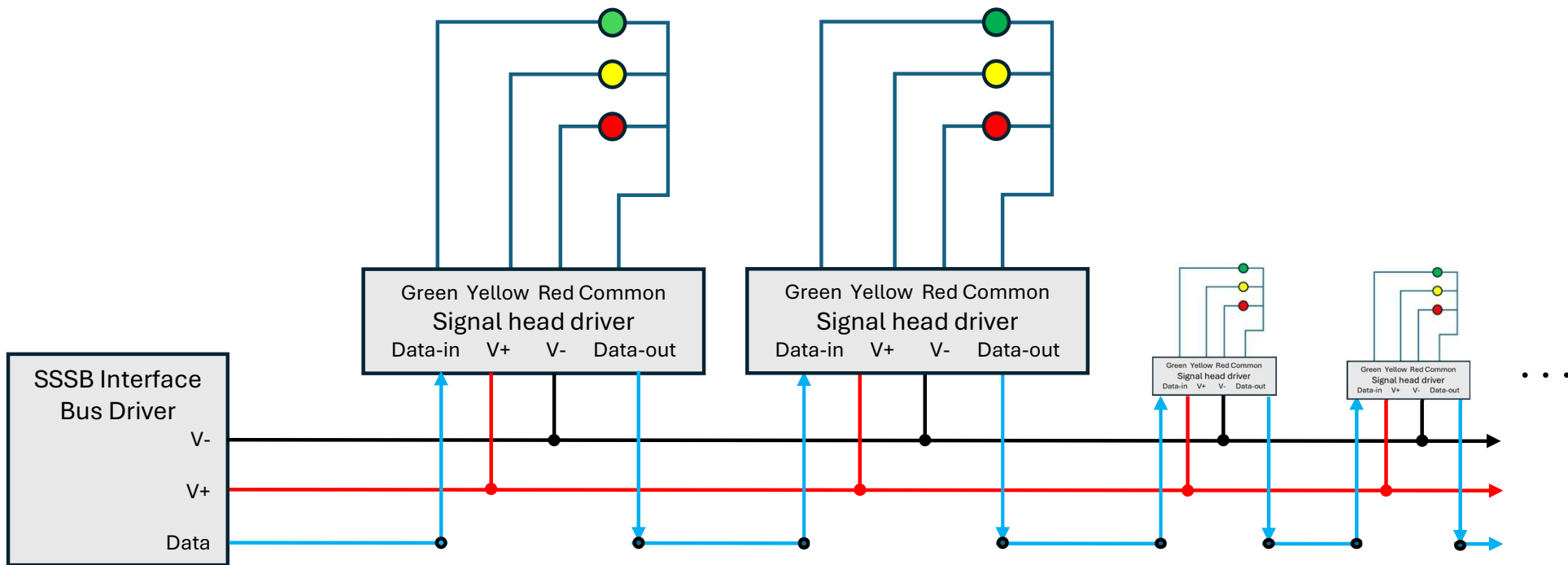


# Physical Wiring of RR-CirKits SSSB (Simple Serial Signal Bus) signal hardware

Peter Ely

Draft Version 0.5 2024-06-19

# Basic Circuit Diagram

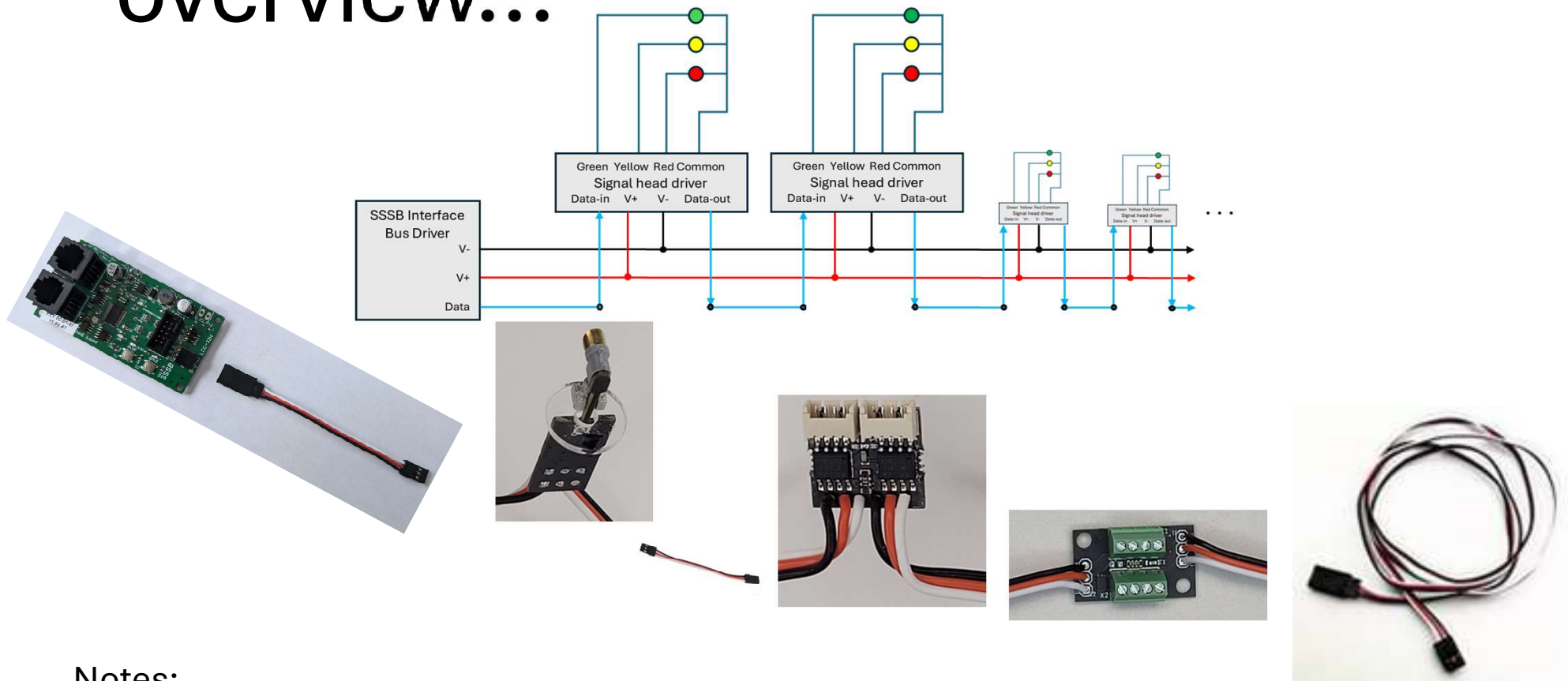


## Notes:

- This is the circuit, not necessarily the physical wiring diagram
  - By example, physical location and order of Green, Yellow, Red, and Common connections differ by actual product
  - Similarly the physical order of V- , V+, Data may differ by board design.
- Architecture supports 96 LEDs = 32 x 3 LEDs = 32 x 3-light signal heads = product name “Signal LCC-32H”
  - Whether all 96 LEDs can be lit at once has not yet been proven. A mid-bus power injector is available from 3<sup>rd</sup> party.
- Driver chips / signal heads are not individually uniquely addressed but rather are addressed colloquially as “the Xth signal head driver from the Interface Bus Driver” .
- Thus if one Signal head driver is physically removed from the chain, it throws all instructions to control a given signal head driver off by one signal head driver position. So if doing so temporarily, either put in another signal head driver to ‘hold the spot’ of the missing one or just accept that everything downstream will temporarily display incorrectly by one head. If a signal head driver is permanently removed, configuration for all downstream heads will need to be redone.

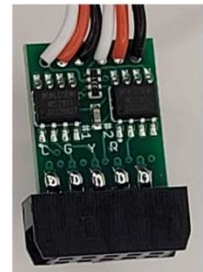
# Physical wiring & product choices

# Signal LCC-32H physical overview...

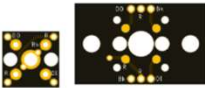

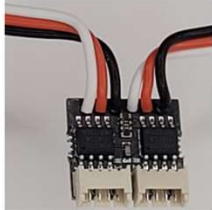
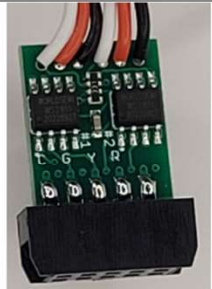


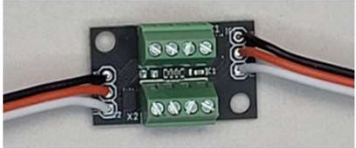


## Notes:

- This is the physical implementation
- Locate one or more Signal LCC-32H's where seems geographically convenient and/or cost effective to collect signals and other LEDs
- 3 wire interconnect cables are “Futaba J” style servo extension (Male-Female) cables
- The bus uses Male-Female cables to maintain the ‘Data-In’ , “Data-Out” architecture and power polarity.
  - There’s nothing magic about these cables except convenience and simplicity. They are widely available
  - Building your own is certainly doable and kits exist for just that but manufactured perhaps more reliable
  - Widely used in RC model planes and similar applications. Available on Amazon, by example.

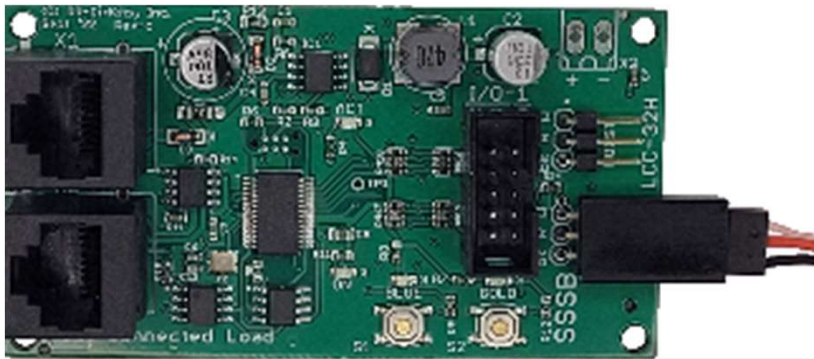


RR-CirKits Simple Serial Signal Bus (SSSB) published portfolio as at June 2024 See [rr-cirkits.com](http://rr-cirkits.com)

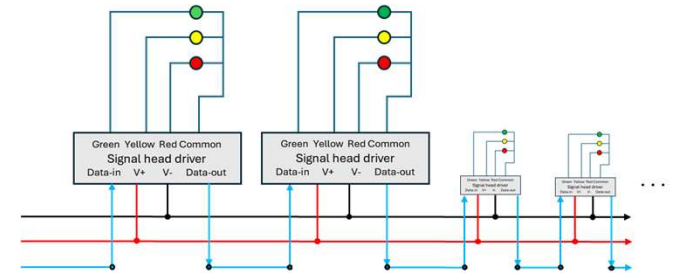
SSSB-Magnetic Base		SSSB style 4 circuit pogo-pin break away magnetic signal mount. Use with 3/32" mast or with SSSB-MB decoder/drivers. (see below) Includes 3-1/2" M-F polarized pigtailed. Removable top portion 11mm square. Screw down base 23.6 mm x 14.6mm.	<del>\$6.95</del>		
SSSB-MB Single	Image not yet available	Single head Decoder/Driver fits 3/32" brass mast base or bridge base. (stackable for multiple heads) 11mm square	<del>\$3.00</del>		
SSSB-MB Dual	Image not yet available	Dual head Decoder/Driver fits 3/32" brass mast base or bridge base. (stackable for multiple heads) 11 mm square	<del>\$4.00</del>		
SSSB-Atlas Single		Single head Decoder/Driver for Atlas Micro JST equipped signals. Includes 3-1/2" M-F polarized pigtailed.	<del>\$7.00</del>	\$6.30	\$5.95
SSSB-Atlas Dual		Dual head Decoder/Driver for Atlas Micro JST equipped signals. Includes 3-1/2" M-F polarized pigtailed.	<del>\$9.00</del>	\$8.10	\$7.65
SSSB-Digitrax Dual		Dual head Decoder/Driver for 10 pin header equipped signals. Includes 3-1/2" M-F polarized pigtailed.	<del>\$9.00</del>	\$8.10	\$7.65
SSSB-Dwarf Single		Single head Decoder/Driver for Showcase Miniatures Type SA. (SKU: 2194) Includes 3 color LED. (decoder/driver only, Showcase Miniatures signal hardware detail not included) Includes 3-1/2" M-F polarized pigtailed.	<del>\$10.00</del>	\$9.00	\$8.50
SSSB-S Single		Single head Decoder/Driver with screw terminals for wire equipped signals. Includes 3-1/2" M-F polarized pigtailed.	<del>\$7.50</del>	\$6.75	\$6.38
SSSB-S Dual		Dual head Decoder/Driver with screw terminals for wire equipped signals. Includes 3-1/2" M-F polarized pigtailed.	<del>\$10.00</del>	\$9.00	\$8.50

# Signal LCC-32H wiring

Optional external power if you prefer not to draw from LCC bus



LCC bus



White = Data  
Red = V+  
Black = V-

## Notes:

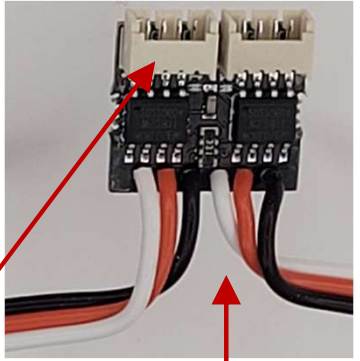
- This is the physical implementation
- Current draw from LCC bus = 20mA plus that of connected load (LEDS)
  - External power can be supplied so LEDs are not power parasites of main LCC bus if desired
  - As long as appropriate PowerPoints are configured, all power can come from LCC bus.



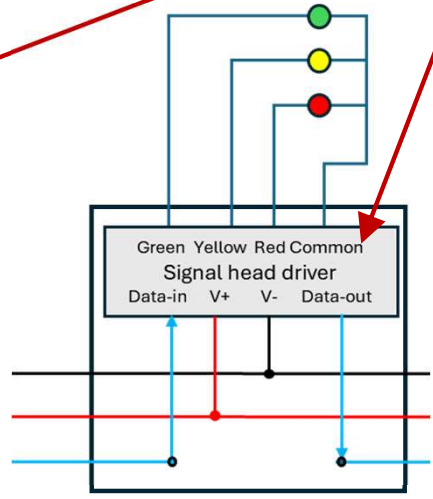
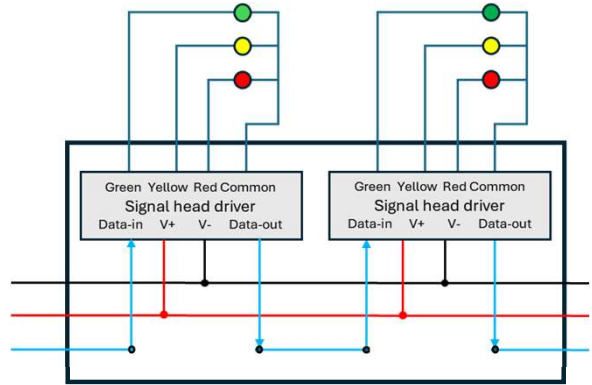
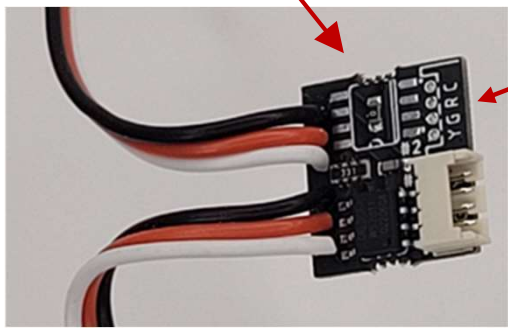
# SSSB-Atlas Dual & Single



JST connector



One Signal Head driver versus two.  
 • Same PCB, just not populated



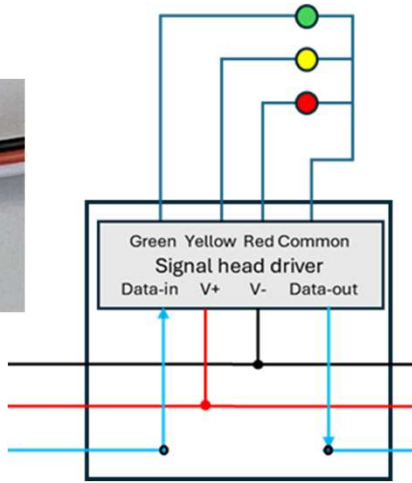
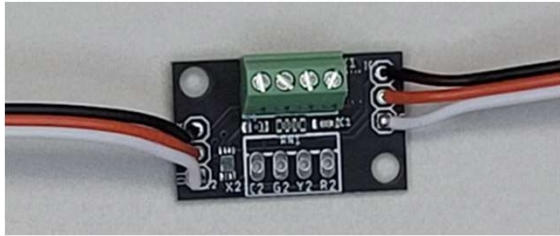
Actual YGRC  
 Y(yellow) G(green) R(red)  
 C(common) physical wiring is  
 labelled on board to wire it  
 yourself if desired. Note  
 different pin out order vs sketch.  
 Differs by product.



**Notes:**

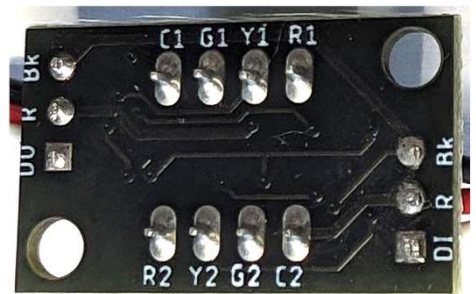
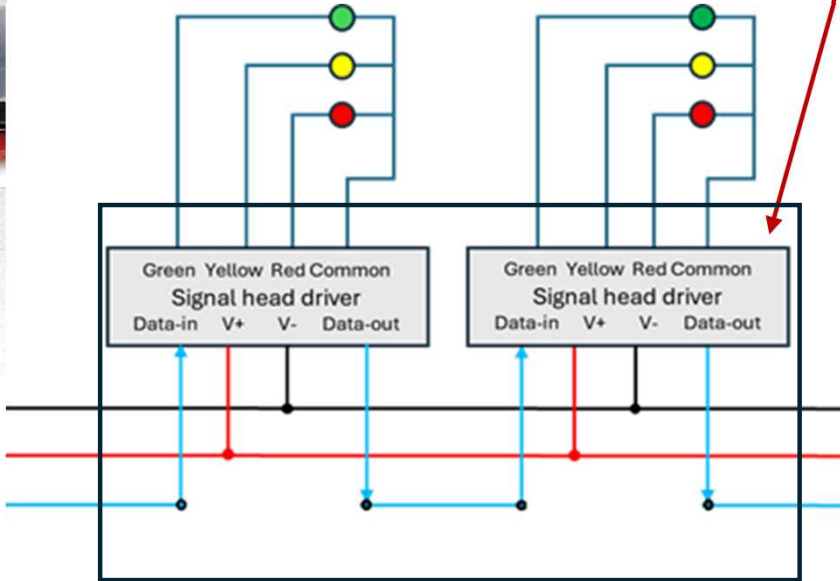
- JST 1.25 4 connector female can be used for “Do it yourself” . No need to use Atlas signals.
- Designed for “plug & play” physical wiring with Atlas signals manufactured with the JST connector (newer versions, not all)
  - This is only physical wiring. Configuration of the LCC node is still required.
  - [Atlas All Scales Signal System \(atlasrr.com\)](http://atlasrr.com)
  - <https://shop.atlasrr.com/t-signals.aspx>

# SSSB-S (screw) Single & Dual



**NOTE**

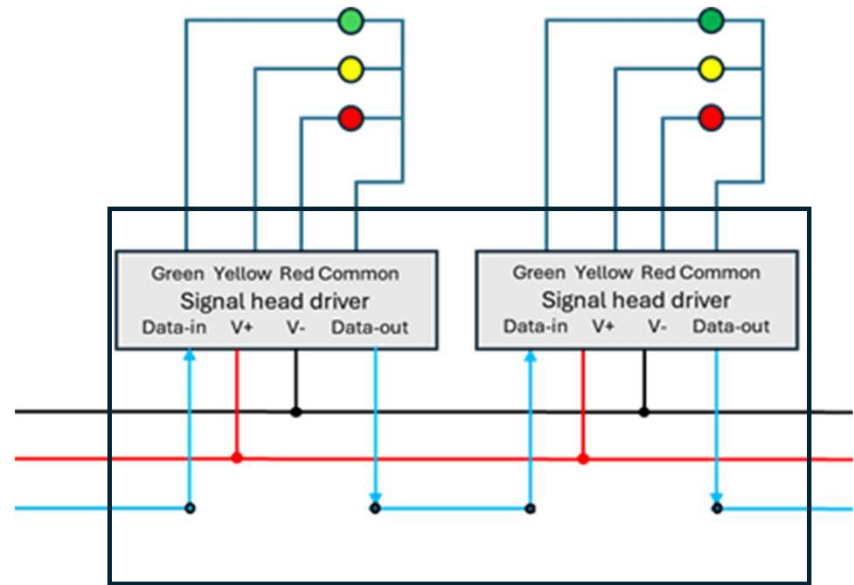
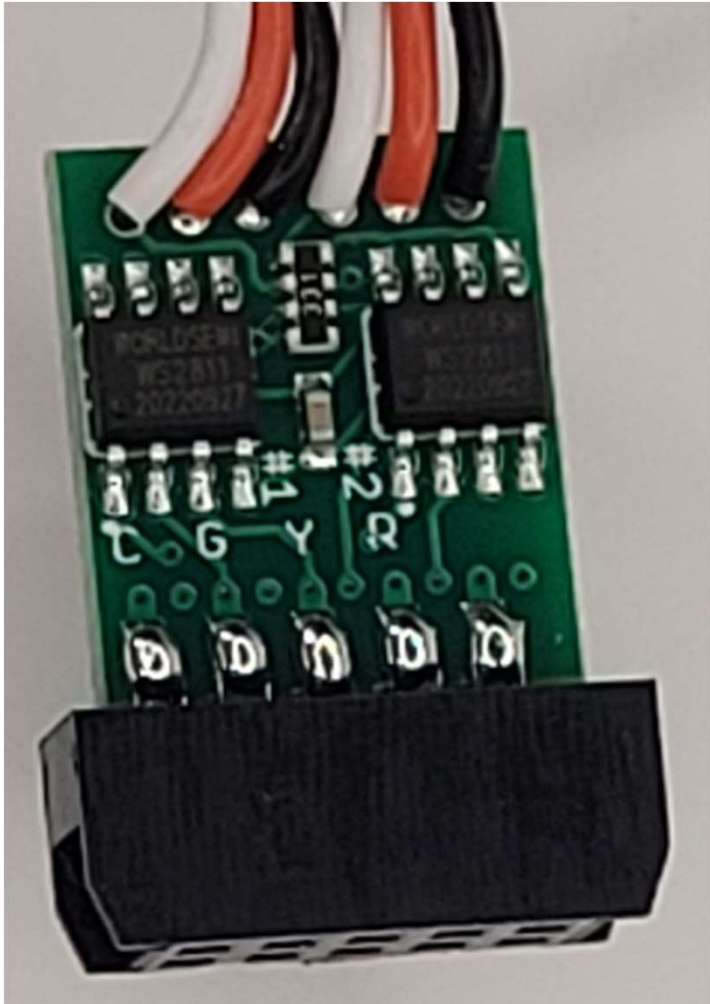
- Screw connections
- Single vs Dual = One chip versus two.
  - Same PCB, just not populated
- Y(yellow) G(green) R(red) C(common) wiring notation shown on underside



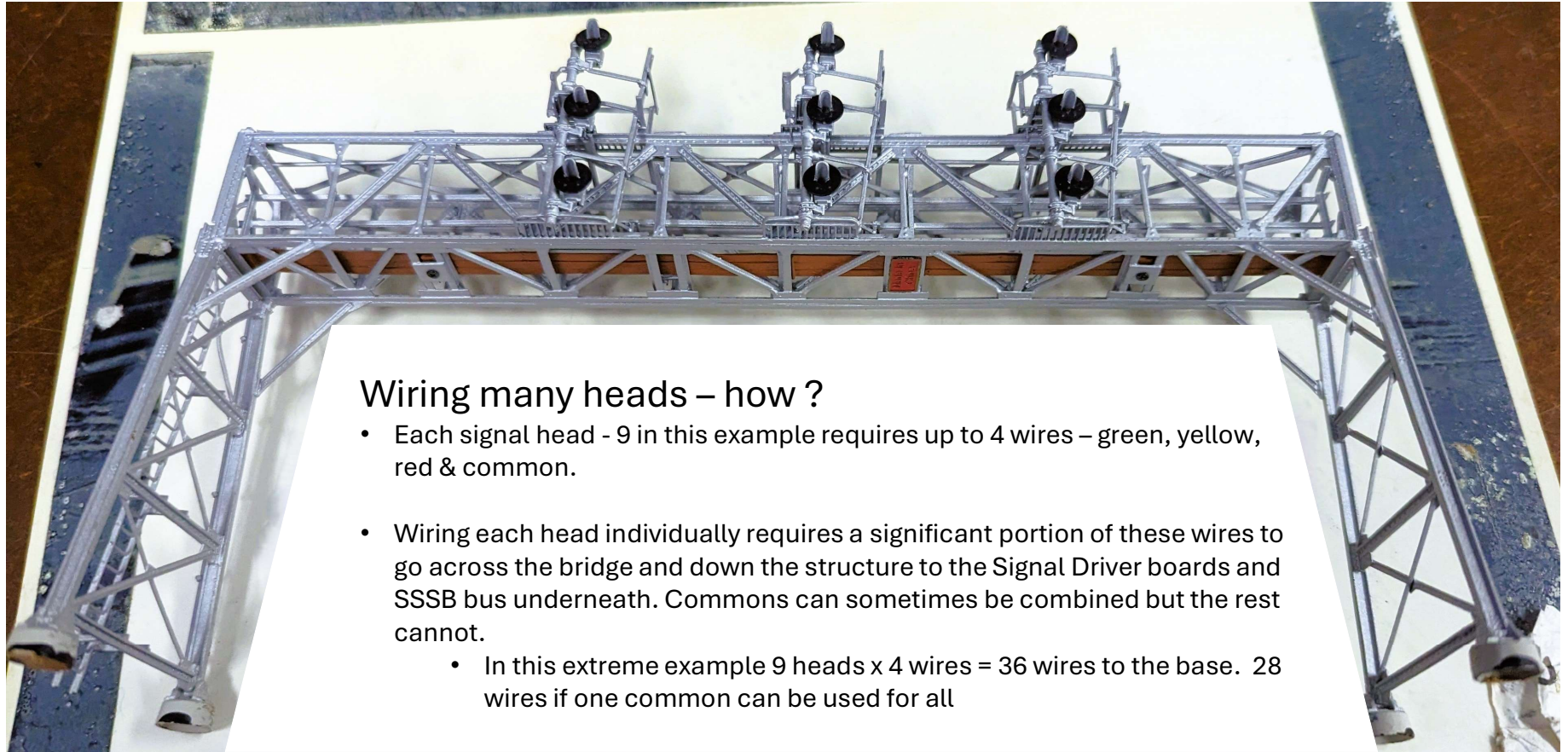
Underside of PCB



# SSSB-Digitrax-Dual



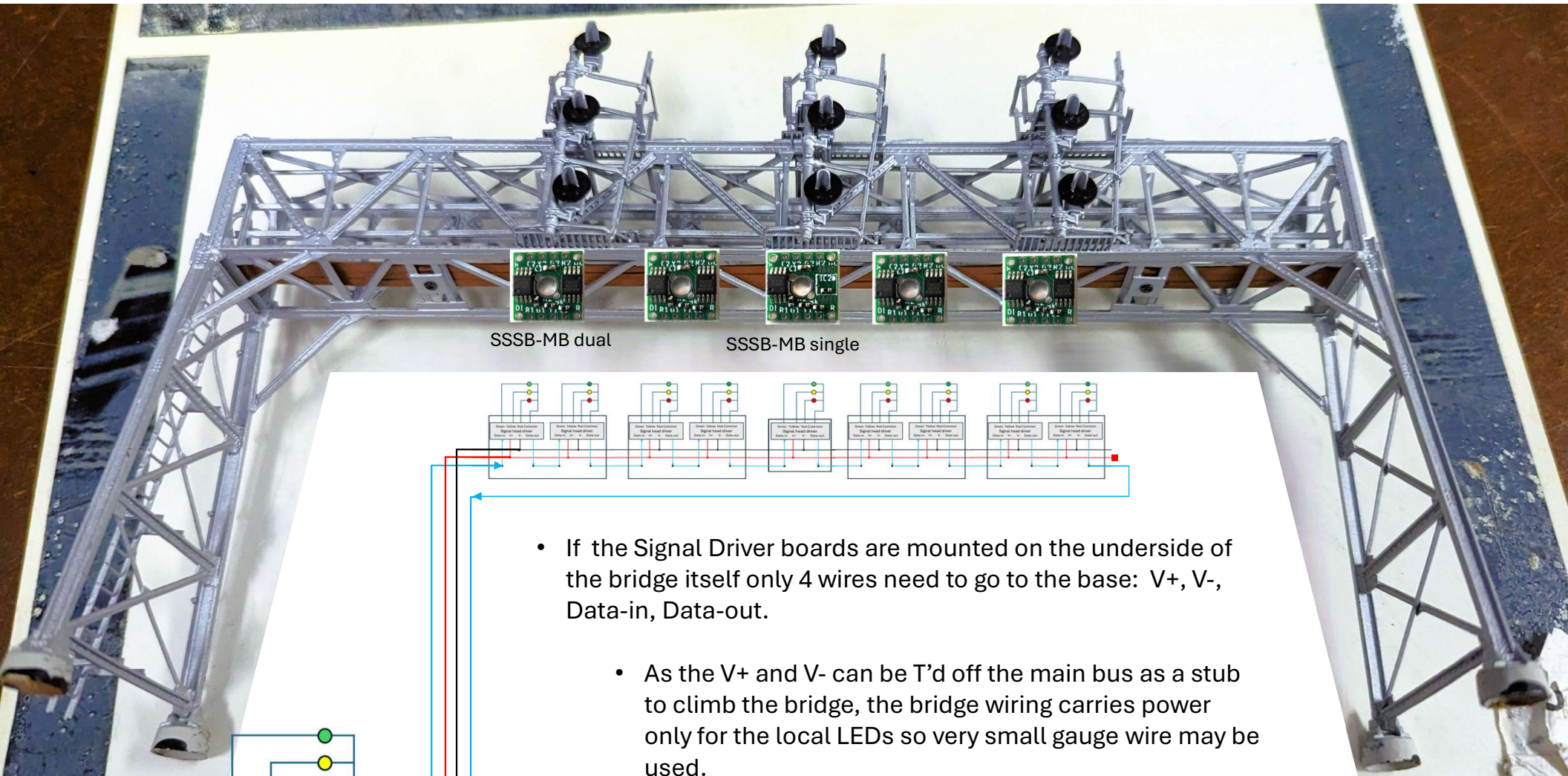
# Bridges or other multi-head structures or signals



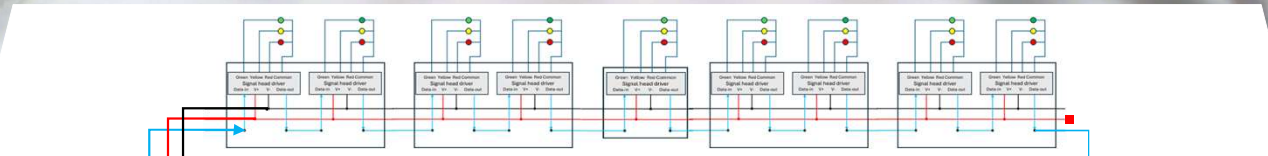
## Wiring many heads – how ?

- Each signal head - 9 in this example requires up to 4 wires – green, yellow, red & common.
- Wiring each head individually requires a significant portion of these wires to go across the bridge and down the structure to the Signal Driver boards and SSSB bus underneath. Commons can sometimes be combined but the rest cannot.
  - In this extreme example 9 heads x 4 wires = 36 wires to the base. 28 wires if one common can be used for all
- Alternative – if the Signal Driver boards are mounted on the underside of bridge itself, only 4 wires need to go to the base: V+, V-, Data-in, Data-out. This is the SSSB-MB's purpose.
- Two heads are essentially a wash vs other choices, like dual SSSB-screw or Atlas/JST : 4 wires versus 7
- As the # of heads are increased, the advantages of the SSSB-MB increase quickly from a wire count saving perspective but so also does the requirement for fine soldering.

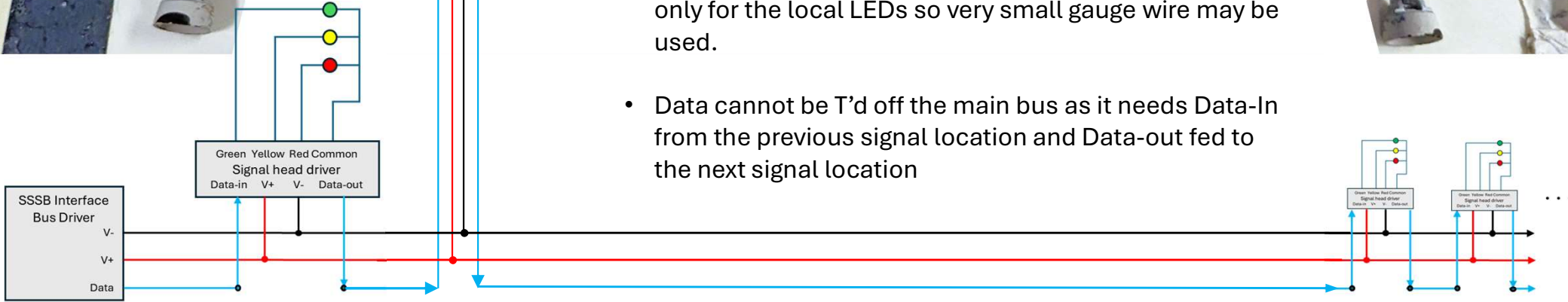
# Bridge with SSSB-MB single & dual



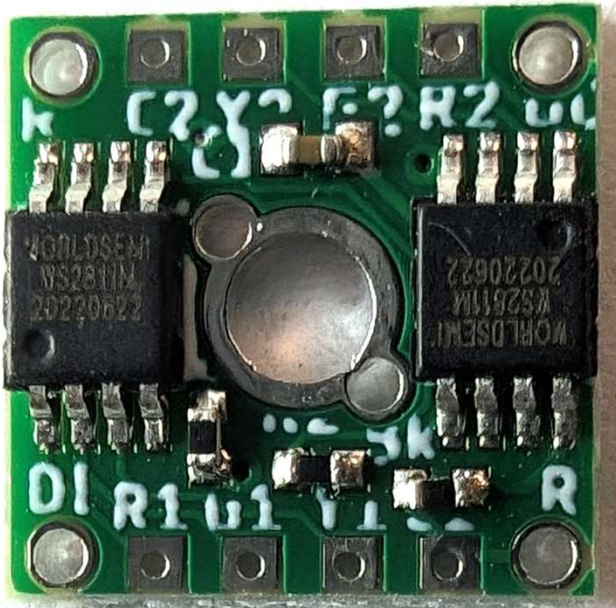
SSSB-MB dual                      SSSB-MB single



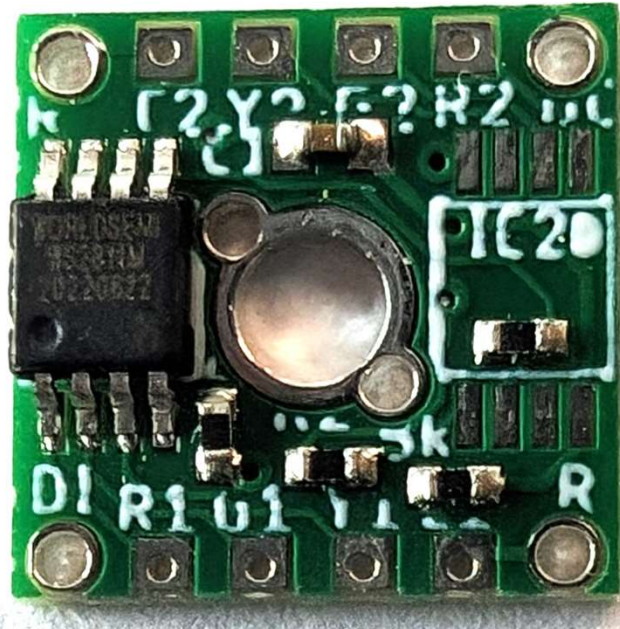
- If the Signal Driver boards are mounted on the underside of the bridge itself only 4 wires need to go to the base: V+, V-, Data-in, Data-out.
- As the V+ and V- can be T'd off the main bus as a stub to climb the bridge, the bridge wiring carries power only for the local LEDs so very small gauge wire may be used.
- Data cannot be T'd off the main bus as it needs Data-In from the previous signal location and Data-out fed to the next signal location



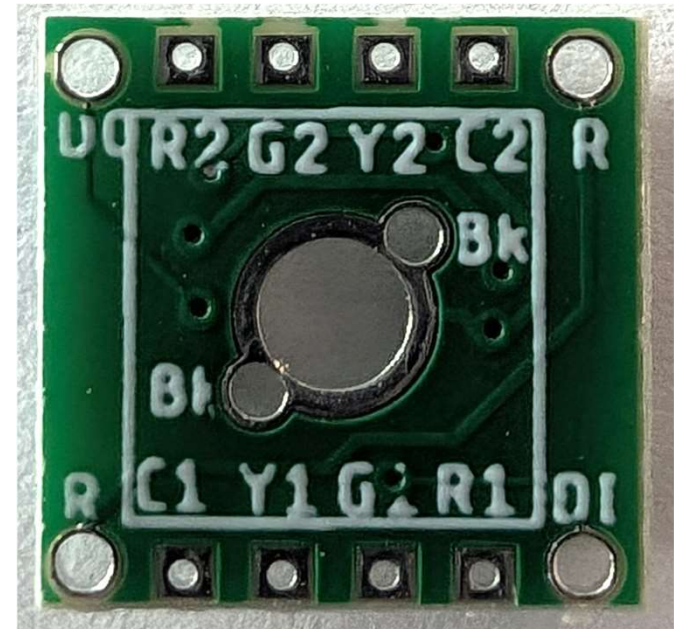
# SSSB-MB single or dual wiring



SSSB-MB dual top side



SSSB-MB single top side  
- Note missing IC2 chip

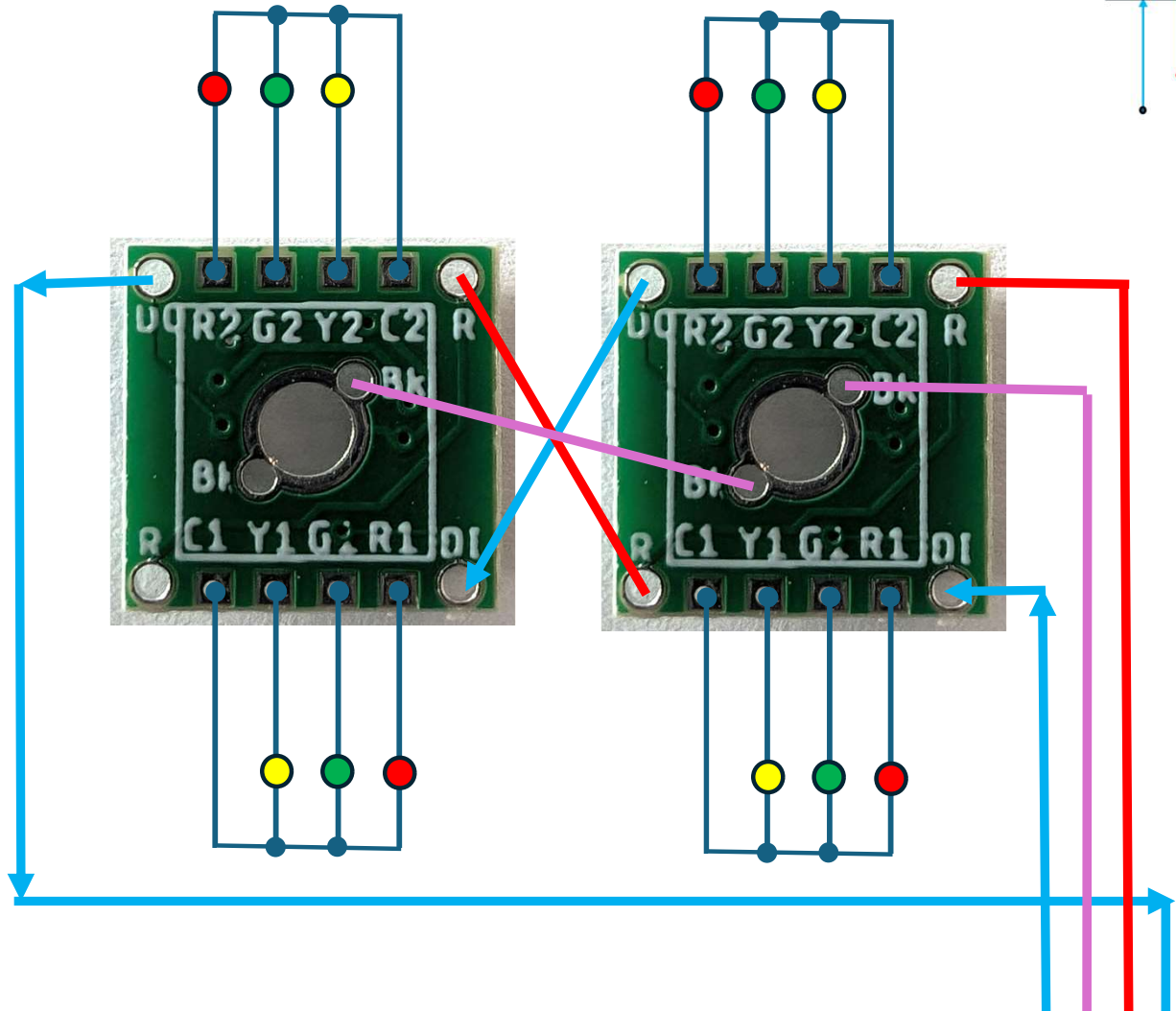
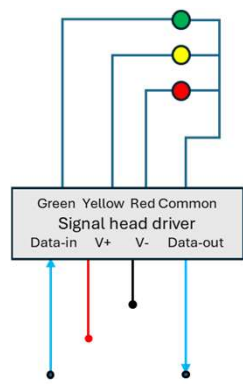


SSSB-MB dual bottom  
- R2, G2, Y2, C2 not used  
in single version

- SSSB-MB means used for “Magnetic” or “Bridge”.
- Hole in the middle designed to accept a signal mast pole
- Multiple SSSB-MB’s may be stacked vertically and all connections will line up for easy vertical connecting
- Multiple SSSB-MB’s may be stacked vertically on top of the SSSB-Magnetic Base allowing all electronics, including magnetic disconnect, to be mounted at base of a multihead signal mast

# SSSB-MB single or dual wiring (View from bottom)

- V- = BK
- V+ = R (Note: not R1 or R2)
- DI = Data In
- DO = Data Out
- Signal head 1
  - G1 = green
  - Y1 = yellow
  - R1 = red
- Signal head 2
  - Not used in SSSB-MB single
  - G2 = green
  - Y2 = yellow
  - R2 = red

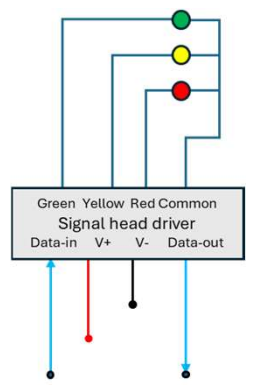
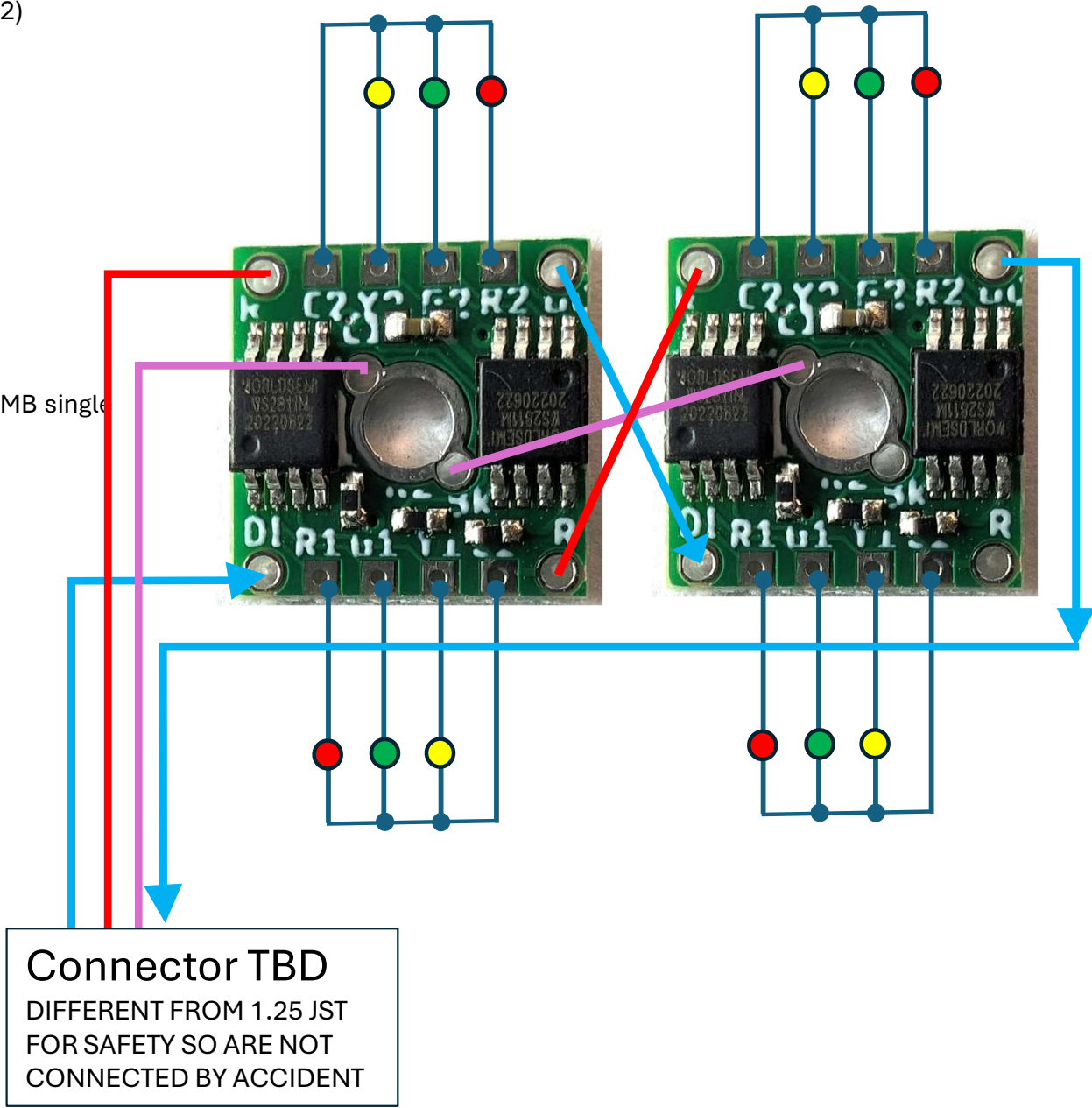


NOTE  
PURPLE — is used for  
BLACK — for print visibility

Connector TBD  
DIFFERENT FROM 1.25 JST  
FOR SAFETY SO ARE NOT  
CONNECTED BY ACCIDENT

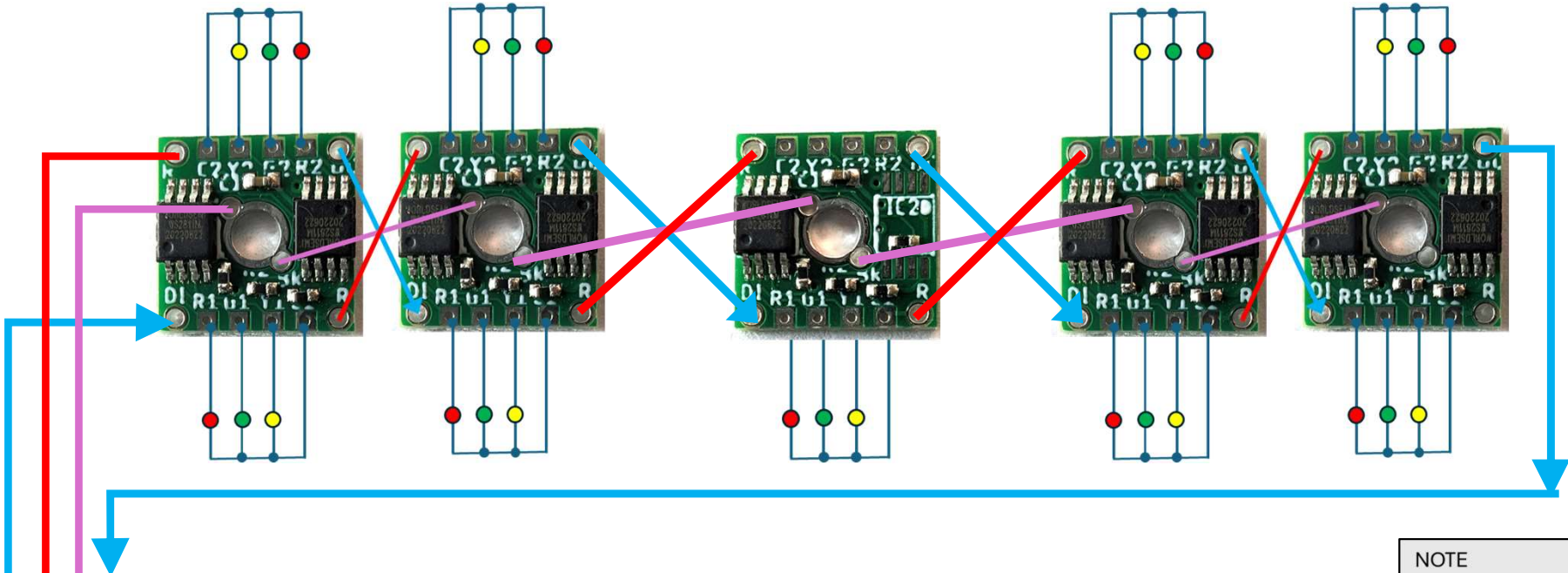
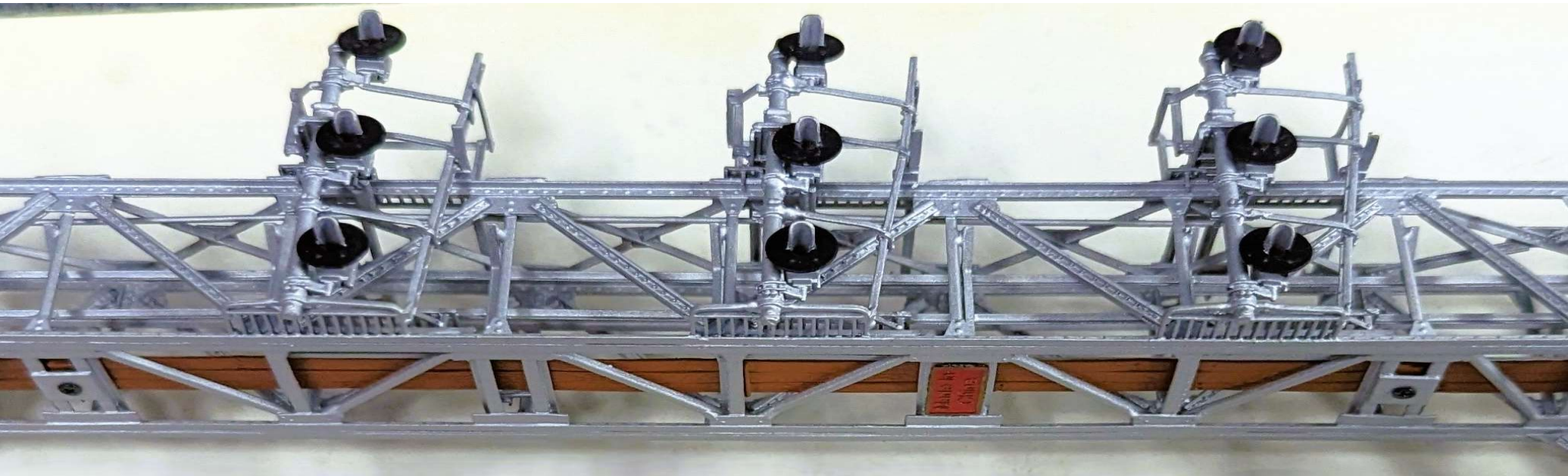
# SSSB-MB single or dual wiring (View from top)

- V- = BK
- V+ = R (Note: not R1 or R2)
- DI = Data In
- DO = Data Out
- Signal head 1
  - G1 = green
  - Y1 = yellow
  - R1 = red
- Signal head 2
  - Not used in SSSB-MB single
  - G2 = green
  - Y2 = yellow
  - R2 = red



NOTE  
 PURPLE ———  
 is used for  
 BLACK ———  
 for print visibility

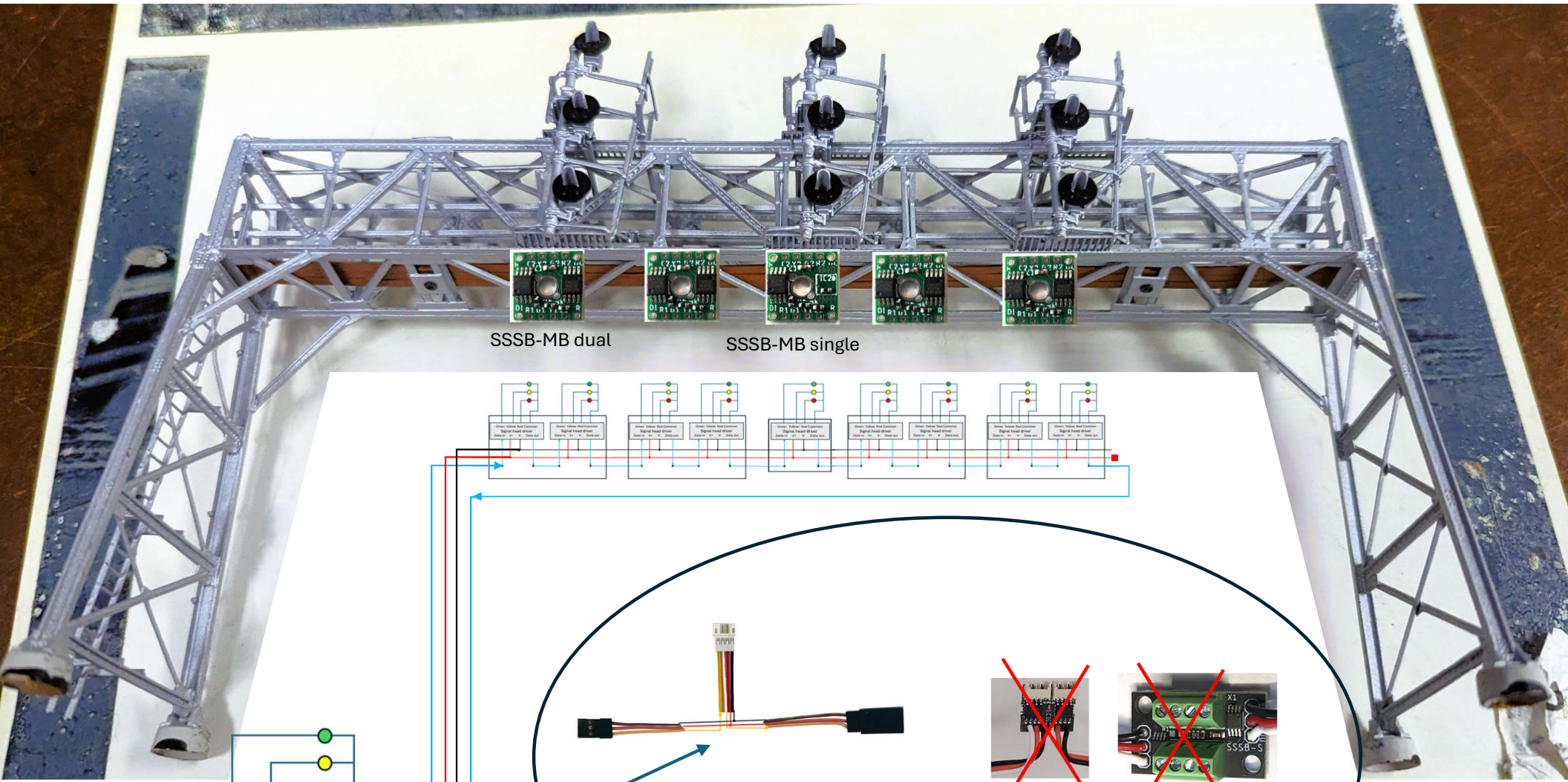
# Bridge with SSSB-MB single & dual



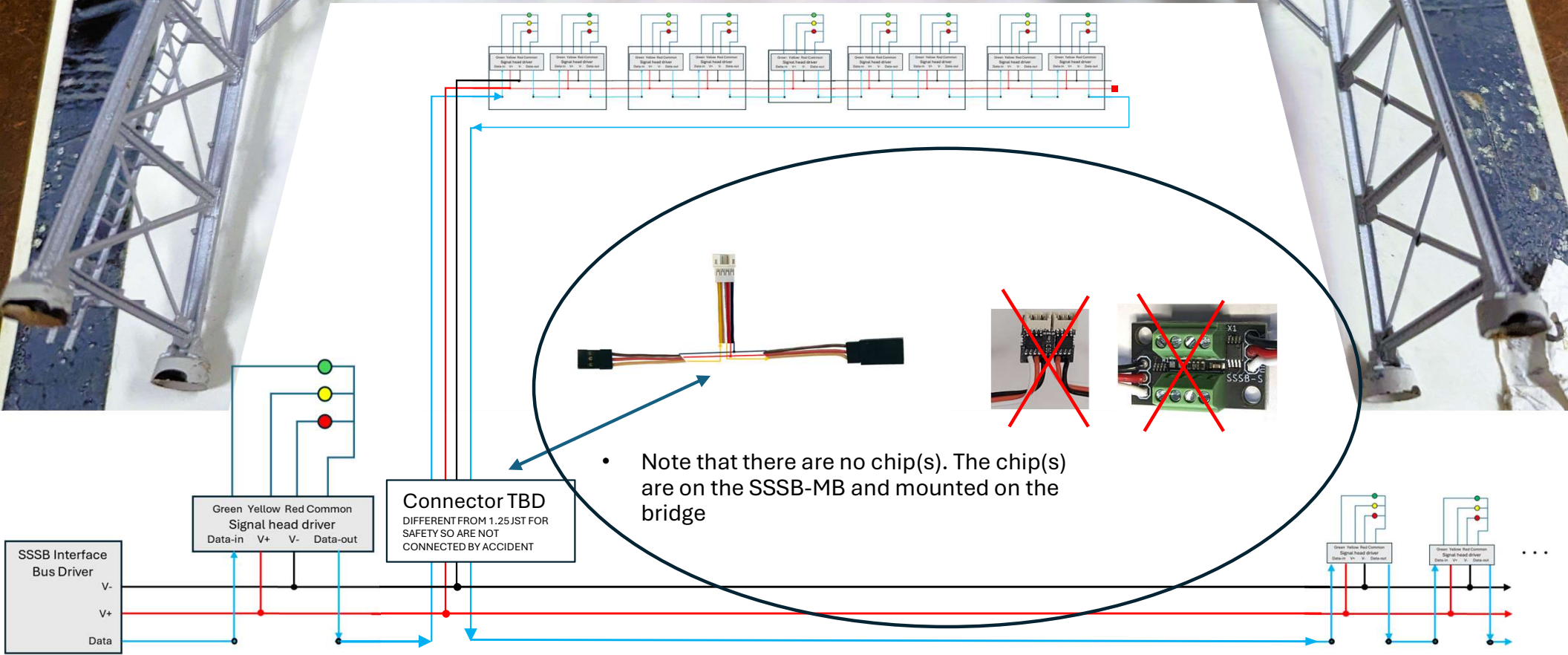
**Connector TBD** DIFFERENT FROM 1.25 JST FOR SAFETY SO ARE NOT CONNECTED BY ACCIDENT

NOTE  
PURPLE — is used for BLACK — for print visibility

# SSSB-MB connection to 3 wire bus

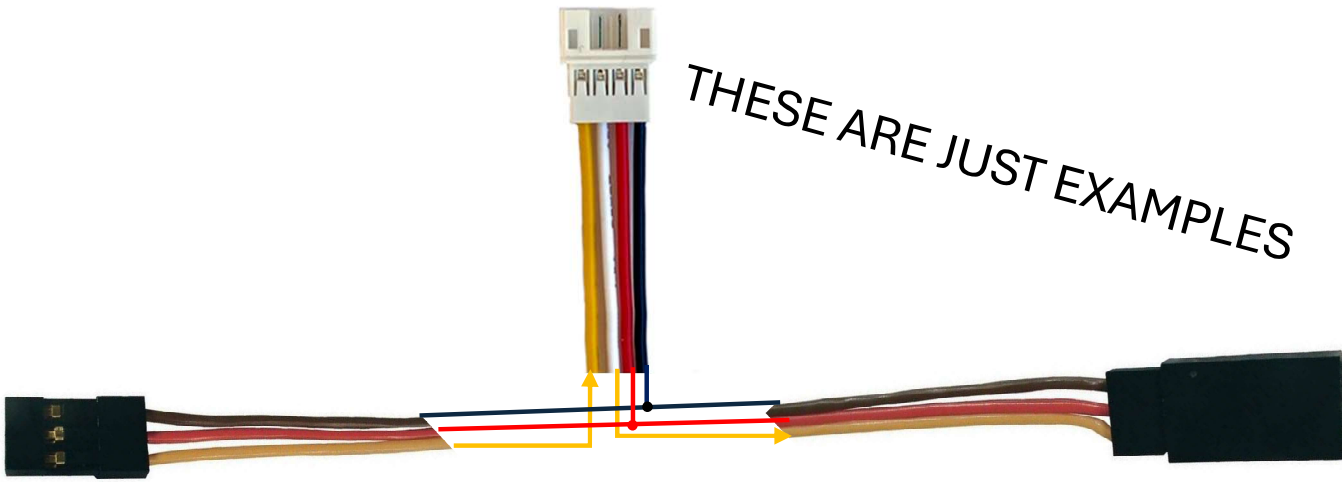


SSSB-MB dual                      SSSB-MB single

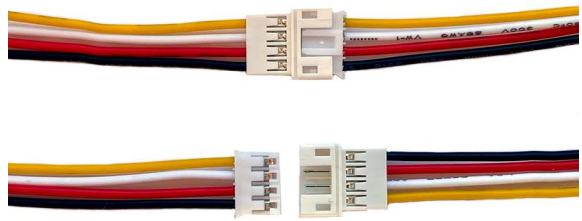




# SSSB-MB connection to 3 wire bus

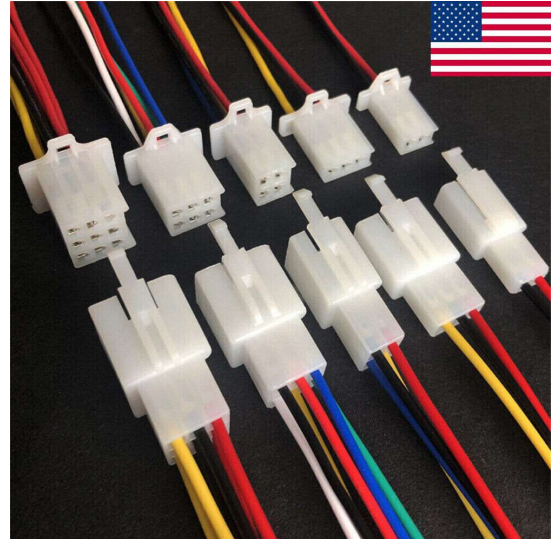


PH 2.0mm 4pin



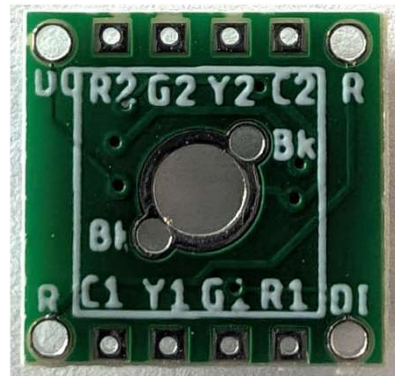
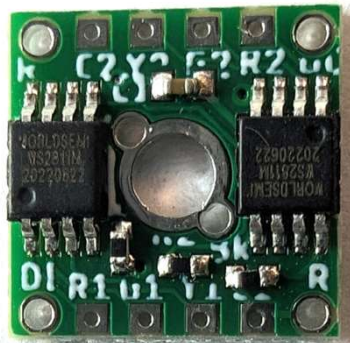
Male Housing Connector plug with 15cm wire x 5pcs  
Female Housing Connector plug with 15cm wire x5 pcs

- Note that there is no chip(s). The chip(s) are on the SSSB-MB and mounted on the bridge.
- Trade off of ease of use under the layout versus size of the hole in the layout top
- We make these ourselves
- Ideas for possible bridge to bus connections
  - Micro JST PH 2.0mm Pitch Male Female Socket Wire Cable Connector 4 pin (vs 1.5 mm of standard Atlas JST)
  - 4 Way Pin Male Female W/Wire Motorcycle Car 2.8mm Connector Plug Socket Set



# SSSB-MB stacking

- Hole in the middle designed to accept a signal mast pole
- Multiple SSSB-MB's may be stacked and all connections will line up for easy vertical connecting
- Board designed such that rotating 180 degrees lines up Data-in vertically with Data-Out while leaving V+ (R) vertically aligned as they're mirrored as are V- (BK)
- A brass or other conductive mast can be used as the V- and soldered directly to the hole which is V- of the board
- Multiple SSSB-MB's may be stacked vertically on top of the SSSB-Magnetic Base allowing all electronics, including magnetic disconnect, to be mounted at base of a multihead signal mast and detachable.
- Multiple physical orientations will work. Be sure D-out lines up with D-In but do not create a loop D-Out->D-In>D-Out>D-In !

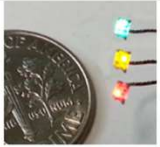


# SSSB-MB or not ?

- Wiring 2 heads on a bridge or cantilever –
- Each signal head - 2 in this example - requires up to 4 wires – green, yellow, red & common.
- Wiring with SSSB-MB requires 4 wires up the structure and an SSSB-MB-dual to be wired.
- Wiring with dual SSSB-S(screw) dual or Atlas/JST dual requires 8 wires through the base and up the structure
- A 3<sup>rd</sup> option – and that envisioned by RR-CirKits – is that the SSSB-MB is small enough to be mounted in the base of the signal - 11mm x 11mm ( about 0.4 in x 0.4 inch) – 8 wires up the structure and 4 wires through the base.



# LEDs

<a href="#">SS-RGY-24</a>		<p>This RGY LED is provided with four 24" long color coded #36 AWG wires. It may be fitted in place of a common T-1 LED with room to spare. The LED provides the three standard searchlight signal colors and is wired the same as a normal three light signal head would be. (common anode connection) (dime not included)</p> <p><a href="#">More Info</a></p>
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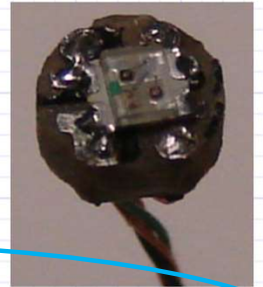
- LEDs (and other diodes) have positive (+) and negative (-) sides to them. For an LED to work it needs to be connected to a voltage source with the correct side. The voltage supply side of the diode is the positive (+) side, this is called the anode. The negative side is called the cathode.
- On the RR-CirKits boards the "C" means "Common", this is the anode, or positive source.
- Magnet wire can be enamel or rubber coated. RR-CirKits LED wires are rubber coated.
- Use a very fine tipped soldering iron and flux. This melts the rubber, exposing the wire. The flux is key because it cleans/floats the burnt rubber away allowing you expose and tin the wire underneath
- Experimentation on extra wire before trying an actual board is probably wise.
- Jury is still out on whether it is better to put the LED wire through hole on board before or after the rubber has been removed.

## Solution

The solution to this is obvious. You need to have a three color LED, not a two color LED. Unfortunately all the readily available three color LEDs that are small enough to fit into a small signal head are the primary light colors of Red, Green, and Blue, not the signal colors of Red, Green, and Yellow. Furthermore the primary color green and the RR signal green are not the same. To solve this issue we contacted a major LED manufacturer and special ordered a three color LED. Because it was a special order in the first place we were able to also specify the proper colors for each LED.

## Advantages

The advantage of using the three color LED is that not only do you get the proper three colors, but the wiring is the same as it would be for any other three color signal. The disadvantage for us as a manufacturer is the difficulty and time required in soldering four very small (#36AWG) wires onto a 3mm diameter circuit board that has the LED mounted on it.



## The Wiring

The wires to the circuit board are color coded red, green, amber, and dark blue. The dark blue wire is the common anode connection.

## Images

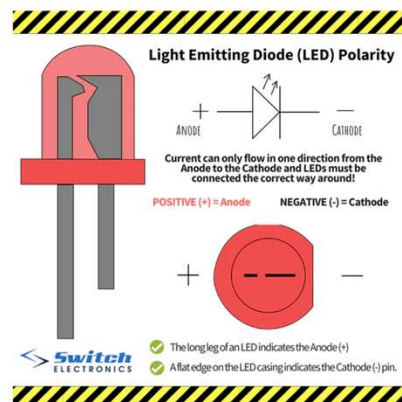
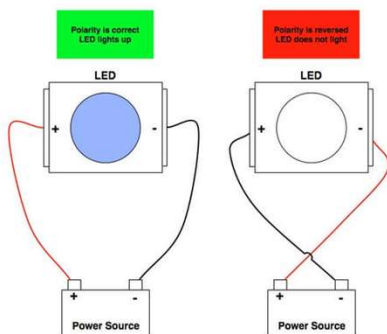
The following images show our 3 color LED mounted into a simple Oregon Rail Supply signal head as compared with another popular searchlight signal. In these photos both signals are being driven from identical circuits at the same current. (4ASD-4) The black chunk is the original sprue which I did not remove. The 3mm circuit board was simply inserted into the rear of the Oregon Rail Supply head. It could just as well have been inserted into any other head with sufficient opening for a 3mm LED.



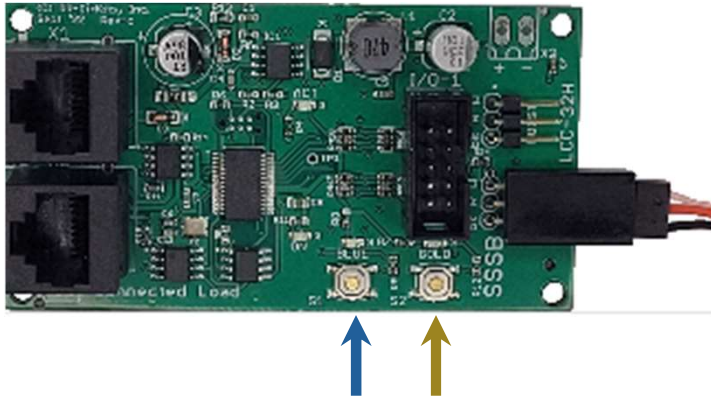
The reason the 3 color LED appears to be so much brighter, even washing out the colors in these photos, is that you are looking directly at the chip. The other signal has to locate its individual LEDs down inside of the housing for sufficient space, and then reflect the light through a clear plastic light pipe to the front of the signal.

## The Parts

RR-CirKits SS-RGY-18 LED with 18" #36AWG color coded wires.



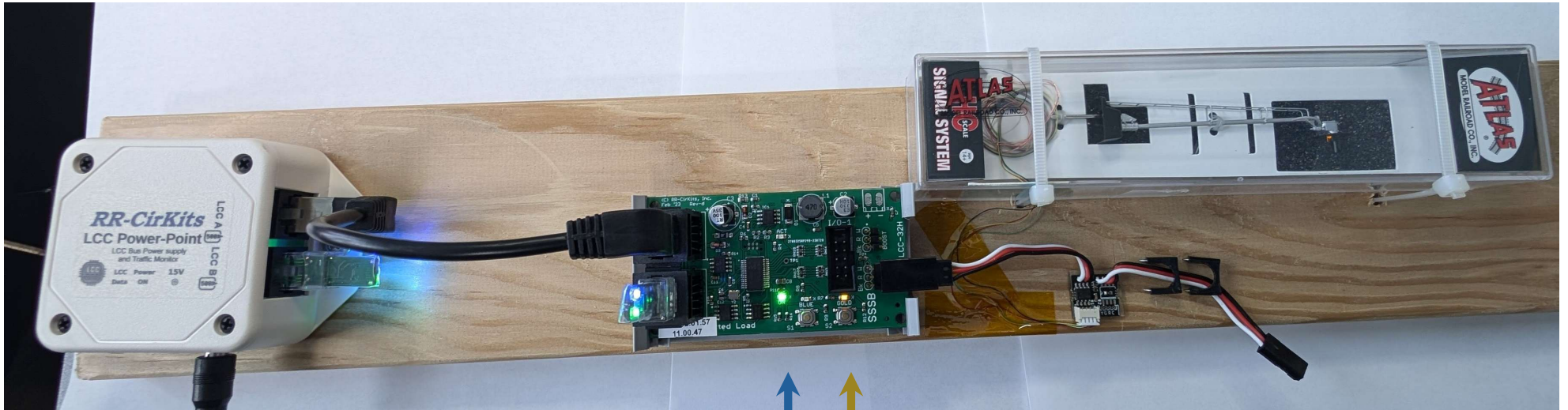
# Testing wiring.



- Pressing the BLUE & GOLD (labelled) buttons together for 5 seconds or so until they flash, and then letting go while they continue to flash, will cause every signal head on the chain to cycle red, green, yellow, pause... repeat red, green, yellow, pause, repeat, etc.
- Press both buttons together again to stop the test.
- Trick – use a known good signal, like a manufactured Atlas signal on an SSSB-Atlas connector to prove to yourself the test works and your chain is good to that point at least.
- Using a known good signal makes it easier to know if your colours are wired correctly as one out of synch with the others is visually obvious.

# Test jig for Mike

Permanently mounted 'known good' reference signal



Wallwart plugs in here

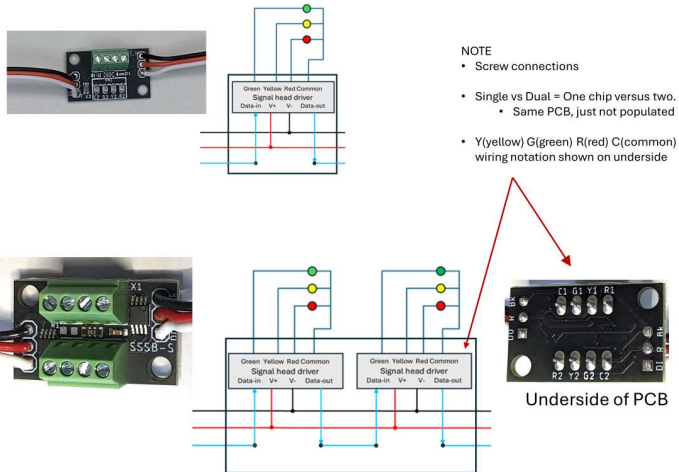
Blue Gold test buttons

Connect one or more signals here.

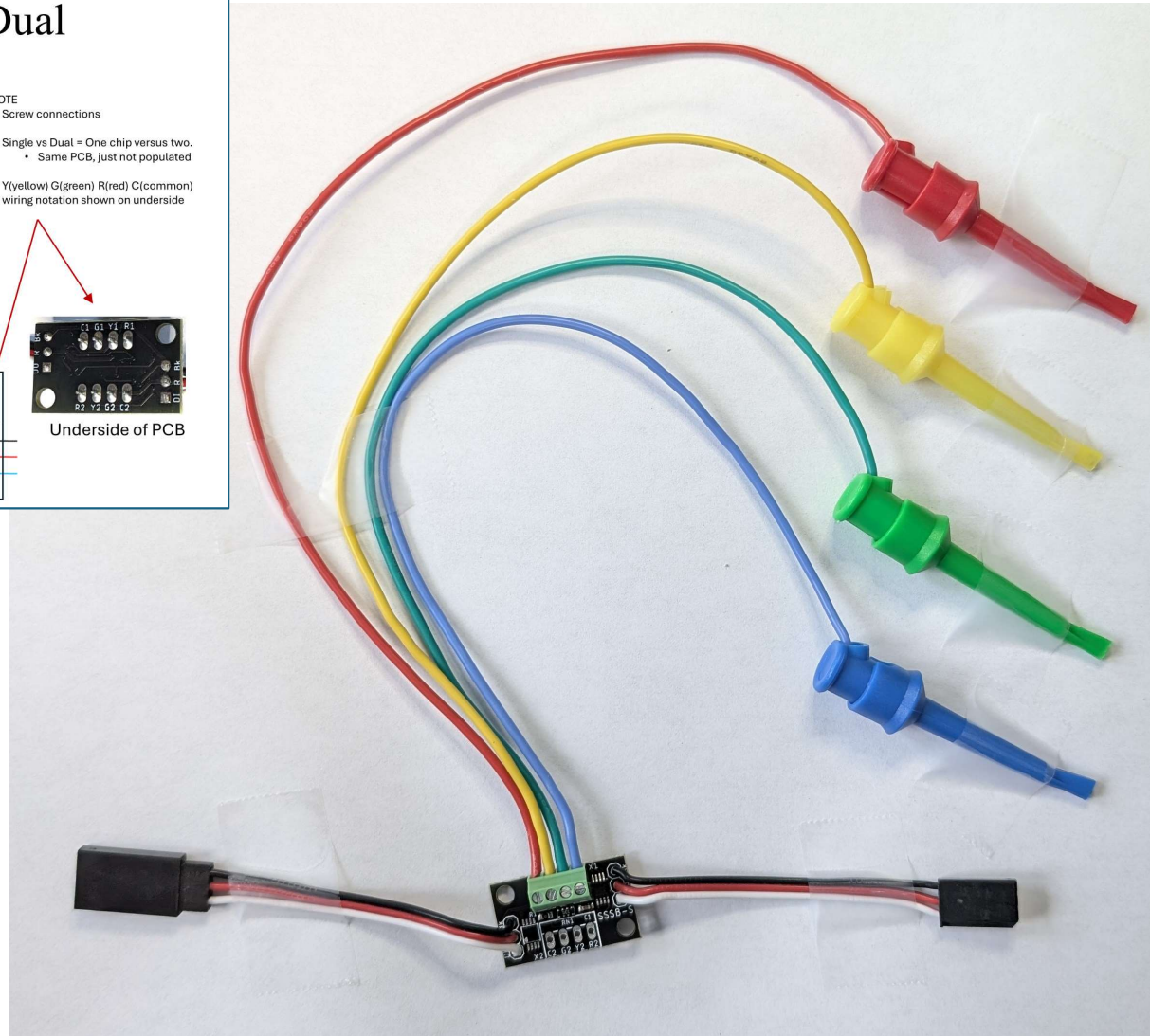
The more the merrier.  
Can use Male-Female extension cords to keep things neat and give you more work bench space

# Test jig to test LEDs or signals that use SSSB-S (screw). Chip on the PCB.

## SSSB-S (screw) Single & Dual



Original slide



Red LED

Yellow LED

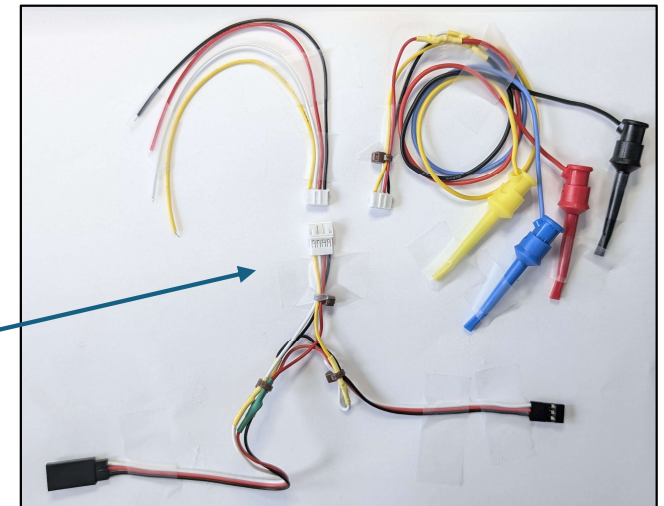
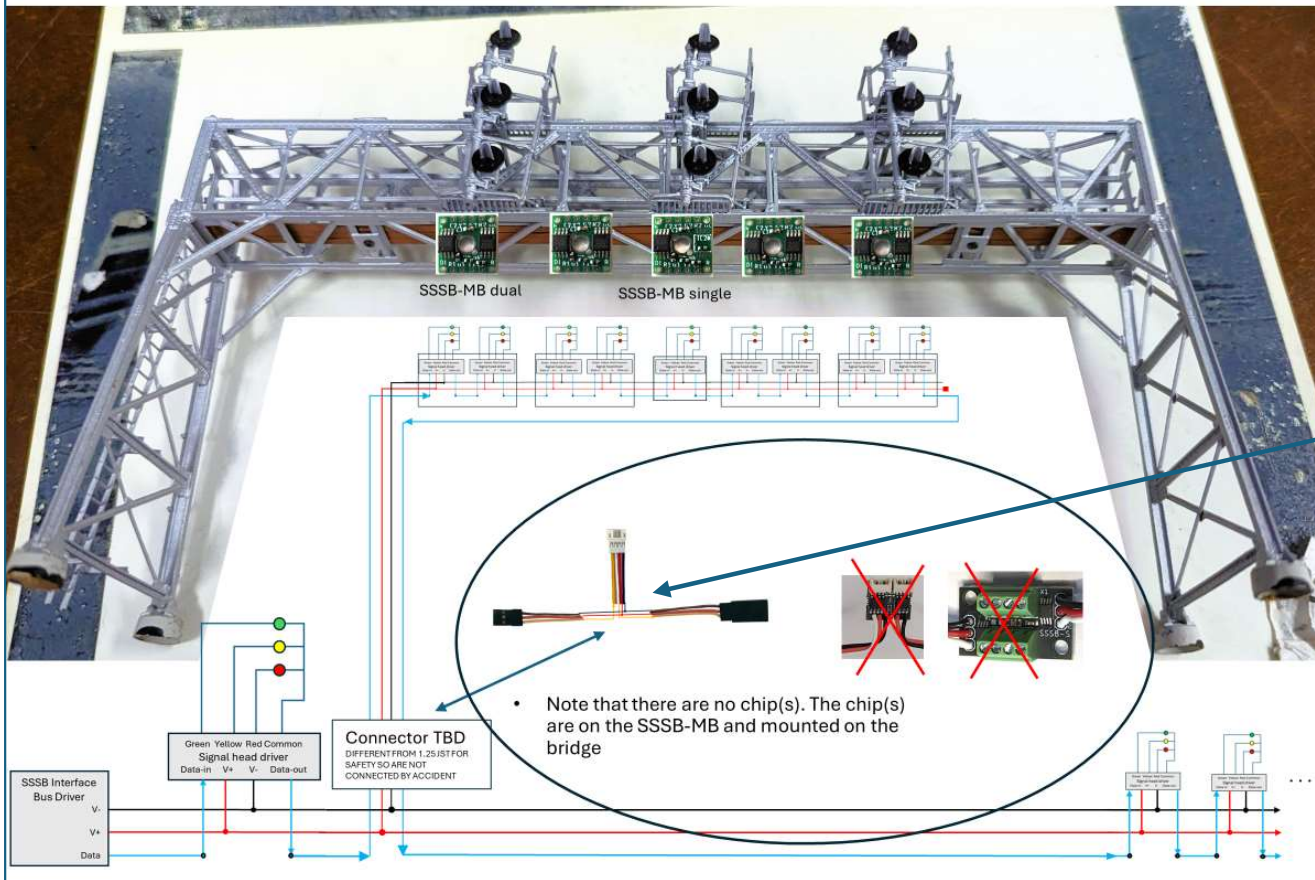
Green LED

Common

# Example of Bus Connection and Test jig for using SSSB-MB (Bridges).

This is just a wiring extension of the 3 wire bus. No chip.

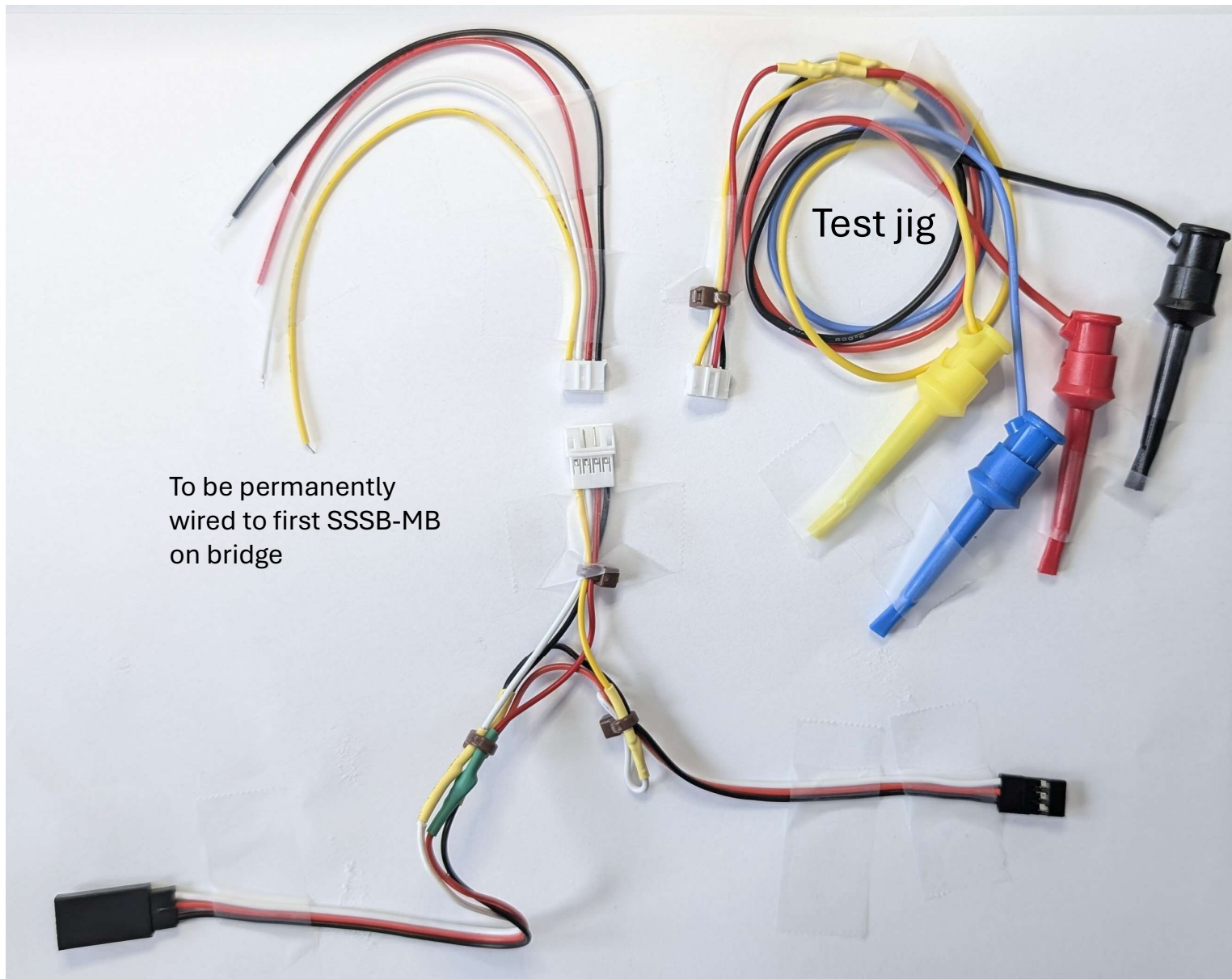
SSSB-MB connection to 3 wire bus



Original slide



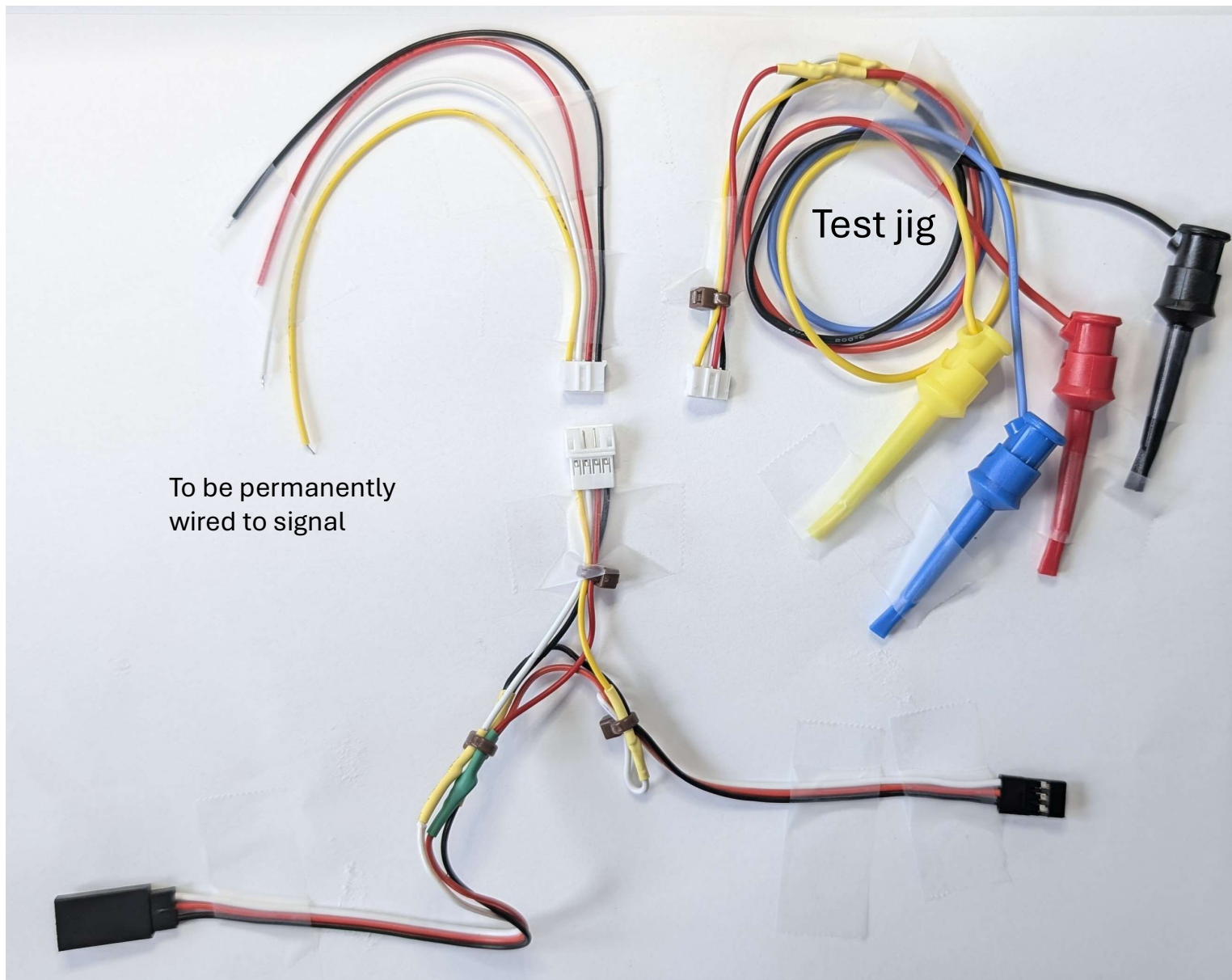
Example of Bus Connection and  
Test jig for using SSSB-MB (Bridges).  
This is a wiring extension of the 3 wire bus. No chip.



To be permanently  
wired to first SSSB-MB  
on bridge

Yellow = Data In  
White = Data Out  
Red = V+  
Black = V-

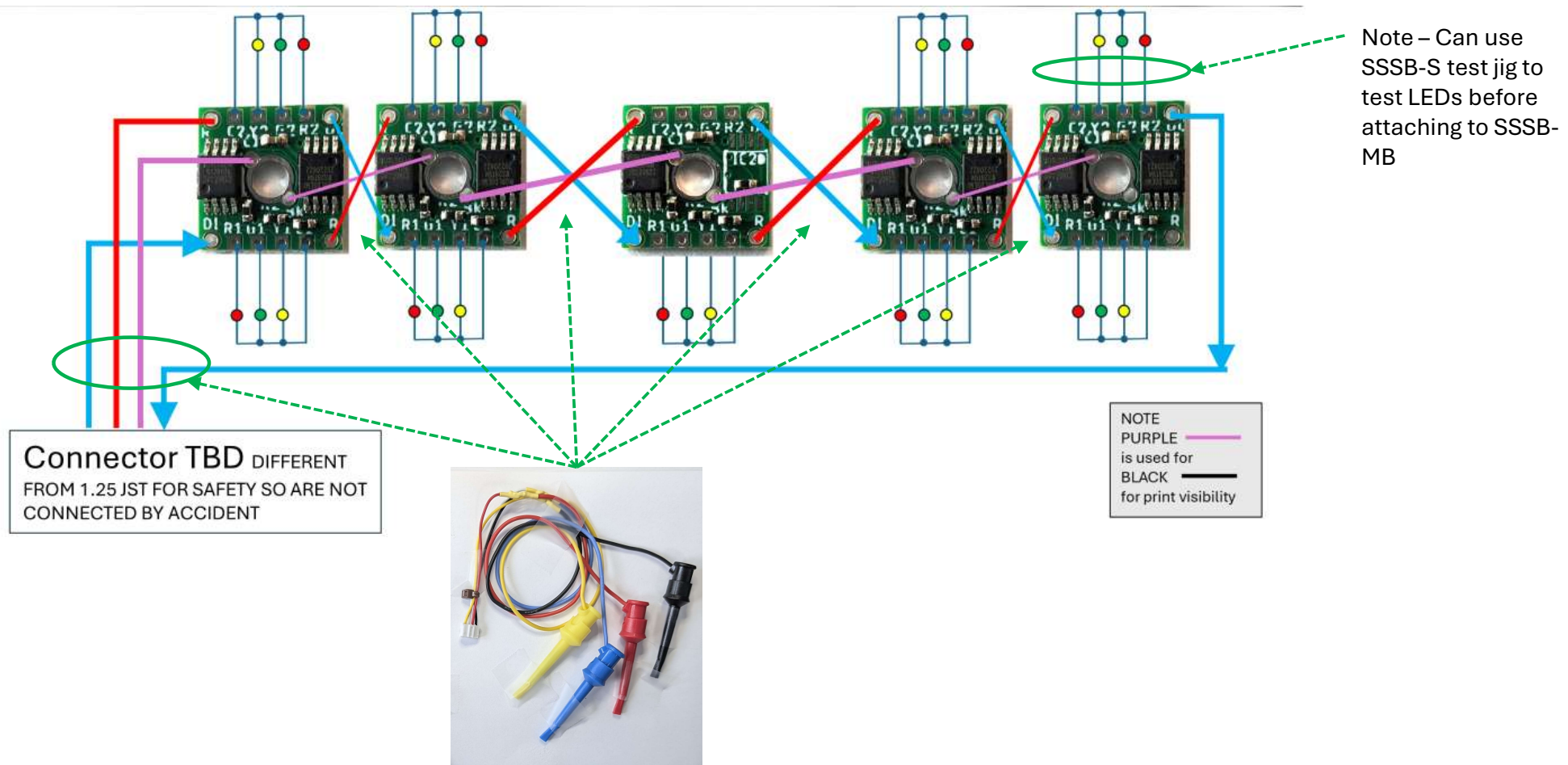
Example of Bus Connection and  
Test jig for using SSSB-MB (Bridges).  
This is a wiring extension of the 3 wire bus. No chip.



To be permanently  
wired to signal

Yellow = Data In  
White = Data Out  
Red = V+  
Black = V-

# Test jig for using SSSB-MB



- Test the work on a given SSSB-MB individually
- Then chain that SSSB-MB to a previously tested SSSB-MB
- Then test the newly extended chain before adding the next SSSB-MB.
- i.e. don't build ahead of your testing as finding an error will be much harder

# To discuss

- RR-CirKits is prototyping the Showcase Miniatures signal head with the RR-CirKits LEDs already installed

