
Version 1.1
Fan Coil Unit (FCU): 8020



LONMARK[®]

Functional Profile:

Fan Coil Unit (FCU)

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Overview

This document describes the profile for the Fan Coil Unit Controller object. This object is used to control the room temperature by controlling one heat and one cool actuator output, or a single actuator for heat and cool and a fan with multiple fan speed stages.

A room temperature sensor input is mandatory and may be provided locally on the node (locally wired) or across the network via network variables .

The FCU profile is shown below.

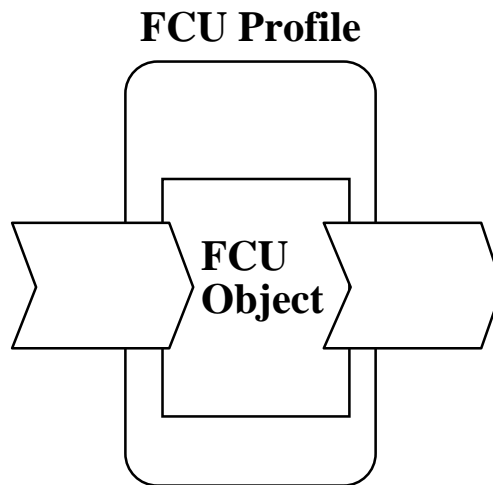


Figure 1.1 Functional Profile

Example Usage

The Fan Coil Unit Controller object interacts with one or more of the following LONMARK nodes:

- room temperature sensor node
- remote wall module (including temperature sensor, setpoint, fan speed switch)
- supervisory node (occupancy mode, heat/cool changeover, supply energy demand)
- monitoring node
- heat actuator node (0..100%)
- cool actuator node (0..100%)
- multi-speed fan node (n-speed)

Object Details

The fan coil unit controller object controls one heat output, one cool output, and one fan output.

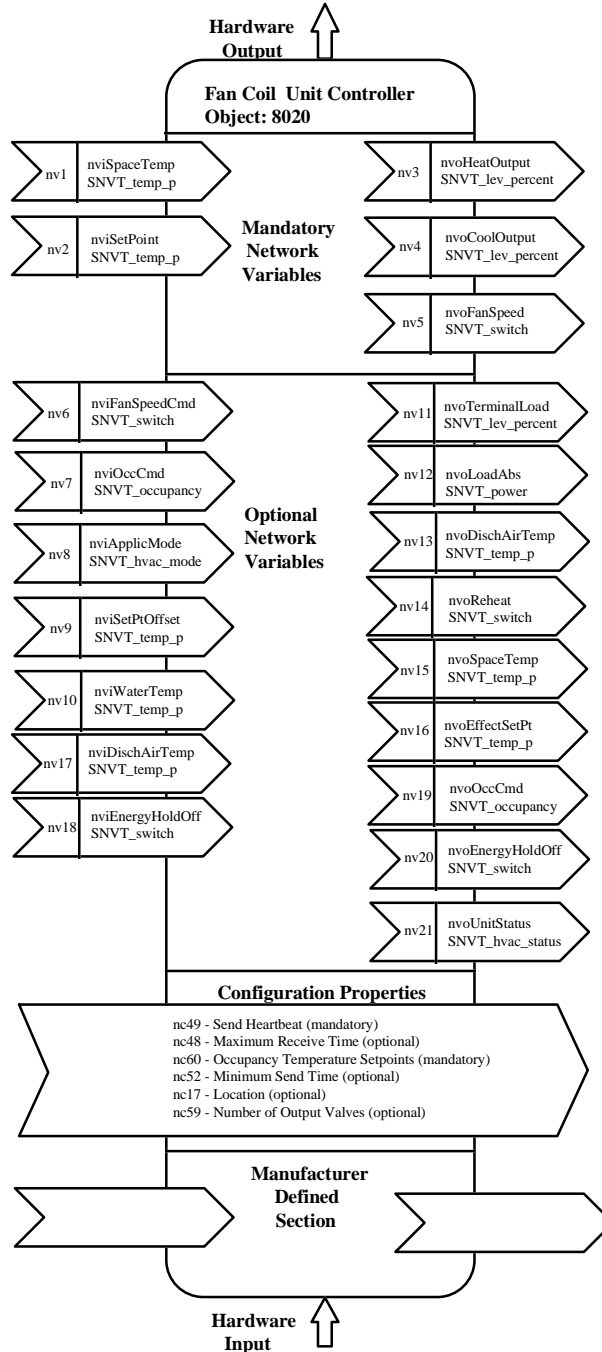


Figure 1.2 Object Details - Fan Coil Unit

Mandatory Network Variables

Space Temperature Input

```
network input SNVT_temp_p nviSpaceTemp;
```

This input network variable is used to connect an external space temperature sensor to the node. It is mandatory to the profile, but it does not have to be bound to a sensor node if the fan coil unit controller node itself provides a locally wired space temperature sensor. In any case, the `nviSpaceTemp` has priority if bound to a sensor node (using the Neuron C function `is_bound()`).

Valid Range

The valid Range is -10°C to 50°C. The value 0x7FFF(=+327.67°C) will be handled as an invalid value.

Default Value

Default Value is 0x7FFF(=+327.67°C). This value will be adopted at power-up and in case of not receiving an update within the specified receive heartbeat time to allow default behavior.

Temperature Setpoint Input

```
network input SNVT_temp_p nviSetPoint;
```

This input network variable is used to allow the temperature setpoint for the occupied and standby mode to be changed via the network. The individual heat/cool setpoints for occupied and standby mode then derive from `nviSetPoint` minus/plus half the occupancy zero-energy-bands calculated from `nciSetPnts` i.e.

```
zeb_occ = occupied_cool - occupied_heat
```

```
zeb_standby = standby_cool - standby_heat
```

where the zero-energy-band is defined as the range where neither heating nor cooling is active.

Although this network variable input is mandatory to the profile, it does not have to be bound to any setpoint node. If not bound (detected by using the Neuron C function `is_bound()`), either a locally wired setpoint knob or the appropriate setpoint as configured in `nciSetPnts` is used.

Valid Range

The valid Range is 10°C to 35°C. The value 0x7FFF(=+327.67°C) will be handled as an invalid value.

Default Value

Default Value is 0x7FFF(= +327.67°C). This value will be adopted at power-up and remains until an update receives. In this case, the fan coil controller object will work according the configuration of `nciSetPnts`.

Heat Control Output

```
network output SNVT_lev_percent nvoHeatOutput;
```

This output network variable reflects the current position of the heat actuator and can be used as part of a control loop and for monitoring purposes. When the Fan Coil Unit object is used in a two pipe (single valve) system the Heat Control Output will be used to control the valve in heating as well as the cooling mode.

Valid Range

The valid range is 0% to 100%.

When Transmitted

The variable is transmitted immediately when its value has changed significantly. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration `nciSndHrtBt`.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Cool Control Output

```
network output SNVT_lev_percent nvoCoolOutput;
```

This output network variable reflects the current position of the cool actuator and can be used as part of a control loop and for monitoring purposes.

Valid Range

The valid range is 0% to 100%.

When Transmitted

The variable is transmitted immediately when its value has changed significantly. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration `nciSndHrtBt`.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Fan Speed Output

```
network output SNVT_switch nvoFanSpeed;
```

This output network variable reflects the current fan speed of a multi-speed (n-speed) fan. It can be used as part of a control loop and for monitoring purposes.

Valid Range

The valid range is described below:

state = 0 or 1 (OFF or ON)

value = as defined below [n>= m]:

state	value	fan speed
0 (OFF)	0 %	OFF
1 (ON)	(1/n) 100%	fan speed #1
1 (ON)	(2/n) 100%	fan speed #2
1 (ON)	(m/n) 100%	fan speed #m
1 (ON)	100%	fan speed #n

NOTE: Truncation should be used when computing the above values.

When Transmitted

The variable is transmitted immediately when its value has changed. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration `nciSndHrtBt`.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Optional Network Variables

Fan Speed Command

network input SNVT_switch nviFanSpeedCmd;

This input network variable is used to connect an external fan speed switch to the node or to allow any supervisory device to override the fan speed controlled by the node's control algorithm. `nviFanSpeedCmd` can be used to support multi-state: OFF / SPEED#1 / SPEED#2 / SPEED#3 / ... / SPEED#n / AUTO.

Valid Range

The valid range is the range provided by `SNVT_switch` as described below:

state	value	fan speed
0 (OFF)	na	OFF
1 (ON)	0%	OFF
1 (ON)	0.5 ... (1/n) 100%	fan speed #1
1 (ON)	0.5+(1/n) 100% ... (2/n) 100%	fan speed #2
1 (ON)	0.5+((m-1)/n) 100% ... (m/n)*100%	fan speed #m
1 (ON)	0.5+((n-1)/n) 100% ... 100%	fan speed #n
0xFF	na	fan AUTO

NOTE: Truncation should be used when computing the above values.

OFF:	The fan should be switched OFF. Depending on the application configuration (e.g. fan interlock), this is used to switch OFF heating / cooling actuators as well.
fan speed #1:	The fan should always run at the lowest speed (fan speed #1).
fan speed #2:	The fan should always run at the second fan speed stage (fan speed #2).
...	
fan speed #m:	The fan should always run at the fan speed stage #m.
fan speed #n:	The fan should always run at the highest fan speed stage (fan speed#n).
fan AUTO:	The fan is not controlled by the switch. The fan speed is determined by the controller.

Default Value

Default value is “fan AUTO”, which means there is no external fan speed switch assigned nor any supervisory device overrides the locally wired fan speed switch.

Occupancy Input

```
network input SNVT_occupancy nviOccCmd;
```

This input network variable is used to command the fan coil unit controller object into different occupancy modes. It is typically bound to a supervisory node’s time program or an externally wired wall module with bypass button.

Valid Range

The valid range is described in the table below:

OC_OCCUPIED:	The fan coil unit controller should operate in occupied mode as defined by the manufacturer (e.g. occupied setpoint).
OC_UNOCCUPIED:	The fan coil unit controller should operate in unoccupied mode as defined by the manufacturer (e.g. unoccupied setpoint, fan=OFF).
OC_BYPASS:	The fan coil unit controller should operate in temporary occupied mode. When the configured bypass time elapses, the fan coil unit controller returns to the original occupancy mode (e.g. time program).
OC_STANDBY:	The fan coil unit controller should operate in standby mode as defined by the manufacturer (e.g. standby setpoint).
OC_NUL:	This is the initial value after power-up and it remains until another value is received. It is used to operate according manufacturer-specific defaults.

Default Value

The default value is OC_NUL = 0xFF.

Application Mode Input

network input SNVT_hvac_mode nviApplicMode;

This network variable input is used to coordinate the fan coil unit controller object with any supervisory controller providing the supply energy, e.g. hot or cold water. It is used as heat/cool changeover.

Valid Range

The valid range is described in the table below:

HVAC_AUTO:	The control loop automatically changes between application modes (e.g. HEAT and COOL) to provide the control objectives. In this case both, heat and cool supply is presumed to be available.
HVAC_HEAT:	The control loop is in HEAT mode and the fan coil unit controller presumes, heat supply is available.
HVAC_COOL:	The control loop is in COOL mode and the fan coil unit controller presumes, cool supply is available.

The other enumeration provided by SNVT_hvac_mode are optional.

Default Value

The default value is HVAC_AUTO. This value will be adopted at power-up and in case of not receiving an update within the specified receive heartbeat time to allow failure reaction.

Setpoint Offset Input

network input SNVT_temp_p nviSetPtOffset;

This input network variable is used to shift the temperature setpoint via network by adding nviSetPtOffset to the current setpoint. It is typically bound to a supervisory node providing outside air temperature compensation or to an external wall module having a relative setpoint knob. This setpoint shifting operates only on occupied and standby setpoints and does not affect the unoccupied setpoint.

Valid Range

The valid Range is -10°C to +10°C.

Default Value

Default Value is 0°C to disable the setpoint offset. This value will be adopted at power-up and in case of not receiving an update within the specified receive heartbeat time to allow failure reaction.

Water Temperature Input

network input SNVT_temp_p nviWaterTemp;

This input network variable is used to allow an automatic heat/cool switchover dependent on the temperature of the supply temperature. The changeover limit is manufacturer-dependent.

Valid Range

The valid Range is -10°C to +90°C.

Default Value

Default Value is 0x7FFF (=+327.67°C). This value will be adopted at power-up and to indicate failure behavior.

Terminal Load Output

```
network output SNVT_lev_percent nvoTerminalLoad;
```

This output network variable reflects the current heat/cool energy demand of the fan coil unit controller which is typically bound to an energy providing node. It is the output of the control algorithm. Negative numbers indicate heating load and positive numbers indicate cooling load.

Valid Range

The valid range is -163.84% to +163.84%.

When Transmitted

The variable is transmitted immediately when its value has changed significantly.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Absolute Power Consumption Output

```
network output SNVT_power nvoLoadAbs;
```

This output network variable reflects the current heat/cool power consumption of the fan coil unit controller. It is typically used for monitoring purposes.

Valid Range

The valid range is 0 Watts to 6,553.5 Watts.

When Transmitted

The variable is transmitted immediately when its value has changed significantly.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Discharge Air Temperature Output

network output SNVT_temp_p nvoDischAirTemp;

This output network variable is used to monitor the temperature of the air that leaves the fan coil, if the fan coil unit controller object provides an internal temperature sensor for this purpose.

Valid Range

The valid Range is -10°C to 50°C. The value 0x7FFF=+327.67°C will be handled as an invalid value in case of a sensor failure.

When Transmitted

The variable is transmitted immediately when its value has changed significantly.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Reheat Output

network output SNVT_switch nvoReheat;

This output network variable reflects the current state of an n-stage reheat output.

Valid Range

The valid range is described below:

state = 0 or 1 (OFF or ON)

value = as defined below [n>= m]:

state	value	reheat stage
0 (OFF)	0 %	OFF
1 (ON)	(1/n) 100%	reheat stage #1
1 (ON)	(2/n) 100%	reheat stage #2
1 (ON)	(m/n) 100%	reheat stage #m
1 (ON)	100%	reheat stage #n

NOTE: Truncation should be used when computing the above values.

When Transmitted

The variable is transmitted immediately when its value has changed significantly.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Space Temperature Output

network output SNVT_temp_p nvoSpaceTemp;

This output network variable is used to monitor the space temperature in case this temperature is locally measured.

Valid Range

The valid Range is -10°C to 50°C. The value 0x7FFF=+327.67°C will be handled as an invalid value in case of a sensor failure.

When Transmitted

The variable is transmitted immediately when its value has changed significantly. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration nciSndHrtBt.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Effective Setpoint Output

network output SNVT_temp_p nvoEffectSetPt;

This output network variable is used to monitor the effective temperature setpoint which may depend on nciSetPnts, nviOccCmd, nviSetPoint, nviSetPtOffset, any local setpoint means.

Valid Range

The valid Range is 10°C to 35°C.

When Transmitted

The variable is transmitted immediately when its value has changed significantly. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration nciSndHrtBt.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Discharge Air Temperature Input

network input SNVT_temp_p nviDischAirTemp;

If the discharge air temperature sensor is a LONMARK device, the FCU object obtains its value through this network variable. The network value has got precedence over the physical value if both are available.

Valid Range

The valid range is -10°C to 50°C. The value 0x7FFF=+327.67°C will be handled as an invalid value.

Default Value

Default Value is 0x7FFF = +327.67C. This value will be adopted at power-up.

Energy Hold Off Input

```
network input SNVT_switch nviEnergyHoldOff;
```

This input is from a device such as a window contact sensor. Moreover it is used if two or more controllers share one physical window contact or another device (EnergyHoldOff device) that forces all of them to go to a lower energy consuming operation. If for instance two controllers share one window contact, or a dew point sensor, the controller to which the sensor is physically connected provides the sensor's state on its output, hence the other may obtain the value and switch to EnergyHoldOff (equals to 'stop heating/cooling while still providing frost protection') when necessary. If a physical sensor is connected *and* the network variable is bound, the network variable overrides the physical value, i.e. the network value has precedence over the physical value. See nvoEnergyHoldOff for the corresponding output network variable.

Valid Range

The valid range is the range provided by SNVT_switch:

EnergyHoldOff (stop heating/cooling) is activated for 'state=1 and value 0%'. 'State=0' or 'state=1 and value=0%' leads to the normal heat/cool control.

Default Value

Default Value is state = FALSE (no Energy Hold Off requested). This value will be adopted at power-up and in case of not receiving an update within the specified receive heartbeat time to allow failure reaction.

Occupancy Output

```
network output SNVT_occupancy nvoOccCmd;
```

The fan coil unit controller object conveys to the network the effective occupancy state of the unit which may derive from an occupancy sensor (hardwired to the fan coil unit controller or connected to the network) or any other means affecting the occupancy mode.

Valid Range

The valid range is described in the table below:

OC_OCCUPIED:	The fan coil unit controller should operate in occupied mode as defined by the manufacturer (e.g. occupied setpoint).
OC_UNOCCUPIED:	The fan coil unit controller should operate in unoccupied mode as defined by the manufacturer (e.g. unoccupied setpoint, fan=OFF).

- OC_BYPASS:** The fan coil unit controller should operate in temporary occupied mode. When the configured bypass time elapses, the fan coil unit controller returns to the original occupancy mode (e.g. time program).
- OC_STANDBY:** The fan coil unit controller should operate in standby mode as defined by the manufacturer (e.g. standby setpoint).
- OC_NUL:** This is the initial value after power-up and it remains until another value is received. It is used to operate according manufacturer-specific defaults.

Default Value

Default Value is 0xFF = OC_NUL. This value will be adopted at power-up.

When Transmitted

Whenever the state changes significantly.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Energy Hold Off Output

```
network output SNVT_switch nvoEnergyHoldOff;
```

This output is used to convey to other devices the state of an EnergyHoldOff device that is hardwired to the controller. Refer to EnergyHoldOff input.

Valid Range

The valid range is the range provided by SNVT_switch as described below:

state	value	Energy Hold Off
0 (OFF)	0 %	no Energy Hold Off
1 (ON)	100 %	Energy Hold Off

Default Value

Default Value is 'state=FALSE and value=0%' (no Energy Hold Off requested). This value will be adopted at power-up.

When Transmitted

Whenever the state changes significantly. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration nciSndHrtBt.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Unit Status Output

network output SNVT_hvac_status nvoUnitStatus;

This output network variable is available to report the object status. It combines the operating mode, the capacity of heating and cooling used, and an indication if any alarms are present in the object.

Valid Range

Mode: HVAC_HEAT, HVAC_COOL, HVAC_OFF - HVAC_AUTO is not used, other enumerations are optional

heat_output_primary: 0-100%, 0xFFFF (INVALID)

heat_output_secondary: 0-100%, 0xFFFF (INVALID)

cool_output: 0-100%, 0xFFFF (INVALID)

econ_output: 0xFFFF (INVALID)

fan_output: 0-100%, 0xFFFF (INVALID)

in_alarm: 0 Means there is no alarm

Not 0 Means there is an alarm.

A filter alarm will also be indicated using this field.

When Transmitted

The variable is transmitted immediately when its value has changed significantly. Additionally this network variable will also be transmitted as a heartbeat output on a regular basis as dictated by the optional Maximum Send Time configuration nciSndHrtBt.

Update Rate

There is no maximum update rate.

Default Service Type

The default service type is unacknowledged.

Configuration Properties

Send Heartbeat (Mandatory)

network input config SNVT_time_sec nciSndHrtBt;

This configuration network variable defines the maximum period of time that expires before the following network variable outputs will automatically being updated:

- nvoHeatOutput,
- nvoCoolOutput,
- nvoFanSpeed.
- nvoEnergyHoldOff

- nvoSpaceTemp
- nvoEffectSetPt
- nvoUnitStatus

Valid Range

The valid range is any value between 0.0 sec and 6,553.4 sec. Setting nciSndHrtBt = 0 disables the automatic update mechanism.

Default Value

0 (no automatic update)

SCPT Reference

SCPTmaxSendTime(49)

Occupancy Temperature Setpoints (Mandatory)

```
network input config SNVT_temp_setpt nciSetPnts;
```

This configuration property defines the occupancy temperature setpoints for heat and cool mode.

Valid Range and Default Value

	Minimum	Maximum	Default
occupied_cool	10 °C	35 °C	23 °C
standby_cool	10 °C	35 °C	25 °C
unoccupied_cool	10 °C	35 °C	28 °C
occupied_heat	10 °C	35 °C	21 °C
standby_heat	10 °C	35 °C	19 °C
unoccupied_heat	10 °C	35 °C	16 °C

SCPT Reference

SCPTsetPnts(60)

Receive Heartbeat (optional)

```
network input config SNVT_time_sec nciRcvHrtBt;
```

This configuration property is used to control the maximum time that elapses after the last update to:

- nviSpaceTemp
- nviApplicMode
- nviSetPtOffset
- nviEnergyHoldOff

before the fan coil unit controller adopts the corresponding default value.

Valid Range

The valid range is any value between 0.0 sec and 6,553.4 sec. Setting nciRcvHrtBt = 0 disables this network variable receive failure detect mechanism.

Default Value

0 (no failure detect)

SCPT Reference

SCPTmaxRcvTime (48)

Minimum Send Time (optional)

```
network input config SNVT_time_sec nciMinOutTm;
```

This configuration property defines the minimum period of time between output network variable transitions.

Valid Range

The valid range is any value between 0.0 sec and 6,553.4 sec.

Default Value

0

SCPT Reference

SCPT_min_snd_t (52)

Location Label (optional)

```
network input config SNVT_str_asc nciLocation;
```

This configuration property can optionally be used to provide more descriptive physical location information than can be provided by the Neuron Chip's 6 byte location string. The location relates to the object and not to the node.

Valid Range

Any NULL terminated ASCII string of 31 bytes total length.

Default Value

The default value is an ASCII string containing all zeros (“\0”).

SCPT Reference

SCPT_location (17)

Number Of Output Valves (optional)

```
network input config SNVT_count nciNumValve;
```

This configuration property is used to inform the controller that it is in a two pipe (one valve) system or a 4 pipe (2 valve) system.

Valid Range

The value 1 implies one output valve (two pipe system) and the value 2 implies two output valves (four pipe system).

Default Value

The default value is 2.

SCPT Reference

SCPTnumValves (59)

Data Transfer

None specified

Power-up State

Upon power-up the input network variables are set to their default values. The output network variables are set to their initial values:

nvoHeatOutput:	0%
nvoCoolOutput:	0%
nvoTerminalLoad:	0%
nvoFanSpeed:	OFF
nvoReheat:	OFF
nvoDischAirTemp:	+327.67°C
nvoSpaceTemp:	+327.67°C

Boundary and Error Conditions

None specified

Additional Considerations

None specified