

# 2-Lane RC Car Drag Race Timer

## Version 3

This timer design is intended for those who wish to replicate the features of a professional drag race system into their 1/10 scale RC car straight line drag race track. It incorporates functions that mimic electronic timing systems associated with professional drag strips including:

- A functional Light Tree (Christmas Tree)
- Vehicle staging with Christmas Tree indication\*
- Measurement/Display of reaction time, 6 Ft time, 66 Ft time, speed, elapsed time & Overall time
- Selectable Standard/Professional/Street Outlaw Tree Operation
- Selectable Manual/Auto start timing
- Selectable 1 or 2 Racer Mode
- Winner indication on Light Tree
- Generation & printout of Time Slips at conclusion of each race

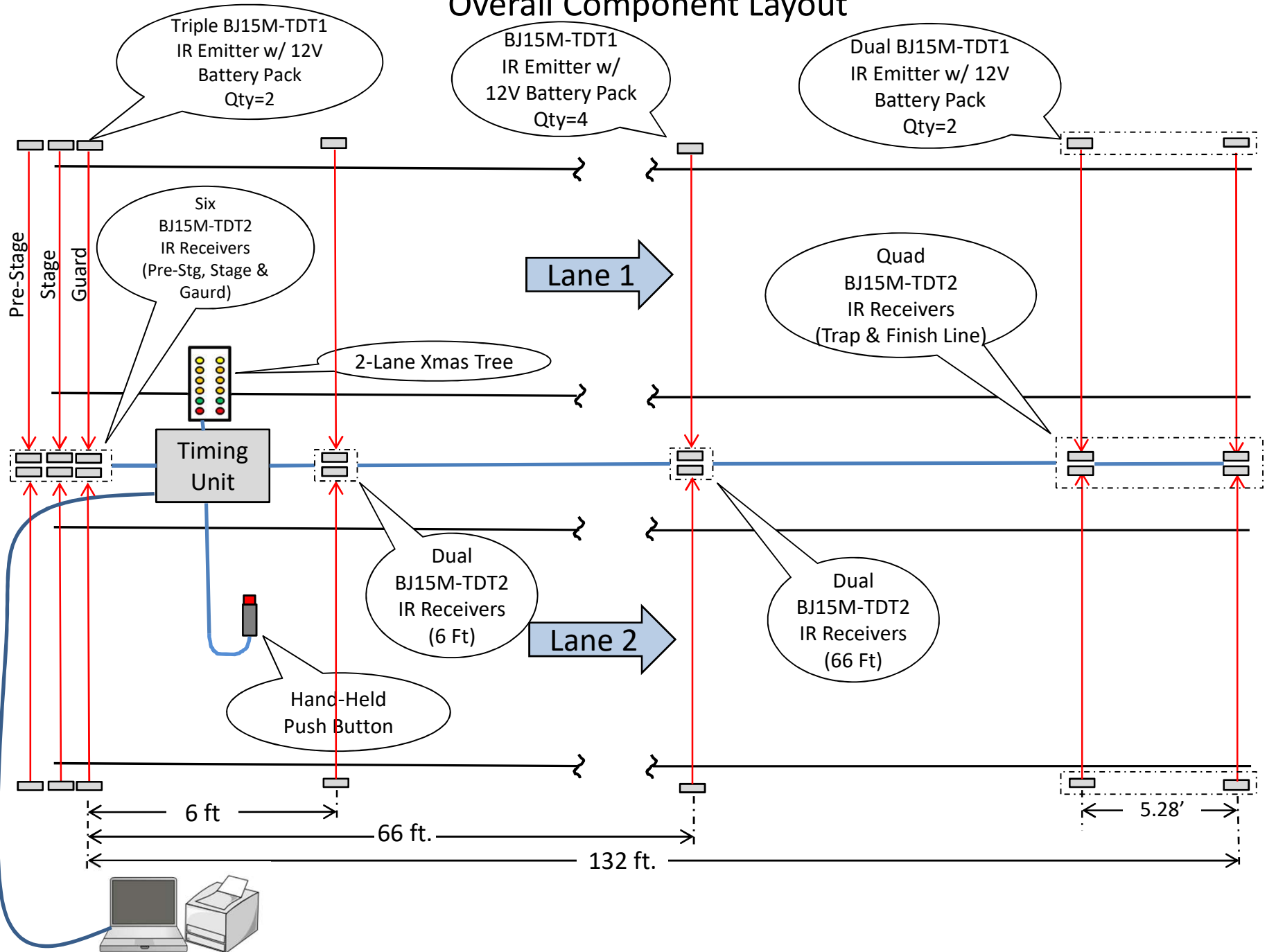
\*Note: Many RC cars do not have adequate chassis/ground clearance to permit start line staging based on front wheel position. Hence, this version uses the car's body to detect its position for pre-stage and stage indications. A "guard" beam positioned about 1" forward of the stage beam is used to detect when the car leaves the start line.

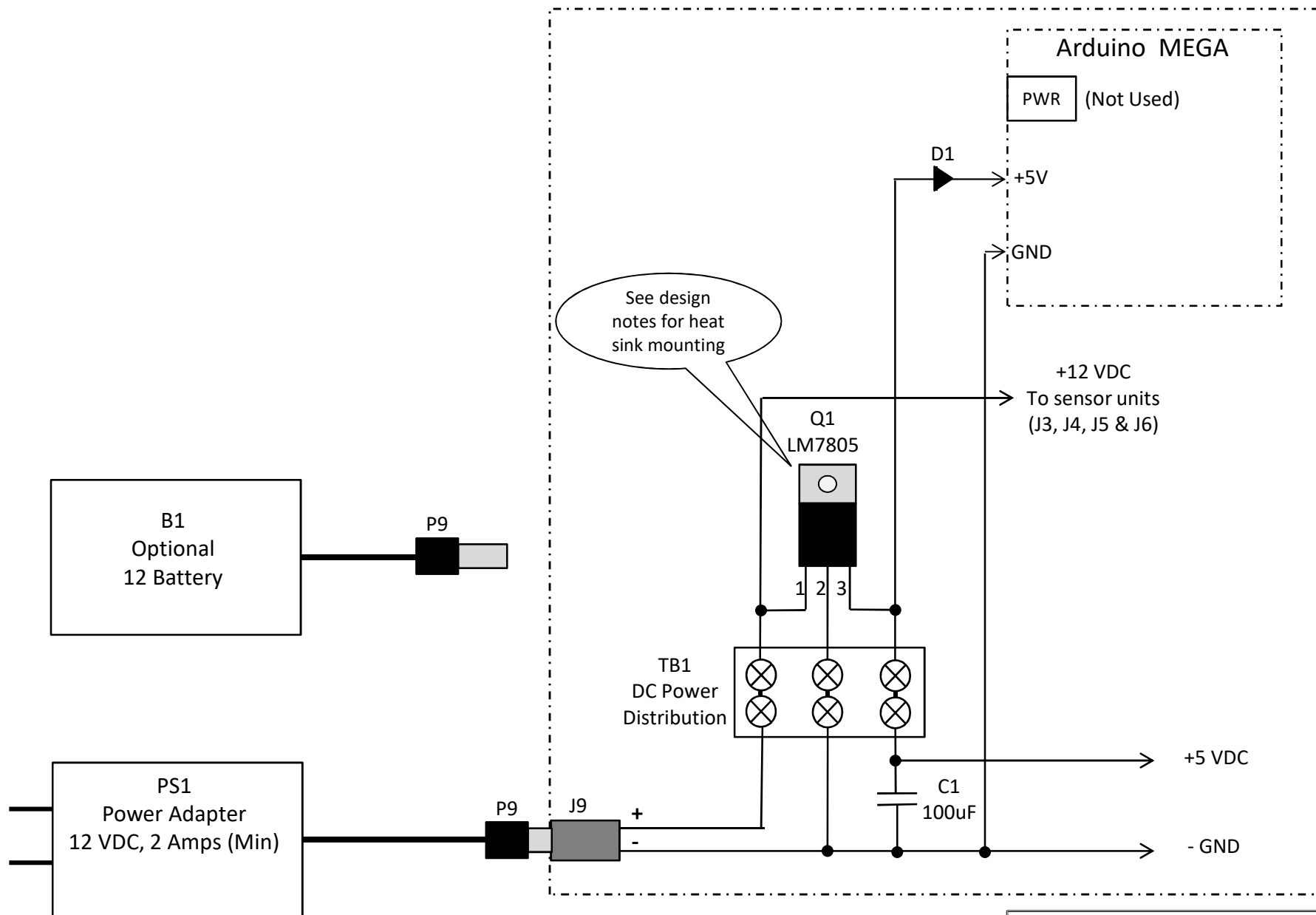
This version uses the Autonics™ BJ15M-TDT Through Beam photo electric sensor (<https://www.autoniconline.com/>) for the Pre-Stage, Stage, 6 Ft, 66 Ft, Trap and Finish line sensor positions.

Relays drive the "User provided" Light Tree (Christmas Tree) and can accommodate any lamp type from 100 Watt incandescent lamps to low power LEDs.

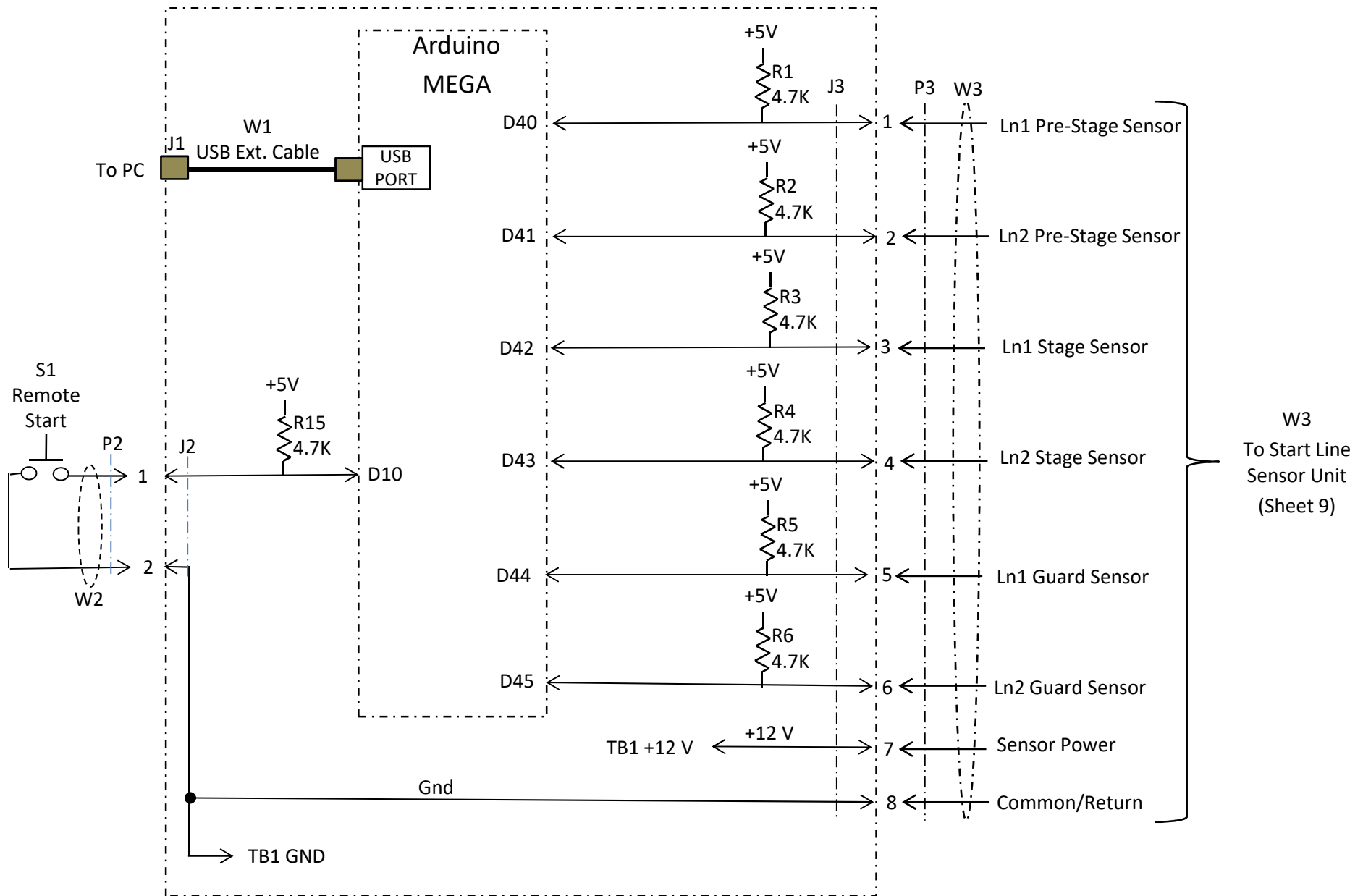
A PC running the provided race management software is required to control the timer and print time slips.

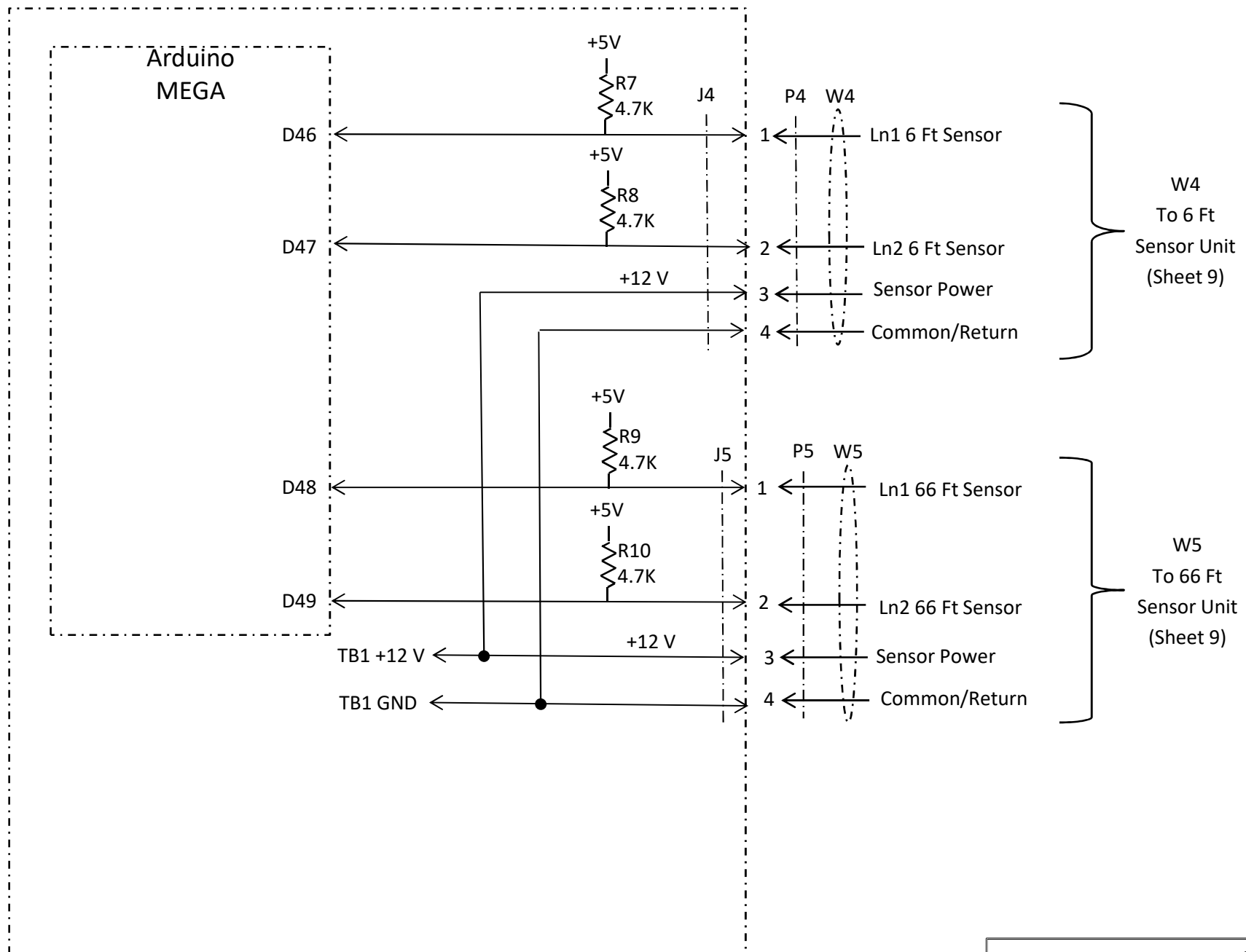
# Overall Component Layout

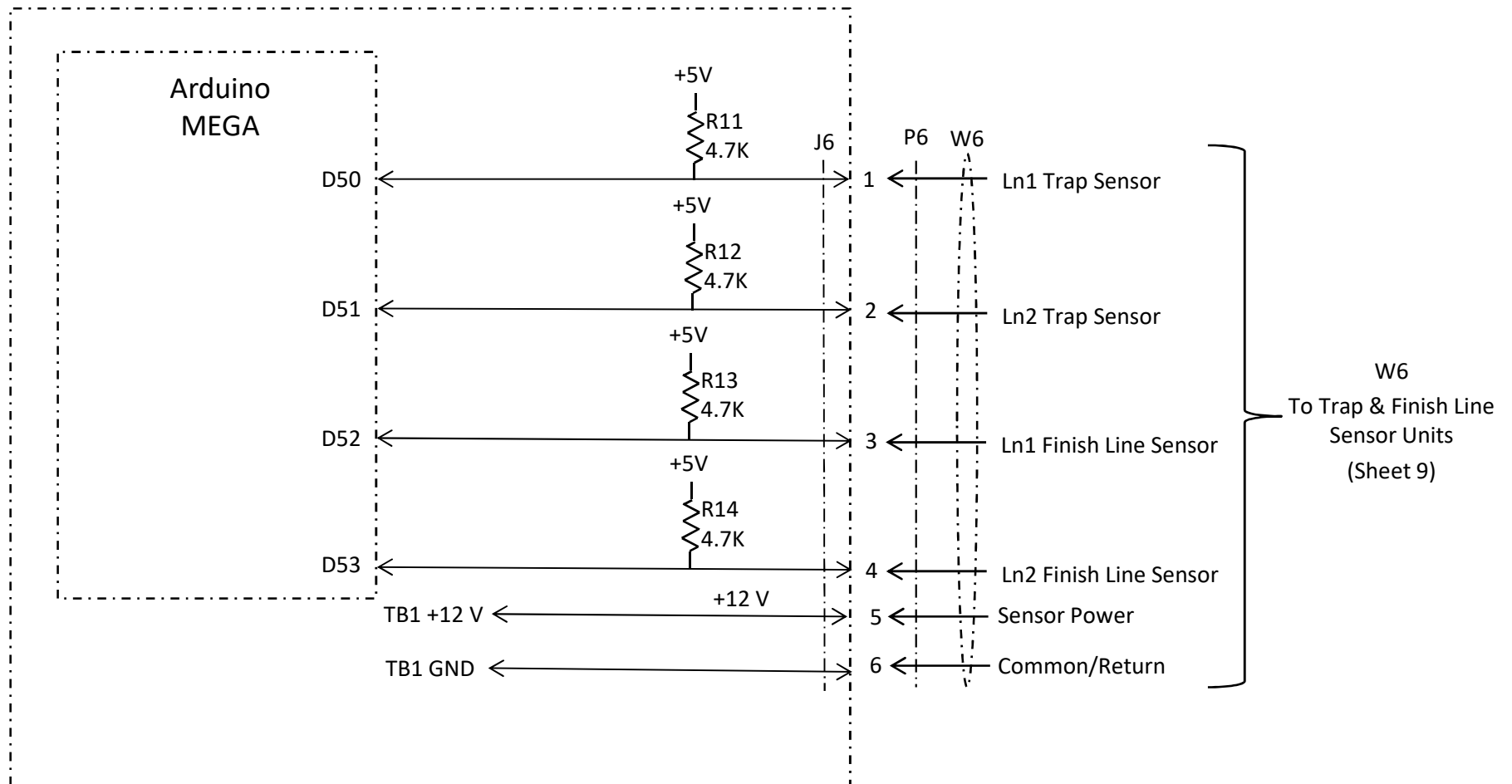


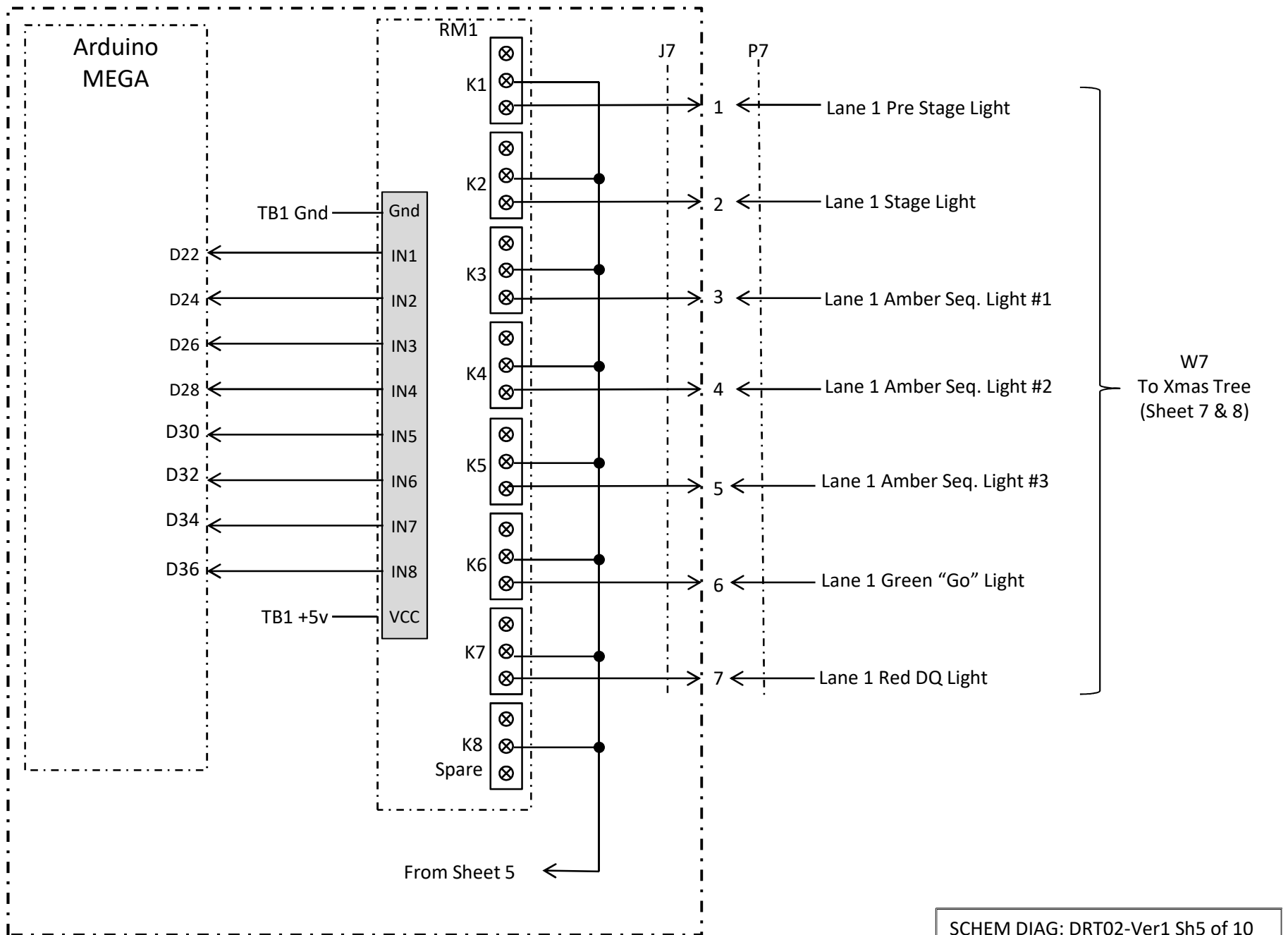


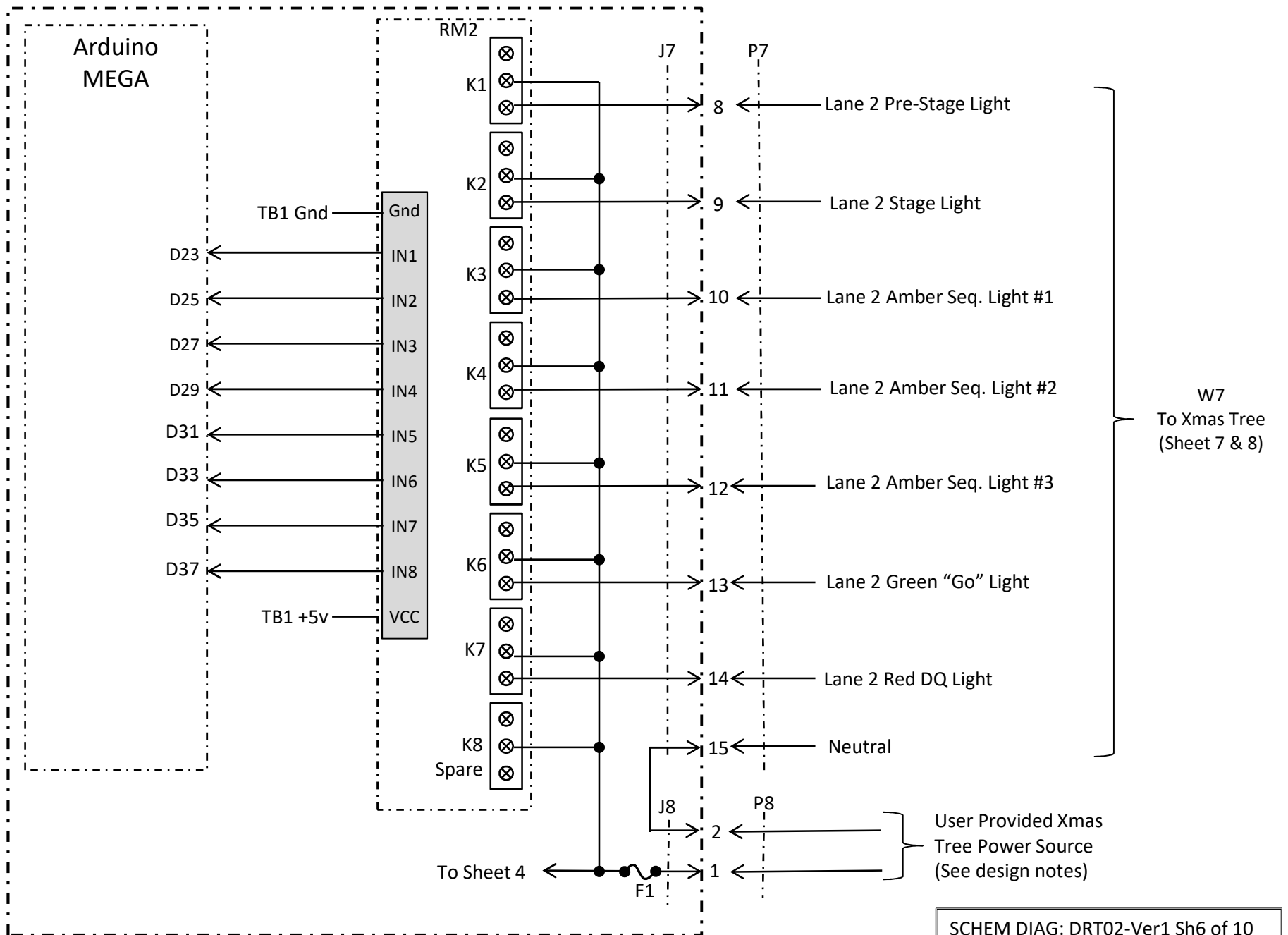
SCHEM DIAG: DRT02-Ver1 Sh1 of 10  
Designed by: W. van Leeuwen  
Email: billv923@outlook.com





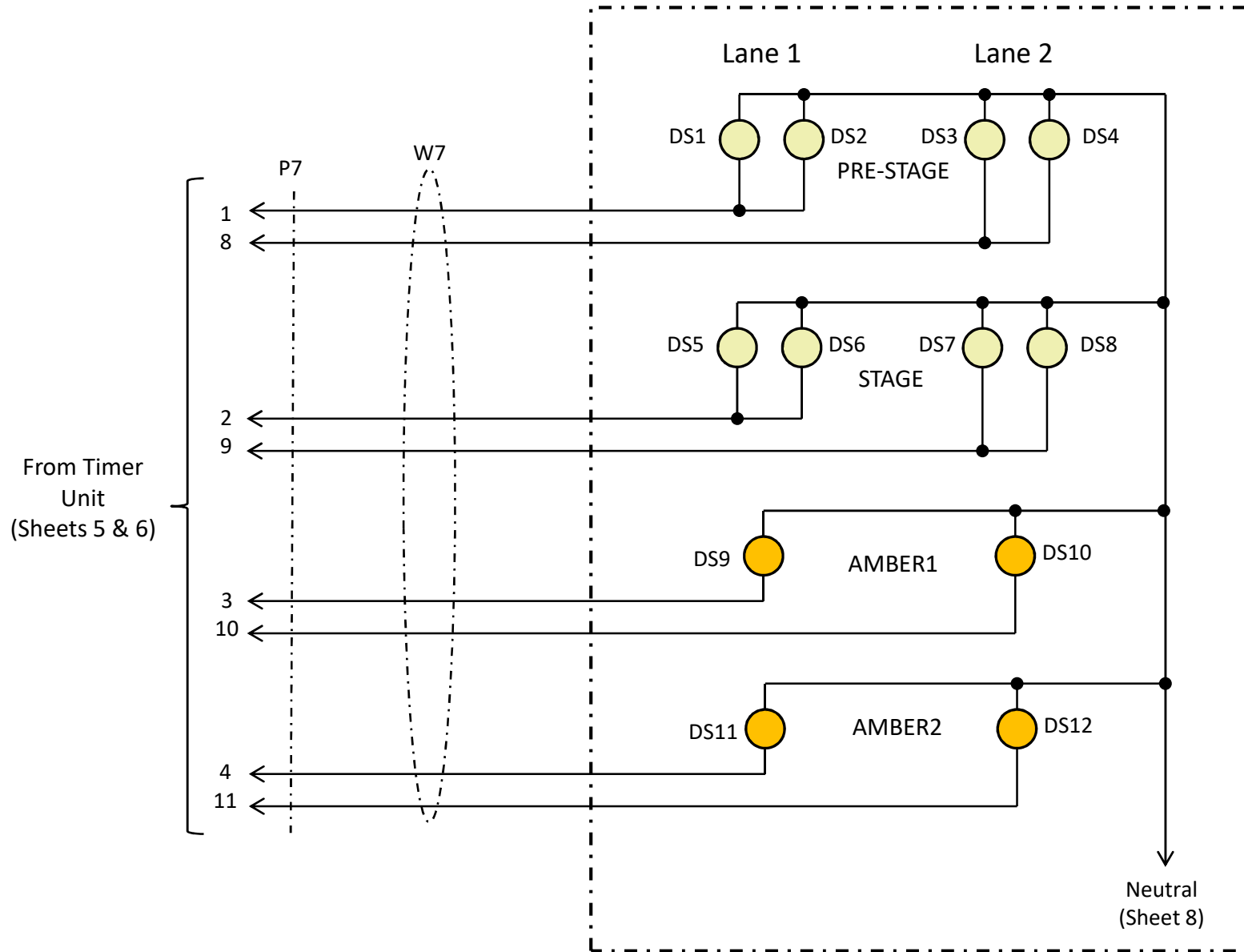






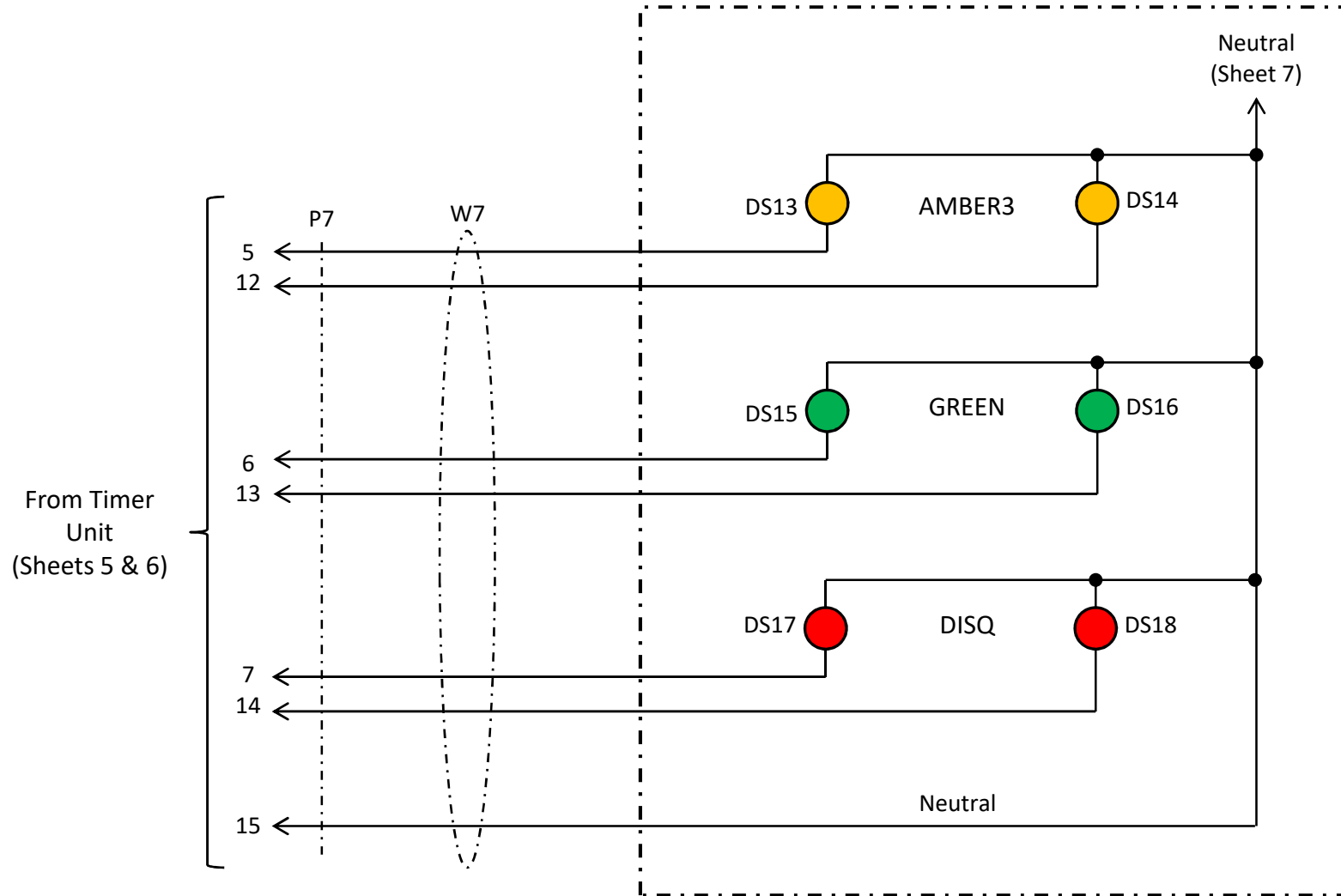
SCHEM DIAG: DRT02-Ver1 Sh6 of 10  
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# Xmas Tree Lights

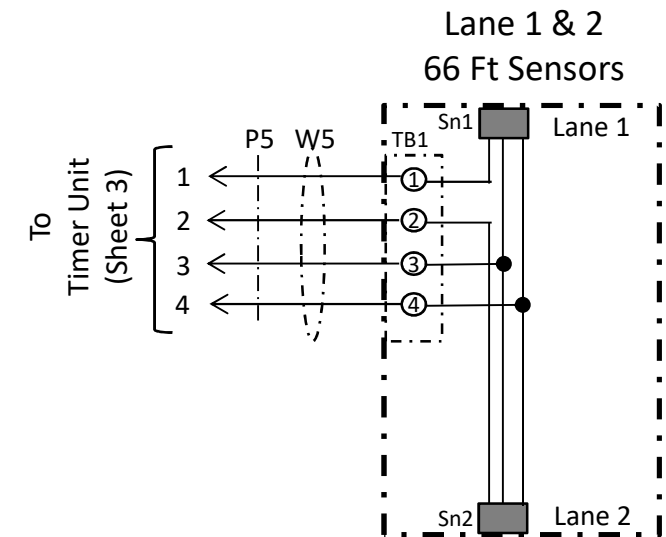
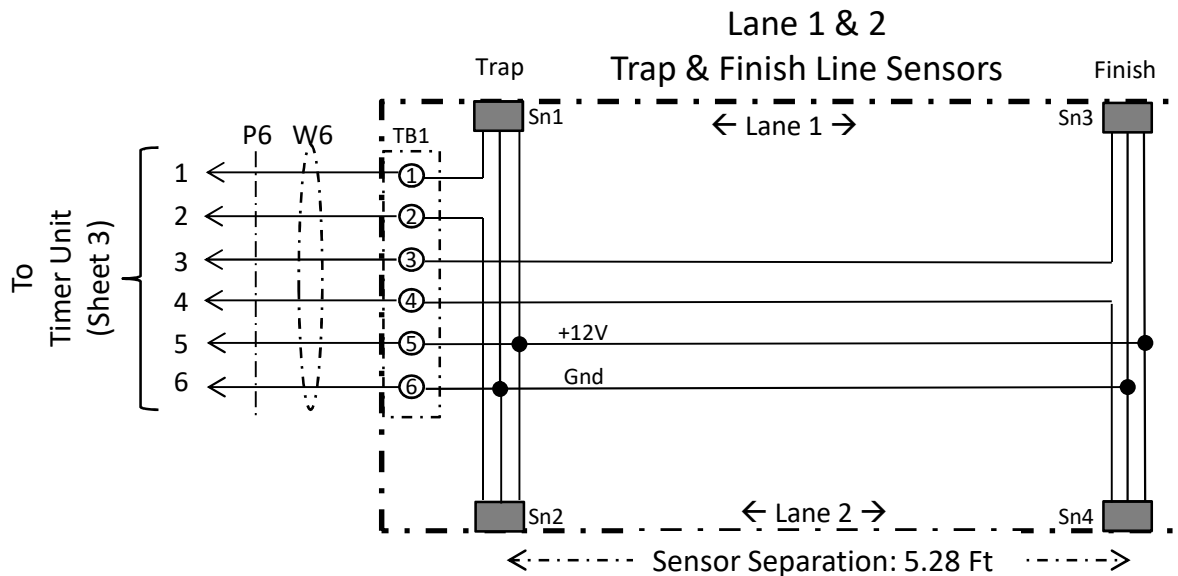
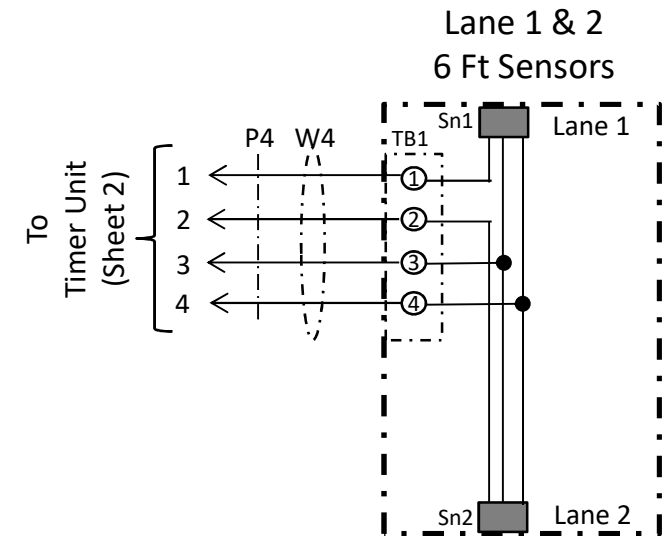
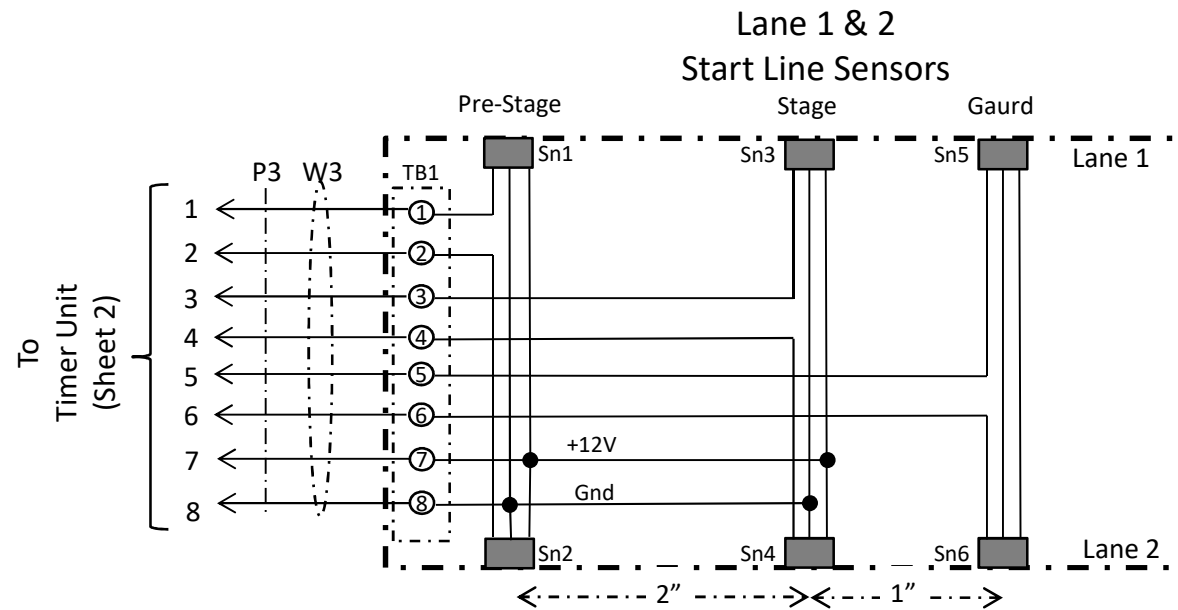


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## Xmas Tree Lights (Cont.)



# AUTONICS™ BJ15M-TDT IR RECEIVERS

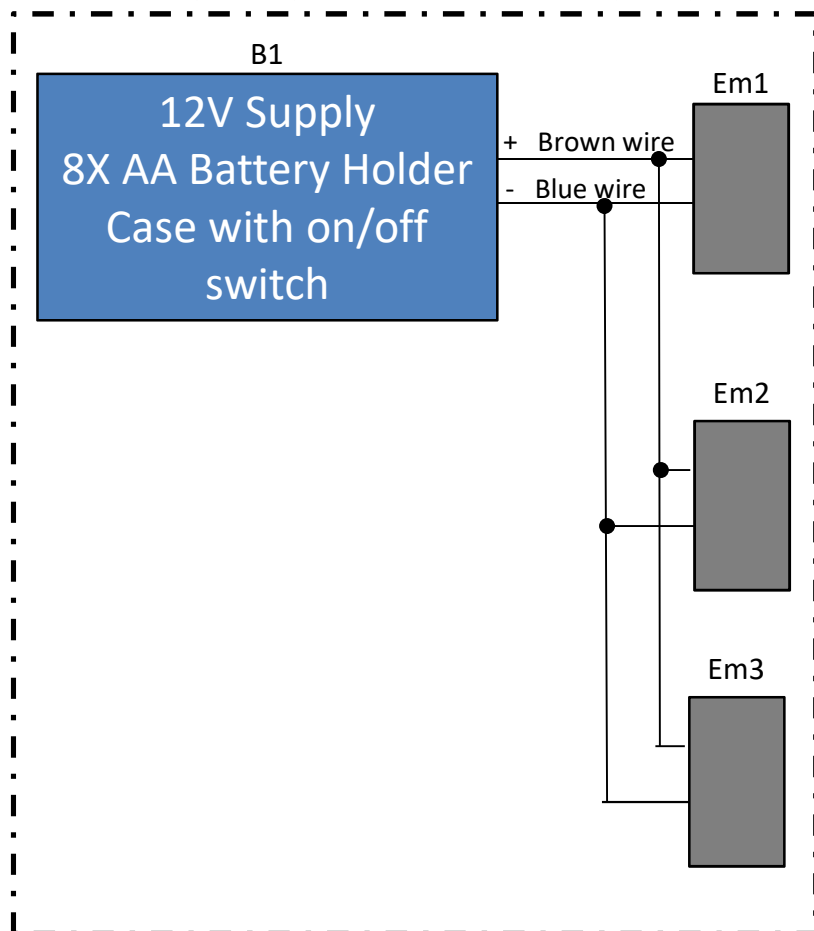


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# AUTONICS™ BJ15M-TDT IR EMITTERS

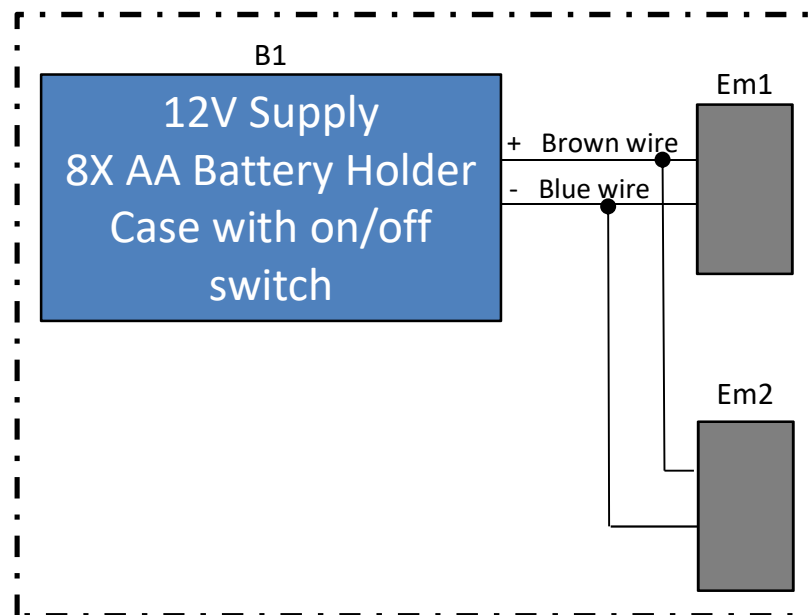
Lane 1 & 2

Pre-Stage/Stage/Gaurd Emitter Assy (Qty=2)



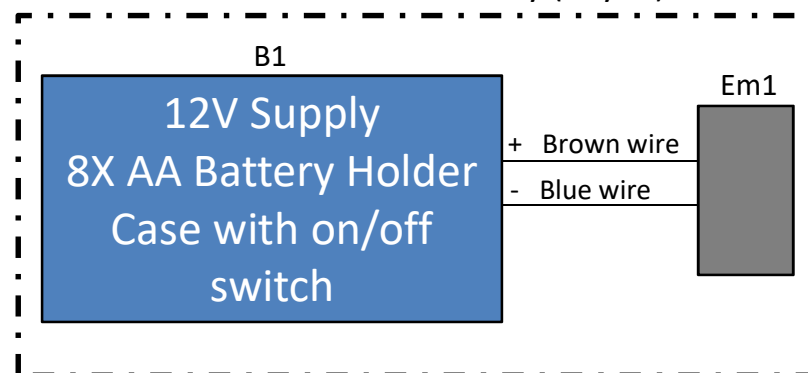
Lane 1 & 2

Trap/Finish Line Emitter Assy (Qty=2)



Lane 1 & 2

6 Ft & 66 Ft Emitter Assy (Qty=4)



SCHEM DIAG: DRT02-Ver1 Sh10 of 10  
Designed by: W. van Leeuwen  
Email: billv923@outlook.com

# Drag Race Timer Schematic Diagram

## Suggested Parts List\*

Ref.	Qty	Description	Part No.	Manufacturer
<b>TIMER UNIT</b>				
--	1	Circuit Board: Arduino MEGA	See <a href="http://www.Arduino.cc">www.Arduino.cc</a>	Arduino
D1	1	Diode, Schotky, 1 Amp	Various	Various
PS1	1	Power Adapter/Supply, 12VDC, 2 Amps (Minimum)	See EBay or Amazon	Various
Q1	1	Voltage Regulator, 5 VDC	LM7805	Various
TB1	1	Terminal Block, 4 position, #6-32 screw	Various	Various
C1	1	Capacitor, Electrolytic, 100uF		
S1	1	Pushbutton switch (hand held)	See design notes	
W1 (J1)	1	USB Male to USB 'B' Female Socket Printer Panel Mount Extension Cable	See EBay	Various
J2	1	Panel Mount 16mm Dia. Screw 2 Pin Metal Aviation Receptacle (See separate sheet for more info)	See EBay	TBD
P2	1	16mm Dia. Screw 2 Pin Metal Aviation Plug (See separate sheet for more info)	See EBay	TBD
R1 – R15	15	Resistor, 4.7K-Ohm, ¼ Watt	Various	NTE Electronics
J3	1	Panel Mount 16mm Dia. Screw 8 Pin Metal Aviation Receptacle (See separate sheet for more info)	See EBay	
J4 & J5	2	Panel Mount 16mm Dia. Screw 4 Pin Metal Aviation Receptacle (See separate sheet for more info)	See EBay	
J6	1	Panel Mount 16mm Dia. Screw 6 Pin Metal Aviation Receptacle (See separate sheet for more info)	See EBay	

**\*Notes:**

- The Autonics BJ15M-TDT sensors are purchased as a pair with 1 emitter unit and 1 sensor unit
- Parts can be substituted to meet the builder's desires/needs (i.e. choice of switches or connectors).
- Parts list does not include enclosure (box) or mounting hardware (screws, circuit board standoffs, etc.).

# Drag Race Timer Schematic Diagram

## Suggested Parts List (Cont.)\*

Ref.	Qty	Description	Part No.	Manufacturer
<b>TIMER UNIT (Continued)</b>				
RM1, RM2	2	Relay Module – 8 Channel, 5VDC EBay: “JBtek 8 Channel DC 5V Relay Module for Arduino”	(See EBay Listings)	JBTEK
J7	1	Jack, Molex .093” 15-pin female	Various	Molex
J8	1	Jack, Molex .093” 2-pin female	TBD	Molex
P8	1	Plug, Molex .093” 2-pin male	TBD	Molex
F1	1	Fuse Holder, Screw Cap with 10 Amp, Slo-Blow fuse	TBD	
W2	1	Cable, 2 Conductor, 20 Ft (Make from light duty 16AWG extension cord)	Various	
<b>TIMER UNIT Miscellaneous</b>				
---	1	Enclosure, 12x8x6, weatherproof	Various	
---	---	Misc. hardware (screws, nuts, washers, standoffs, wire, tie-wraps, etc.)		

### \*Notes:

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- Parts can be substituted to meet the builder’s desires/needs (i.e. choice of switches or connectors).
- Parts list does not include enclosure (box) or mounting hardware (screws, circuit board standoffs, etc.).

# Drag Race Timer Schematic Diagram

## Suggested Parts List (Cont.)\*

Ref.	Qty	Description	Part No.	Manufacturer
<b>LIGHT (XMAS) TREE UNIT</b>				
DS1 – DS8	8	Indicator, White lamp	TBD	
DS9 – DS14	6	Indicator, Amber lamp	TBD	
DS15, DS16	2	Indicator, Green lamp	TBD	
DS17, DS18	2	Indicator, Red lamp	TBD	
W7	1	Cable, 14 AWG, 15 Conductor	TBD	
P7	1	Plug, Molex .093" 15-pin male	TBD	Molex
<b>LIGHT (XMAS) TREE – Miscellaneous</b>				
---	14	Lamp Sockets	TBD	
---	---	Misc. hardware (screws, nuts, washers, wire, tie-wraps)		

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- Parts can be substituted to meet the builder's desires/needs (i.e. choice of switches or connectors).
- Parts list does not include enclosure (box) or mounting hardware (screws, circuit board standoffs, etc.).

# Drag Race Timer Schematic Diagram

## Suggested Parts List (Cont.)\*

Ref.	Qty	Description	Part No.	Manufacturer
<b>START LINE PRE-STAGE / STAGE / GAURD SENSOR UNIT</b>				
Sn1 – Sn6	6	Infrared trough-beam Sensor	BJ15M-TDT2	Autonics
TB1	1	Terminal Block, 8 position, #6-32 screw	TBD	Cinch/Walden
W3	15 ft	Cable, 6 conductor, 18 AWG sprinkler system cable	54706	Southwire
P3	1	16mm Dia. Screw 8 Pin Metal Aviation Plug (See separate sheet for more info)	See EBay	TBD
<b>START LINE EMITTER UNIT (Qty of 2 required – 1 for each lane)</b>				
Em1, Em2 & Em3	3	Infrared trough-beam Emitter	BJ15M-TDT1	Autonics
B1	1	12V Battery Pack, 8X AA Battery Holder Case with on/off switch	See EBay	TBD
<b>TRAP &amp; FINISH LINE SENSOR UNIT</b>				
Sn1 – Sn4	4	Infrared trough-beam Sensor	BJ15M-TDT2	Autonics
TB1	1	Terminal Block, 6 position, #6-32 screw	TBD	Cinch/Walden
W6	130'	Cable, 6 conductor, 18 AWG sprinkler system cable	54706	Southwire
P6	1	16mm Dia. Screw 6 Pin Metal Aviation Plug (See separate sheet for more info)	See EBay	TBD
<b>TRAP &amp; FINISH LINE EMITTER UNIT (Qty of 2 required – 1 for each lane)</b>				
Em1, Em2	2	Infrared trough-beam Emitter	BJ15M-TDT1	Autonics
B1	1	12V Battery Pack, 8X AA Battery Holder Case with on/off switch	See EBay	TBD

# Drag Race Timer Schematic Diagram

## Suggested Parts List (Cont.)\*

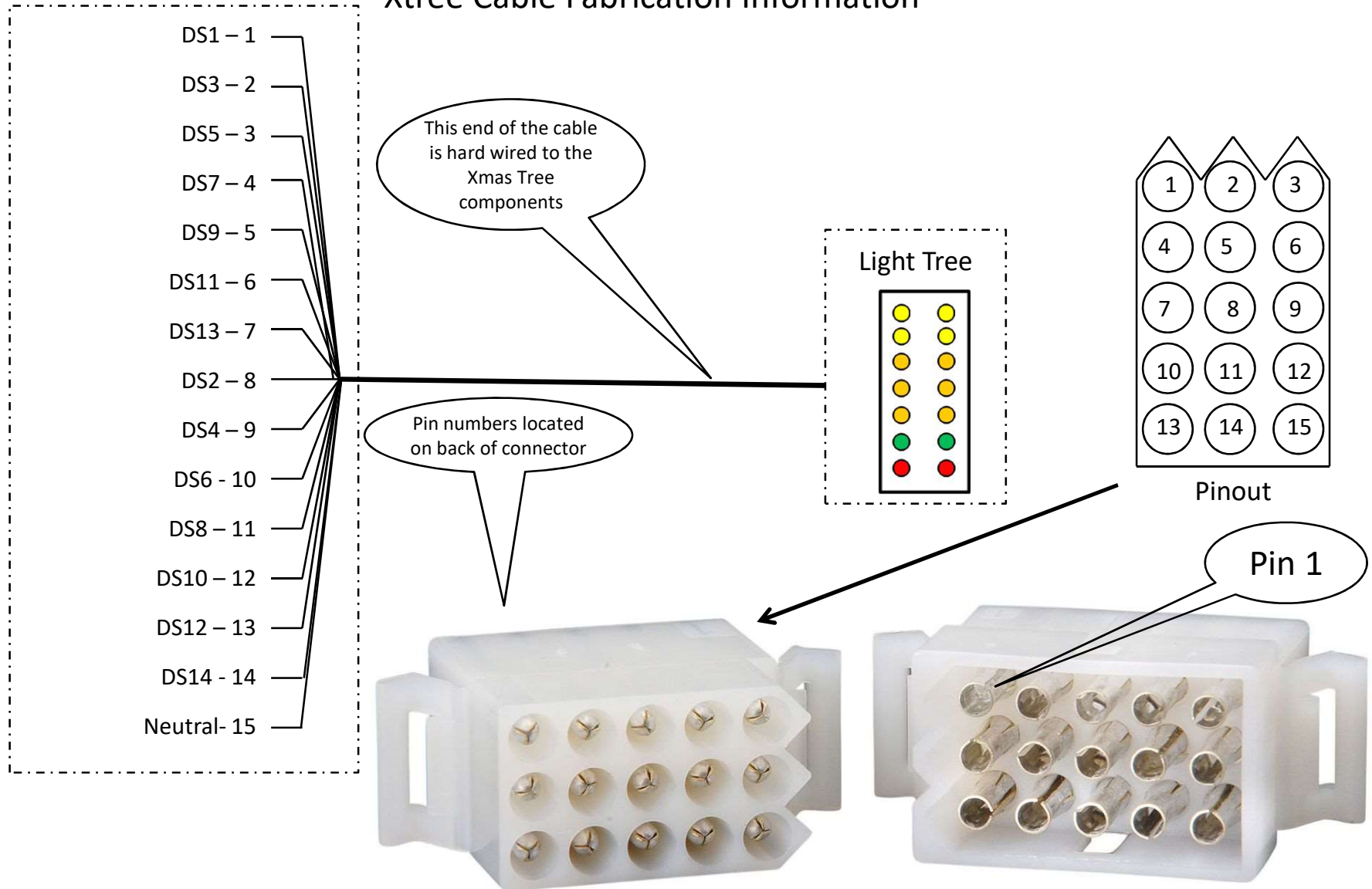
Ref.	Qty	Description	Part No.	Manufacturer
<b>6 FT SENSOR UNIT</b>				
Sn1 – Sn2	2	Infrared trough-beam Sensor	BJ15M-TDT2	Autonics
TB1	1	Terminal Block, 4 position, #6-32 screw	TBD	Cinch/Walden
W4	15 ft	Cable, 6 conductor, 18 AWG sprinkler system cable	54706	Southwire
P4	1	16mm Dia. Screw 4 Pin Metal Aviation Plug (See separate sheet for more info)	See EBay	TBD
<b>6 FT EMITTER UNIT (Qty of 2 required – 1 for each lane)</b>				
Em1	1	Infrared trough-beam Emitter	BJ15M-TDT1	Autonics
B1	1	12V Battery Pack, 8X AA Battery Holder Case with on/off switch	See EBay	TBD
<b>66 FT SENSOR UNIT</b>				
Sn1 – Sn2	2	Infrared trough-beam Sensor	BJ15M-TDT2	Autonics
TB1	1	Terminal Block, 4 position, #6-32 screw	TBD	Cinch/Walden
W5	75 ft	Cable, 6 conductor, 18 AWG sprinkler system cable	54706	Southwire
P5	1	16mm Dia. Screw 4 Pin Metal Aviation Plug (See separate sheet for more info)	See EBay	TBD
<b>66 FT EMITTER UNIT (Qty of 2 required – 1 for each lane)</b>				
Em1	1	Infrared trough-beam Emitter	BJ15M-TDT1	Autonics
B1	1	12V Battery Pack, 8X AA Battery Holder Case with on/off switch	See EBay	TBD

**\*Notes:**

- The Autonics BJ15M-TDT sensors are purchased as a pair with 1 emitter unit and 1 sensor unit
- Parts can be substituted to meet the builder's desires/needs (i.e. choice of switches or connectors).
- Parts list does not include enclosure (box) or mounting hardware (screws, circuit board standoffs, etc.).

# Xtree Timer Cable Assembly (W7)

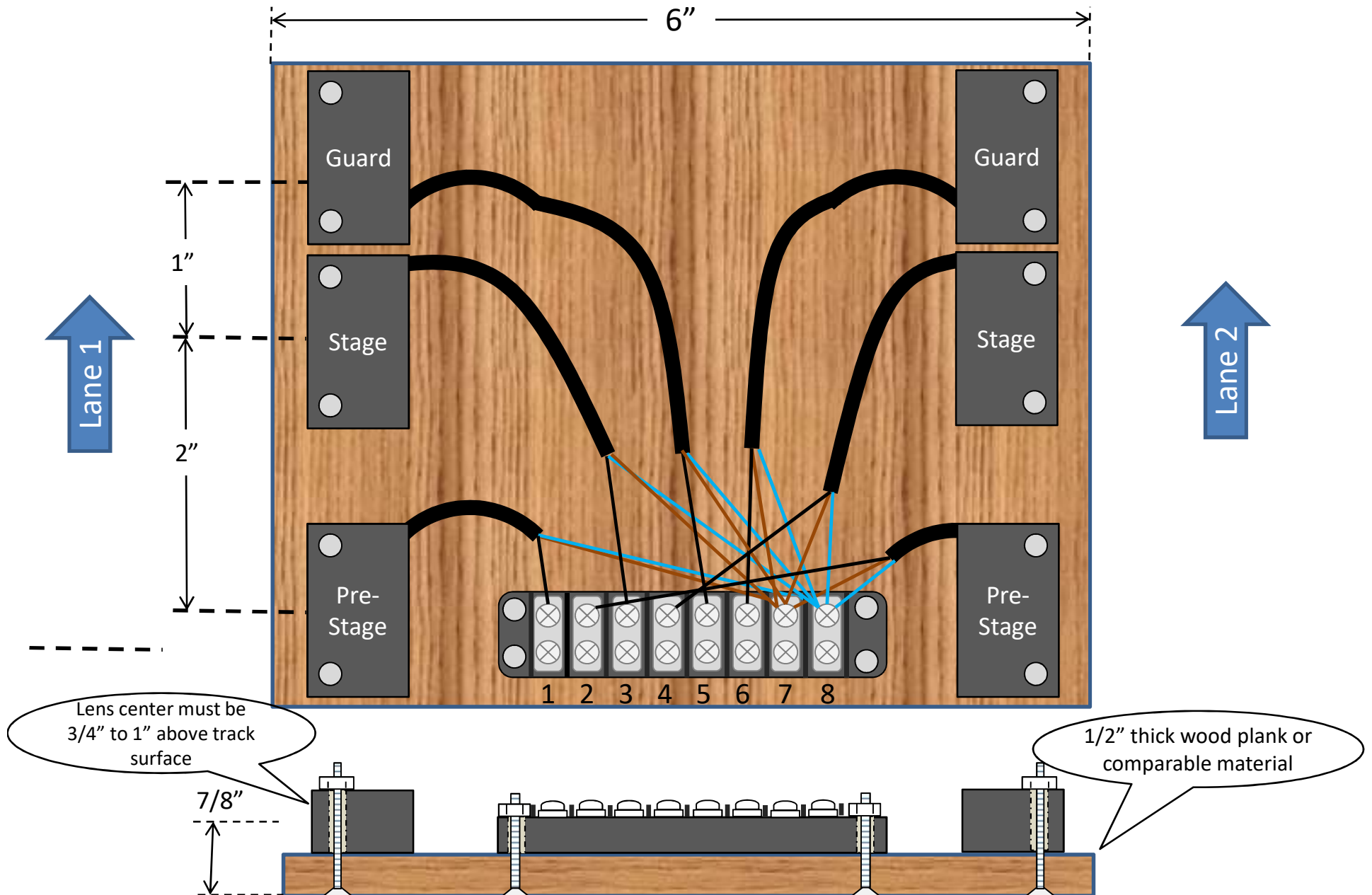
## Xtree Cable Fabrication Information



Recommended connectors for Xmas Tree: 15-Pin Molex, .093" Pins, 18-22 AWG, Panel Mount

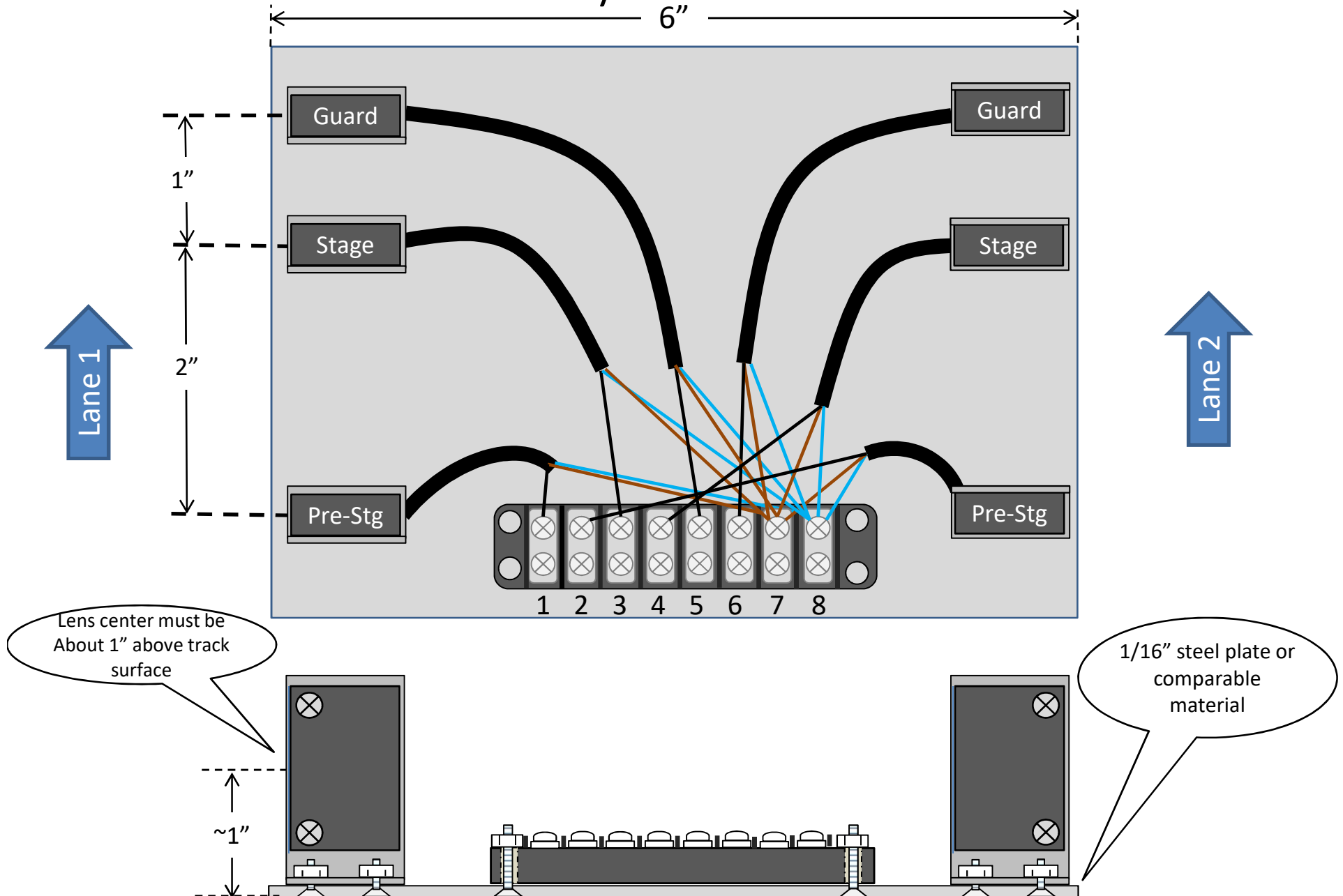
# Conceptual Design: Option 1 Horizontal Mount

## Start Line IR Sensor Assy with 6ea BJ15M-TDT2 Sensors



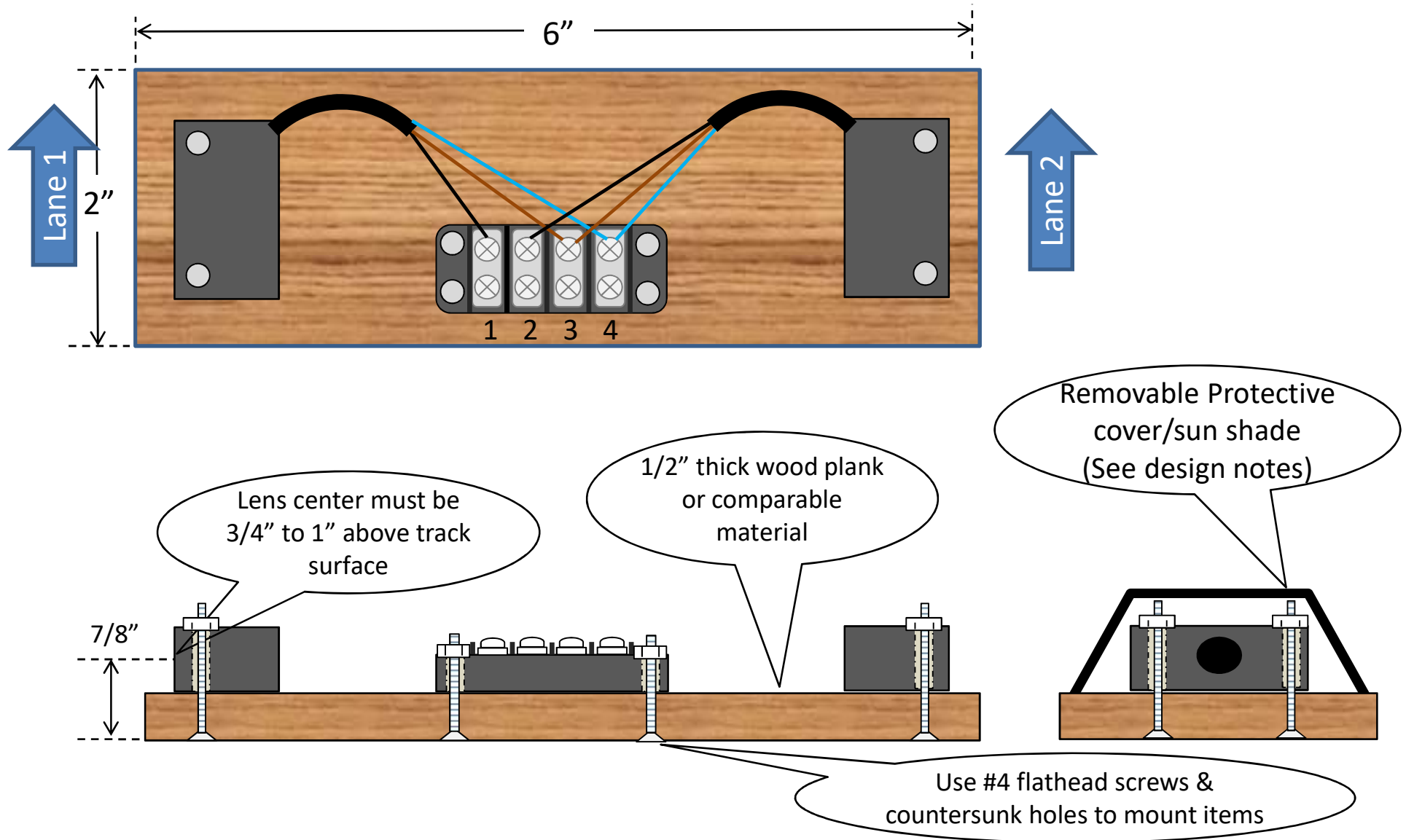
# Conceptual Design: Option 2 Vertical Mount

## Start Line IR Sensor Assy with 6ea BJ15M-TDT2 Sensors



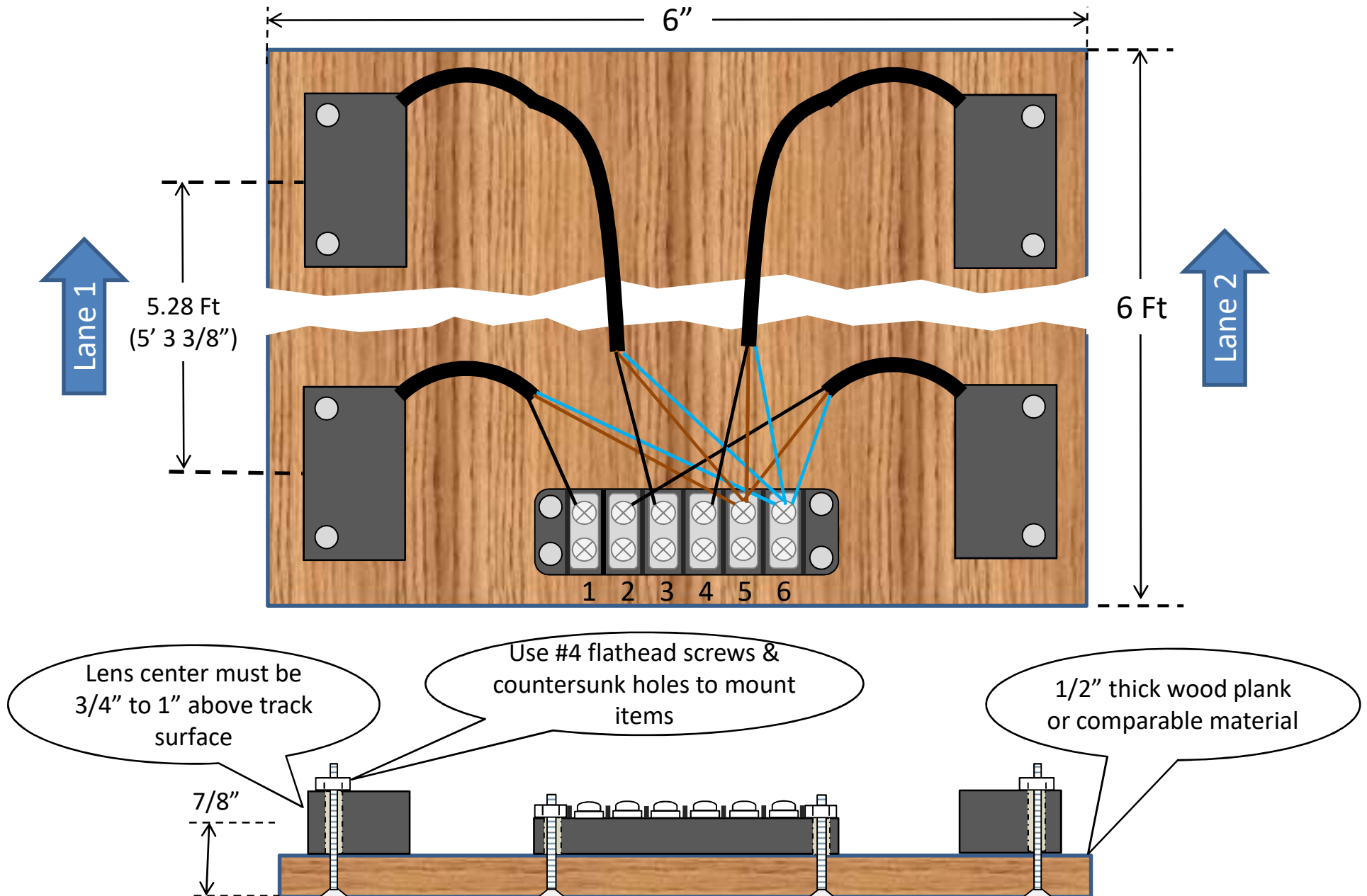
- - Conceptual Design - -

6 Ft & 66 Ft IR Sensor Assy With 2 BJ15M-TDT2 Sensors

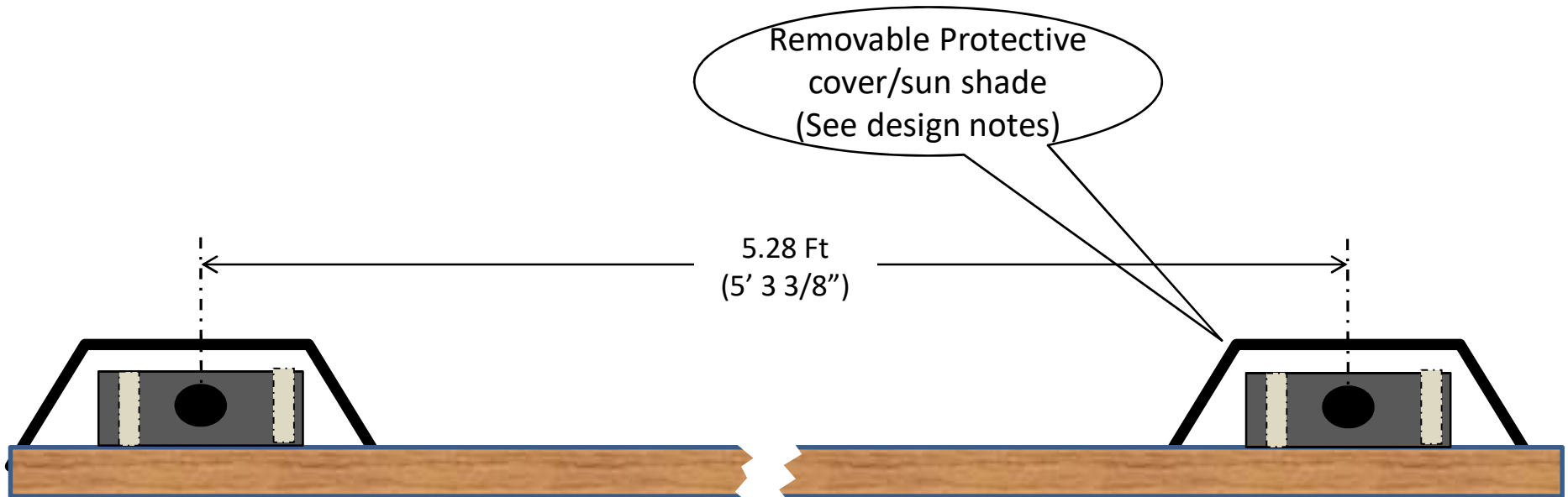


## - - Conceptual Design - -

### Stage & Finish Line IR Sensor Assy with 4ea BJ15M-TDT2 Sensors

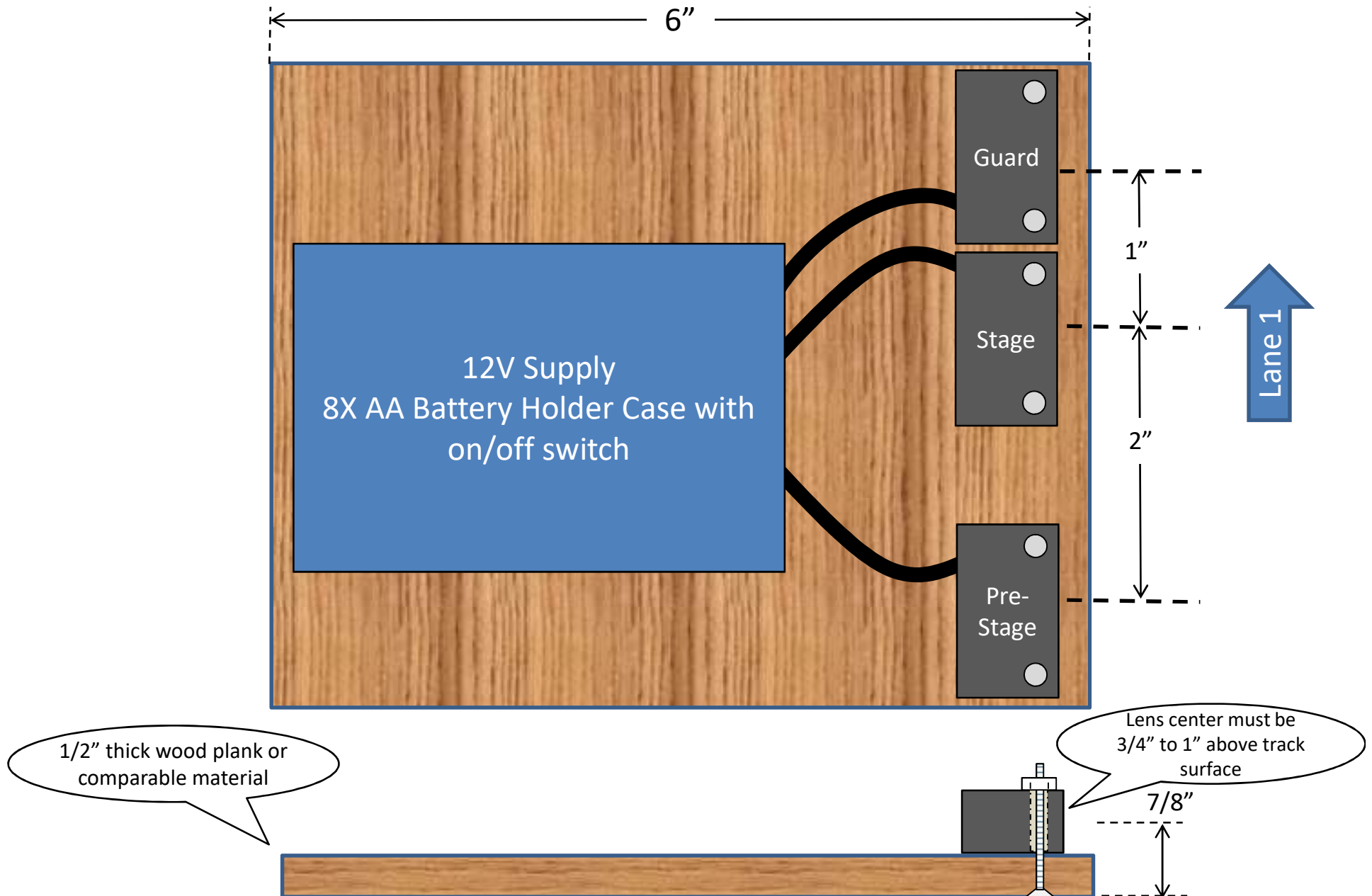


- - Conceptual Design - -  
Stage & Finish Line IR Sensor Assy (Cont.)



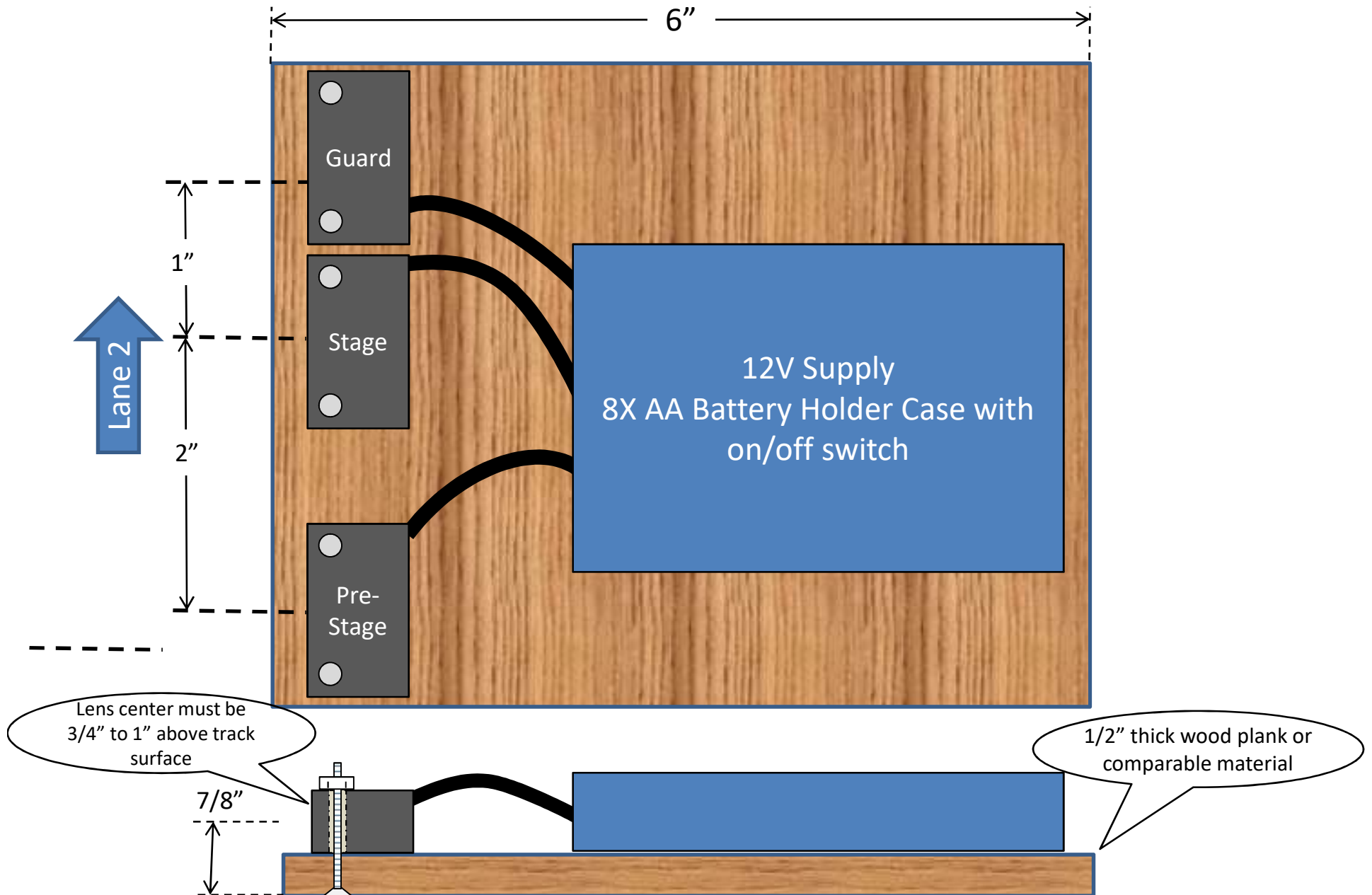
## - - Conceptual Design - -

### Lane 1 Start Line IR Emitter Assy with 3ea BJ15M-TDT1 Emitters



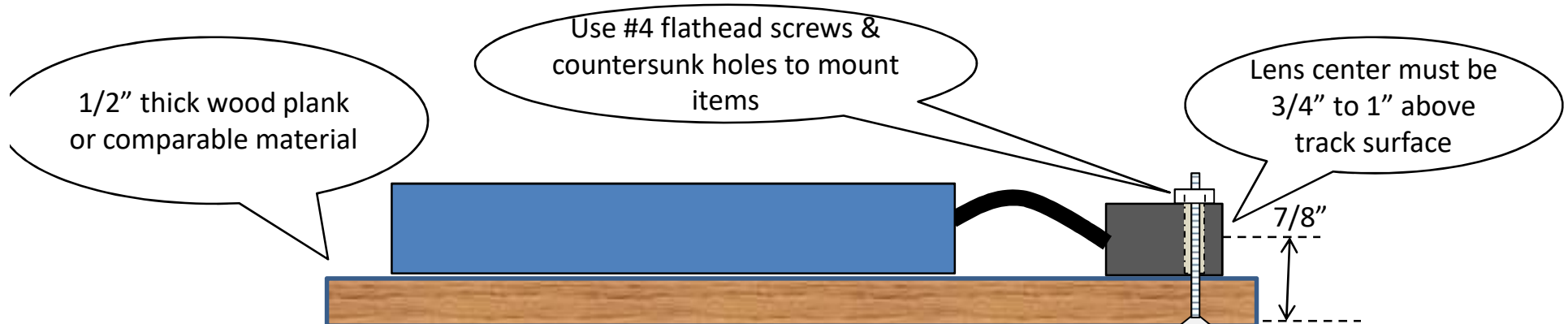
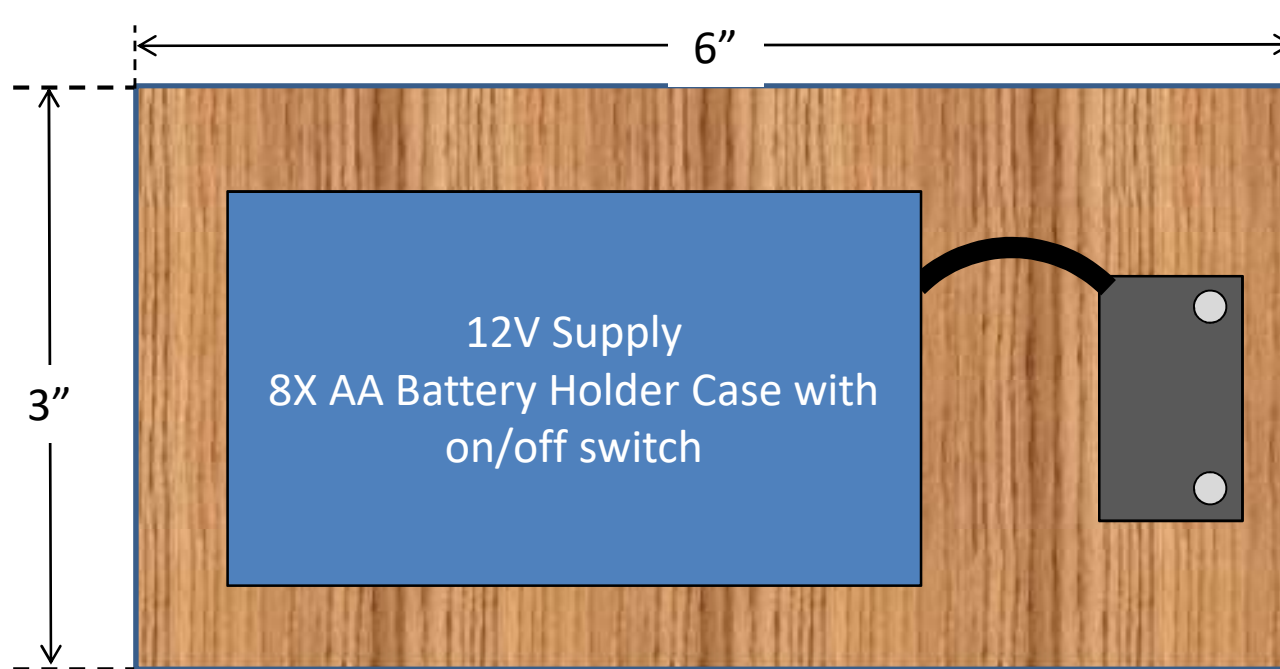
## - - Conceptual Design - -

### Lane 2 Start Line IR Emitter Assy with 3ea BJ15M-TDT1 Emitter



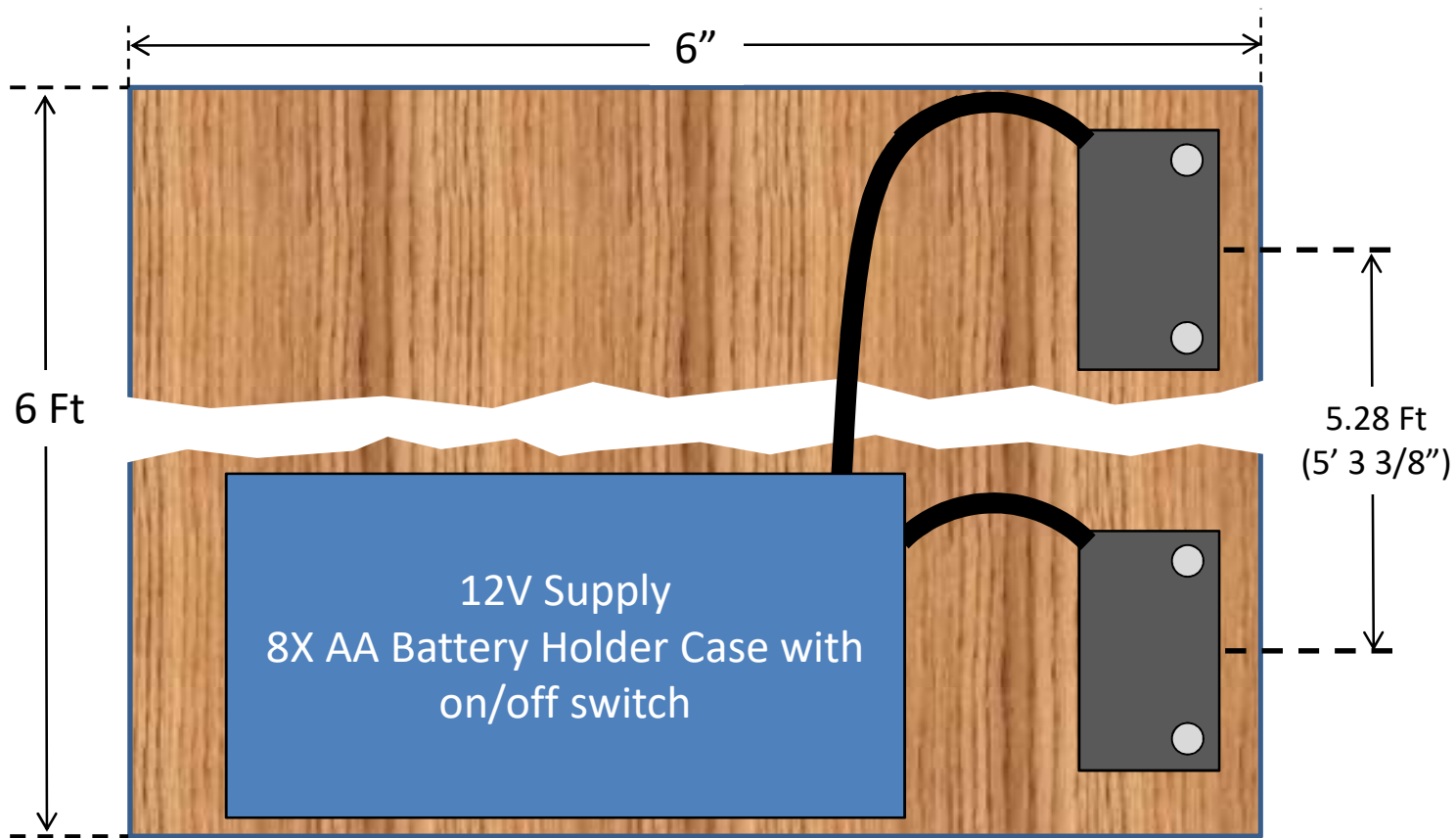
## - - Conceptual Design - -

6 Ft & 66 Ft BJ15M-TDT1 Emitters (Qty=4 - 2 for each lane)



## - - Conceptual Design - -

Stage & Finish Line IR Emitter Assy with 2ea BJ15M-TDT1 Emitters (Qty=2)



1/2" thick wood plank  
or comparable material

Use #4 flathead screws &  
countersunk holes to mount  
items

Lens center must be  
3/4" to 1" above  
track surface



# Timer Design Notes

- The Hand-Held Start switch (S1) use the normally open (N.O.) set of contacts.
- The Christmas tree interface provides Normally Open (NO) relay contacts rated at 10 amps that allow the user to implement almost any kind of indicator of their choice, whether they be 120/240 VAC incandescent lamps, 5 volt LEDs or something in between. It is recommended that LED equivalents be used because they use less power and have an instantaneous on/off cycle time.
- All IR Sensors (Pre-stage, Stage, Guard, 6 Ft, 66 FT, Trap and Finish Line) must be at a height such that the beam is between 3/4" to 1" above the track surface (i.e. high enough to be broken by the RC car body).
- To simplify the floating point math done in the software for the speed calculation (in MPH), the trap and finish line sensors have been specifically set at a separation distance of 5.28 feet (5' 3 3/8") which is one thousands of a mile. The resulting equation for speed thus becomes:
  - $S = 3600 / dT$   
Where:  
S = Speed in MPH  
dT = Time difference in milliseconds between tripping of the trap and finish line sensors

# Timer Design Notes (Cont.)

- BJ15M-TDT Emitter & Sensor Protective Covers (Recommended)
  - Must be removable to allow adjustment of sensitivity control
  - Must provide shade from direct sunlight
  - Be durable enough to protect unit from RC car running over it
- Autonics™ BJ15M-TDT Through-Beam Sensor: Each sensor pair consists of an emitter unit (BJ15M-TDT1) and a receiver unit (BJ15M-TDT2).



- Emitter Unit
  - Power indicator (Green)
- Receiver unit
  - Stability/Power indicator (Green)
  - Beam detect indicator (Red)
  - Light ON/Dark ON mode select switch
  - Sensitivity adjuster
- Refer to manufacturer's data sheets for more information

# Timer Design Notes (Cont.)

Recommended connector for P3/J3: GX16 8-Pin  
Panel Mount 16mm Dia Screw, Metal Aviation  
Wire Connector Plug & Receptacle (See EBay).



Recommended connector for P4/J4 & P5/J5:  
GX16 4-Pin Panel Mount 16mm Dia Screw, Metal  
Aviation Wire Connector Plug & Receptacle (See  
EBay).



Recommended connector for P6/J6: GX16 4-Pin  
Panel Mount 16mm Dia Screw, Metal Aviation  
Wire Connector Plug & Receptacle (See EBay).



# Timer Design Notes (Cont.)

## Pushbutton Cable Fabrication Information (W2)



Recommended connectors for hand-held pushbutton switch: GX16 2 Pin Panel Mount 16mm Dia Screw, Metal Aviation Wire Connector Plug & Receptacle (See EBay).

**Note:** Plug back-shell has a bayonet style fastening system. To detach, remove the tiny screw and slightly rotate back-shell counter-clockwise about 1/8 turn.

# Timer Design Notes (Cont.)

- Voltage regulator LM7805 (Q1) requires a heat sink which can be purchased or made from a piece of scrap aluminum as shown below.




- JBTEK 8 Channel 5 VDC Relay Module (RM1 & RM2)



# Timer Design Notes (Cont.)

- **Time Slip Printer:** There are many Point-Of-Sale (POS) thermal receipt printers available on the market. The author used an Epson ECS/POS 80mm thermal printer purchased from EBay (See picture below). Any printer can be used since the race management software issues a DOS print command to send a text file to the PC's default printer.



The image shows a black Epson ECS/POS 80mm thermal receipt printer. Two circular insets provide close-up views: the left inset shows a finger pressing a button on the side of the printer, and the right inset shows the internal paper roll and print head mechanism.

**LOT 10 USB POS Receipt Thermal Printer 80mm w/ Paper Roll High-speed Printing BA**  
🔥 1 sold in last hour

Condition: **New**  
LOT/PCS: LOT 1 = 1PC  
Quantity: 1 4 available / 2 sold

Price: **US \$65.99** [Buy It Now](#) [Add to cart](#) [Add to watch list](#)

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