



# PRL-900

## PRL-900 WIRELESS PULSE LINK INSTRUCTION SHEET



**SOLID STATE INSTRUMENTS** a division of **BRAYDEN AUTOMATION CORP.**  
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# PRRL-9000

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## Introduction

Thank you for your purchase of the PRL-900 Wireless Pulse Link System. When used properly, the PRL-900 will provide pulses to an Energy Management System, KW or KWh meters, totalizers, recorders or other telemetry equipment. Since many of these systems time pulses for calculating KW demand, it is critical that the output pulse timing of the system match the input pulse timing as nearly as possible. The PRL-900 was designed specifically for this purpose. The PRL-900 provides a near mirror image of the pulses originating from the electric meter's KYZ pulse output.

The PRL-900 continuously detects incoming pulses at the transmitter and sends them to the receiver. The transmitter and receiver each employ a microcontroller with software that continuously tracks the pulses sent in an designated interval. At the end of each interval the receiver "trues-up" the pulse count. In this way, a missing pulse is detected by the receiver's software redundancy algorithm, and automatically compensates for it.

The PRL-900 Wireless Pulse Link system consists of four parts as follows:

- PRT-900 Pulse Radio Transmitter/Antenna Unit
- PRT-2 Pulse Radio Transmitter Base Unit
- PRR-900 Pulse Radio Receiver/Antenna Unit
- PRR-2 Pulse Radio Receiver Base Unit.

Both the Transmitter/Antenna unit and the Receiver/Antenna unit consist of the radio frequency (RF) electronics and the antenna built into one compact unit, designed to minimize the losses from coaxial cable between a typical radio and a separate antenna. In this manner, the distance is maximized for the power level authorized by the FCC. The PRL-900 can handle two Form C (3-wire) pulse channels or four Form A (2-wire) pulse channels to allow for multiple pulses to be sent through one PRL-900 system. Only one PRL-900 system can operate in its radio airspace.

Each Base unit consists of the power supply to power its respective radio/ antenna unit and termination connections to interface with the appropriate equipment on each end, making the PRL-900 quick and convenient to install.

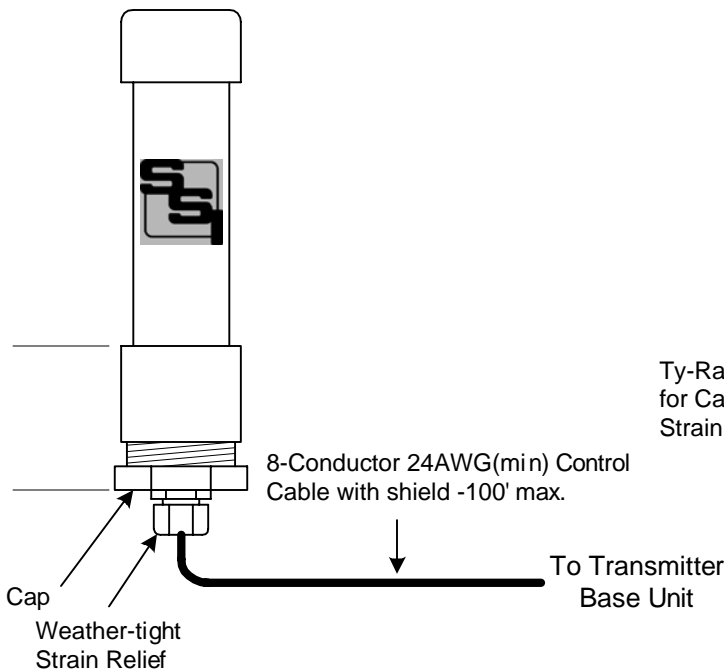
The PRT-2 Base unit features red and green LED's to monitor the incoming pulses from the electric meter. It can also be ordered to accept a +12VDC power input from the SPS-1 Solar Power Supply when 120-277VAC is not available.

The PRR-2 Receiver Base unit features two SPDT optically-isolated dry-contact outputs making for the equivalent of two isolation relays on the outputs, so that additional isolation relays are not required.

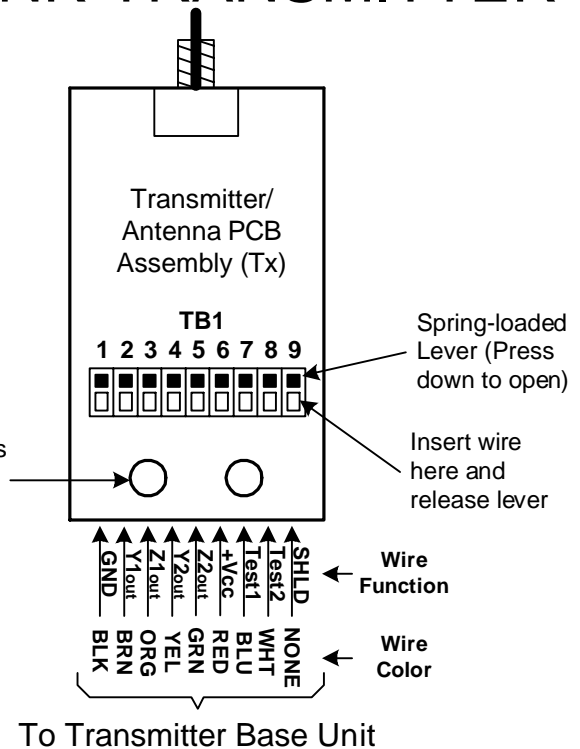
# INSTRUCTION SHEET

## PRT-900 PULSE RADIO LINK TRANSMITTER

FCC ID: TIT-PRT-900



**FIGURE 1**



**FIGURE 2**

**MOUNTING POSITION** - (See Note Below on Cable Connection before mounting) The PRT-900 Transmitter/Antenna unit (Tx) should be mounted in an upright position so that the cable is located on the bottom of the unit. Mount the unit as high as necessary to guarantee LINE-OF-SIGHT with the PRR-900 Receiver/Antenna unit(Rx). Mount using the aluminum mounting bracket supplied, making sure that the center of the transmitter is at least 6-1/4" away from any metal object such as a pole or metal building. Make sure that no metal mounting hardware is placed above the bottom of the Transmitter/Antenna unit case.

**CABLE CONNECTION TO PRT-900** - It is advisable that this task is performed, if possible, in a convenient, clean work area before mounting the Tx unit. Connect the 8-conductor 24AWG(min) shielded control cable to the 9-position connector on the PRT-900 Tx. Access the PCB Assembly by unscrewing the Tx housing cap on the bottom of the unit. Remove the Tx assembly from the housing. Feed the control cable into the housing's weather-tight connector on the cap so that there is approximately 12" of cable through the cap. Tighten the weather-tight cable fitting so that the cable is not quite tight and easily slides back and forth. Strip approximately 2" of the control cable's outer jacket to expose the individual conductors, being careful not to cut the insulation of the conductors or any strands of the shield's drain wire. Strip the insulation of each conductor back 1/4". Connect each conductor of the cable to the 9-position connector TB1 using a small flat-blade screwdriver or other similar tool to open the spring-loaded connector as shown above in Figure 2. Press down on connector lever, slip wire into hole and release. When all conductors are attached, attach the cable tie(ty-rap) included through the Tx PCB Assembly's holes and tighten the control cable down, leaving about 1/4" of jacket above the ty-rap so as to provide adequate strain relief for the cable connections. Pull the cable back through the cap and weather-tight connector and place the Tx PCB Assembly back into the cap's slots. Tighten the weather-tight connector to secure the assembly in place. Put the ring spacer over the Cap's threads and insert the Tx Assembly into the housing. Tighten the cap until spacer is tight. For best results, keep the distance between the Transmitter and the Base Unit to the minimum practical distance. When Tx installation is complete, secure cap to mounting bracket using sheet metal screw in slot.



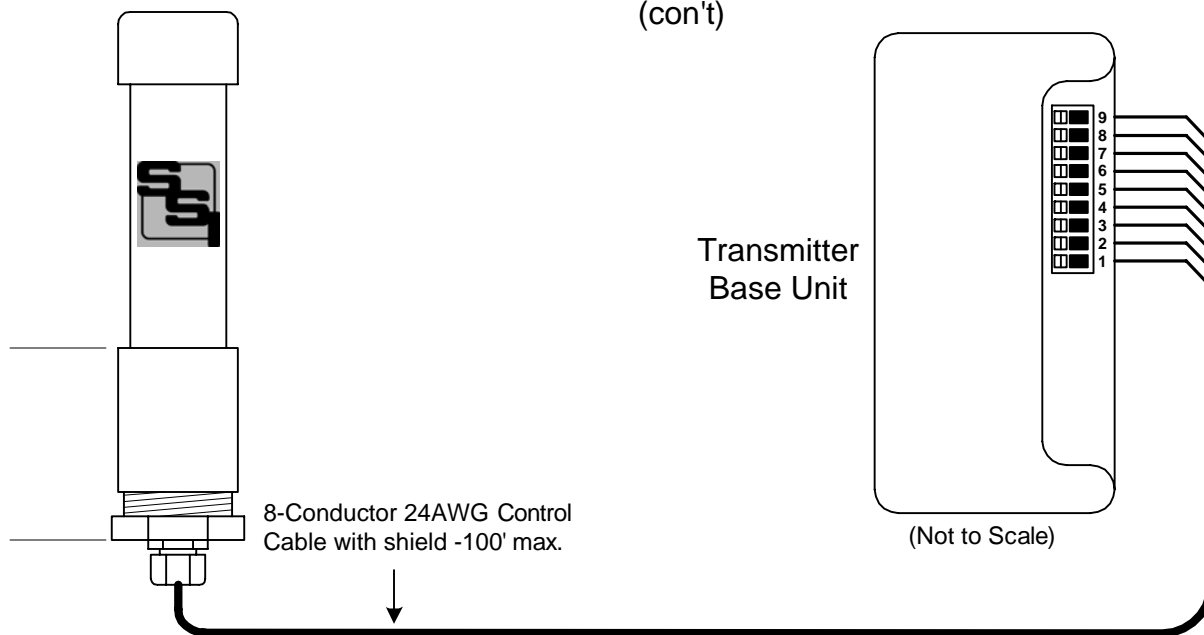
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# INSTRUCTION SHEET

## PRT-900 PULSE RADIO LINK TRANSMITTER

(con't)



**POWER INPUT** - The PRT-900 receives its power supply from the PRT-2 Transmitter Base unit.

**METER INPUTS** - See the PRT-2 Base Unit Instruction Sheet for detailed information on connecting the KYZ inputs to the Electric Meter's KYZ Pulse output.

**RADIO OUTPUT** - The PRT-900's Transmitter/Antenna Unit contains a low-power 916MHz radio transmitter with an integral antenna mounted inside the unit. See diagram on reverse side for mounting method and considerations. Transmission is LINE OF SIGHT up to approximately 1000 feet. Metal poles, buildings or other objects will affect the distance the radio system will effectively work. Trees may also affect transmission distance. The user bears all responsibility for proper mounting and operation of the unit within the PRT-900's operating parameters.

**SET TRANSMISSION MODE** - See Page 3 to properly set the transmission mode in either Form C (3-Wire) or Form A (2-Wire) Mode. Make sure that both the transmitter and receiver are set to the same mode.

### NOTICE TO USER -

FCC ID: TIT-PRT-900

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.

# INSTRUCTION SHEET

## PRT-900 PULSE RADIO LINK TRANSMITTER

**Setting the Transmitting Mode** - The PRL-900 System can be used as either two Form C channels (3-wire, i.e.: KYZ) or four Form A channels (2-wire, i.e.: KY) The mode is set by means of a jumper shunt on pins 7 & 8 of plug strip J1 as shown in Figure 3.

The PRT-900 is shipped from the factory in the Form C mode with the jumper shunt slid onto and held by pin 8 for storage. It is a small black plastic piece with a metal connection between the two pin slots. In this position, there is no connection between pins 7 and 8 of J1, and thus the PRT-900 is in the default Form C (3-Wire) mode.

In Form C mode, all three wires (K,Y, and Z) must be used from the electric meter to the input (of each channel used) of the PRT-2 transmitter/base unit.

If the Form A mode (2-wire) is desired, simply remove the jumper shunt from its storage place on Pin 8 and slide it down over pins 7 and 8, connecting them together. This sets the transmitter into the Form A mode. When in the Form A mode, the transmitter can accept up to 4 Form A pulses from 4 different pulse sources.

Note: The Transmitter and Receiver units must both be in the same mode.

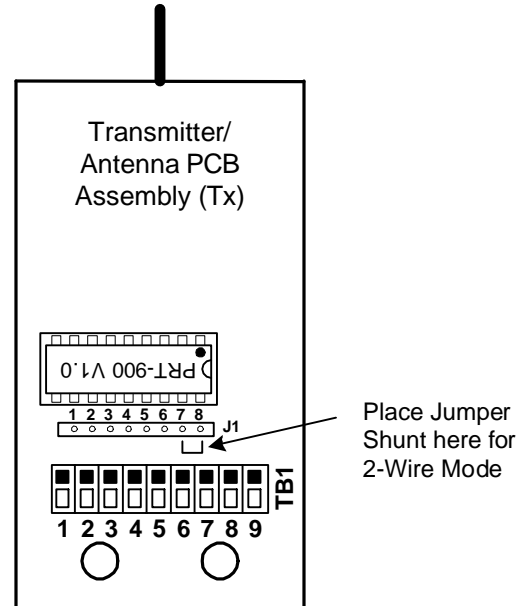
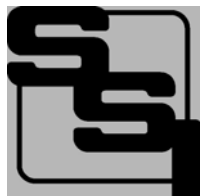


FIGURE 3



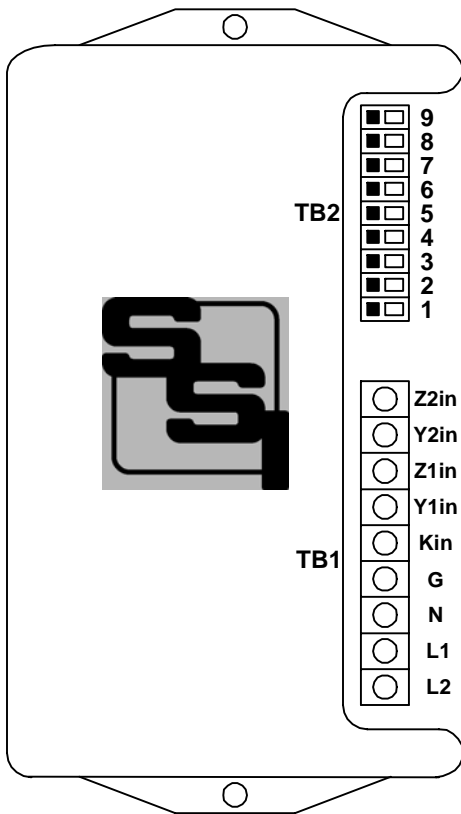
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# INSTRUCTION SHEET

## PRT-2 PULSE RADIO TRANSMITTER

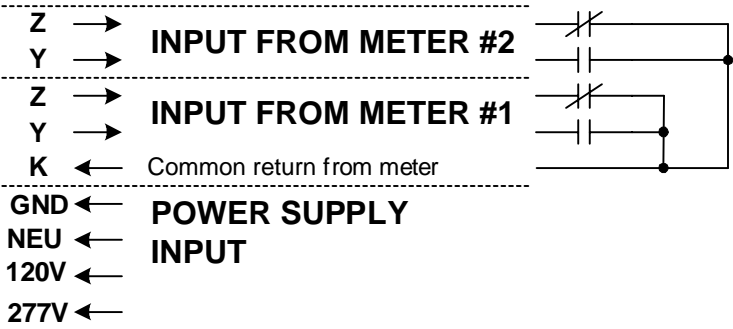
### BASE UNIT



Wire Function	Wire Color
SHLD	NONE
Test2	WHT
Test1	BLU
+Vcc	RED
Z2out	GRN
Y2out	YEL
Z1out	ORG
Y1out	BRN
GND	BLK

To Transmitter Radio/  
Antenna Unit

24AWG (min)/8 conductor with  
shield 100' max.



**MOUNTING POSITION** - The PRT-2 base unit may be mounted in any position.

**ENCLOSURE** - The PRT-2 base unit is housed in a polycarbonate base and cover and is designed to be mounted into another electrical enclosure suitable for the application. An optional NEMA 3R raintight enclosure is available.

**POWER INPUT** - For 120VAC, connect the "hot" lead to the L1 power supply terminal. Connect the neutral lead to the NEU terminal. For a power supply voltage between 208 and 277 VAC, connect the "hot" lead to the L2 power supply terminal and the neutral lead to the NEU terminal. Connect the GND terminal to Ground.

**INPUT CONFIGURATION** - The PRT-2 may accept a Form "A" (2-Wire) input using the K & Y input terminals, or a Form "C" (3-Wire) input configuration the using K, Y and Z input terminals.

**METER CONNECTIONS** - Form A: Connect the PRT-2's "Kxin" and "Yxin" input terminals to meter's "K" and "Y" terminals. Form C: Connect the PRT-2's "Kin", "Y1in" and "Z1in" input terminals to meter #1's "K", "Y" and "Z" terminals, respectively. Connect meter #2 in a similar manner. The PRT-2's "K" terminal is the system common (return). The "Yin" and "Zin" input terminals are "pulled-up" to +13VDC power supply, making it compatible with open-collector transistor meter outputs, as well as all non-polarized mechanical or solid state pulse outputs.

**OUTPUT TO TRANSMITTER/ANTENNA UNIT** - Connect the 8-conductor 24AWG(min) shielded control cable to the PRT-900 Transmitter/Antenna Unit. For best results, it is advisable to keep this distance to the minimum practical distance.

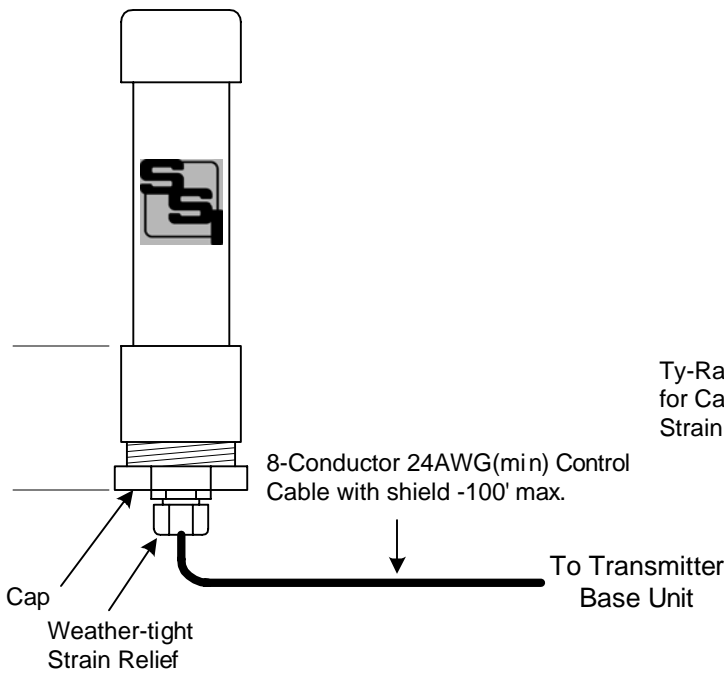


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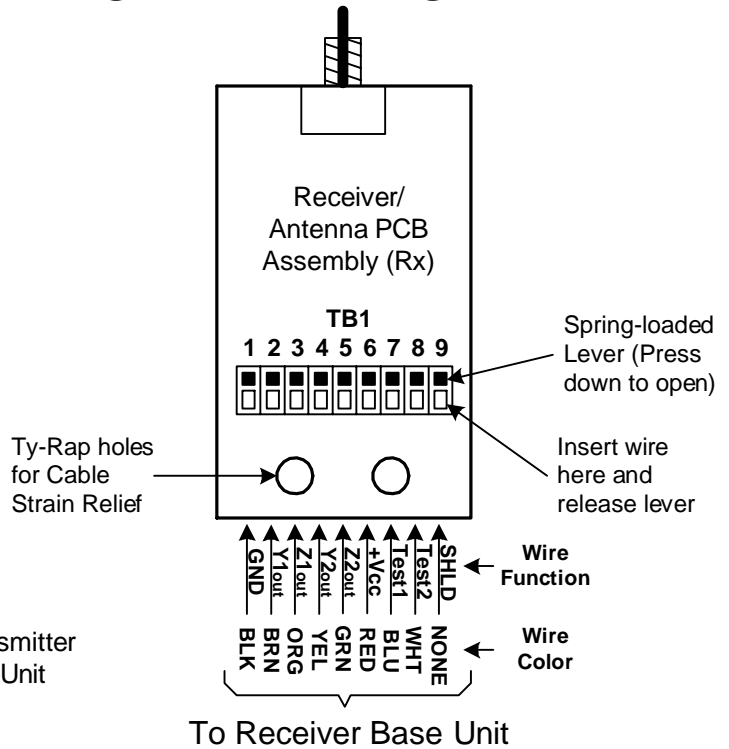
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# INSTRUCTION SHEET

## PRR-900 PULSE RADIO LINK RECEIVER



**FIGURE 1**



**FIGURE 2**

**MOUNTING POSITION** - (See Note Below on Cable Connection before mounting) The PRR-900 Receiver/Antenna unit (Rx) should be mounted in an upright position so that the cable is located on the bottom of the unit. Mount the unit as high as necessary to guarantee LINE-OF-SIGHT with the PRT-900 Transmitter/Antenna unit(Tx). Mount using the aluminum mounting bracket supplied, making sure that the center of the receiver is at least 6-1/4" away from any metal object such as a pole or metal building. Make sure that no metal mounting hardware is placed above the bottom of the Receiver unit case.

**CABLE CONNECTION TO PRR-900** - It is advisable that this task is performed, if possible, in a convenient, clean work area before mounting the Rx unit. Connect the 8-conductor 24AWG(min) shielded control cable to the 9-position connector on the PRR-900 Rx. Access the PCB Assembly by unscrewing the housingcap on the bottom of the unit. Remove the Rx assembly from the housing. Feed the control cable into the housing's weather-tight connector on the cap so that there is approximately 12" of cable through the cap. Tighten weather-tight cable fitting so that the cable is not quite tight and easily slides back and forth. Strip approximately 2" of the control cable's outer jacket to expose the individual conductors, being careful not to cut the insulation of the conductors or any strands of the shield's drain wire. Strip the insulation of each conductor back 1/4". Connect each conductor of the cable to the 9-position connector TB1 using a small flat-blade screwdriver or other similar tool to open the spring-loaded connector as shown above in Figure 2. Press down on connector lever, slip wire into hole and release. When all conductors are attached, attach the cable tie(ty-rap) included through the Rx PCB Assembly's holes and tighten the control cable down, leaving about 1/4" of jacket above the ty-rap so as to provide adequate strain relief for the cable connections. Pull the cable back through the cap and weather-tight connector and place the Rx PCB Assembly back into the cap's slots. Tighten the weather-tight connector to secure the assembly in place. Put the ring spacer over the Cap's threads and insert the Rx Assembly into the housing. Tighten the cap until spacer is tight. For best results, keep the distance between the Receiver and the Base Unit to the minimum practical distance. When Rx installation is complete, secure cap to mounting bracket using sheet metal screw in slot.



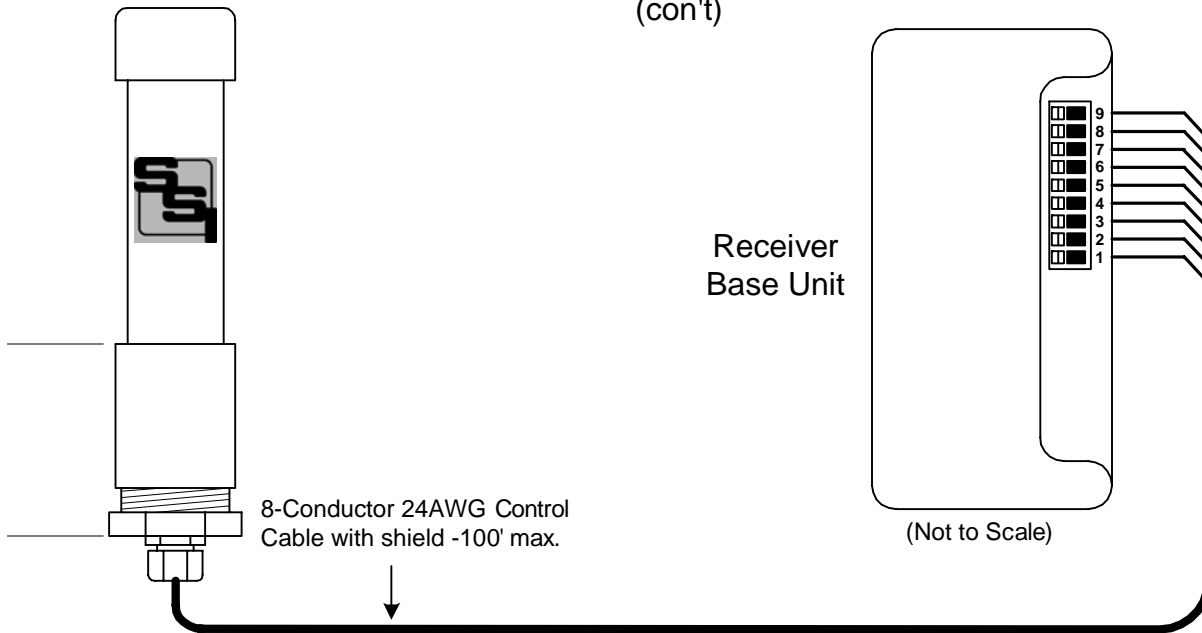
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# INSTRUCTION SHEET

## PRR-900 PULSE RADIO LINK RECEIVER

(con't)



**POWER INPUT** - The PRR-900 receives its power supply from the PRR-2 Receiver Base unit.

**PULSE OUTPUTS** - See the PRR-2 Base Unit Instruction Sheet for detailed information on connecting the KYZ Outputs to the receiving device. The receiving (destination) device may be the input to an energy management system, SCADA system, RTU, or other device configured to receive pulses.

**RADIO RF INPUT** - The PRR-900's Receiver/Antenna Unit contains a low-power 916MHz radio receiver with an integral antenna mounted inside the unit. Observe the following application guidelines: 1.) Mount the receiver as directed on the reverse side of this sheet; 2.) Locate the PRR-900 Receiver so it is LINE-OF-SIGHT with the transmitter with a maximum distance of approximately 1000 feet; 3.) Insure that all metal objects, trees and other obstructions, which may affect the distance the radio system will effectively work, are not within the line-of-sight between the transmitter and receiver.

**SET RECEPTION MODE** - See Page 3 to properly set the reception mode in either Form C (3-Wire) or Form A (2-Wire) Mode. Make sure that both the transmitter and receiver are set to the same mode.

**NOTICE TO USER** - 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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- \* Reorient or relocate the receiving antenna.
- \* Increase the separation between the equipment and receiver.
- \* Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- \* Consult the dealer or an experienced radio/TV technician for help.

This equipment has been certified to comply with the limits for a class B computing device, pursuant to FCC Rules. In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

# INSTRUCTION SHEET

## PRR-900 PULSE RADIO LINK RECEIVER

**Setting the Receiving Mode** - The PRL-900 System can be used as either two Form C channels (3-wire, i.e.: KYZ) or four Form A channels (2-wire, i.e.: KY) The mode is set by means of a jumper shunt on pins 7 & 8 of plug strip J1 as shown in Figure 3.

The PRR-900 is shipped from the factory in the Form C mode with the jumper shunt slid onto and held by pin 8 for storage. It is a small black plastic piece with a metal connection between the two pin slots. In this position, there is no connection between pins 7 and 8 of J1, and thus the PRR-900 is in the default Form C (3-Wire) mode.

In Form C mode, all three wires (K, Y, and Z) are normally used from the output of the PRR-2 Base unit to the input of the receiving (destination) device. Two wires can be used on each output if desired, either K-Y or K-Z of each output.

If the Form A mode (2-wire) is desired, simply remove the jumper shunt from its storage place on Pin 8 and slide it down over pins 7 and 8, connecting them together. This sets the receiver into the Form A mode. When in the Form A mode, the receiver can output up to 4 Form A pulses to 4 different pulse sources. Care needs to be taken to insure that the wetting voltage to the receiving (destination) device is the same on K1-Y1 & K1-Z1, and also on K2-Y2 & K2-Z2 since the K terminal is common to both outputs.

Note: The Transmitter and Receiver units must both be in the same mode.

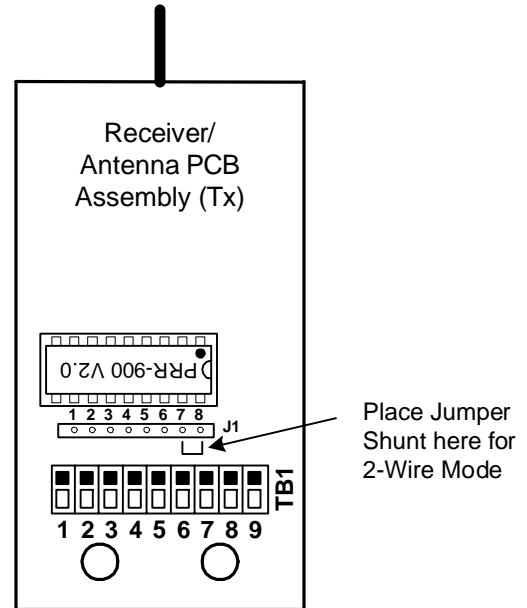


FIGURE 3

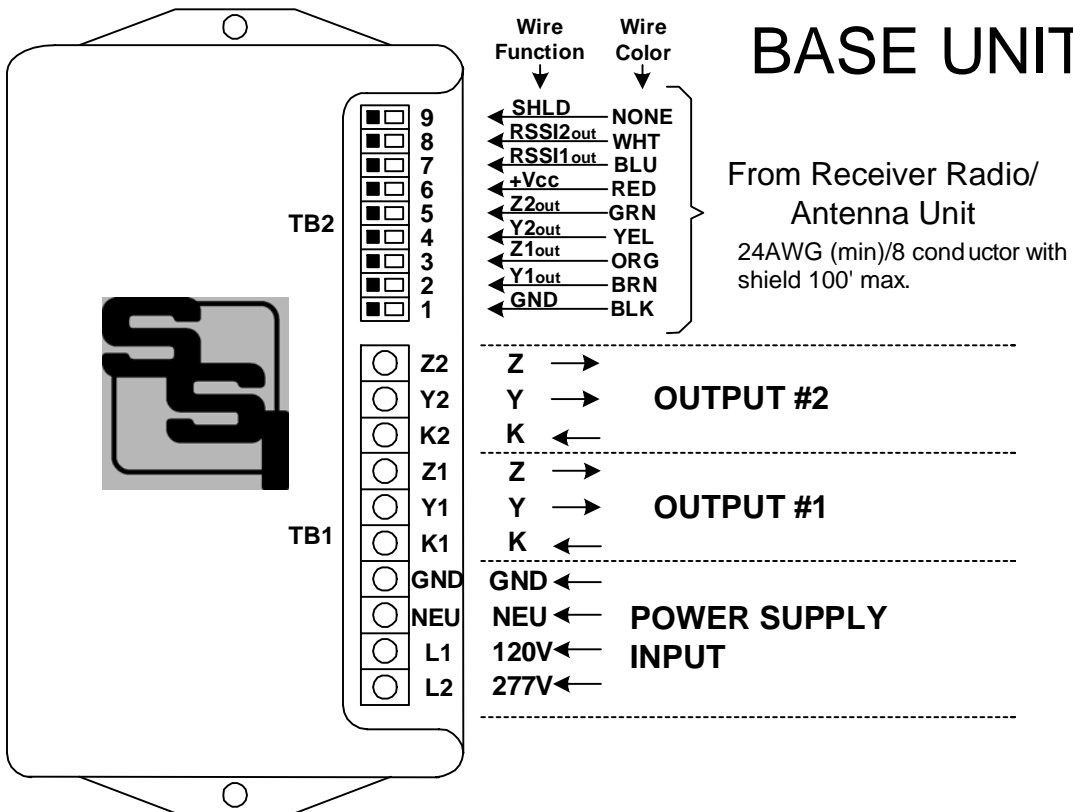


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# INSTRUCTION SHEET

## PRR-2 PULSE RADIO RECEIVER BASE UNIT



**GENERAL** - The PRR-2 serves as a base unit and termination point for the PRR-900 916.25 MHz radio receiver/antenna unit. It contains a power supply, output relays and all connection points for power and the radio receiver/antenna unit.

**MOUNTING POSITION** - The PRR-2 may be mounted in any position.

**ENCLOSURE** - The PRR-2 base unit is housed in a polycarbonate base and cover and is designed to be mounted into another electrical enclosure suitable for the application. An optional NEMA 3R raintight enclosure is available.

**POWER INPUT** - For a power supply of 120 VAC continuous, use the the **L1** terminal for the "hot" lead. For 208 to 277 volts AC continuous, use the **L2** terminal for the "hot" lead. Connect the Neutral lead to the **NEU** terminal. Connect the **GND** terminal to Ground.

**RADIO INPUT** - The PRR-900 radio receiver/antenna unit connects to the 9-position connector labeled TB2. Terminals are numbered in the same order on the PRR-900 and the PRR-2. Connect an 8 conductor shielded control cable between the PRR-900 radio and the PRR-2 making sure that all connections are matched up on both ends: 1 to 1, 2 to 2, etc. Make sure that the control cable's shield is connected to position 9 on each end.

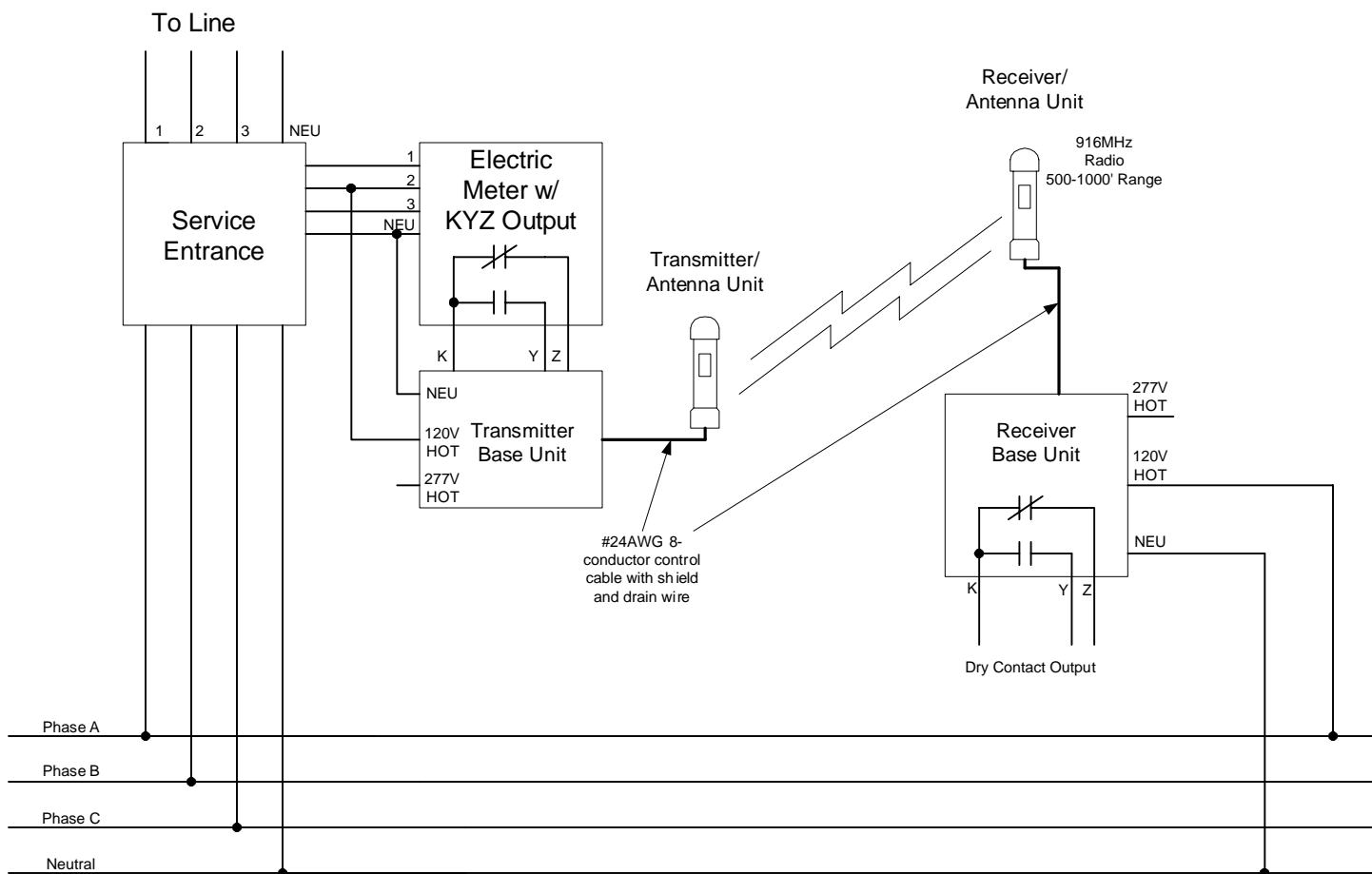
**OUTPUT CONFIGURATION** - The PRR-2 contains two solid state Form C dry-contact outputs using K,Y and Z terminals. The "K" terminal is common. For a 2-Wire Form A configuration, use the "K" and "Y" terminals. For a 3-Wire Form C configuration, use the "K", "Y" and "Z" output terminals. The output is limited to 100mA@ 250VAC. Fuses are sized at 1/10th amp (100mA). Do not exceed this rating as the device will be destroyed. Transient voltage protection for the contacts of the solid state relays are provided by MOVs on board.



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# KYZ Wireless Pulse Link Application



**Notes:**

- 1.) Only one input and output is shown in the drawing above for simplicity. The PRL-900 Wireless Pulse Link is equipped with two Form C inputs and Form C outputs.
- 2.) Inputs can be configured as Form A, and in this configuration up to 4 Form A channels can be transmitted.
- 3.) Transmission is Line-of-sight and must not be blocked by trees, buildings, metal poles, trucks, railcars, etc.
- 4.) Transmission distance is limited to about 1000' depending on conditions. Distance and reliability will increase as the height mounted above the ground increases.

916MHz Wireless Pulse Link System Diagram		REVISIONS		
		NO.	DATE	DESCRIPTION
DATE ORIGINAL	SCALE			
1/5/2010	N/A			
LATEST REVISION	JOB NO.	CHECKED	DRAWN	
			WHB	

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## Hints for Maximum Performance

- 1.) Make sure to use shielded wire between the base unit and the radio/antenna unit. Solid State Instruments part number 0715-1005 is an 8-conductor #24AWG shielded control cable sold by the foot. This cable is not UV rated so must be enclosed in seal-tight, liquid-tight or other non-metallic conduit. You can get your own cable but insure a high-quality communications cable with stranded conductors. Do not use solid conductor wire, especially thermostat wire. Also do not use any heavier wire than #22 or #24 AWG since there is limited space and it will be difficult to work with.
- 2.) Make sure that the transmission path is free of ANY obstacles or anything that can interrupt the radio transmission line-of-sight path between the transmitter and receiver. The Transmitter and Receiver radio units must be in continuous sight of each other – no interruptions from cars, trucks, railcars, trees, light poles, metal buildings, ANYTHING!
- 3.) Mount the transmitter and receiver radio/antenna units as high up off the ground as reasonably possible to prevent RF reflections from the ground. This will increase range and reliability, and also allow for certain obstacles to be avoided.
- 4.) Program the Ke value of the electric meter high enough to allow for a pulse rate that will not exceed 2 pulses per second at maximum KW demand. This is below the system's maximum pulse throughput rate but insures for excellent reliability and almost no need for the compensation algorithm to be invoked. NOTE: the PRL-900 system will not change the pulse value in any way. This is completed determined by the Ke value of the meter and the metering installation multiplier, which is based on Current Transformer (CT) and Potential Transformer (PT) ratios.
- 5.) In extremely heavy rain or snow, the system may not be able to accurately receiver all pulses transmitted. Like any other RF system, with enough interference, communications can be lost.
- 6.) The system's maximum reliable transmission distance will change with each installation since it is dependent on all of the environmental factors of each particular installation. While the distance is nominally specified as 1000 feet, it may work at only 800 feet in one installation and 1800 feet in another installation. In applications where distance is extreme, it may be necessary to add the Yagi Antenna option on the receiver. This option will extend the range and improve the reliability in marginal applications.
- 7.) The base units are designed for mounting inside another control cabinet or enclosure appropriate for a particular application. If a NEMA 4X enclosure is required, order SSI P/N: 05000-47001A for the NEMA 4X Fiberglass enclosure option. This option includes an interior mounting plate that the PRT-2 or PRR-2 mounts onto.

## Troubleshooting

- Make sure that two PRL-900 systems are not operating within the same 1-mile radius of each transmitter. These systems may jam each other.
- Check all wiring connections especially the control cable connections between the base unit and its respective radio/antenna units. Make sure all wires in the correct position and are securely attached to the terminals.
- Check power supply to each base unit.
- Check Form C or Form A mode jumper on Transmitter and Receiver radio/antenna board. Make sure jumpers are correct for the type of input used: 2-wire or 3-wire.
- Check red and green LED's on the input of the PRT-2 Transmitter Base Unit. Make sure LED's are alternately flashing when pulses are received from the meter(s).
- Check the signal strength LED's in the upper left-hand corner of the PRR-2 Receiver Base Unit. Are any lit and/or flashing?
- Are wire antennas securely in place on each radio/antenna unit?
- Use an ohmmeter across the output terminals of each output (with nothing else attached to the output) and determine whether each is opening and closing by watching the outputs resistance change. When the output is open, there should be infinite resistance. When the output is closed, the on-state resistance is approximately 18 to 20 ohms.
- Ensure that the voltage and current on the PRR-2's output(s) are not exceeding the output rating.
- Is the "downstream" equipment, that is the equipment receiving pulses from the receiver, providing a wetting voltage to the dry-contact output of the receiver?

## PRL-900 System Options

1. NEMA 4X weatherproof 10" X 8" X 4" enclosure for PRT-2 or PRR-2. Includes interior mounting panel.  
Order Part Number 05000-47001A
2. SPS-1 Solar Power Supply for PRT-900. Provides a +12VDC power supply for the Transmitter of the PRL-900. Includes Solar Panel, charge controller battery and enclosure. Order special PRT-2 version (P/N: PRT-2-SP6) when you order the PRL-900 system.  
Order Part Number SS4799A-00001
3. Yagi Antenna Option for PRR-900 Receiver/Antenna Unit  
Includes Yagi antenna and mounting hardware.  
Order P/N: SS4790A-00902