



Energy Division

# The LonWorks® Interface For Integra Digital Metering Systems



# **The LONWORKS® Interface**

**Details the LONMARK® Objects which make up  
the network interface for Integra 1530, 1560, 1580  
and 2000 digital metering systems.**

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# 1 THE LONWORKS® INTERFACE

The LONMARK® technology, developed by Echelon®, enables the development of truly interoperable devices and systems. However, since the technology is communication-media-independent and does not prescribe how device application programs are to be structured, simply using the LONWORKS® technology does not guarantee that LONWORKS® devices from different manufacturers can interoperate in the same system. Indeed, the LONWORKS® technology is widely used in proprietary systems such as vehicle control systems, conveyor systems, and telephone central office monitoring systems.

Because there are vast opportunities in many industries for truly interoperable systems, the LONMARK® Interoperability Association was formed in 1994 by Echelon and a group of LONWORKS® users dedicated to building truly interoperable systems products. Interoperability means that multiple devices (also called nodes), from the same or different manufacturers, can be integrated into a single control network without requiring custom node or network tool development. The LONMARK® Association is dedicated to developing standards for interoperability, certifying products to those standards, and promoting the benefits of interoperable systems. Only LONWORKS® devices that have been certified by the LONMARK® Association – called LONMARK® devices - can carry the distinctive LONMARK® logo. Membership in the LONMARK® Association is open to all interested companies; different dues structures exist for manufacturers, system integrators and end users. Complete information about members, current activities, and published standards may be obtained from the Association's website, [www.lonmark.org](http://www.lonmark.org).

The LONWORKS® Interface for the Integra 1000 & 2000 energy meters will be designed to conform to the LONMARK® Interoperability Guidelines version 3.2.

## 2 IMPLEMENTATION

This section details the LONMARK® Objects which make up the network interface for Crompton Instruments Integra 1530, 1560, 1580 and 2000 Energy Meter.

The Implementation covers six key objects: Voltmeter, Ammeter, Power meter, Energy Meter, Demand Ammeter and Demand Power. There is a seventh object known as the Node object which is used by network management tools and/or customised device plug-ins (Windows application) to manage the six primary objects.

## 2.1 OVERVIEW

A device using these object profiles will typically be used in 3 phase industrial power and energy metering applications.

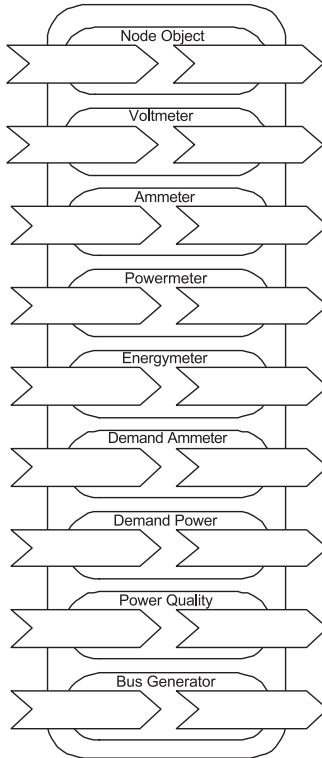


Fig 1. Device Functional Profile

## 2.2 NODE OBJECTS

### Network Variables

#### Object Request

network input SNVT\_obj\_request nvi00 Request

Refer to the LONMARK Application Layer Interoperability Guidelines for definition.

#### Object Status

network output SNVT\_obj\_status nvo00Status

Refer to the LONMARK Application Layer Interoperability Guidelines for definition.

### Configuration Properties

#### Device Label

network input config SNVT\_str\_ascii nciDeviceLabel

This input configuration variable provides a label for the device. The default Value is determined by manufacturer.

Valid Range: Refer to the SNVT Master List.

Default Service Type: Acknowledged

## 2.3 VOLTMETER FUNCTIONAL PROFILE

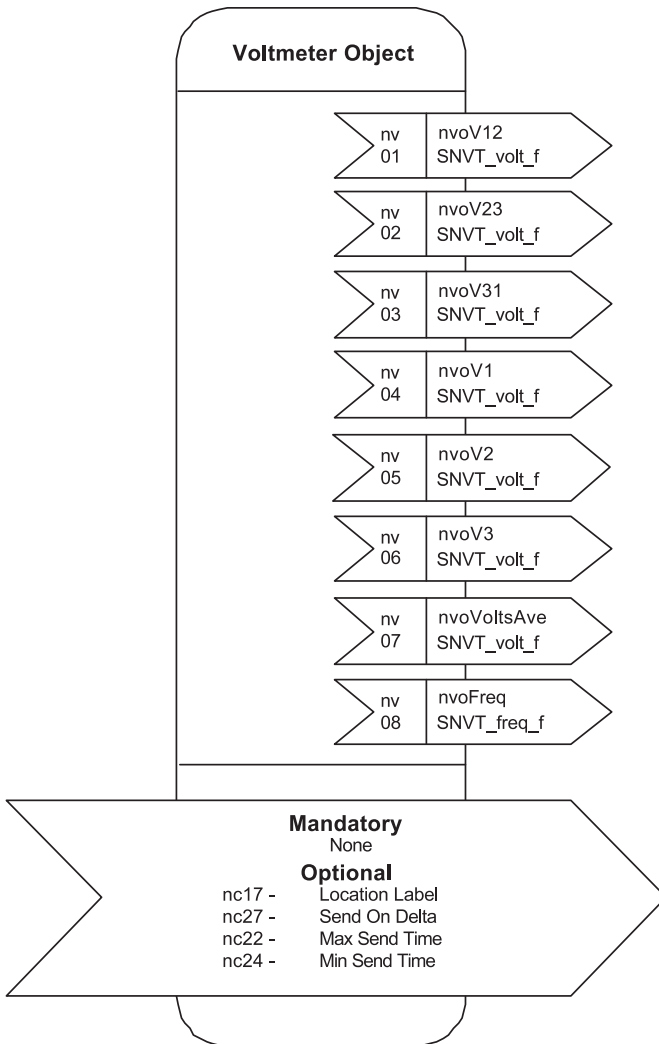


Fig 2. Voltmeter Functional Profile

## Voltmeter Network Variables

### Voltage Between Phases

```
network output SNVT_volt_f nvoV12
```

This output network variable reports the voltage measured from phase L1 to phase L2 in a 3 phase power system.

```
network output SNVT_volt_f nvoV23
```

This output network variable reports the voltage measured from phase L2 to phase L3 in a 3 phase power system.

```
network output SNVT_volt_f nvoV31
```

This output network variable reports the voltage measured from phase L3 to phase L1 in a 3 phase power system.

```
network output SNVT_volt_f nvoV1
```

If applicable based on PT Connection Type, this output network variable reports the voltage measured from phase L1 to the Neutral conductor in a 3 phase power system.

```
network output SNVT_volt_f nvoV2
```

If applicable based on PT Connection Type, this output network variable reports the voltage measured from phase L2 to the Neutral conductor in a 3 phase power system.

```
network output SNVT_volt_f nvoV3
```

If applicable based on PT Connection Type, this output network variable reports the voltage measured from phase L3 to the Neutral conductor in a 3 phase power system.

Valid Range: -1E38...1E38 (Volts)

Default Service Type: Acknowledged

### Voltage Average

```
network output SNVT_volt_f nvoVoltsAve;
```

This output network variable is used to report the average voltage across all of the Phases.

Valid Range: -1E38...1E38 (Volts)

Default Service Type: Acknowledged

### Voltage Frequency

```
network output SNVT_freq_f nvoFreq;
```

This output network variable, if provided, is used to report the nominal fundamental frequency of the voltage in the Power System.

Valid Range: -1E38...1E38 Hertz

Default Service Type: Acknowledged



## Voltmeter Configuration Properties

### PT Connection Type

```
network input config SNVT_lev_disc nciPTConnType
```

This input network configuration variable is used to describe the connection arrangement of the Potential Transformers used to connect 3 phase voltage to the meter.

Default Value: 3

Valid Range: The valid range is specified by the list of valid values given for the different PT system type arrangements given below:

Single Phase : 1

3 Phase 3-Wire System : 2

3 Phase 4-Wire System : 3

Default Service Type: Acknowledged

### Send on Delta

```
network input config SCPT_snd_delta nciVSendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the Voltmeter points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SCPT_snd_delta nciVSendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the Voltmeter points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Max Send Time

```
network input config SNVT_time_sec nciVMaxSendTime;
```

This input configuration network variable defines the maximum period of time that expires before any Voltmeter point will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.4 AMMETER FUNCTIONAL PROFILE

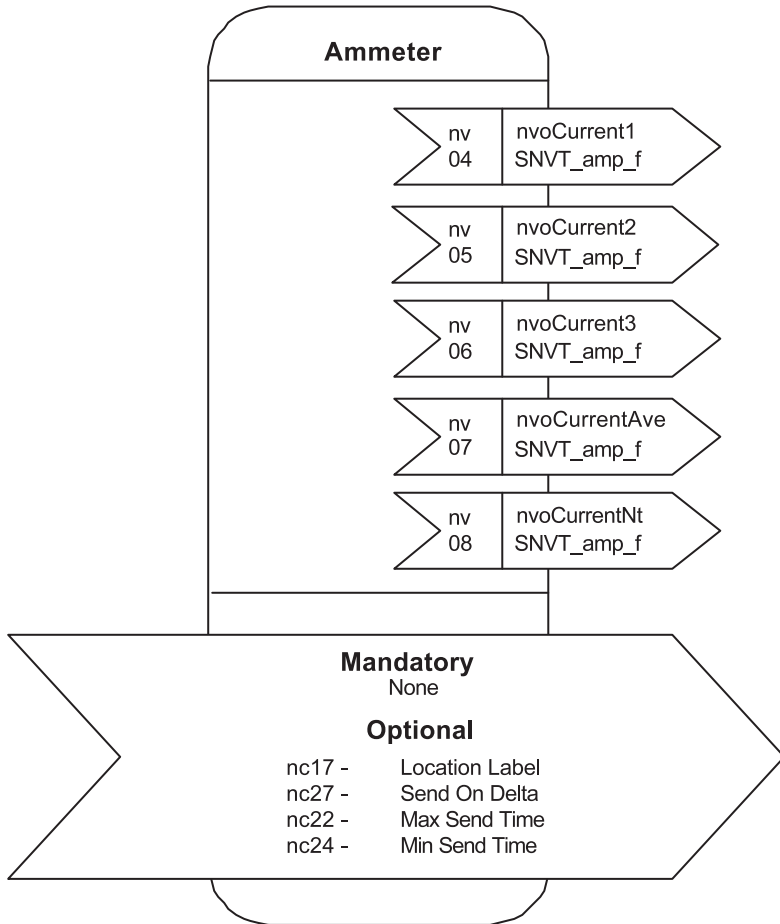


Fig 3. Ammeter Functional Profile

## Ammeter Network Variables

### Current

network output SNVT\_amp\_f nvoCurrent1

This output network variable reports the current measured flowing on phase L1 in a 3 phase power system.

network output SNVT\_amp\_f nvoCurrent2

This output network variable reports the current measured flowing on phase L2 in a 3 phase power system.

network output SNVT\_amp\_f nvoCurrent3

This output network variable reports the current measured flowing on phase L3 in a 3 phase power system.

Valid Range: -1E38....1E38 (Amperes)

Default Service Type: Acknowledged

### Average Current

network output SNVT\_amp\_f nvoCurrentAve;

This output network variable, if provided, is used to report the average of the three phase currents (IL1, IL2, & IL3) in the Power System.

### Neutral Current

network output SNVT\_amp\_f nvoCurrentNt;

This output network variable reports the current measured flowing with respect to Neutral.

Valid Range: -1E38....1E38 (Amperes)

Default Service Type: Acknowledged

## Ammeter Configuration Properties

### Send on Delta

```
network input config SCPT_snd_delta nciASendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the Ammeter points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SNVT_time_sec nciAMinSendTime;
```

This input configuration network variable indicates the minimum period between transmissions of the Ammeter points. When a significant change to any Ammeter point occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

```
network input config SNVT_time_sec nciAMaxSendTime;
```

This input configuration network variable defines the maximum period of time that expires before an Ammeter point will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.5 ENERGY METER FUNCTIONAL PROFILE

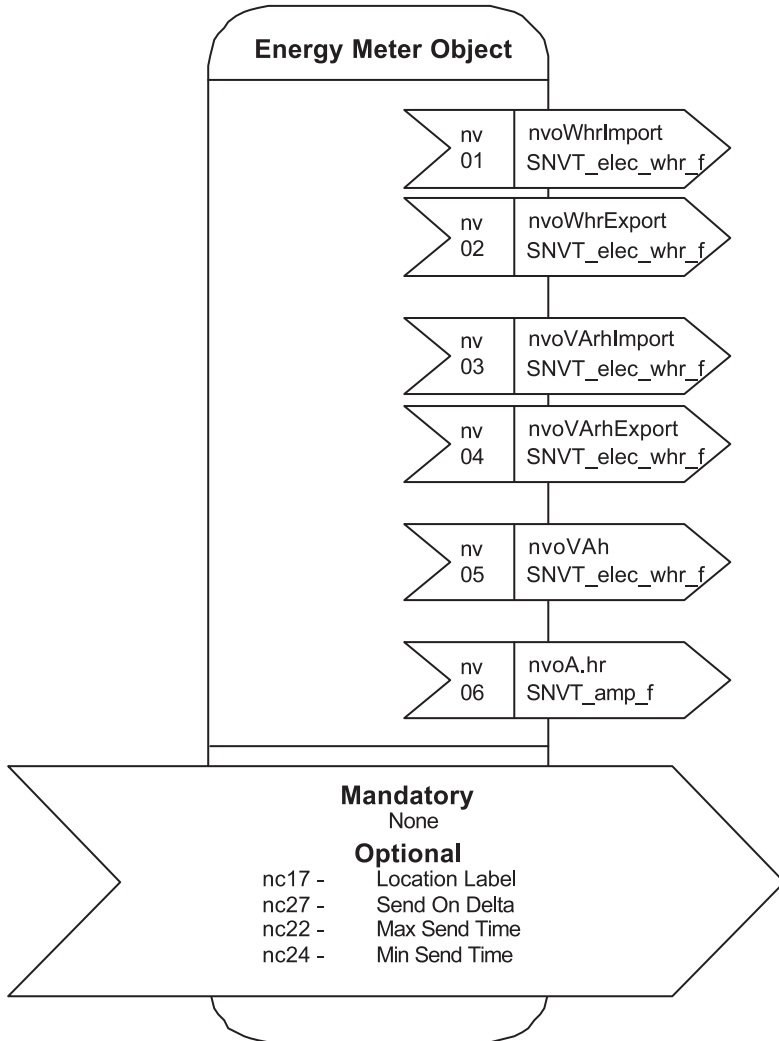


Fig 4. Energy Meter Functional Profile

## Energy Meter Network Variables

### Energy Import

network output SNVT\_elec\_whr\_f nvoWhrImport

This output network variable reports the 3 phase Energy Import measured in a 3 phase power system.

### Energy Export

network output SNVT\_elec\_whr\_f nvoWhrExport

This output network variable reports the 3 phase Energy Export measured in a 3 phase power system.

### Reactive Energy Import

network output SNVT\_elec\_whr\_f nvoVarhImport

This output network variable reports the 3 phase Reactive Energy Import measured in a 3 phase power system.

### Reactive Energy Export

network output SNVT\_elec\_whr\_f nvoVarhExport

This output network variable reports the 3 phase Reactive Energy Export measured in a 3 phase power system.

### Real Energy

network output SNVT\_elec\_whr\_f nvoVAh

This output network variable reports the total 3 phase Real Energy measured in a 3 phase power system.

Valid Range: 0 .. 1E38 (Watt-hour)

Default Service Type: Acknowledged

### Amphours

network output SNVT\_amp\_f nvoAhr

This output network variable reports the current consumption in Amps.

Valid Range: -1E38 .. 1E38 Amps

Default Service Type: Acknowledged

## Energy Meter Configuration Properties

### Send On Delta

```
network input config SCPT_snd_delta nciESendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the Energy meter points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SNVT_time_sec nciEMinSendTime;
```

This input configuration network variable indicates the minimum period between transmissions of any Energy meter point. When a significant change to any Energy meter point occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

```
network input config SNVT_time_sec nciEMaxSendTime;
```

This input configuration network variable defines the maximum period of time that expires before any Energy meter point will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.6 POWER METER FUNCTIONAL PROFILE

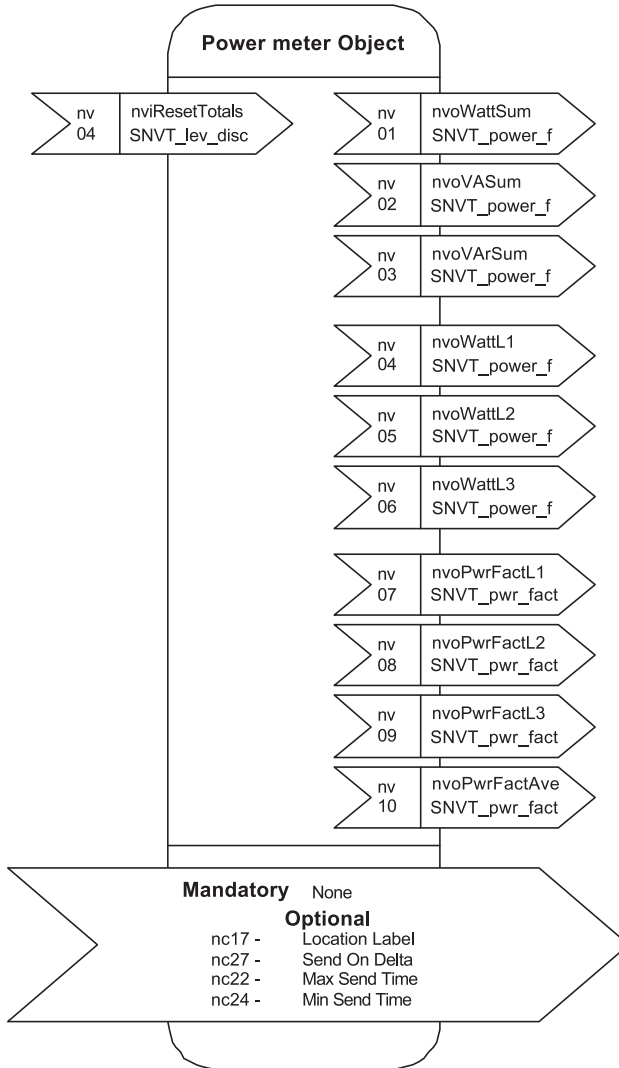


Fig 5. Power Meter Functional Profile



## Power Meter Network Variables

### Watts Sum

network output SNVT\_power\_f nvoWattSum

This output network variable reports the total 3 phase instantaneous real power measured in a 3 phase power system.

### VA Sum

network output SNVT\_power\_f nvoVASum

This output network variable reports the total 3 phase instantaneous power measured in a 3 phase power system.

### VAr Sum

network output SNVT\_power\_f nvoVArSum

This output network variable reports the total 3 phase Instantaneous reactive power measured in a 3 phase power system.

Valid Range: -1E38 .. 1E38 watts

Default Service Type: Acknowledged

### Watts L1, L2, L3

network output SNVT\_power\_f nvoWattL1

This output network variable reports the instantaneous real power measured on Phase 1 of a 3 phase power system.

network output SNVT\_power\_f nvoWattL2

This output network variable reports the instantaneous real power measured on Phase 2 of a 3 phase power system.

network output SNVT\_power\_f nvoWattL3

This output network variable reports the instantaneous real power measured on Phase 3 of a 3 phase power system.

### **Power Factor L1,L2,L3**

network output SNVT\_pwr\_fact nvoPwrFactL1

This output network variable reports the Power Factor measured on Phase 1 of a 3-phase power system.

network output SNVT\_pwr\_fact nvoPwrFactL2

This output network variable reports the Power Factor measured on Phase 2 of a 3-phase power system.

network output SNVT\_pwr\_fact nvoPwrFactL3

This output network variable reports the Power Factor measured on Phase 3 of a 3-phase power system.

### **Average Power Factor**

network output SNVT\_pwr\_fact nvoPwrFactr

This output network variable reports the total 3 phase true power factor measured in a 3 phase power system.

Valid Range: -1.0 .. 1.0 (0.00005)

Default Service Type: Acknowledged

### **Reset Totals**

network input SNVT\_lev\_disc nviResetTotals

This input network variable resets all accumulated power readings when the value of zero (0) is written to it.

Valid Range: 0

Default Service Type: Acknowledged

## **Power Meter Configuration Properties**

### **Send on Delta**

network input config SCPT\_snd\_delta ncipSendOnDelta

This input network configuration variable specifies the maximum amount that any of the Power meter points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SNVT_time_sec nciPMinSendTime;
```

This input configuration network variable indicates the minimum period between transmissions of nvoSlaveStatus. When a significant change to any Power meter points occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

```
network input config SNVT_time_sec nciPMaxSendTime;
```

This input configuration network variable defines the maximum period of time that expires before any Power meter points will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.7 DEMAND AMMETER FUNCTIONAL PROFILE

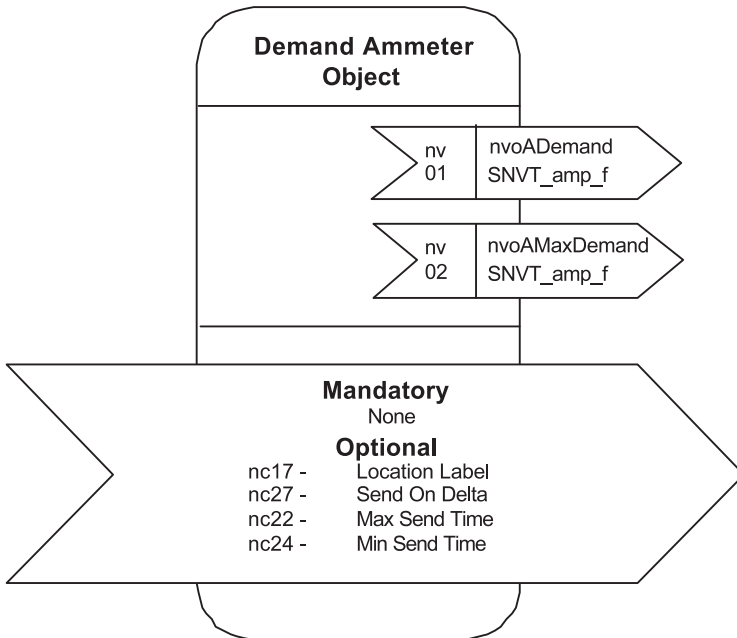


Fig 6. Demand Ammeter Functional Profile

## Demand Ammeter Network Variables

### Demand Current

```
network output SNVT_amp_f nvoADemand
```

This output network variable reports the demand current

Valid Range: -1E38 .. 1E38 Amps

Default Service Type: Acknowledged

### Maximum Demand Current

```
network output SNVT_amp_f nvoAMaxDemand
```

This output network variable reports the maximum demand current

Valid Range: -1E38 .. 1E38 Amps

Default Service Type: Acknowledged

## Demand Ammeter Configuration Properties

### Send on Delta

```
network input config SCPT_snd_delta nciDASendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the demand ammeter points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SNVT_time_sec nciDAMinSendTime;
```

This input configuration network variable indicates the minimum period between transmissions of nvoSlaveStatus. When a significant change to any demand ammeter points occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

```
network input config SNVT_time_sec nciDAMaxSendTime;
```

This input configuration network variable defines the maximum period of time expires before any demand ammeter points will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.8 DEMAND POWER METER FUNCTIONAL PROFILE

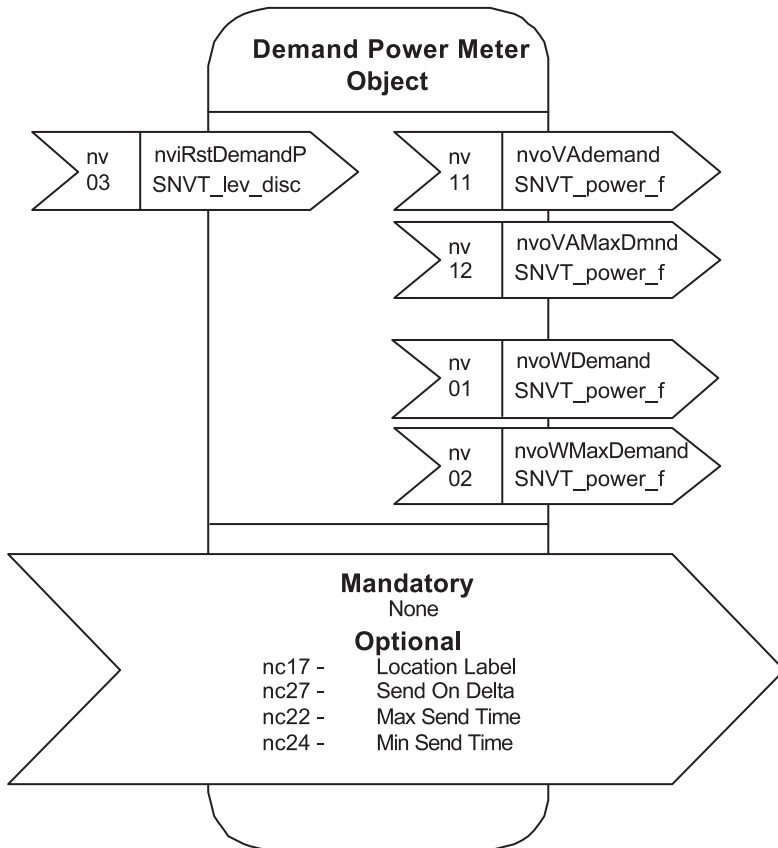


Fig 7. Power Meter Functional Profile

## Demand Power Meter Network Variables

### Power Demand

network output SNVT\_power\_f nvoVAdemand  
VA demand.

### Power Max Demand

network output SNVT\_power\_f nvoVAMaxDmnd  
VA Maximum demand.  
Valid Range: -1E38 .. 1E38 watts  
Default Service Type: Acknowledged

### Watts Demand

network output SNVT\_power\_f nvoWDemand  
This output network variable reports the three phase total real power demand.

### Watts Max Demand

network output SNVT\_power\_f nvoWMaxDemand  
This output network variable reports the peak three phase total real power demand which has occurred since peak demand was last reset.  
Valid Range: -1E38....1E38 (Watts)  
Default Service Type: Acknowledged

### Reset Demand Period

network input SNVT\_lev\_disc nviRstDemandP  
Writing the proper value to this input network variable causes the demand period to be reset.  
Valid Range: 0  
Default Service Type: Acknowledged

## Demand Power Meter Configuration Properties

### Demand Period

```
network input config SNVT_count nciDmdPeriod
```

This input network configuration variable specifies the time interval used when calculating the power demand.

Valid Range: 8, 15, 20 or 30

Default Service Type: Acknowledged

### Send on Delta

```
network input config SCPT_snd_delta nciDPSendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the demand power points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SNVT_time_sec nciDPMinSendTime;
```

This input configuration network variable indicates the minimum period between transmissions of nvoSlaveStatus. When a significant change to any demand power points occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

```
network input config SNVT_time_sec nciDPMaxSendTime;
```

This input configuration network variable defines the maximum period of time that expires before any demand power points will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.9 POWER QUALITY METER

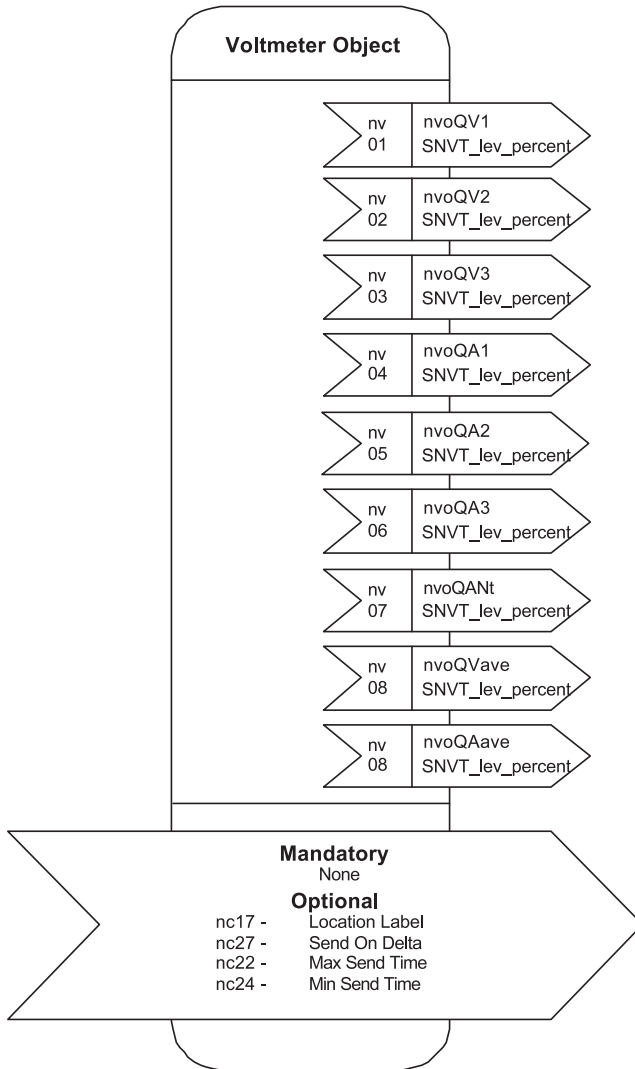


Fig 8. Power Enables Meter Functional Profile



## Power Quality Network Variables

### Quality of Phase Voltages

network output SNVT\_lev\_percent nvoQV1

This output network variable reports the Total Harmonic Distortion (THD) of the voltage on Phase 1 in a 3 phase power system.

network output SNVT\_lev\_percent nvoQV2

This output network variable reports the Total Harmonic Distortion (THD) of the voltage on Phase 2 in a 3 phase power system.

network output SNVT\_lev\_percent nvoQV3

This output network variable reports the voltage measured from phase L3 to phase L1 in a 3 phase power system.

Valid Range: 0% .. 100% (0.5%) the SNVT has a range of -163.84% .. 163.83% (0.005%)

Default Service Type: Acknowledged

### Quality of Phase Voltages

network output SNVT\_lev\_percent nvoQA1

This output network variable reports the Total Harmonic Distortion (THD) of the current on Phase 1 in a 3 phase power system.

network output SNVT\_lev\_percent nvoQA2

This output network variable reports the Total Harmonic Distortion (THD) of the current on Phase 2 in a 3 phase power system.

network output SNVT\_lev\_percent nvoQA3

This output network variable reports the Total Harmonic Distortion (THD) of the current on Phase 3 in a 3 phase power system.

Valid Range: 0% .. 100% (0.5%) the SNVT has a range of -163.84% .. 163.83% (0.005%)

Default Service Type: Acknowledged

### Quality of Current to Neutral

network output SNVT\_lev\_percent nvoQANT

This output network variable reports the Total Harmonic Distortion (THD) of the current with respect to Neutral.

### Quality of Average Voltage

network output SNVT\_lev\_percent nvoQVave

This output network variable reports the Total Harmonic Distortion (THD) of the average voltage.

### Quality of Average Current

network output SNVT\_lev\_percent nvoQAave

This output network variable reports the Total Harmonic Distortion (THD) of the average current.

Valid Range: 0% .. 100% (0.5%) the SNVT has a range of -163.84% .. 163.83% (0.005%)

Default Service Type: Acknowledged

## Power Quality Meter Configuration Properties

### Send on Delta

network input config SCPT\_snd\_delta nciPQSendOnDelta

This input network configuration variable specifies the maximum amount that any of the Power Quality points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

network input config SNVT\_time\_sec nciPQMinSendTime;

This input configuration network variable indicates the minimum period between transmissions of any Power Quality points. When a significant change to any Power Quality points occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

network input config SNVT\_time\_sec nciPQMaxSendTime;

This input configuration network variable defines the maximum period of time that expires before any Power Quality points will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## 2.10 BUS GENERATOR OBJECT

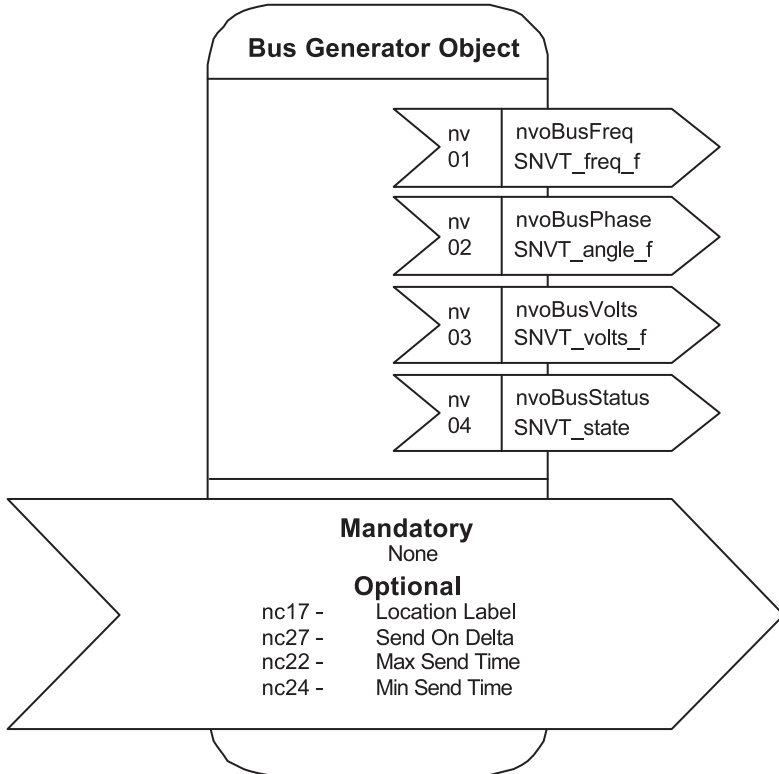


Fig 9. Bus Generator Functional Profile

## Bus Generator Network Variables

### Bus Frequency

network output SNVT\_freq\_f nvoBusFreq

This output network variable reports the frequency of the Bus Generator.

Valid Range: -1E38 .. 1E38 Hertz

Default Service Type: Acknowledged

### Bus Phase Angle

network output SNVT\_angle\_f nvoBusPhase

This output network variable reports the phase angle of the Bus Generator in degrees radians.

Valid Range: -1E38 .. 1E38 radians

Default Service Type: Acknowledged

### Bus Volts

network output SNVT\_volt\_f nvoBusVolts

This output network variable reports the Voltage of the Bus Generator.

Valid Range: -1E38 .. 1E38 Volts

Default Service Type: Acknowledged

Default Service Type: Acknowledged

### Bus Trip Status

network output SNVT\_state nvoBusStatus

This output network variable reports the status of the Bus Generator.

Measurement:	State
Type Category:	Structure
Type Size:	2 bytes
Structure:	<pre>typedef struct {     unsigned bit0 : 1;     unsigned bit1 : 1;     .....     unsigned bit15 : 1; } SNVT_state;</pre>

Field Definitions: Each bit indicates the state of the boolean, with the following interpretations:

0	1
off	on
inactive	active
disabled	enabled
low	high
false	true
normal	alarm

Default Service Type: Acknowledged

## Bus Generator Configuration Properties

### Send on Delta

```
network input config SCPT_snd_delta nciBGSendOnDelta
```

This input network configuration variable specifies the maximum amount that any of the Power Quality points can change without an update occurring on the network. Set to 0 to disable the feature.

Default Value: 0

Valid Range: Refer to SCPT Master List.

Default Service Type: Acknowledged

### Min Send Time

```
network input config SNVT_time_sec nciBGMinSendTime;
```

This input configuration network variable indicates the minimum period between transmissions of any Power Quality points. When a significant change to any Power Quality points occurs this update rate is applied until confirmation has been received via an Ack from the master mimic device.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 1 second.

### Max Send Time

```
network input config SNVT_time_sec nciBGMaxSendTime;
```

This input configuration network variable defines the maximum period of time that expires before any Power Quality points will automatically be updated.

Valid Range: The valid range is any value between 0.0 seconds and 6553.4 seconds.

Default Value: 30 seconds.

## Energy Division

With 4000 employees and more than 6000 customers worldwide, the Energy Division represents a very significant part of Tyco Electronics. Based in headquarters in Ottobrunn, near Munich, Germany, the Energy Division is a global supplier to power utilities and power industry customers, to equipment manufacturers and transport systems. These customers are served by dedicated R&D teams, sales, representatives in more than 80 countries, a professional marketing organization and 25 manufacturing sites in five continents.

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