DCM User's Manual

DCM127-NX1 Dimming Control Module (contains UJX-DCM127-001)

REVISION HISTORY

Date	Version	Description	Author
6/28/2010	1.0	Initial Draft	Ryan Wagner

DCM127-NX1 dimming control module intended for streetlight dimming applications contains proposed FCC ID UJX-DCM127-001 2.4GHz radio modem, also known as Nivis 2.4GHz Mod 2 (part number RF-P9-06-01-01).

DCM127-NX1 Specifications:
Supply voltage: 120-277VAC 60Hz
Power: 1.5-2.0W
Output: 0-10V analog signal settable in 256 increments
Operating Temperature Range: -40C to +85C
Storage Temperature Range: -40C to +100C
Application: Streetlight fixtures 25W-1000W using electronic ballast or driver with 0-10V analog diming control input. Dim command from ROAM portal software is interpreted by DCM127-NX1, which engages a variable analog output signal commanding the fixture driver to vary the overall fixture illumination.

Installation:

1. Ensure the fixture is not powered. Merely removing the photocontrol or shorting cap is not sufficient – power must be disconnected

from the field wiring terminal block. Verify power is removed using a working VOM.

2. Open the fixture electronics enclosure (process varies depending on the fixture make/model).
3. Install the DCM (with or without custom mounting bracket specific to the fixture – dependant on make/model of fixture). The DCM enclosure has mounting tabs that will accommodate up to a #10 screw. A #8 or #10 screw are recommended with a lock or star washer. Ideally, the mounting bosses or bracket will position the DCM directly underneath the NEMA receptacle when the fixture is closed.
4. Locate the 120-277VAC fixture supply wiring and terminal block. If the fixture wiring adheres to NEC standards, this will be a black/white conductor pair. Verify the intended power source is not switched by the photocontrol (not through the red conductor coming from the NEMA receptacle) rather is supplied directly from the black/white conductor pair coming directly from the field wiring terminal block.

This will be the location that supplies power to the DCM.

5. Determine the type of termination needed.
    1. If the field wiring terminal block is the only option, then typically ¼" QC male spade terminals are used (different fixtures may use different size terminals though). In this case, the matching female QC spade terminals must be installed (crimped) to the DCM power leads.
    2. Some fixtures may provide an auxiliary power connector. In this case, the matching type mating connector must be installed to the DCM power input (black and white) leads.
    3. Some fixtures may include tool-less quick connect terminations. These will require no additional hardware installation to support DCM provided there are open conductor slots available on terminations that include the wiring described in #4.
6. Terminate the black and white power supply wires on the DCM to the AC power source as appropriate for the type described above.

7. Locate the dimming driver/ballast 0-10V input wires (violet and grey) and determine the type of termination needed. If multiple drivers are present within the fixture, there will be multiple pairs of driver dimming inputs to terminate to the DCM output wires. The DCM can control up to 4 drivers in parallel.
    1. Typically, tool-less QC connectors are used, these will require no additional hardware to terminate the DCM control wires.
    2. Butt splices are also viable since the DCM output wires will be connecting only to the driver input wires. If used, ensure that the butt splice terminals are appropriately sized for #18AWG wire and have proper insulation for the specific fixture application.
8. Terminate the DCM 0-10V output (grey/violet) wires to the ballast/driver 0-10V input wires (grey//violet) assuring that like colors match.
9. Carefully route and wire tie/anchor all DCM wiring as needed to ensure that it cannot be pinch or stripped when the electronics enclosure or fixture access panel is closed.

Also try to avoid situations where the DCM wiring may come into direct contact with extreme heat sources such as LED heat sink assembly, etc. Carefully close the fixture while ensuring that no new wiring is pinched, stripped or disconnected while doing so.

10. DCM installation is complete. Different methods may be employed to electrically test the fixture or proof the wiring at this point. Due to differences in manufacturing processes, the remaining steps are included only as an example of possible fixture tests.
11. An AC power source can again be installed to the fixture at the field wiring terminal blocks if desired for fixture testing. Preferably, this is a switched source and it can be turned off during installation of the wiring to be made safe.
12. Install a shorting cap in the NEMA receptacle and apply power to the fixture.
13. When initially powered, the DCM will start at 50% dim command level (5V present on 0-10V output) and will stay that way for 4 seconds. After the 4 second period has elapsed, it will command the driver/ballast to

go to full brightness (100% level or 10V present on 0-10V output). A power meter inline with the fixture supply can validate that the observed Wattage consumption follows this pattern (roughly 50% rated Wattage for 4 seconds, then 100% full rated Wattage after the 4 seconds have elapsed). Refer to the specific fixture design specifications or manufacturer to determine the expected numbers for the installed driver/ballast and light engine at 5V and 10V dimming input commands to the driver.

Operating Instructions:
Controlled through ROAM/SSG "ROAM portal" server-based software. This software provides the following controls:
1. Fixture ON/OFF
2. Fixture dim to x% (0-100)
3. Display of fixture diagnostics (lamp out, low power consumed, voltage too high/low)

Direct control of the mesh radio is not provided to the ROAM portal operator.

2.4GHz Mod2/ UJX-DCM127-001 Modem User's Manual (not accessible to end-users).

1. Overview of the Radio Modem Hardware

The 2.4GHz Nivis Radio modem is an 802.15.4 wireless module that allows wireless communication using a standard asynchronous serial data stream. The pin-out of the Nivis radio modem is presented in the figure below.

Trace PIFA
RF SMA
Shield
Double row
90 deg bent
2mm
connector
Mounting
Holes for horizontal
orientation
1.47 in
1.90 in
1
2
17
18

A table of the radio modem pins is provided below, describing the purpose and functionality of the pins and the max voltage range on the pins.

Pin number Pin name Function of pin Nominal voltage/Max voltage
1 VCC Voltage supply 3.3 V 3.6 V
2 GND Ground pin 0 V 0 V
3 RST RESET, active low 3.3V 3.6V
4 BKGD DEBUG line 3.3 V 3.6 V
5 KBD5 PTA5, GPIO1, Interrupt capable 3.3 V 3.6 V
6 VREFH Voltage reference pin 2.5V 3.3 V
7 KBD7 PTA7, GPIO3, Interrupt capable 3.3 V 3.6 V
8 KBD6 PTA6, GPIO2, Interrupt capable 3.3 V 3.6 V
9 SCL SCL line of I2C bus 3.3 V 3.6 V
10 SDA SDA line of I2C bus 3.3 V 3.6 V
11 TXD2 TX line of UART 2 3.3 V 3.6 V
12 RXD2 RX line of UART 2 3.3 V 3.6 V
13 TXD1 TX line of UART 1 3.3 V 3.6 V

14 RXD1 RX line of UART 1 3.3 V 3.6 V
15 ADC2 PTB2, ADC input 3.3 V 3.6 V
16 ADC3 PTB3, ADC input 3.3 V 3.6 V
17 ADC1 PTB1, ADC input 3.3 V 3.6 V
18 ADC0 PTB0, ADC input 3.3 V 3.6 V

2. Operation of the Nivis Radio Modem

Communication with the NIVIS radio modem happens through serial port 2. The baudrate is set to be 19200, 8N1.

2.1. Getting started

Open a terminal software on a serial port with the above settings and connect to the RF modem. Any command is single line followed by enter command. Format of command is: command param1 param2 … <enter> At startup pushing the enter key a few times is necessary until the reception of the prompt string.

PTS Commands description:
1. Clear screen
a. **Description**: clear screen
b. **Command name**: "cls"
c. **Parameters:** None
d. **Ex:** cls<enter>
2. Help
a. **Description**: display commands list and a short description of each command
b. **Command name**: "help"
c. **Parameters:** None
d. **Ex:** help<enter>
3. Read ADC (ATD) channels
a. **Description**: read and display ADC channels values
b. **Command name**: "getadc"
c. **Parameters:** None
d. **Ex:** getadc<enter>
4. Get Modem SPI Register
a. **Description**: get value for a modem register (from page0)
b. **Command name**: "getreg"
c. **Parameters: 1**
- register ID: hex format
d. **Ex:** getreg 00<enter>
5. Set Modem SPI Register
a. **Description**: set value for a modem register (from page0)
b. **Command name**: "setreg"
c. **Parameters: 2**

- register ID: hex format
- register vlaue: hex format
d. **Ex:** setreg 20 80FF<enter>
6. Set Power Amplification value
a. **Description**: set value for a modem PA power (not persistent value)
b. **Command name**: "setpa"
c. **Parameters: 1**
- PA value: hex format
d. **Ex:** setpa FC<enter>
7. Set Modem Channel
a. **Description**: set value for a modem channel (not persistent value)
b. **Command name**: "setch"
c. **Parameters: 1**
- channel number: **decimal format**
d. **Ex:** setch 0<enter>
8. Set red LED value
a. **Description**: set red LED on or off
b. **Command name**: "setredled"
c. **Parameters: 1**
- Red led: 0 or 1
d. **Ex:** setredled 0<enter>
9. Set green LED value
a. **Description**: set green LED on or off
b. **Command name**: "setgreenled"
c. **Parameters: 1**
- Green led: 0 or 1
d. **Ex:** setgreenled 0<enter>
10. Put modem in IDLE state
a. **Description**: put modem in IDLE state
b. **Command name**: "idle"
c. **Parameters: None**
d. **Ex:** idle<enter>
11. Put modem in PULSE state
a. **Description**: put modem in pulse PRBS9 state
b. **Command name**: "pulse"
c. **Parameters: None**
d. **Ex:** pulse<enter>
12. Put modem in RX state
a. **Description**: put modem in RX state
b. **Command name**: "rx"
c. **Parameters: None**
d. **Ex:** rx<enter>
13. Put modem in RX echo state

a. **Description**: put modem in RX echo state (used for message success rate)
b. **Command name**: "rxecho"
c. **Parameters: 1 (but can missing)**
- Msg signature: hex format, default value 0xFF
d. **Ex:** rxecho<enter>

14. Calculate the TX message success rate
a. **Description**: Calculate message success rate
b. **Command name**: "txmsg"
c. **Parameters: 4 (but can missing)**
- Packet no: **decimal format**, default 100
- Delay (in ms): **decimal format**, default 100
- Packet len: **decimal format**, default 125
- Msg signature: hex format, default value 0xFF
d. **Ex:** txmsg 10<enter>

15. Put modem in TX not modulated state
a. **Description**: put modem in continuous TX not modulated state
b. **Command name**: "txnomod"
c. **Parameters: None**
d. **Ex:** txnomod<enter>

16. Put modem in TX modulated state
a. **Description**: put modem in continuous TX modulated state
b. **Command name**: "txmod"
c. **Parameters: None**
d. **Ex:** txmod<enter>

17. Read main info stored on EEPROM
a. **Description**: displays SN, max PA power, and VRef stored on EEPROM
b. **Command name**: "iic_read"
c. **Parameters: None**
d. **Ex:** iic_read<enter>

18. Clear EEPROM (except main info)
a. **Description**: Clear EEPROM except main info
b. **Command name**: "iic_erase"
c. **Parameters: None**
d. **Ex:** iic_erase<enter>

19. Write device SN on EEPROM
a. **Description**: Set device SN on EEPROM and clear rest of EEPROM
b. **Command name**: "iic_setsn"
c. **Parameters: 1**
- Device SN: hex format, up to 16 digits (8 bytes)
d. **Ex:** iic_setsn 4FC0<enter>

20. Write VRef on EEPROM
a. **Description**: Set VRef on EEPROM

b. **Command name**: "iic_setvref"
c. **Parameters: 1**
- Value VRef: **decimal format** (between 2450 and 2550)
d. **Ex:** iic_sevref 2500<enter>

21. Write max PA on EEPROM
a. **Description**: Set max PA on EEPROM
b. **Command name**: "iic_setpa"
c. **Parameters: 1**
- Max power hex format
d. **Ex:** iic_setpa FF<enter>

22. Set output pin in lo
a. **Description**: Set a pin as output and in lo state
b. **Command name**: "outlo"
c. **Parameters: 1**
- Pin definition: string: port and bit
d. **Ex:** outlo A5<enter>

23. Set output pin in hi
a. **Description**: Set a pin as output and in hi state
b. **Command name**: "outhi"
c. **Parameters: 1**
- Pin definition: string: port and bit
d. **Ex:** outhi A5<enter>

3. RF Exposure Limit Warning

To comply with FCC's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

4. Compliance Statement (Part 15.19)

This Device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

5. Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

2.4 GHz Mod2 Frequency Selection

The 2.4 GHz Mod2 is not frequency agile during run-time, but it can select an

unoccupied portion of the spectrum at startup. The series uses a set of channels as defined by the IEEE 802.15.4 / standards which span a range from 2405 to 2475 MHz with 5 MHz spacing between channels:

Center Frequency (MHz) Channel Designator Nominal Occupied BW
2405 11 (default) 2402.5-2407.5
2410 12 2407.5-2412.5
2415 13 2412.5-2417.5
2420 14 2417.5-2422.5
2425 15 2422.5-2427.5
2430 16 2427.5-2432.5
2435 17 2432.5-2437.5
2440 18 2437.5-2442.5
2445 19 2442.5-2447.5
2450 20 2447.5-2452.5
2455 21 2452.5-2457.5
2460 22 2457.5-2462.5
2465 23 2462.5-2467.5
2470 24 2467.5-2472.5
2475 25 2472.5-2477.5

The channel mask is the name used to describe the list of frequency channels that a radio can use. The default channel mask for client radios allows them to operate on any frequency from 2405 to 2475 MHz.