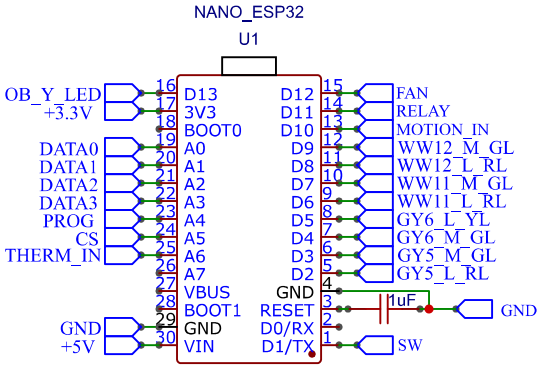
Railroad Signal Controller

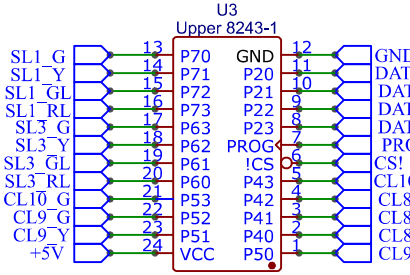
Nano ESP32 Board

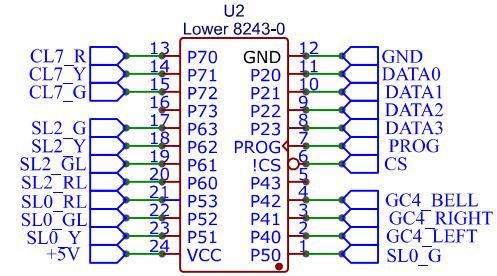


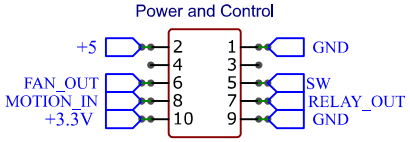
ESP32 Reset Circuit

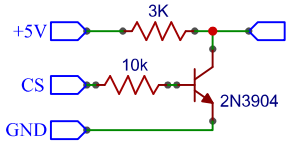
Nano ESP32 Board has a 5k pull up from RESET to +3.3V

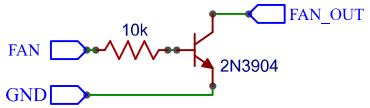
MOTION

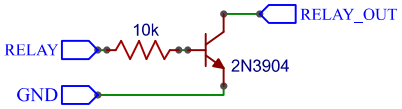




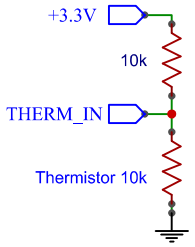


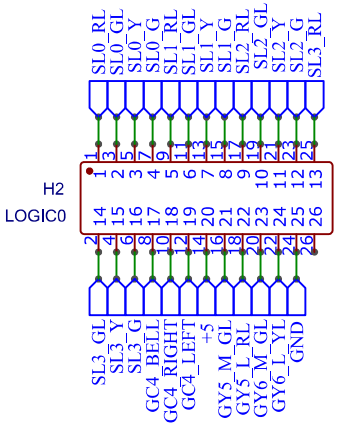


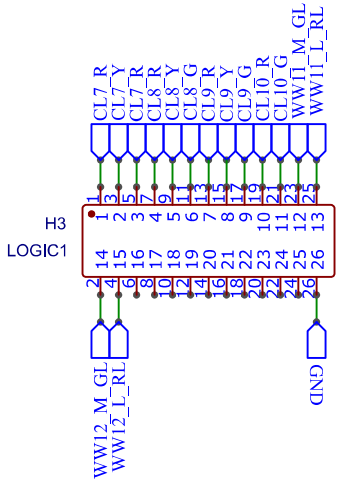




Relay is mechanical.
Inputs are +5, Gnd and
RELAY_OUT (active low).

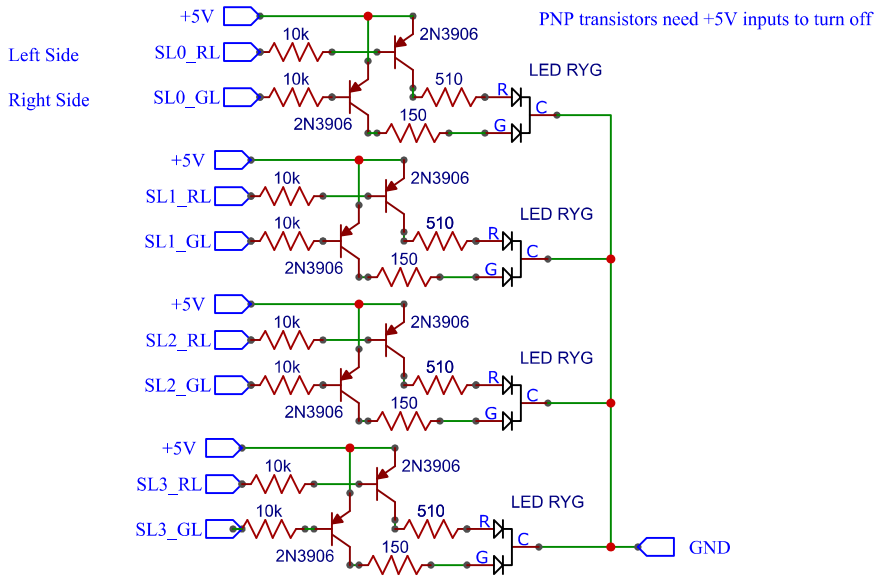


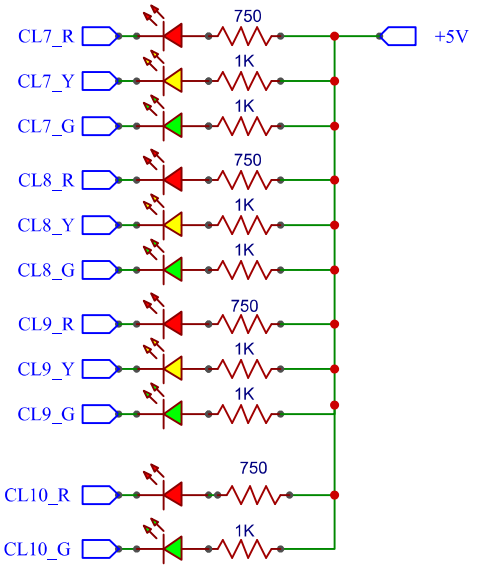


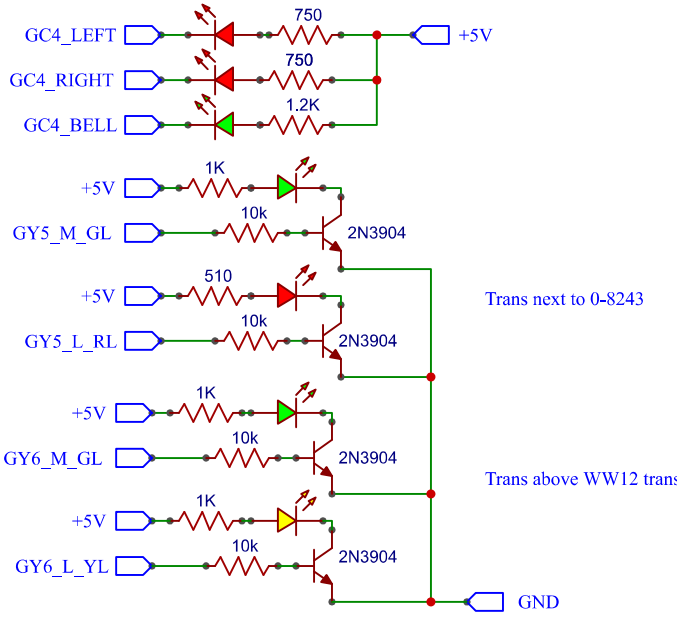


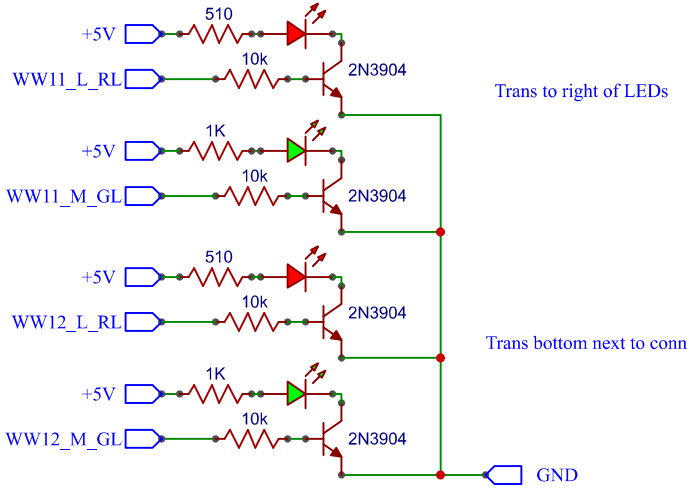
TITLE: Railroad Signal Controller		REV: 2.0
EasyEDA	Company: John Wolfe	Sheet: 1/7
	Date: 2025-03-24 Drawn By: jpwolfe31	

LED indicators

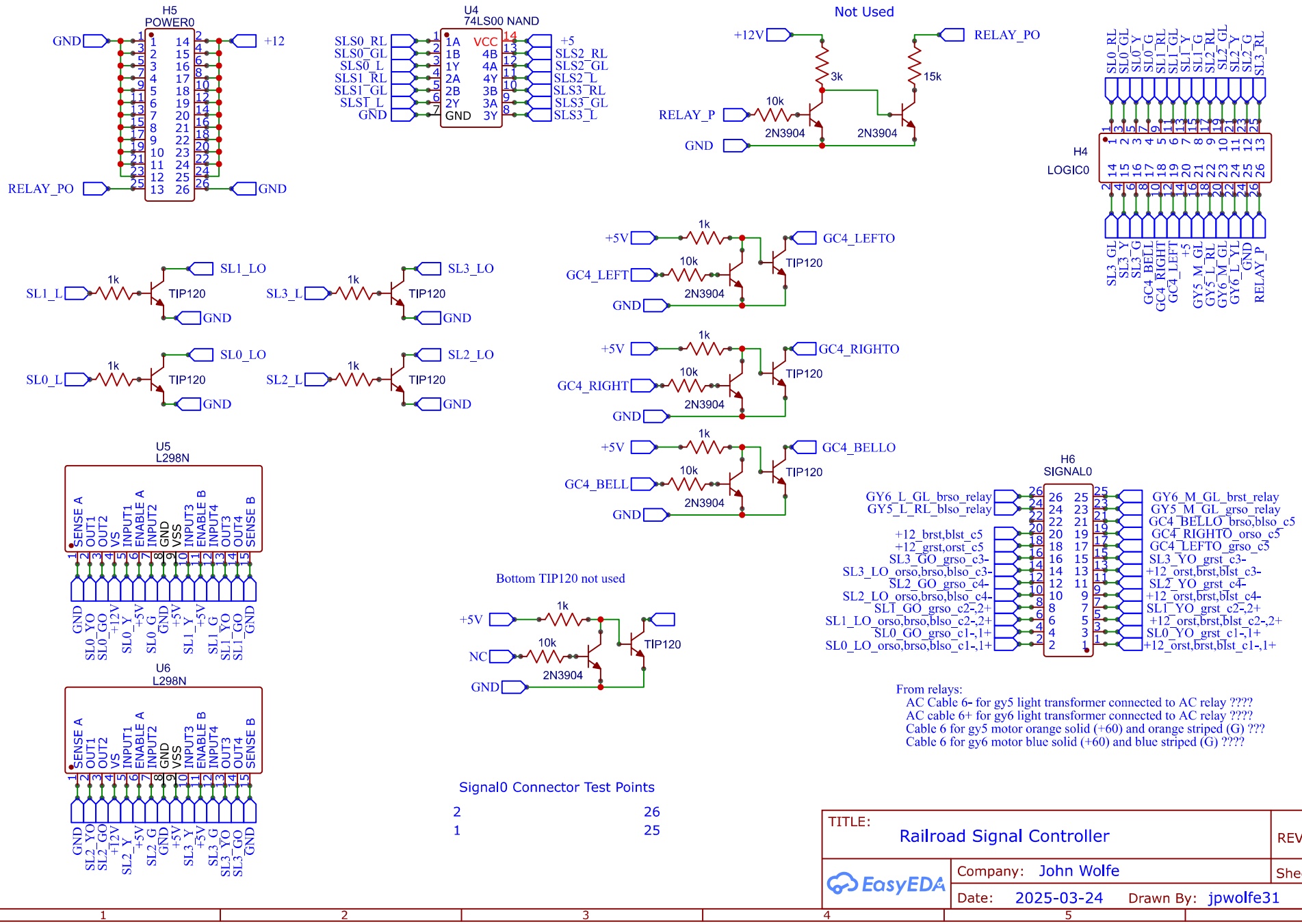


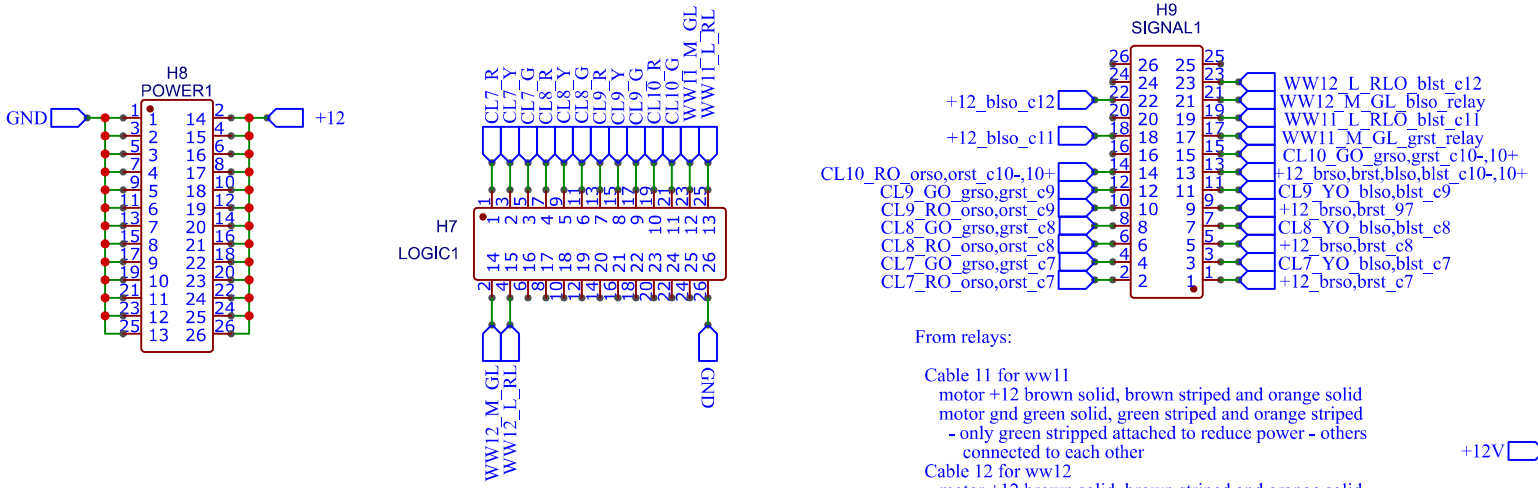






TITLE: Railroad Signal Controller		REV: 2.0
EasyEDA	Company: John Wolfe	Sheet: 2/7
	Date: 2025-03-24 Drawn By: jpwolfe31	

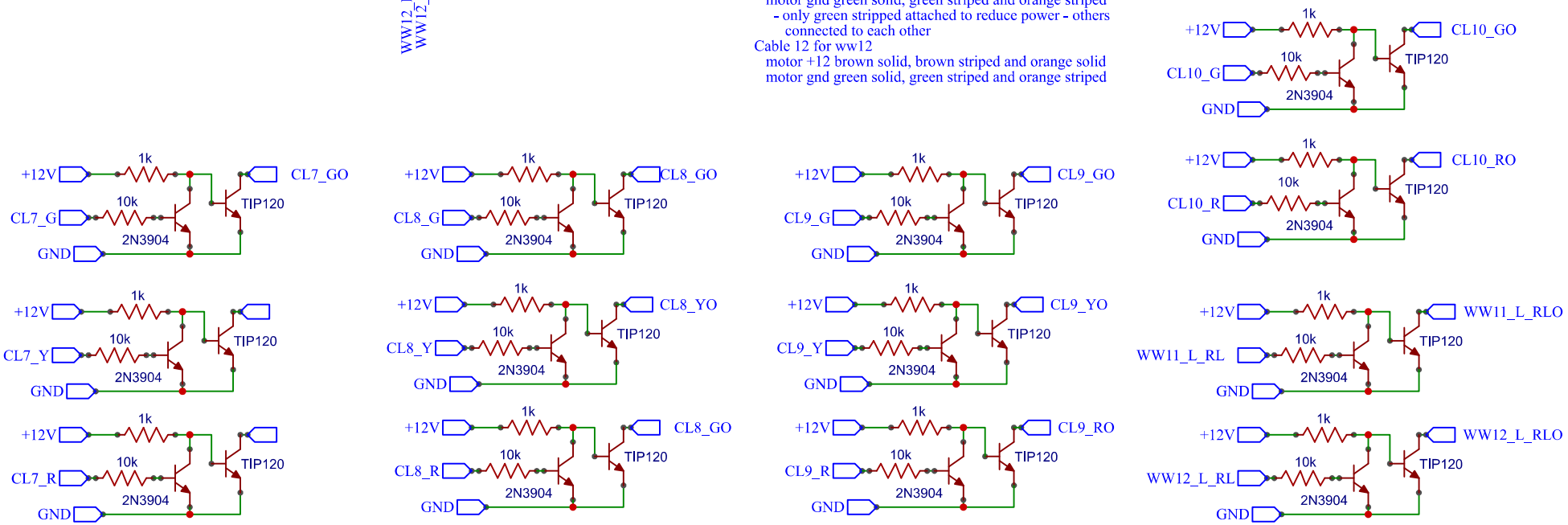

H5
POWER0
GND
+12
RELAY_PO
GND
U4
74LS00 NAND
SLS0_RL
SLS0_GL
SLS0_L
SLS1_RL
SLS1_GL
SLS1_L
GND
1A
1B
1Y
2A
2B
2Y
VCC
4B
4A
4Y
3B
3A
3Y
+5
SLS2_RL
SLS2_GL
SLS2_L
SLS3_RL
SLS3_GL
SLS3_L
Not Used
+12V
RELAY_PO
3k
15k
10k
RELAY_P
2N3904
2N3904
GND
H4
LOGIC0
SL0_RL
SL0_GL
SL0_Y
SL0_G
SL1_RL
SL1_GL
SL1_Y
SL1_G
SL2_RL
SL2_GL
SL2_Y
SL2_G
SL3_RL
SL3_GL
SL3_Y
SL3_G
GC4_BELL
GC4_RIGHT
GC4_LEFT
+5
GY5_M_GL
GY5_L_RL
GY6_M_GL
GY6_L_YL
GND
RELAY_P
SL1_LO
SL1_L
1k
TIP120
GND
SL3_LO
SL3_L
1k
TIP120
GND
SL0_LO
SL0_L
1k
TIP120
GND
SL2_LO
SL2_L
1k
TIP120
GND
+5V
1k
GC4_LEFTO
GC4_LEFT
10k
2N3904
TIP120
GND
+5V
1k
GC4_RIGHTO
GC4_RIGHT
10k
2N3904
TIP120
GND
+5V
1k
GC4_BELLO
GC4_BELL
10k
2N3904
TIP120
GND
U5
L298N
SENSE A
OUT1
OUT2
VS
INPUT1
ENABLE A
INPUT2
GND
VSS
INPUT3
ENABLE B
INPUT4
OUT3
OUT4
SENSE B
GND
SL0_YO
SL0_GO
+12V
SL0_Y
-5V
SL0_G
GND
+5V
SL1_Y
+5V
SL1_G
SL1_YO
SL1_GO
GND
U6
L298N
SENSE A
OUT1
OUT2
VS
INPUT1
ENABLE A
INPUT2
GND
VSS
INPUT3
ENABLE B
INPUT4
OUT3
OUT4
SENSE B
GND
SL2_YO
SL2_GO
+12V
SL2_Y
+5V
SL2_G
GND
+5V
SL3_Y
+5V
SL3_G
SL3_YO
SL3_GO
GND
Bottom TIP120 not used
+5V
1k
NC
10k
2N3904
TIP120
GND
H6
SIGNAL0
GY6_L_GL_brso_relay
GY5_L_RL_blso_relay
+12_brst,blst_c5
+12_grst,orst_c5
SL3_GO_grso_c3-
SL3_LO_orso,brso,blso_c3-
SL2_GO_grso_c4-
SL2_LO_orso,brso,blso_c4-
SL1_GO_grso_c2-,2+
SL1_LO_orso,brso,blso_c2-,2+
SL0_GO_grso_c1-,1+
SL0_LO_orso,brso,blso_c1-,1+
GY6_M_GL_brst_relay
GY5_M_GL_grso_relay
GC4_BELLO_brso,blso_c5
GC4_RIGHTO_orso_c5
GC4_LEFTO_grso_c5
SL3_YO_grst_c3-
+12_orst,brst,blst_c3-
SL2_YO_grst_c4-
+12_orst,brst,blst_c4-
SL1_YO_grst_c2-,2+
+12_orst,brst,blst_c2-,2+
SL0_YO_grst_c1-,1+
+12_orst,brst,blst_c1-,1+
From relays:
AC Cable 6- for gy5 light transformer connected to AC relay ????
AC cable 6+ for gy6 light transformer connected to AC relay ????
Cable 6 for gy5 motor orange solid (+60) and orange striped (G) ???
Cable 6 for gy6 motor blue solid (+60) and blue striped (G) ????
Signal0 Connector Test Points
2
1
26
25
TITLE:
Railroad Signal Controller
REV: 2
EasyEDA
Company: John Wolfe
Sheet: 3/7
Date: 2025-03-24
Drawn By: jpwolfe31



From relays:

Cable 11 for ww11
motor +12 brown solid, brown striped and orange solid
motor gnd green solid, green striped and orange striped
- only green stripped attached to reduce power - others connected to each other

Cable 12 for ww12
motor +12 brown solid, brown striped and orange solid
motor gnd green solid, green striped and orange striped

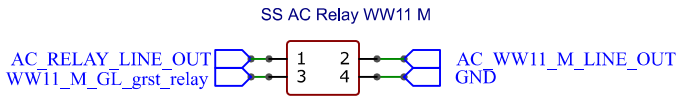


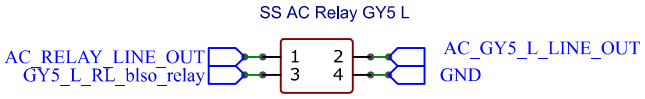
Signal1 Connector Test Points

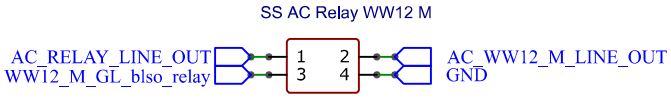
2	26
1	25

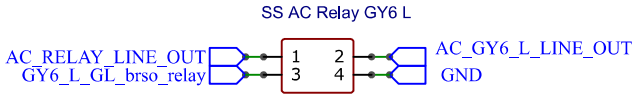
TITLE: Railroad Signal Controller		REV: 2.0
EasyEDA	Company: John Wolfe	Sheet: 4/7
	Date: 2025-03-27 Drawn By: jpwolfe31	

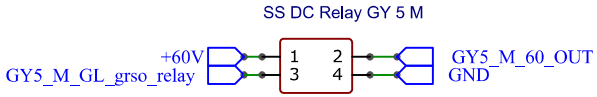
Signal Cabinet

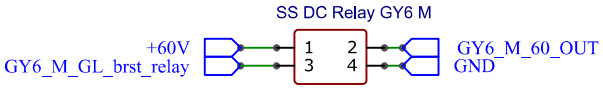


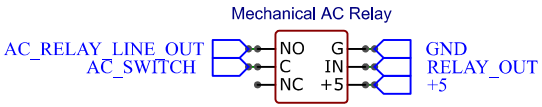


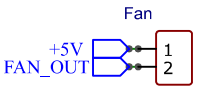


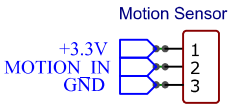


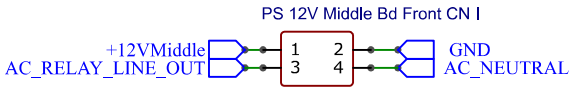


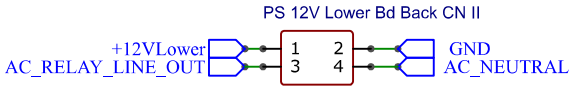


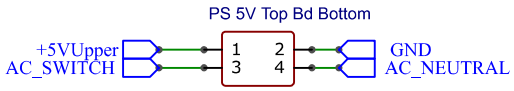


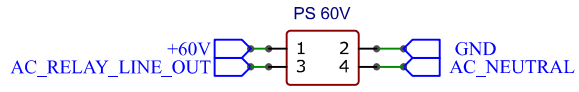


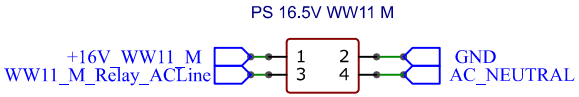


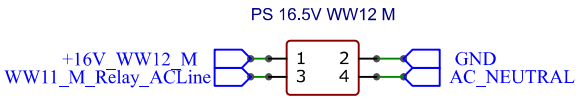


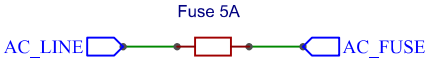


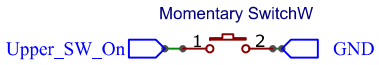


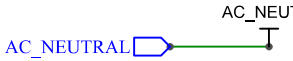


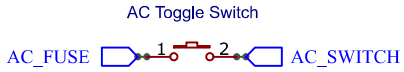












TITLE: Railroad Signal Controller		REV: 2.0
EasyEDA	Company: John Wolfe	Sheet: 5/7
	Date: 2025-03-27 Drawn By: jpwolfe31	

Grade crossing drivers

signal drives 3904 npn through 10K resistor
collector of 3904 connected to +5 through 1K resistor
and to base of TIP 120 such that low level on npn
causes TIP 120 to turn on

Semaphore driver

input taken from searchlight signal output
yellow-green inputs on internal unit with diode
so semaphore only operative when searchlight signal
is green

Gyralight driver

driver signals taken from 3904 npn collector for the leds
for the light, the driver takes the diode of the AC relay
to ground with the other side of the diode tied to +12
this provides AC to a dimmer and then a 12V transformer
which powers the light bulb
the motor is driven similarly through a DC relay which
provides 60V DC to the motor

Color light driver

signal drives 3904 npn through 10K resistor
collector of 3904 connected to +5 through 1K resistor
and to base of TIP 120 such that low level on npn
causes TIP 120 to turn on
additional signals can be added in parallel by adding TIP120s

Wigwag driver

driver signals taken from 3904 npn collector for the leds
for the light, collector of 3904 connected to +5 through 1K
resistor and to base of TIP 120 such that low level on npn
causes TIP 120 to turn on
for the motor, the driver takes the diode of AC relay
to ground with the other side of the diode tied to +12
this turns on a 16V IBM PC power supply that powers the
motor directly

Solid state relays (mounted near top of cabinet left to right)

gy5 motor 60 volt DC green solid
ww11 AC green striped
ww12 AC blue solid
gy5 light AC blue striped
gy6 light AC brown solid
gy6 motor 60 volt DC brown striped
AC ON mechanical relay white

Power supplies

5 volt for top logic board
12 volt for middle board driving sl, gc and gy signals
12 volt for bottom board driving cl and ww signals
60 volt for gy5 and gy6 motors
16 volt IBM ps for ww11
16 volt IBM ps for ww12
(Note - 12 volt power supply for bottom board at its maximum.
Resistor in CLS9 adjusted to lower power requirements.)
(Note - 12 volt supplies turn on faster than 5 volt supply.
Therefore, all lights are illuminated at once on start up
unless Nano-ESP32 delays applying AC to PSs. Puts stress
on start up of 12 volt supply powering the color light signals.)

TITLE: Railroad Signal Controller		REV: 2.0
EasyEDA	Company: John Wolfe	Sheet: 6/7
	Date: 2025-03-31 Drawn By: jpwolfe31	

Signal Locations in Garage (left to right from signal box)

CL10 Unilens Dwarf (CL10- cable)
SL2 USS Searchlight H5 Dwarf ( )??
CL9 Color light Three Aspect Triangle (CL9 cable)
SL0 GRS SA Searchlight (first signal) (top) (SL1 + cable) ??
CL10 Color light two aspect homemade (bottom) (CL10+ cable)
SL2 USS Searchlight H Dwarf with Phankill (SL4- cable)
GC4 Grade crossing signal and bell (GC5 Cable)
SL1 USS Search light H2 Unit on workbench (SL2+ cable)
WW11 WRRS Wigwag (11 cable)
SL0 USS Searchlight H2 (top) (SL1- cable) ??
SL1 USS Searchlight H2 (bottom) (SL2- cable) ??
WW12 Magnetic Flagman Wigwag (12 cable)
GY5 Gyralight red (top) (6 cable, AC 6- cable)
GY6 Gyralight white (bottom) (6 cable, AC 6+ cable)
SL3 Wayside signal (SL3+ cable) (from SL3- with diode) (green arm down)
SL3 USS Searchlight H2 Dwarf (SL3-)
CL7 Color light Three Aspect Triangle (CL7 cable)
CL8 Color light Three Aspect (CL8 cable)

TITLE: Railroad Signal Controller		REV: 2.0
EasyEDA	Company: John Wolfe	Sheet: 7/7
	Date: 2025-03-27 Drawn By: jpwolfe31	