NMEA-splitter

The manual

Rev 0.2

avionics@skyracer.net

Description

The NMEA-splitter is a highly configurable contraption to share information from a RS232 source, for example a GPS, to several devices. With a FLRAM splitter it´s easy to use a single GPS-source for several devices such as transponders, FLARM-display and Oudie.

Since the splitter is configurable by the user, usage is done at own risk. Please note that great care has been put into making a safe design and the splitter has been extensively tested in order to make a safe product.

If you want to skip the technical details and go straight to configuration: see pages 7 to 9

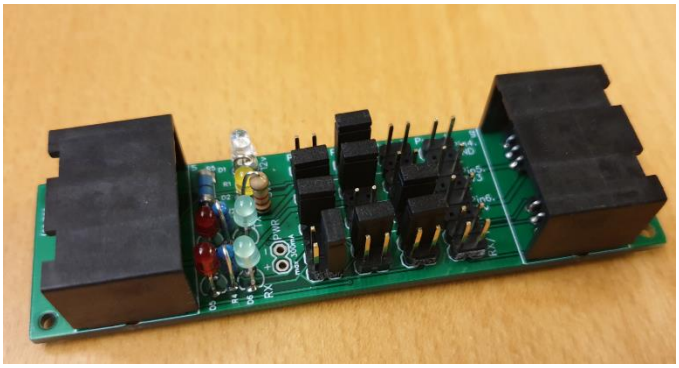
Design philosophy

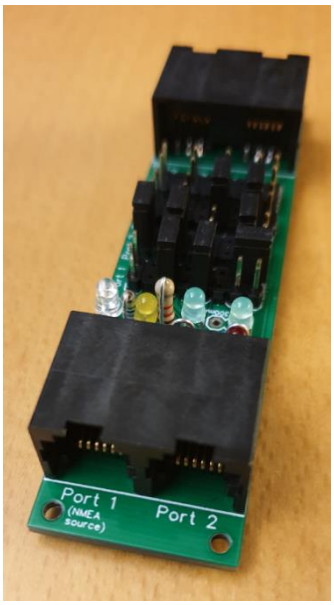
A serial interface consists of three major parts; TX, RX and GND. TX is the output from a device, RX is the input to the device and GND is the common ground. Additional signals (CTS, RTS) can occur but the mentioned above are the most common when it comes to NMEA.

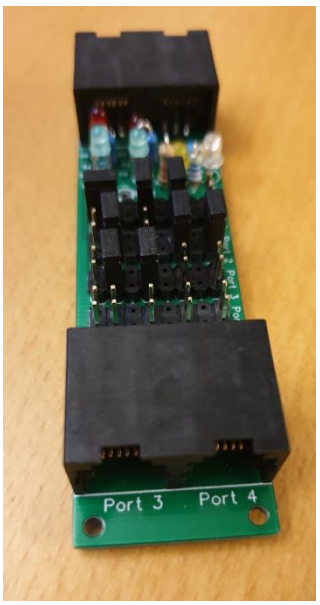
This interface can come in different modes but the most common are TTL and RS232. TTL is used in close proximity to microprocessors (Raspberry Pi, Arduino, Micropython etc.) and spans from 0 to 3,3 volts or 0 to 5 volts (0 = 0 v, 1 = 3,3v or 5v). Often TTL is used within a device or on a PCB, but when it comes to communication between different devices RS232 is used instead since it is more resilient against interference. In a RS232 interface the voltage spans often between -8,5 and +8,5 volt (0 = -8,5v, 1 = +8,5v).

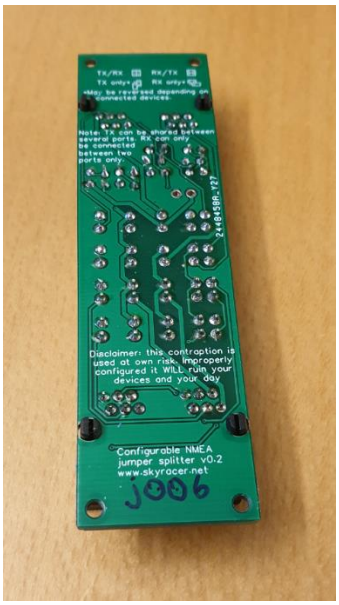
NMEA is a standardized protocol within maritime electronics, autopilots and GPS receivers. The nominal communication speed according to the NMEA 0183 standard is 4800 baud, but the default baud rate for FLARM is 19200 baud although up to 57600 baud are common.

The catch with splitting serial signals to several devices is that the RS232 is by design a two-way communication between two devices only. However, with the proper configuration other devices can intercept parts of the communication. To be technical: TX from a NMEA source can be connected to several “listening devices”. But only one TX from the “listening devices” can be connected to RX on the NMEA source. With the NMEA-splitter this can be achieved quite easily and the intention of this manual is to explain how this can be achieved.







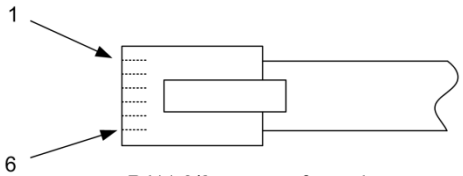


Pictures of the prototype

The details

The port 1 shall be connected to the NMEA-source. The NMEA-listeners shall be connected to port 2 – 4. The RJ11 connectors uses the same pin-configuration as FLARM-units.

Pin	Function
1	GND
2	Flarm: RX, Butterfly: TX
3	Flarm: TX, Butterfly: RX
4	GND
5	+3,3v
6	+12v



RJ11 6/6, as seen from above

Note 1: the numbering of the pins in the IGC-standard does not match the ISO 8877 standard which is used in the rest of the world. Just to be clear, this manual and the NMEA-splitter complies with the ISO 8877 standard when it comes to the pin numbering. However, the functionality of each individual pin matches the IGC-standard.

Note 2: pin 5 is generated by the FLARM and is intended to power FLARM-displays and Butterfly displays.

Note 3: pin 6 provides power to FLARM-devices. Some models of FLARM-units can when powered from another source, also provide power on Pin 6.

Note 4: All of the units connected to the splitter has to share the same baud rate.

The PCB is fitted with connectors in order to provide power to the devices. Please note that it´s not intended for high power consumers. Max 300 mA is recommended.

The PCB has some LED:s to give you an indication about the connectivity of the device on port 1.

LED	Function
+12v	The PCB is fed by 12 volts.
+3v	The device on port 1 is generating +3 volts power
TX	Green: the device on port 1 is connected to the serial transmitting port. Red: the device on port 1 is sending information
RX	Green: the device on port 1 is connected to the serial listening port. Red: the device on port 1 is receiving information

The R5 resistor is a zero ohm resistor is a protector for the 3 volt current from the port 1 device. If the current is too large the resistor will be destroyed instead of the device. The resistor is optional yet highly recommended. If no resistor is mounted you need to connect the two pads with a jumper.

List of material

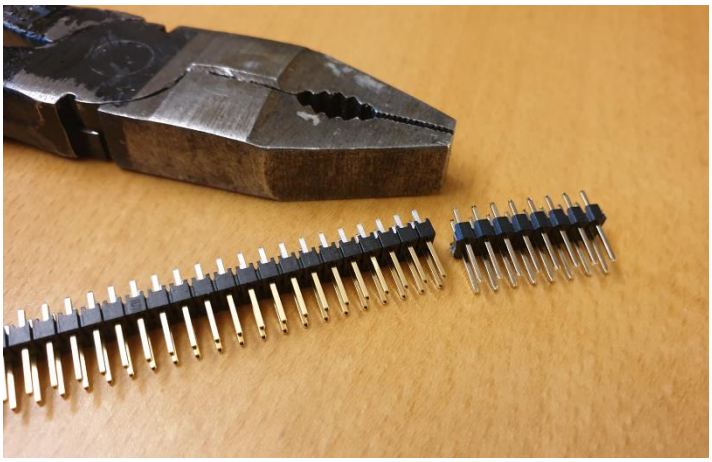
The NMEA-jumper splitter can be bought as a self-assembly kit. This is the list of components.

Designator	Name	Ammount
R1	47k	1
R2	1k2	1
R3, R4	3k3	2
R5	0R	2
n/a	Jumpers	20
n/a	2 x 36 pin headers	1
U1, U2	Dual RJ11 connector	2
D1	Blue led	1
D2	Yellow led	1
D3, D5	Red led	2
D4, D6	Green led	2
n/a	The splitter PCB	1

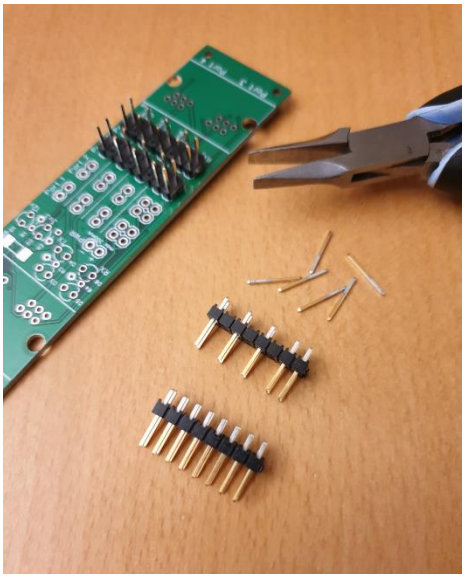
Assembly

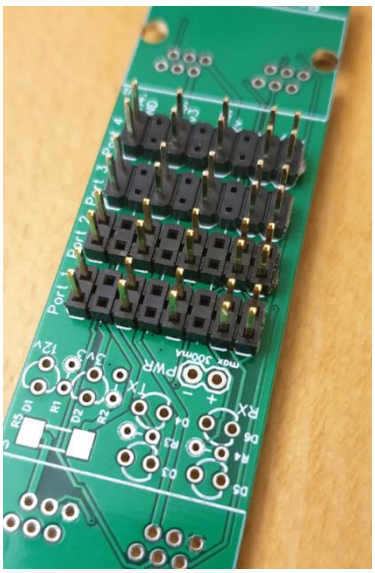
1. Important: Be sure to read and understand the instructions of step seven (7) before executing step 2. Failure to do so may be painful.

2. Start with dividing the jumper banks into 8 x 2 pins using a plier.

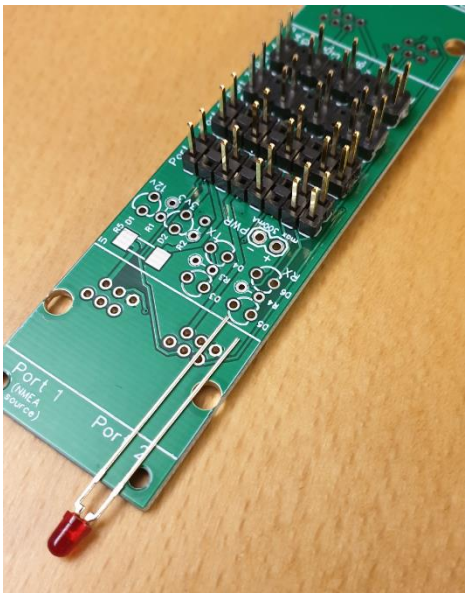


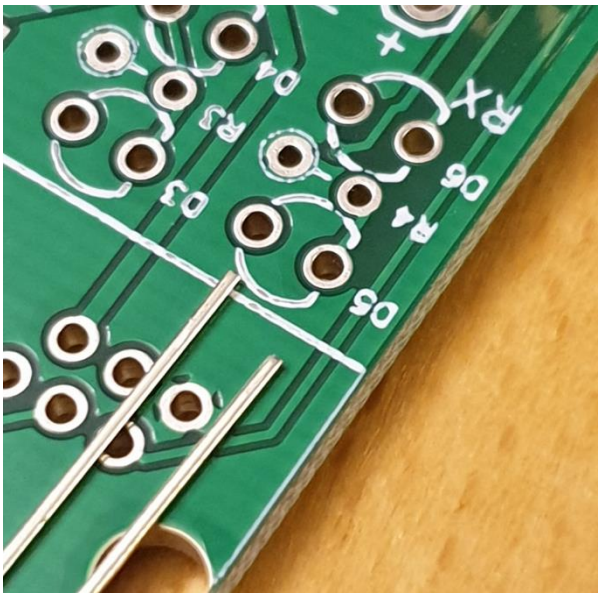
3. Remove pins from the jumper banks in order to make it fit on the PCB. Then solder the jumper banks to the PCB.

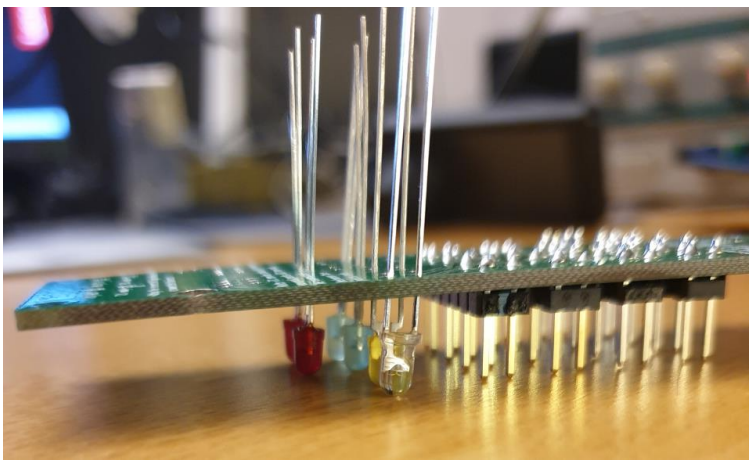


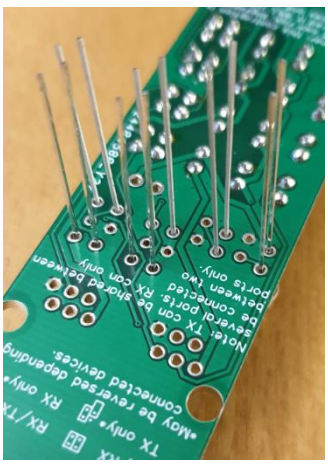


4. Place and solder the LEDs. D1 = blue, D2 = Yellow, D3 and D5 = Red, D4 and D6 = Green
Note, the shorter pin of the LED shall be placed on the flat side of the symbol.

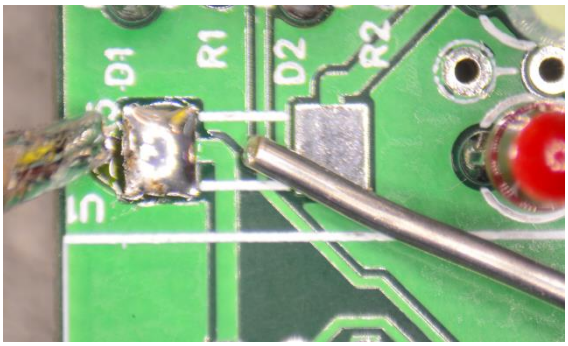


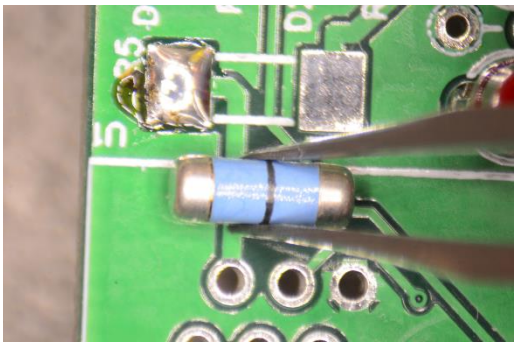
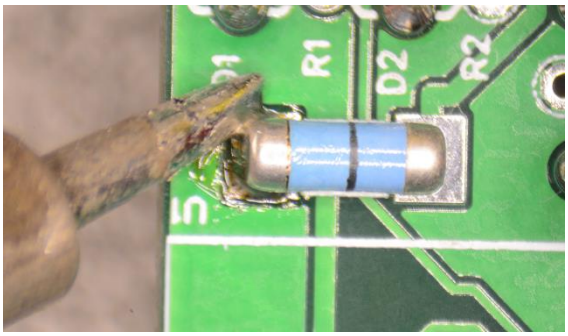


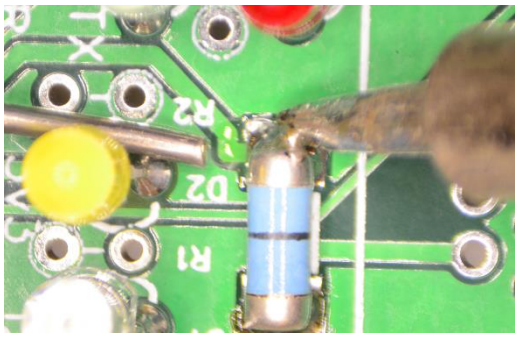




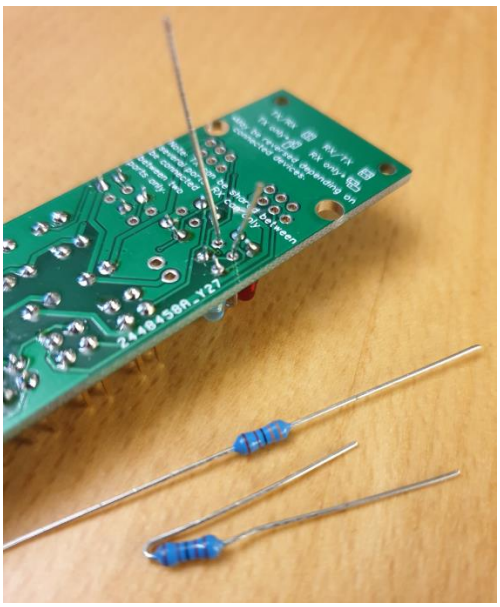
5. Put some solder on one of the pads of R5. Place the 0 (zero) ohm resistor in place while heating the pad with the soldering iron. When the resistor is in the right place, remove the soldering iron and let the resistor stick as the solder hardens. Thereafter solder the other end of the resistor



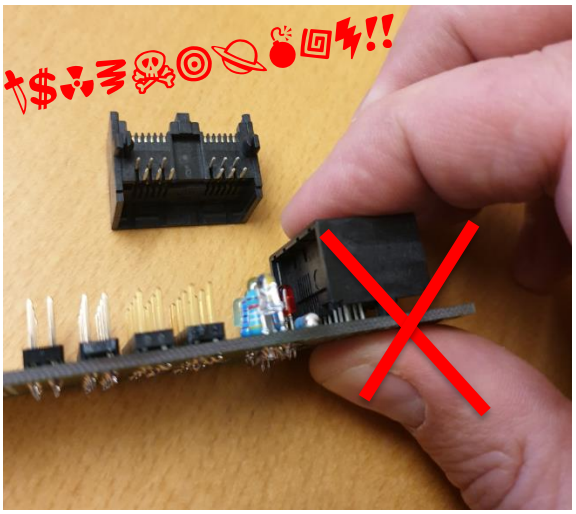



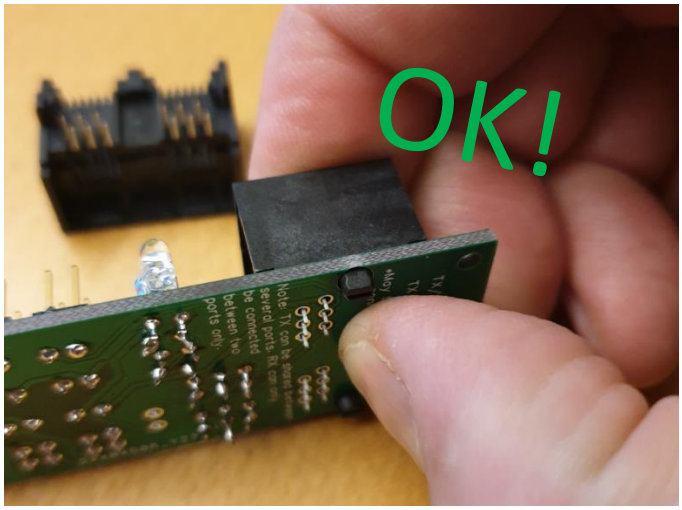


6. Place the resistors and solder them. R1 = 49k, R2 = 1k2, R3 and R4 = 3k3



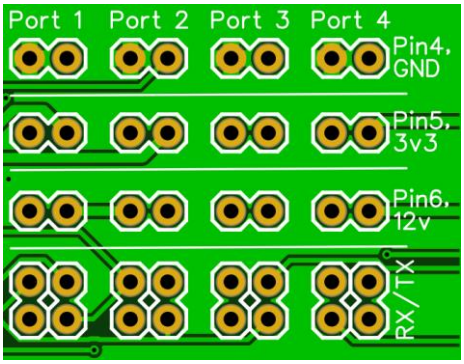
7. Put the RJ11 connectors on the PCB. Note: Be careful otherwise you will punch holes in your thumb.





Configuration

The NMEA-splitter has four banks of jumpers that sets the functionality, one bank for each port. In turn each bank is divided in to rows which has separate function. The reason for the space in-between the rows is that a single jumper never can cause short circuit by simply misconfiguration.



Picture of the banks and rows.

Pin4, GND

Pin 4 on the RJ11 connector is providing FLARM-displays with ground connection. This jumper shall be set when a FLARM-display is connected to the port.

Pin5, 3v3

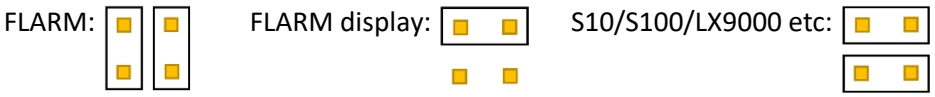
Pin 5 on the RJ11 connector is providing FLARM-displays with power from the FLARM. This jumper shall be set when a FLARM-display is connected to the port.

Pin6, 12v

Pin 6 on the RJ11 connector is providing power. This jumper shall be set if you want to power a device via the RJ11 connector. It can be a source such as a flight computer (LX9000, S8, S100 etc.), or a device that need to be powered (FLARM).

RX/TX

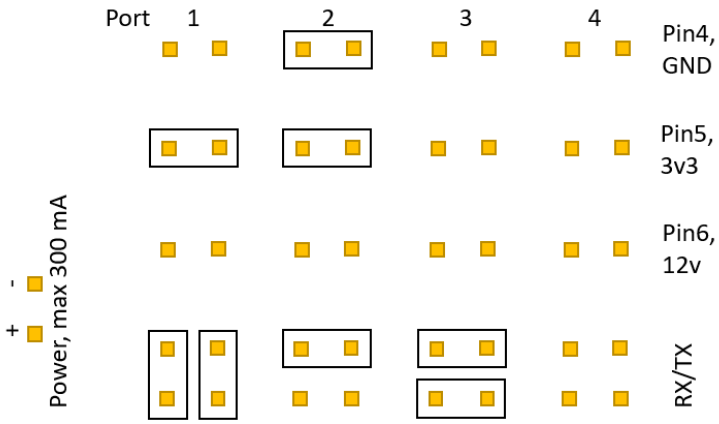
These are connected to the pin 2 and 3 on the RJ11 and determines whether NMEA shall be sent to, received from or both to the device connected to the port. The shortcut to obtain the basic functionality the jumpers shall be set to different positions:



If this setting is not working or you want to know the details, please follow the guide “Normal vs Goofy tutorial” on page 10.

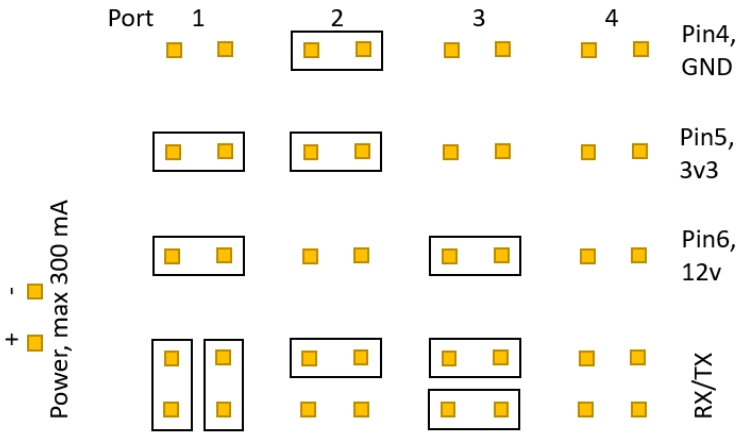
Example 1

In this example a FLARM is connected to port 1, a FLARM-display is connected to port 2, a LX Nav S10 on port 3 and the fourth port is empty. In this case the FLARM is not powered via the NEMA-splitter.



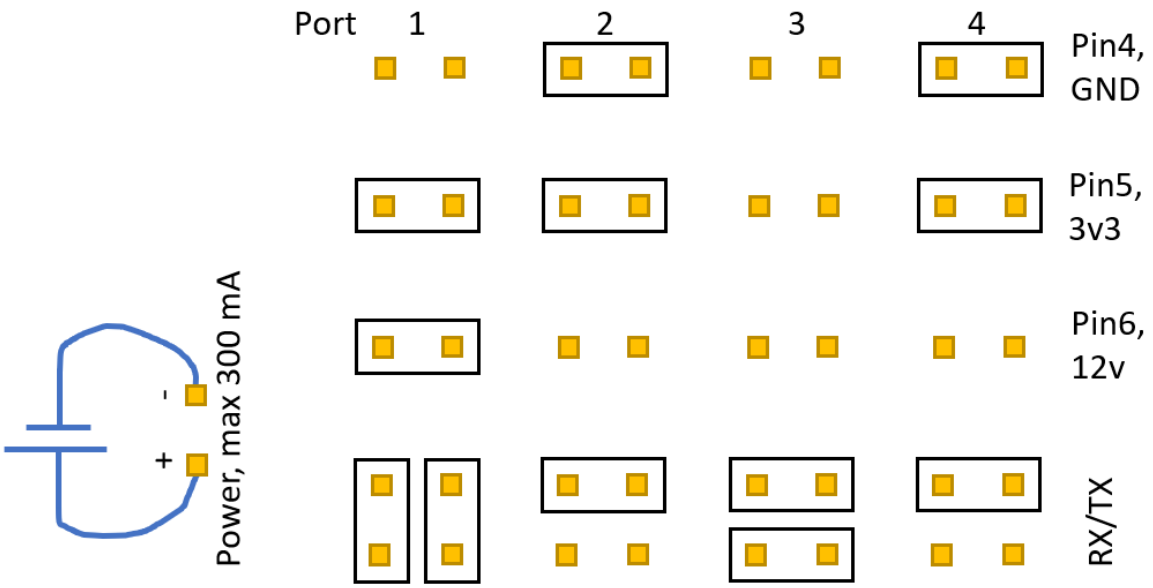
Example 2

In this example a FLARM is connected to port 1, a FLARM-display is connected to port 2, a LX Nav S10 on port 3 and the fourth port is empty. In this case the FLARM is powered by the S10 via the NEMA-splitter.



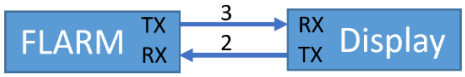
Example 3

In this example a FLARM is connected to port 1, a FLARM-display is connected to port 2, a LX Nav S10 on port 3 and in the fourth port is a secondary FLARM-display connected. In this case the FLARM is powered by connecting a battery to the NEMA-splitter.



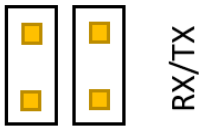
Normal vs goofy tutorial

This tutorial is a guide to find out if a device is “normal” or “goofy” and most cases a FLARM is connected to a display via a straight RJ11 cable. This means that the FLARM has TX on pin 3 and RX on pin 2 and the display has TX on pin 2 and RX on pin 3.



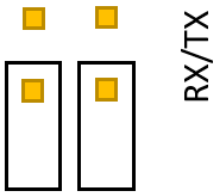
In this example above, the FLARM is defined as “normal” and the display “goofy”. In order to find out if your devices are normal or goofy, please follow the guide:

1. Connect a FLARM port 1 and set the RX/TX jumpers on bank 1 as follows. Make sure the FLARM is powered.



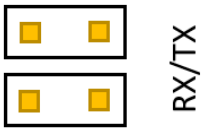
   Then the greed LED of TX is illuminated steadily and the red flash once every second. The LEDs of RX is dark.

2. Set the jumpers of bank 1 “on hold” like this.



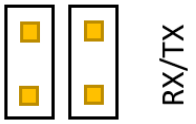
   Now TX ceased to be illuminated.

3. Connect the device you would like to test to port 2 and make sure it is powered*. Set the jumpers like this:



Then the green LED of RX is illuminated steadily and the red flash once every second. The LEDs of RX is dark. By this we can conclude that the device in port 2 is “goofy”.

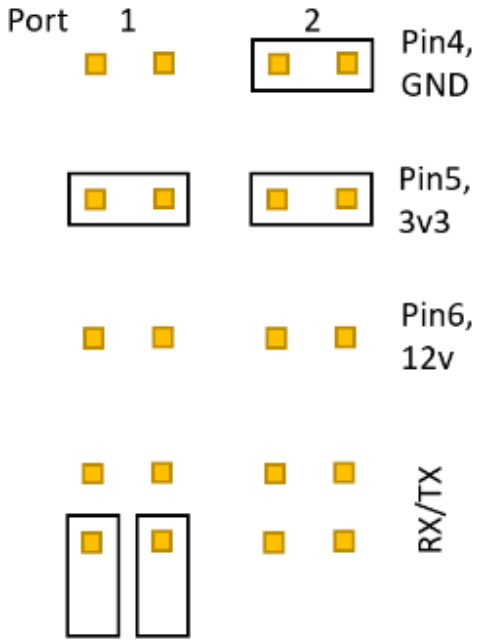
But if instead the green LED of TX is illuminated steadily (and the red is flashing), then the device is “normal”. Set the jumpers like this:



If the green RX is illuminated then its confirmed to be the “normal”.

In case neither the green of TX or RX is illuminated when the jumpers are set, please check if the unit is powered and plugged in to port 2 and that the jumpers are set on the correct bank.

**Note: if the device is a FLARM-display, you need provide it with power from the FLARM. Set jumper “Pin 5, 3v3” on bank 1 and 2 as well as “Pin4, GND” on bank 2. Like this:*

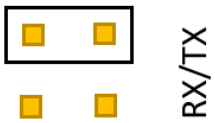


(Jumper banks for port 3 and 4 are excluded from the picture above.)

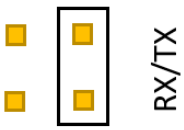
4. Once the “normal” and “goofy” is established, the next task is to decide if the device shall exchange information with the FLARM or if it only shall listen to the FLARM. For example, a FLARM-display is not sending any information to the FLARM unlike a Oudie or a navigation computer like S8, S100 or LX9000 which shall able to exchange information with the FLARM.

   In order to exchange data with the FLARM both of the jumpers shall be left in place. Listening devices shall one of the jumpers be removed as follows:

   For “goofy” devices, remove the lower jumper resulting in a setting like this:



   For “normal” devices, remove the left jumper resulting in a setting like this:



   Please note that when the jumper is removed, the LED of RX shall cease to be illuminated.

Miscellaneous

Credits to Vic Fieger for the curses font on page 7.

Version history

Revision	Date	Comment
0.1	2021-02-04	First revision
0.2	2021-02-15	Added the list of materials