

# Phillips Scientific

## Timing Discriminator

### NIM MODEL 715

### FEATURES

- UNEXCELLED TIMING CHARACTERISTICS
- FIVE TOTALLY INDEPENDENT CHANNELS
- 100 MHz OPERATION
- BOTH FAST VETO AND BIN GATE INHIBITING

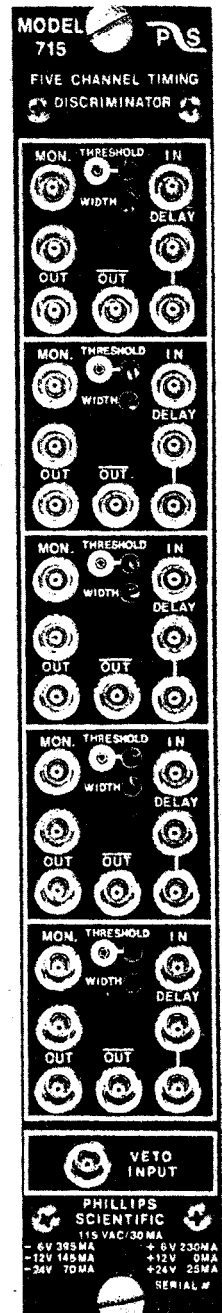
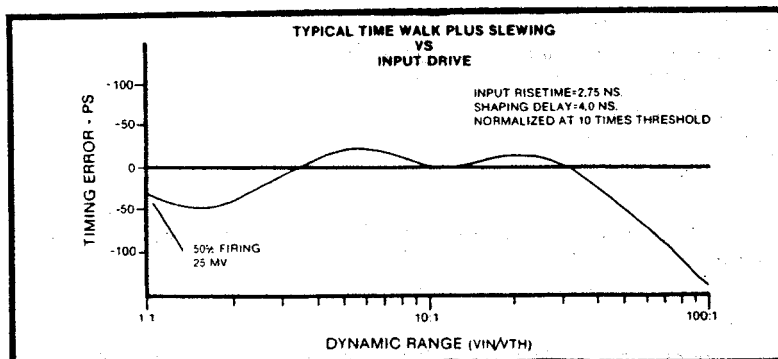
### DESCRIPTION

The Model 715 is a high performance, five-channel constant fraction timing discriminator packaged in a single width NIM module. It exhibits typical time walk plus slewing of  $\pm 75$  pSEC from threshold to 100 times threshold.

Each channel has independent threshold adjustment, output width adjustment, and shaping delay. The threshold is variable from -25 mV to -1 Volt and is monitored from a front panel test point providing a DC voltage ten times the actual threshold setting. The outputs are non-updating with the output width adjustable from 5 nSEC to 150 nSEC. The shaping delay circuit is made complete by connecting the appropriate cable length between two LEMO connectors, allowing the user to optimize time resolution by easily matching the characteristics of each detector. A monitor is also provided to observe the constant fraction shaped pulse to verify that the delay is correct.

A fast veto input allows simultaneous inhibiting of all five channels to reject unwanted events early in the system. Similarly, a bin gate will inhibit the entire module when applied via the rear connector.

The 715 has three individually driven, current switching outputs per channel. Two are normal NIM levels and one complemented. They have typical risetimes and falltimes of 1 nSEC helping to preserve the excellent timing characteristics. The output transition times and shapes are unaffected by the loading conditions of the other outputs.



0983

## INPUT CHARACTERISTICS

### General:

One LEMO connector per channel; 50 ohms  $\pm 2\%$ , direct coupled; less than 5% input reflection for a 2.0 nSEC input risetime; input protection clamps at +7 V and -6 V and can withstand  $\pm 2$  amps ( $\pm 100$  Volts) for a duration of 1 uSEC with no damage to the input.

### Threshold:

Continuously variable from -25 mV to -1 Volt, 15-turn screwdriver adjustment; better than 0.2%/°C stability; front panel test point provides a DC voltage ten (10) times the actual threshold setting.

### Fast Veto:

One LEMO connector input common to all five channels; accepts normal NIM level pulse (-500 mV), 50 ohms direct coupled; must overlap the negative going edge of the input pulse plus the shaping delay time to inhibit all channels; 5 nSEC minimum input width.

### Bin Gate:

Rear panel slide switch enables or disables bin slow gate in accordance with TID-20893. Inhibits entire module within 10 nSEC from application of bin gate.

## OUTPUT CHARACTERISTICS

### General:

Three (3) LEMO connector outputs per channel; two normal NIM level outputs and one complementary output. The normal outputs deliver pulses of -16 mA (-800 mV across 50 ohms). The complemented output is quiescently -16 mA (-800 mV) and goes to zero mA (0 Volts) during output. Output risetimes and falltimes are less than 1.5 nSEC from 10% to 90% levels.

### CF Monitor:

One LEMO connector output per channel; drives 50 ohm load; permits observation of the shaped constant fraction pulse to verify the shaping delay is optimized for the input pulse.

### Width Control

One control per channel; 15-turn screwdriver adjustment; output width is continuously variable from 5 nSEC to 150 nSEC; better than  $\pm 0.2\%/^{\circ}\text{C}$  stability; nonupdating output regeneration.

## GENERAL PERFORMANCE

### Shaping Delay:

Requires a 50 ohm coaxial cable; recommended delay range of 500 pSEC to 100 nSEC; the maximum delay is limited only by the cable attenuation, a factor of two attenuation can be tolerated without significant degradation of the time resolution; stability is better than 10 pSEC/°C. The shaping delay time should approximately equal the input risetime plus one nanosecond.

### Continuous Repetition Rate:

Greater than 100 MHz; with output width set at minimum. (1 nSEC shaping delay)

### Pulse Pair Resolution:

Better than 10 nSEC, with output width set at minimum. (1 nSEC shaping delay)

### Input to Output Delay:

Less than 10 nSEC; with 1 nSEC shaping delay.

### Multiple Pulsing:

One and only one output pulse regardless of input pulse amplitude or duration.

### Power Supply Requirements:

-6 V @ 390 mA	+6 V @ 240 mA
-12 V @ 150 mA	+12 V @ 0 mA
-24 V @ 45 mA	+24 V @ 35 mA

115 VAC @ 30 mA

**NOTE: All currents are within NIM specification limits permitting a full powered bin to be operated without overloading.**

### Operating Temperature:

0°C to 70°C ambient.

### Packaging:

Standard single width NIM module in accordance with TID-20893 and Section ND-524.

### Quality Control:

Standard 36-hour cycled burn-in with switched power cycles.

MODEL 715 FIVE-CHANNEL CONSTANT-FRACTION  
DISCRIMINATOR

(FRONT PANEL DESCRIPTION)

Standard #1 NIM Packaging  
in accordance with  
TID-20898

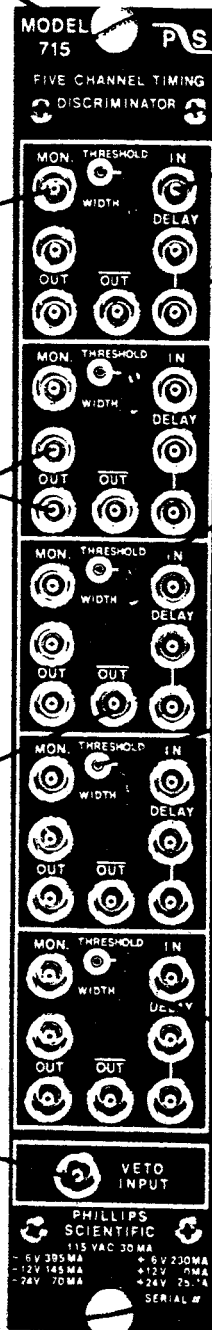
Monitor Output; Used to  
view the constant fraction  
shaped pulse.

Two Individually driven  
normal NIM outputs; delivers  
-16 mA out (-800 mV @ 50 Ohms)

One Complemented NIM Output.  
Quiescently -16 mA (-800 mV)  
Goes to 0 mA (0 Volts) during  
output.

Fast Inhibit Input accepts  
normal NIM logic (-500 mV)  
50 Ohm Impedance

NOTE: Bin Gate Enable/  
Disable Switch on Rear  
Panel permits Inhibiting  
via Bin Connector.



50 Ohm Input

Connect a 50 Ohm Coaxial  
Shaping Delay Cable be-  
tween these Connectors

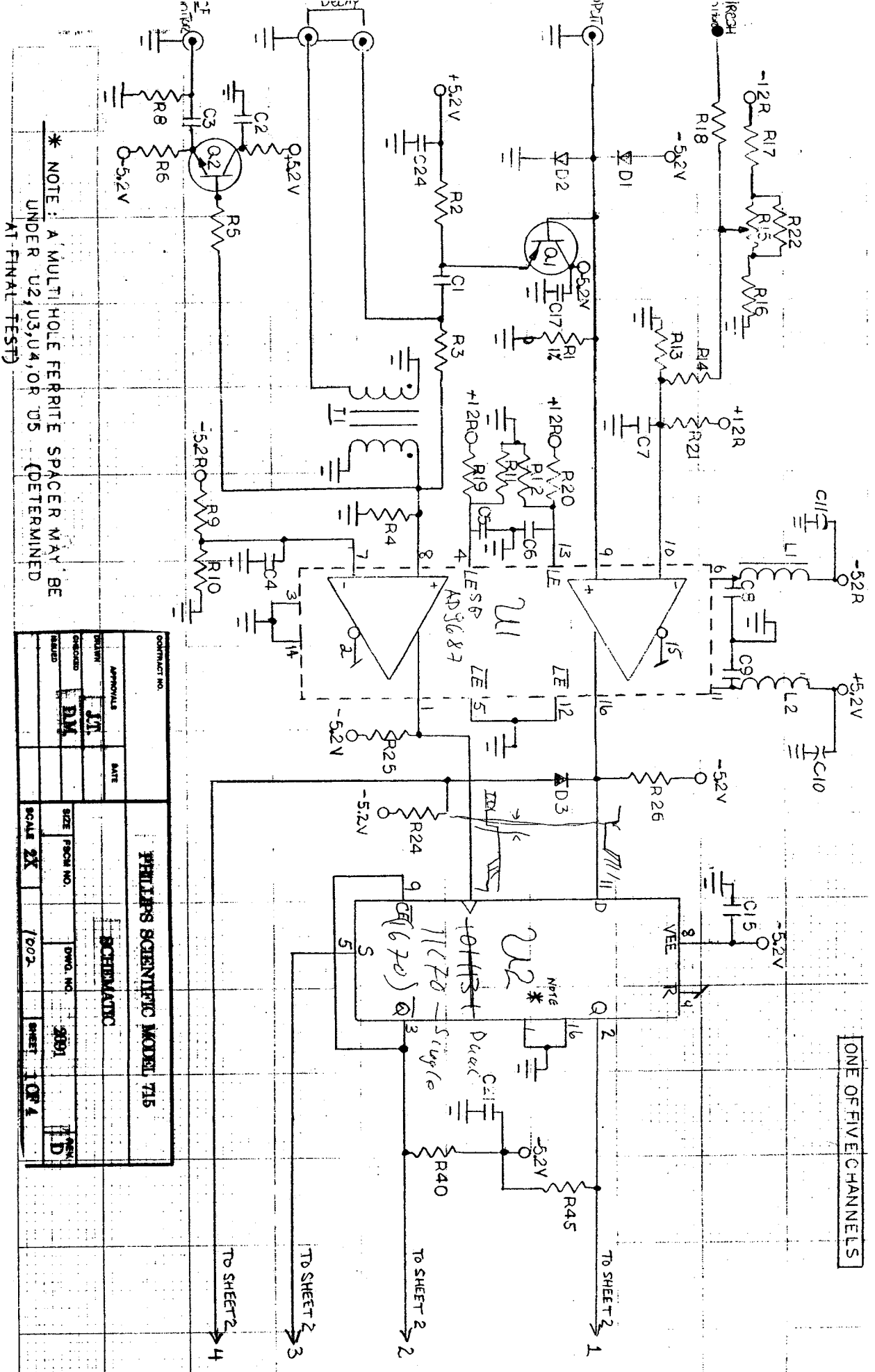
Threshold Control; 15-turn  
Screwdriver Adjustment,  
Variable from -25 mV  
to -1 Volt

Threshold Monitor; Test  
Point provides a DC  
Voltage 10 times the  
actual Threshold Setting  
(-250 mV to -10 V)

Output Width Control;  
15-turn Screwdriver  
Adjustment, Variable from  
5 ns to 150 ns

Voltage and Current  
Requirements





\* NOTE: A MULTIPLE FERRITE SPACER MAY BE UNDER U2, U3, U4, OR U5 (DETERMINED AT FINAL TEST)

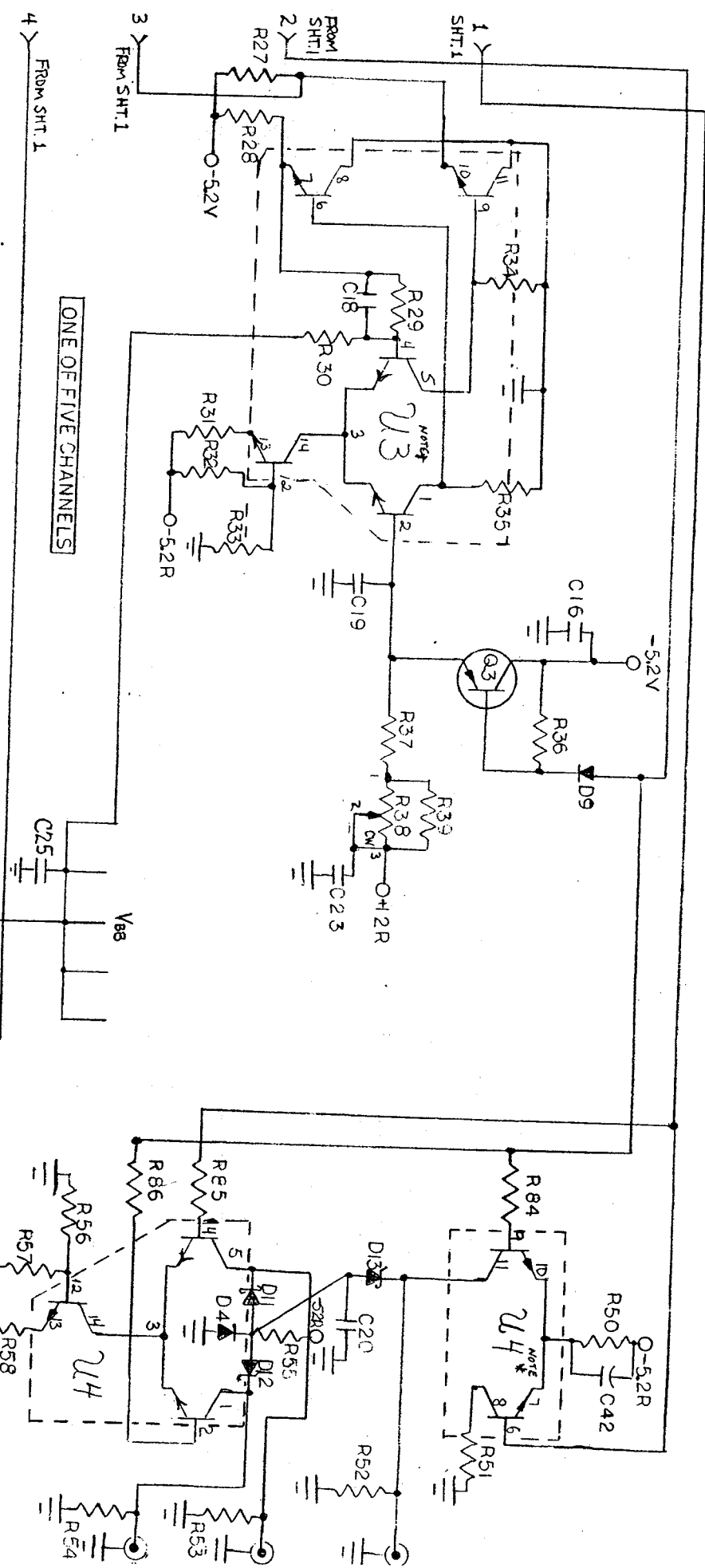
CONTRACT NO.		PHILIPS SCIENTIFIC MODEL 715	
DESIGN	APPROVALS	DATE	SCHEMATIC
CHECKED	BY		
REVISION	SIZE	PROJ. NO.	DWG. NO.
	SCALE	1002	2891
			SHEET 1 OF 4

TO SHEET 2 → 4

TO SHEET 2 → 3

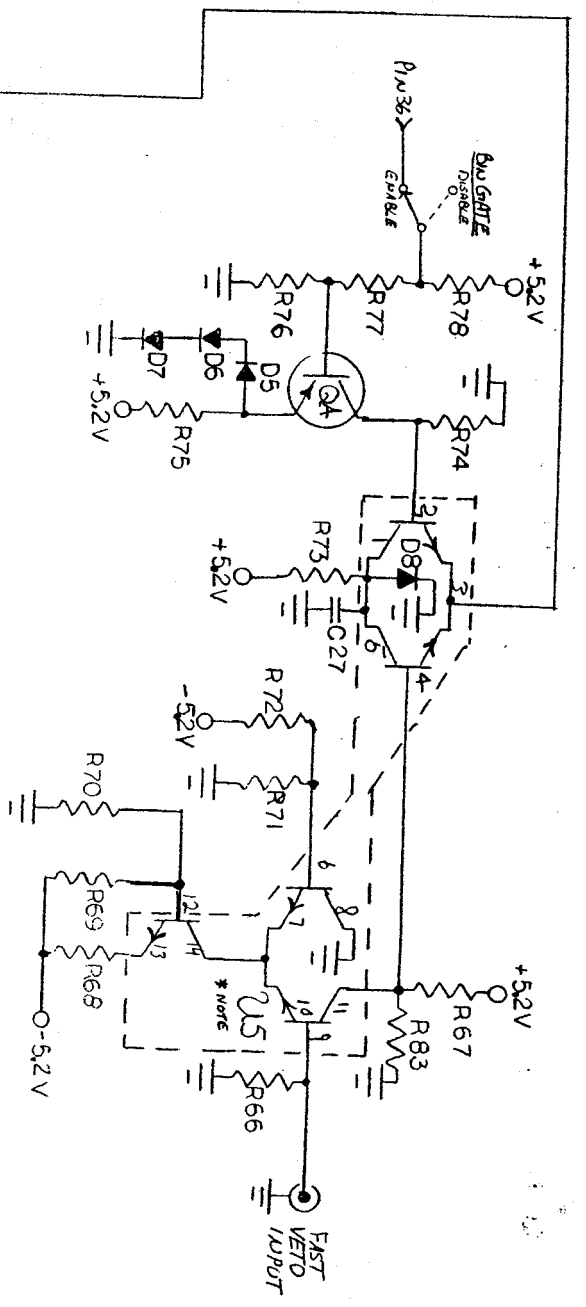
TO SHEET 2 → 2

TO SHEET 2 → 1

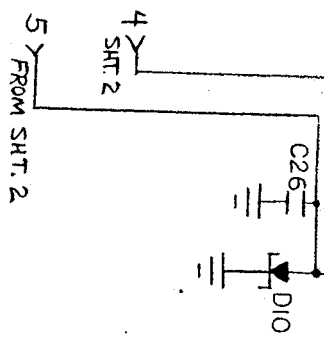


CONTRACT NO.		PHILIPS SCIENTIFIC MODEL 715	
APPROVALS	DATE	SCHEMATIC	
DRAWN <b>JT</b>			
CHECKED <b>DM</b>			
DESIGNED		SIZE PGM. NO.	DRWG. NO.
		<b>2X</b>	<b>2092</b>
		SCALE	SHEET
		<b>2X</b>	<b>2 OF 4</b>
		REV.	
		<b>D</b>	

TO SHEET 3  
TO SHEET 4  
TO SHEET 5

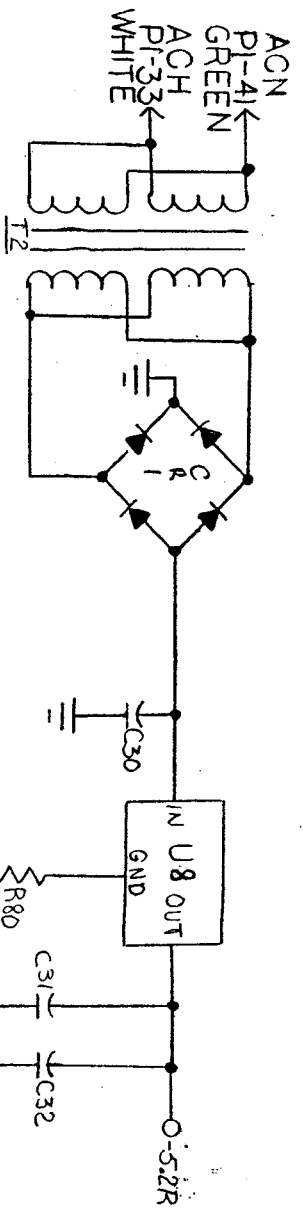


COMMON TO FIVE CHANNELS

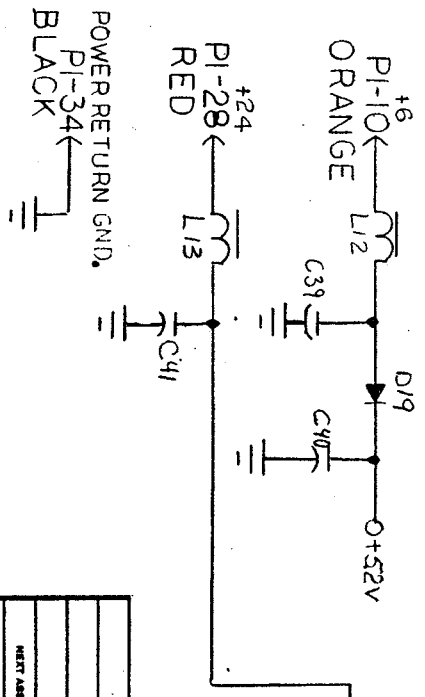
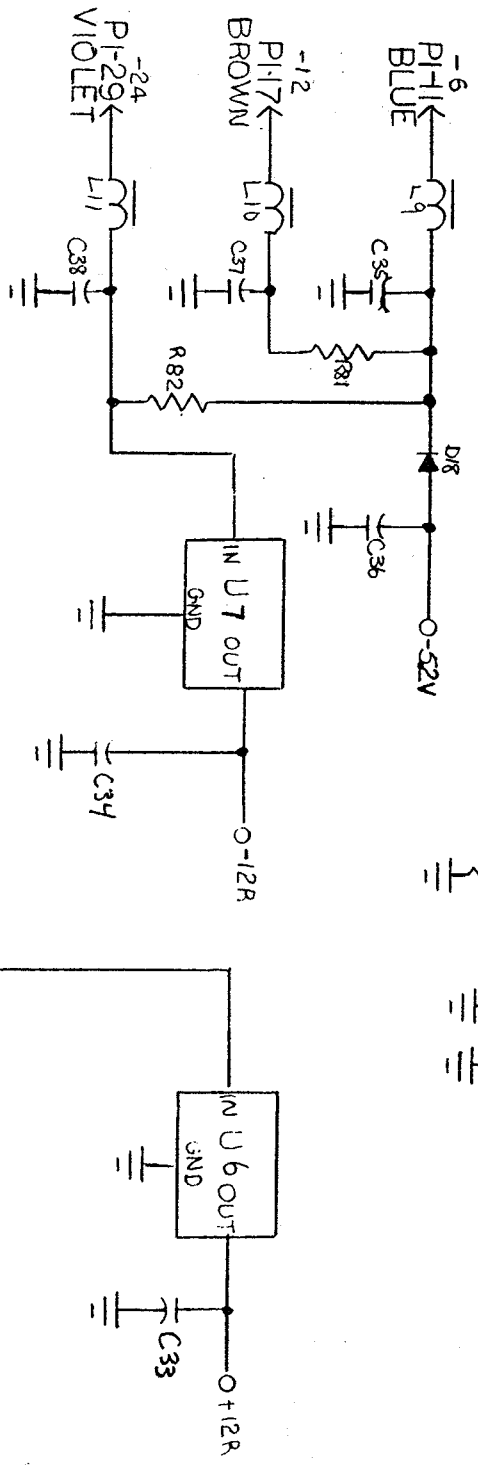


QTY		FSCM NO.		PART OR IDENTIFYING NO.		NOMENCLATURE OR DESCRIPTION		MATERIAL SPECIFICATION	
UNLESS OTHERWISE SPECIFIED									
DIMENSIONS ARE IN INCHES									
TOLERANCES ARE									
FRACTIONS DECIMALS ANGLES									
.XX.X .XX.X .XX.X									
DRAWN		APPROVALS		DATE		PARTS LIST			
CHECKED		DATE		DATE		PHILLIPS SCIENTIFIC MODEL 715			
ISSUED		DATE		DATE		SCHEMATIC			
SIZE		FSCM NO.		DWG. NO.		SCALE		REV	
2X		1002		2088		SHEET 3 OF 4		D	

BISHOP GRAPHICS, INC.  
REORDER NO. 1838



COMMON PS.



QTY		FSCM		PART NO.		NOMENCLATURE		MATERIAL			
REQD	NO.	NO.	IDENTIFYING NO.	IDENTIFYING NO.	IDENTIFYING NO.	IDENTIFYING NO.	IDENTIFYING NO.	IDENTIFYING NO.	IDENTIFYING NO.		
PHILLIPS SCIENTIFIC MODEL 715											
PARTS LIST											
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES				CONTRACT NO.				APPROVALS		DATE	
MATERIAL				DRAWN				J.T.		6-15-83	
FINISH				CHECKED				D.M.		6-18-83	
ISSUED				SCALE				2X		1/2002	
APPLICATION				DO NOT SCALE DRAWING				SIZE		FSCM NO.	
NEXT ASBY				USED ON				DWG. NO.		2094	
SHEET				4 OF 4				REV		D	

BISHOP GRAPHICS, INC.  
RESISTOR NO. 183



Ident.	Qty.	Part Number	Description
R1	5	006554R9	54.9Ω 1% RN55C
R2	5	00101001	1.0KΩ 5% CF 1/8
R3	5	001075R0	75Ω 5% CF 1/8
R4	5	00105100	510Ω 5% CF 1/8
R5	5	00101500	150Ω 5% CF 1/8
R6	5	00105100	510Ω 5% CF 1/8
R7	5	00102700	270Ω 5% CF 1/8
R8	5	00101001	1.0KΩ 5% CF 1/8
R9	5		Trim Resistor CF 1/8
R10	5	001022R0	22Ω 5% CF 1/8
R11	5	001051R0	51Ω 5% CF 1/8
R12	5	001051R0	51Ω 5% CF 1/8
R13	5	00654320	432Ω 1% RN55C
R14	5	00653921	3.92KΩ 1% RN55C
R15	5	05105001	5K Pot. Threshold Adjustment
R16	5	00651100	110Ω 1% RN55C
R17	5	00654750	475Ω 1% RN55C
R18	5	00101001	1.0KΩ 5% CF 1/8
R19	5	00102202	22KΩ 5% CF 1/8
R20	5	00102202	22KΩ 5% CF 1/8
R21	5		Trim Resistor CF 1/8
R22			Not Used
R23			Not Used
R24	5	00105101	5.1KΩ 5% CF 1/8
R25	5	00105100	510Ω 5% CF 1/8
R26	5	00105100	510Ω 5% CF 1/8
R27	5	00105100	510Ω 5% CF 1/8
R28	5	00105100	510Ω 5% CF 1/8
R29	5	00103300	330Ω 5% CF 1/8
R30	5	001051R0	51Ω 5% CF 1/8
R31	5	00103300	330Ω 5% CF 1/8
R32	5	00102701	2.7KΩ 5% CF 1/8
R33	5	00102201	2.2KΩ 5% CF 1/8
R34	5	00101500	150Ω 5% CF 1/8
R35	5	00101800	180Ω 5% CF 1/8
R36	5	00102401	2.4K 5% CF 1/8
R37	5	00101001	1.0K 5% CF 1/8
R38	5	05102003	200K Pot. Width Adjustment
R39	5		Trim Resistor CF 1/8
R40	5	00103300	330Ω 5% CF 1/8
R41			Not Used
R42			Not Used
R43			Not Used
R44			Not Used
R45	5	00103300	330Ω 5% CF 1/8
R46			Not Used
R47			Not Used
R48			Not Used
R49			Not Used
R50	5	00102000	200Ω 5% CF 1/8
R51	5	001051R0	51Ω 5% CF 1/8
R52	5	00105101	5.1KΩ 5% CF 1/8
R53	5	00103901	3.9KΩ 5% CF 1/8
R54	5	00105101	5.1KΩ 5% CF 1/8
R55	5	00101501	1.5KΩ 5% CF 1/8

<u>Ident.</u>	<u>Qty.</u>	<u>Part Number</u>	<u>Description</u>
R56	5	00102001	2.0K $\Omega$ 5% CF 1/8
R57	5	00102701	2.7K $\Omega$ 5% CF 1/8
R58	5	00101000	100 $\Omega$ 5% CF 1/8
R59			Not Used
R60			Not Used
R61			Not Used
R62			Not Used
R63			Not Used
R64			Not Used
R65	1	00101001	1.0K 5% CF 1/8
R66	1	006552R3	52.3 $\Omega$ 1% RN55C
R67	1	00106800	680 $\Omega$ 5% CF 1/8
R68	1	00103300	330 $\Omega$ 5% CF 1/8
R69	1	00102701	2.7K $\Omega$ 5% CF 1/8
R70	1	00102200	220 $\Omega$ 5% CF 1/8
R71	1	00102200	220 $\Omega$ 5% CF 1/8
R72	1	00102701	2.7K $\Omega$ 5% CF 1/8
R73	1	00101500	150 $\Omega$ 5% CF 1/8
R74	1	00102200	220 $\Omega$ 5% CF 1/8
R75	1	00106800	680 $\Omega$ 5% CF 1/8
R76	1	00103901	3.9K 5% CF 1/8
R77	1	00103901	3.9K 5% CF 1/8
R78	1	00105101	5.1K 5% CF 1/8
R79			Not Used
R80	1		Trim Resistor CF 1/8
R81	1	003439R0	39 $\Omega$ 5% CC 2W
R82	1	00345600	560 $\Omega$ 5% CC 2W
R83	1	00102000	200 $\Omega$ 5% CF 1/8
R84			
R85			
R86			
R87			
R88			
R89			
R90			
C1	5	10151003	.1 mfd
C2	5	10151003	.1 mfd
C3	5	10151003	.1 mfd
C4	5	10151003	.1 mfd
C5	5	10151003	.1 mfd
C6	5	10151003	.1 mfd
C7	5	10151003	.1 mfd
C8	5	10151003	.1 mfd
C9	5	10151003	.1 mfd
C10	5	10523305	33 mfd @ 16 volts Al. Elect.
C11	5	10523305	33 mfd @ 16 volts Al. Elect.
C12			Not Used
C13			Not Used
C14			Not Used
C15	5	10151003	.1 mfd
C16	5	10151003	.1 mfd
C17	5	10151003	.1 mfd

<u>Ident.</u>	<u>Qty.</u>	<u>Part Number</u>	<u>Description</u>
C18	5	101015P0	15 pfd Ceramic
C19	5	103015P0	15 pfd Mica
C20	5	10151003	.1 mfd
C21	5	10523305	33 mfd @ 16 volts Al. Elect.
C22	5	10151003	.1 mfd
C23	5	10151003	.1 mfd
C24	5	10151003	.1 mfd
C25	5	10151003	.1 mfd
C26	1	10151003	.1 mfd
C27	1	10151003	.1 mfd
C28			Not Used
C29			Not Used
C30	1	10612207	2200 mfd @ 10 volts Al. Elect.
C31	1	10514706	470 mfd @ 10 volts Al. Elect.
C32	1	10514706	470 mfd @ 10 volts Al. Elect.
C33	1	10541005	10 mfd @ 35 volts Al. Elect.
C34	1	10541005	10 mfd @ 35 volts Al. Elect.
C35	1	10513306	330 mfd @ 10 volts Al. Elect.
C36	1	10513306	330 mfd @ 10 volts Al. Elect.
C37	1	10522206	220 mfd @ 16 volts Al. Elect.
C38	1	10541006	100 mfd @ 35 volts Al. Elect.
C39	1	10513306	330 mfd @ 10 volts Al. Elect.
C40	1	10513306	330 mfd @ 10 volts Al. Elect.
C41	1	10541006	100 mfd @ 35 volts Al. Elect.
C42			
C43			
C44			
C45			
L1	5	15000001	3.9 mhy RF Chokes
L2	5	15000001	3.9 mhy RF Chokes
L3			Not Used
L4	5	15000002	Large Bead 2 turns
L5	5	15000002	Large Bead 2 turns
L6	5	15000002	Large Bead 2 turns
L7			Not Used
L8			Not Used
L9	1	15000000	Power Inductor
L10	1	15000000	Power Inductor
L11	1	15000000	Power Inductor
L12	1	15000000	Power Inductor
L13	1	15000000	Power Inductor
T1	5	15500000	RF Transformer
T2	1	15500001	Power Transformer
D1	5	20004448	1N4448 Diode
D2	5	20004448	1N4448 Diode
D3	5	20004448	1N4448 Diode
D4	5	20004448	1N4448 Diode
D5	1	20004448	1N4448 Diode
D6	1	20004448	1N4448 Diode
D7	1	20004448	1N4448 Diode
D8	1	20004448	1N4448 Diode

<u>Ident.</u>	<u>Qty.</u>	<u>Part Number</u>	<u>Description</u>
D9	5	20100777	FD777 Diode
D10	1	3010N423	ZN423 IC
D11	5	20202835	2835 Shockley Diode
D12	5	20202835	2835 Shockley Diode
D13	5	20202835	2835 Shockley Diode
D14			Not Used
D15			Not Used
D16			Not Used
D17			Not Used
D18	1	20004004	1N4004 Diode
D19	1	20004004	1N4004 Diode
CRI	1	2030BP04	KBP04 Bridge Rectifier
Q1	5	2420T930	BFT93 SOT-23 Transistor
Q2	5	24005770	2N5770 Transistor
Q3	5	24005771	2N5771 Transistor
Q4	1	24005771	2N5771 Transistor
U1	5	38006970	PS006970 IC
U2	5	38006822	PS006822 IC
U3	5	38006524	PS006524 IC
U4	5	38006524	PS006524 IC
U5	1	38006524	PS006524 IC
U6			Not Used
U7			Not Used
U8	1	3010905K	UA7905 Regulator
U9	1	3010812T	7812C Regulator
U10	1	3010912T	7912C Regulator
	11	40000014	14 pin DIP Socket
	10	40000016	16 pin DIP Socket
	36	40100000	RF Connectors
	36	40100001	Lock Washers
	15	40100002	Solder Lugs
	36	40100003	Spanner Nuts
	16	40100005	Shields
	1	40200000	NIM Connector Block
	1	40200001	NIM Connector Shield
	9	40200002	NIM Elect. Pins
	2	40200003	NIM Female Guide Pin
	1	40200004	NIM Male Guide Pin
	1	40200005	NIM Male Guide Pin Gold Plate
	1	40200006	#4 Lock Washer Gold Plate
	1	40200007	#4-40 Hex Nut Gold Plate
TP1	5	40950001	Test Points
	1	40950002	Solder Lugs

SR/AM/AD 6687, 96  
 11C70 14C1670  
 CA 3046  
 CA 3086

<u>Ident.</u>	<u>Qty.</u>	<u>Part Number</u>	<u>Description</u>
S1	1	50000000	Slide Switch
	1	58000102	Back Panel
	1	58000103	Right Side Cover
	1	58000104	Left Side Cover
	2	58000105	Square Rail
	2	58000106	Round Rail
	1	58007150	Front Panel
	4	65025603	2-56 x 3/16" Flat Hd. Screws
	6	65044003	4-40 x 3/16" Flat Hd. Screws Undercut
	6	65144006	4-40 x 3/8" Round Hd. Phillips Screws
	2	65944004	4-40 x 1/4" Fillister Hd. Screws
	10	65944005	4-40 x 5/16" Fillister Hd. Screws
	4	67044000	4-40 Hex Nuts
	4	68000104	#4 Lock Washer
	6	68000500	1/16" Nylon Spacer
	10	72000012	3/4" Roll Spacer
	2	73000000	Rivets
	2	73010000	Stand Off
	2	73010001	Captive Screws
	1	75050000	Heat Sink
	1	8500715D	Model 715 Rev. D Printed Circuit Board