



RFI
TECHNOLOGY SOLUTIONS

Receiver Multicoupler Application Note



Introducing RFI's Expandable Receiver Multicoupler - RxMUX

These Receiver Multicouplers may be used to improve the signal-to-noise performance of a two-way radio system. They are compatible with both analogue and digital technologies and also provide the ability to distribute received signals from a single antenna system to multiple base station receivers.



Receiver Multicouplers PERFORMANCE & FUNCTIONALITY

These Receiver Multicouplers provide unparalleled performance with the flexibility to configure and expand as individual customer requirements demand.

Receiver Multicouplers should always be linked to an appropriate Receiver Preselector that passes the desired receive frequencies and rejects transmitter or other out-of-band signals.

The Challenge

The two-way radio marketplace is a changing landscape. The introduction of digital technologies, shared networks, and ever-increasing expectations for reliability have raised the bar in receiver combiner requirements.

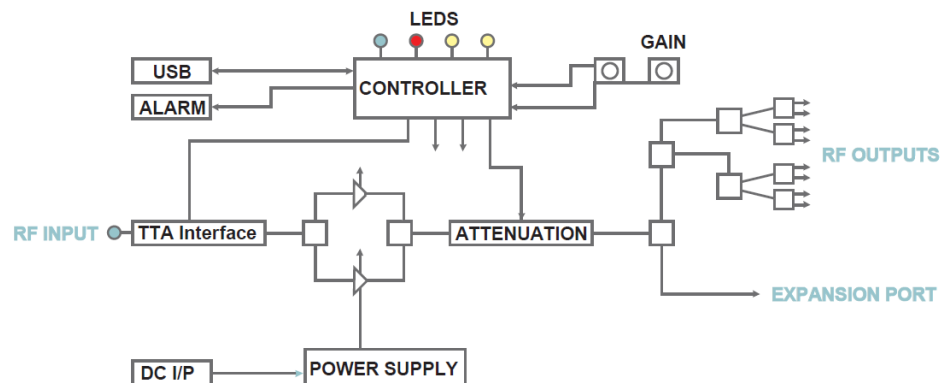
The Solution

RFI offers a range of high performance Receiver Multicoupler products targeted at satisfying these emerging requirements.

PRODUCTS FEATURE:

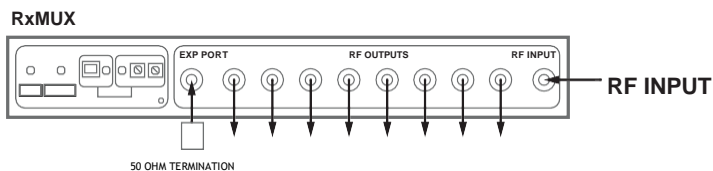
- 12VDC, 24VDC, 48VDC or 90-264VAC Operation
- "Full-band" operation (132 -174, 380-520 or 698-960MHz)
- In-built amplifier redundancy
- Low noise amplifiers (LNA)
- Ease of expandability
- Manual or programmable gain setting
- "Extended-band" operation (88-220, 220-550 or 698-960MHz)
- Local or remote alarm outputs
- Local or remote programming

RFI's Receiver Multicouplers have been designed to incorporate high performance RF specifications and reliability of operation. This high performance level is coupled with a user-friendly configuration capability and comprehensive integral monitoring and alarm status capability.



Product Description

RF INPUT



The RF Input of the Receiver Multicoupler utilises an “N” female connector. Internal protection is fitted to this input to assist with the provision of surge protection for the amplifier stages.

This internal surge protection supplements the correct implementation of external surge protection and grounding practices that should be fitted to all receiver antenna and feeder installations.

TTA INTERFACE

Receiver Multicouplers are available that support a Tower Top Amplifier (TTA), providing the capability to deploy a TTA to realise the benefits of improved system uplink performance in a network.

TTA's can be provided in multiple configurations that can also include Bypass, Auto-Gain and Test Port functionality. TTAs and Receiver Multicouplers may be deployed to support single, dual, and diversity receiver applications.

AMPLIFIER DESIGN

A quadrature Low Noise Amplifier (LNA) design is utilised in the Receiver Multicoupler to provide optimised performance. The use of high 30IP amplifiers and design practices within the LNA ensures that high linearity and low intermodulation susceptibility is provided across a broad dynamic range of input signal levels. This capability is particularly important for in-building and in-tunnel systems that may experience high Input signal levels when radio handsets can venture into close proximity of antennas or radiating cables. In outdoor coverage applications, these high-performance LNAs ensure that the broad dynamic range of input signal levels that can be presented from near-versus-far radio coverage scenarios do not overload the receiver system (near), while still providing low-noise amplification of weak input signals (far).

For digital technologies, this broad dynamic range capability can assist in ensuring maximum performance is provided across the entire range of RF input levels - from the weakest signal from a distant portable, to a strong signal from a nearby mobile. This capability can allow the full potential of low bit error rate (BER) performance in the network's uplink (or “talk-in”) sensitivity to be realised.

An additional benefit of the quadrature LNA design is the inherent redundancy provided by the paralleled amplifier stages. For fault conditions impacting one amplifier stage, the remaining stage will continue to operate. Under these fault conditions, a minimal reduction in performance will be evident. However, a unique ‘Auto-gain’ feature may be enabled to compensate for this and the continued operation of the Receiver Multicoupler will ensure that the network remains in operation until the fault is rectified. Integral amplifier stage status monitoring provides an Alarm LED indication and relay contact output to report the alarm state. This level of redundancy provides an inherent level of fault tolerance and network resiliency that can be of particular benefit in operations-critical applications.



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Receiver Multicouplers EXPANDABILITY & FLEXIBILITY

These Receiver Multicouplers can be easily expanded in the field, catering for output capacities of up to 128 outputs.

They provide unparalleled performance with the flexibility to configure and expand as individual customer requirements demand.

GAIN CONFIGURATION

A digital step attenuator is incorporated within the Receiver Multicoupler design to provide the capability to easily configure the gain of the network's receiver combiner system. This attenuator setting can be configured by manually setting the BCD rotary switches located on the rear of the unit or via the USB programming interface.

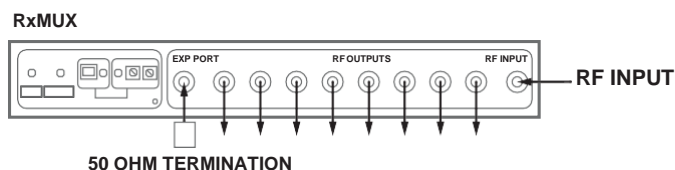
The programming interface can be used to configure whether the BCD or USB gain value is used in the attenuator, and the ability to set this preference can allow the unit to be configured without a PC, or alternatively, to prevent on-site tampering of the system if desired.

The ease of changing the Receiver Multicoupler gain can also be used to compensate for any additional losses introduced into the receiver combiner system through the future addition of Expansion Multicouplers - maintaining consistent system performance throughout future expansion phases.

RF OUTPUTS

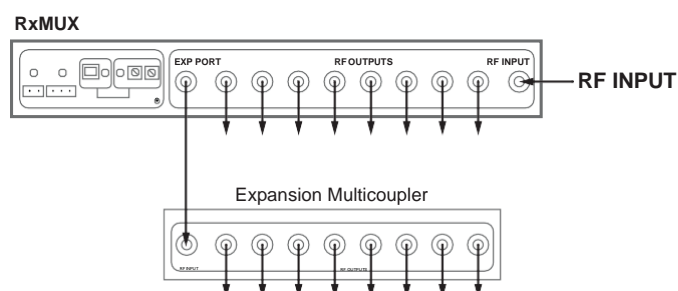
A multi-stage output divider is provided in the Receiver Multicoupler. Eight (8) RF Outputs and One (1) Expansion Port are provided in the Receiver Multicoupler, all utilising N-female connectors.

Capacity 1 to 8 channels

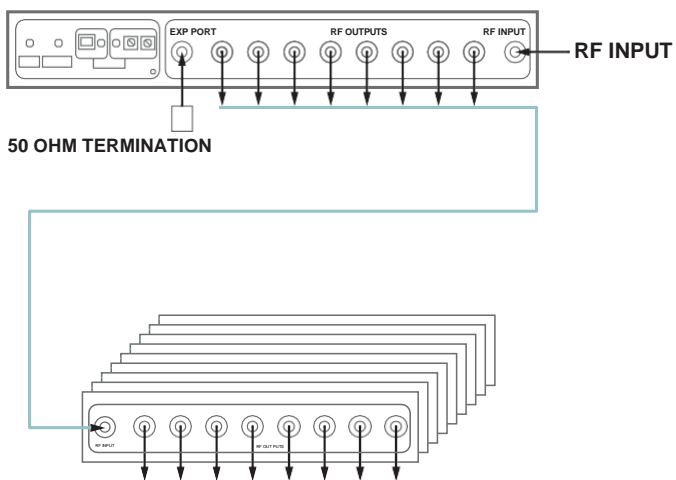


The Expansion Port can be used to expand the initial eight (8) RF outputs up to sixteen (16) RF outputs, all of equal net gain, through the use of an Expansion Multicoupler. If the Expansion Port is not used it should be fitted with a 50 ohm termination.

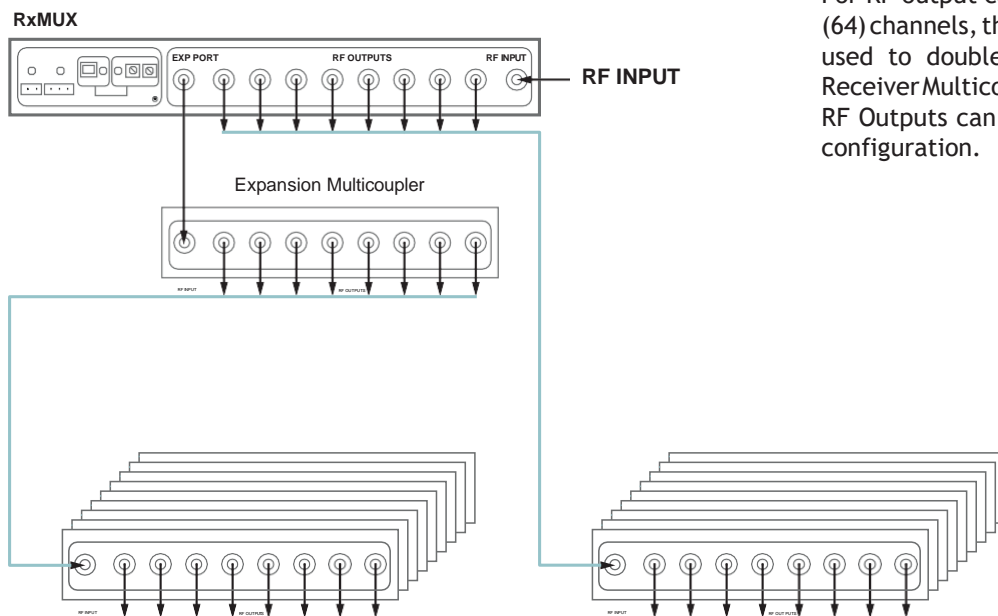
Capacity 1 to 16 channels



Capacity 1 to 64 Channels



Capacity 1 to 128 Channels



For RF output capacities above sixteen (16) channels, the Expansion Port should be terminated, and multiple Expansion Multicouplers connected to the Receiver Multicoupler RF Outputs. Up to sixty-four (64) RF Outputs can be provided through this process.

As the output capacity is increased above that of the 1-16 channel configuration, the gain of the Receiver Multicoupler should be adjusted to compensate for the additional losses introduced in this configuration, restoring the receiver combiner system's net gain to the required value.

Unused RF Outputs can be left unterminated if desired, with a minimal performance degradation.

For RF output capacities above sixty-four (64) channels, the Expansion Port can be used to double the capacity of the Receiver Multicoupler system. Up to 128 RF Outputs can be provided using this configuration.



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The Receiver Multicoupler rear panel contains the RF Input, eight RF Outputs and Expansion Port connectors. It also contains four LED indicators, Manual Gain Switches, DC Power, Alarm Output and USB connectors



Receiver Multicouplers CONFIGURABILITY

These Receiver Multicouplers can be easily configured in the field, allowing parameters to be adjusted to cater for network optimisation, expansion and re-deployments.

POWER SUPPLY

The Receiver Multicoupler is designed to operate from a typical +12VDC source. Other supply voltage options are available to suit 24VDC, 48VDC and other DC supply requirements. Many installations of these Receiver Multicouplers may conveniently use either the Base Station's existing power supply - or the site's main UPS - with an optional wide ranging AC Power supply mains operation also available if required.

FRONT PANEL

RxMUX

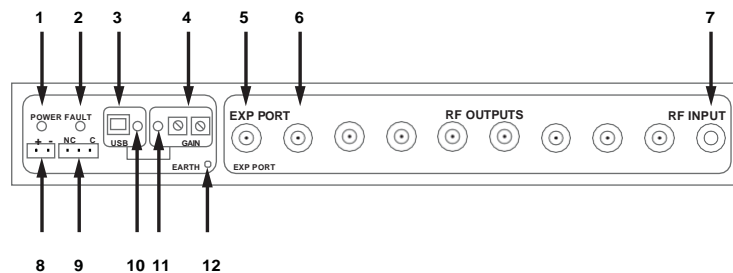


The Receiver Multicoupler front panel displays four (4) LED indicators. These front panel indicators are as follows:

1. Switch Control LED Yellow LED which lights when the gain is controlled by the switches on the rear panel.
2. USB Control LED Yellow LED which lights when the gain is controlled by the USB programmed value.
3. Fault LED Red LED lights when a fault is detected.
4. Power LED Green LED which lights when power is connected.

REAR PANEL

The Receiver Multicoupler rear panel also displays four (4) LED indicators. It also contains the RF Input, Expansion Port and 8 RF Output Ports N connectors. DC Power, Alarm Relay and USB connectors are conveniently located, and the gain setting BCD rotary switches are also presented on the rear panel.



These rear panel indicators and connectors are as follows:

1. Power LED Green LED which lights when power is connected.
2. Fault LED Red LED which lights when a fault is detected.
3. USB Connector Type B connector to connect to a PC.
4. Gain Switches Rotary switches to manually set the gain.

5. Expansion Output	N(f) connector to connect to the optional 8 way Expansion Unit.
6. RF Output	One of eight N(f) connections to the receivers.
7. RF Input	N(f) connection to the receiver antenna via a receiver preselector.
8. Power Connector	2 way Phoenix connector to connect to the DC power supply.
9. Alarm Connector	3 way Phoenix connector to connect to external alarm devices.
10. USB Control LED	Yellow LED which lights when the gain is controlled by the switches on the rear panel.
11. Gain Control LED	Yellow LED which lights when the gain is controlled by the USB programmed value.
12. Earth Screw	Termination for connection to an equipment earth.

PROGRAMMING

A USB serial communications port is provided on the Receiver Multicoupler. This port can be used for programming, status and alarm interrogation and firmware upgrades.

The communications protocol uses a simple, text-only terminal emulation format compatible with most common types of computers. USB drivers are available on RFI's website www.rfi.com.au

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FIRE_TOWER, RX3852-3408-31 VO.1, SERIAL No.14_NOV_2008
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```
12V    9V    AMP-1  AMP-2
OK     OK     OK     OK

USB Gain    =    0dB
Switch Gain =    17dB
Gain Control =    Switches
Current Gain =    17dB
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Programmable parameters include

- Site Name
- Gain Setting
- Manual or Programmable Gain Control

The USB connection can be used to facilitate remote programming and/or monitoring of the Receiver Multicoupler.

ALARMS

The Receiver Multicoupler models feature integral power supply and amplifier stage status monitoring and alarm reporting. Parameter status can be interrogated via the unit's USB port. Alarm conditions are presented by LED indicators and also by dry-voltage relay contacts, with both normally open (N.O.) and normally closed (N.C.) connections available for use.

The alarm conditions that are monitored and reported are

- Internal 12 VDC supply within tolerance
- Internal 9VDC supply within tolerance
- Amplifier 1 status
- Amplifier 2 status

Options

MULTICOUPLER EXPANSION DECK

The Multicoupler Expansion Deck is supplied separately and can be added to provide easy field-expansion of channel capacity as required in the future. The Expansion Deck is a broadband module and is compatible with Receiver Multicouplers operating on any frequency from 66 MHz to 960 MHz. It is supplied on a standard 1RU 19" rack mount panel.



POWER SUPPLY OPTIONS

Mains Power Supply

If the Receiver Multicoupler is not to be operated from the network DC voltage or site UPS power supply, 90 - 264VAC universal mains power supply units are available to power the Receiver Multicoupler. These units are supplied pre-terminated for direct connection to the Receiver Preselector's 12 or 48VDC Input connector.

18- 36VDC Power Supply

A fully floating 18VDC - 36VDC power supply option is available. This option is fitted internally within the Receiver Multicoupler and must be ordered with the Receiver Multicoupler unit. It is not designed to be field retrofitted.

36 - 60VDC Power Supply

A fully floating 36VDC - 60VDC power supply option is also available. This option is also fitted internally within the Receiver Multicoupler and must be ordered with the Receiver Multicoupler unit. It is not designed to be field retrofitted.

SUPPORT

These units are shipped with a Quick Start Guide and a fitted 50 ohm termination on the Expansion Port. A comprehensive Users Manual, Datasheet, Quick Start Guide, USB driver files, the latest firmware files, and Service Bulletins are available for downloading from our website. www.rfi.com.au

Note: These products are available in various configurations. Please contact your nearest RFI Sales Office to discuss specification application requirements. As part of our product improvement program, specifications may be subject to change without notice"

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