XCStick User Manual

Manual edition 1.12

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1. Description

The XCStick is an ergonomic Arduino SW based with USB connection and emulates an USB keyboard.
It features a wired USB connection for a stable and latency free connection, has a low power consumption, and mostly works by plug and play with optimized default key bindings. Two software loads, one for XCSoar and one for LK8000 are available.

The system which is manufactured in large numbers is not expensive, comes readily built up and tested, is an excellent add-on for XCSoar, LK8000 or with custom key bindings also for other navis that support USB keyboards, and keeps being extensible by open source software and can easily adapted to other systems.

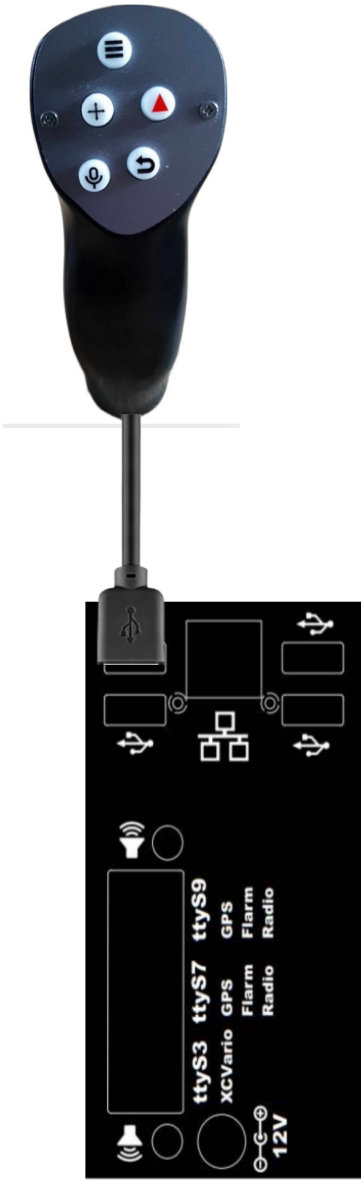
2. Features

- Beech wood or Black Walnut wood remote stick
- 1 meter dual twisted pairs PTFE 28 awg wire
- Silicone keypad with silkscreen printed buttons
- Works with XCSoar, LK8000 (4 custom programmable key bindings)
- Open Source Arduino programmable (https://github.com/iltis42/XCStick/)
- OTA upgradable
- USB 2.0 Type male Usb Jack with screw Terminal Plug
- Almost no latency
- Fit's for almost any stick sizes
    - 19.3mm (DG, LAK, Schempp-Hirth)
    - 20mm (LS, Stemme, Apis, EB29)
    - 24mm (Schleicher, Pipistrel Taurus, Alisport Silent, EB28, JS3)
    - 25.4mm (JS1)
    - Other diameters ask

3. Overview

The following overview shows the embedding of the XCStick in the cockpit environment.

The standard case is the connection with XCTouchNav or similar gadget featuring an USB interface. Any of the USB ports types 2.0 or 3.0 are possible. Recommended is to use one of a USB 2.0 e.g. as provided on rear side of the XCTouchNav connector field.

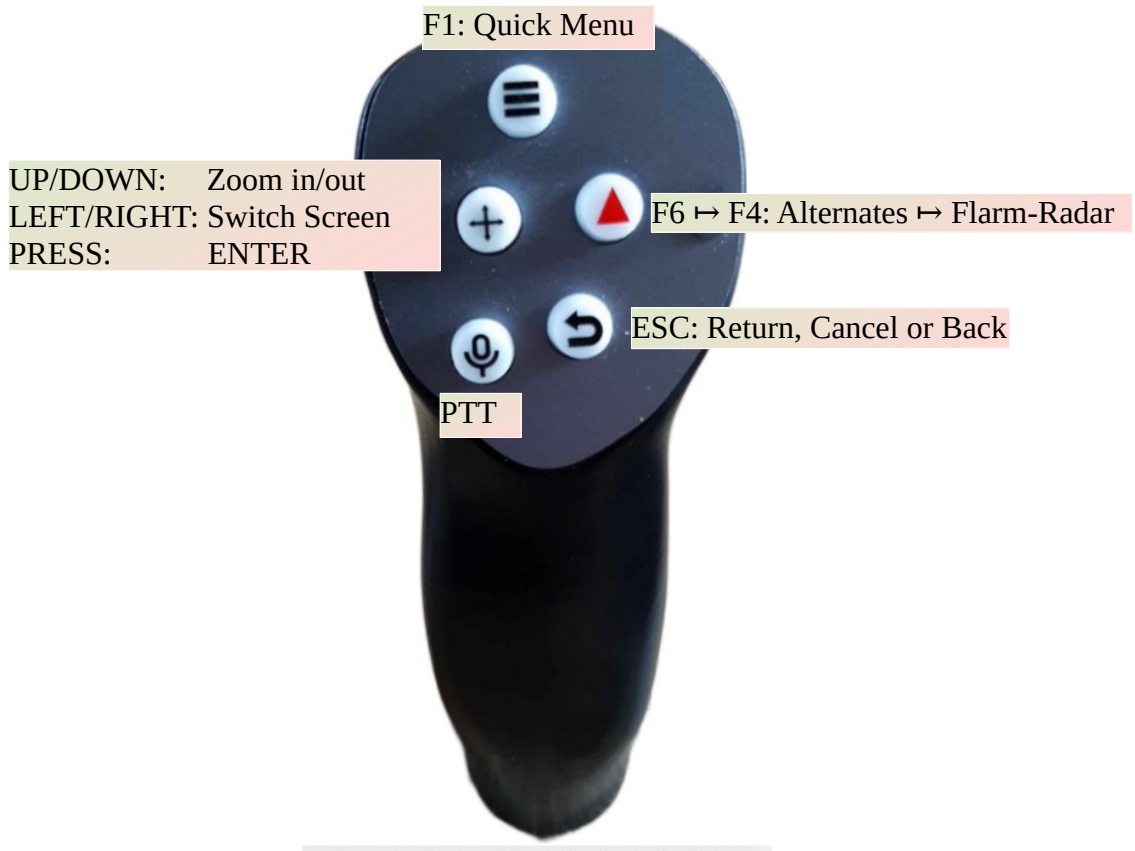


4. XCSoar Keys

The following table shows the keys that are sent. The JOY_.. keys are originated from the 5 joy-stick way switch in the middle left.

```
const byte button_table[][7] = {
//  I/O Button      key first press   second    third   fourth press,  keylongPress
  { 38, TOP_CENTER, KEY_F1,           KEY_ESC,  0,      0,             KEY_ESC },
  { 10, RH_MIDDLE,  KEY_F6,           KEY_ESC,  KEY_F4, KEY_ESC,       KEY_ESC },
  { 12, RH_LOWER,   KEY_ESC,          0,        0,      0,             KEY_ESC },
  { 37, STF,        'S',              'V',      0,      0,             0 },
  { 35, JOY_UP,     KEY_UP_ARROW,     0,        0,      0,             0 },
  { 33, JOY_LEFT,   KEY_LEFT_ARROW,   0,        0,      0,             0 },
  { 34, JOY_RIGHT,  KEY_RIGHT_ARROW,  0,        0,      0,             0 },
  { 36, JOY_DOWN,   KEY_DOWN_ARROW,   0,        0,      0,             0 },
  { 0, JOY_PRESS,   KEY_RETURN,       0,        0,      0,             0 }
};
```

The uppermost button opens the Quick Menu to access almost any function that is needed in flight. The red triangle toggles between Alternates and Flarm-Radar screens, as long a GPS signal and Flarm signal is available. The return key will exit from the any menu that is entered. The Joystick zooms the map, switches between the configured screens and provides the enter key. The S2F switch might be connected to the sticks S2F connector on the PCB and will then sent 'S' or 'V' to the navi.

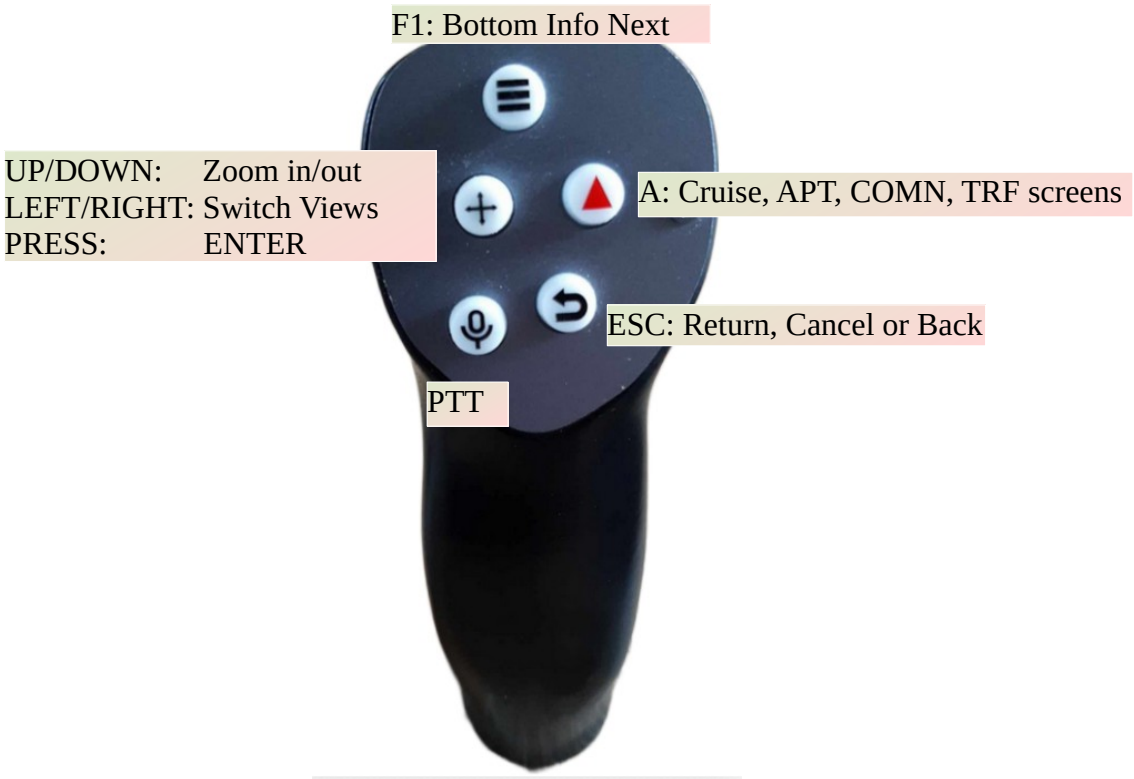


5. LK8000 Keys

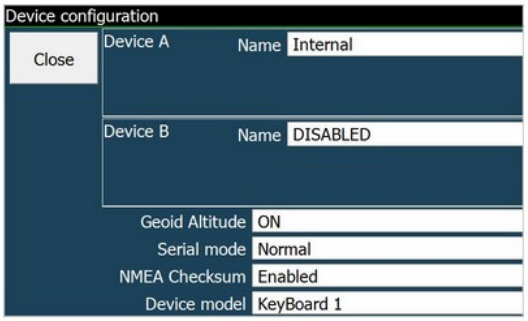
The following table shows the keys that are sent. The JOY_.. keys are originated from the 5 joy-stick way switch in the middle left.

```
const byte button_table[][7] = {
//  I/O Button      key first press   second    third   fourth press, keylongPress  // Symbol
  { 38, TOP_CENTER, 'X',              0,        0,      0,            '1' },      // bottom info right / custom 1
  { 10, RH_MIDDLE,  'A',              0,        0,      0,            '2' },      // alternates        / custom 2
  { 12, RH_LOWER,   KEY_ESC,          0,        0,      0,            '3' },      // menu / escape     / custom 3
  { 37, STF,        'S',              'V',      0,      0,            0 },
  { 35, JOY_UP,     KEY_UP_ARROW,     0,        0,      0,            0 },
  { 33, JOY_LEFT,   KEY_LEFT_ARROW,   0,        0,      0,            0 },
  { 34, JOY_RIGHT,  KEY_RIGHT_ARROW,  0,        0,      0,            0 },
  { 36, JOY_DOWN,   KEY_DOWN_ARROW,   0,        0,      0,            0 },
  { 0, JOY_PRESS,   KEY_RETURN,       0,        0,      0,            '4' }       // enter       / custom 4
};
```

The uppermost button shifts the bottom info fields of LK8000. The red triangle toggles between Cruise, APT (airport), COMN (task) and TRF (traffic) screens. The return key will exit from the any menu that is entered. The Joystick zooms the map (Up/Down), circles through the different views (Left/Right) and provides the enter key.

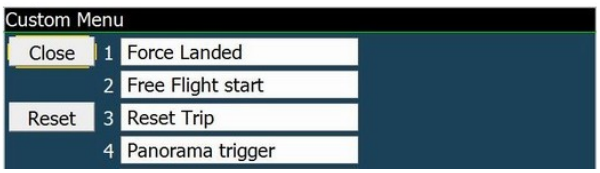


The settings for keyboard 'Device model', see also manual here: LK8000 keyboard setup, is to be set to "XCREMOTE" instead of "KeyBoard 1" as shown below for the correct bindings to a remote stick.



As shown in the button table on last page, all four key's (except PTT) support longpress, a press longer than 600 milliseconds, that can be mapped to a custom menu. The first entries in the table below may be customized. Button numbers are as indicated below. The "Enter" function, means the press on the 5 way joy-stick button is assigned to button number 4.

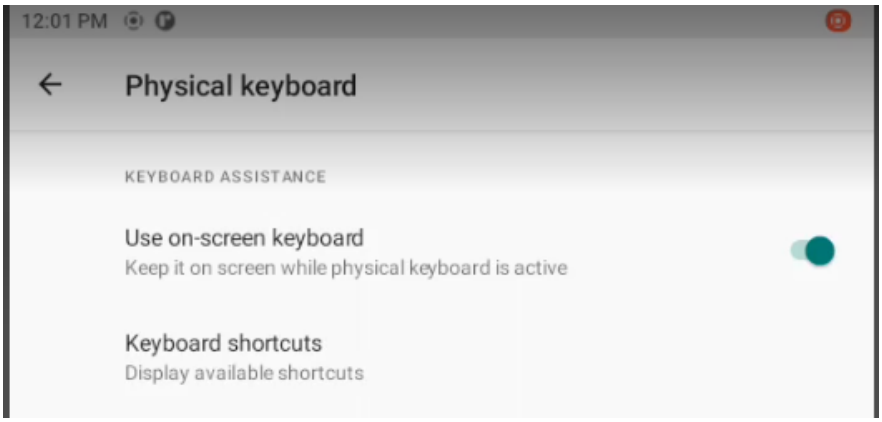
As an example this setting shows the LK8000 custom menu with individual functions that can be reached per longpress to the corresponding button above.



6. Installation

The XCStick can be installed instead of the previous grip onto the naked tube of the stick in the cockpit. On the bottom there is an inbus screw to fasten to lock the XCStick to the metal tube. The allen key to turn this screw is part of the delivery.

On Android devices, beside application specific setup, configure the physical keyboard to use the on-screen keyboard as well, otherwise when the stick is plugged, the stick is the only input device and you can't enter any test in your application.
To do so on XCTouchNav go into Settings -> Languages & Input -> Physical Keyboard and check there "**Use on-screen keyboard**", as shown below.



6.1. Electrical connections

The electrical connections is to be done by the USB-A connector to any USB 2.0 or 3.0 interface. For XCTouchNav models we recommend to use the serial ttyS3, ttyS7 or ttyS9 USB 2.0 sockets.

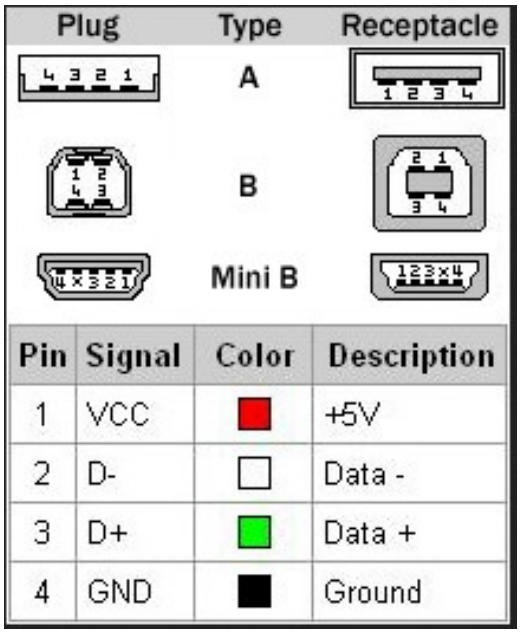
In order to be able to get the cable through small holes, in some models to lay the cable there is a 6 mm hole in the tube to be passed, the cable comes with an open end. This end can be fit after mounting with the screw terminal USB Type A as contained by default.

The shield S is not used. The other cables are to be connected to the pins as shown below.

Red goes to **+**, White to **D-**, Green to **D+** and to Black **-**

It is also possible to solder an USB-A male connector from a cut USB cable with the four colors matching to the XCStick cable after laying the cable.

For other devices, Type B might be applicable, see the corresponding pinout in the Table below.



Pin	Signal	Color	Description
1	VCC		+5V
2	D-		Data -
3	D+		Data +
4	GND		Ground

7. SW Update

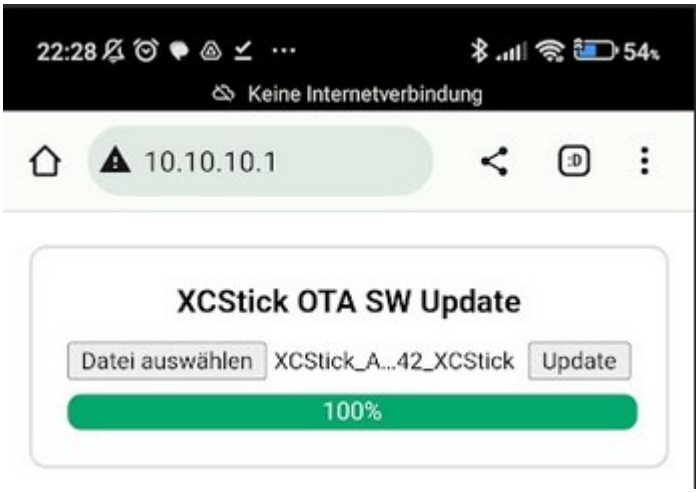
The device is capable for software update Over The Air (OTA). The default installation is XCSoar, in case LK8000 is wished, the software load is to be changed by software update.

To update the SW press the topmost (menu) button on the keypad with the tree horizontal lines and connect the stick to any USB-A port providing power. Then, after power is connected for at least 3 seconds, release the button when power is already connected. The XCStick will now enter the OTA software update mode.

Then use your mobile, tablet or PC to connect to the WIFI network **XCStick20**. The WIFI password is **xcstick20** same as the WIFI name, hence all letters lowercase. Note there will be no internet connection once you are connected with the XCStick for update, in case of corresponding warnings and pop-ups on your device just ignore.

When connected to the XCStick's WIFI, then launch e.g. google chrome web browser and enter URL **http://10.10.10.1** to open the OTA SW update webpage.

There you can select the new software .bin (here German language **[Datei auswählen]**, engl. **[File select]**) file, you might got from github or your own Arduino binary export, and press **[Update]**, and after a couple of seconds all is done. The software update is fine and you can power cycle your XCStick with the new software when the update page looks like this:



8. DC Power

The power supply is 5V DC and comes via the USB connector.

9. Technical specifications

Operating System	ESP32-S2 Arduino
Wireless Interfaces	WiFi 2.4 GHz
USB Interface	1x USB 2.0 male plug
Power consumption	~8 mA @ 5V DC equal 0.04 W
Dimensions	150x40x40 mm
Weight	~120g

10. Maintenance

The device does not require any maintenance. The wooden surface is sealed by clear varnish. Storage shall not be done in a humid environment. Ensure that relative humidity will not exceed 100% in order to avoid condensation.

11. Warranty Policy

For the XCStick, the manufacturer provides a guarantee of two years from the date of purchase with regard to the effort and material costs of the repair. Within this period, components that fail under normal operating conditions will be repaired or replaced free of charge, provided the device was sent to the manufacturer free of charge.

The warranty does not cover damage resulting from misuse, abuse, accidents, unauthorized modifications or repairs, proven incorrect or faulty wiring, over-voltage or fire.

According to the German Civil Code, the return can be made within 14 days of the date of purchase. In this case, the device and its accessories must be returned by the buyer to the address from which it was delivered. The buyer bears the costs for this.

12. Permit

For each instrument, if the equipment is part of the minimum equipment list or requires approval, it may only be installed if the supplier or manufacturer provides a document on the proper check for compliance with the respective specification of the individual piece of equipment, area of EASA this is usually the EASA Form One.

For all other equipment, as well as for standard parts, a corresponding examination and documentation of the same is not required (e.g. device, final approach computer, flight data recording devices, navigation computer, additional antennas, batteries, cameras, additional pressure probes, mosquito cleaning systems, etc.). This is regulated in detail by EASA in AMC 21.A.303(c) 2, with the following wording:

AMC 21.A.303(c) Standard Parts

1. In this context a part is considered as a **'standard part'** where it is designated as such by the design approval holder responsible for the product, part or appliance, in which the part is intended to be used. In order to be considered a 'standard part', all design, manufacturing, inspection data and marking requirements necessary to demonstrate conformity of that part should be in the public domain and published or established as part of officially recognized Standards, or
2. For sailplanes and powered sailplanes, where it is a **non-required instrument** and/or equipment certified under the provision of CS 22.1301(b), if that instrument or equipment, when installed, functioning, functioning improperly or not functioning at all, does not in itself, or by its effect upon the sailplane and its operation, constitute a safety hazard.

'Required' in the term 'non-required' as used above means required by the applicable certification specifications (CS 22.1303, 22.1305 and 22.1307) or required by the relevant operating regulations and the applicable Rules of the Air or as required by Air Traffic Management (e.g. a transponder in certain controlled airspace).

Examples of equipment which can be considered as standard parts are, variometers, bank/slip indicators ball type, total energy probes, final glide calculators, **navigation computers**, data logger / barograph / turnpoint camera, bug-wipers and anti-collision systems. Equipment which must be approved in accordance to the certification specifications shall comply with the applicable ETSO or equivalent and is not considered a standard part (e.g. oxygen equipment). The XCStick is considered as a part of a navigation computer and therefore runs as non required equipment. The aircraft can be operated even without a functioning remote control.

This means that no EASA Form One is required for the XCStick.

Note:
After installation, the equipment list of the aircraft must be adjusted. In case a relevant change in center of gravity due to the additional mass of 0.1 kg is expected, a weighing must be carried out and the change has to be approved.

13. Limitation of Liability

With the purchase of the device, the customer agrees that no liability for any direct or indirect damage, claims for damages or consequential damages of any kind and on any legal basis arising from the use of the device.

This device is a purely extention for cross-country flight tactical navis, it is not part of the required equipment for gliders, and in case of a defect, controlling navigating the aircraft is still possible mechanically. The device therefore does not require any FAA or EASA approval.

14. CE Declaration of Conformity

DECLARATION OF CONFORMITY

XCVario, owner Dipl. Ing (FH) Eckhard Völlm, Panoramastr. 86/1, D-71665 Vaihingen/Enz, explains that in the normal configuration the device hardware meets the requirements of the CE.

The EMC compatibility corresponds to EN 301 489-3:2002-08 for a Class 3 SRD device (equipment type I).