

Honeywell

Primus HF 1050 HF Radio System



HF Technical Description

Honeywell launched the development of our next generation high frequency digital radio, the KHF 1050 system, in late 1999. This new 28Vdc radio advances the performance and capability of our HF systems to meet the emerging needs of the HF market place, while still providing the best value of performance to cost.

The new KHF 1050 System is superior to our existing KHF950 system in many ways. Among many other features, it allows for the separation of the Power Amplifier and Antenna Coupler. This feature allows the antenna coupler to be located closer to the antenna, vastly improving the effective radiation of this 200 watt PEP high frequency system.

1.1 Key Features of the New KHF 1050 System:

- KHF1050 interfaces to the ARINC429 data bus for control purposes.
- KHF 1050 is designed to be compatible with the following controllers: RM-855 Radio Management Unit, PS-440 Stand Alone controller, and the MCDU Multi-function controller and display unit.
- KHF1050 system is hard mounted; no shock mounts required eliminating 1.5 inches installation height and up to 5 inches in sway space restriction
- Stored tuning in non-volatile memory...once tuned, always tuned.
- High fidelity audio data input and data output for interface to external modems.
- 99 User programmable channels with a PS-440 controller.
- 6 Pre-programmed emergency channels including 2.182 MHz.
- 246 International Telecommunications Union (ITU) maritime radiotelephone network channels stored in permanent, non-volatile memory.
- 280,000 discrete operating frequencies covering the 2.0000 to 29.9999 MHz frequency range in 100 Hz steps (1 kHz steps with a RM-855).
- SELCAL[®] compatible audio output to an external SELCAL[®] decoder alerting the pilot of an incoming voice call
- PA/Coupler can be separated; coupler can be mounted next to antenna and tailored to specific aircraft/antenna configurations, maximizing the effective radiated HF power
- RS 232 serial link maintenance ports to PC for test and monitoring control, BIT, and software update on the bench.

1.2 Key Performance Characteristics of the KHF 1050 System:

- Robust performance: Low distortion 200 Watt Peak Envelope Power (PEP) transmitter output .
- Quicker tuning: Coupler will match the antenna impedance with a first acquisition tune time <10 seconds (nominal), and return to stored tune condition in less than 20 milliseconds. This stored tune is placed in a non-volatile memory so that re-tuning will not be necessary for that channel and frequency in that installation as long as the LRU is not removed and antenna impedance does not change.
- Rapid transition from Receive to Transmit
- Superior Receiver selectivity through triple conversion intermediate frequency (IF) amplification and into digital signal processing
- Improved "weak signal" reception and less noise through improved Receiver Sensitivity: SSB Operation -123 dBm > 10 dB SINAD (typ) (-113 dBm min).

- Lower “receive audio” distortion (SSB) less than 5%
- Lower Transmit & Receive VSWR increases coupler (antenna) effective radiated power and antenna receive signal: Tune to less than 1.5:1 VSWR Typical
- Built-in-test capability for (BIT) diagnostic testing
- Unit test and fault diagnostics using external PC or ARINC 429 Controller Display
- Syllabic squelch helps eliminate background noise, yet lets voice signals through. Four pilot-selectable squelch types are available with the PS-440 and MCDU controllers.
- Use of Digital Signal Processing (DSP) and state of the art surface mount technology enables better reliability and overall performance.
- Unit operation up to 55,000 feet outside the pressure vessel of the aircraft. Unit Certified to RTCA DO-160D and DO-178B Level C

1.3 HF Equipment Listing and Weights

<i>Model</i>	<i>Part Number</i>	<i>Description</i>	<i>Length in. *</i>	<i>Width in. *</i>	<i>Height in. *</i>	<i>Weight lbs. *</i>
KRX 1053	064-01073-0101	Receiver/Exciter	10.8	3.1	5.0	5.5
KRX 1053 Install Kit	050-03628-0000	Receiver/Exciter Install Kit(Rack only)	11	3.3	0.25	0.3
KPA 1052	064-01072-0101	Power Amplifier	12.7	7.2	1.8	7.6
KPA 1052 Install Kit	050-03629-0000	Power Amplifier Install Kit(Rack only)	12.8	7.3	0.25	0.7
KAC 1052	064-01074-0101	Antenna Coupler*	13.5	4.7	7.2	15.7
KAC 1052 Install Kits	050-03658-0000	Antenna Coupler Vertical Install Kit (Weight for Rack only)	13.6	4.7	0.25	0.5
	050-03660-0000	Antenna Coupler Horizontal Install Kit (Weight for Rack only)	13.6	7.2	0.25	0.7
	050-03661-0000	Antenna Coupler Dual Vertical Install Kit (Weight for Rack only)	13.6	10	0.25	1.1
PS 440	071-01605-1101	Primus II Select HF Control Head, Amber/Gray	5.375	2.375	2.625	1.1

Connectors and mounting hardware are not included in unit dimensions and weight. New
KHF 1050 Installation Equipment Listing

2. KHF 1050 System

2.1 KPA 1052 Power Amplifier

The KPA 1052 Power Amplifier is all solid-state. The PA mounts in a horizontal orientation, and can be mounted up to 50+ feet away from the Antenna Coupler. It can be mounted outside the aircraft pressure vessel for operation at any altitude up to 55,000 feet and

shock mounts are not required. The KPA 1052 amplifies the signal from the KRX 1053 Receiver/Exciter into a 200 watt peak envelope power (PEP) transmitted signal in single sideband operation or 50 watts of carrier power in AM operation. After filtering, the amplified signal is fed to the KAC 1052 antenna coupler. In the receive mode, the signal is passed through the KPA 1052 to the KRX 1053 receiver.

2.2 KAC 1052 Antenna Coupler

The KAC 1052 Antenna Coupler is mounted near the HF antenna to maximize transmission efficiency. The KAC 1052 can be mounted in either the vertical or horizontal position, outside the aircraft pressure vessel for operation at any altitude up to 55,000 feet, and shock mounts are not required. The antenna coupler matches the impedance of the antenna to the 50 ohm output of the transmitter. A microprocessor in the KAC 1052 controls the antenna coupling function and exchanges information with the controller via the KRX 1053. A bridging amplifier is included in the design of the KAC 1052 allowing elimination of external bridging amplifier for dual HF installations.

2.3 KRX 1053 Receiver/Exciter

The KRX 1053 remote unit contains the receiver and the exciter for the KHF 1050 system. It can be mounted outside the aircraft pressure vessel for operation at any altitude up to 55,000 feet. The exciter generates a low power transmit signal, which is fed to the power amplifier in the KPA 1052. Superior receive performance is achieved by a triple conversion receiver which employs digital signal processing, providing higher fidelity demodulation and a variety of squelch types.

The KRX 1053 supports external SELCAL (SElective CALLing) option. A standard SELCAL decoder (not furnished with the KHF 1050 System) is required for operation. In a SELCAL equipped aircraft, the pilot can have the audio volume turned down completely or squelched to relieve background noise during flight. In order to contact the aircraft, a coded audio signal is sent, which is decoded by the SELCAL decoder on board the aircraft, which causes a visual or audio signal to be generated notifying the crew of the call.

2.4 PS 440 Primus II Select HF Controller

The PS 440 is a new ARINC 429 HF control head. It operates as a stand-alone controller in either single or dual HF installations. Selections of frequency or channel operation, emission modes, squelch and various options (i.e. ITU, Clairifer, HF Data Link, etc) are made by rotating two concentric knobs on the front panel. Two other concentric knobs, with a center push button, are used to select the operating frequency or programmed channel, and entering information into memory. Also, three push buttons are used for selecting emergency frequencies, performing self-tests, and selecting various settings. Information is displayed on a series of LCDs occupying two rows along the top of the controller.



3. Datalink Capability (Future Path Definition)

3.1 Design Objective

The KHF 1050 design provides a clear growth path to support future requirements for HF data link communications. Although there is limited use for HF data link today, operators will need HF to support voice and data in the future to take full advantage of the benefits that will be available when CNS/ATM is fully implemented. The initial KHF 1050 will meet the technical specifications to support data, and can be upgraded in the future to full data link capability without the need for an additional LRU. The KRX 1053 external connector pin numbers have already been designated for the HF data link so that harness wiring can proceed to be ready for the KRX 1053 with HF data link capability.

3.2 Growth Path

The KHF 1050 provides high-fidelity data audio performance to support the error detecting modems needed for data link communications. In addition, the KRX 1053 is being designed to accommodate a card that will contain the needed modem and frequency management functionality. The circuitry will be adapted into a single card that can be *integrated into the KRX 1053*. This upgrade will be available to support future CNS/ATM requirements. The space for that card is already allocated.

4. KHF 1050 Product Availability

The KHF 1050 system is now shipping.

Appendix A – KHF 950 / KHF 1050 Feature Comparison

Feature Set Comparison

KHF 950 and KHF 1050

Feature	KHF 950	KHF 1050
Data Capable		Data interface for use with external modem is standard. Growth path to internal data link capability Supports commercial data link (ACARS/AFIS)
Output Power	150W PEP	200W PEP
Control Buss	Dedicated HF controller required/proprietary buss	ARINC 429 tuning; growth to standalone controller
Shock Mounting	All LRUs require shock mounting for vibration	No shock mounting reqd; saves 1.5" vertical and up to 5" sway space
PA/Coupler tray mounting	PA and Coupler must be mounted together	PA and Coupler can be mounted separately
Squelch Selection and Control	Signal strenght squelch with continuous squelch control	Syllabic squelch available, select between syllabic and signal strength squelch; with step or continuous control
Central Maintenance Computer	N/A	CMC member system for LRU failure identification
HF Coupler tuning		Tuning speed increased. Once tuned, stays tuned at a selected frequency (even w/o power)
DO-160 Categories		Improved environmental ruggedness due to TSO at DO-160D Change 1
External Adapter Requirements	Several required for antenna selections	All external adapters eliminated
Weight	PA/Coupler = 13.8 lbs RX/EX = 6.4 lbs	PA = 7.6 lbs Coupler = 15.7 lbs RX/EX = 5.5 lbs

Appendix B: Volumetric Comparison with KHF 950

The KHF 1050 system volume as measured LRU volume alone is greater than the KHF 950 system. However, the real impact of volume is measured as it's installed in the aircraft. Due to higher levels of integration and ruggedization, the total *installed volume required* of the KHF 1050 is actually far less than that of the KHF 950 as shown in the following analysis.

	KHF 950	KHF 1050
	cu. In.	cu. In.
Single HF System		
Receiver/Exciter		
LRU Volume	161.3	162.3
Shock Mount height addition	48.4	0
Required sway space	107.5	0
Total:	317.2	162.3
Coupler/PA		
LRU Volume	490.4	611.8
Shock Mount height addition	101.6	0
Required sway space	183.3	0
Total:	775.3	611.8
Single HF Shunt Antenna Adapter	54.3	0
Single HF Bus Adapter for KFS594	32.3	0
Total installed volume required for Single HF system	1179.1	774.1
Dual Installation - additional volume required		
Add Dual HF Shunt Antenna Adaptor	84.9	0
Subtract Single HF Shunt Ant Adaptor	54.3	0
Add Dual HF Bridging Amplifier	38.8	0
Add second HF Bus Adapter	32.3	0
	101.7	0
Total installed volume required for dual HF system	2373.3	1548.2