Model Train™ TECHNOLOGY

Speed Stick™

OPERATIONS MANUAL v1.4a

INTRODUCTION

The Model Train Technology™ ***Speed Stick™*** is a portable and highly accurate speed measuring device for model trains from Z to G gauge plus five common European scales. It is small enough to sit on the side of the track and comes with a built-in 500mAh rechargeable lithium battery. The ***Speed Stick*** can be run on the battery or can be plugged into a USB-C cable to run on any 5V phone charger. There are no batteries to replace.

The ***Speed Stick*** uses our **Precision Detector** technology which is extremely fast and is precise to 1mm. The maximum range is 150mm (5.9”) from the from sensor side of the ***Speed Stick***. We do not use reflective IR sensing. As a result, the ***Speed Stick*** is immune to changes in ambient light conditions. It will work outdoor and in a completely darkened room. Our Auto-Ranging mode is built in. This allow you to set the sensor range to the edge of the first rail of your track so that it will ignore objects (or trains) that are just beyond the track of the train you want to measure.

The primary use is to measure the speed of a passing train. The ***Speed Stick*** automatically detects the train direction. At

the push of a button the readout can display MPH (Miles Per Hour) or KPH (Kilometers Per Hour).

The display can also be switched to show “raw” milliseconds.

A secondary mode is called “LOOP”. In LOOP mode you can precisely measure the time it takes for the train to complete a loop around your layout and back to the Speed Stick. The display will show Minutes, Seconds and 100^{th}/second in the format: (59:59:99). The maximum time is 59 minutes. You would have to have a very large layout with a train going very slowly to reach that limit – unless you had the train stop somewhere. By using our online widget you can calculate the scale DISTANCE of your layout track.

There are three color options for the display: Yellow, Blue and White. The display is a 128x32 OLED display. There isn’t a backlight but the display is very easy to read even though it is relatively small.

The ***SPEED STICK*** is our easiest to use product. While there may be an adequate charge on the lithium battery when you receive the unit, you will want to charge it before use. Use the included USB - C to USB cable and plug it in to the supplied USB charger. The plug of the Speed Stick can go in either side

up. You can also use any 5V USB charger. Typically, this will be a phone charger, but you can us your computer's USB socket if you like.

CHARGING THE SPEED STICK

The power switch should be to the OFF (Left) position. When you plug in the USB cable with power OFF, the green light will light. This indicates that the SPEED STICK is charging. The green light will go out automatically when the battery is fully charged. The charge life with the unit off and sitting on the shelf is about 11 years. Our bench testing shows that ***SPEED STICK*** will last about 8 hours of continuous use on a single charge.

Place the two "feet" into the bottom of the ***SPEED STICK***. They are held by friction. A set of spacers is included if you need to raise the ***SPEED STICK*** further. You can remove the feet altogether is you want.

The USB socket is strategically placed at the bottom of the ***SPEED STICK***. This allows you to feed the USB cord up through a small hole in your layout to provide constant power.

SETUP & OPERATION

The ***SPEED STICK*** comes preconfigured to measure HO speed in MPH. Simply place the SPEED STICK parallel to the track you want to use, with the display facing you. Turn the power on (switch it to the right), and the unit will go through its startup steps. Those steps are:

1. Blue LED lights.
2. Display shows our logo.
3. Blue LED flashes 4 times (sensors started and operational)
4. Version number displayed.
5. Battery level displayed.
6. Scale to be used: “HO: 87”
7. Display in MPH or KPH
8. LOOP mode, if it is set – otherwise this is skipped.

To test the unit, place your hand in front of one of the sensors and then move it away. Immediately, the blue LED will light, and an arrow will show the direction of travel. Place you hand in front of the sensor at the other end of the stick (where the arrow is pointing) and the display will show you what the speed would be if the train had tripped the sensors. The blue LED will go off indicating it is ready for the next speed reading.

You can start at either end of the ***SPEED STICK,*** and it will figure out which way the train going.

If you want to change the scale, use the chart on page 12 and press the SELECT button the number of times indicated. The blue LED will flash with each successful press. You should see the updated scale displayed. If it's not right, just try again.

To change between MPH and KPH, push the SELECT button once. The word "SELECT" displays. Then press the button once. The new measurement scale will be displayed. This is a toggle. That means selecting this option again will change the scale back to MPH.

OBSERVATIONS

The internal precision of the SPEED STICK is milliseconds. That is, 1000th of a second. As a result of this level of precision you will notice that even in the short distance of 170mm (distance between sensors) that the time, and thus the speed of the train, will vary even if you don't change the throttle. This is a result of (at least) the variation in the quality of the engine, the motor temperature, friction, humidity and how clean the gears of the train are. Your results may vary.

From a practical point of view, measuring to the MPH/KPH to one decimal is usually enough accuracy. An alternative is to set the display to show you the actual time in milliseconds. You may not care what the scale MPH is but if you are speed matching two engines, the millisecond approach will give you

more precision. That said, it may be too much precision for the variation of the motor speeds. Experiment to find what works best for you.

Lastly, the sensors and our technology are so fast that they can see the gap between cars. Therefore, we added a system that makes sure that all cars of the train have passed before a new reading can take place. You will see the LED dim when the speed is captured and then go off when its ready for another speed measurement.

RUNNING IN MILLISECOND MODE

To measure the speed of the train in millisecond display mode, enter SELECT mode by pressing the button once. The word "SELECT" will appear. Then press the select button 2 times. This is a toggle. Pressing the button again 2 times will change the unit back to MPH or KPH, depending on your previous setting.

LOOP MODE

Loop Mode records the time that the train takes to make one loop of your layout, whatever route that might take. In this mode the ***SPEED STICK*** uses only one of the sensors at a time. Loop mode can get a little confusing at first because we can track and display repeated loops starting at the same spot.

That means that after the first loop when the train is detected by the sensor, that time is both the Finish time for the first loop and is simultaneously the start time for the next loop. We also must keep track of when the train – it's entire length - has exited the ***SPEED STICK*** sensor. We use that to set the trigger for when the train comes back around to the same start/finish point. And finally, we must be able to do this in EITHER direction. However, once a train is making a loop, the ***SPEED STICK*** assumes that the train will come back in the same direction. It WILL work if you reverse loop, but the directional arrow will be backward. Further, the design goal was to compare repeat travel time on a fixed route. While it will be fun to watch reverse loop timings, it probably won't provide much useful information for speed calibration.

Before we describe the entire sequence, you should note that the LOOP mode and associated timers can be RESET by selecting LOOP mode again.

While in LOOP mode, press the SELECT button once. The word "SELECT" will appear in the display. Then press the button three times. This will reset the ***SPEED STICK*** LOOP mode and get it ready to start another looping sequence. This works best if a train (or your finger) is not in front of the sensors. An alternate approach is to simply turn the power off with the train away from the ***SPEED STICK***. The unit will start up normally and will have remembered that it is in LOOP mode. Then, the loop sequence can start from either direction.

Selecting either Speed mode (1) or Time mode (2) will cause the ***SPEED STICK*** to exit LOOP mode.

LOOP SEQUENCE

With the ***SPEED STICK*** ready, a train may enter the detection zone from either direction. When the first sensor is tripped, the active sensor and the direction of travel are set, and the timer starts. At that point, the directional arrow will appear and the blue LED with light. After the entire train has left the vision of the sensor for 2-3 seconds, the arrow will clear, and a live timer will appear.

When the train returns and trips the sensor again, the timer clock display will "freeze" with the loop elapse time. The assumption is that the train will continue for another loop. In that case, a new timer will have started simultaneously in the background.

Once the entire train has passed through the ***SPEED STICK*** zone, the blue LED will light indicating that the timer is active. A second later the arrow will appear to show the train travel direction. A few seconds after that the timer clock will reappear. You will note that even though you could not see the timer until the train left the ***SPEED STICK*** zone, the time shown is based on when the train tripped the sensor on its inbound to the ***SPEED STICK*** on the previous loop. This will keep repeating until you stop the train and/or rest the LOOP mode.

AUTO-RANGING

By default, the ***SPEED STICK*** is set to its maximum range of 150mm (5.9”). This may cause it to “see” objects on the other side of the track instead of just the train. Using Auto-Ranging sets the sensor range to a shorter range based on the distance between the track and the ***SPEED STICK***.

To use Auto-Ranging, place the ***SPEED STICK*** approximately where you want it on the layout. Place a train car on the track in front of the RIGHT-HAND side sensor within 150mm (5.9”). Press the SELECT button so the display shows “SELECT”. Then press and HOLD the select button. The blue LED will light, then go off, and then come back on. When the light comes back on, release the select button. The LED will blink slowly ten times. Then it will flash rapidly. The rapid flashing means that the new range has been successfully set. Turn off power to RELOAD the new range.

RESET

To reset the Speed Stick back to factory defaults:

1. Turn power OFF.
2. Hold the SELECT button WHILE turning power on
3. Continue to hold the button until the word RESET appears.
4. Release the button

To enter SELECT mode, press the button ONCE. The word SELECT will appear. Then, press the button the number of times indicated in the lefthand column.

SPEED STICK OPTIONS

1	MPH or Km/h	Toggle
2	MilliSecond Mode	Toggle
3	LOOP mode	Toggle
4	Z Scale	1:220
5	N Scale	1:160
6	HO Scale	1:87
7	S Scale	1:64
8	O Scale	1:48
9	G Scale	1:22.5
10	N Scale (UK)	148
11	TT Scale (Europe)	120
12	OO Scale (UK)	76
13	OK O Scale (UK)	45
14	OE O Scale (Europe)	43.5

ELECTRONICS AND STATIC ELECTRICITY

The ***MTT PRECISION DETECTOR™ - Trackside*** circuit board and components are exposed when the cover is off. Electricity can be dangerous. Static electricity can cause component failure. Scuffing along a carpet and then touching one of the component connectors can cause a static spark. These components are fairly rugged – some designed for the automotive industry. Just be mindful of the risk. The current on the board will not harm you if the board is powered and operated as per the instructions.

ONE YEAR MANUFACTURER WARRANTY:

We warrant this product to be free from defects in workmanship and materials, under normal residential use and conditions, for a period of one (1) year for the original invoice date. Shipping and handling fees are to be paid for by the customer.

LIMITATION OF LIABILITY

UNDER NO CIRCUMSTANCE SHALL COMPANY OR ITS AFFILIATES, PARTNERS, SUPPLIERS OR LICENSORS BE LIABLE FOR ANY INDIRECT, INCIDENTAL, CONSEQUENCIAL, SPECIAL OR EXEMPLARY DAMAGES ARRISING OUT OF OR IN CONNECTION WITH YOUR USE, OR INABILITY TO USE THE PRODUCT, WHETHER OR NOT THE DAMAGES WERE FORESEEABLE AND WHETHER OR NOT COMPANY WAS ADVISED OF THE POSSIBLITY OF SUCH DAMAGES. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, COMPANY'S AGGREGATE LIABILITY TO YOU SHALL NOT EXCEED THE AMOUNT OF THE PRODUCT. THE FOREGOING LIMITATION WILL APPLY EVEN IF THE ABOVE STATED REMEDY FAILS OF ITS ESSENTIAL PURPOSE.

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