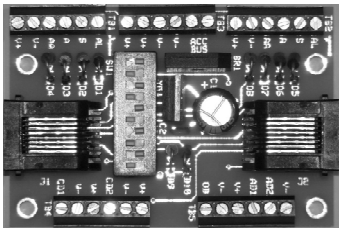
Occupancy Bus Utility Board 2



The Occupancy Bus Utility Board 2 (OBUB-2) is designed for the v1.0 Modular Signal System (MSS) and improves upon the OBUB-1 described in RailModel Journal, February 2005 issue (PDF copy available by request to warbnnt@yahoo.com).

The OBUB-2 simplifies wiring tasks and integrates circuitry for both "Cross-over" and "Cascade" type MSS nodes/modules. It eliminates the tedious task of handling the fine-gauge cable wires of the MSS Occupancy Bus by providing RJ45 jacks for direct cable plug-in, and screw terminals for connecting detectors, turnout position, and signal drivers to the bus. Diodes are incorporated to ensure isolation of Occupancy Bus and signal driver wires.

The OBUB-2 includes a rectifier and 12-volt DC regulator rated to 1 amp, for powering directly from an AC or DCC power source (such as the “Accessory Bus” used in Free-mo modules). Connection points are provided to distribute the 12 volts and system ground to detectors, signal drivers, and other accessories such as turnout motors.

DIP switches are used to configure the OBUB-2 as a MSS "Cross-over" element or a "Cascade" element (see Figure 2). This utility allows dynamic configuration of signal blocks in a modular layout. For example, combine two "too short" signal blocks into one long block, or split one "too long" block into two shorter blocks.

ASSEMBLY INSTRUCTIONS

The table below lists all required components including their Digi-Key stock numbers (www.digikey.com).
The table lists the parts in the suggested order of installation, with shorter components installed first and tallest installed last.
Use the table to match component types to reference designators and board locations.
Pay attention to the Instructions column! Most components must be oriented correctly to avoid damage when power is applied!

Reference Designator	Component Type	Digikey Stock Number	Quantity Required	Instructions
C2	filter capacitor, 0.1uF	399-4151-ND	1	
SW1	DIP switch, 10 position	CT20810-ND	1	orient switch number 1 toward TB3
D1 to D12	1N4001 isolation diodes	1N4001-TPMSCT-ND	12	see Figure 1, right
TB1 to TB5	screw terminal strips	ED2744-ND	5	face terminal openings outward
BR1	bridge rectifier	KBP2005GDI-ND	1	orient beveled edge toward D8
C1	filter capacitor, 330uF	P5167-ND	1	orient positive lead toward BR1
J1 and J2	RJ45 jacks	A31407-ND	2	carefully align 8 leads in holes, snap plastic lugs into board, solder all 8 leads
VR1	voltage regulator, 12V, 1A	LM2940CT-12/NOPB-ND	1	orient metal heatsink side toward C1

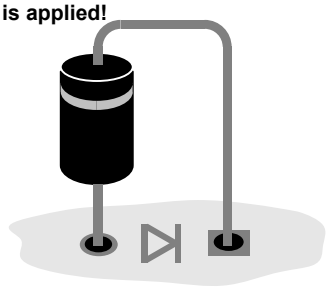
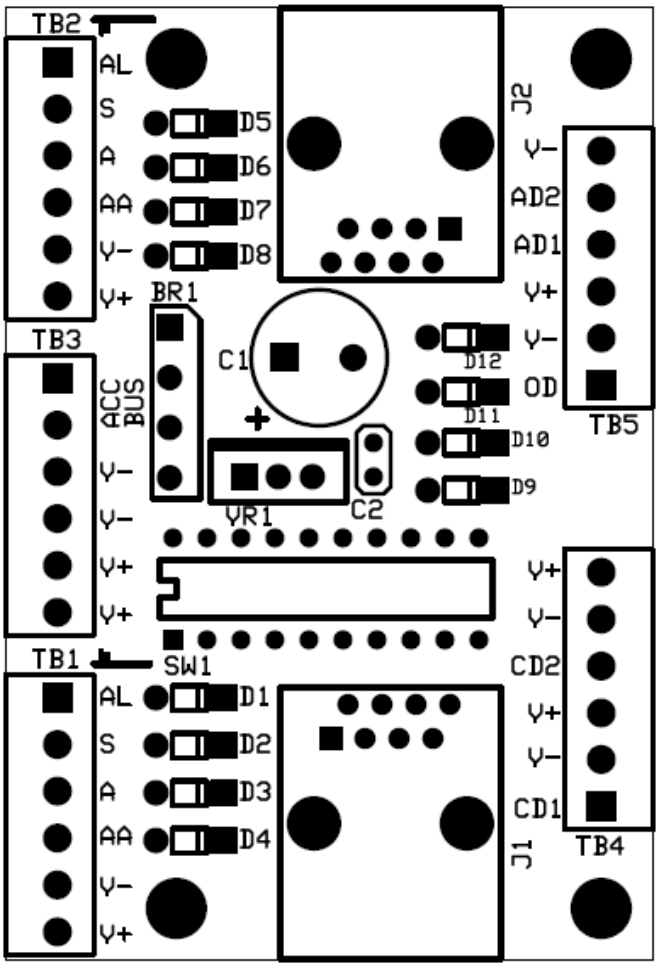


Figure 1

1. Form banded-end diode lead into a "∩".
2. Insert in board oriented as shown.
3. Solder and clip leads.

Refer to the board diagram, right. Each component location is labeled with a reference designator. Install all components on the side of the board shown. Solder the component leads to the opposite side of the board using a “no clean” or “water soluble” type flux solder. Trim excess lead length with wire cutters after soldering. Remove excess solder flux as needed.



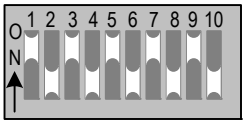
DIP SWITCH CONFIGURATION

Refer to the switch diagrams, Figure 2, below.
The OBUB-2 may be used in either type of MSS node/module by setting the DIP switches as shown.

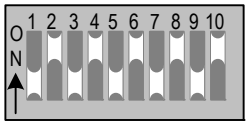
Cascade nodes/modules are located at signal block boundaries where one block ends and the next one begins, and usually have track-side signals. The DIP switches route the Occupancy Bus lines in a “Cascade” pattern as they connect from one signal block to the next.

Cross-over nodes/modules are located within a signal block, and do not have track-side signals. The DIP switches route the Occupancy Bus lines in a “Cross-over” pattern to meet the “odd number of Cross-overs” rule for MSS Cross-over nodes/modules.

Figure 2
slide switch configuration



Cascade mode:
turn ON odd-numbered switches,
turn OFF even-numbered switches



Cross-over mode:
turn ON even-numbered switches,
turn OFF odd-numbered switches

INSTALLATION INSTRUCTIONS

The OBUB has four large corner holes for mounting in a module using screws and standoffs (not included).
Locate it where ambient air can flow to cool the voltage regulator, VR1.

Figure 3 shows typical connections to the OBUB-2 in a Cascade node/module with trackside signals, including current detectors on either side of the block boundary (note the double rail gaps), an optical detector at the boundary, and signal drivers for each direction.

Terminal Block 3 (TB3) receives the input power for the on-board regulator – connect either AC or DCC voltage between 15.2VAC and 26VAC.
TB3 also outputs the regulated 12V DC power (V+, V-). The V- is "ground" or "common" for the MSS.
This power output may be used for a limited number of accessories such as turnout motors, up to the 1.0 amp maximum current limit of 12V regulator.

TB1 and TB2 output DC power (V+, V-) and occupancy lines for connection to signal drivers, including Approach Light (AL), Stop (S), Approach (A), and Advance Approach (AA) aspects. Note the orientation of the trackside signals relative to the OBUB-2. The signal protecting the end of Block 1 connects to TB1.

TB4 receives detection inputs from two current detectors (CD1, CD2) and outputs DC power (V+, V-) to power them.

TB5 receives detection input from one optical detector (OD) and outputs DC power (V+, V-) to power it. TB5 also accepts status from accessories such as turnout positions (AD1, AD2), and provides a ground reference (V-) for them since detection status inputs must be "active low" in the Modular Signal System. See application notes on Page 3 of this instruction.

J1 and J2 receive straight-through (patch) RJ45 cables to extend the Occupancy Bus to the RJ45 couplers at the module endplates.

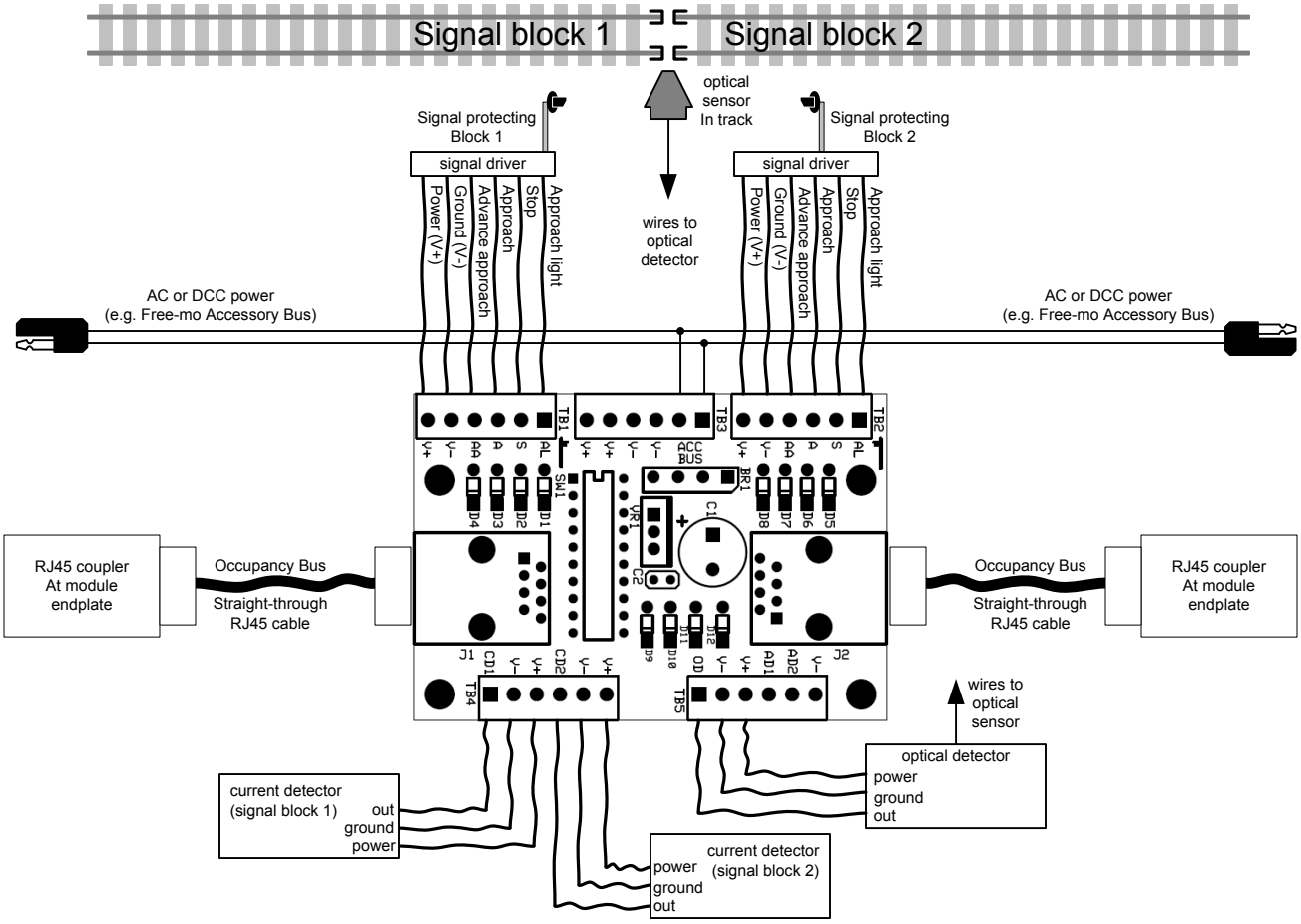
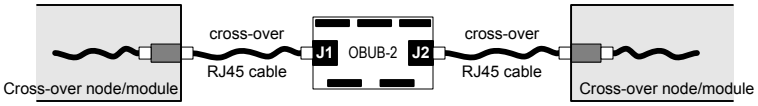


Figure 3

For use in a Cross-over node/module without trackside signals:
Set the OBUB-2 DIP switches per Figure 2 "Cross-over". See page 1 of this instruction.
A typical installation has no signal drivers and just one current detector, which may be wired to either CD1 or CD2.
An optical detector may be connected to OD, but is not required for Cross-over nodes/modules.
The 12VDC regulator may be used to power module accessories up to maximum of 1.0 amp.

ANOTHER APPLICATION

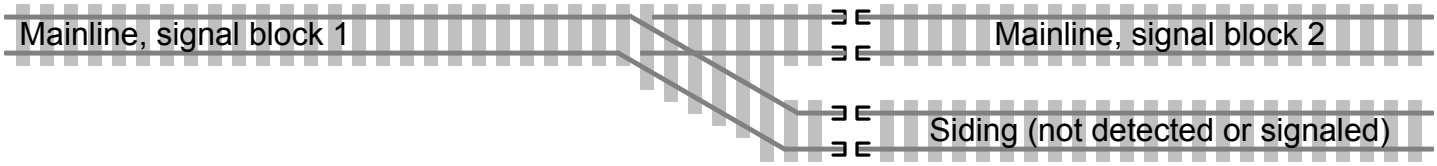
The OBUB-2 may also be used as a "portable Cascade" between Cross-over nodes/modules, for splitting one long signal block into two shorter blocks.
Set DIP switches to "Cascade" pattern. In this case, no connections are made to TB1 through TB5, and the on-board 12VDC regulator is not utilized.

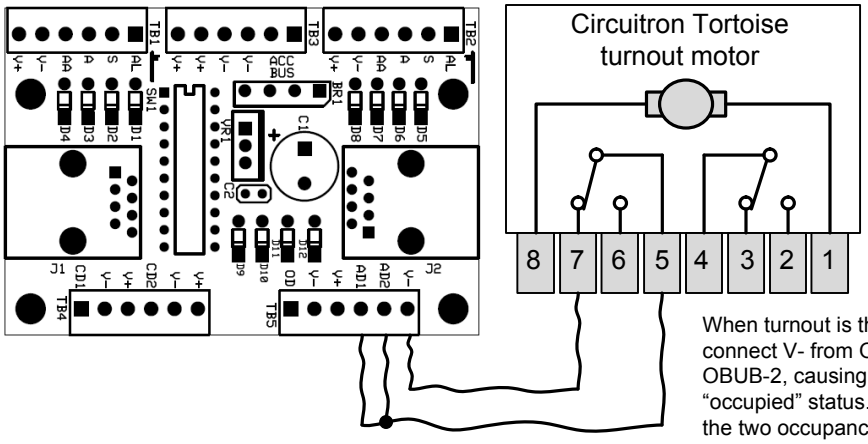


APPLICATION NOTE:
DETECTING TURNOUT POSITION

Often, it is desirable to affect signal aspects based on the position of mainline track switches (turnouts). For example, when a mainline turnout is thrown against the main, the surrounding signals protecting that section of track should drop to “occupied”. The diagrams below show how to connect the auxiliary contacts on a Circuitron-brand Tortoise turnout motor to the OBUB-2's Auxiliary Detection (AD) inputs on TB5, so that the local signal block will show “occupied” status when the turnout is thrown against the mainline.

Situation 1:
Turnout near block boundary, e.g. at end of a passing siding.
Turnout shown thrown against mainline.



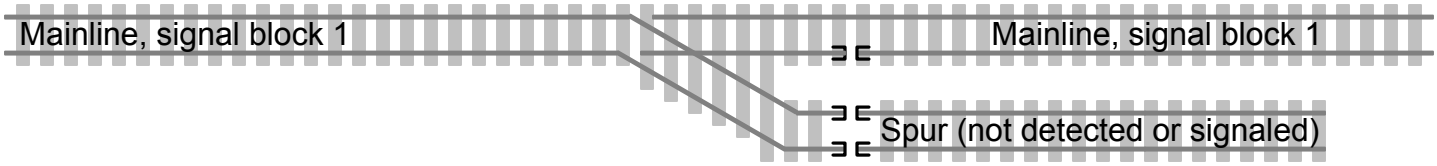


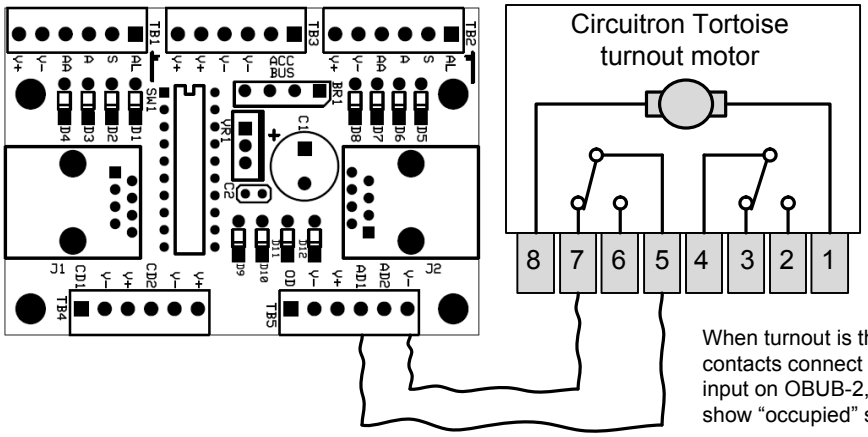
Both rails of the Main are gapped to ensure current detectors for blocks 1 and 2 are fully isolated.

Both rails of the Siding are gapped to ensure current detectors are not affected by trains in the Siding.

When turnout is thrown against mainline, Tortoise contacts connect V- from OBUB-2 to both AD1 and AD2 inputs on OBUB-2, causing both signal blocks 1 and 2 to show “occupied” status. The built-in diodes prevent shorting of the two occupancy lines.

Situation 2:
Turnout in middle of signal block, e.g. to an industry spur.
Turnout shown thrown against mainline.





Only the “frog” rail of the Main is gapped to avoid shorting rails together (standard practice for powered frogs).

Both rails of the Spur are gapped to ensure current detectors are not affected by trains in the Spur.

When turnout is thrown against mainline, Tortoise contacts connect V- from OBUB-2 to only AD1 input on OBUB-2, causing only signal block 1 to show “occupied” status.