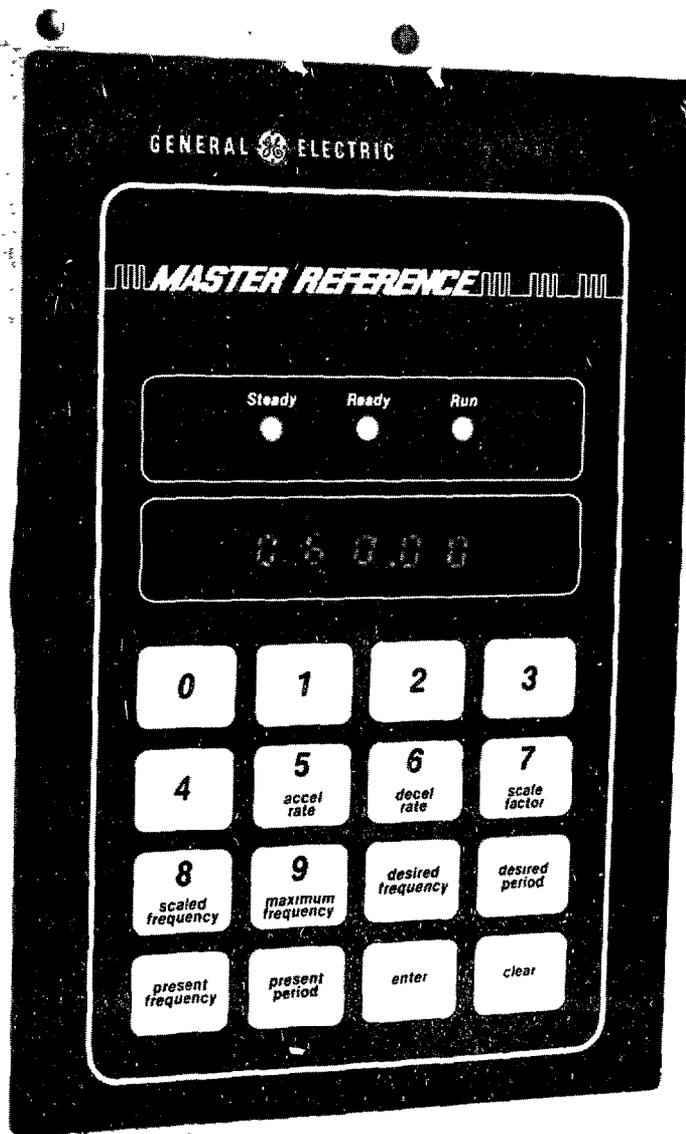




INSTRUCTIONS

Preliminary GEK-24977

MASTER DIGITAL REFERENCE



These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to General Electric Company.

GENERAL  **ELECTRIC**



INSTRUCTIONS

Preliminary GEK-24977

ERRATA SHEET NO. 01

JULY 1982

PAGE 1

MASTER DIGITAL REFERENCE

This Errata Sheet affects GEK-24977. It should be attached to that book and retained as a portion of it. The text of the original publication should be updated in accordance with the following information:

- Page 6:

The statement: "To assist in local electrical code acceptance, U.L. listing for the unit is pending." should be changed to

"To assist in local electrical code acceptance, the unit is U.L. listed."

- Page 14:

Figure 6a should be replaced by the attached.

- Page 31:

Figure 13 should be replaced by the attached.

- Various pages:

References to 193X482AAGO1 should be changed to 193X482BAGO1.

References to 6VDFR10A1 should be changed to 6VDFR10B1.

References to 6VDFR11A1 should be changed to 6VDFR11B1.

References to 6VDMR10A1 should be changed to 6VDMR10B1.

References to 6VDMR11A1 should be changed to 6VDMR11B1.

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GENERAL  **ELECTRIC**

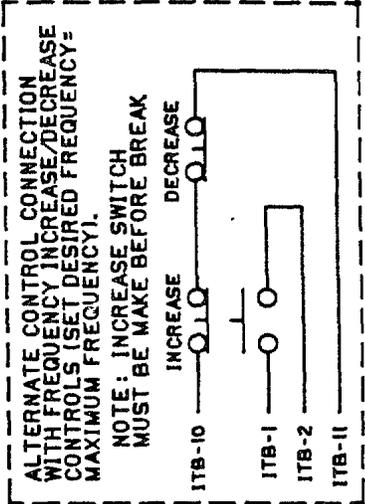
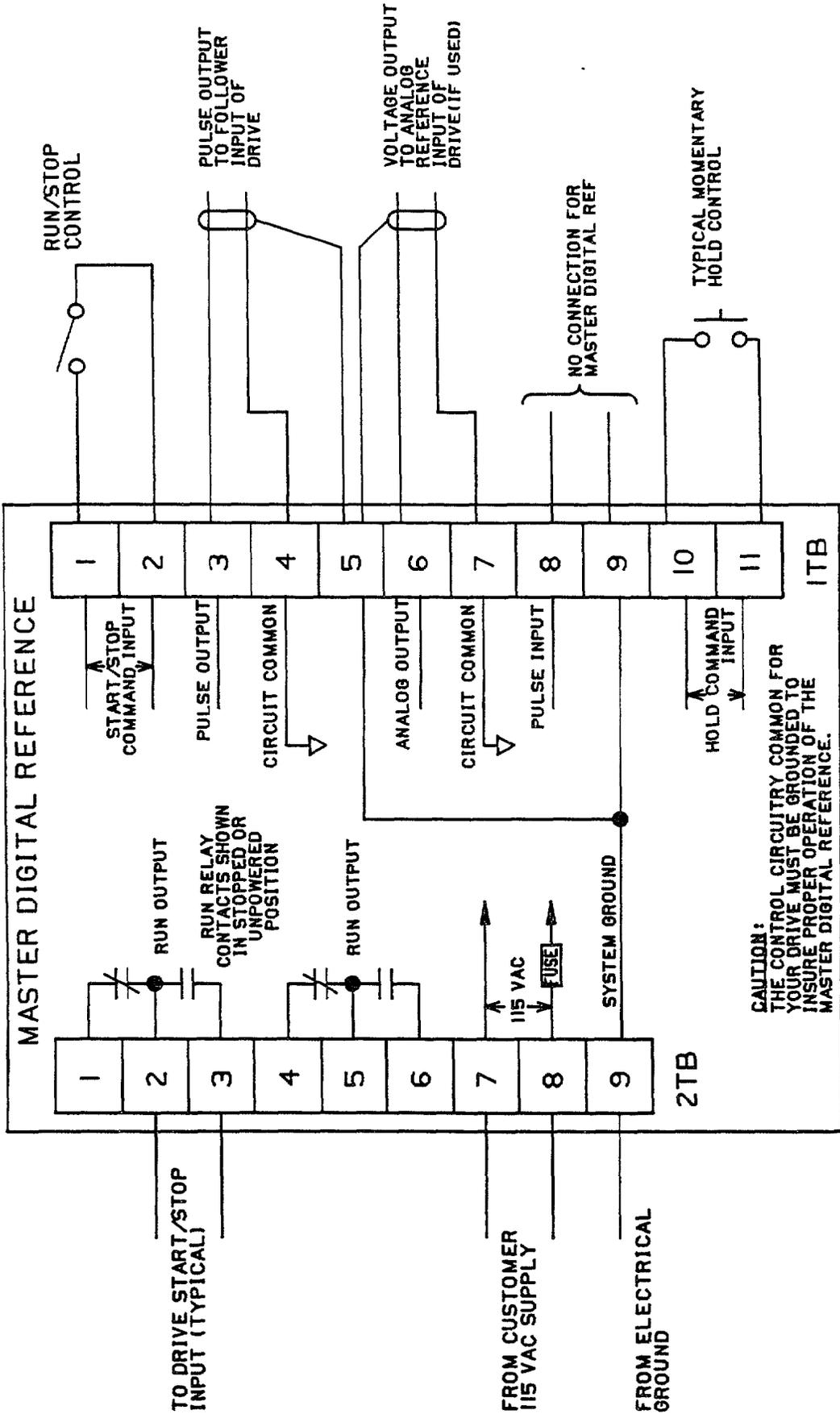


FIGURE 6A
CONNECTION DIAGRAM FOR 1TB AND 2TB

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INTRODUCTION AND DESCRIPTION

This instruction book contains the information needed to place the Master Digital Reference into service. It contains specific details on the installation, operation, maintenance, and troubleshooting of this equipment. This book is intended for electrical technicians or engineers who possess an understanding of electronic terms and concepts.

SAFETY FOR PERSONNEL AND EQUIPMENT

The following paragraphs lists some general safety reminders and safety recommendations to be followed when operating or installing this equipment.

WARNING

DENOTES OPERATING PROCEDURES AND PRACTICES THAT MAY RESULT IN PERSONAL INJURY OR LOSS OF LIFE IF NOT CORRECTLY FOLLOWED.

COLOR — BLACK OR WHITE LETTERING ON RED FIELD.

CAUTION

DENOTES OPERATING PROCEDURES AND PRACTICES THAT, IF NOT STRICTLY OBSERVED, MAY RESULT IN DAMAGE TO, OR DESTRUCTION OF, THE EQUIPMENT.

COLOR — BLACK LETTERING ON AMBER FIELD.

NOTE

DENOTES AN OPERATING PROCEDURE OR CONDITION WHICH SHOULD BE HIGHLIGHTED.

COLOR — BLACK LETTERING ON WHITE FIELD.

WARNING

IMPROPER LIFTING PRACTICES CAN CAUSE SERIOUS OR FATAL INJURY.

LIFT ONLY WITH ADEQUATE EQUIPMENT AND TRAINED PERSONNEL.

WARNING: HIGH VOLTAGE

ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE. WHETHER THE AC VOLTAGE SUPPLY IS GROUNDED OR NOT, HIGH VOLTAGE WILL BE PRESENT AT MANY POINTS. WHEN TEST INSTRUMENTS ARE USED TO WORK ON LIVE EQUIPMENT, GREAT CAUTION MUST BE USED. WHEN ONE OF THE INSTRUMENT LEADS IS CONNECTED TO THE CASE OR OTHER METAL PARTS OF THE INSTRUMENT, ***THIS LEAD SHOULD NOT BE CONNECTED TO AN UNGROUNDED PART OF THE SYSTEM UNLESS THE INSTRUMENT IS ISOLATED FROM GROUND AND ITS METAL PARTS TREATED AS LIVE EQUIPMENT.*** USE OF AN INSTRUMENT HAVING BOTH LEADS ISOLATED FROM THE CASE PERMITS GROUNDING OF THE CASE, EVEN WHEN MEASUREMENTS MUST BE MADE BETWEEN TWO LIVE PARTS.

WARNING

DO NOT SERVICE THE EQUIPMENT WHILE POWER IS APPLIED.

NOTE

ALWAYS READ THE COMPLETE INSTRUCTIONS PRIOR TO APPLYING POWER OR TROUBLESHOOTING THE EQUIPMENT. FOLLOW THE START UP PROCEDURE STEP BY STEP.

READ AND HEED ALL WARNING, CAUTION AND NOTE LABELS POSTED ON THE EQUIPMENT.

CAUTION

DO NOT REMOVE INPUT POWER FROM THE DRIVE UNTIL IT HAS FULLY EXECUTED A STOP SEQUENCE, AS THIS CAN DAMAGE THE DRIVE SYSTEM.

WARNING

SHOCK HAZARD. THIS EQUIPMENT CONTAINS A POTENTIAL HAZARD OF ELECTRICAL SHOCK OR BURN. ONLY PERSONNEL WHO ARE ADEQUATELY TRAINED AND THOROUGHLY FAMILIAR WITH THE EQUIPMENT AND THESE INSTRUCTIONS SHOULD INSTALL, OPERATE, OR SERVICE THIS EQUIPMENT.

FUNCTIONAL DESCRIPTION

The Master Digital Reference, shown in Figure 1, is designed to provide a precise, keypad selected reference pulse train. Its intended application is as a reference for adjustable speed drive control circuits which can follow a digital pulse speed (or frequency) command signal. It may be used to precisely control the frequency applied to a squirrel cage induction motor or synchronous motor through an inverter controller. It may also be used to precisely control the speed of a DC motor equipped with a suitable tachometer and controller.

The Master Digital Reference is compatible with a variety of adjustable speed drives manufactured by the Speed Variator Products Operation of General Electric Company. Further details may be obtained by consulting the Speed Variator Products Operation or your local General Electric Sales Representative.

The front panel of the Master Digital Reference contains a keypad and numeric display for entry and readout of the user programmable operating parameters (Figure 2). The programmable parameters include desired output frequency, maximum output frequency, acceleration time, deceleration time, and a scale factor for displaying an output that is a multiple of the actual operating frequency. The actual pulse output frequency is 6 times the frequency entered and displayed on front panel. Readout of scaled frequency, present frequency, or present period is available at any time on the display. Scaled frequency output is useful in certain processes for the direct readout of process units such as "feet per second" or "gallons per minute". To enhance the reliability of the readout LED's, the display automatically blanks after a certain length of time if there are no inputs to the keypad or start/stop control. To prevent unauthorized or accidental reprogramming of maximum frequency acceleration time, and deceleration time, an internal jumper is provided, which if removed, prevents entering new values for these parameters.

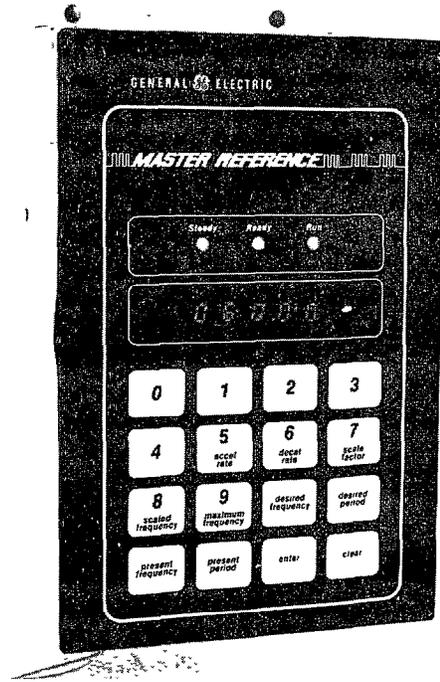


FIGURE 1
Perspective View of Master Digital Reference.

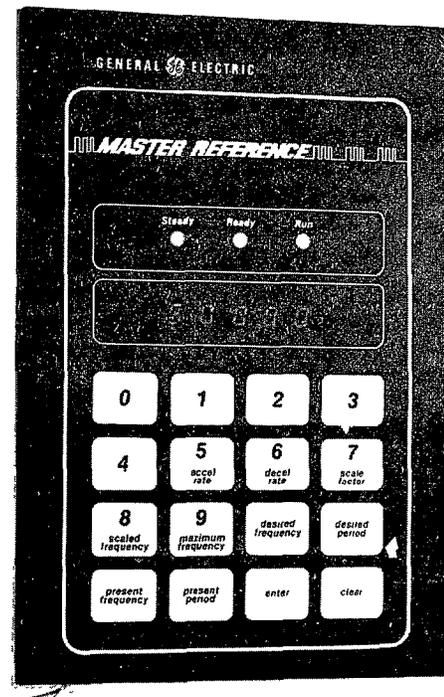


FIGURE 2
Front View of unit showing Keypad display
and Status LED'S.

The unit is powered from a standard 115V AC supply. When power is removed from the unit, the parameters are stored in a special memory device that can retain the settings even in the absence of power. Thus, when power is re-applied, the previous settings will still be in effect until changed by new keypad operations.

A pair of START/STOP terminals is provided for controlling the pulse output of the Master Digital Reference. With AC line power applied to the unit and these terminals open, the pulse output is at the minimum frequency. Also a RUN relay, furnished inside the unit, will be in the deenergized state. When the START/STOP terminals are connected together through an external switch or relay, the RUN relay is energized and the pulse output begins ramping up to the desired frequency (or period). The ramping up rate depends on the acceleration time setting entered from the keypad. Opening the start/stop terminals causes the pulse output to ramp down at an adjustable rate to the minimum frequency, at which time the RUN relay is deenergized. The ramping down rate depends on the deceleration time setting entered from the keypad. Thus the RUN relay may be used to function as a START/STOP command for the adjustable speed drive being controlled by the Master Reference Oscillator.

The desired frequency (or optionally, desired period) may be changed while the unit is running. The unit will automatically ramp up or down to the new setting when it is entered. The ramp time, as always, will depend on the setting for acceleration or deceleration time.

A pair of HOLD terminals is also provided for controlling the pulse output. Whenever these terminals are connected together through an external contact, the pulse output will be held at its present frequency regardless of further inputs from the START/STOP station or keypad. The HOLD is released when the terminals are opened. These terminals may be used to provide a frequency "increase/decrease/hold" control mode.

Three LED status indicators are provided to indicate when the unit is stopped and ready to run, when the unit is running (i.e., RUN relay energized), and when the unit is in steady-state (i.e., providing a pulse train at the desired frequency setting). During frequency transitions and also for a short while after steady-state is reached, the numeric display will automatically indicate present frequency or present period. Improper keypad entries are identified by displaying descriptive messages to aid the operation in proper use.

The Master Digital Reference is housed in an oil resistant, totally enclosed, and non-ventilated, enclosure which is suitable for most industrial environments. Provision is made on the enclosure for either wall or panel mounting. To assist in local electrical code acceptance, U.L. listing for the unit is pending.

An option (order option kit #6VFVR10A1) is available for use with the Master Digital Reference which provides a DC output voltage with an amplitude that is proportional to pulse frequency along with the standard pulse output. This option is included with the Master Digital Reference if ordered as Model #6VDMR11A1 or may be added to Model #6VDMR10A1. This option is described within this instruction.

Also available is a companion unit (order model #6VDFV10A1) called the Follower Digital Reference. The Follower uses a Master Digital Reference as its input and provides a pulse output that is a keypad adjustable percentage faster or slower than the input pulse. This unit is useful in multi-drive systems where all motors must be slaved to a master motor's speed. (Refer to GEK-24978 for installation and use) To include the above voltage output option, order Model #6VFVR10A1.

SPECIFICATIONS

The Master Digital Reference, model #6VDMR10A1, may be ordered as either of two model variations, depending on whether it is desired to enter the desired pulse output in units of frequency or units of period. Unless specifically ordered otherwise, the unit will be shipped as a Master Frequency Reference. The Master Frequency Reference may be converted to a Master Period Reference by removing jumper J1 on the microprocessor card (see Section FINAL INSPECTION).

The option kit, #6VFVR10A1, may be used with either model to provide DC voltage output proportional to pulse frequency output. Master Digital Reference Model #6VDMR11A1 includes this option.

ENVIRONMENTAL SPECIFICATIONS

Ambient operating temperature	0 to +50°C
Ambient storage temperature	-20 to +70°C
Operating and storage relative humidity	0 to 90%
Operating and storage altitude	Sea Level at 3300 ft.
Enclosure	TENV
Mounting	Wall or flush

INPUT REQUIREMENTS

Power requirements	115V AC $\pm 10\%$, 50/60 Hz, 1/4 amp
Power interruption ride-through, maximum	5 cycles at 60 Hz
Internal fault interrupter (supplied) rating	1/2 amp, type 3AG SLO-BLO pigtail fuse
Customer supplied START/STOP contact rating	28V DC, 5mA
Customer supplied HOLD contact rating (if used)	12V DC, 5mA

OUTPUT SUPPLIED

Inverted pulse train reference
DC voltage reference (by option only)
RUN relay with 2 form "C" contacts

PULSE OUTPUT SPECIFICATIONS

Minimum high level voltage 2mA maximum loading	9.75V
Maximum low level voltage at 10mA maximum loading	0.7V
Maximum high level voltage	12.5V
Low level pulse width	50 usec.
Fundamental frequency range (J1 installed)	1.55 - 500.00 Hz
Pulse frequency 6 times fundamental	
Average Pulse period resolution	± 0.043 usec.
Maximum single pulse period jitter	2.72 usec.
Fundamental period range (J1 removed)	2.0 - 65.5 msec.
Pulse period 1/6 times fundamental	
Calibration tolerance	$\pm 0.005\%$ at 25°C
Temperature stability	.01% from 0 - 50°C
Maximum long term drift	.01% per year
Maximum cable length on output	300 ft.
Fundamental frequency output in STOPPED mode	1.55 Hz

VOLTAGE OUTPUT SPECIFICATIONS

(for option kit 6VFVR10A1 only)

Voltage range at 10mA maximum loading	0 to 5V
Maximum voltage output	12.5V
Fundamental frequency output at 5V voltage output Selectable by internal jumper and V/Hz trim pot	80, 160, 320, or 640 Hz
Regulation	.25%
Ripple	0.1 to 1%
Linearity error	1%

OTHER SPECIFICATIONS

RUN relay contact maximum rating	125V AC, 30V DC, 1 amp
RUN relay contact minimum rating	5V AC or DC, 1mA
Acceleration time from STOPPED to 60 Hz fundamental	2.1 - 128 sec.
Deceleration time from 60 Hz fundamental to RUN dropout	2.1 - 128 sec.
Scaled frequency display range in % of fundamental	0.0 - 999.9%
Unpowered parameter retention time	10 years
Maximum allowable parameter reprogramming cycles (each)	10,000
Minimum display auto-blanking time	50 sec.
Keypad contact debounce time	200ms
Dimensions excluding mounting flanges	10.5"H x 7.1"W x 4.2"D
Electrical terminations	15 amp terminal strip

HANDLING AND INSTALLATION

RECEIVING AND STORAGE

The equipment should be placed under adequate cover immediately upon receipt. Each shipment should be carefully examined upon arrival and checked with the packing list. Any shortage or damage should be reported promptly to the carrier. If required, assistance may be obtained from General Electric Company, Speed Variator Products Operation, Erie, Pa 16531. When seeking assistance, please use the model and serial numbers to identify the equipment. The telephone number is (814) 455-3219

If the equipment is not to be installed immediately, it should be stored in a clean, dry location at ambient temperatures between -20°C and 70°C (-4°F and 158°F) and relative humidities less than 90%. The surrounding air should be free of chemical, corrosive, or electrically conductive contaminants.

CAUTION

CAPACITOR DEFORMING. THIS EQUIPMENT USES ELECTROLYTIC CAPACITORS, AN ELECTRONIC DEVICE WHICH IS SUBJECT TO A PROCESS KNOWN AS DEFORMING WHICH OCCURS AS A FUNCTION OF TIME AND TEMPERATURE

WHEN DEENERGIZED. A DEFORMED CAPACITOR MAY FAIL WHEN POWER IS APPLIED TO IT, UNLESS IT IS REFORMED BY A GRADUAL APPLICATION OF VOLTAGE TO EACH CAPACITOR IN THE ASSEMBLY. EQUIPMENT SHIPPED FROM THE FACTORY HAS A MINIMUM SHELF LIFE OF 3 YEARS AT 25°C BEFORE REFORMING IS NECESSARY. CONTACT THE SPEED VARIATOR PRODUCTS OPERATION FOR ANY ADDITIONAL INFORMATION.

INSTALLATION LOCATION

The Master Digital Reference is suitable for most factory areas where other industrial equipment is installed. The unit is designed to operate reliably in non-ventilated areas with ambient temperature up to 50°C (122°F) and relative humidities up to 90%. As with most electronic equipment, however, longer component life can be expected at lower operating temperatures, such as 25°C (77°F).

The totally enclosed, non-ventilated cabinet of the Master Digital Reference is oil and dust resistant and will protect the internal electronics from moderately poor environments. For more reliable operation, however, the unit should be installed where it will be protected from:

- o Dirt, dust and other particulates
- o Vibration and shock
- o Extremes of temperature or fluctuating temperature
- o Moisture and corrosive vapors or fumes

WARNING

FIRE SAFETY. THIS UNIT IS NOT DESIGNED FOR INSTALLATION IN HAZARDOUS LOCATIONS WHERE COMBUSTIBLE VAPORS OR DUSTS ARE PRESENT.

CAUTION

RF INTERFERENCE. RADIO TRANSMITTERS GENERATE ELECTROMAGNETIC WAVES WHICH MAY CAUSE NEARBY ELECTRONIC EQUIPMENT TO MISOPERATE. IT IS RECOMMENDED THAT THIS UNIT BE INSTALLED IN AN AREA WHERE FIXED OR PORTABLE TRANSMITTERS ARE NOT LIKELY TO BE OPERATED IN THE IMMEDIATE VICINITY.

The Master Digital Reference should be installed in an easily accessible location where the front keypad and display can be conveniently viewed and reached. The unit must be located such that the total length of all wires connected to the pulse output terminal does not exceed 300 feet.

MOUNTING

The Master Digital Reference is designed to be either surface or flush (panel) mounted. Holes are provided in the enclosure to accept conduits or other fittings. The suggested conduit connector is a Thomas and Betts No. 5333 connector for 3/4" liquid tight flexible conduit or a No. 371 connector for 3/4" rigid metal conduit. In either case use a No. 5303 "O" ring between the connector and box to maintain the enclosure seal.

To mount, remove the cover by unscrewing the four screws in each corner and carefully lifting the cover off. Take care not to damage the printed circuit card mounted to the back of the cover or the interconnecting cables.

CAUTION

STATIC SENSITIVITY. THIS UNIT USES ELECTRONIC COMPONENTS WHICH MAY BE DESTROYED BY DISCHARGES OF STATIC ELECTRICITY. DRY ENVIRONMENTS, CARPETED AREAS, AND SYNTHETIC OR WOOL CLOTHING AGGRAVATE THE BUILD-UP OF STATIC CHARGES ON THE BODY. TO PREVENT DAMAGE TO THE MASTER DIGITAL REFERENCE DO NOT TOUCH THE CIRCUITRY OR COMPONENTS ON THE CARD MOUNTED TO THE COVER.

To disconnect the cover, grasp the ribbon cable connector at the power supply card inside the enclosure and pull straight off with a steady force. Mentally note the orientation for ease in reinstalling. Remove the cover grounding wire and lay the cover assembly aside where it will be protected from the damage and static electricity. Refer to Figure 3 for details.

The recommended wiring method is to use the conduit opening near terminal strip 2TB to feed wires to 2TB. Use the conduit opening near terminal strip 1TB to feed wires to 1TB. Where bottom entry of wiring is required, the enclosure may be mounted upside down since the cover will mount either way.

For wall mounting, mounting flanges are provided on the outside of the enclosure. For flush mounting, a rectangular panel cutout 9" x 5-5/8" is required with the box mounting behind the panel and cover in front. There are eight inserts in the lip of the enclosure for #10 - 32 screws. Flat head screws may be used to fasten the enclosure to the panel using the four box inserts not used to fasten the cover to the enclosure. Figure 5 shows dimensions required to lay out the cutout and eight holes.

CONNECTIONS

The following wiring must be provided to the Master Digital Reference.

1. 115V AC and grounding wire - 3 conductor #14 AWC
2. Start/Stop Control Input - 2 conductor #18 AWC twisted pair
3. Hold Control Input (if used) - 2 conductor #18 AWC twisted pair
4. Run Control Output - 2 to 6 conductor #18 AWC twisted pairs as required.
5. Pulse output - 2 conductor #18 or larger shielded cable
6. Voltage output (if used) - 2 conductor #18 or larger shielded cable

NOTE: Suggested wire is Belden type 8460 twisted pair or type 8760 or 8719 shielded cable.

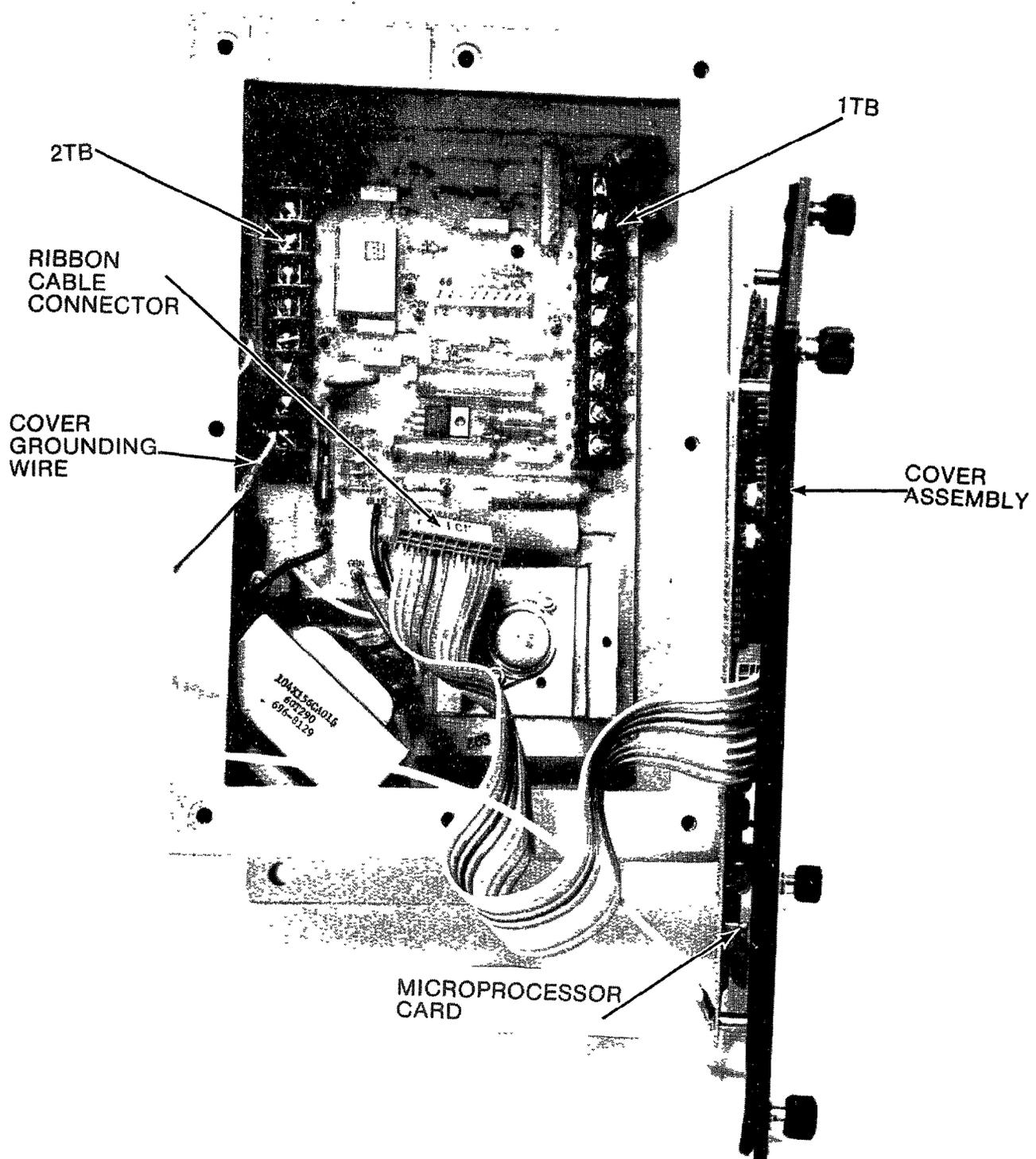
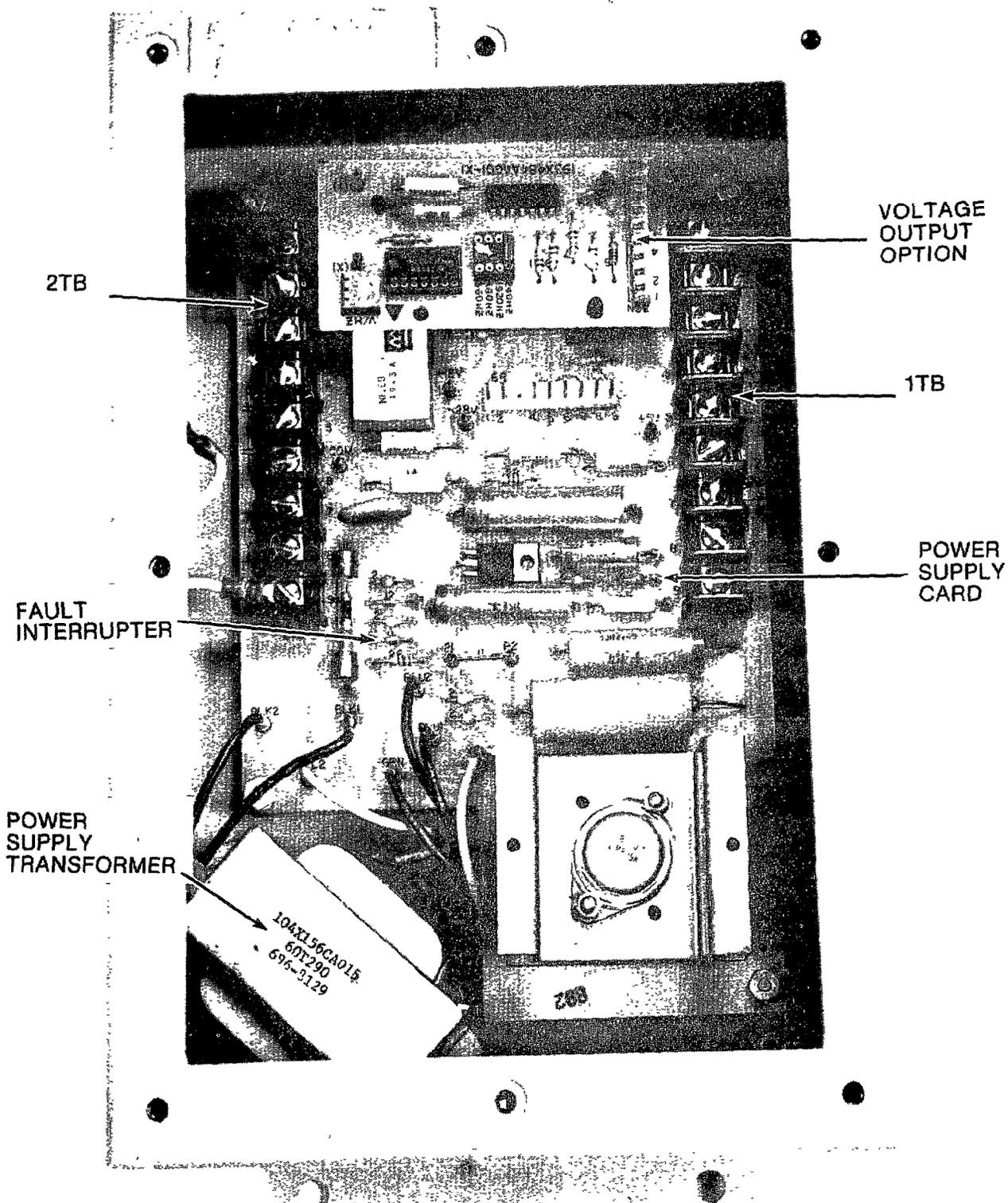


FIGURE 3
Disconnecting the cover, view of all cards and major parts



2TB

VOLTAGE
OUTPUT
OPTION

1TB

FAULT
INTERRUPTER

POWER
SUPPLY
CARD

POWER
SUPPLY
TRANSFORMER

104X156CA015
60T290
696-3129

FIGURE 4
View of unit interior

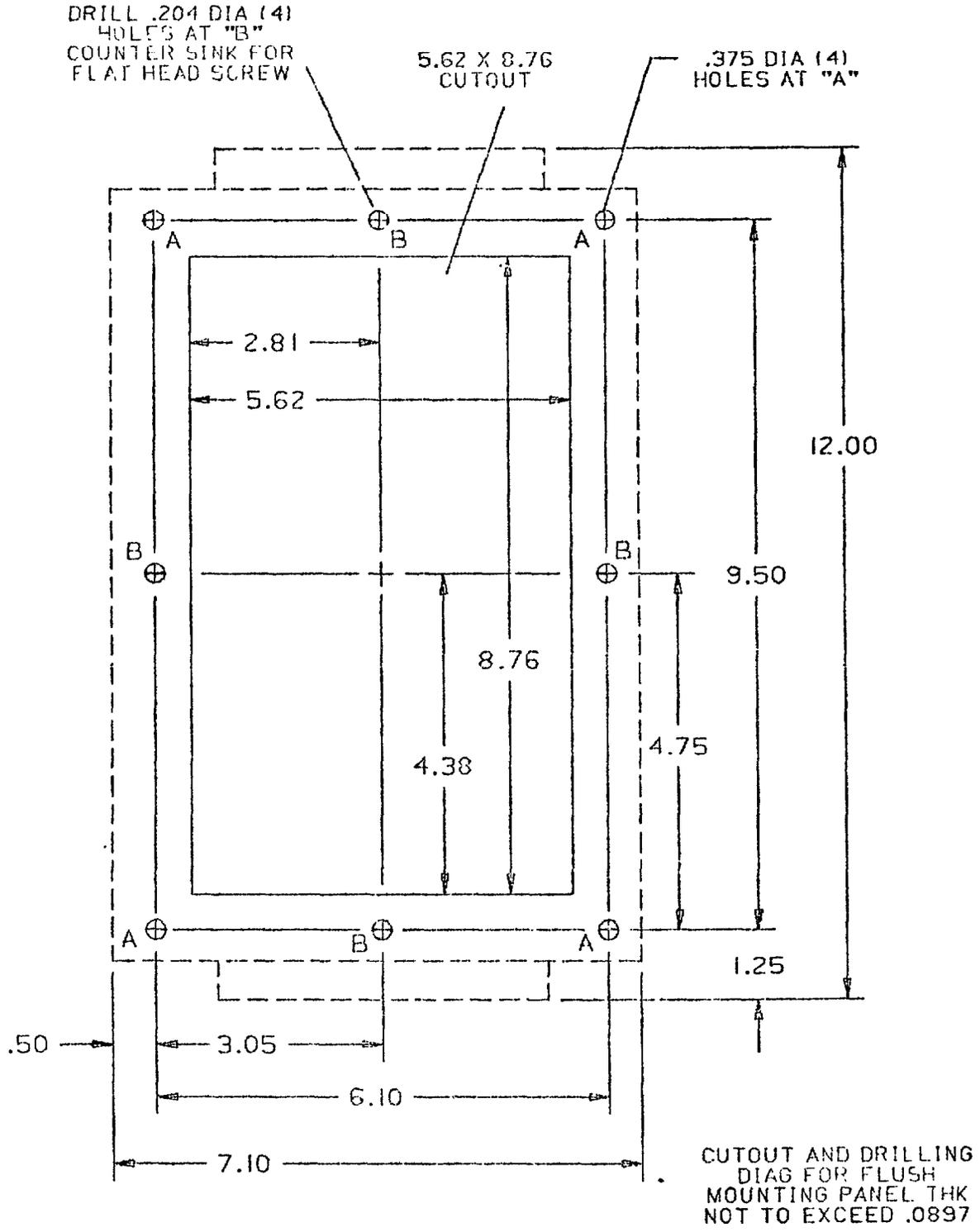


FIGURE 5
Dimensions of Master Digital Reference showing cutout
and holes required for panel mounting.

For short distances, twisted pairs may be used in place of the shielded cable. If shielded wire is used, the shield should be terminated to ground at only one end, preferably at the Master Digital Reference. The wiring may be placed in a common conduit provided all wires are insulated for the maximum voltage (300V minimum) of any conductor and only wires functionally associated with the Master Reference equipment are in the conduit. Care should be taken to see that all interconnecting wiring is sized and installed in accordance with the latest edition of the National Electrical Code and all applicable local codes.

CAUTION

EM INTERFERENCE. NEARBY RELAYS AND SOLENOIDS CAN CAUSE ERRATIC OPERATION OF THE MASTER DIGITAL REFERENCE AND NEARBY DRIVE EQUIPMENT DUE TO ELECTRICAL TRANSIENTS. TO ELIMINATE THIS POSSIBILITY, AN RC SUPPRESSOR SHOULD BE ADDED ACROSS THE COILS OF THESE DEVICES. A 220 OHM 2 WATT RESISTOR IN SERIES WITH 0.5 MFD, 600 VOLT CAPACITOR CAN BE USED IN 115V AC OR 230V AC CIRCUITS. CONTACT THE FACTORY FOR OTHER SUPPRESSOR RECOMMENDATIONS.

Be sure power is disconnected from all power supply and control wires before wiring. Wire terminal boards 1TB and 2TB according to the connection diagram in Figures 6a and 6b. Consult the instruction book for your motor drive control for information on connecting the pulse or voltage outputs and RUN contacts to your system.

CAUTION

THE CONTROL CIRCUITRY COMMON FOR YOUR DRIVE MUST BE GROUNDED TO INSURE PROPER OPERATION OF THE MASTER DIGITAL REFERENCE. CONTACT THE FACTORY FOR INFORMATION ON OPERATION WITH A DRIVE THAT REQUIRES A COMMON ISOLATED FROM EARTH GROUND.

INSTALLATION OF OPTION KIT, 6VFVR10A1

If the option kit 6VFVR10A1 is ordered as a field modification to provide a voltage output in addition to the pulse output, it should be installed at this time. The kit consists of a frequency to voltage card (part No. 193X484AAG01) which plugs into connector 3CN on the power supply card as a daughter board. Install the standoffs on the power supply card as shown in Figure 7. Make sure the pins of 3CN line up with the connector on the daughter board and plug the card as shown in Figure 8. The output voltage from this card is available on the power supply card on terminal 1TB. The output voltage from this card for a

given frequency input depends on the jumper selection in jumper socket JS1 and the setting of the volts/hertz gain adjust. potentiometer, P1. For start-up, set P1 to mid-range and install the jumper according to the maximum frequency to be input.

<u>Max. Fundamental</u>	<u>Six times Fundamental</u>	<u>Jumper</u>
40 to 80 Hz	240 to 480 Hz	240
80 to 160 Hz	480 to 960 Hz	480
160 to 320 Hz	960 to 1920 Hz	960
320 to 500 Hz	1920 to 3000 Hz	1920

Do not attempt to run without a jumper or with more than one jumper in place. After the unit has been started up, the potentiometer may be adjusted to give the desired voltage output for a given frequency.

FINAL INSPECTION

Unless specifically ordered as a Master Period Reference, the unit is shipped as a Master Frequency Reference. Jumper J1 on the Microprocessor Card, mounted to the cover, controls whether frequency or period inputs will be accepted. If it is desired to change a standard unit from frequency to period reference, remove the four card mounting screws and unplug jumper J1 from the jumper socket (Figure 9). Take care not to damage the ribbon cable connectors. Do not remove jumpers J2 or J4 and do not install a jumper in J3. Carefully remount the card taking care that the LED's line up with the holes in the cover assembly.

Before replacing the cover, check that all connections are correct and tight. Be sure all wires are pushed out of the way of the circuit cards and are not near the large heat sink. If the voltage option card is used, be sure it is correctly installed with the correct jumper and pot settings (refer to preceding section). Check that the leads from the transformer are securely fastened to the stab-on posts on the card and that the fault interrupter is in place on the power supply card and not blown. A ground wire must be present from the outside power supply and must ground the box, cover, and terminal 2TB-9. Reattach the cover ground wire removed earlier when the cover was removed and plug the connector from the card back into the power supply card connector, 1CN. Also be sure this cable is still seated in the connector on the cover.

As you are replacing the cover, fold the cable in a manner that clears the heat producing components and does not stress any connections or the connectors. Also take care that the ribbon cable between the card and the keypad does not get pinched between the box lip and the cover. Do not overtighten the cover mounting screws.

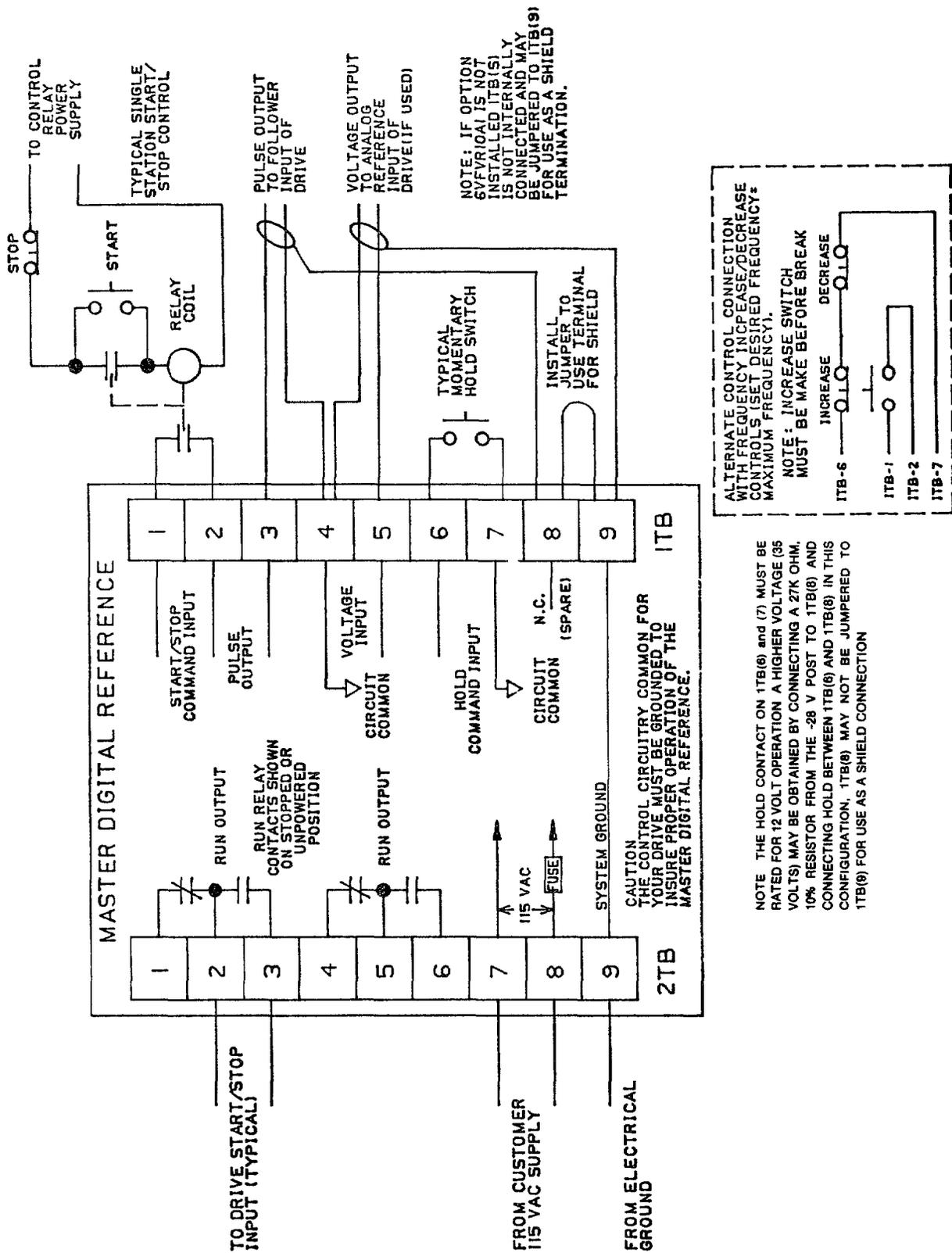
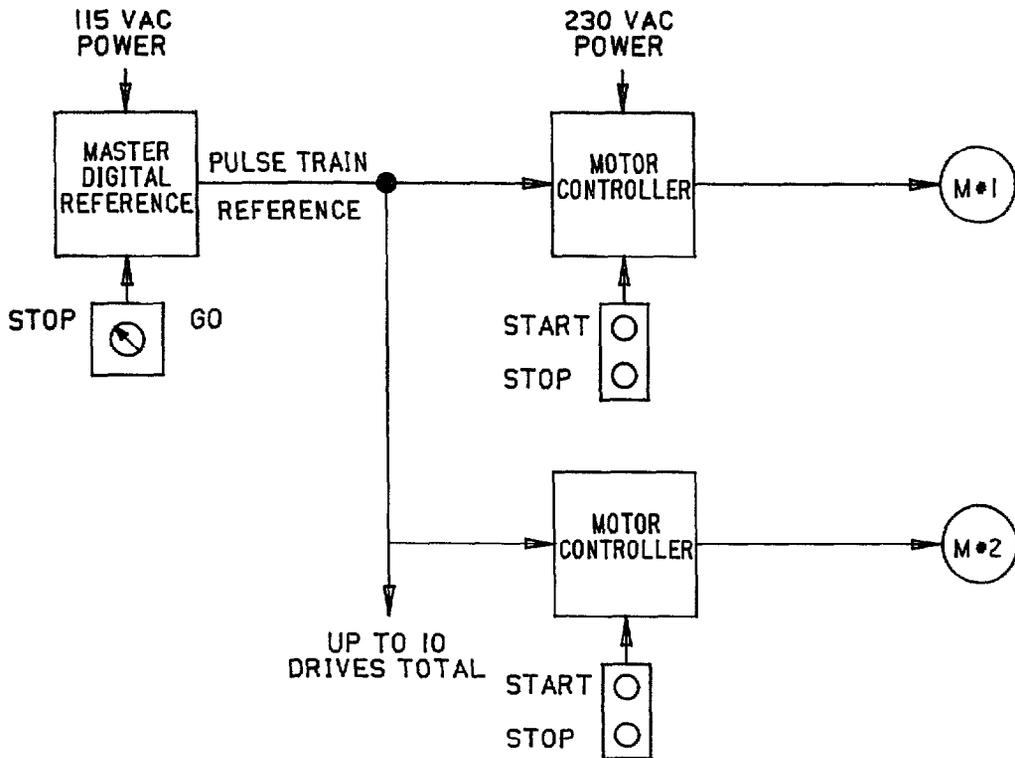
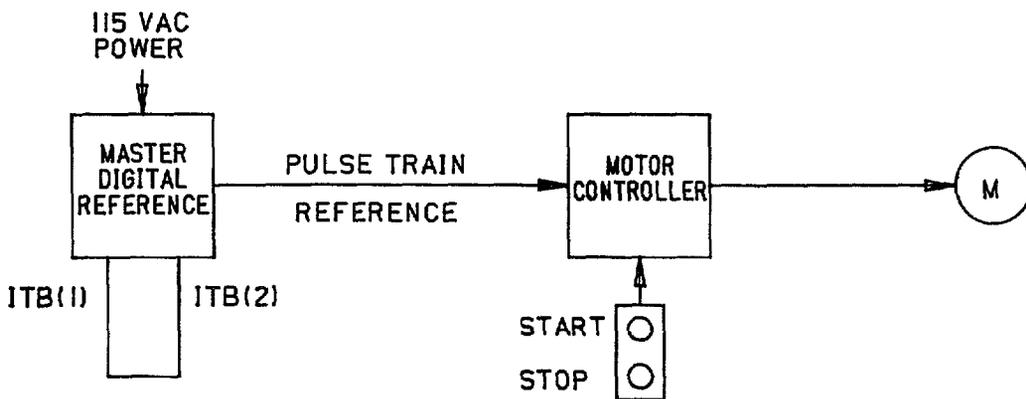


Figure 6a
Connection diagram for 1TB and 2TB



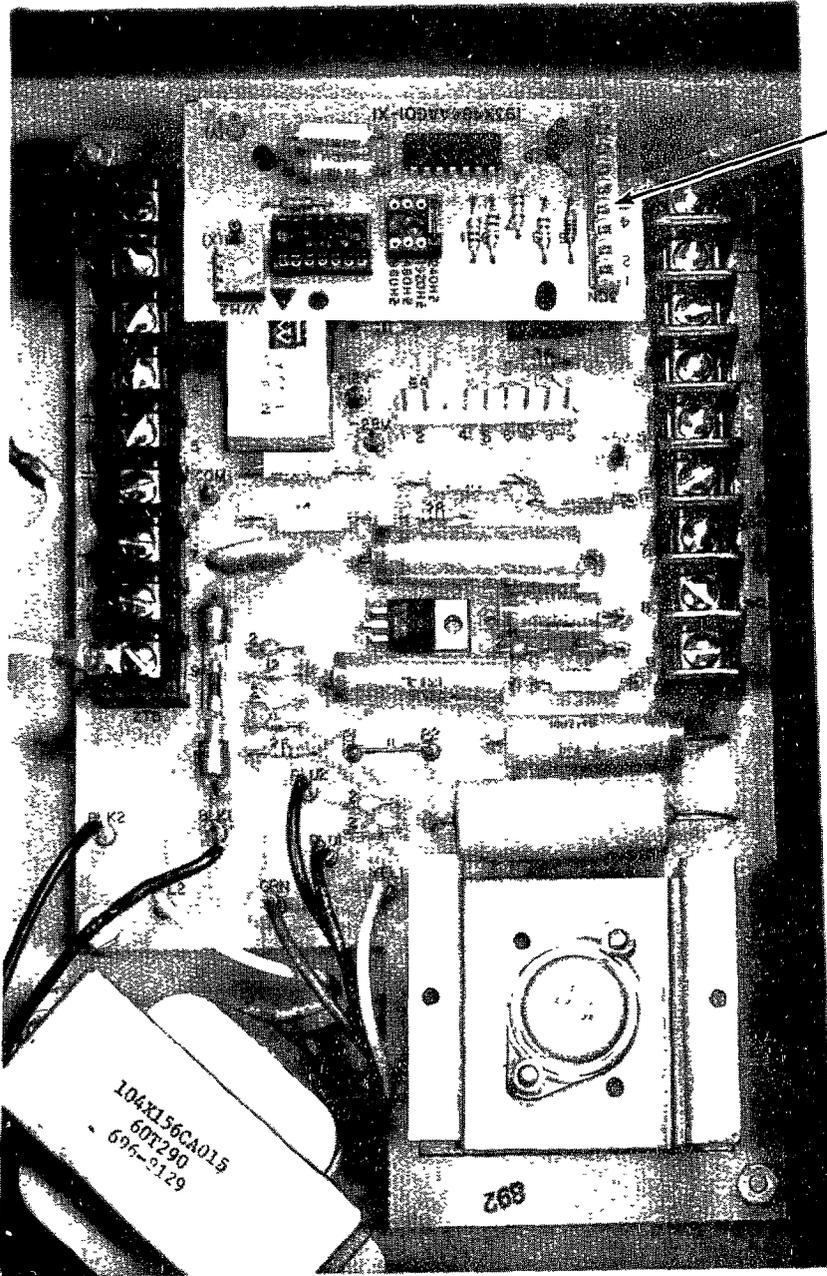
MANUAL OPERATION: EACH DRIVE IS STARTED INDEPENDENTLY BEFORE STARTING THE MASTER DIGITAL REFERENCE.



HARD-WIRED OPERATION: MASTER REFERENCE START/STOP IS WIRED ON. CONTROLLER RUNS ON ITS OWN ACCEL AND DECEL CIRCUITS. MASTER REFERENCE PROVIDES A CONSTANT FREQUENCY REFERENCE OUTPUT.

NOTE: THE CONFIGURATIONS IN FIG. 6b ARE START-SAFE IN THAT NO FAILURES IN THE MASTER DIGITAL REFERENCE CAN CAUSE THE MOTOR CONTROLLER TO START. IN USING OTHER CONFIGURATIONS, BE SURE TO CONSIDER THE SAFETY ASPECTS OF THE SYSTEM.

FIGURE 6b
Alternative connection diagrams



OPTION CARD
SEATED ON
STANDOFFS AND
CONNECTOR 3CN

FIGURE 8
Installation of Option Kit, 6VFVR10A1

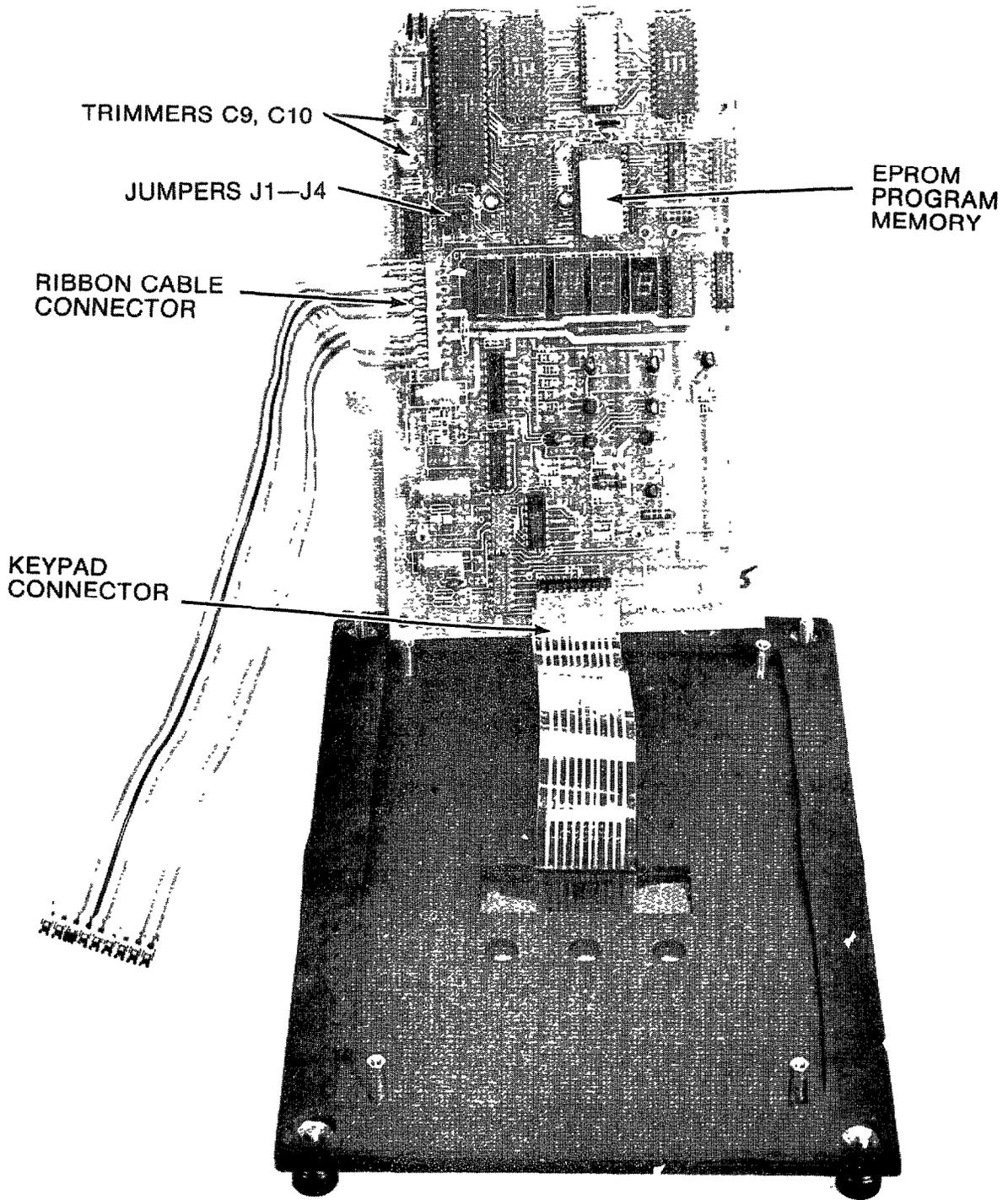


FIGURE 9
View of Microprocessor card

START-UP AND OPERATION

For initial start-up, programming of parameters, and verification of proper operation, it is recommended that the drive controlled by the Master Digital Reference not be energized. Verification of the pulse output is best obtained by using a frequency counter instrument so that actual output frequency can be measured and trimmed if necessary. If this is not available, a standard DC voltmeter with a scale of at least 12 volts may be used to give an indication of the presence of a pulse output since the average voltage of the pulse output depends on its frequency (explained in a following Sub-Section "PULSE OUTPUT").

CAUTION

DRIVE PROTECTION. ALTHOUGH THE MASTER DIGITAL REFERENCE HAS ADJUSTMENTS TO LIMIT THE RAMP RATE AND MAXIMUM FREQUENCY OF THE PULSE OUTPUT, THERE IS NO ASSURANCE THAT THE SETTINGS YOU ENTER WILL BE WITHIN THE MAXIMUM CURRENT AND SPEED RATINGS OF THE DRIVE AND MOTOR CONTROLLER. THE DRIVE MUST HAVE ITS OWN SELF PROTECTING AND MOTOR PROTECTING FEATURES WHICH WILL OVERRIDE AN IMPROPER REFERENCE INPUT. IT IS NOT RECOMMENDED THAT YOU RELY SOLELY ON THE MASTER DIGITAL REFERENCE TO PROVIDE THESE FUNCTIONS.

After checking that all wiring to the Master Digital Reference is correct and that the power to the drive is off, turn on the 115V AC power to the Master Digital Reference. Be sure the START/STOP control signal is calling for STOP (contacts open). The "READY" status indicator should come on and display should read out the message "STOP". If it instead reads "RESET", the unit was energized with the START/STOP contact closed. It must be opened or any keypad key pressed before the keypad and the pulse output will become operative. Double check the START/STOP wiring to be sure it is correct and calling for a STOP. If a "STOP" message cannot be obtained when energizing the unit, refer to the section on troubleshooting.

NOTE

AUTO-BLANKING. IT IS NORMAL FOR THE DISPLAY TO AUTOMATICALLY BLANK OUT WHEN DISPLAYING "STOP" AFTER ONE MINUTE IF NO KEYPAD INPUTS ARE MADE. THE CURRENT STATUS (IN THIS CASE, "STOP") CAN ALWAYS BE RESTORED TO THE DISPLAY BY PUSHING THE KEY LABELLED **PRESENT FREQUENCY** OR **PRESENT PERIOD**

LEAVE THE **START/STOP** CONTACT IN THE OPEN POSITION UNTIL ALL PARAMETERS HAVE BEEN ENTERED AS DESCRIBED IN THE NEXT FOLLOWING SUB-SECTION ON THE **KEYPAD OPERATION**.

KEYPAD OPERATION

The keypad and display on the Master Digital Reference are used to examine and change the programmable parameters and to display the current operating status of the unit. The programmable parameters include maximum frequency, desired frequency/period, acceleration time, deceleration time and display scale factor. Current operating status may be displayed as present frequency, present period, or present scaled frequency. This section will describe how the keypad and display are used.

The keypad consists of 16 keys. These keys use reliable membrane switch technology to provide mechanical switch contacts. Because the contacts only move a few thousandths of an inch, you will not be able to feel any movement in the keys as you press them. Instead, the display is used as a visual indication that the key has been depressed. The keys include the ten decimal digits plus the necessary "command" function keys. Note that some of the keys are dual function keys since they can represent either a command or a number depending on when they are pressed in a key sequence. If they are pressed as the first key in a sequence, the microprocessor interprets the key as a command function. Otherwise, the key is assumed to be numeric.

Readout of the present value of any of the programmable or status parameters is obtained by simply pushing the appropriate function key, assuming the display was previously clear. If the parameter is programmable, it may be changed from its present value by keying in the new value and pressing the ENTER key. Depending on the parameter, either 2, 4 or 5 digits will have to be entered. Once the first digit of a new parameter value is keyed in, the unit automatically prompts for the correct number of digits required by displaying a prompting bar in each position for which a key entry is required. Since a parameter entry will not be accepted if too few or too many digits are keyed in, a degree of protection is provided against accidental or unauthorized entry of incorrect parameters.

Improper or erroneous key sequences are indicated by diagnostic messages on the display. Table A lists all error messages and the conditions which cause them to be displayed.

To extend the life of the display, an automatic blanking feature is incorporated into the system. When the unit is in steady state and no keys have been pressed for a certain

length of time, the display will automatically blank just as if the CLEAR key had been pushed. The exact length of time depends on the parameter being displayed and the frequency of the pulse output, but generally is at least one minute. As a convenience, if the display is blank or no parameter entry is in progress, the display will automatically readout present frequency or present period when the unit is ramping up or down as commanded by the external START/STOP and HOLD contacts.

The following is a description of each of the command keys and examples of parameter reprogramming.

CLEAR

This key may be pushed at any time to blank the display. If the unit is ramping up or down, however, the automatic display of present frequency/period will override display blanking. This key is also used to terminate an improper key sequence. CLEAR must be pressed before any dual-

function key if another programmable parameter is being displayed and it is desired to display the parameter controlled by the key. Otherwise, the unit will interpret the key as a number rather than a command.

ENTER

This key is used to enter the displayed number as the new value of a parameter. It is pressed after the correct value and number of digits for a parameter have been keyed in. The number displayed is not stored until ENTER is pressed. When ENTER is pressed the display will automatically blank unless the unit is ramping, in which case present frequency/period will be displayed. If ENTER is pressed at the wrong time in the key sequence (i.e., a new parameter value has not been keyed in), "ERROR" will be displayed. See Table A for further interpretation of "ERROR" messages.

TABLE A
Display Diagnostic Messages for the Master Digital Reference

DISPLAYED MESSAGES	CAUSES
"STOP"	Normal status message during power-up PRESENT FREQUENCY pressed while stopped PRESENT PERIOD pushed while stopped SCALED FREQUENCY pressed while stopped
"RESET"	START/STOP closed during power-up. Open contacts or press any key to clear.
"TOO HIGH"	Attempted to set maximum frequency > 500.00 Hz. Attempted to set desired frequency > maximum frequency Attempted to set desired period > 65.535 ms.
"TOO LO"	Attempted to set desired frequency < 1.56 ms. Attempted to set maximum frequency < 1.56 ms. Attempted to set a desired period < 1000 ÷ maximum frequency Attempted to set maximum frequency < desired frequency
"ERROR"	Pressed a digit key as the first key Pressed "ENTER" before sequence completed Pressed too many digit keys in sequence
"USE DF"	Pressed "DESIRED PERIOD" on Frequency Reference Model Use "DESIRED FREQUENCY" key
"USE DP"	Pressed "DESIRED FREQUENCY" on Period Reference Model Use "DESIRED PERIOD" key
"NO ENT"	Attempted to set maximum frequency, acceleration or deceleration times when disabled by internal jumper. Entry was not made. Install jumper J2.

PRESENT FREQUENCY

This key may be pressed at any time to display pulse output frequency. The readout is fundamental frequency in hertz. The actual pulse frequency is six times the displayed value. When the unit is stopped, "STOP" will be displayed when this key is pressed. In this mode the pulse output is at the minimum fundamental frequency of 1.55 Hz. When the unit is ramping and there is no keypad activity, present frequency is automatically displayed when used as a Master Frequency Reference.

PRESENT PERIOD

This key may be pressed at any time to display the pulse output fundamental period in milliseconds. The actual period is 1/6 the displayed number. When the unit is stopped "STOP" will be displayed. When the unit is ramping and there is no keypad activity, present period is automatically displayed, when used as a Master Period Reference.

NOTE: Readout of present period is invalid for periods greater than 65.35ms (frequency less than 15.26 hertz).

SCALED FREQUENCY

This key may be pressed any time the display is blank or is displaying a nonprogrammable parameter (otherwise the SCALED FREQUENCY key is interpreted as an "8"). The number displayed will be the product of present frequency and the parameter called scale factor. (Refer to paragraph on scale factor for further description.) SCALED FREQUENCY may then be used to give direct readout of output in meaningful units such as feet per minute or thousands of gallons per hour.

MAXIMUM FREQUENCY

Maximum frequency is a programmable parameter used to set the highest fundamental frequency which the Master Digital Reference will provide as an output. This key may be pressed any time as the first key in a sequence (i.e., when the display is blank or displaying a nonprogrammable parameter) to display the present setting of maximum frequency. If a different setting is desired than what is displayed; simply key in the desired number and press the ENTER key. The range of allowable fundamental frequency values is 001.56 to 500.00 hertz. Actual maximum pulse frequency is six times this number. Note that for the entry to be accepted exactly five digits must be keyed in and that the digits key in from the left. Thus all leading and trailing zeroes must be keyed in. To get a fundamental of 60 hertz, 060.00 must be keyed in. After the first digit is keyed in, a bar is displayed in each position for which another digit must be keyed in. If ENTER is pressed

before 5 digits are keyed in or more than 5 digits are keyed in, "ERROR" will be displayed to indicate an erroneous key sequence. This makes it more difficult for someone unfamiliar with the unit to accidentally change the parameter settings.

ACCELERATION TIME

Acceleration time is a programmable parameter which is used to control how fast the pulse output will ramp from a stopped condition or a low frequency up to a higher frequency. It may be adjusted to give acceleration times in the range of 2 to over 60 seconds for a 60 hertz change in fundamental output frequency. The acceleration is constant so that the frequency ramps up linearly. The ACCEL TIME key may be pressed any time as the first key in a sequence to display the present setting as a two digit number from 00 to 99 (the decimal point is insignificant). To change the displayed acceleration time, key in the new two digit setting and press ENTER. The larger numbers correspond to the longer acceleration times. See Table B to determine what number to enter for the desired acceleration time.

DECELERATION TIME

Deceleration time is used to control how fast the pulse output will ramp from a given frequency to a lower frequency or stopped condition. Operation of the DECEL TIME is the same as the ACCEL TIME. Table B may be used to determine what two digit entry will give the desired deceleration time.

DESIRED FREQUENCY

(Non functional when used as a Master Period Reference). This key is used to set the fundamental frequency the unit will ramp to when the external START/STOP contacts are closed. Any frequency from 001.56 to 500.00 hertz may be entered provided the frequency is less than the maximum frequency parameter. The key may be pressed at any time to display the present desired pulse output frequency in hertz. Actual pulse frequency is six times the displayed value. To change the displayed desired frequency, key in the new five digit value including leading and trailing zeroes and press the ENTER key. If the START/STOP contacts are closed and the HOLD contacts open, the pulse output will automatically ramp to the new setting. Otherwise the pulse output will ramp up to this setting when the contacts are closed.

TABLE B

Time to accelerate or decelerate between "STOPPED" and 60 Hz for each setting of the ACCEL and DECEL TIME parameters. Interpolation may be used to determine times for frequencies other than 60 Hz.

SETTING	TIME (SEC)	SETTING	TIME (SEC)	SETTING	TIME (SEC)
00	2.1	33	5.6	66	15.5
01	2.2	34	5.8	67	16.0
02	2.3	35	6.0	68	16.5
03	2.4	36	6.2	69	17.0
04	2.5	37	6.4	70	17.5
05	2.6	38	6.6	71	18.0
06	2.7	39	6.8	72	19.0
07	2.8	40	7.0	73	19.5
08	2.9	41	7.2	74	20.0
09	3.0	42	7.4	75	21.0
10	3.1	43	7.6	76	22.0
11	3.2	44	7.8	77	23.0
12	3.3	45	8.0	78	24.0
13	3.4	46	8.2	79	25.0
14	3.5	47	8.4	80	26.0
15	3.6	48	8.6	81	27.5
16	3.7	49	8.8	82	29.0
17	3.8	50	9.0	83	31.0
18	3.9	51	9.2	84	33.0
19	4.0	52	9.4	85	35.0
20	4.1	53	9.6	86	37.5
21	4.2	54	9.8	87	40.0
22	4.3	55	10.0	88	43.5
23	4.4	56	10.5	89	48.0
24	4.5	57	11.0	90	52.5
25	4.6	58	11.5	91	58.5
26	4.7	59	12.0	92	65.5
27	4.8	60	12.5	93	75.0
28	4.9	61	13.0	94	90.0
29	5.0	62	13.5	95	102.0
30	5.1	63	14.0	96	128.0
31	5.2	64	14.5	97	170.0
32	5.4	65	15.0	98	258.0
				99	518.0

DESIRED PERIOD

(Nonfunctional when used as a Master Frequency Reference). This key is used to set the desired fundamental period the unit will ramp to when the external START/STOP contacts are closed. Any period from 02.000 to 65.535 milliseconds (corresponding to 15.26 to 500 hertz) may be entered provided the corresponding frequency is less than the maximum frequency setting. The key may be pressed at any time to display the present desired pulse period in milliseconds. The actual pulse period is one sixth the displayed value. To change the displayed desired period, key in the desired five digit value including all leading and trailing zeroes and press ENTER. When the START/STOP contacts are closed and the HOLD contacts are opened (if they are not already) the pulse output will ramp to the entered setting.

SCALE FACTOR

This key is used to display and change the scale factor used in conjunction with the SCALED FREQUENCY key. This key may be pressed any time as the first key in a sequence. A four digit number from 0.000 to 9.999 will be displayed or may be entered as a new setting.

Example: To set parameters as follows for the Master Frequency Reference Model

Desired frequency — 60 Hz
Maximum frequency — 120 Hz
Accelerate and decelerate — 10 seconds to 60 Hz

Using Table B, Accel. Time and Decel. Time should be set to 55 to give ten second acceleration and deceleration times. Thus the following key sequence will program the above 4 parameters

To program desired frequency:

PRESS	DISPLAY
DESIRED FREQUENCY	XXX.XX (previous value)
0	0—.——
6	06—.——
0	060.——
0	060.0—
0	060.00
ENTER	BLANK

The desired frequency of 060.00 Hz is now stored.

To program maximum frequency:

PRESS	DISPLAY
MAXIMUM FREQUENCY	XXX.XX (previous value)
1	1—.——
2	12—.——
0	120.——
0	120.0—
0	120.00
ENTER	BLANK

The maximum frequency of 120.00 Hz is now stored.

To program acceleration time:

PRESS	DISPLAY
ACCEL TIME	.XX (previous value)
5	.5—
5	.55
ENTER	BLANK

The acceleration time of 55 (10 seconds) is now stored.

To program deceleration time:

PRESS	DISPLAY
DECEL TIME	.XX (previous value)
5	.5—
5	.55
ENTER	BLANK

The deceleration time of 55 (10 seconds) is now stored.

EXTERNAL CONTROL AND OUTPUTS

This section will describe the external contacts START/STOP and HOLD, used to control the Master Digital Reference, the pulse and voltage reference outputs provided from the unit, and the RUN relay contacts available within the unit to control the drive system to which the unit is connected. It is recommended that for initial check-out of the unit that power not be applied to the drive system. After proper operation and set-up of the Master Digital Reference is verified, the complete system may be tested.

It is assumed that all keypad programmable parameters have been properly adjusted as described in the previous sub-section on "Keypad Operation".

"HOLD" CONTACTS

When these contacts are closed, the pulse and voltage outputs and RUN relay contacts will not change from their present state. The primary application of these contacts is to provide an increase/decrease hold mode of control. To use this mode, use a connection such as shown in the inset Figure 6 and program desired frequency to be the highest frequency anticipated for normal operation. When the "INCREASE" (make before break) button is held down, the unit will ramp up at a rate controlled by the acceleration time setting. When the "DECREASE" button is held down, the unit will ramp down towards stop. When neither button is depressed the unit will hold at its current state.

"START/STOP" CONTACTS

The HOLD contacts must be open for these contacts to be functional. When the START/STOP contacts are closed, the RUN relay will energize and the pulse and voltage outputs will ramp up to the desired frequency (or desired period), in the Master Period Reference setting entered from the keypad. When the contacts are opened, the pulse and voltage outputs will ramp down to the minimum frequency, at which time the RUN relay will deenergize.

"RUN" RELAY

Two form "C" contacts are provided as shown in Figure 6 for controlling the drive system the unit is connected to. The relay is deenergized when power is off to the unit or when the START/STOP contacts are open and the pulse output has ramped down to the minimum frequency. The RUN relay is energized when the START/STOP contacts are closed and the HOLD contacts are open.

PULSE OUTPUT

The pulse output is a nominal 12 volt inverted pulse train with a frequency 6 times the indicated fundamental frequency on the display. In the stopped mode (RUN relay not picked-up), the actual pulse frequency output is $1.55 \times 6 = 9.3$ hertz. For initial setup of the Master Digital, it is recommended that a frequency counter be used to verify the pulse output. An oscilloscope may be used although the pulse will be difficult to see at low frequencies since the pulse width is 50 microseconds. A DC voltmeter may be used to verify the presence of a pulse output. In the stopped mode with no load on the pulse output, its average DC voltage should be about 11.4 to 11.5 volts. At a frequency of 500 hertz, the pulse output will decrease to an average DC voltage of approximately 10.2 to 10.3 volts. If measured pulse frequency does not correspond to the displayed pulse frequency, it may be trimmed as described in the following sub-section on internal adjustments. If no pulse output can be detected, refer to the section on troubleshooting.

VOLTAGE OUTPUT

This output is available only if the option kit #6VFVR10A1 is installed in the Master Digital Reference (included with Model #6VDMR11A1). The voltage output is proportional to the pulse frequency, with a value near 0V DC when pulse output is at the minimum frequency, and a maximum value of 6V DC. An internal jumper and potentiometer are used to adjust the voltage output at a given frequency (volts/hertz gain). See the following sub-section on "INTERNAL ADJUSTMENTS" for information on adjusting this gain.

After all controls, outputs, and adjustments have been verified to be correct, the unit may be checked out with the drive system powered up.

INTERNAL ADJUSTMENTS

(see "CARD REMOVAL")

Trimming of the output pulse frequency may be obtained by adjusting C9 and/or C10 on the microprocessor card. Trimming of the volts/hertz gain of the voltage output option is obtained by adjusting the trim pot on the voltage output card. If the potentiometer has insufficient range to give the desired setting, move the jumper on the voltage output card to the next higher or lower frequency range as required. If the ripple is too high on the output it may be decreased by installing up to 50 microfarads of capacitance from post "X" to post "Y" on the card. Install electrolytic capacitors with the "+" end on post "X". Adding capacitance will also decrease the response of the output.

Jumper J2 on the microprocessor card may be removed to inhibit the reprogramming of maximum frequency and acceleration and deceleration times.

CAUTION

DO NOT CHANGE JUMPER SETTINGS ON THIS CARD WHILE POWER IS APPLIED. JUMPER J1 MAY BE REMOVED TO CONVERT A MASTER FREQUENCY REFERENCE TO A MASTER PERIOD REFERENCE OR VICE VERSA. DO NOT REMOVE J4 OR INSTALL A JUMPER IN J3.

CIRCUIT DESCRIPTION

The Master Digital Reference consists of two printed circuit cards in the standard unit plus a third card if the voltage output option is specified. The power supply card mounts on the inside back surface of the enclosure. The microprocessor card mounts on the back of the cover and the voltage output card plugs into the power supply card. The power supply transformer mounts on the inside back of the enclosure and connects to the power supply card using stab-on post connectors. The keypad consists of 16 membrane switches built into the cover and wired to the microprocessor card through a ribbon cable and connector. An electrostatic shield is built into the cover to protect the circuits from static discharges. A description of each card is given below.

POWER SUPPLY CARD (193X482AAGO1)

A block diagram of the power supply is shown in Figure 12 and an elementary diagram is shown in Figure 13. Three regulated voltages are required by the unit. The +5 and +12 volt DC supplies are developed by three-terminal regulators supplied from a standard full-wave rectifier circuits. The -28 volt DC supply is produced by a voltage doubler circuit and zener regulator.

The card also contains the RUN relay for controlling the external adjustable speed drive, terminals for customer connections, and connectors to the microprocessor card and voltage output option card.

Test posts are provided for checking each of the regulated voltages. Each should be within 5% of its nominal voltage rating.

MICROPROCESSOR CARD (193X483AAGO1)

The block diagram and elementary diagram for this card are shown in Figures 10 and 14. The heart of this card is an 8-bit single chip microcomputer, the 8039. This device contains

a crystal controlled 11M Hz oscillator, a central processor unit capable of performing general logic and arithmetic operations an 8-bit counter, general purpose read/write memory, and general purpose input/output ports.

All operations performed by the microprocessor are controlled by the instructions contained in the program memory device, a 2716 ultra-violet light erasible, electrically programmable read-only-memory. Programmed on this device are instructions for the microprocessor to perform the following functions:

- o Scan the keypad, START/STOP contact HOLD contact for inputs.
- o Send information to the display and LED indicators.
- o Measure time intervals using the oscillator as a reference.
- o Produce the pulse output at the proper frequency based on the oscillator reference input.
- o Control the pulse output frequency based on the external inputs.
- o Control the RUN relay.
- o Store settings from the keypad in permanent memory.

Other circuits and devices on this card include:

- o I/O EXPANDERS - These devices increase the number of I/O (Input/Output) ports available to the microprocessor.
- o DISPLAY - Five 7-segment LED displays and drivers provide the capability to readout numbers and some alphabetic characters. The display is operated in a multiplexed mode, i.e., only one digit is lit at a time. Successive digits are lit at such a high rate that the display appears continuously lit to the human eye.
- o LED indicators and driver circuits.
- o RUN relay driver circuit.
- o Pulse output buffer circuit.
- o START/STOP and HOLD input buffer circuits.
- o EAROM - This device is an electrically alterable read only memory. When power is available, the microprocessor can read or reprogram the EAROM. When power is off, the EAROM can retain its data for up to ten years. All setting entered from the keypad are stored in this device.
- o WATCHDOG - This circuit monitors whether the microprocessor is correctly stepping through its program. If an electrical transient or other problem causes the microprocessor to get out of step, this device resets it to the proper program. A reset is also sent if the 5 volt DC power supply is below specification.

There are several jumpers on this card. Jumpers J5, J6, J7 and J8 are soldered into place by the factory as required and should not be disturbed. Jumpers J3 and J4 are part of the frequency reference. Jumper J2 must be present to allow reprogramming of maximum frequency, acceleration time and deceleration time. Removal of J2 disables reprogramming of these parameters. This jumper may be used to prevent unauthorized or accidental changing of these parameters.

Jumper J1 is the only electrical difference between the Master Frequency Reference and the Master Period Reference. Jumper J1 must not be present in the Master Period Reference unit. This jumper controls the enabling of the DESIRED FREQUENCY and DESIRED PERIOD keys on the keypad. Depending on which mode the unit is used, the inappropriate key is nonfunctional.

Capacitors C9 and C10 are trimmers which may be used to adjust the oscillator frequency. These should not be adjusted unless an accurate frequency counter is available and the measured pulse frequency does not agree with the displayed present frequency. One or both trimmers may have to be adjusted to bring the oscillator into calibration.

VOLTAGE OUTPUT CARD (193X484AAGO1)

A block diagram and elementary diagram for this optional card shown in Figures 11 and 15. This card converts the pulse output into a DC Voltage with an amplitude proportional to pulse frequency using a frequency-to-voltage converting integrated circuit. A frequency prescaler and a trim pot are provided to allow adjustment of the volts/hertz gain. Refer to the section on the installation of option kit 6VFVR10A1 for information on setting these jumpers.

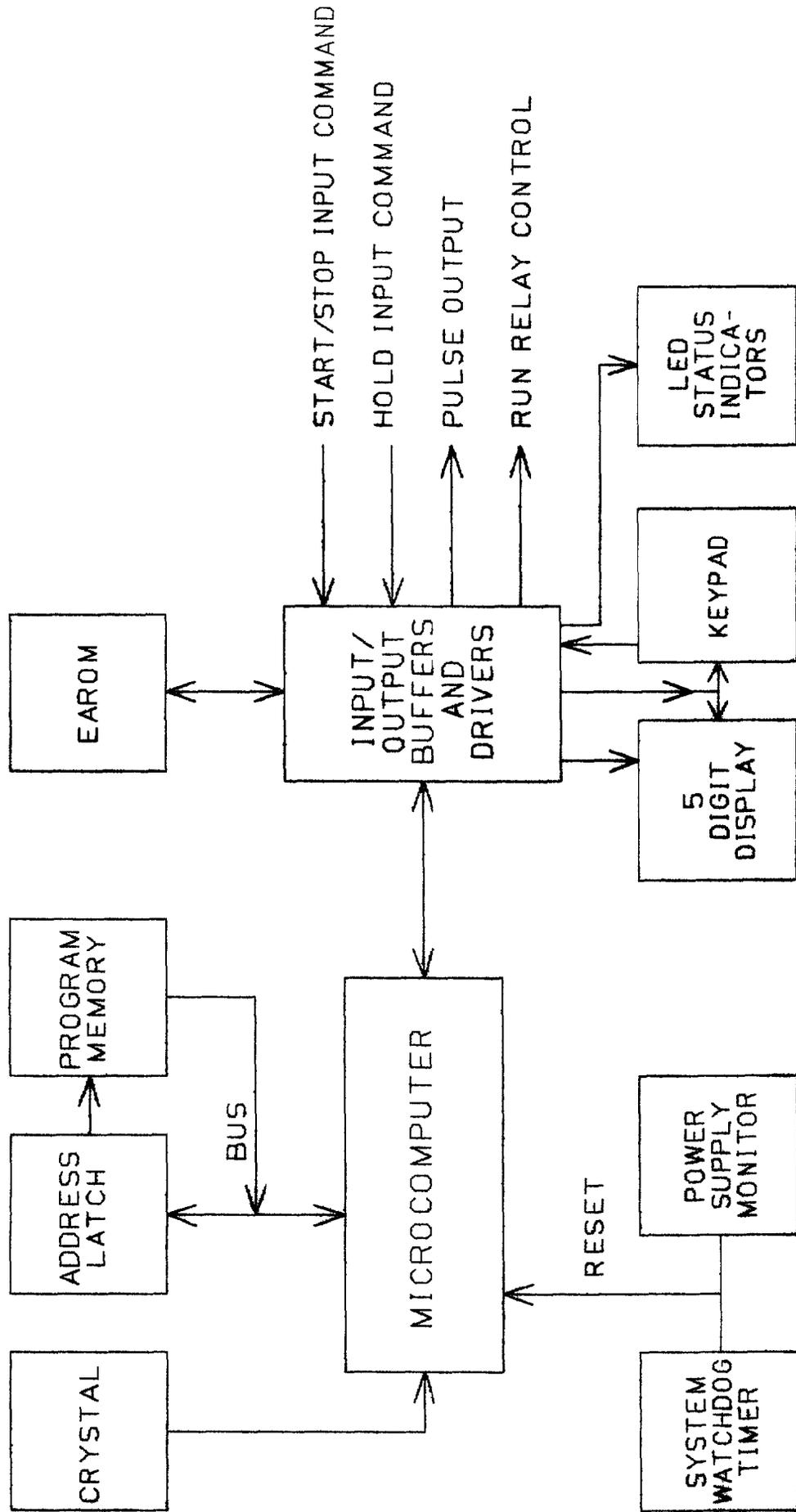


FIGURE 10
Microprocessor Card Block Diagram

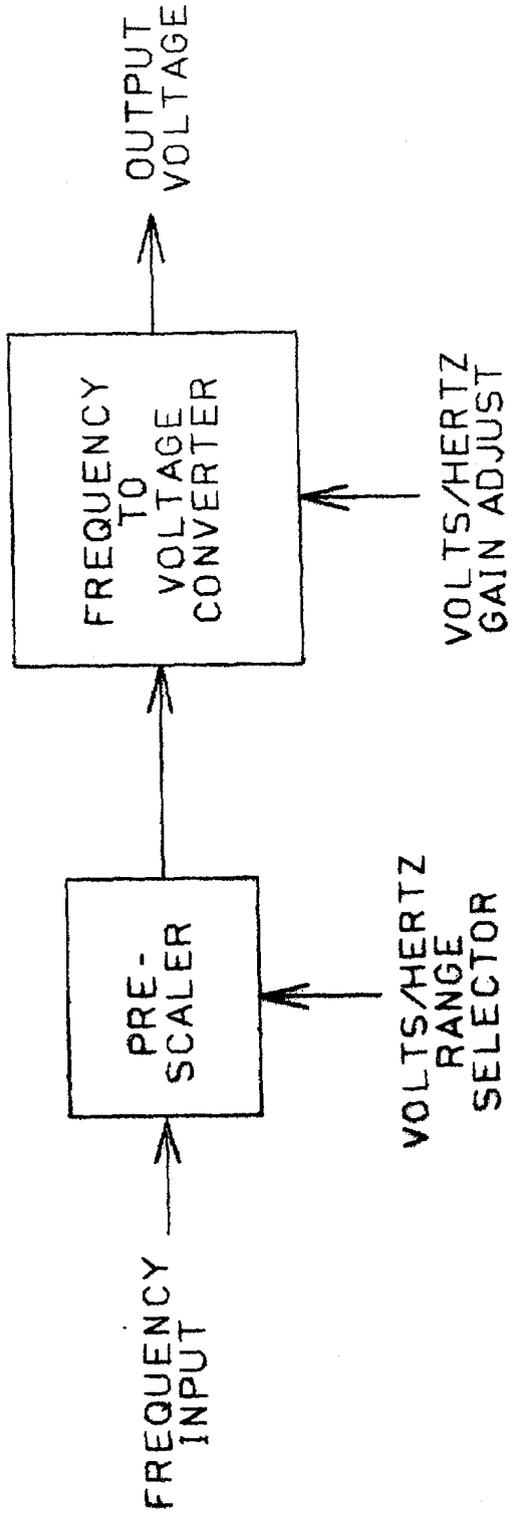


FIGURE 11
Voltage Output Card Block Diagram

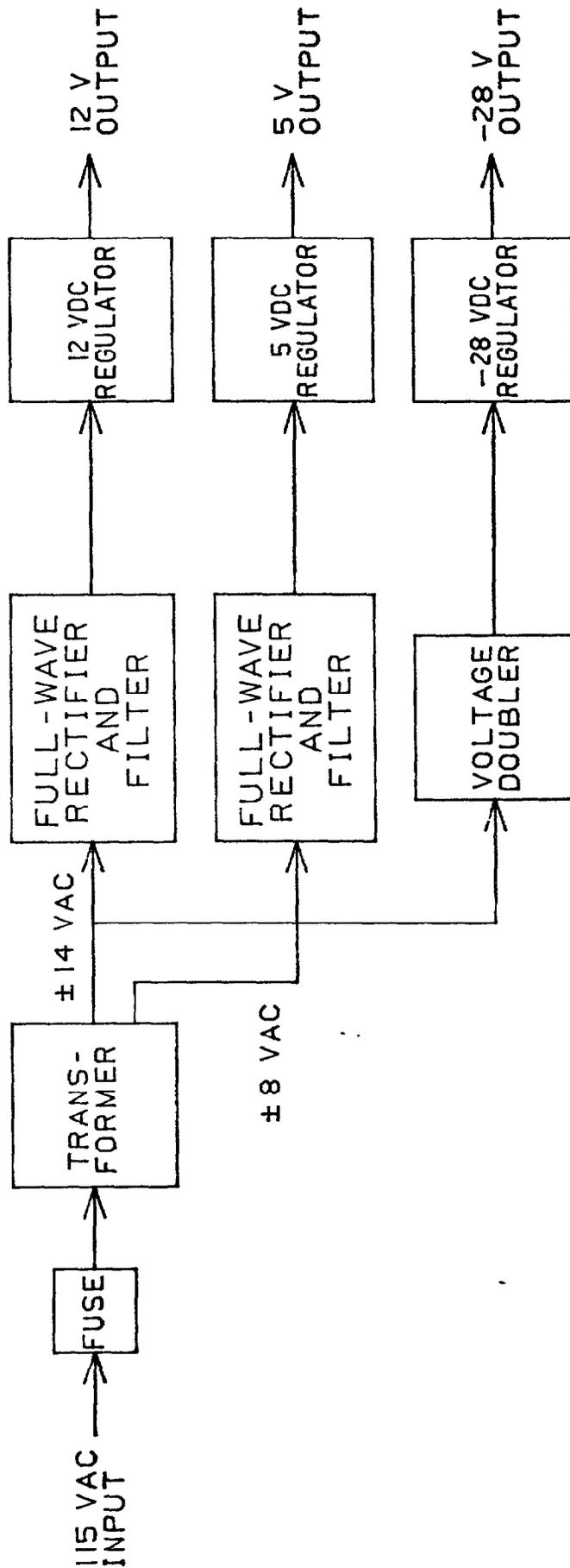
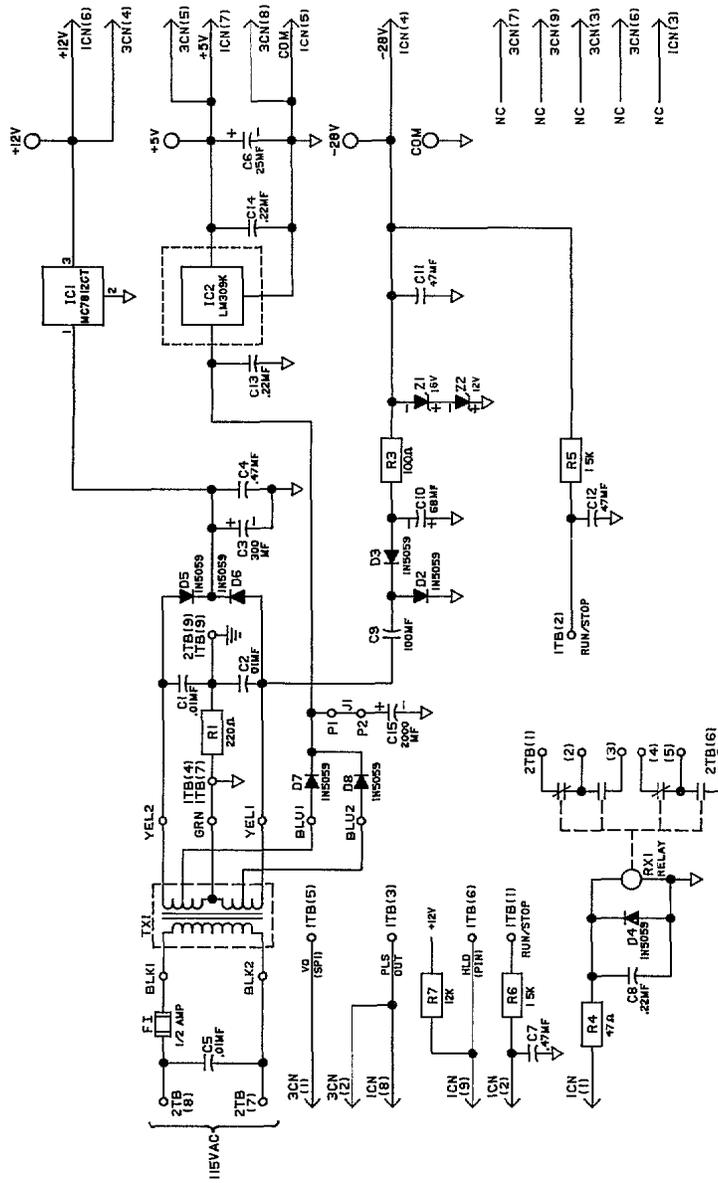


FIGURE 12
Power Supply Card Block Diagram

GENERAL ELECTRIC
 TITLE ELEMENTARY DIAGRAM
 POWER SUPPLY CARD- MASTER REFERENCE OSCILLATOR
 FIRST MADE FOR STD LINE
 193X482AAG01

36C764413AA
 REV. 01
 193X482AAG01



NOTE
 ALL RESISTORS ARE 1/4W UNLESS OTHERWISE NOTED

ITB(8) ○ — SP-2

DO NOT REPAIR OR ALTER THIS
 DIAGRAM WITHOUT THE SPECIFIC APPROVAL
 OF THE DEVELOPMENT ENGINEERING
 DEPARTMENT. THIS IS A GENERAL
 PRODUCT OPERATOR.

REV. NO.	REV. DATE
0	

REV. NO.	REV. DATE
0	

REV. NO.	REV. DATE
0	

REV. NO.	REV. DATE
0	

REV. NO.	REV. DATE
0	

REV. NO.	REV. DATE
0	

FIGURE 13
 Power Supply Card Elementary Diagram

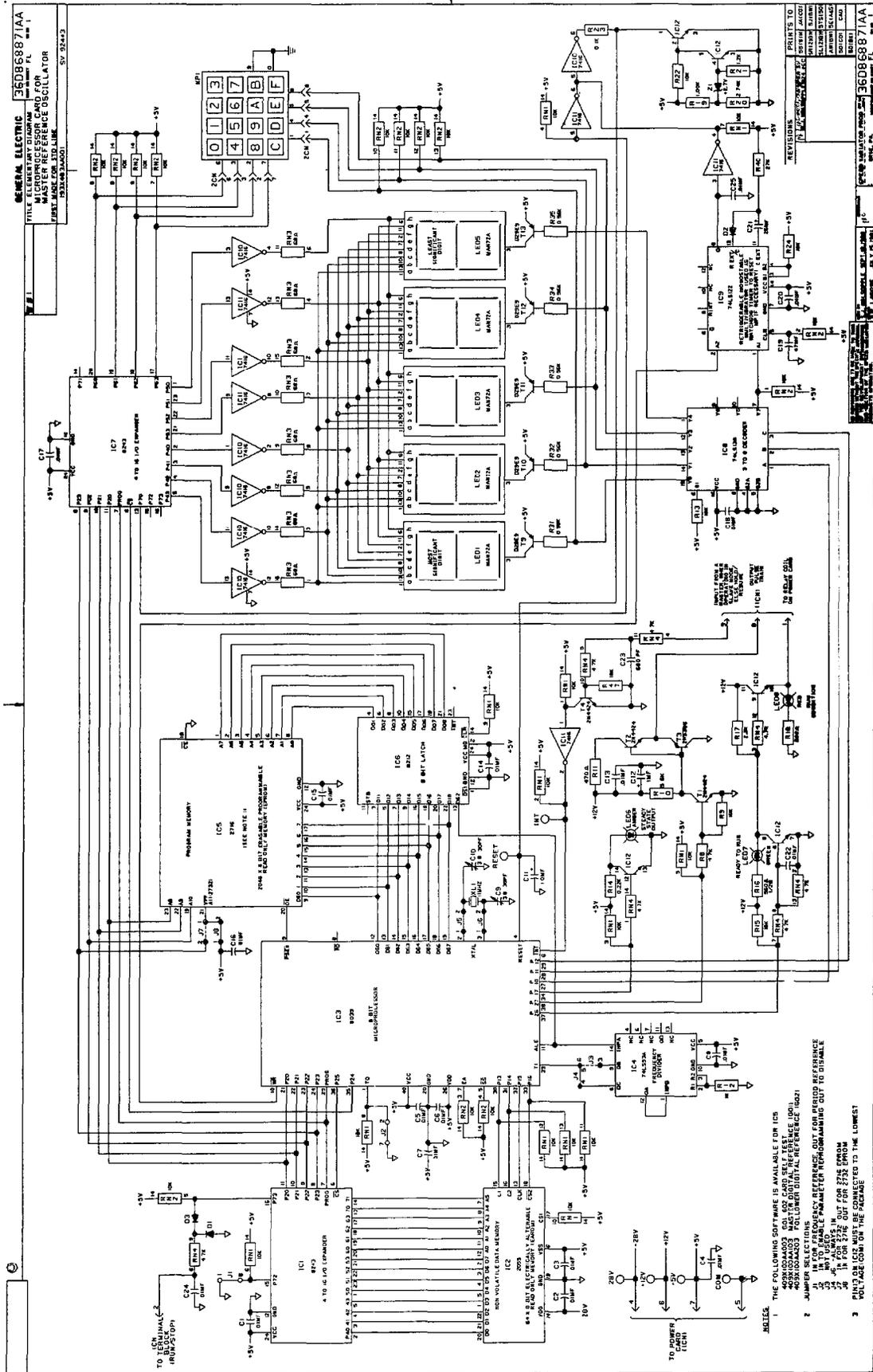
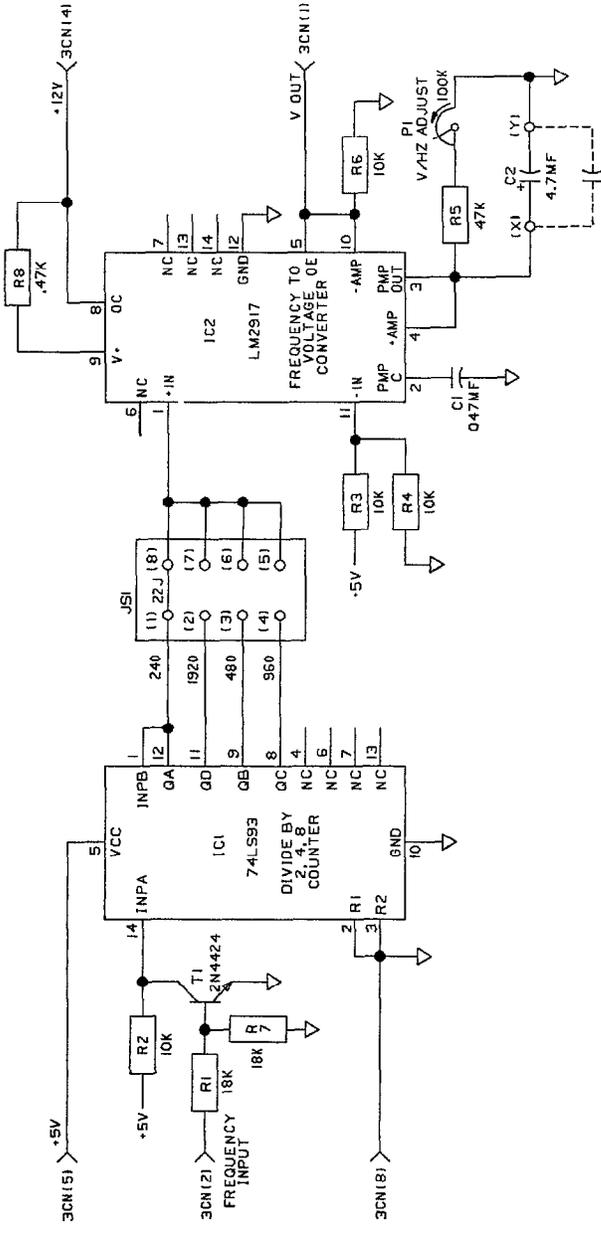


FIGURE 14
 Microprocessor Card Elementary Diagram

GENERAL ELECTRIC
 TITLE ELEMENTARY DIAGRAM
 FREQUENCY TO VOLTAGE CONVERTER
 FIRST MADE FOR MASTER REFERENCE OSCILLATOR
 36B590267AA
 CONT ON SHEET 2
 SH NO 1
 193X48 4AAG01



NO REVISIONS ARE TO BE MADE TO THIS
 DRAWING WITHOUT THE SPECIFIC APPROVAL
 OF THE DEVELOPMENT ENGINEERING
 SECTION OF THE SPEED VARIATOR
 PRODUCTS DEPARTMENT

REVISONS		PRINTS TC	
1	SEPT 17 1981	PER	5B181M JA(CD)
2	MAR 31 1981	BY	5B181M JA(CD)
3	AUG 14 1981	BY	5R121B1 5J1B1W
4	JUL 24 1981	BY	5L121B1 5T1S150
5	JUN 24 1981	BY	AW181W 5E1AAS
6	MAY 24 1981	BY	5D1C1D CAD
7	MAY 24 1981	BY	5D1B1K1

MADE BY S.J. HOLSOFFLE MAR 31 1981
 DESIGNED D. FRANOS AUG 14 1981
 APPROVALS SPEED VARIATOR PROJ. 36B590267AA
 ERIE LOCATION CONT ON SHEET 2
 DIV OR DEPT 5 SELEC
 SH NO 1

FIGURE 15
 Voltage Output Card Elementary Diagram

TROUBLESHOOTING

This section contains general checks and a troubleshooting "fault tree" to systematically isolate most problems based on identification of the symptoms of the problem. Once the faulty part or printed circuit card has been identified, refer to the Maintenance and Renewal Parts Section for information on ordering parts.

TEST EQUIPMENT REQUIRED

These troubleshooting notes are written so that most problems can be isolated with a good quality multimeter or volt-ohmmeter. While not generally necessary, an oscilloscope may be useful in some situations. For precise calibration of the pulse frequency, an accurate frequency counter will be required.

TESTING SAFETY PRECAUTIONS

WARNING

SHOCK HAZARD. ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE. NEVER ASSUME ANY TERMINAL OR CONNECTION IS AT A SAFE VOLTAGE POTENTIAL. HAZARDOUS VOLTAGES CAN BE INSIDE THE MASTER REFERENCE OSCILLATOR ON THE AC POWER SUPPLY LINES AS WELL AS ON THE CONTROL LINES.

BECAUSE SOME READINGS MUST BE TAKEN WHILE POWER IS APPLIED TO THE UNIT, THE TROUBLESHOOTER MUST TAKE CARE TO AVOID ELECTRIC SHOCK TO HIMSELF OR DAMAGE TO THE UNIT. BY FOLLOWING RECOMMENDED SAFETY PRECAUTIONS AND OBSERVING GOOD TESTING PRACTICES, THESE HAZARDS CAN BE REDUCED.

CAUTION

PROTECTION OF CIRCUITRY TO PREVENT DAMAGE TO THE CIRCUITRY, TAKE NOTE OF THE FOLLOWING PRECAUTIONS:

1. DO NOT DISCONNECT OR CONNECT PRINTED CIRCUIT CARDS, COMPONENTS, OR CONNECTORS WHILE POWER IS APPLIED TO THE UNIT.
2. DO NOT SHORT BETWEEN CIRCUITS, CONNECTORS PINS, OR IC DEVICE PINS WHILE TAKING READINGS WITH A METER OR PROBING THE CIRCUIT. USE INSULATING SLEEVES WHERE NECESSARY TO PREVENT SHORTING.

3. PROTECT THE ELECTRONIC DEVICES FROM ELECTROSTATIC DISCHARGE. AVOID NYLON CLOTHING AND OTHER STATIC GENERATING MATERIALS. IF THERE IS A RISK OF STATIC CHARGES BEING PRESENT, TOOLS, TEST EQUIPMENT AND PERSONNEL SHOULD BE DISCHARGED TO GROUND BEFORE TOUCHING CIRCUITS IN THE MASTER DIGITAL REFERENCE.

CARD REMOVAL AND GENERAL CHECKS

The printed circuit cards in the Master Digital Reference are designed to be easily removed through the use of quick-connect connectors and machine screw mounting. Sufficient cable length from the microprocessor card on the back of the cover to the keypad and to the power supply card is provided to allow the card to be removed from the cover for access to test points with all connections intact. Care must be taken however, to avoid stress on the cables and connectors.

The following general checks and inspections should be made as a first step in troubleshooting:

- o Check that all terminal connections on the power supply card are correct and tight.
- o Check that all connectors are correctly installed and seated.
- o Check that all integrated circuits and LED displays are fully seated in their sockets.
- o Check that all stab-on connections on the power supply card are correct and fit snugly. The stab-on posts for the transformer are identified by color of the transformer leads.
- o Check that the following jumper settings are correct on the microprocessor card:

J1 - "In" for Master Frequency Reference.

"Out" for Master Period Reference.

J2 - "In" to enable max. freq., accel., & decel. time reprogramming.

"Out" to disable these keypad entries.

J3 - "Always out."

J4 - "Always in."

- o If the voltage reference option card is used, be sure a single jumper is installed in one of the four positions.
- o Check for poor or broken solder connections.
- o Check for shorts on both sides of the cards.
- o Remove any loose chips of metal.
- o Be sure the power supply card fault interrupter is not blown.

- o Be sure there are no unsuppressed relay or solenoid coils in the vicinity.
- o Check for other sources of electrical or electromagnetic noise which might interfere with the unit.
- o Be sure there are no fixed or portable radio transmitters operating in the immediate vicinity.
- o Be sure the external START/STOP contact and HOLD contact are operating correctly.
- o Check that the 115V AC supply is present and at the correct voltage.
- o Check that the +5V DC, +12V DC, and -28V DC power are present and within 5% of the nominal value on both the power supply card and microprocessor card. Test posts are provided for this purpose.

4. Pulse output problems:
 - No pulse output, or pulse stays at minimum frequency
 - Incorrect pulse frequency
 - Pulse frequency drifts
 - Pulse output is erratic
5. Voltage output problems (if option used)
 - No voltage output
 - Incorrect voltage output
 - Voltage drifts or is erratic
 - Too much ripple on voltage output

If none of these checks locate any problems, proceed with the troubleshooting chart in the following sub-section.

TROUBLESHOOTING CHART

Master Digital Reference problem symptoms can be broken down into one of the following general categories. For each category, a troubleshooting tree is provided in Figure 16 for isolating the problem. To use the troubleshooting trees first find the general category your symptom falls under. Then refer to the tree for that category. Start at the top of the tree, and at each branch, make the indicated check and take the branch based on your response to the question asked at that branch.

1. Display, status LED and power supply problems:
 - No display segments or LEDs light
 - Status LEDs OK, no display
 - Some segments or LEDs do not light
 - Display readout is incorrect or not intelligible
 - Display is erratic
2. Keypad and parameter entry problems:
 - Keypad fully inoperative
 - Keypad partially inoperative
 - Parameters will not reprogram or reprogram incorrectly
 - Parameters reprogram by themselves
3. START/STOP or HOLD problems:
 - RUN relay won't energize but pulse output is OK
 - RUN relay energizes even when start contact open
 - RUN relay operates erratically or at the wrong time
 - HOLD input does not work

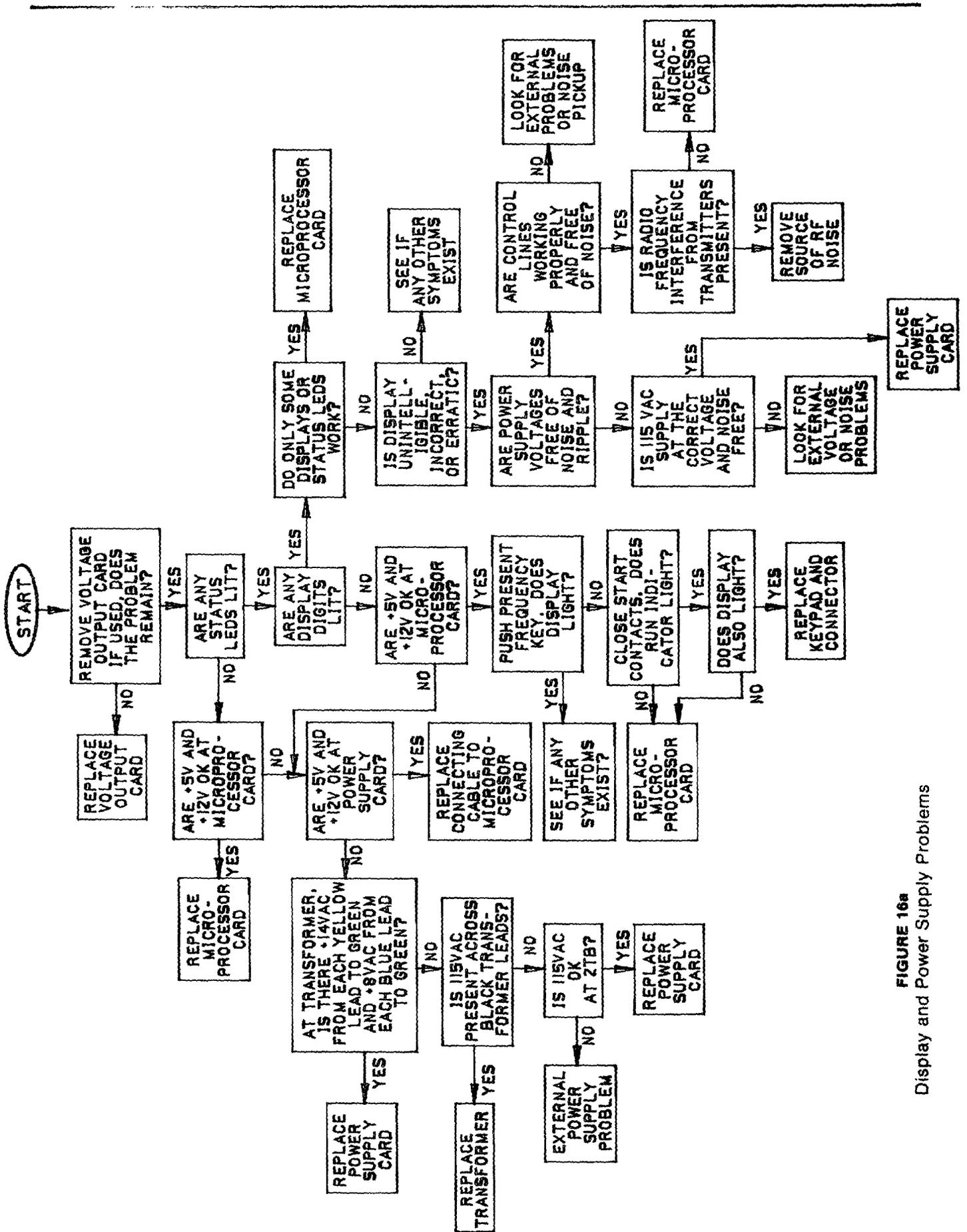


FIGURE 16a
Display and Power Supply Problems

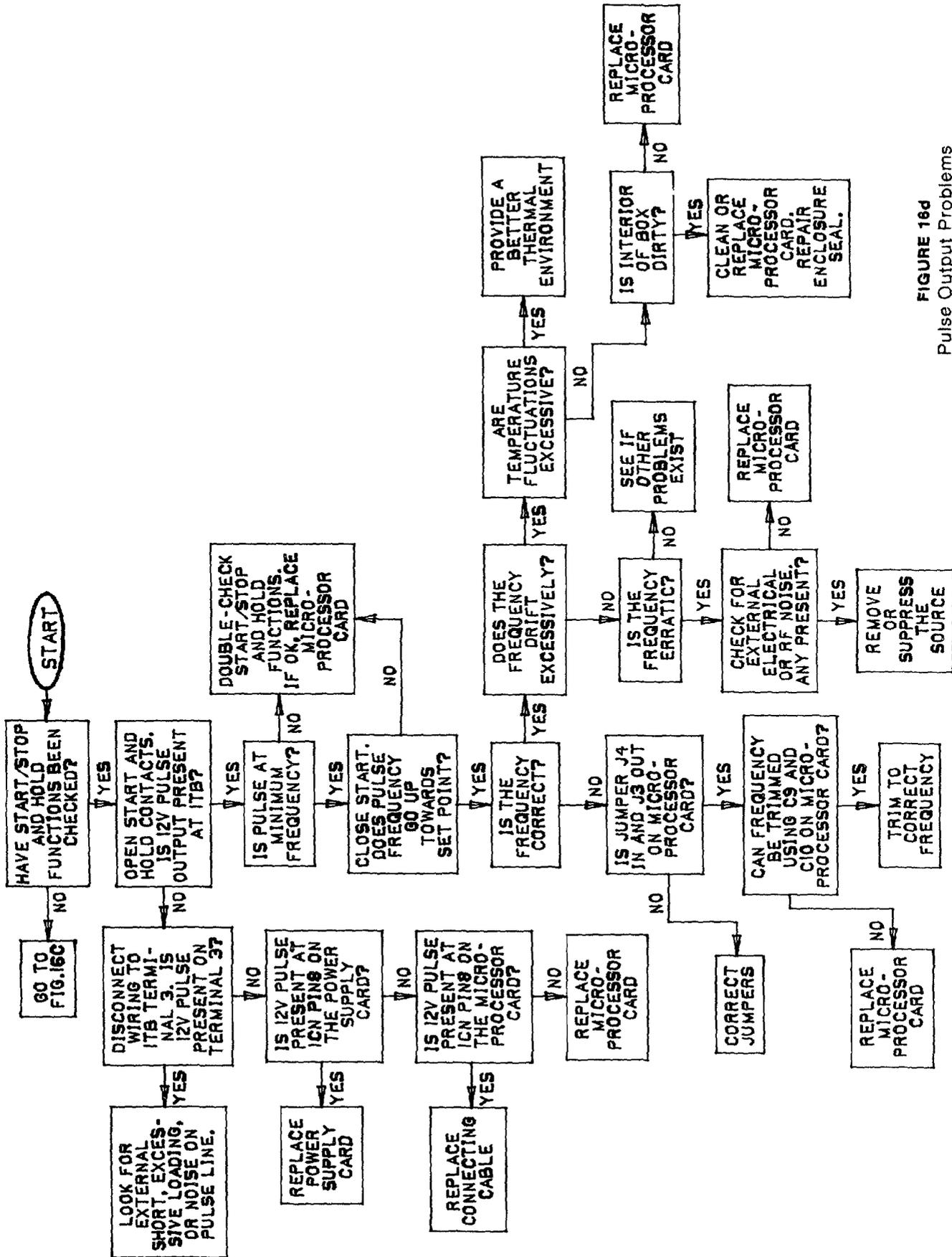


FIGURE 16d
Pulse Output Problems

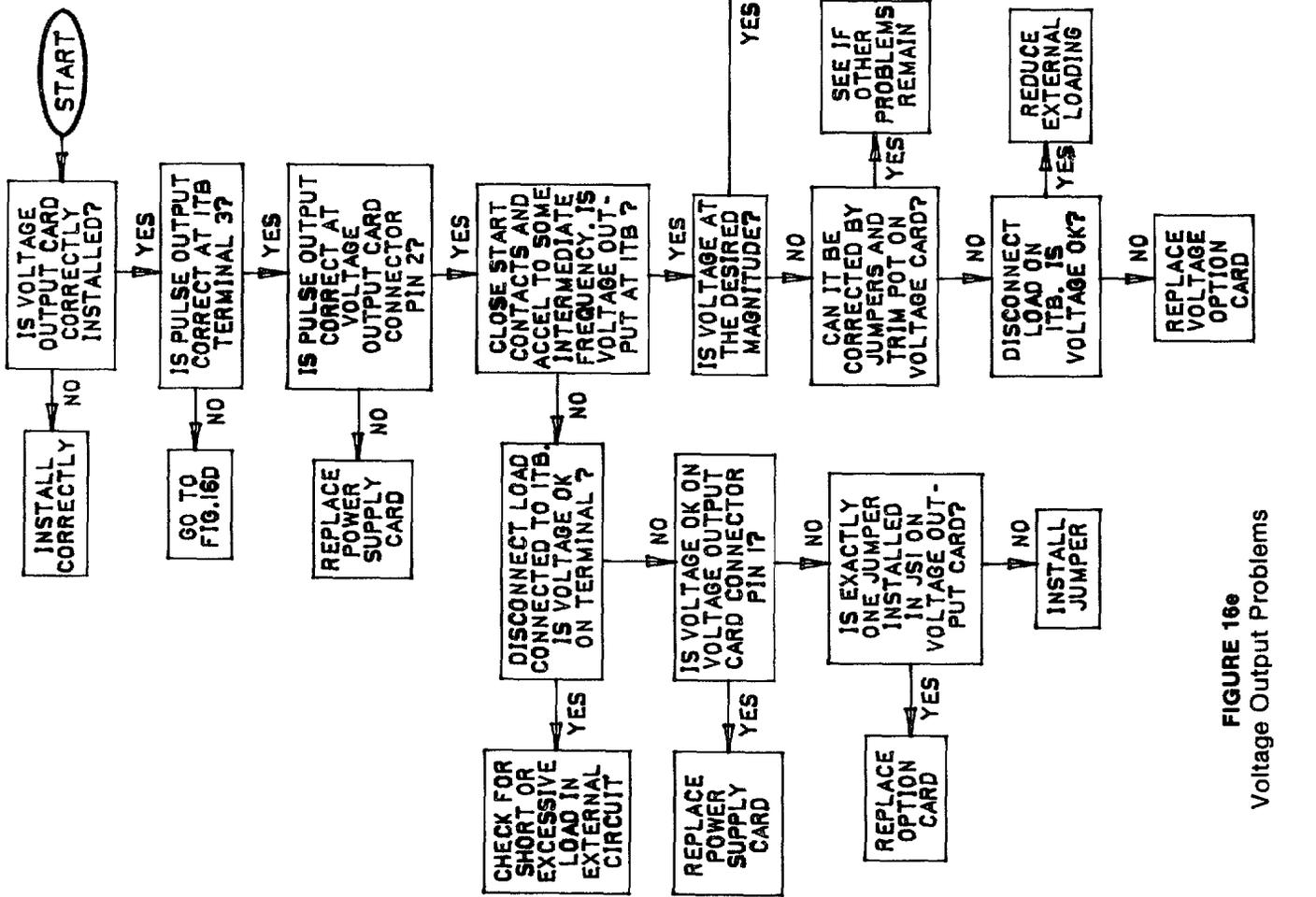


FIGURE 16e
Voltage Output Problems

MAINTENANCE AND RENEWAL PARTS

The Master Digital Reference is designed to require a minimum of maintenance. The keypad and display cover may be kept clean by using a mild detergent. Do not use abrasive cleansers or organic solvents.

The interior of the unit should not require cleaning provided the enclosure seal is maintained.

The pulse output frequency may drift slightly with age. This may be trimmed back into agreement with your calibration instruments by adjusting one or both trimmers on the microprocessor card. (See sub-section on "INTERNAL ADJUSTMENTS")

The voltage output, if this option is used, may also be trimmed if the necessary by adjusting the potentiometer on the voltage output card. (See sub-section on "INTERNAL ADJUSTMENTS")

Renewal Parts

Description	Catalog Number
MASTER DIGITAL REFERENCE	6VDMR10A1
MASTER DIGITAL REFERENCE WITH VOLTAGE OPTION	6VDMR11A1
POWER SUPPLY TRANSFORMER	36A353243BC
POWER SUPPLY CARD	193X482AAGO1
MICROPROCESSOR CARD	193X483AAGO1
MICROPROCESSOR PROGRAM ON 2716 EPROM	409X100AA103
CABLE, POWER SUPPLY TO MICROPROCESSOR CARD	36A358099RFGO1
VOLTAGE OUTPUT CARD	193X484AAGO1
ESCUTCHEON (KEYPAD + CABLE)	36B605463ACGO1
INSTRUCTION BOOK	GEK-24977

For parts, contact your local General Electric Sales Office or your "Authorized" General Electric Parts Distributor.

The Contract Warranty for the Master Digital Reference is stated in the General Electric Apparatus Handbook, Section 105, page 71.

In the event of failure or misapplication during "in warranty", refer to the instruction book to identify the defective part or subassembly.

When the defective part has been identified (or for assistance in identification) call:

GENERAL ELECTRIC COMPANY
ERIE, PENNSYLVANIA
(814-455-3219)
(24 - Hour Phone Service)

Before calling, list catalog numbers for ready reference.

USE WITH FOLLOWER REFERENCE

For applications in which the controllers of one or more adjustable speed slaved to a master unit, a Follower Digital Reference is available. This unit uses the output of a Master Digital Reference unit as its input and generates an output that can be adjusted to be a fixed percentage faster or slower than the Master. Up to ten Followers can be operated from a single Master. Each Follower has override capabilities that allow easy slack take-up or let-down.

The Model Number of the Follower Digital Reference is 6VDFR10A1. Complete details on installation and use may be found in its instruction book, GEK-24978.

**GENERAL ELECTRIC COMPANY
SPEED VARIATOR PRODUCTS OPERATION
ERIE, PENNSYLVANIA 16531**

GENERAL  ELECTRIC

GEK-24977 (3/82) 1M (P)