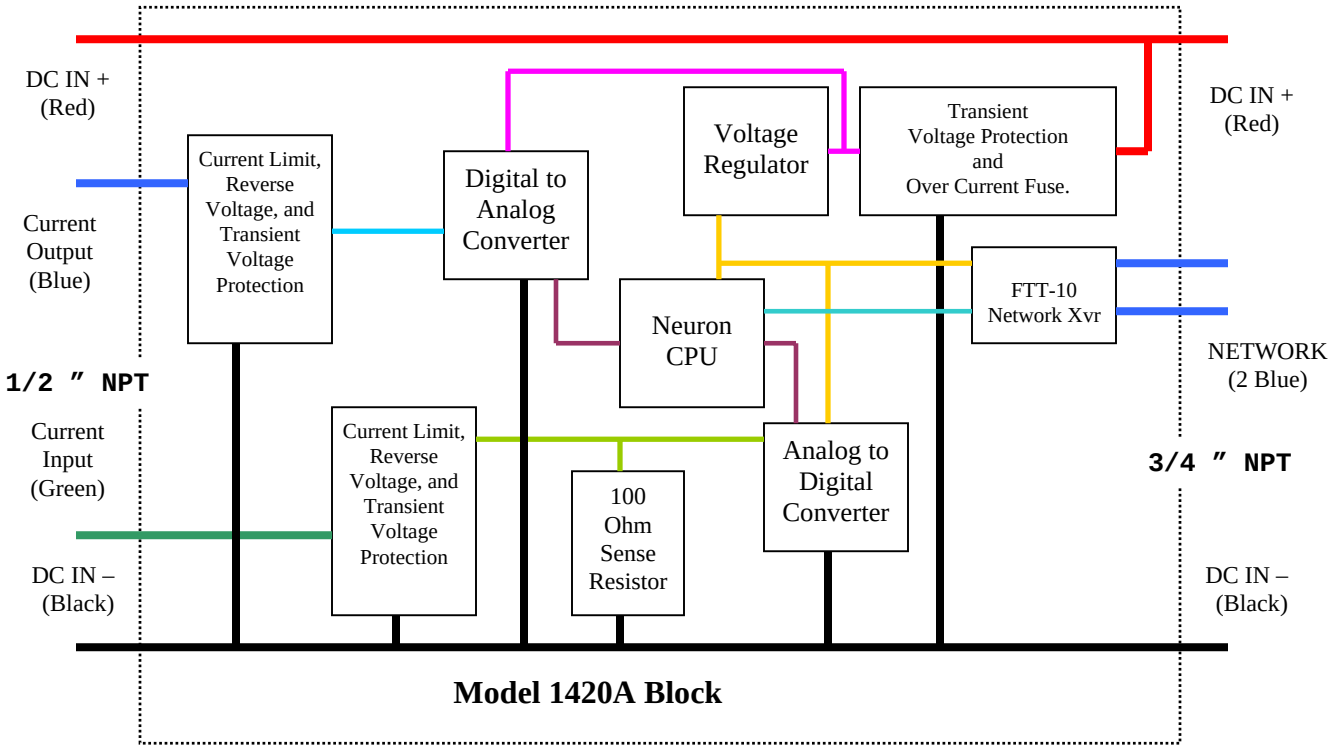
4-20 mA INPUT/OUTPUT NETWORK BRIDGE

- Instantly integrate any standard 4-20 mA sensor and or actuator into the LONWORKS® digital network.
- 4-20 mA output will drive receivers with input impedance in excess of 1200 ohms. It can be rescaled between 0 and 24 mA or driven as a digital output. Resolution is 0.37 uA.
- 4-20 mA input supports loop and self-powered sensors. It can be rescaled between 0 and 23 mA or interpreted as a digital input. Resolution is 0.76 uA.
- Calibration and scaling is digitally accomplished over the network.
- Electronics are sealed for environmental durability.
- Input and output are reverse voltage protected, current limited and transient protected.
- 1/2" NPT connection attaches directly to most sensors' conduit entry.
- 3/4" NPT wiring conduit connection attaches to any standard wiring junction box.
- Multiple sensors multiplexed on same wires
- All outputs and inputs available using Standard Network Variables (SNVT)
- Compact and rugged body for durability
- Very compact package becomes part of the wiring conduit.



Model 1420A Block

MODEL 1420A

DESCRIPTION

The Model 1420A is a bridge between industry-standard 4-20 mA transmitters/actuators and LonWorks devices. While the functionality of the Model 1420A is not new, its packaging allows it to essentially become part of the wiring conduit. One side simply fastens directly into most standard 4-20 mA transmitters or actuators via their 1/2" NPT wiring entry. The other side of the Model 1420A is a 3/4" NPT that allows attachment of any standard electrical conduit box. This approach greatly reduces the amount of wiring and space required for interfacing sensors to LonWorks networks.

Although it is very compact, the Model 1420A electronics include a central processing unit, precision sense resistors, analog to digital converter, digital to analog converter, and a network communication interface. The communication interface is the FTT-10 transceiver. This allows multiple sensors and actuators to be used over a simple four-wire bus installation. Two wires are used for power, the other are used for digital communication.

WIRING OVERVIEW

There are four flying leads that extend out of the 3/4-inch NPT end of the Model 1420A. Also note the Service Switch and LED on this end. The Service Switch and LED are used for network installation. When pressed the unit transmits its internal Neuron ID onto the network. The four wires connect power and the LonWorks network to the Model 1420A as follows:

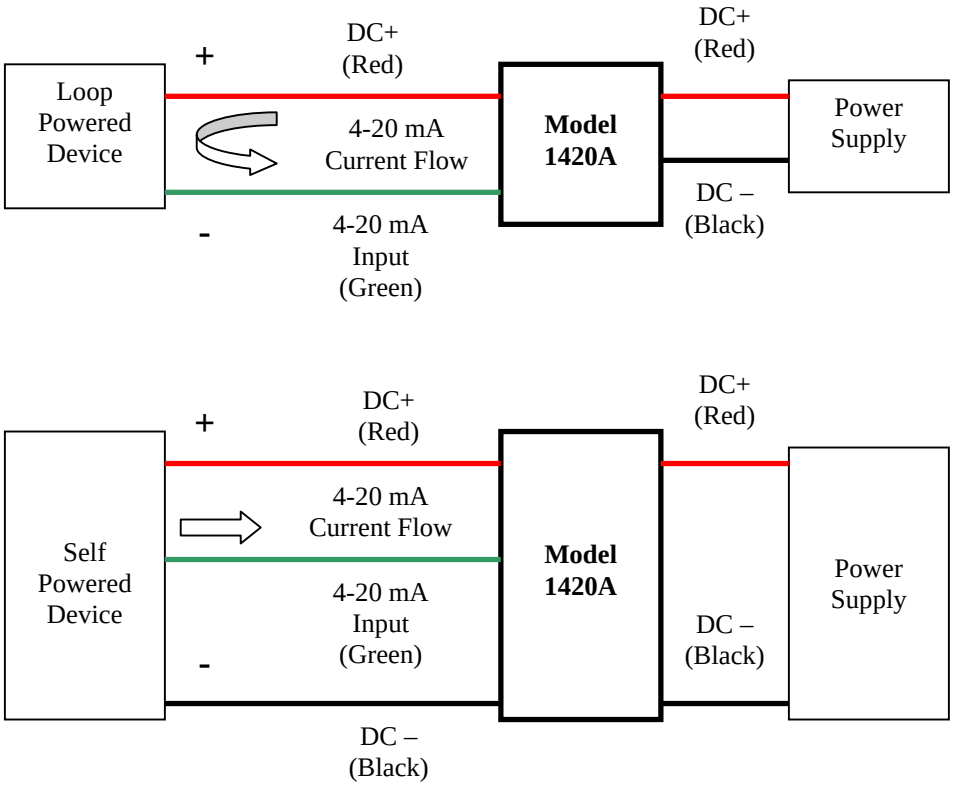
WIRE COLOR	DESCRIPTION
Red	Positive DC Input Voltage of 10 to 32 volts
Black	Negative DC Input Voltage
Blue – 2 Wires	LonWorks FTT-10 network. Polarity insensitive.

There are four additional flying leads that extend out of the 1/2-inch NPT end. These leads connect the Model 1420A's current output and input to external devices. Please note that the Red and Black wires on the 1/2-inch NPT end can be used to supply power to the unit if it is more convenient to do so on that side. Please see later sections and the block diagram above for clarity. The wire connections are as follows:

WIRE COLOR	DESCRIPTION
Red	Positive DC Input Voltage of 10 to 32 volts
Black	Negative DC Input Voltage
Blue	Current Output (4-20 mA Output by default)
Green	Current Input (4-20 mA Input by default)

CURRENT INPUT

The current input supports loop and self powered devices. Loop powered devices require a two wire connection and are normally simple devices that can operate on a current between 4 and 20 mA. Self-powered devices require a three-wire connection and normally require much higher currents to operate. The following diagrams demonstrate proper connection of loop and self powered devices to the Model 1420A. Note, that power can be connected to the Model 1420A from either side.



The current input updates the nvoAI output network variable. By default, 4 mA on the input represents 0% while 20 mA represents 100%. Many 4-20 mA sensors provide a local mean to adjust the 4 mA and 20 mA to some actual process values to re-range the transmitter's current output. If this approach is used, there are no further calibration or adjustment to be made.

Additionally, the input can be digitally calibrated via commands sent across the network. Digital calibration is much more precise and does not suffer from long-term component drift. The Model 1420A's input calibration is very flexible allowing any current value in the range of 0 to 23 mA to be specified. Calibration of the Model 1420A includes zero and span to re-define the 0% and 100% points as well as an offset. For convenience, the Model 1420A allows the customer to also calibrate any two custom points. For example precision input sources may only be available at 23% and 68%. The net result is to simply define the lower and upper points on a straight line. This is then used to internally correlate the input signal to the output percentage value. The offset is used to move the straight line up and down without changing its slope.

For maximum flexibility, there are no limits imposed on the upper or lower calibration points. This is useful since you can actually re-define the upper point to be less than the lower point and thus define a

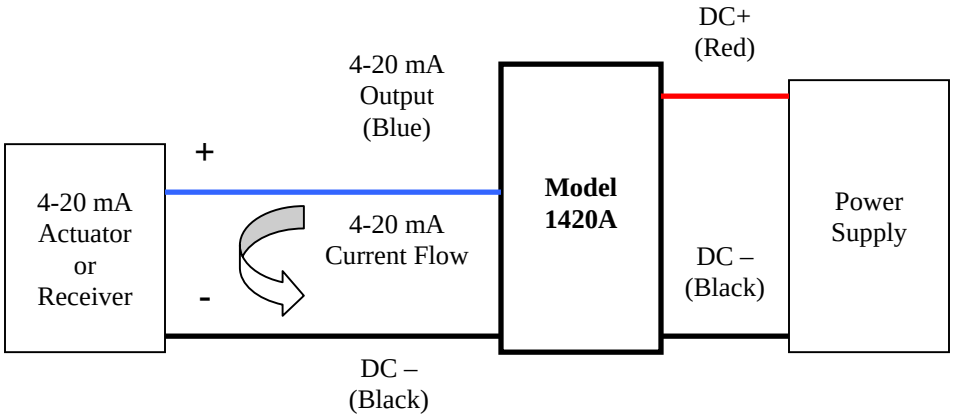
characteristic line with a negative slope. In this case, the percentage output, nvoAI, will actually go down as the input current goes up.

Using The Current Input as a Digital Input

The Model 1420A can report the input current as a digital output via the nvoDI output network variable. Two configuration network variables, nciDILow and nciDIHigh set the thresholds. If nvoAI is equal or less than nciDILow, nvoDI will be set to ST_OFF. If nvoAI is equal or higher than nciDIHigh, nvoDI will be set to ST_ON. This can be useful for triggering an output if the analog input goes above a specified value. The nvoDI is available in addition to the nvoAI network variable and both can be used simultaneously.

CURRENT OUTPUT

The Model 1420A provides a 4-20 mA current output via the blue wire on the 1/2 –inch NPT side. A simple connection diagram is shown below. Note, power can be supplied to either side of Model 1420A.



The current output is controlled via the nviAO input network variable. By default, it is configured so that 0% is equal to 4mA output and 100% is 20 mA output. The output has the ability to be rescaled anywhere between 0 and 24mA. That is, you can actually have the 0% value be equal to 0 mA and the 100% value be equal to anything up to 24 mA. This is done via two configuration network variables, the nciAOOffset, default is 0%, and nciAOScale , default is 100%. Both are specified in percentages. By default nciAOOffset is 0 and nciAOSCale is 100%. Use the following equations to calculate nciAOOffset and nciAOScale to redefine the output range.

NciAOScale = 100 * (Custom100%Value – Custom0%Value)/(Factory100%Value – Factory0%Value)

NciAOOffset = 100 * (Custom0%Value – Factory0%Value)/ (Factory100%Value – Factory0%Value)

Where:

Factory0%Value = 4 mA
Factory100%Value = 20 mA
Custom0%Value = Custom output desired when 0% is written into nvOAI
Custom100%Value = Custom output desired when 100% is written into nvOAI

Example:

To map output between 0 and 24 mA, input the following values into nciAOOffset and nciAOScale:

NciAOScale = 100* (24 – 0)/(20 – 4) = 150%

NciAOOffset = 100 * (0 – 4)/(20-4) = -25%

Note, you do not need to change the nciAOScale or nciAOOffset to drive the output between 0 and 24 mA. This can actually be accomplished with the default configuration by writing a value of –25% to output 0 mA or writing a value of 125% to output 24 mA. However, this may not be compatible with other LonWorks devices that only output a value between 0 and 100%.

By default, the current output on power-up is set to 0%. For the initial factory calibration this is 4 mA. The user can choose any other output value by changing the nciAODefault configuration network variable.

Although the Model 1420A electronics can operate from a wide voltage supply range, the input voltage must be high enough to drive the output current loop. Normally, the output current will drive a receiving circuit that has a certain resistance. Receiver circuits commonly vary between 250 and 600 Ohms. The following formula should be used to insure enough voltage is available:

Minimum 1420A Power Supply Voltage = ReceiverImpedance * MaxOutputCurrent + 4.5volts

For example, if the receiver impedance is 600 Ohms and the maximum output current is 20 mA, the minimum Model 1420A input voltage is equal to (600*0.02) + 4.5 = 16.5 volts. Please note, under all conditions, the voltage into the Model 1420A should not be between 10 and 32 volts.

Using the Current Output as a Digital Output

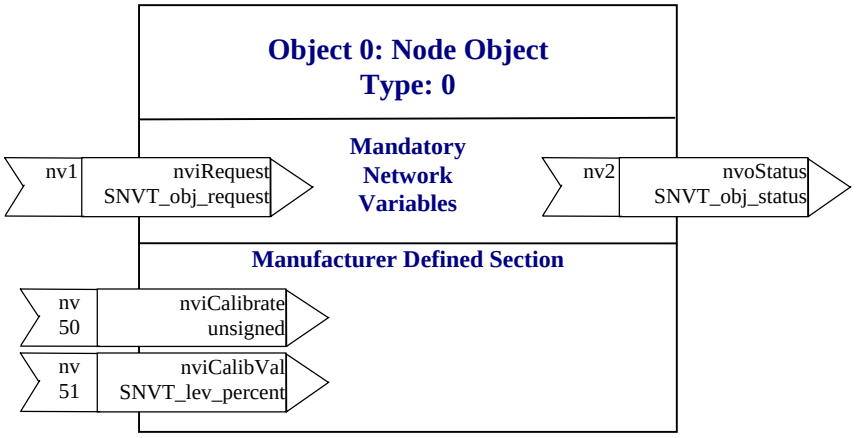
The current output can be controlled as a digital output via the nviDO input network variable. Two configuration network variables, nciDOLow and nciDOHigh control the actual output current. If nviDO is set to ST_OFF, the output current will be set to nciDOLow. If nviDO is set to any value other than ST_OFF, the output current will be set to nciDOHigh. A value of ST_NUL is ignored and causes no change in the output current.

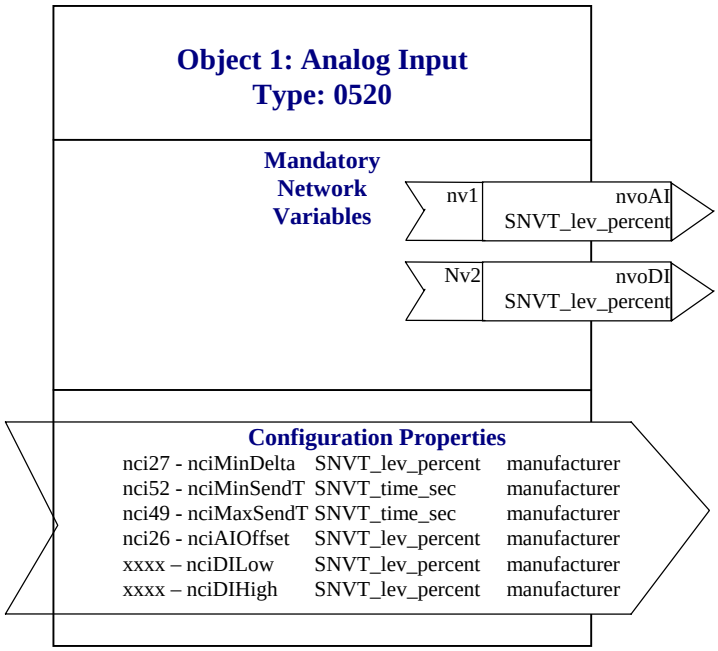
An interesting use of the current output is to drive a low current relay, solid-state relay, or a set of LEDs. Multiple LEDs can be placed in series and driven with the current output. Since the Model 1420A is driving current, no limiting resistor is required. LEDs usually have a voltage drop across them of around two volts. Make sure the Model 1420A has enough input voltage to drive all LEDs in series. For example, to drive 10 LEDs in series with a 2 volts drop, you will need a power supply of at least 24.5 volts. See equations above.

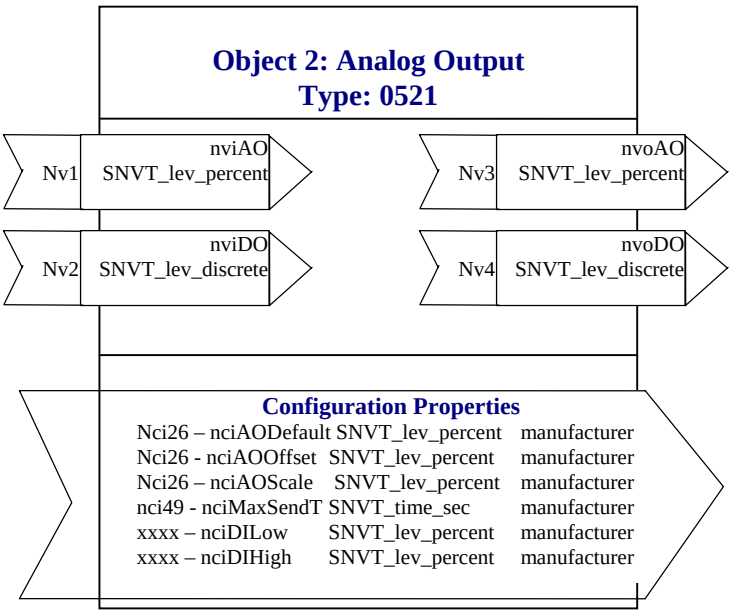
NETWORK OBJECTS

The Model 1420A contains three objects: Node Object, Analog Input Profile, 0520, and Analog Output Profile, 0521. The nviCalibrate and nviCalibVal network variables allow the Model 1420A's input to be calibrated and re-ranged by the customer. Input calibration functions are accomplished by writing the following values into nviCalibrate. The "calibrate by value" function assumes that nviCalibVal contains a valid value before the command is written into nviCalibrate.

- 00 - Zero. The current input signal corresponds to 0%.
- 01 - Span. The current input signal corresponds to 100%.
- 02 - Calibrate Value #1. The current input signal corresponds to lower value which is contained in nviCalibVal.
- 03 - Calibrate Value #2. The current input signal corresponds to upper value which is contained in nviCalibVal.
- 15 - Reset calibration to factory







MODEL 1420A

GENERAL SPECIFICATION

General

CPU	3120 Neuron
Network Transceiver	FTT-10A
Operating Temperature	-40 – 85 C
Operating Humidity	0-95% Relative Humidity non-condensing
Environmental Protection	Electronics are sealed.
Input Power	10 to 32 VDC. Minimum input voltage required may be higher depending on device the current output is driving. Please see the Installation Section for more detail.
Input Power Protection	Input power is fused and transient voltage protected. (Fuse does not need to be replaced)
Current Consumption	20-30 mA Typical with service LED plus power used by 4-20 mA devices. Budget 25 mA for the output plus 25 mA for the loop powered 4-20mA input.
Network Transceiver Type	Echelon FTT-10A transceiver at 78 kbps. DC blocking capacitors for LPT10 network.
4-20 mA Sensor Wiring	Non-terminated 24-awg wire leads 8” length. See Wiring and Installation for connection diagram and wire color.
Input Power and Network Wiring	Non-terminated 24-awg-wire leads 8” length. See Wiring and Installation for connection diagram and wire color. Network wiring is polarity insensitive.

Analog Input

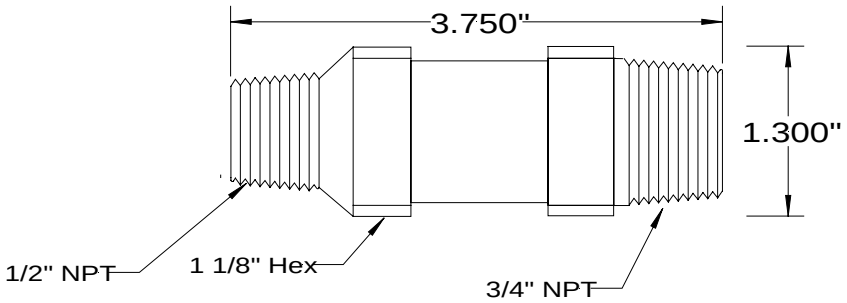
Resolution	0.76 uA
Input Types	0-23 mA current. Factory default is scaled for 4-20 mA
Sense Resistor	100 Ohm
Accuracy	10 uA at 25 C
Firmware Refresh Rate	200 milliseconds.
Temp Coefficient	50 ppm maximum per degree C
Protection	Input is transient voltage protected and current limited at 23.5 mA to protect 100 Ohm sense resistor.

Analog Output

Resolution	0.37 uA
Output Type	0-24 mA current. Factory default is scaled for 4-20 mA
Accuracy	10 uA at 25C and Input Voltage of 23 VDC.
Power Supply Dependency	5 uA/Volt typical, 10-uA/Volt maximum. Unit is factory calibrated at 23 VDC.
Temp Coefficient	35 ppm maximum per degree C
Protection	Output is reverse voltage protected, transient voltage protected, and current limited at 24 mA

Dimension and Materials

Network / Power Connections	3/4 inch Male NPT
4-20 mA In/Out Connections	1/2 inch Male NPT
Probe Body	304 Stainless Steel 1-1/8 inch Hex, Installed length = 3.25”



ORDERING INFORMATION

1420A	**Model 1420A 4-20 mA Input / Output Network Bridge**

Code	**Network Transceiver Option**
-0	TP/FTT-10A

1420A	**-0**	**Model 1420A with FTT-10A transceiver**