

## MANCO Track Signal Buffer/Booster

A common problem with TMCC/Legacy layouts is inadequate command signals that cause poor locomotive operation. MANCO has pioneered efforts to enhance the transmission of the command signal through earth-ground enhancement wires and other techniques, but problem areas remain on some large layouts.

The MANCO Buffer/Booster is designed to provide stronger command signals everywhere on the layout through two improvements. First, the signal source is made stiffer, resulting in less signal loss due to the very heavy loads placed upon the Base by layouts with extensive trackage. As an example, the output of a Legacy base will drop about 45% with major waveform distortion when driving a 50 ohm load. In comparison, the Buffer/Booster drops less than 5% with no distortion.

The second improvement is a three times increase in the signal thanks to a power amplifier in the Buffer/Booster. The normal (unloaded) Base signal of five volts peak-to-peak is amplified to 15 volts peak-to-peak. This triples the signal throughout the layout, even with the heavy loading of a large layout.

The net effect can be more than triple the original loaded-down track signal actually fed to the track when we combine these improvements.

### What is in the box?

The Buffer/Booster combines 3 MANCO products into a single package:

1. A metering circuit to test the Base and to provide quantitative data on performance before and after the Buffer/Booster is inserted into the command stream (<http://www.trainfacts.com/trainfacts/?p=662> and <http://www.trainfacts.com/trainfacts/?p=691> ),
2. An earth-ground attachment wire that ties directly to the output amplifier for distributing the earth-ground component of the transmitted signal to troublesome areas on the layout (<http://www.trainfacts.com/trainfacts/?p=704> ), and
3. The power amplifier that provides a stiffer, stronger track signal.

The kit also includes a DC meter and a hefty “wallwart” power supply for powering the amplifier.

### Connecting the components



The Buffer/Booster **should not** be mounted adjacent to the TMCC/Legacy Base to keep the Buffer/Booster's higher output signal from interfering with reception of the CAB signals by the Base. The cable attached to the 9-pin DSUB connector provides three feet of range for convenient placement.

Orient the Buffer/Booster so that the MANCO label is on the top. This will position the heatsink properly to allow convective cooling as warm air rises through the fins.

Attach the 9-pin DSUB connector to the Computer (TMCC)/Data (Legacy) port of the Base. If an existing connector is already attached, move that connector to the outer connector of the new DSUB stack.

Next, remove the wire or lug attached to the U/Track thumbnut terminal, running to your track Common circuit (outer rails). We will move this wire to the Buffer/Booster's terminal, but not until we have made an initial test of the Base's unloaded output signal. Attach the terminal lug from the Buffer/Booster's cable to the Base U/Track terminal.

(You are a Beta Test Site for this product. I need for you to make accurate notes and write down the measurement values indicated in the following test so that I can determine the effectiveness of the Buffer/Booster.)

Insert the meter's red and black test probes into the corresponding jacks on the Buffer Booster. Set the meter to the 20V DC scale and turn on the meter. Set the toggle switch to the "Base" position to read the raw output of the Base. The reading should be approximately 2 volts. Write down this reading (**I**) in the chart at the end of these instructions.

If this meter reading is not at least 2.0 VDC, you probably have a defective Base. The remainder of this test sequence will be inconclusive since we don't have a good input signal for the amplifier. If your Base is a Legacy model, Lionel should be willing to repair it at no cost except for shipping. (Damage from nearby lightning strokes seems to be the biggest risk of damage.)

Our next test measures the output of the Buffer/Booster amplifier.

1. Plug the coaxial power plug into the "Power" receptacle on the Buffer/Booster.
2. Set the toggle switch to "Booster".
3. Plug the wallwart into an AC outlet.
4. Read the output level on the meter (**II**). If the reading is not approximately 7 VDC, disconnect the coaxial power plug and recheck your connections.

Next we will run a quick check to see if there are any unwanted connections between earth ground and the outer rail/Common circuit.

1. Remove the red test probe from the Buffer/Booster,
2. Set the meter to Ohms 2000 (directly above and slightly left of the meter's ON/OFF switch,
3. Attach the red probe to the layout's track Common wire that you removed from the Base's thumbnut terminal.

The meter should show a "1" (overrange indication) on the left with the rest of the number field blank if there is no connection (more than 2000 ohms) between earth ground and track Common. Record this reading (**III**). There should be no connection between these two circuits, but anything above 1000 ohms is probably not going to interfere with proper command operation. You should determine the source of any bridging circuit and try to eliminate it since this loading is essentially shorting out the desired Track signal.

Now we are ready to determine what happens when the Base signal is actually applied to the layout. Our first measurement will be using the configuration you have been using up until now.

1. Return the red test probe to the red jack on the Buffer/Booster.
2. Set the meter to 20 VDC.
3. Set the toggle switch to "Base".
4. Connect the layout's track Common wire to the screw terminal on the Buffer/Booster

The meter reading (**IV**) is the loaded output voltage getting to the track directly from the Base. For large layouts this can be significantly lower than the approximately 2 volts noted earlier for reading I. The drop is due to the amount of current the Base must supply to drive all of the outer rails of the layout.

And now comes the big test! Move the toggle switch to the "Booster" position so that the amplifier is supplying its boosted signal to the track. Read the meter and record the value (**V**). It should be at least 3 times larger than reading IV.

Test operation of your locomotives in the troublesome areas. The toggle switch will allow you to compare “before” and “after” performance to determine the amount of improvement. (Details of how to build a test car for measuring the radio signal strength at any point of the layout using a modified R2LC control board are available on the O Gauge Forum.)

If you experience difficulties, please call me at (805) 529-2496 or email me at [dmanquen@msn.com](mailto:dmanquen@msn.com). In any case, please email me your set of measurements and the result of the testing.

- I. Unloaded Base output - \_\_\_\_\_VDC
- II. Unloaded Booster output - \_\_\_\_\_VDC
- III. Resistance between earth ground and track Common - \_\_\_\_\_Ohms
- IV. Base output with U/Track load - \_\_\_\_\_VDC
- V. Booster output with U/Track load - \_\_\_\_\_VDC

### **MANCO TMCC/Legacy Track Signal Buffer/Booster Kit**

The kit consists of several items:

1. A wall wart power supply necessary to supply the extra voltage and current for the fortified track signal,
2. A 455 KHz solid-state buffer/booster circuit tailored for driving heavy loads found on large layouts,
3. A track signal metering circuit to test the actual voltage resulting at the track,
4. A digital volt/ohm meter not only for measuring the output of the above metering circuit, but also to test for any stray resistance paths between Layout Common and Earth/Safety ground that might short out the Track Signal,
5. A switching system to allow convenient comparison of signals with and without boost,
6. A “pin 5” ground wire directly attached to the ground side of the Buffer/Booster.

This combination of components facilitates an easy comparison of the actual TMCC/Legacy signal injected into the layout with and without the Buffer/Booster device.

At this time, test results are very encouraging, but this is not an offer to sell this product. For further information, please contact Dale Manquen at MANCO – (805) 529-2496 or [dmanquen@msn.com](mailto:dmanquen@msn.com).