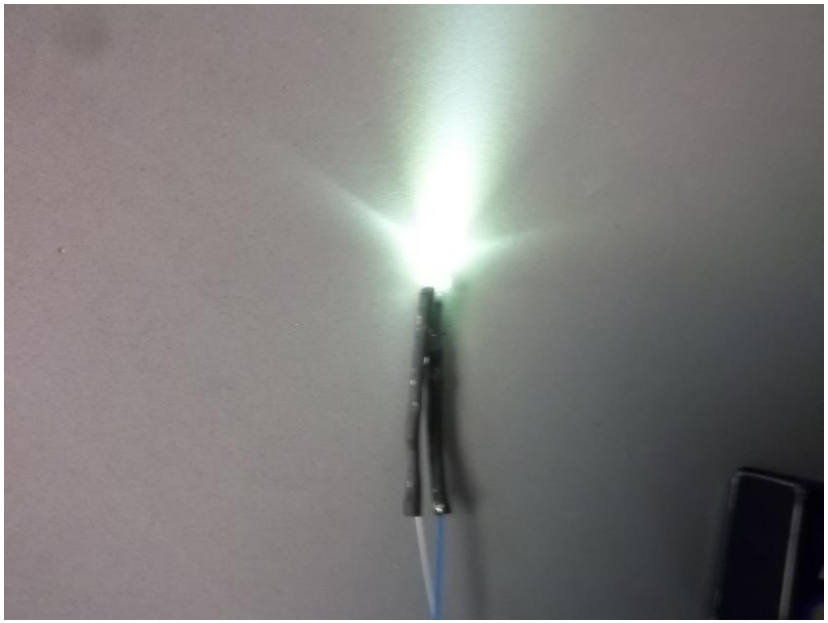
LEDS FOR YOUR LAYOUT



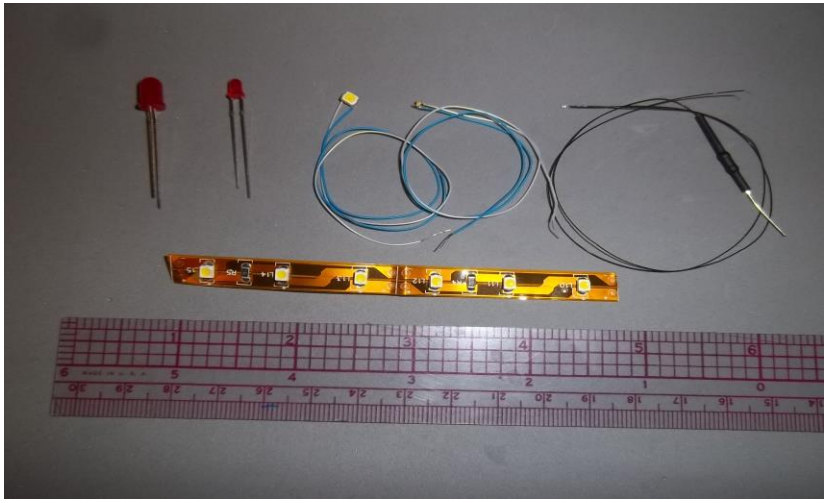
BILL FEAIRHELLER

Div 3 Mid Central Region

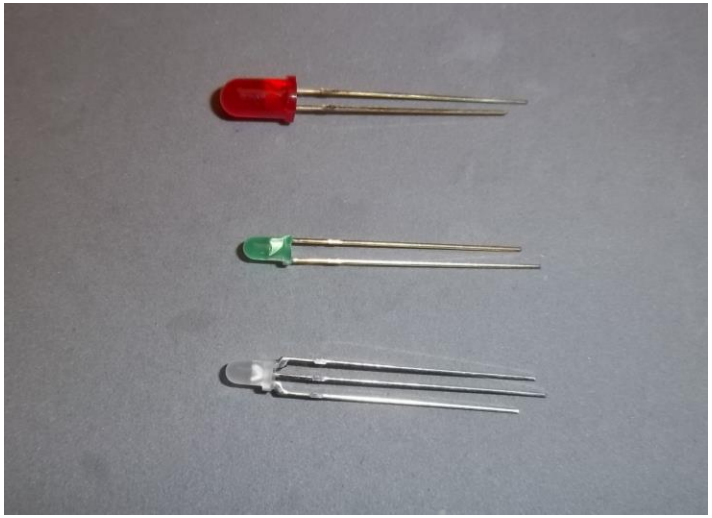
NMRA

LEDS ARE LIGHT EMITTING DIODES

- LEDS ARE DIODES – POLARITY SENSITIVE
- LEDS ARE CURRENT DEVICES
- MOST CIRCUITS NEED A RESISTOR
- MANY COLORS AVAILABLE:IR,BI &TRI COLOR &RGB
- MANY SIZES – T1(3MM), T1¾(5MM), 1.8MM, SMD
- AVAILABLE SINGLE OR UP TO 5M STRIPS



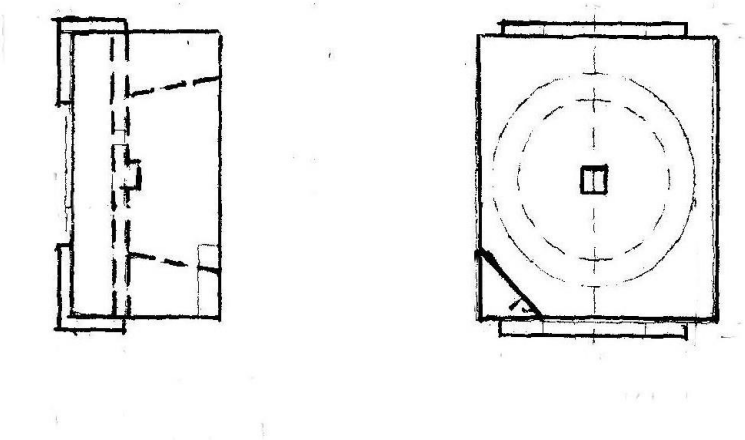
LARGER LEDS HAVE LENS



- PLASTIC CASE ACTS AS LENS
- CASE CAN BE COLORED - CLEAR OR DIFFUSED
- TWO LEADS – LONGER IS ANODE (POSITIVE)
- WIRES SOLDERED TO LEADS
- THREE LEADS – CENTER ANODE OR CATHODE
- LENS IDEAL FOR HEADLIGHTS

SMD LEDS – MANY SIZES

- DESIGNED FOR PC BOARD
- SOLDER PADS ON SIDE AND BACK
- SIZES FROM O4O2 (0.04X0.02 in) TO 5050 (5X5MM)
- NO LENS, BUT WIDE VIEWING ANGLE
- SOME AVAILABLE WITH WIRES AND RESISTOR
- SOLDERING LEADS TYPICALLY REQUIRED
- MAGNET WIRE OR WIRE WRAP WIRE
- SILICONE COVER – COLOR?



SMD – SINGLE OR STRIPS

WORKING WITH SMD LEDS

- RECEIVED IN STRIPS
  - WORK OVER A BOX
  - TEST FOR LIGHTING
- TO SOLDER ON WIRES
  - USE PENCIL IRON
  - ROSIN CORE 60/40 SOLDER
  - USE TAPE TO HOLD LED
  - TIN SOLDER PADS
  - STRIP 30G WIREWRAP WIRE
  - TIN WIRE
  - TAPE WIRE TO PAD
  - TOUCH SOLDERING IRON
  - TEST FOR LIGHTING

USE LEDS FOR:

- LOCOMOTIVE HEADLIGHTS, MARKERS
- LAYOUT LIGHTING
- LIGHTING BUILDING INTERIORS
- LIGHTING OUTSIDE BUILDINGS
- CROSSING SIGNALS
- TRACK OCCUPIED INDICATORS
- TRACKSIDE SIGNALS

HOW TO PICK THE RESISTOR

TYPICAL FORWARD CURRENT = 10 TO 20 MA (0.01 TO 0.02 A)

TYPICAL FORWARD VOLTAGE

RED,ORANGE,YELLOW 2.0 VOLTS

GREEN,BLUE,WHITE 3.0 VOLTS

OHMS LAW V=IR (VOLTS = AMPS X OHMS)

RESISTANCE = VOLTS(supply) – VOLTS(led) / CURRENT(led)

FOR 12 VOLT SUPPLY – R = 12-3/0.02 = 450 (USE 560 OHMS)

IF IN DOUBT – USE 560 FOR 5 VOLTS, 1000 FOR 12 VOLTS

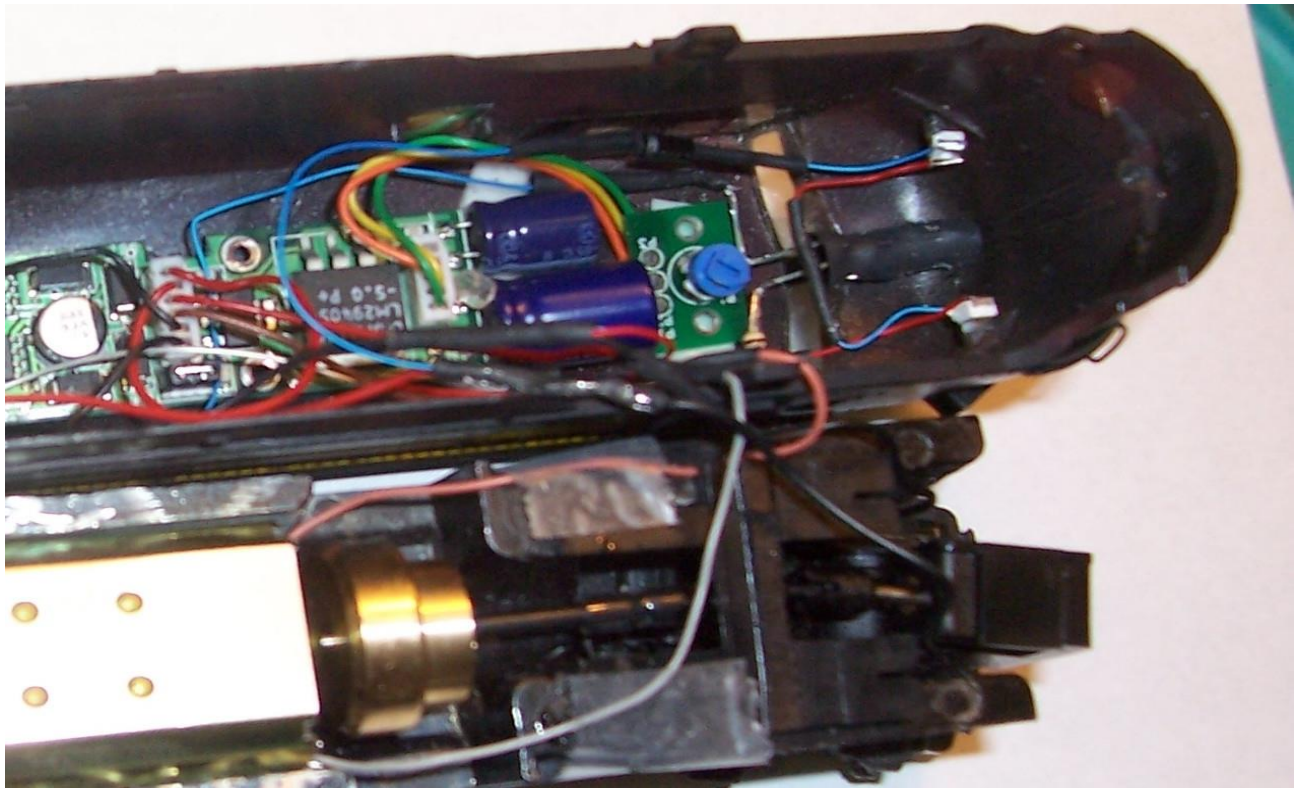
IF LED IS TOO BRIGHT, INCREASE THE RESISTANCE

FOR HIGH INTENSITY, USE 1K OR HIGHER RESISTANCE

LOCOMOTIVE HEADLIGHTS

- WARM WHITE T1 LED, 1K RESISTOR
- DCC - BLUE WIRE + LEAD, WHITE FOR HEADLIGHT
- SHRINK TUBING OR GLUE TO LIGHT TUBE
- SHRINK TUBING INSULATE CONNECTIONS
- SHRINK TUBING OR PAINT FOR LIGHT LEAKS
- NUMBER BOARDS – SMD IN SERIES AND 4.7K RESISTOR

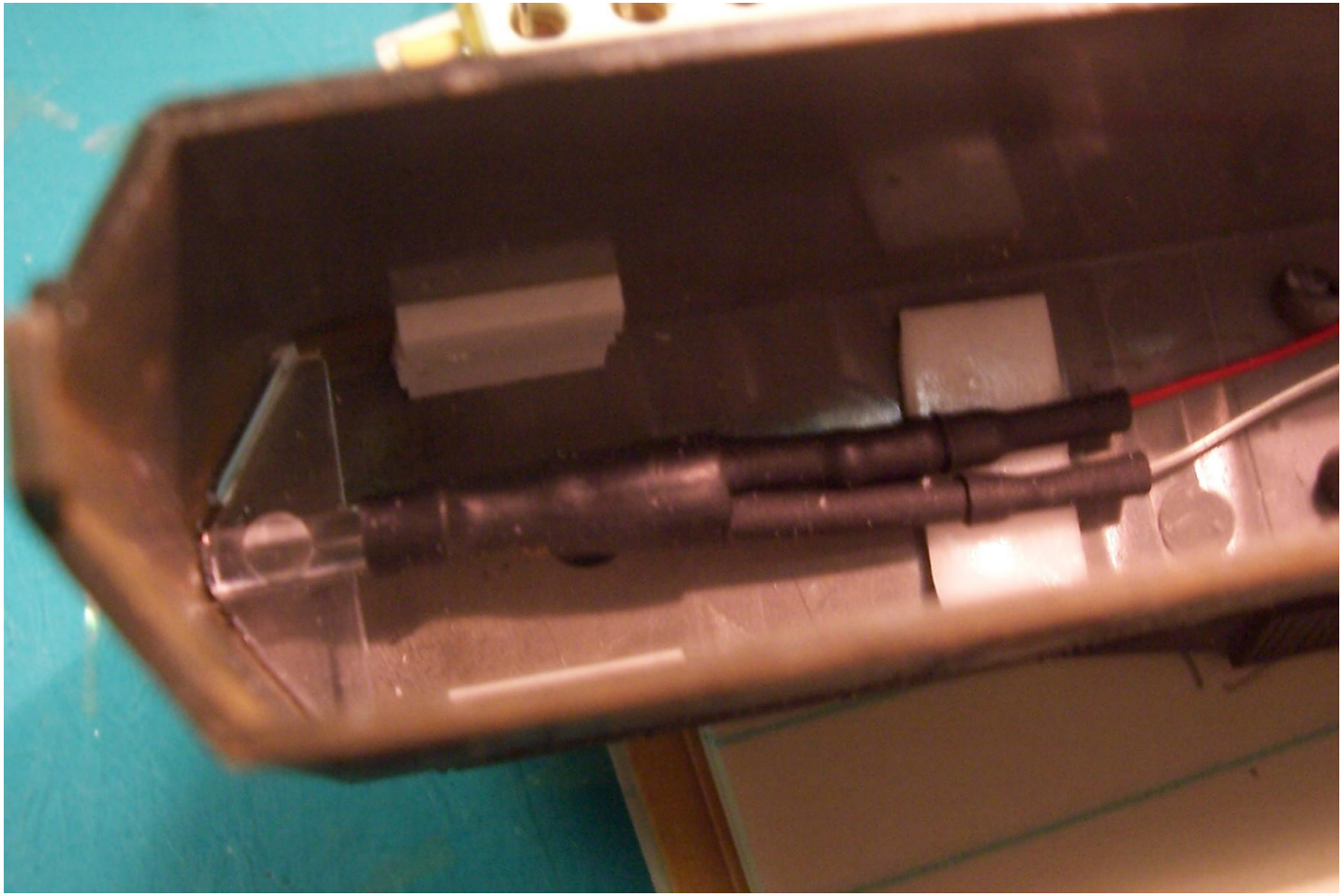
HEADLIGHT AND NUMBER BOARD –FP7



T1 LED FOR HEADLIGHT

SMD LEDS FOR NUMBER BOARDS

HEADLIGHT FOR GP7

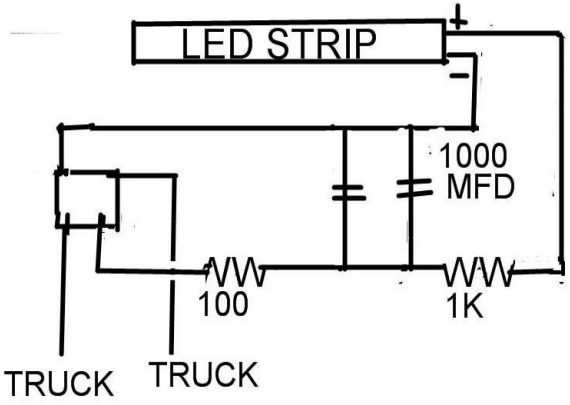


MARKER AND BACK-UP LIGHTS

- 0306 SMD LEDS
- WIRE-WRAP WIRE 30G
- WIRE THROUGH DECODER
- PAINT LED CASE BLACK

PASSENGER CAR LIGHTING

- STRIP LEDS FOR INTERIOR
- SMD FOR MARKERS
- FOR DCC CONVERT TO DC
- USE CAPACITORS
- NO FLICKER



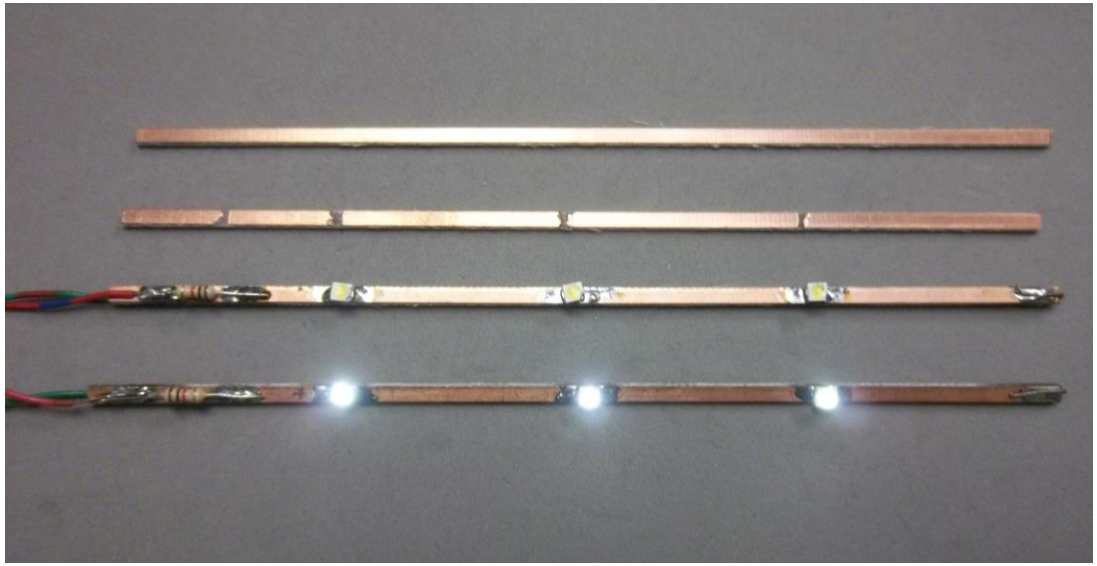
USE FOR LAYOUT LIGHTING

- 5 METER STRIPS
- 5050 OR 3528 LEDS
- 12 VOLTS SUPPLY
- CUT TO LENGTH
- WARM WHITE
- LOW CURRENT
- RESISTOR INCLUDED
- COOL OPERATION

LIGHTING BUILDINGS

- SINGLE OR STRIPS
- 3528 OR 5050
- LIGHT SPECIFIC AREAS
- COOL OPERATION
- OUTSIDE LIGHTING
- DETAILED INTERIOR

LIGHTING STRIPS ARE EASY TO MAKE

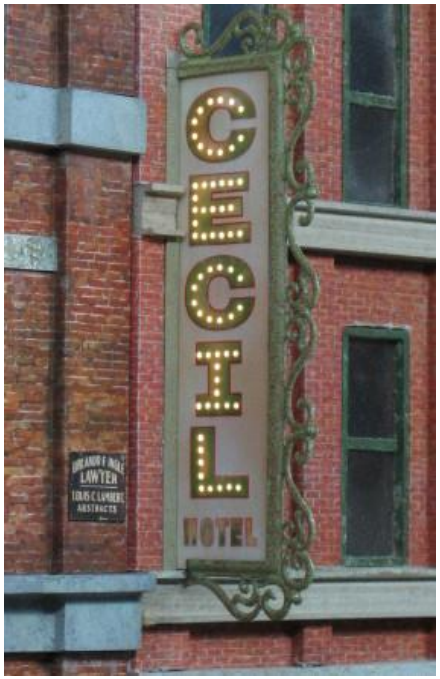


- DOUBLE SIDED PC BOARD TIE STRIPS
- CUT COPPER FOR RESISTOR AND LEDS
- SOLDER LEDS TO PC STRIP, 3 LEDS IN SERIES
- CONNECT UPPER AND LOWER STRIPS WITH WIRE
- ATTACH POS AND NEG LEADS FOR 12V

STREET LIGHTS

- REPLACE BULBS
- LEDS SMALLER
- USE WIRE WRAP WIRE
- POT WITH CAULK
- DRY CAULK COMPLETELY
- LOOKS REALISTIC
- COLOR TINT IF NEEDED

STRIP LEDS FOR BUILDING SIGN

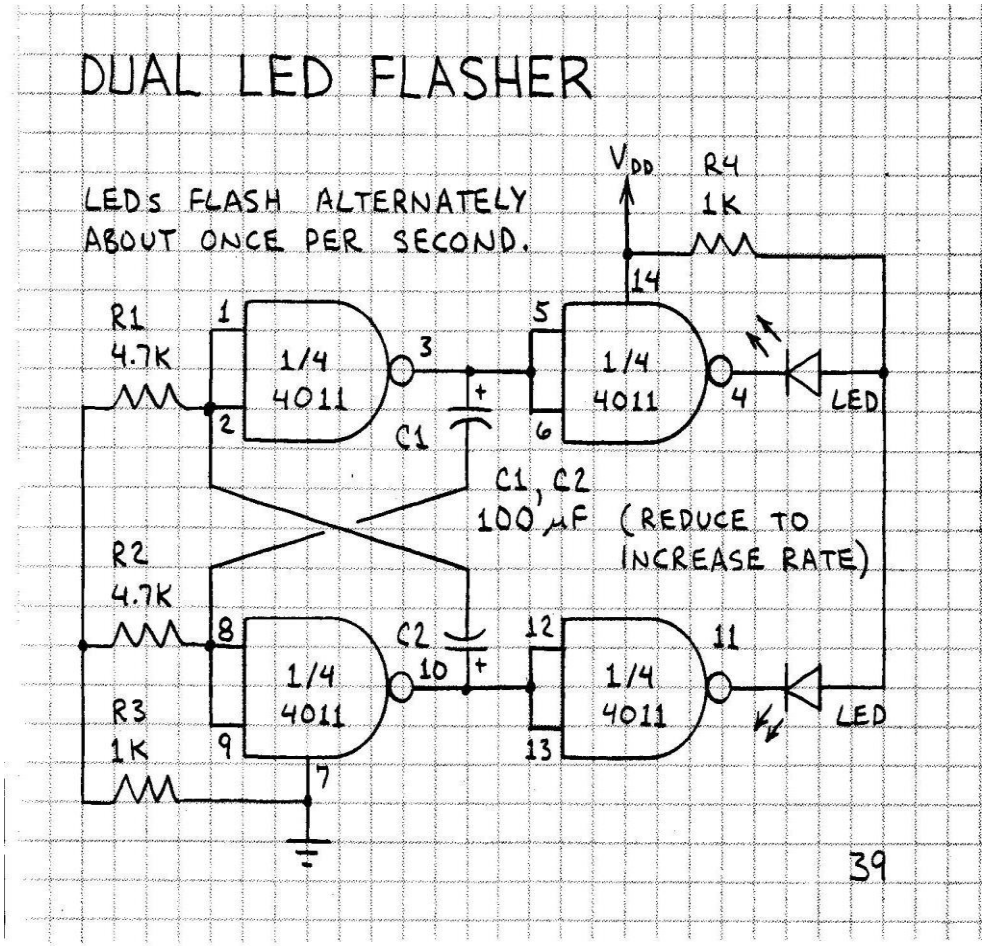


CROSSING SIGNALS

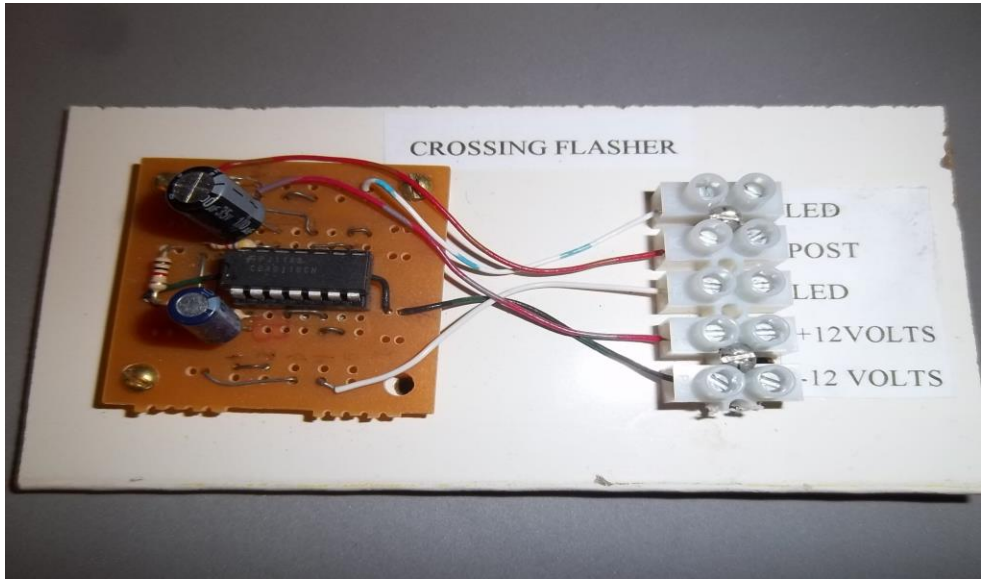
- EASY TO MAKE
- BRASS TUBING
- T1 RED LEDS
- COMMON ANODE
- POST AS POS LEAD
- LEDS INTO CROSS TUBE
- WIRE WRAP FOR NEG
- STYRENE FOR TARGET
- STIRRER FOR VISOR
- PRINT ON CARD STOCK

CROSSING SIGNAL CIRCUIT

(FORREST MIMS “ENGINEER’S MINI NOTEBOOK)



CROSSING SIGNAL CIRCUIT



- 12 VOLT SUPPLY, 1-4011 IC, 2 CAPS, 4 RESISTORS
- FLASH ALTERNATELY ~ 1 PER SECOND
- RADIO SHACK CIRCUIT BOARD
- OPERATED BY SWITCH OR BY DETECTION

CURT LARUE'S LAYOUT

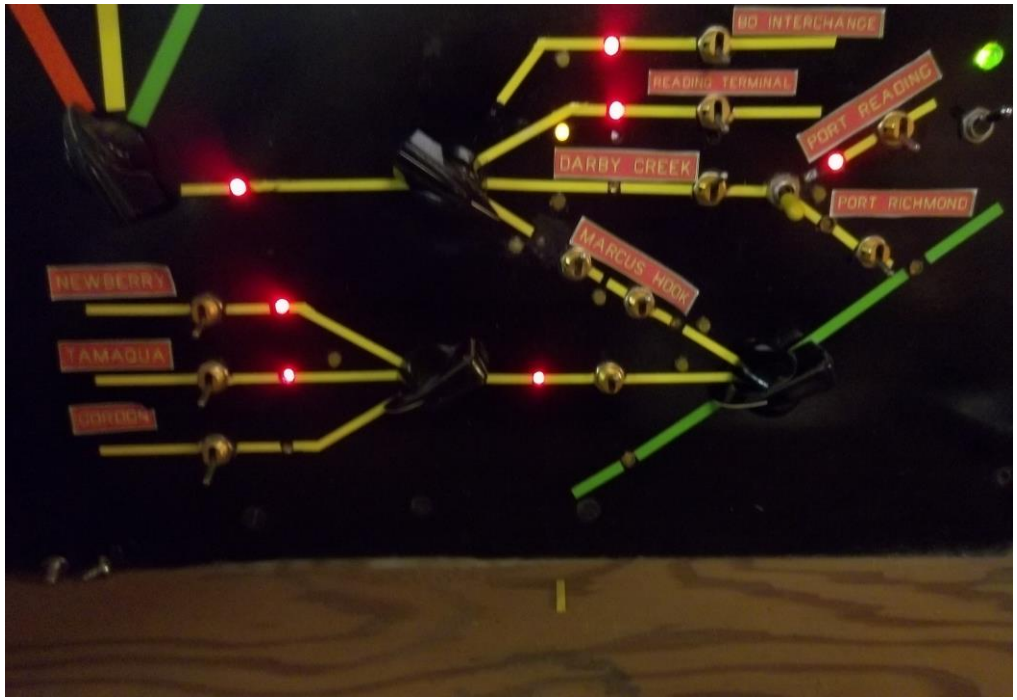
TRACK OCCUPIED DETECTOR

BLOCK DETECTORS

- DC – THROUGH DIODES
- DCC – THROUGH COIL AVAILABLE
- DISPLAY ON PANEL
- NEEDED FOR SIGNALS

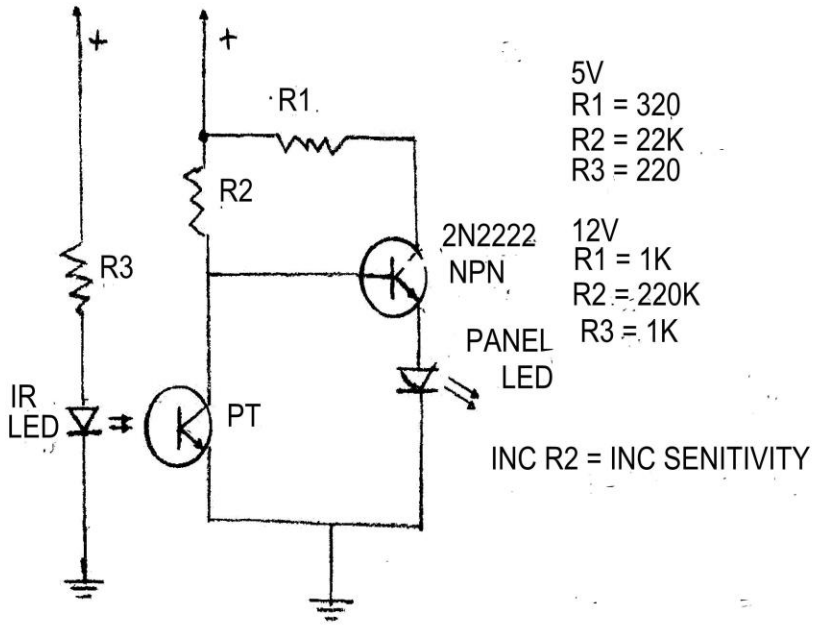
LOCATION DETECTOR

- IR LED
- PHOTO-TRANSITOR
- SIMPLE CIRCUIT
- PANEL INDICATOR
- STAGING ETC
- CLEAR SWITCHES

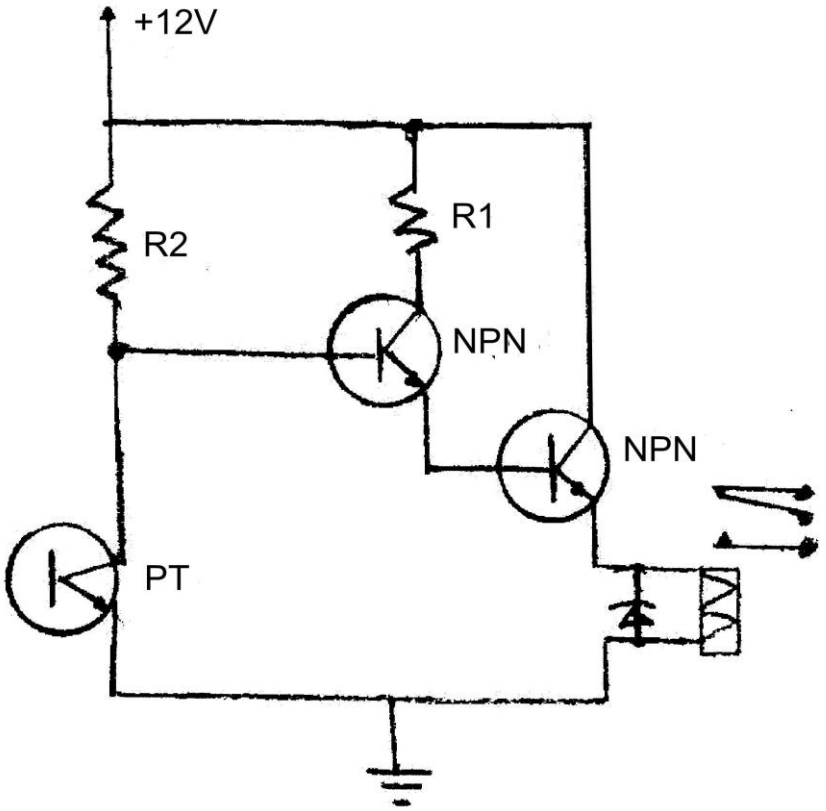


LOCATION DETECTION

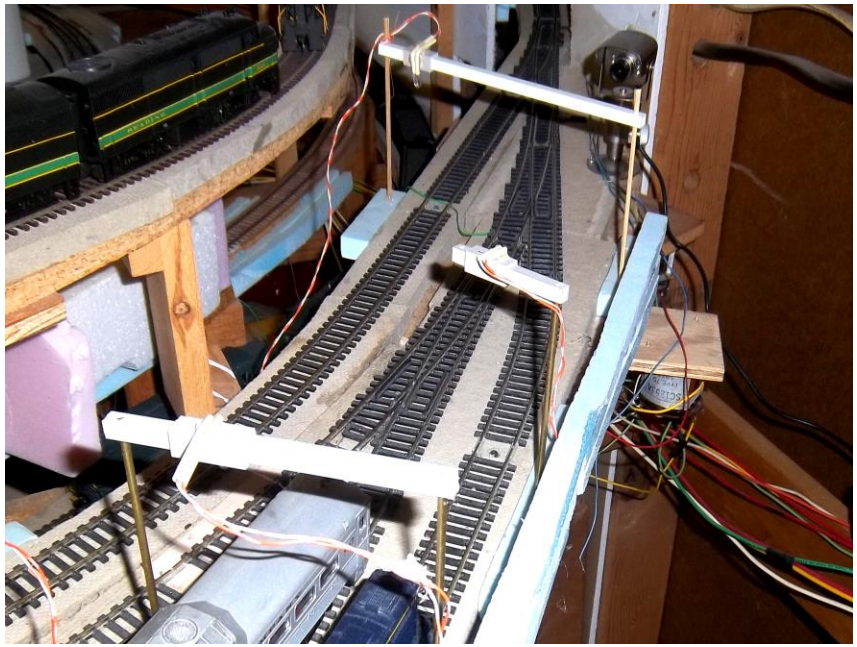
- SIMPLE CIRCUIT
- IR LED
- IR PHOTOTRANSITOR
- 1 NPN TRANSITOR 2N2222
- 3 RESISTORS
- LED ON PANEL
- 5V OR 12V POWER

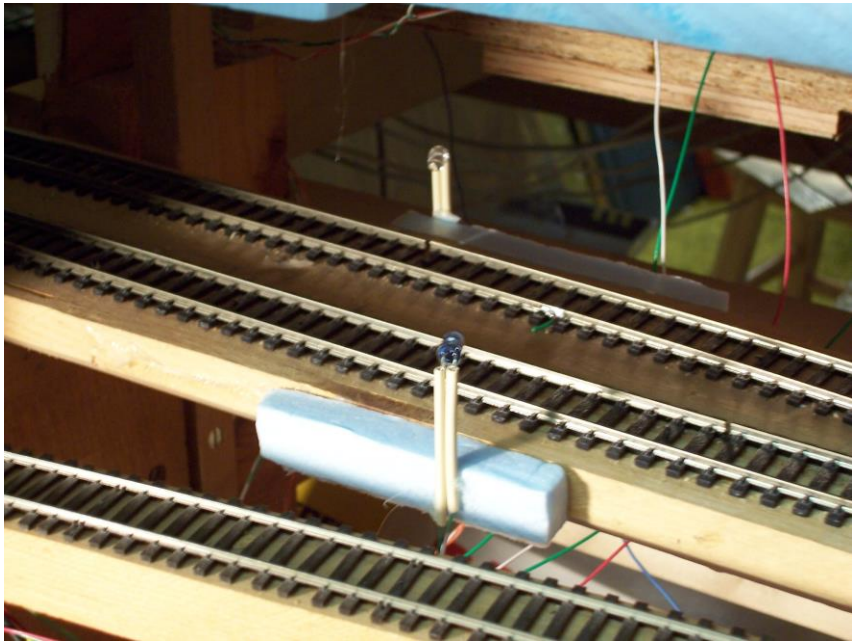


CAN OPERATE RELAY

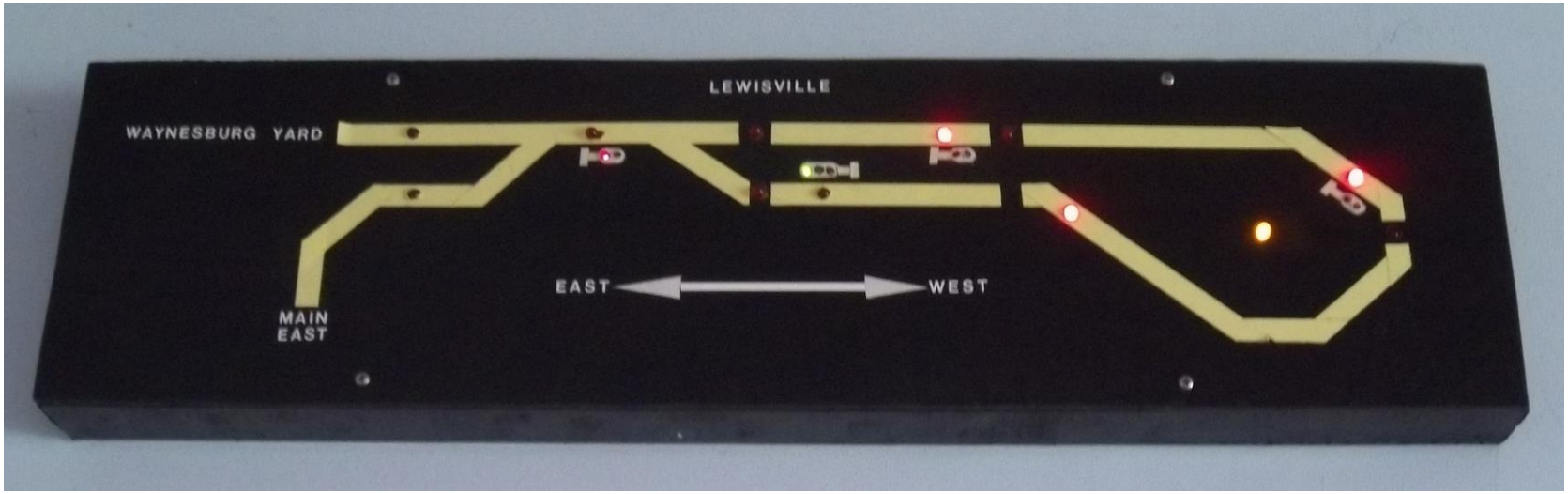


INSTALL LED & PHOTOTRANSITOR ON LAYOUT



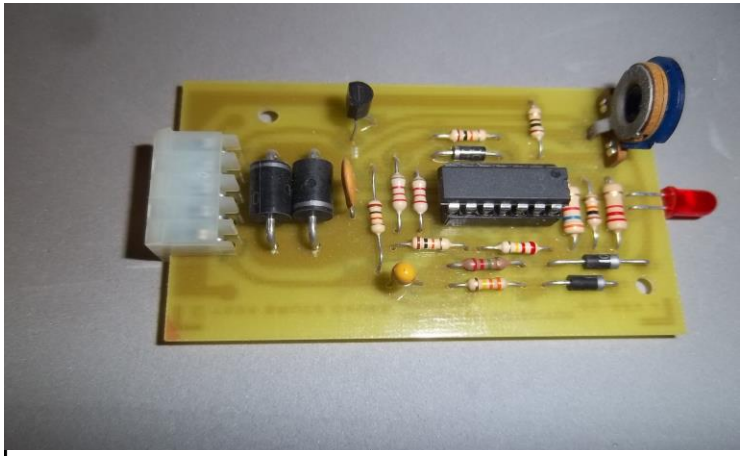


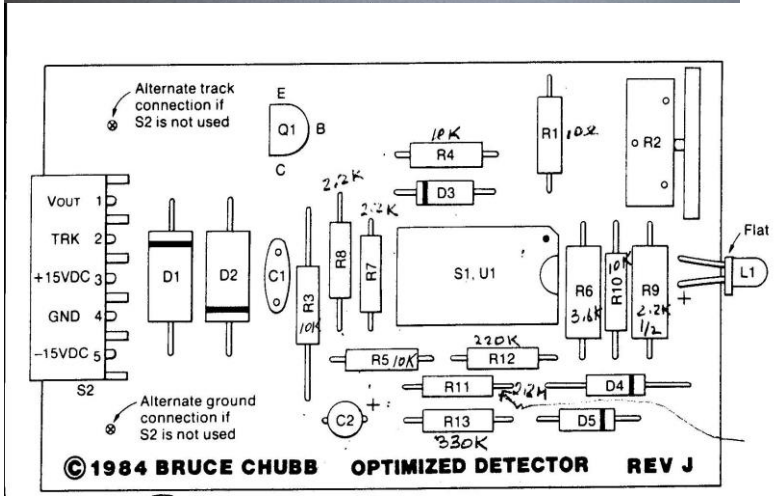
USED ON MERV'S PENNSYLVANIA SOUTHERN LAYOUT



BLOCK DETECTION

- DETECT ENTIRE BLOCK
- FOR DC USE DIODES
- BRUCE CHUBB'S DETECTOR
- ADJUSTABLE SENSITIVITY
- TIME DELAY ON AND OFF
- 1 IC AND 1 TRANSITOR
- OPEN COLLECTOR OUTPUT
- DESIGNED FOR 3 AMPS
- ONE CIRCUIT PER BLOCK
- CIRCUIT BOARD AVAILABLE
- WILL WORK FOR DCC
- RELATIVELY INEXPENSIVE

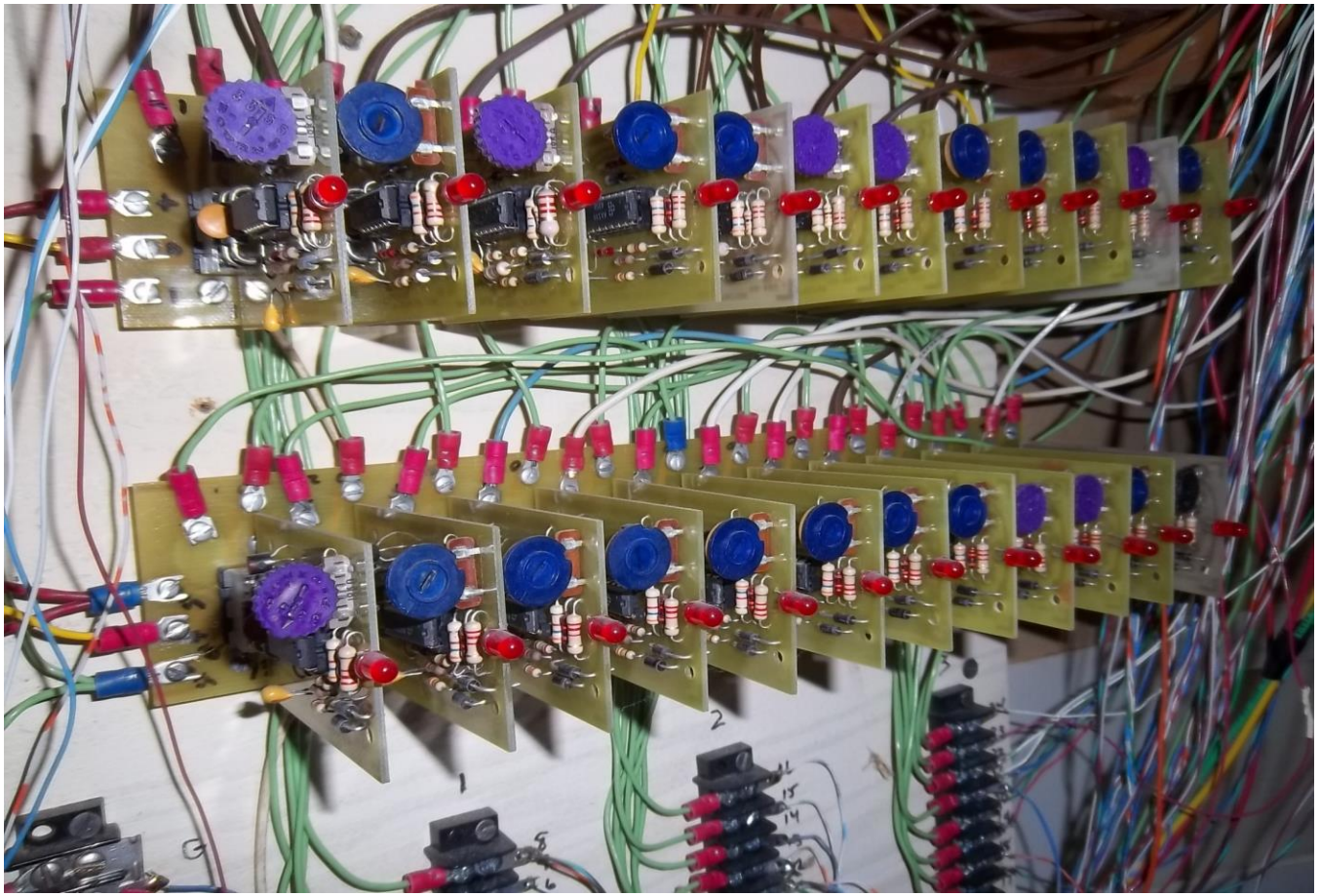




CAN USE DECODER ON DCC

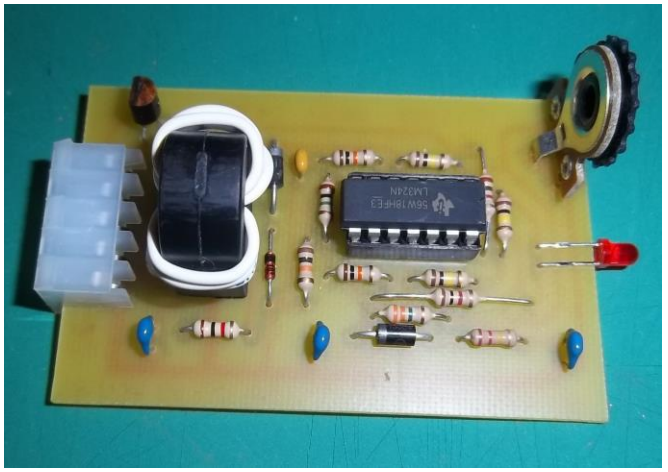
- DECODER USES 3 AMP DIODES
- DCC SUPPLIES 5 AMP OR MORE
- A SHORT WOULD DESTROY DIODES
- A BURNED OUT DIODE SHUTS DOWN SECTION
- USE DIODES WITH HIGHER CURRENT
- OR – USE LIGHT BULB TO LIMIT CURRENT
  - 1152 BULB 1.34 AMP
  - 1142 BULB 1.44 AMPS
  - 1156 BULB 2.10 AMPS *
  - 1157 BULB 2.68 AMPS (PARALLEL FILAMENTS)
  - 2-1152 BULBS 2.55 AMPS
  - 2-1142 BULBS 2.66 AMPS
  - 1156 + 1152 BULBS 3.44 AMPS
  - 2- 1156 BULBS 4.20 AMPS

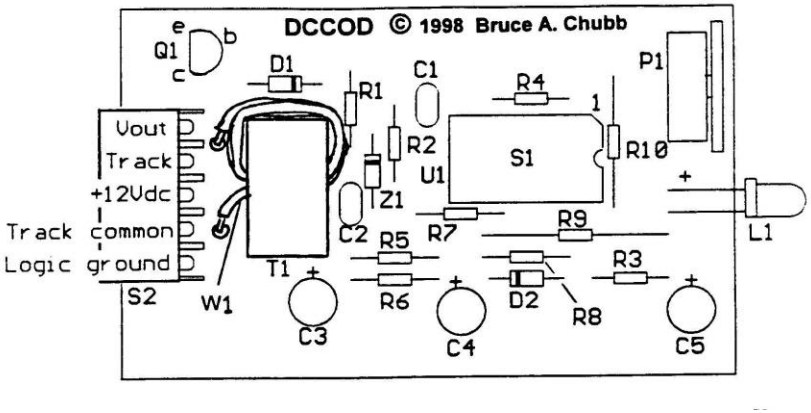
MOTHER BOARD AVAILABLE



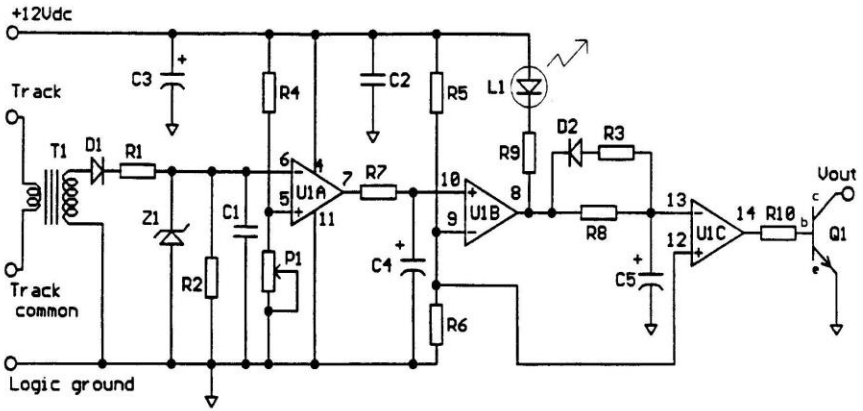
ANOTHER OPTION FOR DCC

- DCC IS AC NOT DC
- TRANSFORMER USED
- TRACK/LOGIC SEPARATE
- CHUBB'S DCCOD
- TRACK UP TO 20 AMPS
- OUTPUT 40V 200MA
- OTHER SUPPLIERS
- INPUT TO COMPUTER
- WITHOUT COMPUTER
- PC BOARD AVAILABLE

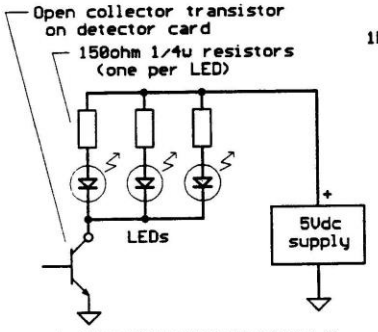




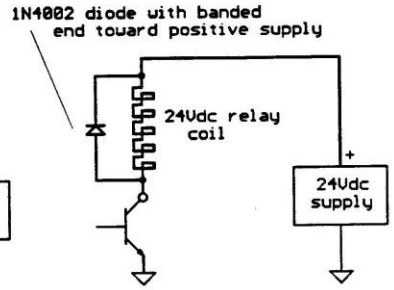
USING THE DCCOD



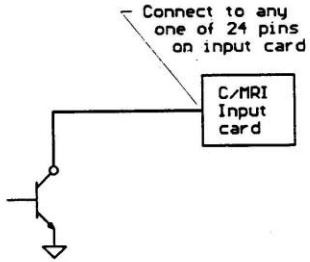
DCCOD © 1998 Bruce A. Chubb



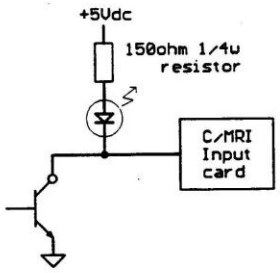
A. MULTIPLE LEDS IN PARALLEL



B. 24Vdc RELAY



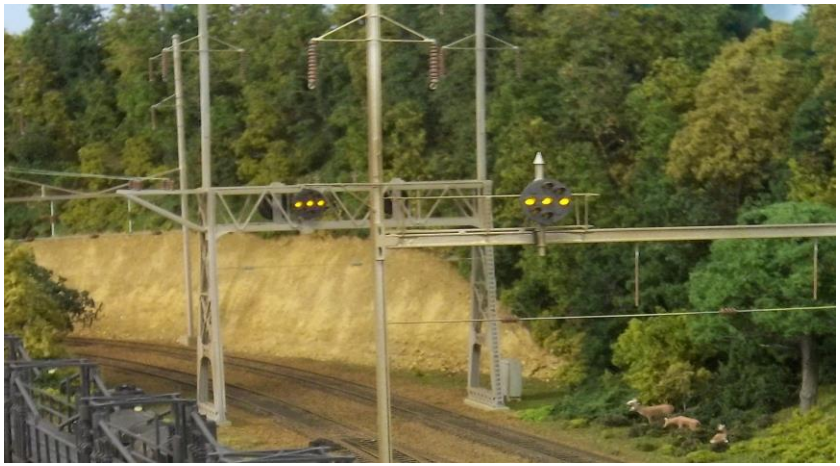
C. C/MRI INPUT CARD



D. LED AND INPUT CARD

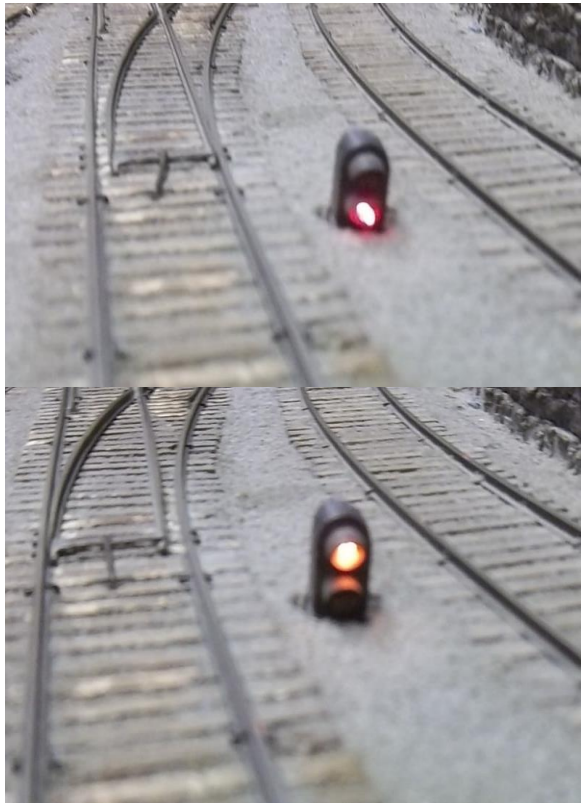
SIGNALS ADD TO LAYOUT

- MANUAL CONTROL
  - ENTER YARD, STAGING
  - CONTROL CROSSING
- TOWER OPERATORS
- TURNOUT INDICATION
- DISPATCHER
- COMPUTER CONTROL
  - JMRI PANEL PRO
- ON LAYOUT OR
- REPEATER PANEL



SIGNALS CAN SHOW SWITCH POSITION

- CONTACTS ON SWITCH MACHINE
- SIMPLE RED/GREEN OR RED/YELLOW
- COULD BE DWARF OR FULL SIZE SIGNAL
- EASY TO DO



PROTOTYPE SYSTEMS ARE COMPLEX

- ABSOLUTE BLOCK SIGNALS (ABS)
  - PROTECTS FOLLOWING TRAIN
  - NO PROTECTION FOR OPPOSING TRAIN
  - NUMBER PLATE MAKES RED PERMISSIVE
- ABSOLUTE PERMISSIVE BLOCK (APB)
  - PROTECTION FOR OPPOSING TRAIN BETWEEN SIDINGS
  - EXIT FROM SIDINGS NOT BY SIGNAL (BY TIMETABLE ETC)
- CENTRALIZED TRAFFIC CONTROL (CTC)
  - REQUIRES DISPATCHER OR COMPUTER
  - CONTROLS MAIN AND SIDINGS
  - CONTROLS OPPOSING TRAINS
  - OFTEN MULTIPLE HEAD SIGNALS – NEED RULE BOOK
- MORE INFO – CHUBB'S RMC ARTICLES

SIGNALS FOR MY LAYOUT

- CIRCUIT AVAILABLE FOR ABS SIGNALS
- USE DISPATCHER FOR OPPOSING PROTECTION
- USE DISPATCHER FOR MAIN LINE SIDINGS
- RED - NOT PERMISSIVE; STOP!!
- YELLOW - PREPARE TO STOP AT NEXT SIGNAL
- GREEN - 2 BLOCKS ARE CLEAR
- STAND ALONE SYSTEM - NO COMPUTER
- IF NO DISPATCHER – ABS WITH SIDING INDICATOR
- SIMPLE TO UNDERSTAND
- SIGNALS FOR SIDING USES TWO HEADS
- APPROACH LIGHTING NOT USED

OPTIONS FOR MY SIGNAL SYSTEM

- MAKE MY OWN SIGNALS
  - T1 LEDS, BRASS TUBING, BUY HEAD OR FABRICATE
  - 3 LIGHT (IN LINE, TRIAGULAR), SEARCHLIGHT
- USE CHUBB'S DETECTOR
  - OPTIMIZED DETECTOR FOR DC (NO DCC THEN)
  - CONVERTED TO DCC – USE SAME DETECTORS
  - INDICATE TRACK BLOCK OCCUPIED - NOT OPTICAL
  - INDICATE TURNOUT POSITION
  - OPTION FOR DISPATCHER INPUT FOR RED
- "NOT SO SIMPLE" 3 LIGHT CIRCUIT
  - SINGLE IC CIRCUIT OPERATES ON 5 VOLTS
  - RON PAISLEY WEB SITE

DIY SIGNALS

SIGNAL HEADS

- IHC 2 & 3 ASPECTS
- BRASS OR STYRENE – DIY
- COLOR LIGHT, TRICOLOR

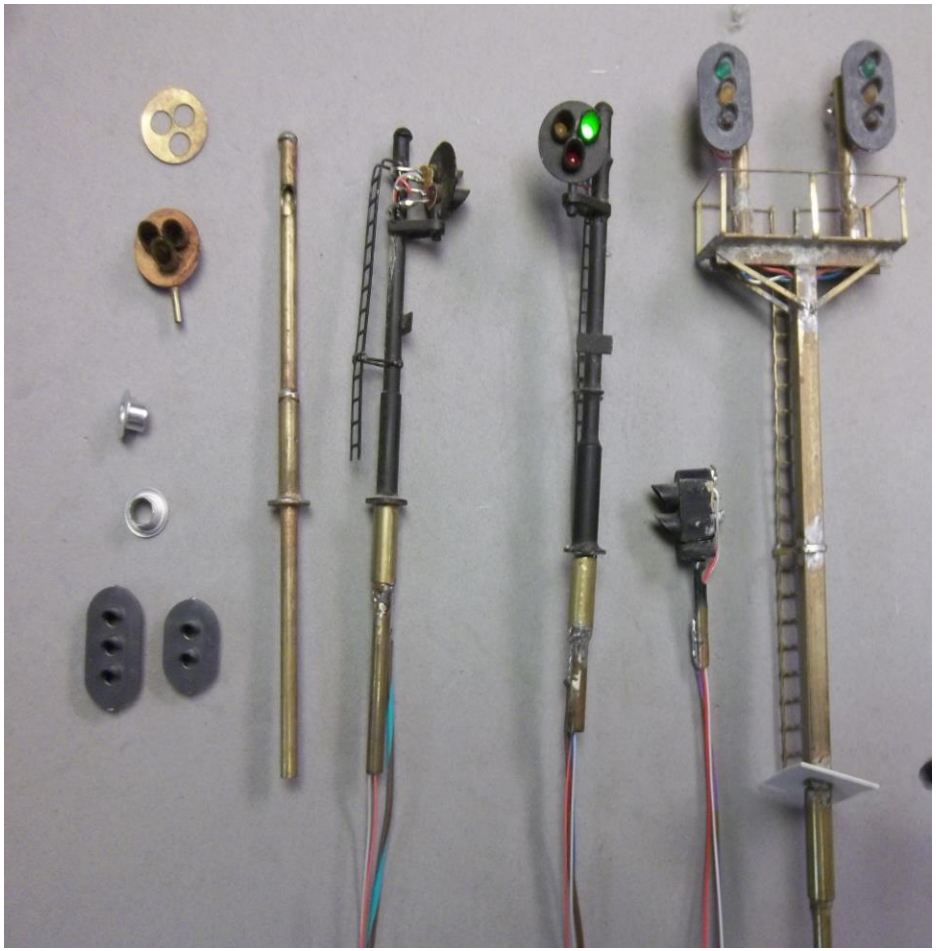
BRASS TUBING AND FITTINGS

LADDERSTOCK

- SIGNAL LADDER
- N GAUGE LADDER

T1 OR 1.8MM LEDS

- R,Y,G UPPER HEAD
- R,Y LOWER SIDING HEAD

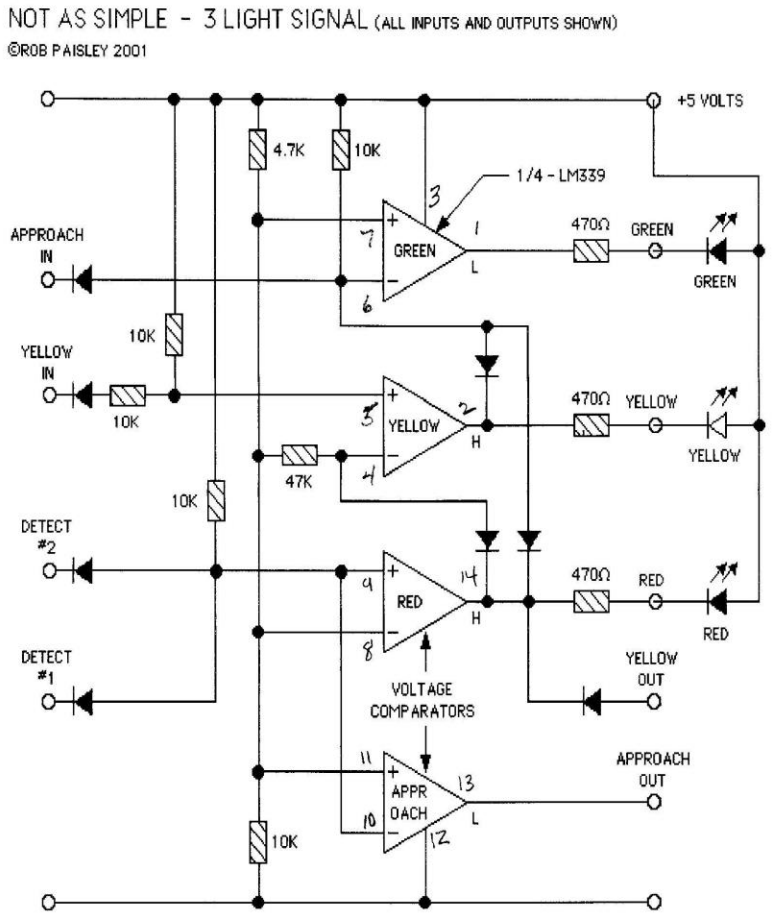


3 COLOR SIGNALS

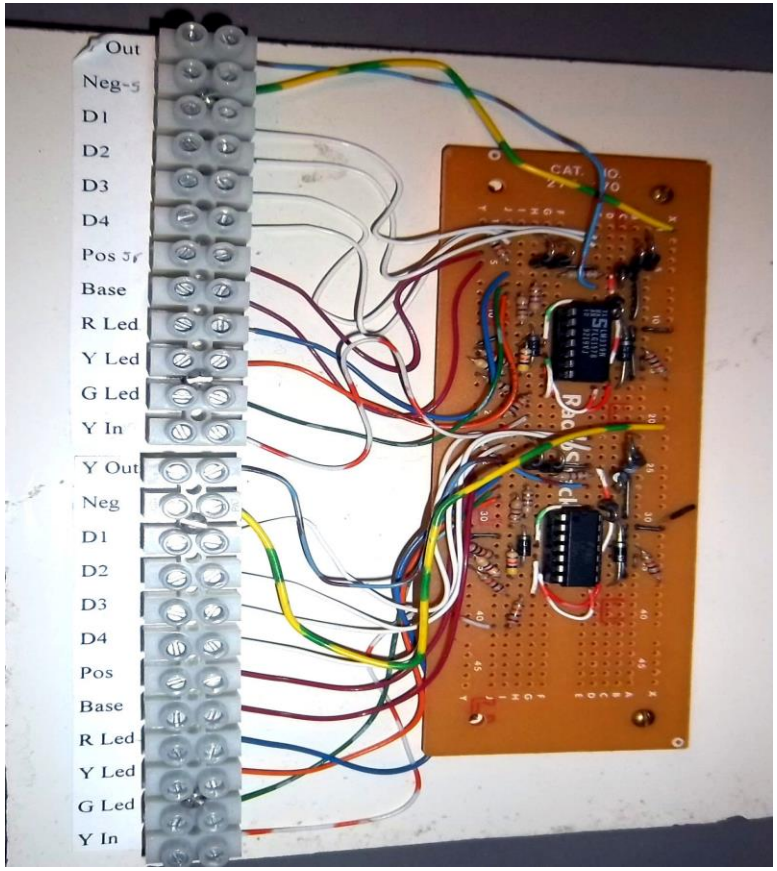
- 2 HEAD SIGNAL
  - USING IHC HEADS
  - T1 LEDS
  - UPPER HEAD – SET FOR MAIN
  - LOWER HEAD - SIDING
- SIGNAL BRIDGE
  - SIDING INTO MAIN
  - 2 HEADS – 1 EACH TRACK
  - SET FOR MAIN –GREEN
  - SIDING - RED

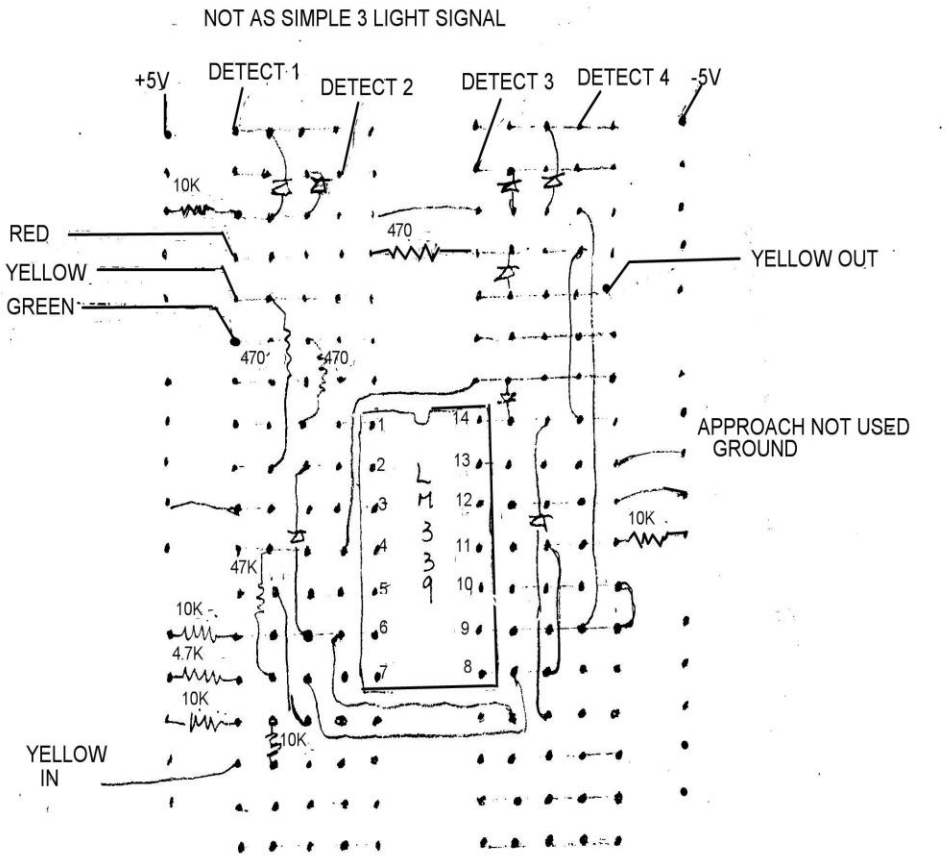
PAISLEY'S CIRCUIT FOR SIGNALS

- NOT AS SIMPLE 3 LIGHT SIGNAL
- USES 1 LM339 IC COMPARATOR
- 9 RESISTORS
- 8 DIODES
- APPROACH –NOT USED
- GROUND DETECT–RED SIGNAL
- 2 ADDED DETECT INPUTS
- YELLOW IN FROM NEXT BLOCK
- 5 VOLT INPUT
- MOUNT ON PC BOARD
- 2 CIRCUITS PER BOARD



PRINTED CIRCUIT BOARD





SEARCHLIGHT SIGNALS REQIURE A DIFFERENT APPROACH

- DEPENDS ON LEDS USED
  - BICOLOR 2 LEADS T1 OR 1.8MM LEDS
  - BICOLOR 3 LEADS T1 OR 1.8MM LEDS
  - RYG SMD LED 4 LEADS

- NOT SO SIMPLE CIRCUIT OK FOR RYG SMD

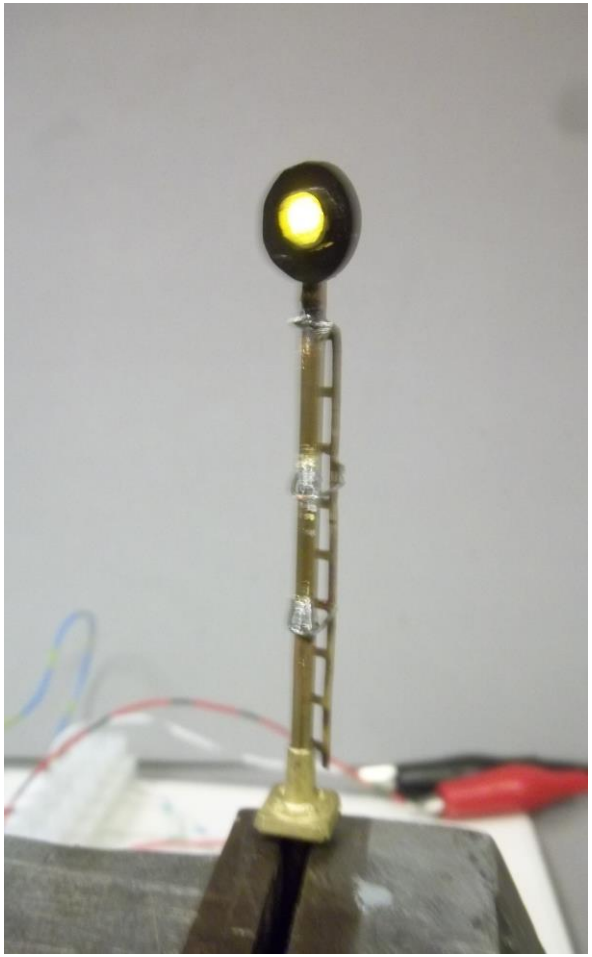
- NEW PAISLEY 3 TRANSITOR CIRCUIT FOR 3 LEAD BICOLOR
  - REQUIRES BOTH RED & GREEN ON FOR YELLOW
  - ADJUST RESISTANCE ON RED, GREEN FOR BEST YELLOW
  - YELLOW LEAVES SOMETHING TO BE DESIRED
  - SOMETIMES CAN SEE RED & GREEN SPOTS

SEACHLIGHT SIGNAL IS EASY TO CONSTRUCT

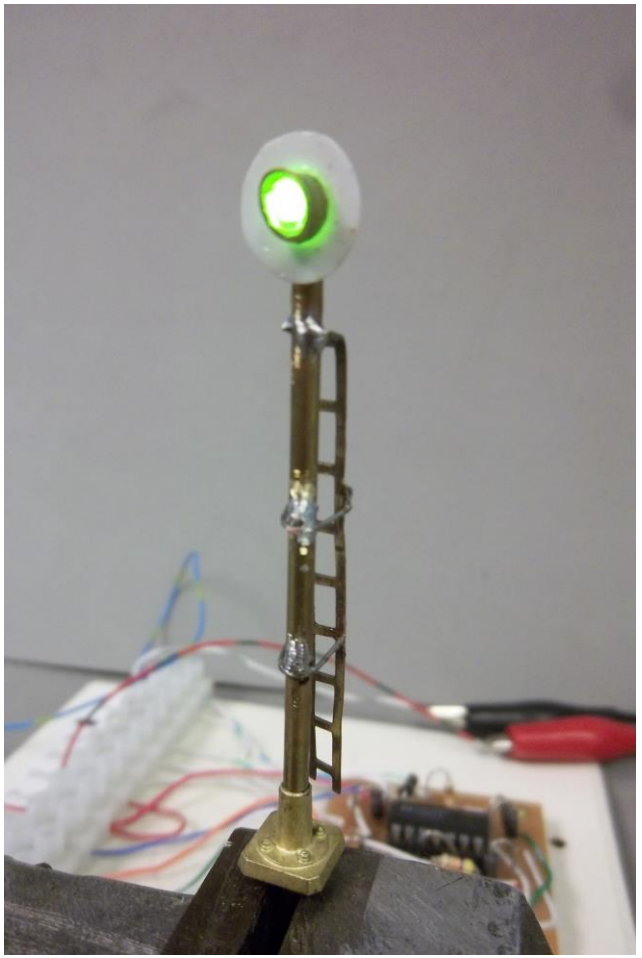
- 3/32 ROUND TUBING FOR MAST
- 1/8 ROUND TUBING FOR LOWER MAST
- 3/16 SQUARE FOR BASE
- SOLDER WIRE FOR ANODE TO LOWER MAST
- SOLDER LADDER STOCK TO MAST
- COMMON ANODE 3 LEAD RED/GREEN LED
- GROVE TOP OF 3/32 TUBE FOR CENTER LEAD
- SOLDER CENTER LEAD OF LED TO MAST
- SOLDER WIRE WRAP WIRE TO OTHER 2 LEADS
- PUNCH OUT 1/2” STYRENE DISC WITH 1/8” HOLE
- CUT I/8 STRAW FOR VISOR
- RUN WIRES DOWN THRU MAST

SEARCHLIGHT SIGNAL USING RYG LED

- SOLDER 4 LEADS ON LED
- PULL THROUGH TUBE
- GLUE LED TO TOP OF TUBE
- GLUE LENS TO LED
- STYRENE FOR TARGET
  - 1/2IN FOR DISC
  - 1/8IN HOLE FOR LENS
- 1/8IN STRAW FOR VISOR
- NOT AS SIMPLE CIRCUIT
- LED, LENS FROM MOUSER
- BETTER YELLOW COLOR



SEARCHLIGHT SIGNALS



LEDS HAVE MANY USES

- AT FIRST, HEADLIGHTS AND PANELS
- NOW, MORE AND MORE USES
- SMD LEDS ADDED NEW USES
- FACEBOOK HAS MANY VIDEOS
- PRACTICE UNTIL YOU CAN DO IT
- TEST AS YOU GO
- BUY EXTRA – MAY LOSE, DESTROY SOME