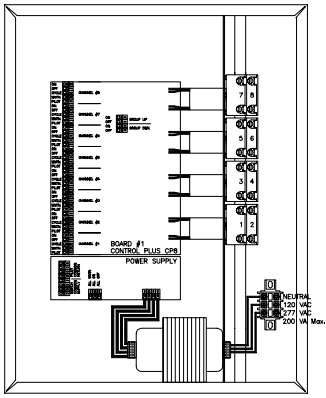
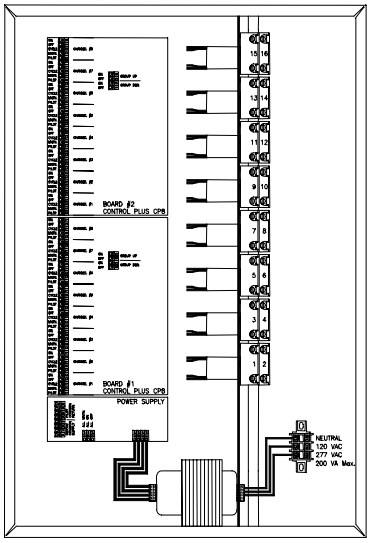
Touch-Plate® Lighting Controls

CPS 0008/0048 System Manual

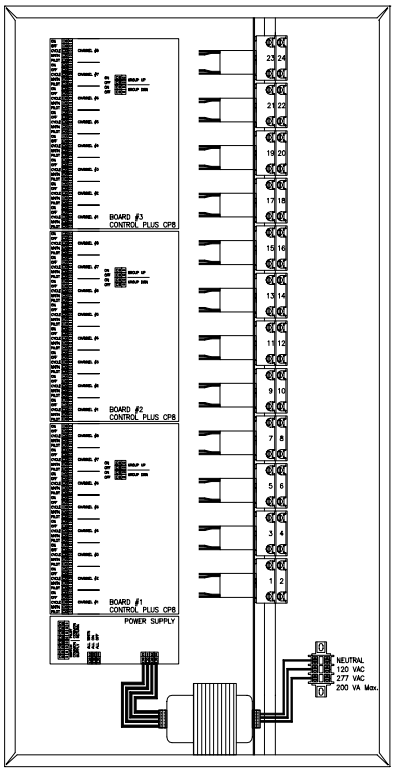




Control *Plus* Series

CPS-0008 Through CPS-0048

System Manual



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I. PREFACE

This manual contains all the information necessary to install, start, and troubleshoot the Control Plus Series 8 through 48 lighting control panels.

Typical System Layout

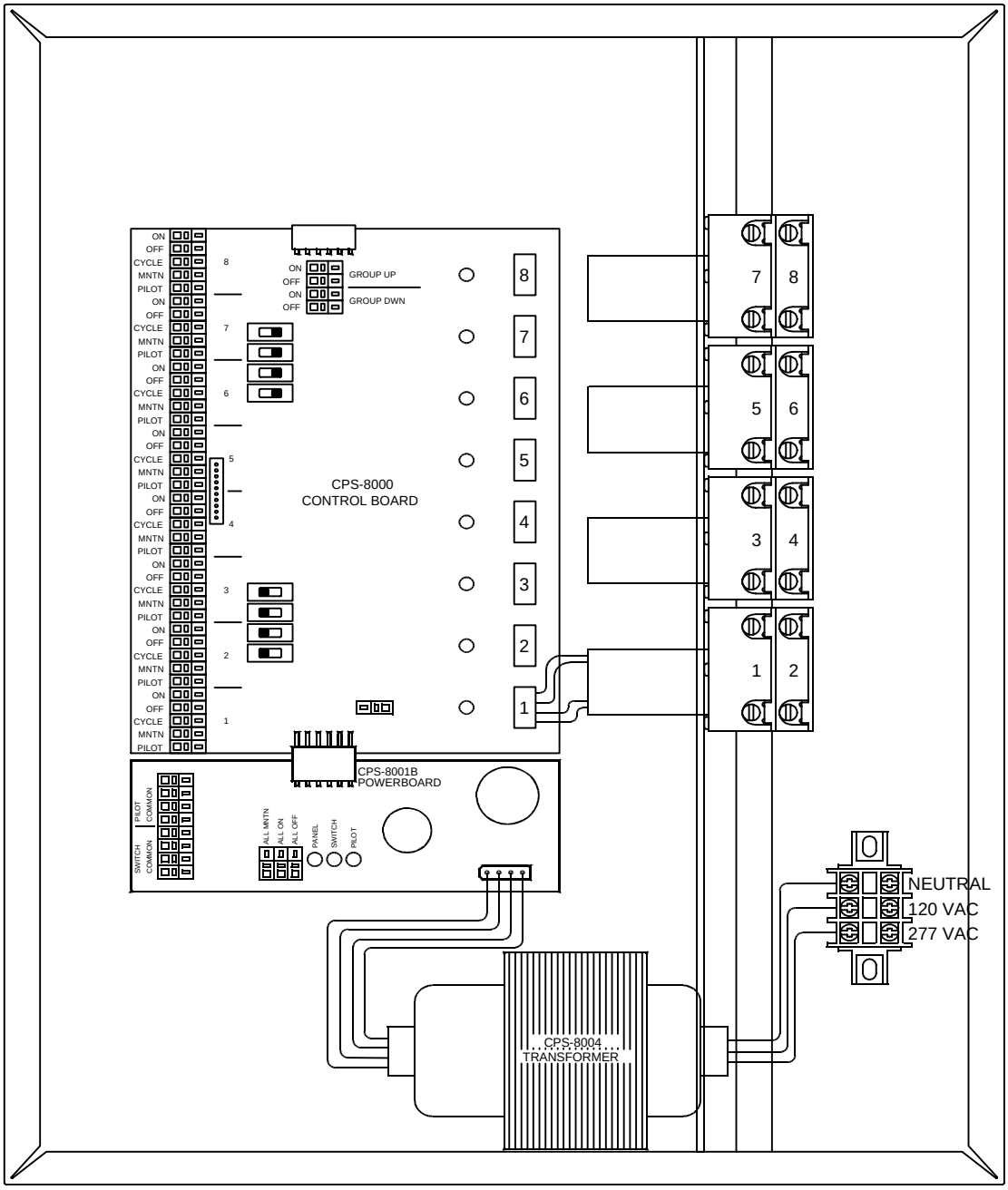


Figure I-1 Typical System Layout

II. OVERVIEW

The Control Plus Series is the best set of low-voltage control panels on the market. The panels are economical, versatile, and easy to operate.

The panel's main features are:

- Up to 48 loads can be controlled individually or in groups.
- Each load (or group of loads) can be controlled by on/off momentary action switches; by maintained contact switches; and, in the case of individual loads, by cycling the load from on to off through a single momentary contact switch.
- All switch input actions override previous commands.
- Completely modular design and assembly.
- Graphic display panels, LED type, which show the status of each relay, can be used with the Control Plus Series.
- Loads can be controlled from many locations via low-voltage #22 AWG wire.
- The relay panels can be powered by 120 or 277 VAC.
- All connectors are color coded.
- Easy to interface with other systems in the building.
- Can incorporate occupancy sensors and photocells.
- Proven reliability with thousands of panels installed nationwide.
- Many feature add-on options through the Solution Series.

III. DESCRIPTION

Each panel contains a power supply, a control board for every eight relays, and the relays themselves. These components are mounted in an ETL-approved enclosure.

All panels use the same transformer and the same power board. The power and control boards are modular in design and are joined by push-in connectors, making assembly and service easy.

The relays are connected to the control boards by push-in connectors.

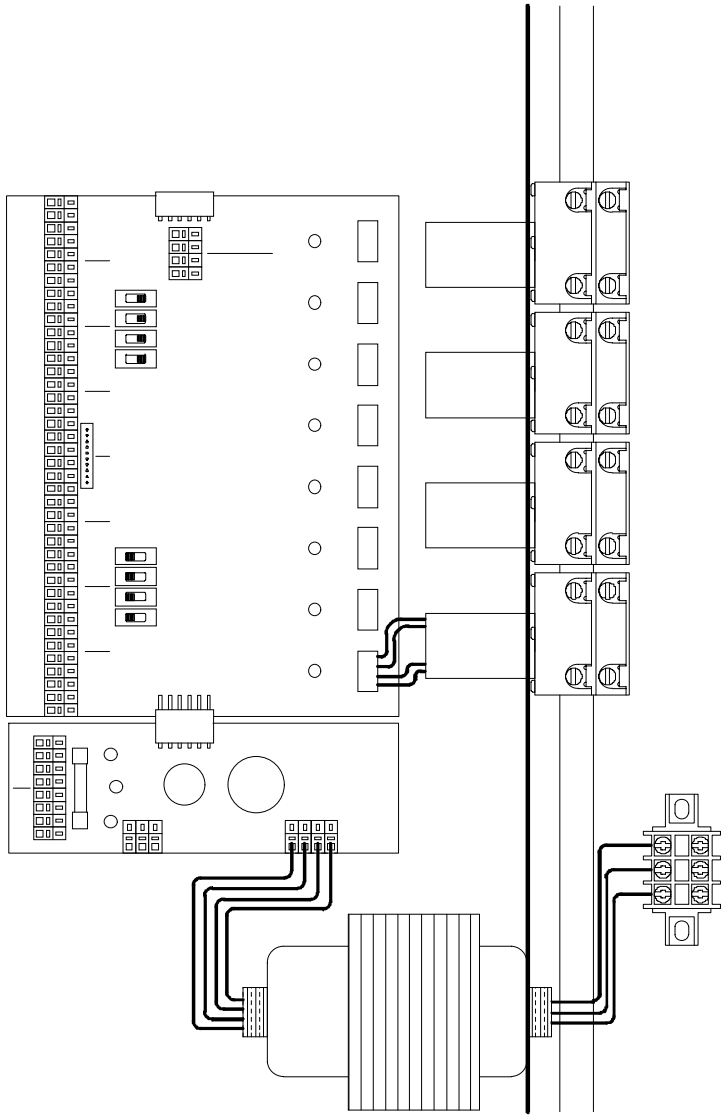


Figure III-1 System Layout

A. Relays

The panels use the Touch-Plate 3000-PL relay. This relay can switch loads rated to 20 amps at 277 VAC Tungsten or Ballast. A secondary contact is provided for use with pilot lights.

When the relay is operated, it changes state, from off to on or vice versa, and mechanically latches in that state. No holding current is required. As a result, heat in the enclosure is minimized.

The secondary contact is used to illuminate lighted switches, light indicators in graphic panels, and other devices. It is also used to provide a status output for the control board. The status output can be used by a computer and other devices.

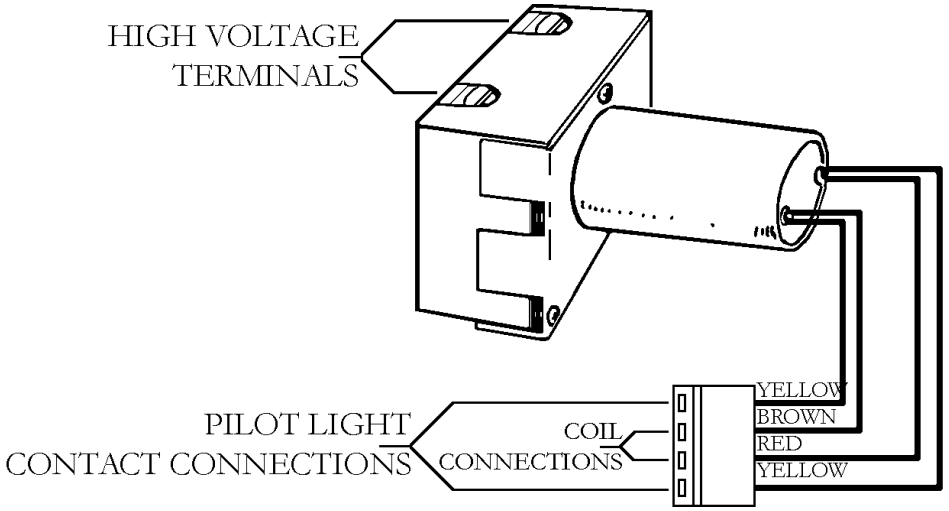


Figure III-2 Touch-Plate Relays

B. Power Supply

The power supply consists of a transformer and a power board, which supplies up to 5.5 amps at 6.3 VAC for the pilot lights and enough power at 30 VDC, in conjunction with the capacitors on each board, to operate all the relays at once.

The power board is also used to provide functions common to the controller as a whole, such as the master switch inputs and the common connections for switch power and pilot lamp returns.

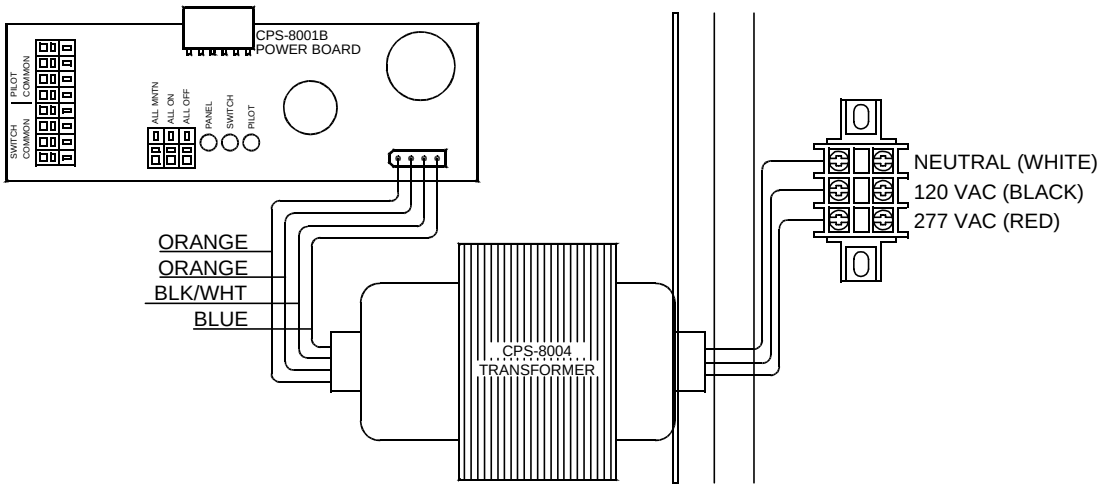


Figure III-3 Power Supply

1. Transformer

The Transformer has connections for 120 and 277 VAC in the primary and 6.3 and 22 VAC in the secondary. The transformer is approved by ETL and accommodates up to 5.5 amps at 6.3 VAC and 2.5 amps at 22 VAC.

2. Power Board

The transformer secondaries are fed into a power board which converts the 20 VAC into 28 VDC. This voltage operates the relays and electronics.

The board contains three green LED's. The left LED, labeled "Panel Supply", is lit when 28 VDC is fed to the relays. The middle LED, labeled "Switch Supply", is lit when 28 VDC is supplied to the switch common output. The right LED, labeled "Pilot Supply", is lit when 6.3 VAC is provided. All three are separately fused with thermal resetting fuses.

3. Inputs

The power board affects the entire panel. It contains the master on, master off, and master maintained outputs.

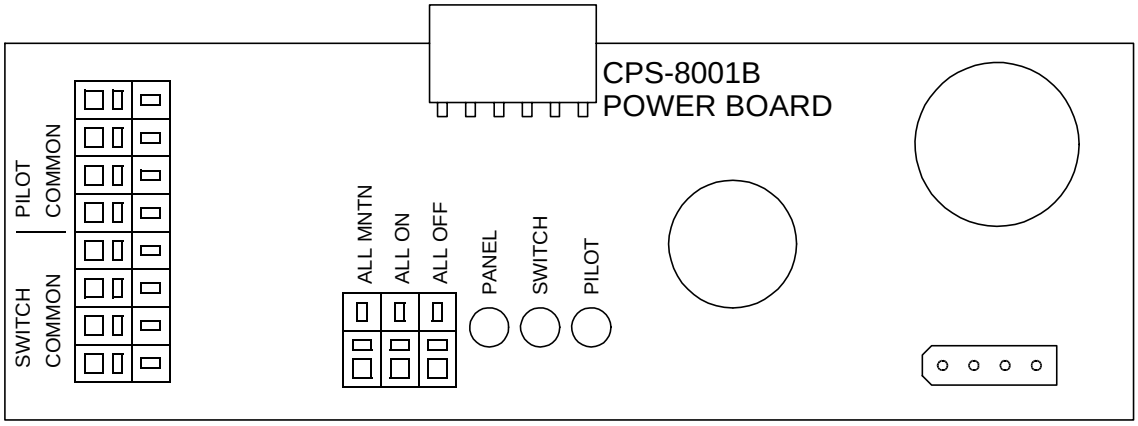


Figure III-4 Power Board

a. Master On And Master Off

Two terminals, green for *ON* and black for *OFF* turn the whole system on or off. For instance, when the switch common terminal is connected to the master on terminal, via a momentary contact switch, all the relays will be turned *ON*.

The relays are turned on or off in sequence to prevent large loads from being switched at once, and to prevent spikes on the power line.

b. Master Maintained

There is a gray terminal next to the on/off connectors for the master maintained operation.

By connecting the switch common terminal to this terminal via a maintained contact on/off switch, all the relays will be turned on when the switch is closed (*on*) and turned off when the switch is opened (*off*). The switching is accomplished in the same manner as described in section *a.* above.

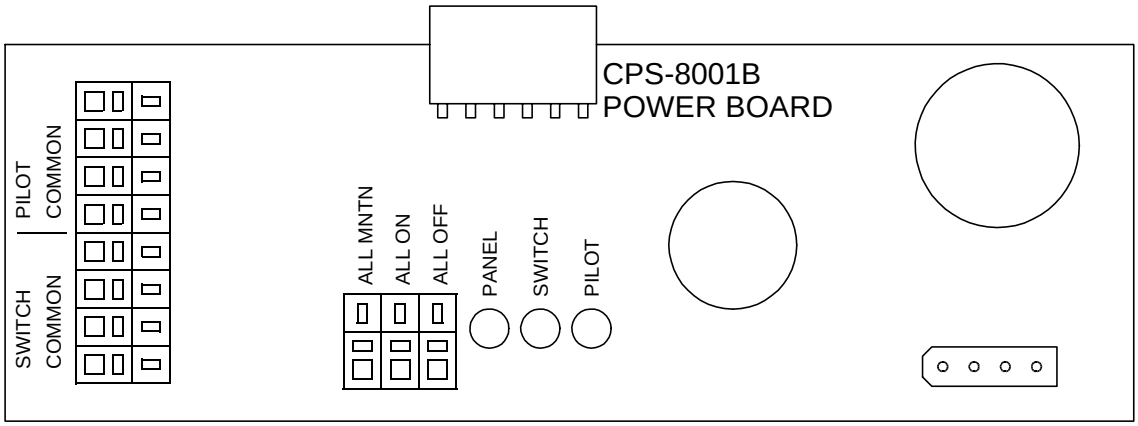


Figure III-5 Master Maintained

The master maintained switch affects the relays only when it is opened or closed. At all other times it has no effect, and any other switch will activate connected relays.

The master maintained feature is normally used with clocks, or key switches. The "ON" signal doesn't affect any relays that are on; the "OFF" signal also doesn't affect any relays that are off.

Relays can be triggered by different inputs, with the last input overriding the others. This means that the relays can be controlled by both master inputs or the inputs on each board. Thus a master on/off switch input can be used as a manual override switch while a time clock is used for automatic controls via the master maintained switch input.

c. Common Connections

The power board has four black terminals labeled pilot common which is the return terminal for all the pilot lamps. It is also the negative side of the 28 volt power supply. All voltages in the controller are referred to this point. When voltage measurements are given, it is assumed that one side of the voltmeter will be connected to this point.

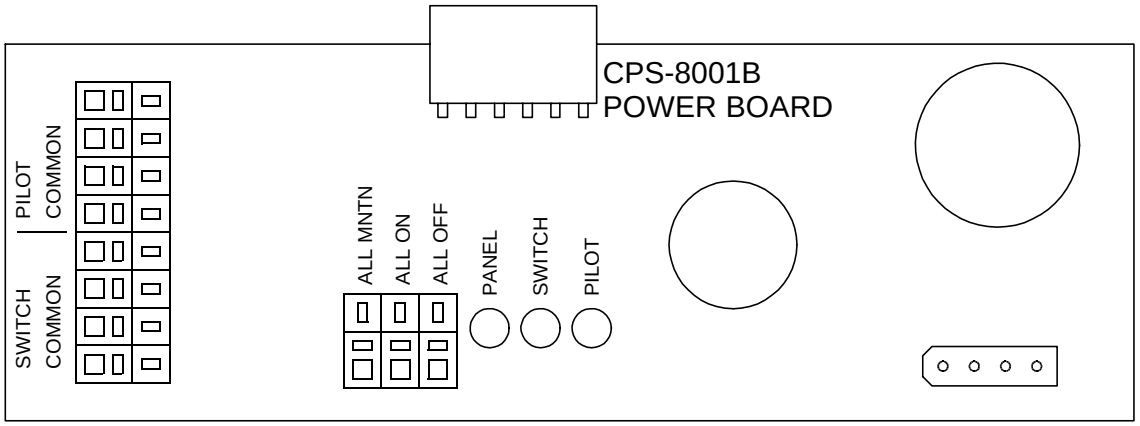


Figure III-6 Common Connections

Four white terminals, labeled switch common, are used to supply the 28 VDC required to switch the relays.

IMPORTANT: When hooking up the system, it is quite easy to brush a wire carrying 28 volts against the 6.3 VAC of the pilot lights. The fuse protects the 6.3 VAC from sending potentially harmful negative voltage to the electronics.

C. The 8 Relay Control Board

There is one eight relay control board for each set of eight relays in the unit. Thus a CPS-0008 has one board, a CPS-0016 has two, and so on.

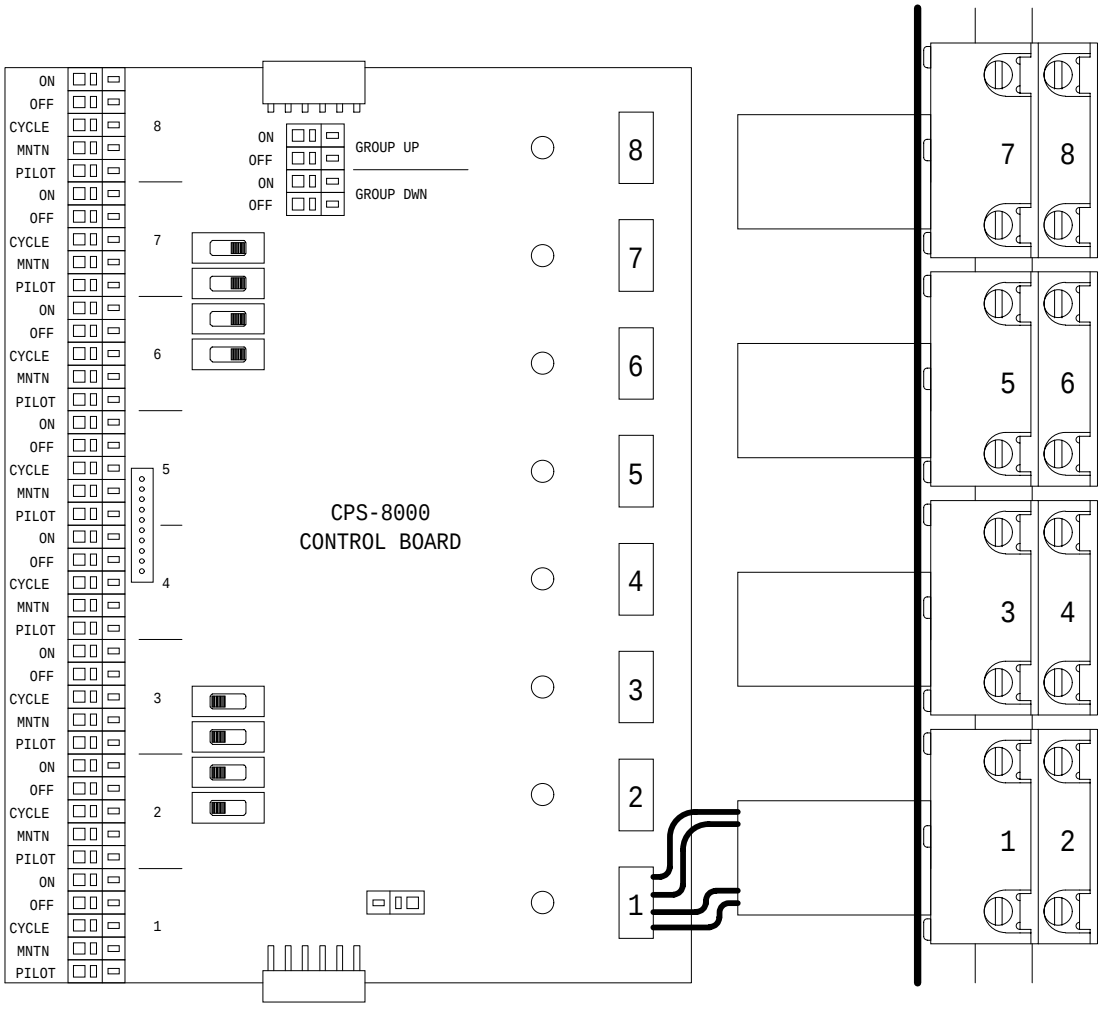


Figure III-7 Control Board

The control board transmits instructions, either from the power board or from the terminals on the control board itself, to its eight relays. It also transmits the outputs from the relays to the pilot lights and status outputs.

1. Inputs

The input terminal block provides a switch input for each relay. There is a terminal for each of the following inputs (and one output):

- Momentary ON input (Green)
- Momentary OFF input (Black)
- Momentary Cycle input (Orange)
- Maintained input (Light Gray)
- 6.3 volt pilot light *output* (Blue)

In addition, there are four terminals in the upper center portion of the board. These inputs correspond to the three position slide switches on the board, and allow for two momentary on/off inputs to control relays selected via the switches.

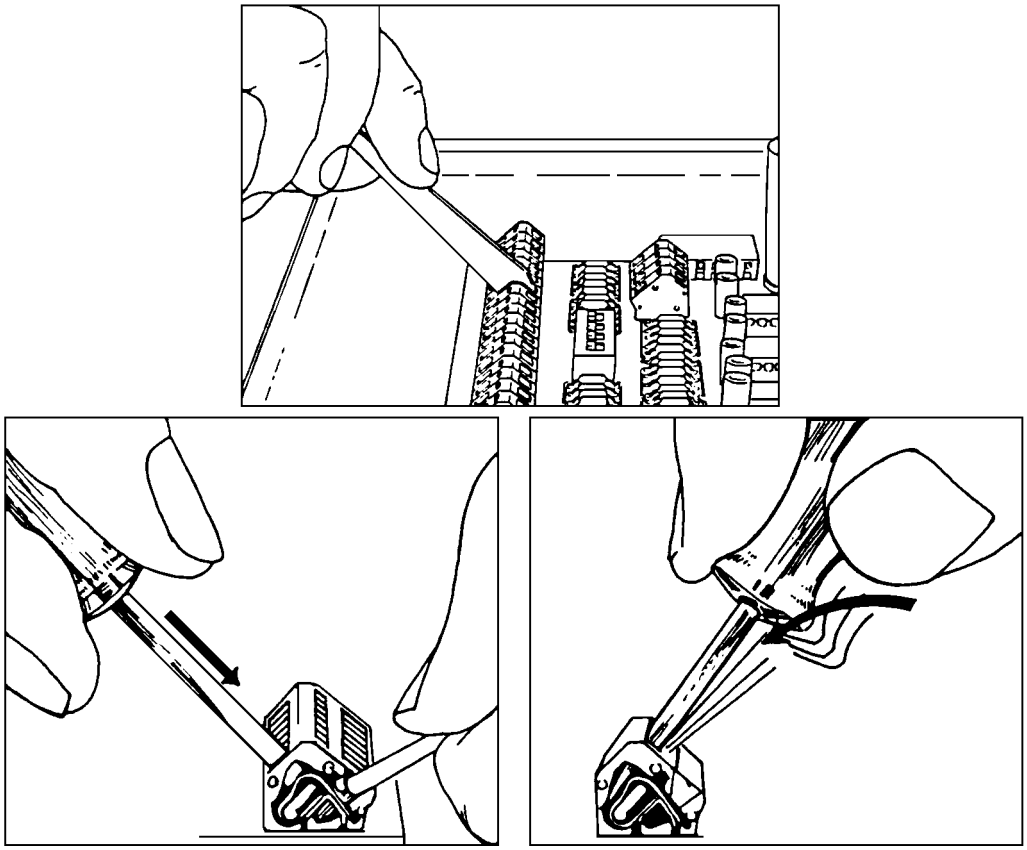


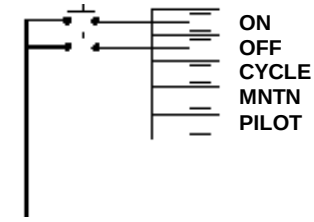
Figure III-8 Quick Connect Terminals

Terminals are clearly identified by function and relay number. All terminals grouped under label 1 will affect relay 1 of that board, and so on for the other terminals. These terminals are best operated by the special tool provided. (If tool is lost, use a small screwdriver.)

a. Summary Of Relay Inputs And Outputs

INDIVIDUAL RELAY INPUTS
(One block per relay output; all types can be used to control a single relay.

Two Button Momentary
Separate signal for "ON" / "OFF"

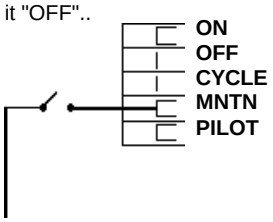


Switch common
(from POWER BOARD)

Single Button Momentary
Each closure changes the state of the relay.

Switch common
(from POWER BOARD)

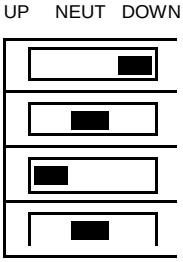
Maintained Contact
Sustained contact runs the relay "ON" open contact runs it "OFF"..



Switch common
(from POWER BOARD)

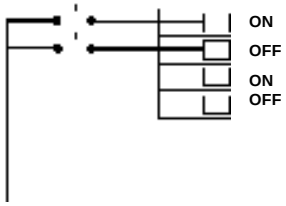
ZONE CONTROL
Switch selectable groups within each 8-relay control board. (Zones are easily configured and re-configured as needed.)

Slide Switch "Programmable" Groups on the CONTROL BOARD



Relays are selected by moving slide switches into a desired group

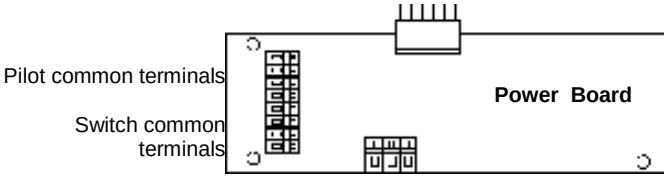
3-position Slide Switches
(1 switch per relay)



Switch common
(from POWER BOARD)
Group inputs are ON/OFF momentary
type only.

MASTER CONTROL
(Single input energizes all relays in the panel.)

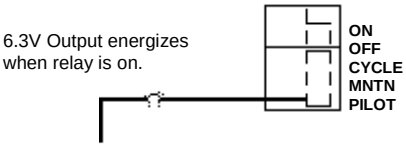
Master Inputs and commons on the POWER BOARD



Master Input Terminals turn all relays on or off. Accepts 2 button ON/OFF momentary or MAINTAINED Input.

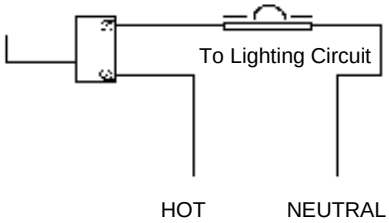
OUTPUTS

Pilot Lamp Output
For indication at switch or enunciator panel



Pilot common
(from POWER BOARD)

Typical Relay/Load Wiring



Several inputs can be used to trigger the same relay. However, the last input will always override the previous ones.

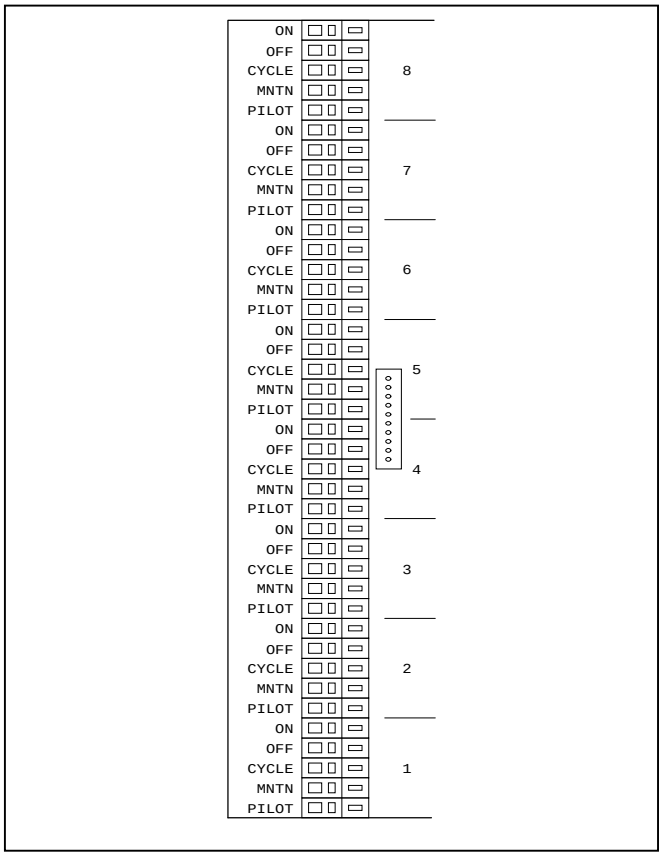


Figure III-9 Relay Inputs

b. Individual On And Off

If the switch common is connected to the on/off terminals via momentary contact switches, then the corresponding relay will be turned on or off. If the relay was on when an *on* signal was sent, then the relay will not change status. If the relay is off, an *off* signal will not affect the relay.

An electronic circuit safeguards the relay from a stuck switch or from a switch that an operator has kept closed too long.

The *on* terminal is green. The *off* terminal is black.

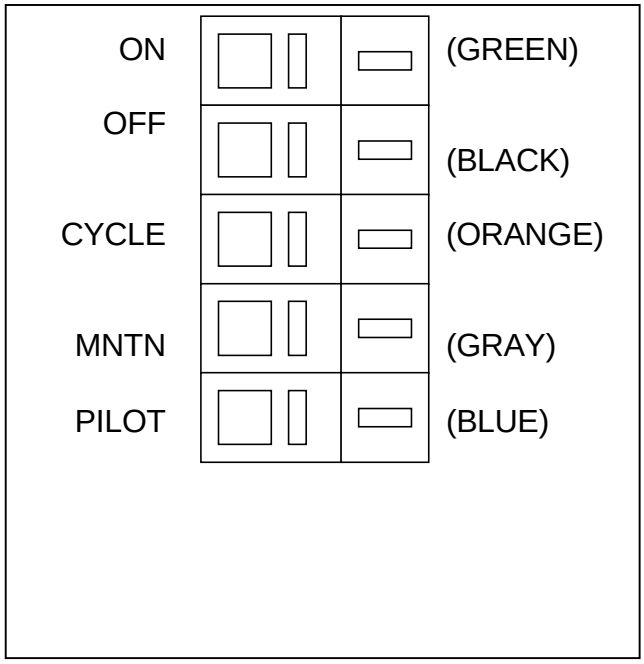


Figure III-10 On/Off Terminals

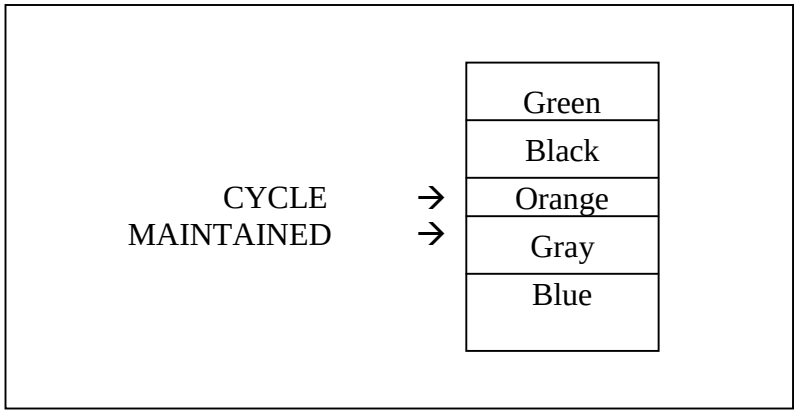


Figure III-11 Cycle and Maintain Terminals

c. Cycle Each

If the switch common is connected to the cycle terminal via a single momentary contact switch, the corresponding relay will be cycled. If the relay is on, it will be turned off; if it is off, it will be turned on.

d. Maintained Each

If the switch common is connected to the maintained terminal via a maintained contact switch, the relay will be turned on when the contact is closed and will be turned off when the contact is opened.

It is the actual closing or opening of the switch that operates the relay. When the switch is in a constant position, it has no effect on the system and any other switch can be used to override its condition.

As a result, a maintained contact switch will sometimes be in the up position, indicating that the relay is *on* even though the relay is obviously off. This discrepancy could be caused by the inadvertent flipping of a master switch. In such a case, turning the switch off and on again will turn on the relay.

The maintained circuit was designed to operate with maintained contacts provided by computers, clocks, photocells, motion detectors, sound detectors, regular wall switches, or any other device that gives a maintained contact closure.

e. Programmable On/Off

These terminals are located on the side of the control board, about one inch from the front edge. They are labeled on/off down and on/off up. Only relays selected by the miniature slide switches in the middle of the board are controlled by these on/off inputs. Numbers next to the miniature slide switches indicate which relay is programmed by that switch.

The miniature slide switches have three positions: up, off, and down. The programmable on/off down input controls all relays where the corresponding selection switches are in the down position; the programmable on/off up input controls all relays where the corresponding selection switches are in the up position. Relays with the selection switch in the off or neutral position will not be affected.

As with all inputs, the relays are protected against stuck switches.

The *on* terminal is green; the *off* terminal is black.

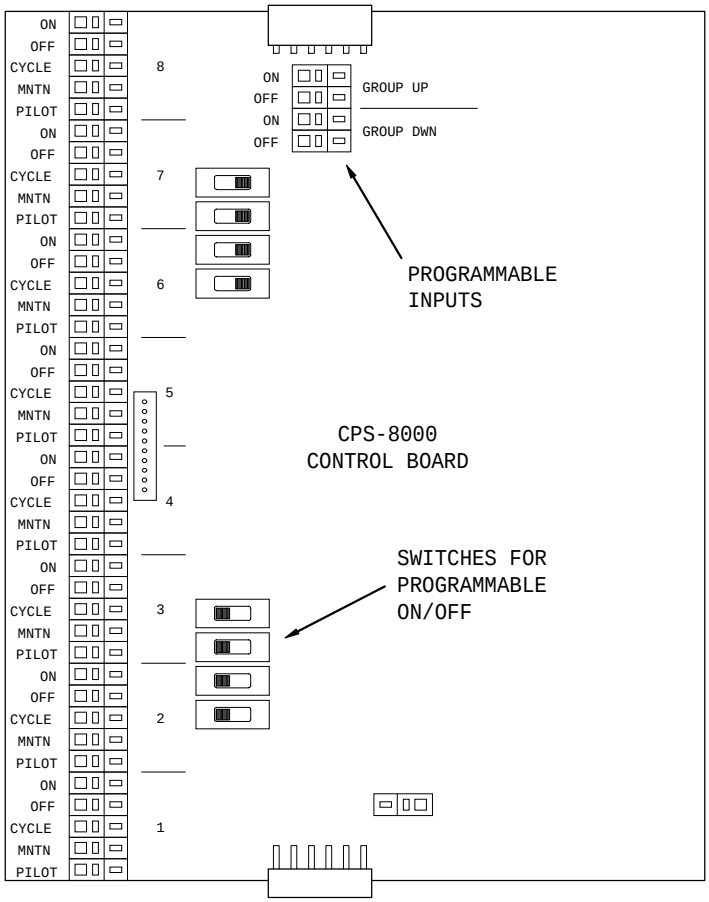


Figure III-12 Programmable ON/OFF

f. Paralleling On/Off Inputs

The programmable inputs simplify the wiring for groups of relays. When setting up a dual-level lighting system, for example, one could put even numbered relays on one switch and odd numbered relays on the other switch.

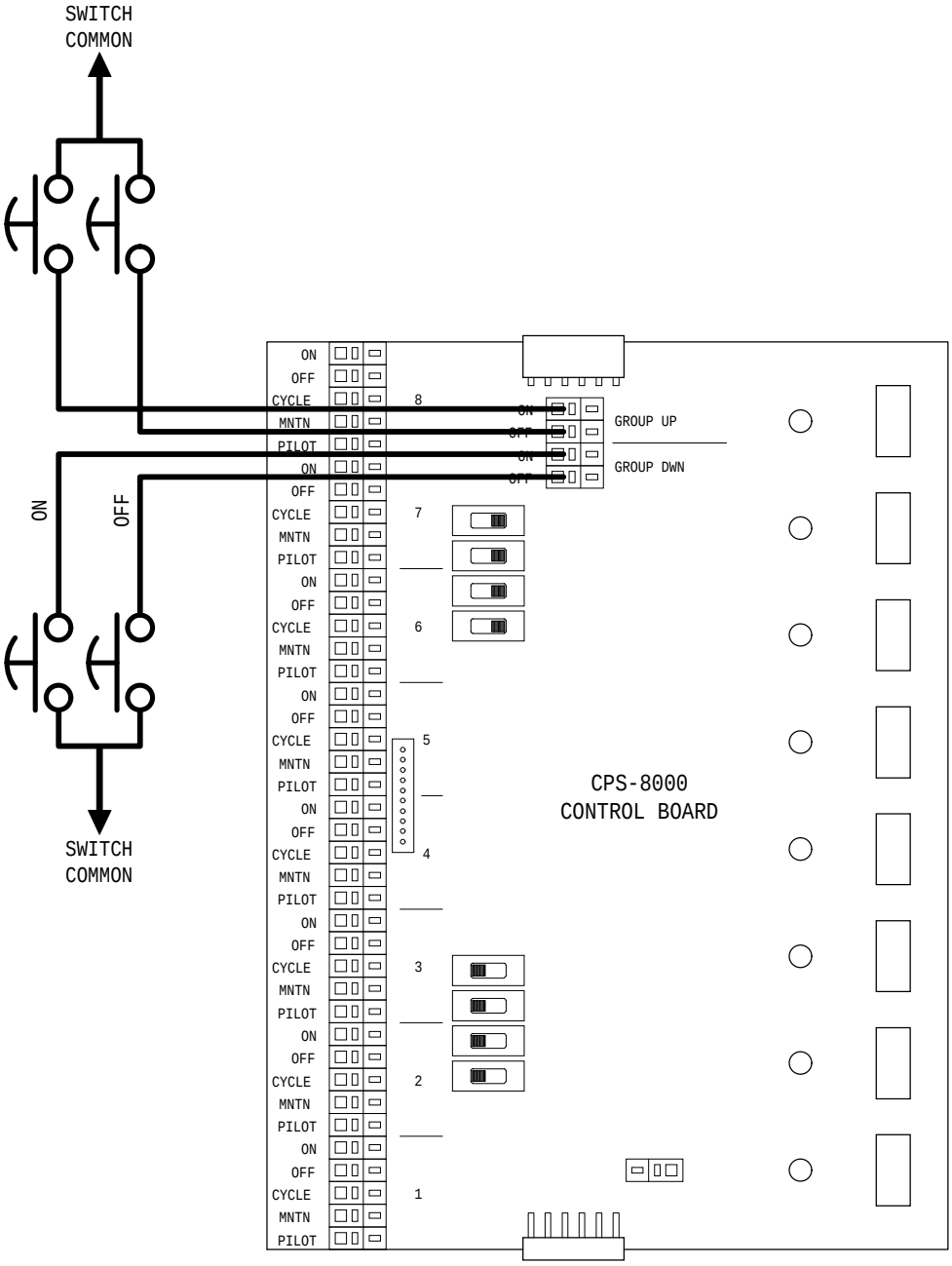


Figure III-13 Dual Level Lighting Using Programmable ON/OFF

Often, a relay control group contains relays controlled by several boards in the unit. To provide this control, connect individual on/off inputs in parallel to make up the groups. There is no limit to the number of individual on/off inputs that may be brought together.

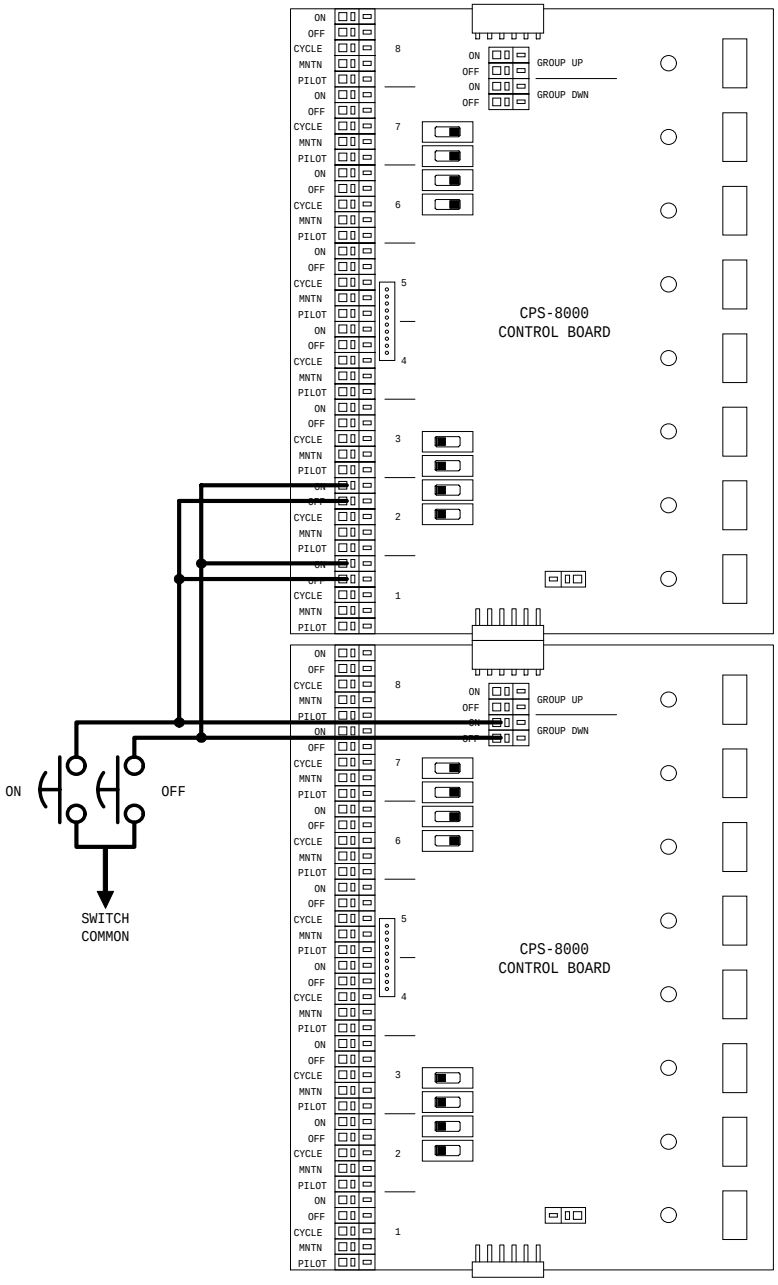


Figure III-14 Paralleling with Individual ON/OFF

g. Additional Pilot Light Power

If you need to power more than 24 *incandescent* pilot lights, call the factory and request the necessary documentation.

2. Outputs

When a relay is actuated, the secondary contact in the relay is closed and opened at the same time as the main contacts. This feature is used to signal the control board that a relay is on or off; to power outside pilot lights; and to notify computers when the relay is on or off. It can also be used to trigger other devices within the power capabilities of the contact and the transformer.

a. Pilot Lights

When a relay is turned on, the relay's secondary contact closes and 6.3 VAC is fed to the blue terminal for that relay at the front of the control board. Each terminal is identified by a number that corresponds to a relay. The relay's pilot light is connected between the blue terminal for that relay and pilot common on the power board.

The pilot light comes on when the relay is on.

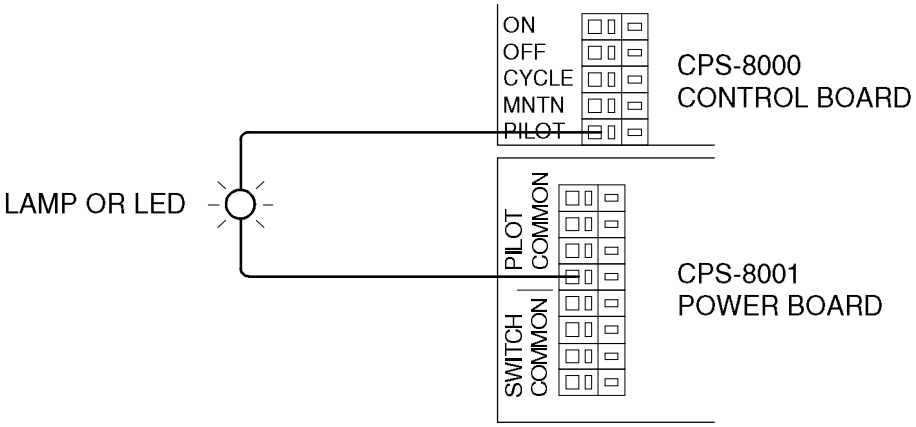


Figure III-15 Pilot Lights

b. Header Output

There is a convenient status output connection via a 0.1"-center, ten pin header located in the center of the board behind the quick connect terminals. The first pin carries 6.3 VAC; the second pin has been removed in order to polarize the connector; the last eight pins carry the outputs from each relay's pilot output.

Whenever the relay is on, the pin will carry 6.3 VAC. The pin corresponding to that relay can be connected, via external circuitry if necessary, to a computer interface board to indicate the status of individual relays or groups of relays.

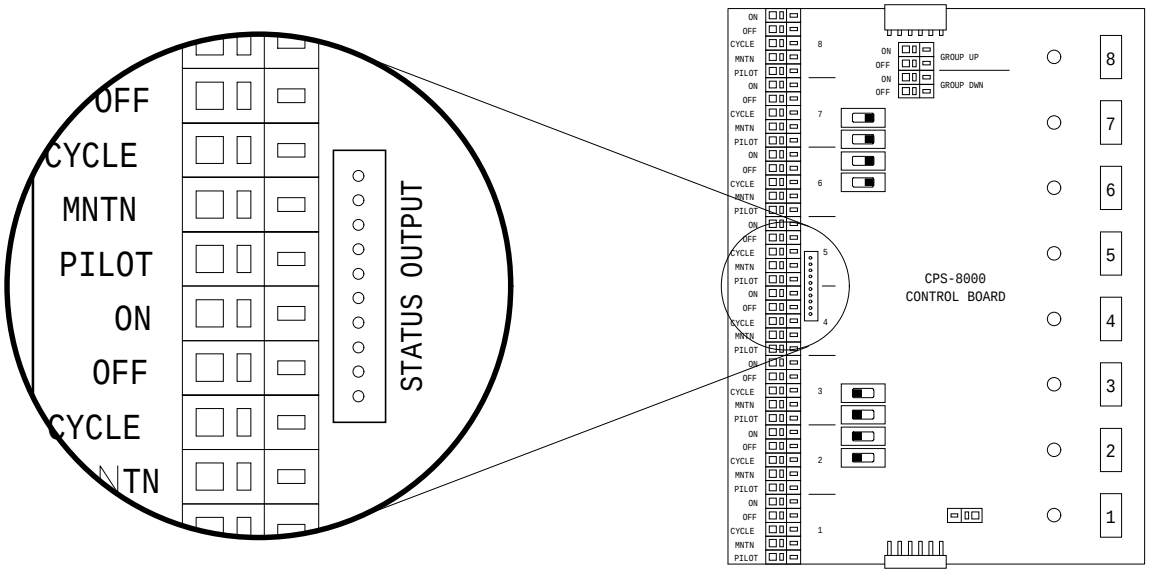


Figure III-16 Status Outputs

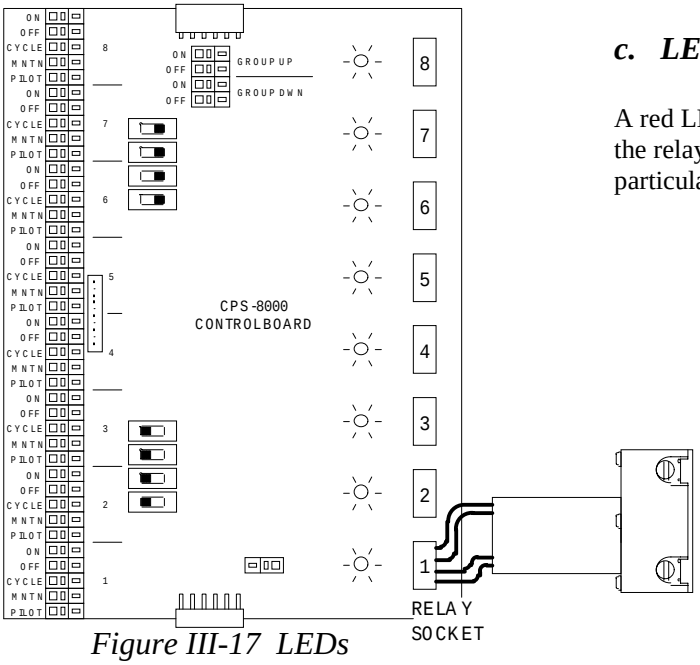


Figure III-17 LEDs

c. LED's

A red LED in front of each relay indicates if the relay is on or off. These LED's are particularly useful for troubleshooting.

d. Locator Lights

A blue connector at one end of the control board provides a continuous source of 6.3 VAC. This connector, or terminal, is also used to attach additional 6.3 VAC transformers and to power switch locator lights. The locator light must be connected between this terminal and pilot common on the power board.

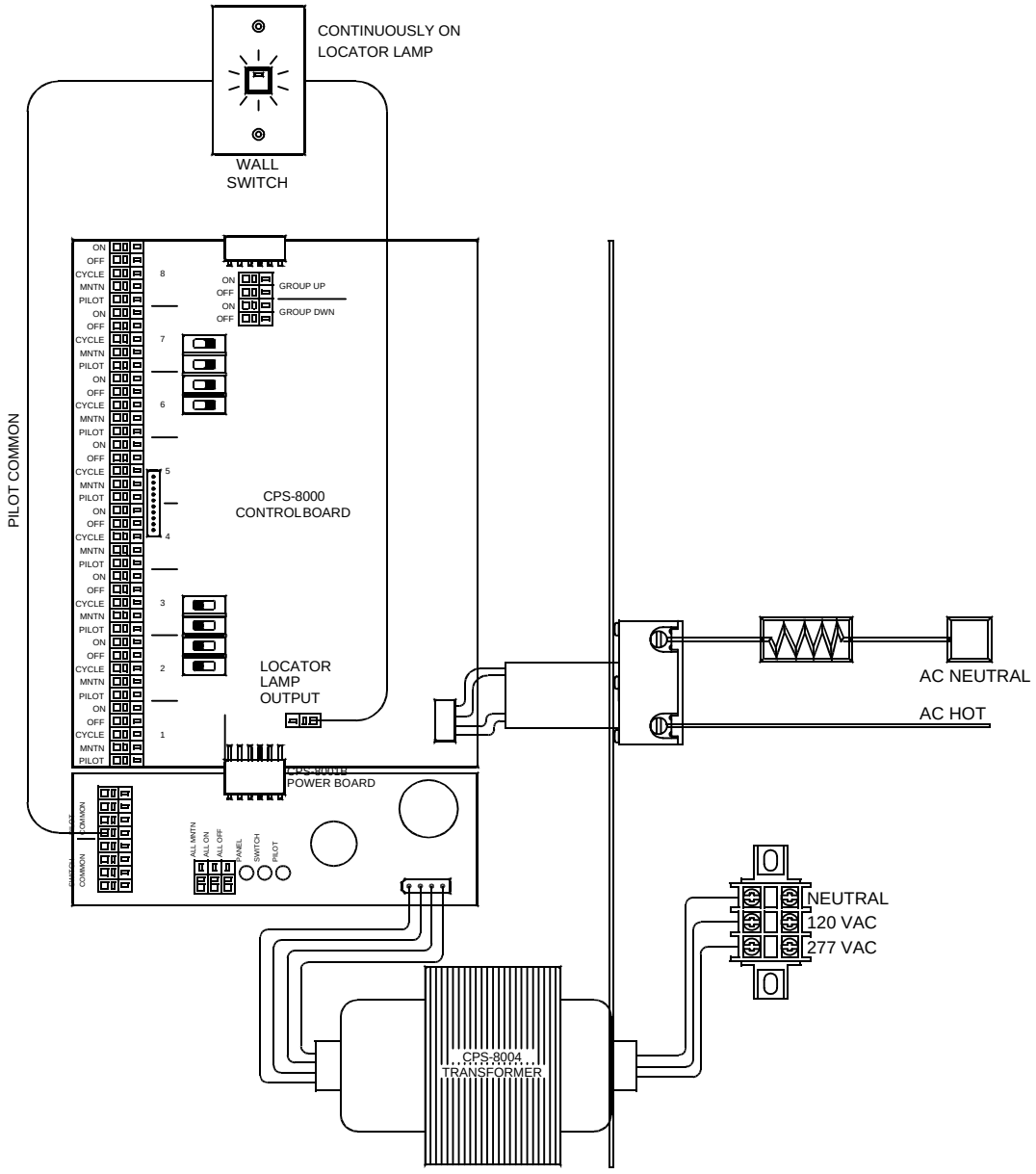


Figure III-18 Locator Lights

e. Relays

The final and most important output is provided by the relay's main contact. This contact is connected to the load to be controlled.

IV. APPLICATIONS

Some of the applications of the Control Plus Series were outlined in the preceding chapter. This chapter discusses applications in greater depth.

A. Design Considerations

In the applications already described, the voltage from a switch common terminal is passed through a switch of some sort back to a relay input terminal on the control board.

When making a connection to a maintained terminal, you must use a switch that closes when the relays should be turned on and opens when the relays should be turned off.

When making a connection to the on/off terminals or the cycle terminal, use a momentary contact switch.

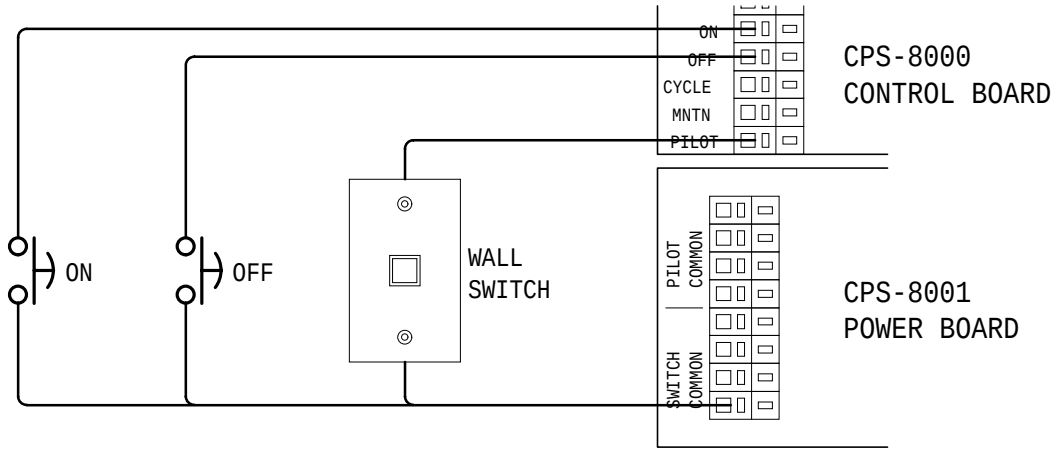


Figure IV-1 Design Considerations

B. Relay Groupings

1. Allowed Groupings

Relays can be grouped in various ways and this chart lists most of them.

a. Grouping With On/Off

	Group	What To Do
1)	All the relays in the unit	Use master on/off on the power board.
2)	All the relays on an eight relay control board	Use programmable on/off.
3)	Selected relays on an eight relay control board	Use programmable on/off.
4)	Selected relays on several individual control boards or several whole boards	Wire the programmable on/offs or on/offs in parallel for the boards concerned

b. Grouping With Maintained

	Group	What To Do
1)	All the relays in the unit	Use master maintained on the power board.
2)	All the relays on an eight relay control board	Parallel all the individual maintained inputs on the board.
3)	Selected relays on an eight relay control board	Parallel the individual maintained inputs selected.
4)	Selected relays on several control boards	Parallel the individual maintained inputs selected.

c. Grouping Cycle Inputs Not OK

Cycle inputs may be operated only for individual relays. They cannot control more than one relay because the relays may eventually fall out of sync.

d. Grouping Pilot Lamp Outputs Not OK

If a pilot lamp is needed on a switch operating a group of relays, just one of the relays should be selected to provide the pilot lamp power. Two or more pilot lamp outputs must not be wired in parallel or the transformer will trip its circuit breaker repeatedly.

Additional problems can be caused if one of the two relays is switched independently, since the board-level electronics checks the voltage on the pilot light wire to determine if the relay is on or off.

e. Paralleling Switches

Any number of cycle or on/off switches may be wired in parallel. The last switch used will have command priority. This is not true for maintained switches. (Note that this refers to switches and not to inputs, which can be run in parallel.) If two switches are wired in parallel to the same set of maintained inputs, neither would be able to override the other. If either of them is *on*, both of the switches will have to be *off* for the relay (or relays) to turn off. In other words, the same rules apply with maintained switches as in the wiring of a conventional wall switch with 120 VAC power.

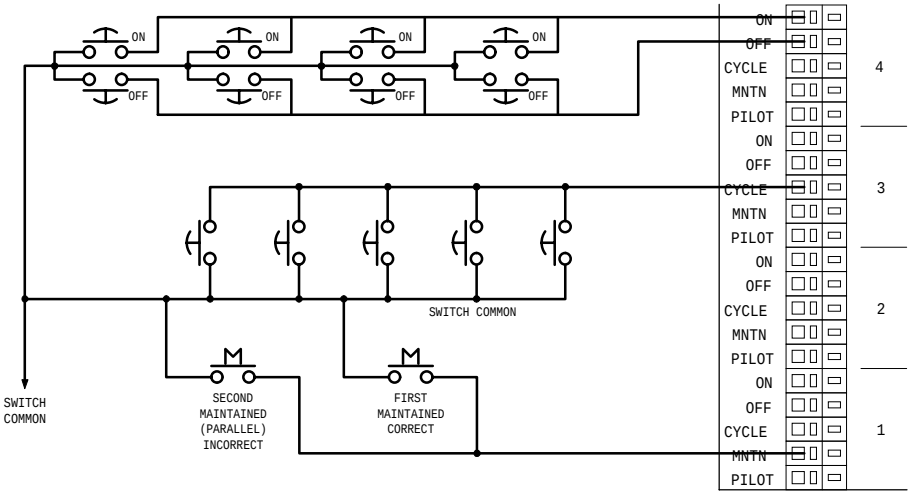


Figure IV-2 Allowed Paralleling of Switches (Not Inputs)

2. Grouping Relays, Diagrams

For almost all applications, it is necessary only to wire the applicable control inputs in parallel. The most common ones are shown in the following diagrams.

a. Grouping Maintained Inputs

To group maintained inputs on a single board or on several different boards simply wire the individual controls in parallel.

Cycle switches, as well as on/off inputs connected to any relay controlled by a paralleled maintain input, will have override capability on that input.

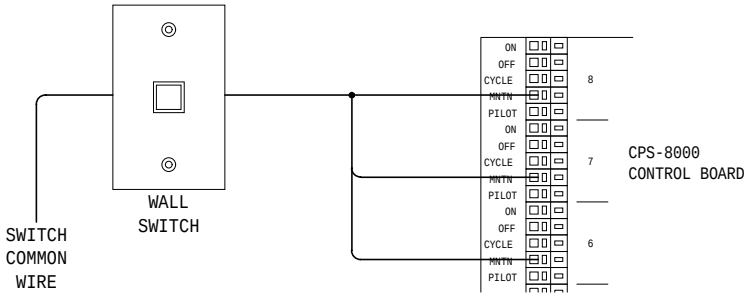


Figure IV-3 Grouping Maintained Inputs (On Board)

Inputs can be run parallel on more than one board.

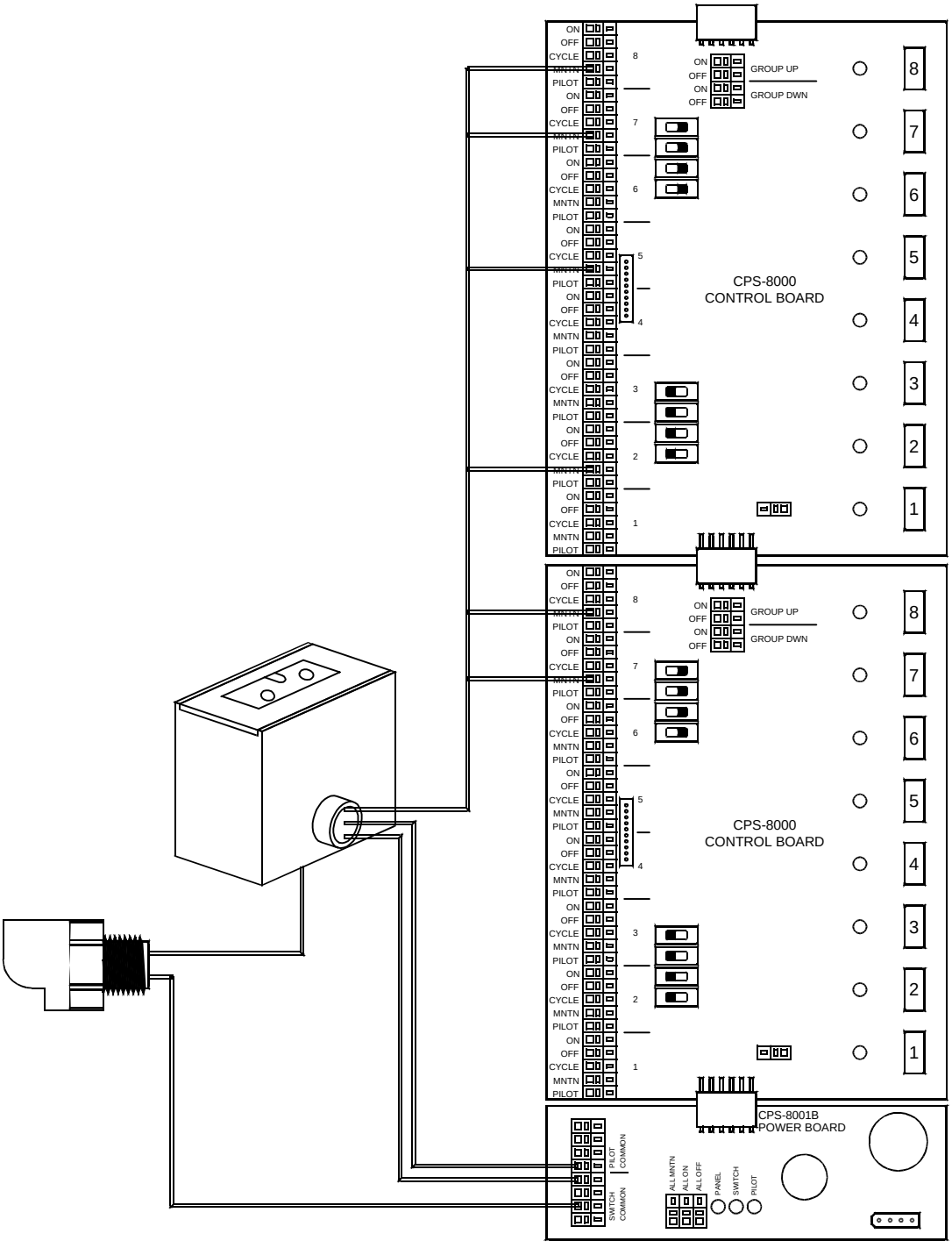


Figure IV-4 Grouping Maintained (More Than One Board)

b. Grouping On/Off On More Than One Board

In this case, the programmable inputs are wired in parallel, leaving the on/off control inputs available for local switching.

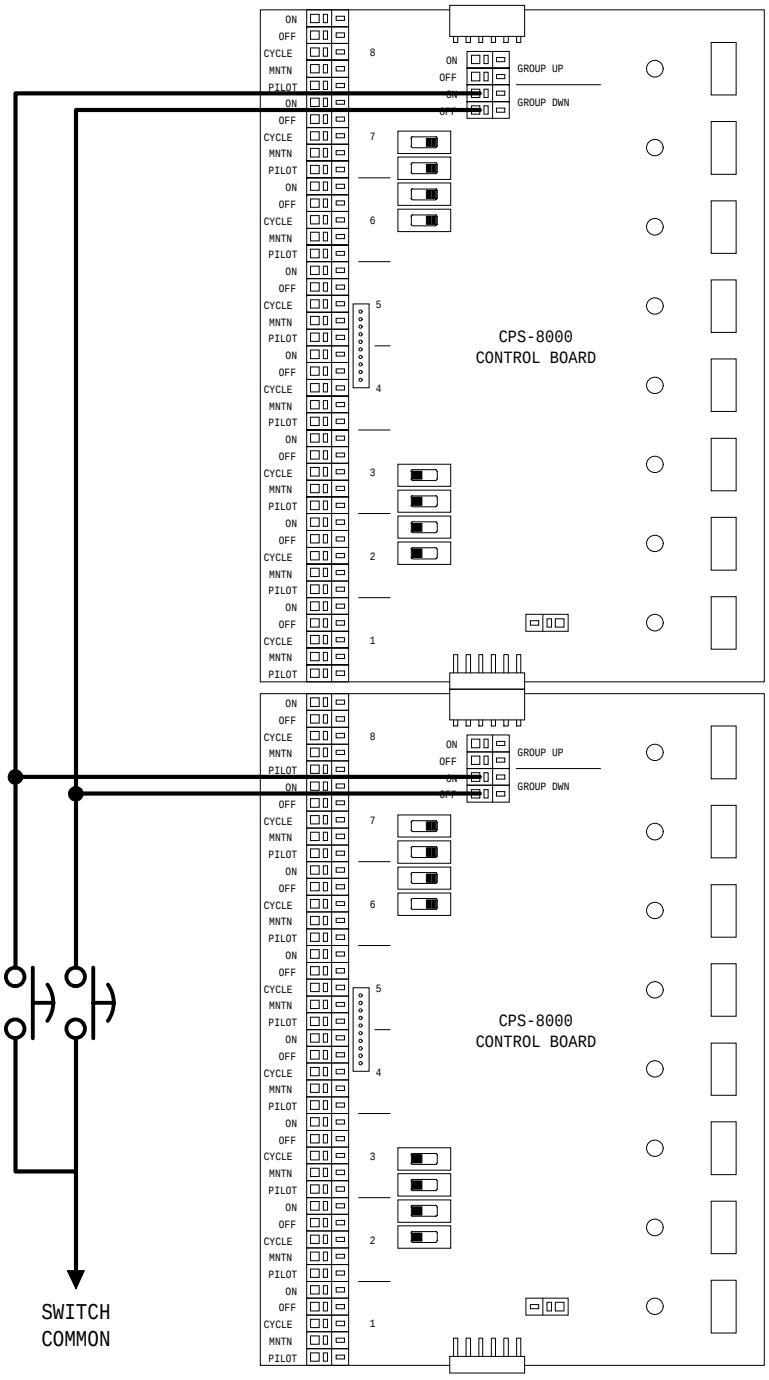


Figure IV-5 Grouping ON/OFF On More Than One Board

c. Grouping With Individual On/Off

On and off inputs may be run in parallel in any combination.

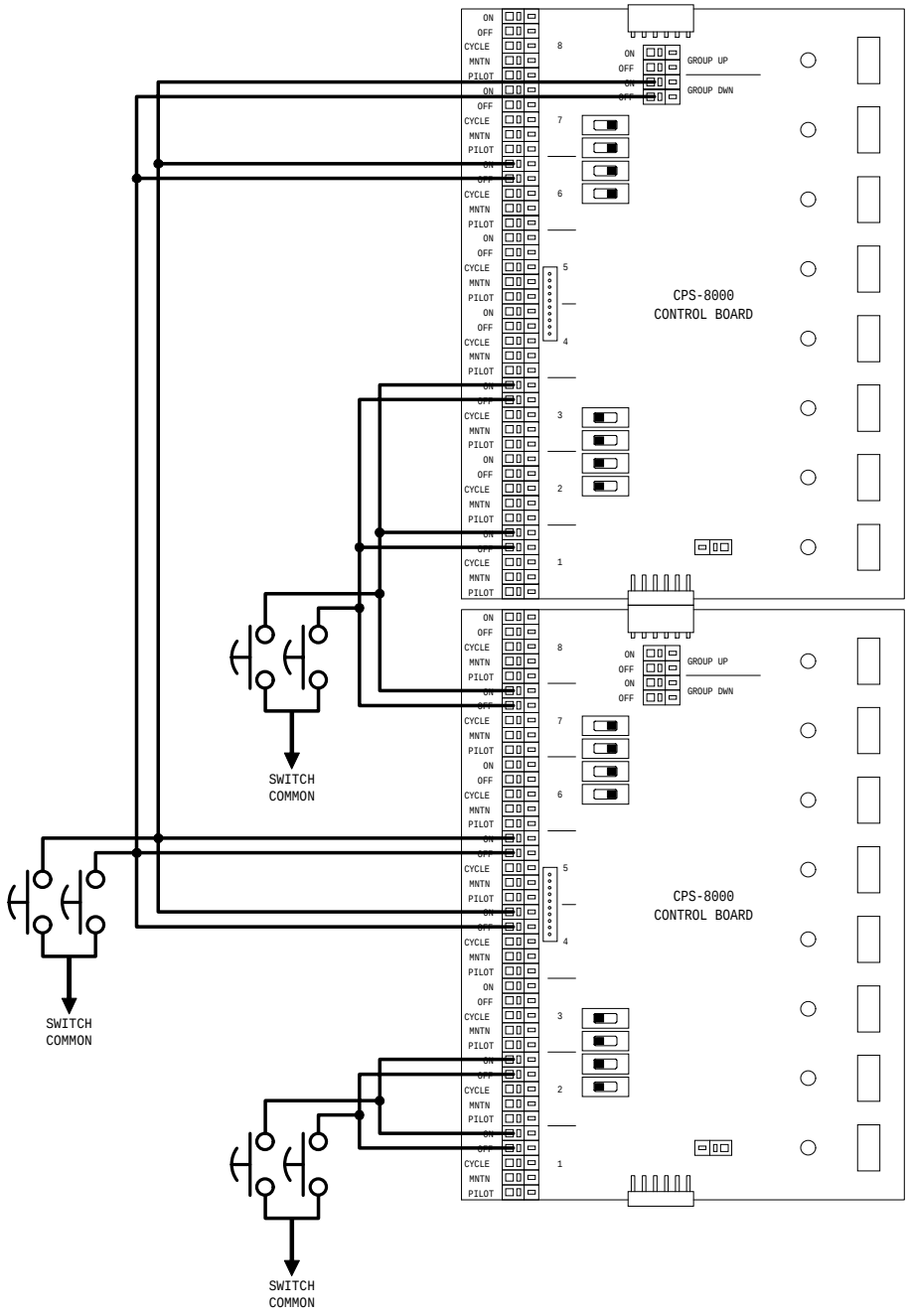


Figure IV-6 Allowed Individual ON/OFF Grouping

C. Programmable Timeclocks

It is possible to use programmable clocks containing a dry contact output which is needed for use with the Control Plus Series.

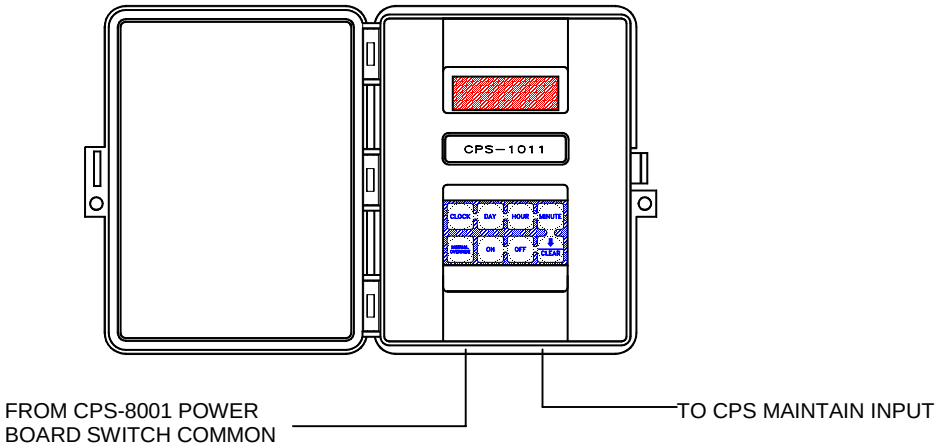


Figure IV-7 Timeclock

Office buildings or factories may use timers or programmable clocks to make sure that lights are turned off at the end of the work day.

Normal usage has the timeclock turn all lights on at the beginning of the day and then turn all lights off at the end of the shift. Workers wishing light in their area use a local wall switch. Afterwards, the timeclock can be programmed to turn off the lights at regular intervals -- for example, every two hours throughout the night -- to ensure that no lights were left on by people working late.

Two channels on the timer are required to do this. You can use one channel for the *on* and one channel for the *off* control connected to the master on and off switch.

Alternatively, one channel can be used with the master maintained input for the *on* in the morning and the first *off* in the evening. The other channel can be connected to the master off input and be set to give a one-second pulse every hour from 6:30 p.m. until 6:30 a.m., for example.

If the timer cannot be turned on and off within one second, this will not cause a problem; use the smallest increment possible (most likely one minute). If the timer can be set in units of one minute only, the system will not be harmed, since stuck switch protection is built into the Control Plus Series.

IMPORTANT: While the switch is closed, no other momentary input switches will work with that relay.

Other timer outputs can be used to control different groups of relays in the same way as a manual switch.

D. Computers

If it is desired to have a computer to interface with the CPS panels through dry contacts or optically isolated signals, Touch-Plate makes interface cards appropriate for any method. See the information on the CPS-9000, CPS-9001, CPS-1020, CPS-1090 and the information on the Solution Series product line.

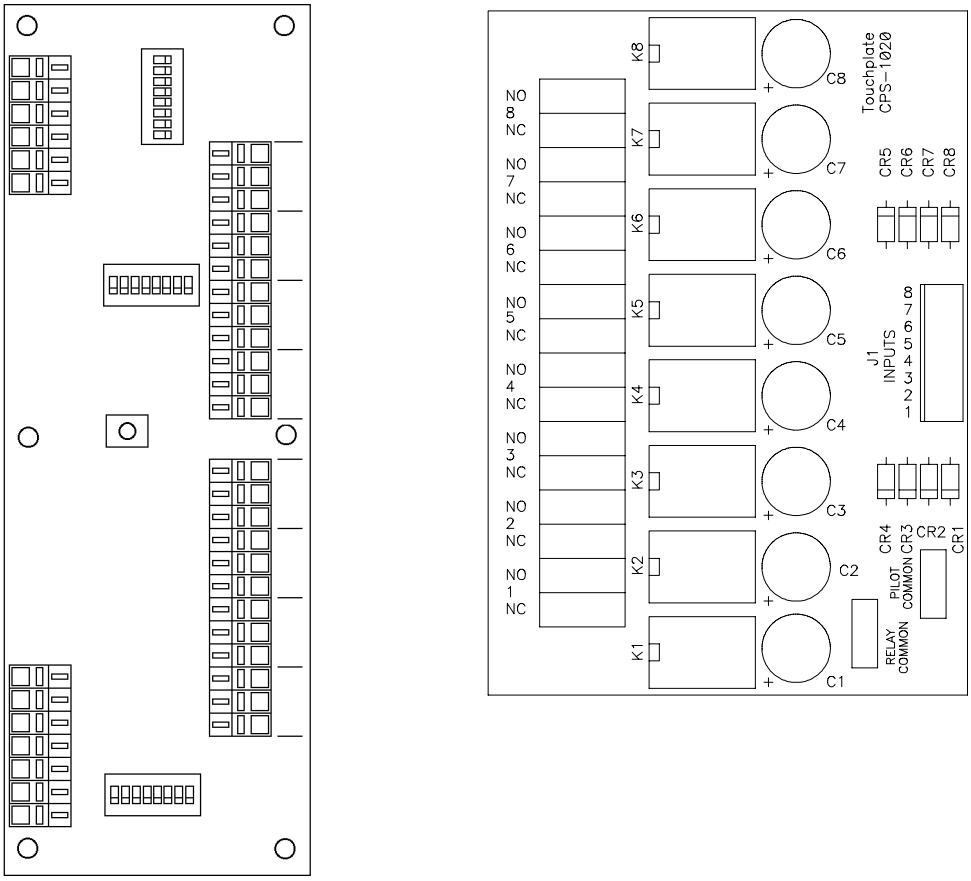


Figure IV-8 Touch-Plate Interface Boards

E. Sensors

The master maintained or grouped maintained inputs are suitable for the type of output available from photocells, and security systems.

All photocell and security systems have, or can be set up to have, a dry contact output. A typical application is to turn on the lights outside a building when someone walks into the beam of an ultrasonic or infrared detector system. (In this application, a series of photocells prevents lights from turning on during the day.)

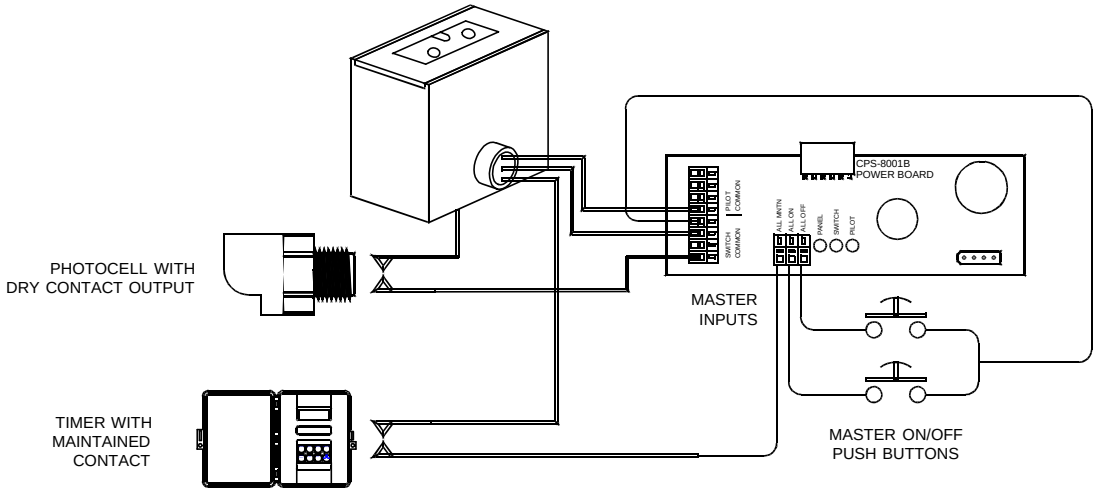


Figure IV-9 Sensors

A second application is to use a photocell, along with a timer or an override control, to turn on the lights at dusk and to turn them off later in the evening.

A third application is to use an output from a security system to turn on all the exterior and selected interior lights when the security system sounds an alarm.

V. INSTALLATION

The Control Plus Series is easy to install and connect. It is also easy to adapt to the user's needs.

A. Planning

Because of the flexibility of the Control Plus Series, it is all too tempting to skip details in planning an installation. You can save a lot of time, however, by carefully considering the needs of your installation before you start work.

The following matters should be taken into consideration in planning your installation:

1. Pilot Light Wiring

Incandescent pilot lamps require 18-gauge wire. For distances over 1,000 feet, a thicker wire is necessary. The use of LED's can reduce the size of the wire; with short runs of 500 feet or less, 22-gauge wire may be used.

Use a single thicker wire, or several wires in parallel, for the pilot common wire.

NOTE: The return current on the pilot common wire is the sum of all outgoing current -- about 0.120 amps for each incandescent pilot lamp and 0.025 amps for each LED. These amperages will prevent the dimming of incandescent lamps as more lamps are turned on.

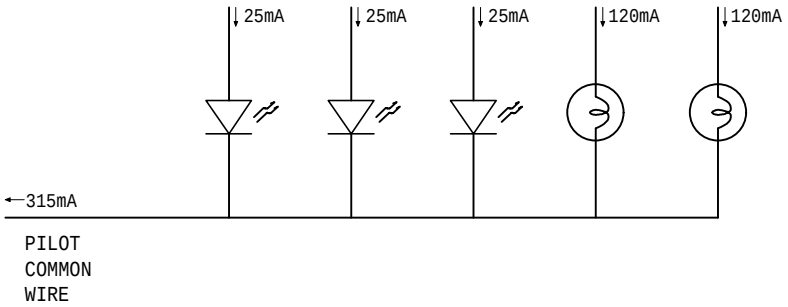


Figure V-1 Pilot Light Wiring

2. Switch Wiring

Since the switch wires carry very little current, smaller gauge wire can be used. A minimum of 22-gauge wire is necessary to ensure that the wire is strong enough to be pulled through conduits and other tight spaces.

NOTE: Don't use twisted-pair wires for wiring switches, because signals induced in the system may give rise to erratic behavior.

Use 22-gauge wire for distances of up to 3,000 feet. Longer distances require thicker wire. Use shielded wire for long runs in areas with strong radio signals.

B. Enclosure

The enclosure contains the power supply, the control boards, and the relays. To install these components, first remove the enclosure door.

Place the enclosure against the wall and secure it with four screws. Then reinstall the door.

IMPORTANT!

Never work on system when the power is on. Any work done on the Control Plus Series when the power is on will cancel the warranty. Before reconnecting the power, check all the connections.

C. Control Plus Power Connection

Control Plus panels require their own circuit breakers to prevent unrelated overloads or short circuits.

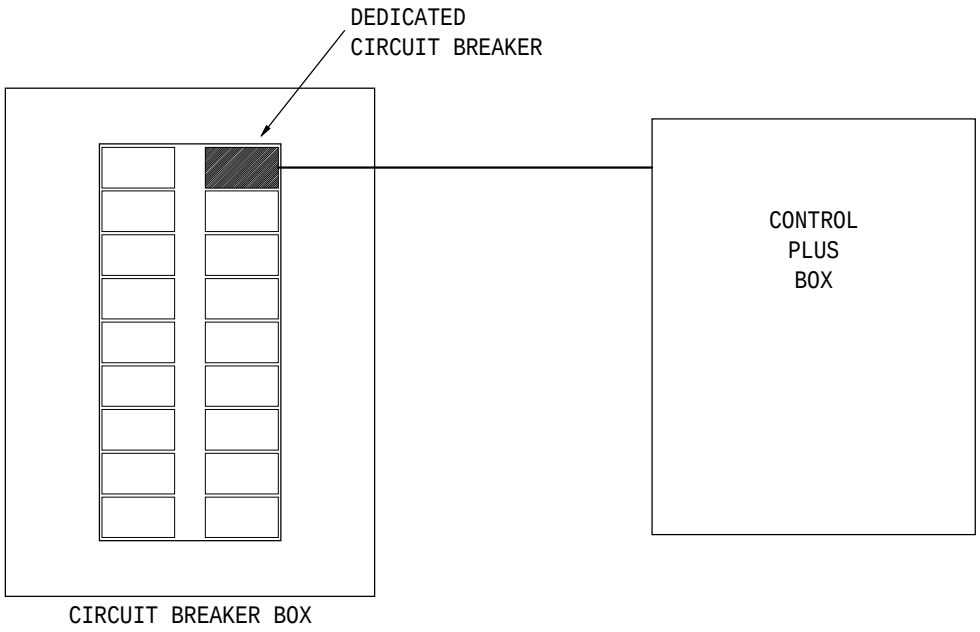


Figure V-2 Circuit Breaker

When working with a Control Plus panel, turn the corresponding circuit breaker off.

D. Multisystem Connections

If there is more than one Control Plus panel in the system, care should be taken to avoid the creation of a continuous loop of wire called a "hum loop". Such a loop may come about when three systems are hooked together like so:

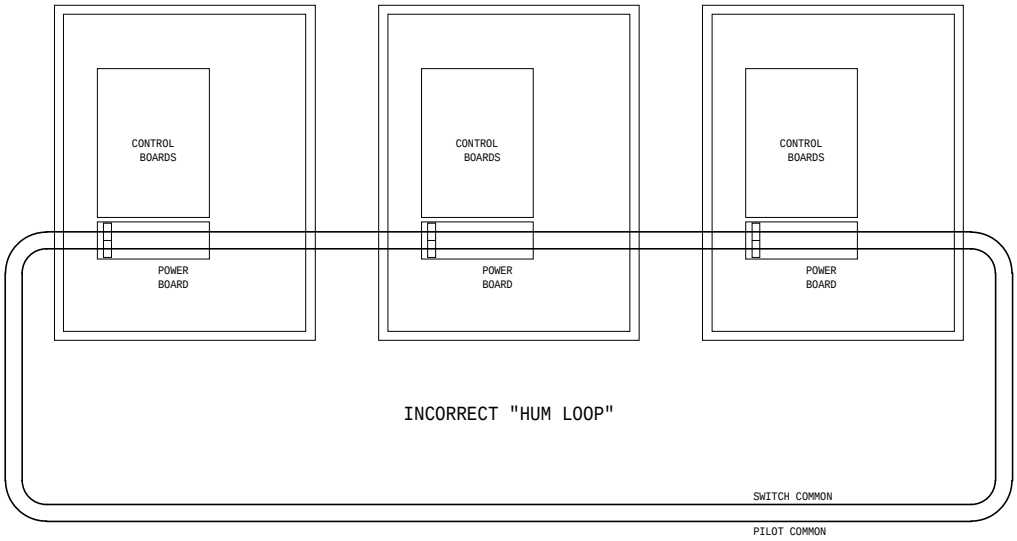


Figure V-3 Hum Loop

Due to electrical fields, this loop will pick up the 60-cycle hum that exists wherever there are electrical wires. While a hum loop may not harm some installations, in others it will cause the relays to fire randomly and continuously until the transistors or the system burns out.

A similar condition can occur if a wire in the system shorts to ground. Buzzing relays indicate a ground loop (a wire shorted to ground).

Hum loops can be created when pilot commons between two cabinets are connected and then wired individually to a master switch, where they are connected together by the switch.

The correct way to hook up a system in either a line or star connection is shown below. Pilot common is generally not connected between panels.

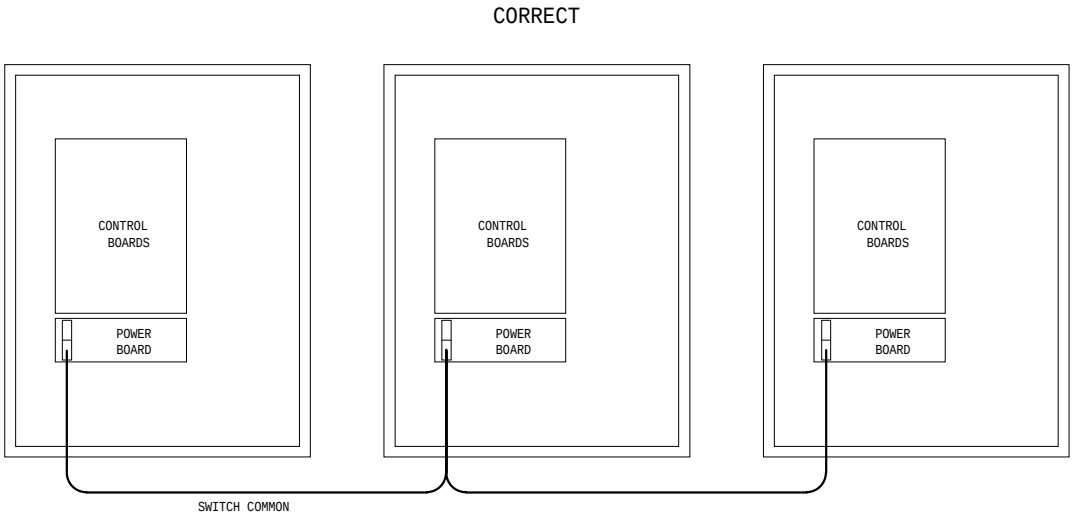


Figure V-4 Line Connection

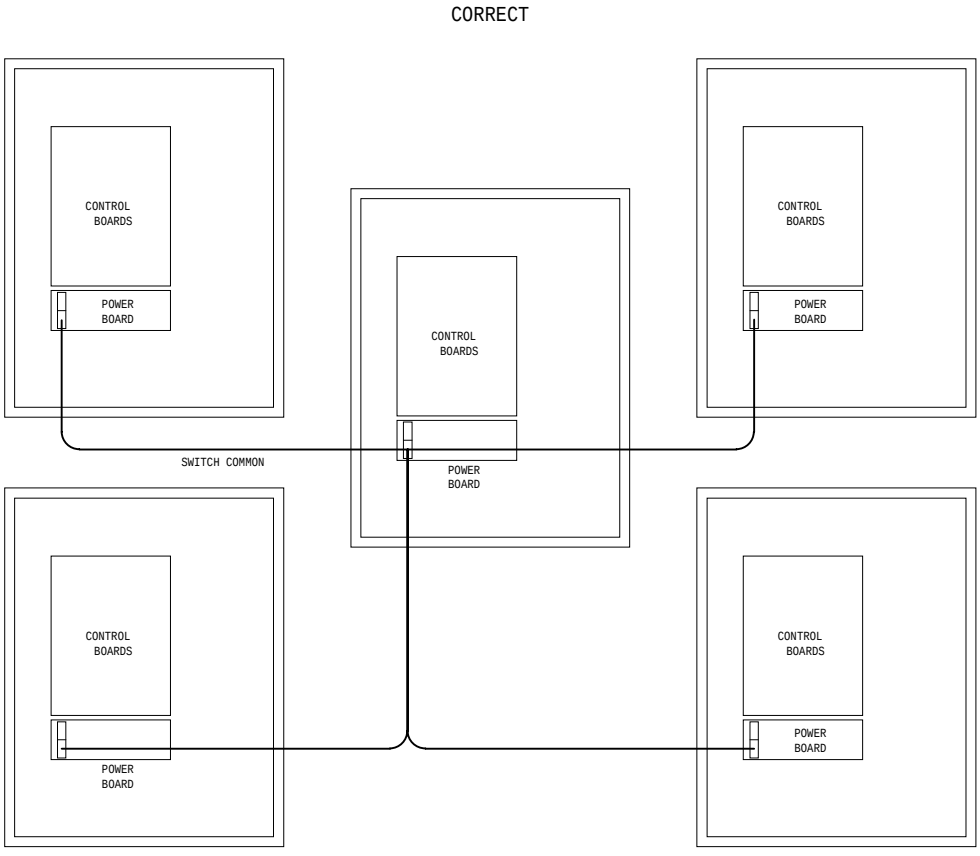


Figure V-5 Star Connection

IMPORTANT! ***Test panels separately before hooking them together.***

E. Electrical Connections

1. High Voltage

One of the terminal screws on each relay should be connected to 120 or 277 VAC. (The voltage varies with the item being controlled).

Power to the relays must come via a circuit breaker. The circuit breaker must not be rated for more than 20 amps, which is the relay's maximum rating.

The connected load to each relay should not be more than that specified by the electrical code for your area.

The power from one breaker can be spread out over more than one relay as long as the above requirements are met.

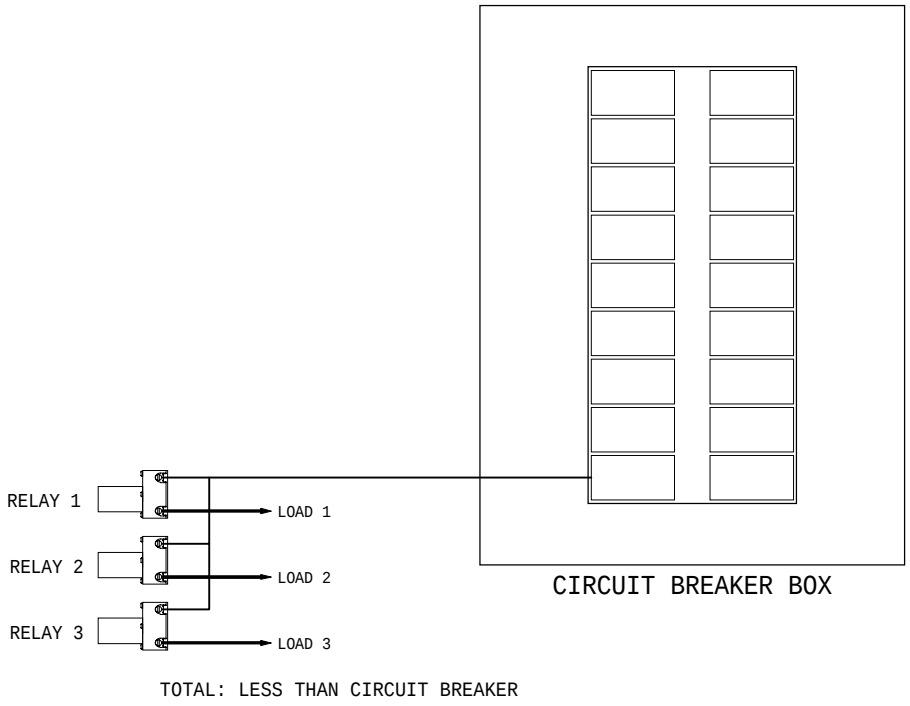


Figure V-6 Relay HV Connection

The relay screw terminals can accept up to two #10 AWG copper wires. Be sure not to exceed the maximum current that can be carried by this conductor size according to the local electrical codes.

If two wires are inserted into one of the relay terminals, they should not differ by more than one wire size. Otherwise the pressure on the smaller wire will be reduced, thus preventing a good electrical contact.

Use 25-pound inch torque on the screws.

NOTE: Make sure load power at the circuit breaker is *off* before connecting any loads to the relay.

2. Power Supply

Connect the panel to its own circuit breaker. Use the hot (120 or 277 VAC) terminal connection.

Make sure that the panel has not been damaged during shipment. Turn on the circuit breaker. The relays should be set in the on position, so all the LED's on the power and control boards should be on.

Check the following points:

- When power is turned on, no relay should change state. If a relay cycles when power is turned on, make sure that the transistor in front of the relay is cool to the touch. (Be careful! If the transistor is hot, it could be *very* hot.) If it is hot, unplug the relay because the transistor is bad.

- Make sure that no LED is brighter than any other LED. If one is brighter, unplug the associated relay, because it is more than likely bad. See the troubleshooting chapter for instructions on testing relays.

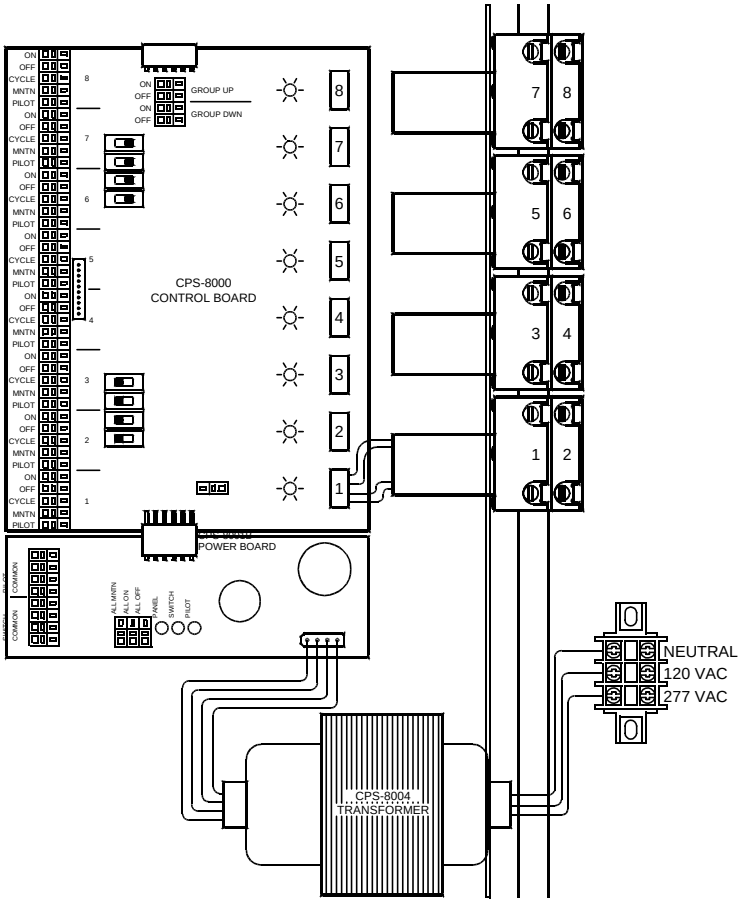


Figure V-7 Power Up

3. Direct Operation Of Relays

To operate the relay directly, use a short length of low voltage wire. Insert one end into Switch Common on the power supply board. Using the other end, touch the orange input (Cycle) in front of the relay you wish to test. The relay should cycle. If the relay fails to cycle, see the troubleshooting section.

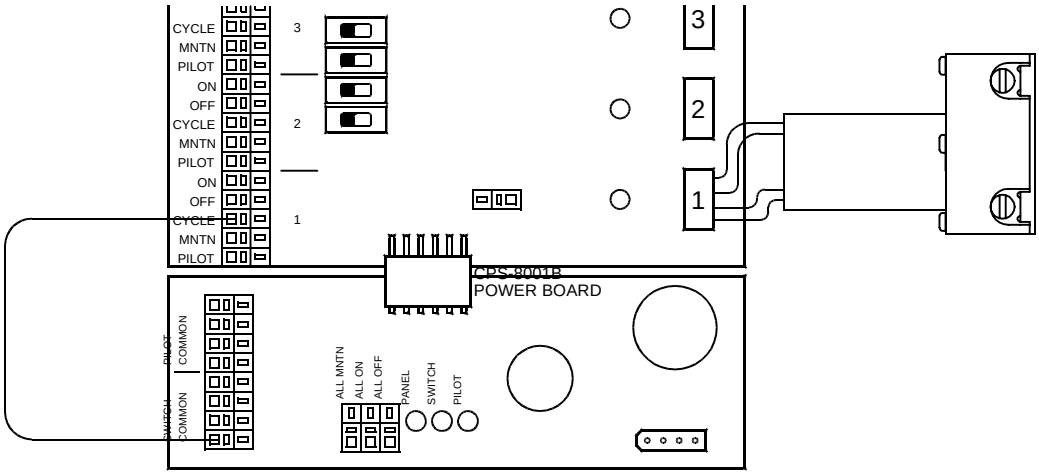


Figure V-8 Direct Operation Of Relay

4. Connecting The Control Wires

After all the relays are on, the lights can be controlled using their corresponding circuit breakers. Switch off the power to the Control Plus Series so that you can safely make the necessary board connections. The warranty is voided if the board is connected with power on.

5. Running Control Wires

IMPORTANT! ***Never run control wires in the same conduit with high voltage wiring (110, 240, 277 AC or higher) even if the building code permits it.***

In long conduits, control wires running next to current-carrying conductors can induce sufficient voltage in the switch wires to cause random switching, bad circuit boards and, in extreme cases, burned out transistors and relays.

6. Inputs

Inputs are wired as shown in the earlier diagrams. One side of the switch must be connected to a switch common terminal on the power board; the other side must be connected to the relevant color-coded connector on the control boards.

7. Pilot Lights

The pilot lights are driven by 6.3 VAC. By using AC rather than DC voltage, we eliminated the need for costly power supplies.

All pilot lights and other indicators are connected between the blue pilot lamp terminal of the relay and a pilot common terminal on the power board.

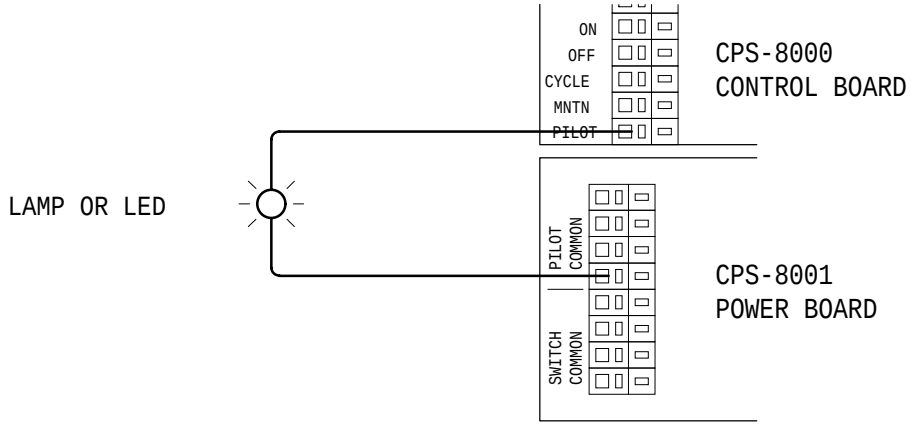


Figure V-9 Pilot Lights

8. Status Output

Each control board has a 10-pin, 0.1"-center male header just behind the row of input terminals. The header is a status output connector, with the pilot light output for each relay extending to it. The second pin is removed and acts as a polarizing hole for the female connector, which has one plugged socket.

The status output connector can be used as an alternate source for remote enunciators and to illuminated switches. It also can be used with the computer interface board (CPS-1020) to provide a dry contact output for positive status feedback.

F. System Turn On

Before the power is turned on for the control boards, perform the following tests:

1. Field Wiring Shorts To Ground

- Remove power from the unit
- All Field Wiring connecting

Power *MUST* be off when checking for resistance.

Major problems are caused by shorts to ground in the field wiring. Use an ohmmeter to measure between switch common and ground, between pilot common and ground, between switch common and pilot common, and between any field wire connected either to an input or a pilot output and ground. The barrel of any relay is a good ground. The ohmmeter should show infinite resistance for each of these readings. If a reading is less than 1 meg. ohm, there is a short somewhere. The location of the short must be found and the short cleared before power can be applied. Otherwise, damage may result to either the power board or the control boards.

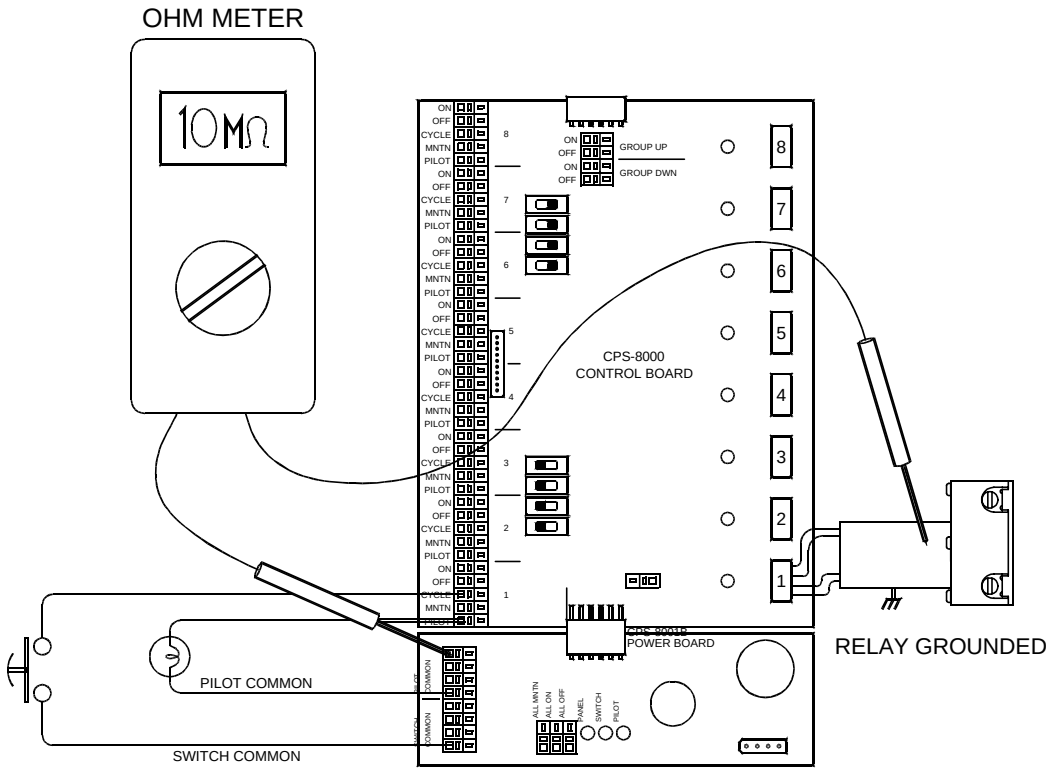


Figure V-10 Checking Field Wiring

2. Switch Inputs And Pilot Output Short

Power *MUST* be off when checking for resistance.

Use an Ohmmeter to measure resistance between the inputs and pilot common. Minimum resistance readings should be as follows:

	INPUT	PILOT COMMON	OHMS READING
ON (GREEN)	+	-	10M OHMS
ON (GREEN)	-	+	10M OHMS
OFF (BLACK)	+	-	10M OHMS
OFF (BLACK)	-	+	10M OHMS
CYCLE (ORANGE)	+	-	10M OHMS
CYCLE (ORANGE)	-	+	800K OHMS
MAINTAIN (GRAY)	+	-	10K OHMS
MAINTAIN (GRAY)	-	+	10K OHMS
PILOT (BLUE)	+	-	* 700K OHMS
PILOT (BLUE)	-	+	* INFINITY

* NOTE: THESE READINGS ARE WITH LED's IN THE CIRCUIT.

If the resistance is less than these readings, then there is a short in the system, and that short must be cleared before the system is turned on.

G. Multipanel Installations

If you need to operate relays in different units from one switch, connect the switch common terminals of each unit. This should be done only after each box has been tested, turned on, and proved to work on its own.

Switch common wires are connected as in figures V-4 and V-5. A typical maintained master switch is shown below.

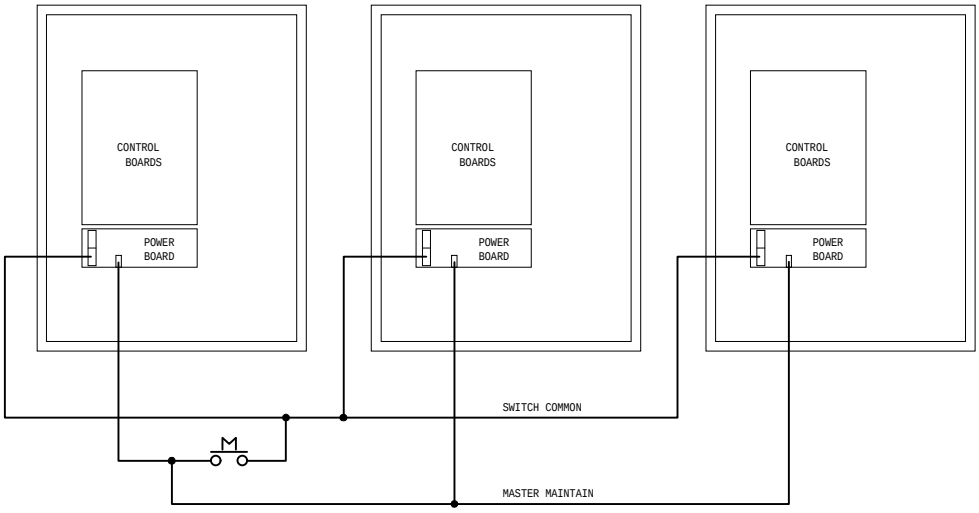


Figure V-11 Master Switch In A Multipanel System

1. Grouping Between CP Panels

When grouping relays in more than one cabinet, a similar connection is used.

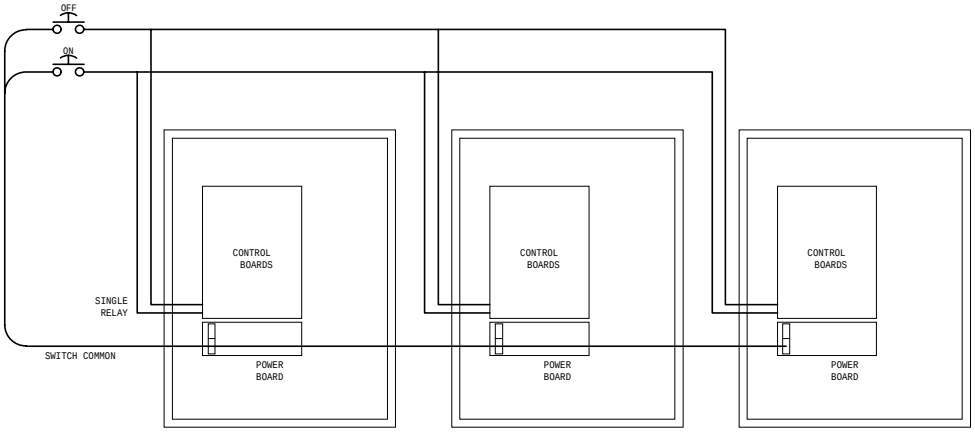


Figure V-12 Grouping Between Panels

VI. TROUBLESHOOTING GUIDE

A. Power Board

When the power board is in the proper condition, all three LED's should be lit and the fuse should not be hot.

1. Right Green LED Not Lit

The most probable cause for an unlit right green LED is a short in one of the pilot wires and the tripping of the 6.3 VAC thermal fuse. However if the fuse is cold, the power board or transformer may have failed.

If the short has been identified and corrected, then the thermal fuse will reset after time when it has cooled.

2. Left Green LED Not Lit

If the left green LED is not lit, then the 28 volts required by the relays are not unavailable.

The most likely reason for a lack of power is that either one of the relays has been connected incorrectly to the control board or one of the relay driver transistors has shorted. In either case, these two faults will cause the fuse on the power board overheat. The bad relay connection or shorted transistor must be found prior to installing a new power board. Failure to do so can cause damage to the new power board. A shorted transistor or relay will be very hot and can be identified easily. Unplug the relay to prevent it from affecting the rest of the system.

3. Middle Green LED Not Lit

If the middle green LED is not lit, there is no voltage for the switch common output. The most likely reason for a lack of power is shorted wires. This may result from having misconnected the wires at a switch connection by crossing the switch leads with the pilot leads.

4. Left and Middle Green LED Not Lit

If no fuses are hot, the likely cause is a transformer failure. The CPS-8004 transformer should be replaced. However if a fuse is hot, try steps 2 and 3 above.

5. Relay Does Not Work

First make sure that the relay is plugged in properly and is making good contact with its connector.

With a wire connected to the switch common terminal, touch the cycle input orange terminal for that relay. If the relay does not work, then test the relay on another channel of the control board.

If the relay still does not cycle, and the other relay worked fine, it is faulty and should be replaced. If the relay does cycle when moved to another location, then the problem is with the control board.

5. On Cycles, Off Does Not

This problem is caused by not feeding 6.3 VAC to the pilot light contact on the relay.

The failure to feed voltage to the pilot light may have three causes; a bad relay with a failed auxiliary contact; a blown circuit breaker on the transformer which will affect all circuits run by that transformer; or a bad connection where the relay plugs into the circuit board.

6. Relays Intermittent

If two cycle inputs are connected in parallel, it is possible that the relays will fall out of sync, with one on and the other off. The relays can not be grouped using the cycle inputs. If this situation is needed, use the Solution Series products to achieve the desired grouping.

7. Failed Transistor

If a control board is faulty, just remove it and install a new one. It has been designed for quick and easy removal and replacement. If the system is large, keep a supply of spare boards on hand.

8. Ground Faults

Ground faults are one of the most confusing problems. Nothing seems to work the way it should, even though everything is connected correctly.

Relays may buzz or feel warm to the touch. The transformer may be hot. Circuits that were working well suddenly do not work any more. Circuit boards and relays burn up. These phenomena may be caused by one or more wires in the field, such as a pilot common being connected to ground.

9. Wiring Loops

Wiring loops can also cause symptoms similar to the ones listed above, particularly in a multiple-panel system in which several master switches control more than one panel. The solution is to break the loop so that humming currents cannot flow.

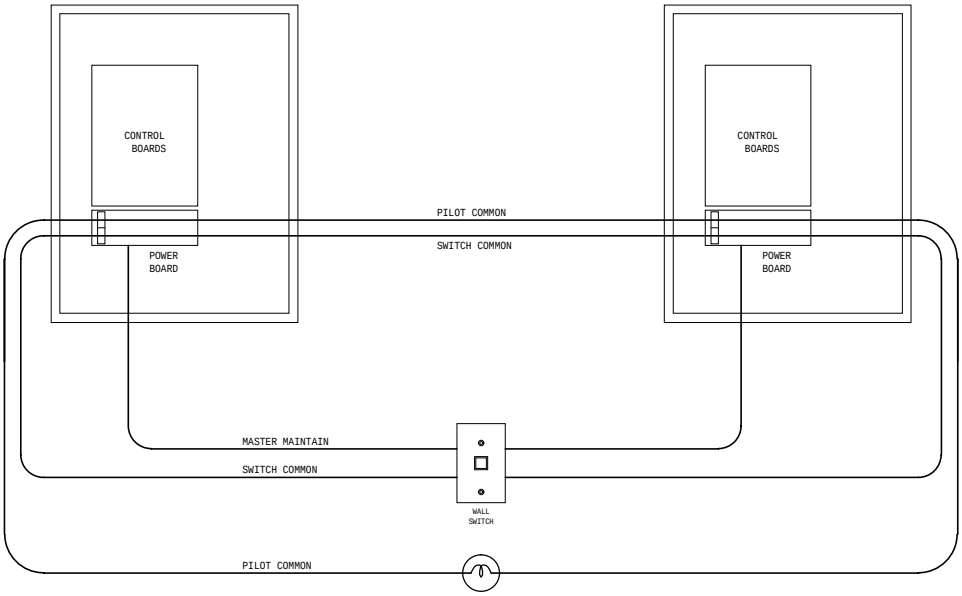


Figure VI-1 Wiring Loop Problems

10. Induced Voltages

Where there are very long wire runs, induced voltages may be a problem if the control wires have been placed next to current-carrying conductors. Never run control wires in the same conduit as current-carrying conductors.

If this is a potential problem in your system, use a good voltmeter and measure the AC volts between pilot common and the switch input of the relays with the most problems. Any induced voltage over 5 volts AC will cause the relay transistor to get hot and may burn out the relay.

You can solve this problem by using lower resistance wiring (18 gauge instead of 22 gauge) and eliminating runs next to current carrying conductors.

11. Verifying Relays

You can test relays with an ohmmeter. A relay might be faulty under the following conditions:

The LED in front of the relay is burning very brightly. This could indicate a short between the coil and the pilot lamp wires.

Use an ohmmeter that can measure resistance down to 6.5 ohms. If the scale on the meter reads "Ohms 1 1000", it will not show the difference between 6.5 and 0 ohms.

VII. SPECIFICATIONS

A. Relay Specifications

1.0 HP 125 VAC	20 amps 125 VAC tungsten
1.5 HP 250 VAC	20 amps 277 VAC ballast
1.5 HP 250 VAC	20 amps 347 VAC ballast

Copper conductors only
Torque to 25 pounds/inch
Maximum wire size 10 AWG

Low voltage contact:	1.0 amp at 6.3 VAC

B. Transformer

Inputs	277 or 120 VAC plus or minus 10%
Outputs	6.3 VAC at 5.5 amps
	22 VAC open circuit; 20 VAC at 2.5 amps

C. Low-Voltage Circuitry

Nominal power voltages: 28 VDC 6.3 VAC

Maximum current to any single relay control: 3mA's

Maximum current to whole board control: 24 mA's

Maximum allowed in-line resistance from switch common to input terminal: 100 ohms

Recommended control wiring up to 3000 ft.: 22 AWG

Recommended lamp wiring:

LED's up to 500 ft.	22 AWG
Lamps up to 1000 ft.	18 AWG

(Increase wiring size for longer distances.)

Operating Temperature Range: 0-65° C
Humidity Range: 10-90% non-condensing

D. Peripheral Control Devices

The CPS Series' panels have many more features and benefits when combined with the Solution Series devices.

CPS-1030 Blink Warn

Designed to provide a "blink" or "flick" warn to let occupants know an "OFF" command will follow in 5 minutes. Has override switch inputs to cancel the "OFF" sweep for the output. Available with either a "Cycle" output for individual relays or with separate "ON" and "OFF" outputs to blink warn a group of relays, or the entire panel.

CPS-1035 Auto-Off Board

Allows 2 channels of automatic "OFF" signals which are user-selectable for intervals of 15 minutes, 30 minutes, 60 minutes or 120 minutes. When the Input is triggered, the time function begins and will generate an Output signal which is wired into the CPS "OFF" input.

CPS-1045 Cycle To Maintain

The CPS-1045 takes up to four Cycle (momentary alternating action) type switch signals, like the normal signal from Touch-Plate switches, and converts the signals to a maintain, or latching type of a signal so groups, zones, or the Master inputs can be controlled by a single switch.

CPS-1050 Cycle to ON/OFF Board

Due to the situation where some relays are included in multiple groups, and/or some of the relays within a group have individual override buttons, it is necessary to get all relays in the group to the same state with a button press. When a single switch tries to control a group, it is possible that from another switch location someone has overridden one or more relays in the group to a different state. When someone hits the Cycle input in that condition, some relays would go ON, others would go OFF. The CPS-1050 watches the state of the relays and toggles the switch signals into two separate outputs wired to the ON and OFF terminals of the CPS panel. This guarantees the relay group goes to the desired setting.

CPS-1050-4 Cycle to ON/OFF Board

Cycle to ON/OFF is a requirement on many occasions when a single momentary button needs to control a group of relays together. Sometimes it is because there are not enough wires at the switch location to accomplish the desired goal, and the CPS-1050/4 reduces the number of wires required for Group switching. The CPS-1050/C has four discreet channels of control. The CPS-1050/4 does not monitor the status of the relays, instead it will alternate between the ON and OFF outputs. If relay monitoring is necessary, use the CPS-1050 standard module.

CPS-1065 ON/OFF to Maintain

The CPS-1065 ON – OFF to MAINTAIN allows 4 discrete channels of conversion from momentary separate ON and OFF inputs to maintained outputs. By connecting the UP and DOWN momentary switches and the top and bottom limit switches, a motor can be controlled to raise and lower curtains.

CPS-10S8 Sequencer Board

The CPS-10S8 fulfills the need for a small, non-programmable sequencer for path lighting and electrical equipment such as audio video equipment. By sequencing audio equipment devices can be powered up and then powered down in the correct order to prevent annoying “pops” and possible damage. The CPS-10S8 can be configured for maintained or pulsed outputs at the factory

E. Summary Of Features & Dimensions

Model #	Power Boards	Control Boards	Individual Inputs on/off	cycle	mntn	Programmable Inputs	Master Inputs on/off	mntn	Outputs Hi-V	Lo-V	Dimensions L	W	D	Shipping Weight
CPS-0008	1	1	8	8	8	2	1	1	8	8	18"	14"	4 1/4"	25 lbs.
CPS-0016	1	2	16	16	16	4	1	1	16	16	24"	18"	4 1/4"	35 lbs.
CPS-0024	1	3	24	24	24	6	1	1	24	24	32"	18"	4 1/4"	48 lbs.
CPS-0032	1	4	32	32	32	8	1	1	32	32	40"	24"	4 1/4"	68 lbs.
CPS-0040	1	5	40	40	40	10	1	1	40	40	48"	24"	4 1/4"	96 lbs.

LOW VOLTAGE CIRCUITRY

Power Supply Voltages: 28 VDC-6.3VAC
Input Current to Switch One relay: 3 mA's
Input Current to Switch entire Eight relay Control Board: 24 mA's
Maximum allowable Input wiring line resistance: 100 ohms
Maximum distance for Switch Input wiring: 3000 ft.
Maximum distance for Pilot Lamp wiring: L.E.D.s 500 ft @ 22awg.
Incandescents 500 ft. @ 18awg.
Operating Temperature: 0-65 deg. C
Humidity: 10% - 90% (non-condensing)

RELAY (Model 3000-PL)

SPST Mechanically Latching Main Contact:
1.0 h.p. at 125VAC
1.5 h.p. at 250VAC
20 amps at 125VAC or 277VAC (347VAC CSA Listed)
(Tungsten and Ballast)
Auxiliary contact: 1 amp at 6.3VAC

TRANSFORMER

Primary Inputs (Accepts Either):
277VAC or 120VAC
Secondary Outputs:
6.3VAC at 5.5 amps
22VAC at 2.5 amps