SY14B
CRYOGENIC PROVER
Cryogenic Transfer Standard

USER'S MANUAL

HP-220
October 2016

HOFFER Flow Controls

Perfecting Measurement™

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Notice

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Please review the complete model number of each item to be connected and locate the appropriate manual(s) and/or drawing(s). Identify all model numbers exactly before making any connections. A number of options and accessories may be added to the main instrument, which are not shown on the basic user wiring. Consult the appropriate option or accessory user manual before connecting it to the system. In many cases, a system wiring drawing is available and may be requested from HOFFER FLOW CONTROLS.

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2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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Disclaimer

Specifications are subject to change without notice.
Some pages are left intentionally blank.

PREFACE

The intended purpose of this manual is to provide the necessary information to correctly install, connect, operate, calibrate, and service the SY14B Prover unit.

The SY14B Prover is an advanced field calibration system designed to calibrate turbine flowmeters used in bulk fluid delivery systems. In addition, the unit is capable of calibrating metering equipment as a system.

The individual sections of this manual cover General Information, Operations Overview, Test Mode Setup, Calibration Mode, Configuration Mode, Service Guide, System Proving, and Calibrating the ***SY14B Prover,*** Version 2.

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1. GENERAL INFORMATION

1.1 INTRODUCTION

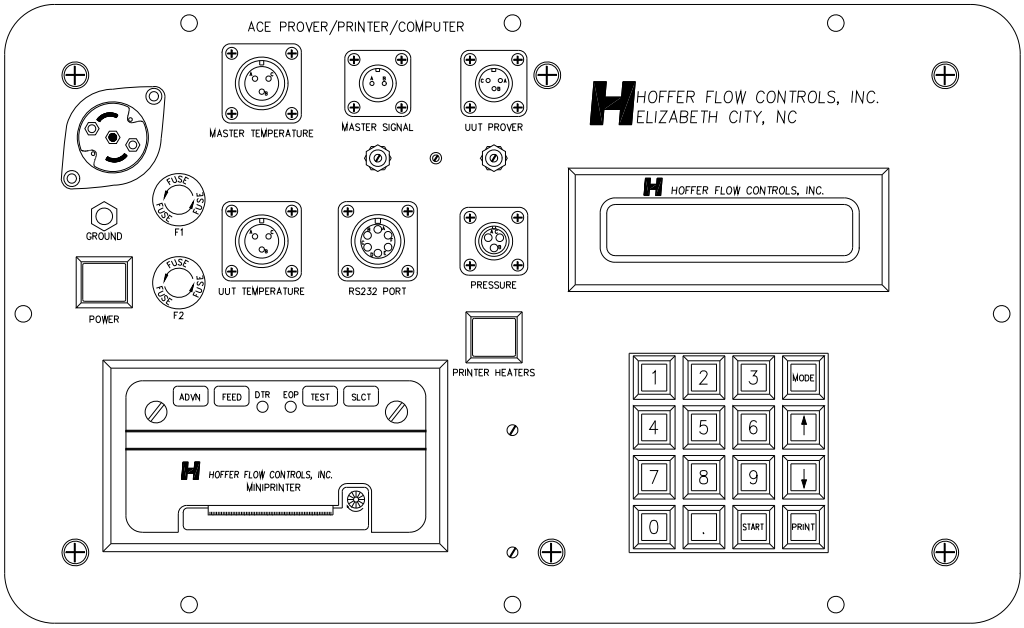

Figure 1-1 Electronics package.

The SY14B Prover is a field calibration system for cryogenic flow metering systems. The system uses an internal computer and a printer to generate calibration reports on various delivery systems. The unit performs the required calculations internally thus eliminating the chance of operator error. When suitably documented by an NIST traceable laboratory, the system offers users a high accuracy standard of comparison to allow adjustment of bulk transport mounted metering systems. The SY14B Prover meets the accuracy requirements of Handbook 44 for a proving device.

Traditionally, the accuracy of flow metering systems for bulk transports has been verified by comparing the metered delivery with the net weight delivered on a certified truck scale. To eliminate road loss errors, the bulk transport had to pump, while on a weigh scale, into a second empty transport off the weigh scale. The low precision resulting from scale inaccuracy and lack of control in pumping rate resolution, necessitated very large sample sizes. In addition, the weight measurements could not be made while pumping. This resulted in a time consuming process where the pump was started and stopped repeatedly and which tied up two trailers and the weigh scale for typically four hours per calibration check. In addition, when finished, both trailers had to be filled before going out again. With the Hoffer SY14B Cryogenic Transfer Standard these problems are eliminated. The liquid is pumped from the trailer through the SY14B Prover and back into the trailer through the top fill connection.

1.2 DESCRIPTION

A complete SY14B Prover system is composed of a transfer standard turbine flowmeter, an electronics console, and a metering run mounted on a portable hand truck. The electronics portion of the prover is provided in a small portable electronics enclosure with military style electrical fittings. Instantaneous indication of the flowrate and flowing temperature is provided as well as a total flow indicator and an accumulative test total indicator.

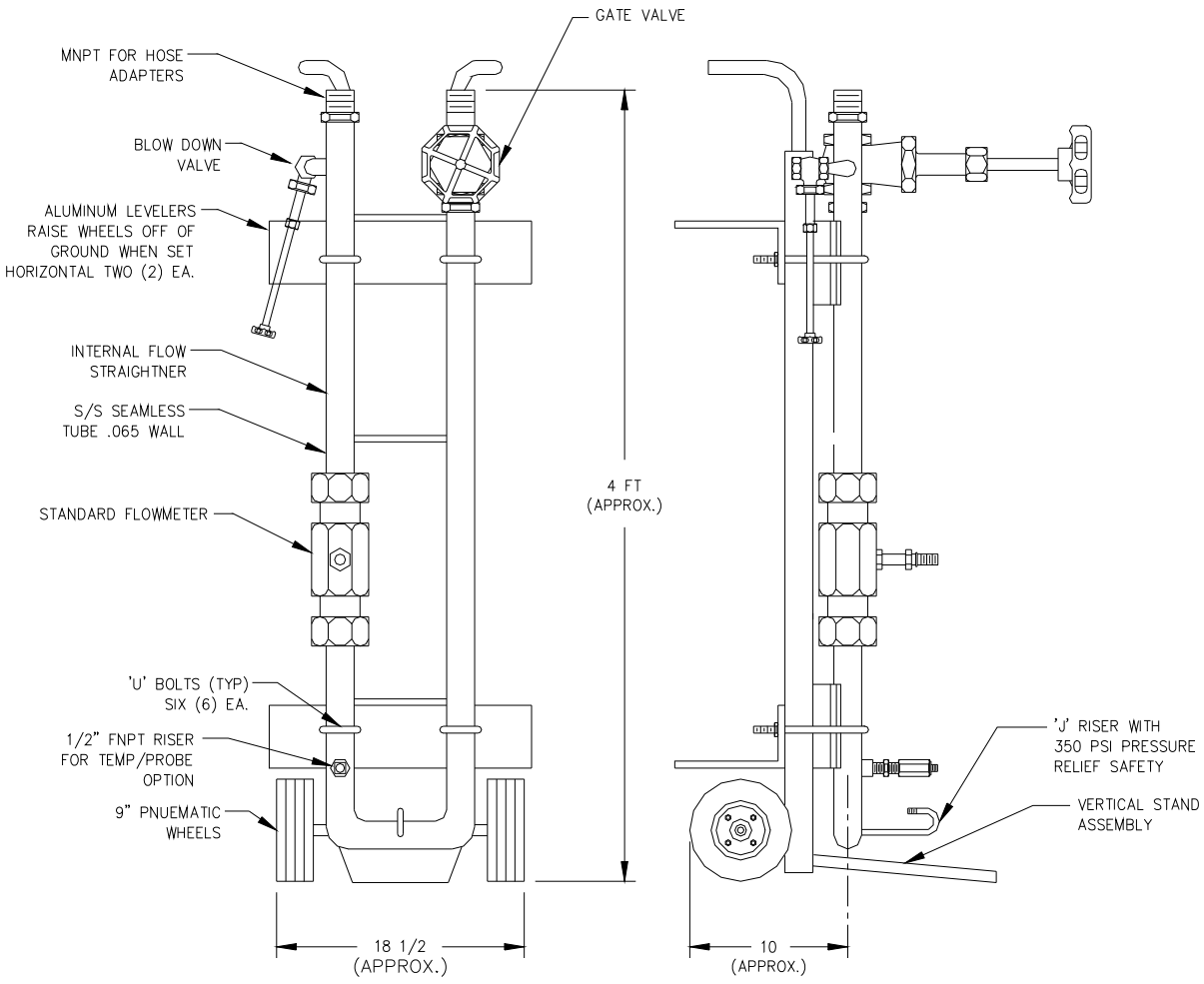

Figure 1-2 Hand truck metering run.

A prover cable connects the transfer standard to the trailer metering system. A prover start button on the SY14B Prover simultaneously starts both systems electronically. The SY14B Prover will automatically stop both system totalizers when the correct test total has been reached. The integrally mounted control valve allows the operator to simulate the typical flowrates and delivery pressures seen in actual service. The pump does not have to shut down between test runs.

1.3 PRECAUTIONS

1.3.1 STATIC ELECTRICITY

The SY14B Prover uses high speed CMOS circuitry which is sensitive to static damage. Accepted safe practices for the handling of electronic devices should observed at all times. All spare parts are shipped in special packages to avoid static damage. These precautions should be observed when servicing the equipment.

Once the SY14B Prover is installed, grounded, and connected, the odds of static discharge damage are greatly reduced. Should a malfunction due to static discharge be suspected, it may be necessary to turn the power OFF and then ON after a 10 second delay to restore normal operation.

Low humidity environments increase the potential for static build up. In these conditions the operator should touch a grounded conductive surface prior to touching controls of the SY14B Prover.

1.3.2 WELDING

Welding should not be performed in close proximity to the PROVER or its connecting cables. If welding under these conditions must be performed, disconnect all cables from the PROVER. Failure to do so may result in damage to the unit.

1.4 PREPARATION FOR SHIPMENT

1.4.1 SHIPPING AND HANDLING

In the event of a malfunctioning system, the following guidelines should be observed for the preparation and shipment of the unit in question. Failure to do so may result in the material reaching its destination damaged.

1.4.2 COMPLETE SY14B PROVER SYSTEM

If the entire SY14B Prover System needs to be returned for service, follow these steps:

- Wrap the complete unit in a cushioning type of material.
- Secure the wrapped unit in a commercial grade shipping container.
- Label the exterior container with bold letters stating "HANDLE WITH CARE".

1.4.3 ELECTRONIC SUBCOMPONENTS

> ***CAUTION*** *- The SY14B is a static-sensitive device. Standard practices for static-sensitive parts should be observed.*

Electronic subcomponents refers to the printed circuit board or any other related electronic components.

The electronic component should be wrapped in a material conforming to MIL-B-81705, Type II, and packaged in a heat sealable bag conforming to MIL-P-81997. These steps are necessary to protect the equipment from electrostatic charges that may occur during handling.

The packaged unit should then be marked with a sensitive electronic device caution label conforming to MIL-STD-129, Appendix C. The equipment should then be wrapped in cushioning material, and placed into a close fitting box conforming to PPP-B-636 Domestic class.

The exterior shipping container should be marked with a sensitive electronic device caution label conforming to MIL-STD-129, Appendix C.

1.5 SPECIFICATIONS

- Display: 32-character, alphanumeric, LED backlit LCD supertwist display, 0.3" character height.
- Keypad: 16-key.
- Printer - Integrally mounted, industrial grade, 40 columns.
- Operating temperature: -20 to +70 °C (-4 to +158 °F)
- Storage temperature: -40 to +90 °C (-40 to +194 °F)
- Flowmeter input: sensitivity 10 mVrms, RF and bandpass filtered.
- Temperature input: 1000 ohm, platinum RTD compatible.
- Self test capabilities: Coil failures, RTD failures, low power, computer operating properly, memory test, and circuitry failure detection.
- Compensation range: LIN/LOX/LAR; 75 to 125 °K, LIN/LNG/C2H4; 75 to 250 °K, CO2; -30 to +20 °F, LH2; 20 to 30 °K, LNG; -260 to -161 °F, and LPG; 0 to 125 °F.
- Power Input: 88-132/176-264 VAC, 47-440 Hz, 1 Amp, Internally Selectable.

1.6 EQUIPMENT ACCESSORIES

- ACC-5A Count Tester.
- ACC-11 Temperature Probe Simulator, LIN/LOX/LAR.
- ACC-15 Temperature Probe Simulator, CO2.
- ACC-32 Temperature Probe Simulator, LH2.
- ACC-58 Temperature Probe Simulator, LPG.
- ACC-62 Temperature Probe Simulator, LNG.
- SCA25CC2-T Temperature Probe Cable.
- SCA6CC2-T Temperature Probe Cable (prover).
- SCA6CC2-S Signal Cable (prover).
- SCA6HP3-P Power Cable (prover).
- SCA-25CC2-DS Dual Start/Stop.
- SCA-25-AB1 Ground Cable.

2. OPERATIONS OVERVIEW

2.1 INTRODUCTION

The SY14B Prover is an automated calibration unit used for testing bulk liquid delivery systems. The SY14B uses a master flowmeter and compares it to the unit under test. The SY14B analyses this comparison and generates printed calibration reports.

During the calibration and proving runs, the SY14B provides warning messages if there is an equipment failure or the unit is operating outside the programmed flow range. There are also helpful messages to guide the operator through the calibration procedure.

2.2 OPERATOR KEY FUNCTIONS

The program control keys consist of the MODE, PRINT, and START keys. Field data entry and option selection are performed using the number (0-9, ".") and PRINT keys. Field parameters are displayed in two forms, text label fields or numeric entry fields. Numeric fields require the entry of numbers using the NUMERIC keys for a particular parameter. Label fields display text messages showing the option currently chosen for a the setup option or parameter. Alternate Label field selections are viewed and selected by pressing the PRINT key.

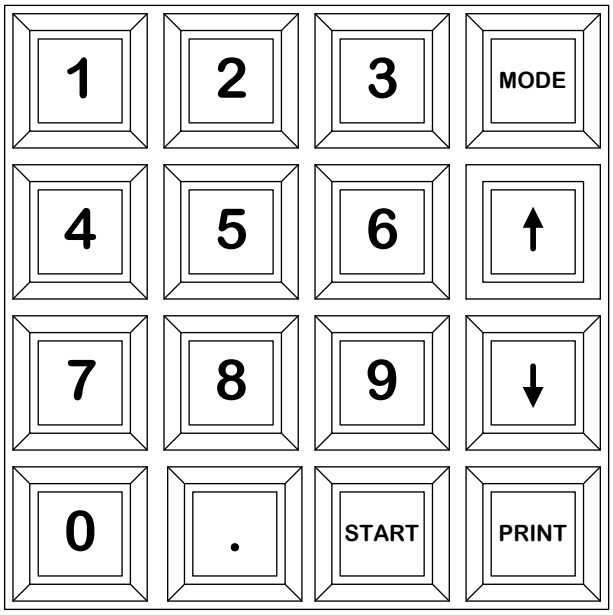

Figure 2-1 SY14B Keypad

MODE KEY Advances from one mode of operation to the next mode. Pressing the MODE key while a test is running aborts the test and returns to TEST MODE SETUP mode.

DOWN ARROW Scrolls the display down through the selected mode field entries.

UP ARROW Scrolls the display up through the selected mode field entries.

PRINT KEY Changes the selection in text list entry fields. Prints the final FLOWMETER CALIBRATION and SYSTEM CHECK reports.

START KEY Enters TEST MODE. Starts and stops calibration and proving runs.

NUMBER KEYS Enters the numbers in numeric entry fields. Pressing the ZERO key while in the SENSOR CHECK test mode, zeroes the STD CNTS, UUT CNTS, and COUNTS display.

DECIMAL KEY Enters the decimal point in numeric entry fields.. Enables or disables the master pulse accumulator when the system is in the SENSOR CHECK test mode. When the system is in the SYSTEM CHECK test mode and the PROVER IN selection is set to YES, the DECIMAL POINT key enables or disables the master pulse accumulator.

2.3 PROGRAM MODE CONTROL

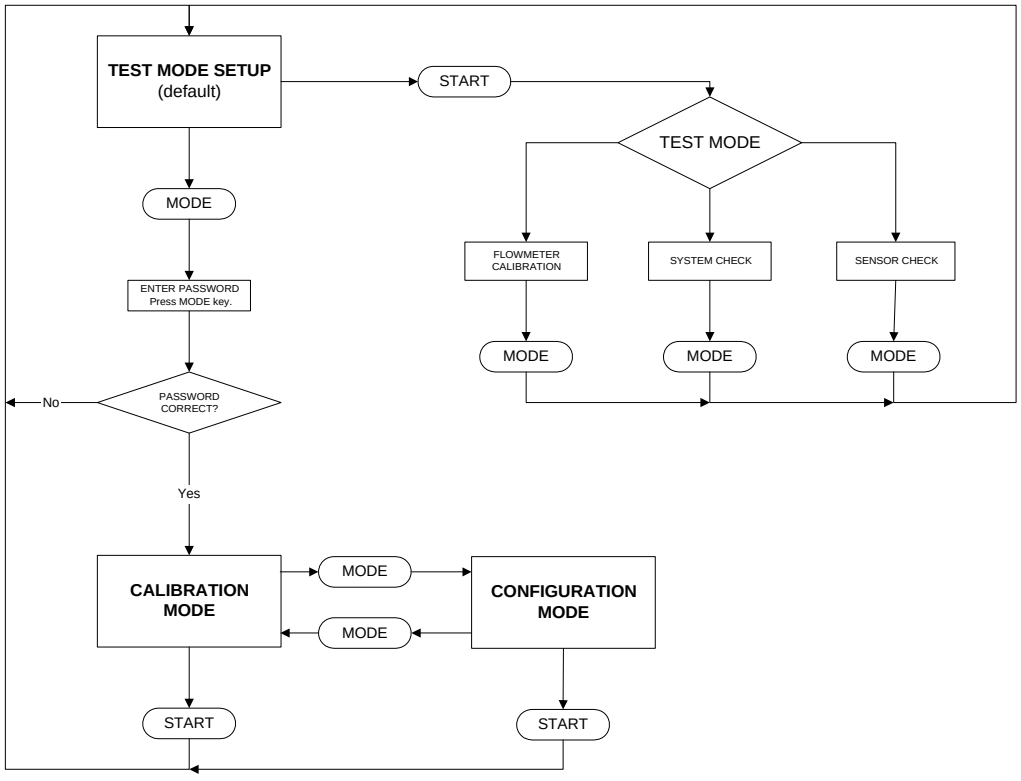

Figure 2-2 Mode control flowchart

2.3.1 OVERVIEW

The SY14B has four modes of program control, TEST MODE SETUP, TEST MODE, CALIBRATION, and CONFIGURATION. The TEST MODE SETUP is used to select/set the parameters/conditions for the TEST MODE. The TEST MODE has three test types, FLOWMETER CALIBRATION, SYSTEM CHECK, and SENSOR CHECK. The CALIBRATION mode is used to enter the master flowmeter parameters. The CONFIGURATION mode is used to enter the system control parameters.

2.3.2 PASSWORD PROTECTION

Both the CALIBRATION and CONFIGURATION modes are password protected to prevent unauthorized personnel from modifying system settings. Hoffer ships all SY14B systems from the factory with a password of 2001. It is recommended that this password be changed when the unit is received. Any password from 0001 to 9999 is acceptable, The password should be confidential information shared only by the serviceman and his supervisor.

WARNING: *You must remember your password or you will not be able to enter the SY14B calibration and configuration modes.*

2.3.3 CHANGING MODES

To enter the TEST MODE, press the START key while in the TEST MODE SETUP. Pressing the MODE key while in FLOWMETER CALIBRATION or SYSTEM CHECK aborts the running test and returns the system to TEST MODE SETUP. The system automatically returns to TEST MODE SETUP when the FLOWMETER CALIBRATION or SYSTEM CHECK test is completed.

To enter the CALIBRATION mode, press the MODE key while in TEST MODE SETUP and the "PASSWORD" prompt appears. Use the number keys to enter in the password. Once the password is entered, press the MODE key to enter the CALIBRATION mode. If an incorrect password is entered, the unit returns to TEST MODE SETUP. Once in the CALIBRATION mode, the UP or DOWN arrow keys may be used to scroll through available fields. Use the PRINT and NUMBER keys to change the calibration values.

Pressing the MODE key while in the CALIBRATION mode shifts the unit into the CONFIGURATION mode. In the CONFIGURATION mode, use the UP or DOWN arrow keys to scroll through the available fields. To change configuration values, use the PRINT and NUMBER keys. Pressing the MODE key in the CONFIGURATION mode returns the unit to the CALIBRATION mode.

Pressing the START key while in either CALIBRATION or CONFIGURATION mode returns the SY14B back in the TEST MODE SETUP. When entering to the CALIBRATION or CONFIGURATION mode, the SY14B returns to the last parameter displayed before that mode was exited.

2.4 PRINTING PRECAUTIONS

The following precautions pertain to the integrally mounted printer:

- Before a long sequence of calibration runs is to be taken, remove the printer head and verify that their is sufficient paper.
- Before initiating a printed report, press the printer feed-key several times to verify that the paper is not jammed.

2.5 ENTERING NUMERICAL VALUES

When entering numerical values into the SY14, use the following procedures:

2.5.1 ENTERING INTEGER VALUES

Enter integer values by entering in the numerical value of the integer, followed by the DECIMAL key. The DECIMAL key erases all remaining values from the display. For example, if "3456756" is displays and "556." is entered, then 0000556 displays the next time the data is reviewed.

2.5.2 ENTERING FLOATING VALUES

Enter floating point values by entering in the floating numerical value, followed by the DECIMAL key. The DECIMAL key determines the number of digits displayed after the decimal-point. Enter the number "95.78" as "95.78." and the SY14B displays "0095.78" the next time the data is reviewed.

3. TEST MODE SETUP and TEST MODE

3.1 INTRODUCTION

The TEST MODE SETUP mode is used to setup the TEST MODE for field calibrations on ACE units, units using system factors (SF) correction methods, stand alone flowmeters, and RTD temperature probe verification.

3.2 TEST MODE SETUP AND TEST MODE ACCESS

The TEST MODE SETUP mode is the default startup mode of the SY14B. The FLOWMETER CALIBRATION, SYSTEM CHECK, and SENSOR CHECK modes are selected from the first entry field in the TEST MODE SETUP mode using the PRINT key. The first entry field in TEST MODE SETUP is named TEST TYPE.

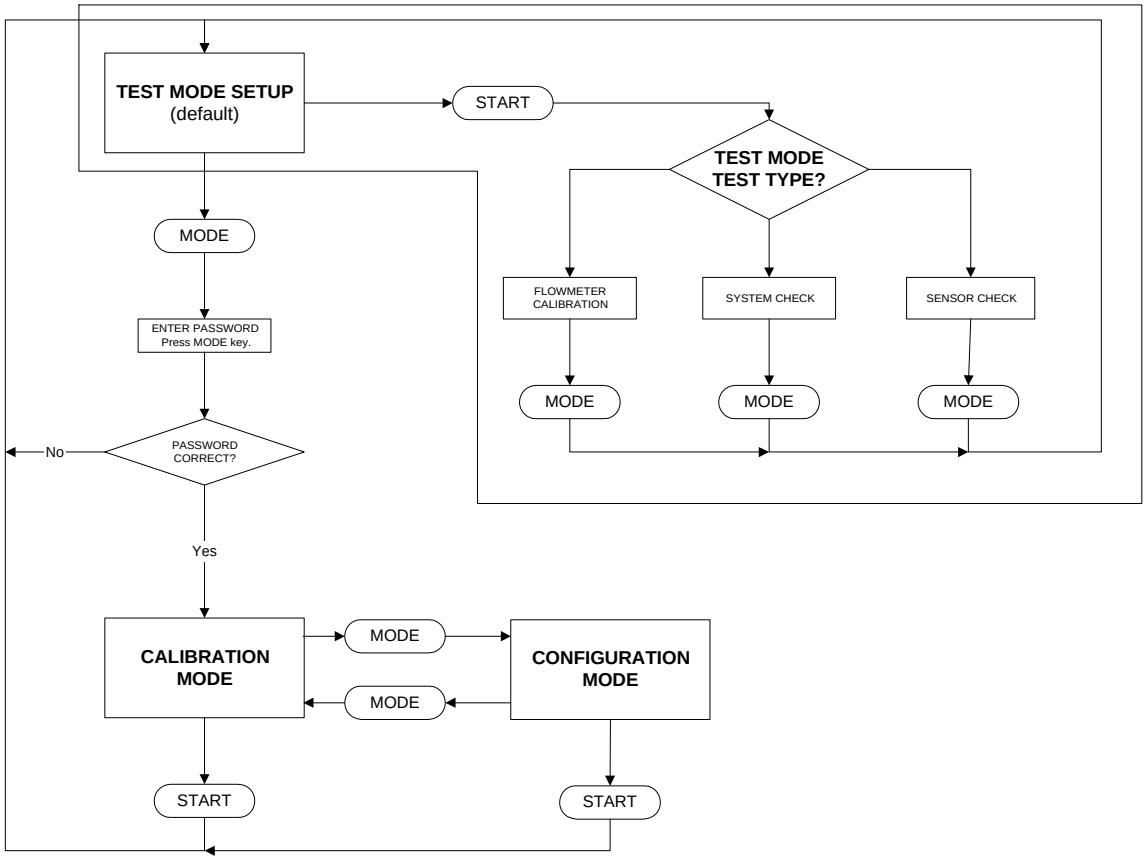

Figure 3-1 TEST MODE SETUP and TEST MODE access flowchart

3.3 KEYBOARD ENTRY

Field parameters are displayed in two forms:

NUMERIC FIELDS — Numeric fields are used for serial number entry and other pertinent numeric information for the system under test. The NUMERIC keys are used for data entry in these fields.

LABEL FIELDS — Label fields display text messages showing which option is currently selected. To change the option press the PRINT key.

The key functionality is as follows:

MODE — Used to advance from one mode of operation to another. When in the TEST MODE SETUP mode, pressing this key once changes the prover to the PASSWORD entry field. Proper password entry allows access to the CALIBRATION and CONFIGURATION modes. Entry into these modes is explained in the CALIBRATION and CONFIGURATION chapters. If the mode key is accidentally pressed in the TEST MODE SETUP mode, press the mode key once more to return back to the TEST MODE SETUP mode. Pressing the MODE key while in the SENSOR CHECK mode, returns the SY14B system to the TEST MODE SETUP. Pressing the MODE while in either FLOWMETER CAL or SYSTEM CHECK test mode aborts the currently running test and returns to TEST MODE SETUP.

DOWN ARROW — Used to scroll down through the field entries.

UP ARROW — Used to scroll up through the field entries.

PRINT — In the TEST MODE SETUP mode, pressing the PRINT key changes the label field. In TEST MODE pressing the PRINT key at the end of either FLOWMETER CALIBRATION or SYSTEM CHECK test modes initiates the final report printing. The SY14B system returns to TEST MODE SETUP once the final report printing is initiated.

START — Pressing the START key while in TEST MODE SETUP switches the SY14B into the selected TEST MODE. When the SY14B is in a suggested flow field, the START key initiates the selected test. A second press of the start key stops the running test. To meet NIST (US Department of Commerce National Institute of Standards and Technology) and API (American Petroleum Institute) requirements, the SY14B performs an automatic test cycle in FLOWMETER CALIBRATION and SYSTEM CHECK test modes. Except for an equipment failure, there is no need to press the START key to stop the running test.

NUMBER KEYS — Allows easy entry of numeric information in numeric entry fields.

DECIMAL POINT — Enters the decimal point in numeric entry fields. When the SY14B system is in the SENSOR CHECK test mode, pressing the DECIMAL POINT toggles the pulse accumulators on and off.

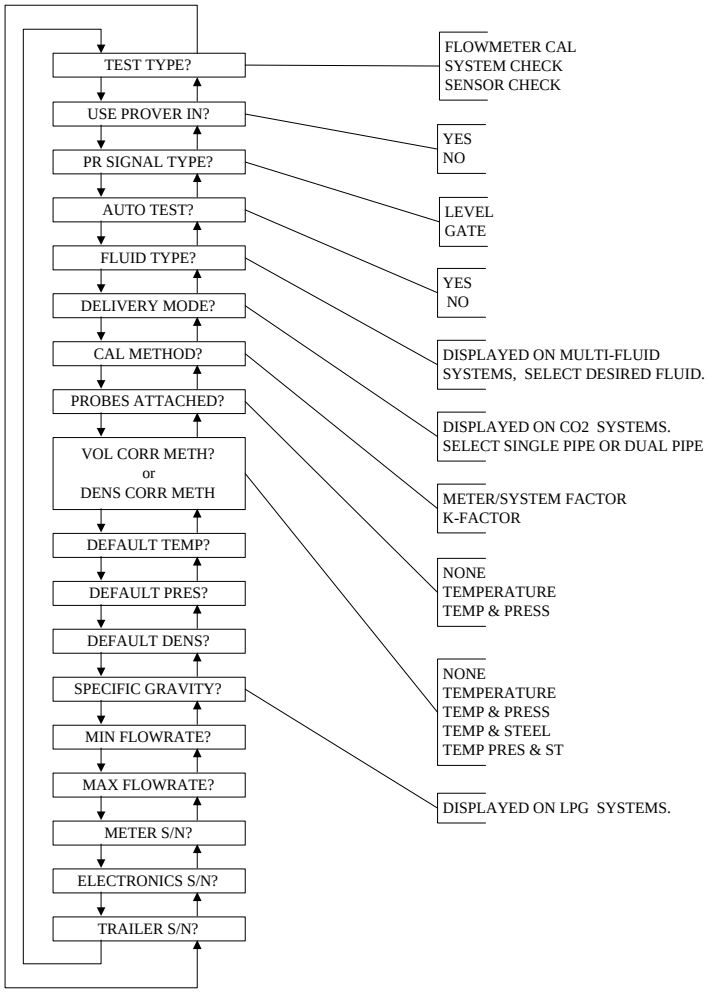

Figure 3-2 TEST MODE SETUP flowchart

3.4.1 TEST TYPE?

Selection of the TEST TYPE is accomplished by pressing the PRINT key in the first field of the TEST MODE SETUP mode. For ACE proving, press the PRINT key until the FLOWMETER CAL appears on the display. For SYSTEM FACTOR PROVING, press the PRINT key until SYSTEM CHECK appears on the display.

3.4.2 USE PROVER IN?

In SYSTEM CHECK and SENSOR CHECK test modes, YES allows the prover input to control the pulse accumulator. Default for USE PROVER IN is NO.

3.4.3 PR SIGNAL TYPE?

PROVER IN SIGNAL TYPE selects the type of input signal used to control the pulse accumulator in SYSTEM CHECK and SENSOR CHECK test modes. Select from either GATE or LEVEL. When PR SIGNAL TYPE is set to GATE, the prover input signal is a 5 to 0 volt signal transition. Each signal transition toggles the pulse accumulator on or off, depending on the pulse accumulator pervious state. When the PR SIGNAL TYPE is set to LEVEL, a 5 volt input signal enables the pulse accumulator and a 0 volt signal disables the pulse accumulator.

3.4.4 AUTO TEST?

When set to YES the SY14B automatically terminates the test when the correct test total is reach. In FLOWMETER CALIBRATION, the correct test total is determined by dividing 10,000 by the K-FACTOR. In SYSTEM CHECK the correct total is determined by multiplying the flow-rate by 2. The default setting for AUTO TEST is YES.

3.4.5 FLUID TYPE?

On the multi-fluid systems, use the PRINT key to select the desired fluid. Not displayed on single fluid systems.

3.4.6 DELIVERY MODE?

Only displayed on CO2 units, use the PRINT key to select SINGLE PIPE or DUAL PIPE delivery mode.

3.4.7 CAL METHOD?

CALCULATION METHOD: Select from either K-FACTOR or SYSTEM/METER FACTOR. See Chapter 7 SYSTEM PROVING.

3.4.8 UUT AVER K-FACT?

UUT AVERAGE K-FACTOR: On LPG systems enter the average K-FACTOR of the flowmeter to be calibrated.

3.4.9 PROBES ATTACHED?

Select either NONE, TEMP, or TEMP & PRESS based on the way the prover system is configured. PROBES ATTACHED setting is restored to the last setting used when power is reapplied.

3.4.10 VOL CORR METH?

VOLUME CORRECTION METHOD: Select from NONE, TEMP, TEMP & PRES, TEMP & STEEL, or TEMP PRES & ST. This setting is only available on LPG systems. VOL CORR METH setting is restored to the last setting used when power is reapplied.

3.4.11 DENS CORR METH?

DENSITY CORRECTION METHOD: Select from NONE, TEMP, or TEMP & PRES. This setting is available on all SY14B systems except for LPG. DENS CORR METH setting is restore to the last setting used when power is reapplied.

3.4.12 DEFAULT TEMP?

Enter the default temperature setting of the unit under test.

3.4.13 DEFAULT PRES?

Enter the default pressure setting of the unit under test.

3.4.14 DEFAULT DENS?

Enter the default density setting of the unit under test. On LPG systems, the setting for DEFAULT DENS is displayed when CAL DENS FROM SG is set to NO.

3.4.15 SPECIFIC GRAVITY?

Enter the specific gravity of the working LPG fluid. The SPECIFIC GRAVITY entry is only available on LPG systems.

3.4.16 MIN FLOWRATE?

Enter the minimum flow-rate of the system under test. The SY14B system uses MIN FLOWRATE setting to determine the flowrate for the first calibration point in FLOWMETER CALIBRATION test mode.

3.4.17 MAX FLOWRATE?

Enter the maximum flowrate of the system under test. The SY14B system uses MAX FLOWRATE setting to determine the flowrate for the last calibration point in the FLOWMETER CALIBRATION test mode. The other three calibration points flowrates are determine from the following equation:

$$Flowrate = MIN\_FR + \left[\left(MAX\_FR - MIN\_FR \right) * \frac{\left(CAL\_PT - 1 \right)}{4} \right]$$

Where:

MIN_FR = MIN_FLOW_RATE,
MAX_FR = MAX_FLOW_RATE,
CAL_PT = CALIBRATION POINT NUMBER (1 to 5 max).

3.4.18 METER SERIAL NUMBER?

Enter the serial number of the flowmeter under test.

3.4.19 ELECTRONICS SERIAL NUMBER?

Enter the serial number of the metering electronics system under test.

3.4.20 TRAILER SERIAL NUMBER?

Enter the serial number of the delivery trailer under test.

3.5 TEST MODE, TEST TYPE = FLOWMETER CALIBRATION

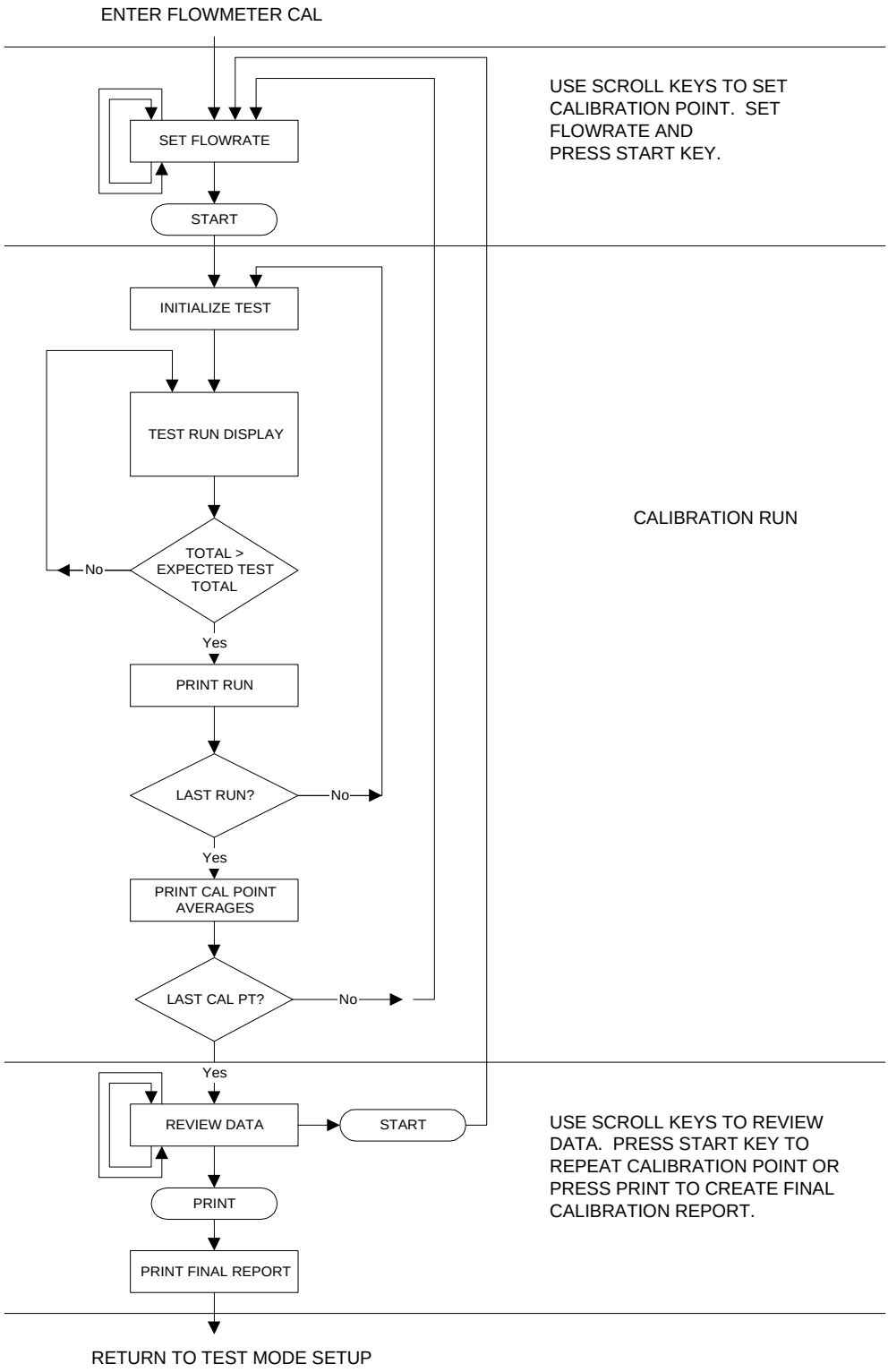

Figure 3-3 Flowmeter Calibration test mode flowchart.

3.5.1 SET FLOWRATE

This field displays the actual flowrate and suggests a flowrate based on MIN FLOWRATE and MAX FLOWRATE entered in TEST MODE SETUP. When the flowrate is adjusted to within ±2.5% of the SET TO flowrate, the display flashes PRESS START. When PRESS START is displayed, pressing the START key begins the flowmeter calibration point runs. Use the SCROLL UP and SCROLL DOWN keys to scroll through the five calibration points flowrates.

3.5.2 TEST RUN DISPLAY

During a FLOWMETER CALIBRATION run, this field simultaneously displays accumulated volumetric total and volumetric flow rate.

3.5.3 FREQUENCY, K/M FACTOR

After each individual run the SY14B prints the RUN#, UNITS/MIN, UNITS TOTAL, FREQUENCY, and K/M-FACTOR. After a short delay the SY14B resets and begins the next run. This cycle continues until the value for REPEAT POINTS is reached. At the end of the all of the runs for the current calibration point, the SY14B prints the AVERAGES of UNITS/MIN, UNITS TOTAL, FREQUENCY, and K/M-FACTOR. After the averages are printed, the SY14B prints the delta repeatability for the FREQUENCY and K/M-FACTOR. After the printing is completed the SY14B returns to SET FLOWRATE and instructs the user to set the flowrate for the next calibration point.

3.5.4 FREQUENCY/K FACTOR#

After all five calibration point runs have been completed and saved, the prover allows the operator to view and/or run a particular run over. View the other runs by pressing the UP and DOWN arrows. To delete and start a calibration run over, press the START key in the run field you desire to rerun. To keep all five calibration point runs and print out a final calibration report, press the PRINT key.

3.6 TEST MODE, TEST TYPE = SYSTEM CHECK

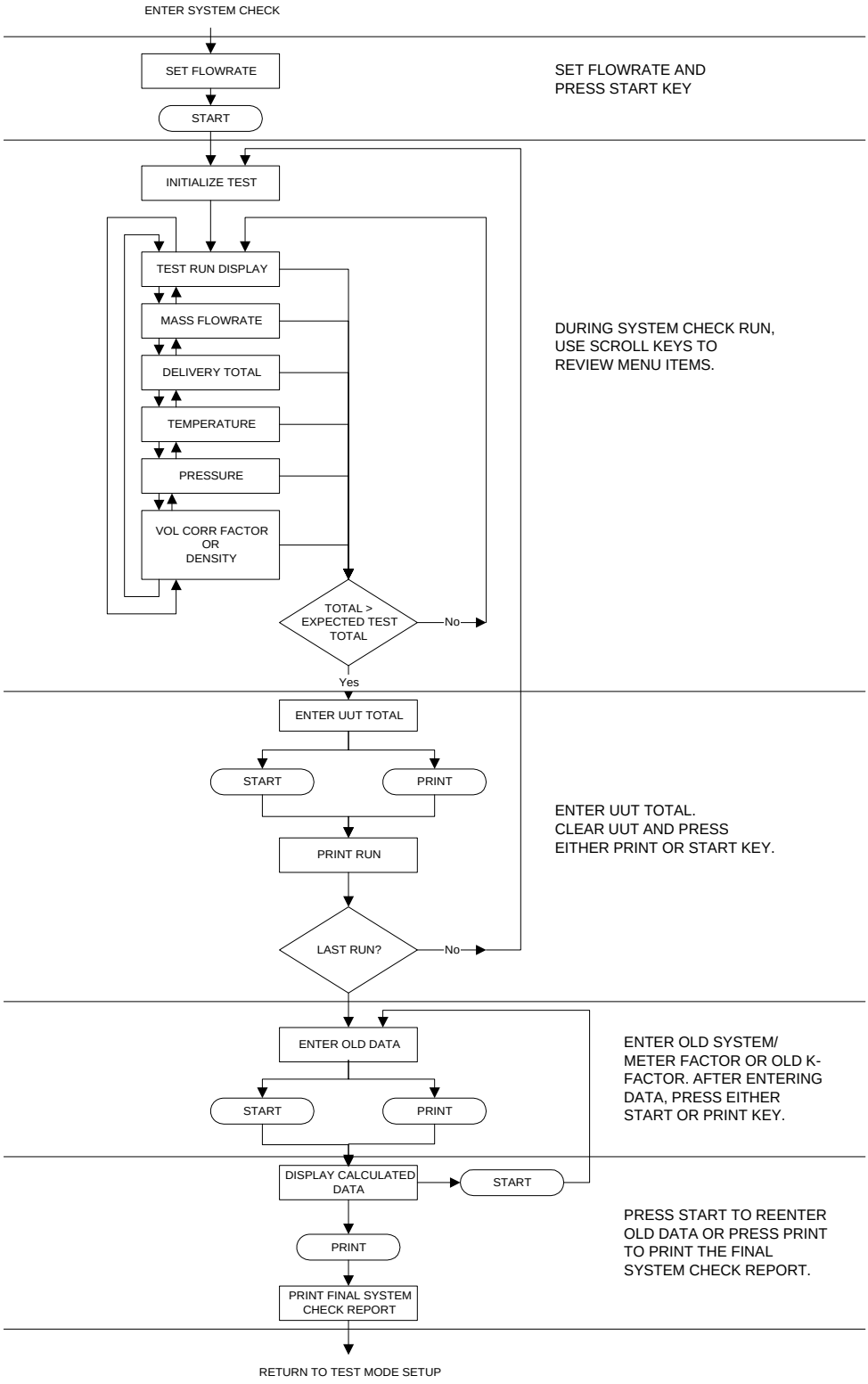

Figure 3-4 System Check test mode flowchart.

3.6.1 SUGGESTED FLOW RATE

This field displays the actual flowrate and suggests a average flowrate based on the MIN FLOWRATE and MAX FLOWRATE settings. Adjust the flowrate and press the START key to begin the SYSTEM CHECK test cycle.

3.6.2 TEST RUN DISPLAY

During a SYSTEM CHECK run, this field simultaneously displays accumulated volumetric total and volumetric flow rate.

3.6.3 MASS FLOW RATE

During a SYSTEM CHECK this field displays the mass flowrate of the fluid, based on the units of measure selected in the CONFIGURATION mode.

3.6.4 DELIVERY TOTAL

During a SYSTEM CHECK this field displays the total compensated equivalent delivery based on the units of measure selected in the CONFIGURATION mode.

3.6.5 TEMPERATURE

During a proving run, this field displays the fluid temperature if a temperature probe is connected and PROBES ATTACHED setting is set for temperature. If PROBES ATTACHED setting is set to NONE then this field will display the default temperature.

3.6.6 PRESSURE

During a proving run, this field displays the fluid pressure if a pressure transmitter is connected and PROBES ATTACHED setting is set for pressure. If PROBES ATTACHED is set to a non pressure setting, then this field will display the default pressure.

3.6.7 VOL CORR FACTOR

On LPG systems this field displays the current VOLUME CORRECTION FACTOR used to correct the DELIVERY TOTAL back to standard conditions. The calculation of the VOLUME CORRECTION FACTOR is based on the setting of VOLUME CORRECTION METHOD.

3.6.8 DENSITY

On all systems except for LPG, this field displays the fluid density based on the setting of DENSITY CORRECTION METHOD.

3.6.9 ENTER UNIT UNDER TEST TOTAL

At the end of each run, enter the total displayed on the unit under test in the units displayed on SY14B. After the UUT total is entered into the SY14B, clear the UUT system and press the PRINT or START key to begin the next run. When the PRINT or START key is pressed to start the next run, the SY14B prints the SY14B DELIVERY TOTAL and UUT DELIVERY TOTAL. After all of the runs are completed, the user is prompted to enter in the OLD SYSTEM/METER FACTOR or the OLD K-FACTOR based on the setting of CALCULATION METHOD.

3.6.10 ENTER OLD SYSTEM/METER FACTOR

At the end of the SYSTEM CHECK runs, enter in the old system/meter factor setting of the unit under test.

3.6.11 ENTER OLD K-FACTOR

At the end of the SYSTEM CHECK runs, enter the old K-FACTOR of the unit under test.

3.6.12 CALCULATE NEW SYSTEM/METER-FACTOR

This value calculated is based on the CALCULATION METHOD setting in TEST MODE SETUP. If the data entered in either ENTER OLD SYSTEM/METER FACTOR or ENTER OLD K-FACTOR is incorrect, then press the START key to enter the correct data. If the data is correct, then press the PRINT key to print the final SYSTEM CHECK report.

3.7 TEST MODE, TEST TYPE = SENSOR CHECK

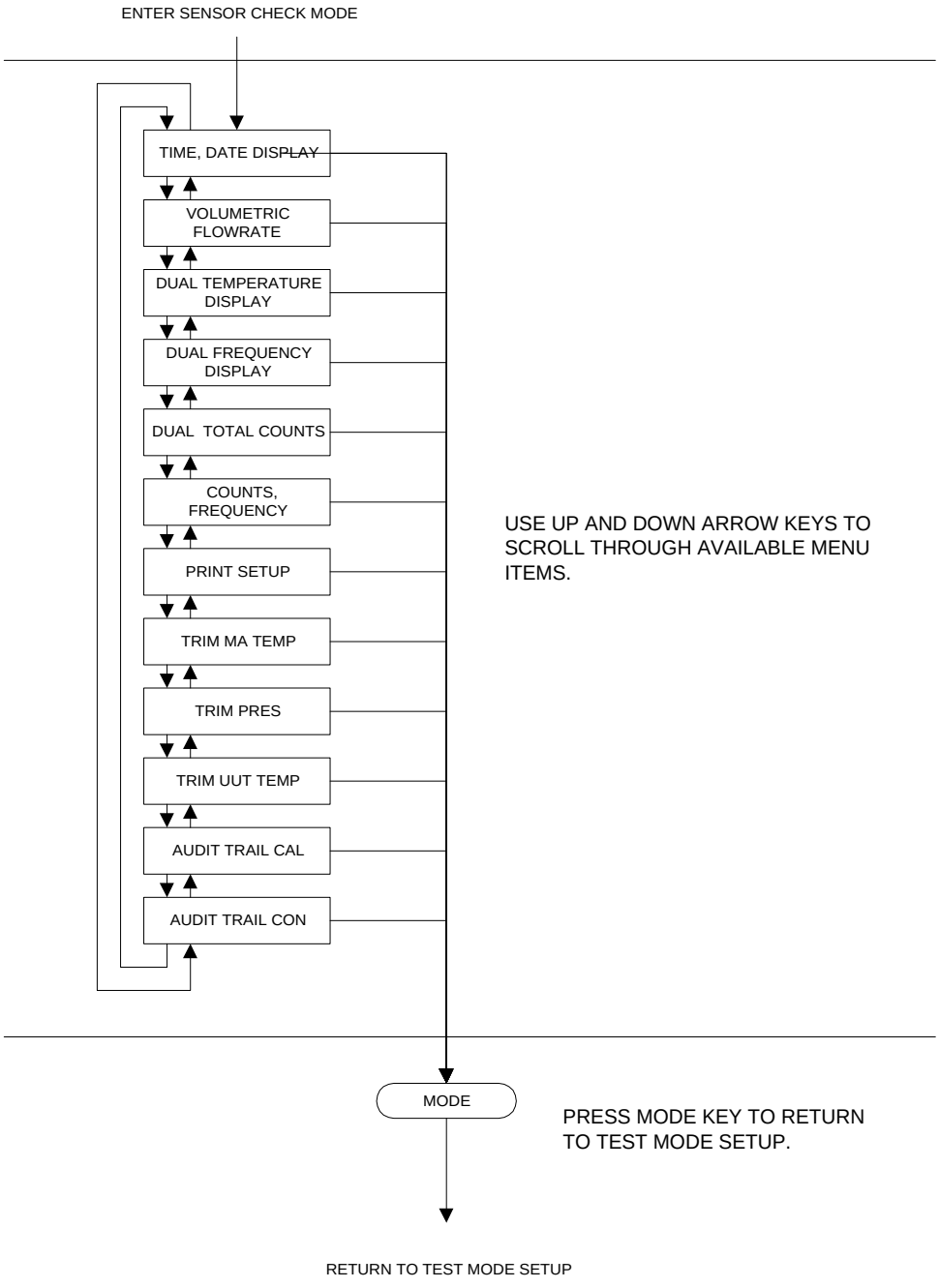

Figure 3-5 Sensor Check test mode flowchart

3.7.1 TIME, DATE DISPLAY

This selection displays the current time and date settings of the SY14B.

3.7.2 VOLUMETRIC FLOWRATE

Displays the VOLUMETRIC FLOWRATE of the SY14B. This display is used to determine the MIN FLOWRATE and MAX FLOWRATE that are entered in TEST MODE SETUP.

3.7.3 TEMPERATURE DISPLAY

This display allows the operator to verify the proper operation and accuracy of the SY14B and UNIT UNDER TEST temperature probes. With the prover piping connected and the system properly cooled down, both the SY14B STD temperature and the UUT temperature should be within a degree or so. This test is designed specifically for HFC recommended temperature probes. Using a non compatible temperature probe may give unpredictable results.

3.7.4 FREQUENCY DISPLAY

This display allows the operator to measure the output frequency of the SY14B and unit under test flowmeters directly.

3.7.5 TOTAL COUNTS

This display allows the operator to monitor the total counts received for the SY14B and unit under test flowmeters directly. The count is started as soon as the display field is entered. To start the count over press the ZERO key.

3.7.6 COUNTS, FREQ HZ

This display is used in conjunction with the prover input to calibrate the master meter. Press the ZERO key to clear.

3.7.7 PRINT SETUP

Prints a report of the SY14B CALIBRATION and CONFIGURATION settings. It is useful for maintaining records for the master meter calibration data. Press the PRINT key to start the report. Settings for DEFAULT TEMPERTURE, DEFAULT PRESSURE, and DEFAULT DENSITY are printed out in US CUSTOMARY units.

3.7.8 TRIM MA TEMP

The TRIM MASTER TEMPERATURE utility aids in factor adjustment of the master temperature input signal conditioner.

3.7.9 TRIM PRESS

The TRIM PRESSURE utility aids in factor adjustment of the pressure input signal conditioner.

3.7.10 TRIM UUT TEMP

The TRIM UUT TEMPERATURE utility aides in factory adjustment of the UUT temperature input signal conditioner.

3.7.11 AUDIT TRIAL CAL

This value is incremented every time that the CALIBRATION mode is accessed and a calibration field is edited. AUDIT TRIAL Calibration is also incremented when DEFAULT TEMPERATURE, DEFAULT PRESSURE, DEFAULT DENSITY, or SPECIFIC GRAVITY are changed in TEST MODE SETUP.

3.7.12 AUDIT TRIAL CON

This value is incremented every time that the CONFIGURATION mode is accessed and a configuration field is edited. AUDIT TRIAL Configuration is also incremented when PROBES ATTACHED, VOLUME CORRECTION METHOD, or DENSITY CORRECTION METHOD is change in TEST MODE SETUP.

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4. CALIBRATION MODE

4.1 INTRODUCTION

The CALIBRATION mode is used to install prover flowmeter calibration information. The SY14B is preprogrammed from the factory based on user specifications. All numeric calibration parameters for the SY14B are always entered in U.S. customary units of measure regardless of the unit of measure selected.

CAUTION: *WHEN MAKING CHANGES IN THE CALIBRATION MODE, THE MODE MUST BE EXITED BEFORE TURNING THE SY-14B OFF OTHERWISE THE CHANGES WILL NOT BE UPDATED IN MEMORY.*

4.2 CALIBRATION MODE

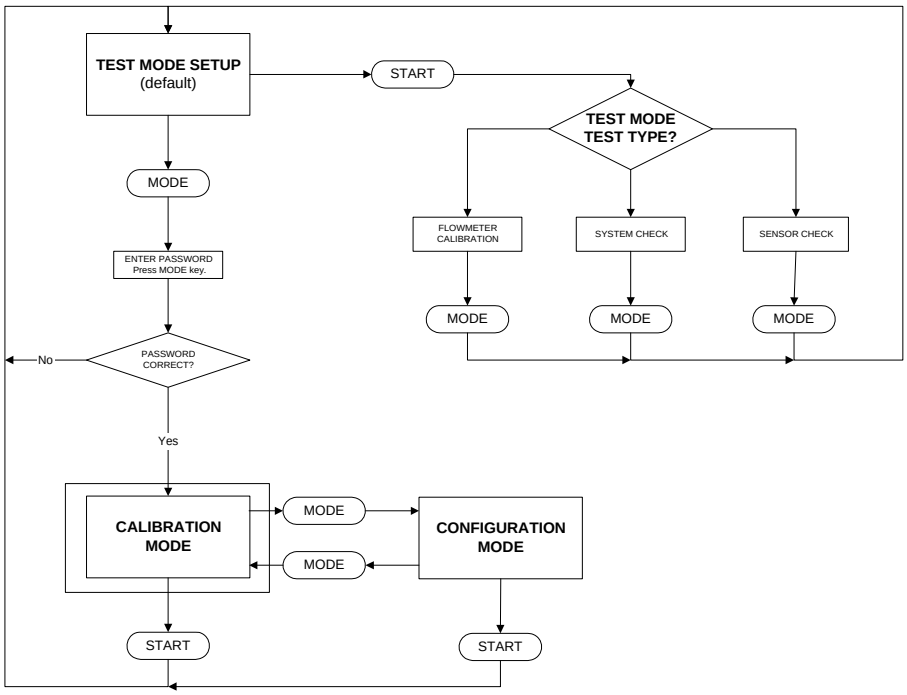

Figure 4-1 CALIBRATION MODE access flowchart

To enter the CALIBRATION mode from the default TEST MODE SETUP mode, you must first press the MODE key. The next screen will prompt you for the password. After keying in the proper password, press the MODE key again to enter the CALIBRATION mode. To exit the CALIBRATION mode and return to TEST MODE SETUP mode, press the START key. To exit the CALIBRATION mode and move to the CONFIGURATION mode press the MODE key. When returning to the CALIBRATION mode, the SY14B Prover displays the last CALIBRATION field displayed.

4.3 KEYBOARD ENTRY

Field parameters are presented in two basic forms:

NUMERIC FIELDS — Numeric fields are used for calibration data and other needed setup data. The NUMERIC keys are used for data entry in these fields.

LABEL FIELDS — Label fields display English messages showing which option is currently selected. To change the option press the PRINT key.

The key functionality is as follows:

MODE — Allows the user to advance from one mode of operation to another. When in the CALIBRATION mode pressing this key once will change the prover to the CONFIGURATION mode. Pressing the mode key once more will return the program to the CALIBRATION mode.

DOWN ARROW — Allows the user to scroll down through the field entries.

UP ARROW — Allows the user to scroll up through the selected field entries.

PRINT — In CALIBRATION mode, this key causes a option change when in a label field. When in a numeric entry field, the PRINT key causes the display cursor to shift to the right one character.

START — Allows the user to advance from one mode of operation to another. When in the CALIBRATION mode pressing this key will change the prover to the TEST MODE SETUP mode.

NUMBER KEYS — Allows easy entry of numeric information in numeric entry fields.

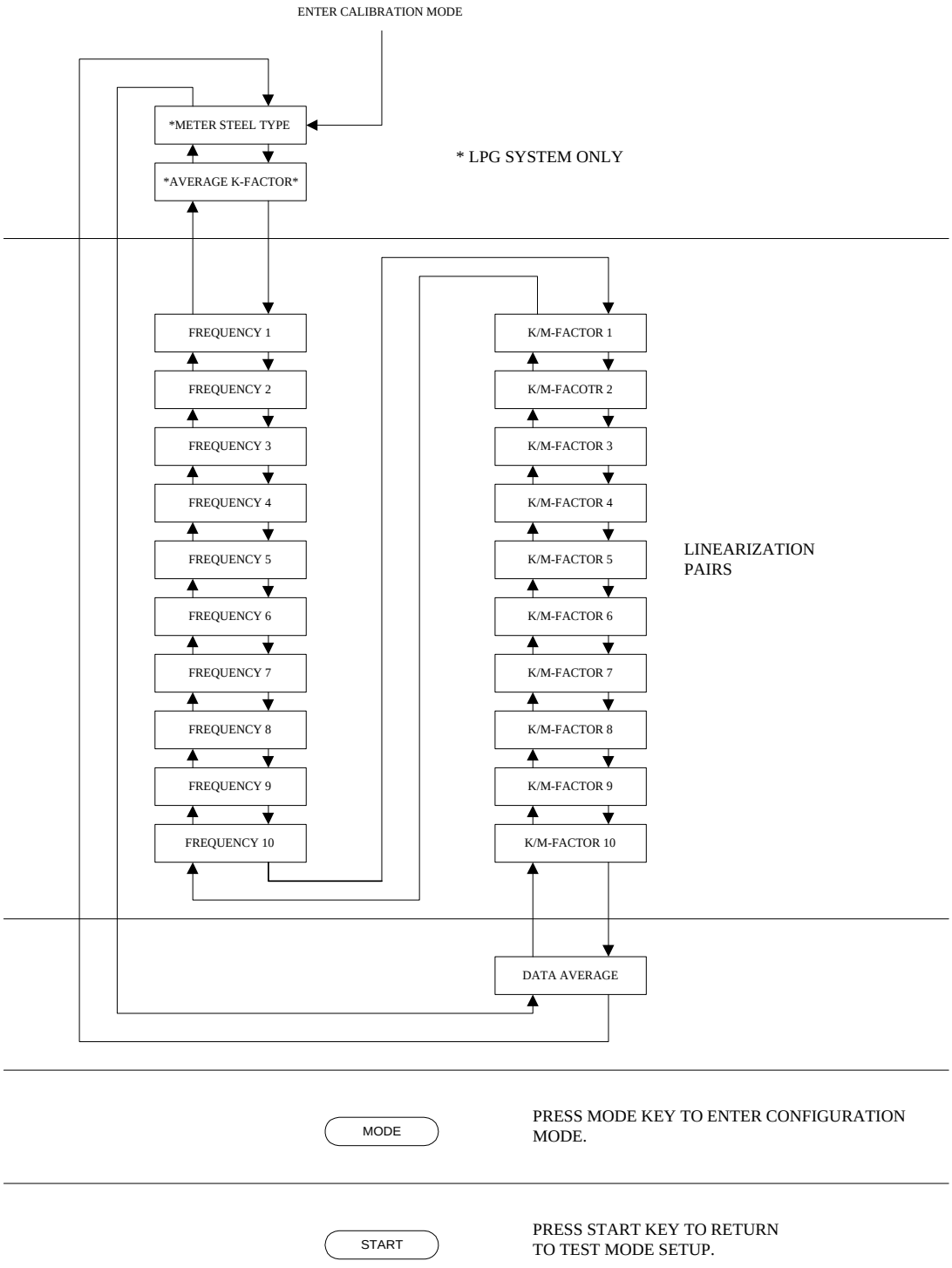

Figure 4-2 CALIBRATION MODE flowchart

4.4.1 METER STEEL TYPE

Sets the master flowmeter stainless steel type. Available settings are 304ss and 316ss. METER STEEL TYPE setting is only available on LPG system.

4.4.2 AVERAGE K-FACTOR

Use the numeric keys to enter the AVERAGE K-FACTOR of the SY14B master flowmeter. This setting is on systems that require use of Meter-Factors instead of K-Factors for the LINEARIZATION table.

4.4.3 LINEARIZATION

The SY14B performs flowmeter linearization. The frequency parameters are entered in units of Hz. The K-Factors are entered in units of pulses per gallon. For systems that uses a AVERAGE K-FACTOR, Meter-Factors are entered in place of K-Factors. This data comes from the factory-supplied flowmeter calibration data sheet or from independent calibration data. Frequency 1 and K/M-Factor 1, and other similarly numbered entries, form table point pairs.

***NOTE**: THE LINEARIZATION PAIRS MUST BE ENTERED STARTING WITH THE LOWEST FREQUENCY FIRST.*

FREQUENCY 1
FREQUENCY 2
FREQUENCY 3
FREQUENCY 4
FREQUENCY 5
FREQUENCY 6
FREQUENCY 7
FREQUENCY 8
FREQUENCY 9
FREQUENCY 10

K/M-FACTOR 1
K/M-FACTOR 2
K/M-FACTOR 3
K/M-FACTOR 4
K/M-FACTOR 5
K/M-FACTOR 6
K/M-FACTOR 7
K/M-FACTOR 8
K/M-FACTOR 9
K/M-FACTOR 10

4.4.4 DATA AVERAGE

The DATA AVERAGE feature is used to smooth out readings for the flow rate, temperature, and pressure that may fluctuate due to rapidly changing conditions. Valid data average entries are 01 to 99. The SY14B will average data before displays are updated for the number of times data average is set. The lower the data average number is, the faster the prover display will respond to changing conditions. The higher the data average number is the slower the SY14B will respond to changing conditions.

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5. CONFIGURATION

5.1 INTRODUCTION

The configuration mode is used to program the SY14B system parameters. The SY14B is preprogrammed from the factory based on user specifications. All numeric configuration parameters for the SY14B are always entered in U.S. customary units of measure regardless of the unit of measure selected.

CAUTION: *WHEN MAKING CHANGES IN THE CONFIGURATION MODE, THE MODE MUST BE EXITED BEFORE TURNING THE SY-14B OFF OTHERWISE THE CHANGES WILL NOT BE UPDATED IN MEMORY.*

5.2 CONFIGURATION MODE ACCESS

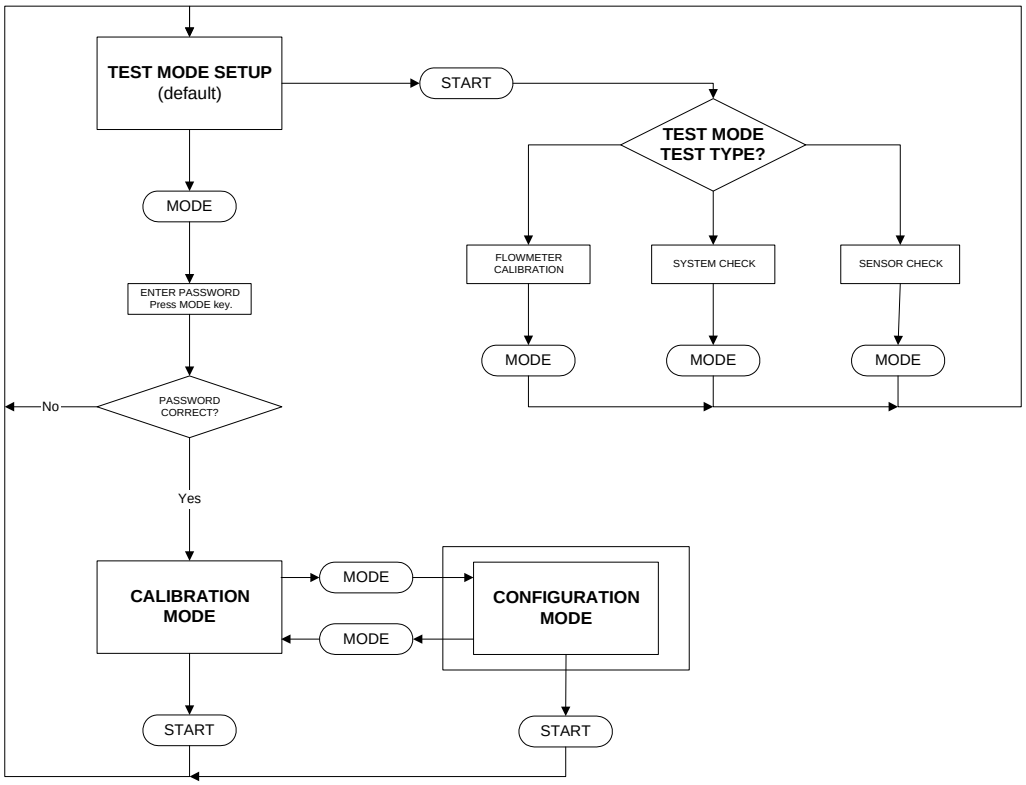

Figure 5-1 CONFIGURATION MODE access flowchart

To enter the CONFIGURATION mode from the default TEST MODE SETUP mode you must first press the MODE key. The next screen will prompt you for the password. After keying in the proper password, press the MODE key again to enter the CALIBRATION mode. From the CALIBRATION mode press the MODE key to enter the CONFIGURATION mode. To exit the CONFIGURATION mode and return to TEST MODE SETUP mode, press the START key. To exit the CONFIGURATION mode and move to the CALIBRATION mode press the MODE key. Upon reentry into the CONFIGURATION mode, the prover displays the last CONFIGURATION field displayed.

5.3 KEYBOARD ENTRY

Field parameters are presented in two basic forms:

NUMERIC FIELDS — Numeric fields are used for date, time, and other needed configuration data. The NUMERIC keys are used for data entry in these fields.

LABEL FIELDS — Label fields display English messages showing which option is currently selected. To change the option press the PRINT key.

The key functionality is as follows:

MODE — Used to advance from one mode of operation to another. When in the CONFIGURATION mode pressing this key will change the prover to the CALIBRATION mode. Pressing the mode key once more will return the program to the CONFIGURATION mode.

DOWN ARROW — Used to scroll down through the field entries.

UP ARROW — Used to scroll up through the selected field entries.

PRINT — In CONFIGURATION mode, this key causes a option change when in a label field. When in a numeric entry field, the PRINT key causes the display cursor to shift to the right one character.

START — When in the CALIBRATION or CONFIGURATION mode, pressing this key will change the prover to the default TEST MODE SETUP mode.

NUMBER KEYS — Allows easy entry of numeric information in numeric entry fields.

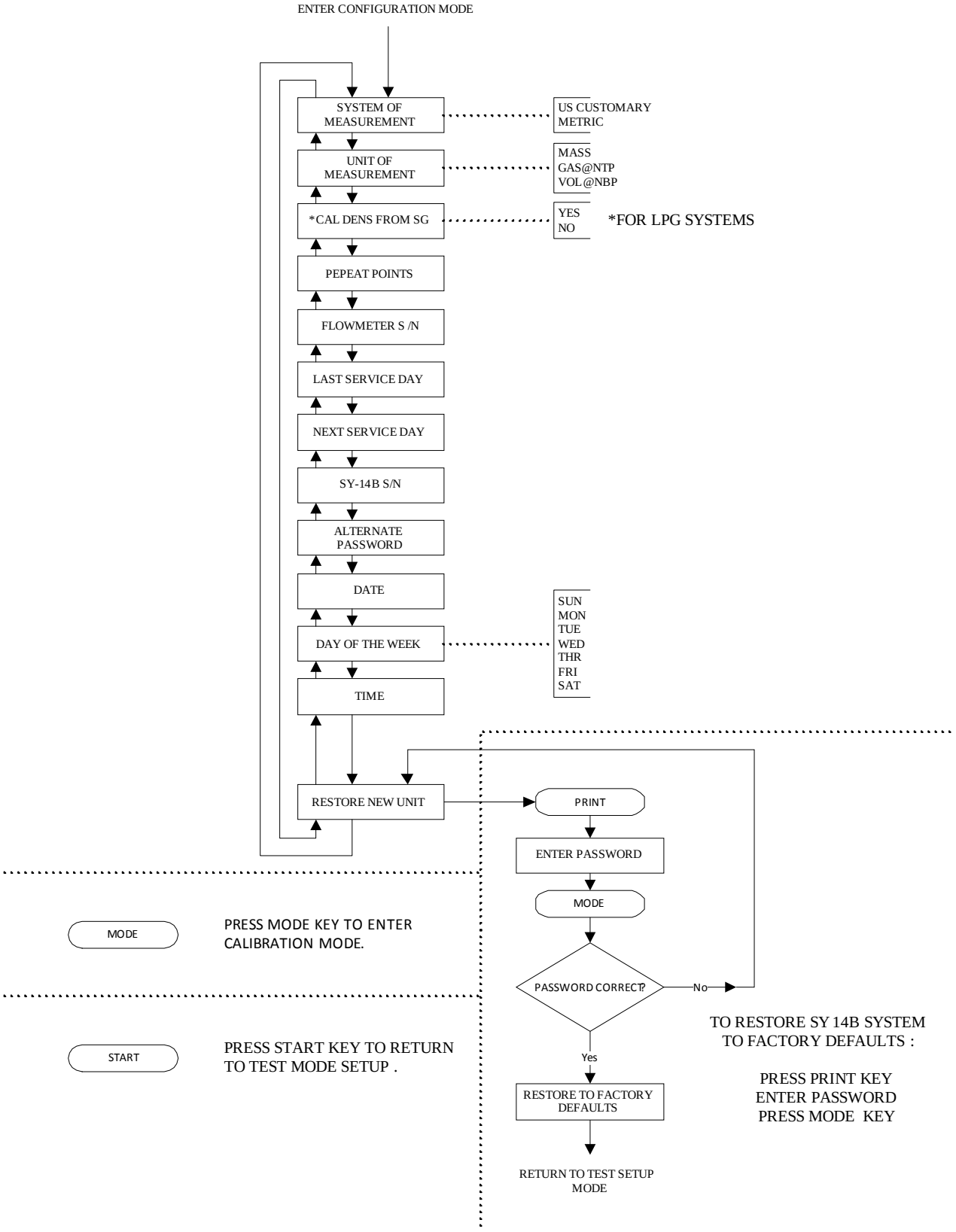
ENTER CONFIGURATION MODE
SYSTEM OF MEASUREMENT
US CUSTOMARY
METRIC
UNIT OF MEASUREMENT
MASS
GAS@NTP
VOL@NBP
*CAL DENS FROM SG
YES
NO
*FOR LPG SYSTEMS
PEPEAT POINTS
FLOWMETER S /N
LAST SERVICE DAY
NEXT SERVICE DAY
SY-14B S/N
ALTERNATE PASSWORD
DATE
DAY OF THE WEEK
SUN
MON
TUE
WED
THR
FRI
SAT
TIME
RESTORE NEW UNIT
PRINT
ENTER PASSWORD
MODE
PASSWORD CORRECT?
No
Yes
RESTORE TO FACTORY DEFAULTS
RETURN TO TEST SETUP MODE
MODE
PRESS MODE KEY TO ENTER CALIBRATION MODE.
START
PRESS START KEY TO RETURN TO TEST MODE SETUP .
TO RESTORE SY 14B SYSTEM TO FACTORY DEFAULTS :
PRESS PRINT KEY
ENTER PASSWORD
PRESS MODE KEY

Figure 5-2 CONFIGURATION MODE flowchart

5.5.1 SYSTEM OF MEASUREMENT

Select the appropriate system of measurement for your various displays of flow, temperature and pressure. Select from U.S. customary or metric.

5.5.2 UNIT OF MEASURE

Select VOL@NTP, MASS, or GAS@NTP to define the delivery units desired. On LPG systems select VOL@60F or MASS. The delivery total will display the following units depending on the SYSTEM OF MEASUREMENT and the UNIT OF MEASURE selected.

UNITS	U. S. CUSTOMARY	METRIC
GAS@NTP	FT3X100	M3
VOL@NBP	GALLONS	LITERS
MASS	POUNDS	KILOGRAMS

5.5.3 CAL DENS FROM SG

Setting CAL DENS FROM SG to yes will cause the SY14B to use the standard density of water to calculate the density for the delivery fluid. The calculated density is used on LPG systems to convert volume units to mass units.

5.5.4 REPEAT POINTS

The Repeat Points setting controls the number of times that each Flowmeter Calibration Point and System Check test are repeated. Enter a number from 2 too 99.

5.5.5 RECAL DATE - MOS

At the end of the Flowmeter Calibration and System Check tests the system will calculate the "Due Date" depending on this setting. Enter a value from 6 to 99 months. The default value for Recal Date is 12 months.

5.5.6 PRESSURE RANGE

Set the Pressure Range setting to agree with the range of the attached pressure transmitter. If the proper range is not selected then in-accurate results will occur. The available ranges are

- 0 to 300 PSI,
- 0 to 500 PSI,
- 0 to 600 PSI

5.5.7 FLOWMETER SN

Allows you to enter the SY14B flowmeter serial number.

5.5.8 LAST SERVICE DAY

Allow you to store the last calibration date of the SY14B.

5.5.9 NEXT SERVICE DAY

Allow you to set the date for the next calibration of the SY14B.

5.5.10 SY14B SYS SN

Allow you to enter the SY14B electronics serial number.

5.5.11 ALTERNATE PASSWORD

The SY14B is shipped with password 2001 from the factory. A unique password is required to protect the SY14B calibration and configuration modes and should be established during the initial commissioning. Passwords between 0001 and 9999 are valid.

This password should be kept confidential. Contact Hoffer Flow Controls, if the password is misplaced.

5.5.12 DATE

The SY14B keeps track of the current date. Enter the date, using the NUMERIC keys in the mm/dd/yy format. The SY14B prevents you from entering an invalid date such as Feb 30.

5.5.13 DAY OF THE WEEK

The SY14B keeps track of the day of the week. Select the appropriate day by pressing the PRINT key.

5.5.14 TIME

The SY14B has a 24 hour clock. Enter the current time in the format of hh:mm:ss using the NUMERIC keys.

5.5.15 RESTORE NEW UNIT

This selection allows you to restore the SY14B to the original setup parameters defined by the factory. Before restoring the factory setup, it is recommended to print out the current setup for the instrument so that this information may be put back in. See the description for PRINT SETUP to see how this is done and print a copy of the current instrument setup before proceeding. To avoid accidental erasure of the current setup parameters, your password must be entered after the PRINT key s pressed. After your password is entered, press the MODE key to restore the unit.

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6. SERVICE GUIDE

6.1 TROUBLE SHOOTING

The SY14B Prover provides extensive self-checking capabilities which assists in troubleshooting and repairing a malfunctioning system. The following is a troubleshooting guide for corrective action in the field.

MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
"PROBE OPEN"	Bad cable connection	Reconnect cable
	Bad cable	Test cable using an ohm meter
	Bad RTD	Replace temperature probe
	Bad PCA-134	Replace/Repair PCA-134
"PROBE SHORT"	Bad cable	Test cable using an ohm meter
	Bad RTD	Replace temperature probe
	Bad PCA-134	Replace/Repair PCA-134
"COIL OPEN"	Bad cable connection	Reconnect cable
	Bad cable	Replace cable
	Bad coil	Replace pickup coil
	Bad PCA-134	Replace/Repair PCA-134
"COIL SHORT"	Bad cable	Test cable with an ohm meter
	Bad coil	Replace pickup coil
	Bad PCA-134	Replace/Repair PCA-134
"TOTAL READ"	Read collision	Maybe self-correcting. If not, replace microcontroller/memory integrated circuit.
	Bad PCA-134	Replace/Repair PCA-134
"FAILED LOOP BACK"	Circuitry Failure	Replace/Repair PCA-134
"COP TIME OUT"	Software/Setup error	Maybe self-correcting. If not, replace microcontroller/memory integrated circuit.
"RATE MALFUNCTION"	Software error	Maybe self-correcting. Disconnect and re-apply power.

MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
"EEPROM FAILURE"	Defective IC	Replace microcontroller integrated circuit.
"2 PHASE WARNING"	Operator error	Operator allowed pressure and/or temperature to be within 25 PSI of the saturated pressure during a delivery. Take no action.
"GAS INHIBIT ON"	Operator error	Operator began a delivery run before the system was fully cooled down
"HIGH FLOW WARNING"	Operator error	Operator gas spun the meter during a delivery run
	High flow setpoint is set to low	Raise the setpoint in the TEST MODE SETUP mode.
"LOW FLOW WARNING"	Operator error	Operator started the delivery run at a flow rate that was outside the meter range or below the low flow setpoint.
	Low flow setpoint is set to low	Lower the low flow setpoint in the TEST MODE SETUP mode.
"COMP RANGE OUT"	Operator error	Operator began delivery before the system was fully cooled down.
	Temperature detector error	Test the temperature feature using simulator.

During operation, certain malfunctions may be observed. The following is a troubleshooting guide for corrective action in the field.

OBSERVED CONDITION	SUGGESTED CORRECTIVE ACTION
SY14B not functioning, no lights on front panel lit.	Check power cable
	Check fuse F-1 on front panel
	Check/Repair prover internal wiring
No display, printer light on	Check fuse F-2
	Check/Repair internal wiring to PCA-134
	Check fuse on PCA-134
	Check/Repair RCA-134
Garbage on Display	Turn the prover off then on
	If problem persists, contact HFC Customer Service Department
Character on display is distorted	Test the keyboard using the keyboard test in the maintenance mode
	Replace display if characters are distorted
Front panel key inoperative	Test the keyboard using the keyboard test in the maintenance mode
	Check the cable wiring and connectors
	Replace keyboard
	Repair/Replace PCA-134
Printer inoperative, but light is on	Press the test key on the printer
	If test fails replace printer
	Run the printer test from the maintenance
	Check printer internal wiring and cabling
Prover inaccurate	Verify operation using Signal simulators ACC-5A, ACC-11 or ACC15.
	Verify that setup parameters are correct for this flowmeter serial number and instrument configuration.
	Inspect the flowmeter internals to ensure proper operation.
	Prove meter and recalibrate against a meter prover or transfer standard.

6.2 CORRECTIVE ACTIONS

CAUTION: The following procedures should be performed by qualified service personnel only. The SY14B Prover is a static-sensitive device and standard practices for static-sensitive parts should be observed.

6.2.1 FUSE REPLACEMENT

The SY14B has five fuses, two external and three internal. Should any one of these fuses require replacement the following procedures should be used.

EXTERNAL FUSES :

1. Turn off the power from the front panel.
2. Press in on the fuse cap and twist clockwise.
3. Pull fuse holder out of socket and remove the fuse from the holder.
4. Verify fuse measures a short with an ohm meter.
5. Replace fuse if an open is measured.
6. Reinstall the fuse holder by pressing and turning clockwise.

INTERNAL FUSES:

1. Turn off the power from the front panel.
2. Disconnect or remove the power supply.
3. Remove the front panel screws from the SY14B.
4. Remove the internal electronics.
5. Carefully remove the fuse from the holder.
6. Verify fuse measures a short with an ohm meter.
7. Replace fuse if an open is measured.
8. Reinstall the internal electronics. Reconnect power.

6.2.2 INTERNAL BATTERY REPLACEMENT

The built in time clock uses a lithium battery to maintain time and date when the power supply is turned off. This battery should last approximately four years under normal operating conditions. If the unit does not maintain the proper time and date after power has been restored to the unit, the lithium battery should be replaced. For battery replacement use the following procedure.

1. Turn off the power from the front panel.
2. Disconnect or remove the power supply.
3. Remove the front panel screws from the SY14B.
4. Remove the internal electronics.
5. Remove the top PCA-134 from its slot.
6. Carefully remove the battery located in the center of the board.
7. Replace the battery with a compatible new battery.
8. Reinstall the printed circuit board into its slot and attach appropriate connectors.
9. Reassemble the SY14B and reconnect power.
10. Go into the setup mode and reset the time and date.

6.2.3 PROGRAM UPGRADE INSTALLATION

The SY14B is programmable allowing for periodic upgrades and/or corrective actions to be performed in the field. Follow these steps:

1. Disconnect power.
2. Remove front panel and the PCA-134 board.
3. Carefully remove the IC U18 with a label attached to it.
4. Install upgraded replacement chip.
5. Reassemble the SY14B and reconnect power.
6. Verify and adjust setup parameters in the setup mode.

6.2.4 DISPLAY CONTRAST ADJUSTMENT PROCEDURE

The display contrast and viewing angle is factory-adjusted at eye level. However, the display contrast may be adjusted for optimum viewing angle and contrast after installation.

1. Disconnect power.
2. Remove front panel being careful not to strain the interconnecting cables.
3. Using a small, nonmetallic screwdriver, turn the control counter-clockwise to darken the display or clockwise to lighten the display.
4. After completing adjustments replace the front panel making sure that the interconnecting wiring is inside the enclosure.

6.2.5 Microcontroller/MEMORY REPLACEMENT

If replacement of the microcontroller/memory chip is necessary, refer to the instructions which accompany the new chip. An overview of the steps follows.

1. Print current setup data.
2. Disconnect power to the SY14B.
3. Disassemble and remove the PCA-134 card.
4. Carefully remove the MC68HCP11 IC chip being careful not to crack the chips socket. This is the largest square IC on the printed circuit board.
5. Install the replacement chip being careful not to bend any of the leads.
6. Reassemble the SY14B.
7. Allow the SY14B to perform a power-up self test to determine if the unit is operating properly.
8. The SY14B should perform a SETUP MEMORY step as part of the first power-up sequence.
9. If it does not, go to the CONFIGURATION mode and perform a restore new unit.
10. Next, use the CALIBRATION and CONFIGURATION modes to examine the contents of the various setup parameters.
11. If necessary, reenter the correct setup parameters.

6.2.6 SENSITIVITY ADJUSTMENT PROCEDURE

The SENSITIVITY is a control used to eliminate false pickup by increasing the signal threshold. This control has been factory adjusted to a level that is satisfactory for the flowmeter size and pickup coil supplied with the system.

1. It is suggested that the sensitivity be turned down in increments of 1/4 turns.
2. After each adjustment, test the unit to determine if the noise pickup problem has been eliminated.
3. After a satisfactory noise rejection has been achieved, verify that the SY14B can satisfactorily measure the output signal from the flowmeter.

6.3 REPLACEMENT PARTS

- FUSE, F1, 0.5A, AGC
- FUSE, F2, 2A, AGC
- FUSE, PCB FUSE, 1A, AGC
- BATTERY, PANASONIC BR2330
- PCA 134-(*)-24V-PROVER (* Specify product)
- PCA 134-(*)-24V-SLAVE (* Specify product)
- Following for older models, check with factory for applicability:
- FUSE, PRINTER POWER SUPPLY, 220V SYSTEM, 2/10A, 3AG
- FUSE, PRINTER POWER SUPPLY, 110V SYSTEM, 4/10A, 3AG

7. SYSTEM PROVING

7.1 GENERAL

This chapter details test procedures and requirements for calibrating cryogenic liquid-measuring devices using the Hoffer portable cryogenic transfer standard. The procedures have been drafted in accordance with the guidelines of Handbook 44 and accepted proving practice. The procedures have been broadly outlined to allow trained operators to successfully calibrate Hoffer metering systems installed on bulk cryogenic transports. The procedures may be modified for testing stationary ground stations in many cases. The procedures may also be applied to allow testing of cryogenic flowmeters manufactured by other venders whose flowmeters use magnetic pickups.

The frequency of re-calibration of the transfer standard must be addressed by the users to be consistent with use. One year calibration interval is recommended by Hoffer Flow Controls, Inc.

Individual bulk transports should be tested at periodic intervals, after they have undergone servicing, or whenever calibration drift is suspect. State requirements may also influence the re-calibration interval.

The flowmeter systems should be tested on the service fluid to be commercially measured. Both the transfer standard and the meter system to be proved should be tested prior to the start of liquid testing using the simulators. See chapter 1 section 1.7 for listing of available simulators. The flowmeter system to be tested and the transfer standard should be pre-cooled prior to the start of testing.

7.2 SYSTEM SETUP

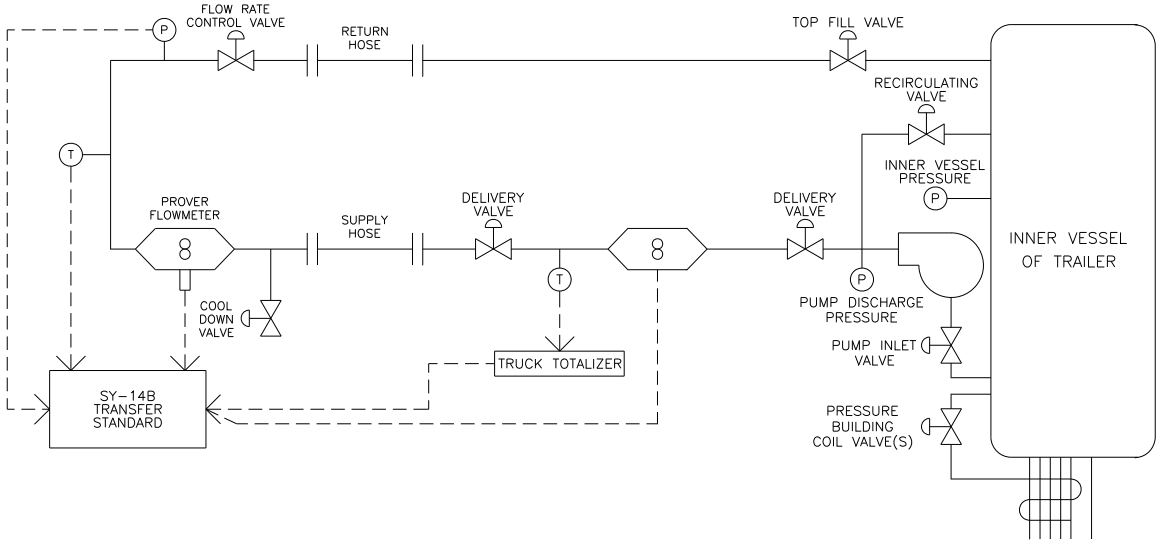

Figure 7-1 System setup.

- Perform a complete test of the truck totalizer system prior to proving the trailer with the SY14B.
- Perform a visual inspection of cabling.
- Perform an electrical test of the truck totalizer.
- Examine flowmeter and/or replace the flowmeter bearings.
- Verify proper flowmeter pickup coil resistance with an ohm meter.
- Fill the trailer with a full load of cold product.
- Connect the system to be tested to the prover system using standard trade practices. Refer to the above diagram as a general guide line for proper hookup of the proving system.
- Turn the power on for both metering systems.

> ***NOTE:*** *Remove the printer head and check the paper level before performing a long sequence of runs..*

- In the TEST MODE SETUP field "TEST TYPE" use the PRINT key to select SENSOR CHECK. Press the START key to enter the SENSOR CHECK test mode.
- Verify that the SY14B is setup properly by printing out the setup information. For ACE units, obtain a print out of the ACE setup. Settings for DEFAULT TEMPERATURE, DEFAULT PRESSURE, and DEFAULT DENSITY are printed out in US CUSTOMARY units. When setting up the SY14B, pay particular attention to the UNIT OF MEASUREMENT and SYSTEM OF MEASUREMENT. These settings are crucial for the SYSTEM CHECK test mode. Refer to chapters 4 and 5, if any of the SY14B calibration or configuration parameters needs to be updated.
- While in SENSOR CHECK test mode, cool down the pump, truck flowmeter and prover taking

> ***WARNING:*** *If the SY14B units and System of Measure option in the CONFIGURATION Mode do not match the display units of the UNIT UNDER TEST(UUT), inaccurate test results will occur.*

care not to gas spin the trailer or prover flowmeters. Use the following COOL DOWN procedure to properly cool down the system:

1. Open pump inlet valve.
2. Open recirculating valve.
3. Open delivery valve.
4. Gradually open outlet valve of prover. Gravity should now start to cool down the prover
5. If necessary use blow down valve of prover to vent gas, to aid in cool down.
6. When system is nearing cool down, close outlet valve of prover, start pump recirculating back into the tank. Gradually open the outlet valve of the prover to finish cool down of prover. Let the pump continue to recirculate for two or three minutes.
7. Use the up or down arrow keys of the prover to display the FLOWRATE.
8. Raise the pump speed to its maximum safe operating speed. Read the flowrate on the prover display, this is the MAX FLOWRATE.
9. Lower the pump speed to its minimum setting. Read the flowrate on the prover display, this is the MIN FLOWRATE.

10. Use the up and down arrows on the prover to display STD TEMPERATURE. Compare this STD temperature to the temperature displayed on the UUT. If both temperature readings are stabilized and within one degree of each other, then the system is properly cool down.

- Return to TEST MODE SETUP by pressing the MODE key. Refer to Chapter 3 Section 4 for instructions on entering in the test parameters. Enter in the minimum and maximum flowrates obtained in the COOL DOWN procedure. Enter in the various serial numbers of the UUT system. If this is a LPG system, enter in the K-FACTOR of the UUT flowmeter and enter in the SPECIFIC GRAVITY of the working fluid. For multi-fluid systems, select the FLUID TYPE to match the fluid that is in use. On CO2 systems, select the proper DELIVERY MODE. For system factor calculation to be perform in the SYSTEM CHECK test mode, set CAL METHOD to SYSTEM FACTOR.
- If the system under test is not equipped with temperature and pressure probes, use the following charts to determine the TEST MODE SETUP parameters required to configure the prover.

Density Correction on all systems except for LPG. Volume Correction applied on LPG systems.						
PROVER SETUP FIELDS	**ACE SYSTEM**			**SYSTEM FACTOR SYSTEM** i.e. MODEL 127, 225, etc.		
PROBES ATTACHED	NONE			NONE		
DENS CORR METH or VOL CORR METH	NONE	TEMP and TEMP & STEEL	TEMP & PRES and TEMP, PRESS & ST	NONE	TEMP	TEMP & PRESS
DEFAULT TEMP	NA	AS SPECIFIED	AS SPECIFIED	NA	AS SPECIFIED	AS SPECIFIED
DEFAULT PRES	NA	NA	AS SPECIFIED	NA	NA	AS SPECIFIED
DEFAULT DENS	AS SPECIFIED	NA	NA	AS SPECIFIED	NA	NA
LPG SPECIFIC GRAVITY	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED

- If the system under test is equipped with a temperature probe and no pressure probe, use the following chart to determine the TEST MODE SETUP parameters required to configure the prover.

PROVER SETUP FIELDS	**ACE SYSTEM**			**SYSTEM FACTOR SYSTEM** i.e. MODEL 127, 225, etc.		
PROBES ATTACHED	TEMP		TEMP & PRES	TEMP		TEMP & PRES
DENS CORR METH or VOL CORR METH	TEMP and TEMP & STEEL	TEMP & PRES and TEMP, PRES & ST	TEMP & PRES and TEMP, PRES & ST	TEMP	TEMP & PRES	
DEFAULT TEMP	NA	NA	NA	NA	NA	NA
DEFAULT PRES	NA	AS SPECIFIED	NA	NA	AS SPECIFIED	NA
DEFAULT DENS	NA	NA	NA	NA	NA	NA
SPECIFIC GRAVITY LPG	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED
DEFAULT DENSITY LPG with CAL DENS FROM SG = NO	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFIED	AS SPECIFYED

- When testing an ACE system, if you are required to enter in the default values for temperature, pressure, and density into the SY14B, use the following table.

ACE SYSTEMS						
FLUID TYPE	DEFAULT TEMP		DEFAULT PRES		DEFAULT DENSITY	
	US CUST. UNITS	METRIC UNITS	US CUST. UNITS	METRIC UNITS	US CUST. UNITS	METRIC UNITS
LIN	83.9 deg K	83.9 deg K	200 PSIA	13.79 BAR ABS	6.509 LBS/GAL	0.7799 KG/LTR
LOX	97.6 deg K	97.6 deg K	200 PSIA	13.79 BAR ABS	9.2307 LBS/GAL	1.1061 KG/LTR
LAR	95.5 deg K	95.5 deg K	200 PSIA	13.79 BAR ABS	11.2889 LBS/GAL	1.35270 KG/LTR
LH2	83.9 deg K	83.9 deg K	150 PSIA	10.34 BAR ABS	6.509 LBS/GAL	0.7799 KG/LTR
CO2	2.0 deg F	-16.6 deg C	500 PSIA	34.48 BAR ABS	8.482 LBS/GAL	1.0163 KG/LTR
LNG	116.48 deg K	116.48 deg K	100.00 PSIA	6.896 BAR ABS	3.4724 LBS/GAL	0.41608 KG/LTR
LPG	60.0 deg F	15.56 deg C	243.4 PSIG	16.79 BAR GA	NA	NA

- When testing Models 127, 225, etc., if you are required to enter in the default values for temperature, pressure and density into the SY14B, refer to the following table.

Models 127, 225, etc.						
FLUID TYPE	DEFAULT TEMP		DEFAULT PRES		DEFAULT DENSITY	
	US CUST. UNITS	METRIC UNITS	US CUST UNITS	METRIC UNITS	US CUST UNITS	METRIC UNITS
LIN	83.9 deg K	83.9 deg K	200 PSIA	13.79 BAR ABS	6.7381 LBS/GAL	0.80740 KG/LTR
LOX	97.6 deg K	97.6 deg K	200 PSIA	13.79 BAR ABS	9.5222 LBS/GAL	1.1410 KG/LTR
LAR	94.5 deg K	94.5 deg K	200 PSIA	13.79 BAR ABS	11.6329 LBS/GAL	1.39392 KG/LTR
CO2	10 deg F	-12.22 deg C	500 PSIA	34.47 BAR ABS	8.7222 LBS/GAL	1.0451 KG/LTR

- Select the TEST MODE of the SY14B by setting the "TEST TYPE" field. Use the PRINT key to select either FLOWMETER CAL or SYSTEM CHECK test type. Refer to the next sections depending on the selected TEST TYPE.

NOTE: *Testing may now begin. The discharge valve on the trailer should remain fully open. The testing should cover the range of flow and pressure that the unit will normally see in service. Pump discharge pressures of 150 PSI or greater are recommended to avoid excessive pump wear. This is done by simulating back pressure with the outlet valve of the SY-14B. Lower pressures may also result in cavitation of the truck or prover metering system. It is also necessary to maintain the internal vessel pressure during proving to avoid cavitation in the pump or flowmeters. The pump speed, prover outlet valve, and the pump recirculating valve may be used to simulate various flow rates and discharge pressures.*

7.3 TEST MODE, TEST TYPE = FLOWMETER CALIBRATION

This test mode is used to perform flowmeter calibration that determines the frequencies, K/M-factors and average K/M-factor to be enter into the ACE system CALIBRATION mode. After selecting the "FLOWMETER CAL" as the TEST TYPE, press the START key to enter the FLOWMETER CALIBRATION test mode.

> ***NOTE:*** *HFC recommends that the AUTO TEST mode (AUTO TEST = YES) be used. If preferred, the manual test mode may be used by setting AUTO TEST = NO. When using the manual test mode, it will required pressing the START key to stop each run.*

> ***NOTE:*** *During the proving runs, the SY14B monitors flowrate, frequency, and fluid conditions. If an operation error occurs, such as GAS INHIBIT, totalization may stop. Please refer to Chapter 6 SERVICE GUIDE when these error conditions exist.*

Use the following procedure for flowmeter calibration:

1. Adjust the flow rate to the suggested flowrate displayed on the SY14B. If the flowrate is adjusted to within +/- 2.5% of the SET TO flowrate then PRESS START will be flashed on the screen.
2. Press the START key to begin a calibration run. The SY14B will control the cycling of the calibration runs until the value of REPEATS POINTS is reached. While the SY14B is running it will print the total, flowrate, frequency, and K/M-factor for each run. After all of the calibration runs for a single calibration point flowrate is completed, the SY14B will stop its cycle process and print the averages of the total, flowrate, frequency and K/M-factor. After printing the averages the SY14B will print the delta repeatability of the frequency and K/M-factor. While the printing is occurring the SY14B will ask the user to adjust the flowrate for the next calibration point.
3. At this point you can review the print ticket information and decide if the data resulting from the calibration runs is acceptable. If the data is not acceptable then you can rerun the same calibration point again by using the UP and DOWN arrow keys of the SY14B to set the calibration point flowrate. If the data from the calibration point runs are acceptable, then return to step 1 above and continue with the flowmeter calibration.
4. Repeat steps 1 through 3 until all five calibration point runs have been completed. This will be indicated by FREQ 1 and KFACT 1 being displayed after the last set of calibration point runs are completed.
5. You can review any of the saved runs by pressing the UP or DOWN arrow keys. If you wish to rerun a run, press the START key while viewing that run. If you are satisfied with all the runs, press the PRINT key to create the FINAL CALIBRATION REPORT. The SY14B will return to TEST MODE SETUP after printing of the FINAL CALIBRATION REPORT is initiated.

- Enter the FREQ s, K/M-FACTOR s and K/M-AVERAGE into the ACE CALIBRATION mode. Calculate the system factor setting for units such as the Model 127, or Model 225. This concludes the first calibration phase of the proving run.
- Perform a final run using the System Check test mode. Use 1.0000 as the Old System Factor for an ACE unit, and use the system factor calculated in the above step for all other units. Follow the procedure in step 7.4.

ACEII / PROVER Users

> ***NOTE:*** *Hoffer Flow Controls recommends programming the ACEII with a 5-point K-Factor table as calculated by the prover calibration and indicated on the Final Calibration Report printout.*

After all 5 prover calibration points have been calculated, the new K/M-FACTOR must be entered into the ACEII from the METER CONFIGURATION menu using the following procedure.

1. Press MENU
2. Select PROGRAM
3. Select METER CONFIGURATION
4. SCROLL down to LINEARIZATION and press EDIT
5. Select K-FACTOR TABLE and press ACCEPT
6. SCROLL down to TBL1 NUMBER OF POINTS and press EDIT
7. Use → Key (Center Button) to move cursor to the right until the last digit is highlighted
8. Use Up and Down SCROLL keys to increment/decrement the last digit until 5 is displayed
9. Press ACCEPT
10. EDIT TBL1 POINT #1 – FREQ and enter point #1 Freq from the Final Calibration Report printout
11. Press ACCEPT
12. EDIT TBL1 POINT #1 – FACTOR and enter point #1 K-Factor from the Final Calibration Report printout
13. Press ACCEPT
14. Continue entering the calibration data in this manner until all 5 points have been entered
15. Press HOME
16. Select YES at Save Data prompt
17. Select RESET at Reset prompt

7.4 TEST MODE, TEST TYPE = SYSTEM CHECK

This test mode is used to prove the calibration accuracy of the UUT system. After selecting "SYSTEM CHECK" as the TEST TYPE, press the START to enter the SYSTEM CHECK test mode.

> ***NOTE:*** *HFC recommends that the AUTO TEST mode (AUTO TEST = YES) be used. If preferred, the manual test mode may be used by setting AUTO TEST = NO. When using the manual test mode, it will required pressing the START key to stop each run.*

> ***NOTE:*** *During the proving runs, the SY14B monitors flowrate, frequency, and fluid conditions. If an operation error occurs, such as GAS INHIBIT, totalization may stop. Please refer to Chapter 6 SERVICE GUIDE when these error conditions exist.*

Use the following procedure to perform a system check.

1. Adjust the flow rate as desire or as close as possible to the suggested flowrate displayed on the SY14B.
2. Clear the UUT total and press the START key to begin the proving runs. Monitor all conditions and maintain a steady flow rate during the proving runs. Use the UP and DOWN arrow keys of the SY14B to review the accumulated data. The SY14B will run each proving run for approximately 2 minutes and then automatically stop itself. The total number of proving runs that the SY14B performs is determine by the setting of REPEAT POINTS.
3. When the SY14B prompts you for the UUT TOTAL, enter the DELIVERY TOTAL of the UUT. After entering the delivery total. clear the UUT total. After clearing the UUT total, press the START or PRINT key of the SY14B to begin the next proving run.
4. Repeat step 3 until the value of REPEAT POINTS is reached. After the total number of repeated proving runs are completed the SY14 will prompt you for the OLD data depending on the setting of CAL METHOD.
5. Enter in the OLD SYSTEM/METER-FACTOR or OLD K-FACTOR into the SY14B. After the OLD data is entered, press the PRINT or START key. The SY14 will display the NEW calculated data based on the setting of CAL METHOD.
6. If the data entered in step 5 is incorrect press the START key to reenter the OLD data. If the OLD data entered in step 5 is correct, press the PRINT key to create the final report. After the final report is initiated the SY14B will return to the TEST MODE SETUP mode.

When testing is complete drain prover piping completely. Store in a manner to prevent entry of water into the prover piping.

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8. CALIBRATING THE SY14B VER 2

8.1 INTRODUCTION

This chapter details test procedures and requirements for calibrating an SY14B prover transfer standard in the field using the HFC corporate SY14B prover transfer standard. For simplicity we will refer to the HFC corporate prover as the CALIBRATOR and the customer transfer standard as the UUT.

There are five parts to this procedure, they are: UUT SYSTEM OPERATION CHECK, SYSTEM COOL DOWN, UUT CALIBRATION PART 1, UUT CALIBRATION PART 2, and UUT SYSTEM CHECK

8.2 TEST EQUIPMENT REQUIRED

This procedure requires the following equipment:

1. HFC Corporate Prover Transfer Standard(SY14B VER 2, Master Flowmeter and Temp Probe).
2. SCA6CC2-DS, Dual Start/Stop cable.
3. *SY14B-VR2-PR, Proving cable.
4. SY14B-VR2-FM, UUT Flowmeter cable.
5. SCA6CC2-S, Signal Cable(prover).
6. SCA6HP3-P, Power Cable(prover).
7. SCA-25-AB1 Ground Cable.
8. AC line cord.
9. Ohm meter.

***Note:** The SY14B-VR2-PR Proving cable is used in place of the Dual Start/Stop cable in Section 8.7, UUT SYSTEM CHECK. This Proving cable will eliminate all errors involved in the shorting of the flowmeter signal.

8.3 UUT SYSTEM OPERATION CHECK

Perform a complete test of the UUT transfer standard using the following procedure.

1. Perform a visual inspection of all cabling.
2. Examine flowmeter and/or replace the flowmeter bearings.
3. Verify proper flowmeter pickup coil resistance with an ohm meter.

- Connect the CALIBRATOR and UUT system using standard trade practices and the figure below.

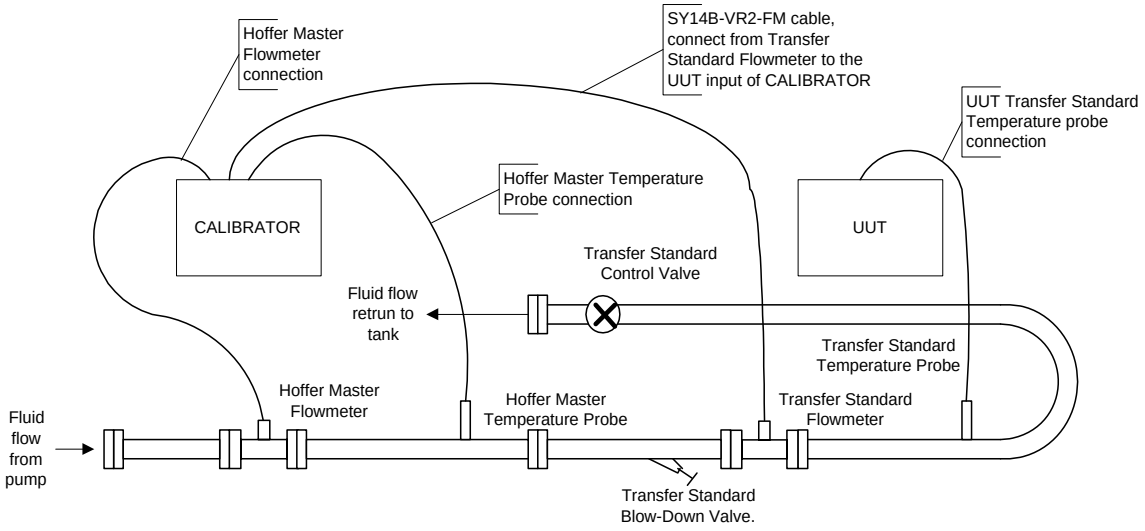

Figure 8-1 Connection diagram for Flowmeter Calibration

- Turn the power on for both the CALIBRATOR and UUT systems.
- On both the CALIBRATOR and UUT systems use the PRINT key at the label field "TEST TYPE" to select SENSOR CHECK. Press the START key on both systems to enter the SENSOR CHECK test mode.
- On both systems use the scroll key to display PRINT SETUP. Press the PRINT keys on both systems to print the setups. Verify that the CALIBRATOR configuration matches the configuration of the UUT system. Pay particular attention to the UNIT OF MEASUREMENT and SYSTEM OF MEASUREMENT settings. If the configuration of both units do not match, enter the CONFIGURATION mode of the CALIBRATOR and set its configuration to match the configuration of the UUT.

> ***WARNING:*** *If the SY14B units and System of Measure option in the CONFIGURATION Mode do not match the display units of the UNIT UNDER TEST(UUT), inaccurate test results will occur.*

- Continue with the next section SYSTEM COOL DOWN.

8.4 SYSTEM COOL DOWN

- While in SENSOR CHECK test mode, cool down the pump, piping, CALIBRATOR transfer standard, and UUT transfer standard taking care not to gas spin the CALIBRATOR and UUT flowmeters. Use the following COOL DOWN procedure to properly cool down the system.

  1. Open pump inlet valve.
  2. Open recalculating valve.
  3. Open delivery valve.
  4. Gradually open outlet valve of the Transfer Standard. Gravity should not start to cool down the system.
  5. If necessary use blow down valve of the Transfer Standard to vent gas.
  6. When system is nearing cool down, close outlet valve of transfer standard, start pump recalculating back into the tank. Gradually open the outlet valve of the prover to finish cool down of prover. Let the pump continue to recalculate for two or three minutes.
  7. Use the up or down arrow keys of the CALIBRATOR to display the FLOWRATE.
  8. Raise the pump speed to its maximum safe operating speed. Read the flowrate on the CALIBRATOR display, this is FLOWRATE_MAX_CD
  9. Lower the pump speed to its minimum setting. Read the flowrate on the CALIBRATOR display, this is FLOWRATE_MIN_CD

> ***WARNING:*** *In steps 8 and 9 above you have determined the operating flowrate range of the test system. If the operating flowrate range of the test system does not cover the operating flowrate range of the transfer standard flowmeter, then the transfer standard will not be able to properly calibrate the truck systems.*

  10. Use the up and down arrow keys on the CALIBRATOR and UUT to display STD TEMPERATURE. Compare the CALIBRATOR STD temperature to the STD temperature displayed on the UUT. If both temperature readings are stabilized and within one degree of each other, then the system is properly cool down.

- Continue with the next section, UUT CALIBRATION PART 1.

8.5 UUT CALIBRATION PART 1

- Return the CALIBRATOR to TEST MODE SETUP by pressing the MODE key. Refer to Chapter 3 Section 4 for instructions on entering in the test parameters. Make the following settings to the CALIBRATOR TEST MODE SETUP mode:

  1. TEST TYPE = FLOWMETER CAL
  2. USE PROVER IN = NO.
  3. AUTO TEST = YES.
  4. FLUID TYPE = working fluid type on LIN LOX LAR systems.
  5. DELIVERY MODE = delivery mode of CO2 system.
  6. UUT AVER K-FACT (LPG systems) = enter K-Factor of UUT flowmeter.
  7. PROBES ATTACHED = TEMPERATURE
  8. DENS CORR METH (non LPG systems) = TEMPERATURE.
  9. VOL CORR METH (LPG systems) = TEMPERATURE
  10. DEFAULT PRES = operating fluid pressure of system.

11. SPECIFIC GRAVITY (LPG systems) = specific gravity of working fluid.
12. MIN FLOWRATE = FLOWRATE_MIN_CD
13. MAX FLOWRATE = FLOWRATE_MIN_CD + ((FLOWRATE_MAX_CD - FLOWRATE_MIN_CD)*(4/9))
14. METER SERIAL NUMBER = serial number of transfer standard flowmeter.
15. ELECTRONICS SERIAL NUMBER = serial number of transfer standard SY14B.

Testing may now begin. The discharge valve on the trailer should be left fully open. The testing should cover the range of flow and pressure that the unit will normally see in service. Pump discharge pressures of 150 PSI or greater are recommended to avoid excessive pump wear. This is done by setting back pressure with the outlet valve of the UUT transfer standard. Lower pressures may also result in cavitation of the CALIBRATOR or UUT metering system. It is also necessary to maintain the internal vessel pressure during proving to avoid cavitation in the pump or flowmeters. The pump speed, prover outlet valve, and the pump recalculating valve may be used to set various flow rates and discharge pressures.

NOTE: *During the* calibration *runs, the SY14B monitors flowrate, frequency, and fluid conditions. If an operation error occurs, such as GAS INHIBIT, totalization may stop. Please refer to Chapter 6 SERVICE GUIDE when these error conditions exist.*

- Use the following procedure for part 1 of the UUT flowmeter calibration:
  1. Adjust the flow rate to the suggested flowrate displayed on the CALIBRATOR. If the flowrate is adjusted to within +/- 2.5% of the SET TO flowrate then PRESS START will be flashed on the screen.
  2. Press the START key to begin a calibration run. The CALIBRATOR will control the cycling of the calibration runs until the value of REPEATS POINTS is reached. While the CALIBRATOR is cycling it will print the total, flowrate, frequency, and K/M-factor for each run. After all of the calibration runs for a single calibration point flowrate is completed, the CALIBRATOR will stop its cycle process and print the averages of the total, flowrate, frequency and K/M-factor. After printing the averages the CALIBRATOR will print the delta repeatability of the frequency and K/M-factor. While the printing is occurring the CALIBRATOR will ask the user to adjust the flowrate for the next calibration point.
  3. At this point you can review the printed ticket information and decide if the data resulting from the calibration runs is acceptable. If the data is not acceptable then you can rerun the same calibration point again by using the UP and DOWN arrow keys of the CALIBRATOR to set the calibration point flowrate. If the data from the calibration point runs are acceptable, then return to step 1 above and continue with the flowmeter calibration.
  4. Repeat steps 1 through 3 until all five calibration point runs have been completed. This will be indicated by FREQ 1 and KFACT 1 being displayed after the last set of calibration point runs are completed.
  5. You can review any of the saved runs by pressing the UP or DOWN arrow keys. If you wish to rerun a run, press the START key while viewing that run. If you are satisfied with all the runs, press the PRINT key to create the FINAL CALIBRATION REPORT. The CALIBRATOR will return to TEST MODE SETUP after printing of the FINAL CALIBRATION REPORT is initiated.
- Continue with the next section, UUT CALIBRATION PART 2.

8.6 UUT CALIBRATION PART 2

- Make the following changes to the TEST MODE SETUP mode of the CALIBRATOR:
  1. MIN FLOWRATE = FLOWRATE_MIN_CD + ((FLOWRATE_MAX_CD - FLOWRATE_MIN_CD) * (5/9)).
  2. MAX FLOWRATE = FLOWRATE_MAX_CD.
- Press the START key of the CALIBRATOR to enter the FLOWMETER CAL test mode. Use the following procedure for part 2 of the UUT flowmeter calibration:
  3. Adjust the flow rate to the suggested flowrate displayed on the CALIBRATOR. If the flowrate is adjusted to within +/- 2.5% of the SET TO flowrate then PRESS START will be flashed on the screen.
  4. Press the START key to begin a calibration run. The CALIBRATOR will control the cycling of the calibration runs until the value of REPEATS POINTS is reached. While the CALIBRATOR is cycling it will print the total, flowrate, frequency, and K/M-factor for each run. After all of the calibration runs for a single calibration point flowrate is completed, the CALIBRATOR will stop its cycle process and print the averages of the total, flowrate, frequency and K/M-factor. After printing the averages the CALIBRATOR will print the delta repeatability of the frequency and K/M-factor. While the printing is occurring the CALIBRATOR will ask the user to adjust the flowrate for the next calibration point.
  5. At this point you can review the printed ticket information and decide if the data resulting from the calibration runs is acceptable. If the data is not acceptable then you can rerun the same calibration point again by using the UP and DOWN arrow keys of the CALIBRATOR to set the calibration point flowrate. If the data from the calibration point runs are acceptable, then return to step 1 above, and continue with the flowmeter calibration.
  6. Repeat steps 1 through 3 until all five calibration point runs have been completed. This will be indicated by FREQ 1 and KFACT 1 being displayed after the last set of calibration point runs are completed.
  7. You can review any of the saved runs by pressing the UP or DOWN arrow keys. If you wish to rerun a run, press the START key while viewing that run. If you are satisfied with all the runs, press the PRINT key to create the FINAL CALIBRATION REPORT. The SY14B will return to TEST MODE SETUP after printing of the FINAL CALIBRATION REPORT is initiated.
- You now have two FINAL CALIBRATION REPORTs. Use the CALIBRATION REPORT that has the lower flowrates, for the first five linearization pairs that are in enter in the UUT CALIBRATION mode. Use the CALIBRATION REPORT that has the highest flowrates as the second five linearization pairs that are in enter into the UUT CALIBRATION mode. See Chapter 4 for information on entering in the calibration results. To recap, the CALIBRATION REPORT obtain from PART 1 is used to program linearization pairs one through five. The CALIBRATION REPORT obtain in PART 2 is used to program the linearization pairs six through ten.
- Perform a set of final runs using the SYSTEM CHECK test mode of both the CALIBRATOR and UUT systems. Continue on with the next section.

8.7 UUT SYSTEM CHECK

- Make the following changes to the system wiring:
  1. Remove SY14B-VR2-FM cable from the CALIBRATOR and the UUT flowmeter.
  2. Reconnect the UUT flowmeter to the UUT SY14B electronics console.
  3. Connect SY14B-VR2-PR cable from CALIBRATOR prover connection to UUT prover connection. See figure below.

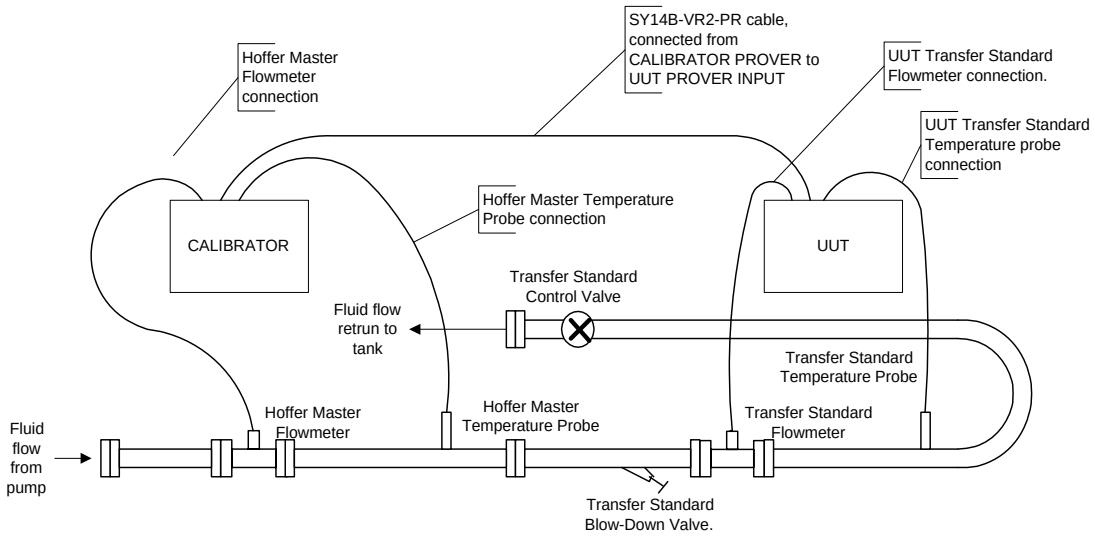

Figure 8-2 UUT System Check wiring diagram

- After programming in the results from FLOWMETER CALIBRATION PART 1 and 2, Press the START key to return the UUT system back to the TEST MODE SETUP mode. Make the following changes to the UUT TEST MODE SETUP mode.
  1. TEST TYPE = SYSTEM CHECK
  2. USE PROVER IN = YES
  3. PR SIGNAL TYPE = LEVEL
  4. AUTO TEST = NO
  5. FLUID TYPE = type of fluid being used on LIN LOX LAR systems.
  6. DELIVERY MODE = delivery mode of CO2 system.
  7. PROBES ATTACHED = TEMPERATURE, note, if both temperature and pressure probes are present then set PROBES ATTACHED to TEMP & PRES.
  8. VOIL CORR METH (LPG systems) = TEMPERATURE
  9. DENS CORR METH (not LPG systems) = TEMPERATURE.
  10. DEFAULT PRES = set to flowing pressure of system.
  11. SPECIFIC GRAVITY (LPG systems) = fluid specific gravity.
  12. MIN FLOWRATE = FLOWRATE_MIN_CD.
  13. MAX FLOWRATE = FLOWRATE_MAX_CD.

- PRESS the START key of the UUT SY14B twice.
- Use the up or down scroll key to display DELIVERY TOTAL on the UUT' SY14B.
- Change the TEST TYPE of the CALIBRATOR to SYSTEM CHECK.
- PRESS the START key of the CALIBRATOR to enter the SYSTEM CHECK test mode. Use the following procedure to perform a system check of the UUT system.
    1. Adjust the flow rate as desire or as close as possible to the suggested flowrate displayed on the CALIBRATOR.
    2. Press the ZERO key to clear the UUT total. Press the START key of the CALIBRATOR to begin the proving runs. Monitor all conditions and maintain a steady flow rate during the proving runs. Use the UP and DOWN arrow keys of the CALIBRATOR to review the accumulated data. The CALIBRATOR will run each proving run for approximately 2 minutes and then automatically stop itself. The total number of proving runs that the CALIBRATOR performs is determine by the setting of REPEAT POINTS.
    3. When the CALIBRATOR prompts you for the UUT TOTAL, enter the DELIVERY TOTAL of the UUT. After entering the delivery total. clear the UUT total by pressing its ZERO key. After clearing the UUT total, press the START or PRINT key of the CALIBRATOR to begin the next proving run.
    4. Repeat step 3 unitil the value of REPEAT POINTS is reached. After the total number of repeated proving runs are completed the CALIBRATOR will prompt you for the OLD data.
    5. There is no need to enter any OLD data into the CALIBRATOR. Press the PRINT or START key to display NEW CALCULATED data.
    6. Press the PRINT key of the CALIBRATOR to create the FINAL SYSTEM CHECK REPORT. After the final report is initiated the CALIBRATOR will return to the TEST MODE SETUP mode.
- The error results of the SYSTEM CHECK should be with the repeatability of the flowmeter and accuracy of the temperature probes.
- Enter the CONFIGURATION mode of the UUT and set the LAST SERVICE DATE and NEXT SERVICE DATE fields.
- Enter the SENSOR CHECK test mode of the UUT and print out the setup.
- Remove power from both the CALIBRATOR and UUT system. Completely drain all piping and disconnect the test system.

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9. DRAWINGS

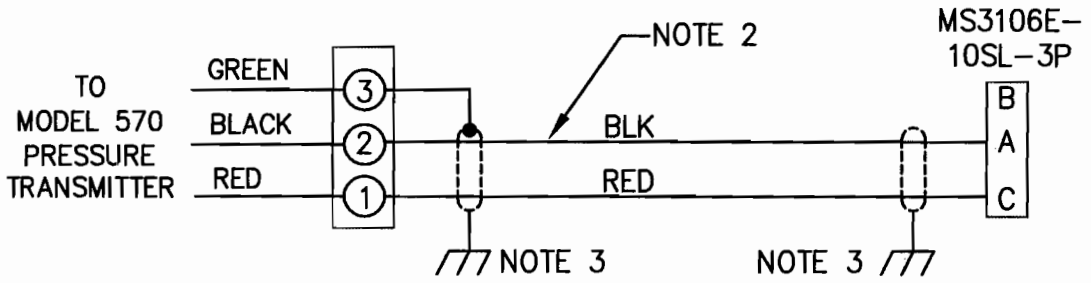
REVISIONS			
REV	DESCRIPTION	DATE	APP

NOTES:

1. SPECIFY CABLE LENGTH WHEN ORDERING.
2. USE CAROL P/N C 2678-21-10 OR EQUIVALENT.
3. BOND SHIELD TO CONNECTOR CABLE CLAMP.

SCA-XCL2-PT

└X DESIGNATES LENGTH NOTE 1



		MATERIAL	DRAWN	DATE	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
		NOTE 2	CHECK	051208	
			PROJ ENG	051208	
		FINISH			TITLE: CABLE ASSEMBLY, PRESSURE- SCA-XCL2-PT
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01, 3 PLACE DECIMAL ±.005, FRACTIONAL ±1/64, ANGULAR ±1/2°		SIZE: A / FSCM NO: 33321 / DWG NO: SCA-913 / REV: -
APPLICATION					SCALE: NONE / SHEET: 1 OF 1

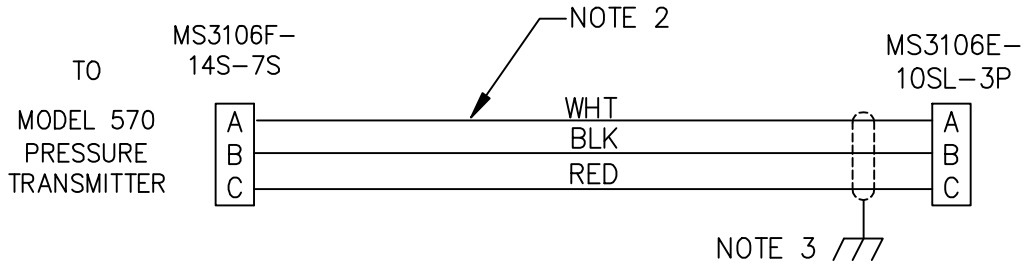
NOTES:

1. SPECIFY CABLE LENGTH WHEN ORDERING.
2. USE CAROL P/N C 2678-21-10 OR EQUIVALENT.
3. BOND SHIELD TO CONNECTOR CABLE CLAMP.

REVISIONS			
REV	DESCRIPTION	DATE	APP
A	CHANGED TITLE, DWG NO WAS SY14B-902. (CS)	970312	ES
B	MODEL NO. WAS SCA-XCC3-P	051208	JJ
C	PER ECP 540	080212	V.K.
D	PER ECP 561, REMOVED SHIELD FROM TRANSMITTER END OF CABLE	091120	JJ

SCA-XCC3-PT

X DESIGNATES LENGTH NOTE 1



REPLACES SY14B-902

		MATERIAL	DRAWN SWEET	DATE 961120	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
		NOTE 2	CHECK E.SALVO	961120	
			PROJ ENG E.SALVO	961120	TITLE: CABLE ASSEMBLY, PRESSURE- SCA-XCC3-PT
		FINISH			
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01, 3 PLACE DECIMAL ±.005, FRACTIONAL ±1/64, ANGULAR ±1/2°		SIZE A | FSCM NO 33321 | DWG NO SCA-906 | REV D
APPLICATION					SCALE NONE | SHEET 1 OF 1

DWG NO. SY14B-304 SH 1 REV E

NOTES:

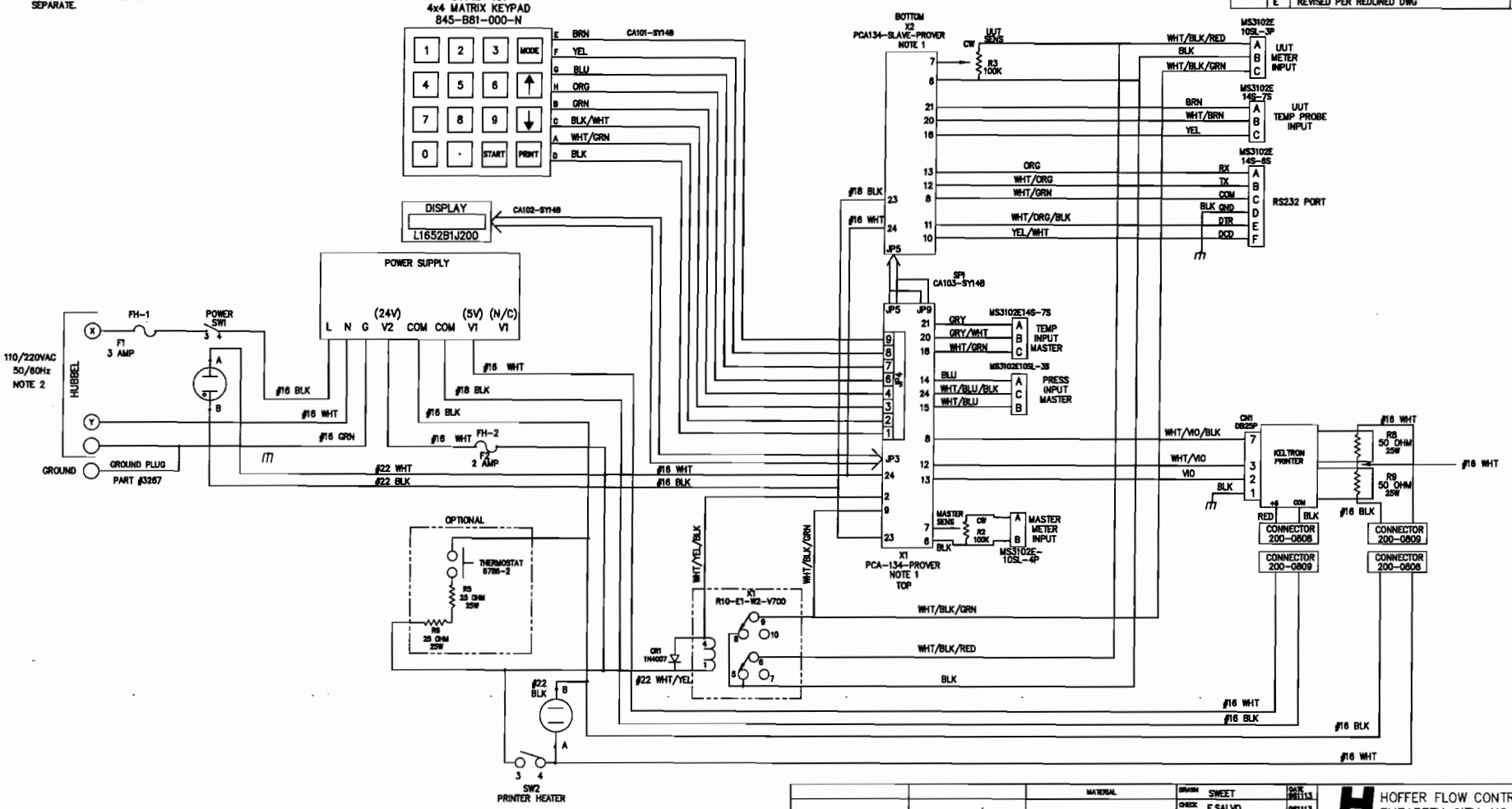
1. EQUIP X1, X2 AS FOLLOWS:

PRODUCT	X1	X2
LIN/LOX/LAR	PCA134-LLL-24-PROVER	PCA134-SLAVE-24V-PROVER-LLL
CO2	PCA134-CO2-24-PROVER	PCA134-SLAVE-24V-PROVER-CO2
LH2	PCA134-LH2-24-PROVER	PCA134-SLAVE-24V-PROVER-LH2

2. DO NOT BUNDLE AC LINES WITH SIGNAL WIRES. RUN AC LINES SEPARATE.

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPD
	A	ZN B1 & B2 ADDED CONNECTOR P/N'S ZN C8 ADDED WIRE GAUGE AND COLOR (CS)	970115	ES
	B	REVISED PER ECP373.	970912	ES
	C	REVISED PER ECP478	030107	VK
	D	REVISED PER REDLINED DRAWING, CHANGED WIRING FOR NEW POWER SUPPLY	050721	JJ
	E	REVISED PER REDLINED DWG	051208	



MATERIAL	
FINISH	
NEXT ASSY	USED ON
APPLICATION	

DRAWN SWEET 961113
CHECK E.SALVO 961113
QA
PROJ ENG E.SALVO 961113

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS:

3 PLACE DECIMALS ± .01
2 PLACE DECIMALS ± .005
FRACTIONAL ± 1/64
ANGULAR ± 1/2°

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

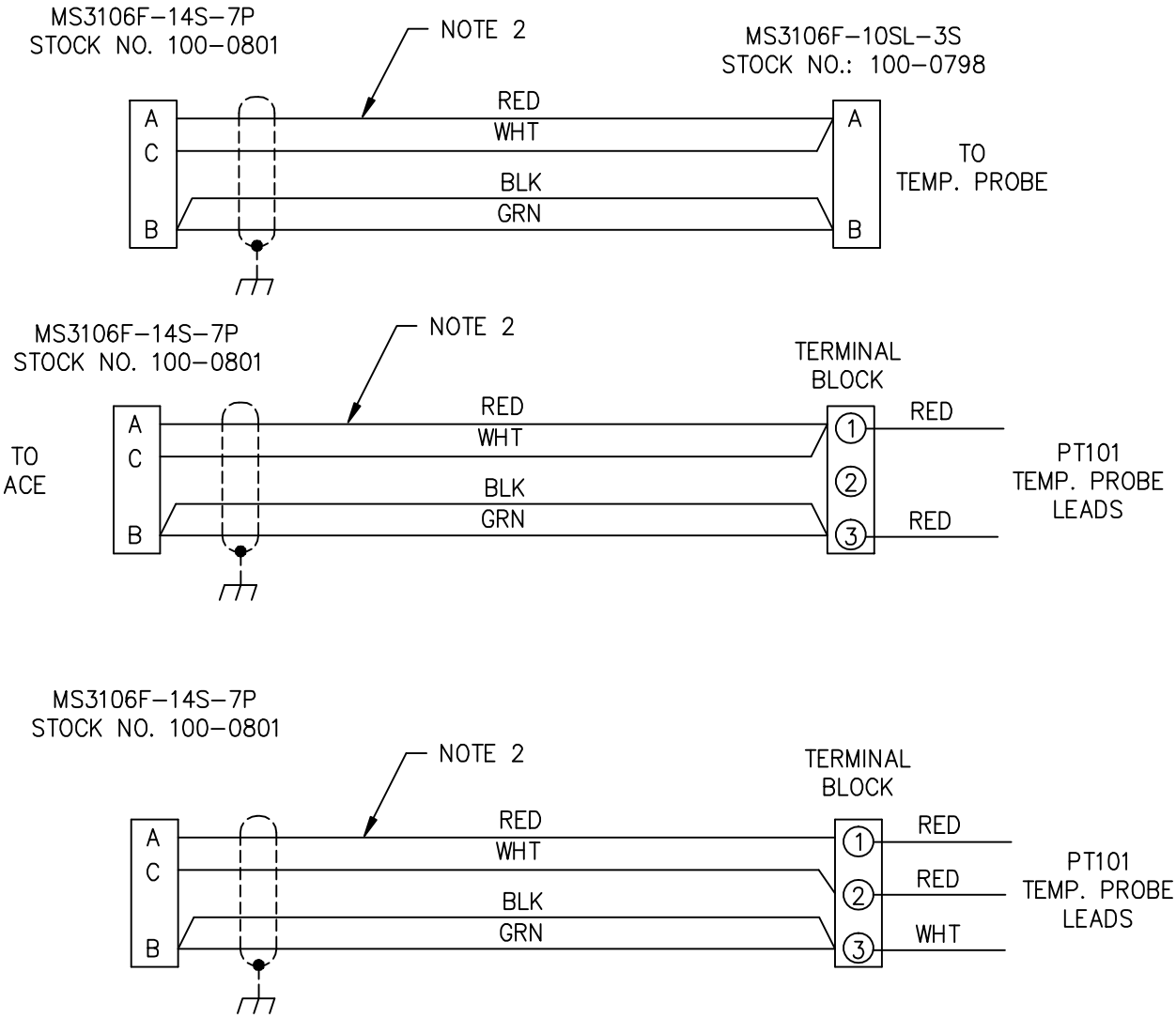
TITLE
ACE PROVER WITH PRINTER
SY14B – AUTO SWITCHABLE
POWER SUPPLY

SIZE	CAGE CODE	DWG NO	REV
D	33321	SY14B-304	E

SCALE N/A SHEET 1 OF 1

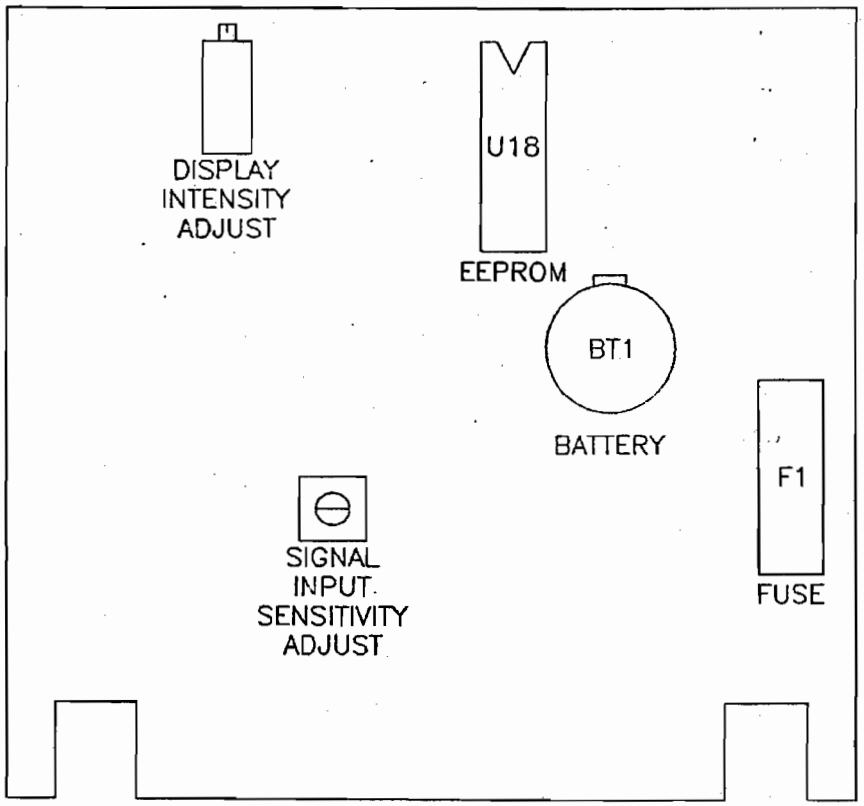
NOTES:
1. SPECIFY CABLE LENGHT WHEN ORDERING.
2. USE CAROL P/N C0-762 OR EQUAL.

REVISIONS			
REV	DESCRIPTION	DATE	APP
A	ADDED 3rd CABLE	051208	JJ
B	PER ECP 540	080211	V.K.
C	PER ECP 561, REMOVED SHIELD FROM ONE END OF CABLE	091120	JJ



		MATERIAL	DRAWN SWEET	DATE 030227	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK V.KEPKA	030227	
			PROJ ENG V.KEPKA	030227	TITLE: CABLE ASSY, 2 WIRE/3 WIRE- TEMPERATURE PROBE
		FINISH			
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01, 3 PLACE DECIMAL ±.005, FRACTIONAL ±1/64, ANGULAR ±1/2°		SIZE A | CAGE CODE 33321 | DWG NO SCA-909 | REV C
APPLICATION					SCALE NONE | SHEET 1 OF 1

REVISIONS			
REV	DESCRIPTION	DATE	APP
A	DRAWING NO. WAS PCA-134.	950818	



REPLACES PCA-134

		MATERIAL	DRAWN DW	DATE 2-27-92	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK JD	2-27-92	
			PRODUCTION		TITLE
		FINISH	PROJ ENG KRH	2-27-92	ACE BOARD
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01, 3 PLACE DECIMAL ±.005, FRACTIONAL ±1/64, ANGULAR ±1/2°	SIZE A	CAGE CODE 33321	DWG NO 500-0160	REV A
APPLICATION				SCALE NONE		SHEET 1 OF 1

H:\DRAWINGS\500\50001601.DWG

DWG NO. SY14B-301 SH 1 REV K

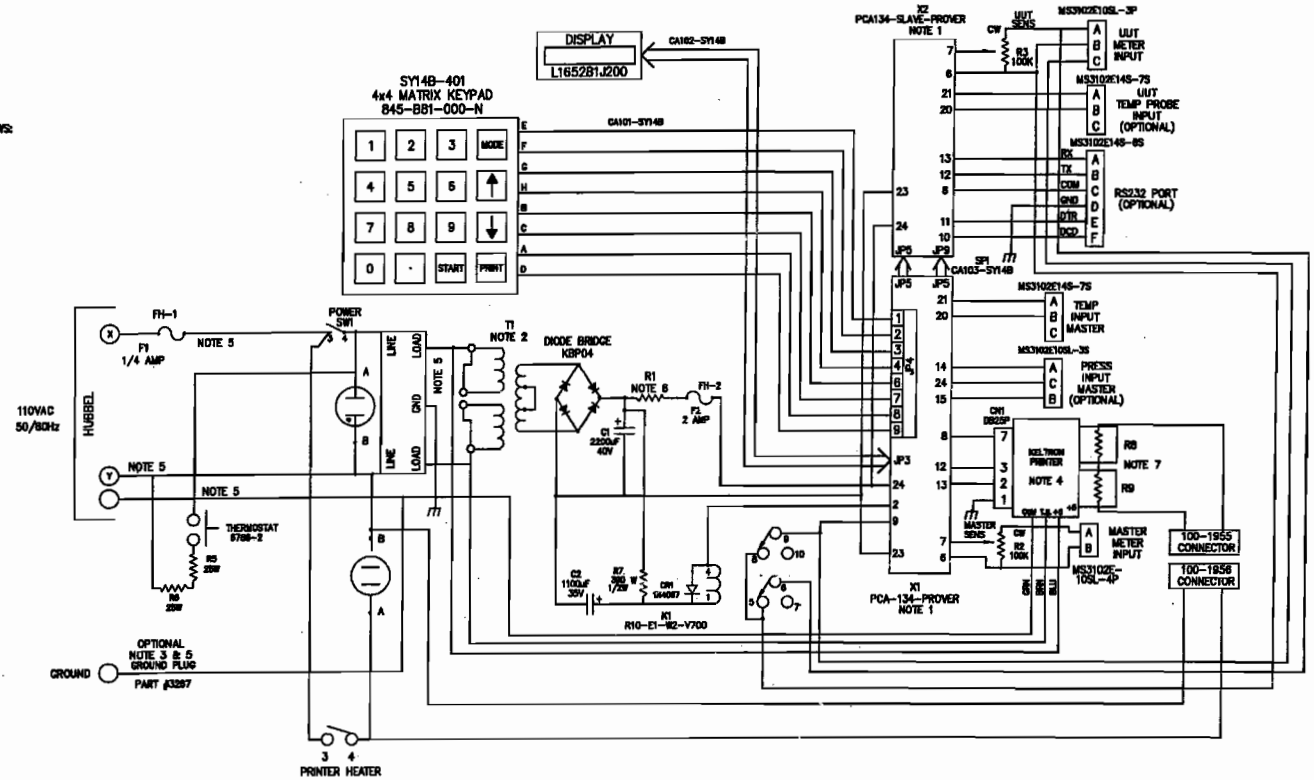
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPD
	A	REDRAWN (DW)	1-24-92	
	B	MRB/CA #221 (DW)	3-18-92	
	C	ADDED NOTE 5 GROUND ISOLATE. (DW)	5-1-92	JD
	D	ADDED NOTE 6 (CS)	9-19-92	JD
	E	CA #370 (CS)	930216	JD
	F	INCORPORATED ECO226 (CS)	950125	JD
	G	INCORPORATED ECO230 (CS)	950318	JD
	H	DRAWING NO. WAS SY14B-301 (CS)	951109	JD
	J	REVISED PER CPA 445, CHG'D DWG # (CS)	951018	ES
	K	REVISED PER ECP 478	030107	V.K.

NOTES:

1. EQUIP X1, X2 AS FOLLOWS:

PRODUCT	X1	X2
LIN/LOX/LAR	PCA134-LLL-→24-PROVER	PCA134-SLAVE-24V-PROVER-LLL
CO2	PCA134-CO2-→24-PROVER	PCA134-SLAVE-24V-PROVER-CO2
LH2	PCA134-LH2-24-PROVER	PCA134-SLAVE-24V-PROVER-LH2

2. EQUIP T1 AS FOLLOWS:
   115VAC P8803 STANCORE
   220VAC P8723 STANCORE
3. EQUIP R5 & R6 AS FOLLOWS:
   115VAC R5, R6 500 OHM 25W
   220VAC R5, R6 2000 OHM 25W
4. EQUIP PRINTER AS FOLLOWS:
   115VAC SMM 4081/5
   220VAC SMM 4085/5
5. DO NOT BUNDLE AC LINES WITH SIGNAL WIRES. RUN AC LINES SEPARATE.
6. EQUIP R1 AS FOLLOWS:
   R1 = 50 OHM 25W FOR 115VAC
   R1 = 20 OHM 5W FOR 220VAC
7. EQUIP PRINTER HEATER AS FOLLOWS:
   115VAC R8, R9 1000 OHM 25W
   220VAC R8, R9 4000 OHM 25W



CONTROLLED

REPLACES 700-0093

		MATERIAL	CONTRACT/JS	HOFFER FLOW CONTROLS, INC ELIZABETH CITY, NC 27909	
			DRAWN DW 1-24-92		
		FINISH	CHECK JD 1-24-92	TITLE ACE PROVER WITH PRINTER	
			QA HC 1-24-92		
			PROJ ENG KH 1-24-92		
NEXT ASSY	USED ON			SIZE D CAGE CODE 33321 DWG NO SY14B-301 REV K	
APPLICATION				SCALE N/A SHEET 1 OF 1	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES UNLESS OTHERWISE THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS:

2 PLACE DECIMALS	± .05
3 PLACE DECIMALS	± .005
PROVISIONAL	± 1/64
ANGULAR	± 1/2°

DWG NO. SY14B-302 SH 1 E F

REVISIONS					
ZONE	REV	DESCRIPTION		DATE	APPD
	A	ADDED TRANSFORMER AND FIG. 1.	(CS)	931012	JD
	B	INCORPORATED EC0226.	(CS)	950125	JD
	C	INCORPORATED EC0230.	(CS)	950319	JD
	D	DRAWING NO. WAS SY14B-302.	(CS)	951109	JD
	E	REVISED PER CPA 445, CHG'D DWG #	(CS)	961016	ES
	F	REVISED PER ECP 478		030107	J.K.

NOTES:

1. EQUIP X1, X2 AS FOLLOWS:

PRODUCT	X1	
LIN/LOX/LAR	PCA134-LLL-+12-PROVER	PCA134-SLAVE-12V-PROVER-LLL
CO2	PCA134-CO2-+12-PROVER	PCA134-SLAVE-12V-PROVER-CO2
LH2	PCA134-LH2-12-PROVER	PCA134-SLAVE-12V-PROVER-LH2

2. DO NOT BUNDLE AC LINES WITH SIGNAL WIRES. RUN AC LINES SEPARATE.

2. EQUIP PRINTER HEATERS AS FOLLOWS:
   115VAC R8, R9 1000 OHM 25W
   220VAC R8, R8 4000 OHM 25W

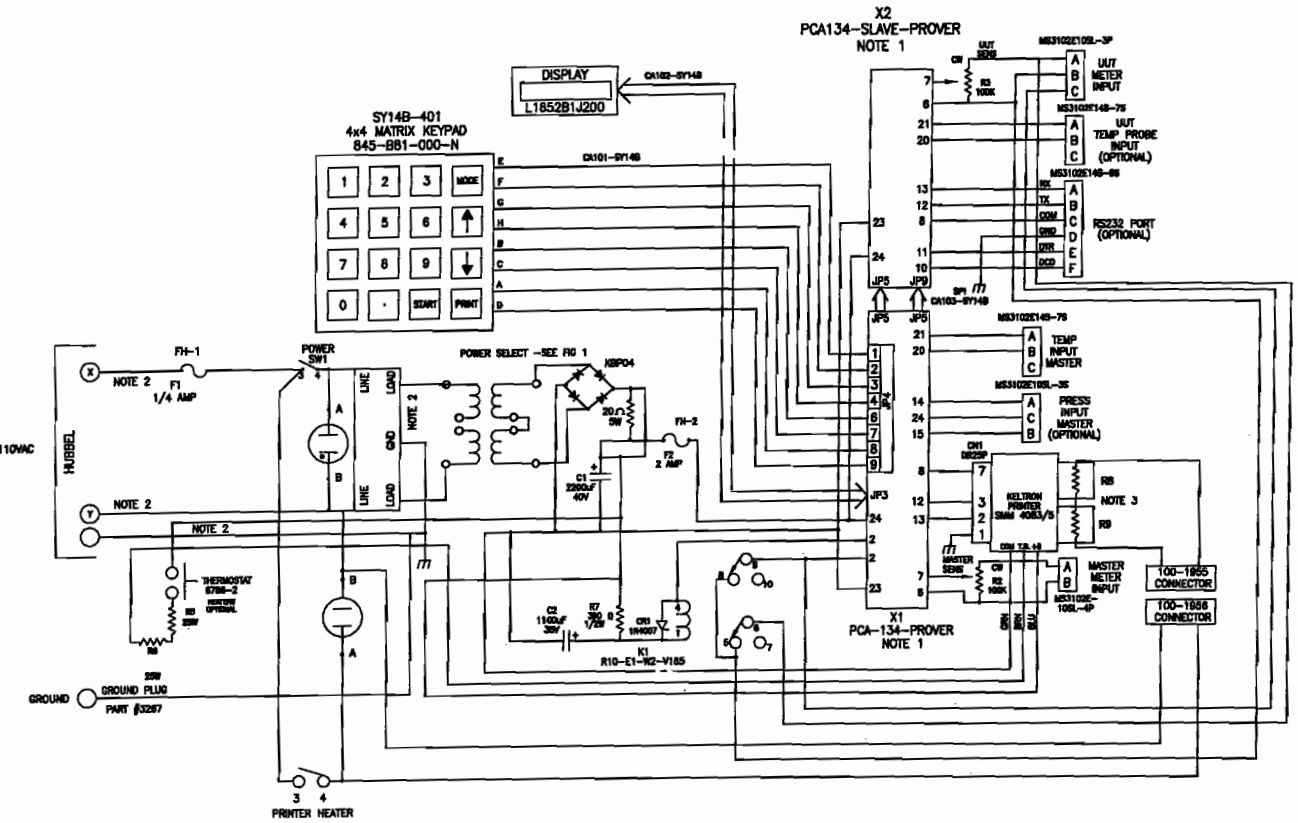
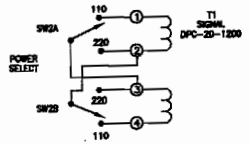


FIG 1 POWER SELECT



CONTROLLED

REPLACES 700-0094

		MATERIAL	CONTRACT/JN	HOFFER FLOW CONTROLS, INC ELIZABETH CITY, NC 27909	
			DRAWN SWEET 021022		
		FINISH	CHECK JD 021022	TITLE SCHEMATIC, ACE PROVER WITH PRINTER	
			QA HC 021022		
			PROJ ENG KH 021022		
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. DATA NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, OR COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE AS FOLLOWS: 2 PLACE DECIMALS ± .01 3 PLACE DECIMALS ± .005 FRACTIONAL ± 1/64 ANGULAR ± 1/2°	SIZE D CAGE CODE 33321 DWG NO SY14B-302 REV F	
APPLICATION				SCALE N/A SHEET 1 OF 1	

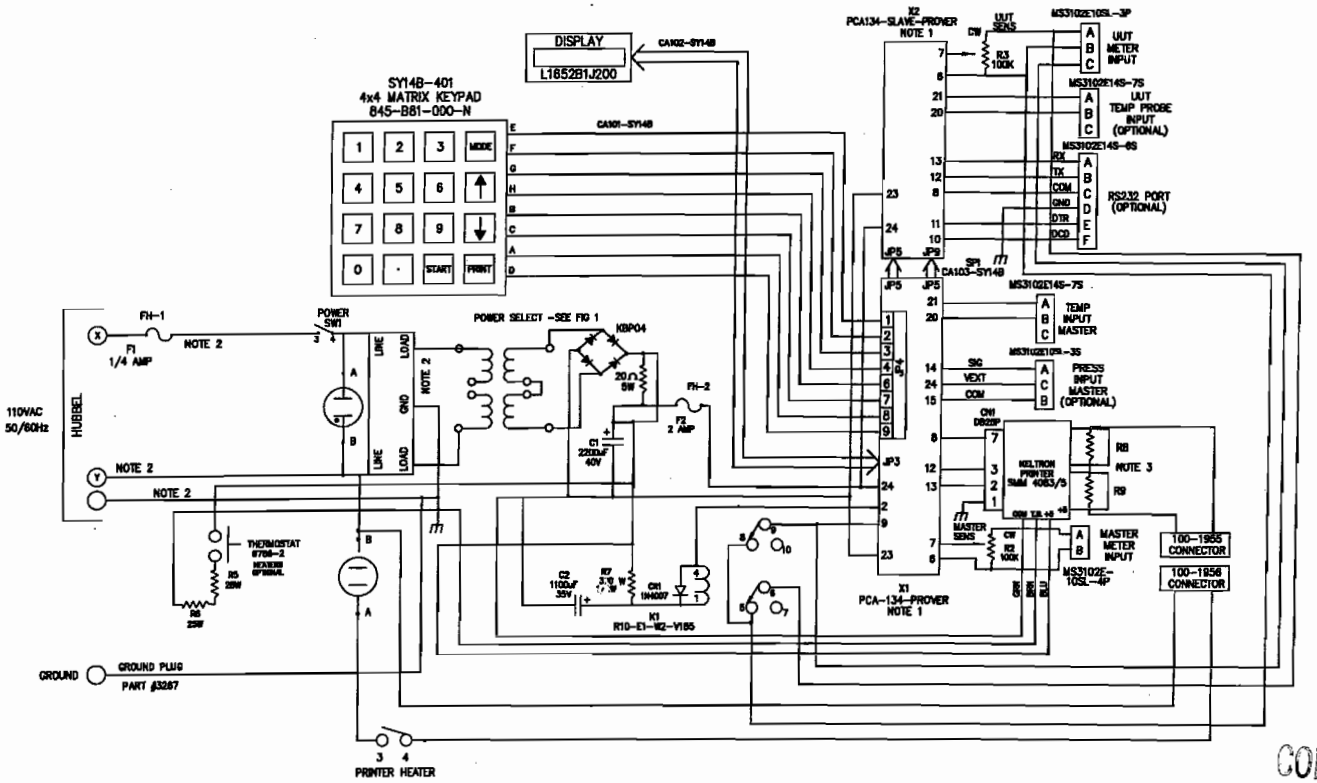
DWG NO. SY14B-303 SH 1 REV E

REVISIONS					
ZONE	REV	DESCRIPTION		DATE	APPD
	A	INCORPORATED ECO226.	(CS)	950125	JD
	B	INCORPORATED ECO230	(CS)	950318	JD
	C	DRAWING NO. WAS SY14B-303.	(CS)	951109	JD
	D	REVISED PER CPA 445, CHG'D DWG #	(CS)	981016	ES
	E	REVISED PER ECP 478		030107	V.K.

NOTES:
1. EQUIP X1, X2 AS FOLLOWS:

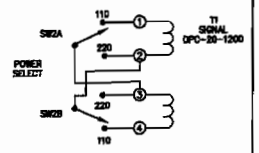
PRODUCT	X1	X2
LPG	PCA134-LPG-+12-PROVER	PCA134-SLAVE-12V-PROVER-LPG

2. DO NOT BUNDLE AC LINES WITH SIGNAL WIRES. RUN AC LINES SEPARATE.
2. EQUIP PRINTER HEATER AS FOLLOWS:
115VAC R8,R9 1000 OHM 25W
220VAC R8,R9 4000 OHM 25W



CONTROLLED

FIG 1 POWER SELECT



REPLACES 700-0095

NEXT ASSY	USED ON	APPLICATION	MATERIAL	CONTRACT/AH
			FINISH	DRAWN SWEET 040503
				CHECK J.DEFEO 040804
				QA
				PROJ ENG

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF BAR MATERIAL SHALL BE HELD AS FOLLOWS:
3 PLACE DECIMALS ± .01
2 PLACE DECIMALS ± .03
FRACTIONAL ± 1/64
ANGULAR ± 1°

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE: SCHEMATIC, ACE PROVER FOR LPG WITH PRINTER

SIZE	CAGE CODE	DWG NO	REV
D	33321	SY14B-303	E

SCALE N/A SHEET 1 OF 1

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10. 80 SERIES MINIPRINTERS - INSTALLATION AND OPERATION

INSTALLATION
AND
OPERATION

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TABLE OF CONTENTS:

LIST OF TABLES:

LIST OF FIGURES:

CHAPTER 1 INTRODUCTION

1.0 INTRODUCTION

Congratulations on your selecting the Keltron 80 Series Miniprinter!!!

The 80 Series Miniprinter is designed to incorporate many features required for scientific, industrial and medical instrumentation.

The Series features compact, reliable, plain paper dot matrix printers capable of printing 16 through 42 columns. Packaged in a rugged metal enclosure, it is available as a panel mount, desk top, space-saver or bare bones.

There are four types of interfaces to ease connection to a host computer and an 8192 character print buffer to free the host computer during the printing process. The Series supports all standard communication handshakes and features easily accessible DIP Switches to select communication and printing features.

The built-in CLOCK/CALENDAR, LINE COUNTER, combined with optional INTERVAL TIMER and paper take-up, make the 80 Series an ideal EVENT RECORDER.

1.1 MODEL NUMBER

To best meet OEM requirements, the 80 Series Miniprinter is built in a variety of configurations. A seven (7) character model number convention is designed to summarize all the features built into your printer. The model number of your unit is printed on the Serial Number Tag and the Model Number Convention is illustrated in the following table:

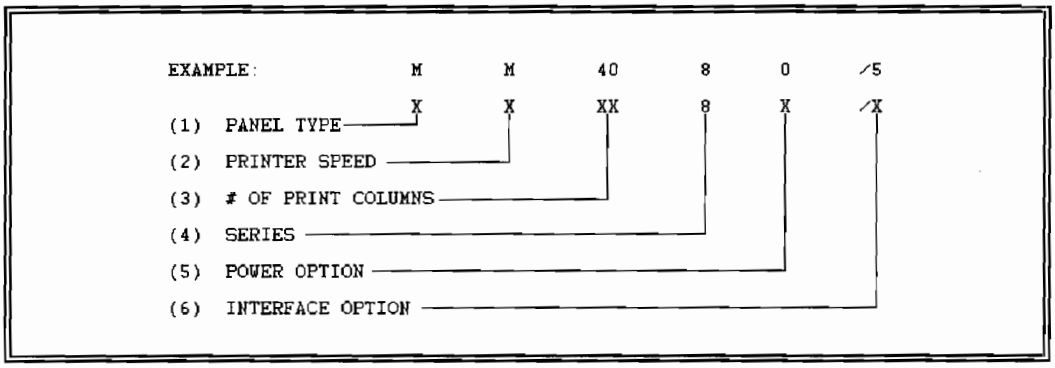

TABLE 1.1 80 SERIES MODEL NUMBER CONVENTION

(1)	**PANEL TYPE:**	
	M	= Standard Enclosure w/Membrane Switch Front Panel
	D	= Standard Enclosure w/Toggle Switch Front Panel (Only with 16 Column format)
(2)	**PRINTER SPEED:**	
	M	= Standard Speed
	H	= High Speed
(3)	**NUMBER OF PRINT COLUMNS:**	
	DM MODELS	= 16 Columns
	MM MODELS	= 24, 32, 40 Columns
	MH MODELS	= 24, 30, 36, 42 Columns
(4)	**SERIES:**	= 8 Universal Printer Controller
(5)	**POWER OPTION:**	
	0	= +5 VDC
	1	= 110 VAC
	2	= 220 VAC
	3	= +10 to +35 VDC (Filtered)
(6)	**INTERFACE OPTION:**	
	4	= Centronix Parallel w/Graphics
	5	= Serial RS232 & Serial Current Loop w/Graphics
	7	= Serial RS422 & Serial Current Loop w/Graphics
	8	= Serial RS232 & Centronics w/Graphics
	9	= Serial RS422 & Centronics w/Graphics

1.2.1 GENERAL SPECIFICATIONS

CHARACTER:	**255 Character Upper & Lower Case ASCII (Style ANSI x3.4-1977)**						
PRINT BUFFER:	**8192 Characters**						
PRINT METHOD:	**Dot Matrix Impact**						
PRINT STYLES:	Standard Character:	5 x 7 Dot Matrix					
	Extended Character:	5 x 14 Dot Matrix					
	Expanded Character:	10 x 7 Dot Matrix					
	Large Character:	10 x 14 Dot Matrix					
	Dot Addressable Graphics						
PRINTER TYPE:	**Supports Two Optional Printer Mechanisms:**						
	Standard Speed:	10S160 Series					
	High Speed:	10S180 Series					
PRINT COLUMNS:	Standard Speed:	16, 24, 32, 40					
	High Speed:	24, 30, 36, 42					
PRINT SPEED:	**For Standard Speed Mechanism:**						
	# of Columns	16	24	32	40		
	Lines/Second	1.0	0.7	0.5	0.4		
	For High Speed Mechanism:						
	# of Columns	24	30	36	42		
	Lines/Second	1.7	1.3	1.1	1.0		
RELIABILITY:	**Standard Speed:**	500,000 Character Lines					
	High Speed:	Varies w/Number of Columns					
	# of Columns	24	30	36	42		
	x 1,000,000 Lines	.7	.7	.6	.5		
CHARACTER SIZE:	# of Columns	16	24	30	32	36	40	42
	Wide (mm)	1.8	1.7	1.4	1.3	1.2	1.1	1.1
	Height (mm)	2.5	2.5	2.6	2.4	2.6	2.5	2.6
	Dots/Line	96	144	180	192	216	240	252
PAPER FEED:	**Unidirectional (Forward) Pressure Roller**						
	Paper Thickness (in.):	0.0027					
	Paper Roll Diameter (in.):	1.75					
	Paper Width (in.):	1.75 for 16 Column					
		2.24 for all other Printers					
INKING/COLOR	**Snap-In Ribbon Cassette / Purple standard (Black Available)**						

1.2.2 ELECTRICAL SPECIFICATION

INTERFACE:	**Supports Four Types of Interfaces:** Serial RS232C Serial RS422 Serial 20mA Current Loop Parallel 8 bit Centronics Compatible			
PROTOCOL:	In Serial Mode, RTS/CTS & XON/XOFF are Supported. In Parallel Mode, a full set of Handshakes & Status lines are Supported.			
COMMUNICATION:	In Serial Mode, the following Baud Rates are Supported: 110,150,300,600,1200,2400,4800, 9600 In Parallel Mode, 6000 Characters/Second			
SETTING:	**All print & communication features are Dip Switch selectable.**			
INPUT POWER:	**Available with three optional Power Configurations.** AC 110 VAC or 220VAC/ 50-440 Hz Fuse 2/10A Slow Blow DC +10 VDC to +35 VDC +/- 10% Filtered DC +5 VDC with the following ratings:			
		IDLE	AVERAGE PRINTING	PEAK PRINTING
	Standard Speed	300mA	1.0 A	2.4 A
	High Speed	300mA	2.0 A	4.8 A
POWER CONNECTOR:	DC MOLEX #03-06-1031 AC LINE CORD Provided			

1.2.3 ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE:	OPERATING:	0°C to 49°C
	STORAGE:	-25° to 70°C
RELATIVE HUMIDITY:	NON-CONDENSING 20% to 85%	

1.2.4 MECHANICAL SPECIFICATIONS

CASE MATERIAL:	METAL	
CASE SIZE:	WIDTH	4.44 in / 112.0 mm
	HEIGHT	2.75 in / 69.9 mm
	LENGTH*	8.00 in / 203.2 mm
FRONT PANEL:	WIDTH	5.25 in / 133.4 mm
	HEIGHT	2.78 in / 70.6 mm
MOUNTING CUTOUT:	WIDTH	4.5 in / 114.3 mm
	HEIGHT	2.78 in / 70.6 mm
WEIGHT:	5VDC VERSION	2.0 lbs

* see Appendix D for Space Saver Configuration dimensions.

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CHAPTER 2 DESCRIPTION

2.0 PHYSICAL LAYOUT

The basic 80 Series Miniprinter is comprised of a microcomputer-based printer controller, a printer mechanism module, a power supply module, and a metal enclosure.

Mounted on the front panel are paper feed, printer test and clock set switches. The printer mechanism, paper-out detector, and paper holder chassis are mounted in back of the front panel.

The printer controller, mounted on the top plate of the enclosure, connects to the front panel via a 44 pin Cinch connector.

The power supply module is mounted on the bottom plate of the enclosure.

The rear panel holds the interface connectors and the power supply fuse for AC input units.

2.1 PRINTER CONTROLLER

The 80 Series miniprinters use the Keltron Part Number 95M3029 universal printer control card. this card holds the printer drivers, communication interfaces, real time clock, 8K print buffer and DIP Switches.

A powerful INTEL microcontroller on the 95M3029 board manages all tasks and features supported by the 80 Series Miniprinters.

Upon initial power up, the 80 Series goes through extensive self test procedures. It verifies the amount of print buffer installed, and checks for presence of the various options installed. Also, the DIP Switches are read to set the operating features selected by the operator.

If the front panel TEST switch is pressed during power up, the printer prints, in a four line sequence, the amount of print buffer found, the program version number, the type of interface selected, the interface setting selected, and a list of options installed. A typical power up print may look like this:

```
8K buffer . . . . . V2.1
Interface . . . . . SERIAL
Mode . . . . . 9600, 8, e, 2, #
BAT. CLOCK INSTALLED
```

TABLE 2.1 TYPICAL POWER UP PRINTOUT W/TEST SWITCH PRESSED

In the idle mode, the printer continuously checks the front panel controls and the paper out detector. It also services the time clock, the print buffer, and the internal processor watchdog monitor.

The data sent to the 80 Series is received by the controller on an interrupt basis. The controller validates the data before saving it in the print queue.

2.2 PRINTER MECHANISM

The Keltron 80 Series Miniprinters are designed using highly reliable alphanumeric impact printer mechanisms. They print 5x7, 5x14, 10x7 or 10x14 dot matrix characters using a continuous, pre-inked ribbon cassette.

The 80 Series Miniprinters are available with two types of printer mechanisms: STANDARD SPEED and HIGH SPEED.

The STANDARD SPEED printers have four dot driver coils and feed paper one dot line at a time.

The HIGH SPEED printers are built with six dot driver coils, and include gears for fast paper feeding.

Both printers need only +5VDC for operation, and are guarded against possible malfunction by a special protection circuit included on the control card.

2.3 FRONT PANEL

The 80 Series Miniprinters are available in two front panel styles with either Toggle or Membrane switches. As illustrated in Figure 2.1. The Operator Controls for the 80 Series Miniprinters are located on the front panel assembly of the unit. For the toggle switch style front panel, a dual function switch is provided. During normal operation, the switch is used for MANUAL TEST, or PAPER FEED, and during the clock set mode for the clock setting.

For the Membrane switch style front panels, four switches are provided. These are labeled SLCT (select), TEST, FEED, and ADVN (advance). The TEST and FEED switches are used for manual testing and paper feeding. The SLCT and ADVN switches are used to set the time clock if the clock feature is enabled, or else they can be used to enable or disable the printer.

For both front panel styles, two LED's mounted on the front panel are provided for various operating indications.

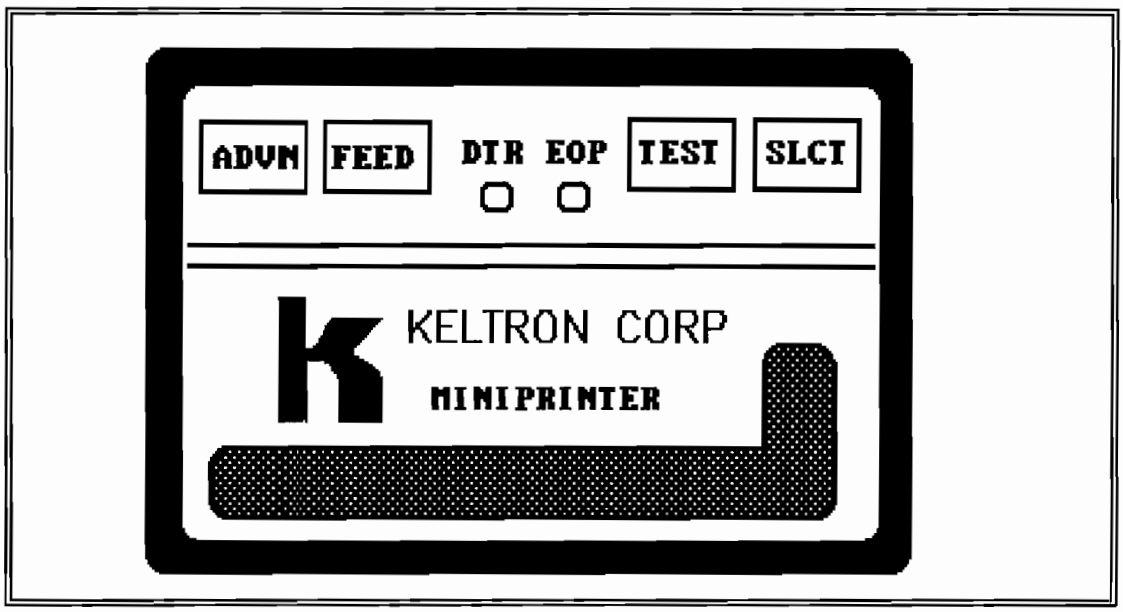


FIGURE 2.1 STANDARD MM80 SERIES FRONT PANEL

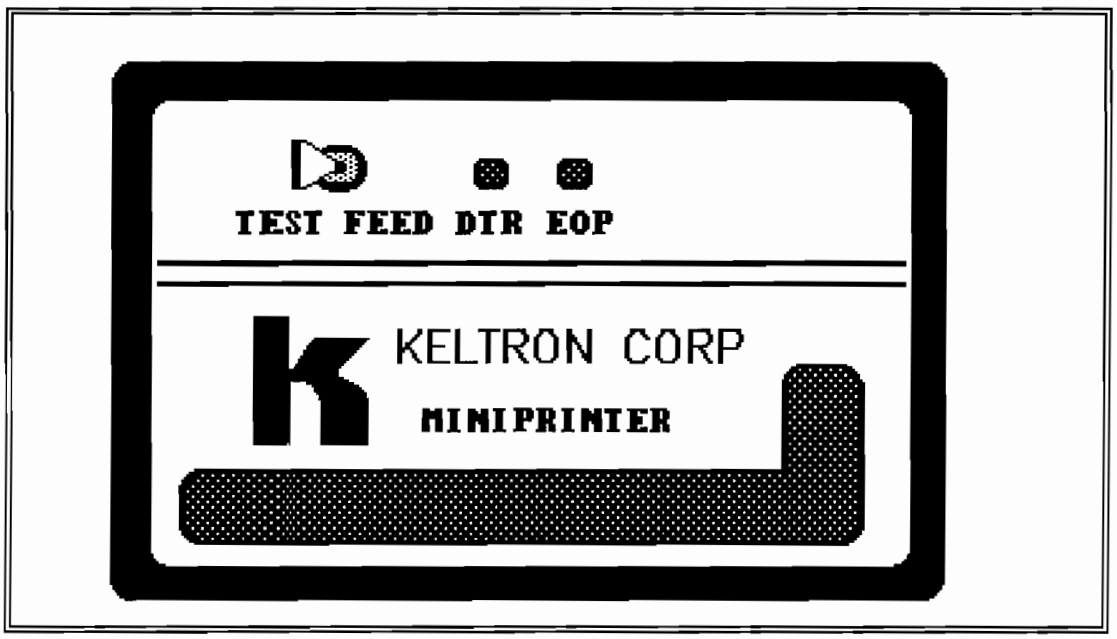


FIGURE 2.1A STANDARD DM80 SERIES FRONT PANEL

The DATA TERMINAL READY (DTR) LED indicates that the printer is ready to receive data from a host printer.
The END OF PAPER (EOP) LED indicates that the printer is out of paper.

2.4 REAR PANEL XX80/5, XX80/7, XX80/8, XX80/9

The DIP Switches to set the printer functions, the DATA INPUT/OUTPUT CONNECTORS, POWER FUSE, and POWER INPUT HARNESS are available at the rear panel of the 80 Series Miniprinters. A standard rear panel is shown in FIGURE 2.2 below:

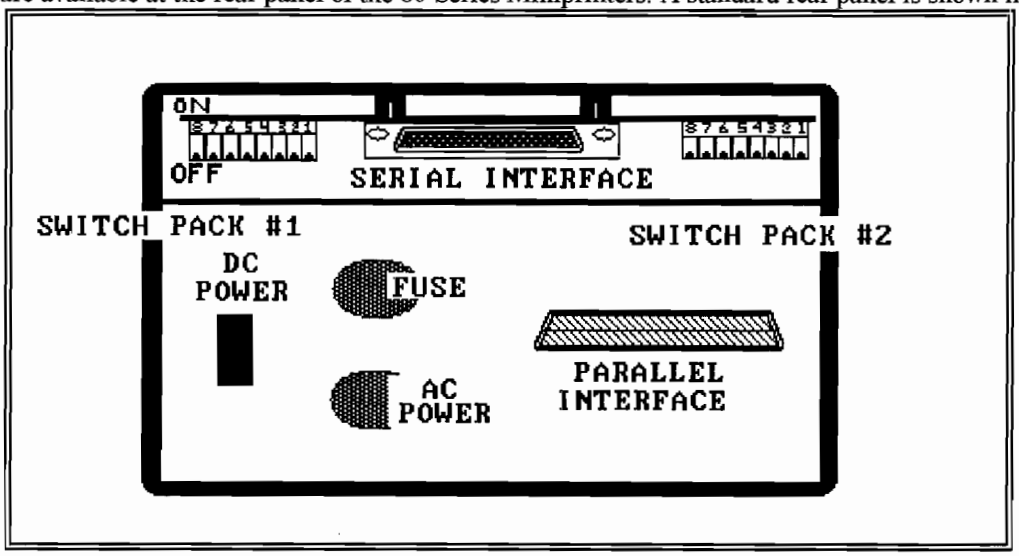


FIGURE 2.2 SERIAL PRINTER REAR PANEL

2.4.1 DIP SWITCH SETTINGS XX80/5, XX80/7, XX80/8, XX80/9

Two 8 position SWITCH PACKS are provided to set the print functions and communication protocols.

SWITCH PACK #1 is used to set the serial port protocols, while SWITCH PACK #1 is used to set the printer features and functions.

APPENDIX A lists the functions of SWITCH PACK #1 & SWITCH PACK #2.

2.4.2 INPUT/OUTPUT CONNECTORS

All the serial input/output signals of the 80 Series printers are terminated on the DB25S female style connector. Pin assignments for each type of interface are listed in CHAPTER 4.

The parallel input/output signals are terminated on an industry standard CENTRONICS COMPATIBLE 36 pin connector. Pin assignments for the parallel interface are listed in sections 4.4 and 4.4.1.

2.4.3 REAR PANEL MODEL XX80/4

The rear panel of the XX80/4 series printer is illustrated below. The XX80/4 series printers are built with parallel interface only.

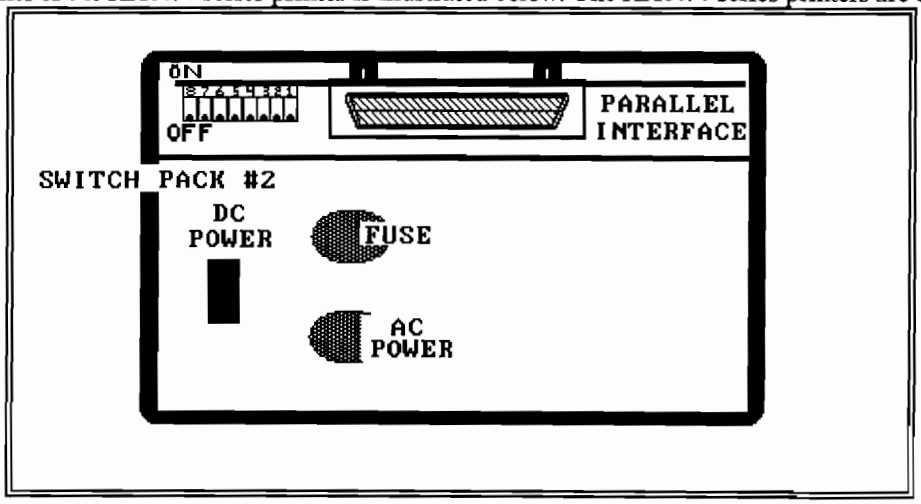


FIGURE 2.2.1 PARALLEL PRINTER REAR PANEL

2.4.4 DIP SWITCH SETTINGS XX80/4

Use Appendix A to set the printer functions for the XX80/4 series printers.

2.5 POWER INPUT

80 Series printers are available in four different power configurations. The SIXTH character in the model number indicates the power configuration for your unit. TABLE 2.3 on the next page summarizes VOLTAGE, CURRENT and FUSE REQUIREMENTS for each type of power configuration.

AC units are equipped with a standard AC line power cord, and SLOW-BLOW fuse.

DC units receive power through a 3 pin MOLEX connector. Use TABLE 2.4 to connect power to your DC unit. No internal fuse is provided with DC units. It is strongly recommended to install external fuses with the values shown in Table 2.3.

MODEL#	**VOLTAGE**	+/-	**CURRENT/POWER**		**FUSE**
			Idle:	**Printing:**	
MMXX80/X	+5 VDC Regulated	+/- 3%	300mA	2.4A	1.0 A
MHXX80/X	+5 VDC Regulatred	+/x 3%	300mA	2.4A	2.5 A
MMXX81/X	110 VAC	+/- 10%	.1	.16	.20 A
MHXX81/X	110 VAC	+/- 10%	.1	.32	.40 A
MMXX82/X	220 VAC	+/- 10%	.05	.08	.10 A
MHXX82/X	220 VAC	+/- 10%	.05	.16	.20 A
MMXX83/X	+10 to +35 VDC Filtered	+/- 10%		4.0 Watts	1.0 A
MHXX83/X	+10 to +35 VDC Filtered	+/- 10%		8.0 Watts	2.0 A

TABLE 2.3 80 SERIES POWER REQUIREMENTS

COLOR	PIN#	DESCRIPTION
BLACK	O	0 VDC COMMON
WHITE	O	NOT USED
RED (OR BLUE)	O	+5VDC (OR 10 to 35VDC)

TABLE 2.4 DC POWER INPUT CONNECTOR

****
CAUTION!!!DO NOT REVERSE POLARITY!!!
****

CHAPTER 3 OPERATION

3.0 SELECTING AN INTERFACE

DIP Switches #1 and #2 on SWITCH PACK #2 are used to select one of the four interfaces built into your unit.

REFER TO APPENDIX A FOR PROPER SETTING.

If the SERIAL interface or the current loop is selected, the serial communication protocol switches must be set.

REFER TO APPENDIX A FOR PROPER SETTING.

The printer will print the type of interface selected on power up if the TEST switch is pressed during power up.

If the SERIAL interface is selected, the following power up message is printed.

INTERFACE: SERIAL

The above message is followed with the serial mode message showing the options selected. For example, if 9600 baud rate, 8 data bits, odd parity, one stop and print on parity error is selected, the MODE print may look as follows:

MODE:9600,8,o,1,#

e letter 'e' is printed if even parity is selected, and 'n' for no parity. CURRENT LOOP and PARALLEL INTERFACE messages are follows:

INTERFACE:20ma
INTERFACE:PARALLEL

PRINTER OPERATING MODES

.1 LINE/BUFFER MODE

e 80 Series printers can operate in two modes: BUFFER MODE or LINE MODE.

BUFFER MODE, the unit does not print until either the printer buffer has less than 256 locations remaining for additional aracters, or an EOT (^D) character is received. In LINE MODE, the unit begins printing as soon as a complete line of characters stored in the print buffer, or a CR, FL, VT, FF character is received.

itch #8 on SWITCH PACK #2 is used to select the LINE/BUFFER mode as indicated in APPENDIX A.

.2 NORMAL/INVERTED PRINT MODES

e 80 Series printers can print in two modes: NORMAL or INVERTED.

NORMAL MODE, the data is printed in lister mode with the last line printed appearing at the top of the page. In INVERTED ODE, the data is printed in text mode with the last line printed appearing at the bottom of the page.

itch #7 on SWITCH PACK #2 is used to select the operating mode as indicated in APPENDIX A.

.3 CR-LF=CR/PRINT ALL MODES

The 80 Series Printers can be set to operate in two modes - CR/LF or PRINT ALL.

In the PRINT ALL mode, all CR and LF characters received are processed. In the CR/LF mode, the following actions are taken on received date:

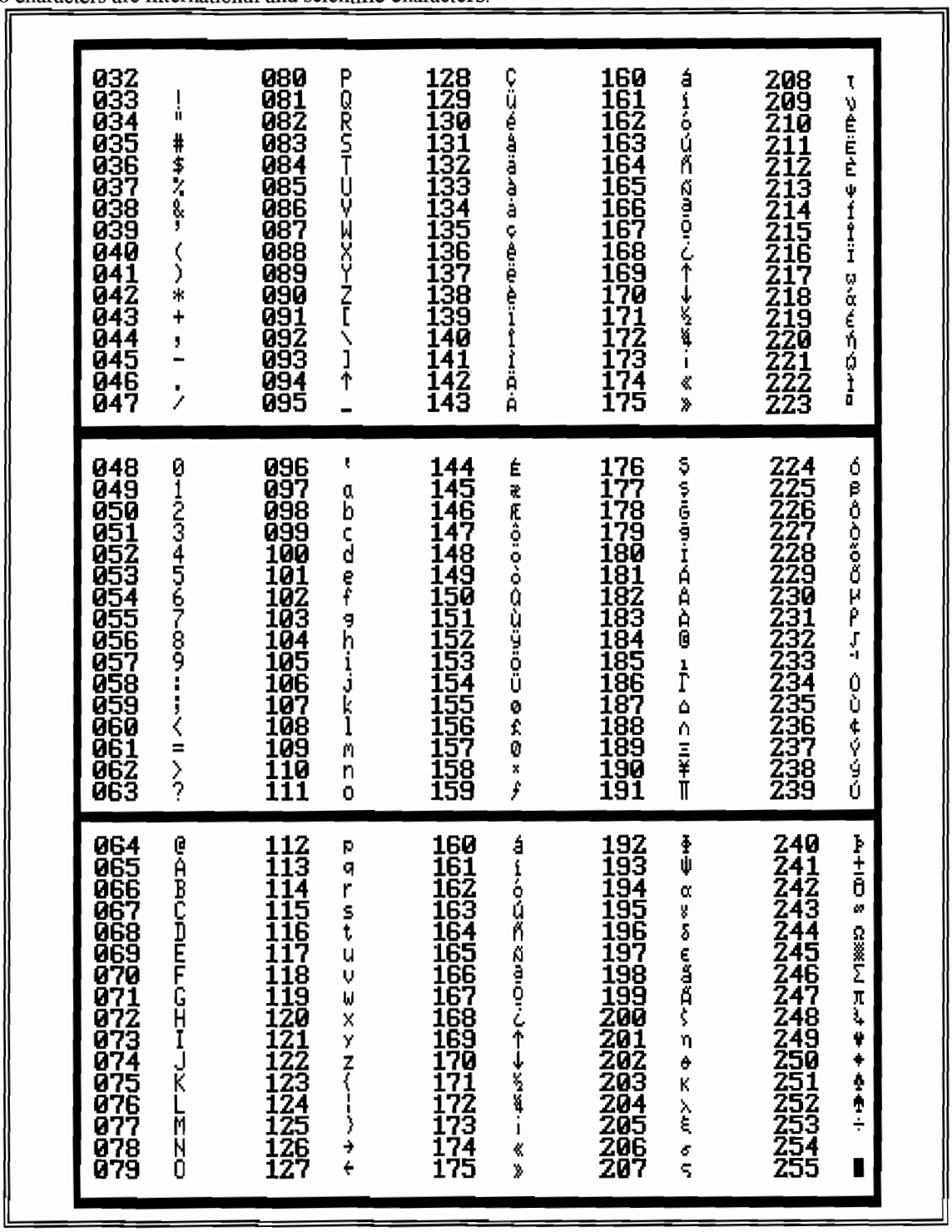
1. If CR-LF is received, it is converted to LF.
2. If CR-LF is received, after 16,24,32,36,40 or 42 characters, i.e., a full line, CR and LF will be ignored.

Switch #5 on SWITCH PACK #2 is used to select these operating modes as indicated in APPENDIX A.

3.2 CHARACTER SET

The character set of 80 Series Miniprinters include 255 CHARACTERS. The first 32 characters, decimal 0 through 31, are reserved control characters. While the remaining 224 characters, decimal 32 through 255, are printable characters.

Table 3.1 lists the printable character set. The first 96 entries in this table are 96 ASCII upper and lower case characters, while the remaining 128 characters are international and scientific characters.



032		080	P	128	Ç	160	á	208	┴
033	!	081	Q	129	ü	161	í	209	┬
034	"	082	R	130	é	162	ó	210	├
035	#	083	S	131	â	163	ú	211	─
036	$	084	T	132	ä	164	ñ	212	┼
037	%	085	U	133	à	165	Ñ	213	╞
038	&	086	V	134	å	166	ª	214	╟
039	'	087	W	135	ç	167	º	215	╚
040	(	088	X	136	ê	168	¿	216	╔
041	)	089	Y	137	ë	169	⌐	217	╩
042	*	090	Z	138	è	170	¬	218	╦
043	+	091	[	139	ï	171	½	219	╠
044	,	092	\	140	î	172	¼	220	═
045	-	093	]	141	ì	173	¡	221	╬
046	.	094	↑	142	Ä	174	«	222	╧
047	/	095	_	143	Å	175	»	223	╨
048	0	096	'	144	É	176	▒	224	╤
049	1	097	a	145	æ	177	▓	225	╥
050	2	098	b	146	Æ	178	▒	226	╙
051	3	099	c	147	ô	179	▓	227	╘
052	4	100	d	148	ö	180	▒	228	╒
053	5	101	e	149	ò	181	▓	229	╓
054	6	102	f	150	û	182	▒	230	╫
055	7	103	g	151	ù	183	▓	231	╪
056	8	104	h	152	ÿ	184	▒	232	┘
057	9	105	i	153	Ö	185	▓	233	┌
058	:	106	j	154	Ü	186	▒	234	▒
059	;	107	k	155	ø	187	▓	235	▒
060	<	108	l	156	£	188	▒	236	▒
061	=	109	m	157	Ø	189	▓	237	▒
062	>	110	n	158	×	190	▒	238	▒
063	?	111	o	159	ƒ	191	▓	239	▒
064	@	112	p	160	á	192	▒	240	▒
065	A	113	q	161	í	193	▓	241	▒
066	B	114	r	162	ó	194	▒	242	▒
067	C	115	s	163	ú	195	▓	243	▒
068	D	116	t	164	ñ	196	▒	244	▒
069	E	117	u	165	Ñ	197	▓	245	▒
070	F	118	v	166	ª	198	▒	246	▒
071	G	119	w	167	º	199	▓	247	▒
072	H	120	x	168	¿	200	▒	248	▒
073	I	121	y	169	⌐	201	▓	249	▒
074	J	122	z	170	¬	202	▒	250	▒
075	K	123	{	171	½	203	▓	251	▒
076	L	124	|	172	¼	204	▒	252	▒
077	M	125	}	173	¡	205	▓	253	▒
078	N	126	→	174	«	206	▒	254	▒
079	O	127	←	175	»	207	▓	255	▒

TABLE 3.1 80 SERIES CHARACTER SET

3.2.1 CONTROL CHARACTERS

In this section, the recognized control characters and the printer actions are summarized.

PRINTER CHARACTER SET			
CHARACTER	**CONTROL**	**HEX**	**ACTION**
EOT	(^D)	04	END OF TEXT IN PRINTER IS IN BUFFER MODE, IT PRINTS CONTENT OF BUFFER. IF PRINTER IS IN LINE MODE, LINE FEED ONLY.
BS	(^H)	08	BACK SPACE REMOVE PREVIOUS CHARACTER IN BUFF
HT	(^I)	09	HORIZONTAL TAB TAB TO 5, 9, 13, 17, 21, 25, 29, 33, 37 OR BEGINNING OF NEXT LINE.
LF	(^J)	0A	LINE FEED ADVANCE TO BEINNING OF NEXT LINE.
VT	(^K)	0B	VERTICAL TAB ADVANCE 5 LINES
FF	(^L)	0C	FORM FEED ADVANCE 11 LINES
CR	(^M)	0D	CARRIAGE RETURN ADVANCE TO BEGINNING OF NEXT LINE.
SO	(^N)	0E	SHIFT OUT ALL CHARACTERS ARE PRINTED IN EXTENDED HEIGHT
SI	(^O)	0F	SHIF IN ADD CHARACTERS ARE PRINTED IN NORMAL HEIGHT
XON	(^Q)	11	TRANSMITTER ON TRANSMITTED IF THE PRINTER IS ON LINE TO ACCEPT DATA. IF RECEIVED, THE HOST COMPUTER IS READY TO ACCEPT DATA.
AUX ON	(^R)	12	PRINT HEAD ON TRANSMITTED ON POWER UP IF THE PRINT HEAD IS OPERATING. TRANSMITTED AFTER LOADING PAPER IN THE PRINTER. IGNORED IF RECEIVED.
XOFF	(^S)	13	TRANSMITTER OFF TRANSMITTED IF PRINT BUFFER IS FULL. TRANSMITTED IF OUT OF PAPER. IF RECIEVED, HOST COMPUTER IS OFF LINE.
AUX OFF	(^T)	14	PRINT HEAD OFF TRANSMITTED ON POWER UP IF THE PRINT HEAD IS NOT OPERATING. TRANSMITTED IF OUT OF PAPER. IGNORED IF RECEIVED.
CAN	(^X)	18	CANCEL CLEARS 8K PRINT BUFFER CONTENT AND RESETS EXTENDED AND EXPANDED PRINT.
ESC	(^{)	1B	EXCAPE USED DURING DOT ADRESSABLE GRAPHICS AND CLOCK/CALENDAR CONTROL AND PRINT MODES.
XPND	(^\)	1C	EXPAND PRINT ON
XPND OFF	(^])	1D	EXPAND PRINT OFF

3.3 CHARACTER SIZE

Four character sizes can be selected through the communication interface: NORMAL, EXPANDED double width, EXTENDED double height and LARGE double width and double height.

The NORMAL characters are formed using a 5x7 dot matrix. EXPANDED size characters are formed by using 10x7 dot matrix. The EXTENDED size characters are formed by using 5x14 dot matrix. The LARGE characters are formed by using 10x14 dot matrix.

EXPANDED PRINT is selected by sending the XPND character, (1CH), to the printer. All succeeding characters will print in EXPANDED form. To reset EXPANDED PRINT, XPND OFF character (1DH) must be sent to printer. all succeeding characters will print in NORMAL form.

EXTENDED PRINT can be selected by two methods:

1. Putting DIP Switch #6 in Switch Pack #2 ON, will force EXTENDED PRINT.
2. Through communication interface by sending the SO (^N) character to select EXTENDED PRINT. SI (^S) character resets EXTENDED PRINT.

(LARGE PRINT is selected if both EXPANDED and EXTENDED PRINT is selected.)

3.4 DOT ADDRESSABLE GRAPHICS

The 80 Series Printers can print special symbols, graphs and characters if operated in the Dot Addressable Graphics mode.

During the Dot Addressable Graphics mode of operation, the printer prints one dot line at a time. Each horizontal dot line is made out of (1x6) dot cells, and the total number of dot cells per line is the same as the maximum number of columns on the printer. For example, a model DM2480 has a total of 24 (1x6) dot cells corresponding to its 24 column capacity.
Each dot in a (1x6) dot cell can be turned ON or OFF by sending specific ASCII characters.

The graphics mode is invoked by sending ASCII characters 'ESC' (1BH) followed by 'G' (47H). Dot line printing starts upon receiving enough dot cells to complete a dot line, or ASCII 'CR' (0DH) or ASCII 'LF' (0AH).

The graphics mode is terminated by sending ASCII characters 'ESC' (1BH), followed by 'A' (41H).

3.4.1 GRAPHIC CHARACTER SET

The graphic character set extends from the character '?' (3FH) to '~' (7EH). Bits 1 through 6 of the characters received are used to turn ON or OFF the dots in a dot cell. If a bit is set (=1), a dot is enabled, otherwise the dot is disabled.

For example for ASCII '?' (3FH or 00111111B), bits 1 through 6 are set. Sending consecutive '?'s will form a one dot solid line across the paper.

3.5 CLOCK/CALENDAR, LINE COUNTER, INTERVAL TIMER FEATURES

The DM80 and the MM80 Series Miniprinters include a built-in real time CLOCK/CALENDAR, LINE COUNTER and an INTERVAL TIMER.

The TIME CLOCK provides military time. Hours, minutes and seconds may be printed.

The CALENDAR automatically compensates for leap years. Months, days and years may be printed.

The FOUR DIGIT LINE COUNTER, counts the number of lines printed.

The INTERVAL TIMER operates with one of fifteen preset time intervals. Its function is to send a pulse to the interfaced machine at the end of each selected time interval. this pulse tells the machine to send a total measurement, incurred during the specific time interval selected, back to the printer to be printed.

The CLOCK/CALENDAR print format is totally user programmable. It can be appended to each line printed if APPEND MODE is selected. In the AUTO CLOCK MODE, the CLOCK/CALENDAR will automatically print with every received carriage return. Section 3.5.1 part 5 discusses how to select these modes.

Also, by sending recognized escape sequences, the CLOCK/CALENDAR data can be printed as a part of the data received. Refer to Section 3.7 for details of this operation.

3.5.1 MANUAL FORMATTING CLOCK/CALENDAR FEATURES

The CLOCK/CALENDAR, LINE COUNTER, and INTERVAL TIMER features are initially disabled. This section lists the steps required to enable and format these features. The steps are summarized in Table 3.5. There are a total of 16 steps to follow in order to set and format these options.

1	TO START FORMATTING, put DIP Switch #3 on SWITCH PACK #2 ON. The printer prints the current CLOCK/CALENDAR setting. **S12:30:00 04-24-91 0000** While in this mode, the TEST SWITCH selects the desired field, and the FEED SWITCH changes information in the chosen field.
2	TO ENABLE THE CLOCK/CALENDAR, choose the sixth field by pressing the TEST SWITCH six (6) times. Now press the FEED SWITCH once, to enable the CLOCK/CALENDAR. The printer prints the default clock format as shown below: **AF12:30:59 12-30-91** The letter 'A' indicates the auto clock mode is selected while the letter 'F' indicates the format mode is selected. Pressing the FEED SWITCH again will disable the clock print, and the printer prints as follows to indicate the mode selected: **AF**
3	TO ADVANCE TO THE NEXT FIELD, press the TEST SWITCH once.
4	The TEST options 7 through 10 are used to enable or disable the printing of a CLOCK/CALENDAR field. To enable or disable a field, press the FEED SWITCH once. The printer prints the current field selection. For example, on the seventh pressing of the TEST SWITCH, the enable/disable time is selected. By default, the time is enabled initially, therefore, pressing the FEED SWITCH once will disable the time print, showing the calendar only: **AF 12-30-91** By successively pressing the FEED SWITCH, one will alternate between disable and enable, and pressing the TEST SWITCH once will advance to the next field.
5	On the 11th pressing of the TEST SWITCH, the CLOCK/CALENDAR print mode can be selected. By pressing the FEED SWITCH, one can alternate between APPEND and AUTO CLOCK modes. If the APPEND CLOCK mode is selected, the Clock Format print looks as follows: **F12:30:59 12-30-91** If the AUTO CLOCK mode is selected, the Clock Format print looks as follows: **AF12:30:59 12-30-91**
6	The 12th pressing of the TEST SWITCH allows the Line Counter to be enabled or disabled. This is accomplished by pressing the FEED SWITCH once to enable, or twice to disable the Line Counter. Initially the Line Counter is disabled. With the Line Counter enabled, the Format printout may look as follows: **AF13:30:59 12-30-91 0012**
7	The 13th pressing of the TEST SWITCH is used to reset the Line Counter. **AF13:30:59 12-30-91 0000**
8	On the 14th pressing of the TEST SWITCH, left or right justified clock printout can be selected. This selection only applies if the CLOCK/CALENDAR is operating in the Append Mode. Initially, the CLOCK/CALENDAR printout is right justified. Pressing the FEED SWITCH once will place the CLOCK/CALENDAR in the left justified print mode, and the format printout may look as follows: **L F12:30:59 12-30-91 0012** **R F12:30:59 12-30-91 0012** The letter 'L' indicates the left print, while 'R' indicates right justified print.
9	The 15th pressing of the TEST SWITCH selects the Auto Line Feed feature. Initially, the Auto Line Feed is set to zero. Press the FEED SWITCH 1 to 4 times to select the number of lines to automatically feed. Press the FEED SWITCH a 5th time to reset this feature to zero. The Format printout for Auto Line Feed may look as follows: **4 F12:30:59 12-30-91 0012** Where '4' indicates 4 lines of Auto Line Feed after each printed line.
10	(Optional-included with Interval Timer option) On the 16th pressing of the TEST SWITCH the Interval Timer feature can be set. A total of 15 intervals are available ranging from 5 seconds to 24 hours. In the leftmost print column, the printer prints letter '@' through 'O ' to indicate the interval selected. For example, if the 30 minutes interval timer is selected, the Format printout may look as follows: **H F12:30:59 12-30-91 0012** TABLE 3.7.1, summarizes the letters and corresponding interval timers. Upon timeout, the ENQ control character (05H) is transmitted serially, and the count output is pulsed for one second and the interval timer is re-loaded. Refer to section 3.8 for details.
11	On the 17th pressing of the TEST SWITCH, the CLOCK/CALENDAR SET FORMAT is restarted, and all the above steps may be repeated.
12	TO RETURN TO THE NORMAL OPERATING MODE, put DIP Switch #3 of SWITCH PACK #2 to the OFF position. The printer prints the new settings, and zeros the seconds before exiting the CLOCK SET MODE.

TEST SWITCH	FUNCTION
1	INCREMENT HOURS
2	INCREMENT MINUTES
3	INCREMENT MONTHS
4	INCREMENT DAYS
5	INCREMENT YEARS
6	ENABLE/DISABLE CLOCK/CALENDAR
7	ENABLE/DISABLE TIME
8	ENABLE/DISABLE SECONDS
9	ENABLE/DISABLE CALENDAR
10	ENABLE/DISABLE YEARS
11	APPEND/AUTO CLOCK MODE
12	ENABLE/DISABLE LINE COUNTER
13	RESET LINE COUNTER

TABLE 3.5 CLOCK/CALENDAR FORMAT TABLE

3.5.2 SETTING CLOCK/CALENDAR FEATURE

The CLOCK/CALENDAR can be set using the TEST and FEED switches located on the front panel of the unit. This section deals only with steps 1 through 5 required for setting of the clock/calendar, as listed in Table 3.5.

1	TO START THE CLOCK SETTING PROCEDURE - put DIP Switch #3 on SWITCH PACK 2 ON. Upon selecting the CLOCK SET MODE, the printer prints the current clock and calendar setting: **S12:30:00 04-24-91 0000**

Setting the CLOCK/CALENDAR is done from left to right in the following order:

	HOURS	/MINUTES	/MONTHS	/DAYS	/YEARS
STEP	**1**	**2**	**3**	**4**	**5**

There are a total of five fields to set the CLOCK/CALENDAR. Initially, NO FIELD IS SELECTED.

2	TO SELECT THE HOURS FIELD, press the TEST switch once.
3	TO ADVANCE THE SETTING OF THE HOURS FIELD, press the FEED SWITCH. The HOURS setting will advance by one for each pressing of the FEED SWITCH.
4	TO ADVANCE TO THE NEXT FIELD, press the TEST SWITCH once.
5	REPEAT STEPS 3 AND 4 to set the rest of the CLOCK/CALENDAR fields. [Note: The Years are looped from 91 through 30. Thus the next Year after 30 will be 91].
6	FORMATTING THE CLOCK PRINT is started after the sixth pressing of the FEED SWITCH.
7	TO VERIFY THE CLOCK SETTING without exiting the clock set mode, press the TEST SWITCH until the printer prints the CLOCK SET message. At this point, steps 1 through 5 can be repeated if the clock setting needs to be modified.

To exit the CLOCK SET MODE, put DIP Switch #3 on SWITCH PACK 2 in the OFF position. The printer prints the new setting and zeros the seconds before exiting the CLOCK SET MODE. While in the CLOCK SET MODE, hours and minutes will remain the same until the mode is exited.

3.5.3 SETTING CLOCK/CALENDAR MM80 SERIES ONLY

The CLOCK/CALENDAR feature for the MM80 Series Miniprinters with membrane switch style front panels may be set using the instructions in Section 3.5.2. However the DM80 Series Miniprinters will not respond to the following directions.

If the CLOCK/CALENDAR feature is ENABLED, the SLCT and ADVN switches located on the front panel can be used to set the clock, while the FEED and TEST switches are used to verify the clock setting. The DIP Switch #3 of Pack #2 must be OFF for this procedure. Setting the CLOCK/CALENDAR is done from left to right in the following order:

	PRINTER OFF LINE	/HOURS	/MINUTES	/MONTHS	/DAYS	/YEARS	/PRINTER ON LINE
SLCT:	**1**	**/2**	**/3**	**/4**	**/5**	**/6**	**/7**

1. To start the clock setting, press the SLCT switch once. The printer will print the current time and date, and the DTR LED will turn off indicating the unit is off line.
2. To select the hours field, press SLCT once, and advance the hours setting using the ADVN SWITCH.
3. To select the minutes field, press SLCT once. Press the ADVN SWITCH to adjust the minute setting.
4. Continue to the next field by pressing SLCT once. Press the ADVN SWITCH to change the information within that field.
   [Note: Years are looped from 91 through 30. Thus the next year following 30 will be 91.]
5. On the seventh pressing of the SLCT switch, the clock setting is automatically terminated. The DTR LED will turn on, showing the printer to be back on line.

3.6 BATTERY BACKED-UP TIME CLOCK FEATURE

To eliminate the need to set the clock after power loss, the BATTERY BACKED-UP CLOCK/CALENDAR FEATURE is available (PART # 31D1243). On initial power up, the printer senses the presence of the BATTERY BACKED-UP CLOCK/CALENDAR, and uses its setting to set the system clock.

The formatting information selected is saved in the BATTERY BACKED-UP CLOCK/CALENDAR FEATURE and restored upon power up.

3.7 RECOGNIZED ESCAPE SEQUENCES

The CLOCK/CALENDAR/LINE COUNT may be formatted or printed by sending a string of characters preceded by an ESC character (1BH). Use of strings other than those shown in Table 3.7 may result in unspecified clock/printer operation. The ESCAPE SEQUENCE to print all or a portion of the CLOCK/CALENDAR/LINE COUNT is **ESC P** followed by a character that selects the format. This sequence may be exited only by terminating the string with the carriage return character. The carriage return will not be printed.

The ESCAPE SEQUENCE to format the CLOCK/CALENDAR/LINE COUNT print is **ESC F**, followed by a character that selects the format. The printer prints a sample f the format selected. This sequence is exited automatically after the receipt of one of the following characters in Table 3.7 below. For example, sending (ESC,F,^) character (1BH, 46H, 5EH) will enable Hours and Minutes print and disable Years, months, days and interval timer print.

The ESCAPE SEQUENCE to transmit all or a portion of the CLOCK/CALENDAR/LINE COUNT is **ESC T** followed by a character that selects the format. This sequence is exited automatically after the receipt of one of the characters from Table 3.7.

The LINE COUNT is reset to 0000 by sending ESC C and is automatically terminated.

CHARACTER COUNT		HOURS/MINUTES	SECONDS	MONTH/DAY	YEARS	LINE
@	(40 HEX)	X	X	X	X	X
A	(41HEX)			X	X	X
B	(42 HEX)	X	X			X
C	(43 HEX)					X
D	(44 HEX)	X	X	X	X	
E	(45 HEX)			X	X	
F	(46 HEX)	X	X			
G	(47 HEX)					
H	(48 HEX)	X		X	X	X
I	(49 HEX)			X	X	X
J	(4A HEX)	X				X
K	(4B HEX)					X
L	(4C HEX)	X		X	X	
M	(4D HEX)			X	X	
N	(4E HEX)	X				
O	(4F HEX)					
P	(50 HEX)	X	X	X		X
Q	(51 HEX)			X		X
R	(52 HEX)	X	X			X
S	(53 HEX)					X
T	(54 HEX)	X	X	X		
U	(55 HEX)			X		
V	(56 HEX)	X	X			
W	(57 HEX)					
X	(58 HEX)	X		X		X
Y	(59 HEX)			X		X
Z	(5A HEX)	X				X
[	(5B HEX)					X
\	(5C HEX)	X		X		
]	(5D HEX)		X			
^	(5E HEX)	X				

TABLE 3.7 CLOCK/CALENDAR RECOGNIZED FORMAT CHARACTERS

3.7.1 INTERVAL OUTPUT USING ESCAPE SEQUENCE

The INTERVAL OUTPUT is set by sending ESC I followed by a character that selects the interval. Below is the list of valid characters and the intervals selected. This sequence is automatically terminated after the receipt of one of the following characters:

@	(40 HEX)	NO INTERVAL
A	(41 HEX)	5 SECONDS
B	(42 HEX)	15 SECONDS
C	(43 HEX)	30 SECONDS
D	(44 HEX)	1 MINUTE
E	(45 HEX)	2 MINUTES
F	(46 HEX)	5 MINUTES
G	(47 HEX)	15 MINUTES
H	(48 HEX)	30 MINUTES
I	(49 HEX)	1 HOUR
J	(4A HEX)	2 HOURS
K	(4B HEX)	4 HOURS
L	(4C HEX)	6 HOURS
M	(4D HEX)	8 HOURS
N	(4E HEX)	12 HOURS
O	(4F HEX)	24 HOURS

TABLE 3.7.1 INTERVAL TIMER OUTPUT RECOGNIZED CHARACTERS

3.8 INTERVAL TIMER OPTION

The Interval Timer Option is a software option for 80 Series Miniprinters. The feature is designed to ease interfacing the 80 Series to control or data acquisition equipment requiring polling or special communication protocols. Fifteen preset timing intervals are available. The interval timer can be set from front panel controls or by sending ASCII data string serially.

To avoid resetting of the interval timer after power loss, an optional BATTERY CLOCK/8K RAM (part # 31D1243) is available.

The methods for selecting an interval timer for the 80 Series are detailed in SECTIONS 3.5 through 3.7 of the Operator's Manual. For manual setting of the interval timer, refer to the clock formatting Section 3.5.1 part 10. If serial setting is desired, use command strings listed in Table 3.7.1 and explained in Section 3.7.1.

Once an interval timer is selected, an 80 Series printer will execute the following actions on timeout:

1- Lower pin #25 on DB25S connector to zero volts from #5 VDC for a period of one sec.
2- Transmits control character ENQ (05 HEX).
3- Restarts timer.

The figure below illustrates the timing characteristics of the Interval Timer Option.

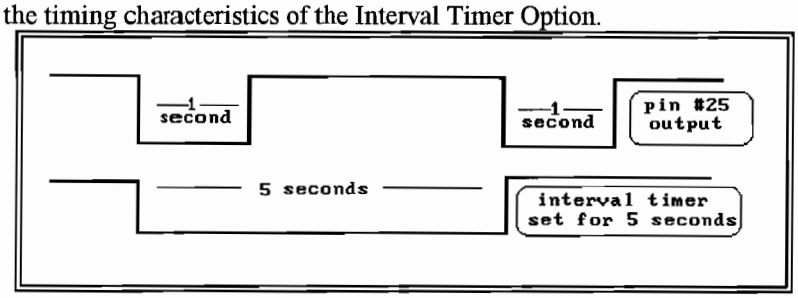


FIGURE 3.8 TIMING CHARACTERISTICS-INTERVAL TIMER

The Interval Timer outputs are located on the DB25S connector located on the rear panel of the 80 Series printers. The output pinouts are summarized in the table below.

DB25S PIN #	DESCRIPTION
7	COMMON
25	TTL OUT (NORMAL +5 VDC, 0V TIMEOUT
2	RS232 DATA OUT (05 HEX)

TABLE 3.8 INTERVAL TIMER-PINOUTS

3.9 TOTALIZING PULSE COUNTER AND INTERVAL TIMER OPTION

The Totalizing Pulse Counter Option is a software option combining the serial Printer, Clock/Calendar, Counter and Interval Timer into a single unit. It is designed to eliminate the need for a separate counter and data logging printer.

The standard version of this option features a built in six digit counter programmable to count transitions within a desired time interval. It accepts transitions up to 25,000 cycles per second. For more detailed information, refer to ADDENDUM 80 SERIES PRINTERS TOTALIZING COUNTER AND INTERVAL TIMER OPTION.

3.10 SYSTEM ERROR PRINTS AND INDICATIONS

If the 80 Series Miniprinters encounters system errors during normal operation, it will alert the operator by printing an Error Message, or turning off the front panel LED.

System errors are listed below:

ERROR	ACTION:
1 - OUT OF PAPER	EOP L.E.D. LOCATED ON THE FRONT IS TURNED ON. AUX OFF IS TRANSMITTED ON SERIAL PORTS. ON THE PARALLEL PRINTER, THE PAPER ERROR BIT IS TURNED ON.
2 - PRINTER HEAD JAM	GIVES INDICATIONS IDENTICAL TO "OUT OF PAPER"
3 - DATA RECEIVE ERROR	THE MESSAGE IS PRINTED IF THE HOST COMPUTER SENDS DATA IGNORING HAND SHAKE PROTOCOLS. (RECEIVED DATA WILL BE LOST.)

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CHAPTER 4 INTERFACE OPTIONS

4.1 SERIAL RS232C

The RS232C Interface signals for the 80 Series Miniprinters are terminated on a DB25S type female connector located on the rear of the unit.

Five connections are needed from the Serial Interface to the host computer for proper operation of this option. TABLE 4.0 lists the Serial Interface signals and pinouts on the DB25S female connector.

80 SERIES DB25 PIN#	DESCRIPTION	
1	PROTECTIVE GROUND	
2	RS232 OUT	(TXD)
3	RS232 IN	(RXD)
4	REQUEST TO SEND OUTPUT	(RTS)
5	CLEAR TO SEND INPUT	(CTS)
7	COMMON	

TABLE 4.0 RS232C PINOUTS

4.1.1 COMMUNICATION SPEED AND PROTOCOL

The proper BAUD RATE and protocol settings are required to communicate with a host computer. DIP Switches 1, 2, and 3 on SWITCH PACK #1 control the BAUD RATE, while DIP Switches 4, 5, and 7 control the protocol as shown in APPENDIX A.

The standard factory setting is 9600 BAUD, 8 DATA BITS, ODD PARITY BIT, and one STOP BIT (all switches in off position).

Two communication protocols are supported by the 80 Series Miniprinters.

1. SERIAL BUSY PROTOCOL:
   In this mode, Pins 4 (RTS) and 5 (CTS) are used to control data flow to and from the printer.

   Pin #4 is used to control the data flow to the printer, which raises RTS when it is ready to accept data and lowers RTS under any of the following conditions:

   1 - PRINT BUFFER HAS LESS THAN 256 LOCATIONS.
   2 - PAPER OUT.
   3 - TEST OR FEED IS SELECTED.

   Pin #5 (CTS) is monitored during data transmission from the printer. The unit transmits only if CTS is high under the SERIAL BUSY PROTOCOL.

2. XON/XOFF PROTOCOL:

   The unit transmits XON when it is ready to accept data, and XOFF for conditions 1 through 3 listed above.

   For XON/XOFF protocol, the data flow out of the printer's Serial Port is halted on XOFF and resumed on XON.

4.1.2 RS232 TECHNICAL SPECIFICATION

DATA TRANSFER RATE	:	110-9600 BAUD	
WORD LENGTH	:	1 START	
		7 OR 8 DATA BITS	
		1 OR 2 STOPS	
SIGNAL LEVELS	:	MARK OR LOGICAL	1= -3 to -15VDC
		SPACE OR LOGICAL	0= +3 to +15VDC
HANDSHAKING	:	RTS/CTS	
		XON/XOFF	

4.2 SERIAL RS422

The RS422 Interface signals for the 80 Series Miniprinters are terminated on a DB25S type female connector located on the rear of the unit.

Nine (9) connections are needed from the Serial Interface to the host computer for proper operation of this option. TABLE 4.1 lists the Serial Interface signals and pinouts on the DB25S connector.

80 SERIES DB25 PIN#	DESCRIPTION	
1	PROTECTIVE GROUND	
2	RS422 OUT+	(TXD+)
9	RS422 OUT-	(TXD-)
3	RS422 IN+	(RXD+)
10	RS422 IN-	(RXD-)
4	REQUEST TO SEND OUTPUT+	(RTS+)
11	REQUEST TO SEND OUTPUT-	(RTS-)
5	CLEAR TO SEND INPUT+	(CTS+)
12	CLEAR TO SEND INPUT-	(CTS-)
7	COMMON	

TABLE 4.1 RS422 PINOUTS

4.2.1 RS422 COMMUNICATION SPEED AND PROTOCOL

Refer to Section 4.1.1 for communication speeds and protocols.

4.2.2 RS422 TECHNICAL SPECIFICATIONS

DATA TRANSFER RATE	:	110-9600 BAUD
WORD LENGTH	:	1 START
		7 OR 8 DATA BITS
		1 OR 2 STOPS
SIGNAL LEVELS	:	MARK OR LOGICAL 1=(SIG+) - (SIG-) >+200 millivolts
		SPACE OR LOGICAL 0=(SIG+) - (SIG-) <-200 millivolts
HANDSHAKING	:	RTS/CTS
		XON/XOFF

4.3 SERIAL 20ma CURRENT LOOP

The Serial 20mA Current Loop interface signals for the 80 Series Miniprinters are terminated on a DB25S type female connector located on the rear of the unit.

Four connections are needed from the Serial Interface to the host computer for proper operation of this option. TABLE 4.2 lists the Serial Interface signals and pinouts on the DB25S connector. Loop current must be provided by the host computer.

80 SERIES DB25 PIN#	DESCRIPTION	
1	PROTECTIVE GROUND	
14	20mA OUT+	(TXD+)
13	20mA OUT-	(TXD-)
16	20mA IN+	(RXD+)
15	20mA IN-	(RXD-)

TABLE 4.2 CURRENT LOOP PINOUTS

4.3.1 CURRENT LOOP COMMUNICATION SPEED AND PROTOCOL

Only the XON/XOFF protocol is supported by the Current Loop Interface. Refer to Section 4.1.1 for communication speeds and protocols.

4.3.2 CURRENT LOOP SPECIFICATION

DATA TRANSFER RATE	:	110-9600 BAUD
WORD LENGTH	:	1 START
		7 OR 8 DATA BITS
		1 OR 2 STOPS
SIGNAL LEVELS	:	MARK OR LOGICAL 1= CURRENT ON
		SPACE OR LOGICAL 0= CURRENT OFF
		MAXIMUM VOLTAGE = +/- 5VDC
		MAXIMUM CURRENT = 40mA
HANDSHAKING	:	XON/XOFF

4.4 8 BIT PARALLEL INTERFACE

The Parallel Interface signals for the 80 Series Miniprinters are terminated on a 36 pin Amphenol connector located on the rear of the printer.

TABLE 4.3 lists the Parallel Interface signals and the connector pinouts. A (/) before a signal name indicates the signal is ACTIVE LOW, otherwise the signal is ACTIVE HIGH.

PIN#	SIGNAL NAME	DIRECTION	FUNCTION
1	/STROBE	IN	DATA READY TO BE READ
2	DATA 1	IN	DATA BIT RECEIVED 1
3	DATA 2	IN	DATA BIT RECEIVED 2
4	DATA 3	IN	DATA BIT RECEIVED 3
5	DATA 4	IN	DATA BIT RECEIVED 4
6	DATA 5	IN	DATA BIT RECEIVED 5
7	DATA 6	IN	DATA BIT RECEIVED 6
8	DATA 7	IN	DATA BIT RECEIVED 7
9	DATA 8	IN	DATA BIT RECEIVED 8
10	/ACK	OUT	DATA RECEIVED ACKNOWLEDGE
11	BUSY	OUT	PRINTER BUSY
12	PE	OUT	PAPER OUT ERROR
13	SELECTED	OUT	PRINTER IS ON LINE
14-15			NO CONNECTION
16	COMMON		SIGNAL COMMON
17	GROUND		CHASSIS GROUND
18			NO CONNECTION
19-30	COMMON		SIGNAL COMMON
31	/PRIME	IN	EXTERNAL PRINTER RESET
32	/FAULT	OUT	PRINTER FAULT
33-36			NO CONNECTION

TABLE 4.3 PARALLEL INTERFACE PINOUTS

4.4.1 PARALLEL INTERFACE OPERATION

Pin #1 of the Parallel Interface connector carries the /STROBE signal from the host computer to the printer. This signal is held at TTL HIGH level normally, and lowered by the computer when the data is ready for the printer. A flip-flop located on the printer control card latches the /STROBE signal, and interrupts the processor to read, validate, and save the data received.

Also, the busy signal (Pin #11) is set to indicate that the printer is busy reading data received.

Upon saving the data received, the printer lowers /ACK (Pin #10) to acknowledge that data has been received, and lowers the busy signal.

4.4.2 PARALLEL INTERFACE SPECIFICATIONS

DATA TRANSFER RATE	:	6000 CHARACTERS/SEC
SYNCHRONIZATION	:	VIA STROBE LINE
HANDSHAKING	:	ACK AND BUSY SIGNALS
SIGNAL LEVELS	:	COMPATIBLE WITH TTL LEVEL

4.5 INTERFACE TIMING DIAGRAMS

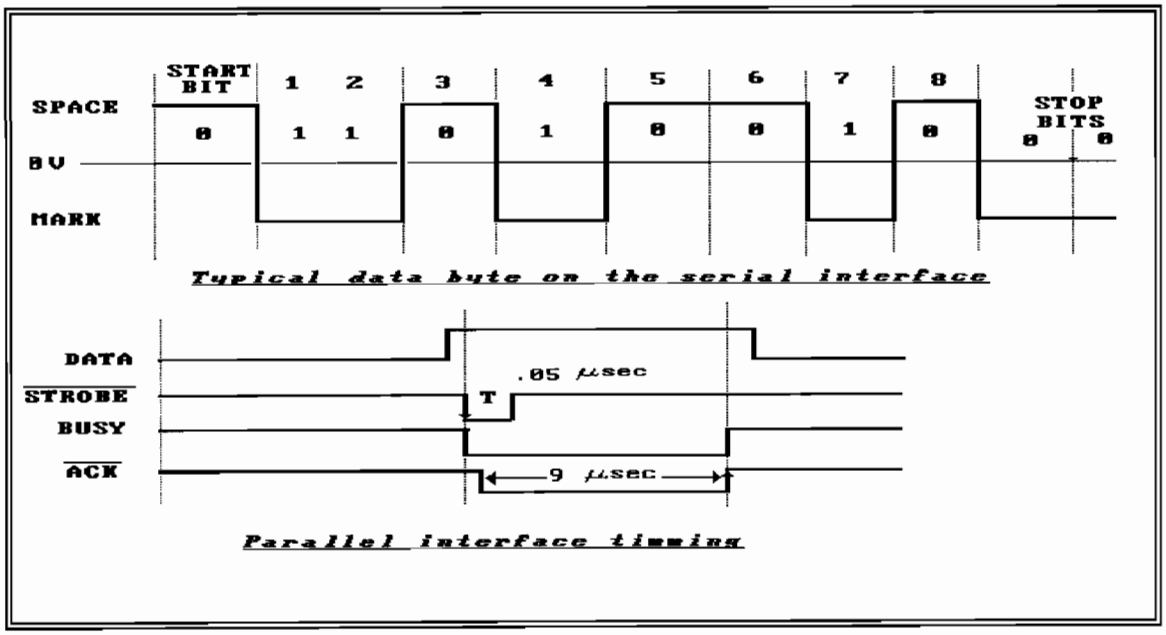

FIGURE 4.5 PARALLEL INTERFACE TIMING DIAGRAMS

5.0 REPLACING PRINTER PAPER AND RIBBON

The print paper tray of the 80 Series Miniprinters is located behind the front bezel. To remove the printer paper tray assembly, turn the front bezel locking fasteners counterclockwise, and pull forward to disconnect. Once the assembly is free, pull the remaining paper on the roll through the mechanism in a forward direction. Then, remove the ribbon cartridge by pushing the "PUSH EJECT" area on the cartridge.

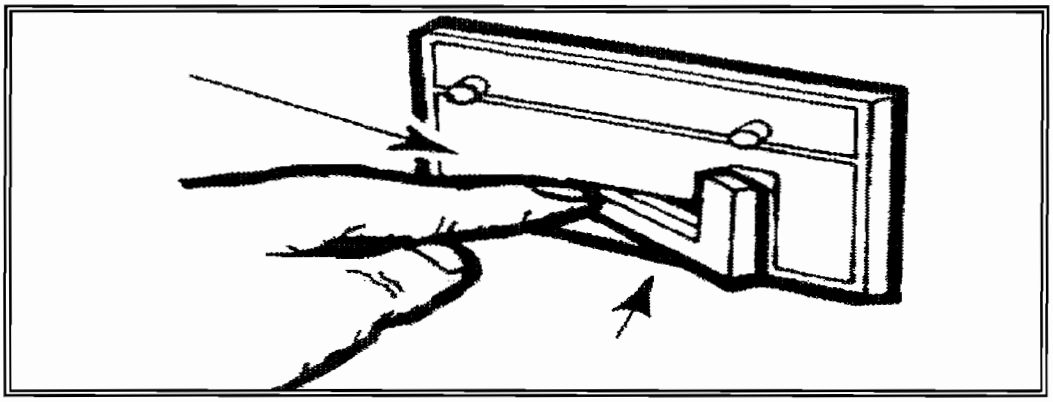

FIGURE 5.0 REPLACING PRINTER PAPER AND RIBBON-STEP 1

Insert a new roll of paper on the paper holder shaft. Then, guide the edge of the paper into the "PAPER OUT" detector.

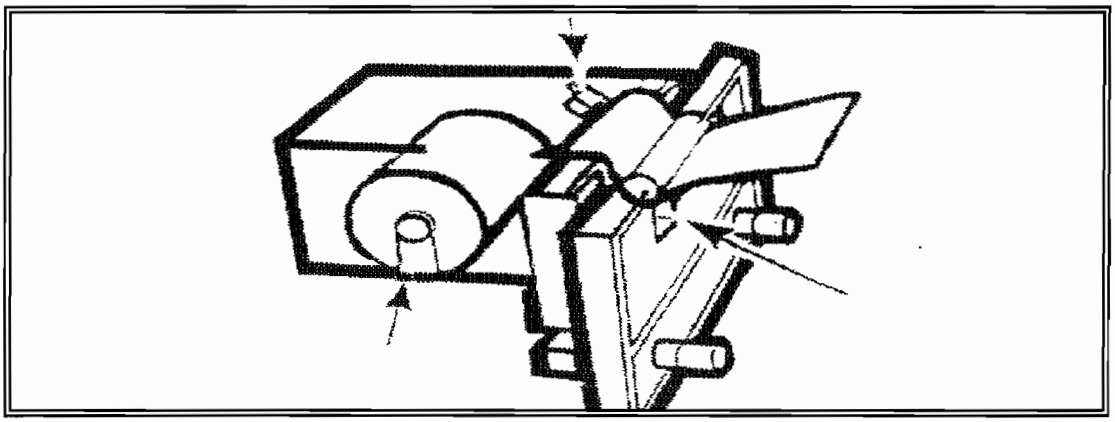

FIGURE 5.0A REPLACING PRINTER PAPER AND RIBBON-STEP 2

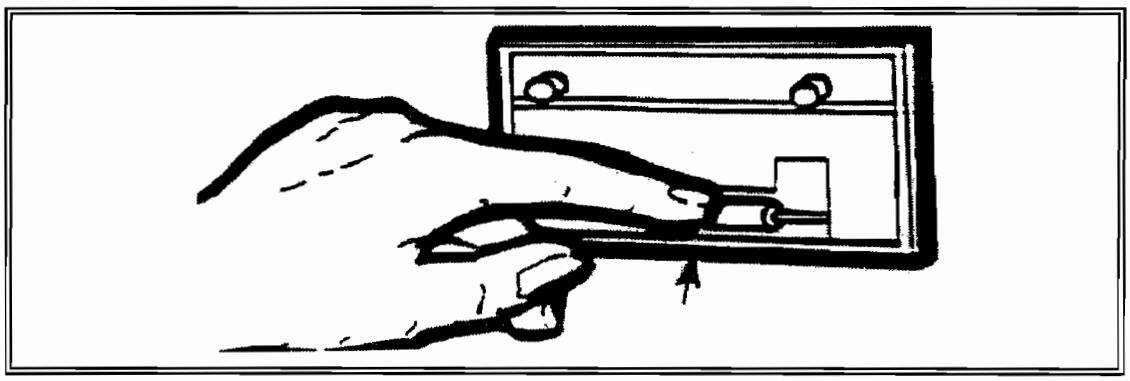

FIGURE 5.0B REPLACING PRINTER PAPER AND RIBBON-STEP 3

Feed the free end of the paper through the bottom and into the printer mechanism paper input. Feed the paper forward by rolling the pressure roller with your finger.

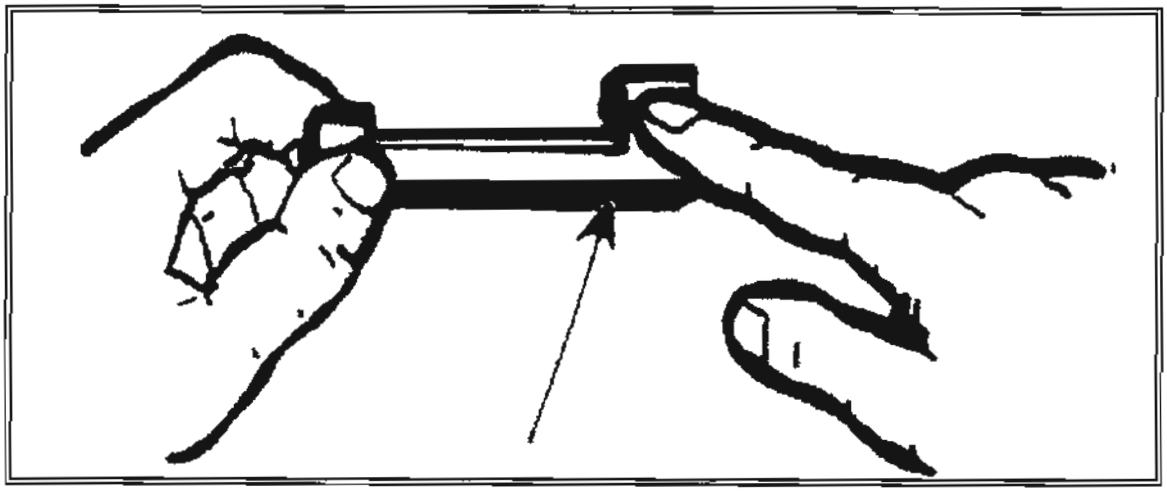

FIGURE 5.0C REPLACING PRINTER PAPER AND RIBBON-STEP 4

Tighten the ribbon, and slip the cartridge over the paper. Plug the printer assembly back into the unit, and rotate the fasteners clockwise to secure the unit in place.

****

CAUTION!!!!!!!!!!!!!!!!!!!!!!DO NOT PULL PAPER BACKWARD THROUGH THE MECHANISM!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

****

5.1 SUPPLIES

DESCRIPTION:	KELTRON PART NUMBER:	
COLUMNS:	16:	24-42:
Roll Paper	10S214	10S216
Ribbon Cartridge	10S213	10S215

Data Input Connectors:

Serial Connector and Hood	21U001 & 21U003
Parallel Connector	21C336
DC Power Input Cable	64K4832

5.2 WARRANTY

The Keltron Corporation warrants all its products against defects in workmanship, materials, and construction under normal use and service, for a period of one year.

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APPENDIX A

Serial Interface Settings
& Printer Function Settings

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SWITCH# 1, 2, 3	A) **BAUD RATE SETTINGS**			
	BAUD RATE	**SW1**	**SW2**	**SW3**
	110	ON	ON	ON
	150	OFF	ON	ON
	300	ON	OFF	ON
	600	OFF	OFF	ON
	1200	ON	ON	OFF
	2400	OFF	ON	OFF
	4800	ON	OFF	OFF
	9600	OFF	OFF	OFF
SWITCH# 4	B) **WORD LENGTH**			
	NUMBER OF DATA BITS		**SW4**	
	8		OFF	
	7		ON	
SWITCH# 5, 6	C) **PARITY SETTINGS**			
	PARITY	**SW5**	**SW6**	
	EVEN	OFF	ON	
	OFF	OFF	OFF	
	DISABLED	ON	OFF	
SWITCH# 7	D) **NUMBER OF STOP BITS**			
			SW7	
	1 STOP		ON	
	2 STOP		OFF	
SWITCH# 8	E) **INPUT ERROR SELECT**			
				SW8
	PRINT CHARACTERS RECEIVED UART ERROR.			ON
	PRINT # ON RECEIVED UART ERROR.			OFF

TABLE A.1 SERIAL INTERFACE SETTINGS

SWITCH# 1	A) **TYPE OF INTERFACE** ON = CENTRONICS/PARALLEL INTERFACE SELECTED OFF = RS232/RS422 SERIAL INTERFACE IS SELECTED
SWITCH# 2	B) **CURRENT LOOP SELECT** ON = CURRENT LOOP IS SELECTED OFF = CURRENT LOOP IS OFF
SWITCH# 3	C) **SET CLOCK/CALENDAR** ON = SELECT CLOCK SET MODE OFF = SELECT CLOCK RUN MODE
SWITCH# 4	**THIS MUST ALWAYS BE OFF**
SWITCH# 5	D) **CR-LF/PRINT ALL MODE** ON = CR-LF=LF IS SELECTED OFF = PRINT ALL IS SELECTED
SWITCH# 6	E) **EXTENDED/NORMAL PRINT** ON = FORCE EXTENDED PRINT OFF = NORMAL PRINT IS SELECTED
SWITCH# 7	F) **TEXT/LIST PRINT** ON = PRINT INVERTED/TEXT OFF = PRINT NORMAL/LIST
SWITCH# 8	G) **BUFFER/LINE MODE** ON = BUFFER MODE IS SELECTED OFF = LINE MODE IS SELECTED

TABLE A.2 PRINTER FUNCTIONS SETTINGS

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APPENDIX B

U.L. Listed 80 SeriesPrinters

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APPENDIX B U.L. LISTED 80 SERIES PRINTERS

DC powered Keltron 80 Series printers are U/L listed as:
System Control Unit Accessories and
System Control Unit Accessories - Component

The following are the U.L. listed model numbers of the 80 Series printers.

DM1680/4	DM1683/4
DM1680/5	DM1683/5
DM1680/7	DM1683/7
MM2480/4	MM2483/4
MM2480/5	MM2483/5
MM2480/7	MM2483/7
MM3280/4	MM3283/4
MM3280/5	MM3283/5
MM3280/7	MM3283/7
MM4080/4	MM4083/4
MM4080/5	MM4083/5
MM4080/7	MM4083/7
MH2480/4	MH2483/4
MH2480/5	MH2483/5
MH2480/7	MH2483/7
MH3080/4	MH3083/4
MH3080/5	MH3083/5
MH3080/7	MH3083/7
MH3680/4	MH3683/4
MH3680/5	MH3683/5
MH3680/7	MH3683/7
MH4280/4	MH4283/4
MH4280/5	MH4283/5
MH4280/7	MH4283/7

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APPENDIX C

Panel Mounting Directions

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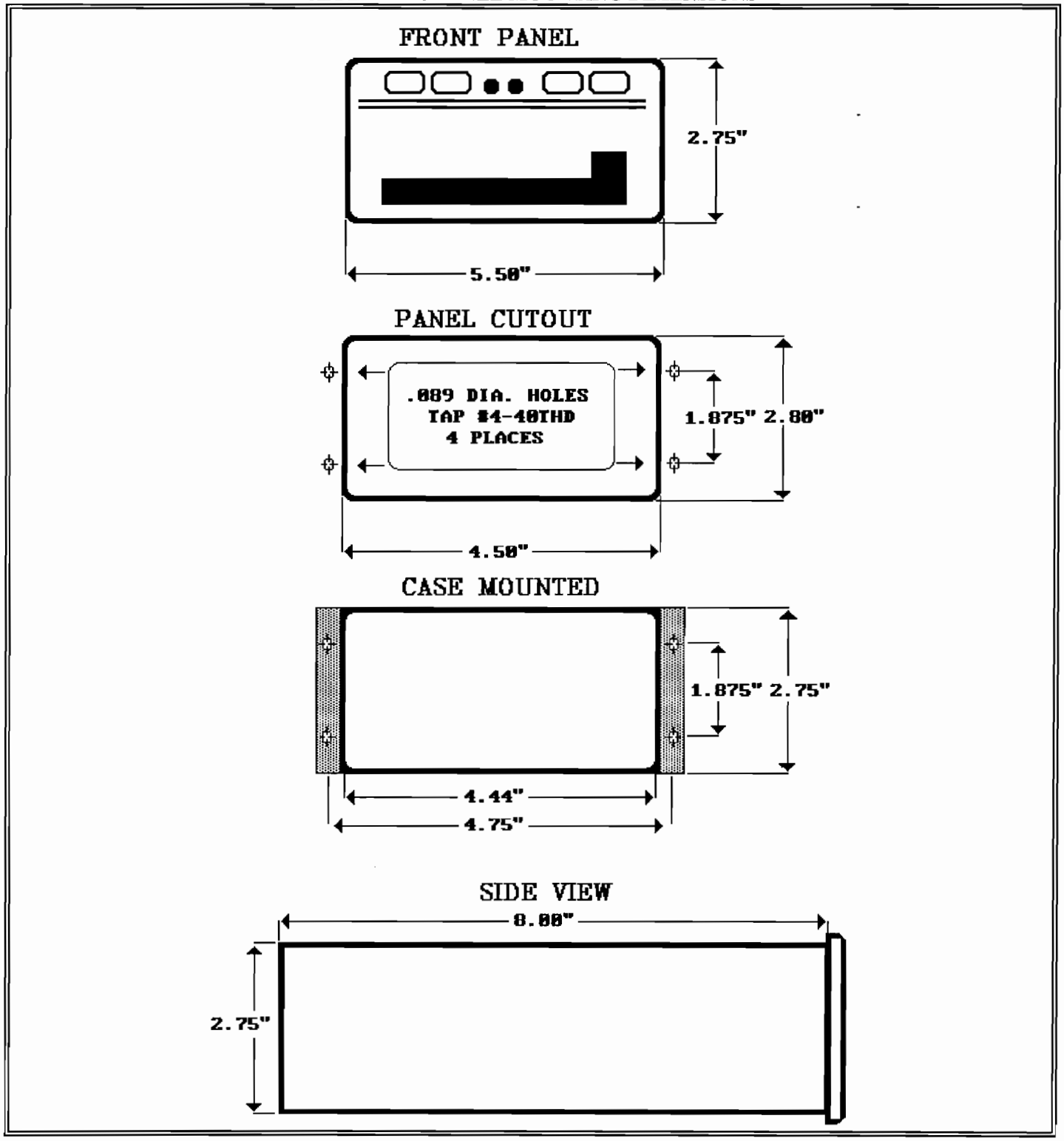
APPENDIX C PANEL MOUNTING DIMENSIONS



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APPENDIX D

Space-Saver Ordering Info. & Mounting Directions

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APPENDIX D SPACE-SAVER ORDERING INFO. & MOUNTING DIMENSIONS

The basic 80 Series Miniprinter is comprised of a front panel assembly, a microcomputer-based printer controller, a power supply module and a metal enclosure. The Space Saver components include the above (with the exception of metal enclosure) plus an interconnecting cable which allows the controller board to be located remotely from the front panel assembly.

The **front panel assembly** includes the printer mechanism, the paper holder chassis, the paper-out detector switch and the front panel operator control switches plus an 88 pin Cinch PC connector for connection to the printer controller board. See Figure D.1 and D.2.

The **printer controller** holds the printer driver and the data interface circuitry. One end has an input connector to accept data. An edge connector at the other end is to connect its printer driver and switch monitoring circuitry to the front panel. This can be done by plugging it directly into the front panel 88 pin Cinch connector or via a ribbon cable. The cables are available in lengths of 12, 24, or 36 inches. See Figure D.3.

The **power supply module** is connected to the printer controller board via molex connector. The modules with DC inputs have a input connector as described in Table 2.4. The AC powered modules have terminal blocks. See Figure D.4.

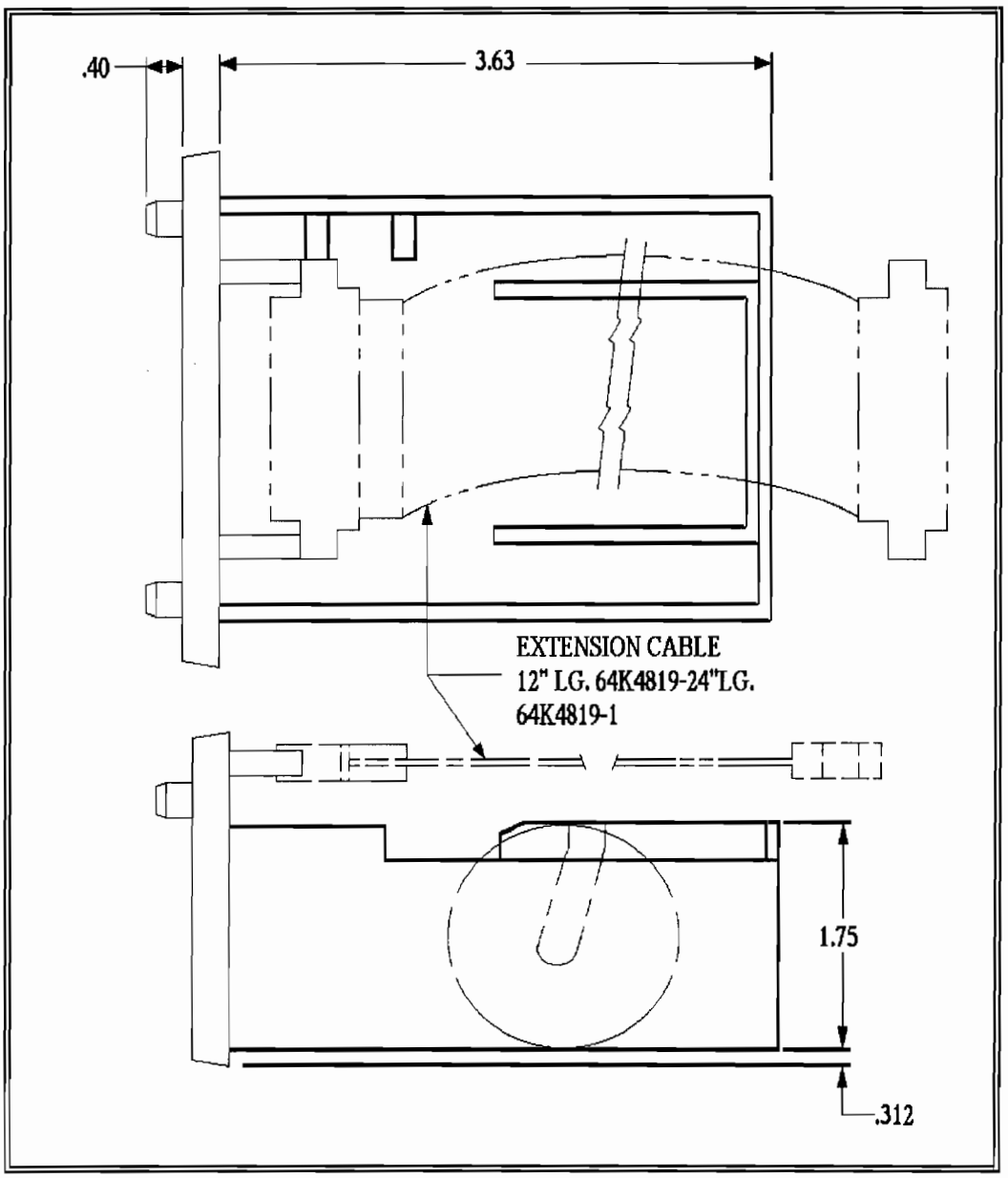

FIGURE D.1

PANEL MOUNTING OF FRONT PANEL ASSEMBLY

The 80 series front panel can be panel mounted if a cutout as shown in FIGURE E.2 is made on the front panel of a host unit. The two mounting thumb screws, located on the front panel assembly hold the front panel in place. 3.7" clearance is required behind the front panel.

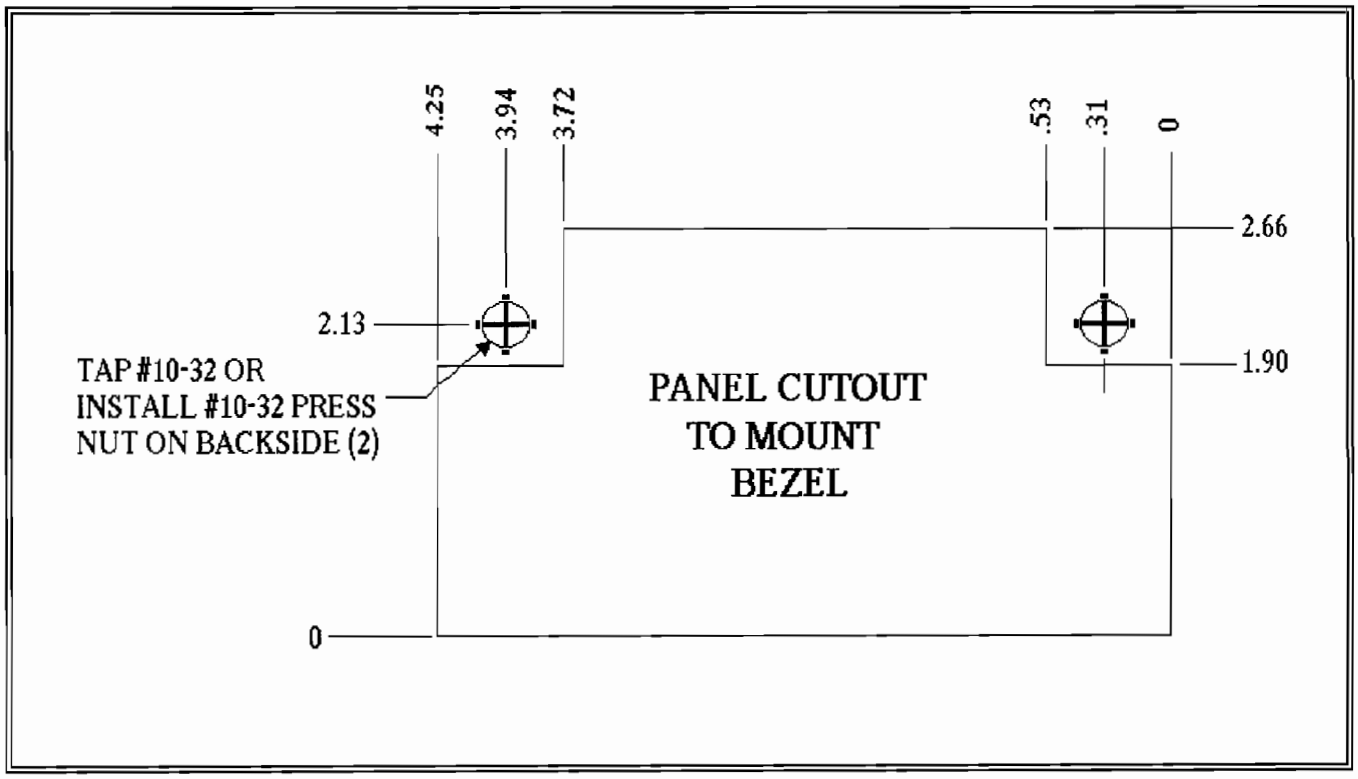

FIGURE D.2

The front panel can be connected to the printer controller using an extension cable. The part number fo the extension cables available are listed below:

MODEL NUMBER	DESCRIPTION
64K4819	12" EXTENSION CABLE
64K4819-1	24" EXTENSION CABLE
64K4819-3	36" EXTENSION CABLE

PRINTER CONTROLLER

SUMMARY OF PRINTER CONTROL CARDS AVAILABLE:

MODEL NUMBER	DESCRIPTION
95M3058	Centronics parallel
95M3029/5	Serial RS232, 20ma
95M3029/7	Serial RS422, 20ma
95M3029/8	RS232, Centronics, 20ma
95M3029/9	RS422, Centronics, 20ma

PRINTER CONTROLLER MOUNTING:

The 80 Series printer controller card can be mounted using four mounting holes provided. FIGURE E.3 summarizes the mechanical dimensions of the 95M3029 and 95M3058 control cards.

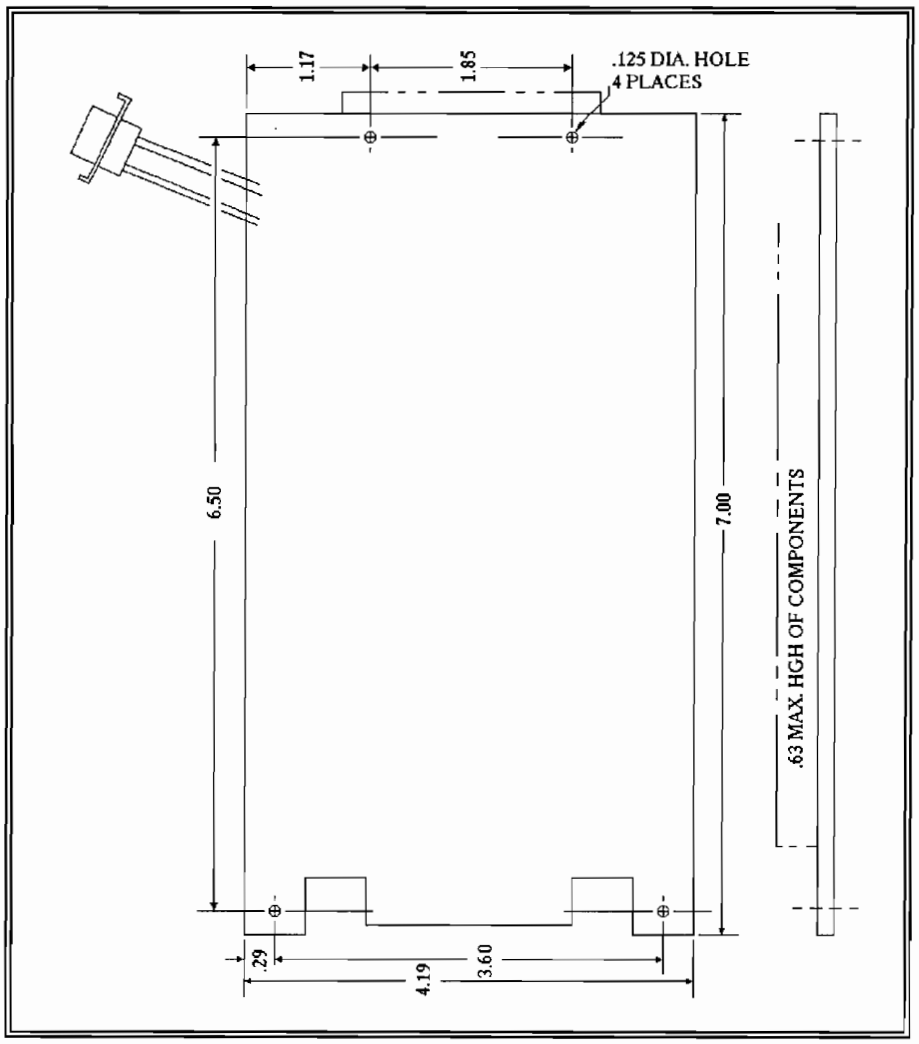

FIGURE D.3

POWER SUPPLY MODULE

Three types of power supply assemblies are available to select from:

MODEL NUMBER	DESCRIPTION
95M2885-2	9-40 volts DC
95M2952-2	120 volts AC
95M2952-6	220 volts AC

Alll three power supply assemblies come mounted on a plate and four holes are provided for mounting as shown in FIGURE E.4.

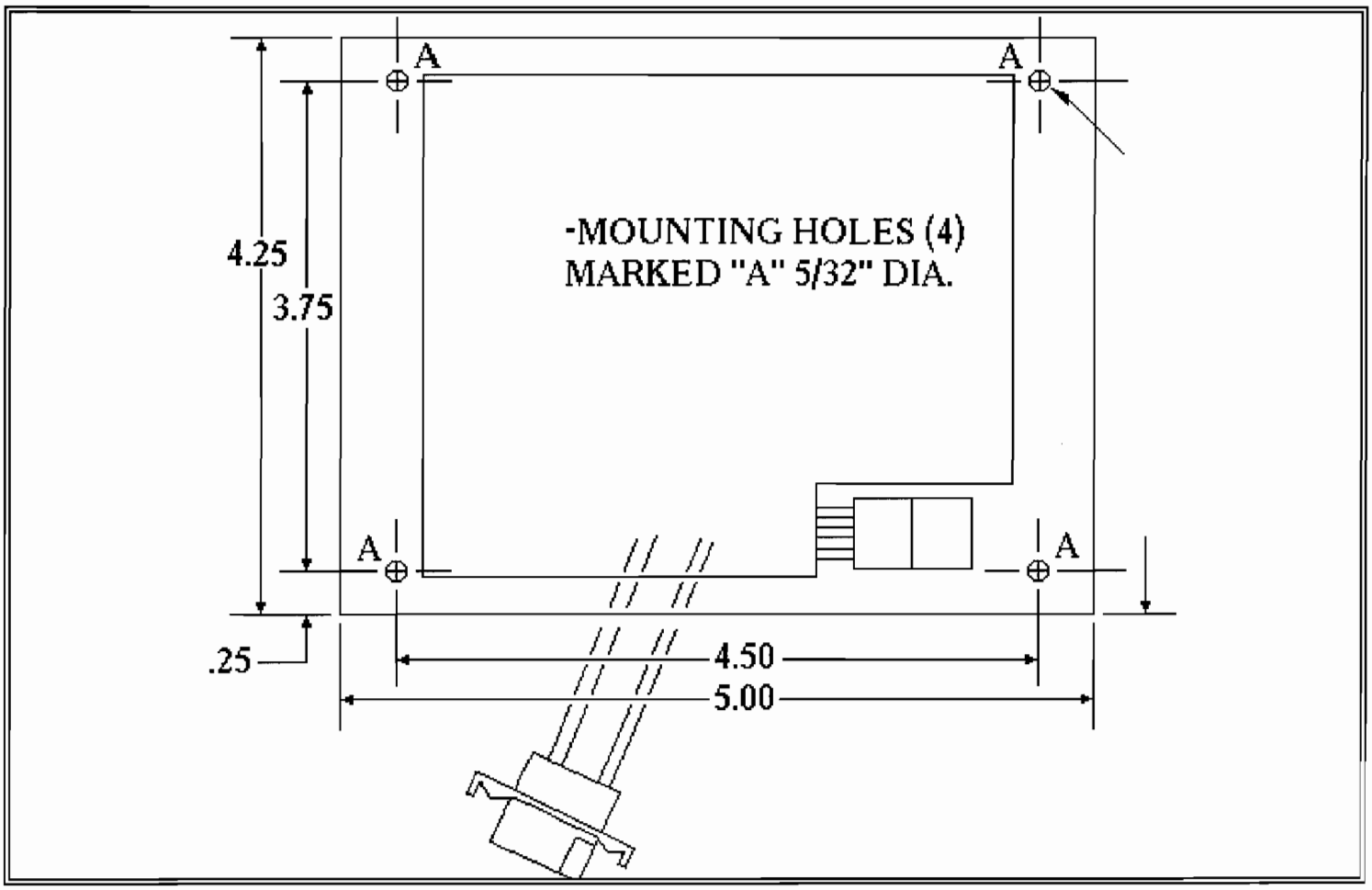

FIGURE D.4