

Integrating the Brookhouse iMux with another on-board network

In this era of technology, many vessels, commercial and pleasure, use an on-board network (LAN) for access to the internet by multiple users via a single gateway, such as a 3G/4G modem for communication with on-shore cellular networks. With a special marine antenna and signal booster, it is not uncommon that internet access is still possible 50km or more off shore.

In most cases the network is created by using a 3G/4G wireless router with cellular modem. iOS devices, Androids, computers can all communicate with the router via wifi or hard-wired ethernet connections and can all access the internet to obtain weather forecasts, to send/receive email and to access many other internet services.

The Brookhouse iMux, used in AP mode (Access Point mode) creates its own separate network and can be simultaneously accessed via wifi in TCP mode by up to 16 iPads, iPhones, Androids and computers to read NMEA data from GPS, AIS and instruments.

Although switching between the vessel's network and the iMux network is simple and quick, it can be advantageous to integrate the two networks and to access the iMux NMEA server through the 3G/4G router. This way, navigation software can access the internet for in-app purchases of charts, grib-files for weather forecasts can be obtained via the internet without having to switch between the 2 access points. All functions are available through the single connection, without the user(s) having to think about it. On larger vessels, computers can receive the NMEA data from the iMux via hard-wired ethernet connections with the router, if they are located too far from the iMux or router for reliable wifi reception.

Integration of the iMux with the vessel's network is possible in two ways:

1. By setting the iMux in "Station Mode" and by joining the vessel's on-board network. In most cases this requires no changes in the router configuration settings.
This method is available in iMux wifi firmware in units shipped since 20/2/2015.
2. With WDS (Wireless Distribution System) bridging. No changes in the default iMux settings are necessary. The iMux works in AP mode. The router has to support WDS.
This method has been available since introduction of the new iMux Mk3, July 2013.

Joining another network in Station Mode.

Background

Although technically the iMux Mk3 firmware has always supported station mode (for joining other networks), this feature was not made available to users so far for the following reason:

Wifi devices can usually be configured for either access point mode or station mode. An embedded wifi module that fully relies on wifi for configuration settings, can become completely inaccessible if an error is made while setting it in station mode. If the smallest mistake is made in IP address or security password, the connection to the other network/router cannot be established. The device is rejected each time it attempts to associate with the network and there is no way the settings can be corrected as AP mode is no longer active to access the internal configuration webpage.

Wifi devices like routers often also have an ethernet port which can be used for configuration, but this is not the case for embedded wifi devices.

We have overcome this problem in the iMux in the latest firmware version, by allowing dual mode operation. If the iMux is configured for Station Mode, to join another network, the AP-mode (access point mode) also remains active, for re-configuration via the internal configuration webpage. The NMEA server can also still be accessed in AP mode.

The maximum of 16 simultaneous TCP sessions is for combined client connections directly to the iMux network and via the router.

Important: If the iMux has been configured for Station Mode and the network to be joined is not available, performance of the NMEA server may be reduced if AP mode is used and large amounts of data are being transmitted. The constant attempts to join the other non-existing network take processing power and can cause interruptions in data transfer.

This situation may occur if the router is switched off when sailing offshore, to save battery power. Use a browser (e.g. Safari on an iPad) to go to the iMux wifi configuration webpage and set the mode back to AP mode only. The parameters for joining the vessel's network are not affected and all it takes to re-activate station mode later on is tapping "Join another network" on the webpage and "save".

IP addressing

The IP address of the iMux in AP mode is 192.168.10.99, the subnet mask is 255.255.255.0. This means that the subnet address is 192.168.10. If the iMux is to join another network, the other network's subnet address has to be different. It is unlikely that a router's subnet (LAN) address will be the same. Common router default subnet addresses are 192.168.0 or 192.168.1, so a conflict is usually not to be expected.

For accessing the iMux NMEA server via a router, it has to have a static IP address that can be specified in the app as the host address. If the iMux IP address is assigned automatically by the router's DHCP server from the pool of available addresses, we cannot be certain what it is and what the app should use as host address.

Not all routers handle static IP addresses in the same way. Three commonly used techniques are:

1. If the static iMux address has a subnet address that matches the router's, the address is accepted and the association process is completed. This is the most common method and requires no settings in the router.
2. The static address specified by the iMux has to match a static address defined in the router in a "static IP addresses table".
3. The iMux does not specify a static address (DHCP is selected). The router maps the iMux MAC address to a static IP address. The iMux MAC address can be found on the internal configuration webpage.

It is recommended to choose a static iMux address that cannot potentially conflict with an IP address automatically assigned by the router's DHCP server.

Example: The router's DHCP IP address range is 192.168.1.10 - 192.168.1.50. Set the static iMux IP address to e.g. 192.168.1.99.

iMux wifi configuration for joining another network

This can be done using a computer, any iOS device or an Android. A Windows 7 computer was used for the example below.

1. Find out the router's subnet (LAN) address and security key.
2. Join the iMux network. Enter the unique iMux WPA2 key Brookhousexxxxxxx. Wait until connected.
3. Start a browser. Enter IP address 192.168.10.99 in the address bar.
4. User name and password are requested.
Enter wifiuser as user name, wifipw as password.



5. The iMux internal configuration webpage is displayed.
Select "Join another network"

Brookhouse wifi User settings

☒ **AP Mode:**
Access Point - All settings are preconfigured

☐ **Join another network:**

Own MAC Address	AC:CF:23:31:49:7D	
AP's SSID	othernetwork	Search...
MAC Address (Optional)		
Security Mode	WPAPSK ▼	
Encryption Type	AES ▼	
Pass Phrase	keyothernetwork	
	STATIC (fixed IP) ▼	
Own IP Address	192.168.1.20	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.1.1	
DNS		

Save

Cancel

For the setting to become effective click on Restart button

Restart

6. Enter the fields: Own IP address, Subnet Mask, Default Gateway

Click or tap "Save"

Click or tap "Search" to display networks in range.

Brookhouse wifi User settings

☐ **AP Mode:**
Access Point - All settings are preconfigured

☒ **Join another network:**

Own MAC Address	AC:CF:23:31:49:7D	
AP's SSID	othernetwork	Search...
MAC Address (Optional)		
Security Mode	WPAPSK ▼	
Encryption Type	AES ▼	
Pass Phrase	keyothernetwork	

STATIC(fixed IP) ▼

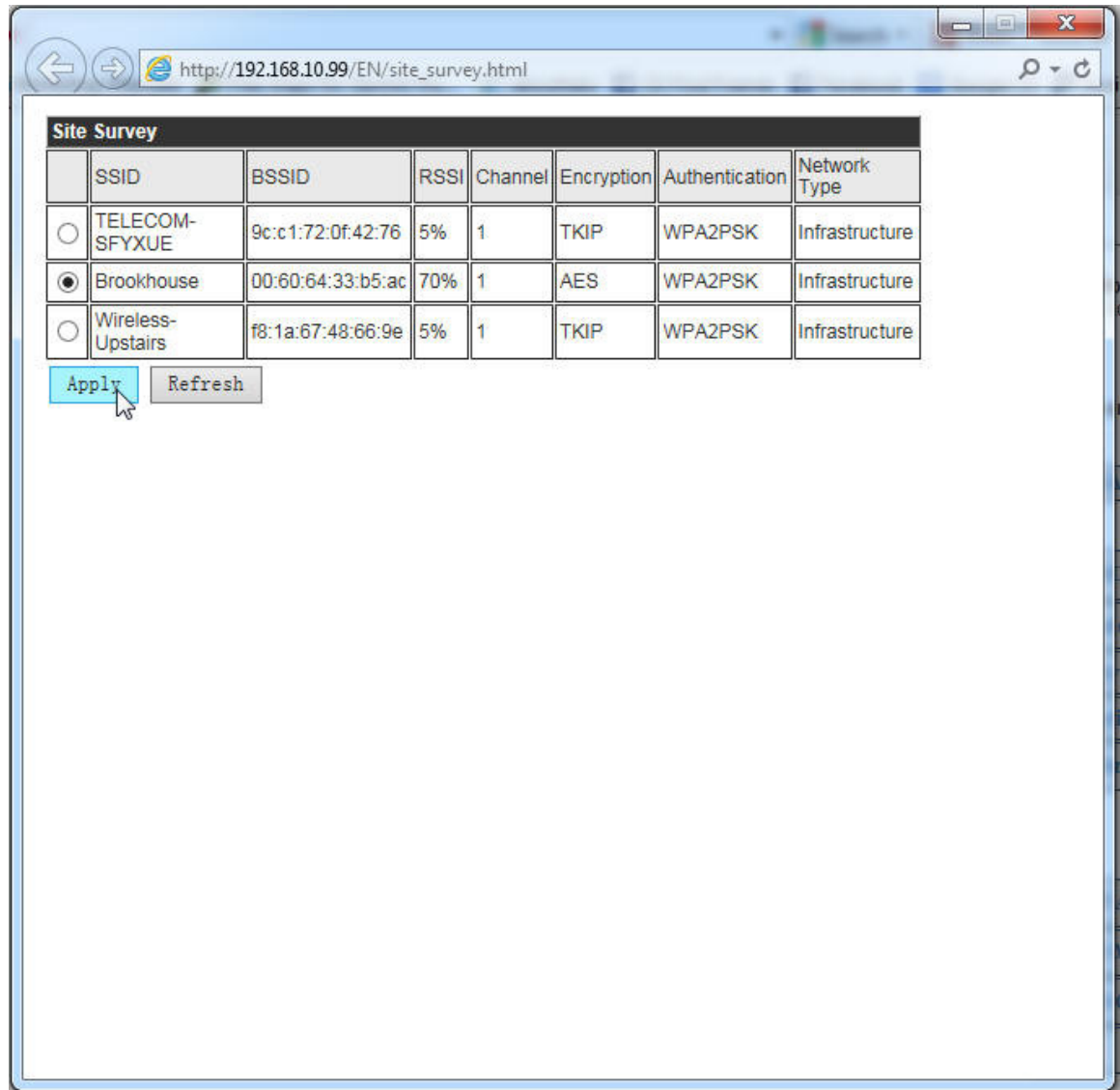
Own IP Address	192.168.1.20
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS	

SaveCancel

For the setting to become effective click on Restart button

Restart

7. A separate window with APs in range appears.
Select the SSID of the network to join and click or tap Apply"



8. Click or tap OK.

Brookhouse wifi User settings

☐ **AP Mode:**
Access Point - All settings are preconfigured

☒ **Join another network:**

Own MAC Address	AC:CF:23:31:49:7D	
AP's SSID	Brookhouse	Search...
MAC Address (Optional)		
Security Mode		
Encryption Type		
Pass Phrase		
		STATIC(fixed IP) ▼
Own IP Address		
Subnet Mask	255.255.255.0	
Default Gateway	192.168.1.1	
DNS	8.8.4.4	

SaveCancel

For the setting to become effective click on Restart button

Restart

8

9. Enter the security key (Pass Phrase)
Click or tap Save

Brookhouse wifi User settings

☐ **AP Mode:**
Access Point - All settings are preconfigured

☒ **Join another network:**

Own MAC Address	AC:CF:23:31:49:7D	
AP's SSID	Brookhouse	Search...
MAC Address (Optional)		
Security Mode	WPA2PSK ▼	
Encryption Type	AES ▼	
Pass Phrase	samplepassphrase	

STATIC(fixed IP) ▼

Own IP Address	192.168.1.20	
Subnet Mask	255.255.255.0	
Default Gateway	192.168.1.1	
DNS		

Save

Cancel

For the setting to become effective click on Restart button

Restart

10. Click or tap Restart

Brookhouse wifi User settings

☐ **AP Mode:**
Access Point - All settings are preconfigured

☒ **Join another network:**

Own MAC Address	AC:CF:23:31:49:7D	
AP's SSID	Brookhouse	Search...
MAC Address (Optional)		
Security Mode	WPA2PSK ▼	
Encryption Type	AES ▼	
Pass Phrase	samplepassphrase	

STATIC(fixed IP) ▼

Own IP Address	192.168.1.20
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS	

SaveCancel

For the setting to become effective click on Restart button

Restart

11. From now on the iMux will always try to automatically connect to network "Brookhouse", but its own SSID Brookhouse_iMux_xxxx will still appear as an AP to access the configuration webpage.

With the example settings, a total of 16 Windows computers, Macs, iOS devices and Androids can access the NMEA data stream of the iMux NMEA 0183 server in 2 ways:

1. By joining network "Brookhouse"
In apps (e.g. iNavX), enter 192.168.1.20 as "Host"
Port 10110
TCP
2. By directly joining iMux network Brookhouse_iMux_xxxx
In apps (e.g. iNavX), enter 192.168.10.99 as "Host"
Port 10110
TCP

WDS (Wireless Distribution System) bridging

This integration method does not require any changes in the default iMux wifi settings. It can be used for all iMux Mk3 units. WDS has to be supported by the router.

Configuring the router for WDS can best be shown with an example.

We used TP-Link for testing at Brookhouse, but there are other routers that support WDS. All that needs to be done is setting the iMux SSID and WPA-2 key in the WDS settings. The connection between router and iMux is automatically established by the router.

TP-LINK® 3G Wireless N Router
Model No. TL-MR3020

Wireless Settings

Wireless Network Name: (Also called the SSID)

Region:

Warning: Ensure you select a correct country to conform local law. Incorrect settings may cause interference.

Channel:

Mode:

Channel Width:

☒ Enable Wireless Router Radio

☒ Enable SSID Broadcast

☒ Enable WDS Bridging

SSID(to be bridged):

BSSID(to be bridged): Example:00-1D-0F-11-22-33

Key type:

WEP Index:

Auth type:

Password:

Wireless Settings Help

Note: The operating distance or range of your wireless connection varies significantly based on the physical placement of the Router. For best results, place your Router.

- Near the center of the area in which your wireless stations will operate.
- In an elevated location such as a high shelf.
- Away from the potential sources of interference, such as PCs, microwaves, and cordless phones.
- With the Antenna in the upright position.
- Away from large metal surfaces.

Note: Failure to follow these guidelines can result in significant performance degradation or inability to wirelessly connect to the Router.

Wireless Network Name - Enter a value of up to 32 characters. The same Name (SSID) must be assigned to all wireless devices in your network.

Region - Select your region from the pull-down list. This field specifies the region where the wireless function of the Router can be used. It may be illegal to use the wireless function of the Router in a region other than one of those specified in this field. If your country or region is not listed, please contact your local government agency for assistance.

Channel - This field determines which operating frequency will be used. It is not necessary to change the wireless channel unless you notice interference problems with another nearby access point. If you select auto, then AP will choose the best channel automatically.

Mode - If all of the wireless devices connected with this wireless router can connect in the same transmission mode(eg. 802.11b), you can choose "Only" mode(eg. 11b only). If you have some devices that use a different transmission mode, choose the appropriate "Mixed" mode.

Channel Width - The bandwidth of the wireless