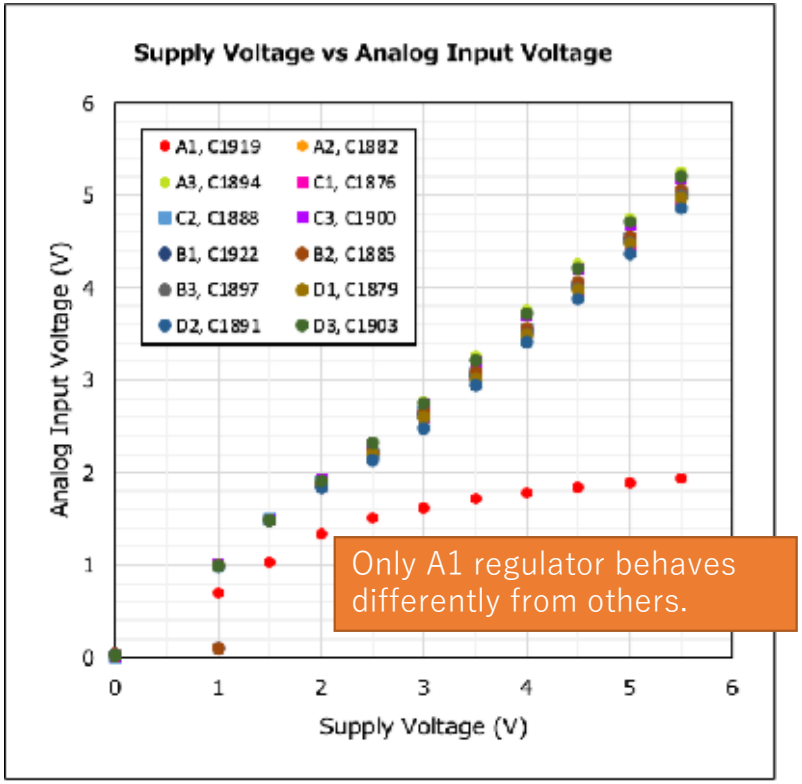
Analogue Regulator for A1 port @ ROC

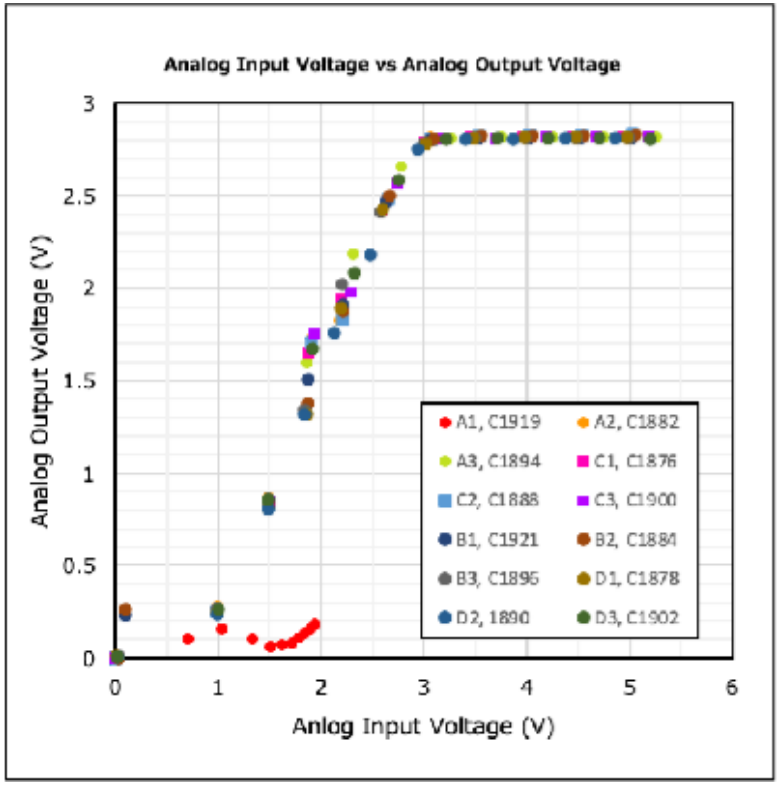
RIKEN/RBRC

Itaru Nakagawa

Input Voltage Anomaly for A1 Analogue Regulator

Voltage scan of the input/output voltage of analogue power regulators for FPHX at ROC



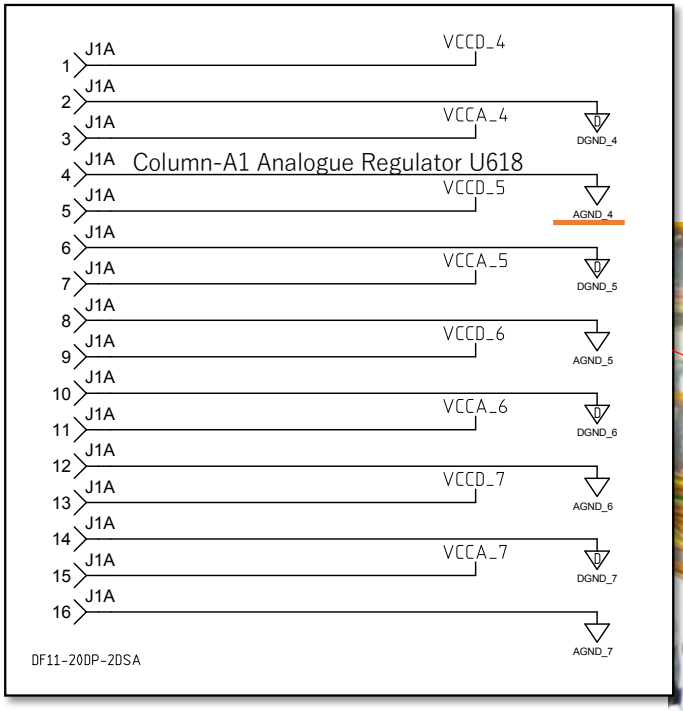


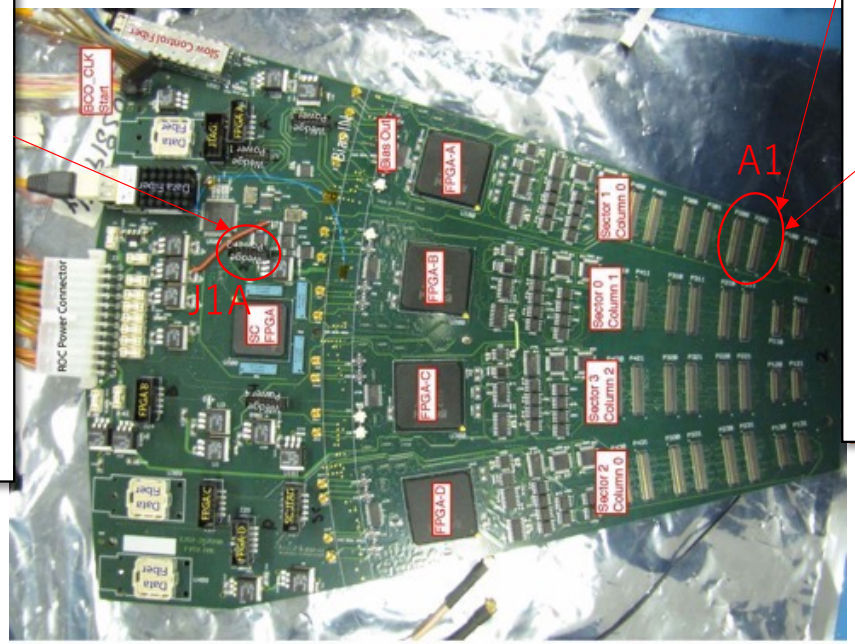
NW4

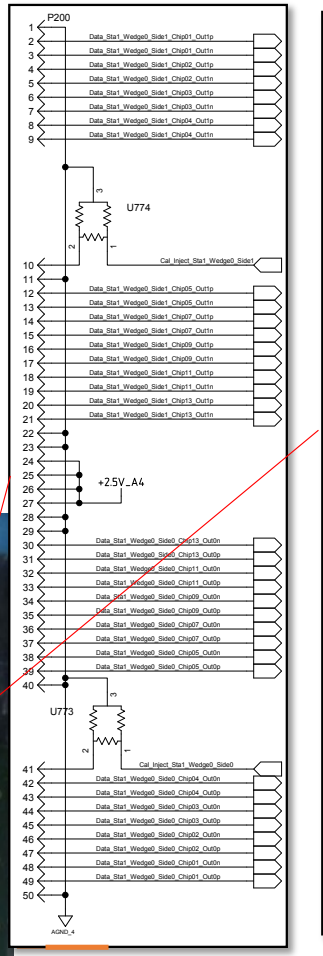
https://indico2.riken.jp/event/3843/contributions/17247/attachments/11088/15802/20210921_RIKEN_activities.pdf

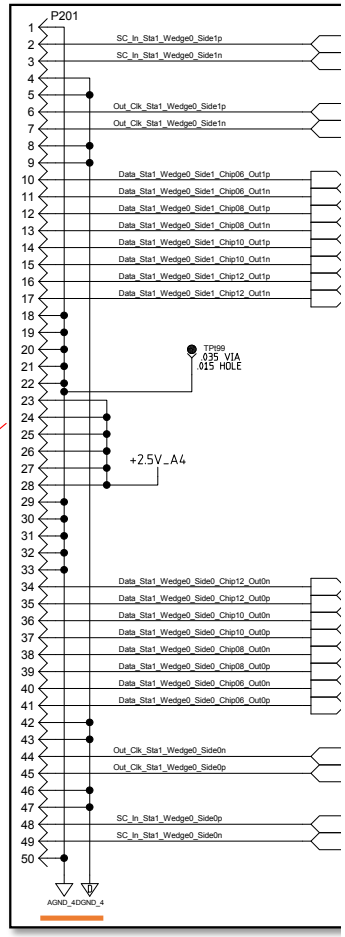
Circuit Design

Traced back circuit for the analogue regulator for A1 port in the ROC circuit drawing.

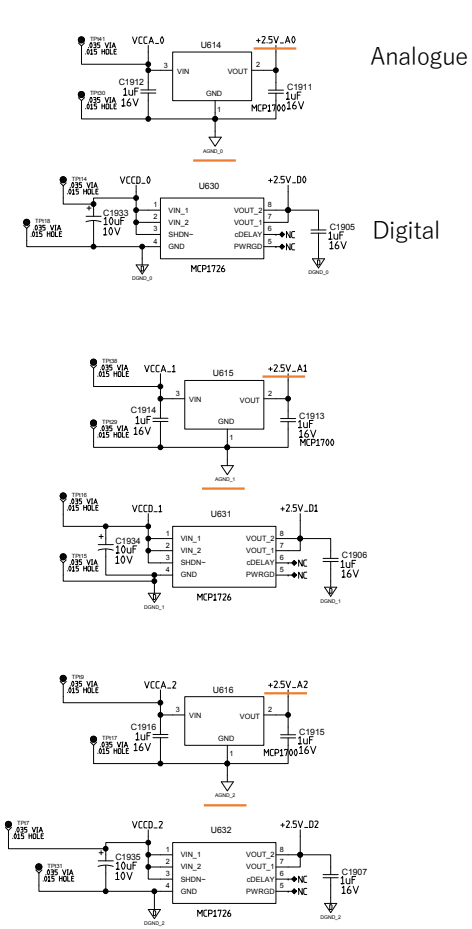








+2.5V V_{out} and AGND

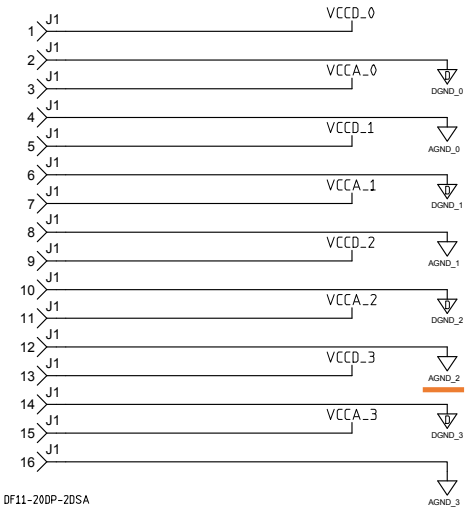


A1 port

Regulator	+2.5V_AX	AGND_X
U614	0	0
U615	1	1
U616	2	2
U617	3	3
U618	**4**	**2**
U619	5	5
U604	6	6
U605	7	7

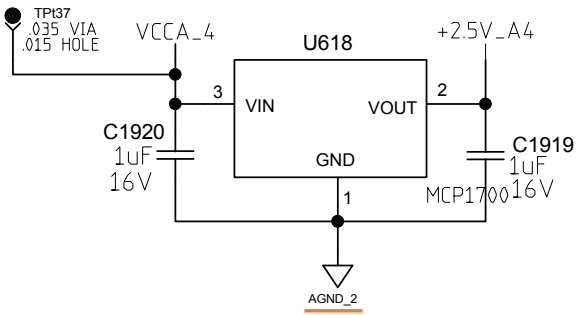
AGND_2 is wired to U616 as well

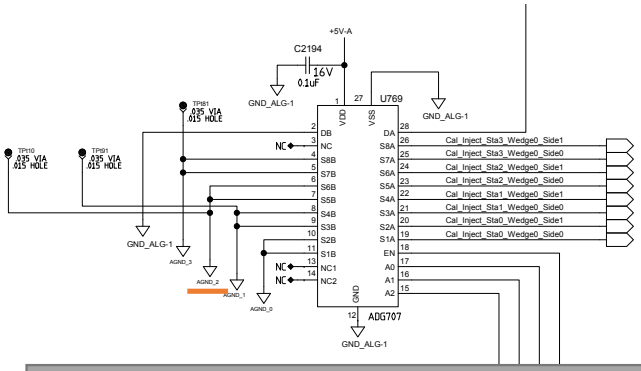
AGND_2 Trace on ROC



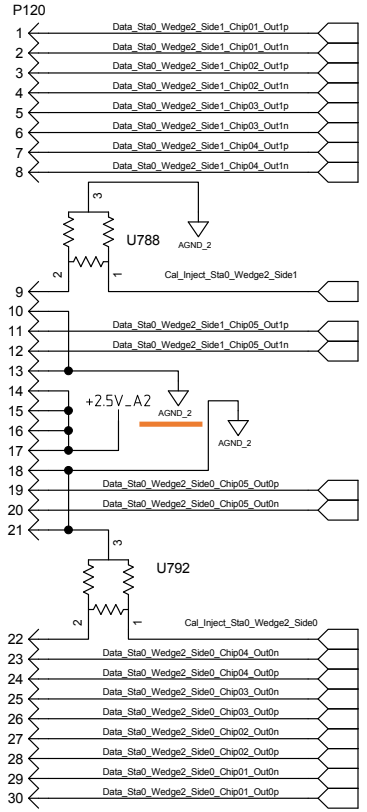
J1 port
(FPHX Power for Station-0)

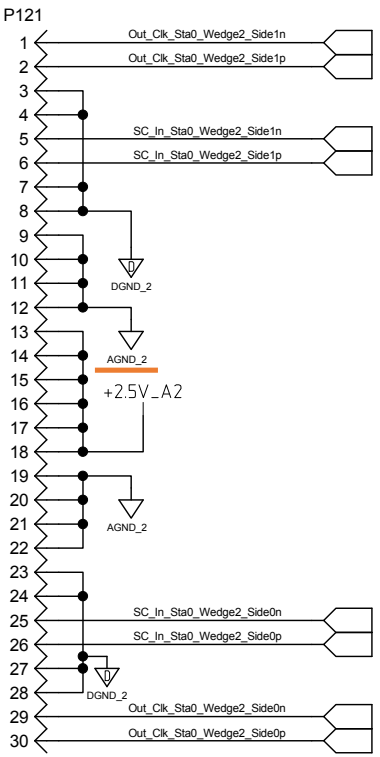
Regulator for Column-A, Station-1





Calib-Multiplexer for Column-A

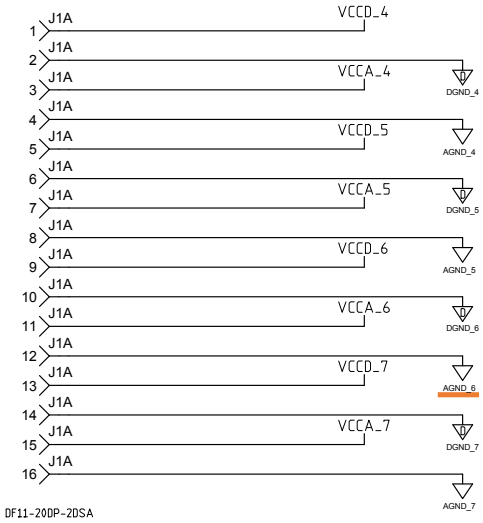




DF18 for Column-A, Station-0

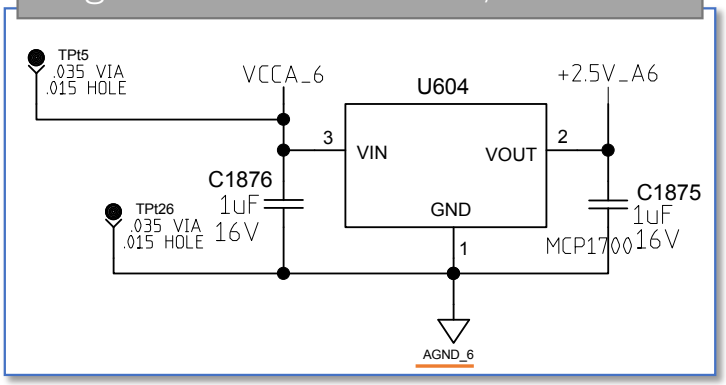
Evidently, there is mis-match in the analogue GND. Station-0 and Station-1 are mixed.

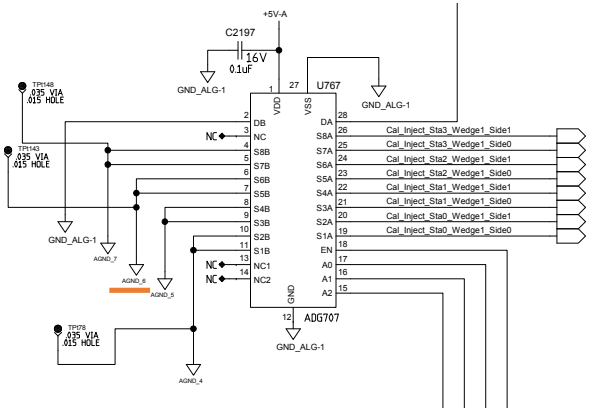
AGND_6 Trace on ROC



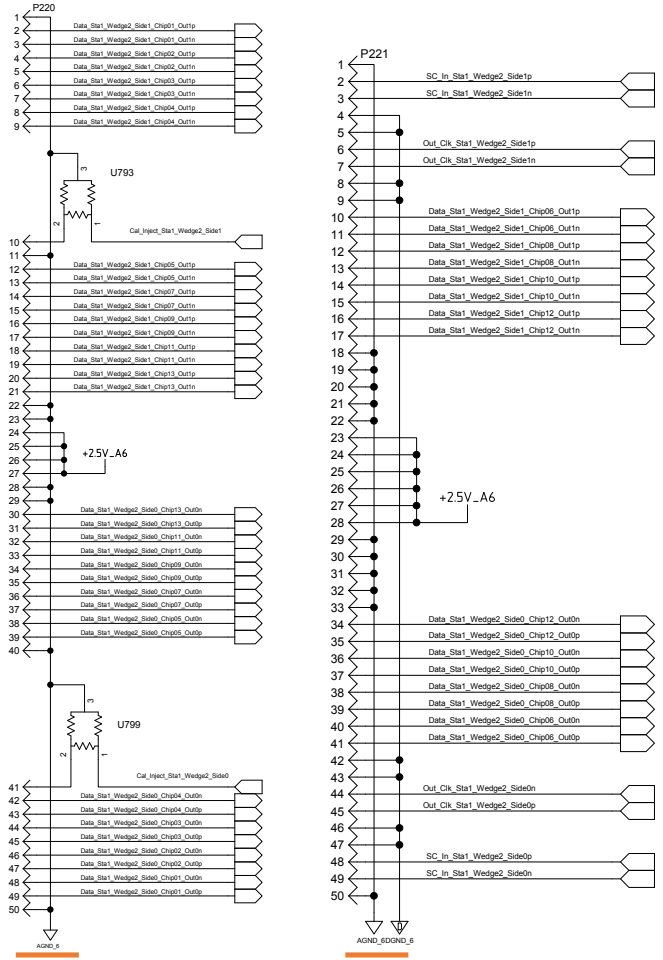
J1A port
(FPHX Power for Station-1)

Regulator for Column-C, Station-1





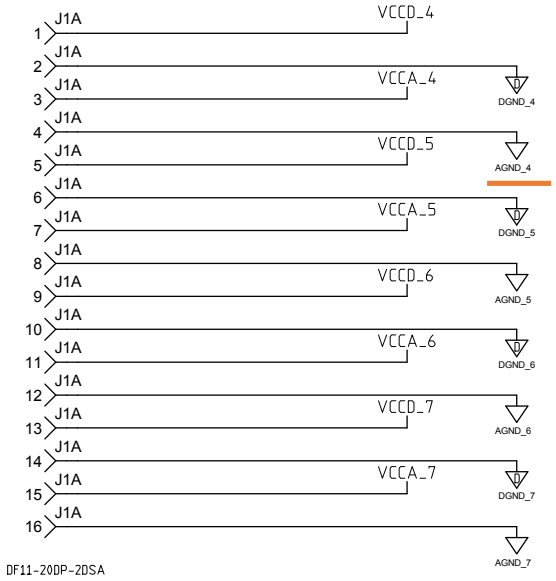
Calib-Multiplexer for Column-C



DF18 for Column-C Station-1

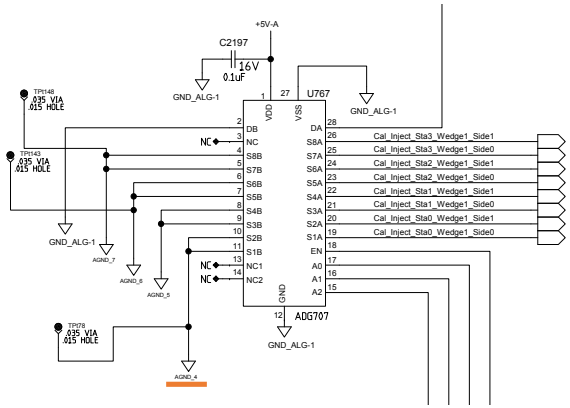
AGND is wired within Column-C, Station-1 throughout ROC trace as expected.

AGND_4 Trace on ROC

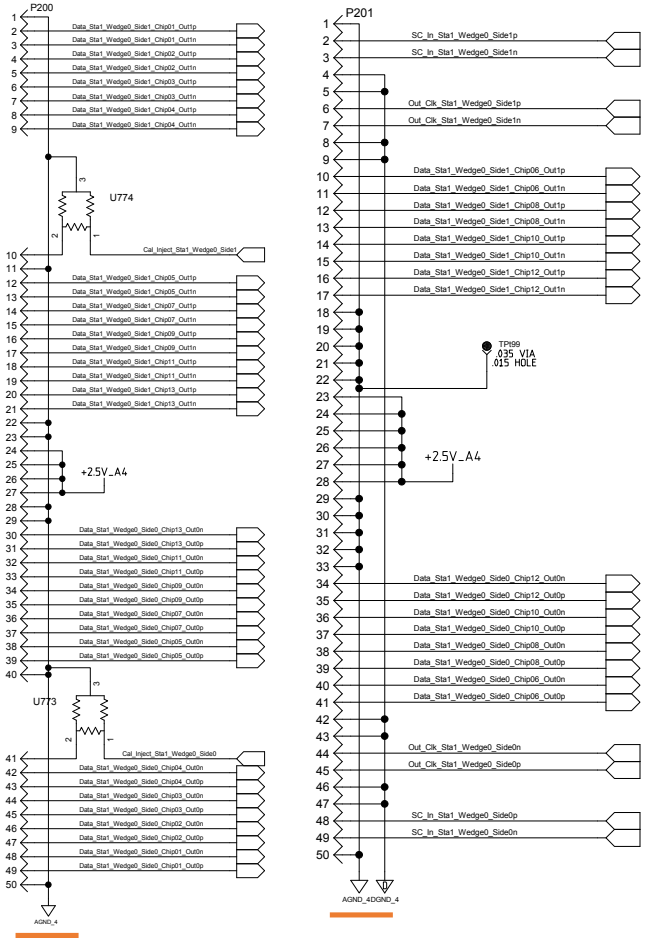


J1A port
(FPHX Power for Station-1)

No regulator is wired from AGND_4



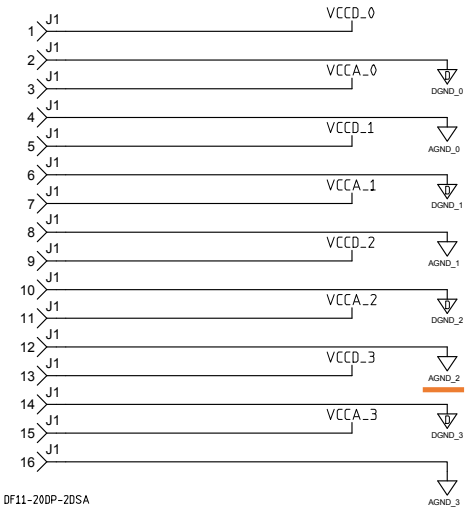
Calib-Multiplexer for Column-B



DF18 for Column-A Station-1

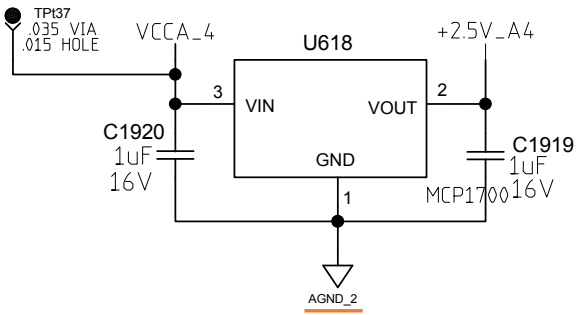
The AGND_4 analogue ground is not wired to any regulators.

AGND_2 Trace on ROC

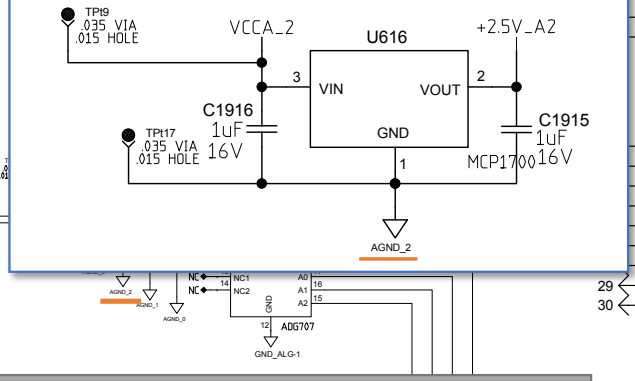


J1 port
(FPHX Power for Station-0)

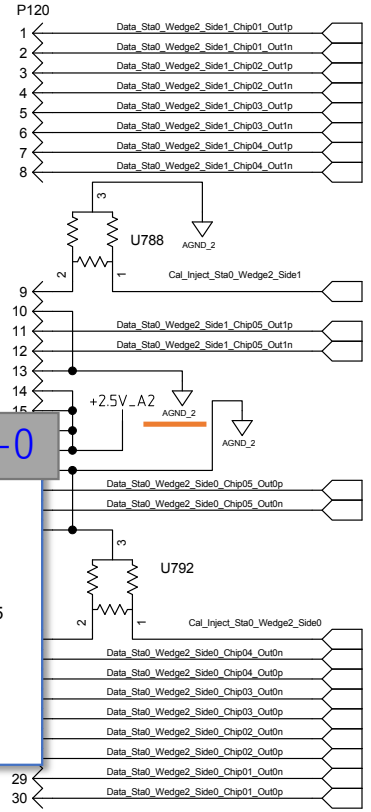
Regulator for Column-A, Station-1

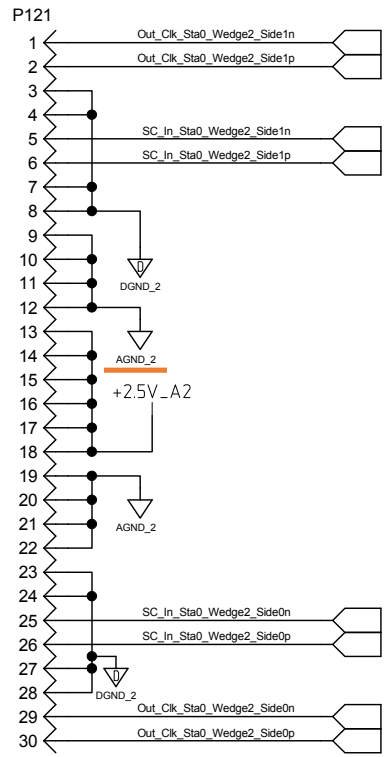


Regulator for Column-A, Station-0



Calib-Multiplexer for Column-A

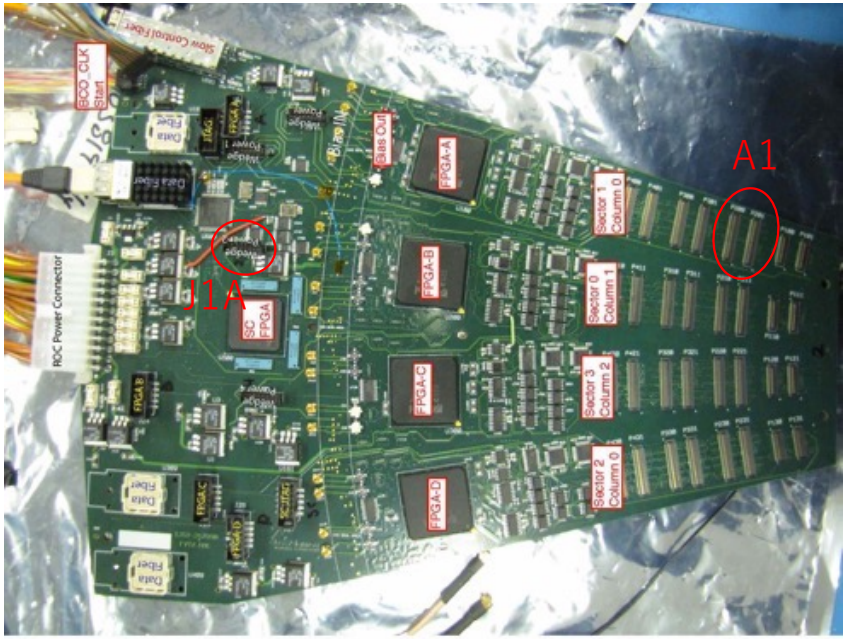


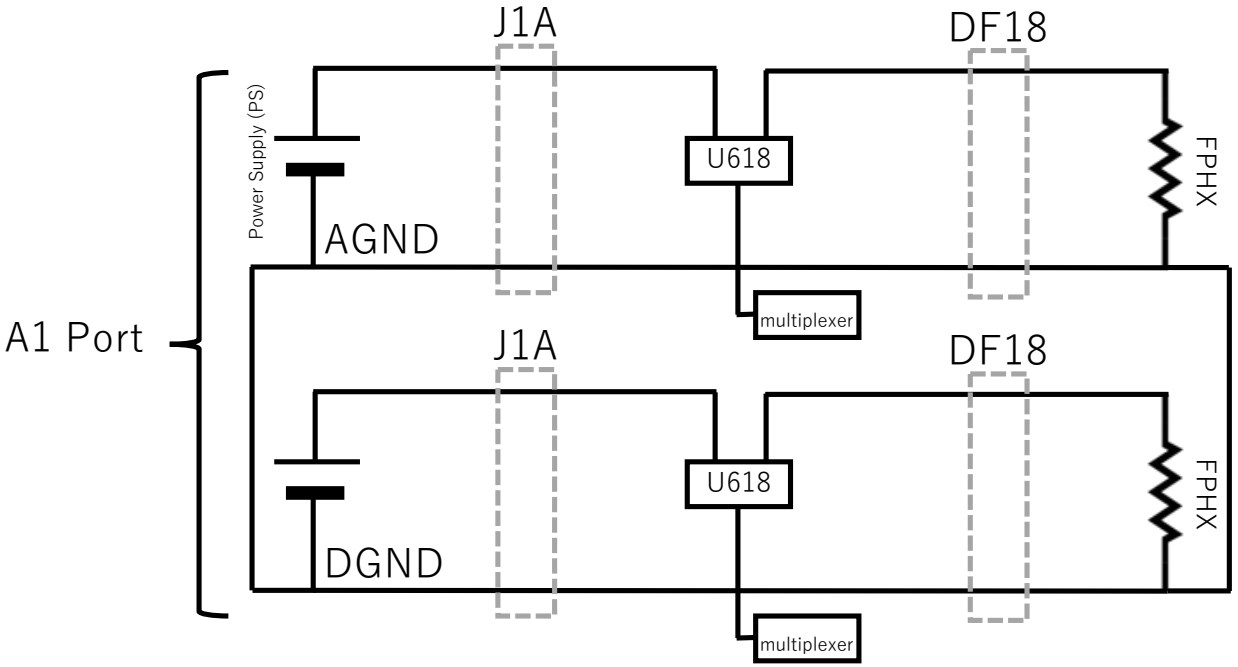


DF18 for Column-A, Station-0

AGND_2 is shared with Column-A, Station-0 and Station-1 analogue regulators.

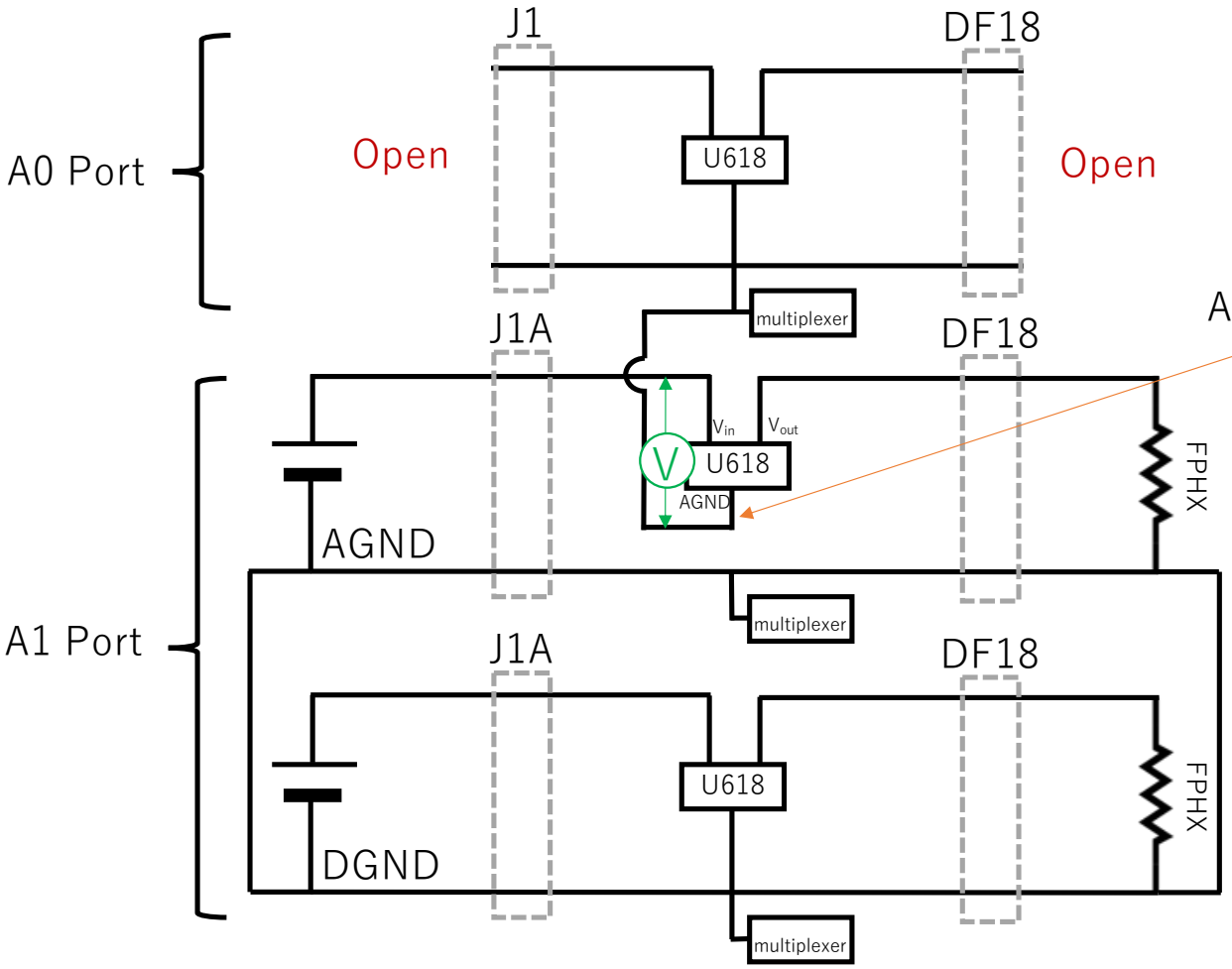
Correct Circuit Configuration

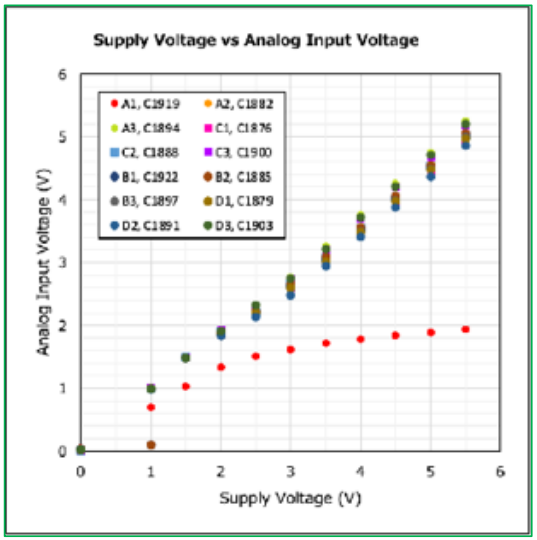




AGND and DGND are shorted at the wedge.

Present Circuit Diagram

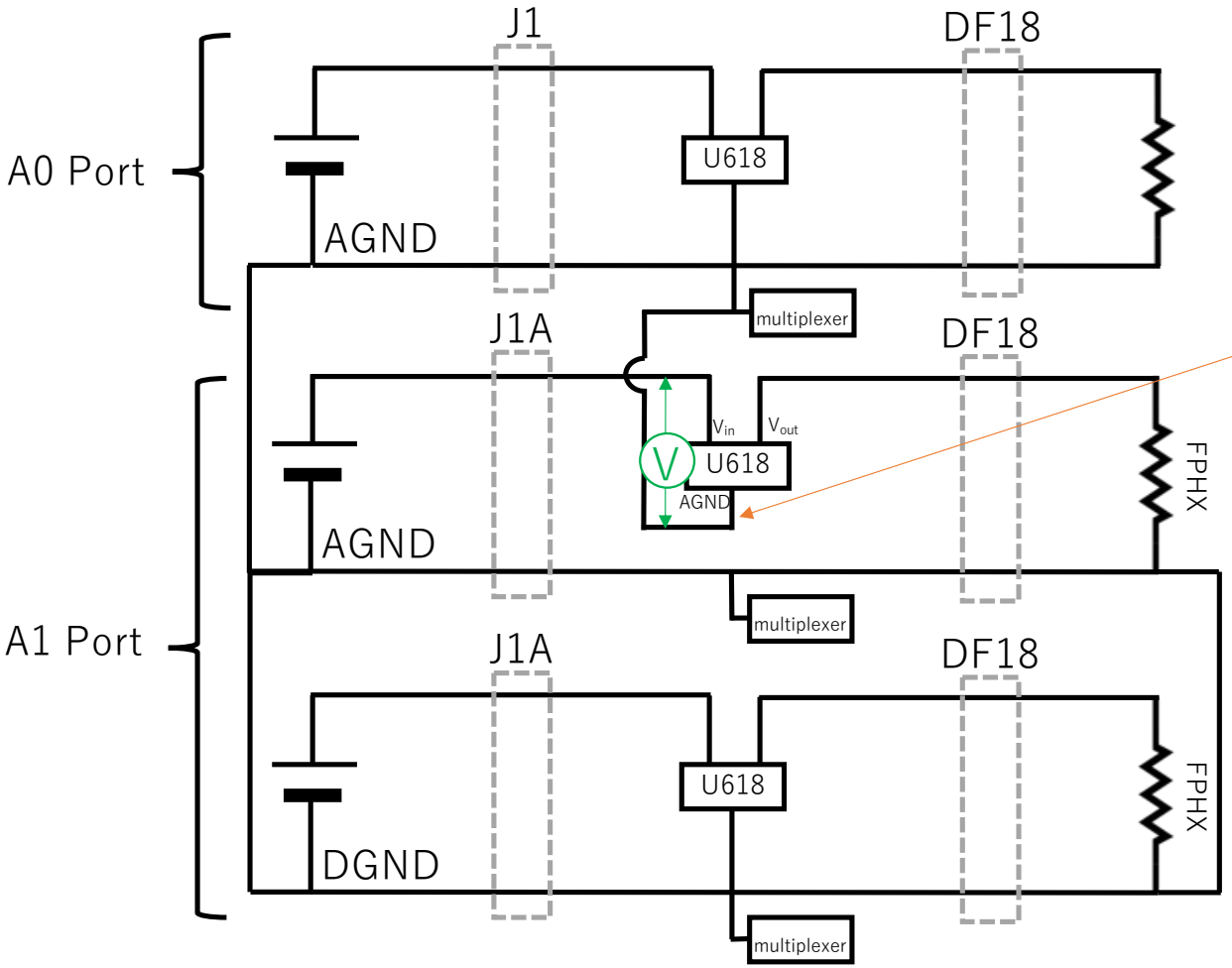




Presumably, the floating AGND also picks up some positive voltage with increasing V_{in}. As the consequence, the input relative voltage V_{in}-V_{AGND} at the regulator becomes smaller than V_{in}. However, the voltage at FPHX recovers ~2.8V because the AGND is provided by PS GND through DGND line.

Not sure how stable U618 regulator output is with this floating ground though

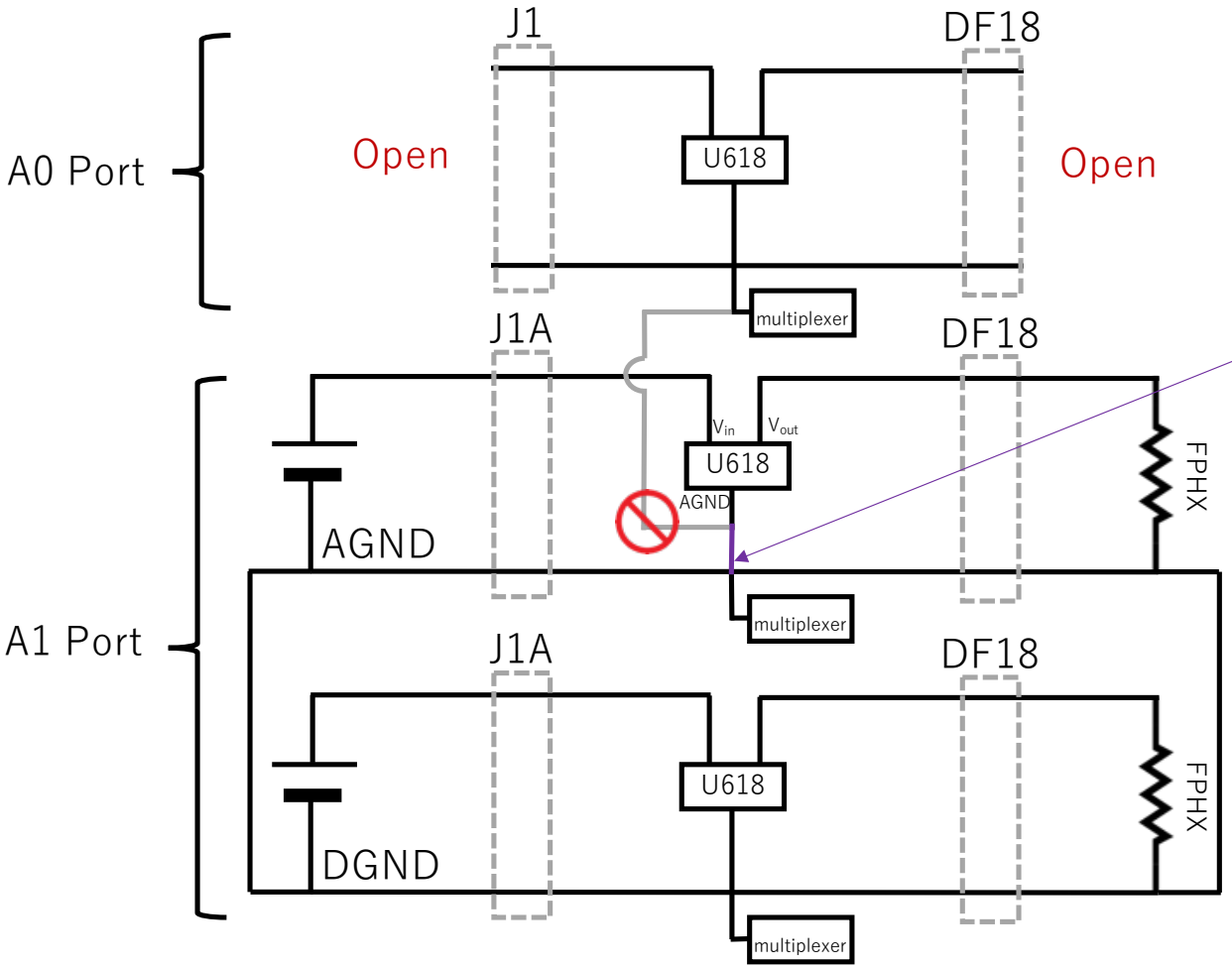
FVTX Case Circuit Diagram



AGND is provided by A0 power supply which is likely to be shared with the GND of A1 analogue power supply. This circuit effectively secures stable operation of U618 regulator presumably.

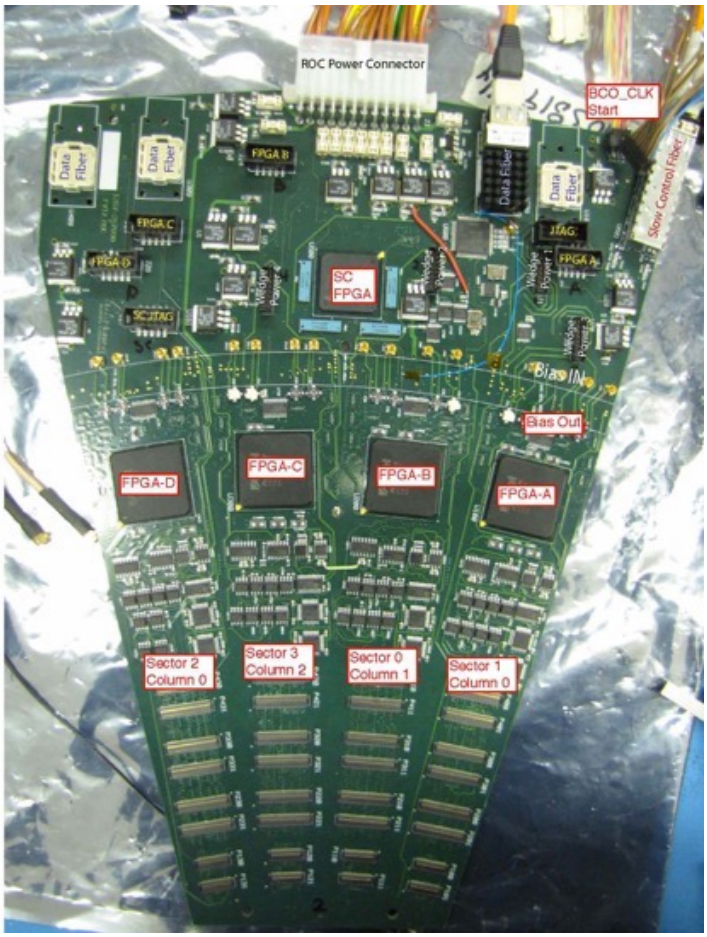
Not sure how stable U618 regulator output is with the floating ground with open J1 and DF18(P100,P101) for INTT case. It is not guaranteed INTT works as well as FVTX.

How can we recover?



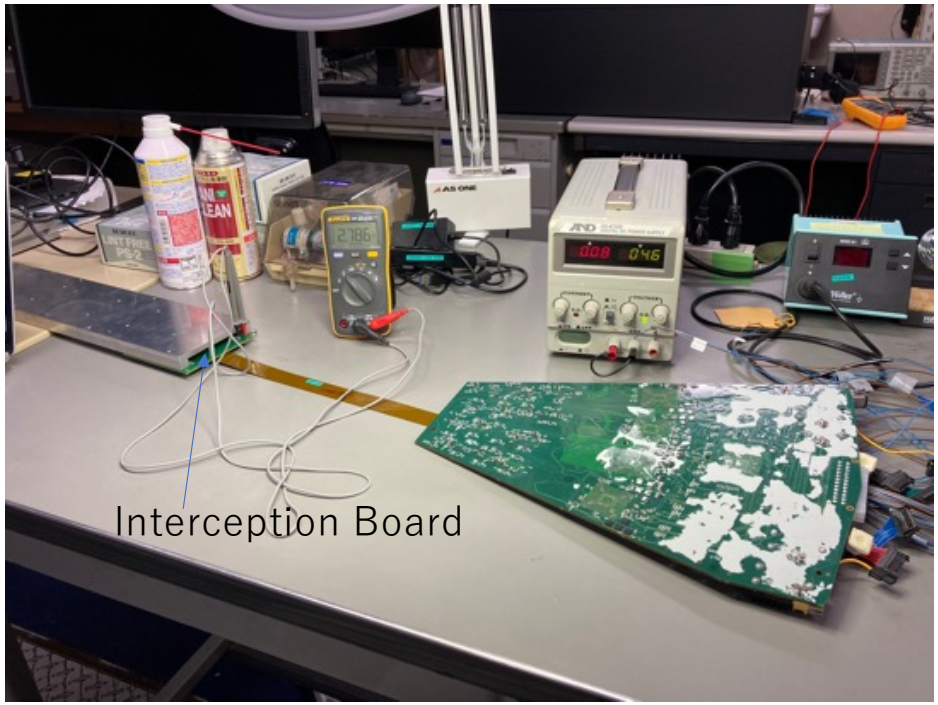
Disable AGND_2 connection and Install new jumper cable.

Need to bridge between primary side and back side of the ROC boards. This is not trivial recovery. Keep searching for more portable solution.


ROC Power Connector
BCO_CLK
Start
Data Fiber
Data Fiber
FPGA B
Data Fiber
Data Fiber
Slow Control Fiber
FPGA C
JTAG
FPGA D
SC FPGA
FPGA A
SC JTAG
Bias IN
Bias Out
FPGA-D
FPGA-C
FPGA-B
FPGA-A
Sector 2 Column 0
Sector 3 Column 2
Sector 0 Column 1
Sector 1 Column 0

2022/3/16

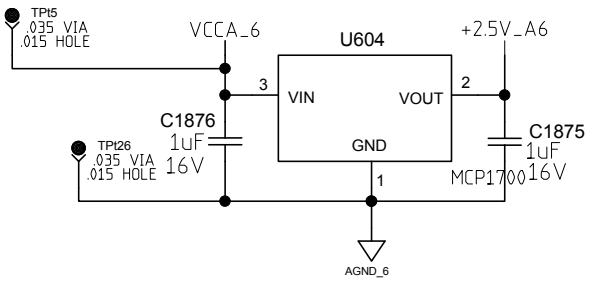
Column-C1 Analogue Regulator Measurement



- Connected only J1A Channel 11,12
- Ladder + 40cm conversion cable on C1 port
- Voltage meas. at U604 & Interception Board
- Observed 0V for digital power at Interception Board

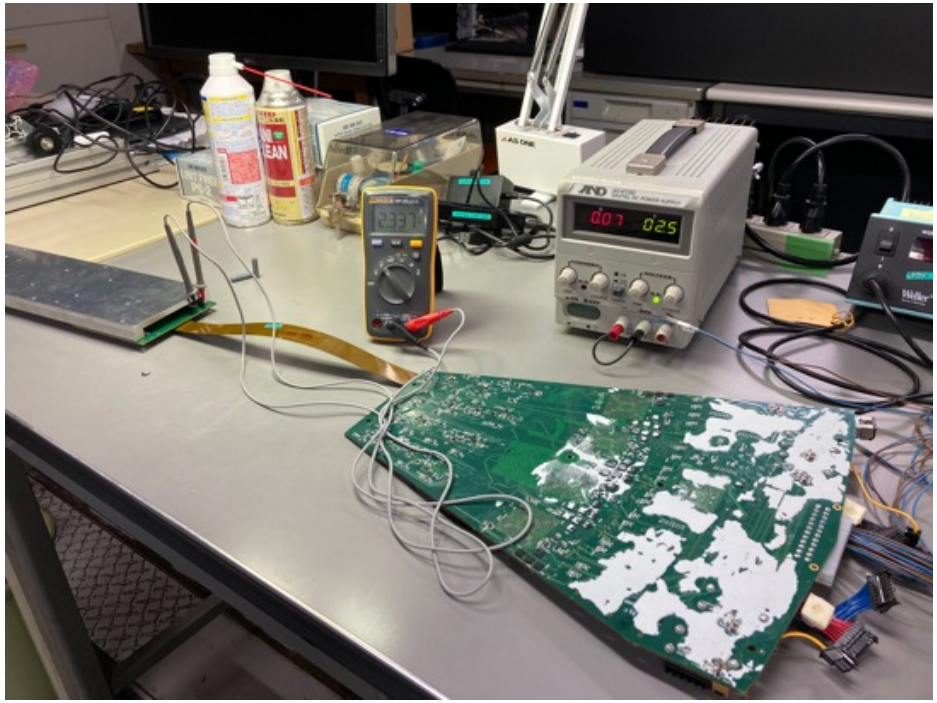
Interception BoardとV_{out}

PS [V]	Current [A]	C1876 [V]	C1875 [V]	Intcpt Bd. [V]
1.5	0.00	1.5	0.8	0.8
2.0	0.05	1.9	1.8	1.8
2.5	0.07	2.3	2.2	2.2
3.0	0.09	2.9	2.8	2.8
3.5	0.09	3.2	2.8	2.8
4.0	0.09	3.8	2.8	2.8
4.5	0.09	4.5	2.8	2.8



2022/3/16

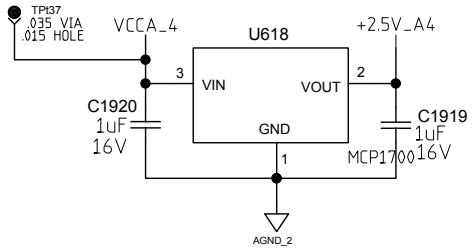
Column-A1 Analogue Regulator Measurement



- Connected only J1A Channel 3,4
- Ladder + 40cm conversion cable on A1 port
- Voltage meas. at U618 & Interception Board
- Observed 0V for digital power at Interception Board

The output voltage at analogue regulator is 2.8V.
Observed +0.4V higher voltage at the interception board.
Presumably it is caused by the ground level difference.

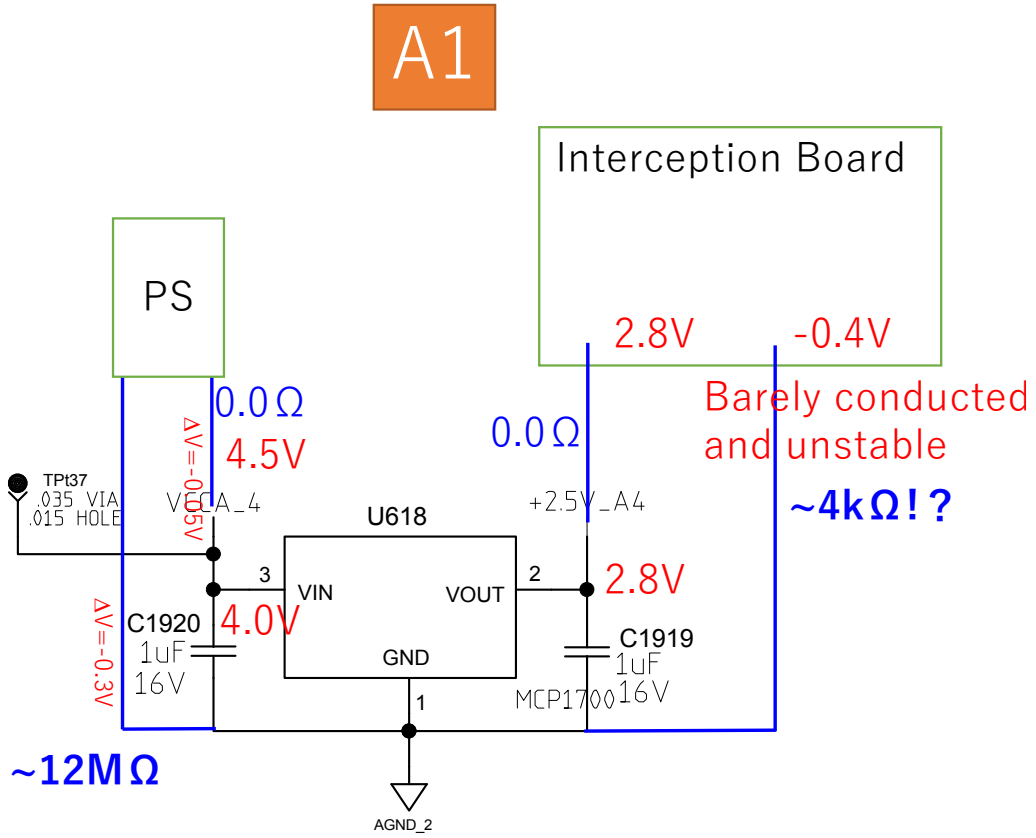
PS [V]	Current [A]	C1920 [V]	C1919 [V]	Intcpt Bd. [V]
1.5	0.00	1.3	0.44	0.58
2.0	0.03	2.0	1.2	1.3
2.5	0.06	2.2	1.9	2.2
3.0	0.09	2.5	2.4	2.7
3.5	0.10	3.1	2.8	3.2
3.9	0.11	3.4	2.8	3.2
4.5	0.11	4.0	2.8	3.2



NE3 Analogue Power Trace Resistance

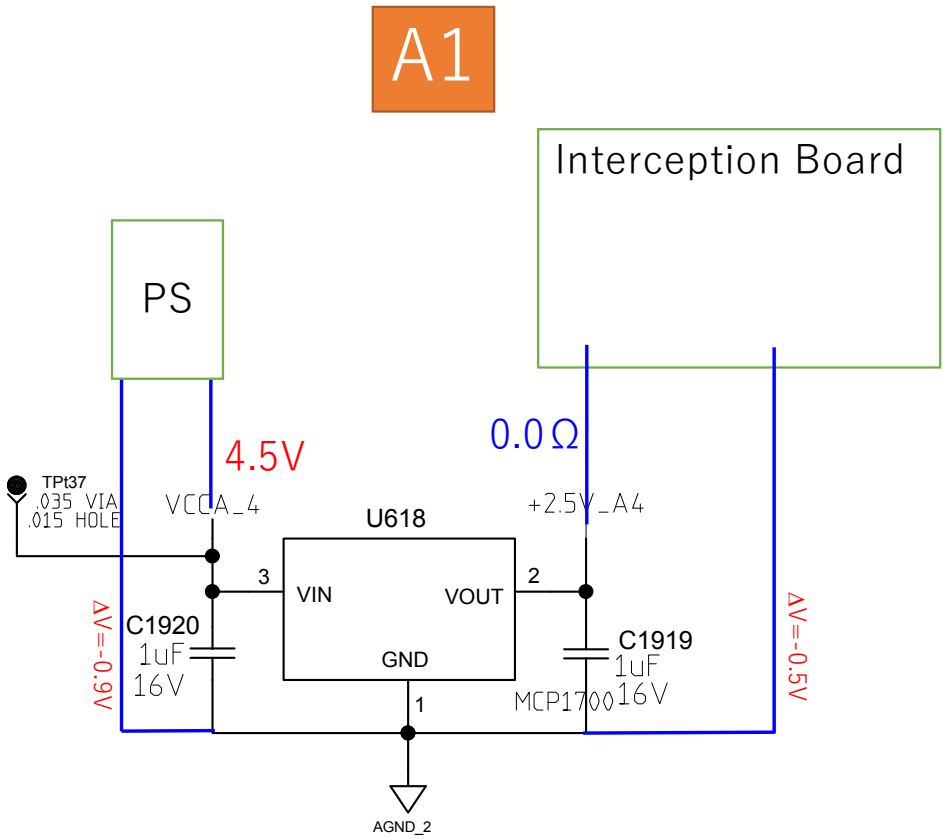
Only J1A Ch-3,4 cables are connected to PS

Analogue GND Line is directly connected to AGND of Interception board

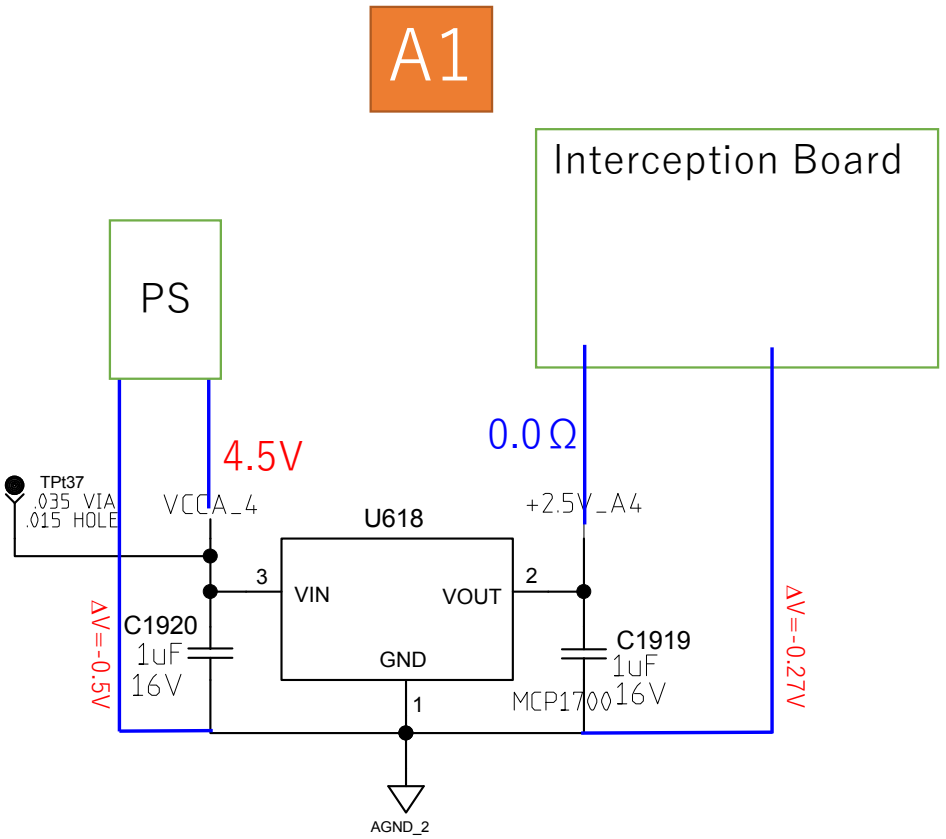


Analogue GND Line is *not* directly connected to AGND of Interception board

NE3 Analogue Power Trace Resistance

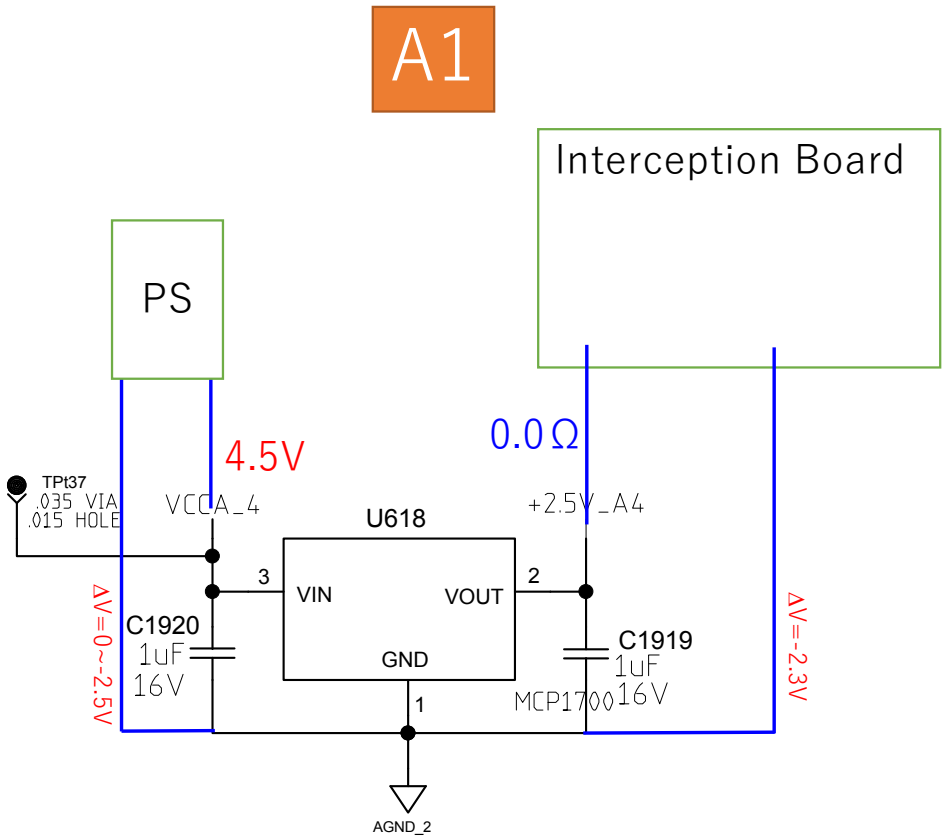


No ROC Power Cable Plugged in

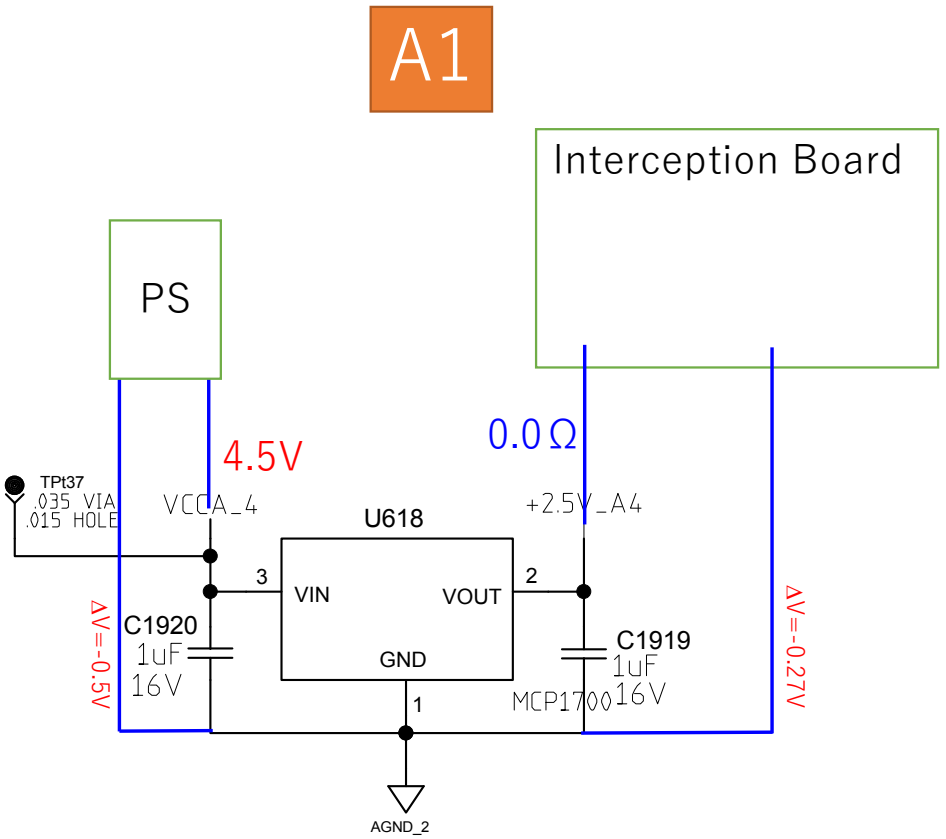


ROC Power Cable Plugged in, but not powered

NE3 Analogue Power Trace Resistance



ROC Power Cable Plugged in, Power On



ROC Power Cable Plugged in, but not powered