



Powerline Ethernet Bridge



User's Manual

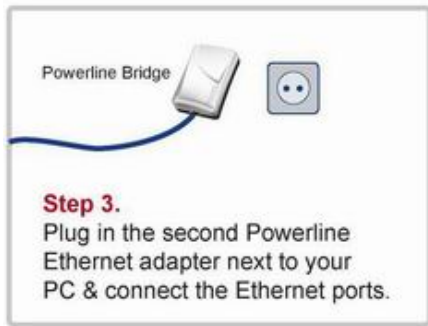
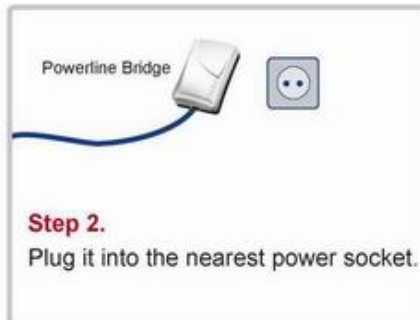
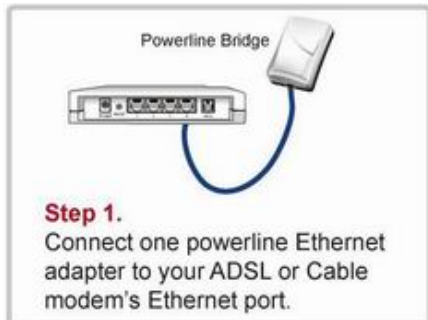
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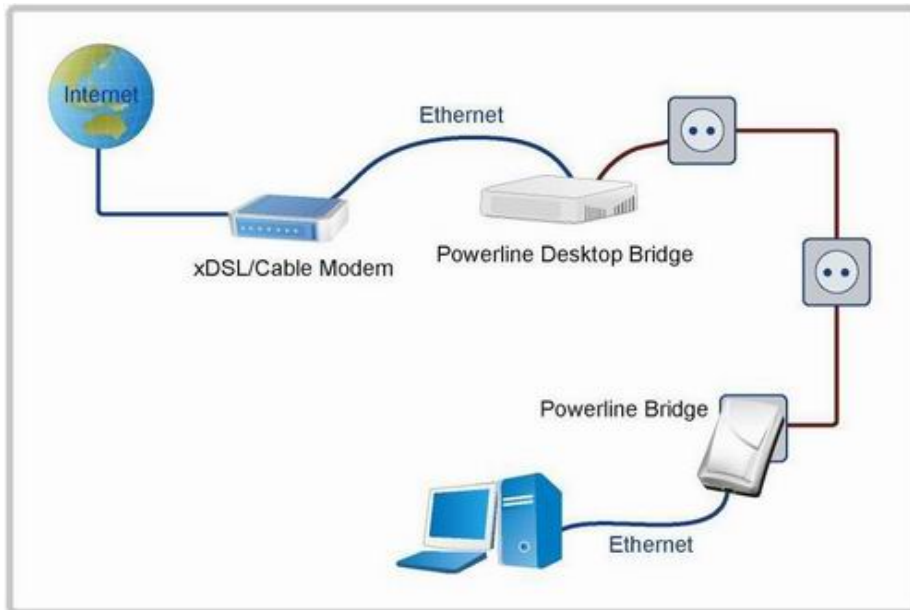
1. Powerline Networking Installation

1.1 Simple step to install Powerline Networking

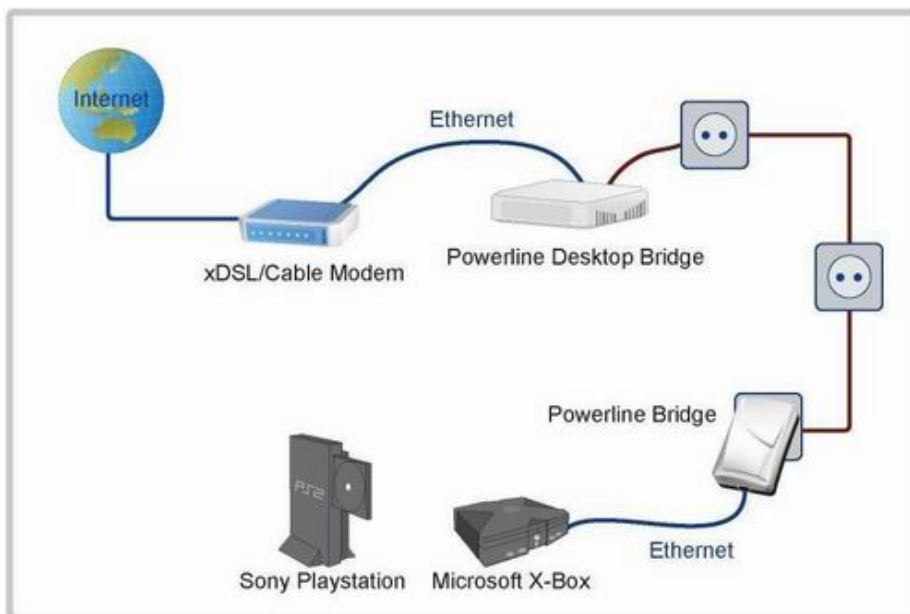


1.2 Application Block Diagram

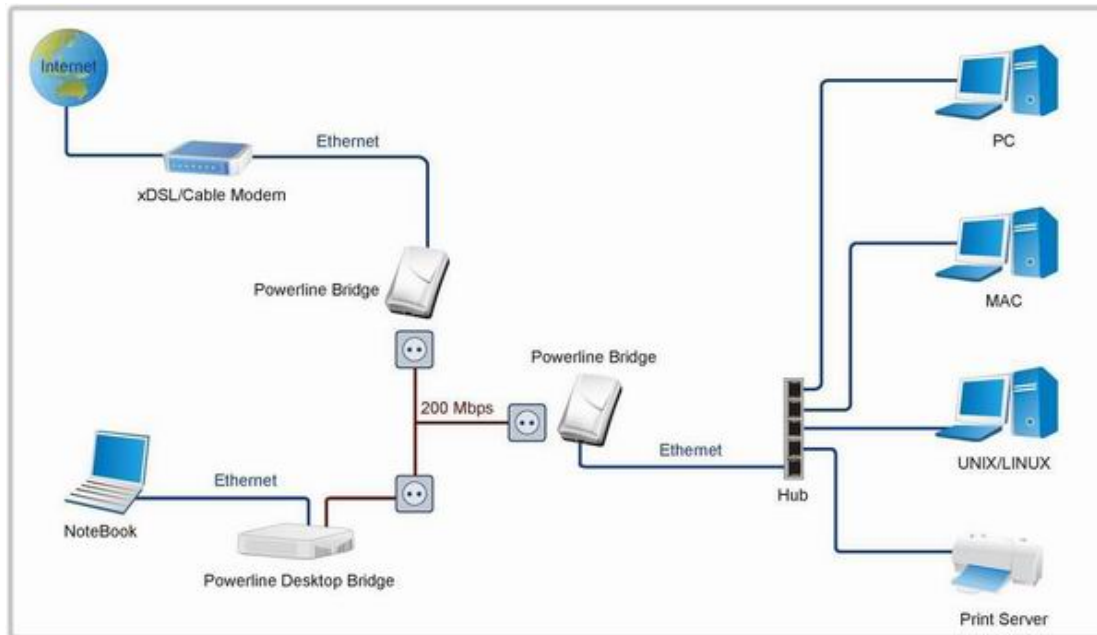
1.2.1 Internet ADSL with one computer via power outlet



1.2.2 Online game via power outlet



1.2.3 Internet ADSL and Home Networking via power outlet



1.3 Benefits

- Data transfers at up to 200 Mbps over the household power circuit
- Ranges of 200 meters
- No need new wires for Home networking
- Deliver the benefits of Ethernet without the wiring expense
- Send even large files between PCs without long waits
- High-speed Internet and DVD-quality video streaming
- Fully compliant with IEEE 802.3, IEEE 802.3u
- Privacy through DES encryption

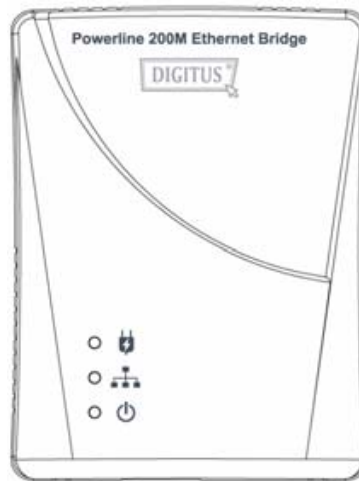
1.4 Features




- Use the home's existing Powerline
- Support coexist with Powerline 85M or 14M bridges
- Easy to install
- Throughout the whole house, just use your power circuit to access the Internet or PC network
- Orthogonal Frequency Division Multiplexing for high data reliability in noisy media conditions
- Integrated Enhanced Quality of Service(QoS) features: Eight levels of prioritized random access, contention free access, and segment bursting
- Up to 200Mbps data rate on Powerline
- Provide 128-bit AES Link Encryption with key management for secure Powerline communications
- LEDs indicate status

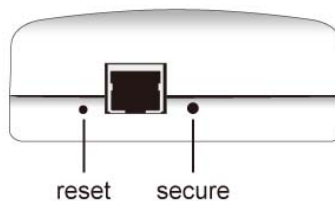
1.5 Package Contents

- Powerline 200M Ethernet Bridge unit
- Powerline Network Management CD
- Quick Installation Guide
- Category 5 cable

1.6 LED Definitions



LED		State	Description
Powerline		ON	Powerline network activity.
		OFF	Search or no Powerline network activity.
Ethernet		ON	Ethernet connection is OK.
		Flashing	Data transfer.
		OFF	No link to Ethernet.
POWER		ON	Power on.
		OFF	Powerline off or failure.



Button	Description
Secure	Button can auto secure and group the Powerline devices.
Reset	Push this button can reset to the factory default settings.

1.7 System Requirements

- Ethernet device
- AC power outlet
- Windows system for encryption setup

2. Powerline Networking Utility

Note

The Powerline Device can auto detect the other Powerline bridges which plug in the same power circuit, you don't need to use this Powerline utility except you want to encryption all the Powerline devices as the same group or you can not access the other computers.

Introduction of Configuration Utility

The Configuration Utility for Windows OS enables the user to find Powerline Ethernet devices on the Powerline network; measures data rate performance, ensures privacy, performs diagnostics and secures Powerline networks.

Configuration Utility Setup

Installation of the Utility

Please verify that no other Powerline Management Utilities are installed before installing this product. If other utilities are installed, uninstall them and restart before installing this software. The utility only support Windows 2000, XP and 2003.

To install, insert the Windows OS Configuration Utility Setup utility CD-ROM into the computer's CD-ROM drive. The Setup utility shall run automatically. Alternatively this can also be done manually by double clicking the setup.exe file on the CD. The CD will launch an installation utility similar to the one shown in *Figure 2.1.1*.

Click the Utility to enter the Utility install page. Please make sure if your windows OS doesn't install the .NET Framework, please install it first, otherwise, the Powerline Utility will work not properly. If already installed the .NET framework, please install the Powerline Utility directly. After that, it will pop up the setup wizard as the Figure 2.1.2, please click the **Next** button to continue.

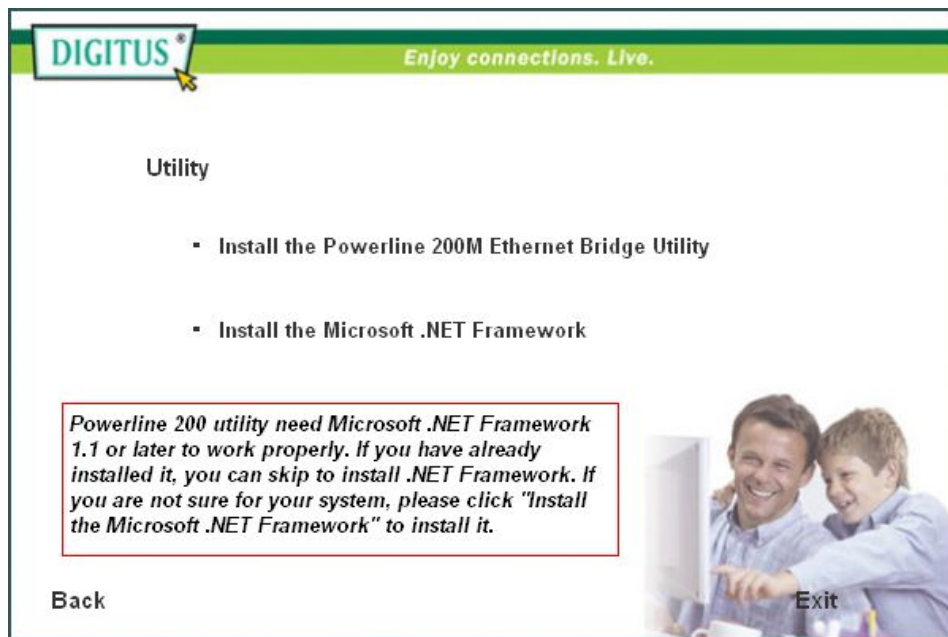


Figure 2.1.1.



Figure 2.1.2.

Common Features of Tabbed Windows

Status Bar

The status bar, along the bottom of each window, contains five fields that provide important network information.

- The first field contains the status of the Device Manager in respect to connection to a Powerline device.

'Connected' indicates a local device has been identified. 'Not connected' indicates no device has been found.

- The read only drop down box of the second field lists the available network adapters found on the system. Use the drop down box to select the appropriate adapter for connection to the local Powerline device.

- The third field lists the MAC Address of the connected node.

- The fourth field lists the firmware version of the locally connected node.

- The fifth field serves as a status indicator for the various download functions of the Device Manager, displaying a progress bar and messages pertaining to the various stages of operation.

This window is an Operation Analysis window that reveals Network information in three categories: CCo Information, Connected STA Information and Topology.

The 'Topology' group shows the TEI, MAC Address, Bridged MAC Address and the transmit (Tx) and receive (Rx) Coded and Raw PHY rates for all nodes on the network (other than the local STA).

The 'Raw' rate is the actual channel bit rate. The Raw rate is determined by carrier bit loading and the applied HomePlug AV Tone Mask which utilizes 917 carriers out of a possible 1155.

With the HomePlug AV Tone Mask applied, the maximum Raw channel rate is approximately 200 Mbps (198 Mbps maximum actual).

[illegible]

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2.2 User Interface - Encryption Tab

This Encryption window is used to set or change the network password on a remote device identified by its DAK password. Clicking the 'Set' button sets the entered passwords. If the DAK password field is left blank, then clicking the 'Set' button will set local device with the entered password. The 'Set Encryption for Remote device' checkbox should be selected to set the Network Password for the remote device.

The Push Button controls box includes the 'Action' drop down box that provides a choice of three actions {Simple Connect, NMK Randomize and AVLN Status} signaled to the device when the 'Simulate Button Push' button is pressed. Additionally, two configuration parameters are exposed in the 'PIB Controls' sub-group box.

Press **Set** button to save the settings.

The screenshot shows the 'Encryption' tab of the 'Powerline 200M Ethernet Bridge 3.0.3032.1116' application. The window has a blue title bar and a menu bar with 'Network Information', 'Encryption', 'Link Information', 'Connection Information', and 'QoS'. The main content area is titled 'Powerline Network Security' and contains three sections: 'Password Setting', 'Push Button', and 'PIB Controls'. The 'Password Setting' section has a 'Network Key to be Set' label, a 'Network Password' text box, a 'Remote Device Access Key' label, a 'Set Encryption for Remote Device' checkbox, a 'DAK Password' text box, and a 'Set' button. The 'Push Button' section has an 'Action' dropdown menu set to 'Simple Connect', a 'Simulate Button Push' button, and a 'PIB Controls' section. The 'PIB Controls' section has a 'Member of AVLN' checkbox checked, a 'Simple Connect Timeout' text box set to '120', a 'Seconds' label, and an 'OK' button. The bottom of the window has a 'Device Selection' dropdown menu set to '00:05:b4:52:8f:9a - L', a 'Copyright @ 2007, All rights reserved.' label, and a 'Close' button. The status bar at the very bottom shows 'Connected', a 'Device' dropdown menu set to 'Device(2b602d02-b96a-4bfc-9alc-', a '00:05:b4:52:8f:9a' label, and an 'INT6300-MAC-3-0-3052-1120-20070816-FINAL-B' label.

Figure 2: Encryption Tab

2.3 User Interface - Link Information Tab

2.3.1. Link Characteristics Box

The context of the link is identified with the Source and Destination address boxes in the Link Characteristics group box. The Source Address defaults to the address of the device selected in the Device Selection box on the lower left of the tab and the Destination Address is selected from a drop down list.

2.3.2. Ethernet Controls

The Ethernet Controls are populated once the Retrieve button is pushed and indicate the PHY settings of both ends of the link.

2.3.3. Control and Statistics Groups

The members of the Statistics group are populated or cleared based on the radio button selection in the Controls group and the pressing of the Execute button. The lower status window provides feedback regarding the processing of the activity.

The screenshot displays the 'Link Information' tab of the 'Powerline 200M Ethernet Bridge 3.0.3032.1116' application. The interface is divided into several sections:

- Link Characteristics:** Contains 'Source Address' (00:05:b4:52:8f:9a - L) and 'Destination Address' (00:05:b4:00:11:eb - R).
- Ethernet Controls:** Contains 'Source Speed' (100), 'Destination Speed' (100), 'Source Duplex' (Half), and 'Destination Duplex' (Half). A 'Retrieve' button is located to the right.
- Controls:** Features two radio buttons: 'Clear Error Statistics' (unselected) and 'Retrieve Statistics' (selected). An 'Execute' button is below them.
- Statistics:** A table displaying various performance metrics.

Statistics	
Avg. Pre-FEC Bit Error Rate	0.00%
Avg. Bits/Carrier	6.51
Avg. SNR/Carrier	17.53dB
Avg. Source PB CRC Error Rate	0.00%
Avg. Attenuation/Carrier	-60.00dB
Avg. Dest PB CRC Error Rate	0.00%
Avg. Output Power/Carrier	-50.00dB

At the bottom, there is a 'Device Selection' dropdown (00:05:b4:52:8f:9a - L), a copyright notice 'Copyright © 2007. All rights reserved.', and a 'Close' button. A status bar at the very bottom shows 'Connected' and a list of device identifiers.

Figure 3: Link Information Tab

2.4 User Interface - Connection Information Tab

The Connection Information window is used to acquire statistics for both transmit and receive operations in the local or remote network.

2.4.1. Connection Select

CSMA : the Destination Address (DA) drop-down menu may be used to select ALL devices or specific devices in the network.

In addition, Channel Access (CA) priority can be defined using the second drop-down menu. The DM allows only certain valid combinations that can be selected by the user. The following table describes the combinations.

Device Selection	Destination Address (DA)	Channel Access priority	Allowed
Local device	All	All	Yes
Local device	Remote device	All	Yes
Local device	Remote device	CA0 or CA1 or CA2 or CA3	Yes
Local device	Local device	Any	No
Remote device	All	All	Yes
Remote device	Local device	All	Yes
Remote device	Local device	CA0 or CA1 or CA2 or CA3	Yes
Remote device	Remote device	Any	No

2.4.2. Transmission and Reception Statistics

The 'Transmission and Reception Statistics' groups return operational data regarding MPDU's and packet data unit handling. Results shown in these fields provide valuable connection quality information.

Transmission Statistics

MPDUs Ack'd	MPDUs sent with SACK received
MPDUs Collided	MPDUs sent with no SACK received
MPDUs Failed	MPDUs sent with SACK 'out of resources' received

Reception Statistics

MPDUs Recvd	MPDUs received and acknowledged
MPDUs Failed	MPDUs not received due to out resources (SACK sent)

The 'Enable Statistics' button is used to acquire the operational data and the 'Clear Statistics' button is used to clear the fields of data. The values shown by the Device manager is a cumulative total of the packet data that was collected from the start of either the 'Enable Statistics' button or the 'Clear Statistics' button click.

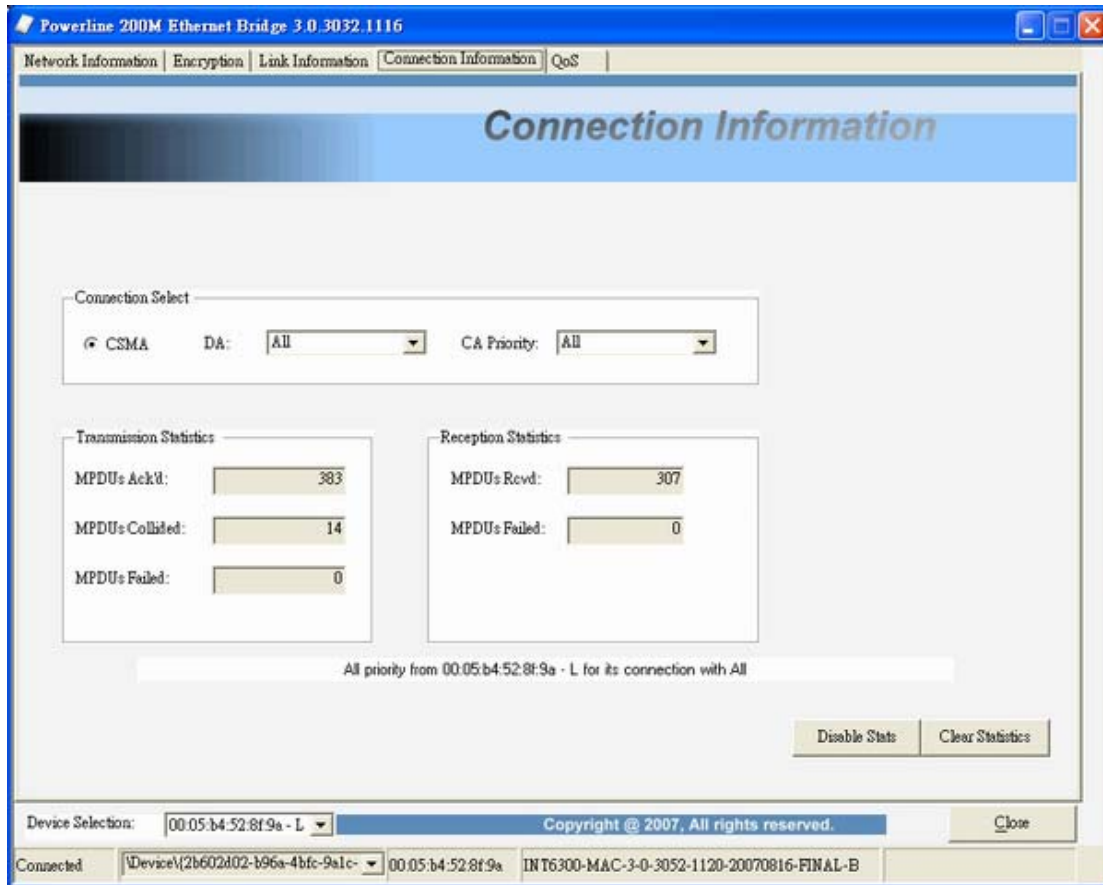


Figure 4: Connection Information Tab

2.5 User Interface - QoS Tab

QoS requirements are different for various data types such as streaming video or music, voice and raw data. To provide higher QoS for streaming data, priority levels can be set using tags at the beginning of data frames. Virtual Local Area Network (VLAN) 802.1p priority tags on Ethernet frames are used to specify 8 (0 – 7) levels of 'user priority'. HomePlug AV powerline allows for 4 levels of Channel Access Priority (CAP (0 – 3)). Therefore, the 8 levels of VLAN Ethernet tags must be mapped to the 4 levels of CAP priority, where CAP 3 is the highest priority and CAP 0 is the lowest. CAP 3 priority might be used for voice and network management frames, CAP 2 is used for streaming video and music while CAP 1 and CAP 0 are used for data. Mapping VLAN tags or TOS bits to CAP levels is easily done using the VLAN Priority Mapping function on the QoS tab window.

2.5.1 List Views

The QoS tab includes two list views to provide simple channel access priority (CAP) classification for individual MAC addresses and IP Ports. There is a collective limit of eight across both lists. No delimiters, colons, or dashes are allowed in the MAC address format.

To write these to the PIB, and other QoS related values found on this tab, the Download PIB checkbox found on the Configuration tab must be checked before exercising the Write button.

2.5.2 Priority Mapping

The 'Priority Mapping' group contains both VLAN and TOS Bit mapping capability. When selected, packets matching the VLAN or TOS Bit priority will be assigned the Powerline contention priority (Channel Access Priority, CAP) as set in the corresponding dropdown box. If a packet has both VLAN and TOS in it, VLAN will override TOS.

2.5.3 Default CAP

The 'Default CAP' group allows for default priority mapping of packets that do not have a VLAN or TOS bit (or if these are disabled). Settings are available for Unicast (directed to a host).

IGMP (default CAP 3):

sets the channel access priority for IGMP frames - these are the group management frames, not the stream data.

Unicast (default CAP 1):

sets the default channel access priority for unicast frames not matching any other classification or mapping.

IGMP managed Multicast Stream (Fixed to CAP 2):

sets the default channel access priority for stream data belonging to a snooped IGMP multicast group.

Multicast/Broadcast - sets the default CAP for multicast frames not in a snooped group and for broadcast frames.

After making CAP settings, clicking the Write button will commit these, along with the values from the Configuration tab, to NVRAM on the connected device.

2.5.4. IGMP

The 'IGMP' group includes controls to disable the query timeouts. Checking the 'Override Defaults' box will enable the other boxes as choices.

2.5.5. Priority TTL Value

The 'Priority TTL Value' determines the life span (Time to live) of each packet in the buffer of the AV device that will be sent over the powerline subsequently. This value can be varied from 10 msec to 65000 msec which can be mapped to different levels of Channel access priority traffic. The default values used are stored in the PIB file as shown below:

CA0 traffic: 2000 msec (used for TCP data traffic)

CA1 traffic: 2000 msec (used for TCP data traffic)

CA2 traffic: 300 msec (used for UDP video/music traffic)

CA3 traffic: 300 msec (used for VoIP traffic)

Intellon highly recommends that the 300 msec and 2000 msec default settings not be changed because they are optimized for the above stated traffic.

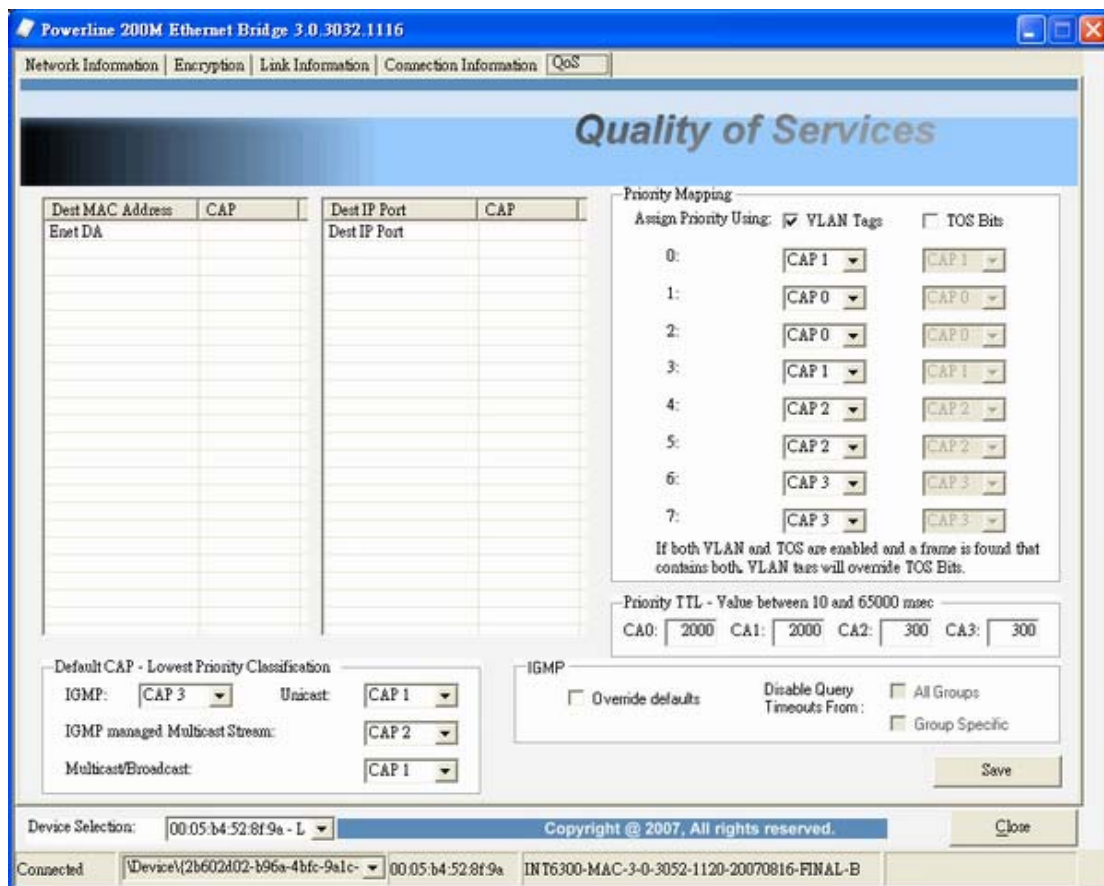
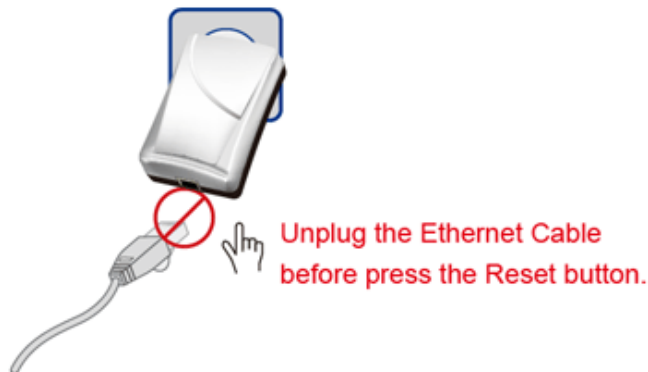


Figure 5: QoS Tab

3. Push Button Setting

There are 2 buttons in this device, one is Reset button the other is Secure button.

Reset: Push this button can reset to the factory default settings. **Be careful, when you press the reset button, please make sure unplug (remove) the Ethernet cable (RJ-45 cable) first, and then press the reset button. After press the reset button (the time need < 3 sec) and then wait the PWR LED light again. Don't power off when the device is in reset process.**



Secure button can auto secure and group the Powerline devices, the follow is the scenario for secure button.

Two Push Button trigger state conditions

“Adder state” for a device providing the NMK for an existing AVLN

“Joiner state” for a device that will join an AVLN

Pushing buttons on any two devices results in one of them becoming an “adder” and the other one a “joiner”

Three possible scenarios

Unassociated device joining an existing AVLN

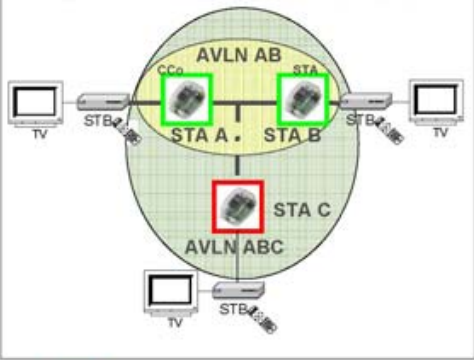
- Two Unassociated devices joining to form a new AVLN
- Special case: one device is a CCo, the other is a STA

Two Associated devices joining to form an AVLN with a new NMK

Possible Use Case Scenario 1: Unassociated device joining existing AVLN


- ◆ STA C wants to join AVLN AB
- ◆ STA A (or B) presses PB < 3 sec
- ◆ STA C presses PB < 3 sec (may precede or follow STA A/B PB)
- ◆ STA A (or B) becomes "Adder"
- ◆ STA C becomes "Joiner"
- ◆ AVLN ABC is formed using NMK of AVLN AB

◆ Existing AVLN with a new Unassociated device added




Assumptions:

- 1) An Associated network consists of at least two Associated devices
- 2) All devices are delivered in matched groupings (preloaded NMK)
- 3) Customer-provided device's NMK is different from Associated NMK



Unassociated NMK Device




Associated NMK Device

Possible Use Case Scenario 2: Two devices joining to form new AVLN

Before this scenario begin, please make sure to press each device secure button > 10 sec till all LEDs re-flash to generate the random network password key first.

- ◆ STA B wants to join with STA A (CCo with pre-existing NMK or a device with higher MAC address)
- ◆ STA A (or B) presses PB < 3 sec
- ◆ STA B presses PB < 3 sec (may precede or follow STA A PB)
- ◆ STA A (CCo or higher MAC value STA) becomes "Adder"
- ◆ STA B becomes "Joiner"
- ◆ AVLN AB is formed using NMK of STA A


◆ Two Unassociated devices forming a new AVLN



MAC address of STA A > MAC address of STA B
or STA A is CCo of former AVLN and STA B is not

Assumptions:

- 1) At least one device has a pre-existing [original] NMK (CCo)
- 2) All devices are delivered in matched groupings (preloaded NMK)
- 3) Customer-provided device's NMK is different from original NMK



Unassociated NMK Device

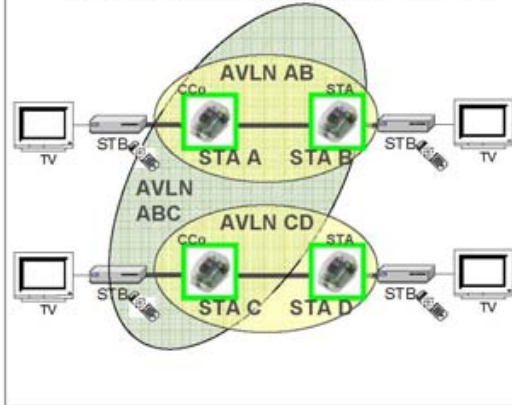
Possible Use Case Scenario 3: Reset

- ◆ STA C wants to join AVLN AB
- ◆ STA C presses PB > 10 sec to reset its NMK to random value
- ◆ AVLN CD is removed; Case 1 scenario exists and implemented
- ◆ STA A (or B) becomes "Adder" (after PB depressed < 3 sec)
- ◆ STA C becomes "Joiner" (after PB depressed < 3 sec)
- ◆ AVLN ABC is formed using NMK of AVLN AB

Assumptions:

- 1) An Associated network consists of at least two Associated devices
- 2) All devices are delivered in matched groupings (preloaded NMK)
- 3) Two distinct and different NMK's exist for AVLN

- ◆ Existing AVLN with a new Unassociated device added



Associated NMK Device

4. Trouble Shooting

1. Why my utility can not work properly after finish install steps?

Ans:

Please follow the steps to check the problem.

1. Check the Control panel for Microsoft .NET Framework install status, if you don't install this, please install it.
2. Reinstall the utility again, you can remove it and reinstall the utility again.

2. What kind of windows OS can install the Powerline utility?

Ans:

Now the Powerline utility only supports Windows 2000, XP and 2003.

3. Why the throughput of Powerline 200M bridge is bad?

Ans:

Please follow the steps to check the problem.

1. Due to the master/slave structure, you need to avoid plugging two Powerline bridge in the same time, so you had better plug the Powerline to the power outlet sequence.
2. Please unplug the Powerline bridge and plug again, please remember plug them in sequence.
Check the Powerline utility and check the throughput again.

4. Why the Powerine 200M device can not work stable?

Ans:

In some respects, User had better to adjust the NB/PC NIC's connection type setting to 100MBaseTx half duplex while connect to powerline 200M device. It will keep the performance to the best status and stable. When user found the link is unstable or not good, please change the NIC's connection type setting to half duplex.