

# SmartSensor HD

USER GUIDE

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# SmartSensor HD

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FCC Part 15 Compliance: The Wavetronix SmartSensor sensors comply with Part 15 of the Federal Communications Commission (FCC) rules which state that operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation. FCC compliance statements for applicable optional modules are to be found in the module specifications. Unauthorized changes or modifications not expressly approved by the party responsible for compliance with the FCC rules could void the user's authority to operate this equipment.

Hereby, Wavetronix LLC, declares that the FMCW Traffic Radar (SmartSensor HD, model number 101-0415) is in accordance with the 2004/108/EC EMC Directive.

The device has been designed and manufactured to the following standards:

- IEC/EN 60950-1:2006, A11:2009, A1:2010, A12:2011 - Electronic equipment safety requirements.
- EN 300 440-2 - Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive.
- EN 301 489-3 - Immunity to RF interference. Compliance with transmission limitations under 1GHz and conducted transmission over power lines, ESD.

The equipment named above has been tested and found to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives. This equipment has been evaluated at 2000m.

IP Protection: IP66

For installation into restricted access location.

All interconnecting cables shall be suitable for outdoor use.

Disclaimer: The advertised detection accuracy of the Wavetronix SmartSensor sensors is based on both external and internal testing, as outlined in each product's specification document. Although our sensors are very accurate by industry standards, like all other sensor manufacturers we cannot guarantee perfection or assure that no errors will ever occur in any particular applications of our technology. Therefore, beyond the express Limited Warranty that accompanies each sensor sold by the company, we offer no additional representations, warranties, guarantees or remedies to our customers. It is recommended that purchasers and integrators evaluate the accuracy of each sensor to determine the acceptable margin of error for each application within their particular system(s).

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# Introduction

## In this chapter

- SmartSensor HD Package
- Selecting a Mounting Location

The Wavetronix SmartSensor HD traffic sensor utilizes the latest technology to collect and deliver traffic statistics. The SmartSensor HD collects information through the use of a 24.125 GHz (K band) operating radio frequency and is capable of measuring traffic volume and classification, average speed, individual vehicle speed, lane occupancy and presence. The SmartSensor HD uses what is classified as frequency modulated continuous wave (FMCW) radar; it detects and reports traffic conditions simultaneously over as many as 22 lanes of traffic.

Once SmartSensor HD is installed, the configuration process is quick and easy. After installation, this unit will require little or no on-site maintenance and can be remotely re-configured for optimal performance. This user guide outlines the step-by-step process of installing and configuring the SmartSensor HD. Any questions about the information in this guide should be directed to Wavetronix or your distributor.

## SmartSensor HD Package

A standard SmartSensor HD package contains the following items:

- SmartSensor HD SS125 detector with installed backplate
- SmartSensor HD quick-reference guides

The following items are not included but are necessary for installation:

- Sensor mount
- Sensor cable

Additional products may be purchased through your distributor. The following optional items are not included unless specifically ordered (check packing list for actual inventory):

- Contact closure adapter such as the Click 100, 104, 110, or 112/114.
- Click 200 surge protector
- Click 201/202 AC to DC converter
- Click 210 circuit breaker
- Click 230 AC surge protector
- *SmartSensor HD User Guide* (doesn't have to be purchased, but does have to be requested from Wavetronix)

## Selecting a Mounting Location

Consider the following guidelines when selecting a mounting location:

- **Lane Coverage** – Sensor mounting locations should be selected so that all monitored lanes are within 6 to 250 ft. (1.8 to 76.2 m) of the sensor and run parallel with each other. The SmartSensor HD can monitor up to 22 lanes, and the HD Legacy can monitor up to 10. Which sensor you use and how many you need will vary based on how many lanes need to be covered.
- **Parallel Lanes** – When the sensor is used to collect both mainline and ramp data, the pole position should be selected so that the on and off ramp lanes run parallel with the mainline. If lanes are not parallel, installation of multiple SmartSensor HD units should be considered.
- **Sensors on the Same Pole** – When multiple sensors are mounted on the same pole, they will not be subject to interference if they are configured to operate using different RF channels and are separated vertically by a few feet. The higher sensor would typically be used for the lanes farther from the pole in order to minimize occlusion.
- **Sensors on Opposing Poles** – SmartSensor HD units facing each other on opposing poles should operate on different RF channels and be separated by a 70-ft. (21.3-m) lateral offset, if possible.
- **Line of Sight** – The SmartSensor HD is designed to work accurately in the presence of barriers, but in general if there is an alternate mounting location that would avoid any type of structural occlusion, this is preferred. Avoid occlusion by trees, signs, and other roadside structures.
- **Neighboring Structures and Parallel Walls** – To eliminate the risk of performance degradation, the sensor locations should have a 30-ft. (9.1-m) lateral separation from overhead signs, overpasses, tunnels, parallel walls, and parallel parked vehicles in order to avoid multiple reflection paths from a single vehicle. This separation removes the objects from the antenna pattern of the sensor. In practice the sensor has been mounted much closer to reflecting objects with minimal impact in sensor performance. For ex-

ample, sensors mounted on gantries have successfully met customer requirements when using a 3-foot extension arm to laterally separate the sensor from the structure. Please talk with a Wavetronix Technical Support representative about your specific situation.

- **Mounting Height** – The mounting height should be based upon the offset from the lanes of interest and is measured from same elevation as the lanes of interest. For each offset, the guidelines for associated mounting heights are shown in Table 1.1 in Chapter 1. In general, a higher mounting height can mitigate occlusion.
- **Mounting Offset** – The minimum recommended offset (distance from the sensor to the edge of the first lane of interest) is 6 ft. (1.8 m).
- **Arterial Locations** – Sensor sites on arterials or other roadway segments with regulated stop lines should be selected at midblock positions to increase accuracy by avoiding positions at which vehicles are often stopped in front of the sensor.
- **Freeway Locations** – The SmartSensor HD is often used at permanent ATR (automatic traffic recorder) stations. The number of stations along a single roadway and the distance between stations should be selected to achieve adequate levels of statistical confidence. Permanent ATR stations, which are selected to cover interstate, principal arterial, and other national and state highways, are used to establish seasonal adjustment factors for count data from temporary collection sites (see Figure I.1).

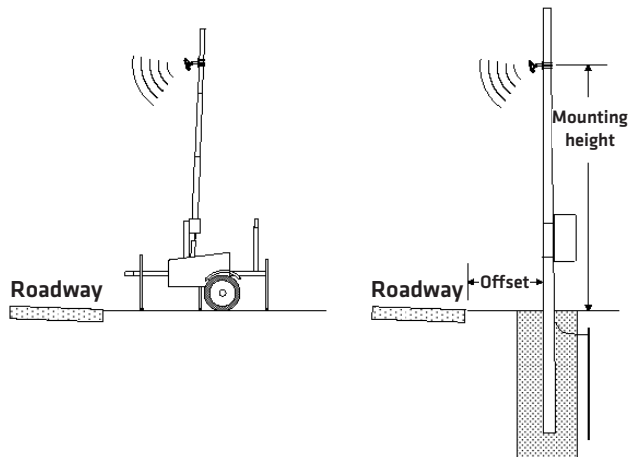


Figure I.1 – Portable (left) and Permanent (right) Sensor Stations

- **Cable Lengths** – Ensure that you have sufficient homerun and sensor cabling. Cables can be as long as 600 ft. (182.9 m) if they're using 24 VDC operation and RS-485 communications; for longer connections, alternate wired and wireless options should be considered.
- **Signaling Delay** – After a vehicle passes in front of the sensor there will be a slight delay before the data for that vehicle is sent from the sensor. In a time-sensitive application—for instance, to supply a dynamic message sign with per vehicle warning messages—it will be necessary to ensure the sensor is sufficiently far upstream from the sign that the system has time to collect the data, process it, and send it to the sign by the time the vehicles reach the problem area. For specifics about signaling delay, see document *0374 Signaling Delays* on the Wavetronix website.





# Part I

## Installing the SmartSensor HD

**Chapter 1** - Installing the SmartSensor HD

**Chapter 2** - Connecting Power and Surge



# Installing the SmartSensor HD

## In this chapter

- Selecting the Mounting Height
- Attaching the Mount Bracket to the Pole
- Attaching the Sensor to the Mount Bracket
- Aligning the Sensor to the Roadway
- Applying Silicon Dielectric Compound
- Connecting the Cable

Installing the SmartSensor HD is quick and easy. Once installed, the SmartSensor HD configures automatically and requires little or no on-site maintenance.

The installation process includes attaching the mounting bracket to the pole; attaching the sensor to the mounting bracket; aligning the sensor; applying a silicon dielectric compound to the sensor connector; and connecting the cable to the sensor.

### Warning

Do not attempt to service or repair this unit. This unit does not contain any components and/or parts serviceable in the field. Any attempt to open this unit, except as expressly written and directed by Wavetronix, will void the customer warranty. Any visible damage to exterior seal labels will void the warranty. Wavetronix is not liable for any bodily harm or damage caused if unqualified persons attempt to service or open the back cover of this unit. Refer all service questions to Wavetronix or an authorized distributor.

## Caution

Use caution when installing any sensor on or around active roadways. Serious injury can result when installation is performed using methods that are not in accordance with authorized local safety policy and procedures. Always maintain an appropriate awareness of the traffic conditions and safety procedures as they relate to specific locations and installations.

## Selecting the Mounting Height

Once you have determined where along the roadway you will be mounting the sensor, you will need to determine the height for mounting the sensor. Make sure the location you choose allows for an offset of at least 6 ft (1.8 meters) from the first point of interest. The recommended offset is in the range of 25–35 ft (7.6–9.1 m).

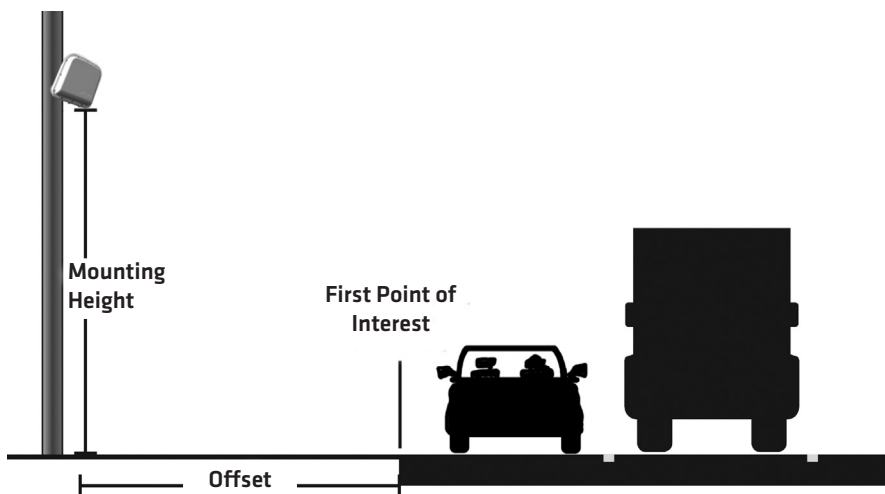


Figure 1.1 – Offset and Mounting Height

After selecting a mounting location with an acceptable offset (see the Introduction and Figure 1.1), use Table 1.1 to select an associated mounting height. Try to use the recommended mounting height, but if that is not possible for your location, mount within the minimum and maximum range shown in the table.

For example, if the pole you are mounting on is 29 feet (8.8 m) from the first point of interest, you would ideally want to mount the sensor 27 feet high on the pole; but, it would be acceptable if you mounted it as low as 18 ft (5.5 m) or as high as 36 feet (11 m). If you have large vehicles, it is recommended to install the sensor towards the max mounting height to help mitigate occlusion.

## Note

The heights listed in Table 1.1 refer to how high the sensor is mounted from the surface of the roadway based on the offset. Please ensure you install or use a structure that will accommodate the listed sensor height. If installing a new pole, take into account that part of the pole that will likely be below ground.

	<b>Offset from first Detection Lane (ft / m)</b>	<b>Recommended Mounting Height (ft / m)</b>	<b>Minimum Mounting Height (ft / m)</b>	<b>Maximum Mounting Height (ft / m)</b>
	6 / 1.8	12 / 3.7	9 / 2.7	19 / 5.8*
	7 / 2.1	12 / 3.7	9 / 2.7	19 / 5.8*
	8 / 2.4	12 / 3.7	9 / 2.7	20 / 6.1*
	9 / 2.7	12 / 3.7	9 / 2.7	21 / 6.4
	10 / 3	12 / 3.7	9 / 2.7	22 / 6.7
	11 / 3.4	12 / 3.7	9 / 2.7	23 / 7
	12 / 3.7	13 / 4	10 / 3	24 / 7.3
	13 / 4	13 / 4	11 / 3.4	25 / 7.6
	14 / 4.3	14 / 4.3	11 / 3.4	26 / 7.9
	15 / 4.6	15 / 4.6	12 / 3.7	26 / 7.9
	16 / 4.9	15 / 4.6	12 / 3.7	27 / 8.2
	17 / 5.2	16 / 4.9	13 / 4	28 / 8.5
	18 / 5.5	17 / 5.2	14 / 4.3	29 / 8.8
	19 / 5.8	17 / 5.2	14 / 4.3	30 / 9.1
	20 / 6.1	18 / 5.5	15 / 4.6	30 / 9.1
	21 / 6.4	19 / 5.8	15 / 4.6	31 / 9.4
	22 / 6.7	20 / 6.1	16 / 4.9	31 / 9.4
	23 / 7	22 / 6.7	16 / 4.9	32 / 9.8
	24 / 7.3	24 / 7.3	16 / 4.9	33 / 10.1
Recommended Offset and Height	25 / 7.6	26 / 7.9	17 / 5.2	33 / 10.1
	26 / 7.9	26 / 7.9	17 / 5.2	34 / 10.4
	27 / 8.2	27 / 8.2	18 / 5.5	35 / 10.7
	28 / 8.5	27 / 8.2	18 / 5.5	35 / 10.7
	29 / 8.8	27 / 8.2	18 / 5.5	36 / 11
	30 / 9.1	29 / 8.8	19 / 5.8	37 / 11.3
	31 / 9.4	29 / 8.8	19 / 5.8	37 / 11.3
	32 / 9.8	29 / 8.8	19 / 5.8	38 / 11.6

<b>33</b> / 10.1	<b>30</b> / 9.1	<b>19</b> / 5.8	<b>39</b> / 11.9
<b>34</b> / 10.4	<b>30</b> / 9.1	<b>19</b> / 5.8	<b>39</b> / 11.9
<b>35</b> / 10.7	<b>30</b> / 9.1	<b>20</b> / 6.1	<b>40</b> / 12.2
<b>36</b> / 11	<b>30</b> / 9.1	<b>20</b> / 6.1	<b>41</b> / 12.5
<b>37</b> / 11.3	<b>31</b> / 9.4	<b>20</b> / 6.1	<b>41</b> / 12.5
<b>38</b> / 11.6	<b>31</b> / 9.4	<b>21</b> / 6.4	<b>42</b> / 12.8
<b>39</b> / 11.9	<b>33</b> / 10.1	<b>21</b> / 6.4	<b>43</b> / 13.1
<b>40</b> / 12.2	<b>33</b> / 10.1	<b>22</b> / 6.7	<b>43</b> / 13.1
<b>41</b> / 12.5	<b>34</b> / 10.4	<b>22</b> / 6.7	<b>44</b> / 13.4
<b>42</b> / 12.8	<b>34</b> / 10.4	<b>22</b> / 6.7	<b>44</b> / 13.4
<b>43</b> / 13.1	<b>35</b> / 10.7	<b>22</b> / 6.7	<b>45</b> / 13.7
<b>44</b> / 13.4	<b>35</b> / 10.7	<b>23</b> / 7	<b>46</b> / 14
<b>45</b> / 13.7	<b>36</b> / 11	<b>23</b> / 7	<b>46</b> / 14
<b>46</b> / 14	<b>36</b> / 11	<b>23</b> / 7	<b>47</b> / 14.3
<b>47</b> / 14.3	<b>36</b> / 11	<b>24</b> / 7.3	<b>48</b> / 14.6
<b>48</b> / 14.6	<b>38</b> / 11.6	<b>24</b> / 7.3	<b>48</b> / 14.6
<b>49</b> / 14.9	<b>38</b> / 11.6	<b>24</b> / 7.3	<b>49</b> / 14.9
<b>50-230</b> / 15.2-70.1	<b>39</b> / 11.9	<b>25</b> / 7.6	Must be < offset

**Table 1.1 – Mounting Height Guidelines in Feet**

\*May see a reduction in the number of reported speeds at this height

## Attaching the Mount Bracket to the Pole

Before attaching the mount bracket to the pole, first make sure that your cables are long enough to reach the sensor and to stretch across the distance from the sensor to the cabinet.

Follow the steps below to correctly attach the mount to the pole (see Figure 1.2):

- 1 Insert the stainless steel straps through the slots in the mount bracket.
- 2 Position the mount bracket on the pole so that the head of the mount is pointing towards the middle of the lanes of interest.
- 3 Tighten the strap screws.

### Note

The sensor will need to be adjusted later, to fine-tune the alignment, so be sure to keep the straps adjustable.

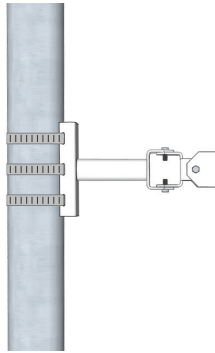


Figure 1.2 – Attaching the Mount Bracket to the Pole

## Attaching the Sensor to the Mount Bracket

Use the following steps to securely fasten the sensor to the mount bracket:

- 1 Align the bolts on the sensor's backplate with the holes in the mount bracket. The connector at the bottom of the unit should be pointing towards the ground.
- 2 Place the lock washers onto the bolts after the bolts are in the bracket holes.
- 3 Thread on the nuts and tighten (see Figure 1.3).

### Note

Do not over-tighten the fasteners.

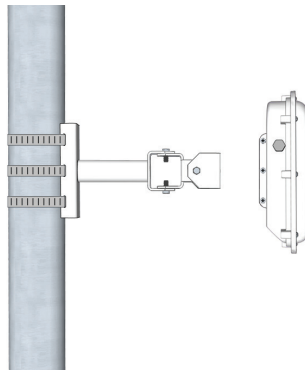


Figure 1.3 – Attaching the Sensor to the Mount Bracket

## Aligning the Sensor to the Roadway

Use the following steps to correctly mount and align the SmartSensor HD:



- 1 Tilt the sensor down so that the front is aimed at the center of the detection area (see Figure 1.4).

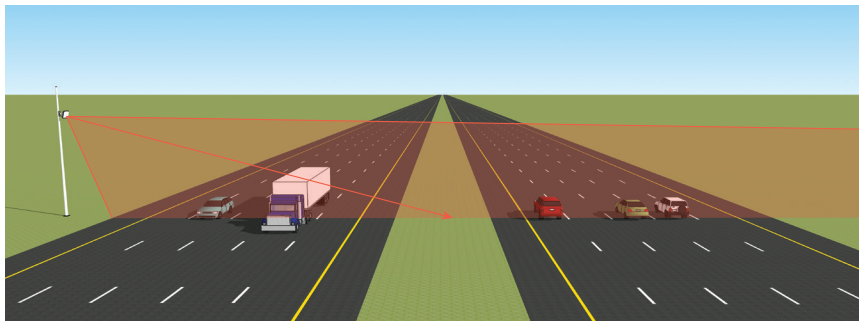


Figure 1.4 - Up-and-down Positioning

- 2 Adjust the side-to-side angle so that it is as close to perpendicular to the flow of traffic as possible (see Figure 1.5).

### Note

The side-to-side alignment will eventually be fine-tuned for better accuracy using SmartSensor Manager HD (SSMHD). That step will be addressed in Chapter 6, after SSMHD has been installed.

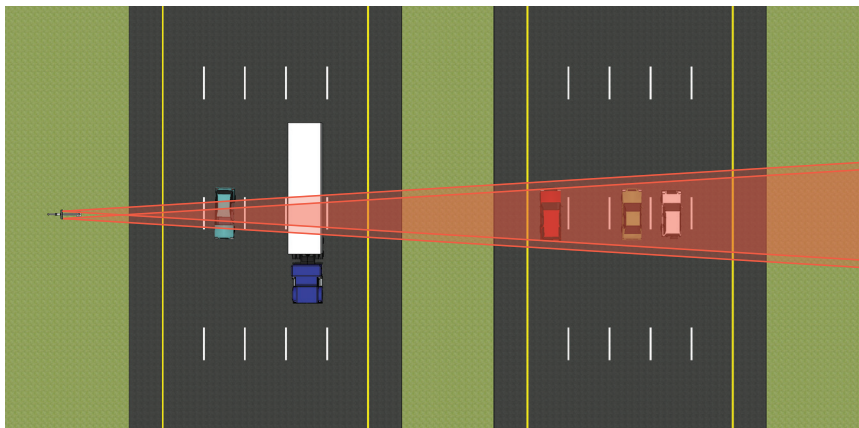


Figure 1.5 - Side-to-side Positioning should be Perpendicular

## Applying Silicon Dielectric Compound

Use the following steps to correctly apply the silicon dielectric compound:

- 1 Tear the tab off of the tube of silicon dielectric compound.

- 2 Squeeze about 25% of the silicon into the connector at the base of the SmartSensor HD (see Figure 1.6). Be sure to wipe off any excess compound.



Figure 1.6 – Applying Silicon Dielectric Compound

## Connecting the Cable

The sensor connector is keyed to ensure proper connection; once you have plugged the cable connector into the sensor connector, simply twist the cable connector clockwise until you hear it click into place. To avoid undue movement from the wind, strap the cable to the pole or run it through a conduit, but leave a small amount of slack at the top of the cable to reduce cable strain (see Figure 1.7).

### Note

If you run the cable through the pole, do not drill through the sensor mount, as the sensor and sensor mount may need to be adjusted in the future.



Figure 1.7 – Sensor Connector

The service end of the cable has a +DC and GND for a power supply of 12 to 24 VDC. Two communication ports (either RS-232 or RS-485) are available to connect the SmartSensor HD to a modem or other communication device. Typically, one RS-485 and one RS-232 port are available.



## In this chapter

- Connecting Lightning Surge Protection
- Wiring to Earth Ground
- Installing the Power Plant
- Connecting the Power Plant to Your Installation
- Wiring Communication

Once the sensor is installed, it will need to be wired for power and surge protection. Wavetronix Click products allow you to quickly and easily include power and surge protection in your sensor application. Please refer to the Click quick-reference guides for more comprehensive product instructions.

There are several ways your sensor might be set up:

- A two-part installation, with components in two areas: first, a pole by the road holds your sensor plus a pole-mount box with a surge protector inside. Second, a main traffic cabinet holds power and communications devices. The cabinet and pole are connected via a homerun cable that runs underground.

### Note

This chapter assumes the box and cabinet are connected by an underground cable run, but in certain circumstances they might not be.

- A single-part installation, with all components on the same pole. This pole holds your sensor. Power and communications devices (most likely wireless) are in a pole-mount box or there is a traffic cabinet at the base of the pole; either way there is no underground cable run. Power comes from the pole itself or from a battery and/or solar panels at the pole.

How you set up the devices in this chapter will vary depending on which of these installations you are using.

## Connecting Lightning Surge Protection

The sensor should be connected to at least one surge protection device. The Click 200 and equivalent devices are designed to prevent electrical surges along cables from damaging the sensor and/or the cabinet. It is also a convenient spot to terminate the cable coming from your sensor, as it has terminals for all the wires.

### Note

If you choose not to use surge protection in your installation, please contact Wavetronix Technical Services for assistance.

If you are using the one-part installation option—no underground cable run—put a Click 200 in the pole-mount box/traffic cabinet (whichever is being employed) as a termination point for the cable from the sensor, and as a way to protect the box/cabinet. When there is no underground cable run, it is safest practice, as well as Wavetronix standard procedure, to connect the cable from the sensor in the UNPROTECTED side of the Click 200.

- 1 Install a Click 200 in the pole-mount cabinet/traffic cabinet by snapping it onto the DIN rail. Your power and communications devices will most likely also be on this DIN rail; make sure the Click 200 is connected to them via wires or the shared communication bus (connecting power will be covered later in this chapter; for how to connect to communications devices, see the *Click 100–400 Series User Guide*).
- 2 Wire the cable from the sensor to the UNPROTECTED side of the Click 200.

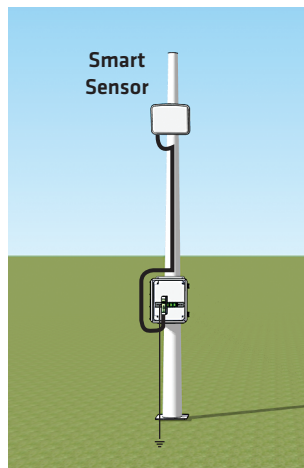


Figure 2.1 – Using a Single Click 200

### Note

The different cables available and how to wire them into the Click 200 will be covered later in this section.

If you are using the two-part installation option, you'll have an underground cable run as part of your installation, connecting the power and comms devices in the main traffic cabinet to the pole-mount box and sensor. When there is an underground cable run, it is safest practice, as well as Wavetronix standard procedure, to use two Click 200s, one on each end of the cable: one in the main traffic cabinet and the other in the pole-mount cabinet. Both ends of the cable should be connected to the UNPROTECTED side of their Click 200s. This is important because the underground cable run will be susceptible to surges caused by lightning striking the ground near it.

If this run is shorter than 600 ft. (182.9 m), you can use a Wavetronix cable; see document *0372 SmartSensor HD Cable Length Recommendations* for more on cable lengths.

- 1 Install one Click 200 device in a pole-mount cabinet on the same pole as the sensor being protected. Install it by snapping it onto the DIN rail.
- 2 Connect the cable from the sensor to the PROTECTED side of this Click 200. This cable should be kept as short as possible.
- 3 Install another Click 200 in the main traffic cabinet. You will likely have power and communications devices in this cabinet; make sure the Click 200 is connected to them via wires or the shared communication bus (connecting power will be covered later in this chapter; for how to connect to communication devices, see the *Click 100–400 Series User Guide*).
- 4 Connect the pole-mount box and the main traffic cabinet by running a cable from the UNPROTECTED side of the Click 200 in the pole-mount box to the UNPROTECTED side of the Click 200 in the main traffic cabinet.

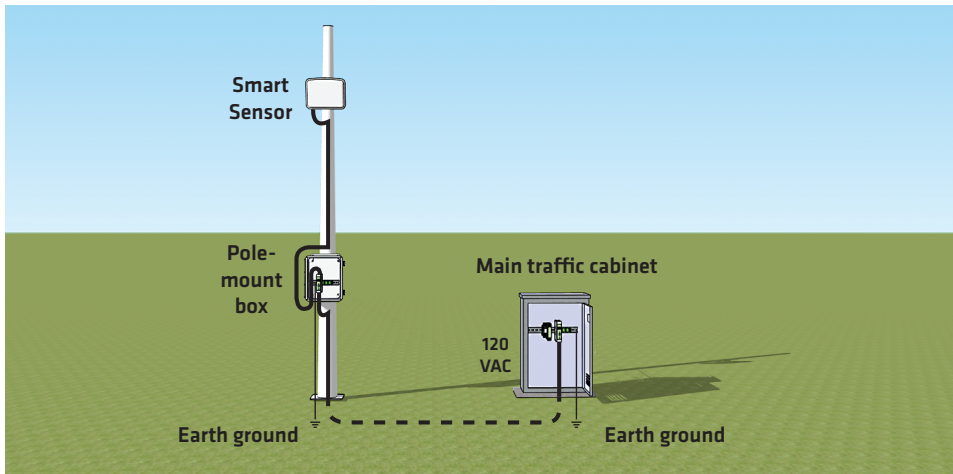


Figure 2.2 – Underground Cable Run

## Wiring the Click 200

There are two cables that may be used with your sensor, the 8-conductor cable and the 9-conductor cable. Which one you use is based largely on the connector on your SmartSensor HD—that is, the connector where the cable will be plugged into the sensor.

There are two different connectors that may be found on a SmartSensor HD:

- The 10-pin connector is used with the SmartSensor HD. It currently only comes installed on the 8-conductor cable.
- The 26-pin connector is used with SmartSensor HD Legacy and retrofitted HDs. It can be installed on the 8-conductor cable or the old 9-conductor cable.

### Note

There may be compatibility issues if you use a 8-conductor/26-pin connector cable with a SmartSensor HD that was manufactured in or before 2008. Contact Wavetrix Technical Services for details and assistance.

The wiring for these two cables is almost identical; the differences are pointed out on the following page.

### Note

If you have an underground cable run that stretches more than 600 ft (182.9 m), you will likely need to use a different cable; in that case the colors won't match the figure below.

The Click 200 contains three terminal connectors on both the top and the bottom of the module (see Figure 2.3). The terminal connectors are red-keyed, allowing each connector to plug into only one specific jack. This both simplifies the wiring process and reduces the possibility of wiring errors.

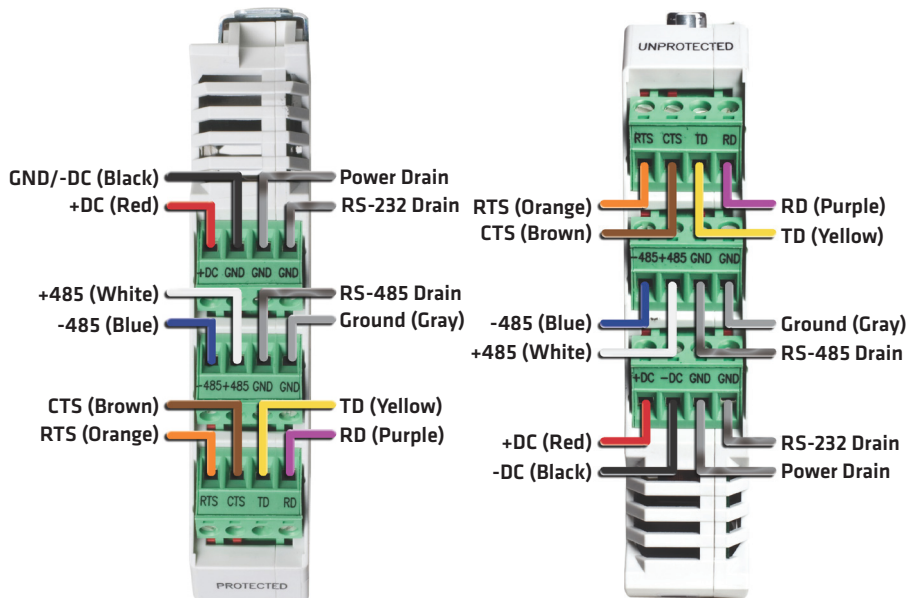


Figure 2.3 – Click 200 Terminal Connections (protected and unprotected sides)

If you have an 8-conductor cable, it will have the following wiring differences:

- There is no gray ground wire.
- Instead of three drains, there is only one. This drain can be connected into any of the screw terminals marked GND.
- The white +485 wire will have a blue stripe.

### Note

See Appendices A and B for cable pinout diagrams for the two different connectors found on SmartSensor HDs.

## Wiring to Earth Ground

All Click 200 devices should be mounted on a DIN rail that is connected to earth ground either through an earth-grounded chassis or a 16 AWG or larger grounding wire attached to a 7-ft. (2.1-m) grounding rod. Follow the steps below to correctly wire to earth ground:



- 1 Connect the grounding wire from either the DIN rail or a GND screw terminal on the UNPROTECTED side of the Click 200 to the lug bolt on the inside of the pole-mount cabinet.
- 2 Connect another grounding wire from the exterior lug bolt to earth ground (see Figure 2.4).



Figure 2.4 - Earth Ground Connections

## Installing the Power Plant

Provide power to your installation using the Click power plant. This set of modules includes the following:

- Click 201/202 AC to DC converter
- Click 210 circuit breaker and switch
- Click 230 AC surge module

A Click 201 provides 1 A of power and is capable of powering a single sensor, while a Click 202 provides 2 A and can power two sensors. (There is also a Click 204 which provides 4 A of power, but that will usually not be necessary in an installation such as the one outlined below.) The Click 230 helps limit current surges on the power lines; the Click 210 interrupts power during overload conditions and provides a convenient way to turn power on and off.

The power plant will either be in a pole-mount box or in a main traffic cabinet. If it's in a traffic cabinet, the power will be sent to the pole via an underground cable run. How to install the power plant and then wire to a Click 200 will be covered in the rest of this section.

It should be noted that if you have ordered a Wavetronix preassembled cabinet, all of this wiring and installation will already be done.

**Note**

An authorized electrical technician should perform installation and operation of this unit. Persons other than authorized and approved electrical technicians should NOT attempt to connect this unit to a power supply and/or traffic control cabinet, as there is a serious risk of electrical shock through unsafe handling of the power source. Extreme caution should be used when connecting this unit to an active power supply.

**Wiring in AC**

The first step is to get AC power into the enclosure. (Sometimes the power source is actually DC; to see Wavetronix's selection of DC power modules, see the *Click 100–400 Series User Guide*.) If you're using a main traffic cabinet, wire from its power source; if you're using a pole-mount box, the power lines or cable can be brought in through the conduit on the bottom-left.

**Note**

Make sure power to AC mains is disconnected while wiring AC input.

**Wiring the Click 210**

The first device in the power plant, as seen in Figure 2.5, is the Click 210. This is a compact circuit breaker DIN rail device designed to interrupt an electric current under overload conditions. The breaker is trip-free and can be easily reset after a current interruption by pushing the reset button.

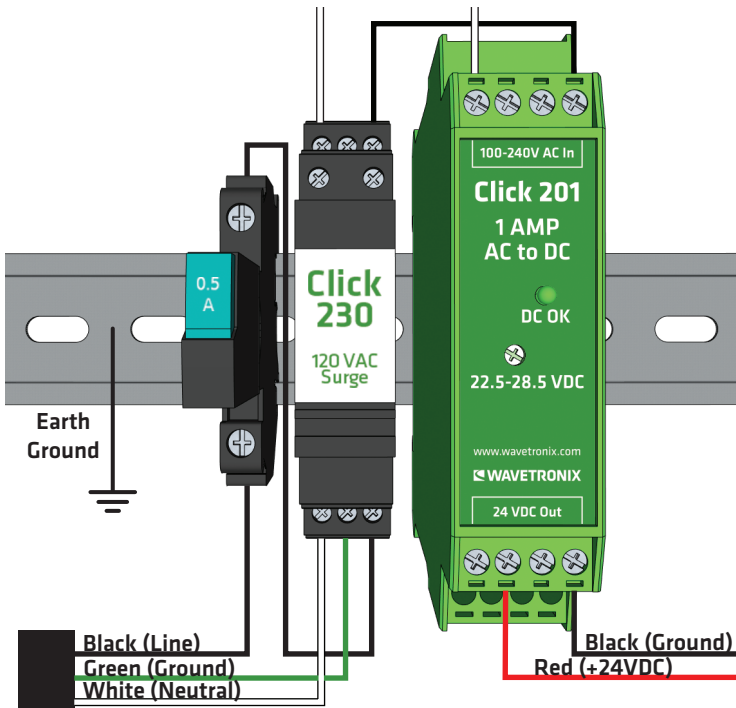


Figure 2.5 – AC Surge Protection

To add a Click 210 circuit breaker and switch (see the left side of Figure 2.5):

- 1 Mount the Click 210 onto the DIN rail.
- 2 Connect the line conductor (usually black) from the AC terminal block or cord in to either side of the module.
- 3 Wire out of the other side.

### Note

For ease in troubleshooting, it is recommended that you follow the wire color scheme outlined in this chapter.

## Wiring the Click 230

The next device in the power plant is the Click 230, which is the AC surge protector (see Figure 2.5). To install:

- 1 Mount the Click 230 onto the DIN rail next to the Click 210.
- 2 Connect the line conductor (black) from the Click 210 to terminal 5 on the IN side of the Click 230.

- 3 Connect the neutral (usually white) wire from the AC terminal block or cord to the terminal marked 1 on the Click 230.
- 4 Connect the ground wire from the AC terminal block or cord to the terminal marked 3 on the Click 230.
- 5 Connect an outgoing and protected line wire to the terminal marked 2 on the Click 230. The line wire should be black.
- 6 Connect an outgoing and protected neutral wire to the terminal marked 6 on the Click 230. The neutral wire should be white.

The terminal blocks 3 and 4 are directly bonded via the metal mounting foot of the base element to the DIN rail. There is no need for any additional grounding between terminals 3 and 4 and the DIN rail.

## Wiring the Click 201/202

The final device in the power plant should be either a Click 201 or 202 (as shown in Figure 2.5). These are AC to DC converters, also occasionally called the power supplies. As noted above, the difference between the two is that the Click 201 outputs 1 A and the Click 202 outputs 2 A (the Click 204 outputs 4 A but will probably not be needed for an HD installation). Choose which device suits your installation best, then follow the steps below to install it (see Figure 2.6):

- 1 Mount the Click 201/202 onto the DIN rail next to the Click 230.
- 2 Connect the line (black) wire from the Click 230 into the L screw terminal on the top of the Click 201/202.
- 3 Connect the neutral (white) wire from the Click 230 to the N screw terminal to the top of the Click 201/202.



Figure 2.6 – Wiring AC Power into the Click 201/202

### Note

The NC screw terminal is not connected internally. Connecting a wire to a no connect (NC) terminal simply gives it a convenient termination point.

To wire the newly converted DC power out of the Click 201/202:

- 1 Connect a +DC conductor (usually a red wire) to the + screw terminal on the bottom of the Click 201/202 (see Figure 2.7).
- 2 Connect a -DC conductor (usually a black wire) to either of the – screw terminals on the bottom of the Click 201/202.



Figure 2.7 – Wiring DC Power Out of the Click 201/202

### Note

Do not wire into the screw terminal marked DC OK; it provides only 20 mA and should be used only for monitoring the power supply.

The screw terminal connectors on the top and bottom of the module are removable to simplify wiring and are red-keyed, allowing the connector to plug into only one correct jack.

## Connecting the Power Plant to Your Installation

Now the power plant is complete and you have reliable, safe DC power. The next step is to get that power to the rest of the installation.

If the power plant is in a pole-mount box, this involves getting that power onto the T-bus; from there it will power any communication devices that may be on it. It will also power the Click 200, which will send the necessary 10–30 VDC, along with communications, to the sensor.

If the power plant is in a main traffic cabinet, this also will involve getting DC from the power plant on the T-bus; from there it will power any communication devices on that bus. It will also power the Click 200, which will send that power, along with communications, along the homerun cable to the Click 200 in the pole-mount box. That Click 200 will put the power (and communications) onto the T-bus, powering any communication devices that may be on it. It will also send the necessary 10–30 VDC, along with communications, to the sensor.

To put power on the T-bus, you will first need to connect a 5-screw terminal block to the end of the T-bus, then follow the steps below to wire DC to it:

- 1 Connect +DC (red) from the Click 201/202 to the top screw terminal on the 5-screw terminal block.
- 2 Connect -DC (black) to the second screw terminal.

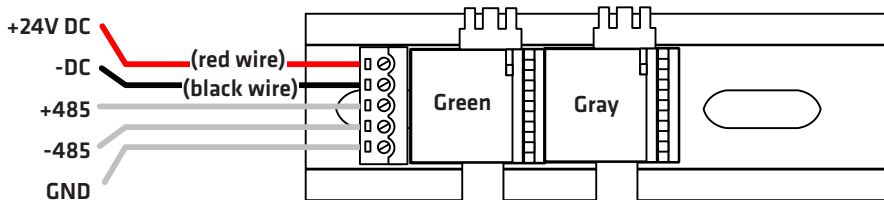


Figure 2.8 - Connecting Power Directly to the T-bus

### Note

Green T-bus connectors conduct power and communication on the DIN rail backplate; gray T-bus connectors only conduct power and are used to distribute power without connecting communication.

You can also wire DC to the Click 200 itself; it will then put that power on the T-bus. If you'd like to do that, follow these steps:

- 1 Connect +DC (red) from the Click 201/202 to the +DC screw terminal.
- 2 Connect -DC (black) to a GND screw terminal.

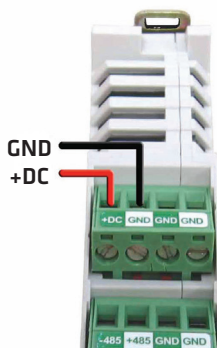


Figure 2.9 - Wiring DC Power into the Click 200

## Wiring Communication

The last thing to do is decide how to communicate with the sensor. How you do this will vary based on your installation. If your sensor is connected to a Click 200 in a pole-mount

box, and you want to access that sensor from a main traffic cabinet or from the traffic operations center, you will need some kind of communication between the two spots: either with the homerun cable, which can carry both RS-232 and RS-485 communications, or by using a Wavetronix Click communication device.

Wavetronix has a variety of wired and wireless communication devices, such as the Click 301 serial to Ethernet converter, which lets you communicate with the sensor via Ethernet, or the Click 400, which is a 900 MHz radio that communicates wirelessly with other radios. See the *Click Catalog*, *Click Series User Guide*, or *ITS Designer Training Guide* for more information.

The Click 200 has several ports for other methods of communication. The faceplate has a DB-9 port you could connect to for RS-232 communication. There are also several RS-485 connections:

- T-bus backplane: puts RS-485 on the T-bus. Because the Click 200 is connected to the sensor, this T-bus connection means the sensor, the Click 200, and any other device on the T-bus all communicate with each other.
- RJ-11 connector on the faceplate for connecting to contact closure devices, if desired.

### Note

The Click 200 does not convert RS-232 communication to RS-485. It simply provides surge protection for these two independent connections.

# Part II

## Using SmartSensor Manager HD

**Chapter 3** - Installing SmartSensor Manager HD

**Chapter 4** - Communication

**Chapter 5** - Settings

**Chapter 6** - Lanes

**Chapter 7** - Data

**Chapter 8** - Tools





## In this chapter

- Installing SSMHD

After the SmartSensor HD is installed, use SmartSensor Manager HD (SSMHD) to configure the sensor to the roadway and change sensor settings. SmartSensor Manager HD is software that enables users to configure and interact with the SmartSensor HD.

## Installing SSMHD

SSMHD can be installed on a Windows® PC. Everything needed to install SSMHD to a PC is contained in the SSMHD **Setup.exe** file.

### Note

You must have administrator rights to run the setup program.

### Note

Microsoft .NET Framework version 3.5 or higher needs to be installed on your computer before installing SSMHD. You can get the .NET Framework from the Microsoft website.

Follow these steps to install SSMHD on a PC:

- 1 To download the install file, go to the Wavetronix website at [www.wavetronix.com](http://www.wavetronix.com).
- 2 Click the **Support** link near the top of the page. This will bring up a page allowing you to select by product line or by document category.
- 3 Click **SmartSensor HD** in the Start by drop-down list and a list of links will appear.
- 4 Select the **SmartSensor Manager HD** link under the Software heading to download the SSMHD install file.
- 5 Once you've downloaded the file, double-click on it. Opening it executes a setup program that will copy all the necessary files to your hard drive and place icons in the Start menu and on the desktop of the PC or laptop (see Figure 3.1).

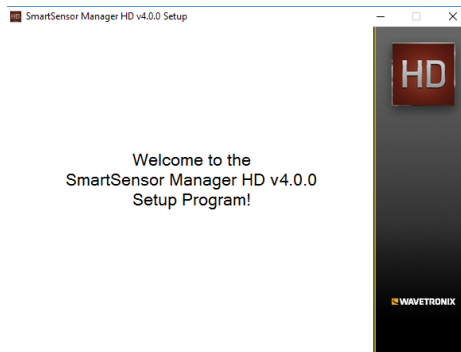


Figure 3.1 – SSMHD Setup Wizard

- 6 Select an installation location. The default location provided is normally “C:\Program Files\Wavetronix.” Click **Browse** to choose another location (see Figure 3.2).

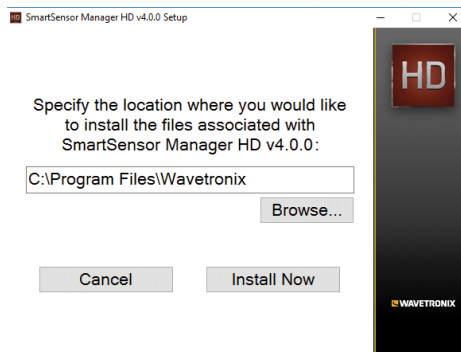
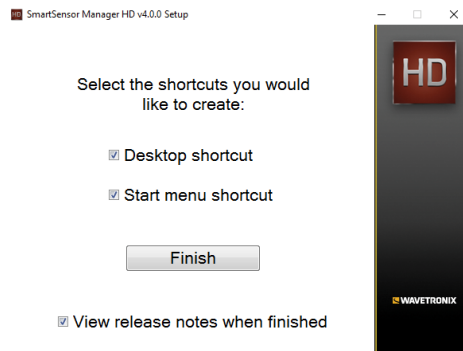


Figure 3.2 – Location to Be Installed

- 7 Click the **Install Now** button.
- 8 After SSMHD is installed, you can create shortcuts to the SSMHD software on the desktop and in the start menu using the corresponding checkboxes (see Figure 3.3). If no shortcuts are desired, uncheck the corresponding boxes.



**Figure 3.3 – Shortcut Options**

- 9 Click the **View release notes when finished** checkbox to view the SSMHD release notes. The release notes contain additional information about the current version of the SSMHD software. A PDF reader program (i.e. Adobe Acrobat Reader) is required to view the release notes.
- 10 Click **Finish** to complete the setup process.

### Note

SSMHD is designed to display text with Normal Size display resolution (96 dpi). If your text is too big and does not display properly, you can edit the Advanced Display property settings on your PC to reduce the display resolution from 120 dpi down to 96 dpi.



## In this chapter

- Serial Connection
- Internet Connection
- Virtual Connection
- Viewing Connection Information
- Installation Type
- Communication Screen Icons
- Uploading the Sensor's Embedded Software

Use the SSMHD software to change settings, view data and configure the sensor to the roadway.

First, physically connect your computer or handheld computer to the sensor. Next, launch SSMHD by either clicking on the icon that was placed on your desktop or clicking the icon found in the Start menu. The SSMHD main screen shown in Figure 4.1 will appear.

The green globe in the lower left corner allows you to select the language for SSMHD. To change the language, click on the image and select the desired language from the drop-down list.

The control to the right of the globe image allows you to change the size of the window. There are three options; click on a box to change the window to the corresponding size.

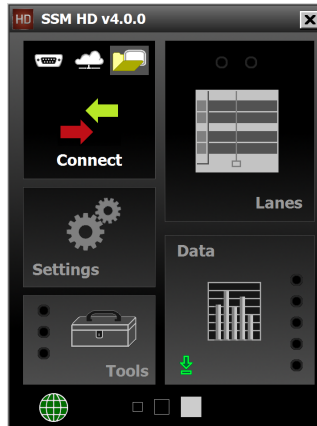



Figure 4.1 – SSMHD Main Screen

To interact with and configure the sensor in SmartSensor Manager HD, connect to the sensor through one of the following three types of connections:

- **Serial connection** – Made using RS-232 or RS-485 communication.
- **Internet connection** – Made using an IP address and a serial to Ethernet converter.
- **Virtual connection** – Can be made for convenience in learning and demonstrating SSMHD functionality.

## Serial Connection

- 1 Click on the **Serial** icon  (see Figure 4.2).
- 2 Set **Port** and **Speed** to the desired settings. It is recommended that the speed be set to 9600 bps.
- 3 Click the **Connect** button.

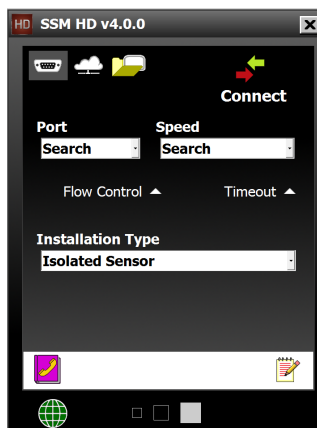


Figure 4.2 – Serial Connection

## Advanced Settings

Below is a list of some advanced settings also available on this screen:

- **Flow Control** – Is usually only used if you are connecting through a RS-232 device that requires hardware handshaking.
- **Timeout** – Allows you to set an additional amount of time (in milliseconds) that SSMHD will wait for a response when communicating with the sensor.

### Note


When connecting directly from a computer running SmartSensor Manager HD to a SmartSensor HD unit (with no modem in between), you should not attempt to connect unless the Flow Control setting is set to **None**. Otherwise you may not be able to successfully connect.

## Internet Connection

The SmartSensor HD can be connected to the Internet, allowing access to the sensor from anywhere with Internet access. Below is a list of a couple ways to connect the SmartSensor HD to the Internet:

- **Serial to Ethernet Converter** – The SmartSensor HD can be connected to a local area network (LAN) by using a serial to Ethernet converter. As an option, the SmartSensor HD can be shipped with a Click 301 serial to Ethernet converter that is Internet addressable, which makes it possible to connect to the sensor from anywhere the adapter's address is accessible.
- **Internet Service Providers** – Cellular providers of wireless Internet services maintain networks in most metropolitan areas in the United States and coverage continues to expand. The SmartSensor HD can be equipped with an optional external modems—for example, CDMA, GMS or GPRS—and assigned an Internet address on these networks.

Use the steps below to connect to the SmartSensor HD using an Internet connection:

- 1 Click on the **Internet** icon  (see Figure 4.3)
- 2 Enter the IP address or URL of the sensor of interest in the **Network Address** field. The IP address consists of four numbers ranging from 0–255 separated by dots. Enter the IP address assigned to either the CDMA modem or the Click 301 serial to Ethernet converter.
- 3 Enter the port number assigned to the CDMA modem or the Click 301 serial to Ethernet converter in the **Port** field. This will be an integer value in the range of 0–65536. The Click 301 port number automatically defaults to 10001.
- 4 Click the **Connect** button to connect to the sensor.



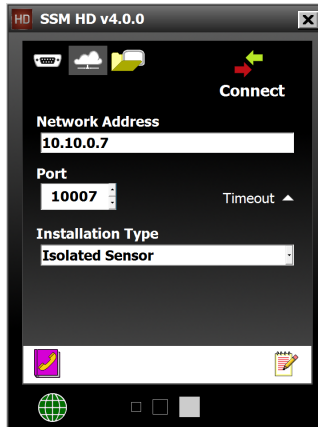


Figure 4.3 – Internet Connection


The **Timeout** field allows you to set an additional amount of time (in milliseconds) that SSMHD will use when communicating with the sensor.

## Virtual Connection

A virtual connection allows you to use the SSMHD software without being connected to an actual sensor. Making a virtual connection can be useful for the following reasons:

- To view a saved sensor setup file.
- To demonstrate functionality for different applications.
- To review how the software works.

Use the following steps to make a virtual connection:

- 1 Click the **Virtual** button  (see Figure 4.4).
- 2 Select or create a virtual sensor file (.sim) by clicking the magnifying glass icon.
- 3 Click the **Connect** button.

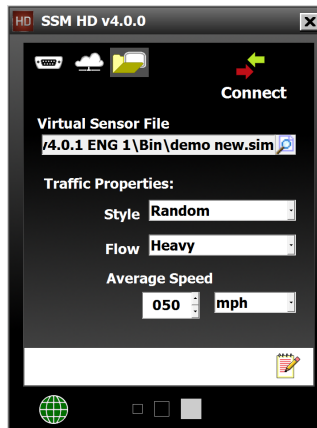


Figure 4.4 - Virtual Connection

## Additional Settings

The Traffic Properties section contains the following settings:

- **Style** - This section allows you to set random or patterned traffic for the simulator.
- **Flow** - Allows you to set the traffic volume for the simulated traffic.
- **Average Speed** - Allows you to set the average traffic speed for the simulated traffic.

## Virtual Sensor File

Since a virtual connection is not made to an actual sensor, a virtual sensor file (.sim) is used to save the configuration settings much like an actual sensor's flash memory. If you are making a virtual connection for the first time, you will need to create a virtual sensor file by clicking on the magnifying glass icon and entering a file name.

### Note

When you are connected using a virtual sensor file, changes that would normally be saved to a sensor's flash memory will automatically be saved to the virtual sensor file.

Backing up a virtual sensor file will change the file to a sensor setup file (.ssc) that can be restored to an actual sensor. To convert a sensor setup file to a virtual sensor file, make a virtual connection and then use the **Restore Sensor Setup** tool in the **Tools** menu. To convert a virtual sensor file to a sensor setup file, use the **Back-up Sensor Setup** tool.

## Viewing Connection Information

Once a connection is made to the SmartSensor HD, the main menu will appear and all

configuration options will become available (see Figure 4.5).

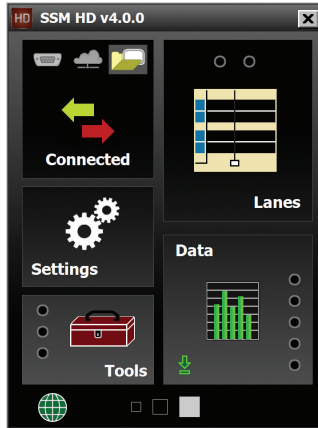


Figure 4.5 – SSMHD Main Screen (connected)

Once connected, you can view additional information about the connection you have established by clicking on the moving arrows on the top left of the main screen, opening the Connection Info window seen below.

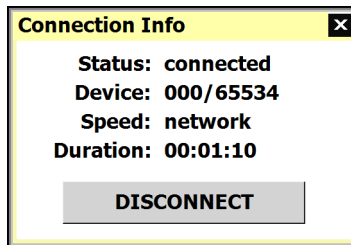


Figure 4.6 – Connection Info Screen

Below is a list of the information available on the Connection Info screen:

- **Status** – Shows that you are connected.
- **Device** – Shows the subnet and sensor ID.
- **Speed** – Shows the baud rate.
- **Duration** – Shows how long you have been connected.

## Troubleshooting Connections

If you have problems connecting, use the following steps to find the problem:

- 1 Make sure that all power and communication wiring is correct.
- 2 Check the port settings (baud rate, port ID).
- 3 Make sure that the sensor ID is correct.

Connection failure can occur for various reasons; if a failure occurs repeatedly, call Wa-

vetronix Technical Services at 801-764-0277 for assistance.

## Installation Type

Once the communication parameters are selected, choose the installation type to be used for the connection.

### Connecting to an Isolated Sensor

This protocol option is recommended when only one sensor exists on the remote end of the connection (see Figure 4.7).

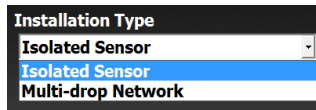


Figure 4.7 – Isolated Sensor

### Connecting to a Sensor in a Multi-drop Network

Connecting to a sensor in a multi-drop network is recommended when more than one sensor exists on the remote end of a connection. To connect to a sensor on a multi-drop network, select **Multi-drop Network** from the drop-down list and enter the multi-drop sensor ID of the sensor you are connecting to (see Figure 4.8).

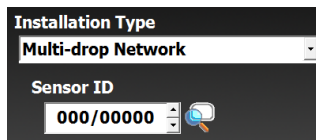


Figure 4.8 – Multi-drop Network

If you do not know the sensor ID, click on the sensor and magnifying glass at the end of the Sensor ID field to do a search for all sensors on the serial bus.

## Communication Screen Icons

At the bottom of the serial and Internet connection screens there is a white bar with icons. This section will explain the purpose of those icons.

### Address Book

The Address Book allows you to save device connection settings for future use. Click the book icon located at the bottom of the screen to add new connection settings to the Address Book (see Figure 4.9).

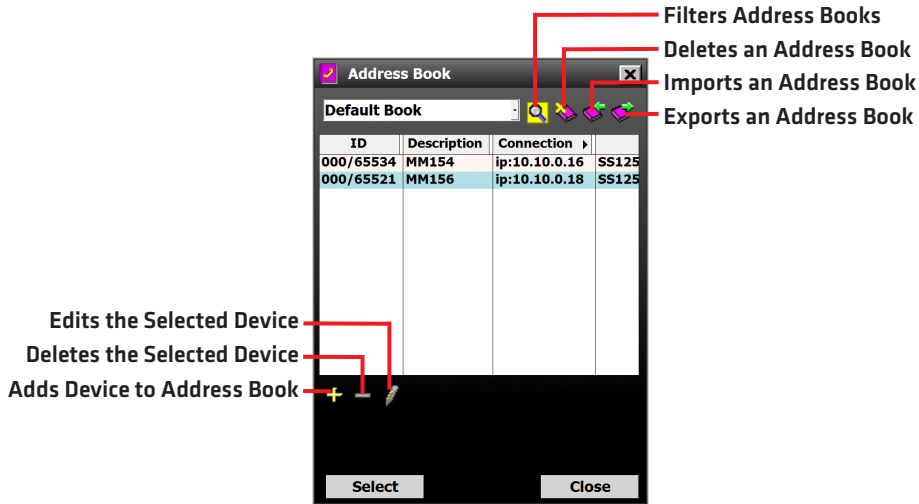


Figure 4.9 – Address Book

## Password

The key icon allows you to create a password for SSMHD. Passwords are associated with the sensor in order to keep the connection and configuration secure. After clicking the icon, enter the desired password and click **OK**. This password will now have to be entered each time you attempt to make a connection (see Figure 4.10).

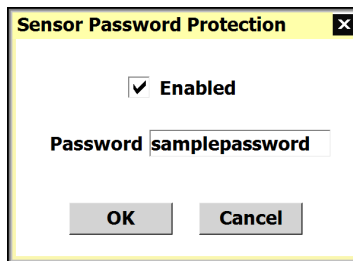


Figure 4.10 – Enter Password Window

If you forget the sensor password, use the **Click Here** link and a new window will open providing information about how to get a new password.

## Communication Error Log

The error log contains all errors stored in the sensor's memory buffer. If you are having trouble connecting, using the error log may be helpful in the troubleshooting process. If you continue having trouble, save the error log file and contact Wavetronix Technical Services.

## Note

The error log is cleared every time you close SSMHD, so if you need to save the file, do so before shutting the program down.

Click the **View Error Log** link to view the communications error log (see Figure 4.11). The error log can also be accessed by clicking on the error log icon at the bottom of the connection screen.

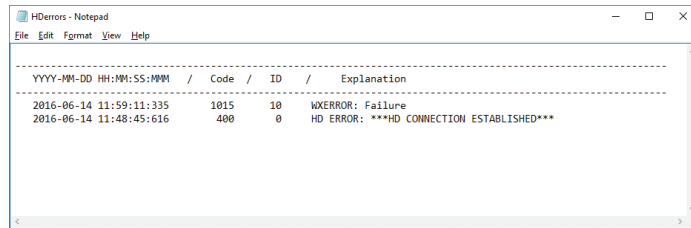


Figure 4.11 – Communication Error Log

## Uploading the Sensor's Embedded Software

After clicking the **Connect** button, the software will check to see if your software version matches the version of the sensor's embedded software. If a discrepancy is detected, the Version Control screen may appear asking you to install firmware upgrades (see Figure 4.12). If you think you have reached this screen in error, clicking the **Recheck** button will have the software retry and ensure that there has not been a communication issue. Clicking the **Details** button will display the current sensor and software information. Click the **Install Upgrade** button to upgrade the software.

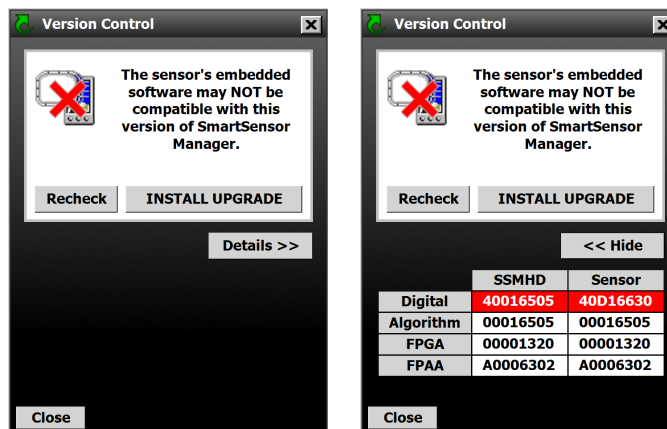


Figure 4.12 – Version Control (left) and Software Upgrade Details (right)

### Note

Clicking the **Close** button and continuing configuration may cause problems with functionality.

The figure below shows how the firmware numbers are interpreted (see Figure 4.13). The month number is written in hexadecimal, meaning the months of October, November and December will be written as A, B and C respectively.

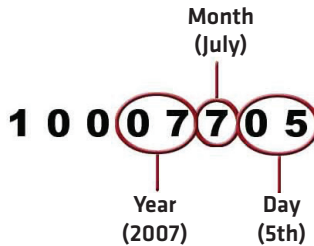


Figure 4.13 – Install Upgrade Numbers

If the row marked Digital is highlighted in red, the firmware upgrade may need to be installed. Compare the sensor number with the SSMHD number in the digital row of the details table. If the SSMHD firmware version date is more recent than the sensor firmware version date, the firmware upgrade will need to be installed; if the sensor's firmware date is more recent than the SSMHD firmware version date, a warning will appear notifying you that the sensor firmware could be downgraded (see Figure 4.14).



Figure 4.14 – Downgrading the Sensor

If the downgrade message appears, it simply means that the sensor firmware is newer than the version of SSMHD that was used to connect to the sensor. The newest version of SSMHD can be updated by downloading the software from [www.wavetronix.com](http://www.wavetronix.com).

Click the **INSTALL UPGRADE** button to install the firmware embedded in SSMHD onto the SmartSensor HD. The **Recheck** button will query the sensor to see if the firmware bundled in SSMHD is different from the version running on the sensor.

## In this chapter

- General Tab
- Ports Tab
- Outputs Tab
- Data Tab

Click the **Settings** link on the main menu to change and save settings on the sensor. The Settings window contains the **General**, **Ports**, **Outputs** and **Data** tabs.

## General Tab

The General tab contains the following fields (see Figure 5.1):



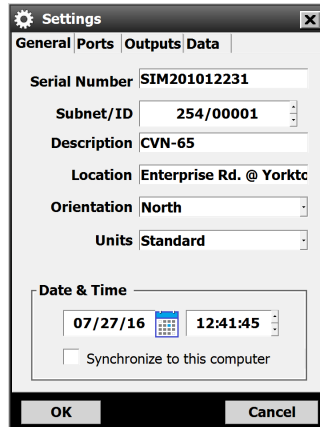


Figure 5.1 – General Tab

- **Serial Number** – Contains the sensor serial number and cannot be edited.
- **Subnet/ID** – Allows you to enter the subnet and ID. A subnet can be used to create groupings of sensors. The subnet default is 000 and the ID default is the last five digits of the sensor serial number. The ID can be changed, but no two sensors should have the same ID. The ID must be unique for all sensors on a multi-drop bus.
- **Description** – Allows you to enter a description for each sensor. Limited to 32 characters.
- **Location** – Allows you to enter the location of the sensor. Limited to 32 characters.
- **Orientation** – Allows you to enter the direction the sensor is pointing. This field is purely for informational purposes and has no effect on performance or the sensor's physical mounting.
- **Units** – Allows you to display either English (mph/feet) or metric (kph/meters) units.
- **Date & Time** – To sync the sensor date and time with the computer, click the **Sync to this computer** checkbox. The sensor itself stores time in Coordinated Universal Time (UTC), formerly known as Greenwich Mean Time (GMT), and does not account for daylight saving time. SSMHD uses the local setting of the computer it is running on to display the date and time in local units.

### Example

If someone in Pacific Standard Time (PST) connect to a sensor and synchronizes the time, then when someone in Mountain Standard Time (MST) connects to the same sensor the time will be correctly displayed as MST. If the settings on either PC adjusts for daylight savings, then this adjustment will also be correctly displayed.

## Ports Tab

The Ports tab contains the following settings (see Figure 5.2):

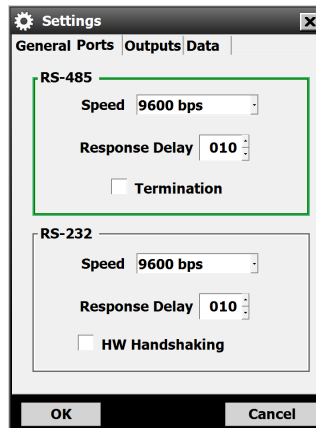


Figure 5.2 – Ports Tab

- **Green highlight** – This indicates the communication link (port) on which SSMHD is connected.
- **RS-485** – Allows you to set the baud rate for RS-485 communication. The **Response Delay** setting is used to configure how long the sensor will wait before responding to a message received. This is useful for some communications devices that are unable to quickly change transmission direction. The default value is 10 milliseconds.

The **Termination** checkbox allows you to electronically turn RS-485 communication bus termination on or off. Only the end devices on a RS-485 bus should be terminated. In general, the termination can be left unchecked until a multi-drop bus becomes overloaded.

- **RS-232** – Allows you to set the baud rate for RS-232 communication. The **Response Delay** setting works the same as the RS-485 section.

The **HW Handshaking** checkbox should be selected if you are connecting your sensor to an RS-232 device (such as some modems). These devices sometimes require flow control handshaking because they cannot keep up with the data rates of higher-performance devices like personal computers and SmartSensor HD. SmartSensor Manager HD and SmartSensor HD have built-in support for RS-232 flow control hardware handshaking; this support allows the SmartSensor HD and SmartSensor Manager HD to work with these slower modem connections. Table 5.1 gives a brief description of each RS-232 line.

Line	Description
TX	Transmit data line
RX	Data receive line
RTS	Request to send flow control hardware handshaking line
CTS	Clear to send flow control hardware handshaking line

Table 5.1 – RS-232 Lines

In order to use hardware handshaking, the sensor's RTS and CTS signals must be properly

connected. If the **Flow Control** option under the Serial connection screen is set to **Hardware**, you will not be able to connect if the sensor's HW handshaking setting has been previously turned off. The reason you cannot connect is that the sensor's RTS line is not asserted; as that line is connected to the computer's CTS line, the computer will not forward data messages it is given by SmartSensor Manager HD. To successfully connect, simply change the **Flow Control** setting to **None**.

## Outputs Tab

The Outputs tab contains the following settings (see Figure 5.4):

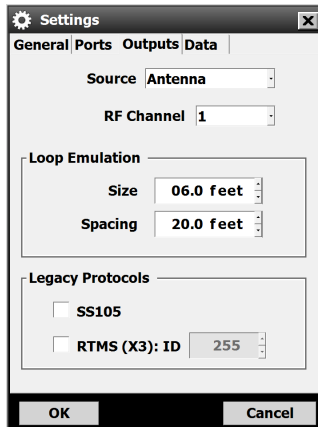


Figure 5.3 – Outputs Tab

- **Source** – Allows you to determine what information is reported. There are two options: **Antenna** reports data as detected by the antenna in the sensor, and **Diagnostic** creates detection events for testing and training purposes.

### Note

If the sensor is in Diagnostic or Replay mode, it will not detect live traffic.

- **RF Channel** – Displays which radio frequency channel the sensor is transmitting on. Using multiple sensors in close proximity will require each sensor to be set to a different RF channel (see the introduction for more information about mounting sensors in close proximity).
- **Loop Emulation** – This section allows you to set loop size and spacing to allow Smart-Sensor HD to emulate dual loops. The settings changed on this screen will apply to all configured lanes. These settings are read by a Click contact closure device and used so that the contact closures can be properly timed to emulate a given loop size and spacing. The loop size is also used by the sensor in the occupancy calculation. For example,

larger loop sizes will result in higher occupancy numbers in the interval data. However, adjusting these parameters will not modify the reported vehicle length or speed (see Chapter 6 of this user guide to accomplish these tasks).

- **Legacy Protocols** – The SS105 protocol must be selected when being used with Click communication and contact closure devices (it is not necessary if you are only using Click surge and power devices). This does not turn off native SSHD protocol.

The **RTMS (X3): ID** checkbox allows you to turn RTMS protocol emulation on or off; only a subset of RTMS data reporting commands are emulated. This does not turn off native SSHD protocol. The RTMS ID field will only be editable if the RTMS Protocol checkbox is selected.

### Note

If you are using a SmartSensor HD in an RTMS-based system, there are two ways to collect data from the sensor. If your system is set up to poll the sensor, the RTMS protocol must be turned on so the sensor can respond to RTMS commands. If your system is simply listening for data pushes from the sensor, the RTMS protocol does not need to be turned on. See Chapter 7 for more information on data push.

## Data Tab

The Data tab contains the following setting (see Figure 5.4):

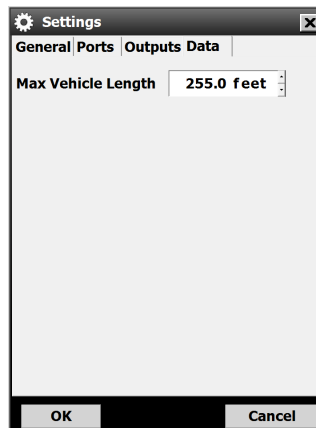


Figure 5.4 – Data Tab

- **Max Vehicle Length** – Any detected vehicle that exceeds this length is reported only as being this long.



## In this chapter

- Configuration
- Verification

Click the **Lanes** link on the main menu to align and configure the sensor, and to verify functionality (see Figure 6.1).

- **Configuration** - Allows you to automatically configure the sensor, manually adjust the lanes (if needed) and edit and save the configuration.
- **Verification** - Allows you to verify that the sensor is detecting accurately and to modify individual lane performance.

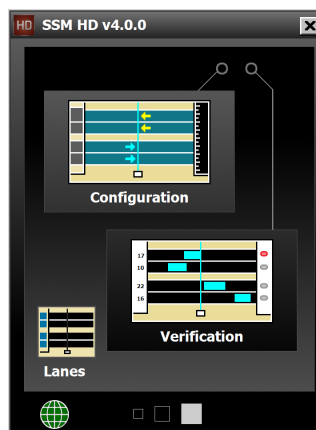


Figure 6.1 - Lanes Screen

# Configuration

The Configuration screen can be used to automatically or manually configure the roadway, manipulate lanes, and control how you see the information onscreen. To reach the screen, click the **Configuration** button.

## Sensor Alignment

The sensor should be properly aligned before beginning lane configuration, so SSMHD includes an alignment feature that gives visual confirmation when the perpendicular alignment of a sensor is correct (see Figure 6.2). SSMHD gives you two different ways to check sensor alignment: the arrow coming out of the sensor and the lane color in the sidebar.

Once you open the Configuration screen, you should see the alignment arrow. If the alignment arrow doesn't appear, click on the magnifying glass icon and then select **Show Alignment**.

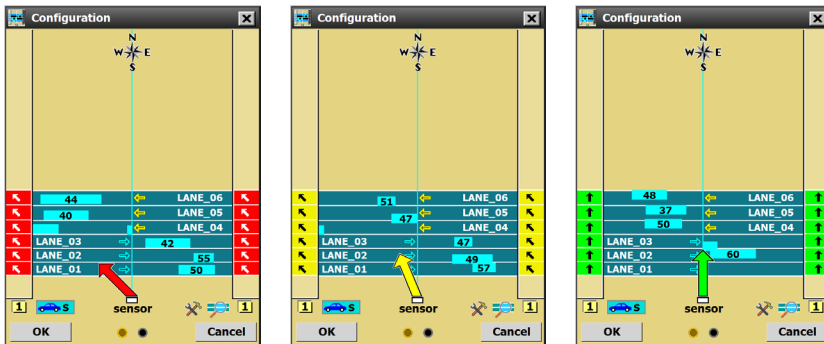


Figure 6.2 – Sensor Alignment

Adjust the sensor according to the arrow displayed in the Configuration window. A green arrow means the sensor is correctly positioned for optimal performance; a yellow or red arrow means the sensor is NOT correctly aligned with the roadway.

### Note

In order for the sensor alignment tool to function properly, traffic must be flowing freely. Also, if the sensor is not already aligned close to perpendicular to the flow of traffic, the sensor alignment tool will display a question mark indicating that the sensor is too far out of alignment for the tool to function properly. Realign the sensor manually and then fine-tune the alignment with the tool. After each adjustment of the sensor, several vehicles must pass before the alignment tool's output is valid.

It may be difficult to align the sensor if there are non-parallel lanes of traffic. In this case, mark the non-parallel lanes as Inactive or Excluded in the lane configuration screen, and

the sensor alignment tool will ignore vehicles traveling in these lanes.

### Note

In cases where traffic lanes are not exactly parallel, the percentage of vehicles with reported speeds may decrease in the lanes that are skewed.

## Auto-Configuration

One of the advantages of the SmartSensor HD is the fast and simple lane auto-configuration function, where the sensor automatically configures the roadway and sets up the lanes based on passing traffic.

Follow the steps below to automatically configure the SmartSensor HD (see Figure 6.3):

- 1 Once the Configuration window appears, click the **Tools** icon and select **Clear Edit Area**.
- 2 Click the Tools icon again and then click **Restart Auto Cfg**.

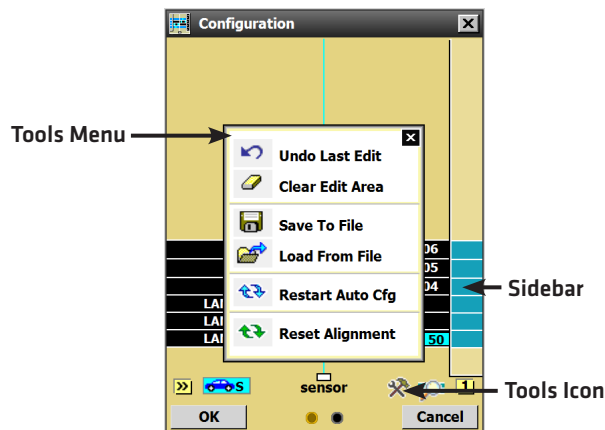


Figure 6.3 – Buttons Used in Automatic Lane Configuration

### Note

You may need to click on the magnifying glass icon and select **Show Auto Lanes** for the automatically discovered lanes to appear.

Depending on where the sensor is mounted and on the amount of traffic, the configuration process could take a few minutes. Once the SmartSensor HD has detected vehicles and created the appropriate lanes, click **OK** and a window will appear asking you to save the



changes to the configuration. Click **Yes** and the configuration will be saved.

Follow the steps below if only a portion of the automatically defined lanes are desired:

- 1 Click anywhere in the Configuration screen.
- 2 Check the **Hide Auto-Lanes** box and the automatically configured lanes will disappear.
- 3 Click on the desired automatic lane in the sidebar (when the sidebar is set to 1) and the Automatic Lane window will appear (see Figure 6.4). This window allows you to select the lanes you want to appear in the roadway. To have all lanes appear in the roadway, click the **Copy Sidebar** button; to have individual lanes appear in the roadway, click the **Copy Lane** button. You can also copy the entire sidebar and then delete the unwanted lanes by clicking on them and selecting **Delete**.

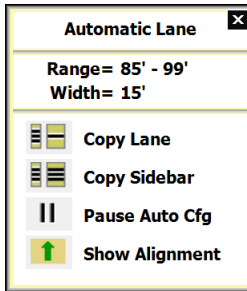


Figure 6.4 – Automatic Lane Window

## Manual Configuration

The Configuration screen can also be used to manually configure and adjust lanes (see Figure 6.5). The following functions and tools are available on the Configuration screen.

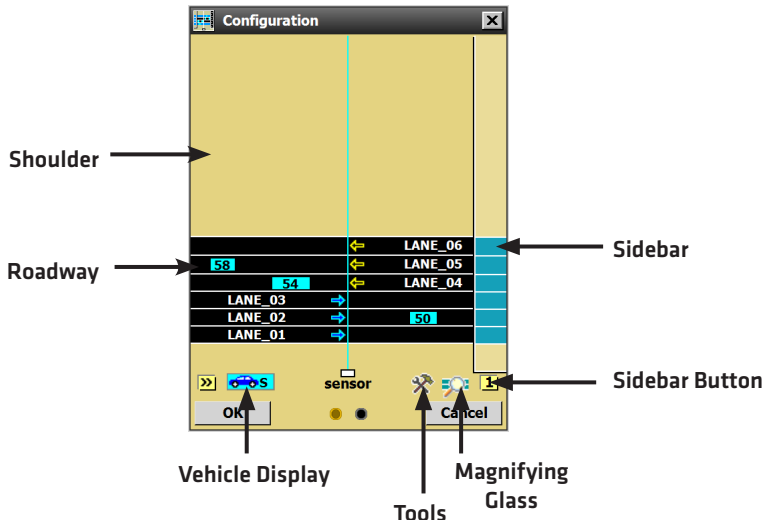


Figure 6.5 – Configuration Screen

## Sidebars

The sidebar buttons on either side of the Configuration screen control the sidebar display. Click and hold the button to see a list of the following different display modes (see Figure 6.6):

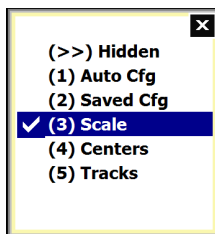


Figure 6.6 – Lane Configuration Sidebar Options

- **Auto Cfg** – Shows the lanes that are automatically configured by the sensor.
- **Saved Cfg** – Shows the lanes that are saved on the sensor.
- **Scale** – Shows the distance from the SmartSensor HD to each lane.
- **Centers** – Shows the relative occurrence of events. Larger arrows indicate a greater number of vehicles at a given range.
- **Tracks** – Shows a track for each detected vehicle; a line is drawn at the center of each vehicle that passes. This sidebar is very useful for manually adding lanes. Click on the tracks sidebar to clear all tracks and start again.

## Vehicle Display

The **Vehicle Display** button  opens a menu that allows you to configure how vehicles are drawn and what information is displayed on them.

In range mode, vehicles are drawn at the correct range regardless of lane definitions. In lane mode, only vehicles detected in configured lanes will be displayed.

SSMHD is able to display the detected speed, length, length-based class (see Definitions in Chapter 7) or no information for each vehicle (see Figure 6.7). To choose to show no information for the vehicle, click again on the option that is currently checked to deselect all options.

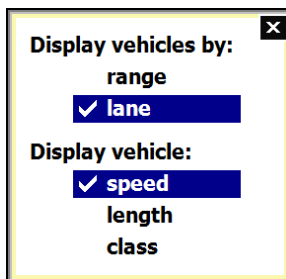


Figure 6.7 – Vehicle Display Options

## Tools

The **Tools** button opens a menu that allows you to automatically configure the sensor, save and load configurations to files and reboot the sensor (see Figure 6.8). Saving or loading the configuration only saves or loads lane configuration information (see the Tools section on the main menu to save all sensor configuration parameters).

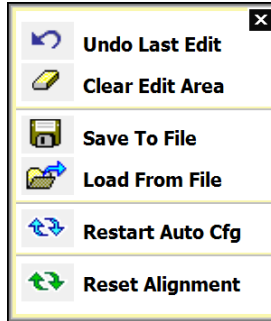


Figure 6.8 - Tools Options

## Magnifying Glass

The **Magnifying Glass** button opens a menu that allows you to show or hide automatically configured lanes, lane names, vehicle direction, and sensor alignment; you can also view a compass (see Figure 6.9). Many of these options can also be turned on or off simply by clicking on them in the edit area.

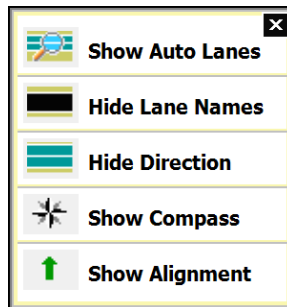


Figure 6.9 - Show/Hide Lanes

## Note

The orientation of the compass is based on the orientation chosen under Settings (see Chapter 5). Changes to the orientation there will result in the compass in the Configuration screen changing to match; conversely, changing the orientation of the compass on the Configuration screen (done by clicking on it) will change the orientation setting under Settings. The orientation does not affect the alignment or operation of the sensor and is simply for your information.

## Shoulder Area

Click in the shoulder and the Shoulder Area window will appear, allowing you to add or exclude the shoulder you just clicked on (see Figure 6.10). This is useful when aligning the sensor when there are non-parallel lanes in its field of view. Alternatively, it can also stop events from being generated in any non-lane areas. In the Verification screen, and when the sensor is reporting data, any vehicles in non-lane defined areas will not be shown regardless of whether the area is excluded or not. Click in an excluded area and the Excluded Area window will appear, allowing you to include the area again.

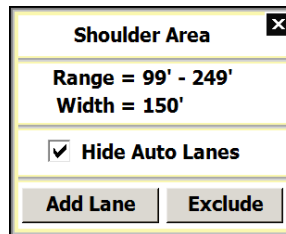


Figure 6.10 – Edit Area Window

## Lane Window

Click anywhere on a lane and the Lane window will appear, allowing you to change the name, direction and activity of a lane (see Figure 6.11). SSMHD uses “LANE\_xx” as the default lane name where “xx” is the number of the lane in range, beginning with “LANE\_01.” When a new lane is added, all lanes with the default lane name format will automatically be renamed to indicate their increasing number in range. If this is not desired, the lane names can be changed in any way; lane names are case and symbol sensitive and are limited to eight characters.

## Note

If you rename a lane with a new lane number, the software won't let you leave the name in the form of LANE\_XX. One easy way to get around this is to lowercase the word "LANE." For example, to change the lane currently numbered as 1 to number 6, change the name from LANE\_01 to Lane\_06.

For RTMS and Z4 data push types, the mapping of the lanes may be changed using the notation #xx (e.g. #08), where 08 is a lane number between 1 and 99. In this case, ALL lanes in the configuration must be assigned a lane number using the #xx notation in order for the new lane mapping to take effect.

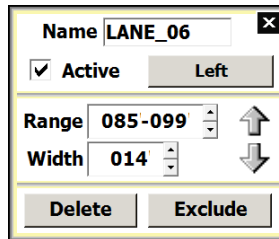


Figure 6.11 – Lane Adjustment Window

The direction button allows you to set the direction for the lane—Left, Right or Bidirectional. The direction chosen determines what data is shown: if Right is the set direction for a lane, only traffic going to the right will be detected; and if Left is the set direction for a lane, only traffic going to the left will be detected (when Direction Protection is on). If the lane is set to Bidirectional, data will be reported for traffic going both directions. This is useful for lanes that change direction depending on the time of day. Selecting Bidirectional is essentially the same as turning off Direction Protection for that lane (see the Lane Adjustments section in Chapter 6 for more information on Direction Protection).

## Note

All detected vehicles are shown on the Lane Configuration screen, regardless of direction.

Click the **Exclude** button to exclude a lane (the lane will turn red once it has been excluded) or click the **Delete** button to delete a lane. Excluded lanes will not be configured and SSMHD will stop showing events in those particular lanes. Click the excluded lane and click the **Include Area** button to include the lane.

The Lane window also allows you to set a lane as active or inactive. Inactive lanes are useful when a lane has been correctly configured and tuned, but data reporting for the lane is not desired. By making the lane inactive instead of deleting it, the lane may be turned on at any

time and will retain the proper configuration and tuning.

## Saving the Configuration

Follow the steps below to save the configuration to a file:

- 1 Click on the **Tools** button on the bottom right of the Configuration screen.
- 2 Select **Save to File**.

## Undoing Manual Changes

To undo changes you have made to the configuration, click on the **Tools** button in the Configuration screen and select **Undo Last Edit** from the choices displayed. To undo all changes made to the configuration, click the **Tools** button and then select **Clear Edit Area**.

## Verification

To verify that the lanes were configured properly, close the Configuration screen and select **Verification** from the Lanes menu.

The Verification screen allows you to monitor lane detection accuracy and to adjust the lane properties for better detection.

## Sidebars

Click and hold the sidebar buttons **>>** **<<** on either side of the Lane Verification window to view the following options (see Figure 6.12):

- **Presence** - Displays buttons to the side of each lane that will light up while the vehicle is being detected.
- **Volume** - Displays the number of events in each lane.
- **Speed** - Shows the average speed of each individual lane.
- **Classes 1-8** - Show count for each length-based class, which can be created using the Class Definitions feature. The number of class bins that appear in this window will be the same number of class bins that were created (see Definitions in Chapter 7).

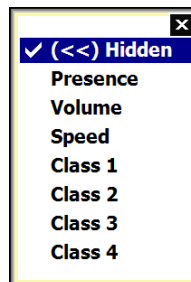



Figure 6.12 - Lane Verification Sidebars with Four Classes

## Vehicle Display

The **Vehicle Display** button  in the Verification window opens a menu that allows you to view associated speed, length, class or no additional data. To switch the display, click on the **Vehicle Display** button and choose which method to display (see Figure 6.13).

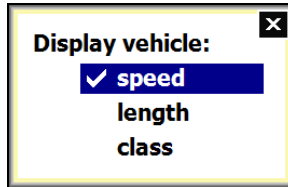



Figure 6.13 – Vehicle Display Window

## Per Vehicle Data

Per vehicle data is data that is recorded each time a vehicle is detected. To access, click the **Per Vehicle Data** button  on the Verification screen (see Figure 6.14). To begin logging per vehicle data, click the **Logging** arrow in the bottom-right corner and turn the logging switch in the on position. Logging will be terminated if the Per Vehicle Data screen is closed.

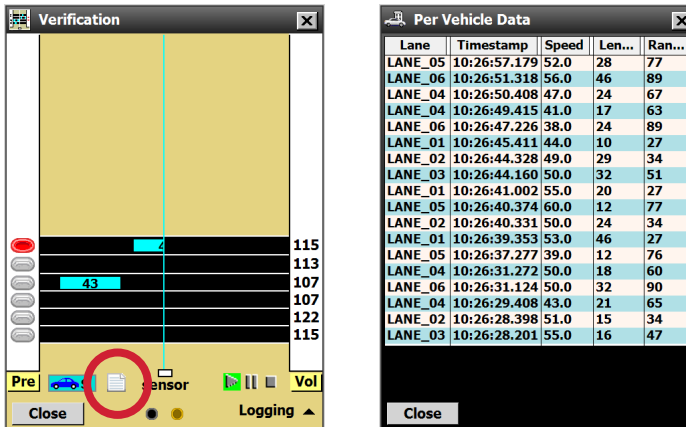



Figure 6.14 – Per Vehicle Screen

The Per Vehicle Data screen displays the following information about each vehicle detected:

- **Lane** – States the lane in which the vehicle was detected.
- **Timestamp** – Displays the time at which the vehicle was detected.
- **Speed** – Shows the speed of the vehicle in miles per hour.
- **Length** – Displays the length of the vehicle in feet.
- **Range** – Shows the range from the sensor to the vehicle in feet.

## Play/Pause/Stop Buttons

The **Play**, **Pause** and **Stop** buttons  allow you to control the data display. When **Pause** is selected, vehicles traveling on the screen will not be included in the presence, volume, speed or class sidebars. Click the **Play** button to add new vehicles to the running totals for all sidebars; click the **Stop** button to reset all volume, speed and class numbers to zero.

## Lane Adjustment

Lane performance can be adjusted by clicking anywhere inside a lane and using the Lane Adjustment tool (see Figure 6.15). The drop-down list allows you to adjust lane volume, detection, speed, length, extension time or direction protection. To return to default settings, select **Set Defaults** from the drop-down list and click the **OK** button. Each lane adjustment is independent of other lanes; setting one lane back to defaults using the **Set Defaults** option will not affect the other lanes.

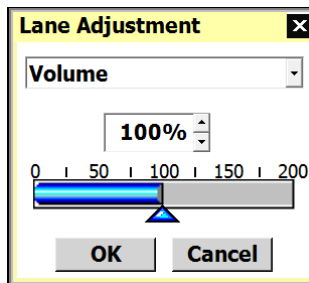


Figure 6.15 - Lane Adjustment Window

- **Volume** - This setting should be adjusted first when a problem with count accuracy is observed. The default is 100%. This setting adjusts the aggressiveness of traffic radar-specific algorithms and is not an arbitrary scale factor. By increasing the percentage by 10% to 15%, you are likely to begin to increase the number of detection, and by decreasing the percentage by 10% to 15%, you are likely to begin to decrease the number of detections. Small adjustments of only 1% or 2% may actually have no impact on the detection performance. Practical values for this setting are typically between 20% and 190%. If the volume lane adjustment is below 20%, many detections in that lane will probably be missed; if it is set greater than 190%, many false detections will probably occur.
- **Detection** - Raises or lowers the threshold for detecting vehicles. The sensor automatically determines where the threshold will be placed, and then adds in this tuning parameter. Entering a larger number will result in fewer detections; entering a small number will result in more detections. The default is 0 dB.

### Note

Changing the detection tuning parameter can drastically effect vehicle detection.



- **Speed** – Raises or lowers the speed calculated for all vehicles in each lane. The sensor calculates the speed, and then multiplies the speed by this factor. The default is 100%.
- **Length** – Increases or decreases the length for all vehicles in each lane. The sensor calculates the length and then adds the length factor. The default is 0 (feet or meters depending on sensor units used). Since the occupancy metric that is reported in the interval data is calculated using length, a change in the length tuning parameter will also change the occupancy that is reported. See page 69 for the equation that is used to calculate occupancy and for a more detailed explanation.
- **Extension Time** – Changes the extension time, which the sensor uses to prevent vehicles with trailers from being broken into multiple detections. A longer extension time will prevent this, but can lead to multiple vehicles being merged into a single detection. The sensor automatically determines the extension time and then multiplies by this factor. The default value is 100%.

### Note

There must be a minimum of 5.5 ft (1.68 m) between vehicles in order for them to be detected as separate vehicles. This separation requirement may increase as vehicle speeds increase.

- **Direction Protection** – Allows you to turn Direction Protection on or off. When Direction Protection is on (default), data will be shown only for vehicles that are going in the direction set for that lane. For example, if a lane is set for traffic moving north, any traffic in that lane that may be moving south will be ignored. However, if the sensor determines that most vehicles are going a direction different from the one that was configured (e.g. during hurricane evacuation), the sensor will begin reporting vehicles going all directions. Turning off Direction Protection allows SSMHD to always report data from vehicles going both directions.

### Note

If a lane has been configured to be bidirectional, Direction Protection will be disabled.

## In this chapter

- Definitions
- Storage
- Download
- Push

Click the **Data** link to set bin definitions; log interval data; store and download data; define approaches; and push data (see Figure 7.1).

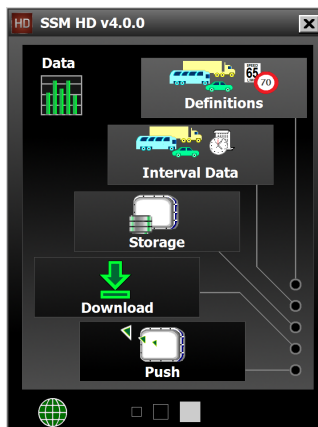


Figure 7.1 - Data Screen

## Definitions

The Definitions screen allows you to set the interval length, set class and speed bins, and group lanes together using approaches. Click the **Definitions** button in the Data screen to access the Definitions window (see Figure 7.2).

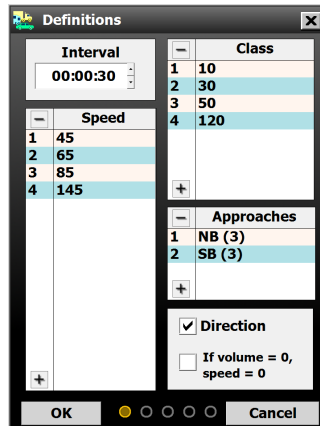


Figure 7.2 – Definitions


There are up to 8 class bins, 15 speed bins and 2 direction bins; all or none of these bins may be simultaneously configured and the number of configured bins will impact the storage capacity, as well as data download time. The term “bins” refers to classifications of vehicles based on their length, speed or direction. Once bins are set, data can be collected for these groupings of vehicles; for instance, the sensor can count for you how many passing vehicles are driving between 90 and 100 mph.

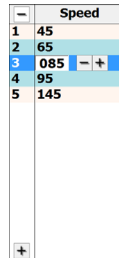
Adding more bins causes data records to be larger, meaning that your sensor’s onboard memory fills up faster and must be downloaded from more often. See the Storage section of this chapter for more information on how to figure out how many days’ worth of memory your sensor has based on its current settings.

## Interval

Interval data refers to the data collected about all the vehicles that pass the sensor in a set amount of time. This interval of time should be carefully chosen because the length of it affects how long the sensor can store data onboard. A shorter interval means the sensor records data more often, which means that the sensor’s onboard memory fills up faster. A longer interval means you can leave the sensor alone for longer periods of time. Ultimately the interval size should be selected to meet the requirements of your application. For example, in real-time applications, onboard storage capacity may not be a concern at all and the data may need to be aggregated over short periods of time (20 seconds) to reduce reporting latency. To set the interval, click anywhere inside the Interval field and use the up/down arrows to change the interval (see Figure 7.2). See the Storage section in this chapter for more information.

## Speed

Speed bins allow you to see how many vehicles are traveling within specified speed ranges. You can have up to 15 speed bins. Click the  button in the Speed window to set up your speed bins (see Figure 7.3).





	Speed
1	45
2	65
3	085  
4	95
5	145

Figure 7.3 – Speed Bins

Here, you are assigning a minimum and maximum speed value for each bin. For example, the maximum speed value for bin 2 is 26 mph. If a vehicle is traveling 25 mph, then that vehicle will be placed in bin 2. If a vehicle is traveling 27 mph, then that vehicle will be placed in bin 3.

You can change the speeds by clicking on a bin and using the +/- buttons to either increase or decrease the value.

## Class

The class bins allow you to classify vehicles by ranges of lengths. If you're not sure what lengths to use, consult your own agency's guidelines. If your agency has no set classification scheme, you can look to the measurements in Table 7.1 as an example; the tables show a scheme called Scheme F, developed by the Maine DOT.


4 Classification Bins		6 Classification Bins	
Lengths	Scheme F	Lengths	Scheme F
0-10	1	0-10	1
10-19	2, 3	10-19	2
19-35	4, 5, 6	19-24	3
35-256	7-13	24-54	4, 5, 6, 7
		54-109	8, 9, 10
		109-256	11, 12, 13

Table 7.1 – Scheme F Length Classifications

## Approaches

Approaches are groupings of lanes used in data collection. Using approaches allows you to

collect per vehicle-based statistics that you could not otherwise get, such as the 85th percentile speed for all northbound lanes, and to store these statistics onboard the sensor. Be aware that adding approaches will increase the size of your data reports, which will affect the number of these reports your sensor can store in its onboard memory. See the Storage section of this chapter for more information.

Click the  button in the Approaches window to group lanes together in four different approaches (see Figure 7.4).

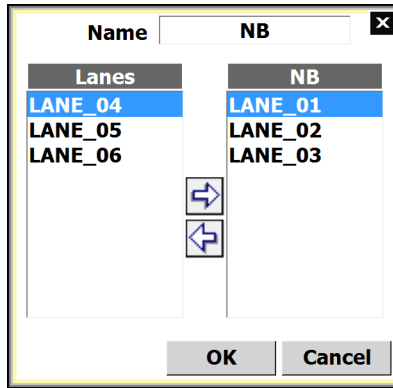



Figure 7.4 – Approaches

Approaches are used in interval data and will contain the same type of information that each lane would. An advantage to using approaches rather than post-processing individual lane data is that approaches gather aggregate data. An example of when this would be useful is in determining speed limits. Using approaches, the sensor could find the 85th percentile speed for all cars in all lanes going one direction, rather than finding it for each lane.

When lanes of differing directions are used, the absolute value of the speed is used to calculate all speed fields. Also, the Right and Wrong direction bins will contain the total number of vehicles traveling with the user-defined direction of the corresponding lanes in the Right bin, and all others in the Wrong bin (see the Direction section below).

To create an approach, select the desired lanes and click the  button. Each approach can be named to coincide with the purpose of the approach.

## Direction

The direction bins are configured as Right and Wrong. This refers to whether vehicles in a given lane are traveling in the direction the lane is configured (to change lane direction, use the lane window in the Configuration screen). This is most useful in the case of reversible lanes, where traffic goes different directions in a lane depending on the time of day. In this case, for part of the day the vehicles would be counted in the Right bin; during the other part of the day, the vehicles would be counted in the Wrong bin.

To enable direction bins, check the **Direction** checkbox.

## If volume = 0, speed = 0

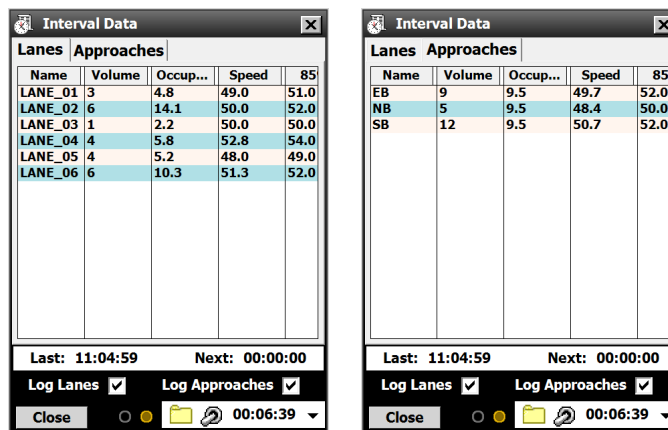
If during an interval, the volume is zero (meaning no cars were detected), SSMHD will report the average speed of the last interval. If you would like the intervals that are reporting zero volume to report speeds as zero, simply check the **If volume = 0, speed = 0** checkbox.

### Note

When NOT using **If volume = 0, speed = 0** feature, then if the volume in the interval is zero, and the occupancy is less than 20%, the speed in the interval will be the speed of the previous interval. If the volume in the interval is zero, and the occupancy is more than 20%, the speed in the interval will be zero.

## Interval Data

The Interval data screen allows you to log lanes and approaches in set interval lengths. Click the **Interval Data** button in the Data screen to access the Interval Data window (see Figure 7.5).



The figure shows two screenshots of the 'Interval Data' window. Each window has a table with columns for Name, Volume, Occupancy, Speed, and a constant value of 85. The left window shows data for lanes LANE\_01 through LANE\_06. The right window shows data for approaches EB, NB, and SB. Both windows have a status bar at the bottom with 'Last: 11:04:59' and 'Next: 00:00:00', and checkboxes for 'Log Lanes' and 'Log Approaches' which are both checked. There is also a 'Close' button and a timer set to '00:06:39'.

Lanes		Approaches			
Name	Volume	Occup...	Speed	85	
LANE_01	3	4.8	49.0	51.0	
LANE_02	6	14.1	50.0	52.0	
LANE_03	1	2.2	50.0	50.0	
LANE_04	4	5.8	52.8	54.0	
LANE_05	4	5.2	48.0	49.0	
LANE_06	6	10.3	51.3	52.0	

Lanes		Approaches			
Name	Volume	Occup...	Speed	85	
EB	9	9.5	49.7	52.0	
NB	5	9.5	48.4	50.0	
SB	12	9.5	50.7	52.0	

Figure 7.5 – Interval Data

Check the **Log Lanes** checkbox to collect interval data for each lane and check the **Log Approaches** checkbox to collect data for each defined approach.

To begin logging interval data, click the **Logging** arrow in the bottom-right corner and turn the logging switch to the on position. Logging will be terminated if the Interval Data screen is closed.

Once you download the interval data, you will have the following information for each lane or approach:

- **Name** - Displays the name of each lane or approach. To change the name, go to the Lane Configuration screen or the Approaches screen.
- **Volume** - Shows the number of vehicles detected during the interval.
- **Occupancy** - Gives the percentage of time during the interval that the detection zone was occupied.

Occupancy is calculated by summing the durations of all vehicles in the interval and dividing that quantity by the length of the interval. For example, if the interval length is five minutes and 100 vehicles pass the sensor during the interval with a duration of 0.09 seconds each (sum of the durations is 9 seconds), then the occupancy for that interval would be calculated by dividing 9 seconds by 300 seconds, which is 3%.

Rather than using the uncalibrated detection duration, or the time that a vehicle is in the radar beam, in the occupancy calculation, a more accurate occupancy measurement is made by first calculating the vehicle length and then converting that to a duration by adding the simulated loop size and dividing by the speed. Occupancy based on vehicle length is more accurate than occupancy based on uncalibrated detection duration because the vehicle length calculation removes the effect of the antenna beam widening as it gets farther from the sensor. The occupancy calculation is shown in the following equation:

$$\frac{1}{\text{Interval Size}} * \sum_{\text{All Vehicles in the Interval}} \frac{\overbrace{\text{Vehicle Length} + \text{Loop Size}}^{\text{Calibrated Duration}}}{\text{Vehicle Speed}}$$

### Note

A change to the length tuning parameter for a given lane will affect the occupancy for that lane since vehicle length is used in the occupancy calculation.

- **Speed** - Indicates the average lane speed during the interval. A negative number will be reported for speed in the following cases: (1) The lane was configured to the left or right and Direction Protection was on, but traffic was traveling against the configured direction, indicating that the direction of the lane has switched. This is useful in hurricane evacuation scenarios. (2) The lane was configured to the left or right and Direction Protection was off, but more vehicles were detected traveling against the configured direction than were detected traveling with the configured direction for the given data interval.

Unlike per vehicle data, lanes that are configured as bidirectional will always report positive average speeds in the interval data.

- **85%** - Shows the 85th percentile speed. Eighty-five percent of the vehicles in the inter-

val were going this speed or slower.

- **Headway** - Displays the average time separation between vehicles detected during the interval, measured from front bumper to the front bumper of the following car.
- **Gap** - Shows the average time separation between vehicles detected in the interval, measured from the back bumper of the first car to the front bumper of the second.
- **Classes** - Refers to length-, speed-, and direction-based bins (see the Speed and Class sections later in this chapter). These columns show the number of cars from each length, speed and direction class that were detected during the interval.

## Storage

The Storage window allows you to turn on/off data storage; see a storage timeline, the storage level and the amount of storage space remaining; and clear all storage on the sensor (see Figure 7.6).

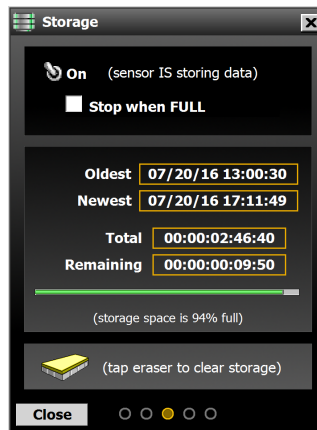


Figure 7.6 – Storage

Use the On/Off switch to turn the sensor's data storage feature on or off. If you check the **Stop when FULL** checkbox, the sensor will stop storing data once the storage capacity is reached, and consequently all new data will not be saved to memory.

The status section shows the date and time that the first and last interval data packet was stored and how much storage is remaining by both a status bar and a percentage. The Total and Remaining fields show how long the sensor has been storing data and how long the sensor will continue to store data before reaching maximum capacity. The capacity is tracked in months, days, hours, minutes and seconds and is based upon the current sensor configuration. The total number of intervals stored is dependent upon the number of configured lanes, approaches and bin data types.

If data is stored with a different number of lanes, approaches or bin data types from the current sensor configuration, the Total field will be incorrect. In this case, the green status bar is a better indicator of storage capacity. Additionally, using a virtual connection will also



cause the information in this screen to be incorrect.

**Note**

Some of the settings discussed in this chapter can affect the storage capacity of your sensor. Changing such data collection settings as the length of the interval for collecting interval data and the number of bins and approaches configured will affect how many reports your sensor can store onboard (see Table 7.2 for examples). Always check back to the Storage screen after you have changed all other settings to get the most accurate information on how often your sensor will need to have information downloaded from it.

Interval	Lanes & Approaches	Class Bins	Speed Bins	Onboard Storage Capacity
20 sec	4	4	0	17 days
20 sec	12	4	0	6 days
20 sec	12	4	10	3 days
15 min	4	4	0	25 months 29 days
15 min	12	4	0	9 months 26 days
15 min	12	4	10	5 months 3 days
1 hour	4	4	0	103 months 29 days
1 hour	12	4	0	39 months 15 days
1 hour	12	4	10	20 months 13 days

**Table 7.2 - Examples of Onboard Storage Time Based upon Configuration**

After clicking the eraser icon, you will be prompted to confirm the delete. Once data storage is deleted, it is not recoverable. Before deleting the data, it is recommended that you use the Download tool to store a copy of the data on a PC or laptop.

## Download

The Download screen allows you to specify the time period for which stored data will be retrieved and the location where it will be saved to a file (see Figure 7.7).

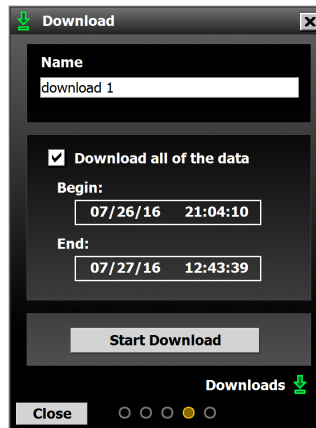


Figure 7.7 - Download

Enter a file name in the **Name** field. To download all data on the SmartSensor HD, click the **Download all of the data** checkbox.

Click anywhere in the Begin and End fields to select the beginning and ending dates/times of the download. SSMHD also keeps a record of the last interval downloaded from each sensor.

### Note

Downloading all the data may take several hours.

Once you click the **Download** button, a Download Progress window will appear. You can stop or pause the download at any time by using the buttons on the bottom of the window (see Figure 7.8).

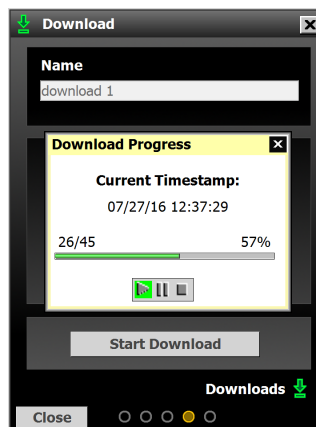


Figure 7.8 - Download Progress

Once SmartSensor Manager HD is finished downloading data from the sensor, a window will appear showing information about the download (see Figure 7.9).

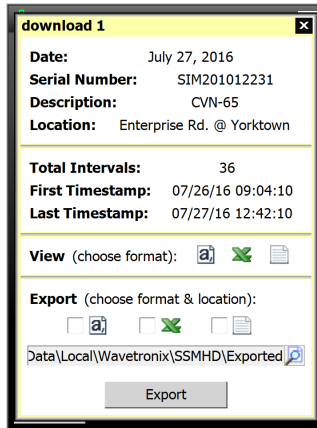


Figure 7.9 – Download Complete

You can view and export the data into the following three different file formats:

- Comma-delimited ASCII text file
- Microsoft Excel file
- Traditional Wavetronix format (see Figure 7.10)

#		Occu-		85%	Class Count										
#	NAME	VOLUME	pancy (%)	Speed (MPH)	Speed (MPH)	C1	C2	C3	C4	C5	C6	C7	C8	HEADWAY	GAP
#####	#####	#####	#####	#####	#####	10	20	30	255						
	LANE_01	3	23.3	46.7	40.0	0	3	0	0	-	-	-	-	1.6	1.3
	LANE_02	3	23.3	46.7	40.0	0	3	0	0	-	-	-	-	1.6	1.3
	LANE_03	4	28.6	50.0	60.0	0	4	0	0	-	-	-	-	1.2	0.9
	LANE_04	3	20.6	53.3	60.0	0	3	0	0	-	-	-	-	1.6	1.3
	LANE_05	3	20.6	53.3	60.0	0	3	0	0	-	-	-	-	1.6	1.3
	LANE_06	3	20.6	53.3	60.0	0	3	0	0	-	-	-	-	1.6	1.3
	APPR_1	10	75.2	48.0	70.0	0	10	0	0	-	-	-	-	0.5	0.1
	APPR_2	9	61.8	53.3	70.0	0	9	0	0	-	-	-	-	0.5	0.2

Figure 7.10 – Traditional Wavetronix Data Format

Wavetronix Command products can also retrieve interval data directly into an SQL database.

## Push

Use the data push function to set your sensor to periodically push data to your computer without waiting for a request from SSMHD. Click the **Push** button on the Data window to access the Push window (see Figure 7.11).

When data push is required for use with a Click device, it is automatically configured by the Click device during its autobaud process. If data push is required for any other use, it must be manually configured.

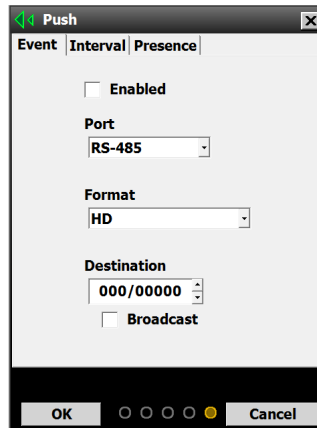


Figure 7.11 – Data Push

To enable data push, select the **Event**, **Interval** or **Presence** tab, then select which method of communication and format you are using and turn the function on by checking the **Enabled** checkbox.

## Port

This allows you to select the SmartSensor HD communications port through which the data will be pushed. If the sensor is pushing data on a half-duplex communication port, the sensor may not respond to commands due to collisions on the communications bus.

### Note

SmartSensor HD's native RS-232 and RS-485 ports are both half duplex.

## Format

The following formats are available for all three data types:

- **HD Format** - This outputs the data in the native SS125 format (see the *SmartSensor HD Released Communications Protocols* document for information on this format).
- **SS105 Simple Format** - This outputs the data in the SSHD SS105 emulation format without a multi-drop header (see the *SmartSensor HD Released Communications Protocols* document for information on this format).
- **SS105 Multidrop Format** - This outputs the data in the SSHD SS105 emulation format with a multi-drop header (see the *SmartSensor HD Released Communications Protocols* document for information on this format).

For Event Data, there are five additional format options. All of them output the data in Z4 format. Z4 is a Wavetronix-specific protocol that allows sensors to talk to other Wavetronix

devices, such as Click contact closure devices. The specific formats are as follows:

- **Z4 2-Loop** – With this format, speed and duration are measured using the loop size and space determined on the Loop Emulation page.
- **Z4 1-Loop** – With this single-loop format, only duration can be determined.
- **Z4 2-Loop Pulsed** – With this format, the outputs will be held active for 125 ms for each vehicle detected, so only speed will be measured.
- **Z4 1-Loop Pulsed** – This format is simply a presence detector (no speed or duration information).
- **Z4 1-Loop Speed** – This single-loop format has a set vehicle length of 15 feet, so the focus is on speed.

For Interval Data, there are two additional formats:

- **HD (legacy)** – This format emulates the interval data from older versions of the SmartSensor HD; it is similar to the current format but lacks speed bins and direction bins and has fewer length-based classes.
- **RTMS Format** – This format is only available in the Interval Data push configuration and will output the data in the SSHD RTMS emulation format (see the *SmartSensor HD Released Communications Protocols* document for information on this format).

For Presence Data, there is one additional format:

- **Z4 Presence** – This outputs data in the Z4 format.

## Destination

This is the address the sensor will push data to and is only valid for HD and Z4 formats. For HD format, it is the 8-bit subnet/16-bit ID, and for Z4 format it is a 24-bit address. Any value up to 255/65535 for SS125 format or 16777215 for Z4 format is valid, but make sure that this destination address is unique for the communications bus in use. Checking **Broadcast** will push the data to the broadcast address (000/65535 for SS125 and 16777215 for Z4). The HD communications protocol reserves subnet/ID 000/00000 for software applications. The subnet/ID should be set to 000/00000 if the SmartSensor HD is pushing data to a custom software application.

## In this chapter

- Backup-Restore
- License
- Power

The Tools section allows you to backup sensor data, view the sensor's licensed features, and reboot the sensor (see Figure 8.1).

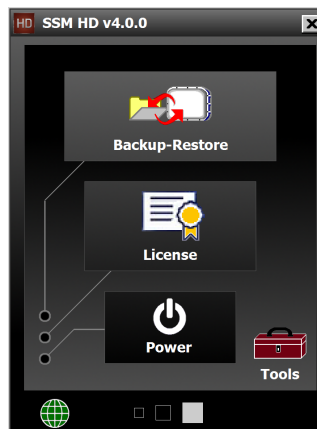


Figure 9.1 – Tools

# Backup-Restore

Access Backup/Restore by clicking the **Backup/Restore** button on the Tools screen (see Figure 8.2).

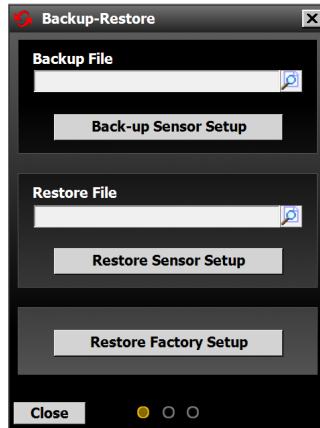


Figure 9.2 - Backup/Restore

## Back-up File

The backup function allows you to backup the sensor settings you have changed. To create a backup, click on the magnifying glass icon in the Backup File section. Choose a destination, type in a filename, and hit **OK**, then click the **Back-up Sensor Setup** button.

### Note

The backup will appear as an .ssc file. While this file can be opened as a text file by using a program such as Notepad, do not edit the file, as it will change the settings you backed up.

## Restore File

The restore function allows you to restore a set of sensor settings you have backed up. To restore, click on the magnifying glass icon in the Restore File section. Select the backup file you wish to restore, hit **OK**, and then click the **Restore Sensor Setup** button.

## Warning

Restoring sensor settings will cause you to lose the settings you currently have, unless they are backed up.

To restore the sensor to factory default settings, click the **Restore Factory Setup** button.

## License

The Licensed Features window contains all of the current configuration features that are inherent to the sensor:

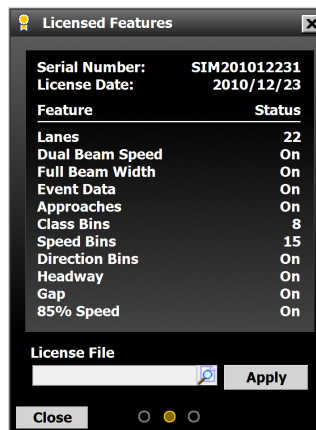


Figure 9.3 – Licensed Features

- **Serial Number** – Shows the serial number of the sensor.
- **License Date** – Shows the date the sensor was licensed.
- **Features** – Lists features inherent to the sensor and shows the status that has been licensed for each feature.

## Note

For more information on each feature, see the earlier chapters in this book.

- **License File** – In the future this field will be used to upgrade licensed features, but for now it can be ignored.



## Power

The Power screen shows you the last time the sensor was powered up and powered down, and when the sensor was last rebooted (see Figure 8.4).

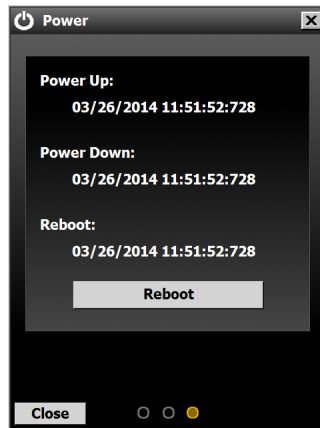


Figure 9.4 – Power

To reboot the sensor, click the **Reboot** button.



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