

RX202 User manual



Document Reference: RX202 V1.1 Serial Reader User Manual

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ABBREVIATIONS

Abbreviation	Meaning
CR	Carriage Return
EOM	End of Message
I/O	Input/Output
ID	Identity
LF	Line Feed
LSB	Least Significant Bit/Byte
m	Meter
mm	Millimetre
MSB	Most Significant Bit/Byte
NC	No Connection
PC	Personal Computer
Pwr	Power
RF	Radio Frequency
RFID	Radio Frequency Identification
Rx	Receive
SOM	Start of Message
TBA	To be Announced
Tx	Transmit
UPS	Uninterruptible Power Supply
RSSI	Received Signal Strength Indicator
PCB	Printed Circuit Board

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1 Product Compatibility

The RX202 is a direct replacement for the RX201 reader and is a member of the Legacy Wiring Family .

The RX202 should only ever be used with the RX201 and PSU300 products , it must be connected using the Legacy cabling format. The Legacy wiring family of products are not compatible with the Cat5 products.

Never connect any of the Legacy family of products with standard Cat5 Patch leads .

Never connect Legacy family products to any Cat5 Patch Lead Family Product product.

Failure to comply with this statement will damage the products and will not be covered by the terms of the warranty.

If you are in any doubt please contact your local Wavetrend representative.

For clarity the products are clearly identified below

Legacy Wiring Family



RX202



RX201



PSU300

Cat5 Patch Lead Friendly Family



RX210



RX211



IPSU

2 Overview

The RX202 Serial reader is designed as a direct replacement for the RX201 in existing Legacy configured RS232/RS485 Networks.

For new Networks Wavetrend recommend using the Cat5 Patch Lead Friendly Products.



The Reader is used in the system to perform the following functions:

- Receive, decode and validate data from Wavetrend L
- Output relevant tag data via USB or via the Reader Network.

The Reader comprises the following functionality and properties:

- RF Module (RF Receiver and Demodulator).
- Micro-controller
- LED indicators on the output connectors.
- Micro USB socket
- 2.5mm Power plug

The RX202 Reader can be used with the following Wavetrend Antennas AN-100 / 200 / 300 / 400 and any other 433MHz antenna that has a 50 Ohm termination resistance.

2.1 New Generation reader Properties

The RX202/RX210 and RX211 family are significantly different from their predecessor the RX201.

These differences are summarised here and explained in more detail throughout the manual.

Front End Filtering

The RX202/RX210/RX211 utilise front end RF filtering allowing them to work extremely effectively in noisy RF environments including in direct proximity to other 433MHZ emitters including TETRA band.

RSSI Response

The RX202/RX210/RX211 have a linear calibrated response which includes operation at both High and Low gain modes.

The sensitivity of the new readers is vastly superior to the RX201 and allows both greater read range at large distances and also RSSI granularity allowing readers to be used for reading tags as close up as 10cm.

This close reading ability has obsoleted the requirement for PROX readers in the new product range, instead the user may simply apply a suitable RSSI filter.

Buffer Size

The RX202/RX210 and RX211 have a larger buffer size of 9 tags compared to the RX201 which was 5 Tags.

RJ45 Connection

In the event that a user connected up an RX201 incorrectly there was a high chance that the damage could be caused to the reader.

All of the RJ45 connections on the RX202/RX210 and RX211 are protected by self resetting fuses. In the event that the user makes a mistake and miss connects the reader, these fuses will set and the reader will appear to be dead. Check the connection then allow the reader 2 seconds to reset.

USB Connection

All the new generation of readers support configuration over USB.

Before you get excited and plug it in please install the FTDI drivers first as detailed later in the manual. This connection can be used for standalone applications.

No Nulls

One of the criticisms of the RX201 network configuration was that in auto poll the system always reported NULL TAG packets when a reader that had an empty tag buffer was polled. There is now an option to turn this off in the Protocol setting.

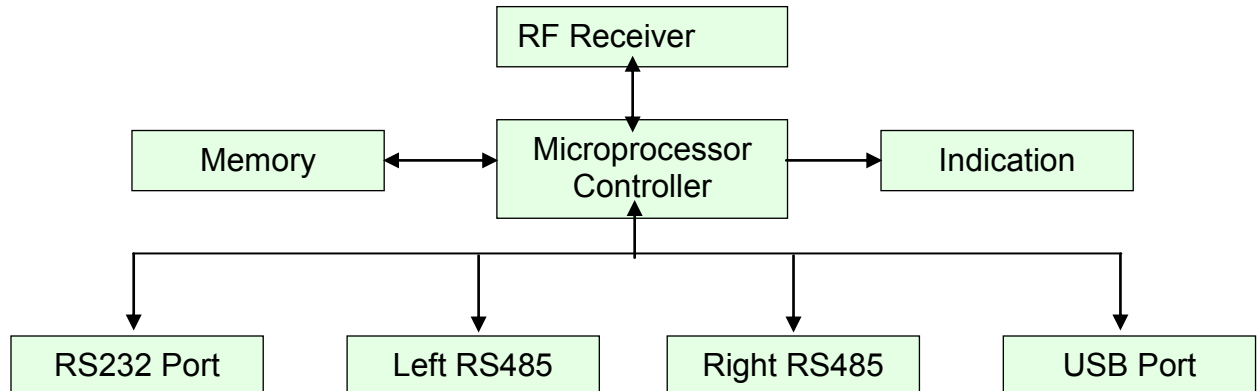
Please note this option is only available for autopoll, a manually polled reader will always respond back with a full or empty tag packet as its ACK.

TTL

TTL is not supported by the RX202/RX210/RX211 Readers

2.2 Functional Diagram

The RX202 Reader has the following functional structure.



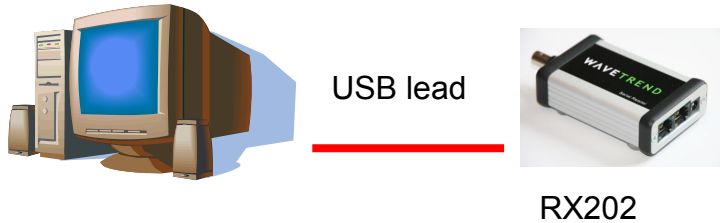
This receiver consists of a microprocessor controller with onboard firmware that communicates directly with the RF Receiver module and connects to the outside world via 3 serial interfaces or the USB port. Data can be sent independently to and from the 2 RS485 ports and will be simultaneously represented on the RS232 port. All connections are done via 2 RJ45 connectors and are protected against EMI and ESD noise. Connection to the USB port is made via a standard USB mini type B plug.

3 Hardware Configurations.

Wavetrend recommend the following configuration methods

Single reader for Demo Purposes

The RX202 when used as a standalone unit can draw power over the USB



Reader Network PSU300

In order to power the readers the RS232 / RS485 the following configuration is recommended .



The RX202 can be put in any configuration with existing RX201s.

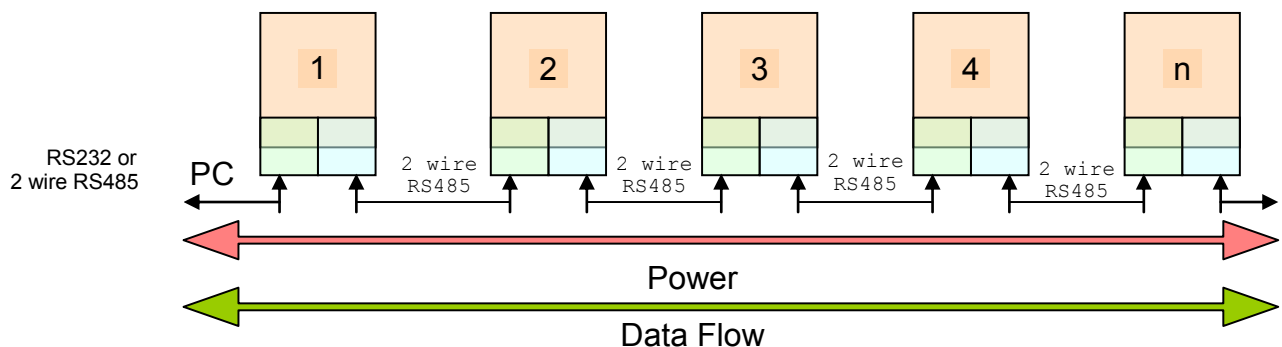
4 Networking

4.1 Single Network structure

The RX202 readers are connected together in a daisy chain type format. That is, Reader 1 is connected to Reader 2 is connected to Reader 3 etc. The network can handle a maximum of 254 readers because of addressing constraints. Communications between readers is done via a 2 wire RS485 connection. Connections from reader 1 to the PC can be done via the RS232 or Left RS485 ports.

Please note that for USB connector in the RX210 is for diagnostic and demo purposes, when connected over the USB the RJ45 sockets are isolated. Therefore you cannot drive the network over the USB interface of the first reader.

This network need not necessarily connect to a PC, but can be some other device such as a buffer or handheld computer etc.



Power is also carried to each reader on the cable running between them. Since each RS485 connection between readers is theoretically a separate network, distances between them can be up to 1.2 km (0.74 miles) according to the RS485 standard depending on the quality of the cable used. In reality copper wiring is not a perfect conductor and over long cable lengths significant voltage drop can occur. The RX210 readers can be powered independently through the regulated 6-28V 2.5 mm jack connector, it is recommended for cable runs over 100m to use this option.

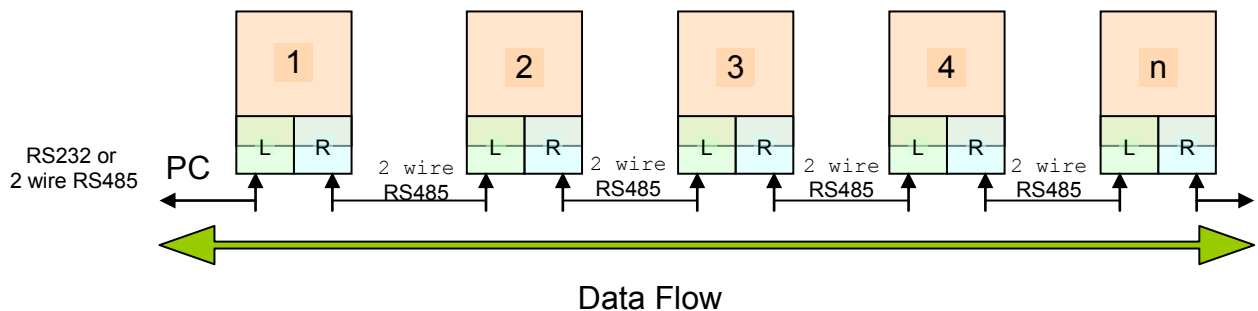
This network operates at speeds of up to 115200 baud and down as low as 9600 baud. These baud rates can be altered, using the application software, by means of the predefined commands referred to in section 4 of this document. Data communication to and from the PC must be at the same baud rate.

The reader net may be supplied with power from multiple points within the network. It is recommended that the network is powered via the Wavetrend IPSU.

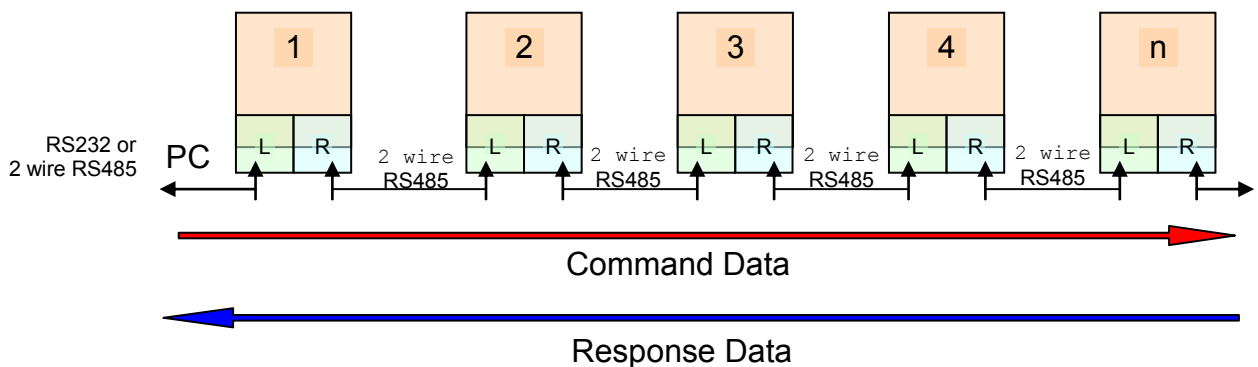
4.2 Basic Network Operation

Data passed up and down this network is arranged in a packet format. (Explained later). Each reader can be individually addressed via 2 address techniques, or the entire network can be broadcast to by assigning the destination address as value 255. These addressing techniques will also be explained later.

Data transmitted from the right port of a reader would be received in the left port of the receiver to the right of it and vice versa. With this kind of configuration, it is possible for the reader to control the direction that the data is flowing, and handle it accordingly. The complete network would look as follows:-



This network works on a Command/Response type operation. That is, a command is sent down to a specific reader in a left to right direction, while the response is sent back from right to left. Simply, commands run left to right, while responses run from right to left.



Each Command and Response is formatted into a specific packet of data with error checking etc included in the protocol format. Data can only flow in one direction at a time since the hardware is using a single serial port to control all this serial data. In order to make the installation of this system easier, it was necessary to stop the need of having to give each reader an individual address via a dipswitch or other plug in computer methods. Because this system is able to determine data direction, it is possible to establish which reader is number 1 and from there the consecutive addresses can be established. As mentioned earlier, there are 2 distinct methods of addressing a reader when sending out a command. The first address is called the NODE ID. This is the electrical address of the reader and is defined automatically by

its position in the network. The first reader (very left) would be assigned NODE ID 1 and increment consecutively to the right until a maximum of 254. The second address is called the READER ID. This address is defined by the user and is written to the non-volatile memory of each reader and can be from 1 to 254.

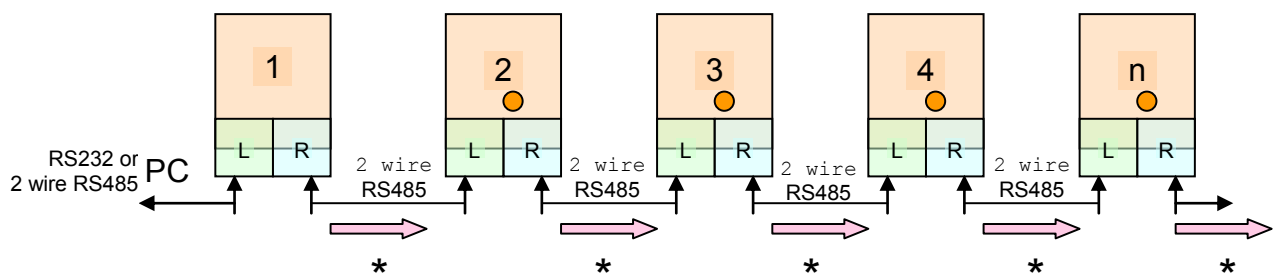
If a reader is removed from the network, or simply bypassed, the NODE ID's will naturally change. The function of the READER ID is therefore to allow a consistent and permanent address assignment to each reader. Logically, one would use NODE ID addresses in a command packet to assign a READER ID to a specific reader. NODE ID's provide a failsafe method of always accessing the correct reader if the network structure is known.

4.3 Establishing Node ID Addressing (automatic assignment)

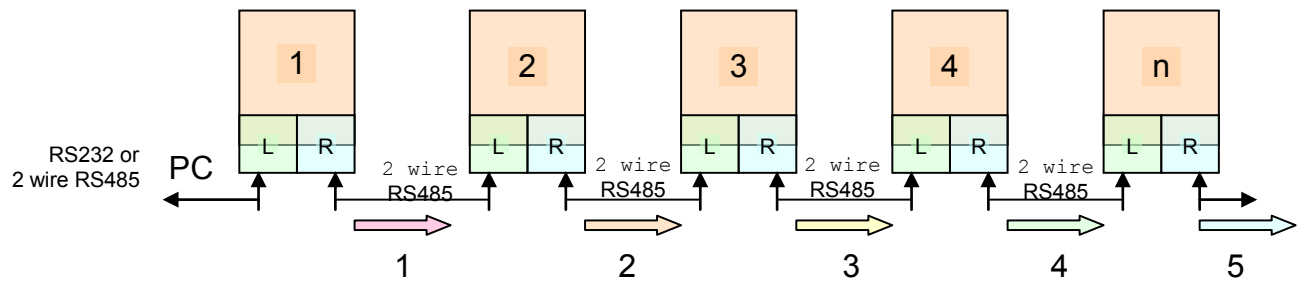
At power up, the NODE ID's are automatically established from the readers' connection position on the network. Basically, how this works is that Reader 1 needs to be established. From there, each subsequent reader can be assigned its NODE ID.

This whole process takes about 3.5 seconds at power up and consists of the following sequences.

1. Each reader powers up and sets its data flow in a right hand direction.
2. Each reader then continuously sends ' * ' s out of their right hand RS485 ports, and prepares to receive this character in their left hand RS485 ports. This character is sent out in single bursts every 25ms. This avoids any framing errors should a reader not be able to lock onto the data stream in the correct position from start up.
3. If an ' * ' is received in the left RS485 port, the TAG LED (slave indicator) is illuminated to indicate this. Each reader, except Reader 1, will therefore receive this character on its left hand RS485 port.
4. Reader 1 has now been established.
5. This process of sending out the right hand RS485 port lasts for 1 second.



6. Once Reader 1 has been established, it will start continuously sending its NODE ID out of the right hand RS485 port. This will be a continuous ' 1 ' and lasts for 500ms.
7. Each remaining reader, on receiving a byte, assumes it to be the NODE ID of the reader to the left of it, adds 1 to this value and assigns it as its own NODE ID. This new NODE ID is passed again to the right. This continuous sending of NODE ID's to the right has a ripple down effect on the network, until every receiver has been assigned its NODE ID and the network has stabilised.



8. Although the Reader 1 only sends the NODE ID 1 out for 500ms, the rest of the network remains in this receive - add 1 - transmit mode for a full second. This prevents any erroneous data from Reader 1 corrupting the whole network assignment.
9. There is now a further 1 second delay before the whole network is now ready and active. Reader 1 actually waits a further 2 seconds after its 500ms timeout before it becomes active, making it active 500ms after the others.

4.4 Packet Control

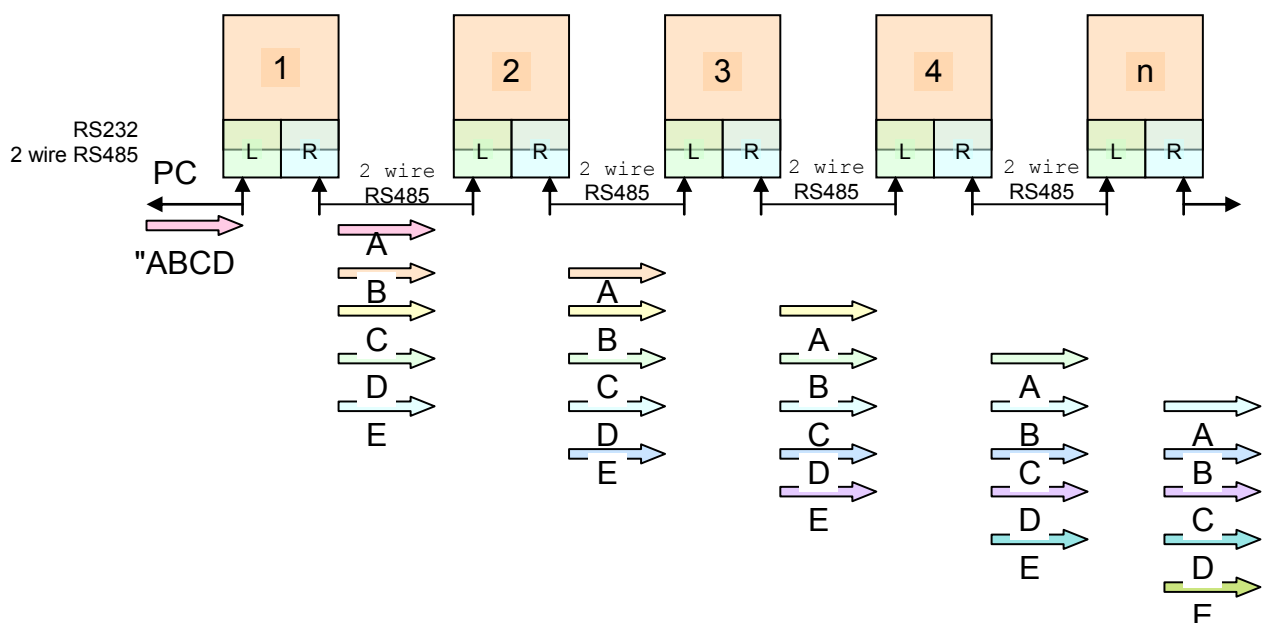
As explained earlier, data is passed up and down this network in a specific packet format. It would be too slow for a reader to receive a complete packet before transmitting it on to the next reader. Because of this, the packet is transmitted byte for byte as it is received.

The reader at the opposite end of the network would therefore have its packet delayed by the time taken to transmit a single byte down the length of the network.

This is a relation of the baud rate and the number of readers on the network.

After start up, the readers are all set into the idle condition, waiting for either a command or response packet. Here they will wait until they receive a command from the PC or a response packet from another reader. The IDLE/OK status LED will be on at this stage.

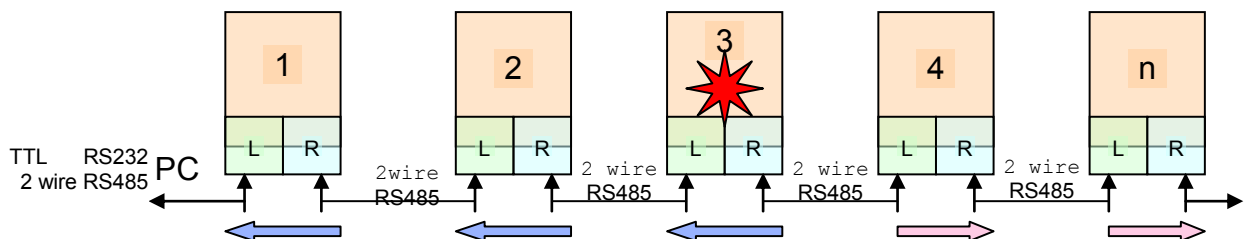
Command packets (Left to Right) are transmitted across the entire length of the network.



In the idle mode, data can be received from either direction. Since there is only one serial port on the microprocessor, the header byte received will determine from which direction the packet is being received. Once this byte has been received, the communication drivers are immediately set-up to flow the data in the correct direction. They will stay in this direction until the entire packet has been received, or the communications has timed out, whereby the reader will go back into the idle mode. While this data is being transmitted down the network, each reader assembles the packet in its memory for analysis when completed. Once a complete command packet is received, the contents are analysed for errors and addressing. Should this be a Command packet, the addressed reader(s) will then respond. After receiving a complete packet, each reader will immediately switch back into the idle mode. (Receive from both directions). In this mode, the next packet (should there be any) will automatically be passed in the correct direction.

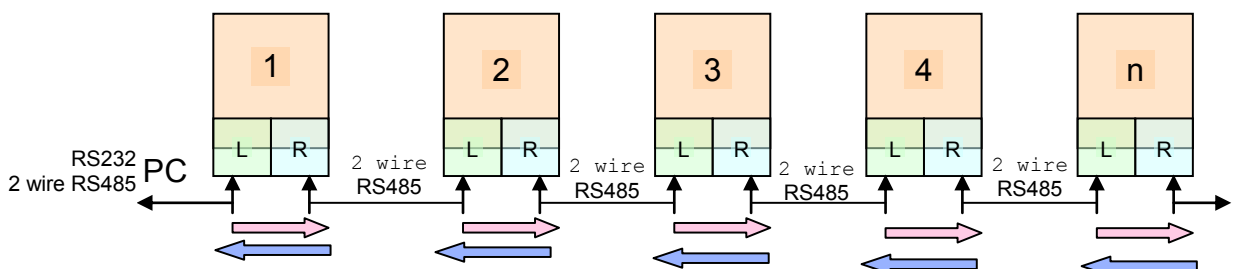
Should there be a break of more than 25ms between any bytes of the data packet, each reader will automatically switch back into the idle mode and ignore that packet. In this way, any communications failure will not result in the network locking up.

Should a spontaneous response packet be initiated e.g. Network Reset as a result of a power glitch, the packet will be passed back to the PC



Each time a valid packet is received, the Packet RX LED will flash. This can be used to determine whether valid communications is taking place.

Response packets are now sent back exactly the same way as the command packet, but in the opposite direction. Each reader would assemble the packet as it passed through to determine when the response is complete. Once it has received a complete response, the reader will switch into the idle mode, ready for the next Command packet.




4.5 Auto Polling

The onboard firmware carries routines to allow this system to be auto-pollled and free running. When reader 1 has the auto polling enabled, it will automatically determine the number of readers connected to its network and sequentially send commands out to receive the tag data from each reader using the 'Get Tag Packet Command 0x06'. These tag packets pass through reader 1 and onto the PC. In this mode, the PC will receive a continuous stream of tag packets without the need for its own polling system. This can be used on systems that have no ability to send data out to the network, or need only monitor the tag data as it appears, making it a very simple system without complicated polling routines.

Where no tag data is available, an empty reply packet will be sent back. This enables the monitoring software to determine if there are any readers on the network that are not responding, and suggest the appropriate action.

Since this data is being received on a continuous basis, a mechanism has been put into place to enable the PC to stop this process so that commands can be sent out to the network. This can be achieved by sending a break character (in this case , ' * ') to reader 1. Should Reader 1 receive this character, it will stop sending 'Get Tag Packet' commands until such time that it is instructed to go back into Auto Polling mode, OR the system is switched off and powered up again.

Since the network cannot see the PC while it is passing a packet from right to left (ie to the PC), it will be necessary to time this character to when the data packets are flowing left to right. This can be tricky, so the suggested method is to simply send a large number of ' * ' characters (400 - 500) to the network. In this manner, the network will always see these characters. 

To guarantee a break occurring, send **400 x ASCII 255 + ' * '** characters. The ASCII 255 character will ensure that there is no possibility of a framing error occurring and the break character not being seen.

0xF	*	400	X
-----	---	-----	---

Breaking the polling sequence does not alter the Auto Polling Flag in the Data EEPROM, but only suspends polling. After a physical reset, this system will start polling again unless the auto polling is disabled with the appropriate command. Auto Polling sequences start with a complete system communications reset to ensure that the network is seen correctly. This happens each time the auto polling is switched on even at power up.

5 Protocols and Addressing

As mentioned earlier data flowing on this network have a specific packet format. This format is defined as follows:

5.1 Command Packets

0xA	Data	Network	Receiver	Node	Command	Data	Checksum
-----	------	---------	----------	------	---------	------	----------

All bytes are HEX Values

1.	Header	1 Byte [0xAA]
2.	Length	1 Byte (Number of Bytes in data section)
3.	Network ID	1 Byte
4.	Receiver ID	1 Byte
5.	Node ID	1 Byte
6.	Command	1 Byte
7.	Data	Up to 64 Bytes of Data
8.	Checksum	1 Byte

CHECKSUM = [Length] XOR [Receiver ID] XOR [Token ID] XOR [Command ID] XOR [Data]...XOR [Data]



5.2 Response Packets

0x5	Data	Network	Receiver	Node	Command	Data	Checksum
-----	------	---------	----------	------	---------	------	----------

All bytes are HEX values.

9.	Header	1 Byte [0x55]
10.	Length	1 Byte (Number of Bytes in data section)
11.	Network ID	1 Byte
12.	Receiver ID	1 Byte
13.	Node ID	1 Byte
14.	Command	1 Byte
15.	Data	Up to 64 Bytes of Data
16.	Checksum	1 Byte (XOR from Length to Last Data Byte),

CHECKSUM = [Length] XOR [Receiver ID] XOR [Token ID] XOR [Command ID] XOR [Data]...XOR [Data]

Command and Response packets are essentially identical except for the header character. This different header character enables equipment receiving all the data to differentiate between command and response packets. Since the RS232 port presents all the data at all times, it will be necessary here to be able to differentiate between these packets.

5.3 Addressing Techniques

The addressing system for these networks has been made as flexible as possible. This will allow for various configurations and keep the system open for later expansion etc.

When addressing a reader, there are 3 addresses to take into account:-

1. Network ID - Identifies the network (used in multi-network configurations)
2. Reader ID - User defined address for a specific reader - Permanent address defined by the user
3. Node ID - Hardware address. This address is defined by the readers' position on the network

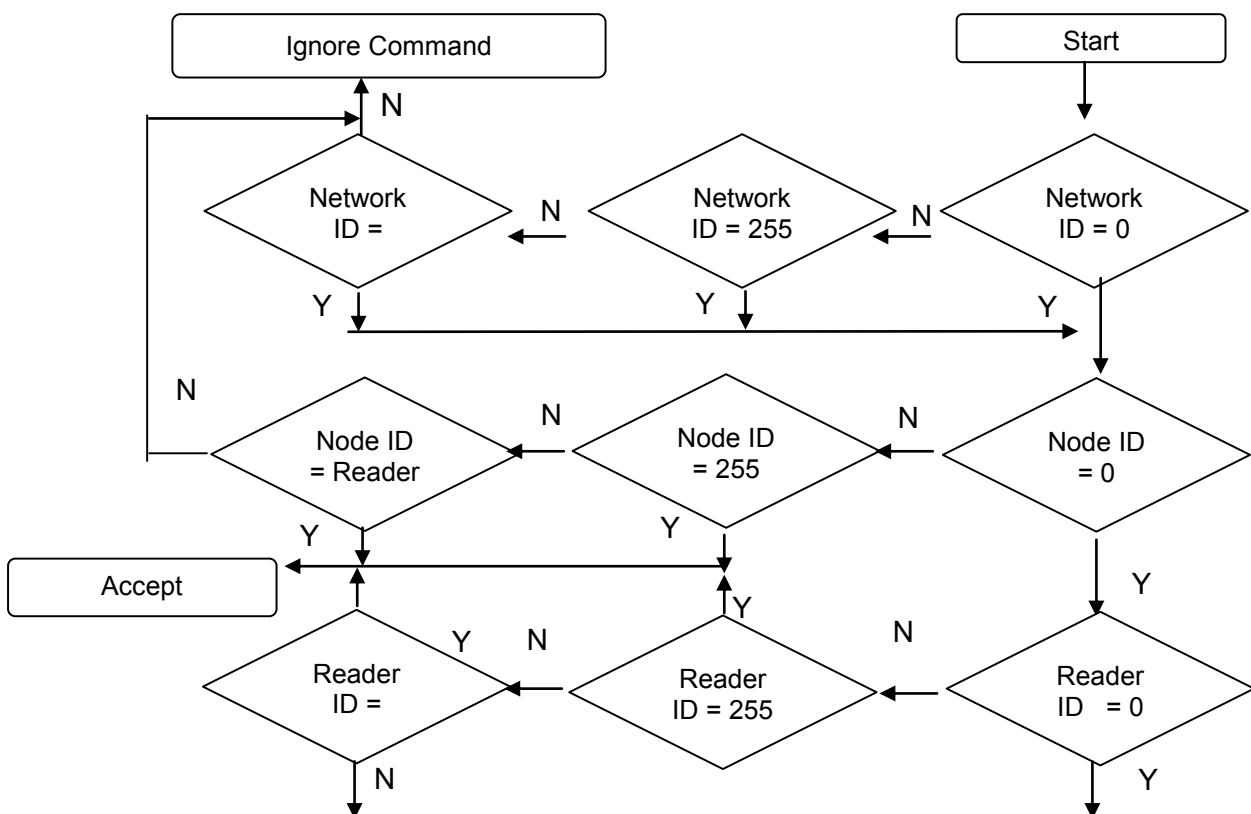
All three of these bytes are settable in the header bytes of the command packet. If a zero is placed into any of these positions, it is an indication to the firmware to ignore this parameter, and only use the remaining addresses to determine the reader being addressed.

If a value of 255 is placed into any of these addresses, it is an indication to the reader that this command is being broadcast to that appropriate level. A 255 value in the Network ID byte means that the command is being broadcast over all the networks. Whereas, a 255 in either the Receiver ID bytes or Node ID bytes means that the command is being broadcast to all the readers in that network.

Node ID addresses take priority over Receiver ID addresses. That is, a valid Node ID address will be accepted before a valid Receiver ID.

When commands are broadcast, there is no response packet generated. The only exception for this is the Reset Network Command.

A simple flow diagram for this logic would be as follows:



Some examples would be as follows:-

0	0	0	Invalid - will have no response
0	12	0	Access Reader with Reader ID = 12
0	0	5	Access Reader 5 on the network
0	12	5	Access Reader 5 on the network. Reader ID address is ignored
1	0	0	Invalid - will have no response
1	4	0	Access Reader with Reader ID = 4 on Network 1
1	0	123	Access Reader 123 on the Network 1
255	12	0	Access all Readers with Reader ID = 12 on all the networks
255	0	45	Access Reader 45 on all the Networks
255	255	0	Access all possible readers
255	0	255	Access all possible readers
0	255	255	Access all possible readers
			Etc ...

6 Commands

6.1 Command shortlist

Shortlist of commands and requests (Command ID's):

0x00	Reset Network	Reply Packet
0x01	Start/Enable Auto Polling	Continuous
0x02	Disable Auto Polling	Reply Packet
0x03	Ping Reader	Reply Packet + Error
0x04	Set Network ID	Reply Packet
0x05	Set Reader ID	Reply Packet
0x06	Get Tag Packet	Tag Packet
0x07	Get RSSI Value	Reply Packet + RSSI
0x08	Set RSSI Value	Reply Packet
0x09	Set Site Code	Reply Packet
0x0A	Get Site Code	Reply Packet + Site Code
0x0B	Set Receiver Gain	Reply Packet
0x0C	Get Receiver Gain	Reply Packet + Gain
0x0D	Set Alarm Filter	Reply Packet
0x0E	Get Alarm Filter	Reply Packet + Status
0x0F	Get Number of invalid Tags	Reply Packet + Counter
0x10	Get Supply Voltage	Reply Packet + Voltage
0x11	Start RF white noise	Reply Packet
0x12	Get RF white noise result	Reply Packet + Result
0xFE	Set Baud Rate	No Reply – Broadcast only
0xFF	Get Version Information	Reply Packet + Version

Command Shortlist

6.2 Command Details

Reset Network Command

The function of this command is to reset the entire network, and re-establish the NODE ID addresses. The NODE ID address in the command packet should hold a 255 (broadcast value) to ensure that the entire network enters into the reset sequence. Only reader 1 will respond with the reply packet. This is the only condition under which a response is sent from a broadcast command.

Note: receiving a reset network reply packet at any point where no reset command was sent, will imply that a spontaneous reset has occurred. This would probably be as the result of a power problem.

Command

0xA	0x0	0x00	0x00	0xFF	0x00	Checksum
-----	-----	------	------	------	------	----------

Response

0x5	0x00	Network	Receiver	0x01	0x00	Checksum
-----	------	---------	----------	------	------	----------

Start / Enabling Polling Mode Command

The function of this command is to set Reader 1 into an Automatic Polling sequence. It sets the Auto Polling flag in the Data EEPROM to enable Auto Polling after power up.

It will establish the size of the network by sending out tag requests until such time that it gets no response. This will determine the number of readers on the network. Once this has been established, it will sequentially poll each reader indefinitely. Data responses from the readers pass through reader 1 and onto the PC. Readers without a valid tag will respond with an empty packet of data. This will enable the monitoring software to determine if any readers are no longer responding. This command can be addressed directly to reader 1, or on a broadcast basis. When broadcasting, any reader that is not Reader 1, will disable its Auto Polling flag in its Data EEPROM to avoid any problems in the future because of incorrect parameters.

This command is used to restart the Auto Polling if it has been stopped by a break character. (See Auto Polling section)

Command

0xA	0x00	Network	Receiver	Node ID	0x01	Checksum
-----	------	---------	----------	---------	------	----------

Response

0x5	0x00	Network	Receiver	Node ID	0x01	Checksum
-----	------	---------	----------	---------	------	----------

Disable Auto Polling Command

The function of this command is to disable future Auto Polling after power up by resetting the Auto Polling flag in the Data EEPROM. This command can be addressed directly to reader 1, or on a broadcast basis.

Command

0xA	0x00	Network	Receiver	Node ID	0x02	Checksum
-----	------	---------	----------	---------	------	----------

Response

0x5	0x00	Network	Receiver	Node ID	0x02	Checksum
-----	------	---------	----------	---------	------	----------

Ping Reader Command

The Ping Command is simply used to check if a reader is on the network and responding correctly. It can be used to read back Network ID's, Reader ID's and Node ID's. Inserted into the response from a Ping Command is an Error Number. This number refers to the last error the respective reader has experienced. Once read, this number is cleared.

To clear all the errors on all the readers, simply broadcast a Ping Command.

Command

0xA	0x00	Network	Receiver	Node ID	0x03	Checksum
-----	------	---------	----------	---------	------	----------

Response

0x5	0x01	Network	Receiver	Node ID	0x03	Error	Checksum
-----	------	---------	----------	---------	------	-------	----------

Error Numbers are as follows:

0	No errors encountered
1	Unknown reader command received
2	Tag Table underflow error
3	Command Packet checksum error
4	RF Module - Unknown command response
5	RF Module - Unknown general response
6	RF Module - Re-sync failure
7	RF Module - Command response failure
8	RF Module - Receive response failure
9	No response packet received from polled reader

Set Network ID Command

The function of this command is to assign the Network ID as well as commit it to the Data EEPROM.

Command

0XA	0x01	Network	Receiver	Node ID	0x04	New Network	Checksum
-----	------	---------	----------	---------	------	-------------	----------

Response

0X5	0x00	Network	Receiver	Node ID	0x04	Checksum
-----	------	---------	----------	---------	------	----------

Reader ID Command

The function of this command is to assign the Reader ID as well as commit it to the Data EEPROM.

Command

0XA	0x01	Network	Receiver	Node ID	0x05	New Reader ID	Checksum
-----	------	---------	----------	---------	------	---------------	----------

Response

0x5	0x00	Network	Receiver	Node ID	0x05	Checksum
-----	------	---------	----------	---------	------	----------

Get Tag Packet Command

This will be the most used command on any system. Its function to request a Tag from the reader if there is one ready for sending. A tag is removed from the tag buffer, and returned with this command, making room for a new tag.

New tags from the RF Module are written over existing tags in the Tag Buffer in order to keep the data fresh.

Should no tag be ready for sending, and empty packet is sent back. That is, no data in the Data field.

Command

0XA	0x00	Network	Receiver	Node ID	0x06	Checksum
-----	------	---------	----------	---------	------	----------

Response (empty)

0x5	0x00	Network	Receiver	Node ID	0x06	Checksum
-----	------	---------	----------	---------	------	----------

Response (Tag Packet)

0x5	Data Length	Network	Receiver	Node	0x06	Dat	Checksum
-----	-------------	---------	----------	------	------	-----	----------

Next Page ...

The Data Field would have this format:

1	!
2	*
3	*
4	Interval
5	Reed Switch Counter
6	Firmware version
7	B
8	C
9	Movement switch counter
10	Age byte MSB
11	Age byte
12	Age byte
13	Age byte LSB
14	Site code MSB
15	Site code
16	Site code LSB
17	Tag ID MSB
18	Tag ID
19	Tag ID
20	Tag ID LSB
21	Type of tag flag
22	Reader ID
23	RSSI signal strength
24	Checksum
25	20H (reserved)
26	Alarm byte
27	Node ID
28	Network ID
29	Reader Set RSSI Value
30	Firmware Version
31	LF
32	CR

Set RSSI Value Command

This command will set the RSSI value and commit it to the Data EEPROM. It also initiates an RF Module reset and writes the new value to the RF Module. Broadcasts here are useful to set all the readers to their most sensitive etc. The RSSI Value ranges from 0 to 255. 0 being the most sensitive.

Command

0xA	0x01	Network	Receiver	Node ID	0x07	New RSSI	Checksum
-----	------	---------	----------	---------	------	----------	----------

Response

0x5	0x00	Network	Receiver	Node ID	0x07	Checksum
-----	------	---------	----------	---------	------	----------

Get RSSI Value Command

This command will return the RSSI value it is currently using, and defined in the Data EEPROM.

Command

0xA	0x00	Network	Receiver	Node ID	0x08	Checksum
-----	------	---------	----------	---------	------	----------

Response

0x5	0x01	Network	Receiver	Node ID	0x08	RSSI	Checksum
-----	------	---------	----------	---------	------	------	----------

Set Site Code Command

The Site Code or Site Code is a group of 3 bytes assigned to each tag. Its function is to enable the reader to filter out any tags that it receives that is not part of the site it is monitoring. These values are committed to the Data EEPROM.

When a Site Code of 0 value is assigned, then all the tags read are reported.

Entering a separate code, will result in any tags other than those meeting this code to be rejected by the reader.

Command

0xA	0x03	Network	Receiver	Node	0x0	Site	Site 2	Site 3	Checksum
-----	------	---------	----------	------	-----	------	--------	--------	----------

Response

0x5	0x00	Network	Receiver	Node ID	0x09	Checksum
-----	------	---------	----------	---------	------	----------

Get Site Code Command

This command will return the active Site Codes.

Command

0xA	0x00	Network	Receiver	Node	0x0A	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x0	Network	Receiver	Node	0x0	Site	Site 2	Site 3	Checksum
-----	-----	---------	----------	------	-----	------	--------	--------	----------

Set Receiver Gain Command

This command will set the RF Module into its 2 different gain levels.

Command

0xA	0x01	Network	Receiver	Node	0x0B	Gain	Checksum
-----	------	---------	----------	------	------	------	----------

Gain = 0 (Low Gain Mode – Short range reader)

Gain = 1 (High Gain Mode – Long range reader)

Response

0x5	0x00	Network	Receiver	Node ID	0x0B	Checksum
-----	------	---------	----------	---------	------	----------

Get Receiver Gain Command

This command will return the Receiver Gain Mode.

Command

0xA	0x00	Network	Receiver	Node	0x0C	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x0	Network	Receiver	Node	0x0	Gain	Checksum
-----	-----	---------	----------	------	-----	------	----------

Gain = 0 (Low Gain Mode – Short range reader)

Gain = 1 (High Gain Mode – Long range reader)

Set Alarm Tag Filter Status Command

This command will filter out tags with a specific Alarm condition.

Command

0xA	0x01	Network	Receiver	Node	0x0D	Status	Checksum
-----	------	---------	----------	------	------	--------	----------

Status = 0 - Report all tags

Status = 1 - Report only tags with an Alarm condition

Status = 2 - Report only tags without any Alarm condition

Response

0x5	0x00	Network	Receiver	Node ID	0x0D	Checksum
-----	------	---------	----------	---------	------	----------

Get Alarm Tag Filter Status Command

This command will return the current Alarm tag filtering status.

Command

0xA	0x00	Network	Receiver	Node	0x0E	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x0	Network	Receiver	Node	0x0	Statu	Checksum
-----	-----	---------	----------	------	-----	-------	----------

Status = 0 - Report all tags

Status = 1 - Report only tags with an Alarm condition

Status = 2 - Report only tags without any Alarm condition

Get Invalid Tag Count

This command will return the number of Invalid Tags received by the RF module since the last read. This data is calculated by the RF Module and is a direct interpretation of tag collisions or read failures. This is a 2 byte value.

Command

0xA	0x00	Network	Receiver	Node	0x0F	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x0	Network	Receiver	Node	0x0	Count_	Count_	Checksum
-----	-----	---------	----------	------	-----	--------	--------	----------

Count_H – Counter High Byte

Count_L – Counter Low Byte

Get Power Supply Voltage

This command will return the voltage of the power supply at this reader. It is a single byte and represents the power in 0.1 voltage increments. Eg Value 131 = 13.1 Volts
Returns the voltage that the reader is receiving, via either its RJ45 ports or via the 2.5mm power socket. It will not return the voltage that it is receiving via the USB socket if this option is being used.

Command

0xA	0x00	Network	Receiver	Node	0x10	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x0	Network	Receiver	Node	0x1	Voltage	Checksum
-----	-----	---------	----------	------	-----	---------	----------

Start Environmental Noise Level Value Calculation

This command will set the reader into an evaluation mode in order to calculate the environmental white noise level at 433.92 MHz. The unit will remain in evaluation mode for a time period of 40 seconds. During this period no tag transmissions will be decoded. Once the calculation has been completed, the reader will resume normal operation.

Command

0xA	0x00	Network	Receiver	Node	0x11	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x00	Network	Receiver	Node	0x11	Checksum
-----	------	---------	----------	------	------	----------

Get Environmental Noise Level Value

This command will retrieve the calculated value (between 0 and 255) of the environmental white noise level. Take note that this command can only follow after the *Start Environmental Noise Level Value Calculation*. If a command is send down to the unit, while still in evaluation mode, the reader will cancel the calculation process, reset and continue normal operation.

Command

0xA	0x00	Network	Receiver	Node	0x12	Checksum
-----	------	---------	----------	------	------	----------

Response

0x5	0x0	Network	Receiver	Node	0x1	Noise	Checksum
-----	-----	---------	----------	------	-----	-------	----------

Reset Network Baud Rate Command

This command will reset the network Baud Rate. It will only accept a broadcast command and there is no response sent. Changes are immediate will result in communications loss if the PC does not change its baud rate accordingly.

Command

0xA	0x01	0xFF	0xFF	0xFF	0xFF	Rate	Checksum
-----	------	------	------	------	------	------	----------

Rate 0 = 115200 baud

Rate 1 = 57600 baud

Rate 2 = 38800 baud

Rate 3 = 19200 baud

Rate 4 = 9600 baud

Get Receiver Version Information Command

This command will return the Receiver Version Information. These include
 Controller Firmware Version
 RF Module Firmware Version
 Controller Hardware Version
 RF Module Hardware Version

RF Module versions are read directly from the module itself. This data is in the following format:

Value = 13 = Version 1.3

Command

0xA	0x00	Network	Receiver	Node	0xFF	Checksum
-----	------	---------	----------	------	------	----------

Response



0x5	0x0	Network	Receiver	Node	0xF	CFV	RFV	CH	RH	Checksum
-----	-----	---------	----------	------	-----	-----	-----	----	----	----------

CFV - Controller Firmware Version

RFV - RF Module Firmware Version
 CHV - Controller Hardware Version
 RHV - RF Module Hardware Version

Set Protocol

The RX202, RX210 and RX211 support the L series+ protocol as well as the existing L series protocol. The Set Protocol has 3 options
 Command

0xAA	0x02	Network ID	Reader ID	Node ID	0x40	Data	Checksum
------	------	------------	-----------	---------	------	------	----------

Data (2 bytes): Protocol: 0 = legacy, 1 = no nulls, 2 = L-Plus
 RS 232 enable: 0 = OFF, 1 = ON

Response

0x55	0x00	Network ID	Reader ID	Node ID	0x40	Checksum
------	------	------------	-----------	---------	------	----------

- 1) **Legacy**, the reader will receive - standard L series tag packets and will generate Null tag packets in the event that no tags are within range. Null packets are empty tag packets that some Legacy software uses as a form of heartbeat to check the network is operating.
- 2) **No Nulls**, the reader will receive - standard L series tag packets. No Nulls will be generated
- 3) **L Series+**, the reader will receive both L series and L series+ tag packets. No nulls will be generated.

Get Protocol

Returns the Protocol setting
 Command

0xAA	0x00	Network ID	Reader ID	Node ID	0x41	Checksum
------	------	------------	-----------	---------	------	----------

Response

0x55	0x02	Network ID	Reader ID	Node ID	0x41	Protocol	Checksum
------	------	------------	-----------	---------	------	----------	----------

Data (2 bytes): Protocol: 0 = legacy, 1 = no nulls, 2 = L-Plus
 RS 232 enable: 0 = OFF, 1 = ON

RS232 Control is a RX210 command and is not supported in the RX202 as the RS232 is always available

Set Info

The serial readers are part of the larger Wavetrend Reader family, some of which include GPS. In order to harmonize the software interface between the serial readers and the GPS enabled units RX910, RX1010, RX1310 the command allows the user to set the following fields

- 1) Latitude (4 bytes)
- 2) Longitude (4bytes)
- 3) User Data (10 bytes)

0xAA	0x12	Network ID	Reader ID	Node ID	0xF0	Data	Checksum
------	------	------------	-----------	---------	------	------	----------

Data (18 bytes): Location: Latitude – 4 bytes
Longitude – 4 bytes
User Data: 10 bytes

Response

0x55	0x00	Network ID	Reader ID	Node ID	0xF0	Checksum
------	------	------------	-----------	---------	------	----------

Get Info

Returns the Set Info settings as well as the following values

Model number (1 byte): 1= RX210, 2 =RX211, 3 = RX202

Reader serial number (4bytes)

Location: Latitude (4bytes), Longitude (4bytes)

User Data (10bytes)

0xAA	0x00	Network ID	Reader ID	Node ID	0xF1	Checksum
------	------	------------	-----------	---------	------	----------

Response

0x55	0x17	Network ID	Reader ID	Node ID	0xF1	Data	Checksum
------	------	------------	-----------	---------	------	------	----------

Data (57 bytes): Model number:(1 byte): 1 = RX210, 2 =RX211, 3 = RX202

Status: bit 0: Not used
bit 1: Not used
bit 2: Autopol setting
bit 3: Gain setting
bit 4: Not used
bit 5: Not used
bit 6: RS232 enable setting
bit 7: Not used

Serial number (4 bytes)
Location: Latitude – 4 bytes
 Longitude – 4 bytes
User Data: 10 bytes
RSSI threshold: 1 byte
Site code filter: 3 byte
Alarm filter: 1 byte
Network Voltage: 1 byte
Not used: 21 bytes
Protocol (1 byte): 0 = legacy, 1 = no nulls, 2 = L-Plus
Controller Firmware Version (1 byte)
RF Module Firmware Version (1 byte)
Controller Hardware Version (1 byte)
RF Module Hardware Version (1 byte)

Status

The Status tab command shows the user all of the reader settings in response to the Get Info command, displayed below in Wavetrend Analyser.

The screenshot shows the 'Reader Status' window with the following settings:

Reader	
Model	L-RX211
Name	
S/N	19088743
Ver	CF:01.0 RF:03.0 CH:01.0 RH:03.0

Location / Mode Settings	
Latitude	0100.000S
Longitude	00100.000E
Autopoll	Off
Gain	High
Protocol	Legacy
RSSI Threshold	0
Network Voltage	0.2
Heartbeat Interval	0
Alarm Filter	All Tags
Site Code Filter	0

Security / Database	
PW Enabled	No
Logged In	Yes
Database Mode	Off
DB records	0
DB Maximum	300
DB CRC	FFFF
Weigand Setting	Slow
Tag Timeout	30
Tag Life	0

Relay (I/O) Settings	
IO-0 Mode	Off
IO-0 On Time (s)	1
IO-0 Off Time (s)	1
IO-0 delay trgr	1
IO-1 Mode	Off
IO-1 On Time (s)	1
IO-1 Off Time (s)	1
IO-1 delay trgr	1

Buttons: Refresh, Close

7 Interfaces and Connections

7.1 Interfaces

The interface standards are as follows:

- Interface Serial RS232 / RS485
- Baud 115 kB/s, 57.6 kB/s, 38.4 kB/s, 19.2 kB/s, 9.6 kB/s Selectable via program port
- Parity None
- Start bit 1
- Stop 1
- Data Bits 8

7.2 Connections

The RX202 has 2X RJ45 connectors and a 2.5mm Power socket on the back.



The RJ45's are configured as follows

RX202 / RX201		Legacy Wiring	
Left Port		Right Port	
1	RS232 – RX	1	Gnd
2	RS232 – TX	2	NC
3	Vin	3	Vin
4	Gnd	4	Gnd
5	RS485 +	5	RS485 +
6	RS485 -	6	RS485 -
7	NC	7	NC
8	NC	8	NC

7.3 USB Connection.

The USB port can be found on the top of the reader , it accepts a standard USB B micro plug.

Before accessing the reader via the port the user must pre install the latest FTDI drivers for their operating system. These can be downloaded from the following URL.

www.ftdichip.com.

8 Diagnostics

8.1 Diagnostic LEDS

The 4 LED's on the RJ45 connectors indicate functions of the system and are used entirely for diagnostic purposes. Their assignments are as follows (from left to right):



8.1.1 Normal Mode

Poll	Orang	Successful Poll of current reader
Packet RX	Green	Valid Packet Received – From either direction
Tag RX	Orang	Valid Tag received from the RF Module
System	Green	Indicates that the system communications are Idle and OK

8.1.2 Auto Poll Mode (Master reader only)

Poll	Orang	Successful Poll of current reader
Packet RX	Green	Valid Packet Received – Return packet only
Tag RX	Orang	Valid Tag received from the RF Module
Cmd	Green	Command request packet sent

8.1.3 Communications Reset (Start-up)

Master	Orang	Reader identified as Master reader
	Green	Not used
Slave	Orang	Reader identified as Slave reader
Break RX	Green	Start-up break characters transmitting

9 Specifications

Environmental <ul style="list-style-type: none">Operating temperatureStorage temperatureHumidity	<ul style="list-style-type: none">: -40°C to +85°C: -20°C to +70°C: 5% to 90% (non condensing)
Physical <ul style="list-style-type: none">SizeWeight (unit)ColourMaterialConnections	<ul style="list-style-type: none">: 105 mm x 58mm x 28mm: 118 grams: Black: Aluminium: 2 x RJ45 socket: 1 Mini USB type socket: 2.5mm Power socket
Radio Frequency <ul style="list-style-type: none">Receive FrequencyModulationSensitivityRF Input	<ul style="list-style-type: none">: 433.92 MHz: ASK: -94 dB: 50 Ohm BNC
Electrical <ul style="list-style-type: none">Supply VoltageMax. current consumption	<ul style="list-style-type: none">: 7V ~ 16Vdc: 20 ma
Protocol Specification <ul style="list-style-type: none">Standard Data RateInterface	<ul style="list-style-type: none">: 9,600 ~ 115,200 (baud rate): RJ45 connectors

10 Certification

The following standards applied in accordance with Article 5 of the directive, 1999/5/EC:

- EN 300 220-1 V1.2.1 (1997-11)
- ETS 300 683 (1997-03).

Summary of tests:

Test Type	
Effective radiated power	25 MHz-4 GHz
EN55022	Radiated emissions 30 MHz – 1 GHz
EN55022	Conducted emissions 150 kHz – 30
EN61000-4-3	Radiated immunity 80 MHz – 1 GHz, excl 433.92 MHz \pm 20 MHz
EN61000-4-4	Electrical fast transients
EN61000-4-2	Electrostatic discharge
EN61000-4-6	Conducted immunity 150 kHz – 80

The RX202 has been tested and certified to meet FCC Part 15 1.01 for unintentional radiators.



The RX210 is produced in the USA to ROHS standards and contains no Lead