

## 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

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

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rev 20051216



## SignalLinc™ Repeater

Increase your home automation  
system's reliability

For models:

4826A

SignalLinc Repeater - 4 Prongs

4826B

SignalLinc Repeater - 3 Prongs

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## Congratulations !

Congratulations on purchasing Signalinc™ Repeater, the world's first plug-in coupler-repeater for home automation signals.

Adding a signal coupler-repeater to a home's electrical system is one of the best steps towards improving the reliability of the automation products used in the home. The Signalinc Repeater will amplify and repeat the powerline carrier signals (PLC) X10 signals between the two phases of the home. The Signalinc Repeater is designed for anyone to install. Simply plug into a 220-volt dryer outlet and the installation is complete. A pass-through outlet is located on the front so that an existing dryer can continue to be used.

Signalinc Repeater has been engineered to only amplify and pass PLC home automation signals, which are transmitted at 120kHz. This means Signalinc Repeater will not pass electrical noise between phases that might interfere with a home's high tech electronics.

## Key Features

- Easy installation, no electrician required.
- Plugs into a 220-volt (207 to 240-volt) 30-amp dryer outlet.
- Includes a feed-through outlet so that a clothes dryer can be used at the same power outlet.
- Small and compact to easily fit behind a dryer.
- Safety tested and approved to ensure the highest quality products available.

## Signalinc Family Members

Signalincs are the easiest way to improve the signal strength of home automation signals in a home. The plug-in models attach to a 240-volt outlet found in most U.S. homes (the outlets used for powering larger appliances, like a clothes dryer or window-mounted air conditioners). Passive models do not amplify or repeat home automation signals.



**#4816B2  
Plug-In Signalinc**

### Passive Models

- #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
- #4816H HardWired Signalinc for connection at the circuit breaker box

### Active Models

- #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

5. Install a PLC phase coupler (signal bridge) or coupler-repeater (amplifier) at the incoming electrical service. A common problem with PLC signals is getting the signals between the two legs of electricity that service the home. A coupler-repeater is recommended for homes of 3,000 square feet or greater. Smaller homes will generally work well with a passive phase coupler.

6. Work with the electrician to isolate non-automation loads. Ask the electrician to place the non-PLC carrying lines on one of the two incoming lines. Having the kitchen and laundry appliances plus the heating systems on one phase will help keep potential noise off the signal-carrying lines. He probably won't be able to accommodate 100% of the loads on one phase or another, but an attempt should be made.

## Specifications

Power line protocol	X-10
X-10 input frequency	120 KHz ±20 KHz
X-10 output frequency	120 KHz ± 0.1%
X-10 input voltage	50 mV to 5 V (peak to peak)
X-10 output voltage	7 volts (peak to peak) into 5 ohms
Power plug and jack (3 prong)	3-prong 2-phase non-grounded
Power plug and jack (4 prong)	4-prong 2-phase grounded
Input power voltage	240 VAC 2 phase
Pass-through current	30 A (max)
Input power frequency	60 Hz
Output power voltage	240 VAC 2-phase
Weight	10.1 oz.
Dimensions	3.13" wide 4.31" high 2.92" deep (4.34" deep with AC prongs)
Operating Temperature	32 to 120 degrees F
Operating Humidity	10% to 95% non-condensing

SMARTHOME  
design

## 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>



**KeypadLinc 6  
with 450W  
Integrated  
Dimmer**

## 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 PLC 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.). Many of the features found in Smarthome products need to be programmed with individual button presses. Using a controller that sends the address and command with one button press will not work. For more info visit: [www.smarthome.com/4020.html](http://www.smarthome.com/4020.html)

### Signal Meter

This is an invaluable tool when it comes to installing and diagnosing problems. By knowing the signal's 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 strength to be reliably triggered. These units can also be used to measure the effects of signal absorption mentioned earlier. Plug in the signal meter and measure the signal's strength, then unplug any devices that are plugged into that and nearby outlets. If 10% or greater change is observed, install a filter (like FilterLinc™) on that device.



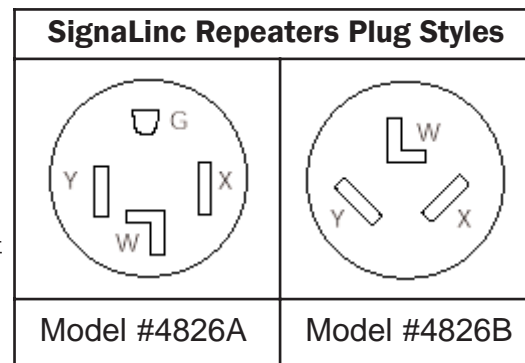
## Helpful Hints for New Construction

By design, X10 (also known as PLC) equipment does not need much in the way of special wiring. The following are six items we recommend for all homes with PLC installations:

1. Ask the builder or electrician to run the neutral wire to each wall switch location. This wiring may be a code requirement or a regular practice in your area, but unless explicitly specified, it may get omitted. Most SwitchLincs and all KeypadLinc controllers require the neutral connection.
2. Specify the installation of deep J-boxes in all locations where PLC switches, receptacles, or transmitters will be used. While all PLC products fit in the spacing offered by all North American electrical boxes, the deep models have extra working space and make the installation go a little easier. Deep boxes only costs a few cents more than normal depth models. Look for single gang boxes that are 22cu or higher (cubic inches) and double gang boxes that are 36cu or higher.
3. If the automation switch is dimming-enabled and is going to be controlling 400 watts or more, do not place insulation around the wall box and consider using metal junction boxes. Dimmers that control high loads will dissipate heat, which may be felt through the switch faceplate. Metal boxes will more efficiently draw out the heat and spread it over all the surfaces of the box. By keeping wall insulation a few inches from the box, free air will help move the heat away.
4. Install a whole-house surge suppressor. Adding a good whole-house surge protector at the breaker will help protect against costly damage to the PLC components and other delicate electrical equipment.

## Installation Procedures

Before installing, please verify that you have the proper model for your home. Check the AC outlet for the dryer. It looks much different than a regular 120-volt outlet. If there are multiple 220-volt outlets for the SignalLinc Repeater, initially try the one that is electrically closest to the home's electrical circuit breaker panel. If you have trouble locating these receptacles, please consult a local electrician for assistance. Once the receptacle is located, compare it to the illustration on the right. The SignalLinc Repeater model number that corresponds to each plug is located next to each illustration.



1. If the receptacle the SignalLinc Repeater will be plugged into is already in use, turn off the dryer.
2. Turn off the circuit breaker to avoid the possibility of electrical shock in case your fingers touch the electrical prongs of the dryer or SignalLinc.
3. Unplug the dryer's AC cord from the wall receptacle.
4. Plug the SignalLinc Repeater into the empty wall receptacle.
5. Plug the dryer's AC cord back into the receptacle on the front of the SignalLinc™ Repeater.
6. Turn the circuit breaker back on.

The SignalLinc™ Repeater is now powered and ready to repeat signals.

## Indicator LEDs on SignalLinc Repeater

The four indicator LEDs on the SignalLinc Repeater represent the status of the powerline signals being processed. They are divided into two pairs of red and green LEDs, one set for each phase of electricity. The LEDs will only illuminate when PLC signals are detected. When no signals are present on the lines, the LEDs will be off.

When a PLC signal is detected, one of the red LEDs will flash (depending on the phase in which it was detected). In some cases, where the signal is very strong, both red LEDs may illuminate to indicate SignalLinc Repeater is detecting the signal on both phases. After a portion of the signal is detected, the SignalLinc Repeater will turn on the transmitting circuit and repeat the signal. If the signal is extremely weak, the red LED may illuminate (to indicate it is detecting something), but the SignalLinc Repeater may not repeat the signal because not enough data was detected.

## How Does a Signal Bridge Compare to Coupler-Repeater?

To determine just how well Signalinc Repeater works in the home, check the signal strength on the receiving phase and transmission phase using a powerline signal analyzer both before and after installing the Signalinc. The table below illustrates the differences achievable in a home with no signal coupler, a passive Signalinc, and a Signalinc Repeater.

Outlet	Phase	No signal coupler	Passive Signalinc	Signalinc Repeater	Improvement over none
Same outlet as transmitter	A	1.000	1.100	1.160	16%
Family room	A	.680	.500	.913	34%
Office lights	A	.560	.430	.825	47%
Master bedroom	A	.440	.340	.595	35%
Laundry room	B	.093	.380	1.50	1513%
Patio	B	.038	.240	.968	2447%
Garage	B	.049	.220	.795	1522%
Home Theater outlets	B	.040	.240	1.10	2650%
Home Theater lighting	B	.012	.013	.105	775%

All values in volts

Generally, most modules will respond to signals that are .100 volts or greater. Smarthome Design products will need much less (at least .050 volts), but can sometimes pick out signals below .015 volts (15 mV). Professional installers want at least .250 volts for a reliable system.

For this test, a special signal generator was calibrated to output a 1.0-volt signal. With **no signal coupler** installed it is easy to notice that half the outlets (on the same phase as the transmitter) have pretty good signal strength (.68 to .44 volts). However, outlets on the opposite line (phase "B") are extremely weak and would very likely experience intermittent operation. 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.

When a **non-amplifying Signalinc** is attached, the signal becomes more evenly distributed. Most of the outlets and switches on the "B" phase now have a much stronger signal. The signal strength on phase "A" actually decreased a little as the signal is more even distributed between phases. Notice that the home theater lighting circuit is still way too low for reliable operation. A closer examination of this circuit reveals the owner has installed multiple 2-way switches and keypad transmitters, which will load down or absorb the PLC signal.

When a **Signalinc Repeater** is installed (in place of the passive Signalinc), all the circuits now have excellent signal strength. The signals on the originating phases show a good increase (16% to 47%). The circuits on the opposite "B" phase all increased considerable. The home theater lighting circuit is still lower than the other phases. If additional 2-way modules are later installed, the signal strength may fall to unreliable levels. On this circuit, the owner should install a BoosterLinc™ (see page 5).

## Other products to improve reliability

Installing a Signalinc 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 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 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 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

Signalinc 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-Way, SwitchLinc™ 2-Ways, ToggleLinc™ 2-Ways, ApplianceLinc™ 2-Ways,

KeypadLinc™, 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.