

# OpenCPI Plutosdr Getting Started Guide

OpenCPI Release: v2.4.6

*Revision History*

| Revision | Description of Change                | Date    |
|----------|--------------------------------------|---------|
| v1.7     | Initial Release                      | 4/2020  |
| v2.0     | Updates Made to Installation Process | 10/2020 |

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# 1 References

The reference(s) in Table 1 can be used as an overview of OpenCPI and may prove useful. The installation guide is required since many of the steps mentioned here are defined there, especially in the section: Enabling OpenCPI Development for Embedded Systems. This document provides details for this system that can be applied to procedures defined there. It is best to use both documents at the same time. This document assumes a basic understanding of the Linux command line (or “shell”) environment.

| Title                           | Link                                                                                               |
|---------------------------------|----------------------------------------------------------------------------------------------------|
| OpenCPI User Guide              | <a href="#">OpenCPI_User_Guide.pdf</a>                                                             |
| Acronyms and Definitions        | <a href="#">Acronyms_and_Definitions.pdf</a>                                                       |
| OpenCPI Installation Guide      | <a href="#">OpenCPI_Installation_Guide.pdf</a>                                                     |
| ADALM-PLUTO (PlutoSDR) Overview | <a href="http://wiki.analog.com/university/tools/pluto">wiki.analog.com/university/tools/pluto</a> |

Table 1: References

# 2 Overview

This document provides steps for configuring a factory provided Analog Device’s ADALM-PLUTO (PlutoSDR) with the OpenCPI run-time environment for executing applications. Support for the PlutoSDR is based on *ocpi.osp.plutosdr* system support project, using the *plutoSDR* OpenCPI HDL (FPGA) platform and the *adi.plutosdr0\_32* OpenCPI RCC (software) platform. The primary mode of operation for PlutoSDR is Server mode (ocpiremote).

# 3 Prerequisites

It is assumed that the tasks defined in the “Enabling OpenCPI Development for Embedded Systems” section of the *OpenCPI Installation Guide* have been successfully performed.

## 3.1 Hardware Setup

OpenCPI has been tested on revision B of the PlutoSDR which is the latest as of 4/2020. PlutoSDR can be configured into two different modes: PlutoSDR-as-Device and PlutoSDR-as-Host. To make PlutoSDR platform act the most similar to other supported device, use the PlutoSDR-as-Host mode with a network adapter.

### 3.1.1 PlutoSDR-as-Device

In this mode PlutoSDR is a USB device to a development host. To enable this mode, connect a cable between the development host and the micro-USB port located on the center of the PlutoSDR with labeled with a USB symbol. Both power and data are provided through this connection. When the PlutoSDR is in this mode it emulates several devices that appear to the development host as USB-attached devices:



Figure 1: Connected micro-USB cable

When the PlutoSDR is in this mode, even though there is single cable, several USB-attached devices appear on the development host:

- **USB serial**, which appears as a Linux tty device in `/dev/ttyACMx` for use by terminal emulators like "screen".
- **Mass storage**, which appears as a writable disk that can be used to update the non-volatile boot firmware inside the PlutoSDR.
- **RNDIS Ethernet**, which appears as a Ethernet link `ethx`. PlutoSDR's IP address is set statically to `192.168.2.1`. The development host will need to statically set it's IP address on `ethx` to be on the same subnet as PlutoSDR, for example `192.168.2.10`. If it is required that multiple PlutoSDR's are to be on the same host, the following change to the PlutoSDR `config.txt` is required. The `config.txt` file is available as part of the emulated mass storage device when connected via USB on a development host. This is necessary because by default the Plutos have the same IP address from the factory. To resolve this, change the following lines in the `config.txt` and modify the Ethernet address to be unique:

```
# [NETWORK]
# hostname = plutosdr
# ipaddr = <unique IP address>
# ipaddr_host = 192.168.2.10
# netmask = 255.255.255.0
```

### 3.1.2 PlutoSDR-as-Host

In this mode the PlutoSDR is the USB host, no development host is required. Supported USB devices include mass storage devices, Ethernet, and WiFi devices. You need a USB On-the-Go (OTG) cable or compatible USB dongle, along with a USB power supply. When an Ethernet dongle is attached the platform's IP address will be issued by a DHCP server. Alternatively, the platform's IP address can be statically set using the `config.txt` file. In this configuration use SSH to access the PlutoSDR's command prompt. Power must be applied to the micro-USB port labeled with power supply symbol.



Figure 2: Connected OTG Ethernet Device

## 3.2 Firmware Setup

A firmware update is required to run OpenCPI run-time environment. The PlutoSDR must be in `??` mode to perform an update. In lieu of having an SD card, PlutoSDR uses an emulated mass storage device as a method to update its firmware. Use the steps below to update the device's firmware. Additional information can be found at <https://wiki.analog.com/university/tools/pluto/users/firmware>

- Connect PlutoSDR to development host in PlutoSDR-as-Device.
- Download prebuilt artifacts provided by analog devices at <https://github.com/analogdevicesinc/plutosdr-fw/releases/download/v0.32/plutosdr-fw-v0.32.zip>.
- Move `pluto.frm` from the unzipped file from above on to the device to update its firmware.
- Unmount storage device.
- (Conditional) If on a VM, eject the usb device from the host as well.
- LEDs on PlutoSDR will begin to blink for about a minute.
- When complete, PlutoSDR will reboot itself and the emulated devices will reappear on the development host.

## 4 Hardware Setup

### 4.1 Establish a Serial Connection

The installation guide provides the procedure establishing a serial console. On PlutoSDR systems the console serial port operates at 115200 baud. You must be in *PlutoSDR as a device* mode to access Linux console.

### 4.2 Issues Regarding Storage

The RCC software platform `adi_plutosdr0_32` does not support NFS mounts. Also, the PlutoSDR only has about 30 MB of volatile storage. In order to use a larger storage volume a USB hub can be used to interconnect a flash drive and the PlutoSDR.

## 5 Configuring the run-time environment on the platform

The installation guide provides the procedure for setting up and verifying the runtime environment. This system has its username and password initially set to `“root:analog”`.

## 6 Run an Application

See the installation guide for running a small test application.