WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

TM-106650

VOLUME 1

OPERATOR'S MANUAL

UNIVERSAL DISTURBANCE ANALYZER

SERIES 626

1 October 1981

DRANETZ

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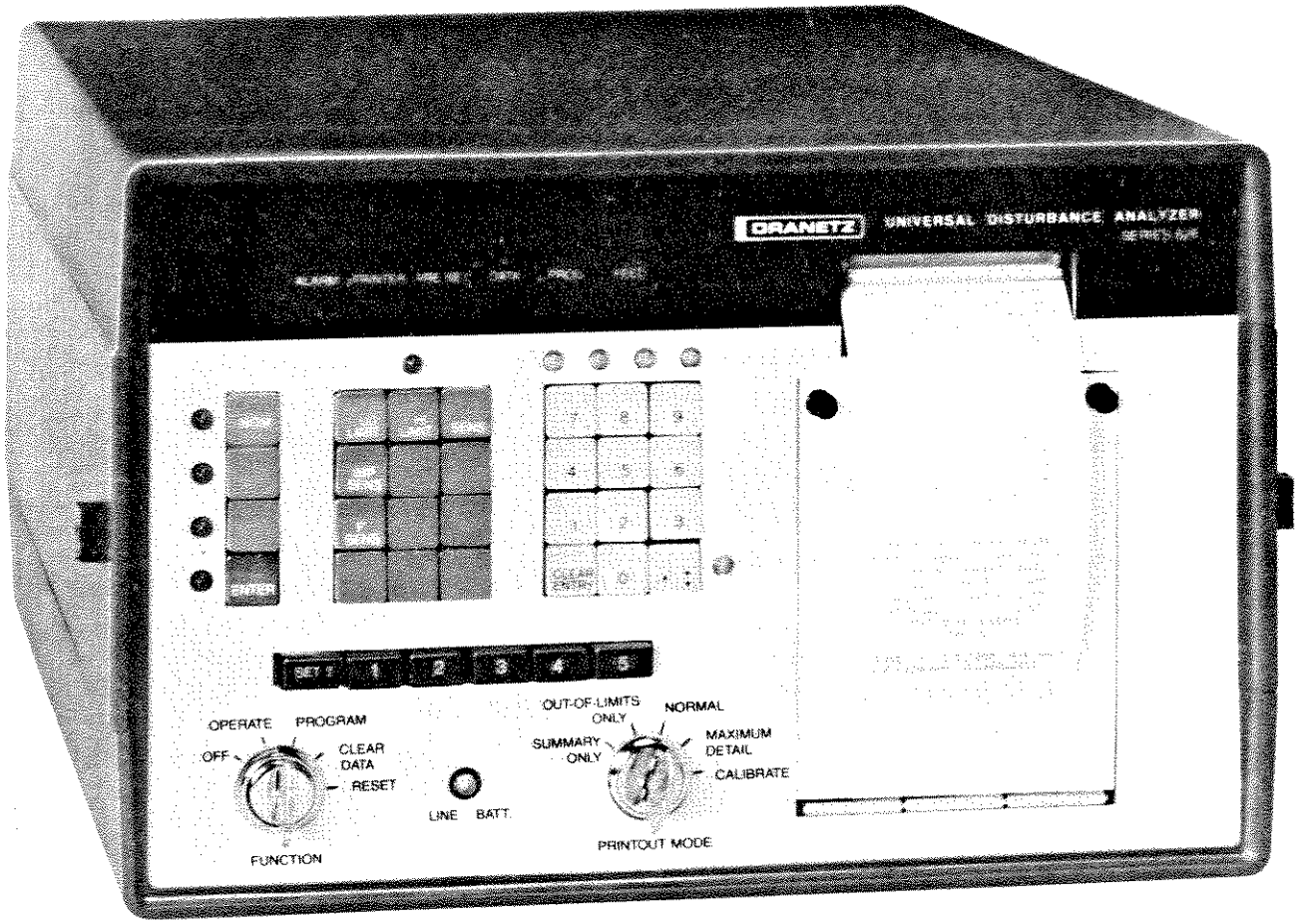

Figure 1. Series 626 Universal Disturbance Analyzer

MAINFRAME

1 INTRODUCTION

This manual contains operating instructions for the Model 626 Universal Disturbance Analyzer (See figure 1.) The Model 626 consists of a mainframe into which may be installed up to five plug-in modules. A wide variety of module types are available for use. Each plug-in module designed for this microprocessor-based universal-type instrument is equipped with its own software.

The mainframe provides the common functions for all plug-ins, its characteristics and operation are described in this manual. Other manuals describe the different plug-ins, their characteristics and operation.

2 PURPOSE

As a Universal Disturbance Analyzer, the Model 626 may be used for many applications. For example, it monitors, measures, records and prints disturbances. Depending on the particular plug-ins installed, the instrument is capable of monitoring disturbances on single phase or 3-phase AC power lines, AC neutral power lines (with respect to earth ground), and DC lines. The Model 626 may also be used as a sequence of events recorder, recording and printing out any changes of state detected at its inputs. Details of these and other specific functions of this universal instrument are presented in other manuals.

3 MAINFRAME DESCRIPTION

3.1 Front Panel

The front panel of the Model 626 contains all operating controls and indicators, regardless of the particular plug-ins installed in the unit. The two horizontal groups of push-button switches, as well as the FUNCTION and PRINTOUT MODE switches, perform basically mainframe functions, with some variations controlled by the particular plug-ins installed. The numeric keyboard is used for both mainframe and module functions while the two left-side groups of switches are module related.

To simplify programming, indicators adjacent to the three centrally located switch groups are used to cue the operator. During the interactive programming sequence, the indicators light when switches should be depressed and go out one by one as the operator makes his selections. A thermal printer at the upper right corner of the instrument furnishes an onboard printout of data. The paper supply is accessible behind a hinged cover below the printer. The high speed printout, at 2-1/2 lines per second, may be switched off at will by the operator, although disturbance data continues to be measured and stored. Since the Model 626 is equipped with an RS232C interface, data may still be transferred to a remote printer or peripheral device. Baud rate may be set by the user to maintain compatibility with the remote equipment.

When the paper supply becomes low, a PAPER LOW message is printed and the thermal printer is automatically turned off to conserve paper. However, a daily summary of disturbance data accumulated during the previous 24-hour interval is printed automatically at midnight.

3.2 Real Time Clock

A crystal controlled (±25 PPM stability) real time clock in the mainframe is used as the source of time printouts. Time may be easily set by the operator, using the front panel facilities.

3.3 Audible Alarm

When the alarm circuits within the mainframe are enabled by the operator, a 1-second audible alarm sounds each time a disturbance or event change is detected (depending on modules installed). A pair of normally open dry contacts, accessible on a rear panel connector, may be used to activate a remote alarm.

3.4 Power Supply

A power supply module plugged into the rear of the instrument furnishes the power required for the mainframe and plug-in modules. (See figure 2.) The power supply may be operated from either 115 VAC or 230 VAC; a 115V/230V switch, located under a decal on its rear panel, selects the desired line voltage. A 3-Ampere fuse on this panel provides overload protection for either line voltage.

3.5 Battery Pack

An on-board battery pack in the mainframe, a standard feature, provides 10 to 40 minutes of uninterrupted operation if line power should fail. To increase back-up time, an external 12V battery source may be plugged into a connector on the power supply. However, the Model 626 will not operate from this source unless it is initialized by the AC line.

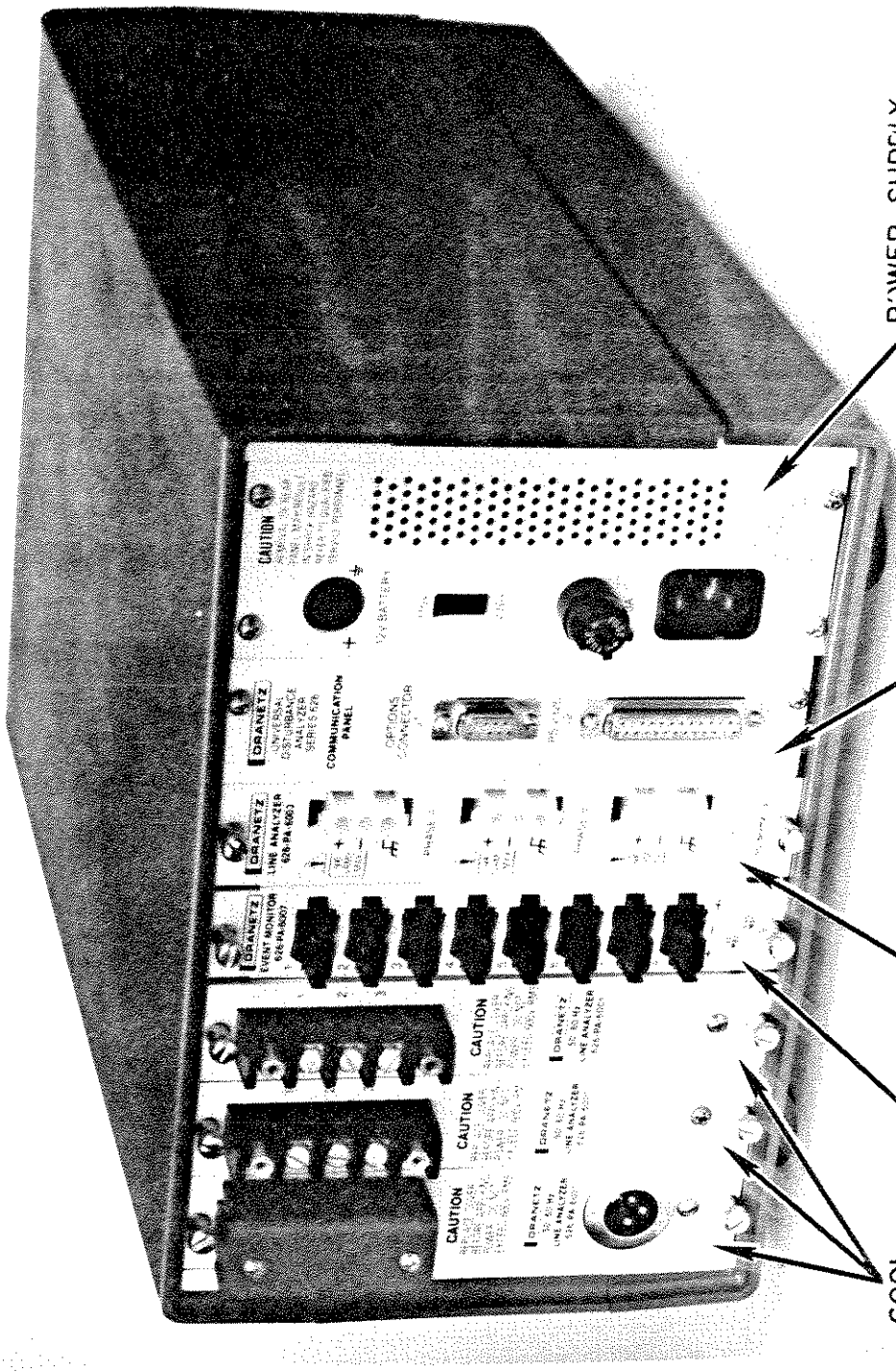

Figure 2. Series 626 Universal Disturbance Analyzer, Rear View

3.6 Communications Panel

The Communications Panel, mounted adjacent to the power supply module, contains options connector J1 and an RS232C connector J2.

3.6.1 Options Connector J1

The options connector pinout is shown in Table 1. The alarm contacts, described in para. 3.3, are rated at 25 volts, 100 mA max. A second set of normally open contacts are undesignated at this printing. The time mark connections are provided as a standard feature. A DC voltage (para. 11b) applied to these contacts produces a time mark along with printout of time. This feature enables the user to correlate an external event in time. Resolution of the time mark is 10 mSec. An isolated field contact power supply option, rated at 12 volt DC @ 10 mA, can be used with sequence of event monitor plug-ins to enable activation from a dry contact.

Table 1. Options Connector J1 Pinout

Pin No.	Function
1	Alarm contact
2	Relay contact*
3	Time mark (-)
4	
5	
6	Alarm Contact
7	Relay contact*
8	Time mark (+)
9	

NOTE: Field Contact Supply is undesignated at this time.

*Undesignated

3.6.2 RS232C Connector J2

Connector J2 carries the RS232C interface signals that enable remote printout and control. The output, a duplicate of that printed on the thermal printer, is formatted in ASCII code. Voltage and impedance levels conform to RS232C standards

The following control lines are used.

REQUEST TO SEND (Pin 4) - Must be true to enable data output from the Model 626.
CLEAR TO SEND (Pin 5) - Always true.
DATA SET READY (Pin 6) - Always true.
DATA TERMINAL READY (Pin 20) - Must be true to enable data input acceptance by 626.

Table 2 identifies all RS232C pin assignments and indicates signal direction.

Table 2. RS232C Connector Pinout

Pin #	Function	(Direction)
1*	Protective Ground	
2	Transmit Data	(626 Input)
3	Received Data	(626 Output)
4	Request to Send	(626 Input)
5	Clear to Send	(626 Output)
6	Data Set Ready	(626 Output)
7*	Signal Ground	
20	Data Terminal Ready	(626 Input)

*Tied together internally to frame ground.

OPERATION OF RS-232 PORT AND PRINTER

The 626 mainframe comes equipped with a "SMART" RS-232 port. Upon powering the unit up, the RS-232 control lines are interrogated to determine the existance of a functional remote device (i.e. teletype, video terminal, etc.). If this test fails for any reason, the normal POWER ON messages (see sec. 1.5.1) will be accompanied by an additional "RS-232 LOST" message and time printout. In this state, disabling the printer is not permitted. Thereafter attempting to push the PRINT push button will cause the following message to be printed:

```
TIME = 12:34:56.78   ↑
    RS232 LOST       |   read up
    PRINTER ON       |
```

(Note: the unit "powers up" in the PRINTER ON mode).

If at any time thereafter, the RS-232 control lines are satisfied, a message: "RS232 RESTORED" and time will be printed and normal operation will be restored.

If during normal operation, the RS-232 control lines become invalid, the "RS-232 LOST" message and time will be printed. The unit is then forced into the "PRINTER ON" mode. The unit will, however "REMEMBER" the last status of the printer, and upon restoration of proper RS-232 operation print "RS232 RESTORED" and time. It will then restore the previous status of the printer and print "PRINTER OFF" and time if applicable.

The "RS232 LOST" message will be accompanied by a "PRINTER ON" message, only if the printer was off at the time.

The "RS232 RESTORED" message will be accompanied by a "PRINTER OFF" message, only if the printer was off at the time of the RS232 LOST "message".

REMOTE INPUT COMMANDS

A remote device connected to the RS-232 port may request a PROGRAM SUMMARY, DATA SUMMARY, or CALIBRATION sequence to be executed by sending the characters: "P", "D", or "C" respectively to the 626.

Any character sent to the 626 via the RS-232 port will be echoed in the first column of the printer (if enabled). Any invalid characters sent will be printed followed by a question mark.

3.6.3 Dranetz RS232C Interconnect Cable

Connection of the Model 626 to a CRT terminal or teletypwriter may be made with a Dranetz RS232C cable (Dranetz Part #103506). (See figure 3.) The cable ties pins 4 and 20 internally to facilitate connection to a terminal and requires only that a logical high signal be applied to pin 20.

4 OPERATING CONTROLS (See figure 4)

The functions of those operating controls primarily concerned with mainframe operation (i.e., used with all plug-in types) are described in Table 3. Where a control function varies when operating with a particular plug-in type, the variation is described in the manual covering that plug-in. Since some pushbuttons are included only for use with certain plug-in modules, they are described in other manuals, in conjunction with the associated modules.

Table 3. Mainframe Controls

Item	Function
ALARM pushbutton	When depressed to "in" position, enables alarm circuit.*
PRINT pushbutton	A momentary pushbutton which alternately enables or disables the thermal printer. With each depression of this pushbutton, the printer will echo either "PRINTER ON" and time, or "PRINTER OFF" and time. In the latter case, further printout is inhibited unless one of the following occurs: 1. Power is turned off or on. 2. End of day produces daily accumulated summary. 3. RS-232 is lost.
PRESET	(Plug-in function)
DATA pushbutton	When depressed to "in" position, and with function switch in operate position, unit prints out day number, time and contents of daily accumulator in each channel (instrument slot position) in sequence (1-5).
PROG pushbutton	When depressed to "in" position, and with FUNCTION switch in OPERATE position, unit prints time and a summary of the program (threshold settings) in each channel in sequence (1-5).

*With some types of disturbances or event changes, this causes 1-second audible tone to sound.

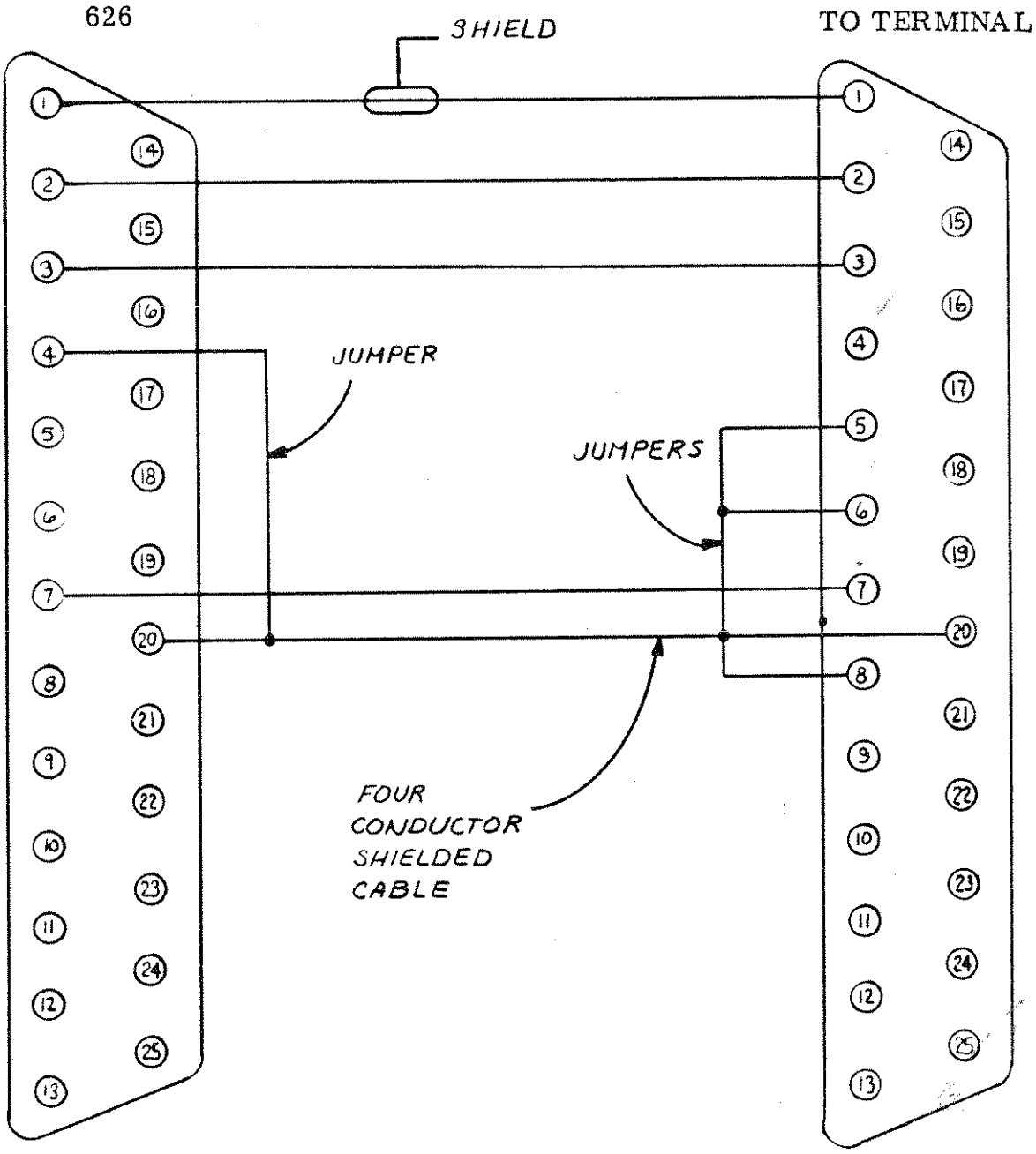

Figure 3. RS232C Interconnect Cable

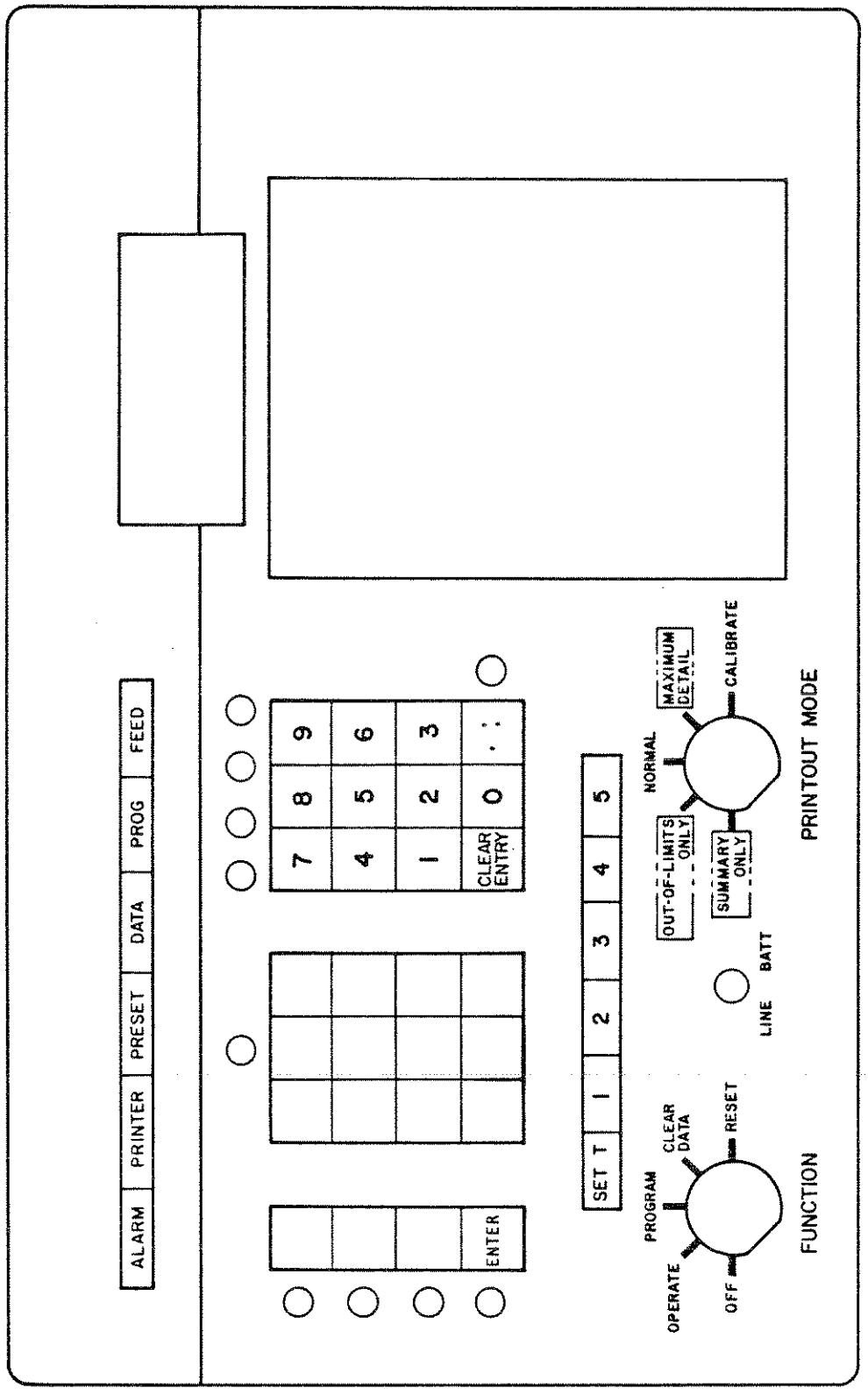

Figure 4. Mainframe Controls

Table 3. Mainframe Controls (Cont'd.)

Item	Function
FEED pushbutton	When held in depressed position, causes paper to feed out of thermal printer.
ENTER pushbutton	When depressed, enters constants in numeric keyboard into real time clock or plug-in program
Numeric keyboard (0-9, ., and CLEAR ENTRY)	Used to enter constants when setting time or programming.
SET T pushbutton	When depressed to "in" position and with FUNCTION switch in PROGRAM position, enables operator to set time.
1-5 pushbuttons	When depressed to "in" position, and with FUNCTION switch in PROGRAM position, selects plug-in channel for programming.
FUNCTION key switch	OFF: turns off instrument. OPERATE: normal operating position. Programming switches are disabled and key may be removed to prevent unauthorized use of instrument. However, top row of pushbuttons (ALARM, PRINT, etc.) may be activated. PROGRAM: enables user to program real time or thresholds of selected channel. CLEAR DATA: Clears all daily accumulators, removing all data obtained that day, but does not affect real time. RESET: Resets the main processor (CPU).
LINE-BATT indicator	Green LINE indicator lights when AC power is present. Red BATT indicator lights when power is lost and unit is automatically switched to battery source.

Table 3. Mainframe Controls (Cont'd.)

Item	Function
PRINTOUT MODE key switch	Printout data reduction occurs as switch is rotated ccw. Key (identical to FUNCTION switch key) may be removed in any position. CAL: Puts all channels in calibrate mode, and printout (in sequence) is produced by self-contained calibrated inputs. MAXIMUM DETAIL: Produces detailed printout (function of plug-in). NORMAL: Produces less detail (function of plug-in). OUT-OF-LIMITS ONLY: Prints disturbance data only when out of limits. SUMMARY ONLY: Printer is inhibited. All data is still loaded into daily accumulators. Provides Daily Summary at midnight.

5 MAINFRAME OPERATING PROCEDURES

5.1 Power On

With instrument plugged into AC power source, rotate FUNCTION key switch from OFF to OPERATE. The printer will provide a Power On message that shows time, mode of selected function and printout mode. Note: An external device is connected to the RS232 Port in this printout. If device not connected "RS232 LOST" message will be printed additionally.

Example:

MAXIMUM DETAIL
OPERATE MODE
TIME = 13:32:30.12
POWER ON RESET

↑ Read Up

When power is applied, the instrument performs diagnostics on its own (non-volatile) internal memory which is maintained during power off intervals by the internal battery pack. Thus, the Model 626 cannot lose its program or time during power off. Each time the instrument is turned on, all modules are reinitialized to their previous programming, even after extended intervals of time. If a normal POWER ON RESET message is generated, the memory is validated.

If the self-diagnostics on the internal memory determine that the memory is invalid (e.g., if the real time board in the mainframe was replaced), the unit prints

POWER ON RESET
MEMORY INVALID ↑ (Read Up)

This indicates that the user must reprogram time as well as the plug-in programs.

1.5.2 Setting Time

This mainframe function should be performed when real time must be reset (e.g., when time zones are switched, if back-up power fails, etc.). Proceed as follows:

a. Set FUNCTION switch to PROGRAM and depress SET T pushbutton. The instrument now prints the existing (old) time.

b. Note that the two right-most cueing indicators above the numeric keyboard light, indicating that two pushbuttons in the keyboard must be depressed to enter hours. Upon entering hours, the two indicators go out and the cueing indicator adjacent to the semicolon pushbutton lights. When the semicolon pushbutton is depressed, the same two cueing indicators above the numeric keyboard come on again, indicating that minutes should be entered.

c. When time (both minutes and hours) has been entered, the indicator next to the ENTER pushbutton lights. Assume that it is almost 12:30. At precisely 12:30, depress the ENTER pushbutton. This enters the time and turns off the cueing indicator. The printout takes the following form:

OPERATE MODE
TIME = 12:30:00:00 (New) ↑ (Read Up)
TIME = 13:44:39:05 (Old)
PROGRAM MODE

The printout shows both old and newly entered time.

6 GENERAL DESCRIPTION OF OTHER OPERATING PROCEDURES AND PRINTOUTS

The following information is presented to give the user an overview of the instrument's operation and to avoid excessive repetition in later sections of this manual. Although some of the printouts necessarily include specific plug-in programs and data, only details common to overall operation (with any plug-in types) are highlighted.

6.1 Program Summary

To obtain a summary of the programs stored in the installed plug-ins, set FUNCTION switch to OPERATE and depress PROG pushbutton.

Example:

Three 626-PA-6001 plug-ins are installed in channels 1, 2, and 3. Channels 4 and 5 are empty. Note that the printout is identified as PROGRAM SUMMARY, time is furnished and each plug-in is identified by slot position and type.


```
IMPULSE SENS 0100V
FREQ SENS     0.5HZ
VOLTAGE SENS  002V
V LOW LIMIT   105V
V HIGH LIMIT  125V
RANGE F.S.    200V
   626-PA-6001
       CH 3

IMPULSE SENS    0100V
FREQ SENS       0.5HZ
VOLTAGE SENS    002V
V LOW LIMIT     105V
V HIGH LIMIT    125V
RANGE F.S.      200V
   626-PA-6001
       CH-2

IMPULSE SENS    0100V
FREQ SENS       0.5HZ
VOLTAGE SENS    002 V
V LOW LIMIT     105 V
V HIGH LIMIT    125 V
RANGE F.S.      200V
   626-PA-6001
       CH 1

TIME = 13:24:57.50
 PROGRAM SUMMARY
```

6.2 Data Summary

To obtain a summary of data, set FUNCTION switch to OPERATE and depress DATA pushbutton. The data summary provides the day number, present time and the accumulated data for each plug-in installed in the mainframe.

Example:

With three plug-ins installed in the mainframe, disturbance data recorded on channel 1 is printed out. (No data has been recorded on channels 2 and 3.)

(Read up)

```
        CH 3
        CH 2
IMP   0377V  002  HT
        CH 1
TIME = 13:27:22.14
      DAY # 00
   DATA SUMMARY
```

6.3 Calibrate Mode

To verify the performance of the plug-ins installed in the mainframe, set the PRINTOUT MODE switch to CALIBRATE. This replaces the normal inputs to all plug-ins with internally generated precise test inputs. The printout then indicates the results of processing the test inputs. This test printout must then be interpreted by the user to determine the accuracy of the plug-ins.

Example:

This printout contains the test data for plug-ins installed in channels 1, 2, and 3. Note that the printout starts and ends with asterisks.

(Read up)

```
*******************************
  PRESENT F 060.0 HZ
  PRESENT V 119.6 V
  IMP     + 0160 V PK
          CH 3
  PRESENT F 060.0 HZ
  PRESENT V 119.6 V
  IMP     + 0160 V PK
          CH 2
  PRESENT F 060.0 HZ
  PRESENT V 120.4 V
  IMP     + 0160 V PK
          CH 1
  TIME = 12: 14:46.03
*******CALIBRATION*******
```

6.4 Internal Battery Pack

If an AC power failure should occur, the battery pack maintains full operation. The green LINE indicator on the front panel goes out and the red BATT indicator lights. The printer outputs a BATTERY ON message which also provides the time of this occurrence.

Example:

↑ TIME = 12:53:51.75
BATTERY ON

If the output of the internal battery pack drops below operating level, a POWER LOSS message is printed, indicating that no further data may be processed. The unit is then automatically switched off.

Example:

↑ TIME = 12:57:26.63
POWER LOSS

When line power is restored, a POWER RESTORED message is printed.

Example:

Note that the operating and printout modes are included.

MAXIMUM DETAIL
OPERATE MODE
TIME = 12:58:01.43 ↑
POWER RESTORED

NOTE

The internal battery pack will recharge to full capacity in approximately 10 hours with the mainframe connected to AC line and unit operating.

When the instrument is turned off, a POWER OFF message is printed, along with time.

Example:

↑ TIME = 12:58:21.96
POWER OFF

6.5 Preset Factory Program

In the event the last program is lost, the program base for the plug-ins is automatically derived from factory-preset non-volatile memory (located in the plug-in). Standard programs are normally prepared for hard storage. As an option, user selected programs may be loaded into hard storage at the factory. The instrument reverts to the hard storage program when a MEMORY INVALID condition exists or when the operator depresses the PRESET pushbutton while in the program mode with the appropriate module selected.

7 INSTALLATION OF PAPER TAPE

The instrument is shipped with a roll of paper already installed. During operation, when the paper supply becomes low, the unit will automatically print,

↑ SUMMARY ONLY
PAPER LOW

and operation will be shifted to the SUMMARY ONLY mode (regardless of the PRINTOUT MODE setting), indicating that the paper roll should be replaced. After the paper is replaced, the unit reverts back to the setting of the PRINTOUT MODE switch.

NOTE

In the SUMMARY ONLY mode, normal printout of disturbance data is inhibited and only the daily accumulated summary is produced. Therefore, if it is anticipated that a large number of disturbances will occur during a period of unattended operation, do not wait for a PAPER LOW condition - install a full roll of paper.

Before replacing the thermally sensitive paper, clean the printhead as described in paragraph 8. After cleaning the printhead, replace the paper roll as follows:

a. Pull two black cover latches to lower cover.

b. Tear paper roll just above old roll. Do not remove remaining paper from printer.

c. Push two spring paper holders outward to release old paper roll and remove roll.

d. Remove holding tab from new paper roll to release end of roll. Use a scissors to cut the edge of the paper straight.

e. Holding the paper roll so that it unrolls, expand the two spring paper holders, install the roll, then release the holders to lock the roll in place.

NOTE

If there is no paper in printer, proceed directly to step i.

f. Ensuring that the new paper is aligned correctly to avoid jamming, insert the cut end between the rubber roller and the remaining old paper so that the old and new paper overlap.

g. Depress and hold FEED pushbutton until the new paper comes into view and the old paper is completely out of the printer.

h. Raise cover and guide paper through opening, then lock cover in place.

NOTE

Proceed with the following steps only if there is no paper in printer.

CAUTION

BE SURE THAT HANDS ARE CLEAN. ANY GREASE OR FOREIGN MATTER ON HANDS MAY CONTAMINATE ROLLER AND CAUSE PRINTER TO MALFUNCTION.

i. Using one hand, feed the cut end of the new paper between the rubber roller and the feed chute opening under the printer. Using the thumb on the other hand, gently rotate rubber roller in the forward direction until the paper comes into view.

j. Depress and hold FEED pushbutton to ascertain that paper moves smoothly. If not, repeat procedure to step i.

k. Raise cover, guide paper tape through opening, then lock cover in place.

NOTE

Due to the coiling action of the paper on its spool, it is likely that repetitive printouts of the PAPER LOW message will occur until the paper supply is clearly below the triggering point of the optical paper sensors. This occurrence is intentional and should not be a cause for concern.

8 CLEANING PRINTHEAD

During the course of normal printer operation, minute particles of thermal sensitive material tend to be dislodged from the surface of the printer paper. These particles accumulate on the surface of the heating matrix in the printhead. This causes a reduction in heat-flow to the paper causing the following symptoms:

Print density too light

No printout

Missing dots

To clean the printhead in the simplest and preferred method, particles may be removed by inserting a length of bond paper (approximately 10 inches in length cut to width of 2.25 inches) into the printer and operating the printer by pressing the FEED button until the length of paper passes through the printer. Insert this paper in the same manner as if replacing the paper roll.

NOTE

For your convenience Dranetz has made available a precut paper roll (Dranetz P/N 103418). This paper served as an abrasive which buffs the surface of the printhead clean. It is a recommended good practice to clean the printhead each time the thermal sensitive paper roll is replaced.

9 SETTING THE BAUD RATE

If an external printer is to be used with the Model 626 (via the RS232C Interface) the baud rate may be set as follows:

a. Remove screws from Communications Panel at rear of instrument.

b. Disconnect two ribbon cables which connect the panel to the CPU and the CPU to the main frame.

c. Withdraw the CPU board from the mainframe.

d. Adjust the baud rate switch mounted on the CPU board (fig. 5) for the desired baud rate, as indicated in Table 4.

Table 4. Baud Rate Selection Chart

Position	Baud Rate	
0	50	(not recommended)
1	75	(not recommended)
2	110	
3	134.5	
4	150	
5	300	
6	600	
7	1200	
8	1800	
9	2000	
A	2400	
B	3600	
C	4800	
D	7200	
E	9600	
F	19200	(not recommended)

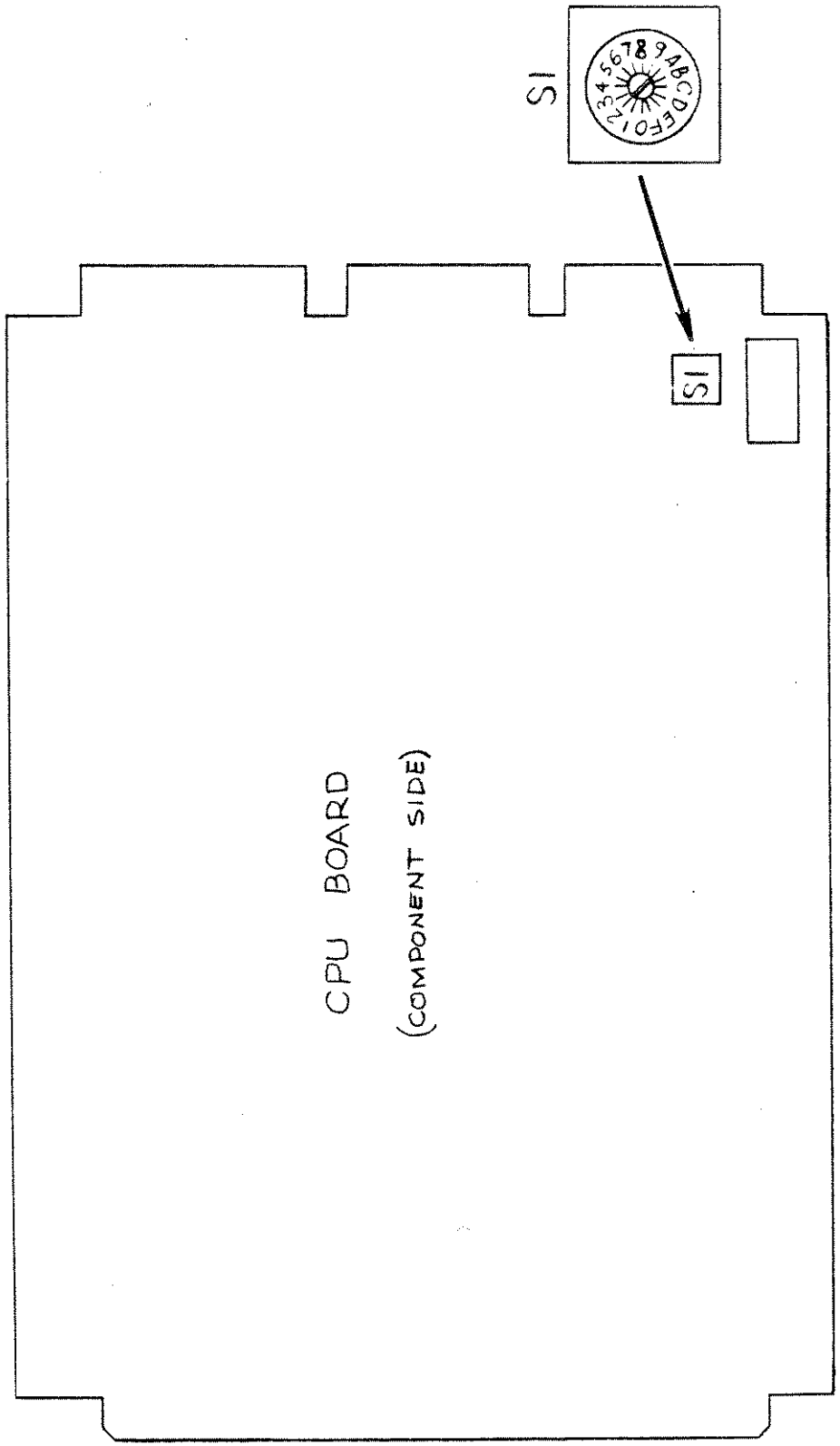

Figure 5. Location of Baud Rate Switch on CPU Board

10 SPECIFICATION SUMMARY

Table 5 summarizes the specifications of the Model 626.

Table 5. Specification Summary

Plug-in Module Capacity	1 through 5
Time Clock	Crystal controlled, ±25 PPM Keyboard entry (approx. ±2 sec/day)
Alarm Circuits (Activated by any printable disturbance)	1. Audible alarm, 1 second self-clearing, keyboard selectable 2. Alarm contact closure
Temperature Range	
Operating	+10 to +40°C
Storage	-40 to +55°C
Power Requirements	
AC	90-140V rms or 180-250V rms, at 47 to 63 Hz 50 Watts
DC	+12 VDC @ approx. 2 Amps
UPS Capacity	10 to 40 minute operation on internal battery pack. 6-10 hr. recharge time
Size	7" high x 11" wide x 14" deep
Data Output	On board thermal printer. RS232C Interface with control capability

11 FEATURES

a. Factory preset program

b. Time Mark: Includes optical coupled time mark circuit which causes Model 626 to print a time mark when externally supplied DC voltage appears at the rear panel options connector. The time mark is useful in providing time correlation with an external event.

Specifications

Input Voltage:	5 to 12 V DC
Input Current:	4 mA @ 5V typical
	22 mA @ 12V typical
Timing:	Operates on leading edge of applied voltage
Pulse Width:	100 uSec minimum
Pulse Rate:	1,000 per sec.
Off Period:	500 uSec minimum

12 STANDARD ACCESSORIES (SHIPPED WITH ALL UNITS)

a. 115 Volt line cord
b. Three (3) rolls of printer paper P/N 102714.
c. One (1) roll of printer cleaning paper P/N 103418.
d. Mating connectors for J1.
e. Mating connector for 12V battery connector.
f. Instruction Manual TM-106650.
g. Individual Instruction Manuals for plug-in modules supplied.

13 626 Module Capacity

The 626 standard mainframe has an upper limit of the total load rating of the installed modules. The overall mainframe capacity is set at 13 units, and individual modules have load ratings as follows:

Plug-in	Load Rating
626-PA-6001	2 Units
626-PA-6001 With Extra Option Board	3 Units
626-PA-6002	2 Units
626-PA-6003	4 Units
626-PA-6006	2 Units
626-PA-6007	1 Unit
626-PA-6011	1 Unit
(626-PA-6012)	3 Units

When selecting modules for installation in any mainframe, simply verify that the sum of the load ratings of the installed modules does not exceed 13.

WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

TM-110235

VOLUME I

PRELIMINARY

OPERATOR'S MANUAL

626-PA-6003

3-PHASE AC MONITOR

1 October 1981

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Line Voltage Measurement Accuracy	±1% of reading, ±0.2% of full scale (75V to 600V)
Line Frequency	
Range	45 - 65 Hz
Resolution	±0.1 Hz
Accuracy	±0.1 Hz
Impulse Range	25 -4000V Pk (1-2000 uSec)
Impulse Peak Resolution	1 V
Impulse Accuracy	±10% of reading ±1%F.S. (5μSec-50μSec.) (decreasing to ±6db from 1μSec to 2mSec) 100V-4000V
Impulse Duration Range	1 uSec to 2 mSec
Impulse Duration Resolution	1 uSec

626-PA-6003 3-PHASE AC MONITOR

1 INTRODUCTION

This manual provides preliminary instructions for the 626-PA-6003 Plug-in, hereinafter referred to as the 6003, used in the Model 626 Universal Disturbance Analyzer. It is assumed that the reader is familiar with the mainframe information described in TM-106650.

2 PURPOSE

The 6003 monitors disturbances on 3-phase AC power lines. Each phase is monitored on a single voltage range of 0 to 600V RMS. With thresholds programmed by the user, the 6003 monitors both short and long term power line disturbances. With this plug-in, the unit stores, analyzes, classifies and prints out quantative and qualitative disturbance data. Accompanying the data is a printout of time derived from a highly accurate crystal-controlled 24-hour clock in the mainframe.

The plug-in monitors any 3-phase power line whose RMS values range from a low value of 0 volts to as high as 600 volts. Three types of disturbances are monitored by the 6003: power line frequency, power frequency transients and waveform disturbances. Power frequency transients are divided into five display categories: overvoltage, undervoltage, voltage change, voltage surge and voltage sag. Waveform disturbances, identified as "impulses," include all conditions that cause the power line waveform to deviate from an ideal waveform. The 6003 measures the peak amplitude of impulses, their polarity and duration. The threshold value of each type of disturbance, as well as the line frequency, above which detection and printout occurs is operator programmable. (All threshold settings are common to all three line phases.) Except for an automatic summary printout at the end of each day, disturbance data is normally printed out only when disturbances occur. In an alternate mode, a disturbance data summary printout occurs only at the end of each day. This feature permits long term unattended operation.

The threshold program may be easily altered, using the front panel switches. Cueing indicators adjacent to the programming switches simplify the programming procedure. A back-up program for the plug-in, stored in hard memory at the factory, may always be recalled upon operator demand. Both the program and the disturbance data in the data accumulators may be printed out upon demand.

NOTE: Frequency measurements are derived from phase A only. Therefore, if single-phase monitoring is desired, phase A should be used.

3 APPLICATIONS

When installed in the 626 mainframe, the 6003 provides the capability of monitoring and evaluating power system performance. Among its typical applications are the following:

a. To determine the effect of power systems operation on equipment malfunction. The time-referenced power fault disturbance record produced by the instrument permits rapid correlation of errors, outages, and equipment damage in computer, industrial process controls, digital communications equipment, medical monitoring apparatus, and so forth, to power line faults.

b. To perform pre-installation site surveys. The 6003 can be used to determine the adequacy of existing power lines intended to support critical electrical equipment. Anticipation of power problems saves time, money, and future trouble.

c. For diagnostic evaluation of power system performance. The portable instrument, particularly well suited for field use, is ideal for determining the probable causes of, and remedies for, power line disturbances.

d. For monitoring life test racks. The printout produced by the instrument provides a clear record of the quality of power supplied during unattended periods.

4 EQUIPMENT CHARACTERISTICS

The 6003 is configured as a plug-in module 6.5" high by 1.25" wide by 10" deep. It is designed for installation in one of four slots of the Model 626 Universal Disturbance Analyzer. Technical specifications of the 6003 are presented in Table 1.

Table 1. 626-PA-6003 Technical Specifications

Input	2 wire differential Z_{in} = 40 Megohms plus 40 pf (each side to ground)
Input Voltage Range	0-600V RMS
Lower Limit of User-Set Voltage (V_{LOW})	50V to 599V
Upper Limit of User-Set Voltage (V_{HIGH})	600V to 51V
Voltage Change Sensitivity (V_{SENS}) (1V Increments)	2 to 60V
Line Voltage Measurement Resolution	0.2V

5 INSTALLATION

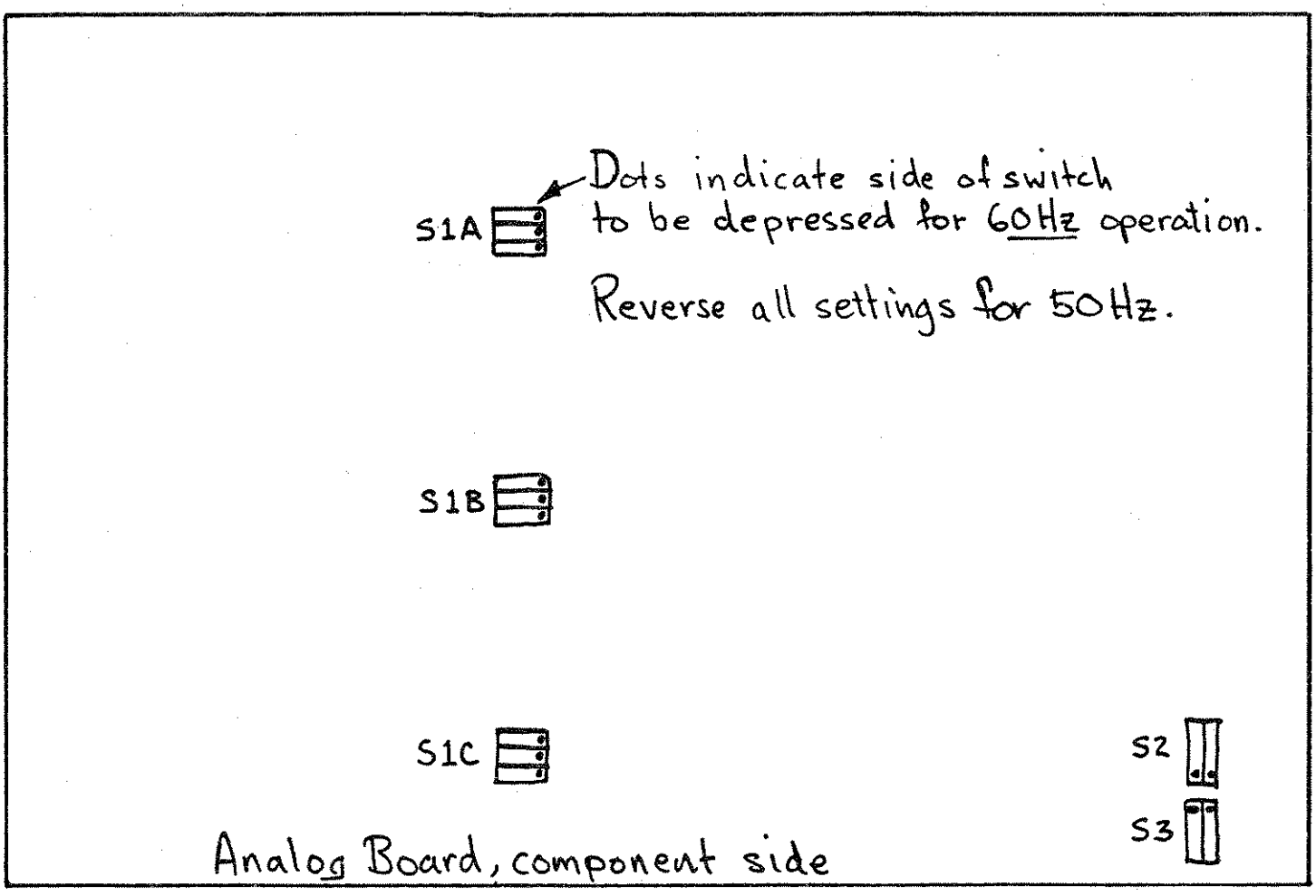
5.1 Selection of Nominal Operating Frequency

The 6003 has switches which are factory set so that measurements are optimized for a nominal frequency of either 50 or 60 Hz. Figure below shows the location of these switches on the Analog board of the module. Dots on switches on the figure indicate which side of the switch is to be depressed for 60Hz. For 50 Hz operation, simply reverse all switches.

5.2 Installation of 6003 in Mainframe

Do not attempt to install a 6003 module in slot 5 of the 626 mainframe. Slots 1-4 may be used, as follows:

a. With the rear panel markings reading correctly, carefully slide the module into the desired slot, with the Digital board within the card-guide tracks, until it is firmly seated.
b. Tighten the top and bottom captive screws to secure the module into the mainframe.



6 CONNECTING POWER SOURCE TO MODULE

The 6003 is equipped with three rear panel AC connectors, one each for phase A, B, and C. Mating connectors are supplied for the user. The 3-wire mating connectors must be wired in accordance with the rear panel connector markings (AC high, AC low, and earth ground from top to bottom).

a. Insert key in FUNCTION key switch on front panel of mainframe and set switch to OFF position.

b. Turn off AC power source that is to be monitored by the module.

c. Attach the wired mating connector to the rear panel connector.

d. Refer to Figure 4 for recommended three-phase connections, then reapply the AC power to the 626 mainframe and module inputs, in that order.

CAUTION

To avoid damaging the equipment, do not apply AC voltages in excess of 600V RMS to any AC phase (A, B, or C) applied to the 6003.

7 OPERATING THE 6003

7.1 Operating Controls and Indicators

The functions of the mainframe operating controls and indicators associated with 6003 operation are described in Table 2. Figure 1 shows the typical front panel controls on a Model 626 that contains a 6003 module. For a description of controls common to overall Model 626 operation, refer to TM-106650.

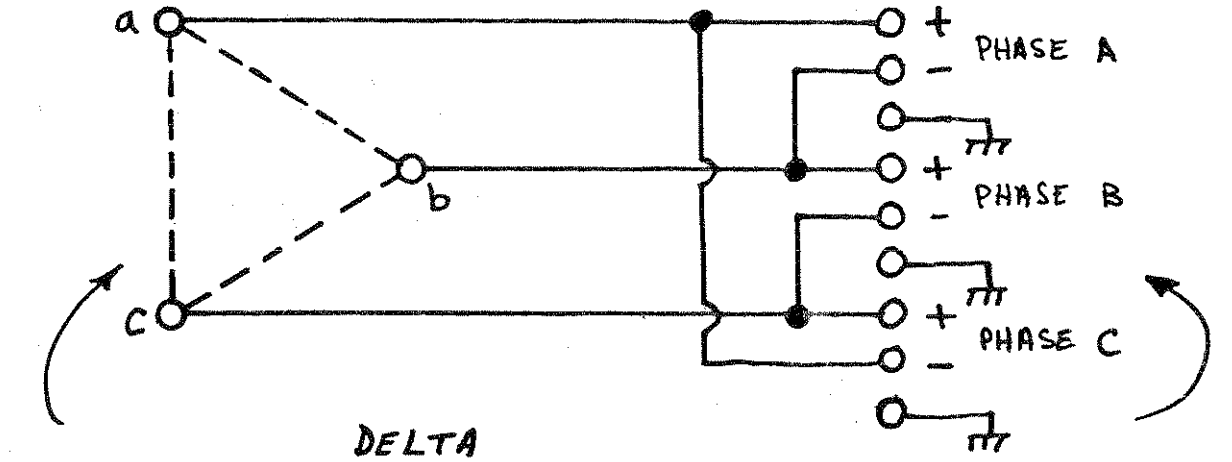
7.2 Programming Procedure

Assume it is desired to program a high limit of 125V, a low limit of 105V, voltage sensitivity of 2 volts, frequency sensitivity of 0.2 Hz and an impulse sensitivity of 25V. Sensitivity sets the deviation from the present value above or below which a detected value produces a recorded disturbance. This is true for both voltage and frequency.

For impulse measurements, the sensitivity corresponds to the absolute threshold, so that an impulse sensitivity of 25 volts, a disturbance is recorded when impulse amplitude rises above 25 volts.

626-PA-6003

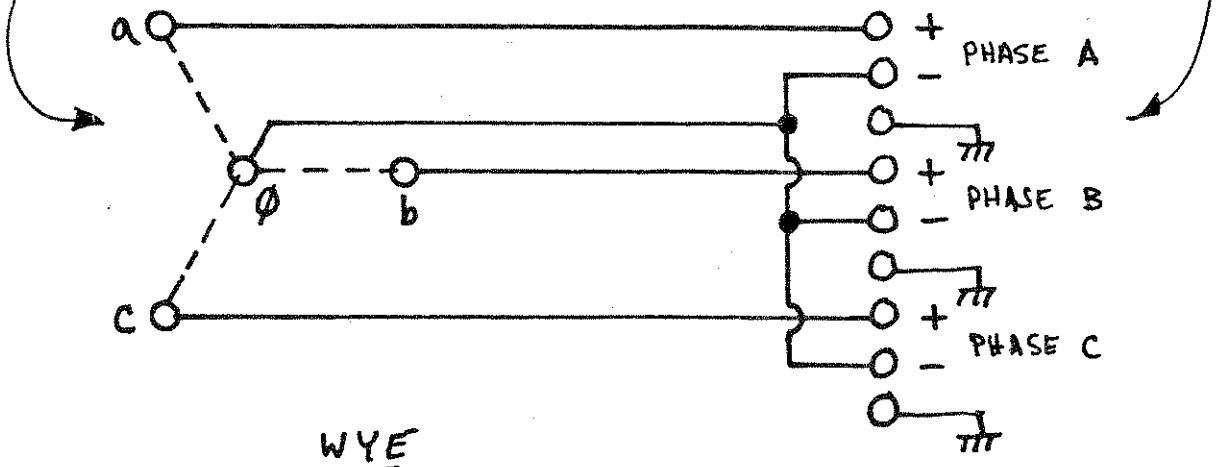
SUGGESTED THREE-PHASE CONNECTIONS



DELTA

VOLTAGE SOURCE

626-PA-6003 REAR PANEL CONNECTIONS



WYE

Plug-type connector color code:

BLACK to "+" on rear panel
WHITE to "–" on rear panel
GREEN to "⏚" on rear panel

Figure 4.

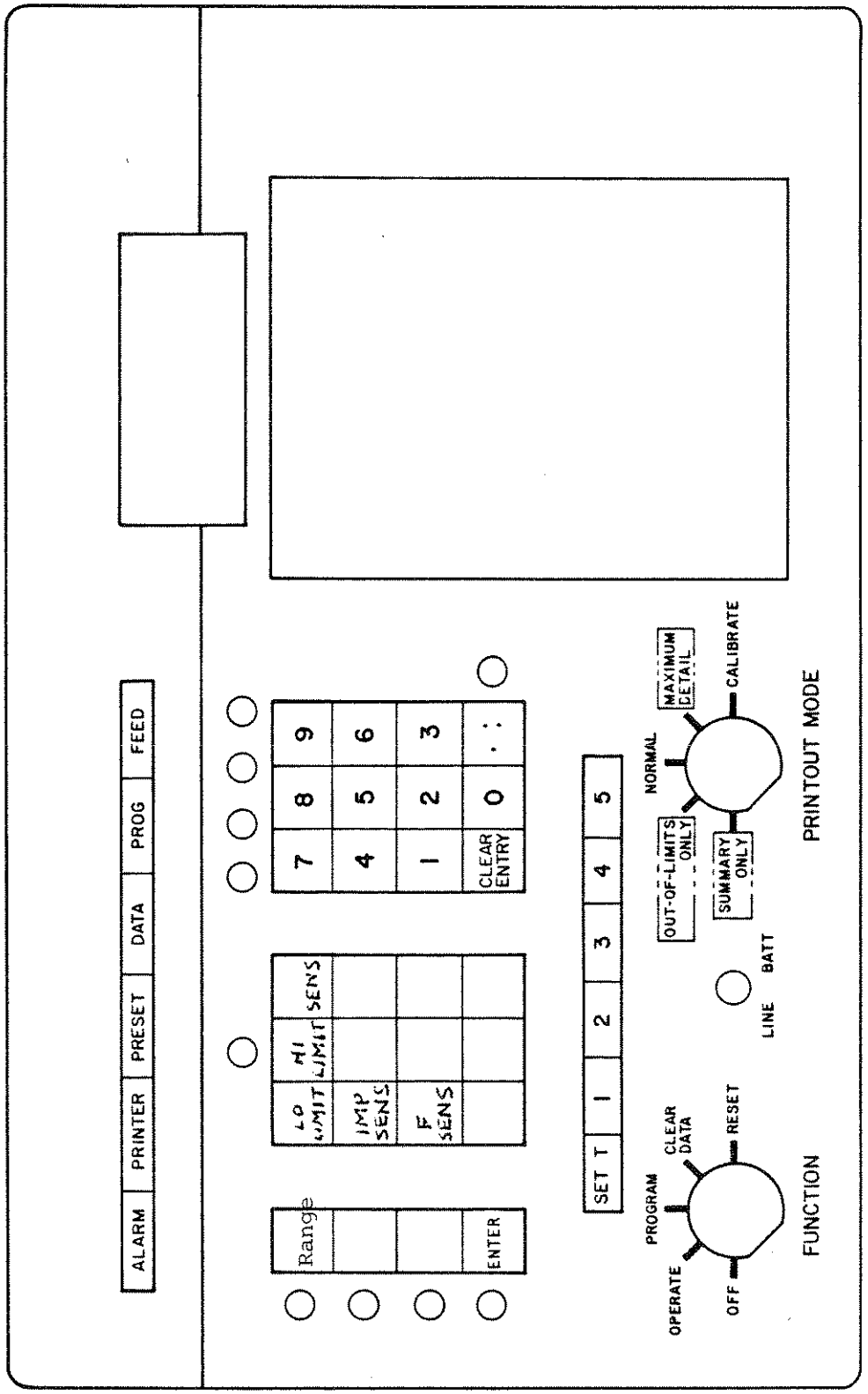


Figure 1. Typical Front Panel with 6003 Installed in Mainframe

Table 2. 6003 Operating Controls

Item	Function
LO LIMIT pushbutton	When depressed, enables numeric keyboard to program low limit voltage.
HI LIMIT pushbutton	When depressed, enables numeric keyboard to program high limit voltage.
SENS pushbutton	When depressed, enables numeric keyboard to program voltage sensitivity value.
IMP SENS pushbutton	When depressed, enables numeric keyboard to program impulse voltage sensitivity value.
F SENS pushbutton	When depressed, enables numeric keyboard to program frequency sensitivity value.
ENTER pushbutton	When depressed, transfers numeric keyboard value into the 6003 memory.
DATA pushbutton	When depressed, produces data summary printout.
PRESET pushbutton	With FUNCTION switch set to PROGRAM and a channel switch (1-5) depressed, depressing PRESET switch recalls nonvolatile factory program for that channel.

For the example cited, program the 6003 as follows:

a. Set FUNCTION switch to PROGRAM.

b. Depress the channel pushbutton (1-5) that corresponds to the slot position of the plug-in to be programmed. Note that a program summary for that channel is immediately printed.

c. Note that a cueing indicator above the center bank of pushbuttons lights. This indicates that a function may be programmed.

d. Depress the HI LIMIT pushbutton. Program the high limit value (125), using the keyboard.

e. When the ENTER indicator lights, depress the ENTER pushbutton. The programmed high limit value will be echoed back on the printout and the ENTER indicator will go out.

f. Repeat steps c, d and e for the low limit voltage (105V) using the LO LIMIT pushbutton.

g. Repeat steps c, d and e for the voltage sensitivity, using the SENS pushbutton and programming the voltage value as 02.

h. Repeat steps c, d and e for the frequency sensitivity (0.2 Hz), using the F SENS pushbutton and programming the value as 0.2.

i. Repeat steps c, d and e for the impulse sensitivity (025 volts), using the IMP SENS pushbutton. The completed program printout should take the following form:

IMPULSE SENS	0025V	
FREQ SENS	00.2 HZ	↑
VOLTAGE SENS	002 V	(Read Up)
V LOW LIMIT	105 V	
V HIGH LIMIT	125 V	

626-PA-6003
CH 4

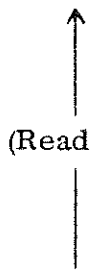
NOTE

The instrument is designed to detect an invalid entry and to automatically shift high and low limits.

j. When the plug-in program is completed, the user may proceed to program another module (by depressing another channel number) or he may place the instrument on line by setting the FUNCTION switch to OPERATE. While on line, the program in effect may be obtained by simply depressing the PROG pushbutton.

8 SELECTING THE FACTORY PRESET PROGRAM

To select the program stored in hard memory, set the FUNCTION switch to PROGRAM and depress the channel number desired. The last operator-set program will be printed out. Now depress the PRESET pushbutton to recall the factory-set program. An example of this sequence appears on the following page.



(Read Up)

IMPULSE SENS 0100V
FREQ SENS 00.5 HZ
VOLTAGE SENS 002V
V LOW LIMIT 105 V
V HIGH LIMIT 120 V
626-PA-6001
CH 1
PROGRAM SUMMARY

Factory Program

Press PRESET

IMPULSE SENS 0025V
FREQ SENS 00.2 HZ
VOLTAGE SENS 002 V
V LOW LIMIT 105 V
V HIGH LIMIT 125 V
626-PA-6001
CH 1
PROGRAM SUMMARY

Operator Program

9 DESCRIPTION OF DATA PRINTOUTS

When any of the disturbances described below is detected by the 6003, it is recorded and displayed in characteristic manner.

9.1 Overvoltage

An overvoltage condition exists when the monitored power line voltage exceeds the user-specified upper limit for more than 2.55 seconds. An overvoltage condition is indicated by a printout such as the following:

4B HI 09:46:07.11

where 4 is the channel number, B is the phase and time is given in hours, minutes and seconds (to .01 sec resolution).

When the line voltage recovers to normal, a printout such as the following occurs:

4B NOR 09:46:15.20
148.6 V MAX

indicating when normal voltage was restored and the value of the highest voltage reached during the overvoltage interval.

9.2 Undervoltage

An undervoltage condition exists when the monitored power line voltage remains below the user-specified lower limit for more than 2.55 seconds. An undervoltage condition is indicated by a printout such as the following:

```
4C  LO  09:46:15.20
```

When the line voltage returns to normal level, a message such as the following is printed:

```
4C  NOR  09:46:18.45
    36.4 V MIN
```

indicating when normal voltage was restored and the value of the lowest voltage reached during the undervoltage interval.

9.3 Voltage Change

A voltage change printout is triggered when the line voltage changes more than a pre-selected amount from the last printed value. The voltage change sensitivity is a user-selected integral voltage between one and 15 volts for a 115-volt line. The following example shows several voltage change printouts:

Printout	Remarks
2C INC 01:02:34.56 115.4 V	Phase C voltage in Channel 2 increased to 115.4V at time shown
3A DEC 01:02:34.56 109.2 V	Phase A voltage in Channel 3 decreased to 109.2V at time shown

9.4 Voltage Surge

A Voltage Surge is defined as a line voltage which increases through a user-selected upper limit and then returns to an in-tolerance condition in less than 2.56 seconds. When a surge begins, its starting time is printed as follows:

```
4B  HI  09:45:33.15
```

When the line voltage returns to a normal level following a Surge condition, a message such as the following will be printed:

```
4B  NOR  09:45:33.38
    128.2 V MAX
    SURGE 0.23 SEC
```

In this case, the time at which the voltage returned to normal is shown as well as the maximum voltage reached and the surge duration.

9.5 Voltage Sag

A Voltage Sag is defined as a line voltage that decreases below the user-selected lower limit and then returns to an in-tolerance condition in less than 2.56 seconds. Sag printouts take the same form as surge printouts, with the term SAG replacing the term SURGE, and the term MIN replacing the term MAX.

NOTE

Voltage inputs less than 25V RMS will be printed out as 0.0V on the 6003.

9.6 Impulses

"Impulse" disturbances represent any line perturbation which contains frequency components in the 300 Hz to 500 kHz range. An impulse type disturbance produces a printout such as the following:

```
2A  IMP  10:12:13.45
    +0139 V,  0010 US
```

This printout indicates that an impulse which deviated from normal line voltage by +139 volts peak and whose duration was 10 microseconds was detected on phase A of Channel 2 at the time shown. Impulse polarity is referenced to "+" and "-" markings on rear panel.

10 CALIBRATE

When the PRINTOUT MODE switch is set to CALIBRATE, a source of precise signals is applied to the front end circuitry of the 6003. Any inputs connected at this time will be automatically disconnected during the calibration period. Successful measurement of these calibration signals fully verify the functionality of the module. Expected calibration measurement results and allowable tolerances are listed below.

AC Voltage	196.0 - 204.0 Volts
Impulse Peak	2700 - 3300 Volts
Impulse Duration	360 - 440 µSec
Frequency	59.8 - 60.2 Hz

11 PRINTOUT MODES

The setting of the PRINTOUT MODE switch on the front panel of the mainframe determines how much detail is printed out. Printout data is reduced as the switch is rotated counterclockwise.

The following example printouts show how various settings of the PRINTOUT MODE switch change the amount of detail in the printed record of a disturbance. It is assumed that the disturbances occurred in phase A of Channel 1 and that the limits for Channel 1 were programmed as follows:

V LOW LIMIT	105 Vrms
V HIGH LIMIT	125 Vrms
V SENSITIVITY	2 Vrms

The example printouts are referenced to figures 2 and 3 which illustrate overvoltage and voltage sag disturbances, respectively.

Disturbances which occur while the PRINTOUT MODE switch is in the SUMMARY ONLY position do not generate individual printouts but they are stored in the daily accumulator and are automatically printed each day at midnight (worst case event and number of occurrences in each category). This printout may also be triggered manually be depressing the DATA button.

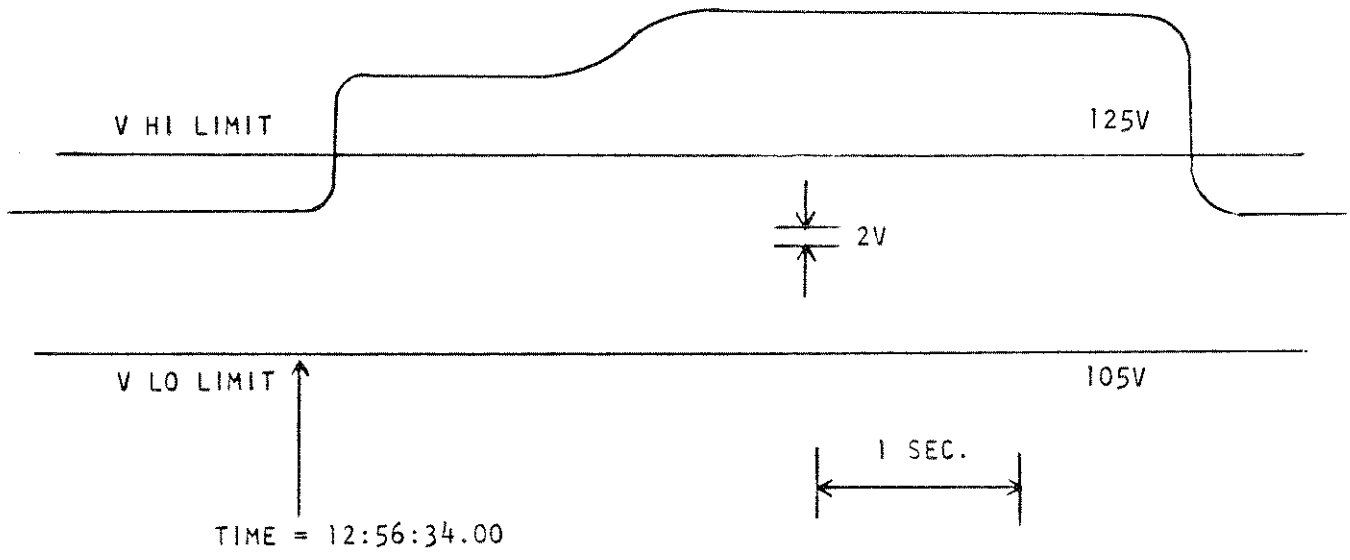


Figure 2. Overvoltage Disturbance (6003)

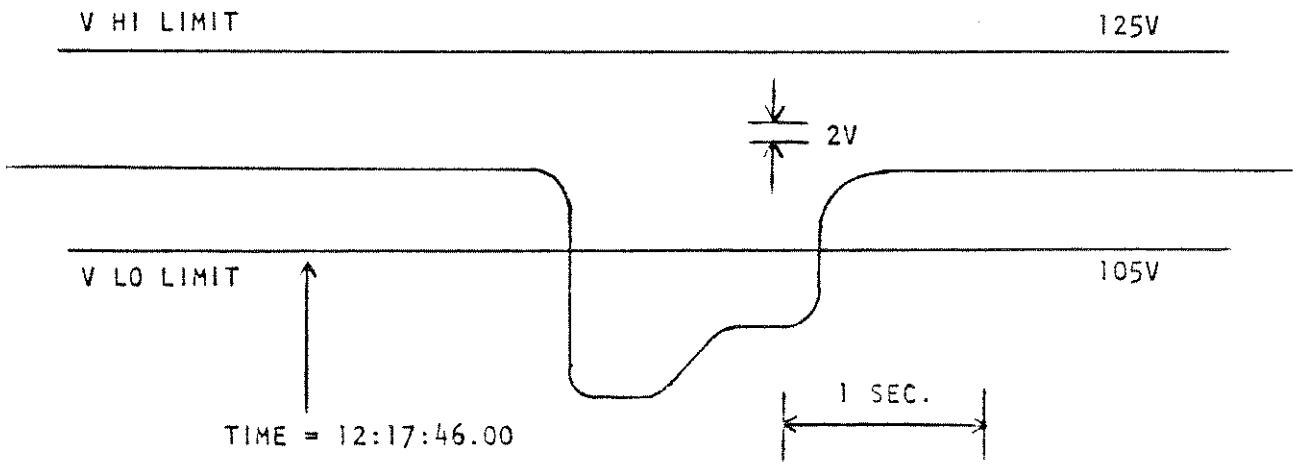


Figure 3. Voltage Sag Disturbance (6003)

```
1A  NOR  12:56:38.51
     139.1  V  MAX

1A  HI     12:56:34.21
```

Printout of overvoltage (fig. 2) in OUT-OF LIMITS ONLY mode

(Read Up)

```
1A  NOR  12:56:38.51
     139.1  V  Max

1A  DEC  12:56:38.50
     130.2  V

1A  INC  12:56:35.78
     137.3  V

1A  INC  12:56:35.62
     135.3  V

1A  INC  12:56:35.40
     133.3  V

1A  INC  12:56:34.22
     131.3  V

1A  INC  12:56:34.21
     129.2  V

1A  HI     12:56:34.21
```

Printout of overvoltage (fig. 2) in NORMAL mode

(Read Up)

1A DEC 12:56:38.61
119.8 V

1A DEC 12:56:38.53
121.8 V

1A DEC 12:56:38.51
124.0 V

1A NOR 12:56:38.51
139.1 V MAX

1A DEC 12:56:38.50
130.2 V

1A INC 12:56:35.78
137.3 V

1A INC 12:56:35.62
135.3 V

1A INC 12:56:35.40
133.3 V

1A INC 12:56:34.22
131.3 V

1A INC 12:56:34.21
129.2 V

1A HI 12:56:34.21

1A INC 12:56:34.20
121.1 V

1A INC 12:50:12.34
119.0 V

Printout of overvoltage (fig. 2) in MAXIMUM DETAIL mode

```
1A  NOR  12:17:48.61
    090.1  V  MIN
    SAG  1.25  SEC

1A  LO   12:17:47.36
```

Printout of voltage sag (fig. 3) in OUT-OF-LIMITS ONLY mode

(Read Up)

```
1A  NOR  12:17:48.61
    090.1  V  MIN
    SAG  1.25  SEC

1A  INC  12:17:48.60
    103.1  V

1A  INC  12:17:48.55
    098.0  V

1A  INC  12:17:48.05
    096.0  V

1A  INC  12:17:47.96
    094.0  V

1A  DEC  12:17:47.39
    091.9  V

1A  DEC  12:17:47.37
    094.1  V

1A  DEC  12:17:47.36
    101.3  V

1A  LO   12:17:47.36
```

Printout of voltage sag (fig. 3) in NORMAL mode

(Read Up)

```
1A  INC  12:17:48.86
    112.1  V

1A  INC  12:17:48.69
    110.1  V

1A  INC  12:17:48.62
    108.1  V

1A  INC  12:17:48.61
    105.9  V

1A  NOR  12:17:48.61
    090.1  V  MIN
    SAG  1.25  SEC

1A  INC  12:17:48.60
    103.1  V

1A  INC  12:17:48.55
    098.0  V

1A  INC  12:17:48.05
    096.0  V

1A  INC  12:17:47.96
    094.0  V

1A  DEC  12:17:47.39
    091.9  V

1A  DEC  12:17:47.37
    094.1  V

1A  DEC  12:17:47.36
    101.3  V

1A  LO   12:17:47.36

1A  DEC  12:17:47.35
    110.8  V

1A  INC  12:16:32.15
    113.0  V
```

Printout of voltage sag (fig. 3) in MAXIMUM DETAIL mode

12 626 Module Capacity

The 626 standard mainframe has an upper limit of the total load rating of the installed modules. The overall mainframe capacity is set at 13 units, and individual modules have load ratings as follows:

Plug-in	Load Rating
626-PA-6001	2 Units
626-PA-6001 With Extra Option Board	3 Units
626-PA-6002	2 Units
626-PA-6003	4 Units
626-PA-6006	2 Units
626-PA-6007	1 Unit
626-PA-6011	1 Unit
(626-PA-6012)	3 Units

When selecting modules for installation in any mainframe, simply verify that the sum of the load ratings of the installed modules does not exceed 13.

13 Standard Accessories

Model No.	Part No.	Quan.	Description
626PA6003-1 (Barrier Block Connections)	TM110235	1	Operating Manual
626PA6003-2 (Plug-type Connections)	TM110235	1	Operating Manual
	110480-G1	3	A.C. Cables