PilotAware Upgrades

'FLARM-IN' via LXNav FlarmMouse

This Information Sheet is designed to assist owners to make the most of their PilotAware by adding **Direct Flarm Detection** so that gliders and other Flarm Traffic can be displayed via the user's Navigation System Display outwith the coverage area of the PilotAware/OGN-R 'Rebroadcast' network.

The upgrade focuses on fitting and connecting an LXNav FlarmMouse to PilotAware. A similar result can be achieved using other Flarm devices, and due to Flarm's policy of standardising connections between devices, the method of connection will be broadly similar, **but care MUST be taken, - especially to check that you have identified the correct pins and wires before making connections.**

The information is provided on the basis that the user has a reasonable knowledge of electrical practice and procedures and will read through all instructions carefully before proceeding. No liability will be accepted by the Author or the PilotAware Team for incorrect connection, bad electrical practice on the part of the installer, or for any changes made by the equipment manufacturers. If you are unsure, please ask for advice on the PilotAware Forum www.forum.pilotaware.com before proceeding. It may also be appropriate to consult your aircraft inspector.

PARTS LIST

- LXNav FlarmMouse (any version) - See separate information sheets for other devices
- USB - RS232 Cable (FTDI USB - RS232 - WE - 1800 - BT_0.0 cable recommended, or alternatively the longer (5 metre) FTDI USB - RS232 - WE - 5000 - BT_0.0)
- Flat 6-core Data Cable with 6-pole RJ12 Connector (See Part 2)
- Heat-shrink sleeving in sizes to fit individual wires and full cables
- 6-pole RJ12 Female to Female Connector (unless using a 4-way or second 2-way splitter)
- Short USB extender cable, unless already running a PilotAware GPS Mouse, (see Part 3)

TOOLS

- Wire Stripper or Craft Knife
- Small Pliers / Side Cutters
- Small Soldering Iron (not essential)
- Heat Gun or lighter (to shrink heat-shrink sleeving)
- Small Multi-meter or low voltage electrical continuity tester

PART 1 - Layout and Installation

The LXNav FlarmMouse along with its Splitter and Power Supply must be installed as described in the installation manual supplied with the unit. In particular, the unit needs to be installed 'Right Way Up' and with a clear view of the sky to ensure it can get a good GPS fix. The antenna should be as near vertical as possible and again must have as clear a view all round as possible, though if not practicable, concentrate on ensuring a good clear view to the front of the aircraft. The power supply (6-18 Volts DC) must be protected by a 3 Amp fuse, which should be separate from fuses protecting any other essential equipment. If your device was supplied with a 2-way Splitter, the connection to PilotAware is best carried out by attaching a suitable USB-RS232 to RJ12 Data Cable to the Splitter using a 6-pole Double Female RJ12 Connector in place of the intended connection to an external Flarm Display, as shown in **Figure 1** (below).
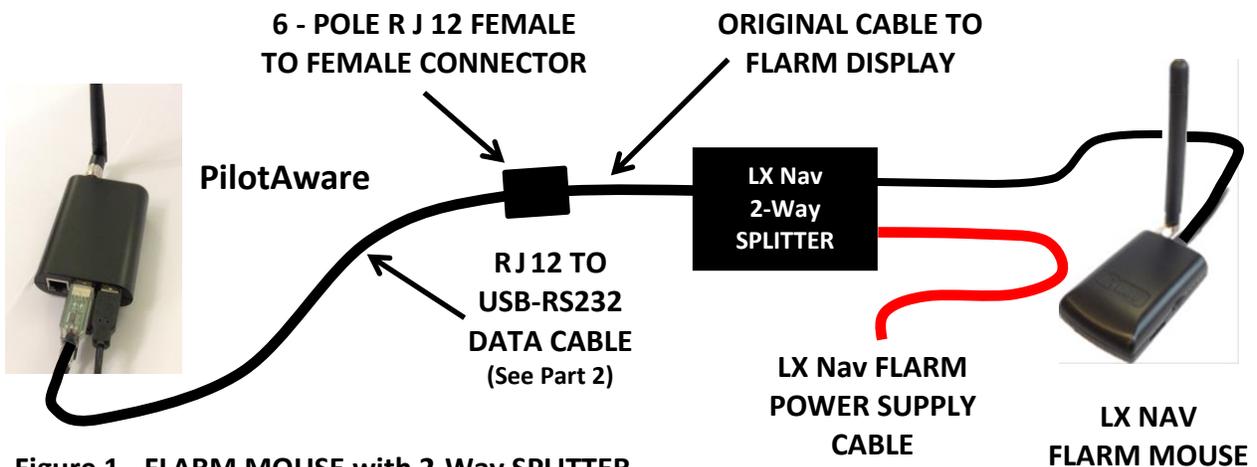
6 - POLE R J 12 FEMALE TO FEMALE CONNECTOR   **ORIGINAL CABLE TO FLARM DISPLAY**

PilotAware

LX Nav 2-Way SPLITTER

R J 12 TO USB-RS232 DATA CABLE (See Part 2)

LX Nav FLARM POWER SUPPLY CABLE

LX NAV FLARM MOUSE

Figure 1 - FLARM MOUSE with 2-Way SPLITTER

If your device was supplied with a new type 4-way Splitter or you wish to include a separate Flarm Display as well as PilotAware, you should connect the devices as shown in **Figure 2** (below), using the new type 4-way splitter. Alternatively, you can achieve the same result by inserting an extra 2-way splitter in series between the original 2-way splitter and the RJ12 to USB cable in place of the female to female connector shown in Figure 1.
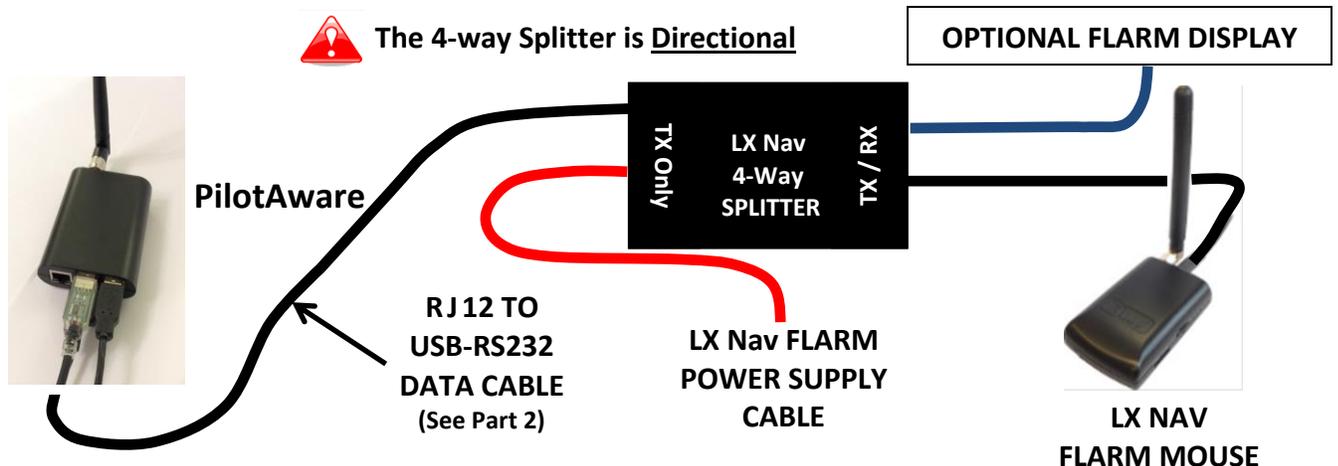
⚠ **The 4-way Splitter is Directional**   **OPTIONAL FLARM DISPLAY**

PilotAware

TX Only | LX Nav 4-Way SPLITTER | TX / RX

R J 12 TO USB-RS232 DATA CABLE (See Part 2)

LX Nav FLARM POWER SUPPLY CABLE

LX NAV FLARM MOUSE

Figure 2 - FLARM MOUSE with 4-Way SPLITTER

PART 2 - Construction of the RJ12 RS232 to USB Data Cable

2.1 FTDI USB-RS232 Cable

R J 12 to USB Data Cables are NOT commercially available, but can be constructed fairly easily by several different methods. The simplest is to purchase a USB to RS232 cable such as FTDI USB - RS232 - WE - 1800 - BT_0.0 (see right), or the 5 metre version FTDI USB - RS232 - WE - 5000 - BT_0.0, both of which come with bare wire ends, - and join the two appropriate wires from this cable to the correct two wires in a length of flat 6-core data cable terminated in a 6-pole R J 12 plug. This new 'combined' RJ12 RS232 to USB Data Cable can then be connected to the Splitter supplied with the FlarmMouse by either of the methods shown in Section 1. The USB end of the cable will be connected to the 'spare' USB Port on the PilotAware (See Section 3).

Unfortunately, a fairly high percentage of cables on sale via the internet reported to contain FTDI chips are fakes. To avoid the possibility of paying full price for fake 'chips', you are advised to purchase FTDI cables from a reputable supplier, such as RS Components or CPC Farnell (see links at end of document). Also be aware that the cable **MUST** be USB to RS232 **Serial Level** - TTL level cables will **NOT** work.

Having obtained the cable, you will see that it comprises a small circuit board contained within a clear housing attached to the USB plug, which handles the RS232 to USB data conversion and has two LED function indicators to indicate **'RED Flashing'** - Data being Transmitted (Not used in this application) and **'GREEN' Flashing**' - Data being Received - which is what we are looking for here. The other end of the cable comprises a set of six (6) insulated coloured wires, with pre-tinned bare ends. For the purpose of this project we will only be using the **BLACK** (**Ground**) and YELLOW (**Receive Data**) wires in the **FTDI Cable**. The other wires must be suitably insulated from each other, by for example the use of fine electrical heat-shrink sleeving shrunk onto each individual wire. It is recommended that you do not cut these wires off in case you might want to use them later.

2.2 R J 12 Flat Data Cable

Assuming you have bought a 'standard' 6-core flat data cable with 6-pole R J 12 connectors on both ends, the simplest way to proceed is to check what overall length you will need once this cable is connected to your FTDI cable then cut the relevant length from one end of the flat data cable, leaving the RJ12 plug in place. (This saves having to attach an RJ12 plug to data cable, which requires the purchase of a special tool.) When checking the overall length, remember to allow a few centimeters 'spare' to make the connections between the two cables. When cutting the data cable, it is useful to leave at least a short length of cable attached to the 'waste' end plug, as this can then be used as a 'tail' for checking electrical continuity before making the connections.

Having cut the data cable to length, carefully cut back the outer insulation to expose the insulated wires inside, but be careful not to cut through any of these wires.

The next stage of the process is to identify the correct wires in the 6-core data cable which we require and strip the wire ends. The pin numbering and other wiring details are included in Section 5 of the LXNav FlarmMouse Manual, but I have repeated the pin numbering here for ease of identification in case the colours in your cable(s) are different from standard. For this application, the two pins and associated wires we are interested in are **Pin 3 - Ground** - and **Pin 4 - Data Out** RS232 transmit line. You <u>could</u> use Pin 6 for the Ground, but as this is also used for the Ground of the 12 Volt supply, it's probably safer to keep clear of this and use Pin 3. For the purpose of this article, I will assume you are using Pins 3 and 4.

**RJ12 Plug
(From Pin Side)**

<u>Pin numbering</u> and functions <u>should</u> be standard throughout the full range of FLARM equipment and accessories, but be wary of using <u>wire colours alone</u> to identify continuity through the whole data cable assembly, as we have found some cables with reversed plugs and '3rd party' cables may use 'non-standard' wire colours. It is therefore **<u>ESSENTIAL</u>** to check cables and continuity carefully with a multimeter or continuity tester before making connections.

Having cut your data cable to length, you should be able to identify the colour of the individual wires attached to the relevant pins by looking carefully at the plug. If in any doubt, check with a multimeter or low-voltage continuity tester before making any connections. Having identified the correct wires within the cable, you can now carefully strip a small section of insulation from each of the two required wires. The other wires, which are not required, should be insulated from each other with heat-shrink sleeving the same as we did with the RS232 cable.

You are now almost ready to assemble the RJ12 RS232 to USB Cable, but before doing so, it is wise to carry out a final continuity check through the splitter system. The easiest way to do this is to utilise the spare cable 'offcut' to take the place of the FlarmMouse. Strip back the cut end of the cable and identify and note down the colours of the two wires connected to Pins 3 and 4 in the plug. Now connect this cable to the splitter. Connect the cut end you are going to use to the other side of the splitter system. Now use your multimeter or continuity tester to carry out a final check to ensure that you have a clear connection between the two ends of your **Pin 3 - Ground** wires and your **Pin 4 - Data Out** wires. You can now remove the 'temporary' cable from the FlarmMouse end and are in a position to safely make the connection between the prepared Data Cable and the RS232 Cable.

2.3 Connecting and Insulating the Cables

It is now a simple matter to connect the two sets of wires together, **but before doing so**, slip a couple of lengths of larger diameter heat-shrink sleeving well along one of the cables away from the joint site. These will be used to close and seal the final joint later. You should also cut two short lengths of smaller heat-shrink sleeving and slip one as far back as possible along each

of the Black and Yellow wires on the FTDI cable. These will be slipped forward again to seal and insulate the two individual wire joints before finally sealing the cable.

Now we come to actually connecting the cable. In my experience, this is best achieved by placing each pair of bare wires together in an 'X' and then twisting them 'gently but firmly' together in opposite directions. **DO NOT OVERDO THIS OR THEY <u>WILL</u> BREAK!**
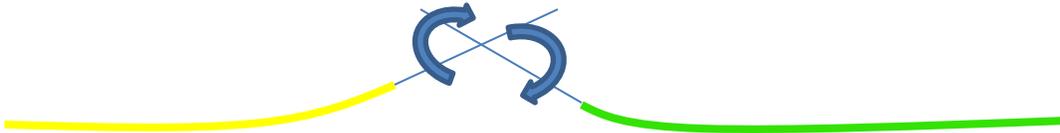
<u>REMEMBER</u> WE ARE CONNECTING:

YELLOW **Data IN** to PilotAware   **to**   **Flarm Data OUT** from FlarmMouse
(Yellow in standard FTDI cables)   (possibly but not definitely **Green**)

and

Ground from PilotAware   to   **Ground** from FlarmMouse
(**BLACK** in standard FTDI)   (possibly but not definitely **Red**)

For increased security and electrical integrity, once the joints have been mechanically twisted together, the application of <u>a very small amount of solder</u> will permanently secure the joints, but BE CAREFUL. Applying too much heat will make the wires brittle and may also shrink the heat-shrink sleeving before you have time to move it properly into place. To minimize this risk, carefully blow the joint to cool it as soon as the solder has taken.

Once you are happy with the joints, move the heat-shrink sleeving into place and shrink it by the careful application of heat. If you have not soldered the joints, this should still be enough to ensure a good electrical connection provided the heat-shrink sleeving fits tightly enough. Now carefully mesh all the wires together then slide the larger heat-shrink sleeving back over the complete joint, shrinking the first layer carefully into place and allowing it to cool before adding the second. You are now ready to connect and set up your units.

Part 3 - Connecting and Setting Up

⚠️ **Before connecting the new cable, make sure that <u>both</u> devices are powered down or turned off.**

3.1 Connecting to the FlarmMouse

This is simply a matter of connecting the RJ12 Connector on your new Data Lead into the spare port in the Flarm Splitter as shown in **Figures 1 or 2**. Remember that if you already have your FlarmMouse connected to an external Flarm Display, it is still possible to connect to your PilotAware at the same time by using a 4-way or additional 2-way splitter. If you wish to do this, make sure you use a splitter supplied by LXNav. Alternatively, splitters supplied by a UK supplier called 'Navboys' also work, but those made by LX Navigation for extending their 'Red Box' to a second FLARM display <u>do NOT carry the 12 volt connection needed to power the FlarmMouse</u>.

3.2 Connecting to PilotAware

Run the cable safely and carefully between the two devices, making sure it can't affect flying controls or other essential apparatus or equipment and secure it as necessary along the route. Finally, connect the USB Plug into the spare USB port on your PilotAware. Looking towards the rear of the unit, with the Ethernet Port on the Left, this will normally be the Top Left Port - **This is <u>USB PORT 1</u>.**

⚠️ **Note:** If you are still using the standard PilotAware GPS dongle in Port 3, you will need to place it on a short USB extender cable to create enough space to plug the new lead into Port 1 as they will not both fit alongside each other. If you are already running a PilotAware Remote GPS Mouse this will not be necessary as both plugs will fit comfortably alongside each other.
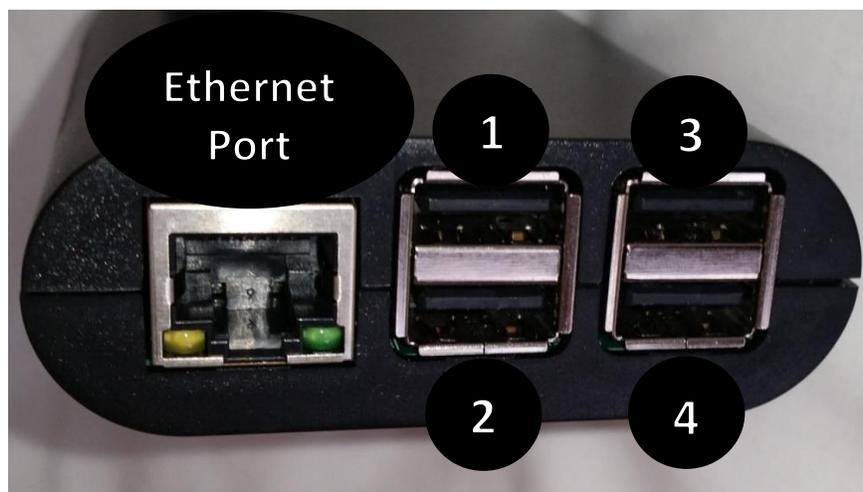
Now double-check your connections and the Port Number. If all is OK you are now ready to configure your PilotAware.

3.3 Configuring PilotAware for Flarm-In

The following instructions assume you have connected the Flarm-IN lead to **Port 1** on the PilotAware. If this is **not** correct, you must apply them by replacing [Port 1] in these instructions with the number of the Port to which the lead <u>has</u> been connected.

- Power up PilotAware as normal. Connect to your PilotAware WiFi, then go to the PilotAware **'Configure'** Page via 192.168.1.1

- Go to **USB Settings**, near the bottom of the page.

- From the available options in the **[Port 1]** left hand drop down menu, select **'Flarm-IN'**

- From the available options in the **[Port 1]** right hand drop down menu, select **'19200'** (Baud)

- Check that you have not accidentally changed any other configuration settings and then click the **'Save'** button at the bottom of the page to save the settings.

- Now simply power up the FlarmMouse and once it establishes a GPS fix and starts transmitting, wait for gliders or other Flarm equipped aircraft to appear.

- You should **NOT** need to make any specific configuration adjustments to the FlarmMouse to cater for PilotAware, though you should follow the standard Flarm Configuration Procedure and may also wish to register your unit (and Hex ID) with FlarmNet and the OGN.

Part 4 - Future USB Updates Warning

Be aware that you should <u>NOT</u> use a USB Port which has been configured for ADSB-OUT or Flarm-IN to connect a memory stick for future software updates via USB as this is likely to corrupt any data held on the memory stick. You should instead temporarily disconnect the GPS dongle or mouse and use that port instead. Do NOT remove the PAW WiFi dongle while the unit is powered up.

Part 5 - Purchasing Links for USB – RS232 Cables

http://uk.rs-online.com/web/p/kvm-mixed-cable-assemblies/6877828

http://cpc.farnell.com/ftdi/usb-rs232-we-1800-bt-0-0/cable-usb-a-rs232-serial-convertor/dp/SC14067

Any feedback or suggestions for improvement to this document would be much appreciated. Please PM me via the Forum.

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