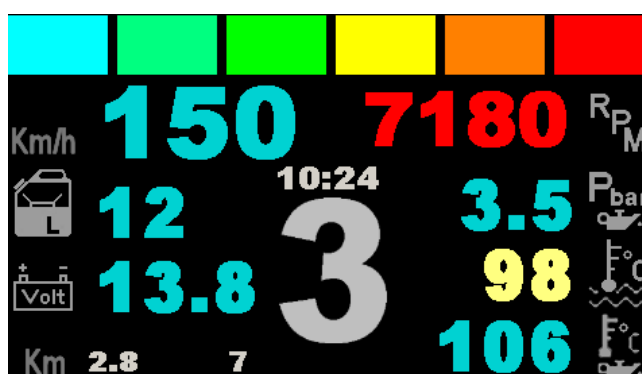
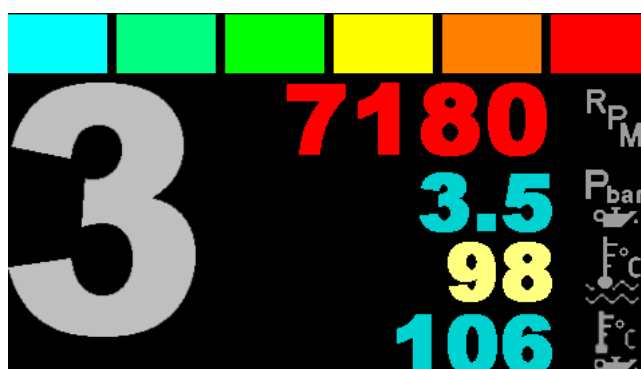




TB400 PRO

User's manual



Version 1704

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Disclaimer

We tried to provide herein the most exact information we could. We shall not be prosecuted in case of error, missing information, or loss of data due to a misuse of the device. We keep the right to change the content of this manual at any time without notice.

It is not permitted to copy this manual whatever the media without written authorisation of Crisartech.

Safety and recommended practices

- Before to use this device, read this manual carefully.
- Switch off power supply in case some smoke is to come out of it.
- Do not use it, if its case is broken.
- Do not use alcohol, gasoline or any flammable liquid to clean this device.
- Do not change, cut or modify the wiring between the case and the connector.
- Do not use any other power supply than a 12V automotive battery or booster
- Keep this device far from high magnetic fields, like the ones generated by electric motors

1 Overview

This display is designed for use in a car racing context. It has three main screens and several configuration screens.

The "special stage" or "race" screen has the following elements:

- engine speed with multicolored bar graph,
- engaged gear,
- engine oil pressure (depending on configuration),
- engine water temperature,
- engine oil temperature (depending on configuration),
- gearbox oil temperature (depending on configuration).

The "road link" screen contains the following elements:

- vehicle speed,
- engine speed with multicolored bar graph,
- gear ratio,
- engine oil pressure (depending on configuration),
- engine water temperature,
- engine oil temperature (depending on configuration),
- fuel gauge,
- battery voltage,
- hour,
- partial and total distance.

The "diagnostic" screen contains several pages of 8 parameters transmitted by the engine computer (throttle position, ignition advance, injection time ...) and the fuel pressure from an optional sensor directly connected to the display.

The background of these 3 screens can be configured to be green coloured beyond a configurable speed (upshift), and red in the event of an alert.

This dashboard has three recording functions:

- memorizing the min / max of certain motor variables
- memorizing "abnormal" events (engine overspeed, overheating, lack of oil pressure) for diagnosis. These events are dated and saved in files (one file per start). The recording conditions are customizable, see § Configuration,
- recording engine data (data logger).

The display comes with a USB "master" port ("host") to read and write the USB drives (formatted "FAT32"). It is not intended to be connected to a computer, tablet or smartphone. This retrieves the event files and perform system updates.

2 Installation

2.1 Power supply

This device is powered by the battery voltage after an emergency switch and **fuses**.

Although it has a non-volatile memory, a permanent power supply is recommended to enable it to properly close any open internal files before complete failure of its power:

- switch off the ignition,
- the screen turns off and go to sleep mode for 8 hours. After 8 hours, it switches off completely to consume only a few mA,
- close the circuit breaker.

Remark: if we can maintain permanent power when cutting ignition, this allows the display to start quickly (about 2 seconds) when the engine is restarted.

2.2 Wiring

2.2.1 Wiring guidelines

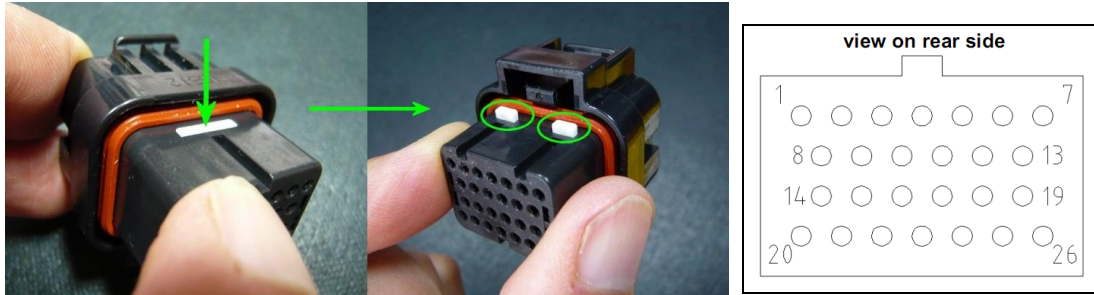
IMPORTANT: Although *this may be difficult to achieve, this will help to ensure a reliable behaviour of the dash:*

1. Each sensor wire must be close to its ground reference coming back to the dash: avoid using the steel frame as a reference, but keep wires close to the steel frame.
2. Use a different ground reference for analogue and digital sensors, and avoid to route analogue wires alongside digital wires: use a separate set of wires.
3. Avoid to share a sensor ground reference with a digital sensor **or** a power device (*ECU, alternator or starter, spark wires, ignition wires...*)
4. The CAN bus should use an independent shielded twisted pair cable. The shield should be linked to the ground voltage on one side only, so that it does not carry currents.

2.2.2 Wires colour and number

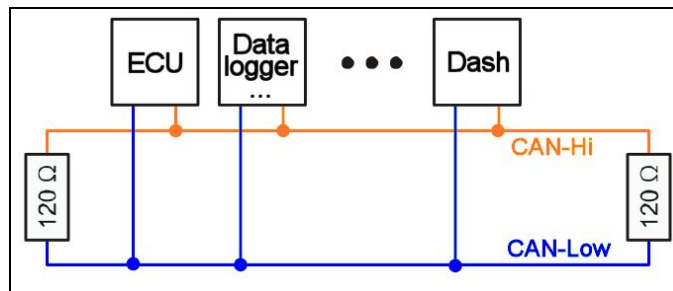
Function	Remark	Colour	Contact
Power supply	Terminal 30. Permanent 12V. If not available, connect to ignition signal.	red	1
Ignition signal	Terminal 15	yellow	2
Vehicle ground	Terminal 31	black	3
CAN bus	CAN High	orange	8
	CAN Low	blue	9
USB power	+5V output	Prewired	12
USB ground		Prewired	13
USB data -		Prewired	14
USB data +		Prewired	15
"page" button (optional)	Second wire to +12V, normally open	white	20
Oil pressure input (optional)		brown	20
Oil temperature input (optional)		green	21
Fuel pressure input (optional)		grey	19
Fuel level gauge (optional)		pink	22

Before inserting the pins in the connector, open the white locker pushing the broad side with a screwdriver. At the end of implementation of pins, you can reattach it only if all pins are properly in place.



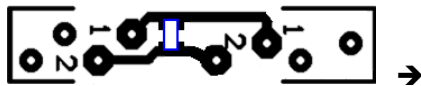
The CAN bus must use preferably a twisted / shielded cable separate from other wires. The shield must be grounded on **one side only**.

The CAN bus must be terminated at both ends by a resistance of 120 Ω :



Generally, a termination is included in engine ECU. Depending on the architecture of the vehicle, it is necessary to connect a resistance display side. CRISARTECH can provide:

- a small printed circuit board with a resistor to help the wiring:



The wires are welded on each side (past into anti-wrenching eyes), and everything is under shrinktube.

- a simple “traversant resistor”:



3 Events recorder

When the system **starts**, a file can be created in the dashboard (see Configuration). Its name indicates the start date and time.

When inserting a USB drive into the plug, all of these files are copied to the USB drive. When the key is extracted, the files are compressed and archived in the dashboard.

These files can be opened with a text editor (notepad ...) or a spreadsheet (MS Excel, OpenOffice), on a PC or Mac computer, a tablet or a smartphone (IOs, Android or Windows).

If the engine speed, vehicle speed and manifold air pressure are higher than a configurable threshold, the dashboard records:

- engine **overspeed** (each event is recorded),
- **overheating** in water / oil (maximum value over a configurable period),
- **lack of oil pressure** (minimum value over a configurable period).

Example: ER_160720_091205.csv: file of July 20, 2016 at 9:12:

						Meaning
10:21:44	Date		20/07/2016			System start date/hour
10:21:44	Start	0h00	0h00	19	°C	Engine hour / loaded engine hour /engine water temperature
10:22:35	EngSpeed	7180	Rpm			Overspeed 7180 RPM at 10h22 and 35 s.
10:37:40	Date		20/07/2016			System start date/hour
10:37:40	Start	0h18	0h13	90	°C	Engine hour / loaded engine hour /engine water temperature
10:49:02	WaterT	105	°C			Engine water overheat at 10h49 and 2 s.: 105°C maxi
10:49:11	OilT	138	°C			Engine oil overheat at 10h49 and 11 s.: 138°C maxi
10:49:22	OilP	1.2	Bar			Engine oil lack at 10h49 and 22 s.: 1.2 b. mini

The water temperature at start-up allows you to recognize the first start in the morning (cold engine), a long pause (warm engine) or a pit stop (hot engine).

Through the configuration screen, an archive file management screen is accessed, see below.

4 Data logger

When the engine is considered "loaded", a file can be created in the dashboard (see configuration). Its name indicates the date and time of the start of this charging phase.

When inserting a USB drive into the plug, all of these files are copied to the USB drive. When the drive is extracted, the files are compressed and archived in the dashboard.

These files can be opened with a text editor (notepad ...) or a spreadsheet (MS Excel, OpenOffice), a PC or Mac, a tablet or a smartphone (IOs, Android or Windows).

To consider the engine "on load", the **the engine speed, vehicle speed and manifold air pressure must be higher than a configurable threshold.** The dashboard then records:

- every 50 ms: engine speed, throttle position, oil pressure,
- every 500 ms: manifold air pressure, engaged gear, fuel pressure,
- every 5 seconds: water, oil, manifold air temperature, hour: minute: second.

5 Ergonomics

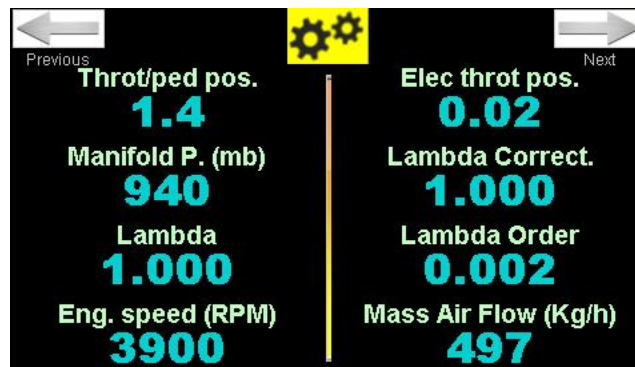
The touch screen is used to change the page and configure the display:

- a tap on the screen to cycle through the pages:
 - race
 - road or link
 - diagnosis
 - Gps lap timer (if applicable)
- a tap on the right part to go the next page,
- a tap on the left part to go the previous page.

The **partial odometer** of the link page is simply **set to 0** by pressing the counter value:



6 Diagnostic page

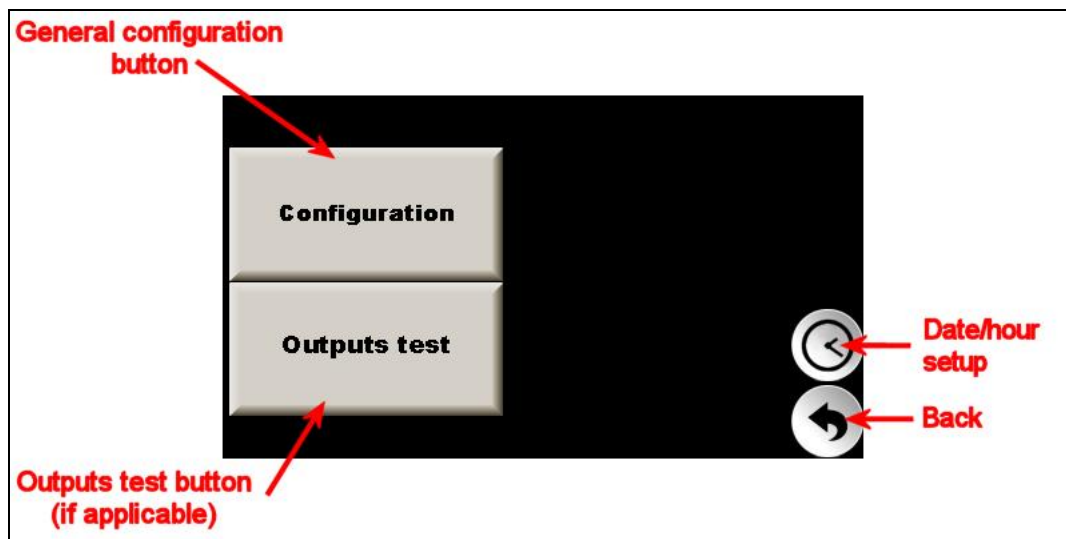


- the number of pages and the order of the variables displayed depends on the computer,
- the colors of the values are based on the thresholds defined in configuration,
- the arrow buttons at the top, right and left move to the next and previous page, respectively,
- the yellow button at the top of the screen allows you to call up the configuration screen.

7 Main menu



The "main" menu is called by pressing the yellow button at the top of the diag screen (see above):



Depending on the level of options, the number of buttons may vary. See the functions detailed in the following paragraphs.

8 Date / hour setup

8.1 GPS Time Synchronization

If a GPS lap timer receiver is connected to the dash, it is best to automatically synchronize the time on the GPS. Check the "GPS sync" box on the left. There is only the offset with the GMT time (time zone) to be configured:



In France (and in Western Europe), configure as follows:

- winter time: 1 hour,
- summer time: 2 hours.

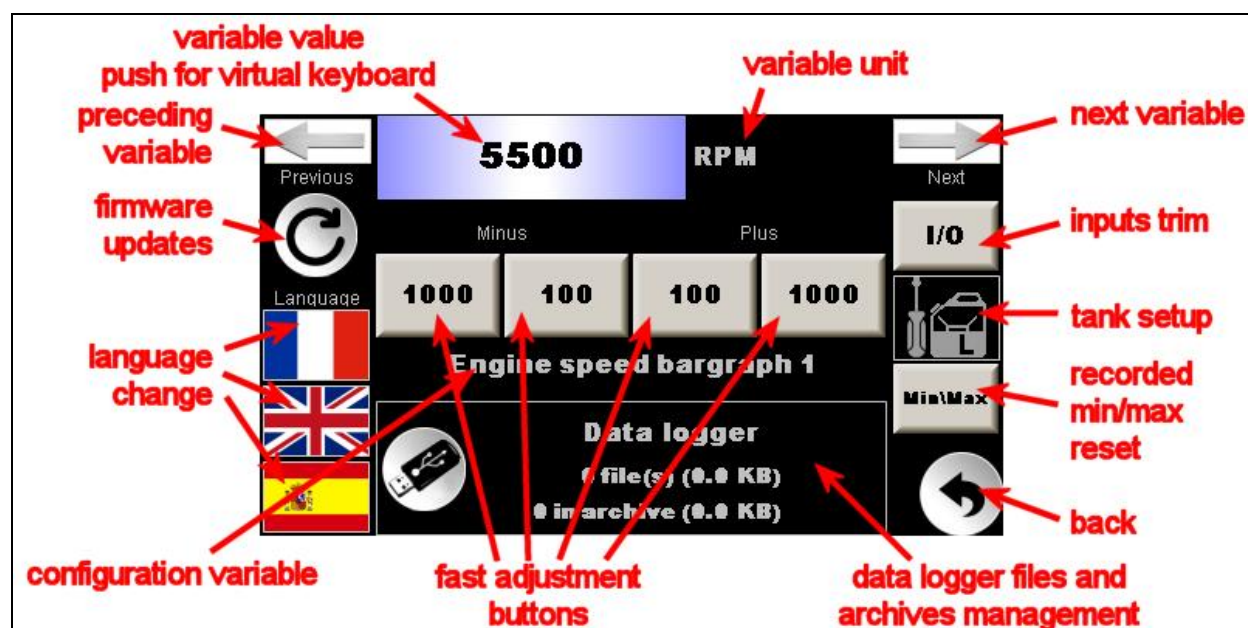
8.2 Manual adjustment

Uncheck the "GPS sync" box on the left:

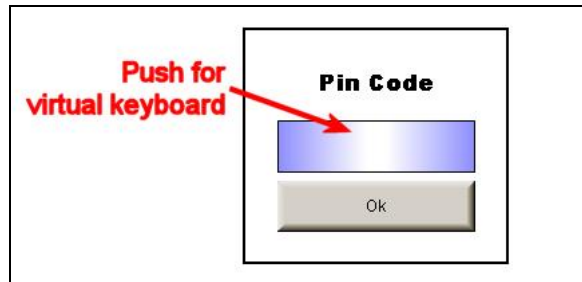


Each time the minute buttons are pressed, the seconds are reset to 0.

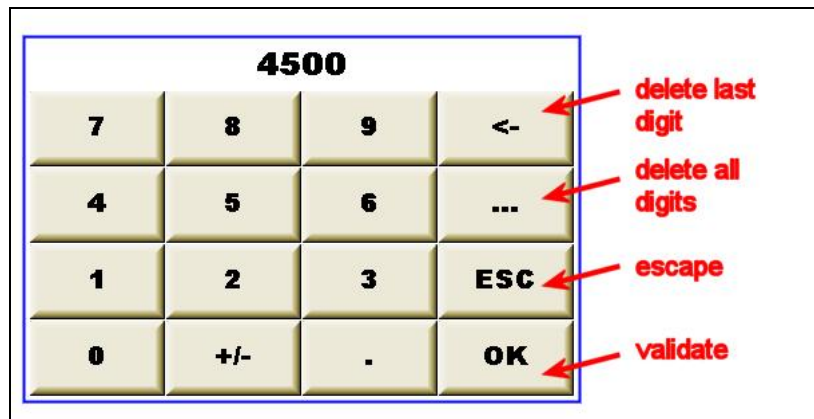
9 Configuration



- if the configuration is locked with a code, a popup widow prompts for this code:



Push on the field to launch the virtual keyboard:



After code validation, we return to the previous window. The input field displays "****", regardless of the number of digits entered.

Press OK.

Once in the configuration screen, this code can be changed (last variable). If the entered code is **0**, then the display will no longer be locked.

- buttons with the upper right and left arrow switch to the next or previous configuration variable, respectively,
- pressing the value (blue background) displays a virtual keyboard, faster for major changes in the values,
- pressing gray buttons with number increment or decrement the variable value indicated on the button, faster for small changes. The small increment value is set in configuration file. The largest value is equal to 10 times the small,
- the bottom frame indicates the status of the data logger, see below,
- the values are stored when returning to the main page. **It is not necessary to 'validate' the entry,**
- 'Tank setup' button displays tank settings page, please see annex § if applicable,
- 'Reset min/max' button resets the minimum and maximum values recorded, **with confirmation,**
- and finally the 'Back' button returns you to the main page, recording the value changes.

9.1 Engine speed

- **Engine speed bargraph 1... Engine speed bargraph 6:** lighting threshold for the 6 levels of the bargraph,
- **Engine speed shift:** optional green background shift-light and optional shift-light output,
- **Engine speed alert:** maximum speed, optional lighting of the background in red and recording of an "overspeed" event,
- **"Engine running" speed:** RPM beyond which the engine is considered to be running and the engine timer is incremented. Usually at 0, but can be configured just above the idle speed if one does not want to count in the "engine hours" idle times,
- **Diag / DL validation engine speed:** threshold of engine speed beyond which the records are active.

9.2 Alertes

For the vital parameters of the engine it is possible to configure:

- **pre-alert**: the value changes to **yellow**,
- **alert**: the value changes to **red**.

And specifically for engine speed: beyond **Engine speed shift**: the value changes to **green**.

Alerts in background: allows the background to change in the same color in the case of pre-alert, alert or "up shift".

Important: **Diag / DL validation engine speed** is also used to validate the oil pressure diagnosis. When the speed is below this value the diagnosis is inhibited (no alert).

9.3 Vehicle speed and gear ratio

To display vehicle speed, the dashboard can use:

- the speed transmitted by the ECU via the **CAN bus**,
- **GPS** speed (if GPS receiver connected),
- **gear ratio** and **engine speed**.

In the latter mode, the dash needs to know the gear ratios. It is therefore necessary to configure **Gear box rate 1** to **Gear box rate 6**.

9.4 Events recorder, data logger and mini/maxi

To avoid recording data which are not consistent or irrelevant, the activation of these 3 functions is only done under the driving conditions:

- engine speed beyond idle speed,
- vehicle speed beyond the running speed in the paddock.
- manifold air pressure corresponding to the motor under load or partially loaded.

The records are configured as follows:

Diag / DL validation engine speed: threshold of engine speed beyond which the records are active,

Diag/DL validation veh speed: vehicle speed threshold beyond which the records are active,

Diag/DL validation MAP: collector pressure threshold above which the records are active. Set to 0 for atmospheric engine. Turbo engine: set to 0 to record all engine operation or to turbo start pressure to record only the engine running with load.

Caution: if the system does not have a vehicle speed, set **Diag/DL validation veh speed** to 0.

Data logger: yes or no to enable or disable data recordings,

Events recording: yes or no to enable or disable events (overspeed, overheat...) recordings,

Events recording period: time between two recordings of the event recorder (in case of permanent overheating, for example).

9.5 Start page

This is the page that will be displayed by default when starting and exiting the configuration page. In rally, it is advisable to put **"Link" page**.

9.6 ECU type

To be configured according to the type of Engine Control Unit.

The **Demo** type is used to set the dashboard as a demo version: the engine parameters are simulated (with engine speed and vehicle speed ramp).

9.7 Lap timer code

This code must be entered to activate the operation of the GPS Lap timer. See annex if applicable.

9.8 Pin code

Allows you to set a code to lock access to the configuration and erase min / max. If value 0: no locking.

10 Min/max values recording

In the last diagnostic pages, the minimum and / or maximum values of certain motor variables can be found. These values are recorded under the same engine speed, vehicle and manifold air pressure conditions than the data logger.

To reset them, a button is available in the configuration page (see §9). Confirmation is requested.

11 Hour Meter and Serial Number

One of the diagnostic pages includes:

- hour meters ("running" motor and "loaded" motor)
- the remaining capacity of the data logger (in KBytes),
- the serial number of the display.

12 Managing files and archives of the data logger

When inserting a USB drive into the socket, all log files are copied to the USB drive. When the drive is removed, the files are compressed and archived in the dashboard.

The remaining capacity of the data logger (in KBytes) is visible on the last diag page, and the details of the files "ready to download automatically" and archive files are visible at the bottom of the configuration page:



1 log file representing 2 KBytes

8 archive files representing 4.3 KBytes

The button with the drive is grayed out because there is no drive in the socket

When a drive is present in the reader you can press the left button and open the file and archive management page:



It includes the number and size of the archive files, as well as the available space.

The first button is used to start copying archive files but also log files to the USB drive present.

The second button is used to delete the archive files.

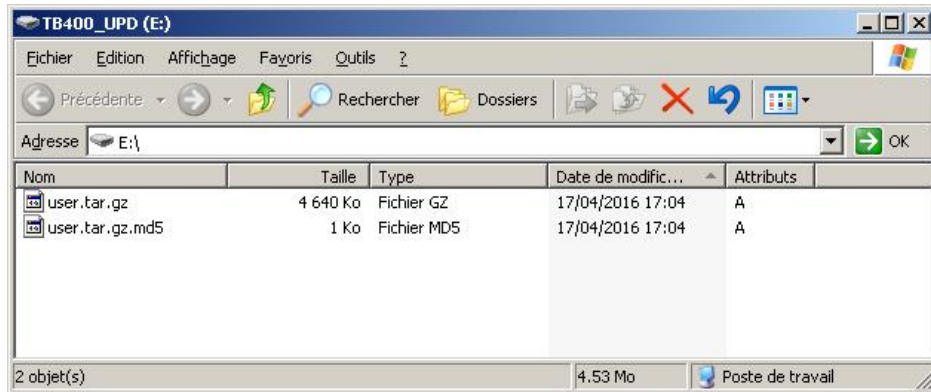
13 Firmware updates

There are two ways to update the **firmware** (programm):

- updating the entire system. At the end of the update, you must calibrate the touch screen. This operation is reserved for very important developments. It contains the files **user.tar.gz** and **user.tar.gz.md5**,
- program update only (application). It includes the files **application.tar.gz** and **application.tar.gz.md5**.

You have to copy these two files on a USB drive, so that you have them at the "root" of the drive.

Important: do not unpack (unzip) the files!



Insert the USB drive into the connector, the dash read it. In the configuration screen a button appears **if both files are found at the "root" of the drive**:

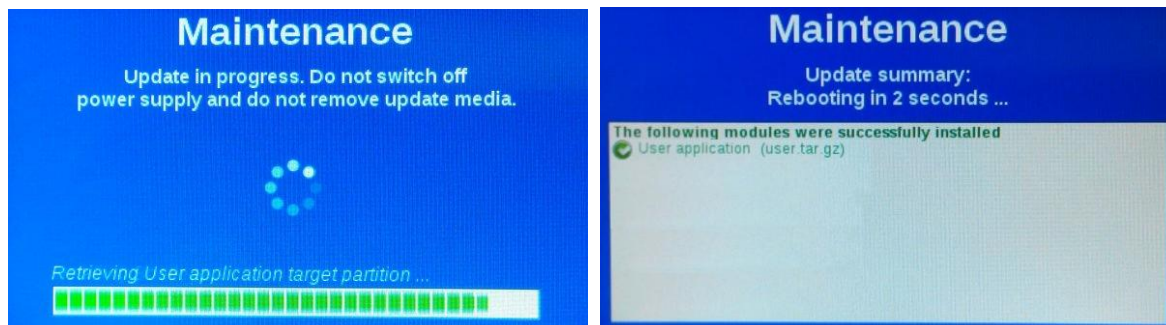


Press this button to go to the system update screen and press the button corresponding to the desired update:

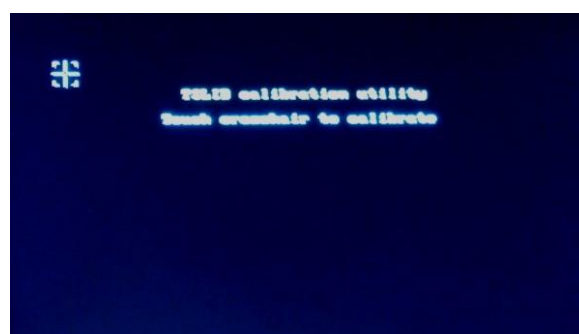


13.1 Complet system update

The dash starts and then displays the following update screens, **do not cut the power or remove the USB drive**:



At the end of the procedure, the display starts, and then displays the calibration screen of the touch screen:

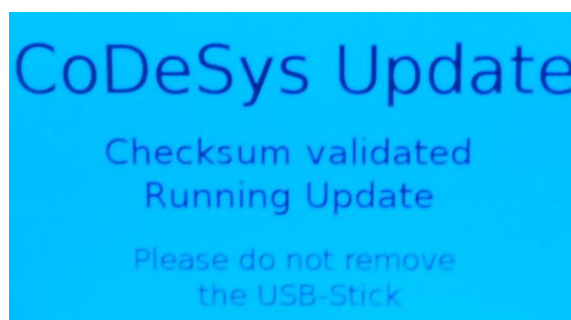


Successively and precisely touch each cross. The update is complete and the display starts its program.

Warning: once launched, this procedure can only be completed in performing the update (with files) or by switching off the ignition, without cutting the permanent supply. So for vehicles without these separate feeds, one should start this procedure only if one is sure to have the files needed to complete the whole procedure. Otherwise the display will remain stuck waiting for these files.

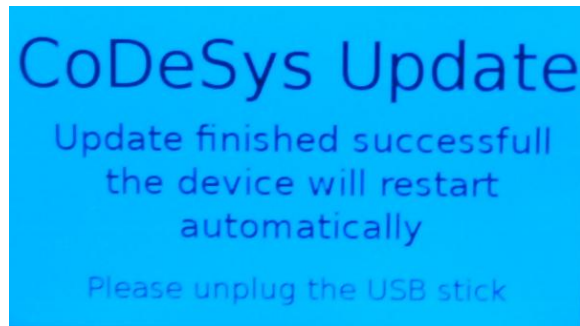
13.2 Firmware update only

Display goes to the following bleu screen:



Do not cut the power or remove the USB drive!

After a few seconds, it goes to the following screen:



The USB drive can be removed, the program restarts.

14 Welcome picture update

Prepare a file with 480 * 272 pixels size and .PNG format. The name must imperatively be "**logo.png**".

Place this file on a USB drive formatted in FAT32 (in the root).

Insert the USB drive into the connector, the display reads and updates the welcome picture (first and longest part only).