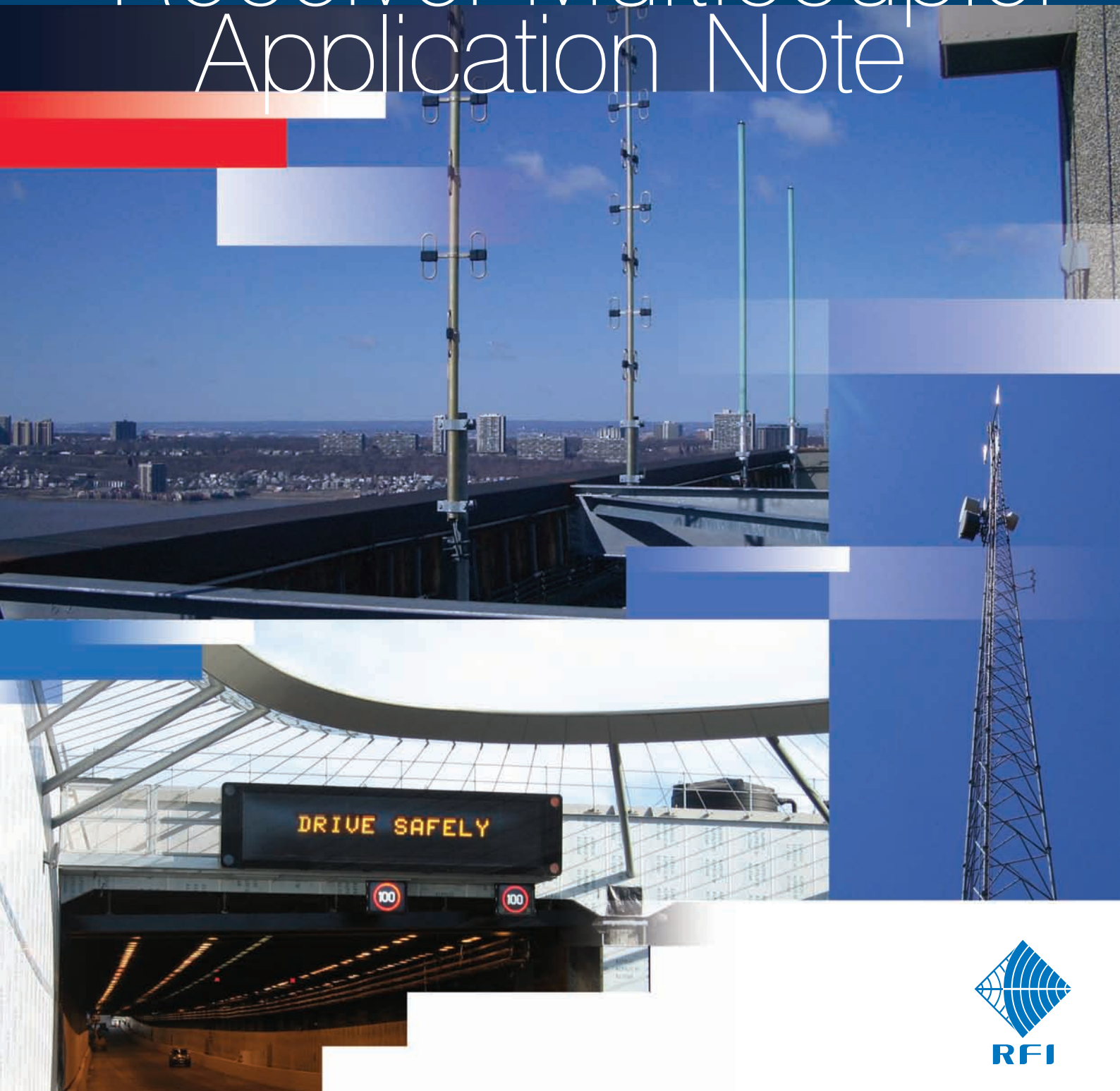


# Receiver Multicoupler Application Note



# Introducing RFI's New 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.

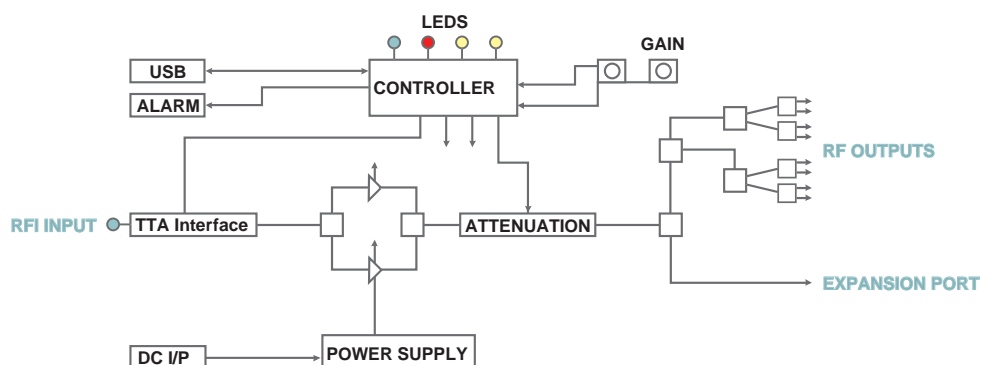
## The Solution

RFI is pleased to announce the introduction of a new range of high performance Receiver Multicoupler products targeted at satisfying these emerging requirements.

### THESE NEW PRODUCTS FEATURE:

- 12 VDC Operation
- "Full-band" operation (132-174 MHz, 380-520 MHz and 698-960MHz)
- In-built amplifier redundancy
- Low noise amplifiers (LNA)
- Ease of expandability
- Manual or programmable gain setting
- Integral status monitoring
- Local or remote alarm outputs
- Local or remote programming
- Auto-gain adjustment on partial quadrature amplifier failure

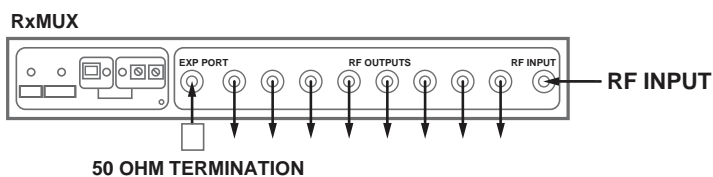
RFI's new Receiver Multicouplers have been designed to incorporate high performance RF specifications and reliability of operation. This high performance level is coupled with a user-friendly configuration capability and comprehensive integral monitoring and alarm status capability.



## 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.

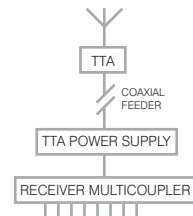


This internal surge protection supplements the correct implementation of external surge protection and grounding practices that should be fitted to all receiver antenna and feeder installations.

## TTA INTERFACE

A Tower Top Amplifier (TTA) Interface can be incorporated into a Receiver Multicoupler application. This capability allows the deployment of an optional TTA with a Receiver Multicoupler to provide the benefits of improved system uplink performance into a network.

This capability provides a future TTA deployment capability to a receiver combiner system utilising this Receiver Multicoupler product range.



## LOW NOISE AMPLIFIER

A quadrature Low Noise Amplifier (LNA) design is utilised in the Receiver Multicoupler to provide optimised performance. The use of high 3OIP devices 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 levels when radio handsets can venture into close proximity of antennas or radiating cables.

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 of the parallel amplifier stages. An Auto-Gain feature automatically restores the set gain of the Receiver Multicoupler in the event of failure impacting one amplifier stage within the quadrature amplifier, allowing continued operation and ensuring the network remains in operation until the fault is rectified. Integral amplifier stage status monitoring will provide 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.

## ATTENUATOR

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.

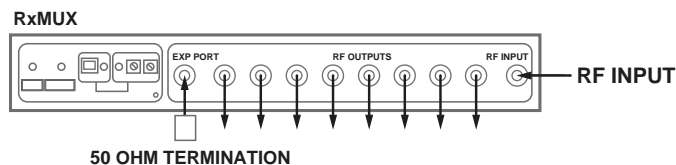
The programming interface can be used to configure whether the BCD or USB gain value is used in the attenuator, and the ability to set this preference can allow the unit to be configured without a PC, or alternatively, to prevent on-site tampering of the system if desired.

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

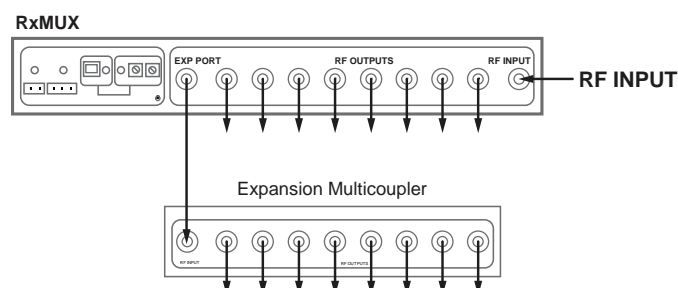
A multi-stage output divider is provided in the Receiver Multicoupler. Eight (8) RF Outputs and One (1) Expansion Port are provided in the Receiver Multicoupler, all utilising N-female connectors.

The Expansion Port can be used to expand the initial eight (8) RF outputs up to **Capacity 1 to 8 channels**

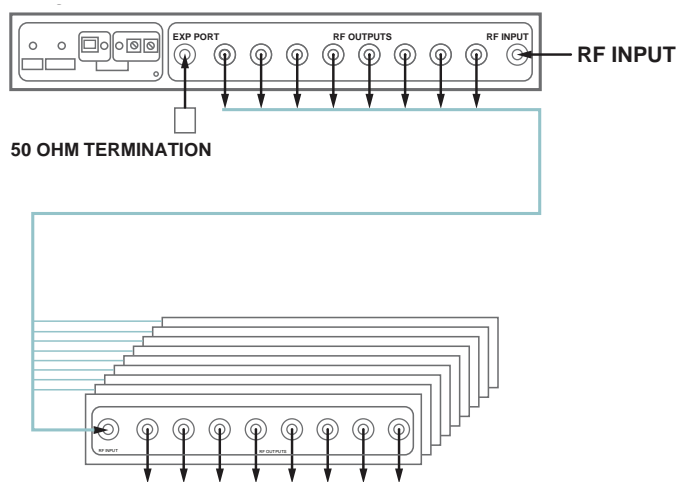


sixteen (16) RF outputs, all of equal net gain, through the use of an Expansion Multicoupler. If the Expansion Port is not used it should be fitted with a 50 ohm termination.

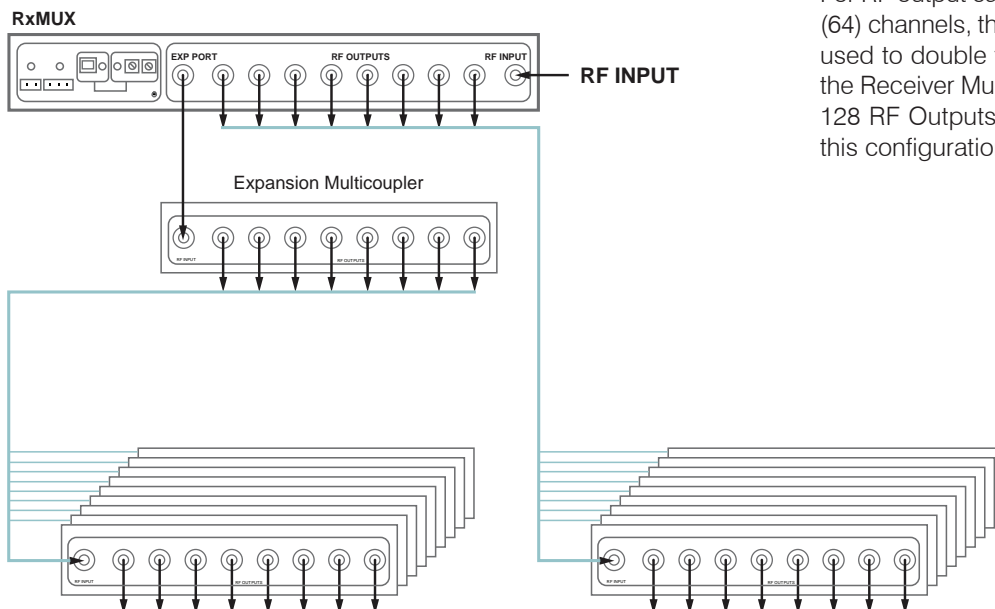
**Capacity 1 to 16 channels**



## 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 9-16 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 only a minimal performance degradation.

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



# Introducing RFI's New Expandable Receiver Multicoupler - RxMUX

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



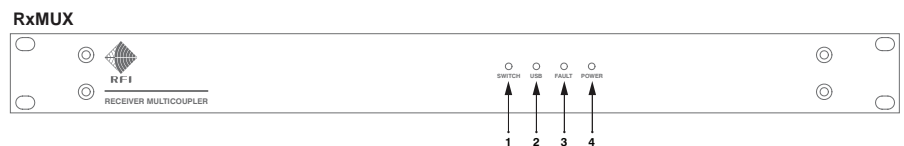
## Receiver Multicouplers CONFIGURABILITY

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 +12 VDC source. Other supply voltage options are available to suit 24 VDC, -48 VDC 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

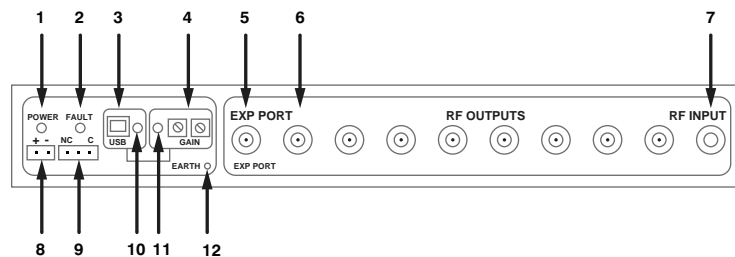


The Receiver Multicoupler front panel displays four (4) LED indicators. These front panel indicators are as follows;

- 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.

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

```
FIRE_TOWER, RX3852-3408-31 V0.1,SERIAL No.14_NOV_2008
```

```
12V      9V      AMP-1    AMP-2
OK       OK       OK       OK

USB Gain    =      0dB
Switch Gain =      17dB
Gain Control =     Switches
Current Gain =      17dB
```

Programmable parameters include;

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

When connected to a landline or wireless modem, this USB connection can be used to facilitate remote programming and/or monitoring of the Receiver Multicoupler.

## ALARMS

The new 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 9 VDC supply within tolerance
- Amplifier 1 status
- Amplifier 2 status

## Options

### EXPANSION MULTICOUPLER

The Expansion Multicoupler is supplied separately, and can be purchased to provide easy field-expansion of channel capacity as required in the future. The Expansion Multicoupler 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, a 100 - 240 VAC universal mains power supply unit is available to power the Receiver Multicoupler. This unit is supplied pre-terminated for direct connection to the Receiver Preselector's 12 VDC Input connector.

#### 18 VDC - 36 VDC Power Supply

A fully-floating 18 VDC - 36 VDC 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 retro-fitted.

#### 36 VDC - 60 VDC Power Supply

A fully-floating 36 VDC - 60 VDC 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 retro-fitted.

### SHIPPING

These Receiver Multicouplers are supplied complete with a Quick Start Guide, a 50 Ohm termination for the Expansion Port, and a CD containing USB drivers and a soft copy of the Quick Start Guide and User Manual.

