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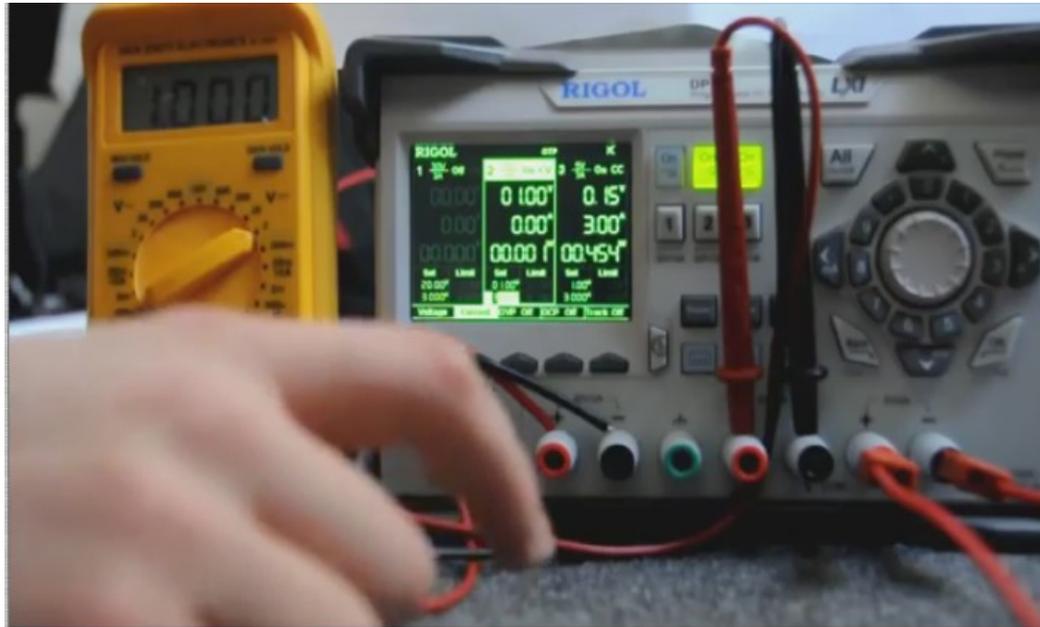
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Beyond Measure

Recommended Connections: DP832 CH2 and CH3 COM Terminals

PROBLEM DESCRIPTION

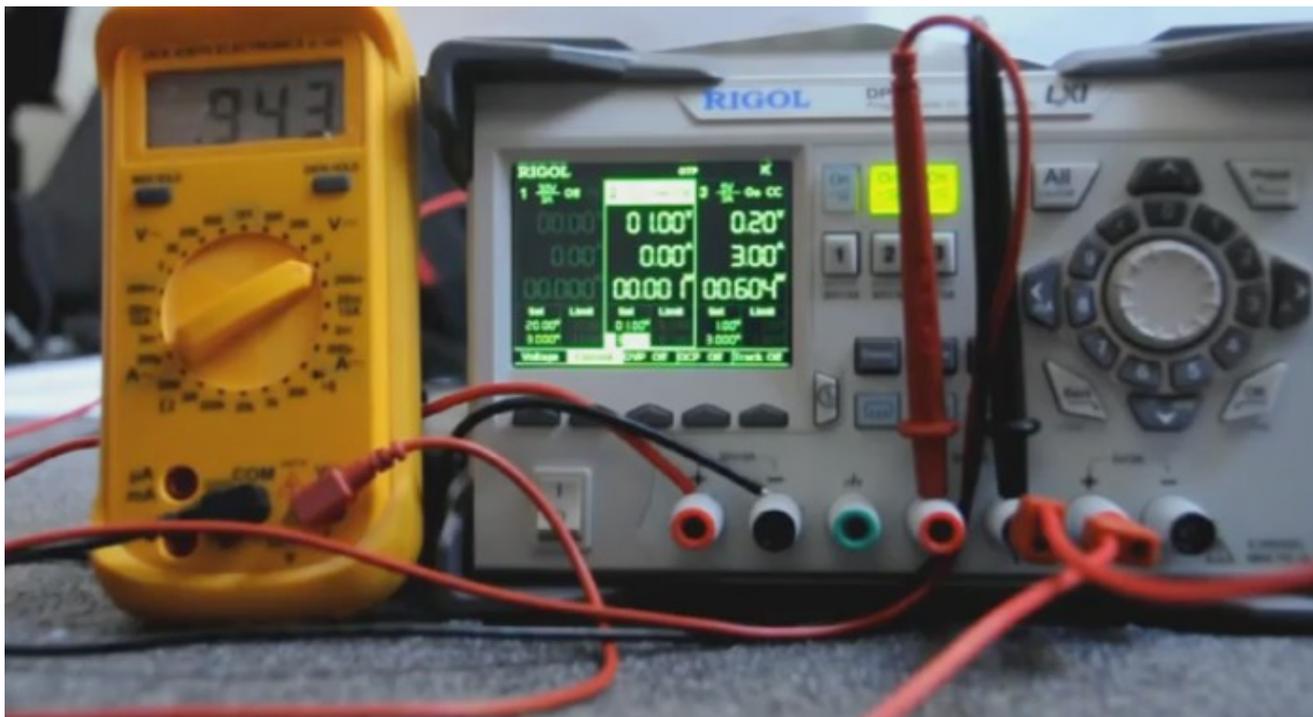
Using Separate Grounds for Channels 2 and 3 - The Rigol DP832 works as expected

You can see this below.. we are sourcing 1V on CH2 into DMM (CV state), and on CH3 source 1V with 3A limit into a short (CC state).



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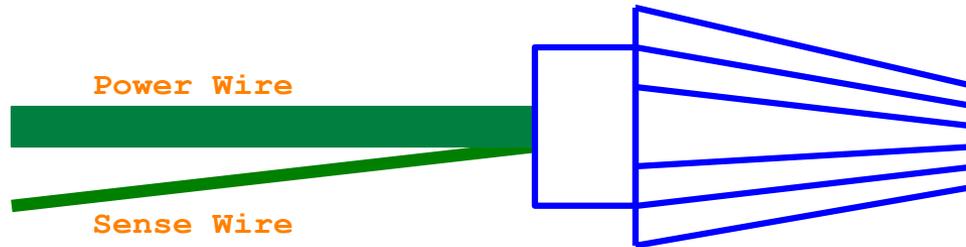
But, if you connect the low from CH3 to CH2 Gound(- Terminal), there is a voltage drop on the CH2 Voltage measurement



Even if you ground the 2 lows together externally, the voltage drop is out of spec for channel 2.

WHY:

The COM Terminal is not Power COM , but Sense COM. Each Terminal has two wires which are Power wire and Sense wire.



The Power Wire delivers the current, and the Sense Wire is fed back to the voltage from the Terminal.

The figure above shows the correct connection method.

The voltage (V_a) at the power output terminal of CH2 (Terminal OUT-CH2, a) returns to the ground point (g) via the feedback line (Sense-).

It is then connected to the ground plain of the internal circuit. The reference level of the control loop of the output channel is $V_{gnd}=V_g=V_a$ (note that the current does not flow through the Sense- trace) and the output is:

$$V_{ch2_out} = V_b + V_a - \left(\frac{V_{ch2_cv} - V_{ref}}{V_{gnd}} \right) \cdot k_1$$

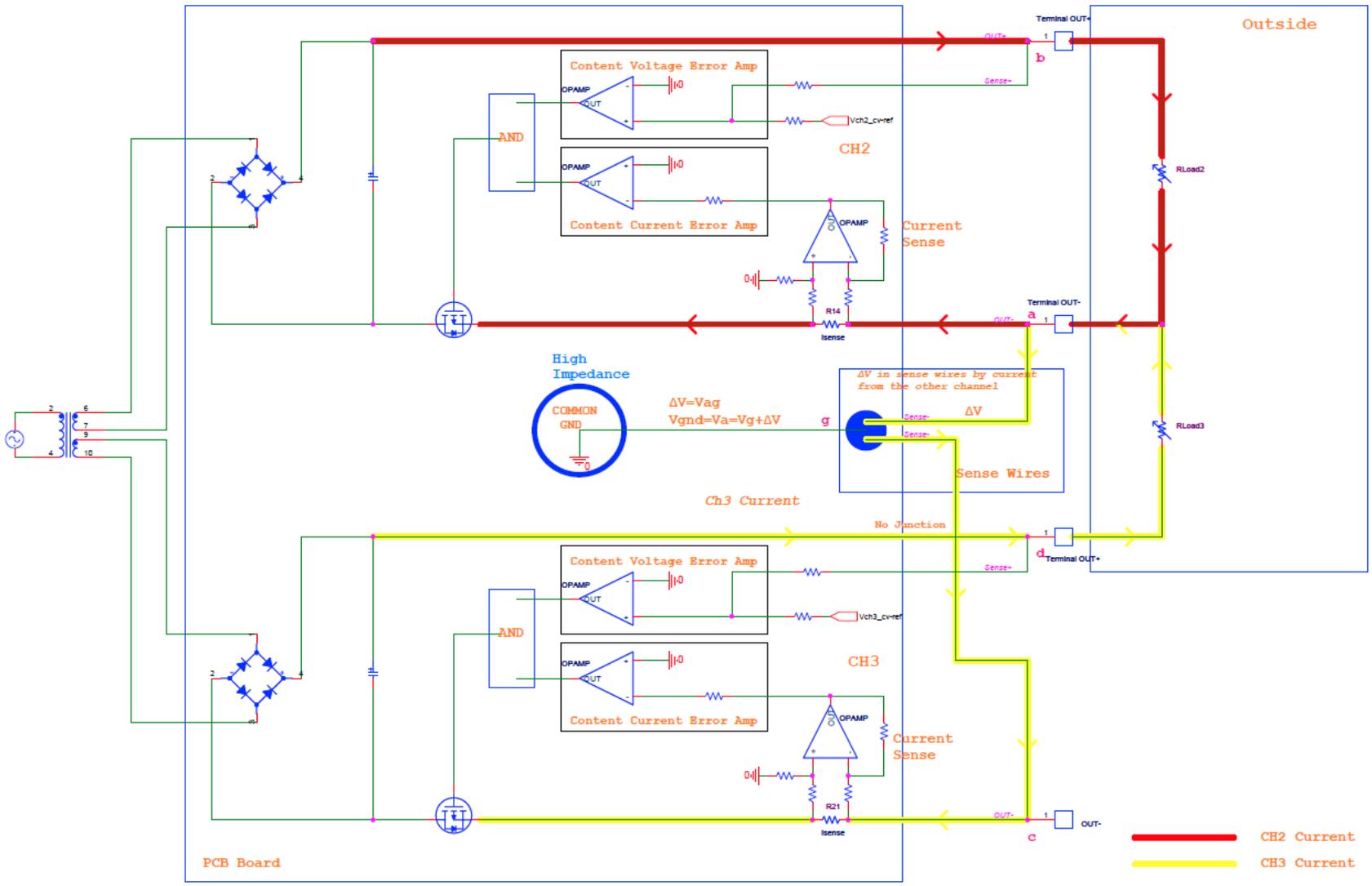
The connecting principle of CH3 is the same with that of CH2 and its output voltage is :

$$V_{ch3_out} = V_d + V_c - \left(\frac{V_{ch3_cv} - V_{ref}}{V_{gnd}} \right) \cdot k_2$$

Note that in the power supply block diagram, the red line shows the current direction of CH2 and the yellow line shows the current direction of CH3.

Under correct connection, the current will only flow through the power trace and will not flow through the Sense trace.

Power Supply CH2/CH3 Block Diagram – Improper Connection



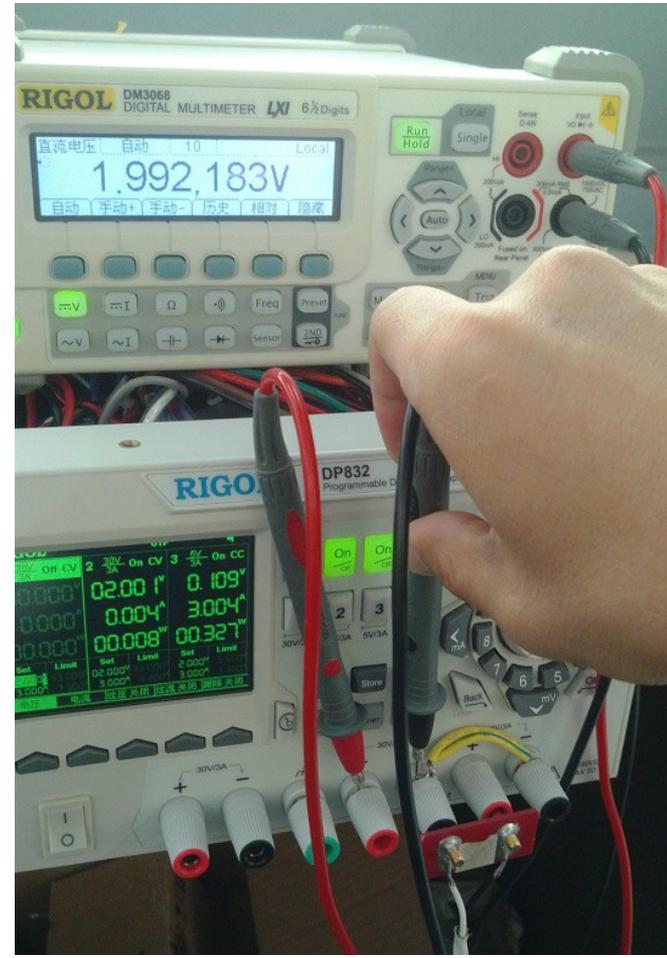
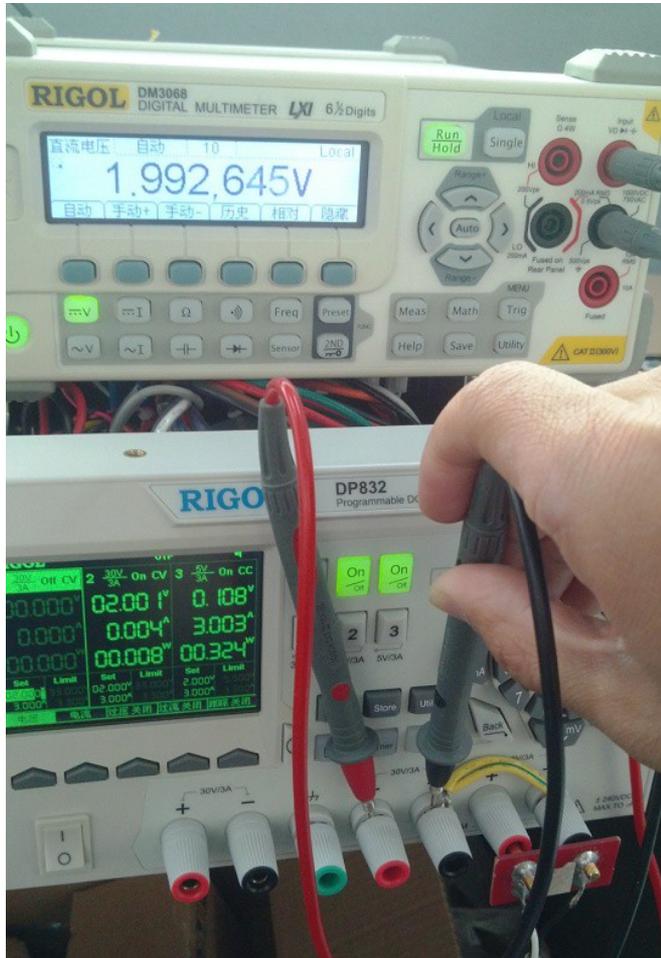
Note that in the cross-connection method (the positive terminal of RLoad3 is connected to the Terminal OUT+ of CH3 and the negative terminal is connected to the Terminal OUT- of CH2).

The yellow line shows the current direction of CH3. The current flows out from the Terminal OUT+ of CH3 must flow in from the Terminal OUT- of CH3.

In this way, the current flows through the Sense- lead of CH2 and a voltage drop (ΔV) is generated between a and g . In this case, $V_{gnd} = V_g = V_a + \Delta V$ and the output voltage is attenuated.

$$\begin{aligned}
 V_{ch2_out} & \dot{=} V_b \dot{-} V_a \\
 & \dot{=} V_b \dot{-} V_g \dot{-} V \\
 & \dot{=} V_b \dot{-} V_{gnd} \dot{-} V \\
 & \dot{=} \dot{F} V_{ch2_cv \dot{-} ref} \dot{-} V_{gnd} \dot{f} \dot{-} k_1 \dot{-} V
 \end{aligned}$$

You are not recommended to use the cross-connection method of the channel output negative terminals for power supply. The voltage attenuation caused by the cross-connection method of the channel negative terminals can be compensated by using an external lead. You can connect a rather thick lead between the Terminal OUT-terminals of CH2 and CH3 to reduce the voltage attenuation to ensure normal application (as shown in the figure below).



Ground the 2 lows together externally using shorted wires

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Thank You !

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