

KENWOOD

SW-200

SWR/POWER METER

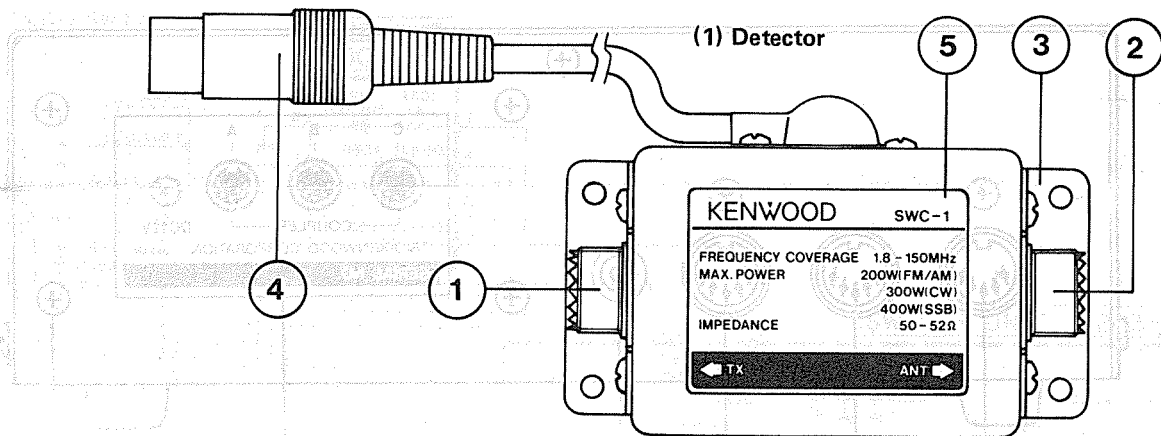
■ Features

The **SW-200** through-type SWR/POWER meter which, in conjunction with a directional coupler, can be used in the 1.8 – 450 MHz frequency range.

- As a through-type meter, it can be connected between the transmitter and antenna so that output can be measured during operation.
- Either a toroidal directional coupler (**SWC-1**) or a strip line directional coupler (**SWC-2**) are used in the companion detectors. Sensitivity is high, the output characteristics are flat and power can be measured without any calibration or calculation. SWR may be measured with as little as 3W of power, in the 1.8 MHz HF band.

■ Component parts and their functions

- 1 TX connector**
A UHF connector accepts transmitter output through a 50Ω coaxial cable.
- 2 ANT connector**
UHF connector for the antenna or dummy load.
- 3 Coupler bracket**
Use this to affix the coupler with screws. The coupler can be mounted on the rear of the display unit.
- 4 Detector cable**
Connect to the coupler input terminal on the display unit rear panel.
- 5 Nameplate**
This indicates the rating of the coupler. Do not attempt to use the coupler at power levels exceeding the specified rating.



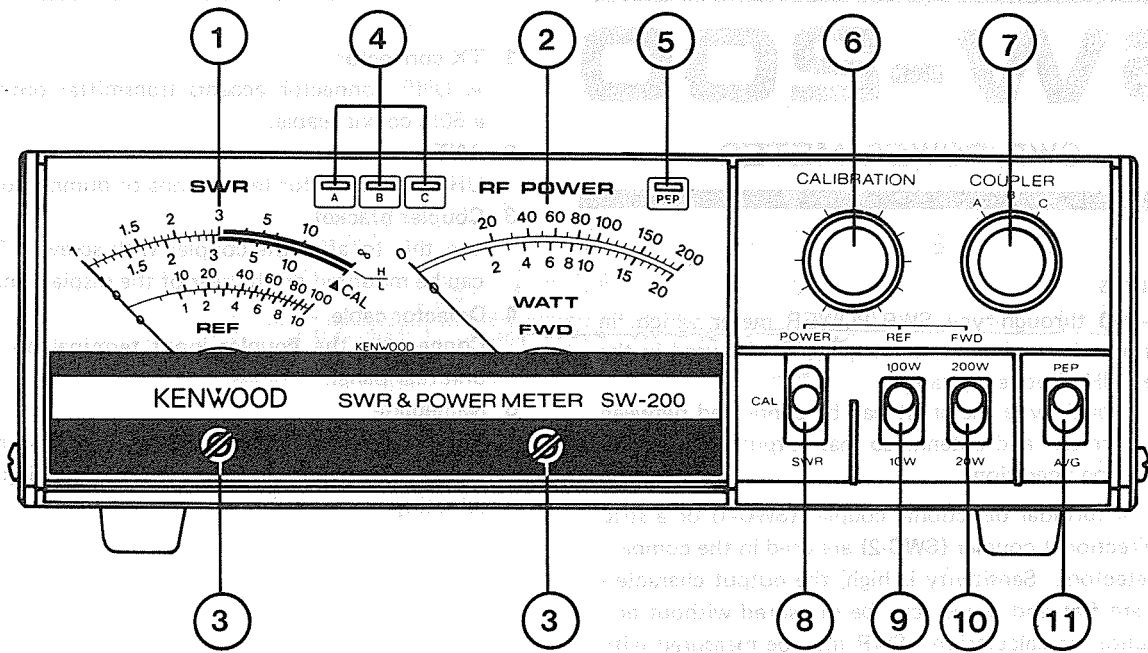
(Figure denotes SWC-1)

- The coupler and display unit can be separated so the display unit can be mounted wherever convenient. Since up to 3 couplers can be connected to the display unit, one display unit can be used to observe a number of transmitters or antenna systems.
- The display unit uses dual meters to simultaneously measure forward and reflected power for fast and easy transmitter and antenna tuning.
- The **SW-200** SWR/POWER meter can measure single side band PEP (Peak Envelope Power).

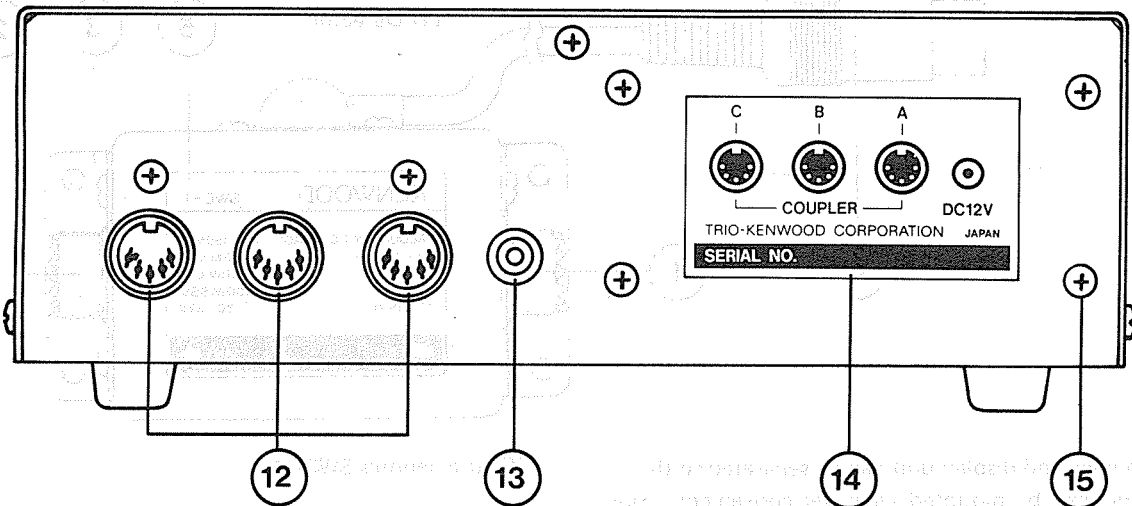
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(2) Display

SW-200 Front View



SW-200 Rear View



- ① **REF/SWR meter**
Displays SWR and the reflected power.
- ② **FWD meter**
Displays the forward power.
- ③ **Meter zero adjustment**
Mechanical adjustment for meter pointer 0.
- ④ **Coupler indicators**
With an RF output power of 5W or more, these indicate which coupler has been selected. In SSB, these "Flicker" with modulation.
- ⑤ **PEP mode indicator**
Lights when the PEP measuring mode is selected.
- ⑥ **Calibration control**
Used to adjust meter calibration in the SWR mode.
- ⑦ **Coupler selector**
Used to select the A, B or C coupler.
- ⑧ **Function selector**
Used to select the power or SWR measuring mode.
- ⑨ **REF power range selector**
Used to select the 10W or 100W reflected power measuring range.
- ⑩ **FWD power range selector**
Used to select the 20W or 200W forward power measuring range.
- ⑪ **Power measurement mode selector**
Used to select AVG or PEP measurement.
- ⑫ **Coupler input connectors**
DIN connectors accept couplers A, B and C.
- ⑬ **DC input jack**
Connect the cable to your station power supply DC for PEP measurement and to light the meters.
- ⑭ **Nameplate**
- ⑮ **Coupler mounting**
The coupler can be mounted with 4 screws.

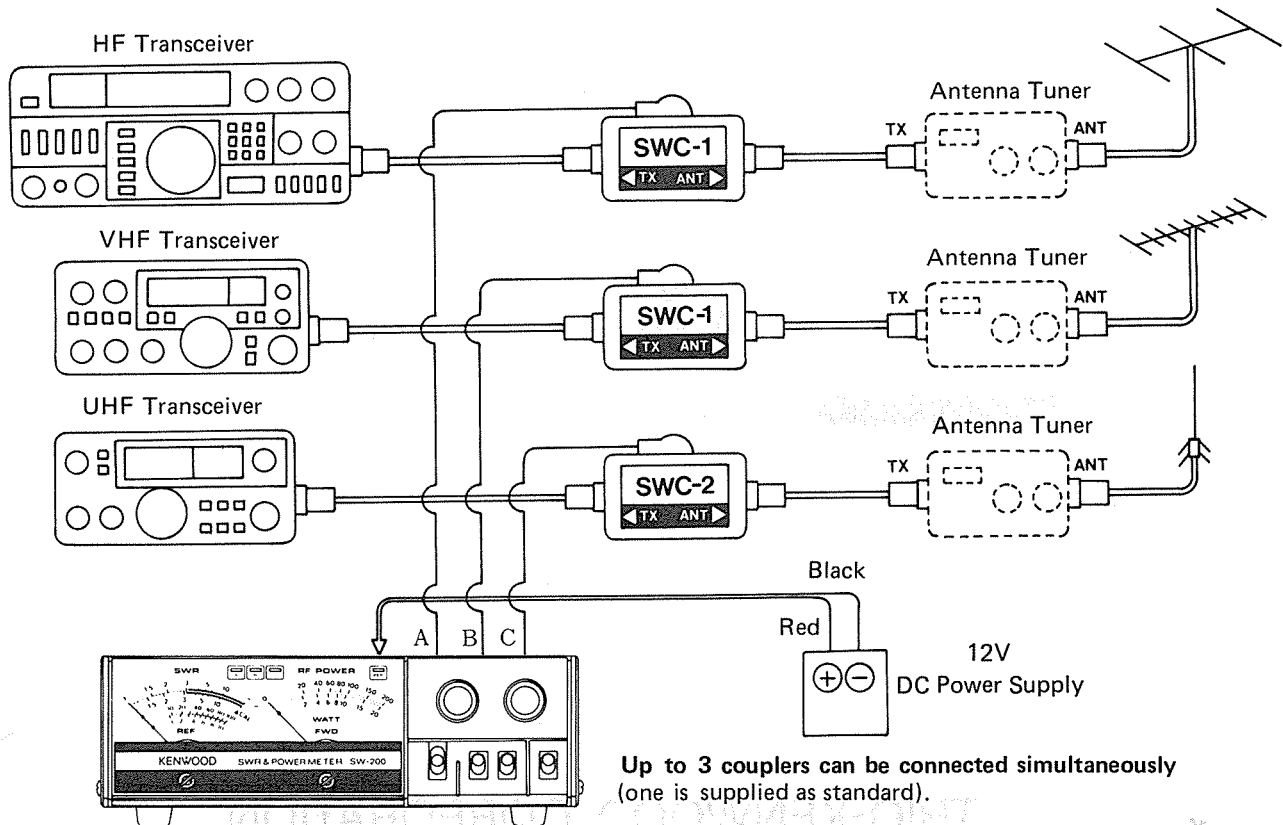
■ Before operation

- 50Ω coaxial cables are required, properly terminated with good quality UHF connectors. If an SWC-2 coupler (140 – 450 MHz) is poorly installed, it will result in measurement errors. Always use heavy coaxial cable.
- For accurate measurement, use good quality non-inductive 50Ω dummy load with a SWR of less than 1.1.

■ Connection

- Connect the transmitter output to the coupler TX connector and the antenna or dummy load to the ANT connector using 50Ω coaxial cable. If an antenna tuner is used, connect it between the antenna and coupler as shown above.
- Select the coupler using the coupler selector. The corresponding indicator lights when RF power is applied.
- To measure PEP or to light the meters, connect the DC input jack to a 12V DC power supply using the red/black cable provided. Connect red to (+) and black to (-). If the cable is connected with reverse polarity, the PEP circuit will not function and the FWD meter will not deflect.

Do not apply a DC voltage greater than 15V



Up to 3 couplers can be connected simultaneously (one is supplied as standard).

■ Operation

- **Remember:** The airwaves are already sufficiently crowded.
 1. Listen on frequency before transmitting.
 2. Use the least possible amount of power from the transceiver consistent with reliable measurement.
 3. Keep dead-carrier transmissions as short as practical. This helps both your equipment, and fellow operators.
 4. Please be courteous when testing.
- Before keying the transmitter, turn the calibration control fully counterclockwise and select the high power range to protect the meter.

(1) Measuring forward (FWD) and reflected (REF) power.

- Set the mode selector to AVG or PEP depending on the transmitter power mode. To measure AM, FM or CW carriers, set the selector to AVG. For SSB operation, select either AVG or PEP, as required.
- Set the function selector to POWER.
- When the transmitter is keyed, both the FWD and REF meters will deflect. Set the power selector to the appropriate range and read the power using the corresponding scale.
- The FWD meter indicates forward power applied from the transmitter to the antenna or dummy load. The REF meter indicates the power reflected from the load. Both meters function simultaneously.
- When adjusting an antenna or antenna tuner, obtain a minimum REF reading.

(2) Measuring nominal forward power

- The nominal forward power is the difference between the forward and reflected power and is equal to the power radiated by the antenna.
Example: When the FWD reading is 100W and the REF reading is 4W, the nominal forward power is 96W.

(3) Measuring PEP power

- Place the mode selector to PEP and the PEP indicator will light. Measure the PEP output in SSB operation just as you would measure AVG power.
- SWR/POWER in FM and AM measures the power of the unmodulated carrier. In SSB there is no carrier and the power output changes with the voice signal. Normally, the peak power of a modulated signal is measured as PEP (Peak Envelope Power).
- The average power meter for FM and AM is calibrated using a CW carrier. In the SW-200, an operational amplifier detects the voice signal peak power during transmission, and this is displayed as the PEP.

- The diagram below shows the carrier power, average power and PEP for each power waveform. In SSB operation, the peak voice signal during communication is the PEP.

RF power with each modulation type

| | Carrier power | Average power | PEP |
|---------------------------------|---------------|---------------|-----|
| AM/FM carrier | 100 | 100 | 100 |
| AM single tone, 100% modulation | 100 | 150 | 400 |
| SSB single tone modulation | — | 100 | 100 |
| SSB, 2 tone modulation | — | 50 | 100 |
| SSB, voice signal modulation | — | 20 ~ 25 | 100 |

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(4) Measuring SWR (standing wave ratio) power

- Set the function selector to CAL.
- Key the transmitter and adjust the calibration control clockwise to bring the SWR meter pointer to the ▲ CAL mark (full scale).
- Place the function selector to SWR and read the SWR power.
- Because detector diode output is non-linear, the actual SWR power is slightly different from the measured value. However, the value is close at low power. To eliminate this error, the SWR meter has dual scales; L for 10W and H for 100W. At low power (up to 20W), use the L scale. At high power (more than 50W), use the H scale.
- The SWR power can be calculated from the FWD power (Pf) and REF power (Pr) using the formula:

$$SWR = \frac{\sqrt{P_f} + \sqrt{P_r}}{\sqrt{P_f} - \sqrt{P_r}}$$

Example
 $P_f = 100W$
 $P_r = 4W$

$$SWR = \frac{\sqrt{100} + \sqrt{4}}{\sqrt{100} - \sqrt{4}} = \frac{10 + 2}{10 - 2} = \frac{12}{8} = 1.5$$

| SWR | P_r / P_f (%) |
|-----|-----------------|
| 1.0 | 0 |
| 1.2 | 0.8 |
| 1.5 | 4.0 |
| 2.0 | 11.1 |
| 2.5 | 18.4 |
| 3.0 | 25.0 |

- The FWD meter does not function in the SWR measuring mode.

Notes

- Fully tighten the coaxial connectors and do not disconnect them during transmission.
- If used with extremely high SWR power, high voltage will be applied to the unit and can result in damage.
- The meters are highly sensitive; protect them from mechanical shock.
- To transport or store the unit, place the function selector to CAL or SWR and the calibration control to 0.
- This unit left the factory calibrated. Do not remove the case or otherwise touch the internal components, as this can result in measuring error or other malfunctions.

Specifications

(1) Coupler section

| Item | SWC-1 (attached to SW-200A) | SWC-2 (attached to SW-200B) |
|-----------------------------|--|---|
| Impedance | 50 - 52Ω | 50 - 52Ω |
| Frequency range | 1.8 - 150 MHz | 140 - 450 MHz |
| Feed through power overload | 200W (FM/AM) 300W (CW) 400W (PEP) | 100W (FM/AM) 150W (CW) 200W (PEP) |
| Insertion loss | Less than 0.3 dB | Less than 0.5 dB |
| Residual SWR | Within 1.2 | Within 1.2 |
| Connector | M type (SO-239) | M type (SO-239) |
| Detector cable length | Approx. 1.5m | Approx. 1.5m |
| Dimensions | 68(W) x 32(H) x 50(D) mm () including projecting part | |
| Weight | (93) (33) (62) 260g. | 260g. |

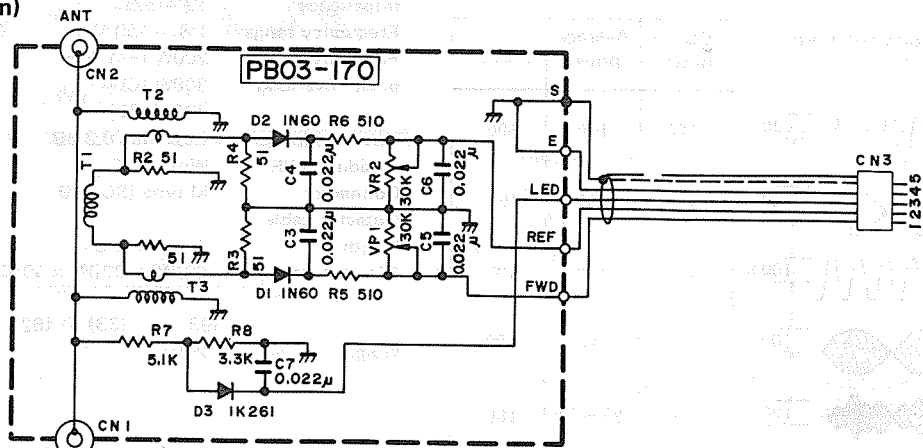
(2) Display section

| | |
|-----------------------------------|---|
| Frequency range | 1.8 - 450 MHz |
| Power measurement range | Progressive wave power (FWD) 0 - 20W, 200W 2 ranges Reflected wave power (REF) 0 - 10W, 100W 2 ranges |
| Power measurement accuracy | ±10% (Full scale) |
| Power measurement mode | AVG, PEP 2 modes |
| SWR measurement range | 1 : 1 - 1 : 10 |
| Minimum power for SWR measurement | Approx. 3W |
| Coupler connection and display | <ul style="list-style-type: none"> Arbitrary coupler SWC-1, SWC-2 3 units connectable 3-couplers switchable and display |
| Power consumption | 11V - 15V DC MAX 100mA (PEP measurement and meter lamp only) |
| Dimensions | 196(W) x 63(H) x 78(D) mm () including projecting part |
| Weight | (200) (70) (92) 650g. |
| Accessories | Red/black DC power cable, 1m length |

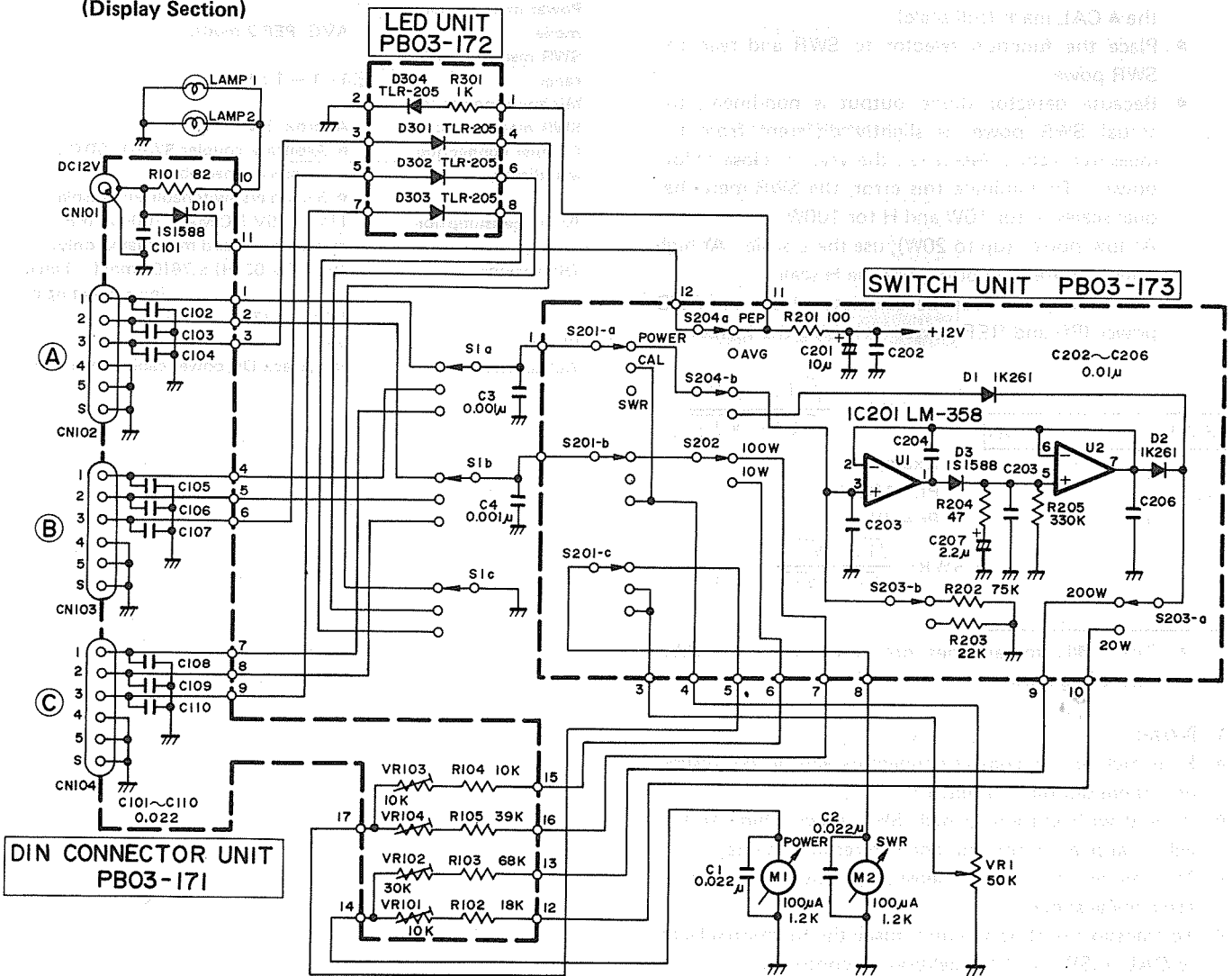
Schematic Diagram

(Coupler Section)

● SWC-1

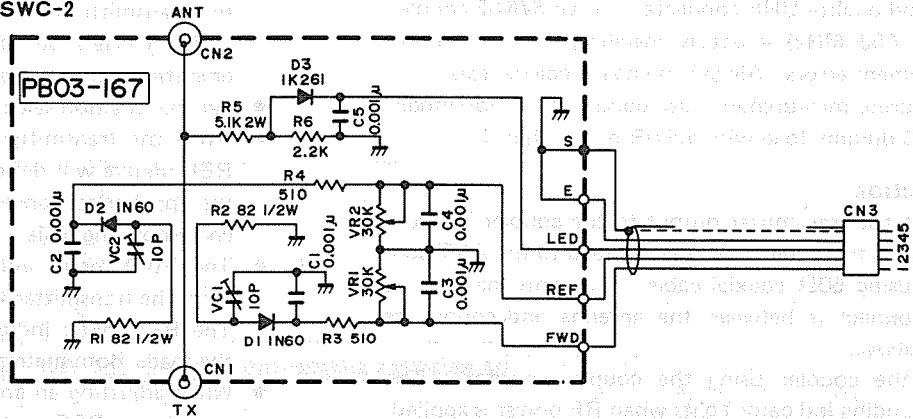


(Display Section)



(Coupler Section)

● SWC-2



Specifications are subject to change without notice.

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