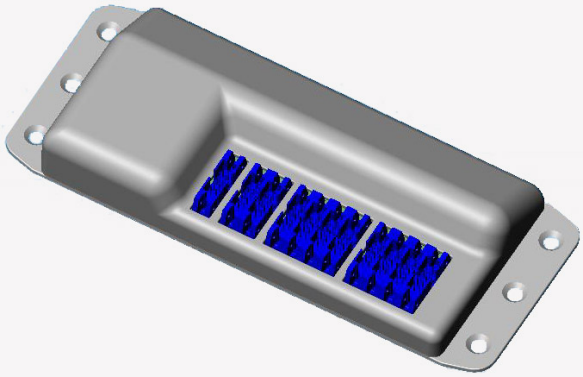
Rosstech

Digital Control Unit
LED Light Controller
for 2007 Production

Software Notes, Testing
and Operations Documentation



Contact: Rob Love, Rosstech Engineering

2 versions of software and hardware are required for 2007 production.

Sundance DCU-6560-131, SD-880 Series, PN 6560-131
2007 Features inlcude:

- Zone 3(1), RGBW, 4-O/Ps, Exterior
- Zone 2, RGB, 4-O/Ps, Top Side and waterfeature lights
- Zone 1(3), RGB, 2-O/Ps, Interior, underwater lighting
- 3 Button Auxiliary control panel functionality
- Single AC ON/OFF mode from the main control panel, to SW AC I/P
- Photocell enabled
- Temp probe and RF output enabled
- Music feature, not implemented

Jacuzzi DCU-2560-131, Jac-J300/J400 and SD-780 series, PN 6560-132/2560-131
The feature list includes all of the above features with 2 changes,

- 2 Button Auxiliary control panel functionality
- No SW AC input control, constant 12vAC power only, all operations are handled from the AUX panel.

Software Features to implement and Basic Operational Guidelines:

The original software design is based on the 2005/2006 version of the DCU-6600 Atmel processor software application. Basic operational features are very similar.

Bryan Huff has supplied a chart for the modes of operation he would like to see included for both a Jacuzzi and Sundance version of the code.

Basic Mode changes for the Standard 8 Modes are listed as per Bryan Huffs Excel Spreadseet chart, which will be included later in this document. The 5th draft rcvd Nov 14/06, has since been implemented in the Nov 27/06 final production code.

There are 5 hidden modes on both the Jacuzzi and Sundance DCU.

Standard Modes are all available with the use of the AUX Mode button only, both versions.

Hidden Modes are available, if the lights are already ON, with a "Push and Hold" of the AUX button for 3 seconds, this will get you the first hidden mode, an additional Mode button press (short duration) will move to the next hidden mode and so on. A 5th push of the Mode Btn will get back to the standard modes of operation at the beginning of the sequence.

A standard 2 Hr timeout is on all standard and hidden modes.
(** Question: can we make one of the hidden modes disregard the timeout for showroom operation**)

New Features Controls added for this DCU

The Photocell feature and Default Mode
The Exterior Zone 3(1) will operate on photocell control.
ON during the night, OFF during the day, Exterior Zone3(1) only.
When no photocell is installed the exterior lights and iPOD white lights will be ON all the time.
If the Photocell Pins are shorted (jumpered) the lights will never be on, always OFF
**Note: A 10 second delay has been implemented in v1.40 software (Nov27/06) as per Charlie B. and Bryans 5th draft of the requested mode.

The "default" colour mode will be initiated whenever the DCU is not in operation, so not turned on from the AUX panel or the SW AC input.

To set/store the default colour mode:
With the interior lighting turned OFF (all lights off except the exterior on photocell control)
Simply "Push and Hold" the Mode button for 3 seconds. Upon release of the button, a new mode will be selected, "Push and Hold" again for another 3 seconds to select the next default mode. Each "Push and Hold" button press will cycle through the STD mode list.

Once a default mode is selected it will be remembered until the DCU power (tub power) is removed.

Intensity of the default mode is not controlled.

Temperature Probe and RF LCD Status Monitor
The DCU contains an RF transmitter, operating at 433.92MHz, it has a periodic transmission of temperature data for a separate battery operated wireless LCD Status monitor.
The intention is that the Status monitor can sit in a consumer's kitchen and have relaitvely up to date information (approx. 15 minute intervals) on the status of the hot tub temperature in the backyard. This should aid in the ability to determine if a circuit breaker has popped or a tub is shut-down, especially during the critical cold winter months, where a freeze up would cause major disasters.

The DCU transmits an updated temperature every 11 seconds.

"Unique ID"
Each DCU will have a Unique ID so it can transmit its code and not interfere with a neighbours LCD unit. There are 65,560 different combinations (0xFFFF), with 0xDEAD being an R&D test case.

"Offset"
Each DCU has a transmission delay upon startup based on the unique ID, this should enable tubs in the neighbourhood, that start at the same time, possibly after a power blackout, a chance to receive a clear transmission and not have 2 tubs broadcast at the same time. (16 variations, 1 second each)

The LCD Status monitor will need to "Bond" to the unique ID of it's respective DCU.

This is a one time procedure and does not need to be repeated for battery changes.

The DCU code must be able to be told to send the "Bond" command, while the LCD Status monitor is in a "listening" for a "Bond" code, and cannot pickup a random transmission from a different tub.

To send the "Bond" command from a DCU, it must be available during any operation status (lights on or off, 2 hr timeout On or off, AC On or Off for Sundance)
"Press and Hold" the Intensity button for 5-seconds (There is only 1 on Jacuzzi so it must be that one)

The DCU will broadcast it's "Bond" command for a period of 4-minutes along with it's temperature transmission. Any LCD (with it's batteries freshly inserted within 20-minutes) listening during this procedure, will be bonded to this DCU, if it does not receive it's own tranmission first.

The DCU, as long as it is powered, regardless of it's lighting status (ON or OFF), will send a periodic transmition of its temperature. (approx every 11 seconds, for a 0.11mS 4680 baud, packet)

The actual baud rate and transmission scheme is as follows:
All packets with a 1 start bit, 0 stop bits and odd parity
11 bits/byte, 55 byte packet
(1) Sync byte and type of transmission (Bond or Temp)
(2) ID, with LSB first and inverted for Linx modules
(1) Temp packet in degrees F only now, as of v1.40
(1) CHKSM

Temperature Probe Input
The first specification for the Temperature probe to be used was the US Sensor Corp Probe.
Sundance Part # 6600-144, now changed to the GE version DC95H303W, as per Tony S.
The DCU is to be made to read the values of this probe with a provided R/T temperature curve chart.
The DCU hardware is currently set to have the Resistive thermocouple to operate from the +5v line to the IC analog input pin, with a 18K resistor used to linearalize the termocouple for the intended range. When a thermocouple is not installed the pin will be pulled to GND.
The LCD Status Display will read "Lo" when no probe is installed or the thermocouple cable is broken.

Upper and Lower Limits are currently set to 55F-115F, or 13C-46C. Above or below that limit will display "Hi" or "Lo".

"Data Transmission", (4680 Baud, 8,0,1)
Data is transmitted approx every 11 seconds.
Initial data time is offset based on the inuque ID of the DCU, so all transmissions will not be happening at the same time after a power failure.
Consists of: Sync Byte and command type(1), Unique ID Word (2), Temp (1), CHKSM(1).

"**Bond**" transmisstion: (4680 Baud, 8,0,1)
Sent after a 3 second intensity button push
transmission packcet is sent for 4 minutes upon regular 11 second intervals
Consists of: Sync Byte and command type(1), Unique ID Word (2), Temp (1), CHKSM(1).

The Music Option (not operational for the 2007 production year)

The music option will have to have some hardware additions (space available on the PCB already) for a stereo or mono music input.

In the future this will allow the lighting to functionally "beat" with the music. Either on a simple Low frequency beat (drums, base etc) or on a 3 frequency spectrum of highs, mediums and lows for different colours to different beats.

Brief Software Testing Checklist

Intensity Controls	- Interior / Exterior Zones (Jacuzzi 1 zone only)
	- High, Med, Low, Off
Modes	- 10 Standard modes
	- Resets to Mode 1 after 5 seconds of Lights OFF
AC Input	- With all modes, and all intensities
	- test intensity controls with SW AC ON/OFF
	- Sundance only, Jacuzzi test for non-functional AC
Hidden Modes	- 5 hidden modes
	- resets to Standard Mode 1 after lights off
Exterior 'default' modes	- Press and hold mode button
Photocell control	- 10 second delay on change, start right away on lights OFF
Temp Output	- 11 second output
	- Bond command by push and hold of correct intensity button
Unique ID	- Test for unique ID update for LCD Status Monitor
2 Hour Timeout	

LCD Status Monitor Basic Software Specification and Operation

LCD code operation:

Batteries are inserted, waits for a 20 minute period for new "Bond" command
Flashes green if it already has a unique ID number in memory.

Displays -- (2 dashes). Once the unit receives an update or the "Bond" command, it will display the current temperature.

Wakes up listens for signal:
rcvs signal
checks timing value
displays temp value
changes status to flash green (which is the same as previous?)

if no signal is rcvd after 34 seconds, go to sleep wait for 15 minutes, lsiten for signal for 34 seconds.

Change status LED to flash RED if it misses 2 updates (30 minutes)

Change the display to remove the temperature reading and display -- , after 2 additional losses of signal (total time 1Hr)

Continues to flash Red with no display, until a return of the signal or the battery dies.

If the signal returns (ie: after power failure),
changes status LED to flash green
Displays Temp

Test condition:
A new LCD unit that is not "Bonded" to a unique ID will always recognize and display a temperature from a unique ID of 0xDEAD for test purposes.

LCD Status Monitor Point Form Installation and Operation Notes

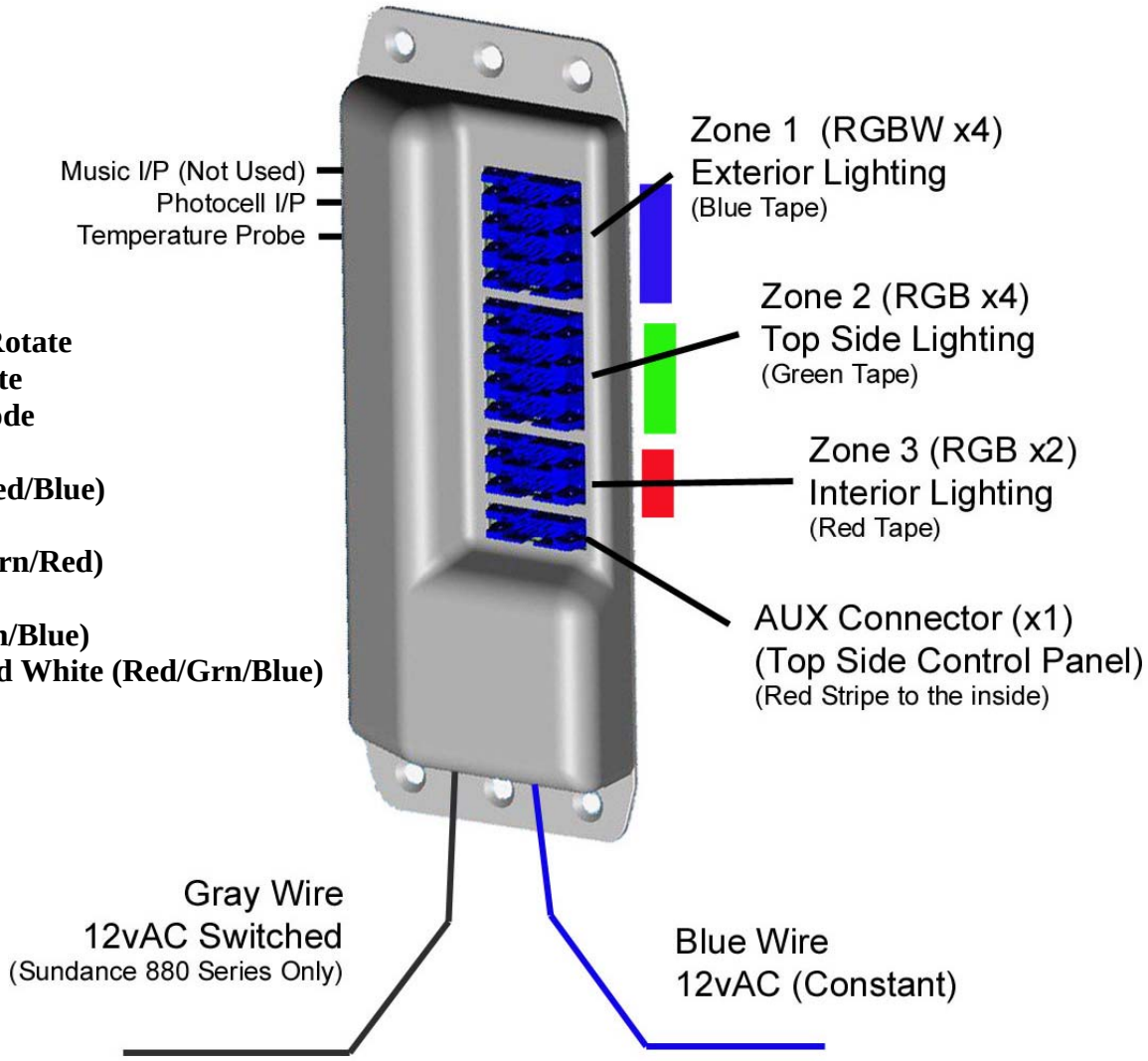
- Remove unit from packaging
- Remove 2 screws from back cover
- Monitor is factory set to indicate degrees in Fahrenheit, for Celsius display, move the small black jumper (located on a 3-pin header below the battery housing) from the left two pins to the right two pins.
- Insert 3 x "AAA" batteries (Alkaline or Lithium recommended)
- Replace the cover and screws
- First time installing batteries:
    - Set the Status Monitor on or near the hot tub
    - Within 15 minutes of installing the batteries, on the hot tub lighting controls, press and hold the light intensity button (*waterfall intensity on SD 880 series*) for 10 seconds to **'bond'** the receiver.
    - Within 1 minute of bonding, the display will update with a temperature indication and the LED indicator will start flashing green every 15-30 seconds.
- Future battery changes – simply replace ALL 3 BATTERIES and allow the unit time to receive several updates (30 minutes to 1 hour)
- If unit does not appear to update properly (after 1 Hr)
    - Ensure the tub is powered properly.
    - Move the unit closer to the tub to ensure it receives an update.
    - It is recommended to wait for 1Hr to ensure reception of several updates.
- Effective range is approx 150 ft in clear line of sight. Each obstacle (ie. wall, fence, window, pet, family member) will decrease this range. Range can also be affected by battery condition.
- If the unit indicates 'Lo' with no temperature units displayed, it could be indicating a problem with the thermocouple connection to the Lighting Controller.
- You may reverse the stand included on the back of the unit to make it a desk top unit.
    - Squeeze the arms at the top of the stand together to release it from the housing.
    - Reverse the stand and re-install the arms, forming a tripod stand.

2007 Sundance DCU-706 Document

Includes Software, Operations and Final Testing Procedure

Current Mode List Summary:
(Sundance 6560-131 and Jacuzzi 2560-131 modes are identical as of 5th draft requests, Nov 27/06)

Mode 1 – Medium Rotate
Mode 2 – Slow Rotate
Mode 3 – Freeze Mode
Mode 4 – Blue
Mode 5 – Purple (Red/Blue)
Mode 6 – Red
Mode 7 – Amber (Grn/Red)
Mode 8 – Green
Mode 9 – Aqua (Grn/Blue)
Mode 10 – Simulated White (Red/Grn/Blue)



Hid-Mode 1 – Very Fast Rotate
Hid-Mode 2 – Mixed Slow Rotate, Topside different then Interior and Exterior
Hid-Mode 3 – Mixed Slow Rotate, All zones different
Hid-Mode 4 – Mixed Fast Rotate, Topside different then Interior and Exterior
Hid-Mode 5 – Mixed Fast Rotate, All zones different

-Mode setting resets to Mode 1 after lights being off for 5 seconds.
-Hidden-Mode settings reset back to standard modes as soon as lights are turned off.

Final Test Procedure: 6560-131
Sundance 2-Wire Systems, while in the Blue Boxes

Connect DCU Blue and Gray Wire	Observe for Blue lights
Connect Lights	
Observe for Zone 1	Observe for Red/Blue/White on Exterior Zone 1
Install photocell	
Press Intensity Button 1	Observe Lights on Zone 3 and White still on
Press Intensity Button 2	Observe Lights on Zone 2, 3 and White still on
Press Mode Button	Press the Mode button a couple of times, Observe for Solid **Blue**, all 3 zones, and **White** Press Mode 2 more times, observe Solid **Red**, all 3 zones, and **White** Press Mode 2 more times, observe Solid **Green**, all 3 zones and **White** observe **White** light should not turn off or dim during mode changes
Press AC ON/OFF	The lights will remain ON for the first push then go completely out for the second button push. Make sure the Exterior Zone 1 Lights are off, if the photocell is installed
Visual for Temp Cal	Visual for temperature calibration written on the board from the initial test
Visual DCU	Pass to next step for packaging Install FCC and Part # label Count the screws installed General inspection

* Notes:

The Mode setting will reset to the beginning of the Mode list after the lights being off for more then 5 seconds.

Final Test Procedure: 2560-131
Jacuzzi Single Wire Systems, while in the Blue Boxes

Connect DCU Blue Pwr Wire	Observe for Blue lights
Connect Lights	
Observe for Zone 1	Observe for Red/Blue/White on Exterior Zone 1
Install photocell	
Press Intensity	Observe Lights on Zone 1, 2, 3 and White still on
Press Mode Button	Press the Mode button a couple of times, Observe for Solid **Blue**, all 3 zones, and **White** Press Mode 2 more times, observe Solid **Red**, all 3 zones, and **White** Press Mode 2 more times, observe Solid **Green**, all 3 zones and **White** observe **White** light should not turn off or dim during mode changes
Press Intensity	Press Intensity observe for change from High to Med, to Low, to OFF With Photocell plugged in (step 4) there should be NO LIGHTS on Zone 1
Visual for Temp Cal	Visual for temperature calibration written on the board from the initial test
Visual DCU	Pass to next step for packaging Install FCC and Part # label Count the screws installed General inspection

* Notes:

Jacuzzi 2560-131 programming, has **2 Button** control panel.

All 3 zones will always work in sequence with each other, unless the "Hidden Modes" are selected.

Jacuzzi 2560-131 does not have a switched AC input. (Grey wire)

The Mode setting will reset to the beginning of the Mode list after the lights being off for more then 5 seconds.

2007 Sundance DCU-706 Document

Includes Software, Operations and Final Testing Procedure

DCU-706, Digital LED Lighting Control Unit, 2007 Production

Electrical

Input……..12vAC, ±2vAC (10-14vAC)
Blue, 18 awg PVC jcktd wire
Power Consumption……...0.8A typ. max.
SW 12vAC input control (optional)……...12vAC, ±4vAC (8-16vAC)
SW 12vAC input power consumption……<0.01A, isolated I/P
Grey, 22awg PVC jcktd wire

Inputs

AUX Control Input.....10-Pin Male Header, for up to a 4-Btn AUX Control panel
In Circuit Programming..(via the AUX cnctr)...10-Pin Male Header, 5-pins rqrd
Temp Probe Input.....GE thermocouple, 30K ohms at 25C
Molex/Amp 2-Pin 0.100" male header
Photocell Input.....CDS Photocell, 5K Dark, >100K Bright
Molex/Amp 2-Pin 0.100" male header
Music Input.....(Not used at this time)

Outputs

3 Zones of LED Lighting Control Outputs
Zone 1* – Exterior, 4-10-Pin male headers, RGBW LED control
Zone 2 – Top Side Zone, 4-10-Pin male headers, RGB LED control
Zone 3* – Interior Zone, 2-10-Pin male headers, RGB LED control
*Note, initial Zone markings are opposite on plastic DCU boxes, as per the PCB and documentation reference.

**** LED outputs are for use with Rosstech LED accessory lighting applications only ****

1. FCC Information to Users @ FCC 15.21 & 15.105

Compliance Statement

Warning: Changes or modifications not expressly approved by Rosstech Signals Inc. could void the user's authority to operate the equipment

This equipment has been tested and found to comply with the limits for a Class B digital devices, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Revision Notes and History Page

Revision Notes and History

Notes and Changes	Date	Initials	Rev #
Initial Document creation	Sep 26/06	RL	1.0
Operation software updates	Oct 17/06	RL	1.1
Show operation changes	Oct 20/06	RL	1.2
Nov – Production code changes	Nov 15/06	RL	1.3
Nov – FCC changes for packet information	Nov 22/06	RL	1.4
Nov – 5th draft Sundance mode changes implemented	Nov 27/06	RL	1.5
Added software check list	Dec 11/06	RL	1.6
New Processor notes, CY8C27443-24PVXI, New Tx2000 RF Module	Feb 19/07	RL	1.7
Updated LCD info for v40 s/w, broadcast F only, displays 'Lo' no probe inst.	Feb 23/07	RL	1.8
Added the FCC Information to Users	Mar 13/07	RL	1.9