Ω-CHECK®
CONCENTRIC NEUTRAL TESTER

HIGH VOLTAGE®
VLF HIPOT INSTRUMENTS

The Best Method of Measuring Concentric Neutral Integrity vital to maintaining system stability, reliability, and safety

- **Ground Cable Resistance Testing also possible**

Easy to use
Simple operating procedure
Few controls and settings to learn
No programming – data entry only
Tests take <10 seconds once setup

Easy to set up
Cables Remain Energized
Neutral remains connected
Light weight and portable
Cable reels make setup easy

Field proven for >15 years
Rugged & Reliable
Simple to service
Water Resistant
Used by many utilities

Results instant & clear
% of neutral remaining
Resistance of neutral
Power factor of neutral
Volts & amps on neutral

Designed specifically for testing energized cables, the Ω-CHECK® Concentric Neutral Tester
accurately measures how many strands of a concentric neutral remain intact

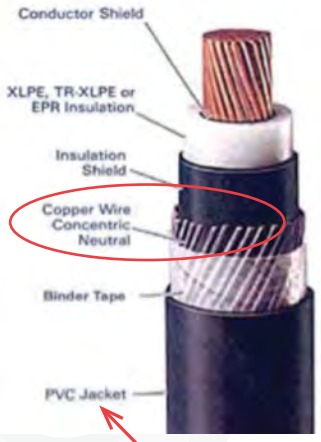
Safety and Operational Benefits of Healthy Neutrals – Many Good Reasons to Test

- Ω **Help prevent shock hazard conditions** and locate stray voltages and currents
- Ω **Help overload protection systems function** as expected during cable faults. Limit possible damage.
- Ω **AC Withstand and diagnostic testing** results, with VLF or 50/60 Hz, can be compromised if no neutral
- Ω **Injecting/Rejuvenating cables?** Make sure enough neutral remains to justify the effort and expense
- Ω **Prioritize cable replacement** efforts by comparing the neutral condition of many cables and replace only the bad ones, not those with acceptable neutrals
- Ω **Fault locating cables:** avoid lost time, minimal success, and unsafe conditions if little neutral remains. Don't thump cables with open neutrals, never to find the fault and sending kjoules of energy into the earth

The **Ω-CHECK®** Tester Difference: AC voltage (not DC) is applied, polarity reversing for neutral load current compensation is performed, voltage drop measurements are taken at the neutral ends, and the test results are compared to the data entered of the actual cable under test, making the **Ω-CHECK®** tester the most accurate method of measuring concentric neutral integrity. It is economical, easy to operate and interpret, very portable, rugged, reliable, and easily serviced.

What is a Concentric Neutral?

Like the pictures below show, a "Concentric" Neutral is a ground shield designed with many individual strands of wire that are wrapped around the outside of a cables insulation layer. They are helically wrapped to twist around the insulation along the length of the cable. The primary purpose for the neutral is to provide a uniform ground shield around the cable to equalize and minimize voltage stress on the cable and to provide a low impedance path for the distribution systems Return and Fault currents. The many purposes of the neutral are described below. There are other neutral designs that use a continuous **foil wrap** or a **tape shield** with many overlapping strips of copper or aluminum. The **Ω-CHECK®** tester is designed to test cables with concentric neutrals.



"Jacketed" Cable

The Vital Functions of a Concentric Neutral:

- Creates a uniform ground plane around the cable to insure equal voltage stress
- Provides a path for Return current if circuit design requires it be used for that
- Provides a safe path for short circuit currents, instead of nearby gas or water pipes
- Maintains system voltage stability and uniform voltage drop along a cable
- Helps prevents high fault currents from reaching a conductor of an adjacent cable
- Permits predictable overload relay coordination, preventing possible damage
- Provides safety from dig-ins of live cables by providing a grounded shield cover

"Unjacketed" Cable

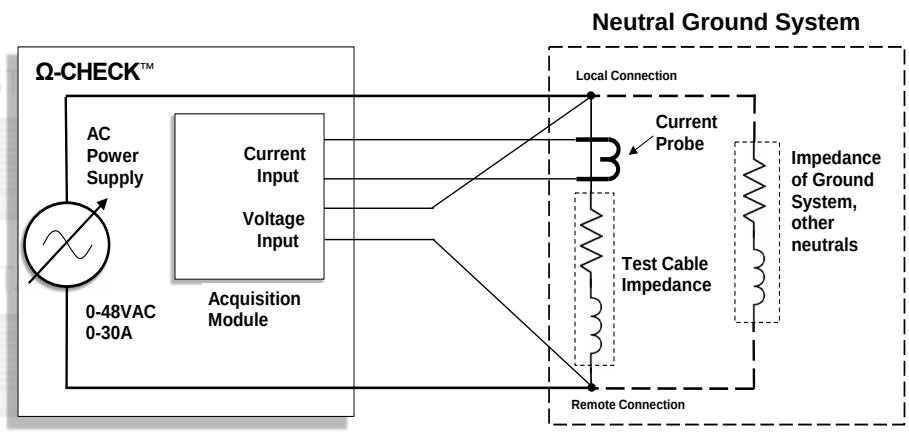
What can the Ω-CHECK® Test?

The Ω-CHECK® tester is designed to test concentric neutrals that consist of many round or flat wires. It cannot test neutrals that are "foil" or "tape shield" designs. The **Ω-CHECK®** tester does not measure the partial corrosion of the wires but measures if they are **open or closed** due to total corrosion or breakage. When a strand opens, there is a very incremental and measureable change in the neutral's resistance. **This is what the Ω-CHECK® tester measures; how many strands remain continuous.**

The **Ω-CHECK®** tester can also be used for other applications, like **substation ground cable integrity testing per IEEE Std 81-2012**, that require an accurate, high current AC output ohm meter designed to make connections far apart.

Theory of Operation

The **Ω-CHECK®** tester is designed to measure how many strands remain of a concentric neutral. The instrument consists of a variable 48 volt AC power supply, a microprocessor based programming, control, and acquisition module, a "clamp-on" current meter, and two 500' reels of two-conductor test lead for connecting to the Local and Remote ends of the neutral being tested: one wire pair is used to inject the current through the neutral and the other pair is used to measure the voltage across the neutral. The AC power supply injects a current up to 30 amperes into the total ground system. The current probe placed around the neutral tested measures the current flowing only in that neutral. The diagram here shows how the system works.



The acquisition module receives the voltage across and the current through the tested neutral, from which the resistance and power factor are computed. Relays are used to swap the test current between polarities to help compensate for neutral load current effect. From the cable's neutral data previously entered into the controls, the system computes, compares, and displays the % of the neutral remaining, and other valuable data.

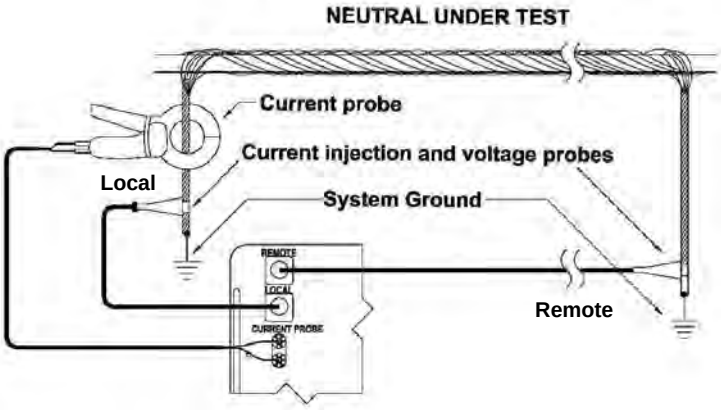
Method of Operation

The Ω-CHECK® tester compares the resistance of the neutral tested to a perfect neutral of the same specifications. To do this, the operator first enters the cables neutral data into the controls. The accuracy of the test results are as good as the accuracy of the data entered.

Data entered: ① Cable length ② # of neutral strands ③ AWG size of strands ④ Test ID #

The microprocessor computes the ideal resistance of a neutral of that specification and then compares it to the test data gathered. The condition of the tested neutral is displayed along with several other important test results.

Test Connections



Setup & Test Procedure

A two wire cable connection is made from the controller to the ***Local & Remote*** ends of the cable

One set of wires injects the AC current through the neutral while the others measure the AC voltage drop across the neutral

The clamp-on current meter is placed around the neutral tested

The operator inputs the neutral's data into the controls

Starting the test, an AC voltage up to 48 volts pushes a current up to 30 amps into the entire neutral ground system

The voltage across and only the current thru the target neutral is measured, not the total current pushed thru all grounds

While the polarity of the voltage & current are swapped several times, the neutral's resistance is computed

When test numbers stabilize, press HOLD to freeze the results

After the test is run, the Ω-CHECK® tester provides the following information:

- The % of the original neutral remaining
- The resistance of the neutral in Ω/100'
- The power factor of the neutral
- The resistance ratio compared to a new neutral
- The voltage and current of the tested neutral
- The option to download test results to SD chip

Cable Connection Application Note

There are two methods of connecting the remote, or far, end of the cable neutral to the **Ω-CHECK®** tester controls. Usually the two cable reels provided are used, however there are circumstances where this may not be the best method.

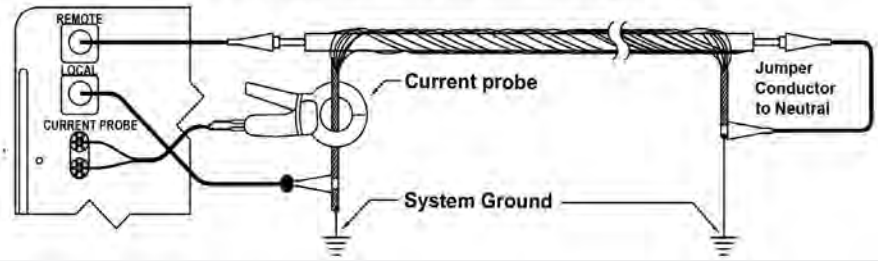
① Two 500' cable reels are provided – one is continuous and the other has connector breaks every 100'

The **Ω-CHECK®** tester must connect to both ends of the neutral tested. The **Local** connection is made to the neutral near the instrument and the **Remote** is made at the far end, possibly 500' – 1000' away. The cables provided are light but rugged enough to be easily dragged to the far end and rewound after. If this method of Remote connection is not practical, or more than 1000' away and you don't have an additional reel, there is an alternative. (Using the cable reels, the maximum test cable length can be 1500' - 2000'.)

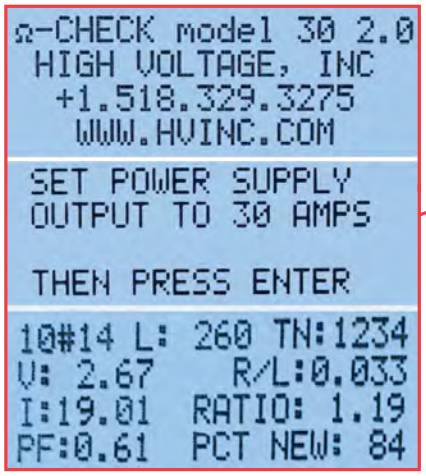
② Use the test cable's conductor or a parallel conductor, if de-energized, as the Remote connection lead

If the cable tested, or a parallel cable, is de-energized, its conductor can be used as the Remote connection to the instrument. Connect the Remote lead from the front panel to the open conductor at the near end. The far end of that conductor must also be open and be connected to the neutral of the cable tested. The test is then carried out as normal, however, the resistance of the conductor must be known and subtracted from the resistance of the neutral being tested. This operation is simple to understand, perform, and calculate the resistance of the tested neutral to determine how it compares to a perfect neutral.

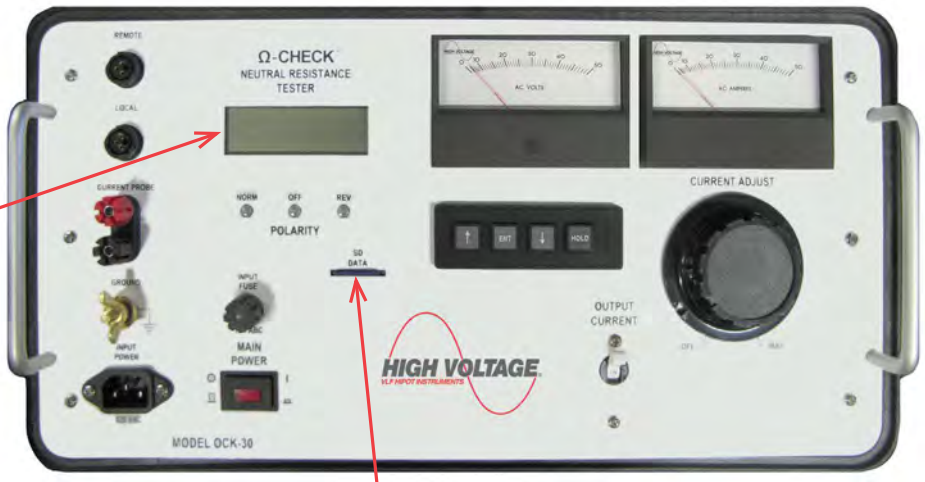
Using Cable Conductor for Remote Connection



Sample Screen Shots



Ω-CHECK® Tester Control Panel



Test Data Export from SD Card

TEST	TIME	DATE	NEUTRAL	LENGTH	VOLTS	AMPS	PF	R/L	RES	PCT
8	13:22	03/26/13	20 #14	375	18.25	30.70	0.22	0.035	0.130	40
1	14:27	07/15/13	16 #12	468	5.27	28.90	0.40	0.016	0.073	70
2	14:30	07/15/13	16 #12	468	1.89	10.33	0.40	0.016	0.074	69

Data Output: The **Ω-CHECK®** tester uses an SD Card to capture the test data. The saved data can be downloaded to a spreadsheet for manipulation and reporting.

Ω-CHECK® Tester Package

Controls/Power Supply
Cable Reels A & B, each 500'
Clamp-on Current Meter, 200A
Clamps for cable connections, 2 pcs
Cable to clamp-on meter, 10'
Cables between reels & neutral, 10'
Line cord 10' & #2 Ground Cable, 20'
SD memory card & Operators manual

Model OCK-30 Specifications

Electrical:	
Input power:	1800 VA, 120 V @ 60Hz, 15 A max.
Output power:	0-48 VAC, 30 A max.
Instrumentation	
Current probe:	Output: 1000:1
V & I meters:	Accuracy: ±2%
V & I measured:	Accuracy: ±1%
Phase angle – P.F.	±1.5°
Environmental	
Temperature Operating:	0 to 45°C, 0 to 113°F
Storage:	-20° to 70°C, -5° to 158°F
Humidity:	85% noncondensing
Dimensions & Weight	
Control box:	20"w x 12"d x 19"h, 55 lbs
Cable reels (ea.):	12"w x 11.5"d x 14.75"h, 23 lbs
Cables & Accessories	Supplied in canvas HVI bag

Cable Testing & Other Products from High Voltage, Inc.

HVI is the world's source for VLF technology. HVI is a world leader in the design and production of high voltage equipment for testing utility, industrial, and commercial applications for most types of substation apparatus, aerial lifts, motors and generators, MV & HV cable, and cable fault locating products. One of our specialties is test equipment for performing **AC Withstand and AC Diagnostic testing** of medium and high voltage cables. We also offer **Tan Delta and Partial Discharge** cable testing diagnostic equipment to operate with our VLF or 50/60 Hz AC power supplies. A quick summary follows:

Very Low Frequency (VLF) AC Hipots: 28 kV – 200 kV, sine wave producing, .4 uF – 50 uF load rating, 0.1 Hz – 0.01 Hz.
Tan Delta & Partial Discharge: HVI designed TD products and PD from others for diagnostic testing cables rated up to 230 kVac
Cable Fault Locating: Standard Thumpers up to 9/18/36 kV @ 3200 joules – custom to 100 kV @ 7500 joules. VLF/Thumper combo, & TDR available
AC Dielectric testers up to 50 kVA, Field Portable AC hipots, DC Voltage Hipots to 600 kV, Oil Testers, Bucket Truck Boom and Liner AC & DC Hipots, HV Dividers, and more.

www.hvinc.com

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