915U-2

Web Page Configuration Supplement

ELPRO Technologies, 9/12 Billabong Street, Stafford Qld, 4053 Australia.
Tel: +61 7 33528600 Fax: +61 7 33528677 Email: sales@elprotech.com
Web: *www.elprotech.com*
ELPRO Support Help-line America (866) 7134409 Rest of the world +617 3352 8624

V1.1

Thank you for your selection of the 915U-2 I/O Module. We trust it will give you many years of valuable service.

ATTENTION!

Incorrect termination of supply wires may cause internal damage and will void warranty. To ensure your 915U-2 module enjoys a long life, double check ALL your connections with the user manual before turning the power on.

CAUTION:

To comply with FCC RF Exposure requirements in section 1.1310 of the FCC Rules, antennas used with this device must be installed to provide a separation distance of at least 20 cm from all persons to satisfy RF exposure compliance.
Avoid:

- Operating the transmitter when someone is within 20 cm of the antenna
- Operating the transmitter unless all RF connectors are secure and any open connectors are properly terminated
- Operating the equipment near electrical blasting caps or in an explosive atmosphere

All equipment must be properly grounded for safe operations.
All equipment should be serviced only by a qualified technician

SAFETY Notice:

Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in Docket 93-62 and OET Bulletin 65 Edition 97-01.

TABLE OF CONTENTS

TABLE OF FIGURES

Chapter 1 - WIBMesh Configuration

1.1 Overview

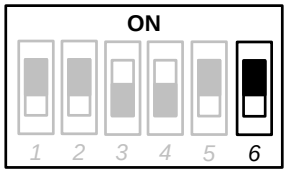
Primarily configuration is done using the MConfig Software however configurations can be made by connecting to the modules internal web pages.

Please Note : It is recomeneded the configuration be done solely byone or the other. Try to avoid configuring modules using both config software and web pages unless absolutly necessary as some parameters of the configuration can become out of sync.

It is recomened that if using Web page configuration it is for minor infield changes only.

1.2 Initial Connection

Open your web browser (Internet Explorer) and enter the IP address of the module.
If the IP address is unknown, the 915U-2 can be configured to temporarily load a factory-default setting by powering the module with the #6 dipswitch under the side configuration panel switched on.
When the module is in 'SETUP mode', wireless operation is disabled. The previous configuration remains stored in non-volatile memory and will only change if the configuration parameters are modified and the changes are saved.



Do not forget to set the switch back to the OFF position and re-cycle the power at the conclusion of the configuration for normal operation otherwise, it will continue to boot into the default IP address.

The default factory IP Address of the 915U-2 is 192.168.0.1XX, where XX is the last two digits of the serial number (the default "Setup IP address" is shown on the printed label on the side of the module)
Netmask 255.255.255.0
Username is "user" and the default password is "user"
If the PC uses a proxy server, ensure that Internet Explorer will bypass the Proxy Server for local addresses.
This option may be modified by opening Tools -> Internet Options -> Connections Tab -> LAN Settings->Proxy Server -> bypass proxy for local addresses.
Enter the default IP address for the 915U-2, you should now see the Module Welcome Screen (below). From this home screen the following config screens can be reached.

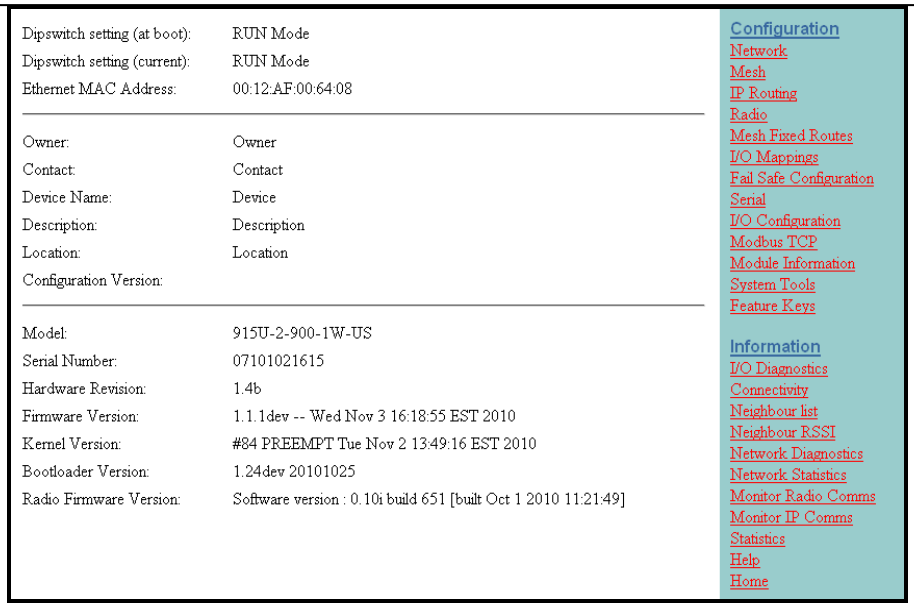


Figure 1 – Main Welcome Screen

1.3 Network Configuration

You can view or modify Ethernet network parameters by selecting the “Network” menu. When prompted for username and password, enter “user” as the username, and “user” as the password in the password field (This is the factory default – See section 3.5 ”Module Information ” to change). If you have forgotten the IP address or password, the Factory Default switch may be used to access the existing configuration. Refer to section above for this procedure.

The Network Configuration page allows configuration of parameters related to the wired and wireless Ethernet interfaces. In general, IP address selection will be dependent upon the connected wired Ethernet device(s) – before connecting to an existing LAN consult the network administrator.

Note: If configuring a system of 915U-2 radios and the Ethernet IP address of each of the 915U-2 modules is configured with the same IP Address and if using a common PC to perform all configurations there can be some issues with web pages not reading correctly. It if far better to assign separate IP addresses to each module.

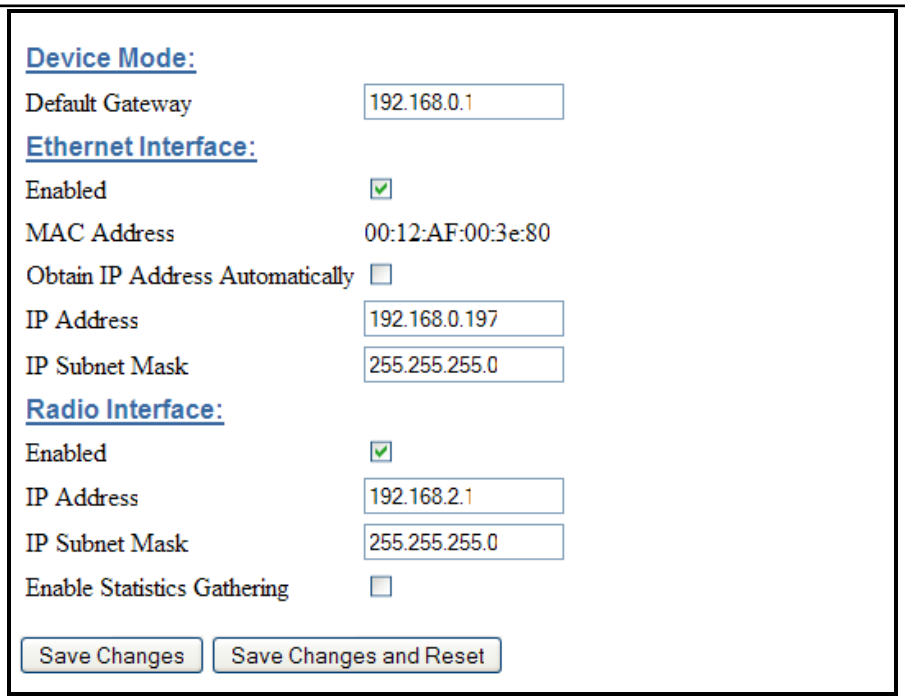


Figure 2 – Network Configuration Screen

This is because Web Browsers associate web pages with an Ethernet IP address, they also cache web pages to speed up the loading process.
This means that if a browser connects to a previously loaded IP address it may sometimes load the web page from the cache and not from the live device.
To overcome this all modules must be configured with an individual ethernet IP address or when connecting to the module force the web pages to be reloaded from the Device instead of from cache by pressing <CRTL F5> after the page has loaded.
Web Browsers can be configured to flush the cache after each session, review browser help for details on how this is done.

Device Mode	
Default Gateway	This is the address that the device will use to forward messages to remote hosts that are not connected to any of the local networks (Ethernet or Wireless). This is only required if the wired LAN has a Gateway unit which connects to devices beyond the LAN - for example, Internet access. If there is no Gateway on the LAN, set to the same address as the Station used for remote configuration - that is, the "Ethernet Interface IP Address" below.
Ethernet Interface	
Enabled	Enables or disables the Ethernet interface. If the Ethernet connection is not used you can disable which will marginally improve the boot time and lower the current drain. To restore the Ethernet port, you can set the Factory Defaults DIP-Switch and reboot the module
MAC Address	This is the unique hardware address of the 915U-2 and is assigned in the Factory.
Obtain IP Address Automatically	Checking this item enables DHCP client on the 915U-2. A DHCP client requests its IP address from a DHCP server, which assigns the IP Address

	automatically. To use this option, you will need to have a DHCP server configured on your network. The module will attempt to register its configured unit name with any connected DNS server.
IP Address	The IP address of the 915U-2 on its wired (Ethernet Interface) port and wireless (Wireless Interface) port. This should be set to the IP address you require.
IP Subnet Mask	The IP network mask of the 915U-2 on its wired (Ethernet Interface) port and wireless (Wireless Interface) port. This should be set to appropriate subnet mask for your system (Typically 255.255.255.0).
Radio Interface	
Enabled	Enables or disables the Radio interface. If using the module as an Ethernet I/O based device.
IP Address	The IP address of the 915U-2 on its Radio (Wireless Interface) port. This should be set to the IP address you require. Default will be 192.168.2.1
IP Subnet Mask	The IP network mask of the 915U-2 on its wired (Ethernet Interface) port and wireless (Wireless Interface) port. This should be set to appropriate subnet mask for your system (Typically 255.255.255.0).
Enable Statistic Gathering	Enabling this option will allow the radio to gather information about the radio throughput, which can then be viewed on the "Network Statistics" web page.
Save Changes	Save changes to non-volatile memory. The module will need to be restarted before the changes take effect.
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

1.4 Mesh

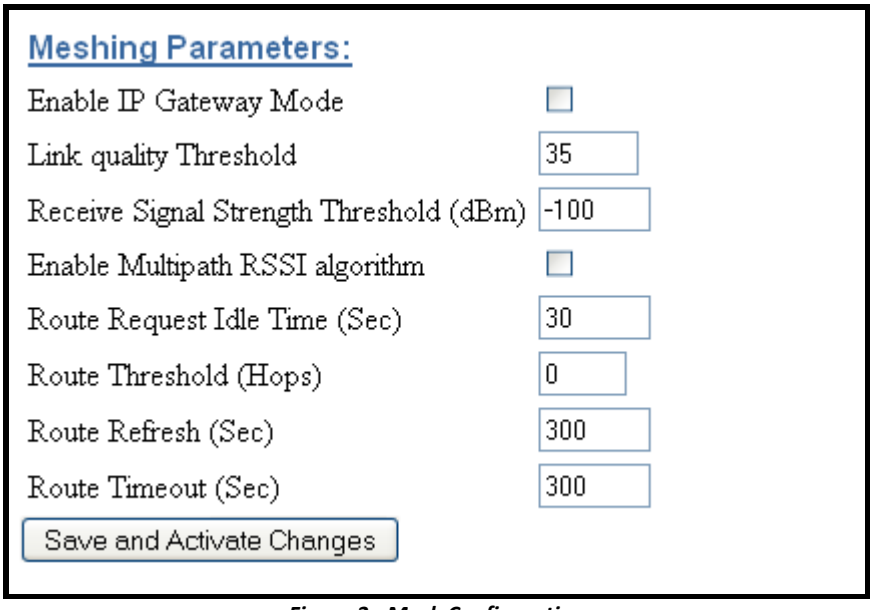


Figure 3 - Mesh Configuration

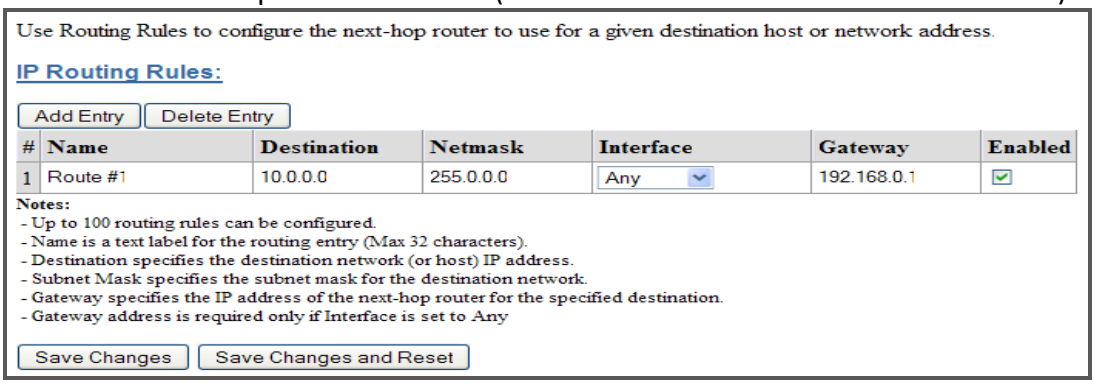
Enable IP Gateway Mode	Enabling this option will allow communicating modules access to an external Ethernet Network if connected (IP address range configured under Network Settings). Care should be taken when enabling this option as it can increase overall network traffic. Default is off and should remain off unless there is an Ethernet network connected and other devices on the radio network need to communicate through this module to the external Ethernet network. All traffic for the external network must be routed through this IP address.
Link Quality Threshold	The radio will use this threshold levels when establishing a mesh link with other radios in the system. It represents a 0-100% level of link quality (100 being the best). If the Link Quality is lower than the threshold the link will be ignored. Link Quality can be monitored on the Connectivity web page. If the link quality is lower than this threshold, then mesh routes will not be assigned over this link. Default value is 35
Receive Signal Strength Threshold	The radio will use this threshold level when establishing a mesh link with other radios in the system. When establishing a mesh the radio sends out a broadcast message and then monitors the signal strength from all other nodes that respond, if any of the signal levels are below the “Receive Signal Strength Threshold” the mesh link will be ignored. The default threshold is -100dBm and is used in conjunction with the “Link Quality Threshold” above
Enable Multipath RSSI Algorithm	Multipath RSSI algorithm should be enabled when the installation is in an environment that is known to have multipath fading. These installations are typically where units are installed inside buildings or in environment where antenna do not have uninterrupted line of sight or have large metallic objects that are close to the antennas. The multipath RSSI algorithm calculates a path RSSI that will be used when establishing mesh links between neighbours. The calculated link RSSI is compared to the configured RSSI threshold. If the calculated RSSI is stronger than the threshold, then a link will be established.
Route Request Idle Time (Sec)	Route Request Idle Time - is the time the module will wait or hold off between route requests messages if the route request fails to get through to the destination. The default time is 30 seconds which means if the module fails to communicate to its destination it will wait 30 seconds before sending out another route request. Without this wait time a network could easily get swamped with route requests when a link fails to get through.
Route Threshold (Hops)	Route Threshold - Configures the number of additional hops that the unit reports when replying to mesh routing requests. Can be used to configure a priority when a module is used as a repeater. E.g. two repeater modules lay between a destination and the source, the repeater with the lowest Route Threshold will be used first. The default value is 0 which will mean the module will always act as

	repeater. Values between 1 and 9 will configure a priority, higher numbers for units that are less preferred as repeaters. Setting the parameter to 10 will means the unit will never be used as a repeater.
Route Refresh (Sec)	Route Refresh - is how often the module will try to find a better (shorter) route for an existing route. This is used where network topology changes can occur that could potentially allow a shorter path to be taken, i.e. a roaming or mobile application. Without route refresh, the existing route which may not be the best or most reliable link would continue to be used. The default value is 300 seconds. Setting this parameter to zero will disable the route refresh operation which will mean the existing route will never refresh other than on module start up.
Route Timeout (Sec)	Route Timeout – is the time the route remains active from the last time it was used. When the timeout expires, the route is deleted from the unit which will mean the module will need to rediscover what routes are available. Normally, this time should be greater than the WIBMesh update time to a destination, so that the routes will not time out, and remain active.
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

1.5 IP Routing

When a 915U-2 receives an IP frame that is destined for an IP address on a different network, it checks to see if the network address matches one of its own interfaces (i.e. hard-wired Ethernet, or Radio) and forwards the frame appropriately. However, if the IP network address does not match the network address of any of its interfaces, the 915U-2 will forward the frame to its default gateway. In this case it is assumed that the default gateway has a valid route to the destination.

In some cases, it is not practical to have just one default gateway (i.e. routed wireless networks with more than two 915U-2 routers. If more than one "next-hop router" is required, the 915U-2 allows for up to 100 routing rules to be configured. A routing rule specifies a destination network (or host) IP address and the corresponding next-hop router that messages for the specified destination will be forwarded to (Gateway). It is assumed that the Gateway will then deliver the data to the required destination (or forward it on to another router that will).


Use Routing Rules to configure the next-hop router to use for a given destination host or network address.

IP Routing Rules:

Add Entry | Delete Entry

#	Name	Destination	Netmask	Interface	Gateway	Enabled
1	Route #1	10.0.0.0	255.0.0.0	Any	192.168.0.1	☑

Notes:
- Up to 100 routing rules can be configured.
- Name is a text label for the routing entry (Max 32 characters).
- Destination specifies the destination network (or host) IP address.
- Subnet Mask specifies the subnet mask for the destination network.
- Gateway specifies the IP address of the next-hop router for the specified destination.
- Gateway address is required only if Interface is set to Any

Save Changes | Save Changes and Reset

Figure 4 - IP Routing

IP Routing	
Name	A name to describe the routing rules (Max 32 characters).
Destination	The destination network or Host IP address. You can specify a whole network by entering the IP range 192.168.0.0 with a Netmask of 255.255.255.0 or specify an individual host IP address by setting the Netmask to 255.255.255.255.
Netmask	The subnet mask for the destination network.
Interface	Choose the interface to use for the route. Selections are Radio, Ethernet or Any – Default is Any.
Gateway	Specifies the IP address of the next-hop router for the specified destination.
Enabled	Check this box to enable the rule. You can Uncheck the box to disable a routing rule without needing to re-enter the information at a later time.
Save Changes	Save changes to non-volatile memory. The module will need to be restarted before the changes take effect.
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

1.6 Radio Settings

Select the "Radio" Menu to change the following configuration parameters. If a change is made, you need to select "Save Changes" to retain the changes. Changes will not take effect until the unit is reset.

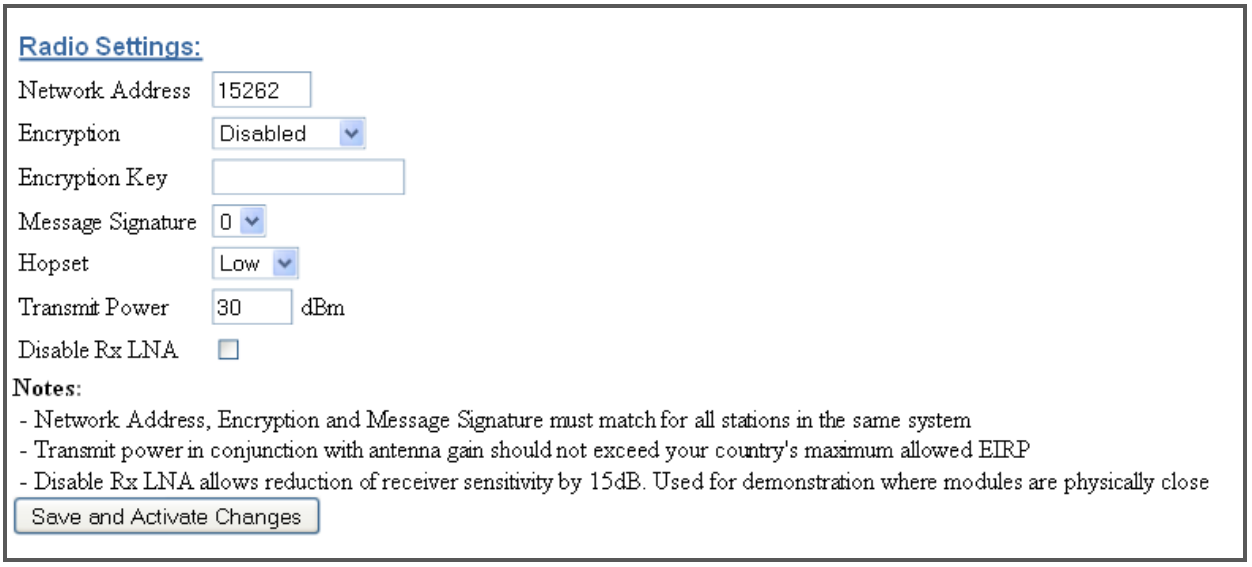


Figure 5 – Radio Configuration Screen

Radio Settings	
Network Address	A unique address that is used to differentiate one wireless system from another, All radios that are required to communicate within the system will need to have the same Network Address Messages received with a different System Address will be ignored. It is used to prevent Cross-talk between systems. Valid values are between 0 and 32768
Encryption	Can select either 64 bit ELPRO Proprietary or 128 bit AES encryption level from the drop down list
Encryption Key	Up to 32 characters are available for Encryption key.
Message Signature	The radio preamble is a section of data at the head of a packet that contains a unique "signature" that the radio locks on to when receiving messages. Any message with a different signature is ignored. There are 4 different Message Signatures and all modules that communicate together will need to have the same one set.
Hopset	From here you can select from available Hopset bands, If the radio has a Country code of US/Canada then there are 2 bands available, Low (902-914MHz) and High (915-928MHz) If country is Australia or New Zealand then the only option is the high band
Transmit Power Mode	Change the Transmit power level from the Normal (1 W) to Low Power (100 mW)
Disable Rx LNA	Check box to disable the LNA (Low Noise Amplifier)

	Reduces the Receive Sensitivity by about 15dB, used during Demos, Bench testing, or close communication paths, etc.
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

1.7 Mesh Fixed Routes

In large radio systems there will often be a number of radios that will act as Repeaters for the other radios. Because these sites are generally stationary they do not need to learn the different paths and can have fixed routes back to the destination. We configure these routes with Mesh Fixed Route Rules.
You can configure up to 100 fixed Route Rules for each site and the rules can be targeted to a specific IP address by using a Host Route or a complete Subnet.

Note: If configuring Fixed Routes and any part of the communication path fails, i.e, path, module, etc there is no fallback to Meshing.

Example #1

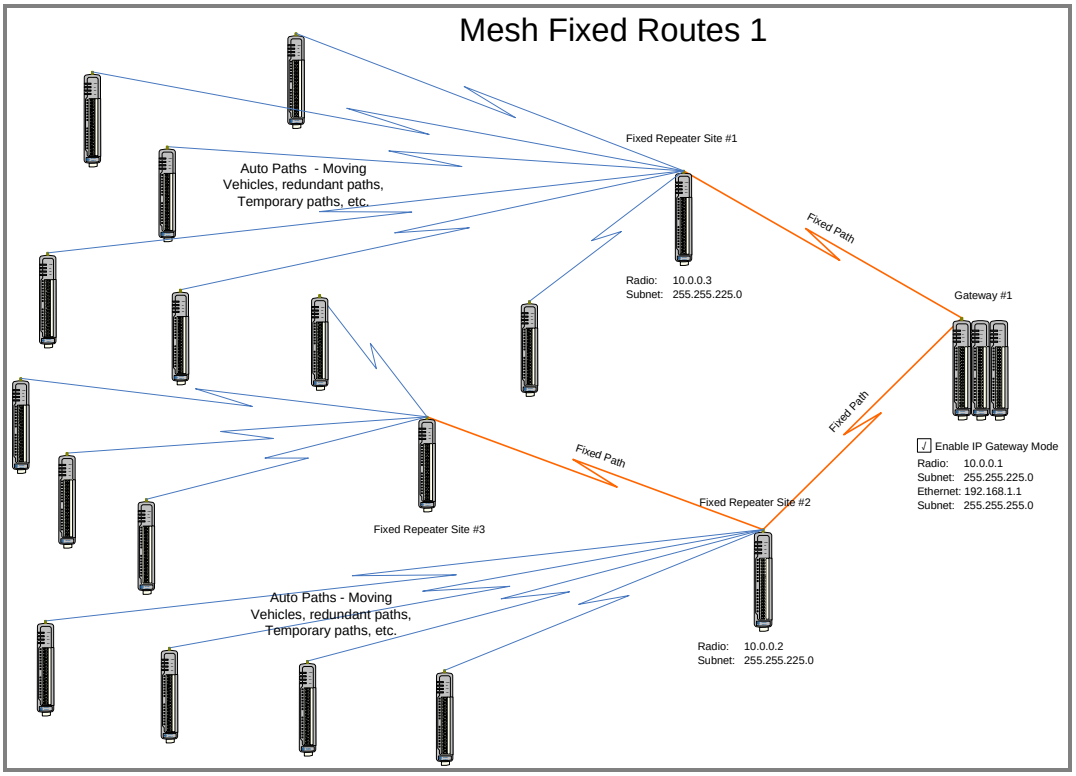


Figure 6 - Mesh Fixed Route #1

The Network Diagram above shows a typical network with mesh fixed routes. Normally a meshing network will automatically learn the routes within a network and setup appropriate communication paths to the destination. When manually configuring these routes all communication paths need to be setup by using Mesh Fixed Routing Rules.

Mesh Fixed Routing Rules:

Add Entry | Delete Entry

#	Name	Destination	Next	Hops	IP Gateway	External	Enabled
1	Rep#3 to Gateway #1	10.0.0.1	10.0.0.2	2	☐	☐	☑
2	Rep#3 to Rep #2	10.0.0.2	10.0.0.2	1	☐	☐	☑

Figure 7 - Mesh Fixed Route#2 Routing Rules

Figure 7 above show the Mesh Fixed Routing Rules for the network diagram in Figure 6 above. In fixed Route #1 it shows the Destination IP Address will be 10.0.0.1 and its Next hop will be 10.0.0.2, there will be a total of 2 hops and the ”IP Gateway” and “External” are un ticked as the destination will be the local I/O on 10.0.0.1.
In Route #2 is a route showing the communication path with repeater #2. The destination and next addresses are both 10.0.0.2 because it’s a single hop and again the “IP Gateway” and “External” are un ticked as the communications is all local and not through a Gateway or out of the mesh.

Example #2

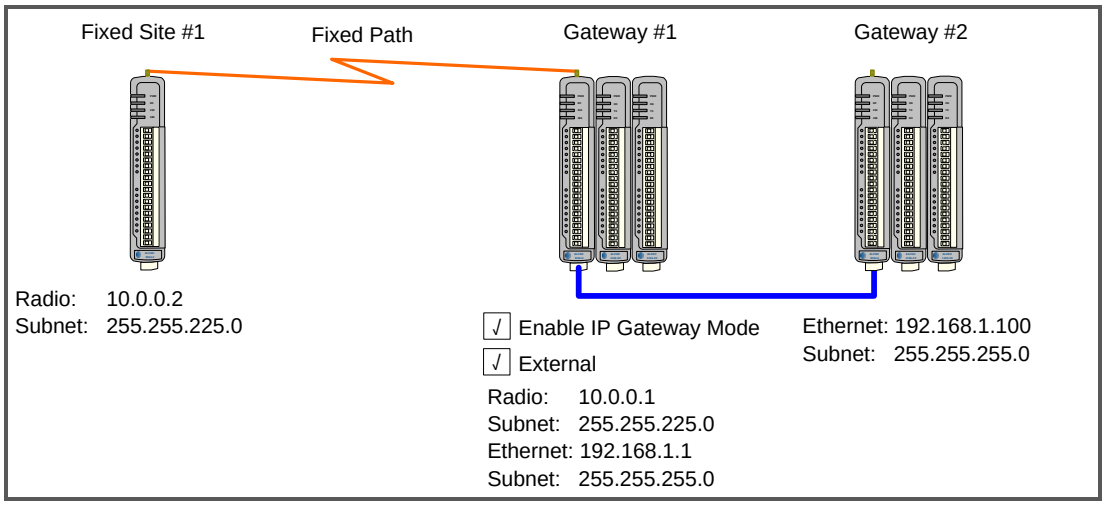


Figure 8 - Mesh Fixed Route #2

Mesh Fixed Routing Rules:

Add Entry | Delete Entry

#	Name	Destination	Next	Hops	IP Gateway	External	Enabled
1	Fixed Site #1 to Gateway #1	10.0.0.1	10.0.0.1	1	☑	☐	☑
2	Fixed Site #1 to Gateway #2	192.168.1.100	10.0.0.1	2	☐	☑	☑

Figure 9 – Mesh Fixed Route #2 Routing Rules

Figure 9 shows the routing rules for the network diagram Figure 8- Mesh Fixed Route #2" above The first route shows the destination and next addresses are both 10.0.0.1 as it's a single hop. Because the destination is a Gateway on an external network the IP Gateway must be enabled. The second routing rules shows the Destination (192.168.1.100) is an external network and is outside of the radio mesh, therefore the External tick box must be enabled. The next address will be 10.0.0.1, which is the IP Gateway.

Mesh Fixed Routing Rules	
Name	A name that describes the routing rule (Max 32 characters).
Destination	The destination network or Host IP address. You can specify a whole network by entering the IP range 192.168.0.0 with a Netmask of 255.255.255.0 or specify an individual host IP address.
Next	Specifies the IP address of the next hop router for the specified destination. Next is the same as destination for the final hop. Next is the same as destination for one-hop routes.
Hops	Indicates the number of routing hops to the destination.
IP Gateway	Indicates the Destination acts as a gateway out of the mesh
External	Indicates that it is routed through a Gateway outside of the mesh
Enabled	Check this box to enable the rule. You can Uncheck the box to disable a routing rule without needing to re-enter the information at a later time.
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

1.8 I/O Mappings

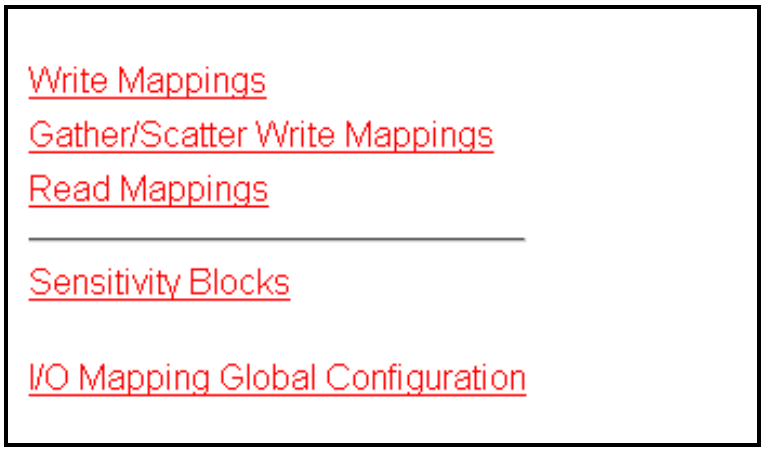
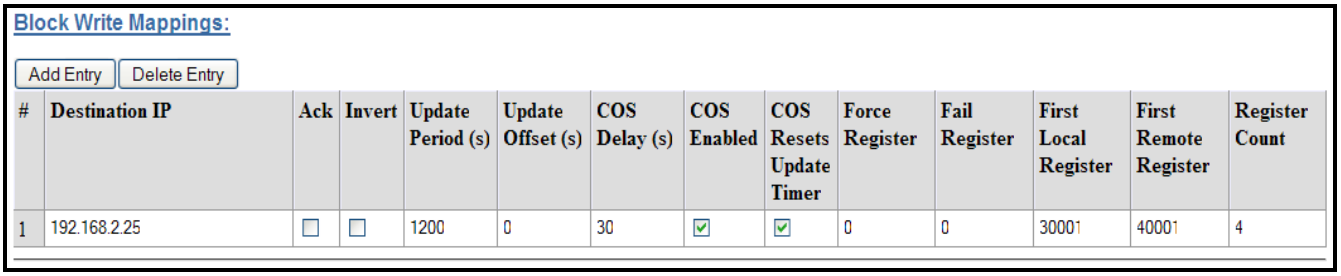


Figure 10 – WIBMesh Mappings

Selecting WIBMesh Mappings from the right hand side of the main menu will show the I/O Configuration screen.
From here you can configure up to 200 x Read mappings, 200 x Write mappings and 200 x Gather/Scatter mappings as well as configure any Sensitivity Blocks.

Write Mappings (Writing Local I/O to remote I/O)


Block Write Mappings:

Add Entry | Delete Entry

#	Destination IP	Ack	Invert	Update Period (s)	Update Offset (s)	COS Delay (s)	COS Enabled	COS Resets Update Timer	Force Register	Fail Register	First Local Register	First Remote Register	Register Count
1	192.168.2.25	☐	☐	1200	0	30	☑	☑	0	0	30001	40001	4

Figure 11 – Write Mappings

Add or delete mapping by using the buttons then select “Save and Activate Changes”.

Block Write Mapping	
Destination IP	This is the IP address that you wish to write the I/O to. If mapping 915U-2 I/O to another 915U-2 I/O via radio, the destination IP address must be the radio IP address. If mapping via Ethernet port (or WAN) then the destination IP Address will be the Ethernet IP of the destination.
Ack	Selecting this box means the mapping will be acknowledged when the end device receives the message. This is an end-to-end acknowledgement, and is over and above the normal hop-by-hop frame acknowledgment between links.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and visa versa. Applies to all of the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values can be inverted.

Update Period (sec)	This is the period that the mappings are sent as an update or check signal. (Zero disabled updates)
Update Offset (sec)	Configures an offset time for the update mapping. Used to stagger the update transmissions so on start-up and every update period the module does not send all mapping at the same time. Default will be 0 however if configured a nominal offset time of around 5 seconds should be used.
Change of State (COS) Delay (sec)	You can enter a delay period such that the message is delayed from sending for the configured time. Used to hold off the transmissions to allow more COS messages to be added to the mapping.
Change of State (COS) Enabled	Can enable or disable the COS messages. If enabled the values will be sent on COS and if the value complies with any Sensitivity blocks (see Sections 0“ Sensitivity Block”). If COS is disabled, messages would only be sent on the update period.
COS Resets Update Timer	The Update Period Timer will be reset if this option is enabled and a COS is received in between updates, meaning it will not receive another update until a further Update period has elapsed - Can help reduce the amount of radio traffic produced when multiple mappings are configured. Note: If the Turn on an I/P and at <30s past COS, check COS is sent 30s past change and old COS time is not used Turn on an I/P and at >30s past COS, check COS is only sent at the old COS time and not at 30s past the change or both.
Force Reg	Register location that when written to will force the Write Mapping to be sent. E.g. External device can initiate the transmissions. (reg 501 – 3000). Note: Do not use DIO’s directly to force mappings. DIO’s are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501) and then use this register to force the mapping.
Fail Reg	Register location that indicates a failure to communicate with the configured remote Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also ‘Ack’ must be enabled.
First Local Reg	Starting Local address that values will be written to.
First Remote Reg	Starting Remote address that the values will read from.
Reg Count	Total number of register values (consecutive)
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Read Mappings (Read remote I/O and storing it locally)

Block Read Mappings:

Add Entry | Delete Entry

#	Destination IP	Invert	Update Period (s)	Update Offset (s)	Response timeout (s)	Force Register	Fail Register	First Local Register	First Remote Register	Register Count
1	192.168.2.25	☐	1200	0	10	0	0	30001	40001	4

Figure 12 – Read Mappings

Add or delete mapping by using the buttons then select "Save and Activate Changes".

Block Read Mapping	
Destination IP	This is the IP address that you wish to read the I/O from. If reading I/O via radio from another 915U-2 the destination IP address must be the radio IP address.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and visa versa. Applies to all the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values can be inverted
Update Period (sec)	This is the period that the module requests updates from the destination. The destination then responds by immediately sending back a message with the requested data. (Zero disables the update)
Update Offset (sec)	Configures an offset time for the update mapping. Used to stagger the update transmissions so on start-up and every update period the module does not send all mapping at the same time. Default will be 0 however if configured a nominal offset time of around 5 seconds should be used.
Response Timeout	The time the module counts down before registering a communications failure for the configured read mapping. When the time out is complete, the FailReg will be activated. *Normally only used with read mappings through repeaters. This is because a direct mapping will use the update periods response as a timeout.
Force Reg	Register location that when written to will force the Read Mapping to be sent. E.g. External device can initiate the transmissions. Note: Do not use DIO's directly to force mappings. DIO's are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501) and then use this register to force the mapping.
Fail Reg	Register location that will indicate a failure to communicate with the remote Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also 'Ack' must be enabled.
First Local Reg	Starting Local address that values will be written to.
First Remote Reg	Starting Remote address that the values will read from.
Reg Count	Total number of register values (consecutive)

Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Gather/Scatter Write Mappings

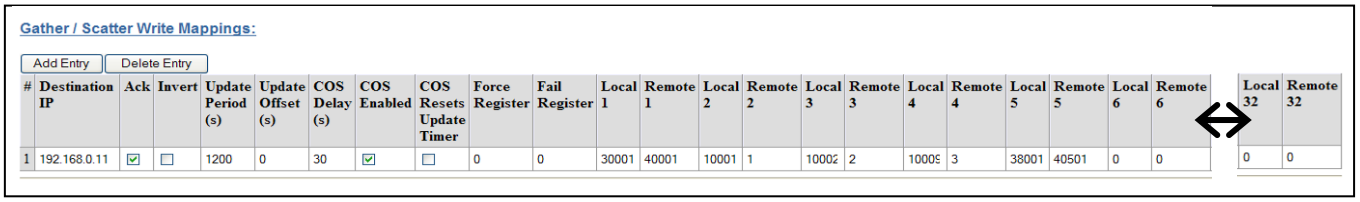


Figure 13 – Gather/Scatter Mappings

Gather/Scatter Write Mapping	
Destination IP	This is the IP address that you wish to write the I/O to. If mapping 915U-2 I/O to another 915U-2 I/O via radio, the destination IP address must be the radio IP address. Use the Ethernet IP of the destination if mapping via Ethernet port (or WAN).
Ack	Selecting this box will mean the mapping will be acknowledged when the end device gets the mapping. This is over and above the normal Ethernet frame acknowledgments between links.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and visa versa. Applies to all the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values
Update Period	This is the period that the mappings are sent as an update or check signal.
Update Offset	Allows an offset to be configured for each mapping. Used to stagger the transmissions so on start-up the module does not try to send all mapping at the same time. Default will be 0 however the normal would be around 5 seconds.
Change of State (COS) Delay	You can enter a delay period such that the message is delayed from sending for the configured time. Used to hold off the transmissions to allow more COS messages to be added to the mapping.
Change of State (COS) Enabled	Can enable or disable the COS messaged. If disabled messages would only be sent on the update period.
COS Resets Update Timer	Enabling this timer will mean If a COS is received in between any updates it will reset the Update timer, meaning it will not receive another update until the further Update period has passed.- used to reduce the amount of radio traffic
Force Reg	Register location that when written to will force the Write Mapping to be sent. E.g. External device can initiate the transmissions. Note: Do not use DIO's directly to force mappings. DIO's are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501) and then use this register to force the mapping.
Fail Reg	Register location that indicates a failure to communicate with the configured remote Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also 'Ack' must be enabled.

Reg Count	Total number of register values (consecutive)
L1 & R2 – L32 & R32	Local and Remote pairs. Up to 32 scattered local I/O registers can be mapped to 32 scattered remote I/O registers
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Sensitivity Block

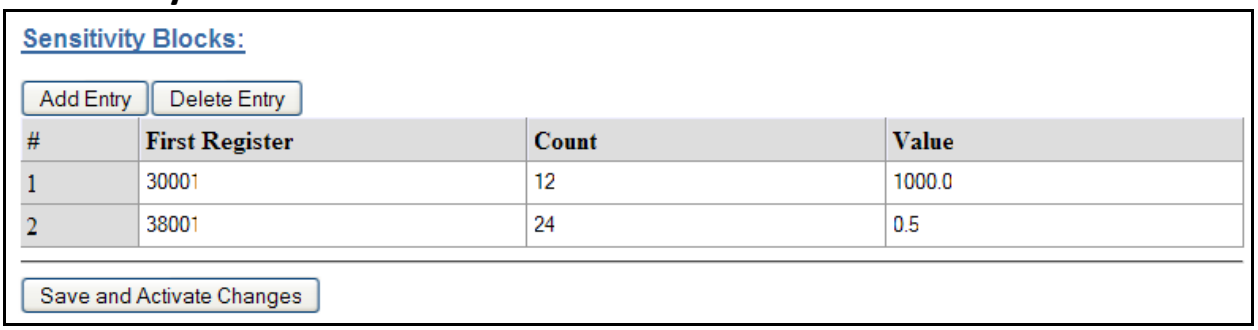


Figure 14 – Sensitivity Block

All registers have a configurable "Sensitivity" value, which determines how much the register needs to change by before being sent as a "Change of State" (COS).
All registers have a default sensitivity value of 1 except the following.
The 12 analog inputs have a sensitivity of 1000 (3.2%) and the 24 floating point values will have a default sensitivity of 0.5 units. In the case of 38001 – 38004 this will be 0.5mA, in the case of 38005-38012 it will be Volts and in 38013 – 38016 it will be Hertz. (The reason is so the module does not send every single bit change of an analog value and subsequently saturate the radio channel with unwanted change messages.
If a lower sensitivity is required then the above blocks can be adjusted and up to 48 more Sensitivity Blocks can be configured for different registers or different values.
They are configured as per the table below

Sensitivity Blocks	
First Register	This is the starting register
Count	Indicates the number of registers in the sensitivity block
Value	This is the number of counts the value needs to change by to force a COS, e.g. a value of 1000 would be a change of 1000 counts in the total range (32768), which would represent about 3%
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

I/O Mapping Global Configuration

WIBMesh is an extremely efficient proprietary radio protocol used for radio communications. The protocol is based on the "Ad hoc On Demand Distance Vector" (AODV) routing algorithm which is a routing protocol designed for ad hoc networks. There is very little configuration for the WIBMesh as the protocol automatically routes through the mesh to the destination.

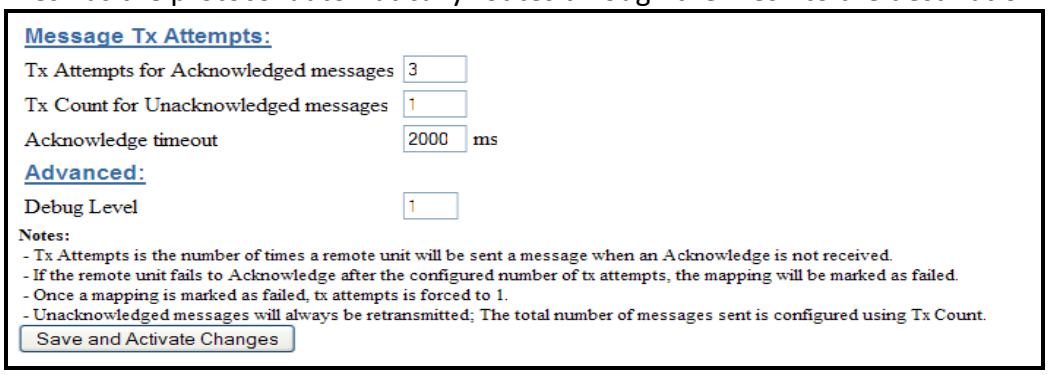


Figure 15 – Global Configuration Screen

WIBMesh Configuration	
TX Attempts for Acknowledged messages	How many times the configured module will attempt to communicate a message to another module (message reties). After failing to communicate the module will be flagged as being in comms fail. If it tries to communicate to the remote module again, it will reduce the number of attempts down to one as it has been flagged as being in Comms fail. If communications is restored the module will go back to transmitting the number of time configured in "Tx Attempts for Acknowledged messages".
TX count for unacknowledged messages	The number of times it transmits the same data message. It is used if the 915U-2 has been setup as a transmit only module (similar to the older ELPRO 905U-K or 505U-K modules). It is done by not selecting the "Ack" tick box in any Block Write and Gather/Scatter Block mappings. (See "1.8 I/O Mappings" above) Being a Transmit only module there is no communication handshake between modules so transmitting the same message a number of times gives a greater reliability in communications.
Acknowledge timeout	Time to wait for the Acknowledgement before the message is timed out. The default time is 2 Seconds but the time can be increased to 10 seconds for very long Mesh networks
Debug Level	The level of debug information that can be shown via the serial port during normal operation and boot up. A value between 1 (only show normal operating parameters) and 8 (showing all debug messages)
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

1.9 Connectivity

The Connectivity webpage displays connections and available networks. The "Connected Devices" section displays the Destination IP Address, the relaying IP Address, the number of hops the message is taking through the network, signal strength and link quality along with some message related information. The readings shown are based upon the last received data message from the device.

Connected Devices:

```
# Total entries: 4
# Dest          Next            Hops RSSI Qual Flags Iface  Age (H:M:S)
192.168.2.107   192.168.2.107      1 -62  100         er0    00:00:03.3
192.168.2.110   192.168.2.110      1 -85  100         er0    00:00:23.3
192.168.2.102   192.168.2.108      3  ~    ~          er0    00:00:56.7
192.168.2.108   192.168.2.108      1  -38 100         er0    00:00:56.7
```

Figure 16 - Connectivity

Note that when updating the Connectivity webpage, ensure the page is current by refreshing the page. It may be necessary to hold down the <ctrl> key while pressing the refresh button so as to force the cache to be refreshed.

<table>
<tr><th colspan="2">Description</th></tr>
<tr><td>Dest</td><td>Destination IP Address</td></tr>
<tr><td>Next</td><td>Next IP Address</td></tr>
<tr><td>Hops</td><td>Number of Hops</td></tr>
<tr><td>RSSI</td><td>RSSI (Radio Signal Strength Indication) measured in dBm which is a negative value scaled from -40dBm (good) to -120dBm (bad). RSSI is displayed for destination addresses, which are direct neighbours. If the Destination IP is not the next hop, you will see an RSSI value of "~" which indicates no direct link to that station.</td></tr>
<tr><td>Qual
(Link Quality Index)</td><td>The LQI is a logarithmic representation of the number of bit errors in the frame that were corrected by the Forward Error Correction algorithm. Each data bit is encoded with 7 forward error correction bits, so a 100 byte frame contains 100 * 8 bits / byte * 7 FEC bits/bit = 5600 bits. (see below this table for details)
<table>
<tr><th>LQI</th><th>Description</th></tr>
<tr><td>100</td><td>No Errors (or better than 1 in 100,000)</td></tr>
<tr><td>80</td><td>1 in 10,000 raw bit errors</td></tr>
<tr><td>60</td><td>1 in 1000 raw bit errors</td></tr>
<tr><td>40</td><td>1 in 100</td></tr>
<tr><td>20</td><td>1 in 10.</td></tr>
</table></td></tr>
<tr><td>Flags</td><td>Addition indications for this entry</td></tr>
<tr><td>Iface</td><td>The connection interface (er0 = Ethernet radio, eth0 = Ethernet LAN)</td></tr>
<tr><td>Age (H:M:S)</td><td>This is the timeout of the message in Hours, Minutes, Seconds</td></tr>
</table>

LQI (Link Quality Indication)

- Because a typical frame is around 80 bytes (4480bits), you should not normally see any readings between 75 and 99.
- Communication becomes unreliable with LQI around 30.
- As the LQI drops below 25, nearly every frame will have enough bit errors that the FEC will no longer be able to recover the original data, so the frame will be corrupted. Hence you will hardly ever see a reading below 25.
- With signal strength (RSSI) -100 dBm or better, the LQI should always read 100. You should expect LQI readings below 100 with signal strength -105 dBm or worse.
- If you have good signal strength and are getting LQI readings less than 100, this is a sign of interference, or of a problem with the radio of the unit you are using.

1.10 Neighbour List

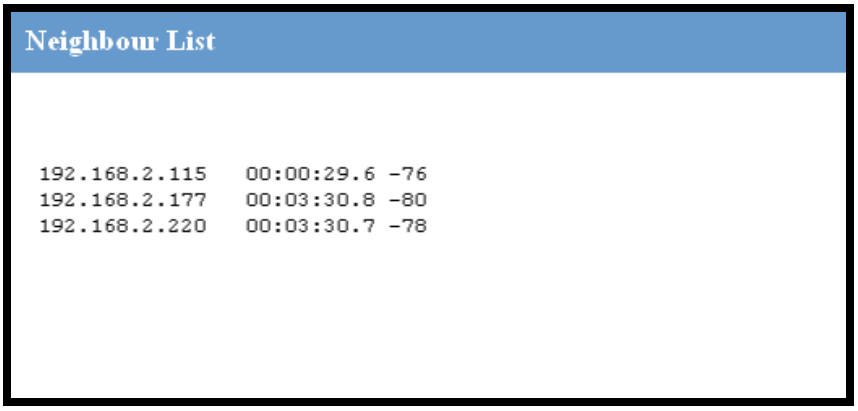


Figure 17 – Neighbour List

Shows a current list of module IP addresses that the radio can hear.
Shows the time since it was last heard from and the calculated RSSI value.
This page is useful for discovering what signal levels the module has to other sites within the system including ELPRO modules on different system addresses.
The list will display all received radio messages, even if the message is not directly communicating to it.

1.11 Neighbour RSSI

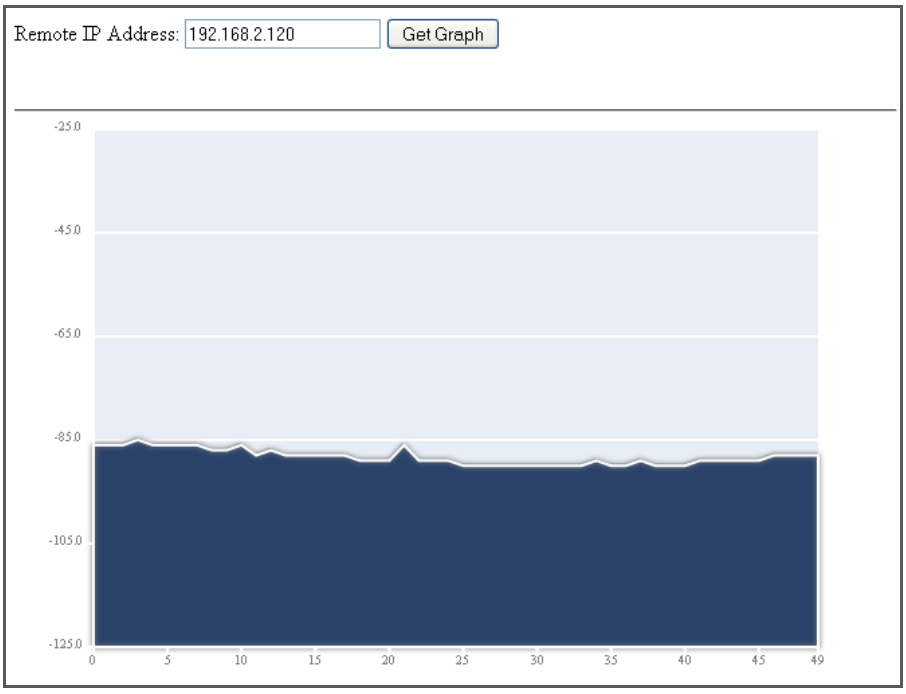


Figure 18 - Neighbour RSSI

Shows the receive signal strength on each of the 50 available channels within the frequency band. To find out if the path between two neighbouring units has a multipath fading issue, enter the radio IP address of the neighbour you wish to view and press “Get Graph”. After the

units have been running for a few minutes, and passing radio data, the graph will fill with RSSI readings across all of the radio channels in use.
If the graph is relatively flat, i.e. Figure 18 - Neighbour RSSI" above then there is no multipath fading between these units. If the graph shows large dips (typically one or two) across several channels, there is multipath fading between units. E.g. Figure 19 - Multipath Fading" below

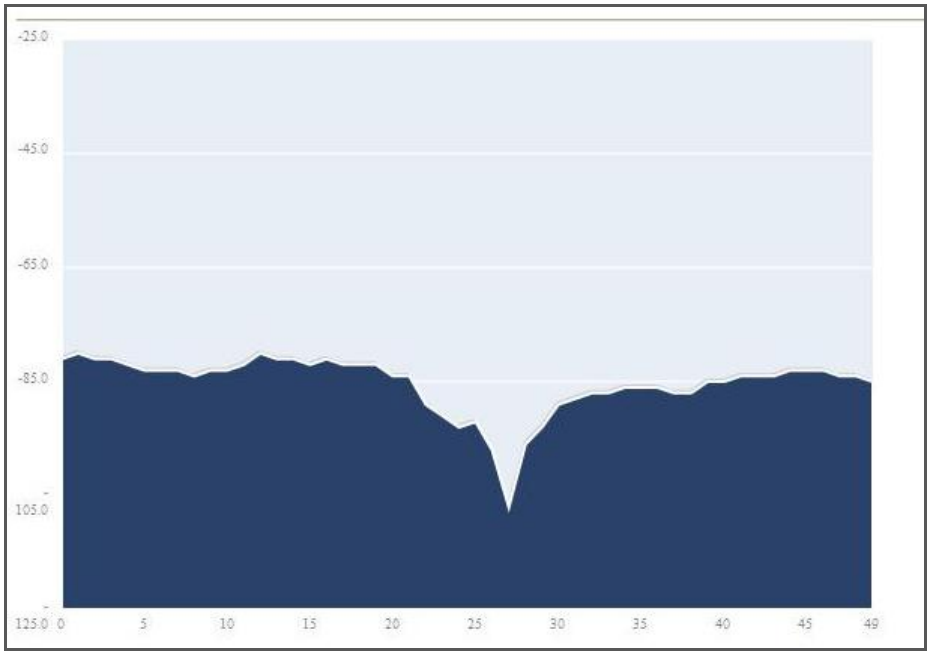


Figure 19 - Multipath Fading

RSSI is gathered during normal radio communications from that site. If communications is infrequent the graph may take a while to fill all channels. If after some time the graph is not filling then it may indicate a multipath communications problem.
The multipath RSSI algorithm calculates an RSSI that will be used when establishing mesh links between neighbours. The calculated RSSI is compared to the configured RSSI threshold. If the calculated RSSI is stronger than the threshold, then a link will be established.
Using this calculated path RSSI ensures that the radio data messages have the best chance of reaching the neighbour once a link is established, taking into account the multipath fading.
Once a link has been established between two units, the connectivity webpage also shows the calculated RSSI value.

1.12 Network Diagnostics

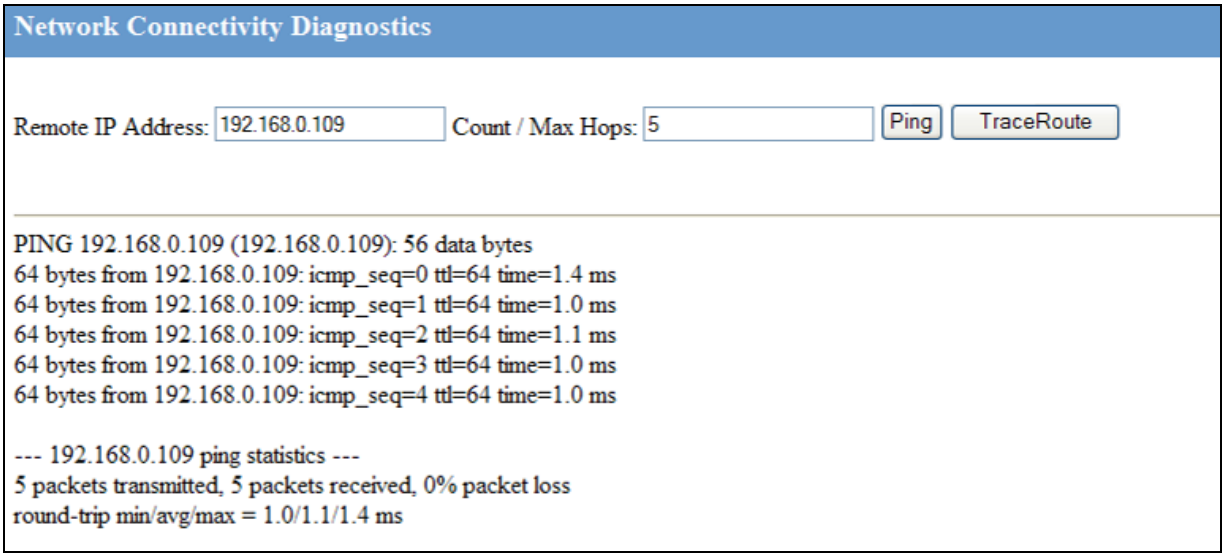


Figure 20 – Network Diagnostics

Network Diagnostics allows you to check the communications path to other modules within the system.

There are two options for checking the communications.

Ping

Ping is a standard Network instruction that sends out a small data probe to the IP address configured letting you know if you have a communication path or not.

You will receive a response for each Ping, which will show a packet size, IP Address, Sequence number and a time in milliseconds.

Followed by a summary showing the number of packets transmitted, the number of packets received, any lost packets and the Minimum, Average and Maximum Ping times in milliseconds.

A Ping can be done on either the Radio Network or Ethernet Network. The ping command will automatically select the correct network interface according to the address selected.

Remote IP Address – This is the IP address that you want to Ping

Count / Max Hops – This is the number of Ping probes that are send out. You should see this many responses come back.

When pinging on the radio network, the response time for the first ping will be longer if the device needs to establish a network route to the destination.

Trace Route

Because the modules use the AODV protocol which is a routing protocol capable of finding its own path through the network it can be difficult to determine the selected communications path.

"Trace Route" allows the communications path to be traced through the network and so determining how many hops the path is taking to get to the destination.

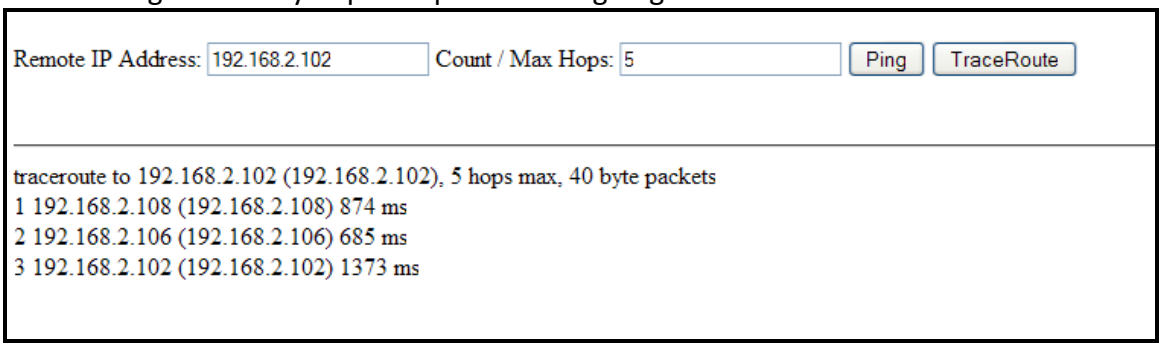


Figure 21 – Trace Route

The example above shows the response time from the Host to the first IP address (192.168.0.102) is 874msec, the second IP address (192.168.0.106) is 685msec and the third IP address (192.168.0.106) is 1373msec.

Each hop is a separate trace route discovery message from the Host device to each remote IP address and therefore the response times can vary as they are dependent on network lag times, throughput, interference, etc.

Each Trace Route message is broken down as follows.

1	192.168.2.108	(192.168.2.108)	874 ms

"1" = Hop number

"192.168.2.108" = DNS Name of the device.

"(192.168.2.108)" = IP Address of the device.

"874 ms" = A roundtrip response time (ping) in milliseconds from the Host IP to each hop point.

1.13 Network Statistics

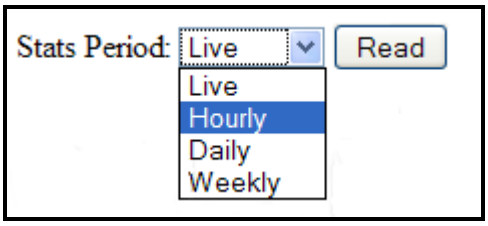


Figure 22 – Network Statistics Period

After enabling the "Gather Statistics" on the Main Network page, this page will display the average Receive and Transmit traffic throughput over a configured time period.

From the drop down "Stats Period", select the appropriate sample period then press the "Read" button.

The following is a list of available sample periods and what will be displayed:

Live, this will display the average Transmit and Receive data through put in kbit/s and the number of data packets seen on the radio interface (er0), displayed in packet per minute.

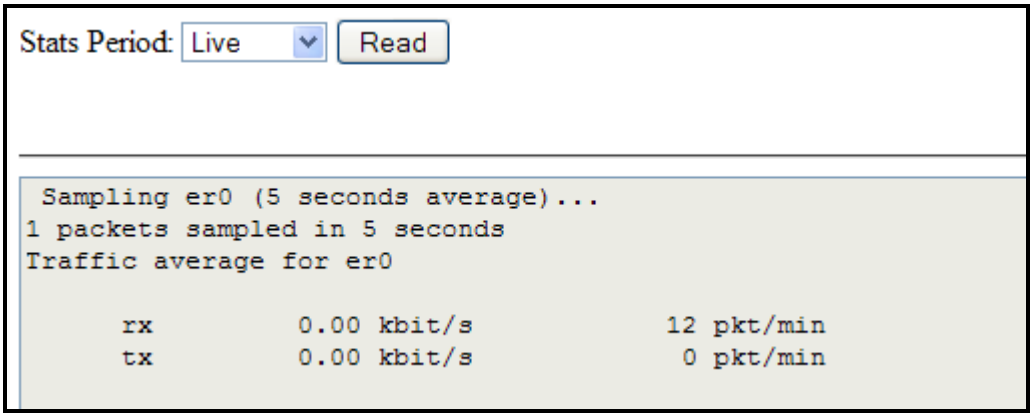
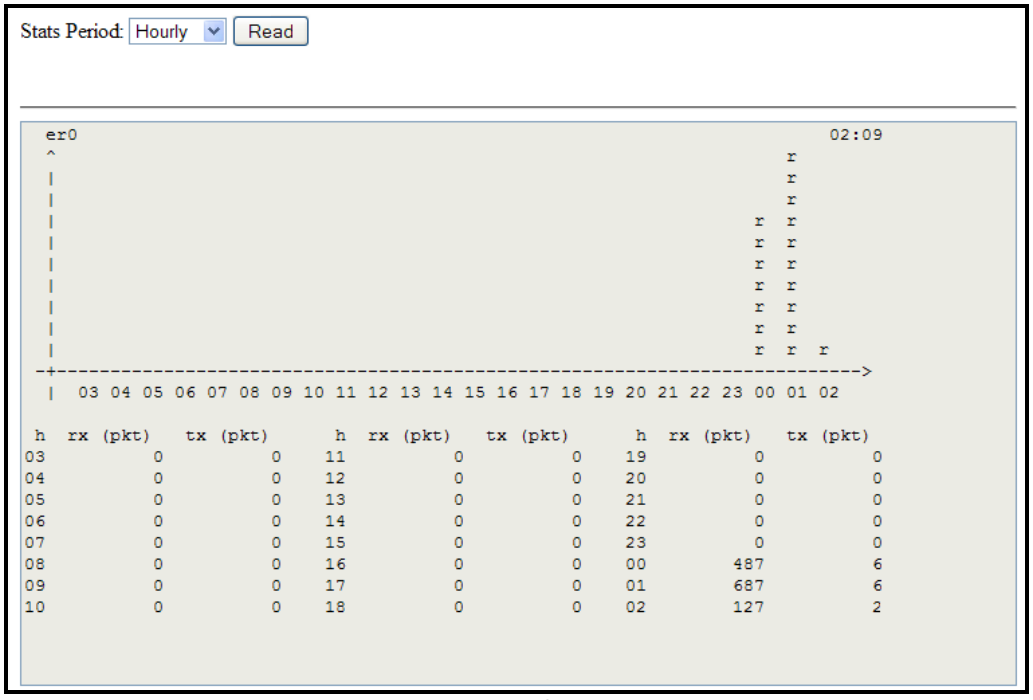


Figure 23 – Network Statistics

Hourly, this will display a graph showing overall transmit (t) and Receive (r) data on an hourly scale in accordance with the module Date and time stamp. ("rt" indicate both Transmit and Receive)
Below the graph is a table showing the average data throughput (in packets) for transmit and receive and for each hour.



h	rx (pkt)	tx (pkt)	h	rx (pkt)	tx (pkt)	h	rx (pkt)	tx (pkt)
03	0	0	11	0	0	19	0	0
04	0	0	12	0	0	20	0	0
05	0	0	13	0	0	21	0	0
06	0	0	14	0	0	22	0	0
07	0	0	15	0	0	23	0	0
08	0	0	16	0	0	00	487	6
09	0	0	17	0	0	01	687	6
10	0	0	18	0	0	02	127	2

Figure 24 – Hourly Statistics

Daily and Weekly, period shows the average throughput over the daily or weekly time period. Also shows the average number of packet received (rx) and Transmitted (tx) as well as the total. Average is an estimated value based on the amount of data gathered in the time available.

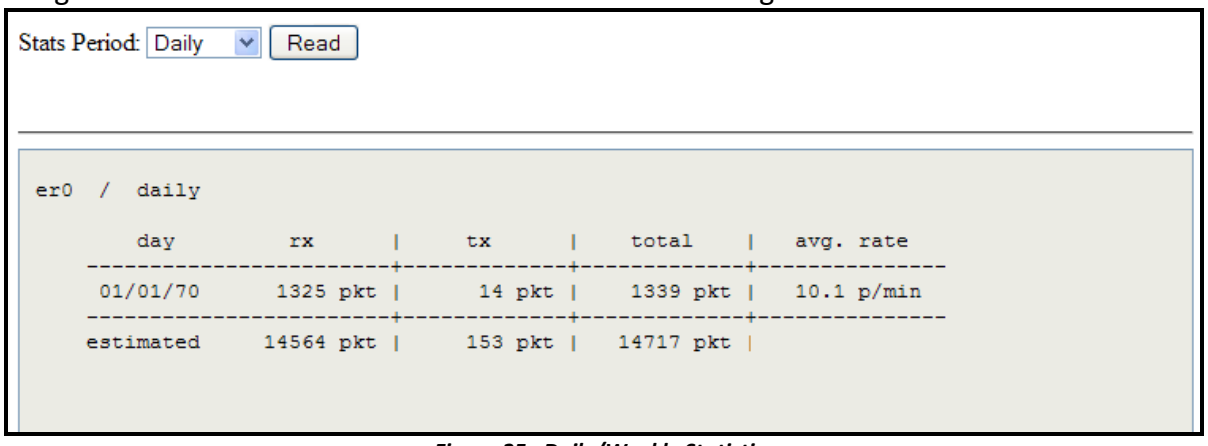


Figure 25 –Daily/Weekly Statistics

1.14 Monitor Radio Comms

The Monitor Comms page shows radio communication frames that are received or transmitted by the radio.

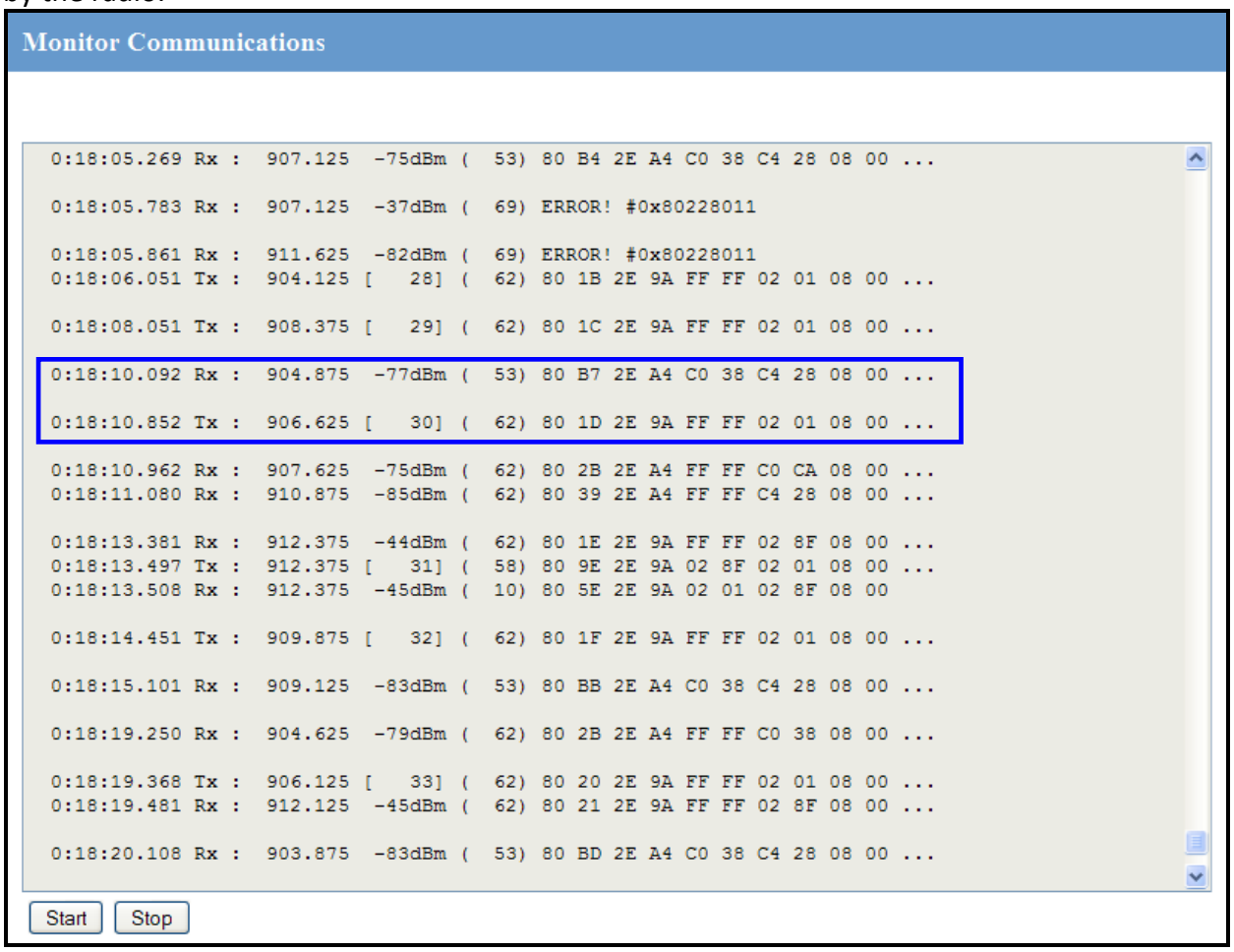


Figure 26 - Monitor Comms

The Table below shows some data frames from the communication log screen above.
Below that is another table explaining each of the field within the data frame.
Corrupted data frames are shown with an “ERROR!” in the frame.

Time	TX/RX	Frequency	Signal Level	Data Length	Data
0:18:10.092	Rx :	904.875	-77dBm	(53)	80 B7 2E A4 C0 38 C4 28 08 00
0:18:10.852	Tx :	906.625	[30]	(62)	80 1D 2E 9A FF FF 02 01 08 00

Time	Time stamp indicating the time from when the module was turned on.
TX/RX	Indicates whether the message is received or transmitted
Frequency	Shows the Frequency of the RX/TX frame
Signal Level	Shows the Receive Signal Level on any received message or internal sequence number for the transmitted message.
Data Length	Total length of the transmitted or received message
Data	The TX Data frame from above is dissected below First two bytes (80 1D) = Frame Flags Second two bytes (2E 9A) = Network Address Third two bytes (FF FF) = Destination Address, (FFFF is A broadcast address) Fourth two bytes (02 01) = Source Address (Convert each byte to decimal and they will be the last two bytes of the Radio IP address.) Fifth two bytes (08 00) = EtherType flag (Internet Protocol, Version 4)

1.15 Monitor IP Comms

This option shows the IP communication data frames. From here you can decode the ELPRO data frame and read the transmitted and received I/O values.

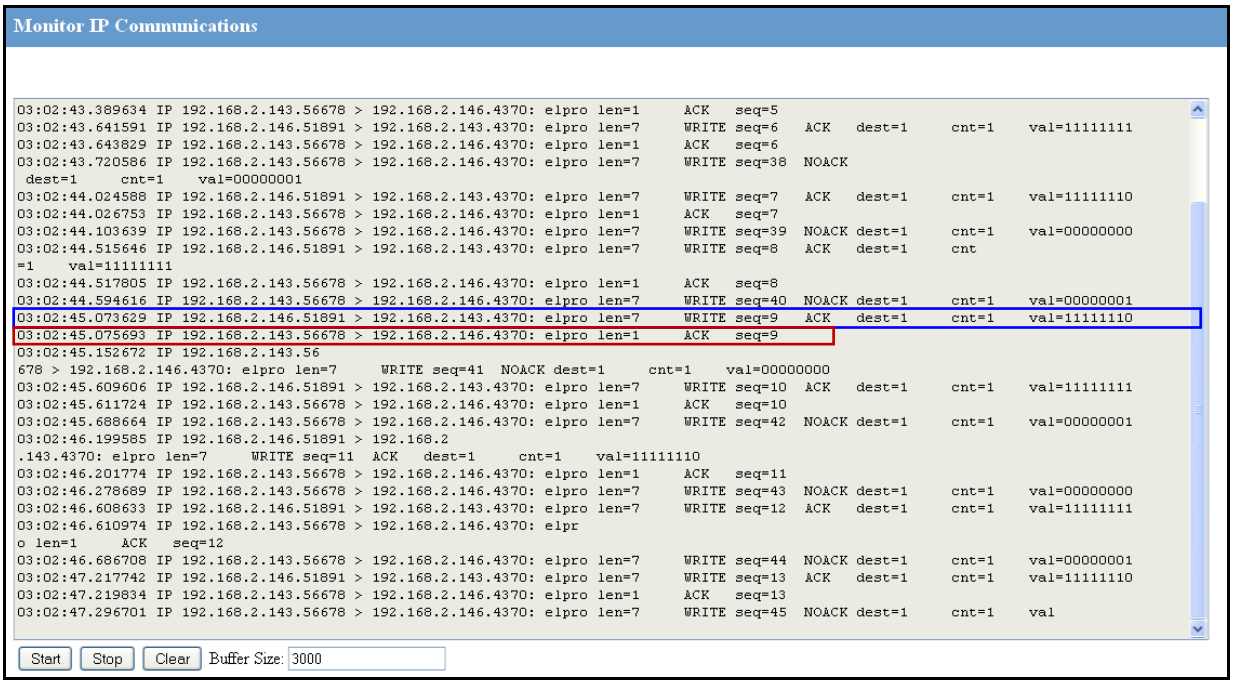


Figure 27 - IP Communication monitoring

Time	Source IP	Dest IP	Len	Type	Seq	Ack	Dest	Cnt	Val
03:02:45.073629	192.168.2.146.51891	192.168.2.143.4370	7	WRITE	9		1	1	11111110
03:02:45.075693	192.168.2.143.56678	192.168.2.146.4370	1	ACK	9				

Time	Message Time Stamp – Time from when module was last started
Header	Displays if message is a receive (In) or a transmit (Out) as well as the type and size of the Ethernet frame
Source IP	Originating or Source IP Address
Dest IP	Destination IP Address
Len	Total length of ELPRO data
Type	Type of Message, i.e. Write, Read, Gather /Scatter, Etc.
Seq	Sequence number of the message
Ack	Indicates if the Elpro data frame is configured to acknowledge or not acknowledged. This is configured in each mapping.
Dest	I/O address at the destination – where the data will be written to or read from.
Cnt	Total I/O count from the “dest” address above
Val	Data values – the number of value will depend on I/O count.

Chapter 2 - WIBNet Configuration

2.1 Overview

Generally the WibNet configuration will be done using the E-Series Configuration Utility because configuration is normally system based and the Configuration software can interface with existing Legacy modules as well as the newer 915U-2 modules.

All parameters are available via the web interface however it is recommended not to use both Configuration software and Web configuration as they configurations can become slightly out of sync.
Some Settings are unavailable via the Configuration Software and can only be setup using the web interface.
These are generally more advanced setting and not usually used by the majority of systems.

When you first connect with the module you will see the standard Welcome Screen (figure 34 below).
The noticeable differences between WIBMesh and WIBNet are the Links on the right hand side of the screen.

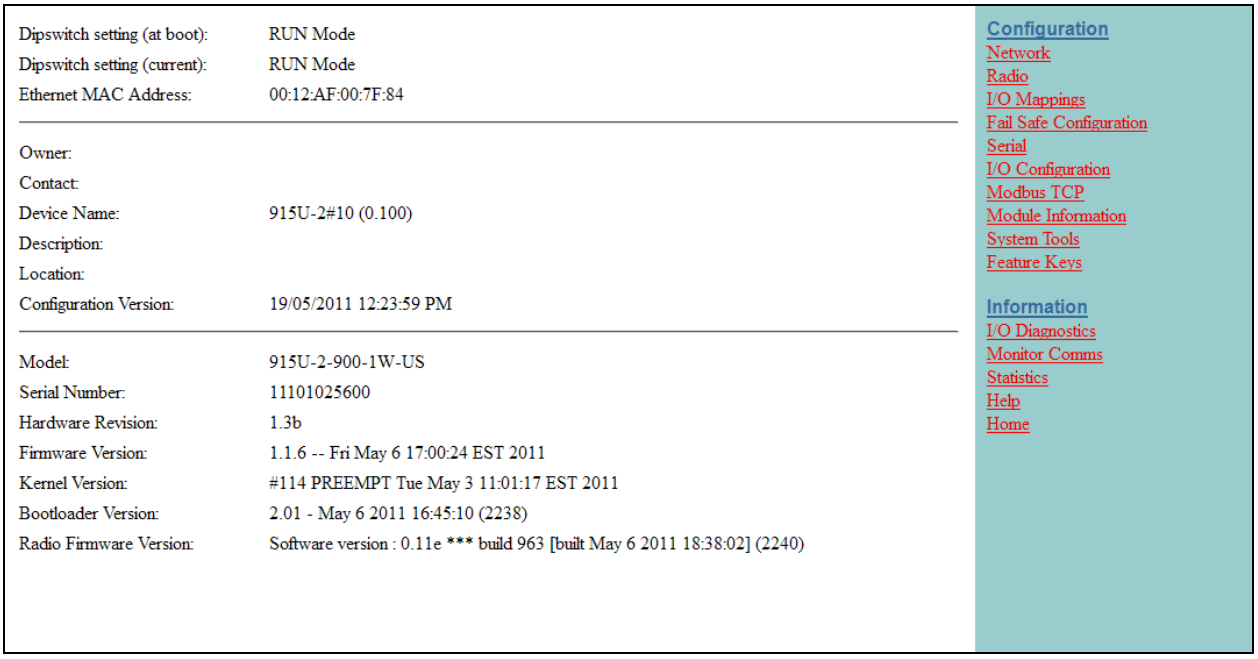


Figure 28- WibNet Welcome

2.2 Network

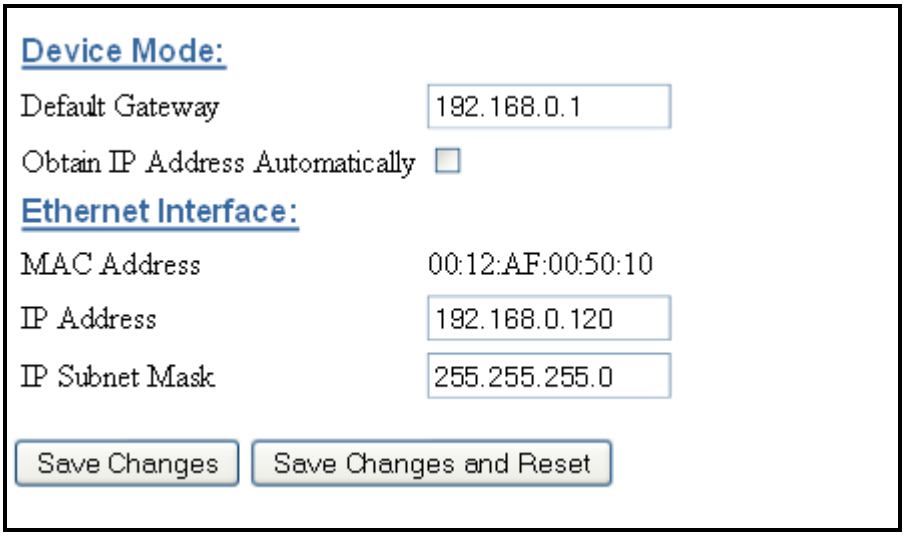


Figure 29- Network

You can view or modify Ethernet network parameters by selecting the "Network" menu. When prompted for username and password, enter "user" as the username, and "user" as the password in the password field (This is the factory default – See "User Manual" to change). If you have forgotten the IP address or password, the Factory Default switch may be used to access the existing configuration. Refer to "User Manual".

The Network Configuration page allows configuration of parameters related to the wired Ethernet interfaces, before connecting to an existing LAN consult the network administrator.

The Web Browsers associate web pages with an Ethernet IP address, they also cache web pages to speed up the loading process. This means that if a browser connects to a previously loaded IP address it may sometimes load the web page from the cache and not from the live device.

To overcome this all modules must be configured with an individual ethernet IP address or when connecting to the module force the web pages to be reloaded from the Device instead of from cache by pressing <CRTL F5> after the page has loaded.

Web Browsers can be configured to flush the cache after each session, review browser help for details on how this is done.

Device Mode	
Default Gateway	This is the address that the device will use to forward messages to remote hosts that are not connected to any of the local networks (Ethernet or Wireless). This is only required if the wired LAN has a Gateway unit which connects to devices beyond the LAN - for example, Internet access. If there is no Gateway on the LAN, set to the same address as the Station used for remote configuration - that is, the "Ethernet Interface IP Address" below.
Ethernet Interface	
Obtain IP Address Automatically	Checking this item enables DHCP client on the 915U-2. A DHCP client requests its IP address from a DHCP server, which assigns the IP Address automatically. To use this option, you will need to have a DHCP server configured on your network. The module will attempt to register its

	configured unit name with any connected DNS server.
MAC Address	This is the unique hardware address of the 915U-2 and is assigned in the Factory and cannot be changed.
IP Address	The IP address of the 915U-2 and should be set to the IP address you require.
IP Subnet Mask	The IP network mask of the 915U-2 on its wired This should be set to appropriate subnet mask for your system (Typically 255.255.255.0).
Save Changes	Save changes to non-volatile memory. The module will need to be restarted before the changes take effect.
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

Note: If configuring a system of 915U-2 radios and the Ethernet IP address of each of the 915U-2 modules is configured with the same IP Address and if using a common PC to perform all configurations there can be some issues with web pages not reading correctly. It if far better to assign unique IP addresses to each module.

2.3 Radio

Select the "Radio" Menu to change the following configuration parameters. If a change is made, you need to select "Save Changes" to retain the changes. Changes will not take effect until the unit is reset.

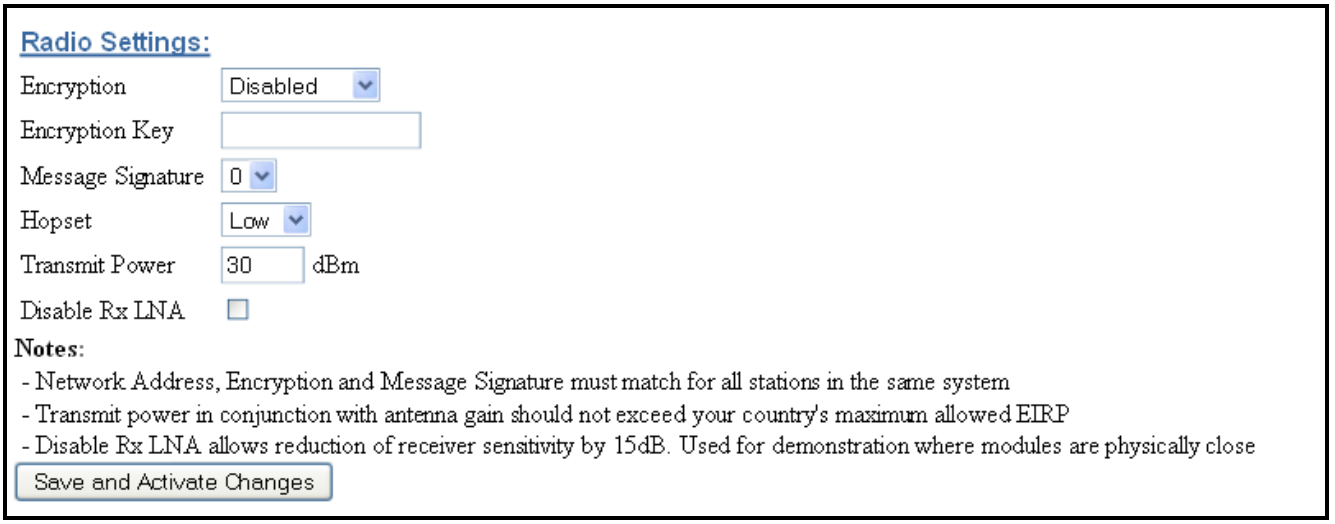


Figure 30 – Radio Configuration Screen

Radio Settings	
Encryption	Can enable 64 bit ELPRO Proprietary encryption level from the drop down list
Encryption Key	Up to 32 characters are available for Encryption key.
Message Signature	The radio preamble is a section of data at the head of a packet that contains a unique "signature" that the radio locks on to when receiving messages. Any message with a different signature is ignored.

	There are 4 different Message Signatures and all modules that communicate together will need to have the same one set.
Hopset	From here you can select from available Hopset bands, If the radio has a Country code of US/Canada then there are 2 bands available, Low (902-914MHz) and High (915-928MHz) If country is Australia or New Zealand then there is only the one 'high band' option.
Transmit Power Mode	Change the Transmit power level from the Normal (1 W) to Low Power (100 mW)
Disable Rx LNA	Check box to disable the LNA (Low Noise Amplifier) Reduces the Receive Sensitivity by about 15dB, used during Demos, Bench testing, or close communication paths, etc.
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

2.4 I/O Mappings

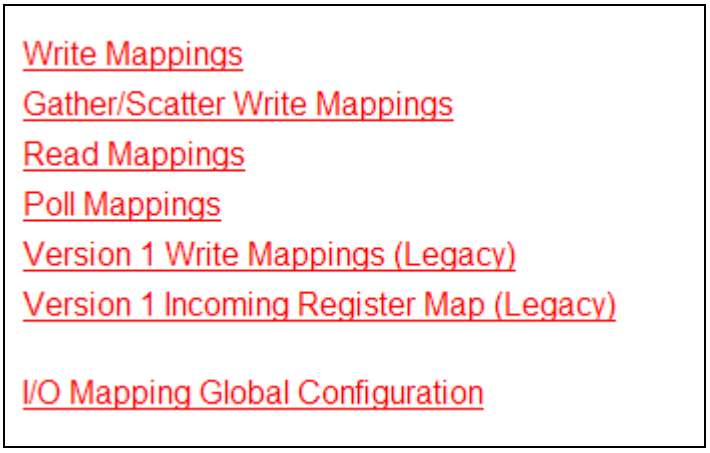
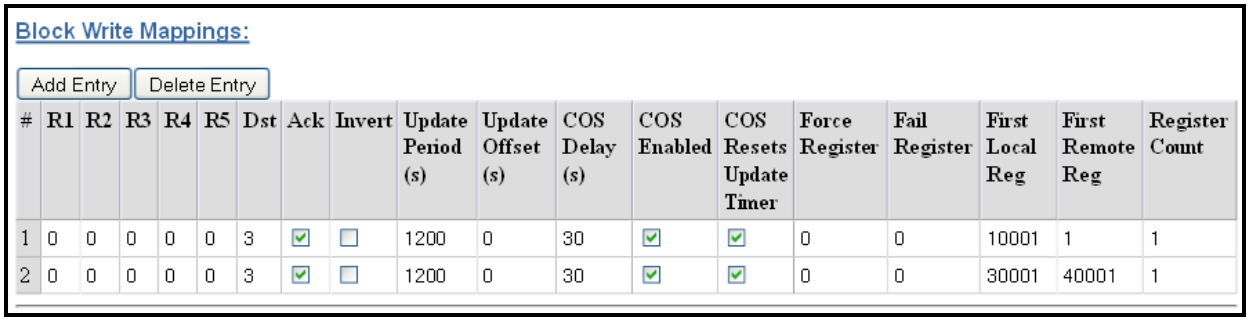


Figure 31 – WIBMesh Mappings

Selecting I/O Mappings from the right hand side of the main menu will show the I/O Configuration screen.
From here you can configure up to 200 x Write mappings, 200 x Gather/Scatter mappings and 200 x Write mappings as well as Poll and Version 1 Legacy mappings.

Write Mappings (Writing Local I/O to remote I/O)



#	R1	R2	R3	R4	R5	Dst	Ack	Invert	Update Period (s)	Update Offset (s)	COS Delay (s)	COS Enabled	COS Resets Update Timer	Force Register	Fail Register	First Local Reg	First Remote Reg	Register Count
1	0	0	0	0	0	3	☑	☐	1200	0	30	☑	☑	0	0	10001	1	1
2	0	0	0	0	0	3	☑	☐	1200	0	30	☑	☑	0	0	30001	40001	1

Figure 32 – Write Mappings

Add or delete mapping by using the buttons then select “Save and Activate Changes”.

Block Write Mapping	
R1 – R5	This is where you configure the repeater addresses for the mapping – if not used just leave as zero.
Dst	This is the destination address for the mapping. The destination address is the ‘Unit Address’ configured under the ‘I/O Mapping Configuration’ of the module as shown above.
Ack	Selecting this box means the mapping will be acknowledged when the end device receives the message. This is an end-to-end acknowledgement, and is over and above the normal hop-by-hop frame acknowledgment between links.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and visa versa. Applies to all of the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values can be inverted.
Update Period (sec)	This is the period that the mappings are sent as an update or check signal. (Zero disabled updates)
Update Offset (sec)	Configures an offset time for the update mapping. Used to stagger the update transmissions so on start-up and every update period the module does not send all mapping at the same time. Default will be 0 however if configured a nominal offset time of around 5 seconds should be used.
Change of State (COS) Delay (sec)	You can enter a delay period such that the message is delayed from sending for the configured time. Used to hold off the transmissions to allow more COS messages to be added to the mapping.
Change of State (COS) Enabled	Can enable or disable the COS messages. If enabled the values will be sent on COS and if the value complies with any Sensitivity blocks (see Sections 0“ Sensitivity Block”). If COS is disabled, messages would only be sent on the update period.
COS Resets Update Timer	The Update Period Timer will be reset if this option is enabled and a COS is received in between updates, meaning it will not receive another update until a further Update period has elapsed - Can help reduce the amount of radio traffic produced when multiple mappings are configured. Note: If the Turn on an I/P and at <30s past COS, check COS is sent 30s past change and old COS time is not used Turn on an I/P and at >30s past COS, check COS is only sent at the old COS time and not at 30s past the change or both.
Force Reg	Register location that when written to will force the Write Mapping to be sent. E.g. External device can initiate the transmissions. (reg 501 – 3000). Note: Do not use DIO’s directly to force mappings. DIO’s are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501)

	and then use this register to force the mapping.
Fail Reg	Register location that indicates a failure to communicate with the configured Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also 'Ack' must be enabled.
First Local Reg	Starting Local address that values will be written to.
First Remote Reg	Starting Remote address that the values will read from.
Reg Count	Total number of register values (consecutive)
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Gather/Scatter Write Mappings

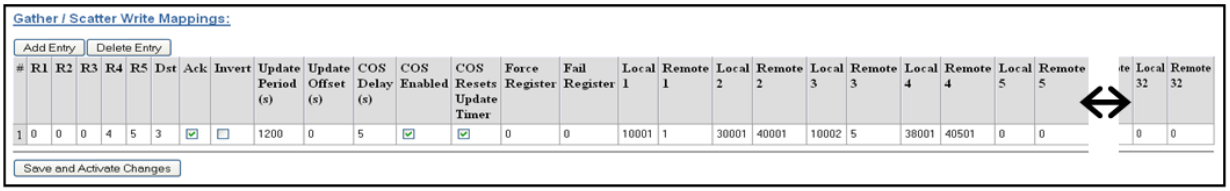


Figure 33 – Gather/Scatter Mappings

Add or delete mapping by using the buttons then select "Save and Activate Changes".

Gather/Scatter Write Mapping	
R1 – R5	This is where you configure the repeater addresses for the mapping – if not used just leave as zero.
Dst	This is the destination address for the mapping. The destination address is the 'Unit Address' configured under the 'I/O Mapping Configuration' of the module as shown in I/O Mapping Configuration above.
Ack	Selecting this box will mean the mapping will be acknowledged when the end device gets the mapping. This is over and above the normal Ethernet frame acknowledgments between links.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and visa versa. Applies to all the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values
Update Period	This is the period that the mappings are sent as an update or check signal.
Update Offset	Allows an offset to be configured for each mapping. Used to stagger the transmissions so on start-up the module does not try to send all mapping at the same time. Default will be "0" however the normal would be around 5 seconds.
Change of State (COS) Delay	You can enter a delay period such that the message is delayed from sending for the configured time. Used to hold off the transmissions to allow more COS messages to be added to the mapping.
Change of State (COS) Enabled	Can enable or disable the COS messaged. If disabled messages would only be sent on the update period.
COS Resets Update Timer	Enabling this timer will mean If a COS is received in between any updates it will reset the Update timer, meaning it will not receive another update until the

	further Update period has passed.- used to reduce the amount of radio traffic
Force Reg	Register location that when written to will force the Write Mapping to be sent. E.g. External device can initiate the transmissions. Note: Do not use DIO's directly to force mappings. DIO's are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501) and then use this register to force the mapping.
Fail Reg	Register location that indicates a failure to communicate with the configured Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also 'Ack' must be enabled.
Reg Count	Total number of register values (consecutive)
L1 & R2 – L32 & R32	Local and Remote pairs. Up to 32 scattered local I/O registers can be mapped to 32 scattered remote I/O registers
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Read Mappings (Read remote I/O and storing it locally)

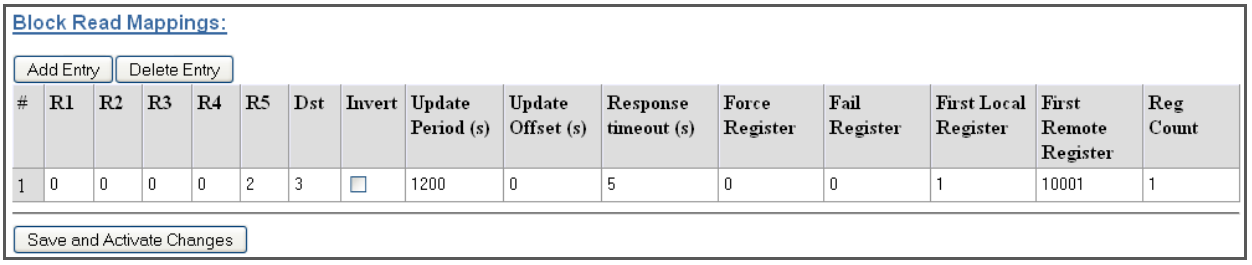


Figure 34 – Read Mappings

Add or delete mapping by using the buttons then select "Save and Activate Changes".

Block Read Mapping	
R1 – R5	This is where you configure the repeater addresses for the mapping – if not used just leave as zero.
Dst	This is the address of the module you wish to read I/O from. The address is the 'Unit Address' which is configured under the 'I/O Mapping Configuration' of the module as shown in I/O Mapping Configuration above.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and vice versa. Applies to all the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values can be inverted
Update Period (sec)	This is the period that the module requests updates from the destination. The destination then responds by immediately sending back a message with the requested data. (Zero disables the update)
Update Offset (sec)	Configures an offset time for the update mapping. Used to stagger the update transmissions so on start-up and update periods the module does not send all mapping at the same time. Default will be 0 however if configured a nominal offset time of around 5 seconds should be used.
Response Timeout	The time the module counts down before registering a communications failure for the configured read mapping. When the time out is

	complete, the FailReg will be activated. *Normally only used with read mappings through repeaters. This is because a direct mapping will use the update periods response as a timeout.
Force Reg	Register location that when written to will force the Read Mapping to be sent. E.g. External device can initiate the transmissions.
Fail Reg	Register location that will indicate a failure to communicate with the Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also 'Ack' must be enabled.
First Local Reg	Starting Local address that values will be written to. Generally it will be an output register, i.e. 1-8 or 40001, 40002, as it's a Read Mapping.
First Remote Reg	Starting Remote address that the values will read from.
Reg Count	Total number of register values (consecutive)
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Poll Mappings

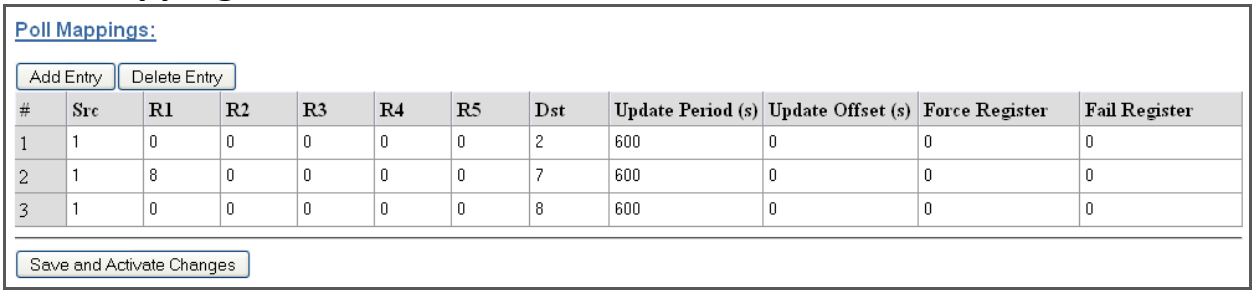


Figure 35 – Poll Mappings

A poll mapping is a special message sent when the module starts up. When the remote module receives a poll mapping, it will immediately respond with update messages for all its inputs that are mapped to the 915U-2. This allows the 915U-2 to have correct up to date values on start-up.

It is possible for the 915U-2to request updates from a remote module at other times apart from start-up. A poll can be sent under the following events:

- Based on a configurable time (Update Period)
- On-demand by the host device.

They are configured as per the table below

Poll Mappings	
Src	This is the source address – The address that is initiating the Poll Mapping
R1-R5	This is where you configure the repeater addresses for the mapping – if not used just leave as zero.
Dst	This is the destination for the Poll mapping. This is the Address of the module you wish to be updated from. The destination address is the 'Unit Address' configured under the 'I/O Mapping Configuration' of the module as shown in I/O Mapping

	Configuration above.
Update Period	This is the period that the module will request the destination address to send any updates. The destination will then responds by immediately sending any I/O updates for the source address.
Update Offset	Allows an offset to be configured for each mapping. Used to stagger the transmissions so on start-up the module does not try to send all mapping at the same time. Default will be "0" however the normal would be around 5 seconds.
Force Register	Register location that when written to will force the Poll Mapping to be sent. E.g. External device can initiate the transmissions. Note: Do not use DIO's directly to force mappings. DIO's are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501) and then use this register to force the mapping.
Fail Register	Register location that indicates a failure to communicate with the configured Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also 'Ack' must be enabled.
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Version 1 Write Mappings

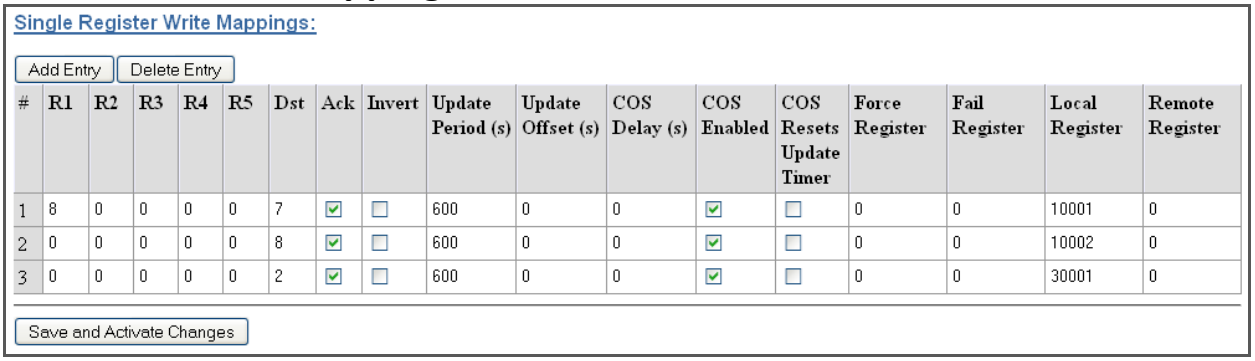


Figure 36- Version 1 Write Mapping

Version 1 mappings allow the 915U-2 to communicate with Elpro modules that communicate using the Legacy protocol, i.e. 905U-1, 2, 3, 4, C, K and normal Gateway mappings.
The version 1 mappings as basically identical to write mapping except it is a single I/O point where as a Block mapping can have multiple I/O points or registers.

Block Write Mapping	
R1 – R5	This is where you configure the repeater addresses for the mapping – if not used just leave as zero.
Dst	This is the destination address for the mapping. The destination address is the 'Unit Address' configured under the 'I/O Mapping Configuration' of the module as shown above.
Ack	Selecting this box means the mapping will be acknowledged when the end device receives the message. This is an end-to-end

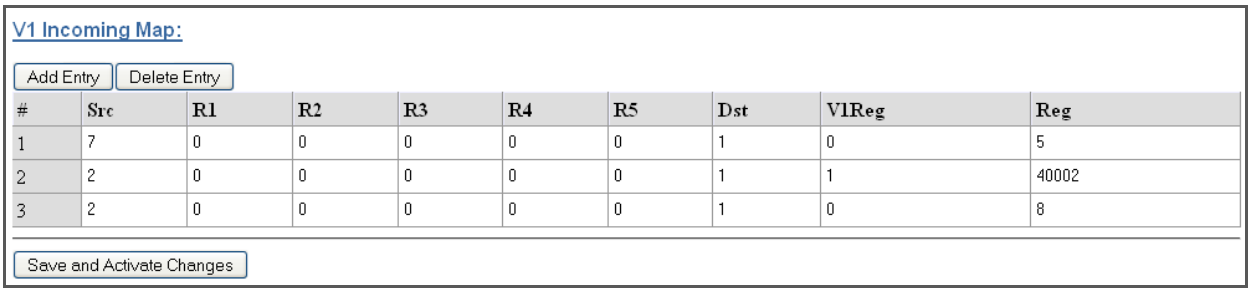
	acknowledgement, and is over and above the normal hop-by-hop frame acknowledgment between links.
Invert	This will allow the mapping to be inverted. E.g. if the digital input is on and inverted then the output will be off and visa versa. Applies to all of the I/O in the mapping and can only be used with Words and Bits, No Floating Point or Long values can be inverted.
Update Period (sec)	This is the period that the mappings are sent as an update or check signal. (Zero disabled updates)
Update Offset (sec)	Configures an offset time for the update mapping. Used to stagger the update transmissions soon start-up and every update period the module does not send all mapping at the same time. Default will be 0 however if configured a nominal offset time of around 5 seconds should be used.
Change of State (COS) Delay (sec)	You can enter a delay period such that the message is delayed from sending for the configured time. Used to hold off the transmissions to allow more COS messages to be added to the mapping.
Change of State (COS) Enabled	Can enable or disable the COS messages. If enabled the values will be sent on COS and if the value complies with any Sensitivity blocks (see Sections 0“ Sensitivity Block”). If COS is disabled, messages would only be sent on the update period.
COS Resets Update Timer	The Update Period Timer will be reset if this option is enabled and a COS is received in between updates, meaning it will not receive another update until a further Update period has elapsed - Can help reduce the amount of radio traffic produced when multiple mappings are configured. Note: If the Turn on an I/P and at <30s past COS, check COS is sent 30s past change and old COS time is not used Turn on an I/P and at >30s past COS, check COS is only sent at the old COS time and not at 30s past the change or both.
Force Reg	Register location that when written to will force the Write Mapping to be sent. E.g. External device can initiate the transmissions. (reg 501 – 3000). Note: Do not use DIO’s directly to force mappings. DIO’s are continually refreshed which will trigger the mapping to be sent. If you wish to use a DIO you must map the DIO to a general I/O area (10501) and then use this register to force the mapping.
Fail Reg	Register location that indicates a failure to communicate with the configured Destination Address. Note: Register must be Bit register, i.e. Digital I/O or internal Bit registers (10501, 501, etc) also ‘Ack’ must be enabled.
First Local Reg	Starting Local address that values will be written to.
First Remote Reg	Starting Remote address that the values will read from.
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

V1 Incoming Mappings

When configuring Version 1 mappings from 905U-1, 2, 3, 4, K modules to Gateway and now 915U-2 modules the configuration software required that the destination be reprogrammed so the new mapping can take effect. This is because the Legacy protocol was unable to address locations above 16 (0-15).

What would happen is the Software would configure an incoming mapping at the destination that would match the Legacy address to the actual address in the Gateway. These mappings were normally hidden and the reason the Gateway needed to be reprogrammed after setting up the mapping.

The Configuration software still adds these mappings behind the scenes but when configuring via the web interface they will need to be added manually.



#	Src	R1	R2	R3	R4	R5	Dst	V1Reg	Reg
1	7	0	0	0	0	0	1	0	5
2	2	0	0	0	0	0	1	1	40002
3	2	0	0	0	0	0	1	0	8

Figure 37- V1 Incoming Mapping

The above Version 1 incoming mappings configured at Unit address #1 are explained below

1. Shows a mapping from remote address #7 (905U-1) going to address #1 (Itself). The V1 Legacy address is 0 which will be Digital Output 1 or Analog output 1 depending on what model the source is. In this case it is a 905U-1 so when Unit #1 receive a mapping from Unit #7 that is going to Digital Output 1 it needs to map it across to Register #5.
2. Shows a mapping from remote address #2 (915U-2) going to address #1 (Itself). The V1 Legacy address is 1 which will be Digital Output 2 or Analog output 2 depending on what model the source is. In this case as it is a 915U-2 so when Unit #1 receive a mapping from Unit #2 that is going to Analog Output 1 it needs to map it across to Register #40002.
3. Again shows a mapping from remote address #2 (915U-2) going to address #1 (Itself). The V1 Legacy address is 0 which will be Digital Output 2 or Analog output 2 depending on what model the source is. In this case as it is a 915U-2 so when Unit #1 receive a mapping from Unit #2 that is going to Digital Output 1 it needs to map it across to Register #8.

V1 Incoming Mapping	
Src	This is the source address – The address that the mapping is coming from.
R1 – R5	This is where you configure the repeater addresses for the mapping – if not used just leave as zero.
Dst	This is the destination address for the I/O mapping. Normally the address of the module were the V1 mapping is configured. The destination address is the 'Unit Address' configured under the 'I/O Mapping Configuration' of the module as shown above.

V1Reg	The version 1 Protocol address – Will be 0-15 and depending on the module will represent either a Digital/Pulsed or Analog output. See table below for output numbers
Reg	This is the Register in either the Gateway or 905U-2 were the output will be mapped to.
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

2.5 I/O Mapping Configuration

Parameters used for WIBNet communications with other modules, e.g. Addressing, Messaging and debugging.

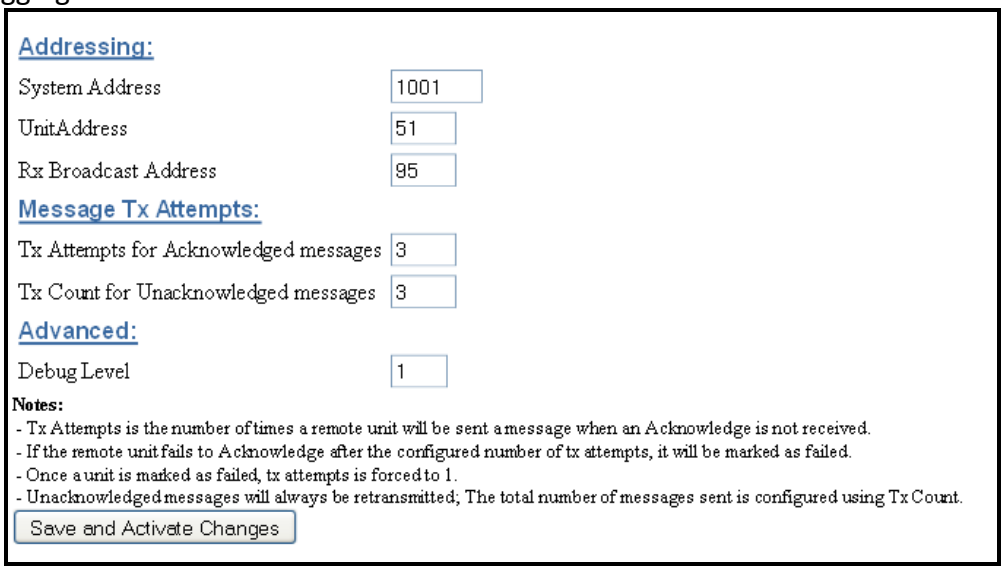


Figure 38 – Global Configuration Screen

WIBMesh Configuration	
System Address	An Address unique to the system, all modules that need to communicate must be configured with the **same** 'System Address". Prevents systems in close proximity communicating with each other.
Unit Address	A unique address for the particular module. Each module in the system must have a different 'Unit Address'.
RX Broadcast Address	A separate Receive Broadcast address that the module will receive on but not acknowledge. E.g. If a number of modules in the system are configured with the same Broadcast Address and an input is sent to an output at this broadcast address. All broadcast address outputs will reflect the state of the configured input at the same time. The message is sent like all other WibNet messages to and output number and a module address. In this case the module address is the Receive Broadcast Address and the output will be the same for all modules. Therefore the output must be available on all receiver modules.
TX Attempts for Acknowledged	How many times the configured module will attempt to communicate a message to another module (message reties).

messages	After failing to communicate the module will be flagged as being in comms fail. If it tries to communicate to the remote module again, it will reduce the number of attempts down to one as it has been flagged as being in Comms fail. If communications is restored the module will go back to transmitting the number of time configured in "Tx Attempts for Acknowledged messages".
TX count for unacknowledged messages	The number of times it transmits the same data message. It is used if the 915U-2 has been setup as a "transmit only "module (similar to the ELPRO 905U-K or 505U-K modules). It is done by de-selecting the "Ack" tick box in any Block Write and Gather/Scatter Block mappings. (See 0" I/O Mappings" below) Being a Transmit only module there is no communication handshake between modules so transmitting the same message a number of times gives a greater reliability in communications.
Debug Level	The level of debug information that can be shown via the serial port during normal operation and boot up. A value between 1 (only show normal operating parameters) and 8 (showing all debug messages)
Save Changes and Reset.	Save settings to non-volatile memory, and reboot 915U-2. Once the module has completed the reboot sequence, all changes are in effect.

2.6 Monitor Comms

The Monitor Comms page shows radio communication frames that are received or transmitted by the radio. Communications Log shows a time, radio frequency, Receive signal strength and the raw data frame.

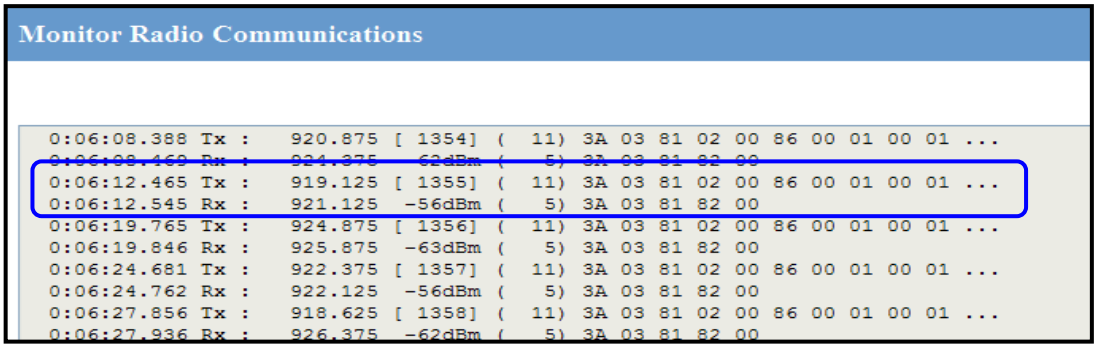


Figure 39 - Monitor Comms

The Table below shows an excerpt from the above screen shot.
Data frames are displayed similar to the WibMesh Monitor Radio Comms except the data is a different format..
Below that is another table explaining each of the field within the data frame.
Corrupted data frames are shown with an "ERROR!" in the frame.

Time	TX/RX	Frequency	Signal Level	Data Length	Data
0:06:12.465	Tx :	919.125	[1355]	(11)	3A 03 81 02 00 86 00 01 00 01 ...
0:06:12.545	Rx :	921.125	-56dBm	(5)	3A 03 81 82 00

Time	Time stamp indicating the time from when the module was turned on.
TX/RX	Indicates whether the message is received or transmitted
Frequency	Shows the Frequency of the RX/TX frame
Signal Level	Shows the Receive Signal Level on any received message or internal sequence number for the transmitted message.
Data Length	Total length of the transmitted or received message
Data	The TX Data frame from above is dissected below First two bytes (3A 03) = System Address Next 1 to 5 bytes (dynamic) = Unit Address and any repeater addresses. As the message gets passed to the next address the address gets 128dec (80hex) added to it which shows the message has passed through the repeater or been received and acknowledged. You can see in the above table the fourth byte of the transmitted message shows 02 which changes to 82 on the received message and indicates the acknowledgment back from the receiving module. fifth byte (00) = Zero Byte spacer sixth byte (86) = Frame Flag – Type of message The rest shows the message count and values. For a full breakdown of the protocol contact Elpro Technologies.

Chapter 3 - Common Web pages

3.1 Fail Safe Configuration

Fail Safe Block configuration allows registers to be set to a pre configured value on start-up as well as configuring the outputs to reset to a predefined value after a timeout period has elapsed, when the real value comes in it will update as normal. Also if the value is lost because of a communication problem it can be configured to set the output to a failsafe value after the pre-configured time.

"Invalid" register state

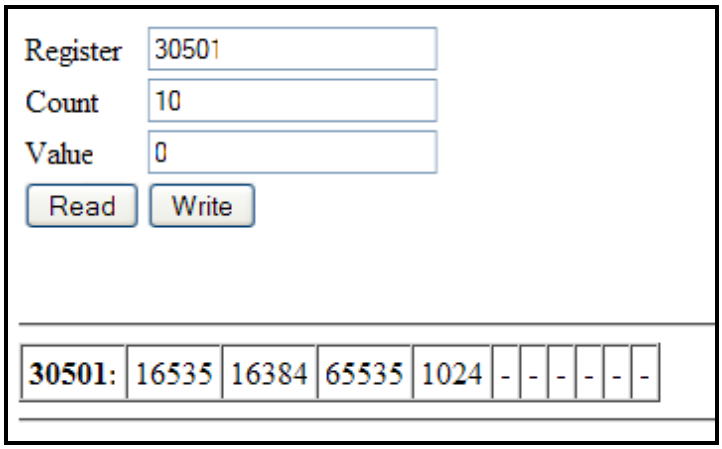


Figure 40- Invalid Register State

All registers within the module can have various states depending on what type of register it is and what sort of value it holds, a typical analog range is between 0 and 65535 and a digital can be 0 or 1.

All registers that are not associated with any physical I/O have another state which we call "invalid", this state means that the value has not been written to and so does not hold a value but more a non value or null.

If you were to read the registers using the "I/O Diagnostics" an invalid register would read "~"as shown in Figure 40 above.

Any mapping with an invalid register will be inhibited from sending. This is to ensure the data that gets to the destination is valid and not just default values that the module starts up with. Refer to "Fail Safe Blocks" section below for a way of configuring a registers with a valid value at start-up

Fail Safe Blocks

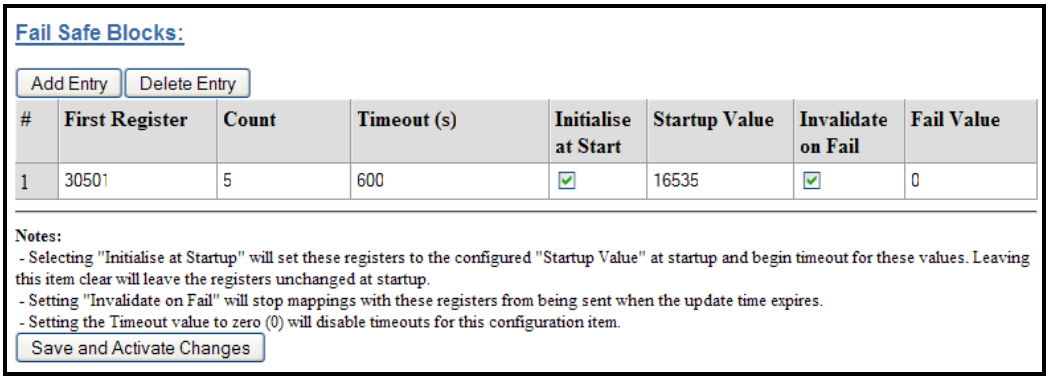


Figure 41 – Fail Safe Blocks

In the screen shot above, register 30501 is an analog value that has been mapped from another module, it has an update interval of 1 minute.
On start-up this module will write a value of 16535 into register 30501 and then start counting down from the "Timeout" value (in this case 600 seconds).
If after 600 seconds, the module still has not received an update from the other module, register 30501 will be set to the "Fail Value" (in this case 0).
If the "Invalidate on Fail" were ticked, the value would be set to a null or invalidated value (~).
If this register was mapped to some other location the mapping would be inhibited until the" Invalid" value was updated with a real value.
The maximum number of Fail Safe blocks you can have is 50.

Fail Safe Blocks	
First Register	This is the starting register
Count	Indicates the number of registers in the Fail Safe block
Timeout	This is the starting timeout value in seconds. (setting value to 0 will disable the Timeouts)
Initialise at Start-up	Indicates that on start-up the Fail Safe Block registers will be set to the Start-up value.
Start-up Value	This is the value that the Fail Safe block registers will be set to on Start-up if the "Initialise at Start-up" is ticked.
Invalidate on Fail	If ticked will set the registers back to an Invalid state when failed. (See "Invalid Register State" above)
Fail Value	The value the register will be set to when the timeout has counted down. **Note "Invalidate on Fail" will override this value**
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

3.2 Serial Configuration

The 915U-2 has an RS-232, and an RS-485 port for serial communications. These ports may be used to connect external Modbus RTU devices via the Modbus TCP to RTU Gateway and or ELPRO serial expansion I/O modules.

Modbus TCP to RTU Gateway

The Modbus TCP to RTU Gateway allows an Ethernet Modbus/TCP Client (Master) to communicate with a serial Modbus RTU Slave. The 915U-2 makes this possible by internally performing the necessary protocol conversion. The conversion is always performed by the 915U-2, which is directly connected to the Modbus serial device (i.e. only this module needs to have Modbus TCP to RTU Gateway enabled).

The example below demonstrates how a Modbus/TCP Client (Master) can connect to one or more Modbus RTU (i.e. serial) Slaves. In this example the remote 915U-2 is configured with the "RS232 Modbus/TCP to RTU Gateway" enabled

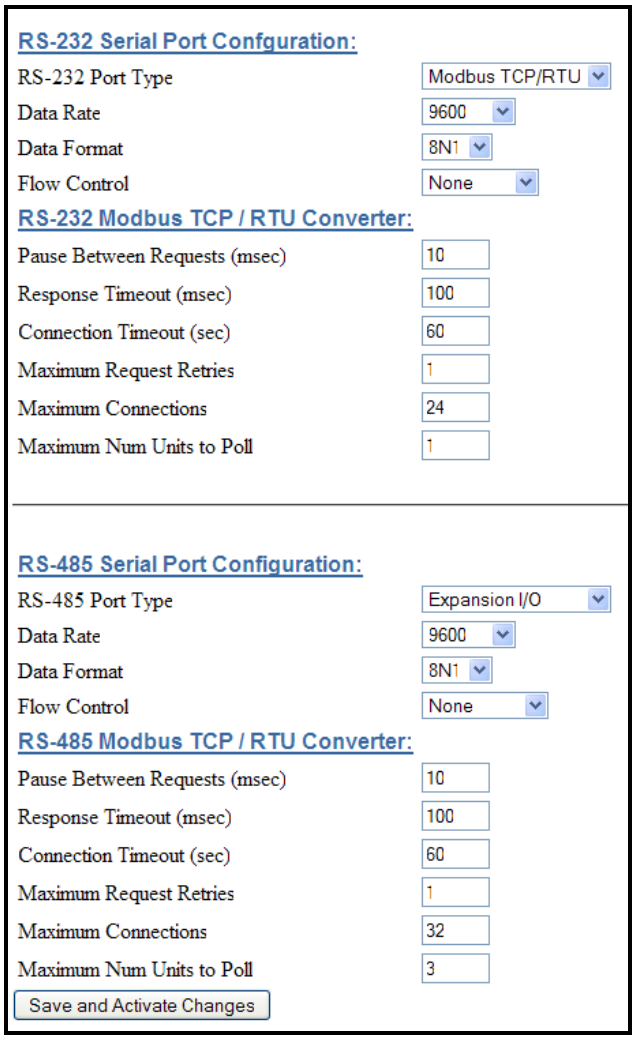


Figure 42– Serial Port Configuration

Once enabled, the gateway converts the Modbus/TCP queries received from the Master into Modbus RTU queries and forwards these over the RS232 port to the Slave.

When the serial response to the query arrives from the Slave, it is converted to a Modbus/TCP response and forwarded via the network to the Modbus/TCP Master. If no response was received serially by the 915U-2 within the configured Response Timeout, the 915U-2 will initiate a number of retries specified by the configured Maximum Request Retries.
The Modbus TCP to RTU Gateway may be configured to operate on either the RS-232 or RS-485 port.

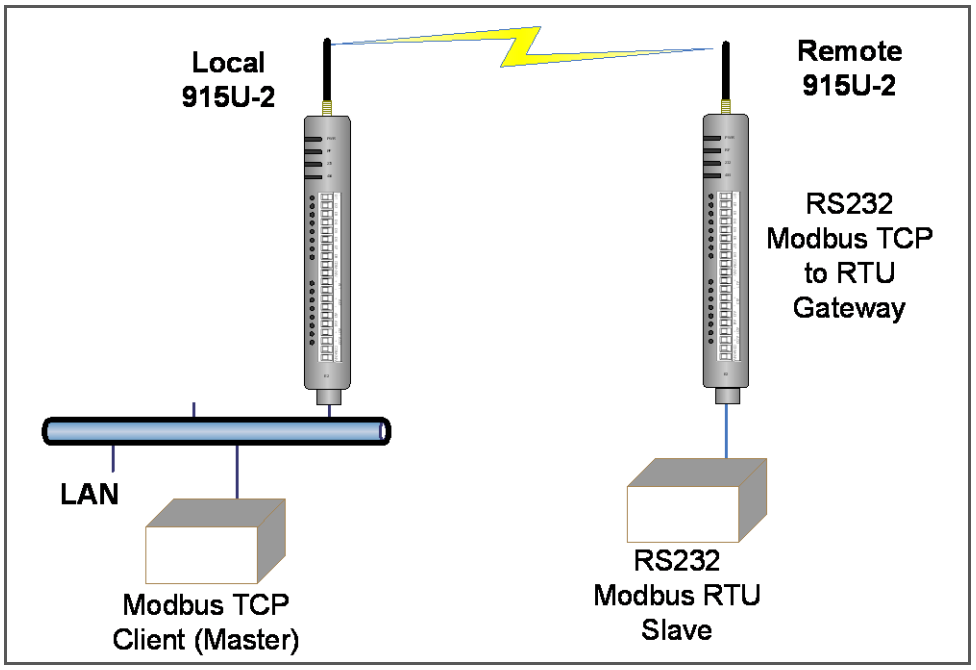


Figure 43- Modbus TCP to RTU

RS232 / RS485 Modbus TCP / RTU Converter	
Pauses Between Requests	Enter the delay between serial request retries in milliseconds
Response Timeout	Enter the serial response timeout in milliseconds – a serial retry will be sent if a response is not received within this timeout.
Connection Timeout	Enter the TCP connection timeout in seconds – if no Modbus/TCP data is received within this timeout then the TCP connection will be dropped. Set this field to zero for no timeout.
Maximum Request Retries	Enter the maximum number of request retries performed serially.
Maximum Connections	Enter the maximum number of simultaneous TCP connections to the server allowed.
Maximum num units to Poll	This is the maximum number of slave addresses that the Modbus Client will scan or poll for. Default is 3. If adding more that 3 115S expansion I/O module this number will need to be increased.
Save Changes and Activate.	Save changes to non-volatile memory, and restarting the function to load new configuration.

Expansion I/O

By default the RS485 port will be automatically enabled for “Expansion I/O “.
This means that when expanding the I/O all that is needed is to add the ELPRO Expansion I/O module/s, e.g. 115S-11, 115S-12, or 115S-13 to the RS485 port and the I/O will automatically be available from within the 915U-2’s I/O store. See User Manual for location addresses.
By default the Data Rate, Data Format will all be standard 9600, N81 and none for Flow Control which matches the default Serial baud rate and data Format of the 115S serial expansion module.
Serial parameters can be adjusted for compatibility or faster serial performance by adjusting the rates and format and then selecting the “Save and Activate” Button.
Serial port parameters will also need to be changed on the expansion I/O module by using the 115S Configuration Utility which can be downloaded from the ELPRO Technologies Website (www.elprotech.com)

Note: Be aware that using settings other than the default will mean new 115S serial modules from the factory will require a configuration to change these serial settings.

RS232 / RS485 Serial Port Configuration	
RS232 / RS485 Port	Select the desired functionality. Select either Modbus TCP / RTU or Expansion I/O
Data Rate	The serial data rate desired. Serial data rates available range from 110bps to a maximum of 230,400bps.
Data Format	The data format desired. All the standard data formats are supported.
Flow Control	Selects CTS/RTS or None

3.3 I/O Configuration

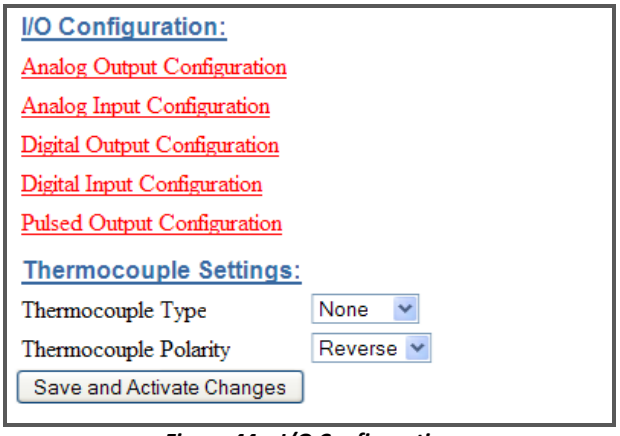


Figure 44 – I/O Configuration

The main I/O Configuration Selection page from where you select the I/O type that you wish to configure.

The Thermocouple Type selection and polarity are also selected on this page

Thermocouple Settings	
Thermocouple Type	Selects the type of Thermocouple – Type J, Type K, Type T or None
Thermocouple Polarity	Selects the Thermocouple Polarity, Normal, or Reverse.

Analog Inputs

#	Name	Zero	Span	Filter(sec)	Lower Setpoint	Upper Setpoint	Invert	Window
1	AI1(0-20mA)	8192	2048	5	0	0	☐	☐
2	AI2(0-20mA)	8192	2048	5	0	0	☐	☐
3	AI3(0-20mA)	8192	2048	5	0	0	☐	☐
4	AI4(0-20mA)	8192	2048	5	0	0	☐	☐
5	VSupply	8192	1024	5	0	0	☐	☐
6	24V	8192	1024	5	0	0	☐	☐
7	VBatt	8192	1024	5	0	0	☐	☐
8	VExt	8192	1024	5	0	0	☐	☐
9	AI1(0-20V)	8192	2048	5	0	0	☐	☐
10	AI2(0-20V)	8192	2048	5	0	0	☐	☐
11	AI3(0-5V)	8192	8192	5	0	0	☐	☐
12	AI4(0-5V)	8192	8192	5	0	0	☐	☐
13	PRate1	16384	2048	0	0	0	☐	☐
14	PRate2	16384	2048	0	0	0	☐	☐
15	PRate3	16384	2048	0	0	0	☐	☐
16	PRate4	16384	2048	0	0	0	☐	☐

Figure 45 – Analog Input Configuration

The 915U-2 Analog inputs have the following configuration parameters.
Name – The inputs can be named to help with configuration or use the default, up to 30 characters including spaces.
Zero / Span – These variables will change the Scale of the Analog Inputs.
Zero – Starting Value (counts) when measured value is zero
Span – Number of counts per measured value (mA, V, Hz, etc)
Filter (sec) – The Filter time Constant is the time the analog takes to settle on a step changed of an analog value. By default, all the inputs except the Pulse Rates have a Time constant of 5 seconds. Pulsed input rates are not filtered.
Lower & Upper Setpoints – Are the upper and lower control point values that will be used to turn on and off the Analog Setpoint digital signals located at register 10009 – 10020. Setpoint values are entered in the scale of the input, i.e. Analog input 1-4 will be in mA, Analog inputs 9-12 will be volts, etc.

The analogs inputs are controlled by using the setpoints and the two control options explained below. All analogs have these controlling setpoints and options.

The two main Setpoint control options are.

- **Deadband** (Default) - If the Analog Input is greater than the Upper Set point, the set-point status will be active (on, "1"). The setpoint will reset (off, "0") when the Analog Input is less than the Lower Set Point. Note that the Upper Set Point must always be higher than the Lower Set Point."
- **Windowed** – If the analog value is inside the upper and lower setpoints, the setpoint will be active (on, "1"), and if the analog value is outside of these setpoints the setpoint will be reset (off, "0")

Invert –This option toggles the Setpoint control logic between the default normal and inverted state. The function does not change, only the operation is inverted, e.g. if setpoint is on in its normal state, inverting the signal will mean the setpoint will be off in the normal state.
Window – This option toggles the Set point operation between the default Dead band and Windowed modes.

The Analog is a linear scale with an overall Raw range of 8192 to 49152 decimal (Total = 40960). The input Engineering range can have many different forms i.e. 0-20mA, 0-5V, or 0-1000Hz which is why the zero and span can be scaled to give the correct Raw range.

Calculating Span

The Span is calculated by using the formula
Span = Elpro Raw Range / Engineering Range
The Raw range is the number of counts between minimum and maximum analog values. Elpro standard is minimum= 8192 and maximum value is 49152 so the Range is 40960 counts (49152-8192).
The Engineering range will be the range of engineering units – 0-20mA = 20, 0-5V = 5
Some example Span calcs are:
If the Engineering range is 0-20mA (20) the Span would be 2048 (40960/20)
If the Engineering range is 4-20mA (16) the Span would be 2048 (40960/16)
If the Engineering range is 0-5V (5) the Span would be 8192 (40960/5)

Calculating Zero

The zero is calculated by using the formula -
Zero = Maximum Raw Elpro Scale – (Maximum Engineering Value x Span).

E.g. If the Engineering Range is 0-20mA the Engineering value will be 20. The span from the 0-20mA calculation above was 2048 therefore the Zero calculation will be 49152 – (20x2048) = 8192
For a 0-5V input the Engineering Value will be 5, the Span from the 0-5V calculation above was 8192 therefore the Zero calculation will be 49152 – (5x8192) = 8192

Input	Engineering Range	Raw Range (Total)	Zero	Span

AI1(4-20mA)	0-20mA	8192-49152 (40960)	8192	$\frac{40960}{20} = 2048$
AI3(0-5V)	0-5Volts	8192-49152 (40960)	8192	$\frac{40960}{5} = 8192$
Pulsed Rate1 (mA)	0-16mA	16384/49152 (32768)	16384	$\frac{40960}{16} = 2048$

Analog Outputs

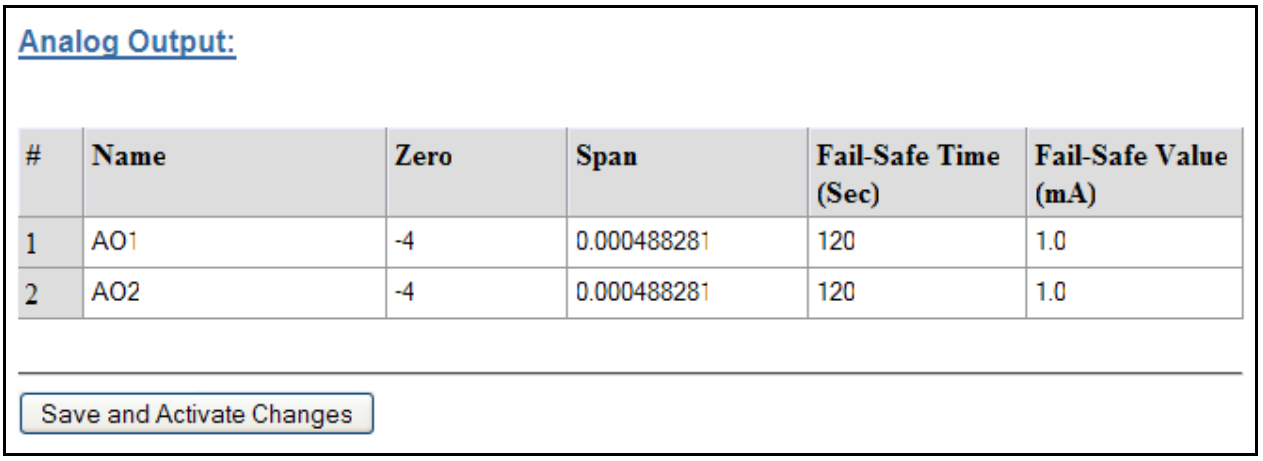


Figure 46 – Analog Output Configuration

Name – The inputs can be named to help with configuration or use the default, up to 30 characters including spaces.
Zero / Span – These variables will change the Scale of the Analog Outputs.
Zero – Starting Value of 8192 counts = -4
Span – Number of mA per bit

Engineering Range	Zero	Span
4-20mA	-4	$\frac{16mA}{32768} = 0.0004882815$
0-20mA	-4	$\frac{20mA}{32768} = 0.0006103515$

Failsafe Time (sec) – The Fail Safe Time is the time the output needs to count down before activating the failsafe state. Receiving an update or a COS message will reset the Fail Safe Timer back to its starting value. If the Fail Safe Timer gets down to zero then the output will be set to the Fail Safe state (mA)

It is recommend this Fail Safe Time be configured for a little more than twice the update time of the input that is mapped to it, that way the output will reset if it fails to receive two update messages. Entering a zero in the Fail Safe Time will disable.

Failsafe value (mA) – The value that you wish the output to be set to on activation of the failsafe timeout.

Digital Input

Digital Input:

#	Name	Debounce Time (Sec)
1	DI1	0.5
2	DI2	0.5
3	DI3	0.5
4	DI4	0.5
5	DI5	0.5
6	DI6	0.5
7	DI7	0.5
8	DI8	0.5

Save and Activate Changes

Figure 47 – Digital Input Configuration

Name – The inputs can be named to help with configuration or use the default, up to 30 characters including spaces.

Debounce Time (sec) – Debounce is the time which an input must stay stable before the module decides that a change of state has occurred. If a digital input changes (on - off) and changes again (off - on) in less than the debounce time, then the module will ignore both changes. Default debounce time is .5 seconds.

Digital Output

Digital Output:

#	Name	Fail-Safe Time (Sec)	Fail-Safe State
1	DO1	0	☐
2	DO2	0	☐
3	DO3	0	☐
4	DO4	0	☐
5	DO5	0	☐
6	DO6	0	☐
7	DO7	0	☐
8	DO8	0	☐

Save and Activate Changes

Figure 48 – Digital Output Configuration

Name – The inputs can be named to help with configuration or use the default, up to 30 characters including spaces.

Failsafe Time (sec) – The Fail Safe Time is the time the output needs to count down before activating the failsafe state. Receiving an update or a COS message will reset the Fail Safe Timer back to its starting value. If the Fail Safe Timer gets down to zero then the output will be set to the Fail Safe state (ON or OFF)

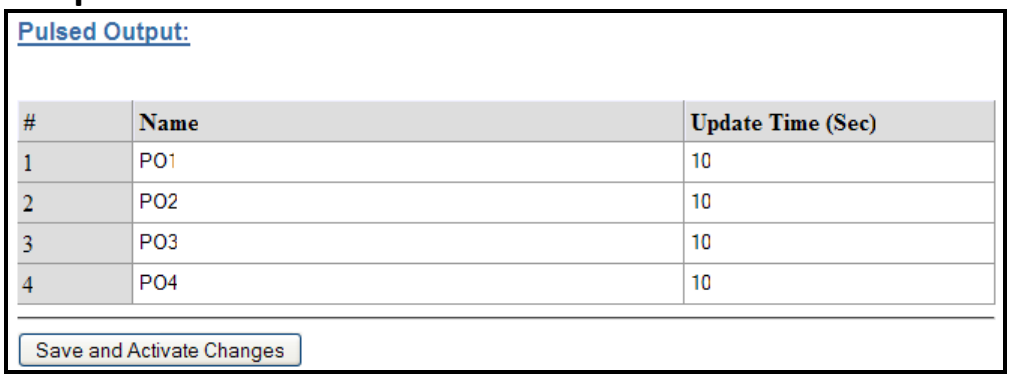
It is recommend this Fail Safe Time be configured for a little more than twice the update time of the input that is mapped to it, that way the output will reset if it fails to receive two update messages.

Fail Safe State – The state that the output will go to after the 'Failsafe Time' has elapsed.

If the Failsafe state is enabled (ON) this will indicate with the LED flashing briefly OFF and the digital output will turn on.

If the Failsafe state is disabled (OFF) this will indicate with the LED flashing briefly ON and the digital output will turn off.

Pulsed Outputs


Pulsed Output:

#	Name	Update Time (Sec)
1	PO1	10
2	PO2	10
3	PO3	10
4	PO4	10

Save and Activate Changes

Figure 49 – Pulsed Output Configuration

Name – The inputs can be named to help with configuration or use the default, up to 30 characters including spaces.

Update Time (sec) – Time that the output will be updated with the latest received value. The time is related to the update time of the pulsed input that is mapped to it. E.g. If the pulsed input update time is configured for 10 seconds the number of pulses will be counted and send to the receiving module every 10 seconds. The receiving module will then output the pulse count over the configured update time, i.e.10 seconds

3.4 Modbus TCP Transfer

The 915U-2 provides Modbus TCP Client and Modbus TCP Server functionality for I/O transfer. There are pre-defined areas representing Inputs and Outputs as well as the different I/O types, e.g. Bits, Words, Long, Floats, etc, which include the onboard Input/Output) and are shared for both Client and Server. For a full list of the available I/O and address, locations please see 915U-2 User Manual.
Modbus TCP Client (Master) and Modbus TCP Server (Slave) are both supported simultaneously, and when combined with the built in Modbus TCP to RTU Gateway the 915U-2 can transfer I/O to/from almost any combination of Modbus TCP or RTU devices.
Modbus TCP Server (Slave) enables the 915U-2 to accept connections from one or more Modbus TCP Clients (Masters). All Modbus transactions routed to the onboard Modbus TCP Server are directed either to/from the onboard general purpose I/O registers. The Modbus TCP Server is shared with the Modbus TCP to RTU Gateway, so that the Modbus "Device ID" is used to determine if a Modbus transaction is to be routed to the onboard Modbus TCP Server or to a Modbus RTU device connected to the serial port. Care should therefore be taken that all serially connected Modbus devices use a different Modbus Device ID (i.e. Modbus Slave Address) to the onboard Modbus TCP Server. Up to 32 separate connections to the Modbus TCP Server are supported.

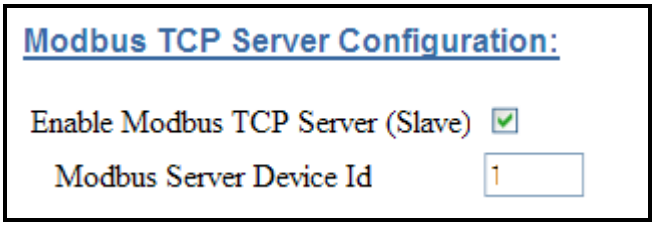


Figure 50 - Modbus Server

Modbus TCP Client (Master) enables the 915U-2 to connect to one or more Modbus TCP Servers (Slaves).
All Modbus Master Messages are directed either to/from the onboard I/O registers depending on configuration (described below). The Modbus TCP Client may also poll Modbus TCP (Ethernet) and Modbus RTU (serial) devices connected to either the local module or a remote 915U-2 module. This is done by enabling the Modbus TCP to RTU gateway at the corresponding serial port. See section 3.2 "Serial Configuration"

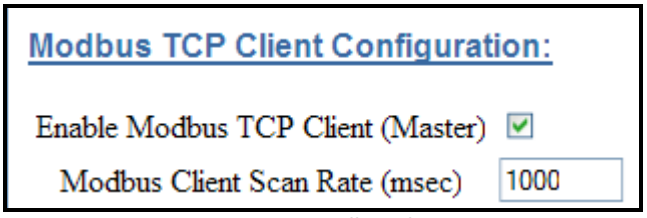


Figure 51 - Modbus Client

Modbus TCP Client functionality allows connections to a maximum of 24 different Modbus TCP Servers and up to 100 mappings can be configured.
The screen shot shows below some example Client Mappings.

Add Entry | Delete Entry

#	Local Register	IO Count	Function Code	Destination Register	Device Id	Server IP Address	Server Port	Response Timeout (ms)	Comm Fail Register
1	30501	4	04: Read Inputs	1	10	192.168.0.10	502	2000	8
2	10501	8	02: Read Discretes	1	10	192.168.0.10	502	2000	7
3	10509	8	02: Read Discretes	1	5	127.0.0.1	504	2000	6
4	10501	8	15: Write Coils	4	10	192.168.0.10	502	2000	5

Notes:
- A maximum of 100 mappings may be configured.
- A maximum of 24 different Modbus TCP Servers can be specified.

Save and Activate Changes

Figure 52 - Modbus TCP Client Mappings

The first mapping shows the Modbus Client (Master) is configured to read analog values from a device connected on the LAN. The mappings function code is “04 Read Inputs” and is reading a count of 4 values (Analogs) from Ethernet IP address 192,168.0.10, Device ID #10, starting at address 1, and then writing these values into its own local registers starting at 30501. The server Port is 502, which is a standard Modbus TCP Port address.

Note: Destination Registers start at zero as the offset is calculated from the Modbus Function Code, e.g. 3X, 4X, 1X, etc.

The next mapping shows something similar however, instead of analog value they are digital values. The Function code is “02 Read Discretes” again from IP address 192.168.0.10 and Device ID #10. It will read 8 values starting from address 1 and writing them to the local address starting at 10501.
The third mapping is similar to the second however, instead of reading from an Ethernet device it will read from a Serial device connected to the local RS485 port.
Mapping shows a function code “02: Read Discretes” from Device ID #5 connected to the Localhost IP address 127.0.0.1 (***Note**) It is reading 8 values from address 1 and then writing these values to local register 10509. One main difference is that the Server Port is configured for 504, which is the port number assigned for RS485 serial devices, Port 503 can also be used if using devices on the RS232
The last mapping shows the Modbus Client can also write values to Modbus devices either on serial or TCP. This mapping is setup to “Write Coils” with an I/O Count of 8 from the local address 10501 to Device 10 on Server IP address 192.168.0.10 at address location 4.
The Modbus Client Scan rate is set to 1000msec (see Figure 51 above) and each mapping is configured with a response timeout (in this case 2000msec). This time is how long the master will wait for a response before indicating the failure on the Comms Fail Register. (In this example register 8 -5 are register for local digital outputs 8 – 5)
***Note: The IP address 127.0.0.1 is a standard loopback address that represents “localhost” (this computer). Using the loopback address will mean if the module address is ever changed the Server IP address will not need to be changed as it will automatically use the localhost address.**

Modbus TCP Configuration

Enable Modbus TCP Server (Slave)	Check this box to enable the onboard Modbus TCP Server. All Modbus TCP connections to the module IP Address and specified Modbus Server Device ID will be routed to the onboard I/O registers.
Modbus Server device ID	Specify the Modbus Device ID for the onboard Modbus TCP Server. Allowed values are 0 to 255.
Enable Modbus TCP Client (Master)	Check this box to enable the onboard Modbus TCP Client. I/O to be transferred via the Modbus TCP client is specified with Modbus TCP Client Mappings.
Modbus Client Scan Rate	Enter the delay (in milliseconds) between executions of consecutive Modbus TCP Client Mappings to the same Server.

Modbus TCP Client Mappings

Local Register	Enter the starting onboard I/O register number that the specified Modbus Master transaction will transfer I/O to/from.
I/O Count	Specify the number of consecutive I/O register to be transferred for the specified transaction.
Function Code	Specify the Modbus Function Code for the transaction.
Destination Register	Enter the starting I/O register number in the destination device that the specified Modbus Master transaction will transfer I/O to/from.
Device ID	Enter the Modbus Device ID of the destination Modbus device
Server IP Address	Specify the IP Address of the destination Modbus TCP Server for the specified transaction.
Server Port	502 is the general Modbus TCP port number and used if accessing the internal registers. Port 503 has been assigned for the RS-232 port or to 504 for the RS-485 port.
Response Timeout (ms)	Enter the timeout (in milliseconds) to wait for a response to the specified transaction.
Comm Fail Register	Enter the onboard I/O Register number to store the communication status of the specified transaction. The Specified register will be set to 0 if communications is successful, 0xFFFF if there is no connection to the specified server, or 0xFFxx where xx is the Modbus Exception Code
Modbus Client Scan Rate	Enter the delay (in milliseconds) between executions of consecutive Modbus TCP Client Mappings to the same Server.

3.5 Module Information Web Page

This Web page is primarily for information purposes. With the exception of the password, the information entered here is displayed on the home configuration webpage of the 915U-2.

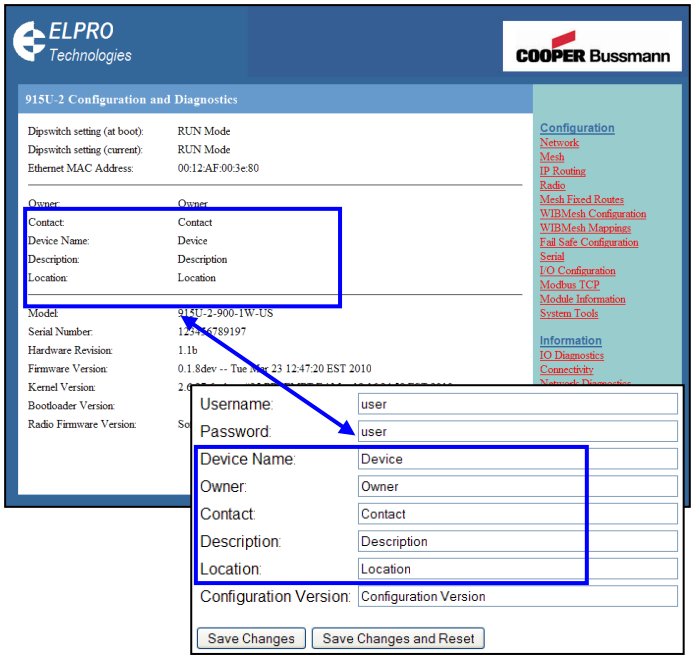


Figure 53 – Module Information

Username **default = "user"**	Configuration of Username. This is the username used to access the configuration on the 915U-2. Take care to remember this username if you change it as it will be needed to access the 915U-2 in future.
Password **default = "user"**	Configuration of Password. This is the password used to access the configuration on the 915U-2. Take care to remember this password if you change it as it will be needed to access the module in future.
Device Name	A text field if you wish to label the 915U-2. Also "Device Name" is the DNS Host name given to the module if used with a DHCP Client
Owner	A text field for owner name.
Contact	A text field for owner phone number, email address etc.
Description	A text field used for a description of the purpose of the unit.
Location	A text field used to describe the location of the 915U-2.
Configuration Version:	A text field to enter in a version description.

3.6 System Tools Web page

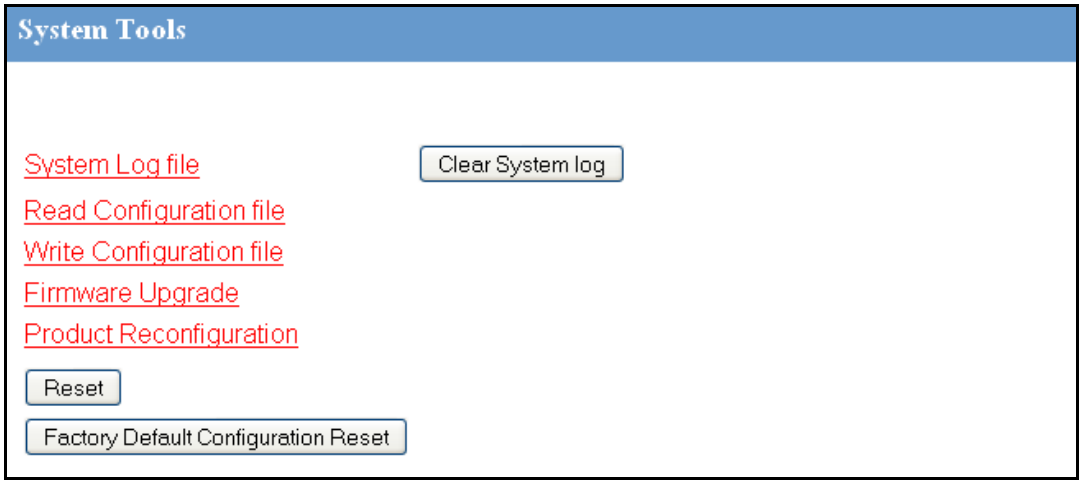


Figure 54 – System Tools

System Log File

Logs system instructions, etc to the screen where the log screen can be saved to a file. Not normally used, however maybe used by Technical Support to diagnose problems.
The "Clear System Log" clears the log screen.

Reading Configuration File

Reads the module configuration into an XML file, which can be saved by selecting "Save As" from the File menu.

Writing Configuration File

Allows a previously saved XML configuration file to be loaded back into the module.

Firmware Upgrade – Web Page

This option allows the module firmware to be upgraded locally. The process is done by selecting "Firmware update" and then browsing for the saved firmware file.
Locate and load the firmware file, press the "Send" button which will upload the file to the module and then press the "Reset" button. The module will do some checks to ensure the file is valid before a reset can be initiated.

Note: All existing configuration parameters will be saved however if any new parameters are added to the firmware the default values will be used.

Firmware Upgrade – USB

Firmware can also be upgraded by plugging a USB flash drive with the firmware files installed into the USB port underneath the "Access Configuration Panel" on the side of the module. The module will automatically identify that a USB drive has been plugged in and will initiate the upgrade process.

Instructions for upgrading Firmware are as follows.

1. You will need valid ELPRO 915U-2 Firmware upgrade files. Contact ELPRO Technologies for the latest version. Files must not be renamed, compressed, or zipped.
2. You will also need a dedicated USB Flash drive which needs to be formatted and completely free of any other file. Copy the firmware files to the Flash drive making sure they are in the root of the drive and not in a sub directory.
3. Before upgrading the firmware it is good practice to backup the existing configuration. Go to the "System Tools" webpage and save the configuration by selecting "Read Configuration File" and when the XML file is displayed press <CTRL> F5 to refresh the cache and select "Save As" or "Save Page As" on the File menu to save the XML as a file.
4. To upgrade, remove the "Configuration Panel" from the side of the module and plug the Flash drive into the USB port. If the module is mounted on a DIN rail with other I/O modules it will need to be removed to gain access to the side panel.
5. Power cycle the module to begin the upgrade process. As the module powers up it will recognise that a Flash drive has been installed and start upgrading the firmware. You will see the normal boot up LED sequence (see 915U-2 User Manual" for details) however the orange indication will be on for longer.

DO NOT remove the Flash drive or interrupt the power to the module while this is happening. If the upgrade process is interrupted module could become unserviceable and will need to be returned to ELPRO for repair.

Upgrade will take approximately 2 minutes and 40 seconds, 120 seconds over the normal boot time. When update is complete (Solid Green PWR LED indication) remove the flash drive.

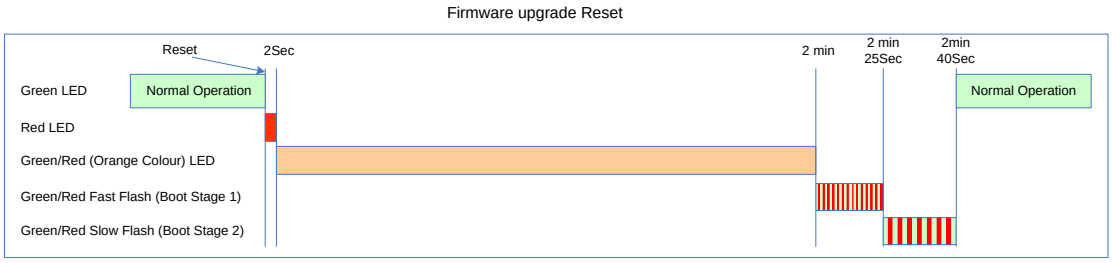


Figure 55 - Firmware Upgrade LED Indications

6. The upgrade process will clear the module flash so you will need to load the configuration file back into the module. To do this select "Write Configuration File" from the "System Tools" menu. Browse for the saved XML file and when loaded press Send and then Reset.

Product Reconfiguration

Allows the module configuration to be change from WIBMesh to WIBNet.
WIBNet is a compatibility mode that will allow communications between the 915U-2 and earlier ELPRO E-Series Telemetry units, e.g. 905U-1, 2, 3, 4, G, K, L, etc.

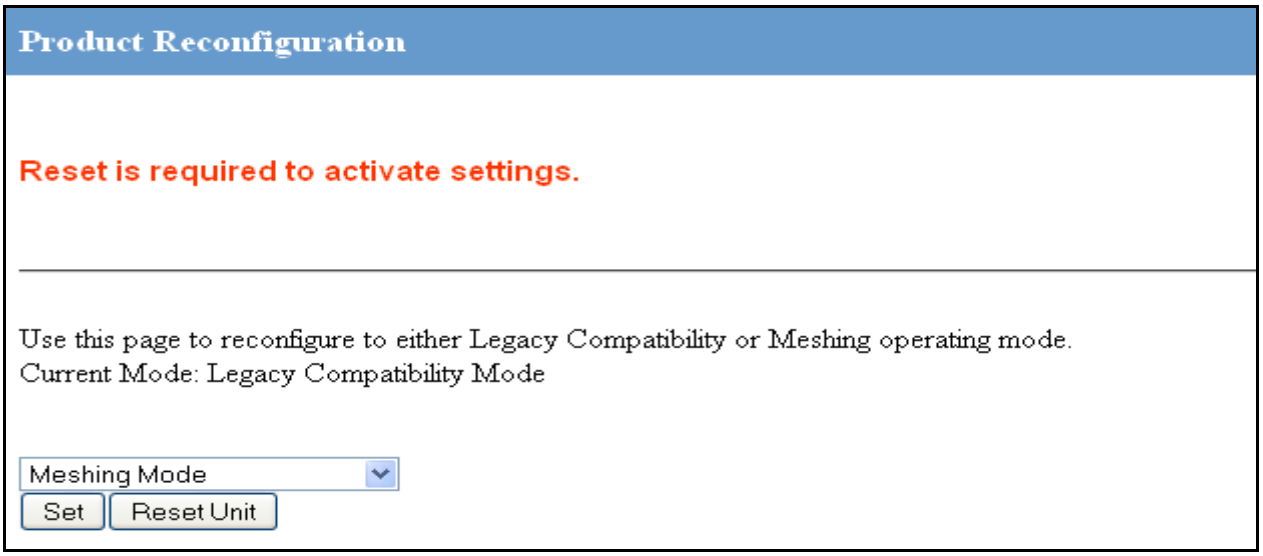


Figure 56-Product Reconfiguration

The Dropdown box has two selections,
Meshing Mode - Standard Elpro WIBMesh and is the format that the module will be in when it arrives from the factory.
Legacy Compatibility Mode – E-Series compatibility mode, will allow communications with ELPRO E-Series modules Wireless I/ modules
To change from one to the other select the appropriate mode and then press ‘Set” and then ‘Reset Unit’ when prompted.
Module will then reset and when complete will be in the selected mode.
.

3.7 Feature Licence Keys Web Page

Allows the module to be upgraded with enhanced features or upgraded to a more advanced model .i.e. enabling the Modbus option.
The Feature Licence unlock codes are purchasable by contacting ELPRO Technologies or your local distributor. The module serial number is needed to generate the Feature Licence Key which can be found on the default start-up web page of the module, for details on what this looks like see Figure 1 – Main Welcome Screen on page number 6 of this manual.
The upgrade or advanced features are made available by entering in the purchased "Feature Licence Key" into the appropriate box next to the feature or enhancement. After entering the code press the "Save Changes and Reset" button.
The screen will indicate the validity of the code by showing a green tick or a red cross.

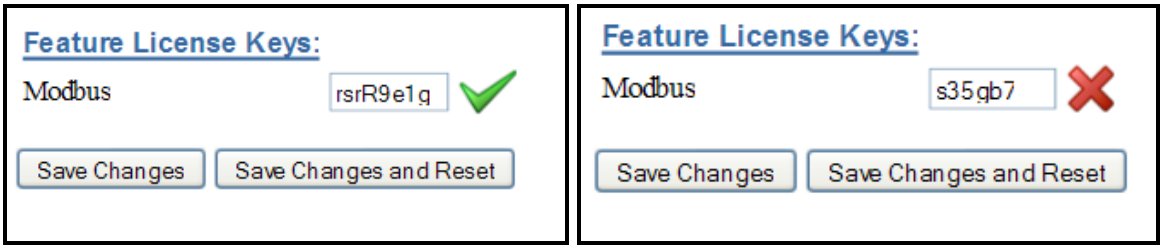


Figure 57 - Feature License Keys

3.8 IO Diagnostics

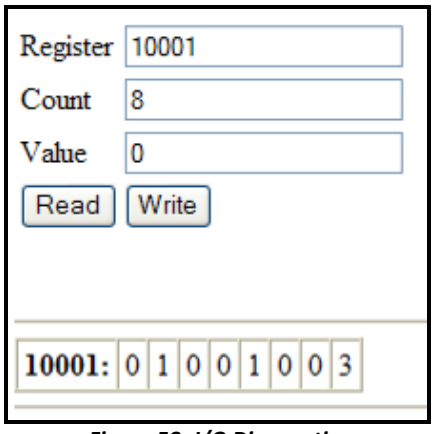


Figure 58- I/O Diagnostics

Selecting this option from the main screen will allow some basic reading and writing of the I/O store registers within the module.
To read a register location, enter an address location, e.g. 10001 (for digital Inputs), enter a count (number of consecutive registers) and then press the "Read" button
Below the buttons, you will see the returned address location and the returned values
To "Write" to outputs, enter the address location, count, and value and then press the "Write" button.
You will then see the outputs change to the value you entered.

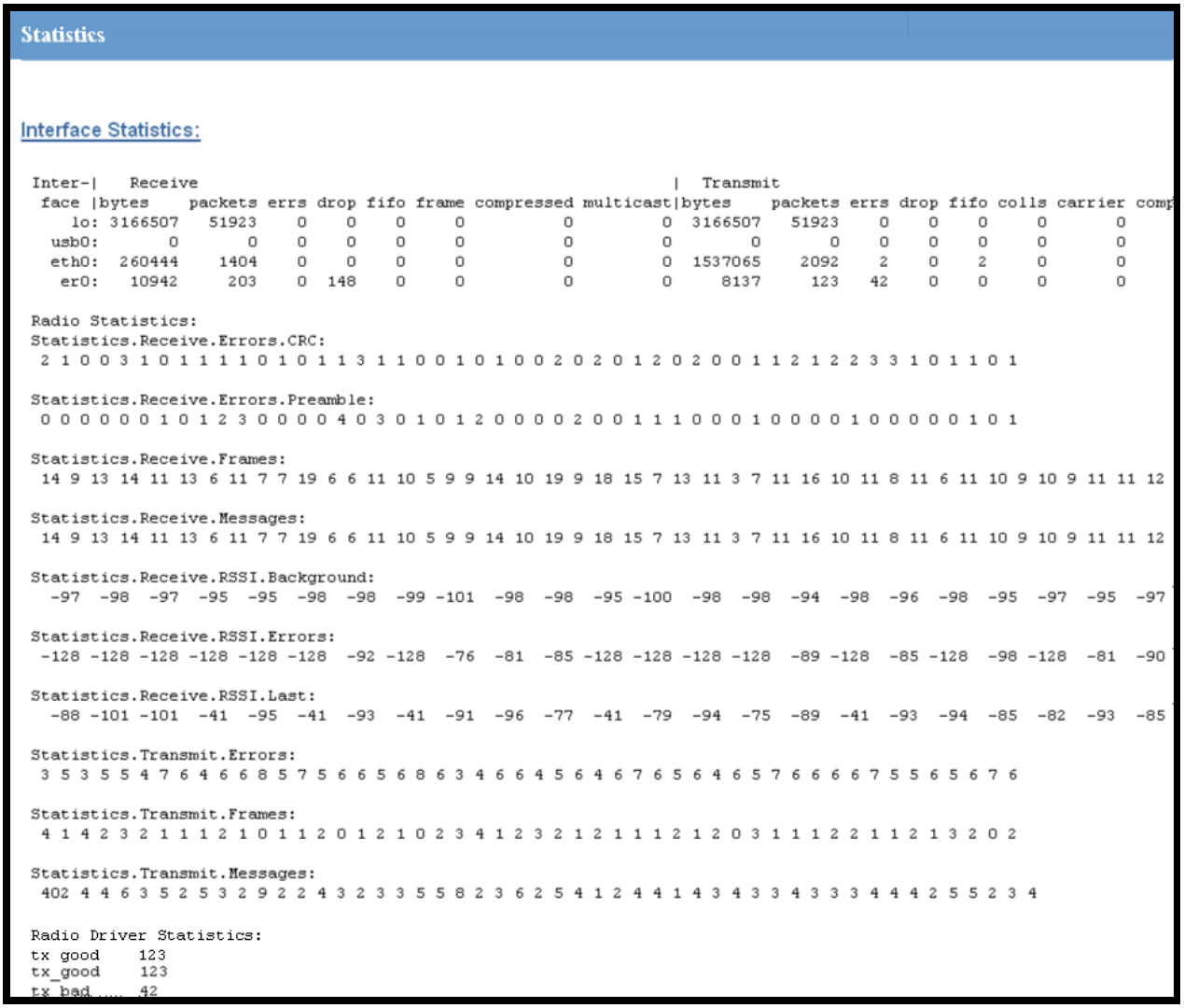
E.g. Write to Register 1 with a count of 8 and a value of 1 will turn all the Local Digital Outputs on.
Write to Register 40001 with a count of 2 and a value of 49152 will turn all the Local Analog Outputs to 20mA.
Note: If when reading a register and getting the symbol "~"this indicates that the register has not been written to and so it has no value (not even zero).

Note: if there is a mapping configured and any one of the source register values has an invalidated state "~" the mapping will not be sent (see 3.1 "Fail Safe Configuration" below for more details.

A mapping will only be sent when all registers have a value. You can use the Fail Safe Block Configuration to set an initial value for registers on start-up. This can be done using the Configuration software or Web based configuration. See Configuration Supplements for details.
Using the I/O Diagnostics you can check the register locations for these "~" values and even write values if required.
If when reading the Status of the DIO on the module you see the value "3", this indicates that the DIO is being used as an output in the "ON" state.

3.9 Statistics

The Statistics webpage is used for advanced debugging of 915U-2. This webpage details the state of the 915U-2 and performance information.
The page is useful to ELPRO technical support personnel in diagnosing problems with the module.
Note that when updating the Statistics webpage, it is necessary to hold down the <ctrl> key while pressing the refresh button. Otherwise, the information will not be updated.



Statistics

Interface Statistics:

```
Inter-|   Receive                                                |  Transmit
 face |bytes    packets errs drop fifo frame compressed multicast|bytes    packets errs drop fifo colls carrier comp
    lo: 3166507   51923    0    0    0     0          0         0  3166507   51923    0    0    0     0       0
  usb0:       0       0    0    0    0     0          0         0        0       0    0    0    0     0       0
  eth0:  260444    1404    0    0    0     0          0         0  1537065    2092    2    0    2     0       0
   er0:   10942     203    0  148    0     0          0         0     8137     123   42    0    0     0       0

Radio Statistics:
Statistics.Receive.Errors.CRC:
 2 1 0 0 3 1 0 1 1 1 1 0 1 0 1 1 3 1 1 0 0 1 0 1 0 0 2 0 2 0 1 2 0 2 0 0 1 1 2 1 2 2 3 3 1 0 1 1 0 1

Statistics.Receive.Errors.Preamble:
 0 0 0 0 0 0 1 0 1 2 3 0 0 0 0 4 0 3 0 1 0 1 2 0 0 0 0 2 0 0 1 1 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 1

Statistics.Receive.Frames:
 14 9 13 14 11 13 6 11 7 7 19 6 6 11 10 5 9 9 14 10 19 9 18 15 7 13 11 3 7 11 16 10 11 8 11 6 11 10 9 10 9 11 11 12

Statistics.Receive.Messages:
 14 9 13 14 11 13 6 11 7 7 19 6 6 11 10 5 9 9 14 10 19 9 18 15 7 13 11 3 7 11 16 10 11 8 11 6 11 10 9 10 9 11 11 12

Statistics.Receive.RSSI.Background:
  -97  -98  -97  -95  -95  -98  -98  -99 -101  -98  -98  -95 -100  -98  -98  -94  -98  -96  -98  -95  -97  -95  -97

Statistics.Receive.RSSI.Errors:
 -128 -128 -128 -128 -128 -128  -92 -128  -76  -81  -85 -128 -128 -128 -128  -89 -128  -85 -128  -98 -128  -81  -90

Statistics.Receive.RSSI.Last:
  -88 -101 -101  -41  -95  -41  -93  -41  -91  -96  -77  -41  -79  -94  -75  -89  -41  -93  -94  -85  -82  -93  -85

Statistics.Transmit.Errors:
 3 5 3 5 5 4 7 6 4 6 6 8 5 7 5 6 6 5 6 8 6 3 4 6 6 4 5 6 4 6 7 6 5 6 4 6 5 7 6 6 6 6 7 5 5 6 5 6 7 6

Statistics.Transmit.Frames:
 4 1 4 2 3 2 1 1 1 2 1 0 1 1 2 0 1 2 1 0 2 3 4 1 2 3 2 1 2 1 1 1 2 1 2 0 3 1 1 1 2 2 1 1 2 1 3 2 0 2

Statistics.Transmit.Messages:
 402 4 4 6 3 5 2 5 3 2 9 2 2 4 3 2 3 3 5 5 8 2 3 6 2 5 4 1 2 4 4 1 4 3 4 3 3 4 3 3 3 4 4 4 2 5 5 2 3 4

Radio Driver Statistics:
tx good     123
tx_good     123
tx_bad      42
```

Figure 59 – Module Statistics

Appendix A: GNU Free Document Licence

Version 2, June 1991

51 Franklin Street, Fifth Floor, Boston, MA 02110-1301, USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users. This General Public License applies to most of the Free Software Foundation's software and to any other program whose authors commit to using it. (Some other Free Software Foundation software is covered by the GNU Lesser General Public License instead.) You can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the software, or if you modify it.

For example, if you distribute copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

We protect your rights with two steps: (1) copyright the software, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the software.

Also, for each author's protection and ours, we want to make certain that everyone understands that there is no warranty for this free software. If the software is modified by someone else and passed on, we want its recipients to know that what they have is not the original, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that redistributors of a free program will individually obtain patent licenses, in effect making the program proprietary. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License applies to any program or other work which contains a notice placed by the copyright holder saying it may be distributed under the terms of this General Public License. The "Program", below, refers to any such program or work, and a "work based on the Program" means either the Program or any derivative work under copyright law: that is to say, a work containing the Program or a portion of it, either verbatim or with modifications and/or translated into another language. (Hereinafter, translation is included without limitation in the term "modification".) Each licensee is addressed as "you".

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running the Program is not restricted, and the output from the Program is covered only if its contents constitute a work based on the Program (independent of having been made by running the Program). Whether that is true depends on what the Program does.

1. You may copy and distribute verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and give any other recipients of the Program a copy of this License along with the Program.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Program or any portion of it, thus forming a work based on the Program, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) You must cause the modified files to carry prominent notices stating that you changed the files and the date of any change.

b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Program, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Program, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Program.

In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may copy and distribute the Program (or a work based on it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you also do one of the following:

a) Accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)
The source code for a work means the preferred form of the work for making modifications to it. For an executable work, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.
If distribution of executable or object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place counts as distribution of the source code, even though third parties are not compelled to copy the source along with the object code.

4. You may not copy, modify, sublicense, or distribute the Program except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense or distribute the Program is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

5. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Program or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Program (or any work based on the Program), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Program or works based on it.

6. Each time you redistribute the Program (or any work based on the Program), the recipient automatically receives a license from the original licensor to copy, distribute or modify the Program subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

7. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Program at all. For example, if a patent license would not permit royalty-free redistribution of the Program by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Program.
If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply and the section as a whole is intended to apply in other circumstances.
It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system, which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.
This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

8. If the distribution and/or use of the Program is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Program under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

9. The Free Software Foundation may publish revised and/or new versions of the General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.
Each version is given a distinguishing version number. If the Program specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Program does not specify a version number of this License, you may choose any version ever published by the Free Software Foundation.

10. If you wish to incorporate parts of the Program into other free programs whose distribution conditions are different, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally. NO WARRANTY

11. BECAUSE THE PROGRAM IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE PROGRAM, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PROGRAM IS WITH YOU. SHOULD THE PROGRAM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

12. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE PROGRAM AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PROGRAM (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE PROGRAM TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.