ECHELON®

CPD 3000 Lighting Controller

Integration Guide

Version 1

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Echelon Corporation
www.echelon.com

Welcome

Echelon's Power Line based lighting controller, the CPD 3000, can be used to control outdoor street lights which support proportional level control level control using 0-10V or PWM control. In addition to control, the CPD 3000 collects vital data such as run hours, voltage, current, power consumption, energy usage, diagnostic alarms, and power factor. The information collected is shared through communication on the AC mains. The CPD 3000 optimizes communications with integrated power line meshing.

Smart Street Lighting with a CPD 3000 involves remotely collecting vital data from the lighting controller (such as LED drivers, HPS ballasts, Induction Generators) and communicating over the power lines with a Segment Controller (Echelon SmartServer) which manages switching and dimming schedules, and captures and forwards diagnostic alarms and energy consumption data to operations monitoring servers over TCP/IP networking, including support for GRPS or GSM wireless networks.

This document describes the hardware installation and wiring specifications for the CPD 3000, plus the lighting controller interface. Because much of this interface is derived from an outdoor luminaire resource file set that is used by the LonMark organization, you can gain a full understanding of the scope of resource files at the LonMark International web site, www.LonMark.org.

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CPD 3000 Installation and Wiring Guidelines

The CPD 3000 Lighting Controller can be installed within the lighting fixture, in the access hold of the lighting fixture pole, in the gear tray, or in a separate box.

Installation

Installation for the CPD 3000 OLC uses the following steps. It is important to disconnect line voltage before installing or replacing a CPD 3000 module.

1. Install the CPD 3000 OLC module.
2. Connect the AC mains power to the module.
3. Connect the filtered power output of the CPD 3000 OLC module to the luminaire power supply (electronic ballast/generator, ballast, or driver).
4. Connect the CPD 3000 control signal wires to the luminaire control input.

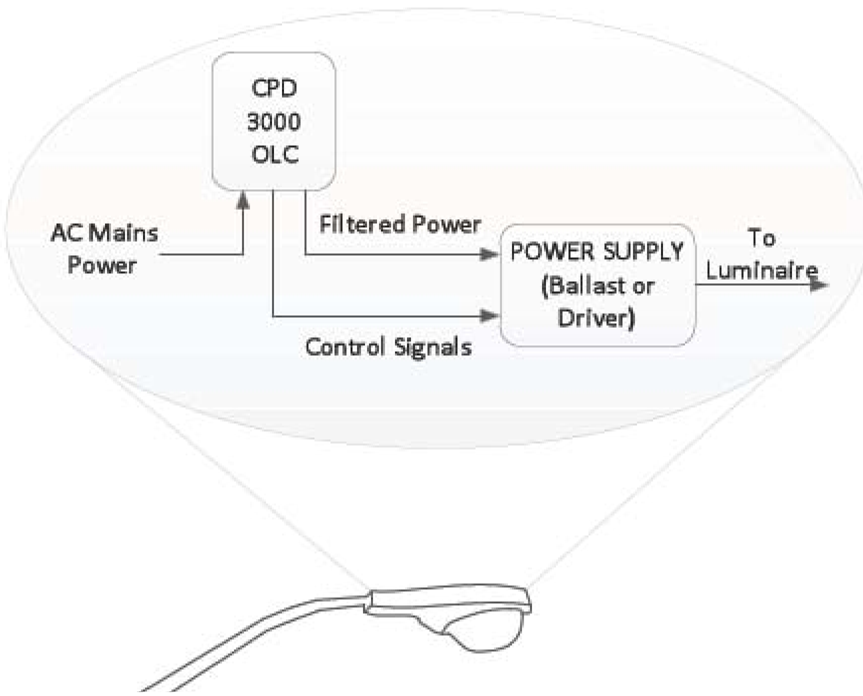

Figure 1. CPD 3000 Installed in the Light Fixture

Wiring Specification and Diagram

Here are the wiring specifications and diagram for US and European models of the CPD 3000. The CPD 3000 is not suitable for installing above 15,000 feet altitude. The controller must be installed in the light fixture, inside a street light pole, or in a street light cabinet. The CPD 3000 is not intended to be installed in an open outdoor environment.

US Model

Three AWG 16 wires for AC mains input:

Black	Line In
White	Neutral In or Line 2 In*
Green	Ground

* May be powered Line-to-Line if Line-to-Line Voltage is 100-277 VAC and all CPD 3000s, and the segment controller, are connected to the same circuit pair.

Three AWG 22 wires for control of signal ouput (IEC60929)

Blue	10V signal for PWM control
Black	Ground
Violet	Signal for 0-10V control

European Model

Three AWG 16 wires for AC mains input:

Brown	Line In
Blue	Neutral In or Line 2 In*
Green/Yellow	Ground

* May be powered Line-to-Line if Line-to-Line Voltage is 100-277 VAC and all CPD 3000s, and the segment controller, are connected to the same circuit pair.

Three AWG 22 wires for control of signal ouput (IEC60929)

Blue	10V signal for PWM control
Black	+ Signal for 0-10V control
White	- Signal for 0-10V control

Two AWG 16 wires for filtered power output (both models)

Red	Line Out
Blue	Neutral Out or Line 2 Out

The 0-10V control signal of the CDP 3000 works with current sourcing inputs. The CPD 3000 will sink up to 1500mA. The filtered switch AC output will handle load up to 500 VA.

CPD 3000 Mechanical Dimensions

This diagram shows the dimensions of the CPD 3000 in millimeters.

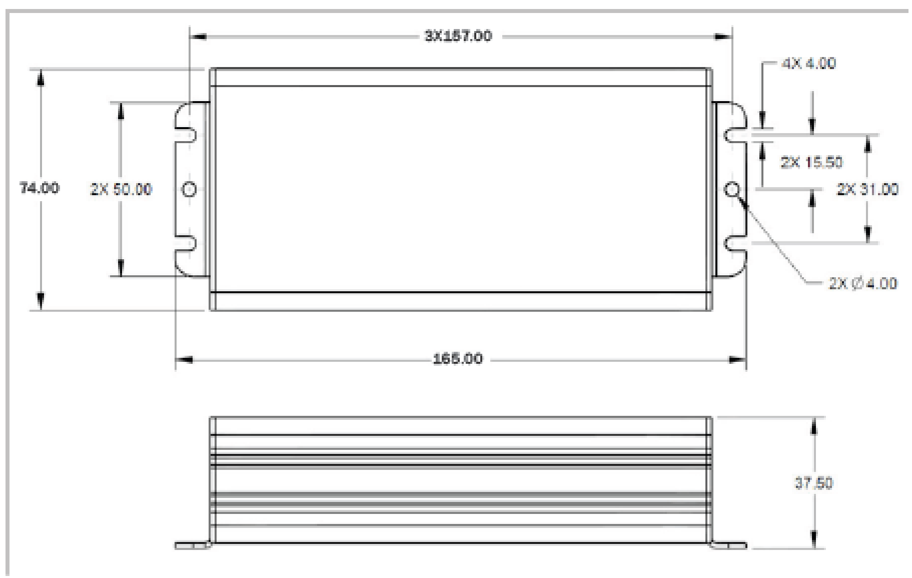

Figure 2. CPD 3000 Housing Profile

See the CPD 3000 Outdoor Lighting Controller data sheet (003-0513-01) on the Echelon web site for all specifications of the CPD 3000.

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CPD 3000 Lighting Controller Interface

The CPD 3000 Lighting Controller borrows much of its interface from the `SFPToutdoorLuminairController (3512)` defined in the LonMark standard resource file set version 13.10. To meet the memory requirements of the PL3120-E4 Smart Transceiver, a specific profile is defined in an Echelon device specific scoped resource file set defined in the DRF files set `EchelonLighting.*` (Program ID [scope 4] 80 00001 1E00 03 11 03). These resource definitions were first defined in version 1.03, and apply to version 1.05, the current release at thewriting of this document

Application as Function Block

The application for the CPD 3000 is developed as a sole function block. The `UFPTlightingController` is referred to as the LC in the remainder of this document.

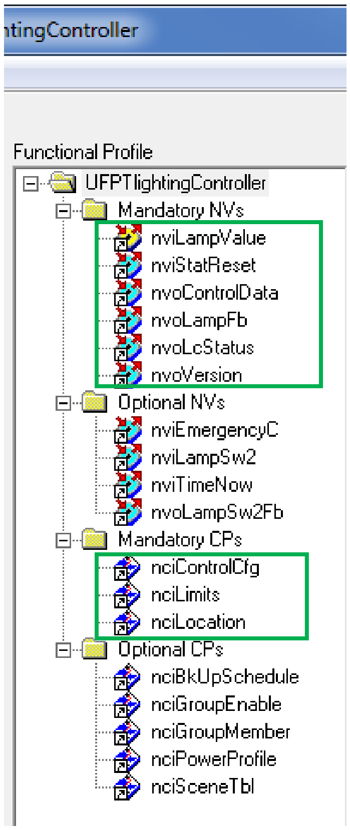

Figure 3. `UFPTlightingController` Funtional Profile Interface used in CPD 3000

`UFPTlightingController` Network Variables

The following table describes the network variables defined for the CPD 3000 implementation of the `UFPTlightingController`. The CPD 3000 implements only the mandatory network variables and CPs in the initial release.

Table 1 LC Network UNVTfaults Variables Implemented on the CPD 3000

Network Variable	Type	Notes
nviLampValue	SNVT_switch	Primary control input. The level translates to a 0-10V control signal with the transform being subject to the values configure in nciControlConfig defined below. By default, 50% results in a 5V control signal to the ballast, driver, or, generator controlled by the CPD 3000.
nviStatReset	UNVTstatControl	Sets/initializes energy, runtime, and error counts.
nvoControlData	UNVTcontrolData	A structured variable describing all current operating values and state of the LC. This is described in the following section.
nvoLampFb	SNVT_switch	Feedback of the current nviLampValue. In normal operating conditions, this value will reflect the nviLampValue. It may differ if the heartbeat interval is exceeded and the defaultLevel differs from the value in nviLampValue.
nvoLcStatus	UNVTfaults	Feeds alarm logs only on change to minimize the data requirement on the IP network. The frequency of changes to this variable is carefully managed to conserve bytes consumed by data logs.
nvoVersion	UNVTversion	A string describing the version of the OLC application, such as 1.00.09.

UNVTcontrolData – nvoControlData Details

The LC conserves power line bandwidth by reporting the operating state of the LC in a single output network variable nvoControlData (UNVTcontrolData), described in this section. Previous profile designs typically require three poll transactions to capture level control feedback, environmental variables, and alarm conditions. This network variable reflects all of this information in one single-structured data type defined by `UFPTcontrolData`.

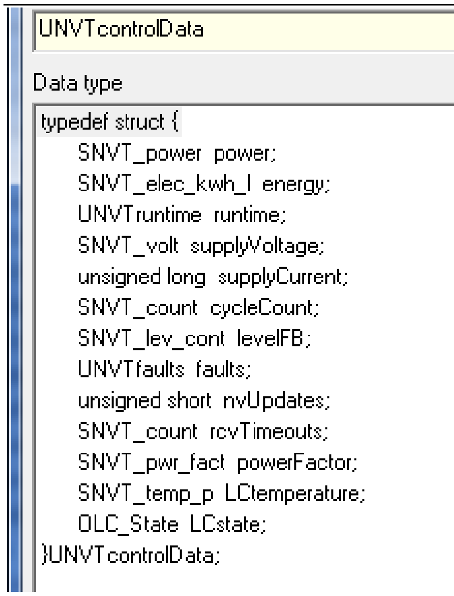

Figure 4. `UNVTcontrolData(nvoControlData)` Fields

The fields for `UNVTcontrolData` are described in table 2.

Table 2 `nvoControlData` Fields (`UNVTcontrolData`)

Field	Type	Notes
`power`	`SNVT_power`	Reflects the instantaneous power consumed by the LC and controlled fixture. (0.1w resolution) This value is updated each second by the power measurement chip on the LC.
`energy`	`SNVT_elec_kwh_l`	Reports the accumulated energy usage to 0.1kwh resolution. The LC writes this to EEPROM memory every 12 hours, and at the transition to OFF. Installations which kill power to the streetlight segment at dawn should delay the switch of the power for several minutes after the lights are scheduled OFF to allow the controller to store this value in EEPROM memory.
`runtime`	`UNVTruntime`	The number of operating minutes for the fixture. Stored to EEPROM with each OFF transition. The presentation format for this field is an integer value of hours.

`supplyVoltage`	`SNVT_volts`	Measured supply voltage 0.1V resolution. This value is updated every second.
`supplyCurrent`	`unsigned long`	Measured current with 0.01 amp resolution. This value is updated every second.
`cycleCount`	`SNVT_count`	Number of operating cycles (ON-OFF). Updated with each transition to OFF.
`LevelFB`	`SNVT_lev_cont`	0.5% resolution 0-100%. Tracks the .value field of `nvoLampFb`. 0% if the state is 0.
`faults`	`UNVTfaults`	Fault bits. Details are provided in the alarms section. These bits represent current conditions of the last alarm evaluation and not the latched values as reflected in `nvoLcStatus`.
`nvUpdates`	`Unsigned`	Used to assess application level communication performance. Every 30 minutes, this field is updated to report the number of times `nviLampValue` was updated in the previous interval. If the defined heartbeat for `nviLampValue` is defined as 10 minutes, this value reports a value of 2-4 during steady state operation.
`rcvTimeouts`	`SNVT_count`	The maximum receive timeout for this device (part of `nciControlCfg`) is set to three times the control input heartbeat. In practice, this number increases only when an update is not received after three heartbeat intervals.
`powerFactor`	`SNVT_pwr_factor`	Reports the measured power factor for the LC/Fixture combination. When the controlled load is OFF, this value will be very low (around .3). Alarms against power factor are only evaluated when the load is turned ON. For efficient light operation, it is good practice to limit the control signal the CPD 3000 drives to keep the power factor above 0.8.
`LCtemperature`	`SNVT_temp_p`	Reports the temperature sensed by the power measurement chip on the CPD 3000. Typical accuracy is +/-5 degrees C.
`LCstate`	`OLC_State`	Reports the current state of the CPD 3000 LC controller. Valid values include: `OLC_INIT`, `OLC_COOLDOWN`, `OLC_WARMUP`, `OLC_ON`, and `OLC_OFF`.

Broadcast Support

The CPD 3000 supports the limited broadcast message support implemented on SmartServer 2.1 Firmware (service release 1). Control updates through this mechanism are reflected on the network variable interface (`nviLampValue`, and `nvoLampFb`). Note that the `nviLampValue` data point should not have a defined heartbeat to properly use the broadcast feature. Behavior for reflection in `nvoLampFb` follows the Use Case Realization described by the LonMark organization at http://types.lonmark.org/index.html (see `SFPTisiLampActuator`).

Enumeration (value)	**Description**	**Notes**
`SW_NUL (-1)`	Invalid value	This is the initial value for `nviLampValue`. The default output state is taken as unconfigured, and configured nodes with no hw RTC. Hw RTC nodes that are configured adopt the state defined by the backup schedule.
`SW_SET_OFF (0)`	Set state OFF	Sets the output state to OFF. The Relay is open. 0-10v output driven to 0v. If a rampTime is non-zero, the 0-10v sweeps from the current value to 0v over the defined time, which opens the Relay.
`SW_SET_ON (1)`	Set State ON	Sets the output state to ON, 100% level. The relay coil is energized, and the level is set to 100%.
`SW_SET_LEVEL (5)`	Set level	Provide `SNVT_switch` behavior. Use the `SW_SET_ON`, and `SW_SET_OFF` behaviors described above. RampTime applies

CPD 3000 Configuration (`nciControlCfg`)

The CPD 3000 uses a limited number of configuration properties (CPs) implemented using network variables on the CPD 3000. The main portion of the configuration is defined by the fields in `nciControlCfg` (`UCPTcontrolCfg`).

Configuration Property	**Type**	**Notes**
`nciControlCfg`	`UNVTcontrolCfg`	Defines many of the operating parameters for the LC.
`nviLocation`	`SNVT_geo_position`	Provides tagging for GPS location, and physical asset tagging. Version 13.04 standard.
`nciLimit`	`UNVTfaultLimits`	Used for alarm thresholds as defined in Alarming, below.

`nciPowerProfile`	`UNVTpowerProfile`	Defines the nominal power measured at 5 commanded `nviLampValues` 0.5%, 25%, 50%, 75%, 100%) while driving the driver/lamp combination. This CP must be set for lowPower/HighPower, and measured with `nvoLampFb` values to work correctly. They will depend on the `minPWM` and `maxPWM` fields defined in the following section.

#

UNVTControlCfg

This section describes how the fields in this configuration property are applied in the LC.

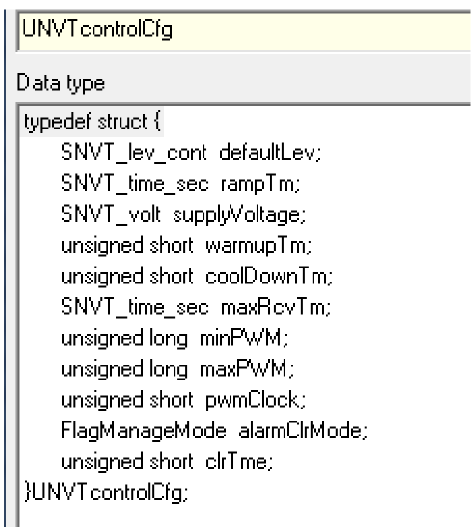

Figure 5. `UNVTcontrolConfig` Field Details

Field	Type	Notes
`defaultLev`	`SNVT_lev_cont`	This is the initial value before an update to nviLampValue is received by the LC to drive the lamp value at power ON or reset. The default value is 100%. This value only applies after the CPD 3000 is commission by the SmartServer. When unconfigured, the CPD 3000 will turn ON the controlled light to full ON. When power is applied to the OLC, the application enforces a 10s minimum time (even if `CoolDownTm` =0) before applying this value. A non-zero

		CoolDownTm will extend this time.as required when controlling certain lamp types such as HPS.
rampTm	SNVT_time_sec	Controls how the LC ramps between level transitions. Only used after the lamp is ON to go between intermediate steps. The CPD 3000 limits this value to a maximum of 30s. (Default value – 1.5s)
supplyVoltage	SNVT_volt	The nominal supply voltage for the fixture. Used of voltage level alarms. (Default value – 240V).
warmupTm	unsigned short	The number of minutes the LC allows the fixture to warm up before allowing dimming commands. During warm up, the dimming commands are deferred. If the LC is set to go to 75% ON, the LC will set the 0-10V signal to 10V for warmupTm minutes before issuing the appropriate dimming level. In LED applications, this is typically 0. Any **nviLampValue** less than 100% will be delayed while the LC is in the state OLC_WARMUP. (Default value – 0s). This also delays power alarm processing which is important in the case of control of magnetic ballast technology.
coolDownTm	unsigned short	The number of minutes the LC will delay commands to turn ON after the fixture has been turned OFF. This is important for improving certain lamp technology life times. **The CPD 3000 enforces a 10s COOLDOWN to allow recovery of the inrush protection circuit. This 10s minimum is subject to change in the future.** (Default value – 0s)
maxRcvTm	SNVT_time_sec	If the LC fails to receive an update to nviLampValue for this time (0s default), the LC will drive the lamp to the defaultLevel. The segment controller should update nviLampValue up to three times within this period. If the maxRcvTm is 900s, the heartbeat rate of 300s should be used by the segment controller. Note that maxRcvTm = 0 means lights will retain the last commanded value if the SmartServer cannot communicate to the device, or if it fails.
minPWM	unsigned long	It may be necessary to set the lowest 0-10V signal to a value that can be used to drive the controlled fixture. This value

		lower limit of the PWM output with the `nviLampValue` is at 0.5%. **Limit to 0-255.** (Default value – 0). Use this to limit the low level light setting to maintain efficient operation.
`maxPWM`	`unsigned long`	It may be necessary to set the highest 0-10V signal to a value that can be used to drive the controlled fixture. This value upper limit of the PWM output with the nviLampValue is at 100%. **Limit to 0-255.** (Default value – 255)
`pwmClock`	`unsigned short`	Allows programming of the PWM clock. The values (0-7) are valid values as defined in Neuron C. **The default value of 6 should be used.**
`alarmClrMode`	`FlagManamentMode`	**Not supported**. Controls how the alarm flags are cleared by the LC. (`FL_DAILY` is only supported)
`clrTime`	`unsigned short`	Depending on alarmClrMode, this number is used to manage automatic clearing of fault flags. See the section on LC Alarms. **This value is scaled with a 6 minute resolution. It should be set to allow for alarm logs to be sent on schedule, well after sunrise has occurred. Default = 300**

Analog Control

Dimming drivers and ballast controllers will exhibit different end results with respect to power usage and light output response when subjected to a linear control signal. An LED fixture with a particular Phillips driver was specified to operate over the range of 0-10VDC. When tested for power efficiency and visible light level response, the result was 2-8.6VDC. The fields `minPWM` and `maxPWM` are used to control how `nviLampValue.value` translates to a control signal that drives the controlled driver/ballast. The values are determined by experimenting with an actual controlled fixture. In one particular application, the `minPWM` value may be established by monitoring the reported power factor, or the measured delivered light level of the installed fixture. For example, at 1.5V control signal, the power factor may be adequate at .82, but the delivered light level is not adequate until 2.5V. Measuring the control signal while driving a specific driver is required to determine at what `minPWM` value, 2.5V is measured. The value for `maxPWM` may be determined by observing the measured power or the delivered lux level to the pavement using a lux sensor. You may find the last volt of control signal has no effect on the delivered light or power level measured for the load so you could choose a value for `maxPWM` at around 240.

Working with the CPD 3000 and the target driver/ballast is required to determine the limits for the best scaling of the nviLampValue.value to the actual control signal. These values must be set before the nciPowerProfile initialization can be determined.

LC Alarm Management

The LC provides rich support for status bits which are derived from the power measurement chip included in CPD 3000 hardware. Alarms require characterization of nominal operating conditions defined by various CP fields described in this section. The current existing alarm conditions are always reflected in nvoControlData.faults before any time filters are applied. The alarms reported in nvoControlData.faults have no filters applied and are potentially quite dynamic at the transition. The CPD 3000 applies several filters to limit the frequency of alarm events. First, at each state transition (OFF to ON, or WARMUP to ON) Alarms are not checked for 120s. Second, the network variable nvoLCstatus contains latched versions of the fault bits that have a 60 second active before setting condition as reported in nvoControlData.faults. If a defined condition exists of 60s, the alarm flag in nvoLcStatus is set and it will persist until power to the CPD 3000 is cut, action is taken by updating the value of nviStatReset, or UNVTcontrolCfg.ClrTm minutes have expired after the lamp is switched OFF at sunrise.

It is important to understand how alarm conditions are filtered to prevent nuance alarm conditions. Alarms are only checked if the CPD 3000 state is OLC_ON or OLC_OFF. If the output level or the state is changed, alarm conditions are not checked for 120s. If you reset the CPD 3000 at T = 0s, and set control the line voltage to 100VAC with a 120V nciControlCfg.supplyVoltage value, the nvoControlData.faults.lowSupplyVoltage flag will not be set until T = 130s (the transition from OLC_COOLDOWN occurs 10s after reset). To be registered as a fault in nvoLcStatus, the condition of low supply voltage must exist for an additional 60s. The flag in nvoLcStatus is latched, and will not be cleared until the configured time after the CPD 3000 switches the load OFF at sunrise, as described below.

CP Field	Type	Notes
nciControlCfg.supplyVoltage	SNVT_volt	Nominal supply voltage for the installed streetlight segment. (Default - 240V)
nciControlCfg.defaultLev	SNVT_lev_cont	Value to use at reset, or if maxRcvTmo expires. (Default: 100%)
nciControlCfg.maxRcvTm	SNVT_time_sec	The time used to determine if communication to the segment controller no longer exists. At this point, the RcvTmo alarm is triggered, and the fixture is

		controlled to `defaultLev` (Default –0s; which means HB checking is disabled)
`nciPowerProfile`	`UNVTpowerProfile`	Defines the nominal power at 0.5, 25, 50, 75, 100% lamp `nviLampValue.value`. Used to determine the expected power draw using linear interpolation for `nviLampValue.values` in between steps defined in the table.
`nciLimits.powerLowFault`	`SNVT_lev_cont`	The percentage deviation of expected power below which the `LowPower` alarm is triggered. (Default value - 15%)
`nciLimits.powerHighFault`	`SNVT_lev_cont`	The percentage deviation of expected power above which a `HighPower` alarm is triggered. (Default value - 15%).
`nciLimits.voltageLow`	`SNVT_lev_cont`	The percentage deviation below the configure `supplyVoltage` at which the `LowSupplyVoltage` alarm is triggered. (Default value - 15%).
`nciLimits.voltageHigh`	`SNVT_lev_cont`	The percentage deviation above the configured `supplyVoltage` at which the `HighSupplyVoltag` alarm is triggered. (Default value - 15%).
`nciLimits.pfLow`	`SNVT_pwr_fact`	Power factor alarm point. Power factor alarms are only tested when the controlled load is ON. (Default value - .65)
`nciLimits.rcvHb`	`SNVT_time_sec`	The rate at which the segment controller is expected to update `nviLampValue`. Best practice is to set this value at 3x shorter than `nciControlCfg.rcvTmo` (Default value – 0s).
`nciLimits.highTemp`	`SNVT_temp_p`	The temperature above which a high temperature

		alarm is triggered. (Defaults value - 65.0 C)
`nciLimits.lampFailFault`	`SNVT_lev_cont`	The threshold of power drop measured when the lamp fails. In some technologies, induction lights for example, the power draw at bulb failure may be quite high. (Default value - 20%).

The field `nciControlCfg.clrTm` controls when the alarm flags reported in nvoLcStatus will be cleared. In an SLV managed lighting system, alarm logs are scheduled for daily delivery at some point *after* the sunrise OFF command. For example, this could be scheduled for 10:00AM. Over the year, sunrise time varies with the season and the geographic location. For example, it could occur between 5:15 and 7:45 AM. To support proper management of alarms, alarms should not be cleared until at least five hours or more after sunrise.

`nciControlCfg.clrTm` should be set to 300 minutes to support clearing of the alarms after the logs have been delivered.

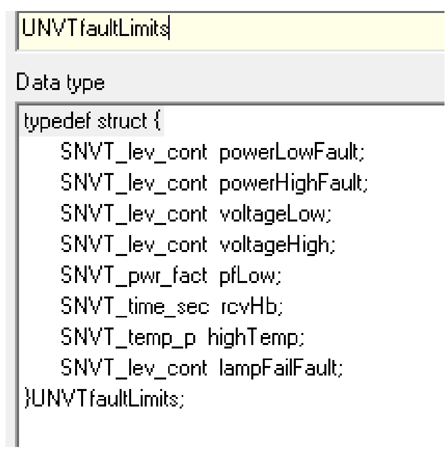

Figure 6. Fault Limits

During characterization of a driver/lamp combination, it may be useful to use `nviStatReset.cmd`, a value of `SM_CLEAR_ALARMS`. The following table lists the fault bits reported by `nvoControlData.faults` and `nvoLCstatus`.

Table 3. Fault Bit Reported by `nvoControlData.faults`, and `nvoLCstatus`

Fault Bit	**Condition**
`LowPower`	Measured power is `nciLimits.powerLowFault` % below the expected power
`HighPower`	Measured power is `nciLimits.powerHighFault` % above the expected power

LowSupplyVoltage	Measured voltage is nciLimits.voltageLow % below the voltage defined by nciControlCfg.supplyVoltage
HighSupplyVoltage	Measured voltage is nciLimits.voltageHigh % above the voltage defined by nciControlCfg.supplyVoltage
RelayFailed	Power measured when the load switch relay is disengaged above 6.0W. This would occur if the relay contacts were to weld shut.
FailedStart	**Not supported at this time**
Cycling	**Not supported at this time**
CommMargin	Set if no update to nviLampValue is received before nciLimits.rcvHb. It is recommended that the rcvHb parameter be set to a value that is 50% longer that the configured update rate for nviLampValue by the segment controller.
RcvTmo	Set if the no update to nviLampValue is received before nciControlCfg.maxRcvTm. This alarm typically results in the load under control being driven to the level defined by nciControlCfg.defaulLev.
HighTemp	Set when the onboard temperature sensor exceeds 65 degrees C.
LampFailed	Occurs when the power measured is below the % low value defined by nciLimits.lampFailFault.
LowPF	Set if the power factor of the controlled load falls below nciLimits.pfLow when the load is ON. It is normal for the power factor reported in nvoControlData to be in the range of .30-.40 when the load is OFF. Alarm is only set if the load is ON.

nviLampValue -> nvoLampFb Relationship

The SNVT_switch type defines the range of control from 0-100% which maps to control voltages between minPWM and maxPWM as determined appropriate for a particular fixture application. A fixture used near an intersection, for example, may have a maxPWM of 255 to generated full light output, while the same fixture applied to a residential street may clip the light level maximum output by setting maxPMW to 220. The value setting is a %, not a delivered light level. The response of a driver/ballast is implementation dependent over the range of 0-100% level. Ideally the response of the driver over the control range is a continuous change in light level, or change in measured power. A 0VDC signal to the driver results in a minimum light level, and power draw for the fixture which are not 0. It is not uncommon for power at minimum controlled level to be 25% of full brightness power.

The nvoLampFb typically reports value of nviLampValue. The only time this is not the case is if the LC is configured to monitor the update rate, and a receive timeout occurs forcing the brightness to the define nciControlCfg.defaultLev.

The CPD 3000 uses the `nciPowerProfile` table to define the expected power at five equally spaced `nviLampValue.values` (.5%, 25%, 50%, 75%, 100%) once the `minPWM` and `maxPWM` CP fields have been established.

Note that `nviLampValue.state` is set to -1 at powerup/reset.

CPD 3000 Control Sequence

The CPD 3000 implements the state machine diagram depicted in figure 5 below. The field `nvoControData.LCstate` reports the current active state for the controller. To manage inrush current, the CPD 3000 uses an NTC Thermistor to limit current inrush current commonly encountered with LED drivers and other electronic ballasts. To be effective, the device needs a recovery time of 10s after the load is switched ON. This means that power loss or reset will switch the load OFF for 10s before turning the load ON. The configuration property field `nciControlCfg.cooldownTm` provides additional if required by the load under control.

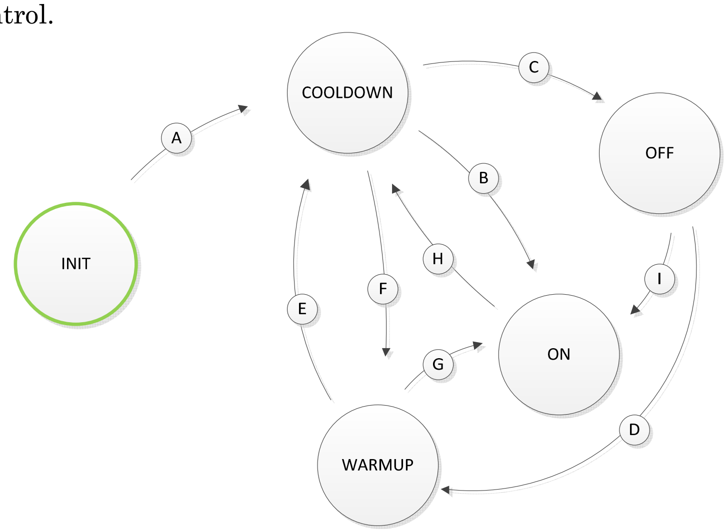

Figure 7. CPD 3000 State Diagram

Table 4. CPD 3000 Control State Transition Descriptions

Path	Condition	Comments
A	Power-up or Reset	10s COOLDOWN minimum enforced for inrush limiter recovery.
B	COOLDOWN state timer expires AND (command ON OR .defaultLev > 0)	An unconfigured node will follow this path FULL_ON level
C	COOLDOWN state timer expires AND (.defaultLev == 0 AND rcvTmo) OR command OFF	
D	(Command ON OR (.defaultLev > 0 AND rcvTmo)) AND .warmup > 0	Warmup state always drives the control signal to the configured high limit.

E	WARMUP state timer expires OR commanded OFF	Updates to nviLampValue are delayed until out of WARMUP.
F	COOLDOWN state timer expires AND (.defaultLev > 0 AND rcvTmo) OR command ON	Occurs when .warmupTm is > 0
G	WARMUP state timer expires AND (commanded ON OR (rcvTmo AND .defaultLev > 0))	
H	command OFF OR (rcvTmo AND .defaultLev == 0)	COOLDOWN for at least 10 for inrush circuit recovery
I	.warmupTm == 0 AND (Command ON OR (rcvTmo AND .defaultLev > 0)	

During the transition from OFF to ON, the CPD 3000 drives the 0-10V control signal directly to the final level at the time the load switching relay is engaged. If the CPD 3000 is configured with a `nciControlCfg.warmupTm` > 0, the control signal is driven to the 100% level, and finally the level defined by `nviLampValue.value` after the `warmupTm` has completed. Changes in lamp level while the load is ON are applied as a smooth ramp over the time specified by `nciControlCfg.rampTm` (0 – 30.0 s, 0.1s steps). The transition to OFF will sweep the 0-10V control to the minimum level before releasing the load switching relay.

Creating the CPD 3000 Device on your SmartServer

To create a LONWORKS device, follow these steps. For more information, see *Creating LonWorks Devices* in Chapter 5 of the SmartServer User's Guide.

If you are using the SmartServer in Standalone mode, copy the following files to the SmartServer flash disk:

- Copy the external interface (XIF) files of the devices to be managed by the SmartServer to the root/LonWorks/import folder on the SmartServer flash disk.
- Copy the device resource files to the root/LonWorks/types/user folder.
- If you plan on upgrading the devices using the SmartServer, you need to copy the devices' application image files to the root/LonWorks/import folder.
- Reboot the SmartServer.