

**OPERATING INSTRUCTIONS**  
**KNOPP TYPE FS-9 PORTABLE UNILOAD TEST SET**

**Serial Number:** \_\_\_\_\_

**Standard Serial Number:** \_\_\_\_\_

**APPLICATION**

This FS-9 equipment is constructed for field testing of watt-hour meters, both single-phase and polyphase. In the case of single-phase meters, two-wire and three-wire meters can be tested, and in the case of polyphase meters, one can test regular two-element meters, network meters, and three-element meters, all at unity power factor. Polyphase meters are tested on a single-phase power supply, each element separately for balance and the elements in series for full load and light load tests. For these element and series tests, it may be necessary to change the lead connections to the meter-under-test as well as the current and voltage jumpers.

The current loading ranges are: .5, 1.5, 3, 5, 15, and 30 amperes, and the test set is designed for operation on, and is provided with switch positions for, both 120 volts and 240 volts. It may also be used with good accuracy on 208 volts using the 240-volt switch position. For such tests, the loading current would be reduced proportionately.

**PRINCIPLE**

The testing equipment is of the phantom load type and incorporates the Knopp uniload system in the current circuit. Because of the uniload principle, the rotating standard test meter operates only at full load current regardless of what current is selected to be applied to the meter-under-test. It is impossible through manipulation of the switches to apply excessive current to the standard that would damage the instrument or adversely affect its calibration.

The primary of the phantom load transformer is connected across the input supply. You may refer to the attached wiring diagram. The secondary of this transformer has two identical tapped windings insulated from each other. Connected to these secondary windings are two sets of loading resistors of equal resistance, and in turn, two primary windings of the three-wire precision multirange current transformer. These windings are also insulated from each other. The current coil of the reference standard is energized from the 5-ampere secondary of this three-wire precision transformer.

Generally speaking, a current from a selected tap of the phantom load transformer is caused to flow in series through the meter-under-test and a selected tap of the precision current transformer. The secondary current of nominal 5 amperes flows through the current coil of the reference standard.

This method of selecting and applying the current through use of a precision multirange transformer results in a very high accuracy of measurement over a wide range with a single-range standard for the following reasons:

1. The standard always operates at full load current.
2. The precision transformer always works at full excitation, and since it has a very flat ratio curve, especially at or near full excitation, the currents can vary considerably from the nominal selected values without affecting the accuracy of measurement.

For testing three-wire, single-phase meters, the two current coils in the meter-under-test are simultaneously energized each from one half to the secondary of the current supply transformer, the two halves being insulated from each other. For this test, it is unnecessary to open the voltage link, and the voltage coil of the meter-under-test receives voltage from the line while the standard receives the same voltage through leads A and B. This feature is known as the Knopp unilink series test system. (See wiring diagram.)

For testing other meters, single-phase and polyphase, the two separate loading circuits are connected in series, again giving the energy of both halves of the secondary of the current supply transformer, and this current is circulated through the test circuit.

### **GENERAL OPERATING INSTRUCTIONS**

The current to be applied to the meter-under-test is selected by means of the rotary switch at the front of the panel. This switch has an "off" position and must be in the "off" position when the set is being connected to the meter to be tested.

The voltage of the line supplying the meter-under-test is one of the determining factors for the position to which the voltage selector switch at the back of the panel should be set. The other factor is the type of meter. Use one of the 3-wire positions when a 3-wire, single-phase meter is being tested. For other meters (2-wire, single-phase meters and also polyphase meters), use one of the 2-wire positions. This switch must be set to the proper position before connecting the test set to the meter to be tested. This switch connects the loading transformer primary for the line voltage involved, 120 volts or 240 volts, and connects the loading circuit for either 2-wire or 3-wire testing.

Before disconnecting the test set or whenever it becomes necessary to work on the meter being tested, the current range switch must be placed in the "off" position.

If the test leads had been disconnected from the set for some reason, be sure in reconnecting the cable, to insert the colored plugs into the matching colored receptacles. The voltage connections to the reference standard voltage coil are made by means of a keyed receptacle.

## **PROCEDURE OF TEST**

1. Place current range selector in "off" position. Do this before connecting set to meter to be tested.
2. Place voltage selector switch on FS-9 in position for the line voltage and in 2-wire or 3-wire position as required by meter to be tested. Place voltage selector switch on solid-state standard to the same line voltage value (NOT necessary if standard is an RM-10).
3. Connect the test leads securely to the proper terminals of the meter, switch, test block, or test jack. Bear in mind that the sequence of the connections can differ from one meter installation to another.
4. With the current switch still in the "off" position, and after connecting the leads but before selecting any current range, first check for voltage between the "A" terminal and "D" terminal, and between the "B" terminal and "C" terminal by observing the two glow lamps on the panel of the set. If a voltage is indicated by a glow of either lamp, the test leads are improperly connected. Check and correct connections before proceeding. For more information on the glow lamps and their use, see the paragraphs under the subtitle "Glow Lamps."
5. Close the current loading circuit by closing the current range switch to the 1/2-ampere position. It is suggested that this light load position be selected first, regardless of the capacity of the meter being tested, so that in the event the test set had been improperly connected to the circuit or a short because of a defective meter is encountered, the test set will be protected by the 2-ampere fuse. The closing of this circuit completes the connections to the meter-under-test and loads the meter and reference standard. The meter-under-test should now rotate slowly. Furthermore, when the voltage timing switch is then closed, the standard will also rotate, rotating at full load speed. If the standard is an RM-10, voltage is always applied to the meter-under-test. The standard is then "gated" with the hand-held switch to start the test (see RM-10 manual). These results prove that the test circuits are wired correctly and that the meter may now be tested.
6. With the voltage timing switch open, place the current range switch in the required load current position based on the capacity of the meter to be tested. The comparative test, full load first, can now be made by closing the voltage timing switch, thus energizing the voltage coil of the standard. (THE ABOVE DOES NOT APPLY WHEN USING AN RM-10—SEE RM-10 MANUAL.)
7. Before disconnecting the test set, make certain the current range switch is in the "off" position.

## **GLOW LAMPS**

The left-hand glow lamp is connected internally across the "A" and "D" terminals and the right-hand lamp is connected across the "B" and "C" terminals. The main function of these glow lamps is to give a warning of a faulty connection that would result in having voltage applied across the current circuits of the set, a condition that would damage the equipment. The warning signal is given by a fairly bright glow of either lamp or both lamps. The degree of brightness depends upon the voltage present.

On the other hand, a very dim glow of either lamp is indicative of an open circuit in the meter or in the leads to the meter, with the exception that when two-wire meters are being tested, the right-hand lamp may glow very dimly because the "C" clip is not connected. In such a case, it should be possible, with continuity in the circuit, to eliminate this dim glow by connecting the "C" clip to the "B" clip.

For the warning indication of these glow lamps to protect the set against damage in the event of a faulty connection or a faulty meter, it is essential that the current range switch of the set be in its "off" position before the leads of the set are connected to the meter to be tested and that the switch not be closed or moved from the "off" position if there is a warning glow on one or both lamps.

It is recommended that the operator of this test set make himself/herself familiar with the appearance of the "bright" glow and the "dim" glow under conditions of illumination that are apt to be experienced in the field. This will avoid any problem of distinguishing between the two during field tests.

Keep in mind that the "bright" glow of one or both lamps means a dangerous condition exists and that no attempt should be made to proceed with the test until the condition has been corrected.

## **FUSES**

The FS-9 is equipped with the following fuses:

- 2 – Type BAN – 30A buss fibre tube fuse, 250V
- 2 – Type ABC – 2A buss ceramic tube fuse, 250V
- 2 – Type ABC – 6A buss ceramic tube fuse, 250V

It is important that fuses be replaced with the same type and current rating.

## **ADDITIONAL SUGGESTIONS**

Do not use the Knopp Portable Uniload Test Set for continuity or hidden jumper tests. Such tests should be made with a Knopp Voltage Tester.

The Knopp Portable Uniload Test Set is an accurate instrument, and should be handled with care in order to maintain its accuracy over a long period of time. As the test set is not waterproof, moisture should be kept away from it.

The FS-9 is fan-cooled, air inlet on bottom, outlet on slots in top panel.

Exercise all of the precautions described in the operating instructions to prevent accidental shorts while connecting and disconnecting.

**KNOPP INC.**

1307 – 66<sup>th</sup> Street

Emeryville, CA 94608

(510) 653-1661

(800) 227-1848 (Toll-Free)

(510) 653-2202 (Fax)

[sales@knoppinc.com](mailto:sales@knoppinc.com) (e-mail)

**ATTACHMENTS**

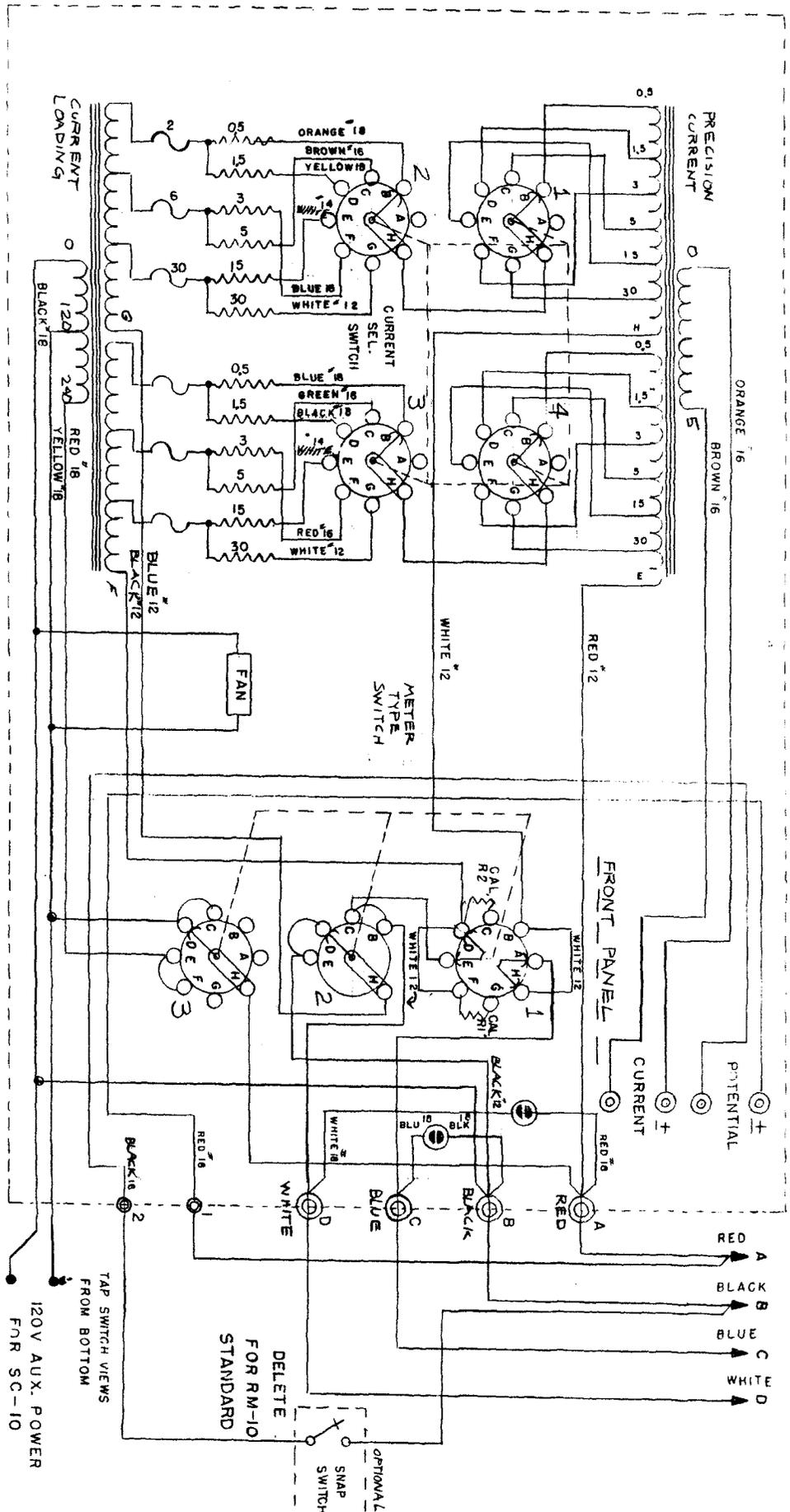
Drawing No. 9637 – Schematic Wiring Diagram

Drawing No. 7750A)

Drawing No. 7751A) – Meter Hook-ups

Drawing No. 7752A)

January 2009



Beginning Ser = 714110

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A	9-81	FA		
B	11-68			
C	3-91			

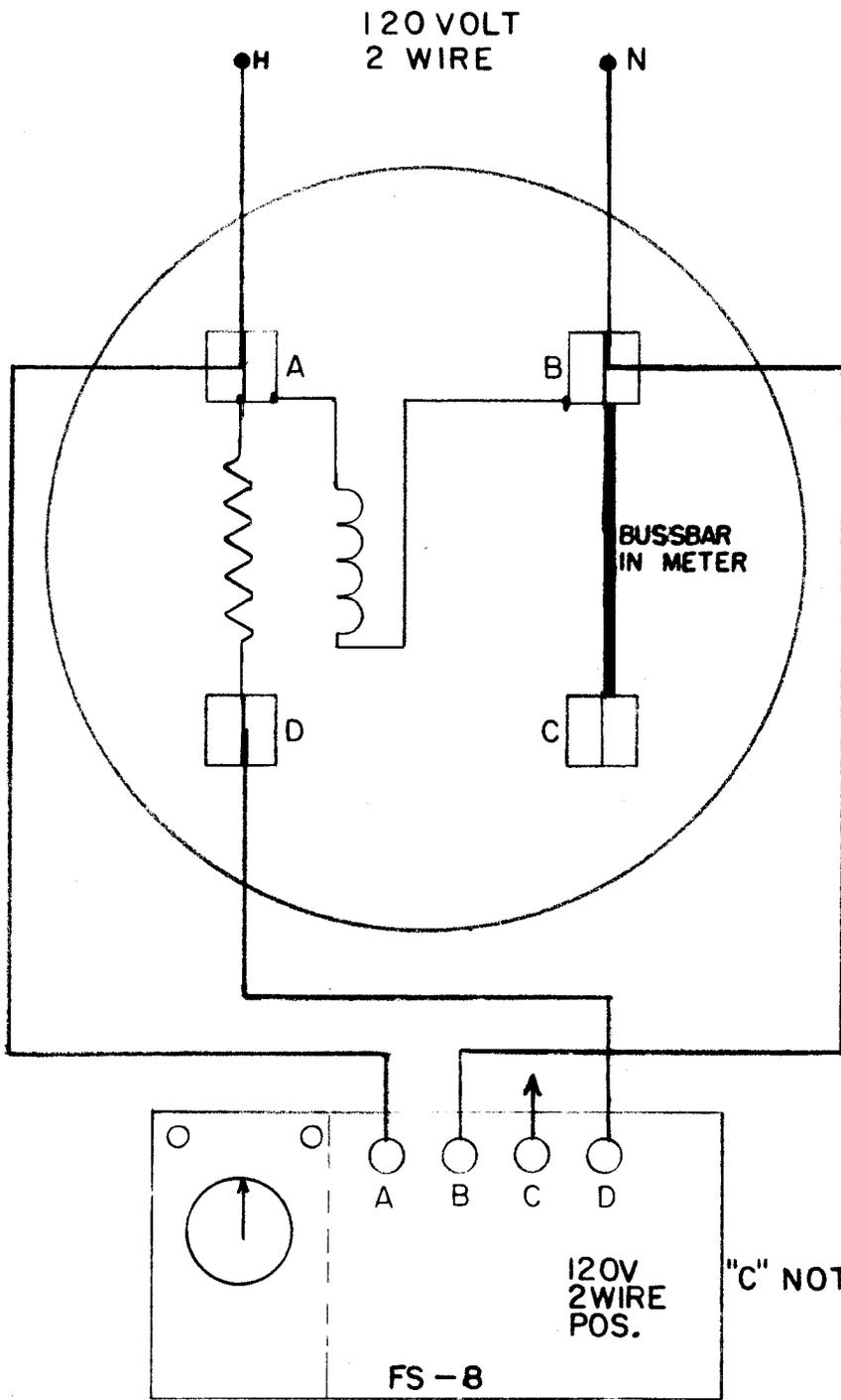
Knopp

FACTORY

9657-C

SCHEMATIC FS-9

11-17-80



ON FS-9 STANDARD IS SEPARATE

**CAUTION**

If lights are burning brightly do not turn on current switch. This indicates that the current circuits are not properly connected. Interchange leads "C" and "D" the lights should go out. If the current switch is turned on while the lights are burning the results will be blown fuses.

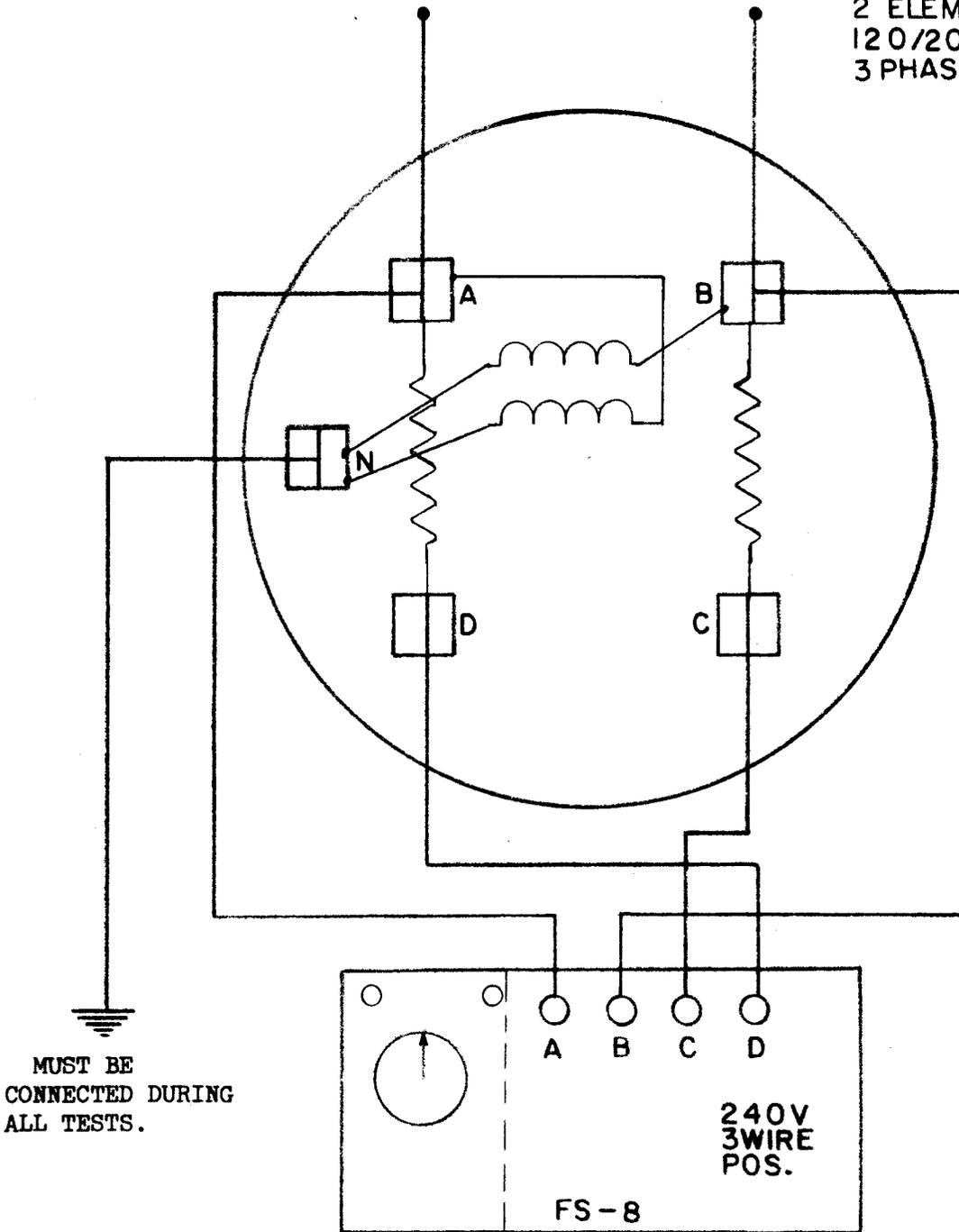
With "C" lead disconnected the right hand lamp may have a glow.

SUPERSEDES		SCALE		SHEET 1 OF 1		DRAWING NUMBER		7750A	
METER HOOK-UP FOR		FS-8 120V 2WIRE		FS-9		1302 - 42TH STREET		KNOOPP INC. OAKLAND, CALIF. 94608	
APPR'D	ENGR	CHK'D	DWN BY	JOB	FILE	DATE	AP	CK	AP
		F.K.	ADD FS-9						
REV	DATE	DESCRIPTION							
A	1180								
DRAWING NUMBER		7750A							



208 VOLT

2 ELEMENT METER  
120/208 VOLTS  
3 PHASE 3 WIRE  
NETWORK



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ALL TESTS.

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SUPERSEDES		SCALE		SHEET 1 OF 1		DRAWING NUMBER	
						7752 A	
METER HOOK-UP FOR FS-8 120/208 V 3 PHASE 3 WIRE NETWORK FS-9							
1307 46TH STREET <b>KNOPP INC.</b> OAKLAND, CALIF. 94608							
APP'D	ENG'R	CHK'D	F.K.	DWN BY	FILE	JOB	DATE 10-19-71
F.K.						CK	AP
A 11-80	ADD	FS-9				DESCRIPTION	
REV	DATE						
DRAWING NUMBER							
7752 A							