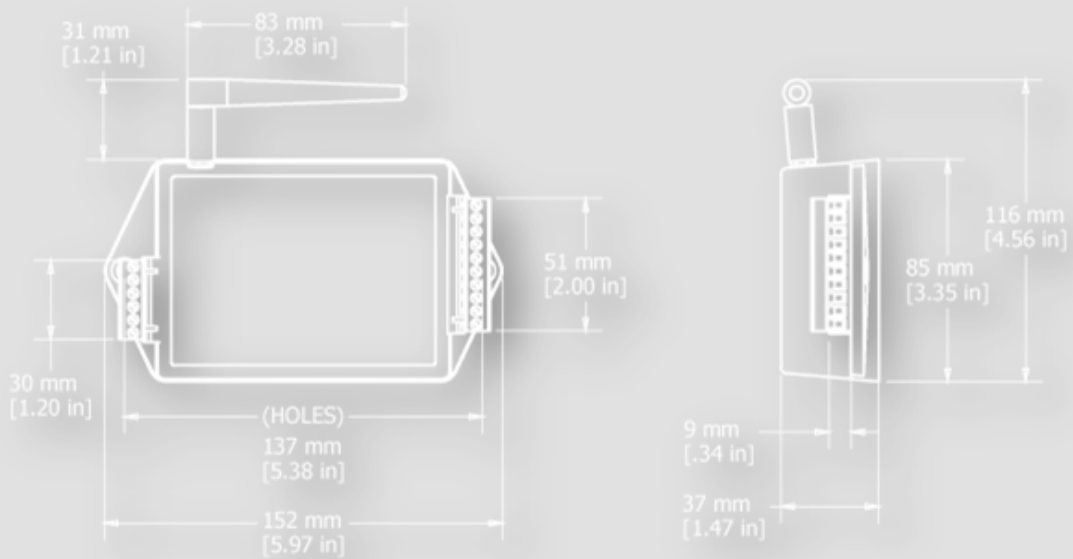


# Watt-Link™

## Installation Guide





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MicroStrain® Sensing Systems  
459 Hurricane Lane  
Suite 102  
Williston, VT 05495  
United States of America  
Phone: 802-862-6629  
Fax: 802-863-4093

[www.microstrain.com](http://www.microstrain.com)  
[support@microstrain.com](mailto:support@microstrain.com)

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# Chapter 1 - Precautions

## Buyer Acknowledgement

BUYER ACKNOWLEDGES AND AGREES THAT THE WATT-LINK PRODUCTS (THE “PRODUCTS”) MUST BE INSTALLED ONLY BY A LICENSED ELECTRICIAN AUTHORIZED TO CONDUCT BUSINESS IN THE JURISDICTION IN WHICH THE PRODUCTS ARE TO BE INSTALLED. IN ADDITION, BUYER AGREES THAT SELLER SHALL HAVE NO LIABILITY WHATSOEVER FOR ANY DAMAGES RESULTING FROM THE INSTALLATION OF A PRODUCT BY ANY PERSON THAT IS NOT A LICENSED ELECTRICIAN IN THE JURISDICTION IN WHICH THE PRODUCT IS INSTALLED. FURTHERMORE, REGARDLESS OF WHETHER THE PERSON THAT IS INSTALLING A PRODUCT IS A LICENSED ELECTRICIAN, BUYER AGREES THAT SELLER SHALL NO LIABILITY WHATSOEVER IN CONNECTION WITH ANY DAMAGES RESULTING (i) DURING THE INSTALLATION OF THE PRODUCT AND/OR (ii) FROM THE IMPROPER INSTALLATION OF THE PRODUCT.








## Precautions

These installation/servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Always adhere to the following checklist:

1. Only a licensed electrician qualified to conduct business in the jurisdiction where the products are to be installed may install the Watt-Link meter. **The mains voltages of 120 Vac to 600 Vac can be lethal!**
2. Follow all applicable local and national electrical and safety codes.
3. Install the meter in an electrical enclosure (panel or junction box) or in a limited access electrical room.
4. Verify that circuit voltages and currents are within the proper range for the meter model.
5. Use only UL recognized current transformers (CTs) with built-in burden resistors, that generate 0.333 Vac (333 millivolts AC) at rated current. Do not use current output (ratio) CTs such as 1 amp or 5 amp output CTs: they will destroy the meter and may create a shock hazard. See [Current Transformers](#) for CT maximum input current ratings.
6. Ensure that the line voltage inputs to the meter are protected by fuses or circuit breakers (not needed for the neutral wire). See [Circuit Protection](#) for details.
7. Equipment must be disconnected from the **HAZARDOUS LIVE** voltages before access.
8. The terminal block screws are not insulated. Do not contact metal tools to the screw terminals if the circuit is live!
9. Do not place more than one line voltage wire in a screw terminal; use wire nuts instead. You may use more than one CT wire per screw terminal.
10. Before applying power, check that all the wires are securely installed by tugging on each wire.
11. Do not install the meter where it may be exposed to temperatures below  $-30^{\circ}\text{C}$  or above  $55^{\circ}\text{C}$ , excessive moisture, dust, salt spray, or other contamination. The meter requires an environment no worse than pollution degree 2 (normally only non-conductive pollution; occasionally, a temporary conductivity caused by condensation must be expected).
12. Do not drill mounting holes using the meter as a guide; the drill chuck can damage the screw terminals and metal shavings can fall into the connectors, causing an arc risk.
13. If the meter is installed incorrectly, the safety protections may be impaired.
14. Read and fully understand this quick start guide and the installation guide in entirety before attempting to install or operate the Watt-Link™.

Table 1. Symbol Definitions

Symbol	Definition
	Read, understand, and follow all instructions including warnings and precautions before installing and using the product.
	Potential shock hazard from dangerous high voltage.
	Functional ground; should be connected to earth ground if possible, but is not required for safety grounding.
	UL listing mark.
	FCC Mark. This logo indicates compliance with part 15 of the FCC rules
	Complies with the regulations of the European Union for Product Safety and Electro-Magnetic Compatibility.
	This indicates an AC voltage.



## Chapter 2 - Overview

Congratulations on your purchase of the Watt-Link meter. The Watt-Link meter enables you to make power and energy measurements within electrical service panels avoiding the costly installation of subpanels and associated wiring. It is designed for use in demand side management (DSM), sub-metering, and energy monitoring applications. The Watt-Link meter communicates using the MicroStrain® wireless protocol over 802.15.4, allowing for remote monitoring.

### Additional Literature

See the LORD MicroStrain Sensing Systems website ([www.microstrain.com](http://www.microstrain.com)) for product pages, data-sheets, and support pages for the Watt-Link. The Watt-Link has an Operating and Reference Guide with detailed information on the available measurements and wireless communication interface.

### Electrical Service Types

Below is a list of service types, with connections and recommended models. Note: the ground connection improves measurement accuracy, but is not required for safety.

**Table 2. Watt-Link™ Models**

Model	Type	Line-to-Neutral**	Line-to-Line**	Electrical Service Type
Watt-Link-LXRS 3Y-208	Wye	120	208-240	1 Phase 2 Wire 120V with neutral 1 Phase 3 Wire 120V/240V with neutral 3 Phase 4 Wire Wye 120V/208V with neutral
Watt-Link-LXRS 3Y-400	Wye	230	400	1 Phase 2 Wire 230V with neutral 3 Phase 4 Wire Wye 230V/400V with neutral
Watt-Link-LXRS 3Y-480	Wye	277	480	3 Phase 4 Wire Wye 277V/480V with neutral 1 Phase 2 Wire 277V with neutral
Watt-Link-LXRS 3Y-600	Wye	347	600	3 Phase 4 Wire Wye 347V/600V with neutral
Watt-Link-LXRS 3D-240	Delta / Wye	120–140	208–240	1 Phase 2 Wire 208V (no neutral) 1 Phase 2 Wire 240V (no neutral) 1 Phase 3 Wire 120V/240V with neutral 3 Phase 3 Wire Delta 208V (no neutral) 3 Phase 4 Wire Wye 120V/208V with neutral 3 Phase 4 Wire Delta 120/208/240V with neutral
Watt-Link-LXRS 3D-400	Delta / Wye	230	400	3 Phase 3 Wire Delta 400V (no neutral) 3 Phase 4 Wire Wye 230V/400V with neutral
Watt-Link-LXRS 3D-480	Delta / Wye	277	480	3 Phase 3 Wire Delta 480V (no neutral) 3 Phase 4 Wire Wye 277V/480V with neutral 3 Phase 4 Wire Delta 240/415/480V with neutral

*\*The wire count does NOT include ground. It only includes neutral (if present) and phase wires.*

*\*\*All Line-to-Neutral and Line-to-Line values are in Vac.*

### Single-Phase Two-Wire with Neutral

This configuration is most often seen in homes and offices. The two conductors are neutral and line. For these models, the meter is powered from the N and ØA terminals. Up to three such circuits may be monitored with one meter by also using the ØB and ØC inputs. See Figure 1 for reference.

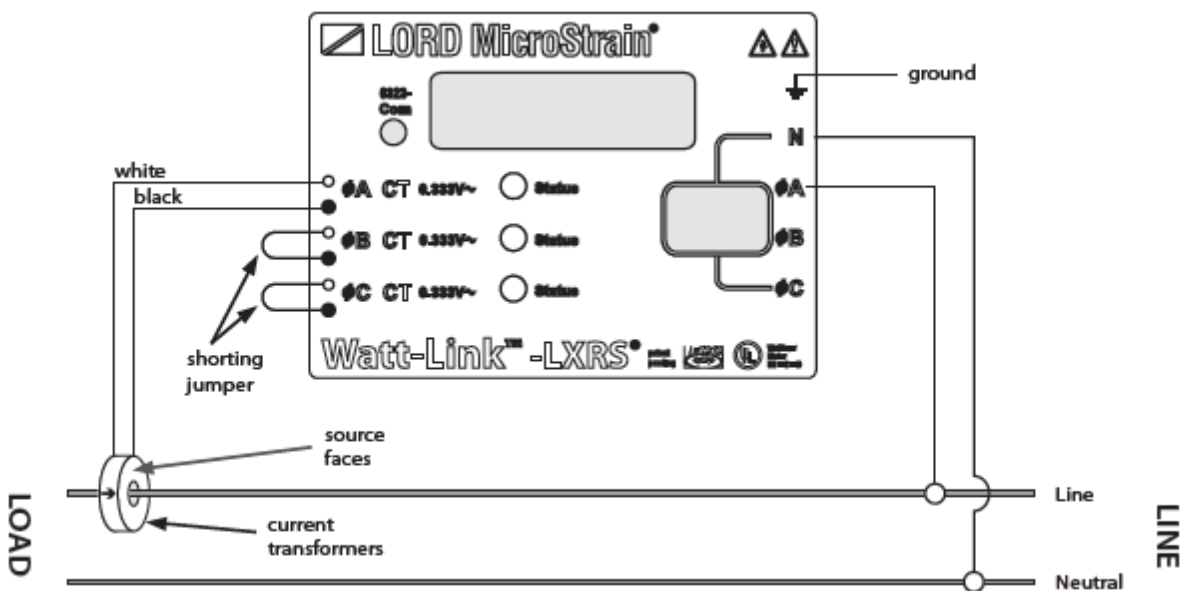


Figure 1. Single-Phase Two-Wire Connection

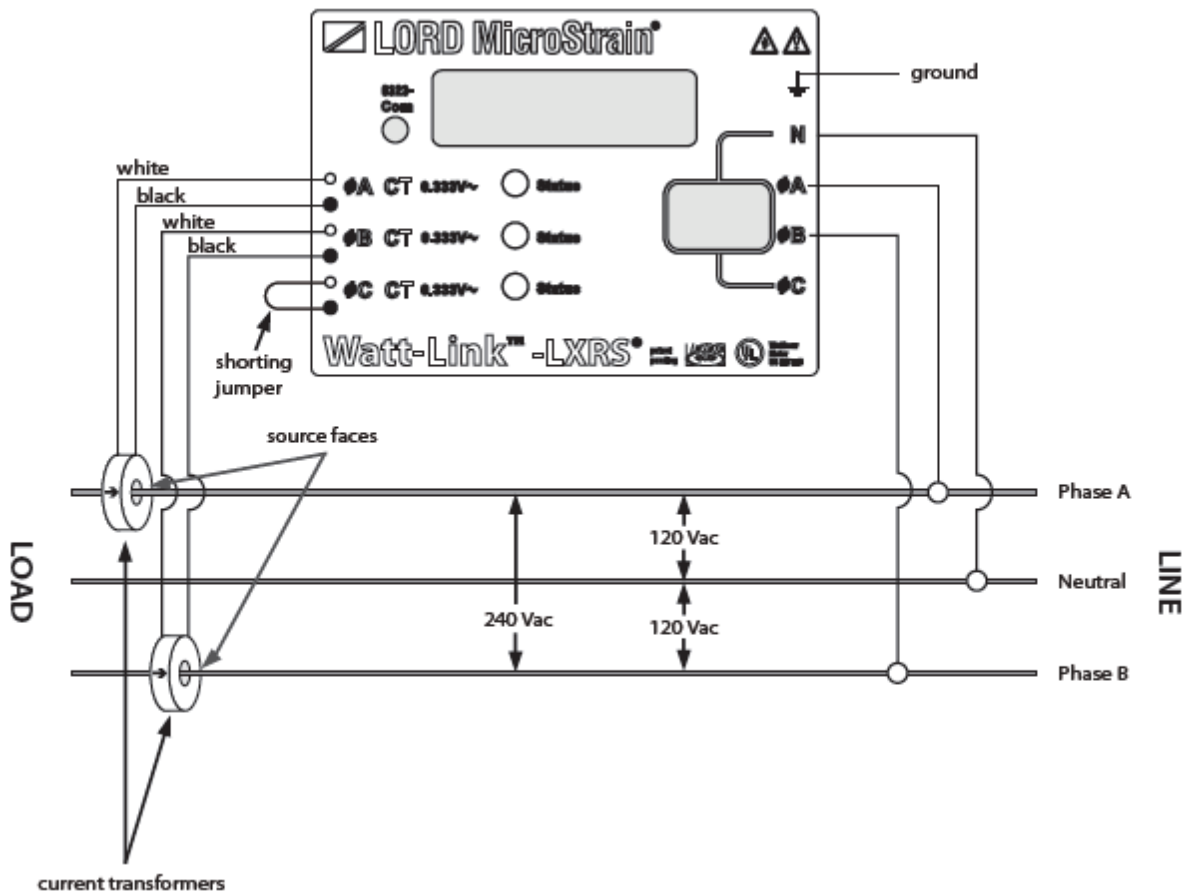
The following table shows the Watt-Link models that should be used, depending on the line to neutral voltage.

Table 3. Suggested Watt-Link™ Models for Single-Phase, Two Wire Service

Line to Neutral Voltage	Watt-Link™ Model
120 Vac	Watt-Link-LXRS 3Y-208
230 Vac	Watt-Link-LXRS 3Y-400
277 Vac	Watt-Link-LXRS 3Y-480

**Single-Phase Three-Wire (Mid-Point Neutral)**

This configuration is seen in North American residential and commercial service with 240 Vac for large appliances. The three conductors are a mid-point neutral and two line voltage wires with AC waveforms 180° out of phase; this results in 120 Vac between either line conductors (phase) and neutral, and 240 Vac (or sometimes 208 Vac) between the two line conductors (phases).



**Figure 2. Single-Phase Three-Wire Connection**

The following table shows the Watt-Link models that can be used. If neutral may or may not be present, you should use the Watt-Link-LXRS 3D-240 (see [Single-Phase Two-Wire without Neutral](#) below). If neutral is present, it must be connected for accurate measurements. If phase B may not be present, you should use the Watt-Link-LXRS 3Y-208 (see [Single-Phase Two-Wire with Neutral](#) above).

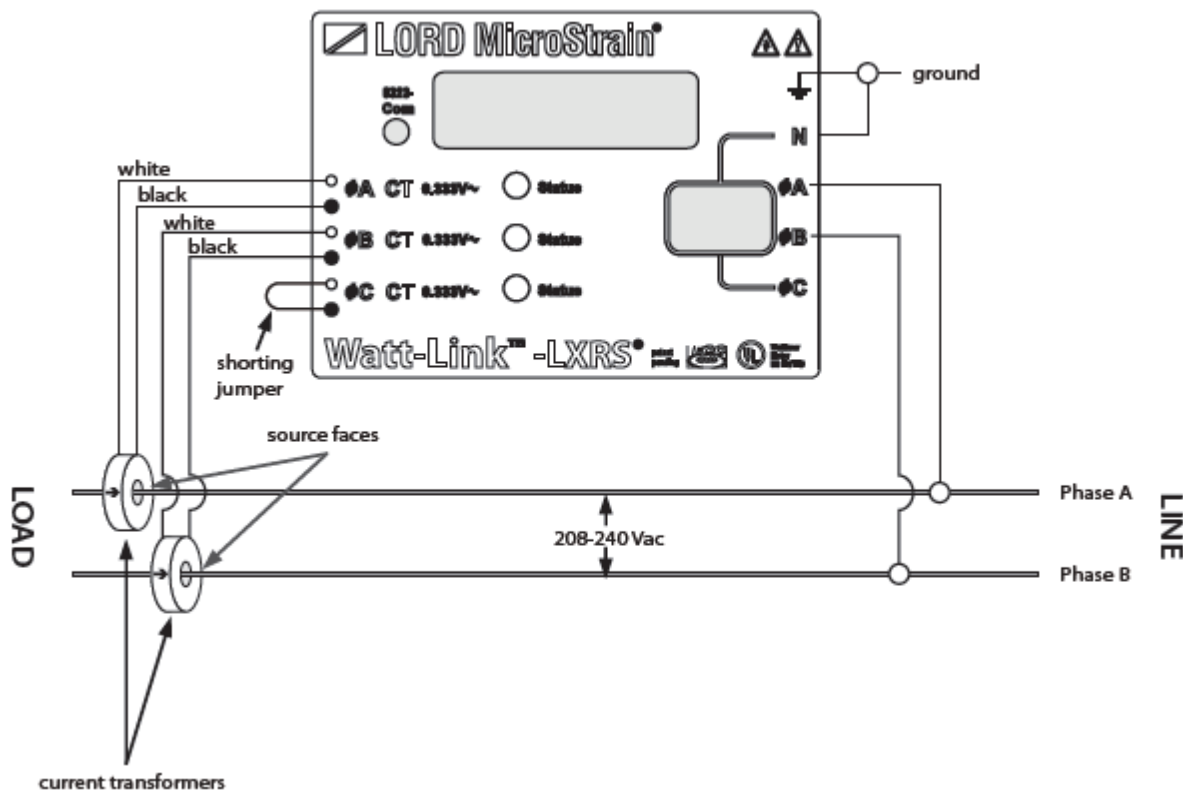
**Table 4. Suggested Watt-Link™ Models for Single-Phase, Three Wire Service**

Meter Power Source	Watt-Link™ Model
N and ØA (Neutral and Phase A)	Watt-Link-LXRS 3Y-208
ØA and ØB (Phase A and Phase B)	Watt-Link-LXRS 3D-240

**Single-Phase Two-Wire without Neutral**

This is seen in residential and commercial service with 208 to 240 Vac for large appliances. The two conductors have AC waveforms 120° or 180° out of phase. Neutral is not used. For this configuration, the meter is powered from the ØA and ØB (phase A and phase B) terminals.

For best accuracy, we recommend connecting the N (neutral) terminal to the ground terminal. This will not cause ground current to flow because the neutral terminal does not power the meter.



**Figure 3. Single-Phase Two-Wire without Neutral Connection**

This configuration is normally measured with the following Watt-Link model.

**Table 5. Suggested Watt-Link™ Models for Single Phase, Two Wire Sans Neutral**

Line-to-Line Voltage	Watt-Link™ - Model
208 - 240 Vac	Watt-Link-LXRS 3D-240

If neutral is available, you may also use the Watt-Link-LXRS 3Y-208 model. If you use the Watt-Link-LXRS 3Y-208, you will need to hook up the meter as shown in section [Single-Phase Three-Wire \(Mid-Point Neutral\)](#) and connect neutral. You will need two CTs.

If one of the conductors (phase A or phase B) is grounded, see [Grounded Leg Service](#) below for recommendations.

### Three-Phase Four-Wire Wye

This is typically seen in commercial and industrial environments. The conductors are neutral and three power lines with AC waveforms shifted 120° between phases. The line voltage conductors may be connected to the ØA, ØB, and ØC terminals in any order, so long as the CTs are connected to matching phases. It is important that you connect N (neutral) for accurate measurements. For wye “-3Y” models, the meter is powered from the N and ØA terminals.

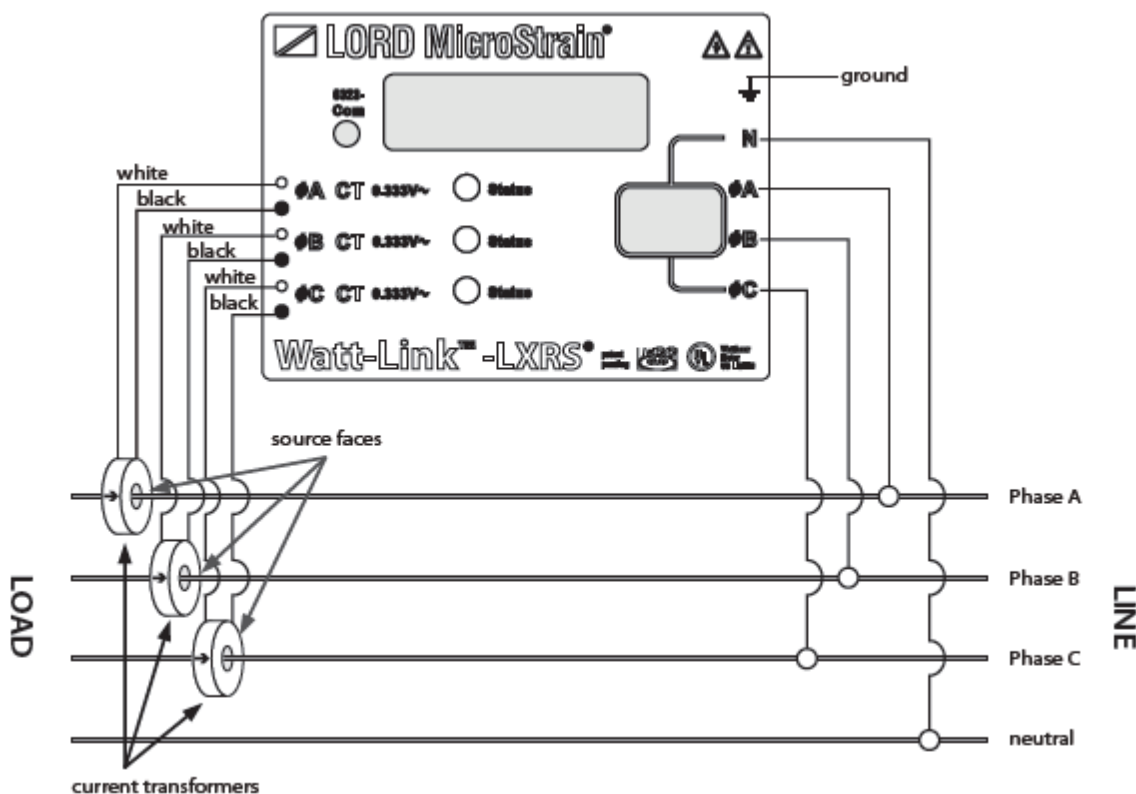


Figure 4. Three-Phase Four-Wire WYE Connection

The following table shows the Watt-Link models that should be used, depending on the line-to-neutral voltage and line-to-line voltage (also called phase-to-phase voltage).

Table 6. Suggested Watt-Link™ Models for Three Phase, Four Wire WYE Service

Line-to-Neutral Voltage	Line-to-Line Voltage	Watt-Link™ - Model
120 Vac	208 Vac	Watt-Link-LXRS 3Y-208
230 Vac	400 Vac	Watt-Link-LXRS 3Y-400
277 Vac	480 Vac	Watt-Link-LXRS 3Y-480
347 Vac	600 Vac	Watt-Link-LXRS 3Y-600

Note: you may also use the following delta Watt-Link models to measure three-phase four-wire wye circuits. The only difference is that delta Watt-Link models are powered from ØA and ØB, rather than N and ØA. If neutral is present, it must be connected for accurate measurements.

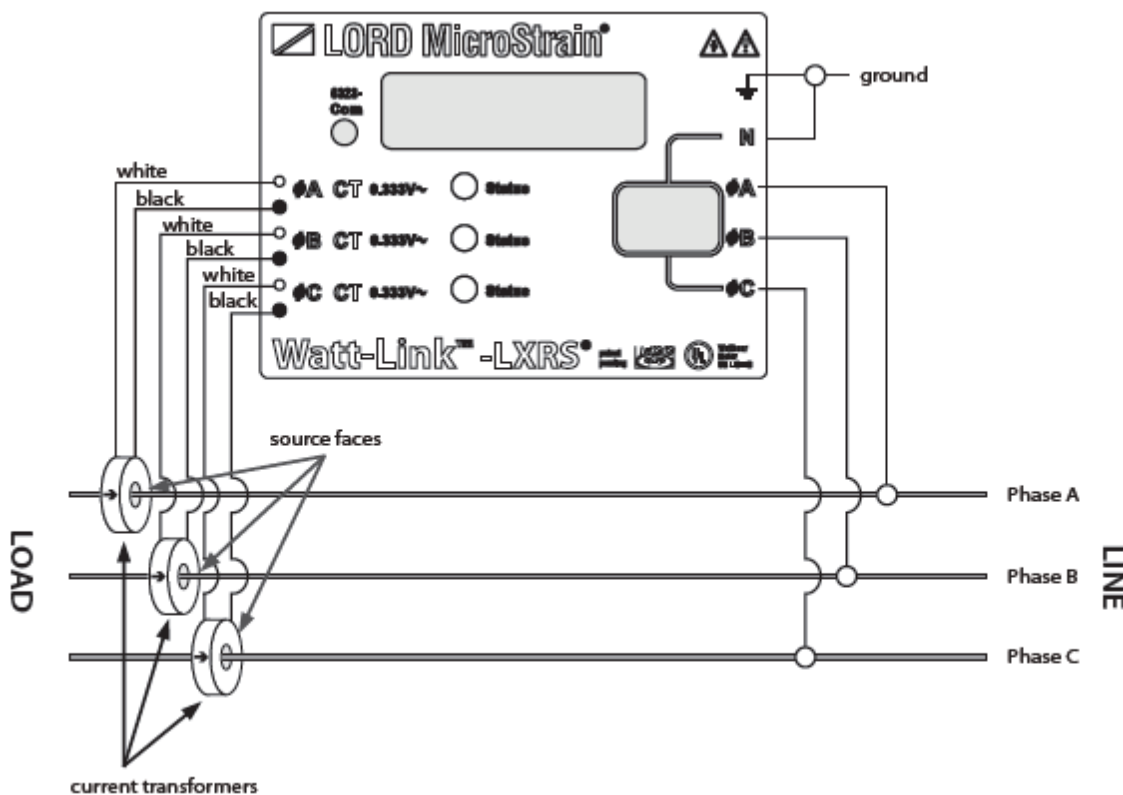
**Table 7. Suggested Watt-Link™ Models for Three Phase, Four Wire WYE Service**

Line-to-Neutral Voltage	Line-to-Line Voltage	Watt-Link™ Model
120 - 140 Vac	208 - 240 Vac	Watt-Link-LXRS 3D-240
230 Vac	400 Vac	Watt-Link-LXRS 3D-400
277 Vac	480 Vac	Watt-Link-LXRS 3D-480

**Three-Phase Three-Wire Delta Without Neutral**

This is typically seen in manufacturing and industrial environments. There is no neutral wire, just three power lines with AC waveforms shifted 120° between the successive phases. With this configuration, the line voltage wires may be connected to the ØA, ØB, and ØC terminals in any order, so long as the CTs are connected to matching phases. For these models, the meter is powered from the ØA and ØB (phase A and phase B) terminals. Note: all delta Watt-Link models provide a neutral connection N, which allows delta Watt-Link models to measure both wye and delta configurations.

For best accuracy, we recommend connecting the N (neutral) terminal to earth ground. This will not cause ground current to flow because the neutral terminal is not used to power the meter.



**Figure 5. Three-Phase Three-Wire Delta Connection**

The following table shows the Watt-Link models that should be used, depending on the line-to-line voltage (also called phase-to-phase voltage).

**Table 8. Suggested Watt-Link™ Models for Three Phase, Three Wire Delta Service**

Line-to-Neutral Voltage	Watt-Link™ Model
208 - 240 Vac	Watt-Link-LXRS 3D-240
400 Vac	Watt-Link-LXRS 3D-400
480 Vac	Watt-Link-LXRS 3D-480

### ***Three-Phase Four-Wire Delta (Wild Leg)***

The uncommon four-wire delta electrical service is a three-phase delta service with a center-tap on one of the transformer windings to create a neutral for single-phase loads.

The high-leg or phase with the higher voltage as measured to neutral has traditionally been designated “Phase B”. A change to the 2008 NEC now allows the high leg of a four-wire three-phase delta service to be labeled as the “C” phase instead of the “B” phase. The Watt-Link meter will work correctly with the high-leg connected to ØA, ØB, or ØC.

### ***Grounded Leg Service***

In rare cases with delta services or single-phase two-wire services without neutral, one of the phases may be grounded. You can check for this by using a multimeter (DMM) to measure the voltage between each phase and ground. If you see a reading between 0 and 5 Vac, that leg is probably grounded (sometimes called a “grounded delta”).

The Watt-Link meter will correctly measure services with a grounded leg, but the measured voltage and power for the grounded phase will be zero and the status LED will not light for whichever phase is grounded, because the voltage is near zero. Also, one or both of the active (non-grounded) phases may indicate low power factor because this type of service results in unusual power factors.

For optimum accuracy with a grounded leg, you should also connect the N (neutral) terminal on the meter to the ground terminal; this will not cause any ground current to flow because the neutral terminal is not used to power the meter. If you have a grounded leg configuration, you can save money by removing the CT for the grounded phase, since all the power will be measured on the non-grounded phases. We recommend putting the grounded leg on the ØB or ØC inputs and attaching a note to the meter indicating this configuration for future reference.

# Chapter 3 - Installation

## Installation Checklist

- **Turn off power** before making line voltage connections.
- Connect appropriate circuit breakers or fuses and disconnects (see [Circuit Protection](#)).
- Connect the line voltage wires to the green terminal block of the meter (see [Connecting Line Terminals](#)).
- Mount the CTs around the line conductors. Make sure the CTs face the source (see [Connect Current Transformers](#)).
- Connect the twisted white and black wires from the CTs to the black terminal block on the meter, matching the wire colors to the white and black dots on the meter label (see
- 
- 
- [Connecting Current Transformers](#)).
- Check that the CT phases match the line voltage phases (see [Connect Current Transformers](#)).
- Record the CT rated current for each meter, because it will be required during commissioning.
- Connect the output for each meter, because it will be required during commissioning.
- Check that all the wires are securely installed in the terminal blocks by tugging on each wire.
- Apply power to the meter.
- Verify that the LEDs indicate correct operation (see [Normal Startup](#)).



## Mounting

Protect the Watt-Link meter from moisture, direct sunlight, temperatures below  $-30^{\circ}\text{C}$ , temperatures above  $55^{\circ}\text{C}$ , and conductive pollution (salt spray, metal dust, etc.) The meter requires an environment no worse than pollution degree 2 (normally only non-conductive pollution; occasionally, a temporary conductivity caused by condensation). If moisture or conductive pollution may be present, use an IP 66 or NEMA 4 rated enclosure to protect the meter.

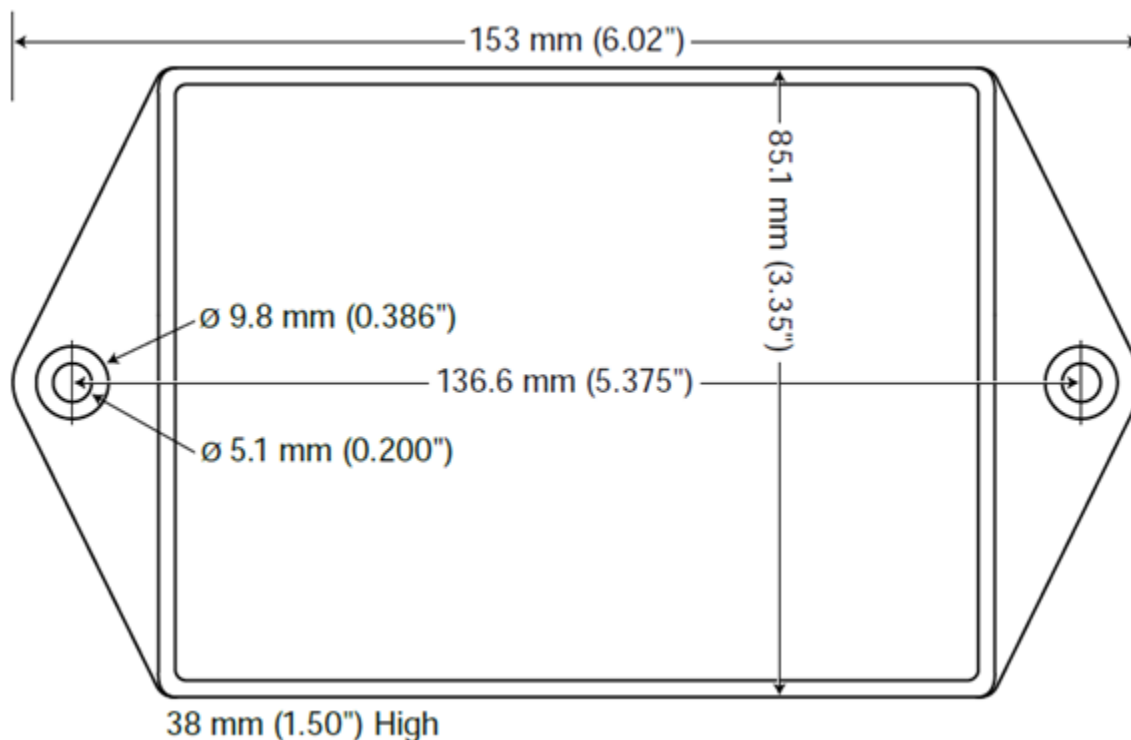


Figure 6. Watt-Link™ Meter Dimensions

Due to its exposed screw terminals, the meter must be installed in an electrical service panel, an enclosure, or an electrical room. The meter may be installed in any orientation, directly to a wall of an electrical panel or junction box. The Watt-Link meter has two mounting holes spaced 5.375 inches (137 mm) apart (center to center). These mounting holes are normally obscured by the detachable screw terminals. Remove the screw terminals by pulling outward while rocking from end to end. The meter may be used as a template to mark mounting hole positions, but **do not drill the holes with the meter in the mounting position** because the drill may damage the connectors and leave drill shavings in the connectors.

You may mount the meter with the supplied #8 self-tapping sheet metal screws using 1/8 inch pilot hole (3.2 mm). Or you may use hook-and-loop fasteners. If you use screws, avoid over-tightening which can crack the case. If you don't use the supplied screws, the following sizes should work (**bold** are preferred); use washers if the screws could pull through the mounting holes.

Table 9. Mounting Screws

Screw Style	U.S.A. UTS Sizes	Metric Sizes
Pan Head or Round Head	#6, #8, #10	M3.5, M4, M5
Truss Head	#6, #8	M3.5, M4
Hex Washer Head (integrated washer)	#6, #8	M3.5, M4
Hex Head (add washer)	#6, #8, #10	M3.5, M4, M5

## Connecting Voltage Terminals

### Circuit Protection

The Watt-Link meter is considered “permanently connected equipment”, because it does not use a conventional power cord that can be easily unplugged. Permanently connected equipment must have overcurrent protection and be installed with a means to disconnect the equipment.

- A switch, disconnect, or circuit breaker may be used to disconnect the meter and must be as close as practical to the meter and must be easy to operate. If a switch or disconnect is used, then there must also be a fuse or circuit breaker of appropriate rating protecting the meter.
- Watt-Link meters only draw 10-30 milliamps; LORD MicroStrain® recommends using circuit breakers or fuses rated for between 0.5 amps and 20 amps and rated for the line voltages and the current interrupting rating required.
- The circuit breakers or fuses must protect the ungrounded supply conductors (the terminals labeled ØA, ØB, and ØC). If neutral is also protected (this is rare), then the overcurrent protection device **must interrupt neutral and the supply conductors simultaneously**.
- Any switches or disconnects should have at least a 1 amp rating and must be rated for the line voltages.
- The circuit protection / disconnect system must meet IEC 60947-1 and IEC 60947-3, as well as all national and local electrical codes.
- The line voltage connections should be made with wire rated for use in a service panel or junction box with a voltage rating sufficient for the highest voltage present. LORD MicroStrain® recommends 14 or 12 AWG (1.5 mm<sup>2</sup> or 2.5 mm<sup>2</sup>) stranded wire, rated for 300 or 600 volts. Solid wire maybe used, but must be routed carefully to avoid putting excessive stress on the screw terminal.
- The Watt-Link meter has an earth connection, which should be connected for maximum accuracy. However, this earth connection is not used for safety (protective) earthing.

### Connecting Line Terminals

**Always turn off or disconnect power** before connecting the line voltage inputs to the meter. Connect each phase voltage to the appropriate input on the green terminal block; also connect ground and neutral (if required).

The voltage inputs to the meter do not need to be powered from to the same branch circuit as the load being monitored. In other words, if you have a three-phase panel with a 100 A three-pole breaker powering a motor that you wish to monitor, you can power the meter (or several meters) from a separate 20 A three-pole breaker installed in the same, or even adjacent panel, so long as the load and voltage connections are supplied from the same electric service.

The green screw terminals handle wire up to 12 AWG (2.5 mm<sup>2</sup>). Strip the wires to expose 1/4" (6 mm) of bare copper. When wiring the meter, do not put more than one wire under a screw. If you need to distribute power to other meters, use wire nuts or a power distribution block. The section [Electrical Service Types](#) shows the proper connections for the different meter models and electrical services. **Verify that the voltage line phases match the CT phases.**

If there is any doubt that the meter voltage rating is correct for the circuit being measured, unplug the green terminal block (to protect the meter), turn on the power, and use a voltmeter to compare the voltages (probe the terminal block screws) to the values in the white box on the meter front label. After testing, plug in the terminal block, making sure that is pushed in all the way.

The Watt-Link meter is powered from the voltage inputs: **ØA** (phase A) to **N** (neutral) for wye “-3Y” models, or **ØA** to **ØB** for delta “-3D” models. If the meter is not receiving at least 80% of the nominal line voltage, it may stop operating. Since the meter consumes a small amount of power itself (typically 1-3 watts), you may wish to power the meter from a separate circuit or place the current transformers downstream of the meter, so its power consumption is not measured.

For best accuracy, always connect the **N** (neutral) terminal on the meter. If you are using a delta meter and the circuit has no neutral, then jumper the earth ground to the **N** (neutral) terminal.

When power is first applied to the meter, check that the LEDs behave normally (see [Normal Startup](#)): if you see the LEDs flashing red-green-red-green, then disconnect the power immediately! This indicates the line voltage is too high for this model (see Figure 7).



Figure 7. Watt-Link™ LED Overvoltage Warning

### Grounding

The Watt-Link uses a plastic enclosure, insulation, and internal isolation barriers instead of protective earthing. The ground terminal on the green screw terminal block is a functional ground, designed to improve the measurement accuracy and noise immunity. If necessary, this terminal may be left disconnected on wye models (-3Y).

### Connect Current Transformers

The Watt-Link REQUIRES current transformers that contain built-in burden resistors which generate .33333 VAC at the rated AC current and are UL recognized. **WARNING: TO AVOID SAFETY RISKS AND DAMAGE TO THE DEVICE USERS SHOULD ONLY ATTACH CURRENT TRANSFORMERS THAT MEET THE SPECIFICATIONS STATED HEREIN.**

### Selecting Current Transformers

The rated full-scale current of the CTs should normally be chosen somewhat above the maximum current of the circuit being measured (see Current Crest Factor below for more details). In some cases, you might select CTs with a lower rated current to optimize accuracy at lower current readings. Take care that the maximum allowable current for the CT cannot be exceeded without tripping a circuit breaker or fuse; see Current Transformers in Chapter 6 - Specifications.

LORD MicroStrain offers ACT-0750-xxx-WATT-Link-CT type current transformers with 5, 20, 50, 100, 200 & 250 Amp ratings.

Visit <http://files.microstrain.com/Watt-Link-Current-Transformers.pdf> for more information, or to inquire about other CT options.

**Table 10 - LORD MicroStrain Current Transformers**

Model	Rated Amps
ACT-0750-005-WATT-LINK-CT	5
ACT-0750-020-WATT-LINK-CT	20
ACT-0750-050-WATT-LINK-CT	50
ACT-0750-050-WATT-LINK-CT	100
ACT-0750-200-WATT-LINK-CT	200
ACT-0750-250-WATT-LINK-CT	250

CTs can measure lower currents than they were designed for by passing the wire through the CT more than once. For example, to measure currents up to 1 amp with a 5 amp CT, loop the wire through the CT five times. The CT is now effectively a 1 amp CT instead of a 5 amp CT. The effective current rating of the CT is the labeled rating divided by the number of times that the wire passes through the CT.

If you are using the measurement phases of the Watt-Link (ØA, ØB, and ØC) to measure different circuits, you can use CTs with different rated current on the different phases. Instead of setting one CtAmps value for all phases, you can use different values for each phase: CtAmpsA, CtAmpsB, and CtAmpsC.

### Current Crest Factor

The term “current crest factor” is used to describe the ratio of the peak current to the RMS current (the RMS current is the value reported by multimeters and the Watt-Link meter). Resistive loads like heaters and incandescent lights have nearly sinusoidal current waveforms with a crest factor near 1.4. Power factor corrected loads such as electronic lighting ballasts and computer power supplies typically have a crest factor of 1.4 to 1.5. Battery chargers, VFD motor controls, and other nonlinear loads can have current crest factors ranging from 2.0 to 3.0, and even higher.

High current crest factors are usually not an issue when metering whole building loads, but can be a concern when metering individual loads with high current crest factors. If the peak current is too high, the meter’s CT inputs can clip, causing inaccurate readings.

This means that when measuring loads with high current crest factors, you may want to be conservative in selecting the CT rated current. For example, if your load draws 10 amps RMS, but has a crest factor of 3.0, then the peak current is 30 amps. If you use a 15 amp CT, the meter will not be able to accurately measure the 30 amp peak current. Note: this is a limitation of the meter measurement circuitry, not the CT.

The following graph shows the maximum RMS current for accurate measurements as a function of the current waveform crest factor. The current is shown as a percentage of CT rated current. For example, if you have a 10 amp load with a crest factor of 2.0, the maximum CT current is approximately 85%. Eighty-five percent of 15 amps is 12.75, which is higher than 10 amps, so your measurements should be accurate. On the other hand, if you have a 40 amp load with a crest factor of 4.0, the maximum CT current is 42%. Forty-two percent of a 100 amp CT is 42 amps, so you would need a 100 amp CT to accurately measure this 40 amp load.

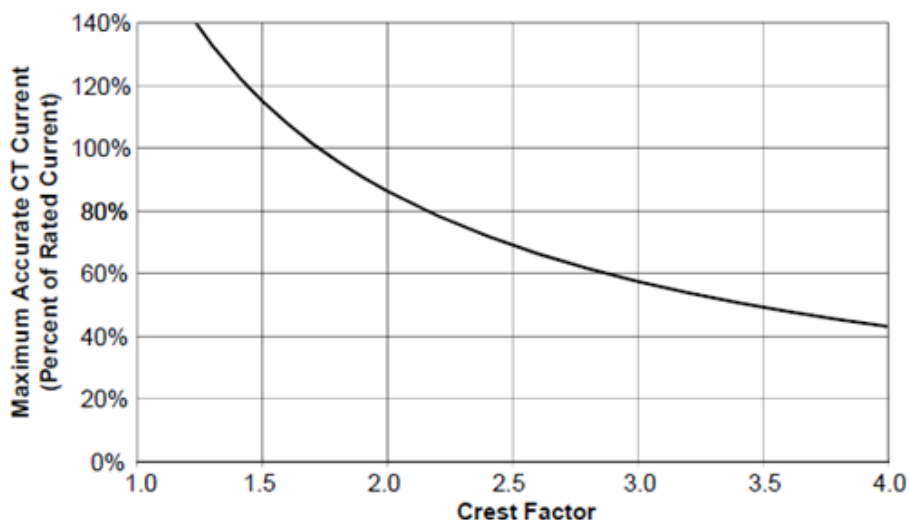


Figure 8. Maximum CT Current vs. Crest Factor

You frequently won’t know the crest factor for your load. In this case, it’s generally safe to assume the crest factor will fall in the 1.4 to 2.5 range and select CTs with a rated current roughly 150% of the expected RMS current. So if you expect to be measuring currents up to 30 amps, select a 50 amp CT.

## Connecting Current Transformers

- Use only UL recognized current transformers (CTs) with built-in burden resistors that generate 0.33333 Vac (333.33 millivolts AC) at rated current. See [Current Transformers](#) in [Chapter 6 - Specifications](#) for the maximum input current ratings.
- **Do not** use ratio (current output) CTs such as 1 amp or 5 amp output CTs: they will **destroy** the meter and present a shock hazard! These are commonly labeled with a ratio like 100:5.
- Find the arrow or label “THIS SIDE TOWARD SOURCE” on the CT and face toward the current source: generally the utility meter or the circuit breaker for branch circuits. If CTs are mounted backwards or with their white and black wires reversed the measured power will be negative. The diagnostic LEDs indicates negative power with flashing red LEDs.
- Be careful to match up the current transformers to the voltage phases being measured. Make sure the ØA CT is measuring the line voltage connected to ØA, and the same for phases B and C. Use the supplied colored labels or tape to identify the wires.
- To prevent magnetic interference, the CTs on different phases should be separated by 1 inch (25 mm). The line voltage conductors for each phase should be separated by at least 1 inch (25 mm) from each other and from neutral.
- For best accuracy, the CT opening should not be much larger than the conductor. If the CT opening is much larger, position the conductor in the center of the CT opening.
- Because CT signals are susceptible to interference, we recommend keeping the CT wires short and cutting off any excess length. It is generally better to install the meter near the line voltage conductors instead of extending the CT wires. However, you may extend the CT wires by 300 feet (100 m) or more by using shielded twisted-pair cable and by running the CT wires away from high current and line voltage conductors.
- OPTIONAL: if you see spurious readings on unused phases, jumper the unused CT inputs.

To connect CTs, pass the wire to be measured through the CT and connect the CT to the meter. **Always remove power before disconnecting any live wires.** Put the line conductors through the CTs as shown in [Electrical Service Types](#). You may measure generated power by treating the generator as the source. For solid-core CTs, disconnect the line voltage conductor to install it through the CT opening.

Split-core and bus-bar CTs can be opened for installation around a wire by pulling the removable section straight away from the rest of the CT or unhooking the latch; it may require a strong pull. Some CT models include thumb-screws to secure the opening. The removable section may fit only one way, so match up the steel core pieces when closing the CT. If the CT seems to jam and will not close, the steel core pieces are probably not aligned correctly; **DO NOT FORCE** together. Instead, reposition or rock the removable portion until the CT closes without excessive force. A nylon cable tie can be secured around the CT to prevent inadvertent opening.

Some split-core CT models have flat mating surfaces. When installing this type of CT, make sure that mating surfaces are clean. Any debris between the mating surfaces will increase the gap, decreasing accuracy.

Next, connect the CT lead wires to the meter terminals labeled **ØA CT**, **ØB CT**, and **ØC CT**. Route the twisted black and white wires from the CT to the meter. We recommend cutting off any excess length to reduce the risk of interference. Strip 1/4 inch (6 mm) of insulation off the ends of the CT leads and connect to the six position black screw terminal block. Connect each CT lead with the white wire aligned with the white dot on the label, and the black wire aligned with the black dot. Note the order in which the phases are connected, as the voltage phases must match the current phases for accurate power measurement.

Finally record the CT rated current as part of the installation record for each meter. If the conductors being measured are passed through the CTs more than once, then the recorded rated CT current is divided by the number of times that the conductor passes through the CT.

### **Wireless Connectivity**

The Watt-Link does not require a physical connection for communication. As such, the user may remotely configure the device using a LORD MicroStrain Sensing Systems base station and Node Commander. More information on configuring the Watt-Link can be found on the LORD MicroStrain website ([www.microstrain.com](http://www.microstrain.com)). Wireless signals are often significantly attenuated when passing through metallic enclosures. To maximize the wireless range of the Watt-Link be sure to use non-metallic enclosures.

### **Installation Summary**

1. Mount the Watt-Link meter.
2. Turn off power before installing solid-core (non-opening) CTs or making voltage connections.
3. Mount the CTs around the line voltage conductors being measured. Take care to orient the CTs facing the source of power.
4. Connect the twisted white and black wires from the CT to the six position black terminal block on the meter, matching the wire colors to the white and black dots on the front label.
5. Connect the voltage wires including ground and neutral (if present) to the green terminal block, and check that the current (CT) phases match the voltage measurement phases.
6. Apply power to the meter.
7. Verify that the LEDs light correctly and don't indicate an error condition.

# Chapter 4 – Operation

## Initial Configuration

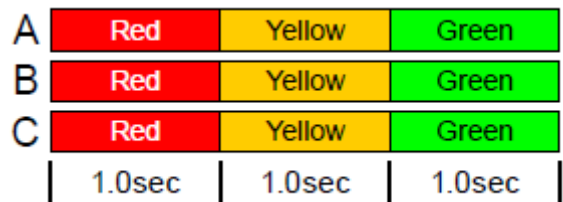
Generally, the network integrator will remotely configure the Watt-Link meter and the variables. For details on configuring the Watt-Link meter, see the **Watt-Link™ Operating Instructions**.

The meter does not include a display or buttons, so it is not possible to configure or monitor the meter directly, other than the basic LED diagnostics described below.

At a minimum, the **CtAmps** must be programmed with the rated amps of the attached current transformer for accurate measurements.

## Power Status Diagnostics

The Watt-Link meter includes multi-color power diagnostic LEDs for each phase to help verify correct operation and diagnose incorrect wiring. The LEDs are marked “Status” on the label. The following diagrams and descriptions explain the various LED patterns and their meanings. The A, B, and C on the left side indicate the phase of the LEDs. Values like “1.0sec” and “3.0sec” indicate the time the LEDs are lit in seconds. In the diagrams, sometimes the colors are abbreviated: R = red, G or Grn = green, Y = yellow.

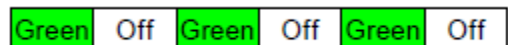


## Normal Startup

On initial power-up, the LEDs will all light up in a red, yellow, green sequence. After this startup sequence, the LEDs will show the status, such as Normal Operation below.

## Normal Operation

During normal operation, when positive power is measured on a phase, the LED for that phase will flash green. Typical flash rates are shown below.



**Table 11. LED Rates vs. Power**

Percent of Full-Scale Power	LED Flash Rate	Flashes in 10 Seconds
100%	5.0Hz	50
50%	3.6Hz	36
25%	2.5Hz	25
10%	1.6Hz	16
5%	1.1Hz	11
1% ( and lower)	0.5Hz	5



**Zero Power**

For each phase, if line Vac is present, but the Measured power is below the minimum that the meter will measure; see Creep Limit (p. 32), the meter will display solid green for that phase.



**Inactive Phase**

If the meter detects no power and line voltage below 20% of nominal, it will turn off the LED for the phase.

**Negative Power**

If one or more of the phase LEDs are flashing red, it indicates negative power (flowing into the grid) on those phases. The rate of flashing indicates magnitude of negative power (see Table 11 above).



This can happen for the following reasons:

- This is a bidirectional power measurement application, such as a photovoltaic system, where negative power occurs whenever you generate more power than you consume.
- The current transformer (CT) for this phase was installed backwards on the current carrying wire or the white and black wires for the CT were reversed at the meter. This can be solved by flipping the CT on the wire or swapping the white and black wires at the meter. Alternatively, you can use the configuration register **CtDirections** to reverse the polarity of one or more of the CTs.
- The CT wires are connected to the wrong inputs, such as if the CT wires for phases B and C are swapped or the CT wires are rotated one phase.

Note: if all three LEDs are flashing red and they always turn on and off together, like the diagram for Low Line Voltage below, then the meter is experiencing an error or low line voltage, not negative power.

### Erratic Flashing

If the LEDs are flashing slowly and erratically, sometimes green, sometimes red, this generally indicates one of the following:



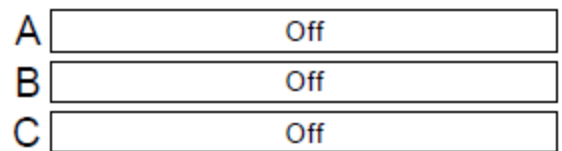
- Earth ground is not connected to the meter (the top connection on the green screw terminal).
- Voltage is connected for a phase, but the current transformer is not connected, or the CT has a loose connection.
- In some cases, particularly for a circuit with no load, this may be due to electrical noise. This is not harmful and can generally be disregarded, provided that you are not seeing substantial measured power when there shouldn't be any. Try turning on the load to see if the erratic flashing stops.

To fix this, try the following:

- Make sure earth ground is connected.
- If there are unused current transformer inputs, install a shorting jumper for each unused CT (a short length of wire connected between the white and black dots marked on the label).
- If there are unused voltage inputs (on the green screw terminal), connect them to neutral (if present) or earth ground (if neutral isn't available).
- If you suspect noise may be the problem, try moving the meter away from the source of noise. Also try to keep the CT wires as short as possible and cut off excess wire.

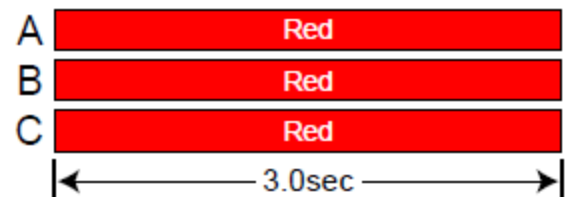
### Meter Not Operating

It should not be possible for all three LEDs to stay off when the meter is powered, because the phase powering the meter will have line voltage present. Therefore, if all LEDs are off, the meter is either not receiving sufficient line voltage to operate, or is malfunctioning and needs to be returned for service. Verify that the voltage on the Vac screw terminals is within ±20% of the nominal operating voltages printed in the white rectangle on the front label.



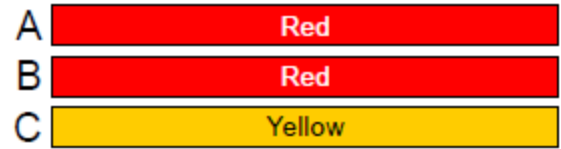
### Meter Error

If the meter experiences an internal error, it will light all LEDs red for three seconds or longer. Check the ErrorStatus (1710) register to determine the exact error. If this happens repeatedly, return the meter for service. Refer to the **Watt-Link™ Operating Instructions** for more information.



**Bad Calibration**

This indicates that the meter has detected bad calibration data and must be returned for service.



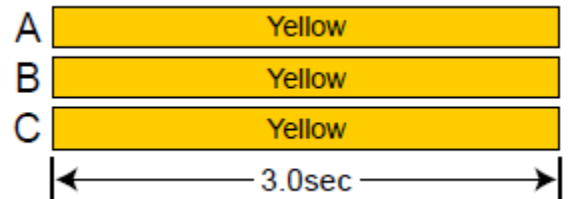
**Line Voltage Too High**

Whenever the meter detects line voltages over 125% of normal for one or more phases, it will display a fast red/green flashing for the affected phases. This is harmless if it occurs due a momentary surge, but if the line voltage is high continuously, the **power supply may fail**. If you see continuous over-voltage flashing, disconnect the meter immediately! Check that the model and voltage rating is correct for the electrical service.



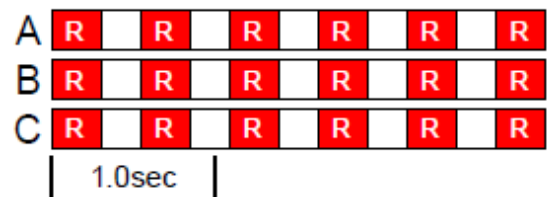
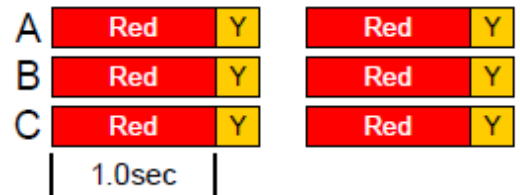
**Bad Line Frequency**

If the meter detects a power line frequency below 45 Hz or above 70 Hz, it will light all the LEDs yellow for at least three seconds. The LEDs will stay yellow until the line frequency returns to normal. During this time, the meter should continue to accurately measure power. This can occur in the presence of extremely high noise, such as if the meter is too close to an unfiltered variable frequency drive.



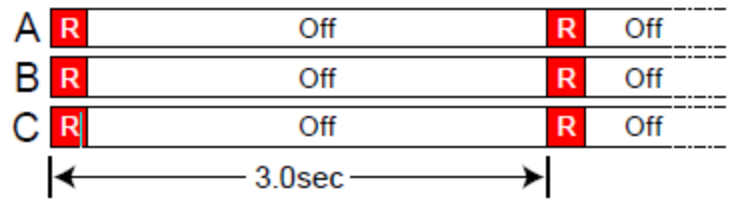
**Low Line Voltage**

These LED patterns occur if the line voltage is too low for the meter to operate correctly and the meter reboots repeatedly. The pattern will be synchronized on all three LEDs. Verify that the voltage on the Vac screw terminals is not more than 20% lower than the nominal operating voltages printed in the white rectangle on the front label. If the voltages are in the normal range and the meter continues to display one of these patterns, return it for service.



**No Line Voltage**

If the measured line voltage on all three phases is less than 20% of the nominal line V<sub>ac</sub>, then the meter will briefly flash all three status LEDs together every three seconds. This is very rare, but can indicate the following:



- You have purchased a DC instrument powered Watt-Link meter and the meter has power, but the circuit being monitored is off. You can check for this by measuring the AC volts from neutral to each phase or between phases for delta circuits.

The measurement circuitry has been damaged and cannot read the line voltages.

**Other Fixed Pattern**

If you see any other steady (non-flashing) pattern, contact LORD MicroStrain® customer service for support.

**Wireless Communication LED**

Near the upper left corner, there is a diagnostic COM (communication) LED. A green flash indicates that a valid packet addressed to the device has been received and responded to. Any other color indicates that the Watt-Link has been improperly configured before shipping. Please contact support in this case.

**Monitoring**

The meter does not include a display or buttons, so it is not possible to operate the meter directly. The following is a brief overview of the possible remote monitoring.

The Watt-Link meter models communicate measurements over the LORD MicroStrain Sensing Systems wireless network. The measurements include: energy, power, voltage, current, line frequency, power factor, reactive power, and demand.

In order to monitor and configure networked Watt-Link models, you will need to a MicroStrain WSDA or WSDA-base and Node Commander. Node Commander can be replaced with software of your own design. See the **Watt-Link™ Operating Instructions** for a complete list of the network accessible variables and functions.

**Maintenance and Repair**

The Watt-Link meter requires no maintenance. It is not user serviceable and there are no replaceable parts except the pluggable screw terminals. There are no diagnostic tests that can be performed by the user, other than checking for errors via the wireless interface or the status LEDs.

In the event of any failure, the meter must be returned for service (contact LORD MicroStrain Sensing Systems for an RMA). For a new installation, follow the diagnostic and troubleshooting instructions in Chapter 5 – Measurement Troubleshooting before returning the meter for service, to ensure that the problem is not connection related.

The Watt-Link meter should not normally need to be cleaned, but if cleaning is desired, power must be disconnected first and a dry or damp cloth or brush be used.

## Chapter 5 – Measurement Troubleshooting

There are a variety of possible measurement problems. The following procedure should help narrow down the problem. This assumes you can communicate with the meter and read registers. You can combine these diagnostic steps with the status LED diagnostics mentioned in the previous chapter.

### Voltage

Start by checking the reported voltage (VoltA, VoltB, VoltC) for active (connected) phases. Make sure the voltages match the expected line-to-neutral voltages (or line-to-ground for delta circuits). You should check the actual voltages present at the Watt-Link meter with a DMM (multimeter) if possible.

- If one or more voltages are zero, then you either have a wiring problem or something is wrong with the meter. Verify the actual voltages with a DMM (multimeter). In rare cases, with delta circuits, one phase may be grounded and will read zero volts.
- If one or more voltages are too low (by more than 5%), then make sure you have the correct model. For example, a Watt-Link-LXRS 3Y-208 expects line-to-neutral voltages of 120 Vac and can measure up to about 150 Vac. If you apply 208 Vac line-to-neutral, the Watt-Link meter will read a voltage in the 150 Vac to 180 Vac range.
- If any voltages read high, then check your wiring. If the wiring is correct, contact support.
- If the voltages are close to the measured (or expected) values, continue with the next step.

### Power

Next, check the measured power for each active phase (**PowerA**, **PowerB**, **PowerC**). If possible, estimate or measure the actual power. Also, make sure the load you are measuring is currently on.

- If one or more active phases are reporting zero power, then the problem is probably one of the following:
  - There is no active power (the load is off) or the power is too low to measure (generally less than 1/1000th of full-scale).
  - CT wires are not securely connected.
  - The CT or its wires are damaged.
  - There is strong electrical interference, as might occur if the meter is in very close proximity to a variable speed drive (also called variable frequency drive or inverter).
  - The meter is not working correctly: try swapping it with a replacement Watt-Link meter.
- If one or more active phases are reporting negative power:
  - The current transformer has been installed backward on the wire being measured. CTs are marked with either an arrow or a label saying “This side toward source”. If the arrow or label are not oriented toward the source of power (generally the panel or breaker), then the measured current will be

inverted and the power negative. This can be fixed either by flipping the CT or by swapping the white and black wires where they enter the meter.

- The current transformer white and black wires have been swapped where they enter the Watt-Link meter (at the black screw terminal block).
  - The line voltage phases (green screw terminals) are not matched up with the current phases (black screw terminals). For example, the phase A CT is around the phase B wire.
  - This may be normal if you are measuring in an environment where power may be consumed or generated, such as a house with PV panels.
- If one or more phases are reporting low or high power:
    - Make sure the **CtAmps** configuration is set correctly for your current transformers.
    - The current transformers may have a rated current too high or too low for your application. CTs should be used between 10% and 100% of their rated current for best results. They generally work with reduced accuracy as low as 0.5% to 0.1% of rated current.
    - The CTs may not be installed properly. Check for: CTs touching each other or preexisting CTs; CT opening too large for the conductor being measured.
    - The voltage phases (green screw terminal block) are not matched up with the current phases (black screw terminal block). The easiest way to determine this is to skip ahead to the next troubleshooting section: [Power Factor and Reactive Power](#).
    - Interference from a variable frequency or variable speed drive: VFD, VSD, inverter, or the like. Generally, these drives should not interfere with the Watt-Link meter, but if they are in very close proximity, or if the CT leads are long, interference can occur. Try moving the Watt-Link meter at least three feet (one meter) away from any VFDs. Use short CT leads if possible. **NEVER** install the meter downstream of a VFD: the varying line frequency and extreme noise will cause problems!
    - Our current transformers can only measure AC currents. Strong DC currents will saturate the magnetic core of the CT, preventing an accurate measurement of the AC current. The overwhelming majority of AC powered electric devices do not draw significant DC current, so this is a rare occurrence.
    - Loads with a high current crest factor (ratio of the peak current to the RMS current) can cause clipping in the measurement circuitry, resulting in lower than expected readings. You can check for this with a handheld power quality analyzer that can measure crest factor (CF) or by trying a CT with a higher rated current, which should allow the meter to measure the peak current accurately.
    - The CTs may be malfunctioning. If possible, use a current clamp to verify the current, then use a DMM (multimeter) to measure the AC voltage between the white and black wires from the CT (leave them connected to the meter during this test). At rated current, the CT output voltage should equal 0.333 Vac (333 millivolts AC). At lower currents, the voltage should scale linearly, so at 20% of rated current, the output voltage should be  $0.20 * 0.333 = 0.0666$  Vac (66.6 millivolts AC).

- If possible, verify the expected power with a handheld power meter. Current clamps can be useful to very roughly estimate the power, but since they measure current, not power, the estimated power (voltage times current) may be off by 50% or more.

## Power Factor and Reactive Power

The measured power factor and reactive power are very useful in determining if there is a phasing mismatch between the voltage and current measurement phases on the meter. For example, if the phase A CT is around the phase B wire.

However, this troubleshooting is complicated because different loads have different typical power factors and the power factor can vary significantly for some devices, like motors, as a function of the mechanical load on the motor. Here are some general guidelines:

- **Motors, idling or with a light load:** power factor from 0.1 to 0.6, positive reactive power.
- **Motors, normal or heavy load:** power factor from 0.5 to 0.8, positive reactive power.
- **Motor with VSD:** power factor between 0.5 and 0.9.
- **Incandescent lighting:** power factor near 1.0, small negative reactive power.
- **Florescent lighting:** power factor between 0.4 and 1.0.
- **Electrical heating:** power factor near 1.0.
- **Office equipment:** power factor between 0.6 and 1.0, reactive power may be positive or negative.

Negative power factor values either indicate you are generating power (as with a PV system) or that the CTs are reversed.

If the measured power factor or reactive power appears to be outside the normal ranges, this most commonly indicates that the voltage and current phases on the meter are not connected properly, although some loads fall outside the normal ranges. Check the following:

- The CT connected to the **ØA CT** terminal is installed around the line wire being measured by the **ØA Vac** terminal (green terminal block).
- The CT connected to the **ØB CT** terminal is installed around the line wire being measured by the **ØB Vac** terminal (green terminal block).
- The CT connected to the **ØC CT** terminal is installed around the line wire being measured by the **ØC Vac** terminal (green terminal block).

If this doesn't solve your problem, contact LORD MicroStrain® technical support for more assistance.

# Chapter 6 - Specifications

## Models

Table 12. Watt-Link™-LXRS Models

Model	Nominal Vac Line-to-Neutral	Nominal Vac Line-to-Line	Phases	Wires
Watt-Link-LXRS 3Y-208	120	208–240	3	4
Watt-Link-LXRS 3Y-400	230	400	3	4
Watt-Link-LXRS 3Y-480	277	480	3	4
Watt-Link-LXRS 3Y-600	347	600	3	4
Watt-Link-LXRS 3D-240	120*	208–240	3	3-4
Watt-Link-LXRS 3D-400	230*	400	3	3-4
Watt-Link-LXRS 3D-480	277*	480	3	3-4

\*Note: the delta models have an optional neutral connection that may be used for measuring wye circuits. In the absence of neutral, voltages are measured with respect to ground. Delta WattNode models use the phase A and phase B connections for power.

## Model Options

Any of these models are available with the following options.

### General Options

**Option CT=xxx:** Pre-assign xxx as the global *CtAmps* value of the attached current transformers.

**Option CT=xxx/yyy/zzz:** Pre-assign xxx to *CtAmpsA*, yyy to *CtAmpsB*, and zzz to *CtAmpsC*. This is used if non-matching CTs are connected to different phases.

## Accuracy

The following accuracy specifications do not include errors caused by the current transformer accuracy or phase angle errors. “Rated current” is the current that generates a CT output voltage of 0.33333 Vac.

### Condition 1 – Normal Operation

**Line voltage:** -20% to +15% of nominal

**Power factor:** 1.0

**Frequency:** 48 - 62 Hz

**Ambient Temperature:** 25°C

**CT Current:** 5% - 100% of rated current

**Accuracy:** ±0.5% of reading

### Condition 2 – Low CT Current

All conditions the same as Condition 1 except:

**CT Current:** 1% - 5% of rated current

**Accuracy:** ±1.0% of reading



### **Condition 3 – Very Low CT Current**

All conditions the same as Condition 1 except:

**CT Current:** 0.2% - 1% of rated current

**Accuracy:**  $\pm 3.0\%$  of reading

### **Condition 4 – High CT Current**

All conditions the same as Condition 1 except:

**CT Current:** 100% - 120% of rated current

**Accuracy:**  $\pm 1.0\%$  of reading

### **Condition 5 – Low Power Factor**

All conditions the same as Condition 1 except:

**Power factor:** 0.5 ( $\pm 60$  degree phase shift between current and voltage)

**Additional Error:**  $\pm 0.5\%$  of reading

### **Condition 6 – Temperature Variation**

All conditions the same as Condition 1 except:

**Ambient Temperature:**  $-30^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$

**Additional Error:**  $\pm 0.75\%$  of reading

## **Measurement**

**Creep Limit:** 0.067% (1/1500th) of full-scale. Whenever the power or reactive power for a phase drops below the creep limit, the power or reactive power for the phase will be forced to zero. Also, if the line voltage for a phase drops below 20% of nominal Vac, the output power for the phase will be set to zero. These limits prevent spurious readings due to measurement noise. To customize the creep limit, see **Creep Limit** in the **Watt-Link™ Operating Instructions**.

**Update Rate:** 1.0 second. Internally, all measurements are performed at this rate.

**Start-Up Time:** Approximately 1.0 second. The meter starts measuring 50-100 milliseconds after AC power is applied, but requires a full 1.0 second measurement cycle before it starts reporting data. The Watt-Link meter does not respond to measurement requests during this start-up time.

**Current Transformer Phase Angle Correction:** 1.0 degree leading. Current transformers (CTs) typically have a leading phase angle error ranging from 0.2 degrees to 2.5 degrees. The Watt-Link meter is normally programmed to correct for a 1.0 degree phase lead to provide good accuracy with typical CTs. The CT phase angle correction can be changed using the *PhaseAdjustA*, *PhaseAdjustB*, *PhaseAdjustC* registers.

**Electrical**

**Over-Voltage Limit:** 125% of nominal Vac. If the line voltage for one or more phases exceeds this limit, the status LEDs for these phases will flash alternating red-green as a warning. Extended over-voltage operation can damage the meter and void the warranty. See [Line Voltage Too High](#).

**Over-Current Limit:** 120% of rated current. Exceeding 120% of rated current will not harm the Watt-Link meter but the current and power will not be measured accurately.

**Maximum Surge:** 4kV according to EN 61000-4-5.

**Table 13. Watt-Link™ Model Service Types**

Model	Nominal Vac Line-to-Neutral	Nominal Vac Line-to-Line	Phases	Wires
Watt-Link-LXRS 3Y-208	120	208-240	1 - 3	2 - 4
Watt-Link-LXRS 3Y-400	230	400	1 - 3	2 - 4
Watt-Link-LXRS 3Y-480	277	480	1 - 3	2 - 4
Watt-Link-LXRS 3Y-600	347	600	1 - 3	2 - 4
Watt-Link-LXRS 3D-240	120*	208-240	1 - 3	2 - 4
Watt-Link-LXRS 3D-400	230*	400	3	2 - 4
Watt-Link-LXRS 3D-480	277*	480	3	2 - 4

\*Note: The delta models have an optional neutral connection that may be used for measuring wye circuits. In the absence of neutral, voltages are measured with respect to ground. Delta Watt-Link models use the phase A and phase B connections for power.

**Power Consumption:** The following table shows typical power consumption and power factor values with all three phases powered at nominal line voltages. The power supply draws most of the total power consumed, while the measurement circuitry draws 1-10% of the total (6-96 milliwatts per phase, depending on the model). Due to the design of the power supply, Watt-Link meters draw slightly more power at 50 Hz.

**Table 14. Power Supply Characteristics**

Model	Real Power at 60 Hz	Real Power at 50 Hz	Power Factor	Rated VA*	Power Supply Range	Power Supply Terminals
Watt-Link-LXRS 3Y-208	1.5 W	1.8 W	0.79	4VA	96 - 138 Vac	N and ØA
Watt-Link-LXRS 3Y-400	1.6 W	1.8 W	0.73	4VA	184-264 Vac	N and ØA
Watt-Link-LXRS 3Y-480	1.6 W	2.0 W	0.69	4VA	222-318 Vac	N and ØA
Watt-Link-LXRS 3Y-600	1.0 W	1.3 W	0.76	4VA	278-399 Vac	N and ØA
Watt-Link-LXRS 3D-240	1.2 W	1.5 W	0.70	4VA	166-276 Vac	ØA and B
Watt-Link-LXRS 3D-400	1.1 W	1.4 W	0.67	3 VA	320-460 Vac	ØA and B
Watt-Link-LXRS 3D-480	1.2 W	1.6 W	0.70	3 VA	384-552 Vac	ØA and B

\*Note: This is the rated VA is the maximum at 115% of nominal Vac at 50 Hz. This is the same as the rated power that appears on the front label of the meter.

**Maximum Operating Power Supply Voltage Range:** -20% to +15% of nominal (see Table 14).  
 For the Watt-Link-LXRS 3D-240, this is -20% of 208 Vac (166 Vac) to +15% of 240 Vac (276 Vac).

**Operating Frequencies:** 50/60 Hz

**Measurement Category:** CAT III

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

The line voltage measurement terminals on the meter are rated for the following CAT III voltages (these ratings also appear on the front label):

**Table 15. Watt-Link™ CAT III Ratings**

Model	CAT III Voltage Rating
Watt-Link-LXRS 3Y-208 Watt-Link-LXRS 3D-240	240 Vac
Watt-Link-LXRS 3Y-400 Watt-Link-LXRS 3D-400	400 Vac
Watt-Link-LXRS 3Y-480 Watt-Link-LXRS 3D-480	480 Vac
Watt-Link-LXRS 3Y-600	600 Vac

**Current Transformer Inputs:**

**Nominal Input Voltage (At CT Rated Current):** 0.33333 Vac RMS

**Absolute Maximum Input Voltage:** 5.0 Vac RMS

**Input Impedance at 50/60 Hz:** 23 kΩ

**Certifications**

**Safety:** UL 61010-1; CAN/CSA-C22.2 No. 61010-1-04; IEC 61010-1

**Immunity:** EN 61326: 2002 (Industrial Locations)

**Electrostatic Discharge:** EN 61000-4-2: 4 kV contact, 8 kV air: (B) Self-Recovering

**Radiated RF Immunity:** EN 61000-4-3: 10 V/m: (A) No Degradation

**Electrical Fast Transient / Burst:** EN 61000-4-4: 2 kV: (B) Self-Recovering

**Surge Immunity:** EN 61000-4-5: 1 kV I/O, 4 kV AC: (B) Self-Recovering

**Conducted RF Immunity:** EN 61000-4-6: 3 V: (A) No Degradation

**Voltage Dips, Interrupts:** EN 61000-4-11: (B) Self-Recovering

**Emissions:** FCC Part 15, Class B; EN 55022: 1994, Class B

**Environmental**

**Operating Temperature:** -30°C to +55°C (-22°F to 131°F)

**Altitude:** Up to 2000 m (6560 ft)

**Operating Humidity:** non-condensing, 5 to 90% relative humidity (RH) up to 40°C, decreasing linearly to 50% RH at 55°C.

**Pollution:** POLLUTION DEGREE 2 - Normally only non-conductive pollution; occasionally, a temporary conductivity caused by condensation must be expected.

**Indoor Use:** Suitable for indoor use.

**Outdoor Use:** Suitable for outdoor use when mounted inside an electrical enclosure (Hammond Mfg., Type EJ Series) that is rated NEMA 3R or 4 (IP 66).

## Mechanical

**Enclosure:** High impact, ABS and/or ABS/PC plastic

**Flame Resistance Rating:** UL 94V-0, IEC FV-0

**Size:** 153 mm . 85 mm . 38 mm (6.02 in . 3.35 in . 1.50 in)

**Weight:** 307 gm (10.8 oz) 314 gm (11.1 oz)

**Connectors:** Euroblock style pluggable terminal blocks

**Green:** up to 12 AWG (2.5 mm<sup>2</sup>), 600 V

**Black:** up to 12 AWG (2.5 mm<sup>2</sup>), 300 V

## Current Transformers

Watt-Link meters use CTs with built-in burden resistors generating 0.33333 Vac at rated AC current. The maximum input current rating is dependent on the CT frame size (see the tables below). Exceeding the maximum input current rating may damage CTs, but should not harm the meter.

None of these CTs measure DC current and the accuracy can be degraded in the presence of DC currents, as from half-wave rectified loads. The solid-core CTs are most susceptible to saturation due to DC currents.

Watt-Link meters should only be used with UL recognized current transformers, which are available from LORD MicroStrain. Using non-approved transformers will invalidate the meter UL listing. The following sections list approved UL recognized current transformers.

## LORD MicroStrain Supported Current Transformers

**Type:** voltage output, integral burden resistor

**Output Voltage at Rated Current:** 0.33333 Vac (one-third volt)

**Standard CT Wire Length:** 2.4 m (8 feet)

**Optional CT Wire Length:** up to 30 m (100 feet)

## Split-Core CTs

Also called “opening” current transformers. The accuracy of the split-core CTs are specified from 10% to 100% of rated AC current. The phase angle is specified at 50% of rated current (amps). Some low current split-core CTs have unspecified phase angle errors.

LORD MicroStrain offers ACT-0750-xxx-WATT-Link-CT type current transformers with 5, 20, 50, 100, 200 & 250 Amp ratings.

Visit <http://files.microstrain.com/Watt-Link-Current-Transformers.pdf> for more information, or to inquire about other CT options.

**Table 16 - LORD MicroStrain Current Transformers**

<b>Model</b>	<b>Rated Amps</b>
ACT-0750-005-WATT-LINK-CT	5
ACT-0750-020-WATT-LINK-CT	20
ACT-0750-050-WATT-LINK-CT	50
ACT-0750-050-WATT-LINK-CT	100
ACT-0750-200-WATT-LINK-CT	200
ACT-0750-250-WATT-LINK-CT	250

The Watt-Link REQUIRES current transformers that contain built-in burden resistors which generate .33333 VAC at the rated AC current and are UL recognized. WARNING: TO AVOID SAFETY RISKS AND DAMAGE TO THE DEVICE USERS SHOULD ONLY ATTACH CURRENT TRANSFORMERS THAT MEET THE SPECIFICATIONS STATED HEREIN.

## Chapter 7 – Limitation of Liability

BUYER ACKNOWLEDGES AND AGREES THAT THE WATT-LINK PRODUCTS (THE “PRODUCTS”) MUST BE INSTALLED ONLY BY A LICENSED ELECTRICIAN AUTHORIZED TO CONDUCT BUSINESS IN THE JURISDICTION IN WHICH THE PRODUCTS ARE TO BE INSTALLED. IN ADDITION, BUYER AGREES THAT SELLER SHALL HAVE NO LIABILITY WHATSOEVER FOR ANY DAMAGES RESULTING FROM THE INSTALLATION OF A PRODUCT BY ANY PERSON THAT IS NOT A LICENSED ELECTRICIAN IN THE JURISDICTION IN WHICH THE PRODUCT IS INSTALLED. FURTHERMORE, REGARDLESS OF WHETHER THE PERSON THAT IS INSTALLING A PRODUCT IS A LICENSED ELECTRICIAN, BUYER AGREES THAT SELLER SHALL NO LIABILITY WHATSOEVER IN CONNECTION WITH ANY DAMAGES RESULTING (i) DURING THE INSTALLATION OF THE PRODUCT AND/OR (ii) FROM THE IMPROPER INSTALLATION OF THE PRODUCT.