SPECTRUM
DESIGN & DEVELOPMENT, INC.

OWNERS MANUAL FOR
MODEL EFC-1 LIGHTING CONTROLLER

INTRODUCTION

Spectrum's EFC Foot Operated Lighting Controller was designed to provide professional quality lighting control for live entertainment lighting in situations where a full time lighting director is not available. It is an eight channel, four scene preset controller with numerous automatic functions that will allow an operator to generate professional results with a minimum of effort. The EFC-1 will operate with Spectrum Design's QEP rig mountable power modules.

DESCRIPTION

The EFC is a four scene preset, eight channel remote lighting controller. Since it was designed to be foot operated all functions can be initiated with a single push of a button. Functions provided include adjustable timed cross-fades and pile-ons, fade-out, and black-out. Sequencing through the four scenes is possible at adjustable rates and a programable channel chase is also provided. An auto-reset switch allows the engagement of one function to disengage all others or allows all functions to operate independently and simultaneously. External devices such as synthesizers and, under controlled conditions, audio signals can be used to control the rate of chase and sequence functions.

Following is a list of each function of the EFC along with a complete description of the function and all related controls.

SCENE FUNCTION

The four SCENE PUSH buttons, labelled A, B, C AND D are used to initiate a crossfade to a desired scene. If the SCENE A button is pressed, for example, the EFC will crossfade its output from the current setting to SCENE A at the rate preset with the FADE RATE control. Note that all crossfades performed by the EFC are theatrical grade dipless crossfades. That is, during a crossfade all channel outputs will fade simultaneously and linearly from their settings on the current scene to their settings on the target scene. Also, any channel that is set the same on both the current and target scenes will not vary (or dip) during the crossfade.

A crossfade cannot be initiated while one is already in progress (when the READY light is OFF). Thus, the operation of the SCENE buttons will be ignored during crossfades.

The four groups (SCENES A, B, C, D) of eight sliders are used to adjust and preset desired lamp intensities. Only the scene or scenes engaged by the SCENE push-buttons (as indicated by the SCENE indicator lamps) will be active. In the event that more than one scene is active at one time (piled-on) the brightest slider setting will over-ride all others for any

particular channel.

The FADE RATE control adjusts the time required to perform a complete crossfade. The range is from an instant crossfade at '9' to approximately 15 seconds at '1'. As described in the Sequence section this adjustment also controls the SEQUENCE rate since Sequence is simply back to back crossfades (see SEQUENCE). This control also controls the time for a complete fade-out.

The four red LED indicators labeled A, B, C, and D indicate the status of the four preset scenes, respectively. Their intensities will be proportional to the staus of the scenes.

READY INDICATOR

The green READY light is the indication to the operator that a crossfade is in progress. On slow fades it is sometimes hard to tell exactly when a fade starts and stops. When the READY light is OFF it is the indication that a crossfade is in progress and the crossfade commands (SCENE or FADE-OUT buttons) will be accepted. Only when the READY light is ON will the EFC accept input on the A, B, C, or D SCENE or FADE-OUT push-buttons. The CHASE, SEQUENCE, PILE-ON and BLACK-OUT buttons are unaffected by the READY indicator.

PILE-ON BUTTON

This button toggles the PILE-ON function ON and OFF. The red PILE-ON LED indicates the status of the PILE-ON function. When the LED is on, pressing a SCENE button (A, B, C, D) will cause that scene to fade up without fading current scene(s) out. That is, it will pile-on the next scene selected. The PILE-ON function is reset after each crossfade and must be re-engaged each time it is desired.

FADE-OUT BUTTON

The FADE-OUT button initiates a fade-out at the rate set by the FADE RATE control.

A crossfade cannot be initiated while one is already in progress (when the READY light is OFF). Thus, the operation of the FADE-OUT button will be ignored during crossfades.

BLACK-OUT BUTTON

The BLACK-OUT button turns OFF all scenes instantly, terminates a crossfade if one is in progress and resets all functions to off.

CHANNEL INDICATORS

The eight red LED indicators labeled 1 through 8 indicate the status of the output of the eight channels, respectively. Their intensities will be proportional to the intensity level of the outputs.

CHASE FUNCTION

The CHASE button toggles the CHASE function ON and OFF. The red CHASE LED indicates the status of the CHASE function. The CHASE RATE control knob adjusts the internal Chase Rate clock. from approximately 9 steps per second at '9' to approximately 3 seconds per step at '1'. The CHASE will step one position on each pulse from the clock as indicated by the CHASE RATE LED unless the CHASE EXT TRIG selector switch is in the ON position (see EXTERNAL TRIGGER). The rate displayed by the CHASE RATE LED indicator is active regardless of the status of the Chase function or of the staus of the CHASE EXT TRIG selector switch.

The CHASE Matrix is a miniature 8x10 matrix switch which is used to program (or pre-set) the CHASE function. Each of the eight vertical sliders in the Matrix Switch corresponds to one of the eight CHASE positions. Position 1 is the slider on the extreme left and position 8 the one to the extreme right. DO NOT CONFUSE THE EIGHT CHASE SLIDERS WITH THE EIGHT CHANNELS OF THE EFC. THEY ARE NOT THE SAME. Each slider can be set to select any one of the eight channels or RESET or OFF.

When engaged by the CHASE push-button the CHASE function will begin with position 1 and step through the other positions (at the rate set by the CHASE RATE control or the EXTERNAL TRIGGER input) in increasing order until it encounters a RESET or reaches position 8. In either case it will then return to position 1 and repeat its cycle until disengaged. As the CHASE steps through each position it will turn ON, to full intensity, the channel assigned to it. That is, if the slider for position 4 is set to channel 7, then as the CHASE steps to position 4 channel 7 will turn ON full and remain ON full until the CHASE steps to the next position. If a slider is set to the OFF position a 'dead' spot will result for that CHASE step. A slider set to RESET will cause the CHASE to return to position 1 at that step. That is, if the slider for CHASE position 4 is set to RESET then the CHASE will step only through the first three positions. No 'dead' spots result from using RESET.

SEQUENCE FUNCTION

The SEQUENCE button toggles the SEQUENCE function on and off. The red SEQUENCE LED indicates the status of the SEQUENCE function. When engaged, the SEQUENCE function will crossfade, continuously, through the four scenes (A-B-C-D-A...). The end of each crossfade will initiate the start of the next until the function is disengaged. When disengaged, the crossfade in progress will continue until complete. You will notice the READY light displaying the start and stop of each crossfade during the SEQUENCE functon. Since the SEQUENCE function is simply back-to-back crossfades the rate of the SEQUENCE function is determined by the FADE RATE control.

AUTO RESET

Placing the AUTO RESET switch in the ON position causes the engagement of one function to disengage all other functions. For example, if the SEQUENCE function is on and the AUTO RESET switch is on then pressing the CHASE button will engage the CHASE function and turn OFF the SEQUENCE function. Similarly, now pressing the SCENE A button would cause SCENE A to fade up and turn OFF the CHASE function. With AUTO RESET OFF two or more functions, such as CHASE and SCENE B or CHASE and SEQUENCE may be turned ON at the same time.

EXTERNAL TRIGGER FUNCTION

The step rates of both the CHASE and SEQUENCE functions may be controlled externally through the EXTERNAL TRIGGER input jack located on the rear panel of the EFC. The EXTERNAL TRIGGER can be assigned independently to either the CHASE or SEQUENCE functions via the two EXT TRIG switches. When either switch is in the OFF position the step rate of that function will be controlled by its appropriate internal rate control. When either switch is in the ON position its step rate will be controlled by the signal applied to the EXTERNAL TRIGGER Input jack.

The EXTERNAL TRIGGER circuit is voltage sensitive. The EXT TRIG LEVEL control is used to adjust the threshold voltage of the EXTERNAL TRIGGER circuit. Whenever the input signal voltage exceeds this threshold voltage the EXTERNAL TRIGGER circuit sends a step pulse to the selected function(s). The EXT TRIG LED indicates these pulses. The EXT TRIG indicator LED will be active regardless of the position of either EXT TRIG selector switches.

In the case of the CHASE function the CHASE will step each time a step pulse is received from the EXTERNAL TRIGGER circuit. This means that the CHASE rate will follow exactly the pulse rate of the input signal (up to a maximum of approx. 15 pulses per second).

The SEQUENCE function works slightly differently with the EXTERNAL TRIGGER. As described in the SEQUENCE section, under normal operation, the SEQUENCE rate is simply a continuous series of back to back crossfades where the end of one crossfade intitiates the start of the next. When in the EXTERNAL TRIGGER mode, however, the SEQUENCE function will stop at the end of each crossfade and wait for the next pulse from the EXTERNAL TRIGGER circuit before beginning the next fade. Any pulses received during a crossfade will be ignored. Thus, an input signal whose rate is faster than the preset Fade Rate will not trigger a fade with each pulse.

Voltages between .50vdc and 10vdc should be supplied to the EXTERNAL TRIGGER input jack for satisfactory operation. WARNING! UNDER NO CIRCUMSTANCES SHOULD ANY VOLTAGE HIGHER THAN 12V AC OR DC BE CONNECTED TO THE EXTERNAL TRIGGER INPUT. The types of signals that are recommended are trigger outputs from synthesizers, sequencers, drum machines, etc. Under controlled conditions the output from mixer channels that carry discete signals from instruments like bass or snare drums (instruments that generate discrete pulses) may be used successfully. Audio signals that contain mixed signals or signals that do not

generate pulses (guitars, taped music, etc,) generally will not function successfully. When connecting an external input start with the EXT TRIG LEVEL adjustment slider all the way up and pull it down slowly, with a live input signal, until the EXT TRIG LED indicator shows an acceptable reponse.

INSTALLATION

To set-up and operate an EFC with eight channels you will need, in addition to the EFC, two QEP Power Modules, two QECC control cables of your specified length and two power cables with which to power up the QEP's. At minimum, the EFC can be operated with one of each of the these additional components for four channel operation.

Place the EFC in the desired location. Set-up the QEP Power Modules according to their Owner's Manual. Run a QECC control cable from each of the two QEPs to the two CONTROL IN connectors on the back panel of the EFC. The labels '1-4' and '5-8' on these connectors indicate which channels are output to each connector. Connect each control cable to the desired connector. No external AC power source is required for operation of the EFC. Control power is obtained from the QEP power module via the QECC control cables.

SET-UP AND OPERATION

This section will cover most of the operational considerations of the various functions of the EFC controller. At this point it may be advantageous to have your EFC installed and follow the discussion with hands (and/or feet)-on operation. Lighting instruments need not be connected to the QEP as the LED indicators will provide operational status of all functions.

Before you can use the EFC effectively there are some functions that must be preset. Most importantly, of course, are the four scene presets. To set the presets in the most efficient manner turn the FADE RATE control fully clockwise, press the BLACK-OUT button and then the SCENE A button. Now adjust the eight sliders of SCENE A to your liking. When finished press the SCENE B button and adjust the SCENE B sliders. Do this for SCENESC and D, too. Keep in mind as you adjust your presets that you have the capability to pile-on more than one scene at a time. By piling-on scenes you are not limited to four single scene outputs but actually have sixteen different output combinations to work with.

Once the scenes are preset you will have to preset your CHASE MATRIX for the desired Chase pattern. Review the description of the CHASE MATRIX if necessary to preset the Chase pattern to your liking. A small, black plastic programming 'pen'

is included with your EFC. This tool is recommended to use to program the matrix as it will not contaminate the matrix contacts as may a ball point pen or other likely substitute device. Also note that a self adhesive tool holder is included that may be mounted directly to the EFC so that the programming tool will always be at hand.

Next you must decide how you want to set the AUTO RESET switch. Review the description of this function if necessary. If you want to be able to have more than one function on at a time then put it in the OFF position. This will mean that there will be no interaction between functions. You will be able to have the CHASE and SEQUENCE functions on at the same time, for example.You will also be able to perform crossfades and FADE-OUTs while the CHASE function is ON. It will also mean that to go from one function to another will require two foot presses; one to turn OFF the first function and another to turn ON the second.

If you would prefer to be able to go from function to function with only one foot press and do not care to have more than one function operative at a time then put the AUTO RESET switch in the ON position. This will cause each foot press to reset any function(s) currently active.

NOTE! The AUTO RESET function detects foot presses (that is, buttons being pushed) as an indicator that the current function(s) should be disengaged. It does not differentiate between turning a function OFF or ON. This means that if two functions are on at the same time that the AUTO RESET switch is turned from OFF to ON then subsequently turning either of these functions OFF will turn BOTH OFF! To prevent this situation from inadvertently occurring it is suggested that the BLACK-OUT switch be pressed immediately either before or after this switch is set. The intent of the AUTO RESET switch, as described, is to allow the operator to preset the mode of operation preferred and not to be used as a dynamic control.

Lastly you must preset the two EXTERNAL TRIGGER selector swicthes to their appropriate settings. If no external trigger is desired then put both switches in the OFF position. If an external trigger input is desired then put the desired switch(s) (CHASE and/or SEQUENCE) in the ON position. Review the description of this function as necessary.

After all these functions have been preset you are ready to begin using your EFC controller. From here it is pretty straightforward.

To perform a crossfade set the FADE RATE control to the desired fade rate and press the desired SCENE button; A, B, C, or D. The EFC will crossfade from the current setting to the Scene selected at the rate selected. To crossfade to the next scene simply set the FADE RATE again (if a different rate is desired) and press the SCENE button for the next scene desired. Simple! With a little practice you will learn to turn the FADE RATE (and the CHASE RATE) control knob with the edge of your shoe.

To pile-on one scene on top of another simply press the PILE-ON button before pressing the desired scene to pile-on. Notice that the PILE-ON indicator LED lights to indicate the

Pile-On mode. This means that the next SCENE button pressed will fade up normally but the current scene(s) will not fade out. This function resets to OFF each time it is used so it must be re-selected each time its function is desired. To return to a single scene simply press the appropriate SCENE button, even if it its already ON, and all piled-on scenes will fade out. NOTE! It is possible to crossfade from one scene to itself. Try it!

Notice that the Scene indicator LEDs display the status of each scene as it progresses through the crossfade and that the Channel indicator LEDs display the channel status. Also notice that the green READY indicator LED is ON at the beginning and end of the crossfade and goes OFF during the crossfade. The purpose of this light is to indicate that a crossfade is in progress. Remember, while a crossfade is in progress the EFC will ignore the pressing of any SCENE button and the FADE-OUT button.

The reason for this is that, due to the way the EFC operates internally, it is necessary that it complete the current crossfade before a new crossfade may begin. If a new fade is desired immediately on completion of the current one the desired SCENE button should be held down through the end of the crossfade (the point when the READY light comes back on). This will initiate the next crossfade immediately at the completion of the current one. If it is necessary to end the current crossfade in a hurry then press the BLACK-OUT button or turn the FADE RATE control fully clockwise.

The FADE-OUT function provides a means to crossfade to darkness at the preset Fade Rate. It can be treated like a NO SCENE button in that it operates very similar to a SCENE button.

The BLACK-OUT function is very simple. When the BLACK-OUT button is pressed it resets all functions to OFF, terminates a crossfade if one is in progress and turns all SCENES OFF.

The SEQUENCE function provides a very dramatic effect by contiuously crossfading from scene to scene. This results in all eight channels changing continuously. To initiate the SEQUENCE function simply press the SEQUENCE button. Note that the SEQUENCE indicator LED will turn ON and OFF with successive presses of the SEQUENCE button. The Sequence pattern will always begin with SCENE A.

IMPORTANT NOTE WHEN USING THE SEQUENCE FUNCTION WITH THE AUTO RESET ON! As previously mentioned, the EFC will ignore SCENE and FADE-OUT button presses during crossfades. Since the SEQUENCE function is a series of continuous crossfades it will ignore all subsequent SCENE or FADE-OUT button presses, RIGHT!? Well, sort of. As also previously mentioned, the AUTO RESET function reacts to button presses but it DOES NOT ignore them during crossfades. This means that, with AUTO RESET ON, the SEQUENCE function will be reset by a SCENE(or FADE-OUT) button press but that the SCENE pressed will not fade up unless its button is held down through the end of the crossfade (the point where the READY light comes on) or pressed a second time after the crossfade is complete.

Take for example, the case where SEQUENCE is running, the AUTO RESET switch is ON and the FADE-OUT button is pushed once, quickly, while the READY light is OFF (during a crossfade). The result will be that the SEQUENCE function will be turned OFF but, instead of fading out, the last SCENE in the sequence will

remain ON.

There are two ways to account for this peculiarity. For short fade durations it is easiest to keep your foot on the FADE-OUT (or SCENE or CHASE) button until you see the READY light blink or are certain that the current fade has finished and the new fade begun. For long fades it may be easiest to press the FADE-OUT(or SCENE or CHASE) button once to reset the SEQUENCE function and again at the end of the crossfade (when the READY light comes ON) to initiate the desired fade. This won't be of much consequence during fast crossfades but may take some consideration during slow fades.

The CHASE function offers an intense, generally fast paced effect. To initiate the CHASE function simply press the CHASE button. Note that the CHASE indicator LED will turn ON and OFF with successive presses of the CHASE button. The Chase pattern will always begin with position 1.

TIPS:

Interesting effects can be obtained from using the CHASE function on top of Scenes and Scene changes.

Be careful when using CHASE and SEQUENCE at the same time. The result can be bland if too many lights are on most of the time.

Preset your scenes to take advantage of the PILE-ON capability of the EFC. If SCENE A, for example, highlights one performer and SCENE B another don't preset SCENE C to highlight both. Instead use A+B to obtain that preset.

Experiment with the EXTERNAL TRIGGER input. If you can isolate a drum channel in your mixer or use a synthesizer or drum machine trigger or gate output you will be able to synchronize your lights with your music.

EXPANSION

Two or more EFC controllers may be connected to build systems with additional scenes and /or channels. The two methods of expansion are explained below.

To expand your system to sixteen channels two EFCs can be linked via an EFCX expansion cable. This cable is installed between the MASTER I/O connectors on the rear panel of each EFC. You will need, of course, additional power modules and control and power cables to achieve this additional capability. A system using this arrangement will provide four scenes of sixteen channels and can be operated from either of the two EFC controllers. All function buttons except CHASE will operate both EFCs. The CHASE functions will remain confined to their respective controllers the result being two independent Chase functions.

To expand your system to eight scenes with eight channels two EFC controllers may be paralleled using two DZNY cables and an EFCXC cable. The DZNY cables are used to 'Y' the channel outputs of the EFCs together to common power modules and the EFCX cable is used to connect the MASTER I/O connectors together. The result of this arrangement is a system with eight

scenes and eight channels. The SCENE buttons of both EFCs will be used to operate all eight scenes. They may be considered as A,B,C,D and A',B',C',D'. The FADE-OUT and BLACK-OUT functions may be operated from either controller as their result will be the same. The PILE-ON, SEQUENCE and CHASE functions will function only on the local controller and not on both.

The EFC may be also be interfaced with either the DZN or the DZN-2C controllers. These manual controllers are twelve channel devices so the user must chose which eight channels will be interfaced. Two DZNY cables will be required for this arrangemnet. Use them to 'Y' the channels output connectors of the EFC and DZN/DZN-2C together. The result of this arrangement will be a system with twelve channels, eight of which have four additional presets and CHASE and SEQUENCE functions.

SPECIFICATIONS

Mechanical

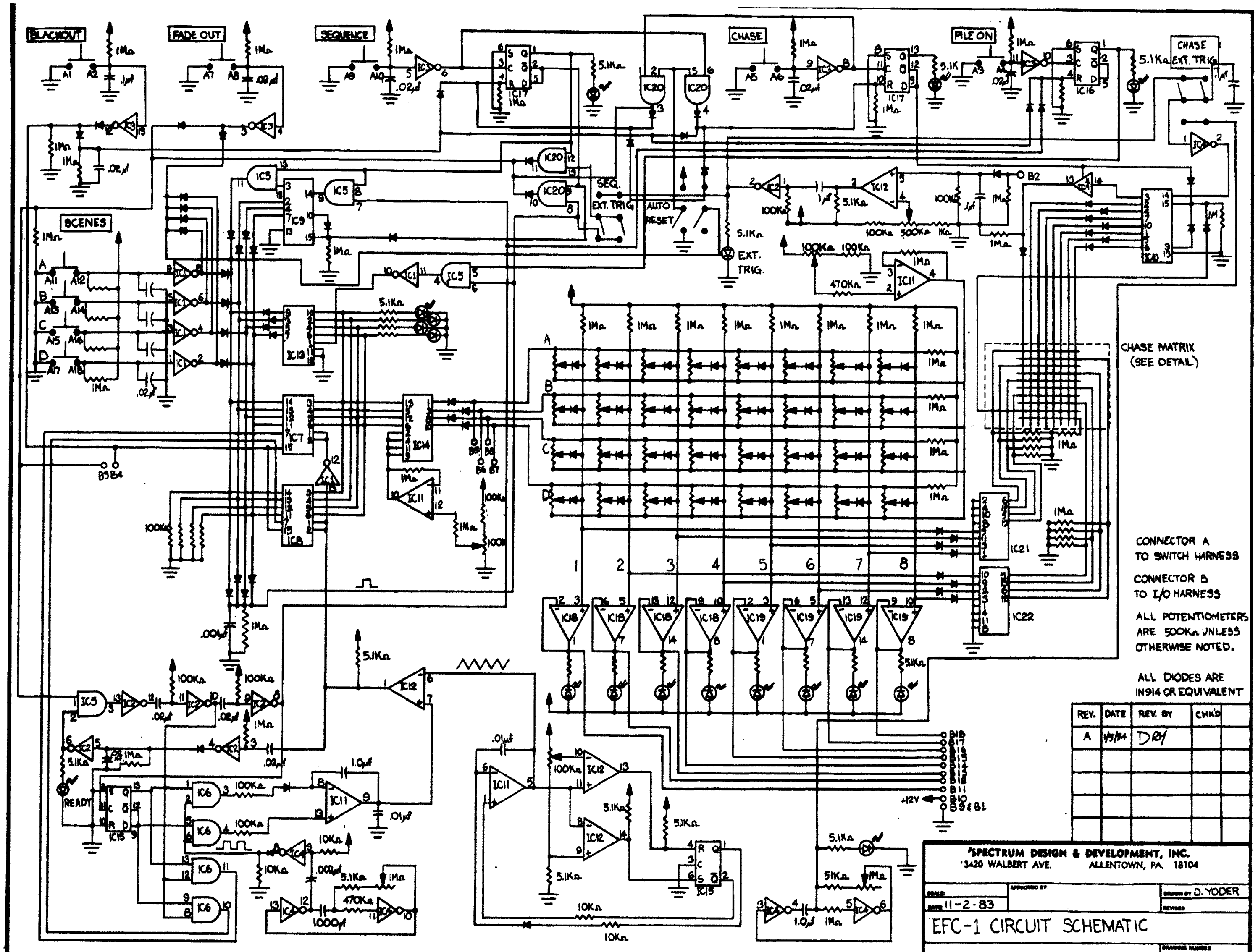
Housing - 16 gauge steel cabinet
Size - 3.50"H x 19.00"W x 10.88"D
Weight - 11.5 lbs.

Electrical

Power Required: 10-15 VDC power must be supplied through control cable
Control signal output voltage: 2VDC to 10VDC, Factory Set (Adjustable from .50VDC to 1VDC less than power supply voltage)
Trigger Voltage- Max. 12VDC Input
Threshold- 0VDC to 10 VDC, variable

CONNECTOR PIN-OUTS

Control, Ch. 1-4	Pin 1 - GRD " 2 - Ch. 1 " 3 - Ch. 2 " 4 - Ch. 3 " 5 - Ch. 4 " 6 - Vcc (in)
Control, Ch. 5-8	Pin 1 - GRD " 2 - Ch. 5 " 3 - Ch. 6 " 4 - Ch. 7 " 5 - Ch. 8 " 6 - Vcc (in)
Control, Mas. I/O	Pin 1 - GRD " 2 - Scene A " 3 - " B " 4 - Scene C " 5 - Scene D " 6 - Initiate " 7 - Blackout " 8 - Vcc (out)



CONNECTOR A TO SWITCH HARNESS

CONNECTOR B TO I/O HARNESS

ALL POTENTIOMETERS ARE 500KΩ UNLESS OTHERWISE NOTED.

ALL DIODES ARE IN914 OR EQUIVALENT

REV.	DATE	REV. BY	CHK'D
A	1/3/84	DRY	

SPECTRUM DESIGN & DEVELOPMENT, INC.
3420 WALBERT AVE. ALLENTOWN, PA. 18104

DATE 11-2-83

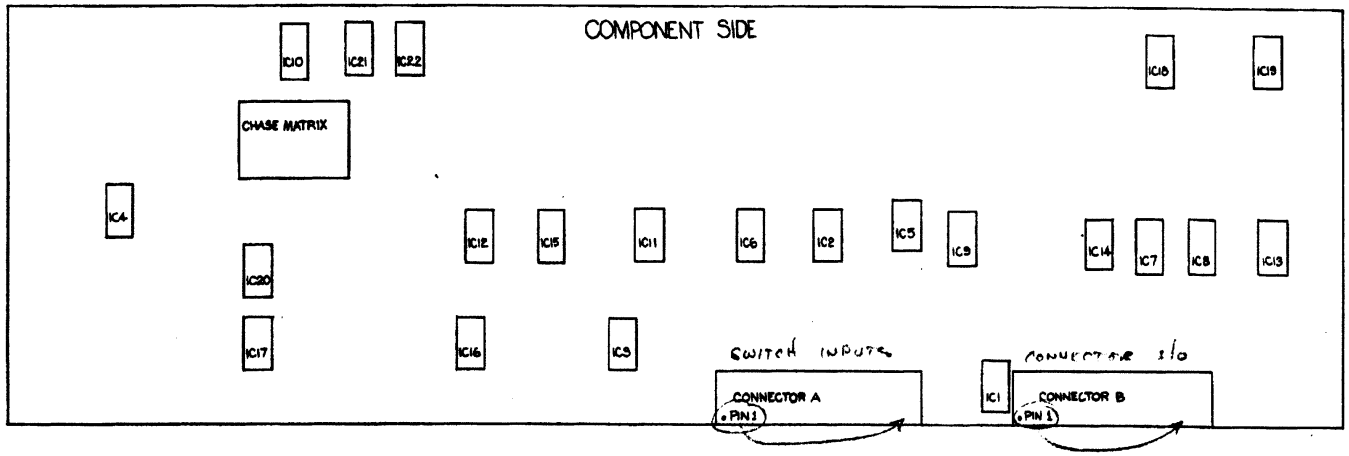
APPROVED BY

DRAWN BY D. YODER

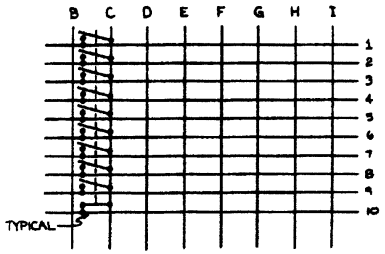
REVISED

EFC-1 CIRCUIT SCHEMATIC

DRAWING NUMBER 4SD2144



CHASE MATRIX DETAIL



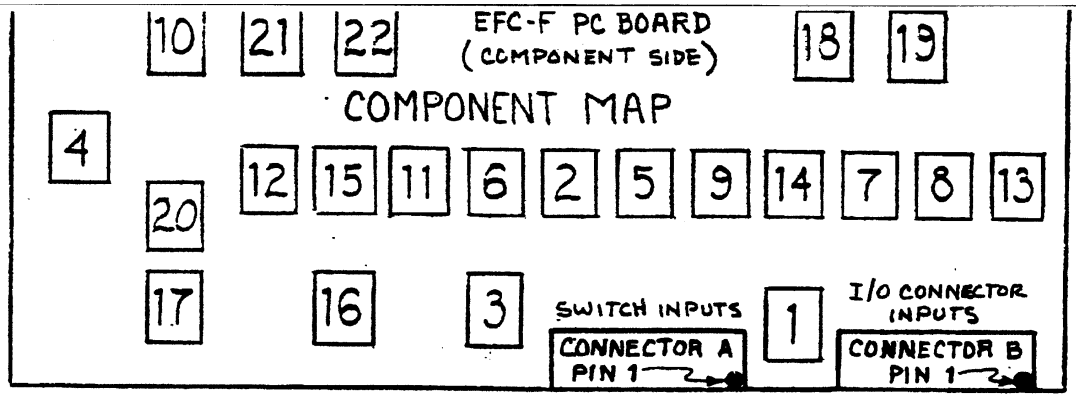
NOTE: ALL SWITCHES IN A COLUMN INTERACT.
ONLY ONE SWITCH CLOSED AT A TIME.

PART	PART NUMBER	PART	PART NUMBER
IC 1	4584	IC 12	LM339
IC 2	4584	IC 13	4503
IC 3	4584	IC 14	4066
IC 4	4584	IC 15	4013
IC 5	4081	IC 16	4013
IC 6	4081	IC 17	4013
IC 7	4076	IC 18	LM324
IC 8	4076	IC 19	LM324
IC 9	4017	IC 20	4081
IC 10	4017	IC 21	4066
IC 11	LM3900	IC 22	4066

SCALE
DATE 11-7-83
APPROVED BY
DRAWN BY D. YOC
REVISED

EFC - COMPONENT LAYOUT

DRAWING NUMBER
ARDUAR



NOTES: 1) ALL POTENTIOMETERS ARE 500 KΩ UNLESS OTHERWISE NOTED.

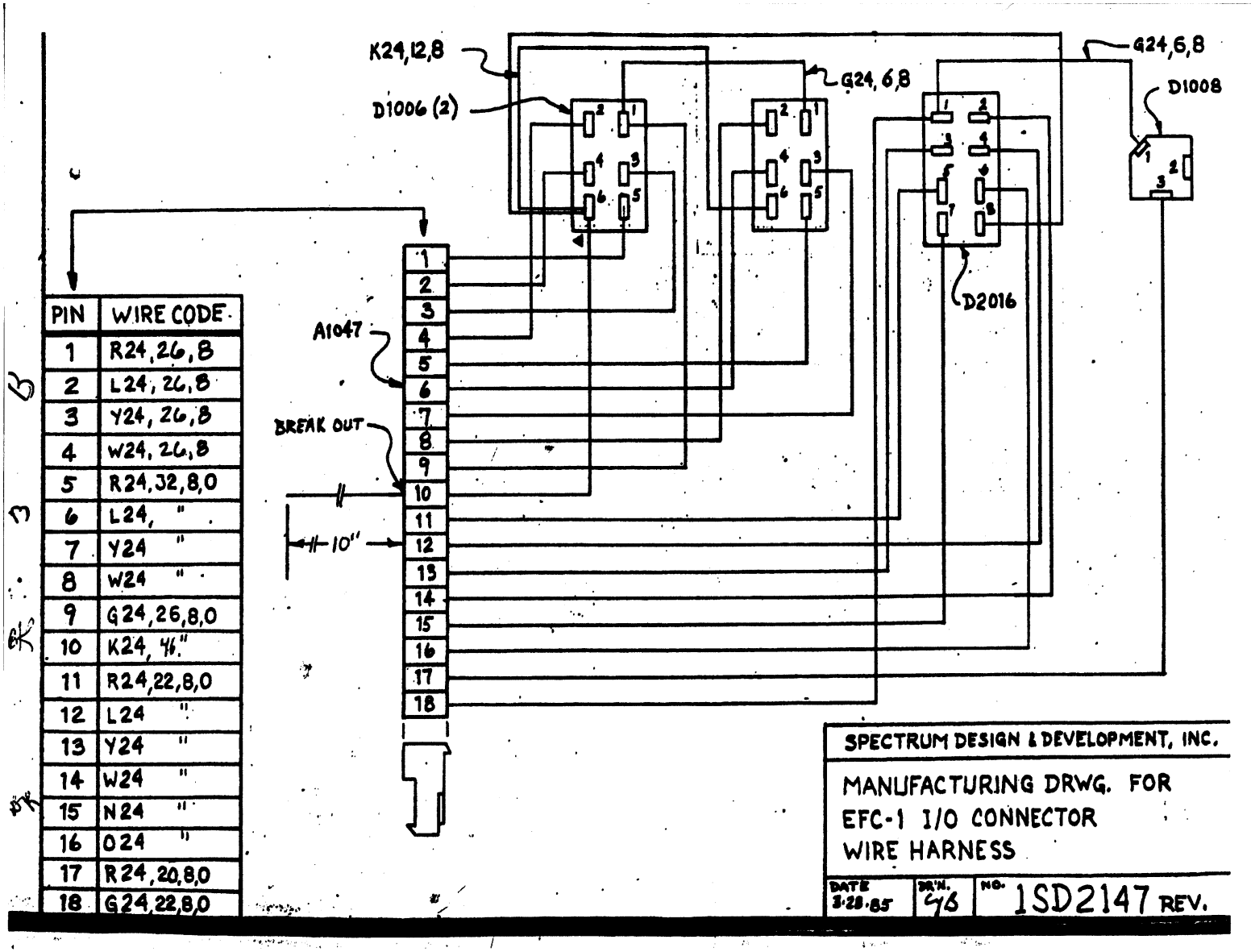
2) ALL DIODES ARE, IN 914, OR EQUIVALENT.

3) ▲ DENOTES +12 VDC

4) MODEL-1 SHOWN. FOR MODEL-2 REVERSE ALL DIODES AND JUMPERS MARKED WITH *

5) REF. 1SD2207 FOR I/O CONNECTOR WIRING DIAGRAM.

PIN	CONNECTOR A	PIN	CONNECTOR B	COMPONENT	PART NO.
18	GRD.	18	GRD.	IC 22	4066
17	B/O.	17	EXT. TRIG. IN.	IC 21	4066
16	GRD.	16	INITIATE	IC 20	4081
15	P/O	15	BLACK OUT	IC 19	LM324
14	GRD.	14	SC. A	IC 18	LM324
13	CHASE	13	SC. B	IC 17	4013
12	GRD.	12	SC. C	IC 16	4013
11	F/O	11	SC. D	IC 15	4013
10	GRD.	10	+12 VDC	IC 14	4066
9	SEQ.	9	GRD.	IC 13	4503
8	GRD	8	CH. 1	IC 12	LM339
7	SC. A	7	CH. 2	IC 11	LM390C
6	GRD.	6	CH. 3	IC 10	4017
5	SC. B	5	CH. 4	IC 9	4017
4	GRD.	4	CH. 5	IC 8	4076
3	SC. C	3	CH. 6	IC 7	4076
2	GRD.	2	CH. 7	IC 6	4081
1	SC. D	1	CH. 8	IC 5	4081
				IC 4	4584
				IC 3	4584
				IC 2	4584
				IC 1	4584



PIN	WIRE CODE
1	R24,26,8
2	L24, 26, 8
3	Y24, 26, 8
4	W24, 26, 8
5	R24,32,8,0
6	L24, "
7	Y24 "
8	W24 "
9	G24,26,8,0
10	K24, 46"
11	R24,22,8,0
12	L24 "
13	Y24 "
14	W24 "
15	N24 "
16	O24 "
17	R24,20,8,0
18	G24,22,8,0

SPECTRUM DESIGN & DEVELOPMENT, INC.

MANUFACTURING DRWG. FOR
EFC-1 I/O CONNECTOR
WIRE HARNESS

DATE	DR'N.	NO.
3-28-85	GB	1SD2147 REV.