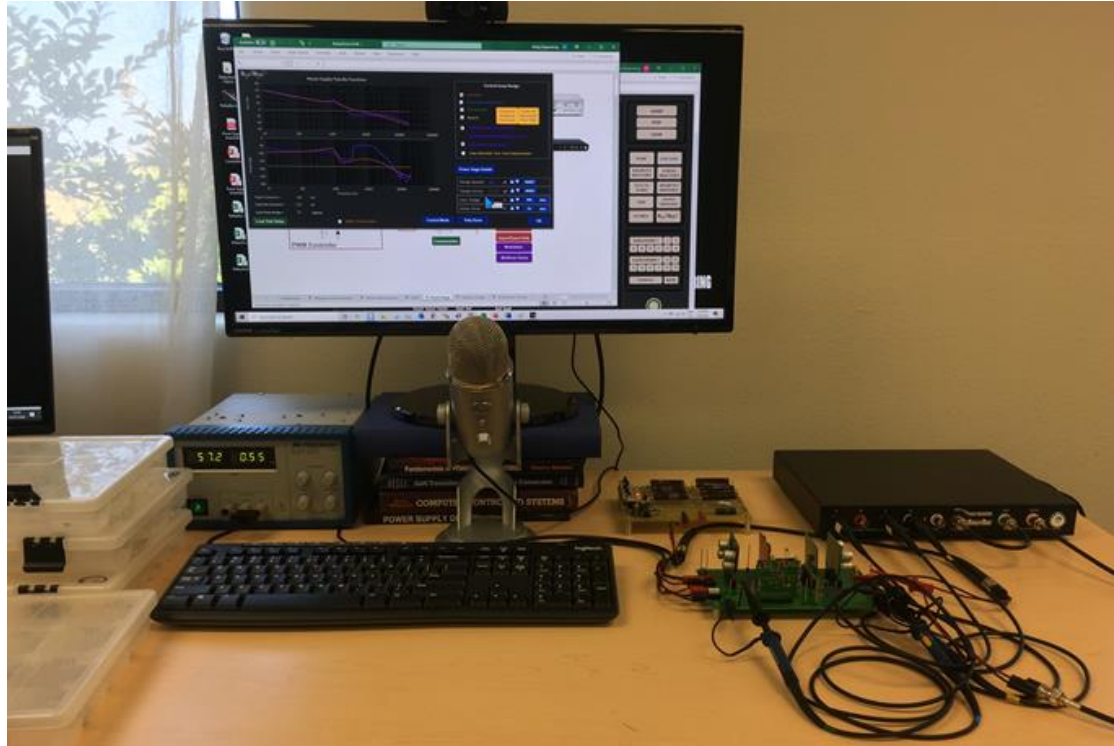


# Designing and Measuring Converter Control Loops



**Webinar July 9, 2020 10:00 am PCT**

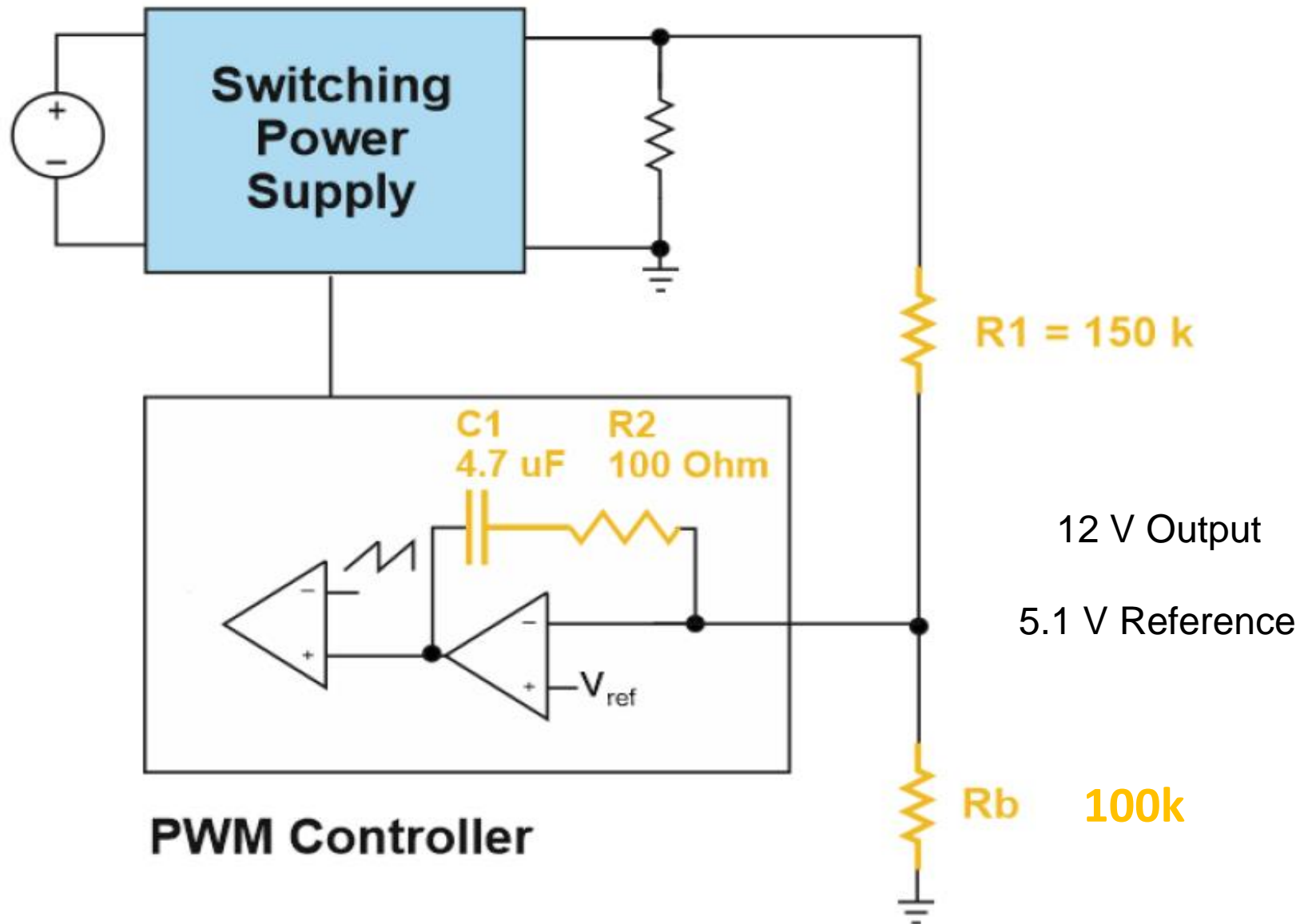
**Dr. Ray Ridley      Ridley Engineering**

**Download [LoopDesign.pdf](#)**

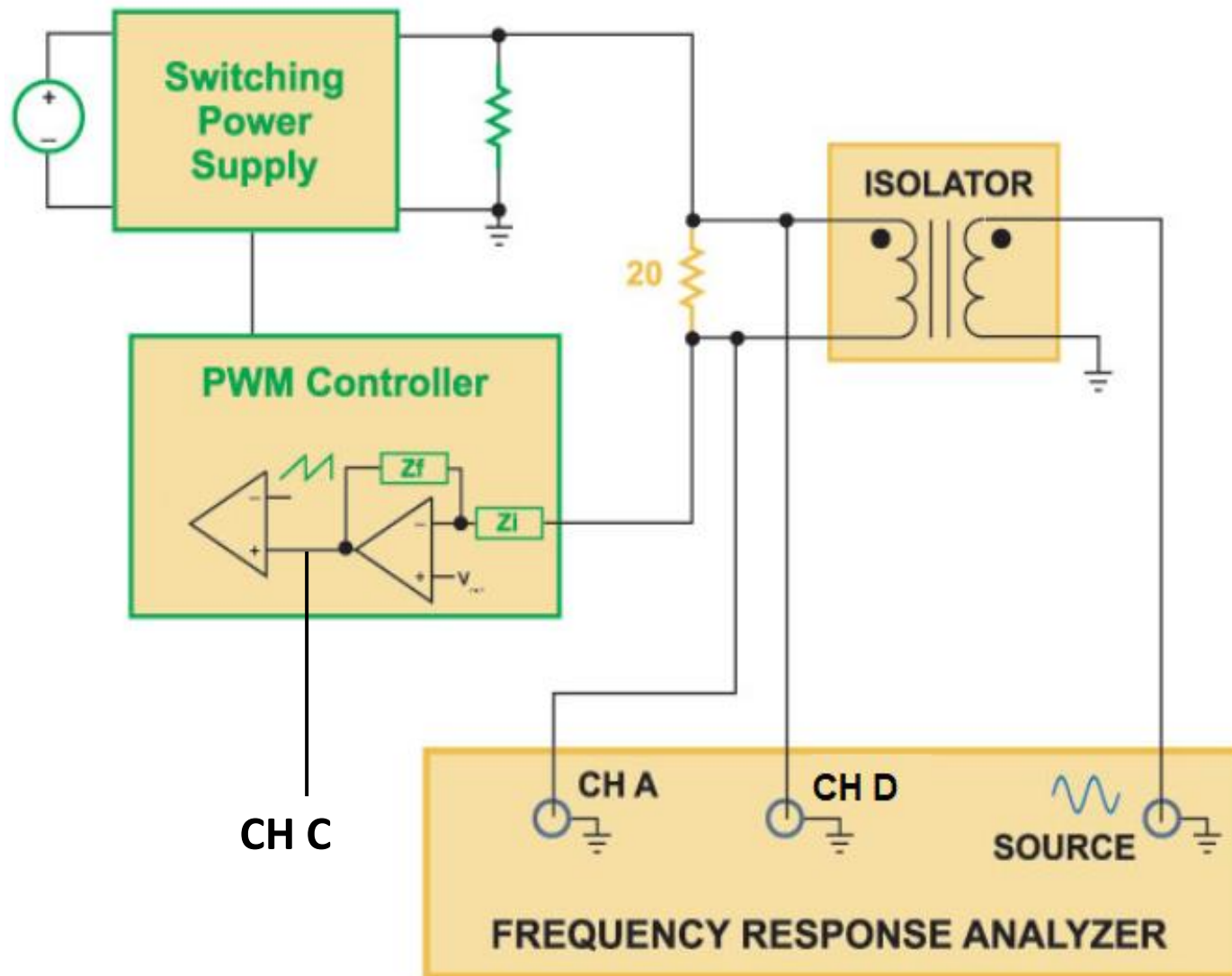
## Loop Design Process - Who Measures Bode Plots?

1. Build Power Stage
2. Close the Loop Slowly (Low Bandwidth  $< 10$  Hz)
3. Measure the Power Stage
4. Compare with Theory
5. Design Compensator
6. Measure Loop
7. Compare Loop with Theory

## Step 1 – Close the Loop Slowly

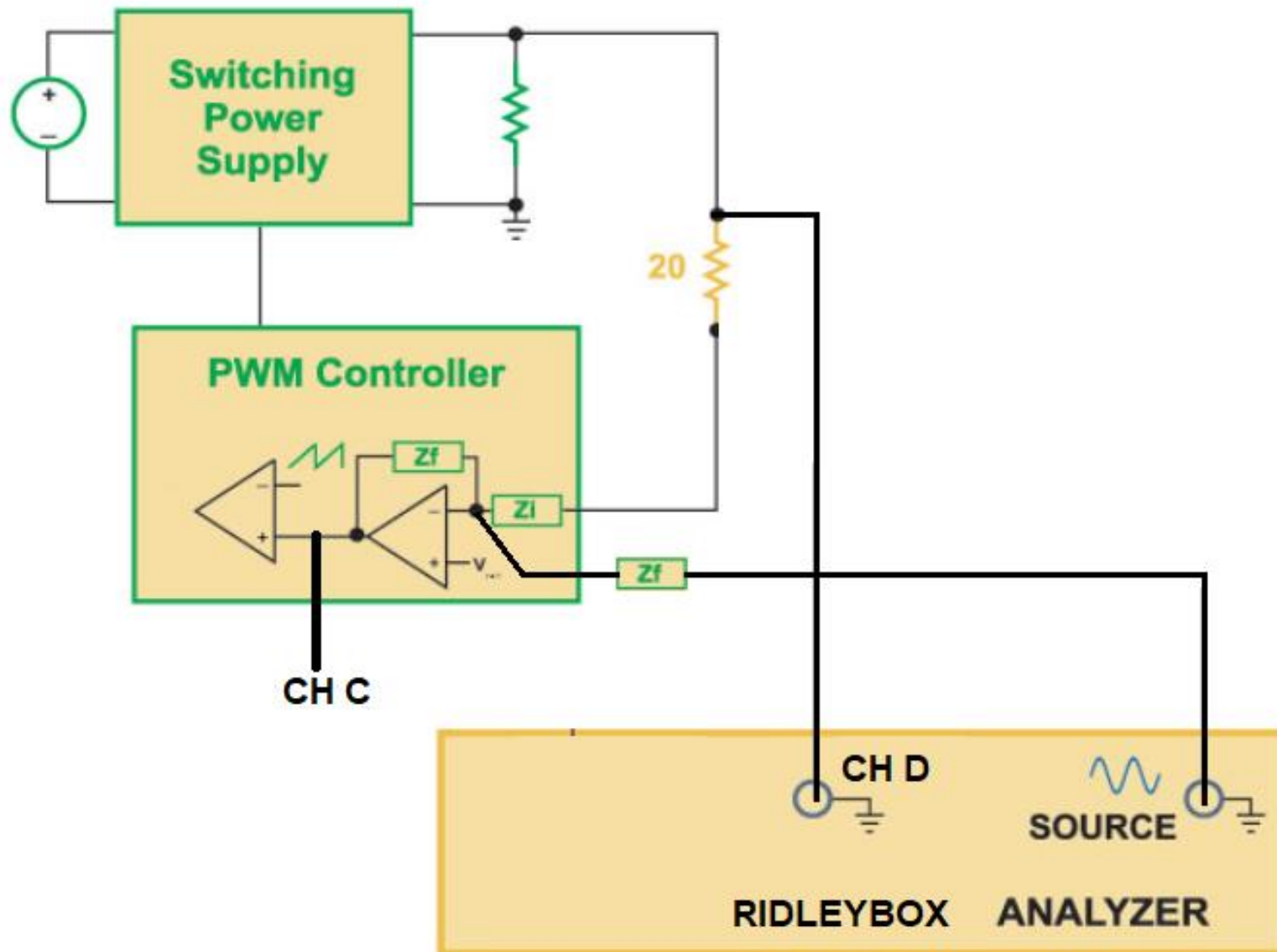


## Loop Injection and Power Stage Measurement



This won't work well with a very low gain loop

## Step 2 – Signal Injection and Power Stage Measurement



# CCM Flyback Power Stage

Input and Output Specifications

Flyback CCM 24W

Clear Design

INPUT VOLTAGE RANGE

☐ 120 VAC ☐ 240 VAC ☐ 120-240 VAC ☒ DC Input

Low Line Voltage 36

Nominal Input Voltage 48

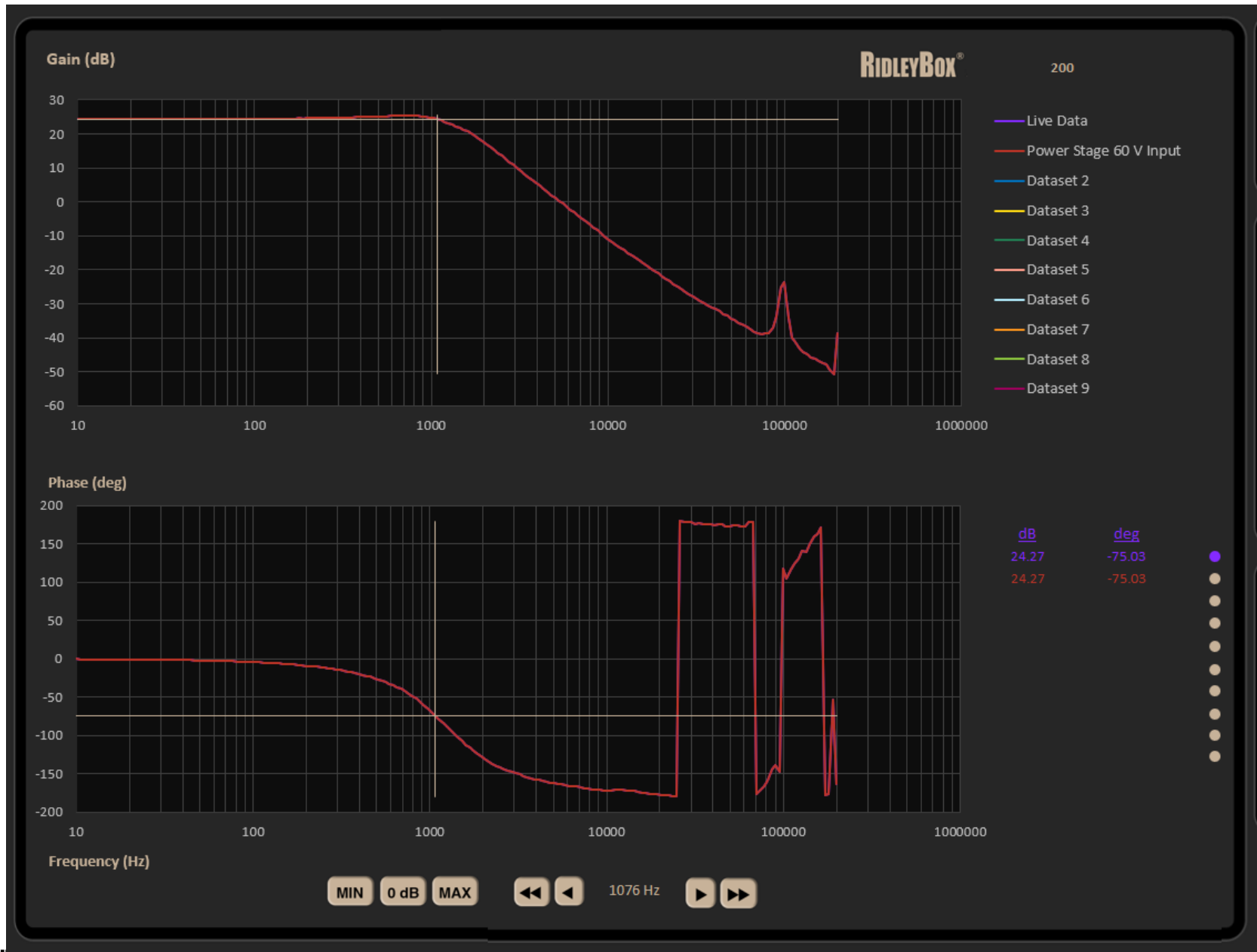
High Line Voltage 60

OUTPUT VOLTAGE AND CURRENT

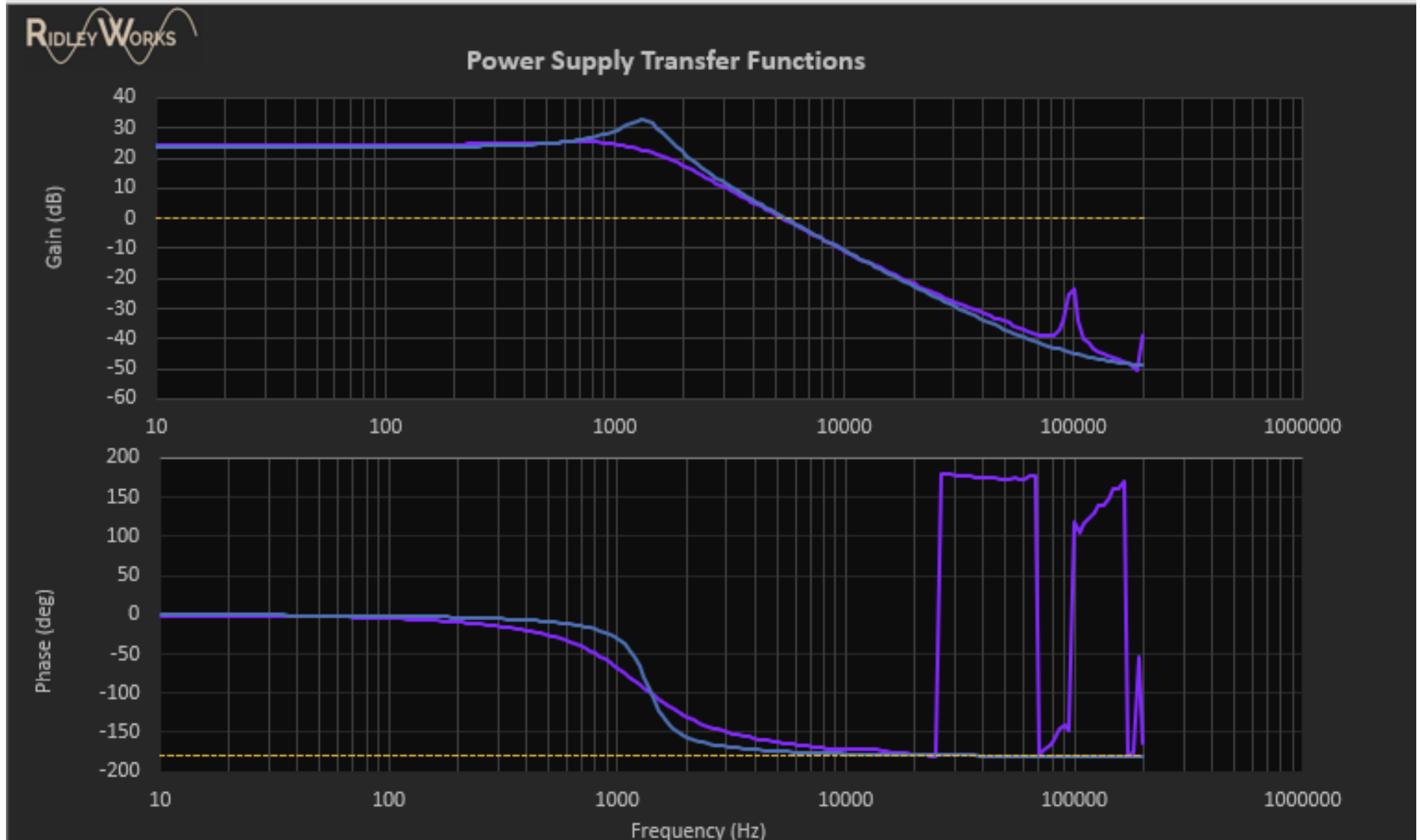
	Main	Aux 1	Aux 2	Aux 3	Aux 4
Output Voltage	12				
Output Current	2				

Clear Aux

## Step 3 - Power Stage Measurement

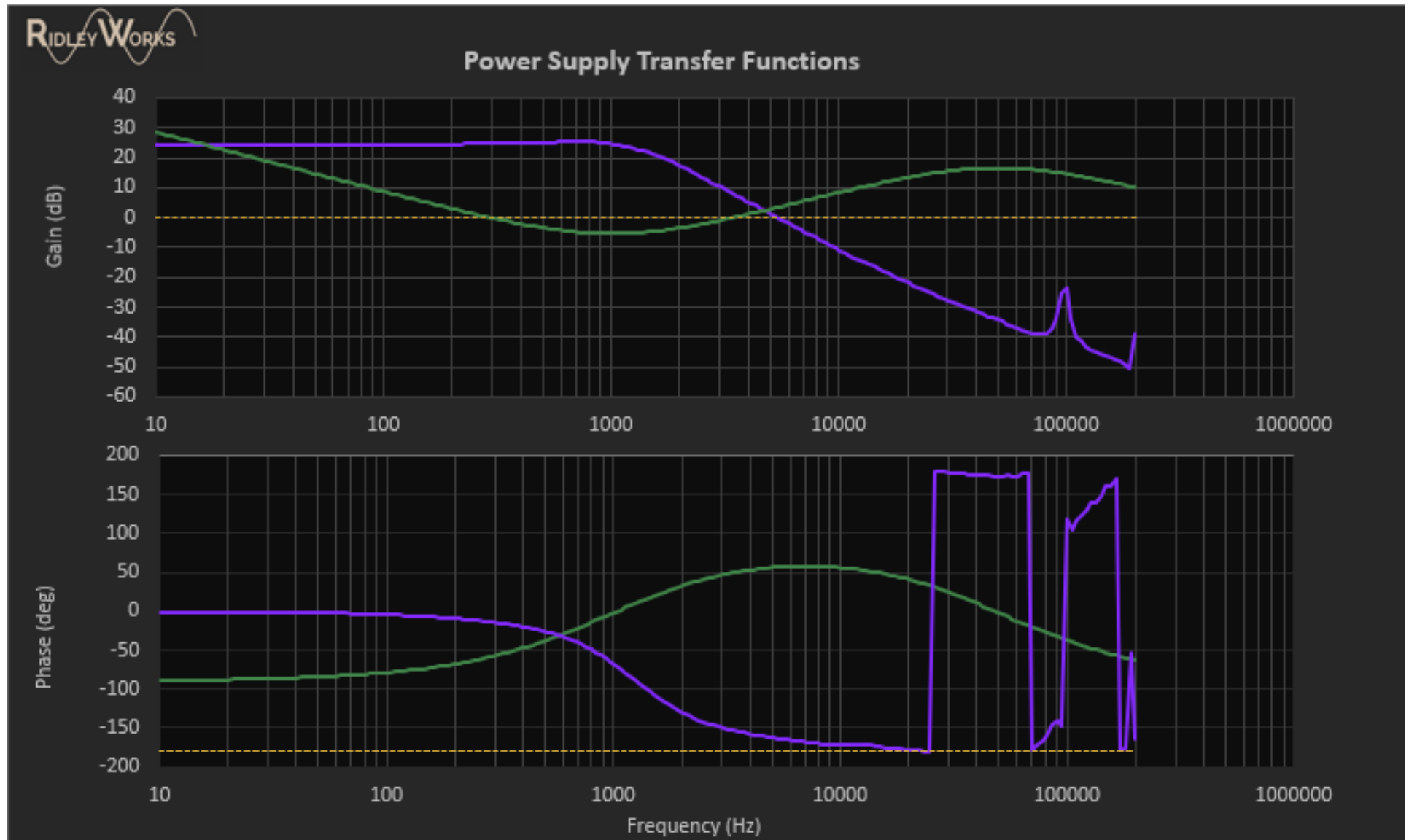


## Step 4 - Power Stage Measurement vs Theory

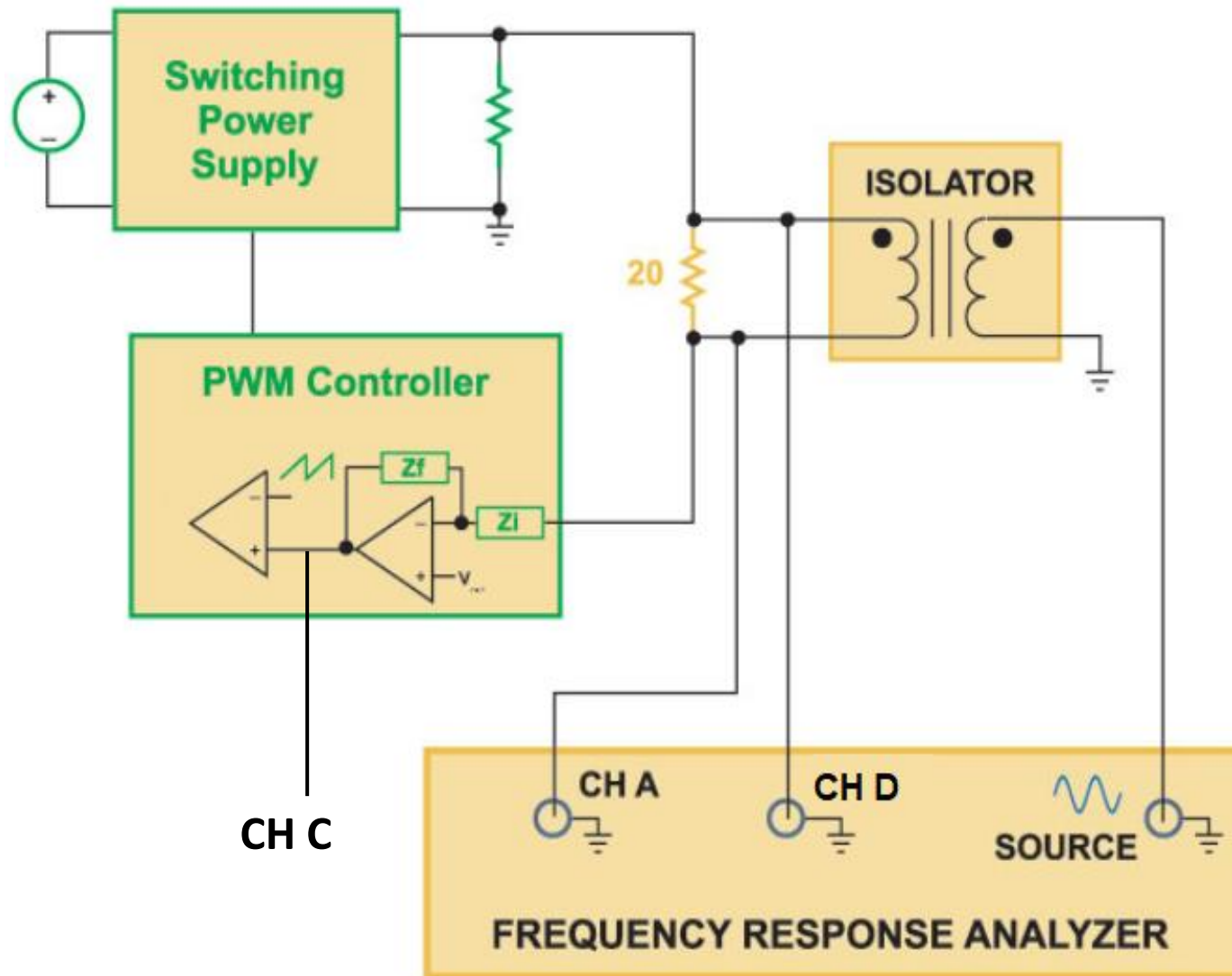




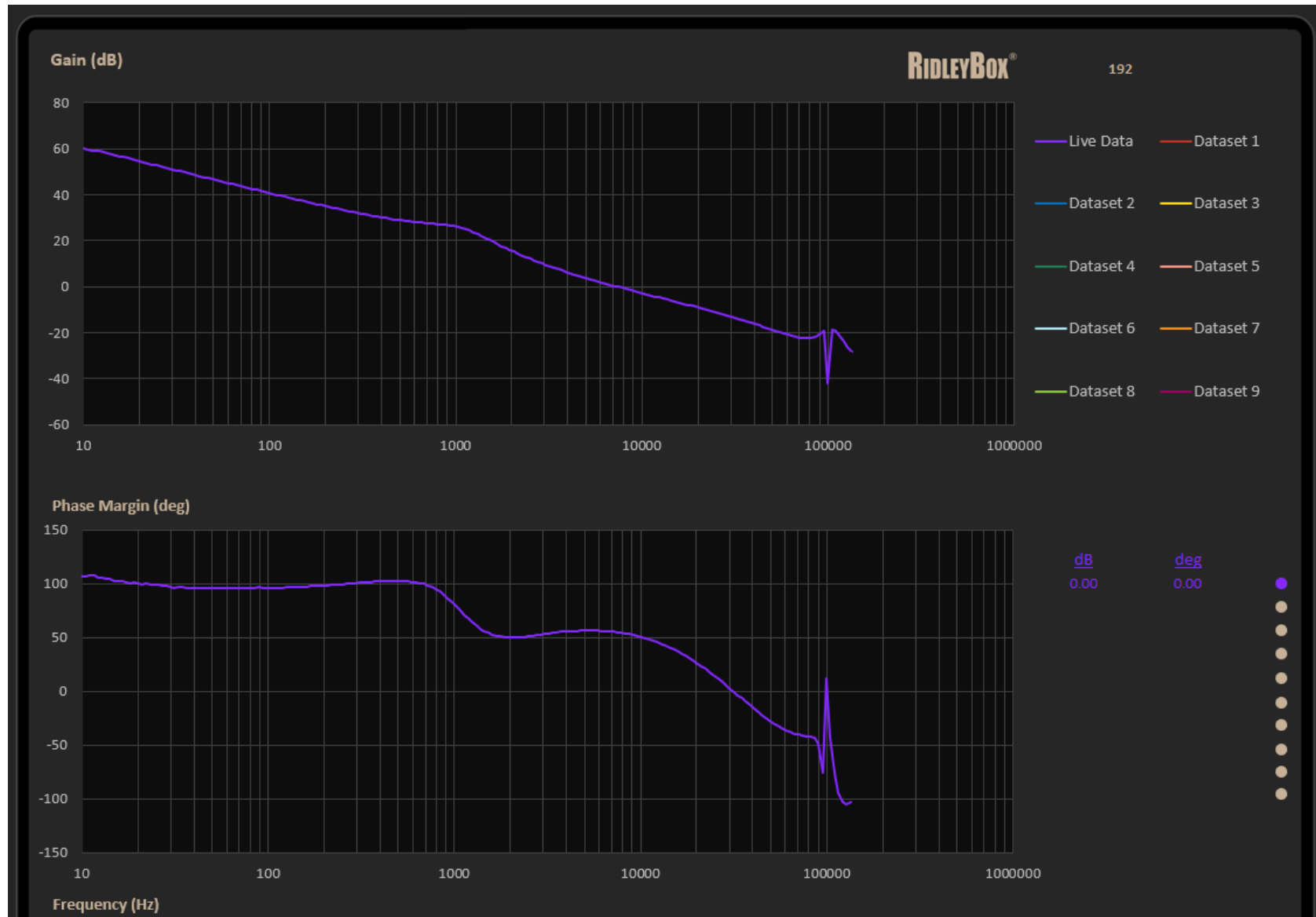
## Step 5 – Compensator Design



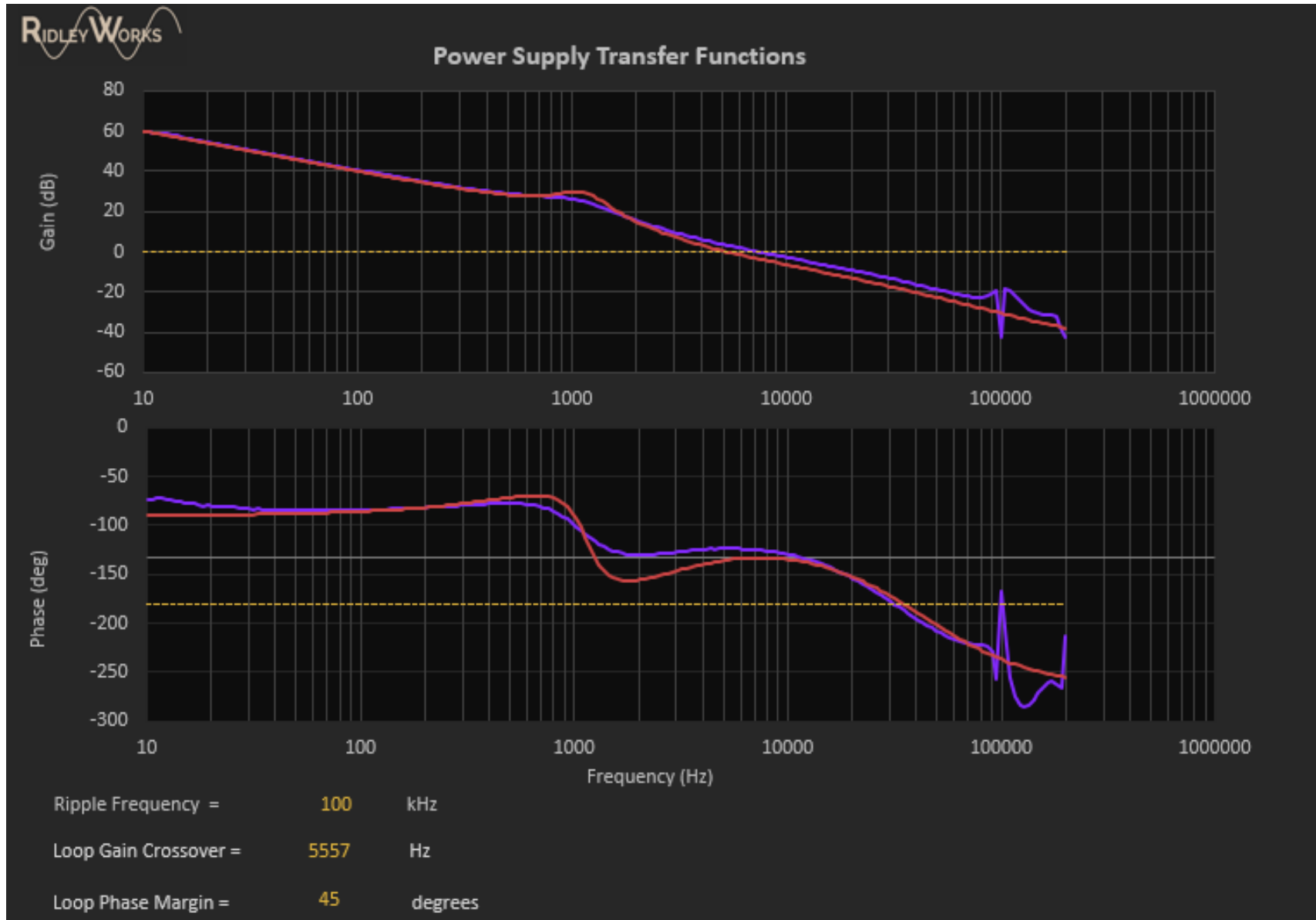
## Step 6 – Loop Injection and Measurement



## Step 6 – Loop Measurement



## Step 7– Loop Measurement vs Theory



## How to Learn More



Email [info@ridleyengineering.com](mailto:info@ridleyengineering.com)  
For full demo



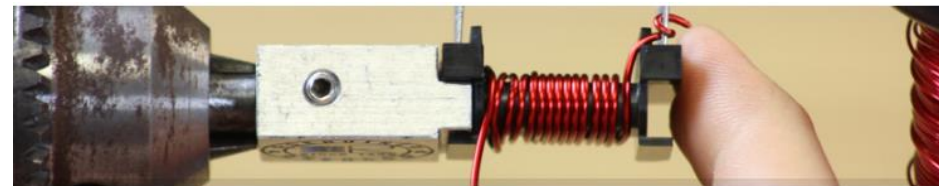
## Frequency Response Analyzers



### A New Small-Signal Model for Current-Mode Control

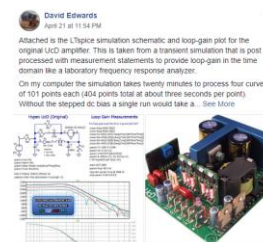
Raymond B. Ridley

Free  
Book



> Education > Power Design Workshop > Intro

## POWER SUPPLY DESIGN WORKSHOPS



## Power Supply Design Center Facebook Group

## Power Supply Design Center Articles

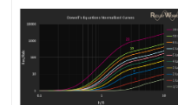
### [113] THE ADVENTURES OF 'OHM

This custom-designed comic strip is for all the electrical engineers who are suddenly working from home.



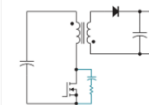
### [112] THE POWER OF DOWELL'S EQUATIONS AND CURVES

The standardized curves of Dowell's equations are a superb tool for designing better high-frequency magnetics. A careful balance of layer count and wire or foil count is needed to reach an optimum design.



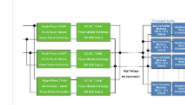
### [A24] FLYBACK CONVERTER SNUBBER DESIGN

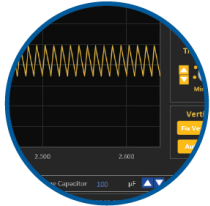
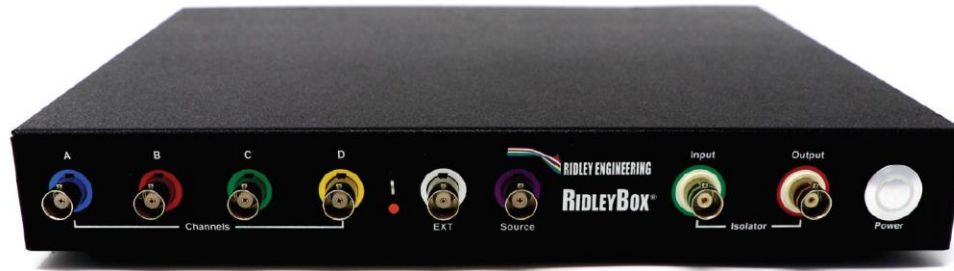
In this article, we will talk about practical design techniques for the most commonly used snubber and clamp circuits for the flyback converter.



### [111] ZVS FULL-BRIDGE CONVERTER EMPLOYING AN ACTIVE SNUBBER

The ZVS full bridge converter can be enhanced greatly by implementing an active snubber on the secondary side of the transformer.

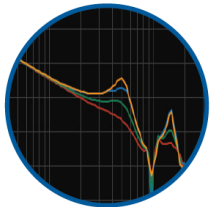




### RidleyWorks® Lifetime License

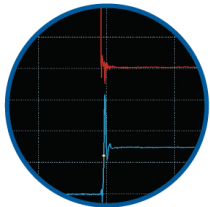
Power Stage Designer  
Power Stage Waveforms  
Magnetics Designer  
Transfer Function Bode Plots

Closed Loop Design  
Automated FRA Control  
LTspice® Automated Link  
PSIM® Automated Link



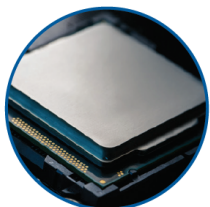
### 4-Channel Frequency Response Analyzer

Frequency Range 1 Hz - 20 MHz  
Source Control from 1 mV - 4 V P-P  
Built-In Injection Isolator  
Bandwidth 1 Hz - 1 kHz  
Automated Setup from RidleyWorks®  
Direct Data Flow into RidleyWorks®



### 4-Channel 200 MHz Oscilloscope

Picoscope® 5444D 4-Channel Oscilloscope  
200 MHz Bandwidth  
1 GS/s at 8-bit res; 62.5 MS/s at 16-bit res  
Signal Generator up to 20 MHz  
Computer Controlled



### Embedded Computer

Intel® Computer with 32 GB RAM, 256 GB SSD  
Intel® HD Graphics 620  
Integrated Dual Band Wireless, Bluetooth 4.2  
Dual HDMI and USB Ports, Ethernet