INSTRUCTION MANUAL
FOR
MODEL NRD-515 ALL WAVE RECEIVER

JRC

Japan Radio Co., Ltd.

JRC's many years of technical achievement and field-proven experience have made it possible to develop the highest-class all-wave receiver, designed with the latest solid-state devices and digital circuits.

Before operating the receiver, you should read this technical instruction manual. This receiver has been manufactured under rigorous quality control in our factory, however, if there is something wrong with the receiver, contact the sales store or JRC Sales and Service Office at once.

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SECTION 1

SPECIFICATIONS

1.1 Frequency Range for Reception
100 kHz to 30 MHz

1.2 Mode of Operation
AM, SSB (USB and LSB), CW and RTTY

1.3 Receiving System
Double superheterodyne,
First IF: 70.455 MHz, Second IF: 455 kHz.

1.4 Sensitivity, S/N = 10 dB

FREQUENCY \ MODE	SSB & CW	AM
1.6 to 30 MHz	Less than 0.5 μV	Less than 2 μV
100 to 1600 kHz	Less than 2 μV	Less than 6 μV

1.5 Selectivity

BAND \ BAND-WIDTH	6 dB down	60 dB down
6 kHz	More than 4 kHz	Less than 10 kHz
2.4 kHz	More than 2 kHz	Less than 6 kHz
0.6 kHz*	More than 0.5 kHz	Less than 3 kHz
AUX*	More than 0.26 kHz	Less than 2 kHz

NOTE: Bands marked "*" are provided by optional filters: CFL-260 filter incorporated for the 0.6 kHz-band and CFL-230 filter for the AUX.
In the AUX position, a crystal filter having a desired bandwidth may be incorporated.

1.6 Image Suppression
More than 70 dB

1.7 IF Interference Suppression
More than 70 dB

1.8 Frequency Stability
Less than 50 Hz per hour, after warming up.

1.9 Antenna Input Impedance
50 to 75 ohms, unbalanced.

1.10 AF Output Power
Speaker output: 1 W or higher, 4 ohms (distortion less than 10%)

Line and record output: 1 mW or higher, 600 ohms, unbalanced (distortion less than 3%)

Headphone output impedance: 4 to 8 ohms.

1.11 IF Output
Level: 50 mV or higher for antenna input voltage of 3 μV; 455 kHz, 75 ohms, unbalanced.

1.12 VFO Output
Level: 0.2 V or higher; 75 ohms, 2.455 to 3.4549 MHz

1.13 VFO Input
Level: 0.2 V or higher; 75 ohms, 2.455 to 3.4549 MHz

1.14 Antenna Input Attenuator
Attenuation: 10 dB, 20 dB, approx.

1.15 AGC Characteristic
AF output variation less than 10 dB against antenna input change of 3 μV to 100 mV.

1.16 Passband Tuning (PBT) Range
Variable in excess of ±2 kHz

1.17 ΔF Range
Variable in excess of ±2 kHz

1.18 Frequency Memory
Up to 96 spot frequencies using optional memory unit (separate unit).

1.19 Power Requirements
100/117/220/240 V AC, 50/60 Hz;
Power consumption 50 VA, approx.

1.20 Dimensions (excl. projections)
340(width) x 140(height) x 300(depth)mm

1.21 Weight
7.5 kg, approx.

NOTE: The specifications and used semiconductor elements may be subject to change for improvement of performance.

SECTION 2
FEATURES

2.1 PLL Digital VFO

The NRD-515 employs a digital VFO system which is a combination of a photo type rotary encoder using light-emitting diodes with a PLL synthesizer controlled by a reference crystal oscillator having an elevated stability, thus assuring a preeminently high stability of frequency and accuracy. The digital VFO has no mechanism for operation nor any backlash, ensuring high reliability without calibration error nor secular variation.

The heart of the synthesizer is housed in an aluminium die-casting case, ensuring high quality.

2.2 Digital Tuning System

Rotating the TUNE dial on the control panel produces pulses for controlling the frequency, which is changed at a rate of 10 kHz per rotation in steps of 100 Hz. This facilitates tuning with the dial. An automatic quick tuning facility with the UP/DOWN switch is provided for rapid frequency setting. In addition, the frequency can be automatically made transition to the next band by turning the dial only.

Therefore, continuous and quick tuning can be done without switching the MHz-selector.

In addition, an electric dial lock function is provided for preventing the operating frequency deviating due to vibration or careless operation.

2.3 Frequency Memory Unit (Option) over 96 Channels

This is a separate memory unit capable of storing the frequencies in 96 channels. Programming and change of the memory contents can be performed very easily by using the switches on the control panel. By designating the channel of the memory unit, the receiving frequency can be set as a memory frequency instantly and an automatic tuning reception can be made.

The memory unit connector on the rear panel of the receiver can also be used for a frequency data input/output line, allowing extended application for control of a microcomputer or peripheral device.

2.4 All-Wave and All-Mode Reception

The receiver can continuously cover an extensive range of 100 kHz to 30 MHz and receive in any of the AM, LSB, USB, CW and RTTY modes. LF/MF bands below 1.6 MHz can be clearly received when a filter/tuning circuit is used. The receiving frequency is indicated down to the digit of 100 Hz based on the synthesizer frequency control information, ensuring high frequency reading accuracy.

The analog sub-dial directly connected to the tuning dial permits reading of 500 Hz, giving convenience in QSY.

2.5 Up-Conversion System in Direct Mixer

A double-superheterodyne in up-conversion system has been employed for converting the frequency of 100 kHz to 30 MHz into the first IF of 70.455 MHz.
A direct mixer consisting of a high-performance balanced mixer circuit is incorporated in the front end input circuit, and a crystal filter is inserted in the first IF stage. Thus, the multi-signal characteristic and proximity interference characteristic have been improved.

2.6 Passband Tuning

The IF filter is switched in four steps for the bands: 6 kHz, 2.4 kHz, 0.6 kHz (option) and AUX (option), independently of mode switching. A 0.3 kHz-filter or other filter having a desired bandwidth may be incorporated into the AUX position.

A passband tuning function is provided, which eliminates radio interference with adjacent frequencies in CW and SSB reception. In CW reception a desired tone is heard when BFO is adjusted.

2.7 Electronic Tuning and Electronic Switching

Tuning and switching are performed electronically, no mechanism is employed for them. Simply constructed, it provides a quick response, high reliability and long life.

2.8 Full-Solid-State Circuitry

The latest semiconductor elements, including low-power Schottky TTL IC's and CMOS IC's, are used for all the circuits of this equipment. Less power is consumed because of these IC's.

2.9 Full-Modular Structure with Little Wiring

A modular structure combined with plug-in type PC boards make servicing easy. The PC board is made of a glass-epoxy resin, and automatic soldering is used for it. Mother board are used for connections, reduce wiring, equalize quality, and improve reliability.

2.10 Excellent Controllability and Compact and Robust Structure

Providing an excellent controllability, including the tuning dial with good touch and reasonable controls layout, in addition to a panel design, providing a good appearance.

The front panel has a die-casting frame, and the chassis is made of aluminium, thus making for a compact, light-weight, robust structure.

2.11 Full Accessory Circuits

These include a passband tuning circuit, noise blanker circuit, ΔF (RIT) circuit, two-step switching input attenuator circuit, AGC three-step switching circuit, recording output, line output, headphone output, AC voltage switchover etc.

2.12 Practicable Combined with NSD-505/NSD-515 Transmitter

Provided with all the functions necessary for operating an amateur radio station. It is practicable to combine with the NSD-505/NSD-515.

2.13 Various Options

Various options are available, including memory unit, CW 600 Hz-filters, CW 300 Hz-filter, and speaker unit.

SECTION 3

PRECAUTIONS FOR OPERATIONS

3.1 Accessories

The Model NRD-515 includes the following accessories. Check them.

(1) Instruction manual 1
(2) M-type coaxial plug (J1, for antenna connection) 1
(3) RCA type pin plug (J2, for SP, RECORD, LINE OUT and IF OUT connection) 4
(4) Square plug (J3, for TX connection) 1
(5) Single-head plug (J7, for PHONES connection) 1
(6) Pilot lamp (12 V, 0.16 V) 1
(7) Fuse (1 A) 1
(8) AC power cord 1

3.2 Installation Place

Select a well ventilated place for installation; avoiding places exposed to direct sunshine, hot air from a heater, dust, vibration, or moisture, in order to maintain the proper performance and assure long use. Leave as much space as possible around the equipment.

3.3 Installation Method

Prior to operation, the following preparations are necessary.

NOTE: In case of the operation combined with the transmitter, refer to Paragraphs 5.5 and 5.6.

3.3.1 Connecting the Antenna

Fit the furnished M-type coaxial plug to a 50 to 75 ohms antenna and connect the plug to the ANT jack on the back panel.

If other than a 50 to 75 ohms antenna is to be used, insert an impedance matching unit, such as an antenna coupler.

The antenna dominantly governs the performance of the receiver. Therefore, an antenna having the best possible characteristics should be selected.

3.3.2 Connecting the Earth Line

Connect an earth line to Terminal E on the rear side of the receiver, along the shortest path from the ground, in order to protect the user from electric shock and to prevent the receiver interfering with other equipment.

Use a thick wire for the grounding line, if possible.

NOTE: Never use gas pipes or electrical conduit for the ground.

3.3.3 Connecting the Speaker

Select a dynamic type speaker having a 4 ohms voice coil and connect the speaker to SP jack using the furnished RCA type pin plug. The jack is on the rear side of the receiver. An NVA-515 exclusive speaker is available.

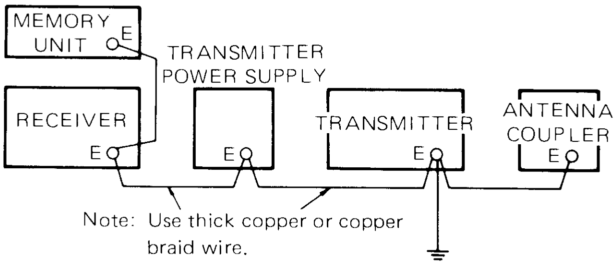


Figure 3-1 Illustrative Connection of Each Line

3.3.4 Connection of Power Line

100, 117, 220 or 240 volts, 50/60 Hz commercially available power line can be used for the power supply.

For converting an available power line voltage, set the line voltage selector to the line voltage to be used.

If a power line having a line voltage other than above is to be used, set the selector to a voltage nearest the line voltage to be used, provided that the difference between the voltage at the selected position and line voltage to be used is less than 10 V. If the voltage difference exceeds 10 V, insert a voltage step-down transformer or variable voltage transformer into the circuit.

Example: Line voltage of 110 V . . . . . set to 117 V
Line voltage of 115 V . . . . . . set to 117 V
Line voltage of 120 V . . . . . . set to 117 V
Line voltage of 230 V . . . . . . set to 220 V

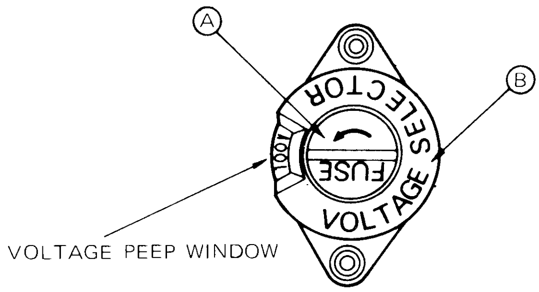


Figure 3-2 Voltage Selector

The voltage selector is combined with the fuse holder, as illustrated in Figure 3-2.

First, unscrew Cap A and then move B to the side. Set B so that the line voltage value appears in the indication window, and insert the piece. Then, screw Cap A into place; the fuse must be inserted together.

Make sure the POWER switch is OFF, connect the furnished power cord to the main unit, and then insert the power cord plug into a power outlet.

3.4 Preparations before Operation

Do the following before switching on the POWER:

(1) When using the headphone, prepare the furnished single-head plug and insert in the PHONES jack on the front panel. Inserting the plug cuts off speaker output.
Select headphone having low impedance.

(2) When recording, insert the furnished RCA type pin plug in the RECORD or LINE OUT jack on the back panel.

(3) When using the IF output (455 kHz), insert the furnished RCA type pin plug in the IF OUT jack on the back panel.

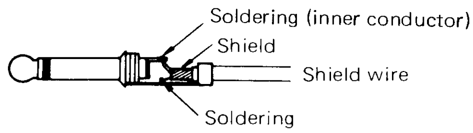


Figure 3-3 Assembling the Single-Head Plug

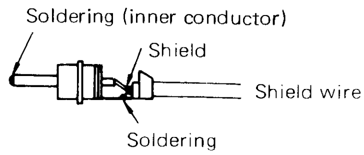


Figure 3-4 Assembling the RCA Plug

3.5 Precautions before Operation

(1) If the MHz-dial is set incorrectly the equipment may malfunction. Set the dial correctly.

(2) Unless absolutely necessary, do not touch semi-fixed resistors, trimmer capacitors, cores of transformers, etc.

(3) This equipment has a large number of semi-conductor elements. Great care should be taken during maintenance and checks not to short them.

(4) When the receiver is operated with a paired transmitter, the receiver's input circuit is sometimes burnt out by transmitting waves induced to the antenna input. Therefore, the induction of transmitting waves to the antenna input must be examined by operating the transmitter before installating the receiver.

(5) Arrester diodes have been inserted in the input end of the antenna in the receiving unit to protect it against an excessively high input power.
If there is a strong signal near the operating frequency, inter- or cross modulation may occur because of the diode's property. Removing the diode will reduce such undesired modulation but leave the possibility of damage in the receiver. The arrester diode may be removed when there is no combined operation or it is assured that no excessively high input is applied to the antenna.
See Figure 3-5 for how to remove the diode.

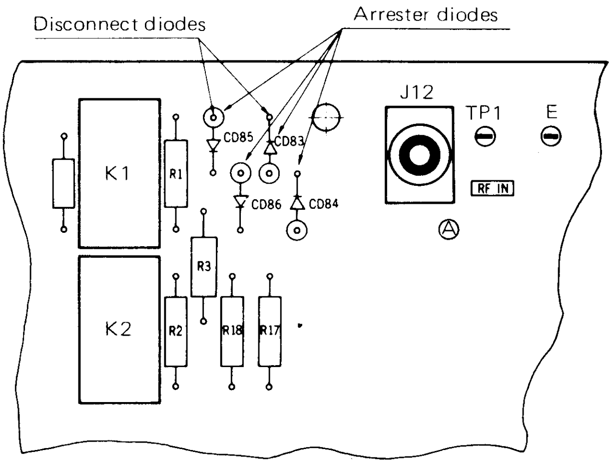


Figure 3-5

SECTION 4

OPERATING CONTROLS

4.1 Front Panel Controls

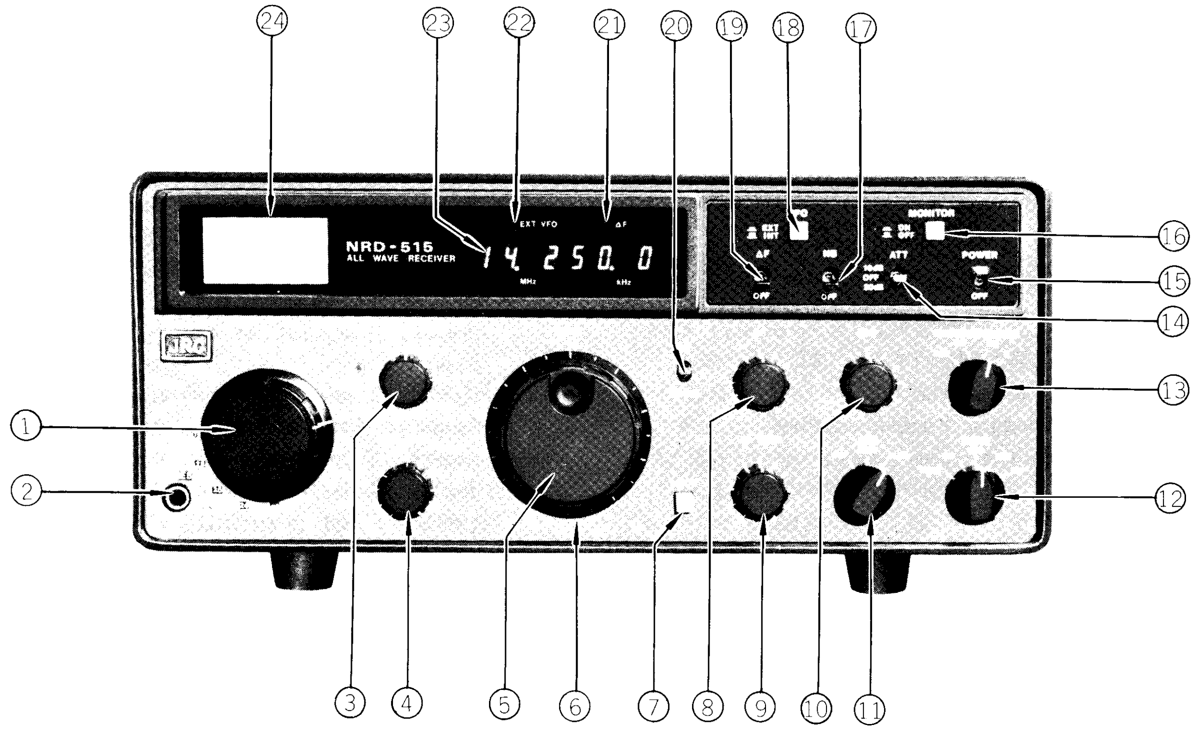


Figure 4-1 Front Panel

(1) MHz control .... For selecting a desired MHz-digit. Full rotation covers the entire frequency range.

(2) PHONES jack .... For connecting the headphone. Inserting, the plug disconnects speaker output.

(3) BFO & BC TUNE control .... For adjusting the beat tone, with the MODE switch set at CW. Clockwise rotation increases the BFO frequency. During MF broadcast reception between 600 and 1599.9 MHz the same control is used for tuning the preselector.

(4) RF GAIN control .... For adjusting the IF gain.

(5) TUNE dial .... For setting the frequency. Full rotation covers 10 kHz, variable in steps of 100 Hz.

(6) Sub-dial scale
Having minimum divisions of 500 Hz.
Full rotation covers 10 kHz.
Available for up-down operation in QSY.

(7) LOCK pushbutton .... For electrically locking the dial.

(8) ΔF control .... Enabled with the ΔF switch set at ΔF. For finely adjusting the frequency.

NOTE: If this control is turned, the frequency display remains unchanged.

In the transceive operation, this control can be used as the RIT. Clockwise rotation increases the frequency.

(9) AF GAIN control .... For adjusting the AF gain

(10) PBT control .... For tuning the passband. This control eliminates the adjacent radio interference in the CW, SSB or RTTY mode.

(11) AGC switch .... For switching on and off the AGC and the time constant.
Position:
- OFF .... Disables the AGC; the gain is controlled manually by the RF GAIN control.
- FAST ... For short time constant. Mainly used for reception in the AM or CW mode.
- SLOW... For long time constant. Mainly used in the SSB mode.

(12) MODE switch
For selecting the reception mode.

Position:

PTTY ... For receiving with a radio teletype.
CW .... For telegraph reception
USB ..... For upper sideband reception
LSB ..... For lower sideband reception
AM .... For AM reception

(13) BANDWIDTH switch .... For switching the bandwidth of the IF filter. Both 6 kHz- and 2.4 kHz-filters have been incorporated, while the 0.6 kHz- and AUX filters are optional.
The CFL-260 filter can be incorporated in the position of 0.6 kHz and the CFL-230 in the position of AUX; both are optional.

(14) ATT switch .... For switching on and off the 10 dB and 20 dB attenuators inserted into the antenna input circuit.
10 dB/20 dB position .... when a signal is subject to powerful radio interference.
OFF position .... in normal condition.

(15) POWER switch .... For switching on and off the power supply.

(16) MONITOR switch .... For monitoring the RF signal transmitted from the self station when operating together with the transmitter.

(17) NB switch .... For switching on and off the noise blanker. Set at ON when a pulsive noise produced from automobiles or the like is incoming at a high level.

(18) VFO switch .... For selecting the alternative of the internal or external VFO operating in the receiver, operating with the transmitter.
Positions:
INT ...... Internal VFO
EXT ..... External VFO
If the receiver operates without the transmitter, set the switch at INT.

(19) ΔF switch .... For switching the ΔF circuit on and off.
Refer to Number (8).
Set at OFF usually.

(20) UP-DOWN switch .... For automatically and quickly changing the tuning frequency.
Positions:
UP .... Increasing the frequency
DOWN ...... Decreasing the frequency

(21) ΔF indicator .... Turns to illuminate when the ΔF switch is set at ΔF.

(22) EXT VFO indicator .... Turns to illuminate when the VFO switch is set at EXT.

(23) Receiving frequency display .... For indicating a frequency when receiving in the minimum unit of 100 Hz, on the light emitting diodes indicator. In the USB and LSB modes, the indication represents the suppressed carrier frequency.

(24) S meter
For indicating the input intensity of a received signal. The meter is calibrated up to the 9th division in the S unit, with divisions of about 20 dB-steps, above the 9th division.
Set the RF GAIN knob to maximum and the AGC switch to "FAST" or "SLOW".

4.2 Rear Panel

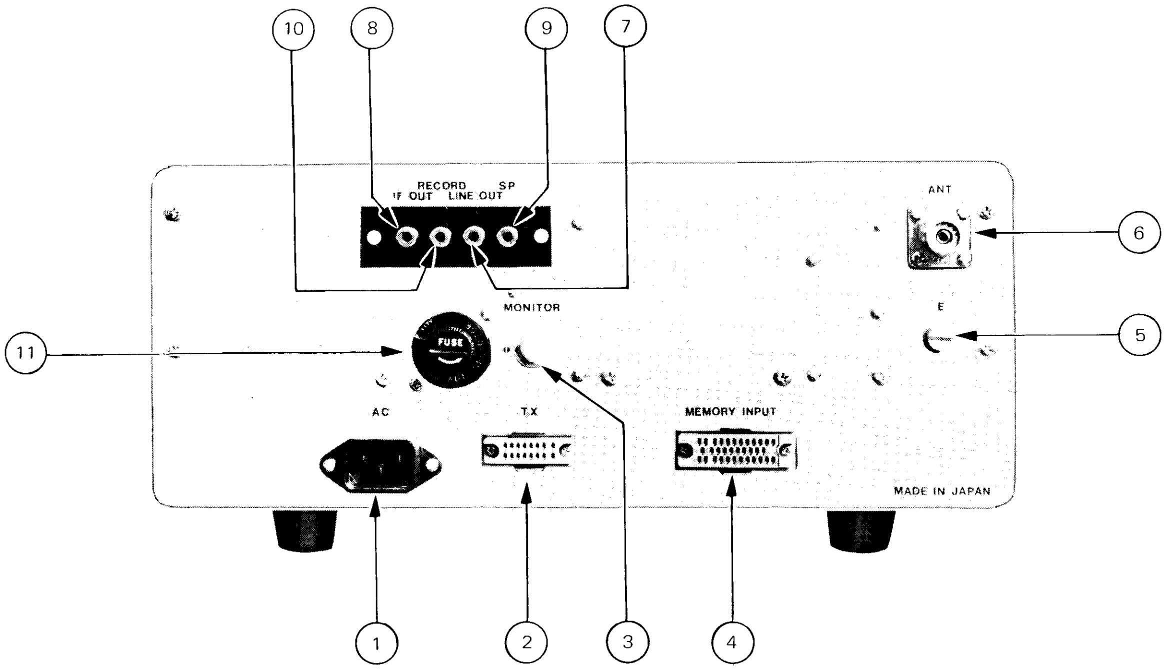


Figure 4-2 Rear Panel of Receiver

(1) AC connector .... For connecting the power cord.

NOTE: Read Paragraph 3.3.4 and then insert the plug into a power outlet.

(2) TX connector .... For use together with the transmitter.
The VFO output, external VFO input, MUTE line, SIDE TONE input, AF output for ANTI TRIP, VFO CONT line and the MHz-digit control line of the frequency, are connected to this connector.

(3) MONITOR control .... For adjusting the monitor level when operating together with the transmitter. Enabled for adjustment, only when the MONITOR switch is set at ON.

(4) MEMORY INPUT connector .... For connecting the memory unit.

(5) E terminal .... For connecting the earth line.

(6) ANT connector .... For connecting an antenna of 50 to 75 ohms, unbalanced.

(7) LINE OUT jack .... For connecting the AF output (600 ohms) to be recorded and others. The AF output level can be adjusted with the LINE ADJ control in the receiver unit.

(8) IF OUT jack ... For connecting the IF output of 455 kHz (75 ohms).

(9) SP jack .... For connecting a speaker of 4 ohms.

(10) RECORD jack .... For connecting the AF output (600 ohms) to be recorded.
This output is constant, irrespective of the position of the AF GAIN control, as well as the LINE OUT jack (7). The output level can be adjusted with the LINE ADJ control in the receiver unit.

(11) VOLTAGE SELECTOR switch .... For switching the AC power line voltage.
Combined with the fuse holder.
The voltage can be switched to 100 V, 117 V, 220 V or 240 V AC.
The fuse is a glass tube type of 1 A.

SECTION 5
OPERATIONS

5.1 Reading and Setting the Frequency

The operating frequency can be directly read on the numerical LED display of 6 digits.

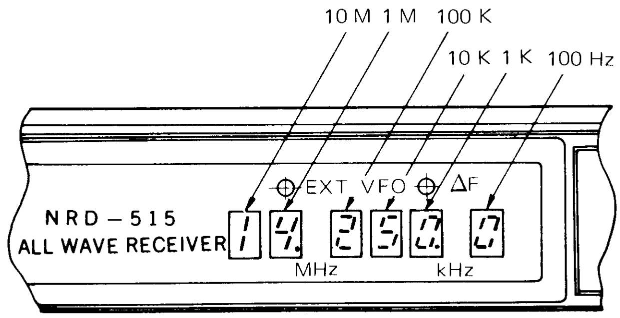


Figure 5-1

In the USB or LSB mode, a suppressed carrier frequency is indicated.

(1) MHz-control .... For setting the MHz-digit.
A band designated with the MHz-control is indicated on the LED display and scale on the panel with 30 equidistant divisions.

NOTE 1: If the tune dial is turned in excess of one megahertz, the LED display of the MHz digit changes to the next megahertz band automatically.
The mechanical position of the MHz control knob, relative to its scale on the panel becomes different from the actual receiving frequency displayed on the LED display.

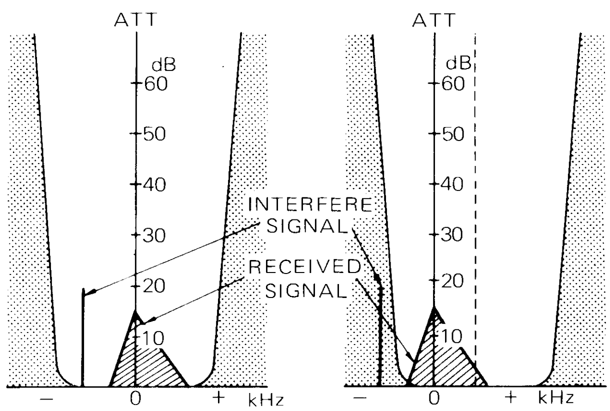
NOTE 2: The manual changing of the MHz digit by the MHz control knob is preference to the automatical changing by the tune dial.

(2) TUNE dial
Several rotations of the TUNE dial cover the entire frequency band continuously in steps of 100 Hz without switching the MHz-control. Full rotation covers 10 kHz.
The automatic quick tuning function with the UP/DOWN switch is provided for rapid tuning.
If a large frequency change over 1 MHz is desired, set the MHz-control at a desired band position.

NOTE 1: If the power switch is set at off and left for a while as is, the last dialed frequency will be erased and the tuning frequency must therefore be set again.
To avoid this, see Paragraph 5.6 (6).

5.2 Operating the Control and Switches

(1) PBT control
In this system the BFO is electrically ganged and tracked with the first local frequency. The desired signal can be moved around in the IF filter passband without changing the received frequency, and at the same time interfering signals can be pushed off the edge of the passband. In SSB mode, it may also be used for changing the tone of speech signal suited for hearing.
Usually, this control is used for CW, SSB and RTTY reception.
During AM reception, this control is disabled, but can be used for removing beat interference of a desired AM signal with an adjacent signal, as follows:
Change the MODE switch to the USB or LSB position, then adjust the ΔF control for a zero-beat with the carrier of the desired signal, then adjust the PBT control to remove the radio interference.



PBT control set at mid position | With PBT control turned clockwise from mid position

Figure 5-2 PBT Operation Illustration

Figure 5-2 illustrates an example for relatively eliminating an interfering signal until going away from the passband of the filter, as the PBT control is rotated clockwise.

The PBT control functions as follows:

PBT CONTROL	RECEIVED SIGNAL FREQUENCY
Clockwise rotation	Shifting to lower from center
Mid position	Center frequency
Counterclock-wise rotation	Shifting to higher from center

NOTE: Return the PBT control to the mid position when the frequency for reception or operation mode is changed, or when this control is not used.

(2) NB switch
When the equipment is used in the CW, SSB, or AM mode reception in a pulsive-noisy environment, this switch is effective for removing the offensive noise.

NOTE: The NB LEVEL adjuster is located on the receiver unit. It can be found if the upper cover is removed from the case in accordance with the description in Paragraph 7.1.
This adjuster is for setting the threshold level for starting the noise blanker circuit in accordance with the noise level.

NOTE: Do not touch the NB LEVEL adjuster, unless absolutely necessary, since it has been set at the standard level.
If it is set at a wrong level, the reception signal may be distorted.

(3) ATT switch
Used when an incoming signal being received is subject to powerful radio interference or an excessively high-power signal is received to cause distortion.
In accordance with the receiving condition, set this switch at the 10 dB- or 20 dB-position for best reception.
It is usually set at OFF.

(4) ΔF switch and ΔF control
The ΔF control is enabled, only when the ΔF switch is set at the ΔF position.
This control is used as:
a. a clarifier for SSB reception,
b. a fine adjuster for CW, RTTY and preset reception,
c. RIT (receiver incremental tuning) when operating together with the transmitter.

NOTE: So long as the equipment is in the condition of transmitting, the ΔF circuit is cut off, i.e., the RIT is off, even if the ΔF switch is set at the ΔF position. As a result, the ΔF control is not effective.

(5) LOCK pushbutton
For electrically locking the tune dial. Pressing this pushbutton causes the TUNE dial to rotate. However, once tuned the frequency is held unchanged.
This pushbutton is used for:
a. preventing a set frequency from shifting due to vibration or mis-operation
b. calibrating the sub-dial scale to a frequency displayed on the LED display.

(6) VFO switch
For use when operating together with the transmitter. Refer to Paragraph 5.5.
When the receiver is used on its own, set this switch at the INT position.

(7) MONITOR switch
For monitoring the RF signal transmitted from the self station when operating together with the transmitter. See Paragraph 5.5
When the receiver is used independently, this switch does nothing.

(8) BFO & BC TUNE control
CW reception mode:
For adjusting the beat tone while listening. Clockwise rotation from the mid position increases the frequency of BFO and vice versa.
Medium-wave broadcast (BC) reception (600 to 1599.9 kHz):
Used as a pre-selector tuning control and is used in conjunction with the S meter to peak the received signal. If a desired broadcast signal is being subject to radio interference, use this control together with the ATT switch for better suppression of the radio interference.

This BFO & BC TUNE control is available as follows:

FREQUENCY	AM MODE	CW MODE
600 to 1599.9 kHz	BC TUNE	BC TUNE and variable BFO
Other frequencies than 600 to 1599.9 kHz	Inoperative	Variable BFO

NOTE: When receiving in the CW mode in the BC range of 600 to 1599.9 kHz, this control acts as a BFO, doubling as a BC TUNE control.

(9) Sub-dial scale
Calibrated into 20 equidistant scale divisions, each of 500 Hz; full rotation covers 10 kHz.
Use as follows:
a. Set the TUNE dial for a value of 0 or 5 at the 100 Hz-digit on the LED display.
b. Press the LOCK pushbutton.
c. Then, set the TUNE dial for a desired position of the sub-dial scale.
This scale can be conveniently used for changing the frequency several kilohertz, the UP and

DOWN operation, for QSY etc.

(10) Others

When the frequency for reception is changed around specific frequencies of 600 kHz, 1600 kHz, 3 MHz, 5 MHz, 9 MHz, and 17 MHz, a click may be heard. This is, however, not a fault.

5.3 Operation for Reception

In the usual case, set the controls as follows:

LOCK button . . . . . Non lock
ATT switch . . . . OFF
MONITOR switch . . . OFF
NB switch . . . . OFF
VFO switch . . . . INT
ΔF switch . . . . OFF
PBT control . . . . Mid position
and then
POWER switch . . . . . ON

Reception is done as follows:

5.3.1 SSB Reception

Control settings:

(1) MODE switch . . . . USB or LSB
(2) BANDWIDTH switch . . . . 2.4 kHz
(3) AGC switch . . . . FAST or SLOW
(4) RF GAIN control . . . . Full clockwise
(5) MHz-control, TUNE dial and UP/DOWN switch . . . . For a desired frequency
(6) AF GAIN control . . . For a desired sound level
(7) TUNE dial or ΔF control with ΔF switch set at ΔF . . . . . For good articulation, if necessary.

NOTE: Amateur radio communication, in general, uses the LSB in the 3.5/7 MHz-band and USB in the 14/21/28 MHz-band in the SSB mode.

5.3.2 CW Reception

Control settings:

(1) MODE switch . . . . CW
(2) BANDWIDTH switch . . . . 2.4 kHz
(3) AGC switch . . . . OFF or FAST
(4) BFO & BC TUNE . . . . . . About one division shifted from mid position in either direction
(5) RF GAIN control . . . For a desired noise level
(6) MHz-control, TUNE dial and UP/DOWN switch . . . . For a desired frequency
(7) AF GAIN control . . . For a desired sound level
(8) Finely adjust the BFO & BC TUNE knob for a suitable tone for listening.
(9) If the optional filter is incorporated, turn the BANDWIDTH switch to the 0.6 kHz or AUX position.

If this switching causes a received sound to be lowered or heard no more, then finely adjust the TUNE dial or ΔF control for maximum sensitivity.

NOTE: If the optional filters are not incorporated into the 0.6 kHz and AUX positions, reception is not possible, of course, when the BANDWIDTH switch is set at either of these positions.

5.3.3 AM Reception

Control settings:

(1) MODE switch . . . . AM
(2) BANDWIDTH switch . . . . 6 kHz
(3) AGC switch . . . . FAST or SLOW
(4) RF GAIN control . . . . Full clockwise
(5) MHz-control, TUNE dial and UP/DOWN switch . . . . For a desired frequency
(6) AF GAIN control . . . For a desired sound level
(7) BANDWIDTH switch . . . . . 2.4 kHz, if much radio interference.

NOTE: In this position, the sound quality may be degraded, because of the narrow passband.

5.3.4 RTTY Reception

Control settings:

(1) MODE switch . . . . RTTY
(2) BANDWIDTH switch . . . . 2.4 kHz
(3) AGC switch . . . . FAST or SLOW
(4) NB switch . . . . OFF
(5) RF GAIN control . . . . Full clockwise
(6) MHz-control, TUNE dial and UP/DOWN switch . . . . For a desired frequency
(7) AF GAIN control . . . For a desired sound level
(8) BANDWIDTH switch . . . . Any bandwidth in accordance with the shift width of an FS signal.

NOTE: For the 0.6 kHz and AUX positions, separate optional filters are necessary.

(9) FS converter . . . . Connected to
a. LINE OUT jack (600 ohms, located on the rear panel) for AF operation
b. IF OUT jack (75 ohms) for IF operation of 455 kHz.

NOTE: In the AF operation, the BFO is predetermined at 452.79 kHz. This oscillator frequency can be changed by adjusting the RTTY semi-fixed resistor RV7 located on the synthesizer unit.

For IF operation, take care of the IF OUT, which provides an output with marks and spaces inverse to the ANT input of the receiver.

5.4 Preset Reception with the Optional NDH-518 Memory Unit.

The optional memory unit can be connected to this equipment to easily program up to 96 frequencies for preset reception. Once they are programmed, automatic tune preset reception can be performed only by selecting desired channels, thus providing higher degree operation.

For using the memory unit, refer to the NDH-518

Memory Unit Instruction Manual.

(1) Manual Receiving
Set the PRESET/MANUAL switch of the memory unit at MANUAL. Then, set the Receiver controls, the same as denoted in Paragraph 5.3.

(2) Preset Receiving
Set the PRESET/MANUAL switch of the memory unit at PRESET.
Then, set the receiver controls, the same as denoted in Paragraph 5.3, wherein both MHz-control and TUNE dial of the receiver do not need adjusting.
If the frequency is wanted to be finely adjusted, use the ΔF control having a variable range in excess of ±2 kHz, approx.

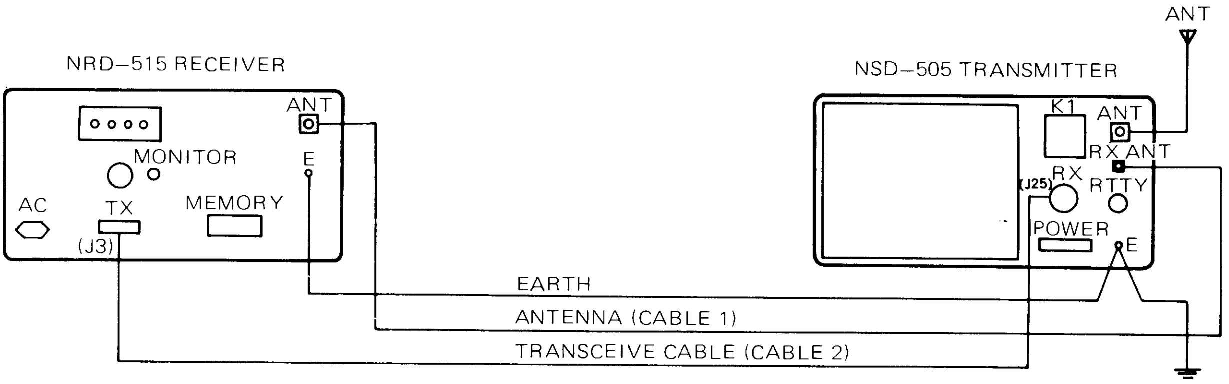
5.5 Operation in Combination with JRC Transmitter

Operation can be made in combination with the Model NSD-505/NSD-515 transmitter.

Interconnect between the receiver and NSD-505 transmitter as follows: For operation with NSD-515 transmitter, refer to the NSD-515 Instruction Manual.

5.5.1 Interconnection

Connect as illustrated in Figure 5-3.



Cable 2 Connection

	J3 Pin No.	Connection to	Line No.	Connection to	J25 Pin No.
NOTE 1	14	VFO OUT	a	VFO EXT IN	2
NOTE 1	13	EXT VFO IN	b	VFO OUT	4
	11	SIDE TONE	c	SIDE TONE	6
	9	ANTI TRIP	d	ANTI TRIP	7
	10	MUTE	e	XMIT	8
	12	EARTH	f	EARTH	1
	Receiver side			Transmitter side	

NOTE 1: No need to connect a transmitter having VFO providing a frequency other than 2.455 to 3.455 MHz is used.

Figure 5-3 Interconnection between Receiver and Transmitter

Connect the TX – RX connectors located on the rear panel, as follows:

(1) Line No. a (VFO OUT)
For feeding the VFO output of the receiver to the transmitter.
Used for the transceive and cross operations.

(2) Line No. b (EXT VFO IN)
For feeding the VFO output from the transmitter to the receiver.
Used for the same operations as denoted in (1).

(3) Line No. c (SIDE TONE)
For feeding the side tone from the transmitter to the receiver in the CW operation.
Used for keying monitor.
In the keying monitor mode, set the MONITOR switch located on the receiver's panel, at the OFF position.

(4) Line No. d (ANTI TRIP)
For sending the AF output from the receiver to the transmitter's VOX circuit.
Used for preventing a received tone of the speaker from entering the microphone during VOX operation. If a tone enters the equipment could go to the transmit mode.

(5) Line No. e (MUTE)
For muting the receiver during transmission:

Pin #10 grounded ..... Receive mode
opened .... Muting

Mute level setting:

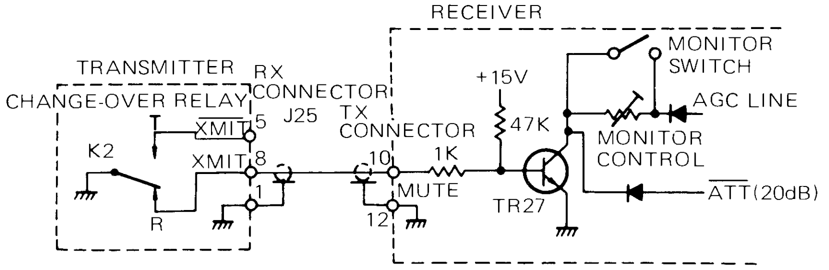
Set the MONITOR switch located on the receiver's panel at ON.

Then, adjust the MONITOR control located on the rear panel for a desired mute level.

(6) In other than the transceive or cross operation, Lines a and b do not need wiring.

How to assemble cables 1 and 2 for connection is shown in Figures 5-5 and 5-6.

NOTE: When operating with the transmitter, remove the upper cover of the case and take out the short plug (P35) from J35 located in the receiver unit.
Unless the short plug is taken out, the receiver cannot be muted when transmitting.



When the base of TR27 is released from earth during transmission, TR27 turns on to cause AGC line to be grounded, resulting in receiver muting.

Figure 5-4 Connection of Mute Circuit

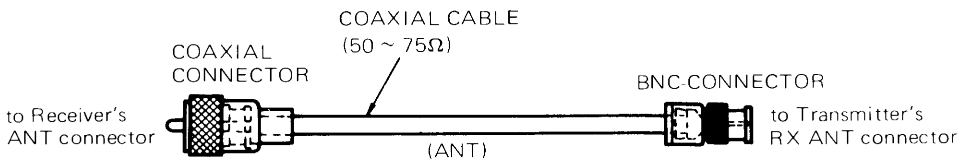
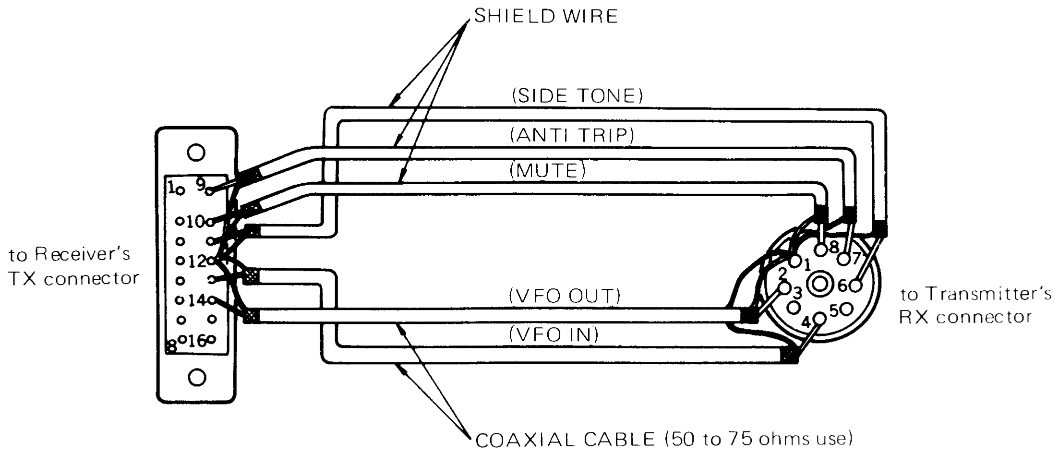


Figure 5-5 Assembling the Cable 1 with Connector



NOTE
1. Connect as short a cable as possible.
2. Do not forget to fix the cover of each connector.
3. Cover the bundle of lines with a shield in case they one subject to induction from the transmitter.

Figure 5-6 Assembling Cable 2 with Connector

5.5.2 Operating Procedure

Table 5-1 (NOTE. 1)

MEMORY UNIT MANUAL/PRESET SW.	RX VFO SW.	TX VFO SW.	RECEIV. FREQ. SETTING	RX DISPLAY	TRANSMIT. FREQ. SETTING	TX DISPLAY	OPERATING MODE
MANUAL	INT	INT	RX VFO	RECEIV. FREQ.	TX VFO	TRANSMIT. FREQ.	Separate
	INT	EXT	RX VFO	RECEIV. and TRANSMIT. FREQ.	RX VFO	RECEIV. and TRANSMIT. FREQ.	Transceive with RX VFO
	EXT	INT	TX VFO	— (NOTE.2)	TX VFO	RECEIV. and TRANSMIT. FREQ.	Transceive with TX VFO
	EXT	EXT	TX VFO	TRANSMIT FREQ.	RX VFO	TRANSMIT. FREQ.	Cross (NOTE.3)
PRESET	INT	INT	MEMORY CHANNEL	RECEIV. FREQ.	TX VFO	TRANSMIT. FREQ.	Separate with fixed frequency for reception
	INT	EXT	MEMORY	RECEIV. and TRANSMIT FREQ.	MEMORY CHANNEL	RECEIV. and TRANSMIT. FREQ.	Transceive with RX VFO
	EXT	INT	TX VFO	— (NOTE.2)	TX VFO	RECEIV. and TRANSMIT. FREQ.	Transceive with TX VFO
	EXT	EXT	TX VFO	TRANSMIT. FREQ.	MEMORY CHANNEL	TRANSMIT. FREQ.	Cross with fixed frequency transmission

Table 5-1 NOTE

1. Table 5-1 shows a case where the NDH-518 memory unit (option) is used. When there is no memory unit, refer to only the MANUAL column.
2. The LED display of RX is unchanged at either INT or EXT position of the VFO switch. This means that the display indicates only a frequency of the internal VFO, but a frequency of an external VFO supplied from TX cannot be read on the display.
3. Read the frequency for reception on the TX display, except its MHz-digit, by temporarily turning the VFO switch of TX to the INT position.
4. For setting the frequency at the MHz-digit, use the MHz control each on RX and TX.
   In particular, for a transceive operation with TX VFO in the 1.8 MHz band, use the TUNE dial for setting the frequency up to 1.8 MHz.
5. If the VFO switch on RX is set at EXT, the memory cannot be written to with the VFO frequency fed from TX.
6. When the VFO switch on RX is set at EXT, the ΔF control is disabled, irrespective of the position of the MANUAL/PRESET switch.
   The output of the internal VFO can be finely adjusted with the ΔF control in the reception mode.

(1) Set the VFO switches of receiver RX and transmitter TX, and MANUAL/PRESET switch of the optional memory unit, as shown in Table 5-1. Also set other switches and controls as denoted in Paragraph 5.3.

(2) Monitoring in CW Operation

Since the side tone signal caused in the keying operation is sent to the receiver from the transmitter, it can be directly monitored.

For adjusting the monitor level, MONITOR control RV2 is provided in the VOX unit of the transmitter and SIDE TONE control RV9 in the receiver unit of the receiver; either may be used.

Even if the transmission and reception frequencies are different, the CW can be monitored provided that the MONITOR switch of the receiver is set at OFF.

(3) Monitoring the SSB Operation

For monitoring an RF wave transmitted from the owner station, set the MONITOR switch of the receiver at the ON position and adjust the MONITOR control located on the rear panel.

Clockwise rotation of the MONITOR control increases the monitor level.

It is noted that if the transmission and reception frequencies are different, monitoring cannot be done.

(4) Frequency Setting between Receiver and Transmitter

In the transceive operation, both the transmission and reception frequencies must be equal. For setting them, refer to the Model NSD-505 Transmitter Instruction manual, Paragraph 5.4.2.

NOTE: When connection is made to the receiver's antenna from the other antenna change-over circuit or the like, in other than the way described in Figure 5-3, prevent an excessively high power RF wave induced due to transmission from being applied to the antenna input of the receiver. In particular, when a linear amplifier is used, great care must be taken.

5.6 Other Operations

(1) Operation Combined with Transmitter Having Different VFO Frequency.

The frequency of VFO in the NRD-515 Receiver ranges from 2.455 to 3.455 MHz.

Neither transceive nor cross operation can be done with a transmitter having a different VFO frequency.

When a combined operation is to be performed in a method other than described above, connect in the same way as described in Paragraph 5.5.1, provided that both lines a and b do not need connecting.

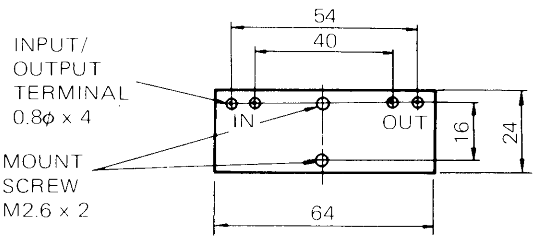
(2) Filters for "AUX" Position of BANDWIDTH

Not only the optional CFL-230 (300 Hz) filter but also other crystal filters having desired bandwidths can be incorporated into the AUX position, if they meet the following requirements.

a. Input and output impedance
. . . . 600 ohms, 60 pF

b. Insertion loss . . . . Less than 6 dB

c. Overall dimensions
. . . . . . 64(W) x 24(D) x 22(H) mm or less



(BOTTOM VIEW)

d. Others . . . . . . Input and output terminals are DC-coupled.

NOTE: If the optional CFL-260 (600 Hz) filter is not provided, a separate PC board (MPPC07961) is necessary for mounting the filter.

(3) Using MEMORY INPUT Connector J4

Connector (jack) J4 located on the rear panel of the receiver provides a frequency data input/output port.

When no memory unit (option) is used, this connector is useful for:

a. controlling the frequency of an external peripheral equipment.

b. controlling the reception frequency by using external equipment such as micro computers.

This connector provides frequency data which occupies six positions: 100 Hz-digit through 10 MHz-digit, in the form of a 22-bit BCD code at the TTL level.

The PRESET line on Pin 13 of J4 must be high when the BCD code information is given from the receiver, and low when the receiver is controlled by an external unit.

NOTE: Various digital IC's have been connected to the lines of J4.

Great care must be taken when using.

The output should be limited to one fan-out per TTL IC.

(4) Using the TX Connector J3

Located on the rear panel of the receiver. Pins #2 – #7 provide 6-bit BCD code signals at the TTL level, representative of the frequency information at the 1 MHz- and 10 MHz-digits.

Connector J3 is useful for:

a. interlocking with the MHz-band in the transmitter

b. controllers for antenna couplers and antenna rotors

c. other uses described in Paragraph 5.5.1. Before use, read the NOTE in (3) for operation.

(5) Receiving the FAX Signal

The FAX signal can be received similarly to CW and RTTY waves.

a. FAX Reception in CW Method

In the method described in Paragraph 5.3.2, set

AGC switch . . . . at FAST

BANDWIDTH switch . . . . at 2.4 kHz

BFO & BC TUNE control . . . . . . for a correct white-black signal, or for a clear FAX picture on a recorder.

Other controls . . . . as described in Paragraph 5.3.2.

b. FAX Reception in RTTY Method

Set in the same way as described in Paragraph 5.3.4, but RV7 semi-fixed control for a desired frequency of BFO in accordance with a.

c. Connecting the FAX Unit

Connect the unit to the LINE OUT jack (600 ohms) for AF operation, and the IF OUT jack (75 ohms) for 455 kHz-IF operation. Both jacks are located on the rear panel.

NOTE: The IF output connector provides a white-black signal inverse to the antenna input.

(In general, the center frequency of the amateur FAX unit is 1700 Hz in the AF operation. Accordingly, the BFO must be set at 456.7 kHz.)

(6) Back-up of up-down counter

As described in Paragraph 5-1, if the power switch is turned off and then on after a while, the last dialed frequency will be erased and the tuning frequency must be set again.

To avoid this a cell can be connected to the CMG-62A synthesizer unit, such as

TP35 .... + terminal of cell

E .... – terminal of cell

Thus, data for the last dialed frequency is held and displayed.

Use a 3 to 4.5 V silver-oxide or alkali cell.

The cell should be replaced after using approximately half a year. No cell holder is provided.

SECTION 6

CIRCUIT DESCRIPTION

6.1 Functional Block Diagram and Schematic Diagram

The system diagram is illustrated in Figure 1 and connection diagrams in Figures 2 through 6.

6.2 Description of Units

6.2.1 Chassis and Panel unit CFQ-608A

The chassis and panel unit consists of a front panel, rear panel, chassis and power supply circuit.

(1) The printed circuit board on the front panel has various controls, including switches, potentiometers, S-meter, PHONES jack, TUNE dial, frequency display, and other indicators. MHz-switch S10 consists of a rotary switch for producing the MHz digit BCD frequency information. The TUNE dial consists of a photo type (light-emitting diodes) rotary encoder, which generates 100 pulses per rotation.

In the frequency display circuit, BCD frequency information is code-converted in a BCD-to-7 segment decoder of IC1-IC6 to light light emitting diodes CD1-CD6 in the digital indicator.

(2) Rear Panel

Various jacks, connectors, monitor controls, voltage selector, and power supply unit are mounted on the rear panel.

The power supply unit comprises CD1, CD2, IC1-IC3 etc. for supply voltages of +5 V and +15 V to other units.

(3) Chassis

The receiver unit, synthesizer unit, power transformer etc. are housed, here.

6.2.2 Receiver Unit CMA-105A

The receiver unit consists of an RF input filter, RF amplifier, IF amplifier, and AF amplifier circuits.

(1) RF Input Filter Circuit

Consists of a 10 dB-20 dB attenuator, 35 MHz lowpass filter, 1.6 MHz highpass filter, BC band preselector, and six filters.

The 1.6 MHz highpass filter, preselector, and six filters are selected automatically, depending on the operating frequency.

IC1 is a decoder for converting the BCD code sent from the synthesizer unit into a 10-line signal for selecting the filters.

(2) RF Amplifier Circuit

The RF amplifier circuit consists of a lowpass filter of 35 MHz, balanced mixer comprising FET TR2, first local amplifier TR7, crystal filter FL1 for the first IF frequency of 70.455 MHz, first IF amplifier comprising TR3, second mixer comprising TR4, second local amplifier TR8, second IF amplifier comprising TR5 for the second IF frequency of 455 kHz, and noise blanker circuit. In the noise blanker circuit, a signal of 455 kHz is amplified in transistors TR10 and TR11, and detected in TR15. DC voltage proportional to the level of this signal is amplified in another amplifier of TR16 and TR17 and applied to transistors TR10 and TR11, as an AGC signal. Pulsive noises exceeding the average level of the signal are rectified through TR12, amplified in TR13 and applied to gate circuits of TR14 and TR32 to prevent impulsive noises being transmitted.

(3) IF Amplifier Circuit

The 455 kHz signal is passed through one of filters FL2–FL5 and amplifiers of TR20–TR23 and applied to a detector circuit. The AF output signal from the detector circuit is fed into switching circuit IC2. Part of the signal amplified in TR25 is detected through CD61, and amplified in amplifier TR26 to produce an IF AGC signal and RF AGC signal. A mute control circuit consists of TR27, 28 and 29.

Filter FL2 is made of ceramic, and filters FL3 and FL4 are mechanical.

Filter FL5 is made of crystal.

Filters FL4 and FL5 are optional.

(4) AF Amplifier Circuit

The AF output signal from the detector circuit is amplified in IC3 and IC4, and applied to the line output and speaker.

6.2.3 Synthesizer Unit CMG-62A

Consists of a reference signal generator, UP/DOWN counter, digital VFO, BFO, second local oscillator, VFO mixer, and loop 1 circuits.

(1) Reference Signal Generator Circuit

This comprises IC41 for generating, the reference frequency signal of 10 MHz, and frequency dividers of IC42–IC43 for dividing the reference frequency to provide a reference signal of 500 kHz for loop 1 and another of 1 kHz for the digital VFO.

(2) UP/DOWN Counter Circuit

Consisting of IC1 through IC19:

IC7 through IC9 control the UP-DOWN pulses fed from the TUNE dial and feed them to the UP/DOWN counter IC18 and IC19 are multivibrators for changing the frequency quickly, IC1 through IC6 are UP/DOWN counters for controlling the receiving frequency ranging from the 100 Hz-to 10 MHz-digit, and IC15 through

IC17 are gate circuits for controlling the frequency information in the UP/DOWN counter.

(3) Digital VFO Circuit

Consisting of TR1 through TR9 and IC20 through IC40, as follows:

VCXO of TR8 generates a 19 MHz signal, and the filter circuit of T1 and T2 picks out a 38 MHz signal, twice the output of VCXO, and applies it to mixer TR3 for mixing the 38 MHz with the output of VCO (24.55 to 34.55 MHz) to provide an output of 13.45 to 3.45 MHz. The output is fed, after being amplified, to the variable frequency divider of IC21 through IC25. Its output and reference frequency of 1 kHz are applied to the phase detector of IC34 for detecting the frequency and phase difference to control the VCO.

NOTE: When the VCO is unlocked, the CD2 LED turns to illuminate.

The VCO output is applied to the amplifier, 1/10-fixed frequency divider of IC40 and lowpass filter, for providing a VFO frequency between 2.455 and 3.455 MHz to be fed to the VFO mixer circuit.

Fine adjustment of ΔF is done in the 19 MHz–VCXO circuit of TR8.

(4) BFO Circuit

Consisting of TR10, TR11, TR22, TR26 and IC60.

VCXO of TR26 generates a 5.455 MHz and VCXO of TR26 oscillates in 5 MHz. The mixer of TR22 provides an output of 455 kHz ±2 kHz or higher in the CW mode, 456.5 kHz in the USB mode, 453.5 kHz in the LSB mode, and 452.79 kHz in the RTTY mode. Passband tuning control is performed in the 5 MHz–VCXO.

(5) Second Local Oscillator Circuit

TR21 oscillates in 70 MHz and IC58 amplifiers the output of TR21. The output of IC58 is fed to the second mixer in the receiver unit and VFO mixer in the synthesizer unit.

(6) VFO Mixer Circuit

Consists of TR23 through TR25, CD19 through CD22, as follows:

The mixer of TR23 for mixing the oscillator outputs of 70 MHz and 5 MHz to produce a 65 MHz signal, which is, after passing through the BPF and amplifier of TR24, fed to the balanced mixer of CD19 through CD22 for mixing the 65 MHz with the output of the digital VFO to produce an output signal of 67.455 to 68.455 MHz. This output is fed to the loop 1 circuit, after passing through the amplifier of TR25 and BPF.

(7) Loop 1 Circuit

In the loop 1 circuit, both frequency signals of 67.455 to 68.455 MHz from the VFO mixer and 70.455 to 100.455 MHz fed from loop 1 VCO A-1 are applied to a balanced mixer of CD11 to CD14 to produce an output signal of 3 to 32 MHz, while the output signal of the loop 1 VCO is amplified in TR17 to produce the first local frequency signal. The output signal of 3 to 32 MHz fed from the mixer is passed through a lowpass filter of 35 MHz, amplified in IC46 and TR12 through TR14, and then is divided by 2 through IC49. The divided output is supplied to a variable frequency divider of IC50 and IC51.

The output signal of 500 kHz fed from the variable frequency divider and another reference frequency signal of 500 kHz are applied to the phase detector of IC54 to detect a frequency and phase difference. The phase detector output is passed through a lowpass filter to control loop 1 VCO.

NOTE: When the VCO is unlocked, the CD16 LED turns to illuminate.

IC52, IC53, and TR18 through TR20 compose a VCO switching circuit, and decoder IC61 (P-ROM IC of 1024-word x 4-bit) is provided for switching the RF input filter, depending on the BCD code frequency information.

SECTION 7

MAINTENANCE AND CHECKING

This equipment has been perfectly adjusted and inspected before shipping. The following maintenance and checks, however, will assure high performance for a long time.

7.1 Preparation before Maintenance and Checks

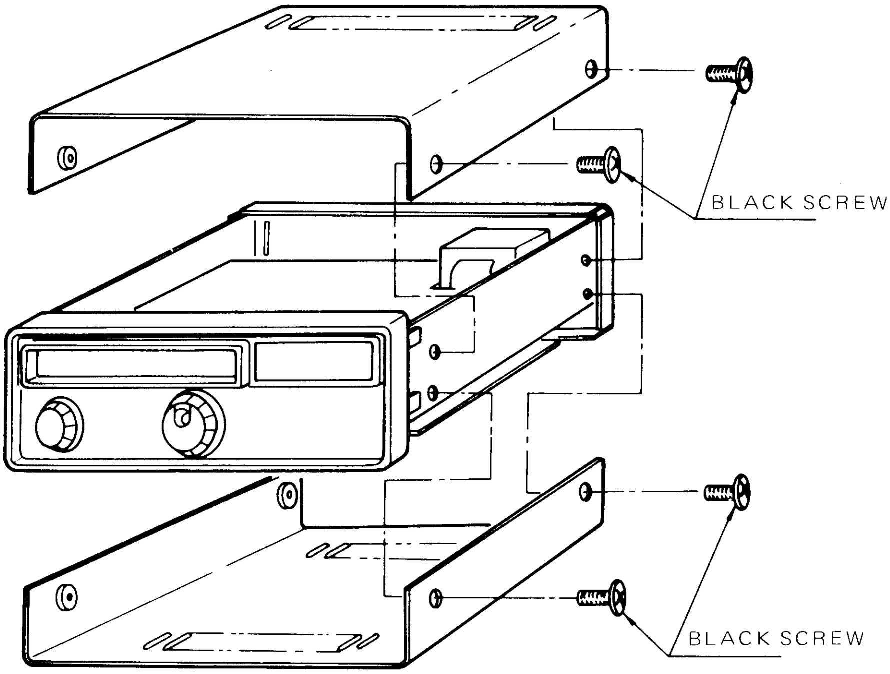


Figure 7-1

This equipment is composed of the chassis, front panel, rear panel, receiver, and synthesizer units.

In the front panel unit, a PC board doubling the mother board is mounted on a die-cast frame. Both synthesizer and receiver units are the plug-in type; they are inserted into the mother board. The power supply circuit comprises a power transformer incorporated in the chassis unit and AVR unit in the rear panel unit, for supplying the required power voltages to other circuits.

(1) Removing the Upper and Bottom Covers from the Case.
As shown in Figure 7-1, remove the eight black screws from the upper and bottom covers. Then, both covers can be removed.

(2) Demounting the Receiver Unit
First, remove the upper cover. Then, disconnect eight pin plugs marked "A" through "H" and square connector P11, each connected to the receiver unit, and remove seven screws, which secure the receiver unit. Draw out this unit to the back side away from the panel.

(3) Demounting the Synthesizer Unit
First, remove the bottom cover. Then, disconnect five pin plugs marked "B", "E", "H", "I" and "J" and square connectors P29 through P31, and remove seven screws, which secure the synthesizer unit. Draw out this unit to the back side away from the panel.

(4) Precautions

a. Make sure that solder and wiring chips do not enter the unit when the cover is removed from the case.

b. Unless absolutely necessary, do not touch any control, including the cores of transformers trimmer capacitors, and semifixed variable resistors.

c. Since both the receiver and synthesizer units handle high-frequency signals in the VHF band, suitable measuring instruments and skilled techniques are required.

7.2 Maintenance and Checks

(1) Cleaning

Softly wipe the panel surface, control knobs, upper cover and bottom cover with soft cloth or silicone oil.

Remove dust and chips from the interior of the equipment, using a brush and cleaner. Since no gearing is used, there is no need to lubricate.

(2) Pilot Lamp

If a pilot lamp for illumination of the S-meter is not working, then remove the upper cover, loosen the screws securing the lamp holder, and take out the holder. Replace with a furnished new lamp, 12 V, 2 W in rating (BA 7S/13 base type).

(3) Fuse

If the power fuse blows, check the cause. Replace after repairing. The fuse holder doubles as the voltage selector at the rear panel. To replace, unscrew Cap A of Figure 3-2, and insert the furnished 1 A glass fuse.

(4) Circuit Elements

IC's transistors, and doides will be damaged only by instantaneous short-circuiting. Therefore, check carefully. Check each circuit element, including resistors, capacitors, coils and transformers for burns or discoloration. When a defective element is replaced, select a new one having the same value, withstand voltage, tolerance, and size as the defective element.

(5) Power Supply Circuit

Check the DC voltages on TP terminals of the CBD-375 AVR unit, located on the rear panel. They have standard values:

+15 V	between	TP5 and TP9 (earth)
+15 V	between	TP6 and TP9 (earth)
+5 V	between	TP7 and TP9 (earth)

(6) Checks and Adjustment of Oscillator Frequencies

a. 10 MHz-Reference Oscillator Circuit

a-1. Frequency Setting with Frequency Counter

1) Connect a frequency counter to TP15 of the synthesizer unit.

2) Set trimmer CV1 located in the shield case at the left side of TP15 for a frequency of 10 MHz.

a-2. Frequency Setting with Standard Frequency Station of the JJY.

1) Receiver settings:

MODE switch . . . . AM
BANDWIDTH switch . . . . 2.4 kHz
Other controls . . . . For a desired sound level.

2) Receive the standard frequency in 2.5, 5, 10 and 15 MHz, and select one of them, which can be received at a high sensitivity without radio interference.

3) Connect a thin polyvinyl wire to terminal TP16 (500 kHz output) of the synthesizer unit, through a ceramic capacitor of 0.01 μF. With the other free end of the wire, couple near the antenna of the receiver, and slowly adjust the trimmer CV1 of the synthesizer unit to a zero beat.

b. PBT Circuit

b-1. Frequency Setting with Frequency Counter

1) Connect a frequency counter to TP19 of the synthesizer unit.

2) Receiver settings:

MODE switch . . . . CW
PBT control . . . . Mid position.

Set semi-fixed control RV3 for a frequency of 5 MHz.

3) Change the MODE switch to AM and set the other semi-fixed control RV4 for the same frequency of 5 MHz.

b-2. Frequency Setting with Standard Frequency Station of the JJY.

1) Receiver settings:

MODE switch . . . . CW
BANDWIDTH switch . . . . 2.4 kHz
PBT control . . . . Mid position

Thus, receiving the 5 MHz JJY.
Adjust the BFO & BC TUNE control to a zero-beat.

2) Connect a thin polyvinyl wire to terminal TP19 (5 MHz output) of the synthesizer unit, through a ceramic capacitor of 0.01 μF. With the other free end of the wire, couple near the antenna of the receiver, and adjust semi-fixed control RV3 to a zero-beat with JJY.

3) Change the MODE switch to AM and adjust the other semi-fixed control RV4 in the same way to a zero beat with JJY.

c. ΔF Circuit

c-1. Frequency Setting with Frequency Counter

1) Connect a frequency counter to TP11 of the synthesizer unit.

2) Set the receiver controls:

ΔF switch . . . . ΔF
ΔF control . . . . Mid position
RV2 semi-fixed control . . . . For a frequency of 38 MHz.

3) Change the ΔF switch to OFF and set the other semi-fixed control RV1 for the same frequency of 38 MHz.

c-2. Frequency Setting with Reference Frequency of 10 MHz.

1) Set the controls for a frequency of 10 MHz as described in (6), a.

2) Set the panel controls:

MODE switch . . . . CW
BANDWIDTH switch . . . . 2.4 kHz
ΔF switch . . . . Mid position

Frequency dial . . . . For a frequency of 19.000 MHz.

Then, connect a thin polyvinyl wire to terminal TP16 (500 kHz output) of the synthesizer unit via a ceramic capacitor of 0.01 μF.

With the other free end of the wire, couple near the antenna of the receiver, and adjust the BFO & BC TUNE control to a beat tone of 1000 Hz, approx.

3) Connect a thin polyvinyl wire to terminal TP11 of the synthesizer via a ceramic capacitor of 0.01 μF. With the other free end of the wire, couple near the antenna of the receiver, adjust the other semi-fixed control RV2 to a double zero beat (resonance point) with the reference signal.

4) Set the ΔF switch at OFF and then the semi-fixed control RV1 in the same way to a zero beat (resonance point) with the 500 kHz reference signal.

d. Second Local Oscillator

Connect a frequency counter to TP31 of the synthesizer unit and then adjust trimmer CV2 for a frequency of 70 MHz.

e. BFO Circuit

Connect a frequency counter to TP30 of the synthesizer unit. With the BFO & BC TUNE control and PBT control set at mid positions, adjust as tabulated in Table 7-1.

Table 7-1

MODE SWITCH	CONTROL	FREQUENCY
CW	RV8	455 kHz
USB	RV5	456.5 kHz
LSB	RV6	453.5 kHz
RTTY	RV7	452.79 kHz

(7) Lock Indicator

The synthesizer unit has two lock indicators: LED CD2 and CD16.

The CD2 indicator turns to illuminate when the digital VFO circuit is unlocked, and the other of CD16 turns on when the loop 1 circuit is unlocked.

Both indicators are for locating a defect, judging from their indications, as tabulated in Table 7-2.

Table 7-2

LOCK INDICATOR		TROUBLE
CD2	CD16	
Lighting	Lighting	VFO switch being set at EXT.
Lighting	Lighting	Defective 10 MHz reference oscillator circuit.
Lighting	Lighting	Defective ΔF oscillator circuit
Not lighting	Lighting	Defective PBT oscillator circuit
Not lighting	Lighting	Defective second local oscillator circuit
Lighting	Lighting	Defective UP/DOWN counter circuit

NOTE 1. This table illustrates possible troubles when no external VFO is connected.

2. CD2 instantaneously lights when the frequency is changed from 999.9 kHz to 000.0 kHz and from 000.0 kHz to 999.9 kHz below the MHz-digit.

3. CD16 also instantaneously lights when the MHz control is switched and the frequency is changed in the same way as denoted in NOTE 2.

(8) Others

a. Check that the pin plugs and connectors connected to the units are making proper contact.

b. Adjusting the S-Meter

Set the panel controls:

MODE switch . . . . AM
RF GAIN control . . . . Maximum
AGC switch . . . . FAST
BANDWIDTH switch . . . . 2.4 kHz.

With the ANT connector set opened, adjust the ZERO ADJ of the receiver unit for a reading of S1 on the S-meter.

Then, connect an SSG (output level of 100 dB, not modulated) to the ANT connector and tune it. Adjust the FULL ADJ control for a reading of S9 + 60 dB. The reception frequency is set near 7.15 MHz for this adjustment.

7.3 Troubleshooting

Troubleshoot simple faults by referring to the following table:

NO.	SYMPTOM	POSSIBLE TROUBLE	REMEDY
1	Neither frequency display nor meter lamp light when POWER switch is on.	1) Poor contact of AC power plug 2) Fuse blown	1) Fully insert the AC power plug into the service outlet. 2) Locate a defective section, repair it and replace the fuse.
2	No sound with POWER switch-on.	1) No speaker connected 2) Headphone connected to PHONES jack.	1) Connect the speaker to the SP jack on the rear panel. 2) Unplug the headphone.
3	Meter lamp dim (or too bright)	AC line voltage low (or high)	Switch the voltage selector (located on the rear panel) to line voltage.
4	Cannot receive; antenna connected satisfactorily	1) VFO switch set at EXT. 2) BANDWIDTH switch set at 0.6 kHz or AUX position, where no option filter is incorporated.	1) Set at INT. 2) Set at 6 kHz or 2.4 kHz position. Separate option filters are required for 0.6 kHz and AUX positions.
5	Reading of frequency for reception on display cannot be changed by turning TUNE dial.	LOCK pushbutton is pressed.	Release the LOCK pushbutton.
6	Reading above zero on S-meter, while no signal incoming into receiver.	RF GAIN control is fully counterclockwise.	Set fully clockwise.
7	Tone distorted during broadcast reception	1) AGC switch set at OFF. 2) Excessively large input.	1) Set at FAST. 2) Insert attenuator.
8	Tone distorted and poor articulation during SSB reception	1) MODE switch set at wrong position. 2) AGC switch set at OFF. 3) Tuned frequency slightly deviated. 4) BANDWIDTH switch set at wrong position. 5) PBT control deviated.	1) Change MODE switch at USB or LSB. 2) Set at SLOW or FAST. 3) Accurately set the TUNE dial and ΔF control. 4) Change the BANDWIDTH switch to the 2.4 kHz position. 5) Set the PBT control at the mid position. If radio interference occurs, adjust this control.
9	No variable tone when ΔF control is turned.	ΔF switch set at OFF.	Set at ON.
10	PBT control disabled during AM reception.	PBT function is disabled if MODE switch is set at AM	
11	Poor sensitivity	ATT switch set at 10 dB or 20 dB position.	Set at OFF.

SECTION 8

OPTION

For higher level operation of this equipment, the following are available:

8.1 Memory Unit NDH-518

This unit can store up to 96 desired frequencies. Once stored the frequencies can be easily changed. This assures higher level operation for the user.

This unit can be used only by inserting the plug of the connection cable furnished in the unit into the receiver connector.

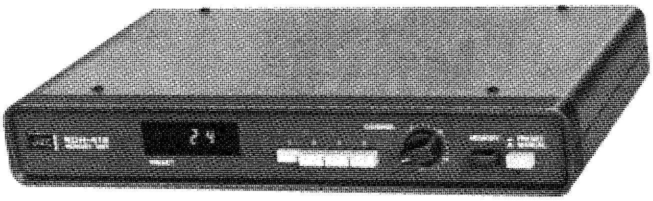


Figure 8-1

Specifications:

a. Memory capacity	96 frequencies
b. Channel indication	Numeric display of LED
c. Input/output data	BCD code, 22 bits
d. Memory write	Possible at any time
e. Power source	Supplied from receiver
f. Dimensions	340(W) x 500(H) x 200(D) mm
g. Weight	3.5 kg, approx.

8.2 Speaker NVA-515

This receiver is not provided with any built-in speaker.

The NVA-515 speaker is available for the receiver's exclusive use. It has been finished to match the design of the receiver and provides a clear, soft sound quality.

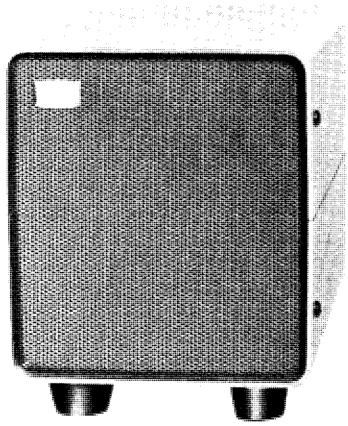


Figure 8-2

Specifications

a. Input impedance	4 ohms
b. Maximum input	3 W, nominal
c. Dimensions	130(W) x 140(H) x 200(D) mm
d. Weight	1 kg, approx.

8.3 Filter CFL-260, 600 Hz

This mechanical filter provides sharp selectivity in CW signal reception and is very effective for rejecting radio interference.

This filter can be operated only by mounting it on the filter PC board and inserting into the receiver.

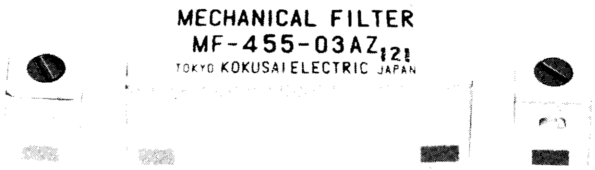


Figure 8-3

Specifications

a. Input/output impedance	1 kΩ
b. Bandwidth	6 dB; more than 0.5 kHz 60 dB; less than 3 kHz

NOTE: For mounting instructions, see Paragraph 8.5.

8.4 Filter CFL-230, 300 Hz

Consists of a crystal filter having a more sharp selectivity suited for CW signal reception.

This filter can be operated only by mounting it on the filter PC board and inserting into the receiver unit.

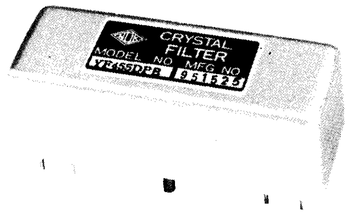


Figure 8-4

Specifications

a. Input/output impedance — 600 ohms, 60 pF

b. Bandwidth — 6 dB; more than 0.26 kHz
60 dB; less than 2 kHz

NOTE: For mounting, refer to Paragraph 8.5.

8.5 Mounting the Option Filters

Filters CFL-260 and -230 must be mounted as follows:

NOTE: Each of these filters has one PC board for mounting the filter.
When using both filters, mount them on either PC board.

8.5.1 Mounting the CFL-260 Filter

Mount both transformers marked P28 and G28 on the PC board at areas marked P28 and G28, and the main body of the filter at an area marked CFL-260, so that letters P and G are arranged in the same direction.

Using a soldering iron of about 20 W, skillfully solder the leadwire.

8.5.2 Mounting the CFL-230 Filter

Mount the filter on the PC board at an area marked CFL-230, then clamp nuts set over two screws projecting to the back side until tight, and solder the four leads.

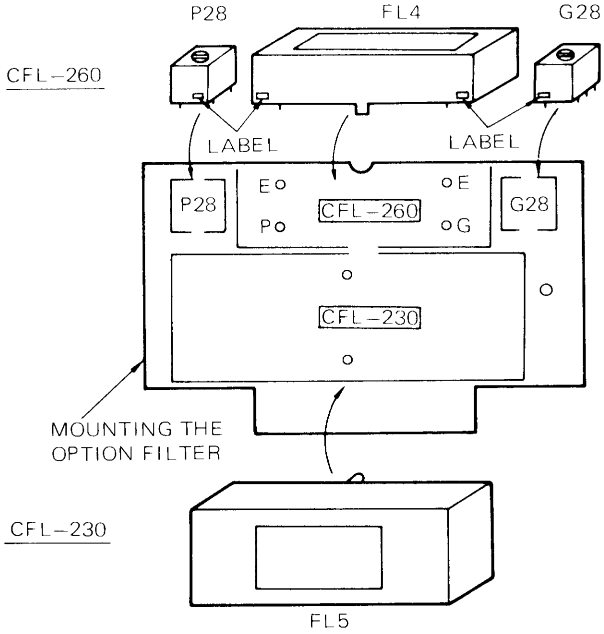


Figure 8-5

8.5.3 Inserting the Filter into Receiver

Insert the PC board with the filter into the receiver unit at a space marked J27, then clamp one screw to the support for fixing the PC board. This board will be connected with a plug-in connector.

Take care with the position of the PC board when mounting with the plug-in; circuit elements mounted on the PC board must be located at the front panel side.

Since the filter has been rigorously adjusted and inspected in the factory, there is no need to readjust after mounting.

NOTE: When the CFL-260 filter of 600 Hz is used, for set numbers BR20787 through BR20886, both resistors R146 of 100 ohms and R148 of 100 ohms located in the receiver unit must be removed by cutting.
Unless these are removed, the filter cannot operate.

※ [ ] OPTIONを示します。

付図 1
APPENDIX 1

NRD－515
全 波 受 信 機 系 統 図
ALL-WAVE RECEIVER FUNCTIONAL BLOCK DIAGRAM

付図 2
APPENDIX 2

CFQ - 608A

シャーシ・パネル部 接続図

MAIN CHASSIS AND FRONT PANEL CONNECTION DIAGRAM

注 1). 特記外の 抵抗は全てΩおよび 1/4W を示し容量は PF を示す。

2). ※印は調整用部品を示す。

NOTES 1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS CAPACITANCES ARE IN MICRO-MICRO FARADS.

2. ※ VALUES SELECTED IN MANUFACTURE.

付図 3
APPENDIX 3

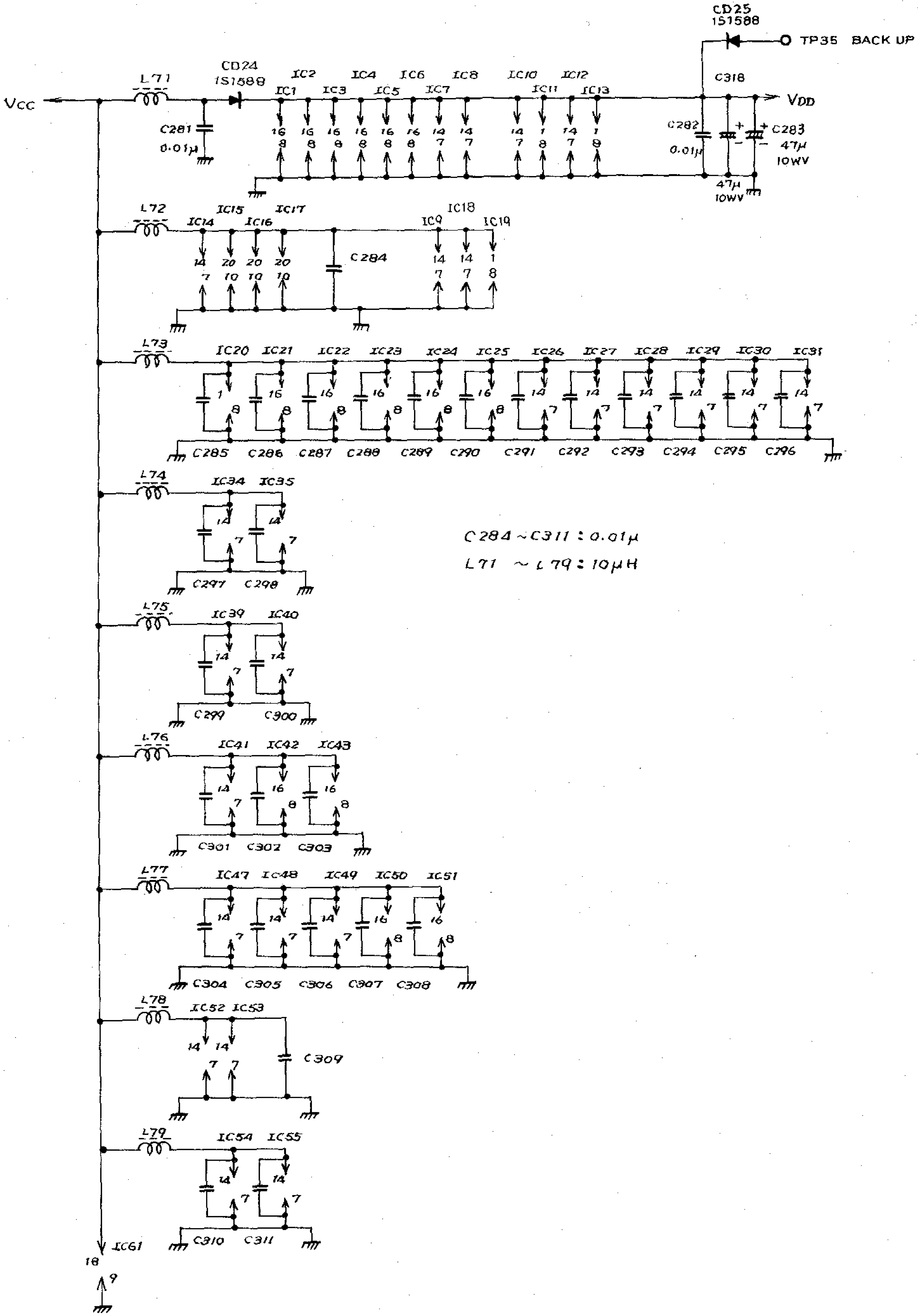
CMA-105A
受信部接続図
RECEIVER UNIT SCHEMATIC DIAGRAM

MDMW00552C
MPPC07760D

MDEW00403C
MPPC07761D

付図 4
APPENDIX 4

CMG-62A
シンセサイザ部 接続図 (1/2)
SYNTHESIZER UNIT SCHEMATIC DIAGRAM (1/2)



IC1	TC4510BP	IC36	TC4016BP
IC2	〃	IC37	TC4011BP
IC3	〃	IC38	TC4016BP
IC4	〃	IC39	SN74LS00N
IC5	〃	IC40	SN74LS196N
IC6	〃	IC41	SN7400N
IC7	TC4001BP	IC42	SN74LS390N
IC8	TC4011BP	IC43	〃
IC9	TC4001BP	IC44	TC4016BP
IC10	TC4013BP	IC45	TC4049BP
IC11	TC4049BP	IC46	MC1350P
IC12	TC4023BP	IC47	SN74LS04N
IC13	TC4049BP	IC48	SN74LS20N
IC14	SN74LS04N	IC49	SN74S74N
IC15	SN74LS244N	IC50	SN74LS192N
IC16	〃	IC51	〃
IC17	〃	IC52	SN74LS00N
IC18	TC4011BP	IC53	SN74LS26N
IC19	TC4049BP	IC54	11C44DC
IC20	〃	IC55	SN74LS26N
IC21	SN74LS192N	IC56	TC4016BP
IC22	〃	IC57	μA723T
IC23	〃	IC58	TA7045M
IC24	〃	IC59	TC4049BP
IC25	〃	IC60	TC4016BP
IC26	SN74LS00N	IC61	μPB426D(2)
IC27	SN74LS10N		
IC28	SN74LS00N		
IC29	SN74LS10N		
IC30	SN74H30N		
IC31	SN74S74N		
IC32	MC1350P		
IC33	μA723T		
IC34	11C44DC		
IC35	SN74LS26N		

MC 4044

MC 4044

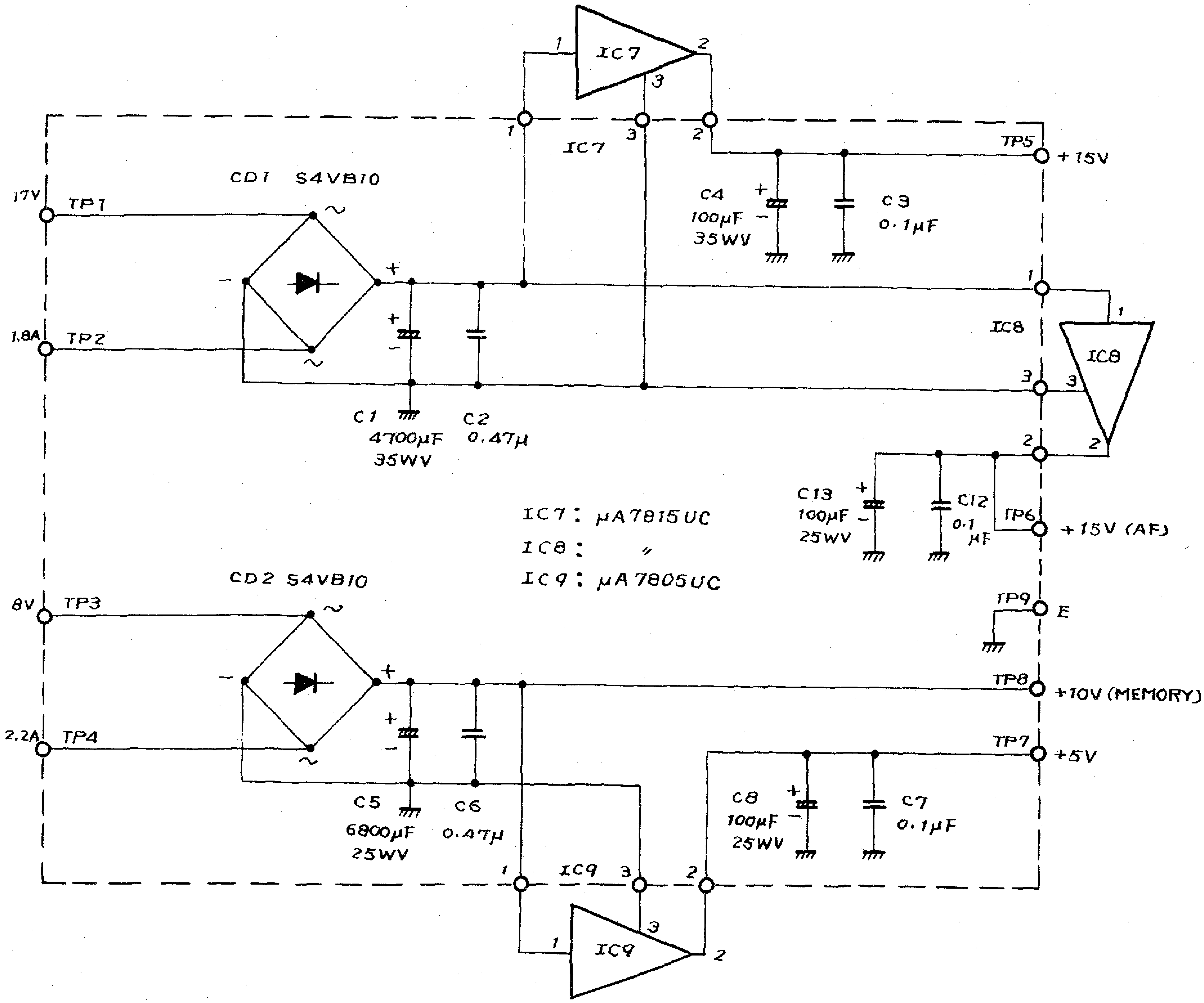
付図 5

APPENDIX 5

CMG-62A

シンセサイザ部接続図 (2/2)

SYNTHESIZER UNIT SCHEMATIC DIAGRAM(2/2)



MDBW00795
MPPC07962

付 図 6
APPENDIX 6

CBD - 375

電源部接続図

RECTIFIER UNIT SCHEMATIC DIAGRAM