

LightSwarm

16 Channel Lighting Controller

LS-MLS16P

LS-MLS16PU



The **LS-MLS16P** and **LS-MLS16PU** are microprocessor controlled 16 channel lighting systems designed to control LED and incandescent lighting in architectural models, exhibitions displays, and any environment requiring multiple channels of independently controlled lighting.

The **LS-MLS16P** and **LS-MLS16PU** are identical, except the U version has an internal USB interface. This document will refer to both controllers as the **LS-MLS16P**.

These controllers have been specifically designed to drive large numbers of LED lighting channels. Each of the channels can simultaneously drive loads of up to 500 milli-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 controlled. 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-MLS16P** 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,

- 16 Channel LED lighting controller.
- Remote control of individual channels including programmable brightness and timed fade sequences.
- Each channel can drive 500 mA at 12 volts
- LED indicators for status of 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.

commencing automatic fade-up and fade-down sequences, and other effects. Each channel can be programmed with pseudo-addresses that allow a channel to take on multiple identities. This allows one command to be received and activated by many channels distributed across multiple control 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 switching frequency is higher than the eye can perceive. The longer the time that the channel is off, the lower the apparent brightness, and therefore gives the appearance that the light is on continuously, but at a lower brightness level.

The LightSwarm system includes a variety of lighting controllers for driving low and high current lighting, RGB lighting, and audio playback. A range of cable management solutions is also available, simplifying the construction of models and displays when large numbers of lighting channels are used. LightSwarm also provides touch screen and tablet based control systems.

Technical Details

Number of channels:	16
Operating Voltage:	12 volts DC nominal (8 to 14 volts DC)
Maximum current per channel:	LED: 500 milli-amps at 12 volts DC (6 watts) Incandescent: 400 milli-amps at 12 volts DC (4.8 watts)
Power Consumption (internal electronics):	200mA
Power Configuration:	1 power supply input provided by supplied removable plug
Power Protection:	Internal and replaceable M205 fuse.
Pulse Width Modulation:	256 steps, 150 Hz
Fade Control:	Automatic fade up/down to level with 1/100 second steps
Switching:	Low-Side switching (common positive rail)
Dimensions:	(W) 148mm x (H) 68mm x (D) 28mm
Interface:	2 x RJ25 LightSwarm bus interfaces 1 x USB Mini Type-B connector (LS-MLS16PU version) 1 x 34 way ribbon cable socket
LightSwarm Bus baud rate:	1200, 2400, 9600, 19200, 38400, 64000 and 128,000 bps
Construction:	Black plastic ABS housing.
Indicators:	16 LEDs show status of each channel 4 LEDs for power indication, heartbeat, bus activity, and fault
Number of pseudo-addresses:	32 per channel

Shipping Contents

Each **LS-MLS16P** is supplied with a DC power input screw terminal plug, spare fuses, and a LightSwarm bus interface cable.

LightSwarm Bus

The LightSwarm bus is a 3 wire interface that multiple LightSwarm modules connect to for communications purposes. A bus will typically have one or more master devices (e.g. a touch screen computer, mobile device such as an iPad, or keypad), and one or more slave devices such as a **LS-MLS16P** 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 people with a moderate level of programming experience would be able to create kiosk style touch screen controllers that interface to the bus.

Addressing

The **LS-MLS16P** occupies 16 addresses within the protocol address range. Rotary switches set one of 224 base addresses that range from 0 to 3,568, allowing up to 224 LightSwarm **LS-MLS16P** modules can co-exist in a single system, providing 3,584 lighting channels, without overlapping addresses.. 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.

Combinations of different types of LightSwarm modules can share the same bus.

LightSwarm Commands

The **LS-MLS16P** supports the following LightSwarm protocol commands:

MDP_ON	Set channel on
MDP_OFF	Set channel off
MDP_LEVEL	Set channel level
MDP_RGB_LEVEL	Set level for 3 consecutive channels
MDP_TOGGLE	Invert the channel level
MDP_FADE	Set channel fade
MDP_PADDSET	Set channel pseudo address
MDP_PADDERASE	Erase channel pseudo address table

Configuration Switch Settings

Two rotary switches are provided on the front panel, with each switch being labelled in hexadecimal from 0 to F (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F). The switch nearest the top of the controller is referred to us the “Upper” switch, and the other switch is the “Lower” switch. The switches have two purposes:

- to set the base address of the controller
- to set configuration settings such as the baud rate

The base address setting is updated in the controller each second, so the base addresses can be changed while the controller is powered. The configuration settings can only be change by cycling the power. Configuration changes are stored in flash memory, so they are remembered even if the power is interrupted. To set a configuration setting, follow these steps:

1. Turn-off the power to the controller.
2. Select the setting number required. E.g. “E3” will set the baud rate to 19,200 bits per second.
3. Turn-on the power to the controller. The Activity and Heartbeat LED will flash with an alternating pattern to indicate the setting has been saved.
4. Turn-off the power to the controller.
5. Set the rotary switches to the preferred base address value.
6. Turn-on the power and the controller will operate with the new settings.

Switch		Address	Switch		Address	Switch		Address	Switch		Address
Upper	Lower		Upper	Lower		Upper	Lower		Upper	Lower	
0	0	0 to 15	4	0	1024 to 1039	8	0	2048 to 2063	C	0	3072 to 3087
0	1	16 to 31	4	1	1040 to 1055	8	1	2064 to 2079	C	1	3088 to 3103
0	2	32 to 47	4	2	1056 to 1071	8	2	2080 to 2095	C	2	3104 to 3119
0	3	48 to 63	4	3	1072 to 1087	8	3	2096 to 2111	C	3	3120 to 3135
0	4	64 to 79	4	4	1088 to 1103	8	4	2112 to 2127	C	4	3136 to 3151
0	5	80 to 95	4	5	1104 to 1119	8	5	2128 to 2143	C	5	3152 to 3167
0	6	96 to 111	4	6	1120 to 1135	8	6	2144 to 2159	C	6	3168 to 3183
0	7	112 to 127	4	7	1136 to 1151	8	7	2160 to 2175	C	7	3184 to 3199
0	8	128 to 143	4	8	1152 to 1167	8	8	2176 to 2191	C	8	3200 to 3215
0	9	144 to 159	4	9	1168 to 1183	8	9	2192 to 2207	C	9	3216 to 3231
0	A	160 to 175	4	A	1184 to 1199	8	A	2208 to 2223	C	A	3232 to 3247
0	B	176 to 191	4	B	1200 to 1215	8	B	2224 to 2239	C	B	3248 to 3263
0	C	192 to 207	4	C	1216 to 1231	8	C	2240 to 2255	C	C	3264 to 3279
0	D	208 to 223	4	D	1232 to 1247	8	D	2256 to 2271	C	D	3280 to 3295
0	E	224 to 239	4	E	1248 to 1263	8	E	2272 to 2287	C	E	3296 to 3311
0	F	240 to 255	4	F	1264 to 1279	8	F	2288 to 2303	C	F	3312 to 3327
1	0	256 to 271	5	0	1280 to 1295	9	0	2304 to 2319	D	0	3328 to 3343
1	1	272 to 287	5	1	1296 to 1311	9	1	2320 to 2335	D	1	3344 to 3359
1	2	288 to 303	5	2	1312 to 1327	9	2	2336 to 2351	D	2	3360 to 3375
1	3	304 to 319	5	3	1328 to 1343	9	3	2352 to 2367	D	3	3376 to 3391
1	4	320 to 335	5	4	1344 to 1359	9	4	2368 to 2383	D	4	3392 to 3407
1	5	336 to 351	5	5	1360 to 1375	9	5	2384 to 2399	D	5	3408 to 3423
1	6	352 to 367	5	6	1376 to 1391	9	6	2400 to 2415	D	6	3424 to 3439
1	7	368 to 383	5	7	1392 to 1407	9	7	2416 to 2431	D	7	3440 to 3455
1	8	384 to 399	5	8	1408 to 1423	9	8	2432 to 2447	D	8	3456 to 3471
1	9	400 to 415	5	9	1424 to 1439	9	9	2448 to 2463	D	9	3472 to 3487
1	A	416 to 431	5	A	1440 to 1455	9	A	2464 to 2479	D	A	3488 to 3503
1	B	432 to 447	5	B	1456 to 1471	9	B	2480 to 2495	D	B	3504 to 3519
1	C	448 to 463	5	C	1472 to 1487	9	C	2496 to 2511	D	C	3520 to 3535
1	D	464 to 479	5	D	1488 to 1503	9	D	2512 to 2527	D	D	3536 to 3551
1	E	480 to 495	5	E	1504 to 1519	9	E	2528 to 2543	D	E	3552 to 3567
1	F	496 to 511	5	F	1520 to 1535	9	F	2544 to 2559	D	F	3568 to 3583
2	0	512 to 527	6	0	1536 to 1551	A	0	2560 to 2575	E	0	Baud * 1200
2	1	528 to 543	6	1	1552 to 1567	A	1	2576 to 2591	E	1	Baud * 2400
2	2	544 to 559	6	2	1568 to 1583	A	2	2592 to 2607	E	2	Baud * 9600
2	3	560 to 575	6	3	1584 to 1599	A	3	2608 to 2623	E	3	Baud * 19200
2	4	576 to 591	6	4	1600 to 1615	A	4	2624 to 2639	E	4	Baud * 38400
2	5	592 to 607	6	5	1616 to 1631	A	5	2640 to 2655	E	5	Baud * 64000
2	6	608 to 623	6	6	1632 to 1647	A	6	2656 to 2671	E	6	Baud * 128000
2	7	624 to 639	6	7	1648 to 1663	A	7	2672 to 2687	E	7	Reserved
2	8	640 to 655	6	8	1664 to 1679	A	8	2688 to 2703	E	8	Reserved
2	9	656 to 671	6	9	1680 to 1695	A	9	2704 to 2719	E	9	Reserved
2	A	672 to 687	6	A	1696 to 1711	A	A	2720 to 2735	E	A	Reserved
2	B	688 to 703	6	B	1712 to 1727	A	B	2736 to 2751	E	B	Reserved
2	C	704 to 719	6	C	1728 to 1743	A	C	2752 to 2767	E	C	Reserved
2	D	720 to 735	6	D	1744 to 1759	A	D	2768 to 2783	E	D	Reserved
2	E	736 to 751	6	E	1760 to 1775	A	E	2784 to 2799	E	E	Reserved
2	F	752 to 767	6	F	1776 to 1791	A	F	2800 to 2815	E	F	Reserved
3	0	768 to 783	7	0	1792 to 1807	B	0	2816 to 2831	F	0	Reserved
3	1	784 to 799	7	1	1808 to 1823	B	1	2832 to 2847	F	1	Reserved
3	2	800 to 815	7	2	1824 to 1839	B	2	2848 to 2863	F	2	Reserved
3	3	816 to 831	7	3	1840 to 1855	B	3	2864 to 2879	F	3	Reserved
3	4	832 to 847	7	4	1856 to 1871	B	4	2880 to 2895	F	4	Reserved
3	5	848 to 863	7	5	1872 to 1887	B	5	2896 to 2911	F	5	Reserved
3	6	864 to 879	7	6	1888 to 1903	B	6	2912 to 2927	F	6	Reserved
3	7	880 to 895	7	7	1904 to 1919	B	7	2928 to 2943	F	7	Reserved
3	8	896 to 911	7	8	1920 to 1935	B	8	2944 to 2959	F	8	Reserved
3	9	912 to 927	7	9	1936 to 1951	B	9	2960 to 2975	F	9	Reserved
3	A	928 to 943	7	A	1952 to 1967	B	A	2976 to 2991	F	A	Reserved
3	B	944 to 959	7	B	1968 to 1983	B	B	2992 to 3007	F	B	Reserved
3	C	960 to 975	7	C	1984 to 1999	B	C	3008 to 3023	F	C	Reserved
3	D	976 to 991	7	D	2000 to 2015	B	D	3024 to 3039	F	D	Reserved
3	E	992 to 1007	7	E	2016 to 2031	B	E	3040 to 3055	F	E	Reserved
3	F	1008 to 1023	7	F	2032 to 2047	B	F	3056 to 3071	F	F	Reserved

Terminal Connections

The **LS-MLS16P** is provided with three 5 connectors:

- 2 x LightSwarm Bus interface sockets (RJ25)
- 1 x 2 way DC power socket for supplying 12V DC
- 1 x USB Mini Type-B socket (**LS-MLS16PU** version only)
- 1 x 34 way ribbon cable socket for channel outputs

The channel outputs are connected via 34 way ribbon cable IDC (Insulation Displacement Connector) sockets. The connector provides 16 channels, with each channel having 2 wires. Therefore a total of 32 wires are required. The additional 2 wires (number 33 and 34) supply a 0V output and a +12V output.

Pin 1 of the connector and each additional odd pin-number are the switched ground outputs, and pin 2 and each even numbered pin are the common +12 volt outputs. Pin 1 of the cable often has a coloured stripe identifying that it is the first pin.

Each channel has an output capacity of 500 milli-amps per channel. Therefore a maximum of 8 Amps can be supplied by each controller to lighting devices. The current rating of each channel must not be exceeded.

Currents at these levels can cause serious faults if appropriate protection circuitry is not included. **An internal M205 fuse is provided. The size of this fuse should be selected to match the total load on the channels.**

Terminal Number	Channel	Polarity
1	0	-
2	0	+
3	1	-
4	1	+
5	2	-
6	2	+
7	3	-
8	3	+
9	4	-
10	4	+
11	5	-
12	5	+
13	6	-
14	6	+
15	7	-
16	7	+
17	8	-
18	8	+
19	9	-
20	9	+
21	10	-
22	10	+
23	11	-
24	11	+
25	12	-
26	12	+
27	13	-
28	13	+
29	14	-
30	14	+
31	15	-
32	15	+
33	Power	0V Out
34	Power	+12V Out

LS-MLS16P Cable Assignments