

System Manual

PLT

0.5.6

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Preface

Document containing instructions for using the PLT system to deploy and execute test suites.

1. PLTcloud User Manual

1.1 Introduction

This document describes the features of the PLT cloud with its different sections. As an example, it focuses on the “IoTSDK Demo” project, that aims to program the *STM32 Discovery kit IoT node* with a firmware image integrating the BLE protocol and test it.

1.2 Home

Use the Home page to navigate easily across the different sections of the PLTcloud website.

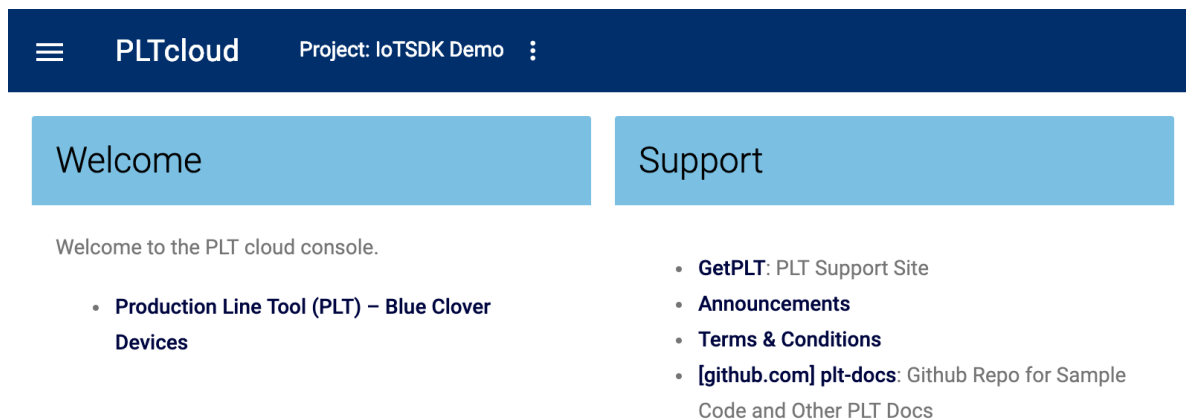


Figure 1.1. Home screen

1.3 PLTs

PLTs are grouped in “Deployment Groups”. These are groups of PLTs that are meant to run the same set of tests. For example, you can have a group of PLTs that you will want to use for In-Circuit (ICT) testing and another group of PLTs that you will want to use for Final Assembly, Test & Packout (FATP) testing.

New Deployment Groups can be created in the “PLTs” view.

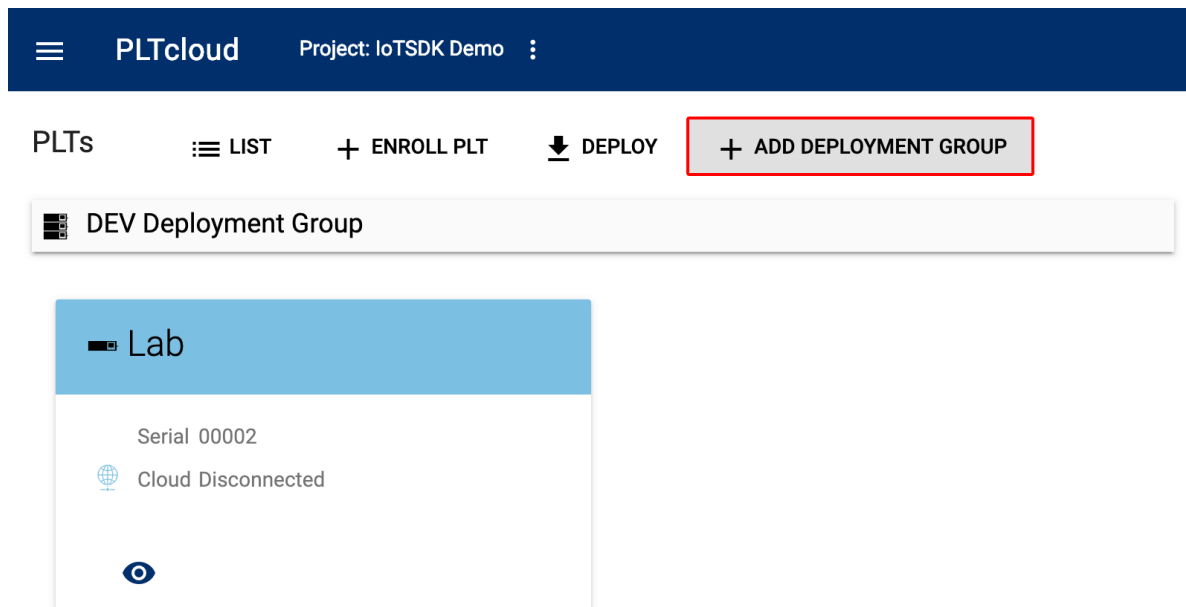


Figure 1.2. PLTs, grouped in Deployment Groups

You can then fill out the name and the description of the group.

PLTcloud

Project: IoTSDK Demo

New Deployment Group

Name

DEV

Description

Development

CREATE

Figure 1.3. New Deployment Group

From the “PLTs” view, detailed information on a PLT can be seen by clicking on the dark-blue eye icon.

PLTcloud

Project: IoTSDK Demo

Lab PLT

SETTINGS

SET DEPLOYMENT GROUP

RESET

Serial Number	00002
Name	Lab
Connection	Disconnected
Deployment Group	<div><div></div>DEV</div>
Project	<div><div></div>IoTSDK Demo</div>
Current Release	None.
Available Release	1.0.0

Figure 1.4. PLT Detail View

In the case of the “STM IoT SDK” project, we are deploying to PLTs that are part of the “DEV” group.

1.4 Adding a PLT

On the PLT UI panel, press the Menu button to enter the PLT Menu, and select Enroll.

The PLT will show an enrollment code on the OLED display.

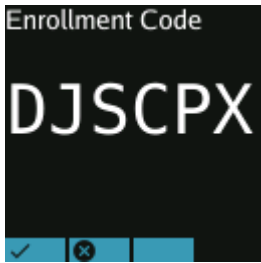


Figure 1.5. Enrollment Code on PLT OLED display

You can enroll your PLT under the “PLTs” section of the PLTcloud website. On the PLTcloud website, use this code as the Activation code in the “Enroll PLT” form.

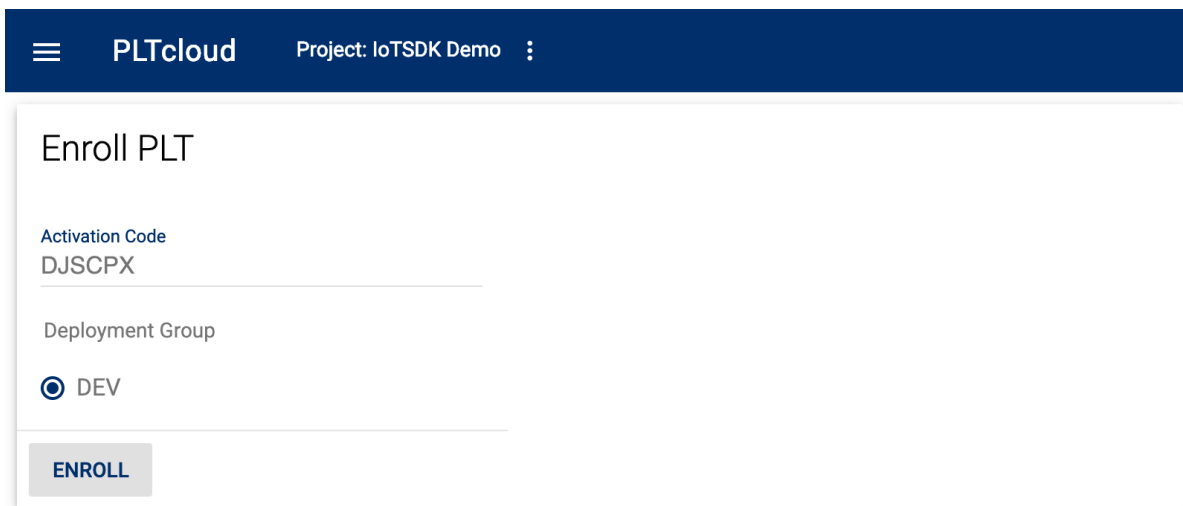
A screenshot of the PLTcloud website's "Enroll PLT" form. The form is white with a dark blue header. The header contains a hamburger menu icon, the text "PLTcloud", and "Project: IoTSDK Demo" followed by a vertical ellipsis. The form itself has a title "Enroll PLT". Below the title, there is a label "Activation Code" and a text input field containing "DJSCPX". Below that is a label "Deployment Group" and a radio button selection with "DEV" selected. At the bottom left of the form is a blue button labeled "ENROLL".

Figure 1.6. PLT Enrollment Form

You can then set the PLT to a specific deployment group by clicking on on “SET DEPLOYMENT GROUP”.



Lab PLT: Set Deployment Group

DEV



SET DEPLOYMENT GROUP


Figure 1.7. Setting Deployment Group for a PLT


For the “STM IoT SDK” project, we set to the “DEV” deployment group.


1.5 PLT Views

You can see a list of all PLTs by pressing “LIST” from the “PLTs” view:

 **PLTcloud** Project: IoTSDK Demo 

PLTs  **DEPLOYMENT GROUPS** **+ ENROLL PLT**

Name		Serial Number
	Lab	00002

Items per page
10 

1-1 of 1



 

Figure 1.8. PLT list view

Or in grouped by deployment group by clicking on on “DEPLOYMENT GROUPS”.

PLTcloud

Project: IoTSDK Demo

PLTs

LIST

+

ENROLL PLT

DEPLOY

+

ADD DEPLOYMENT GROUP

DEV Deployment Group

Lab

Serial 00002

Cloud Disconnected

Figure 1.9. PLTs, grouped by Deployment Group

1.6 Create Project

You can create a project or go through the list of projects already created by clicking on the 3 dots in the top app bar:

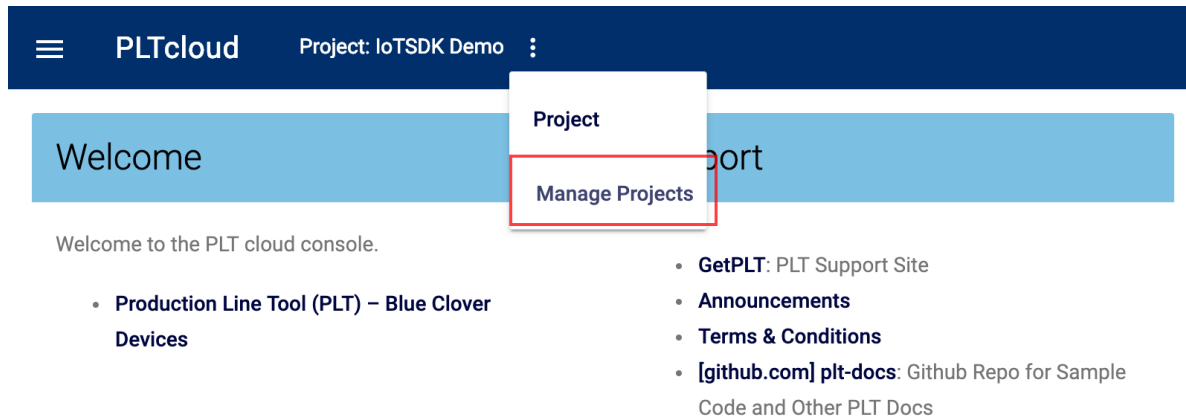


Figure 1.10. Project Menu


The list of projects allows you to switch between them and to select the project you want to work on in PLTcloud. In our case, we selected the “IoTSDK Demo” project.

PLTcloud

Project: IoTSDK Demo

Projects

+ ADD PROJECT

Name	Description	Active
 IoTSDK Demo	Acme' First Project	✓

Items per page

10

1-1 of 1



<

>


Figure 1.11. Project List







1.7 Project Elements


You can add elements to a project.

 **PLTcloud** Project: IoTSDK Demo 

IoTSDK Demo Elements [+ ADD ELEMENT](#)

Show Active 

	Name	Description	Size	Last Modified
  	suite-stm32l4dk-IOT-BLE.yaml	Test Suite		Fri Feb 8 12:17AM
  	STM32L4_IOT-HR.elf	Firmware		Fri Feb 8 12:17AM

Items per page
10 



1-2 of 2  

Figure 1.12. Element List

Elements that you might want to add to a project can, for example, be firmware images (`.hex`, `.elf`, `.bin`), or test suite definition files (`.yaml`).

To test and program the STM IoT demo board, we need to upload the firmware and the test plan. The firmware can be uploaded as an ELF file, for example, `STM32L4_IOT-HR.elf`. The test plan is supplied as a YAML file, for example, `suite-stm32l4dk-IOT-BLE.yaml`:

```
title: "LY10-PLT demo: stm32 DK IoT node"
suite:
- ident: ICT-T1
  title: Erase stm32l4_DevKit with USB ST-Link
  steps:
    - command: erase stm32l4_DevKit
- ident: ICT-T2
  title: Program STM32L4-IOT-BLE stm32l4_DevKit with USB ST-Link
  steps:
    - command: program stm32l4_DevKit none,STM32L4_IOT-HR.elf,none
- ident: ICT-T3
  title: Identify DUT
  steps:
    - command: identify stm32l4_IoT_DevKit
- ident: ICT-T4
  title: BLE discovery
  steps:
    - command: bledis %BLEMAC% 30 # Wait up to 30 seconds for BLE discovery to
complete
```

1.8 Project Releases

You can create releases for your projects.

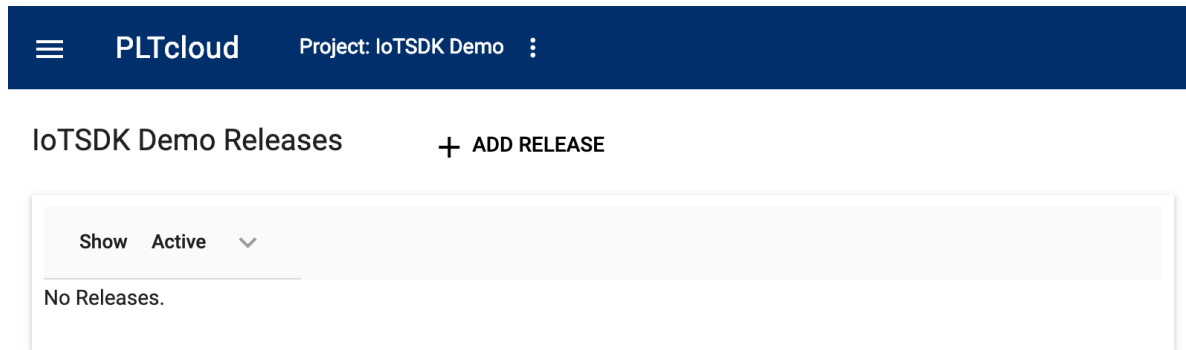


Figure 1.13. Release List (empty)

The elements that you will be able to add to a new release are elements that you will have previously added through the “Elements” section. You can create multiple releases per project.

For example, to create a new release, you would fill the version and description of cases of your release, and select the elements (firmware images and YAML files) you want to be part of your release.

In our case, we need to create a release of the firmware image (`STM32L4_IOT_HR.elf`) and of the YAML file (`suite-stm32l4dk-iot-ble.yaml`) for the “IoTSDK Demo” project. These two elements are therefore checked when creating the release that we named “STM32L4 IoT node BLE”.

Figure 1.15. Release List

1.9 Project Settings

The **Edit** view can be used to modify basic project settings: - Project Name and Description - Serial Number Allocation scheme (Monotonic / Webhook)

1.9.1 Serial Number Webhook API

To perform number allocation through an external webhook API, select the **Webhook** Serial Number Allocation scheme.

Specify the API endpoint:

- WebHook URL: URL of the API endpoint accepting HTTP POST requests from PLTcloud.
- Authentication Token: Hex-encoded token, used to sign the JSON payload sent to the provided URL

1.9.1.1 Webhook Request payload

The configured webhook endpoint will be sent an HTTP POST request containing a JSON payload like below:

```
{
  "dut_id": "<DUT IDENTIFIER>",
  "ble_mac": "<BLE MAC>",
  "mcu_id": "<MCU ID>",
  "MYCUSTOMKEY": "my custom value"
}
```

For security reasons, you probably want to limit requests to those coming from PLTcloud. This can be accomplished by setting an authentication token, and validate the X-Hub-Signature header sent in the webhook request.

The X-Hub-Signature header contains a SHA1 HMAC hexdigest of the webhook payload, using the webhook's authentication token as the key and prefixed with sha1=. The way you verify this signature varies, depending on the language of your codebase.

1.9.1.2 Webhook Response

The API endpoint should return something like:

```
{
  "serial_number": "<SERIAL NUMBER>"
}
```

1.9.2 Debug Keys

The **Debug Keys** view allows managing public SSH keys to control local access to PLTs while in *Debug Mode*.

The SSH keys for which public keys are attached for a project can be used to upload test plan YAML files and other artifacts using **SFTP**.

Once a debug SSH (.pub) key is set on a project that is deployed to a PLT, the debug mode can be activated from the **Reset** section of the PLT view in PLTcloud:



- Reset PLT in Debug Mode
- Wait for PLT to restart in debug mode

While the PLT is in debug mode, an SFTP client (such as sftp or *WinSCP*) can be used to upload release elements.


```
$ sftp debug@<PLT IP>
debug@<PLT_IP>$ put myTestPlan.yaml
debug@<PLT_IP>$ put firmware.hex
debug@<PLT_IP>$ quit
```


1.10 Reports


When a test is executed on a PLT, the report will be automatically generated and be available under the “Reports” section.


 **PLTcloud** Project: IoTSDK Demo 


Test Reports


Project **All** 


Date **All** 

Test Plan **All** 

Test Result **All** 

Deployment Group **All** 

PLT ID **All** 

Any 

FIND

No matching Reports.

Figure 1.16.

Reports are listed in chronological order, and they will be bolded if they were generated less than 5 minutes ago.

2. PLT Operation Guide

2.1 Summary

The Production Line Tool (PLT) executes one or more test plans, for In-Circuit Test (ICT), Final Assembly, Test and Packout (FATP) or other production stations.

With a custom test suite definition, the PLT can also be used for integration testing during development.

It tests interactions over:

- BLE
- UART

During the Test plan, the PLT may also perform firmware programming of:

- RF SoC
- External flash

2.2 Setup

- Connect the Ethernet port to a local network with (outbound) Internet access.
- Connect the AC power socket to AC power (110-240VAC, 50-60Hz)
- (Optional) Connect Zebra label printer to external USB port
- (Optional) Connect Symbol bar code scanner to external USB port
- Use power switch on rear of unit to power on the PLT.

2.3 Usage

2.3.1 DUT Connection

- Use Tag-Connect TC2030-IDC cable to connect 6-pin rear-end IDC SWD socket with the DUT.
- PLT-100A: Use Tag-Connect TC2070-IDC cable to connect 14-pin rear-end IDC Test socket with the DUT.
- PLT-200A: Use Tag-Connect TC2050-IDC cable to connect 10-pin rear-end IDC JTAG socket with the DUT.
- PLT-200A: Use HD78 cable to connect 78-pin rear-end ICT socket with the In-Circuit Test Fixture.

2.3.2 Main Screen

After starting up, the PLT shows the currently selected test plan on the display.

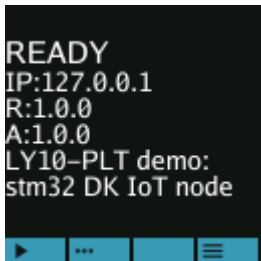


Figure 2.1. Main PLT OLED display

Press button 2 to switch to the correct test plan.

2.3.3 Test Suite Execution

From the main screen, press button #1 to start the test suite.



Figure 2.2. PLT OLED display while tests are passing.

The test suite items will be executed until a failure occurs.

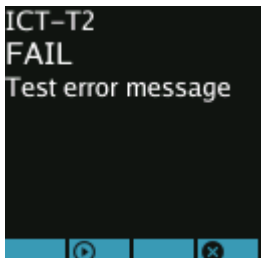


Figure 2.3. PLT OLED display for Test Item failure

When a test item fails, press button 2 to continue with the next item from the test suite.

Press button 4 to abort the test plan.

2.3.4 Operator Tests

Some test steps are not fully automated and require operator intervention.

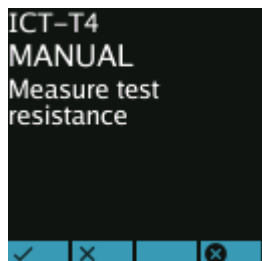


Figure 2.4. PLT OLED display for Operator test item step

2.3.5 Test Suite Completion

Upon completion of the ICT and FATP test plans, a label is printed on a ZPL barcode printer.

2.4 Label Test

To print a test label, first press button #3 from the main screen.

Use button #1 (Up) and button #2 (Down) to highlight the “Label Test” menu entry.

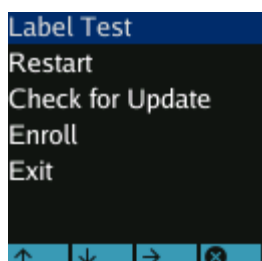


Figure 2.5. Menu on PLT OLED display

Press button #3 (Select) to print a test label.

A test label will be printed on the attached Zebra label printer.

Press button #4 (Exit) to return to the main screen.

2.5 Check for Update

To check for updated PLT firmware, first press button #3 from the main screen.

Use button #1 (Up) and button #2 (Down) to highlight the “Check for Update” menu entry.

Press button #3 (Select) to check for updated PLT firmware label.

If an updated PLT firmware is available, it will be installed.

If no updated PLT firmware is available, a message stating “No Update Available” will be shown.

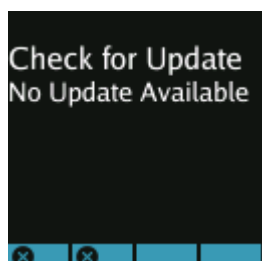


Figure 2.6. Check for Update without available update

3. PLT Probes and Signals

3.1 Summary

The PLT-200A Production Line Tool provides several test probes and signals:

- 8 Power Rails
- 49 Digital Probes
- 45 Analog Probes
- Serial interfaces
 - 1x SWD
 - 1x JTAG
 - 2x UART/SPI
 - 1x CAN

3.2 Probes and Signals

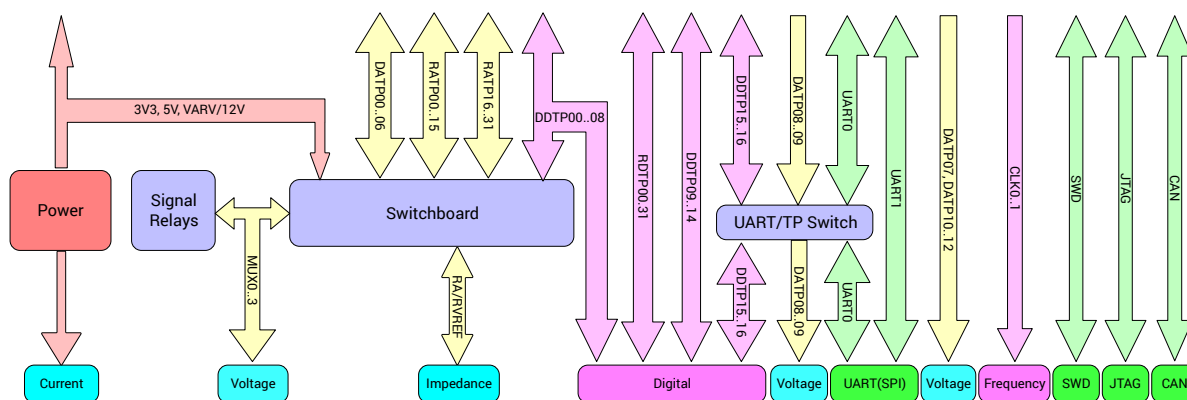


Figure 3.1. PLT-200A Probes and Signals

3.3 Power Rails

- 3V3 (3.3V)
- 5V (5V)
- VARV, 12V (2..12V)
- SWD (3.3V)
- JTAG (3.3V)
- UART0, UART1 (3.3V)

Table 3.1. PLT-200A Power Rails

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
3V3	3.3V	y	y	y	(Switchboard)	y
5V	5V	y	y	y	(Switchboard)	y
12V/VARV	2..12V	y	y	y	(Switchboard)	y
SWD_VDD	3.3V	y	y	n	n	n
JTAG_VCC	3.3V	y	y	n	n	n
UART0_VDD	3.3V	y	y	n	n	n
UART1_VDD	3.3V	n	y	n	n	n
GND	GND	y	y	y	(Switchboard)	n

3.4 Analog Signals

- 13x DATPxx: DATP00..DATP12
- 32x RATPxx: RATP00..RATP31

Table 3.2. PLT-200A Analog Test Probes

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
DATP00		n	n	y	(Switchboard)	n
DATP01		n	n	y	(Switchboard)	n
DATP02		n	n	y	(Switchboard)	n
DATP03		n	n	y	(Switchboard)	n
DATP04		n	n	y	(Switchboard)	n
DATP05		n	n	y	(Switchboard)	n
DATP06		n	n	y	(Switchboard)	n
DATP07		n	n	n	y	n
DATP08	(Alt: UART0_RXD)	y	y	n	y	n
DATP09	(Alt: UART0_TXD)	y	y	n	y	n
DATP10		n	n	n	y	n
DATP11		n	n	n	y	n
DATP12		n	n	n	y	n
DATP00	ADG0 Bank	n	n	y	(Switchboard)	n
RATP01	ADG0 Bank	n	n	y	(Switchboard)	n
RATP02	ADG0 Bank	n	n	y	(Switchboard)	n
RATP03	ADG0 Bank	n	n	y	(Switchboard)	n
RATP04	ADG0 Bank	n	n	y	(Switchboard)	n
RATP05	ADG0 Bank	n	n	y	(Switchboard)	n
RATP06	ADG0 Bank	n	n	y	(Switchboard)	n
RATP07	ADG0 Bank	n	n	y	(Switchboard)	n
RATP08	ADG0 Bank	n	n	y	(Switchboard)	n
RATP09	ADG0 Bank	n	n	y	(Switchboard)	n
RATP10	ADG0 Bank	n	n	y	(Switchboard)	n
RATP11	ADG0 Bank	n	n	y	(Switchboard)	n
RATP12	ADG0 Bank	n	n	y	(Switchboard)	n
RATP13	ADG0 Bank	n	n	y	(Switchboard)	n
RATP14	ADG0 Bank	n	n	y	(Switchboard)	n
RATP15	ADG0 Bank	n	n	y	(Switchboard)	n
RATP16	ADG1 Bank	n	n	y	(Switchboard)	n
RATP17	ADG1 Bank	n	n	y	(Switchboard)	n
RATP18	ADG1 Bank	n	n	y	(Switchboard)	n
RATP19	ADG1 Bank	n	n	y	(Switchboard)	n
RATP20	ADG1 Bank	n	n	y	(Switchboard)	n
RATP21	ADG1 Bank	n	n	y	(Switchboard)	n
RATP22	ADG1 Bank	n	n	y	(Switchboard)	n
RATP23	ADG1 Bank	n	n	y	(Switchboard)	n
RATP24	ADG1 Bank	n	n	y	(Switchboard)	n
RATP25	ADG1 Bank	n	n	y	(Switchboard)	n

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
RATP26	ADG1 Bank	n	n	y	(Switchboard)	n
RATP27	ADG1 Bank	n	n	y	(Switchboard)	n
RATP28	ADG1 Bank	n	n	y	(Switchboard)	n
RATP29	ADG1 Bank	n	n	y	(Switchboard)	n
RATP30	ADG1 Bank	n	n	y	(Switchboard)	n
RATP31	ADG1 Bank	n	n	y	(Switchboard)	n

3.5 Digital Signals

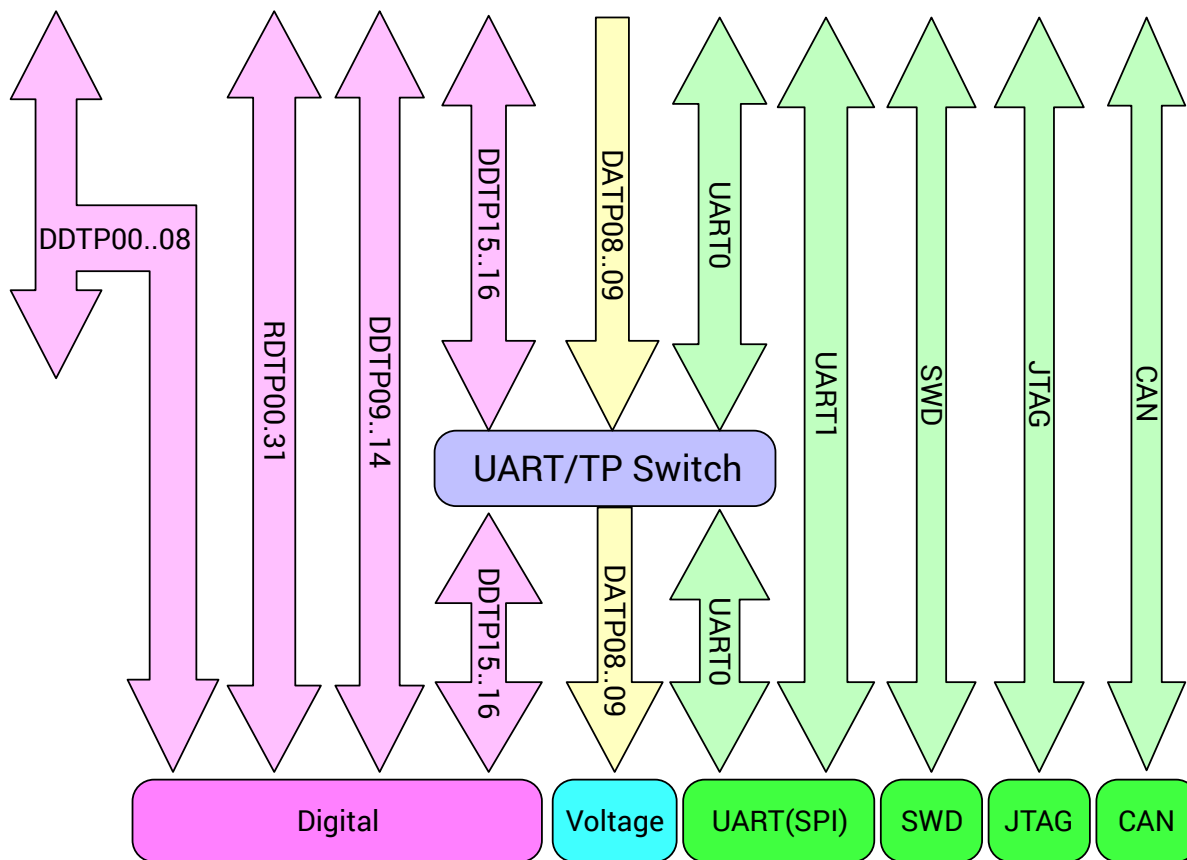


Figure 3.2. PLT-200A Digital Signals

3.5.1 Digital Probes

- 17x DDTPxx: DDTP00..DDTP16
- 32x RDTPxx: RDTP00..RDTP31

Table 3.3. PLT-200A Digital Test Probes

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
DDTP00		n	y	y	(Switchboard)	n
DDTP01		n	y	y	(Switchboard)	n
DDTP02		n	y	y	(Switchboard)	n
DDTP03		n	y	y	(Switchboard)	n
DDTP04		n	y	y	(Switchboard)	n
DDTP05		n	y	y	(Switchboard)	n
DDTP06		n	y	y	(Switchboard)	n
DDTP07		n	y	y	(Switchboard)	n
DDTP08		n	y	y	(Switchboard)	n
DDTP09		n	y	n	n	n
DDTP10		n	y	n	n	n
DDTP11		n	y	n	n	n
DDTP12		n	y	n	n	n
DDTP13		n	y	n	n	n
DDTP14		n	y	n	n	n
DDTP15	(Alt: UART0_CTS)	y	y	n	n	n

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
DDTP16	(Alt: UART0_RTS)	y	y	n	n	n
RDTP00		n	y	n	n	n
RDTP01		n	y	n	n	n
RDTP02		n	y	n	n	n
RDTP03		n	y	n	n	n
RDTP04		n	y	n	n	n
RDTP05		n	y	n	n	n
RDTP06		n	y	n	n	n
RDTP07		n	y	n	n	n
RDTP08		n	y	n	n	n
RDTP09		n	y	n	n	n
RDTP10		n	y	n	n	n
RDTP11		n	n	n	n	n
RDTP12		n	n	n	n	n
RDTP13		n	n	n	n	n
RDTP14		n	n	n	n	n
RDTP15		n	n	n	n	n
RDTP16		n	n	n	n	n
RDTP17		n	n	n	n	n
RDTP18		n	n	n	n	n
RDTP19		n	n	n	n	n
RDTP20		n	n	n	n	n
RDTP21		n	n	n	n	n
RDTP22		n	n	n	n	n
RDTP23		n	n	n	n	n
RDTP24		n	n	n	n	n
RDTP25		n	n	n	n	n
RDTP26		n	n	n	n	n
RDTP27		n	n	n	n	n
RDTP28		n	n	n	n	n
RDTP29		n	n	n	n	n
RDTP30		n	n	n	n	n
RDTP31		n	n	n	n	n

3.5.2 Clock Signals

- CLK0, CLK1

Table 3.4. PLT-200A Clock Signals

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
CLK0		n	n	n	n	n
CLK1		n	n	n	n	n

3.5.3 Serial Interfaces

- UART0, UART1
- SWD
- JTAG
- CAN

Table 3.5. PLT-200A Serial Interface Signals

PLT-200A	Notes	Rear	ICT	Switchboard	Voltage	Current
UART0_TXD	(Alt: DATP09)	y	y	n	(Alt: DATP09)	n
UART0_RXD	(Alt: DATP08)	y	y	n	(Alt: DATP08)	n
UART0_CTS	(Alt: DDTP15)	y	y	n	n	n
UART0_RTS	(Alt: DDTP16)	y	y	n	n	n
UART1_TXD		n	y	n	n	n
UART1_RXD		n	y	n	n	n
UART1_CTS		n	y	n	n	n
UART1_RTS		n	y	n	n	n
SWD_NRST		y	y	n	n	n
SWD_SWDIO		y	y	n	n	n
SWD_SWCLK		y	y	n	n	n
SWD_SWO		y	y	n	n	n
JTAG_TMS		y	y	n	n	n
JTAG_TCK		y	y	n	n	n
JTAG_TDO		y	y	n	n	n
JTAG_TDI		y	y	n	n	n
JTAG_TRST		y	y	n	n	n
CAN_L		n	y	n	n	n
CAN_H		n	y	n	n	n

3.6 Switchboard

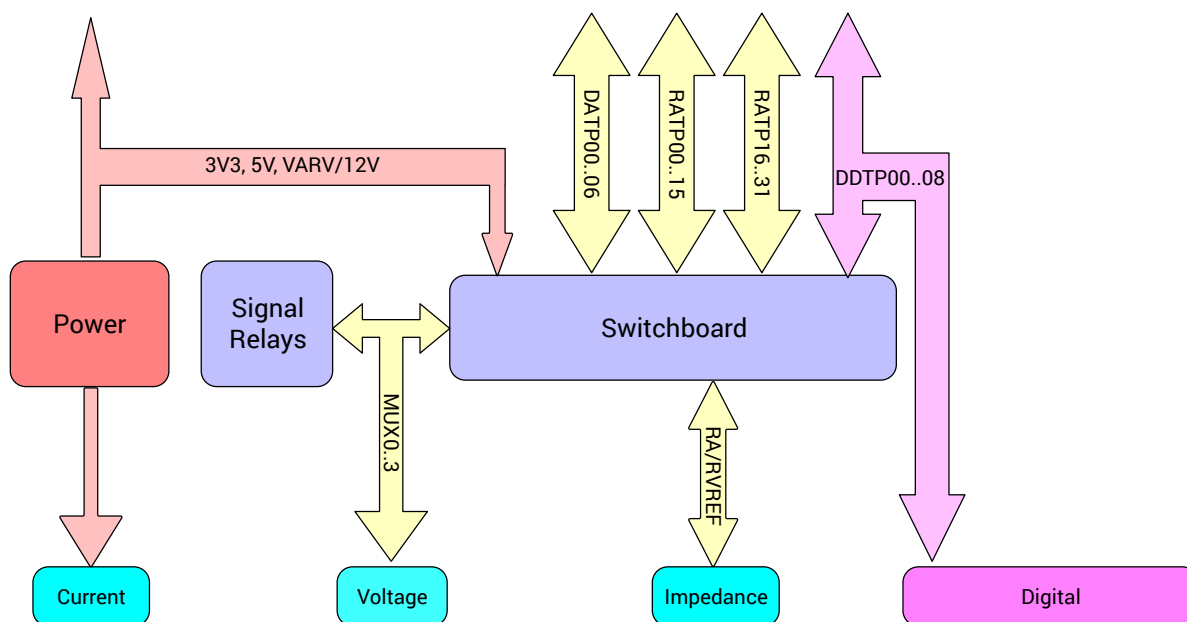


Figure 3.3. PLT-200A Switchboard

The mux command can be used to assign any of the following signals to one of 4 multiplex channels.

signal	MUX	Description
DATP00..DATP06	0, 1	Direct Analog Test Probes
RATP00..RATP31	0, 1	Routed Analog Test Probes
DDTP00..DDTP08	2, 3	Direct Digital Test Probes
RVREF	all	Impedance measurement, reference voltage
RA	all	Impedance measurement, test voltage
GND	all	Ground
3V3OUT	all	3.3V power rail
5VOUT	all	5.0V power rail
VARVDIV	all	VARV power rail, after 1/3 voltage divider

Relays between the different multiplex channels can be controlled using the short command.

```
suite:
- ident: ICT-T1
  title: Setup MUX
  steps:
    - command: mux 0 DATP02
    - command: mux 1 DATP03
    - command: mux 2 RA
    - command: mux 3 RVREF
    - command: short 0 2 set
    - command: short 1 3 set
- ident: ICT-T2
  title: Measure impedance DATP02..DATP03
  steps:
    - command: measure impedance 10-200k0hm
```

Bibliography

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