Smart Power Cable User's Manual

Version 1.7

Wiring Device – Kellems
Hubbell Incorporated (Delaware)
Shelton, CT 06484
1-800-288-6000
www.hubbell-wiring.com

Contents

Safety summary and specifications

This manual is intended for use by personnel responsible for installing or removing the Smart Power Cables. Hubbell Incorporated assumes no liability for user's failure to comply with these safety guidelines. Please read this manual carefully before proceeding.

This symbol is used throughout this manual to indicate critical safety information. Failure to observe the information following this symbol may result in injury or death.

CAUTION

- ❑ Read all instructions carefully prior to installation.
- ❑ Smart Power Cables should only be connected to the type of power source indicated on the label.
- ❑ Do not overload a Smart Power Cable as this can result in a risk of fire or electrical shock.
- ❑ Adhere to voltage and amperage guidelines and utilize a proper branch circuit protector.
- ❑ Cables must be connected to a terminal that is compatible with the connector on the cable and has the appropriate electrical rating.
- ❑ Cables must be connected to a grounded (earthed) outlet.
- ❑ No field-serviceable parts. Do not attempt to disassemble the product as potentially severe electrical shock may result. Installation and maintenance must be performed by qualified personnel.
- ❑ Follow basic safety precautions to reduce the risk of electrical shock and damage to equipment.
- ❑ Store in a clean, dry location. Clean with a dry cloth.
- ❑ Intended for indoor use only, do not install in a wet location.
- ❑ Adhere to all local electrical codes and guidelines.
- ❑ Failure to use the product in the specified manner may lead to injury or death and damage to equipment.

Note: "R" in catalog number indicates Smart Power Cables that will support three-phase or single-phase power. "S" in catalog number indicates Smart Power Cables that will support single-phase power only. Please note carefully the type of power your cable is designed to support as indicated on the cable's label. Use only with the indicated type of power.

Introduction

Smart Power Cable Overview

Service types

Smart Power Cables are power cables with embedded wireless power monitors that transmit real time power and energy usage data wirelessly to a central Gateway module. The Smart Power Cable is a monitoring-only device and it cannot disconnect, switch or otherwise interfere with the electrical current flowing through the cable and is inherently failsafe with no risk of interrupting the circuit in the event of failure to the monitoring device. The monitoring mechanism is powered from the cable itself and consumes less than 0.6W of power.

The cables are provided in an "S" (single phase) and "R" (three phase and high current single phase) form.

The appropriate Smart Power Cable is selected based on the appropriate voltage, current and connector type shown in the chart below. Smart Power Cables are available in just about any connector type and are universally operational at 50/60 Hz.

Figure 1: "S" Cable

Figure 2: "R" Cable

S Cables		R Cables	
Voltage	**Amperage**	**Voltage**	**Amperage**
1Ø 120VAC	20 amps	3Ø Wye 120V/208V	30 amps
1Ø 240VAC	20 amps	3Ø Wye 240/415VAC	32 amps
1Ø 240VAC	30 amps	3Ø Delta 240V	50 amps

⚠ **Cables should only be connected to the type of power source indicated on the label. If you are unsure of the type of power supply, consult an electrician or the power company. Refer to the label to confirm the current and voltage rating.**

Communication

The Smart Power Cables incorporate Hubbell's advanced zero-configuration wireless mesh networking technology to transmit power measurement data. Data is sent across the wireless network to the Hubbell Ethernet Gateway which connects using a standard Ethernet port to the customer's wired network infrastructure.

Hubbell Monitoring Solution Overview

The overall Hubbell system consists of the following components:

Wireless Monitoring Nodes

Wireless Power and Environmental Monitors including:

- **Smart Power Cables** that can record true power usage and monitor temperature readings in real time integrated in a cable format
- **Environmental Monitors** that record up to 6 temperature channels and humidity
- **Power Monitors** that can record true power usage and monitor temperature readings in real time on devices such as distribution panels or switchgear.
- **Intelligent Wiring Device** that incorporates a wireless full power and internal temperature monitor into an industrial power connector.

Ethernet Gateways

Hubbell Ethernet Gateways gather data from hundreds of monitoring devices via a wireless mesh radio network. The Gateways form the bridge between the wireless monitoring network and the facility's LAN.

Figure 1: Ethernet Gateway

Communications

Information gathered by a power cable is transmitted via a Hubbell radio network operating at either 900 MHz or 2.4 GHz (the exact frequencies vary with region – please contact Hubbell for details). The network operates in a mesh topology. Each device in the network must be within range of at least one other device (either another monitoring node or the Gateway) in the network. The effective range of the radio in the Smart Power Cables varies depending on several factors, including the environment in which the product is used. Typically, each device has an effective range of 10 to 30 meters. The Smart Power Cable will not transmit effectively if it is installed in an enclosure that entirely blocks radio signals such as fully enclosed metallic enclosures.

Every site where a Smart Power Cable is deployed must have installed at least one compatible Hubbell Gateway device and associated software to collect data and prepare it for transmission to approved monitoring and analysis applications. It is not necessary for all cables to communicate directly with the Gateway. As long as each cable can communicate with at least one other cable, and one cable can also communicate with the Gateway, information from all cables will reach the Gateway.

The rate at which power monitoring information is gathered from a cable depends primarily on the ratio of the number of cables to the number of gateways. As an example, at a ratio of 100 cables per Gateway, a Gateway should read from each cable every 5 to 15 seconds, and a system with a small number of monitoring unit could gather information every second. The system will automatically reallocate network traffic across Gateways when new Gateways or devices are added. It is possible to isolate groups of wireless devices from each other when operating in the same location (contact Hubbell for more information).

Note: In the event of a loss of power to a power cable, energy consumption information (Wh) is retained in non-volatile memory and will be transmitted when power is restored.

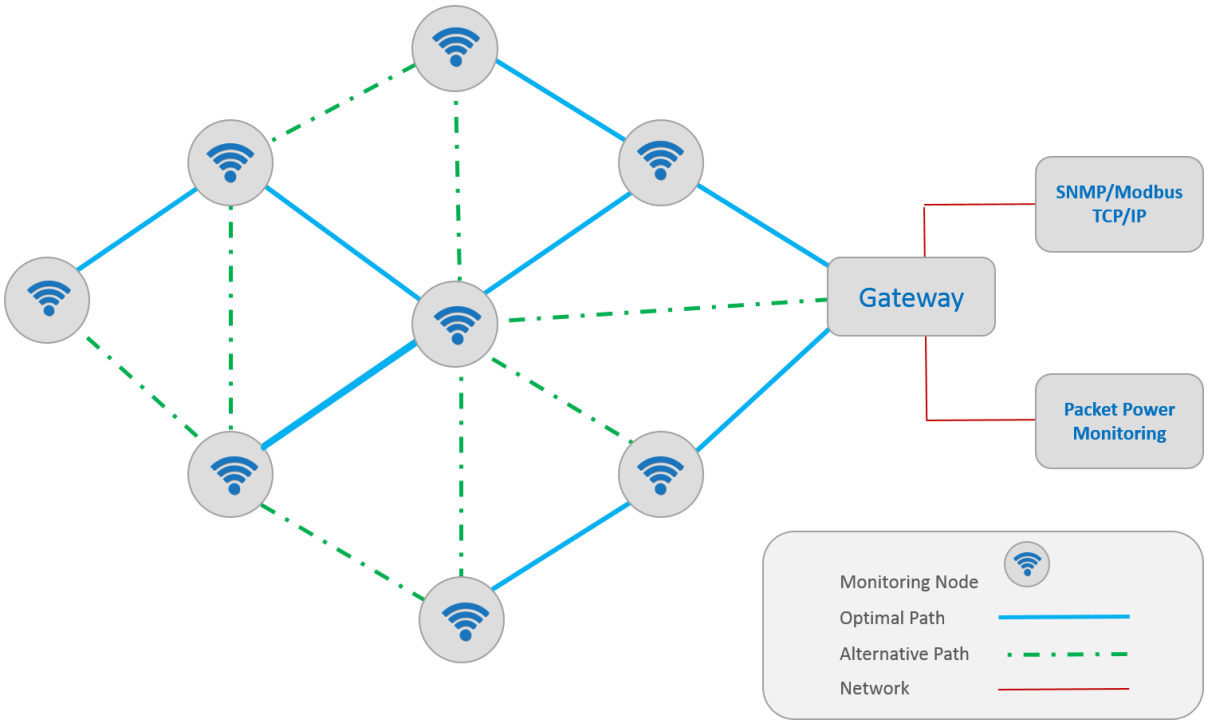
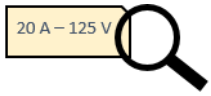
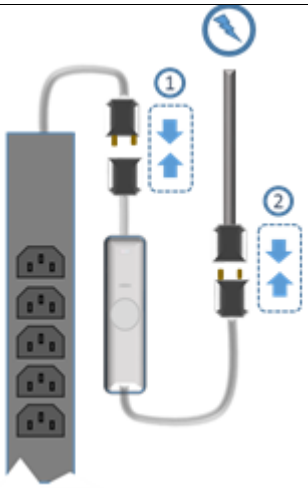


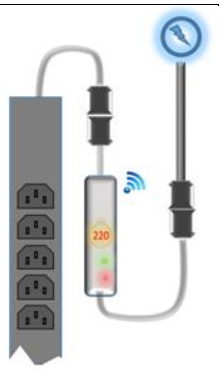
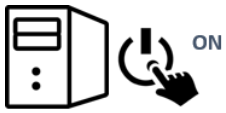
Figure 6: Hubbell Communications Architecture

Installation

Installing the Cables

Prior to installation, check to make sure the Smart Power Cable has not been damaged.

1	Confirm that the cable is correctly rated for the power and voltage.	
2	Make sure that any devices that may be interrupted by the process are safely powered down.	
3	While Smart Power Cables can be plugged into an energized source, It is recommended for that if possible, the power source energizing the Smart Power Cable be turn-off during installation.	
4	Remove any existing power cables	
5	Plug-in the supply-side (plug or "male") connector of the Smart Power Cable into to the power source. (2) Connect the load side (receptacle or "female") connector of the Smart Power Cable to the load device or power strip. (1)	
6	If the source power was disconnected, reconnect the source power.	

7	The cable should now be energized and the indicator lights and LED display will be active. The Smart Power Cable will immediately attempt to join the wireless network (if available) and transmit power data.	
8	Power up any devices.	

DISCLAIMER

Installation of Hubbell monitoring cables involves the disruption of power flow to your devices. Disconnecting power supply cables on running computing equipment and other electrical devices may lead to interruption of service, data loss, equipment damage and other potential losses. Hubbell is not responsible for any losses incurred due to power interruptions during the installation process. The customer is responsible for understanding and mitigating any consequences of interrupting and re-starting power flow to any equipment during the installation process. Installation should only be performed by personnel otherwise authorized to manage power connections to the equipment to be monitored. Dual-powered ("A & B") devices can in some cases be connected live, with one side (e.g. "A") being replaced first, followed by the other side (e.g. "B"). However, any time one of the power supplies is disconnected, the redundancy of a dual power supply and all of the protections it provides against failure are compromised. You are responsible for completely understanding this risk and taking responsibility for any consequences of a power loss while connecting power cables.

Smart Power Cable Indicator Lights and LED Display

Smart Power Cables have a 3 character alpha-numeric LED that displays monitoring data, and 3 small lights on the left side of the LED that provide operating status information.

P5	XXX Firmware Version
Id	ABC last 3 digits of the Hubbell node ID
A1 / A2 / A3	current on channel A,B,C in Amps
U1 / U2 / U3	voltage on channel A,B,C in Volts (may not be displayed in certain regions)
P1 / P2 / P3	power on channel A,B,C in kW (custom setting only)
F1 / F2 / F3	power factor on channel A, B,C (custom setting only)
Fr	Frequency in Hz (custom setting only)

If the device cannot establish radio communication, the display will show "No XX.X" where XX.X is the abbreviation for the radio zone the unit is set to.

Blue LED 1 (indicates meter status)
Blinking = taking measurement
Blinking (8Hz) = waiting for next measurement

Red LED 2
Solid red indicates an error condition is present on the node
2 Hz flashing opposite to the green LED indicates the node is searching for a network
8 Hz flashing indicates near mode (non-mesh communication) activity typically for node configuration
Repeating 500 ms of 8 Hz flashes followed by 500 ms off indicates the node is receiving a firmware or configuration update
10 seconds of 4 Hz flashes indicates the node has received a FINDME signal from another node or Gateway

Green LED 3 (indicates network communication)
Solid on indicates the node is connected to a network
2 Hz flashing indicates the node is actively searching for a network to connect to
Solid off indicates that the node is not configured to connect to a network

Installing the Ethernet Gateway

Each location in which Smart Power Cables are deployed must have one or more Hubbell Ethernet Gateways to gather data from the Smart Power Cables.

Refer to Hubbell's Ethernet Gateway User's Manual or Quick Start Guide for more information.

Specifications

Technical Specifications

Measurement

Measurements	V, A, W, Wh, VA, Hz, PF
Accuracy	± 1.0%
Input voltage	100 - 480V AC
Current range	Up to 100A
Circuit types	Single- and three-phase

Communications

Operating frequency	860 to 930 MHz and 2.4 GHz (frequencies vary by region)
Wireless network protocol	Frequency hopping self-configuring load-balancing mesh
Data output (Gateway)	SNMP and Modbus TCP/IP protocols
Firmware updates	Wireless
Typical transmission range	10 to 30 meters indoors between any two devices in mesh network
Antenna	Fully enclosed, fixed configuration
Cable to gateway ratio	Over 100 cables per gateway with unlimited gateways per site
Multi-site support	Yes
Encryption	Optional
Local display	Volts, Amps and Watts

Environmental & Mechanical

Operating environment	7° to 75°C (20° to 167°F); 5% to 95% non-condensing
Water and dust resistance	Not rated
Size and weight (for standard cable length)	
S models under 16A	150 cm (60 in); 0.45kg (1 lb)
S models 16A and above	120 cm (48 in); 0.75 - 1.0 kg (1.5 to 2 lbs)
R models	120 cm (48 in); 1.5 - 3.0 kg (3.5 to 7 lbs)
Power usage	0.6W
Certifications	UL/ANSI 61010-1; CAN/CSA-C22.2 No. 61010-1 (ETL); FCC Class B; CE (IEC/EN 61010-1:2001, ETSI EN 300 220-2, ETSI EN 301 489-3, IEC/EN 61326-1); ICASA; AS/NZA 4268:2008

Regulatory Information and Labels

This product has been certified to and conforms to the following requirements:

- UL 61010-1 Issued: 2004/07/12 Ed: 2 Rev: 2008/10/28 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements
- CSA C22.2#61010-1 Issued: 2004/07/12 Ed: 2 (R2009) Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements, with general instruction No.1:2008/10/28-(R2009)*AMD

This product has been tested and complies with the following requirements:

- Council Directive 2006/95/EC (December 12, 2006) on Low Voltage Equipment Safety; IEC 61010-1:2001 **(Second Edition) and EN 61010-1:2001 (Second Edition)**
- Council Directive 1999/05/EC - European Union (EU) Radio & Telecommunications Terminal Equipment Directive (R&TTE) ETSI EN 300 220-2, Issued:2006/04/01 and ETSI EN 301 489-3, Issued:2002/08/01 V1.4.1
- Council Directive 2004/108/EC (December 15, 2004) on Electromagnetic Compatibility CENELEC EN 61326-1 Issued:2006/05/01; IEC 61326-1:2005;:1997 –
- AS/NZS 4268: 2008

Class B Device Statement / FCC Regulations:

Section 15.105(a) of the FCC Rules: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Section 15.19 of the FCC Rules: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this product not expressly approved by Hubbell LLC might cause harmful interference and void the FCC authorization to operate this product.

Pursuant to part 2.1091c of the FCC rules device is categorically excluded from routine RF Exposure regulations.

Industry Canada (IC) Compliance Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

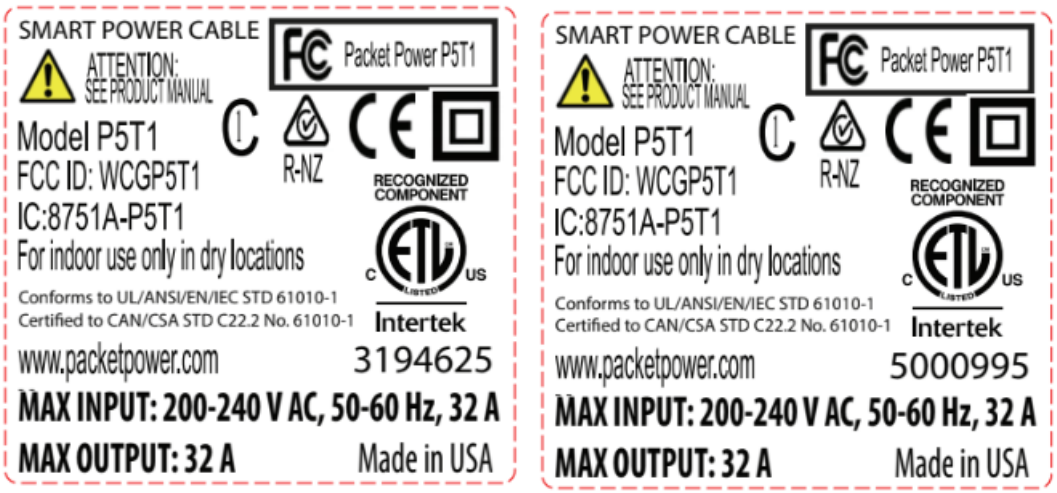
(1) This device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Per section RSS-102, 2.5 of Industry Canada regulations, this device is categorically excluded from Routine Evaluation Limits.

Industrie Canada (IC) Déclaration de conformité

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance ipoosotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Sample S Cable Labels



Sample R Cable Labels