TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS LIST

FOR

ANALYZER, ELECTRICAL POWER, AC PORTABLE MODEL NO. 5173 (A&M INSTRUMENTS, INC.) (NSN 6625-00-624-4846)

HEADQUARTERS,

DEPARTMENT

OF

THE ARMY

FEBRUARY 1982

WARNING

HIGH VOLTAGES PRODUCE LETHAL SHOCKS – <u>BE CAREFUL!</u> IF EXTERNAL CT'S ARE USED, SECONDARIES MUST NOT BE OPEN CIRCUITED, OR LETHAL VOLTAGES MAY OCCUR.

Technical Manual

No. 9-6625-2803-14&P

HEADQUARTERS DEPARTMENT OF THE ARMY Washington, DC, 8 February 1982

Operator's, Organizational,Direct Support and General Support Maintenance Manual Including Repair Parts List

For

ANALYZER, ELECTRICAL POWER, AC PORTABLE MODEL NO. 5173 (NSN 6625-00-624-4846)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished direct to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this equipment is issued.

Manufactured by: A&M INSTRUMENTS, INC. 5 Nassau Street Rockville Center Long Island. NY 11571 Procured under Contract No. DAAA09-78-B-6617

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

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PRECAUTIONARY NOTES

1. High Voltages produce lethal shocks - BE CAREFUL!

- 2 Open Circuit Breaker before hooking up Analyzer.
- 3. Do not change connections or tighten terminals without opening Circuit Breaker. Remove terminal tightening tool before energizing.
- 4. Set Voltmeter and Power Switches to 500 volts before connecting.
- 5. Connect load leads to terminals having no less than the expected current rating. When in doubt, connect to the 220A terminals.
- 6. Use on AC only with voltage less than 600 volts and frequency between 45 and 425Hz.
- If external CT's are used, secondaries must not be open c•uited, or lethal voltages may occur.

ANALYZER, ELECTRICAL POWER

ALTERNATING CURRENT, PORTABLE

<u>NSN 6625-00-624-4846</u>

1.0 GENERAL DESCRIPTION

1.1 The Analyzer is designed for alternating current circuits and should not be used on direct current.

1.2 It consists of a Voltmeter, Ammeter, Watt/Var Meter, and Frequency Meter, and the necessary switches connected to facilitate the industrial testing of three-phase, three and four-wire, as well as single-phase, two and three-wire loads.

1.3 As long as the currents and voltages to be measured are within the ranges of the Analyzer, including the overload limits, it may be left in circuit continuously.

1.4 See Drawing 1462 for ranges, size, etc.

2.0 VOLTMETER

2.1 $\underline{\text{TYPE}}$ - The Voltmeter is the moving iron type having RMS sensing. Transformers with taps are used to obtain the three ranges.

2.2 <u>SCALES AND CONTROLS</u> - The Voltmeter has three full scale voltage readings -- 500, 250 and 125 volts. Two switches are used. These are indicated by the "Select Volts" label. Full scale voltage is selected by the "Set Range" switch. The second switch allows any Line to Line or Line to Neutral (4-wire only) voltage to be selected. 3.0 AMMETER

3.1 <u>TYPE</u> - The Ammeter is of the moving iron type designed for use with the current transformers contained in the Analyzer.

3.2 <u>SCALES</u> - The Ammeter has four full scale ampere ranges -- 220, $1\overline{10}$, 55 and 5.5 amps. The proper full scale value is selected by connecting the load wires to the proper binding posts.

3.3 <u>PHASE SELECTION</u> - The "Line Amps" switch is used to insert the Ammeter into Phase A, Phase B, Phase C or Neutral. (Neutral is used for 30, 4-wire only).

3.4 <u>POINTER LIFT</u> - The Ammeter is equipped with a device to lift the pointer from the zero position. This is controlled by a knob on the front of the Ammeter. The pointer lifter is used in determining motor starting currents. To do this, the pointer is "lifted" to a position where it just barely moves when the motor is started. This value of current so indicated is the motor starting current.

3.5 <u>ACCURACY</u> - Ammeter indications, together with the transformer contained in the Analyzer, are correct within +/- 1% of the full scale value from 45 to 425Hz. It reads RMS value of applied current.

4.0 WATT/VAR METER

4.1 <u>TYPE</u> - The Watt/Var Meter is of the transducer type, designed for operation with three-phase, four-wire circuits, as well as two and three-wire single phase circuits.

4.2 <u>SCALES</u> - The Watt/Var Meter has a range of 0 to 1.2KW/KVAR, corresponding to the 3-phase range on the 5.5A and 125V switch positions. Other ranges are obtained using internal or external CT'S or PT's. The internal Potential Transformers are connected to the "Select Power - Set Ø-Ø Range" switch. The CT inputs are to the ØA, ØB and ØC load binding posts which are marked with the current range. Use the full scale switch voltage and the value of current determined from the binding posts to determine the scale multiplier printed on the face of the KW/KVAP Meter. Multiply the meter readings by this multiplier to obtain correct KW/KVAR. (Note: For single-phase, threewire, the indication is half of the actual value).

4.3 <u>KW/KVAR READINGS</u> - <u>EXAMPLE</u>: If the voltage setting is 250 on BOTH switches, and the load wires are in the 50A binding posts, the scale multiplier is 20. If the scale reading is .80, then the power is .80 x 20 = 16KW, if the "Select Power" switch is set on "30", or if the "Select Power" switch is set on lead or lag KVAR, the indication is 16KVAR.

4.4 <u>ACCURACY</u> - The Watt/Var Meter indication is accurate to $\pm 2\%$ of full scale on any frequency from 45 to 425Hz.

4.5 <u>CAUTION</u> - Set the "Select Power - Set \emptyset - \emptyset Range" voltage switch higher than the actual phase to phase voltage as read on the Voltmeter, or damage can result. Observe maximum current ratings in connecting to load terminals.

5.0 FREQUENCY METER

5.1 <u>TYPE</u> - The Frequency Meter is of the transducer type and operates from the same switches as the Voltmeter.

 $^{5.2}$ SCALES AND CONTROLS - The Frequency Meter has three scales 45-55, 55-65 and 375-425Hz. The proper value of frequency is selected by means of the switch marked "Hertz".

5.3 <u>ACCURACY</u> - The Frequency Meter is accurate to ± 0.2 HZ on the 50 to 60Hz scales, and ± 1 Hz on the 400Hz scales, with an input voltage of 50 to 100% of the Voltmeter range.

6.0 OPERATING INSTRUCTIONS

6.1 <u>TEST SET</u> - This instrument measures complete line and load conditions of a single and polyphase system. Indications will be correct for any current unbalance, provided the polyphase voltages are balanced.

6.2 <u>ROTATION</u> - Phase rotation A-B-C is assumed and must be correct for proper indication. If phase rotation is reversed, the Var Meter will indicate up scale when the switch is set to lead and the load has a lagging power factor such as an unloaded induction motor. To correct the phase rotation, it is necessary to interchange any two leads of a polyphase system.

6.3 PRECAUTIONS

- 6.3.1 <u>NEVER</u> connect this Test Set to a direct current source.
- 6.3.2 Always set switches to Off (see below), before applying power.
- 6.3.3 Always connect load leads to the same current range on all three phases of the Test Set and to a high enough range such that the full scale value of the Ammeter will not be exceeded.



6.4 SWITCHES

- 6.4.1 <u>VOLTMETER</u> The Voltmeter is supplied with two switches, one for connecting the meter across the various lines, and the second for range selection.
- 6.4.2 WATT/VAR METER The Watt/Var Meter is supplied with two switches, one for selecting single phase watts, three phase watts or Vars, and the second for voltage range. This switch must be set to the same line to line voltage as the Voltmeter.
- 6.4.3 <u>FREQUENCY METER</u> The Frequency Meter is provided with a switch for selecting a frequency range of 45-55, 55-65 and 375-425Hz. The correct voltage to operate the Frequency Meter is provided by the Voltmeter circuit, when the Voltmeter reads above mid scale.

- 6.4 SWITCHES (Continued)
 - 6.4.4 <u>AMMETER</u> The Ammeter switch connects the Ammeter into each line or neutral, and shorts the current transformer in all Off positions.

6.5 ACCURACY - The Test Set accuracy is rated plus or minus 1% on amperes and volts, from 45 to 425Hz plus or minus 2% on watts, vars and frequency.

6.6 <u>CONNECTIONS</u> - The Test Set can be connected directly as shown or used with current and potential transformers to extend its useful range.



7.0 CLEANING AND LUBRICATION

7.1 No lubrication is required in the Test Set. The panel and meters should be cleaned with a slightly damp, soft cloth. Care should be taken not to damage the meters by pressing against the windows. A very light touch is all that is required. The case may be cleaned using a soft cloth moistened with linseed oil.

8.0 TROUBLESHOOTING

8.1 If trouble is suspected, the fuses should first be checked. Access to these fuses can be obtained by removing the outer panel screws and lifting the panel out of the case. A spare set of fuses are mounted in the case. A blown fuse can be diagnosed using an Ohmmeter to measure its continuity.

8.2 Additional troubleshooting should be done in a Base shop containing adequate Standards. Currents can be applied to the Ammeter, and the various switch ranges tested. If the trouble is in the current range, recalibration or the meter, or its replacement, can be performed if required. Operation on some switch positions, but not on others, would indicate that the switch has to be replaced.

8.3 If the problem is in the Voltmeter, application of standard voltages can identify whether the problem is in the meter itself, the switching, or in the transformers. These parts can then be replaced as indicated.

8.4 The Frequency Meter can be checked on each range using a standard frequency source. The transducer adjustments can be used to bring the meter into calibration. If this is not possible, the meter itself should be checked and replaced as indicated. If the meter is alright, the transducer should be replaced.

8.5 The Watt/Var Meter should be tested by applying a standard three phase voltage and load. Slight calibration adjustment can be performed on the wattage transducer. Large errors are a cause which requires that the meter movement be tested. If it is okay, the transducer should be replaced.

9.0	REPLACEMENT PARTS LIST	TM9-6625-2803-14&P			
QTY	DESCRIPTION	MFGR/PART NO.	FSCM		
2	BINDING POST LINE & 240 AMP POST		15309		
1	BINDING POST LINE AND	A&M 1462-6	II		
1	BINDING POST, 120 AMP POST	A&M 1462-8	"		
1	BINDING POST, 120 AMP INSULATOR	A&M 1462-9	II		
1	BINDING POST, 60 AMP POST	A&M 1462-10	"		
1	BINDING POST, 60 AMP INSULATOR	A&M 1462-11	II		
1	BINDING POST NEUTRAL & 5 AMP WHITE	A&M TC419-1	"		
1	BINDING POST NEUTRAL & 5 AMP BLACK	A&M TC419-2	II		
1	FREQUENCY, METER	A&M SC4053C	"		
1	WATT/VAR, METER	A&M SC4055C	II		
1	CURRENT, METER	A&M SC4054C	II		
1	CURRENT, METER	A&M SC4054C	II		
1	VOLTAGE, METER	A&M SC4056C	II		
1	FREQUENCY, TRANSDUCER	A&M 1462-44A	"		
1	WATT/VAR, TRANSDUCER	A&M 1462-43A	II		
1	CURRENT, TRANSDUCER	A&M 1462-42A	II		
1	CURRENT, TRANSFORMER	A&M 1462-42B	II		
1	POTENTIAL, TRANSFORMER	A&M 1462-99D	II		
1	SWITCH, CURRENT	A&M 1462-48A	"		
1	SWITCH, WATT/VAR	A&M 1462-49A	II		
1	SWITCH, WATT/RANGE	A&M 1462-50A	"		
1	SWITCH, FREQUENCY	A&M 1462-50A	"		
1	SWITCH, VOLTAGE	A&M 1462-47A	"		
1	SWITCH, VOLTAGE/RANGE	A&M 1462-51A	"		
1	CASE, CARRYING	A&M 1462-3	"		
1	TERMINAL, TOOL	A&M 1462-7	"		
6	KNOBS	A&M TC419-40	"		

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

- 1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
- 1 Meter= 100 Centimeters = 1000 Millimeters = 39.37 Inches
- 1 Kilometer=1000 Meters= 0.621 Miles

WEIGHTS

- 1 Gram =0.001 Kilograms = 1000 Milligrams = 0.035 Ounces 1 Kilogram =1000 Grams =2.2 Lb
- 1 Metric Ton=1000 Kilograms=1 Megagram=1.1 Short Tons

LIQUID MEASURE

1 Milliliter=0.001 Liters=0.0338 Fluid Ounces 1 Liter=1000 Milliliters=33.82 Fluid Ounces

SQUARE MEASURE

- T Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
- 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu Centimeter =1000 Cu Millimeters =0.06 Cu Inches 1 Cu Neter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

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TEMPERATURE

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Cubic Yards	Cubic Meters	0.765	1 1
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Pints	Liters	0.473	12-F
Quarts	Liters	0.946	I F
Gallons	Liters	3.785	
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Square Centimeters	Square Inches	0.155	L .
Square Meters	Square Feet	10.764	£
Square Meters	Square Yards	1.196	E
Square Kilometers	Square Miles	0.386	
Square Hectometers	Acres	2.471	1 5
Cubic Meters	Cubic Feet	35.315	
Cubic Meters.	Cubic Yards	1.308	
Milliliters	Fluid Ounces	0.034	
Liters	Pints.	2.113	
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