INSTALLATION INSTRUCTION SHEET
PCL-1 Pulse-to-Current Loop Converter

Rx 🟢
Tx 🔴

USB Port

→ USB PROGRAMMING PORT

24VDC Loop Power Supply

250 Ohm Typ. 4-20mA OUTPUT

- → CURRENT LOOP
+ → OUTPUT

Yin(+) → Y "pulled up" to +13VDC
INPUT FROM METER
Kin(-) ← Common Return

Y
Dry Contact
K
ELECTRIC METER

GND ←
NEU ← **POWER SUPPLY**
120V ← **INPUT**
277V ← Use one power input ONLY

(Terminal labels: L2 L1 NEU GND Kin Yin +Out -)
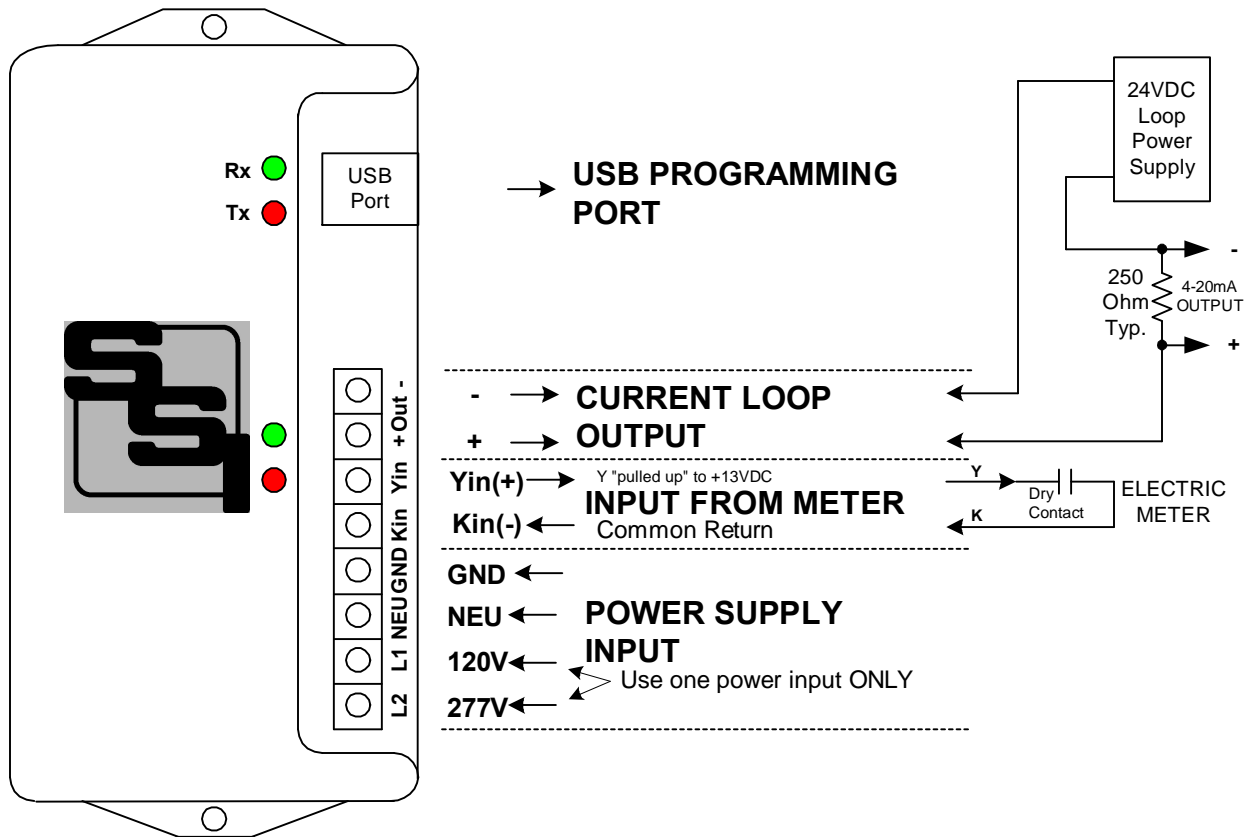
MOUNTING POSITION - The PCL-1 can be mounted in any position. Two mounting holes are provided.

POWER INPUT - The PCL-1 is powered by an AC voltage of between 90 and 300 volts. For 208 to 277VAC, connect the AC line's "hot" wire to the **L2** terminal. For 120VAC, connect the AC line's "hot" wire to the **L1** terminal. Connect the **NEU** terminal to the AC line's "neutral" wire. Connect **GND** to electrical system Ground. Ground must be connect for proper operation. DC power supply input available by special order.

METER INPUT - The PCL-1 has a 2-Wire (Form A) input. Connect the PCL-1's "Kin" and "Yin" input terminals to the meter's "K" and "Y" output terminals. The PCL-1's "Kin" terminal is the common return. The +13VDC wetting voltage is "pulled-up" internally on the PCL-1's Yin terminal. Each closure of the meter's Y output will "pull down" the input line to the common return. The Red LED lights each time a pulse is received. All settings are programmed into the PCL-1 by means of the USB Programming Port, and are saved in Non-Volatile EEPROM memory so they are never lost or not inadvertently changed. See page 5 for "Programming the PCL-1".

OUTPUT - The PCL-1 outputs a current of 4 to 20mA proportional to the KW demand as calculated by the pulse value and system settings. Two output modes are available. Instantaneous or Average KW demand may be selected for output. The Green LED lights each time the Digital to Analog converter outputs a value. Transient voltage protection for the output is provided by MOVs and zener diodes on board. The 4-20mA loop must be powered by a 24VDC Loop Power Supply, which is external to the PCL-1. This power supply supplies all power to the output stage of the PCL-1 and is optically isolated from the rest of the PCL-1.

OPERATION - See the following pages for a full explanation of the operation of the PCL-1. Maximum output voltage is 5VDC at a full scale 20mA output.
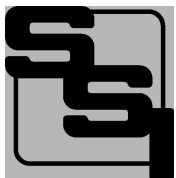
SOLID STATE INSTRUMENTS
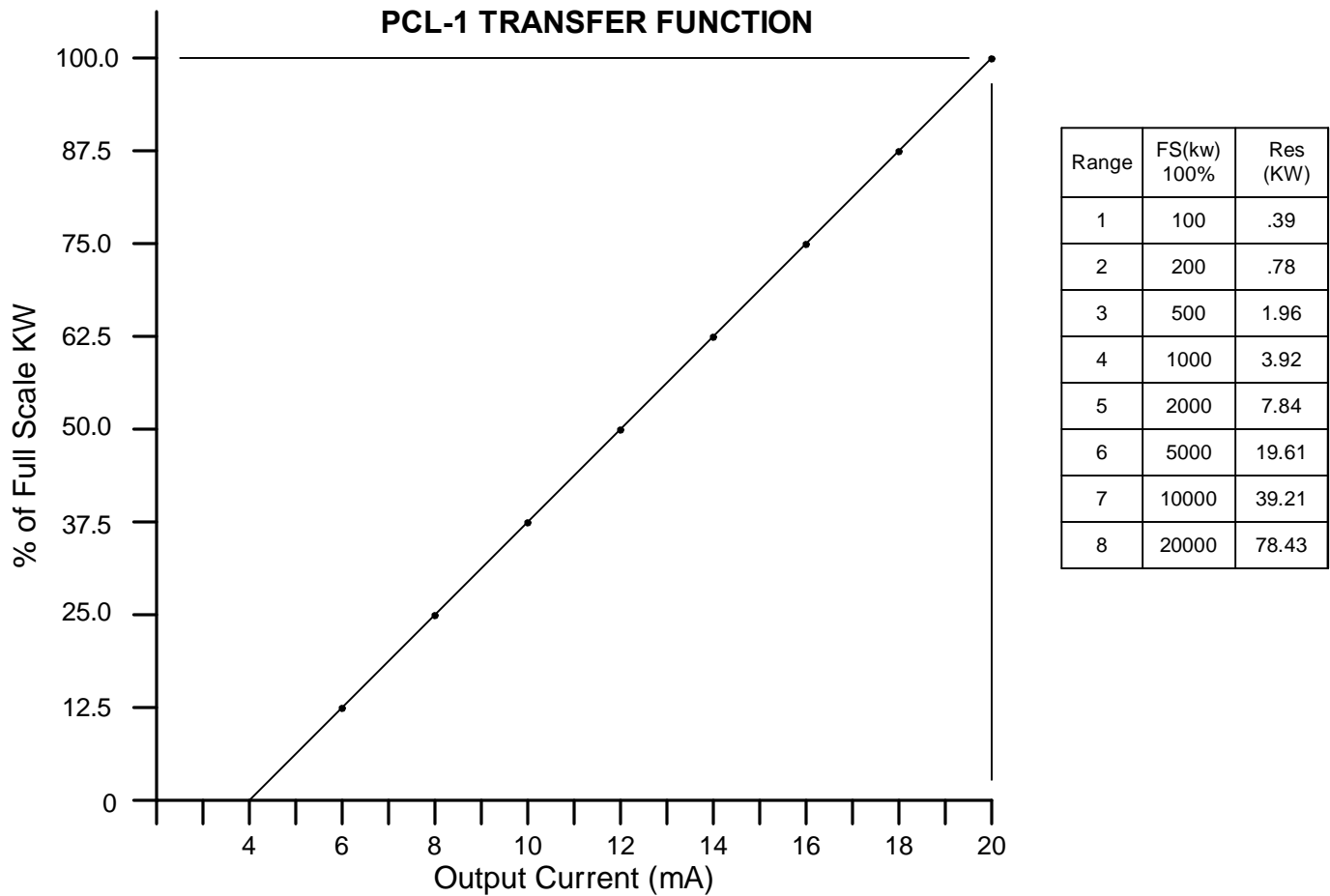## a division of Brayden Automation Corp.
6230 Aviation Circle, Loveland, Colorado 80538
Phone: (970)461-9600
E-mail: support@brayden.com

WORKING WITH THE PCL-1 RELAY

Operation: The PCL-1 Pulse to 4-20mA Current Loop Converter Module is designed to output an analog voltage with a current between 4 and 20 milliamps, proportional to the value of the instantaneous or average KW demand. Below is an example of how the PCL-1 works and how it is programmed.

PCL-1 TRANSFER FUNCTION

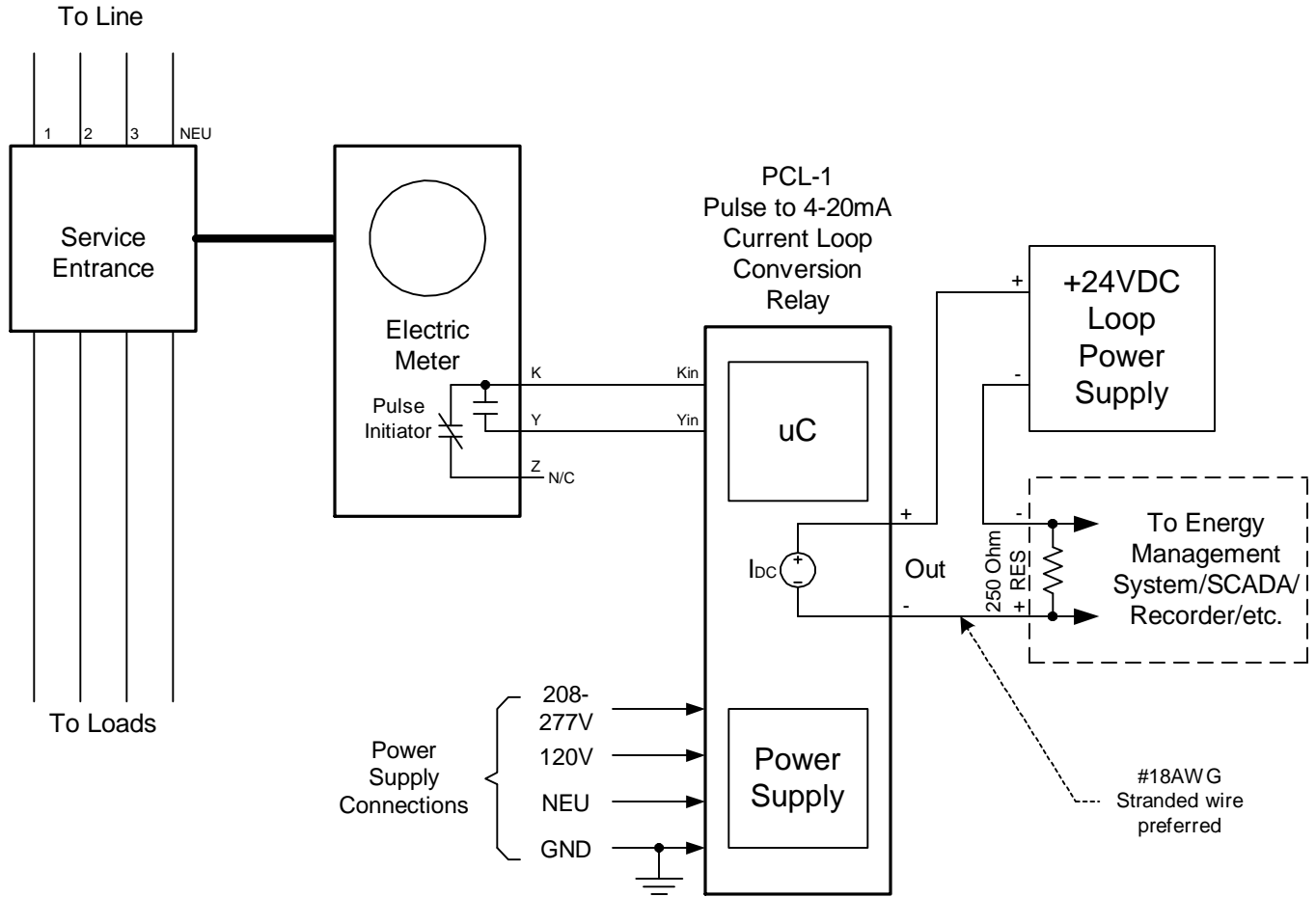| Range	FS(kw) 100%	Res (KW)
1	100	.39
2	200	.78
3	500	1.96
4	1000	3.92
5	2000	7.84
6	5000	19.61
7	10000	39.21
8	20000	78.43

Example, if a building has a 483KW maximum demand, set the Full Scale Value at 500KW. Therefore, 500KW = 20mA. 0KW = 4mA. Resolution would be 500 / 255 or 1.961KW (or .3922% of full scale) per step. Assume the electric meter's PKe Pulse value (3-Wire) is 240 wh/pulse (or .240kwh/pulse). The 2-Wire equivalent is .480kWh/p or 480wh/p. Suppose that pulses being received at this moment in time are at a rate of one pulse per 4 seconds and the load is steady. Conversion would be: .480 Kwh X 3600 = 1728 kW-sec / 4 sec = 432 kW. Output current would be 432/500 = 86.4% X 16mA = 13.824mA + 4mA = 17.824mA out. Output resolution is 16mA / 256 steps or .0625mA per step. So, 256 * 86.4% = 221.18 steps of 256. Rounding off 221 X .0625mA = 13.8125mA + 4mA = 17.8125mA output. Accuracy = 99.9168%.

PCL-1 Wiring Diagram

To Line

1 2 3 NEU

Service
Entrance

To Loads

Electric
Meter

Pulse
Initiator

K   Kin

Y   Yin

Z N/C

PCL-1
Pulse to 4-20mA
Current Loop
Conversion
Relay

uC

I_{DC}

Out

+

-

+24VDC
Loop
Power
Supply

+

-

-

250 Ohm
RES

+

To Energy
Management
System/SCADA/
Recorder/etc.

#18AWG
Stranded wire
preferred

Power
Supply
Connections

208-
277V

120V

NEU

GND

Power
Supply

PCL-1WiringDiagram.vsd

	REVISIONS		
PCL-1 Pulse to 4-20mA Conversion Relay Wiring Diagram	NO.	DATE	DESCRIPTION
DATE ORIGINAL 03/10/2013	SCALE N/A		
LATEST REVISION	JOB NO.	CHECKED	DRAWN WHB

PCL-1 4-20mA Current Loop Converter Module
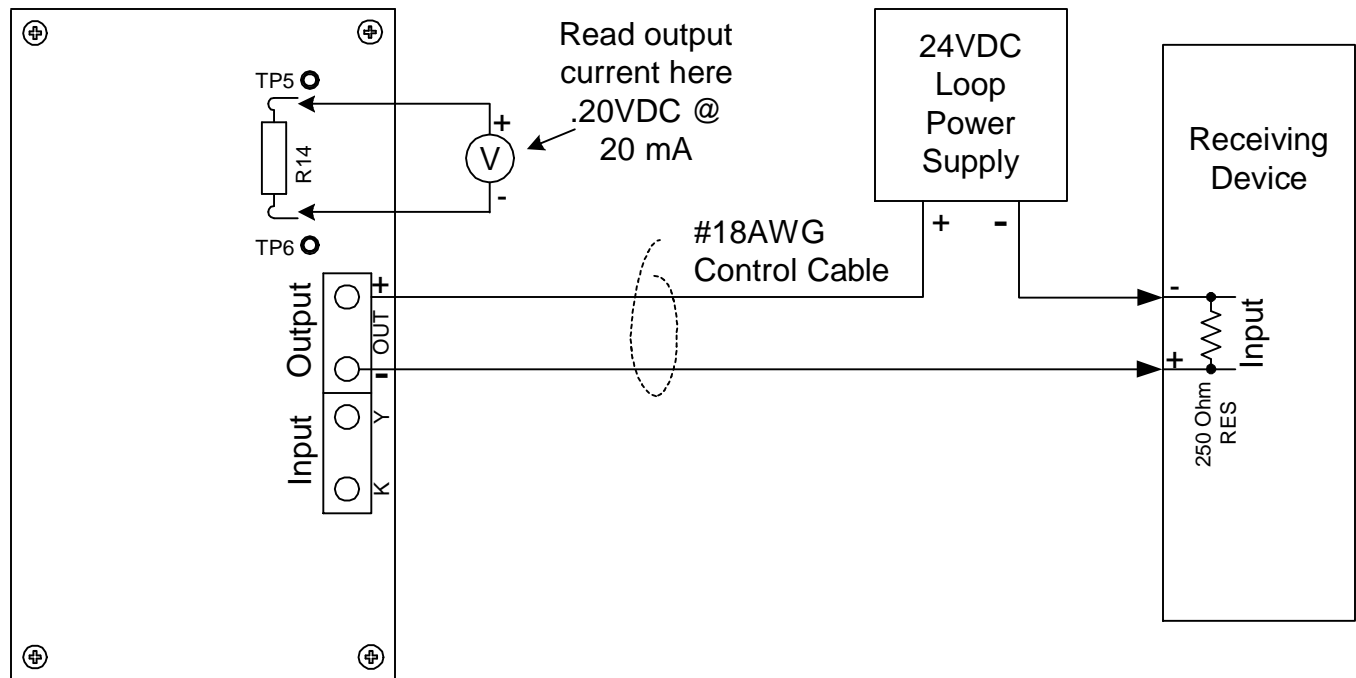
Testing the PCL-1

Using a good quality Digital Volt Meter (DVM) which is capable of reading very low voltages accurately, connect the leads across Resistor R14 above the current loop output connector. Put the PCL-1 into the test mode.(See Page 5.) The PCL-1's output must be connected to the receiving device's input and must be powered up, or connected to a suitable test setup. The voltage across R14 is proportional to the output current. At 20mA of output current, the output voltage across R14 will be .20VDC. At 4mA of output current, the output voltage across R14 will be .04VDC. In test mode the output current will sweep from 4mA to 20mA in 10 seconds, and remain at 20mA for 4 seconds. It will reset to 4mA for 4 Seconds and then repeat. Therefore, your meter will climb from .04V to .20 V in 10 seconds, stay at .20V for 4 seconds, go to .04V for 4 seconds and then climb again from .04 to .20V. This repeats continuously while in the test mode. While in Test Mode, the pulse input is ignored and does not matter if it is connected or not. Take the PCL-1 out of test mode and return to Normal Operation mode. Connect electric meter's pulse output to the input of the PCL-1 if not already connected. Ensure that the red LED next to the Yin terminal is on when the Y input line is low(has continuity with the Kin terminal).

Interfacing the PCL-1 to the Receiving Device

The receiving device must have an input suitable for accepting a 4-20mA current, equipped with a 250 ohm precision resistor, at a maximum voltage of +5VDC.   Use a #18AWG to #22AWG two conductor control cable between the PCL-1 and the receiving device. 4mA will yield 1VDC across the 250 ohm resistor, while 20mA will yield 5VDC.

Programming

The PCL-1 requires you to connect it via it's USB port to a computer for programming. See Page 5. Parameters that must be programmed are:

> Pulse Value in Watt-hours
> Full Scale Value; Range 1 to 8 (see chart)
> Operating Mode selection, either Instantaneous or Average
> Demand Averaging Interval (if the above selection is Average)
> Enter and Exit Test Mode

Technical Support

Contact Brayden Automation Corp. Tech Support at 888-BRAYDEN (888-272-9336) if you need assistance on the application of the PCL-1 4-20mA Pulse to Current Loop Converter Module.

Programming the PCL-1 4-20mA Current Loop Converter Module

Software Required

The PCL-1 is programmed using SSI's PCL-1 Programmer software, available as a free download on the SSI website at http://solidstateinstruments.com/productpages/pcl-1-software.php. Go to the Documentation tab and locate the link "Download PCL-1 Windows Software". Install the software on your PC. An Icon with the SSI Logo will be placed on the desktop for access. Be sure to have your PCL-1 connected to the USB port on the computer and powered up. Double-click on the icon to start the program. The program will open up and you should see the main page shown below.
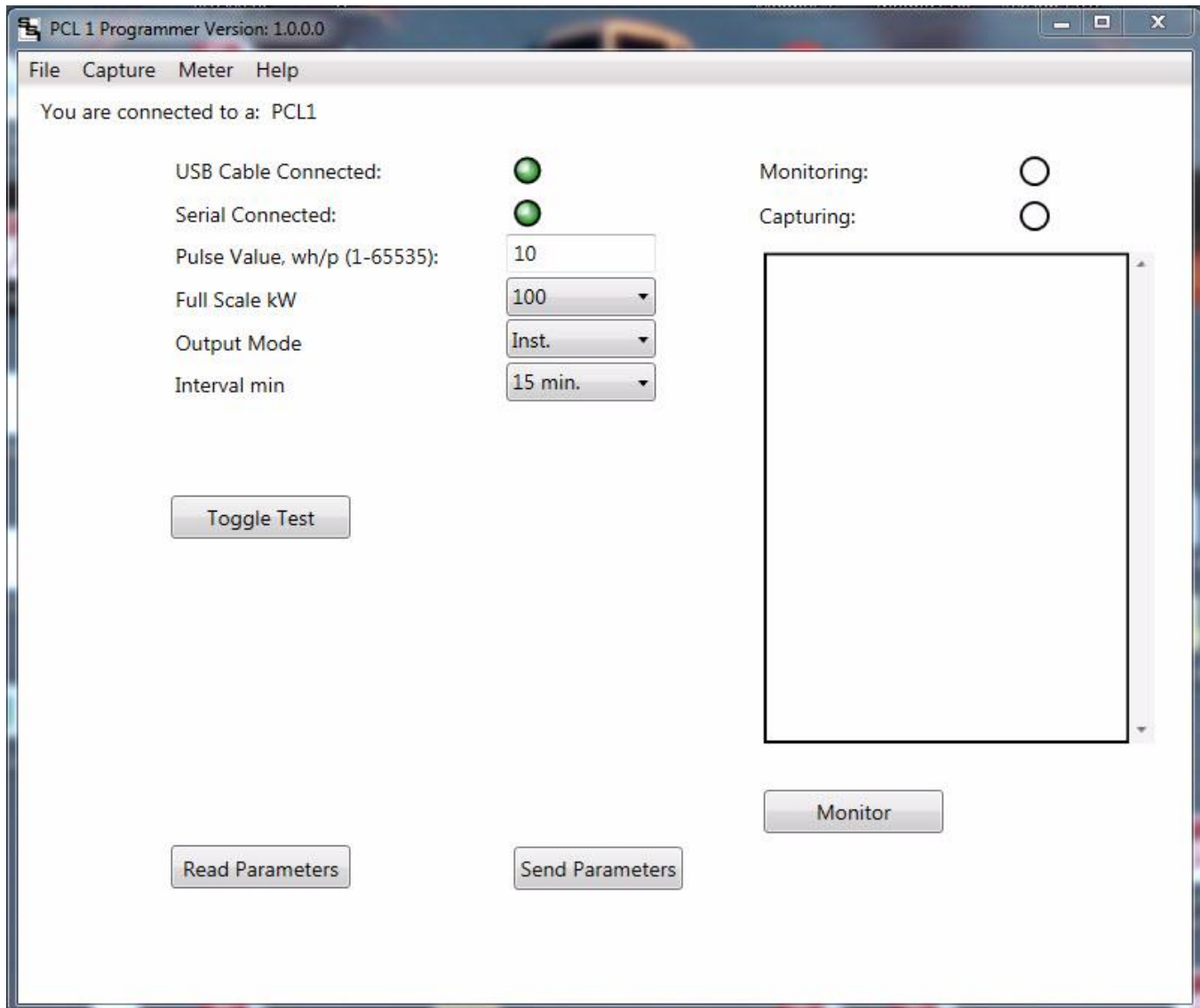
To READ the parameters currently stored in memory, click on <Read Parameters>. The PCL-1 Programmer will return the actual values of each parameter currently stored in EEPROM memory.

To program a new setting into the memory, enter the value desired in the appropriate entry box and click on <Send Parameters>. You can change multiple values if desired and when done, click on <Send Parameters>.

Pulse Value: Enter the pulse value in Watt-hours(wh) per pulse, with a number from 1 to 65535. You may not enter a decimal point. The value must be in whole (integer) number. Once the correct value is entered, click on <Send Parameters>.

Full Scale (kW): Pull down the pulldown menu under the Full Scale entry box and select a maximum kW value. Once the correct value is entered, click on <Send Parameters>.

Programming the PCB-1 (con's)

You are connected to a: PCL1

USB Cable Connected:	🟢
Serial Connected:	🟢
Pulse Value, wh/p (1-65535):	10
Full Scale kW	100 ▾
Output Mode	Inst. ▾
Interval min	15 min. ▾

Output Mode: Pull down the pulldown menu and select **Ins** for Instantaneous or **Avg.** for Average mode. Instantaneous Mode means that the instantaneous value in kilowatts (kW) will be updated on the 4-20mA output each time a new pulse is received. The Average Mode means that the kW will be averaged over the interval selected and the result will be updated on the 4-20mA output every 15 seconds.

Averaging Interval: Pull down the pulldown menu and select the number of minutes over which you would like to average the kW represented by the incoming pulses. Enter the desired Interval value in the Interval (min) entry box and click <Send Parameters>. Intervals available are 1, 5,10 15, 30, and 60 minutes.

Test Mode: Click on the Test Mode button to enter the test mode. Upon entering the test mode the pulse input is ignored and the PCL-1 begins an output sweep from 4mA to 20mA in 10 seconds. It will remain at 20mA for 4 seconds, then reset to 4mA for 4 seconds. It will start again and repeat this sequence continuously until the power to the unit is cycled. Upon power up, test mode will be exited and normal operation will resume.

When programming is complete, close the software by pressing X in the upper right-hand corner of the window or unplug the USB cable. When the USB cable is unplugged you will see the software attempting to reconnect. If you plug back in the USB cable the PCL-1 should automatically reconnect to the PCL-1 Programmer software.

All parameters will be saved in EEPROM memory. EEPROM memory uses no battery for backup so all parameters will never be lost. Data retention is typically 10 years in absence of power.

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