Simpson

INSTR 'TS THAT STAY ACCURATE

# OPERATOR'S MANUAL

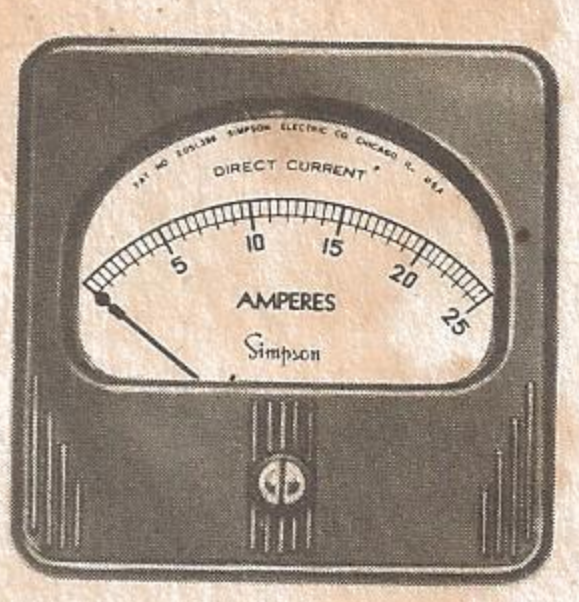
## FIEL STRENGTH METER
## MODEL 498

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago 44, Illinois, ES 9-1121

In Canada, Bach-Simpson, Ltd., London, Ontario

# PANEL METERS by Simpson




**MODELS 27, 37, 47, 57**
3½" RECTANGULAR
ACCURACY: 2%
SCALE LENGTH: 2-9/16"


**SIMPSON MODERNISTIC "CLEAR-VUE"**
BUILT TO SPECIAL ORDER
2½", 3½", 4½", 5½" SIZES


**MODELS 25, 35, 45, 55**
3½" ROUND, ACCURACY 2%
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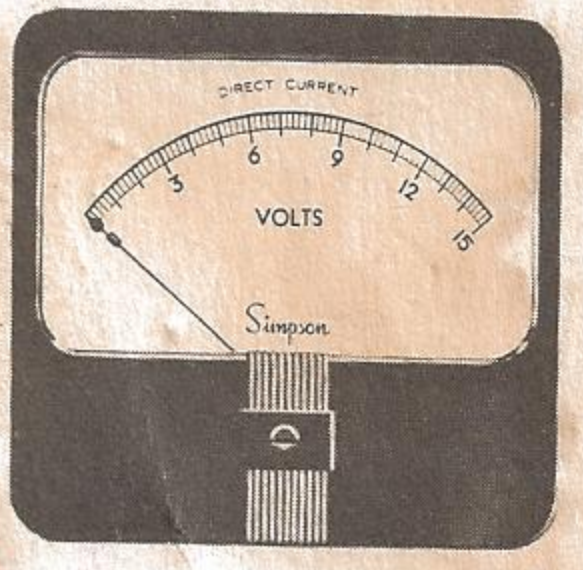
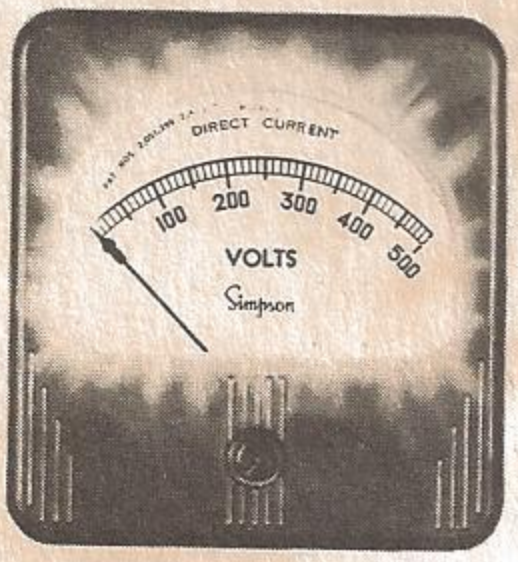
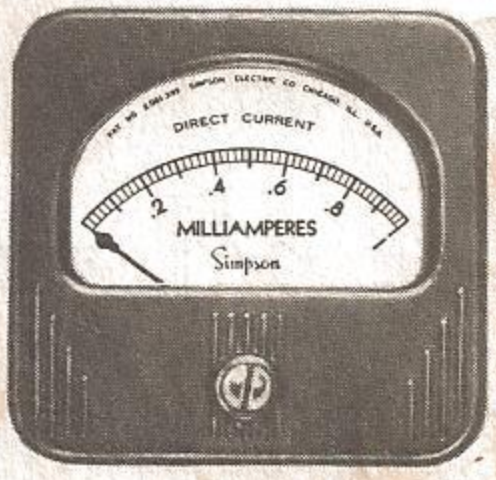



**MODELS 29, 39, 49, 59**
4½" RECTANGULAR
ACCURACY: 2%
SCALE LENGTH: 3-29/32"




**MODELS 27, 37, 57**
ILLUMINATED
3½" RECTANGULAR
ACCURACY: 2%
SCALE LENGTH: 1-5/16"




**MODELS 127, 137, 147, 157,**
2½" RECTANGULAR
ACCURACY: 2%
SCALE LENGTH: 1-7/8"

NEARLY 800 DIFFERENT SIZES AND KINDS OF SIMPSON PANEL METERS ARE AVAILABLE FROM YOUR ELECTRONIC PARTS JOBBER. WHETHER YOU NEED ONE PANEL METER ..... OR A DOZEN ..... LOOK FOR THE FAMILIAR ORANGE COLORED SIMPSON BOX. FOR FURTHER INFORMATION WRITE SIMPSON ELECTRIC CO., 5200 W. KINZIE ST., CHICAGO 44, ILL., ESTEBROOK 9-1121.

# OPERATOR'S MANUAL

## FIELD STRENGTH METER
## MODEL 498

**SIMPSON ELECTRIC COMPANY**

5200 W. KINZIE ST., CHICAGO 44, ILLINOIS. ESTebrook 9-1121

IN CANADA, BACH-SIMPSON, LTD., LONDON, ONTARIO


FIGURE 1. SIMPSON FIELD STRENGTH METER MODEL 498

# SECTION I

# GENERAL DESCRIPTION

The Simpson Field Strength Meter Model 498 is an instrument which was designed to be used to measure the strength of a television signal – either black-and-white or color – available from an antenna. You can tune it to any TV channel, 2 through 83, and determine the relative effectiveness of the antenna for reception of signals at the tuned frequency. The strength of the signal picked up by the antenna is indicated on a large easy-to-read meter on the front panel.

## MAJOR APPLICATIONS

The main use for this field strength meter is to help select an antenna position and orientation which will provide optimum reception. This is much more important for color reception than for black-and-white, but is an influencing factor for all reception quality. Maximum signal strength will usually provide the best results.

The instrument can also be used to compare the effectiveness of various possible antennas, for predicting fringe area installation possibilities, for locating sources of interference, and for many other applications.

## SIGNAL SUBSTITUTION FOR TESTING

Since the Simpson Field Strength Meter Model 498 contains a Standard Coil Products tuner which produces a 45 megacycle intermediate frequency output, you can use the instrument for signal substitution when you check a receiver in

which the tuner's operation is doubtful. The tested receiver must be one of the later models which also has a 45 megacycle IF. See Section V of this manual for further instructions.

## INDICATIONS

The meter indicates video carrier strength, when it is properly tuned, since the strength of the video carrier is usually the most important consideration. Due to the nature of the circuits, it is also possible to obtain a sound output for all channels except 4, 6, and 13. There is a convenient jack in the rear panel into which you can insert a standard 2-conductor phone plug. With a pair of high impedance headphones connected to the plug, you can hear the sound output.

## PORTABILITY

The Simpson Field Strength Meter Model 498 can be completely portable, or can be operated from a 117 volt AC power source. To make it portable, use a 6 volt storage battery in the space provided in the case. It can also be used with the 6 volt electrical system in your truck or automobile. Up to 100 feet of #12 extension cord can be used for the DC input.

## SENSITIVITY

The sensitivity of the Simpson Field Strength Meter Model 498 is variable from below 50 microvolts to over 50,000 microvolts. Variation of sensitivity is obtained with a potentiometer, which is a front panel control.

The knob rotates past four points marked on the panel. These are labelled 50, 500, 5000, and 50000. When the sen-

sitivity knob is set at any of these four positions, full scale meter deflection will be obtained when that approximate number of microvolts is present at the antenna terminals and the instrument is tuned to the signal frequency.

## POWER CONSUMPTION

The power consumed by the Model 498 is approximately 18 watts for a 117 volt AC input. The current drain from a 6 volt storage battery is about 3 amperes.

## CASE

The Simpson Field Strength Meter Model 498 is housed in a grey metal cabinet which measures 11½'' long x 7½'' high x 9½'' deep. The instrument weighs 14-3/4 pounds (without an internal battery).

# FRONT PANEL CONTROLS AND CONNECTIONS

## ANTENNA TERMINALS

There are two sets of signal input terminals at the upper left hand corner of the front panel. One of these is for UHF connections, for channels 14 through 83. The other is for VHF connections, for channels 2 through 13.

## NEON LAMP

Below the input terminals is a neon lamp which glows when power is applied to the circuits of the instrument. This glows for either a 117 volt AC input or for a 6 volt DC input, and also when the battery is being charged.

## CHANNEL SELECTOR

In the lower left hand corner is the channel selector. It has

three concentric controls. The inner ring has 13 positions; one for each of the VHF channels, 2 through 13, and one position to set up the tuner for UHF operation. The center knob is used for tuning UHF channels, 14 through 83. The outer ring is used for fine tuning.

## FUNCTION SWITCH

At the right of the channel selector is the function switch. It has three positions; UHF, VHF, and BATT TEST. The first two positions are self-explanatory. The BATT TEST position sets up a meter circuit which will provide an indication of the battery's terminal voltage when a battery is in use. The switch is spring loaded, so the switch knob cannot be left in this position; it returns to the VHF position when it is released.

## SENSITIVITY CONTROL

The next knob to the right, below the meter, is for the sensitivity control of the Model 498. It has four marked settings which are labelled 50, 500, 5000, and 50000. These are the approximate points where you can set the knob to obtain full scale deflection on the meter when the indicated number of microvolts of signal strength is coming in at the antenna terminals and the instrument is tuned to the frequency of the incoming signals. The sensitivity control is continuously variable, and may be set at any point in its rotation which provides satisfactory indications.

## POWER SWITCH

The switch at the far right hand side below the meter has four positions. The positions are marked OFF, AC, DC, and

CHARGE. Set it at the OFF position to turn the entire instrument off.

When the power cord is attached to a 117 volt AC power source, you can turn the instrument on for field strength measurements with this switch in the AC position. When there is an internal vibrator and either an internal battery or an external connection to a 6 volt DC source, you can turn the instrument on with this switch in the DC position. When you wish to charge the battery, connect the power cord to a 117 volt AC power source and set this switch at CHARGE.

## INDICATING METER

The meter is a 4½-inch easy-to-read Simpson Instrument, which is both rugged and sensitive. It has a 50 microampere movement similar to the one used in the famous Simpson Volt-Ohm-Milliammeter Model 260. There are two scales on the meter; one is marked from 0 to 50, and is the scale on which you will read field strength; the other is marked from 5V to 8V, and is the scale on which you will read battery terminal voltage.

## REAR PANEL CONNECTIONS

Looking at the rear of the cabinet, there are two power input receptacles, two fuses, two output jacks, and an access door.

## ACCESS DOOR

The large door in the rear panel swings open to give you access to the internal battery compartment and to the lead compartment. Store your power leads in this special place

# GENERAL DESCRIPTION

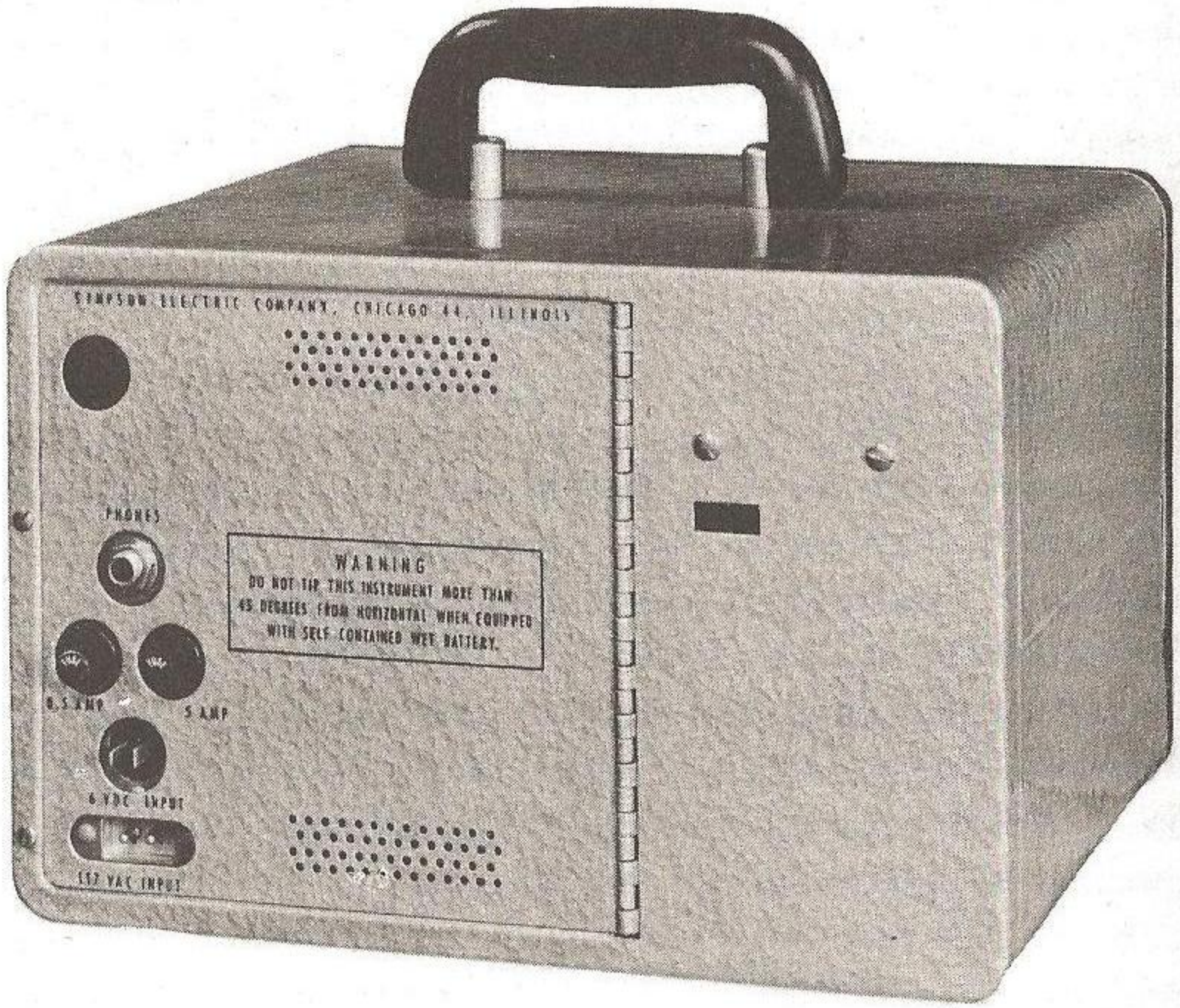



FIGURE 2. REAR VIEW OF CABINET,
SIMPSON FIELD STRENGTH METER MODEL 498

inside the rear of the cabinet, and they will always be handy when you need them.

There are holes through the left hand side of the access door through which you can reach the power connections, fuses, and sound output jack, whether the door is opened or closed.

## AC POWER INPUT RECEPTACLE

There is an oval shaped opening through the access door at the left hand side of the rear panel. Inside this opening is located the receptacle for 117 volts AC input. Attach the mating line cord connector into this receptacle whenever you wish to connect the instrument to a 117 volt AC source of power.

## DC POWER INPUT RECEPTACLE

Directly above the AC receptacle is a polarized DC connection. This is where you will connect an external source of 6 volts DC to the instrument. It will usually be connected to the 6 volt electrical system in your truck or car. It can be used to operate the entire instrument, or to recharge an internal storage battery in the Model 498 while you are riding between jobs.

The mating plug for this jack is furnished with the instrument; use #12 or larger wire to make up a lead for your method of application. The wider blade is the positive terminal and the narrower blade is the negative terminal.

## FUSES

Two fuses are located side-by-side. The left hand fuse is a type 3AG 1/2 ampere fuse for the AC circuits. The right

hand fuse is a type 3AG 5 ampere fuse for the DC circuits.

## SOUND OUTPUT JACK

Directly above the fuses is a phone jack. When you wish to use the audio output of the Model 498, connect a pair of high impedance headphones to this jack with a regular 2-conductor phone plug.

## IF OUTPUT JACK

On the right hand side of the rear panel, there is a rectangular jack. This is the connection point for the IF output of the tuner. Use it to connect the IF signal to the input of a 45 megacycle IF strip in a TV receiver when you wish to test the receiver tuner by signal substitution methods.

The mating plug for this application is provided with the instrument. Use as short a piece of coaxial R.F. cable as practical to make the lead.

## POWER LEAD

There is an AC power lead furnished with the instrument, and it is packed inside the lead compartment. It has a female plug on one end which will fit into the AC receptacle at the lower left hand corner of the rear panel. On the other end is a standard AC power plug which will fit into an AC convenience outlet. The lead is 6 feet long.

# ACCESSORIES

## VIBRATOR

To use your Simpson Field Strength Meter Model 498 with a 6 volt DC power input, either internal or external, you will have to check first if the vibrator is installed inside the

instrument. The correct vibrator for this use is a Mallory type 659 (or equal). See Section IV for installation instructions.

## BATTERY

If you wish to have a completely portable field strength meter, independant from any outside power connections while you use it, install a 6 volt storage battery in the compartment in the rear of the case.

The correct battery for this installation is shown in figure 3. It is a replacement battery for Harley-Davidson Motorcycles, Model 125, 1948 and 1949. The battery shown in figure 3 is a Model H-3, manufactured by Amplus Battery


FIGURE 3. 6 VOLT BATTERY FOR INTERNAL INSTALLATION

Company, Chicago, Illinois. Use #10-32 screws and nuts, which are supplied with the instrument, to connect the two leads in the Model 498 to the battery terminals; connect the black lead to the negative terminal and the red lead to the positive terminal. The positive terminal of the battery should face the rear access door.

## CALIBRATOR

Normal uses for the Simpson Field Strength Meter Model 498 do not require extreme accuracy of metered indications. However, if you wish to use your instrument to read microvolts of signal strength accurately, use a calibration source which will set up a known frequency and a known microvolt strength. Then apply this signal at the antenna terminals of the field strength meter.

Tune the instrument for the incoming frequency, and then adjust its sensitivity with the front panel control until the meter indicates the microvolt strength of the signal. Because of the variation of tuner sensitivity, this calibration is only good for the frequency at which you set it up.

# SECTION II

# OPERATING INSTRUCTIONS

## WITH 117 VOLT AC POWER INPUT

To use the Simpson Field Strength Meter Model 498 to measure TV signal strengths with a 117 volt AC power input, proceed as follows:

1. Open the access door through the rear of the cabinet and remove the AC power cord. Close the access door again.

## OPERATING INSTRUCTIONS

Attach the plug into the receptacle inside the lower left hand corner of the access door. Connect the other end of the power cord to a convenient source of 117 volt, 60 cycle AC, single phase power.

2. Set the power switch in the lower right hand corner of the front panel at AC. Allow time for the instrument to warm up before you make any measurements.
3. Connect the transmission line from the black-and-white or color antenna to the input terminals at the upper left on the front panel. If the instrument is to be used to measure a VHF signal, connect the transmission line to the pair of terminals at the right; if it is to be used for a UHF signal, connect the transmission line to the pair of terminals at the left.

**NOTE**

**The natural impedance for either VHF or UHF terminals is 300 ohms. If you use transmission line with any impedance other than 300 ohms, match it to the terminals as you would for a TV receiver.**

4. Set the function switch (to the right of the channel selector) at the proper position, VHF or UHF, depending on the channel which is to be tested.
5. Tune the channel selector for the channel which is to be received and measured.
6. Adjust the sensitivity control to a position which will provide some meter deflection.
7. For VHF, adjust the fine tuning ring around the channel selector for a maximum deflection on the meter. For UHF, adjust the UHF tuning knob first and then the fine

tuning for this maximum deflection.

8. If the meter tends to read off scale, turn the sensitivity control counterclockwise to reduce the sensitivity and bring the pointer back on the meter scale again.

9. After you have tuned the channel selector for a maximum meter indication, set the sensitivity control knob at the panel mark furthest clockwise which still keeps the pointer on the meter dial. The panel mark indicates the nominal amount of microvolts for full scale indications.

10. Read the meter. Use the 0 to 50 marks. The full scale value is the approximate number of microvolts indicated by the sensitivity control position (step 9 above).

**NOTE**

If you are using the field strength meter for orientation or for antenna placement, proceed through step 9 above, and then move the antenna while you observe the meter indications. Locate the antenna and orient it at the position which provides the greatest meter indication with the lowest sensitivity setting.

If you are using the field strength meter to compare the output strengths of two or more antennas or systems, compare the meter indications when the sensitivity control is set in exactly the same position for all readings.

## PROCEDURE WITH 6 VOLT DC INTERNAL BATTERY

To use the Simpson Field Strength Meter Model 498 as a completely portable instrument, free from any external leads, first install a storage battery according to instruc-

tions in Section IV in this manual. Then proceed as follows:

1. Set the power switch at DC. Allow a short time for the instrument to warm up.
2. Turn the UHF, VHF, BATT TEST switch to BATT TEST and observe the meter indication for terminal voltage of the storage battery. The battery will provide satisfactory results if the meter reads 5.4 volts or more. If it is less than that amount, recharge the battery before you attempt to use it.
3. Connect the transmission line from the black-and-white or color antenna to the input terminals at the upper left on the front panel. If the instrument is to be used to measure a VHF signal, connect the transmission line to the pair of terminals at the right; if it is to be used to measure a UHF signal, connect the transmission line to the antenna terminals at the left.

**NOTE**

**The natural impedance for either VHF or UHF terminals is 300 ohms. If you use transmission line with any impedance other than 300 ohms, match it to the terminals as you would for a TV receiver.**

4. Set the function switch (at the right hand side of the channel selector) at the proper position, VHF or UHF, depending on the channel which is to be tested..
5. Tune the channel selector for the channel which is to be received.
6. Adjust the sensitivity control to a position which will provide some meter deflection.

7. For VHF, adjust the fine tuning ring around the channel selector for a maximum meter deflection. For UHF, adjust the UHF tuning knob first and then the fine tuning for this maximum deflection.
8. If the meter tends to read off scale, turn the sensitivity control counterclockwise to reduce the sensitivity and bring the pointer back on the meter scale again.
9. After you have tuned the channel selector for a maximum meter indication, set the sensitivity control knob at the mark furthest clockwise which still keeps the pointer on the meter dial. The panel mark indicates the nominal amount of microvolts for full scale deflection.
10. Read the meter. Use the 0 to 50 marks. The full scale value is the approximate number of microvolts indicated by the sensitivity control position (step 9 above).

## NOTE

If you are using the field strength meter for orientation or for antenna placement, proceed through step 9 above, and then move the antenna while you observe the meter indications. Locate and orient the antenna at the position which provides the greatest meter indication with the lowest sensitivity setting.

If you are using the field strength meter to compare the output strengths of two or more antennas or systems, compare the meter indications when the sensitivity control is set in exactly the same position for all readings.

# OPERATING INSTRUCTIONS

## PROCEDURE WITH 6 VOLT DC EXTERNAL POWER SOURCE

For many applications, it is convenient to use the 6 volt electrical system in your truck or automobile for the power input for your field strength meter. Be sure to check and see that your electrical system has 6 volts before you connect the field strength meter to it; many late model cars are now using 12 volt electrical systems. If you apply 12 volts to the DC power input of your Model 498, you will damage the instrument.

There are other sources of 6 volt DC power which may be used. For instance, a separate 6 volt storage battery which is not located inside the instrument case, or a 6 volt DC generator. Use any of these power sources which are convenient for your applications.

Use the polarized plug furnished with your instrument to make up a connecting lead for your 6 volt DC power source. Use the wider contact for connection to the positive polarity of the power source, and the narrower contact for negative polarity. Use heavy enough lead wire to carry the current, which is about 3 amperes.

As an example, you can connect the output of your 6 volt electrical system in your car or truck through an extension cord as long as 100 feet if it is made with #12 wires. This assumes that you will keep your engine running fast enough so the ammeter does not show discharge while you use the instrument, in order to use the generator voltage which is about 7 volts. Shorter lengths of extension cord or larger wire sizes are required when you are using the battery.

## OPERATING INSTRUCTIONS

Connect the polarized plug into the receptacle on the rear of the instrument. See figure 2 for the location of this receptacle.

### NOTE

**If you connect DC power from your truck or car to the Model 498, check to see which polarity is grounded in the vehicle. If there is a negative ground, do not allow the metal case of the Model 498 to contact any metal in the vehicle or you will short out the vehicle's electrical system.**

After you have connected 6 volts DC through the polarized plug and receptacle, proceed as for internal battery. See instructions under heading "PROCEDURE WITH 6 VOLT INTERNAL BATTERY."

## BATTERY CHARGING

When you have a battery inside the case of your Model 498, you will need to recharge it periodically. Whenever the meter indicates that the battery is getting low, as shown on the battery test circuit, recharge it.

There are two methods for recharging your internal battery. One uses a 117 volt AC power input. The second uses the DC charging circuit of your truck or automobile, providing it has a 6 volt system.

## BATTERY CHARGING WITH 117 VOLTS AC

Connect the power cord into the receptacle in the lower left hand corner in the rear of your Model 498. Connect the other end of the power cord to a 117 volt AC power outlet. Set the power switch, in the lower right hand corner of the front

panel, at CHARGE. The power transformer will step down the voltage and this will be rectified and applied across the battery to charge it.

When the power switch is set at CHARGE, and you turn the function switch to BATT TEST, the meter will indicate the voltage applied from the charging circuit rather than that for the battery itself. This voltage at the beginning of charging is approximately 6 to 6.5 volts, and slowly rises to about 7.8 volts. If there is no further rise of the voltage for one hour, the battery is considered fully charged. It takes about 12 to 18 hours to charge the battery which was discharged to 5.4 volts.

## CHARGING FROM A DC SOURCE

To charge the battery inside the case of your Model 498 from a DC source, such as the output from your 6 volt electrical system in your truck or car, connect a power cord to the polarized plug and receptacle through the rear of the cabinet. Then connect this cord to the electrical system. You can use the cigarette lighter for connections. Set the power switch for the Model 498 at OFF while you charge the internal battery from a DC source.

### NOTE

**Be sure to observe polarity for the connection. Connect the positive polarity from the power source to ground in the Model 498 through the wider contact in the polarized plug.**

**Do not allow the instrument case to contact any metal in the vehicle, if the vehicle's electrical system has a negative ground.**

## OPERATING INSTRUCTIONS

**Keep the engine running while you charge the battery.**

Turn the function switch to BATT TEST from time to time during the charging procedure to see how the voltage is increasing in your battery.

The rate of current is not constant. It varies from a fraction of an ampere to about 2 amperes, depending on the speed of the engine and the relative charged condition of the battery. The total time which would be required for fully charging a discharged internal battery with this method could be from 10 to 12 hours, and you will probably only use this method to restore its use temporarily when you are isolated from a more efficient charging source.

# SECTION III
# THEORY OF OPERATION

The circuits which are used to make the Simpson Field Strength Meter Model 498 operate are similar to those in a television receiver. They are shown, in block form, in figure 4. The signal from a transmitter is received through an antenna and applied at the antenna input terminals. It is then selected and converted to a nominal 45 megacycle intermediate frequency in the tuner. The IF is then amplified through two stages to reach a satisfactory strength for detection and application to the meter circuit.

## IF AMPLIFIERS

The two IF amplifiers are peak tuned, rather than being tuned for broad band response as they would be in a television receiver. This is true because the strength indication on the meter is to be carrier strength; modulation is not

# THEORY OF OPERATION

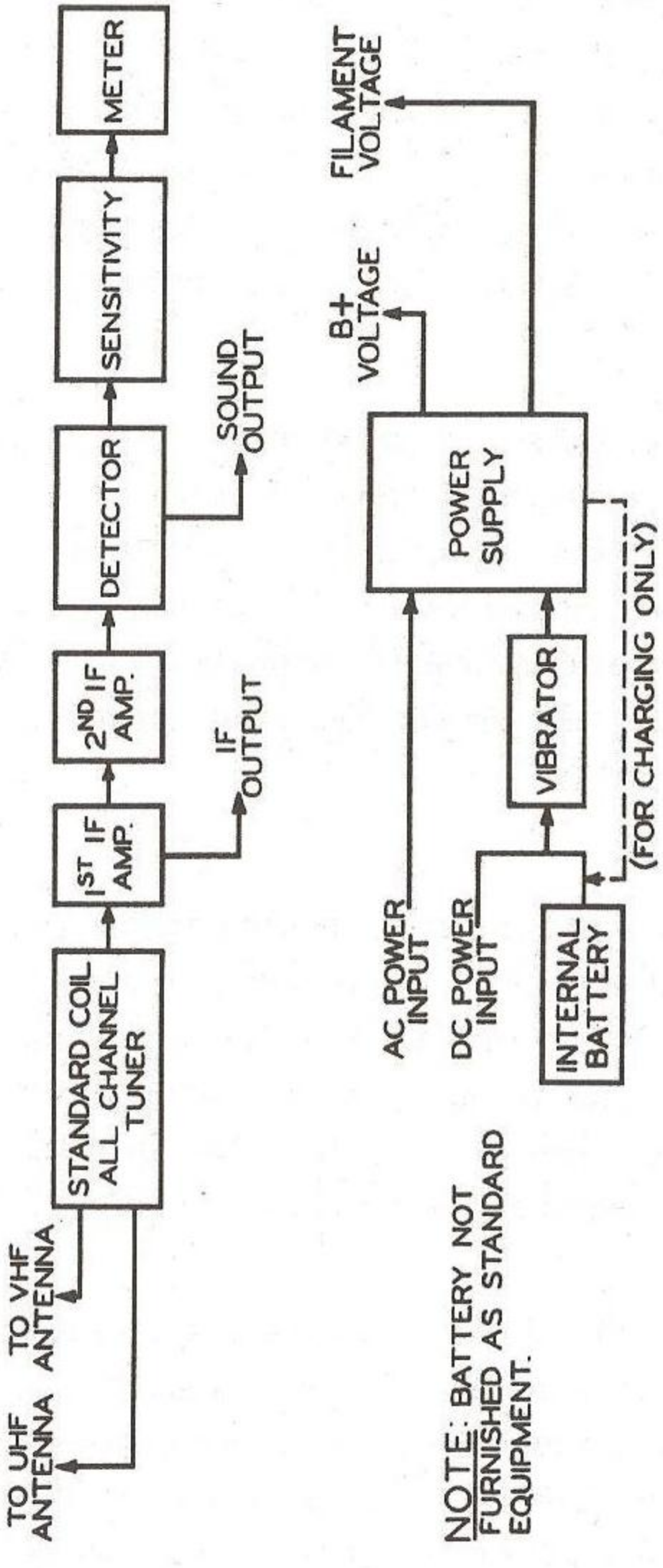



FIGURE 4. BLOCK DIAGRAM OF SIMPSON FIELD STRENGTH METER MODEL 498

important, so broad band response is not desirable.

## CONSTANT AMPLIFICATION FACTOR

The voltage output from the detector is proportional to the carrier strength of the tuned channel. The sensitivity control allows the operator to select a level of sensitivity in the meter circuit which will provide satisfactory deflection for any usable signal strength at the antenna.

## IF OUTPUT

For convenience, there is an IF output connection built into the rear panel of the field strength meter. It may be used for signal substitution in receivers where the intermediate frequency is 45 megacycles. The signal is taken from the cathode circuit of the first IF amplifiers, and its band width at this point is still broad, the same as it would be in the receiver under test.

## AUDIO OUTPUT

There is also a phone jack, located in the rear panel, into which you can connect a 2-conductor phone plug and a pair of earphones. There are two ways in which you can use this sound output. One is to hear the sound modulation on the carrier, and the second is to hear the 60 cycle buzz which identifies the vertical synchronization signal on the video carrier.

To hear sound modulation, set the tuner to receive the next higher channel than the one for which you are measuring field strength. Rotate the fine tuning control and listen for a sound output. Because the video carrier frequency of the next higher channel is near the sound carrier frequency of

the channel in which you are interested, you can tune close enough to the sound carrier to bring it into the slope area of the peaked IF response.

The detector will demodulate the FM sound and it will be heard in the headphones. Do not expect receiver quality from this sound, since the method of detection is not a normal FM demodulation. It is included as a convenience only.

## NOTE

To hear a sound output, the next higher channel must have a frequency band adjacent to that of the tuned channel. There is no provision for channels 4, 6, or 13.

## LISTEN TO SYNC BUZZ

When you have tuned the video signal for normal operation and metered indications, there will be a characteristic 60 cycle buzz which you can hear in earphones connected to the sound output. This is due to the vertical synchronizing pulses in the incoming signal. Use it to identify the fact that a transmitted signal is causing the meter deflection, rather than a signal from some interference. This is especially valuable when you suspect interference.

## POWER SUPPLY

The lower section of figure 4 shows a block diagram of the power supply for the Model 498. Either 117 volts of AC power or 6 volts of DC power will cause the power supply to furnish operating voltages for the rest of the circuits in the instrument.

The dotted line leading from the power supply back to the

## THEORY OF OPERATION

DC power source indicates how a charging circuit is set up to recharge an internal battery. When the power switch is set at CHARGE, this circuit is connected but no B+ or filament voltages are applied in the instrument.

# SECTION IV
# MAINTENANCE

## OPENING THE CASE

To obtain access to the chassis inside the case of the Field Strength Meter, remove the four screws on the back which hold the front panel and chassis to the instrument case. Pull forward on the front panel; the chassis is attached and will come out with it.

## BATTERY LEADS

To remove the chassis completely from the case, feed the red and black battery leads through the grommet in the wall of the battery compartment. They are attached to the power supply chassis and will come out with it.

When you place the chassis back into the case, be sure to feed the battery leads back through the grommet into the battery compartment again.

## INTERNAL 6 VOLT STORAGE BATTERY INSTALLATION

The correct 6 volt storage battery for installation inside the case of the Model 498 is the same as is made to fit Harley-Davidson motorcycles, 1948 and 1949. One brand of this battery is shown in figure 3. It is made by the Amplus Battery Company, Chicago, Illinois, and is their Model H-3.

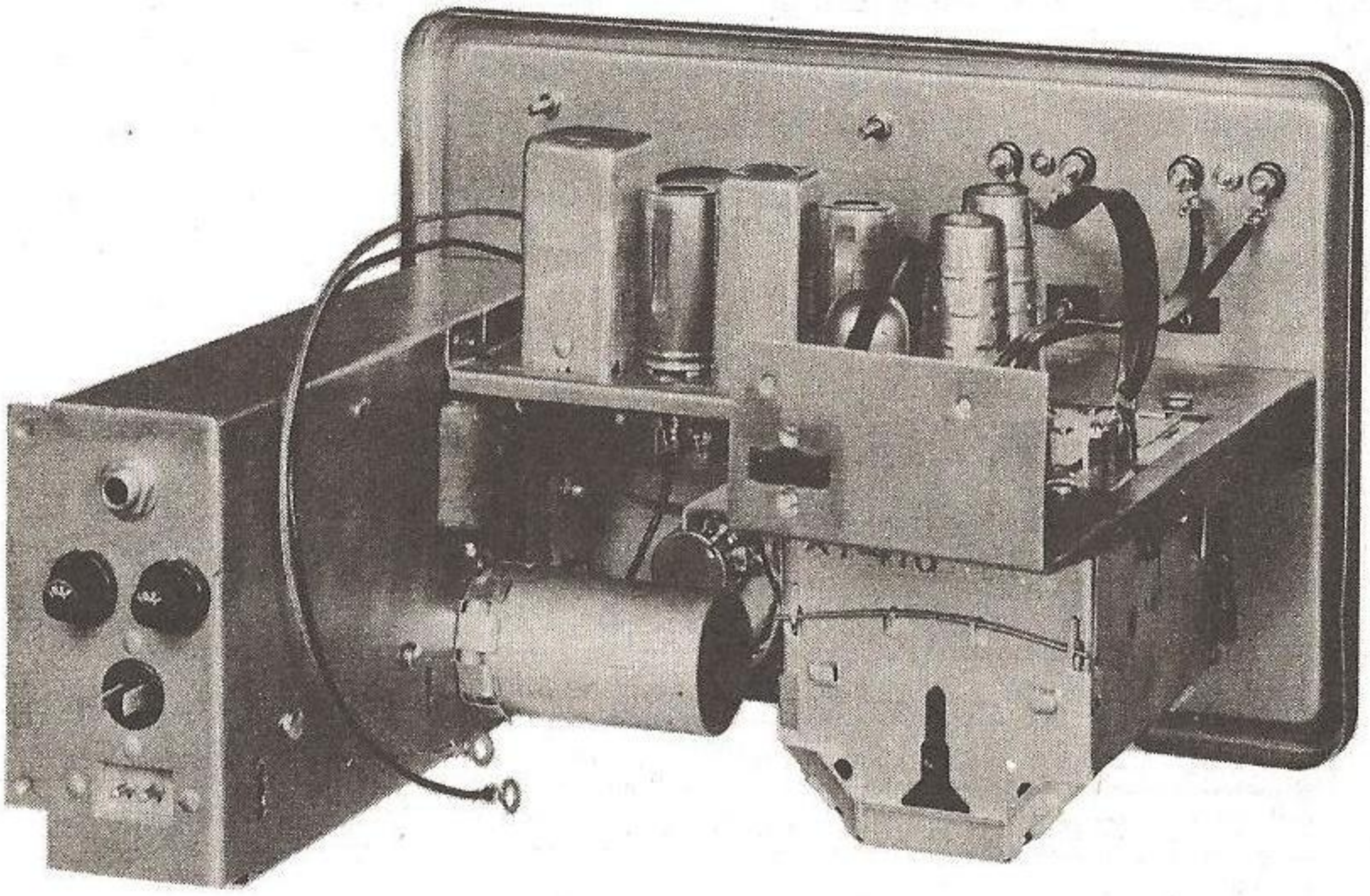


FIGURE 5. CHASSIS REAR VIEW,
SIMPSON FIELD STRENGTH METER MODEL 498

# MAINTENANCE

It measures 4-1/8 x 3½ x 5½ inches and weighs 6 lbs, 15 oz.

The battery is furnished with two terminal lugs. They are marked + and –, and require screws and nuts, which are supplied, for attaching the battery leads from the Model 498. Attach the red lead to the + (positive) terminal and the black lead to the – (negative) terminal.

The battery leads inside the case of the Model 498 are long enough that you can pull them out through the access door and fasten them to the battery. Then fold them carefully back into the battery compartment as you move the battery into place.

## NOTE

**When you have a battery in place in your Model 498, always carry and use the instrument in a horizontal position. Do not tip the instrument into a vertical position; the battery, although rated spillproof, can allow drops of acid to leak out through the vent holes in the caps. Acid will attack and corrode the inside of the battery compartment and the leads and insulation.**

## BATTERY MAINTENANCE

As a storage battery is used, the chemical changes inside it increase its internal resistance and reduce its terminal voltage under load. A fully charged battery should be able to furnish enough power for a full day's work. The battery will operate for 10 to 15 periods of 12 to 15 minutes duration before it is discharged far enough to interfere with further operation.

# MAINTENANCE

Check the terminal voltage under load by turning the function switch to BATT TEST while the power switch is set at DC. This terminal voltage indicates the battery condition. When the terminal voltage gets down to 5.4 volts, recharge the battery before you use it any more.

## ELECTROLYTE

The storage battery uses sulfuric acid electrolyte, which is standard for lead-acid storage cells. This is composed of sulfuric acid and distilled water. It is mixed so the original specific gravity is 1.300. During use, the specific gravity decreases. Then during charging, it increases again. It is normal for the maximum specific gravity after recharging to be about 1.275 rather than 1.300. A specific gravity of about 1.175 indicates a low state of charge.

The liquid level of the electrolyte will vary over a period of time. Natural evaporation of the water, aided by heat produced in the battery while it is used, is responsible. Add distilled water only whenever the liquid level is less than 1/8 inch above the plates in each cell. Never add acid or tap water.

### CAUTION

**Adding more liquid than ¼ inch above the plates may cause spilling during charging.**

## CHARGING WITH 117 VOLTS AC

The built-in charging circuit in the Model 498 will apply a charging voltage to the internal battery when the instrument is connected to 117 volts AC. Set the power switch, in the

lower right hand corner of the front panel, at CHARGE, and connect the AC lead from the receptacle at the rear of the instrument to a 117 volt AC power source.

If you turn the function switch to BATT TEST while the charging circuit is set up in the instrument, the meter will read the voltage from the charging circuit rather than battery voltage. At the beginning of charging this voltage is about 6 to 6.5 volts and it rises gradually, as the charging proceeds, to approximately 7.8 volts. If there is no further rise during the next hour, the battery may be considered fully charged.

After you have used the Field Strength Meter as a portable instrument through the day, or at any time when your battery shows that it needs to be recharged, connect it for the AC charging circuit over night. The starting rate of current for charging will be about 0.7 ampere for a discharged battery. This will come down to about 0.5 ampere as the battery becomes charged.

## CHARGING FROM AN AUTOMOTIVE CIRCUIT

If you need to recharge your battery while you are driving from one job to another during the day, or at any other time when it is convenient to do so, you can connect it to the 6 volt electrical system in your truck or car.

### NOTE

**Do not connect the Model 498 to a 12 volt electrical system such as is found in some late model passenger automobiles. This will damage the instrument.**

Use the polarized plug which is furnished with your Model 498, and make up a lead to connect the instrument to your

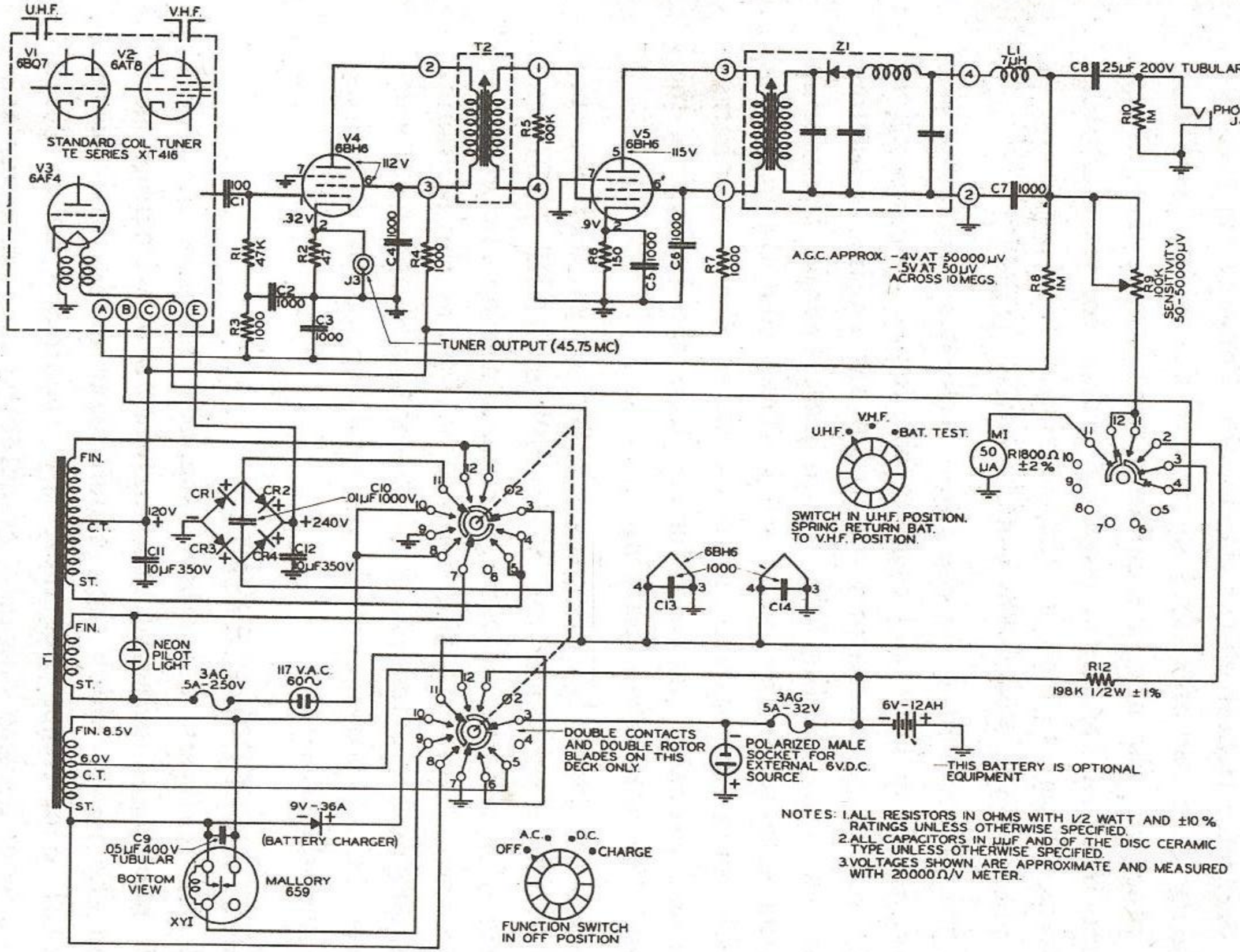
electrical system. A convenient outlet for this connection is the cigarette lighter on the dashboard. Connect the positive polarity from the electrical system to the wider contact in the plug, and the negative polarity to the narrower contact. If the truck or car has a negative ground for its electrical system, be sure to insulate the instrument from any metal in the vehicle. The Model 498 has a positive ground.

Set the power switch, in the lower right hand corner of the front panel, at OFF and connect the lead to the electrical system. Charge the battery only when the engine is running (that is, while driving from job to job). Operate the engine so the ammeter in the car or truck shows that the generator is charging the battery. If the ammeter shows discharge, you are probably drawing current from the battery in the Model 498 rather than charging it.

When you have a DC charging circuit set up, and you turn the function switch of the Model 498 to BATT TEST, the meter will indicate the voltage in the charging circuit rather than battery voltage. This voltage will be at the beginning of charging approximately 6 to 6.5 volts, and about 7.8 volts at the end of charging, while the charging current is flowing through the battery.

## PARTS AND REPLACEMENT

All the resistors and other component parts of the Model 498 have been selected and engineered to withstand more than the power which they should have to dissipate under normal conditions. But there are conditions under which parts may become damaged or defective and need replacement.




NOTES: 1. ALL RESISTORS IN OHMS WITH 1/2 WATT AND ±10% RATINGS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS IN μμF AND OF THE DISC CERAMIC TYPE UNLESS OTHERWISE SPECIFIED.
3. VOLTAGES SHOWN ARE APPROXIMATE AND MEASURED WITH 20000 Ω/V METER.

FIGURE 6. OVERALL SCHEMATIC DIAGRAM, SIMPSON FIELD STRENGTH METER MODEL 498

## MAINTENANCE

Consult the schematic diagram, figure 6, to help identify the suspected part. If the meter movement is defective, do not attempt to repair it. Any repair on this delicate movement must be made by trained repairmen with the proper tools. Return the instrument to your nearest official Simpson Repair Station, or return it to the repair department at the factory.

Whenever you send in an instrument for repair, write a letter to explain what is wrong with it. Indicate whether you want an estimate on the repairs first, or if you wish to have the repair department proceed on it. This information will speed the repair job and reduce your expense.

## PARTS LIST

| Symbol | Description | Simpson Part No. |
|---|---|---|
| C1 | Capacitor, 100 $\mu\mu$f | 1-113912 |
| C2 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C3 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C4 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C5 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C6 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C7 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C8 | Capacitor, 0.25 $\mu$f, 250 v | 1-114718 |
| C9 | Capacitor, 0.05 $\mu$f, 200 v | 1-115459 |
| C10 | Capacitor, 1000 $\mu\mu$f | 1-115462 |
| C11 | Capacitor, 10 $\mu$f, 350 v, electrolytic | 1-115600 |
| C12 | Capacitor, 10 $\mu$f, 350 v, electrolytic | 1-115600 |
| CR1 | Selenium Rectifier, 65 ma, 117 v | 1-115592 |
| CR2 | Selenium Rectifier, 65 ma, 117 v | 1-115592 |

| | | |
|---|---|---|
| CR3 | Selenium Rectifier, 65 ma, 117 v | 1-115592 |
| CR4 | Selenium Rectifier, 65 ma, 117 v | 1-115592 |
| CR5 | Selenium Rectifier, 0.36 a, 9 v | 1-115593 |
| F1 | Fuse, 0.5 amp, 250 v, 3AG | 1-115595 |
| F2 | Fuse, 5 amp, 32 v, 3AG | 1-115594 |
| I1 | Neon Lamp | 1-115601 |
| J1 | Receptacle, Male, for AC Input | 1-115597 |
| J2 | Receptacle, Male, for DC Input | 1-115649 |
| J3 | Connector, for IF Output | 1-116045 |
| J4 | Phone Jack, for Sound Output | 1-114219 |
| L1 | RF Choke Coil, 7 microhenries | 1-115650 |
| M1 | Meter, 50 $\mu$a, 1800 ohms | 15-352498 |
| R1 | Resistor, 47K, ½ w, 10% | 1-114881 |
| R2 | Resistor, 47 ohms, ½ w, 10% | 1-113921 |
| R3 | Resistor, 1K, ½ w, 10% | 1-111689 |
| R4 | Resistor, 1K, ½ w, 10% | 1-111689 |
| R5 | Resistor, 100K, ½ w, 10% | 1-113949 |
| R6 | Resistor, 150 ohms, ½ w, 10% | 1-113926 |
| R7 | Resistor, 1K, ½ w, 10% | 1-111689 |
| R8 | Resistor, 1 megohm, ½ w, 10% | 1-113952 |
| R9 | Potentiometer, 100K | 1-113876 |
| R10 | Resistor, 1 megohm, ½ w, 10% | 1-113952 |
| R11 | Resistor, 198K, ½ w, 1% | 1-115116 |
| S1 | Switch, Rotary, 3 sections, 1 deck | 1-115555 |
| S2 | Switch, Rotary, 6 sections, 2 decks | 1-115554 |
| T1 | Power Transformer | 1-115577 |
| T2 | First IF Transformer | 1-115602 |
| V1 | Tube, 6BQ7A, RF Amp in tuner | |
| V2 | Tube, 6AT8, VHF Osc and Mix in tuner | |
| V3 | Tube, 6AF4, UHF Osc in tuner | |

| | | |
|---|---|---|
| V4 | Tube, 6BH6, 1st IF | 1-115604 |
| V5 | Tube, 6BH6, 2nd IF | 1-115604 |
| XY1 | Socket, 4-pin for vibrator | 1-115599 |
| Z1 | Compound circuit, with 2nd IF transformer, detector, and filter | 1-115603 |
| | Knobs, switch or sensitivity control | 1-115548 |
| | Knob, Tuner; consists of 3 parts: | |
| | 1. Vernier tuning | 10-890257 |
| | 2. V.H.F. channel selector | 10-890256 |
| | 3. U.H.F. channel selector | 10-890258 |
| | Case assembly | 10-890207 |
| | Front panel | 3-230176 |
| | Handle with posts | 1-114024 |
| | AC lead | 1-115780 |
| | DC polarized plug | 1-115607 |
| | Standard Coil Products Tuner, TE Series, XT416 | 1-115589 |
| | Vibrator | 1-115598 |

If replacements are required for the individual strips in the VHF portion of your Standard Coil Products Tuner, purchase these through your local distributor. Specify series TE strips for the desired channel or channels.

# SECTION V
# SPECIAL USES

## IF SIGNAL SUBSTITUTION

The front end section in the Simpson Field Strength Meter Model 498 is the same as in many commercial TV receivers. There is a pair of antenna terminals to which you will con-

nect the lead-in-wire from whatever antenna you are using. The signal passes from these terminals through a tuner section, and the modulation is transferred from the original carrier frequencies to the intermediate frequency carriers. The nominal IF for the tuner which is used in the instrument is 45 megacycles. Actually, the video carrier is 45.75 mc, and the sound carrier is 41.25 mc.

For normal use, when video carrier strength is to be read on the meter, the IF amplifiers in the instrument will amplify the 45.75 mc signal and disregard the rest of the band of tuned frequencies. This happens because the IF transformers are peak tuned at 45.75 mc. However, the entire spectrum of frequencies for the transmitted channel is included in the output of the tuner section.

Occasionally, in your service work, you will suspect that a TV receiver has a defective tuner section. For your convenience in such cases, the IF output of the tuner in the Model 498 is available to use as a substitute signal. Transfer it to the input of the IF section in the receiver and compare reception qualities. Of course, the receiver IF must be designed for tuning in the 45 megacycle range.

The cathode circuit of the first IF amplifier in the Field Strength Meter has been set up to function as a cathode follower. The cathode resistance is approximately 50 ohms. Connector J3 is connected across this resistance. The signal strength at this connector on the rear panel is very nearly the same as the signal voltage coming from the tuner.

Connect a piece of 50 ohm coaxial transmission line from the connector to the IF input of the receiver which you wish

to test. Disconnect the lead from the receiver tuner to its IF strip. There will be a series capacitor in this lead which you can use for the input from the Model 498. Connect the center lead of the coaxial line to the capacitor lead and the shield to the receiver ground. Then connect a 50 ohm resistor across the receiver connections to terminate the transmission line and prevent standing waves.

Turn on the receiver and the Model 498. Tune the signal from the antenna with the Model 498 and observe the picture and sound in the receiver. If they are improved over their qualities when using the receiver tuner, this proves that the receiver tuner is not operating properly. If the qualities are not improved, the fault probably lies in some other part of the receiver.

## MEASURING ABSOLUTE FIELD STRENGTHS

The measurement of field strengths in terms of microvolts-per-meter is useful in determining the radiation pattern of a transmitter. The Model 498 is a serviceman's tool, and is made to read signal strength available from a commercial antenna, through commercial lead-in, at the receiver location. As such, it is made to indicate on a relative basis. That is, for any given sensitivity setting and channel tuning the meter will show more deflection for a stronger signal and less for a weaker signal.

Frequency response in the tuner varies widely through the spectrum of received frequencies, channels 2 through 83. For this reason, the instrument sensitivity must be adjusted at the video carrier frequency of the channel being tested before you can interpret the readings in terms of absolute

microvolts.

To set up the instrument for such uses, apply a signal from a calibrated signal generator to the input terminals of the Model 498. The frequency of this signal should be the video carrier frequency of the channel which you are to test. Tune the Model 498 to receive the signal with a maximum meter deflection according to the instructions in Section II, Operating Instructions.

Then set the sensitivity control of the Model 498 at a position which will cause the meter to read the exact number of microvolts being furnished at the antenna terminals. Leave the sensitivity control at this exact position while you read the number of microvolts from the tested source.

Other factors will also affect the sensitivity of the Model 498. Among these are impedance matching for all high frequency connections and regulation of power supply input voltage. If you are using 117 volts AC for a power input, measure the AC voltage at the time the instrument is calibrated and then provide the same input AC voltage when measurements are taken. If you are using a 6 volt DC power source, use the BATT TEST circuit in the Model 498 to be sure that this voltage remains constant.

## WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.


Simpson ELECTRIC COMPANY

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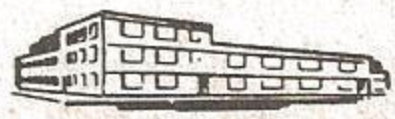

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Quality is the indispensable component
of every Simpson instrument . . . . . .