### Specifications

**General**
- **Channels:** 120 channels in 3 bands
- **Modulation Modes:** FM, AM, LSB, USB
- **Frequency Range:** 26.965 to 28.305 MHz
- **Tune:** ±5 kHz
- **Frequency Control:** Phase-locked synthesizer
- **Frequency Tolerance:** ±0.005%
- **Frequency Stability:** ±0.003%
- **Operating Temperature Range:** -30°C to +50°C
- **Microphone:** Plug-in (4-pin), 600 Ohm dynamic type
- **AC Input Voltage:** 220V, 50/60 Hz
- **AC Power Consumption:** 70W
- **DC Current Drain:** 1.5A [at maximum audio modulation]
- **Antenna Connectors [A and B]:** 6-1/4", 2 FETs, 52 Transistors (Excluding the Roger Bep unit)
- **Semiconductors:** Indicating relative RF power output/attenna SWR, Indicators received signal strength
- **Meter #1:** Standard SO-239 type
- **Meter #2:**
- **Transmitter:**
  - **Power Output:** 4W or 0.5W — AM/FM, 12W (PEP) — Single sideband
  - **SMP Generation:** Class B amplifier, collectors modulator
  - **AM Modulation:** Better than 60 dB
  - **AM Modulation Capability:** AM/FM 5000 Hz
  - **SMP Frequency Response:** 400 to 5000 Hz
  - **Output Impedances [A and B]:** 50 Ohms unbalanced
  - **Output Indicators:** R[t] Meter shows relative RF output power
  - **Tune:** 1.5 kHz minimum

**Receiver**
- **FM Sensitivity:** 0.5 µV for 20 dB S/N
- **AM Sensitivity:** 0.7 µV for 10 dB S/N
- **SMP Sensitivity:** 0.2 µV for 10 dB S/N
- **SMP Selectivity:** 5 kHz at 4 kHz, 50 kHz at 10 kHz
- **Image Rejection:** 5 dB at 2 kHz
- **IF Rejection:** More than 50 dB
- **AGC:** More than 60 dB at 455 kHz
- **Squelch:** Change in audio output: less than 12 dB from 10 µV to 0.4 V
- **Audio Frequency Response:** Adjustable — threshold less than 0.7 µV
- **Distortion:** Less than 10% at 3 watts output 8 Ohms
- **Adjacent Channel Rejection:** >75 dB at 0.3 µV
- **Cross Modulation:** >50 dB
- **Intermediate Frequency:** 10.695 MHz [AM-1st, SSB], 165 kHz [AM-2nd]
- **Clarifier Range:** ±800 Hz
- **Tune Range:** ±4.5 kHz minimum
- **Noise Blanker:** IF single gate type
- **Audio Output Power:** More than 3 watts into 8 Ohms
- **Built-in Speaker:** 8 Ohms, dynamic
- **External Speaker (optional):** Disables internal speaker when connected
General Description

The HAM International JUMBO is an advanced FM/AM/SSB 2-way transceiver primarily designed for base station operation. It employs the very latest technology to provide 120 channels operation for 2 modes of transmitting and receiving by means of the phase-locked loop (PLL) circuitry. The use of the PLL circuitry assures a precise on-frequency operation on every channel that is unmatched by conventional frequency synthesizer system units. The JUMBO also features the following:

- "Roger Beep" built-in,
- Electromagnetic TX-RX switching enables selective call facility,
- Two relay switched antenna inputs,
- Tune facility allows between-channel operation specially in SSB with more convenience than VFO,
- RF power (4W/0.5W) switch provided,
- Optional: Table pre amplified composite microphone model TW2325 from HAM international,
- 120 channels in 3 bands,
- Modulation control lamp,
- Output for frequency counter,
- Giant LED's assures bright channel display,
- Detachable hand grips for professional 19" rack mounting.

Description Générale

L'amateur-récepteur JUMBO de HAM International utilise les techniques les plus avancées dans le domaine des radio-communications. On y trouve les innovations techniques les plus récentes tel que la modulation de fréquence à déviation linéaire, les 120 canaux continus produits par circuit intégré à jonction logique (PLL) ainsi que la instrumentation électronique émission-réception. Le JUMBO offre aussi les nouveautés suivantes:

- Roger Beep incorporé,
- Connexions prévu pour l'utilisation d'un appel sélectif Ham International,
- 2 entrées d'antennes commutable par relais,
- Le tour de "TUNE" permet aussi d'épargner sur tous les canaux intermédiaires spécialement en SSB avec plus de confort qu'un VFO,
- Switch sortie RF (4W/0.5W) prévu,
- En option: le micro de table pré-amplifié à compresseur, le modèle TW2325 de HAM International,
- 120 canaux divisés en 3 bandes,
- Lampe de contrôle de la modulation,
- Sortie pour compteur de fréquence,
- Diodes électro-luminescentes grandies pour affichage digital très-lisible,
- Poignées détachables pour montage en rack professionnel 19".

Algemene Beschrijving

De HAM International JUMBO is een technisch vergezicht de FM/AM/SSB zendereceptietoestel ontworpen met het oog op een gebruik hoogstgekleurd in basisinstallatie. De laatste technologische stappen worden gebruikt om 120 kanalen voor te bereiden door middel van digitale frequentie systeem met Phased lock loop (PLL circuits). Deze PLL schakeling verzekert een nauwkeurige frequentie van ieder kanaal, in alle modi. Dit systeem is wat betreft kwaliteit niet te evenaren door de conventionele kristal synthesizers. De JUMBO heeft bovendien een aantal uitzonderlijke extra's.

- 120 kanalen in 3 banden
- Ingebouwde Roger Beep
- Aansluiting voor selektieve systemen
- 2 omvankbare antenne aansluitingen (4W/0.5W)
- Tuning valk te toelaten tussen de kanalen (zou worden boven in SSB gemakkelijker dan met een VFO)
- RF vermogen (4W/0.5W) schakelbaar voorzien.
- Controle lamp voor de modulatie
- Aansluiting voor frequentie teller
- Zeer heldere kanalenindicaties met rode led display
- Met professionele afneembare bandvaten voor montage in een HIFI RACK (19 inch)
- Sijbeheugen tegen meermalen te baken van Ham International - TW2325 Top kwaliteit tafel mikrofoon niet ingebouwde kompressor voorversterker.
Installation

Connection

The transceiver is supplied with AC power cord. Proceed as follows to complete all necessary connections to the transceiver:

1. Your transceiver has two standard antenna connectors of type SO-239 located on rear panel, for easy connection to standard PL-259 coax plugs. Use only enough cable to suit your needs. This will insure a proper impedance match and maximum power transfer from the transmitter to the antenna. If the coax antenna cable must be made longer, use coax cable with high efficiency and quality such as type RG-8/U.

2. AC Power Operation: Use 220 volts AC power for base station operation. Plug AC power cord into a working 220 volts household outlet.

Noise Interference

There are several kinds of noise interfering you may encounter in base station operation. Some of these noise sources are: fluorescent buzz, nearby commercial broadcast, electrical appliance, lawn mower, and electrical storms, etc. Commercial products are available to reduce interference from these sources. Consult your dealer or CB/Amateur radio supply shops.

Antenna

Ham International has designed a high power antenna for best performance in local and DX use with large bandwidth for equal quality on 120 channels: The Superstar.

Remote Speaker

The external speaker jack (EXT. SP) on the rear panel is used for remote receiver monitoring. The external speaker should have 8 ohms impedance and be able to handle at least 3 watts. When the external speaker is plugged in, the internal speaker is disconnected.

Installation

Connections

Procédez aux connections dans l’ordre suivant:


2. Utilisation sur le secteur AC 220V

Connectez le câble d’alimentation AC dans la prise prévue à cet effet sur le panneau arrière et l’autre extrémité dans une prise de courant 220V.

ANTENNAS

HAM INTERNATIONAL a prévu pour votre Jumbo une antenne de base de haut rendement avec une large bande passante pour un résultat optimal en local ou en DX sur les 120 canaux: le modèle SUPERSTAR.

Plaatsing

Aansluitingen

1. Deze zenderontvanger heeft twee antenne aansluit mogelijken op het achterpaneel. Gebruik uitsluitend kabel van 50 ohm en de klassieke PL-259 Plugs (ampho-

nolen).

2. Gebruik op 220V netspanning

Sluit het overeenkomstige snoer op de AC aansluitplug en op het stopcontact 220V.

Antennes

Ham International heeft voor uw JUMBO een bijpassende antenne met hoog rendement en een groot bandbreedte voor een maximum resultaat zowel voor lokaal als voor DX: De Superstar.
Control Function
1 Power Switch
Place in POWER (lever up) position to apply power to the unit.
2 Noise Blanker Switch
This switch activates the noise blanker circuit when placed in lever up position. Use this noise blanker is very effective for repetitive impulse noise such as ignition interference.
3 ANL Switch
When this switch is placed in the ANL (lever up) position, the automatic noise limiter in the audio is activated. The ANL may be used when noises generated from such sources as atmospheric discharge, electronic machinery etc., are present.
4 RF Power (4W/0.5W) Switch
Permits you to adjust the RF output when AM/FM transmitting - 4W or 0.5W.
5 High Filter Switch
This switch is used to remove high frequency noise from received signal.
6 SWR-Calibrate Switch
This switch serves for SWR check of your antenna:
CALIB (lever down): Used to calibrate the SWR meter before measuring your antenna's SWR ratio.
SWR (lever up): Used to directly read the SWR of antenna connect- ed to the unit. See SWR check.
7 Calibrate Control
This control is used for calibrating the SWR meter for accurate SWR measuring in conjunction with the SWR-CALIB Switch 6.
8 Tune
In pulled position, allows to vary the operating frequency with plus minus 4.5 kHz and functions as a VFO. In pushed position, the frequency is the centre frequency of the channel displayed.
9 RF Gain Control
This control is used primarily to optimize reception sensitivity in strong signal areas. Under normal operating conditions the control should be turned fully clockwise. When strong overload or distort-ed signals are received rotate this control counterclockwise to re
duce gain.
Note: The Squelch Control 15/ may require readjustment with re-duced RF Gain Control.

Face Avant
1 POWER
Placer ce switch en position power pour alimenter l'appareil.
2 N B
Net le filtre "noie blanker" incorporé en fonctionnement pour atténuer seulement les parasites tel que ceux produit par les moteurs à explosion.
3 ANL
Met le filtre "ANL" incorporé en fonctionnement pour atténuer les bruits de fond pendant la ré-
ception.
4 Switch Sortie HF/RF (4W/0.5W)
Commande le niveau sortie RF en émission MA/RF - 4W ou 0.5W.
5 HI-FI
Cet interrupteur permet de diminuer les sous aigus indésirables signaux reçus.
6 SWR-Calibrate
- En position CALIB: Pour calib-
ber le TDS-mètre avant la mesure du TOS.
- En position SWR: Lecture du TDS sur le TOS-mètre.
7 Calibrate
Permet de calibrer le TDS-mètre lorsque l'inverser SWR-CALIB est en position CALIB.
8 Tune
- En position tiroir, ce bouton, permet de varier la fréquence d'opération de ±4,5 kHz par rapport à la fréquence du canal indiqué.
- En position poussée le tiroir ne fonctionne pas.
9 RF Gain
Pour atténué les signaux trop puissants en réception, sa position normale est la position maximale à droite.
10 MIC Gain
Un circuit pré-amplificateur pour le micro est incorporé dans votre JUMBO et permet une adaptation optimale à vos conditions de transmission.
11 Channel
Le bouton permet de déterminer le canal d'opération en combinai-
on avec le sélecteur de bande.
12 Mode
Le bouton détermine le mode de modulation soit:
FM: Fréquence modulée à dévia-
tion étroite.
AM: Modulation d'amplitude.

Voorzijde
1 Power
Plaats deze schakelaar in de posi-
tie POWER om het toestel aan te schakelen.
2 NB
Plaats de schakelaar omhoog om de Noise Blanker in de schakelaar. Deze is alleen effectief om korte repetitieve stoorpulsen zoals ont-
tekeningstoring van wagens te ver-
mijden.
3 ANL
De schakelaar omhoog stelt de automatische ruis en storings-
donkderikker in werking in het audio deeltje, nuttig om a-
molmiserende en allerhande storin-
gen te onderdrukken. Gewoonlijk wordt hij ontvankelijk ingeschakeld.
4 RF Vermogen Schakelaar (4W/ 0.5W)
Regelt de AM/FM zendvermogen bij de zenden - 4W of 0.5W.
5 HI-FI
Met deze schakelaar kan men scherpe tonen tijdens de ont-
vangst wegnemen.
6 SWR-Calibrate
In de positie Calib: om het voor de standaard golven-
verhouding de meter in te stellen. In de positie SWR: aflezing van de standaard golfverhouding (SWR).
7 Calibrate
Hiermee regelt men de naald van de SWR meter op het terwijl de SWR/Calib schakelaar in de stand Calib staat.
8 Tune
Als men de knop uittrekt kan men zowel zendl als ontvangst fre-
wente 14,5 kHz bijstellen als de knop ingedrukt is krijgt men auto-
matisch de juiste kanaalfrekwen-
tie.
9 RF Gain
Om te sterke signaal bij ont-
vangst af te zwakken deze regeling staat normaal op maximun (wij-
tertuin) - minimaal verzwakking.
10 MIC Gain
In de JUMBO is een microfoon-
voorversterker ingebouwd, deze regelaar laat toe rijke miks-uitslag of stem optimaal aan te passen.
11 Channel
In samenhang met de bandscha-
kelar kan men hiermee elk ge-
wenst kanaal kiezen.
10 Microphone Gain Control
A preamplifier circuit is built into this unit to increase microphone gain. Experiment with this control for the setting that will best suit your individual use.

11 Channel Selector
This control selects any one of the 120 citizens band channels desired. The selected channel is digitally displayed in the window directly above the control.

12 Mode Select
This control selects the mode of operation in either FM, standard AM, upper sideband, or lower sideband. Transmission in a mode can only be communicated to stations operating in the same mode.

13 Antenna A/B Selector
For switching between two types of antennas or dummy load that may be connected to the unit. You may connect a ground plane antenna (non-directional) to Antenna A receptacle, and a beam type antenna (highly directional) to the Antenna B receptacle on rear panel for long-range communications.

14 Band Selector (HI-MID-LOW)
This is used in conjunction with the Channel Selector and selects one of 3 bands which are composed of 40 channels. Setting this to Low position enables you to operate over channels 1 through 40; MID position channels 41 to 80; and HI position channels 81 to 120.

15 Squelch Control
This control is used to cut off or eliminate receiver background noise in the absence of an incoming signal. For maximum receiver sensitivity it is desired that the control be adjusted only to the point where the receiver background noise or ambient background noise is eliminated. Turn fully counterclockwise then slowly clockwise until the receiver noise just disappears. Any signal to be received must now be slightly stronger than the average received noise. Further clockwise rotation will increase the threshold level wherein a signal must overcome in order to be heard. Only strong signals will be heard at a maximum clockwise setting.

16 AF Gain (Volume) Control
Permits you to adjust the listening level when receiving.

LSB, USB: Modulation of amplitude to bands laterale uninue (B.L.U.) LSB bande inférieure, USB bande supérieure.

13 Antenne A et B
Branch the antenna connected to l'entrée A ou B.

14 Band Selector
Suiivant le canal choisit, placer ce sélecteur en position: L pour les canaux de 1 à 40, M pour les canaux de 41 à 80, H pour les canaux de 81 à 120.

15 Squelch
Le squelch permet d'éliminer le bruit de fond indésirable en réception en l'absence de signal significatif. Plus le bouton est tourné à droite, plus fort le signal doit être pour ouvrir le récepteur.

16 Volume
Contrôle le niveau sonore en réception.

17 Clarifier
Fonctionne comme "delta-tune" en AM ou FM et permet de clarifier la réception en B.L.U. (USB et LSB) en position tirée. En position poussée le clarifier ne fonctionne pas et la f. de réception est la même que celle d'émis.

12 Mode
Hiermmer kann eine der modulation soorten gekozen worden. FM: Frekwentie modulatie met heel smalle zwai. AM: Amplitude modulatie. LSB/USB: Enkelzijdigband modula
tie (SSB), LSB = Lage zijd. USB = Hohe zijd.

13 Antenne A en B
Mogelijkheid tot 2 antennes gelij
ekkrikt aan te sluiten en met de schakelaar in een oogwenk om te schakelen vb. van Horizontaal naar Verticaal.

14 Band selector
Stand L geeft de kanalen 1 tot 40, Stand M geeft de kanalen 41 tot 80, Stand H geeft de kanalen 81 tot 120. (Oogpast sommigen van deze laatste vallen in de 10m amateurband).

15 Squelch
Hiermee kan men het vervelende achtergrondgeruis bij afwezigheid van uitzendingen, of het lawaai van zwakke ongeenwachte stations wegan違反.

16 Volume
Regelt de geluidsterkte bij de ontvangst.

17 Clarifier (Filter/Regeling)
Deze regeling laat toe de ont
corner af te stemmen op uitzendi
ningen welke niet op de juiste frequentie zijn. In SSB wordt deze gebruikt om de juiste toonhoogte van de klank te verkrijgen voor een natuurgetrouwe weergave. De clarifier is slechts toege
schikt als de knop uitgetrokken is. In Down posie is de ontvangst frekwentie gelijk aan de zending tie en werkt de clarifier niet.
Clarifier
The clarifier works only in pulled position. In pushed position the clarifier does not operate and the frequency of the receiver is same as the transmitter.

Rear Panel
1 220V AC Power Cable
2 Fuse
3 External Speaker Jack
For 8 Ohm external Speaker Connection. When the plug is inserted to this jack, the internal speaker is silenced.
4 Selective Call Jack
Used to connect the optional Selective call unit (available from Ham International).
5 Antenna Connectors A/B
Used to connect antennas to the unit and mate with 50 Ohm coaxial plug, type PL-259.
6 Frequency Counter Output

Face Arrière
1 Cable d'alimentation 220V AC
2 Fusible
3 Connecteur ext. sp.
Pour connecter un haut-parleur extérieur de 8 ohms. En introduisant la fiche, le HP intérieur est mis hors circuit.
4 Connecteur Sel Call
Prévu pour connecter un système d'appel sélectif HAM Internationnal.
5 Connecteur d'antenne A et B
Prévu pour connecter le câble coaxial 50 ohms par l'intermédiaire d'une fiche PL259.
6 Sortie pour fréquencemètre.
Indicators
See page 3.

1 Signal Strength Meter
   The left hand meter provides a relative indication of the signal strength of a received signal in 5 units during reception. Note that SSB signals will respond this meter only during voice modulation. This being due to the fact that SSB transmissions do not contain a continuous RF carrier as is found on AM or FM.
2 RF Power SWR Meter
   Used for two purposes - to indicate relative transmitting power (4W or 0.5W AM/FM - selectable, 2W PEP SSB) when transmitting; to indicate the antenna SWR (standing wave ratio).
3 Channel Display
   This is an LED (light emitting diode) digital readout which indicates the channel selected by the Channel Selector 11.
4 Function Indicators
   The LED indicators located in this area permit you to know instantly the mode with which the unit has been engaged:
   Hi-End: Lights up when unit is operating in Hi 40 channels.
   On Air: Lights up during transmit mode indicating you are on-the-air.
   Modulation: Lights up during transmitting with intensity varied according to the strength of your voice modulation.
   FM, AM, SSB: Indicates a mode selected by the Mode Selector 12.

Push-to-Talk Microphone
The receiver and transmitter are controlled by the Push-to-Talk switch on the microphone. Press the switch and the transmitter is activated; release the switch to receive. When transmitting, hold the microphone two inches from the mouth and speak clearly in a normal voice. The radio comes complete with the low impedance dynamic microphone supplied.
Optional: TW2335 tabla microphone.

Operating Procedure
To Receive
   Important: Make sure antenna, power source, and microphone are connected before you operate.
   1 Turn the unit on by setting the Power Switch 1) to On position. Now the meters, Channel Display and Function Indicator will be illuminated.
   2 Temporarily, set the Mode Selector 12) in AM position.
   3 Set the Squelch Control 15) in fully counterclockwise position and adjust the A/F Gain control 16) for a comfortable listening level.
   4 Listen to the background noise from the speaker. Turn the Squelch Control 15) slowly clockwise until the noise just disappears (no signal should be present). Leave the Squelch Control at this setting. The Squelch Control is now properly adjusted. The receiver will remain quiet until a signal is actually received. Do not advance the Squelch Control too far clockwise or some of the weaker signals will not be heard.
   5 Set Tune and Cerrifier in the pushed and center position respectively.
   6 Select a desired mode of operation, FM, AM, SSB, or, USB. Adjust Clarifier 17) for advanced operation.
To Receive
   1 Select the desired channel and mode of transmission.
   2 If the channel is clear, depress the Push-to-Talk switch on the microphone. Speak in a normal tone of voice.
   SWR Check
   Though most antennas are factory-tuned, adjusting the length of antenna using the SWR meter may peak the antenna efficiency and protect the final RF power transistors from an overload due to mismatch. Proceed as follows:
   1 Set the unit in the receive mode as instructed under the Operating Procedure to Receive section.
   2 Set the Mode switch 12) to AM position; the SWR-Cal 8) switch to the Cal position.
   3 Pressing the Push-to-Talk switch on the microphone and turn the Calibrate Control 7) clockwise (past click) so that the SWR meter pointer exactly coincides with the Set mark on the scale. Release the Push-to-Talk switch.
   4 Set the SWR-Cal switch to the SWR position and depress the Push-to-Talk switch again. The SWR of your antenna is read directly on the scale. An SWR below 2 or less is desired as this indicates that over 95% of the transmitted power is broadcast into the air.

7
The transmitter is specifically designed for the environment encountered in the base station use. The use of fully solid state circuitry and its rugged construction result in high reliability. Should a failure occur, however, replace parts only with identical parts. Do not substitute. Refer to the Schematic Diagram and Replacement Parts List in this manual. If the performance described in the Operation section is not obtained, review the Installation section to ensure that proper procedures were followed. If a problem still exists, refer to your HAM international dealer.

Circuit Description
The transmitter is a 120 channel CB radio which uses a phase locked loop (PLL) system of frequency synthesis to produce the precise controlled channel and IF signals used in operation of the transmitter and receiver sections of the unit. The basic PLL system is comprised of a free-running voltage controlled oscillator (part of IC2), a phase detector, a reference crystal oscillator (Q3) and a programmable divider (IC11), as seen in diagram below.

PLL Theory (PT05000 Circuit Board)

The voltage controlled oscillator (VCO) operates in the frequency range of 17,5550 to 18,4450 MHz in the AM/FM/USB mode and 17,5535 to 18,4435 MHz in the LSB mode, and is used to produce two output signals: #1, 37,660 to 39,000 MHz in the AM/FM/USB mode and 37,657 to 38,997 MHz in the LSB mode, #2, at 2,55 to 2,11 MHz. Reference frequency oscillator Q4 oscillates at 10,6525, 10,165, or 10,2775 MHz in accordance with the Band Selector switch (1.5 kHz lower when LSB mode). Its output is fed through a band pass filter (BPF)/ doubler resulting in an output signal, 20,105, 20,33, or 20,555 MHz in accordance with the band selected (3 kHz lower when LSB mode). This signal then goes to the VCO free-running signal producing a 37,66 to 39,0 MHz in the AM/FM/USB mode and 37,657 to 38,997 MHz in the LSB mode, which is fed to the receiver first mixer (Q2) and also to IC3 (on main circuit board PTBM099), the transmitter mixer. The second VCO output signal, at 2,55 to 2,11 MHz, is fed to the programmable divider in IC1. Simultaneously, the 10.24 MHz output of Q3 through the buffer G2 is applied to the programmable divider in IC1 and is divided down in 10 kHz steps. As a channel is chosen by the Channel Selector switch (SW1 on PTS-W076), an n/od frequency is applied to the terminals [pin No. 8 to 15 of IC1] on the programmable divider in IC1, to preset the divider. The two signals, the crystal oscillated signal [10.24 MHz] from Q3, and the signal from the VCO via the lowpass filter [LPF] and buffer [in the IC1], are compared in the phase detector of IC1 and the phase detector produces a DC output voltage derived.
from the phase difference in the signals fed to it. This DC output is applied through an LPF to the VCO, forming the phase loop. This DC voltage applied to the VCO causes it to shift frequency until its output signal locks up with the count-down frequency provided from reference oscillator Q3 (when two signals are in phase) at which point no DC output is produced in the phase detector, and the VCO remains locked on frequency. When a new channel is selected a new IC is applied to the programmable divider. The VCO is no longer locked because of the resulting phase difference in the phase detector, and it again shifts frequency to a locked condition, in turn producing 37 MHz output signal corresponding to the new channel programmed by the new N code. In summary it will be seen that a stable VCO frequency range will be produced, each specific frequency being determined by the N code selected by the Channel Selector switch.

Main Board Assembly (PT680059)
The crystal oscillator Q12 is operating at 10.695 MHz in the AM/FM/USB mode, and 10.692 MHz in the LSB mode controlled by the crystal X3. This signal is fed to the AM and FM mode of transmission, fed to the IC3 to be mixed with the first TX local oscillator frequency and result in 27 MHz transmitter frequencies, and +2; in the SSF mode of transmission, modulated through the balanced modulator IC4 with the audio output signal from the microphone amplifier, IC5. The resultant output of the balanced modulator is a double sideband, suppressed carrier signal. The crystal filter, Xf, pass band is restricted to 3.3 Hz so that it allows only one sideband to pass through its output terminals, either USB or LSB mode, depending upon the Mode Selector switch selection. The exact frequency of which was determined by the Channel Selector switch selection and the PLL circuitry, as previously outlined, the resultant frequency, therefore, that is fed to the RF amplifier in IC3, is the channel frequency on the channel selected (channel 1 through 120 over 26,905 to 28,305 MHz).
The 27 MHz RF amplifier output is coupled to RF predriver transistors Q7, 3, through T4, 5. The predrivers serve to isolate the oscillator and mixer stages from the output amplifiers, and at the same time provide a certain amount of power gain. Q8 output is applied to the base input of Q9, the RF driver stage and in turn to the Q10, the RF power output stage of the transmitter. These stages amplify the 27 MHz RF signal resulting in an output at L13 of 4W for 0.9W in AM or FM mode, and 15 watts PEP [peak envelope power] in the SSF mode.

TX Diagram

Modulating Circuit
AM: The microphone feeds voice audio through Q701 on PT85072 to the power audio IC IC5, and finally to collectors of Q9 and final RF power amplifier Q15 through T16, thereby amplitude modulating the carrier in AM transmission.
FM: In the FM mode, IC5 output is led to the anode of the FM modulating variable capacitor D6 (also involved for "Tune" control) in circuit board assembly PT85006, varying its bias to change parallel capacitance to X2, X3, or X4, finally giving deviation to PLL output frequency. D26: The IC5 output is directly fed to the balanced modulator IC4, resulting in suppressed carrier double side band, which is in turn supplied to the crystal filter to carrier remove.
ALC: An audio ALC (automatic level control) voltage derived from the audio signal at Q35 is led to IC2 to control the output of audio amplifier to prevent overmodulation. In the AM or FM transmission, the output of Q35 is fed to Q37 and is used to control the output of T16, whereas in the SSF transmit mode, the output of Q15 is fed to Q38 and is connected to the primary side of T16. This being due to the fact that the output of IC5 [modulation signal] is fed [to modulate the RF signal] from the secondary side of T16 in the AM or FM mode, and from the primary side of T16 in the SSF mode of transmission.
The transmitter is also equipped with the RF ALC circuit utilizing the RF output in this channel at the input of L12 in the SSF mode only. The minus voltage detected through D8 is applied to the DC
plus bias circuit (pin number 7 of IC3, TX mixer) thus reducing the gain of the TX mixer as high level RF signal is observed at L12. This circuit is disabled in the AM or FM mode of transmission. In summary, the ALC circuit [both audio and RF] accomplishes very important function, not only preventing overmodulation, but in the view of harmonic and spurious suppression [especially in the SSB transmit mode].

Antenna Transmission Line

The lowpass filter between the antenna and collector of Q10 serves to pass the 27 MHz signals, attenuating higher frequency signals. It also acts to match the antenna impedance to the output impedance of the transmitter output stage, this nominally being 50 Ohm.

Receiver

The RF signal, at a frequency between 26.965 to 28.305 MHz, feeds from the antenna through L13, L2, L1, and T7 to the 27 MHz RF amplifier Q20. Then the amplified output signal from Q20 is coupled through T9 to first mixer Q22 where it is mixed with an injection signal from the VCO, IC7, through the VCO buffer Q2. The frequency of the injection signal from IC2 depends on the channel being selected, as a signal of the 37 MHz range is programmed by the Channel Selector. The output of Q22 is therefore, 10.695 MHz in the AM/FM/USB modes, and 10.692 MHz in the LSB mode, the first intermediate frequency and is the result of the RF input and mixing of IC2 VCO signals.

In case of the AM or FM receive mode, this 10.695 MHz first IF signal is then fed to the second mixer, balanced D22 and D23. Also fed to the second mixer is the second local oscillator signal, 10.24 MHz, from Q3. Mixing of these two signals result in a signal at a frequency of 455 kHz in T14. This is the second intermediate frequency for AM or FM mode of reception. In AM mode, the 455 kHz signal passes through the ceramic bandpass filter CF, and fed to IF amplifiers Q27, 28, and 29, which include IF transformer T15. The output of Q29 is applied to D25, the AM diode detector, while in FM receiving mode, the 455 kHz signal amplified only through Q27 is led to FM demodulat- ing IC, IC3 on the PTO5006 through T4. Resultant demodulated audio is achieved from the IC pin #12 and input to AF gain control VR, VR1. In the SSB mode of reception, the signal obtained as a result of the mixing of the RF input and IC2 VCO signals, 10.695 MHz in the USB, and 10.692 MHz in the LSB mode, is not converted down to lower intermediate frequency, but is passed through the crystal filter, XF, and fed to the SSB IF amplifiers, Q14, 16, and 17, which includes T11, and 12. The signal at the secondary side of T12 is fed to Q19, the product SSB detector and beat with the BFO [beat frequency oscillator] signal from the Q12 and finally rectified to audio frequency signal. The audio signal output from detectors (for AM [D25], FM [IC2], and SSB [Q19]), is passed through the AF Gain Control, VR1, to the input of the audio amplifier, IC5. The audio output is transformer-coupled to the internal speaker, or to an external speaker through External Speaker jack, J3.

RX Diagram

Squelch

Q32, 33, and 34 are the squelch amplifier transistors. At low [or no] signal levels Q34 collector conducts to ground and its output connected to pin number 8 of IC5 results in no signal output from the audio amplifier. As the incoming RF signal increases it results in opening up the AF amplifier and output is activated. The point at which Q34 cuts-off is determined by setting of the Squelch Control, VR2.
Noise Blanker

The noises contained in the RF signal at the output of RF amplifier, C20, is fed through C112 to the base of Q23. The amplified signal output of Q20 is rectified by diodes D20 and 21. The resultant DC voltage turns on Q24 [FET] which in turn turns on Q25 and 26. This causes the IF signal [10.695 or 10.692 MHz] at T10 to be conducted to ground through C121 and Q26 during the presence of the noise impulses, blanking out the noise from the audio output.

'Tune' Circuit (PIT00006)

The 'Tune' control facility allows between-channel operation shifting both the transmit and receive frequencies 4.5 kHz above or below the assigned channel frequency continuously. The active elements of the circuit are variable-capacitance diodes D4, D5 and V14. Both diodes capacitances vary in accordance with the bias level determined by V14 adjustment, thus increasing or decreasing the parallel capacitance to R14 at Q4 emitter through C25 (by D4) and the external capacitance to X1, X2 or X3 (by D5) simultaneously. The bias of both diodes is fixed when VR4 is pulsed to OFF.

Clarifier Circuit

The clarifier is operative only in receive mode and changes the receive frequency regardless of the transmitting frequency. VR6 acts to vary the plus bias voltage of Q206 (on circuit board Y3) in the same way as in 'Tune' circuit description. Thus, Q4 oscillating frequency is pulled above (VR8 clockwise rotated) or down (VR8 counterclockwise rotated) its normal channel frequency. Q206 is fixed biased when the unit is transmitting.

High Filter

The high-frequency-cut filter acts to improve readability in congested areas etc., eliminating high frequency noise component in audio output. In PITS072 circuit board, Q702 serves to compensate CR filter loss.

Power Supply

The supplied 220V AC is stepped down through T201 and rectified by bridge rectifiers D1 to 4 on PTT007. When the voltage output at pin #3 on the circuit board decreases the collector current of Q2 also decreases causing reduced collector voltage. This will increase Q1 bias and Q201 bias. The voltage across the collector to emitter of Q201 decreases thus restoring the initial voltage imbalance.

Adjustment

Test Equipment

The following equipment are required for servicing:

1. A 50 Ωm resistive antenna load, 20W.
2. A frequency counter operable in the required range.
3. A δω signal generator operable over 50 kHz to 60 MHz.
5. An FM deviation meter.
6. A digital Voltmeter.
7. An 8 Ohm 5W resistive speaker load.
8. Two audio signal generators, 10 Hz to 20 kHz.
10. A circuit tester, input impedance 20 kOhm/√V.
11. A 220V 50 Hz AC power source.
12. Dummy microphone plug wired as shown beside applicable set-up.

To activate the transmitter without using the microphone PTT bar, use the dummy plug. This plug is also used to introduce a modulating audio signal to the microphone input circuit as described in the following procedures.

Precautions

Before performing any adjustment, check visually all jacks, plugs and solder joints for normal connection. Shown in the schematic diagram are nominal tested-voltage values for the transistors and ICs. For turn-up and servicing, be sure to use identical parts as listed in the Replacement Part List.

Power Supply Alignment

Important: This alignment should be performed first of all items.
1. Connect circuit tester across the terminal 159 (+) and 160 (minus) on PTT007.
2) Turn unit on at 220V 50 Hz input.
3) Reading should be 13.8 Volt. If necessary adjust, RV1.

Transmitter Alignment

Connect testing equipment to the unit as shown:

PLL Alignment (PTOS006)
1) Connect frequency counter to TP1 for IC1 pin (23) through 1,000 pF capacitor.
2) Adjust CT1 for 10.240 MHz. Tolerance within ±50 Hz is acceptable.

Off-set Frequency Alignment (PTOS006, unless otherwise noted)
1) Connect frequency counter to TP4, with maximum level range.
2) Set the Mode selector to USB.
3) Set the Band selector to Lo.
4) Adjust CT2 for 20.105 MHz ±40 Hz.
5) Set the Band selector to Mid.
6) Adjust CT3 for 20.330 MHz ±40 Hz.
7) Set the Band selector to Hi.
8) Adjust CT4 for 20.555 MHz ±40 Hz.
9) Set the Band selector to Mid, the Channel selector to 60.
10) Connect scope to TP4.
11) Adjust T1 for maximum scope amplitude.
12) Connect frequency to TP5 (PTBM058).
13) Adjust CT5 (PTBM059) for 10.695 MHz ±50 Hz.

LFR Off-set Alignment
1) Set the Mode selector to LSB, the Band selector to Lo.
2) Connect frequency counter to TP4 (PTOS006).
3) Adjust CT5 (PTOS006) for 20.105 MHz ±40 Hz.
4) Connect frequency counter to TP5 (PTBM059).
5) Adjust CT4 for 10.692 MHz ±50 Hz.

VCO Alignment
1) Set the Band selector to Lo and the Channel selector to 1.
2) Connect digital Voltmeter between TP2 and ground.
3) Adjust VCO block core to obtain 3.6V ± 0.1V.
4) Set the Channel selector to 41, and the Band selector to Mid.
5) Adjust VR1 for 3.7V ± 0.1V.
6) Set the Channel selector to 1, and the Band selector to Hi (B1 channel).
7) Adjust VR2 for 3.8V ± 0.1V.

RF Power Amplifier Alignment (PTBM058, unless otherwise noted)
1) Set the Band selector to Lo and the Channel selector to 1.
2) Set the Mode switch to USB.
3) Feed 2,400 Hz 10 mV audio to unit.
4) Adjust T3 (PTOS006) and T5 (PTBM058) for maximum scope display.
5) Set the Band selector to Hi and the Channel selector to 40 (120 channel).
6) Adjust T2 (PTOS006) and T4 (PTBM058) for maximum scope display.
RF Driver Alignment (P70M058)
1) Set the Channel selector to 60 with the Band selector set to Mid.
2) Feed 2,400 Hz 10 mV audio to unit.
3) Adjust T6, L11, L12 and L13 for maximum output on RF Wattmeter.
4) Remove testing audio.
5) Adjust RV4 and RV5 for minimum carrier leakage on scope.

Two-Tone Alignment (Refer to next page diagram)
1) Feed 500 Hz and 2,400 Hz audio tones to the mic circuit simultaneously. Use two audio signal generator sets.
2) Adjust both testing audio levels by means of attenuators on the generators, so that the scope presents wave figure like shown as 'A' of diagram next page.
3) Adjust RV11 to obtain 12W Output power output.

AM/FM RF Power Alignment
1) Set Mode switch to AM, TX mode, channel 60.
2) Set RF Power switch to 0.5W.
3) Adjust RV9 to 0.5W on Wattmeter.
4) Set RF Power switch to 4W.
5) Adjust RV8 to 4W on Wattmeter.

AM Modulation Alignment
1) Apply 2,400 Hz 7 mV audio to the unit microphone input.
2) Adjust RV12 for modulation depth of 80%.
3) Increase audio level to 70 mV.
4) Check modulation depth increases to 80%.

FM Modulation Alignment
1) Set the Mode switch to FM position.
2) Apply 2,400 Hz 10 mV audio to modulation circuit. Use dummy mic plug.
3) Connect deviation meter to antenna output on the unit.
4) Adjust RV3 (PTOS006) to obtain 1.5 kHz deviation.

RF Power Meter Alignment
1) Set the unit to AM mode.
2) Comparing the external RF power meter and the one built-in the unit, adjust RV3 (P70M058) for equal indication on the unit power meter.

Transmitting Frequency Check
Verify that the frequency counter indicates channel frequencies tabulated in the Frequency Table with tolerance within ±800 Hz.

Receiver Alignment
Connect testing equipment as shown:
AGC Alignment
1) Connect digital Voltmeter to circuit board PTBM059 terminal 15 (Q20, Q22 AGC input) and chassis ground.
2) Set the transceiver to channel 60.
3) Rotate the RF Gain control fully clockwise.
4) Adjust RV8 for 2V reading.

AM Receiver Sensitivity
1) Set the signal generator to 27.655 MHz with 1 kHz 30% modulation.
2) Set the transceiver tuned to channel 60.
3) Set the Mode selector to AM position.
4) Adjust T7, T8, T9, T10, T13, T14 and T15 for maximum audio output across speaker dummy resistor.

Note: Keep generator output as low as possible to avoid AGC action through this alignment.
5) After completing above procedure, rotate T7 to decrease the audio output by 2 dB.

Squelch Alignment
1) Set the Mode selector to AM position.
2) Set the signal generator to provide RF input signal of 300 µV 1 kHz 30% modulated and rotate the Squelch control to the fully clockwise position.
3) Adjust RV9 so that the audio appears on scope.

S-Meter Alignment
1) Set the Mode switch to AM position.
2) Select channel 60 (Mid band).
3) Set the signal generator to provide 100 µV (40 dB) output.
4) Adjust RV7 so that the S-meter pointer indicates '9'.

A. Properly adjusted transmitter.
B. Unequal tones — Adjust generator outputs to balance.
C. Excessive modulation — Adjust RV11 counterclockwise.
D. Final transistor incorrectly biased — Adjust VR1.
E. Undermodulation — Adjust RV11 clockwise.
F. Similar to A but showing hum — Check for proper testing condition.
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**Symbolic or Exploded View No.:**
- A1
- B2
- C3

**Note:**
- All parts are in stock.
- Parts are available for immediate delivery.

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**Symbolic or Exploded View No.:**
- A1
- B2
- C3

**Note:**
- Parts are available for immediate delivery.
- All parts are in stock.
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