SCIENTIFIC TECHNOLOGIES INCORPORATED

31069 Genstar Road
Hayward, CA 94544-7831 USA

Voice 510/471-9717
Fax 510/471-9752

August 15, 1995

RE: Profiling Vehicle Separation Sensor for Automated Toll Systems

Enclosed is information regarding products used for vehicle profiling separation sensing applications for Automated Toll Systems. These products offer performance and features unmatched in the industry. These performance features include the following:

- Detection of the smallest trailer hitches consistently
- Unique DoubleScan software available for improved resolution
- Microprocessor based control for added intelligence
- Easy installation and alignment
- No false readings due to vibration from large vehicles
- Excess gain of 25 to 1 allows operation in rain, snow, direct sunlight, and vehicle head lights
- Operation in temperatures from -22F to 158F
- Serial or parallel data transfer allowing access to each beam
- Custom software available, including software to ignore small objects
- 0.5 inch, 0.75 inch, 1.5 inch beam spacing available
- Scanner heights available from 1 to 5 feet (other custom lengths and beam spacings available
- Stainless steel and aluminum environmental enclosures available with defroster system

Who is STI? STI is a publicly traded diversified manufacturer of factory automation equipment including profiling scanners and sensors, optical sensors, fiber optics, micro computers and optical and radio frequency modems. After introducing the infrared solid proximity control in March of 1971, STI has become the leader in moduled infrared array scanners. Please feel free to contact us for more information, or add us to your bidder's list. We look forward to hear about your specific application and needs. My telephone number is 1-800-221-7060 Ext. 101.

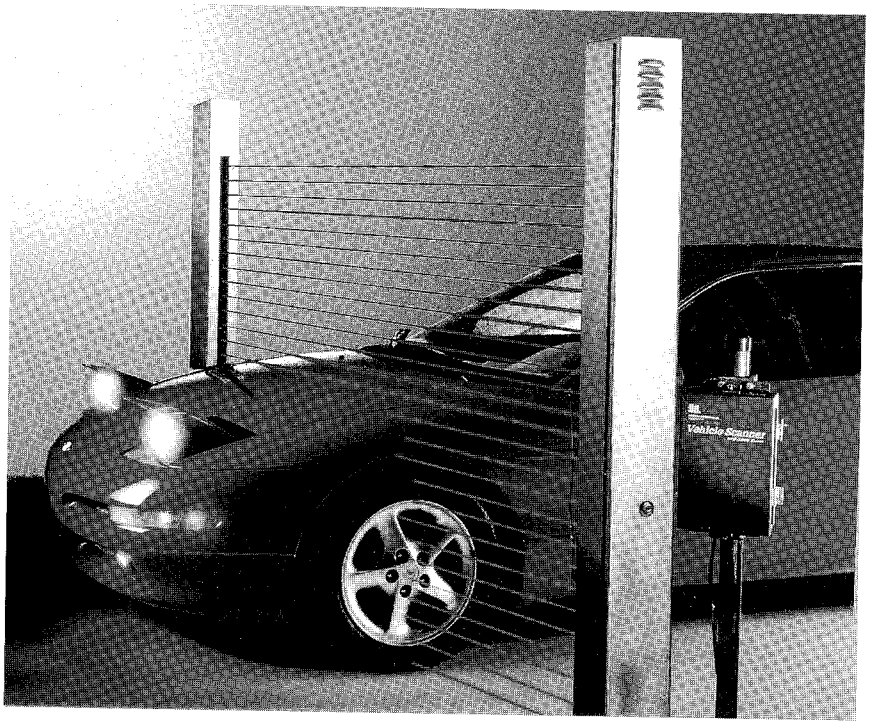
Best regards,

James A. Lazzara
Senior Vice President

JJL/ch

P.S. See you at IBTTA in New York

VEHICLE SCANNER



Features

- High speed profiling scanners for scanning moving vehicles.
- Specifically designed for vehicle detection and classification in automated toll systems.
- Three beam spacings available: 0.5, 0.75, and 1.5 inches (12.7, 19.1 and 38.1 mm).
- Maximum range of 80 feet (24 m), provides high excess gain when used for normal lane widths.
- High degree of immunity to all kinds of ambient lighting.
- Four separate outputs: RS-232 or RS-422 serial data, parallel data, relay and optional analog output solid-state relay driver.
- Non-volatile RAM to store user's settings.
- Default mode suitable for many applications.
- Towers serve as heavy duty environmental enclosures.
  - Rugged stainless steel design or aluminum with corrosion resistant paint.
  - Fan prevents overheating in summer.
  - Defroster prevents build-up of ice and frost on the optical window in cold weather.
- Special software ignores small objects such as snowflakes while still detecting narrow trailer hitches.

Description

STI's VSS6000 Vehicle Scanner is a family of high speed profiling scanners specifically designed for vehicle detection and classification in automated toll systems. A complete Vehicle Scanner consists of a transmitter, a receiver, a controller, two tower environmental enclosures, and interconnecting cables.

The transmitter houses a linear array of LED's (light emitting diodes) while the receiver has a linear array of photodetectors. Each LED and its corresponding photodetector form a beam. When a vehicle passes between the transmitter and receiver some of the beams will be blocked, and the vehicle is detected.

The Vehicle Scanner comes in scanning lengths of 2, 3, 4, and 5 feet (610, 914, 1219 and 1524 mm). Each length is available with beam spacings of 0.5, 0.75, and 1.5 inches (12.7, 19.1, and 38.1 millimeters) providing resolution of 0.75, 1.125, and 2.25 inches (19.1, 28.6, and 57.2 millimeters) respectively.

Vehicle Separation

The VSS6000 provides a relay and a relay driver for simple on or off vehicle detection in separator applications. A sophisticated software function enables reliable vehicle detection using this simple control output.

Some less sophisticated vehicle separators have difficulty distinguishing between a tailgating vehicle and a trailer following a vehicle. When these systems are set to detect small objects, they distinguish between the tailgater and the trailer but small objects such as birds, insects, and even snowflakes can be erroneously detected as vehicles. When the system is set to detect only larger objects they fail to distinguish between the tailgater and the trailer.

STI's Vehicle Scanner overcomes this difficult problem with a special software function that allows you to set separate turn-on and turn-off sizes for the output. A high turn-on size prevents false detection of small objects as vehicles, while a low turn-off size ensures the scanner detects only one vehicle if the vehicle's profile changes to a narrow hitch and then to the trailer.

Classification

The VSS6000 is ideal for integration into classification systems. The scanner includes an 8-bit parallel output and an RS-232 or RS-422 serial data output that can be used for this purpose. An optional analog output is also available. For these systems, the scanner provides a series of measurements as the vehicle passes. The classification system records these measurements and interprets them to determine the class.

Note that the scanner does not directly classify the vehicles, but provides measurements for an external system to perform this operation. The outputs for classification and detection can be used simultaneously.

Custom Scanners

For applications requiring longer scan lengths or different beam spacing including variable beam spacing, please contact STI. For appropriate quantities, STI will consider custom hardware and software modifications to the Vehicle Scanner system.

Environmental Towers

To protect the scanners from the elements and vandalism, the VSS6000 has rugged environmental enclosure towers. These are available in 316 stainless steel or aluminum with a special corrosion resistant polyurethane paint. The enclosures have a defroster to prevent frost and ice from building up on the window, and a fan to keep the scanner from overheating in hot weather.

Range

The VSS6000 has a range of 80 feet, which provides an excess gain of 25 when used at the typical lane width of 16 feet. This gain minimizes the impact of dirt and grime on the optical performance of the scanner.

Setup

The Vehicle Scanner uses a microprocessor to control the system. Although the factory default settings work in many applications, some applications will require other settings. Setup is easy using a personal computer or an ASCII terminal. After changing the settings you instruct the controller to store them in non-volatile RAM. A switch setting allows you to start the scanner using your custom settings or the factory default. Setup commands are fully documented in the installation manual, available upon request.

Special Functions

The Vehicle Scanner incorporates many special functions. These are built into the operating software and can be activated through the setup commands. A brief synopsis is presented here, and further information is available in the installation manual or by calling STI.

DoubleScan – improves resolution by a factor of 2 for some applications.

Synchronous, hardware and software triggers – allows you to update the scanner's outputs at regular time intervals or upon demand.

Masking – allows you to manipulate the reported status of each beam.

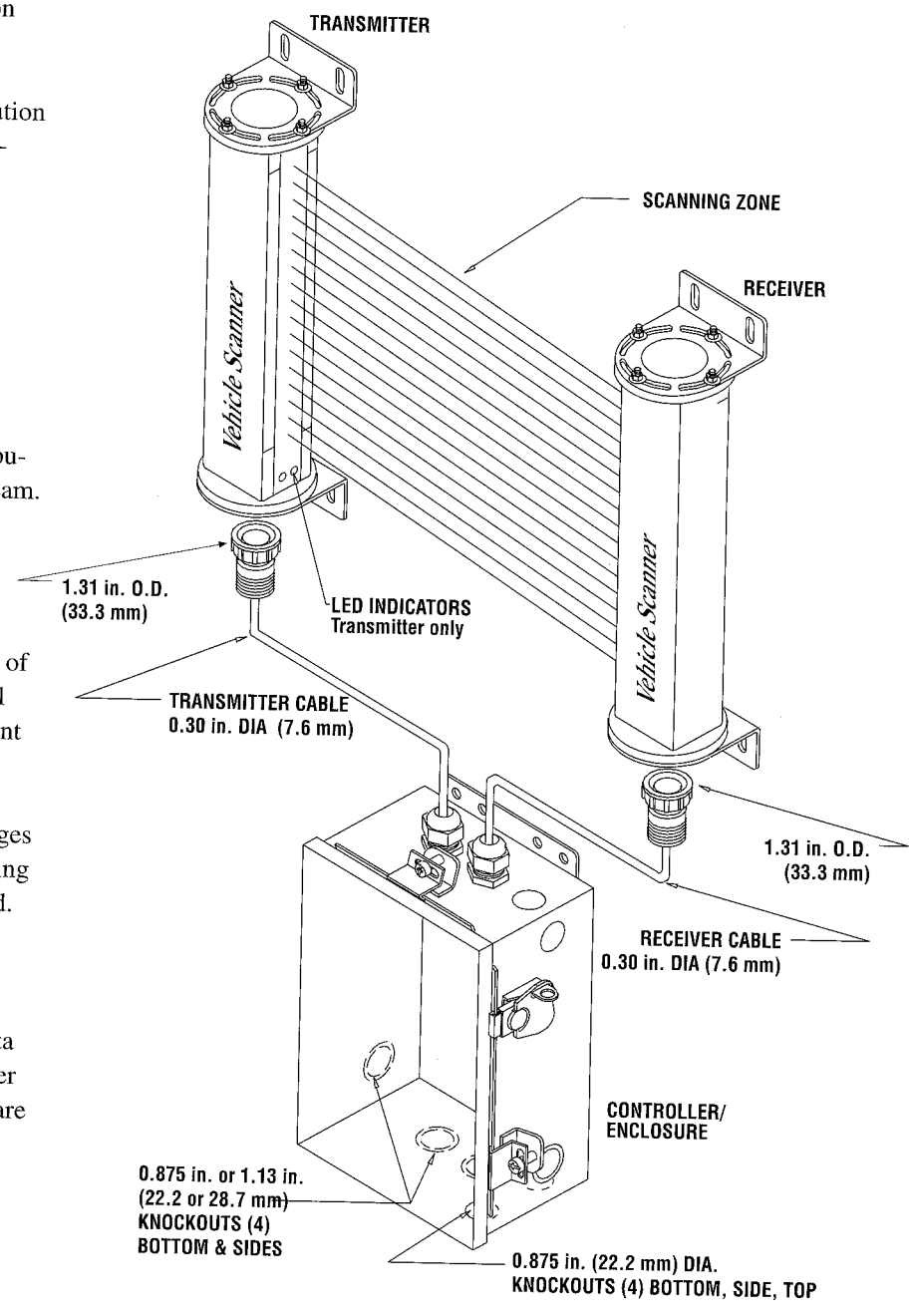
Screen – allows you to set a minimum value to be reported.

Quiet mode – inhibits reporting of repetitive zero values on the serial data output, minimizing the amount of data to be processed.

Delta mode – reports only changes on the serial data output, minimizing the amount of data to be processed.

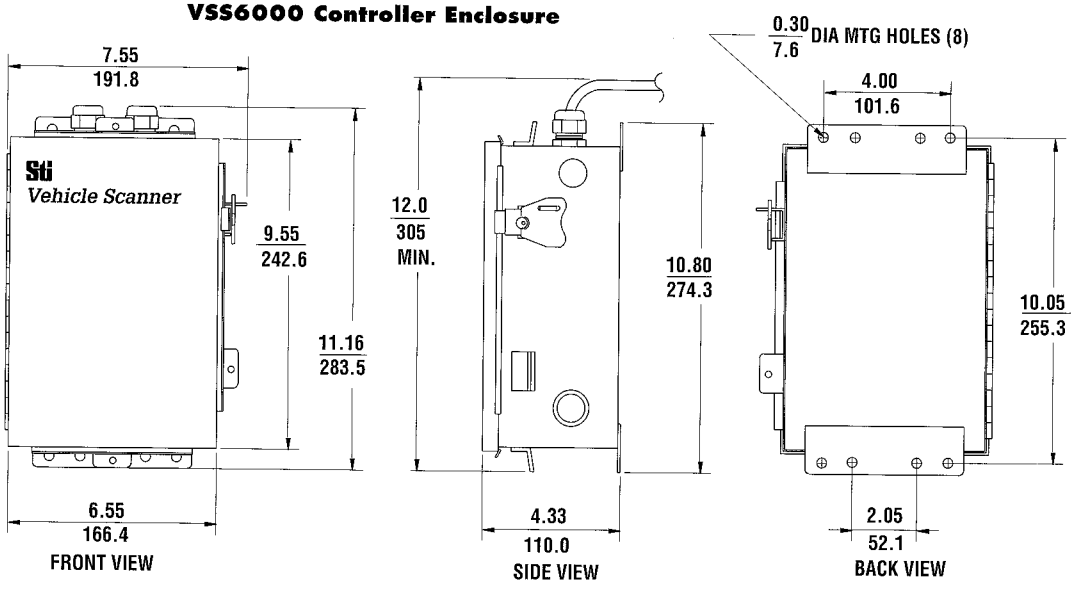
Heartbeat – forces serial data output reports at regular time intervals in spite of Quiet and Delta modes. Used to indicate the scanner is functioning even if no vehicles are detected over a long time period.

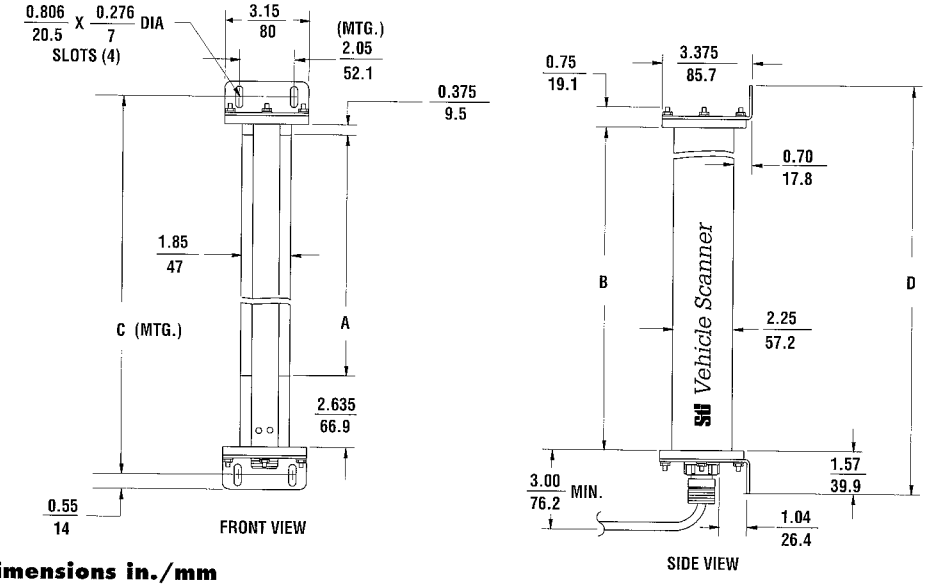
System Drawing



Dimensional Drawings

VSS6000 Controller Enclosure

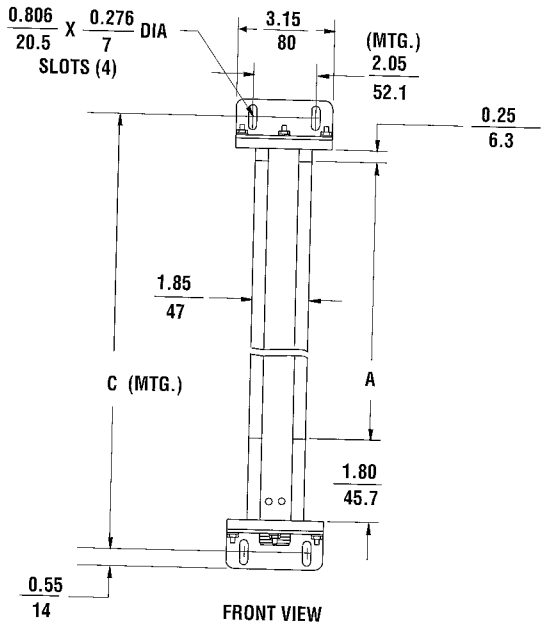


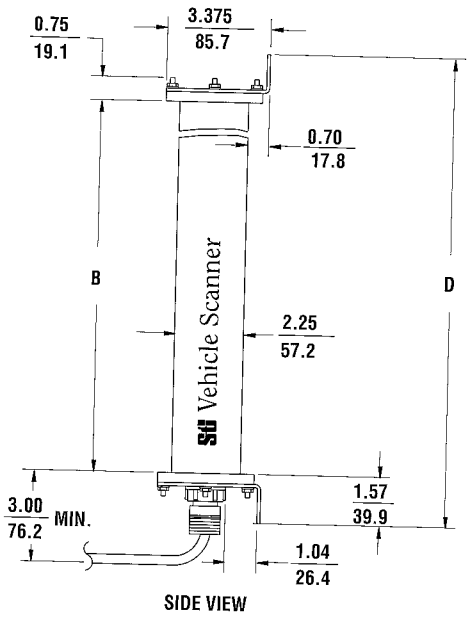


VSS6000-0.50 Series Dimensions in./mm

Scan Length	A	B	C	D
24/609.6	23.5/596.9	26.5/673.1	28.5/723.9	29.6/751.8
36/914.4	35.5/901.7	38.5/977.9	40.5/1028.7	41.6/1056.6
48/1219.2	47.5/1206.5	50.5/1282.7	52.5/1333.5	53.6/1361.4
60/1524	59.5/1511.3	62.5/1587.5	64.5/1638.3	65.6/1666.2

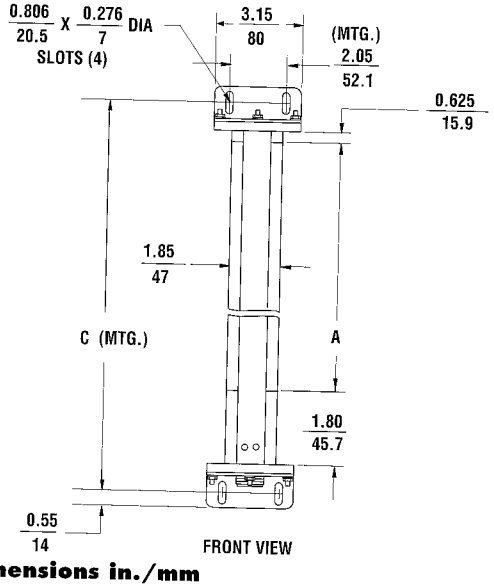
Dimensional Drawings

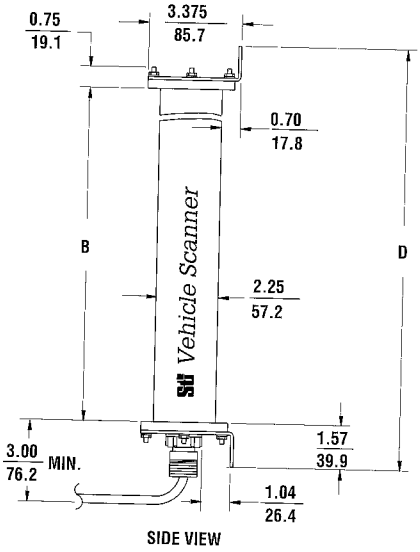




VSS6000-0.75 Series Dimensions in./mm

Scan Length	A	B	C	D
24/609.6	23.25/590.6	25.3/642.6	27.3/693.4	28.4/721.4
36/914.4	35.25/895.4	37.3/947.4	39.3/998.2	40.4/1026.2
48/1219.2	47.25/1200.2	49.3/1252.2	51.3/1303.0	52.4/1330.0
60/1524	59.25/1505.0	61.3/1557.0	63.3/1607.8	64.4/1635.8





VSS6000-1.50 Series Dimensions in./mm

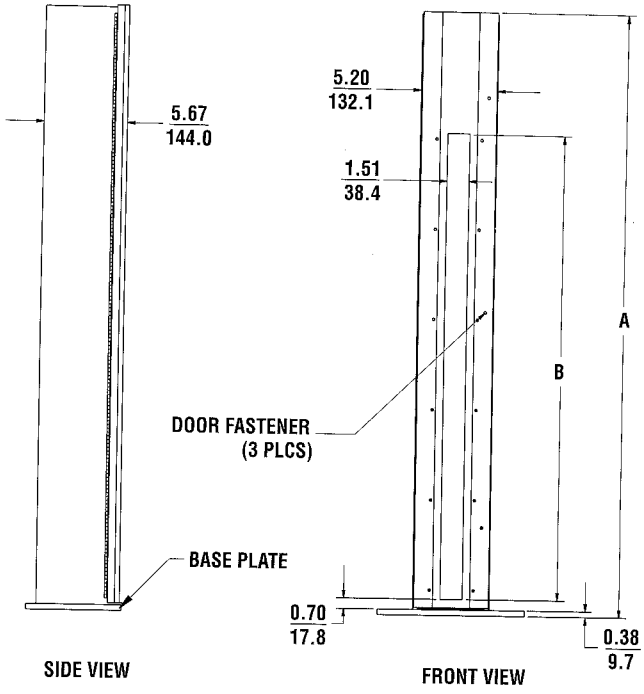
Scan Length	A	B	C	D
24/609.2	22.88/581.2	25.3/642.6	27.3/693.4	28.4/721.4
36/914.4	34.88/886.0	37.3/947.4	39.3/998.2	40.4/1026.2
48/1219.2	46.88/1190.8	49.3/1252.2	51.3/1303.0	52.4/1330.0
60/1524	58.88/1495.6	61.3/1557.0	63.3/1607.8	64.4/1635.8

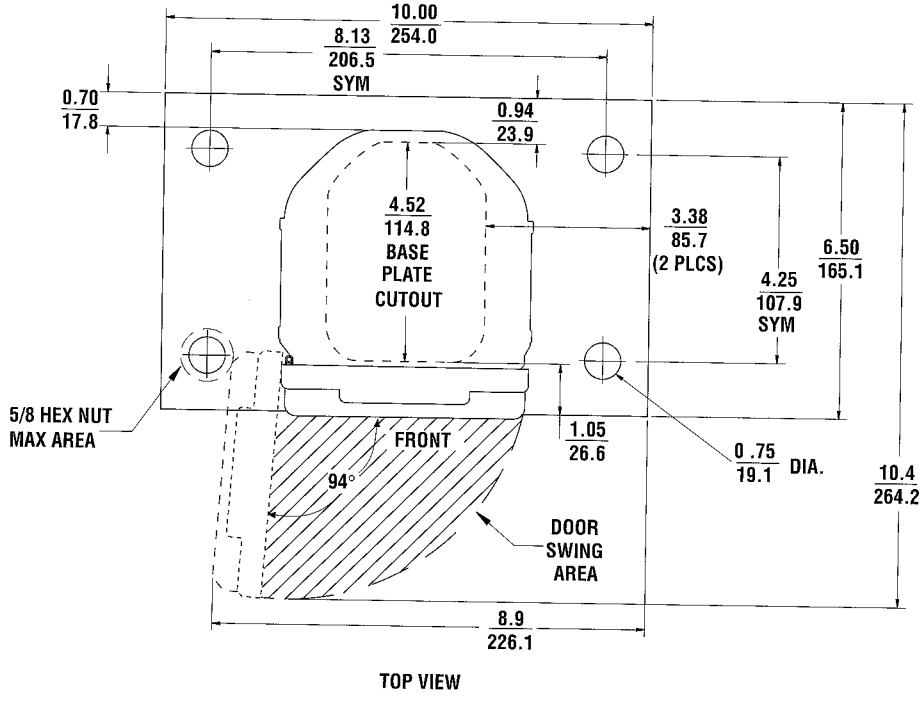
Dimensional Drawings

Aluminum Tower

VSS6000-ENC-AL Dimension in./mm

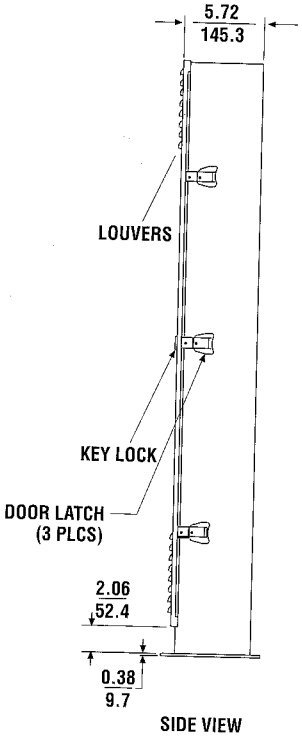
Scan Length	A	B
24/609.6	40.1/1019	31.0/787
36/914.4	52.1/1323	43.0/1092
48/1219.2	64.1/1628	55.0/1397
60/1524	76.1/1933	67.0/1702



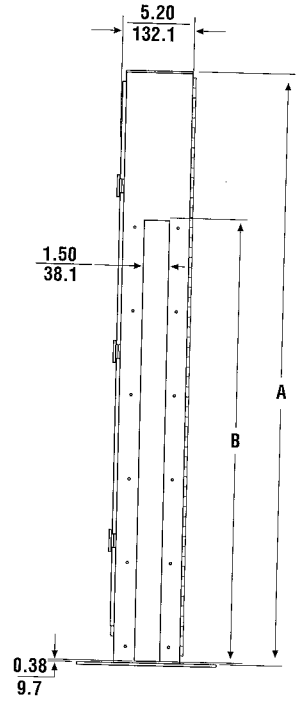


Dimensional Drawings

Stainless Steel Tower



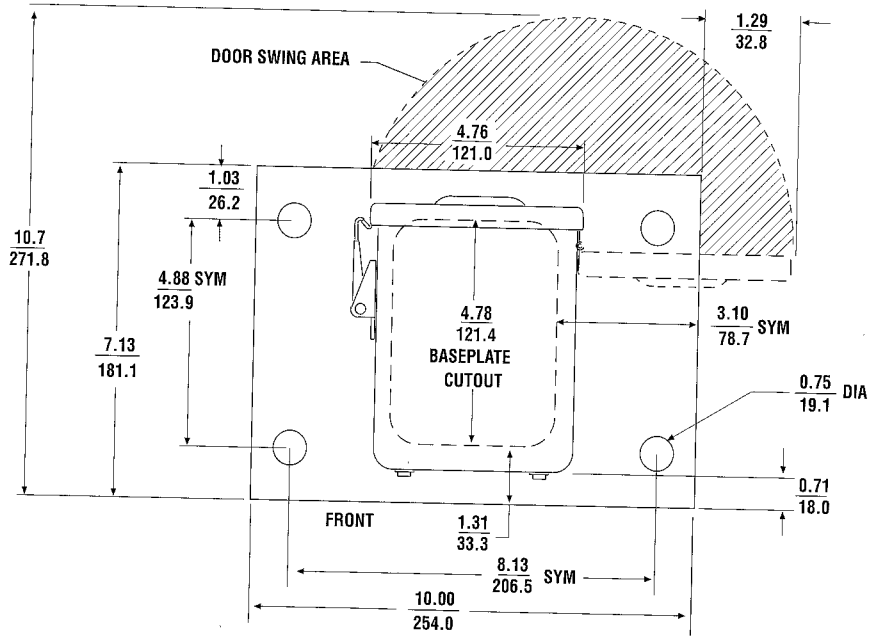
SIDE VIEW



FRONT VIEW

VSS6000-ENC-SS Dimension in./mm

Scan Length	A	B
24/609.6	42.5/1080	31.5/800
36/914.4	54.5/1384	43.5/1100
48/1219.2	66.5/1689	55.5/1410
60/1524	78.5/1994	67.5/1710



TOP VIEW

Specifications

Beam Spacing

0.5, 0.75, or 1.5 inches; 12.7, 19.1, or 38.1 mm. Other spacings available – consult factory.

Scan Lengths

2, 3, 4, or 5 feet; 609.6, 914.4, 1219.2 or 1524 mm. Other lengths available – consult factory.

Operating Range

16 ft. (4.9 m) with excess gain of 25.
80 ft. (24.4 m) with gain of 1.

Minimum Detectable Object

Beam Spacing	Minimum Detectable Object
0.5 in (12.7 mm)	0.75 in (19.1 mm)
0.75 in (19.1 mm)	1.125 in (28.6 mm)
1.5 in (38.1 mm)	2.25 in (57.2 mm)

Scan Rate

50 µs x the number of beams set plus 200 µs. (Scanner can be set to scan fewer beams than are physically present.) When the serial port is used to communicate excessively long data, the communication time may exceed the scan time. Scan time will be delayed until communication is complete.

Serial Communications

RS-232 or RS-422 with standard firmware
19,200 or 38,400 baud rate.

Analog Output Model No. AIC-02 (Optional)

Selectable for -4 to -20 mA, -10 to +10 VDC, or 0 to +10 VDC

Analog Relay Card Model No. ARC-02 (Optional)

Provides 4 relays driven by the analog output. Each has an independent potentiometer to set the turn-on point, an indicator LED, and an SPDT electromechanical relay.

Parallel Output

8 bits, 0 to +5 VDC transition. Sources or sinks 16 mA. Optional connection kit provides terminal block wiring for the parallel output (Model No. VS6500-PCK). Separate DATA VALID bit indicates when output is in a valid state.

Relay Output

SPDT; 25 VDC maximum voltage, 100 mA maximum current. Do not use this relay to control AC voltages.

Solid State Output

Sinks 100 mA maximum at 5 VDC maximum.

Power Requirements

– Scanner

115 VAC, 230 VAC ±10%, 50/60 Hz or

24 VDC ± 2 VDC, 100 mV ripple maximum, 30 VA power consumption

– Environmental Towers

- 120 VAC versions: 240 VA maximum
- 24 VAC versions:

Scan Length	Power Requirements
24 in. (610 mm)	80 VA
36 in. (914 mm)	80 VA
48 in. (1219 mm)	130 VA
60 in. (1524 mm)	175 VA

Hardware Trigger

– Optically isolated input. Signal transition between 0 and +5 VDC required. Positive signal is active. Be sure to limit current to 20 mA maximum. Input circuit does not provide limiting.

– If trigger persists for less than the scan time, then one update of the outputs will occur.

– If trigger persists for longer than one scan time, then the outputs will update continuously while trigger persists.

– Minimum trigger time is 200 µs.

Transmitter and Receiver Cables

Maximum Length: 100 ft. (30 m)

Environmental rating

Scanner: NEMA 4, 12, IP 65.

Environmental Tower: NEMA 3.

Temperature Rating

Scanners alone: 32° to 131°(0° to 55° C).

In environmental enclosures: -22°to 131°F (-30° to 55°C)

Consult factory if your application exceed these temperatures.

Endurance

– X, Y, Z Axes

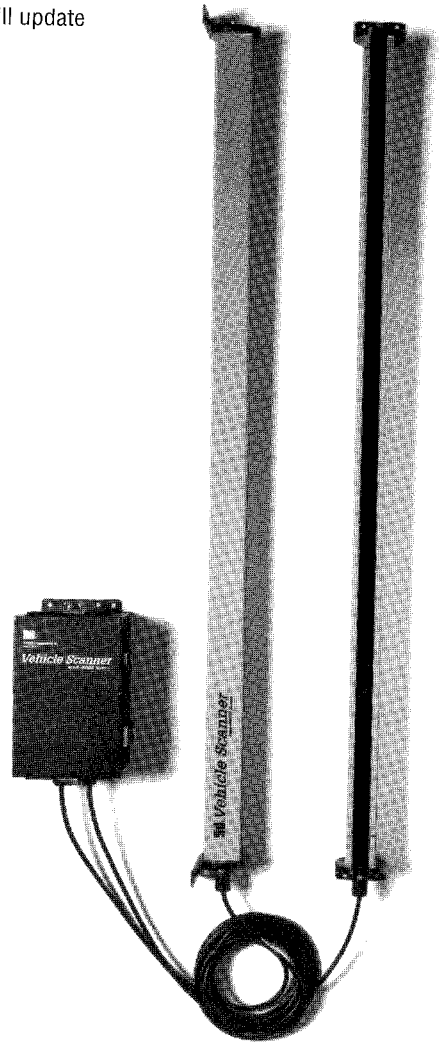
Vibration: 0 to 100 Hz

Acceleration: 10 G, 98 m/s²

Shock: 3.0 ft-lb, 4.1 Joules

Safety Agency Approvals

UL and CSA pending on scanners only, (not towers).



Outputs

The outputs of the scanner can provide different information depending upon your setup configuration. The standard Vehicle Scanner firmware (VSS6000-FW1) allows you to set the serial data, analog, and parallel outputs independently of each other.

– Serial Data RS-232 or RS-422

Binary or ASCII:	Status of each beam
	Highest beam blocked
	Lowest beam blocked
	Size of the largest object detected
Binary only:	Total number of beams blocked
	Position of the center of the largest object detected
	First beam blocked and the number of beams blocked for the largest object detected.
ASCII only:	Number of objects detected, the position and size of each. Position is the first beam blocked and size is the number of beams blocked.

– Analog and Parallel Outputs

Total number of beams blocked
Highest beam blocked
Lowest beam blocked
Size of the largest object detected
Position of the center of the largest object detected

– Relay

Detection of any beams blocked
Detection of a minimum number of objects
Hysteresis to specify the turn-on and turn-off points for the relay

Selection Charts

Transmitters

Scan Length	Beam Spacing 0.5 inch	0.75 inch	1.5 inch
24 inch	VSS6024-0.50X	VSS6024-0.75X	VSS6024-1.50X
36 inch	VSS6036-0.50X	VSS6036-0.75X	VSS6036-1.50X
48 inch	VSS6048-0.50X	VSS6048-0.75X	VSS6048-1.50X
60 inch	VSS6060-0.50X	VSS6060-0.75X	VSS6060-1.50X

Receivers

Scan Length	Beam Spacing 0.5 inch	0.75 inch	1.5 inch
24 inch	VSS6024-0.50R	VSS6024-0.75R	VSS6024-1.50R
36 inch	VSS6036-0.50R	VSS6036-0.75R	VSS6036-1.50R
48 inch	VSS6048-0.50R	VSS6048-0.75R	VSS6048-1.50R
60 inch	VSS6060-0.50R	VSS6060-0.75R	VSS6060-1.50R

Aluminum Environmental Tower Enclosures

All enclosures include defroster and ventilation fan and work for transmitters or receivers.

	Operating Voltage for defroster and fan	
Scan Length	**120 VAC**	**24 VAC**
24 inch	VSS6024-ENC-AL-AC120	VSS6024-ENC-AL-AC24
36 inch	VSS6036-ENC-AL-AC120	VSS6036-ENC-AL-AC24
48 inch	VSS6048-ENC-AL-AC120	VSS6048-ENC-AL-AC24
60 inch	VSS6060-ENC-AL-AC120	VSS6060-ENC-AL-AC24

Stainless Steel Environmental Tower Enclosures

All enclosures include defroster and ventilation fan and work for transmitters or receivers.

	Operating Voltage for defroster and fan	
Scan Length	**120 VAC**	**24 VAC**
24 inch	VSS6024-ENC-SS-AC120	VSS6024-ENC-SS-AC24
36 inch	VSS6036-ENC-SS-AC120	VSS6036-ENC-SS-AC24
48 inch	VSS6048-ENC-SS-AC120	VSS6048-ENC-SS-AC24
60 inch	VSS6060-ENC-SS-AC120	VSS6060-ENC-SS-AC24

Controller, Firmware, and Documentation

VSS6000-CTLR	Controller with NEMA 4 enclosure, for AC 120 or 230 V
VSS6000-CTLR-PCB	Controller, circuit board assembly (no enclosure) for 24 VDC
VSS6000-FW1	Standard firmware for operating controller
VSS6000-DOC	Documentation kit, including installation manual and demonstration/setup software

Cables

Cable Length	Transmitter Cable	Receiver Cable
25 ft (7.6 m)	QCX-25	QAR-25
50 ft (15.2 m)	QCX-50	QAR-50
75 ft (22.9 m)	QCX-75	QAR-75
100 ft (30.5 m)	QCX-100	QAR-100

Options

Model No.	Description
AIC-02	Analog Isolator Card: provides analog output or 0 to +10 VDC, -10 to +10 VDC, or current loop of -4 to -20 mA
ARC-02	Analog Relay Card: provides 4 SPDT relays driven by analog output. Each has a potentiometer to set the turn-on point and an LED indicator.
25194-0010	Rubber mounting gasket for aluminum towers.
25194-0020	Rubber mounting gasket for stainless steel towers.

Ordering Checklist

Before ordering you will need to consider the following:

- Beam spacing needed and size of object you need to detect
- Scanning length
- Environmental conditions
- Tower enclosure material
- Tower operating voltage (120 or 24 VAC)
- Do you need an enclosure for the controller
- Operating voltage: 120 or 230 VAC, 24 VDC
- Cable length: transmitter to controller
- Cable length: receiver to controller
- Number of documentation kits required

For one complete Vehicle Scanner system order the following items:

- One transmitter
- One receiver (must be the same beam spacing and scan length as the transmitter)
- Two tower enclosures
- One controller - specify if operating voltage is other than 120 VAC.
- Firmware kit
- Cable: transmitter to controller
- Cable: receiver to controller
- Documentation kit

Applications Assistance

If you need assistance in selecting the proper scanner or need to discuss possible custom configurations please call our applications engineering department.

⚠ CAUTION!

STI photoelectric scanners are not designed for and should never be used for personnel protection (safety) applications. STI has a wide range of special safety products designed for use in these applications. Contact STI for information on our safety products.

Corporate Headquarters (after January 1, 1996)
Scientific Technologies Inc.
6550 Dumbarton Circle
Fremont, CA 94555
Internet Address:
sales @ sti.com

European Sales Office
STI Scientific Technologies GMBH
Bötzinger Straße 29
79111 Freiburg, Germany
Voice: 49 761-455 26 0
Fax: 49 761-455 26 26