ICC PRO Manual

ICC Pro is a tool designed to allow quick and easy diagnostic of an iPhone or iPad with Lightning port and Tristar/Hydra IC. Additionally, it has a test to detect possible short circuit on the main power line of the device or other problems with the power/charging system.

Interface & Operation

ICC Pro has a 0.96'' OLED Display (**1**) with monochrome yellow status bar and monochrome blue main area.

The device is operated via a single button (**2**), located on the front panel of the tool. The button starts and restarts the device. After the test is ended and the test result is displayed and kept on the screen for 10 seconds, ICC Pro shuts off automatically.

ICC Pro operates from a rechargeable lithium-ion battery with the capacity of 250mah. The battery can be charged via USB Type-C port (**3**). The full charging time is around 3 hours*. The charging current is up to 100ma. The device can work up to a month on a single charge (heavily depends on frequency of use). The device cannot be operated while charging.

The Lightning plug (**4**) goes into the tested device. ICC Pro can operate only with display facing the same direction as iPhone's/iPad's display and it can't be flipped. Make sure the tested device has a clean Lightning port and that the case allows to insert the plug all the way into the tested device. It is strongly recommended to remove the case from the tested device before testing.

*if the device displays "Low Battery" message after start

Battery Access & Hard Reset

The bottom lid of the device is held with plastic clips and can be removed. It's best to use a thin plastic card or a finger nail to remove it. Slowly apply increasing force at the longer side of the device to pull the lid off.

The battery of the ICC Pro is located on the bottom side of the board. Maximum charging current of the battery is 250ma, but it is limited through hardware to 100ma to preserve battery life. Maximum battery voltage is 4.2V. The battery has short circuit protection. If short circuit protection is triggered, the battery has to be reactivated via applying 4.2V with a current limit of 250ma for 1-3 seconds directly to battery terminals (red wire – positive terminal, black wire – negative terminal).
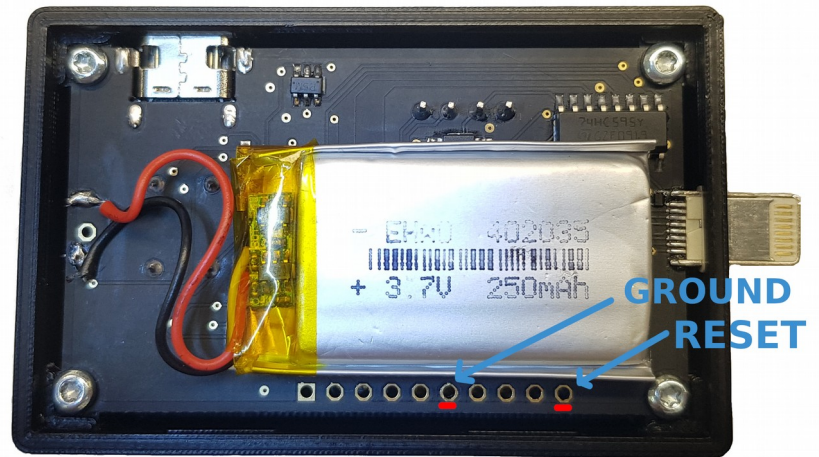
While the device has built-in software error detection system that performs automatic system reset in case of error during program execution, the user can perform hard reset manually through shorting the RESET and the GROUND test points marked in the picture (for instance, with conductive tweezers) to remove any software errors that can't be automatically fixed. Hard reset must always be performed if the battery was disconnected and connected again.

It's advised not to operate the device without its housing, as holding the board with bare hands may induce unwanted errors. These errors will be detected by the error detection system, but they will nevertheless hinder the proper program execution.

Basic Testing & Test Results

Press the button on the front panel to start the device. The device performs a quick Tristar/Hydra test ("**Instant-Test**") during the splash screen. Should Tristar/Hydra be heavily damaged, the according message will show on the display after the splash screen ("**Tristar/Hydra fail!**"). No further testing will be made. This message suggests that Tristar/Hydra IC is heavily damaged and needs to be replaced.

If the instant-test is passed, the device will proceed with the full **dock flex test**. It will test continuity, and should there be any open lines ("breaks") between the Lightning port and the Tristar/Hydra IC, the message after the test will indicate so ("**Check dock flex!**"). Additionally, up to three failed lines' names will be indicated (see "Additional Information" section). This message suggests the problem in continuity, and the device has to be tested with another dock flex.

If the dock flex test is passed, ICC Pro runs full Tristar/Hydra+PP5V0 test ("**IC Test**"). If one of the Tristar/Hydra lines fails the test, you will see the fail message after the end of the test and recommendation to try another dock flex first ("**Tristar/Hydra fail! Try another dock flex!**"). You will also be given the failed line's name. It is recommended to run the test again with another dock flex. If the test still fails on the same line, there is a problem with the Tristar/Hydra IC. If two of the lines fail the test, the test stops immediately and you get a test fail message with the failed line's names ("**Tristar/Hydra fail!**"). It's an indication of a damaged Tristar/Hydra IC. If the problem is on PP5V0_USB (but not on Tristar/Hydra lines), you will be notified accordingly ("**PP5V0_USB fail!**").

If the IC Test is passed, ICC Pro runs an **Additional test**. If the problem is encountered, you will be advised to check main power line ("**Tristar/Hydra OK! Check VCC_MAIN**"). If all tests are passed successfully, you will see an according message ("**Tristar/Hydra OK! VCC_MAIN OK!**").

Extended Diagnostic

We have performed huge amount of tests with the ICC Pro and gathered all our data here to provide all possible information one can extract from the ICC Pro during diagnostic process.

This section of the manual discusses less likely problems with the iPhone or iPad that can cause certain test results. ICC Pro is not simply a device to test Tristar/Hydra IC, but a full-scale diagnostic tool, able to provide more information for the technician to repair the phone or tablet as quickly as possible.

There is a very slight chance the dock flex test fails even with the known good dock flex. Since the dock flex test tests for continuity, it's an indication of a missing connection. In extremely rare cases that may occur due to cracked solder ball under the Tristar/Hydra IC. Cracked solder ball may also cause spontaneous fails and passes of the dock flex test with the known good dock flex. Replace (or reball, but we strongly recommend to have a new chip) the Tristar/Hydra to solve the issue.

It's also advised to run second test on device with the unplugged battery. An expected ("good") result should be "Tristar/Hydra OK! Check VCC_MAIN". If Tristar/Hydra fails the test only with the battery plugged in, but passes the IC test without the battery, it's advised to try another battery. If the problem stays, it's likely to be a Tristar/Hydra issue that can't be detected via port pins.

Tristar and Hydra IC have a lot of pins (36 and 56 respectively), only 6 of which are directly accessible via the Lightning port. Although those 6 pins are a lot more likely to fail, since they are the only pins to contact with the "outer world", there is a slight chance those pins will pass the test even if the Tristar/Hydra are damaged. The chance for that is very slim, but not zero.
The final decision in the diagnostic is always after the technician!

An additional test estimates the condition of the power system. While short circuit on the main power line is the most common issue with the power system, "Check VCC_MAIN" message means there may be a problem with VCC_MAIN itself or power/charging systems directly attached to it. ICC Pro is able to detect a main line short circuit

(including partial short), but <u>defective</u>, <u>disconnected</u> or <u>deeply discharged</u> battery may also cause "Check VCC_MAIN" message. Problems with generating the main power line or charging will cause "Check VCC_MAIN". In extremely rare cases, DFU device may also give "Check VCC_MAIN" results, although it's not common. However, if you see "Check VCC_MAIN", we strongly advise to check the battery and the main line voltage, and the problematic component should be easy to identify.

Make sure it's not a hardware problem before assuming it's a board level problem! Always gather as much information about the behavior of the diagnosed device as possible before making final conclusions!

Due to differences in the power systems of iPhones and iPads, for instance, greater batteries that require greater charging currents, there will be inaccuracy in additional test with the iPads. Additional test is not guaranteed to work with the iPads correctly.
The dock flex test and IC test work extremely accurately with both iPhones and iPads.
See "Reliability" section for more information.

Additional Information

If ICC Pro shows fail after dock flex test or IC test, it will indicate failed lines' names. The list of the possible lines is the following:

Pin Number	ICC Pro Line Name	Description of the line
1	ACC1	ID/Accessory line 1
2	DP1P	Differential pair 1, positive
3	DP1N	Differential pair 1, negative
4	PP5V	PP5V0_USB 5v from USB cable
5	ACC2	ID/Accessory line 2
6	DP2N	Differential pair 2, negative
7	DP2P	Differential pair 2, positive
8	GND	iPhone's/iPad's ground

ICC Pro has 3 charging modes that switch automatically: trickle charge mode for deep discharge, constant current mode and constant voltage mode. This ensures maximum battery life of the ICC Pro.

If the device is heavily discharged and the battery is below 2.9V, it will be in trickle charge mode to preserve battery life (around 10ma). The screen may or may not turn on when the charging cable is plugged in. It may take a few minutes to a few hours to recover battery to usable voltage in case of deep discharge. It's advised to charge battery as soon as "Low Battery" appears on the screen (3.1V).

Most of the charging process is constant current charging. If the device shows "Low Battery" screen, it will immediately charge with the quickest constant current charging mode. The charging current is 100ma, the screen will turn on for a few seconds, show that it's charging and turn off to maximize charging speed. It usually takes only a few minutes to charge ICC Pro from "Low Battery" to operable state (over 3.1V).

When the battery is almost fully charged, the charging voltage stays at 4.2V and the charging current starts to decrease. Full charging from 3.0V to 4.2V takes up to 3 hours.

Reliability

ICC Pro has undergone extensive testing during all stages of engineering and production. We are confident in its accuracy and want to present you our reliability table*:

	Dock Flex test PASS	Dock Flex test FAIL	IC test PASS	IC test FAIL	Additional test PASS	Additional test FAIL
Dock Flex GOOD	>99%**	<1%**				
Dock Flex BAD	0%	100%				
Tristar/Hydra GOOD			100%	0%		
Tristar/Hydra BAD			1%**	99%**		
Main line GOOD					1%***	99%***
Main line BAD					99%***	1%***

*estimated values based on over hundred tests
**see "Extended Diagnostic" section
***iPhones only; Test result not guaranteed for iPads

See "Extended Diagnostic" section for details.