RX2 Mk2
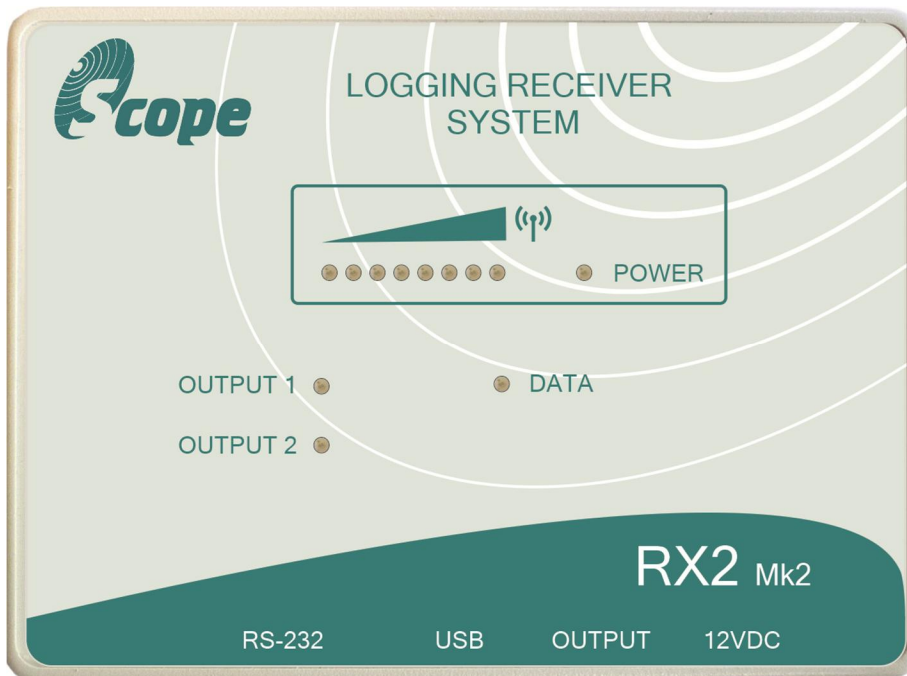## Logging Receiver System

USER MANUAL

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RX2 MK2
Logging Receiver System

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PREFACE

Important Installation Information

It is the purchasers' responsibility to determine the suitability of this equipment and its derivatives for any given application, Scope cannot give specific advice in this manual, as each use will require independent evaluation.

Scope has, wherever possible, employed extra safeguards to monitor the system's performance. Certain system installations, operational requirements or budgets may, however, limit the effectiveness of these safeguards. Again, the suitability of the system for any given application must therefore be decided by the installer and their customer, relative to the application and risk.

Good working practice dictates that a suitable system installation log must be generated, together with a record of the dates when the system has been manually checked, (with the aid of signal strength meters etc.) enabling the system performance to be compared with the original installation data.

For UK equipment, Scope has no control of the use and application of the frequencies issued by OFCOM. Some equipment that is licensed may have greater protection than other equipment which is operated on a WT Act License Exempt basis.

The supply of this equipment is governed by our standard terms and conditions of sale, which can be provided on request.

Important Safety Information

Scope products are designed to operate safely when installed and used according to general safety practices. The following requirements should be observed at all times.

Do NOT subject this equipment to:
Mechanical shock
Excessive humidity or moisture
Extremes of temperature
Corrosive liquids

This equipment is designed for indoor use, unless expressly stated otherwise, and must not be used in classified Hazardous Areas, including areas containing explosive or flammable vapours, unless express authorisation has been given in writing by the manufacturer. If in doubt, consult your local product dealer for further information.

Do not obstruct any slots or openings in the product. These are provided for ventilation to ensure reliable operation of the product and to protect it from overheating. Only use a damp cloth for cleaning (not liquid or aerosol based cleaners), and ensure that any power is removed from the unit prior to beginning the cleaning operation.

Removal of covers from the equipment must only be undertaken by authorised service personnel, who must ensure that power is isolated prior to removal.

Installation

Installation must only be undertaken by an Approved contractor, who shall ensure that all work is carried out in compliance with National Wiring Regulations. For mains powered equipment, a readily accessible isolating fuse or switched socket must be located within 1 metre of the equipment.

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No User Serviceable Parts

Alteration or modification to any part of this equipment, without the prior written consent of the manufacturer, will invalidate all Approvals and Warranties attaching to the equipment. Further liability for the operation of the equipment, under the applicable law, will pass to the user, who will absolve the manufacturer of any further responsibility for it's correct operation and use.

Liability

Scope does not accept liability for any damage or injury, howsoever caused as the result of misuse of this equipment. It is the responsibility of the user to ensure that the equipment is operated in the manner for which it was intended and that it is the correct item of equipment for the required task.

Warranty

This product is warranted as free from defects of workmanship and materials for a period of one year from the original purchase date. During this time, if there is a defect or malfunction of this product, Scope will, with proof of purchase, repair or replace at it's discretion any defective parts, free of charge. This does not include where the adjustments, parts and repair are necessary due to circumstances beyond the control of Scope, including but not limited to fire or other casualty, accident, neglect, abuse, abnormal use or battery leakage damage.

Hereby, the manufacturer Scope Communications UK Ltd declares that the radio equipment type:
RX2,
is in compliance with Radio Equipment Directive 2014/53/EU and ROHS Directive 2011/65/EU.
The full text of the EU Declaration of Conformity is available at the following internet address: www.scope-uk.com/technical/doc/DOCRX2.pdf
or from Scope at: Quantum House, Steamer Quay, Totnes, TQ9 5AL United Kingdom.

$$C\:E$$

Do not discard. At end of life this equipment must be sent to an authorised waste treatment centre. Contact Scope at the above address for further details.

1: Brief Overview

The RX2 is a POCSAG receiver decoder equipped with 2 individually switchable output relays, an RS232 serial port, SD Card logging and graphing functionality. An on board RTC (real time clock) is also included for date/time stamping of decoded messages or continuous signal strength logging, this feature allows for site surveys or live viewing of signal strength and incoming messages to be performed using the supplied PC software.

A full function PC programming utility allows each relay to be configured to respond to a transmitted RIC (receiver identity code) or a range of RICs. This will allow the user to independently energise (Close), de-energise (Open) or change the state of each relay by transmitting specified RICs or ranges of RICs, with or without a beep type filter enabled.

Additionally, the user can latch each relay for a defined time period (5 - 255 seconds, in 5 second intervals). Sending repeat transmissions during the set time period will reset the timer, which allows a relay to be used as an 'in service' monitor, i.e. so long as the unit keeps seeing the repeat transmissions within the set time period, the relay will remain latched. If a transmission fails to be received within the set window, the relay will drop out at the end of the set time period.

Both relays have N/O (normally open), N/C (normally closed) and Common connections available through the RJ45 connector. The maximum contact rating of each relay is 0.5A @ 240V AC, 1A @ 60V DC.

The relays can be reset by transmitting a programmed RIC or range of RICs. This will return the relays to their default states.

The RS232 serial port provides additional logging or repeater functionality. This can be programmed to send the transmitted messages to the serial port when a range of RICs is specified. Additionally the unit can be configured to output in various protocols (see below for details), with the option to add 'identification' and 'signal strength LED' information to the output string. A selectable output delay of 0.5 to 3 seconds is also available in 0.5 second intervals or until the carrier has gone (with a 10 second timeout).

Front panel LEDs indicate the state of each output relay and a flashing LED advises when transmitted data has been decoded. A cool blue power LED completes the picture.
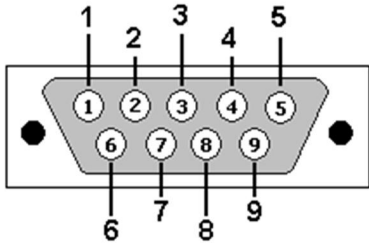
Recommended power input is 12V DC @ 500mA.

An SD Card with a maximum capacity of 32GB is required for data logging functionality, and should be formatted to use the FAT filling system, NTFS will **not** work.

* Each RIC must be a seven digit number in the range 0000008 – 2097143, excluding ranges 2007664 – 2007671 and 2045056 – 2045063.
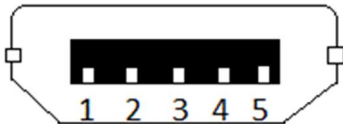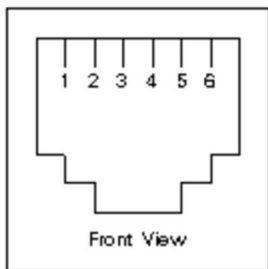
2: Port Pin-out Connections

2.1: RS232 Pin-out

PIN	DESCRIPTION
1	Not Connected
2	RX
3	TX
4	Not Connected
5	Ground
6	Not Connected
7	Not Connected
8	Not Connected
9	5V

2.2: Micro USB B Pin-out

PIN	DESCRIPTION
1	VBUS
2	Data -
3	Data +
4	Not Connected
5	Ground

2.3: RJ-45 (Relays) Pin-out

PIN	DESCRIPTION
1	Relay 1 Normally Open
2	Relay 1 Common
3	Relay 1 Normally Closed
4	Relay 2 Normally Open
5	Relay 2 Common
6	Relay 2 Normally Closed

2.4: HIROSE Power Input Pin-out
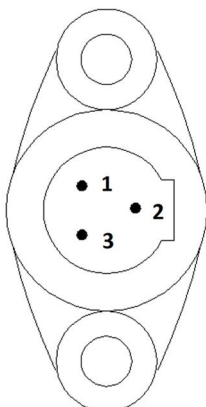
PIN	DESCRIPTION
1	12V DC
2	Not Connected
3	Ground

3: Programming Utility

3.1: Main Window
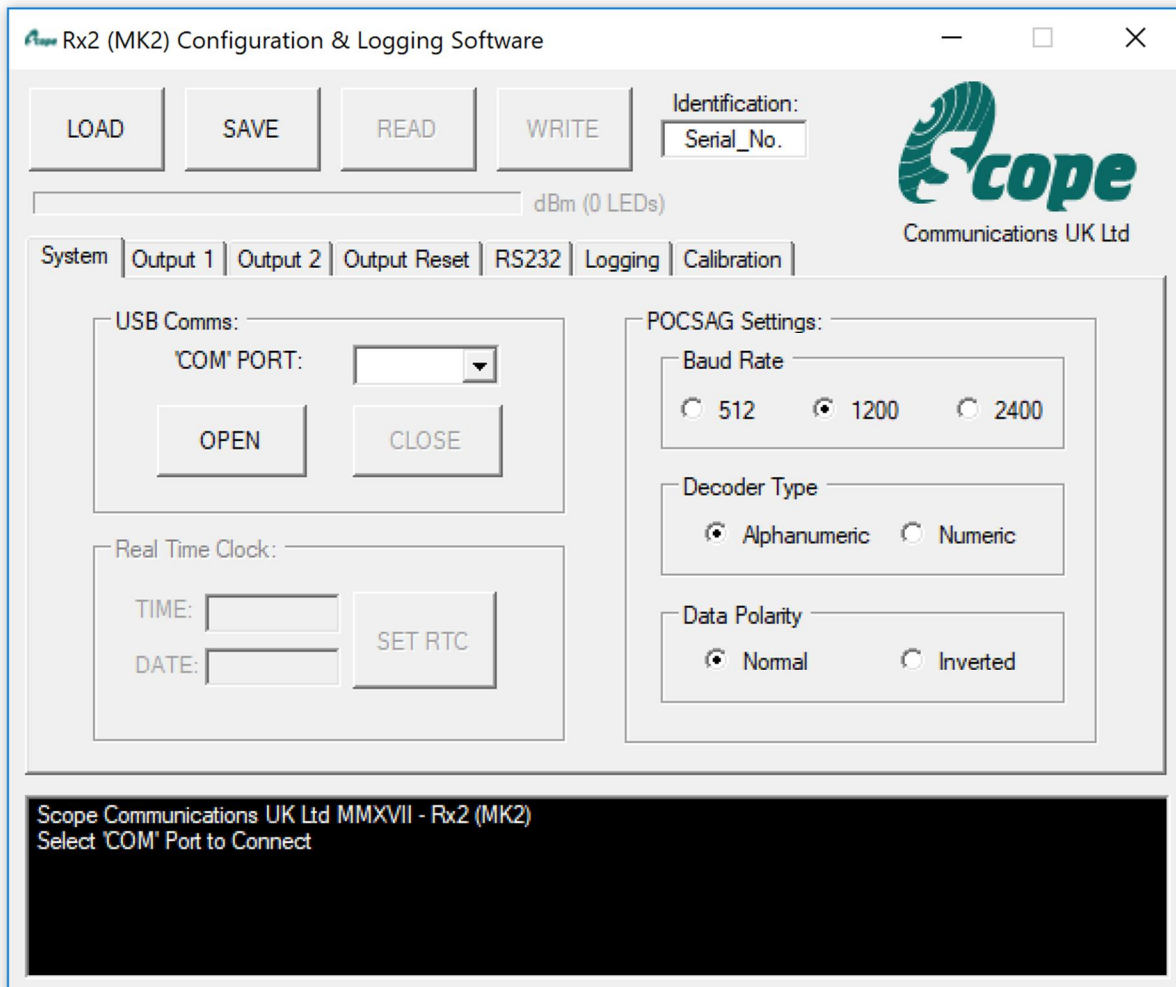
i) 'LOAD' Button

Loads a previously saved '.rx2' configuration file.

ii) 'SAVE' Button

Saves the configuration to a file with a '.rx2' extension.

iii) 'READ' Button

Reads the current configuration from the device.

iv) 'WRITE' Button
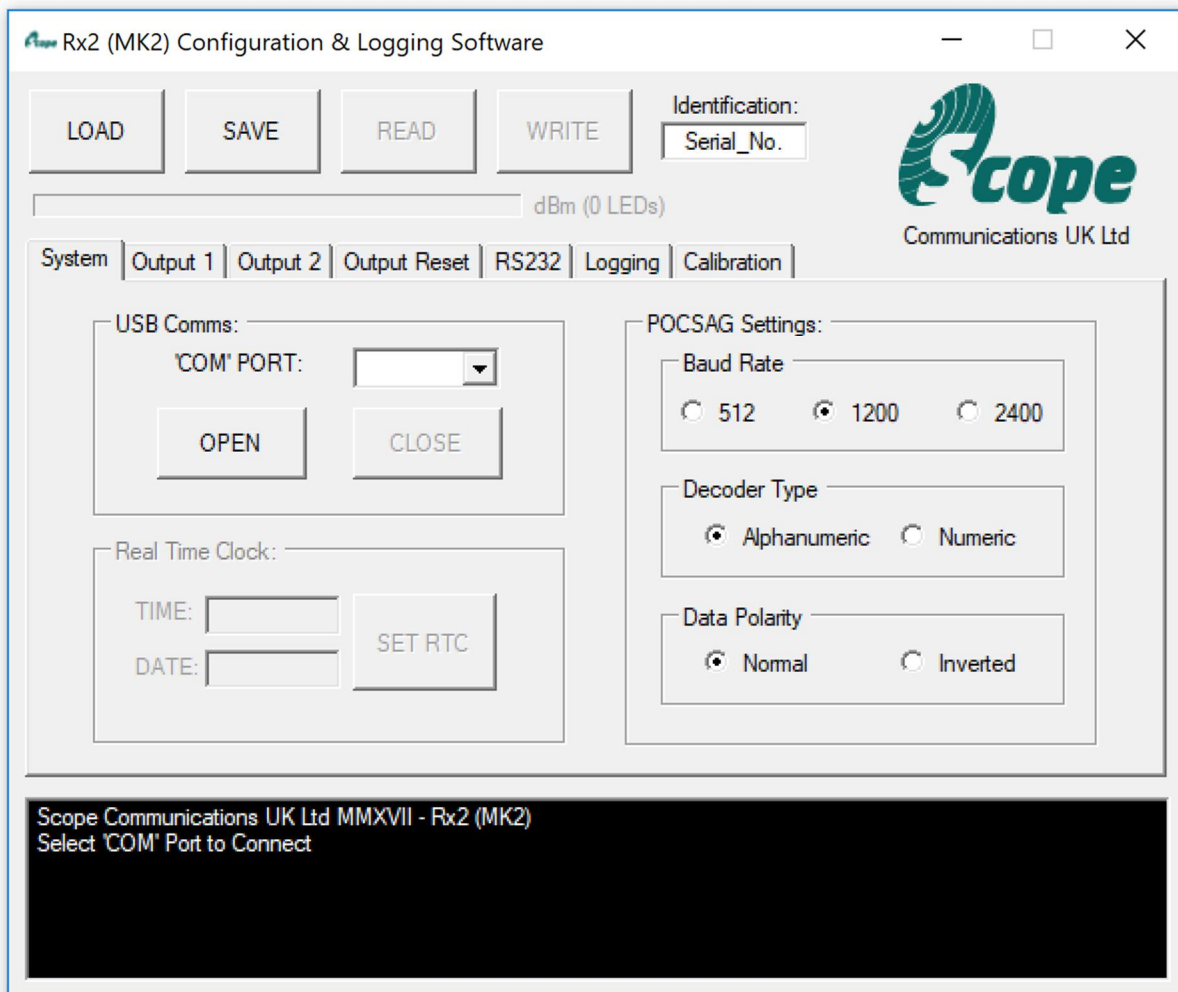
Writes the configuration to the device.

v) 'Identification' Text Box

Allows for a unique id to be programmed (mandatory 10 characters, with no spaces).

3.2: 'SYSTEM' Tab

i) USB Comms

To connect and program the RX2, first select the 'COM' port from the list of available ports and click the 'OPEN' button. If a correct connection is established you will then be asked if you want to read configuration information from the device.

ii) Real Time Clock

This displays the current 'TIME' and 'DATE' settings of the on board real time clock, click 'SET RTC' to set the time and date.

iii) POCSAG Settings

Baud Rate: There are three different POCSAG baud rates to choose from 512, 1200 or 2400bps.*
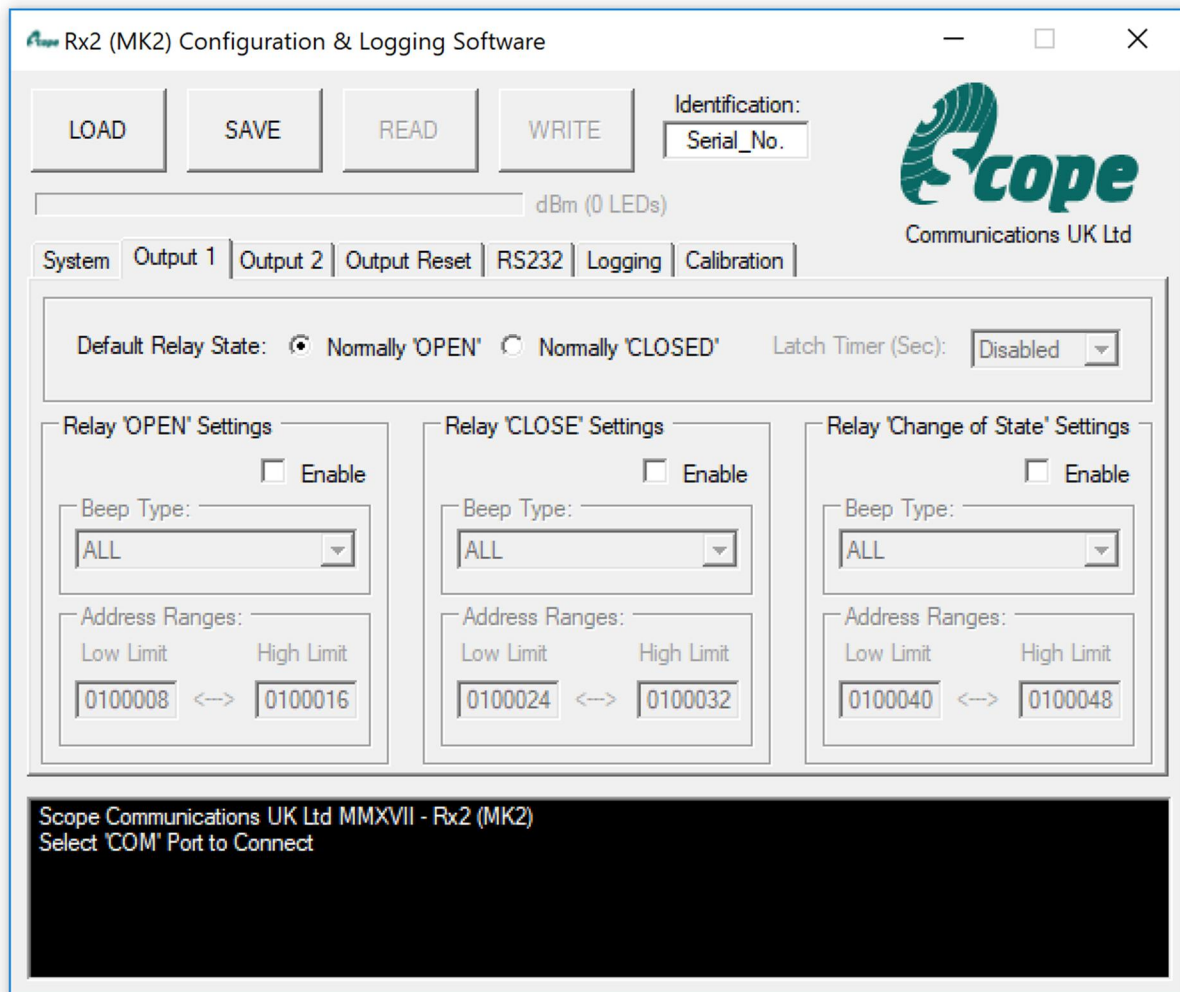
Decoder Type: Receiver can decode 'Alphanumeric' or 'Numeric' messages.*

Polarity: Data polarity can be either 'Normal' or 'Inverted'.*

* These must be chosen to match the settings of the transmitter used with the system.

3.3: 'OUTPUT 1' and 'OUTPUT 2' Tabs

i) Default Relay State

This setting determines whether the output relay is 'Normally Open' (de-energised) or 'Normally Closed' (energised) in its default state.

ii) Relay 'OPEN' Settings

Enable: Enable or Disable the relay 'OPEN' function.

Beep Type: Allows a beep-type filter to be added. Choose from either A, B, C, D or ALL.

Address Ranges: Specifies the range of Addresses or RICs that cause the relay contact to open.

iii) Relay 'CLOSE' Settings

Enable: Enable or Disable the relay 'CLOSE' function.

Beep Type: Allows a beep-type filter to be added. Choose from either A, B, C, D or ALL.

Address Ranges: Specifies the range of Addresses or RICs that cause the relay contact to close.

iv) Relay 'Change of State' Settings

Enable: Enable or Disable the relay 'Change of State' function.

Beep Type: Allows a beep-type filter to be added. Choose from either A, B, C, D or ALL.

Address Ranges: Specifies the range of Address or RICs that cause the relay contacts to change state.

v) Latch Timer

If selected the latch timer returns the relay contact to its default state after a given time (0 – 255 seconds, in 5 second intervals). If activated again within the given time the counter is reset, thereby extending the period by the set time. This feature allows output relays to be used for 'Out of Service' checking.

3.4: 'OUTPUT RESET' Tab

i) Reset Settings

 Enable: Enable or Disable the 'OUTPUT RESET' function.

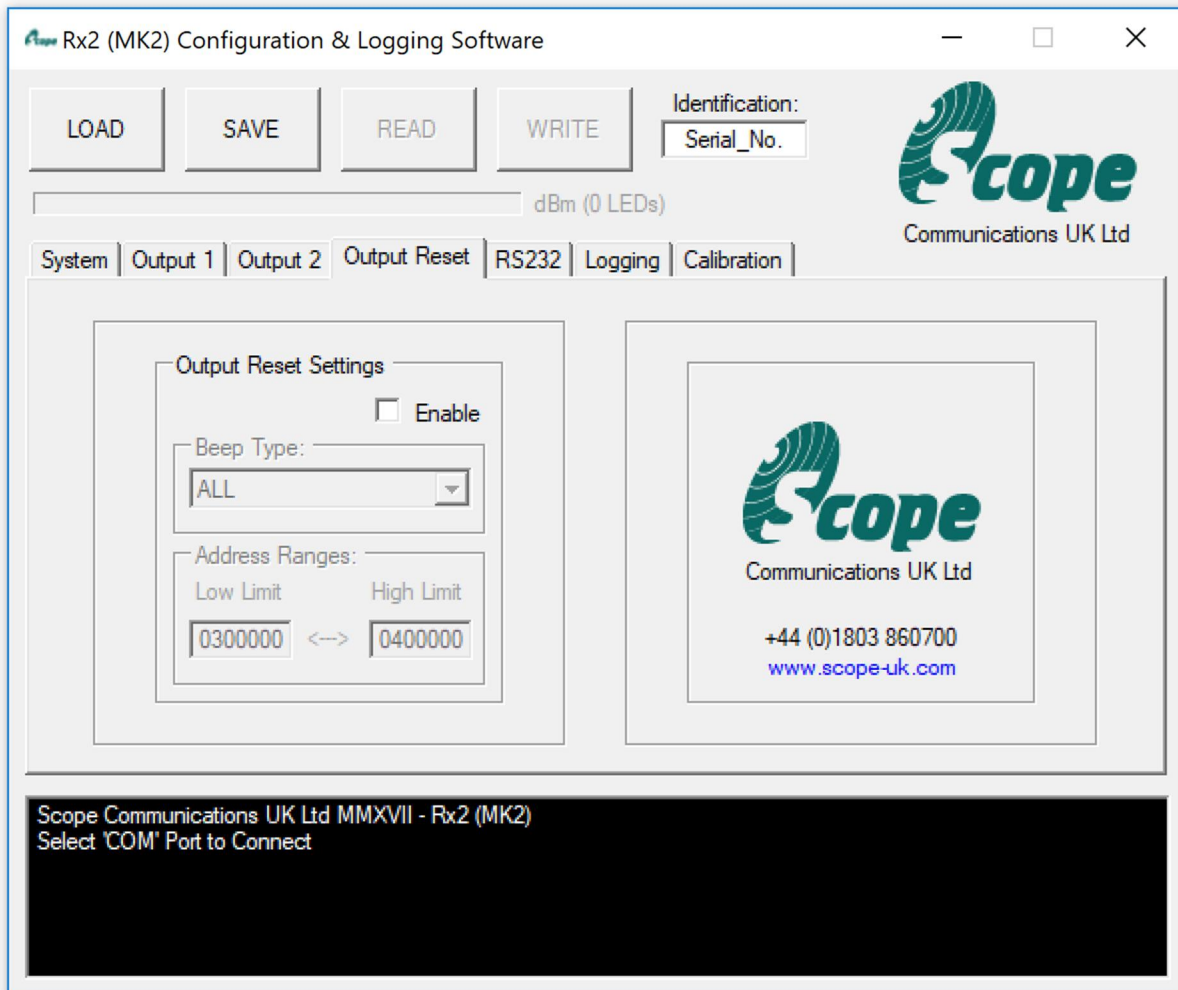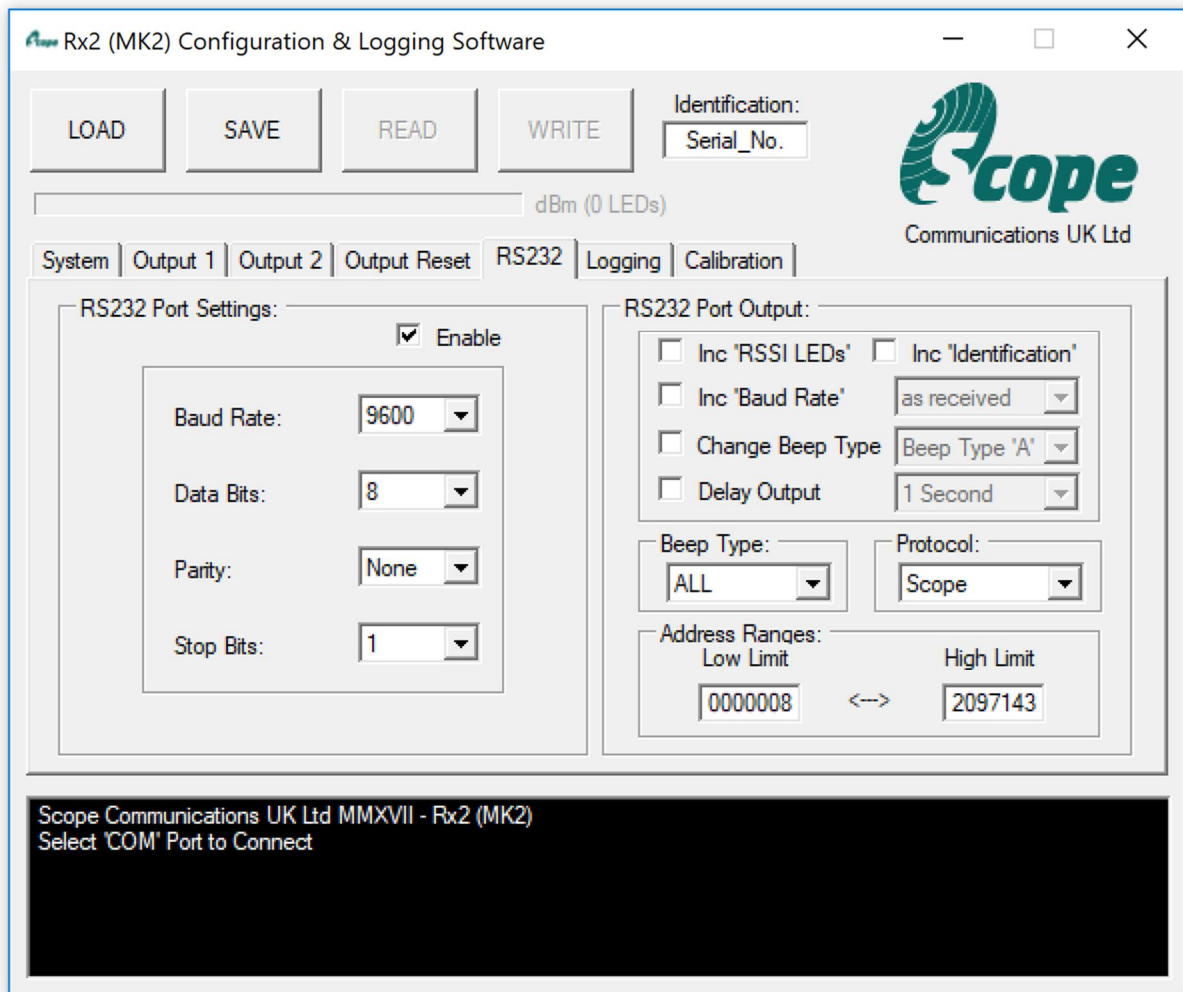 **Beep Type:** Allows a beep-type filter to be added. Choose from either A, B, C, D or ALL.

 Address Ranges: Specifies the range of Address or RICs that cause the relay contacts to change state.

3.5: 'RS232' Tab

i) RS232 Port Settings

Baud Rate: The following baud rate settings can be applied.
1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800 or 115200bps.
(default - 9600bps)

Data Bits: The following data bit settings can be applied.
5, 6, 7, 8 or 9. (default - 8)

Parity: The following parity settings can be applied.
None, Even or Odd. (default - None)

Stop Bits: The following stop bit settings can be applied.
1 or 2. (default - 1)

ii) <u>RS232 Port Output</u>

Enable: Enables or Disables the RS232 port output function.

Inc. 'Baud Rate': Selects whether the output string includes the following baud rate characters. N (512bps), F (1200bps) or V (2400bps).

Inc. 'Identification': Selects whether the output string includes the identification string.

Inc. 'RSSI LEDs': Selects whether the signal strength LED count is included in the output string (0 - 8).

Delay Output: Enables or Disables a delay in the serial output data (this is useful for when used in a repeater configuration). Delay time is selected from the drop down box directly below this control and has the options of delaying the output by 0.5, 1, 1.5, 2, 2.5 or 3 seconds or until the carrier has gone (with a 10 second timeout).

Please note that when an output delay is used the receiver will not decode during the delay period, this is because there is only a single storage buffer for the received message and any subsequent messages would overwrite any previous data before it was outputted.

Beep Type: Allows a beep-type filter to be added. Choose from either A, B, C, D or ALL.

Protocol: The following serial output protocols are available:

Codewords – This option outputs the raw sampled codewords in hexadecimal format.

Message – Outputs just the message string.

Repeater_A – This option allows the receiver to be used as a repeater, the characters 'RP:' are added to the start of the received message string before being sent to the serial output, when the message gets re-transmitted and received a filter then looks for the 'RP:' characters in the message, if found the message is not then re-forwarded to the serial output, thus preventing infinite looping.

Repeater_B – This option is similar to the Repeater_A function, differing in that no extra characters are added to the message, instead the receiver will ignore the next message (within a timeout period or 6 seconds), this is also to prevent infinite loops.

Scope – The output string is formatted to conform to scope protocol.

Log Format – Outputs a string in the same format as is written to the SD card.

RP0: – When selected, this option will only forward messages to the serial port which don't contain the 'RPx:' suffix.

RP1: - This option will only forward messages to the serial port if the message contains the 'RP0:' suffix or no suffix is present. (RP1: + Ignore is the same except that messages without the 'RP0:' suffix are ignored, i.e. the original message is ignored).

 RP2: - This option will only forward messages to the serial port if the message contains the 'RP1:' suffix or no suffix is present. (RP2: + Ignore is the same except that messages without the 'RP1:' suffix are ignored, i.e. the original message is ignored).

 RP3: - This option will only forward messages to the serial port if the message contains the 'RP2:' suffix or no suffix is present. (RP3: + Ignore is the same except that messages without the 'RP2:' suffix are ignored, i.e. the original message is ignored).

 RP4: - This option will only forward messages to the serial port if the message contains the 'RP3:' suffix or no suffix is present. (RP4: + Ignore is the same except that messages without the 'RP3:' suffix are ignored, i.e. the original message is ignored).

 RP5: - This option will only forward messages to the serial port if the message contains the 'RP4:' suffix or no suffix is present. (RP5: + Ignore is the same except that messages without the 'RP4:' suffix are ignored, i.e. the original message is ignored).

 RP6: - This option will only forward messages to the serial port if the message contains the 'RP5:' suffix or no suffix is present. (RP6: + Ignore is the same except that messages without the 'RP5:' suffix are ignored, i.e. the original message is ignored).

 RP7: - This option will only forward messages to the serial port if the message contains the 'RP6:' suffix or no suffix is present. (RP7: + Ignore is the same except that messages without the 'RP6:' suffix are ignored, i.e. the original message is ignored).

 RP8: - This option will only forward messages to the serial port if the message contains the 'RP7:' suffix or no suffix is present. (RP8: + Ignore is the same except that messages without the 'RP7:' suffix are ignored, i.e. the original message is ignored).

 RP9: - This option will only forward messages to the serial port if the message contains the 'RP8:' suffix or no suffix is present. (RP9: + Ignore is the same except that messages without the 'RP8:' suffix are ignored, i.e. the original message is ignored).
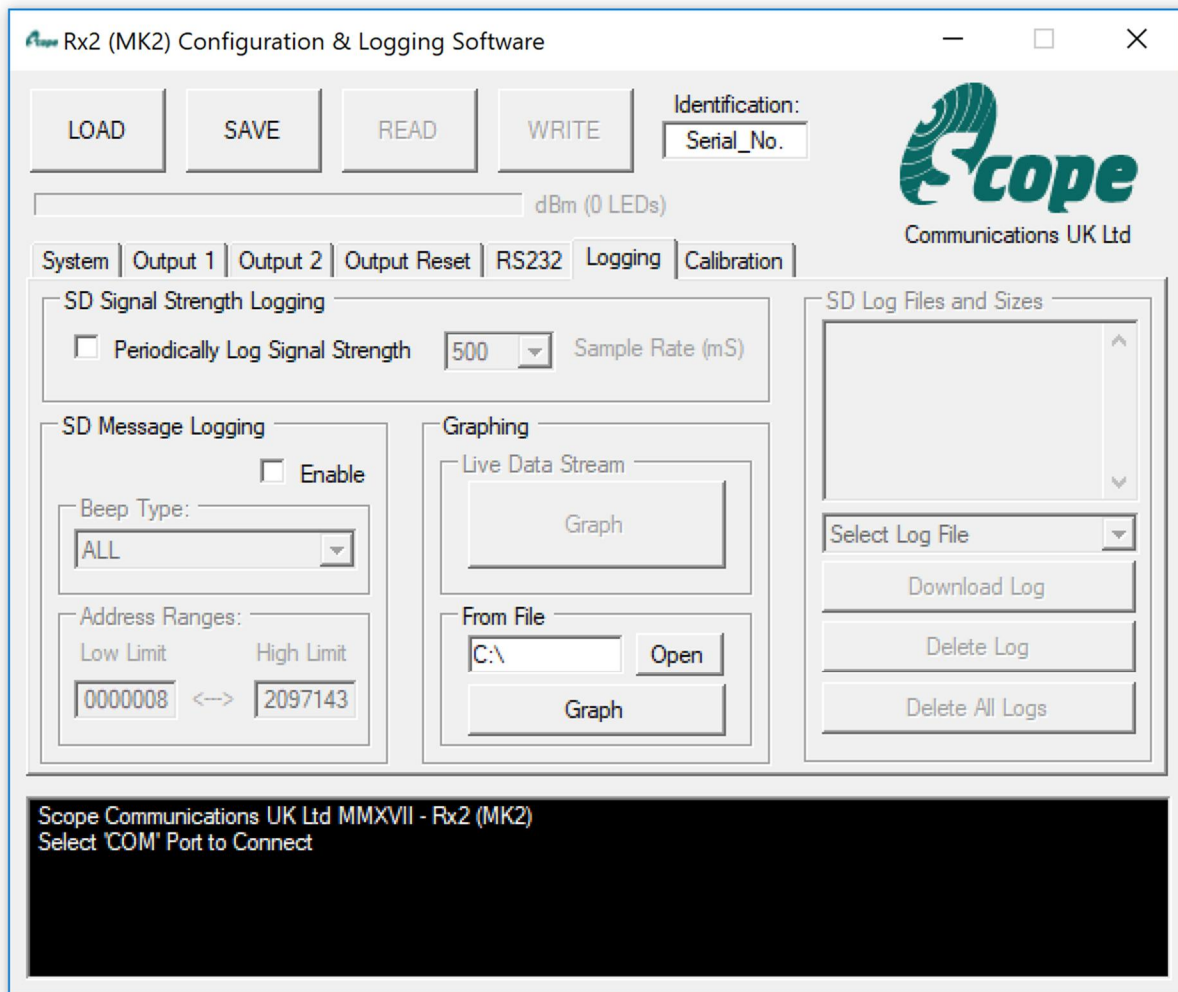
Address Ranges: Specifies the range of Addresses or RICs that allow for serial output.

3.6: 'LOGGING' Tab

i) SD Signal Strength Logging

When the 'Periodically Log Signal Strength' tick box is enabled the received signal strength is logged to the SD Card with selectable sample rates of 100, 200, 300, 400 or 500mS.

ii) SD Message Logging

Enable: Enable or Disable the 'SD Message Logging' function.

Beep Type: Allows a beep-type filter to be added. Choose from either A, B, C, D or ALL.

Address Ranges: Specifies the range of Addresses or RICs that allow message logging.

iii) Graphing

Live Data Stream: This function allows for viewing the live data stream in graph form. (see graphing section of the manual for further details).

From File: Downloaded log files can also be viewed in graph form with this function. (see graphing section of the manual for further details).

iv) <u>SD Log Files and Sizes</u>

This section shows the available stored SD log files and there sizes, in bytes. Working with a particular file is as easy as picking the file using the drop down menu and choosing to either download or delete (please note that downloading is slow, so a little patience is required. Preferred method is to remove the SD card and read directly using a card reader and PC).
A running total of the amount of downloaded bytes is displayed in the message window.
Alternatively all logs can be deleted by clicking the 'Delete All Logs' button.

NOTE: To access the logged files the 'Logging Password' must be entered, located under the 'CALIBRATION' tab, this prevents unauthorised access.

3.7: 'CALIBRATION' Tab
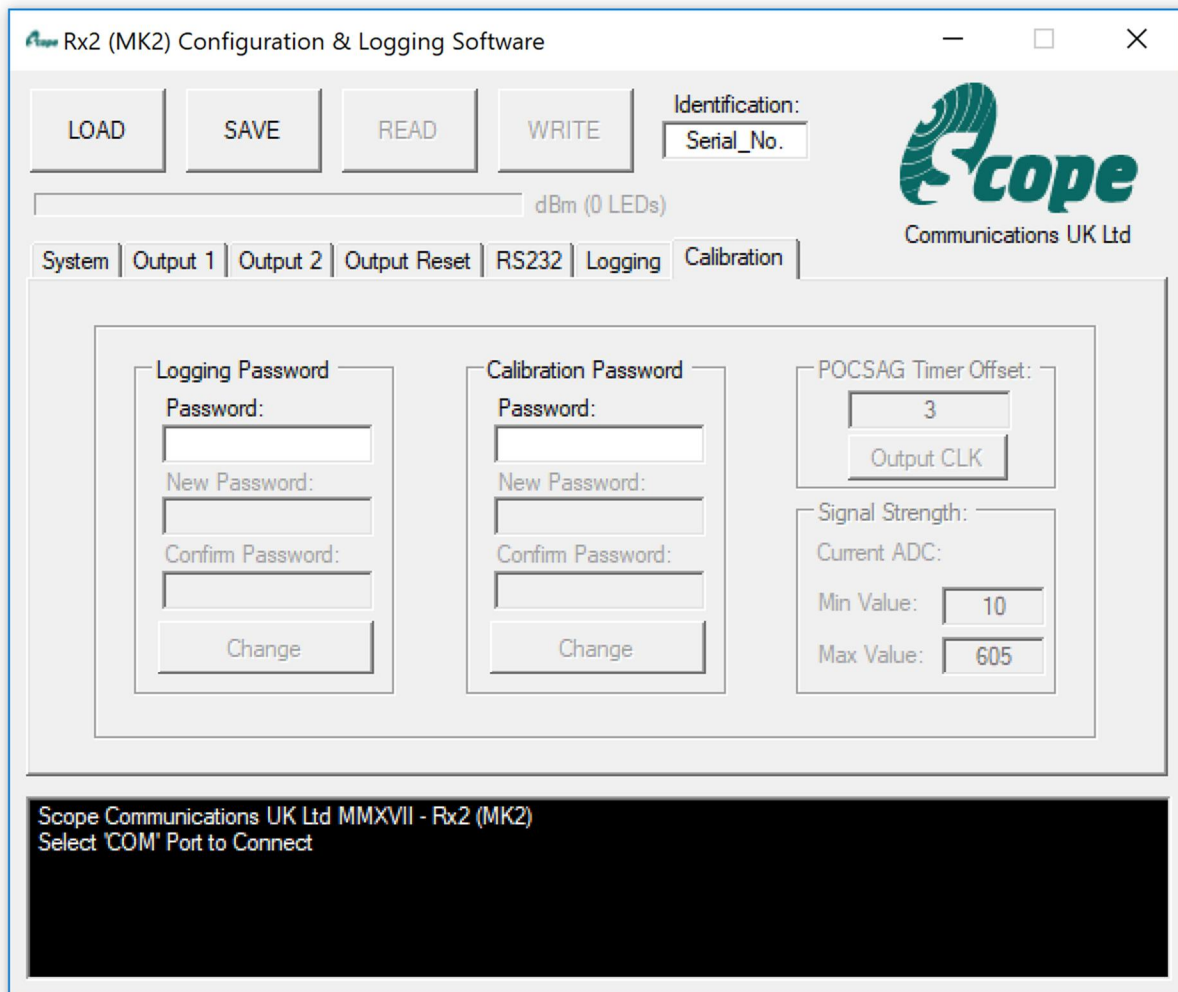
i) <u>Logging Password</u>

To prevent unauthorised access to the saved log files the 'Logging Password' must be entered here. The default password is 'scope' and can be changed by entering and confirming the new password in the text boxes provided, then clicking on the 'Change' button.

ii) <u>Calibration Password</u>

To enable the calibration functions the 'Calibration Password' must be entered here (this is for Scope use and settings should not require changing by the customer). The password can be changed by entering and confirming the new password in the text boxes provided, then clicking the 'Change' button.

iii) <u>POCSAG Timer Offset</u>

This setting is for fine tuning the timer used to sample the incoming POCSAG signal and should not be altered by the customer as a two channel oscilloscope or logic analyser is required to physically check that the clock and data signals are synchronised, for this reason the option is protected with a calibration password. (this should not need altering unless there is lots of corruption in the decoded data). The 'Output CLK' button outputs the sample clock on a GPIO pin which can be probed at test point TP1.

iv) <u>Signal Strength</u>

Current ADC: Displays the raw ADC value that corresponds the analogue RSSI output pin of the receiver (0 – 1023), this is used to set the Min and Max values of the Signal Strength.

Min Value: This value is used to represent the state when no carrier signal is present, all RSSI LEDs will be off

Max Value: This value represents the maximum carrier signal that the receiver can measure, all RSSI LEDs will be on.

3.8 : Graphing Utility
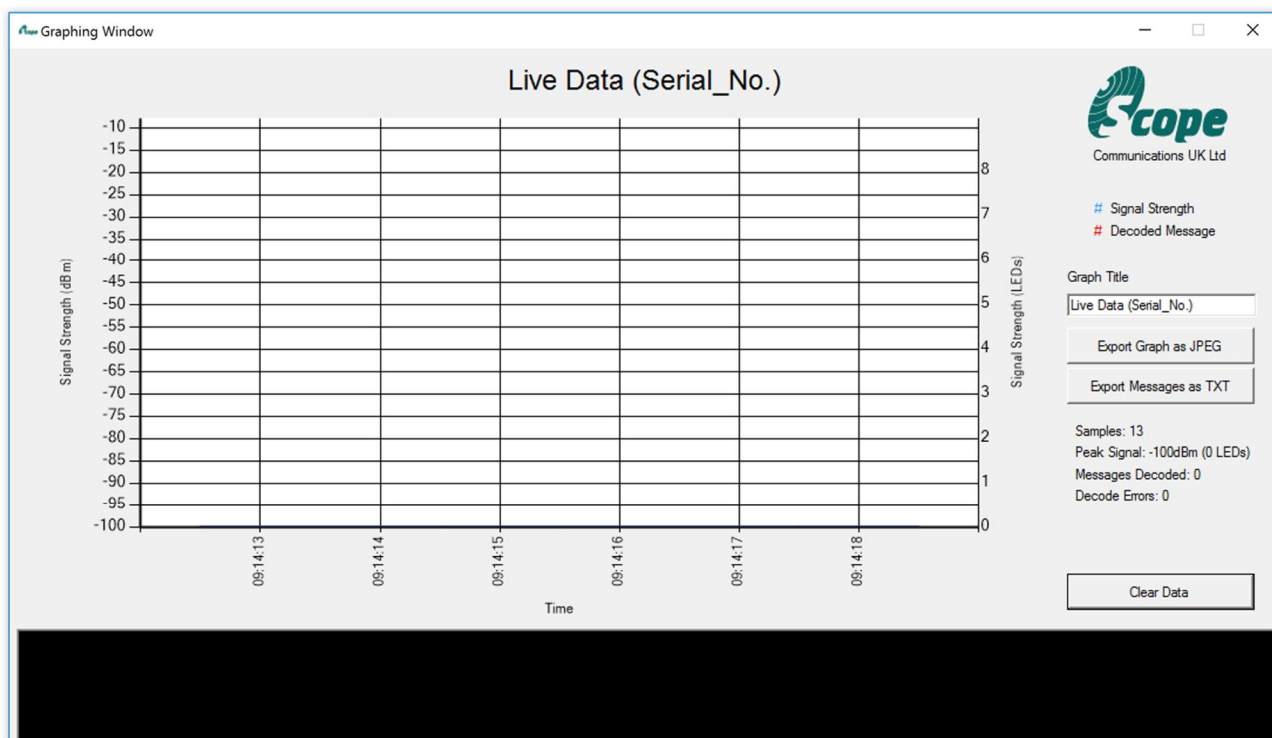
The graphing utility allows for the visualisation of the current RSSI level and any decoded data. Any saved log file can be loaded and displayed, this is ideal for site surveying applications.

Graph statistics can be viewed in the right-hand column, and include:
 'Samples' – The amount of captured samples,
 'Peak Signal' – Displays the highest signal strength recorded,
 'Messages Decoded' – Shows the decoded messages count.
 'Decode Errors' – any errors in the message decode are counted and displayed here.

The graph title can be changed by entering text in the 'Graph Title' text box.

Zooming into graph data is possible by clicking and holding the mouse button in the graphing window and dragging either left or right over the desired data (this can be quite slow when there are a lot data points, so please be patient). To zoom back out press the small square button that appears in the bottom left of the X/Y axis.

Export Graph as JPEG

This option exports a current screen shot of the graph in .jpg format to a specified location.

Export Messages as TXT

Any decoded messages can also be exported to a specified location as a .txt file.

Clear Data

To reset the graph, and clear all the data, press the 'Clear Data' button.

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Specification

Power Input:	12V to 13.8V dc max @ 0.5A
Power Consumption Standby (relays off, no serial port)	36.5 mA
Standby (relays off, serial port connected)	38mA
Active serial decoder	92mA
Active all relays	126mA
Signal Format	POCSAG FSK NRZ (Normal or Inverted)
Frequency (programmable)	430 –470MHz
Channel Spacing	12.5KHz or 25KHz
Frequency Deviation	+/- 2.5KHz or +/- 4.5 KHz
Over Air Baud Rate (fixed programmable)	512/1200/2400 bps
Sensitivity	-117dBm for 1% error
RX Performance	Category 1.5, EN 300 220-1 V3.1.1
Relay Contact max rating	0.5A @ 125V ac, 1A @ 60V dc
Serial Port	RS232
Serial Configuration	N, 8, 1
Serial Baud Rate (fixed programmable)	1200 to 115200

E & OE. Scope's policy is one of continuous development and specifications are subject to change without notice