

Pack 1220

Plano, Texas

***Pinewood Derby
Track Notebook***

Designed and built in 1987 by:

John Mouser

Jeff Sherman

Pack 1220
Plano, Texas
Pinewood Derby Track
Designed and Built in 1987

How its works - Woodwork

The track design goals were: regulation size, easy and quick to assemble/disassemble, no tools required, smooth curve, no bumps, compact and light weight for storage and moving, and no "track advantage".

The five track sections and finish box are kept aligned with dowel pins and held together with recessed quick snaps on the sides. The side panels and controll/storage box are held together with eye bolts and permanently mounted tee nuts. There are four adjustable feet, one at each corner so the track can be easily leveled. Construction was done with wood glue only, no nails or screws were used. The paint is a high gloss polyurethane enamel giving a very durable finish. For improved speed a lemon oil based furniture polish was applied before racing.

The smooth curve was accomplished by using three methods: support braces under the first joint, weight of the wood, and two pins in the side panels that hold the track in place. To stop the cars the guide rails are lined with a high friction rubber material which will rub the bottom of the cars as the guide rails are elevated.

Assembly time: 5 to 10 minutes.

Pack 1220

Plano, Texas

Built 1987

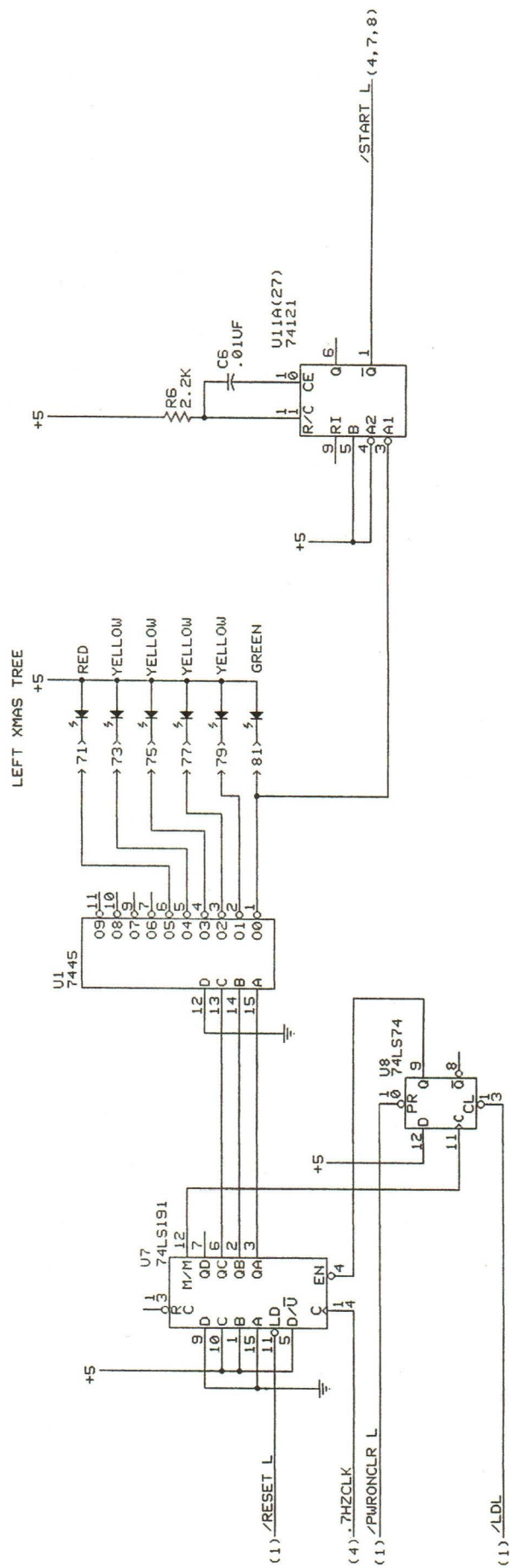
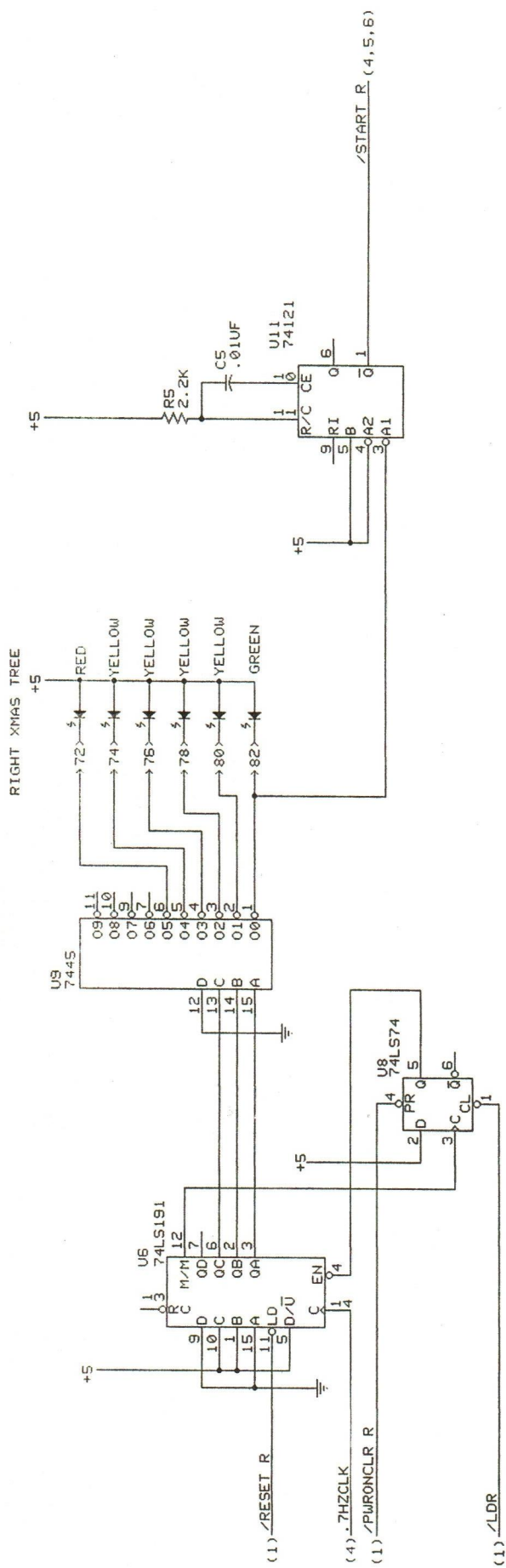
Pinewood Derby Track

How it Works - Electronics

The Pack 1220 pinewood derby track is a completely automatic race track with the ability to run two separate races at once or up to four cars at one time. On the back of the control/storage box is a visual indicator of the race mode selected. There is a start switch for the white and gold tracks and a switch for the red and yellow tracks. In the four car mode either start switch can be used to start the race.

When a start switch is pushed the elapse time displays are reset to zero and the 'CHRISTMAS TREE' LED's begin to count down. When the green LED lights the starting gate is pulled down by an electric solenoid and the elapse time display begins to count. Once a start switch is pushed it is 'locked out' until a car crosses the finish line or the elapse time reaches 9.99 seconds.

The finish line contains a photocell, an infrared light emitting diode and a 'win' indicator for each of the four tracks. The first car crossing the finish line breaks the infrared beam sending a signal to the control/storage box. The winning car's elapsed time will blink and the 'win' indicator will flash for about seven seconds. The cars that finish after the winning car will have only their times displayed. Elapsed times are to the hundredth of a second but the electronics can tell the difference between cars to the millionth of a second.



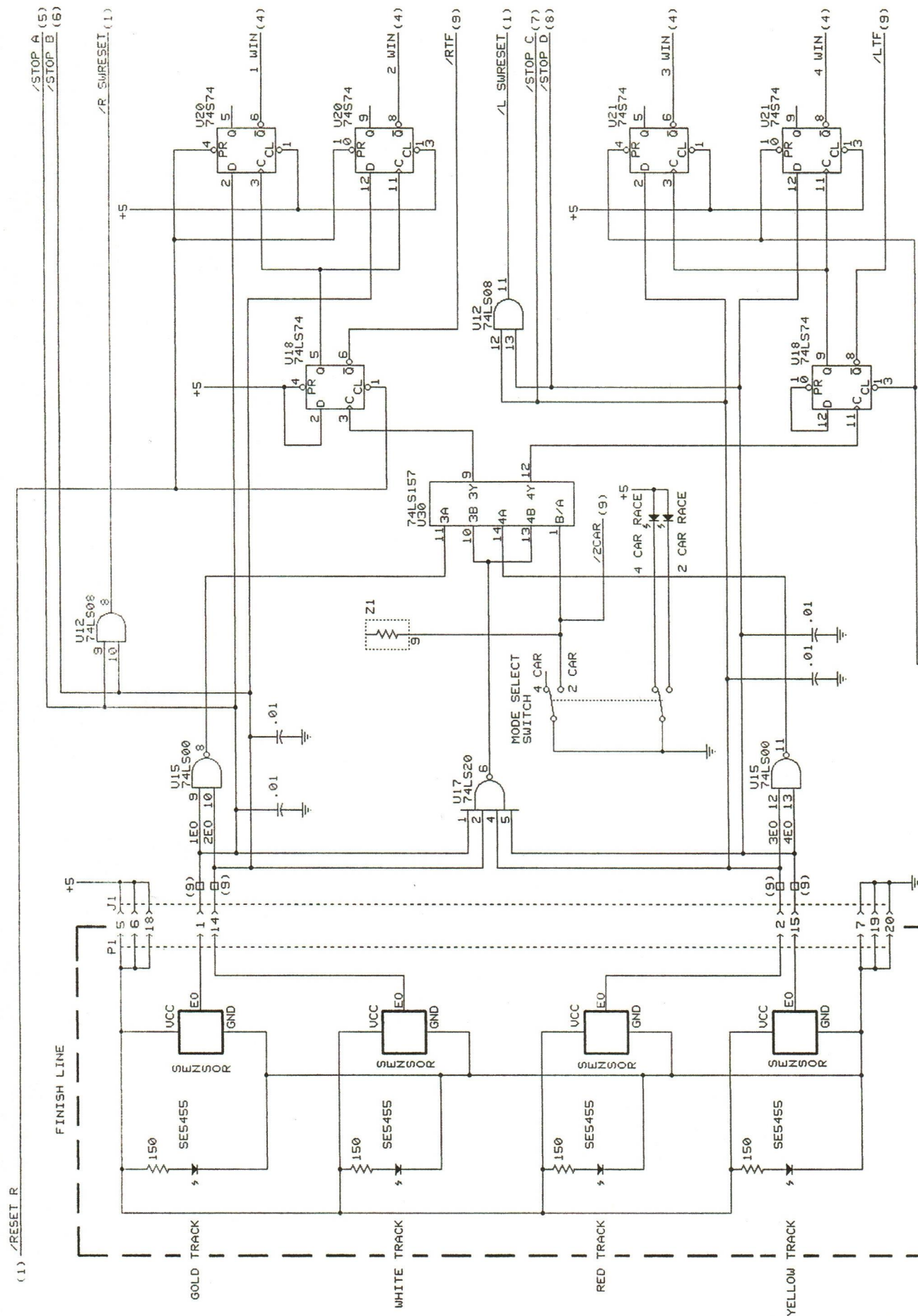
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PACK 1220 PINWOOD DERBY
CONTROL ELECTRONICS

JOHN MOUSER

DATE: 2-20-91

SHEET 2 OF 11



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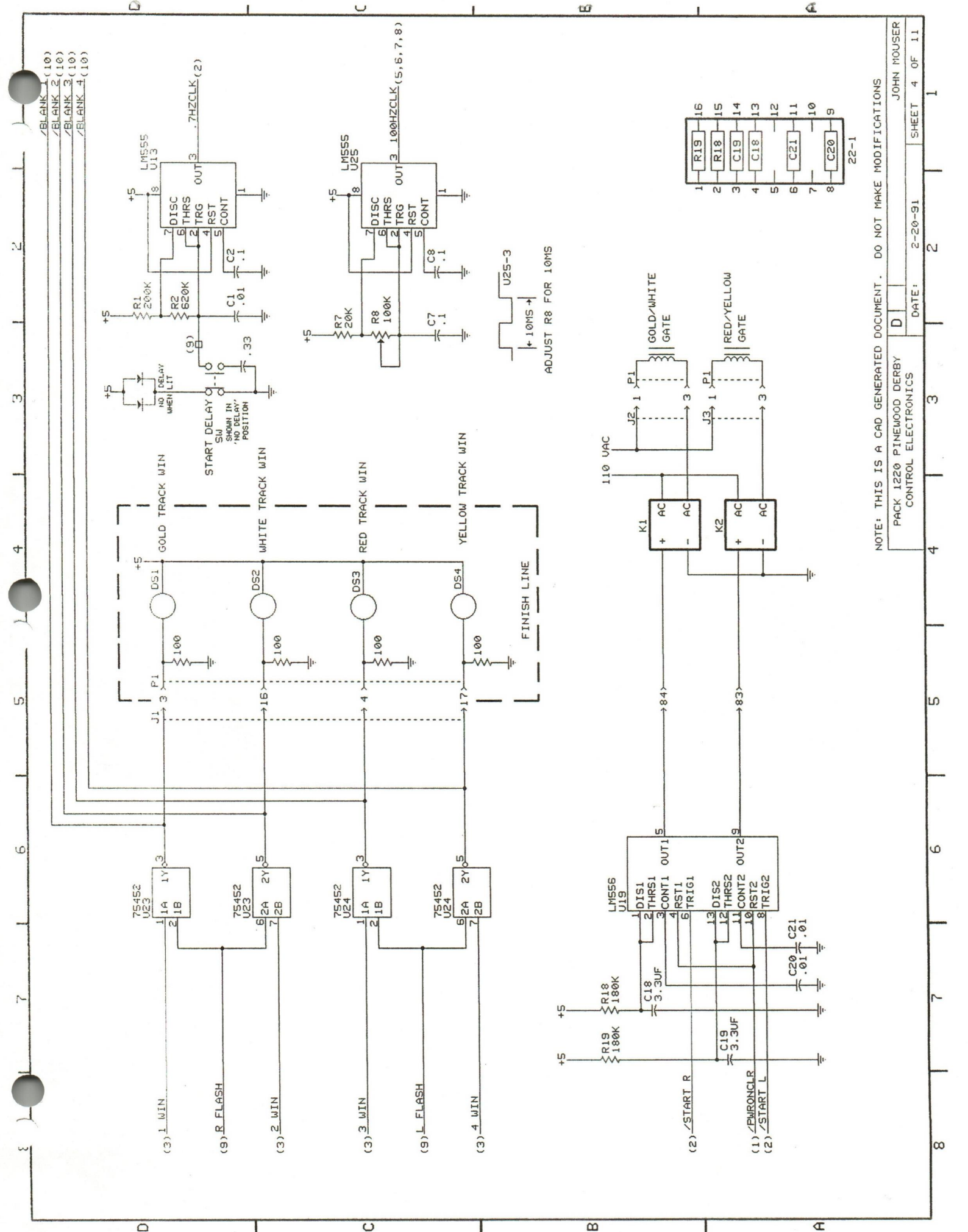
PACK 1220 PINWOOD DERBY
CONTROL ELECTRONICS

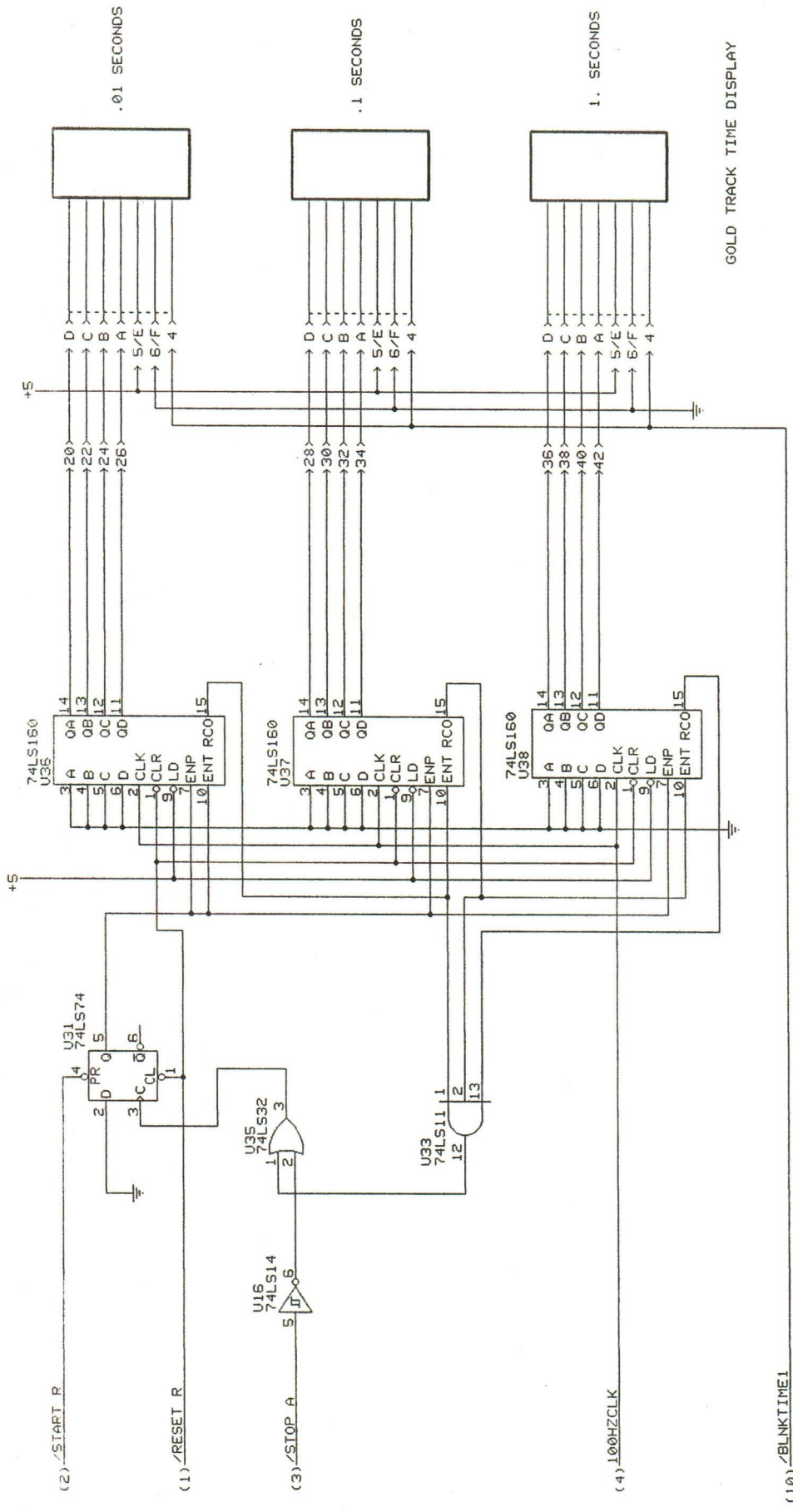
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JOHN MOUSER

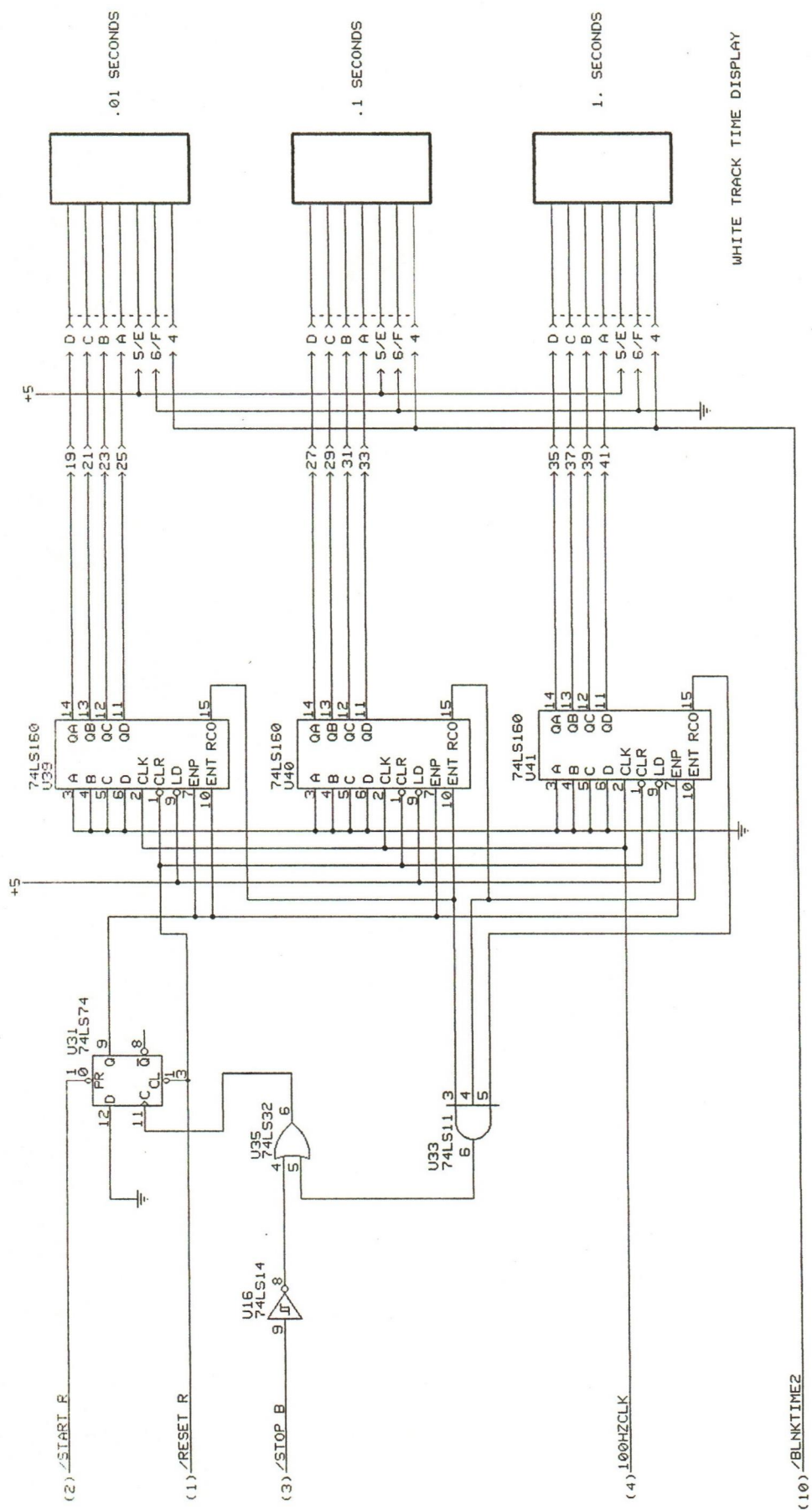
SHEET 3 OF 11

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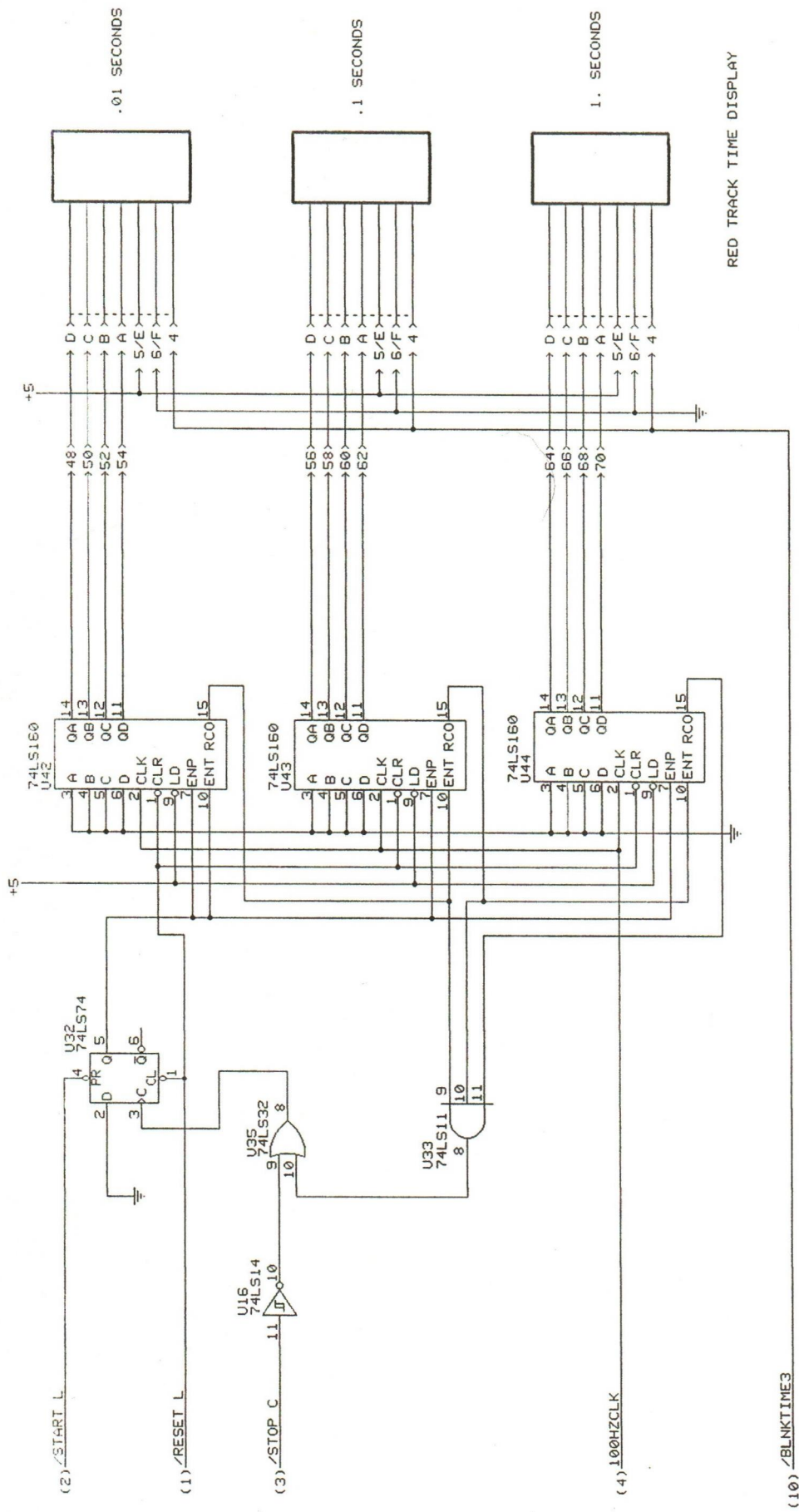




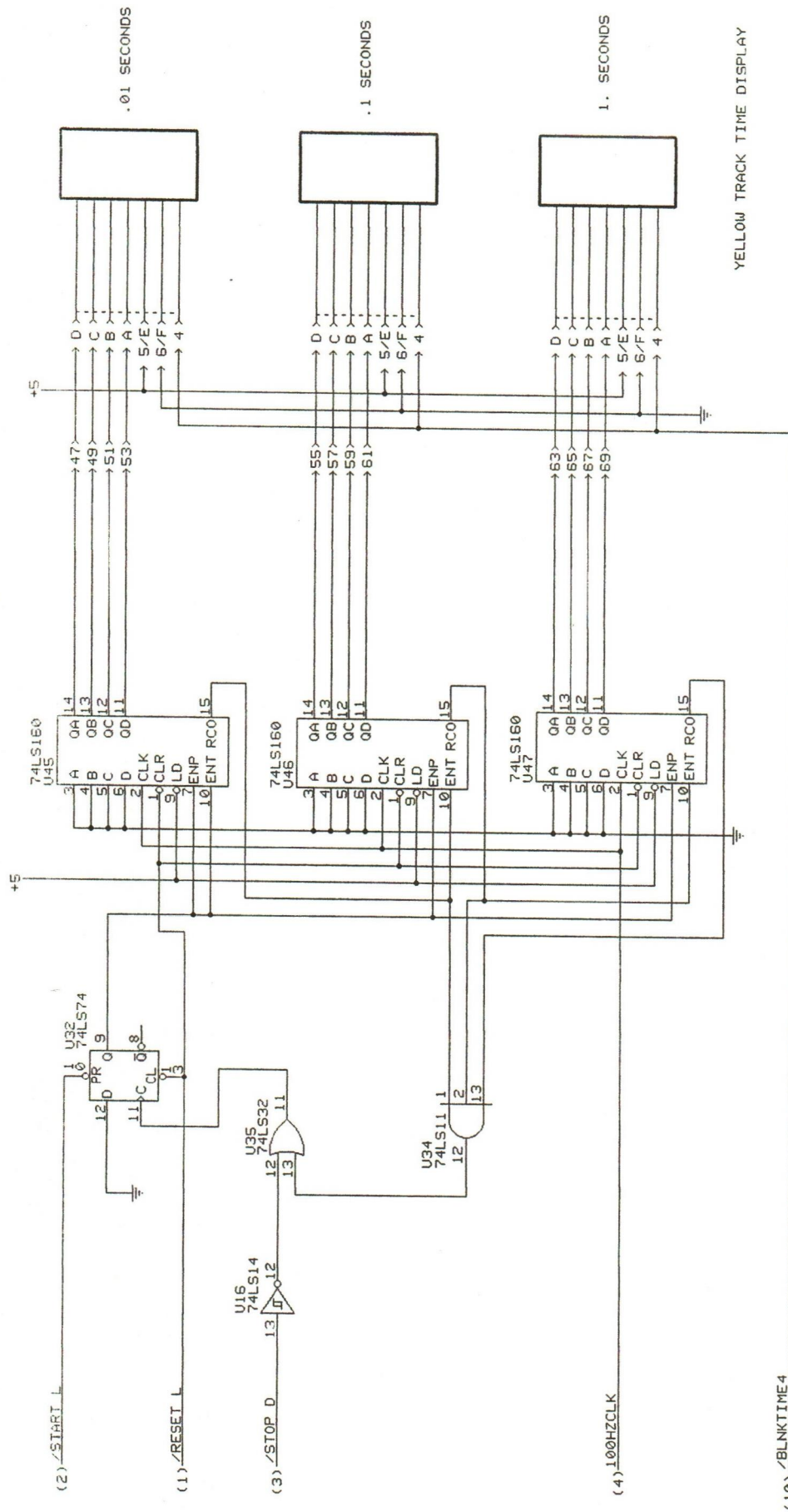
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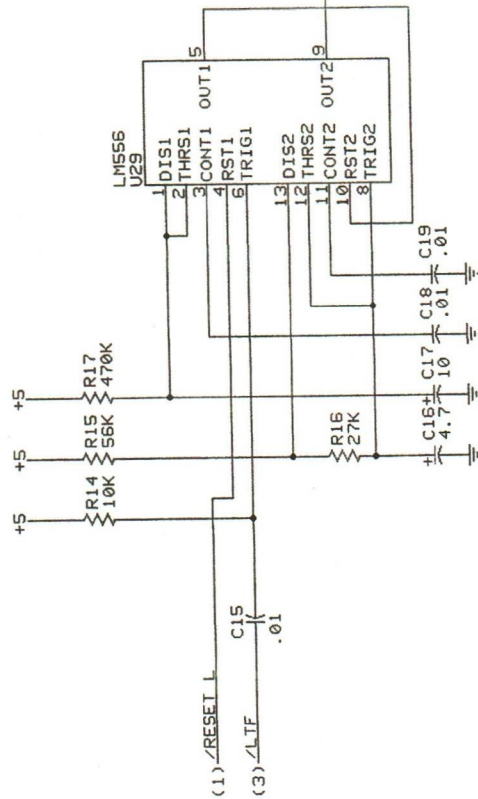
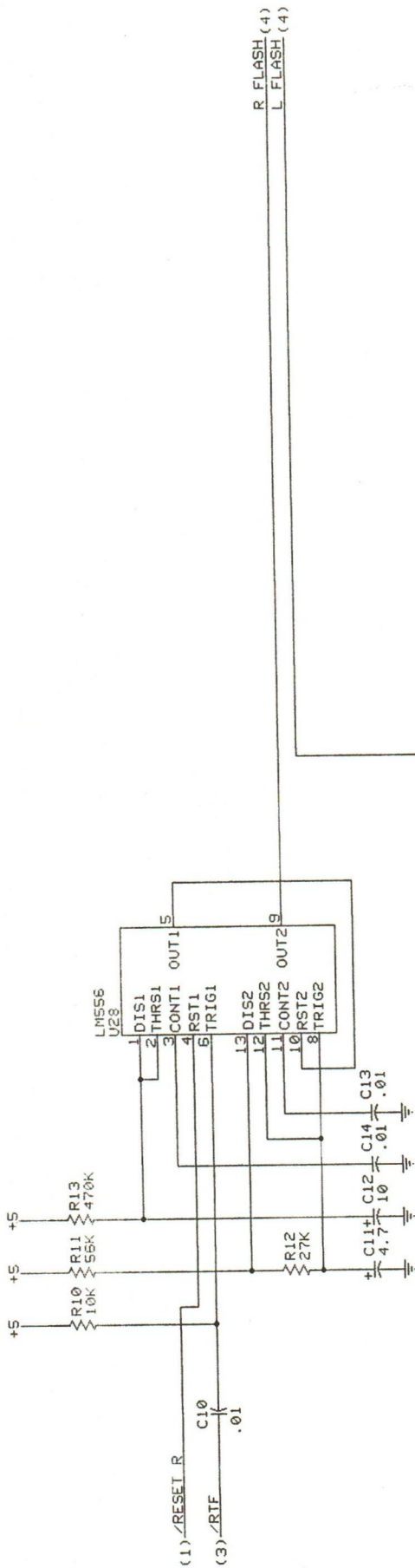
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PACK 1220 PINEMOOD DERBY
CONTROL ELECTRONICS

JOHN MOUSER

DATE: 2-20-91

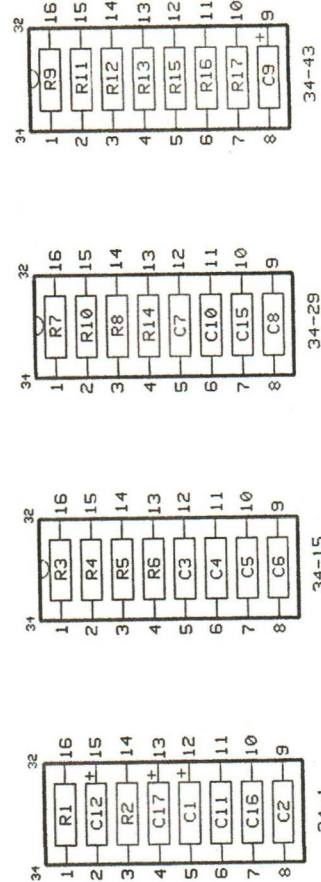
SHEET 8 OF 11



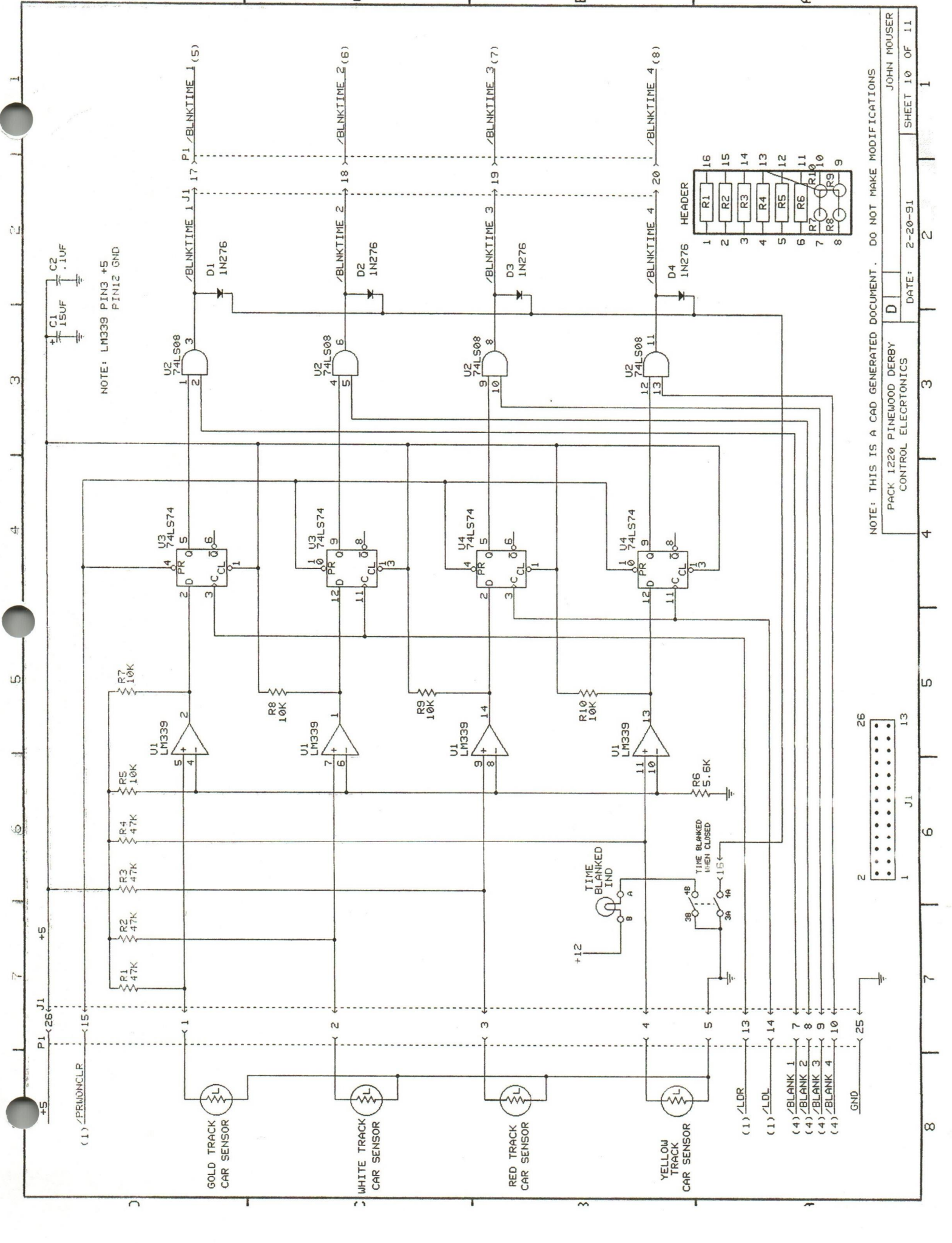
NOTE: NUMBERS BELOW HEADERS INDICATE LOCATION OF PIN 1 OF THE HEADER ON THE CIRCUIT BOARD

L	START SW	IND	1	16	R	START SW	IND
RED (3EO)	J1-2	2	15	J1-1 (1EO) GOLD			
YELLOW (4EO)	J1-15	3	14	J1-14 (2EO) WHITE			
	/RESET L	4	13	/RESET R			
RESET SW GND	5	12	RESET SW				
/2CAR	6	11	START DELAY SW				
(DS1) J1-3	7	10	J1-4 (DS3)				
(DS2) J1-16	8	9	J1-17 (DS4)				

42-19

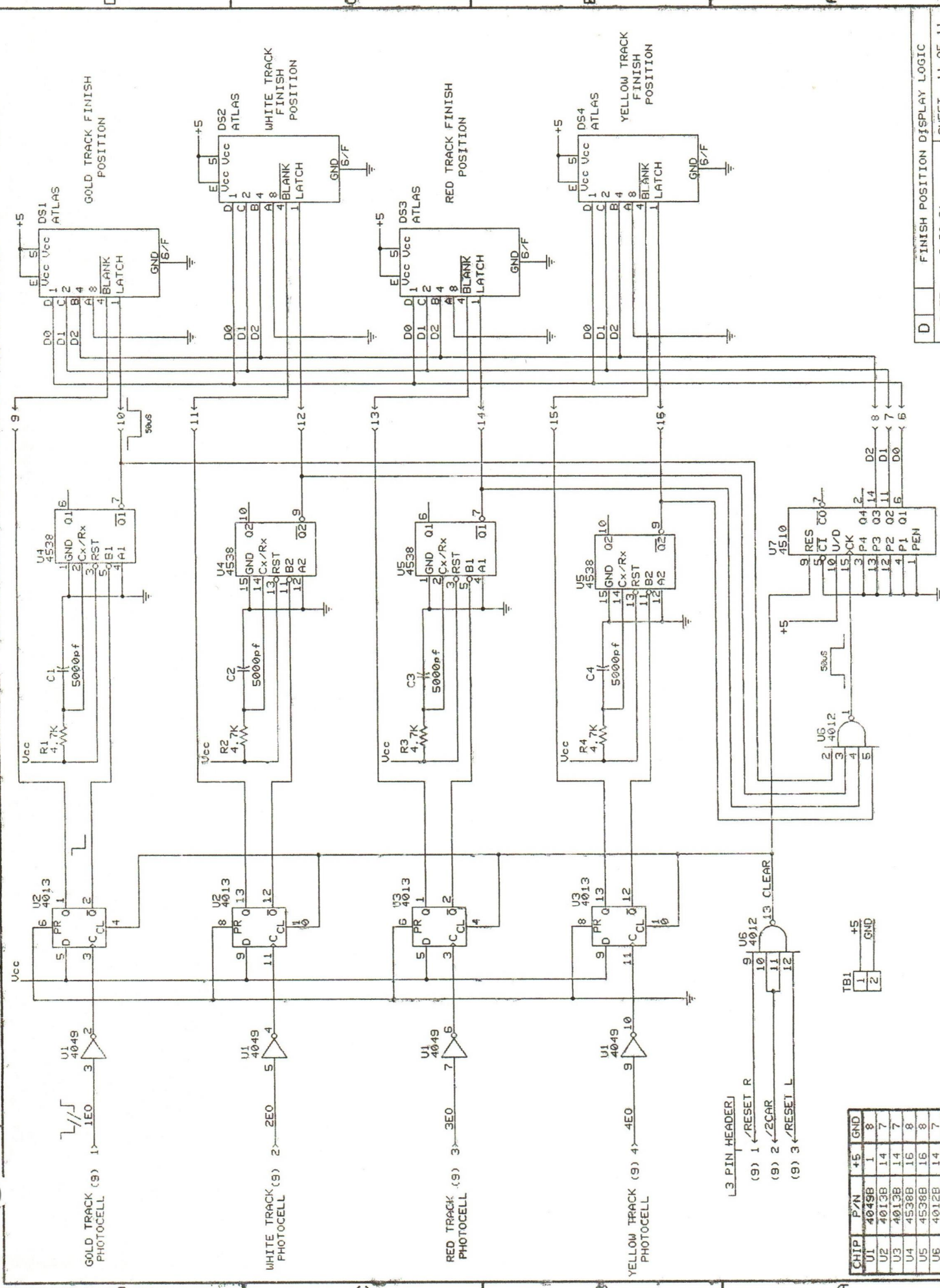


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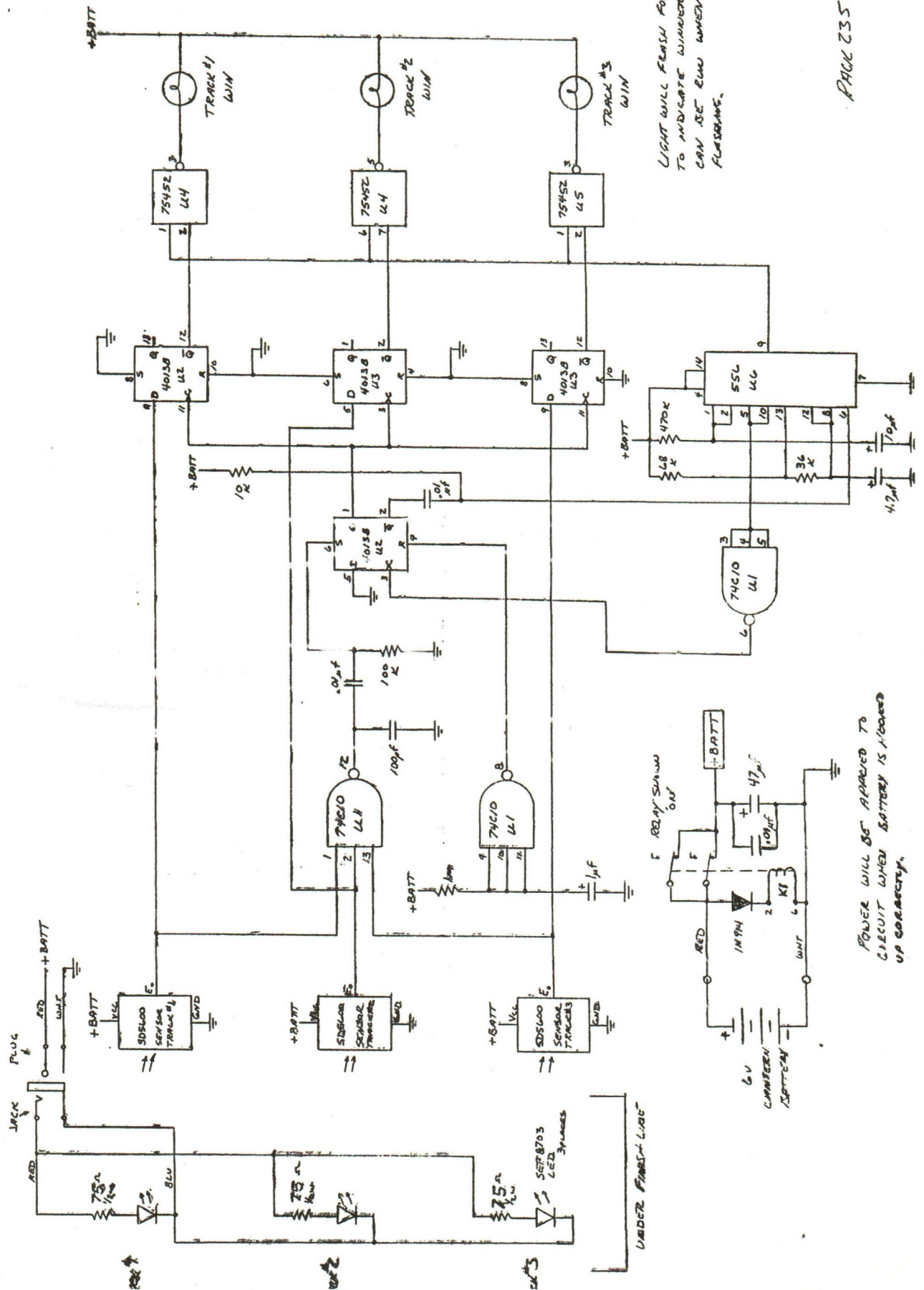




CHIP	P/N	+5	GND
U1	4049B	1	8
U2	4013B	14	7
U3	4013B	14	7
U4	4538B	16	8
U5	4538B	16	8
U6	4012B	14	7
U7	4510B	16	8

3 PIN HEADER
 (9) 1 /RESET R
 (9) 2 /2CAR
 (9) 3 /RESET L

TBI	+5	GND
1		
2		



LIGHT WILL FLASH FOR APPROX 5 SEC
TO INDICATE WINTER. NEXT READ
CAN BE RUN WHEN LIGHT STARTS
FLASHING.

PACK 235 FINISH CARE
1-18-88
J. HONAN

POWER WILL BE APPLIED TO
CIRCUIT WHEN BATTERY IS "BORED
UP CORRECTLY"

PACK 1220
PINWOOD DERBY TRACK
COST ESTIMATES

BILL OF MATERIAL:

ELECTRONICS BOX

Displays	\$603.68
PCB and P/S	353.64
Start Gate Solenoid	28.20
Relays	48.67
Switches	20.61
Circuit Breakers	9.40
LEDs (R-Y-G)	7.17
25 Pin Connector	5.62
PCB Connectors	65.59
Terminal Blocks	<u>7.17</u>
Total:	\$1149.75

FINISH LINE

Win Indicators	\$25.56
Sensors/Socket	36.00
IR LED & Resist	6.36
25 Pin Fm. Conn.	4.23
Assembled I/O	<u>75.00</u>
Total:	\$147.15

SUMMARY: ELECTRONICS (PARTS ONLY)

ELECTRONICS BOX	\$1,149.75
FINISH LINE	<u>147.15</u>
TOTAL:	\$1,296.90

WOODWORKING MATERIALS: HARDWARE AND WOOD \$240.00

ESTIMATED LABOR (ELECTRONICS ONLY)

DESIGN, PROTOTYPING, FABRICATION, ASSEMBLY, AND TEST

100 HOURS @ \$18.00/HR. = \$1,800.00

ESTIMATED LABOR (WOODWORKING ONLY)

DESIGN, PROTOTYPING, FABRICATION, ASSEMBLY, AND TEST

200 HOURS @ \$18.00/HR. = \$3,600.00

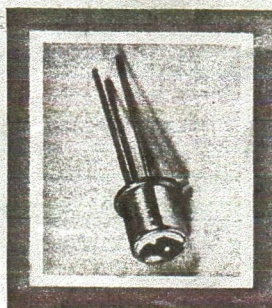
WOODWORKING TOTAL:	LABOR	\$3,600.00	
	PARTS	<u>240.00</u>	\$3,840.00
ELECTRONICS TOTAL:	LABOR	\$1,800.00	
	PARTS	<u>1,296.90</u>	\$3,096.90
TOTAL			\$6,936.90

Pinewood Derby Track Expenditures

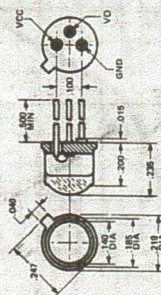
1/15/88

Date	Location	Description	Cost
12/01	Home Depot	Hinges for top of track	3.70
		Dowel kit w/dowels	4.67
		2x2x8	.95
		Saw blade	5.94
		2 @ 3/8" 4x8 AC Plywood	25.08
	Payless	1 @ 1/2" 4x8 AB Plywood	20.00
12/03	Home Depot	Sanding belt	2.09
12/04	Home Depot	Shelving	1.39
12/11	Home Depot	Hardware (Tee nuts)	1.08
		Sandpaper	1.95
		1 @ Eye bolt	.26
12/12	Home Depot	Contact cement for gluing the lanes on	6.25
		4 @ Foam applicator brushes	1.04
		2 @ Hinges (4)	2.76
		1x6x3 Oak board for top of track	6.81
12/13	Home Depot	Hardware (Tee nuts)	1.08
		7 @ Eye bolts	1.82
12/19	Shamburger	Lattice strips for lanes	32.31
12/27	Home Depot	Contact cement	3.89
		Blue paint 1 qt.	4.90
01/02	Home Depot	Sandpaper	1.87
		Primer 1 gal.	15.97
01/10	Payless	Tapping screws for track latches	2.69
		Tapping screws for track latches	2.29
01/12	Home Depot	3 @ 1x2x8	1.47
		Brass corner braces	2.54
		Door support for top section of box	1.44
		Sandpaper	1.95
		1 @ Eye bolts	.24
		2 @ Eye bolts	.66
01/13	Home Depot	2 @ Foam brushes	.70
		2 @ Foam brushes	.52
		4 @ 1x2x8	1.96
		Brass handles for box	1.44
		Brass corner braces	2.54
		Vinyl lettering	18.00
Subtotal			\$184.25
8% tax			14.74
Woodwork Total			\$198.99
Electronics Total			\$71.01
Total Cost			\$270.00

OPTO SCHMITT DETECTOR

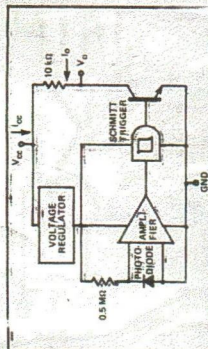


OUTLINE DIMENSIONS



NOTES

1. Two place decimals $\pm .02$.
2. Three place decimals $\pm .010$.
3. Leads are .017 DIA.
4. All dimensions are inches.



APPLICATIONS

- Limit switch
- Paper sensor
- Counter
- Chopper
- Coin sensor
- Schmitt Trigger Output
- Integrated circuit detector
- Low cost
- TTL/LSTTL/CMOS compatible

FEATURES

- Schmitt Trigger Output
- Integrated circuit detector
- Low cost
- TTL/LSTTL/CMOS compatible

DESCRIPTION

The Spectronics SD56000 Opto Schmitt Detector provides precise position sensing with a high noise immunity output. The single chip IC photo detector consists of a photodiode, amplifier, voltage regulator, Schmitt trigger and output σ . With a propagation delay time of only 5 nsec, the output transition time is typically 60 nanoseconds. The input sinks 10 TTL loads when no threshold level, the output sinks 10 TTL loads when no threshold level. The output is high through an internal 40 ohm pull-up. Output rise and fall times are independent of the rate of change of incident light. The photodiode portion of the IC is spectrally matched for infrared light and the device will also respond to visible light. Detector sensitivity has been internally temperature compensated to match the power out versus temperature characteristic of the Spectronics SE5455-1 LFR D.

ABSOLUTE MAXIMUM RATING ;

at Standard Atmospheric Conditions unless otherwise specified)

Storage Temperature	-55°C to 115°C
Operating Temperature	-40°C to 100°C
Lead Soldering Temperature (10 sec)	260°C
Maximum Allowable V _{cc}	20 V
Output sink (@ -55°C < T _A < 100°C)	40 mA

Recommended Operating Conditions

Operating Free-Air Temperature	-40°C to +100°C
Supply Voltage V _{cc}	4.5 V to 16 V
Output Current I _{OL} (10 std. TTL Loads)	18 mA
Operate Point (turn on irradiance)	0.5mW/cm ²

IND-25

Spectronics

Recommended Operating Conditions	
Operating Free-Air Temperature	-40°C to +100°C
Supply Voltage Vcc	4.5 V to 16 V
Output Current I _{OL} (10 std. TTL Loads)	16 mA
Operate Point (turn on irradiance)	0.5mW/cm ²

(NOTE 2)

Spectronics

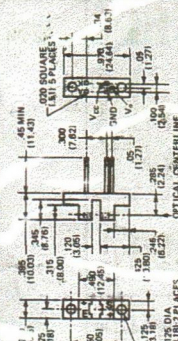
SPECTRONICS • A DIVISION OF HONEYWELL, INC.
830 EAST ARAPAHO ROAD
RICHARDSON, TEXAS 75081
(214) 234-4271 • TELEX 73-0890

SPX 2001
(230-2001-001)

TRANSMISSIVE OPTO SCHMITT SWITCH

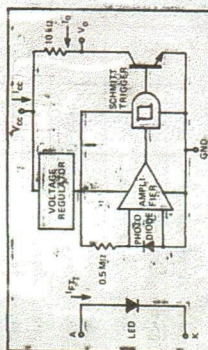


OUTLINE DIMENSIC IS



NOTES

- Two place decimals $\pm .03$.
Three place decimals $\pm .010$.
Hr-sling material is glass filled polyester.
Components are transfer molded plastic.
Leads are .020 x .020 square.
All dimensions are inches (metric).
Mounting hole tolerances for .125 DIA are $\pm .004$
 $\pm .001$



APPLICATIONS

- Schmitt Trigger Output
- Integrated circuit detector
- Ga As emitter
- Low cost
- TTL/LSTTL/CMOS

FEATURES

- Schmitt Trigger Output
- Integrated circuit detector
- Ga As emitter
- Low cost
- TTL/LSTTL/CMOS

DESCRIPTION

The Spectronics SPX-2001 optical switch offers precision position-sensing with an integrated photo detector. The IC photo detector consists of a photodiode, amplifier, voltage regulator, Schmitt trigger, and output stage. With a propagation delay time of only 5 microseconds, the output transition time is typically 50 nanoseconds. The output sinks 10 to 100 TTL loads when the light beam is interrupted. Detector sensitivity has been internally temperature compensated to match the GaAs λ_{max} over a wider temperature range. Output rise and fall time is independent of object speed. Interval voltage regulation provides high noise immunity.

ABSOLUTE MAXIMUM RATINGS

at Standard Atmospheric Conditions unless otherwise specified)

Storage Temperature	-55°C to 100°C
Operating Temperature	-40°C to 100°C
Lead Soldering Temperature (10 sec)	260°C

Input Diode	
Forward DC Current	10 mA
Peak Forward Current	3 A
as pulse width, 300-pps	
Reverse DC Voltage	1 V
Power Dissipation	100 mW

Output S/nor	
Maximum allowable V_{ce}	20V
Power dissipation @ 25°C Ambient	250 mW
$(V_{ce} = 10V, \text{Output low})$	
Derate li early from 25°C	3.3 mW/°C
Output sink	40 mA

Spectronics

RESPECTRONICS • A DIVISION OF HONEYWELL, INC.
330 EAST ARAPAHO ROAD
RICHARDSON, TEXAS 75081
(214) 234-4271 • TELEFAX 73-0890

Spectronics Incorporated reserves the right to make changes at any time in order to improve design and to supply the best product possible.



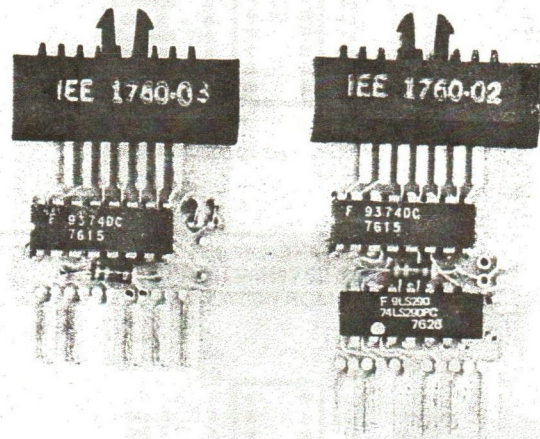
DECODER/DRIVERS

DMD1760
SERIES

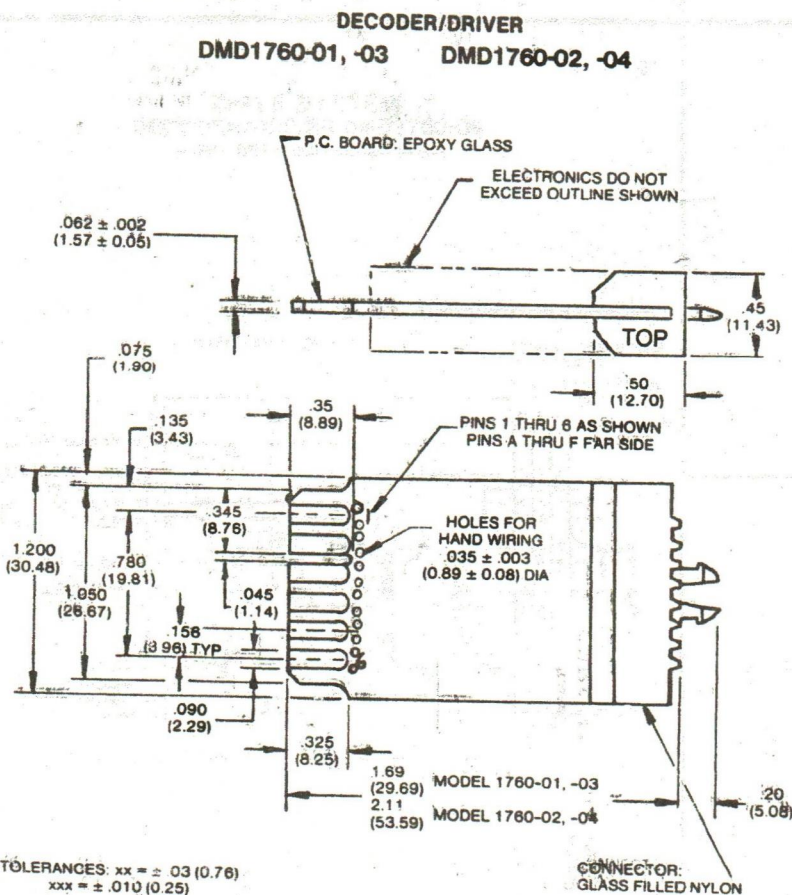
TECHNICAL DATA MAY/79

FEATURES

- MOUNTS EASILY ON BACK OF IEE DISPLAY MOUNTING HARDWARE (WIREWRAP TERMINAL MODELS)
- ACCEPTS EITHER FOUR LINE BCD OR SERIAL, PULSE COUNT INPUTS
- ALL MODELS INCORPORATE AN INHERENT MEMORY CAPABILITY
- MODEL DMD 1760-01, -03 DECODER/DRIVER WITH MEMORY
- MODEL DMD 1760-02, -04 DECODER/DRIVER WITH MEMORY AND COUNTER
- DMD1760 SERIES DECODER/DRIVERS ARE DESIGNED TO OPERATE WITH COMMON ANODE LED READOUTS ONLY.



PACKAGE DIMENSIONS



NOTE: The following connectors can be used with IEE DMD 1760 Series of Decoder/Drivers.

Viking Connector: 2VH6/1AN5 (has pierced tail)
(Use 091-002 polarizing insert)

Masterite: S014GR6-DR-H-X (has pierced tail)
(Use 091-0040-000 polarizing insert)

EDAC Inc: 307-012-500-202 (has pierced tail) (Use polarizing insert #307-240-318)