 **Project documentation**

FIRO2.1 Docking station controller

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1. Overview

Description

The docking station controller is a part of FIRO charging system. The purpose of this circuit is to turn on the external power supply in response to the rover’s signal, to match output voltage polarity to rover’s orientation and to shut off the external power supply after charging sequence ends.

**Features:**

* Safe delivery of 12A constant charging current
* Activation signal polarity matching
* Automatic and adjustable shutdown based on no current flow
* Temperature-based emergency shutdown
* No µC onboard – high radiation tolerance

Usage

**Safety**

WARNING: High voltage section present, use extreme caution when handling the device.

Before mounting or testing the high voltage section of the device make sure the high voltage guard is attached and undamaged. Most of the testing and adjustment can be done without connecting any high voltage to the board, as it is only used to toggle power to the external supply.

**Considerations**

Before use make sure that the CJ jumper cables are soldered correctly (in a crossing pattern) and the thermistor probe is positioned correctly in the T PROBE zone.

Potentiometer trimming is acceptable during operation as long as no high voltage source is connected as there’s minimal risk of injury to the user (damage to the board and components is still possible)

**Mechanical assembly**

High voltage guard should be glued into its designated position. Take care not to mismatch the guard with the mounting holes of the high voltage section.

The device should be mounted into its designated position with use of 4xM3 screws and (if needed) spacer sleeves.

**Connection**

Charging pad connector: AMASS XT60-PW-F, polarity not crucial.

Supply voltage: 2x AWG14 cable, soldered to SUPPLY+ and SUPPLY- terminals. Supply 24V/12A.

High voltage: 220V live wire to LIVE IN (refer to pinout), LIVE OUT to supply LIVE IN. Supply neutral to neutral wire. Use extreme caution when handling high voltage.

**Obraz zawierający tekst, diagram, linia, Czcionka

Opis wygenerowany automatycznie**

**Operation**

To initialize the device, provide 24V signal onto the charging pads. The device will respond with the 24V power signal of matched polarity. The device turns off when the output current is lower than the set threshold for a set amount of time.

Correct operation of the device is signaled by 2 green power LEDs and a blue CHG LED glowing. The device will also signal the detected polarity via the LINE A/LINE B blue LEDs near the charging pad connector.

**Trimming**

End-of-charging cutoff parameters can be easily adjusted via two onboard potentiometers:

* CUR TSH – sets the current cutoff value in range of 0 to ~500mA. This current includes the controller’s internal logic current, so setting this value too low can result in the device never shutting down.
* CUR CHG – sets the delay time between cutoff current event and real supply cutoff in range of 0 to ~5.5s. Setting the delay too low can result in supply turning off before charging-start signal from the rover ends.

It is possible to extend the available delay times for end-of-charging cutoff by exchanging C7 capacitor for one of higher capacitance.

Emergency cutoff temperature is controlled trough matching the R19 resistor value to expected thermistor resistance at given temperature, [nominally - Table 3 in VISHAY NTCLE413E2103F520L documentation].

Pinout

Obraz zawierający tekst, obwód, elektronika, Inżynieria elektroniczna

Opis wygenerowany automatycznie

Troubleshooting

No common issues were encountered at this stage.

1. Design

Requirements

* 24V/12A charging capabilities
* 2-pin operation, no polarity dependence
* Automatic turn-off after charging sequence end
* On state latch-up avoidance
* Faulting to off state wherever possible.

Components

This section should highlight the most important components and their functions.

Schematic

Include an exported image of the PCB schematic.  
Optionally describe any relevant details about the schematic design

Layout

Include exported images of the PCB layouts

* Combined layout with dimensions. Include all important dimensions: PCB width and height, mounting holes size and position, etc.
* Combined layout without dimensions
* Separate layouts for each layer  
  Optionally describe any relevant details about the layout

Reference Documentation

Include links to relevant reference documents such as datasheets for the components. When possible, host the documents in the project repository. It will guarantee they are easily accessible in the future, even If the original links would be no longer valid.

1. Firmware

Overview

Device isn’t programmable, there’s no firmware present onboard.

1. Manufacturing

Manufacturing Considerations

Include any manufacturing considerations for the PCB design, such as panelization, solder mask requirements, or impedance control.

Assembly Instructions

Include any specific guidelines or precautions that need to be followed during the assembly process.

Testing

Describe the testing procedures and methodologies used to verify the functionality of the PCB.

1. Conclusions

Summarize the key findings of the PCB project. Provide recommendations for future improvements.