

# LightSwarm

## 16 Channel High-Current Lighting Controller

## LS-D16P3000



**The LS-D16P3000 is a microprocessor controlled 16 channel high-current lighting system designed to control LED and incandescent lighting in architectural models, exhibitions displays, and any environment requiring multiple channels of independently controlled lighting.**

The **LS-D16P3000** has been specifically designed to drive high current lighting loads, such as long strings of flexible LED lighting strips. Each of the 16 channels can simultaneously drive loads of up to 3 Amps at 12 volts. Combinations of different LED types can be connected to the same module, including conventional white LEDs, colored LEDs, and RGB LEDs. Incandescent lighting can also be used. The outputs can also be used to drive electromechanical and solid state relays, and other devices that require a 12 Volt signal to operate.

The **LS-D16P3000** is a member of the LightSwarm family of modules. LightSwarm modules share a common communication bus that allows multiple devices to be controlled easily by one or more master stations.

Commands sent to the module control the turning on and off of channels, setting the brightness level, commencing automatic fade-up and fade-down sequences, and other effects. Each channel can be programmed with pseudo-addresses that allow a

- 16 Channel LED lighting controller for models and exhibition displays.
- Remote control of individual channels including programmable brightness and timed fade sequences.
- Each channel can drive 3 Amps at 12 volts
- LED status indicators for each channel.
- Multiple modules can be daisy-chained together to control thousands of lights.
- Modules can be mixed with other devices that support the LightSwarm protocol.
- Industrially designed for mounting inside models and displays.
- Modules can be remotely controlled and distributed around large display suites.
- Can be controlled from PCs, handheld keypads, and other devices.

channel to take on multiple identities. This allows one command to be received and activated by many channels distributed across multiple modules.

Brightness control is achieved using Pulse Width Modulation (PWM). PWM is a technique whereby the outputs are turned on and off at high speed. The longer the time that the channel is off, the lower the apparent brightness. The switching frequency is higher than the eye can perceive, and therefore gives the appearance that the light is on continuously, but at a lower brightness level.

Other members of the LightSwarm family include programmable wireless keypads that can control complex lighting effects from the touch of a button, wired keypads, audio playback modules, and USB interfaces for PC touch screen displays. A range of cable management solutions is also available, simplifying the construction of models and displays when large numbers of lighting channels are used.

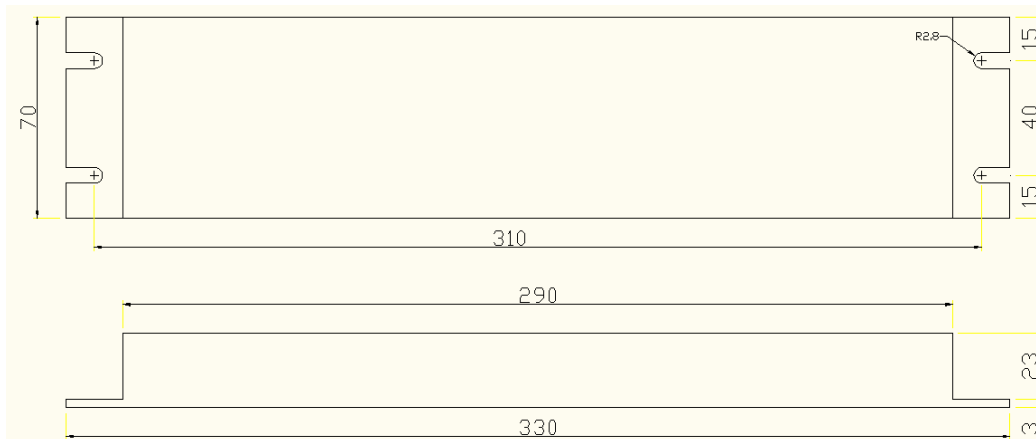
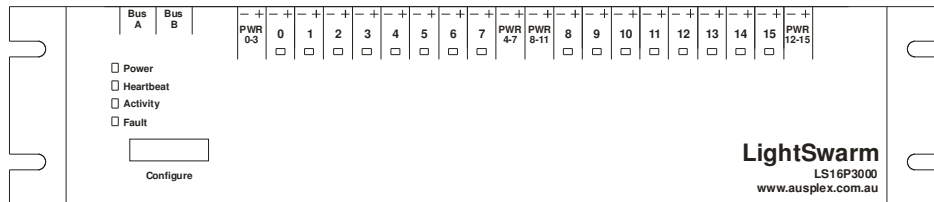
## Technical Details

Number of channels:	16
Operating Voltage:	12 volts DC nominal (10 to 14 volts DC)
Maximum current per channel:	LED: 3 amps at 12 volts DC (36 watts) Incandescent: 2 amps at 12 volts DC (24 watts)
Power Consumption (internal electronics):	250mA (sourced from channels 0-3 power input)
Power Configuration:	4 power supply inputs, one for each group of 4 channels
Power Protection:	4 x in-line blade fuse holders supplied.
Pulse Width Modulation:	256 steps, 150 Hz
Fade Control:	Fade up/down to level with 1/100 second steps
Switching:	Low-Side switching (common positive rail)
Dimensions:	(W) 310mm x (H) 70mm x (D) 26mm
Interface:	2 x RJ25 LightSwarm bus interfaces 40 x plug and socket screw terminals
LightSwarm Bus baud rate:	9600, 38,400 and 128,000 bps
Construction:	Black anodized 3mm mounting plate and fascia.
Indicators:	16 LEDs show status of each channel LEDs for power indication, heartbeat, bus activity, and fault
Number of pseudo-addresses:	64 per channel

## Shipping Contents

Each **LS-D16P3000** is supplied with 40 screw terminal plugs (5 x 8 plugs), 4 in-line fuse assemblies, a selection of fuses, and a LightSwarm bus interface cable.

## Mechanical Layout



## LightSwarm bus

The LightSwarm bus is a 4 wire interface that multiple LightSwarm modules connect to for communications purposes. A bus will typically have one or more master devices (e.g. a handheld keypad), and one or more slave devices such as a LS-D16P3000 lighting controller.

The bus is physically similar to modular connectors used on telephone systems. The electrical levels are RS485 compliant. The protocol is a propriety protocol designed specifically for architectural and lighting display systems. It is a highly efficient and simple protocol, minimizing the overheads required by master devices. Most programmers familiar with Visual Basic would be able to create kiosk style touch screen controllers that interface to the bus.

## Addressing

The LS-D16P3000 occupies 16 addresses within the protocol address range. A DIP switch sets one of 256 base addresses that range from 0 to 4,080. The channel address is calculated by adding the channel number to the base address. For example, if the base address is set to 240, then the addressable range for a 16 channel module is 240 to 255. Therefore, up to 256 LS-D16P3000 LightSwarm modules can co-exist in a single system, providing 4,096 lighting channels, without overlapping addresses.

Combinations of different types of LightSwarm modules can share the same bus, extending the number of available channels to much higher levels.

## LightSwarm Commands

The LS-D16P3000 supports the following LightSwarm protocol commands:

MDP_ON	Set channel on
MDP_OFF	Set channel off
MDP_LEVEL	Set channel level
MDP_FADE	Set channel fade
MDP_PADDSET	Set channel pseudo address
MDP_PADDERASE	Erase channel pseudo address table

# Configuration Switch Settings

Address Switch (Switch 1 to 8)

C = Closed (or "ON"), O = Open

Switch Number	Address	Switch Number	Address	Switch Number	Address	Switch Number	Address
1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8	
O O O O O O O O	0 to 15	O O O O O O O O	1024 to 1039	O O O O O O O O	2048 to 2063	O O O O O O O O	3072 to 3087
O O O O O O O O	16 to 31	O O O O O O O O	1040 to 1055	O O O O O O O O	2064 to 2079	O O O O O O O O	3088 to 3103
O O O O O O O O	32 to 47	O O O O O O O O	1056 to 1071	O O O O O O O O	2080 to 2095	O O O O O O O O	3104 to 3119
O O O O O O O O	48 to 63	O O O O O O O O	1072 to 1087	O O O O O O O O	2096 to 2111	O O O O O O O O	3120 to 3135
O O O O O O O O	64 to 79	O O O O O O O O	1088 to 1103	O O O O O O O O	2112 to 2127	O O O O O O O O	3136 to 3151
O O O O O O O O	80 to 95	O O O O O O O O	1104 to 1119	O O O O O O O O	2128 to 2143	O O O O O O O O	3152 to 3167
O O O O O O O O	96 to 111	O O O O O O O O	1120 to 1135	O O O O O O O O	2144 to 2159	O O O O O O O O	3168 to 3183
O O O O O O O O	112 to 127	O O O O O O O O	1136 to 1151	O O O O O O O O	2160 to 2175	O O O O O O O O	3184 to 3199
O O O O O O O O	128 to 143	O O O O O O O O	1152 to 1167	O O O O O O O O	2176 to 2191	O O O O O O O O	3200 to 3215
O O O O O O O O	144 to 159	O O O O O O O O	1168 to 1183	O O O O O O O O	2192 to 2207	O O O O O O O O	3216 to 3231
O O O O O O O O	160 to 175	O O O O O O O O	1184 to 1199	O O O O O O O O	2208 to 2223	O O O O O O O O	3232 to 3247
O O O O O O O O	176 to 191	O O O O O O O O	1200 to 1215	O O O O O O O O	2224 to 2239	O O O O O O O O	3248 to 3263
O O O O O O O O	192 to 207	O O O O O O O O	1216 to 1231	O O O O O O O O	2240 to 2255	O O O O O O O O	3264 to 3279
O O O O O O O O	208 to 223	O O O O O O O O	1232 to 1247	O O O O O O O O	2256 to 2271	O O O O O O O O	3280 to 3295
O O O O O O O O	224 to 239	O O O O O O O O	1248 to 1263	O O O O O O O O	2272 to 2287	O O O O O O O O	3296 to 3311
O O O O O O O O	240 to 255	O O O O O O O O	1264 to 1279	O O O O O O O O	2288 to 2303	O O O O O O O O	3312 to 3327
O O O O O O O O	256 to 271	O O O O O O O O	1280 to 1295	O O O O O O O O	2304 to 2319	O O O O O O O O	3328 to 3343
O O O O O O O O	272 to 287	O O O O O O O O	1296 to 1311	O O O O O O O O	2320 to 2335	O O O O O O O O	3344 to 3359
O O O O O O O O	288 to 303	O O O O O O O O	1312 to 1327	O O O O O O O O	2336 to 2351	O O O O O O O O	3360 to 3375
O O O O O O O O	304 to 319	O O O O O O O O	1328 to 1343	O O O O O O O O	2352 to 2367	O O O O O O O O	3376 to 3391
O O O O O O O O	320 to 335	O O O O O O O O	1344 to 1359	O O O O O O O O	2368 to 2383	O O O O O O O O	3392 to 3407
O O O O O O O O	336 to 351	O O O O O O O O	1360 to 1375	O O O O O O O O	2384 to 2399	O O O O O O O O	3408 to 3423
O O O O O O O O	352 to 367	O O O O O O O O	1376 to 1391	O O O O O O O O	2400 to 2415	O O O O O O O O	3424 to 3439
O O O O O O O O	368 to 383	O O O O O O O O	1392 to 1407	O O O O O O O O	2416 to 2431	O O O O O O O O	3440 to 3455
O O O O O O O O	384 to 399	O O O O O O O O	1408 to 1423	O O O O O O O O	2432 to 2447	O O O O O O O O	3456 to 3471
O O O O O O O O	400 to 415	O O O O O O O O	1424 to 1439	O O O O O O O O	2448 to 2463	O O O O O O O O	3472 to 3487
O O O O O O O O	416 to 431	O O O O O O O O	1440 to 1455	O O O O O O O O	2464 to 2479	O O O O O O O O	3488 to 3503
O O O O O O O O	432 to 447	O O O O O O O O	1456 to 1471	O O O O O O O O	2480 to 2495	O O O O O O O O	3504 to 3519
O O O O O O O O	448 to 463	O O O O O O O O	1472 to 1487	O O O O O O O O	2496 to 2511	O O O O O O O O	3520 to 3535
O O O O O O O O	464 to 479	O O O O O O O O	1488 to 1503	O O O O O O O O	2512 to 2527	O O O O O O O O	3536 to 3551
O O O O O O O O	480 to 495	O O O O O O O O	1504 to 1519	O O O O O O O O	2528 to 2543	O O O O O O O O	3552 to 3567
O O O O O O O O	496 to 511	O O O O O O O O	1520 to 1535	O O O O O O O O	2544 to 2559	O O O O O O O O	3568 to 3583
O O O O O O O O	512 to 527	O O O O O O O O	1536 to 1551	O O O O O O O O	2560 to 2575	O O O O O O O O	3584 to 3599
O O O O O O O O	528 to 543	O O O O O O O O	1552 to 1567	O O O O O O O O	2576 to 2591	O O O O O O O O	3600 to 3615
O O O O O O O O	544 to 559	O O O O O O O O	1568 to 1583	O O O O O O O O	2592 to 2607	O O O O O O O O	3616 to 3631
O O O O O O O O	560 to 575	O O O O O O O O	1584 to 1599	O O O O O O O O	2608 to 2623	O O O O O O O O	3632 to 3647
O O O O O O O O	576 to 591	O O O O O O O O	1600 to 1615	O O O O O O O O	2624 to 2639	O O O O O O O O	3648 to 3663
O O O O O O O O	592 to 607	O O O O O O O O	1616 to 1631	O O O O O O O O	2640 to 2655	O O O O O O O O	3664 to 3679
O O O O O O O O	608 to 623	O O O O O O O O	1632 to 1647	O O O O O O O O	2656 to 2671	O O O O O O O O	3680 to 3695
O O O O O O O O	624 to 639	O O O O O O O O	1648 to 1663	O O O O O O O O	2672 to 2687	O O O O O O O O	3696 to 3711
O O O O O O O O	640 to 655	O O O O O O O O	1664 to 1679	O O O O O O O O	2688 to 2703	O O O O O O O O	3712 to 3727
O O O O O O O O	656 to 671	O O O O O O O O	1680 to 1695	O O O O O O O O	2704 to 2719	O O O O O O O O	3728 to 3743
O O O O O O O O	672 to 687	O O O O O O O O	1696 to 1711	O O O O O O O O	2720 to 2735	O O O O O O O O	3744 to 3759
O O O O O O O O	688 to 703	O O O O O O O O	1712 to 1727	O O O O O O O O	2736 to 2751	O O O O O O O O	3760 to 3775
O O O O O O O O	704 to 719	O O O O O O O O	1728 to 1743	O O O O O O O O	2752 to 2767	O O O O O O O O	3776 to 3791
O O O O O O O O	720 to 735	O O O O O O O O	1744 to 1759	O O O O O O O O	2768 to 2783	O O O O O O O O	3792 to 3807
O O O O O O O O	736 to 751	O O O O O O O O	1760 to 1775	O O O O O O O O	2784 to 2799	O O O O O O O O	3808 to 3823
O O O O O O O O	752 to 767	O O O O O O O O	1776 to 1791	O O O O O O O O	2800 to 2815	O O O O O O O O	3824 to 3839
O O O O O O O O	768 to 783	O O O O O O O O	1792 to 1807	O O O O O O O O	2816 to 2831	O O O O O O O O	3840 to 3855
O O O O O O O O	784 to 799	O O O O O O O O	1808 to 1823	O O O O O O O O	2832 to 2847	O O O O O O O O	3856 to 3871
O O O O O O O O	800 to 815	O O O O O O O O	1824 to 1839	O O O O O O O O	2848 to 2863	O O O O O O O O	3872 to 3887
O O O O O O O O	816 to 831	O O O O O O O O	1840 to 1855	O O O O O O O O	2864 to 2879	O O O O O O O O	3888 to 3903
O O O O O O O O	832 to 847	O O O O O O O O	1856 to 1871	O O O O O O O O	2880 to 2895	O O O O O O O O	3904 to 3919
O O O O O O O O	848 to 863	O O O O O O O O	1872 to 1887	O O O O O O O O	2896 to 2911	O O O O O O O O	3920 to 3935
O O O O O O O O	864 to 879	O O O O O O O O	1888 to 1903	O O O O O O O O	2912 to 2927	O O O O O O O O	3936 to 3951
O O O O O O O O	880 to 895	O O O O O O O O	1904 to 1919	O O O O O O O O	2928 to 2943	O O O O O O O O	3952 to 3967
O O O O O O O O	896 to 911	O O O O O O O O	1920 to 1935	O O O O O O O O	2944 to 2959	O O O O O O O O	3968 to 3983
O O O O O O O O	912 to 927	O O O O O O O O	1936 to 1951	O O O O O O O O	2960 to 2975	O O O O O O O O	3984 to 3999
O O O O O O O O	928 to 943	O O O O O O O O	1952 to 1967	O O O O O O O O	2976 to 2991	O O O O O O O O	4000 to 4015
O O O O O O O O	944 to 959	O O O O O O O O	1968 to 1983	O O O O O O O O	2992 to 3007	O O O O O O O O	4016 to 4031
O O O O O O O O	960 to 975	O O O O O O O O	1984 to 1999	O O O O O O O O	3008 to 3023	O O O O O O O O	4032 to 4047
O O O O O O O O	976 to 991	O O O O O O O O	2000 to 2015	O O O O O O O O	3024 to 3039	O O O O O O O O	4048 to 4063
O O O O O O O O	992 to 1007	O O O O O O O O	2016 to 2031	O O O O O O O O	3040 to 3055	O O O O O O O O	4064 to 4079
O O O O O O O O	1008 to 1023	O O O O O O O O	2032 to 2047	O O O O O O O O	3056 to 3071	O O O O O O O O	4080 to 4095

## Switches 9 to 12

Switch	Baud Rate
9 10	
C C	Do not use
O C	128000
C O	38400
O O	9600

Switch	Function
11	
C	Terminate Bus With 120R Resistor
O	No Termination

Switch	Function
12	
C	Feed Voltage To Bus
O	No Voltage Feed

## Terminal Connections

The LS-D16P3000 is provided with a plug and socket screw terminal interface with 40 terminals available for connecting power to the unit, and for the 16 output channels. This module has 4 separate power supply inputs, distributing power to groups of 4 separate channels. The negative supply is common across all inputs. The negative supply is also connected to the metal case of the module. The voltage supplied on terminals 1 and 2 to channels 0-3 also supplies the internal control electronics of the module.

Each channel has an output capacity of 3 Amps per channel. Therefore a maximum of 12 Amps can be supplied to each block of 4 channels. The current rating of each channel must not be exceeded, as this could damage the modules.

Currents at these levels can cause serious faults if appropriate protection circuitry is not included. **An in-line fuse should be connected from the power supply to each of the power inputs, to protect the circuitry in case of short circuits or other fault conditions on the channel outputs.**

Fuses must be sized correctly for the appropriate power consumption. The fuses should normally be installed close to the power supply, to not only protect the LightSwarm units, but also the power supply and distribution cabling.

Four in-line blade fuse holders are provided with each LS-16P3000 module. A selection of blade fuses is also provided.

Terminal Number	Function	Polarity
1	Voltage Sypply Ch 0-3 (negative ground)	-
2	Voltage Sypply Ch 0-3 (positive)	+
3	Channel 0	-
4	Channel 0	+
5	Channel 1	-
6	Channel 1	+
7	Channel 2	-
8	Channel 2	+
9	Channel 3	-
10	Channel 3	+
11	Channel 4	-
12	Channel 4	+
13	Channel 5	-
14	Channel 5	+
15	Channel 6	-
16	Channel 6	+
17	Channel 7	-
18	Channel 7	+
19	Voltage Sypply Ch 4-7 (negative ground)	-
20	Voltage Sypply Ch 4-7 (positive)	+

Terminal Number	Function	Polarity
21	Voltage Sypply Ch 8-11 (negative ground)	-
22	Voltage Sypply Ch 8-11 (positive)	+
23	Channel 8	-
24	Channel 8	+
25	Channel 9	-
26	Channel 9	+
27	Channel 10	-
28	Channel 10	+
29	Channel 11	-
30	Channel 11	+
31	Channel 12	-
32	Channel 12	+
33	Channel 13	-
34	Channel 13	+
35	Channel 14	-
36	Channel 14	+
37	Channel 15	-
38	Channel 15	+
39	Voltage Sypply Ch 12-15 (negative ground)	-
40	Voltage Sypply Ch 12-15 (positive)	+

Terminal 1 is adjacent to the Interface Bus Connectors.

Metal case is connected to ground (0V) level.