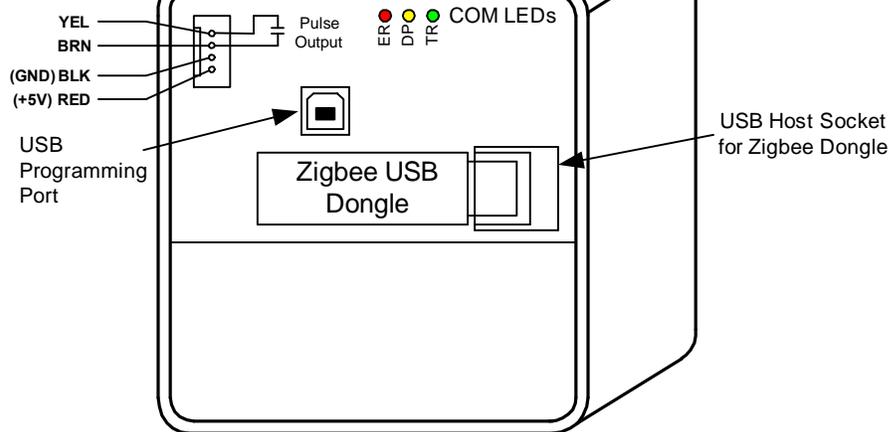


# MPG-2ES

*Standard Solid State*

## ZIGBEE PULSE GENERATOR INSTRUCTION SHEET

### WIRE HARNESS CONNECTIONS



**GENERAL** - The MPG-2ES is a scaled-down, specific purpose version of the MPG-1C and MPG-2 that allows cost reduction when only basic features and one K-Y output are needed.

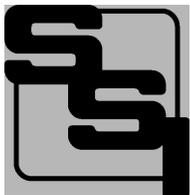
**MOUNTING POSITION** - The MPG-2ES may be mounted in any position but is intended to be mounted with the orientation above such that the circuit board is upright. The MPG-2ES must be mounted within 75' of the meter. Actual operational distance may vary with building construction and ability for the RF signal to penetrate building materials. For best results, mount the MPG-2ES as close to the meter as reasonably possible.

**POWER SUPPLY INPUT** - The MPG-2ES is powered from +5VDC. Connect the RED wire to the +5VDC positive source. Connect the BLK wire to the 5VDC ground (negative) terminal.

**ZIGBEE WIRELESS COMMUNICATION** - The MPG-2ES is designed to receive power monitoring information from an electric meter equipped with Zigbee wireless communications. The Zigbee tranceiver dongle is mounted on the MPG-2ES's circuit board. Ensure that the dongle is properly seated in the USB host socket. Do not remove.

**PULSE OUTPUT** - A 2-wire (Form A) K-Y output is available for connection to the pulse receiving device. The BLK 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.

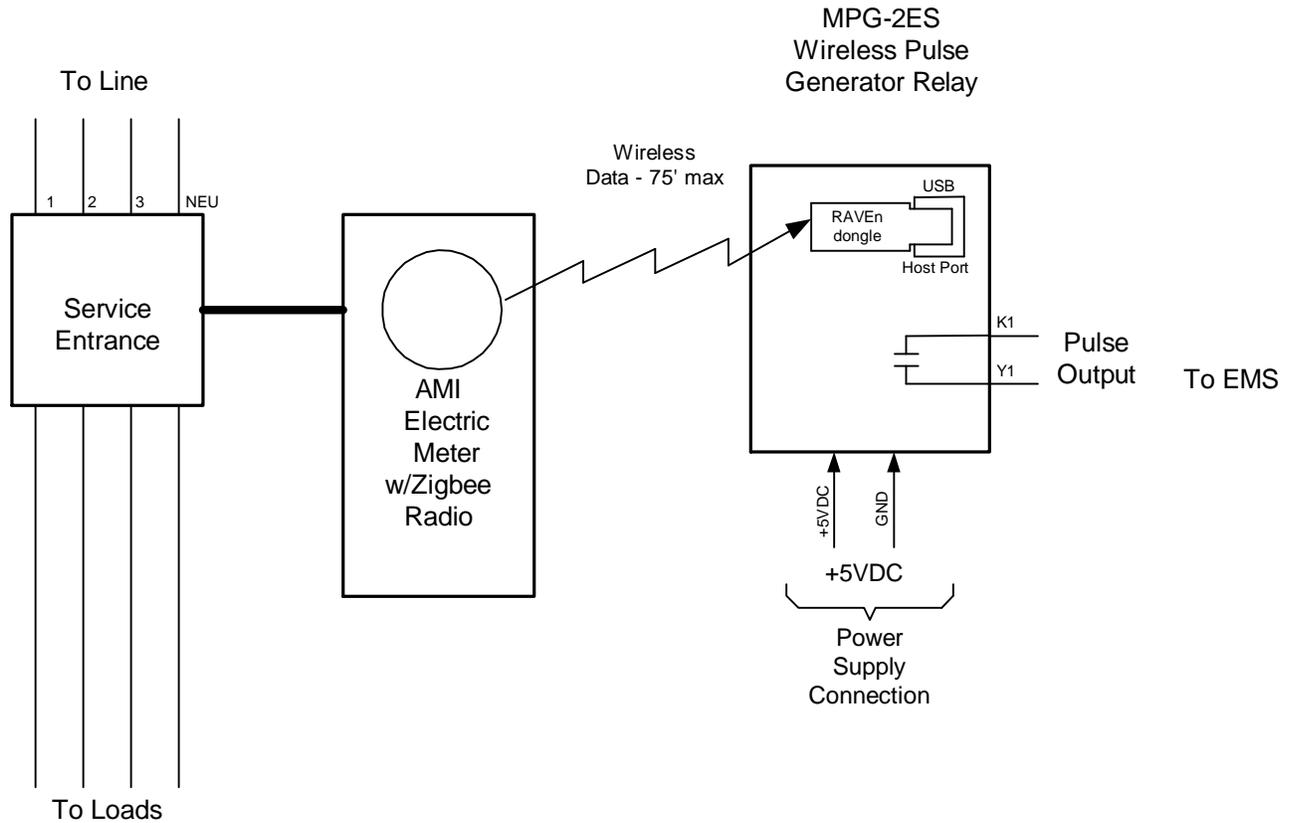
**OPERATION** - See the following pages for a full explanation of the operation of the MPG-2ES.



## SOLID STATE INSTRUMENTS

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# MPG-2ES Wiring Diagram



MPG-2ESWiringDiagram.vsd

MPG-2ES Wireless Pulse Generator Wiring Diagram		REVISIONS	
		NO.	DATE
DATE ORIGINAL	SCALE		
10/6/18	N/A		
LATEST REVISION	JOB NO.	CHECKED	DRAWN
			WHB

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# MPG-2ES Wireless Meter Pulse Generator

## 1.0 General

The process for installing the MPG-2ES usually is done in this order but may vary depending on several factors:

1. Provisioning (Section 2)
2. Hardware Installation (Section 3)
3. Programming Setup (Section 4)
4. Programming System Settings (Section 5)
5. Operation (Section 6)

If your utility is doing the installation and they are experienced with this process, they may choose to do it in a different order.

1.1 Provisioning - This is the process of pairing the Zigbee transceiver (dongle) in the MPG-2ES with the electric meter that will be sending it power monitoring information. It is usually best to get this done first if you are not familiar with the process. Provisioning can be done by the utility after the MPG-2ES is installed by sending the MAC address 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-2ES will be paired.

1.2 Hardware Installation - Once you are confident that the MPG-2ES's Zigbee transceiver is paired with the meter, completing the installation of the physical unit is the next step. If the utility is doing the MPG-2ES installation and they are experienced in provisioning, then the provisioning process may be done after installation. Installation includes mounting the unit at or near the electric meter and connecting the outputs to the destination (pulse receiving) devices.

1.3 Programming Setup - To program the MPG-2ES, a Windows 7 or 10 PC computer with the SSI Universal Programmer program is required. The SSI Universal Programmer program can be downloaded from the [solidstateinstruments.com](http://solidstateinstruments.com) website located on the MPG-2ES's webpage.

1.4 Program the System Settings - Once the ability to communicate with the MPG-2ES 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.

# MPG-2ES Wireless Meter Pulse Generator

## 2.0 Provisioning

### 2.1 Pairing the USB Zigbee Dongle Transceiver

The USB Zigbee Transceiver device 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 dongle must be powered to be paired with the meter and must be within range of the meter, usually within 75 feet. Distances may vary depending on the types of structures and building materials that the radio signal must penetrate.

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

### 2.2 Power up the MPG-2ES for Provisioning

Apply power to the MPG-2ES using the +5VDC source. Make sure to get the positive lead (usually red) is connected to the **+5V** terminal. Connect the negative lead (usually black) connected to the **GND** terminal. Upon power-up the yellow COM LED will light indicating the the MPG-2ES's microprocessor senses the presence of the Zigbee dongle and that it is installed correctly.

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

2.4 Unsuccessful Pairing - If the dongle's RED LED is not on continuously, the network has not been created, and the MPG-2ES will not receive information from the dongle. If no connection has been made, the MPG-2ES will reset the dongle every 120 seconds (default reset time) attempting to establish a connection. The RED LED on the dongle 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 dongle has not been previously paired with a different meter.

2.5 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 dongle, you will have to contact them to get this accomplished. Give them the dongle's MAC address and the Installation ID code, supplied with the MPG-2ES.

## 3.0 Installing the MPG-2ES

3.1 Mounting Location - Mount the MPG-2ES to the building at or near the electric meter that will be wirelessly sending communications to the MPG-2ES. It must be within 75' but distances may vary depending on whether the radio signal must go through any walls and the material of those walls. For best results mount the MPG-2ES as close to the meter as possible with an unobstructed line-of-sight with the meter if possible.

3.2 Mounting Hardware - Four mounting flanges, two top and two bottom, are provided in the polycarbonate enclosure. Mount with the mounting flanges on the top and bottom. Use 10-32 screws or suitable hardware to attach the MPG-2ES to the building as necessary.

3.3 Wire the Power Supply - Knock out one of the 1/2" conduit knockouts in the lower compartment of the enclosure and run conduit as necessary to the +5VDC power supply. Wire the power supply to the MPG-2ES' RED and BLK leads.

3.4 Wire the Pulse Outputs - If Pulse outputs going to a separate enclosure, knock out a second 1/2" conduit knockout and run 1/2" conduit as desired to destination wiring enclosure. Run a #18AWG 2-conductor control cable from the destination device into the MPG-2ES. A 2-Wire (Form A) connection will use two wires, K and Y. The optimum wire size of #18AWG is recommended. Although smaller wires will adequately carry the ultra-low current involved, it is generally hard to work with and subject to easy breakage. Larger wires will be difficult to work with in the limit space in the enclosure.

# MPG-2ES Wireless Meter Pulse Generator

## 4.0 Programming Setup

All settings of the MPG-2ES 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-2es-wireless-pulse-generator.php> if you have not already done so. The download link is under the Documentation tab.

### 4.1 Equipment Required -

- a.) Windows computer
- b.) USB A-B cable

4.2 Setting up the Programming Port - Connect a USB cable with one USB Type A connector and one USB Type B connector. Connect the USB-B end to the MPG-2ES. Start the SSI Universal Programmer program.

4.3 Verify Communications with MPG-2ES - Turn on power to the MPG-2ES and after the initialization process, the RED LED on the dongle should be lit continuously. The SSI Universal Programmer software should immediately recognize that it is connected to the MPG-2ES. A green simulated LED at the top of the programming page indicates that the connection has been made.

Assuming that the dongle is paired (correctly) with the meter, is on, and is within 75' of the meter, then every 8 to 10 seconds, you will see information similar to the listing below received from the MPG-2ES in the SSI UP monitor mode:

```
-----  
Time Stamp: 21582e64  
Demand: 000967  
Multiplier: 00000001  
Divisor: 000003e8  
Energy (U): 5.35 Wh  
Energy (F): 5.70 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 - Stop the monitoring mode and press "Read" button to view the current status or value of all current system programming parameters. This is what is currently stored in the MPG-2ES's memory. The MPG-2ES will return the following information:

```
-----  
Multiplier: 1  
Pulse Value: 10 Watt-hours  
Output Mode: Normal  
Output Form: C  
Dongle Mode: Normal  
Reset Time: 120 seconds  
Filter: Enabled  
Filter Setting: 2 Samples
```

## 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. 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.

If the building on which you are using the MPG-2ES has an "Instrument-Rated" electric meter (an electric meter that has 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-2ES's operating parameters. To check out whether or not this is needed, look at the serial output using the MPG-2ES'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.

## MPG-2ES Wireless Meter Pulse Generator

### 5.1 Multiplier (CT Ratio or CT x PT Ratio) (Con't)

Determine the multiplier of the facility's electric meter. If the meter is a self-contained meter (no external current transformers), the multiplier is 1. The default external multiplier in the MPG-2ES is one (1), so you can skip this step. If the utility's Zigbee transmission to the dongle includes the correct CT/PT multiplier value (*primary* value), you can skip this step also. This is very rare on instrument-rated metering implementations however, since most utilities do not want to program the multiplier into the meter due to conflicts with the billing process. If you are looking at the serial data received from the meter, you will be able to see what internal multiplier is being sent in every transmission. This will be in hexadecimal format. What you're looking for is whether this is 1 or something else besides 1. If, for instance, the multiplier is a decimal 160, it will be transmitted by the meter to the dongle as a hexadecimal "A0". If the multiplier is one (1), (and this is the standard) AND *you know* that that the meter's external multiplier is something other than 1, you will have to program the correct external multiplier into the MPG-2ES so that the true energy value, and thus the kW demand, is correct.

To change the multiplier in the MPG-2ES, enter the correct multiplier in the **Meter Multiplier** field. If you are done entering information you can press the <Send> box and the multiplier will be sent to the MPG-2ES and will show correctly now in the Meter Multiplier field.

The USB serial link will return the current multiplier stored in the MPG-2ES, along with all other system settings. The maximum multiplier is 99999 and must be an integer (whole) number.

### 5.2 Programming the Output Pulse Value

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-2ES 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-2ES's registers or the maximum number of output pulses per second. Enter 100 in the Pulse Value field and press <Send> 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  
-----

### 5.3 Set Output Mode

For one-direction operation, set the MPG-2ES's Output Mode to **Normal** mode (kWh delivered). Set the MPG-2ES'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, bidirectional energy, positive and negative, are separately recorded and positive pulses generated. However, because the MPG-2ES 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 <Send> to set the Output Mode to Normal Mode. The serial link to the MPG-2ES will return:

-----  
Normal  
-----

For Signed Mode:

Set the mode field to Signed and press <Send> to set the Output Mode to Signed Mode. The serial link to the MPG-2ES will return:

-----  
Signed  
-----

### 5.4 Set the Pulse Output Form

The MPG-2ES has two output forms, the 3-Wire (Form **C**) **Toggle** mode or the 2-Wire (Form **A**) **Fixed** mode. 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, to the opposite state, each time a "pulse" is generated by the MPG-2ES. Even though there are three wires, it is common to use K and Y, or K and Z, for many two-wire systems that require or desire a generally symmetrical 50/50 duty cycle pulse. 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.

## MPG-2ES Wireless Meter Pulse Generator

### 5.4 (Con't)

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(dwel) 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 <Send> to set the Output Form field to the Toggle (Form C) Mode. The serial link to the MPG-2ES will return:

-----  
C  
-----

For Form A (Fixed) Mode:

Select A and <Send> to set the Output Form field to the Fixed (Form A) Mode. The serial link to the MPG-2ES will return:

-----  
A  
-----

### 5.5 Set the Form A Pulse Width Time

If you are using the MPG-2ES in the Fixed Mode, set the output closure time or pulse width using the Form A Width field, selectable 25 to 1000 mS (~1 second) in 6 possible pulse widths. Upon a pulse being generated, the K-Y terminals of each contact will close for the selected pulse width. This setting applies only to the Form A output mode, 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 <Send>. The serial link to the MPG-2ES will return:

-----  
200  
-----

### 5.6 Full Factory Reset

If you find that you want to reset all parameters of the MPG-2ES back to the factory defaults, pull down the File dropdown menu and select **Reset Factory Defaults**. The following parameters will default back to the factory settings as follows:

Multiplier=1

Pulse Value: 10

Reset Time: 120 seconds

Note that this resets the non-volatile memory of the MPG-2ES's processor only. It does not reset the memory in the dongle. Contact factory regarding factory reset of the dongle.

### 5.7 Viewing the Firmware Version

The MPG-2ES's firmware version is displayed in the upper left-hand corner of the SSI-UP software and shows:

**You are connected to an: MPG-2 V2.13**

### 5.8 Dongle Monitor Mode

There are two dongle readout modes available on the MPG-2ES, **Normal** and **Echo**. The Normal mode is the default and shows you the Time Stamp, the Demand, the Multiplier and the Divisor coming from the meter. The Normal mode is set by selecting the Normal radio button on the right side of the SSI-UP dialog box and clicking on **Monitor**.

The Echo mode allows you to view the entire transmission coming from the meter the way it is received by the MPG-2ES' microcontroller from the dongle in XML format. This mode may be useful in troubleshooting in the event of intermittent transmissions from the meter. The Echo mode is set by selecting the Echo radio button on the right side of the SSI-UP dialog box and clicking on **Monitor**.

## MPG-2ES Wireless Meter Pulse Generator

### 5.9 Filter Mode Enable/Disable

The MPG-2ES includes a filtering mode to smooth out the erratic demands transmitted from the electric meter which happen for a number of known and unknown reasons. This mode allows you to use 2 to 10 samples, each at about 8 seconds long, to average usage, and thus smooth kW demand, over the selected interval from approximately 16 to 80 seconds.

Depending on the device receiving the pulses and the methodology it uses to interpret them, this can be a great help in representing the *real* kW demand and eliminate the quantization problem caused by the meter's measurement method.

To enable the filter mode select **Enable** in the Filter field. Hit <Send>. The serial link on the MPG-2ES will return the following:

-----  
Enabled  
-----

To disable the filter mode select **Disable** in the Filter field. Hit <Send>. The serial link on the MPG-2ES will return the following:

-----  
Disabled  
-----

### 5.10 Set the Number of Filter Samples

Select the number of samples used by the Filter mode from 2 to 10. The default is 2. Hit <Send>. The serial link on the MPG-2ES will return the following:

-----  
5  
-----

# MPG-2ES Wireless Meter Pulse Generator

## 6.0 Operation

### 6.1 Communication LEDs

Upon power-up, the yellow COM LED should light indicating that the Zigbee dongle is enumerated, correctly initialized and communicating with the MPG-2ES'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 RAVEn dongle and successfully relayed by the MPG-2ES's 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 dongle's ability to receive data reliably from the meter. To correct this, move the MPG-2ES closer to the meter if possible and eliminate any metallic obstructions between the meter and the MPG-2ES. For the longest distances you must have line-of-sight.

### 6.2 Pulse Outputs

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-2ES uses only two output wires so the HARDWARE is FORM A only. However, it can be operated in either the Toggle or Fixed mode.

If the pulse output value is too high and pulses are too slow, then select a lower pulse value using the programming port and a terminal program (See Page 6).

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-2ES's processor for pulse output timing exceeds 15 pulses per second, the MPG-2ES 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-2ES will continue even though some pulses were 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.

The MPG-2ES 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 ( $7 \text{ seconds} / 5 = 1.4 \text{ seconds}$ ). 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-2ES will be.

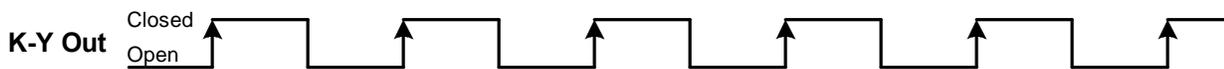
### 5.3 Overranging the Output

As mentioned above, if there are too many pulses calculated to be generated in a 7-second interval than the MPG-2ES can generate given the timing constraints, the MPG-2ES 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-2ES to reset the red COM LED. This is intended to notify the user that a higher pulse value is needed. 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-2ES to reset the red COM LED after increasing the pulse value.

# WORKING WITH THE MPG-2ES RELAY

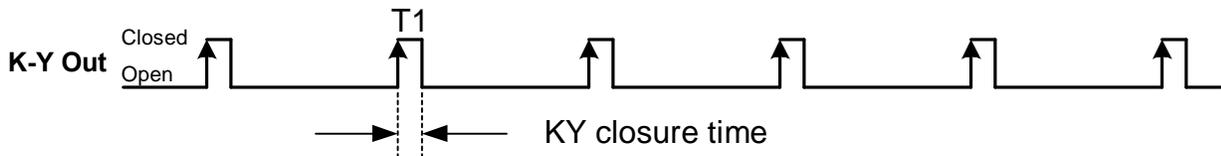
**PULSE OUTPUT MODES:** The MPG-2ES Meter Pulse Generator allows the outputs to be configured in either the Toggle or Fixed pulse output mode. In the Toggle mode, the outputs alternate or toggle back and forth each time a pulse is generated. This is synonymous with the classic 3-Wire pulse metering and emulates the SPST KYZ switch model. Figure 1 below shows the timing diagram for the Toggle output mode. Since the MPG-2ES 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.

**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 ( $T_1$ ) 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.) 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**

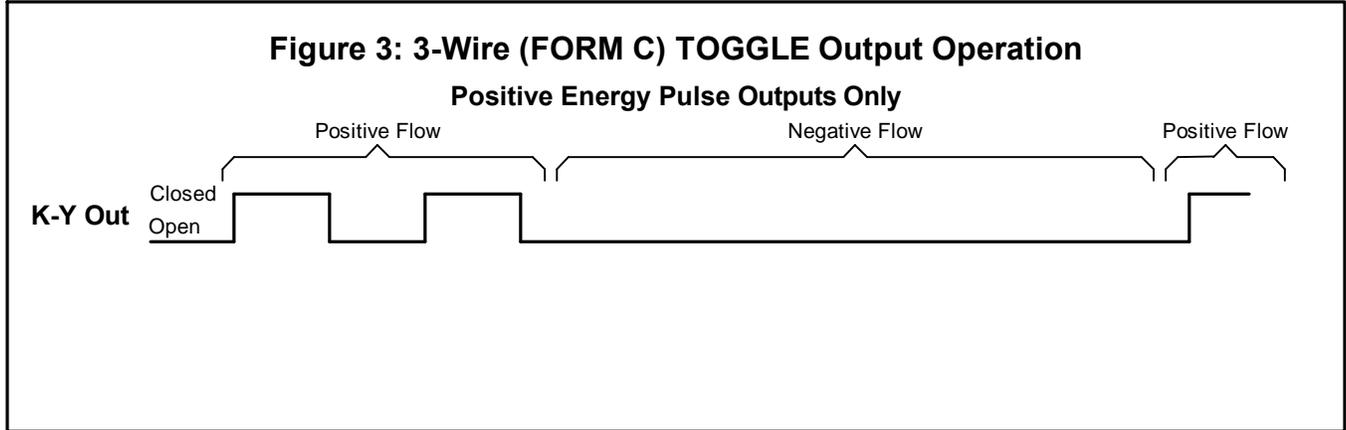


Contact the factory for technical support at (970) 461-9600.

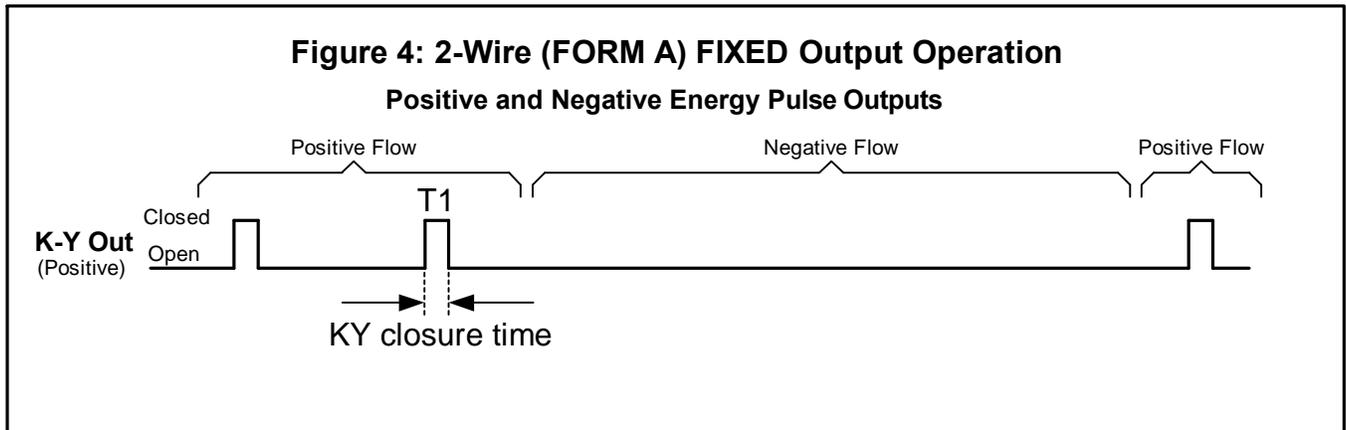
## Working with the MPG-2ES (cont)

### Bi-Directional Energy Flow (Signed Mode)

Because the MPG-2ES has only one pulse output, the bi-directional pulse mode will only give you output pulses for positive energy flow. No pulses are outputted when there is negative energy flow. Therefore, Normal and Signed mode in the MPG-2ES are essentially the same. The only option would be whether positive pulses are toggle or fixed as shown below.



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.



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-2ES 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 resettime, seconds (XXX is 30 to 600).  
'f0<CR>' or 'F0<CR>' - Disable filter.  
'fx<CR>' or 'Fx<CR>' - Enable filter and set number of samples (x=2 to 10)  
'r<CR>' or 'R<CR>' - Read parameters.  
's0<CR>' or 'S0<CR>' - Set into normal mode (positive only with Form A or C set by C command)  
'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  
'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