

1587

two tools in one

Application Note

What electrician wouldn't want to carry fewer tools on his heavy belt? As long as he had everything he needed right there—and that's always the catch.

Fluke tool users had been saying for years that Fluke should combine an insulation resistance tester and a DMM, and make it small. It would be their main test unit, they said, the one they used every day.

As it was, these electricians knew the importance of testing insulation, both at installations and for regular maintenance, but the tool usually only came out when really needed, for troubleshooting failures. Because, more often than not, they only had one insulation tester, shared among a team. It was bulky, expensive and probably back in the shop. It might even be hand-cranked.

Feature rich

The right technology has finally come along. Fluke engineers have become adept at making complex tools easy to use and easy to carry in the palm of your hand. The new 1587 and 1577 Insulation Multimeters combine all the functions of an advanced multimeter with the most frequently used features of an insulation tester—for less cost than some insulation testers alone and half the size and weight.

Their small size is made possible by higher circuit densities and advances in safety design. For example, both meters are 600 V CAT IV and 1000 V CAT III overvoltage rated. They're designed for use on service entrances up to 600 V, and on PWM inverter dc buses up to 1000 V. They automatically disable insulation testing if connected to a live circuit with more than 30 volts. And following insulation resistance testing, the meters discharge all capacitive voltage from the equipment user test to help prevent accidental shocks.

Other advances include a remote activation probe that enables one-handed insulation testing via a voltage trigger on the probe handle.

The 1587 provides insulation resistance testing up to 2 GΩ, with five output voltages ranging from 50 V to 1000 V, while the 1577 tests up to 600 MΩ of resistance with 500 or 1000 V. Both meters also offer a low-ohms function for continuity and ground connection testing.



Steve Uhrich of Valley Electric using the Fluke 1587 Insulation Multimeter.

This new category of test tool is ideal for electricians who work on motors, switchgear and cabling and for HVAC/R technicians who work with compressors. To make the advanced

model even more flexible, Fluke engineers added a low-pass filter for accurately measuring variable frequency drives, Min/Max, temperature, diode test, frequency, and capacitance.

The goal is to help electricians do **more tests in less time**, providing better service to the customer and getting **more accurate, reliable results** from more comprehensive tests.

What the Fluke 1587 Insulation Multimeter can do

Measurement Troubleshooting	Applications
Volts ac	<ul style="list-style-type: none"> • Line voltage level • Phase voltage unbalance
Volts ac, with low-pass	<ul style="list-style-type: none"> • “Envelope” voltage measurement on PWM motor drive output
Volts dc	<ul style="list-style-type: none"> • Battery voltage • Voltage on dc power supplies used in electronic equipment • DC buses on motor drives and uninterruptible power supplies
Amps with current clamp	<ul style="list-style-type: none"> • Running current • Current unbalance
Amps, in-line	<ul style="list-style-type: none"> • Low current control circuits such as 4 to 20 mA or alarm systems
Ohms	<ul style="list-style-type: none"> • Coil resistance in contactors, relays • Contact resistance in switches, circuit breakers • Use to check Resistance Temperature Detectors (RTD’s) or thermistors • Check strain gauges
Continuity	<ul style="list-style-type: none"> • Verify conductor integrity • Connection integrity • Check fuses
Insulation resistance testing	<ul style="list-style-type: none"> • Check for conductor insulation degradation to bonded conduit • Check for insulation degradation between conductors sharing a conduit or raceway • Check for motor winding insulation degradation to bonded frame • Check for insulation degradation in transformers
Temperature*	<ul style="list-style-type: none"> • Check air temperature in HVAC systems • Check surface temperature of motor frames • Check surface temperature of switchgear and transformer enclosures • Corroborate other thermometers, thermostats or temperature transmitters
Hertz	<ul style="list-style-type: none"> • Check generator output • Check pulse output flow sensors • Check pulse output of optical encoders • Check “six step” motor drive output frequency
Hertz, with low-pass	<ul style="list-style-type: none"> • Check PWM motor drive output frequency
Capacitance	<ul style="list-style-type: none"> • Verify the proper capacitance of <ul style="list-style-type: none"> ◦ Filter capacitors on dc power supplies ◦ Motor start and run capacitors
Diode	<ul style="list-style-type: none"> • Check rectifier diodes for shorts and opens in power supplies, motor drives and UPS’s/LED’s
Min/Max/Avg recording	<ul style="list-style-type: none"> • Check for ac line voltage sags and swells • Use on current setting to track Max load • Track temperature excursions
Other	<ul style="list-style-type: none"> • Pressure, with appropriate accessory like PV350

*with k-type thermocouple adapter and temperature probe

Why test insulation?

Electrical insulation includes the entire complex system of cable insulation, bushings, and spacers within conduit, motors and general equipment. Low insulation resistance indicates that current is leaking through the insulation. That can cause heat build up, which in turn causes the insulation to degrade even faster and eventually fail. Leaking current can cause over-current protection devices to trip and motors and transformers to overheat, and is just plain unsafe and inefficient.

Insulation problems are usually caused by improper installation, environmental contamination, mechanical stress or age. Insulation testing can easily be combined in with regular maintenance, to identify degradation before failure, and during installation procedures to verify system safety and performance. When troubleshooting, insulation resistance testing can be the missing link that enables you to get a unit back into operation the easy way, by simply replacing a cable.

Insulation testers apply a dc voltage across an insulation system and measure the resulting current. This allows them to calculate and display the resistance of the insulation. Typically, the test verifies high insulation resistance between a conductor and ground or high insulation resistance between adjacent conductors. Two common examples include testing motor windings for insulation from the motor frame and checking phase conductors for resistance from bonded conduit and enclosures.

Saving the customer money

Steve Uhrich is the TEGG Service supervisor for the Valley Electric Company in Everett, WA and a JATC instructor. He says the 1587 will replace his DMM and his insulation tester. "Now I have one tool to do both jobs," he says.

Valley Electric is a full service electrical contractor providing design build, construction, service, maintenance and testing services. About 80 percent of Valley Electric's TEGG Service work is maintenance/testing and the remainder is troubleshooting. One of his most common trouble calls involves troubleshooting a tripping circuit breaker or blown fuse. "Before re-energizing the circuit I will always check the insulation resistance of the circuit conductors and load equipment," he says. After checking the insulation resistance he closes the breaker and checks the voltage, starts the load and checks the current, all with one tool.

For his maintenance contracts, Uhrich prefers to test insulation at least every three years, comparing the readings to a previous baseline, the manufacturer's specifications, or NETA recommendations. Typically the readings are so high that a minor change isn't worth noting. However, anything close to a 25 percent change is enough to cause alarm and further investigation, and over 50 percent change signifies a critical problem.

Now that he has the 1587, he also uses it for current measurements, looking for overloaded components and checking loads.

Commonly he checks the output voltage on a drive and uses the low-pass filter function to check low frequency. The filter cuts out anything above 400 hertz, where most drive carrier frequencies are found. As an example, Uhrich says that in one case, when he checked a drive output circuit in the normal mode, he measured 480 volts. Using the low pass filter tightened the reading to 460 V. He also uses the frequency measurement mode to check the signal output of drives.

Uhrich says his own service electricians may soon be carrying the 1587, instead of relying on a shared insulation tester. When a service electrician is on a trouble shooting call and doesn't have the proper tools, they have to call for backup, extending the length of time to get the load back up and running. This delay ends up costing the customer time and money.

The other hazard arises when an electrician makes the wrong diagnosis based on inadequate information. In one case involving a tripping load, a customer was told he needed a totally new motor when he actually had a simple insulation resistance problem on a pump motor that could be easily repaired.

Habit forming

Mac Perkins, head of technical services and founder of Pacific Northwest Theater Association (PNTA) in Seattle, is still finding new uses for the 1587. PNTA specializes in theatrical sound and lighting, as well as museums, art and architectural lighting. In Perkins' job, the customers are often thinking "outside the box" and unusual applications for electrical systems are the norm.

Until he acquired the 1587, "I had a couple of DMMs that were my workhorses." Having the 1587 gives him the insulation testing opportunities he didn't used to have. "We didn't usually carry an insulation tester. Having the insulation tester with me is cool. It could be habit forming," he says.

He adds that, "We do run into mysterious problems that often prove to be insulation related." In one recent incident, a system was repeatedly tripping its breaker. "The load was fine," he says, and he pulled out his 1587 to do an insulation test. "At that point we found a coil was breaking down." That diagnosis saved him from having to take the module back with him to the shop to work on overnight.

Most importantly for Perkins, the tool allows him to take troubleshooting and preventative maintenance further and more systematically. "A lot of people do things by rote and they'll skip steps," he says. To avoid short-cuts, he's putting a best standards guideline together for diagnosis and maintenance.

"Having (the 1587) makes that easier," he says.

Today more than ever, Perkins says, his customers need a quick diagnosis to their problem. No one wants to lose productivity time, and many customers are anxious to know whether they need to repair something or simply replace it. On an inexpensive piece of machinery, Perkins says, customers don't want him to take a long time diagnosing a problem that will be too expensive to fix.



Fluke. *Keeping your world up and running.*

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