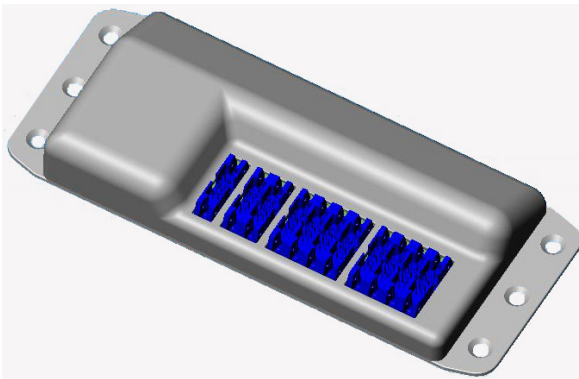


Rosstech
Digital Control Unit
LED Light Controller
for 2007 Production

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 include:

- 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 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 (jumped) 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 relatively 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 transmission first.

The DCU, as long as it is powered, regardless of it's lighting status (ON or OFF), will send a periodic transmission 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 linearize the thermocouple 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" transmsstion: (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	

RF Transmission Section

The RF transmission section is based on Spectron Electronics Inc. TX2000 design. The RF section is used as periodic data transfer. It is comprised of compact surface-mount components. The TX2000 transmitter utilizes a highly-optimized SAW architecture. It allows wireless transmission, capable of transferring serial data at distances of 150 feet clear line of sight. The antenna is a PCB trace incorporated into the PCB board.

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Supply Voltage VCC	-0.3 to +6.0 VDC
Any Input or Output Pin	-0.3 to VCC VDC
Operating Temperature	-30 to +70 °C
Storage Temperature	-45 to +85 °C
Soldering Temperature	+225°C for 10 seconds

TX2000 Transmitter Specifications

Operating Voltage VCC	2.7 – 5.2 VDC
Supply Current ICC	10.0 mA
Power-down Current	1.5 μ A
Transmit Frequency:	433.92 MHz
Center Frequency Accuracy	– +50 kHz
Output Power	< 1 mW
Harmonic Emissions	-40 dBc
Data Rate	100 – 5,000 bps

RF Output Impedance	50 Ω
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Theory of operation

The TX2000 transmitter transmits data using Carrier-Present Carrier-Absent (CPCA) modulation. This type of AM modulation is often referred to by other designations, including Continuous Wave (CW) and On-Off Key (OOK). This type of modulation represents a logic low '0' by the absence of a carrier and a logic high '1' by the presence of a carrier. The TX2000 transmitter is based on a simple but highly optimized architecture that achieves a high fundamental output power with low harmonic content. The TX2000 transmitter is exceptionally stable over time. Due to the accuracy of the SAW device, most of the output power is concentrated in a narrow bandwidth.

A CMOS / TTL level data input is provided on Pin 2. This line is normally supplied with a serial bit stream input directly from a microprocessor. During standby, or the input of a logic low, the carrier is fully suppressed and the transmitter consumes less than 2 μ A of current. During a logic high, the transmitter generates a carrier to indicate to the receiver the presence of a logic '1'.

TX2000 RF section does not encode or packetize the signal content in any manner. The received signal will be affected by such factors as noise, edge jitter, and interference, but it is not purposefully manipulated or altered by the module.

1. FCC Information to Users @ FCC 15.21 & 15.105

For Class B Unintentional Radiators:

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:

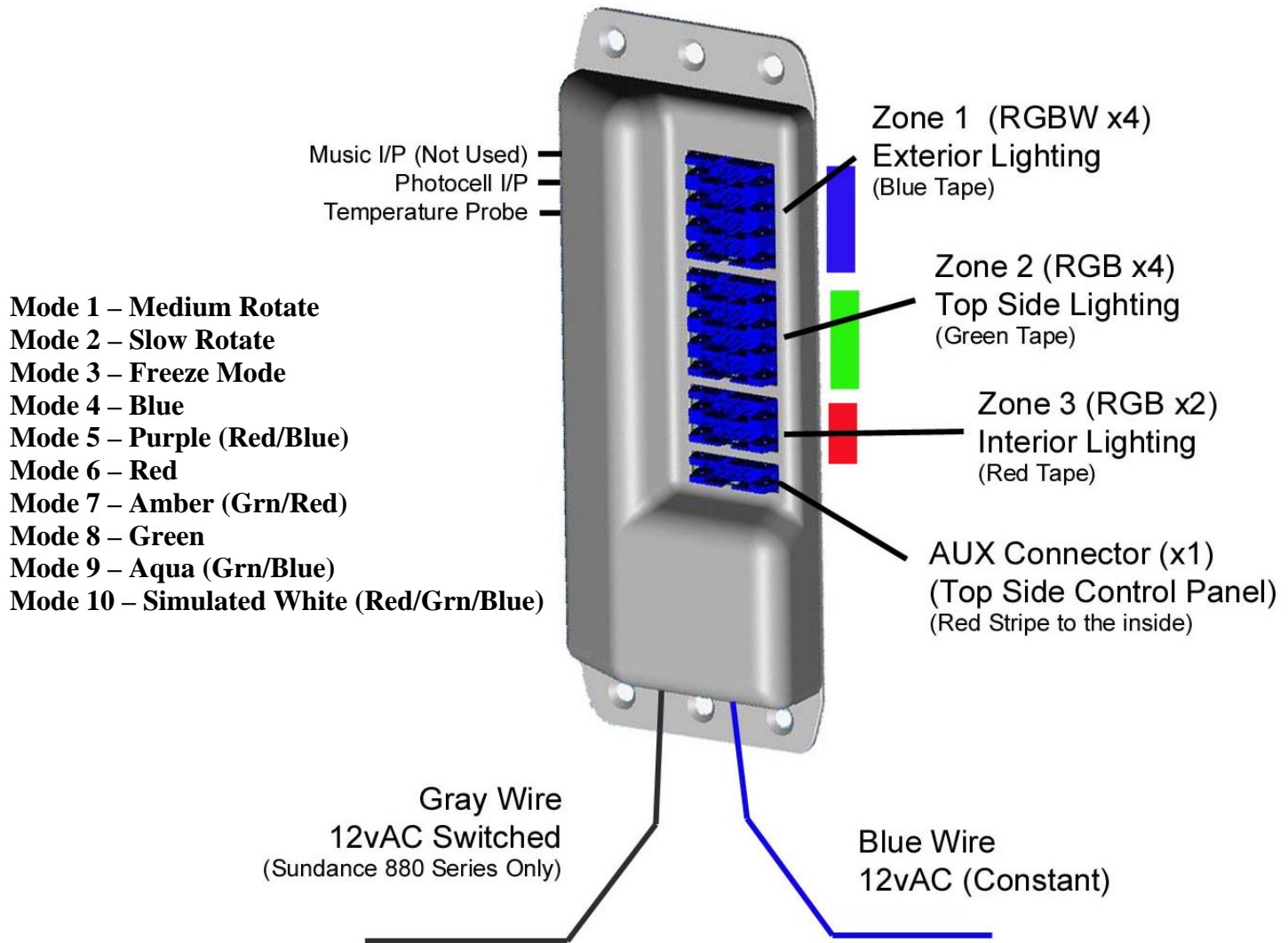
- *Reorient or relocate the receiving antenna*
- *Increase the separation between the equipment and receiver*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

2. Warning to Users @ FCC 15.21 & 15.105

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

Current Mode List Summary:

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



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.

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

Electrical

Input.....	12vAC, ± 2 vAC (10-14vAC) Blue, 18 awg PVC jcktd wire
Power Consumption.....	0.8A typ. max.
SW 12vAC input control (optional).....	12vAC, ± 4 vAC (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 ****

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
Add FCC warning and notes to document	Mar 13/07	RL	1.9