SmartSensor Matrix

Model
225

v 0.5

Model 225

SmartSensor Matrix

ENGINEERING USER GUIDE

WAVETRONIX™

SMART SENSOR iQ®

WAVETRONIX™

FCC Part 15 Compliance: This device complies with Part 15 of the Federal Communications Commission (FCC) rules which states 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.

Disclaimer: The advertised detection accuracy of the company's 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).

Introduction

In the Introduction

- SmartSensor Matrix Package
- Selecting a Mounting Location

The Wavetronix SmartSensor Matrix™ traffic sensor is a stop bar presence detector designed for use at signalized intersections (see Figure I-1). The SmartSensor Matrix detects vehicle demand through the use of a 24.125 GHz (K band) operating radio frequency. Classified as a Frequency Modulated Continuous Wave (FMCW) radar, the SmartSensor Matrix detects and reports vehicle presence in as many as 10 lanes simultaneously.

Figure I-1: Wavetronix SmartSensor Matrix

SmartSensor Matrix is a first-of-its-kind radar vision device that delivers the reliability of radar and the simplicity of non-intrusive detection for stop bar applications. The unit will work consistently in all weather and lighting conditions to keep your intersection running safely and efficiently. In most situations the sensor is installed on the roadside in order to prevent the need for lane closures and traffic control. Once the unit 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 configured. This user guide outlines the step-by-step process of installing and configuring the SmartSensor Matrix. Any questions about the information in this guide should be directed to Wavetronix or your distributor.

Caution

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. Wavetronix is not liable for any bodily harm or damage caused if service is attempted or if the back cover of the SmartSensor unit is opened. Refer all service questions to Wavetronix or an authorized distributor.

SmartSensor Matrix Package

SmartSensor Matrix is the radar vehicle sensing device used in a Wavetronix Stop Bar Detection System. The minimal stop bar detection system package contains the following items:

- SmartSensor Matrix SS225 detector(s) with installed sensor back-plate
- Sensor Mounting Kit(s)
- Sensor Cable(s) and connectors(s)
- Pre-wired cabinet unit (PCU) with installed underground surge, termination blocks, and DC surge option
- Detector Rack Card(s) with patch cable(s)
- SmartSensor Manager Matrix (SSMMTX) software
- SmartSensor Matrix User Guide

Standard packages are built and ready to order for 1, 2, 3 and 4 approach systems with as many as eight sensors. Figure I-2 illustrates a 4-sensor system. Check the packing slip for actual contents. If any of items are missing, note the serial numbers located on the back of the sensors and contact your distributor.

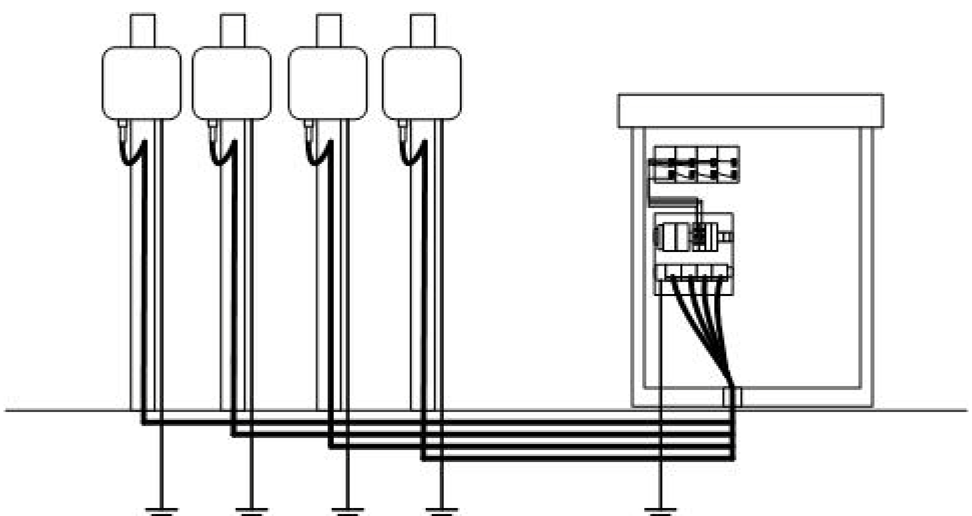


Figure I-2: System Diagram of a 4-Sensor Wavetronix Stop Bar Detection System

The total Wavetronix Stop Bar Detection system includes other recommended options (see Figure I-3) which include:

- **AC power conversion option** – This option is pre-loaded onto the PCU and is normally recommended by Wavetronix instead of the DC surge protection option, because it will not burden the existing DC power modules in the cabinet and it will provide reliable power for the sensors and PCU components.
- **Wavetronix Configuration Toolkit** – The toolkit makes installation and maintenance more convenient than ever. The toolkit provides both wired and wireless configuration capability using a handheld configuration utility and a Click! 421. The Click! 421 connects to the Command and Control Bridge via a T-bus expansion port. The handheld configuration tool comes preloaded with SmartSensor Manager and Click! Supervisor software, for simple management of your system.
- **Remote IP Connection option** – This option is pre-loaded onto the PCU and is recommended for remote management.

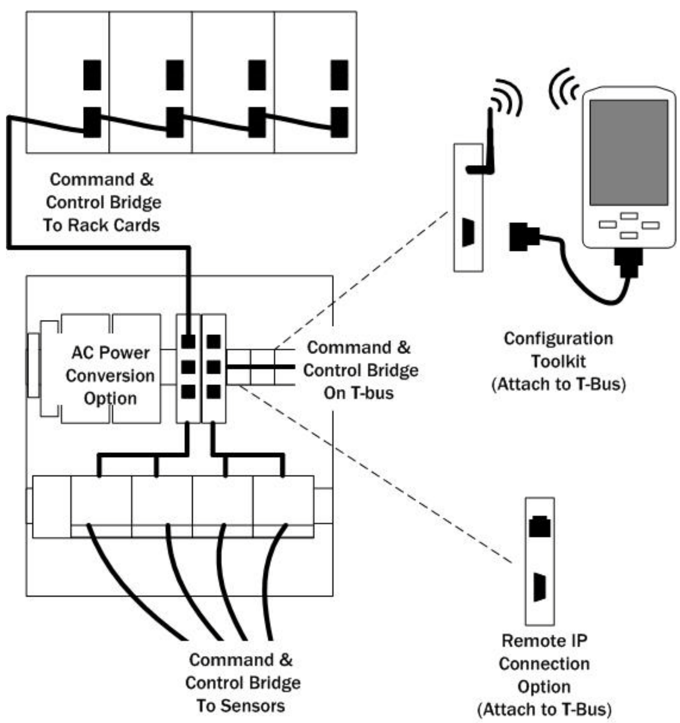


Figure I-3: Integration of Options via the Command and Control Bridge

Note

The Wavetronix Intersection Detection System provides a Command and Control Bridge for management of all connected SmartSensor and Click! devices. This Command and Control Bridge is completely separate from the dedicated channels used for communication of contact closure detection calls in real-time.

The Wavetronix Stop Bar detection system is part of the broader Wavetronix Intersection Detection System which includes certified systems for advance (dilemma zone) and mid-block (system control) detection. The Wavetronix Intersection Detection System has been designed to simply integrate the reliable presence detection data of SmartSensor Matrix, with the superior passage detection data of SmartSensor Advance, and high-quality count data of SmartSensor HD in order to control signalized intersections more safely and efficiently than ever before. Contact your authorized Wavetronix representative to learn how these packages can be cost-effectively bundled together.

In addition the complete line of Click! products and Click! Cabinet Systems offers a connectivity and integration solution for virtually every intersection application. Contact Wavetronix technical services for assistance with your application specific integration questions.

Selecting a Mounting Location

Consider the following guidelines when selecting a mounting location for each SmartSensor Matrix unit:

- **Corner radar** – SmartSensor Matrix is a corner radar with a panoramic 90° degree 100-foot view. The corner radar vision device detects in traffic in a two-dimensional matrix to provide industry leading stop bar detection performance. The sensor's mounting location should be selected so that all stop bar detection zones on an approach are within 6 to 100-foot radial distance. Figure I.4 presents a top down view of a corner radar mounted to detect the stop bar on a four lane intersection approach. The corner radar device uses its radar vision to automatically determine the location and orientation of lanes and stop bars within its field-of-view. It then detects vehicle presence on a lane-by-lane basis.

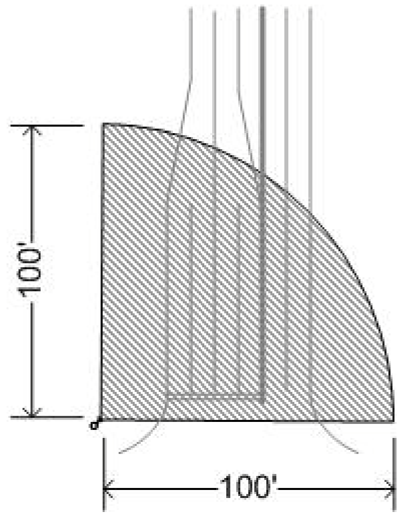


Figure I-4: Corner Radar

- **Mounting pole** – The sensor is usually mounted on a corner vertical mast pole or strain pole. On wide approaches the sensor can also be mounted on the back side of a mast arm using an appropriate sensor mount. In either case, the sensor should be mounted with at least a six-foot offset from the first detected lane. Figure I.5 illustrates common mounting locations: A – far side of approach, B- near side of approach, C – back side of mast arm. Other mounting locations may be possible if these are not available at your intersection. Contact Wavetronix Technical Services for assistance if you would like to test an alternative mounting location.

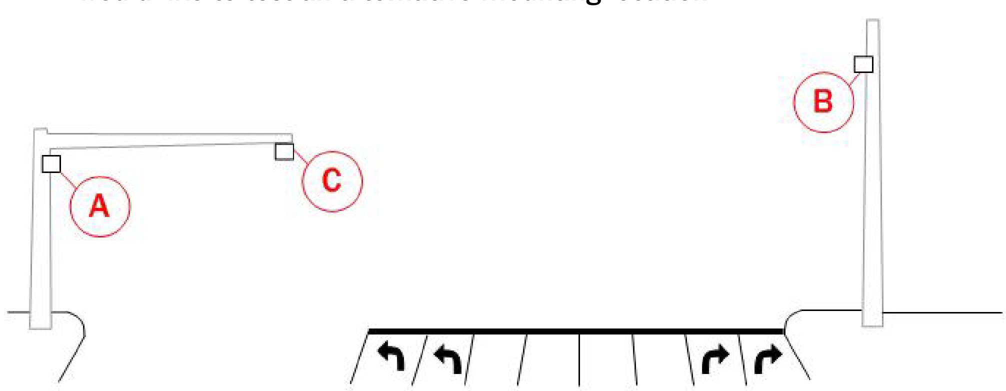


Figure I-5: Mounting locations

- **Line-of-sight** – Position the sensor so that it will have line-of-sight to the entire detection area of interest. Avoid structural occlusion including trees, signs, and other roadside structures.
- **Detection coverage** – Position the sensor so that it will be able to reach all the specified stop bar detection zones. Also consider that the sensor will track vehicles as they enter and exit desired detection zones. Accordingly, the sensor will often work better if you position detection coverage to track vehicles for several feet before they reach the first zone in each lane.

Likewise, if the detection coverage is aligned so that the sensor has a view several feet beyond the stop bar (downstream from the stop bar into the intersection) it is more likely to have better performance of detecting queue dissipation. With the installation software, the presence and location of the stop bar in each lane can be configured in order to enable advanced logic to minimize the effects of occlusion of small vehicles by queued traffic.

- **Closest roadside** – It is recommended that you mount the sensor on the side of the road closest to the lanes of primary interest. In many cases this will be near side. However, if left turn detection is more critical than through movement detection the closest road side may be the far side of the approach. Always mount the sensor high enough to prevent traffic from occluding approaching detections. If you mount the sensor on the back side of a mast arm, mount the sensor near the end of the arm to reduce the potential the mast arm or departing traffic to occlude approaching vehicles.
- **Mounting height** - Mounting the sensor higher will generally improve line-of-sight and decrease occlusion of vehicles. A minimum height of 15 feet is recommended. If the sensor is mounted on a vertical pole with a mast arm, it is recommended that the sensor be mounted to avoid occlusion of the roadway by the mast arm. This may require mounting the sensor below the mast arm.
- **Mounting offset** – A minimum offset of 6 feet to the first lane of interest is required.
- **Redundant detection** – It is possible to have multiple sensors monitoring the same approach.
- **Sensor proximity** – When multiple sensors are mounted at the same intersection, interference can be avoided by configuring each sensor to operate on a unique RF channel. In cases, where zones are spread over more than 100 feet, multiple sensors are needed.
- **Departing lanes** – There is usually no need to view traffic in departing lanes or to configure departing lanes. However, if they are configured then the stop bar should NOT be configured.
- **Suspended electrical cables** - The sensor is designed to work in the presence of suspended power lines and other electrical cables, however these cables should be mounted at least ten feet away from the front of the sensor.
- **Neighboring structures and parallel walls** – For best performance, it is preferred that the sensor be mounted without signs or other flat surfaces mounted directly behind it. This will help reduce multiple reflection paths from a single vehicle.
- **Cable length** – Ensure that you have sufficient homerun and sensor cabling. Cable runs as long as 500 feet are achievable using 24 VDC operation and the system's native RS-485 communications. If you have an application that requires a cable length longer than 500 feet, contact Wavetronix technical services for assistance.

Part I
Installing SmartSensor Matrix

Installing the SmartSensor Matrix

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 the Silicon Dielectric Compound
- Connecting the SmartSensor Cable

Installing the SmartSensor Matrix is quick and easy. Once installed, SmartSensor Matrix 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 SmartSensor cable to the sensor.

> **Warning**
>
> Caution should be used 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 a Mounting Height

After selecting a mounting location within the recommended range of offsets (see introduction), use Table 1.1 to select a mounting height.

Offset from first Detecton Lane (ft)	Recommended Mounting Height (ft)	Minimum Mounting Height (ft)	Maximum Mounting Height (ft)
6	17	15	30
10	18	15	30
15	19	15	30
20	20	15	30
25	21	15	30
30	22	15	30
35	23	15	30
40	24	15	30
45	25	15	30
50	26	15	30

55	27	15	30
60 or more	28	15	30

Table 1.1

> **Note**
>
> It is possible to mount the sensor lower than 15 feet in some scenarios. The sensor will continue to detect vehicles at lower heights, but missed detections due to occlusion may become more prevalent or problematic depending upon your application.

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 height and to stretch across the distance from the sensor to the cabinet.

Follow the steps below to correctly attach the mount to the pole.

1. Insert the stainless steel straps through the slots in the mount bracket.
2. Position the mount on the pole so that the head of the mount is pointing toward the lanes of interest at about a 45° angle. Figure 1.1 illustrates the sensor mount pointed at a 45° angle. (Figure 1.1 also depicts the sensor attached to the mount. This is intended to help visualize the objective of pointing the mount at a 45°. The objective is that a 45° pointing will often provide a ballpark alignment of the sensor beam over roadway, once the sensor is attached. The next section of this chapter explains how to attach the sensor.)
3. Tighten the strap screws.

> **Note**
>
> The sensor mount may need to be adjusted later to fine-tune the alignment. This is most easily achieved using the double-swivel mount. One swivel joint is used to pan the sensor beam left or right. The other swivel joint is used to tilt the sensor down towards the roadway. If you are NOT using the double swivel-mount be sure to keep the pole straps adjustable at this point in the installation process.

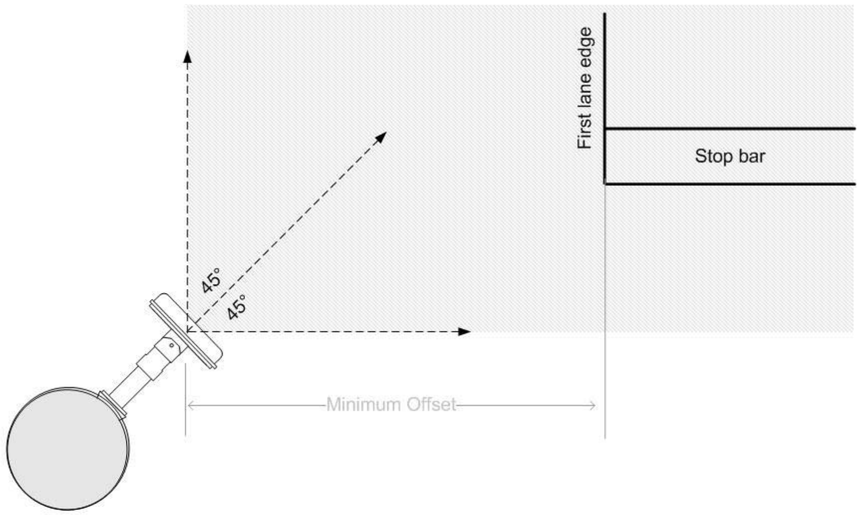


Figure 1.1 – Attach the Mount Bracket to the Pole

> **Note**
>
> If you are mounting the sensor to the back side of the mast arm, you will probably need to mount the sensor down toward the road. This will allow you to use one swivel to point down towards the road and the other to pan left and right.

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 back plate with the holes in the mount bracket. The 8-pin connector receptacle 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 mount bracket holes.
3. Thread on the nuts and tighten (see Figure 1.2)

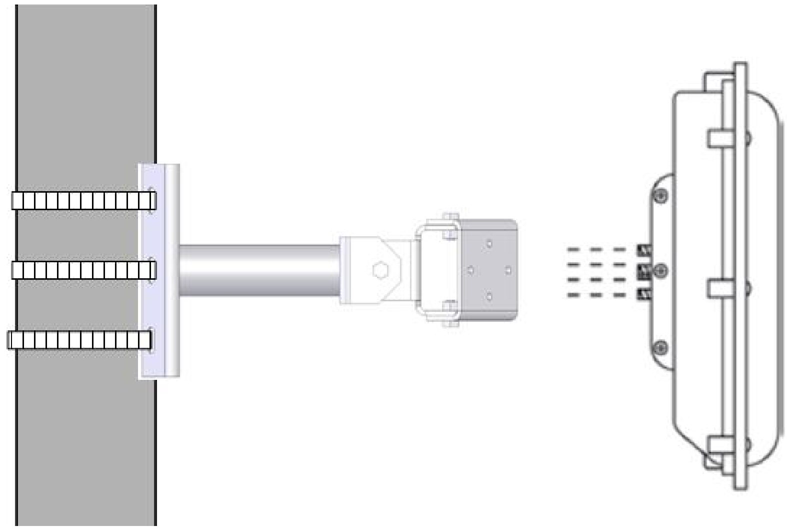


Figure 1.2 Attaching the Sensor to the Mount Bracket

> **Note**
>
> Do NOT over-tighten the fasteners.

Aligning the Sensor to the Roadway

In most applications, the goal is to position the corner radar so that its fan-shaped footprint provides coverage of all lanes approaching the stop bar. The sensor's view fans out 45° to the left and 45° degrees to the right, creating a 90° corner radar.

To visualize the extent of the sensor beam an installer can use a square framing tool (e.g. rafter square) or other solid surface with a right-angle. The tool can be held above the sensor as a visual aid similar to the illustration in Figure 1.1. By looking down both edges of the square instrument you can visualize the extent of the radar's coverage.

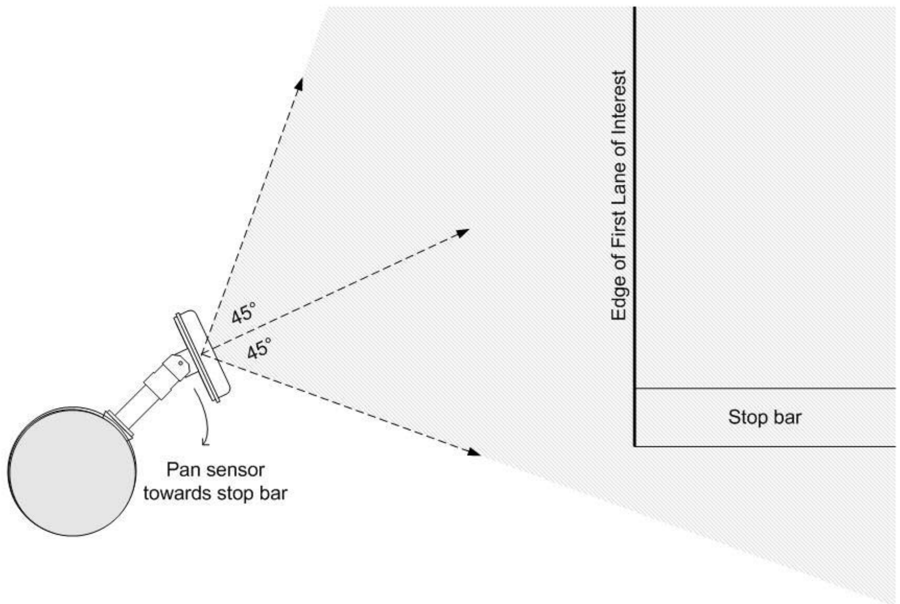


Figure 1.3 – Corner radar beam position

Usually the front-edge of the sensor's beam is aligned to provide coverage beyond the stop bar. This will allow placement of detection zones in beyond the stop bar (not all vehicles stop behind the line), and it will also provide the sensor with a view of vehicles exiting queues. If the sensor pole is upstream of the stop bar as in Figure 1.2, it is recommended to pan in the direction of the stop bar.

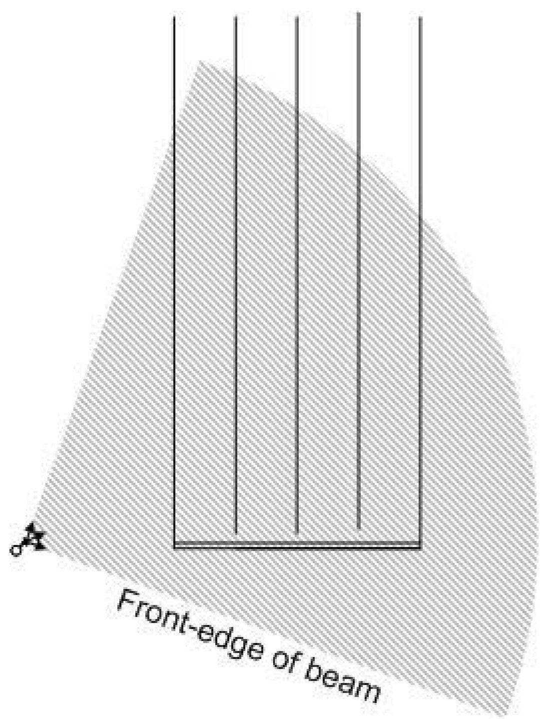


Figure 1.4 – Sensor Aligned by Rotating Towards the Stop Bar

Use the following steps to correctly align SmartSensor Matrix.

1. Adjust the side-to-side angle so that the front-edge of the beam provides a view downstream of the stop bar.
2. Tilt the sensor down so it is aimed at the center of the lanes of interest.
3. If necessary rotate the sensor back plate so that the bottom-edge of the sensor is parallel with the roadway. This is necessary where the intersection approach has a significant grade.

Applying Silicon Dielectric Compound

Use the following steps to correctly apply the silicon dielectric compound: Tear the tab off of the tube of Silicon Dielectric Compound.

1. Squeeze about 25% of the silicon onto the pins of the receptacle-side of the connector at the base of the SmartSensor Matrix (see Figure 1.5).
2. Be sure to wipe off any excess compound.

Figure 1.5 – Connector Receptacle (left) and Protective Earth Lug (right)

Connecting the SmartSensor Cable

The sensor connector is keyed to ensure proper connection (see Figure 1.6); simply twist the plug end of the connector clockwise until you hear it click into place.

Use the following steps to connect the SmartSensor Matrix Cable:

1. Insert and turn the connector to attach it. Match up the key for a quick connection.
2. Connect one end of a protective earth ground wire to the ground lug terminal. A 12 AWG stranded wire is recommended for ground connections.
3. Connect the other end of a protective earth ground wire to an earth ground connection point.

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.

Figure 1.6 – Sensor Connector

(Left – Plug end with sockets A-H, Right – Plug and Back shell)

> **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.

Route the SmartSensor Matrix home run cable from the sensor location back to the main traffic cabinet. Then attach the cable to the sensor. Do not strip the service end of the cable until after it has been routed through conduit. The cable should be one continuous run without any splices.

> **Note**
>
> The SmartSensor Matrix cable with connector can be purchased in standard lengths (e.g. 50, 150, or 250 feet). If you need longer cable or would like to create custom length cables, you can also purchase bulk spools of 1000-foot cable. When using bulk spools, you will need to purchase the plug end of the connector and the appropriate crimping tool separately. See Appendix D for information on crimping.

Once the sensor cable is routed into the cabinet, prepare to label the service end of the cable. Before you label the sensor, you may want to carefully strip back the cable jacket and insulation of the service end of the cable (see Figure 1.7). The wires comprise: one DC power wire pair, two RS-485 communication pairs, and a drain wire. The service end of the cable connects to plug-in terminals on the main cabinet back plate.

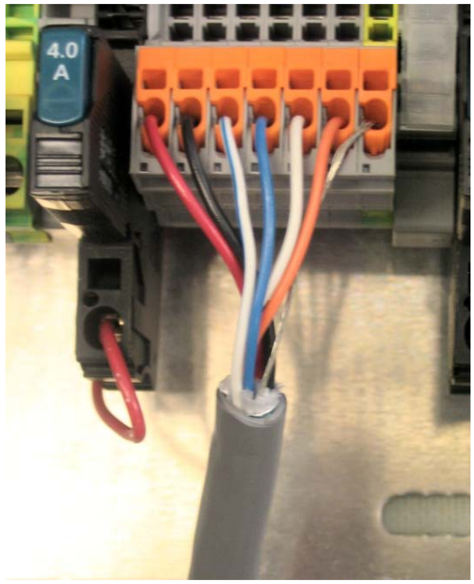


Figure 1.7 – Service End Terminated At Traffic Cabinet Back Panel

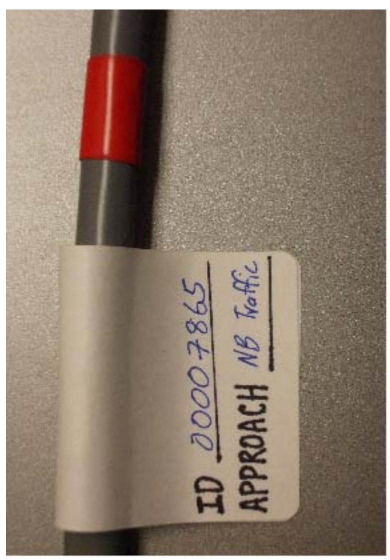


Figure 1.8 – Service End Labeling

In Chapter 2 there is a section detailing how to properly terminate the service end of the cable (see Figure 2.6). After landing each sensor cable, and powering each sensor, you can enter location information specific to each sensor as described in Chapter 4 (see Figure 4.2).

Note

To setup the network in an orderly fashion, it is recommended that labeling be used on the service end of each SmartSensor Matrix cable. Label the cables according to agency guidelines. In addition you may elect to use labels to mark the last seven digits of the serial number on each sensor, and the direction of traffic monitored (see Figure 1.8). This can help expedite software naming of sensor description, location, and approach fields.

Connecting Power, Surge, and Communications

In this Chapter

- Mounting the Pre-wired Cabinet Unit
- Connecting AC Power
- Controlling DC Power Distribution
- Providing System Surge Protection
- Terminating the Sensor Cables
- Attaching the Serial Configuration Toolkit
- Wiring Contact Closure Communications

After installation, each SmartSensor Matrix unit will need to be integrated into the traffic cabinet for power, surge, and communications. Pre- wired cabinet units (PCUs) are available for sensor integration. As an example, this chapter will detail integration of a Wavetronix stop bar detection system PCU panel that accommodates four SmartSensor Matrix units (one for each stop bar of a common four approach intersection).

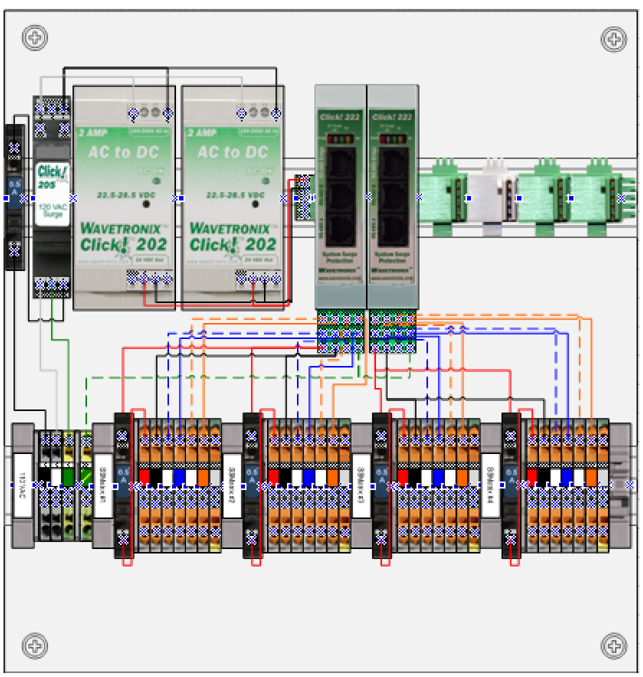


Figure 2.1 – Four approach Pre-built Cabinet Unit for SmartSensor Matrix

The standard four-approach PCU back plate is sized 11 inches wide and 11.5 inches high. Softcopy and hardcopy plans of the cabinet unit wiring are available for maintenance personnel. All wiring in the on the PCU is done using stranded wires with wire ferrules for screw terminal connections. The stranded wires are flexible and simplify maintenance. The wire ferrules provide a solid connection end point for screw terminal connections.

Mounting the Back Plate

Use the following steps to mount the back plate in the traffic cabinet:

1. Locate the space planned for mounting the back plate. Often, the PCU will be able to mount on the side panel of a NEMA style cabinet.
2. Attach the back plate with the u-channel mounting screws.

> **Note**
>
> If you have a 330 series (170/2070 style cabinet) with a 19" EIA rack, please contact Wavetronix Technical Services for assistance. Wavetronix can provide modified PCUs that attach to a 19 inch rack.

Connecting AC Power

Since SmartSensor Matrix operates on 10-28 VDC, the standard Wavetronix stop bar detection system back plates provide an AC power conversion option. If you select this option, the back plate will be loaded with the necessary AC to DC power conversion, power surge, and circuit breaker.

If you choose to have your PCU built without the AC power conversion sub-assembly, you will need to tap into surplus DC power capacity resident in the traffic cabinet. In this case, Wavetronix recommends the use of the Click! 221 to protect the PCU and SmartSensor Matrix units from DC surges. The Click! 221 is an 8-amp DC surge module. For wiring and other information on the Click! 221 see Appendix E.

Warning

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

The AC termination points for line (AC+, hot), neutral (AC-), and ground are found on the bottom din rail next to the 110 VAC label. Use the following steps to connect power wires from the AC terminal block or cord to the pluggable terminal blocks on the bottom din-rail (see Figure 2.2):

1. Connect a neutral wire to the bottom-side of the white block labeled “N” for neutral. The neutral wire is usually white.
2. Connect a ground wire to the bottom-side of the green block labeled “G” for ground. The ground wire is usually green. (Please note that the ground connection is different than the protective earth connection. See the section on Providing System Surge Protection for instructions on connecting to protective earth.)
3. Connect a line wire to the bottom-side of the black block labeled “L” for line. The line wire is usually black.
4. Connect or turn on AC mains power.
5. Press the circuit breaker switch on the left side of the top din-rail to switch power to the Wavetronix stop bar detection system panel. The switch is on if the push button is below the level of the device housing. The switch is off if the button is raised above the surface of the housing.
6. Verify that DC power is properly regulated by checking the Click! 201/202 devices to see that the DC OK LEDs are illuminated.

Caution

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.

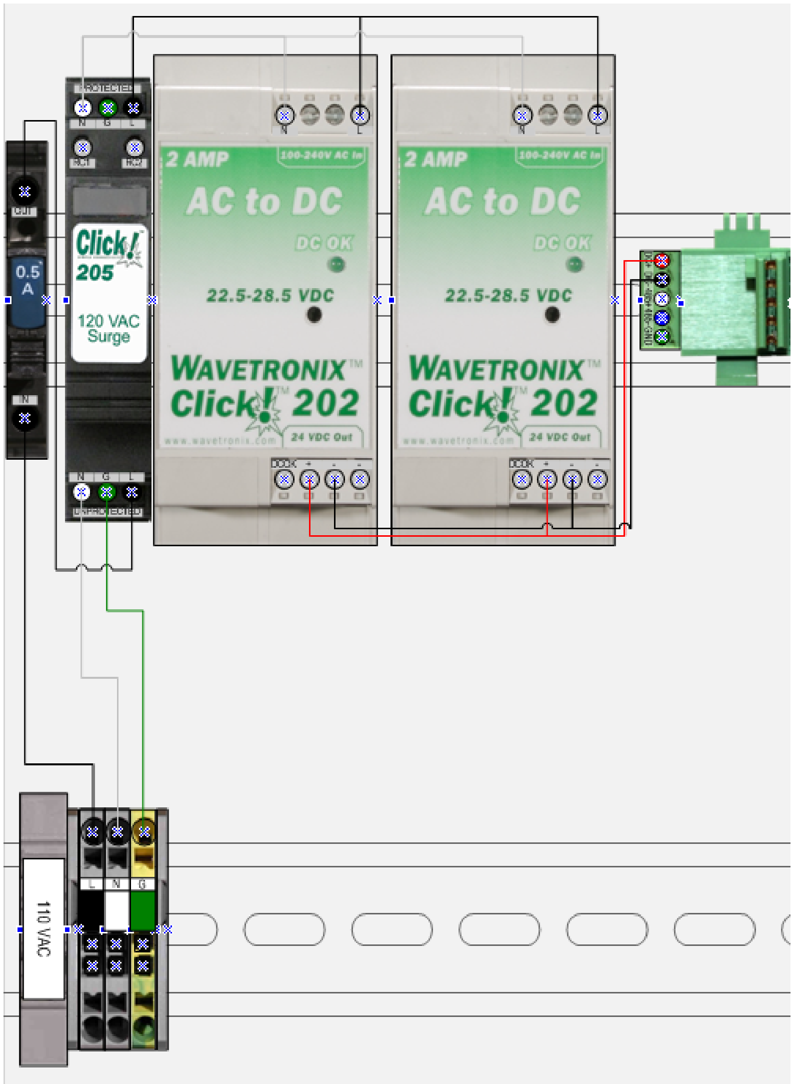


Figure 2.2: AC Power Conversion

Each AC power conversion sub-assembly will come pre-wired as shown in Figure 2.2. The main three components of the sub-assembly include:

- Click! 201/202 AC to DC converter
- Click! 205 AC surge module
- Click! 206 circuit breaker and switch

A Click! 201 provides 1 amp of power and is capable of powering a single sensor, while a Click! 202 provides 2 amps and can power two sensors. The Click! 205 helps limit current surges on the power lines; the Click! 206 interrupts power during overload conditions and provides a convenient way to turn power on and off for the entire system.

A PCU will use wired blocks with one terminal at the top and two on the bottom when one conductor needs to be routed two directions. For example, although not shown in Figure 2.2, this type of wired block is used to connect AC power from the one Click! 205 to both Click! 202 modules. These blocks are also used to route the DC power from both Click! 202 to the 5-position screw terminal on the left side of the T-bus.

Controlling DC Power Distribution

The 24V DC+ and DC- (common) connections from the AC to DC power convertors distribute power to the sensors via the Click! 222 System Surge Protection units (see Figure 2.2). The DC power wires out of the System Surge Protection units are connected to a 2.0 Amp circuit breaker for each SmartSensor Matrix. The circuit breakers provide a convenient way to switch power to each sensor independently. When a switch is off power distribution is disabled.

To enable or disable DC power distribution, use the following steps:

1. Switch the main circuit breaker (left side of upper din-rail).
2. Switch the individual circuit breaker (left side of each sensor's set of terminal blocks.

Tip

With either the main or individual circuit breakers, you will enable power distribution when the switch is on. When the switch button is level with the device housing (pushed in) the switch is on. When the switch button is raised above the surface of the housing (popped out) the switch is off. If you cannot visually whether the button is pushed in or popped out, you should be able to feel it with your hands.

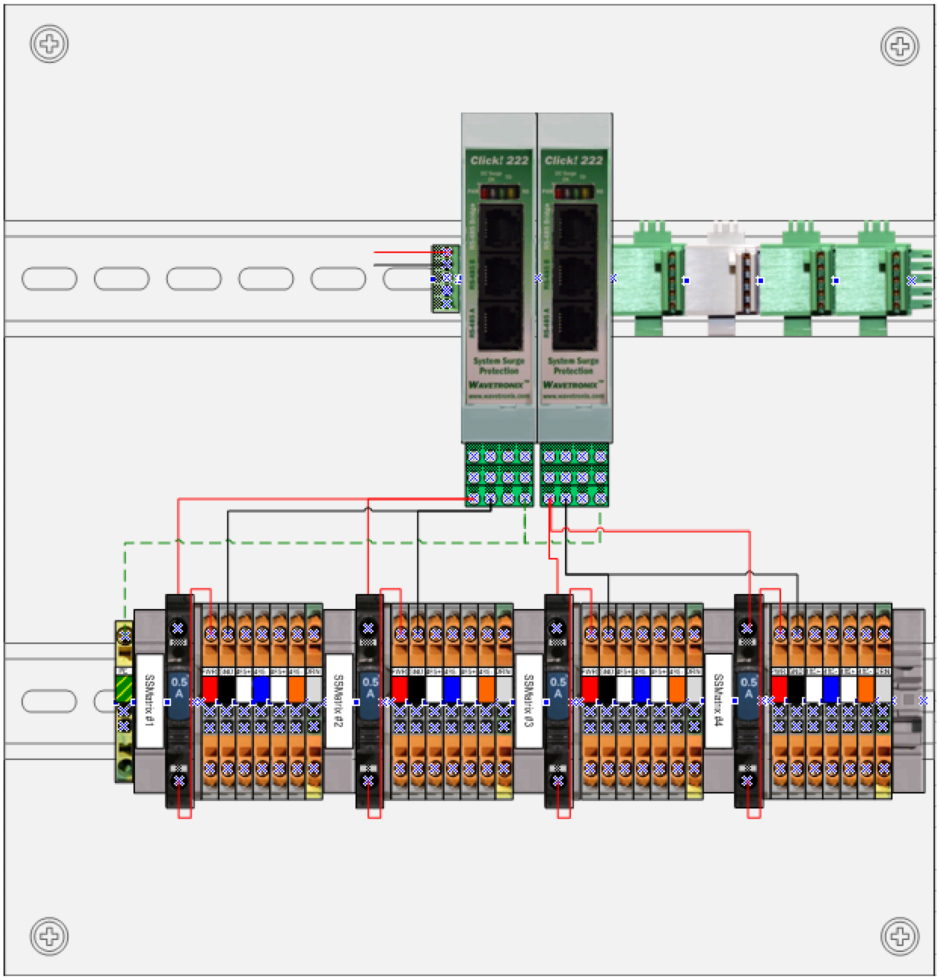


Figure 2.2 – DC Power Distribution from System Surge Protection

The four-approach PCU has the 24VDC power wired from the output of the AC to DC convertor into a 5-position screw terminal on the left side of the T-bus. This T-bus has both green and gray connectors. Green T-bus connectors conduct DC power and RS-485 communications from the left to the right side of the modules. Gray T-bus connectors conduct only DC power from the left to the right side of the modules. This means that a device that is attached to a gray T-bus connector will send RS-485 communications to devices on its right side, but not its left side (see Figure 2.3).

For example, the gray T-bus in Figure 2.2 has its communication lines connected with the two green T-bus devices on the right side, but not to the one on the left side.

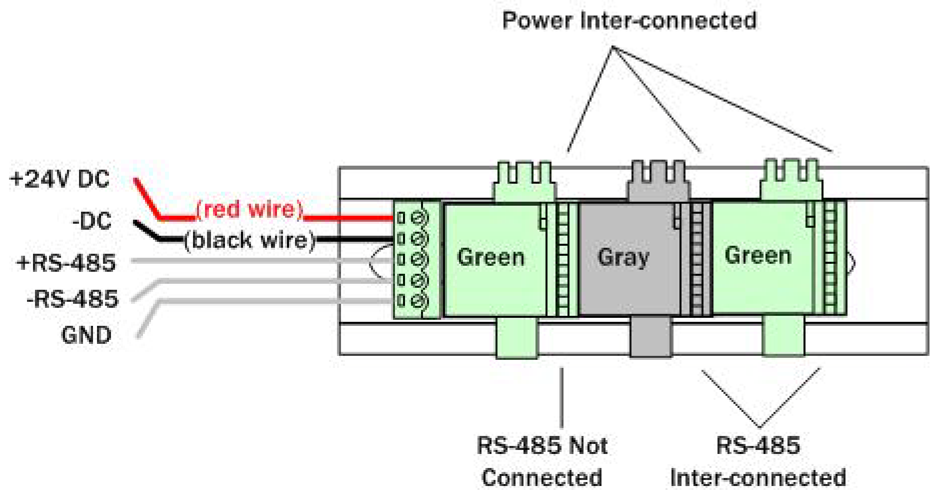


Figure 2.3 – T-bus Pinout Diagram

Providing System Surge Protection

The Wavetronix Click! 222 system surge protection devices are designed to prevent electrical surges conducted along underground cables from damaging the cabinet equipment.

> **Note**
>
> The SmartSensor Matrix unit has built-in surge protection and there is not a need to use a pole-mount box for surge protection. However, it is strongly recommended that the sensor be connected to a surge protection device in the main traffic cabinet. If you choose not to use surge protection in your main traffic cabinet, please contact Wavetronix Technical Services for assistance.

The power and RS-485 serial connections on the T-BUS and faceplate are protected from surges on the incoming wires of the sensor cable. The sensor cables are connected via the terminal blocks on the PCU to the screw terminals on the bottom side of the Click! 222. The screw terminals on the bottom side of the Click! 222 have circuitry that prevents impedance matching issues on long non-uniform cable runs to the sensor installation sites.

The PWR and DC Surge OK LEDs indicate that the device is powered and that DC surge protection is operational. The TD (transmit data) and RD (received data) LEDs indicate when data is transmitted or received over the RS-485 T-bus, Bridge, C & D ports. However, the TD and RD LEDs do not indicate data transmitted on RS485 A or RS485 B. Furthermore, after an electrical surge there is no method to determine if the RS-485 surge protection is still operational.

Note

If the DC Surge OK LED is not lit up when the Click! 222 is powered, call Wavetronix Technical Services for assistance.

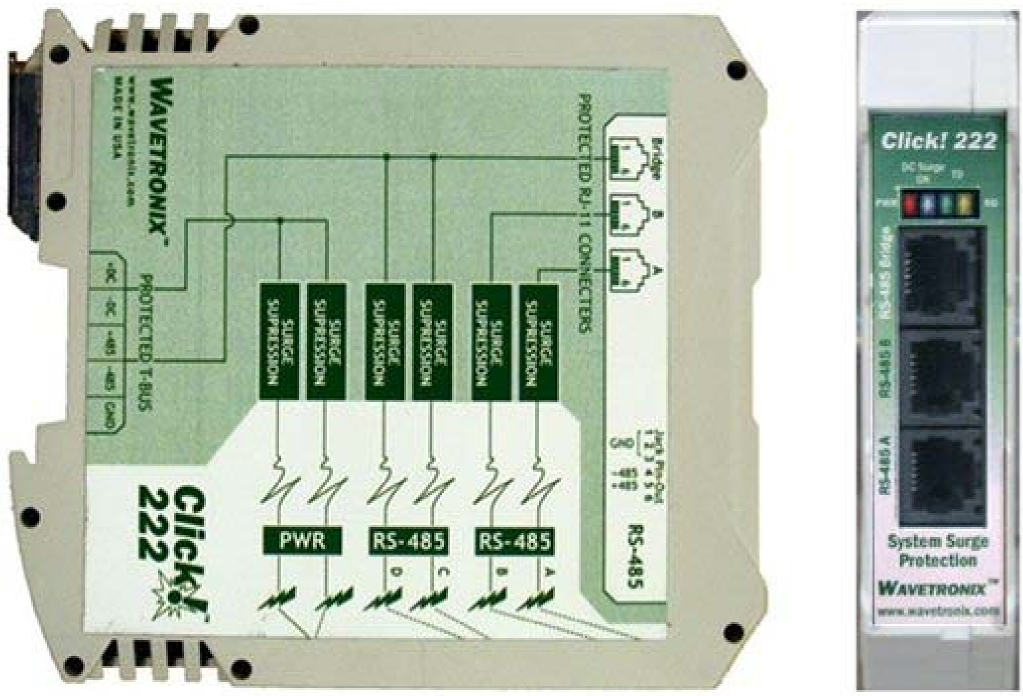


Figure 2.4 – System Surge Protection

The communication wires running from the pluggable termination blocks on the PCU’s bottom din-rail to the system surge protection devices are connected to provide three independent serial connections:

1. Command and Control Bridge
2. Dedicated communications for sensor A detection calls
3. Dedicated communications for sensor B detection calls.

One serial connection is an RS-485 Bridge that enables a multi-drop shared communication bus between all sensors on the panel. In a Wavetronix stop bar detection system, the Bridge connection is designed for command and control of all SmartSensor Matrix units, rack cards, and other connected Click! devices. This bus is formed by wiring the C and D terminal blocks and landing the system surge devices on a shared T-BUS.

Note

When configuring the sensor, the configuration link of the install kit is rocked onto the T-BUS, to the left of the gray T-bus connector. This connects the configuration link to the Command and Control Bridge and allows for convenient access to all sensors and rack cards from one connection point. The configuration tool can automatically search for a list of all sensors or rack cards on the bus.

The other two serial connections provide dedicated communications to each sensor. During real-time traffic operations with multiple sensors, one sensor will send detection calls to a detector rack card over port A, and the other will send detection calls to another detector rack card over port B.

On a 2-sensor or 4-sensor PCU, the sensor wired into the left most terminal block will be connected to port A & C on the leftmost Click! 222. Port A is for detection calls and port C is connected to the Command and Control Bridge. The sensor wired to the next terminal block from the left will be wired to port B & D on the leftmost Click! 222. Port B is for detection calls and port D is connected to the command and control Bridge.

Similarly, on a 4-sensor PCU the sensor wired to the third terminal block from the left will be wired to Port A & C on the right most Click! 222. And finally, the sensor wired to the rightmost terminal block will be wired to Port B & D on the rightmost Click! 222.

In other words, for detection calls the ports will be used in an ABAB pattern from left to right on a 4-sensor PCU. Likewise, for the command and control Bridge, the ports will be used in a CDCD pattern from left to right.

All these connections are surge protected when the protective earth ground is wired to the PE terminal block on the back plate. Normally, the back plate should be mounted to the chassis of the cabinet to provide a ground path. In addition it is strongly recommended to provide a low impedance protective earth connection.

To provide a low impedance protective earth connection:

1. Connect a protective earth ground wire to the bottom-side of the PE block. A 10 AWG stranded wire is recommended for protective earth ground connections. A 10 AWG wire is the largest that will fit in the terminal block.
2. Connect the protective earth ground wire to a protective earth screw terminal within the main traffic cabinet.

Terminating the Sensor Cables

Before SmartSensor Matrix is powered the wires from each sensor cable must be correctly landed into the plug-in terminals (refer to Figure 2.5 and 2.6).

To land the sensor cables, use the following steps:

1. Properly strip back the cable jacket and shielding on the service end of the cable.
2. Open the insulation displacement connector using a screwdriver. Insert the wire leads into the bottom side of the plug-in terminal according to the color code show in the following table and Figure 2.4. Make sure the wires are bottomed in the terminal.
3. Close the insulation displacement connector using a screwdriver. The plug-in terminals will automatically displace the insulation and complete the electrical connection. (There is no need to manually strip the insulation on the end of each wire.)

The insulation displacement connector plugs are keyed from left to right. The blue socket can be used to visually see which plug goes into which terminal block. On the leftmost terminal block, the PWR connection is blue (not gray like the others). On the next terminal block, the GND connection is blue. The blue connection continues to move one connection to the right as you move from left to right.

Wire Color	Signal
Red	DC+
Black	Common for Power and Communication
White with blue stripe	Command and Control 485+ (Sensor Port 1)
Blue	Command and Control 485- (Sensor Port 1)
White with orange stripe	Detection Call 485+ (Sensor Port 2)
Orange	Detection Call 485- (Sensor Port 2)
Bare metal	Drain

Figure 2.5 – Cable Wiring Color Code

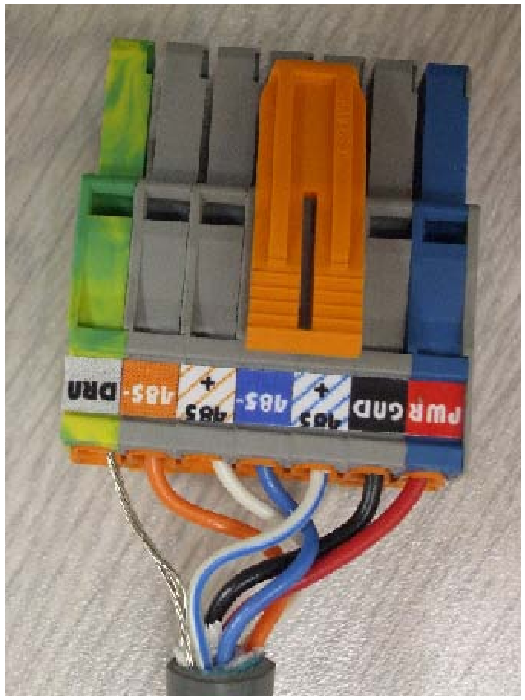


Figure 2.6 – Color Label on Plug-in Terminals

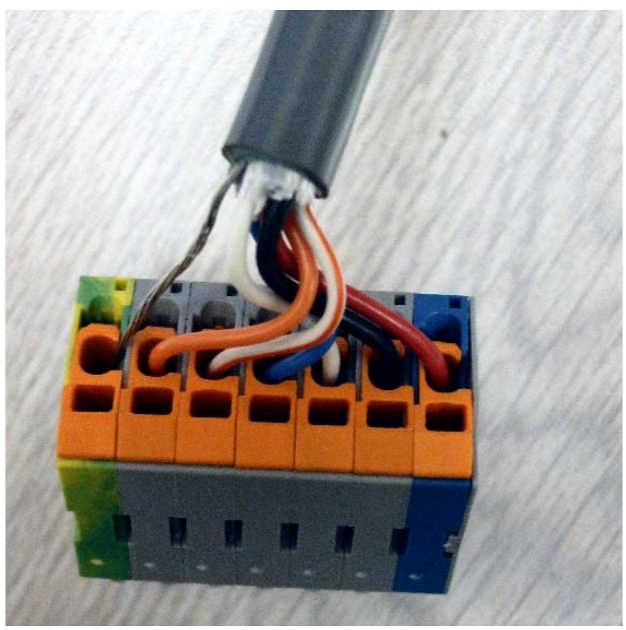


Figure 2.7 – Opening View of Plug-In Terminal

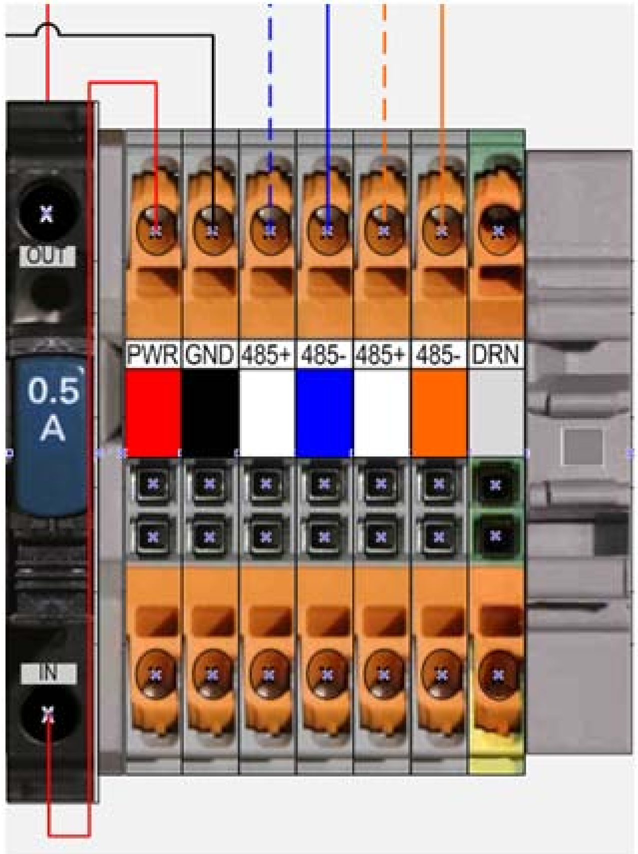


Figure 2.8 – Sensor Cable Terminal Block

Configure Contact Closure Communications

Each SmartSensor Matrix unit communicates to standard traffic cabinets using Click! 112/114 detector rack cards. During real-time operations up to four channels from each sensor can be signaled to a Click! 114 (or to a pair of Click! 112 units daisy-chained together).

Figure 2.7: Click! 112/114 Rack Cards

The rack cards are simple to setup. The cards have been pre-configured using DIP switches to communicate at 57.6 kbps (the baud rate for SmartSensor Matrix). DIP switches have also been used to select a group of input channels coming from SmartSensor Matrix to signal on the Click! 112/114 output channels. The factory default setting for the Input Mapping switches selects channel group 1.

On a Click! 114 channel group 1 comprises input channels 1-4. When this channel group is selected; input channel 1 will be mapped to output channel 1, input channel 2 will be mapped to output channel 2, input channel 3 will be mapped to output channel 3, and input channel 4 will be mapped to output channel 4.

Note

If you have space in your detector rack, Wavetronix typically recommends using a 4-channel card. This simplifies the installation process and allows you to us all four channels from SmartSensor Matrix. If you have a detector rack that only accepts 2-channel cards (e.g. 170/2070 controller types), then of course this is your best option. Daisy chain pairs of 2-channel rack cards together in order to receive all four channels from each sensor. If you do not have a detector rack in your cabinet, contact Wavetronix technical services for assistance.

On a Click! 112 channel group 1 comprises input channels 1-2, where input channel 1 will be mapped to output channel 1 and input channel 2 will be mapped to output channel 2. In order to map input channel 3 to output channel 1 and input channel 4 to output channel 2, you will need to select channel group 2. There are three ways to select channel group 2: using DIP switches, using the Mode Switch on the faceplate, or using Click! Supervisor.

The DIP switches override the Mode Switch and Click! Supervisor, so if you are planning on using either the Mode Switch or Click! Supervisor then you will need to first check that the DIP switches are set to allow for software configuration.

One benefit of using DIP switches to select the channel group is that if you ever have a field service call and need to replace a Click! 112, all you need to do is match the pattern of the DIP switches on the card you are replacing. This paradigm will even work in situations where the old rack card will not even power up.

On the other hand, a benefit of using the software configuration is that you can remotely manage the configuration of the cards (assuming you have interconnect to the traffic cabinet and a Click! 301 or equivalent device on the Command and Control Bridge). In this paradigm, it becomes the responsibility of the traffic manager in the operations center to keep a record of how each card was configured.

Tip

The status of SmartSensor Matrix output channels are sent using a contact closure serial communications message (see Figure 2.8). Bits within the message are dedicated to channels 1, 2, 3, and 4. If the designated bits are set to 1 the associated channel is on (contact closed on rack card), and if they are set to 0 the associated channel is off (contact open on rack card). When the serial message sent by a SmartSensor Matrix reaches a rack card the sensor output channels are now considered rack card input channels. It is then the job of the rack card to relay the status of the input channels (sensor output channels) to the selected rack card output channels.

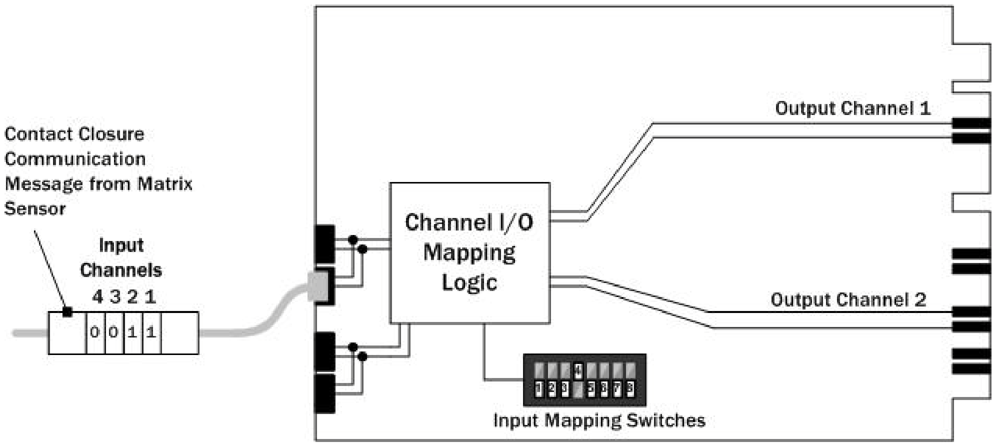


Figure 2.8: Symbolic Representation of Click! 112 I/O Channel Mapping

By default the DIP switches of a Click! 112/114 will be set as seen in Figure 2.9. On a two-channel card this default setting selects, Matrix output channels 1 & 2 for output. To select channels 3 & 4 move switch 4 down and switch 3 up as shown in Figure 2.10. To make the channels software configurable, set switches 1-4 down as shown in figure 2.11

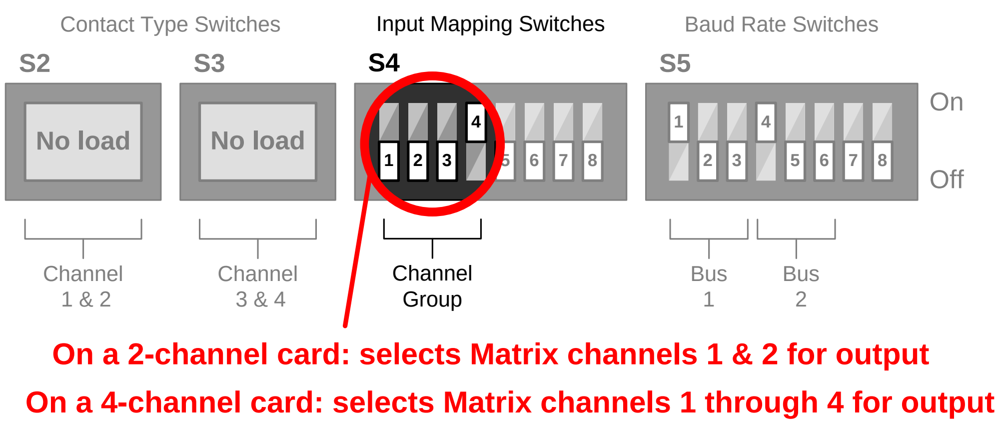


Figure 2.9 – Default Position of S4 – Input Mapping Switches

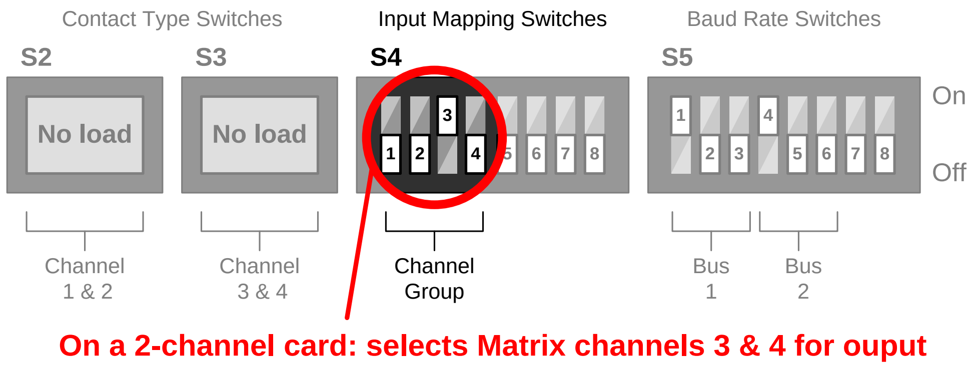


Figure 2.10 – Position of S4 – Input Mapping Switches to Select Matrix channels 3 & 4

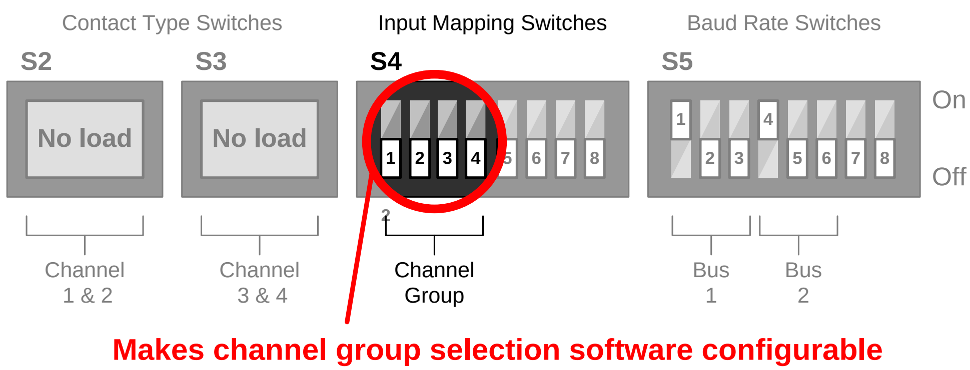


Figure 2.11 – Position of S4 – Input Mapping Switches to Make Channel Group Software Configurable

At a maximum each sensor uses one 4-channel card or two 2-channel cards for normal operations. This means that a standard 4-approach stop bar detection system can be accommodated by a 16-channel detector rack. Use the following steps to setup the contact closure rack cards for each sensor.

1. Plug all the cards into the detector rack. This will provide power.

Steps 2-5 are used to connect the isolated detection call links used for real-time traffic control.

2. Run a long 6-foot patch cord from the Click! 222 RS-485 A port to a Bus 1 port on the appropriate rack card.
3. Run a long 6-foot patch cord from the Click! 222 RS-485 B port to a Bus 1 port on another rack card.
4. If using 2-channel rack cards, use a short 8-inch patch cord to share BUS 1 between cards dedicated to the same sensor. Also, configure one card to use Matrix channels 1 & 2 and configure the other card to use Matrix channels 3 & 4.
5. If you have more than 2 sensors in your system, reuse steps 2-4 to connect Bus 1 for all remaining rack cards.

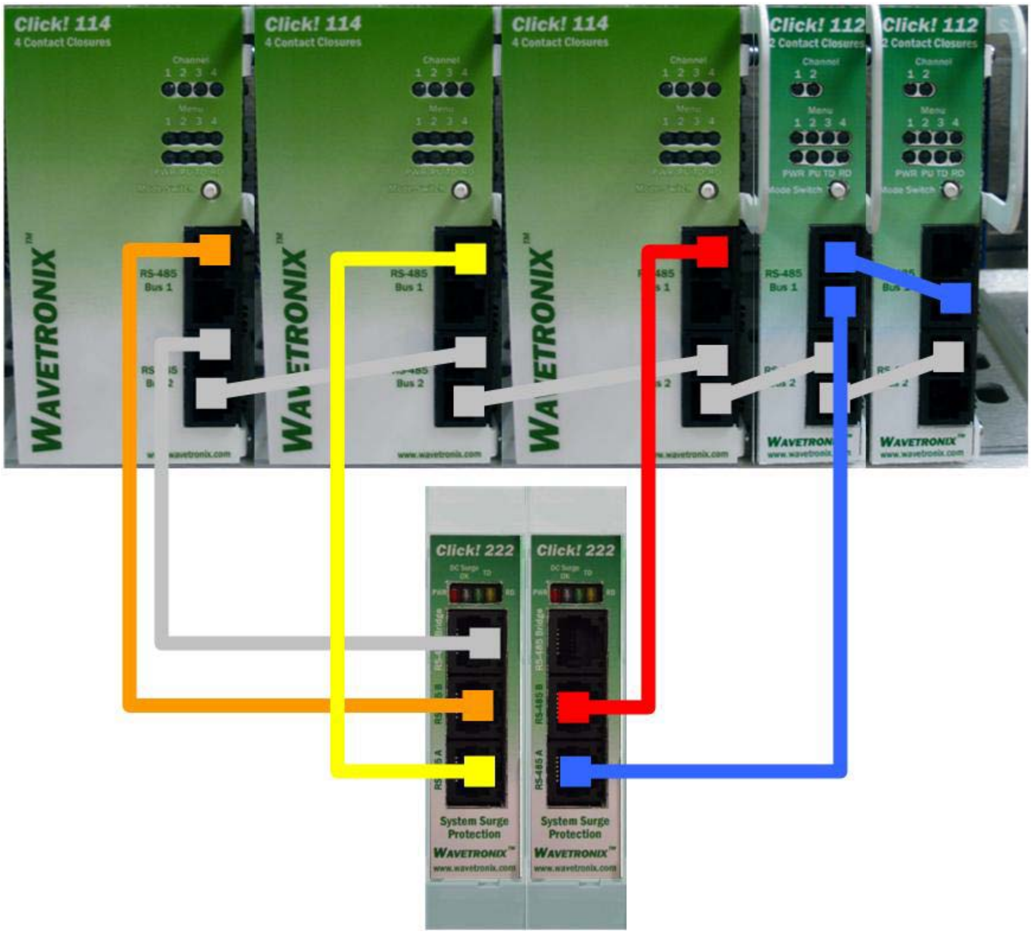


Figure 2.8 – Surge-to-Rack Card Patch Wiring

Steps 6-7 are used to connect the Command and Control Bridge used for shared access between all sensors, rack cards, and other Click! devices.

6. Run a long 6-foot patch cord from one of the Click! 222 Bridge ports to Bus 2 of the rack cards.
7. Use the short 8-inch patch cords to create a daisy-chain that shares Bus 2 between all of the rack cards. Bus 2 will be used for command and control.

Once you have completed the wiring, check the main menu LEDs. The red PWR LED should be on indicating that the card is powered and in normal operating mode. In normal operating mode you will observe the following:

- The green TD LED will activate whenever the card transmits serial communications.
- The yellow RD LED will activate whenever the card receives serial communications.
- The red detection channel LEDS (on top) will light up when a call is placed on the corresponding contact closure output channel.

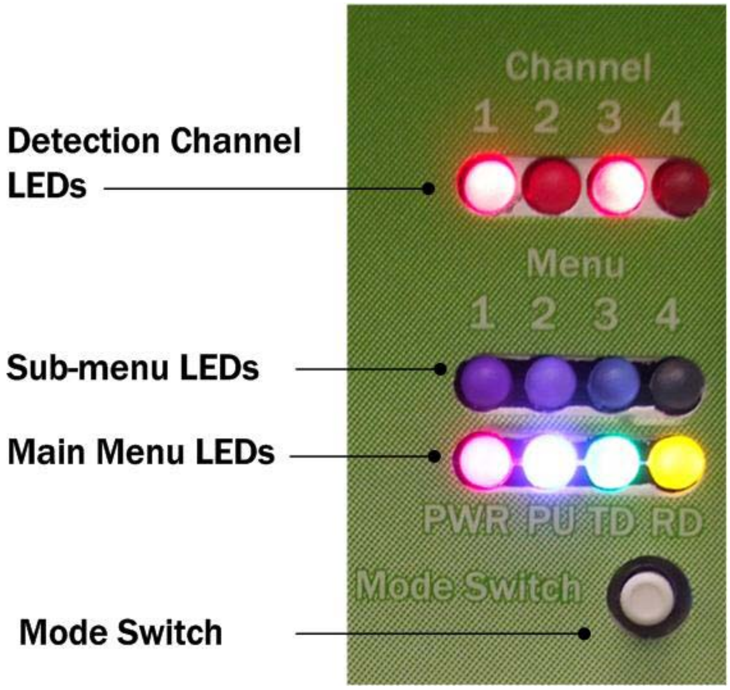


Figure 2.12 – Click! 112/114 Menu

The rack cards are also fail safe. This means that when a sensor does not receive communications from a sensor within 10 seconds the rack card outputs will all active. Normally, a SmartSensor Matrix unit will send 10 contact closure messages per second. In other words, the rack card will go into fail safe mode after 100 messages have gone undetected by the rack card. All the detection channel LEDs on the faceplate will also light up when a rack card is in failsafe mode.

> **Note**
>
> Detection call messages are sent by SmartSensor Matrix 10 times per second. The latency from transmission by the sensor to actuation on the backplane of the rack card is less than 3.5 milliseconds.

For additional information about Click! 112/114 rack cards consult Appendix D.

Once the Click! 112/114 rack cards are installed, you will need to make sure that each detector rack channel is properly mapped to correct traffic phase in the traffic controller. The general NEMA standard for 8-phase numbering is presented in Figure 2.13. In practice, many intersections will not have 8 phases and in some cases they may not even follow the NEMA convention. Check the plans in the traffic signal cabinet to verify how the phases are numbered at each intersection.

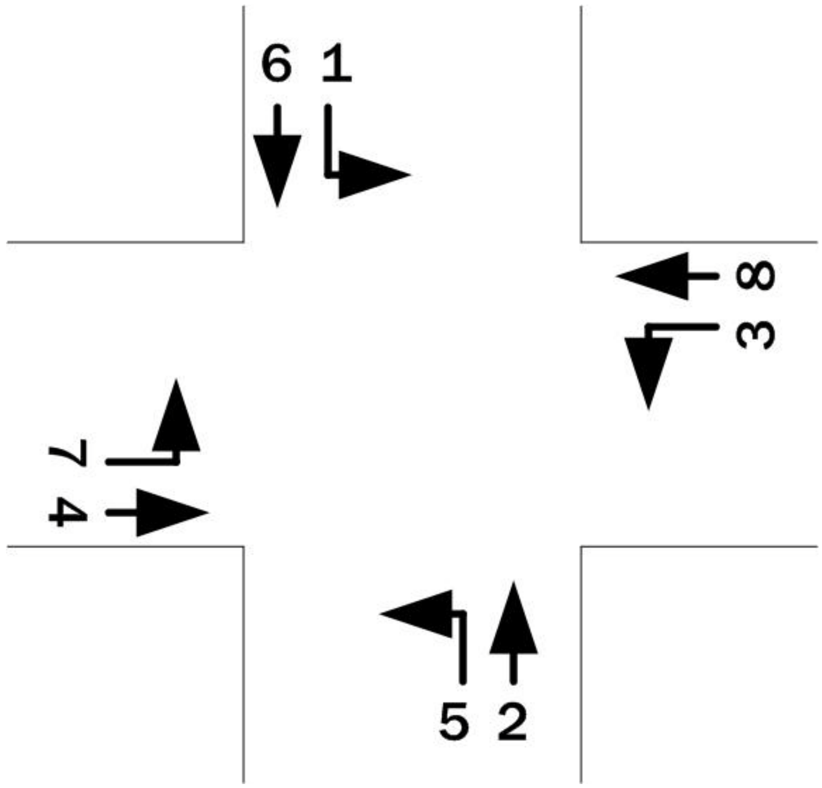


Figure 2.13 – Standard NEMA 8-Phase Number Scheme

Phases 1, 2, 5, and 6 are often used for the “main” street and phases 3, 4, 7 and 8 are often used for the “side” street as shown in Figure 2.13.

> **Note**
>
> In the chapter on SmartSensor Manger Matrix Tools, you will find a section about Rack Card Tools which explains how the channel to phase mapping can be verified with or without the sensors installed.

Since each Matrix unit often detects both the left-turn phase and the through-movement phase for a single approach, the associated rack card will have often have channels that correspond to one of the following phase (ϕ) pairs: ϕ2 and ϕ5, ϕ6 and ϕ1, ϕ4 and ϕ7, ϕ8 and ϕ3.

NEMA TS2, 2070, and other advanced traffic cabinet systems usually allow software programming of the detector card channel outputs to traffic phases via a channel-to-phase mapping grid in the controller menu. Figure 2.14 illustrates how the detector channels 1 to 16 of a NEMA TS-2 rack can be assigned to the standard 8-phases using four Click! 114 cards. The rack card slots are numbered across the top and the channel positions are represented by the gray labels C1 – C16.

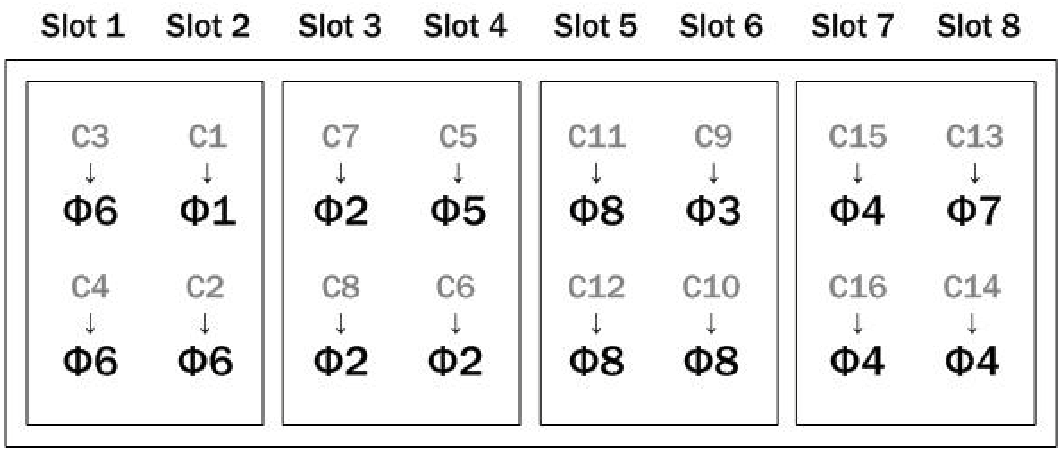


Figure 2.14 – NEMA TS-2 Rack Channel to Traffic Phase Example

In Figure 2.14, four channels are used from each SmartSensor Matrix unit. In this example, channel 1 from the first sensor is mapped to traffic phase 1 (left-turn phase on main street). Channels 2, 3, and 4 from the first sensor are mapped to traffic phase 6. This represents a case where detections from three through-movement lanes are brought in separately. This type of lane-by-lane detection is beneficial in some situations. Wavetronix typically recommends the use of 4-channel cards in racks that will accommodate them, because it offers greater flexibility of signaling contact closures.

Note

The channel positions in Figure 2.14 are representative of their arrangement when two-channel cards are used, even though four-channel cards are depicted in this example. In reality, all the channels of a four-channel rack card are signaled through the backplane contacts connected into the in the even numbered rack slots. NEMA TS-2 channel order is based upon a four-channel dominant scheme, instead of two-channel dominant scheme. A four channel dominant scheme will allow two-channel or four-channel cards to be inserted, but the numbering is based upon a four-channel card. This is why channels 1 and 2 are in slot 2, instead of slot 1.

Figure 2.15 illustrates how the detector channels 1 to 8 of a NEMA TS-1 rack can be assigned to the standard 8-phases using four Click! 112 cards. The rack card slots are numbered across the top and the channel positions are represented by the gray labels C1 – C8. This example has the economy of only using four rack slots, but it does not provide lane-by-lane signaling of the through-movement for cases where there are multiple through lanes. If you are using a rack with a two-channel dominant scheme (Four channel cards are not allowed and channels 1 and 2 are in slot 1), you can provide lane-by-lane signaling by using two Click! 112 cards for each sensor. Each pair of Click! 112 cards are daisy chained together.

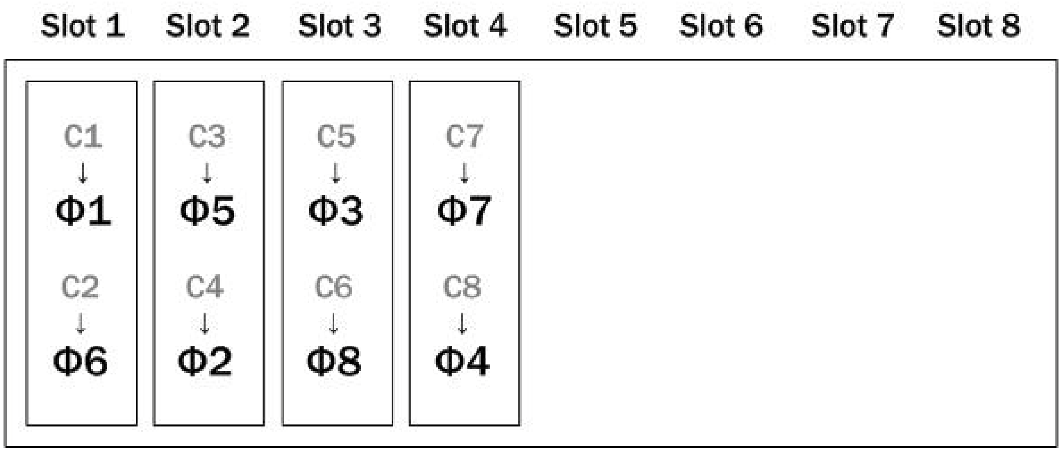


Figure 2.15 – NEMA TS-1 Rack Channel to Traffic Phase Example

With NEMA TS1 and other legacy systems the programming is often done via a wiring panel on the side of the controller cabinet. With wired systems you will need to verify that the wiring on the detector programming panel provides the proper mapping from the rack channel outputs to the controller input wires dedicated for ϕ1-ϕ8 detector calls.

Part II

Using SmartSensor Matrix

Installing SmartSensor Manager Matrix Configuration Tool

In this Chapter

- Wavetronix Configuration Toolkit
- Installing SSMMX
- Microsoft .NET Framework

The SmartSensor Manager Matrix (SSMMX) software enables users to configure and interact with the SmartSensor Matrix (SS225). This software comes preloaded on the Wavetronix Configuration Tool. This chapter gives an overview of the toolkit. Also if you are not using the toolkit, or if you would also like to install SmartSensor Manager Matrix on other devices, this chapter explains how you can get SSMMX up and running.

Wavetronix Configuration Toolkit

The Wavetronix configuration toolkit is available for reliable and convenient management of Wavetronix stop bar detection systems. The toolkit includes:

- A portable system link
- A handheld configuration device
- SmartSensor Manager Matrix and other Wavetronix configuration software

The portable system link will convert the wired or wireless serial data to RS-485 and then send it to all devices on shared multi-drop communication bus on the PCU in order to allow command and control of all SmartSensor Matrix units from a single access point.

The portable system link (Click! 421) provides both a wired and wireless serial connection to the handheld configuration device. The wired connection is made using a USB-to-serial convertor and a USB adapter cable.

The wireless connection is made via preset Bluetooth serial link. A whip antenna can be attached to the Click! 421 to increase the roaming distance and reliability of the serial link.

The handheld device is lightweight for extended use outdoors and its screen has provides for excellent viewing in bright outdoor settings.

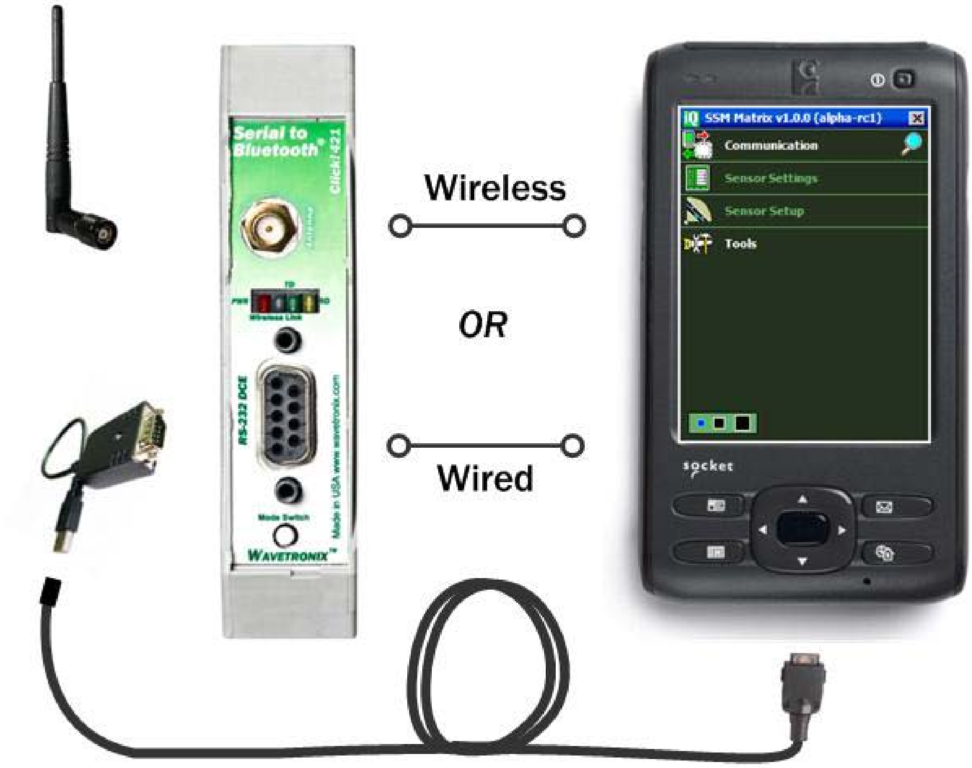


Figure 3.1 Wavetronix Configuration Toolkit

> **Note**
>
> The Wavetronix Configuration Toolkit can also be used to configure SmartSensor Advance, SmartSensor HD, and a host of Click! devices. For example, the Toolkit also comes pre-loaded with Click! Supervisor to allow software management of Click! 112/114 rack cards.

To attach portable system link:

1. Rock the Click! 421 DIN rail mounted device onto the green T-bus expansion slot to the left of the gray T-bus connector.
2. Make a serial connection between the DIN rail mounted device and the handheld. In the case of a wired connection, you will need to physically connect the serial cable from the handheld device. You can add a USB extension cable to increase the length of you run is necessary.

If you wish to establish a wired connection with a laptop computer instead of the handheld device, use the laptop's native RS-232 serial port to connect to the Click! 421. Or a USB-to-serial convertor if the laptop does not have an RS-232 serial port. You may also wish to establish a Bluetooth connection from your laptop to the Click! 421. To do so, consult your laptop's software guidelines on how to discover Bluetooth devices and configure a Bluetooth serial connection.

The toolkit will also come with a RJ-11 patch cord with a pigtail on one end. The pigtail is wired to the RS-485 screw terminal on the Click! 421 and can be used to patch into RJ-11 sockets on the rack cards or PCU for troubleshooting.

Installing SSMMX

The SSMMX software is contained on a CD that is shipped with each sensor; and it can be downloaded at http://portal.wavetronix.com. If you are unable to login, or you do not have a username, call Wavetronix Technical Services at 801-764-0277 for assistance.

> **Note**
>
> You can check the Wavetronix portal to ensure that you have the latest version of SmartSensor Manager Matrix. To access the portal, open a web browser and go to portal.wavetronix.com. Login with the username "guest" and password "wavetronix." In the menu on the left side, select SmartSensor Products. The latest version of the software, along with the release date, will be listed under SS225 Software.

SSMMX can be run on a Windows® PC or on the handheld of the configuration toolkit (It is not supported on other Windows® CE devices). Everything needed to install SSMMX to a PC is contained in the SSMMX **Setup.exe** file.

> **Note**
>
> You must have administrator rights to run the setup program.

Follow these steps to install SSM MX on a PC:

1. Place the CD in the CD drive.
2. Double click the **Setup.exe** icon listed in the contents of the CD. This executes a setup program that will copy all the necessary files to the hard drive and place icons in the Start menu and on the desktop of the PC or laptop (see Figure 3.2).

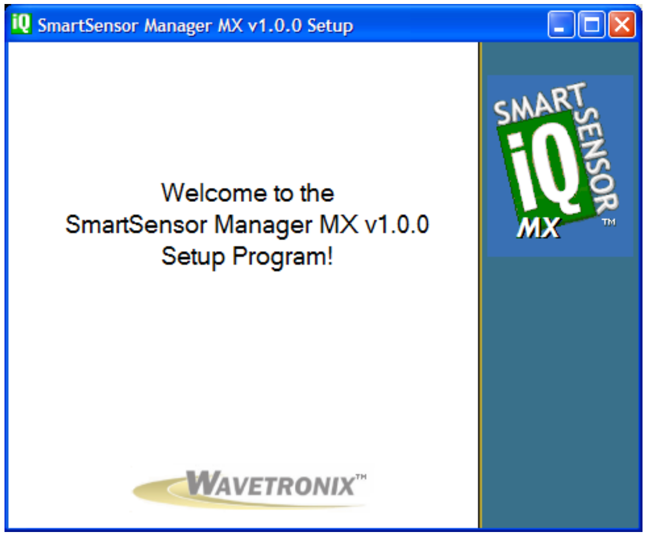


Figure 3.2 – SSMMX Setup Wizard (New Screenshot Needed)

3. Select an installation location. The default location provided is normally "C:\Program Files\Wavetronix." Click Browse to choose another location (see Figure 3.3).

Figure 3.3 – Location to Be Installed (New Screenshot needed)

4. Click the Install Now button.
5. After SSMMX is installed, you can create shortcuts to the SSMMX software on the desktop and in the start menu using the corresponding checkboxes (see Figure 3.4). If no shortcuts are desired, uncheck the corresponding boxes.

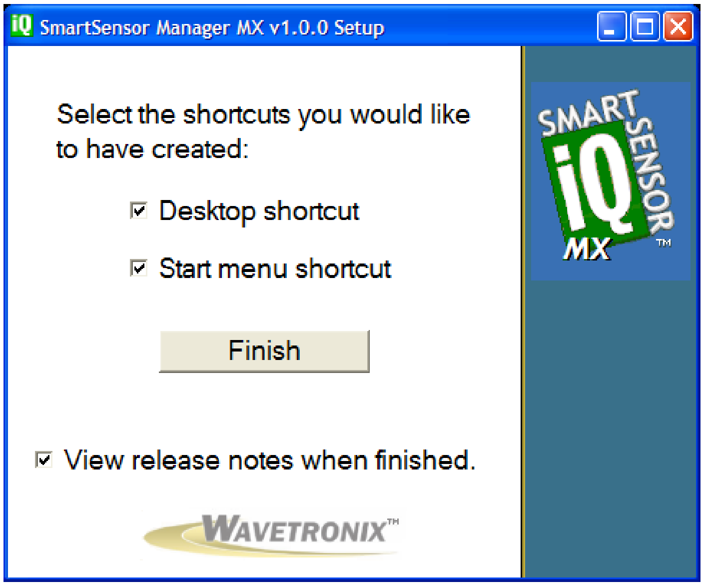


Figure 3.4 –Shortcut Options (New Screenshot Needed)

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

Note

SSMMX 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.

Use these steps to install SSMMX on a Pocket PC® (Windows Mobile):

1. Ensure the Pocket PC is connected to the PC and synced.
2. Click on the **SSMMX Setup.exe** file to run the setup program on the host computer. The SSMMX Setup Wizard will automatically check the host computer to see if Microsoft ActiveSync is installed (ActiveSync is a program that is used to communicate with a Pocket PC device). If the ActiveSync program is found, the option of installing SSMMX to a Pocket PC device will become available.
3. Click the **Pocket PC** checkbox and then the **Next>>** button to install SSMMX on a connected Pocket PC device (see Figure 3.4). If both the **Computer** and **Pocket PC** boxes are checked, the setup program will first install the SSMMX software to the PC.

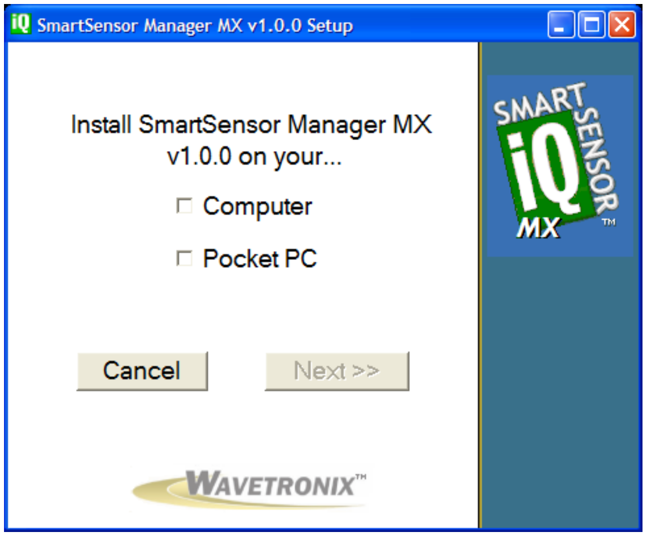


Figure 3.5 Destination Selection (New Screenshot Needed)

4. Click **Continue>>** to start the Pocket PC installation process (see Figure 3.6). The setup program runs the Add/Remove Programs application for Windows handheld devices. If a Pocket PC device is connected to the computer, Add/Remove Programs will immediately begin installing SSMMX on the Pocket PC device. If a Pocket PC device is not connected to the computer, SSMMX will be downloaded the next time a Pocket PC device is connected to the computer.

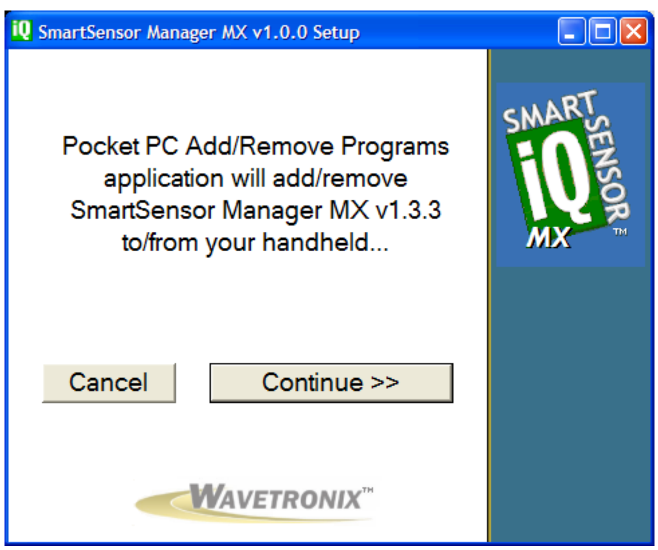


Figure 3.6 - Adding SSMMX to a Pocket PC (New Screenshot Needed)

5. Click **OK** once the download is complete.

Microsoft .NET Framework

The SSMMX setup program will automatically detect whether Microsoft .NET Compact Framework v2.0 (screenshot says v3.5, but actually v2.0) is installed on your PC. If it is not installed, you will be prompted to install it (see Figure 3.7).

Figure 3.7 – Microsoft .NET Framework V2.0 Prompt (New Screenshot Needed)

Use the following steps to install Microsoft .NET Framework:

1. Click the **Install Framework** button.
2. Click the **I Agree** radio button when the License Agreement appears (see Figure 3.8).
3. Click **Install**. A window will appear stating that the .NET Framework has been installed successfully.

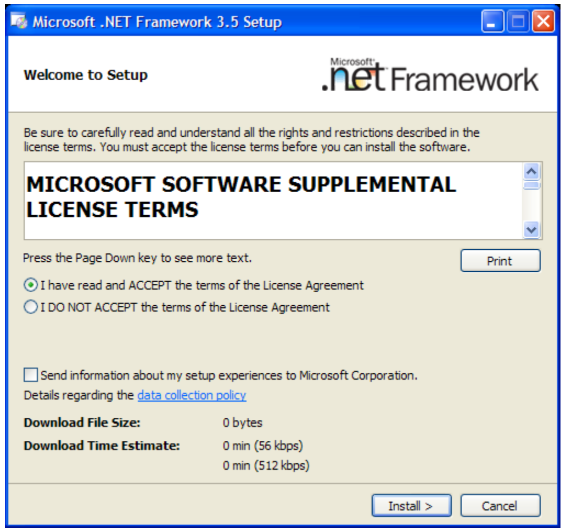


Figure 3.8 – License Agreement (New v2.0 Screenshot needed?)

4. Click **OK** and you will be returned to the SmartSensor Manager Matrix Setup program.

Communication

In this Chapter

- Serial Connection
- Internet Connection
- Virtual Connection
- Address Book
- Viewing Connection Information
- Uploading the Sensor's Embedded Software

Once the SmartSensor Matrix units are installed, use the SSMMX software to change settings, view data, and configure the sensors to the roadway.

First, connect your configuration computer to the Wavetronix Stop Bar Detection System command and control bus. Next, launch SSMMX by either clicking on the icon that was placed on your desktop or clicking the icon found in the Start menu. The SSMMX main screen shown in Figure 4.1 will appear.

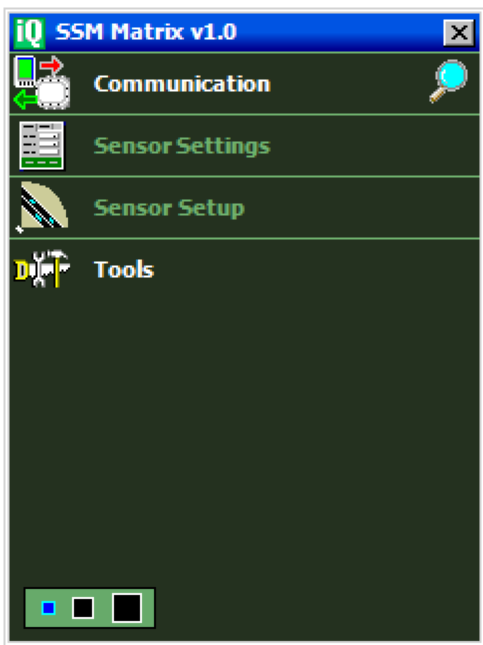


Figure 4.1 – SSMMX Main Screen (New Screenshot needed)

Tip

If you are using SSMMX on a laptop computer, you can use the panel in the lower-left of the main screen to change the size of the program on your computer. By default the smallest size is selected. If you click on the larger rectangles you can increase the size of the program by two or three times.

To interact with and configure Matrix sensors with SSMMX, connect to the sensor through one of the following three types of connections:

- a serial connection;
- an Internet connection, made using an IP address and a serial to Ethernet converter;
- or a virtual connection, which can be made for convenience in learning and demonstrating SSMMX functionality.

Tip

Click the magnifying glass icon on the right side of the communication link of the main SSMMX page to help expedite completion of a connection using the most-recently-used parameters. For example, if your most recent connection was an Internet connection, click on the magnifying glass to bring up the Internet tab with the last IP Address, port, and timeout values specified. When the page appears, you will notice that SSMMX is searching at the selected destination using the last type of search (Quick or Full) that you selected. The magnifying glass will only appear when there is no connection currently established.

Serial Connection

1. Click on **Communication** to access the Communication window (see Figure 4.2).
2. Select the **Serial** tab.
3. Set **Port** and **Timeout** to the desired settings.
4. Select the type of search you would like to perform using the radio buttons (Full or Quick).
5. Click the **Search** button. Please wait up to 30 seconds while the sensors on your network bus are discovered and listed. (You can click **Cancel**, if the sensor of interest has already been listed.)
6. Click on the desired row from the list to select a sensor. The list presents the Sensor ID, Location, and Approach fields of each sensor discovered.
7. Click the **Connect** button. When a connection is established you will be directed back to the home page.

If you select a Full search, the search engine will go through an exhaustive process to find all SmartSensor Matrix units on the selected network bus. This process will reassign each sensor on the network bus a new communication time slot, and can take up to 30 seconds.

A Quick search is much faster because it requests that each sensor respond using a previously assigned communication time slot. However, a quick search should not be used the first time you connect to a network, or if you have added a new sensor to an existing network, because by default sensors may have conflicting time slots.

The first time you connect to a sensor network bus, the default Sensor ID of each discovered sensor will be unique (based upon the last seven digits of the serial number). However, the default names in the Location and Approach text fields will all be the same.

Tip

It is recommended that you use labeling on the service end of each SmartSensor Matrix cable (see Figure 1.8). If you have not already labeled the service end of the sensor cable, you may be able to do so now. If not, you may need to rely upon traffic patterns to sort out the sensors.

To setup network names (e.g. Description, Location, and Approach) in an orderly fashion, it is recommended that the circuit breaker switches be used to selectively power sensor. First, power only one sensor and enter its naming information. Then repeat this process to power additional sensors, one at a time.

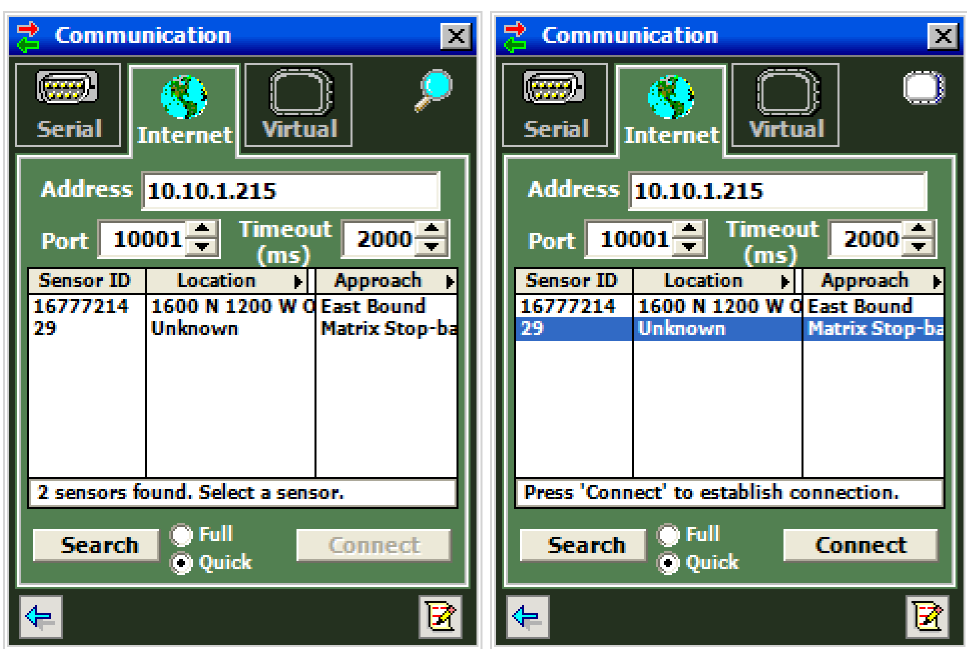


Figure 4.2 – Serial Connection Screen (New Screenshot needed)

Once you have selected a sensor from the device list, you can click again on that row to bring up a Sensor Info popup (see Figure 4.3). To bring up the Sensor Info popup, you can also click on the sensor icon that appears in the upper right corner of the screen (see Figure 4.2).

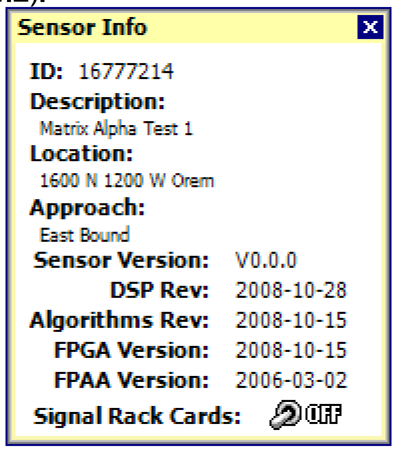


Figure 4.3 – Sensor Info Popup

The Sensor Info popup is also available on the Internet Connection and Virtual Connection screens. This screen lists the following sensor settings and version information:

- **Sensor ID** – Unique Address (by default based upon the last seven digits of the serial number).
- **Description** – User-definable 32 character text field use to describe the sensor. Can be used to indicate items such as the application (e.g. stop bar detection) or GPS coordinates.
- **Location** – User-definable 32 character text field typically describing the intersection where the sensor is located (e.g. “Main & Center – Anytown USA”).
- **Approach** – User-definable 32 character text field that typically indicates which approach of the intersection the sensor monitors (e.g. “EB Main Traffic”).
- **Sensor Version** – Overall sensor product version which represents a released combination of the DSP, Algorithm, FPGA, and FPAA subcomponent versions.
- **DSP Rev** – DSP code version as a date (YYYY-MM-DD).
- **Algorithms Rev** – Algorithm code version as a date (YYYY-MM-DD)..
- **FPGA Version** – FPGA version as a date (YYYY-MM-DD).
- **FPAA Version** – FPAA version as a date (YYYY-MM-DD).

The Sensor Info popup also has a **Signal Rack Cards** toggle switch. When the switch is on, any rack cards connected to this sensor will identify themselves by flashing a blink sequence on the main menu LEDs of the rack card (see Figure 2.10).

Internet Connection

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

1. **Serial to Ethernet Converter** – The SmartSensor Matrix can be connected to a local area network (LAN) by using a serial to Ethernet converter. As an option, the SmartSensor Matrix 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.
2. **Serial to 802.11b Wireless** – The Click! 401™ is a serial to 802.11b converter that provides serial devices with an IP address on a wireless 802.11b network.
3. **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 Matrix can be equipped with optional external modems—for example, CDMA, GMS or GPRS— and assigned an Internet address on these networks. (Please test that SmartSensor Matrix will work with a particular manufacturer's modem, or contact Wavetronix technical services for assistance and guidance.)

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

1. Click on **Communication.**
2. Click the **Internet** tab and the Internet setting options will appear (see Figure 4.4).
3. Enter the IP address or URL of the sensor of interest. 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.
4. 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**.
5. Select the timeout value.
6. Select the type of search you would like to perform using the radio buttons (Full or Quick).
7. Click the **Search** button. Please wait up to 30 seconds while the sensors on your network bus are discovered and listed. (You can click **Cancel**, if the sensor of interest has already been listed.)
8. Click on the desired row from the list to select a sensor. The list presents the Sensor ID, Location, and Approach fields of each sensor discovered.
9. Click the **Connect** button. When a connection is established you will be directed back to the home page.

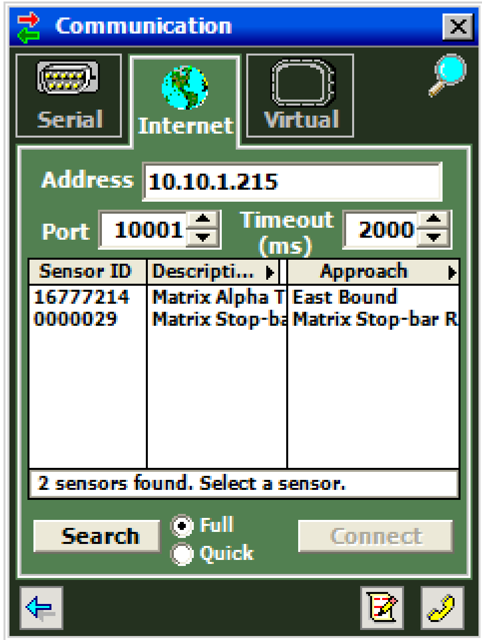


Figure 4.4 – Internet Connection Screen

Virtual Connection

A virtual connection allows you to use the SSMMX 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 soft ware works.
- To play back previously logged traffic. (This feature is not available yet)

To make a virtual connection:

1. Click the **Communication** button.
2. Select the **Virtual** tab (see Figure 4.5).
3. Select or create a virtual sensor file (.vsf) by clicking the magnifying glass icon.
4. Select the type of search you would like to perform using the radio buttons (Full or Quick).
5. Click the **Search** button. Please wait up to 30 seconds while the sensors on your network bus are discovered and listed. (You can click **Cancel**, if the sensor of interest has already been listed.)
6. Click on the desired row from the list to select a sensor. The list presents the Sensor ID, Location, and Approach fields of each sensor discovered.

Click the **Connect** button. When a connection is established you will be directed back to the home page.

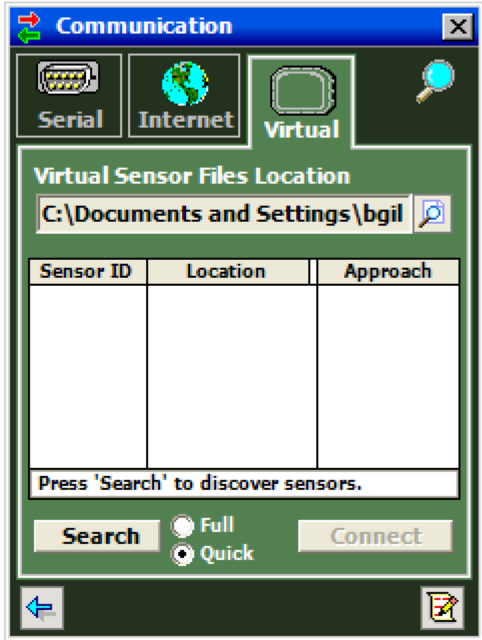


Figure 4.5 – Virtual Connection Screen

Virtual Sensor File

Since a virtual connection is not made to an actual sensor, a virtual sensor file (.vsf) 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.

Example

If you wanted to configure channels for a future installation, you could connect using a virtual connection, create a virtual sensor file and then backup the configuration settings that you created. After the file is successfully backed up, the virtual sensor file will change to a sensor setup file and can be restored to any sensor in the field.

When a connection is made to the SS200, the main menu will appear and all configuration options will become available (see Figure 4.6).

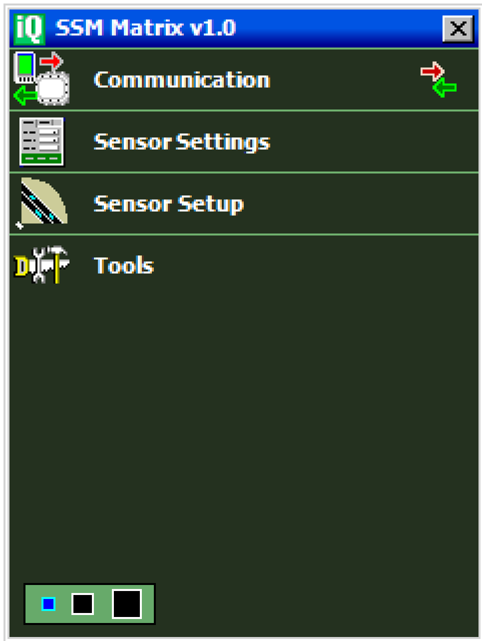


Figure 4.6 – Main Menu (Connected)

If you have problems connecting:

1. Make sure that all power and communication wiring is correct;
2. Check the Port settings (Port ID).

Connection failure can occur for various reasons; if a failure occurs repeatedly, call Wavetronix Technical Support at 801-764-0277 for assistance.

Address Book

PLEASE NOTE – The Address Book is still under design. The documentation in this section will need to be updated once the software is completed. For now this explanation is just a placeholder.

The Address Book allows you to save device connection settings for future use.

Click the **Address Book** button located at the bottom of the Communication page to add new connection settings to the Address Book (see Figure 4.7).

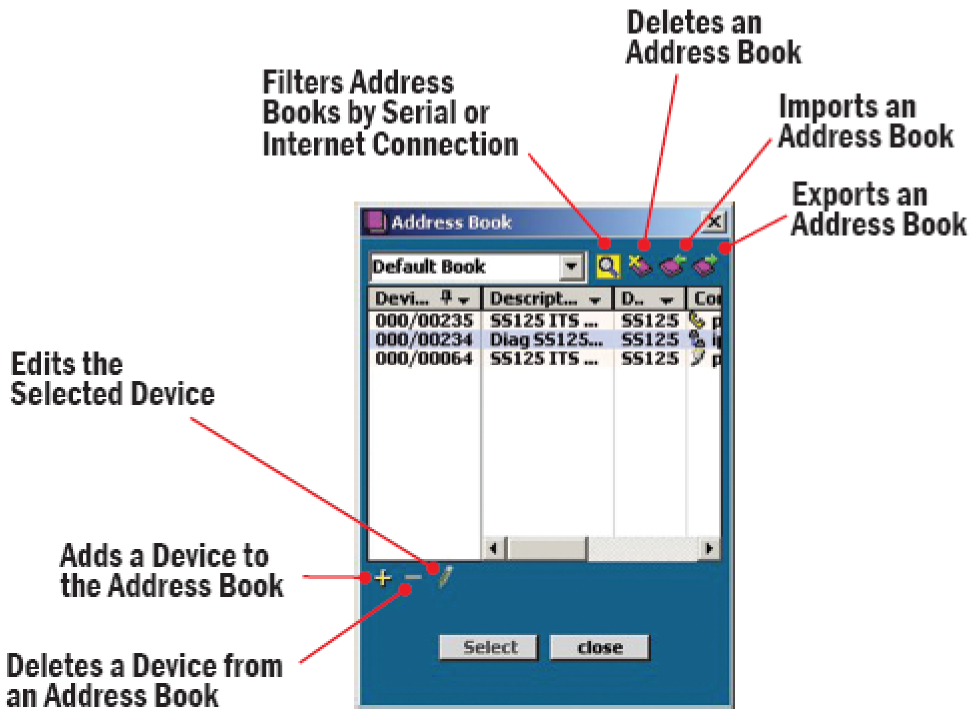


Figure 4.7 – Address Book and Address Book Filter (New Figure Needed)

Viewing Connection Info

Once connected, you can view additional information about the connection you have established by clicking on the moving arrows icon on the top-right of the main menu page or on the bottom-right of the Communication screen (see Figure 4.8). These arrows are only visible when there is an established connection.

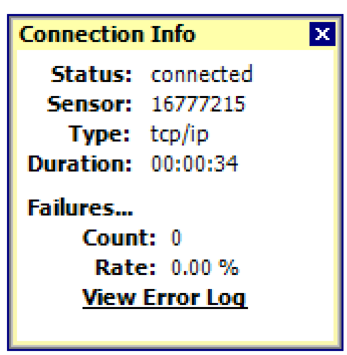


Figure 4.8 – Connection Info Screen

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.

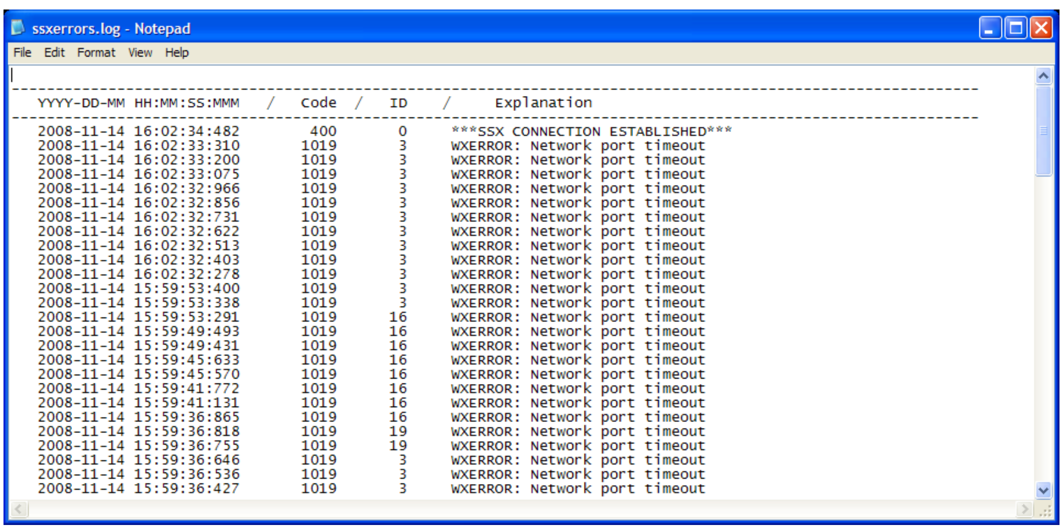
- **Type** – Shows the type of connection and baud rate.
- **Duration** – Shows how long you have been connected.
- **Failures** – Shows the amount of failures during the connection, the percentage rate of failure and a link to the Communication Error Log.

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 SSMMX, 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 Communication screen.


ssxerrors.log - Notepad

File Edit Format View Help

```
-------------------------------------------------------------------------------------------------
   YYYY-DD-MM HH:MM:SS:MMM   /   Code  /   ID    /     Explanation
-------------------------------------------------------------------------------------------------
   2008-11-14 16:02:34:482        400       0     ***SSX CONNECTION ESTABLISHED***
   2008-11-14 16:02:33:310       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:33:200       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:33:075       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:966       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:856       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:731       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:622       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:513       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:403       1019       3     WXERROR: Network port timeout
   2008-11-14 16:02:32:278       1019       3     WXERROR: Network port timeout
   2008-11-14 15:59:53:400       1019       3     WXERROR: Network port timeout
   2008-11-14 15:59:53:338       1019       3     WXERROR: Network port timeout
   2008-11-14 15:59:53:291       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:49:493       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:49:431       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:45:633       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:45:570       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:41:772       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:41:131       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:36:865       1019      16     WXERROR: Network port timeout
   2008-11-14 15:59:36:818       1019      19     WXERROR: Network port timeout
   2008-11-14 15:59:36:755       1019      19     WXERROR: Network port timeout
   2008-11-14 15:59:36:646       1019       3     WXERROR: Network port timeout
   2008-11-14 15:59:36:536       1019       3     WXERROR: Network port timeout
   2008-11-14 15:59:36:427       1019       3     WXERROR: Network port timeout
```

Figure 4.11 – Error Log

Uploading the Sensor's Embedded Software

After clicking the **Connect** button, the soft ware will check to see if your soft ware version matches the version of the sensor's embedded soft ware. 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 soft ware retry and ensure that there has not been a communication issue. Clicking the **Details** button will display the current sensor and soft ware information. Click the **Install Upgrade** button to upgrade the software.

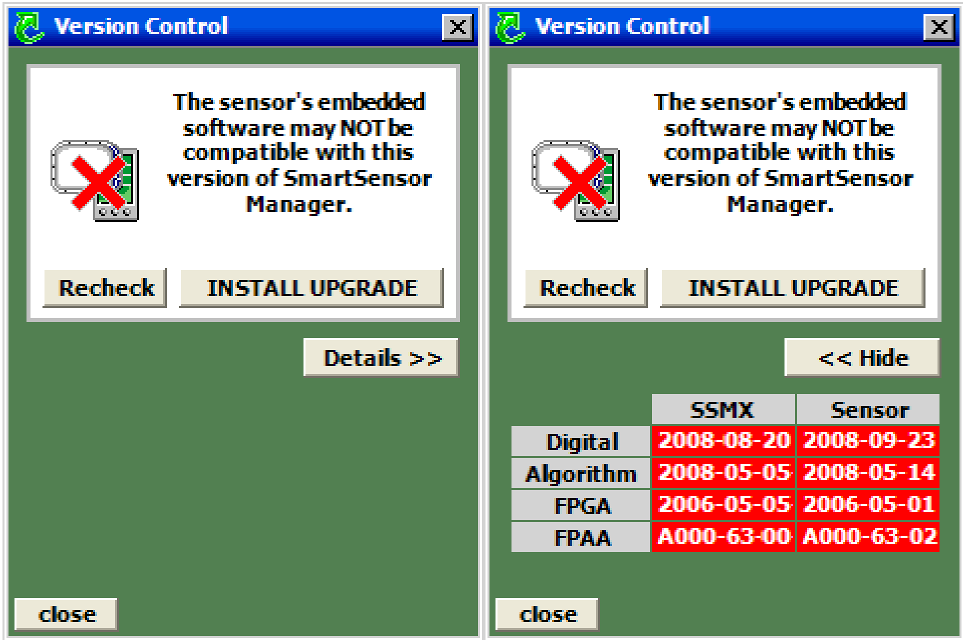


Figure 4.12 – Sensor's Embedded Software Upgrade (left) and Details Table (right)

Click the **Details** button to view the firmware versions of both the SSMMX software and the sensor.

Once the Version Control screen appears, you can do one of the following:

1. Upgrade the sensor's embedded software by clicking the **INSTALL UPGRADE** button.
2. Click the **close** button and continue the configuration process.
3. Find the version of SSMMX software that is compatible with the sensor's embedded software.

> **Warning**
>
> Clicking the **close** button and continuing configuration without upgrading may cause problems with functionality.

If the row marked Digital is highlighted in red, the firmware upgrade may need to be installed. Compare the Sensor number with the SSMCE number in the Digital row of the details table. If the SSMMX 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 SSMMX firmware version date, a warning will appear notifying you that the sensor firmware could be downgraded (see Figure 4.13).

Figure 4.13 – Sensor Firmware Downgrade

If the downgrade message appears, it simply means that the sensor firmware is newer than the version of SSMMX that was used to connect to the sensor. The newest version of SSMMX can be updated by downloading the software from the Wavetronix Portal.

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

Sensor Settings

In this Chapter

- Sensor Settings

Click the **Sensor Settings** link on the main menu to change and save settings on the sensor.

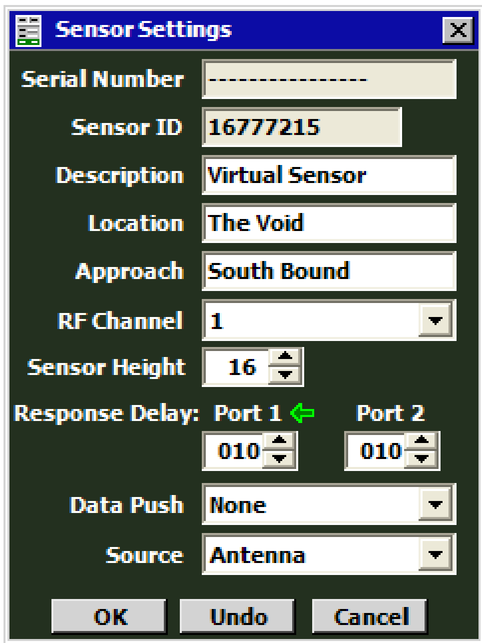


Figure 5.1 – Serial Settings Window (New Screenshot Needed)

The Sensor Settings window contacts the following fields (see Figure 5.1):

- **Serial Number –** Contains the sensor serial number and cannot be edited.
- **Sensor ID –** ID used to uniquely identify all sensors on a multi-drop bus. This ID is based upon the last seven digits of the Serial Number and cannot be edited.
- **Description –** Allows you to enter a description for each sensor. Limited to 32 characters.
- **Location –** Allows you to enter the intersection location of the sensor. Limited to 32 characters.
- **Approach –** Allows you to enter the direction of traffic the sensor is detecting (e.g. NB, SB, WE, WB). Limited to 32 characters.
- **RF Channel –** Displays which radio frequency channel the sensor is using. There are eight RF channels available. 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).
- **Sensor Height –** The height of the sensor in feet. This value impacts the performance of the sensor.

- **Response Delay** – This 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. This value can be selected for both of the sensors ports independently.

Note

A green arrow is used to show the port over which SSMMX is connected to the sensor. In many cases, the SSMMX will be connected over Port 1. Port 1 is usually designated for command and control and is connected to the blue RS-485 wire pair. However, during troubleshooting or other special cases SSMMX may connect to the sensor over Port 2. Port 2 is connected to the orange RS-485 wire pair and is typically used for detection calls.

- **Data Push** – Data can be pushed over port 1, port 2, or both. To prevent data push, select "None". In many cases, data push will only occur over Port 2 which is typically designated for detection calls (based upon the pre-wired connections of a PCU).

Note

If for some reason SSMMX connects over the Port that SmartSensor Matrix is pushing data, the software will continue to poll the sensor for detection call messages. This will help keep the intersection operating as normal during the configuration process.

- **Source** – In normal use the source is always the radar Antenna. However in some cases, other sources may be used for demonstrations or evaluations. When the source is switched to diagnostic, the antenna is not longer used. Instead a predetermined sequence of traffic will appear. The replay source is only available if the sensor is equipped with this special hardware.

Sensor Setup

In this Chapter

- Lanes and Stop Bars
- Zones and Channels
- Verification

The Sensor Setup screen allows provides automatic and manual controls to quickly and easily configure the sensor to the roadway. Configuration is a three step process that follows the tabs below the Sensor Setup title bar.

Lanes and Stop Bars

In Step 1 the lanes and stop bars of the corresponding intersection approach are configured. Lanes, stop bars, and vehicle tracks are shown within the sensor's 100-foot 90° degree view (see Figure 6.1). This view has the appearance of a baseball infield with the sensor icon shown at the position where home base would be.

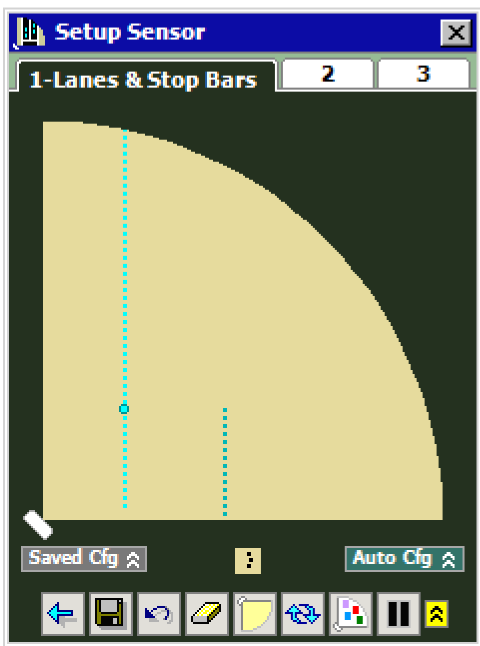


Figure 6.1 – Lanes & Stop Bars View (Edit Area)

Before any lanes are discovered you will see vehicle tracks in the auto-configuration view. Vehicle tracks can be represented with or without a track history. To toggle the track history on or off press the little detection display button below the middle of the sensor view. When it the track history is on the button will appear like as a circle . When the track history is off the button will appear as a vertical series of dots .

> **Note**
>
> When on the Lanes & Stop Bars view, you only see vehicle tracks. These tracks are not constrained to lanes, even after you have saved a lane configuration to the sensor. Vehicle detections are only viewed on the Verification View.

When on the Lanes & Stop Bar view there are three display options:

- Edit Area only
- Edit Area with Saved Configuration Overlay
- Edit Area with Automatic Configuration Overlay

Figure 6.1 shows the Edit Area only. The Edit Area shows changes that have been made within SSMMX, but that have not yet been saved on the sensor. Figure 6.2 shows the Lanes and Stop Bars view with the Saved Configuration Overlay (left) and the Automatic Configuration Overlay (right). To show or hide these overlays toggle the **Saved Cfg** and/or **Auto Cfg** buttons. These buttons are found below the sensor view and above the menu bar.

SmartSensor Matrix is constantly running the auto-configuration process in order to find undiscovered lanes and stop bars.

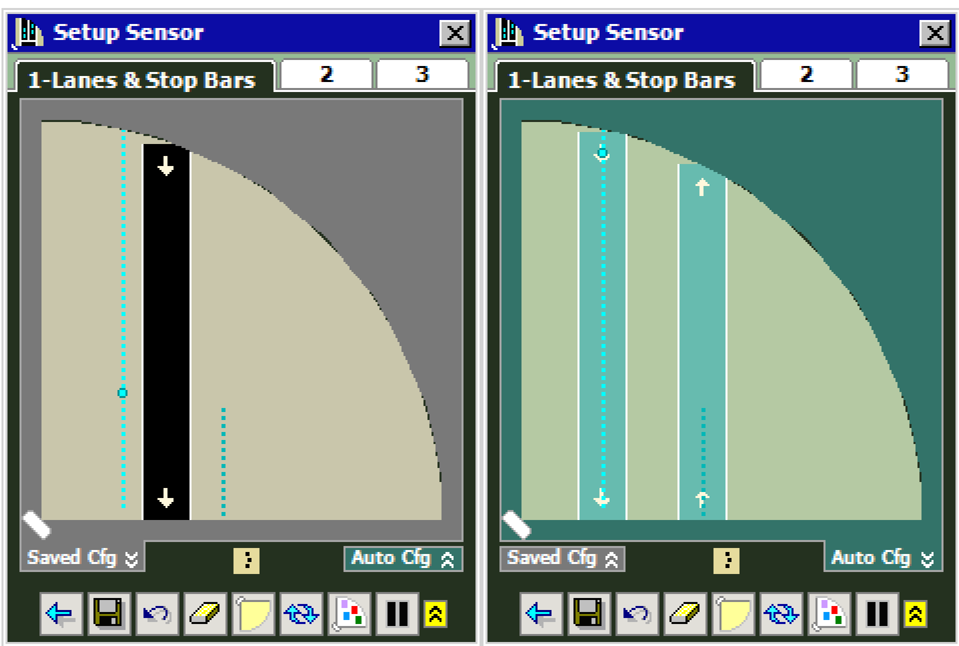


Figure 6.1 – Lanes & Stop Bars View with Overlays

The menu bar at the bottom of the screen will allow you to perform a variety of operations during Sensor Setup. Press the yellow up-arrows icon at the right side of the menu bar to open a pop-up view of the Lanes & Stop Bars menu (see Figure 6.2).

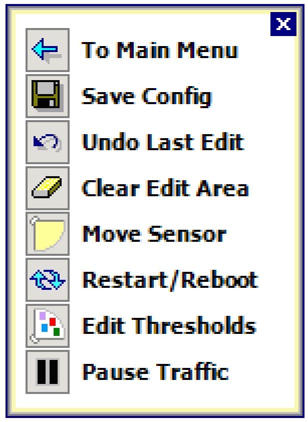


Figure 6.2 – Sensor Setup Menu Popup

Use the blue back-arrow to return to the main menu. Click the **Save Config** button to save the sensor configuration at any time. To undo the last change in the Edit Area, click the **Undo Last Edit** button. To clear all your pending changes, click the **Clear Edit Area.** Click the **Pause Traffic** / **Play Traffic** button to suspend or resume movement of vehicle tracks on the screen.

In general, the following order is recommended for completion of Step 1 – Lanes and Stop Bars.

1. Move Sensor to correct location.
2. Restart Automatic Lane Configuration. Allow the automatic configuration process to run for several cycles around the intersection (approximately 5 to 10 minutes).
3. Capture Lanes & Stop Bars to Edit Area
4. If necessary, make manual adjustments to the Lane & Stop Bar Configuration using the Edit Area
5. Save the desired changes to the sensor.

Move Sensor

The sensor is typically used to monitor traffic on one approach of the intersection. Often the sensor is mounted on the near-side of the approach near the intersection. In this case the sensor monitors the traffic approaching the stop bar as it travels towards the sensor. If your sensor is not mounted from this vantage point, click the **Move Sensor** Icon until the sensor has moved to the correct corner of the screen.

The sensor will move in the following sequence:

- **Bottom left-hand corner** - near side of approach monitoring traffic traveling towards the sensor's location.
- **Top left-hand corner** - near side of approach monitoring traffic traveling away from the sensor's location.
- **Top right-hand corner** - far side of approach monitoring traffic traveling away from the sensor's location.
- **Bottom right-hand corner** - far side of approach monitoring traffic traveling. This sensor placement allows direct line-of-sight to the first left turn lane.

Restart Automatic Lane Configuration

When you enter the Sensor Setup screen for the first time, restart the auto-configuration process to erase auto-configuration information that may have been gathered before the sensor's alignment was finalized.

To restart the automatic lane configuration process:

1. Click the **Restart or Reboot** button 
2. Click OK on the Restart of Reboot popup window (see Figure 6.3).

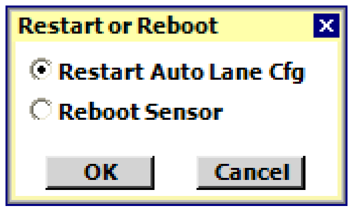


Figure 6.3 – Restart or Reboot Popup

Capture Lanes and Stop Bars to Edit Area

When auto-configured lanes appear they can be captured by clicking on them. Once a lane is captured it becomes part of the Edit Area. Captured lanes are not saved to the sensor until after clicking on the **Save Config** button.
To capture a single lane:

1. Click on the lane once to select it.
2. Click on the lane a second time to bring up the Capture pop-up window (see Figure
3. Click on the **Capture Lane** button to capture the selected lane.

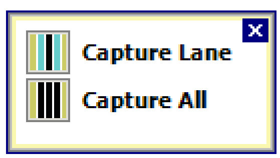


Figure 6.4 – Capture Popup

Each lane has its own stop bar. If a stop bar is found for a lane it will be captured with the lane. If you want to capture all the configured lanes, press the **Capture All** button.

Make Manual Adjustments

If necessary the following manual adjustments can be made:

- Add / delete a lane
- Insert / delete a lane stop bar
- Move a lane stop bar
- Insert / delete a lane node
- Move a lane node
- Adjust the width of a lane node

- Adjust thresholds

To add a lane:

1. Click in the Edit Area in the vicinity of the lane.
2. Click on the Add Lane option. There are a maximum of ten lanes and lanes cannot overlap. (You may be able to add an overlapping lane to the edit area, but you will not be able to save it.)

Figure 6.5 – Edit Area Popup

Note

Lanes have a direction shown by white arrows on top of the lane. The lane direction is dictated by the order of the lane nodes. When a lane is first added it will only have two nodes. To switch the lane direction, simply click on the arrows. Before you save the configuration, check to make sure that all the arrows are pointing in the correct direction.

To delete a lane:

1. Click in the Edit Area to select a lane.
2. Click on the selected lane to bring up the Edit Lane popup.
3. Click on the Delete Lane option of the Edit Lane popup.

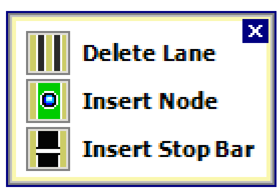


Figure 6.6 – Edit Lane Popup

To insert a lane stop bar:

1. Click in the Edit Area to select a lane.
2. Click on the selected lane to bring up the Edit Lane popup.
3. Click on the Insert Stop Bar option of the Edit Lane popup.

To delete a lane stop bar:

1. Click in the Edit Area to select a lane.
2. Click on the stop bar within the selected lane.
3. Click on the Delete Stop Bar option of the Edit Stop Bar popup.

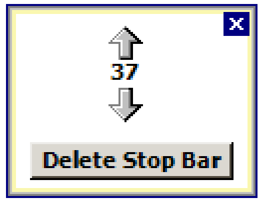


Figure 6.7 – Edit Stop Bar Popup

To move a lane stop bar:

1. Click in the Edit Area to select a lane.
2. Click on the stop bar within the selected lane.
3. Click on the arrows to move the lane stop bar in the desired direction. The number between the arrows indicates the distance from the lane's end node.

To insert a lane node:

1. Click in the Edit Area to select a lane.
2. Click on the selected lane in the vicinity of the desired node to bring up the Edit Lane popup (see Figure 6.6).
3. Click on the Insert Node option of the Edit Lane popup. A lane can have a maximum of six nodes.

To delete a lane node:

1. Click in the Edit Area to select a lane.
2. Click on the selected lane in the vicinity of the desired node to bring up the Edit Node popup (see Figure 6.8).
3. Click on the Insert Node option of the Edit Lane popup. A lane can have a maximum of six nodes.

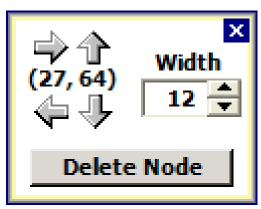


Figure 6.8 – Edit Node Popup

To move a lane node:

1. Click in the Edit Area to select a lane.
2. Click on the selected lane in the vicinity of the desired node to bring up the Edit Node popup (see Figure 6.8).
3. Click on the arrows to move the node in the desired direction. The numbered pair (x,y) between the arrows indicates the distance within the sensor's view. The x-value indicates the distance from the right edge of the sensor's view in (feet). The y-value indicates the distance from the left edge of the sensor's view (In feet).

Adjacent lane nodes can be placed to follow the curve of a turn movement. However there is a limitation to the amount of curvature that is acceptable (see Figure 6.9). The departure from a straight path cannot exceed 45 degrees. While you will be able to allow move the node anywhere on the screen you will get a notification that the "lane configuration is invalid" if the allowable limits are exceeded.

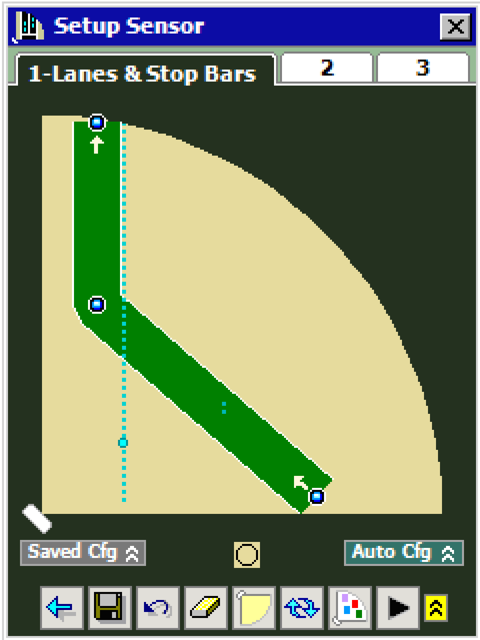


Figure 6.9 – Example of an Invalid Lane Configuration

To adjust the width of a lane node:

1. Click in the Edit Area to select a lane.
2. Click on the selected lane in the vicinity of the desired node to bring up the Edit Node popup (see Figure 6.8).
3. Click on the Width Edit Box up/down bumpers to change the width of the node (in feet). Adjusting the node width will impact detection search area for that lane.

To adjust thresholds:

1. Click on the Edit Thresholds Button.
2. Click within the sensor view. This will bring up the Sensitivity popup (see Figure 6.10)

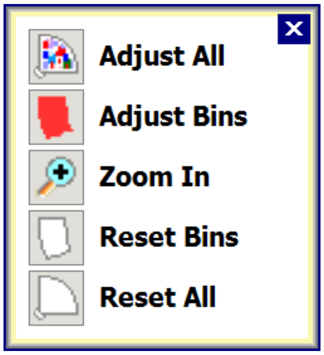


Figure 6.10 – Sensitivity Popup

3. If you wish to edit all sensor thresholds, click on the **Adjust All** button.
4. If you wish to reset all sensor thresholds to defaults, click on the **Reset All** button.

5. If you wish to edit a subset of thresholds, drag over the area of interest. For selection of individual bins, you can use the **Zoom In / Zoom Out** button. Once the desired bins are selected you can then click on **Adjust Bins.**
6. If you wish to reset only selected bins to defaults, click on the **Reset Bins** button.
7. After you click on **Adjust Bins** or **Adjust All**, the Sensitivity Slider popup (see Figure 6.11) will appear. Click on the sensitivity up/down bumpers to change the sensitivity (in decibels). Negative values will lower the rejection threshold in order to increase sensitivity. Positive values will increase the rejection threshold in order to decrease sensitivity.

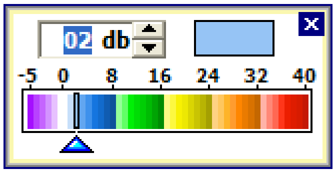


Figure 6.11 – Sensitivity Slider Popup

Save Desired Changes to the Sensor

After the configuration is complete, click the **Save Config** button to save the changes to the sensor. If you attempt to leave the Lanes & Stop Bar view before saving your changes you will be presented with the following prompt (see Figure 6.12).

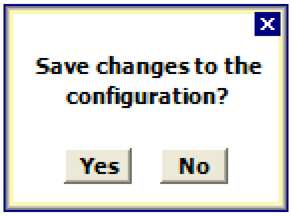


Figure 6.12 – Save Changes Dialog

Zones and Channels

After the Lanes and Stop Bar configuration is saved, click on the Step 2 tab to bring up the Zones & Channels view. This view allows you to place zones and configure detection channels (see Figure 6.3). Each SmartSensor Matrix unit supports up to eight zones and four channels. If unused, the eight zones are placed outside the sensor view and labeled Z1 through Z8.

Detection zones are automatically placed in each lane near the stop bar. By default, the zones are 30 feet in length. Each automatically placed zone is then mapped to a detection channel.

To make changes to the zones and channels use the menu bar (see Figure 6.14).

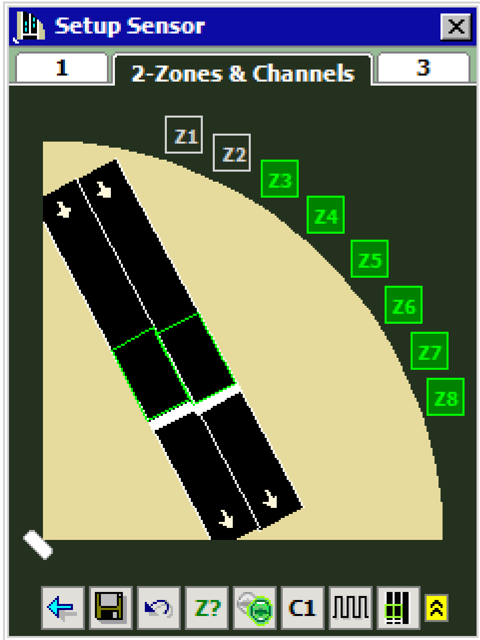


Figure 6.13 – Setup Zones & Channels View

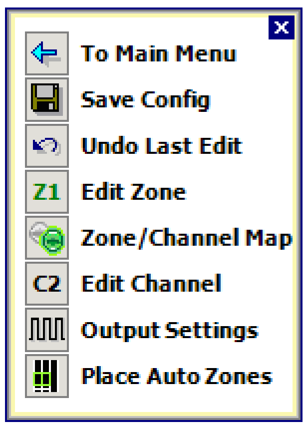


Figure 6.14 – Setup Zones & Channels Menu Bar

The **Edit Zone** button will allow you to move a zone, and also specify the channels to which it is mapped. Use the arrows to move the zone. To move just one corner of a zone, select the zone by clicking on it, and the click again on the desired node. Then drag the zone to the desired location. Zones are allowed to overlap each other.

Click on the C1 through C4 LEDs to map the selected zone to the desired channels. If the LED is green the zone will be mapped to that channel. If it is gray then it will not be mapped.

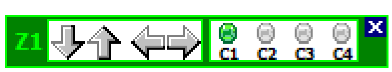


Figure 6.15 – Edit Zone Button

The **Zone/Channel Map** will also allow you to map or un-map zones to channels (see Figure 6.16). A zone is mapped to a channel if the corresponding LED is green. Otherwise it is not mapped.

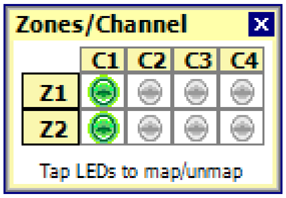


Figure 6.16 - Zone/Channel Map Popup

The **Edit Channel** popup will also allow you to map / un-map channels. Click on the LEDs to configure the mapping. This popup also allows you to view and then edit extend and delay settings for the selected channel (see Figure 6.17). To edit the extend and delay, click in the white box with the E and D, and the corresponding edit boxes will appear (see Figure 6.18).

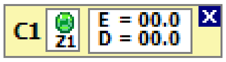


Figure 6.17 – Edit Channel Popup

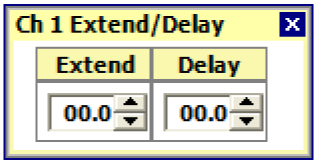


Figure 6.18 – Edit Extend Delay

The extend and delay settings can also be specified using the **Output Settings** popup (Figure 6.19). This popup also allows you to specify the minimum pulse width. The minimum pulse width is the minimum duration a presence detection will be signaled via the contact closure rack cards. All these output settings are specified in seconds.

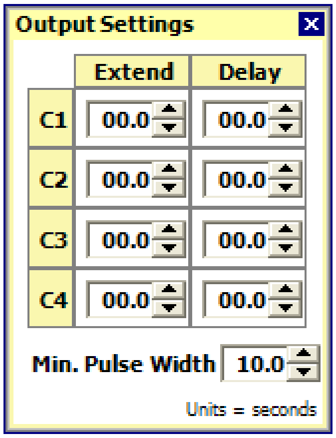


Figure 6.19 – Output Settings Popup

Press the **Place Auto Zones** button if you would like to manually invoke this automatic feature. Please not that this will move any zone adjustments that you may have made before saving.

After the configuration is complete, click the **Save Config** button to save the changes to the sensor. If you attempt to leave the Zones & Channels view before saving your changes you will be presented with the following prompt (see Figure 6.20).

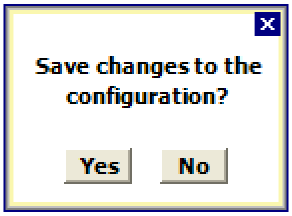


Figure 6.20 – Save Changes Dialog

Verification

After the configuration is complete, you will want to verify vehicle detections. To do so click on the Step 3 tab. This will bring up the Verification View (see Figure 6.21).

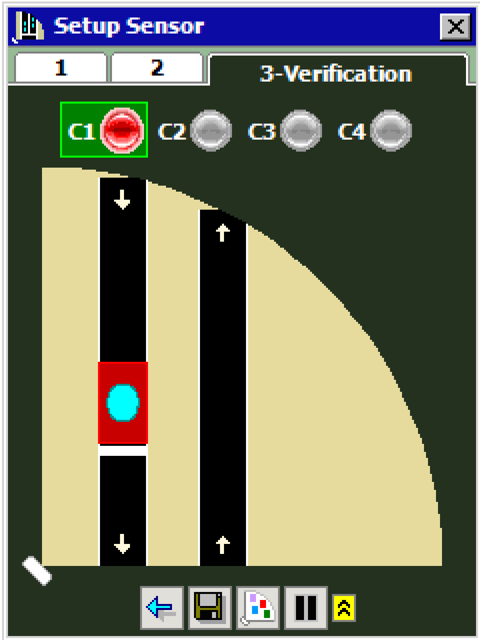


Figure 6.21 – Verification View

In the Verification View, vehicle detections will appear as light blue objects. The extent of these detections will vary based upon the length of the detected vehicle and the length of queued traffic.

Note

Vehicle detections in a stopped queue are represented by a continuous light blue bar. This representation ensures that a zone will activate when queued vehicles stop before and after the zone, but not directly over it. In addition, if the first queued vehicle stops behind the stop bar and but is within 30 feet, the displayed queue will be extended to the stop bar. This ensures that a stop bar zone will activate when a vehicle stops near it in the corresponding lane.

When detections are within a zone, they will cause the LEDs for the channels mapped to that zone to activate. Active channels will appear red, and inactive channels will appear gray (blank).
To see detections active the zones mapped to a particular channel, select that channel by clicking on its LED. Active zones for the selected channel will appear red, and inactive channels for the selected zone will appear black (blank).

Note

Only the zones for the selected channel will appear. If zones are not mapped to any channel, they will not be seen in the Verification View.

As on the Edit Lanes & Stop Bar screen, you can use the menu bar to: save a configuration, undo your last edit, edit thresholds, and pause/play traffic (see Figure 6.22).

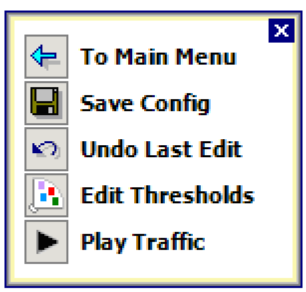


Figure 6.22 – Verification View Menu Bar

Tools

In this Chapter

- Backup / Restore
- Rack Card Tools
- Tracker Logging

The Tools Screen allows you to perform several functions (see Figure 7.1).

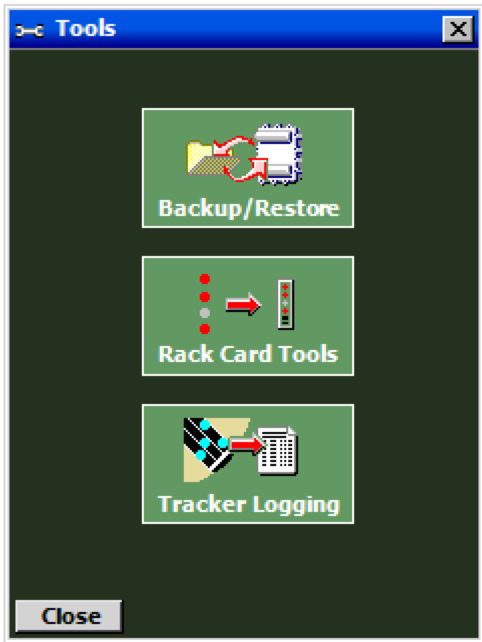


Figure 7.1 – Tools Screen

Backup / Restore

Access Backup/Restore by clicking the **Backup/Restore** button on the Tools screen (see Figure 7.2)

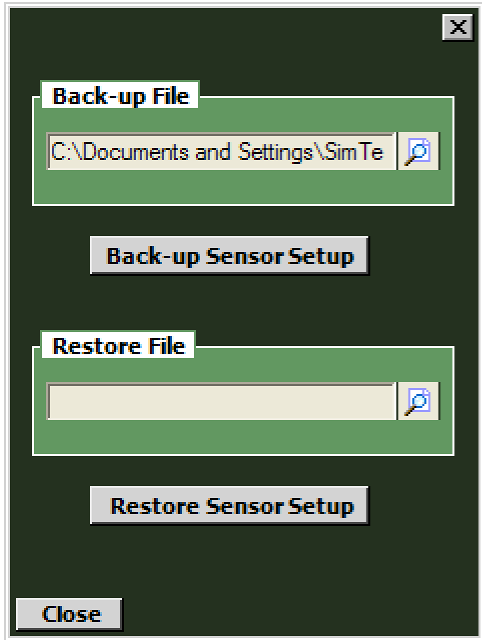


Figure 7.2 – Backup / Restore

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 Back-up 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.

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 previously on the sensor, unless they are backed up.

Rack Cards Tools

Access rack card tools by clicking the **Rack Card Tools** button on the Tools screen (see Figure 7.3)

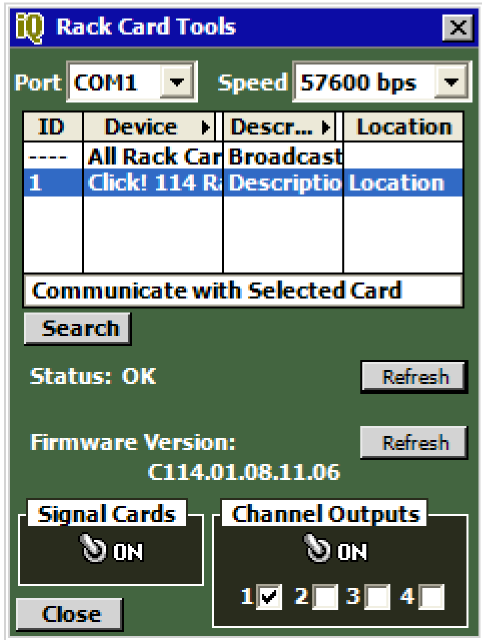


Figure 7.3 – Rack Card Tools

Note

To reduce the amount of time spent onsite when installing a Wavetronix Stop Bar Detection System, you can use the Rack Card Tool to setup the racks cards, while cable is being pulled through conduit or the sensors are being installed. This tool will allow you to verify that you have the correct channel mapping into the traffic controller, even without the sensors installed. This tool can also be used for troubleshooting.

Serial data messages sent by the Rack Card Tool normally reach the rack cards via T-bus and the patch cord connecting the Command and Control Bridge directly to contact closure card shared multi-drop bus. The Rack Card Tool does not cause the sensors to send contact closures to the rack cards.

Note

When used with SmartSensor Matrix the rack cards should be configured to communicate at 57,600 bps. If you are having communication issues, you may want to verify that the rack cards are configured to communicate at 57,600 bps. See Appendix D to learn how to configure the rack cards.

To search for Click! 112/114 rack cards on the communication bus to which SmartSensor Manager is connected:

1. Select the correct communications port using the **Port** drop down control.
2. Select the correct communications baud rate using the **Speed** drop down control.
3. Click on the **Search** button.
4. Once a list of devices appears, click on the desired row. If you would like to communicate to all the devices, select the first row, with the title "All Rack Cards" in the device column. This selection will send broadcast messages to all the connected rack cards. If you would like to communicate to an single device, select the corresponding row. You can identify a device by its ID, Device, Description, or Location fields.

When you are communicating with an individual device, the **Status** and **Firmware Version** fields will be valid. The Status field indicates whether the rack card is operating normally (OK) or whether it is in failsafe mode. If the device is in failsafe mode, the text message may help you understand why the device is in failsafe. For example if the text reads "Failsafe Initializing", this indicates that the rack card has never seen any detection call messages since it was rebooted. Or if the message reads "Failsafe Timeout (No Data)", this indicates that the rack card was previously receiving detection calls, but has received any in the last 10 seconds or more.

The Firmware Version field lists the version of the rack card firmware. In the example in Figure 7.3, the firmware is for a 114 card and was released on 11/06/2008. If you are communicating will all devices, the status and firmware version fields are not applicable (N/A). When you would like to refresh the status of these fields, click the associated **Refresh** button.

To help single-out devices you can use the **Signal Cards** toggle switch. When the switch is ON, all selected devices will flash their main menu LEDs (see Figure 2.10). If you have selected All Rack Cards, every card connected on the bus will flash the main menu LEDs. If you have selected a single device, only the LEDs on this device will flash.

The **Channel Outputs** toggle switch and 1-4 checkboxes are used to help assist in testing of the rack card outputs. Boxes 3 and 4 will not appear if you are connected to a two-channel rack card.

If the Channel Outputs switch is ON, all the selected outputs on the Click! 112/114 rack card will be determined by the checkboxes (unless a sensor is actively pushing data to the rack card over the detection call bus).

Warning

It is recommended that you disable pushing by sensors, or disconnect the detection call bus patch cord for each sensor before using this tool. Otherwise, the rack card may be receiving conflicting calls on its other bus.

If there are not competing messages from another communication bus, an output will be active when associated a box is checked. An active output will cause the corresponding contact outputs on the card's backplane to close and the detection channel LED on the faceplate to activate (see Figure 2.10). If a box is not checked, the output will be inactive. An inactive output will cause the corresponding contact outputs on the card's backplane to open and the detection channel LED on the faceplate to deactivate.

When on the Channel Outputs toggle switch and 1-4 checkboxes can be very helpful in verifying the I/O channel mapping from the rack card outputs to the traffic controller inputs. By sequentially checking boxes 1-4 you should be able to quickly verify the mapping of each channel, even in the absence of traffic.

Note

If the Channel Outputs toggle switch is OFF, no channel output messages will be sent to the Click! 112/114. However, this does not mean that the channel outputs will be inactive. In fact, normally the cards will go into failsafe mode. In failsafe mode, all detection channel outputs and their corresponding LEDs will be active.

Tracker Logging

Access the Tracker Logging tool by clicking on the **Tracker Logging** button on the Tools screen (see Figure 7.4). This tool will allow you to log vehicle detections as they are tracked through the sensors view. (This tool does not log vehicle tracks seen on the Lanes & Stop Bars view of the Sensor Setup screen. It only records vehicle detections as shown on the Verification page.) Recorded vehicle detections can be used later for playback using a virtual connection.

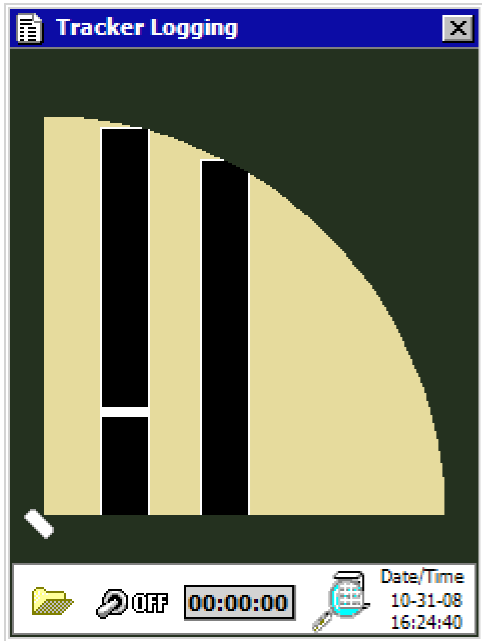


Figure 7.4 Tracker Logging Tool

Click on the **Log File** icon to select a log file. The Select Tracker Log File screen allows the user to specify the name of an existing log file or to create a new file (see Figure 7.5).

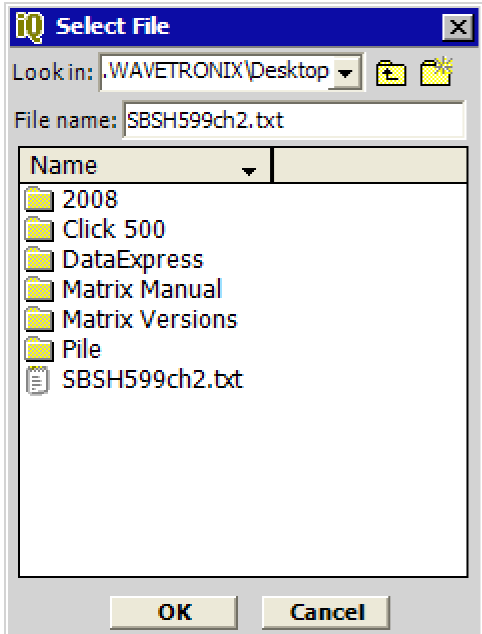


Figure 7.5 – Select Detection Log File Screen

Click the **ON/OFF** toggle switch icon to the "ON" position to begin logging vehicle detections. Once activated, the duration of the logging session is displayed on the "Elapsed:" timer display. Click the toggle switch to the "OFF" position to end a logging session.

The vehicle detection log file is an ASCII text file and can be viewed using a standard text editor. Click on the **View Log** icon to view the current log file using the system's default text editor (see Figure 7. 6).

Figure 7.6 – Log File

Appendix

In this Appendix

- A – SmartSensor Matrix (SS225) Specifications
- B – Matrix Cable Connector Assembly Instructions
- C – Cable Lengths
- D – Click! 112/114 Reference Guide

Appendix A – SmartSensor Matrix (SS225) Specifications

Parameters	Specifications
Operating Frequency:	24.125 GHz (K-band)
Detection Zones:	Up to 8 zones
Detection Channels:	Up to 4 channels
Detection Range:	6 to 100 ft (1.83 m to 30.48 m)
Detection View:	90 degrees
Elevation Angle:	65 degrees
Measured Quantities:	Vehicle presence
Communications:	Two RS-485 half-duplex connections
Power:	10.0 watts @ 9-28 VDC
Physical Dimensions:	13.2 in x 10.6 in x 3.3 in (33.5 cm x 27 cm x 8.3 cm)
Zone Resolution:	1 foot (0.3 m)
Ambient Operating Temp:	-40 C to 70 C
Humidity:	Up to 95% RH
Shock:	10 g 10 ms half sine wave
Transmitted Power at 3m:	<100 dBUv/m @24.125 GHz

Appendix B – Matrix Cable Connector Assembly Information

The connector end of the SmartSensor Matrix cable mates to the eight socket connector on the sensor as shown in Figure B.1. Socket A is near the connector's key. Figure B.2 details the pinout of the cable connector and the corresponding wire in the cable. The SmartSensor Matrix cable has 7 wires. Internal to the sensor another pair of wires connect to the protective earth lug.

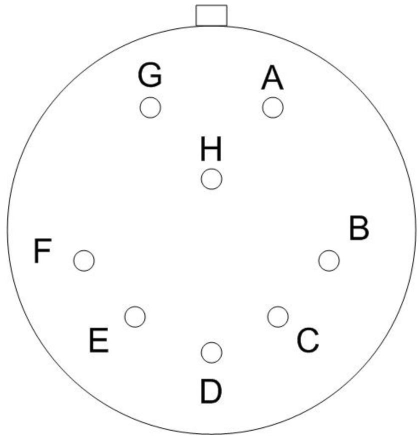


Figure B.1 – SmartSensor Matrix Connector (Plug End with Sockets)

Pin	Cable Wire	Signal Description
A	Red	DC+
B	White with orange stripe	Detection Call 485+ (Sensor Port 2)
C	Orange	Detection Call 485- (Sensor Port 2)
D	Drain / Shield	Drain
E	White with blue stripe	Command and Control 485+ (Sensor Port 1)
F	Blue	Command and Control 485- (Sensor Port 1)
G	Black	Common (Ground)
H	—	Reserved

Figure B.2 – Pinout for Power and Communication Signals

To create custom cables proper connector crimping tools are necessary. The SmartSensor Matrix cable connector uses a MILC-C-26482 Series 1 connector, crimping contacts, and a watertight back shell. A kit with these parts can be ordered directly from Wavetronix.

Size 20 contacts are used to accommodate the 20 and 22 gauge wires in the cable. (The SmartSensor cable's red and black wires provide a 20 AWG wire pair. The other pairs on the SmartSensor cable are 22 AWG and are normally used for communication.)

To create a custom cable (see Figure B.3):

1. Slide the strain relief, follower, grommet, and back shell over the cable.
2. Strip the cable jacket and shielding back about 1.5 inches.
3. Strip each of the 7 SmartSensor cable wires back about 0.25 inches.
4. Insert the wires into the contacts and verify the wire is visible through the contact inspection hole.
5. Crimp the wires by following the crimping tool instructions. Daniels Manufacturing Company provides professional grade crimping tools and detailed instructions on crimping. Wavetronix recommends the DMF AF8 M22520/1-01 or equivalent tool for crimping.
6. Manually press the contacts into the backside of the connector plug using the pinout information in Figure B.2.
7. Use a DMC DAK20 or equivalent insertion tool to fully seat the contact into the connector plug. Check the mating face of the connector to ensure that

all the contacts are fully inserted. (A DMC DRK20 extractions tool or equivalent is necessary to remove a misplaced or misaligned contact.)

8. Thread the back shell onto the connector plug. To keep the connector from rotating during the threading process, connect the plug and coupling ring to a sensor connector receptacle.)
9. Press all of the connector parts together. Thread the strain relief on to the back shell.
10. Tighten the strain relief screws on the back

Figure B.3 – Connector sub-assembly parts

Appendix C – SmartSensor Matrix Cable Lengths

It is recommended that the sensor be powered off of 24 volts to achieve reliable operation up to 500 feet away. Figure C.1 lists maximum cable lengths for 12 and 24 volts.

Power Wire Gauge	24 Volts	12 Volts
20 AWG	500 ft	100 ft

Figure C.1 – Maximum Cable Length for Power (ft)

For communications, both of the sensor's RS-485 communication ports operate at 57.6 Kbps to achieved reliable communications up to 500 feet away (see Figure C.2).

Baud Rate	RS-485
57.6 Kbps	500 ft

Figure C.2 – Maximum Cable Length for Wired Communications (ft)

Note

If you have a need for a cabled connection over 500 feet, contact Wavetronix technical services for assistance.

Appendix D – Click! 112/114 User Reference Guide

The Click! 112 and 114 are 2-channel and 4-channel contact output rack cards. Each contact output is electrically isolated and are normally open. When the cards receive the appropriate serial messages from SmartSensors, they will close the contact outputs. The contact closure is used to pull-down the 24VDC reference provided by standard traffic controllers and traffic cabinet bus interface units. This type of digital I/O is standard in NEMA TS1, NEMA TS2, 170, 2070, and ATC traffic cabinet systems.

When used with SmartSensor Matrix the rack cards usually receive broadcast detection call messages. However, the rack card protocol also supports individual addressing. Individual addressing is used by the rack card tools in SSMMX.

Note

On power up, the rack cards will go into failsafe mode if they are not receiving detection call messages from SmartSensor Matrix. So even though the contact outputs are normally open, they will be closed when an active connection from SmartSensor Matrix (or other source device) does not exist.

The rack cards are software and hardware configurable. Hardware configuration is performed using switches on the side of the card (see Figure D.1).

Switch Name	Description	Card Labels
Mode Switch	Push button on faceplate	S1
Contact Type Switch Channel 1 & 2	1-switch DIP switch	S2
Contact Type Switch Channel 3 & 4	1-switch DIP switch	S3
Channel Group / Input Mapping Switch	8-switch DIP switch	S4
Baud Rate Switch	8-switch DIP switch	S5

Figure D.1 – Hardware Configuration Switches

Figure D.2 illustrates the 4 possible DIP switch modules on the side of the card. To turn a switch on, push it up. To turn a switch off, push it down. In this example, only switches 1 and 4 of S5 are on.

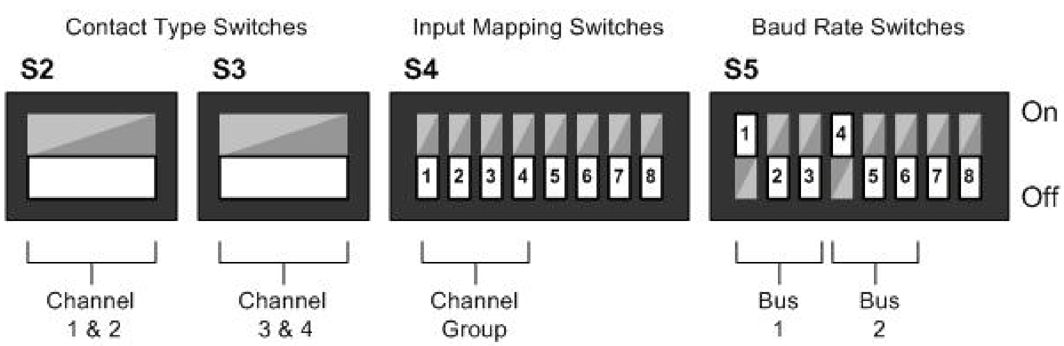


Figure D.2 – DIP Switches on the side of the card

When S2 is switched off it will provide a contact outputs (dry outputs) for channels 1 and 2. When S2 is switched on it will provide voltage outputs (wet outputs) for channels 1 and 2. S3 has the same functionality, but for channels 3 and 4. S2 and S3 are normally both on or both off.

> **Note**
>
> A switch is also off if it is not loaded onto the card. For example, S2 and S3 are not typically loaded because the rack card normally provides contact outputs. These switches are only present in cases where the rack card needs to output a voltage (wet) instead of a contact (dry). Please contact Wavetronix customer support, if you have an application that requires a voltage output. The voltage will normally be near VCC (typically 12 or 24 V). Then when the contact closes, the output voltage will be near 0 V.

The first four input mapping switches (1-4) for S4 are used to select a channel group. A channel group indicates which input channels are mapped to the cards output channels. If the first four input mapping switches are all off then the channel group is software configurable. Otherwise, the pattern of these switches selects the channel group (see Figure D.3). The same on/off pattern used for these dip switches is also used when doing software selection of the channel groups using the faceplate mode switch (Compare Figure D.3 to Figure D.6). This allows selection of channels as high as channel 28. Contact Wavetronix technical support if you have questions on how to select channel groups.

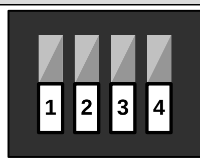
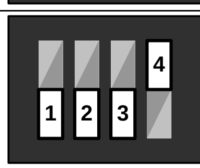
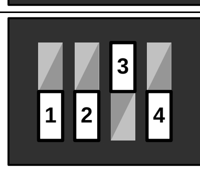
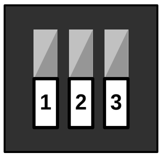
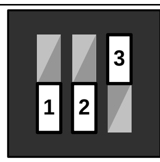
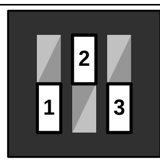
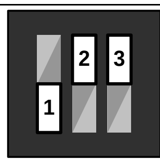
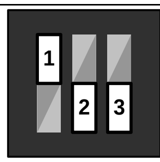
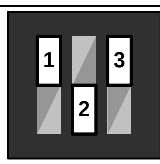
S4 DIP Switch Pattern	Click! 114	Click! 112
	Software configured	Software configured
	Channels 1-4	Channels 1-2
	Channels 5-8	Channels 3-4

Figure D.3 – Channel Group Selection Using Input Mapping Switches (1-4)

The first three baud rate switches (1-3) for S5 are used to select the baud rate for Bus 1. If the first three baud rate switches are all off then the Bus 1 baud rate is software configurable. Otherwise, the pattern of these switches selects the Bus 1 baud rate.

Likewise, the next three baud rate switches (4-6) for S5 are used to select the baud rate for Bus 2.   If these baud rate switches are all off then the Bus 2 baud rate is software configurable. Otherwise, the pattern of these switches selects the Bus 2 baud rate.

S5 DIP Switch Pattern	Bus 1 Baud Rate
	Software configured
	9600 bps
	19200 bps
	38400 bps
	57600 bps
	115200 bps

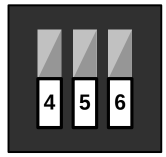
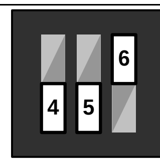
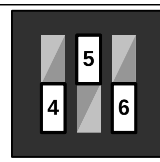
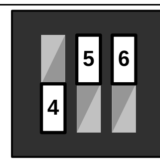
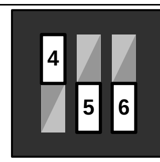
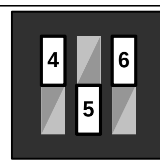
S5 DIP Switch Pattern	Bus 2 Baud Rate
	Software configured
	9600 bps
	19200 bps
	38400 bps
	57600 bps
	115200 bps

Figure D.4 – Baud Rate Selection using Baud Rate Switches

There are two methods of software-driven configuration: mode switch (on the card's front panel) and Click! Supervisor software.

Figure D.1 lists the modes that can be selected using the front panel mode switch. To select a mode hold down the mode switch button, until the corresponding LED activates. Release the button and then momentarily press it once again in order to select the mode.

Menu Mode LEDs	Description
Red	Normal operation
Blue Flashing	Select input channel group
Green	Automatically configure baud rates to a compatible device

Yellow	Manually configure BUS1 baud rate
Yellow Flashing	Manually configure BUS2 baud rate
Red Flashing	Reset configuration to factory defaults
None	Cancel and exit menu

Figure D.5 Front-panel software configuration modes

The Blue Flashing mode is used to select the input channels to map to the output channels. This mode will display the input channel group, but not allow it to be software configured unless the S4 DIP switch makes the channel group selection software configurable. Figure D.2 shows them submenu LED patterns that correspond to specific channel selections. While in the Blue Flashing Mode hold the mode switch until the desired submenu LED pattern is displayed. Release the button and then momentarily press it once again in order to finalize selection of the input mapping. After selection of the channel group, the card will return to the normal operating mode.

Submenu LED Pattern	Click! 114	Click! 112
○○○●	Channels 1-4	Channels 1-2
○○●○	Channels 5-8	Channels 3-4
○○●●	Channels 9-12	Channels 5-6
○●○○	Channels 13-16	Channels 7-8
○●○●	Channels 17-20	Channels 9-10
○●●○	Channels 21-24	Channels 11-12
○●●●	Channels 25-28	Channels 13-14
●○○○	NA	Channels 15-16
●○○●	NA	Channels 17-18
●○●○	NA	Channels 19-20
●○●●	NA	Channels 21-22
●●○○	NA	Channels 23-24
●●○●	NA	Channels 25-26
●●●○	NA	Channels 27-28
○○○○	Cancel menu and exit	Cancel menu and exit

Figure D.6- Blue Flashing Mode Submenu

Note

The LED pattern of all blanks will cancel the menu and exit. Any inactivity of about 1 minute will automatically exit the menu making no selection, and return to normal operation.

The Green mode is used to automatically detect the baud rate for both BUS1 and BUS2. This mode will not be present unless the S5 DIP switch makes the baud rate selection software configurable. Figure D.3 shows them submenu LED patterns that correspond to specific auto-baud actions. While in the Green mode hold the mode switch until the desired submenu LED pattern is displayed. Release the button and then momentarily press it once again in order to execute the desired action.

Submenu LED Pattern	Action
○○○●	Auto-configure baud rate of BUS 1
○○●○	Auto-configure baud rate of BUS 2
○○○○	Cancel menu and exit

Figure D.7 – Green Flashing Mode Submenu

Note

You only have access to the auto baud menu when one or both ports are software configurable.

During auto-discovery the submenu LEDS will sequence. Then, when the baud rate is detected the submenu LEDS will momentarily display an on/off pattern that indicates the detected baud rate (see Figure D.8). If the baud rate could not be detected, all four submenu LEDs will activate. After display of the detected baud rate the card will return to the normal operating mode.

Submenu LED Pattern	Baud Rate
○○○●	9600 bps
○○●○	19200 bps
○○●●	38400 bps
○●○○	57600 bps

○●○●	115200 bps
●●●●	Error

Figure D.8 – Baud Rate Encoding

Note

When the DIP switches control the baud rates, you the specified baud rate is displayed in the menu, but cannot be changed.

The Yellow and Yellow Flashing modes are used to manually software-select the baud rate for Bus 1 and Bus 2 respectively. Figure D.3 shows them submenu LED patterns that correspond to specific auto-baud actions. While in either mode hold the mode switch until the desired submenu LED pattern is displayed (see Figure D.8). Release the button and then momentarily press it once again in order to execute the desired action. If you wish to cancel and exit the menu without having made a selection wait until the submenu LEDs are all blank (see Figure D.9).

Submenu LED Pattern	Action
○○○○	Cancel menu and exit

Figure D.9 –LED Submenu Pattern to Cancel Menu and Exit

The Red Flashing mode is used to reset the sensor to software factory defaults. Please note that the position of the DIP switches may override software factory defaults.

The Click! Supervisor software runs on PC and Pocket PC platforms. To learn how to install the Click! Supervisor software, contact Wavetronix Technical Services or consult the Click! user documentation. To help you select an individual rack card on a multi-drop bus, Supervisor will auto-discover the device ID, model number and description. You may wish to enter into the description field information pertaining to rack slot position and detected traffic direction. For example, you can enter “NB traffic slot 2”. Select the rack card you want to configure from the list (see Figure D.10) and then select the driver you wish to use to configure the card from the list of available drivers.

Once you connect to the rack card, Supervisor will recommend to upgrade the embedded software if a newer version is available. The code files for an upgrade should be installed in the “Click Home\Drivers\112” and “Click Home\Drivers\114” directories. Contact Wavetronix customer service if you have questions regarding the code or driver files in these directories. The last three pairs of numbers in the filename (before the .txt suffix) indicate the release date of the code: YY.MM.DD (year.month.day).

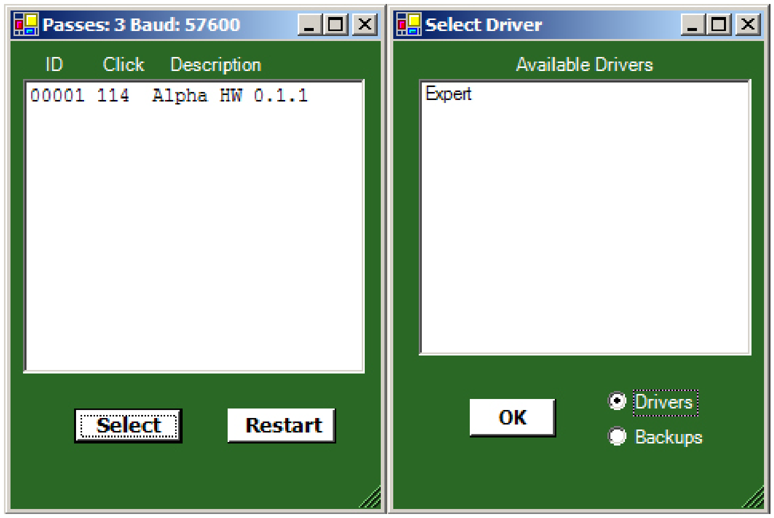


Figure D.10 – Supervisor Connection and Driver Selection

Figure D.11 illustrates the settings that are configurable using the Expert driver. As explained earlier, some settings are only software configurable if the hardware switches are set appropriately. For example, the baud rates for bus 1 and bus 2 are software configurable based upon the configuration of the baud rate switches on the side of the board (S5). If the hardware switches prevent software configuration for a specific setting, the user control will display the current setting, but will be disabled and read-only.

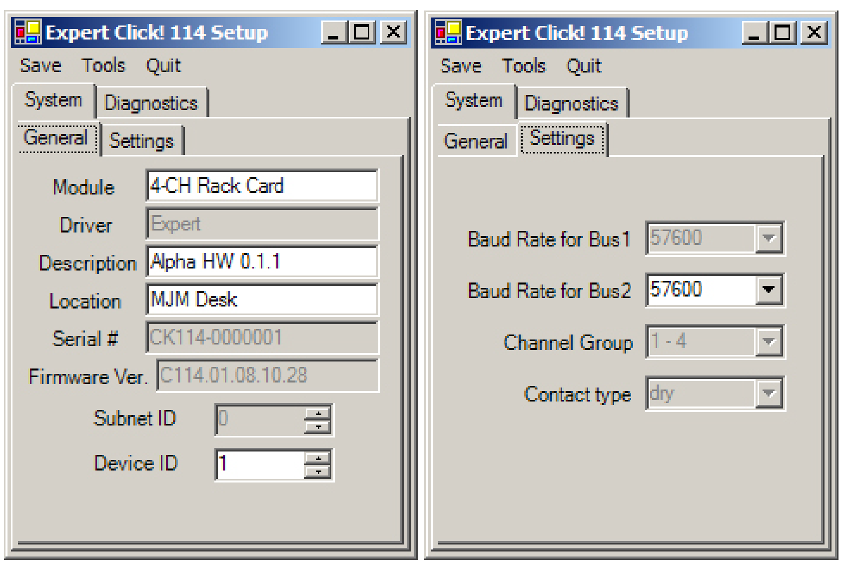


Figure D.11 – Software Configuration

To setup or view the individual address of a rack card click on the Device ID control (see Figure D.11).

The pin out of the Click! 112/114 backplane contacts is shown in Figure D.13.

Pin	Back View Description	Pin	Front View Description
A	-DC (Common)	1	No Connection
B	+DC (12 to 24VDC Power)	2	No Connection
C	Reset Input	3	No Connection
D	No Connection	4	No Connection
E	No Connection	5	No Connection
F	Out Channel 1+, Normally Open / Drain	6	No Connection
H	Out Channel 1-, Common / Source	7	No Connection
J	No Connection	8	No Connection
K	No Connection	9	No Connection
L	Chassis Ground	10	No Connection
M	No Connection	11	No Connection
N	No Connection	12	No Connection
P	No Connection	13	No Connection
R	No Connection	14	No Connection
S	Out Channel 3+, Normally Open / Drain	15	No Connection
T	Out Channel 3-, Common / Source	16	No Connection
U	No Connection	17	No Connection
V	No Connection	18	No Connection
W	Out Channel 2+, Normally Open / Drain	19	No Connection
X	Out Channel 2-, Common / Source	20	No Connection
Y	Out Channel 4+, Normally Open / Drain	21	No Connection
Z	Out Channel 4-, Common / Source	22	No Connection

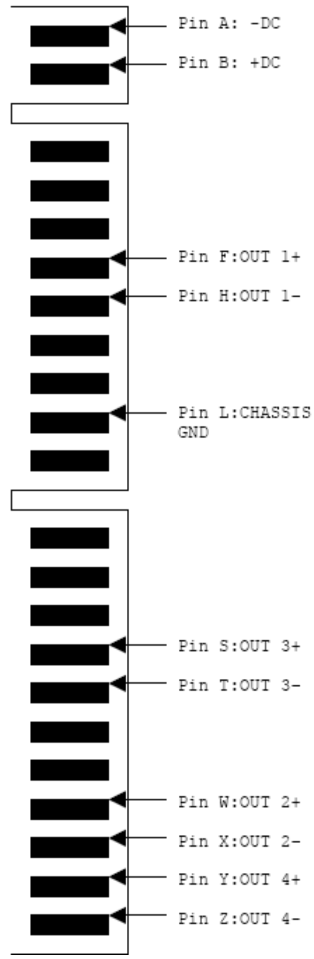
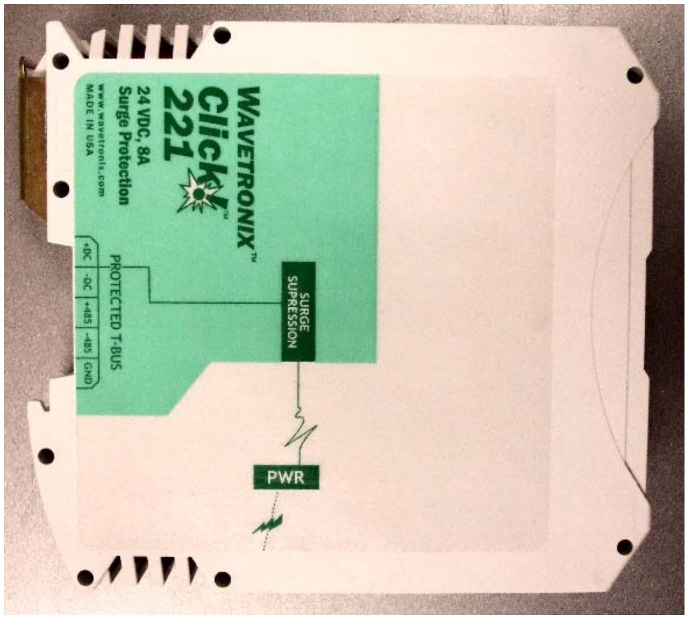


Figure D.12 – Rack Card Pin Out

Appendix E – Click! 221 User Reference Guide

The Click! 221 is a DC 8-Amp surge protection device (8 amps is the maximum rating of a T-bus connector). The DC source voltage and PE (protective earth) should be wired into the screw terminals on the bottom side of the device. A protective earth wire of 12 AWG is recommended. The device works with up to 8 amps of continuous current at a maximum of 28 VDC.

DC-voltage outgoing onto the T-bus is protected from electrical surges incoming from the DC+ and DC- screw terminals. These terminals do not have reverse-polarity protection, but assumes that all downstream devices will have proper polarity protection. The surge protection meets the IEC 61000-4-S 4KV (Class 4) specification.



The LED on the faceplate will be on if the device is properly powered and the surge protection is operational. If the DC wires are wired backwards (reverse polarity), the device is not powered, or the surge protection circuitry is no longer operational the LED will be off. If the LED flickers on an then off when power is applied, this means that the device is conducting power but that the surge is no longer fully functional. When the surge is no longer fully functional, please contact Wavetronix Technical Services for assistance.