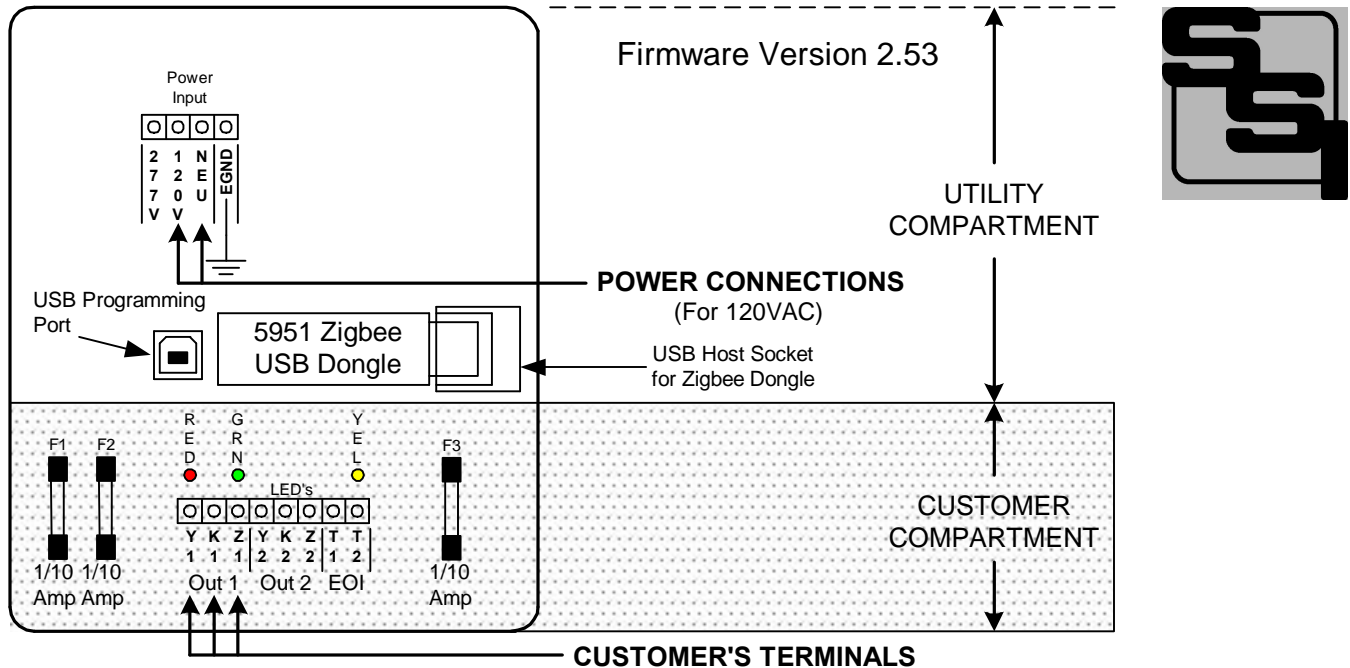


# MPG-2

Premium Solid State

# ZIGBEE PULSE GENERATOR INSTRUCTION SHEET



**MOUNTING POSITION** - The MPG-2 may be mounted in any position but is intended to be mounted with the hinged door on the left such that the circuit board is upright. The MPG-2 must be mounted within 25' line-of-site 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-2 as close to the meter as reasonably possible.

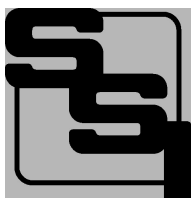
**POWER INPUT** - For 120VAC, connect **120VAC** "hot" lead to the 120V terminal. Connect the neutral wire to the **NEU** terminal. For 208 to 277VAC, use the **277V** terminal for the "hot" lead and the **NEU** terminal for the neutral power supply lead. The **EGND** terminal **MUST** be connected to the power supply ground. If the MPG-2 is mounted at the meter and powered from the meter potentials, **AND** no true neutral exists at the meter, connect the EGND and NEU terminals to the electrical system ground.

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

**CUSTOMER OUTPUTS** - The customer's outputs are located at the bottom of the MPG-2 board in the customer compartment. There are two KYZ Form C (3-wire) dry-contact outputs for watt-hour pulses, and one End-of-Interval (EOI) KY Form A (2-Wire) pulse output. The two 3-wire isolated pulse outputs are provided on the MPG-2, with output terminals K1, Y1 & Z1 and K2, Y2, & Z2. The End-of-Interval pulse output uses terminals T1 & T2. Transient suppression for the contacts of the solid-state relays is provided internally. The output loads should be limited to 100 mA at 120 VAC/VDC with maximum power dissipation of each output limited to 800mW.

**FUSES** - Fuses are 3AG fast-blow type. One-fourth (1/4) Amp fuses (the maximum size) are supplied standard. The KYZ outputs for Output1 and Output 2 are protected by fuses F1& F2, respectively. The EOI output is protected by fuse F3.

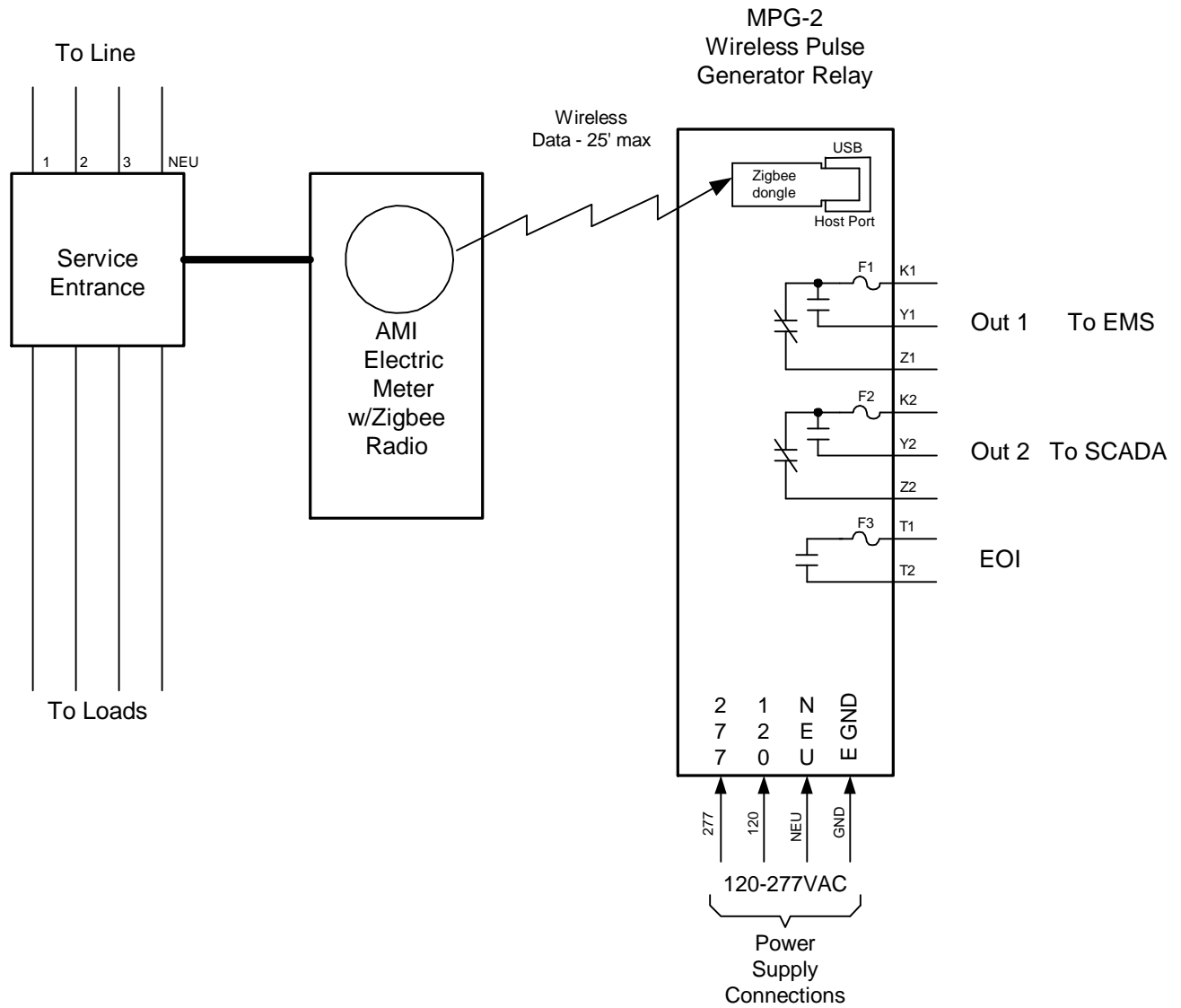
**OPERATION** - See the following pages for a full explanation of the operation of the MPG-2.



## SOLID STATE INSTRUMENTS

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# MPG-2 Wiring Diagram



MPG-2WiringDiagram.vsd

<b>MPG-2 Wireless Pulse Generator Wiring Diagram</b>		REVISIONS	
		NO.	DATE
DATE ORIGINAL	SCALE		
1/26/2020	N/A		
LATEST REVISION	JOB NO.	CHECKED	DRAWN
			WHB

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# MPG-2 Wireless Meter Pulse Generator

## 1.0 General

The process for installing the MPG-2 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-2 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-2 is installed by sending the MAC address and Installation ID to the electric meter through the AML system. This means that the utility can send this information directly to the specific electric meter to which the MPG-2 will be paired.

1.2 Hardware Installation - Once you are confident that the MPG-2'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-2 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-2, 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-2's Downloads webpage.

1.4 Program the System Settings - Once the ability to communicate with the MPG-2 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-2 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 25 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-2 for Provisioning

Apply power to the MPG-2 using a 120VAC line cord. Make sure to get the Hot lead(usually Black) of the line cord connected to the **120V** terminal. Connect the neutral lead(usually White) connected to the **NEU** terminal. Connect the ground lead (Green) to the **EGND** terminal. Upon power-up the yellow COM LED will light indicating the the MPG-2'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-2 will not receive information from the dongle. If no connection has been made, the MPG-2 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-2.

### 3.0 Installing the MPG-2

3.1 Mounting Location - Mount the MPG-2 to the building at or near the electric meter that will be wirelessly sending communications to the MPG-2. 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-2 as close to the meter as possible with an unobstructed line-of-sight with the meter if possible.

3.2 Mounting Hardware - Two mounting flanges, top and bottom, are provided in the fiberglass NEMA 4X enclosure. Mount with the hinge on the left hand side of the enclosure and latches on the right hand side. Use 1/4" Lag Bolts or suitable hardware to attach the MPG-2 to the building.

3.3 Wire the Power Supply - Drill a suitable 1/2" conduit-sized hole (.875" max) into the upper compartment from the left hand side of the enclosure. Wire the power supply to the MPG-2. For 120VAC, wire the Hot lead(usually Black) to the **120V** terminal. Connect the neutral lead(usually White) to the **NEU** terminal. Connect the ground lead (Green) to the **EGND** terminal. If the MPG-2 is mounted directly to the meter, AND no true Neutral exists at the meter, wire the NEU and EGND terminals both to Ground.

3.4 Wire the Pulse Outputs - Drill a suitable 1/2" conduit-sized hole (.875" max) into the lower compartment from the bottom or lower sides of the enclosure into the customer compartment. Run 1/2" conduit as desired to destination wiring enclosure. Determine whether the device(s) receiving pulses from the MPG-2 will need 2 wires or 3 wires. A 3-Wire (Form C) connection will use all three wires K,Y, and Z. A 2-Wire (Form A) connection will use only two wires, usually K and Y. See Figure 1 or Figure 2 for wiring diagrams. A minimum 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.

3.5 Wire the End-of-Interval Output - If you are using the EOI output for synchronization of the demand interval to the meter you will use the 2-Wire (Form A) pulse output. Two wires will be required to the T1 and T2 terminals.

## MPG-2 Programming

### 4.0 Programming Setup

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

#### 4.1 Equipment Required -

- a.) Windows computer running Windows 7 or later OS.
- 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-2.

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

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-2. Click on the Monitor box to enter the SSI UP Monitor mode:

```
-----  
Time Stamp: 271678F5 TSR:N  
Demand: 0002D0  
Multiplier: 00000001  
Divisor: 000003E8  
Summation: 000003BCF478  
Energy (U): 16.00 Wh  
Acc. Energy: 1341402.87 Wh
```

Note that the Timestamp, Demand, Multitplier 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-2's memory. The MPG-2 will return the following information:

```
-----  
Multiplier: 1  
Pulse Value: 10 Watt-hours  
Output Mode: Normal  
Output Form: C  
Dongle Mode: Normal  
Energy Adj.: Enabled  
Date: 10/11/20  
Time: 22/35/57  
DOW:1  
Odometers - As of 10/07/20 17:06:56  
Pulse #1: 128451  
Pulse #2: 0  
Energy: 1284519.50 Wh  
-----
```

### 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-2 has an "Instrument-Rated" electric meter (an electric meter that has current

## MPG-2 Programming

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 enter the Meter Multiplier into the MPG-2's program. To check out whether or not this is needed, look at the serial output using the MPG-2'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.

### 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-2 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-2 so that the true energy value, and thus the kW demand is correct.

To change the multiplier in the MPG-2, 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-2 and will show correctly now in the Meter Multiplier field.

The USB serial link will return the current multiplier stored in the MPG-2, 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-2 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-2'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-2's Output Mode to **Normal** mode (kWh delivered). Set the MPG-2'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 (delivered) is displayed and pulses generated. In the Signed mode, bidirectional energy (delivered or received) can be displayed and pulses generated for each mode individually. 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-2 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-2 will return:

-----  
Signed  
-----

### 5.4 Set the Pulse Output Form

The MPG-2 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** or the **A** 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,

## MPG-2 Programming

### 5.4 (Con't)

each time a "pulse" is generated by the MPG-2. Even though there are three wires (K, Y, & Z), 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 at any given time. 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 contact closure as a pulse (not the subsequent contact opening also). Red and Green Output LEDs show the output status. 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 <Send> to set the Output Form field to the Toggle (Form C) Mode. The serial link to the MPG-2 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-2 will return:

-----  
A  
-----

### 5.5 Set the Form A Pulse Width Time

If you are using the MPG-2 in the Form A 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 and light the RED LED only. 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-2 will return:

-----  
200  
-----

### 5.6 Full Default Settings Reset

If you find that you want to reset all parameters of the MPG-2 back to the SSI 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

Note that this resets the non-volatile memory of the MPG-2's processor only. It does not reset the memory in the dongle. See Page 13 for a Hard Reset of the dongle.

### 5.7 Viewing the Firmware Version

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

**You are connected to a: MPG-2 V2.53**

### 5.8 Dongle Monitor Mode

There are two dongle readout modes available on the MPG-2, 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**.

-----  
Dongle Model: Normal  
-----

The Echo mode allows you to view the entire transmission coming from the meter the way it is received by the MPG-2's 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-2 Programming (cont)

5.9 This section removed

5.10 This section removed

### 5.11 End-Of-Interval Mode

The MPG-2 has a synthesized End-Of-Interval (EOI) feature. The MPG-2 has an internal software Real Time Clock (RTC). The MPG-2 reads the timestamp from the meter at 1 hour intervals and updates the internal RTC if necessary to keep the timeclock accurate. If the EOI feature is enabled, upon the stroke of the quarter hour (if set for a 15-minute interval), the MPG-2 will output an End-Of-Interval pulse, the duration of which is determined by the Ex setting.

E0 - EOI disabled and no EOI pulses will be generated.

E1 - EOI enabled at 50mS (1/20th of a second).

E2 - EOI enabled at 100ms (1/10th of a second).

E3 - EOI enabled at 250ms (1/4th of a second).

E4 - EOI enabled at 500ms (1/2 of a second).

E5 - EOI enabled at 1000ms (1 second).

E6 - EOI enabled at 2000ms (2 seconds).

E7 - EOI enabled at 5000ms (5 seconds).

E8 - EOI enabled at 10000ms (10 seconds).

To disable the EOI feature enter E0 and press <Enter>. The serial link on the MPG-2 will return the following:

-----  
EOI Pulse: Disabled  
-----

To enable the End-of-Interval mode AND set the Pulse Width for 100mS enter E2 and <Enter>. The serial link on the MPG-2 will return the following:

-----  
EOI Pulse: Enabled-100mS  
-----

### 5.12 Setting the Interval Length

The MPG-2 allows the user to set the internal length for the correct meter interval. While a 15 minute interval is almost universal for interval data and the majority of demand rates, other intervals may also exist, like 30 or 60 minutes. The MPG-2 uses the "I" command to set the interval length from 1 minute to 60 minutes.

I1 - EOI length 1 minute.

I2 - EOI length 5 minutes.

I3 - EOI length 10 minutes.

I4 - EOI length 15 minutes.

I5 - EOI length 30 minutes.

I6 - EOI length 60 minutes.



## MPG-2 Programming (cont)

### 5.12 (con't)

To enter the desire interval length for 15 minutes for example, I4 and <Enter>. The serial link on the MPG-2 will return the following:

-----  
Interval Energy: 15 min.  
-----

### 5.13 Setting the Real Time Clock

The MPG-2 allows the user to set the internal real time clock (RTC) with an initial time setting using the K command. Once the time is set, the time will elapse until the 2nd data packet is received from the dongle, usually about 30 to 60 seconds after startup. When the 2nd packet is received the timestamp from the meter will be compared to the RTC setting and the time adjusted to match the meter. The clock setting feature is provided for situations where the Zigbee transmissions from the meter may not be immediately available. The clock is set as follows:

"KMODYYRHRMNSC<CR>"

Where: K - Command Write RTCC

MO - Month (01-12)

DY - Day of Month (1-31)

YR - Year (00-99)

HR - Hour (00-23)

MN - Minutes (00-59)

SC - Seconds (00-59)

Note 1: CR terminates the command.

Note 2: The Firmware will calculate the correct day of week for the provided Month, Day, and Year.

Note 3: A proper date must be provided, Feb. 29th 2017 is not accepted, as it does not exist. However, Feb. 29th. 2020 is accepted. Any improper parameter will result with a response of 'Error'. If the month is provided as 13, this will result in 'Error'. etc. If the day is provided as 31 on a month that only has 30 days, response 'Error', etc.

Responses:

"Error" - Improper values provided or invalid command.

- or -

-----  
06/23/19 06:06:06 DOW :1 TSR:N  
-----

Note: RTCC defaults upon power up as 1/1/2019 00:00:00.

# MPG-2 Wireless Meter Pulse Generator (con't)

## 6.0 Operation

### 6.1 Communication LEDs

Upon power-up, the YELLOW comm LED should light indicating that the Zigbee dongle is enumerated, correctly initialized and communicating with the MPG-2's processor. Within about approximately 45 - 60 seconds, the GREEN comm LED will blink each time a valid transmission is received from the meter. As long as valid transmissions are received by the dongle and successfully relayed by the MPG-2's processor, the Green comm LED will blink about once every 8-9 seconds. If the Green comm 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 comm 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, change the proximity of the MPG-2 to the meter, move it closer to the meter if possible and eliminate any metallic obstructions between the meter and the MPG-2. Also check to make sure that any walls or barriers between the MPG-2 and the meter have as little metal in them as possible. For the longest distances you must have line-of-sight.

### 6.2 Pulse Outputs

Outputs 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 desired pulse format that the receiving device prefers to see.

If the dongle is reliably receiving data from the meter and passing it on to the MPG-2's processor, then you should see the Red and Green output LED's toggle each time the selected pulse value is reached, and the MPG-2's processor generates a pulse. If the pulse output value is too high and pulses are too slow, then select a lower pulse value using the programming port and the SSI Universal Programmer program or 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 50mS each in toggle mode. If the calculation by the MPG-2's processor for pulse output timing exceeds 15 pulses per second, the MPG-2 will light the RED comm 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 a indication that an error has occurred. The operation of the MPG-2 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 as closely as possible resembles an actual KYZ pulse output from the meter.

The MPG-2 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 yields 24 wh have been used. Since 24 watt-hours exceeds the 10 watt-hour setting, two pulses must be generated. The first 10wh pulse will be generated immediately. About three seconds later the second 10wh 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 to 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 be outputted 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-2 will be.

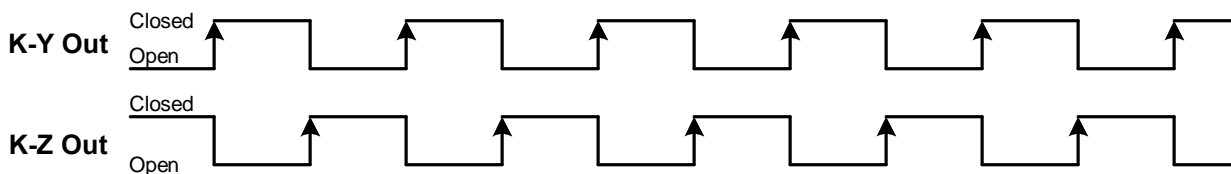
### 5.3 Overranging the Output

As mentioned above, if there are too many pulses calculated to be outputted in a 7 second interval than the MPG-2 can generate given the timing constraints, the MPG-2 will light the RED comm LED. In this situation, simply increase the pulse output value using the programming port, and cycle power to the MPG-2 to reset the RED comm 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 pulse value, 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-2 to reset the RED comm LED after increasing the pulse value.

# WORKING WITH THE MPG-2 RELAY

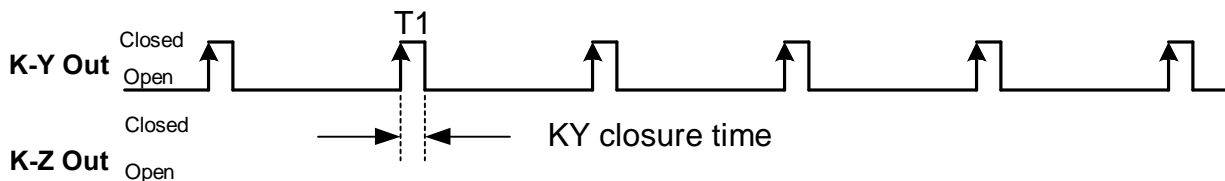
**PULSE OUTPUT MODES:** The MPG-2 Meter Pulse Generator allows the outputs to be configured in either the "Toggle" or "Fixed" pulse output mode. In the Toggle mode, the outputs alternate or toggle back and forth each time a pulse is generated. This is synonymous with the classic 3-Wire Pulse metering and emulates the SPST KYZ switch model. Figure 1 below shows the timing diagram for the "Toggle" output mode. KY and KZ closures or continuity are always opposite of each other. In other words, when the KY terminals are closed (on), the KZ terminals are open(off). This mode is best for timing pulses to derive demand, whether 2 or 3 wires are being used.

**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 W command 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. The K-Z output is not used in the Normal/Fixed(A) mode. However, it is used in the Signed mode. See Page 7.

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



In Signed mode, with a Form A output mode selected, the K-Z output pulse represents negative (or kWh received) energy. (See Page 7.)

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

## Working with the MPG-2 (cont)

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

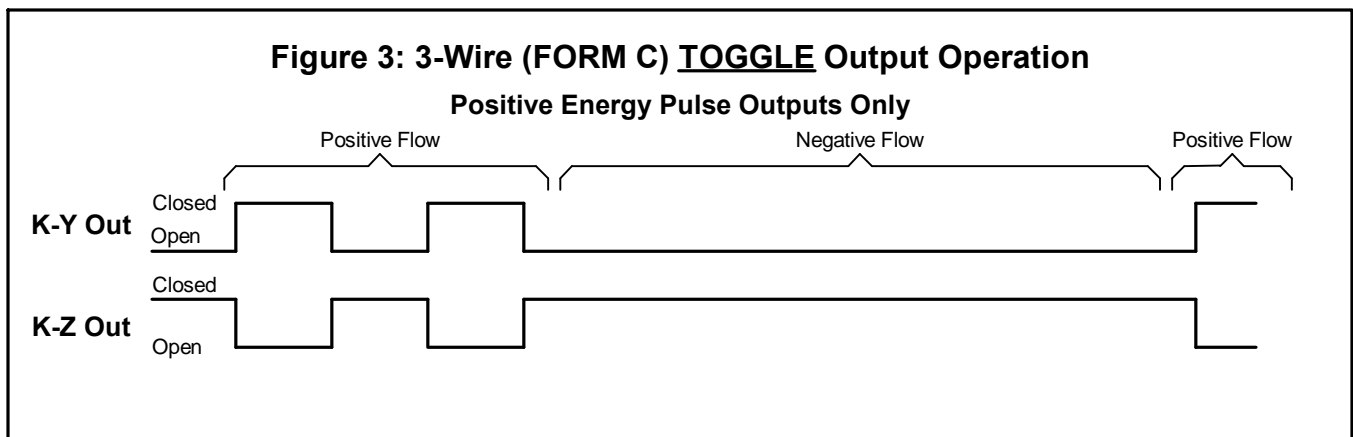
If you have energy flowing in both directions in the case of distributed energy resources (solar, wind, etc), the MPG-2 can provide both positive and negative pulses. This is known as the **Signed** mode, meaning that "kWh Delivered" (*from the utility to the customer*) is positive or forward flow, and "kWh Received" (*from the customer to the utility*) is negative or reverse flow.

The Pulse Value Setting is the same for both positive and negative values.

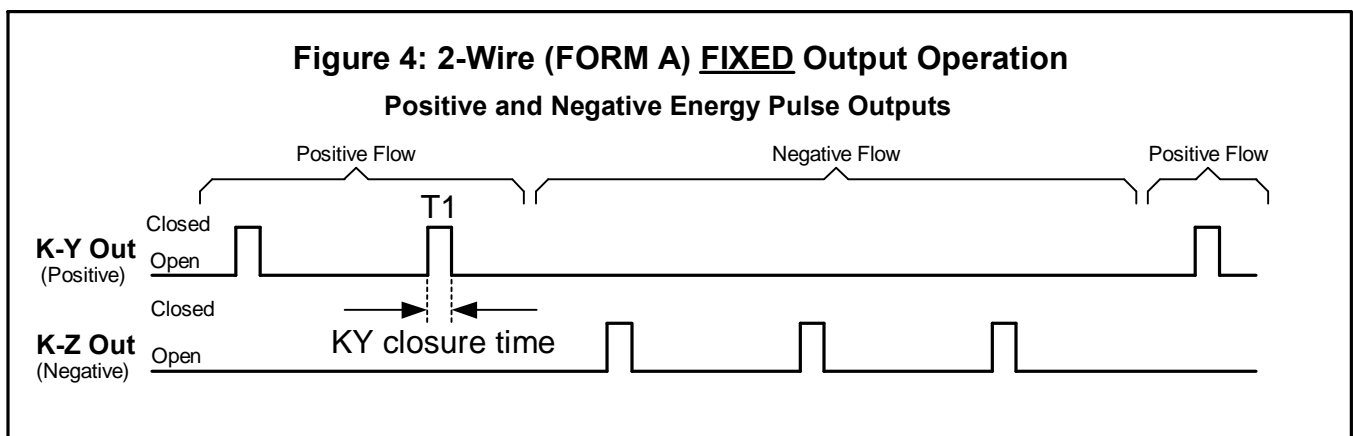
To enter the functional or operational mode into the MPG-2, use the Pulse Mode field. Select **Normal** to set the MPG-2 in the Normal mode. Hit "Send". Select **Signed** to set the MPG-2 in the Signed mode. Hit "Send". The serial link to the MPG-2 will return "Signed". To read click on Read Values. The serial link will return the mode stored in the MPG-2. For example, "Normal" will be returned for the Pulse Mode. Case does not matter.

Form C Signed mode - A positive energy value received from the meter is added to the positive Accumulated Energy Register(+AER). Negative energy values received are ignored. Only Form C toggle pulses are generated on the KYZ output for Positive energy flow. See Figure 3 below.

Form A Signed mode - A positive energy value received is added to the positive Accumulated Energy Register(+AER). A negative energy value received is added to the negative Accumulated Energy Register(-AER). When either register equals or exceeds the Pulse Value setting, a pulse of the corresponding sign is outputted on the correct line. Pulses in this mode are Form A (2-wire) "Fixed" only. K-Y pulses are Positive pulses and K-Z pulses are negative pulses. They share a common K terminal on the output. Set the pulse value with the Pulse Value field. Set the pulse width using the Pulse Width field. See Figure 4 below.



In Signed mode, with a Form C output mode selected, the K-Y and K-Z output pulses represent positive (or kWh delivered) energy; 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; K-Z output pulse represents negative (or kWh received) energy.

### Energy Adjustment Mode Enable/Disable (A)

The MPG-2 includes an energy adjustment mode to validate the energy represented by number and value of output pulses against the accumulated energy from the electric meter. This mode automatically adjusts the AER positive or negative, each time the energy summation register of the meter changes. In this way, the number and value of the pulses being outputted from the MPG-2 will always directly match the energy that the meter is reporting has been consumed.

To enable the Energy Adjustment mode enter Ax and <ENTER>. x is 1 for enabled and 0 is disabled. The default is 1. Enter A1, and <ENTER> and the EA mode is enabled. The serial link on the MPG-2 will return the following:

-----  
Energy Adj: Enabled  
-----

To disable the filter mode enter A0 and <ENTER>. The serial link on the MPG-2 will return the following:

-----  
Energy Adj: Disabled  
-----

### Odometer Reset

The MPG-2 also contains diagnostic odometers which track the total energy of all pulses outputted by both output channels. This can be reset using the "O0" command. Enter O0 and press <ENTER> and the odometers are reset to zero.

### Factory ("Hard") Reset of Dongle

The MPG-2's 5951 dongle may be completely reset if necessary. This is generally known as a factory or "hard" reset. Once the dongle is reset all provisioning information that was stored is lost and the dongle must be provisioned or paired with an electric meter again. If you are moving your MPG-2 to another location (that has a different meter) or if the electric meter has been changed in the current location, a factory reset must be performed before the 5951 dongle can be provisioned with another meter or re-provisioned with the current meter.

To do a hard reset on the 5951 Dongle:

- 1.) Press and hold the button on the side of the dongle until the Green LED begins to blink rapidly.
- 2.) Release button.
- 3.) Within 2 seconds, press and hold the button down for 5 seconds again, until both LEDs turn off.
- 4.) Release button.
- 5.) If the factory reset was successful, the RED LED should be off and blink once every 3 seconds to indicate that it is scanning for a network to join.

You can also accomplish the hard reset on the dongle by using the **SSI Universal Programmer** software.

**WARNING:** A hard reset of the dongle will completely disconnect the dongle from the meter, and would have to be re-provisioned with the meter.

# List of MPG-2 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)  
'a0<CR>' or 'A0<CR>' - Disable Energy Adjustment mode.  
'a1<CR>' or 'A1<CR>' - Enable Energy Adjustment mode.  
'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>' - Disable Dongle mode  
'd1<CR>' or 'D1<CR>' - Set into Dongle Normal mode  
'd2<CR>' or 'D2<CR>' - Set into Dongle Echo mode  
'd8<CR>' or 'D2<CR>' - Set into Energy Adjustment mode (reports adjustments only)  
'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

## EOI Form A Pulse Width

'eX<CR>' or 'EX<CR>' - EOI Pulse Width in Form A mode, milliseconds - 50 to 10000mS, 1000mS default;

### EOI Form A Pulse Width Selections:

'e0<CR>' or 'E0<CR>' - EOI disabled  
'e1<CR>' or 'E1<CR>' - 50mS Closure  
'e2<CR>' or 'E2<CR>' - 100mS Closure  
'e3<CR>' or 'E3<CR>' - 250mS Closure  
'e4<CR>' or 'E4<CR>' - 500mS Closure  
'e5<CR>' or 'E5<CR>' - 1000mS Closure  
'e6<CR>' or 'E6<CR>' - 2000mS Closure  
'e7<CR>' or 'E7<CR>' - 5000mS Closure  
'e8<CR>' or 'E8<CR>' - 10000mS Closure

# List of MPG-2 Commands

## EOI Interval Length

'iX<CR>' or 'IX<CR>' - EOI Interval Length, minutes - 1 to 60 minutes, 15 min. default;

## EOI Interval Length Selections:

'i1<CR>' or 'I1<CR>' - 1 Minute Interval

'i2<CR>' or 'I2<CR>' - 5 Minute Interval

'i3<CR>' or 'I3<CR>' - 10 Minute Interval

'i4<CR>' or 'I4<CR>' - 15 Minute Interval

'i5<CR>' or 'I5<CR>' - 30 Minute Interval

'i6<CR>' or 'I6<CR>' - 60 Minute Interval

'o0<CR>' or 'O0<CR>' - Reset Odometers