

About Hardwired Signalinc's Certification

Signalinc™ 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



Limitations:

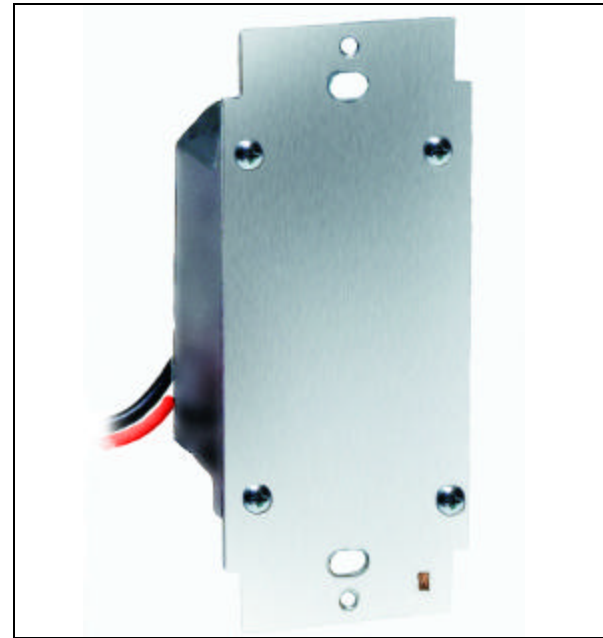
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IN NO EVENT SHALL SMARTHOME BE LIABLE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES RESULTING FROM THE POSSESSION OR USE OF THIS PRODUCT, INCLUDING WITHOUT LIMITATION DAMAGE TO PROPERTY AND, TO THE EXTENT PERMITTED BY LAW, PERSONAL INJURY, EVEN IF SMARTHOME KNEW OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts and/or the exclusion or limitation of damages, in which case the above limitations and/or exclusions may not apply to you. You may also have other legal rights, which may vary from state to state.

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800.SMART.HOME - 949.221.9200 - www.smarthome.com

rev 082703



HardWired Signalinc™

Increase your home automation
system's reliability

For model: 4816H

READ ALL INSTRUCTIONS BEFORE INSTALLING

SMARTHOME™
MAKING LIFE MORE CONVENIENT, SAFE AND FUN

Congratulations !

Congratulations on purchasing Hardwired SignaLinc™, a unique wired-in phase coupler!

Adding a phase coupler to a home's electrical system is the first step towards improving the reliability of the automation products used in the home. The Hardwired SignaLinc will passively couple the powerline carrier signals (PLC) X10 signals between the two phases of the home. When the Hardwired Signal is installed within a few feet of your home's breaker box, it will provide the most efficient coupling with the least amount of signal losses.

SignaLinc has been rigorously tested by ETL, a nationally recognized testing service and meets UL Standard 60950 and CSA 60950 (for Canada). Additionally, SignaLinc has been engineered to only pass PLC home automation signals, which are transmitted at 121kHz. This means SignaLinc will not pass electrical noise that might interfere with a home's high tech electronics.

Key Features

- Passively allows only PLC/X10 signals to easily travel between the two phases or electrical lines in a home
- Located at the breaker box, it provides the most effective PLC/X10 signal transfer
- Using a tuned circuit for coupling the signals, the Hardwired SignaLinc decreases the chance of electrical noise traveling between phases
- Safety tested and approved
- No neutral wire connection required

Other SignaLinc Family Members

Plug-in SignaLincs are the easiest way to passively or actively couple the powerline carrier signals in a home. These SignaLincs plug into a 240-volt outlet found in most U.S. homes (the outlets used for powering larger appliances, like clothes dryers, stoves, or window-mounted air conditioners).

- #4816A2 Plug-in SignaLinc for 4-Wire Dryer Outlets
- #4816B2 Plug-in SignaLinc for 3-Wire Dryer Outlets
- #4816C Plug-in SignaLinc for 3-Wire Appliance Outlets
- #4826A Plug-in SignaLinc Repeater for 4-Wire Dryer Outlets
- #4826B Plug-in SignaLinc Repeater for 3-Wire Dryer Outlets
- #4828A Plug-in SignaLinc Booster for 4-Wire Dryer Outlets
- #4828B Plug-in SignaLinc Booster for 3-Wire Dryer Outlets



Caution!

NOTICE, this product is for installation by a qualified electrician or a homeowner who is comfortable and skilled with making electrical connections and working around an exposed electrical panel. Install in accordance with National and Local Electrical Codes and the following these instructions.

There is a risk of electrical shock, fire, or death. Electricity is dangerous; follow these safety procedures and use common sense:

- Disconnect power before installing or making connections.
- Verify that the power has been successfully disconnected by testing wires or terminals with an AC voltmeter or neon test light.
- Never work on equipment with the electricity turned "ON".
- Follow all instructions with your test equipment.
- Work at a steady and safe pace and in a well lit area.

Helpful Tools

If you're investing in home automation, there are a few tools that will make your projects run smoother:

Maxi-Controller

This plug-in transmitter has the ability to send individual X10 commands. The buttons are separated into Addresses and Command functions. To use this controller, you have to press the address (for example, "5"), then the command (ON, OFF, BRIGHT, etc.). Some of the KeypadLinc and SwitchLinc advanced programming features need to be programmed with individual button presses in order to set certain features. For more info visit:

<http://www.smarthome.com/4020.html>

Powerline Analyzer

This is an invaluable tool when it comes to installing and diagnosing problems. By knowing the signal strength at a specific location, you can make sure that the signal will always trigger that module. Generally, it is ideal to have at least 100mV at each location. Conservative installers will want even more; perhaps 250mV just in case the homeowner installs a new big-screen TV after final installation. The extra margin will still give the receivers enough signal to be reliably triggered. These units can also be used to measure the effects of signal absorption mentioned earlier. Plug in the transmitter and measure the signal, then unplug the device that's plugged into that outlet. If you see a 10% or greater change, it's time for a filter on that device. Smarthome has three units to choose from:

www.smarthome.com/4814.html

www.smarthome.com/4811.html

www.smarthome.com/4813.html



Invest in better Home Automation Products

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



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>

How Does a Signal Bridge work?

The SignalLinc™ is a passive coupler and does not amplify the PLC signals. This means the signals coupled onto the receiving phase will only be as strong as the signals on the transmitting phase. How well the SignalLinc™ works in your home is dependent on many factors, including signal strength for the transmission phase. Other considerations include:

1. The phase receiving the signal through the SignalLinc™ may have electrical devices plugged in that will attenuate the signal from the transmission phase. Some of the electrical devices that might cause the receiving phase to take absorb the transmitted signal include power line carrier (PLC) X10 transmitters, noise/surge suppressors (like those found in multi-outlet strips), and any electrical device that contains a complex power supply like those found in computers and audio-video products. If the PLC signal is severely attenuated, it may cause devices that once worked on the transmission phase to stop working.
2. Noise on the receiving phase may be transferred through the SignalLinc™ onto the transmitting phase, resulting in some interference among receivers. This interference may prevent PLC devices from receiving the signal correctly, even if they were once working properly before SignalLinc™ was installed. Noise from the transmission phase may also be transmitted to the receiving phase, resulting in missed signals from transmitters devices on the receiving phase.
3. In the case of a plug-in SignalLinc™, if there is more than one receptacle in the home for the SignalLinc™ to plug into, choose the one closest to the main circuit breaker distribution box. The further away the SignalLinc™ is from the circuit breaker distribution box, the longer the distance the signal has to travel. This results in signal attenuation - a weakening of the signal. By installing the SignalLinc™ as close as possible to the main circuit breaker distribution box, you'll ensure that the least amount of signal attenuation will occur before the signal is coupled.

To determine just how well SignalLinc™ works in the home, try checking the signal strength on the receiving phase and transmission phase using a Powerline Signal Analyzer both before and after installing the SignalLinc™. The table below illustrates the before and after effects of having a signal coupler installed in a home.

Outlet	Phase	No Signal Coupler	With Signal Coupler	Improvement
Same Outlet as Transmitter	A	2.3	2.3	0
Master Bedroom	A	.86	.89	3%
Master Bathroom	A	.76	.72	-5%
Light Circuit 2	A	.31	.32	3%
Light Circuit 1	A	.17	.18	5%
Laundry Room	B	.42	1.1	261%
Garage Outlet	B	.10	.95	950%
Dishwasher	B	.082	.75	914%
Patio	B	.075	.70	933%
Outlet in Kitchen	B	.065	.69	1062%

All values are volts

From this example, the signal starts out at 2.3 volts and is quickly loaded down to much lower levels as the signals travels throughout the house. The phase "B" outlets are circuits that are on the opposite phase of the transmitter. Remember, most homes have two lines of 120-volts coming in from the utility company. Each line or "phase" services half the electrical devices in the home. You can quickly see that circuits that are shaded have a lower signal level than those on the same phase as the originating transmitter. Without the SignalLinc's circuit breaker being on, the PLC signal must travel through the utility company's distribution transformer to get to the other phase.

- Do not touch electric circuits or devices when you are wet or standing on a wet surface.
- Do not install this product if there are distractions that could take your concentration away EVEN FOR A MOMENT.
- The Hardwired SignalLinc phase coupler should only be installed in approved electrical enclosures and wired code-rated wires like Romex or BX cable.
- Use only indoors or in a weather-protected enclosure.
- Consult a local electrician for any questions you might have about your home's wiring.
- The Hardwired SignalLinc does not have any user-serviceable parts. Do not attempt to service or repair the unit. Doing so may result in severe injury or electrocution.

Be sure you read and understand all of the installations before beginning installation.

Installation Procedures

1. At the service entrance, shut off all power to the breaker box. In some homes, this will be the "Main" breaker in the circuit breaker panel. If there isn't a main power shut OFF (master switch) or you can't find it, do not attempt the work. Call a licensed electrician.
2. Remove the circuit breaker panel cover
3. Use the circuit tester or AC voltmeter to be sure the circuits are OFF. Check to make sure that there is no voltage from the screw terminals of several circuit breakers to the ground or neutral bus bar.
4. The Hardwired SignalLinc will need to be wired directly to two circuit breakers. It is a violation of the electrical code to use an existing breaker that already has a wire connected to it. Install a new 220-volt 15-amp (double-pole) circuit breaker. These breakers have a bar between the paddles so that if one breaker detects an overloaded condition, both will trip.

TIP: If you don't have any space in your panel for new circuit breakers, use a quad-pole breaker like the one pictured on the right. You will need to remove two existing breakers that are adjoining each other. The quad breaker will need to have two of the poles rated for the amperage as the ones removed. For example, if you removed two 20-amp breakers, you would need a 20/15/15/20 quad breaker. The two 15-amp poles will be for the new SignalLinc while the two 20-amp poles will be for the circuits that were connected to the old breakers. A home improvement or electrical supply store should have a good assortment of these.

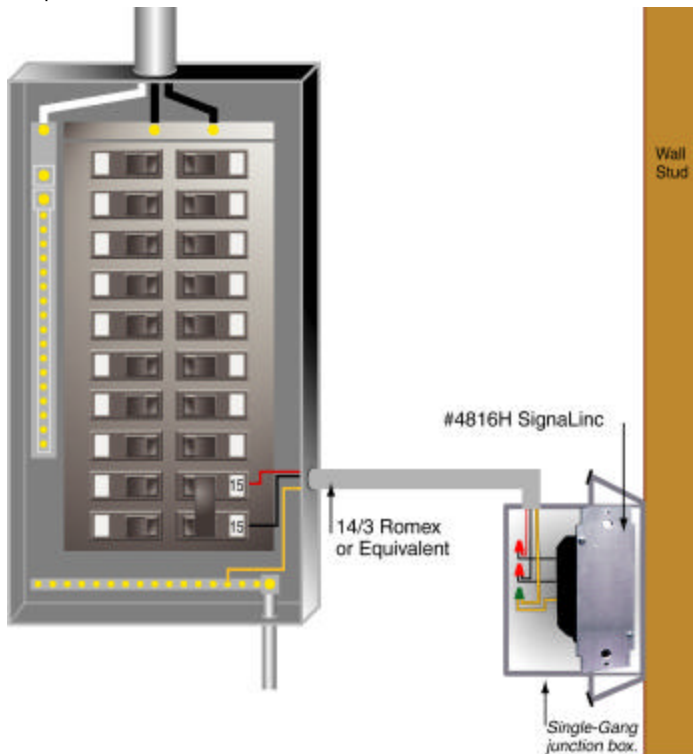


Quad Breakers can help if you don't have space for more breakers.

5. Install a single-gang electrical outlet box for the SignalLinc near the breaker box. Use either a metal or plastic outlet box. The sales people at your local home improvement center or electrical supply store can help guide you to the right choice that will comply with any local electrical ordinances.
6. Run electrical cable between the circuit breaker panel and the mounting box for the SignalLinc. The cable should be secured with a clamp or wire nail to the wall stud within a few inches of the mounting box. We recommend using 14/3 cable, which has three conductors plus a ground wire.
7. Connect the bare copper ground wires together. Using a pair of pliers, twist ground wire from the SignalLinc and the ground wire going to the breaker box together in a clockwise motion. Make several turns to insure a good connection. Place a wire nut on this connection (this is a code requirement)

8. Connect the black wire on the SignalLinc to the black wire going to the panel. Strip back about 3/4" of insulation. Using pliers, twist the conductors together in a clockwise motion. Cut the exposed twisted copper wires back to about 1/2". Place a wire nut over this connection.
9. Connect the red wires following the same instructions above. If you are using 14/2 wire, use a black marker to color the white wires black (at both ends, at the SignalLinc and the breaker box). Believe it or not, this too is an electrical code requirement.
10. If you have a white wire left over, place a wire nut on it. It is not connected to the SignalLinc.
11. At the circuit breaker box, connect the ground wire to the ground bus bar. Some panels do not have a separate ground bus bar so the ground wire must be connected to the neutral bus bar. The ground wire must be connected for safety purposes.
12. Connect the BLACK wire to one of the 15-Amp circuit breakers.
13. Connect the RED wire (or the white wire colored black with a marker if you are using 14/2 cable) to the other 15-Amp breaker.
14. Check to be sure that all the wires are securely fastened, no copper is exposed (except for the ground wire) and all screws are tight. You can confirm that the SignalLinc is wired to the correct breakers if you can read 220 to 240 volts AC between the two breakers when the power is turned on. If there is no voltage between the two breakers, check to be sure that both of the breakers and the master breaker are "ON". If there is still no voltage between the two breakers, then they are probably on the same leg, and you will have to select another breaker for one of the wires.
15. Replace the circuit breaker panel cover.
16. Restore power to the main breaker.

Tip: Be sure that there is only ONE wire connected to each circuit breaker terminal!



Other products to improve reliability

Installing a SignalLinc Repeater is one of the best things you can do to increase the reliability of your home automation system, however in some cases, you may need to take additional steps to help ensure that your system operates reliably.

Since the 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, a PLC signal looks 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
- Audio/Video gear
- Power supplies for laptops and cell phones
- Computer systems
- Computer UPS's and power strips

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 signals from being absorbed and raise the signal strength of the entire home. FilterLinc Plug-in Filters will fix the problem. By the way, the "AC Line Interference Filter" sold by a large ubiquitous electronics store for \$12.99 doesn't work; so don't bother with it. 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 Hardwired 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 SignalLinc, 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 is absorbing them! In addition to plug-in transmitters, LampLinc 2-Way, SwitchLincs 2-Ways, ToggleLinc 2-Ways, ApplianceLinc 2-Ways, KeypadLincs, 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 a multiple 2-way devices on one branch circuit may necessitate the use of local amplifier like Smarthome's BoosterLinc™.