

# Film-Tech

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XETROL IV  
LIGHTING CONTROL SYSTEM  
PRINCIPLE OF OPERATION

1 JUNE 1983

XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200

"Phase Control" is a method of fast ON/OFF switching that connects an AC supply to a load for a controlled fraction of each cycle. This becomes a highly efficient means of controlling the average power to a theatre lighting system. It controls the brightness of the lamps due to the fact that in respect to the AC power wave shape, it can release the power from 0 to 180 degrees of one alternation. As the number of degrees or time increases, the average power to the load increases.

While this is a "phase controlled" device, the actual phase control which insures the operation of the unijunction Q3 at the proper time is obtained from a feedback circuit from the positive side of the full wave bridge rectifier through a one megohm resistor to the emitter of Q3. This being pulsating DC exerts the proper control.

The output of Q3, through its output transformer, is connected to the gate terminals of the SCRs to control their conduction. The SCRs can be visualized as switches in series with the lamps representing the load. With no gate voltage being applied to the SCRs, their resistance is very high or infinite and no current flows to the lamps. When the gate voltage reaches the "switch ON" value, the effective resistance of the SCRs drops almost instantaneously to nearly zero for the balance of the alternation. In effect the switch is always closed at the same speed but the time it remains closed "ON" as determined by the phase of the control pulse determines the amount of power being delivered to the load. When the lights have reached their full "ON" condition, the SCRs are conducting for virtually the entire 180 degrees of the alternation.

For dimming the SCRs which were operating for virtually the full 180 degrees the alternation now begins to conduct over a shorter time period—in effect the switch closures are progressively shorter in duration until they cease to conduct and present the maximum resistance in series with the load. This is for the full "OFF" condition. When the preset lower limit is reached, the SCRs still conduct on a very small portion of the alternation.

Reference to the circuit diagram XD-190-30 will show that when the unit is switched to "ON" or "Up Bright", a direct current voltage starting at the 15 volt output of the Zener diode, through the up speed pot (1 megohm) the relay contacts 1 and 9 (relay in closed position) charging the 100 mfd capacitor (C1) through the 4.7K resistor. This capacitor discharges through a one megohm resistor to the base of Q1.

A DC signal is developed and further amplified by Q2 and connected to C2 (.1 mfd) and the emitter of Q3. The amplitude of this signal is a function of the charge/discharge rate of C1 and is determined by the amount of resistance in series or the position of the up speed pot. At a certain voltage level the unijunction transistor Q3 starts its switching action and discharges C2 across the primary of the output transformer and on the SCR gates.

When switched to dim, the pulses are still being generated due to the power stored in C1. However, in the dim position this charge begins to bleed off to ground through the relay contacts 5 and 9 (relay open) and the down speed, low limit pots. The low limit pot is only 5000 ohms maximum as compared to the one megohm for the down-speed pot and therefore contributes little to the downspeed function. Its purpose is to set the voltage level to which the capacitor C1 drops when the circuit is in the dim position. This voltage is adjustable to control the load from 75% brightness (full clockwise) to fully off (full counterclockwise).



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LIGHTING CONTROL SYSTEM

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### Description

This equipment provides for automatic or pushbutton control of incandescent lights within a load capacity of up to 4200 watts.

While primarily designed to be used with automated theatre projection equipment to control the auditorium lighting, it can also be used in hotels, restaurants and other installations where such control of lighting is required.

Being an electronic device, there are no motors or mechanical timing devices. The unit measures 17 1/2" wide by 10" high and 8" deep. It is to be wall mounted and includes knockouts on all sides to simplify the installation. A heavy vented metal cover is provided and is easily removed for installation.

The centrally located control panel has illuminated pushbuttons for the up (bright) and down (dim) functions. A manual control (P2) is provided to change the low limit of illumination when required. In some cases, it may be desirable to elevate the low level without disturbing P3.

Four control potentiometers are mounted on the chassis. P3 provides an adjustable lower limit for the light when in the dim position. This can be a maximum dim of the light completely off or at any required brightness—up to 60%. P4 regulates the speed of the dimming action. This can be adjusted for a fast dim of about one second to as much as thirty minutes. Ten to twelve seconds going from dim to bright is nominal for theatres. P5 controls the brightening speed. This is also adjustable from one second to thirty minutes but the normal time would be ten to twelve seconds, (for theatres).

P1 is the high level adjustment which sets maximum brightness of the load. High level can be depressed as much as 60%.

A fuse (0.5 amperes) is located to the right of the four potentiometers. This fuse protects the 12 VAC switching circuit and the SCR control circuit.

The terminal block for power input/output and remote control is located under the hinged cover to the left of the four potentiometers.

### Installation Instructions

The unit will normally be mounted on the front wall to the left or right of the projectors, usually on the side toward the booth power distribution panel. It should not be adjacent to the amplifier. Separate by 6 to 8 feet if possible.

The auditorium lighting circuit should be tested by connecting it to a 120 volt source before connecting to the Xetrol IV. This is a necessary precaution because if there should be a short circuit it could damage the equipment.

The terminal blocks are well marked. The pair of wires from the distribution panel should be capable of carrying 40 amperes and the circuit breaker should have a capacity of 40 amperes.

Refer to the circuit diagram, XD-190-30 for connections to load, line and automation equipment.

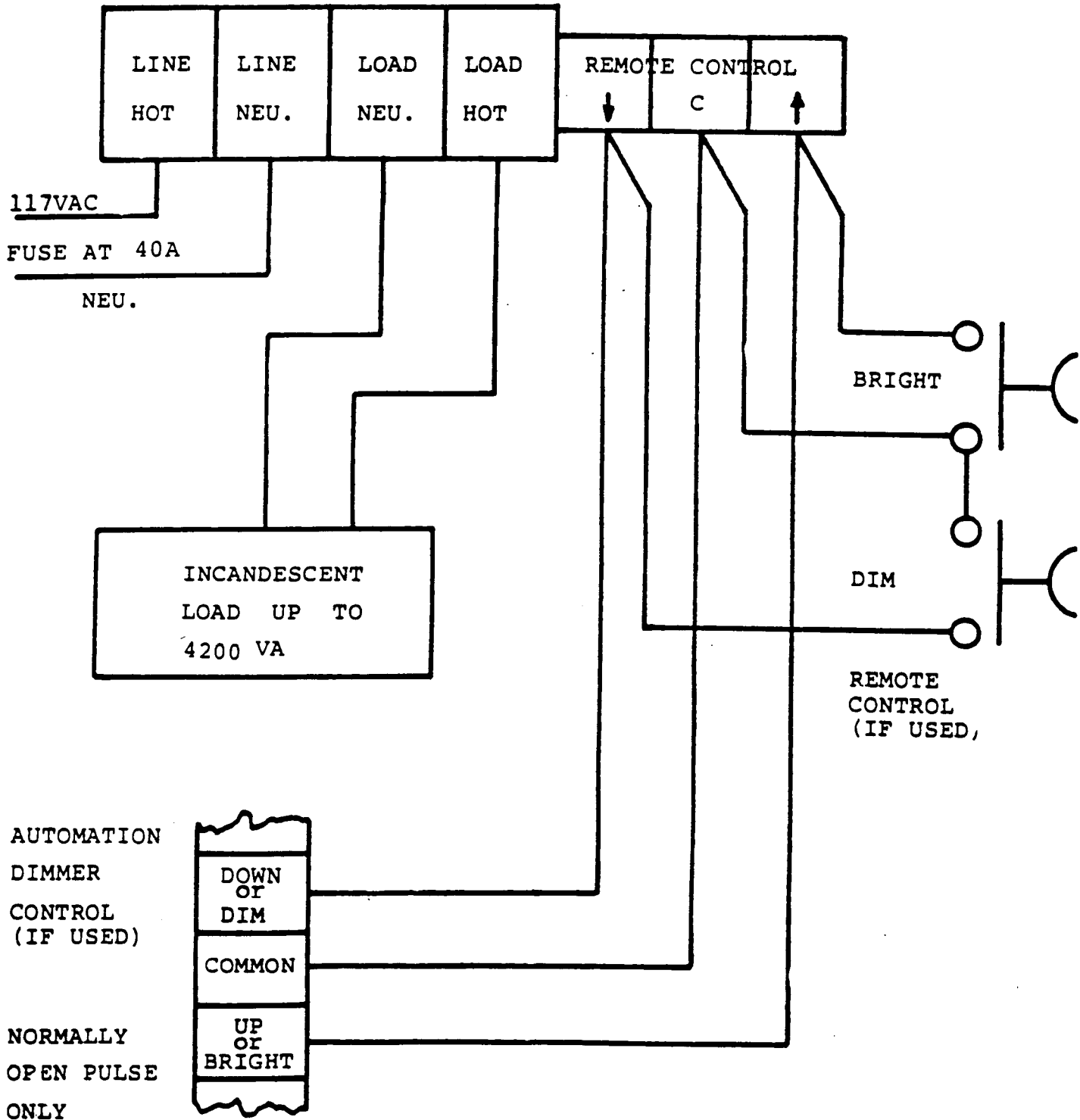
For use with automated projector equipment or for remote control, connect as shown on DWG. XD-006A.



XETROL IV  
TERMINATION

XD-Manual-4  
Dwg. #XD-006A  
Date: 3 June 1981

XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200



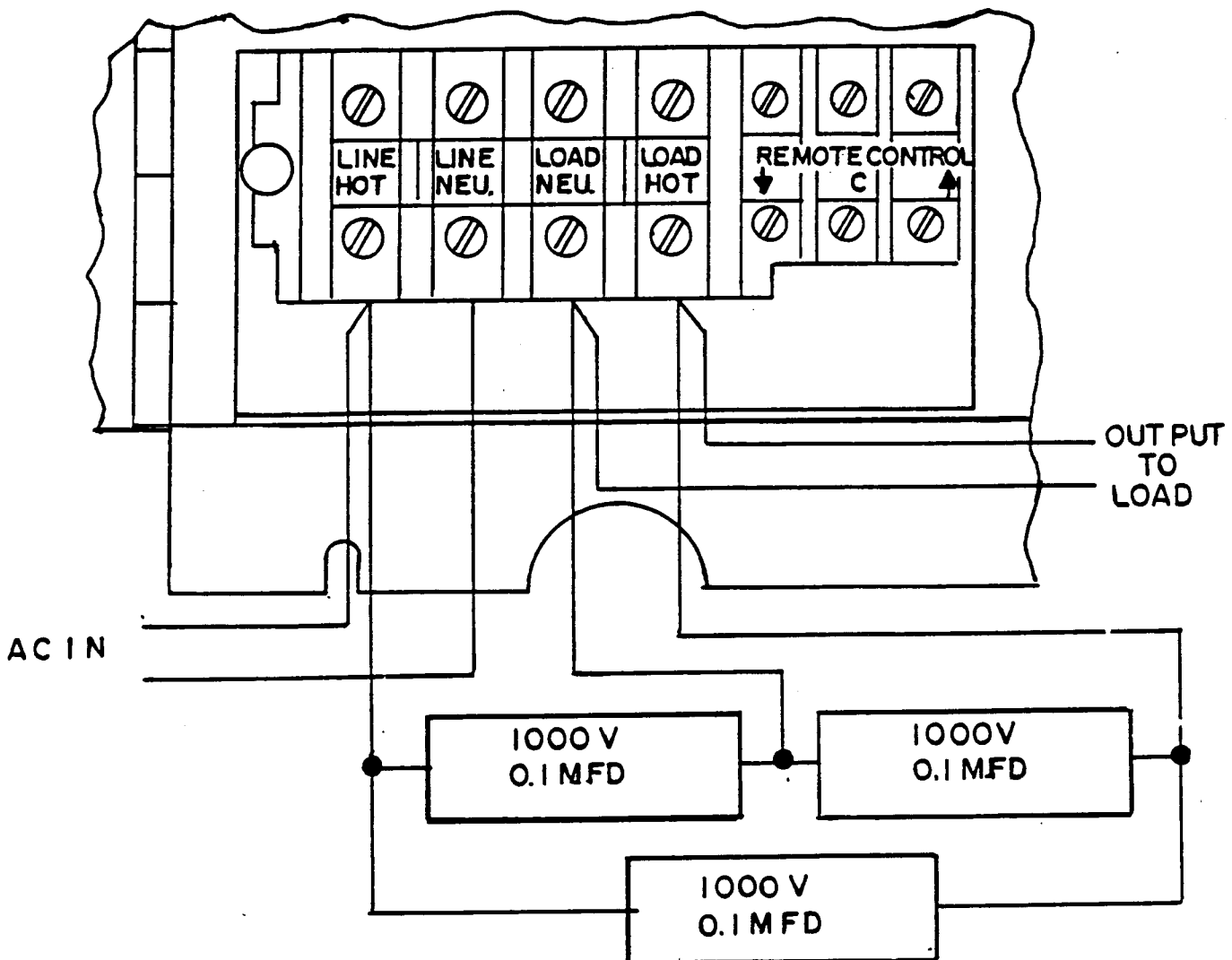


XETROL IV  
CROSSTALK

XD-Manual-5  
MARCH 1985

XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200

In some instances where multiple Xetrol IV's are installed, a condition called "crosstalk" can result manifested by flickering, instability, random flashing and other undesirable effects. It is caused by the SCR firing circuits contained in each dimmer "talking to" the SCR's in the other units. The condition is most prevalent when the lighting loads share a neutral. "Crosstalk" can be eliminated by the use of a suppression network field installed on each unit. The network consists of three 1000V 0.1 mfd capacitors for each unit. Connect one from "HOT IN" to "NEU. OUT", one from "HOT OUT" to "NEU. OUT" and one from "HOT IN" to HOT OUT".



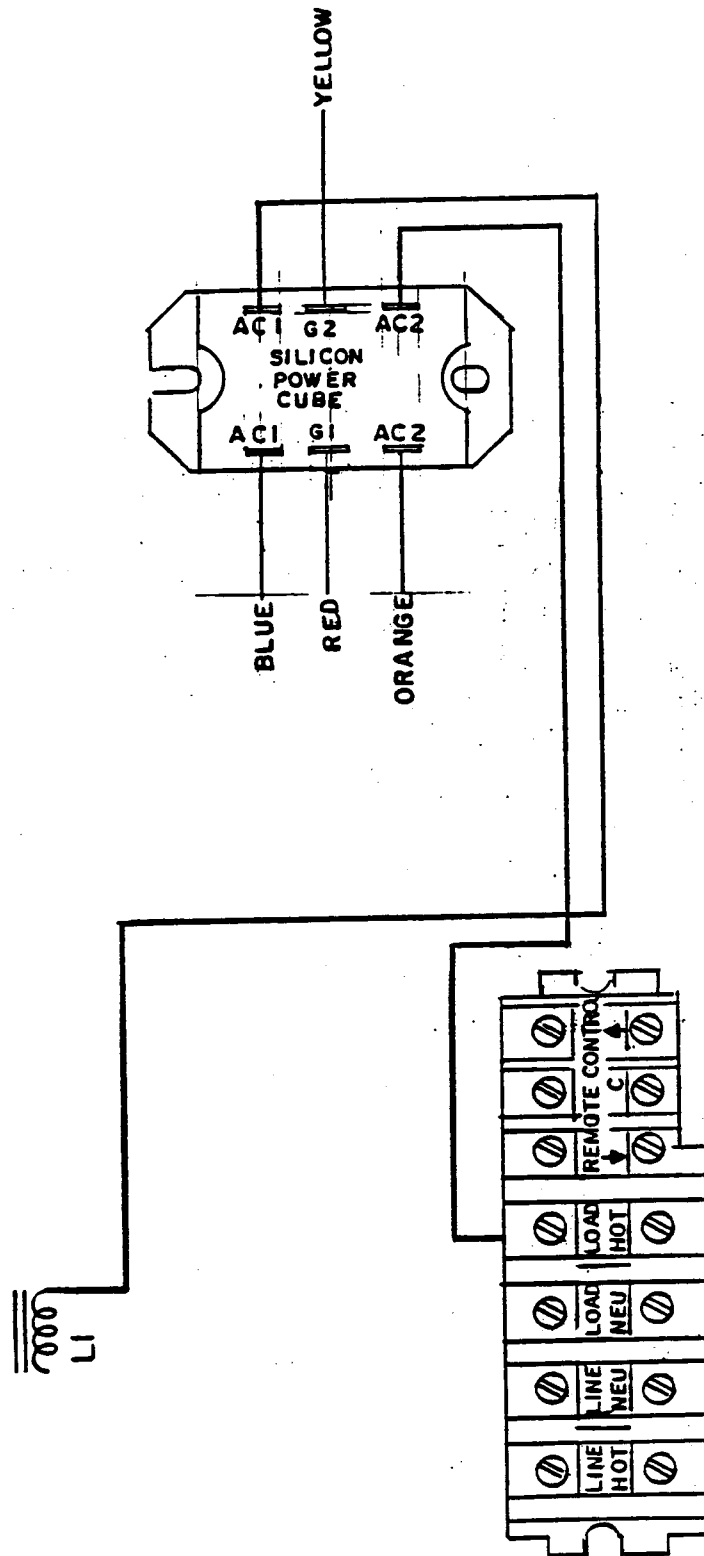


A.C. TERMINATION SWITCH

XD-Manual-6

April 1985

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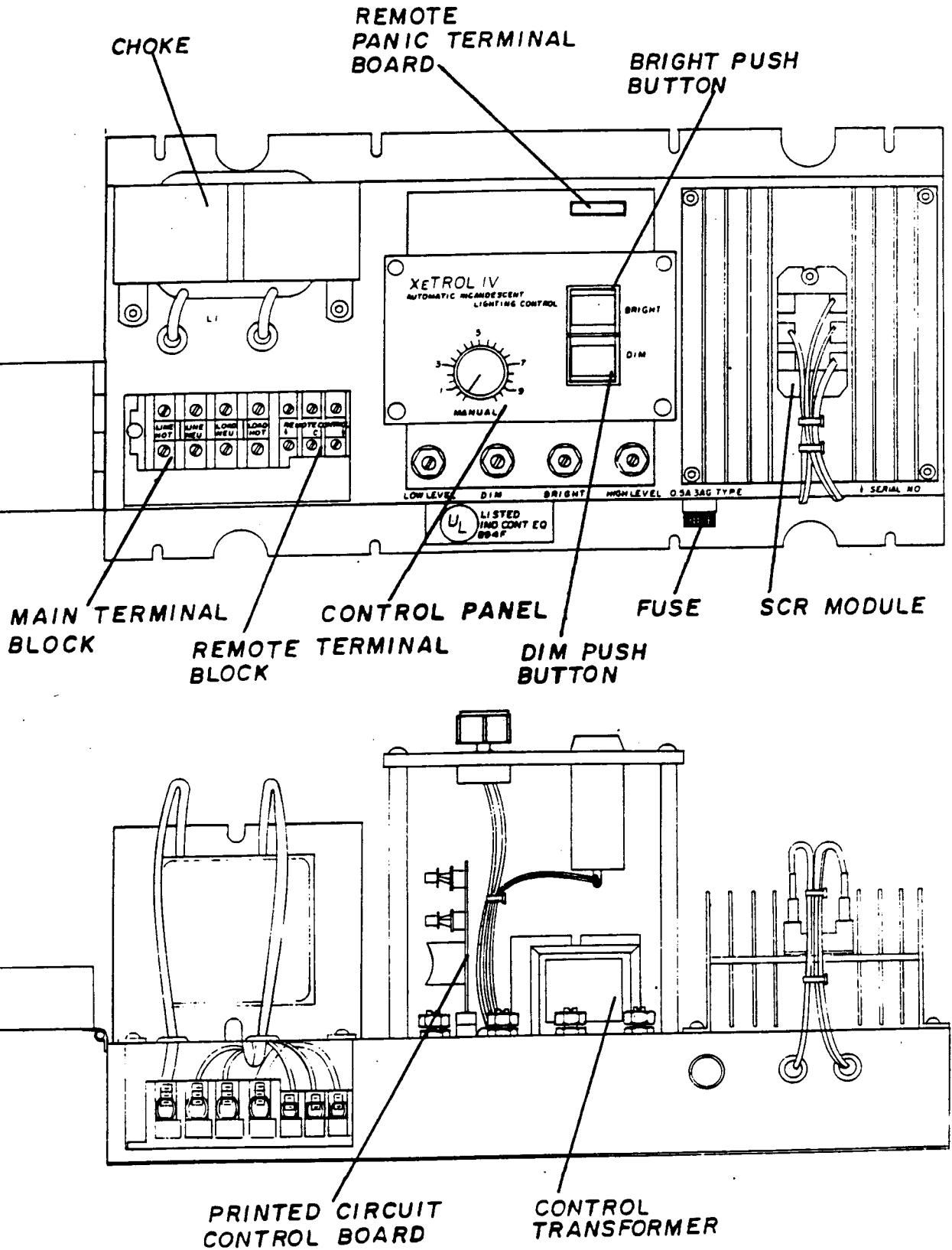
# XETROL IV DIMMER

XD-Manual-7

Date: 6-1-81

Dwg. #XD-191

XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200





**XETRON®**

**XETROL IV TROUBLESHOOTING GUIDE**

**MARCH 1985**

**XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200**

**DIMMER DOESN'T FUNCTION**  
(No pilot lights)  
(No house lights)

Check for AC  
NO A.C.  
Check breaker  
YES A.C.  
Check fuse

**FUSE BLOWS AGAIN** - Check for problems in pilot bulb sockets or in transformer.  
**FUSE DOESN'T BLOW AND PILOTS AND RELAYS OPERATE NORMALLY** - the problem is in the Control Board. It should be replaced and the defective unit sent back to Xetron for repair via your dealer.

**FUSE BAD**  
Remove Control Board.  
Replace fuse.  
**FUSE GOOD**  
Check for loose connector

**DIMMER DOESN'T FUNCTION**  
(Yes pilot lights)  
(No house lights)

Check connections from control circuit to SCR chip

**CONNECTIONS BAD**  
Repair connections  
**CONNECTIONS GOOD**  
Replace Control Board

**UNIT OPERATES** - the problem is then in the Control Board. The unit should be replaced and the defective unit returned to Xetron for repair via your dealer.  
**UNIT DOESN'T OPERATE** - the problem is most likely in the A.C. switch (XD-120-7C). The unit should be replaced.

**DIMMER CONTROL FUNCTIONS OPERATE NORMALLY BUT HOUSELIGHTS EITHER STAY AT FULL BRIGHTNESS WILL ONLY DIM HALFWAY OR WILL ONLY COME UP HALFWAY**

Check high and low level adjustments

**UNIT IS MISADJUSTED** - Read as follows: Using a V.O.M. on the A.C. scale, monitoring the dimmer output. Low level should be adjusted counter clockwise until output voltage is 10 to 15 volts with the dimmer in dim and the manual control all the way down. High level should be adjusted clockwise until the output voltage is 105 to 115 volts with the dimmer in bright and manual control all the way down.

**UNIT IS ADJUSTED CORRECTLY**  
Change control board

**UNIT OPERATES NORMALLY**  
The problem is in the control card.  
Send defective card back to Xetron for repair via your dealer.

**UNIT STILL DOESN'T OPERATE NORMALLY**  
Check connections to gate circuit  
**CONNECTIONS BAD**  
Repair connections  
**CONNECTIONS GOOD**  
The problem is in the AC switch (XD-120-7C).  
The unit must be replaced.





XETROL IV INCANDESCENT

LIGHTING CONTROL

SEE DWG. #XD-200

XD-Manual-8

APRIL 1982

XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200

<u>Part #</u>	<u>Description</u>
XD-100	Back Box
XD-110	Cover
XD-120-B	Chassis
XD-120-1B	12 VAC Control Transformer
XD-120-2B	Control Relay 3 PDT 12 VAC Coil--Serial #2879 & Below
XD-120-2C	Control Relay 4 PDT 12 VAC Coil--Serial #2880 & Above
XD-120-4	Potentiometer--Dim
XD-120-4	Potentiometer--Bright
XD-120-5	Potentiometer--Low Level
XD-120-5	Potentiometer--High Level
XD-120-6B	Heat Sink (SCR Type)--Serial #1723 to #2457
XD-120-6C	Warning Label Plate
XD-120-6D	Heat Sink (AC Switch Type)--Serial #2458 & Above
XD-120-7B	SCR (35A 400V STUD)
XD-120-7C	A.C. Switch--Serial #2458 & Above
XD-120-9*	P.C. Board Plug Polarizing Key
XD-120-11B	Terminal Block Assembly Complete
XD-120-11BL	Terminal Block Section--Large
XD-120-11BS	Terminal Block Section--Small
XD-120-13	Grommet
XD-130-1A	Fuse Holder
XD-130-1AF	Fuse 0.5 Amp
XD-130-3A	Blue P.B. Switch Body Only--Less Lens & Bulb
XD-130-5A	Pilot Bulb (Series 4 Type Switch)
XD-130-6	Stand Off
XD-130-7A	Manual Potentiometer
XD-130-8	Knob
XD-130-9	Blue Lens Only (Series 4 Type Switch)
XD-130-10	Yellow Lens Only (Series 4 Type Switch)
XD-130-B	Face Plate (Series 4 Type Switch)
XD-130-E	Face Plate (AML Type Switch)
XD-140-A	Choke
XD-150-C	Printed Circuit Control Board
XD-160	Mother Board--Sub Asbly--Less 2 Relays & P.C. Board
XD-160-1*	Face Plate Screw
XD-160-2*	Stand Off Screw
XD-160-3*	Chassis Swing Cover Screw
XD-160-4*	Choke Mounting Screw
XD-160-5A*	Heat Sink Mounting Screw (Nylon)
XD-160-5B	Heat Sink Mounting Insulator
XD-160-6*	P.C. Socket Mounting Screw

\*Not Illustrated On DWG. #XD-200



XETROL IV INCANDESCENT

LIGHTING CONTROL

SEE DWG. #XD-200

XD-Manual-9

NOVEMBER 1983

XETRON CORPORATION, Ten Saddle Rd., Cedar Knolls, NJ 07927 U.S.A. Telephone (201) 267-8200

<u>Part #</u>	<u>Description</u>
XD-160-7*	Chassis Mounting Screw
XD-160-8*	Cover Mounting Screw
XD-160-9	Socket For Remote Control Cable
XD-170-1*	Panic/Gang Relay Box With Cover
XD-170-2*	Panic/Gang Chassis
XD-170-3*	Panic/Gang Relay (4 PDT)
RS-1	Panic/Gang Relay Socket
XD-180*	Remote Box With Cover
XD-180-1*	Remote Bright Switch Complete
XD-180-2*	Remote Dim Switch Complete
XD-180-3*	Remote Panic Switch Complete
XD-180-4*	Remote Normal Switch Complete
XD-190	P.B. Switch Body Only (AML Type)
XD-190-1	Blue Lens Only (AML Type)
XD-190-2	Yellow Lens Only (AML Type)
XD-190-5	Pilot Bulb (AML Type Switch)

\*Not Illustrated On DWG. #XD-200



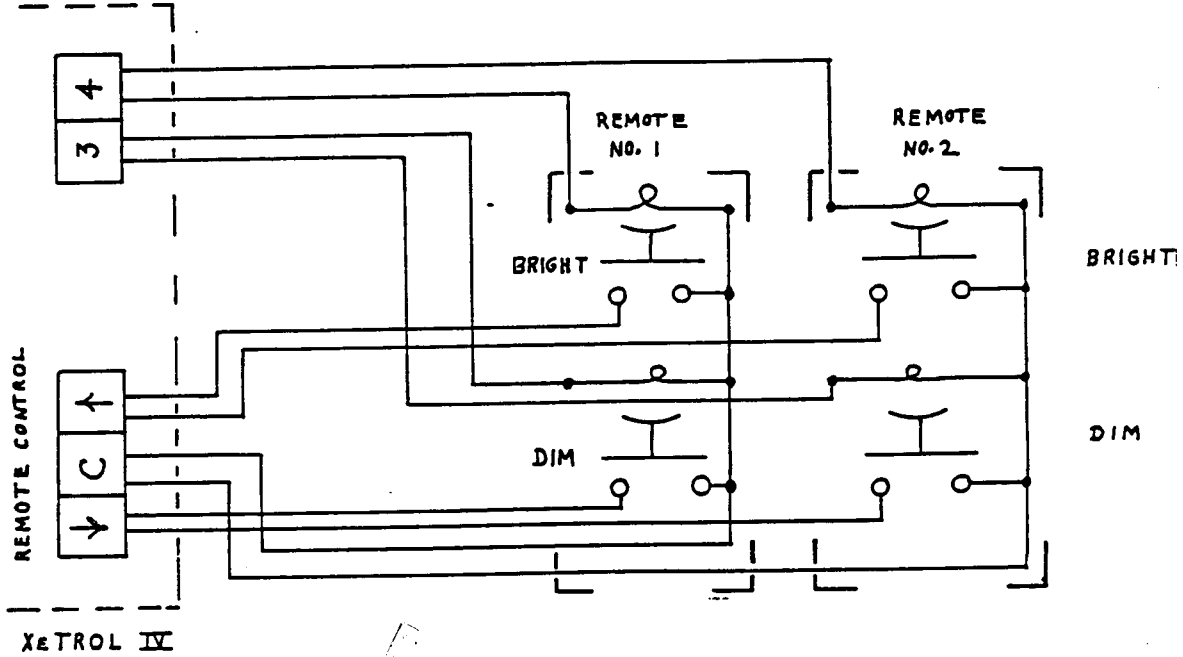
WIRING DIAGRAMS

XD-Manual-10

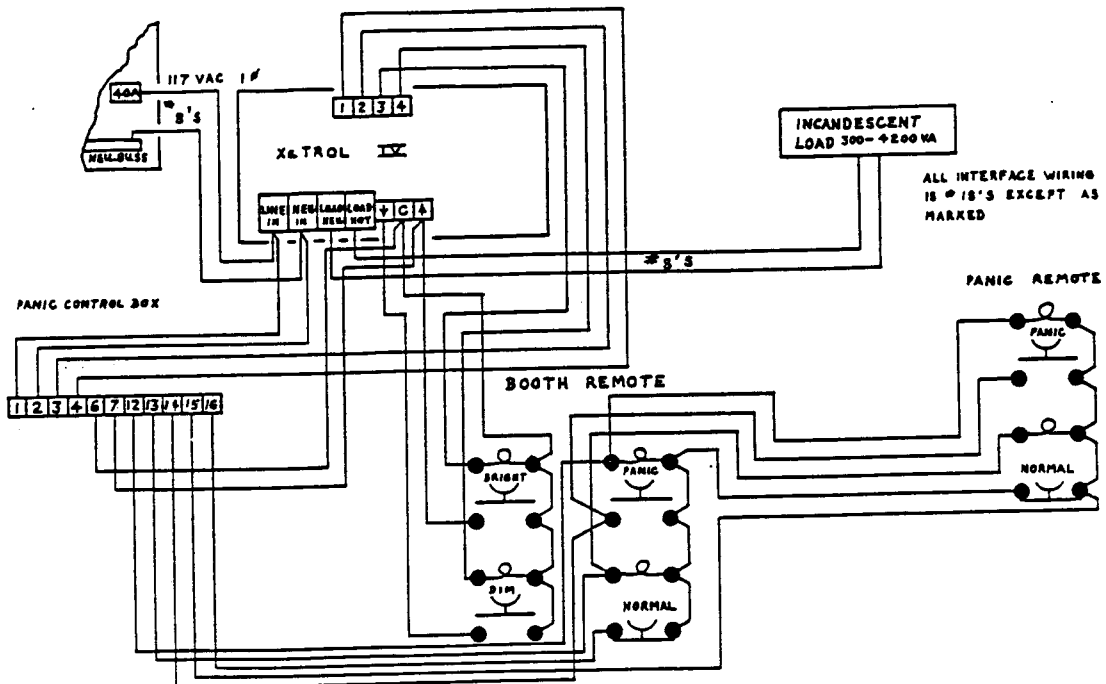
- OPTION A
- OPTION B
- OPTION C

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OPTION A



OPTION B = OPTION C





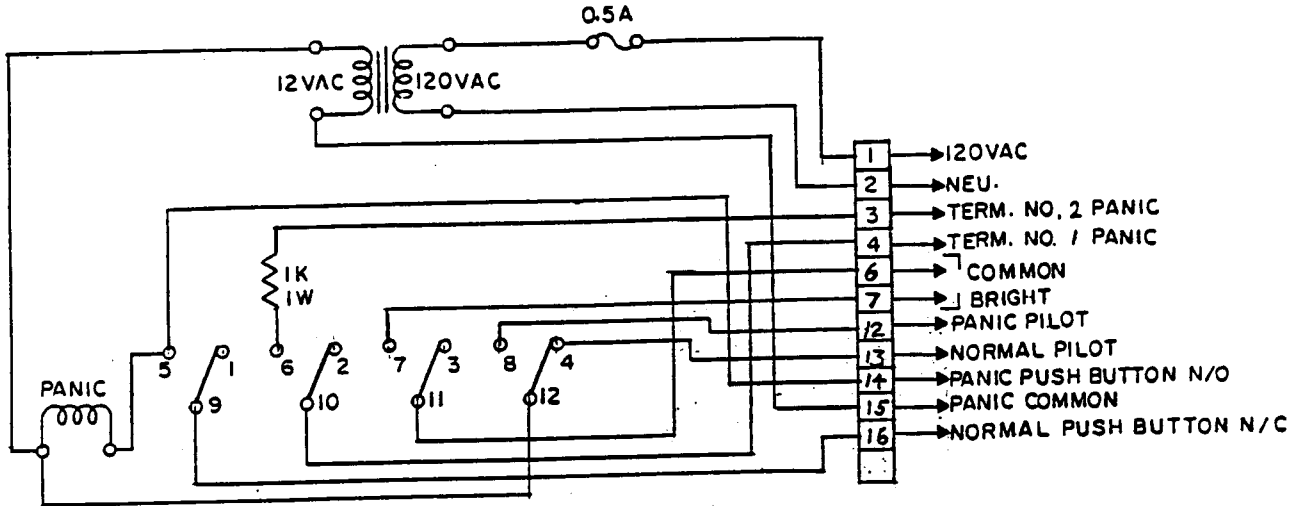
WIRING DIAGRAMS

XD-Manual-11

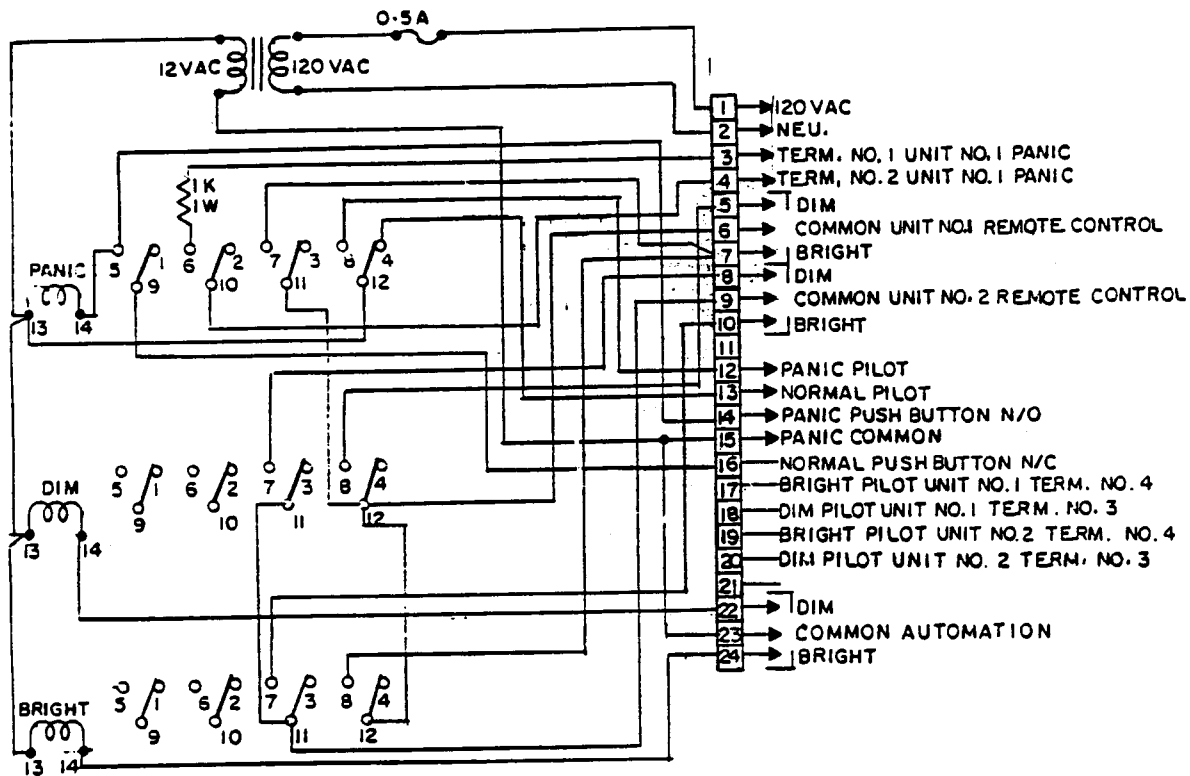
Option D-Panic Relay Control Box  
Option E-Panel Relay and Gang

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OPTION "D"



OPTION "E"



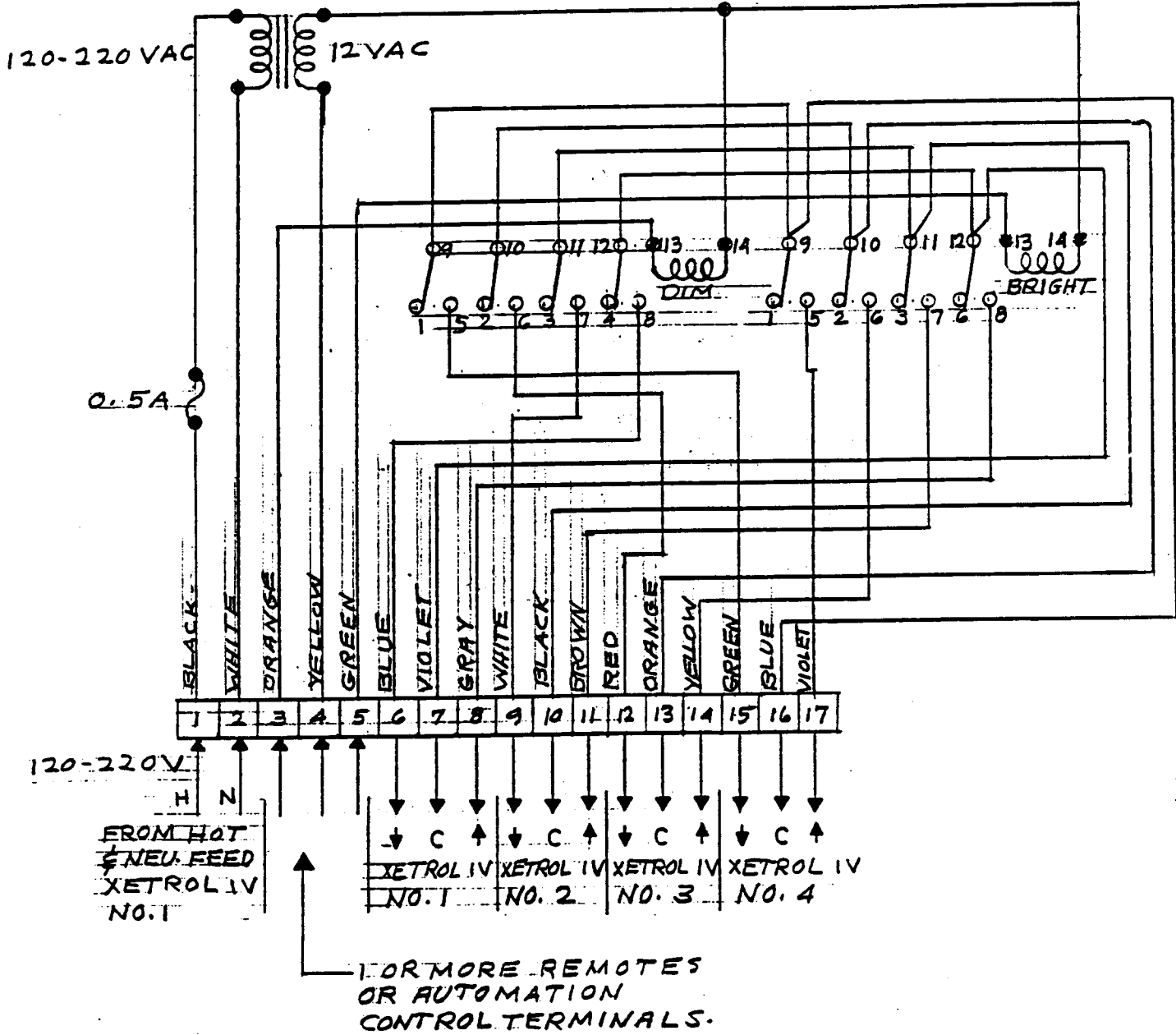


WIRING DIAGRAM  
Option F-Multiple Gang Control Box

XD-Manual-12

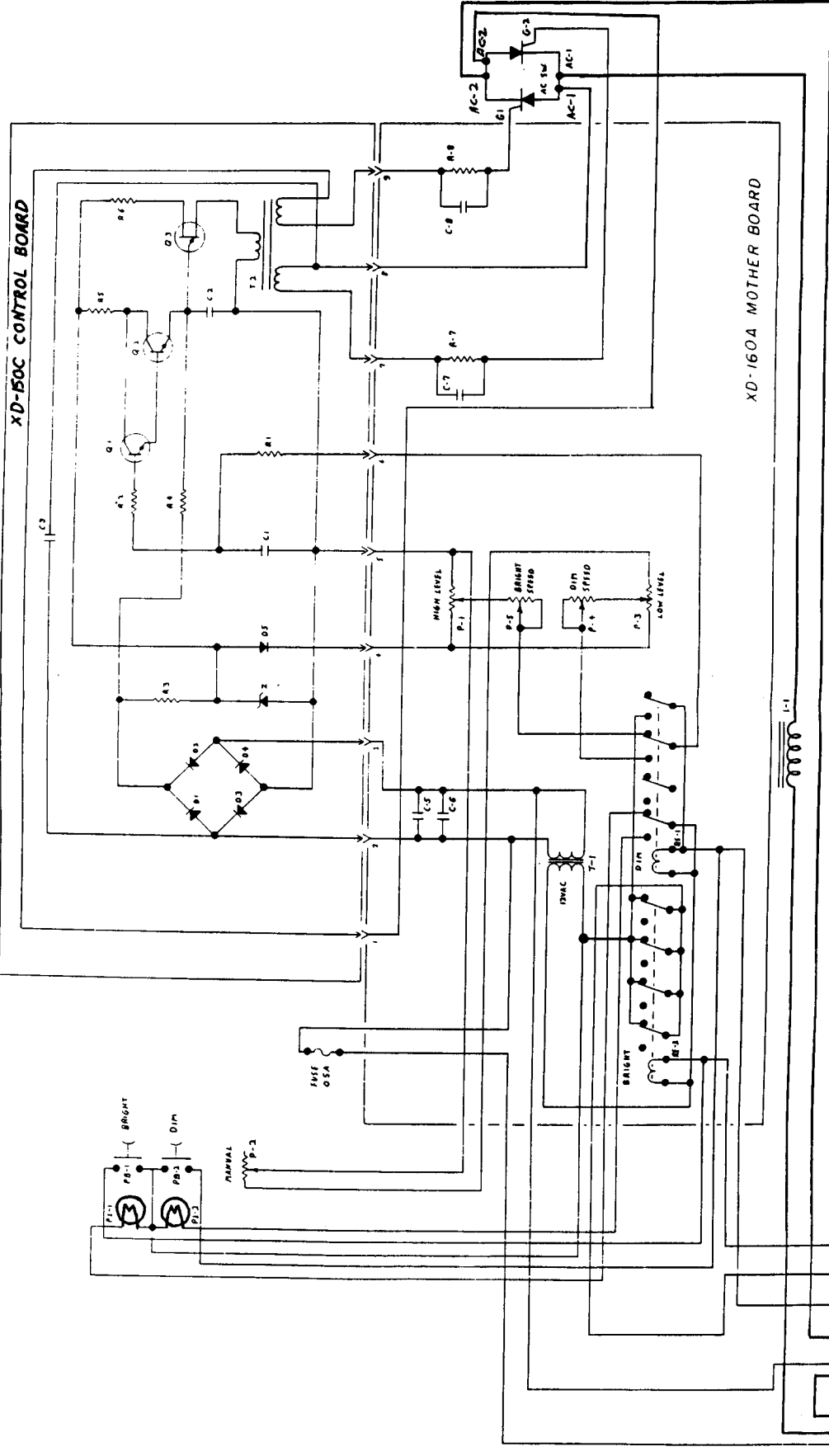
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OPTION "F"



XD-50C CONTROL BOARD

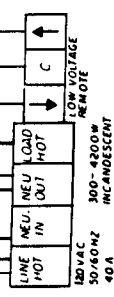
XD-160A MOTHER BOARD



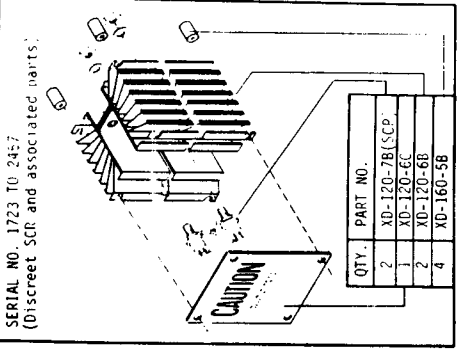
REVISED AC SWITCH TERMINATION

DATE	BY	CHKD	APP'D
10/1/85	J. J. BROWN	J. J. BROWN	J. J. BROWN
XETROL IV DIMMER MODULE			
SCHEMATIC			
REV	DATE	BY	APP'D
1	8/17/80	J. J. BROWN	J. J. BROWN

REV 3/85

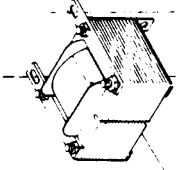


SERIAL NO. 1723 TO 2457  
(Discrete SCR and associated parts)

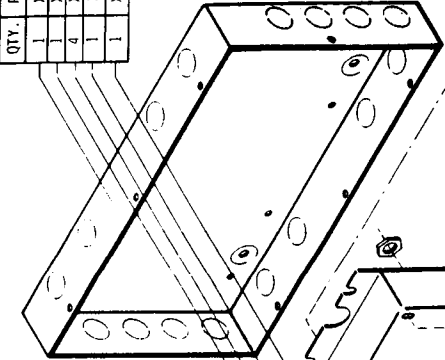


QTY.	PART NO.
2	XD-120-7B(SCP)
1	XD-120-6C
2	XD-120-6B
4	XD-160-5B

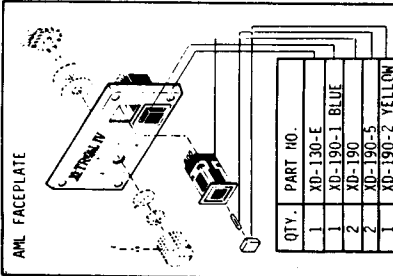
XD-120-11B ASSEMBLY	
QTY.	PART NO.
4	XD-120-11B1
3	XD-120-11B5



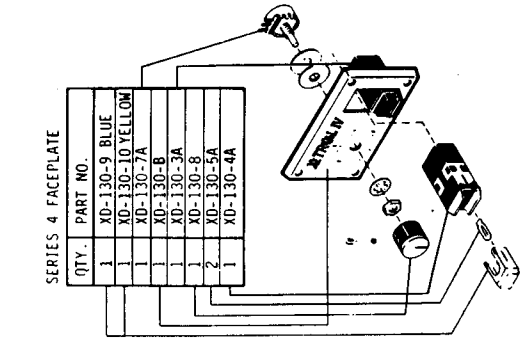
QTY.	PART NO.
1	XD-140-A
1	XD-110
2	XD-130-6



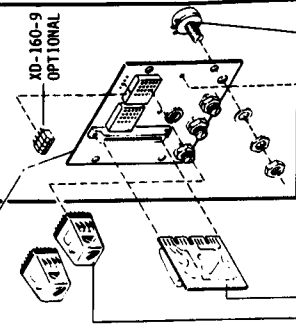
QTY.	PART NO.
1	XD-100
1	XD-120-B
4	XD-120-13
1	XD-130-1A
1	XD-130-1AF 0.5A



QTY.	PART NO.
1	XD-130-E
1	XD-190-1 BLUE
2	XD-190
2	XD-190-5
1	XD-190-2 YELLOW



SERIES 4 FACEPLATE	
QTY.	PART NO.
1	XD-130-9 BLUE
1	XD-130-10 YELLOW
1	XD-130-7A
1	XD-130-B
1	XD-130-3A
1	XD-130-8
2	XD-130-5A
1	XD-130-4A



XD-160-9  
OPTIONAL

XD-160 SUBASSEMBLY	
QTY.	PART NO.
1	XD-150-C
1	XD-120-1B
2	XD-120-2E*
2	XD-120-4
2	XD-120-5

Serial No. 2889 and above  
(4 pole relay XD-120-2C)  
Serial No. 2879 and below  
(3 pole relay XD-120-2B)

QTY.	PART NO.
1	XD-120-6D
1	XD-120-7C

Serial No. 2458 and above  
(AC switch XD-120-7C)



XETRON IV INCANDESCENT  
LIGHTING CONTROL

DATA CURRENT  
AS OF 6/81

DRW NO. XD-200

XETRON CORPORATION P.O. Box 400, Cedar Knolls, NJ 07027 Telephone (201) 267-8200