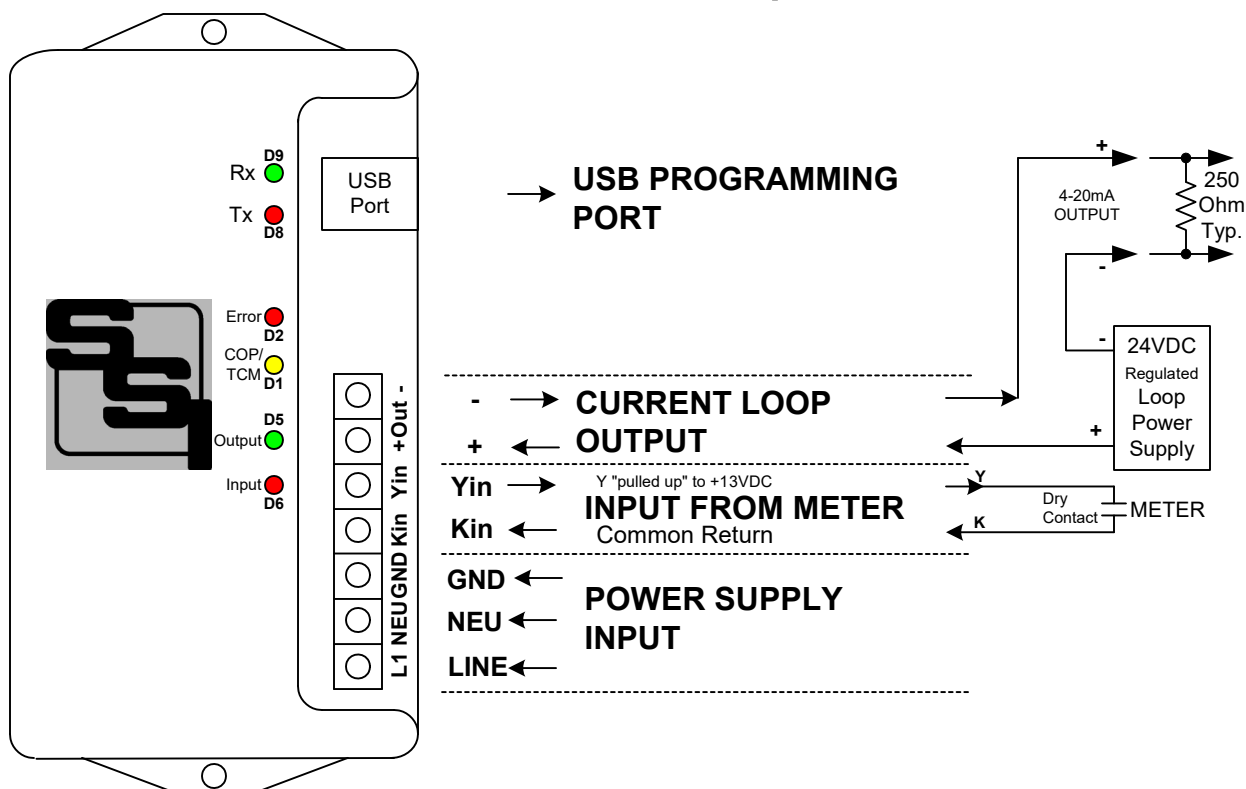


INSTALLATION INSTRUCTION SHEET

PCL-2 Pulse-to-Current Loop Converter



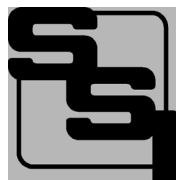
MOUNTING POSITION - The PCL-2 can be mounted in any position. Two mounting holes are provided.

POWER INPUT - The PCL-2 is powered by an AC voltage of between 120 and 277 volts. Connect the AC line's "hot" wire to the **L1** Line terminal. Connect the AC line's "neutral" wire to the **NEU** terminal. Connect the **GND** terminal to electrical system Ground. Ground must be connected to electrical system ground. If a true neutral does not exist, connect both the NEU and GND terminals to ground. ***Warning***: The PCL-2 Power input must be wired Phase-to-Neutral, NOT Phase-to-Phase. See wiring diagram on Page 6.

METER INPUT - The PCL-2 has a 2-Wire (Form A) pulse input. Connect the PCL-2's "Kin" and "Yin" input terminals to the meter's "K" (-) and "Y" (+) output terminals. The PCL-2's "Kin" terminal is the common return. The +13VDC wetting voltage is "pulled-up" internally on the PCL-2's Yin terminal. Each closure of the meter's output line will "pull down" the Y input line to Z, the common return, thus representing a pulse. A RED LED D6(next to the Yin input terminal) shows when a pulse is received. All settings are programmed into the PCL-2 by means of the USB Programming Port, and are saved in Non-Volatile EEPROM memory, so they are never lost or inadvertently changed. See page 8 for "Programming the PCL-2".

OUTPUT - The PCL-2 outputs a current of 4 to 20mA proportional to the rate-of-usage calculated by the pulse value and full scale system settings using 12-bit digital to analog conversion. For electric this is kW; for water or gas, it's gallons or CCF, respectively, per the selected unit of time. In general purpose mode, the output is simply the number of pulses per unit of time. Two output modes are available: Instantaneous or Average rate of usage may be selected for output. Transient voltage protection for the output is provided internally. The 4-20mA loop must be powered by a regulated +24VDC Loop Power Supply, which is external to the PCL-2. This power supply supplies all power to the output stage of the PCL-2 and is optically isolated from the rest of the PCL-2.

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



SOLID STATE INSTRUMENTS

by Radian Research, Inc

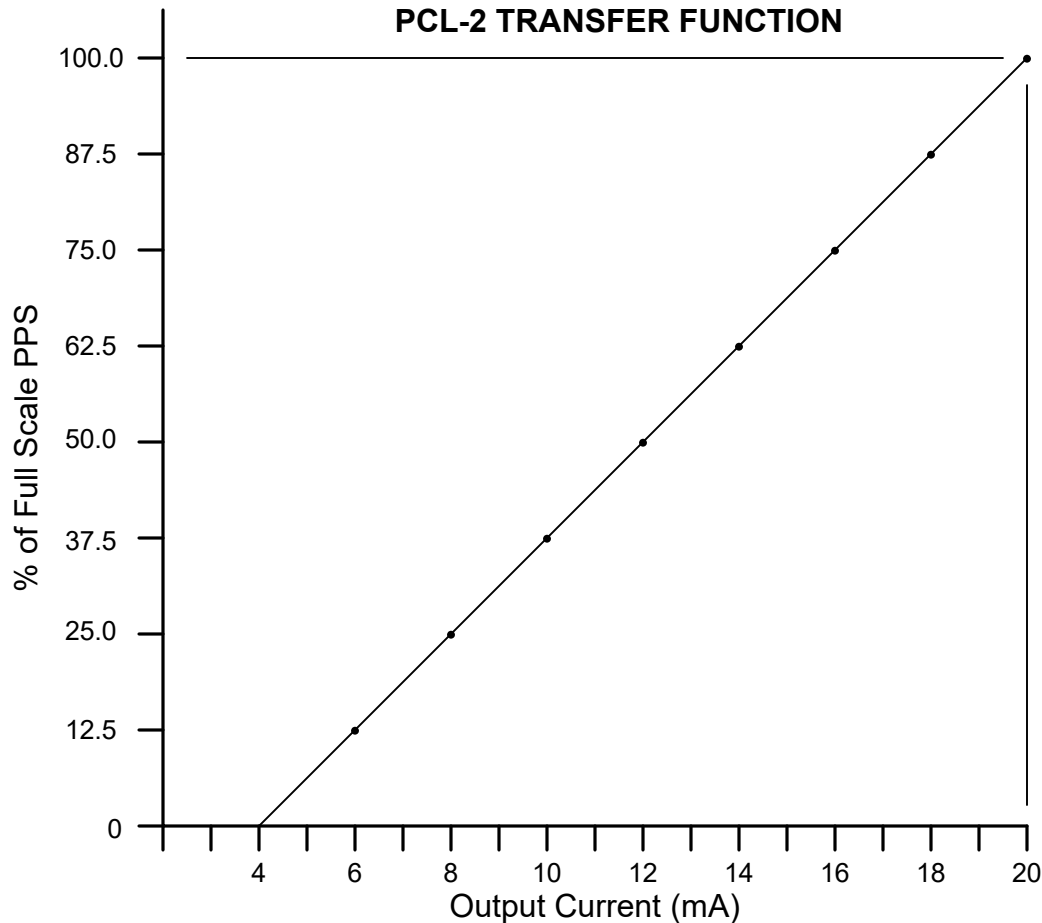
3852 Fortune Dr, Lafayette, IN 47905

Phone: (765) 449-5576

Mail: technicalsupport@radianresearch.com

PCL-2 OPERATION

General Purpose Mode: The PCL-2's General Purpose mode converts the number of pulses per second, minute or hour to a 4-20mA Current with a fixed 1-second update interval. This is the simplest mode and only requires a programmable maximum # of pulses per second, minute or hour over which the output current is calculated. The pulse value is fixed at 1. Below is an example of how the PCL-2 works in a General Purpose application and how it is programmed.



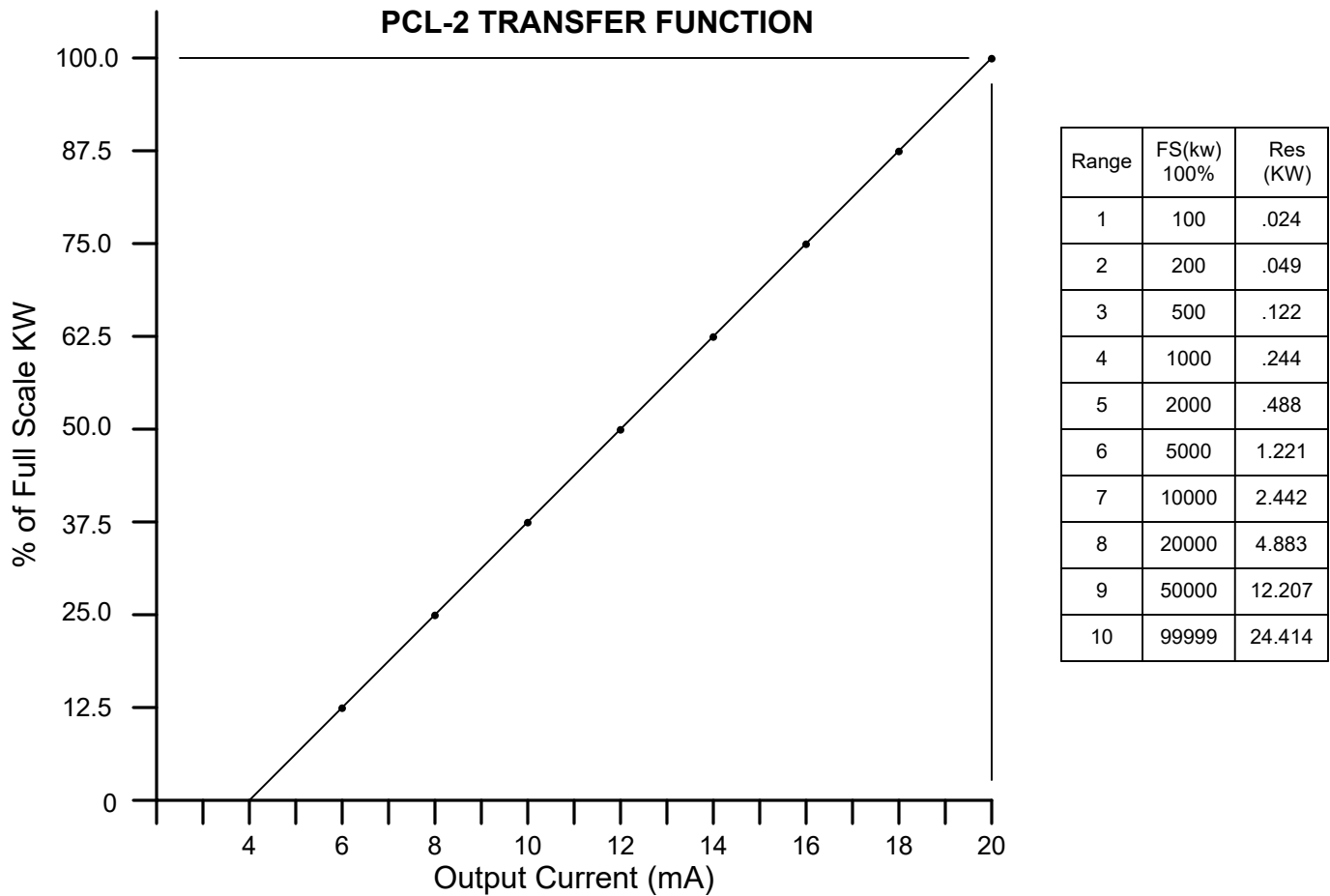
Time Integral	Max # of Pulses/Time
Second	100
Minute	10,000
Hour	1,000,000

Example: Suppose you have a variable speed motor application where you need to know the revolutions per second. There is one pulse per revolution. The motor is 3450 RPM. Rounding up to 3600 RPM gives us 60 pulses per second. The Full Scale pps value is set to 60. Therefore, 3600 RPM or 60 RPS = 20mA. Zero RPS = 4mA. Since the motor's revolutions per second is equal to pulses per second, the # of pulses/sec is a direct relationship of revolutions per second. Assume that pulses being received at this moment in time are at a rate of 43 pulses per second and the load is steady. The conversion would be: $43/60 = 71.6\% \times 16\text{mA} = 11.4666\text{mA} + 4\text{mA} = 15.4666\text{mA}$ out. Output resolution is $16\text{mA} / 4096 \text{ steps} = .003906 \text{ mA per step}$. So, $4096 \times 71.466\% = 2927.247 \text{ steps of } 4096$. Rounding off to $2927 \times .003906\text{mA} = 11.433\text{mA} + 4\text{mA} = 15.4328\text{mA}$ output, which represents 43pps. Accuracy = 99.78%.

PCL-2 Pulse to 4-20mA Current Loop Converter Transfer Function General Purpose Mode		REVISIONS		Solid State Instruments by Radian Research Inc 3852 Fortune Dr Lafayette, IN 47905 (765) 449-5576 technicalsupport@radianresearch.com www.solidstateinstruments.com	
		NO.	DATE		DESCRIPTION
DATE ORIGINAL 01/01/2025	SCALE N/A				
LATEST REVISION A	JOB NO.	CHECKED	DRAWN WHB		

PCL-2 OPERATION (con't)

Electric Mode: The PCL-2 Pulse to 4-20mA Current Loop Converter Module is designed to output a current of between 4-20mA, which creates a voltage on the loop proportional to the value of the instantaneous or average KW demand. Below is an example of how the PCL-2 works in an electric application and how it is programmed.



Example: Suppose a building has a 483KW maximum demand. Set the Full Scale Value at 500 kW. Therefore, 500kW = 20mA. 0kW = 4mA. Resolution would be 500 / 4096 or .122 kW (or .0244% of full scale) per step. Assume the electric meter's PKe Pulse Form C (3-Wire) value is 240 wh/pulse (or .240kwh/pulse). The 2-Wire equivalent is .480kWh/p or 480wh/p. Assume that pulses being received at this moment in time are at a rate of one pulse per 4 seconds and the load is steady. The conversion would be: .480 Kwh X 3600 = 1728 kW-sec / 4 sec = 432 kW. Output current is calculated as 432/500 = 86.4% X 16mA = 13.824mA + 4mA = 17.824mA out. Output resolution is 16mA / 4096 steps or .003906 mA per step. So, 4096 * 86.4% = 3538.944 steps of 4096. Rounding off 3539 X .003906mA = 13.82422mA + 4mA = 17.82422mA output. Accuracy = 99.9988%.

PCL-2 Pulse to 4-20mA Current Loop Converter Transfer Function Electric Mode		REVISIONS	
		NO.	DATE
		DESCRIPTION	
DATE ORIGINAL	SCALE		
01/01/2025	N/A		
LATEST REVISION	JOB NO.	CHECKED	DRAWN
A			WHB

**Solid State Instruments
by Radian Research Inc**
 3852 Fortune Dr
 Lafayette, IN 47905
 (765) 449-5576
technicalsupport@radianresearch.com
www.solidstateinstruments.com

PCL-2 Application examples

Electric Mode, Instantaneous kW example: Assume that 109.8kW was measured as the current demand. Set the full-scale setting at 200kW. Output current would be $109.8/200 = .549$ or 54.9% of full scale. If $200\text{kW} = 16\text{mA}$, then $16\text{mA} \times .549 = 8.784\text{mA}$. $8.784\text{mA} + 4\text{mA} = 12.784\text{mA}$. Since a 12-bit DAC is used on a 200kW full scale, the output resolution would be $16\text{mA}/4096$ or $.003906\text{ mA}$ per step. Therefore $8.784\text{mA}/.003906 = 2248.85$ steps. Round down to $2249 \times .003906 = 8.7845\text{ mA} + 4\text{mA} = 12.7845\text{mA}$. Accuracy would be $12.7845/12.784 = 99.996\%$. The value of 2248 is written to the DAC, which outputs a current of 12.7845mA.

Water Mode example (Gallons In, Gallons per Second Out): Assume that a building has a maximum of 883GPM water flow. The equivalent (average) maximum rate per second is $883/60 = 14.71667\text{ GPS}$. The output desired is in Gallons per Second so the output time interval is set to Seconds. Let's set the Full Scale Value at 16 GPS. Therefore, $16\text{GPS} = 20\text{mA}$. $0\text{ GPM} = 4\text{mA}$. Output flow rate resolution would be $16\text{GPS} / 4096$ or $.00390625\text{ GPS}$ (or $.02442\%$ of full scale) per step. Assume the water meter's Pulse value is 10 Gallons / pulse. Suppose that pulses being received at this moment in time are at a rate of one pulse per 4 seconds and the flow is steady. $10\text{ Gallons}/4\text{ seconds} = 2.5\text{ Gallons per second}$. $2.5/16 = 15.625\%$. $15.625\% \times 16\text{mA} = 2.50\text{ mA} + 4\text{mA} = 6.50\text{mA}$ output. Output resolution is $16\text{mA} / 4096$ steps or $.00390625\text{ mA}$ per step. So, $4096 \times 15.625\% = 640.0$ steps of 4096. $640 \times .003906\text{mA} = 2.49984\text{mA} + 4\text{mA} = 6.49984\text{mA}$ output. Accuracy = 99.9975%. A value of 640 is written to the DAC which would yield an output on the current loop of 6.49984mA.

Suppose the building's flow resulted in 1 pulse per second. That would equal 10 gallons per second. $10\text{G}/16\text{GPS} = 62.50\%$. Calculated output is $62.50\% \times 16\text{mA} = 10\text{mA} + 4\text{mA} = 14.0\text{mA}$. $.625 \times 4096 = 2560.0$ steps. $2560 \times .003906 = 9.99936 + 4\text{mA} = 13.99936\text{mA}$, representing a flow rate of 10 GPS.

Let's assume that the building has 2 pulses per second, or 20 Gallons per second. This would overrange the PCL-2 full scale of 16 GPS; The RED Error LED D2 would light indicating an erroneous condition. Change the full scale a number higher than 20.

Water Mode example (Gallons In, Gallons per Minute Out): Assume the same building has a maximum of 883GPM water flow. The output desired is in Gallons per Minute so the output time interval is set to Minutes. Let's set the Full Scale Value at 1000 GPM. Therefore, $1000\text{GPM} = 20\text{mA}$. $0\text{ GPM} = 4\text{mA}$. Output flow rate resolution would be $1000\text{GPM} / 4096$ or $.02441\text{GPM}$ (or $.02441\%$ of full scale) per step. Assume the water meter's Pulse value is 10 Gallons / pulse. Suppose that pulses being received at this moment in time are at a rate of one pulse per 4 seconds and the flow is steady. $10\text{ Gallons}/4\text{ seconds} = 15\text{ pulses per minute} = 150\text{ Gallons per minute}$. $150/1000 = 15.00\%$. No rounding required. $15\% \times 16\text{mA} = 2.40\text{ mA} + 4\text{mA} = 6.40\text{mA}$ output. Output resolution is $16\text{mA} / 4096$ steps or $.003906\text{ mA}$ per step. So, $4096 \times 15\% = 614.4$ steps of 4096. $614.4 \times .003906\text{mA} = 2.3998\text{mA} + 4\text{mA} = 6.3998\text{mA}$ output. Accuracy = 99.9976%. A value of 614 is written to the DAC which would yield a current loop output of 6.3982mA representing 150 gallons per minute.

PCL-2 Application Examples (con't)

Water Mode example: (Gallons In, Gallons per Hour Out)

Example: Assume that a building has a maximum of 883GPM flow rate. This equates to 883×60 or 52,980 GPH. The output desired is in Gallons per Hour so the output time interval is set to Hours. Let's set the Full Scale Value at 60,000 GPH. Therefore, $60,000\text{GPH} = 20\text{mA}$. $0\text{ GPM} = 4\text{mA}$. Output flow rate resolution would be $60,000\text{GPH} / 4096$ or 14.6484GPH (or .02441% of full scale) per step. Assume the water meter's Pulse value is 10 Gallons / pulse. Suppose that pulses being received at this moment in time are at a rate of one pulse per second and the flow is steady. $10\text{ Gallons/second} = 60\text{ pulses per minute (or }3600\text{ pulses/hour)} = 36000\text{ Gallons per hour}$. $36000 / 60000 = 60.00\%$ of full scale. No rounding required. $60\% \times 16\text{mA} = 9.6\text{ mA} + 4\text{mA} = 13.60\text{mA}$ output. Output resolution is $16\text{mA} / 4096\text{ steps}$ or .003907 mA per step. So, $4096 \times 60\% = 2458$ steps of 4096. $2458 \times .003907\text{mA} = 9.6039\text{mA} + 4\text{mA} = 13.6039\text{mA}$ output. Accuracy = 99.9713%. The PCL-2's processor writes a value of 2458 to DAC which would yield an output of 13.6039mA representing 36000 gallons per hour flow rate.

Gas Mode examples:

These will be generally the same as water examples, but input and output units must be the same. For example, if input value per pulse is in Cubic feet, then the output must also be in cubic feet/unit of time selected. This could also be in cubic meters in & cubic meters out/unit of time. The units don't matter as long as they are the same. There is no conversion of units in the PCL-2 for Water and Gas applications. In an Electric application, there is a conversion included for watthours in / kilowatts out. This is a unique situation and thus has been addressed in the PCL-2's program.

LED Indicators

LED Functions:

INPUT RED LED (D6): This LED lights each time a pulse is received from the meter sending the pulses to the PCL-2, and thus the input is active. Short input durations are often difficult to see, particularly on Water and Gas meters. A bright RED LED is used to help mitigate this problem.

OUTPUT GREEN LED (D5): This LED flashes once per second for 100ms, indicating that the PCL-2's microcomputer is writing an output value to the Current Loop Amplifier.

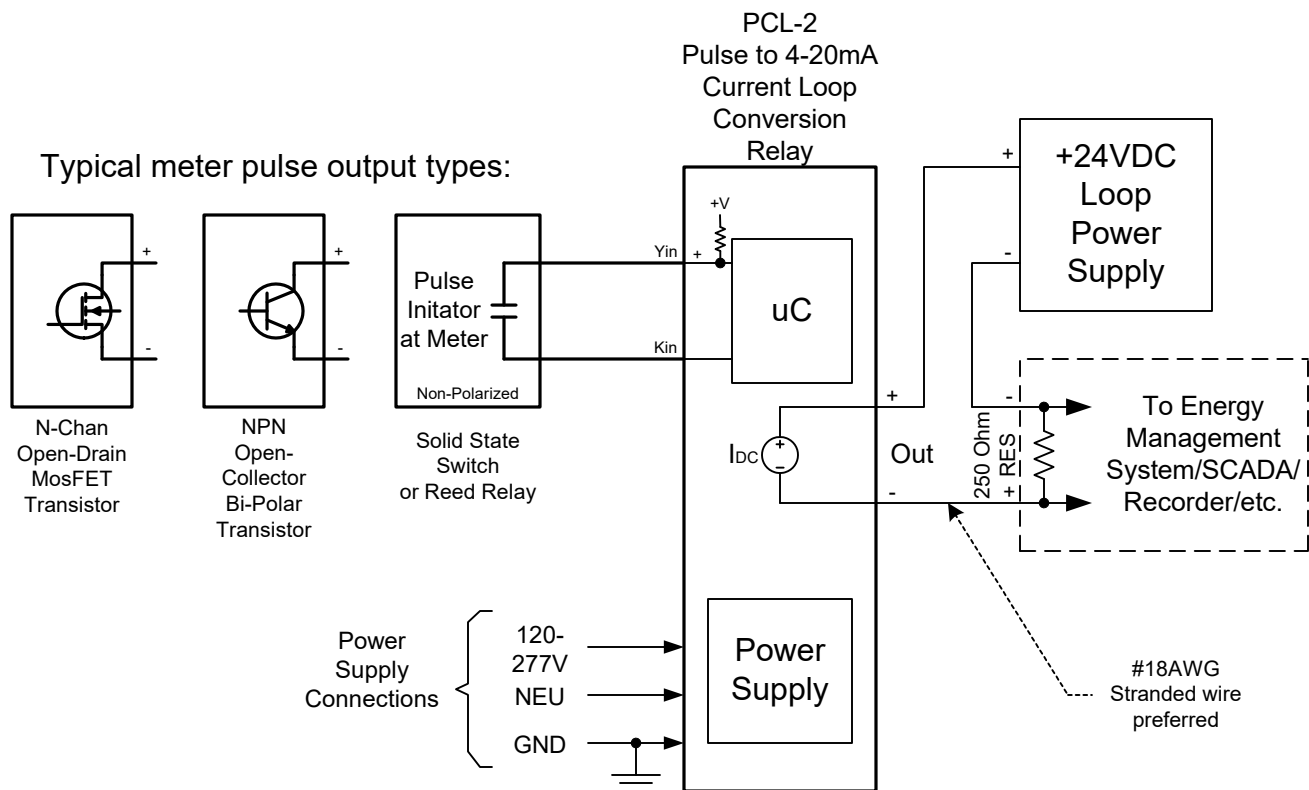
CONVERTER OPERATING PROPERLY (COP)/TEST-CALIBRATE MODE YELLOW LED (D1): In Normal operational mode, LED D1 flashes for 100mS every 3 seconds simply to show that the processor is alive and running through its program loop correctly. When the PCL-2 is in either the Test Mode or Calibrate mode, LED D1 is lit continuously. When Test or Calibrate mode is exited, the D1 will resume flashing once every 3 seconds.

ERROR RED LED (D2): This LED will light continuously to indicate that an overrange error exists, generally that the Full Scale is too small or the Pulse Value is too large. When this happens, the Full Scale will need to be increased since the pulse rate is generally fixed and cannot be changed.

USB TX GRN LED (D9): This LED flashes when the USB port is sending data out of the PCL-2 to the host computer running the SSI Universal Programmer.

USB Rx RED LED (D8): This LED flashes when the USB port is receiving data from the host computer running the SSI Universal Programmer software or a ascii terminal software program.

PCL-2 Wiring Diagram

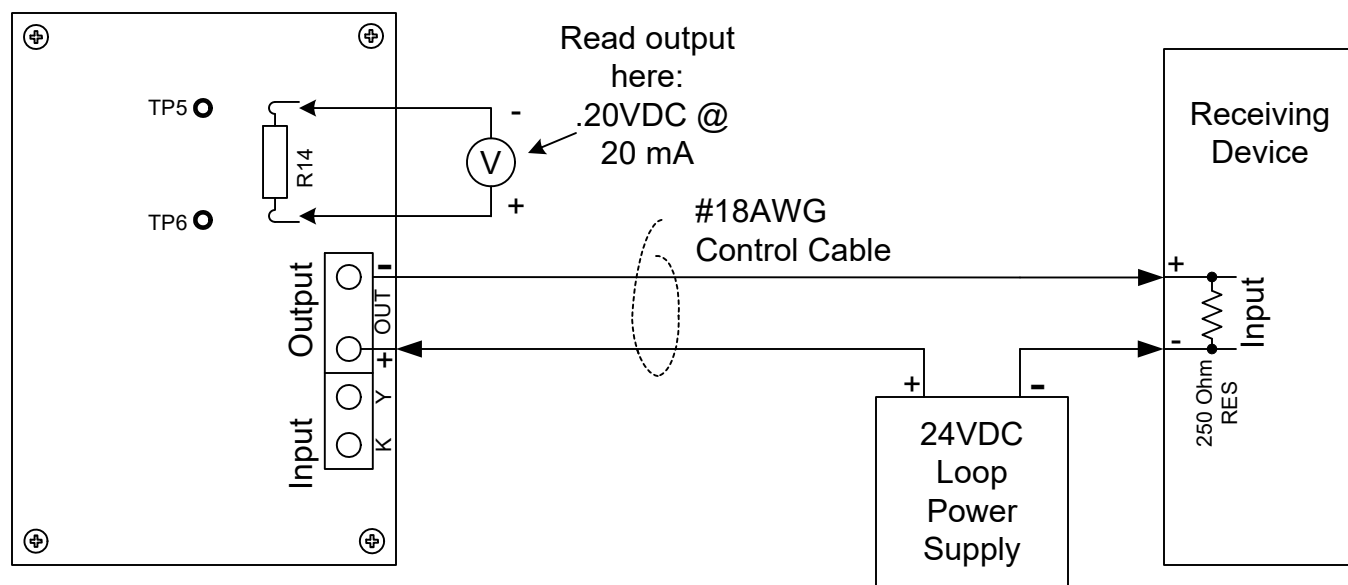


PCL-2WiringDiagram2.vsd

PCL-2 Pulse to 4-20mA Conversion Relay Wiring Diagram		REVISIONS		
		NO.	DATE	DESCRIPTION
DATE ORIGINAL 01/01/2025	SCALE N/A			
LATEST REVISION	JOB NO.	CHECKED	DRAWN WHB	

**Solid State Instruments
by Radian Research Inc**
3852 Fortune Dr
Lafayette, IN 47905
(765) 449-5576
technicalsupport@radianresearch.com
www.solidstateinstruments.com

PCL-2 4-20mA Current Loop Converter Module



Testing the PCL-2

Using a good quality (0.000V) 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. Alternately Test Points TP5 and TP6 can be used. Put the PCL-2 into the test mode. (See Page 9.) Yellow LED D1 will light continuously. The PCL-2'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-2 out of test mode and return to Normal Operation mode. Connect electric meter's pulse output to the input of the PCL-2 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). Pressing any key on the keyboard while in Test or Calibrate (DAC) mode will cause the PCL-2 to exit Test Mode or Calibrate Mode and return to run mode.

Interfacing the PCL-2 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 (1% or better), at a maximum voltage of +5VDC. Use a #18AWG to #22AWG 2-conductor stranded control cable between the PCL-2 and the receiving device. 4mA will yield 1VDC across the 250 ohm resistor, while 20mA will yield 5VDC. Keep the cable length to the minimum possible. Shielded cable is recommended with the shield connected away from the PCL-2.

Programming

The PCL-2 requires you to connect to it via its USB port to a computer for programming. See Page 5. Parameters that must be programmed are:

Operational Mode: General Purpose, Electric, Water or Gas
Output Time period: seconds, minutes or hours
Pulse Value, 1 to 99999 Watt-hours, Gallons or CCF per pulse*
Input Debouncing Filter, 0.5, 1, 5, 20mS
Full Scale Value; Range 1 to 99999 pulses/sec, kW, Gallons/time, or CCF/time, depending on mode of operation.*
Output Mode selection, either Instantaneous or Average (Electric only)
Demand Averaging Interval (if the above selection is Average) 1-60 minutes
Test Mode or Calibration Mode, Enter and Exit
(*See special note on Pulse Value and Max Full Scale Value for General Purpose Mode.)

Technical Support

Contact Radian Research, Inc. Tech Support at 765-449-5576 if you need technical support.

Programming the PCL-2 4-20mA Current Loop Converter Module

Software Required

The PCL-2 is programmed using SSI's Universal Programmer software, available as a free download on the SSI website at www.solidstateinstruments.com/downloads. Download the software version V1.xxx (TBD) or later from the solidstateinstruments.com website. See Page 10 for instructions on installing the SSI-UP software.

For subsequent programming after it has been set up the first time, follow these instructions:

Using the USB programming cable that accompanied the PCL-2, plug the "B" end into the PCL-2. Plug the "A" end into your computer's USB port. Do this first and apply power to the PCL-2 before starting the SSI-UP programming software.

Run the SSI Universal Programmer software. The SSI-UP software should automatically recognize that a PCL-2 is plugged into the computer and open the PCL-2 programming page. The current programming parameters will be read from the PCL-2 and displayed in the PCL-2 window. To READ all parameters back from the PCL-2 at any time, click on the <Read Parameters> button.

To program a new setting into the PCL-2, enter the desired value in the appropriate box in the window and click on <Save Parameters>. There are four settings on the PCL-2 and a test mode.

Operation Mode: Pull down the pull-down menu and select the type of application, General Purpose, Electric, Water, or Gas. Depending on the mode selected, certain features may be grayed out which are not compatible with the mode selected.

Pulse Value: Enter the Form A (2-wire) pulse value in the selected units for the mode, with a number from 1 to 99999. Electric is watthours, Water is gallons, Gas is in Cubic Feet. For General Purpose mode the pulse value is 1 and cannot be changed. (For Electric, you will need to multiply the kWh value by 1000 to get the watthour value.) You may not enter a decimal point. The value must be in whole (integer) numbers. For example, if your Form A (2-Wire) value is .144 kWh/pulse, then your watthour value per pulse is 144wh/p. Enter 144 in the Pulse Value box. Click on <Save Parameters> if done or change another setting.

Full Scale: Enter the desired full scale value from 1 to 99999 to the desired Full Scale KW, Gallons or Cubic Feet. For General purpose mode, the maximum full scale value range is dependant on Time Integral selected. For Seconds, 1-100, Minutes 100-10000, and Hours 10000-1000000. This gives you the flexibility to enter a value that will work with the 12-bit resolution with the receiving telemetry. For example, enter 500 for a for 500kW full scale value. Click on <Save Parameters> if done or change another setting.

Time Integral: Pull down the pull-down menu and select Seconds, Minutes or Hours. This period is the time over which the current output represents the usage or flow rate. This setting is not used in Electric mode.

Output Mode: Select Instantaneous or Average for the Output Mode. In Instantaneous Mode, the the 4-20mA output will be updated each second with the current readings result. In Average Mode, the calculated average will be written to the output amplifier for the averaging interval selected. Click on <Save Parameters> if done or change another setting.

Average Interval: Select the desired Averaging Interval from 1 to 60 minutes (if the Output Mode selection is Average). 15 minutes is the default since most electric meters use a 15-minute demand averaging interval. This setting is not used if you are operating in the Instantaneous Output mode. Click on <Save Parameters> if done or change another setting.

Input Debounce: Select the debounce time in milliseconds, either .5, 1, 5, or 10 milliseconds. This is the time that an active input must be present at the input before it is qualified as a valid pulse. This is a filtering technique to filter out noise and prevent noise on the input line from appear to be a pulse. Shielded cable from the meter is also recommended to reduce noise. Tie the shield to the ground at the meter to shunt noise away from the PCL-2.

Programming the PCL-2 4-20mA Current Loop Converter Module (con't)

When changing system settings is complete make sure to click on <Save Parameters>. All parameters will be saved in non-volatile 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.

Test Mode: Select On or Off: Selecting On sets the PCL-2 in test mode and begins a sweep from 4mA to 20mA in 10 seconds. It will remain at 20mA for 5 seconds, then reset to 4mA for 5 seconds. It will start again and repeat this sequence continuously until either Off <Save Parameters> is selected or until 5 minutes elapses. Any character being sent over the USB interface will exit the Test Mode. In addition, cycling the power will cause the test mode to be exited. The Test Mode overrides normal operation so make sure you exit test mode or cycle power to return to normal operation.

Calibration Mode: To Calbrate the PCL-2's output with your regulated 24VDC power supply, turn off Test Mode, and set the Calibration mode to On. Turn on your 24VDC loop power supply.

- Set 4mA Low setpoint: Select the DAC0 radio button. This sets the output at 4mA. Use your volt meter to read the voltage across R14. Adjust Pot R16 until the volt meter reads .040VDC.
- Set 20mA Full scale: Select the DAC4095 radio button. This sets the output at 20mA. User your volt meter to read the voltage across R14. Adjust Pot R15 until the volt meter reads .200VDC.
- Check mid-scale: Select the DAC2047 radio button. This will set the output at 12mA. The volt meter should read a voltage of approxiately .120VDC. Use calibration "goop" on the pots R15 and R16 to prevent them from moving.
- Any character being sent over the USB interface will exit the Test Mode.

Set Factory Defaults: In the event that you want to reset all PCL-2 settings to the factory defaults, select Reset Parameters and Click on <Save Parameters>.

Read Firmware Version: To read the firmware version is listed on the page when the SSI Universal Software connects to the PCL-2.

Read Parameters: Click on <Read Parameters>. All current settings in the PCL-2 will be displayed on the page in their respective menu boxes.

Technical Support

Contact Radian Research, Inc. Tech Support at (765) 449-5576 if you need assistance on the application of the PCL-2 4-20mA Pulse to Current Loop Converter Module.

Installing the SSI Universal Programmer software

Installation Procedure

- 1.) Download the software at www.http://solidstateinstruments.com/sitepages/downloads.php
If your computer is a Windows 7 32-bit machine select that file. If your computer is Windows 7 64-bit or Windows 10, select the regular download file.
- 2.) Make a file folder called "SSI Universal Programmer" and copy the SSIUniversalProgrammer.msi file into this folder.
- 3.) Doubleclick on the SSIUniversalProgrammer.msi file to begin the installation of the program.
- 4.) Follow the directions on each box that will install drivers and get the program ready to use.
- 5.) When done click "Finish" and close the Installation window(s).
- 6.) Connect the PCL-2 to your PC with the Type A-B USB cable and power up the PCL-2.
- 7.) Double click on the SSI logo ICON on your desktop to start the program.
- 8.) The SSI Universal Program window should open with the correct boxes for the PCL-2 settings. Follow the directions on Page 5.

Technical Support

Contact Radian Research, Inc. Tech Support at (765) 449-5576 if you need assistance on the application of the PCL-2 4-20mA Pulse to Current Loop Converter Module.

SSI UP Screen shot

SSI Universal Programmer

File

Devices

Connect

Help

USB Cable Connected

Serial Connected

You are connected to a: **PCL-2**

Firmware Version: 1.03

Output Mode (GP,Elec,Water,Gas)

Electric

Pulse Value, (units) (1-99999):

10

Full Scale Value (1-99999):

100

Output Time Integral (S,M,H):

Second

Output Mode (Inst or Avg):

Inst

Output Average Int, min (1-60):

15

Input Debounce, mS
(.5, 1, 5, 10mS):

10

Test Mode (On,Off)

On

Calibration Mode (On,Off)

Off

DAC0

DAC4095

DAC2047

Save

Read Parameters

Send

Monitor Window
(not needed with PCL-2)

Revision: 01/01/2025

Programming using ASCII Text Commands

The PCL-2 may be also be programmed using a Terminal program like TeraTerm, Hyperterminal, ProComm or almost any Ascii terminal program. Parameters are 57600 baud, 8 data bits, 1 stop bit, no parity, no flow control. Upper or lower case does not matter. ***Make sure Local Echo is ON (checked) and Receive is set to CR+LF.***

Commands are as follows:

'H','h' or '?' for a list of all commands.

'MX<CR>' Set operation mode, (X is 0-General Purpose, 1-Electric, 2-Water, 3-Gas).

'DX<CR>' Set input debounce, (X is 0-500us[.5mS], 1-1ms, 2-5ms, 3-10ms).

'PXXXXX<CR>' Set pulse input value, (1-99999). [Fixed at 1 in General Purpose mode].

'FXXXXX<CR>' Set full scale value, (1-99999). [See Note Below].

'IX<CR>' Set time integral, (X is 0-Seconds, 1-Minutes, 2-Hours).

'CX<CR>' Set output mode, (X is 0-Instantaneous, 1-Average).

'iXX<CR>' Set averaging interval, (XX is 1-60 minutes).

'TX<CR>' Set test mode, (X is 0-Disabled, 1-Enabled 5 min.).

'T<CR>' - Read Parameters.

'rm<CR>' - Reset Micro

'Z<CR>' - Set Factory Defaults

'V<CR>' - Query Firmware version

'DACXXXX<CR>' Sets the output to the designated step between 0 and 4095 for Output calibration:

Set to 'DAC0 for 4mA (Enabled 5 min.)

Set to 'DAC4095<CR>' Sets the output at 20mA (Enabled 5 min.)

Set to 'DAC2047<CR>' Sets the output at 12mA (Enabled 5 min.)

Full Scale Value Setting Range for General Purpose Mode

For Electric, Water and Gas, the Full Scale Value is 1-99999. However, in General Purpose Mode, the Full Scale Value varies with the Output Time Integral:

If Time Integral(m) is set to Seconds, the range of Full Scale Value is 1-100;

If Time Integral(m) is set to Minutes, the range of FullScale Value is 100-1,0000;

If Time Integral(m) is set to Hours, the range of FullScale Value is 1,0000-1,000,000.