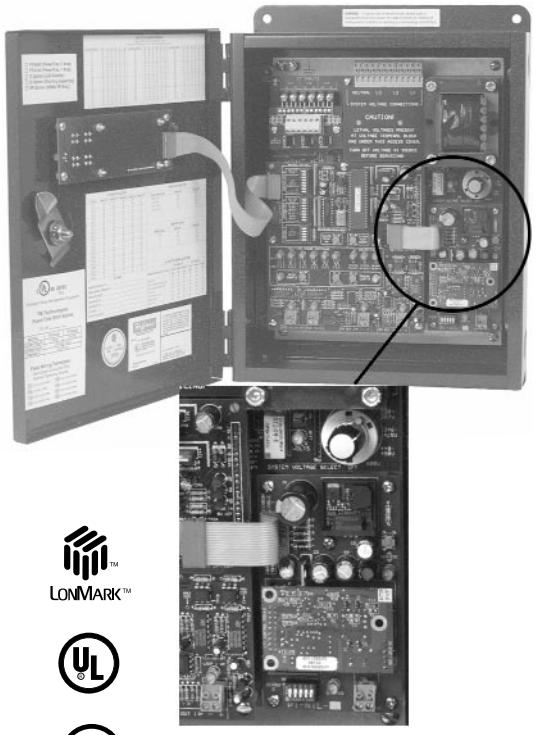
LonWorks Communication Module for PT-9000

MODEL PT-NTL-10

Technologies
A Kele Company

DESCRIPTION

The **PT-NTL-10** is the LonWorks Communication Module for the **PowerTrak PT-9000** Power Monitoring Interface. The **PT-NTL-10** reads data from the **PT-9000's** main processor, formats it, and transmits the data to a LonWorks network using the LonTalk communications protocol. The **PT-NTL-10** allows all of the power system parameters measured by the **PowerTrak** to be monitored over a single pair of wires using the LonWorks FTT-10 Free Topology Transceiver. In addition, the **PT-9000** configuration switches, CT polarity, and voltage-current phasing settings can be monitored. Because the **PT-NTL-10** is designed to meet LonMark Interoperability Guidelines, multiple **PowerTraks** can be connected with other LonWorks devices on the same network.



PT-NTL-10

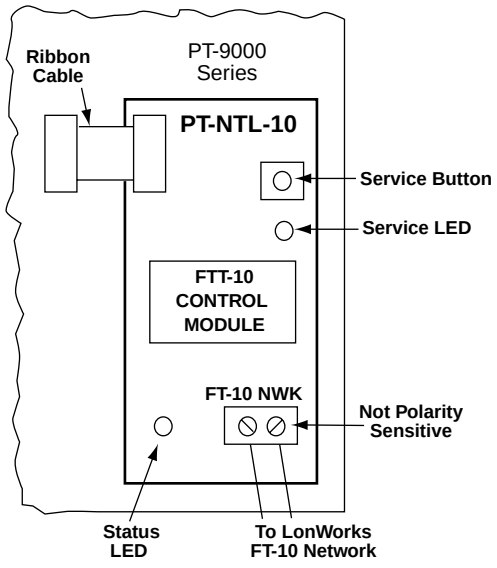
FEATURES

- ***Monitor all PowerTrak parameters over a single pair of wires***
- ***Allows remote reset (with time stamp) of KWH and Peak KW parameters***
- ***FTT-10 transceiver***
- ***Standard Network Variable Types (SNVT) are used to meet LonMark Interoperability Guidelines***
- ***Pluggable field wiring screw terminals***
- ***Status LED indication***
- ***Factory or field installation to any PT-9000***

SPECIFICATIONS

Power supply	None required (powered by PT-9000)
Network	LonWorks FTT-10 transceiver
Field wiring	Pluggable screw terminals
Dimensions	4.5"H x 2.6"W x 1.7"D (11.4cm x 6.6cm x 4.3cm)
Operating temperature	32 to 122°F (0-50°C)
Humidity	0-95% noncondensing
Weight	0.7 lb (0.32 kg)
Approvals	UL Listed, file #E161500 Certified to LonMark Interoperability Guidelines Version 3.1

WIRING



INSTALLATION OF THE PT-NTL MODULE

If the **PT-NTL** option was ordered with the **PT-9000**, it will be pre-installed at Kele. If the **PT-NTL** is to be field installed, follow these steps:

1. The main processor firmware must be at least Revision 1.3 for use with the **PT-NTL** option. If the label on your main processor (large 40-pin IC chip in middle of **PT-9000** upper board) shows a revision level less than 1.3, contact Kele and we will send you an updated processor.

2. Ground yourself before removing the **PT-NTL** module from its anti-static bag. Both the **PT-NTL** and the Echelon FTT-10 control module which mounts on top of the **PT-NTL** are static sensitive!

3. Unplug the Echelon FTT-10 control module from the top of the **PT-NTL** board. (See diagram below).

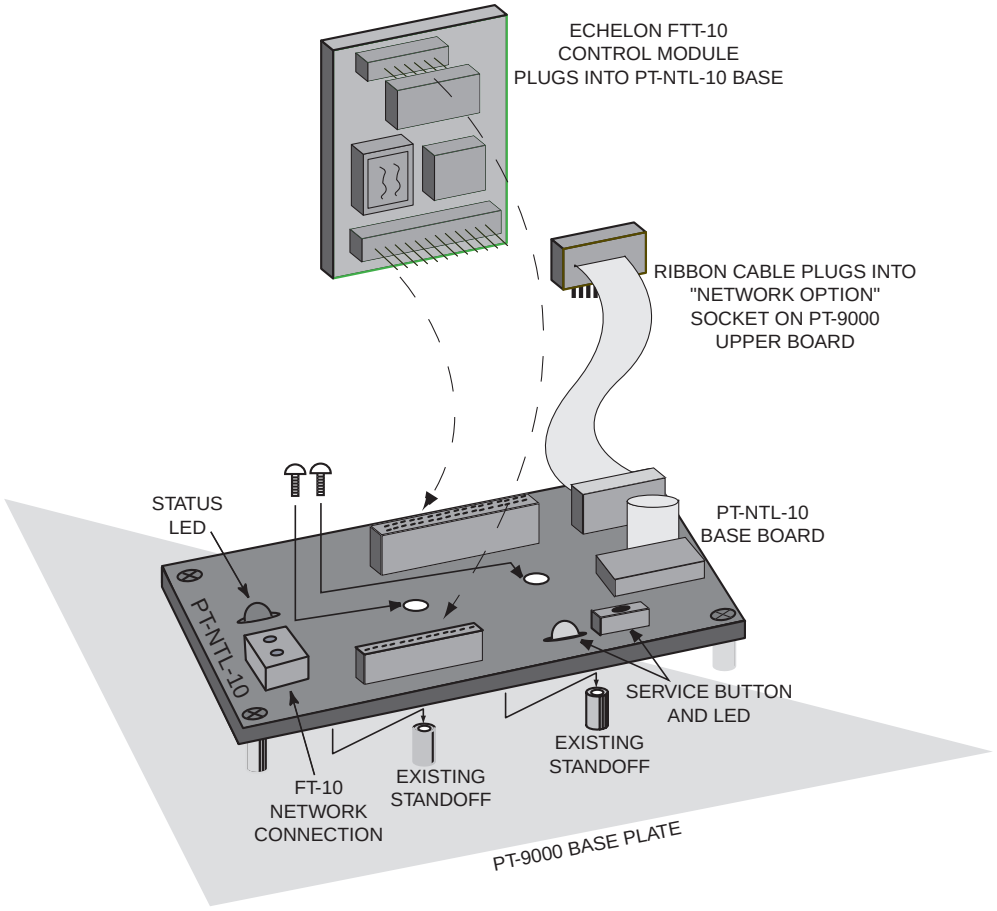
4. Lower the **PT-NTL** board over the two standoffs on the lower right corner of the **PT-9000** sub-base. Orient board so that the ribbon cable is on the upper left corner. Install the two 6-32 screws to secure the **PT-NTL** board to the standoffs.

5. Plug the Echelon FTT-10 control module back onto the top of the **PT-NTL** board. Be careful to line up the connector pins correctly!

6. Turn off the **PT-9000** power using the System Voltage Select Switch. Plug the ribbon cable header from the **PT-NTL** into the “Network Option” socket on the **PT-9000** main processor board.

7. Turn the **PT-9000** power back on. Connect the LonWorks network twisted pair to the 2-screw terminal block on the lower right corner of the **PT-NTL** board. Information on LonWorks network wiring (topologies, terminating resistors, wire types, etc.), can be found in Echelon Corporation publications such as the User’s Guide for the FTT-10 Free Topology Transceiver.

8. This completes installation of the **PT-NTL** LonWorks Module.



CONFIGURING THE PT-NTL LONWORKS MODULE ON THE NETWORK

Upon initial power-up, the **PT-NTL** red service LED will blink indicating that it is unconfigured. A third-party network management software program running on a personal computer is required to configure the **PT-NTL** (and other LonWorks nodes). The computer running the network management software may be removed from the system after the network is configured or may remain for continuous monitoring of network variables and network status.

The **PT-NTL** LonWorks Module can be configured on the network in three ways:

1. If the network management software supports identification by Service Pin, the **PT-NTL** Service pushbutton can be pushed when the network management software requests it. This causes an identification message to be sent out on the network which will be picked up by the network management software.
2. The **PT-NTL's** Neuron chip ID number can be entered manually into the network control console when requested by the network management software. The Neuron chip ID number is written on the Echelon FTT-10 control module in the format XX-XX-XX-XX-XX-XX.
3. If the network management software is capable of finding unconfigured nodes automatically, the Wink command can be sent to the ID of each unconfigured node. Then the nodes can be physically checked to see which node corresponds to which address. When the **PT-NTL** receives a Wink command, it blinks its Status LED rapidly (5 times per second) for 5 seconds.

CLEARING NETWORK CONFIGURATION ON PT-NTL (SETTING UNCONFIGURED STATE)

If the network configuration in the **PT-NTL** ever needs to be cleared (put the **PT-NTL** in the Unconfigured State), this can be accomplished by holding the Service button down while powering up the unit and continuing to hold the Service button down for at least 7 seconds. After releasing the Service button, the red Service LED should begin to flash to show that the **PT-NTL** has been reset to the Unconfigured State.

EXTERNAL INTERFACE (XIF) FILE

Each **PT-NTL** unit comes with a 3.5" diskette containing documentation about the **PT-NTL-10's** network variables and internal hardware configuration. The diskette contains the following:

A:\XIF_40\PTNTL102.XIF (Version 4.0 of External Interface File)
A:\XIF_31\PTNTL102.XIF (Version 3.1 of External Interface File)
A:\ResFiles\PTNTL102.TYP (User Resource "Type" File)
A:\ResFiles\PTNTL102.FPT (User Resource "Functional Profile Template" File)
A:\ResFiles\PTNTL102.FMT (User Resource "Format" File)
A:\ResFiles\PTNTL102.ENU (User Resource "US English Language" File)
A:\UserMan\PTNTL102.DOC (Microsoft Word version of this user's manual)

Most network management software will accept an XIF file when building the node's database. Version 4.0 of the XIF file is preferred by the LonMaker network management software. Other third-party network management software may prefer the 3.1 version of the XIF file. The XIF file is a plain text file. If ever in doubt as to which version is being used, you may view the file with any text editor program and look at the version number in the first-line header.

VERIFY OPERATION

After proper physical installation of the **PT-NTL** and configuration on the network, the green Status LED on the **PT-NTL** will blink off once every five seconds. This indicates that the **PT-NTL** is requesting and receiving data from the **PT-9000**. The red service LED will be off if the **PT-NTL** has been configured.

To verify communication over the network, you should be able to query any of the **PT-NTL** network variables through the network management software tool. You can also use the network management software to cause the **PT-NTL** to Wink. Issuing a Wink command from the network management software tool will cause the **PT-NTL** green Status LED to blink five times per second for five seconds.

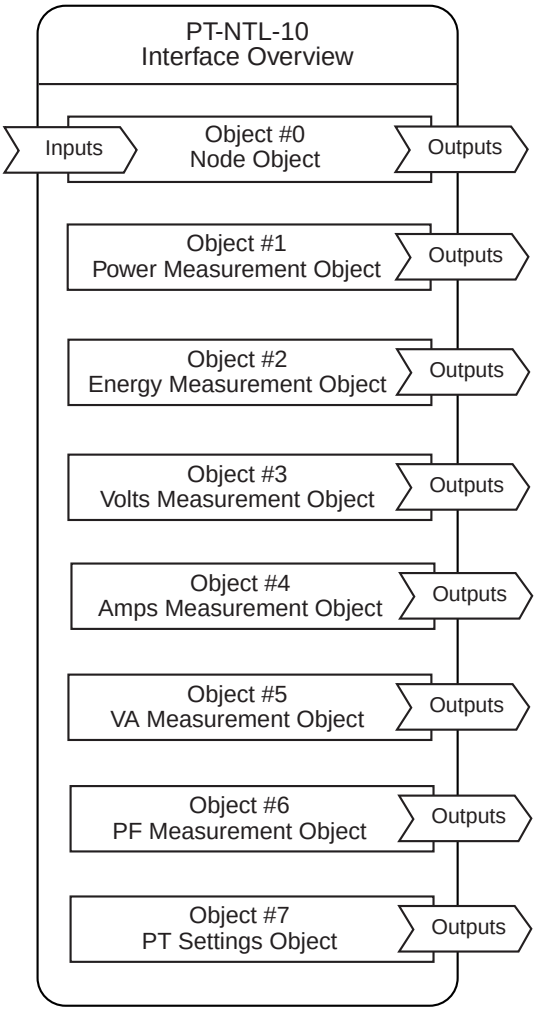
If the **PT-NTL** green Status LED is not blinking off once every five seconds, verify that the **PT-NTL** has been properly installed by checking for loose or improper connections at the ribbon cable and the network terminal strip.

VERIFY OPERATION (CONTINUED)

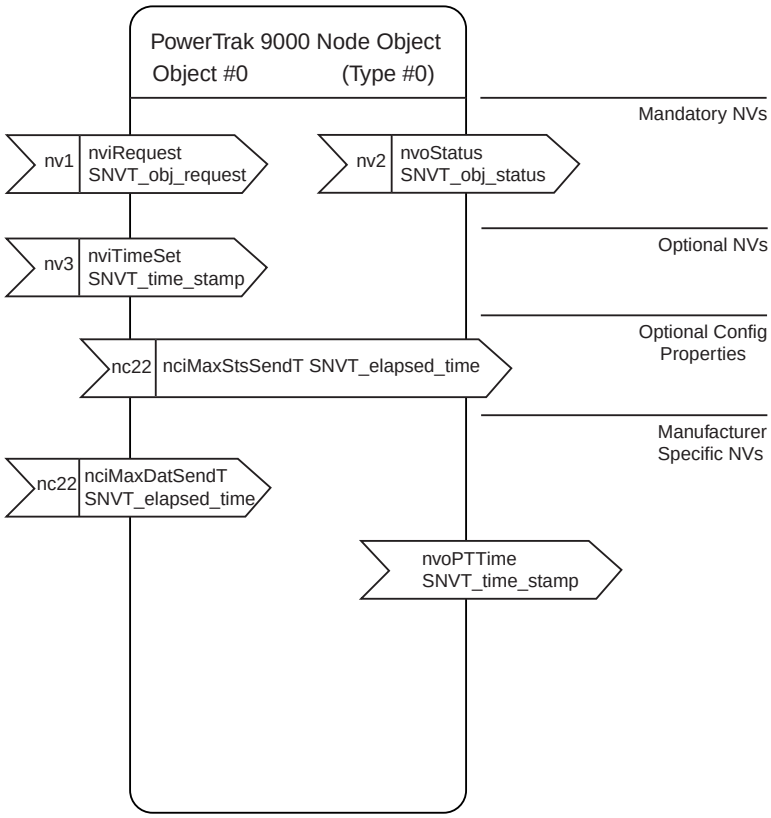
If the **PT-NTL** green Status LED is blinking off once every five seconds but you are unable to communicate over the network, verify that the **PT-NTL** has been properly installed on the network according to the installation process described in the network management software documentation. Also, verify there are no breaks in the network wiring between the **PT-NTL** and the network management software tool, and that the network is properly terminated.

PT-NTL-10 INTERFACE OVERVIEW

The **PT-NTL-10** is LonMark certified to LonMark Interoperability Guidelines version 3.1. The **PT-NTL-10** interface is composed of a Node Object plus seven additional objects as shown below. The following sections discuss each of the LonMark objects and the network variables associated with them.



OBJECT 0 - THE NODE OBJECT



Network input variable nviRequest allows the user to request information from or change the state of different objects in the node. The nviRequest contains an object ID field that specifies which object receives the request. The following request types are supported:

1. RQ_NORMAL (value 0) — If sent to Object 1, the Power Measurement Object, removes the object from the Override Mode (explained below). If sent to Object 2, the Energy Measurement Object, removes the object from the Override Mode (explained below). If sent to Object 0, the Node Object, removes both Object 1 and Object 2 from the Override Mode. Has no effect if sent to any other objects since they do not have override modes.

2. RQ_UPDATE_STATUS (value 2) — Requests the status of the object specified in the object ID field. If sent to Object 0, the status response contains the status bits of all the node objects OR'ed together.

   All objects support the status bit "unable_to_measure" which will be set if the **PT-NTL** is unable to get data from the main processor. This should only occur if the main processor is doing an auto-configure, which is typically done only during **PT-9000** installation. When data is again available from the main processor, the "unable_to_measure" bit in all object statuses will be reset.

   Objects 1 and 2 support the status bit "in_override". This bit will be set when the object receives a RQ_OVER-RIDE command. This bit will be reset when the object is removed from override with a RQ_NORMAL command.

3. RQ_REPORT_MASK (value 5) — Requests the object to report which status bits it supports. All objects support the "unable to measure" status bit. Objects 1 and 2 support the "in_override" status bit. If sent to Object 0, report has each status bit set which is supported by any object in the node (both "unable_to_measure" and "in_override" bits will be set).

4. RQ_OVERRIDE (value 6) - If sent to Object 1, the Power Measurement Object, clears the Peak Sliding Window Watts value which is kept in nonvolatile memory. If sent to Object 2, the Energy Measurement Object, clears the WattHours count which is kept in nonvolatile memory. If sent to Object 0, clears both of the above values. If sent to any other object, an "invalid_request" response is returned.

   After a value is cleared using RQ_OVERRIDE, the value begins to update again in normal fashion even though the object is still technically in override. Clearing the override state using RQ_NORMAL is strictly optional.

Network output variable nvoStatus returns the information requested by nviRequest. The status response will indicate the status of the object that received the request. The following status fields are supported by the **PT-NTL**:

1. invalid_id
2. invalid_request
3. unable_to_measure
4. in_override

One nvoStatus response will be returned for each nviRequest. The configuration variable nciMaxStsSendT can also be used to automatically send out status updates periodically (explained further below).

Network input variable nviTimeSet is used to set the internal time-of-day and date. The **PT-NTL** uses its internal time and date to time stamp certain events (clearing watt-hour counter, clearing peak demand, logging new peak demand).

If the user does not care to use time stamping in his application, the time and date can be ignored and need not be set. No functions other than time stamping use the time and date.

Whenever the **PT-NTL** powers up, its internal time and date values are zeroed until new values are set using the nviTimeSet input variable (the **PT-NTL** does not maintain time and date across power outages).

For best accuracy, the **PT-NTL's** internal time should be updated using nviTimeSet at least once per day. Due to crystal error and software uncertainties, the time could drift several minutes per day if uncorrected.

Network configuration variable nciMaxStsSendT allows the **PT-NTL** to automatically send out status updates at regular time intervals if so desired. If nciMaxStsSendT is nonzero, the status of each object within the **PT-NTL** is sent out round-robin fashion at the interval specified in nciMaxStsSendT. If nciMaxStsSendT is zero, status is only sent out in response to nviRequest commands.

Network configuration variable nciMaxDatSendT allows the **PT-NTL** to automatically propagate all measurement values at regular time intervals if so desired. If nciMaxDatSendT is nonzero, all measurement output variables (except nvoPTTime) are sent out at the specified time interval. If nciMaxDatSendT is zero, measurements are never sent out automatically, but they may be polled as desired by another node.

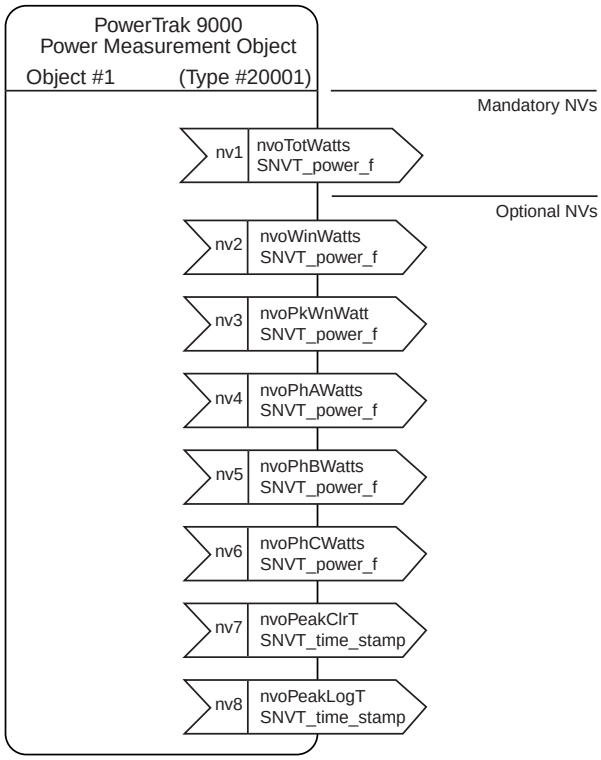
The minimum nonzero time supported by nciMaxDatSendT is 5 seconds. If nciMaxDatSendT is set to a nonzero value less than 5 seconds, the **PT-NTL** will automatically convert it to 5 seconds.

The **PT-NTL** acquires new measurement values from the **PT-9000** main processor every 5 seconds regardless of the value of nciMaxDatSendT, so polling the measurement variables will always return current values even if nciMaxDatSendT has been set to zero or a very large value.

Network output variable nvoPTTime will output the current time and date as maintained by the **PT-NTL**. Because of poor long-term accuracy and the fact that the time and date are lost during a power outage, the **PT-NTL's** time and date should not be used to set the time on other nodes. The main use of nvoPTTime is to verify that the **PT-NTL's** time and date are valid.

Unlike other measurement output variables, nvoPTTime is not propagated when nciMaxDatSendT causes automatic sending of measurements. This is because it is not needed on a regular basis by any other node.

OBJECT 1 - THE POWER MEASUREMENT OBJECT



Network output variable nvoTotWatts is the total power (in Watts) measured by the **PT-9000**. The indicated value is the instantaneous power (averaged over the last 7-8 seconds).

Network output variable nvoWinWatts is the total power (in Watts) measured in a 15-minute sliding window. The value is recalculated every 30 seconds.

Network output variable nvoPkWnWatt is the peak sliding window value (in Watts) recorded since the last time the peak was cleared (by overriding Object 1). The peak value is stored in nonvolatile memory and is retained during power outages.

Network output variable nvoPhAWatts is the instantaneous power (in Watts) for Phase A of the power system. Valid for 3-phase wye, 1-phase 3-wire and 1-phase 2-wire power systems. Not valid for 3-phase delta power systems.

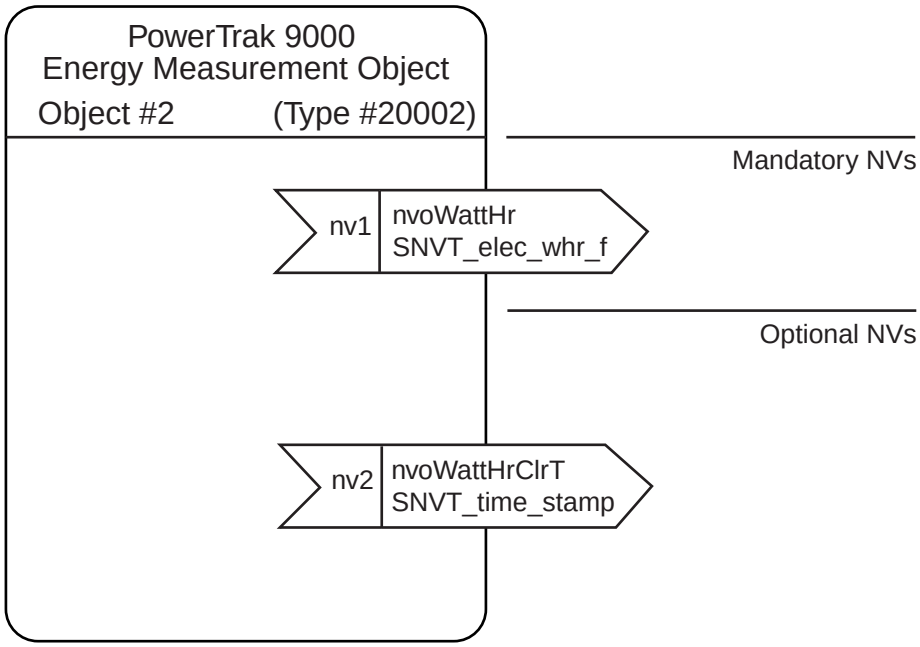
Network output variable nvoPhBWatts is the instantaneous power (in Watts) for Phase B of the power system. Valid for 3-phase wye, 1-phase 3-wire power systems. Not valid for 3-phase delta or 1-phase 2-wire power systems.

Network output variable nvoPhCWatts is the instantaneous power (in Watts) for Phase C of the power system. Valid for 3-phase wye power systems. Not valid for 3-phase delta, 1-phase 3-wire, or 1-phase 2-wire power systems.

Network output variable nvoPeakClrT is a time stamp of when the last sliding window peak value was cleared (by overriding Object 1). Only valid if time and date had been set to valid values (through nviTimeSet) prior to the clearing. This time stamp is stored in nonvolatile memory and is retained during power outages.

Network output variable nvoPeakLogT is a time stamp of when the peak sliding window value occurred. Only valid if time and date had been set to valid values (through nviTimeSet) prior to the logging. This time stamp is stored in nonvolatile memory and is retained during power outages.

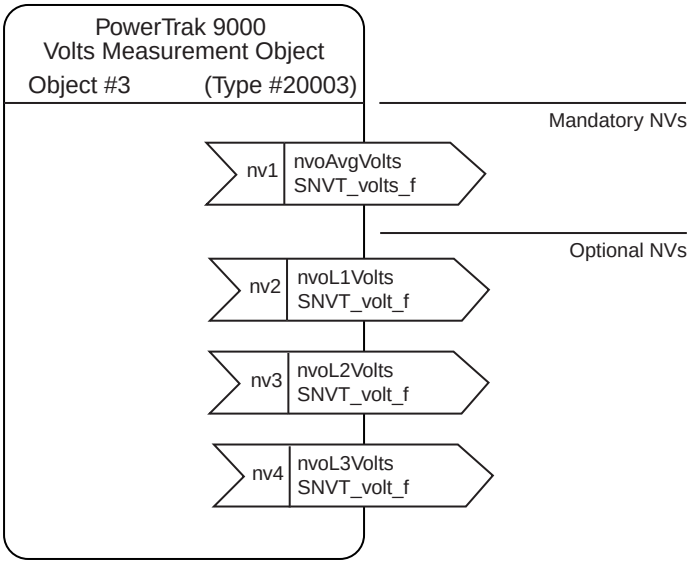
OBJECT 2 - THE ENERGY MEASUREMENT OBJECT



Network output variable nvoWattHr is the total watt-hours of energy consumed since the last time the count was cleared (by overriding Object 2). The watt-hour count is stored in nonvolatile memory and is preserved across power outages.

Network output variable nvoWattHrClrT is a time stamp of when the watt-hours counter was last cleared. Only valid if time and date had been set to valid values (through nviTimeSet) prior to the clearing. This time stamp is stored in nonvolatile memory and is preserved across power outages.

OBJECT 3 - THE VOLTS MEASUREMENT OBJECT



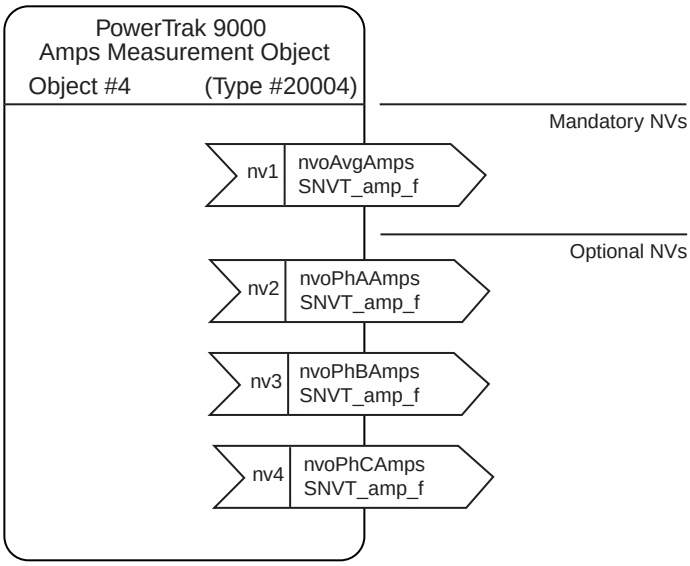
Network output variable nvoAvgVolts is the average value of all active line voltages on the power system. For a 3-phase delta, this is the average of the three line to line voltages. For a 3-phase wye, this is the average of the three line to neutral voltages. For a 1-phase 2-wire system, this is the average of L1 to N and L2 to N. For a 1-phase 2-wire system, this is just L1 to N.

Network output variable nvoL1Volts is the value of either L1 to L2 volts (3-phase delta system) or L1 to N volts (3-phase wye, 1-phase 3-wire, 1-phase 2-wire systems).

Network output variable nvoL2Volts is the value of either L2 to L3 volts (3-phase delta system) or L2 to N volts (3-phase wye or 1-phase 3-wire systems). Not valid for a 1-phase 2-wire system.

Network output variable nvoL3Volts is the value of either L3 to L1 volts (3-phase delta system) or L3 to N volts (3-phase wye system). Not valid for 1-phase 3-wire or 1-phase 2-wire systems.

OBJECT 4 - THE AMPS MEASUREMENT OBJECT



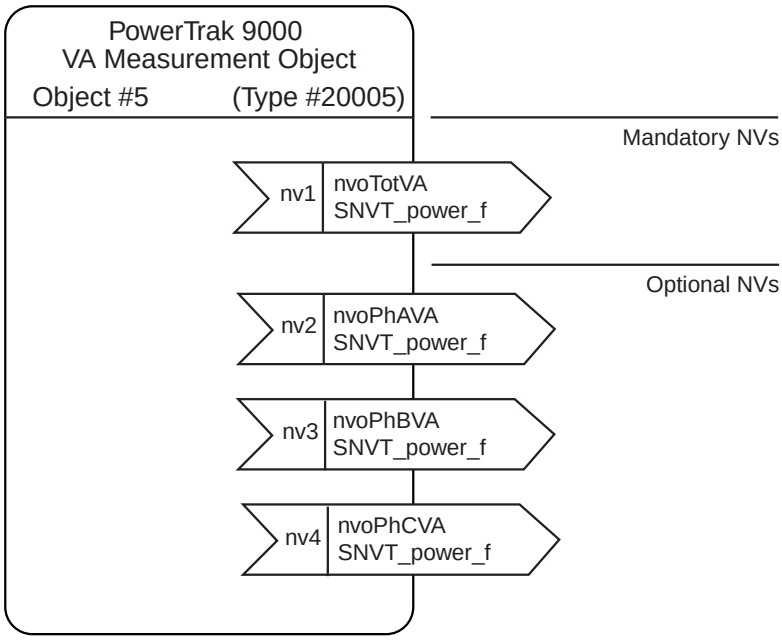
Network output variable nvoAvgAmps is the average value of the power system current in amps. To get total amps for a 3-phase system, multiply average amps times 3. To get total amps for a 1-phase 3-wire system, multiply average amps times 2.

Network output variable nvoPhAAmps is the Phase A amps for the power system. Valid for all power system configurations.

Network output variable nvoPhBAmps is the Phase B amps for the power system. Valid for 3-phase and 1-phase 3-wire systems. Not valid for 1-phase, 2-wire systems.

Network output variable nvoPhCAmps is the Phase C amps for the power system. Valid for 3-phase power systems. Not valid for 1-phase 3-wire or 1-phase 2-wire systems.

OBJECT 5 - THE VA (APPARENT POWER) MEASUREMENT OBJECT



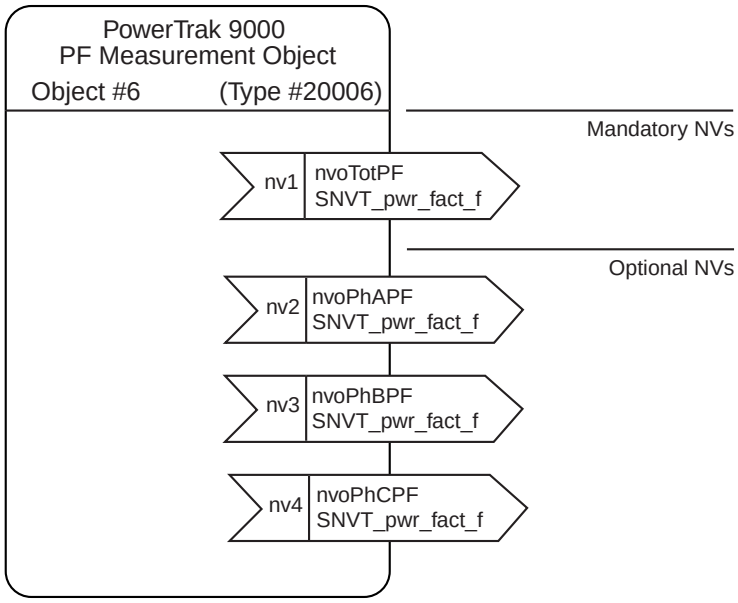
Network output variable nvoTotVA is the total volt-amps (apparent power) for the power system.

Network output variable nvoPhAVA is the volt-amps for Phase A of the power system. Valid for 3-phase wye, 1-phase 3-wire and 1-phase 2-wire power systems. Not valid for 3-phase delta systems.

Network output variable nvoPhBVA is the volt-amps for Phase B of the power system. Valid for 3-phase wye and 1-phase 3-wire systems. Not valid for 3-phase delta and 1-phase 2-wire systems.

Network output variable nvoPhCVA is the volt-amps for Phase C of the power system. Valid for 3-phase wye systems. Not valid for 3-phase delta, 1-phase 3-wire or 1-phase 2-wire systems.

OBJECT 6 - THE POWER FACTOR MEASUREMENT OBJECT



Network output variable nvoTotPF is the total power factor for the power system. It is calculated as total watts divided by total volt-amps.

Network output variable nvoPhAPF is the power factor for Phase A of the power system. It is calculated as Phase A watts divided by Phase A volt-amps. Valid for 3-phase wye, 1-phase 3-wire and 1-phase 2-wire systems. Not valid for 3-phase delta systems.

Network output variable nvoPhBPF is the power factor for Phase B of the power system. It is calculated as Phase B watts divided by Phase B volt-amps. Valid for 3-phase wye, 1-phase 3-wire systems. Not valid for
3-phase delta or 1-phase 2-wire systems.

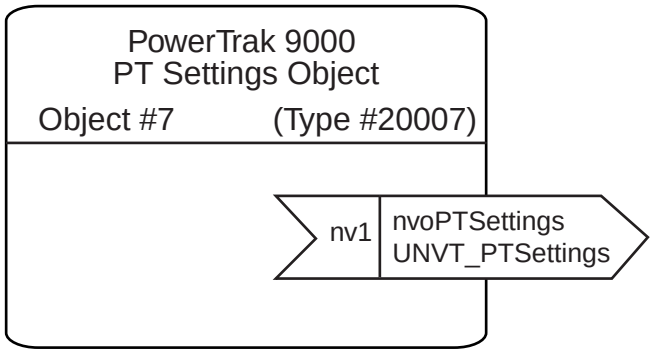
Network output variable nvoPhCPF is the power factor for Phase C of the power system. It is calculated as Phase C watts divided by Phase C volt-amps. Valid for 3-phase wye systems. Not valid for 3-phase delta, 1-phase 3-wire or 1-phase 2-wire systems.

OBJECT 7 - PT SETTINGS OBJECT

Network output variable nvoPTSettings is a special User-defined Network Variable Type (UNVT_PTSettings). It contains structures which indicate the PT9000's dipswitch, rotary switch, CT polarity, and V-I match settings. Its use is strictly optional. Since it is not an industry standard SNVT, custom programming may have to be done at the receiving node to properly decode the information. See Appendix A for a description of the UNVT_PT Settings data structure.

The User Defined Resource Files on the 3.5" diskette also contain formatting information about the special UNVT_PTSettings variable type. These files may be used by some network manager software packages to automatically decode and display nvoPTSettings without the need for any custom programming.

nvoPTSettings does not propagate automatically when nciMaxDatSendT is nonzero. This is because switch settings rarely change once the unit has been properly configured. nvoPTSettings may be polled at any time as needed.



APPENDIX A

Decoding PT-9000 switch settings and power configuration through the structures in the network output variable nvoPTSettings.

The data structures in nvoPTSettings contain information about the **PT-9000** dipswitch settings, rotary voltage switch settings, CT polarities, V-I matching, and whether the **PT-9000** was manually or automatically power system configured. Because this information does not fit into any industry-standard SNVT, a User-defined Network Variable Type (UNVT) called UNVT_PTSettings was created. nvoPTSettings was then assigned the data type UNVT_PT Settings. The layout of UNVT_PTSettings is given below:

```
typedef struct
{
struct                                  // dipswitch A (top dipswitch) settings
{
unsigned systype          :2;           // power system type select (2 top switches)
unsigned lowvolts         :6;           // low voltage threshold for alarm contacts (6 bottom switches)
}dipswa;

struct                                  // dipswitch B (middle dipswitch) settings
{
unsigned kwhpp            :2;           // KWH per pulse on pulse output (top 2 switches)
unsigned ma2outsel        :3;           // mA output #2 function select (middle 3 switches)
unsigned ma1outsel        :3;           // mA output #1 function select (bottom 3 switches)
}dipswb;

struct                                  // dipswitch C (bottom dipsw) and rotary switch settings
{
unsigned rotswcode        :3;           // 3-bit code shows rotary switch position
unsigned ctratcode        :5;           // CT ratio select (all 5 switches on dipswitch C)
}dipswc;

struct                                  // shows polarity for each current transformer
{
unsigned ct_c_pol         :1;           // C current transformer polarity (0 = normal, 1 = reverse)
unsigned ct_b_pol         :1;           // B current transformer polarity (0 = normal, 1 = reverse)
unsigned ct_a_pol         :1;           // A current transformer polarity (0 = normal, 1 = reverse)
unsigned auto_man         :1;           // (0 = manual config, 1 = auto config)
unsigned notused          :4;
}ctpolarity;

struct                                  // shows which input voltages are paired with which currents
{
unsigned notused          :2;
unsigned camps_match      :2;           // 2-bit code shows which voltage paired with C amps
unsigned bamps_match      :2;           // 2-bit code shows which voltage paired with B amps
unsigned aamps_match      :2;           // 2-bit code shows which voltage paired with A amps
}vimatch;
}UNVT_PTSettings;

network output UNVT_PTSettings nvoPTSettings;   // simplified variable declaration

network output polled sd_string ("@7#1;PTSettings") UNVT_PTSettings bind_info
(unackd) nvoPTSettings;                  // full variable declaration from
                                         //actual PT-NTL-10 neuron C code
```

APPENDIX A (CONTINUED)

For all dipswitch settings, a bit field = 1 indicates the switch is ON. The meanings of the different switches are explained in the PT-9000 data sheet and on the labels on the inside of the PT-9000 door.

For the rotary switch settings, 3-bit code indicates switch position:

001 (decimal 1) = 120-144V
010 (decimal 2) = 190-277V
011 (decimal 3) = 346-415V
100 (decimal 4) = 440-480V
101 (decimal 5) = 600V

For V-I matching, 2-bit code indicates which voltage is paired with this particular current input:

00 (decimal 0) = L3 paired with this current
01 (decimal 1) = L2 paired with this current
11 (decimal 3) = L1 paired with this current