Digital Lighting Systems, Inc.

PD408

Four Channel Dimmer and Switch Packs

PROTOCOL

PD408

S2 S1

1 2 3 4
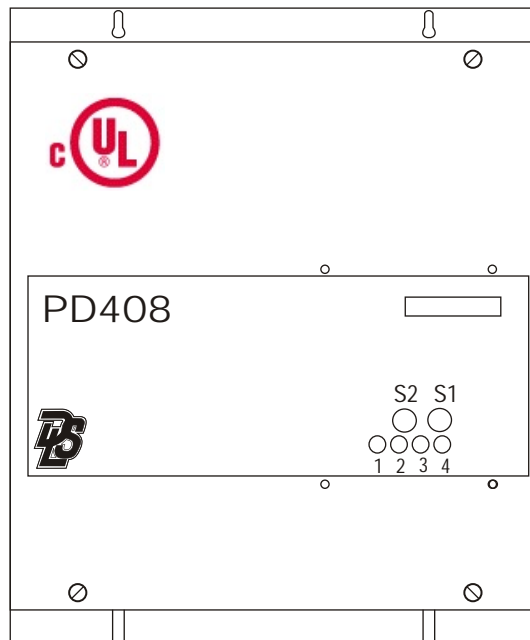
USER'S MANUAL

GENERAL DESCRIPTION

The PD408 is a 4-channel dimmer pack for the PROTOCOL lighting control system. The PD408 dimmer pack contains 4 solid-state dimmers. Power is fed to the PD408 from *two 20 Amp. breakers on the same electrical phase*. Each breaker feeds two dimmers and each dimmer is rated for a maximum output current of 8 amperes (960 Watts at 120 VAC). The PD408 contains two printed circuit boards, the load driver module (LDM) and an INT04 control modules. The dimmers are triggered by the firing board (INT04).

THE INTO4 - (See diagram on Page 2)

The INT04 is a microprocessor based control board with a nonvolatile memory chip, a communications chip, and a regulated DC power supply. The INT04 also contains, address selectors, LED output monitors and other support circuitry. The microprocessor is driven by powerful distributed intelligence software which handles all control and communications functions. The memory chip on the INT04 holds all of the PD408′s pertinent information and settings which include low and high trim levels for each of the four outputs it controls.

The PD408 does not rely on any shared data source and functions independently of any other system component and without a central system controller. The PD408 communicates with Protocol system stations and controllers over a single twisted-pair of wires and can be connected anywhere on the system network bus. This adds convenience and versatility by allowing PD408 dimmers to be installed close to their loads and/or service panels.

THE LDM (LOAD DRIVER MODULE) - (See Diagram on Page 2)

The LDM is equivalent to four solid-state relays (SSR's) assembled on a single circuit board. The LDM is mounted at the bottom of the PD408's enclosure which also serves as a heat sink. The relays are triggered by low-voltage signals generated by the INT04 module. These signals are optically-isolated by the LDM circuitry from all line voltage elements. A step-down 10 VAC- transformer on the LDM board supplies power to the INT04 module described above.

OTHER INFORMATION- (See diagram Page 4)

Several PD DIMMERS (PD804, PD408 and PD216 dimmer packs) may be daisy-chained together in any combination, up to a maximum of 63 individually addressed INT04′s (each PD408 and PD216 has 1x INT04 each, each PD804 has two INT04′s). PD Dimmers are dasiy-chained using the RJPD-6 cables (cat5 network cables) supplied with the units. Each PD408 has a set of address selectors which must be set to a unique address. Please see *Table 4* on *Page 9* of this manual or the PROTOCOL *SOFTWARE MANUAL* for more information on addressing the PD408 dimmer pack.

DIMMING/SWITCHING - (See Page 8 for more information)

Through the PROTOCOL′s "SOFTPRO" configuration software, each of the PD408 outputs may be independently configured not to dim. APD408 may control any combination of dimmed and switched loads.

There is also a HARDWARE lock to ensure circuits do not dim. All four outputs controlled by the INT04 may be configured not to dim by the installation of a small jumper on the back of the INT04 circuit board. This may be done at the factory or in the field. This jumper may be removed to allow the future dimming of those outputs. Please see *Page 8* for location of this jumper.

Alternatively, the PD408 may be ordered as a SWITCH-ONLY unit, the PD408-S. This unit has all the same features as the PD408 except that there is no dimming, and there are no chokes installed inside the unit. All other information in this manual is the same for both the PD408 and the PD408-S.

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PD408 Load Driver Module Information

Figure 1 - PD408 LDM Detail
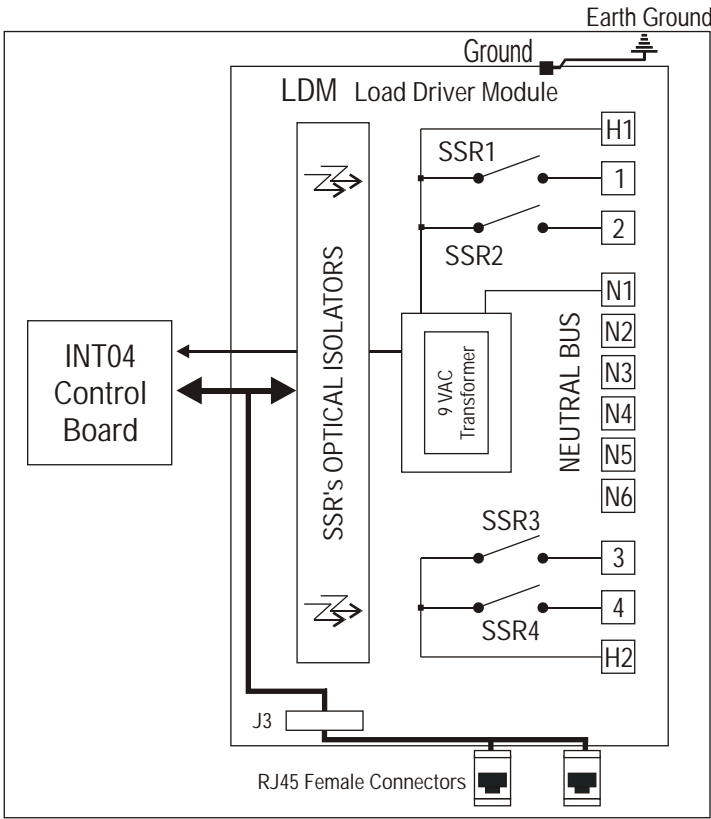
Table 1 - Terminals Definition

NAME	DESCRIPTION
1	Output Of Solid-State Relay #1
2	Output Of Solid-State Relay #2
3	Output Of Solid-State Relay #3
4	Output Of Solid-State Relay #4
H1	Hot Line Feed For Relays 1 & 2.
H2	Hot Line Feed For Relays 3 & 4.
N1-N6	Neutral Bus Connections.

Table 2 - Absolute Maximum Electrical Ratings

Electrical Characteristic	Terminal	Maximum
Relay Load Current	1 to 4	8 Amps.
Input Current For Relays 1 & 2	H1	20 Amps.
Input Current For Relays 3 & 4	H2	20 Amps.
Input Voltage	H1-H2	120 VAC,1-Phase.

PD408- INT04 Detail

Table 3 - INT04 Circuit Legend

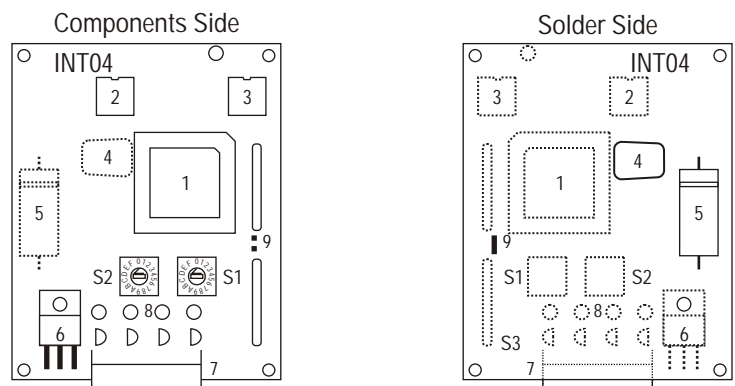|	
1	Microprocessor.
2	Nonvolatile Memory.
3	Communications Chip.
4	Quartz Crystal.
5	Power Supply Capacitor.
6	Voltage Regulator.
7	Signal & Power Connector.
8	Output LED Monitors.
9	Jumper for switches only

S1-S2 Address Selectors.

NOTE:
PD408 has one INT04 control board.

Components Side

Solder Side

Figure 2 - PD408 / INT04 PROTOCOL Firing board Detail

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Enclosure Installation

Surface mount the dimmer pack in a well ventilated area where the ambient temperature does not exceed 104° F for full load operation. Allow 2" of side clearance for proper air circulation and servicing. Installation clearance shall meet local and/or NEC code requirements. Enclosures may be attached to the wall or other mounting surface by holes in the heat sink flanges. Refer to the drawings below (FIGURE 3) for the correct dimensions. Conduit shall be pulled to the top of the dimmer packs.

NOTE

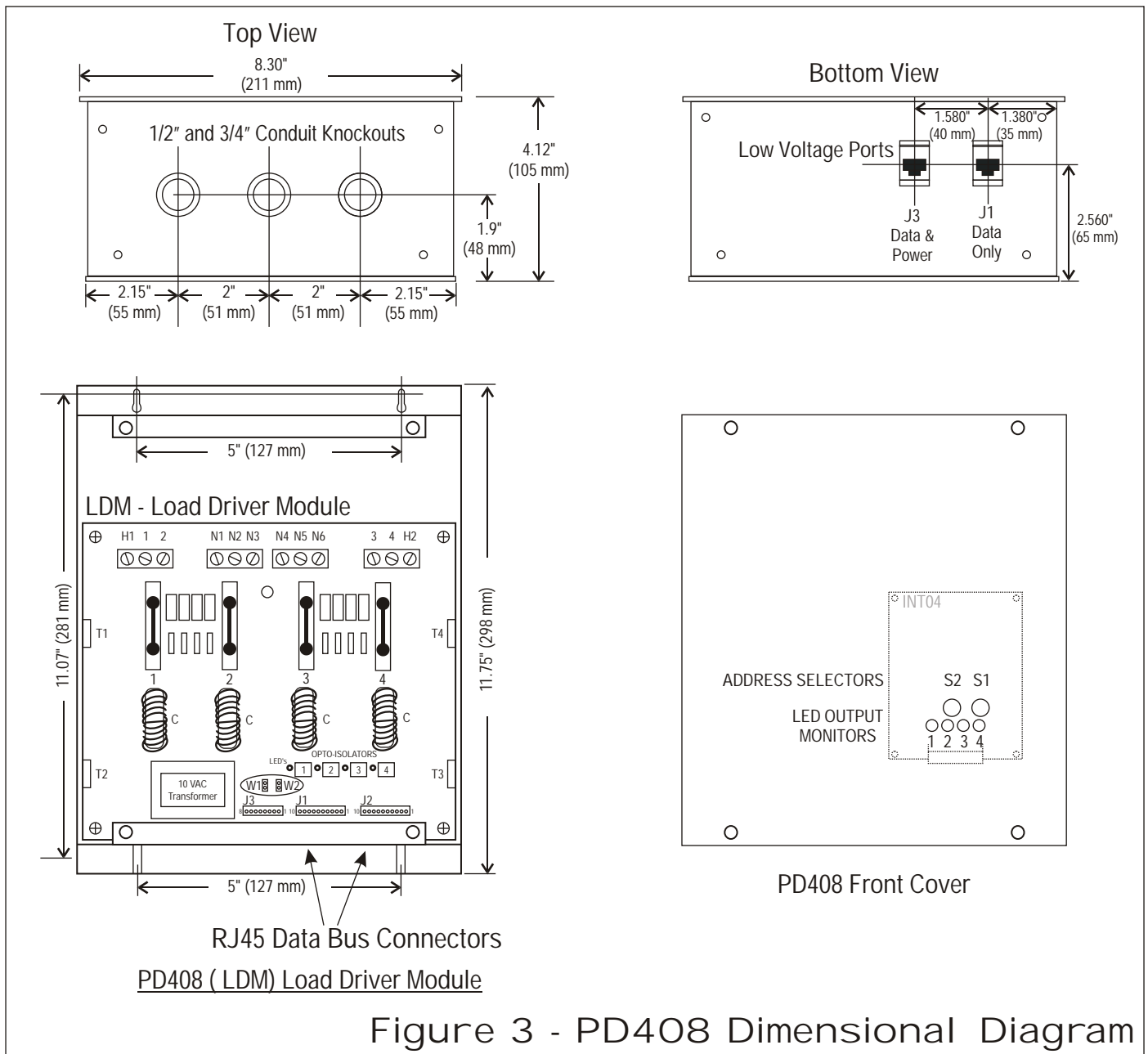The PD408 may create a slight buzzing noise and should not be located where this is objectionable.

Top View

Bottom View

LDM - Load Driver Module

PD408 Front Cover

RJ45 Data Bus Connectors

PD408 (LDM) Load Driver Module

Figure 3 - PD408 Dimensional Diagram
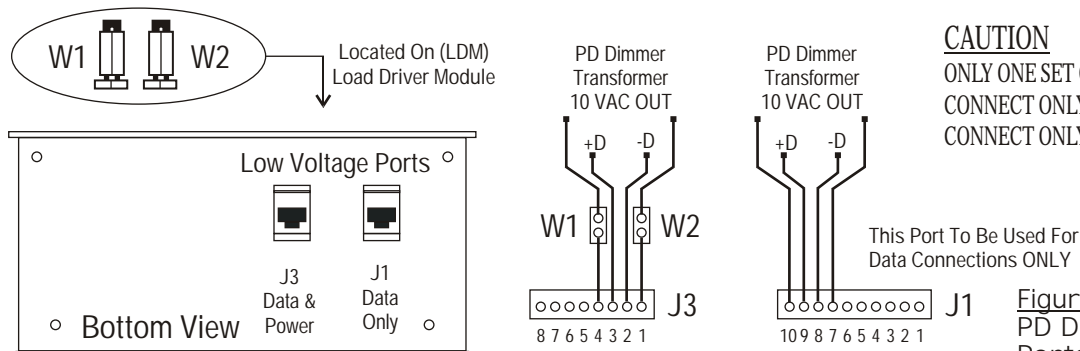
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PD4O8 Low Voltage Wiring Methods

☐ **W1-W2 Shunt Jumpers**

Protocol systems with 3 control nodes or less (PS Series stations, DCO, DCI or RAU) do not require an external power supply transformer. Power for these components can be supplied by one of the PD DIMMER packs. *Figure 4* shows the PD408's network ports with its pin assignments. Installing W1 and W2 connects the 9 VAC transformer output to the network bus via J3. The 9 VAC output is permanently connected to J1. *Figure 5* shows a typical small system with one PD Dimmer supplying power to the network. *Figure 6* shows a typical system with an external transformer. System accessories such as extension cables and jumper boards are available from DLS and can simplify network bus connections.

<u>TO AVOID PARALLELING THE OUTPUTS OF SEVERAL TRANSFORMERS IN A PROTOCOL SYSTEM:</u>

⊗   Do not install the jumpers in any of the PD Dimmers when a DB44 panel with an external transformer is used in a system.

⊗   Do not install jumpers in more than one PD Dimmer per system when no external transformer is used.

W1   W2

Located On (LDM)
Load Driver Module

Low Voltage Ports

J3
Data &
Power

J1
Data
Only

Bottom View

PD Dimmer
Transformer
10 VAC OUT

+D   -D

W1   W2

J3

8 7 6 5 4 3 2 1

PD Dimmer
Transformer
10 VAC OUT

+D   -D

J1

10 9 8 7 6 5 4 3 2 1

This Port To Be Used For
Data Connections ONLY

<u>CAUTION</u>
ONLY ONE SET OF W1-W2 JUMPERS PER SYSTEM.
CONNECT ONLY TO J1 PINS 8 & 9.
CONNECT ONLY TO J3 PINS 1-4.

Figure 4
PD Dimmer Network
Ports Internal Connections.

Figure 5 -
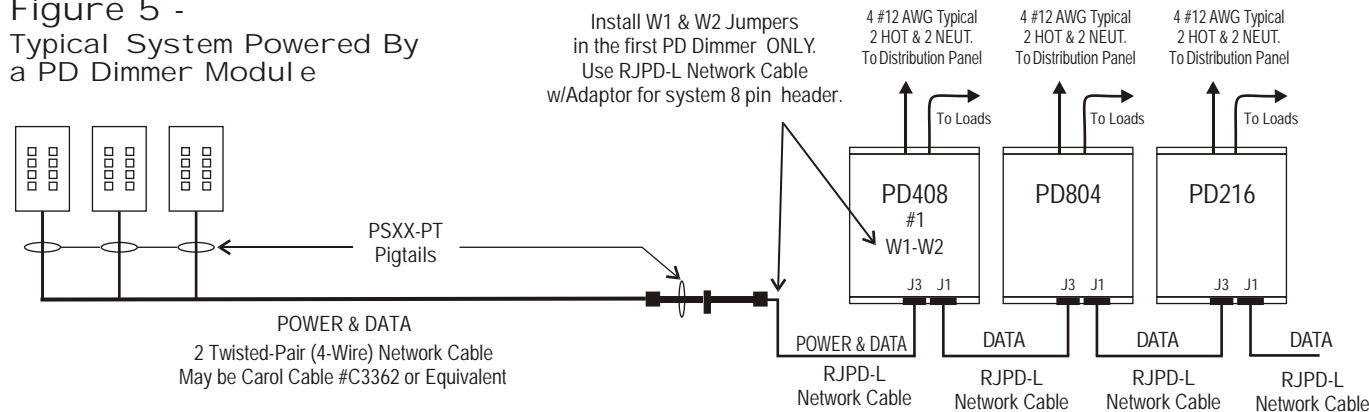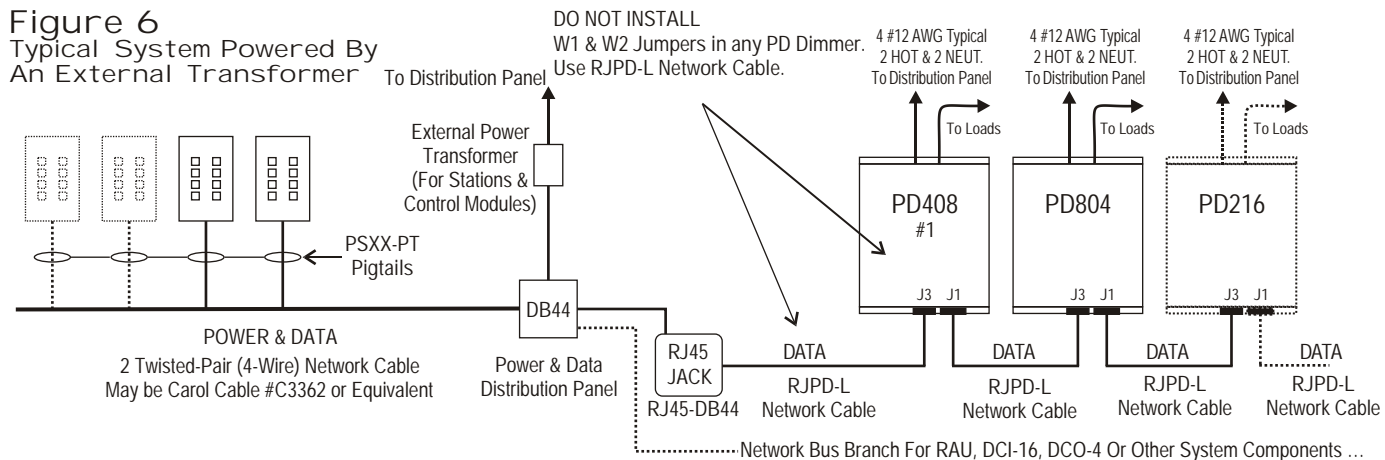Typical System Powered By
a PD Dimmer Module

Install W1 & W2 Jumpers
in the first PD Dimmer ONLY.
Use RJPD-L Network Cable
w/Adaptor for system 8 pin header.

4 #12 AWG Typical
2 HOT & 2 NEUT.
To Distribution Panel

4 #12 AWG Typical
2 HOT & 2 NEUT.
To Distribution Panel

4 #12 AWG Typical
2 HOT & 2 NEUT.
To Distribution Panel

To Loads   To Loads   To Loads

PD408
#1
W1-W2

PD804

PD216

J3 J1   J3 J1   J3 J1

PSXX-PT
Pigtails

POWER & DATA   DATA   DATA   DATA

POWER & DATA
2 Twisted-Pair (4-Wire) Network Cable
May be Carol Cable #C3362 or Equivalent

RJPD-L
Network Cable

RJPD-L
Network Cable

RJPD-L
Network Cable

RJPD-L
Network Cable

Figure 6
Typical System Powered By
An External Transformer

To Distribution Panel

DO NOT INSTALL
W1 & W2 Jumpers in any PD Dimmer.
Use RJPD-L Network Cable.

4 #12 AWG Typical
2 HOT & 2 NEUT.
To Distribution Panel

4 #12 AWG Typical
2 HOT & 2 NEUT.
To Distribution Panel

4 #12 AWG Typical
2 HOT & 2 NEUT.
To Distribution Panel

To Loads   To Loads   To Loads

External Power
Transformer
(For Stations &
Control Modules)

PD408
#1

PD804

PD216

J3 J1   J3 J1   J3 J1

PSXX-PT
Pigtails

DB44

RJ45
JACK

RJ45-DB44

DATA   DATA   DATA   DATA

POWER & DATA
2 Twisted-Pair (4-Wire) Network Cable
May be Carol Cable #C3362 or Equivalent

Power & Data
Distribution Panel

RJPD-L
Network Cable

RJPD-L
Network Cable

RJPD-L
Network Cable

RJPD-L
Network Cable

Network Bus Branch For RAU, DCI-16, DCO-4 Or Other System Components …
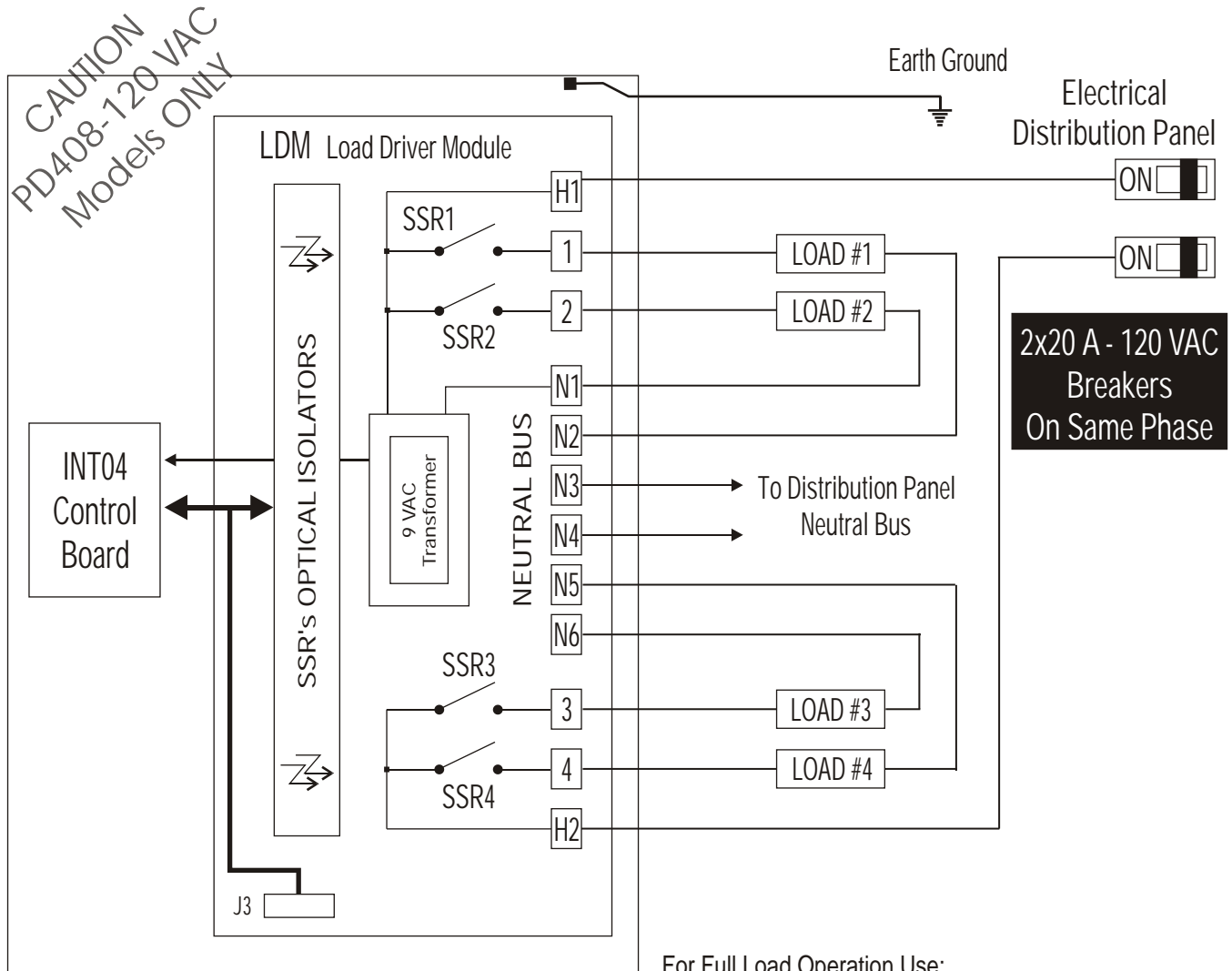

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PD408 General Wiring Instructions

Wiring Notes

- DO NOT EXCEED 960 W (8 Amps.) per dimmer output @ 120VAC.
- All wiring between the control stations, dimmers, and other system controllers (network bus) is low voltage (NEMA Class 2) and may be run with two, twisted pair, shielded #18 AWG wire. Control network bus may be Carol Cable #C3362 unless otherwise required. Consult the PROTOCOL Hardware Installation Manual, Appendix E, for maximum wire length.
- PD408 dimmer packs may be fed by one or two 20 A (maximum) branch circuits and may have up to four separately dimmed loads.
- Both breakers must be on the same power phase.
- CAUTION: DO NOT attempt to parallel outputs to increase capacity.
- Installations must conform to local and/or NEC code requirements.
- Each load must have its own Neutral wire for full load operation.
- All line voltage wires must have copper conductors of adequate Gauge with 90° C wire insulation.
- POWER EACH LOAD DIRECTLY BEFORE CONNECTING IT TO THE PD408 TO ENSURE PROPER WIRING.

Figure 7 - PD408 Typical 120 VAC Wiring.

CAUTION PD408-120 VAC Models ONLY

Earth Ground

Electrical Distribution Panel

LDM Load Driver Module

SSR's OPTICAL ISOLATORS

INT04 Control Board

9 VAC Transformer

NEUTRAL BUS

SSR1
SSR2
SSR3
SSR4

H1
1 — LOAD #1
2 — LOAD #2
N1
N2
N3 → To Distribution Panel Neutral Bus
N4 →
N5
N6
3 — LOAD #3
4 — LOAD #4
H2

J3

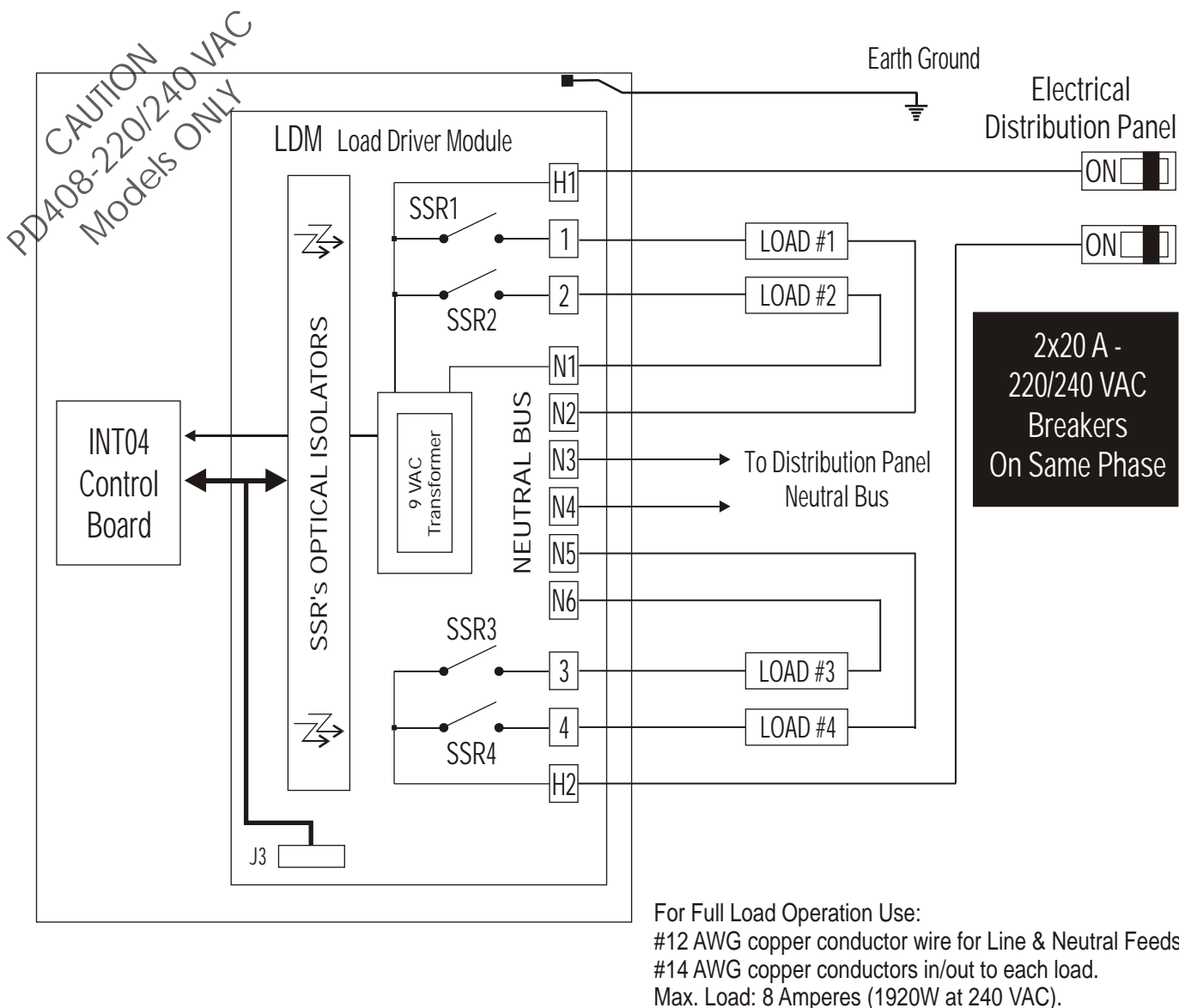2x20 A - 120 VAC Breakers On Same Phase

For Full Load Operation Use:
#12 AWG copper conductor wire for Line & Neutral Feeds.
#14 AWG copper conductors in/out to each load.
Max. Load: 8 Amperes (960W at 120 VAC).

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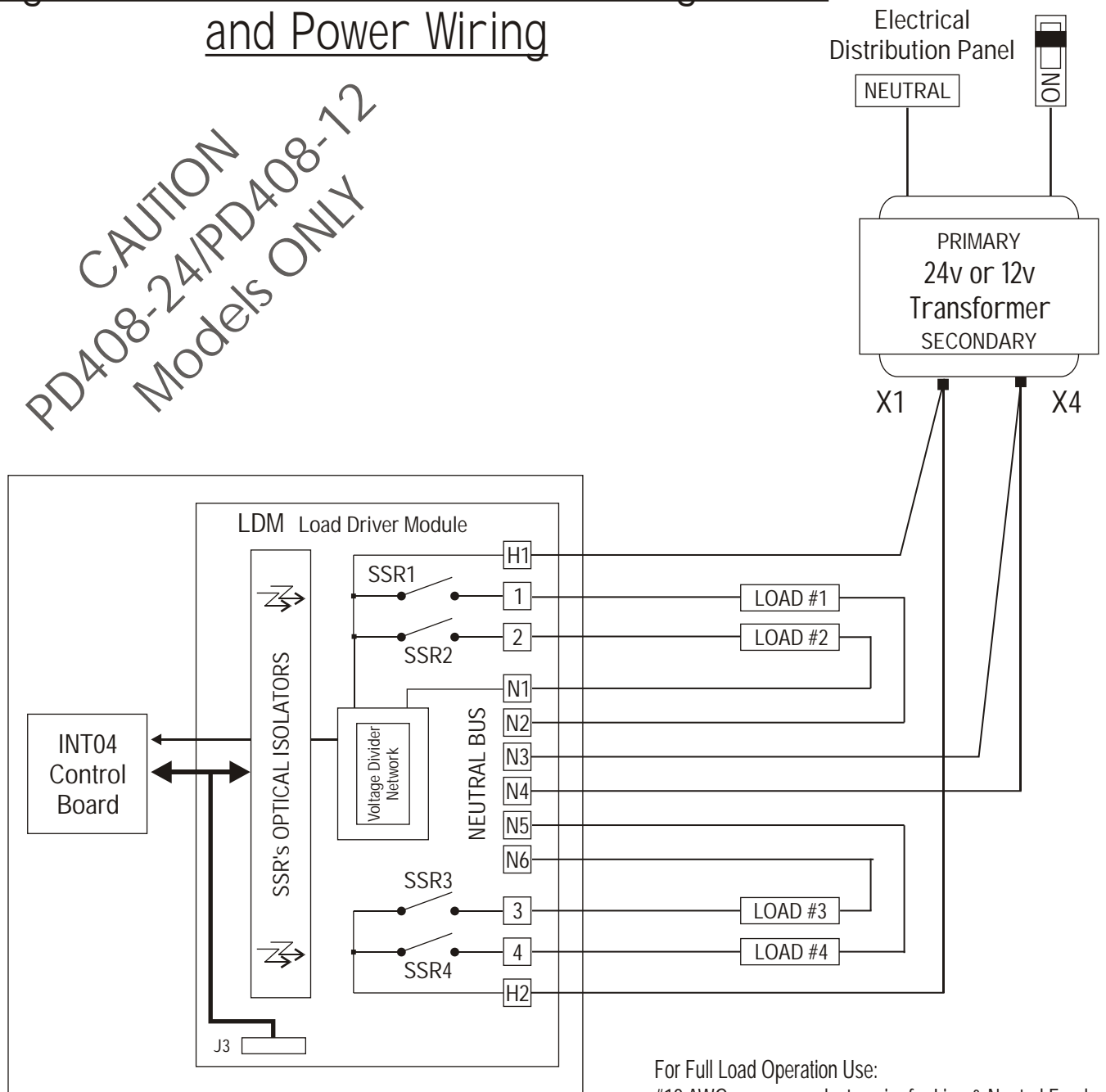# PD408-220 General Wiring Instructions

Wiring Notes

- DO NOT EXCEED 1920 W (8 Amps.) per dimmer output @ 240VAC.
- All wiring between the control stations, dimmers, and other system controllers (network bus) is low voltage (NEMA Class 2) and may be run with two, twisted pair, shielded #18 AWG wire. Control network bus may be Carol Cable #C3362 unless otherwise required. Consult the PROTOCOL Hardware Installation Manual, Appendix E, for maximum wire length.
- PD408 dimmer packs may be fed by one or two 20 A (maximum) branch circuits and may have up to four separately dimmed loads.
- Both breakers must be on the same power phase.
- CAUTION: DO NOT attempt to parallel outputs to increase capacity.
- Installations must conform to local and/or NEC code requirements.
- Each load must have its own Neutral wire for full load operation.
- All line voltage wires must have copper conductors of adequate Gauge with 90° C wire insulation.
- POWER EACH LOAD DIRECTLY BEFORE CONNECTING IT TO THE PD408, TO ENSURE PROPER WIRING.

Figure 8 - PD408 Typical 220/240 VAC Wiring.

CAUTION
PD408-220/240 VAC
Models ONLY

Earth Ground

Electrical
Distribution Panel

LDM Load Driver Module

SSR's OPTICAL ISOLATORS

INT04
Control
Board

9 VAC Transformer

NEUTRAL BUS

H1
SSR1
1   LOAD #1
SSR2
2   LOAD #2
N1
N2
N3   To Distribution Panel
N4   Neutral Bus
N5
N6
SSR3
3   LOAD #3
SSR4
4   LOAD #4
H2

J3

ON

ON

2x20 A -
220/240 VAC
Breakers
On Same Phase

For Full Load Operation Use:
#12 AWG copper conductor wire for Line & Neutral Feeds.
#14 AWG copper conductors in/out to each load.
Max. Load: 8 Amperes (1920W at 240 VAC).

Figure 9 - PD408-24/12 Low Voltage Load and Power Wiring

CAUTION
PD408-24/PD408-12
Models ONLY

Electrical
Distribution Panel

NEUTRAL

ON

PRIMARY
24v or 12v
Transformer
SECONDARY

X1   X4

LDM Load Driver Module

INT04
Control
Board

SSR's OPTICAL ISOLATORS

Voltage Divider Network

NEUTRAL BUS

H1
SSR1
1
2
SSR2
N1
N2
N3
N4
N5
N6
SSR3
3
SSR4
4
H2

LOAD #1
LOAD #2
LOAD #3
LOAD #4

J3

For Full Load Operation Use:
#12 AWG copper conductor wire for Line & Neutral Feeds.
#14 AWG copper conductors in/out to each load.
Max. Load per circuit : 8 Amperes (192W at 24 VAC).

NOTES

1   With PD408-24 you may use a single 24 VAC-800 VA or better transformer or two separate 24 VAC-400 VA or better transformers.
2   With PD408-12 you may use a single 12 VAC-400 VA or better transformer or two separate 12 VAC-200 VA or better transformers.
3   Follow transformer's installation & wiring instructions from manufacturer.
4   Maximum Load Per Output: 96 Watts at 12 VAC.
5   Maximum Load Per Output: 192 watts at 24 VAC.

PROTOCOL Address Setting

Up to 63 uniquely addressed INT04 boards (two in each **PD804**, one in each **PD408** and **PD216**) may be installed in any one system. Each **INT04** must be set to a unique decimal address between 1 and 63. **INT04** #63 output 4 is not available for use. Total number of zones ((63 x 4) -1 = 251). Refer to **TABLE 4** On **Page 9** of this manual for proper setting of the address selectors S1 and S2 on the **PD408**.

Example:

S2 & S1 should be set respectively to **1 & A** if the desired address is 26 (1 x 16 + A= 26, A=10). In this example, outputs 1 through 4 of **PD408** # 26 are referred to as 26.1, 26.2, 26.3 and 26.4 when configuring buttons on PROTOCOL stations, using the PROTOCOL "**SOFTPRO**" programming software. Address used must not be an address already used elsewhere in the system).

NOTE:

It is also possible to quadruple the maximum number of outputs on a system up to 1004 circuits. An **INT04** may have a decimal address of up to, and including, 252. Please contact factory for more details. For a complete Decimal to Hexadecimal conversion chart, please refer to **Appendix A** in the PROTOCOL **Hardware** and **Software Manuals**.

Non-Dim Output Setting

Whilst outputs may be programmed to dim or not dim through the "SOFTPRO" configuration software, in some circumstances it may be preferable for all four outputs in the **PD408** to be configured for non-dim (switch only) operation by a hardware lock. This prevents inadvertent dimming, or damage, of loads that cannot be dimmed, such as contactors, mechanical relays, motors, non-dim fluorescent, etc...

Since this procedure involves adding a jumper to the **INT04** board, it is preferable to have it performed by the factory, at time of order. However, any qualified electronic technician can perform the procedure in the field when necessary. **Figure 10** shows the location for installing the non-dim (ND) jumper.

Jumper to Ensure Non-Dim function of INT04 to be installed here.
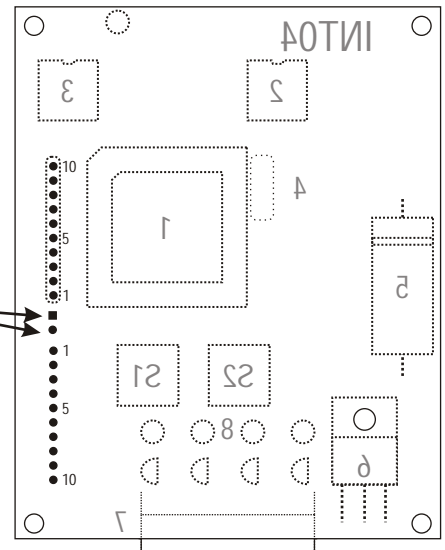
INT04 Solder (Back) Side

Figure 10 - PD408 INT04 DETAIL

PD408 Installation Check List

BEFORE ENERGIZING THE PD408 MAKE SURE:

☐ Loads are tested before connecting to dimmers.
☐ Breaker feed lines are on same electrical phase.
☐ PD408 has been properly grounded.
☐ All line voltage screw terminals are properly tightened to prevent hot spots.
☐ Low voltage data lines connections are properly insulated.
☐ Low voltage data lines polarity is observed throughout the system.
☐ The PD408's INT04 is set to the right addresses.

☐ ALL KNOCKOUT HOLES MUST BE COVERED WHEN UNIT IS INSTALLED

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Table 4 - PD DIMMER Address Selection Information

00 INVALID ADDRESS
01 set S2,S1 to **0,1**
02 set S2,S1 to **0,2**
03 set S2,S1 to **0,3**
04 set S2,S1 to **0,4**
05 set S2,S1 to **0,5**
06 set S2,S1 to **0,6**
07 set S2,S1 to **0,7**
08 set S2,S1 to **0,8**
09 set S2,S1 to **0,9**
10 set S2,S1 to **0,A**
11 set S2,S1 to **0,B**
12 set S2,S1 to **0,C**
13 set S2,S1 to **0,D**
14 set S2,S1 to **0,E**
15 set S2,S1 to **0,F**
16 set S2,S1 to **1,0**
17 set S2,S1 to **1,1**
18 set S2,S1 to **1,2**
19 set S2,S1 to **1,3**
20 set S2,S1 to **1,4**
21 set S2,S1 to **1,5**
22 set S2,S1 to **1,6**
23 set S2,S1 to **1,7**
24 set S2,S1 to **1,8**
25 set S2,S1 to **1,9**
26 set S2,S1 to **1,A**
27 set S2,S1 to **1,B**
28 set S2,S1 to **1,C**
29 set S2,S1 to **1,D**
30 set S2,S1 to **1,E**
31 set S2,S1 to **1,F**
32 set S2,S1 to **2,0**

33 set S2,S1 to **2,1**
34 set S2,S1 to **2,2**
35 set S2,S1 to **2,3**
36 set S2,S1 to **2,4**
37 set S2,S1 to **2,5**
38 set S2,S1 to **2,6**
39 set S2,S1 to **2,7**
40 set S2,S1 to **2,8**
41 set S2,S1 to **2,9**
42 set S2,S1 to **2,A**
43 set S2,S1 to **2,B**
44 set S2,S1 to **2,C**
45 set S2,S1 to **2,D**
46 set S2 S1 to **2,E**
47 set S2,S1 to **2,F**
48 set S2,S1 to **3,0**
49 set S2,S1 to **3,1**
50 set S2,S1 to **3,2**
51 set S2,S1 to **3,3**
52 set S2,S1 to **3,4**
53 set S2,S1 to **3,5**
54 set S2,S1 to **3,6**
55 set S2,S1 to **3,7**
56 set S2,S1 to **3,8**
57 set S2,S1 to **3,9**
58 set S2,S1 to **3,A**
59 set S2,S1 to **3,B**
60 set S2,S1 to **3,C**
61 set S2,S1 to **3,D**
62 set S2,S1 to **3,E**
63 set S2,S1 to **3,F**

NOTES:
00 Decimal (S2,SI = 0,0) is not allowed on any device.
Max PD408 Address: 63 Decimal (S2,S1 = 3,F)

LIMITED WARRANTY

Digital Lighting Systems, warrants to the purchaser that its products have been carefully manufactured and inspected and are warranted to be free from defects of workmanship and materials when used as intended. Any abuse or misuse contrary to normal operation shall void this warranty.

Digital Lighting Systems' obligation under this warranty shall be limited to replacement or repair of any units as shall within two years of date of invoice from Digital Lighting Systems, prove defective; and Digital Lighting Systems shall not be liable for any other damages, whether direct or consequential. The implied warranties of merchantability and fitness for a particular purpose are limited to the duration of the expressed warranty. Some states do not allow the exclusion of the limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, you may also have other legal rights which vary from state to state.

Defective merchandise may be returned to Digital Lighting Systems, prepaid, after prior notification has been given and approval obtained for the return. To obtain prior approval for the return of the defective items, contact your local Digital Lighting Systems distributor, representative, or:

Digital Lighting Systems, Inc.
Attn: Customer Service Department
7588 NW 8th Street
Miami, FL 33126
(305) 264-8391

Upon request, replacement unit(s) will be shipped as soon as available. Unless immediate shipment of replacement merchandise is requested, Digital Lighting Systems will not ship replacement merchandise until defective merchandise is received, inspected, and determined to be defective.

No labor charges in connection with warranty problems will be reimbursed by Digital Lighting Systems without prior written approval from the factory.

Digital Lighting Systems distributors and representatives have no authority to change this warranty without written permission.

Digital Lighting Systems reserves the right to determine the best method of correcting warranty problems.