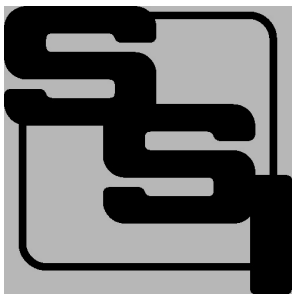
PRL-1000 Wireless Pulse Link System Technical Manual



Solid State Instruments
A division of Brayden Automation Corporation
6230 Aviation Circle
Loveland, CO, USA 80538
(970)461-9600
(970)461-9605
email: sales@brayden.com

PRL-1000 Wireless Pulse Link System

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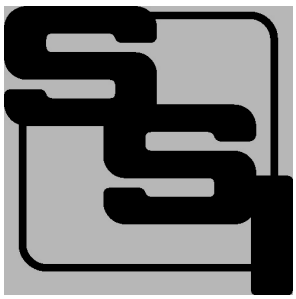


Solid State Instruments

A division of Brayden Automation Corporation
6230 Aviation Circle
Loveland, CO, USA 80538
(970)461-9600 8AM - 5PM Mountain Time
(970)461-9605 Fax
email: support@brayden.com

Introduction

The PRL-1000 Pulse Radio Link is a hub and node system that collects KYZ pulses from up to 8 separate meters wirelessly. The short-hop PRL-1000 has a range of up to 1000 feet depending on site topography and solves the problem of getting pulses across parking lots, vacant lots or other obstacles. With the PRL-1000, you're now able to connect real-time KYZ pulses from eight meters' pulse initiators back to one point called the "Hub". All pulses from each meter are independently outputted on one of the eight channels, corresponding with each Node's address from 1 to 8. For example, pulses going into Node number 7 will appear on the Hub's #7 output. The PRL-1000 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 mitigated since there is no electrical connection between the two devices.

The PRL-1000 Radio Pulse Link system consists of one PRH-1000 Hub and up to eight PRN-1000 Nodes. The system operates at one of 8 frequencies in the 903 to 921MHz and allows unlicensed operation by the user, allowing multiple systems to operate in the same radio airspace. The PRL-1000 will nominally transmit pulses 1000 feet in an unobstructed line-of-sight configuration. Longer distances may be possible with optimal site conditions.

PRH-1000 HUB

The PRH-1000 Hub consists of the following:

*PRH-1000 Pulse Radio Hub Transmitter/Antenna Unit

*PRH-1 Pulse Radio Hub Base Unit

The PRH-1000 contains the transceiver radio, a microcomputer and all the circuitry and software to coordinate the operation of the Nodes. The PRH-1 Base Unit contains the power supply, output relays and termination points where all connections are made. Eight Form A (2-wire) output channels are available, one for each of the 8 Nodes. Each output channel contains one KY Form A (2-Wire) Solid State output. The Transceiver/Antenna unit is intended to be mounted outdoors, in a direct line-of-sight with all Nodes' Transceiver/Antenna units. It cannot operate if obstructed by trees, metal poles, buildings or other objects. The Hub Base Unit is designed to mount indoors, or inside an existing control enclosure suitable for the application. The Base and Transceiver/Antenna Units are connected together by means of an 8-conductor, four twisted pair, #24AWG shielded control cable. It is important for noise immunity and error-free communications between the Base and Transceiver that twisted pair wire be used.
The PRH-1000 is capable of operating on supply voltages of 120, 208-277VAC.

PRN-1000 NODE

The PRN-1000 Node consists of the following:

*PRN-1000 Pulse Radio Node Transceiver/Antenna Unit

*PRN-1 Pulse Radio Node Base Unit

The PRN-1000 Node collects pulses from a meter's KYZ pulse initiator and sends them to the PRH-1000 Hub unit wirelessly. Each node operates independently and is polled several times per second by the Hub. Each time a pulse is received from the meter's pulse KYZ initiator, the Node validates this pulse and reports it to the Hub upon the next polling cycle. The Hub will set its corresponding KYZ output to the correct state, to reflect the state of the pulse at the PRN-1000's input. The PRN-1000 Transceiver/Antenna Unit contains the transceiver radio, a microcontroller and all the circuitry and software to communicate with the Hub. The PRN-1 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 PRN-1000 Node is capable of operating on supply voltages of 120, 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.

PRL-1000 SYSTEM DESIGN AND PLANNING

SYSTEM CONFIGURATION - The PRL-1000 Series 1 comes in two configurations. These are an 8 x 1 configuration and a 2 x 4 configuration. Choose the configuration desired for your application.

8 X 1 Configuration: The 8 x 1 configuration consists of up to 8 nodes with 1 pulse input on each node. Each node's address number is the data channel# (or Output #) on which the pulses are delivered at the PRL-1 Hub base unit. For example, the node that is addressed as #3, has the pulses that are transmitted by it, go to Output #3 on the PRH-1 Hub base unit.

2 X 4 Configuration: The 2 x 4 configuration consists 2 nodes with 4 pulse inputs on each node, numbered 1 through 4. Node #1's pulses are delivered to outputs 1 through 4 on the PRH-1, while Node #2's pulses are delivered to Outputs 5 through 8. The node's address, either number 1 or 2 determines the bank of four outputs that it will transmit pulses to.

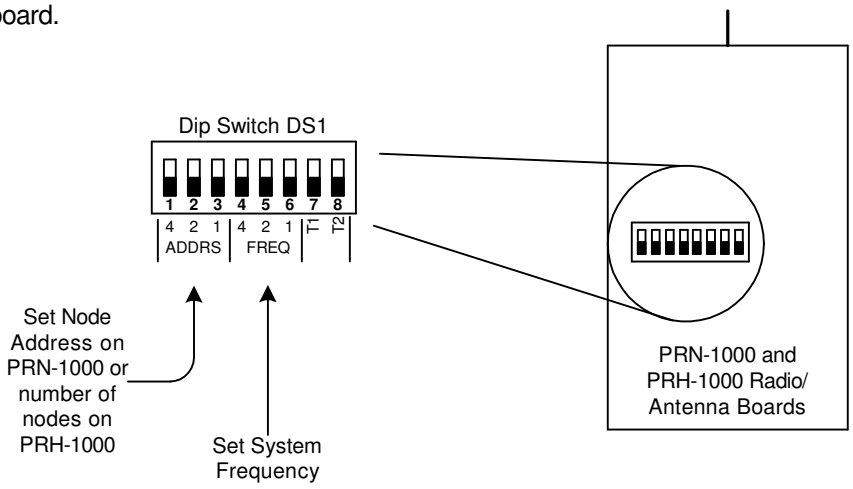
Determine the address desired on/for each node and configure Dip Switch DS1's switches #1 through #3 on each the PRN-1000 Pulse Transceiver Node board.

Table 1

Node Address	DS1.1	DS1.2	DS1.3
1	DN	DN	DN
2	DN	DN	UP
3	DN	UP	DN
4	DN	UP	UP
5	UP	DN	DN
6	UP	DN	UP
7	UP	UP	DN
8	UP	UP	UP

Table 2

Freq	DS1.4	DS1.5	DS1.6
921.37	DN	DN	DN
919.87	DN	DN	UP
915.37	DN	UP	DN
912.37	DN	UP	UP
909.37	UP	DN	DN
907.87	UP	DN	UP
906.37	UP	UP	DN
903.37	UP	UP	UP



SYSTEM FREQUENCY - The PRL-1000 System operates on one of 8 frequencies in the 903MHz to 921MHz range. This allows great flexability in finding a frequency that is quiet, or that little or no other RF transmissions on it. If you have a sprectrum analyzer tool you can characterize the energy on each channel. Short of that, pick a frequency and set all Nodes and the Hub for a system to the same frequency. Multiple systems can operate in one radio airspace by each system having a different frequency. Determine the frequency that you will use and configure Dip Switch DS1's switches #4 through #6 on each the PRN-1000 Pulse Transceiver Node board and the PRH-1000 Pulse Transceiver Hub board. Table 2 shows the dip switch combinations for each frequency.

NOTE: Power must be cycled to the unit after the DIP switches are changed for the changes to take effect.

SOLID STATE INSTRUMENTS
a division of Brayden Automation Corp.
6230 Aviation CIrcle, Loveland, Colorado 80538
Phone: (970)461-9600 Fax: (970)461-9605
E-mail:support@solidstateinstruments.com

CONSIDERATIONS FOR A SUCCESSFUL INSTALLATION

GENERAL - The PRL-1000 System is designed to consolidate pulses at a central point called the "Hub" from up to 8 meters, called "Nodes".

LINE OF SIGHT - Make sure that you have the Hub in a central location where all Nodes can "see" it. The PRL-1000 is a Line-Of-Sight system, and all Nodes must have uninterrupted and unrestricted sight of the Hub Radio at all times. Make sure that there are no trees, buildings, light poles, rail cars, trucks, or any other obstruction that gets in the line-of-sight between the Nodes and Hub at any time. Interruptions in the line-of-sight will cause pulses to be lost. Generally speaking, the PRL-1000 will not transmit through concrete, concrete block or masonry walls. It has been reported that in some cases it does in fact work but it is our recommendation not to count on reliable communications in applications that are not line-of-sight.

HEIGHT - Get the Hub and Node Radio/Antenna units up off the ground as high as reasonably possible to improve reception and transmission distance. The higher the Node is off the ground, the longer the transmission distance and the more reliable reception by the Hub.

MOUNTING: If mounting the Radio/Antenna unit on the side of a metal building, make sure that the antenna wire in the Transceiver/Antenna unit is mounted at least 6.1" away from the metal siding. Use the brackets supplied with the PRL-1000 to get this distance. You may have to rotate the board to insure that the antenna wire is not closer to the metal surface than 6.1" If the unit is mounted any closer than that, the signal will be corrupted and transmissions will be affected.

INTERFERENCE - The PRL-1000 generally speaking will not work in substations or in other areas where there is high power RF energy which may jam the signal. The electromagnetic field around high voltage conductors may cause enough interference so as to keep the system from transmitting correctly.

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Phone: (970)461-9600 Fax: (970)461-9605
E-mail:support@solidstateinstruments.com

INSTRUCTION SHEET
PRN-1000 PULSE RADIO NODE TRANSCEIVER

FCC ID: TIT-PRN-1000

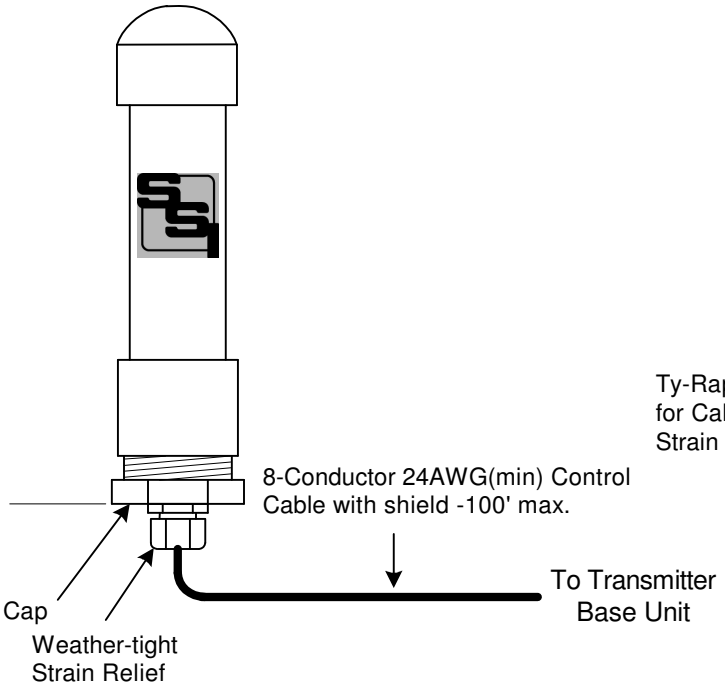

FIGURE 1

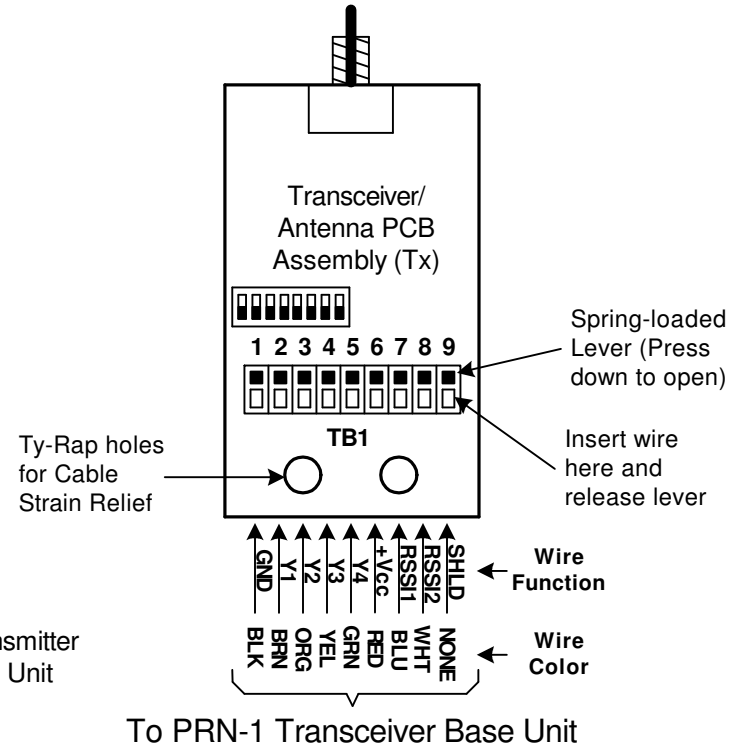

FIGURE 2

MOUNTING POSITION - (See Note Below on Cable Connection before mounting) The PRN-1000 Transceiver/Antenna unit (Node) 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 PRH-1000 Transceiver/Antenna unit(Hub). 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 PRN-1000 Transceiver/Antenna unit case.

CABLE CONNECTION TO PRN-1000 - It is advisable that this task is performed, if possible, in a convenient, clean work area before mounting the Node unit. Connect the 8-conductor 24AWG(min) shielded control cable to the 9-position connector on the PRN-1000 Node. Access the PCB Assembly by unscrewing the Node housing cap on the bottom of the unit. Remove the Node 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 Node 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 Node PCB Assembly back into the cap's slots. Set Node # and Frequency. Tighten the weather-tight connector to secure the assembly in place. Put the ring spacer over the Cap's threads and insert the Node 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 Node installation is complete, secure cap to mounting bracket using sheet metal screw in slot.

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a division of Brayden Automation Corp.
6230 Aviation Circle, Loveland, Colorado 80538
Phone: (970)461-9600 Fax: (970)461-9605
E-mail:support@solidstateinstruments.com

INSTRUCTION SHEET
PRN-1000 PULSE RADIO NODE TRANSCEIVER

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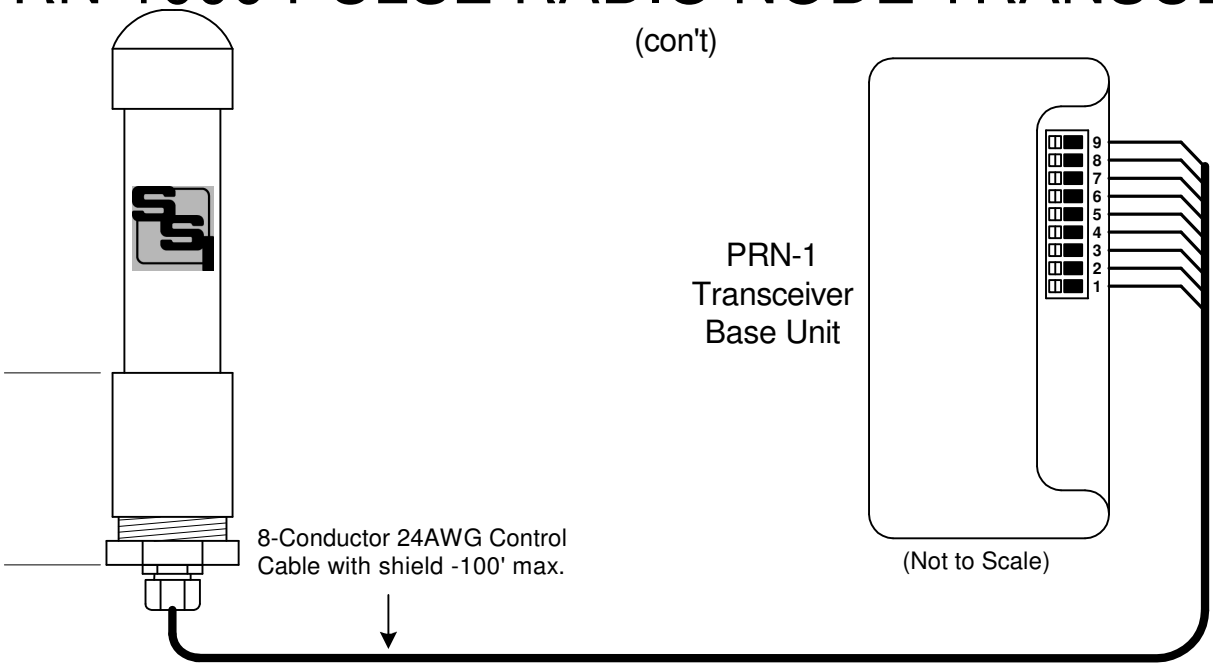

POWER INPUT - The PRN-1000 receives its power supply from the PRN-1 Node Base unit.

METER INPUTS - See the PRN-1 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 PRN-1000's Transceiver/Antenna Unit contains a low-power 900MHz band radio transceiver 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 PRN-1000's operating parameters.

NODE ADDRESS - See Page 8. This is set on the PRN-1000 Transceiver Board.

NODE FREQUENCY - See Page 8. This is set on the PRN-1000 Transceiver Board.

NOTICE TO USER -

FCC ID: TIT-PRN-1000

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
PRN-1000 PULSE RADIO NODE TRANSCEIVER

Setting the Address - The PRN-1000 System requires that each Node has a unique address. This makes it possible for the central control unit - the "Hub" - to send and receive information to and from each individual Node. The address is set by means of the first three switches on DIP Switch S1, located below the microcontroller on the Node Tranceiver board, as shown in the diagram at right. The address is set as a binary code plus 1. Switch #1 is worth 4 while Switch #2 is worth 2 and Switch #3 is worth 1. To add the value of each switch, set it in the UP position. If all three switches are down, then the address is equal to (0 + 0 + 0) +1, or address #1. If the first and third swtiches are in the up position, that would be equal to (4 + 0 + 1) +1 or Address #6. See the table at right for complete list of the addresses.

Setting the System Frequency - Each system -- the Hub and all Nodes in that system - operate at one of eight different frequencies. This allows multiple systems to operate in the same radio airspace without any interference with another system. Therefore, all nodes and the hub that consist of a system, must have their frequency set to the same number. The address is set as a 3-bit binary code plus 1. Switch #4 is worth 4 while Switch #5 is worth 2 and Switch #6 is worth 1. To add the value of each switch, set it in the UP position. If all three switches are down, then the frequency is equal to (0 + 0 + 0) +1, or Frequency #1. If the second and third swtiches are in the UP position, that would be equal to (0 + 2 + 1) +1 or Frequency #4. See the table at right for complete list of the frequencies.

Setting the Node Operating Mode - If the system is being used in the 8 x 1 mode, each Node must have Dip Switch #8 in the DOWN position. If the system is being used in the 2 x 4 mode, then only two Nodes can be used, addressed as Node #1 and Node #2, and must have Dip Switch #8 in the UP position.

Dip Switch #7 must be in the Down Position for normal operations.

NOTE: Power must be cycled to the unit after the DIP switches are changed for the changes to take effect.

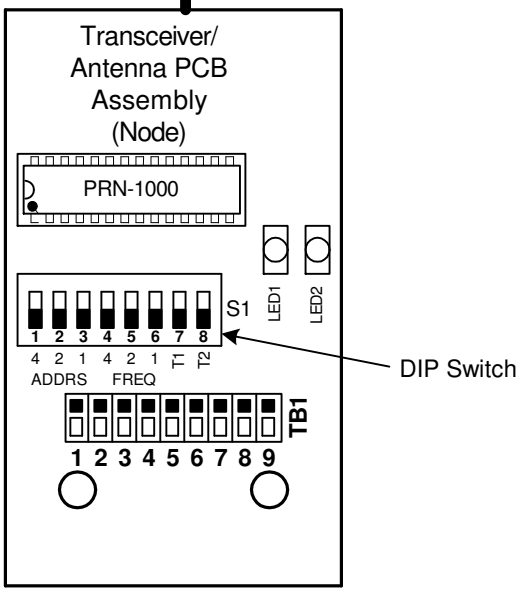

FIGURE 3

TABLE 1

ADDRESS	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
7	UP	UP	DN
8	UP	UP	UP

TABLE 2

Frequency	SW#4	SW#5	SW#6
921.37	DN	DN	DN
919.87	DN	DN	UP
915.37	DN	UP	DN
912.37	DN	UP	UP
909.37	UP	DN	DN
907.87	UP	DN	UP
906.37	UP	UP	DN
903.37	UP	UP	UP

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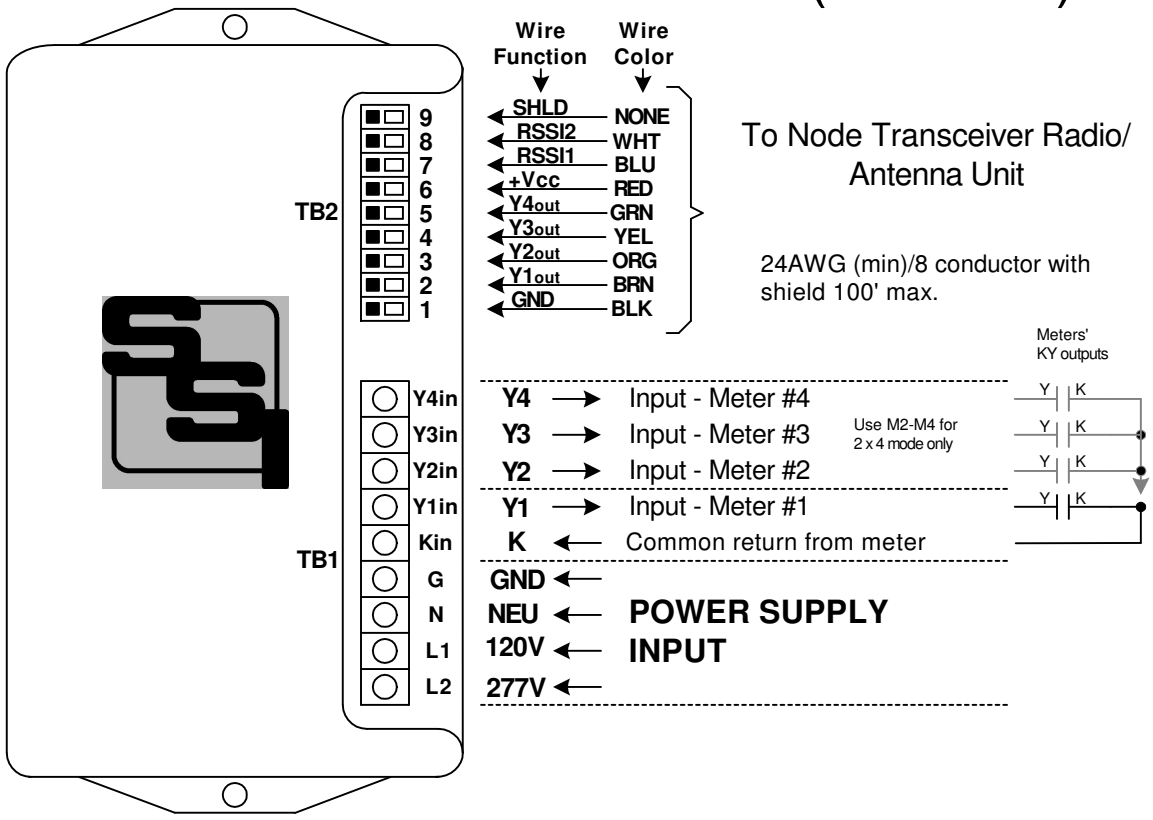
a division of Brayden Automation Corp.
6230 Aviation Circle, Loveland, Colorado 80538
Phone: (970)461-9600 Fax: (970)461-9605
E-mail:support@solidstateinstruments.com

INSTRUCTION SHEET
PRN-1 PULSE TRANSCEIVER ("NODE") BASE



MOUNTING POSITION - The PRN-1 Base unit may be mounted in any position.

ENCLOSURE - The PRN-1 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 PRN-1 accepts a Form "A" (2-Wire) input using the K & Y input terminals. Input Y1 is used in the 8x1 system mode. Y2 - Y4 are used along with Y1 in the 2x4 mode. (See Page 4.)

METER CONNECTIONS - Connect the PRN-1's "K" and "Y_1" input terminals to meter's "K" and "Y" terminals. The PRN-1's "K" terminal is the system common (return). 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.

OUTPUT TO PRN-1000 TRANSCEIVER/ANTENNA UNIT - Connect the 8-conductor 24AWG(min) shielded control cable to the PRN-1000 Node Transceiver/Antenna Unit. For best results, it is advisable to keep this length of this cable to the minimum practical distance.

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E-mail:support@solidstateinstruments.com

INSTRUCTION SHEET
PRH-1000 PULSE RADIO HUB TRANSCEIVER

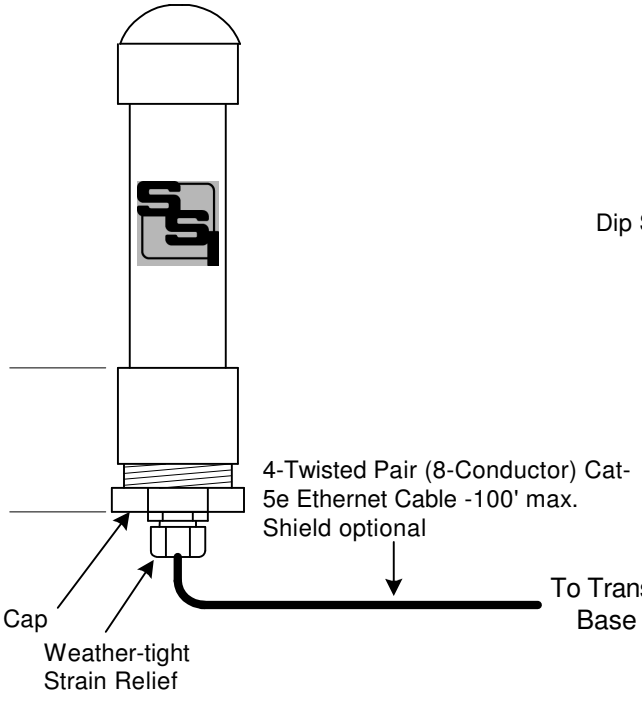

FIGURE 1

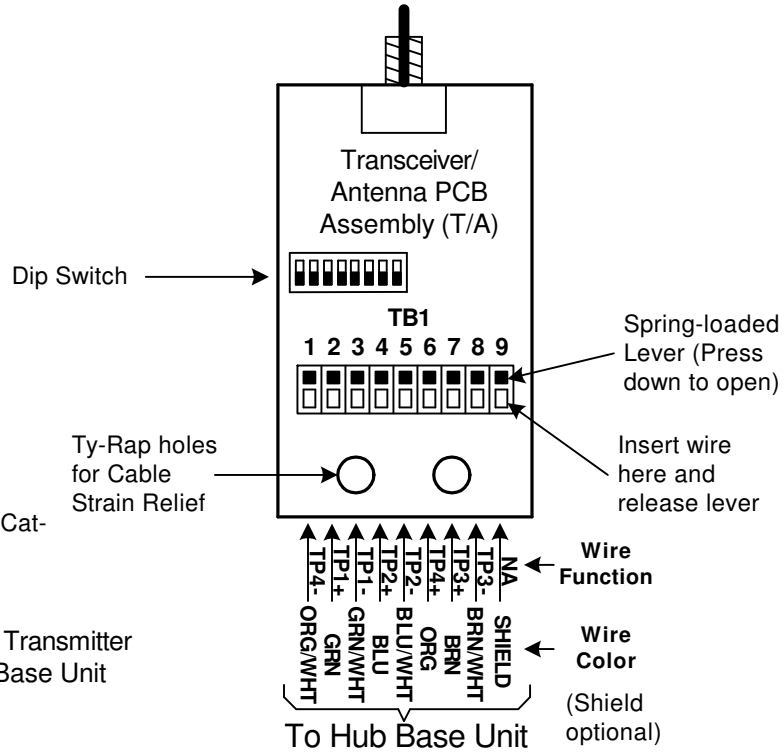

FIGURE 2

MOUNTING POSITION - (See Note Below on Cable Connection before mounting) The PRH-1000 Hub Transceiver/ 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 PRN-1000 Node Transceiver/Antenna unit. Mount using the aluminum mounting bracket supplied, making sure that the antenna wire of the transceiver 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 transceiver unit case.

CABLE CONNECTION TO PRH-1000 - Perform this task in a convenient, clean work area before mounting the Hub T/A unit. Connect the 4-twisted pair (8-conductor) CAT-5e Ethernet cable to the 9-position connector on the PRH-1000 T/A. (See page 13) Access the PCB Assembly by unscrewing the housing cap on the bottom of the unit. Remove the T/A 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 T/A 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 T/A PCB Assembly back into the cap's slots. Tighten the weather-tight connector to secure the assembly in place. Set the Number of Nodes and the Frequency on the Dip Switch. Put the ring spacer over the Cap's threads and insert the T/A Assembly into the housing. Tighten the cap until spacer is tight. For best results, keep the distance between the Transceiver and the Base Unit to the minimum practical distance. When T/A installation is complete, secure cap to mounting bracket using sheet metal screw in slot.

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Phone: (970)461-9600 Fax: (970)461-9205
E-mail:support@solidstateinstruments.com

INSTRUCTION SHEET
PRH-1000 PULSE RADIO HUB TRANSCEIVER

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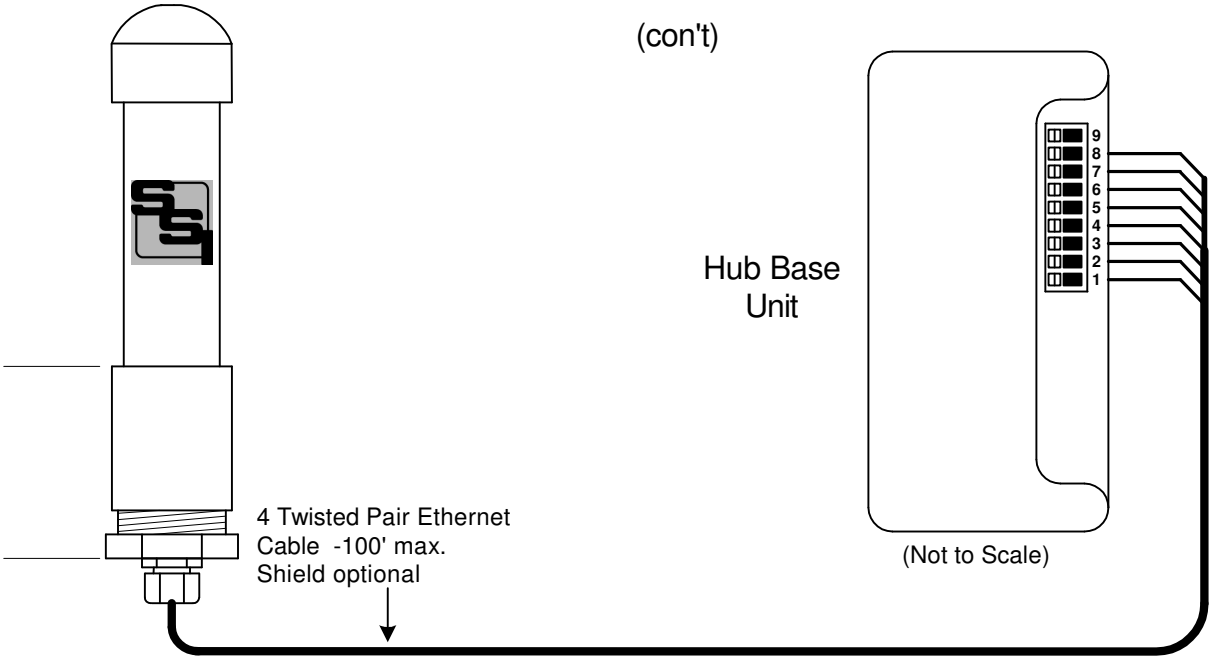


POWER INPUT - The PRH-1000 receives its power supply from the PRH-1 Transceiver Base unit.

PULSE OUTPUTS - See the PRH-1 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 PRH-1000's Hub Transceiver/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 PRH-1000 Transceiver/Antenna unit so it is LINE-OF-SIGHT with all NODEs in the system 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.

OPERATING MODE - The PRH-1000 does not need to be set for the 8x1 or 4x2 operating mode. It will automatically adapt to either 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.

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
PRH-1000 PULSE RADIO HUB TRANSCEIVER

Setting the # of Nodes - The PRH-1000 System requires that you tell it how many Nodes are in the system. This allows the microcomputer to only scan for the number of nodes that are present. The faster scan time enhances reliabilty and response. The number of Nodes is set by means of the first three switches on DIP Switch S1, located below the microcontroller on the Hub Tranceiver board, as shown in the diagram at right. The number of nodes is set as a binary code plus 1. Switch #1 is worth 4 while Switch #2 is worth 2 and Switch #3 is worth 1. To add the value of each switch, set it in the UP position. To not add the value of the switch(in other words to make the value of that switch equal to zero), put it in the DN position. For example, if all three switches are down, then the number of Nodes is equal to (0 + 0 + 0) +1, or address #1. If the first and third switches are in the UP position, that would be equal to (4 + 0 + 1) +1 or Address #6. See the table at right for complete list of the dip switch settings for the number of Nodes desired.

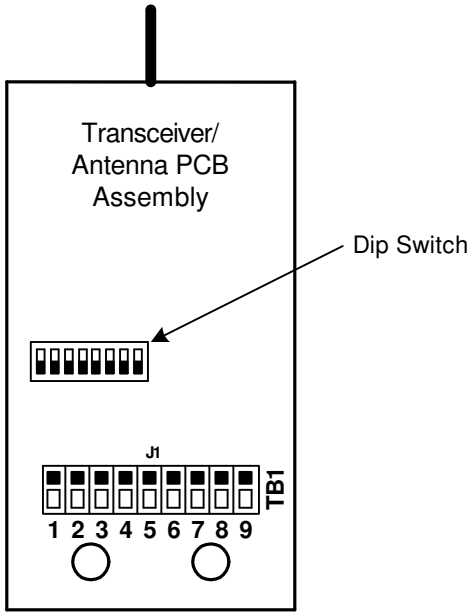


FIGURE 3

Setting the System Frequency - Each system -- the Hub and all Nodes in that system - operate at one of eight different frequencies. This allows multiple systems to operate in the same radio airspace without any interference with another system. Therefore, all nodes and the hub that consist of a system, must have their frequency set to the same number. The address is set as a 3-bit binary code plus 1. Switch #4 is worth 4 while Switch #5 is worth 2 and Switch #6 is worth 1. To add the value of each switch, set it in the UP position. If all three switches are down, then the frequency is equal to (0 + 0 + 0) +1, or Frequency #1. If the second and third switches are in the UP position, that would be equal to (0 + 2 + 1) +1 or Frequency #4. See the table at right for complete list of the frequencies and the dip switch settings for each frequency.

Dip Switch #7 and #8 must be in the Down Position for normal operations.

NOTE: Power must be cycled to the unit after the DIP switches are changed for the changes to take effect.

TABLE 1

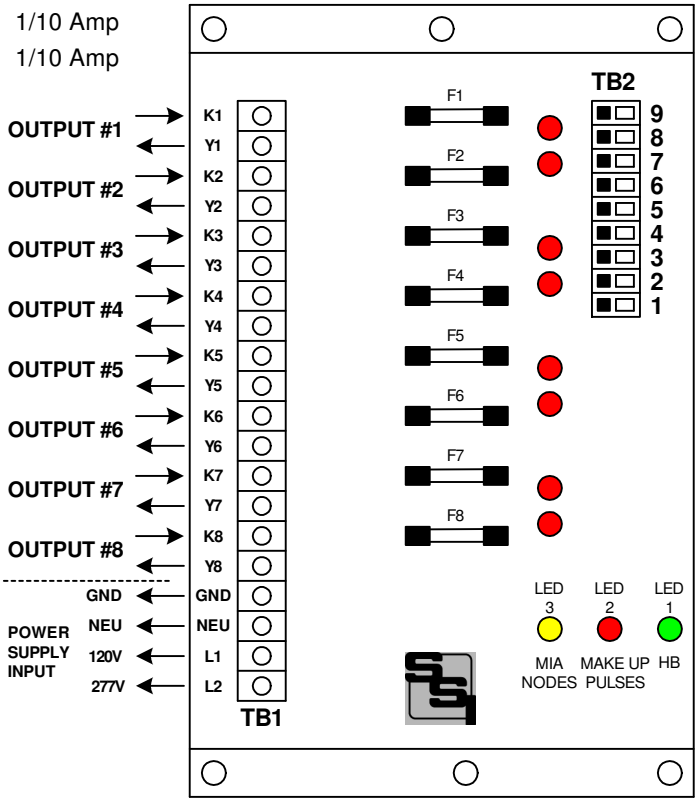
# of Nodes	SW#1	SW#2	SW#3
1	DN	DN	DN
2	DN	DN	UP
3	DN	UP	DN
4	DN	UP	UP
5	UP	DN	DN
6	UP	DN	UP
7	UP	UP	DN
8	UP	UP	UP

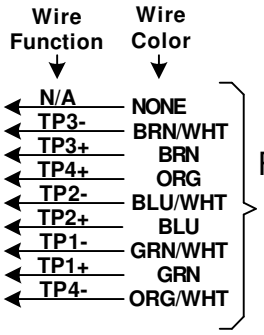
TABLE 2

Frequency	SW#4	SW#5	SW#6
921.37	DN	DN	DN
919.87	DN	DN	UP
915.37	DN	UP	DN
912.37	DN	UP	UP
909.37	UP	DN	DN
907.87	UP	DN	UP
906.37	UP	UP	DN
903.37	UP	UP	UP

SOLID STATE INSTRUMENTS
a division of Brayden Automation Corp.
6230 Aviation Circle, Loveland, Colorado 80538
Phone: (970)461-9600 Fax: (970)461-9605
E-mail:support@solidstateinstruments.com

INSTRUCTION SHEET
PRH-1 PULSE RADIO HUB BASE UNIT





From Transceiver Radio/ Antenna Unit

CAT-5e Ethernet Cable (4 twisted pairs)

TABLE 1

Twisted Pair#/ Conductor	Ethernet Cable Color	PRH-1000 TB2 Terminal #	PRH-1 TB2 Terminal #
1+	GRN	2	2
1-	GRN/WHT	3	3
2+	BLU	4	4
2-	BLU/WHT	5	5
3+	BRN	7	7
3-	BRN/WHT	8	8
4+	ORG	6	6
4-	ORG/WHT	1	1

GENERAL - The PRH-1 Hub serves as the central control unit and system coordinator for the PRL-1000 900 MHz band wireless pulse link system. It contains the microcontroller, software, power supply, output relays and all connection points for powering the PRH-1000 transceiver/antenna unit.

MOUNTING POSITION - The PRH-1 may be mounted in any position.

ENCLOSURE - The PRH-1 base unit is designed to be housed in a control panel or other electrical enclosure suitable for the application. An optional NEMA4X raintight/dusttight 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 electrical system Ground.

RADIO INPUT - The PRH-1000 radio transceiver/antenna unit connects to the 9-position connector labeled TB2. Terminals are numbered in the same order on the PRH-1000 and the PRH-1. Connect a Cat-5e ethernet cable with 4 twisted pairs between the two units as shown in Table 1 above.

OUTPUT CONFIGURATION - The PRH-1 contains eight solid state Form A dry-contact outputs using "K" and "Y" terminals. 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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Troubleshooting

LED Status Lights - The PRH-1 has three status light to help the installer determine whether the system is operating correctly or whether there is a problem.

Green LED - "HB" for Heartbeat
This LED blinks on and off once per second indicating the system is operating and the microcontroller is going through its program loop. There is no other meaning to this except that the system is alive and running, and appears to be operating normally.

Yellow LED - "MIA Nodes" for Missing Nodes
This LED will blink the number of times equal to a node's address that is supposed to be reporting but is not sending any data. For instance, if Node #4 is not reporting, the MIA Nodes LED will blink 4 times, stop for 2 seconds and then blink 4 times again. Let's say that both Node #4 and #7 are not reporting. The LED will blink four times, stop for two seconds, then blink seven times, stop for two seconds and then start over. This handy light can save you lots of steps to insure that each node is reporting and if not, which one it is. When the node or nodes begins reporting again, the Yellow LED light will automatically go out.

Red LED - "Makeup Pulses"
This LED indicates when a makeup pulse has been added to insure that the correct number of pulses has been received by the PRH-1. Each blink is equal to one added pulse.

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Phone: (970)461-9600 Fax: (970)461-9605
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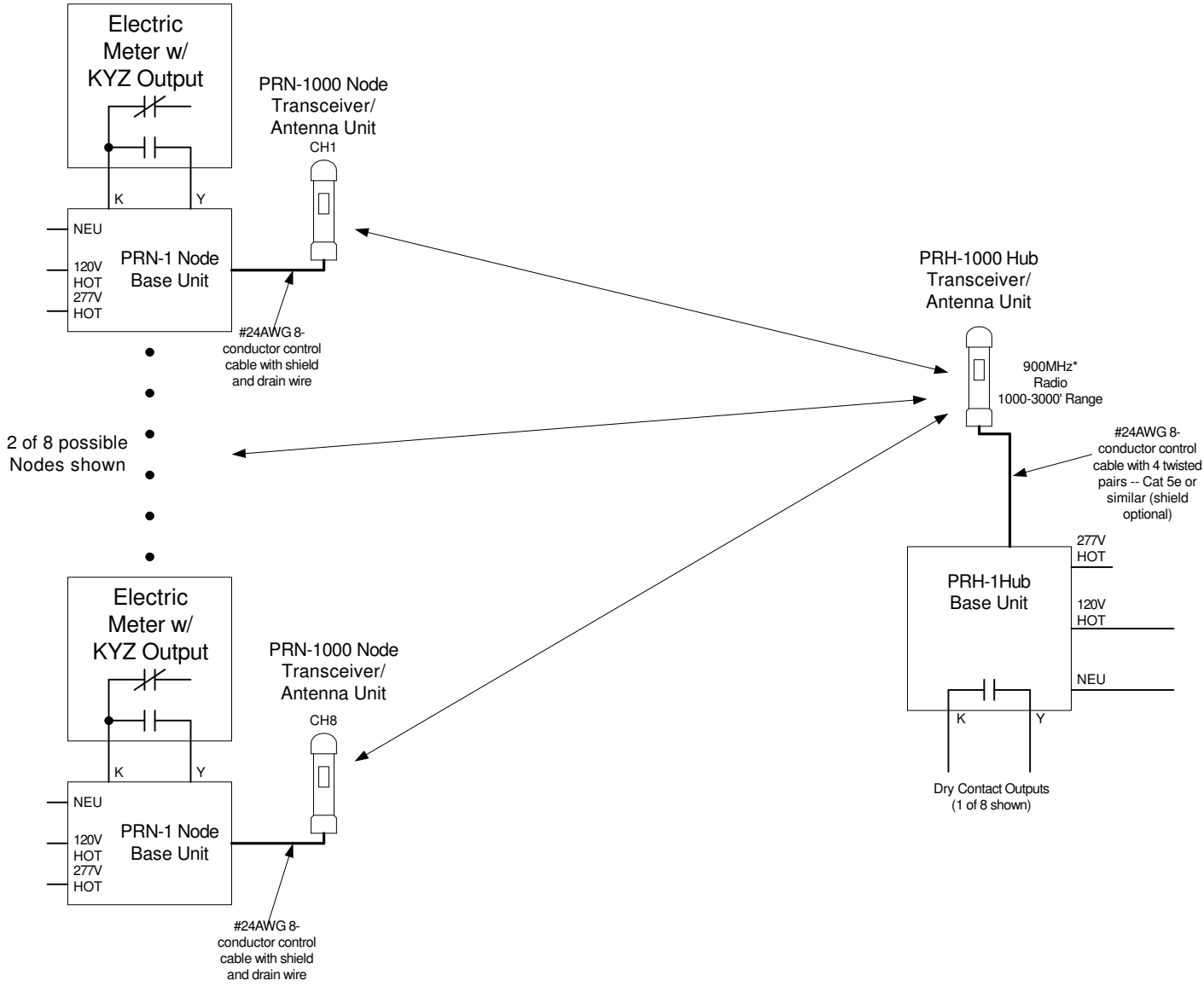
Wireless Pulse Link Application



Notes:

1.) Only two nodes are shown for simplicity. The PRL-1000 Wireless Pulse Link can be equipped with up to eight nodes. Each node is equipped with one Form A input. Set the Meter Form A output in toggle mode or simply either use K-Y or K-Z in Form C mode.

2.) Inputs are configured as Form A, and in this configuration up to 8 Form A channels can be transmitted.

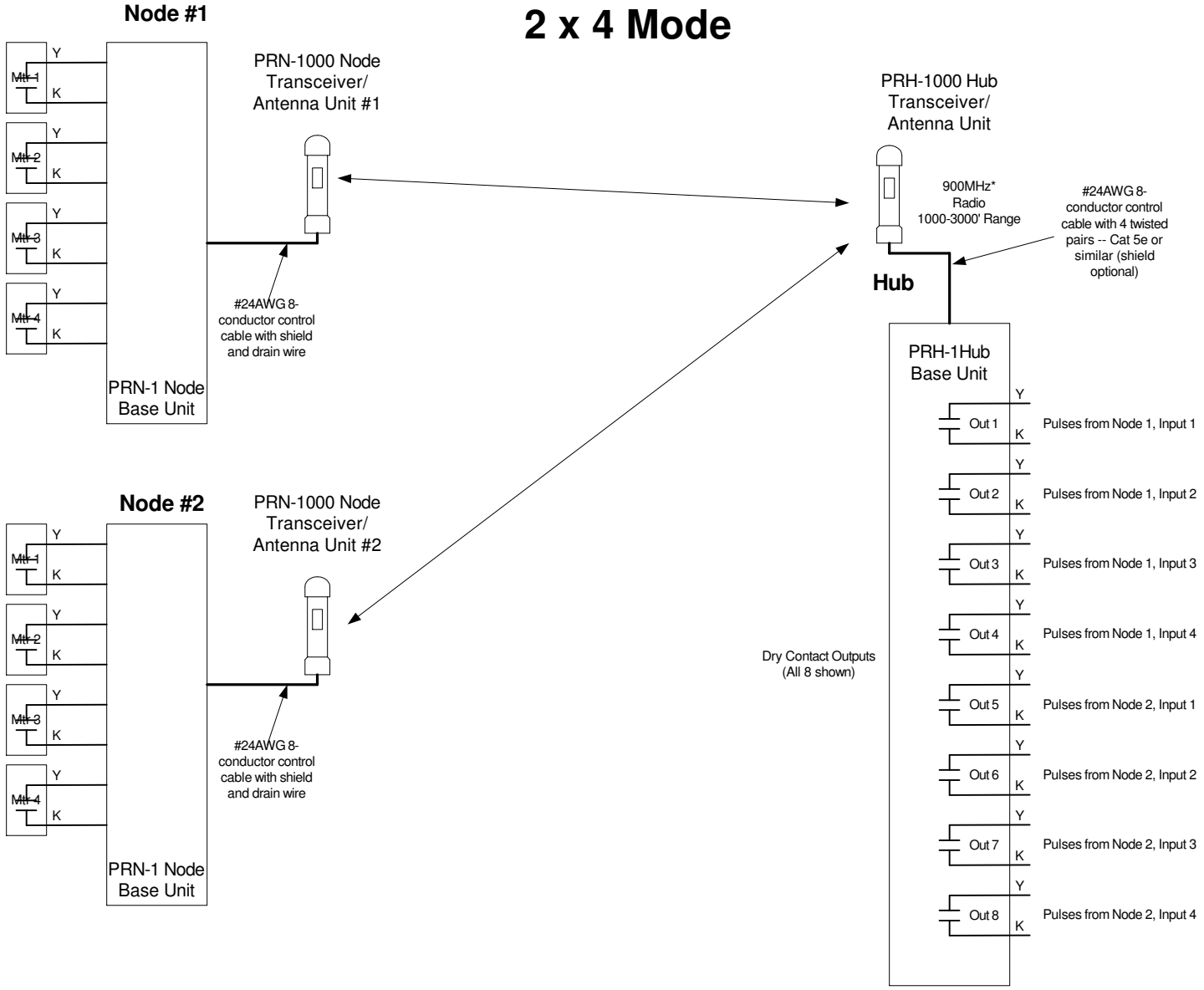
3.) Transmission is Line-of-sight and must not be blocked by trees, buildings, metal poles, trucks, railcars, etc.

4.) Transmission distance is variable from 500' to 1000' depending on site conditions. Distance and reliability will increase as the height mounted above the ground increases. During extremely heavy rain, transmissions may not be reliable.

PRL-1000 900MHz Wireless Pulse Link System Diagram		REVISIONS NO. / DATE / DESCRIPTION	
DATE ORIGINAL 12/9/13	SCALE N/A		
LATEST REVISION	JOB NO.	CHECKED	DRAWN WHB

Solid State Instruments div. of Brayden Automation Corp.
6230 Aviation Circile
Loveland, CO 80538
(970)461-9600
(970)461-9605 fax
www.solidstateinstruments.com

Wireless Pulse Link Application
2 x 4 Mode



Notes:

1.) Only two PRN-1000 Nodes are used in this system configuration. Both Nodes are configured to use all four Form A inputs. The meter's Form A outputs are programmed for toggle mode, not momentary mode. Using two wires (K and Y) on a Form C output is acceptable. Dip Switch #8 must be UP on the Nodes for this configuration.

2.) Inputs are configured as Form A, and in this configuration up to 8 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 variable from 500' to 1000' 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-1000
Wireless Pulse Link
System Diagram
2 X 4 Mode

REVISIONS

NO.	DATE	DESCRIPTION

DATE ORIGINAL	SCALE
08/02/13	N/A

LATEST REVISION	JOB NO.	CHECKED	DRAWN
			WHB

Solid State Instruments div. of
Brayden Automation Corp.
6230 Aviation Circile
Loveland, CO 80538
(970)461-9600
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Troubleshooting and Tech Support

1.) Make sure to use shielded wire between the PRN-1 Base Unit and the PRN-1000 Transceiver/Antenna unit. Solid State Instruments part number 0715-0005 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 acquire your own cable but insure a high-quality communications cable with eight #24 stranded conductors. Do not use solid conductor wire, especially thermostat wire. Also do not use any heavier wire than #22 AWG since there is limited space and it will be difficult to work with.

   For the Hub, use a shielded 4-twisted pair (8-conductor) control cable to wire between the PRH-1000 Transceiver/Antenna unit and the PRH-1 Base unit. The shield is optional on this cable, however it is recommended for long distances between the PRH-1000 and the PRH-1 and high electrical noise environments. CAT-5E Ethernet cable may be used.

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

3.) Mount the Transceiver/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 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 insures for excellent reliability and almost no need for the compensation algorithm to be invoked. NOTE: the PRL-1000 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 your 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.) If there is interference on the frequency that you have selected, change to another frequency. There are eight frequencies to choose from.

7. 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.

8.) The Node base unit is 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 PRN-1 or PRH-1 mounts onto.

Troubleshooting Procedure:

- Check all wiring connections especially the control cable connections between the Transceiver/Antenna unit and the Base unit.
- Check that power is on and applied properly to all components.
- Check to make sure that all Hub and Node units are all on the same frequency (Dip Switches #4-6)
- Make sure that the Hub is set for the correct number of Nodes in the system. (Dip Switches #1-3 on the PRH-1000 board)
- Make sure that each Node is set for the correct sequential Node number in a system. Nodes in a system may <u>not</u> have the same Node number. (Dip Switches #1-3 on the PRH-1000 board)
- Make sure that there is not another system operating in the same RF airspace that has the same frequency selected.
- Check red LED's on the Base Unit's input and make sure they are flashing with pulses received from the meter.
- Check that the wire antennas are securely soldered to the Transceiver/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 Hub, providing a wetting voltage to the dry-contact output of the Hub? Is the wetting voltage within the maximum specifications?

FCC WARNING STATEMENT

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.

NOTES: