



# TesterLinc™ Signal Analyzer

Troubleshoot and measure your home automation system's reliability

For models:  
4819  
4919A

TesterLinc  
TestLinc with PowerLinc II

**SMARTHOME™**  
MAKING LIFE MORE CONVENIENT, SAFE AND FUN

# Congratulations !

Congratulations on purchasing TesterLinc™ a low cost, portable X10/PLC signal analyzer. TesterLinc helps to easily identify powerline carrier signals (PLC) also known as X10 signals. It simply plugs into any AC outlet via the PowerLinc™ II interface module (available separately or together as a kit). The two units together will detect PLC signals, display the quality of the signal, and display a digital average of any electrical noise on the line. For advanced users, a signal dissect mode will display the binary representation and the quality count for each "1" bit.

TesterLinc can be installed permanently and left running. It records the history of the last 63 detected commands. TesterLinc displays the address and command of detected signals. It is able to detect all commands including extended codes and extended data. TesterLinc will identify bad signals and signals that don't conform to the X10 specification.

## Key Features

- Two-Line, 16-character LCD display
- Displays signal address and command
- Displays X10/PLC signal's Quality
- Logs the last 63 powerline commands
- Reports electrical noise on the AC line
- Works with PowerLinc II interface
- Convenient operations and decode label on the back

## Other Smarthome Products

TesterLinc will work with all X10/PLC products from Smarthome Design as well as other manufacturers. For wall switches and dimmers, check out the new ToggleLinc™ series of traditional looking toggle wall switches or the new decorative SwitchLinc RX™, which is ideal for retrofit applications where there isn't a neutral wire at the switch's wall box. The KeypadLinc™ Wall Mounted Transmitter allows you to control multiple devices from one location at the press of a single button. And for plug-in devices, the ApplianceLinc™ and LampLinc™ modules will automate just about anything that plugs in. Please visit the Smarthome web site or contact your distributor for more information.



## What is a Quality Count?

Rather than using an averaged voltage measurement, TesterLinc will report the number of cycles it "sees" when a signal is received. One quality count is a valid line signal in the 110khz to 140khz frequency range. The X10 spec requires that at least 48 cycles of the signals must be detected in the first 700 microseconds after the zero crossing to be considered a binary ONE. Most X10 devices will transmit longer than 700 microseconds (where 1000 microseconds or 1 (ms) millisecond being typical). For most of these transmitters, there can be up to 120 or more such valid signals during the first 1 ms after the zero crossing. The quality count can be low if there is noise on the line or if the signal is very weak and below detection threshold levels. We have experienced that strong signals will be 90 to 100 and weaker signals may drop down to 50 to 60 or below if there is also noise. The default threshold for the TesterLinc is 40.

## Connecting and Operating TesterLinc

The TesterLinc must be used with a PowerLinc II Interface (available from Smarthome separately as #1132B). TesterLinc will not work with the original PowerLinc Interface (made from 2001 to early 2003) nor will it operate with PowerLinc II interfaces used in other Smarthome products, like TempLinc or IRLinc, (which are specially modified for those devices).

The PowerLinc II Interface #1132B includes an eight-conductor cable with RJ-45 modular plugs for the connection to the TesterLinc. When using TesterLinc, the PowerLinc II Interface cannot be connected to other devices (via the included splitter with the PowerLinc II). Doing so may damage the PowerLinc II interface, the TesterLinc, or the other connected device.

To operate the TesterLinc:

1. Unplug the PowerLinc II Interface from the AC if it is plugged in.
2. Plug in the eight-conductor cable between the PowerLinc II and the TesterLinc.
3. Plug in the PowerLinc II Interface

TesterLinc will not operate properly if the cable is plugged into it while the PowerLinc II Interface is plugged into a live AC outlet.

## Operation Modes:

TesterLinc has four operating or display modes:

1. Signal Address and command with quality count
2. Dissect Mode
3. History Mode
4. Noise Mode

Pressing the MODE button will cause the TesterLinc to cycle between modes.

### PLC/X10 Display Mode (shown at startup)

This display scrolls detected PLC/X10 from right to left across the LCD as they are detected. The top line shows the PLC/X10 address or command while the bottom line is the quality count for the detected signal. A total of four commands or addresses can be displayed at one time. As new commands or addresses are received, the previous signals will scroll to the left.

The TesterLinc will display the full address of the received signal, for example A16, C14, and P2. Commands will be abbreviated, except for ON. The chart on the right decodes the commands received by TesterLinc. This same chart is attached to the back of the TesterLinc for easy reference in the field.

Example:

L9	LON	P16	32%
67	68	62	65

Shows that address L9 and an ON command were received at a quality count of 67 and 68. The second pair is decoded as P16 with a Preset Dim command of 32%.

Pressing either the FORWARD or BACK buttons will clear the display.

### Dissect Mode

The Dissect Mode allows the user to look at each of the 22 120AC cycles that make up the last signal received (i.e. L9, F15, or LON). The cycle number is shown, starting with cycle 1 followed by the interpreted signal of 1 or 0. The quality count of the 'bit' signal is shown on the bottom line. Zero bits, which represent the lack of any signal, will not have a quality count reading.

DISSECT:	0	1
CYCLE	05	000 063

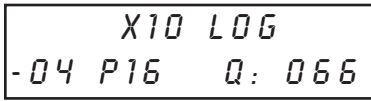
The FORWARD or BACK buttons are used to move through the cycles.

TESTERLINC MODEL 4819

#1:	L1 - X10 CODE	MODES
	L2 - QUALITY COUNT	
#2:	L1 - CURRENT CYCLE BITS	
	L2 - CURRENT CYCLE	
#3:	L2 - LOG POS.CODE.QUAL	
#4:	L2 - #120KHZ/500MS	
ON:	ON	
OFF:	OFF	
DM:	DIM	
BT:	BRIGHT	
%:	PRE-SET DIM VALUE	
LN:	ALL LIGHTS ON	
UF:	ALL UNITS OFF	
LF:	ALL LIGHTS OFF	
SR:	STATUS REQUEST	CODES
SN:	STATUS ON	
SF:	STATUS OFF	
EC:	EXTENDED CODE	
ED:	EXTENDED DATA	
HR:	HAIL REQUEST	
HA:	HAIL ACKNOWLEDGE	
BSC:	BAD START CODE	
BBK:	BAD BLOCK	
BCY:	BAD 3 CYCLE GAP	
HOLD NEXT MODE BUTTON, PLUG IN POWERLINC, RELEASE BUTTON AFTER 10 SECONDS, "RESET" APPEARS		
<b>TesterLinc Decode Table</b>		

### History Mode

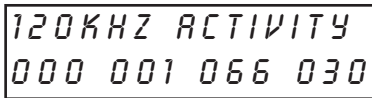
Displays the last 63 codes recorded since power-up. The FORWARD and BACK buttons are used to move through the history. The quality count for each signal is shown on the bottom line. The last received signal is displayed when this mode is selected. Pressing the BACK button will show the previously received signals.



In the example above, P16 was the fourth most recent signal received with a quality count of 66. To reset the history log, unplug the PowerLinc II Interface for a few seconds, and then plug it back in.

### Noise Mode

The Noise Mode displays the average PLC/X10 signal detected over the last half second. It represents the sum of all quality counts for the last 60 zero crossings divided by 60. The PowerLinc II interface will detect signals (or noise) in the 110 to 140kHz frequency range. Electrical noise outside of that range is not likely to interfere with home automation signals.



As new samplings are taken, every half-second, the previous readings will scroll off the screen to the left.

### Reset

If the TesterLinc begins to operate strangely, in most cases, simply unplugging the PowerLinc II interface from the AC lines for a few moments, then plugging it back in will clear the problem. In severe instances, the internal memory and registers may become glitched and a factory reset may be necessary to restore normal operation. To reset the TesterLinc and PowerLinc II interface, follow these procedures:

1. Unplug the PowerLinc II interface from the AC outlet.
2. Wait five seconds.
3. Hold down the MODE button on the TesterLinc and plug the PowerLinc II Interface into an outlet.
4. Continue to hold the Mode button for 10 seconds after plugging in the PowerLinc II Interface, then release.
5. The TesterLinc will briefly display "RESET" followed by it going into Mode 1.

# How Powerline Signals Travel Around A Home and How To Improve Reliability

Most homes in North America have two lines of 120 volts coming into the home from the utility company. This split-single phase electricity is divided out at the home's breaker box into the circuits that feed light switches, plug-in outlets, and appliances. Half of the electricity outlets and wall switches are fed by one of the 120-volt lines and the second 120-volt line feeds the other half. The intermittent operation of PLC/X10 modules usually happens when the transmitter is sending signals on one line and the receiver module is plugged into an outlet on the other line. For the signals to get to the receiver, it must leave the home, travel to the utility company transformer then come back in on the other AC line. By the time the signal gets back to the home, travels through the electrical meter and circuit breaker box, there may not be enough signal left to trigger the module.

The first order of business will be to install a coupler-repeater, also known as amplifier. A coupler-repeater will 'see' the incoming signal, re-generate it, and blast it out over both lines of the 120 volts. We recommend that any home larger than 3000 square feet install a coupler-repeater. In smaller homes, a passive phase coupler also known as a signal bridge may give satisfactory results.

Once the signal has been amplified, it's time to preserve it. Since PLC signals go everywhere in the home, some electrical devices will have more of an effect on the signal strength than other devices. PLC signals are like water pressure in pipes, it actually goes everywhere it can, not just to the receiving module. In the last 20



years, an explosion of electrical devices has invaded our homes. Computers, video gear, and fancy high-end electronics are more present than in years past. The more complicated the electrical power supply is in a device, the more likely it is to absorb PLC signals. Engineers who design power supplies build in traps to filter out and kill electrical noise. Unfortunately, the PLC signals look like electrical noise to these devices. The result is that a large percent of the transmitted signal is lost to these devices leaving less for the receivers. The most common sources of signal loss are:

- Televisions
- Computer systems
- Audio/Video gear
- Computer UPS's and power strips
- Power supplies for laptops and cell phones

Testing for the problem is simple. If a device is suspected of causing signal absorption, unplug the device and then re-transmit the signal. It is very important that the device is unplugged and not just turned off! If the controlled product begins working after the appliance is unplugged, then a filter will be needed on that device to keep PLC signals from being absorbed and raise the signal strength of the entire home. Smarthome has many filters that will fix the problem. An average home will need between three and five filters. If you are in the business of installing automation systems and not in the 'call-back' business, include some of these in your bid as part of the standard package.



#1626 FilterLinc™ Plug-In Filter

### Smarthome's BoosterLinc™ can solve localized problems



#4827 BoosterLinc™ Plug-In Amplifier

SignalLinc Repeater is ideal for improving the home automation signal strength throughout all the outlets in a home. But, as the PLC signals travel down a circuit and away from the repeater, it will weaken by the same factors listed above. Additionally, the signal will get weaker as it passes installed PLC transmitters. Each PLC transmitter contains a tuned circuit that when it's not sending signals it's absorbing them! In addition to plug-in transmitters, LampLinc™ 2-Ways, SwitchLinc™ 2-Ways, ToggleLinc™ 2-Ways, ApplianceLinc™ 2-Ways,

KeypadLinc™ Controllers, or any module with 2-way abilities will load down the available signal. With so many transmitters installed, the signal is loaded down to a point where some modules will be unable to receive a signal. Installing multiple 2-way devices on one branch circuit may necessitate the use of local amplifier like Smarthome's BoosterLinc.

## SMARTHOME design

### Invest in Better Home Automation Products

Unlike most electric items, many PLC-based products haven't changed much over the years.



KeypadLinc 6 with 450W integrated dimmer

Our Marketing and Customer Service teams surveyed our customers, like you, and our engineers have invented new and better wall switches and plug-in modules. We include more features, higher load handling, and better signal sensitivity for a superior user experience. While in some cases, they cost more; we hope you'll agree that not having to replace a dead module every couple years is worth the added expense and reduced aggravation. Please visit a retailer or distributor for the complete line of automation products from Smarthome Design. Check out our web site at:

<http://www.smarthome.com/smarthomedesignstore.html>

## About PowerLinc II Interface's Certification

The PowerLinc II has been thoroughly tested by ITS ETL SEMKO, a nationally recognized independent third-party testing laboratory. Products bearing North American ETL Listed mark signifies that the product has been tested to and has met the requirements of a widely recognized consensus of U.S. and Canadian product safety standards, that the manufacturing site has been audited, and that the manufacturer has agreed to a program of quarterly factory follow-up inspections to verify continued conformance.



## Smarthome Limited Warranty

Smarthome warrants to the original consumer purchaser of this product that, for a period of two years from the date of purchase, this product will be free from defects in material and workmanship and will perform in substantial conformity to the description of the product in this Owner's Manual. This warranty shall not apply to defects or errors caused by misuse or neglect.

If the product is found to be defective in material or workmanship or if the product does not perform as warranted above during the warranty period, Smarthome will either repair it, replace it or refund the purchase price, at its option, upon receipt of the product at the address below, postage prepaid, with proof of the date of purchase and an explanation of the defect or error. The repair, replacement, or refund that is provided for above shall be the full extent of Smarthome's liability with respect to this product.

For repair or replacement during the warranty period, call Smarthome customer service to receive an RA# (return authorization number), properly package the product (with the RA# clearly printed on the outside of the package) and send the product, along with all other required materials to:

Smarthome  
ATTN: Receiving Dept.  
16542 Millikan Ave  
Irvine, CA 92606-5027

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