



RFI

RECEIVER MULTICOUPLER

Models:

RX1317-3408-31

RX3852-3408-31

RX6996-3408-31

EXPANSION MULTICOUPLER

Model:

RX0696-3008-31

USER MANUAL

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1. Safety Precautions

- There is no On/Off switch on the unit - it becomes active as soon as DC power is connected or the AC plug pack is switched on at the AC outlet.
- Do not allow the unit or any associated equipment to become wet or to be subjected to temperatures outside the specified operating temperature range.
- Do not open the unit as there are no user serviceable parts inside. All faulty equipment should be returned to RFI for repair.
- Do not operate the unit near any flammable substances or in a flammable atmosphere.
- Ensure that all connectors are fully mated.
- Under certain adverse conditions the external surfaces of the unit may become hot and should not be handled without some form of protection, such as gloves.
- Permanently hardwire one of the Protective Earthing points on the back panel to the premises protective earth wiring. This connection provides protection from hazardous and transient voltages.
- Before installing or replacing this equipment the entire manual should be read and understood. The user needs to supply the appropriate DC voltage to the equipment and install it accordance with this manual. Incorrect installation can damage the equipment and may cause injury to the user

2. Overview

The RFI Receiver Multicoupler (RxMUX) is an active multicoupler designed to distribute an antenna signal to multiple receivers without loss and to provide high isolation between the RF outputs. In a typical installation the RxMUX will be fed from a receive antenna via a frequency selective band pass filter selected for the particular application.

The RFI RxMUX design is based on a low noise, high IP3 quadrature amplifier which provides high dynamic range, high reliability and minimal degradation if one path of the amplifier fails.

An optional Expansion Multicoupler can be added to expand the number of outputs from 8 to 16, each with equal gain. If more outputs are required, then further Expansion Multicouplers can be added to provide up to 128 outputs.

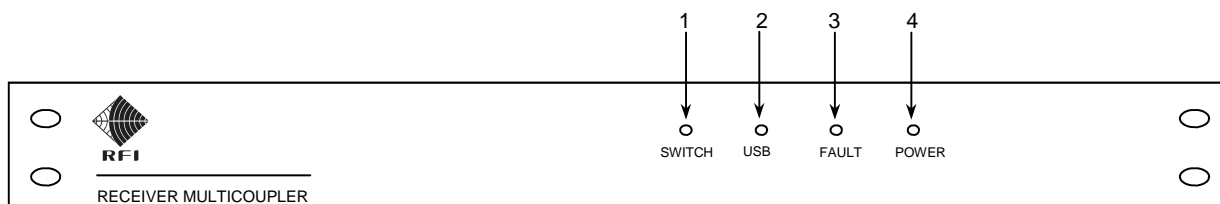
The gain can be manually set using switches on the back panel and the gain and various other parameters, including fault status, can be controlled and monitored via the USB interface.

Alarm relay contacts are provided which can be used to activate a user supplied external alarm such as a bell, light, or some other signal to alert operators to a fault condition.

DC operation is standard with an optional external power supply available for AC operation.

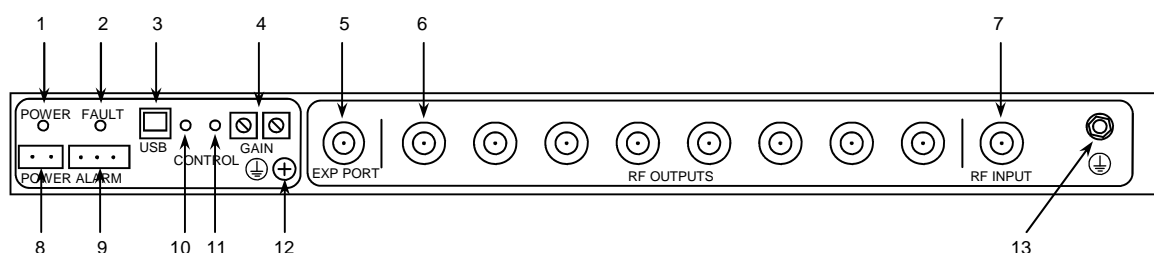
2.1. Connectors and Indicators

2.1.1. Front Panel



- | | |
|-----------------------|---|
| 1. Switch Control LED | Yellow LED lights when the gain is controlled by the GAIN switches on the back panel. |
| 2. USB Control LED | Yellow LED lights when the unit is controlled via the USB interface. |
| 3. Fault LED | Red LED lights when a fault is present. |
| 4. Power LED | Green LED lights when correct polarity power is connected. |

2.1.2. Back Panel



- | | |
|----------------------|--|
| 1. Power LED | Green LED lights when power is connected. |
| 2. Fault LED | Red LED lights when a fault is present. |
| 3. USB Connector | Type B connector to connect to a PC. |
| 4. Gain Switches | Rotary switches to manually set the gain. |
| 5. Expansion Port | N(f) connector to connect to the optional Expansion Multicoupler. |
| 6. RF Output | One of eight N(f) connections to the receivers. |
| 7. RF Input | N(f) connection to the antenna (usually via a BP filter) |
| 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 lights when the unit is controlled via the USB interface. |
| 11. Gain Control LED | Yellow LED lights when the gain is controlled by the GAIN switches. |
| 12. Earth Screw | M5 screw for connection to an earth point. |
| 13. Earth Stud | M6 stud for connection to an earth point. |

2.1.3. Serial Number Label

The Serial number label can be found on the side of the unit – see Fig 1. This label gives the following information:

- The Model Number
- The Frequency Band the unit operates over.
- Typical Gain, Amplifier Third Order Intercept Point and Noise Figure for this model.
- The DC voltage required to power this unit.
- The Serial Number.

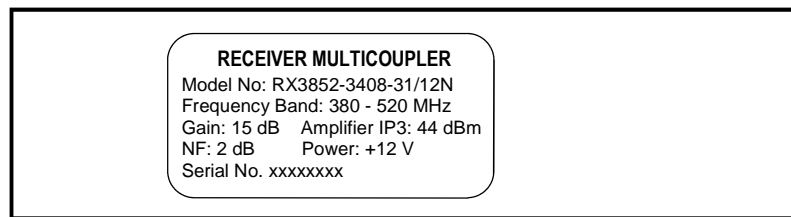


Fig. 1 – Serial Number Label

3. Installation

3.1. Mounting

The RxMUX is to be mounted indoors only. It is designed to fit in a 1U rack space and should be mounted clear of any equipment that generates excess heat. Be careful not to mount the unit inside a fully enclosed cabinet without some ventilation or heat path to a cooler environment. Allowance must be made for the fact that the unit dissipates approximately 8W and over a long period of time can become very hot if adequate ventilation is not provided. If the unit is operated continuously outside its specified temperature range then the performance may degrade and premature failure may occur.

3.2. Power

3.2.1. DC

The supplied 2 pin Phoenix plug can be wired to any convenient DC external supply that will provide the appropriate voltage and current (see specifications). The polarity of the input is marked on the back panel and is shown in Fig 2. Reverse polarity protection is provided so connecting the DC input voltage incorrectly will not damage the unit. Operation of the unit outside the specified voltage range is not recommended and may cause damage to the unit. If the input voltage is below or above the specified range a fault will be triggered and the alarm relay will be activated.

As the input voltage decreases below the specified range the performance of the unit will gradually degrade until the gain drops to a very low value. As the input voltage increases above the specified range the power dissipation of the unit will increase. When operating with a high input voltage, after some time the excess power dissipation in the unit may cause it to overheat. If this occurs the internal power supplies will shut down and the gain of the unit will drop to a very low value. Continuous operation at very high input voltages will cause high internal temperatures which may lead to premature failure of the unit.

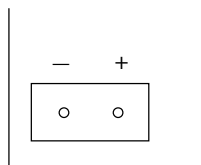


Fig. 2 DC Power Connections

3.2.2. AC

An optional AC to DC external power supply is available that will allow the RxMUX to operate from a wide range of AC supplies. The power supply is supplied with a two way Phoenix connector that will plug directly into the DC Power input. The power supply should be mounted safely in a convenient location that is well ventilated and away from any equipment that generates excess heat.

3.3. Protective Earth

Two Protective Earthing points are provided on the back panel, an M5 screw and an M6 stud, indicated by the symbol:-



Compliance with international electrical safety standards requires that at least one of these points be permanently hardwired to the premises protective earth system using 1.5mm² (14 AWG) minimum cross-sectional area conductor. This connection provides protection from hazardous and transient voltages.

3.4. Alarm relay

Alarm relay outputs are provided on the back panel. Three connections to a set of dry relay changeover contacts are provided. The alarm relay is energized when the RxMUX is powered on and there are no faults. When energized the contacts marked “NC” and “COM” are open. If a fault occurs or power is lost these contacts close. The “NO” contact is also available on the centre pin – see Fig 3. These contacts may be connected to an external device or system to alert operators to a fault condition. A mating three way Phoenix connector is supplied with the unit.

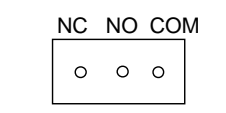


Fig 3. Alarm Relay Connections

3.5. RF Input

This is an N(f) connector input. The specified maximum signal level into this input should be observed to avoid damaging the low noise input amplifier. This input is fitted with a gas filled surge voltage arrester and a high pass filter to provide some protection against transient voltages.

3.6. Expansion Port

This port is provided to connect to an optional Expansion Multicoupler. The Expansion Multicoupler has one input and eight outputs and will expand a standard 8 output RxMUX to 16 outputs. Equal signal levels will be available at each of the 16 outputs. If the optional Expansion Multicoupler is not fitted it is important to fit a 50 ohm termination to the Expansion Port. If it is not terminated the RxMUX performance – in particular the frequency response - will be degraded. The Expansion Port can also be used as another output; however the output level will be approximately 10 dB higher than the eight RF Outputs. Fitting a 10 dB attenuator to the Expansion Port reduces the level to give a RxMUX with nine equal level outputs. See section 6.2.

3.7. RF Outputs 1 to 8

Eight N(f) connector output ports are provided. These are equal in level and well isolated from each other. It is good installation practice to fit a 50 ohm termination to any unused RF output but in practice the performance degradation is minimal if the unused RF outputs are left unterminated.

3.8. USB Control

The RxMUX can be operated via a USB communications link. This will allow the user to set the gain and to view the status of the unit. To use the USB interface, the USB drivers provided on the CD included with the RxMUX will need to be installed on the PC. Connect the RxMUX to a PC using a USB cable with a type A connector on one end and a type B on the other. When the RxMUX is first powered on you will be asked to install new USB drivers. Insert the RxMUX CD into your PC and browse to the “USB Driver” folder. This will contain a folder with the latest version of the USB drivers. Follow the on screen instructions to install the driver. Two different drivers are provided and it may be necessary to install both drivers depending on your particular computer configuration. If you have problems installing the drivers there are several helpful “Installation Guides” included on the CD.

The length of the USB cable between the computer and RxMUX should be no longer than 5m for reliable communications.

3.9. Auto Gain

Auto Gain is a feature that automatically restores the gain of the RxMUX in the event of an internal amplifier fault. If a fault occurs in one half of the quadrature amplifier the RxMUX gain will decrease by approximately 6dB. If the gain was initially set to at least 6 dB lower than the maximum gain available *Auto Gain* will restore the gain to the initial set level. If the gain was initially set to a level between the maximum gain and 6 dB less than the maximum gain then *Auto Gain* will restore the gain to a level 6dB below the maximum gain.

Example:

Assume the RxMUX has a maximum gain of 15 dB. If the gain is initially set to 7 dB and an amplifier fault occurs, Auto Gain will automatically restore the gain to 7 dB. If the gain is initially set to 12 dB and a fault occurs then *Auto Gain* will set the gain to 6 dB less than the maximum gain which, for this unit, is 9 dB.

Note:

- Although the gain is restored, one half of the quadrature amplifier is not operating and therefore the Noise Figure will be degraded by approximately 3 dB and the Input Return Loss and Third Order Intercept Point will be degraded by up to 6 dB.
- This feature will not automatically compensate for all possible amplifier faults.
- This feature is only available on units with firmware version 1.1 or greater. Units with firmware version 1.0 can be upgraded to include this feature by installing the latest firmware. This applies to all models of RxMUX.

4. Operating Instructions

4.1. Switch Control Mode

Two rotary switches are provided to set the gain of the RxMUX. One is labelled “X10” which is used to step the gain in 10 dB steps and the other “X1” which is used to step the gain in 1 dB steps.

The minimum gain is 0 dB with the switches set to “00”. Rotating the “X1” switch through the values “1” to “9” will increase the gain in 1 dB steps up to 9 dB.

To set 10 dB gain the “X10” switch is set to “1” and the “X1” switch to “0”.

For gains above 10 dB up to the maximum gain of the unit the “X10” switch is left set to “1” and the “X1” switch again stepped up through the values “1” to “9”.

The gain will reach a maximum at a setting between 14 dB and 18 dB depending on the factory calibration of the particular RxMUX.

At all switch settings outside the “00” to “XX” range (XX = Maximum Gain) the gain will be 0 dB and the yellow Switch LED will flash to indicate that the value set on the switches is outside the specified gain range.

Example for a RxMUX with a factory calibrated maximum gain of 15 dB.

X10” Switch	“X1” Switch	RxMUX Gain (dB)	
0	0	0	
0	1	1	
0	2	2	
0	3	3	
0	4	4	
0	5	5	
0	6	6	
0	7	7	
0	8	8	
0	9	9	
1	0	10	
1	1	11	
1	2	12	
1	3	13	
1	4	14	
1	5	15	Maximum Gain
1	6	0	
1	7	0	
1	8	0	
1	9	0	
2	0	0	
2	1	0	
⋮	⋮	⋮	
9	9	0	Reset to Switch Control mode (see section 4.3)

4.2. USB Control Mode

Launch a terminal programme on the PC (eg: Hyperterminal™), and configure the programme to the correct “COM” port. In Hyperterminal™ this can be found by selecting “Properties” under the “File” menu.

On the “Connect To” tab select the required “COM” port in the “Connect using:” drop down box, e.g. COM8.

Note: If the “Connect using:” drop down box is greyed out your session needs to be disconnected. You can disconnect by choosing “Disconnect” under the “Call” menu.

Note: Settings on the “Configure” button such as “Data Rate” etc. have no effect on the USB communications.

On the “Settings” tab select “VT100” in the drop down “Emulation” box. Once USB communications has been established commands found in the “Command Interface” section of this manual can be used to monitor and control the RxMUX.

4.3. Resetting to Switch Control Mode

If the RxMUX is in USB Control mode but the user does not have access to a PC, the unit can be forced into Switch Control Mode by setting the rotary GAIN switches to “99” and cycling the power.

4.4. Visual Interface

Note that the LEDs on the front and back panels are in parallel and therefore give identical status information.

4.4.1. Green Power LED

The green ‘Power’ LED is on when external power is present, and the internal controller is operational. If the green LED is not on then either the DC voltage is not connected or the polarity is incorrect.

During a firmware update the green LED will flash to indicate that new firmware is being downloaded into the RxMUX. If the green LED does not stop flashing after some time the download has failed. See section 5.2 for further details.

4.4.2. Red Fault LED

The red “Fault” LED will come on under the following circumstances.

- The input voltage is either too high or too low.
- The internal power rails are not within their normal operating range.
- The internal amplifier current drains are not within their normal operating range.

4.4.3. Yellow Control Mode LEDs

The yellow LEDs indicate which control mode is active. If the “USB” yellow LED is on, then the gain will be set via the USB communications link. If the “Switch” yellow LED is on, then the two rotary switches on the back of the unit will determine the gain. If the “Switch” yellow LED is flashing then the rotary switches on the back panel are set to a value outside the gain range of the unit.

5. Command Interface

5.1. Terms and Conventions

- Operator commands are displayed in upper case on the terminal screen, regardless of the case entered.
- Unless specifically noted, all user entered commands and responses are case insensitive.
- This manual uses the following notational conventions:
 - { } Text enclosed in curly brackets denotes variable operator input.
 - {0 ... 24} Means any value from 0 to 24 is required.
 - {UP | DN} Means either UP or DN is required.
 - [] Text enclosed in square brackets denotes input is optional.
 - < > Text enclosed in these symbols denotes a specific command key.
- Unless specified otherwise, all commands are executed by pressing the <Enter> key.
- The last command may be repeated with the “,” or “.” commands. “,” allows editing with the <Backspace> key, “.” immediately re-issues it.
- When the ‘>’ character is displayed, the system is ready for user input. When first connecting to an already powered-up system, you may need to press the <Enter> key before the command prompt is visible.

5.2. DOWNLOAD

Purpose: Initiates the download of updated firmware.

Syntax: download

Example: Type: DOWNLOAD

Response: This will overwrite the current firmware!

Are you sure? (YES/NO) >

Type: YES

Response: Ready to receive a new application.

- Activate the TRANSFER/SEND FILE (Binary) menu items,
 - Select the relevant .BIN application file,
 - If presented with the option, select XMODEM protocol,
 - Press OK and/or SEND.
- To cancel a download:
- Send one or more CTRL-D characters,
- OR
- Unplug the local terminal.

If possible, the previous application will then be restarted.

.

At this point, activate your terminal software's File Transfer protocol. For example for Hyperterminal™, invoke Transfer/Send File, then enter (or Browse) the filename (e.g. RXMUX_MAIN_V1_1.BIN), set the Protocol to Xmodem (NOT 1K Xmodem !), then press the Send button.

When the transfer is complete, the new firmware will automatically start.

Comments: If for any reason the download fails or is interrupted, the system will restart the previous firmware.

During firmware update the green LED will flash. The LED will stop flashing when the firmware update is complete.

5.3. HELP

Purpose: Displays a brief summary of the available commands.

Syntax: help

5.4. SET CONTROL

Purpose: Selects whether the gain is controlled by the back panel switches or the USB interface.

Syntax: set control {usb | sw }

Example: Type: SET CONTROL USB

Response: Gain range = 0 to 16dB
Gain control = USB

USB Gain = 7dB (active)
Switch Gain = 8dB

5.5. SET GAIN

Purpose: Sets the USB interface controlled gain.

Syntax: set gain { 0...<maxgain> }

Example: Type: SET GAIN 13

Response: Gain range = 0 to 16dB
Gain control = Switches

USB Gain = 7dB
Switch Gain = 8dB (active)

Comment The multicoupler gain range is at least 0-14dB, but some units may have a higher maximum gain. The command will accept a maximum value up to the actual gain available.

The (active) status indicates which setting is currently active. See the SET CONTROL topic above.

5.6. SET NAME

Purpose: Used to designate the name of the site.

Syntax: set name {name}

Example: Type: SET NAME SITE-1234A

Response: >

Comment The name can be up to 16 characters long. Any of the visible characters from a PC keyboard may be used, except for a space. When other commands such as SHOW ID and SHOW STATUS are used, they will include the site name.

5.7. SHOW ID

Purpose: Displays the Name, ID, Firmware Version and Serial number.

Syntax: show id

Example: Type: SHOW ID

Response:

```
RYDE, RX3852-3408-31, V1.0, Serial No.  
09010001  
>
```

5.8. SHOW STATUS

Purpose: Displays the unit status.

Syntax: show status

Example: Type: SHOW STATUS

Response:

```
RYDE, RX3852-3408-31 V0.3, Serial No.  
09010001
```

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

```
Gain range    = 0 to 16dB
```

```
Gain control  = USB
```

```
USB Gain      = 7dB (active)
```

```
Switch Gain   = 8dB
```

5.9. START

Purpose: Resets the screen to scrolling mode and re-displays the banner.

Syntax: start

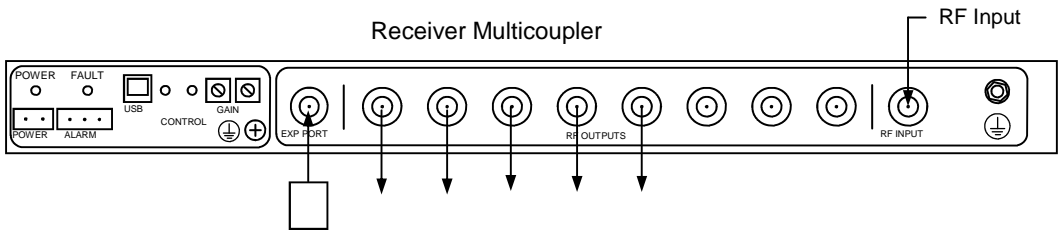
Example: Type: START

Response:

```
(C) Copyright 2009, RF Industries -  
RX3852-3408-31, V1.0
```

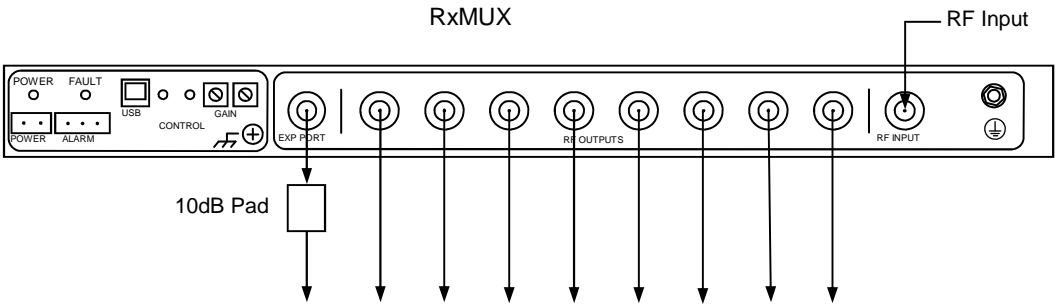
6. Typical Receiver Multicoupler Configurations

6.1. Configuration 1 – Up to 8 Outputs



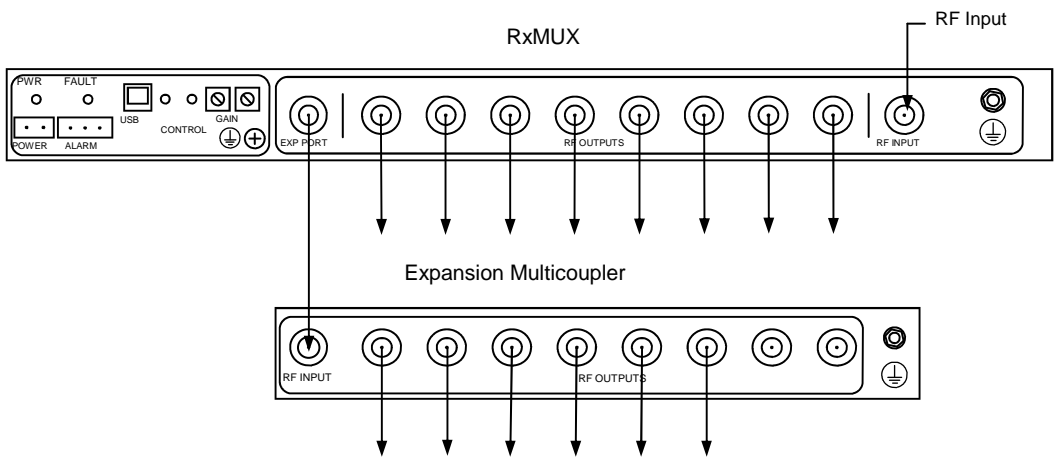
Example: 5 equal level RF Outputs – Gain = 0 to +15 dB

6.2. Configuration 2 – 9 Outputs



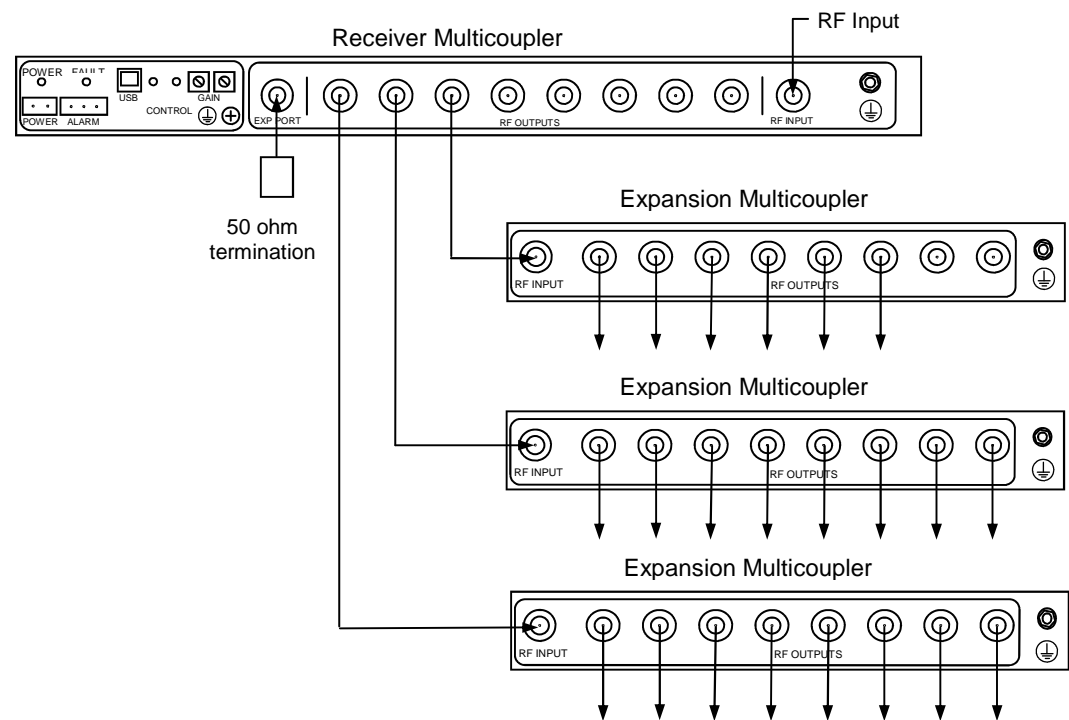
Example: 9 equal level RF Outputs – Gain = 0 to +15 dB

6.3. Configuration 3 – Up to 16 Outputs



Example: 14 equal level RF Outputs – Gain = 0 to +15 dB

6.4. Configuration 4 – Up to 64 Outputs



Example: 22 equal level RF Outputs – Gain = 0 to +5 dB

7. Troubleshooting

Symptom	Possible Cause	Action
All LEDs off	DC power supply not connected or switched off. DC power connected reverse polarity.	Check voltage is present with a multimeter. Also check for correct polarity and reverse the DC connections if necessary.
Green LED flashing	Firmware is being updated. If flashing does not stop after several minutes the download has not been successful.	Send one or more CTRL-D characters or unplug the local terminal.
Red LED on	DC input voltage too high or too low. RF input signal is too high Internal voltage rails are out of tolerance. Internal amplifier currents are out of tolerance.	With a multimeter, check the DC supply voltage at the RxMUX DC input connector is within the recommended range. Reduce the RF input level. Return to RFI for service. Return to RFI for service.
Yellow SWITCH LED flashing	Back panel GAIN switches are set to an illegal value.	Set switches to a value between "00" and the "[maximum gain]", e.g. "15".
Gain does not change when using the USB interface	Unit is in Switch Control Mode.	Send "SET CONTROL USB" command.
Gain does not change when rotating switches	Unit is in USB Control Mode.	Either send "SET CONTROL SW" command via USB or set the GAIN switches to "99" and cycle the power.
Levels on eight RF outputs are not equal	Expansion Port has no termination.	Fit a 50 ohm termination to the Expansion Port.

8. Specifications

8.1. Receiver Multicouplers

NB: Unless otherwise stated all specifications are typical values at 25°C with the gain set to maximum and all RF Outputs terminated.

Frequency range	
RX1317-3408-31	132 - 174MHz
RX3852-3408-31	380 - 520 MHz
RX6996-3408-31	698 - 960 MHz
Max. Gain - RF Outputs 1-8	15 dB
Max. Gain - Expansion Port	25 dB
Gain setting range	0 to 15 dB
Gain setting accuracy	±1 dB
Gain flatness	±1 dB
Gain variation with temp	±1 dB
Gain step size	1 dB
Gain step error	±0.5 dB
Noise figure	2 dB
Impedance	50 ohm
Input return loss	>14 dB
Output return loss	>14 dB
Isolation between outputs	>20 dB
Internal amplifier OIP3	44 dBm
Maximum input level	0 dBm
DC supply options	+11 to +16 V DC 18 to 36 V DC - floating 36 to 60 V DC - floating
DC Current Drain	720 mA max @ 12 V 425 mA max @ 24 V 210 mA max @ 48 V
AC supply option	100 to 240 V AC
Reverse polarity protection	Yes
Alarm Relay output	NO/NC 1 A, 60 V (30 W Max) - dry relay contacts
Fault conditions	DC power fail First stage amplifier current high or low Second stage amplifier current high or low Input voltage high or low Internal DC supplies high or low
Connectors	RF.....N female DC.....Phoenix 2-pin Alarm Relay...Phoenix 3-pin USB.....USB type B

Operating temperature range	-30 to +60 °C
Earthing	M5 earthing screw and M6 earthing stud
Lightning protection	Internal gas filled surge absorber on RF input
Mechanical dimensions	To fit a 1U x 19" rack space, 44 x 483 x 117mm, including connectors
Weight	1.8 kg

8.2. Expansion Multicoupler

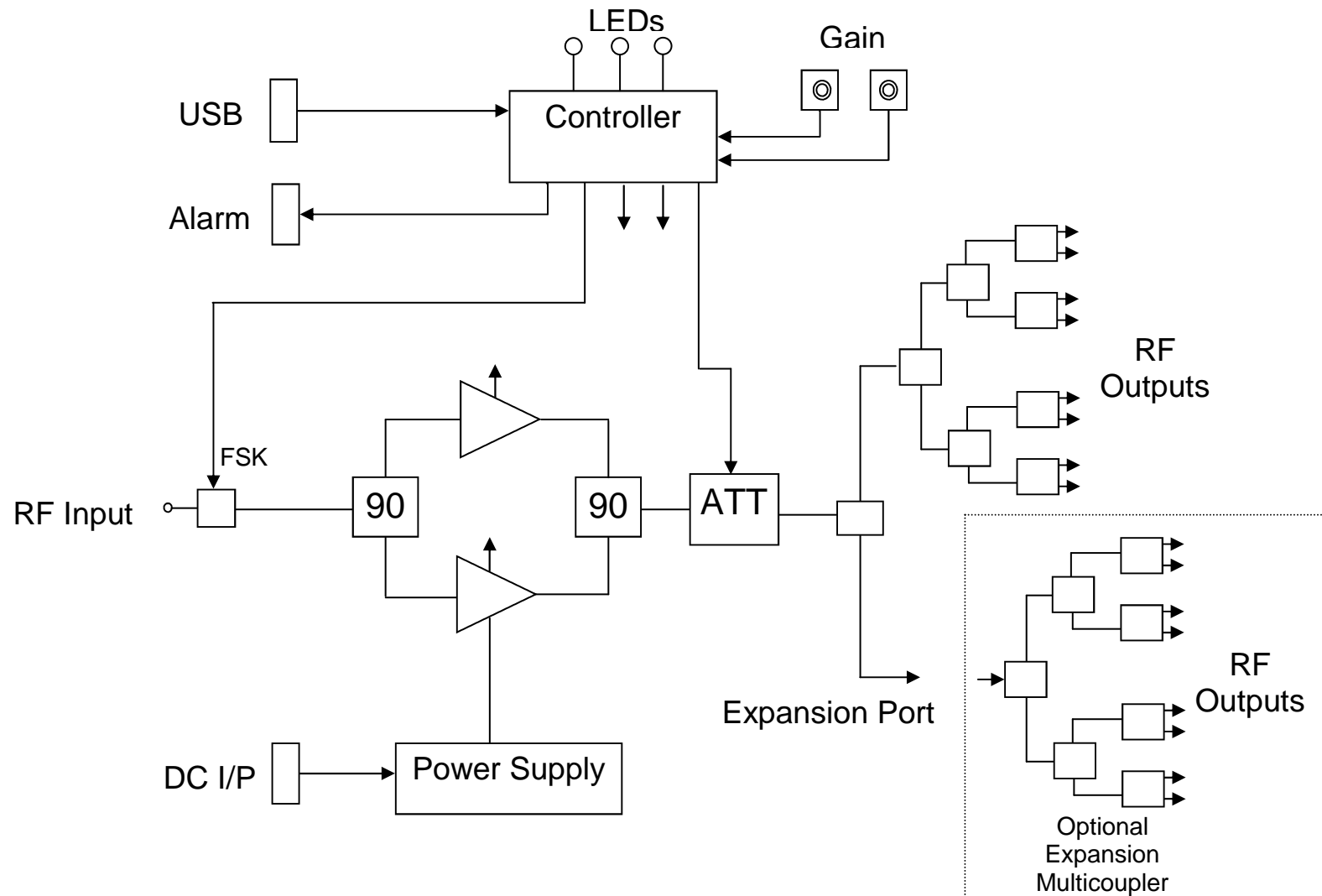
Typical specifications at 25 °C with all RF Outputs terminated.

Model Number	RX0696-3008-31
Frequency range	60 - 960 MHz
Insertion Loss: RF Outputs 1-8	10.5 ± 0.5 dB
Insertion Loss variation with temp	±0.2 dB
Impedance	50 ohm
Input return loss	>14 dB
Output return loss	>14 dB
Isolation between outputs	>20 dB
Maximum input level	24 dBm
RF connectors	N female
Operating temperature range	-30 to +60 °C
Earthing	M6 earthing stud
Mechanical dimensions	To fit a 1U high rack space 44 x 483 x 117mm, including connectors
Weight	1.3 kg

8.3. Optional External AC Power Supply

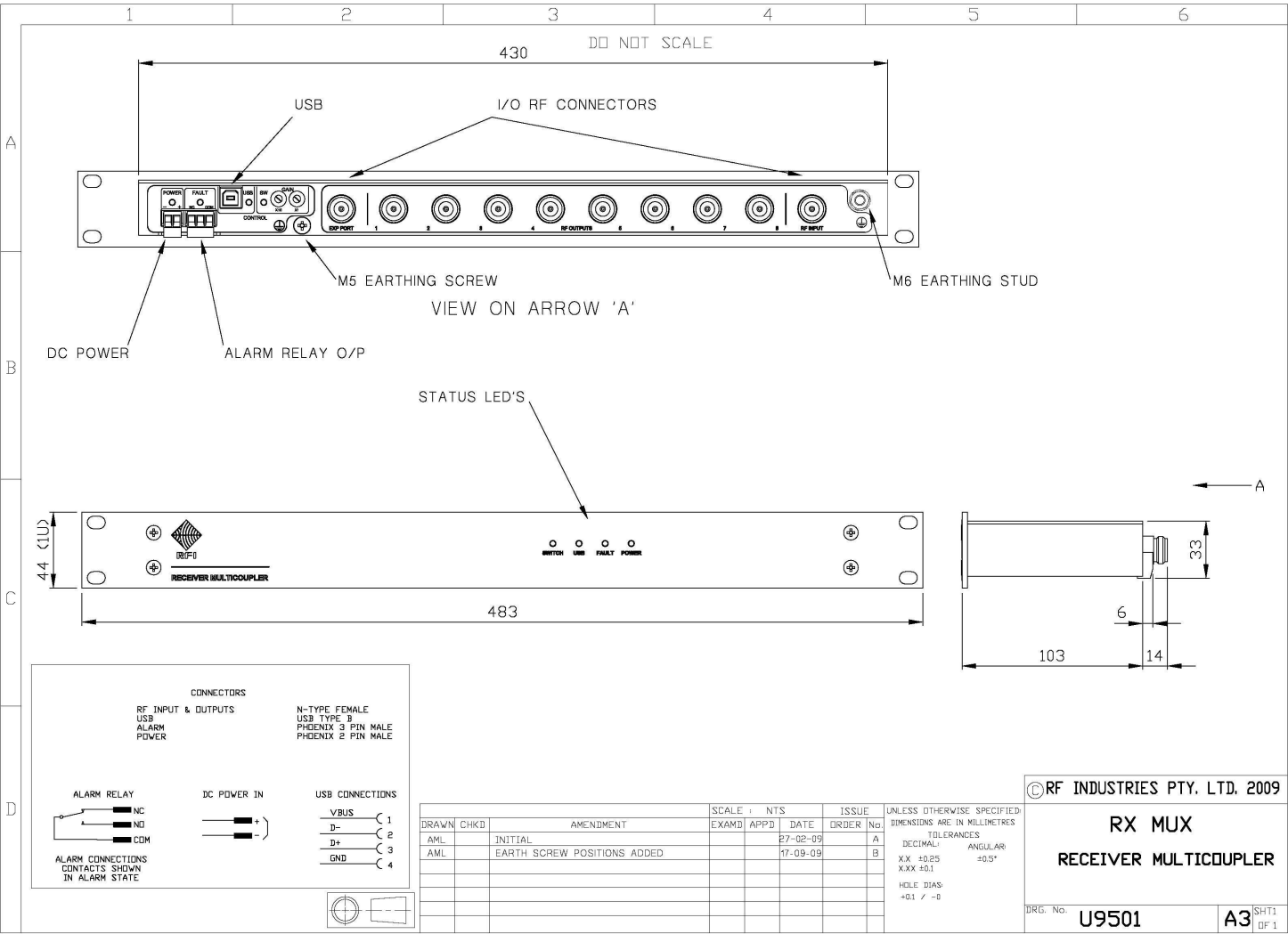
Model Number	RX0000-3000-AC
Input	100 - 240 V AC, 50/60 Hz
Output	12 V DC, 1.5 A
DC power cable	Fixed – 1.2 m long
AC input connector	IEC 320-C14
Size	50 x 32 x 150mm
Weight	0.3 kg

9. Block Diagram





10. Dimensions
10.1. Receiver Multicoupler





10.2. Expansion Multicoupler

