"For a video cable, I can put a 75 Ω terminator on one side. If I go to the other end of the cable and check for DC resistance, I can get a 'quick pass' feel for the impedance I will see on the cable. In short, I should find a DC resistance of about 75 Ω. If that's what appears, I can continue with confidence. If not, there's a problem. Higher or lower resistance measurements could indicate an open circuit, bad termination, short, or other cabling anomaly."

According to Grieshaber, the use of a DMM simply reinforces the application of good common sense. "When we build a system and test the infrastructure, we're looking for absolutely anything that could go wrong once we turn it on."

Checking gain stages

Once the various logical blocks in the system have been fully tested, it's time to energize the system.

"Assume that the destination is a video display, and my source is a server that serves out high-definition video content. To perform measurements on that signal chain, I would use a signal generator to provide a specific test signal. I need a good reference signal — something that has fixed amplitude at fixed frequency ranges."

In the process of commissioning a system, Grieshaber performs a series of gain adjustments. This process involves a signal that goes through multiple devices, each with an adjustable amplifier. "I'll be looking at the outputs of these amplifiers at several places in the circuit — also called gain stages — and I can use the DMM to measure voltage at each stage. Using this process, I work my way, one stage at a time, from source to destination, adjusting the output voltage at each stage to control the voltage gain or loss that I want to see at each amplifier."

If Grieshaber finds variability in the outputs of the amplifiers, he can 'push' the gain up or down to compensate for factors such as cabling loss or connector loss. "I need to optimize how those gain stages interact with each other, in order to reduce the overall noise floor and provide a stable signal."

An army of one

The DMM is an "incredibly multi-faceted tool," says Grieshaber. "It's like a Swiss Army knife. With it I can confirm or deny preliminary assumptions, suspicions or theories about what's going on. And then, only if I need to, I can resort to more specialized, application-specific instruments.

"If I want to put the system through its paces, I'll specify a voltage — let's say for the color black — because I'm using black as a reference point. Black, from the perspective of a signal generator, has a specific voltage and amplitude at fixed frequencies. I'll

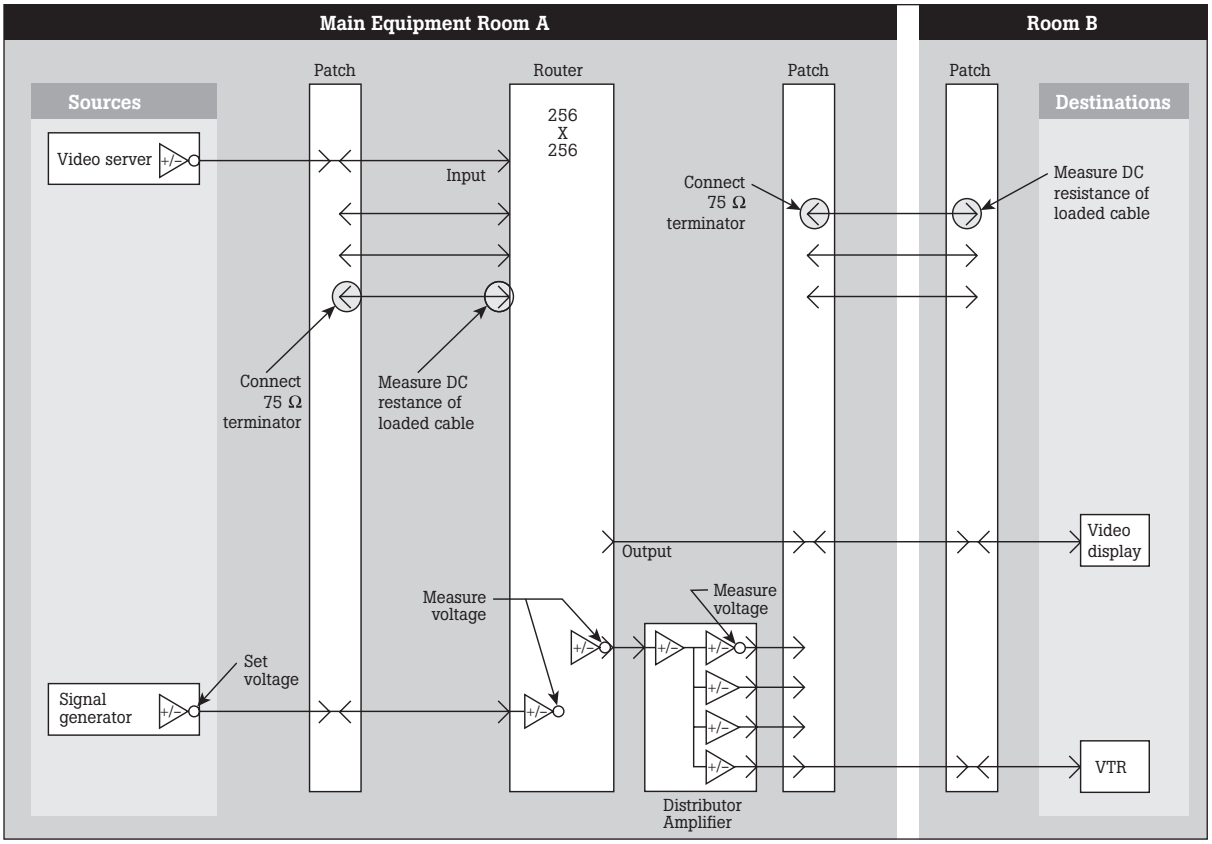
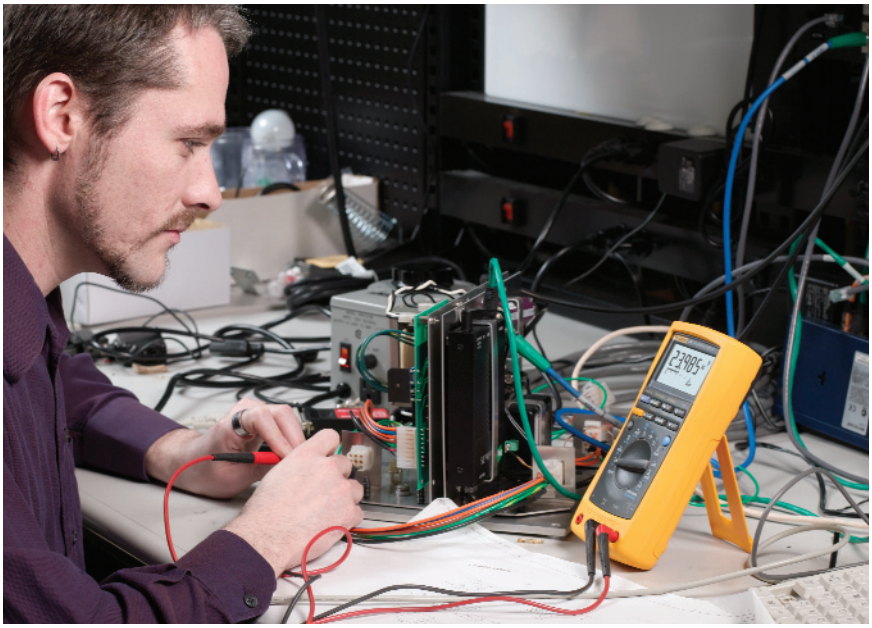


Figure 1. Load testing and gain structure optimization.



To power and network a particular PTZ (Pan Tilt Zoom) camera installation, Grieshaber's team built specialized a control assembly that could supply 24 V AC, 24 V DC and 5 V DC regulated. The load components include an analog-digital converter for video, an electrical-optical converter, a hardened serial server, and the camera. Grieshaber uses the Fluke to measure voltage and current on the PCB board power supply, confirming regulation on the 5 V side and testing how well the power supply deals with irregular input voltage.

check various points along the path and ask 'have I incurred a voltage loss, or a voltage gain?'

"I'll take my DMM out and stick it on various nodes to look at voltages and currents; typically, with analog audio or video signals, I'm looking at voltage. At the input and output of a particular stage, I should find the voltage within a narrow range, as specified by the test signal I am using. If I find what I expect with the DMM, I can say, for the most part, that things are working properly."

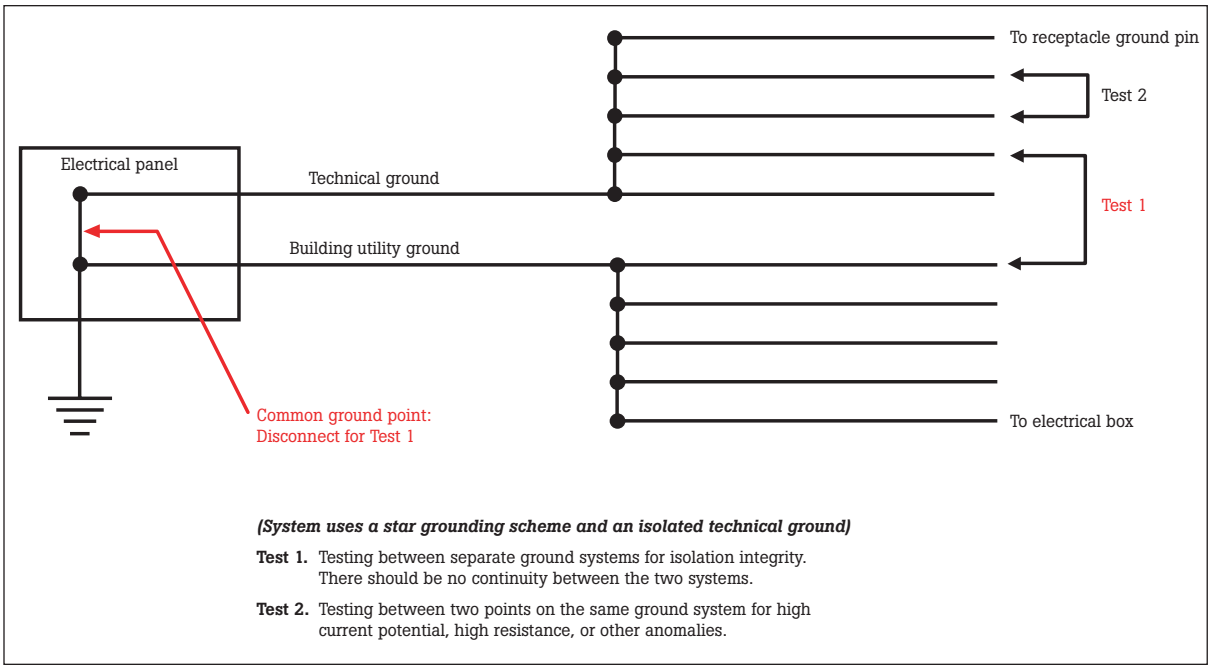
Power considerations

While system testing is key to performance, Grieshaber is just as focused on requirements for clean power. "With the high-level power infrastructure, we are concerned that, if the provided power is either at the wrong voltage or exhibits strong harmonics, we'll see the consequences ripple throughout the system."

For that reason, he conducts two types of power-supply testing for every system:

- Testing of the high-voltage power infrastructure
- Testing of system power supplies and how they respond to the delivered power

"Often we specify an isolated ground system for power to the A/V and IT systems, and that means testing for isolation *between two isolated ground systems*. The DMM makes it very easy to get a quick read on how well an isolated ground has been implemented. One way to do that is to test for continuity between the two systems." (See Figure 2, Test 1.)



(System uses a star grounding scheme and an isolated technical ground)

Test 1. Testing between separate ground systems for isolation integrity. There should be no continuity between the two systems.

Test 2. Testing between two points on the same ground system for high current potential, high resistance, or other anomalies.

Figure 2. Grounding tests.