

**Model 820-303, 820-303-1**

**Remote Displays**

SERIAL NUMBER \_\_\_\_\_  
Revision A  
May 31, 2000

# TABLE OF CONTENTS

<u>SECTION</u>	<u>PARAGRAPH</u>	<u>TITLE</u>
<b>ONE</b>		<b><u>GENERAL INFORMATION</u></b>
	1.1	Scope of Manual
	1.2	Purpose of Equipment
	1.3	Physical Specifications
	1.4	Environmental Specifications
	1.5	Power Specifications
	1.6	Display Specifications
	1.7	RS-232C Interface Specifications
	1.8	RS-422A Interface Specifications
	1.9	Code Input Specifications
<b>TWO</b>		<b><u>INSTALLATION AND OPERATION</u></b>
	2.1	Introduction
	2.2	Installation
	2.3	Alphanumeric Mode
	2.3.1	I/O Port Selection
	2.3.2	Data Rate and Format Selection
	2.3.3	CTS Enable
	2.3.4	Command Set Selection
	2.3.5	Address Selection
	2.3.6	Port B Mode Selection
	2.4	Alphanumeric Operation
	2.4.1	Display Format
	2.4.2	I/O Port Commands
	2.4.3	Amplified Command Set
	2.4.3.1	Enter Text Command
	2.4.3.2	Display Stored Text Command
	2.4.3.3	Display Keyboard Text Command
	2.4.4	Abbreviated Command Set
	2.5	Time Code Translator Mode
	2.5.1	Format Selection
	2.5.2	Data Display Selection
<b>THREE</b>		<b><u>THEORY OF OPERATION</u></b>
	3.1	Introduction
	3.2	Circuit Card Descriptions
<b>FOUR</b>		<b><u>MAINTENANCE &amp; TROUBLESHOOTING</u></b>
	4.1	Introduction
	4.2	Preventative Maintenance
	4.2.1	Inspection
	4.2.2	Cleaning
	4.2.3	Qualification
	4.3	Troubleshooting
	4.3.1	General Troubleshooting Procedures

## TABLE OF CONTENTS (Continued)

<u>SECTION</u>	<u>PARAGRAPH</u>	<u>TITLE</u>
<b>FOUR</b>		<b><u>MAINTENANCE &amp; TROUBLESHOOTING</u></b> (Continued)
	4.3.2	Power Circuits
	4.3.3	Locating Drawings
	4.3.4	Locating Circuits
	4.3.5	Circuit Card Removal
	4.3.6	Replacing Components
<b>FIVE</b>		<b><u>DRAWINGS</u></b>
<b><u>Drawing Number</u></b>		<b><u>Title</u></b>
820-303		Top Assembly
820-303-1		Top Assembly
800-5284		Display Assembly
800-5270		Display Assembly
800-5270-1		Decoder Assembly
800-5269		Processor Assembly
800-5269-1		Connector Assembly

## SECTION ONE

### GENERAL INFORMATION

#### 1.1 SCOPE OF MANUAL

This manual contains the information necessary to operate and maintain a TrueTime model 820-303 series Alphanumeric/Code Translator Remote Display.

#### 1.2 PURPOSE OF EQUIPMENT

The 0.45 inch Remote Message Display may display up to one hundred 24-character alphanumeric messages input via either an RS-232C port or an RS-422A port, or display time translated from an input code. The 820-303 model contains two identical displays that can be controlled independently. In models with two displays, the internal boards nearest the front, the lefthand front panel display, and the top row of rear panel I/O connectors are display #1. The internal boards nearest the rear, the righthand front panel display, and the bottom row of rear panel I/O connectors comprise display #2.

In alphanumeric mode only 12 characters may be displayed at one time; longer messages may be scrolled across the display. Messages 12 characters or less may be scrolled, displayed static or blink. Messages are retained in non-volatile RAM at power-down, and therefore need not be re-entered upon subsequent power-up.

The RS-232C and RS-422A ports may be connected to terminals, computers, or other devices using the appropriate signal levels. Secondary RS-232C and RS-422A output ports duplicate the input signals and therefore permit "daisy-chaining" of multiple units. The data rate and format of the RS-232C and RS-422A ports are switch-selectable at the rear panel. The address of the unit may be set from 1 to 255, and also responds to master address 000 common to all like units.

In code input mode, the unit autodetects the input code (IRIG B, MILA, BUDX, CS1-4) and translates the coded information. It is not necessary to cycle power when the input code is changed. If the input is disconnected, the Remote Display will display all blank.

#### 1.3 PHYSICAL SPECIFICATIONS

Height:	1.73 in (4.39 cm)
Width:	Suitable for mounting in a standard 19.0 in (48.26 cm) rack
Depth:	14.0 in (35.56 cm) plus mating connectors
Weight:	Approximately 10 lb

#### 1.4 ENVIRONMENTAL SPECIFICATIONS

Operating Temperature:	+32° to +122°F (0° to +50°C)
Storage Temperature:	-40° to +158°F (-40° to +70°C)
Humidity:	95% relative, non-condensing
Cooling Mode:	Convection

## 1.5 POWER SPECIFICATIONS

Voltage:	95 to 260 VAC
Frequency:	47 to 440 Hz
Power:	Approximately 20 W
Fuse:	3AG 1 Amp slow blow
Connector:	CORCOM 6EF1

## 1.6 DISPLAY SPECIFICATIONS

Display:	12 5x7 Dot Matrix LED displays
Digit Size:	0.45 in (1.1 cm)
Luminescence:	90 $\mu$ cd/dot minimum
Lens:	Anti-glare coated
Character Set:	All printable ASCII characters

## 1.7 RS-232C INTERFACE SPECIFICATIONS

The primary RS-232C Input Interface specifications are:

Data:	Serial ASCII characters
Levels:	RS-232C
Data Rate:	Selectable, 110, 150, 300, 600, 1200, 2400, 9600 or 19200 bps, see Table 2-1
Data Bits:	Selectable, 7 or 8
Stop Bits:	Selectable, 1 or 2
Parity:	Odd, even, none
Connector:	Male 25-pin D subminiature, J5 (J11)*
Mating Connector:	Female 25-pin D subminiature
Pin Assignment:	See Table 1-1

\* Indicates data for second independent display when present

**Table 1-1**  
**RS-232 Connector J5 (J11) Pin Assignment**

Pin	Assignment
2	RXD Input
3	TXD (Not used)
4	CTS (Optional)
5	RTS
6	DTR
7	GND

The buffered secondary RS-232C Output Interface specifications are identical to the primary specifications except:

Connector:	Female 25-pin D subminiature, J6 (J12)
Mating Connector:	Male 25-pin D subminiature
Pin Assignment:	See Table 1-2

**Table 1-2  
RS-232 Connector J6 (J12) Pin Assignment**

<b>Pin</b>	<b>Assignment</b>
2	RXD Output
3	TXD (Not used)
4	CTS (Optional)
5	RTS
6	DTR
7	GND

1.8 RS-422A INTERFACE SPECIFICATIONS

Data:	Serial ASCII characters
Levels:	RS-422A
Data Rate:	Selectable, 110, 150, 300, 600, 1200, 2400, 9600 or 19200 bps, (see Table 2-1)
Data Bits:	Selectable, 7 or 8
Stop Bits:	Selectable, 1 or 2
Parity:	Odd, even, none
Primary Connector:	Female Twinax
Mating Connector:	Male Twinax
Pin Assignment:	Center pin RX+, outside conductor RX-

The secondary RS-422A Interface specifications are identical to the primary interface specifications. Note that the secondary interface is not buffered.

1.9 CODE INPUT SPECIFICATIONS

Format:	IRIG B, MILA, CS-1 110, CS-2 111, CS-3 114, CS-4 112/116
Frequency:	1 kHz
Amplitude:	0.3 to 12 Vp-p
Ratio:	2:1 to 6:1
Impedance:	600 Ω
Direction:	Forward
Polarity:	Positive or Negative
Connector:	Female BNC, "Code In"

Format:	BUDX
Frequency:	345 Hz
Amplitude:	0.3 to 12 Vp-p
Ratio:	2:1 to 6:1
Impedance:	600 Ω
Direction:	Forward
Polarity:	Positive or Negative
Connector:	Female BNC, "Code In"

## SECTION TWO

### INSTALLATION AND OPERATION

#### 2.1 INTRODUCTION

This section contains installation instructions and operating procedures.

#### 2.2 INSTALLATION

Unpack the unit and carefully inspect the unit for shipping damage. Any damage must be reported to the carrier immediately.

Fabricate any required cables and connect them to the appropriate rear-panel connectors. Connect the power-cord to the connector on the rear panel.

Use the DIP switches on the appropriate 800-5269-1 switch board to select the I/O port parameters, device address and Port B mode as described below. All switches may be changed while the power is on and any change will take effect immediately.

#### 2.3 ALPHANUMERIC MODE

Select Alphanumeric mode by turning off S3 Section 8 before power up. To change to translator mode during operation, send the following string to the appropriate RS input:

<STX>AN###S3-8=OFF<ETX>

The unit will use the actual setting of the internal S3-8 as the default upon subsequent power-up.

##### 2.3.1 I/O PORT SELECTION

Select either RS-232C or RS-422A port control with switch S1-1 and S1-2. Refer to Table 2-1 for the appropriate switch settings.

**Table 2-1**  
**I/O Port Selection Switch S1**

Port	Section 1	Section 2
RS-232C	OFF	ON
RS-455A	ON	OFF

##### 2.3.2 DATA RATE AND FORMAT SELECTION

Use switch S1 Sections 4 through 7 to select the data rate for either the RS-232C or RS-433A ports as shown in Table 2-2.

Use switch S3 Sections 3 through 5 to select the number of data bits, the parity and the number of stop bits for either the RS-232C or RS-422A port as shown in Table 2-3.

**Table 2-2  
Data Rate Selection Switch S1**

Rate	Section 4	Section 5	Section 6	Section 7
110	OFF	OFF	OFF	OFF
150	ON	OFF	OFF	OFF
300	OFF	ON	OFF	OFF
600	ON	OFF	OFF	ON
1200	OFF	OFF	ON	OFF
2400	ON	ON	OFF	OFF
4800	OFF	ON	ON	OFF
9600	ON	ON	ON	OFF
19200	ON	ON	ON	ON

Note: Section 8 is not used.

**Table 2-3  
Data Format Switch S3**

DATA BITS	PARITY BITS	STOP BITS	SECTION 3	SECTION 4	SECTION 5
7	EVEN	2	OFF	OFF	OFF
7	ODD	2	ON	OFF	OFF
7	EVEN	1	OFF	ON	OFF
7	ODD	1	ON	ON	OFF
8	NONE	2	OFF	OFF	ON
8	NONE	1	ON	OFF	ON
8	EVEN	1	OFF	ON	ON
8	ODD	1	ON	ON	ON

Note: Sections 6, 7, and 8 are not used in Alphanumeric mode.

### 2.3.3 CTS ENABLE

The use of the RS-232C port handshake line CTS is optional. Set switch S1-3 ON to enable the CTS line. Set the switch OFF to use the port without handshaking.

### 2.3.4 COMMAND SET SELECTION

Use switch S3-2 to select one of two command sets. Turn the switch OFF to select the amplified command set and ON to select the abbreviated command set.

### 2.3.5 ADDRESS SELECTION

Use switch S2 to select the 8-bit binary address of this unit. Section 1 of the switch represents the least significant bit and Section 8 represents the most significant bit. Each section represents successive powers of 2, the place values in a binary number, as shown in Table 2-4. ON is a binary 1 and OFF is a binary zero. The maximum address is 255, that is, binary 11111111.

Example 1: The address 197 codes to 11000101 because  $1 \times 128 + 1 \times 64 + 0 \times 32 + 0 \times 16 + 0 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1 = 197$ .

Example 2: The address 10 codes to 00001010.



**Table 2-4  
Address Selection Switch S2**

SECTION	>	8	7	6	5	4	3	2	1
PLACE VALUE	>	128	64	32	16	8	4	2	1

2.3.6 PORT B MODE SELECTION

Use switch S3 Section 1 to select the mode for port B, either channel output mode or code output mode. ON selects channel output mode and OFF selects code output mode. Refer to Section 2.3.3.3 for an explanation of the operation of port B.

2.4 ALPHANUMERIC OPERATION

The following paragraphs explain the operation of the Remote Display in Alphanumeric mode.

2.4.1 DISPLAY FORMAT

Upon first power-up the 12-character display will show the message TRUETIME INC. The message or messages displayed are in response to commands sent via the I/O port selected. Any message longer than 12 characters will be scrolled across the display. Messages will blink only if the BLINK attribute was set in the command that stores the message.

2.4.2 I/O PORT COMMANDS

Commands are sent via the selected I/O port, either RS-232C port or the RS-422A port. There are two possible command sets, Amplified and Abbreviated, selected by switch S3 Section 2.

2.4.3 AMPLIFIED COMMAND SET

The Amplified Command Set contains four commands each with a different syntax. All commands may use either upper- or lower-case characters although all messages will display in upper-case characters. The four commands available are:

- Enter Text
- Display Stored Text
- Change Parameter
- Display Keyboard Text

### 2.4.3.1 ENTER TEXT COMMAND

To enter or alter stored text send a command to the input port of the form

```
<STX>AN<ADDR>TEXT#<NUMBER>[<ATTRIBUTE>]=<TEXT><ETX>
```

where

<STX>	is a ASCII start-of-text character (CTRL-B, HEX 02)
AN	is the ASCII string AN
<ADDR>	is the 3-digit address of the unit that will receive the text
TEXT#	is the ASCII string TEXT#
<NUMBER>	is the 2-digit identification number assigned to the text
[	is the ASCII character [
<ATTRIBUTE>	is either the ASCII string NORMAL, BLINK or SCROLL
]	is the ASCII character ]
=	is the ASCII = character
<TEXT>	is the 0- to 24-character text to be displayed
<ETX>	is the ASCII end-of-text character (CTRL-C, HEX 03)

The display will show no apparent change even if the specified text is currently being displayed. Note that different texts may have the same text number provided they are sent to units with different addresses. To alter only the ATTRIBUTE of a previously-stored text, send a command of the above form but omit the = and the text field. If the attribute field is omitted, the attribute NORMAL will be assumed unless the text is longer than 12 characters, in which case the attribute SCROLL will be assumed. The address 000 is a universal address. Any command specifying address 000 will be stored in all units.

Sample command:

```
<STX>AN201TEXT#21[BLINK]=ALERT <ETX>
```

Result:

The text "ALERT" is stored as text #21 with a BLINK attribute in the unit with address 201.

Sample command:

```
<STX>AN001TEXT#22[NORMAL]=Clear<ETX>
```

Result:

The text "CLEAR" is stored as text #22 with a NORMAL ATTRIBUTE in the unit with address 001.

Sample command:

```
<STX>AN001text#21[SCROLL]<ETX>
```

Result:

The ATTRIBUTE of the previously stored text #21 in the unit with address 001 is now SCROLL.

### 2.4.3.2 DISPLAY STORED TEXT COMMAND

To display stored text send a command to the input port of the form:

<STX>AN<ADDR>TEXT#<NUMBER><ETX>

where

<STX>	is a ASCII start-of-text character (CTRL-B, HEX 02)
AN	is the ASCII string AN
<ADDR>	is the 3-digit address of the stored text
TEXT#	is the ASCII string TEXT#
<NUMBER>	is the 2-digit identification number assigned to the text or a series of such numbers separated with commas
<ETX>	is the ASCII end-of-text character (CTRL-C, HEX 03)

The display will respond by displaying the text specified in the command using the ATTRIBUTE stored with that text on the unit with the specified address. The address 000 is a universal address. Any command specifying address 000 will display on all units.

Sample command:

<STX>AN201TEXT#21<ETX>

Result:

The previously-stored text #21 "ALERT" blinks on the display of the unit with address 201.

Sample command:

<STX>AN001TEXT#22<ETX>

Result:

The previously-stored text #22 "CLEAR" displays on the unit with address 001 until another command is sent to that unit.

Sample command:

<STX>AN000TEXT#22<EXT>

Result:

All units display their text #22, which may be different in different units.

Sample command:

<STX>AN001TEXT#21,22<EXT>

Result:

Unit 001 will display the combined text #21 and #22 sequentially: "ALERT CLEAR". If the combined text had exceeded 12 characters, it would have scrolled across the display.

### 2.4.3.3 DISPLAY KEYBOARD TEXT COMMAND

To display text immediately as typed on a keyboard send the command

<STX>AN<ADDR>KEYBD<ETX>

where

<STX>	is a ASCII start-of-text character (CTRL-B, HEX 02)
AN	is the ASCII string AN
<ADDR>	is the 3-digit address which will receive the command
KEYBD	is the ASCII character string KEYBD
<ETX>	is the ASCII end-of-text character (CTRL-C, HEX 03)

The display will blank and await keyboard entry. Characters will display as they are entered on the keyboard each set of 12 characters overwriting the previous set. Display of keyboard-entered characters ceases upon receipt of an end-of-text character <ETX>.

### 2.4.4 ABBREVIATED COMMAND SET

The Abbreviated Command Set contains only one command which is used to immediately display text as entered. Send a command of the form

<STX><ADDRESS><TEXT><ETX>

where

<STX>	is a ASCII start-of-text character (CTRL-B, HEX 02)
<ADDRESS>	is a single ASCII character whose decimal equivalent is the unit address
<TEXT>	is the 0- to 24-character text to be displayed - any ASCII character is permitted.
<ETX>	is the ASCII end-of-text character (CTRL-C, HEX 03)

The address CTRL-@ (ASCII decimal equivalent 000) is a universal address. Any command specifying this address will be displayed on all units. The default parameters are:

- HI display intensity
- FAST blink rate or scroll speed
- NORMAL attribute for text shorter than 13 characters
- SCROLL attribute for text longer than 12 characters

Sample command:

<STX>BLift Off<ETX>

Result:

The text "LIFT OFF" is immediately displayed on the unit with address 65 (the ASCII decimal equivalent of B).

Sample command:

<STX><CTRL-@>All Clear<ETX>

Result:

The text "ALL CLEAR" is immediately displayed on all units.

## 2.5 TIME CODE TRANSLATOR MODE

Select Time Code Translator mode by turning S3-8 on prior to power up. To change to translator mode during operation, send the following string to the appropriate RS input:

<STX>AN###S3-8=ON<ETX>

The unit will use the actual setting of the internal S3-8 as the default upon subsequent power-up.

### 2.5.1 FORMAT SELECTION

The format of the time display can be controlled using S3, segment 6. Table 2-5 shows the display format for each type of code for either switch position.

**Table 2-5  
Display Formats**

<b>Input Code</b>	<b>S3-6 Off</b>	<b>S3-6 On</b>	<b>Range</b>
IRIG B	DDD HH MM SS	DDD HH MM SS	001:00:00:00 to 366:23:59:59
CS-1 110 TOY	±DDD HH MM SS DDD	±DDD HH MM SS	±001:00:00:00 to ±366:23:59:59
CS-1 110 ECS	HH MM SS *DD HH MM SS	DDDHHMMSS -DDDHHMMSS	-99:23:59:59 to 366:23:59:59 (Off) -366:23:59:59 to 366:23:59:59 (On)
CS-2 116 ECS	DDD HH MM SS *DD HH MM SS	DDDHHMMSS -DDDHHMMSS	-99:23:59:59 to 366:23:59:59 (Off) -366:23:59:59 to 366:23:59:59 (On)
CS-2 116 SBS	SS,SSS,SSS	SS,SSS,SSS	00,000,001 to 39,999,999
CS-3 114 ECS	DDD HH MM SS *DD HH MM SS	DDDHHMMSS -DDDHHMMSS	-99:23:59:59 to 366:23:59:59 (Off) -366:23:59:59 to 366:23:59:59 (On)
CS-3 114 Launch	HH MM SS.S	DDDHHMMSS.S	001:00:00:00.0 to 366:23:59:59
CS-4 112/116 ECS	DDD HH MM SS *DD HH MM SS	DDDHHMMSS -DDDHHMMSS	-99:23:59:59 to 366:23:59:59 (Off) -366:23:59:59 to 366:23:59:59 (On)
MILA	DD HH MM SS -DD HH MM SS	SSSSSS -SSSSSS	-99:23:59:59 to 99:23:59:59 (Off) -86399 to 86399 (On)
BUDX/FDME°	MMM SS -MMM SS	SSSSS -SSSSS	-999:59 to 999:59 (Off) -59999 to 59999 (On)

- \* Displays a minus sign when hundreds of days is zero.  
Displays a minus sign with range error indicator if hundreds of days is non-zero.

## 2.5.2 DISPLAY DATA SELECTION

For time codes containing more than one set of time information, S3-7 is used to select which time to display. Table 2-6 shows the data displayed for each switch position.

**Table 2-6  
Display Data Selection**

<b>Input Code</b>	<b>S3-7 Off</b>	<b>S3-7 On</b>
IRIG B	Time of Year	Time of Year
CS-1	Event Count Status	Time of Year
CS-2	Event Count Status Seconds	Event Count Status
CS-3	Time of Year Launch Time	Event Count Status
CS-4	Event Count Status (SBS)	Event Count Status
MILA	Countdown Time	Countdown Time
BUDX	Countdown Time	Countdown Time

Note: SBS indicates Straight Binary Seconds.

**SECTION THREE**  
**THEORY OF OPERATION**

3.1 INTRODUCTION

The theory of operation is presented with detailed descriptions of each of the circuit boards that are supplied with the unit.

3.2 CIRCUIT CARD DESCRIPTIONS

The following pages contain the circuit card descriptions. They are inserted in numerical order.

## SECTION FOUR

### MAINTENANCE AND TROUBLESHOOTING

#### 4.1 INTRODUCTION

Effective maintenance and troubleshooting of this system requires a thorough understanding of equipment characteristics, operating procedures, theory of operation and knowledge of both linear and logic circuit elements. The equipment characteristics, operating procedures and the theory of operation for the system processor are provided in SECTION ONE through SECTION THREE of this manual.

#### 4.2 PREVENTIVE MAINTENANCE

A systematic preventative maintenance routine will reduce the possibility of a malfunction. This routine should include inspection, qualification and cleaning of the instrument.

##### 4.2.1 INSPECTION

**CAUTION:** Disconnect equipment from the primary power prior to inspection. Dangerous voltages are present that can cause serious injury or loss of life.

Exercise care when handling this equipment. It contains precision parts that can be damaged by improper handling. Do not touch connector pin surfaces. Foreign material deposited on contact surfaces can cause corrosion, resulting in equipment damage or failure. Inspect the unit for damaged components, loose or frayed connections and corrosion on metal surfaces. If damage is found, correct it immediately.

##### 4.2.2 CLEANING

**CAUTION** Disconnect equipment from the primary power prior to cleaning. Dangerous voltages are present that can cause serious injury or loss of life.

Accumulations of dust and dirt can impair cooling and generally distracts from equipment appearance. A soft cloth and a commercial cleaner (such as Windex) may be used to clean the paint and the lens. Be careful not to get the cleaner into switches.

##### 4.2.3 QUALIFICATION

Verify that the unit meets all of the applicable specifications listed in SECTION ONE. Failure to meet a specification is an indication of malfunction and should be corrected immediately.

#### 4.3 TROUBLESHOOTING

**CAUTION:** Only a qualified technician should attempt repair to this unit. Dangerous voltages are present that can cause serious injury or loss of life. The power supply in particular uses high voltages.



The following suggestions are general in nature. When followed, they will minimize equipment down time. Use these suggestions in conjunction with the drawings in SECTION FIVE and the circuit descriptions in SECTION THREE to diagnose equipment malfunctions.

#### 4.3.1 GENERAL TROUBLESHOOTING PROCEDURES

Since an apparent problem may actually be the result of operator error, misunderstanding or misuse, the technician will need a thorough understanding of the normal operation. Refer to SECTION TWO for a description of normal operation. Thoroughly evaluate the procedures used by the operator when the malfunction occurred.

#### 4.3.2 POWER CIRCUITS

Verify that power supply is as specified. Verify that the primary power fuse has not blown and that primary power is present. Check external loads where applicable.

#### 4.3.3 LOCATING DRAWINGS

Reduced drawings of all mechanical assemblies and circuit cards are located in SECTION FIVE of this manual. The index contains a list of the drawings in this manual.

#### 4.3.4 LOCATING CIRCUITS

SECTION THREE provides a written description of each circuit card. Use this information in conjunction with the schematics while troubleshooting.

#### 4.3.5 CIRCUIT CARD REMOVAL

**CAUTION:** Disconnect equipment from the primary power prior to disassembly. Dangerous voltages are present that can cause serious injury or loss of life.

To remove a circuit card first remove the screws that secure the lid to the case. Remove the screws from the case which hold the spacers to the case. Lift the circuit cards and their spacers from the case. Reinstall the circuit cards in the same positions that they occupied before disassembly.

#### 4.3.6 REPLACING COMPONENTS

It is imperative that the ICs are replaced with exactly the same type of component. Do not guess in this area. Use the parts lists to find the exact IC part number. Be sure not to bend under the IC legs when replacing them.

When replacing soldered components use a low temperature iron and be careful not to disturb the etch. Use a resin-core flux and clean the soldered joints carefully with alcohol. Do not allow the cleaner to penetrate the pots or switches.

## SECTION FIVE

### DRAWINGS

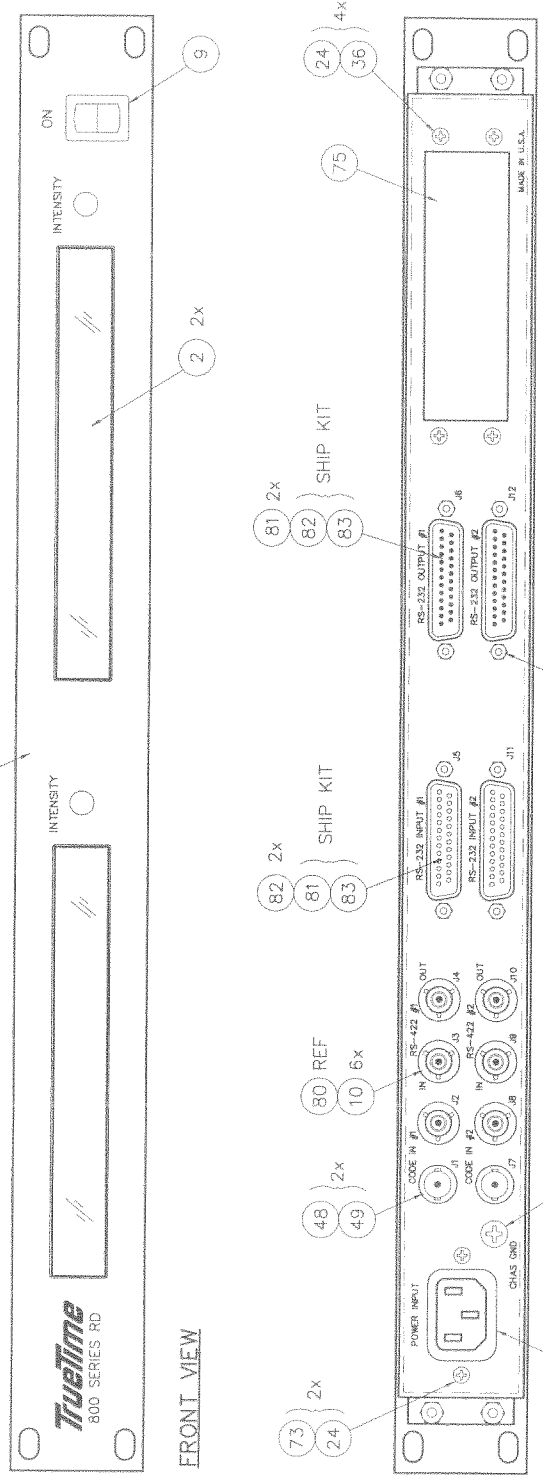
#### 5.1

#### DRAWINGS

820-303	Top Assembly
820-303-1	Top Assembly
800-5284	Display Assembly
800-5270	Display Assembly
800-5270-1	Decoder Assembly
800-5269	Processor Assembly
800-5269-1	Connector Assembly

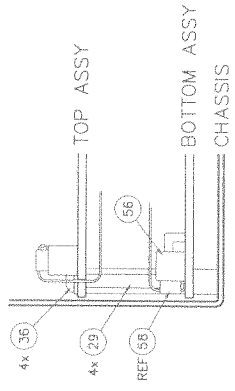
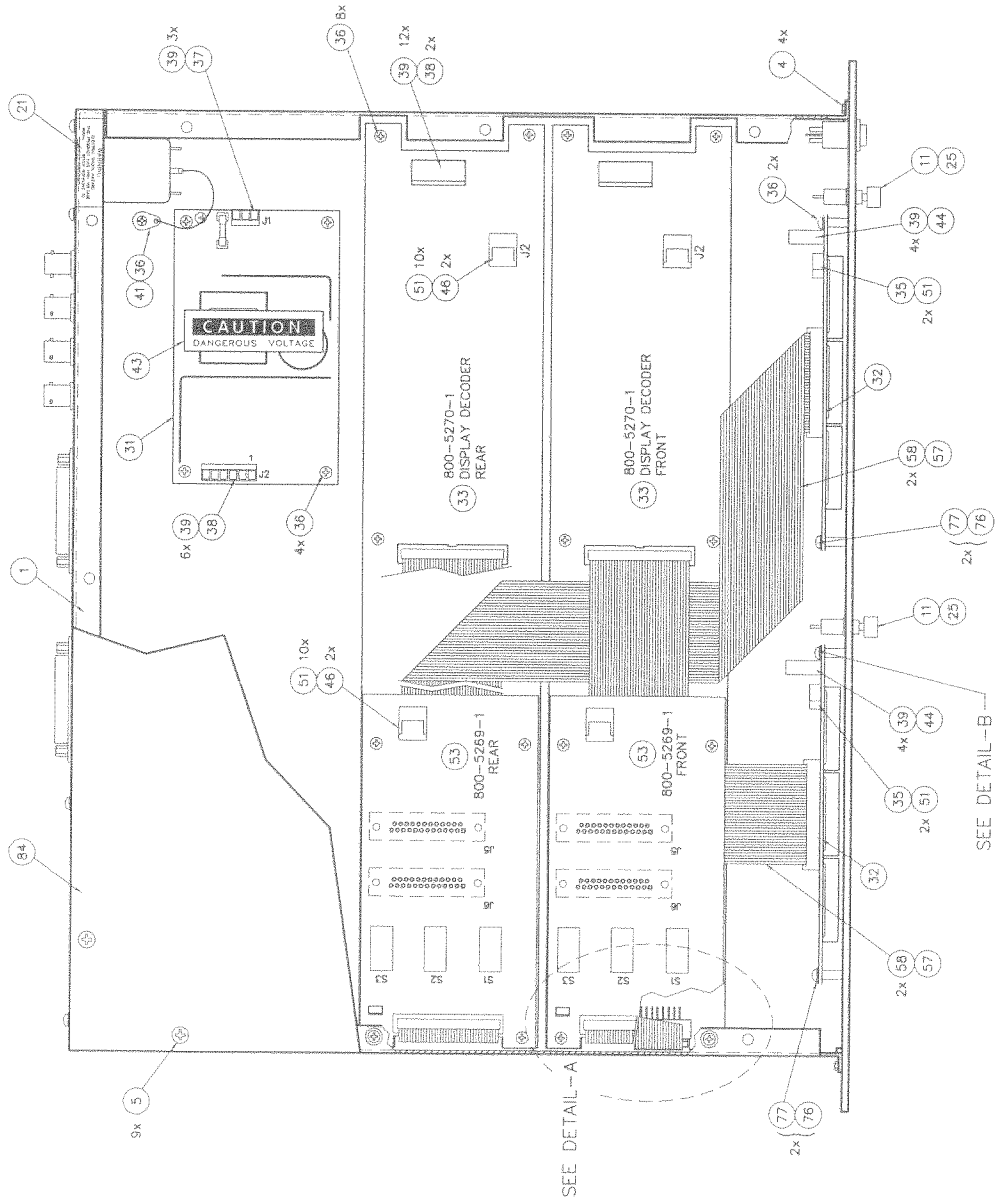
© TrueTime, Inc. 2000 All Rights Reserved.  
 PROPRIETARY NOTICE  
 THIS DOCUMENT, WHETHER PATENTABLE OR NON-PATENTABLE, SUBJECT MATTER, EMBODIES PROPRIETARY AND CONFIDENTIAL INFORMATION AND IS THE EXCLUSIVE PROPERTY OF TRUETIME, INC. IT MAY NOT BE REPRODUCED, USED OR DISCLOSED TO OTHERS FOR ANY PURPOSE EXCEPT THAT FOR WHICH IT IS LOANED, AND IT SHALL BE RETURNED UPON DEMAND.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	CAR 506 & CAR 474	05-10-00	

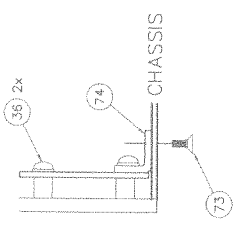


CONTRACT NO.		DATE	
APPROVALS		3/97	
DRAWN BY RKLEIN		5/97	
CHECKED BY		5/97	
APPROVED BY		5/97	
NEXT ASSY			
TrueTime® "World's Best Value" Subcontractor for the "Industrial Factory" 2835 Duke Ct. Santa Rosa, CA 95407		ASSEMBLY 800 SERIES RD	
SIZE	CODE IDENT NO.	DRAWING NO.	REV
B		820--303	A
SCALE		NONE	
SHEET		1 OF 3	

FILENAME: 820\_303A  
 DATE: 05-10-00



DETAIL-A 2x

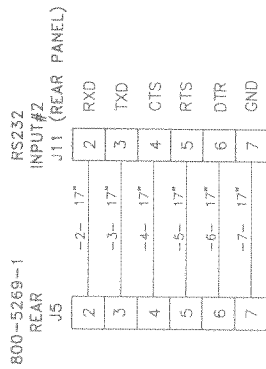
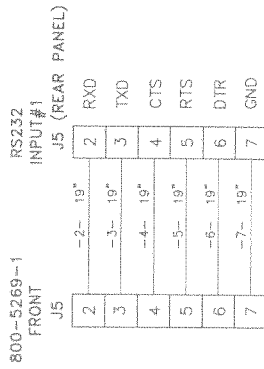
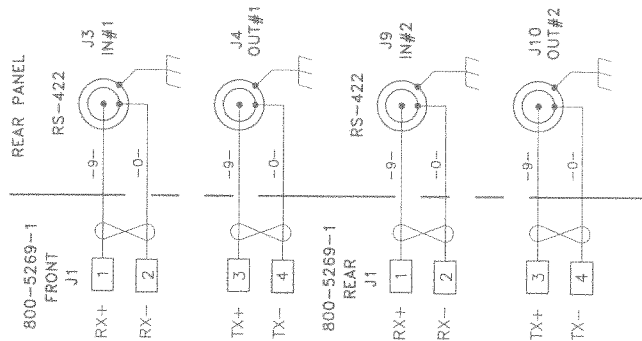
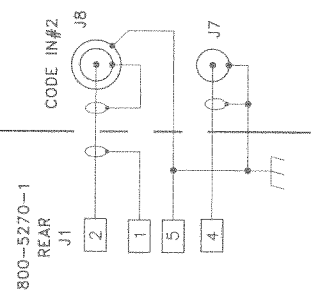
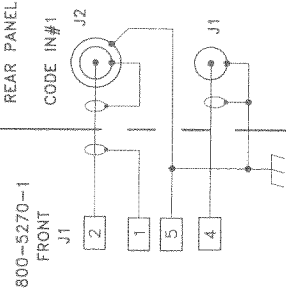
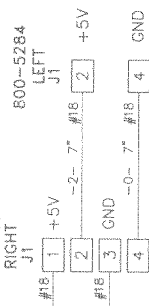
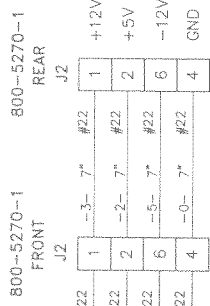
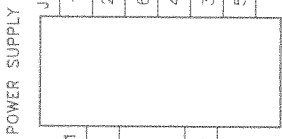
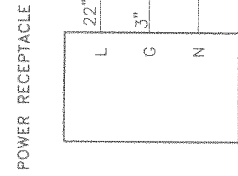
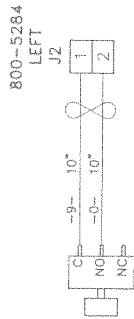


DETAIL-B

<b>TrueTime</b> <small>TRUETIME CORPORATION, 10000 WILSON AVENUE, SUITE 100, DALLAS, TEXAS 75243</small>	
FILE NAME: 1820 303B	SCALE: NONE
DATE: 05-10-00	
SIZE: B	CODE: BENT HO
REV: A	DRAWING NO: 820-303
	SHEET 2 OF 3



WIRE SWITCH AS SHOWN



- 4 USE #315-016-189UL.
- 3 USE #315-024-006UL.
- 2 USE #315-024-001UL.
- 1. USE 22AWG WIRE.

NOTES: UNLESS OTHERWISE SPECIFIED

FILENAME: 820\303C  
DATE: 05-11-00

**TrueTime®**  
Where Customer Satisfaction is our Highest Priority!  
2835 Duane Ct. Santa Rosa, CA 95407

SIZE CODE IDENT NO. DRAWING NO. REV  
B 820-303 A  
SCALE NONE SHEET 3 OF 3

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
820-303	DUAL DISPLAY	1.75 IN. RACK MOUNT				EA	
0000-APPROVAL	PARTS LIST APPROVAL		000000		1.0000	EA	<i>SBK 05/00</i>
0000-PL	PARTS LIST REV LEVEL		000000		1.0000	EA	REV A (05-16-00)
0000-PRINT	REFERENCE PRINT		000000		1.0000	EA	820-303 REV A
057-4005	DIODE 1N4005	1N4005	000000		1.0000	EA	85
064-008	SWITCH PUSHBTN SPST	C&K 8121SHCGE	000000		2.0000	EA	11
064-012	SWITCH POWER DOUBLE POLE	ALCO XRM210N00	000000		1.0000	EA	09
075-002	BLACK CAP	C&K #8018BLK	000000		2.0000	EA	25
088-80017	PWR SUPPLY +5, +/-12V 4A	ARTESYN NFS40-7628	000000		1.0000	EA	31
208-001	BRACKET UNIV L SHAPE	KEYSTONE 612	000000		1.0000	EA	74
238-004-002	SCREW PH PN SEP 4-40X1/4	SCREW SEP	000000		29.0000	EA	36
238-004-003	SCREW PH PN SEP 4-40X3/8		000000		3.0000	EA	73
240-004-002	SCREW PH PN SS 4-40X1/4	SCREW PAN	000000		4.0000	EA	77
240-010-003	SCREW PH BH SS 10-32X3/8	AROW SBM-10F06-S-0 (NAV)	000000		1.0000	EA	30
249-004-002	SCREW 4-40X1/4 W/WASHER	STAINLESS STEEL	000000		9.0000	EA	05
251-004	NUT KEP SS 4-40	AROW KN-04C-S-0-M	000000		14.0000	EA	24
251-006	NUT KEP SS 6-32 .250 HEX	KEPNUT SMALL PATTERN	000000		4.0000	EA	04
255-4F-4M-06	SPCR HEX AL M-F 4-40X3/4	SMALL PATTERN 3/16 HEX	000000		8.0000	EA	29
256-.375	LUG SOLDER BR 3/8 DIA	HH SMITH 1497	000000		2.0000	EA	49
256-004	LUG SOLDER BR 4	HH SMITH 1412-4	000000		1.0000	EA	41
269-004	WSHR FLAT NYL 4 1/16	1/4INCH OD	000000		4.0000	EA	76
315-016-189UL	WIRE 16 AWG GR/YLW UL1015	BELDEN 8917-189	000000		0.4000	FT	SEE WIRING
315-018-002	WIRE 18AWG PVC INS RED		000000		0.7500	FT	SEE WIRING
315-018-010	WIRE 18AWG PVC INS BLACK	1429	000000		1.7500	FT	SEE WIRING
315-022-000	WIRE 22AWG PVC INS BLK/WT	1429-22/7-0-9 21TWIST/FT	000000		7.5000	FT	SEE WIRING
315-022-002	WIRE 22AWG PVC INS RED	UL1429-22/7-2	000000		8.2500	FT	SEE WIRING
315-022-003	WIRE 22AWG PVC INS ORANGE	UL1429-22/7-3	000000		8.2500	FT	SEE WIRING
315-022-004	WIRE 22AWG PVC INS YELLOW	UL1429-22/7-4	000000		6.5000	FT	SEE WIRING
315-022-005	WIRE 22AWG PVC INS GREEN	UL1429-22/7-5	000000		8.2500	FT	SEE WIRING
315-022-006	WIRE 22AWG PVC INS BLUE	UL1429-22/7-6	000000		6.5000	FT	SEE WIRING
315-022-007	WIRE 22AWG PVC INS VIOLET	UL1429-22/7-7	000000		6.5000	FT	SEE WIRING
315-022-010	WIRE 22AWG PVC INS BLACK	UL1429-22/7-0	000000		1.7500	FT	SEE WIRING
315-024-001UL	WIRE 24 AWG BROWN UL1015	BELDEN 9924-1	000000		3.5000	FT	SEE WIRING
315-024-006UL	WIRE 24 AWG BLUE UL1015	BELDEN 9924-6	000000		1.0000	FT	SEE WIRING
332-002	CORD POWER	BELDEN 17250	000000		1.0000	EA	08 SHIPPING KIT
372-25H	CONN HOOD FOR 372-25P	KELTRON #HM-25	000000		4.0000	EA	83 SHIPPING KIT
372-25P	CONN 25-P ML D S/CUP	CANNON DB25P	000000		4.0000	EA	
	81 QTY 2 INSTALLED, QTY 2 SHIPPING KIT						
372-25S	CONN 25-P FM D S/CUP	CANNON DB-25S	000000		4.0000	EA	
	82 QTY 2 INSTALLED, QTY 2 SHIPPING KIT						
372-609-003	JACK SOCKET SET OF 2	THOMAS & BETTS 609-003	000000		4.0000	EA	13
375-001	CONN BNC FM BULKHD RECP	KINGS KC-79-35 (NAV)	000000		2.0000	EA	48
375-BJ77	CONN TWINAX BULKHD 3 LUG	TROMPETER BJ77	000000		6.0000	EA	10
375-PL75	CONN CABLE PLUG MATE	TROMPETER PL75-8	000000		0	EA	80 (FOR CUSTOMER REF)

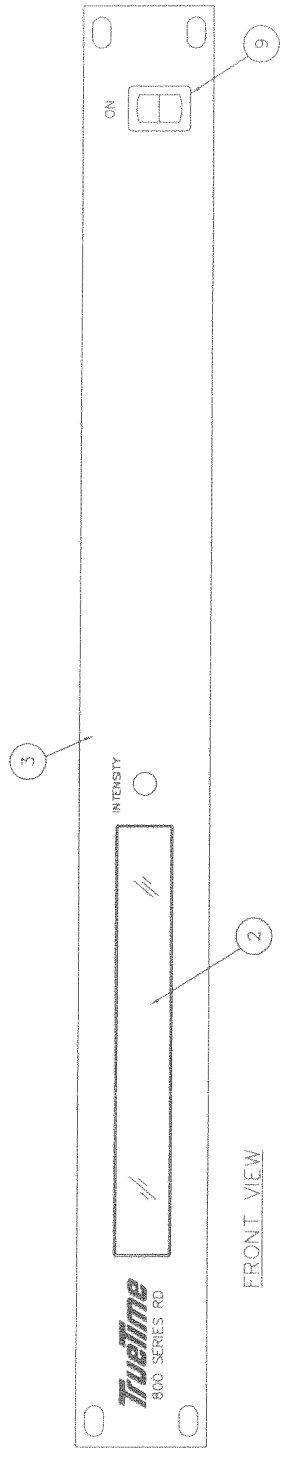
MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	UOM	REV LVL	REFERENCE DESCRIPTION
376-001	RECPT POWER	SWITCHCRAFT EAC-309	000000		1.0000	EA	07	
385-034-002	CONN 34-P FM CBL MT	THOMAS & BETTS 609-3441	000000		4.0000	EA	58	
386-34RT	CONN 34-P ML PC MT RT ANG	ANSLEY 609-3407	000000		2.0000	EA	56	(J4 ON ITEM 33)
387-034-028	CABLE FLAT 28AWG 34-COND	THOMAS & BETTS 201-34	000000		2.0000	FT	57	
400-007	LABEL WARNING	700262	000000		1.0000	EA	21	
400-009	CAUTION DANGEROUS VOLTAGE	2.5 X .75 YLW VINYL/BLKTX	000000		1.0000	EA	43	
402-001	PIN 22-30 AWG MINI-KK	MOLEX 08-65-0805	000000		24.0000	EA	51	
402-007	PIN 18-24 AWG STD-KK	MOLEX 08-50-0106	000000		29.0000	EA	39	
403-003	CONN 3-P CBL MT LCK .156	MOLEX 09-50-3031	000000		1.0000	EA	37	
403-004	CONN 4-P CBL MT LCK .156	MOLEX 09-50-3041	000000		2.0000	EA	44	
403-006	CONN 6-P CBL MT LCK .156	MOLEX 09-50-3061	000000		3.0000	EA	38	
403-01-01-02	CONN 2-P CABLE MOUNT LCK	MOLEX 22-01-3027	000000		2.0000	EA	35	
403-01-01-05	CONN 5-P CABLE MOUNT LCK	MOLEX 22-01-3057	000000		4.0000	EA	46	
560-3160	EPROM PROGRAMMING		000000		1.0000	EA	226	(ON 800-5270-1)
800-1002	COVER TOP	FAB	000000		1.0000	EA	84	
800-1003	COVER PLATE	FAB	000000		1.0000	EA	75	
800-1004	LENS, 800 SERIES	PROF PLASTICS 800-1004	000000		2.0000	EA	02	
800-1149	CHASSIS 1-3/4 IN. DISPLAY	FAB/SCREEN	000000		1.0000	EA	01	
800-1150	FRT PNL DUAL DISPLAY	FAB/PAINT/SCREEN (1-3/4)	000000		1.0000	EA	03	
800-5269-1	ASSY REAR CONN BOARD		000000		2.0000	EA	53	
800-5270-1	ASSY DISPLAY/DCDR HAN		000000		2.0000	EA	33	
800-5284	ASSY 800 HAN DISPLAY	MADE FROM 800-2284	000000		2.0000	EA	32	
LA	LABOR ASSEMBLY COST HRS		000000		0	EA		
LT	LABOR TEST COST HOURS		000000		0	EA		

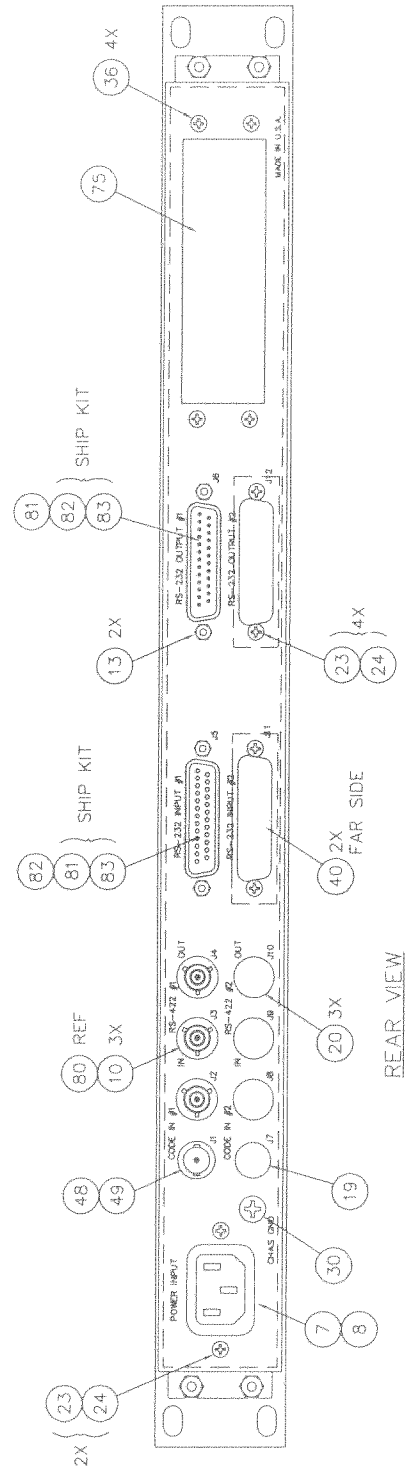
© TrueTime, Inc PROPRIETARY NOTICE  
 THIS DOCUMENT, WHETHER PATENTABLE OR NON-PATENTABLE SUBJECT MATTER, EMBODIES PROPRIETARY  
 INFORMATION AND IS THE EXCLUSIVE PROPERTY OF TRUETIME, INC. IT MAY NOT BE  
 REPRODUCED, USED OR DISCLOSED FOR ANY OTHER PURPOSES WITHOUT THE WRITTEN  
 AND IT SHALL BE RETURNED UPON DEMAND.

REVISIONS

REV	DESCRIPTION	DATE	APPROVED



FRONT VIEW



REAR VIEW

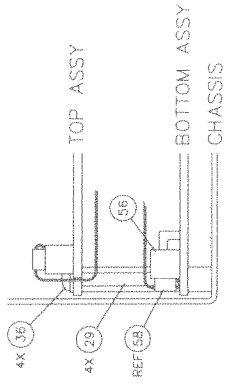
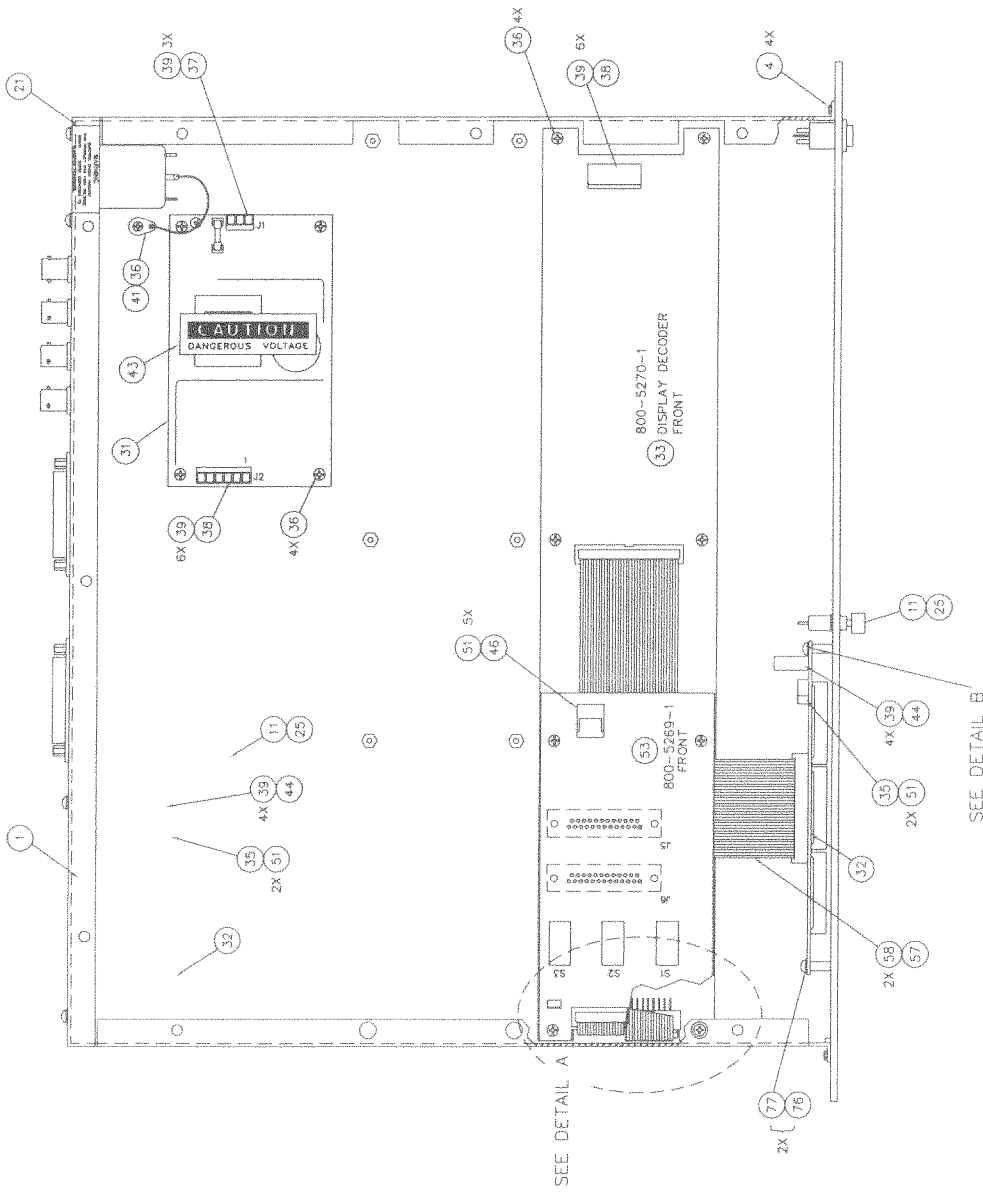
UNLESS OTHERWISE SPECIFIED		CONTRACT NO.	
DIMENSIONS ARE IN INCHES		APPROVALS	DATE
TOLERANCES ARE:	DECIMALS ANGLES	DRAWN BY RKLEIN	4/97
±	XX±.2 ON	CHECKED BY	
	XX±.5 OVER	APPROVED BY <i>cc</i>	<i>shll</i>
	XX±.1 OVER	NEXT ASSY	
ALL SURFACES TO BE CLEANED PER ANSI Y14-6			
MACH. COOR. DIMS. TO DIMS. OF CON.			
SH. MAT. - DEBURR & BREAK EDGES .015 MAX. R			
DIM. AND TOL. APPLY FIN. TREAT.			
MATERIAL			
FINISH			
FILENAME: \820\303-1A		SIZE	CODE IDENT NO.   DRAWING NO.
DATE: 05-06-97		B	820-303-1
		SCALE	NONE
			SHEET 1 OF 3

**TrueTime**  
 2835 DUKE CT. SANTA ROSA CA 95407

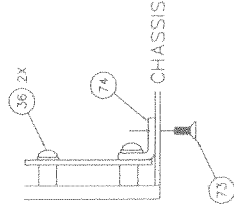
ASSEMBLY  
 800 SERIES RD

REV N/C  
 820-303-1





DETAIL A



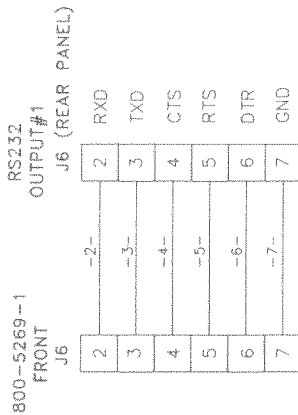
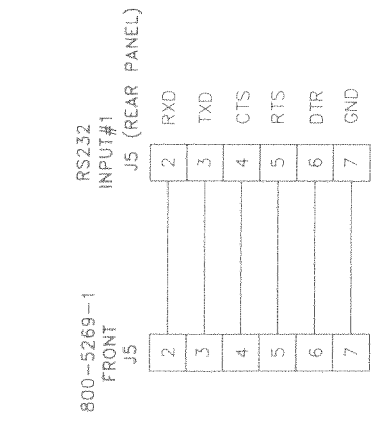
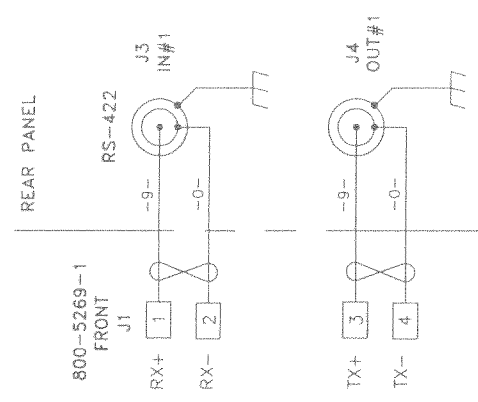
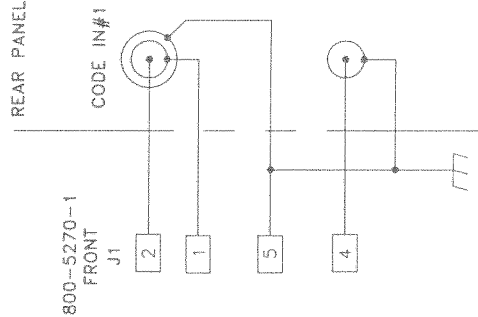
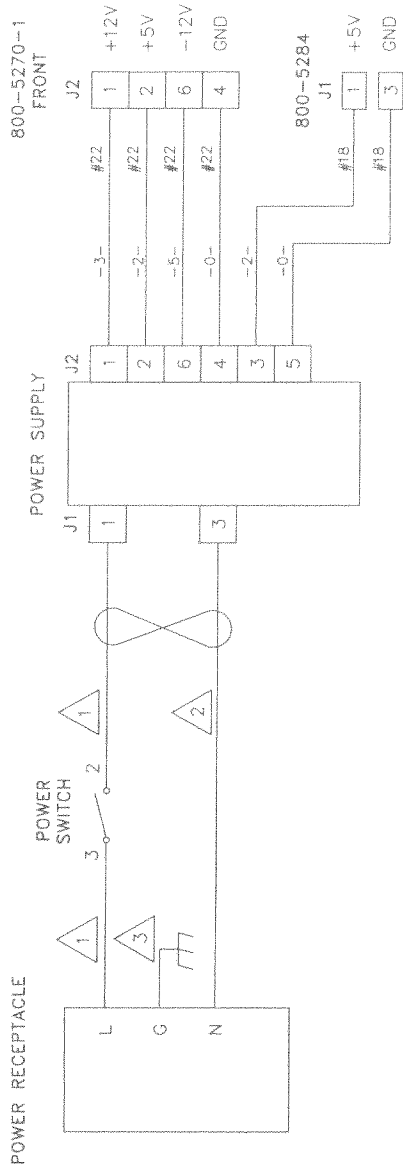
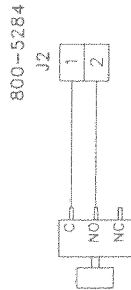
DETAIL B

<b>TrueTime</b> 2635 DRAKE CT. SANTA ROSA, CA 95407	
SIZE	CODE PRINT NO. DRAWING NO.
B	820-303-1
SCALE	NONE
REV	SHEET 2 OF 3
1%	

FILENAME: 820\303-1B  
DATE: 05-08-97  
NEXT ASSY:



WIRE SWITCH AS SHOWN



- 3 USE #315-016-189UL
- 2 USE #315-024-006UL
- 1 USE #315-024-001UL

NOTES: UNLESS OTHERWISE SPECIFIED

SIZE	CODE IDENT NO.	DRAWING NO.	REV
B		820-303-1	1
SCALE NONE			SHEET 3 OF 3

FILENAME: \820\303-1C  
DATE: 05-06-97

NEXT ASSY

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

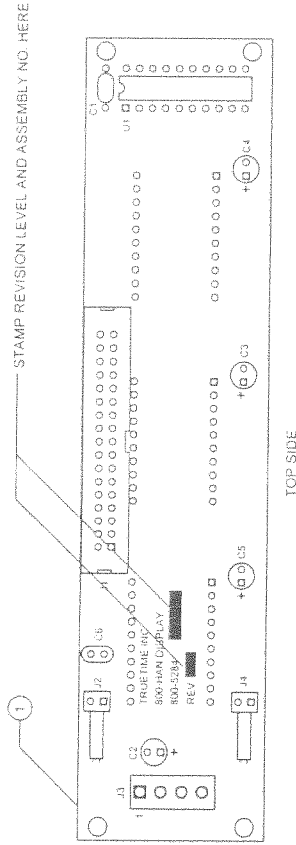
PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	UOM	REV LVL	REFERENCE DESCRIPTION
820-303-1	SINGLE DISPLAY	1.75 IN. RACK MOUNT					EA	
0000-APPROVAL	PARTS LIST APPROVAL				1.0000		EA	<i>CK 5/97</i>
0000-PL	PARTS LIST REV LEVEL				1.0000		EA	REV N/C (05-07-97)
0000-PRINT	REFERENCE PRINT				1.0000		EA	820-303-1 REV N/C
064-008	SWITCH PUSHBTN SPST	C&K 8121SHCGE			1.0000		EA	11
064-012	SWITCH POWER DOUBLE POLE	ALCO XRM210N00			1.0000		EA	09
075-002	BLACK CAP	C&K #8018BLK			1.0000		EA	25
088-80017	PWR SUPPLY +5, +/-12V 4A	COMPUTER PROD NFS40-7628			1.0000		EA	31
206-205-008	PLATE, COVER 25-P CONN	FAB			2.0000		EA	40
208-001	BRACKET UNIV L SHAPE	KEYSTONE 612			1.0000		EA	74
238-004-002	SCREW PH PN SEP 4-40X1/4	SCREW SEP			17.0000		EA	36
238-004-003	SCREW PH PN SEP 4-40X3/8				1.0000		EA	73
240-004-002	SCREW PH PN SS 4-40X1/4	SCREW PAN			4.0000		EA	77
240-004-004	SCREW PH PN SS 4-40X1/2	SCREW PAN			6.0000		EA	23
240-010-003	SCREW PH BH SS 10-32X3/8	SCREW			1.0000		EA	30
251-004	NUT KEP SS 4-40	KEPNUT			6.0000		EA	24
251-006	NUT KEP SS 6-32 .250 HEX	KEPNUT SMALL PATTERN			4.0000		EA	04
255-4F-4M-06	SPCR HEX AL M-F 4-40X3/4	SMALL PATTERN .187 HEX			4.0000		EA	29
256-.375	LUG SOLDER BR 3/8 DIA	HH SMITH 1497			1.0000		EA	49
256-004	LUG SOLDER BR 4	HH SMITH 1412-4			1.0000		EA	41
269-004	WSHR FLAT NYL 4 1/16	1/4INCH OD			4.0000		EA	76
274-005	PLUG HOLE NYL 3/8 DIA	HH SMITH 3091/HEYCO 2617			1.0000		EA	19
274-008	PLUG HOLE NY .437 DIA.	TROMPETER HP-.437			3.0000		EA	20
332-002	CORD POWER	BELDEN 17250			1.0000		EA	08 SHIPPING KIT
372-25H	CONN HOOD FOR 372-25P	KELTRON #HM-25			2.0000		EA	83 SHIPPING KIT
372-25P	CONN 25-P ML D S/CUP	CANNON DB25P			2.0000		EA	
	81 QTY 1 INSTALLED, QTY 1 SHIPPING KIT							
372-25S	CONN 25-P FM D S/CUP	CANNON DB-25S			2.0000		EA	
	82 QTY 1 INSTALLED, QTY 1 SHIPPING KIT							
372-609-003	JACK SOCKET SET OF 2	ANSLEY 609-003			2.0000		EA	13
375-001	CONN BNC FM BULKHD RECP	KINGS KC-79-35			1.0000		EA	48
375-BJ77	CONN TWINAX BULKHD 3 LUG	TROMPETER BJ77			3.0000		EA	10
375-PL75	CONN CABLE PLUG MATE	TROMPETER PL75-8			0		EA	80 (FOR CUSTOMER REF)
376-001	RECPT POWER	SWITCHCRAFT EAC-309			1.0000		EA	07
385-034-002	CONN 34-P FM CBL MT	ANSLEY 609-3441			2.0000		EA	58
386-34RT	CONN 34-P ML PC MT RT ANG	ANSLEY 609-3407			1.0000		EA	56 (J4 ON ITEM 33)
387-034-028	CABLE FLAT 28AWG 34-COND	ANSLEY 201-34			1.0000	FT		57
400-007	LABEL WARNING	700262			1.0000		EA	21
400-009	LABEL CAUTION DNGR VOLT	127431			1.0000		EA	43
402-001	PIN 22-30 AWG MINI-KK	MOLEX 08-65-0805			7.0000		EA	51
402-007	PIN 18-24 AWG STD-KK	MOLEX 08-50-0106			19.0000		EA	39
403-003	CONN 3-P CBL MT LCK .156	MOLEX 09-50-3031			1.0000		EA	37
403-004	CONN 4-P CBL MT LCK .156	MOLEX 09-50-3041			1.0000		EA	44
403-006	CONN 6-P CBL MT LCK .156	MOLEX 09-50-3061			2.0000		EA	38

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
403-01-01-02	CONN 2-P CABLE MOUNT LCK	MOLEX 22-01-3027			1.0000	EA	35
403-01-01-05	CONN 5-P CABLE MOUNT LCK	MOLEX 22-01-3057			1.0000	EA	46
560-3160	EPROM PROGRAMMING				1.0000	EA	226 (ON 800-5270-1)
800-1003	COVER PLATE	FAB			1.0000	EA	75
800-1004	LENS, 800 SERIES	PROF PLASTICS 800-1004			1.0000	EA	02
800-1149	CHASSIS 1-3/4 IN. DISPLAY	FAB/SCREEN			1.0000	EA	01
800-1151	FRT PNL SINGLE DISPLAY	FAB/PAINT/SCREEN (1-3/4)			1.0000	EA	03
800-5269-1	ASSY REAR CONN BOARD				1.0000	EA	53
800-5270-1	ASSY DISPLAY/DCDR HAN				1.0000	EA	33
800-5284	ASSY 800 HAN DISPLAY	MADE FROM 800-2284			1.0000	EA	32
LA	LABOR ASSEMBLY COST HRS				0	EA	
LT	LABOR TEST COST HOURS				0	EA	

NOTE: UNLESS OTHERWISE SPECIFIED

1. CAPACITORS ARE IN MICRO FARADS, RESISTORS IN OHMS.
2. ASSEMBLE PER ASSEMBLY REQUIREMENT DOCUMENT 421-11.
3. DS1-3 ARE INSTALLED ON BOTTOM SIDE OF PCB.



REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	DESIGN CHANGES	7-16-97	

TrueTime, Inc. Santa Rosa, California	
Title	800-HAN DISPLAY
Site	B
Number	800-5284
Rev	A
Date	7-15-97
Filename	800-2284A PCB
Sheet	1 of 2

CONTRACT NO.	APPROVALS	DATE
DESIGNED BY	J. G. C.	2-13-97
CHECKED		
APPROVED		
REV. ASST		

PROPRIETARY NOTICE  
 THIS DOCUMENT WHETHER PATENTABLE OR NON-PATENTABLE  
 INFORMATION AND IS THE EXCLUSIVE PROPERTY OF TRUETIME INC.  
 IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR  
 BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING,  
 RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM,  
 WITHOUT THE WRITTEN PERMISSION OF TRUETIME INC. ANY  
 VIOLATION SHALL BE RETURNED UPON DEMAND.

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	UOM	REV LVL	REFERENCE DESCRIPTION
800-5284	ASSY 800 HAN DISPLAY	MADE FROM 800-2284					EA	
0000-APPROVAL	PARTS LIST APPROVAL				1.0000		EA	<i>Cont'd 7/15/97</i>
0000-PL	PARTS LIST REV LEVEL				1.0000		EA	REV A (07-16-97)
0000-PRINT	REFERENCE PRINT				1.0000		EA	800-5284 REV A
0001-PRINT	REFERENCE PRINT				1.0000		EA	800-2284 REV A
036-054	CAP MONO 680PF 100V R	MURATA RPE121C0G681J			1.0000		EA	C6
036-095	CAP MONO 0.1UF 100V R 20%	MURATA RPE122Z5U104M50V			1.0000		EA	C1
037-033	CAP TANT 2.2UF 35V R	NEMCO TB2.2/35 K1			3.0000		EA	C3,4,5
037-041	CAP TANT 10UF 20V R 20%	KEMET T350E106M020AS @			1.0000		EA	C2
178-74HC245	74HC245 8 BUS XCEIVER	74HC245			1.0000		EA	U1
189-030	DISPLAY 4 CHAR ALPHA 0.45	SIEMENS PD4435			3.0000		EA	DS1,2,3
386-341	CONN 34-P ML PC MT HDR	ANSLEY 609-3427			1.0000		EA	J1
401-01-01-04	HEADER 4-P SQ LOCKING	MOLEX 26-60-4040			1.0000		EA	J3
401-02-01-02	CONN 2-P PC MT RT ANGLE	MOLEX 22-05-3021			1.0000		EA	J2
800-2284	PCB 800 HAN DISPLAY	FAB			1.0000		EA	01
LA	LABOR ASSEMBLY COST HRS				0		EA	
LT	LABOR TEST COST HOURS				0		EA	
NOTE 1					1.0000		EA	J4 NOT INSTALLED
OSV800-5284	OUTSIDE LABOR 800-5284	PCA			1.0000		EA	

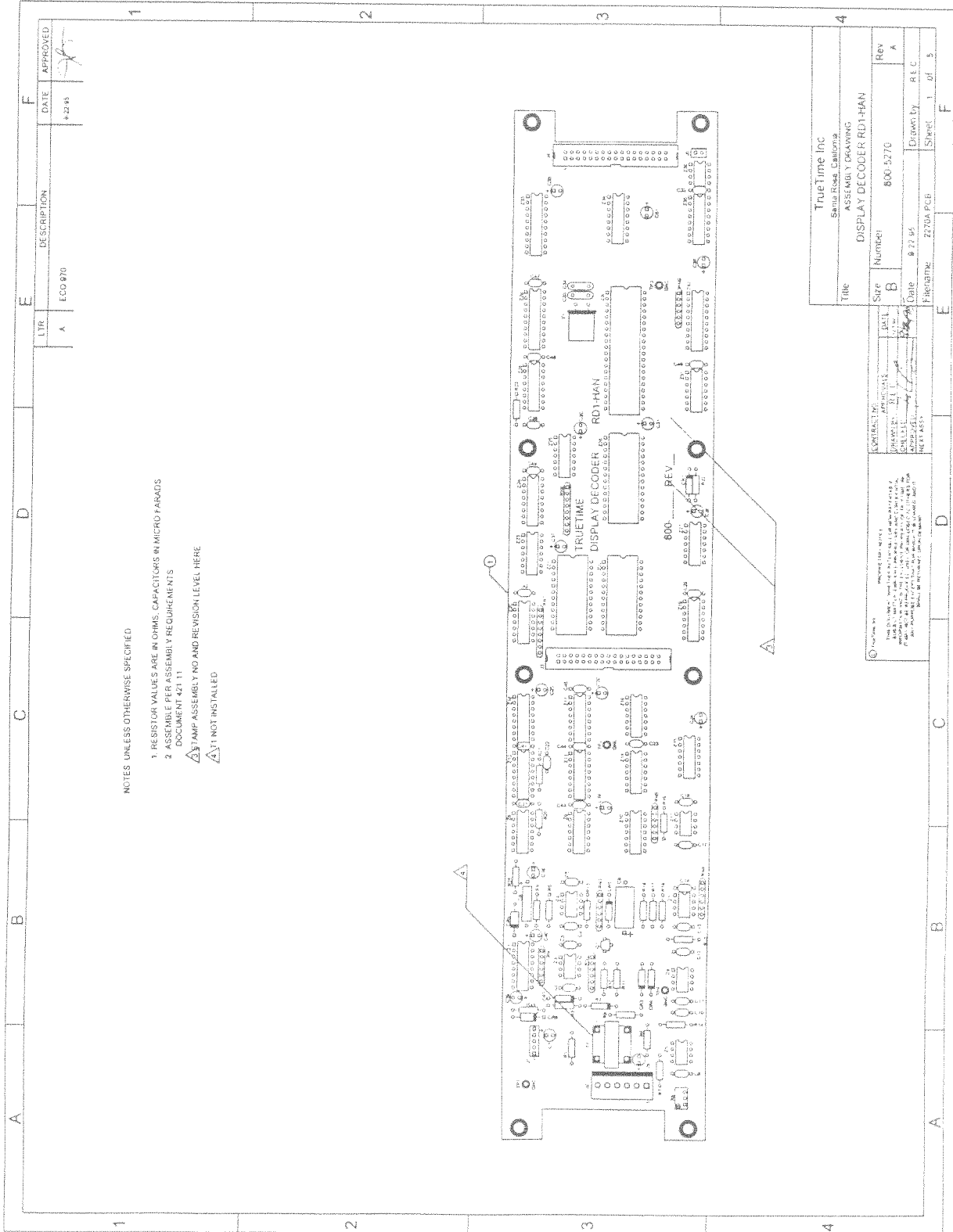
MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECH #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
800-5270-1	ASSY DISPLAY/DCDR HAN					EA	
0000-APPROVAL	PARTS LIST APPROVAL				1.0000	EA	<i>CK/PR 3/97</i>
0000-PL	PARTS LIST REV LEVEL				1.0000	EA	REV N/C (03-18-97)
0000-PRINT	REFERENCE PRINT				1.0000	EA	SEE 800-5270
0000-REV	PCB REV LEVEL HERE >>>>				1.0000	EA	800-2270 REV A
002-061	RES 330 OHM 1/4W 5%	R25J331			2.0000	EA	R24,25
002-063	RES 390 OHM 1/4W 5%	R25J391			3.0000	EA	R4,6,9
002-073	RES 1K OHM 1/4W 5%	R25J102		@	1.0000	EA	R3
002-077	RES 1.5K OHM 1/4W 5%	R25J152			3.0000	EA	R20,21,23
002-084	RES 3K OHM 1/4W 5%				1.0000	EA	R18
002-097	RES 10K OHM 1/4W 5%	R25J103			3.0000	EA	R1,11,17
002-101	RES 15K OHM 1/4W 5%	R25J153			1.0000	EA	R7
002-105	RES 22K OHM 1/4W 5%	R25J223			2.0000	EA	R13,19
002-113	RES 47K OHM 1/4W 5%	R25J473			1.0000	EA	R14
002-118	RES 75K OHM 1/4W 5%	R25J753			1.0000	EA	R5
002-121	RES 100K OHM 1/4W 5%	R25J104			1.0000	EA	R16
002-125	RES 150K OHM 1/4W 5%	R25J154			2.0000	EA	R10,15
002-129	RES 220K OHM 1/4W 5%	R25J224			1.0000	EA	R22
011-077-06S	RESNET 1.5K OHM 6-P ISL	DALE CSC06A03-152G			2.0000	EA	RM3,5
011-089-06C	RESNET 4.7K OHM 6-P COM	DALE CSC06A01-472G			2.0000	EA	RM4,9
011-089-06S	RESNET 4.7K OHM 6-P ISL	BOURNS 4606X-102-472			2.0000	EA	RM1,2
011-097-08C	RESNET 10K OHM 8-P COM	DALE CSC08A01-103G			2.0000	EA	RM7,8
019-008	POT 20K 20 TURN T ADJ	BECKMAN 68WR20K			1.0000	EA	R8
023-010-02S	CAP AE 10UF 25V A	PANASONIC ECE-B1EU100			1.0000	EA	C6
023-100-03S	CAP AE 100UF 35V A	PANASONIC ECE-B1VU101			1.0000	EA	C8
029-014	CAP MICA 18PF V R 5%	CORNELL CD15CD180D03			2.0000	EA	C33,34
032-041-02S	CAP TANT 10UF 25V R				1.0000	EA	C1
036-101	CAP MONO .1UF 50V	KEMET C410C104(1)5U5CA @			27.0000	EA	
		C2-5,9-14,17,18,21-23,29,32,38,41-49					
037-033	CAP TANT 2.2UF 35V R	WEMCO TB2.2/35 K1 @			15.0000	EA	
		C16,19,20,24,25,28,30,31,35-37,39,40,50,51					
054-024	XFORMER COUPLING	MICROTRAM T1104			0	EA	T1 (OPTIONAL)
055-5233	ZENER 1N5233 6V .5W	MOTOROLA 1N5233			2.0000	EA	CR8,CR9
055-914A	DIODE 1V 20MA	1N914A			6.0000	EA	CR1-5,7
059-49152	XTAL 4.9152	MTRON MP1-4.9152			1.0000	EA	Y1
175-1087	XSISTOR FET P-CHANNEL	NATIONAL P1087			1.0000	EA	Q1
176-082	TL082CP DUAL OP AMP	TL082CP			2.0000	EA	Z3,4
176-311	LM311N VOLTAGE COMPARATOR	NATIONAL #LM311N			4.0000	EA	Z5-7,11
176-40107	40107 DUAL 2-INPUT BUFFER	HARRIS CD40107BE			1.0000	EA	Z36
176-63B03	63B03 PROCESSOR	HITACHI HD63B03RP			1.0000	EA	SOCKETED Z30
176-NVR2-001	DS1220AB 2KX8 NV RAM	SEE PART MASTER NOTES			2.0000	EA	Z21,22 SOCKETED
177-27256	CERAMIC 27C256 @ 200NS	INTEL,AMD,GI,TI,NATL ONLY			1.0000	EA	SOCKETED Z26
178-74HC00	MM74HC00N QUAD NAND GATE	MM74HC00N			1.0000	EA	Z19
178-74HC08	MC74HC08 QUAD AND GATE	MC74HC08			1.0000	EA	Z9
178-74HC107	74HC107 DUAL JK FLIP-FLOP	74HC107			1.0000	EA	Z8
178-74HC138	MC74HC138 1 OF 8 DECODER	MC74HC138			2.0000	EA	Z28,34

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	REV UOM LVL	REFERENCE DESCRIPTION
178-74HC14	74HC14 HEX SCHM INVERTER	SN74HC14N			2.0000	EA	Z14,27
178-74HC173	74HC173 QUAD D FLIP-FLOP	74HC173			2.0000	EA	Z17,35
178-74HC193	74HC193N UP/DN COUNTER	74HC193N			1.0000	EA	Z13
178-74HC221.7	ONE SHOT TIME CONT T=.7RC	HARRIS CD74HC221			2.0000	EA	Z12,24
178-74HC244	MC74HC244 3-STATE BUFFER	MC74HC244			2.0000	EA	Z32,33
178-74HC245	74HC245 8 BUS XCEIVER	74HC245			1.0000	EA	Z29
178-74HC32	MC74HC32 QUAD OR GATE	MC74HC32			1.0000	EA	Z25
178-74HC390	74HC390 DUAL BI-QUINARY	74HC390			1.0000	EA	Z16
178-74HC4053	74HC4053 MULTIPLEXER	74HC4053			1.0000	EA	Z1
178-74HC74	MC74HC74 DUAL D FLIP-FLOP	MOTOROLA MC74HC74AN			5.0000	EA	Z10,15,18,23,31
178-74HC86	74HC86 QUAD EX OR GATE	SN74HC86N			1.0000	EA	Z20
273-015	TERM TEST POINT (WHITE)	COMP. CORP TP-104-01-09			4.0000	EA	TP1-4
379-024	SOCKET IC 24 PIN MACHINE	ROBINSON NUGENT ICT246STG			2.0000	EA	Z21,22
379-028-001	SOCKET IC 28 PIN MACHINE	ROBINSON NUGENT ICT286STG			1.0000	EA	Z26
379-040	SOCKET IC 40 PIN MACHINE	ROBINSON NUGENT ICT406STG			1.0000	EA	Z30
386-341	CONN 34-P ML PC MT HDR	ANSLEY 609-3427			1.0000	EA	J3
386-34RT	CONN 34-P ML PC MT RT ANG	ANSLEY 609-3407			1.0000	EA	J4
401-01-01-02L	CONN 2-P LOCKING STRGHT	MOLEX 22-23-2021			1.0000	EA	J5
401-01-01-05	CONN 5-P MLE STRGHT	MOLEX 22-23-2051			1.0000	EA	J1
401-01-01-06	CONN 6-P PC MT STRGHT	MOLEX 26-60-4060			1.0000	EA	J2
800-2270	PCB CPU RD1	FAB			1.0000	EA	01
LA	LABOR ASSEMBLY COST HRS				0	EA	
LT	LABOR TEST COST HOURS				0	EA	
OSV800-5270-1	OUTSIDE LABOR 800-5270-1	PCA			1.0000	EA	





NOTES UNLESS OTHERWISE SPECIFIED

- 1. RESISTOR VALUES ARE IN OHMS. CAPACITORS IN MICRO FARADS
- 2. ASSEMBLE PER ASSEMBLY REQUIREMENTS DOCUMENT 4271.11
- 3.  $\Delta$ 11 AMP ASSEMBLY NO AND REVISION LEVEL HERE

$\Delta$ 11 NOT INSTALLED

TrueTime Inc Santa Rosa, California	
ASSEMBLY DRAWING	
Title	DISPLAY DECODER RD1-HAN
Number	800-5270
Size	B
Rev	A
Date	8/22/95
Drawn by	RLC
File name	2720A.PCB
Sheet	1 of 5

Contract No.	2720A
Contract Name	DISPLAY DECODER RD1-HAN
Contract Description	ASSEMBLY DRAWING
Contract Date	8/22/95
Contract Status	OPEN
Contract Location	SANTA ROSA, CA
Contract Manager	RLC
Contract Engineer	RLC
Contract Designer	RLC
Contract Checker	RLC
Contract Approver	RLC
Contract Release	RLC

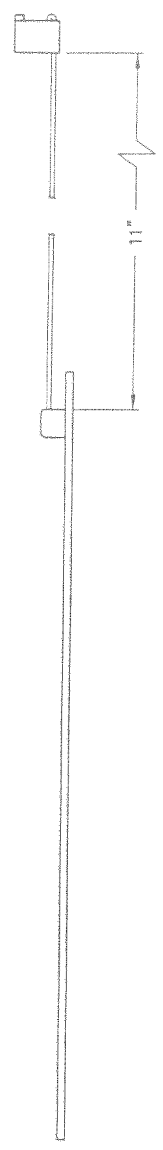
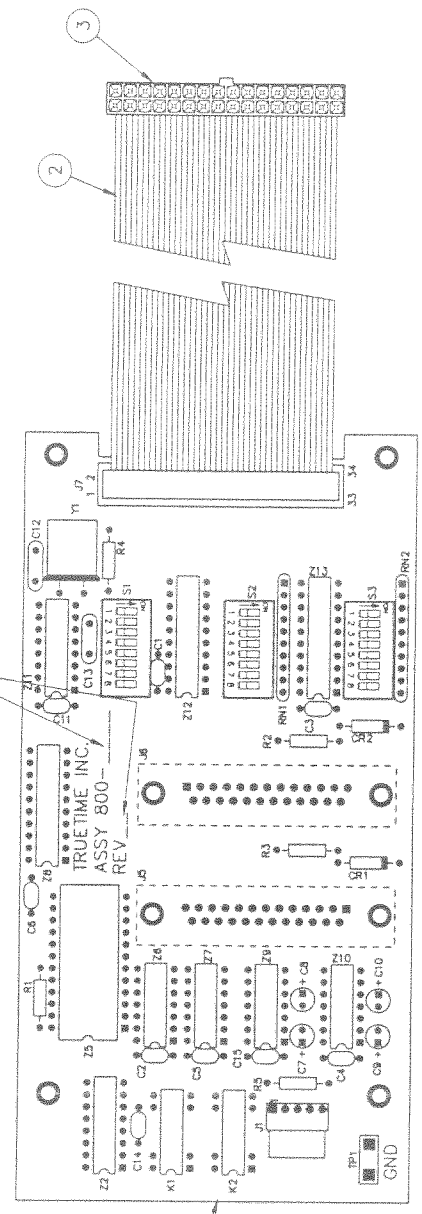
© TrueTime, Inc PROPRIETARY NOTICE  
 THIS DOCUMENT, WHETHER PATENTABLE OR NON-PATENTABLE, SUBJECT MATTER, EMBODIES PROPRIETARY  
 AND CONFIDENTIAL INFORMATION AND IS THE EXCLUSIVE PROPERTY OF TRUETIME, INC. IT MAY NOT BE  
 REPRODUCED, USED OR DISCLOSED TO OTHERS FOR ANY PURPOSE EXCEPT THAT FOR WHICH IT IS LOANED,  
 AND IT SHALL BE RETURNED UPON DEMAND.

REV	DESCRIPTION	DATE	APPROVED

NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ARE IN OHMS AND CAPACITORS IN MICRO FARADS.
2. ASSEMBLE PER ASSEMBLY REQUIREMENTS DOCUMENT 421-11.

STAMP ASSEMBLY No. AND REVISION LEVEL.



UNLESS OTHERWISE SPECIFIED		CONTRACT NO.	
DIMENSIONS ARE IN INCHES	DECIMALS	APPROVALS	DATE
FRACTIONS	ANGLES	DRAWN BY SEBERT	3/97
1	1/2	CHECKED BY	3/97
	1/4	APPROVED BY CLK	
ALL DIMENSIONS TO BE CLASS 2 PER ANSI Y14.8		NEXT ASSY	
SMALL DECIMALS & BREAK EDGES 0.15 MAX Ø		FINISH	
Ø AND ROL APPLY UNLESS OTHERWISE SPECIFIED		FILENAME: \800\5269-1	
MATERIAL		DATE: 3-19-97	
FINISH		FILENAME: \800\5269-1	
DATE: 3-19-97		DATE: 3-19-97	

**TrueTime**  
 2835 DUKE CT SANTA ROSA CA 95407

**ASSEMBLY, REAR  
 CONNECTOR BOARD**

SIZE CODE IDENT NO DRAWING NO. REV  
 B 800-5269-1 1/C

SCALE NONE SHEET 1 OF 1

MAX \* BILL OF MATERIALS \* SINGLE-LEVEL EXPLOSION BY PART IDENTIFIER W/REFERENCE

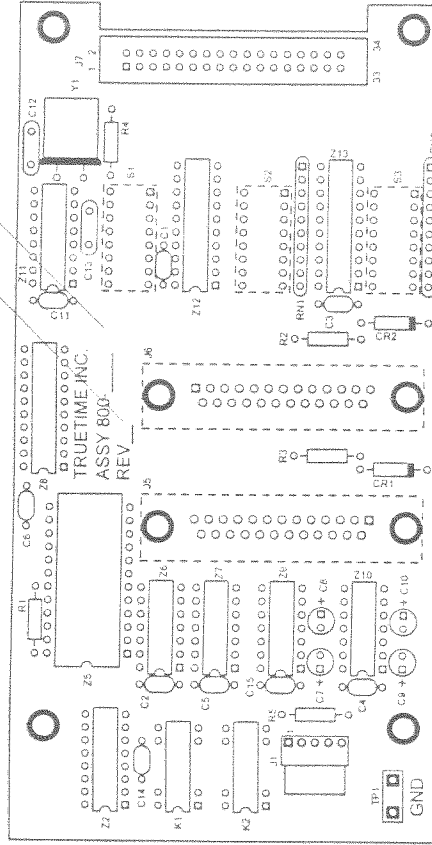
PART IDENTIFIER	DESCRIPTION 1	DESCRIPTION 2	EFF DATE	ECN #	QTY/ASSY	UOM	REV LVL	REFERENCE DESCRIPTION
800-5269-1	ASSY REAR CONN BOARD						EA	
0000-APPROVAL	PARTS LIST APPROVAL				1.0000		EA	<u>OK/2 3/97</u>
0000-PL	PARTS LIST REV LEVEL				1.0000		EA	REV N/C (03-18-97)
0000-PRINT	REFERENCE PRINT				1.0000		EA	800-5269-1 REV N/C
0000-REV	PCB REV LEVEL HERE >>>>				1.0000		EA	800-2269 REV A
0001-PRINT	REFERENCE PRINT				1.0000		EA	SEE 800-5269
002-097	RES 10K OHM 1/4W 5%	R25J103			3.0000		EA	R1,2,3
002-169	RES 10 MEG OHM 1/4W 5%	R25J10106			1.0000		EA	R4
011-089-10C	RESNET 4.7K OHM 10-P COM	BOURNES 4310R-101 4.7K			2.0000		EA	RN1,RN2
029-027	CAP MICA 56PF V R 5%	MALLORY CM04ED560J03			2.0000		EA	C12,13
036-101	CAP MONO .1UF 50V	KEMET C410C104(1)5U5CA @			9.0000		EA	C1-6,11,14,15
037-033	CAP TANT 2.2UF 35V R	NEMCO TB2.2/35 K1 @			4.0000		EA	C7-10
055-914A	DIODE 1V 20MA	1N914A			2.0000		EA	CR1,CR2
059-2.4576	NDK 2.4576 CRYSTAL	NDK #NDK024A			1.0000		EA	Y1
065-008	SWITCH DIP 8 POS	C&K 8008			3.0000		EA	
	S1-S3 INSTALL S1-S3 ON COMPONENT SIDE WITH SECTION 1 ACROSS PINS 1 AND 16.							
069-002	RELAY REED DIP 5V 2000HM	MAGNECRAFT W172DIP-5			2.0000		EA	K1,2
176-231	MAX231 RS232 INTERFACE	MAXIM #MAX231			2.0000		EA	Z9,10
176-4702	HD-3-4702 BAUD RATE GEN	HARRIS HD-3-4702-9			1.0000		EA	Z11
176-63850	63850 ACIA	68850 OR HITACHI HD63850P			1.0000		EA	Z5
176-8923N	DS8923N DIFF LINE DRIVER	NATIONAL DS8923N			1.0000		EA	Z2
178-74HC08	MC74HC08 QUAD AND GATE	MC74HC08			1.0000		EA	Z7
178-74HC244	MC74HC244 3-STATE BUFFER	MC74HC244			2.0000		EA	Z12,Z13
178-74HC32	MC74HC32 QUAD OR GATE	MC74HC32			1.0000		EA	Z6
273-009	TERMINAL TEST POINT	METHODE CD1283-103-205			1.0000		EA	TP1
379-020	SOCKET IC 20 PIN MACHINE	HUGENT ICT-203-ST6			1.0000		EA	Z8
385-034-002	CONN 34-P FM CBL MT	ANSLEY 609-3441			1.0000		EA	03
386-034	CONN 34-P CABLE MT PC MT	ANSLEY 622-34-53			1.0000		EA	J7
387-034-028	CABLE FLAT 28AWG 34-COND	ANSLEY 201-34			1.0000		FT	02
401-02-01-05	CONN 5-P PC MT RT ANGLE	MOLEX 22-05-3051			1.0000		EA	J1
560-4005	PROG DEV GAL16V8(RAL16L8)				1.0000		EA	Z8 SOCKETED
800-2269	PCB REAR CONN BOARD	FAB			1.0000		EA	01
LA	LABOR ASSEMBLY COST HRS				0		EA	
LT	LABOR TEST COST HOURS				0		EA	
NOTE 1					1.0000		EA	R5 NOT USED
OSV800-5269-1	OUTSIDE LABOR 800-5269-1	PCA			1.0000		EA	

REVISIONS		
LTR	DESCRIPTION	DATE
A	MECHANICAL DESIGN CHANGE	9-24-95

NOTE: UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE IN OHMS AND CAPACITORS IN MICRO FARADS.
2. ASSEMBLE PER ASSEMBLY REQUIREMENTS DOCUMENT 421-11.

STAMP ASSEMBLY NO. AND REVISION LEVEL



TrueTime, Inc. Santa Rosa, California	
Title	ASSEMBLY DRAWING
Part Number	800-5269
Rev.	A
Date	9-25-95
File name	2209A.PCB
Sheet	1 of 3

CONTRACT NO.	APPROVALS	DATE
ENGR BY: REC	12 0 94	
CHKD BY:		
APPROVED:		
IN 93 ASSY		

PROPRIETARY NOTICE  
 THIS DOCUMENT, WHETHER PATENTABLE OR NON-PATENTABLE,  
 SUBJECT MATTER, EMBODIMENT, PROPRIETARY AND CONFIDENTIAL  
 INFORMATION OF TRUE-TIME, INC. ANY DISCLOSURE OF THIS  
 INFORMATION TO ANY OTHER PARTY WITHOUT THE WRITTEN  
 CONSENT OF TRUE-TIME, INC. SHALL BE PROHIBITED.  
 ANY PURCHASES OF THIS DOCUMENT SHALL BE FOR IMMEDIATE  
 DEMAND.

