Instruction Manual
For Snap Link

Part Number 30300 and 30400

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1.0   About Your SNAP Link Wireless Adapters SNAP Link Adapters

The SNAP Link family of industrial-class, mesh networking, wireless serial adapters allows you to connect RS-232 and RS-485/422 devices to each other without using cables. SNAP Link adapters provide the highest data-rates, longest distance, and most reliable signal in the industry.

SNAP Link devices are available in two models:
- SL232K-001 – RS-232 with 250 Kbps wireless data rate
- SL232K-002 – Adds DC power option to 001 version
- SL485K-001 – RS-485/422 with 250 Kbps wireless data rate
- SL485K-002 – Adds DC power option to 001 version

Each SNAP Link adapter comes with SNAP EasySet, an intuitive application program that runs on Microsoft® Windows®-based computers that allows you to configure the device quickly and easily. Please refer to software specifications in the appendix of this document for exact operating system requirements.

You can also configure your SNAP Link adapters using internal DIP switches in the event a computer running EasySet is not available.

Key Features of SNAP Link
- Features SNAP® — the Synapse Network Application Protocol — instant-on, self-healing, mesh network operating system.
- Available with wireless data rates up to 2 Mbps.
- Supports wireless RS-232, RS-422, and RS-485 transparent serial data transfers.
- Hardened Modbus wireless protocol included for 99.5% reliable transport.
- Enables simple, one button pairing for fast, easy installation.
- Supports one-to-one (point-to-point) and one-to-many (multipoint) relationships.
- Performs mesh hopping, which can extend distances across many miles.
- Includes SNAP Link EasySet software for advanced configurations.
- Requires no changes to existing equipment and software.

Download Supporting Materials

All the following documentation and software are available on the www.amerex-monitoring.com/downloads/snaplink

Documentation pertaining to SNAP Link devices
The SNAP Link User Guide (the document you are reading now)
The Synapse SNAP EasySet configuration software

2.0   Setting Up Your SNAP Link Wireless Adapters

Refer to your SNAP Link Quick Start Guide accompanying your SNAP Link wireless adapter for illustrations showing you how to set it up quickly. This chapter gives you more detail about the various modes of operation and the three indicator lights.

Modes of Operation

SNAP Link units are powered via a USB cable through their micro-B USB connector. They can be powered by connecting a USB cable to the supplied AC adapter, or by plugging the cable into the USB port of a computer. It will be necessary to use a computer's USB port if you wish to configure your SNAP Link units using the EasySet software, which is described in the next chapter.

All models of SNAP Link can operate in either point-to-point mode, also known as unicast, or in multipoint mode, also known as multicast. In point-to-point mode two SNAP Link units are paired, thereby providing a wireless connection between two external serial devices. In multipoint mode, one of the SNAP Link devices is designated the master and multiple other devices can be configured as slaves. This section provides more detail on how these modes can be set manually by pressing the MODE button on the SNAP Link device.

SNAP Link State Indicators

You can change the state of your adapter either by holding down the MODE button or by pressing it in rapid succession.

There are three LEDs on a SNAP Link device. LED A is located on the front next to the MODE button. LEDs B and C are located on the back panel between the micro-B USB and serial connectors.

Set from the factory, these three LEDs communicate various configuration settings or traffic status events as documented next, unless the Modbus firmware script has been uploaded to the SNAP Link adapter.

Note: The three LEDs perform differently when the Modbus hardened reliability firmware has been installed, as documented in the Modbus Firmware Appendix

The A LED indicates the wireless broadcast state. It can be off, green, amber or red, and can be steady or flashing depending upon the current status or mode of operation:

Description	Status LED 'A'						
	Off	Green	Amber	Red	Flashing Green	Flashing Amber	Flashing Red
Reset or Broadcast state	X						
When the unit is seeking a pair							X
When the unit is paired, either in unicast mode or as a slave in multicast mode.*		X	X	X			
When the unit is in multipoint mode and is seeking a master						X	
When the unit is set up as a master – alternate flashing					X	X	
If a master detects another master on the same channel and network– alternate flashing						X	X

* Green indicates a strong wireless signal, amber indicates a weak signal, and red indicates no signal or loss of signal from its partner. No matter what the colour, the LED will flicker while wireless transmission is occurring

The B LED indicates the USB state. Green indicates the unit is being supplied with power. It will glow steadily in idle and will flicker when data is being transferred via the USB port.

The C LED indicates the serial interface state. If an RS-232 device is attached to the DB9F connector of the SL232 adapter, the LED will glow steadily green in idle and will flicker as data is being transferred. If an RS-484/422 device is attached to the terminal bock of the SL485 adapter, the LED will not glow, but will flicker as data is being transferred.

Note: It may be difficult to differentiate an amber coloured LED from one showing green or red, depending upon your viewing angle. When viewed from above, an amber LED may look red and when viewed from below it might look green. If in doubt, try viewing the LED at different angles.

Changing SNAP Link States

When a SNAP Link device is initially powered on, its serial communications parameters are set to factory defaults. This initial state is called broadcast state, because at this point SNAP Link hasn't been paired with another unit. However, it will join and become a member of a greater SNAP mesh network. Most commonly, each SNAP Link device will be married to, or paired with, another SNAP Link.

The factory default serial port settings for all SNAP Link devices is 9600 baud, 8 data bits, no parity, and 1 stop bit. For SL232 devices flow control is disabled, and for SL485 devices flow control is always enabled. The SNAP network ID is set to 0x1C2C and the channel number is set to 4. Many of these can be altered using EasySet or by using a bank of DIP switches located on the SNAP Link circuit board inside the unit, as shown in the chapter 'Configuring your Adaptor' using the DIP Switches. Resetting a unit causes the SNAP Link device to read the DIP switches and set itself accordingly.

Reset a unit, or return it to broadcast state	Broadcast state is the initial SNAP Link state as set by the factory. To return to broadcast state, remove power, hold down the MODE button, re-apply power. After 5 seconds, when all LEDs are rapidly flashing green-amber-red, release the MODE button. The B LED will be green, signifying power. The C LED will be green only if an RS-232 device is attached. The A LED, which signifies broadcast state, will be off.
Pair a unit in point-to-point	While in broadcast state, hold down the MODE button for at least 5 seconds. When LED A turns red, release the MODE button. The unit will then look for another SNAP Link to pair with, as indicated by the LED rapidly flashing red. When it finds a partner, the A LED will glow steadily. Green indicates a strong signal from the partner, amber indicates a weak signal, and red indicates no signal (the partner is powered off or else is out of range). **Note:** A SNAP Link adapter will only pair with another adapter that is also seeking a pair. So you must perform the above procedure on two SNAP Link adapters simultaneously to form a pairing.
Back out of searching for a pair	While LED A is rapidly flashing red, hold down the MODE button for at least 5 seconds. LED A should go dark. Release the MODE button and the unit is now back in broadcast state.
Remove pairing	Hold down the MODE button for at least 5 seconds. When LED A turns red, release the MODE button. The unit drops any current pairing and will then begin looking for another SNAP Link unit with which to pair.
Set a unit to multipoint mode	While in broadcast state, press the MODE button 4 times in rapid succession (within 3 seconds). LED A will rapidly flash amber. The unit is now in multipoint mode and will begin looking for a master to pair with. If it finds one, it will pair with it and the A LED will glow steady, but will flicker as data is transmitted.

Set up a unit as a multipoint master	While in multipoint mode, again press the MODE button 4 times in rapid succession. LED A will then blink slowly, alternating between green and amber, indicating the unit is the master in a multipoint network. Any slave units on the same channel and with the same network ID, which were previously set to multipoint mode, will then begin pairing with the master. If LED A should begin alternating between red and amber, that indicates another master is already on the same channel and with the same network ID.
Back out of multipoint mode when previously set up as a master	If the unit was previously set up as a master, press and hold the MODE button (for at least 5 seconds) until LED A rapidly flashes. The unit is no longer a master, but is still in multipoint mode, and is now looking for a master with which to pair.
Back out of multipoint mode altogether	If the unit was previously set up as a master, first back out by following the procedure above. Then, press and hold the MODE button again (for at least 5 seconds) until LED A glows steadily. Release and the unit is now back in broadcast state. It can now be set up in point-to-point mode or in multipoint mode.

Pin Outs
RS-232 (DB9F) Pin Outs

The SL232 adapter provides a DB9 female connector with the following pin outs:
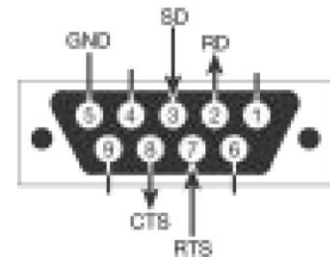
Note – Arrows indicate signal direction

The SL232 adapter uses a standard DB9 female connector configured as a DCE (Data Communications Equipment) device. A DCE device can be connected to a DTE (Data Terminal Equipment) device using a straight through serial cable. A computer is typically defined as a DTE and communications peripherals, such as the SL232, are defined as a DCE. To connect a DCE with another DCE, or DTE to another DTE, a null modem adapter, or crossover cable, is required. The null modem adapter swaps certain pins, typically pins 2 and 3, and 7 and 8, to convert a DCE into a DTE and vice-versa.

RS-485/422 Pin Outs

The SL485 adapter can operate in either 2-wire mode or 4-wire mode according to the following pin outs:

TWO-WIRE MODE FOUR-WIRE MODE
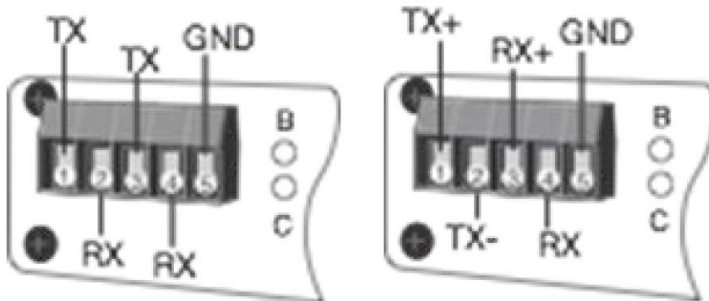
A terminal block is provided to which the transmit (TX), receive (RX), and ground (GND) wires can be attached. The factory default is set to 2-wire, but can be changed using the DIP switches located on the circuit board inside the adapter case. See the chapter ―Configuring your Adaptor using the DIP Switches‖ for details in setting the DIP switches.

To wire a connection in two-wire mode, pick a pair of TX/RX pins – either 1 and 2 or 3 and 4.

3.0   SNAP Link EasySet Software

The SNAP Link EasySet software has developed as an intuitive software application to help you configure your SNAP Link adapter.

SNAP EasySet, provides a graphical interface to access settings such as baud rate, flow control, and parity bits.
EasySet is currently available for Microsoft Windows XP (SP2) or newer and Windows 7 operating systems, and can be downloaded from the Synapse Wireless website at:

www.amerex-monitoring.com/downloads/snaplink

After downloading the software launch the installer to guide you through the installation process.
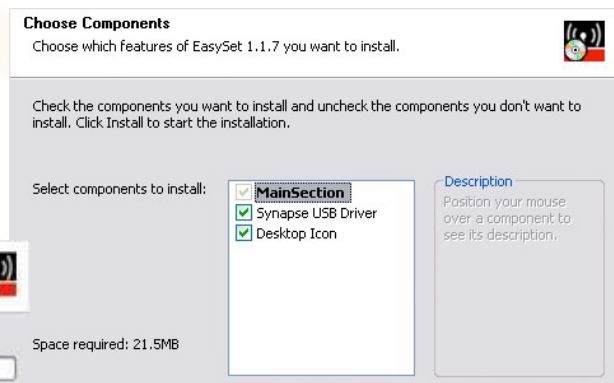
Installing EasySet

Upon launching the installer, this dialog is presented.
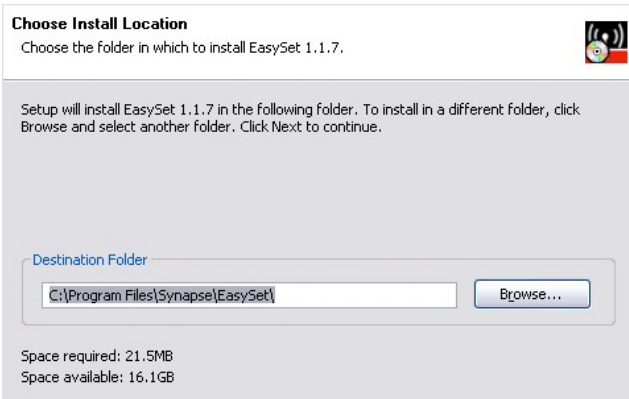
Click Next to continue and follow the on screen installation instructions. First specify where EasySet should be installed, the default being the Synapse folder within Program Files. Then press Install and the software will be installed to the specified location.

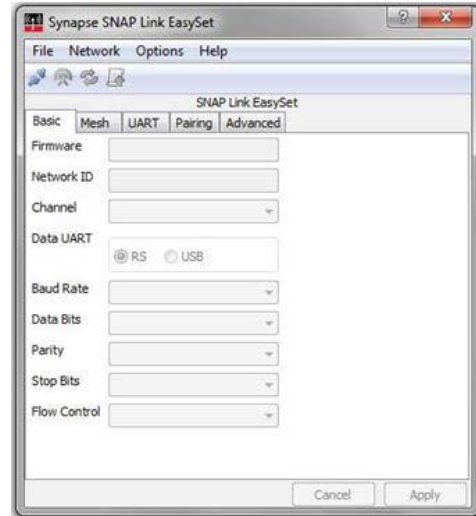This dialog gives you the option to exclude certain components.

During installation you're asked to disconnect any Synapse USB devices. This is so the installer can load new drivers. Disconnect any Synapse USB devices and press Ok to complete the installation.

Using EasySet

Launch EasySet by selecting EasySet from the Windows Start menu. EasySet will start up and present this window.
You will see four icons in the tool bar across the top of the window. Most of these are inactive (greyed out) until EasySet is connected with a SNAP Link adapter.
There are also four tabs in a tab bar below the tool bar.

Toolbar
The four toolbar commands are:

	Connect / Disconnect Serial Port – used to connect and disconnect from the attached SNAP Link device. Because this icon changes when you connect or disconnect, it also serves as a quick status indicator.
	Ping – causes EasySet to make a quick connectivity test to the attached SNAP Link device.
	Refresh Node Information – causes EasySet to poll the attached SNAP Link device for configuration information.
	Upload SNAPpy Image – prompts EasySet to upload the SNAP Link operating software into the attached SNAP Link device. It will be necessary to do this only upon release of new SNAP Link software, or upon instruction by technical support.

Connect a SNAP Link Device

Connect a SNAP Link device to your computer using the supplied USB cable. The micro-B side of the cable fits into the back of the SNAP Link device and the USB end fits into any standard USB port on your PC. This connection supplies power to the SNAP Link and also allows EasySet to communicate with it.

Next, tell EasySet to scan the computer's communications ports for a Synapse device. Press the Connect Serial Port button and EasySet will scan all serial ports and will stop when it believes it has found a SNAP Link device.

When EasySet finds a Synapse device, press the Connect button. If it failed to find the correct device type, press the Scan button to the right of the port identifier. This will cause EasySet to continue the scan.

If EasySet finds an attached device, but it's not a SNAP Link, then you will see this error message. Press Ok and then Scan again.

When successfully connected to a SNAP Link device, EasySet populates the communication fields with the data currently set in the SNAP Link device.

When the SNAP Link device is powered up for the first time, you will see the factory default settings set internally by the DIP switches. Once the configuration is changed by EasySet, the SNAP Link device will retain the new configuration in flash memory.

Tab Bar

There are four tabs across the top of the window – Basic, UART, Pairing, and Advanced – which allow you to match the communications settings of your SNAP Link adapter to that of the serial communications device to which you are connecting.

Selecting Basic Communications Settings

Below the icons and immediately above the tab bar is the SNAP Link adapter type: either RS-232 or RS-485/422. To the right of that is the adapter's MAC (media access control) address. The same address is also printed on a label on the bottom of the device.
Set the items under the Basic tab to match those of the serial communications device you are connecting to your SNAP Link adapter.
In this example we are attaching a device running at 9600 baud with 8 data bits, no parity, 1 stop bit, and with flow control enabled.

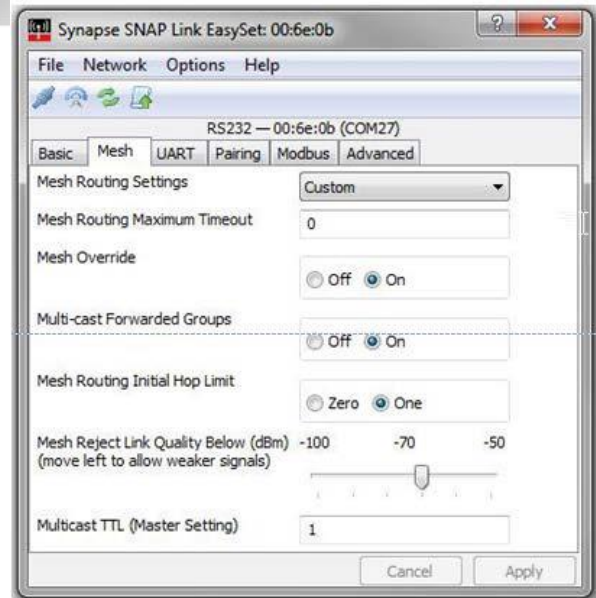|	
Network ID	The network ID can be thought of as a logical channel. This 16-bit integer may be assigned any hexadecimal value from 0x0001 through 0xFFFE. Devices in a SNAP network must share both the same channel and same network ID to communicate. This allows multiple SNAP networks to share the same channel if required, although it is preferred to place independent networks on separate physical channels to reduce collisions. SNAP Link defaults to network ID 0x1C2C.
Channel	The channel number can range from 0 to 15. All SNAP Link devices that you wish to include in the same network must be set to identical channel numbers. Due to FCC regulations, channel 15 provides slightly less output power than channels 0 to 14. Hence, in most cases it is recommended to avoid using channel 15.
Data UART	SNAP Link adapters contain two UARTs (Universal Asynchronous Receiver/Transmitter), one for the USB port and one for the serial communications (RS-232 or RS-485/422) port. This setting indicates which port is connected to your serial device, therefore defining where the serial data should be transmitted. The factory default is to send all serial data through either the RS-232 DB9 or RS-485/422 terminal block and NOT through the USB cable. The default setting of the USB port is to communicate only with EasySet. You can change this arrangement, but doing so will make your device unreachable via the USB port for further programming by EasySet. If you choose "USB" using this Data UART setting in EasySet and later need to reprogram the device, the easiest method is to reset the device, thereby setting it back to its default settings.
Baud Rate	Set the SNAP Link baud rate to match that of your serial device. The baud rate for all devices can range from 0 to 115,200. Adapters can send chunks of data in bursts up to 115,200, and safely sustain a maximum of 19,200 baud.
Data Bits	Set the number of data bits to 7 or 8.
Parity	Set the parity to none, odd, or even.
Stop Bits	Stop bits is always 1.
Flow Control	If your device uses flow control, then this setting should be enabled. Otherwise, this setting should be disabled.

Note: EasySet Versions earlier than V1.2.3 had three parameters shown on the Basic tab: Mesh Routing Setting, Mesh Routing Maximum Timeout and Mesh Override. These parameters are now located on the Mesh Tab in EasySet versions 1.2.3 and higher.

Mesh Settings – Custom

|	
Mesh Routing Setting	AMEREX Integrated (AI) nodes on the same channel and same network communicate with each other using mesh routing. This means any device can communicate with any other device (they are all logical peers within the mesh) even though in some cases units that are out of radio range with each other might have to pass messages through intermediate nodes. Mesh routing can be enabled, disabled, or set to custom. Enable mesh routing to allow a SNAP Link device to participate as a node in a wider SNAP mesh network.
Mesh Routing Maximum Timeout	If you set Mesh Routing to custom, then the maximum age, in milliseconds, can be specified here. The default value should cover most network topologies and should be changed only under the direction of technical support. Be careful when changing these values on remote nodes as you could make it impossible to communicate with the node remotely.
Mesh Override	If you set Mesh Routing to custom, then check this box to indicate mesh override. This means to use mesh routing, but not to route for other nodes in the network.
Multi-Cast Forwarded Group	Select 'On' to have the connected SNAP Link adapter re-transmit or re-broadcast any communications it receives from the Master. This is typically enabled on a SNAP Link client mode adapter located approximately halfway between the Master unit and the SNAP Link adapter client that exhibits poor transmission signal strength behaviour as documented in the chapter called Troubleshooting.
Mesh Routing Initial Hop Limit	Select 'On' to have the connected SNAP Link adapter limit Hops to 'One'. A hop limit of 'One' directs a SNAP Link unit to request routing paths from other SNAP devices one hop away. It will automatically attempt to discover a routing path up to five hops away, if this initial one hop discovery fails. By setting this parameter to zero (0), you are telling the SNAP Link attached adapter to attempt sending a packet directly to the address first, before seeing if there is a route path to get to him. This setting is most useful when fast timing is required and you are pretty sure they are within one hop distance.

Mesh Reject Link Quality From (dBm)	The Mesh Reject Link Quality slider allows you to require the minimum signal strength, as measured in dBm strength, that the connected SNAP Link adapter is allowed to use for transmitting to a neighbouring node, even if the neighbouring node is the Master device. **WARNING: setting this slider to the far right could result in an oddly behaving mesh network, including no connection success at all. dBm is a logarithmic setting from 0 to -127 and the slide allows you to require the minimum signal strength to be between -100 (weak) to -50 (very strong). Sliding it to the left may allow more packets to become lost, never arriving at its destination. Sliding it to the right will decrease the number of these dropped packets, but may result in no communication at all if set too far to the right.**
Multicast TTL (Master Setting)	Multicast Time-To-Live parameter only needs to be set on the SNAP Link adapter designated as the Master. As discussed in other sections, Master transmissions use the Multicast protocol in order for multiple clients to all receive the Master transmissions. By default, Multicast TTL has been set to '1', which means that even if a Client adapter's Mesh Routing Initial Hop Limit is set to 'On', they will not retransmit or rebroadcast the Master's transmissions. Example: There are four SNAP Link adapters in a long linear line: Master, Client1, Client2 and Client3. Master node transmissions do not get to the farthest Client (3), but it appears Client1 could get it to Client2 and Client2 could get it to Client3 since each Client is about 1/3 of the distance away from its neighbours. In this example, setting the Master TTL to 4 on the Master adapter and setting Client 1 and Client 2 to 'On' for the Mesh Routing Initial Hop Limit should make sure all transmissions are received. **Note:** If you still have issues, please review the Modbus Firmware appendix.

Mesh – No Mesh

Mesh Routing Settings – No Mesh
Setting the Mesh Routing Settings parameter to 'No Mesh' keeps transmissions to a minimum, reducing interference and collisions that may add lag, or delays, in the smooth timing operation of your SNAP Link adapters (sometimes referred to as a —broadcast storm). Only enable mesh routing if you have determined that you need some of your Client mode adapters to help retransmit or rebroadcast transmissions in order for all Clients to receive and transmit their information.
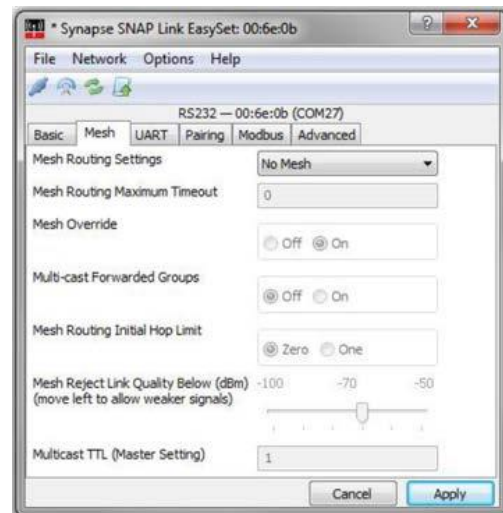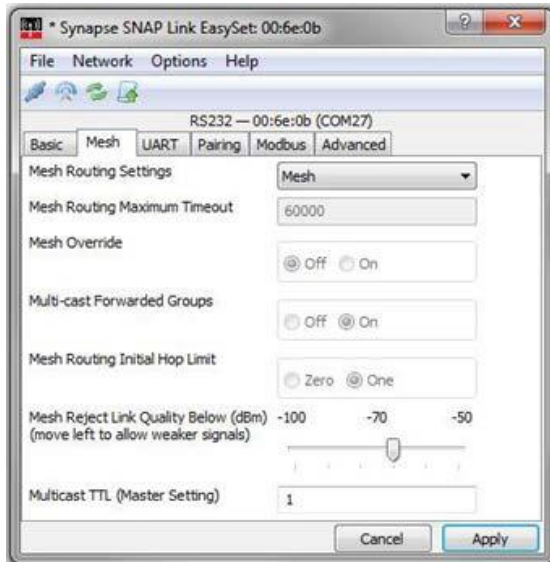
Mesh – Mesh Defaults

Mesh Routing Settings - Mesh
These are the default parameters when you select 'Mesh' from the Mesh Routing Settings pull down menu. Selecting Mesh indicates that you want the connected SNAP Link adapter to assume an additional role of ―transmission repeater/router. As long as the Master adapter has the Multicast TTL (Master Setting) assigned to a number larger than 1, all nodes with this 'Mesh' pull down menu selection will repeat unicast and multicast transmissions they receive.

Modbus Firmware (If Script has been loaded)

Modbus Firmware
A new tab called 'Modbus' has been added in the release of EasySet V1.2.3 once a SNAP Link adapter has uploaded the 'Modbus' script and reset to factory default. The new Firmware field denotes this connected SNAP Link adapter has had the script uploaded by displaying 'Modbus' along with a new Modbus tab. The Modbus script enables a new

hardened wireless Modbus protocol that provides the highest reliability transport along with the ability to fine-tune the retransmissions and lag or latency introduced by those retries. Please review the Modbus appendix later in this document for more information.
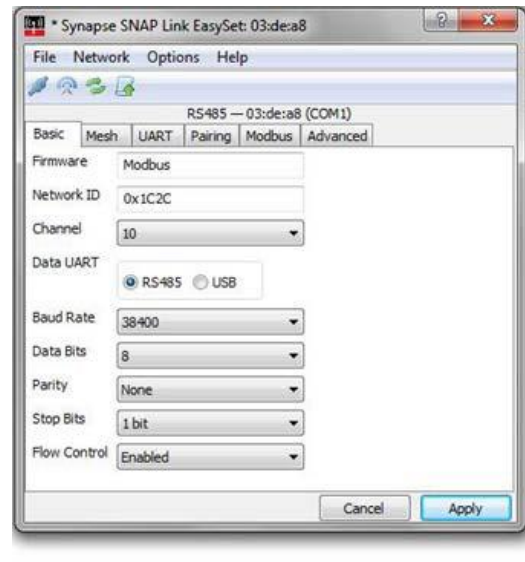
UART Settings

The UART tab contains three parameters allowing you to fine tune data transmission. These can be set according to the needs of the serial device. You may have to adjust these, depending upon transmission speed and the size of data packets. See the chapter on Application Usage Scenarios for more help in setting these parameters.

Buffering Timeout

This setting controls the overall serial data timeout. The value is in milliseconds with the default being 0, or no timeout.

The Buffering Timeout controls the elapsed time between an initial character being received and a packet of serial data being enqueued for processing. When the timeout passes, regardless of the number of characters buffered or the rate at which they are received, the buffered data will be sent. The larger this value, the more buffering that will take place. However, while this allows for more data to be sent per packet, which might be more efficient depending upon your application, it also increases latency.

Note that other events, controlled by Buffering Threshold and Inter-character Timeout, can also trigger the buffer of data to be sent.

Buffering Threshold

This setting indicates the maximum packet size used when sending data. The default is 100 bytes and the maximum is 123 bytes. Values over 100 are not recommended as they could result in buffer overrun.

Buffering Threshold causes buffered data to be sent whenever the threshold is reached. However, triggering the Buffering Timeout or Inter-character Timeout settings could cause data to be sent before the threshold is reached. Each packet of data includes a header, which comprises 12 bytes for multipoint packets and 15 bytes for point-to-point packets. So, the actual number of data bytes sent will be either 12 or 15 bytes fewer.
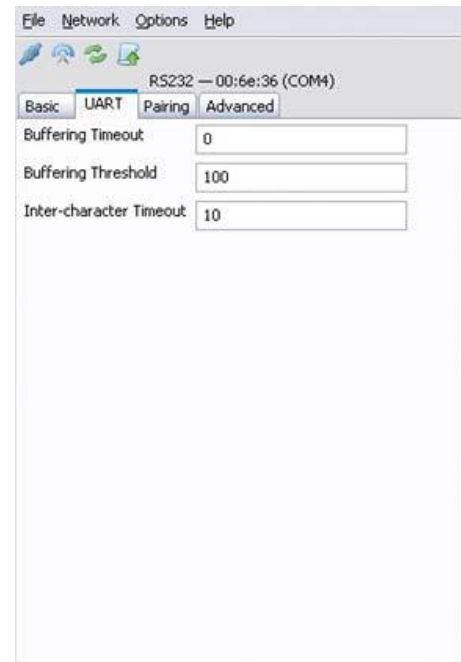
If you set Buffering Threshold to a large number, then larger, more efficient packets will be sent, but with greater latency. At higher baud rates setting this value too high can result in dropped characters.

Inter-character Timeout

This setting allows you to tune the inter-character serial data timeout. This value is in milliseconds and defaults to 10.
Inter-character Timeout is the maximum elapsed time that should pass before sending the enqueued packet after receiving a character. It restarts with every received character. This parameter or Buffering Timeout can trigger transmission of buffered data before Buffering Threshold is reached. Conversely, if the timeouts are high or disabled altogether, then data will be transmitted when the Buffering Threshold is reached.

Setting a large Inter-character Timeout can give better multicast transparent mode reliability but with greater latency.

Pairing Settings

The Pairing tab indicates whether the SNAP Link adapter is paired with another adapter, which is denoted by displaying the other pair's SNAP address.

State
This is the paired state. The value can be:

> • Simple Broadcast – Unit is in a reset state and is waiting to be set up.
> • Searching for Master – Unit is in multipoint mode and is searching for a master unit with which to pair.
> • Master – Unit is in multipoint mode and is the master. It is now willing to accept slave units.
> • Slave – Unit is in multipoint mode, is a slave, and has paired with a master.
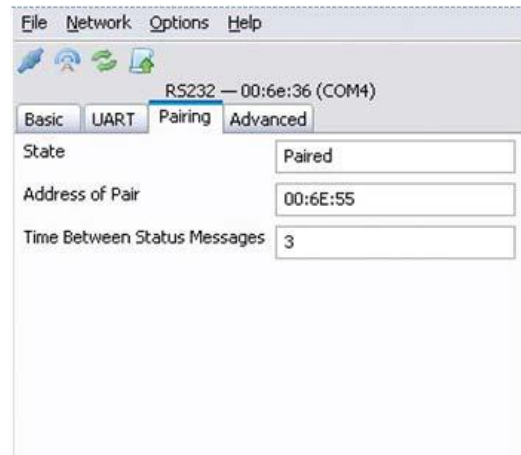
• Ready to Pair – Unit is in point-to-point mode and is looking for another unit with which to pair.
• Paired – Unit is in point-to-point mode and has been paired with another.

Address of Pair

When paired, this will be the device address the unit is paired with. If a slave, this will be the address of the master. If a master, this field will be blank.

Time Between Status Messages

The number of seconds between pings. The device will periodically ping its partner to confirm connectivity.

Advanced Settings

The Advanced tab contains a single checkbox labelled Button Lockout. When checked, the MODE button on the front of the SNAP Link adapter will be disabled. However, the MODE button can still be used to perform a reset, putting the SNAP Link device back into broadcast state.

4.0   Configuring your Adaptor using the DIP Switches

You use the MODE button on the front panel of your SNAP Link adapter to define which SNAP Link adapters communicate with each other, as discussed in earlier sections of this manual. You use the EasySet software to modify the entire range of parameters, also as discussed in earlier sections of this manual.
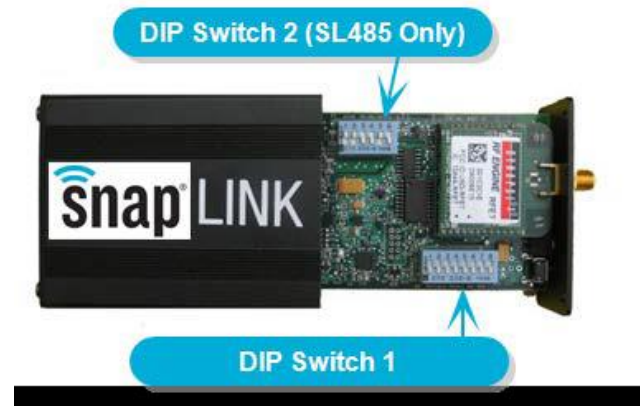
However, if you do not have access to a computer running EasySet, you can configure some communication parameters using the DIP switches located inside the unit.

Changing DIP switch settings will override the default parameters, or parameters previously configured using the EasySet software. However, EasySet can also override the DIP switch settings. SNAP Link adaptors have built-in intelligence to determine if EasySet or the DIP switches were last used to change the configuration. The general rule is: the last method used to change the settings is the one that takes precedence.

SL232 has a set of 8 internal switches that set Flow Control, Baud Rate, and SNAP Channel.

SL484 has the same set of 8 switches plus a second set of 6 switches that configure the device for either 2- wire or 4-wire operation.

To access the DIP switches, remove the four screws on the antenna end of the device and slide out the enclosed PC board to expose the switches.

DIP Switch 1

DIP switch 1 consists of 8 individual switches, which are applicable to all SNAP Link devices. All possible switch settings are shown in the tables below. This example highlighted in Red indicates the following;
Flow control Off/Disabled, 2400 BAUD, and SNAP channel 9.
See photograph of switch positions

Switch Setting	Flow Control	Switch Setting			Baud Rate	Switch Setting				SNAP Channel
	1	4	3	2		8	7	6	5	
0= Off	Disabled	0	0	0	9,600	0	0	0	0	0
1 = On	Enabled	0	0	1	19,200	0	0	0	1	1
		0	1	0	38,400	0	0	1	0	2
		0	1	1	57,600	0	0	1	1	3
		1	0	0	115,200	0	1	0	0	4
		1	0	1	300	0	1	0	1	5
		1	1	0	1,200	0	1	1	0	6
		1	1	1	2,400	0	1	1	1	7
						0	0	0	0	8
						0	0	0	1	9
						0	0	1	0	10
						0	0	1	1	11
						0	1	0	0	12
						0	1	0	1	13
						0	1	1	0	14
						0	1	1	1	15

DIP Switch 2

DIP switch 2 consists of 6 individual switches and is present only in SL485 devices. It is used to configure the device for 2-wire or 4-wire operation. Note that 2- wire is always half duplex and 4-wire can be switched between half or full duplex. RS-422 is always 4-wire, full duplex.

Configuration	Switch Setting					
	1	2	3	4	5	6
2 Wire Half Duplex	1	1	0	1	1	0
4 Wire Half Duplex	0	0	1	1	1	0
4 Wire Full Duplex	0	0	1	1	0	1
RS-422	0	0	0	1	0	1

Some device manufacturers might refer to these as 3-wire or 5-wire. This is referring to the same settings described above, but are including the ground wire in their specification.

5.0   Application Usage Scenarios

The UART parameter settings in EasySet can affect end-to-end data communications performance between the SNAP Link adapters and your RS-485/422/232 devices. This section provides several scenarios to illustrate setting the UART parameters for optimal performance. Your application or device may require a few trial-and-error adjustments before performing as desired. These scenarios provide recommended rule-of- thumb starting points to begin this trial-and-error process.

Refer to the UART discussion in the EasySet chapter for a description of the UART parameters, but in summary, the three parameters are:

• Buffering Timeout – the total length of time to wait before buffered data is transmitted. The unit of measure is milliseconds and the default is 0. 0 effectively turns the buffering timer off.
• Buffering Threshold – the minimum number of characters to enqueue before the buffer is transmitted. SNAP Link contains a 123

byte buffer, but that must include a 12 byte header when in multipoint mode and a 15 byte header when in point-to-point mode. The default value is 100. Values over 100 are not recommended, especially at high baud rates, because the buffer could be overrun resulting in dropped characters.

• Inter-character Timeout – is the length of time to wait between the arrivals of characters before the buffer is transmitted. The unit of measure is in milliseconds and the default is 10.

Scenario 1: Card Scanner

In this example, a card scanner is sending small but continuous packets of data. One of its requirements is fast turnaround, hence a small buffer needs to be emptied frequently to reduce latency. Suggested parameters are:

• Buffering Timeout – 0 turns this timer off. In this case, we'll let the threshold and inter-character timer take care of flushing the buffer.

• Buffering Threshold – This should be set to the size of the card scanner packets plus an additional 12 or 15 bytes of header. So if the packet size of the payload is 16 bytes, then this buffer could be set to 28 if using multicast or 31 bytes if using unicast. SNAP Link adapters configured as masters in a multipoint configuration always use multicast. Slaves and paired adapters always use unicast communications.

• Inter-character Timeout – This should be a low number, such as 3 to 10 milliseconds, to prevent data from being buffered too long. Higher baud rates should use a lower value, and lower baud rates need a higher value.

Scenario 2: File Transfer, Continuous Stream

In this example a large continuous block of data is transmitted, such as what would take place during a file transfer. In this case latency is not an issue, but maximizing the transfer rate is. Suggested parameters are:

• Buffering Timeout – This should be set to a fairly large number to ensure the transmit buffer is filled before being transmitted. At 19,200 baud, an appropriate number would be 50 to 60 milliseconds.

• Buffering Threshold – This should be set to as large a number as possible. The maximum would be 108 bytes in point-to-point mode and 111 bytes in multipoint mode, however as stated above, numbers above 100 are not recommended.

• Inter-character Timeout – This should be set to 0 to turn this parameter off. We don't want the buffer transmitted if the serial device should hesitate for a few milliseconds. Instead, we want the buffer to be filled to capacity, so we'll let the other two parameters control when the buffer is transmitted.

Scenario 3: Lowest Latency at Highest Baud Rate

In this example we have bursts of up to 75 bytes that we want transmitted with the least amount of latency. Suggested parameters are:

• Buffering Timeout – This should be set to a small number to keep the smaller packets flowing and allow the buffer to fill when a larger packet arrives. At 19,200 baud around 35 milliseconds should work, and at 115,200 baud around 5 milliseconds should suffice.

• Buffering Threshold – Set this value to 90 to allow the larger packets to buffer (75 bytes plus 15 bytes for the unicast header). The Buffering Timeout will force the smaller packets to be sent, preventing them from sitting in the transmit buffer for too long.

• Inter-character Timeout – This parameter should be smaller than the Buffering Timeout to force transmission of very small payloads with pauses between them. In this scenario, set this parameter at about half of the Buffering Timeout setting.

6.0   Troubleshooting

In the realm of wireless communications, many factors can affect reliable data communications. This section lists a number of known factors and possible remedies.

If your question is not adequately answered here, visit the SNAP Link support forum on the Synapse Wireless website where you can post a question and interact with other SNAP Link users. The SNAP Link Support forum can be accessed at:

forums.synapse-wireless.com/forumdisplay.php?f=11

Signal Strength Problems

SNAP Link adapters should communicate well when placed in near proximity of one another (as indicated by a mostly green LED A), why might they not communicate well when moved further apart (as indicated by LED A turning amber, indicating weak signal strength, or red, indicating loss of signal)? You can make several adjustments to remedy this situation:

    • Try orienting the external antenna into different positions. Since antennas work best when they are in the same spacial plane, essentially parallel to one another without being directly above or below each other, try to position the antennas of all your SNAP Link devices in the same orientation.
    • There could be other interference problems in your vicinity such as large metal objects, dense foliage, and other objects that prevent signal transmission or attenuation (signal loss). Microwave ovens can cause interference problems. Try moving the units physically to another usable location to see if signal strength improves.
    • Try changing the channel of each device. There are 16 separate channels (0 – 15) spread within the 2.4GHz frequency. Various other 2.4GHz devices, such as cordless phones and WiFi routers, may be flooding one channel, but not another one.
    • Refer to the Advanced Management section for reference to the Synapse Portal® software. This software contains a Channel Analyzer tool that can help you determine which channel has the least traffic interference.

Multiple Masters

In a multipoint network, if SNAP Link devices are unable to pair with a master, check for the presence of multiple masters.
There can be only one master in a multipoint network. If you wish to operate multiple masters within the same vicinity, then be sure to set each master to a different channel and/or network ID using either EasySet or the DIP switches. To reduce crosstalk, set the network channels as far apart as possible.

When operating normally, a SNAP Link master will slowly blink the A LED, alternating between green and amber. If it detects the presence of another master on the same channel, it will then alternate the colours between red and amber.

Can't Find a Master

If a SNAP Link device is unable to pair with a master, there may be several possible problems:

• Ensure there are not multiple masters on the network by observing LED A as described above.
• Ensure all units on the multipoint network are using the same channel number and network ID.
• Ensure the unit is within broadcast range of the master. If in doubt, try to pair the units within the same room. Once paired, move the slave unit farther away while observing LED A. It should start off green, but if the unit is moved to the fringe of its broadcast range, the LED will turn amber, indicating weak signal strength. If the LED turns red, then it has lost its connection with the master.
• Try adjusting the antennas as described above.

Poor Performance

If you believe your SNAP Link adapter are not performing adequately, this could be caused by a number of factors, such as:

• Poor signal strength – try adjusting the antennas as described above.
• Incorrect data communications parameters – confirm your serial communication settings in EasySet with those of your serial device.
• Premature sending of packets, holding on to packets for too long, or just dropped packets – try optimizing the UART parameters for your particular application. Revisit the UART parameter settings in the EasySet chapter and also review the Application Usage Scenarios chapter.

Paired but not communicating

If a unit appears to be paired in multipoint mode, but still doesn't work, check the communications parameters using EasySet. If you don't see an occasion blink of the green A LED, then you might have an incorrect setting in baud rate, flow control, stop bits, parity, or flow control. If you have more than two SNAP Link units, confirm that each unit is paired to the desired unit. Each unit's address is printed on a label located on the bottom. The unit it is paired with can be confirmed using EasySet.

7.0   Frequently Asked Questions

Does the SL485 product provide power to an attached device off the terminal block? In other words, if my RS-485 device requires power, can it obtain that power from the SNAP Link product?
★ No. The SNAP Link family requires only a tiny fraction of the power specified by the RS-485 standard and does not have the capability of driving an RS-485 device from the SNAP Link provided power source.

If I power off and power back on a SNAP Link product, does it forget the configuration changes I have previously applied, such as baud rate, parity, flow control, UART parameters, channel, or network ID?
★ No. SNAP Link units store those parameters into non-volatile (NV) RAM, maintaining your settings when power is cycled.

As shipped from the factory, are the SL485 products configured to use 2-wire or 4-wire RS-485 cabling?
★ Factory default settings are to assume an RS-485 2-wire cable. To support a 4-wire configuration, the unit must be opened and some settings on the six DIP switch box must be changed as shown in the chapter on DIP switch settings.

I have a 3-wire or 5-wire RS-485. Do you support those as well?
★ Yes. Some documentation does not count the ground wire when discussing an RS-485 cable. Therefore, a 2-wire isn't counting the ground wire, while saying 3-wire does count it. They are both the same. A 4-wire is also the same as saying 5-wire for the same reason.

In a multipoint configuration my master device shows an amber flicker periodically. Does this mean it has a weak signal strength? Can I determine the signal strength on the master unit?

★ No. A master's A LED displays a mostly green color, with a regular amber flash. This display simply indicates that the unit is the master node in a multipoint network.

★ The master does not indicate signal strength when communicating with its slaves. However, by looking at LED C you can determine when the master unit has data transmission activity with its attached serial device.

★ The only way to determine signal strength in a multipoint network is by looking at LED A on the slave units to see if they have a good connection with the master.

I need to replace the master SNAP Link unit in a multipoint setup that has been working. Must I reset each device, or can I merely set up the new master?

★ You will need to perform a simple one-button process at each slave. This is by design since you wouldn't want slave devices to automatically switch to a new master if one were one to be powered up for a different purpose. This is documented in the setup chapter, but the process is as follows:

1. Hold down the MODE button for 5 seconds until LED A begins to flash red. Release the MODE button, LED A will no longer be lit.

2. Click the MODE button four times in rapid succession. LED A will rapidly flash amber to indicate it is seeking a master and, upon finding one, will change to green.

Is the SNAP Link RS-232 product a DTE (data terminal equipment) or a DCE (data communications equipment)? When do I need to use a null modem cable or adapter?

★ The SNAP Link RS-232 devices use a standard DB9 female connector configured as a DCE. It can be connected to a DTE using a straight through cable. If you need to connect an SL232 to another DCE device, then a null modem adapter, or cross over cable, will be required. See the discussion of RS-232 pin outs for further information.
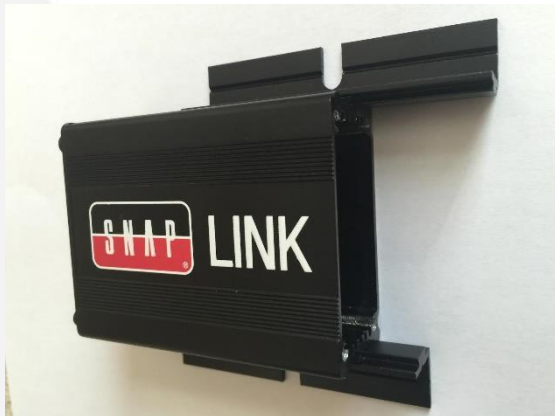
Appendix A Mounting Options

SNAP Link devices can sit on a table top or be wall mounted using the included mounting brackets.

Remove an end panel by unscrewing the 4 screws and removing the panel.


Slide the brackets into place as shown.

Reattach the end panel using the 4 screws. The end panels will securely hold the brackets in place.

The completed assembly is now ready to be hung on a ceiling or wall.

Appendix B Modbus Firmware

With the release of EasySet V1.2.3, SNAP Link adapters can load a new version of script firmware to increase the reliability of wireless transmissions, by allowing an automatic number of retransmissions by the Master adapter. This multicast retry feature ensures the master continues to retransmit a command if no response is received due to the original transmission. By adjusting two parameters, you can balance the number of retries attempted by the Master adapter. However, lag or latency is introduced by each retry.
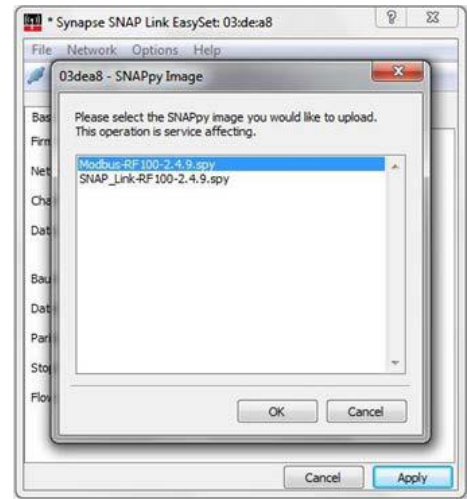
Select Modbus script, as shown, for uploading the Modbus firmware to the connected SNAP Link adapter.
The Modbus tab enables retransmission by the Master adapter based on retry count and the waiting period between them.
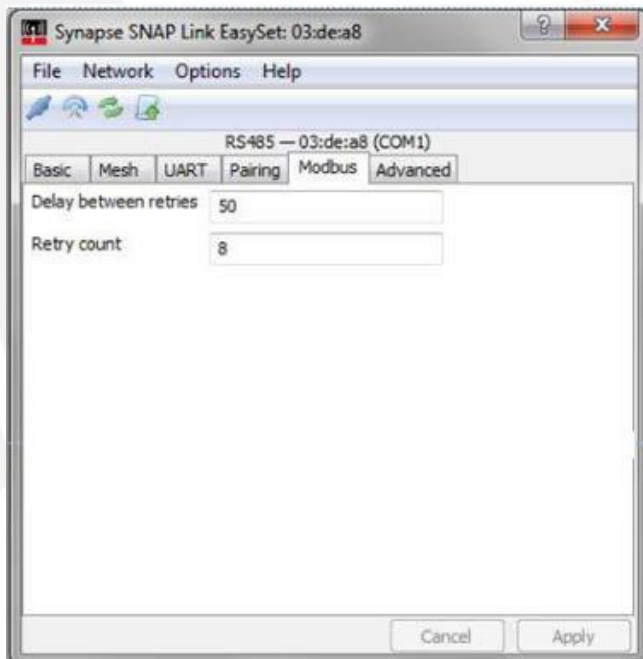
Delay between retries.
The delay between retries is a millisecond timer that counts down after the Master adapter transmits a modbus command. Once the transmission occurs, the Master adapter will count down the assign number, in milliseconds. If a reply is not received before the timer reaches zero, the Master unit will retransmit the original Modbus command up to the number of Retry count assigned

Retry count
The number of times the Master will re-transmit the original broadcast if no

response is received within the Delay between retries setting.

Note: Your Modbus application may be affected by lag due to these settings. If a Master adapter has to retry to the maximum number set, it will incur a lag in milliseconds equal to the following formula: "Delay between retries" * "Retry Count" = "Maximum milliseconds of lag potentially added after each Modbus command is transmitted.

Appendix C Advanced Management

The SNAP Link EasySet software was designed to set up SNAP Link adapters quickly and easily. However, if you should encounter situations where a more powerful tool is needed, Synapse Wireless offers Portal™, an advanced SNAP network Administration tool, as a free download from the web site. To access the download you will need to register on the Synapse forum site at:

forums.synapse-wireless.com/register.php

Once registered, download Portal and its related documentation from:

forums.synapse-wireless.com/showthread.php?t=9

Specifications

General	
Radio Frequency	2.4 GHz (2.4000 – 2.4835 GHz)
Spreading Spectrum Type	Direct Sequence (DSSS)
Frequency Control	Offset-Quadrature Phase Shift Keying (O-QPSK)
Network Topology	Point-to-Point Paired; Point- Multipoint (Master/Slave); Transparent Mesh Networking
Channel Capacity	16 isolated channels; 65534 logical networks per channel
Serial Data Interface	Two: Selectable between RS- 232/422/485 or USB
Raw Data Rate	250 Kbps
Supported Baud Rate	300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600, 115,200
Max Sustainable Throughput	19,200 bps

Power Requirements	
Supply Voltage	4 – 5.25 VDC; Standard micro- B USB Universal Connector
Max. Power Consumption	RS-232: 0.6WRS-485: 0.825W

Physical Properties	
Enclosure Type	Extruded aluminium, black anodized, wall mount brackets included
Enclosure Size	1.18H x 2.5W x 3.15L in. (3 x 6.4 x 8 cm)
Weight	RS-232: 6.12 oz (174 g) RS-485: 6.25 oz (177 g)
Operating Temperature	-30C to +85C. Included wall plug: 0 to + 45C
Operating Humidity	10 to 90% non-condensing
Wireless Link Failure	Integrated Wireless Link Failure LED indicator

RF (Wireless) Properties	
Protocol	IEEE 802.15.4, SNAP
Indoor Range (with included antenna)	Up to 1000 feet indoors Line of Sight (LoS). RF interference can reduce range.
Outdoor Range (with included antenna)	Up to 3 miles Line of Sight (LoS)
RF Transmit Power	63 mW (18 dBm)
Receive amplifier Gain	10 dBm
Receiver Sensitivity	-102 dBm at 1% packet error rate
Features	Real-time RSSI signal strength indicator; AT Command; Terminal Emulation; Modem emulation

Antenna

Type Included	External Reverse Polarity SMA connector, omni directional
Gain	3.2 dBi
Length	5.875 in (14.9 cm)
Impedance	50 Ohms unbalanced

Certifications

FCC Part 15, Class B	Yes
Power Supply	UL
RoHS (lead free) Compliant	Yes
Energy Star Compliant	Yes
IC Certification	Yes

RS232

Connector	DB9F DCE
Data bit; Parity; Stop bit	7, 8; no parity, even, odd; 1

RS485/422

Connector	Terminal block; 2 or 4 wire: ITX+, TX-, RX+, RX-, GND (selectable) Terminal block; 2 or 4 wire: ITX+, TX-, RX+, RX-, GND (selectable)
Data bit; Parity; Stop bit	7, 8; no parity, even, odd; 1

Software

OS Support	Microsoft Windows XP (SP2) or Windows 7
Configuration	EasySet - Configuration Tool Included