DC_Dimmer_4CH
DMX512 Controlled Four-Channel
DC Dimmer/DMX Relay

Instruction Manual

Hardware Revision 2
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Description

There are several versions of this product, this manual is for the standard DMX512 controlled DC Dimmer/DMX Relay version.

The DC_Dimmer_4CH is a small 4-channel dimmer intended for built-in and portable applications. It will dim a wide range of DC lamps including halogen and LEDs in both fixed and mobile applications.

Small motors (DC and stepping) and relays may also be controlled using the “non-dim” mode. In this mode the dimmer becomes a 4 channel “DMX Relay”.

For applications requiring static lighting levels (such as display cases), you can set these levels as defaults and then turn off or disconnect the DMX512 controller. Now, every time the power is turned on, the lights will go to the levels you set.

The dimmer is normally supplied as a PC board that must be installed in an enclosure. It may also be ordered already installed in an enclosure with or without power supplies. Custom firmware is also available, for example to play a set sequence in a loop or on a trigger for applications like fountain lighting.

This is a “Low Side” dimmer, it places the dimming control between the lamp and the low (“-”, “0V”, or GROUND) side of the power supply. One side of each lamp is directly connected to the “+” output of the power supply and the other side of each lamp is connected to a dimmer channel. A heavy ground wire (or two) goes from the dimmer back to the power supply “-“ output. The dimmer only connects to the “+” output of the power supply if the processor power is supplied by the lamp power supply.

Dimming is accomplished using Pulse Width Modulation (PWM) which turns power to the lamp on and off rapidly. With incandescent lights, the filament averages out these pulses and it appears to dim smoothly. LEDs, however, actually blink at the PWM rate. This can sometimes cause undesirable visual effects such as flickering, especially if the LED or the viewer is moving or the viewer is looking directly at the LEDs. LEDs that are slowly faded will look much better if you can use the 16-bit dimming mode.

The idea of dimming LEDs (Light Emitting Diodes) has been patented by another company. Use of any brand of dimmer for LEDs may infringe upon one or more patents. It is up to the installer to verify that they are authorized to dim LEDs.

We will gladly assist you in setting up your application. There may also be newer documentation and/or application notes on our web page.

Specifications

Lamp outputs (four independent):

- 10 Amps each output, 20 Amps max for the board.
- Screw Terminals accept up to 14 Gauge (2 square mm) wire
- Lamp voltage 5-48VDC
- Designed to drive the high peak current of halogen lamps.
- 16-bit mode makes LEDs look better.
- Low-side switching (N-channel protected MOSFET, 0.02 ohm).
- Short[1], over-voltage, over-heat, reverse-voltage protected.
- The board may be operated in dim or non-dim (DMX Relay) mode.
- Safe for inductive loads in non-dim mode.
- PWM pulses are sequenced to reduce power surges in the lamp power supply.
- PWM switching time is controlled to reduce electrical noise (EMI).
- PWM/flicker frequency is approximately 122 Hz.
- 8-bit mode has 256 dimming levels.
- 16-bit mode has over 65,000 dimming levels.

Processor power:

- 9-30VDC, 100mA max.
- You may use the same power supply as the lamp power[2] or a separate 9, 12, or 24V supply.
- Ground is shared between the processor supply, and the lamp supply.

Control Input:

- DMX512 or DMX512A
- All 512 channels supported
- Isolated and protected per ANSI Standard E1.11 (no electrical connection between the control input and the lamp outputs or the processor power)
- DMX termination may be enabled with a switch
- 1 second timeout (outputs go to default levels on timeout)

Switches:

- DMX termination
- 8/16 bit mode
- Dim/Non-Dim mode selection.
- Default level SET switch (memorizes current levels)
- Starting Channel
    - In 8-bit mode the board uses a block of 4 channels starting every 2 channels (1-4, 3-6, 5-8, etc.)
    - In 16-bit mode the board uses a block of 8 channels starting every

1 The output drivers will deliver up to 50A for a short period of time before overheating and turning off. They will turn back on about every 2 seconds to see if the problem is fixed. The power supply should be fused to prevent damage to it, the dimmers, and/or the wiring.

2 If your lamp power supply is over 30VDC, then a small regulator IC such as an LM7824 can be used to reduce it to 24V to power the processor. Contact us for details if needed.

4 channels (1-8, 5-12, 9-16, etc.).

- Byte Order (16-bit mode only)

Default Levels:

- The factory default is for all 4 channels to turn OFF on loss of DMX signal.
- You may change the defaults at any time (a DMX source is required to set new levels).
- Each channel's default level may be different (ex: 1=100%, 2=50%, 3 & 4=0%).
- Defaults may be set in 8 or 16-bit mode.
- The default levels will be used at power up until a valid DMX512 signal is detected and any other time the DMX signal is missing for more than 1 second.
- Great for stand-alone applications where the dimming levels don't change such as display lighting and also for night lights (active when the DMX source is turned off).

Indicator Lights:

- 4 orange for output status, 1 green for Power/Fault status.
- Dimmers may be ordered with a wire connector instead of LEDs to allow remote mounting of the LEDs.

Environmental:

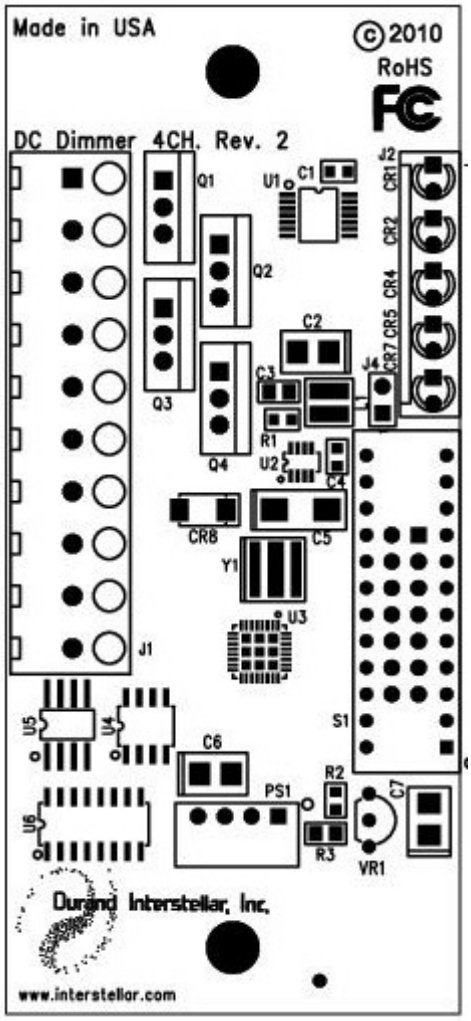
- 0-40C (32-104F) for normal operation and longest life.
- Non-condensing humidity.
- The board will shut down if the processor reaches approximately 85C (185F)
- Individual channels will shut down if the output transistors reach approximately 150C (302F).

Mounting:

- Board size is 3.8" (96.5mm) tall and 1.7" (43mm) wide
- Two mounting holes are provided that will accommodate #6 (4mm) screws. They are 0.18" (4.6mm) diameter and spaced 0.25" (6.4mm) in from each end of the board.
- Each end of the board has a 0.5" (12.7mm) clear area that may be mounted directly to metal or non-metalic surfaces (top or bottom).
- Recommended clearances for the component area of the board (the area between the two clear areas on the ends):
    - Back of the board to any surface is 0.25" (6.4mm).
    - Top of the board to any surface is 1" (25.4mm).
- Board may be mounted at any angle
- Cooling only needs to be provided if the total load exceeds several Amps (exact number depends on the enclosure and ambient temperature).

Mounting & Connecting

ALWAYS follow all applicable national and local codes when installing and using this device. Use common sense and plan ahead. Never run low voltage wires with AC Mains (power) wires.



If you have the standard version of the board, you will need to install it in an enclosure. If you ordered a version already installed in an enclosure or customized in any way, please refer to any additional instructions that may have been included.

Handle the board carefully as you would any electronic device. The board is relatively rugged, but can be damaged by physical abuse and static-electricity. If in doubt, connect a temporary ground wire to one of the “G” terminals leaving a bit of bare wire exposed. The other end should be connected to either the metal enclosure you’re working on or a grounded appliance (soldering iron, computer, conduit, etc.). You should then touch the bare spot of ground wire before touching the board. If you have a grounding strap, then connect this to the ground wire.

Looking at the board you’ll notice that not all the parts are installed. This is normal since the same board is also used for other models.

The screw terminal connections are listed on the back of the board as well as a short reminder of the DIP switch functions.

To mount the board, use #6 (4mm) screws (not included) through the two mounting holes (the large holes at the top and bottom). Never screw the board directly to a flat surface without spacers, the components and protrusions on the back of the board will cause it to warp, breaking connections on the board. It will also short out if the surface is metal. Each end of the board is clear of components and conductors so you may use metal or non-metal spacers or even a short stack of washers. Make sure no bare wires or other metal will touch or fall on any other part of the board when the power is on.

If you are mounting this to a standard USA electrical box, then the holes will line up with the mounting screws on a standard blank cover plate. If the cover plate is metal, you may wish to put insulating material like “Fish Paper” (a UL Listed insulating material) between it and the board but this usually isn't required.

Other mounting methods may occur to you, use what works and is safe.

In any installation, cooling should be considered; the dimmer module will dissipate up to 3W if used at max capacity but in most applications it will barely get warm. Allowing some air flow is normally all that's required (avoid small air-tight plastic enclosures), but in a hot environment a small DC fan may be advisable.

The four MOSFET devices (Q1-4) may get VERY hot (150C, 302F) in fault conditions, do not let wires touch these devices as the insulation may melt. Also, keep your fingers away to prevent burns when the unit is operating.

If installed outdoors or in damp locations, protect the board from moisture and condensation. A NEMA compliant water/oil-resistant enclosure is often the best choice.

You may place any number of these boards in the same enclosure; just remember to supply enough power and cooling for all of them.

Verify that your lamp power supply is the proper voltage for the lamps you are using and does not supply more than 48VDC for the lamps and 9-30VDC for the processor power. AC will not work with this dimmer. The power supply should also be able to supply enough current operate all 4 lamps at the same time.

NEVER connect this dimmer directly to AC power/mains lines!

The dimmer outputs are not fused, but will current-limit at about 50A in the case of a short until they overheat and shut off. Your lamp power supply should either have a fused output or preferably automatically shut down the output in the case of excessive current draw (often called "fold back current limiting").

Connect one side of each lamp to the "+"output of the lamp power supply (possibly through a fuse). Connect the other side of each lamp to one of the screw terminals (J1) marked "CH1"-"CH4". If you don't need all four channels, simply leave the unused ones unconnected.

Using heavy-gauge wire, connect BOTH ground ("GND") terminals on J1 to the "-" output of the lamp power supply. If the total lamp draw is under 10 Amps, then you can get away with only a single ground wire.

If the output of the lamp power supply is less than 30VDC, you may also use it to supply the processor power to the dimmer board. Run a wire (a small diameter wire for this one connection is fine) from the "+" output of the lamp supply to the "9-30VDC" terminal on J1. The lamp supply will now power the lamps and the processor on the board.

If your lamp supply is over about 28VDC, you can still use it to power the processor but you will need to add a small regulator IC such as an LM7824 to reduce the voltage to 24.

If you wish to use a separate supply for the processor power, you may use any small DC power supply or AC adapter that can supply 100mA or more between 9VDC and 30VDC (9VDC @ 300mA would be a typical size). Note that some adapters supply considerably higher voltage than they are marked as supplying, if in doubt, measure your adapter with no load on it. Connect the "-" lead to either of the "GND" terminals on J1, sharing the terminal with one of the lamp ground wires (it may be easier to connect directly to the "-" output of the lamp power supply). Connect the "+" lead to the "9-30VDC" terminal on J1. Note that in this case the "+" side of the lamp power supply is **NOT** connected to the dimmer at all. When using two power supplies, it does not matter which one is turned on or off first.

Now we will connect the DMX512 wires to the lower three terminals. The DMX512 Ground connection goes to the terminal marked "COM", Data+ goes to the terminal marked "D+" and Data- goes to the terminal marked "D-". All three wires are always required. The other wires in the DMX512 cable are not used.

If this is not the last device on this DMX512 cable, then you would need to connect the wires going to the next device to these same terminals (parallel connection). Do NOT connect DMX512 cables in a "star" configuration. If in doubt, either contact us or refer to other reference material as to how to run and connect DMX512 cables. When using CAT5 cable, only two pair are normally used, tape or cut off the spare wires to prevent shorts.

The DMX512 input is both isolated and protected per the DMX512-A specification. You will sometimes see this called "opto" or "optically" isolated.

If this is the last device on the DMX512 cable, enable termination by setting DIP switch #1 to ON (towards the left in the picture above, it should also be marked on the switch itself). Otherwise, turn it off.

If you are using this in a stand-alone application (hallway, museum, etc.) where you don't want the dimming levels to change once set, you only need to hook up the DMX512 cable to set the default levels. Once set the DMX512 cable can be removed. This could even be done in your office with only the processor power and DMX512 wires connected. If you have a stand-alone application where the levels need to change over time in a loop or other special needs, contact us for custom programming.

Application hints:

1. Hook two 75W, 12V halogen lamps in series and use a 24V lamp power supply to give you 150W of light per channel.
2. Hook three 75W, 12V halogen lamps in series and use a 36V lamp power supply to give you 225W of light per channel. In this case, you'd have to use a separate processor power supply since 36V is too high for the processor.

The above works because lamps in series will still draw the same current as one lamp (as long as you increase the voltage of the lamp power supply).

Status Indicators

There are 5 status indicator LEDs on the board. The top one is GREEN and is used to indicate any faults.

- Steady on: Board is healthy and a valid DMX512 signal is being received.
- Slow Blinking: Board is healthy, DMX512 signal timeout (stand-alone mode or bad/missing DMX signal).
- Fast Blinking: Fault (over-temperature, possibly shorted output).
- Slow Alternating (1 second solid, 1 second fast blink): SET switch is on.
- Off: Processor power off or board failure.

The remaining four LEDs are orange and show the current status of the outputs. They will dim along with the outputs.

- If an output is shorted to ground, the Indicator Light for that channel will be on full.
- If a channel overheats or is shorted to power, then the LED for that channel will be off.
- If the board overheats, all four LEDs will be off.
- If the lamp power supply is off, then the LEDs may be on regardless of the dimmer setting (as long as the processor power is on).

Setting the DIP Switches

DIP switches are used to set the starting address, termination, and other options. You'll find the DIP switch ("S1") on the right side of the board with 12 individual switches numbered from "1" on the bottom to "12" on the top. Slide the white button towards the right to set a switch to OFF, slide it left to turn it ON. Do not use a pencil to slide the button since pieces may break off and jam the switch. Instead, use a small screwdriver, paper clip, or other such item to slide it. On the back of the board is a reminder of each switch function.

DMX Termination

Switch #1 enables the DMX512 termination. The last physical device on a DMX512 cable MUST have its termination enabled; all other devices MUST have it disabled. Turning switch #1 on enables termination.

Starting Address

The next 8 switches are used to select the DMX512 starting address for the dimmer channels. If the starting address is 5, this means the first dimmer channel is 5, the second is 6, the third is 7, and the fourth is 8. See the table below for all possible address settings. There is no harm in more than one device having the same address selected, they will simply dim to the same levels.

If you are using 16-bit dimming, then each dimmer channel uses two consecutive DMX channels. Switch #2 is used to select the byte order in 16-bit mode.

Default Dimming Levels

Switch #10 (SET) is used to set the default dimming levels. These are the levels the outputs are set to on loss of the DMX512 signal and when used in stand-alone mode. When this switch is turned on, the current level of all four channels is memorized (if the DMX512 signal is missing, it will re-memorize the previous defaults). After a very short time, the Power LED will start alternating between solid on and fast blinking to indicate that the levels have been memorized. You should now turn this switch off to restore normal operation. If you leave it on, the incoming DMX signal will be ignored.

The default levels will be remembered until you change them, even if the power is off for years. You may change the default levels as often as you wish[3].

Dim/Non-Dim Mode

The next switch, #11, is used to select between dim and non-dim modes. Setting this switch to ON selects non-dim (DMX Relay) mode for all four channels, you can not have some channels in dim mode and others in non-dim on the same board. In dim mode the outputs are turned on and off rapidly in order to dim a lamp. If you are operating a relay, small motor, or other device, this pulsing could damage something or at least cause undesired operation. In non-dim mode, a

3 The memory will wear out after about 300,000 SET cycles. If you were leave switch #10 on and cycle the power a LOT, you would eventually wear out the internal memory. Even if you wear the memory out, the dimmer will still work when there's a DMX signal.

DMX512 level below 50% will cause the output to be off, any level above 50% will turn the channel full on with no pulsing. This mode works the same in 8 and 16 bit mode.

NOTE: The defaults saved with switch #10 are based on the current mode. If you later select non-dim mode be sure to check to see if your defaults still work like you wish.

DIP Switch Table for 8-Bit Mode

A switch setting of zero means the switch is off, 1 means it is on. To set a starting address of 137, you would set switch 2 -3 off, 4 on, 5-7 off, 8 on, and 9 off. Switches 1 and 10-11 are used for other options and do not effect the Starting Address. **Switch 12 should be OFF for 8-Bit Mode.**

Channel	Switches 9:2		Channel	Switches 9:2		Channel	Switches 9:2
1	00000000		91	00101101		181	01011010
3	00000001		93	00101110		183	01011011
5	00000010		95	00101111		185	01011100
7	00000011		97	00110000		187	01011101
9	00000100		99	00110001		189	01011110
11	00000101		101	00110010		191	01011111
13	00000110		103	00110011		193	01100000
15	00000111		105	00110100		195	01100001
17	00001000		107	00110101		197	01100010
19	00001001		109	00110110		199	01100011
21	00001010		111	00110111		201	01100100
23	00001011		113	00111000		203	01100101
25	00001100		115	00111001		205	01100110
27	00001101		117	00111010		207	01100111
29	00001110		119	00111011		209	01101000
31	00001111		121	00111100		211	01101001
33	00010000		123	00111101		213	01101010
35	00010001		125	00111110		215	01101011
37	00010010		127	00111111		217	01101100
39	00010011		129	01000000		219	01101101
41	00010100		131	01000001		221	01101110
43	00010101		133	01000010		223	01101111
45	00010110		135	01000011		225	01110000
47	00010111		137	01000100		227	01110001
49	00011000		139	01000101		229	01110010
51	00011001		141	01000110		231	01110011
53	00011010		143	01000111		233	01110100
55	00011011		145	01001000		235	01110101
57	00011100		147	01001001		237	01110110
59	00011101		149	01001010		239	01110111
61	00011110		151	01001011		241	01111000
63	00011111		153	01001100		243	01111001
65	00100000		155	01001101		245	01111010
67	00100001		157	01001110		247	01111011
69	00100010		159	01001111		249	01111100
71	00100011		161	01010000		251	01111101
73	00100100		163	01010001		253	01111110
75	00100101		165	01010010		255	01111111
77	00100110		167	01010011		257	10000000
79	00100111		169	01010100		259	10000001
81	00101000		171	01010101		261	10000010
83	00101001		173	01010110		263	10000011
85	00101010		175	01010111		265	10000100
87	00101011		177	01011000		267	10000101
89	00101100		179	01011001		269	10000110

Channel	Switches 9:2		Channel	Switches 9:2		Channel	Switches 9:2
271	10000111		361	10110100		451	11100001
273	10001000		363	10110101		453	11100010
275	10001001		365	10110110		455	11100011
277	10001010		367	10110111		457	11100100
279	10001011		369	10111000		459	11100101
281	10001100		371	10111001		461	11100110
283	10001101		373	10111010		463	11100111
285	10001110		375	10111011		465	11101000
287	10001111		377	10111100		467	11101001
289	10010000		379	10111101		469	11101010
291	10010001		381	10111110		471	11101011
293	10010010		383	10111111		473	11101100
295	10010011		385	11000000		475	11101101
297	10010100		387	11000001		477	11101110
299	10010101		389	11000010		479	11101111
301	10010110		391	11000011		481	11110000
303	10010111		393	11000100		483	11110001
305	10011000		395	11000101		485	11110010
307	10011001		397	11000110		487	11110011
309	10011010		399	11000111		489	11110100
311	10011011		401	11001000		491	11110101
313	10011100		403	11001001		493	11110110
315	10011101		405	11001010		495	11110111
317	10011110		407	11001011		497	11111000
319	10011111		409	11001100		499	11111001
321	10100000		411	11001101		501	11111010
323	10100001		413	11001110		503	11111011
325	10100010		415	11001111		505	11111100
327	10100011		417	11010000		507	11111101
329	10100100		419	11010001		509	11111110
331	10100101		421	11010010			
333	10100110		423	11010011			
335	10100111		425	11010100			
337	10101000		427	11010101			
339	10101001		429	11010110			
341	10101010		431	11010111			
343	10101011		433	11011000			
345	10101100		435	11011001			
347	10101101		437	11011010			
349	10101110		439	11011011			
351	10101111		441	11011100			
353	10110000		443	11011101			
355	10110001		445	11011110			
357	10110010		447	11011111			
359	10110011		449	11100000			

DIP Switch Table for 16-Bit Mode

A switch setting of zero means the switch is off, 1 means it is on. To set a starting address of 137, you would set switch 3 off, 4 on, 5-7 off, 8 on, and 9 off. Switches 1 and 10-11 are used for other options and do not effect the Starting Address. Switch #2 is used to determine byte order (off = high-byte first, on = low-byte first). **Switch 12 should be ON for 16-Bit Mode.**

Channel	Switches 9:3		Channel	Switches 9:3		Channel	Switches 9:3
1	0000000		181	0101101		361	1011010
5	0000001		185	0101110		365	1011011
9	0000010		189	0101111		369	1011100
13	0000011		193	0110000		373	1011101
17	0000100		197	0110001		377	1011110
21	0000101		201	0110010		381	1011111
25	0000110		205	0110011		385	1100000
29	0000111		209	0110100		389	1100001
33	0001000		213	0110101		393	1100010
37	0001001		217	0110110		397	1100011
41	0001010		221	0110111		401	1100100
45	0001011		225	0111000		405	1100101
49	0001100		229	0111001		409	1100110
53	0001101		233	0111010		413	1100111
57	0001110		237	0111011		417	1101000
61	0001111		241	0111100		421	1101001
65	0010000		245	0111101		425	1101010
69	0010001		249	0111110		429	1101011
73	0010010		253	0111111		433	1101100
77	0010011		257	1000000		437	1101101
81	0010100		261	1000001		441	1101110
85	0010101		265	1000010		445	1101111
89	0010110		269	1000011		449	1110000
93	0010111		273	1000100		453	1110001
97	0011000		277	1000101		457	1110010
101	0011001		281	1000110		461	1110011
105	0011010		285	1000111		465	1110100
109	0011011		289	1001000		469	1110101
113	0011100		293	1001001		473	1110110
117	0011101		297	1001010		477	1110111
121	0011110		301	1001011		481	1111000
125	0011111		305	1001100		485	1111001
129	0100000		309	1001101		489	1111010
133	0100001		313	1001110		493	1111011
137	0100010		317	1001111		497	1111100
141	0100011		321	1010000		501	1111101
145	0100100		325	1010001		505	1111110
149	0100101		329	1010010			
153	0100110		333	1010011			
157	0100111		337	1010100			
161	0101000		341	1010101			
165	0101001		345	1010110			
169	0101010		349	1010111			
173	0101011		353	1011000			
177	0101100		357	1011001			

California Proposition 65 Warning

The following information is required by the State of California's Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). This California regulation does not address safe levels; therefore, even trace amounts of the chemicals included on Proposition 65's list of chemicals known to the State of California to cause cancer or reproductive toxicity must be noted.

WARNING: This product contains lead and/or other chemicals known to the State of California to cause cancer and/or birth defects and/or other reproductive harm.

FCC Statement

This device complies with part 15 of the FCC Rules, Class A.

Operation is subject to the following 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.

Warranty

Durand Interstellar, Inc. warrants this product to be free from manufacturing defects in original material, including original parts, and workmanship under normal use and conditions (“manufacturing defect”) for a period of one (1) year from date of original purchase. A charge will be made for repairs not covered by the warranty.

Should service become necessary, contact Durand Interstellar, Inc. for return authorization and then:

- Pack the unit in a well-padded corrugated box
- Enclose a copy of your proof of purchase, if you are not the original purchaser
- Ship the unit prepaid via an insured carrier

NOTE: This warranty is void if the product is:

- Damaged through negligence, misuse, abuse, or accident
- Modified or repaired by anyone other than Durand Interstellar, Inc.
- Damaged because it is improperly connected to other equipment
- Damaged by any power source that does not meet stated specifications

NOTE: This warranty does not cover:

- Damage to equipment connected to the product
- Cost incurred in the shipping of the product to Durand Interstellar, Inc.
- International shipping costs.
- Damage or improper operation of unit caused by customer abuse, misuse, negligence, or failure to follow operating instructions provided with the product
- Ordinary adjustments to the product which can be performed by the customer as outlined in the instruction manual
- Improper operation of the unit caused by software written by any third party

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