HX400 Alignment

The **HX400** has been carefully aligned at the factory for the specified performance across the marine and LMR bands.

Realignment should therefore not be necessary except in the event of a component failure.

All component replacement and service should be performed only by an authorized STANDARD HORIZON representative, or the warranty policy may be voided.

The following procedures cover the sometimes critical and tedious adjustments that are not normally required once the transceiver has left the factory. However, if damage occurs and some parts are replaced, realignment may be required. If a sudden problem occurs during normal operation, it is likely due to component failure; realignment should not be done until after the faulty component has been replaced.

We recommend that servicing be performed only by authorized STANDARD HORIZON service technicians who are experienced with the circuitry and fully equipped for repair and alignment. Therefore, if a fault is suspected, contact the dealer from whom the transceiver was purchased for instructions regarding repair. Authorized STANDARD HORIZON service technicians realign all circuits and make complete performance checks to ensure compliance with factory specifications after replacing any faulty components. Those who do undertake any of the following alignments are cautioned to proceed at their own risk.

Problems caused by unauthorized attempts at realignment are not covered by the warranty policy. Also, STANDARD HORIZON must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners. Under no circumstances should any alignment be attempted unless the normal function and operation of the transceiver are clearly understood, the cause of the malfunction has been clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary. The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting from use of improper test equipment is not covered under the warranty policy. While most steps do not require all of the equipment listed, the interactions of some adjustments may require that more complex adjustments be performed afterwards. Do not attempt to perform only a single step unless it is clearly isolated electrically from all other steps. Have all test equipment ready before beginning, and follow all of the steps in a section in the order presented.

Required Test Equipment

- ❒ RF Signal Generator with calibrated output level at 200 MHz
- ❒ Frequency Counter: >0.1 ppm accuracy at 200 MHz
- ❒ AF Signal Generator
- ❒ Deviation Meter (linear detector)
- ❒ VHF Sampling Coupler
- ❒ Inline Wattmeter with 5% accuracy at 200 MHz
- ❒ 50-ohm Non-reactive Dummy Load: 10W at 200 MHz
- ❒ 7.4 VDC, 2A Regulated DC Power Supply

Alignment Preparation & Precautions

A dummy load and inline wattmeter must be connected to the main antenna jack in all procedures that call for transmission, except where specified otherwise. Correct alignment is not possible with an antenna. After completing one step, read the following step to determine whether the same test equipment will be required. If not, remove the test equipment (except dummy load and wattmeter, if connected) before proceeding.

Correct alignment requires that the ambient temperature be the same as that of the transceiver and test equipment, and that this temperature be held constant between 68 °F and 86 °F (20 °C and 30 °C). When the transceiver is brought into the shop from hot or cold air it should be allowed some time for thermal equalization with the environment before alignment. If possible, alignments should be made with oscillator shields and circuit boards firmly affixed in place. Also, the test equipment must be thoroughly warmed up before beginning.

Note: Signal levels in dB referred to in this procedure are based on 0 dBμ = 0.5 μV(closed circuit).

Notice: Do not change the adjustment item except those written in the following adjustment procedures.

Entering the Alignment mode

Press and hold in the [**H/L**], [▲] and [**CLR**] keys while turn the transceiver on to enter the alignment mode.

PLL Section

PLL Reference Frequency Adjustment

- ❒ Connect the wattmeter, dummy load, and frequency counter to the antenna jack.
- ❒ Press the [▲] or [▼] key to select the display to "**REF**".
- ❒ Press the [**SQL**] key, then press the [**H/L**] key to enable adjustment of the PLL Reference Frequency.
- ❒ Press the **PTT** key to transmit the transceiver, if necessary, press the [▲] or [▼] key to adjust the frequency so the counter frequency is 156.800 MHz (±100 Hz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Receiver Section

Squelch Gain Adjustment

- ❒ Referring to the "**Receiver Section Alignment Setup**" on the next page, connect the RF Signal Generator to the antenna jack, and connect the DC voltmeter to **TP1032**.
- ❒ Press the [▲] or [▼] key to select the display to "**GAIN**".
- ❒ Press the [**SQL**] key to enable adjustment of the Squelch Gain level.
- ❒ Press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Set the RF Signal Generator output level 0 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz) at 156.800 MHz.
- ❒ Press the [**H/L**] key, then press the [▲] or [▼] key so that the DC voltmeter reading is 0.3 V (±0.05 V).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.

- ❒ Change the RF Signal Generator to 174.000 MHz. The output level keeps 0 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key, then press the [▲] or [▼] key so that the DC voltmeter reading is 0.3 V (±0.05 V).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 134.000 MHz. The output level keeps 0 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key, then press the [▲] or [▼] key so that the DC voltmeter reading is 0.3 V (±0.05 V).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Squelch Threshold Adjustment (Wide Bandwidth)

- ❒ Press the [▲] or [▼] key to select the display to "**N TH W**".
- ❒ Press the [**SQL**] key to enable adjustment of the Squelch Threshold level.
- ❒ Press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Set the RF Signal Generator output level –8 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz) at 156.800 MHz.
- ❒ Press the [**H/L**] key to read the Squelch Threshold level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Threshold level at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 174.000 MHz. The output level keeps –8 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key to read the Squelch Threshold level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Threshold level at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 134.000 MHz. The output level keeps –8 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key to read the Squelch Threshold level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Threshold level at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Squelch Threshold Adjustment (Narrow Bandwidth)

- ❒ Press the [▲] or [▼] key to select the display to "**N TH N**".
- ❒ Press the [**SQL**] key to enable adjustment of the Squelch Threshold level.
- ❒ Press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Set the RF Signal Generator output level –8 dBμV (with a standard FM modulation: ±1.5 kHz deviation @ 1 kHz) at 156.800 MHz
- ❒ Press the [**H/L**] key to read the Squelch Threshold level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Threshold level at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.

- ❒ Change the RF Signal Generator to 174.000 MHz. The output level keeps –8 dBμV (with a standard FM modulation: ±1.5 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key to read the Squelch Threshold level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Threshold level at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 134.000 MHz. The output level keeps –8 dBμV (with a standard FM modulation: ±1.5 kHz deviation @ 1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to read the Squelch Threshold level at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Squelch Tight Adjustment (Wide Bandwidth)

- ❒ Press the [▲] or [▼] key to select the display to "**N TI W**".
- ❒ Press the [**SQL**] key to enable adjustment of the Squelch Tight level.
- ❒ Press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Set the RF Signal Generator output level 0 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz) at 156.800 MHz
- ❒ Press the [**H/L**] key to read the Squelch Tight level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Tight level at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 174.000 MHz. The output level keeps 0 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key to read the Squelch Tight level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Tight level at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 134.000 MHz. The output level keeps 0 dBμV (with a standard FM modulation: ±3.0 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key to read the Squelch Tight level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Tight level at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Squelch Tight Adjustment (Narrow Bandwidth)

- ❒ Press the [▲] or [▼] key to select the display to "**N TI N**".
- ❒ Press the [**SQL**] key to enable adjustment of the Squelch Tight level.
- ❒ Press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Set the RF Signal Generator output level 0 dBμV (with a standard FM modulation: ±1.5 kHz deviation @ 1 kHz) at 156.800 MHz
- ❒ Press the [**H/L**] key to read the Squelch Tight level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Tight level at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 174.000 MHz. The output level keeps 0 dBμV (with a standard FM modulation: ±1.5 kHz deviation @ 1 kHz).

- ❒ Press the [**H/L**] key to read the Squelch Tight level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Tight level at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Change the RF Signal Generator to 134.000 MHz. The output level keeps 0 dBμV (with a standard FM modulation: ±1.5 kHz deviation @ 1 kHz).
- ❒ Press the [**H/L**] key to read the Squelch Tight level, then press and hold the [**H/L**] key for 2 seconds to save the Squelch Tight level at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Transmitter Section

TX Power Adjustment (Hi Power)

- ❒ Connect the wattmeter and dummy load to the antenna jack.
- ❒ Press the [▲] or [▼] key to select the display to "**H PWR**".
- ❒ Press the [**SQL**] key, then press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Press the [**H/L**] key to enable adjustment of the TX Output Power at the band center.
- ❒ Press the **PTT** key to enable the transmitter (make sure the DC input voltage to the battery terminals is at 7.4VDC), press the [▲] or [▼] key to adjust the output power to 5.0 W (±0.1 W).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.
- ❒ Press the [**H/L**] key to enable adjustment of the TX Output Power at the high band edge.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the output power to 5.0 W (±0.1 W).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Press the [**H/L**] key to enable adjustment of the TX Output Power at the low band edge.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the output power to 5.0 W (±0.1 W).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

TX Power Adjustment (Low Power)

- ❒ Connect the wattmeter and dummy load to the antenna jack.
- ❒ Press the [▲] or [▼] key to select the display to "**L PWR**".
- ❒ Press the [**SQL**] key, then press the [**H/L**] key to enable adjustment of the TX Output Power.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the output power to 1.0 W (±0.1 W).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting.
- ❒ Press the [**CLR**] key to exit from this alignment item.

TX Deviation Adjustment (Max Deviation)

- ❒ Connect the wattmeter and dummy load to the antenna jack, then connect the deviation meter to the antenna jack through the VHF sampling coupler.
- ❒ Connect the AF Generator to the **MIC/SP** jack, then adjust the AF Generator output to 100

mV at 1 kHz.

- ❒ Press the [▲] or [▼] key to select the display to "**MOD**".
- ❒ Press the [**SQL**] key, then press the [▲] or [▼] key to select a small character of lower right corner of the display to "**C**".
- ❒ Press the [**H/L**] key to enable adjustment of the TX TX Deviation at the band center.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the deviation to 4.2 kHz (+0 kHz/–0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the band center.
- ❒ Press the [▲] key to change the "**C**" character to "**H**" at the lower right corner of the display.
- ❒ Press the [**H/L**] key to enable adjustment of the TX TX Deviation at the high band edge.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the deviation to 4.2 kHz (+0 kHz/–0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the high band edge.
- ❒ Press the [▼] key twice to change the "**H**" character to "**L**" at the lower right corner of the display.
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the low band edge.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the deviation to 4.2 kHz (+0 kHz/–0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the low band edge.
- ❒ Press the [**CLR**] key to exit from this alignment item.

TX Deviation Adjustment (Modulation Balance)

- ❒ Connect the wattmeter and dummy load to the antenna jack, then connect the deviation meter to the antenna jack through the VHF sampling coupler.
- ❒ Connect the AF Generator to the **MIC/SP** jack, then adjust the AF Generator output to 300 mV at 350 Hz.
- ❒ Press the [▲] or [▼] key to select the display to "**MODBAL**".
- ❒ Press the [**SQL**] key ,then press the [▲] or [▼] key to set a small character of lower right corner of the display to "**L**".
- ❒ Press the [**H/L**] key to enable adjustment of the TX TX Deviation Modulation Balance at the low band edge.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the deviation to 4.2 kHz (+0 kHz/–0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the low band edge.
- ❒ Change the AF Generator to 300 Hz. The output level keeps 300 mV.
- ❒ Press the [▲] key twice to change the "**L**" character to "**H**" at the lower right corner of the display.
- ❒ Press the [**H/L**] key to enable adjustment of the TX TX Deviation Modulation Balance at the high band edge.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the deviation to 4.2 kHz (+0 kHz/–0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the high band edge.
- ❒ Press the [▼] key to change the "**H**" character to "**C**" at the lower right corner of the display.
- ❒ Press the [**H/L**] key to enable adjustment of the TX TX Deviation Modulation Balance at the band center.
- ❒ Press the **PTT** key to enable the transmitter, press the [▲] or [▼] key to adjust the deviation

to 4.2 kHz (+0 kHz/–0.1 kHz).

- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting at the band center.
- ❒ Press the [**CLR**] key to exit from this alignment item.

TX Deviation Adjustment (DCS)

- ❒ Connect the wattmeter and dummy load to the antenna jack, then connect the deviation meter to the antenna jack through the VHF sampling coupler.
- ❒ Press the [▲] or [▼] key to select the display to "**DCS**".
- ❒ Press the [**SQL**] key, then press the [**H/L**] key to enable adjustment of the TX Deviation (DCS).
- ❒ Press the **PTT** key to enable the transmitter and to output a DCS tone, press the [▲] or [▼] key to adjust the deviation to 0.6 kHz (±0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting.
- ❒ Press the [**CLR**] key to exit from this alignment item.

TX Deviation Adjustment (CTCSS)

- ❒ Connect the wattmeter and dummy load to the antenna jack, then connect the deviation meter to the antenna jack through the VHF sampling coupler.
- ❒ Press the [▲] or [▼] key to select the display to "**CTCSS**".
- ❒ Press the [**SQL**] key, then press the [**H/L**] key to enable adjustment of the TX Deviation (CTCSS).
- ❒ Press the **PTT** key to enable the transmitter and to output a CTCSS tone, press the [▲] or [▼] key to adjust the deviation to 0.7 kHz (±0.1 kHz).
- ❒ Press and hold the [**H/L**] key for 2 seconds to save the new setting.
- ❒ Press the [**CLR**] key to exit from this alignment item.

Exit from the Alignment mode

To exit from the Alignment mode, turn the transceiver off.