

NAVMAN

Service Manual

25/1 Watt VHF Marine Radio
VHF7200EU, VHF7200US

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SPECIFICATIONS

NAVMAN VHF7200EU

Feature	Unit	Limit
Frequency Range: Transmit	MHz	156.025 to 162.425
Frequency Range: Receive	MHz	156.025 to 162.425
Number Of Channels		55 INT Channels
Oscillate Mode		PLL
Modulation		FM (16KOG3E), DSC (16K0G2B)
Channel Spacing	kHz	25
Frequency Stability	PPM	±10
Standard Operation Temperature	°C	-15 to +55
Normal Working Voltage	V	+13.6 V DC
Minimum operating Voltage	V	≤10
Low battery detect Voltage	V	10.5 ± 0.5
Digital Selectivity Calling (DSC)		Class "D" (EN301025)

Receiver	Unit	Limit
Intermediate Frequency : 1st	MHz	21.4
: 2nd	kHz	450
Sensitivity: 20dB SINAD	dBμV	≤-3 (EMF)
Squelch Sensitivity: at tight	dBμV	≤2 (EMF)
Spurious Response Rejection Ratio	dB	≥70
Adjacent Channel Selectivity	dB	≥70
Intermodulation Response	dB	≥68
S/N at 3kHz Deviation	dB	≥40
Audio Output Power at THD 10%	W	≥2
Audio Distortion	%	≤10
Audio Response	dB	EIA STANDARD
Current Drain At : Max Audio Power	A	≤1.5
: Stand-By	A	≤0.25

Transmitter	Unit	Limit
Frequency error	kHz	$\leq \pm 1.5\text{kHz}$
RF Power : Hi	W	23 ± 2
: Lo	W	0.8 ± 0.2
Maximum Deviation	kHz	± 5
S/N at 3kHz Deviation	dB	35
Modulation Distortion $\pm 3\text{kHz}$	%	≤ 7
Audio Response at 1kHz Deviation	dB	EIA STANDARD
Spurious/Harmonic Emissions: Hi/Lo	dB	$\geq 80/70$
Modulation Sensitivity	mV	≤ 12
Current Drain at 13.6V DC : Hi Power	A	≤ 6
: Lo Power	A	≤ 1.5

NAVMAN VHF7200US

Feature	Unit	Limit
Frequency Range: Transmit	MHz	156.025 to 157.425
Frequency Range: Receive	MHz	156.025 to 163.275
Number of Channels		55 INT Channels 53 USA Channels 61 CANADA Channels 10 Weather Channels
Oscillate Mode		PLL
Modulation		FM (16K0G3E), DSC (16K0G2B)
Channel Spacing	kHz	25
Frequency Stability	PPM	± 10
Standard Operation Temperature	$^{\circ}\text{C}$	-15 To + 55
Normal Working Voltage	V	+13.6 V DC
Minimum operating Voltage	V	≤ 10
Low battery detect Voltage	V	10.5 ± 0.5
Digital Selectivity Calling (DSC)		Class "D" (EN301025)

Receiver	Unit	Limit
Intermediate Frequency : 1st	MHz	21.4
: 2nd	kHz	450
Sensitivity: 20dB SINAD	dB μ V	\leq -3 (EMF)
Squelch Sensitivity: at tight	dB μ V	\leq 2 (EMF)
Spurious Response Rejection Ratio	dB	\geq 65
Adjacent Channel Selectivity	dB	\geq 65
Intermodulation Response	dB	\geq 65
S/N at 3kHz Deviation	dB	\geq 40
Audio Output Power at THD 10%	W	\geq 2
Audio Distortion	%	\leq 10
Audio Response	dB	EIA STANDARD
Current Drain at : Max Audio Power	A	\leq 1.5
: Stand-By	A	\leq 0.25

Transmitter	Unit	Limit
Frequency error	kHz	\leq \pm 1.5 kHz
RF Power : Hi	W	23 \pm 2
: Lo	W	0.8 \pm 0.2
Maximum Deviation	kHz	\pm 5
S/N at 3 kHz Deviation.	dB	35
Modulation Distortion \pm 3 kHz	%	\leq 7
Audio Response at 1kHz Deviation.	dB	EIA STANDARD
Spurious/Harmonic Emissions: Hi/Lo	dB	\geq 70/60
Modulation Sensitivity	mV	\leq 12
Current Drain at 13.6V DC : Hi Power	A	\leq 6
: Lo Power	A	\leq 1.5

Note: Nominal specifications represent the design specifications. All units should be able to approximate these specs. Some will exceed these specs, and others may drop slightly below them. Limit specs represent the absolute worst condition that might still be considered acceptable. A unit should never fail to meet limit specs.

THEORY OF OPERATION

This PLL controlling VHF marine mobile transceiver provides an accurate and stable multi-channel operation.

The transceiver consists of 15 main sections:

- **Transmitting stage**
- **Receiving stage**
- **Local oscillator PLL (Phase Lock Loop) Circuit**
- **Memory backup**
- **Low voltage detection**
- **Large LCD**
- **Local/distance Circuit**
- **2nd Receiver (only VHF7200 EU)**
- **WX Alert Circuit (only VHF7200 US)**
- **Software upgrade and Clone**
- **DSC Feature**
- **GPS Message**
- **ATIS Feature (only VHF7200 EU)**
- **BARO & TEMP Mode**
- **NAVBUS**

- **Transmitter Stage**

The audio is picked up from the internal Mic. The audio signal is then amplified by Audio Amplifier, IC205C, IC205B and filtered by a low pass filter IC10C, IC10D. The audio that is adjusted by VR3 to obtain a suitable RF frequency-deviation, modulates the carrier of VCO, through Varicap (VD2).

The modulated signal output from the VCO is pre-amplified by Q2 and IC1. When the supply voltage is 13.6V, this signal will be amplified by IC1 up to 1W or 25W RF power. The signal is filtered by low-pass filter circuit of which consists of L1, L2, L4, C1, C2, C3, C5, C6, C14, C47 and C62. These low pass filters are necessary to suppress the second and the third harmonics as higher. The signal is then fed into the antenna termination and radiated out. The signal is also fed into another path consisting of C9, C10, D3, D4 for sampling, and is converted into a direct current voltage for the Automatic Power Control (APC) circuit IC12, Q5, Q14, Q15 and Q24 to control the voltage of IC1 Pin 2 to maintain the output power stability. Q15 is used for control Hi/Lo power.

When the unit is transmitting, the channel control voltage is added to the TX VCO varicap VD6. The capacitance of VD2 is varied following the audio signal, therefore the carrier is modulated to form the modulated signal.

- **Receiver Stage**

The receiver uses a double frequency super-heterodyne circuit. The first Intermediate Frequency (IF) is 21.4 MHz and the second is 450 kHz.

The RF signal is received by the antenna, and passes through a low-pass filter network L1, L2, L3, L9, C1,

C2, C3, C5, C6, C14, C47 and C62 to filter out unwanted signal. The received RF signal then passes through a high RF transformer L10 and is amplified by RF amplifier Q9. L11, L12, L13, C15, C18, C20 form the band pass filter. The RF signal then is mixed with the local oscillation frequency by the mixer D22, D23. The first IF (Immediate Frequency) 21.4 MHz is produced. This IF is passed through a coil T2 and a pair of crystal filter F1, F2 to further filter out other unwanted signals. The first IF then is amplified by Q11 and the IF amplifier IC7. (IC7 is an integrated IF amplifier which consists of a local oscillator, a demodulator, a second mixer, squelch control circuit, and IF amplifier). The 21.4 MHz IF then is mixed here with second mixer and converted into 2nd Immediate Frequency (IF) 450 kHz. The 2nd IF passes through a ceramic filter F4 to filter out the residue unwanted signal at pin 5 of IC7 output this final IF signal and The demodulated AF signal is output at pin 9 of IC7.

The demodulated AF signal passes through IC15, and then passes through a volume control VR201 through de-emphasis circuit feeding IC10A, IC10B, and finally is amplified by Audio amplifier IC11 and is heard in the speaker.

The squelch control signal is also produced by IC7. The rectified noise signal is output by Pin 14 of the IC7, and passes through the network by composition of C170, R44 and is sent to the MCU to mute the audio speaker path and to indicate the RX station on LCD, R214, R217 and VR203 form a variable resistor, which correspond to the squelch level.

The RSSI signal also is produced by IC7. RSSI signal is output by Pin 12 of the IC7, and passes through the network by composition of C129, R133 and is sent to the MCU to indicate the RF signal strength on LCD, which corresponds to the received RF level.

- **Local oscillator PLL (Phase Lock Loop) Circuit:**

The receiver and transmitter both share the same PLL (Phase Lock Loop) circuitry to produce the carrier frequency or the receiver local oscillation frequency. The local oscillator consists of a fundamental frequency oscillator Q301 and a phase Lock Loop (PLL) IC16. When Rx 5V voltage is supplied, the VCO will produce receiver local oscillator frequency. The high stability frequency is determined by crystal X2 and as the PLL reference oscillator. This signal is frequency-divided by IC16 and a 12.5 kHz signal is produced. When the VCO frequency applied to IC16 pin1 and frequency-divided by IC2 produces a frequency comparable to 12.5 kHz, PLL IC pin 3 will output a PD voltage to control the VCO. When these two frequencies are matched, a constant control voltage is output from PLL to lock VCO in desired frequency. Otherwise, the PLL IC pin 5 will also output a unlock indication to MCU to indicate that the PLL is in the frequency unlock state.

- **Memory Backup**

IC201 is an EEPROM AT24C64, which acts as a memory backup for the working channel code and the system parameters. Every time when the unit is switched on, the MCU will reset the system, clear the RAM, and recall the memory from the EEPROM to refresh the RAM in MCU IC203.

- **Low Voltage Detection**

The battery voltage divided by R250 and R251 through R254 is input to IC203 for voltage level detection. If the battery voltage drops below 10V, LCD will indicate the battery is in low state.