PRL-1600 Wireless Pulse Link System Technical Manual

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Version 2.01 FIRMWARE

Solid State Instruments

PRL-1600 Wireless Pulse Link System

Table of Contents

Solid State Instruments

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Introduction

The PRL-1600 Pulse Radio Link is a Transmitter and Receiver system that wirelessly sends up to four channels of KYZ pulses from the transmitter to a paired receiver. The short-hop PRL-1600 has a range of up to 5,000 feet depending on site topography and solves the problem of getting pulses across parking lots, vacant lots, roads, railroad tracks or other obstacles. With the PRL-1600, you're now able to connect real-time KYZ pulses from 2 Form C pulse channels or 4 Form A pulse channels. Pulses from each meter output are independently outputted on one of the four channels in the receiver. The PRL-1600 eliminates trenching or other costly methods of getting wires strung between each meter and the destination device as well as providing superior isolation against transients that could be induced in a long cable run. Additionally, ground rise problems are eliminated since there is no electrical connection between the two devices.

The PRL-1600 Radio Pulse Link system consists of one PRT-1600 Transmitter and one PRR-1600 Receiver. The system uses Frequency Hopping Spread Spectrum (FHSS) technology to communicate on 64 frequencies between 902 to 927MHz, using one of 6 hop sequence "channels", and allows unlicensed operation by the user, allowing multiple systems to operate in the same radio airspace. Nominally, the PRL-1600 will transmit pulses between 2,500 and 5,000 feet in an unobstructed <u>line-of-sight</u> configuration but may go farther depending on optimal site conditions.

PRT-1600 TRANSMITTER
The **PRT-1600** Transmitter consists of the following:
>   ***PRNT-1600** Pulse Radio Transmitter/Antenna Unit **(2.0x Firmware)**
>   ***PRT-16** Pulse Transmitter Base Unit   **(2.0x Firmware)**

The PRT-1600 Transmitter receives pulses from a meter's KYZ pulse initiator and sends them to the PRR-1600 Receiver unit wirelessly. Each 10 second interval, the number of pulses received from the meter's pulse KYZ initiator, is transmitted to the Receiver upon the next transmission cycle. The Receiver will then generate the correct number of pulses at KYZ outputs, over the next 10 seconds. The PRNT-1600 Transmitter/Antenna Unit contains the transceiver radio, a microcontroller and all the circuitry and software to communicate with the Receiver. The PRT-16 Base Unit contains the power supply, termination points, and has a built-in low voltage transformer-isolated power supply generating a +13VDC sense (wetting) voltage. The sense voltage is connected to meter's dry-contact KYZ pulse initiator. The PRT-1600 Transmitter is capable of operating on supply voltages of 120 or 208-277VAC. In addition to line power, it can be operated with batteries or a solar power supply such as Solid State Instruments' SPS-1 Solar Power Supply by using the PRT-16S 12VDC Transmitter Base Unit.

PRR-1600 RECEIVER
The **PRR-1600** Receiver consists of the following:
>   ***PRNR-1600** Pulse Radio Receiver/Antenna Unit   **(2.0x Firmware)**
>   ***PRR-16** Pulse Receiver Base Unit   **(2.0x Firmware)**

The PRR-1600 contains the transceiver radio, a microcontroller and all the circuitry and software to receive pulses from the Transmitter and output them on one of four output channels. The PRR-12 Base Unit contains the power supply, output relays and termination points where all connections are made. Four output channels are available, and can be configured as 4 Form A or 2 Form C. Each output channel contains one KY Form A (2-Wire) Solid State output. The Receiver/Antenna unit is intended to be mounted outdoors, in a direct line-of-sight with the Transmitter/Antenna units. It cannot operate if obstructed by trees, metal poles, buildings or other objects. The Receiver Base Unit is designed to mount indoors, or inside an existing control enclosure suitable for the application. The Base and Radio/Antenna Units are connected together by means of an 8-conductor, #24AWG 4 twisted pair shielded control cable. It is important for noise immunity and error-free communications between the Base and Transceiver that 4-twisted pair shielded control cable be used. The PRR-1600 is capable of operating on supply voltages of 120VAC or 208-277VAC. Other power supply voltages are available upon special order.

PRL-1600 SYSTEM DESIGN AND PLANNING

SYSTEM CONFIGURATION - The PRL-1600 can be used in one of two configurations: 4 Form A pulse channels or 2 Form C pulse channels. The entire system operates in either one mode or the other. They cannot be mixed.

Form A Configuration: The Form A configuration will transmit four 2-Wire (KY) pulse channels.
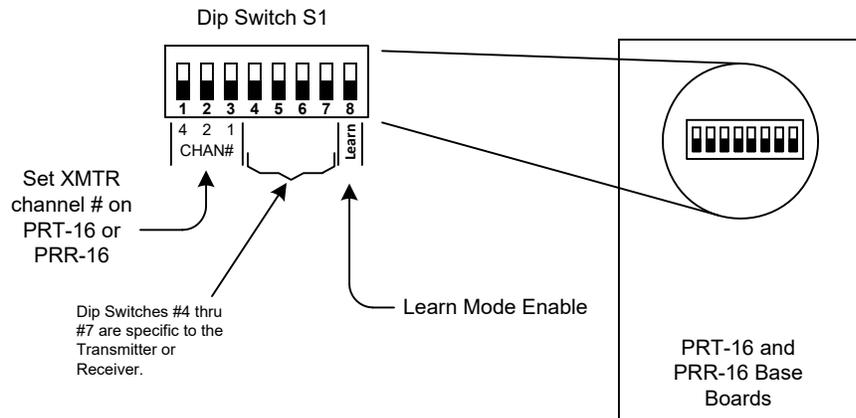
Form C Configuration: The Form C configuration will transmit two 3-wire (KYZ) pulse channels.

Determine the desired mode for the system.

Dip Switch S1's switches #1 through #3 set the channel # or "hop" sequence. Both the PRT Transmitter and the PRR Receiver units must be set to the same channel or hop sequence. See Table 1 at left.

Table 1

Channel #	S1.1	S1.2	S1.3
1	DN	DN	DN
2	DN	DN	UP
3	DN	UP	DN
4	DN	UP	UP
5	UP	DN	DN
6	UP	DN	UP
6	UP	UP	DN
6	UP	UP	UP

Dip Switch S1

Set XMTR channel # on PRT-16 or PRR-16

Dip Switches #4 thru #7 are specific to the Transmitter or Receiver.

Learn Mode Enable

PRT-16 and PRR-16 Base Boards

SYSTEM CHANNEL - The PRL-1600 System operates on one of 6 hop sequence channels. Each channel consists of 50 unique frequencies out of 64 frequencies available in the 902MHz to 927MHz range. This allows enhanced reliability since RF transmissions are transmitted on one of the channel frequencies until they are received by the receiver. Set the Transmitter and the Receiver to the same channel number. Multiple PRL-1600 systems can operate in the same radio airspace by each system having a different channel number. Once you have determined the channel # that you will use, configure Dip Switch S1's switches #1 through #3 on the PRT-16 or 16S Transmitter Base board and the PRT-16 Receiver Base board. Table 1 shows the dip switch combinations for each channel.

SYSTEM OPERATING MODE - The PRL-1600 System operates in a near real-time operational mode, where the PRT-1600 Transmitter transmits one transmission every 10 seconds with the pulse data it has received from the meter over the previous 10-second period. When the transmission is received by the PRR-1600 Receiver, pulses are generated over the next 10-second period. Additional error checking and pulse verification are used in this mode for the highest possible accuracy. Packet Transmissions and Receptions are visually indicated with an LED on both base units.

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CONSIDERATIONS FOR A SUCCESSFUL INSTALLATION

GENERAL - The PRL-1600 System is designed to provide mirror-image pulses from the transmitter to the receiver. This is important for Peak Demand Control since the KW demand is determined by timing the pulses. The greater the time between pulses, the lower the demand. Conversely, the shorter time between pulses, the higher the demand. Every effort is made in the PRL-1600 to be a "virtual copper wire" and make the pulses coming out of the receiver the same pulse width as the pulses going into the transmitter.

The PRL-1600 System is designed for concentrated RF environments where there is a significant amount of RF traffic on these or adjacent frequencies. Pulses are collected by the transmitter for 10 seconds. The number of pulses received in the immediate 10-second period is then sent to the receiver which duplicates those pulses over the next 10 seconds. All output pulses are thus delayed by 10 seconds. The benefit of this method is significantly reduced RF traffic and high-accuracy due to the expanded error checking and pulse count "true up".

APPROPRIATE PULSE CONSTANT - It is important to properly program the Pulse Constant of the meter such that there are no more than 2 pulses per second at the peak KW demand of the building or facility. Pulses faster than this may be lost. If a high pulse rate is unavoidable from the meter and cannot be slowed down, consider one of the DPR Dividing Pulse Relays (DPR-1, DPR-2 or DPR-4) from Solid State Instruments.

MINIMUM PULSE WIDTH - Make sure that the pulse width coming from the meter is at least 100mS in duration.

LINE OF SIGHT - Make sure that you have the Receiver Radio/Antenna Unit in a location where the Transmitter's Radio/Antenna unit can "see" it with a wide field of view. The PRL-1600 is a Line-Of-Sight system, and the transmitter must have uninterrupted and unrestricted sight with the receiver radio at all times. Make sure that there are no trees, metal buildings, light poles, rail cars, trucks, buses or any other obstruction that gets in the line-of-sight between the transmitter and receiver at any time. Interruptions in the line-of-sight may cause pulses to be lost. Generally speaking, the PRL-1600 will not transmit through concrete, concrete block or masonry walls. We can't stress this enough: The RF path must be line of sight!

HEIGHT - Mount the Transmitter and Receiver Radio/Antenna units up off the ground as high as reasonably possible, 14' minimum, to eliminate RF reflections, improve reception and transmission distance. The higher the transmitter is off the ground, the longer the transmission distance and the more reliable the reception by the receiver.

MOUNTING: If mounting the Receiver Radio/Antenna unit on the side of a metal building, make sure that the antenna in the Radio/Antenna unit is mounted at least 6.1" away from the metal siding. Use the brackets supplied with the PRL-1600 to get this distance. You may have to rotate the board to insure that the antenna is not closer to the metal surface than 6.1", since the antenna is not exactly in the center of the board as well as the board being mounted in an off-set fashion. If the antenna is closer than 6.1", the signal may be corrupted and transmissions may be affected. Rotate each radio/antenna units' board if possible so the board is perpendicular to the transmtter or receiver on the opposite end of the system, keeping the antenna 6.1" away from any metal.

INTERFERENCE - The PRL-1600 is a Frequency-Hopping Spread Spectrum system the communicates on 50 of the 64 frequencies. It may or may not work in substations or in other areas where there is high-power energy fields exist or where RF energy may jam the signal. The electromagnetic field around high voltage conductors may cause enough interference so as to keep the system from transmitting correctly or may significantly reduce the range of the system. It has been reported that other high-power RF transmitters mounted within close proximity can jam the signal even though they are not using the same frequencies.

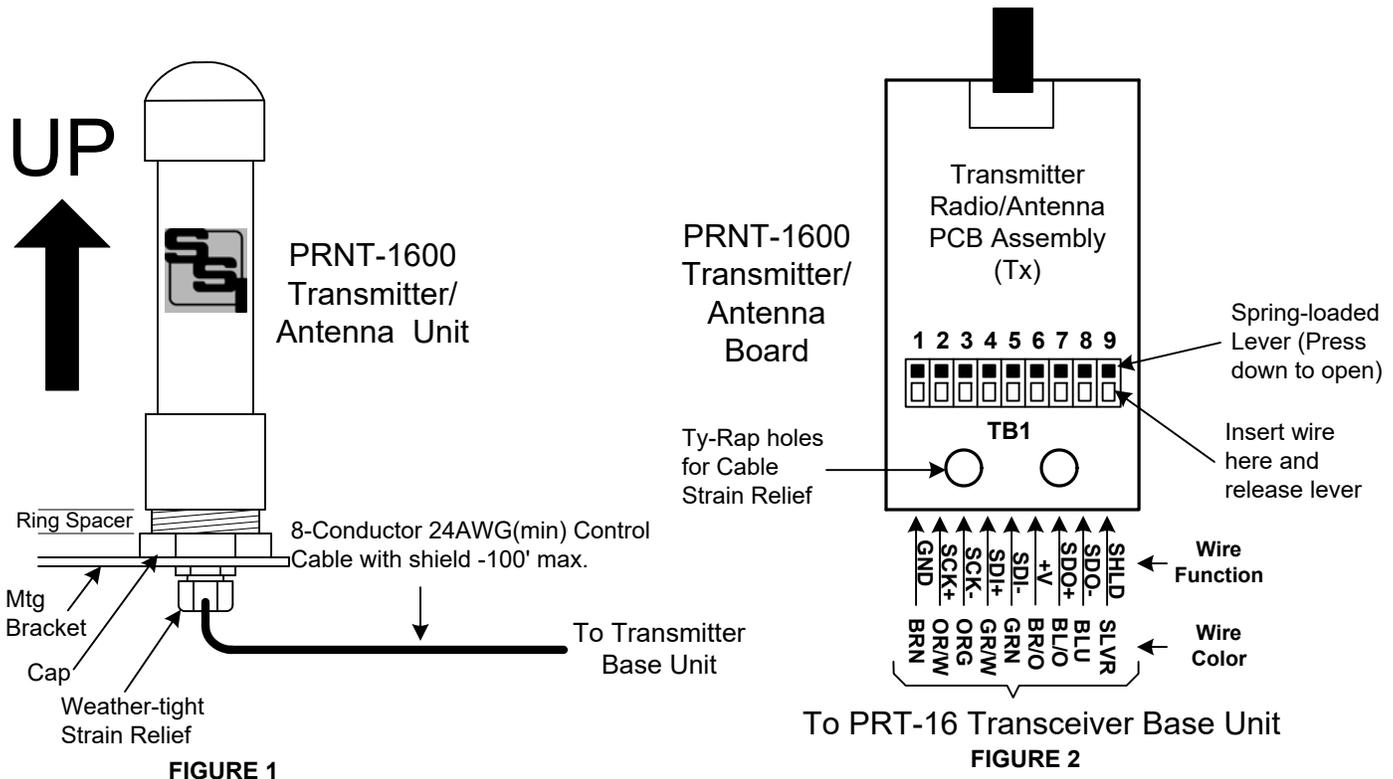# SOLID STATE INSTRUMENTS
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INSTRUCTION SHEET
PRNT-1600 PULSE RADIO TRANSMITTER

UP

PRNT-1600
Transmitter/
Antenna Unit

Ring Spacer

Mtg
Bracket

Cap

Weather-tight
Strain Relief

8-Conductor 24AWG(min) Control
Cable with shield -100' max.

To Transmitter
Base Unit

FIGURE 1

PRNT-1600
Transmitter/
Antenna
Board

Transmitter
Radio/Antenna
PCB Assembly
(Tx)

1 2 3 4 5 6 7 8 9

Spring-loaded
Lever (Press
down to open)

TB1

Ty-Rap holes
for Cable
Strain Relief

Insert wire
here and
release lever

Wire Function	GND	SCK+	SCK-	SDI+	SDI-	+V	SDO+	SDO-	SHLD
Wire Color	BRN	ORW	ORG	GR/W	GRN	BR/O	BL/O	BLU	SLVR

To PRT-16 Transceiver Base Unit
FIGURE 2

MOUNTING POSITION - (See Note Below on Cable Connection before mounting) The PRNT-1600 Transmitter/ Antenna unit 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 PRNR-1600 Receiver/Antenna unit. Mount using the aluminum mounting bracket supplied, making sure that the center of the transmitter is at least 6.1" 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 PRNT-1600 Transmitter/Antenna unit case.
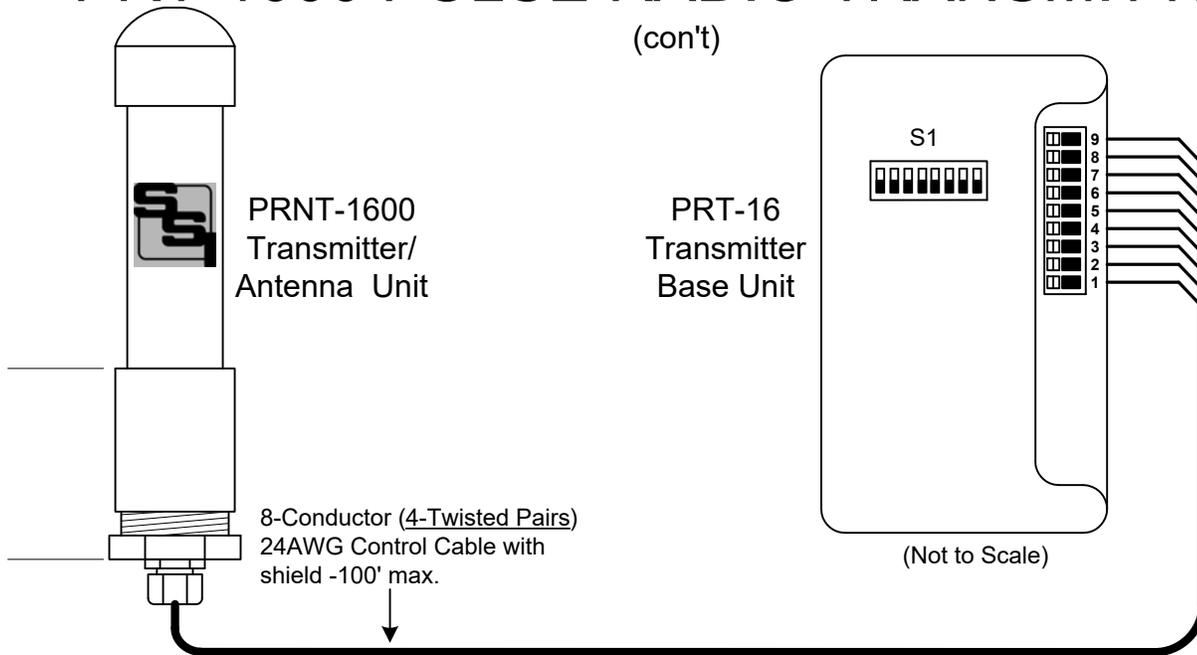
CABLE CONNECTION TO PRNT-1600 - It is advisable that this task is performed, if possible, in a convenient, clean work area before mounting the Transmitter unit. Connect the 4-twisted pair 24AWG(min) shielded control cable to the 9-position connector on the PRNT-1600 Board. Access the PCB Assembly by unscrewing the Transmitter housing cap on the bottom of the unit. Remove the Transmitter 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. Alternately, non-metalic conduit ("Seal-Tight" or "Carflex") may be used to connect directly to the housing and run the control cable to the Base unit inside this conduit.

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 a cable tie (ty-rap) through the Transmitter 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 Transmitter 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 Transmitter Assembly into the housing. Tighten the cap until spacer is tight. For best results, keep the length between the Transmitter and the Base Unit to the minimum practical distance. When Transmitter installation is complete, secure cap to mounting bracket using sheet metal screw in slot.

INSTRUCTION SHEET
PRT-1600 PULSE RADIO TRANSMITTER
(con't)

PRNT-1600
Transmitter/
Antenna Unit

PRT-16
Transmitter
Base Unit

S1

8-Conductor (4-Twisted Pairs)
24AWG Control Cable with
shield -100' max.

(Not to Scale)

POWER INPUT - The PRNT-1600 receives its power supply from the PRT-16 Transmitter Base unit.

METER INPUTS - See the PRT-16 Base Unit Instruction Sheet for detailed information on connecting the K-Y pulse inputs to the Electric Meter's KYZ Pulse output.

RADIO OUTPUT - The PRT-1600's Transceiver/Antenna Unit(PRNT-1600) contains a 900MHz band FHSS radio transceiver with an integral antenna mounted inside the unit. See diagram for mounting method and considerations. Transmission is LINE OF SIGHT up to approximately 5,000 feet max. 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-1600's operating parameters.

TRANSMITTER CHANNEL - Set the channel number (hop sequence) using DIP Switches #1 through #3 ON S1 as shown in Table 1 on page 4. This is set on the PRT-16 Transmitter Base Board.

NOTICE TO USER -

FCC ID: TIT-PRT-1600

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
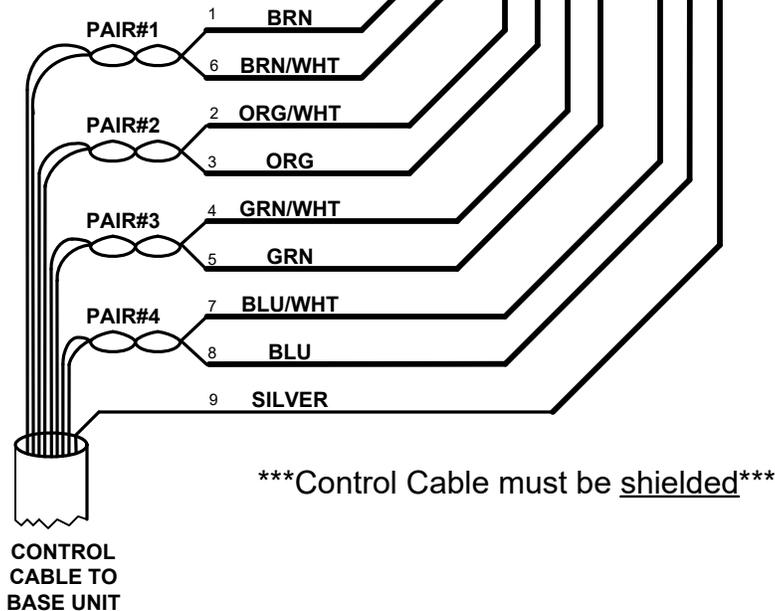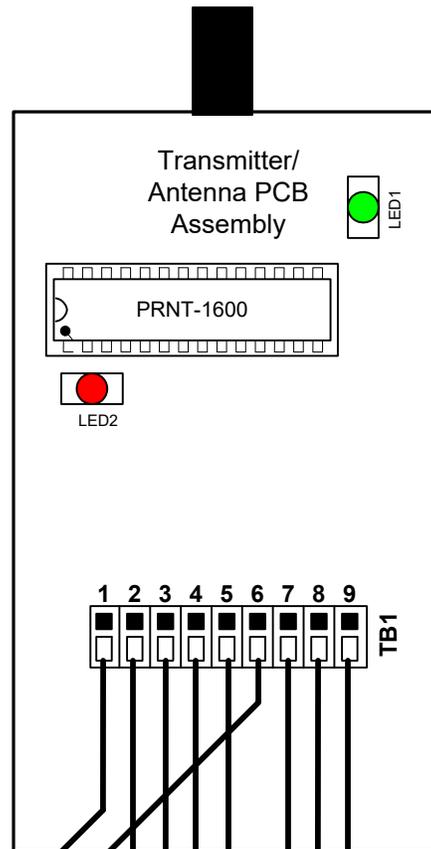
1. This device may not cause harmful interference; and

2. This device must accept any interference received including interference that may cause undesired operation.

INSTRUCTION SHEET
PRNT-1600 RADIO/ANTENNA UNIT WIRING

Wire Connection Assignments

Terminal #	Function	Pair #	Color	Size (AWG)
1	GROUND	1B	BRN	24
2	SCK+	2A	ORG/WHT	24
3	SCK-	2B	ORG	24
4	SDI+	3A	GRN/WHT	24
5	SDI-	3B	GRN	24
6	VIN	1A	BRN/WHT	24
7	SDO+	4A	BLU/WHT	24
8	SDO-	4B	BLU	24
9	SHIELD	-	SILVER	24

Transmitter/
Antenna PCB
Assembly

LED1

PRNT-1600

LED2

1 2 3 4 5 6 7 8 9   TB1

PAIR#1
1 BRN
6 BRN/WHT

PAIR#2
2 ORG/WHT
3 ORG

PAIR#3
4 GRN/WHT
5 GRN

PAIR#4
7 BLU/WHT
8 BLU

9 SILVER

**CONTROL
CABLE TO
BASE UNIT**

Control Cable must be <u>shielded</u>

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INSTRUCTION SHEET
PRT-16 BASE UNIT

Setting the System CHANNEL - Each system -- the Transmitter and Receiver -- must operate on one of six different channels. A "channel" is a collection of 50 specific frequencies that are arranged in a specific "hop sequence". A unique channel allows multiple systems to operate in the same radio airspace without any interference with each other. Therefore, the transmitter and receiver must have the same channel setting. The channel address is set using a 3-bit binary code. See **Table 1** at right for complete list of the channels. Note that Channel #6 is the highest channel number and even though there are eight unique switch combinations, Channel 6 is the highest channel that can be selected. The last three switch combinations all result in Channel #6 being selected.
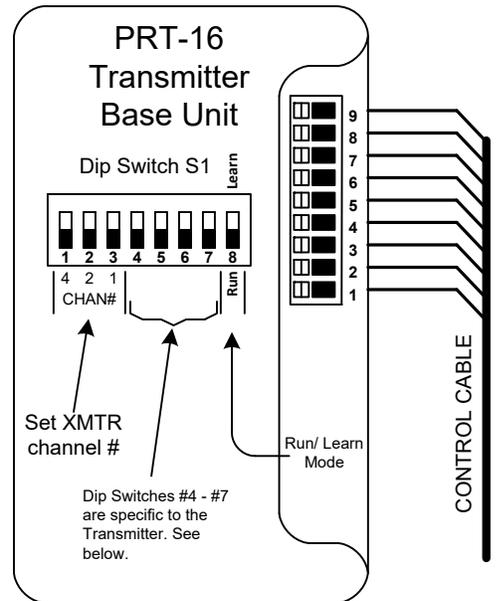
Switch #4 - Not used on line-powered systems.

Switch #5 - Not used.

Switch #6 - Not used

Switch #7 - Setting the Transmitter Input Mode - The PRL-1600 can operate in the Form C or Form A modes. In the Form C (3-Wire) mode, each input channel uses the K, Y and Z inputs. Two independent 3-Wire meter pulse channels can be transmitted. In the Form A (2-Wire) mode, each pulse channel uses the K (common) and a Y input. Four independent 2-Wire meter pulse channels can be transmitted. Set **Switch #7** to the **DOWN** position for the Form A mode and **UP** for Form C mode.

Switch #8 - Pairing the Transmitter and Receiver - The PRT-1600 System requires that each Transmitter and Receiver are paired together. Each Transmitter must learn the address of the Receiver it is designated to talk to. This makes it possible for the Transmitter to only talk to the designated Receiver and ignore other devices sending and receiving information on a particular frequency. After installation is complete, perform the pairing procedure described on page 15 ONLY IF the system has not been previously paired at the factory. *****Do not switch #8 UP if the system is already paired.*****

PRT-16 Transmitter Base Unit

Dip Switch S1

4 2 1 CHAN#

Run

Learn

Set XMTR channel #

Run/ Learn Mode

Dip Switches #4 - #7 are specific to the Transmitter. See below.

CONTROL CABLE

TABLE 1

CHANNEL#	SW#1	SW#2	SW#3
1	DN	DN	DN
2	DN	DN	UP
3	DN	UP	DN
4	DN	UP	UP
5	UP	DN	DN
6	UP	DN	UP
6	UP	UP	DN
6	UP	UP	UP

TABLE 2

Mode	SW#4	SW#5	SW#6
DEFAULT	DN	DN	DN

TABLE 3

Input Mode	SW#7
FORM A (2W)	DN
FORM C (3W)	UP

TABLE 4

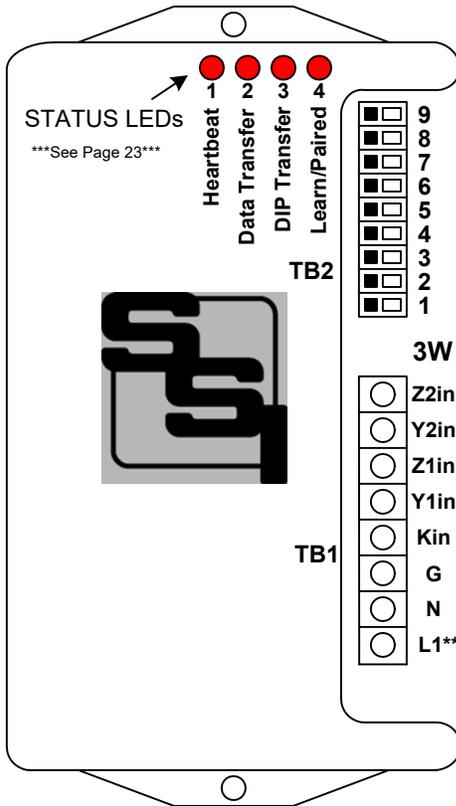| Run/Learn	SW#8
RUN	DN
LEARN	UP

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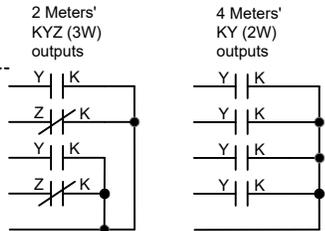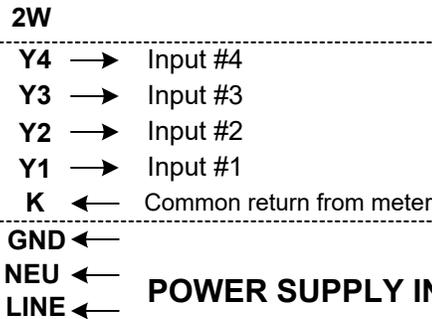E-mail: support@brayden.com

INSTRUCTION SHEET
PRT-16 PULSE TRANSMITTER BASE

STATUS LEDs
See Page 23

1 Heartbeat
2 Data Transfer
3 DIP Transfer
4 Learn/Paired

TB2

Wire Function	Wire Color
SHLD	SVR
SDO-	BLU
SDO+	BL/W
+V	BR/W
SDI-	GRN
SDI+	GR/W
SCK-	ORG
SCK+	OR/W
GND	BRN

To PRNT-1600 Transmitter Radio/ Antenna Unit

24AWG (min)/8-conductor (4-twisted pairs) with shield 100' max. See Page 8.

3W / **2W**

2 Meters' KYZ (3W) outputs | 4 Meters' KY (2W) outputs

TB1

3W	2W	
Z2in	Y4 →	Input #4
Y2in	Y3 →	Input #3
Z1in	Y2 →	Input #2
Y1in	Y1 →	Input #1
Kin	K ←	Common return from meter
G	GND ←	
N	NEU ←	**POWER SUPPLY INPUT**
L1**	LINE ←	

** If the L2 terminal is not loaded, the L1 is auto-ranging from 120-277VAC. If both L1 and L2 are loaded, then use the appropriate terminal for the supply voltage used. L1=120VAC; L2=208-277VAC.

MOUNTING POSITION - The PRT-16 Base unit may be mounted in any position.

ENCLOSURE - The PRT-16 base unit is housed in a polycarbonate base and cover and is designed to be mounted into another electrical enclosure suitable for the application. Optional NEMA 3R or NEMA 4X outdoor enclosures are available.

POWER INPUT - For 120 to 277VAC, connect the "hot" lead to the **L1** power supply terminal. Connect the neutral lead to the **NEU** terminal. Connect the **GND** terminal to Ground. (**See Note above about Auto-Ranging Power Supply)

INPUT CONFIGURATION - The PRT-16 accepts either 2 Form "C" (3-Wire) inputs using the K, Y & Z input terminals, or 4 Form "A" (2-Wire) inputs using the K & Y and K & Z terminals. See Dip Switch Definitions and Settings.

METER CONNECTIONS - Form A (2W) mode: Connect the PRT-12's "K" and "Y1" input terminals to meter's "K" and "Y" terminals. The "Yx" 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. Form C (3W) mode: Connect the PRT-16's "K", the "Y1" and the "Z1" input terminals to the meter's "K", "Y" and "Z" terminals. The PRT-16's "K" terminal is the system common (return).

OUTPUT TO PRNT-1600 TRANSMITTER/ANTENNA UNIT - Connect the 8-conductor **(4-TWISTED PAIRS)** 24AWG(min) underlined shielded control cable to the PRNT-1600 Transmitter/Antenna Unit. For best results, it is advisable to keep this length of this cable to the minimum practical distance.
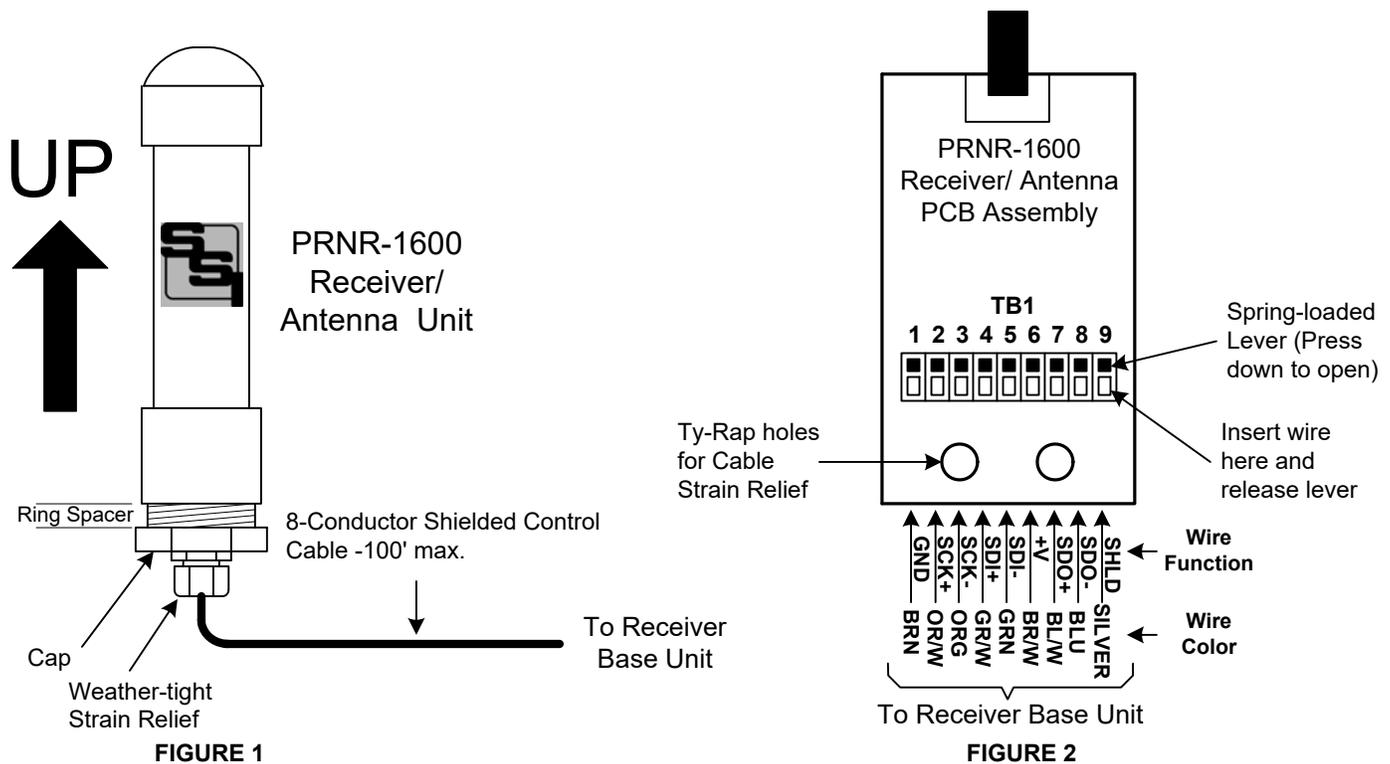
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INSTRUCTION SHEET
PRNR-1600 PULSE RADIO RECEIVER

UP

PRNR-1600
Receiver/
Antenna Unit

Ring Spacer

8-Conductor Shielded Control
Cable -100' max.

To Receiver
Base Unit

Cap

Weather-tight
Strain Relief

FIGURE 1

PRNR-1600
Receiver/ Antenna
PCB Assembly

TB1
1 2 3 4 5 6 7 8 9

Spring-loaded
Lever (Press
down to open)

Ty-Rap holes
for Cable
Strain Relief

Insert wire
here and
release lever

Wire Function	Wire Color
GND	BRN
SCK+	OR/W
SCK-	ORG
SDI+	GR/W
SDI-	GRN
+V	BR/W
SDO+	BL/W
SDO-	BLU
SHLD	SILVER

To Receiver Base Unit

FIGURE 2

MOUNTING POSITION - (See Note Below on Cable Connection before mounting) The PRNR-1600 Receiver/Antenna unit 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 (14' min.) to guarantee LINE-OF-SIGHT with the PRNT-1600 Transmitter/Antenna unit. Mount using the aluminum mounting bracket supplied, making sure that the antenna of the receiver is at least 6.1" 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 PRNR-1600 - Perform this task in a convenient, clean work area before mounting the Receiver unit. Connect the 8-conductor (4-twisted pairs) shielded control cable to the 9-position connector on the PRNR-1600 PCBA. (See page 14) Access the PCB Assembly by unscrewing the housing cap on the bottom of the unit. Remove the board 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 the connector lever, slip wire into hole and release. When all conductors are attached, attach the cable tie(ty-rap) included through the PCBA'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 PCB Assembly back into the cap's slots. Tighten the weather-tight connector (cable gland, if used) to secure the assembly in place. Rotate the board until it is perpendicular with the transmitter, making sure that the Antenna is 6.1" away from any metalic mounting surface. Put the ring spacer over the Cap's threads and tighten the cap until spacer is finger tight. For best results, keep the distance between the Receiver and the Base Unit to the minimum practical distance. When PCBA installation is complete, secure cap to mounting bracket using sheet metal screw in slot.
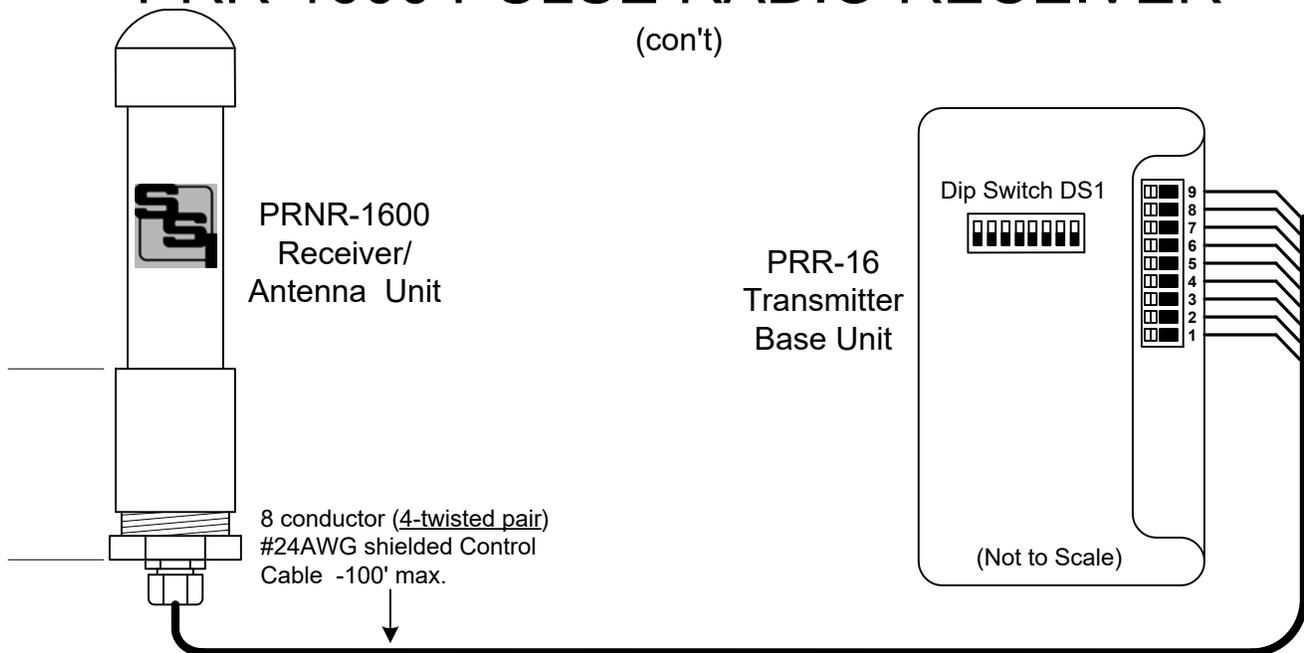
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INSTRUCTION SHEET
PRR-1600 PULSE RADIO RECEIVER
(con't)

PRNR-1600
Receiver/
Antenna Unit

PRR-16
Transmitter
Base Unit

Dip Switch DS1

9
8
7
6
5
4
3
2
1

(Not to Scale)

8 conductor (4-twisted pair)
#24AWG shielded Control
Cable -100' max.

POWER INPUT - The PRNR-1600 receives its power supply from the PRR-16 Receiver Base unit.

PULSE OUTPUTS - See the PRR-16 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, recorder, SCADA system, RTU, or other device configured to receive pulses.

RADIO RF INPUT - The PRNR-1600's Receiver/Antenna Unit contains a low-power 900MHz radio transceiver with an integral antenna mounted inside the unit. Observe the following application guidelines: 1.) Mount the transceiver as directed on the reverse side of this sheet; 2.) Locate the PRNR-1600 Receiver/Antenna unit so it is LINE-OF-SIGHT with the transmitter of the system; 3.) Ensure 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.

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.
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-16 BASE UNIT

Setting the System CHANNEL - Each system -- the Transmitter and Receiver -- must operate on one of six different channels. A "channel" is a collection of 50 specific frequencies that are arranged in a specific "hop sequence". A unique channel allows multiple systems to operate in the same radio airspace without any interference with each other. Therefore, the transmitter and receiver must have the same channel setting. The channel address is set as a 3-bit binary code. See **Table 1** at right for complete list of the channels. Note that Channel #6 is the highest channel number and even though there are eight unique switch combinations, Channel 6 is the highest channel that can be selected. The last three switch combinations all result in Channel #6 being selected.
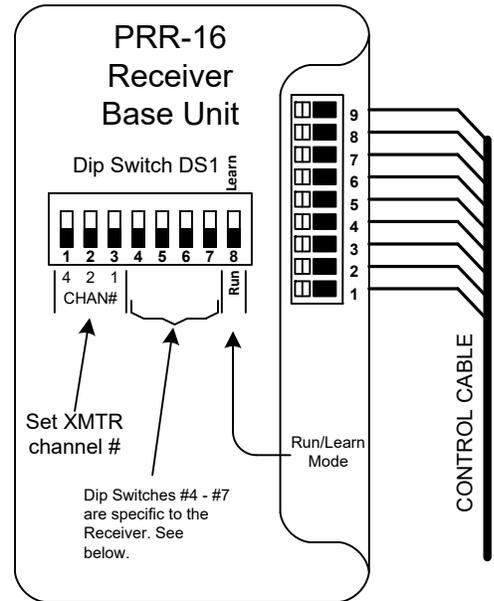
Switch #4 - Not used.

Switch #5 - Fixed Pulse Width. Sets the output pulse width to 50mS (**DOWN**) or 100mS (**UP**) when in Form A mode.

Switch #6 - Not used.

RSSI Indicator* - The receiver has an Signal Strength Indicator to show the signal strength of the Transmitter. **This is a test mode and can only be used during installation.** See Diagnostics on page 18. Once the system is operational, set **Switch #7** to **DOWN** to turn off the RSSI.

Pairing the Transmitter and Receiver - The PRL-1600 System requires that each Transmitter and Receiver are paired together. Each Transmitter must learn the address of the Receiver it is designated to talk to. This makes it possible for the Transmitter to only talk to the designated Receiver and ignore other devices sending and receiving information on a particular frequency. After installation is complete perform the **Pairing Procedure** described on page 16 ONLY if the pairing procedure has NOT been done at the factory. *****Do not put switch #8 into the UP position if the system has already been paired.*****

PRR-16 Receiver Base Unit

Dip Switch DS1

Set XMTR channel #

Dip Switches #4 - #7 are specific to the Receiver. See below.

Run/Learn Mode

CONTROL CABLE

TABLE 1

CHANNEL#	SW#1	SW#2	SW#3
1	DN	DN	DN
2	DN	DN	UP
3	DN	UP	DN
4	DN	UP	UP
5	UP	DN	DN
6	UP	DN	UP
6	UP	UP	DN
6	UP	UP	UP

TABLE 2

Mode	SW#4	SW#6
DEFAULT	DN	DN

TABLE 3

Pulse Width	SW#5
50 mS	DN
100 mS	UP

TABLE 4

RSSI Mode	SW#7*
RSSI Disable	DN
RSSI Enable	UP

TABLE 5

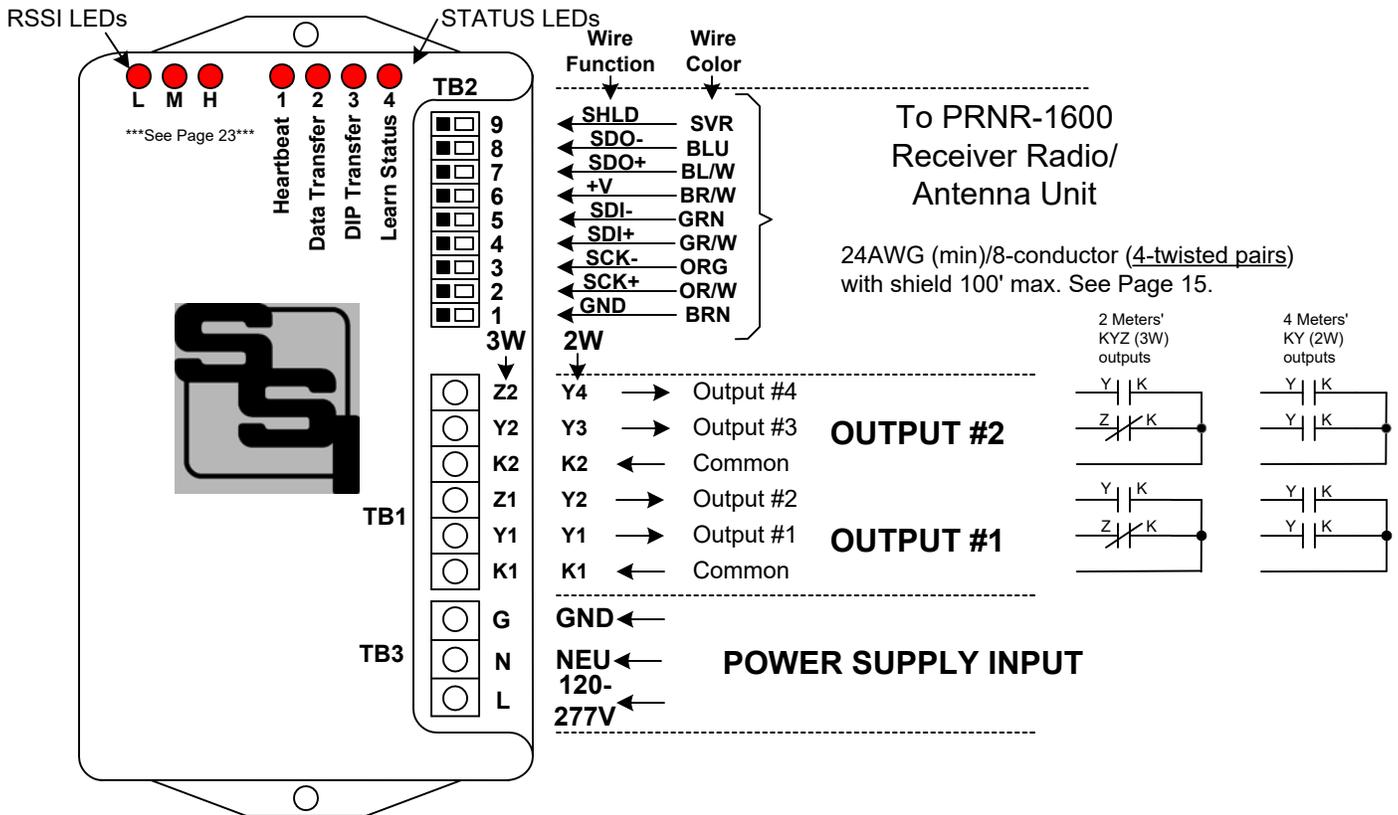| Run/Learn	SW#8
RUN	DN
LEARN	UP

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INSTRUCTION SHEET
PRR-16 PULSE RECEIVER BASE UNIT

RSSI LEDs   STATUS LEDs

L M H   **1 2 3 4**

See Page 23

Heartbeat, Data Transfer, DIP Transfer, Learn Status

TB2

Wire Function	Wire Color
SHLD	SVR
SDO-	BLU
SDO+	BL/W
+V	BR/W
SDI-	GRN
SDI+	GR/W
SCK-	ORG
SCK+	OR/W
GND	BRN

9 8 7 6 5 4 3 2 1

3W   **2W**

To PRNR-1600 Receiver Radio/ Antenna Unit

24AWG (min)/8-conductor (4-twisted pairs) with shield 100' max. See Page 15.

2 Meters' KYZ (3W) outputs   4 Meters' KY (2W) outputs

TB1

3W	2W	
Z2	Y4 →	Output #4
Y2	Y3 →	Output #3 — **OUTPUT #2**
K2	K2 ←	Common
Z1	Y2 →	Output #2
Y1	Y1 →	Output #1 — **OUTPUT #1**
K1	K1 ←	Common

TB3

G	GND ←
N	NEU ←
L	120-277V ←

POWER SUPPLY INPUT

GENERAL - The PRR-16 serves as a base unit, and termination point for the PRNR-1600 receiver radio/antenna unit. It contains a power supply, output relays and all connection points for the receiver/antenna unit.

ENCLOSURE - The PRR-16 base unit is mounted on a aluminum base and is designed to be mounted into another electrical enclosure suitable for the application. Optional NEMA 3R and 4X raintight enclosures are available.

POWER INPUT - For a supply of 120-277VAC, use the the **L (Line)** terminal on TB3 for the "hot" lead. Connect the Neutral lead to the **N** terminal. Connect the **G** terminal to Ground. GROUND MUST BE CONNECTED TO A GOOD ELECTRICAL SYSTEM GROUND!!! If no true neutral exists, connect both N and G terminals to GROUND.

SIGNAL INPUT - The PRNR-1600 receiver/antenna unit connects to the 9-position connector labelled TB2. Terminals are numbered in the same order on the PRNR-1600 and the PRR-16. Connect #24AWG 8-conductor (4-twisted pairs) shielded control cable between the PRNR-1600 receiver/antenna board and the PRR-16 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.

STATUS LEDS - The PRR-16 has four status LEDs to indicate the status of the system at all times. See Page 23 for description of the Status LED functions.

RSSI SIGNAL STRENGTH INDICATOR - The PRR-16 contains a 3-LED bar graph that tells the relative signal strength coming from the Transmitter. It consists of three RED LEDs in the upper left-hand corner of the board.

OUTPUT CONFIGURATION - The PRR-16 contains four solid state Form A dry-contact outputs, two each for both "K", "Y" and "Z" outputs. Each solid state output is limited to 100mA@ 250VAC, 800mW maximum. 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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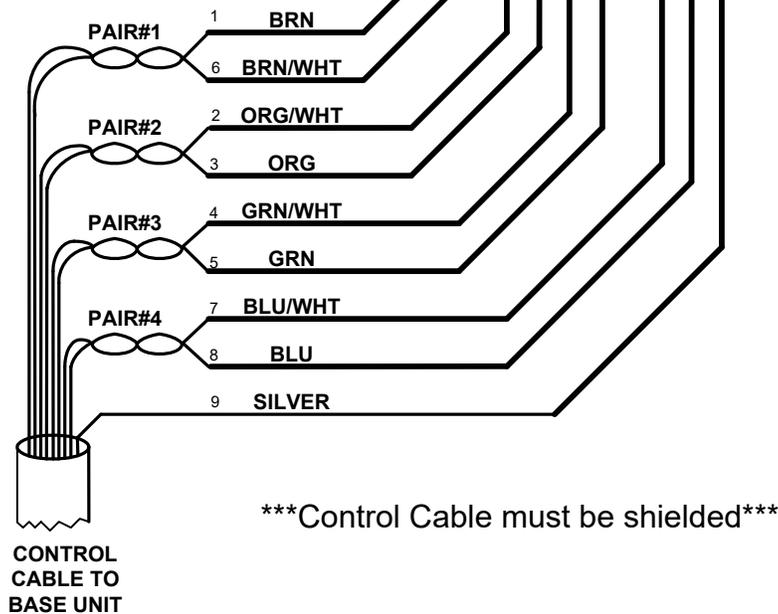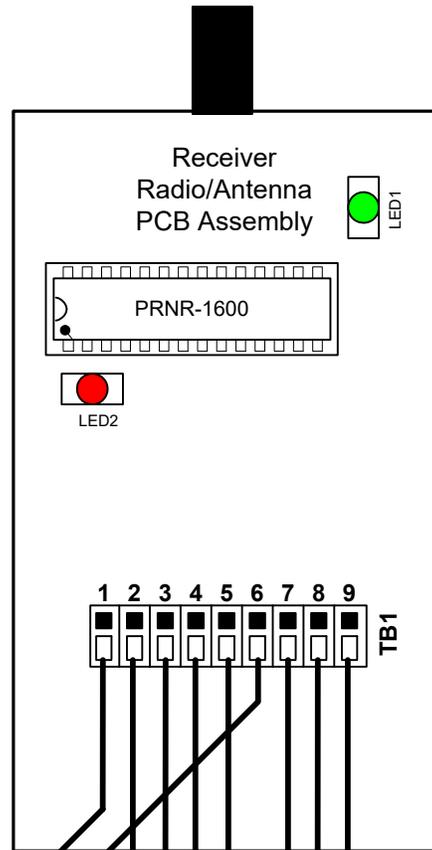Phone: (970)461-9600
E-mail:support@brayden.com

INSTRUCTION SHEET
PRNR-1600 RADIO/ANTENNA UNIT WIRING

Receiver
Radio/Antenna
PCB Assembly

LED1

PRNR-1600

LED2

Wire Connection Assignments

Terminal #	Function	Pair #	Color	Size (AWG)
1	GROUND	1B	BRN	24
2	SCK+	2A	ORG/WHT	24
3	SCK-	2B	ORG	24
4	SDI+	3A	GRN/WHT	24
5	SDI-	3B	GRN	24
6	VIN	1A	BRN/WHT	24
7	SDO+	4A	BLU/WHT	24
8	SDO-	4B	BLU	24
9	SHIELD	-	SILVER	24

1 2 3 4 5 6 7 8 9   TB1

PAIR#1
1 BRN
6 BRN/WHT

PAIR#2
2 ORG/WHT
3 ORG

PAIR#3
4 GRN/WHT
5 GRN

PAIR#4
7 BLU/WHT
8 BLU

9 SILVER

CONTROL
CABLE TO
BASE UNIT

Control Cable must be shielded

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INSTRUCTION SHEET
# PRR-16 PULSE RECEIVER BASE UNIT

(CON'T)

USING THE OUTPUT IN 3-WIRE MODE - When the PRL-1600 is operated in the Form C (3-Wire) mode, each output channel "toggles" back and forth like a single-pole, double throw switch. For one pulse there is continuity between K and Y (a closure) while there is no continuity between K and Z (an open). Upon the next pulse being received from the meter they reverse positions, K-Z closes and K-Y opens. In Form C mode, Y and Z are always opposite of each other. When one is closed and the other is open. There is logic in the PRNR-1600's software that disallows two pulses of the some type in a row in Form C mode. They MUST alternate.

Each KYZ output is isolated, meaning there is no voltage applied to it internally. The wetting voltage for each KYZ output of the PRR-16 output must be supplied by the receiving ("downstream") device or by an auxiliary power supply. The outputs are solid state and are non-polarized. They may be used for AC or DC voltages. The output is limited to 100mA@ 250VAC, <u>800mW</u> maximum. Fuses are sized at 1/10th amp (100mA). Do not exceed this rating as the solid state MOS-FET switching device may be destroyed. Transient voltage protection for the contacts of the solid state relays are provided by MOVs on board between the K and Y, as well as the K and Z outputs. Depending on user requirements the PRL-1600 can be operated in Form C mode and only two wires used on the output for the downstream device. This is perfectly acceptable, but remember to double the Form C pulse constant if your receiving device does not automatically adjust the pulse value.
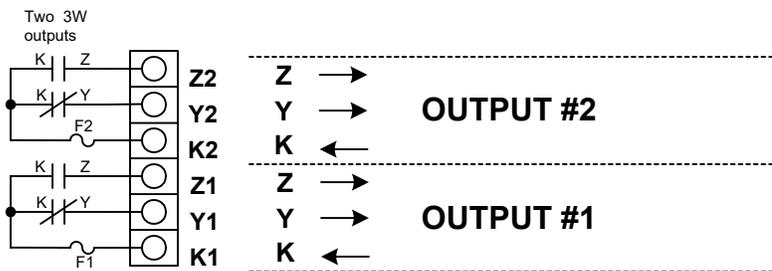
USING THE OUTPUT IN 2-WIRE MODE -

The PRR-16's two KYZ outputs contain four solid state Form A dry-contacts and may be used independently as four Form A outputs. In this case instead of Y and Z being opposite of each other they are independently used. See the numbering of the output terminals in the diagram below. Even though the devices are operated independently in Form A mode, each set (Y1-Y2 and Y3-Y4) must be operated at the same voltage, from the same voltage source.
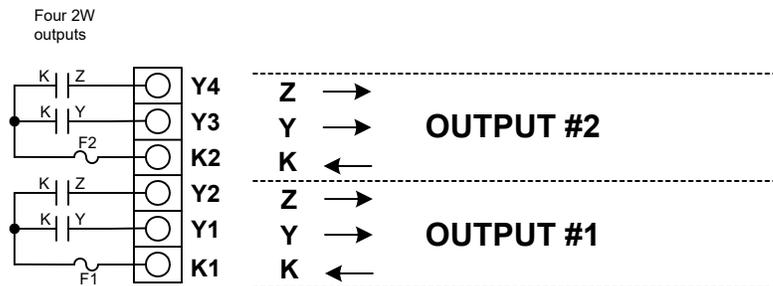
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Transmitter and Receiver Pairing Procedure (Learn Mode)

*** <u>THE PRL-1600 IS FACTORY PAIRED. DO NOT PAIR THE SYSTEM UPON INITIAL INSTALLATION.</u> ***

<u>Required only if re-pairing has not been done or if one end has been replaced.</u>

This procedure pairs the PRT-1600 Transmitter with a specific PRR-1600 Receiver. The PRL-1600 system WILL NOT work unless this procedure is completed. <u>The PRL-1600 system is factory paired and tested as a system</u>, so the pairing procedure is not normally necessary to do at installation. In the event that Dip Switch #8 is put in the UP position either accidentally or intentionally, the unit may be unpaired. Therefore, this procedure will need to be performed.

1. With the system powered down (OFF) at both ends, set the transmitter and receiver channel numbers (Dip Switches 1-3) to the same setting. (See instructions on pages 9 and 13 for the transmitter and receiver, respectively.

2. Set Dip Switch #8 on both the transmitter and receiver to the "UP" position to put the system in the Learn mode.

3. Turn on power to the PRR-1600 Receiver. The RED system status LED should flash slowly about once per second.

4. Turn on power to the PRT-1600 Transmitter. The RED system status LED should flash in slow mode about once per second for a few seconds and then flash fast, about 4 times per second. The fast flash means that the system has paired itself together. Once each end has learned the digital serial number of the other end, the Receiver LED will also start to flash fast when paired.

5. Return Dip Switch #8 to the "DOWN" position on PRR-16 Receiver Base <u>FIRST</u>. This puts the Receiver in the RUN (normal operation) mode.

6. Return Dip Switch #8 to the "DOWN" position on the PRT-16Transmitter Base <u>SECOND</u>. This will put the Transmitter into the RUN (normal operation) mode.

6. Once both units are in the RUN mode, after 10 to 20 seconds, you will see the KYZ outputs on the Receiver changing state to reflect the state of the transmitter's inputs.

7.   Once the system has been paired and is in RUN mode, AND data is being received by the Receiver, the LEARN/PAIRED LED on both ends will light in about 30-45 seconds and stay lit assuming a valid transmission is received and acknolwledgement is sent back within the last 35 seconds.   If this LED is on, this is definitive proof that the system is paired and receiving data.

8.) If the Transmitter and Receiver boards ever need to be changed or if the transmitter and receiver units ever have to be deployed in a new system with a different transmitter or receiver board, the pairing procedure will have to be performed again.
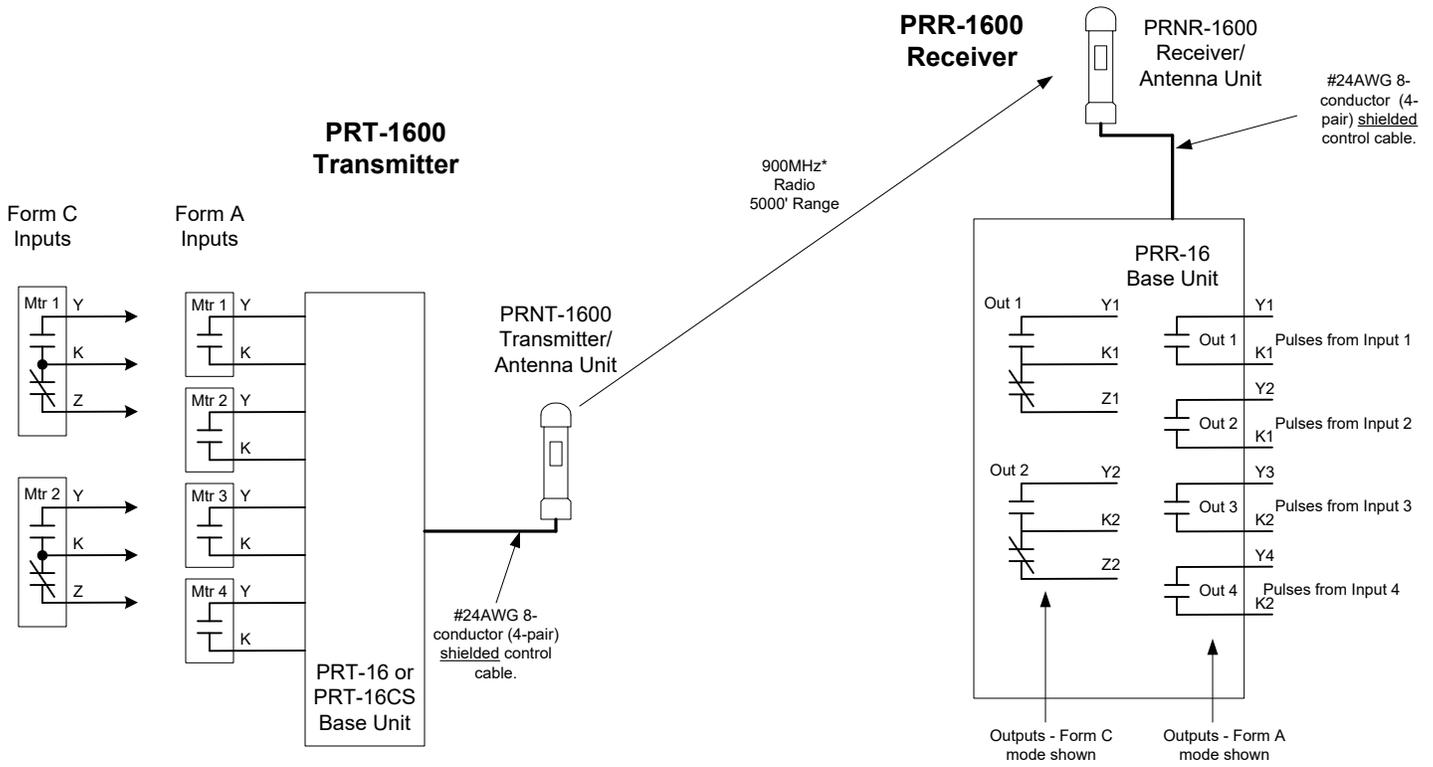
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PRL-1600 Wireless Pulse Link Application

PRR-1600 Receiver

PRNR-1600 Receiver/ Antenna Unit

#24AWG 8-conductor (4-pair) shielded control cable.

PRT-1600 Transmitter

900MHz* Radio 5000' Range

Form C Inputs

Form A Inputs

PRNT-1600 Transmitter/ Antenna Unit

Mtr 1 — Y / K / Z

Mtr 2 — Y / K / Z

Mtr 1 — Y / K

Mtr 2 — Y / K

Mtr 3 — Y / K

Mtr 4 — Y / K

PRT-16 or PRT-16CS Base Unit

#24AWG 8-conductor (4-pair) shielded control cable.

PRR-16 Base Unit

Out 1 — Y1 / K1 / Z1

Out 2 — Y2 / K2 / Z2

Out 1 — Y1 / K1 — Pulses from Input 1

Out 2 — Y2 / K1 — Pulses from Input 2

Out 3 — Y3 / K2 — Pulses from Input 3

Out 4 — Y4 / K2 — Pulses from Input 4

Outputs - Form C mode shown

Outputs - Form A mode shown

Notes:

1.) Configure the Transmitter Base Unit for Form A or Form C mode. Make sure that the utility configures all the meter's outputs for toggle mode, not momentary mode. Form C (3-wire) mode is preferred from the meter to the transmitter's input(s). Set the Transmitter to Form C by setting Dip Switch #7 to the UP position. No Form C or Form A selection is necessary on the Receiver Base Unit.

2.) Dip Switch #8 must be DOWN on the both ends for normal operation (in RUN mode).

3.) Transmission is Line-Of-Sight and must not be blocked by trees, buildings, metal poles, trucks, railcars, etc.

4.) Transmission distance is variable up to 5000' depending on conditions. Distance and reliability will increase as the height mounted above the ground increases. During extremely heavy rain, transmissions may not be reliable.

PRL-1600 Wireless Pulse Link System Diagram	REVISIONS			Solid State Instruments div. of Brayden Automation Corp. 6230 Aviation Circle Loveland, CO 80538 (970)461-9600 www.solidstateinstruments.com
	NO.	DATE	DESCRIPTION	
DATE ORIGINAL 06/17/2024 — SCALE N/A				
LATEST REVISION A — JOB NO. — CHECKED — DRAWN WHB				

Troubleshooting and Tech Support

1.) Use **shielded** 4 twisted pair control cable between the PRT-16 Base Unit and the PRNT-1600 Transmitter/Antenna unit, as well as between the PRR-16 Base Unit and the PRNR-1600 Receiver/Antenna unit. Solid State Instruments' part number 0715-1050 is an 8-conductor (4 twisted pairs) #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 acquire your own twisted pair cable but insure a high-quality communications cable with four #24 stranded conductor pairs. Do not use solid conductor wire, especially thermostat wire. Do not use any heavier wire than #22 AWG since there is limited space and it will be difficult to work with.

2.) Make sure that the transmission path between the Transmitter and the Receiver is free of ANY obstacles or anything that can interrupt the radio transmission line-of-sight path between the transmitter and receiver. The Transmitter or Receiver Radio/Antenna units <u>MUST</u> be in continuous sight of each other – no interruptions from cars, trucks, railcars, trees, light poles, metal buildings, ANYTHING!

3.) Mount the Transmitter or 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. Do not mount the Transmitter Radio/Antenna unit within 50 feet of high voltage powerlines.

4.) Program the pulse constant (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 well below the system's maximum pulse throughput rate but ensures excellent reliability. NOTE: the PRL-1600 system does not change or modify the pulse values in any way. The pulse value is completely 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. Some meters are different, and the programming of the pulse constant may vary from meter brand to meter brand.

5.) In extremely heavy rain or snow, the system may not be able to accurately receive all pulses transmitted. Like any other RF system, with enough interference, communications can be lost.

6.) RED System Status LED Light - The PRT-16 and PRR-16 Base Unit boards have Status LEDs to help the installer determine whether the system is operating correctly. Please see the tables on the Page 22:

7.) If there is interference on the "hop sequence" channel you have selected, change to another channel. There are six channels to choose from. Both ends must have the same channel number. The system does not   need to be powered down to change the channel #. However, it will not communicate while the channel numbers are not identical.

8. The system's maximum reliable transmission distance will change with each installation since it is dependent on all of the environmental and electrical factors of each particular installation. While the distance is nominally specified as up to 5,000 feet, it may not work at the full range in some installations.

9. The PRT-16 Transmitter and PRR-16 Receiver base units are designed for mounting inside another control cabinet or enclosure appropriate and suitable for the particular application. If a NEMA 4X enclosure is required, order SSI P/N: 05000-47001A for the NEMA 4X Fiberglass 12" x 10" x 4" enclosure option. This option includes an interior mounting plate that the PRT-16 or PRR-16 mounts onto.

Troubleshooting Procedure:

- Check all wiring connections especially the control cable connections between each Radio/Antenna unit and its respective Base unit.
- Check that power is on and applied properly to all components.
- Check the RED and GREEN LEDs on the Transmitter and Receiver Radio/Antenna boards in the white tube and make sure they are flashing a burst of about 6-8 rapid flashes, once each 10 seconds.
- Check to make sure that all Transmitter and Receiver units are both on the same channel (Dip Switches #1-3).
- Make sure that there is not another system operating in the same RF airspace that has the same channel hop sequence selected.
- Make sure that the Transmitter is set for the desired Input Mode, Form A (2-wire) or Form C (3-wire). (Dip Switch #7 on Transmitter base unit).
- Make sure the output is set to the desired 2-Wire Output mode, either Toggle or 100mS Fixed. All channels operate in the same mode depending on Dip Switch #5.
- Check Red LED's on each Base Unit's input or output, and make sure they are flashing with pulses received from the meter.
- Use the Signal Strength LEDs (RSSI) on the Receiver to measure signal strength. Put Dip Switch #7 on the Receiver base unit in the UP position to enable the RSSI indicator. Put in DOWN position when test complete to turn off RSSI. **Do not leave the RSSI indicator on during normal operation. Pulses will be lost if the RSSI is left on. The RSSI is a diagnostic tool only and not for normal operation.**
- Check that the antennas are securely screwed to the Radio/Antenna board.
- Use an ohmmeter or continuity checker across the KY terminals of each output and determine whether each is opening and closing by watching the output's resistance change. When the output is open, there should be infinite resistance. When the output is closed, the on-state resistance should be approximately 18 to 25 ohms.
- Is the "downstream" equipment, that is receiving the pulses from the Receiver, providing a wetting voltage to the dry-contact output of the Receiver? Is the wetting voltage within the maximum specifications?

Appendix A - PRT-1600 Dip Switch Settings and LED Indicators

PRT-16A Transmitter Base DIP Switch Settings — V2.01

Hop Sequence			LED1-LED5 Timeout (10 minutes)		# of SPI Transmissions		Not Used		Input Mode		Learn Mode	
DIP1	DIP2	DIP3	DIP4		DIP5		DIP6		DIP7		DIP8	
			UP	Enabled	UP	6	UP	XXX	UP	Form C	UP	LEARN
			DOWN	Disabled	DOWN	4	DOWN	XXX	DOWN	Form A	DOWN	RUN

000 - Channel 1
001 - Channel 2
010 - Channel 3
011 - Channel 4
100 - Channel 5
101 - Channel 6
110 - Channel 5
111 - Channel 5

Note1: Down (0), Up (1) -- Default All Down.
Note2: Learn Mode supercedes all modes of operation.

PRNT-1600A Transmitter Radio/Antenna LED Indicators — V2.01

	LED1 (D4 GREEN) Data Transfer	LED2 (D3 RED) RF Module Communication
On Power Up		
Interval	------	None
10 Quick Blinks	------	Unable to communicate with RF Module
Run Mode		
Interval	10 Seconds	------
Burst/Blinks	Data Transmit/Receive	------
1 Blink		Every 10 sec Data Transferred
3 Blinks		Every 10 s - Packet Received/CRC16 Error
Learn Mode		
Burst/Blinks	Data Transmit/Receive	
Slow Blink		Learning
Fast Blink		Done Learning

PRT-16A Transmitter Base LED Indicators — V2.01

	LED1 Heartbeat	LED2 (DATA XFER) Data Transfer/Ack	LED3 (DIP XFER) DIP Settings Transfer/Ack	LED4 (LEARN/PAIRED) Learn Status/Connection Status	
Run Mode					
Interval	3 Seconds	10 Seconds	1 Second	35 Seconds	
1 Blink	------	Data Transfer	DIP Transfer	------	
2 Blinks	------	Data Transfer & Ack	DIP Transfer & Ack	------	
3 Blinks					
On				Connected	
Off				No Connection	
Learn Mode					
Interval	3 Seconds	10 Seconds	1 Second		
1 Blink		Data Transfer	DIP Transfer		
2 Blinks		Data Transfer & Ack	DIP Transfer & Ack		
Slow Blink	------	------	------	Learning	
Fast Blink	------	------	------	Done Learning	

Appendix B - PRR-1600A Dip Switch Settings and LED Indicators

PRR-16A Receiver Base DIP Switch Settings											V2.01

Hop Sequence			LED1-LED5 Timeout (10 minutes)		Fixed Pulse Width		Not Used		RSSI Enable		Learn Mode	
DIP1	DIP2	DIP3	DIP4		DIP5		DIP6		DIP7		DIP8	
			UP	Enabled	UP	100mS	UP	XXX	UP	Enabled	UP	LEARN
			DOWN	Disabled	DOWN	Toggle	DOWN	XXX	DOWN	Disabled	DOWN	RUN

000 - Channel 1
001 - Channel 2
010 - Channel 3
011 - Channel 4
100 - Channel 5
101 - Channel 6
110 - Channel 5
111 - Channel 5

Note1: Down (0), Up (1) -- Default All Down.
Note2: Learn Mode supercedes all modes of operation.

PRNR-1600A Receiver Radio/Antenna LED Indicators			V2.01

	LED1 (D4 GREEN) Data Transfer	LED2 (D3 RED) RF Module Communication
On Power Up		
Interval	------	None
10 Quick Blinks	------	Unable to communicate with RF Module
Run Mode		
Interval	10 Seconds	None
Burst/Blinks	Data Transmit/Receive	
1 Blink		Every 10 sec Data Transferred
3 Blinks		Every 10 s - Packet Received/CRC16 Error
Learn Mode		
Burst/Blinks	Data Transmit/Receive	
Slow Blink		Learning
Fast Blink		Done Learning

PRR-16A Receiver Base LED Indicators					V2.01

	LED1 Heartbeat	LED2 (DATA RCV) Data Transfer/Ack	LED3 (DIP XFER) DIP Settings Transfer/Ack	LED5 (LEARN/PAIRED) Learn Status/Connection Status	
Run Mode					
Interval	3 Seconds	10 Seconds	1 Second	35 Seconds	
1 Blink	------	Data Transfer	DIP Transfer	------	
2 Blinks	------	Data Transfer & Ack	DIP Transfer & Ack	------	
3 Blinks					
On				Connected	
Off				No Connection	
Learn Mode					
Interval	3 Seconds	10 Seconds	1 Second		
1 Blink		Data Transfer	DIP Transfer		
2 Blinks		Data Transfer & Ack	DIP Transfer & Ack		
Slow Blink	------	------	------	Learning	
Fast Blink	------	------	------	Done Learning	

APPENDIX C
STATUS LED DEFINITIONS - A-Series

RSSI LEDs (PRR-16 Receiver Only)

SYSTEM STATUS LEDs (Both Boards)

L M H

Heartbeat 1
Data Transfer 2
DIP Transfer 3
Learn Status 4

TB2

9 8 7 6 5 4 3 2 1

Z2
Y2
K2
Z1
Y1
K1
G
N
L

TB1

TB3

PRR-16 Receiver Base Unit (Shown)
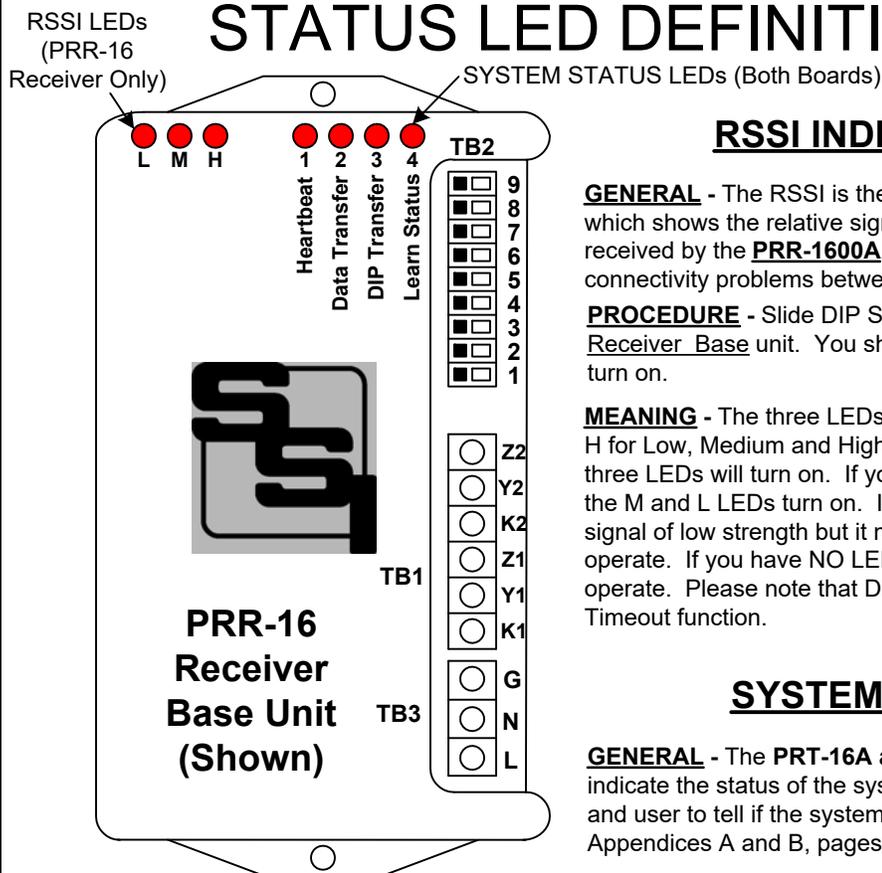
RSSI INDICATOR LEDS

GENERAL - The RSSI is the Receiver Signal Strength Indicator bar graph which shows the relative signal strength of the PRT-1600A's RF Signal as received by the **PRR-1600A**. This is helpful in troubleshooting non-connectivity problems between the transmitter and receiver.

PROCEDURE - Slide DIP Switch #7 to the **UP** position on the PRR-16A Receiver Base unit. You should see one or more of the three RSSI LED's turn on.

MEANING - The three LEDs on the **PRR-16A(only)** are labeled L, M and H for Low, Medium and High. If you have a strong or "High" signal, all three LEDs will turn on. If you have a Medium strength signal, you will see the M and L LEDs turn on. If you have a Low signal then you have a signal of low strength but it may be sufficient for the PRL-1600A to operate. If you have NO LED's on, then the PRL-1600A system will not operate. Please note that DIP Swtich #4 must be down to disable the LED Timeout function.

SYSTEM STATUS LEDS

GENERAL - The **PRT-16A and PRR-16A** have four System Status LEDs to indicate the status of the system at all times. These LEDs allow the installer and user to tell if the system is paired and operating correctly. More Detail in Appendices A and B, pages 21 and 22.

HEARTBEAT - LED #1 - LED#1 is the "heartbeat LED and blinks once every 3 seconds to tell the user/installer that the processor(microcontroller) on the PRT/PRR-16A base units is running and its software program is being executed. If LED #1 is not blinking, the processor is not running or the board has no power being applied to it. Check wiring and power.

DATA TRANSFER - LED #3 - LED #2 is the Data Transfer LED that shows that the data has been passed from the Base unit to its respective Radio/Antenna unit. This will blink twice every 10 seconds in normal operation. The first blink indicates that the Base unit's processor has sent the data to the Radio/Antenna unit's processor. The second blink, which should immediately follow the first blink, means that the Radio/Antenna unit's processor has received the data packet and sent back an acknowledgement to the Base unit indicating that it has received and processed it.

DIP TRANSFER - LED #3 - LED #3 is the Dip Transfer LED which shows that the dip switch settings data has been transfered from the Base unit to the Radio/Antenna unit. This will blink twice every second in normal operation. The first blink indicates that the Base unit's processor has sent the DIP data to the Radio/Antenna unit's processor. The second blink, which should immediately follow the first blink, means that the Radio/Antenna unit's processor has received the DIP data packet and sent back an acknowledgement to the Base unit indicating that it has received and processed it.

LEARN STATUS - LED #4 - LED #4 is DUAL PURPOSE. This a new feature in Version 2.0x firmware. When in the **LEARN** mode, LED #4 shows the status of the Learning process. (See Page 17). Please refer to the Pairing process sheet for a description of this LED's blinking pattern.

In the **RUN** Mode, this LED shows definitively that the system is paired and operating correctly. LED #4 on the PRR-16A Receiver Base Unit shows that the receiver has received a valid transmission from the transmitter in the last 35 seconds. LED #4 on the PRT-16A shows that the transmitter has received an acknowledgement back from the receiver in the last 35 seconds. If this LED is not lit, it is an indication that power is off at the opposite end, that the transmitter and receiver are not paired, or that some other condition exists that is causing the transmitter and receiver not to communicate or communicate reliably every 35 seconds. This could be caused by a Line-of-Sight path interterruption or blockage, or a high ambient electrical noise issue.

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FCC / IC NOTICES

This product contains FCC ID: OJM-HUMA-900 / IC: 5840A-HUMA900
This device complies with Part 15 of the FCC rules and Industry Canada license-exempt RSS standards. Operation of this device 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.

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.

Any modifications could void the user's authority to operate the equipment.

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. 'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.