

**Raytheon**

**JPS Communications**

# RTU-292

## Radio/Telephone Interface Unit



The **RTU-292 Radio/Telephone Interface Unit** provides trouble-free automatic connection between a radio system and a telephone system or other two-wire line. The unit is suited for use with HF, VHF, UHF, or satellite systems and is applicable to full-duplex or half-duplex modes. The unit incorporates a full-featured telephone set and monitor speaker.

### ADVANTAGES

- Suited for Use with HF, VHF, UHF or Satellite Systems.
- Unmanned Auto-Dial/Auto-Answer Capability.
- Automatic Adaptive Hybrid Balance: No Hybrid Adjustments.
- DSP-Based VOX.
- Sophisticated Call Progress Monitoring.
- Line Reversal Detection Going On-Hook.
- Radio Remote Control, Local Phone and ALE Interface Options.
- STU-III Interface Option.
- Voice Prompting in Many Languages.
- Incorporates a Full Featured Telephone Set.
- Front Panel Keypad with DTMF or Pulse Dialing.
- Remote Dial-Through of Phone Numbers.
- Standard Telephone Operation Over Twisted Pair Field Wire.

The RTU-292 is an automatic telephone interconnect unit for the connection of one telephone line with one radio. It offers the flexibility of several modes for manned or unmanned station operation.

When used in manual mode, first a radio-to-radio link is established. Then, using the telephone in the RTU-292, the operator places a call to the distant telephone that will be patched into the radio link. Once the distant telephone party is on the line, the operator pushes a front-panel button to complete the patch to the radio link. The operator may communicate with either party using the unit's handset, and may monitor both sides of the conversation with the speaker.

The RTU-292 contains auto-dial/auto-answer capability. This feature enables users to dial from any phone system through unmanned radio stations into other phone systems.

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Since the RTU-292 has built-in DSP (Digital Signal Processor) VOX (Voice Operated Xmit) capability, the voice on the phone line at each end of the link keys that RTU-292's respective unmanned radio.

With its handset and front panel telephone keypad, the RTU-292 may be used as a telephone (independent of radio connections) using either DTMF or push dialing. The handset may also be used to transmit and receive via the radio without a telephone connection. The front panel includes pushbuttons for monitoring the radio audio, telephone audio, or both simultaneously using the front panel speaker and/or headphone jack.

The RTU-292 offers a standard four-wire audio connection to the radios with balanced/unbalanced 600 Ohm or high impedance interfaces. The unit also provides a transmit PTT driver, receiver COR input and serial port for

optional remote control of radios. Input and output levels are adjustable to accommodate all types of radio systems. A setup mode allows the adjustment of signal levels without the need for external test equipment.

The PSTN telephone interface of the RTU-292 contains a unique adaptive hybrid circuit implemented with DSP. This circuit is completely automatic, eliminating conventional VOX and hybrid adjustments. The adaptive hybrid achieves a broadband balance on reactive phone lines and continuously adapts to changing line conditions, making operation insensitive to line impedance changes. The unit has an RJ11C connector on its rear panel into which a PSTN line, cellular telephone, or satellite terminal can be plugged.

A 4-wire capability allows the RTU-292 to interface a device like a STU-III secure telephone set with a radio.

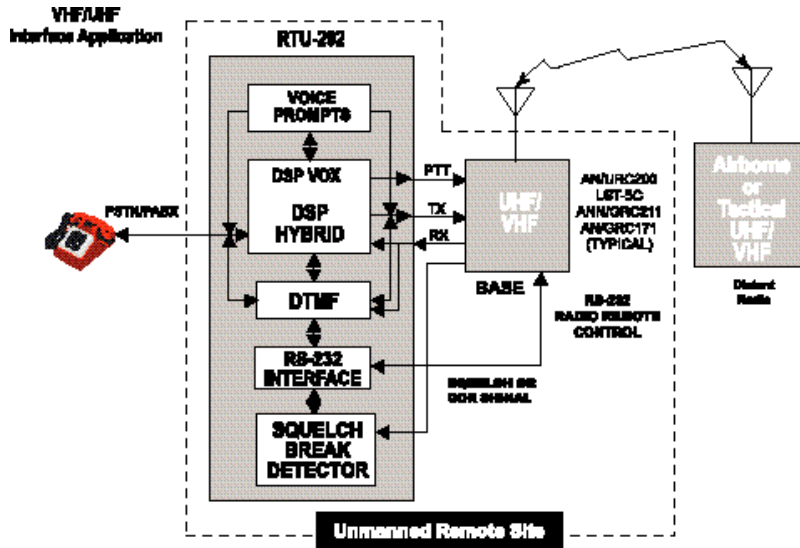
When equipped with the voice prompt option, the RTU-292 contains prerecorded messages called voice prompts that are played to guide the user in the operation of the system. For example, a radio user attempting to access the system would hear the words "enter password". When successfully connected, the user would hear "connection was successful, proceed with your conversation". These voice prompts inform the user of the status of the system and the call they are placing, helping an inexperienced or infrequent user to know the status of the system.

In addition to the HF ALE option and the Voice Prompt option, the RTU-292 can be equipped with a Radio Remote Control option, a VMR (Voice Modulation Recognition)/Noise Reduction option, and a Local Phone option. The Local Phone option allows a conventional telephone to control the RTU-292 via a length of twist-

ed pair field wire. The VMR/Noise Reduction option uses a second DSP to provide high reliability VMR and effective noise reduction to HF radios.

The Radio Remote Control Option uses the RTU-292's serial port to remotely control radios over telephone lines, permitting a user to change internal radio parameters such as mode, channel, or frequency of distant unmanned radios. Optional software is available for many kinds of radio remote control and different operational scenarios.

The RTU-292 is set up to interface cleanly with a computer for the purpose of automatically sending or receiving telephone calls over an HF link using ALE capability. If a customer already has computer control of the HF ALE capability, the RTU-292 may be interfaced to the computer without any engineering design modifications in the unit.



The block diagram above shows an application in which an RTU-292 is interfaced to a tactical or airborne VHF/UHF radio system. In this system, the RTU-292 is commanded from the distant radio to dial one of a group of

previously-stored telephone numbers. The command can be given by the radio to the RTU-292 either via DTMF or a series of "squelsch breaks", a number of which determines the selected telephone number. In either

case, the RTU-292 responds to the radio command with a voice prompt sent to the radio which notifies the distant radio user of the selection he has made and asks for confirmation of the selection before proceeding.

Once the connection is established, the VOX in the RTU-292 keys the base radio when the telephone line party speaks. Note that operation is completely automatic and that the remote site need not be manned.

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The RTU-292 can also be used to construct a system which interconnects two telephone systems via a half-duplex HF Radio link without computer intervention. In this situation, the RTU-292 must be provided with custom software to interface directly with the HF ALE controller if this capability doesn't already exist. This system uses the Automatic Message Display (AMD) message facility of a FED-STD-1045 Automatic Link Establishment (ALE) system to transfer telephone numbers from the local to the distant station. The RTU-292 allows an untrained user who is unfamiliar with radio operating procedures to make a telephone call over a radio link. A user must know only the following three numbers: (1) the telephone number of the local unmanned radio station, (2) his user password, and (3) the destination code of the distant individual or facility he wishes to call (if this information has been previously stored in the speed dial memory of the RTU-292).

### Block Diagram Description

The block diagram below shows the system connections and equipment necessary to pass

telephone numbers and audio over an HF ALE radio system. The system includes, at each end, an HF transceiver equipped with ALE interfaced to an RTU-292. Of course, the system is not limited to two stations, but may include any number of stations, each with its own address in the ALE system.

### Main Operating Scenario

User at the telephone set A desires to place a call through the HF system to distant telephone set D.

1. The user picks up the receiver of telephone set A and dials the number of the local RTU-292 system.
2. The RTU-292 B answers with a voice message and waits for the user to enter his password (password optional).
3. User enters his password and the function code for placing a call through the ALE system. The following functions are typically available from the RTU-292:  
Place a call.  
Monitor receiver audio.  
Transmit/Receive via phone.  
Switch VOX on/off.  
Key/unkey the transmitter.

Store number in speed dial memory.  
Recall a number from speed dial.  
Cancel an operation.  
Disconnect (hang up).

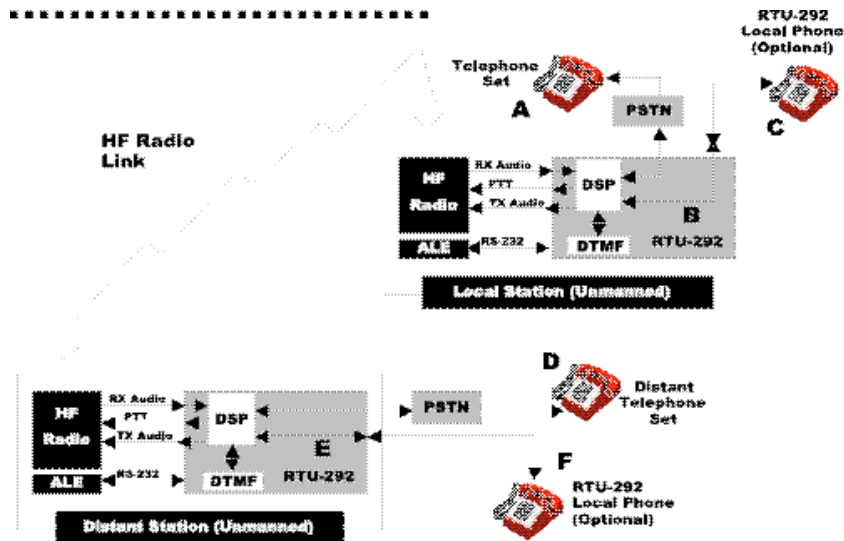
4. If the ALE system is available, the RTU-292 responds with a voice message.
5. Using the telephone keypad, the user enters the speed dial code for the stored telephone number he wishes to dial. If the desired number is not yet stored in the RTU-292, the user may enter the information manually. The number includes the address of the distant ALE system plus any digits that must be dialed, such as the area code, country code, etc.
6. If the ALE system is available, the RTU-292 passes the number to be dialed to the ALE system's orderwire message buffer, and directs the system to link with the distant station.
7. At this point, the telephone user is given a voice prompt stating that the link is being established.
8. When a link is made, a voice message is sent to the phone A, while the distant RTU-292

obtains the number to be dialed from the ALE's orderwire message buffer and dials the distant phone number. If the link should fail, a voice prompt is sent and the user may then hang up or dial another number.

9. The party at the distant phone D answers and hears a voice message that he is receiving a call via radio. He may then key the transmitter via DTMF commands or use VOX (default) and talk to the party who dialed at A.

### Call Progress Monitoring

The RTU-292 contains sophisticated call progress monitoring which enables the distant unit to determine when a party has actually answered the distant phone. This is necessary because following distant call dialing, several scenarios are possible:  
The call is answered normally.  
The call is not answered.  
A dead line results.  
A busy or trunk busy is obtained.  
The call is answered by a FAX machine or modem.



# RTU-292 Radio/Telephone Interface Unit

## SPECIFICATIONS

Telephone Line Interface	
Output Level to Phone Line	Nominally -9 dBm (adjustable -12 to -6 dBm in 3 dB steps).
Input Level from Phone Line	Nominally -9 dBm (adjustable -12 to -6 dBm in 3 dB steps).
Frequency Response	300 Hz to 3200 kHz $\pm$ 2dB.
Output Impedance to Phone Line	600 Ohms.
VOX Sensitivity	16 $\pm$ 2dB below input level setting (-25dBm @ -9dBm level setting for example).
VOX Hang Time	11 second or 1.5 seconds, internally adjustable.
Hybrid Balance/Adaptation Speed (into 600 Ohms)	-30 dB over 300 to 3200 Hz bandwidth within 1.25 seconds; measured with white noise source.
Ultimate Hybrid Balance (into 600 Ohms)	-50 dB typical over 300 to 3200 Hz bandwidth; measured with a single tone.
Hybrid Impedance Matching Capability	0 to infinity Ohms complex impedance.
Phone Line Connections	RJ-11C connector (J1) and screw terminals.
Radio Interface (P1, DB-9 Male)	
Input Impedance	Balanced or unbalanced 600 or 56k Ohms.
Input Level	-20 to -10 dBm, internally adjustable.
Output Impedance	600 Ohms, balanced.
Output Level	-20 to -10 dBm, internally adjustable.
Frequency Response	300 to 3200 Hz $\pm$ 2 dB.
Key Relay Output	Low level relay contacts, 60 VA max. Switching speed 5 msec.
Telephone	
Handset (RJ-12C Jack)	Electret microphone, dynamic receiver.
Dialing Modes	DTMF, pulse at 10 or 20 pps.
Pulse Dial Make/Break Ratio	40/60.
Dialing Keypad	3 x 4, standard telephone layout.
General	
Microphone Interface	ALC (Automatic Level Control) having 30 dB dynamic range.
Headphone Interface (Monaural Phone Jack)	Drives high, medium, or low impedance headphones. Delivers not less than 10mW into 600 Ohm headphones.
Speaker Driver Power	4 W min. @ 10% distortion.
Internal Speaker	3 inch square, 3.2 Ohms.
Indicators	Indicators for each push button, plus peak level and keypad LEDs.
Front Panel Controls	Power on/off switch, Dialing keypad, Speaker volume control, Phones volume control. Pushbuttons: Tel-Line-Phone, Tel-Line-Radio, Handset-Phone, Handset-Radio, Speaker-Phone, Speaker-Radio, Tel-VOX, Manual Key, Auto Ans., Auto Ring.
DC Input Power	+11 to +15 VDC or +22 to +30 VDC, 1A maximum.
AC Input Power	115 or 230 VAC $\pm$ 15%, 47-63 Hz, 20 VA typical, 50 VA maximum.
Size	3.5"H x 19"W x 10"D (6.9 x 48.3 x 25.4 cm).
Weight	12 lbs. (5.5 kg).
Operating Temperature	-25 degrees C to +55 degrees C.
Storage Temperature	-40 degrees C to +85 degrees C.
Humidity	Up to 95% @ 55 degrees C.
Shock	MIL-STD-810D, method 516.3 procedure VI.
Options	Radio remote control, VMR/noise reduction, Local phone, ALE control, Voice prompts, DTMF telephone.
Vibration	MIL-STD-810D, method 514.3 category I.

## OTHER OPERATIONAL SCENARIOS

The main scenario describes a call placed from telephone A to telephone D, but all other call combinations are possible including calls from 292 local phone C or RTU-292 B to distant points D, E or F (refer to the block diagram below).

In another application, an ALE-equipped HF radio may call into either station shown in the block diagram below and place a telephone call via the RTU-292 in the system.

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