

- Instantly integrate any standard power meter with a pulse output into the LonWorks® digital network.
- The firmware executes on a NeuroLogic Research Model 2200A and provides a low-cost interface to two power meters with no additional hardware. **The Model 2200A is firmware compatible with our previous Model 2200.**
- **Operates from 12 VDC, 24VDC, 48VDC and 24VAC power supply rails. Power input is not polarity sensitive**
- Total energy is saved to non-volatile memory every 30 seconds and is available in watt-hours via a Standard Network Variable Type, SNVT\_elec\_whr\_f.
- Number of firmware restarts is available via output network variable to log power or network interruptions.
- Power, in watts, can be averaged over a user configurable period of one minute to two hours. It is available using a Standard Network Variable type of SNVT\_power\_f.
- Power is additionally available as a percent, SVNT\_lev\_percent, to easily interface to other LonWorks devices.



- Accumulated pulse count and input state are available for diagnostics or other applications.
- Internal pulse accumulator has a capacity of 2,147,483,648 counts and can handle input frequencies up to 3600 Hz.

## DESCRIPTION

NeuroLogic Research's Model 2200 is a pulse count input node that is housed in a compact DIN rail enclosure. It allows integration of up to 2 digital pulse inputs into the LonWorks distributed digital network.

This datasheet describes the functionality of the 2200PM. It is a special program that tailors the Model 2200 for power monitoring or electric metering applications. The firmware executes on a standard Model 2200 and is available at no charge. It is downloaded to a base Model 2200 via a LonWorks Network Installation Tool such as LonMaker or pre-loaded if ordered as Model 2200PM

Pulse meters with a dry contact, NPN transistor, or a voltage output can be connected directly to the Model 2200. An input frequency of up to 3600 Hz can be captured. The internal pulse accumulator has a capacity of 2,147,483,648. In case power is lost, the accumulated pulse count is saved internally once every 30 seconds.

The amount of energy per pulse, in watt-hours, for each meter is entered as a configuration parameter. It is used

to calculate the total energy in watt-hours. The amount of energy measured is averaged over a user configurable period of 1 to 120 minutes. The average energy is used to calculate the demand power. The calculated power is made available via Standard Network Variable Types in watts and as a percentage value. The percentage output allows a simple interface to other LonWorks devices.

### NOTE

This PDF datasheet has attachments. To access them, it may be necessary to use an actual Adobe Reader. since some readers built into internet browsers do not allow access to attachments.

## Power Supply

The Model 2200A features an exceptionally flexible switching power supply. It allows the Model 2200A to be easily integrated into building automation, industrial automation, telecommunication and remote telemetry type systems. It operates from 12 VDC, 24 VDC, 48 VDC and 24 VAC power supply rails with a design margin better than +/-25% to allow for installation variations. A main advantage of the on board power

supply is low power consumption. The unit draws less than 10 mA at 24 VDC. This makes it ideal for low cost battery backup systems if one is desired.

The power supply is well protected against overvoltage spikes via solid state transient voltage suppressors. It is

additionally protected against over current conditions via fuses on both voltage input lines. On board thermal fuses do not have to be replaced. They will simply recover when the fault condition is corrected. Input voltage is polarity insensitive.

**WIRING AND INSTALLATION**

Input power and network communication is done via a single 4-position terminal block at the upper end of the enclosure. Please see the wiring table below for attaching power and network wiring.

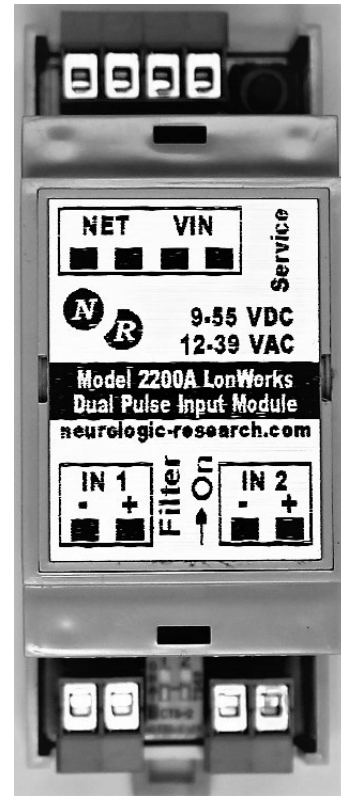
The on-board Service switch and LED allow installation on to the LonWorks network. The Service LED and switch are in the upper right hand corner

Each pulse input is attached to the Model 2200A via a 2-position removable terminal block on the lower portion of the enclosure.

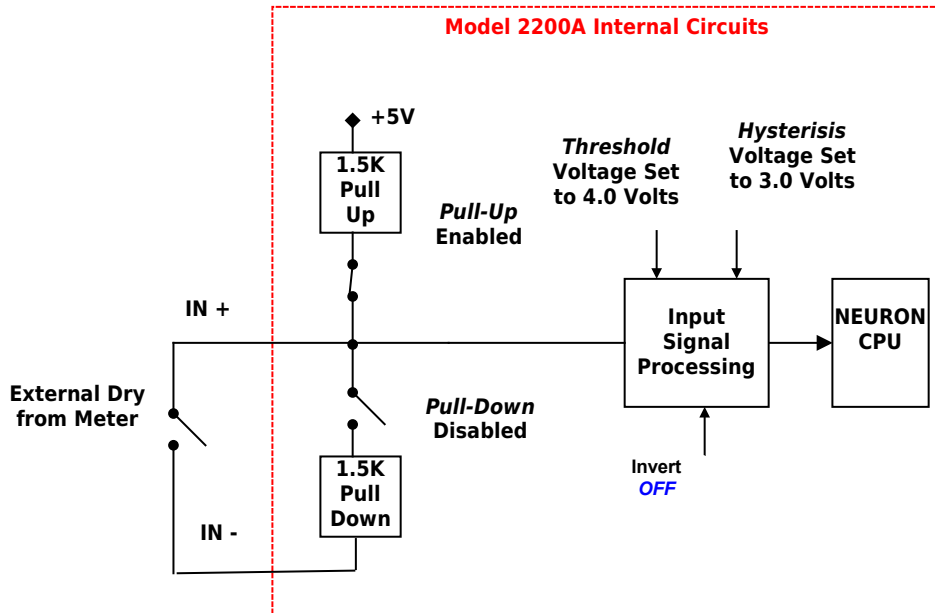
Please see the table below for identification of each position on the terminal blocks. Please see the following sections for a complete explanation of how the Model 2200A processes the input signal as well as wiring diagram for different input types.

Upper Terminal Block	Connection
NET(2)	Position labeled Net connects the Model 2200A to the LonWorks FTT-10 network. These wires are not polarity sensitive.
VIN(2)	Positions labeled VIN connect the power supply to the Model 2200A. Not polarity sensitive and accept a wide input voltage range of DC and AC voltages. 9 to 55 VDC or 12 to 39 VAC at 0.25W maximum.

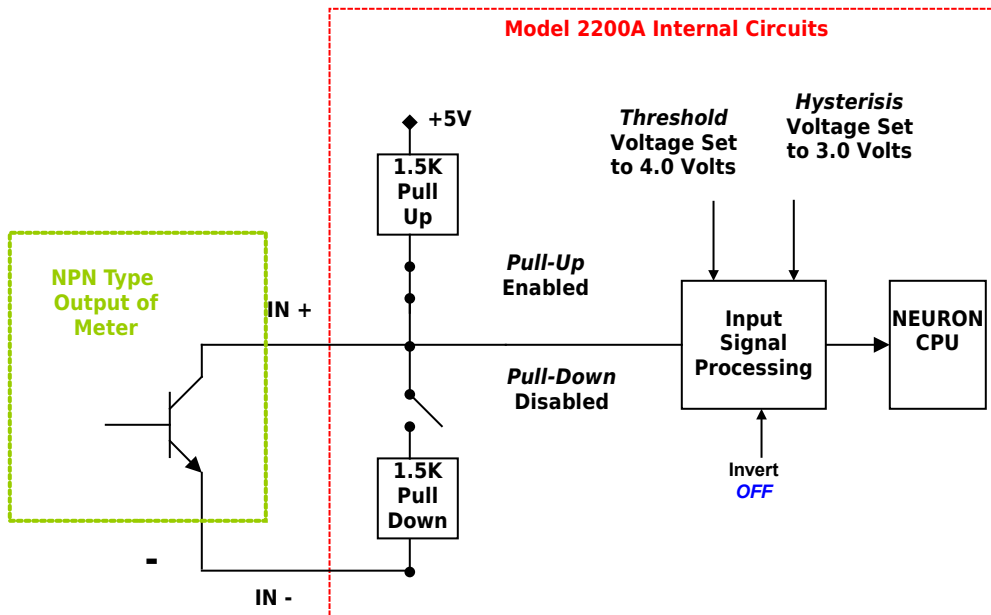
Lower Terminal Blocks	Connection
	<b>Note: Left = Channel 1, Right = Chanel 2</b>
IN +	Positive connection of input signal. Please see the wiring diagrams that follow.
IN -	Negative connection of input signal. Please see wiring diagrams below.



**Dry Contact Input Connection Diagram**



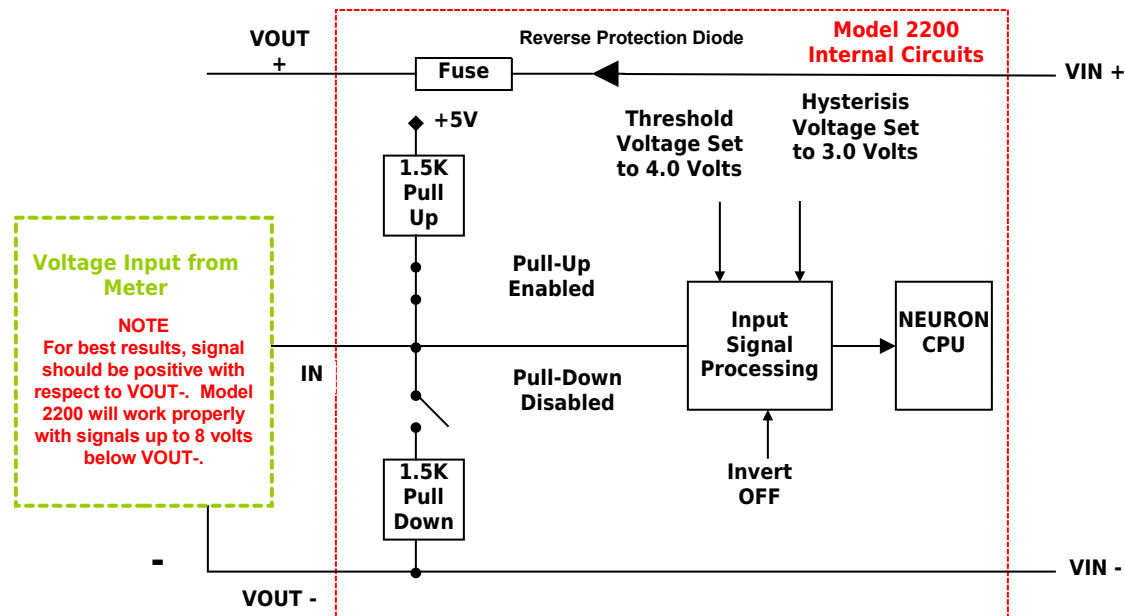
**NPN Transistor Input Connection Diagram**



## Voltage Input Connection Diagram

Note, the hardware can handle an input voltage range up to the input power supply voltage, VIN+, without damage. An input pulse is counted when it drops below

1.0 volts and must go above 4.0 volts before the next pulse can be detected.



## How The Pulse/Energy Accumulator Works

The 2200PM firmware configures each input with a threshold voltage of 4.0 volts and 3.0 volts of hysteresis. The internal 1500-Ohm pull-up resistor is always enabled. With this configuration, an input voltage less than 1.0 volt is considered ON while a voltage higher than 4.0 volts is considered OFF. Since the internal 1500-Ohm resistor is pulling the input up to an internal 5.0 volts supply, the input need only pull the input below 1.0 volt to be counted. The OFF to ON transitions are counted. Please see the Model 2200 datasheet if more information is required regarding the hardware's capabilities.

The internal pulse accumulator has a count capacity of 2,147,483,648. The Standard Network Variable Type of SNVT\_count has a capacity of only 65535. This data is available using the nvoCount network variable. When the maximum value is reached, the nvoCount will rollover and start again from 0. The 2200PM firmware makes a second network variable available, nvoCountOverflow. It will increment once each time the nvoCount value rolls over. By looking at both values, very large count accumulations can be realized.

The actual value of the total count is  $nvoCountOverflow * 65535 + nvoCount$ .

Power meters output a pulse each time a particular amount of energy is measured. The measured energy is usually in watt-hours. The number of watt- hours per pulse is entered via the nciEPerPulse configuration network variable.

Total accumulated energy is calculated and is available via the nvoEnergy output network variable. It is in watt-hours. In case power is lost, the accumulated energy is saved every 30 seconds to non-volatile memory. When power is restored, the firmware will resume counting from the last saved value. To keep track of restarts, the neoRestarts network variable is incremented every time the firmware is restarted. Firmware restarts can occur due to power interruptions or commands received over the network that may put the firmware "online" after being taken "offline".

Finally, the user can actually reset the count to any starting value by writing to the nviEStart. When this value is written, the actual internal accumulator is

updated with the value written into nviEStart divided by the nciEPerPulse.

### ***How Power Measurement Works***

Input pulses are accumulated over a user configurable period of 1 to 120 minutes. The 2200PM firmware will support input pulses having a frequency up to 3600 Hz. The averaging period is configured via the nciPwrAvgMinutes configuration network variable.

variable. Additionally, the power is available as percentage value via the nvoPwrPercent network variable. The percentage output is scaled using two configuration network variables. The nciPwrMin defines the value that represent 0% and nciPwrMax defines the value that represent 100%.

The average demand power is calculated over the specified period and is available via the nvoPwr network

### ***Looking at Input as a Discrete Digital***

For steady state input signals, the nvoState output network variable reports the ON / OFF state of the input

signal. The digital state is sampled by the firmware 10 times per second.

## NETWORK INTERFACE

The Model 2200 uses the Echelon FT-10 network transceiver interface with DC blocking capacitor so it can also be directly connected to LPT-10 networks. Before the Model 2200 can be used, it must first be installed into a LonWorks network. This procedure is slightly different for each system. It often involves telling the system to add a new device. The system will then ask the user to press the Service button on the device. When pressed, the Model 2200 will transmit its unique physical Neuron ID. The System then assigns a logical address to the unit and then data from the device is available. The data is available using Standard Network Variable formats that have been defined by the LonMark Association. The Model 2200 has self documentation of the network interface enabled and it can be uploaded by the installation tool. Additionally, an XIF is also attached to this PDF datasheet.

### NOTE

If you purchased a Model 2200PM, 2200VM or 2200 they can be converted to the type described in this datasheet by downloading the attached .NXE file over the LonWorks network. This is accomplished using your network installation tool when you install the device. If your network tool does not support this function we can do this for you at the factory, please contact us.

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## Configuration Network Variables

Network Variable	Format	Defaults	Description
nciEPulse[2]	SNVT_elec_whr_f	1.0	Defines the watt-hours per input pulse
nciESndDelta[2]	SNVT_elec_whr_f	1.0	Minimum change required before nvoEnergy, nvoCount, and nvoCountOverflow are updated
nciPwrAvgMinutes[2]	SNVT_count	1 Minute	Number of minutes used to calculate average power, nvoPwr. Values are limited between 1 and 120 minutes.
nciPwrSndDelta[2]	SNVT_power_f	1.0	Minimum change required before nvoPwr and nvoPwrPercent are updated
nciPwrMin[2]	SNVT_power_f	0.0	Value equal to 0% for nvoPwrPercent
nciPwrMax[2]	SNVT_power_f	100.0	Value equal to 100% for nvoPwrPercent
nciMinSendT	SNVT_time_sec	15.0 Sec	Minimum elapsed time before a network update is sent even if the configured delta change has been met.
nciMaxSendT	SNVT_time_sec	30.0 Sec	Maximum elapsed time before a network update whether or not the configured delta change has been met.

**Output Network Variables**

Network Variable	Format	Description
nvoEnergy[2]	SNVT elec whr f	Total accumulated Energy in watt-hours
nvoPwr[2]	SNVT_power_f	Power averaged over a user configurable period of 1 minute to 2 hours. See nciPwrAvgMinutes.
nvoPwrPercent[2]	SNVT_lev_percent	Power represented a percent value. See nciPwrMin and nciPwrMax to configure.
nvoCount[2]	SNVT_count	Accumulated raw count. Value is between 0 and 65535.
nvoCountOverflow[2]	SNVT_count	Number of time nvoCount[] overflows. Total accumulated count is nvoCountOverflow*65536 + nvoCount
nvoState[2]	SNVT_lev_disc	Status of the discrete input. Can be used for diagnostics or to interface to standard switch closure
neoRestarts	SNVT_count	Non-volatile variable that is incremented every time the firmware restarts. Usually due to a power loss, however, it will also occur if the unit is placed online via a network command.

**Input Network Variables**

Network Variable	Format	Description
nviEStart[2]	SNVT_elec_whr_f	Allows the nvoEnergy[] accumulator to be reset or started at any value.

## SPECIFICATION

### General

CPU	Neuron FT5000
Operating Temperature	-40 – 85 C
Operating Humidity	0-95% Relative Humidity non-condensing
Input Power	9 to 55 VDC or 12 to 39 VAC at 0.25W maximum.
Input Power Protection	Input power is fused and transient voltage protected. (Fuses do not need to be replaced)
Current Consumption	Echelon TP/FT10 transceiver at 78 kbps. DC blocking capacitors for LPT10 network.
Network Transceiver Type	Removable terminal blocks. Accepts 14-26 GA wire. Input power is reverse voltage protected. Network wiring is polarity insensitive.
Input Power and Network Wiring	Removable terminal blocks. Accepts up to 14-26 GA wire. Input power is reverse voltage protected. Network wiring is polarity insensitive.

### Inputs

Inputs	2
Input Types	Dry contact, NPN transistor, 0-5 volts input minimum
Input Voltage Range	0-36 VDC. Input voltage signal must be capable of sinking 3.5 mA due to internal 1500 resistor.
Threshold Voltage Range	< 1.0 Volts or < 375 Ohm indicates input is ON > 4.0 Volts or > 6000 Ohm indicates input is OFF
Internal Pull-Up	1500 Ohms to 5 Volts DC
Power Averaging	1 – 120 minutes
Frequency Input Range	3600 Hz with filter off, 200 Hz with filter on
Pulse Accumulator Capacity	2,147,483,648

### Dimension and Materials

External Dimension	36 mm (1.8”) W x 90 mm (3.54”) L x 58 mm (2.28”) H
Enclosure Type	DIN rail mount to 35 mm rail
Enclosure Material	Grey frame retardant Noryl UL94 V0

## ORDERING INFORMATION

2200PM	Model 2200PM LonWorks Dual Power/Electric Pulse Meter Interface
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