

Circuit Mapping Saves Wiring Troubleshooting Time and Money

EXECUTIVE OVERVIEW:

Whether the construction job is a new building or a renovation, electrical contractors are plagued with the problem of tracing circuits. Despite electrical codes that require electrical connections be clearly labeled, inevitably there are circuits that are not marked, marked incorrectly, have been rewired, require troubleshooting, or are simply difficult to trace. In addition to creating construction delays, badly marked circuits pose a safety hazard to construction professionals, building management, tenants, and others. Depending on the size of the project, an electrical contractor can spend hundreds of man hours manually tracking down circuit terminations points. However, there are tools that offer a safer, faster, more efficient way to map circuits for any type of construction project. This white paper will review the issues related to identifying electrical wiring and discuss the advantages of Circuit Mapping as a new circuit tracing strategy.

Introduction

When you are installing thousands of feet of electrical cable on a construction job, keeping track of circuit end points can be problematic. You may have multiple contractors on the job, each applying their own best practices when it comes to installing and labeling wiring. If you are working on retrofitting an older building, you may run into wiring that predates current building codes or was just poorly labeled. When it comes to identifying circuits, electricians have to deal with the unexpected every time they are called to a new job.

In the construction business, time is money, and any unexpected delays in completing a job mean added expense. There is nothing more frustrating than running into an unnecessary delay or cleaning up someone else's mistake. However, when it comes to identifying circuits, the latest circuit testing technology can eliminate hours of tedious circuit tracing and put money back in your pocket.

Simplifying Safety Compliance

As a construction professional, you know that it's important that you properly label wiring as part of regulatory compliance and installation safety. The National Electrical Code (NEC) and the Occupational Safety and Health Administration (OSHA) both have clearly defined regulations regarding proper circuit labeling. For example, OSHA 1910.335(b)(1) states, "Safety signs, safety

symbols, or accident prevention tags shall be used where necessary to warn employees about electrical hazards which may endanger them..."¹ NEC 408.4 states that:

Every circuit and circuit modification shall be legibly identified as to its clear, evident, and specific purpose or use. The identification shall include an approved degree of detail that allows each circuit to be distinguished from all others. Spare positions that contain unused overcurrent devices or switches shall be described accordingly. The identification shall be included in the circuit directory that is located on the face or inside of the panel door in the case of a panelboard and at each switch or circuit breaker in a switchboard or switchgear. No circuit shall be described in a matter that depends on transient conditions of occupancy.²

Failure to properly label circuits can result in expensive fines. OSHA conducted almost 32,000 inspections in 2016³ and found 1,424 electrical wiring violations. Fines for failure to meet OSHA requirements can add up to thousands of dollars per violation.⁴ The simplest remedy is to ensure that circuits are properly labeled from the outset, and if you see a potential violation due to poorly marked wiring, address the issue immediately rather than waiting to face OSHA fines.

Properly labeling circuit panels is clearly an ongoing safety concern. Mislabelled breakers in residential, industrial, and commercial buildings can pose a hazard to building management as well as emergency personnel in the event of a fire or other natural disaster. In fact, to help make circuit panels even safer, the NEC amended 408.4 in 2008 to require all panelboards to be labeled to indicate the source of the power supply.⁵ Otherwise, electricians working in large commercial or industrial facilities could be working on energized panelboards because they could not locate the connection to de-energize the equipment.

The Benefits of Circuit Mapping

Wouldn't it be great if everyone adhered to NEC standards? Unfortunately, too often panelboard circuit directories are left blank or mislabeled, which not only makes troubleshooting more difficult but can pose a serious safety hazard.

You can apply the old-fashioned method of trial and error to trace circuit breakers and fuses. However, with all the expensive equipment that companies rely on, suddenly dropping the power load by throwing the breaker to identify a circuit could create expensive system failures. Even using a two-man team to test circuit end points with probes is time-consuming and inefficient. What you need is a safe, fast, and reliable way to identify a breaker and define the circuit without dropping the load.

In addition, once you identify the individual circuits you still have to label each one and integrate them into a circuit map of the building. Most circuit tracing devices typically only trace one branch circuit at a time. You still have to assemble the individual circuits into a

comprehensive wiring diagram, especially if you are working on a new construction or a comprehensive retrofit.

A Circuit Mapping system simplifies circuit tracing by applying a new approach. Rather than using individual probes to trace end-to-end connections, a Circuit Mapper uses a transmitter that connects at the panel instead of the end of each branch circuit. Using digital signal processing, the receiver displays each corresponding circuit number, either with or without direct electrical contact. As a result, you know exactly which breaker is connected to each transmitter lead.

A Circuit Mapper System saves time exponentially over traditional circuit tracing methods. Field studies conducted at job sites have demonstrated a time reduction ranging from 3.5 to 6 times that of using conventional approaches to trace and map energized circuits. When you consider that labor costs an average of \$38 per hour or more⁶, the savings in time and labor costs can be substantial.

A Circuit Mapper can trace both de-energized and energized circuits, but the real savings come with tracing and mapping energized circuits. The Circuit Mapper can help electricians create an accurate circuit map without having to shut down the power, which means customer service is not disrupted. This can be a particularly important consideration when you are wiring a data center, medical facility, or other building where a power interruption could affect vital electronic equipment.

The Tasco Circuit Mapper System

Tasco's Circuit Mapper System is a circuit testing solution unique in the construction industry, allowing a single electrician or electrical contractor to trace electrical circuits from the panel in record time.

The Circuit Mapper System consists of two components: the Transmitter and the Receiver.

The Transmitter connects to the panel and sends distinct digital signals to individual branch circuits on both powered and unpowered systems, inducing a unique code for each circuit. The Transmitter uses non-contact inductive clamps to connect to the circuits to be tested. The clamps are insulated to reduce risk from electrical shock as well as the need for a live voltage direct connection. The clamps are interchangeable since the digital signal at each output jack generates a unique numeric code.

The Receiver is programmed to recognize and identify the specific digital signal sent to the circuit via the Transmitter clamps. The

The Tasco Circuit Mapper: Product Features

- Identify which breakers serve circuit branches in seconds
- Identifies lines on any wiring system
- Circuits can be tested with or without power – no downtime
- Only one operator saves valuable man hours
- Microprocessor-based signal for utmost accuracy
- Locate up to 84 circuits simultaneously
- Battery operated (standard 9V) with automatic shutdown³ for energy conservation

signal must be repeated twice before generating a reading for optimal accuracy and to eliminate false positives.

The Circuit Mapper System can trace up to 42 circuits in a single panel. To trace more than one panel or more than 42 circuits, a second Transmitter can be added.

Using the Circuit Mapper System, there is no time wasted comparing signals or looking for the strongest signal. One person can map all the branch connections from the panelboard saving man-hours and substantially reducing labor costs.

About Tasco

Tasco is an innovator in electrical testing equipment, developing testing tools that save valuable time and pay for themselves many times over. All of Tasco's electrical test tools are designed for ease of operation and reliable results. Tasco's electrical test products include the Buried Line Locator, which does not require manual signal strength adjustments; Power Trace, which uses a uniquely synthesized signal to reduce error rates to near zero; and the Circuit Mapper System, a unique branch circuit mapping tool that allows a single person to trace circuits to multiple breakers.

- 1) United States Department of Labor, Occupational Safety and Health Administration (OSHA) Standards:
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9912&p_table=STANDARDS
- 2) Full text of the National Electrical Code:
https://archive.org/stream/NationalElectricalCode/National%20Electrical%20Code_djvu.txt

- 3) United States Department of Labor, Occupational Safety and Health Administration (OSHA) Enforcement: https://www.osha.gov/dep/2016_enforcement_summary.html
- 4) OSHA's Top 10 Most Cited Violations, Safety & Health Magazine (November 26, 2016): <http://www.safetyandhealthmagazine.com/articles/14927-2016-oshas-top-10-most-cited-violations>
- 5) Switches, Receptacles, and Panelboards, EC&M Magazine (February 21, 2012): <http://www.ecmweb.com/code-basics/switches-receptacles-and-panelboards>
- 6) Electrical Contractor Salary, PayScale.com: http://www.payscale.com/research/US/Job=Electrical_Contractor/Hourly_Rate