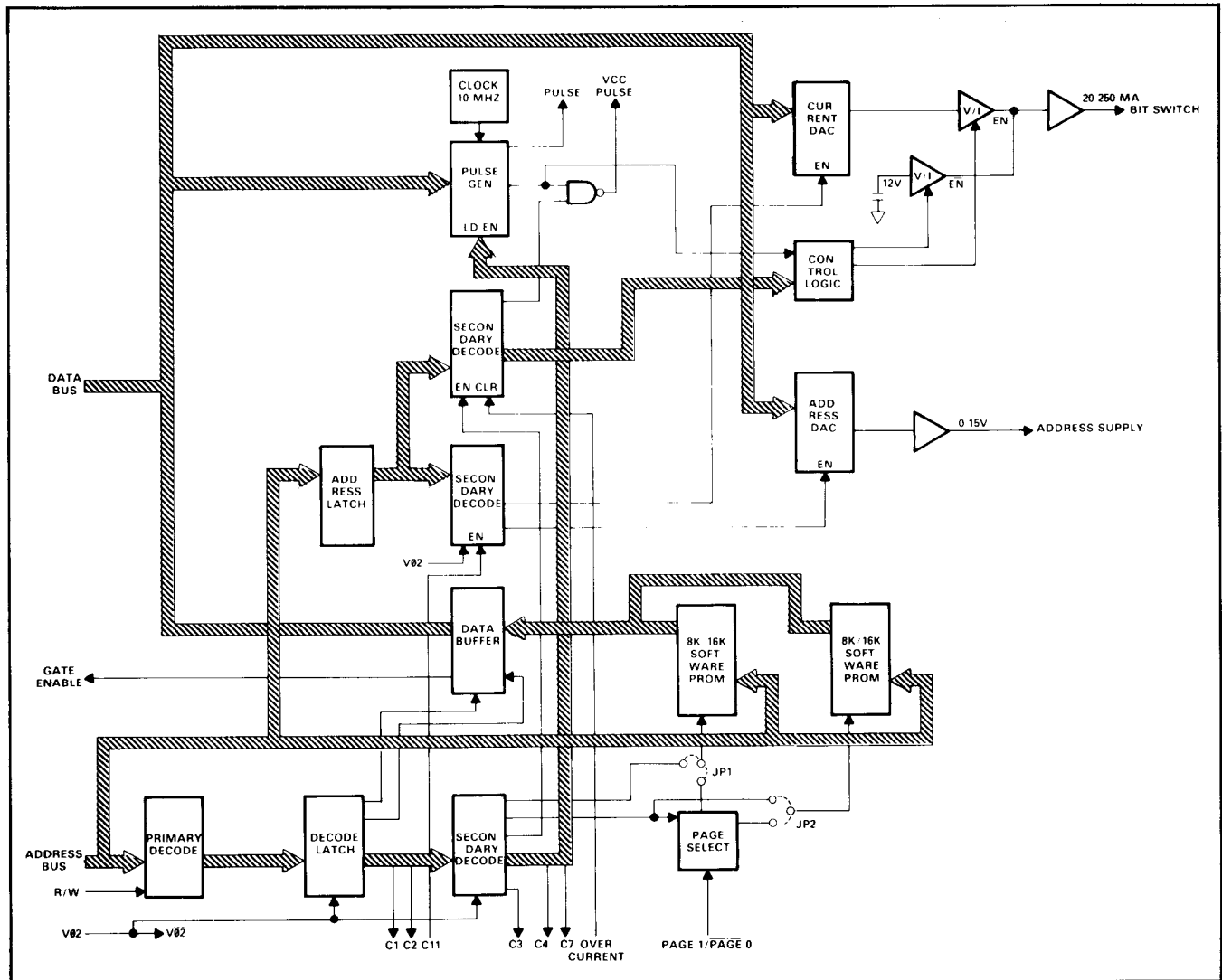


Figure 5-7. Block Diagram, Memory Card

Paging is used when the 16K x 8 PROMs are installed. Two EPROMs and a latch comprise the primary decoding for the entire UniPak 2™. The EPROMs connect to the 12 high-order address lines and the $\overline{R/\overline{W}}$ line. Outputs from the primary-decoder latch connect to the secondary decoder and also to secondary decoders on the address card and the waveform generator. A 1-of-8 decoder, timed with $\overline{V\bullet\theta_2}$, provides the secondary decoding for the software EPROMs. Two additional lines from this decoder connect to the address card to provide the decode signals for the data gate and comparator gate/multiplexer. Additional outputs from the binary decoder enable the data buffer during all software-read operations and lower the data gate enable line during any access of the UniPak 2™.

The pulse generator consists of a count-up ripple counter, an 8-bit latch, and a 10-mHz crystal-controlled clock. The latch is connected to the data bus and is used to load the counter, allowing the pulse generator to be programmable between 0.1 and 25.5 μ s.

The current source consists of a fixed 20-mA current source and a programmable current source. The control logic selects which current source is active. The pulse generator can be selected to control the programmable current source.

The address supply generates the voltage necessary to drive the CMOS buffers located on the socket card. The voltage is generated from the 24V power supply using an NPN transistor driven by an op amp. The input of the op amp is a DAC, which allows the voltage to be software selectable.

APPENDIX A

FAMILY AND PINOUT CODES

ERROR CODES

KEY TO HEADINGS AND FOOTNOTES

- **Device Part Number.** The number assigned by the device manufacturer.
- **Family Code.** A 2-digit number that designates the programming algorithm.
- **Pinout Code.** A 2-digit number used to differentiate device types based on pin assignment and array size.
- **Software Version.** A number in this column specifies the earliest software version of the 22A that will program the device to the manufacturer's latest specifications.
- **Approval Status.** The following is an explanation of the symbols used in this column.
 - A - Written approval obtained.
 - O - Device is obsolete and no longer in production. No approval can be obtained. Algorithm has been used and approved in previous Data I/O equipment.

S - This algorithm is in the process of submission for manufacturer approval. The algorithm has been tested by Data I/O or the manufacturer, but no representation as to yield level is made or implied.

CAUTION

Entry of an invalid family/pinout code, other than those listed in this table can cause unpredictable results at the device socket, which may damage a device. A valid family code and a valid pinout code may be combined to produce an invalid (illegal) combination. The correct combination for your device is published in this table. All family/pinout combinations not contained in this table are considered "illegal". Data I/O assumes no responsibility or liability for results produced by entry of "illegal" family/pinout combinations.

Table A-1. UniPak 2™ Family and Pinout Codes

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Advanced Micro Devices					Advanced Micro Devices (Continued)						
2708	21	27	003	-	A	27S45	16	77	V04	351A-066	A
27128	AF	51	V04	-	A	27S47	16	77	V04	351A-066	A
27128A	C1	51	V05	-	A	27S49	16	67	003	-	A
2716	19	23	003	-	A	27S65	16	93	V05	351A-073	A
27256	C1	32	V05	-	S	27S75	16	94	V05	351A-073	A
2732	19	24	003	-	A	27S85	16	95	V05	351A-073	A
2732A	27	24	003	-	A	9864	C9	A6	V05	-	A
27512	DD	A4	V05	-	A	9864-3	C9	A6	V06	-	A
2764	AF	33	V04	-	A	29750A	16	02	003	-	A
2764A	C1	33	V05	-	A	29751A	16	02	V03	-	O
27LS18	16	02	003	-	A	29760A	16	01	V03	-	A
27LS185	16	06	003	-	A	29761A	16	01	V03	-	O
27LS19	16	02	003	-	A	29770	16	03	V03	-	O
27PS181	16	37	003	-	A	29771	16	03	V03	-	O
27PS184	16	06	003	-	A	29774	16	85	V04	351A-067	S
27PS185	16	06	003	-	A	29775	16	85	V04	351A-067	S
27PS191	16	68	003	-	A	AM9708	21	27	003	-	A
27PS281	16	37	003	-	A	AM9716	19	23	003	-	A
27PS291	16	68	003	-	A	AM9732	19	24	003	-	A
27PS41	16	53	003	-	A	AM9764	AF	33	V04	-	A
27PS43	16	63	V03	-	A	Electronic Arrays					
27PS49	16	67	003	-	A	2708	21	27	003	-	S
27S08	15	02	003	-	O	2716	19	23	003	-	S
27S09	15	02	003	-	O	Eurotechnique					
27S10	15	01	003	-	O	ET2716	19	23	V04	-	A
27S12	16	03	V03	-	A	ET2732	19	24	V04	-	A
27S13	16	03	V03	-	A	ETC2716	19	23	V04	-	A
27S15	16	79	V04	351A-068	A	ET2764	35	33	V05	-	S
27S18	16	02	V03	-	A	Exel					
27S180	16	37	V03	-	A	2B16A	B7	23	V05	-	S
27S181	16	37	V03	-	A	Fairchild					
27S184	16	06	V03	-	A	2708	21	27	003	-	A
27S185	16	06	V03	-	A	93417	01	01	003	-	A
27S19	16	02	V03	-	A	93427	01	01	003	-	A
27S190	16	68	V03	-	A	93436	01	03	003	-	A
27S191	16	68	V03	-	A	93438	01	15	003	-	A
27S20	16	01	V03	-	A	93446	01	03	003	-	A
27S21	16	01	V03	-	A	93448	01	15	003	-	A
27S24	16	65	V03	-	A	93450	01	16	003	-	A
27S25	16	65	V03	-	A	93451	01	16	003	-	A
27S26	16	85	V04	351A-067	A	93452	01	05	003	-	A
27S27	16	85	V04	351A-067	A	93453	01	05	003	-	A
27S28	16	09	V03	-	A	93460	01	16	003	-	A
27S280	16	37	V03	-	A	93461	01	16	003	-	A
27S281	16	37	V03	-	A	93510	01	21	003	-	A
27S29	16	09	V03	-	A	93511	01	21	003	-	A
27S290	16	68	V03	-	A	93514	01	06	003	-	A
27S291	16	68	V03	-	A	93515	01	06	003	-	A
27S30	16	36	V03	-	A	93L450	01	16	003	-	A
27S31	16	36	V03	-	A	93L451	01	16	003	-	A
27S32	16	38	V03	-	A	93Z450	A4	16	V04	-	A
27S33	16	38	V03	-	A	93Z451	A4	16	V04	-	A
27S35	16	66	V03	-	A	93Z510	A4	21	V04	-	A
27S37	16	66	V03	-	A	93Z511	A4	21	V04	-	A
27S40	16	53	V03	-	A	93Z564	A4	67	V05	-	S
27S41	16	53	V03	-	A	93Z565	A4	67	V05	-	S
27S43	16	63	V03	-	A						

Table A-1. UniPak 2™ Family and Pinout Codes (Continued)

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Fujitsu					Fujitsu (Continued)						
27128	45	51	V04	-	S	8516	19	23	003	-	S
2732A	27	24	003	-	S	8518	21	27	003	-	S
2732A-35	27	24	003	-	S	8532	19	24	003	-	S
2764	45	33	V04	-	S	8742	50	57	004	351A-070	S
27C128	45	51	V04	-	S	8749H	50	57	004	351A-070	S
27C256	45	32	VO5	-	S	General Instruments					
27C32A	27	24	003	-	S	5716	83	23	003	-	A
27C64	45	33	V04	-	S	5816	37	23	003	-	A
7051	78	02	003	-	A	Harris					
7052	78	01	003	-	A	6616	88	75	VO5	-	S
7053	78	03	003	-	A	6641	40	47	003	-	A
7054	78	05	003	-	A	7602	05	02	V04	-	S
7055	78	69	003	-	A	7603	05	02	V04	-	S
7056	78	02	003	-	A	7608	05	16	003	-	A
7057	78	01	003	-	A	7610	05	01	003	-	A
7058	78	03	003	-	A	7611	05	01	003	-	A
7059	78	05	003	-	A	7616	05	42	003	-	A
7060	78	69	003	-	A	76160	05	21	003	-	O
7111	68	02	003	-	A	76161	05	21	003	-	A
7112	68	02	003	-	A	76165	05	53	003	-	A
7113	68	01	003	-	A	7620	05	03	003	-	A
7114	68	01	003	-	A	7621	05	03	003	-	A
7115	68	03	003	-	A	7629	05	43	003	-	O
7116	68	03	003	-	A	76320	05	63	003	-	O
7117	68	08	003	-	A	76321	05	63	003	-	A
7118	68	08	003	-	A	7640	05	15	003	-	A
7119	68	14	003	-	A	7641	05	15	003	-	A
7120	68	14	003	-	A	7642	05	05	003	-	A
7121	68	05	003	-	A	7642P	05	38	003	-	O
7122	68	05	003	-	A	7643	05	05	003	-	A
7123	68	09	003	-	A	7643P	05	38	003	-	O
7124	68	09	003	-	A	7644	05	04	003	-	O
7125	68	15	003	-	A	7647R	05	79	VO5	351A-068	S
7126	68	15	003	-	A	7648	05	09	003	-	A
7127	68	06	003	-	A	7649	05	09	003	-	A
7128	68	06	003	-	A	76641	05	67	003	-	A
7131	68	16	003	-	A	7680	05	16	003	-	A
7132	68	16	003	-	A	7680RP	05	16	003	-	O
7137	68	21	003	-	A	7681	05	16	003	-	A
7138	68	21	003	-	A	7681RP	05	16	003	-	O
7141	68	63	003	-	A	7684	05	06	003	-	A
7142	68	63	003	-	A	7684P	05	06	003	-	O
7143	68	67	003	-	A	7685	05	06	003	-	A
7144	68	67	003	-	A	7685P	05	06	003	-	O
7151	68	53	003	-	S	Hitachi					
7152	68	53	003	-	S	25044	74	05	003	-	O
7225LA	68	15	VO5	-	S	25045	74	05	003	-	O
7226LA	68	15	VO5	-	S	25084	74	06	003	-	O
7226RA	68	B1	VO6	351A-066	A	25084S	66	06	003	-	O
7226RS	68	B1	VO6	351A-066	A	25085	74	06	003	-	O
7231LA	68	16	VO5	-	S	25085S	66	06	003	-	O
7232LA	68	16	VO5	-	S	25088	74	16	003	-	O
7232RA	68	B2	VO6	351A-066	A	25088S	66	16	003	-	O
7237LA	68	21	VO5	-	S	25089	74	16	003	-	O
7238LA	68	21	VO5	-	S	25089S	66	16	003	-	O
7241LA	68	63	VO5	-	S	25168	74	21	003	-	O
7242LA	68	63	VO5	-	S	25168S	66	21	003	-	O

Table A-1. UniPak 2™ Family and Pinout Codes (Continued)

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Hitachi (Continued)					Intel (Continued)						
25169	74	21	003	-	O	8749H	50	57	V04	351A-070	A
25169S	66	21	003	-	O	8751	53	58	V04	351A-071	A
27C32	19	24	003	-	O	8751H	D5	58	V05	351A-071	S
27C32A	27	24	003	-	O	8755A	47	55	V04	351A-072	S
462532	19	25	003	-	A	Intersil					
462716	19	23	003	-	A	5600	D4	02	V05	-	O
462732	19	24	003	-	A	5603A	70	01	003	-	A
462732P	19	24	003	-	S	5604	70	03	003	-	A
48016	33	23	003	-	A	5610	D4	02	V05	-	O
4827128	79	51	003	-	A	5623	70	01	003	-	A
482732A	27	24	003	-	A	5624	70	03	003	-	A
482764	79	33	003	-	A	6716	59	64	003	-	A
Hughes					Mitsubishi						
3004-1	58	62	V04	-	S	2708	21	27	003	-	A
3004-2	58	61	V04	-	S	27128	79	51	003	-	A
3008	58	60	V04	-	S	2716	19	23	003	-	A
3104-1	58	62	V04	-	S	2732	19	24	003	-	A
3104-2	58	61	V04	-	S	2732A	27	24	003	-	A
3108	58	60	V04	-	S	2764	79	33	003	-	A
Intel					Monolithic Memories						
2704	21	26	003	-	A	5300	11	01	003	-	A
2708	21	27	003	-	A		E5	01	V06	-	S
27128	79	51	003	-	A	5301	11	01	003	-	A
27128A	93	51	V04	-	A		E5	01	V06	-	S
2716	19	23	003	-	A	5305	11	03	003	-	A
27256	93	32	V04	-	A		E5	03	V06	-	S
2732	19	24	003	-	A	5306	11	03	003	-	A
2732A	27	24	003	-	A		E5	03	V06	-	S
27512	4B	A4	V06	-	S	5308	11	08	003	-	A
2758	19	22	003	-	A		D1	08	V05	-	A
2764	79	33	003	-	A	5309	11	08	003	-	A
2764A	93	33	V04	-	A		D1	08	V05	-	A
27C64	93	33	V04	-	S	5330	29	02	003	-	A
2815	85	23	003	-	A		E7	02	V06	-	S
2816	37	23	003	-	A	5331	29	02	003	-	A
2816A	A5	96	V05	-	S		E7	02	V06	-	S
2817A	BF	A2	V05	-	S	5335	11	14	003	-	A
3628	75	16	003	-	A		D1	14	V05	-	A
3628A	75	16	003	-	A	5336	11	14	003	-	A
3632	75	63	003	-	A		D1	14	V05	-	A
3636	75	21	003	-	A	5340	11	15	003	-	A
3636B	75	21	003	-	A		D1	15	V05	-	A
82HS181	75	16	003	-	A	5340JS	11	15	003	-	A
82HS191	75	21	003	-	A		D1	15	V05	-	A
82HS321	75	63	003	-	A	6341	11	15	003	-	A
82S181	75	16	003	-	A		D1	15	V05	-	A
82S191	75	21	003	-	A	6341JS	11	15	003	-	A
82S321	75	63	003	-	A		D1	15	V05	-	A
8704	21	26	003	-	A						
8708	21	27	003	-	A						
8741	56	59	V04	351A-070	S						
8741A	56	59	V04	351A-070	S						
8742	50	57	V05	351A-070	S						
8744	53	58	V05	351A-071	S						
8748	52	56	V04	351A-070	A						
8748H	50	56	V04	351A-070	A						

Table A-1. UniPak 2™ Family and Pinout Codes (Continued)

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Monolithic Memories (Continued)					Monolithic Memories (Continued)						
5348	11	09	003	-	A	6352	11	05	003	-	A
	D1	09	V05	-	A		D1	05	V05	-	A
5349	11	09	003	-	A	6353	11	05	003	-	A
	D1	09	V05	-	A		D1	05	V05	-	A
5352	11	05	003	-	A	6380	11	16	003	-	A
	D1	05	V05	-	A		D1	16	V05	-	A
5353	11	05	003	-	A	6380JS	11	16	003	-	A
	D1	05	V05	-	A		D1	16	V05	-	A
5380	11	16	003	-	A	6381	11	16	003	-	A
	D1	16	V05	-	A		D1	16	V05	-	A
5380JS	11	16	003	-	A	6381JS	11	16	003	-	A
	D1	16	V05	-	A		D1	16	V05	-	A
5381	11	16	003	-	A	6388	11	06	003	-	A
	D1	16	V05	-	A		D1	06	V05	-	A
5381JS	11	16	003	-	A	6389	11	06	003	-	A
	D1	16	V05	-	A		D1	06	V05	-	A
5388	11	06	003	-	A	63D1641	B2	80	V05	351A-073	A
	D1	06	V05	-	A	63D1642	B2	80	V05	351A-073	A
5389	11	06	003	-	A	63DA1643	AA	87	V05	351A-073	A
	D1	06	V05	-	A	63DA441	AA	AC	V05	351A-073	A
53LS080	18	02	003	-	O	63DA841	AA	AD	V05	351A-073	A
53LS081	18	02	003	-	O	63DS1643	AA	87	V05	351A-073	A
53S080	18	02	003	-	O	63LS080	18	02	003	-	A
53S081	18	02	003	-	O	63LS081	18	02	003	-	A
6300	11	01	003	-	A	63LS140	18	01	003	-	A
	E5	01	V06	-	S	63LS141	18	01	003	-	A
6301	11	01	003	-	A	63LS240	18	03	003	-	A
	E5	01	V06	-	S	63LS241	18	03	003	-	A
6305	11	03	003	-	A	63LS441	18	05	003	-	A
	E5	03	V06	-	S	63PL1681	18	21	V05	-	S
6306	11	03	003	-	A	63PS1681	18	21	V05	-	A
	E5	03	V06	-	S	63RA1681	18	A3	V05	-	A
6308	11	08	003	-	A	63RA441	18	07	V04	-	A
	D1	08	V05	-	A	63RA481	EC	66	V06	-	S
6309	11	08	003	-	A	63RS1681	18	A3	V05	-	A
	D1	08	V05	-	A	63RS881	18	86	V04	-	A
6330	29	02	003	-	A	63S080	18	02	003	-	A
	E7	02	V06	-	S	63S081	18	02	003	-	A
6331	29	02	003	-	A	63S140	18	01	003	-	A
	E7	02	V06	-	S	63S141	18	01	003	-	A
6335	11	14	003	-	A	63S1640	18	53	003	-	A
	D1	14	V05	-	A	63S1641	18	53	003	-	A
6336	11	14	003	-	A	63S1680	18	21	003	-	A
	D1	14	V05	-	A	63S1681	18	21	003	-	A
6340	11	15	003	-	A	63S1681J	18	21	003	-	A
	D1	15	V05	-	A	63S240	18	03	003	-	A
6340JS	11	15	003	-	A	63S241	18	03	003	-	A
	D1	15	V05	-	A	63S3281	18	63	V03	-	A
6341	11	15	003	-	A	63S440	18	05	003	-	A
	D1	15	V05	-	A	63S441	18	05	003	-	A
6341JS	11	15	003	-	A	63S480	18	09	003	-	A
	D1	15	V05	-	A	63S481	18	09	003	-	A
6348	11	09	003	-	A	63S840	18	06	003	-	A
	D1	09	V05	-	A	63S841	18	06	003	-	A
6349	11	09	003	-	A	63S881	18	16	003	-	A
	D1	09	V05	-	A						

Table A-1. UniPak 2™ Family and Pinout Codes (Continued)

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Mostek					National Semiconductor (Continued)						
2716	19	23	VO3	-	A	54S572	08	05	003	-	O
Motorola											
68732-0	25	44	003	-	O	54S573	08	05	003	-	O
68732-1	25	45	003	-	O	74LS471	08	08	003	-	A
76161	05	21	003	-	A	74S188	08	02	003	-	A
76165	05	53	003	-	S	74S287	08	01	003	-	A
6836E16	2D	5A	VO6	-	S	74S288	08	02	003	-	A
7620	05	03	003	-	O	74S387	08	01	003	-	A
7621	05	03	003	-	A	74S471	08	08	003	-	A
7640	05	15	003	-	O	74S472	08	09	003	-	A
7641	05	15	003	-	A	74S473	08	09	003	-	A
7642	05	05	003	-	O	74S474	08	15	003	-	A
7643	05	05	003	-	A	74S475	08	15	VO3	-	A
7649	05	09	003	-	S	74S570	08	03	003	-	A
7680	05	16	003	-	O	74S571	08	03	003	-	A
7681	05	16	003	-	A	74S572	08	05	003	-	A
7684	05	06	003	-	O	74S573	08	05	003	-	A
7685	05	06	003	-	A	74S574	08	34	003	-	A
MCM2532	19	25	003	-	A	77LS181	08	16	VO3	-	A
MCM2708P	21	27	003	-	O	77S180	08	16	VO3	-	A
MCM2716	19	23	003	-	A	77S184	08	06	VO3	-	A
MCM2808	81	72	003	-	A	77S185	08	06	VO3	-	A
MCM2816	43	23	003	-	A	87LS181	08	16	003	-	A
MCM2817	81	71	003	-	A	87S180	08	16	003	-	A
MCM2832	81	70	003	-	A	87S181	08	16	003	-	A
MCM68708	21	27	003	-	A	87S184	08	06	003	-	A
MCM68764	25	29	003	-	A	87S185	08	06	003	-	A
MCM68766	25	29	003	-	A	87S190	08	21	003	-	A
TMS2716	23	28	003	-	A	87S191	08	21	003	-	A
National Semiconductor						87S195	08	53	003	-	A
2532	19	25	003	-	A	87S280	08	16	003	-	A
25C32	19	25	003	-	A	87S281	08	16	003	-	A
2708	21	27	003	-	A	87S290	08	21	003	-	A
2716	19	23	003	-	A	87S291	08	21	003	-	A
2732	19	24	003	-	A	87S295	08	15	003	-	A
2758A	19	22	003	-	A	87S296	08	15	003	-	A
2758B	19	35	VO3	-	A	87SR191	08	77	VO6	351A-066	S
2764	35	33	003	-	S	87S321	08	63	003	-	A
2764H	63	33	VO5	-	S	87SR181	08	66	VO5	-	A
27C16	19	23	003	-	A	87SR25	08	81	VO4	-	A
27C16H	BD	23	VO5	-	S	87SR474	08	81	VO5	-	A
27C32	19	24	003	-	A	87SR27	08	85	VO6	351A-067	S
27C32H	BD	24	VO5	-	S	9716	B3	23	VO4	-	A
2816	37	23	003	-	A	Nippon Electric Company, Ltd.					
2864	C7	A5	VO6	-	S	27128	79	51	VO5	-	A
54LS471	08	08	003	-	O	2716	19	23	003	-	A
54S188	08	02	003	-	O	2732	19	24	003	-	A
54S287	08	01	003	-	O	2732A	27	24	003	-	A
54S288	08	02	003	-	O	2764	79	33	003	-	A
54S387	08	01	003	-	O	8741AD	56	59	VO4	351A-070	S
54S471	08	08	003	-	O	8748AD	52	56	VO4	351A-070	S
54S472	08	09	003	-	O	8755A	47	55	VO4	351A-072	S
54S473	08	09	003	-	O	B403	72	01	003	-	A
54S474	08	15	VO3	-	A	B405	72	15	003	-	A
54S475	08	15	VO3	-	A	B406	72	05	003	-	A
54S570	08	03	003	-	O	B408	72	16	003	-	A
54S571	08	03	003	-	O	B409	72	21	003	-	A

Table A-1. UniPak 2™ Family and Pinout Codes (Continued)

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Nippon Electric Company, Ltd. (Continued)					Raytheon (Continued)						
B417	72	16	003	-	A	29663	11	01	003	-	A
B419	72	42	003	-	A	29671	11	63	003	-	A
B423	72	01	003	-	A	29673	11	63	003	-	A
B425	72	15	003	-	A	29680	11	21	003	-	A
B426	72	05	003	-	A	29680SM	11	21	003	-	A
B428	72	16	003	-	A	29681	11	21	003	-	A
B429	72	21	003	-	A	29681SM	11	21	003	-	A
Oki					Ricoh						
2532	19	25	003	-	S	RD5H32	27	24	003	-	S
2708	21	27	003	-	A	Rockwell					
27128	79	51	003	-	S	R87C32	27	24	V05	-	S
2716	19	23	003	-	A	87CB4	93	33	V05	-	S
2732	19	24	003	-	S	Seeq					
2732A	27	24	003	-	S	27C256	93	32	V05	-	S
2758	19	22	003	-	A	5133	79	33	V04	-	A
2764	79	33	003	-	A	2816A	B7	23	V05	-	S
8755A	47	55	004	351A-072	S	2816AH	DF	23	V06	-	S
Raytheon					SGS Technology						
29600	11	08	003	-	A	2532	19	25	002	-	A
29601	11	08	003	-	A	2716	19	23	003	-	A
29602	11	08	003	-	A	2764	35	33	V05	-	A
29603	11	08	003	-	A	Signetics					
29610	11	03	003	-	A	2708	21	27	003	-	A
29611	11	03	003	-	A	82123	10	02	003	-	A
29612	11	03	003	-	A	82LS135	10	08	003	-	A
29613	11	03	003	-	A	82LS137	10	05	003	-	A
29620	11	09	003	-	A	82HS195	CF	53	V06	-	A
29621	11	09	003	-	A	82LS180	10	16	003	-	A
29622	11	09	003	-	A	82LS181	10	16	003	-	A
29623	11	09	003	-	A	82PS180	10	16	003	-	A
29624	11	15	003	-	A	82PS181	10	16	003	-	A
29625	11	15	003	-	A	82HS321	10	63	V06	-	A
29626	11	15	003	-	A	82S123	10	02	003	-	A
29627	11	15	003	-	A	82S126	10	01	003	-	A
29630	11	16	003	-	A	82S129	10	01	003	-	A
29630SM	11	16	003	-	A	82S130	10	03	003	-	A
29631	11	16	003	-	A						
29631SM	11	16	003	-	A						
29632	11	16	003	-	A						
29632SM	11	16	003	-	A						
29633	11	16	003	-	A						
29633SM	11	16	003	-	A						
29634	11	16	003	-	A						
29635	11	16	003	-	A						
29636	11	16	003	-	A						
29637	11	16	003	-	A						
29640	11	53	003	-	A						
29641	11	53	003	-	A						
29642	11	53	003	-	A						
29643	11	53	003	-	A						
29650	11	06	003	-	A						
29651	11	06	003	-	A						
29652	11	06	003	-	A						
29653	11	06	003	-	A						
29660	11	01	003	-	A						
29661	11	01	003	-	A						
29662	11	01	003	-	A						

Table A-1. UniPak 2™ Family and Pinout Codes (Continued)

Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status	Device Part Number	Family and Pinout Codes	Software Version	Adapter	Approval Status		
Signetics (Continued)					Texas Instruments (Continued)						
82S131	10	03	003	-	A	28P166	13	21	003	-	A
82S135	10	08	003	-	A	28P42	13	09	003	-	A
82S136	10	05	003	-	A	28P45	13	15	003	-	A
82S137	10	05	003	-	A	28P85	13	16	003	-	A
82S140	10	15	003	-	A	28S166	13	21	003	-	A
82S141	10	15	003	-	A	28S2708	13	16	003	-	A
82S146	10	09	003	-	A	28S42	13	09	003	-	A
82S147	10	09	003	-	A	28S45	13	15	003	-	S
82S180	10	16	003	-	A	28S46	13	15	003	-	A
82S181	10	16	003	-	A	28S85	13	16	003	-	A
82S182	10	16	003	-	A	28S86	13	16	003	-	A
82S183	10	16	003	-	A	28SA166	13	21	003	-	A
82S184	10	06	003	-	A	28SA42	13	09	003	-	A
82S185	10	06	003	-	A	28SA46	13	15	003	-	A
82S190	10	21	003	-	A	38S16	A1	21	VO6	-	S
82S191	10	21	003	-	A	28SA86	13	16	003	-	A
82S195	10	53	003	-	A	54LS478	13	16	003	-	O
82S23	10	02	003	-	A	54S476	13	38	003	-	O
82S2708	10	16	003	-	A	54S477	13	38	003	-	O
82S321	10	63	003	-	A	38S030	A1	02	VO6	-	S
27C64	35	33	003	-	S	54S478	13	16	003	-	O
						54S479	13	16	003	-	O
Synertek											
2716	19	23	003	-	A	74LS478	13	16	003	-	O
Texas Instruments											
24S10	13	01	003	-	A	74S2708	13	16	003	-	O
24S166	13	53	003	-	A	74S454	13	06	003	-	O
24S41	13	38	003	-	A	74S455	13	06	003	-	O
24S81	13	06	003	-	A	74S476	13	38	003	-	O
24SA10	13	01	003	-	A	74S477	13	38	003	-	O
24SA166	13	53	003	-	A	74S478	13	16	003	-	O
24SA41	13	38	003	-	A	74S479	13	16	003	-	O
24SA81	13	06	003	-	A	TMS2716	23	28	VO3	-	A
2508	19	22	003	-	A	Thompson					
2516	BD	23	V05	-	A	71190	92	21	003	-	S
2532	BD	25	V05	-	A	71191	92	21	003	-	S
2564	BD	30	V05	-	A	Toshiba					
25L32	19	25	003	-	A	27128	79	51	003	-	S
2708	21	27	003	-	A	2732	19	24	003	-	S
27128	79	51	V03	-	S	2732A	27	24	003	-	S
2732	BD	24	V05	-	A	2732D	19	24	003	-	S
2732A	63	24	V05	-	A	2764	79	33	003	-	S
2764	79	33	003	-	A	321	21	26	003	-	S
27L08	21	27	003	-	A	322	21	27	003	-	S
28L166	13	21	003	-	A	323	19	23	003	-	S
28L22	13	46	003	-	A	8755AC	47	55	V04	351A-072	S
28L42	13	09	003	-	A	Xicor					
28L45	13	15	003	-	A	2804A	B7	82	V05	-	S
28L85	13	16	003	-	A	2816A	B7	23	V05	-	S
28L86	13	16	003	-	A	2864A	C3	98	V05	-	S
28LA22	13	46	003	-	A						

ERROR CODES

NOTE

In the case of an error condition, be sure that the family and pinout codes are correct for the PROM installed; refer to table A-1 in appendix A to cross check family and pinout codes.

CODE	NAME	DESCRIPTION
21	Illegal-Bit Error	The device cannot be programmed due to already programmed locations of incorrect polarity.
23	First-Pass Verify Error	The device data was incorrect on the first pass of the automatic verify sequence during device programming.
24	Second-Pass Verify Error	The device data was incorrect on the second pass of the automatic verify sequence during device programming.
27	Insufficient RAM	Due to the value of the Begin RAM Address, there is insufficient RAM to program the device, or the total allotment of RAM resident is less than the word limit of the device.
30	No Programming Algorithm	Valid family and pinout codes are not selected, or family code selection not followed by pinout code selection.
31	Excessive Current Drain	The operation aborted due to excessive current drain by a device.
32	Backward Device	The operation aborted due to V_{CC} level test indicating a backward device.
35	Faulty Chip Select	The operation aborted due to data being present while a device is disabled.
37	Socketing Error	Operation aborted due to a low V_{CC} level indication on sockets presumed to be empty. A device may be in the wrong socket, or two or more devices may be socketed simultaneously.
38	Illegal Operation During Calibration	An illegal or invalid operation was attempted during calibration.
39	Failure to Lock Security Fuse	The security bit did not program and the device is not locked.
70	Faulty Bit Supply	The operation aborted due to a faulty bit supply. Do not use UniPak 2™ until repaired.
71	Faulty CS Supply	The operation aborted due to a faulty CS supply. Do not use UniPak 2™ until repaired.
72	Faulty V_{CC} Supply	The operation aborted due to a faulty V_{CC} . Do not use UniPak 2™ until repaired.
A1	No Identifier Found	The device does not have an electronic identifier. The electronic identifier mode cannot be used.
A2	Invalid Identifier	The electronic identifier of the device has been read and it indicates that the device cannot be programmed using the selected family and pinout codes. Consult table A-1 for the correct family and pinout codes. Try again using these codes.
B0	Byte Erase Error	The device does not have a byte erase mode. Block limits must be removed and a chip erase performed. The entire chip may then be reprogrammed.
B1	Chip Erase Error	The device does not have a chip erase mode.

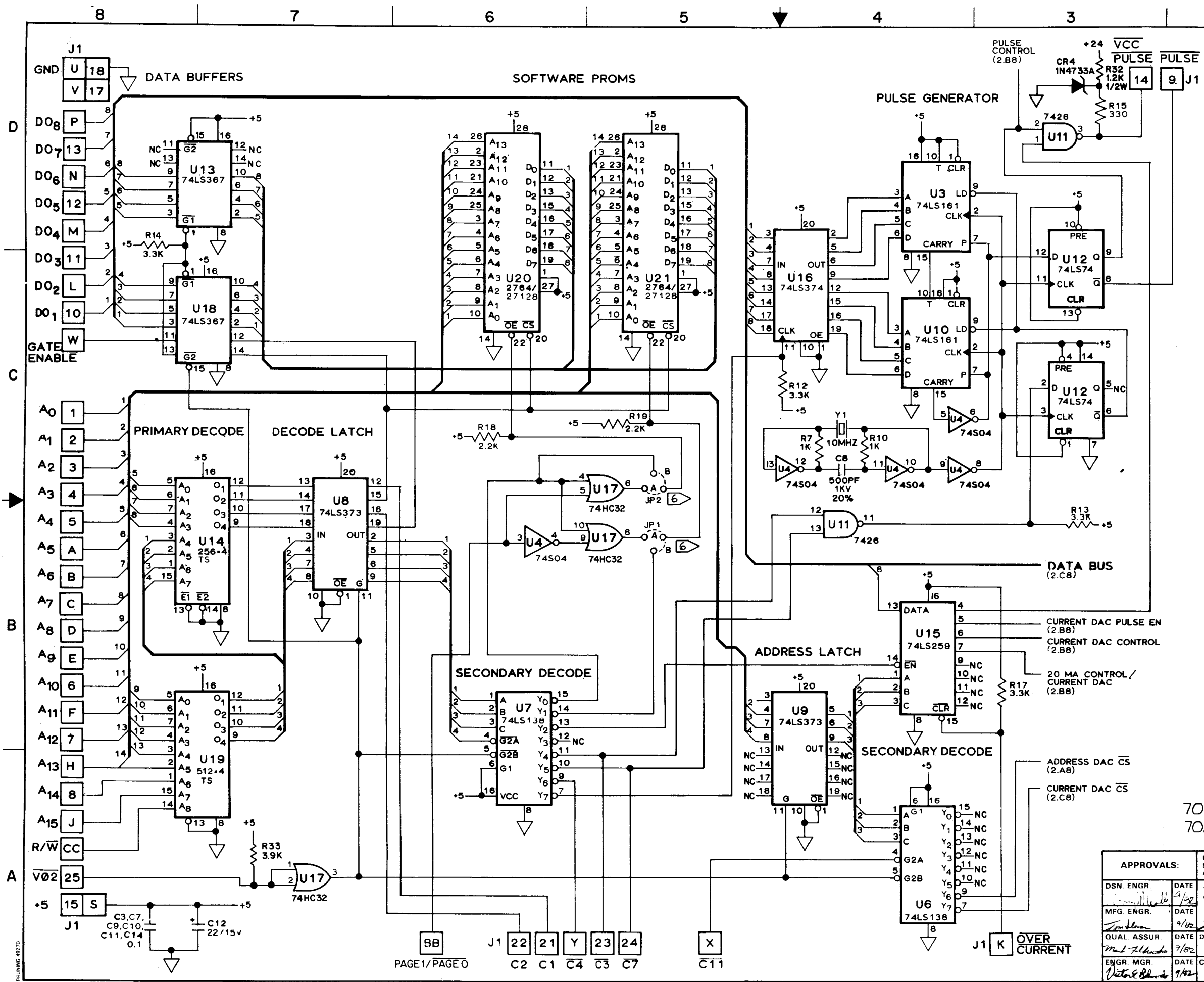
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APPENDIX B TIMING DIAGRAMS

APPENDIX C

SCHEMATICS

30-702-1650	Rev E	Memory Card
30-701-1655	Rev B	Address Card
30-702-1659	Rev D	Socket Card
30-702-1661	Rev A	Motherboard
30-701-1690	Rev A	Waveform Generator



REVISIONS					
LTR	DESCRIPTION	DR	CHK	APPR'D	DATE
A	RELEASE	MP/	AK		4/82
B	ECN 4760	CL			2/83
C	ECN 4768	CL			2/83
D	ECN 4827	CL			5/83
E	ECN 4889	BV			4/84

NOTES: UNLESS OTHERWISE SPECIFIED.

- RESISTORS ARE 1/4W AND IN OHMS, 5%
- CAPACITORS ARE 50V AND IN MICROFARADS 10%.
- LAST REFERENCE DESIGNATORS USED: R33, C14, CR4, VR3, U23, Q3, Y1, JP2
- REFERENCE DESIGNATORS NOT USED: U1, R22, R23

I.C. NO.	+5	GND
U4	14	7
U11	14	7
U17	14	7

5. UNUSED GATES:

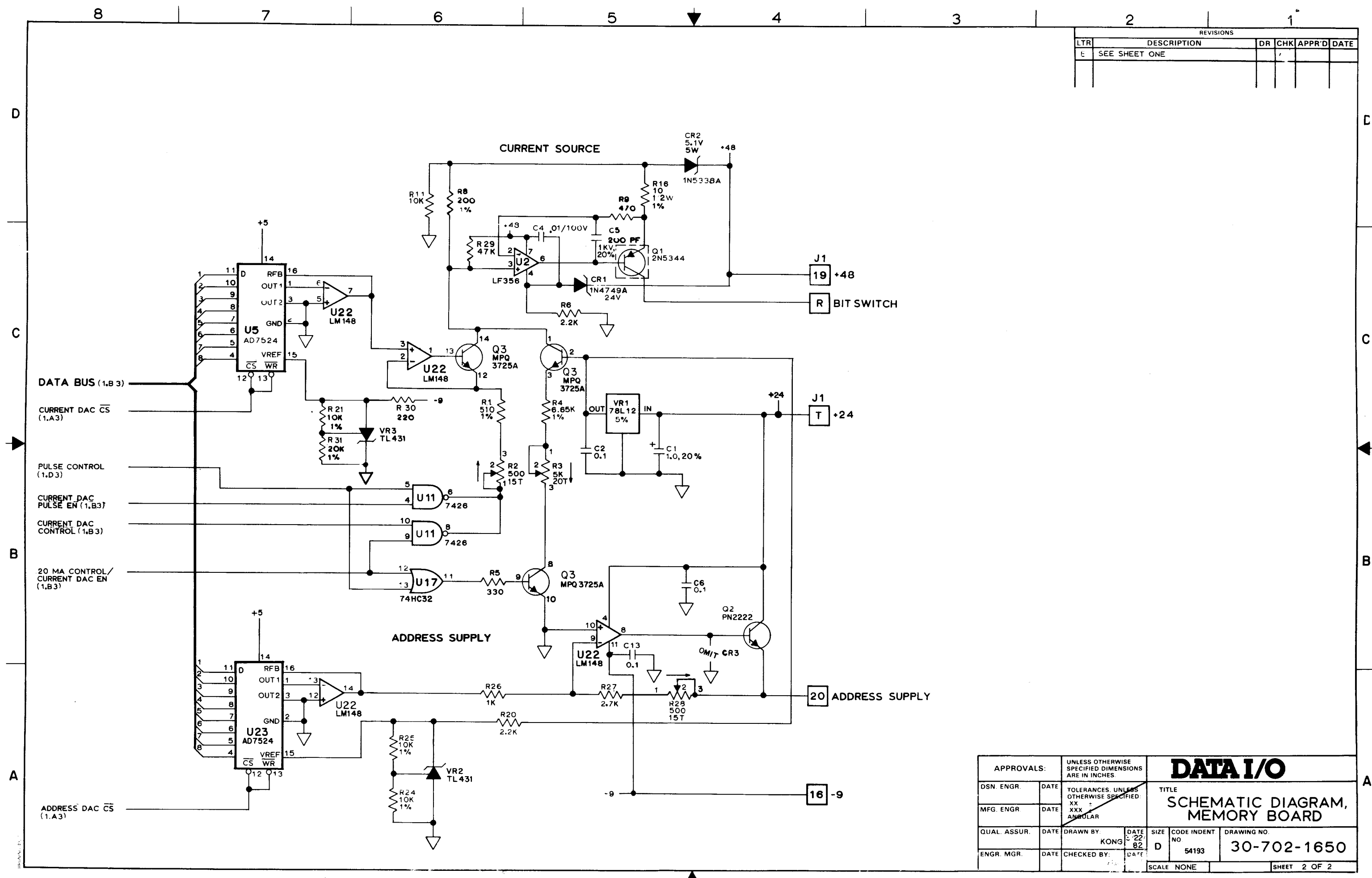
⑥ -002 INSTALL JP1 AND JP2 IN POSITION B,
-003 INSTALL JP1 AND JP2 IN POSITION A.

702-1650-002 SHOWN
702-1650-003 AS NOTED

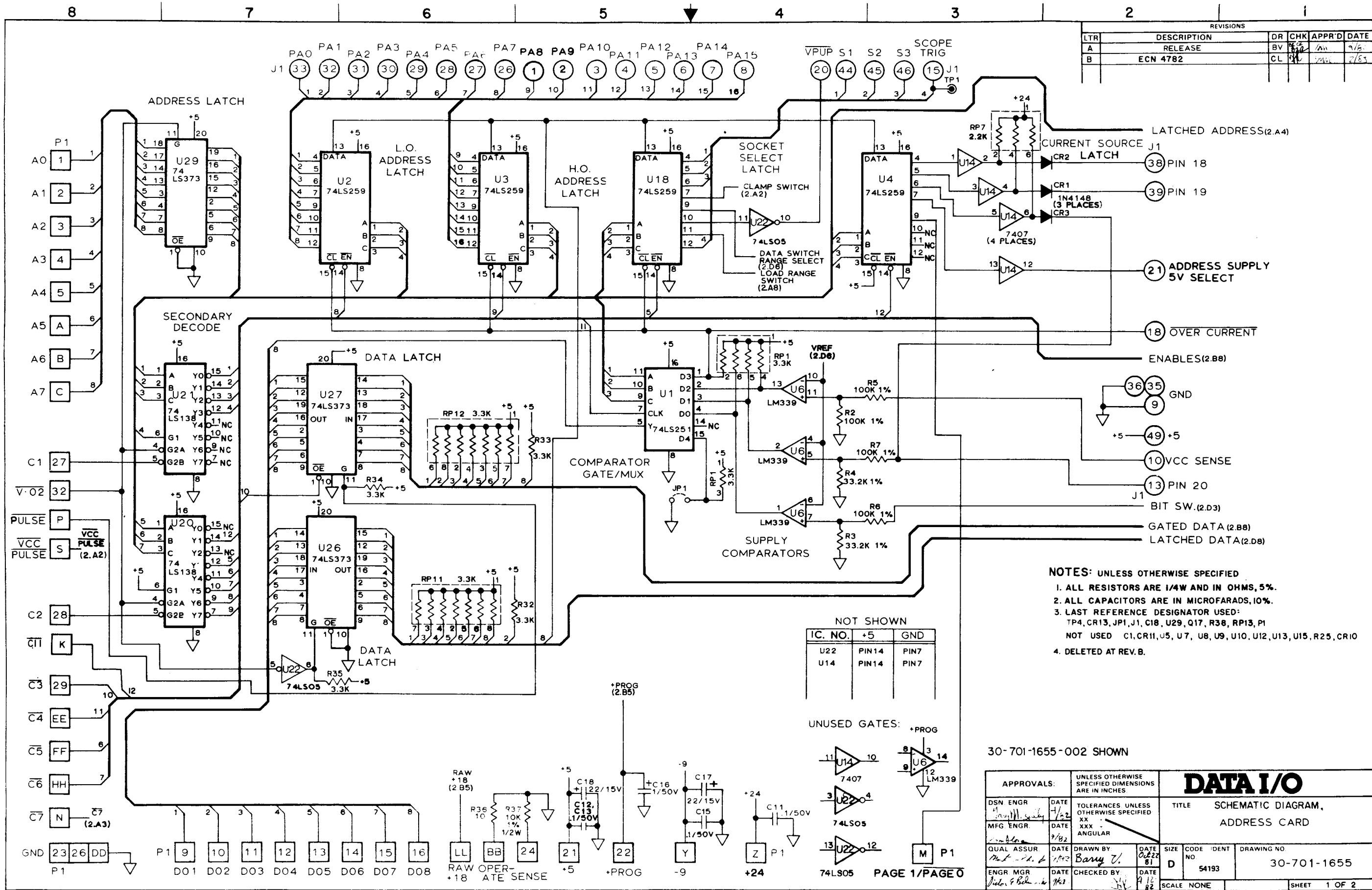
APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.		TOLERANCES, UNLESS OTHERWISE SPECIFIED:		TITLE	
DSN. ENGR.	DATE	TOL. UNLESS OTHERWISE SPECIFIED:	XXX ±	ANGULAR		DATA I/O	
MFG. ENGR.	DATE					SCHEMATIC DIAGRAM, MEMORY BOARD	
QUAL. ASSUR.	DATE	DRAWN BY:	DATE	SIZE	CODE INCHENT. NO.	DRAWING NO.	
ENGR. MGR.	DATE	KONG	3/17/82	D	54193	30-702-1650	
		CHECKED BY:	DATE	SCALE			SHEET 1 OF 2
		BK. CHK. BK	9/82	NONE			

PAGE 1/PAGE 0
BB J1 22 21 Y 23 24 X C11
C2 C1 C4 C3 C7

REVISIONS					
LTR	DESCRIPTION	DR	CHK	APPR'D	DATE
E	SEE SHEET ONE				



APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.		DATA I/O	
DSN. ENGR.	DATE	TOLERANCES, UNLESS OTHERWISE SPECIFIED:			
MFG. ENGR.	DATE	XX ±		TITLE SCHEMATIC DIAGRAM, MEMORY BOARD	
QUAL. ASSUR.	DATE	XXX ±			
ENGR. MGR.	DATE	ANGULAR		DRAWN BY: KONG	DATE: 22/82
CHECKED BY:		DATE:	SIZE: D	CODE INDENT NO: 54193	DRAWING NO. 30-702-1650
SCALE: NONE			SHEET 2 OF 2		

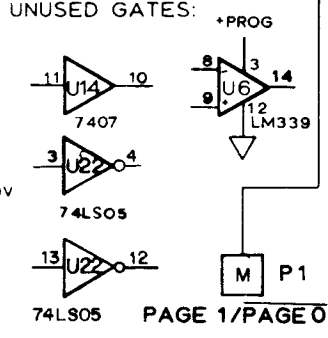


REVISIONS				
LTR	DESCRIPTION	DR	CHK	APPR'D DATE
A	RELEASE	BV	W	1/82
B	ECN 4782	CL	W	2/83

- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/4W AND IN OHMS, 5%.
 2. ALL CAPACITORS ARE IN MICROFARADS, 10%.
 3. LAST REFERENCE DESIGNATOR USED:
 TP4, CR13, JP1, J1, C18, U29, Q17, R38, RP13, P1
 NOT USED C1, CR11, U5, U7, U8, U9, U10, U12, U13, U15, R25, CR10
 4. DELETED AT REV. B.

NOT SHOWN

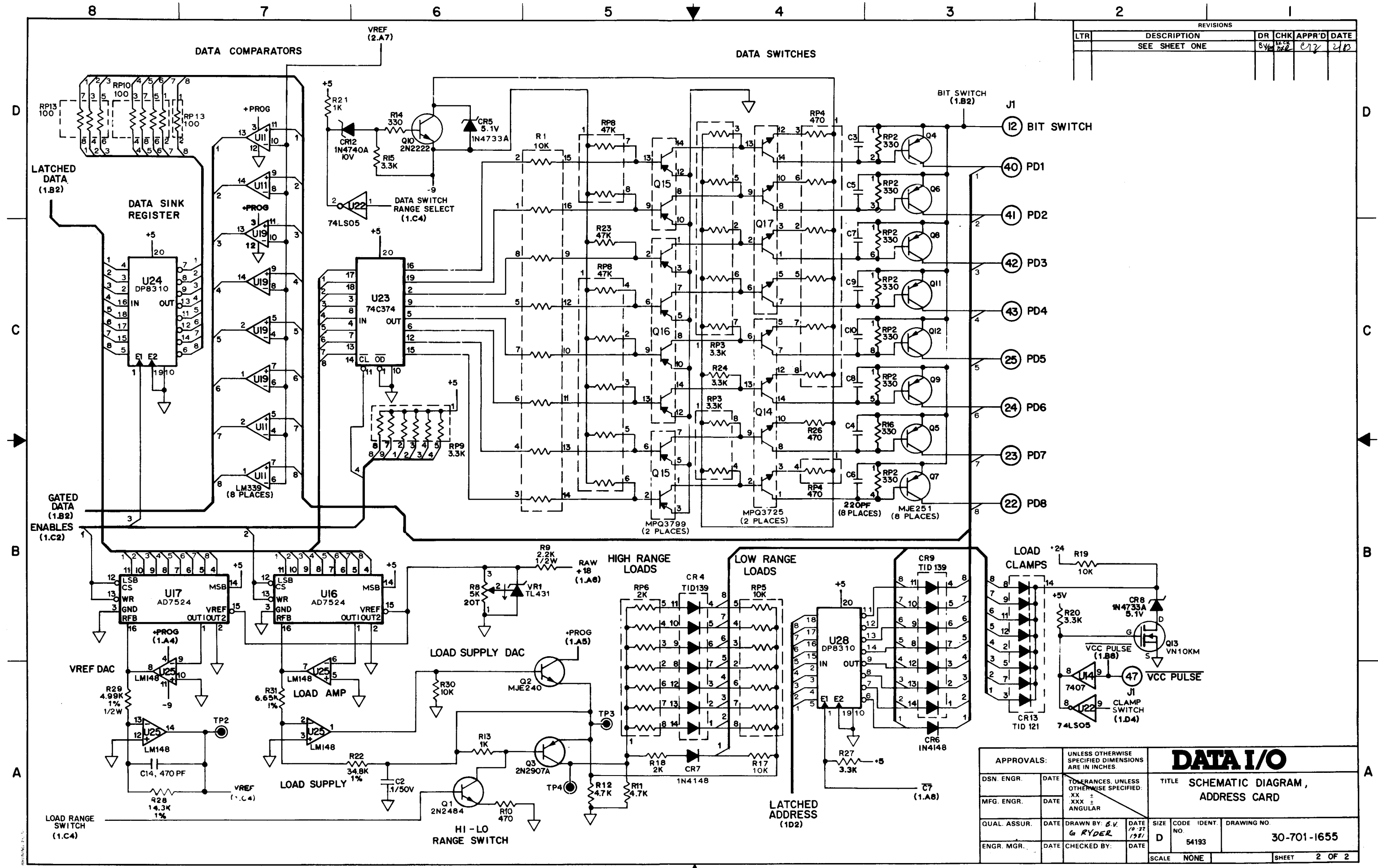
IC. NO.	+5	GND
U22	PIN14	PIN7
U14	PIN14	PIN7



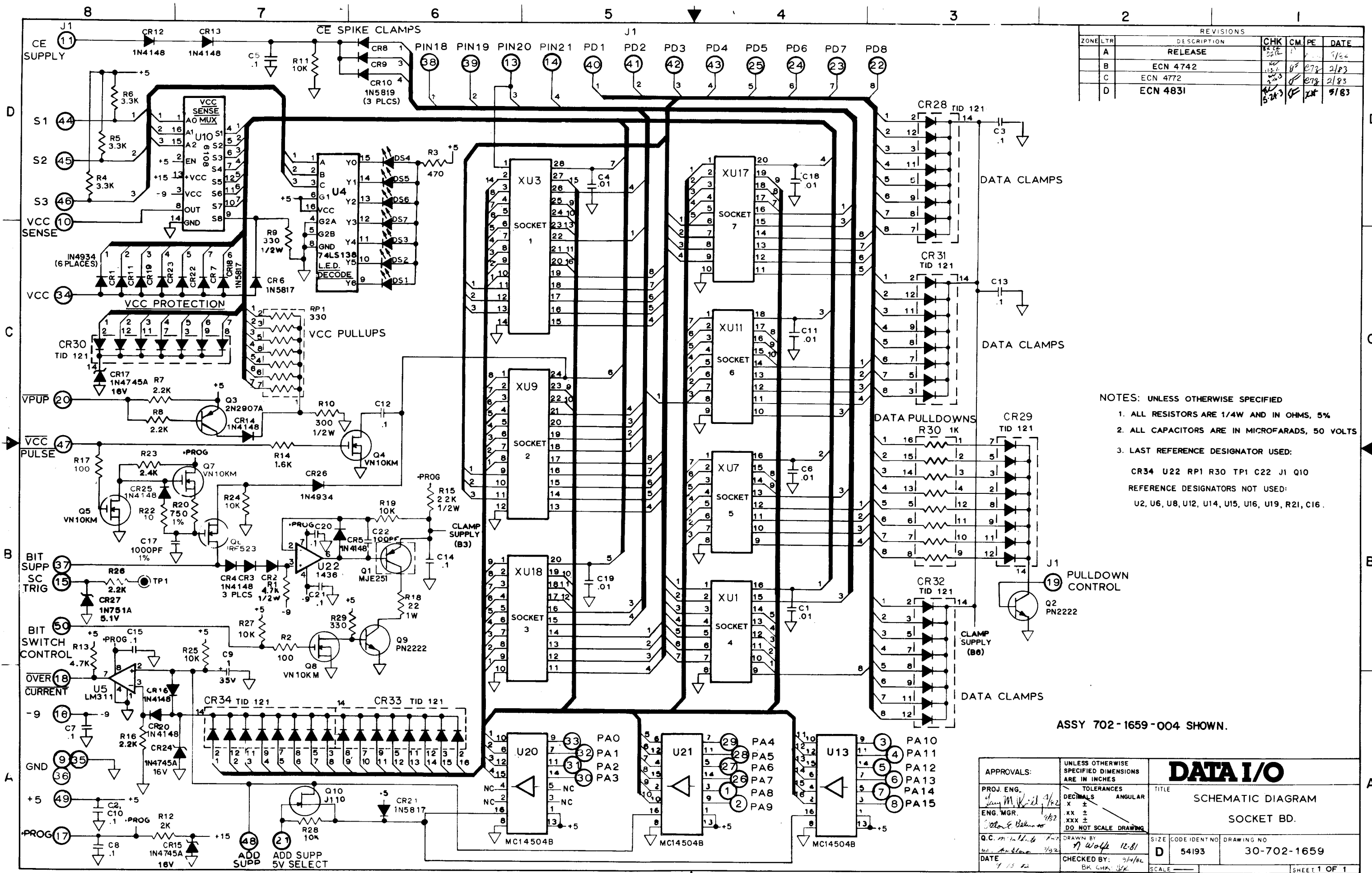
30-701-1655-002 SHOWN

APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		DATA I/O	
DSN ENGR	DATE	TOLERANCES UNLESS OTHERWISE SPECIFIED	TITLE SCHEMATIC DIAGRAM, ADDRESS CARD		
MFG ENGR	DATE	XX - ANGULAR	DATE	SIZE	CODE IDENT
QUAL ASSUR	DATE	XXX - ANGULAR	DRAWN BY	D	54193
ENGR MGR	DATE		CHECKED BY	DATE	DRAWING NO
					30-701-1655
				SCALE NONE	SHEET 1 OF 2

REVISIONS					
LTR	DESCRIPTION	DR	CHK	APPR'D	DATE
	SEE SHEET ONE	BV	MEG	CR	2/8



APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.	TITLE		
DSN. ENGR.	DATE		TOLERANCES, UNLESS OTHERWISE SPECIFIED:	DATA I/O	
MFG. ENGR.	DATE	.XX ±	SCHEMATIC DIAGRAM,		
QUAL. ASSUR.	DATE	.XXX ±	ADDRESS CARD		
ENGR. MGR.	DATE	ANGULAR	SIZE	CODE IDENT.	DRAWING NO.
			D	54193	30-701-1655
			SCALE	NONE	SHEET 2 OF 2



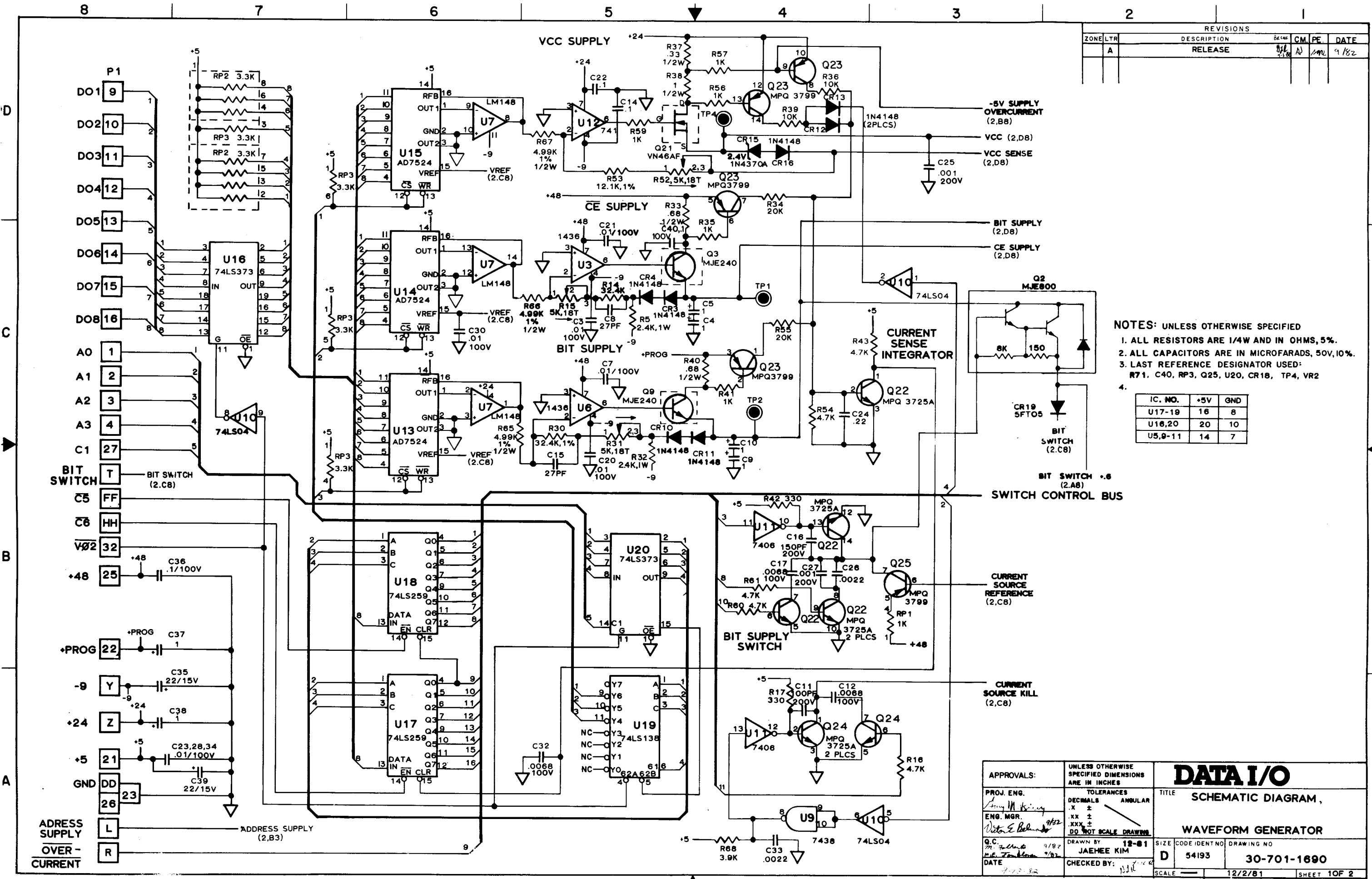
REVISIONS				
ZONE	LTR	DESCRIPTION	CHK	DATE
A		RELEASE		7/82
B		ECN 4742		2/83
C		ECN 4772		2/83
D		ECN 4831		9/83

- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/4W AND IN OHMS, 5%
 2. ALL CAPACITORS ARE IN MICROFARADS, 50 VOLTS
 3. LAST REFERENCE DESIGNATOR USED:
CR34 U22 RP1 R30 TP1 C22 J1 Q10
- REFERENCE DESIGNATORS NOT USED:
U2, U6, U8, U12, U14, U15, U16, U19, R21, C16.

ASSY 702-1659-004 SHOWN.

APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		DATA I/O	
PROJ. ENG. <i>[Signature]</i> ENG. MGR. <i>[Signature]</i> DATE 7/13/82		TOLERANCES DECIMALS: .XX ± ANGULAR: .XXX ± DO NOT SCALE DRAWING			
Q.C. <i>[Signature]</i> DATE 7/13/82		DRAWN BY: <i>[Signature]</i> CHECKED BY: <i>[Signature]</i> BK. CHK. <i>[Signature]</i>		SIZE: D CODE: 54193 IDENT NO: 30-702-1659 DRAWING NO: 30-702-1659 SCALE: _____ SHEET 1 OF 1	

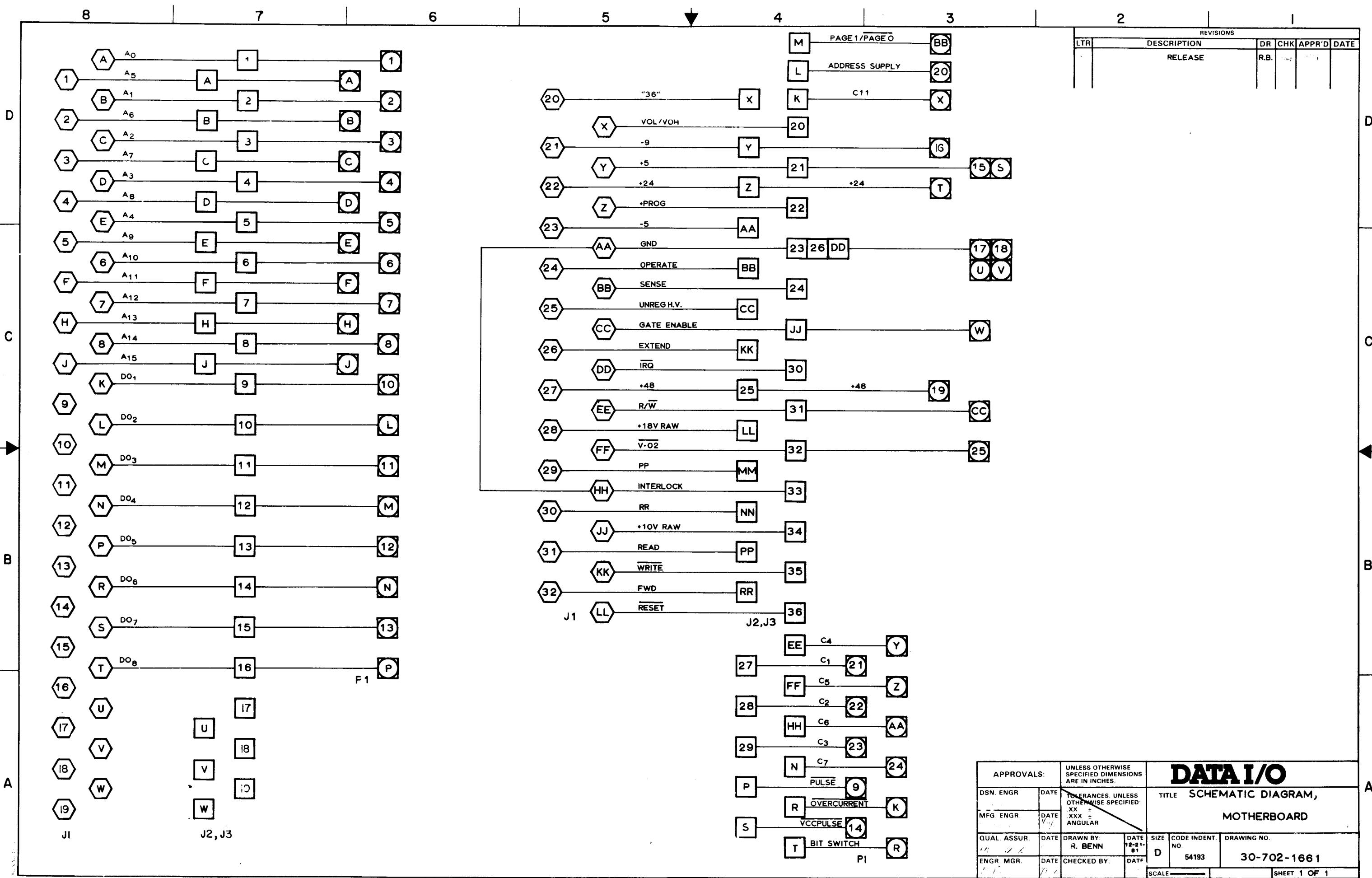
REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
A		RELEASE	9/82



NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTORS ARE 1/4W AND IN OHMS, 5%.
 2. ALL CAPACITORS ARE IN MICROFARADS, 50V, 10%.
 3. LAST REFERENCE DESIGNATOR USED:
 R71, C40, RP3, Q25, U20, CR18, TP4, VR2
 4.

IC. NO.	+5V	GND
U17-19	16	8
U16,20	20	10
U5,9-11	14	7

APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		DATA I/O	
PROJ. ENG. <i>Andy M. King</i>	ENG. MGR. <i>Diana E. Bell</i>	TOLERANCES	ANGULAR		
DATE 9/12/82		DRAWN BY JAEHEE KIM		WAVEFORM GENERATOR	
G.C. <i>M. J. ...</i>		SIZE D	CODE/IDENT NO 54193	DRAWING NO 30-701-1690	
CHECKED BY: <i>[Signature]</i>		SCALE	12/2/81	SHEET 1 OF 2	



REVISIONS				
LTR	DESCRIPTION	DR	CHK	APPR'D DATE
	RELEASE	R.B.		

APPROVALS:		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.		DATA I/O TITLE SCHEMATIC DIAGRAM, MOTHERBOARD		
DSN ENGR	DATE	TOLERANCES, UNLESS OTHERWISE SPECIFIED: XX ± XXX ± ANGULAR				
MFG ENGR	DATE	DRAWN BY: R. BENN	DATE 12-21-81	SIZE D	CODE INDENT. NO. 54193	DRAWING NO. 30-702-1661
QUAL ASSUR.	DATE	CHECKED BY:	DATE	SCALE	SHEET 1 OF 1	

8

7

6

5

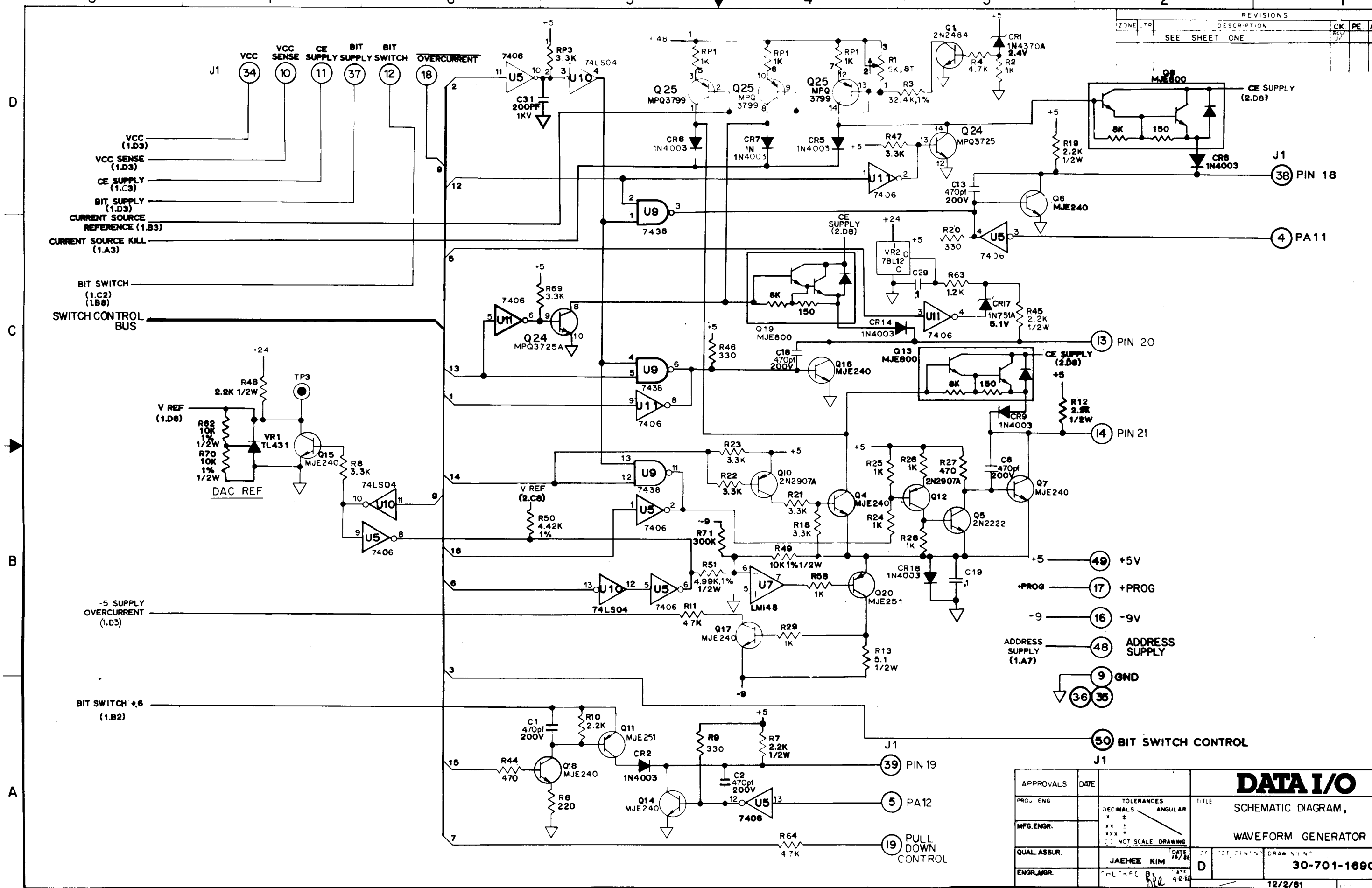
4

3

2

1

REVISIONS					
ZONE	DESCRIPTION	CK	PE	APP	DATE
SEE SHEET ONE					



- (49) +5V
- +PROG (17) +PROG
- (16) -9V
- ADDRESS SUPPLY (48) ADDRESS SUPPLY
- (9) GND
- (36) (35)

APPROVALS	DATE	TOLERANCES		TITLE
PROJ. ENGR.		DECIMALS	ANGULAR	
MFG. ENGR.		X ±		SCHEMATIC DIAGRAM, WAVEFORM GENERATOR
QUAL. ASSUR.		XX ±		
ENGR. MGR.		XXX ±	DO NOT SCALE DRAWING	
		DATE		DATE
		JAEHEE KIM		D
		12/2/81		30-701-1690
				12/2/81 2 OF 2