NaviTop

COMPUTER PYPILOT-TINYPILOT WITH IMU AND INPUT/OUTPUT NMEA0183

This pypilot computer, combined with a pypilot motor controller, creates a high-performance autopilot with very low power consumption. The three pypilot controller models, each with a nominal output current of 7, 15, or 30 amps, allow pypilot to be adapted to all existing motors or rudder actuators.

This computer uses the free PYPILOT software, conceived and designed by Sean D'EPAGNIER, combined with the simplified TINYCORE Linux system, available as an SD card image under the name TINYPILOT. With this file system, the pypilot ECU works perfectly with a small Raspberry Pi and can be safely turned on and off with a simple switch on the electrical panel.

The fully waterproof computer case includes a printed circuit board integrating the LCD display, the IMU, the UART interface to the motor controller, an NMEA0183 port with galvanically isolated input, EMC surge protections and a GPIO connector allowing the use of a Raspberry Pi Zero 2W or Zero W. The printed circuit board is marinized on the component side by applying three layers of tropicalizing varnish.

- TDK ICM20948 IMU integrated circuit directly installed on the printed circuit board with its interface circuits to the PI operating at 3.3V
- LCD display JLX12864G-086-PN 3.3V
- Calculator powered by 5V DC with two PCB pins or by a micro-USB socket on the Raspberry Pi. Both are protected from overvoltage's by a TVS diode added to the printed circuit
- Header 2X20 contacts for installing a Pi Zero W or Pi Zero 2W with tinypilot installed in the microSD card
- NMEA0183 port (ttyAMA4):
  - Input galvanically decoupled by optocoupler
  - Asymmetrical (default) or symmetrical TTL output protected against short circuits and overvoltages
- Pins on the PCB to connect an 8-button keypad
- PCB marinized with tropicalizing acrylic varnish
- Waterproof autopilot computer enclosure with waterproof cable glands
- Waterproof 4 pins connection to the motor controller
- Optional 4 pins waterproof connection to input and output NMEA0183 or connector with USB-A female socket for connecting a NMEA0183-USB or NMEA2000-USB adapter
- Location for an IRM-3636M3F45 infrared sensor which is not supplied because IR remote controls directly recognized by pypilot are becoming almost impossible to find

Dimensions
- Enclosure : 85 x 58 x 33 mm (96mm between the two fixing holes)

Pypilot Autopilot Control

This Pypilot computer offers many control options such like LCD display and push buttons or the pypilot web server accessible via wifi at the address 192.168.14.1 from the web browser of any tablet, computer, or phone.

From another computer on the same wifi network, it is also possible to control pypilot with:

- The pypilot plugin for the OpenCpn application,
- Pypilot client scripts installed with a software suite such as OpenPlotter or Bareboat Necessities (BBN).

Simply run Pypilot client scripts such as "pypilot_control", "pypilot_scope", "pypilot_calibration", etc., from the Linux command line.

But it's important to keep in mind that the "pypilot" server script can only run on the computer connected to the motor controller and the IMU. This server script constitutes a sort of table of all the data used by Pypilot and the various client scripts.

This is why the main "pypilot" script should never be run on any machine other than the Pypilot-tinypilot computer, even though it's often useful to install Pypilot on other machines so you can run the Pypilot client scripts from the Linux

command line. It's always amazing how well Pypilot is designed when you see these client scripts automatically connect to the Pypilot-tinypilot computer.

NMEA0183 Serial Port of the ECU

The NMEA serial port of this computer uses the ttyAMA4 port with TX and RX connected to the GPIO12 and GPIO13 pins of the Pi Zero respectively.

The RX input, protected from surges, is provided by an optocoupler providing galvanic isolation.

- Input + or A (metal and brown wire)
- Input – or B (metal and blue wire)

The 5V TTL output is provided by a UA9638 circuit protected from short circuits and surges. It is asymmetrical by default, with the - output connected to GND, which is suitable for almost all cases. If necessary, it can be symmetrical so that the - wire is at +5V when the + wire is at 0V. To do this, break the bridge of JP1 between 1 and 2 and then connect 2 and 3 with solder points.

- Output + or A or Y (metal and black wire)
- Output – or B or Z (metal wire)

Use of external data

Without external data, pypilot only works in Compass mode. To use Apparent Wind mode, you must provide pypilot with NMEA data from a wind vane. To use True Wind mode, which is useful downwind, as well as GPS mode, you must also provide NMEA data from a GPS.

Sean, the designer of pypilot, advises using a conventional wind vane that can provide data that is as unfiltered as possible so that pypilot, which performs very fast calculations, can accurately determine the true wind, even with heel and waves.

The following sentences can be received and used by pypilot:

- MWV : apparent and true wind
- VWR : apparent wind (alternative legacy)
- VWT : true wind (alternative legacy)
- APB : autopilot bearing for route following
- VWH : water speed
- LWY : leeway
- RMC : gps
- RSA : rudder angle (for faster action of the stroke limiter, however, it is advisable to connect the sensor directly to the motor controller)

The following sentences can be output:

- MWV : afteer calibrated
- RSA : rudder angle
- RMC : if gps filter combines IMU and GPS data this can provide a high speed output for speed/track
- XDR : Pitch and roll
- HDM : magnetic heading
- ROT : rotation rate

The NMEA0183 connections are either on serial ports, usb port with NMEA0183>USB converter, or via wifi with port TCP 20220. If the connection is a serial port or virtual comm port, it will be detected with a baud rate of 4800 or 38400. Sentences received over usb/serial not used by the autopilot will be relayed to devices connected to wifi