MPG-3ES
Standard Solid State

Firmware V3.07_G

ZIGBEE PULSE GENERATOR INSTRUCTION SHEET

WIRE HARNESS CONNECTIONS

- Pulse Out LED
- Pulse Output
- COM LEDs (TR, DP, ER)
- USB Programming Port
- YEL
- BRN
- (GND) BLK
- (+10-60VDC) RED
- Zigbee Module

GENERAL - The MPG-3ES is a scaled-down, specific purpose version of the MPG-3 that provides cost reduction when a low-voltage power supply and one K-Y output are needed.

MOUNTING POSITION - The MPG-3ES may be mounted in any position but is intended to be mounted in the orientation above such that the circuit board is upright. The MPG-3ES must be mounted within 75' of the meter. Actual operational distance may vary with building construction and adjacent obsticles causing RF reflections or interference. For best results, mount the MPG-3ES as close to the meter as reasonably possible.

POWER SUPPLY INPUT - The MPG-3ES is powered from low voltage source of either 10-50VDC or 10 to 40VAC. Connect the RED wire to the positive (+DC) positive source. Connect the BLK wire to the negative (-DC) ground of the power supply. When using a AC voltage source either wire may be connected to either AC source terminal. Avoid damage caused by any overvoltage by insuring that the voltage does not exceed maximum ratings.

ZIGBEE WIRELESS COMMUNICATION - The MPG-3ES is designed to receive power monitoring information from an electric meter equipped with Zigbee wireless communications. The Zigbee transceiver module is mounted on the MPG-3ES' circuit board. Ensure that the module is properly seated and fastened into its socket. Do not remove. The transmission path must be Line-Of-Sight(LOS) with no interruptions. The MPG-3ES and the meter must be able to continuously "see" each other.

PULSE OUTPUT - A 2-wire (Form A) K-Y output is available for connection to the pulse receiving device. The BRN wire is connected to the K terminal. The YEL wire is connected to the Y terminal. The output load should be limited to 100 mA at 24 VAC/VDC with maximum output power dissipation of 800mW. A RED LED in the upper left-hand corner of the PCB displays when the K-Y switched pulse output is closed and has continuity between the Brown(K) and Yellow(Y) wires. When the LED is off, the pulse switch is open and there is no continuity between K and Y. There is no hardware to support the K-Z output or the EOI output, so ignore references to them in the programming software.

OPERATION - See the following pages for a full explanation of the operation of the MPG-3ES.
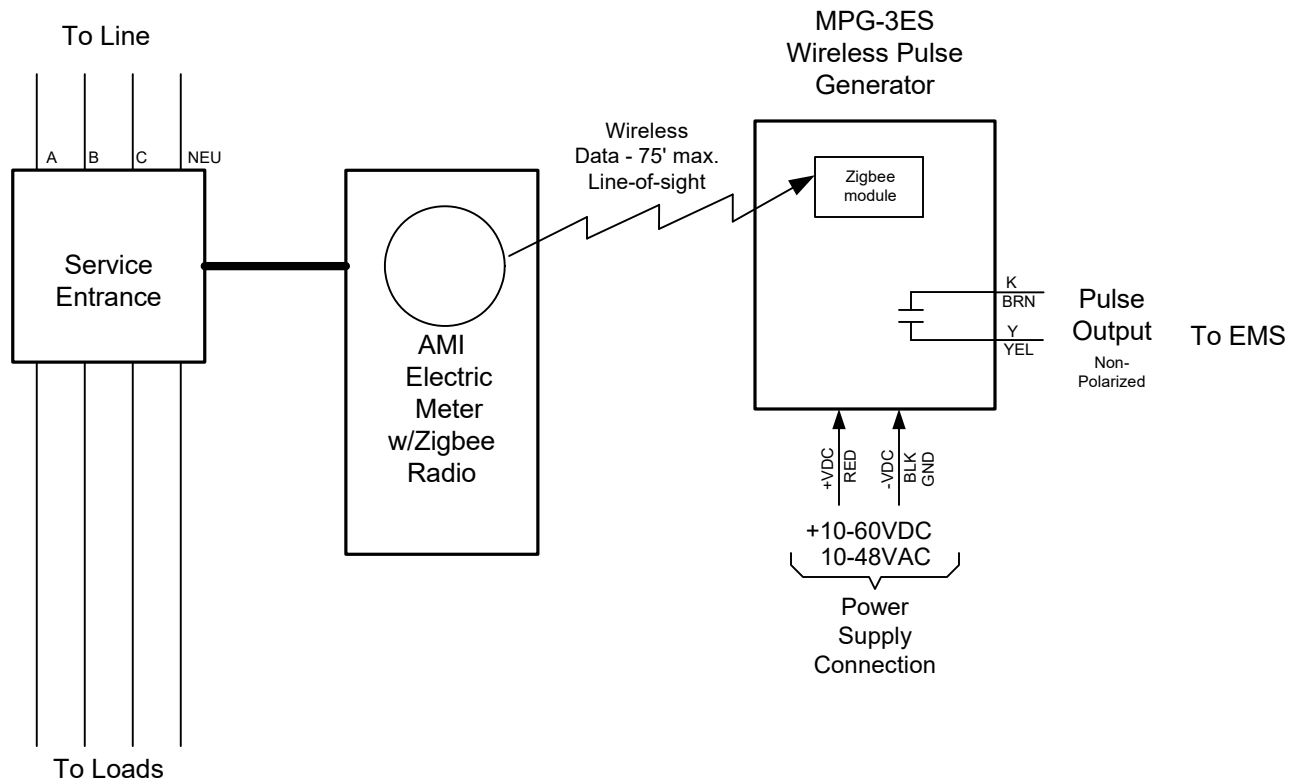
SOLID STATE INSTRUMENTS

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

MPG-3ES Wiring Diagram

To Line

A B C NEU

Service
Entrance

To Loads

AMI
Electric
Meter
w/Zigbee
Radio

Wireless
Data - 75' max.
Line-of-sight

MPG-3ES
Wireless Pulse
Generator

Zigbee
module

K
BRN

Y
YEL

Pulse
Output

Non-
Polarized

To EMS.

+VDC
RED

-VDC
BLK
GND

+10-60VDC
10-48VAC

Power
Supply
Connection

MPG-3ESWiringDiagram.vsd

	REVISIONS		
MPG-3ES Wireless Pulse Generator Wiring Diagram	NO.	DATE	DESCRIPTION
DATE ORIGINAL 7/12/2021	SCALE N/A		
LATEST REVISION	JOB NO.	CHECKED	DRAWN WHB

**Brayden Automation Corp./
Solid State Instruments div.**
6230 Aviation Circle
Loveland, CO 80538
(970)461-9600
support@brayden.com
www.solidstateinstruments.com

MPG-3ES Wireless Meter Pulse Generator

1.0   General

The process for installing the MPG-3ES usually is done in this order but may vary depending on several factors:
1.   Installation (Section 2)
2.   Provisioning (Section 3)
3.   Programming Setup (Section 4)
4.   Programming System Settings (Section 5)
5.   Operation (Section 6)

1.1   Installation - Installation includes mounting the unit at or near the electric meter, connecting the power supply and connecting the pulse output to the destination (pulse receiving) device.

1.2   Provisioning - This is the process of pairing the Zigbee transceiver module in the MPG-3ES with an AMI electric meter that will be sending it power monitoring information. It is usually best to get this done early in the process since it may take some time for the designated meter to receive the provisioning command. Provisioning can be done by the utility after the MPG-3ES is installed by sending the EUI and Installation ID to the electric meter through the AMI system. This means that the utility can send this information directly to the specific electric meter to which the MPG-3ES will be paired. This provisioning command is usually only good for 24 hours so you must install the MPG-3ES before or within the allowed time period. If, on the other hand, provisioning will be done in the field using on-site programming by the utility, then the hardware installation must be done first.

1.3   Programming Setup - To program the MPG-3ES, a Windows 7 or 10 PC computer with the SSI Universal Programmer program (V1.0.8 or later) is required. The SSI Universal Programmer program can be downloaded from the solidstateinstruments.com website located on the home page or from any MPG product's webpage. All programming uses the USB B-Type connector located on the right side of the MPG-3ES' board.

1.4   Program the System Settings - Once the ability to communicate with the MPG-3ES has been established, all system settings must be configured. This includes the Output Pulse Value, Output Pulse Mode, Directional Mode, Fixed Pulse Width Time, Reset Time, as well as a number of other settings.

1.5   Operation - Once the unit has been paired and programmed, it will automatically begin operating.

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2.0 Installing the MPG-3ES

2.1   Mounting Location - Mount the MPG-3ES to the building at or near the electric meter that will be wirelessly sending communications to the MPG-3ES. It must be within 75' with an unobstructed line-of-sight with the meter.   The meter must be mounted outside of the meter enclosure. Meters mounted inside a metallic meter enclosure may have trouble communicating with the MPG-3ES.

2.2   Mounting Hardware - Four mounting feet, two top and two bottom, are provided on the polycarbonate enclosure. Mount with the mounting feet on the top and bottom. Use 10-32 screws or suitable hardware to attach the MPG-3ES to the building as necessary. If necessary the mounting feet may be snapped off to allow flush mounting to an electrical enclosure using a chase nipple.

2.3   Wire the Power Supply - Knock out the 1/2" conduit knockout on the bottom center of the enclosure and run non-metallic conduit ("seal-tight" or "carflex") as necessary to the power supply. Use non-metallic fittings and a non-metallic lock nut to attach the 1/2" conduit fitting to the enclosure. Wire the power supply to the MPG-3ES' RED and BLK leads.   Do not use the knockouts on the sides or back of the enclosure. Make wire terminations outside of the MPG-3ES enclosure and minimize any wire in the enclosure. Make sure that no wires run in front of the Zigbee module.

2.4   Wire the Pulse Outputs - If Pulse outputs are going to a separate enclosure, carefully knock out a second 1/2" conduit knockout and run 1/2" conduit as desired to destination wiring enclosure. Run the #18AWG yellow and brown wires into another enclosure to make connections.

3.0 Provisioning

3.1   Pairing the USB Zigbee Module Transceiver
The Zigbee module must be paired with a Zigbee-equipped AMI electric meter. This may be accomplished either manually with the assistance of the utility or on their website if they have the process automated. The process for accomplishing this varies from utility to utility and not all utilities provide Zigbee radio availability. Contact your electric utility to find out how their pairing process is accomplished. This process is also known as "provisioning". The module must be powered to be paired with the meter and must be within range of the meter, usually within 75 feet. The transmission path must be Line-of - Sight (LOS). Distances may vary depending on adjacent structures and building materials that may cause RF reflections, which attenuate the radio signal.

The meter must be programmed with the module's EUI address and Installation ID code. By being "paired", the meter creates a network with only two nodes, and knows that it can only send and receive data to that particular module and the module only accepts data from that particular electric meter. Non-volatile memory in the module and meter provides retention of pairing data.

3.2   Power up the MPG-3ES for Provisioning
Once installed, apply power to the MPG-3ES using the low voltage source. Upon power-up the yellow COM LED will light indicating the the MPG-3ES's microprocessor senses the presence of the Zigbee module and that it is installed correctly and communicating with the MPG-3ES' main microprocessor.   The Red LED on the Zigbee module will flash once every 3 seconds to indicate that it is ready to be provisioned.

3.3   Pairing Process - If the utility has previously sent the provisioning information to the electric meter, the RED LED on the Zigbee module will flash once per second for up to 60 seconds while it is establishing network communications with the meter. Once it has completed establishing communications with the meter, the module's RED LED will stay on continuously (solid). If the module's RED LED is on continuously, it is correctly provisioned and you may proceed with programming.

3.4   Unsuccessful Pairing - If the module's RED LED is not on continuously, the network has not been created, and the MPG-3ES will not receive information from the meter. If no connection has been made, the MPG-3ES will reset the module every 120 seconds (default reset time) attempting to establish a connection. The RED LED on the module MUST be lit continuously before moving on. If it is not, then it is not provisioned correctly with the utility's meter. Do not proceed until this step is successfully completed. Make sure that the module has not been previously paired with a different meter.

3.5   Contact Utility - If the utility has not previously sent the provisioning information to the electric meter, or has not previously paired this meter with this module, you will have to contact them to get this accomplished. Give them the module's EUI address and the Installation ID code, supplied with the MPG-3ES.

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4.0   Programming Setup

All settings of the MPG-3ES are made through the the USB Programming Port. Programming is accomplished by using the SSI Universal Programmer software. Download it from http://solidstateinstruments.com/productpages/MPG-3ES-wireless-pulse-generator.php if you have not already done so. The download link is under the Documentation tab. Install the software on your computer. There is also a link to the software download on the main SSI webpage.

4.1   Equipment Required -
   a.)   Windows computer
   b.)   USB A-B cable

4.2   Setting up the Programming Port -
Connect the USB Type A connector to your computer's USB port, Connect the USB Type B end to the MPG-3ES' programming port. Make sure power to the MPG-3ES is on. Start the SSI Universal Programmer program.

4.3   Verify Communications with MPG-3ES -
After the initialization process, the RED LED on the module should be lit continuously. You should immediately recognize that it is connected to the MPG-3ES.   A green simulated LED at the top of the programming page indicates that the connection has been made. All fields will populate with the current setting for each parameter.

Assuming that the module is paired (correctly) with the meter, is on, and is within 75' of the meter, then every 8 to 10 seconds, you will see the Green COM LED flash once to indicate that the module has received a data packet from the meter and passed it on to the microprocessor. You will also see information similar to the listing below received from the MPG-3ES in the SSI UP monitor mode:

```
----------------------
Time Stamp: 286A41A3 TSR:N
Demand: 00037E
Multiplier: 00000001
Divisor: 000003E8
Summation: 000004477198
Energy (U): 1.99 Wh
Acc. Energy: 92252.73 Wh
```

Note that the Timestamp, Demand, Multiplier and Divisor are all in hexadecimal format and this represents the identical information received from the meter. Also keep in mind that this Multiplier is the INTERNAL multiplier that is sent by the meter, NOT the EXTERNAL multiplier (CT Ratio) that is programmed by the user.

4.4   Read System Parameters -
If Monitoring is on, stop the monitoring mode by pressing <Stop Monitoring>. Click on <Read Parameters> to view the current status or value of all current system programming parameters. This is what is currently stored in the MPG-3ES's memory. The MPG-3ES will return information that looks similar to the following:

```
----------------------
Multiplier(1-99999): 1
Pulse Value, wh/p (1-99999): 10
Output Mode: Normal
Output Form: C
Form A Width, mS:
EOI Interval Length(Min):
EOI Pulse Width (mS): Disabled
Energy Adjustment: Enabled
Dongle Monitor Mode: Normal
```

5.0   Programming System Settings

5.1   Programming the Multiplier (CT Ratio or CT x PT Ratio)
This is the programmable EXTERNAL multiplier that represents the Transformer Factor of the utility's metering configuration. This is usually the current transformer (CT) ratio. In configurations that use potential (voltage) transformers, this is the current transformer ratio (CT) x potential (voltage) transformer ratio (PT). An 800 Amp to 5 Amp current transformer has a ratio of 160. Therefore, the meter multiplier on a building with 800:5A CT's would be 160. Determine the multiplier of the facility's electric meter. The multiplier is normally printed on the monthly utility bill. If you cannot find it any other place, call your utility and ask what the meter or billing multiplier is.

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<u>5.1   Multiplier (CT Ratio or CT x PT Ratio) (Con't)</u> If the building on which you are using the MPG-3ES has an "Instrument-Rated" electric meter (an electric meter that has external current transformers), AND the local utility has not included this multiplier in the programming of the meter (which is normally the case), you will have to program the meter multiplier into the MPG-3ES' operating parameters. To check out whether or not this is needed, see if the multiplier is listed on the utility bill or call the utility to find out. If this information is not available, look at the serial output using the MPG-3ES's programming USB port using the SSI-UP, and convert the demand data in hexadecimal format to to decimal data. If the kW demand is not correct, then the meter is sending a Secondary value, meaning that the multiplier is not included, and must be entered with the SSI UP's Multiplier entry field.

If the meter is a self-contained meter (no external current transformers), the multiplier is 1.   To change the multiplier in the MPG-3ES, enter the correct multiplier in the **Meter Multiplier** entry field. If you are done entering information you can press the <Save Parameters> box. The multiplier will be sent to the MPG-3ES and will show correctly now in the Meter Multiplier field. The maximum multiplier is 99999 and must be an integer (whole) number.

<u>5.2   Programming the Output Pulse Value</u>
The output pulse value is the number of Watt-hours that each pulse is worth. This is represented by the **Pulse Value** field. The MPG-3ES can be set from 1 Wh to 99999 Wh per pulse. Select a pulse value that you think will be appropriate for your application. A good starting point is 100 wh/pulse. You can adjust it up or down as needed. Larger facilities will require a larger pulse value to keep from overranging the MPG-3ES's registers or the maximum number of output pulses per second. Enter 100 in the Pulse Value field and press <Save Parameters> to set the Output Pulse Value at 100 wh/pulse. The Pulse Value on the SSI-UP will now show the correct value:

```
---------------------------------------
Pulse Value: 100 Watt-hours
---------------------------------------
```

<u>5.3   Set Output Mode</u>
For one-direction operation, set the MPG-3ES's Output Mode to **Normal** mode (kWh delivered). Set the MPG-3ES's mode to the **Signed** mode (kWh delivered or received) if desired for a distributed energy resource(DER) application such as solar or wind. In the Normal mode, only positive energy is recorded and positive pulses generated. Negative energy is ignored. In the Signed mode, bi-directional energy, positive and negative, are separately recorded and positive pulses generated. However, because the MPG-3ES only has one output, negative energy pulses are not available, so Signed mode and Normal mode are effectively the same. Use the Output Mode field to select desired mode. The Normal mode is the default.

For Normal Mode:
Set the mode field to **Normal** and press <Save Parameters> to set the Output Mode to Normal Mode.
For Signed Mode:
Set the mode field to **Signed** and press <Save Parameters> to set the Output Mode to Signed Mode.

<u>5.4   Set the Pulse Output Form</u>
The MPG-3ES has two output forms, the 3-Wire (Form **C**) **Toggle** mode or the 2-Wire (Form **A**) **Fixed** mode. The MPG-3ES has only one 2-Wire output so essentially you are selecting Toggle Mode or Fixed Mode for the K-Y output only. Set the Toggle mode by selecting **C** in the Output Form field from the pull-down menu. The toggle mode is the classic pulse output mode that emulates the standard KYZ 3-Wire electric meter output. It toggles back and forth in a generally symmetrical 50/50 duty cycle format, to the opposite state,(open to closed, closed to open) each time a "pulse" is generated by the MPG-3ES. Even though there are three wires in the Form C configuration, it is common to use the physical 2 wire connection - K and Y - with the MPG-3. The toggle mode is used for systems that are doing demand control and need regularly spaced "symmetrical" pulses. The 3-Wire pulse value must be doubled if your pulse receiving device uses only two wires AND is only counting the closure as a pulse (not the subsequent contact opening also). See additional information on Page 9.

In the Form A (fixed) mode, only the K-Y output is used. This is the standard 2-Wire system where the output contact is normally-open until such time as a pulse is generated. When a pulse is generated, the contact is closed for a selected fixed time interval(dwell) in milliseconds. Form A mode is generally associated with energy measuring systems that are only counting kWh or some other volumetric unit but are not concerned about how or at what rate the energy is consumed at.
For Form C (Toggle) Mode:
Select C and <Save Parameters> to set the Output Form field to the Toggle (Form C) Mode. T

For Form A (Fixed) Mode:
Select A and <Save Parameters> to set the Output Form field to the Fixed (Form A) Mode.

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5.5   Set the Form A Pulse Width Time
If you are using the MPG-3ES in the Fixed Mode, set the output closure time or pulse width, selectable at 25mS, 50mS, 100mS, 200mS, 500mS or 1000mS (1 second) using the Form A Width entry field. Upon a pulse being generated, the K-Y terminals of the output contact will close and the RED Output LED will light for the selected pulse width . This setting applies to the Form A output mode only, and does not affect the toggle output mode. Use the Form A Width field pull-down menu to select the output pulse width to **200** mS, for example. Press <Save Parameters>.

5.6   End-Of-Interval Capability
While the MPG-3's firmware has provisions for an End-of-Interval pulse, the MPG-3ES' hardware does not support this feature. Set the EOI Pulse Width box to **Disabled** and click on <Save Parameters>. If you need the end-of-interval capability, visit the SSI website and view the MPG-3SC or contact Solid State Instruments division of Brayden Automation Corporation.

5.7   Energy Adjustment Algorithm
The MPG-3ES contains a high-accuracy Energy Adjustment algorithm which keeps track of the total amount of energy received in the transmissions from the meter and also the total amount of energy represented by the pulses which have been generated. Once an hour, the two values are compared and an adjustment is made if necessary to "true-up" the energy represented by pulses to the energy reported from the meter. Set the Energy Adjustment box to **Enabled** and click <Save Parameters>. Once enabled, click on <Reset Odometers> to clear out any old information in the MPG-3ES' EAA registers.

5.8   Module Monitor Modes
There are two module readout modes available on the MPG-3ES, Normal and Echo. The Normal mode is the default and shows you the Time Stamp, the Demand, the Multiplier and the Divisor being received by the Zigbee module from the meter and passed from the module to the MPG-3ES' processor. The Normal mode is set by selecting **Normal** in the Dongle Monitor Mode entry field and clicking <Save Parameters>.

The Echo mode allows you to view the entire transmission coming from the meter the way it is received by the MPG-3ES' Zigbee module. This mode may be useful in troubleshooting in the event of intermittent transmissions from the meter. The Echo mode is set by selecting **Echo** in the Dongle Monitor Mode entry field and clicking on <Save Parameters>.

To initiate monitoring, click on the Monitor button. Once you have clicked on the Monitor button, all settings on the left side of the SSI-UP will be grayed out since you can't change any system parameters while you are monitoring. The Monitoring box on the right-hand side of the window will begin showing transmissions each time they are received, about every 8 seconds. You cannot change settings of the MPG-3ES while the SSI Universal Programmer is in the Monitor mode. To go back to Programming mode, click on the Stop Monitoring button.

5.9   Reading back all Programmable Parameters
To view the values of all programmable settings that are currently programmed into the MPG-3, click on <Read Parameters>. The USB serial link will return the current value of each setting if you are connected to the MPG-3 with the SSI Universal Programmer software.

5.10   Reset All Settings to Factory Defaults
If you find that you want to reset all parameters back to the factory defaults, simply pull down the File menu and select "Reset Factory Defaults. The following parameters will default back to the factory settings as follows:
Multiplier=1
Pulse Value: 10 Wh

5.11   Viewing the Firmware Version
The version of firmware in the MPG-3ES is displayed in the upper left hand
corner of the SSI Universal Programmer, and will read something similar: You are connected to: **MPG3 V3.07**

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6.0 Operation

6.1   Communication LEDs
Upon power-up, the yellow COM LED should light indicating that the Zigbee module is enumerated, correctly initialized and communicating with the MPG-3ES's processor. Within approximately 45 - 60 seconds, the green COM LED will blink each time a valid transmission is received from the meter. As long as valid transmissions are received by the Zigbee module and successfully relayed by the MPG-3ES' processor, the green COM LED will blink about once every 8-9 seconds. If the green COM LED does not blink, that is an indication that the data transmissions from the meter are not being received, may be corrupted, or in some manner are not valid transmissions. If the green COM LED has been blinking reliably for some time, then stops for a while and then restarts again, this indicates that transmissions are intermittent and sporadic, or generally means there is a problem in the module's ability to receive data reliably from the meter. To correct this, move the MPG-3ES closer to the meter if possible and eliminate any metallic obstructions between the meter and the MPG-3ES. You must have uninterrupted line-of-sight between the meter and the MPG-3ES.

6.2   Pulse Output
The Output can be configured to be in the **Toggle** (Form C) mode or the **Fixed** (Form A) mode. Generally speaking, the Form C mode can be used with either 2-Wire or 3-Wire pulse receiving devices, while the Form A mode uses only a 2-Wire interface to the downstream (receiving) pulse device. The choice would depend on the pulse format that is most compatible with the application of the receiving device. The MPG-3ES uses only one 2-Wire output so the HARDWARE is FORM A only. However, it can be operated in either the Toggle (C) or Fixed (A) mode.

If the pulse output value is too large and pulses are too slow, then select a smaller pulse value using the SSI Universal Programmer programming software(See Page 6, Section 5.2).

If pulses are being generated too rapidly, select a higher pulse output value. The maximum number of pulses per second is approximately 10, which means that the output's open and closed times are about 50 mS each in Toggle mode. If the calculation by the MPG-3ES's processor for pulse output timing exceeds 15 pulses per second, the MPG-3ES will light the red COM LED, indicating an overflow error, and that the pulse value is too small. The LED is "latched" on so that the next time you look at it this red LED will be lit, and you will have an indication that an error has occurred. The operation of the MPG-3ES will continue even though some pulses may be lost. In this way, you can quickly determine if a pulse output value is too small, and thus pulses too fast at a high demand. However, in the optimum application, pulses would not exceed more than one pulse every 2 seconds, with a 1 pulse per second maximum. This allows a very even and "normal" pulse rate that resembles an actual KYZ pulse output from the meter as closely as possible. See the SSI website for "Picking a Good KYZ Pulse Value" at https://solidstateinstruments.com/newsletters/picking-a-good-kyz-pulse-value.php.

The MPG-3ES will spread out the pulses over the next 7 second period if a high enough watt-hour value is received in a transmission to require that more than one pulse is generated. For example, suppose you have the output pulse value of 10 Wh selected. The next 8-second transmission indicates 24 Wh have been used. Since 24 watt-hours exceeds the 10 watt-hour setting, two pulses must be generated. The first 10 Wh pulse will be generated immediately. About three seconds later the second 10 Wh pulse will be generated. The remainder of four watt-hours stays in the accumulated energy register (AER) awaiting the next transmission and the energy value of that transmission will be added to the contents of the AER. Another example: Assume 25 Wh/p output pulse value. Let's say the next transmission is for 130 watt-hours. 130 is greater than 25, so 5 pulses will need to be generated over the next 7 seconds, approximately one each 1.4 seconds (7 seconds / 5 = 1.4 seconds). The remainder of 5 Wh will stay in the AER awaiting the next transmission. Some trial and error may have to be done for any particular building since pulse rates will change depending on maximum load. The larger you can make the pulse value the more regular the output pulses from the MPG-3ES will be.
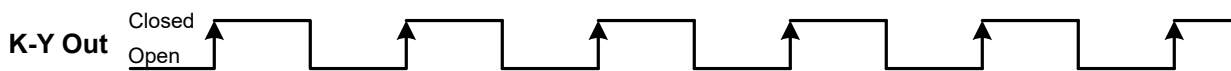
6.3   Overranging the Output
As mentioned above, if there are too many pulses calculated to be generated in a 7 second interval than the MPG-3ES can generate given the timing constraints, the MPG-3ES will light the red COM LED. In this situation, simply increase the Pulse Output Value using the programming port, and cycle power to the MPG-3ES to reset the red COM LED. This is intended to notify the user that a higher pulse value is needed to reduce the number of pulses per second at the peak demand. As load is added to a building over time, there is some likelihood that this will occur so be sure to consider this if/when you add load to the building. If an error condition occurs, set the pulse value to a higher, for example double the current value. Remember to change the pulse constant of your receiving device as well, since pulses will now be worth a higher watt-hour value. Cycle power to the MPG-3ES to reset the red COM LED after increasing the pulse value.

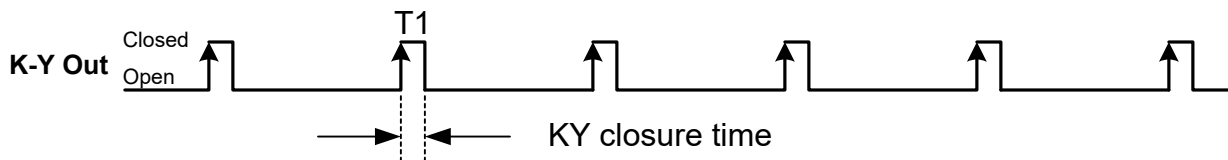# WORKING WITH THE MPG-3ES RELAY

PULSE OUTPUT MODES: The MPG-3ES Meter Pulse Generator allows the outputs to be configured in either the Toggle or Fixed pulse output mode. In the Toggle mode, the outputs alternate or toggle back and forth each time a pulse is generated in a generally symmetrical 50/50 duty cycle format. This is synonymous with the classic 3-Wire pulse metering and emulates the SPDT KYZ switch model. Figure 1 below shows the timing diagram for the Toggle output mode. Since the MPG-3ES uses only 2 wires, there are only KY closures. KY closures are alternately opened and closed. This mode is best for timing pulses to derive kW demand. The KZ side of the contact is not shown.

Figure 1: 2-Wire or 3-Wire TOGGLE Output Operation

In the Fixed output mode shown in Figure 2 below, an output pulse (K-Y closure only) is a fixed width (T1) each time the output is triggered. The pulse width (closure time) is determined by the Form A Pulse Width setting using the Programming port. (See Page 7, Section 5.5) This mode is best for energy *counting* systems but generally is not best for systems doing demand control where pulses are timed to derive instantaneous kW demand.

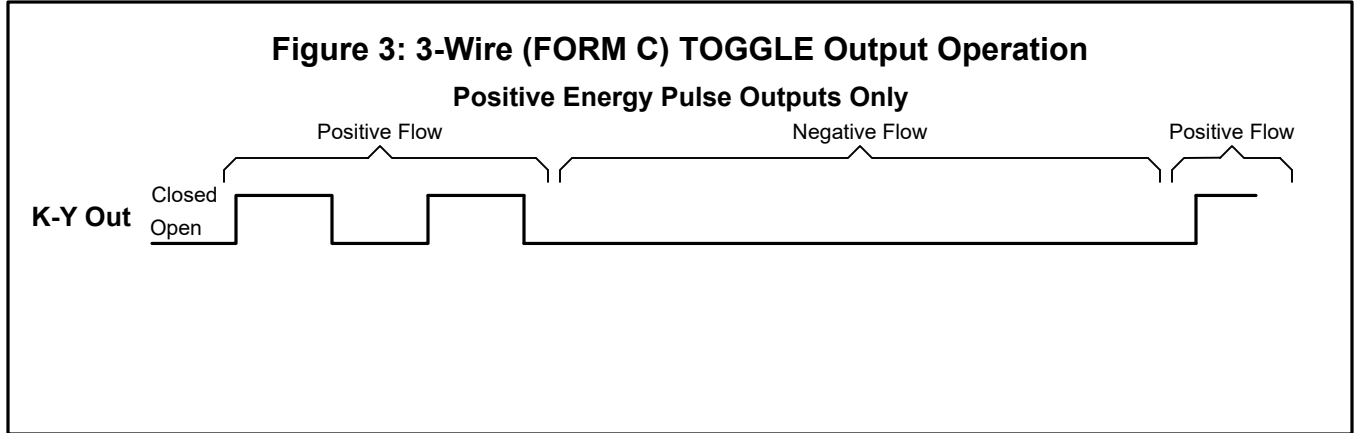### Figure 2: 2-Wire Only FIXED Output Operation

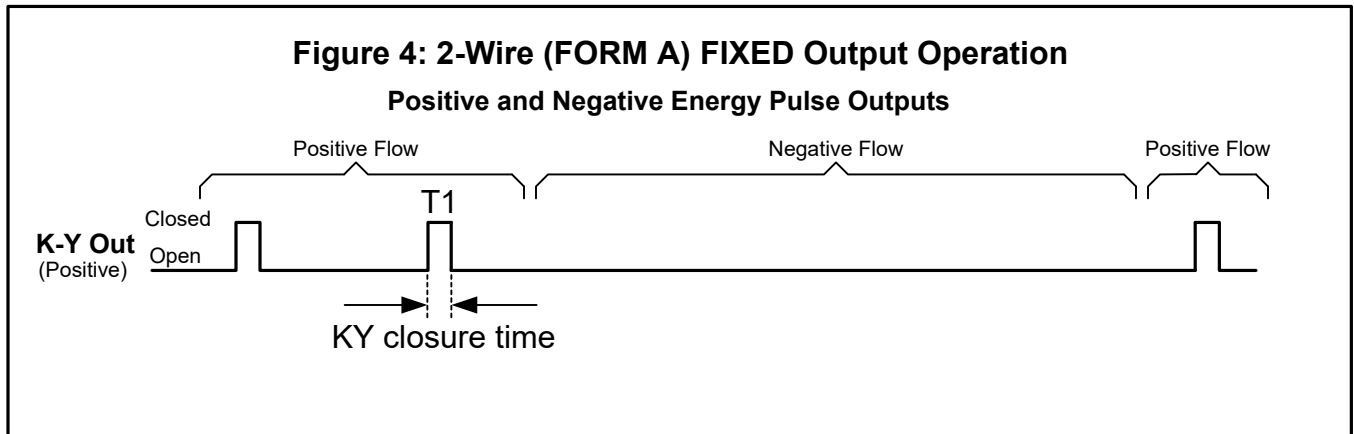Contact the factory for technical support at (970) 461-9600.

Working with the MPG-3ES (cont)

<u>Bi-Directional Energy Flow (Signed Mode)</u>
Because the MPG-3ES has only one pulse output, the bi-directional pulse mode will only give you output pulses for positive energy flow (kWh Delivered). No pulses are outputted when there is negative energy flow(kWh Received). Therefore, Normal and Signed mode in the MPG-3ES are essentially the same. The only option would be whether positive pulses are toggle or fixed as shown below.

Figure 3: 3-Wire (FORM C) TOGGLE Output Operation
Positive Energy Pulse Outputs Only

In Signed mode, with a Form C output mode selected, the K-Y output pulses represent positive (or kWh delivered) energy with a toggle pulse output; Negative (or kWh received) energy is ignored.

Figure 4: 2-Wire (FORM A) FIXED Output Operation
Positive and Negative Energy Pulse Outputs

In Signed mode, with a Form A output mode selected, the K-Y output pulse represents positive (or kWh delivered) energy with a fixed width pulse; Negative (or kWh received) energy is ignored.

List of MPG-3ES Commands

Here is a list of the available commands if you are using an ASCII terminal program instead of the SSI Universal Programmer software. If you don't remember them use the help, 'h', 'H', or '?' to bring up the list.

mXXXXX<CR> or MXXXXX<CR> - Set multiplier (XXXXX is 1 to 99999).
pXXXXX<CR> or PXXXXX<CR> - Set pulse value, Watt-hours (XXXXX is 0 to 99999)
tXXX<CR> or TXXX<CR> - Set reset time, seconds (XXX is 30 to 600).
'r<CR>' or 'R<CR>' - Read parameters.
's0<CR>' or 'S0<CR>' - Set into normal mode (positive only with Form A or C set <u>by C command</u>)
's1<CR>' or 'S1<CR>' - Set into signed mode (positive/negative with only Form A)
'd0<CR>' or 'D0<CR>' - Set into dongle normal mode
'd1<CR>' or 'D1<CR>' - Set into dongle echo mode
'eX<CR>' or 'EX<CR>' - Set End Of Interval, (X is 0-8), 0-Disabled.
'iX<CR>' or 'IX<CR>' - Set Interval Length, (X is 1-6) (This feature not supported on MPG-3ES.)
'aX<CR>' or 'AX<CR>' - Energy Adjustment enable/disable, 0-Disabled, 1-Enable.
'KMODYYRHRMNSC<CR>' - Set Real Time Clock Calendar, MO-Month, DY-Day, etc.'z<CR>' or 'Z<CR>' - Set Factory Defaults
'v<CR>' or 'V<CR>' - Query Firmware version

Pulse Output Mode (Form)
'c0<CR>' or 'C0<CR>' - Pulse output mode Form C disabled (Form A Output Mode)
'c1<CR>' or 'C1<CR>' - Pulse output mode Form C enabled (Form C Output Mode) (default)

Form A Pulse Width
'wX<CR>' or 'WX<CR>' - Pulse width in Form A mode, milliseconds - 25 to 1000mS, 100mS default;

Form A Pulse Width Selections:
'w0<CR>' or W0<CR>' - 25mS Closure
'w1<CR>' or 'W1<CR>' - 50mS Closure
'w2<CR>' or 'W2<CR>' - 100mS Closure
'w3<CR>' or 'W3<CR>' - 200mS Closure
'w4<CR>' or 'W4<CR>' - 500mS Closure
'w5<CR>' or 'W5<CR>' - 1000mS Closure