

Lights, camera, action!

Our thanks to Fluke for allowing us to reprint the following article.

When a feature film or TV show comes on the screen, one element the audience rarely considers is the lighting. However, lighting is every bit as critical to the production as the camera. Behind the scenes of any show, lighting technicians blend art and science to make the magic appear.

Los Angeles is home to one of the largest concentrations of lighting technicians, most of whom are represented by Studio Electrical Lighting Technicians IATSE Local 728. Local 728 sets the standard for efficiency and safety on set and builds expertise among its membership. Each year Local 728 administers more than 50 skills training classes geared specifically to the electrical challenges of lighting for motion pictures and television and taught by top professionals in the industry.



Ruben Esobar, Best Boy Electrician on the set of the Jimmy Kimmel show and a member of Local 728, uses the Fluke 434 Series II Energy Analyzer to look at the individual phases of the power being distributed to the lighting set at an outdoor concert stage. Balancing the power on these systems has been tricky in the past, so he keeps a close eye on them with his 434.

The approximately 2,400 members of IATSE Local 728 design, install, and troubleshoot portable power systems, cabling layout, and dimming and distribution equipment on productions in a variety of situations and locations. They work with everything from high power ac and dc systems to Ethernet and RS-485 (DMX) controlled automated lights and dimmers.

The driving (and sometimes conflicting) forces guiding these technicians are safety, speed, and creativity—not necessarily in that order. Lighting can make or break a

production; each hour of downtime costs tens of thousands of dollars. Nevertheless, lighting technicians must maintain electrical safety while constantly pushing the envelope to deliver ever more sophisticated effects.

Meeting that challenge requires extensive knowledge, versatility, and nerves of steel. They are all contract workers and typically purchase and maintain their own tools. Needless to say they all have their own war stories.

Keeping harmonics under control

One of the biggest challenges for lighting technicians is keeping track of loads and harmonics. “On many of our sets virtually all of our lights are on phase control dimmers. Turning the knob or sliding the slider chops the voltage and feeds harmonics back into the system. The only way to get an accurate reading on those types of dimmers is with a good quality true-RMS meter,” says Roger Lattin, a Studio Set Lighting Technician and lead training instructor with the Local 728 since 1988. Lattin typically uses a Fluke clamp meter to monitor current. “Our loads are constantly changing minute to minute so it’s easy to clamp the meter around the cable to see if you’re approaching the ampacity of the cable,” he adds.

Another challenge is bad cable. A broken or damaged cable can overheat, producing a voltage drop resulting in dim or flickering lights during a shot. When Lattin worked on the movie *Dream Girls* a few years ago he encountered a problem that baffled him. They were shooting a scene in a little theater in the LA area. The main portable power feeds for just the stage lighting were two 17-piece runs of 4/0 AWG feeder cable running side by side (carpet laid). Each 17-piece run consisted of:

- six pieces for the neutral to handle the high harmonic content expected from running dimmers and discharge lamps
- three parallel pieces each for the black, blue, and red phases to provide ampacity and accommodate line loss
- two pieces for ground leads.

Lattin’s amp clamp had been lost the day before, so on the way to the new location he purchased a new Fluke i410 AC/DC Current Clamp for his Fluke 189 Digital Multimeter. Wanting to familiarize himself with the new

tool, he took readings on all three phases. He noticed that, on each phase, the first piece of cable was running 30 or 40 amps higher than the other two pieces on the same phase. "The load should have been roughly the same on all three pieces of each phase. I still had at least 150 amps of available ampacity per piece of cable as a fudge factor, so I wasn't alarmed, but it was a concern," says Lattin.

Using an infrared thermometer, Lattin found the cables were well within their temperature rating, so he wasn't worried until the lighting designer requested 100 more discharge lights. "Since I didn't know what was causing the imbalance, I was afraid that the extra load might push the cable past its capabilities," Lattin says.

As he ran the current clamp on the cable again, Lattin happened to turn the dial to "Frequency." "In the frequency mode I noticed that the pieces of cable in question flickered to 180 Hz." Lattin deduced that they had a harmonics issue. The mystery was why it was only occurring on the first piece of each phase.

"That's when a light bulb went off in my head," says Lattin. "The way we had laid the cable caused the second and third conductors of each phase to magnetically push the harmonics from all of the dimmed loads and the discharge lamps into the first piece of cable in each phase. The first piece of cable didn't have any magnetic lines of force because it was next to a different- color cable." It turned out they didn't add the extra lights, so they were able to complete shooting at that location without changing the cable layout.

"That discovery led to a series of learning experiences," says Lattin. "I purchased the Fluke 434 power analyzer shortly after that, so now I can see all three phases of power simultaneously and monitor that kind of situation."



On a set for television production at CBS Studios, Roger Lattin checks the current on an overhead power supply with his Fluke 376 Clamp Meter.

Keeping the lights up when voltage drops

Like location shoots, studio lighting for series TV presents a lot of variables. Heather Newsom, a Local 728 member and Studio Lighting Technician on various features and TV shows, including *Desperate Housewives*, believes that one of those variables shouldn't be the accuracy of your test tool. "In the studio, if something goes wrong and they're waiting even 15 minutes for you to fix the problem, there are a lot of people tapping their feet," says Newsom. She has been a lighting technician for the past 15 years and during that time has relied extensively on her Fluke 30 Clamp Meter. "Fluke gives us right-on readings, with no ghosting voltages; if it says it's 125.6 V it is 125.6, it doesn't float around on you."

That accuracy came in handy a few years ago when all of a sudden the color temperature shifted to orange and the light output declined for no apparent reason. When Newsom checked the voltage at the transformer with her clamp meter she found that they had lost about 10 V of power. It turned out that during the peak air conditioning season in Southern California the voltage on one of the transformers declined. They tapped up the transformer an extra 5 V, and Newsom started taking a voltage reading each morning before the shooting started and again when they were under load. "If the voltage still wasn't up to what we needed, we could change the power source or shorten or add a cable," Newsom says.

Automation presents new challenges

The introduction of automation to entertainment lighting has expanded the creative possibilities tremendously and has also upped the level of required expertise. "A lot of what we're doing now is very sophisticated electronically. We have automated moving lights, media server systems, and LED and fluorescent lighting," says Charlie McIntyre, a Chief Rigging Gaffer and Local 728 member, who has spent his 26-year career in the motion picture and television industry working mostly on feature productions.

He works everywhere, from sound studios that are completely cabled and wired, to bare-shell buildings where his crews have to bring in all of the power. "Some of the power comes off the building transformers, which start at 480 V, and we step it down to 120 V or 208 V. Then we also bring in additional generators and transformers if we need them," says McIntyre.

McIntyre uses Fluke digital multimeters during the location setup to find and resolve problems along the way. "The meter allows us to quantify the situation electrically so we know that everything is good to go when the cameras start rolling," says McIntyre.

That monitoring continues as the shoot progresses. On a recent shoot the script called for Lightning Strikes (specific lighting instruments). "Those Lightning Strikes took anywhere from 70,000 watts to 250,000 watts of power generated by four gigantic battery packs that run 350 V dc," says McIntyre. After the first day, the light output of Lightning Strikes declined significantly, which brought the process to a standstill.

McIntyre brought out his Fluke 117 Digital Multimeter and tested the dismantled battery packs for proper dc output voltage. "We found quite a few internal problems, including blown-out batteries that had to be replaced," McIntyre continues. "To me the Fluke meter is your 'go to' item for troubleshooting," says McIntyre. "Being able to switch between ac and dc voltages made the troubleshooting go faster and enabled us to isolate the problem sooner. With an entire production company waiting for answers, I want my meter to be the tool that helps solve the problem."



Phil Muskett of DADCO Power and Lights checks the continuity of an HMI light fixture's globe (lightbulb) with a Fluke 337 Clamp Meter. This is one of the largest light fixtures in the industry at 24,000 kilowatts.

FLUKE®