Atorch UD18: Bluetooth protocol and node-red applications

UD18 hardware

This low price device (13.88 €) is more than just a digital USB tester (https://it.aliexpress.com/item/4000001021645.html , https://www.banggood.com/UD18-USB3_0DCType-C-18-in-1-USB-Tester-APP-DC-Digital-Voltmeter-Ammeter-HD-Color-Screen-6-Bit-High-Precision-Display-UD18-Bluetooth-Digital-Meter-p-1564949.html).
The tester has 4 inputs (USB M, DC 5.5mm M, USB-typeC M, USB-tytpeC F) to be connected to a generator, and 3 outputs (USB F, DC 5.5mm F, USB-tytpeC F) to connect to a load.

There are two buttons ([-] and [+]) and two LEDs: red (power) and blue (Bluetooth).

Fig. 1: UD18

The measures that UD18 can carry out are:

- Tension: 3.6…32 V
- Current: 0...5.1 A
- Power: 0...163.99 W
- Equivalent resistance: 0…999.99 Ω
- Capacity: 0...99999 mAh (cumulative)
- Charge: 0...999.99 Wh (cumulative)

Furthermore:

- Time: 0...999 ore
- USB-data+: 0...2,99 V
- USB-data-: 0...2.99 V

Numerous accessories are also available: NTC for temperature measurements, constant current loads, triggers for PD and QC power supplies, etc ...

In addition, UD18 can function as a charge/discharge controller (***FCOP***: *Full Cut Off Power*), disconnecting the load when one of the following events occurs (the values *indicated* are user configurable):

- Power < *minW* (1...9W) for *XX* (01...99 min.)
- Time > *T-C* (countdown hh:mm, 0...24h)
- Current > *Over-C* (0...9A)
- Tension > *Over-V* (0...36V)
- Tension < *Low-V* (0...29V)

If FCOP is ON and intervenes, an ad hoc view identifies the reason.

Fig. 2: A screen

Fig. 3: B screen

Main view A can be rotated clockwise in 90 ° steps by pressing the [+] key for a long time, and presents the instantaneous values: V, I, W (*V*I*) and Req (*V/I*). View B rotates only 180°.
A short press on [-] key switches to view B, which presents all the accumulated values (Time, mAh, Wh), the FCOP conditions, the USBdata + and USBdata- values.
In view B, the values used by FGOP can be set: by long press on [-] key the field is chosen, then it can be modified (keys [+] and [-]). Timed automatic saving.

UD18 software

UD18 can communicate via Bluetooth (it use a JDY19, low power) and two applications can be downloaded, one for PC and another App for smartphone. Unfortunately, both applications provided are derived from programs developed for an AC current meter (AT3010) and present various problems.
On the other hand, the use of the only two buttons on tester is quite complex: with an application the configuration of UD18 is simplified and new commands are also available.

UD18 protocol (reverse enginnering)

In order to use the UD18 in custon applications, the first step is to discover the protocol used.

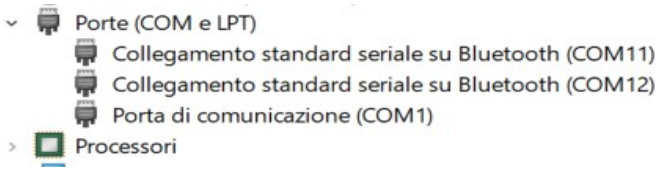

Fig. 4: Device manager

The Bluetooth connection originates two virtual serial ports, visible in 'Device Manager'.
The minor index serial port is used (on my PC: COM11).

Using the application on PC and using the excellent "*Serial port monitor*" (https://www.eltima.com/products/serial-port-monitor/) as sniffer I managed to capture and partially decode the messages exchanged via Bluetooth. For tests and verifications I also used '*Termite*', a serial hexadecimal terminal (https://www.compuphase.com/software_termite.htm).
The current state of knowledge about the protocol is in the **`UD18-protocol.txt`** file. Contributions are obviously appreciated.
Some notes:

- *I have not discovered the CRC8 algorithm used. It is therefore possible to use only the commands captured.*
- *Measurements are sent by UD18 at 1 second intervals. Voltage and current are transmitted with only 2 decimal places, instead of the 5 available on the display.*

UD18 custom applications

It is now possible to develop custom applications in any language, but the fastest and most versatile solution is to use ***node-red*** (https://nodered.org/). Node-red is available on many platforms (Windows, Linux, Raspberry, etc) and has an impressive collection of modules for IOT, also communication with databases and for creating UI: perfect for quick experimental realizations or for extensive IOT integrations.
The attached flow (**`UD18flow.json`**) is very simple: Reads the data sent by UD18, decodes them and presents them in the debug window. Sends 8 commands.

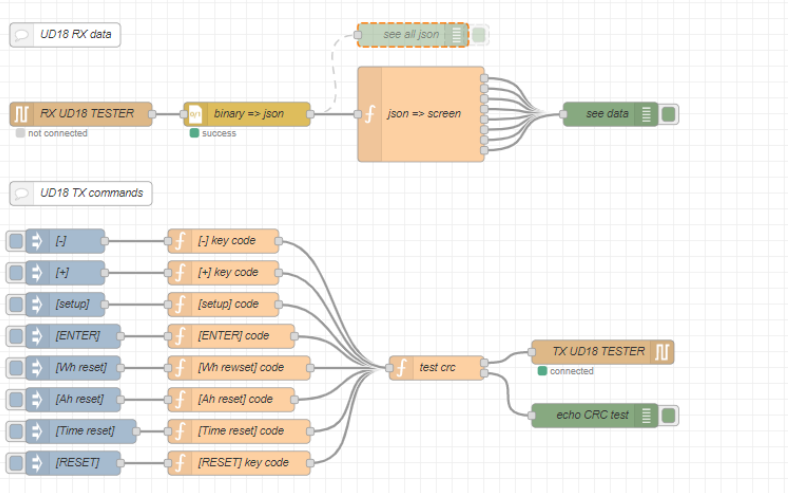

Fig. 5: UD18 flow

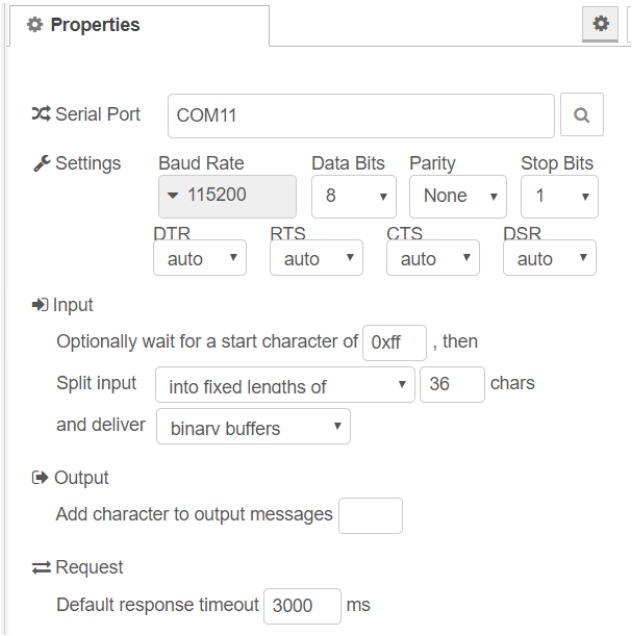

Fig. 6: Serial port

The received serial data packet is first transformed into a json structure, then the data are scaled and formatted to be presented on the screen. The outputs are, in order: V, I, mAh, Wh, USB_data-, USB_data +, time (h:m:s) and seconds.

For transmission, the complete message first passes into an experimental node, to test the CRC algorithms, then it is sent to UD18.
It is easy to extend the flow to view the data of interest, save it on a DB, create automatisms, etc ...

The code for the Bluetooth association is '1234': the blue LED flashes during the search phase and is fixed when UD18 is connected.
After a 'deploy' the serial connection is reactivated either immediately or after a few seconds.

The serial port (COM11) is configured as in fig. 6: 8N1, 115200.

The commands work in the following way:

[+], **[-]** switch between *view A* - *black screen* - *view B*
[ENTER] rotates 90 ° *view A* and 180 ° *view B*
[setup] rotates *view A*. With *view B* the values used by FCOP can be changed:
with subsequent **[setup]** commands, you move forward through the fields
with **[+]**, **[-]** you adjust the value (ON / OFF or numeric)
with **[ENTER]** you save the new value
[RESET] clears all cumulative fields (mAh, Wh, T) also exits the FCOP activated signaling screen.

Installation

1. Install the PC application first: allows you to check the correct operation of Bluetooth and the tester (I use a USB Bluetooth dongle adapter).
2. Add new nodes to the **node-red** 'palette': **`node-red-node-contrib-binary`** and **`node-red-node-serialport`**
3. Copy the contents of the **`UD18flow.json`** file to the clipboard.
4. Import into a new **node-red** flow from the clipboard
5. Check the used COM ports in 'device manager' and configure **node-red**.