SAFETY, TECHNOLOGY & INNOVATION

OMRON

OptoShield OS3101 Series
Installation and Operating Manual

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OS3101 Series

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1 IMPORTANT SAFETY WARNINGS

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⚠ ***WARNING!*** ***Read and understand this section prior to installing the OptoShield OS3101 system.***

An OptoShield OS3101 system is a general purpose presence sensing device designed to guard personnel working around hazardous machinery.

Whether a specific machine application and OptoShield OS3101 system installation complies with safety regulations depends on the proper application, installation, maintenance and operation of the OS3101 system. These items are the responsibility of the purchaser, installer and employer.

The employer is responsible for the selection and training of personnel to properly install, operate, and maintain the machine and its safeguarding systems. An OS3101 system should only be installed, verified and maintained by a ***qualified*** person. A qualified person is defined as "*a person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training or experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work*." (ANSI B30.2-1983)

To use an OS3101 system the following requirements must be met:

— The guarded machine **must** be able to stop anywhere in its cycle. Do not use a safety sensor on a press with a full-revolution clutch.

— The guarded machine must not present a hazard from flying parts.

— The guarded machine must have a consistent stopping time and adequate control mechanisms.

— Severe smoke and particulate matter may degrade the efficiency of a safety sensor, causing it to unexpectedly enter a Machine Stop state.

— Use of mirrors in the protection plane must be avoided, as they can hide part of the area to be monitored.

— All applicable governmental and local rules, codes, and regulations must be satisfied. This is the employer's responsibility.

— All safety-related machine control elements must be designed so that an alarm in the control logic or failure of the control circuit does not lead to a failure to danger.

— Additional guarding may be required to prohibit access to dangerous areas not covered by the OS3101 system.

— Perform the Omron STI test procedure at installation and after maintenance, adjustment, repair or modification to the machine controls, tooling, dies or machine, or the OS3101 system.

— Perform only the test and repair procedures outlined in this manual.

— Follow all procedures in this manual for proper operation of the OS3101 system.

— An additional measurement error may need to be added due to reflective backgrounds, refer to Section 11—*Specifications and Additional Information*.

The enforcement of these requirements is beyond the control of Omron STI. The employer has the sole responsibility to follow the preceding requirements and any other procedures, conditions and requirements specific to his machinery.

2 DESCRIPTION OF USE AND FEATURES

2.1 THEORY OF OPERATION

The OptoShield OS3101 is an optical safety sensor that uses diffuse reflection of a pulsed laser light to determine the location of objects entering a predefined zone. Internally, a spinning mirror assembly scans an area by sending a pulse of light which reflects off the first object in its path. The distance from the sensor to the object is determined by meauring the time that the light requires to return from the sensed object. This sequence is repeated as the optical assembly rotates so that the entire intended area is scanned.

This method of sensing allows for standard, simple or irregular shapes to be used as the predetermined sensed safety zones. It also allows for the safety zone to be changed if the hazardous area changes. Using diffused reflection of light back to the same sensor that emits it precludes the need for a traditional transmitter/receiver pair.

Within the sensing range of the OS3101, two fields can be defined simultaneously.

- A *Safety Zone* is used to detect personnel or other objects entering an area that has been determined to be a hazard. Upon sensing that the object is within the Safety Zone, the sensor will send a stop signal to the control circuitry of the machine being guarded.
- A *Warning Zone* can be defined to detect objects that are closely approaching the hazardous area of the Safety Zone and can be used to initiate a warning signal for personnel before the actual Safety Zone is encroached.

Applications for the OS3101 included stationary use, such as within a robotic work cell, in front of a press or around other hazardous machinery; as well as mobile applications on automatic guided vehicles (AGV) or transfer carts.

NOTE: The applications described in this manual are for informational and instructional purposes only, and may not respresent actual usage. This publication has been carefully checked for accuracy and is thought to be fully consistent with the product it describes. However, Omron STI does not assume liability for the contents of this publication or the use of any products described herein. Omron STI reserves the right to make changes to the products and/or documentation without further notification.

2.2 FEATURES

2.2.1 STANDARD FEATURES

- Diagnostic Code Display
- Intrusion Indicators (IIs)
- Three possible operating modes:

— Automatic Start (with or without delay)

— Start Interlock

— Start/Restart Interlock

- Two Safety (PNP) Outputs
- Selective Auxiliary Output (PNP or NPN option configured at factory)

— Follow mode

— Alarm mode

- Selective Warning Output (PNP or NPN option configured at factory)

— Warning Zone mode

— Weak Signal mode

— Warning Zone/Weak Signal mode

2.2.2 CONTROL INPUTS

- Reset Input
- ED (MPCE) Monitoring
- External Zone Select

2.2.3 OPTIONAL FEATURES

- DeviceNet

2.2.4 System Components

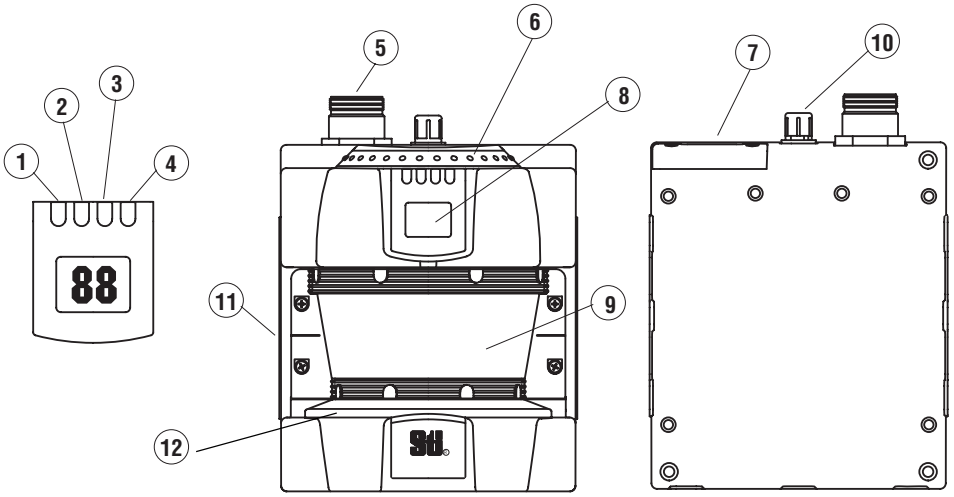

Figure 2-1 System Components

System Components and Indicators		Description
1	Machine Run (green)	Status indicator: green LED will light when no intrusion is detected in the safety zone.
2	Machine Stop (red)	Status indicator: red LED will light when an intrusion is detected in the safety zone.
3	Interlock (yellow)	Status indicator: yellow LED will light (interlock) when an waiting for restart signal.
4	Auxiliary/Warning Zone Output (amber)	Status indicator: amber LED will light when intrusion is detected in warning zone or the aux. output is activated.
5	Power & Controls Connector	A 14-pin mini-type connector is provided for power and control connections.
6	Intrusion Indicators	These LEDs will light when an intrusion is detected in the section, 16 sectors total. Each sector = 11.25°.
7	Serial Port Connector	A DB-9 connector is provided for RS232 interface.
8	Status/Diagnostic Display	Two 7-segment displays are provided for status and diagnostic information.
9	Scan Window	The window where the light is emitted and received.
10	DeviceNet Connector	A 5-pole, M-12, male connector for DeviceNet interface (optional).
11	Scan Plane Indicator	This mark (arrow) indicates the exact location of the scan plane.
12	Dust Ring	Dust detection cover with refllective surface.

Table 2-1 System Components and Indicators

3 SYSTEM OPERATION

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3.1 OPERATING STATES

The operating condition of an OptoShield OS3101 system is described in terms of states. The following operating states exist for the OS3101 system.

3.1.1 MACHINE RUN

The two scanner safety outputs are in the ON state, the green machine run indicator is lit, and the auxiliary output is in a state consistent with its configuration. The protected machine is allowed to operate. Pressing and releasing the start button has no effect.

3.1.2 MACHINE STOP

The two scanner safety outputs are in the OFF state, the red machine stop indicator is lit, and the auxiliary output is in a state consistent with its configuration. The protected machine is not allowed to operate.

3.1.3 INTERLOCK

The two scanner safety outputs are in the OFF state, the red machine stop indicator and yellow interlock indicator are lit. The auxiliary output is in a state consistent with its configuration. The interlock state does not allow the protected machine to operate until the detection zone is clear of intrusion and the start button is pressed and released.

3.1.4 FAULT

The two scanner safety outputs are in the OFF state, the red machine stop indicator is lit, the yellow interlock indicator is flashing, and the auxiliary output is in the OFF state. The fault state does not allow the protected machine to operate. The primary difference between fault and interlock is that the OS3101 system will remain in the alarm state until the alarm is corrected, regardless of power cycling or an external start button press and release.

		Optoshield Operating Indicator Status			
Diagnostic Display	**OS3101 Status**	**Machine Run (Green)**	**Machine Stop (Red)**	**Aux./Warning Output**	**Safety Outputs**
XX**	Machine Run	ON	OFF	Configuration Dependent. See Section 3.3.1.	ON
– –	Machine Stop	OFF	ON	Configuration Dependent. See Section 3.3.1.	OFF
01	Interlock	OFF	ON	Configuration Dependent. See Section 3.3.2.	OFF
5X	Fault	OFF	ON	ON (If it is configured for Alarm mode.)	OFF

**See *Table 3-5* for more information.

Table 3-1 Operating States

3.2 OPERATING MODES

3.2.1 AUTOMATIC START

In Automatic Start mode, the sensor will power up with its OSSD outputs in the OFF state. It will perform system initialization and self-tests and if no intrusion is detected within the protected zone, enter the Machine Run state. An object entering the protected zone shall cause the sensor to change from Machine Run to Machine Stop within the specified response time, and remain in Machine Stop

for as long as the intrusion remains in the protected zone. Once the protected zone is clear, the sensor will automatically change from Machine Stop to Machine Run with no operator intervention.

Optoshield Modes:Automatic Start				
	Indicator Status		Output Status	
Power UP State	Machine Run (Green)	Machine Stop (Red)	Aux./Warning	Safety
Safety Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	ON
Safety Zone Infringed	OFF	ON	Configuration Dependent. See Section 3.3.2.	OFF
Warning Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	
Warning Zone Infringed	ON	OFF	Configuration Dependent. See Section 3.3.2.	

Table 3-2 Automatic Start Mode

3.2.2 START INTERLOCK

In Start Interlock mode, the sensor will power up with its OSSD outputs off and perform system initialization and self test. If no fault is detected and the protected zone is clear of intrusion, the sensor enters the Interlock state. If an obstruction is present, the sensor will remain in Machine Stop. When the obstruction is clear of the protection zone, the sensor automatically transitions to Interlock. The sensor's OSSD outputs will remain in the OFF state during power up testing, initialization, and transition to Interlock. The operator must press and release the sensor's Start button before the sensor enters the Machine Run state. Once the sensor is in Machine Run, an object entering the protection zone shall cause the sensor to change from Machine Run to Machine Stop within the specific response time, and remain in Machine Stop for as long as the obstruction remains in the protected zone. Once the protected zone is clear, sensor shall automatically change from Machine Stop to Machine Run, with no operator intervention.

Optoshield Modes:Automatic Start				
	Indicator Status		Output Status	
Power UP State	Machine Run (Green)	Machine Stop (Red)	Aux./Warning	Safety
Safety Zone Clear	OFF	ON	Configuration Dependent. See Section 3.3.2.	OFF
Press Reset w/Safety Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	ON
Safety Zone Infringed	OFF	ON	Configuration Dependent. See Section 3.3.2.	OFF
Warning Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	
Warning Zone Infringed	ON	OFF	Configuration Dependent. See Section 3.3.2.	

Table 3-3 Start Interlock

3.2.3 START/RESTART INTERLOCK

In Start/Restart Interlock mode, the sensor shall power up with its OSSD outputs in the Off state and perform system initialization and self test. If no faults are detected and the protected zone is clear of obstructions, the sensor enters the Interlock state. If the protected zone has an intrusion, the sensor remains in Machine Stop. When the intrusion is removed, the sensor OSSD outputs remain in the Off condition during power up testing, initialization, and transition to Interlock. The operator must press and release the sensor's Start button before the sensor enters the Machine Run state. Once sensor is in Machine Run, an object entering the protected zone shall cause the sensor to change from Machine Run to Machine Stop. When the obstruction clears it will automatically change from Machine Stop to Interlock. The operator must press and release the Start button before the sensor enters the Machine Run state.

Optoshield Modes: Start/Restart Interlock				
	Indicator Status		Output Status	
Power UP State	Machine Run (Green)	Machine Stop (Red)	Aux./Warning	Safety
Safety Zone Clear	OFF	ON	Configuration Dependent. See Section 3.3.2.	OFF
Press Reset w/Safety Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	ON
Safety Zone Infringed	OFF	ON	Configuration Dependent. See Section 3.3.2.	OFF
Safety Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	ON
Warning Zone Clear	ON	OFF	Configuration Dependent. See Section 3.3.2.	
Warning Zone Infringed	ON	OFF	Configuration Dependent. See Section 3.3.2.	

Table 3-4 Start/Restart Interlock

3.3 PARAMETER CONFIGURATION

The configuration properties consist of two sections Safety-Critical Parameters and Non-Safety Critical parameters.

3.3.1 SAFETY-CRITICAL PARAMETERS

- External Device Monitoring (ED) (MPCE)

ED (MPCE) monitoring is an important safety function. It verifies that the external control elements are responding correctly.

The OS3101 can operate with this feature enabled or disabled. When EDM (MPCE) is enabled, the OS3101 requires that a Normally Closed contact from each Control Element be fed back in for monitoring. If these contacts do not respond as expected the OS3101 will enter a Fault state and turn off the safety outputs.

In the Machine Run state, the OS3101 expects to see the ED (MPCE) input open. In the Machine Stop state, the OS3101 expects to see the ED (MPCE) input closed. The ED (MPCE) inputs must change state within 300 ms of the OptoShield's OSSD safety outputs or a fault will occur.

- Response Time

The response time of the OS3101 is proportional to the number of scans. The safety outputs will not change from on to off until the preset response time has expired. The response time can be set from 80mS to 680mS; each scan is equal to 40mS. The minimum number or scans is two, the maximum is 17. The number of scans may be increased when operating the OS3101 in a dirty environment to avoid nuisance trips caused by floating particulate matter.

⚠ ***WARNING! A change in the response time requires a recalculation of the safety distance (See Section 6*** *Stationary Installation and Configuration****) and may require the position of the scanner to be relocated. Failure to use the correct safety distance may result in a person entering a hazardous area while the machine, robot, or hazard is still in motion, resulting in severe injury.***

- Operating Modes

The OS3101 can be configured to operate in three different modes: Automatic Start, Start Interlock and Start/Restart Interlock.

- Monitoring Zone Setting

Two zone sets can be configured and saved within the OS3101. These zones can then be recalled via the RS232/422 port or by using the external inputs. There are three settings: Zone Set 1, Zone Set 2, or Multiple Zones.

- Status Code Display

The following status codes will appear on the scanner's 7-segment display during machine run state. They are representive of the zone setting and the scanners operating response time. Example: code '24' indicates zone set 2 with a response time of 160mS. **Note: Response times longer than 400mS are represented by a Zero.**

Active Zone Set	First Digit
Zone Set 1	1
Zone Set 2	2
Union of Zone 1 and 2	U
Response Time (mS)	**Second Digit**
80mS	2
120mS	3
160mS	4
200mS	5
240mS	6
280mS	7
320mS	8
360mS	9
400mS	0
440mS	0
480mS	0
520mS	0
560mS	0
600mS	0
640mS	0
680mS	0

Table 3-5 Status Code Display

3.3.2 Non-Safety-Critical Parameters

- Auxiliary Output Mode

There are two possible auxiliary output settings: Follow OSSD and Fault Indicate. In Follow OSSD mode, the auxiliary output will follow the state of the safety output. In the Fault Indicate mode, the auxiliary output will only change when the OS3101 enters a Fault state.

- Warning Output Mode

The Warning output can be configured to three possible modes: Warning Zone Infringed, Weak Signal and Warning Zone/Weak Signal.

— In Warning Zone Infringed mode, this output reports the status of the Warning Zone.

— In Weak Signal mode, this output reports the detection of a weak signal due to contamination on the window.

— In Warning Zone/Weak Signal mode, this output reports both modes, one at a time.

4 Outputs

4

4.1 Safety Outputs

⚠ ***WARNING!*** ***This product is designed for use on a 24 VDC, negative ground (protective earth) electrical system only. Never connect the OptoShield OS3101 to a positive ground (protective earth) system. With a positive ground (protective earth) wiring scheme, certain simultaneous shorts of both safety outputs may not be detected and the guarded machine may not stop resulting in severe operator injury.***

The OS3101 provides two PNP safety outputs, each capable of sourcing 625 mA @ 24VDC. These two outputs can be interfaced directly into a Safety Programmable Logic Controller or may be used to directly energized the machine's primary control element. The safety outputs will turn on and supply up to 625 mA @ 24 VDC when the safety zone is clear and the OS3101 enters a Machine Run state. The OS3101 will turn off its safety outputs and enter a Machine Stop state when it detects an intrusion in the safety zone.

4.2 Auxiliary Output

The OS3101 has a non-safety auxiliary output, either for PNP (sourcing) or NPN (sinking), max. 100 mA @ 24VDC. This output is factory configured only at time of order. In the field, this output can be configured to operate in two modes. In follow mode it will turn on and off following the status of the safety outputs. In the Fault mode it will turn on only when an internal fault is detected. These operating modes are selected through the set-up software (CFG tool).

4.3 Warning Zone/Contamination Output

The OS3101 has a non-safety auxiliary output, PNP (sourcing) or NPN (sinking), max. 100 mA @ 24VDC.

In the field this output can be configured to operate in one of three ways:

— Warning Zone Infringed
— Weak Signal Mode
— Both Warning and Zone/Weak Signal.
These modes are selected through the set-up software (CFG tool).

5 Applications

5

5.1 Applying the OptoShield OS3101

The OS3101 may be used for personnel safeguarding. Typical applications include work cell area guarding and collision prevention of AGV (Automated Guided Vehicles).

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5.2 Work Area Guarding

There are many areas in today's manufacturing facilities that require guarding. The OptoShield is ideal for safeguarding hazardous work areas. The flexibility of the OS3101 allows for easy configuration of the scan fields to conform to a variety of work cell shapes. The OS3101 incorporates two zone sets which can be preset and selected via the Set Up software or external hardware inputs, refer to Section 8.10 for more information on this feature. Each Zone Set consists of one Safety Zone and one Warning Zone. *Figure 5-1* shows a single zone set configuration, *Figure 5-3* shows dual zone set configuration.

Horizontal scan field applications include:

- Robotic work cells
- Material transfer stations
- Metalforming equipment
- Elevators
- Automated production equipment

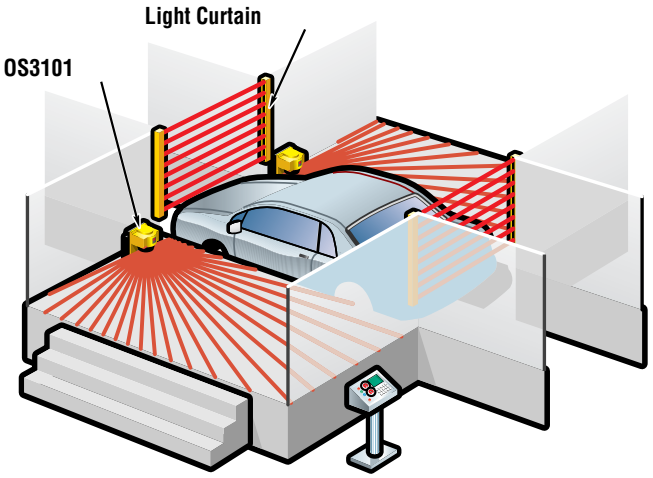


Figure 5-1 OS3101 Automotive Application

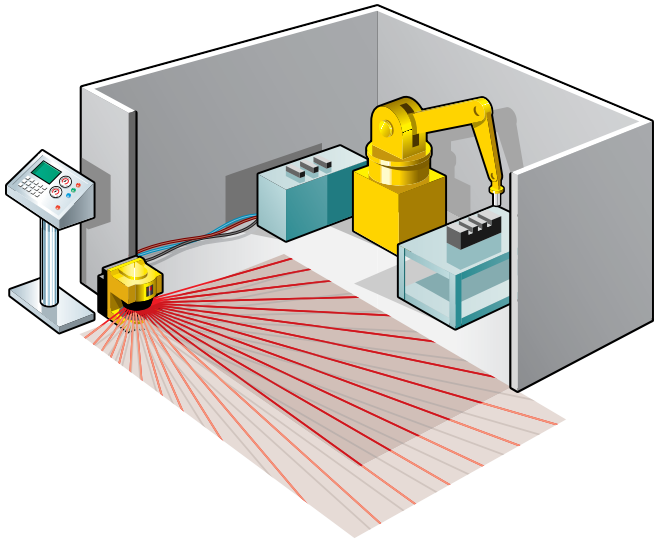


Figure 5-2 Material Transfer Station

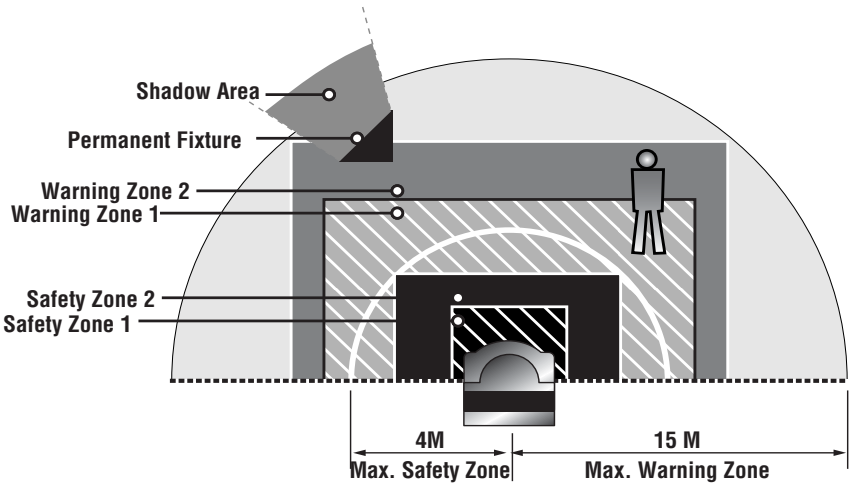


Figure 5-3 Configuration and Ranges of OptoShield

5.3 Guarding Interior Areas of Hazardous Equipment

On large equipment (i.e. large power press, injection molding) the OS3101 can be used to guard the interior space. If it is possible for the operator to enter the hazardous area the OS3101 can be used as a secondary safety device. This type of equipment would require a safety light curtain as the primary safety device (See Figure 5-4 *Guarding Interior Areas*).

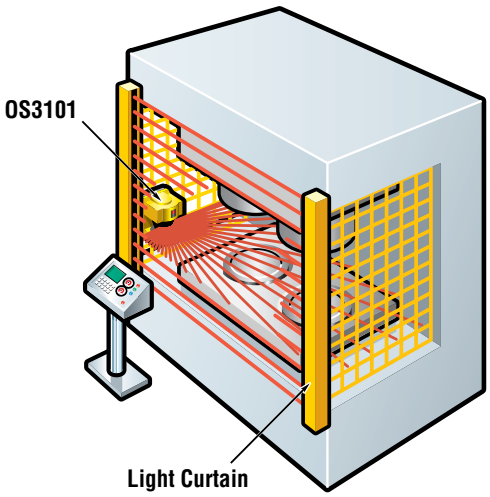


Figure 5-4 Guarding Interior Areas

5.4 Applying the OS3101 on Automated Guided Vehicles (AGV)

Unmanned automated vehicles require guarding devices to prevent accidental collisions. The OS3101 will scan the path of the AGV and will reliably stop the vehicle if it detects an object or person. The OS3101 is more adjustable and reliable than conventional pressure bumpers. In addition, the use of the OS3101 allows an AGV to travel at higher speeds than if using conventional bumpers.

The OptoShield OS3101's flexibility allows two types of detection.

5.4.1 Warning Zone Detection

The warning zone auxiliary output will send a signal to the AGV when the warning zone is infringed. This will trigger the vehicle to slow down, allowing a person to move away from the vehicle path.

5.4.2 Safety Zone Detection

The two safety outputs will send an E-stop to the AGV when the safety zone is infringed. This will signal the vehicle to come to a complete stop.

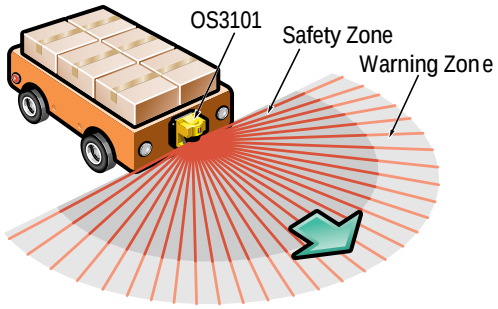


Figure 5-5 AGV Navigation

5.5 Mounting Considerations

The following considerations should be taken into account when determining the mounting location for the OptoShield. Although rare, it is possible for ambient light to interfere with normal operation of the sensor. Ambient light interference DOES NOT lead to a loss of safety, it may, however, cause false nuisance stops of the guarded equipment.

Avoid direct exposure to:

— High intensity incandescent light
— Stroboscopic light
— Light from an identical or similar safety scanner
— Infrared light from a safety light curtain.

Some installations may require that the OptoShield be mounted in direct exposure to ambient light. In these situations you must assure that the separation between the scan plane of the OS3101 and the light source be greater than ± 8°.

5.6 Configuring Multiple OS3101 Scanners

5.6.1 Use of Several Safety Laser Scanners

The possibility exists that two OS3101 may interfere with each other. To avoid this when using multiple Optoshields in the same location, please review the following mounting recommendations. The scan plane reference location is marked on the sides of the OS3101's front window.

— Adjust the scanners to offset the scanning plane by tilting the OS3101s.
— Adjust the scanners to offset the scanning plane by mounting the OS3101s at different heights.
— Mount the scanners alternating the orientation of the OS3101s by 180°
— Adjust the scanners to different scanning planes and additional sampling scans on the OS3101s
— Install a barrier to block the direct path of possible signal crossing.

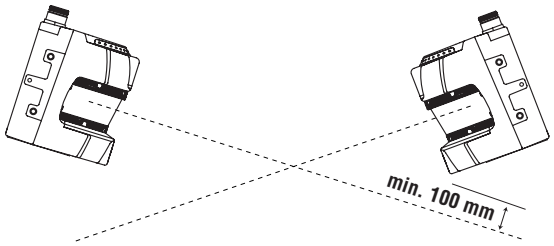


Figure 5-6 Offset Scanning Level by Tilting

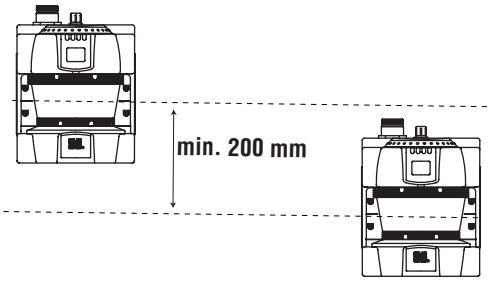


Figure 5-7 Offset Parallel Scanning Levels by Different Installation Height

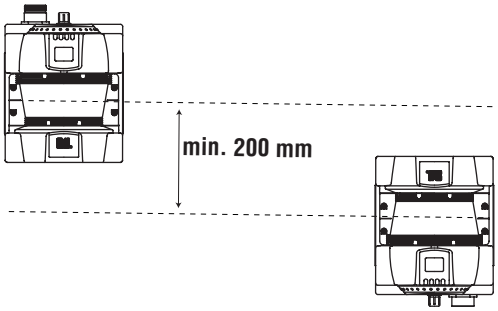


Figure 5-8 Offset Parallel Scanning Levels by Alternate Installation in Upright and Inverted Position.

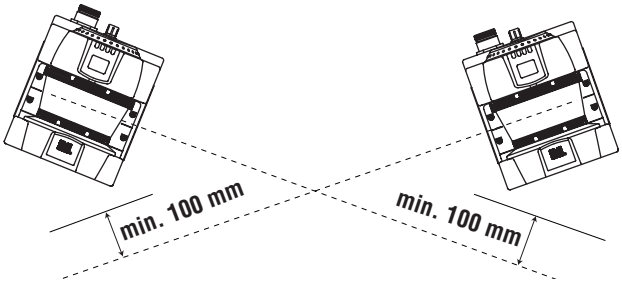


Figure 5-9 Offset Parallel Scanning Levels Plus Additional Sampling Scans

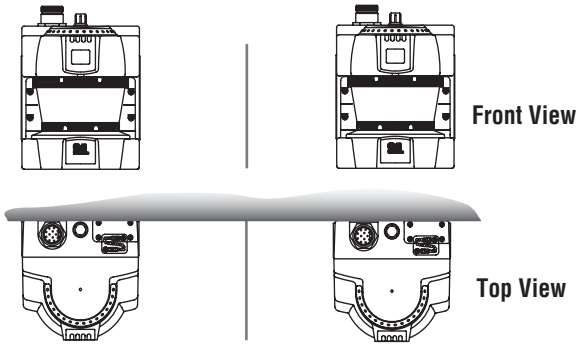


Figure 5-10 Screening Up to Front Edge of the Detection Window

6 STATIONARY INSTALLATION AND CONFIGURATION

6

6.1 POSITION

The OptoShield OS3101 must be installed so that the protection zone covers the danger area. Areas which cannot be scanned (e.g. behind obstacles) must be guarded by taking additional measures (e.g. barriers).

The reset/restart switch for clearing an Interlock state must be positioned so that the entire danger zone is in view and the reset switch cannot be reached from inside the danger zone.

Always mount the OS3101 so that it is protected from moisture and dirt.

Mount the scanner so that the Status and Intrusion Indicators are visible.

Avoid locations where the OS3101 is exposed to excessive shock and vibration.

6.2 INSTALLATION HEIGHT (DETECTION LEVEL)

The installation mounting height of the OS3101 is very important. Personnel should not be able to crawl under, stand behind or climb over the protective field.

According to EN999, for an installation height of >300mm, the possibility of 'creeping' under the protective field must be taken into account. On installations where the OS3101 is mounted higher than 300mm, additional guarding may be required. (See Figure 6-1—*Setup for Area Scanning*).

Omron STI offers a mounting stand that allows the OS3101 to be mounted at three different heights. This is useful when multiple scanners are guarding an area and the possibility of cross-talk exists. (Refer to Figure 11-10—*Mounting Stand*).

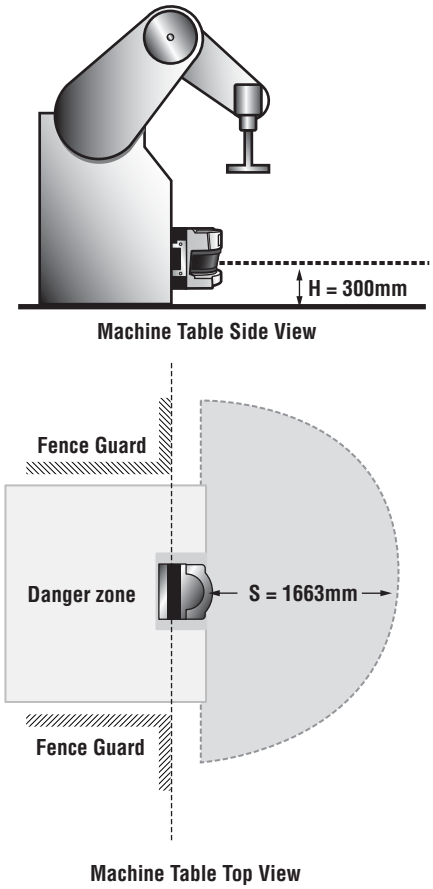


Figure 6-1 Setup for Area Scanning

6.3 Whole Body Detection (Vertical Installation of the Area Scanner)

Omron STI recommends the use of a safety light curtain in vertical sensing applications over an area scanner (OS3101) mounted vertically.

Vertical guarding applications are usually better protected by light curtains, which offer:

— a selection of different detection capabilities (finger, hand, body)
— a higher safety level (type 4 for a safety light curtain vs type 3 for an area scanner)
— faster response times
— greater operating range
— lower cost

Also, per the international standard IEC 61496-3, area scanners must reference and monitor the boundaries of the vertical passage limits, such as the entrance or door frame. If the distance between the scanner and the boundaries exceeds 4m, any change in the positioning of the scanner or the boundaries of the detection zone greater than 100mm must be detected. This may be achieved by

limiting the width of the references that make-up the boundary. If the detection zone is infringed or if the detection zone side reference boundaries are changed, the scanner should turn off the two OSSD outputs. The OS3101 does not currently employ reference boundary monitoring, and thus is not recommended in vertical applications requiring this international standard.

The two US standards which reference the use of area scanners, ANSI B11.19 -2003 and ANSI/RIA 15.06-1999 do not address the issue of vertical installations. Omron STI does require the user to prevent unauthorized changes in the position of the area scanner and detection zone through administrative (such as a password) and engineering means.

NOTE: The OS3101 does not yet employ a reference monitoring function.

6.4 Configuration of the Safety Distance (Required Depth of Protected Zone)

When using the OS3101 for area scanning, the Start/Restart Interlock mode should be selected. The regulations applying to the machine must be complied with.

Always configure the protected zone so that the machine comes to a stop in the time taken to reach the danger point of the machine after infringing (interrupting) the protection zone.

The standard EN 999-1998 must be used to calculate the minimum safety distance. According to EN 999, the minimum safety distance, S, from the danger zone area to the outer edge of the protected zone is calculated as follows:

$$S = (K \times (t1 + t2)) + C + Z$$

where:

S = Minimum safety distance in mm measured from the danger area to the outer contour of the protected zone.

K = Movement or approach speed in mm/s (constant K = 1600 mm/s)

T = Response time: the delay between the interrupting of the protected zone and the complete stoppage of the machine, which is the sum of:

t1 = Response time of the safety device

t2 = Rundown time of the machine (mechanical rundown and reaction time of control system)

C = Safety constant, where C = 1200 mm – 0.4 x H and C must always equal > 850mm

H = protection field detection height (installation height of the scanner)

Z = Additional safety factors (maximum measurement error), the sum of:

z1 = The scanner's maximum measurement error (135mm)

z2 = Errors due to highly reflective surfaces, if necessary (See Section 11.2—*Reflective Surface Considerations*).

6.5 Example Calculation Exercise

The following equipment and application parameters will be used for a calculation exercise.

K = 1600 mm/s Movement or approach speed

T = 280 ms, (t1) response time of the scanner with two scans = 80 ms, (t2) = 200 ms includes response time and rundown of the machine)

C = 1080mm Safety constant, where C = 1200 mm – (0.4 x H) and C must always > 850 mm

H = 300 mm

Z = 135mm (z1=135mm + z2=0 mm)

S = (K x (t1 + t2)) + C + Z

S = (1600 mm/s x T) + (1200 mm – (0.4 x H)) + 135 mm

S = (1600 mm/s x 280 ms) + (1200 mm – (0.4 x 300 mm)) + 135 mm

S = 448 mm + 1080 mm +135 mm

S = 1663 mm

This resulted in a calculated protection zone of 1663mm, see Figure 6-2—*SF Distance Example*.

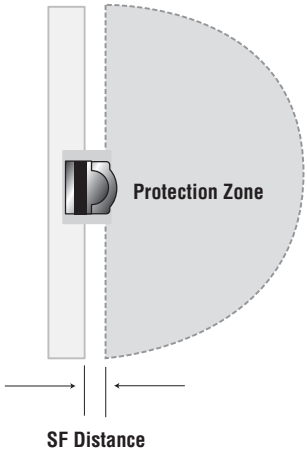


Figure 6-2 SF Distance Example

6.6 Other Required Safety Factors

There are three typical mounting methods for an OS3101, they will all result in a different unprotected space (dead zone). Refer to Figure 6-3—*Mounting Options*.

SF Distance (scanner dead zone, from back of scanner to center-line).

Once you determine the mounting method, it is recommended that additional guarding methods be implemented to prevent access within the unprotected area. Refer. to Figure 6-3—*Mounting Options*.

— OS3101 w/out brackets
— OS3101 w/B1 bracket kit
— OS3101 w/B2 bracket kit and back plate

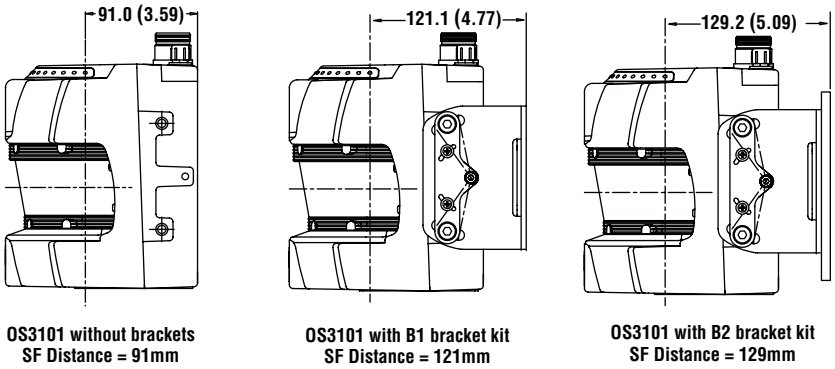


Figure 6-3 Mounting Options

6.7 Mounting Within a Recessed Area

When the OS3101 is used in such a way that it is under the guarded machine then a minimum undercut must be utilized. The depth of the undercut is determined based on the mounting method used. Refer to *Figure 6-4* on page 28.

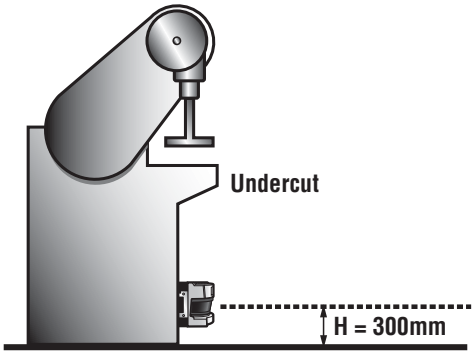


Figure 6-4 Undercut example

The depth of the undercut must be equal to or greater then the SF distance of the mounting method used.

6.8 Documentation of Configuration Parameters

The person responsible for the set-up and commissioning must record the scanner's configuration parameters, print out and sign the report. To do this:

— In the configuration tool menu select "File" ➔ "Record"
— Print out the configuration parameters

7 MOBILE INSTALLATION AND CONFIGURATION

7

7.1 APPLYING OS3101 ON AUTOMATED GUIDED VEHICLES (AGV)

The OptoShield must only be used in AGV applications where the vehicle is equipped with electric motors. AGV equipped with an OptoShield should only be used on private or company property and not allowed to operate on public streets.

The following items must be considered:

- Mounting Height
- Mounting Options

— Recessed
— Protruding
— Bracket Type

- Protective Field Length
- Protective Field Width

Additionally, the recommendations of the AGV manufacturer must be followed.

Always configure the protection zone size large enough, so that the AGV can come to a complete stop before a collision can occur.

7.2 MOUNTING HEIGHT

The OptoShield must be mounted so that it provides a horizontal safety scan plane in the path of the AGV. The height of the scan plane must not exceed 200mm in height. Omron STI recommends a height of 150mm which ensures that objects 150mm in height are detected. After installation, the entire hazardous area must be tested to verify detection of the 150mm object.

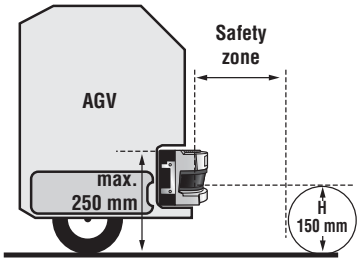


Figure 7-1 Installation on Automatically Guided Vehicle

7.3 MOUNTING OPTIONS

Careful consideration should be given to minimizing or eliminating a dead zone where no object will be sensed by the OS3101.

7.3.1 Recessed Front End Mounting

A recessed installation reduces the size of the dead zone. However, in some cases this technique may create dead angles. If the OptoShield is mounted too deep within the vehicle, the scanner will not be able to properly scan the hazardous area. These areas are referred to as Dead Angles. On vehicles capable of speeds greater than 0.3 m/s within 3 seconds, additional safety measures must be taken.

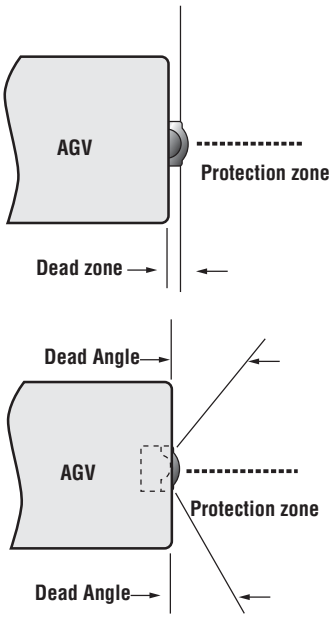


Figure 7-2 Recessed Installation on AGV

7.3.2 Protruding Front End Mounting

When the application requires installation on the front end of the vehicle, it is necessary to eliminate dead zones. These inactive zones can be minimized by recessed installation of the OptoShield. On vehicles capable of speeds greater than 0.3m/s within 3 seconds, the dead zone must be minimized to prevent a person from standing in the undetected space. This can be accomplished with additional guarding measures, i.e. hard guarding or pressure-sensitive bumpers.

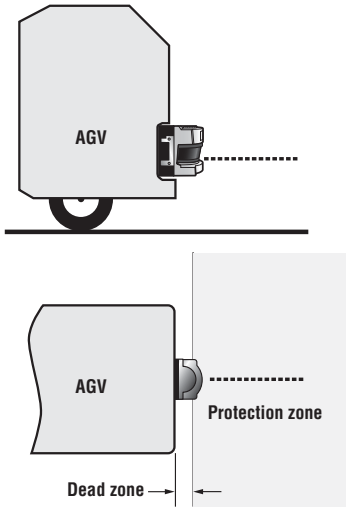


Figure 7-3 Protruding Installation on AGV

7.3.3 Bracket Type

The following bracket types are available. The SF Distance (supplied in *Figure 7-4* on page 31) must be considered to determine the size of any dead zones (unprotected space) that may exist between the scanner and the AGV. It is recommended that additional guarding methods be implemented to prevent access within the unprotected area.

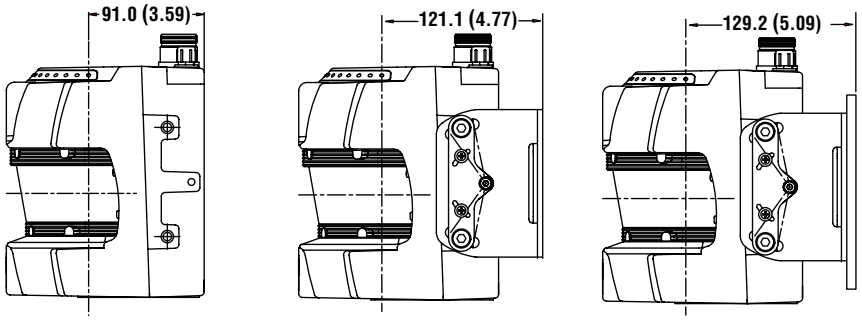


Figure 7-4 Mounting Options

7.4 Safety Distance – Safety Zone Depth

To calculate the proper safety distance, the size of the Protection zone, the following variables must be considered.

The minimum safety distance, S, is measured from the AGV to the outer contour of the protected zone, this should be calculated using the formula:

S=Minimum Safety Distance

S=Sp + Z + Zgc + Zbf

Sp=Maximum Stopping Distance

Sp= (Vmax. x T) + Sbrake

Vmax=Maximum speed of AGV, from AGV specifications

T = Response time: the delay between the interrupting of the protected zone and the complete stoppage of the machine, which is the sum of:

t1 = Response time of the safety device (scanner)

t2 = Response time of AGV controls

Sbrake = Braking distance of AGV, from AGV specifications

Z = Additional safety factors (maximum measurement error), the sum of:

z1 = The scanner's maximum measurement error (135mm)

z2 = Errors due to highly reflective surfaces, if necessary. See “Reflective Surface Considerations” on page 65..

Zgc = Safety factor for lack of ground clearance. See *Figure 7-5* on page 32.

Zbf = Safety factor for reduction in brake force of the AGV through wear and usage.

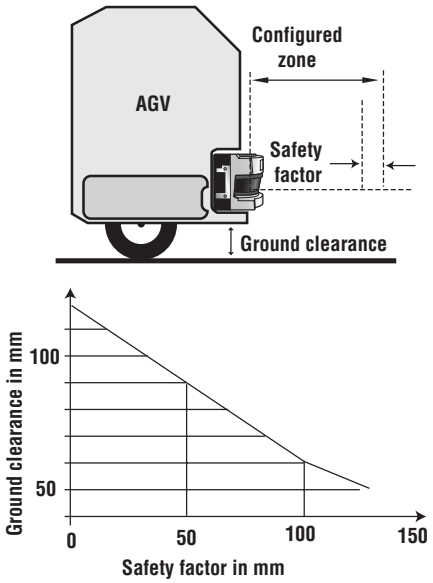


Figure 7-5 Safety Factor for Low Ground Clearance

7.4.1 Example Calculation Exercise of AGV Protection Zone Depth

The following AGV application parameters will be used for a calculation exercise.

Sp=Maximum stopping distance=1600mm

Z=Additional safety factors=135mm

z1=Scanner’s maximum measurement error=135mm

z2=Errors due to highly reflective surfaces= 0mm

Zgc=Safety factor for lack of ground clearance=50mm

Zbf=Safety factor for reduction in brake force=100mm

Minimum safety distance depth: S=Sp + Z + Zgc + Zbf

Minimum safety distance depth: S=1600mm + 135mm + 50mm + 100mm

Minimum safety distance depth: S=1885mm

7.5 Safety Zone Width for An AGV

Since a moving AGV can be approached from the side, it is recommended that the safety field be configured wider than the AGV. The minimum width must be greater then the AGV width.

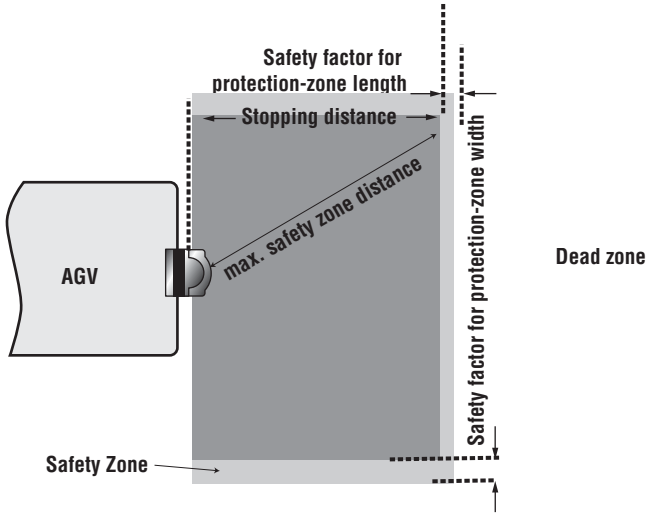


Figure 7-6 Protective Zone of an AGV

7.5.1 Example Calculation Exercise of AGV Protection Zone Width

The minimum safety zone width, Sw, is calculated as follows:

Sw=Minimum safety distance width

Sw=Vw + (2 (Z + Zgc + Zbf))

Vw=AGV width=1100mm

Z=Additional safety factors=135mm

z1=Maximum measurement error of Scanner=135mm

z2=Errors due to highly reflective surfaces=0mm

Zgc=Safety factor for lack of ground clearance=50mm

Zbf=Safety factor for reduction in brake force=100mm

Minimum safety distance width: Sw = Vw + (2 (Z + Zgc + Zbf))

Minimum safety distance width: Sw = 1100mm + (2(135mm + 50mm + 100mm))

Minimum safety distance width: Sw = 1100mm + 570mm

Minimum safety distance width: Sw = 1670mm

The example calculations for the protection zone depth and width yield the following values for configuring a rectangular protection zone when the OS3101 is mounted centrally on the vehicle. Make sure that the width supplemental factors are added to both sides of the AGV. Refer to *Figure 7-6* on page 33.

7.6 Regulatory Standards for AGVs

In addition to the information that we have provided, it is essential that you follow the guarding recommendations set forth in the following standards:

— ASME/ANSI B56.5-1993
— EN 1493
— EN 1525
— 61496-3

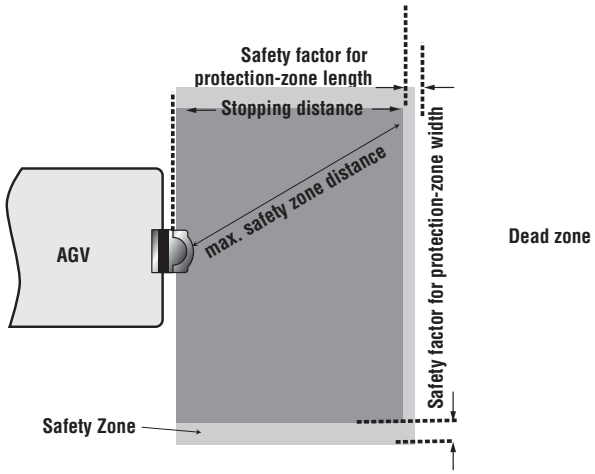


Figure 7-7 Regulatory Standards for AGVs

8 Getting Started

8

8.1 Basic Steps

The configuration and installation of an OptoShield is a simple process. We have outlined the basic steps needed to get started. Refer to the appropriate section for more information on any of these steps.

- Loading the set-up program on to your computer.
- Connect the scanner to your computer.
- Start the program

— Auto connects
— Connection confirmed

- Log-on

— Select Access Level
— Enter password

- Configuring the safety-related parameters

— EDM (MPCE)
— Response Time
— Operating Mode
— Zone Monitor

- Configuring the non-safety parameters

— Auxiliary Output
— Warning Output
—
- Select the unit of measure

— Centimeters
— Inches

- Zone Configuration

— Configure Zone set 1
— Configure Zone set 2

- Save your Password
- Start the OptoShield

8.2 Loading the CFG Setup Program

Optoshield setup and configuration requires the use of the CFG tool. Each OS3101 is supplied with a configuration software package. For optimal set-up performance the following computer system hardware requirements are recommended.

— Pentium processor
— Windows 9X, Windows NT, Windows 2000, Windows XP
— 32 MB Ram (5 MB Ram hard drive space available).

8.2.1 CFG Installation

The installation of the CFG Tool Demo is quick and easy.

— Load the CFG tool CD.
— Run the Setup.exe file
— After installation, the Optoshield CFG Tool icon is available from the your desktop.

8.2.2 The Password

Due to the safety nature of the OptoShield, it is required that all users log-in with a password. The password grants the user, the right to view the configuration or the right to change/modify the configuration. The configuration is defined as all the parameters that have been defined to safely guard an application. The OS3101 is shipped with a default password “supeusr ” (case sensitive). It is strongly recommended that the password be changed after initial set-up.

There are two user levels:

- Operator Access – The operator can access the OptoShield in a monitor mode. This mode does not require a password as the operator cannot make any changes to the sensor’s parameters.
- Supervisory Access – Supervisors and maintenance personnel may access the OptoShield and perform a variety of functions. They may stop the scanner, transfer and download a new program or modify an existing program.

8.2.3 Changing the Password

The default password may be changed, allowing maintenance personnel to restrict access to unauthorized persons. To change the password, the user must log-on in the supervisor access level, password “supeusr”.

To change the password:

— Select Change Password
— A screen will appear, it will ask for an authorization password (default password is supeusr)
— Click continue
— Enter the new password and confirm the new password*
— Click OK to change the password
— Then OK the change

Note: The password needs to be at least 5 characters but not more than 7. The password is case-sensitive and must always be entered with the same combination of upper and lower-case letters.

8.2.4 Forgot the Password?

In cases where the password was changed and forgotten the encrypted password may be retrieved.

To retrieve the Encrypted Password, the user must log under the Operator access level, no password is needed to access this level.

To retrieve the password:

— Go to the Utilities menu
— Select Read encrypted password
— A screen will appear, displaying the password code
— Write down the password exactly as it appears

Call the Omron STI technical support department at 1/888/510-4357 and they will be able to decode the encrypted word.

8.2.5 The Configuration Screen

The CFG Tool (configuration tool) incorporates easy to understand screens illustrates the basic layout, Figure 8-2 *The Tool Bar* describes the full functions of the Tool Bar.

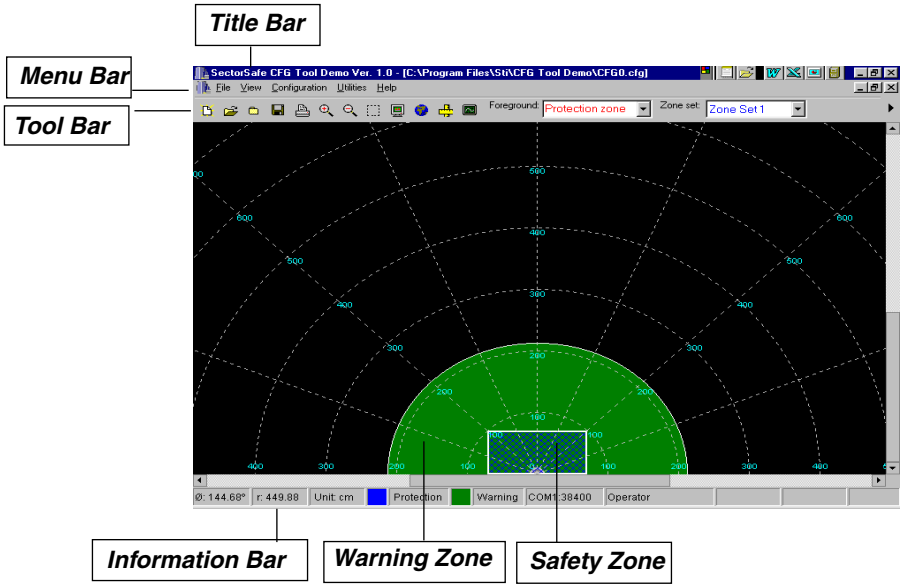


Figure 8-1 Getting to Know the Screen

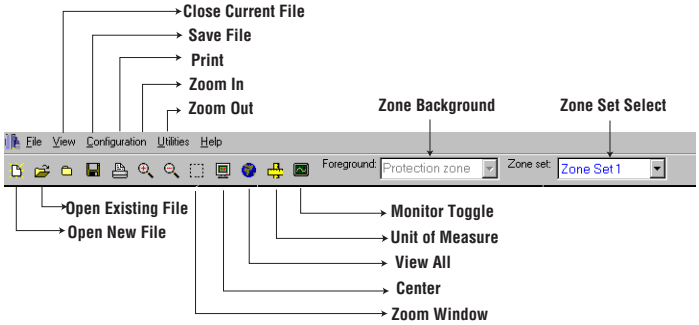


Figure 8-2 The Tool Bar

8.3 Start the CFG Programming Tool

8.3.1 Auto Connect

This is the first step in establishing a communication line with the OptoShield. This Setup Program will automatically select the proper Com Port and Baud Rate.

1. With an OS3101 connected to the computer, click on the “Continue” button

Figure 8-3 Auto Connect

8.3.2 CONNECTION CONFIRMED

A notification screen will appeared. It will notify you of the selected Com Port and Baud Rate.

Click on the ‘continue’ button.

Figure 8-4 Connection Confirmed

8.3.3 SELECTING THE ACCESS LEVEL

The access level needs to be selected and must be followed by a password. The default supervisor password is ‘supeusr’ (lower case).

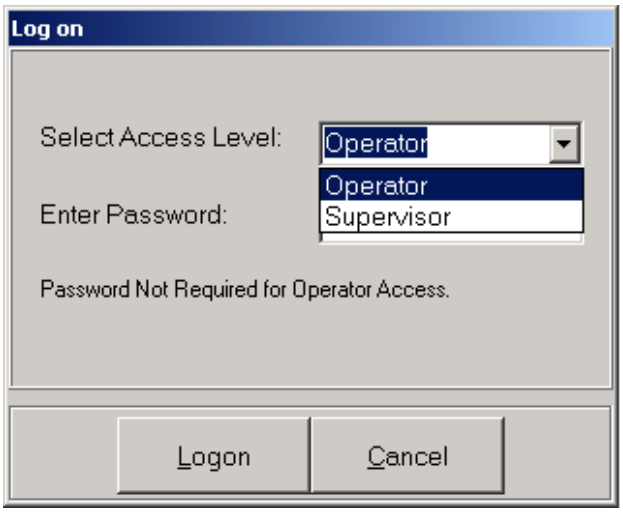


Figure 8-5 Selecting the Access Level

- Select Access Level
- Enter password
- Click on the 'Log on' button

8.3.4 CONFIGURING THE PARAMETERS

You have now successfully logged on. The first step is to define and configure the operating parameters.

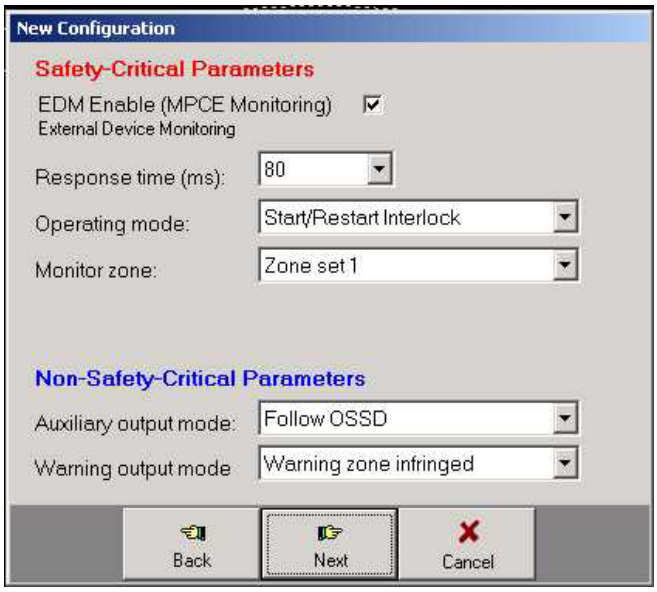


Figure 8-6 Configuring Parameter

- System Parameters

These include both safety-critical and non-safety critical parameters:

— Safety-critical: EDM (MPCE), response time, and monitor (active) zone
— non-safety critical: Auxiliary output and warning output modes

After all the selections are made, press “Next”

- Safety-Related

— Select EDM (MPCE)
— Select the Response Time
— Select the Operating Mode
— Select the Zone Monitor

- Non-safety-related

— Auxiliary Output Mode
— Warning Output Mode

8.4 Unit of Measure Selection

The OS3101 can be configured to measure centimeters or inches.

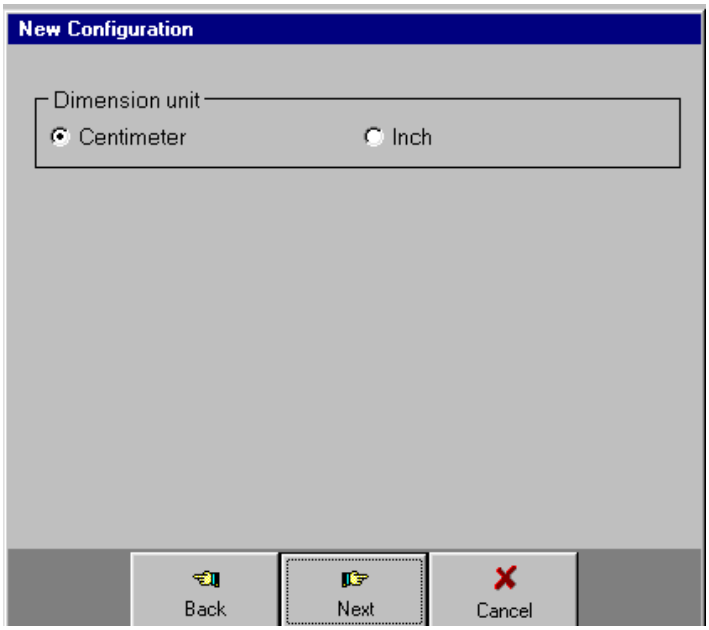


Figure 8-7 Unit of Measure

8.5 Zone Set Setup

8.5.1 Zone Set 1 Setup

Zone Setup includes both protection safety zone and the warning zone. The shape and size of the zone needs to be determined. In this example (Zone Set 1) we have selected The safety zone to be a semi-circle with a radius of 100 cm. The warning zone is configured as a rectangle with a height of 200 cm and a width of 300 cm. After your specific selections are made, press “Next”.

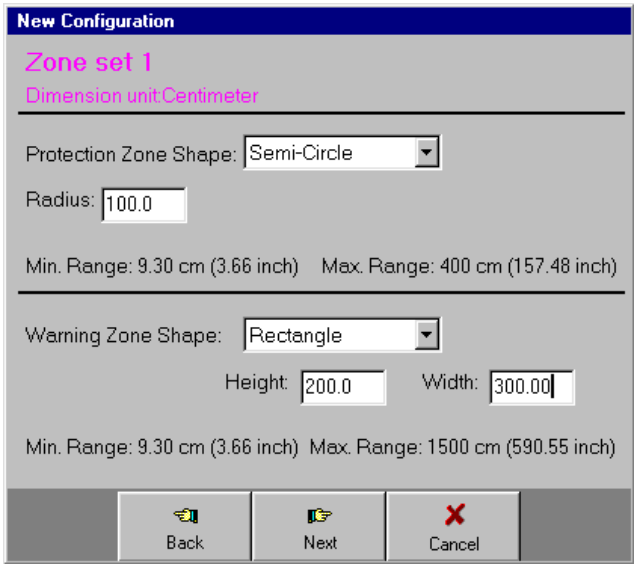


Figure 8-8 Zone Set 1 Setup

This is Zone Set 1, the safety zone to be a semi circle with a radius of 100 cm. The warning zone is the rectangle with a height of 200 cm and a width of 300 cm.

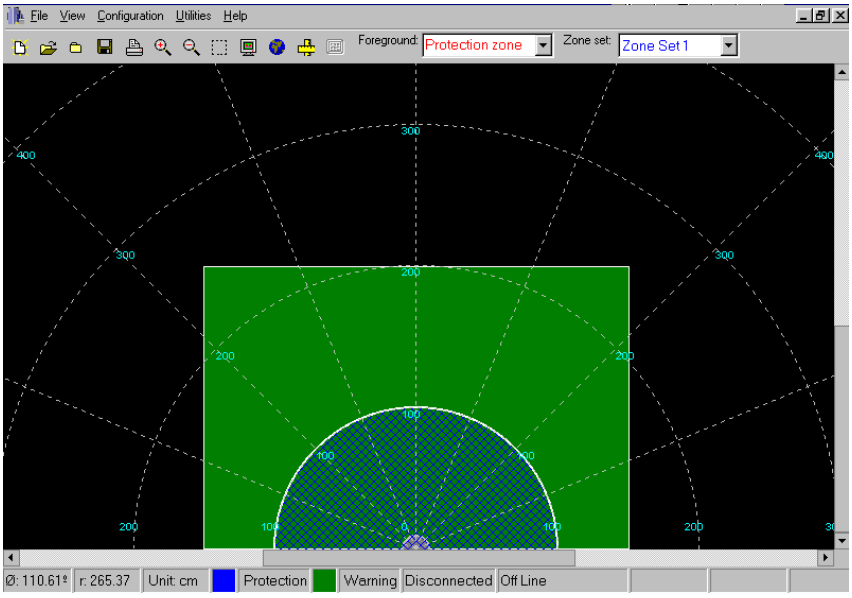


Figure 8-9 Zone Set 1 Screen Display

Note: Section 8.5—*Zone Set Setup* details the configuration of multiple zones. When only one zone is selected in the properties only the selected zone needs to be configured.

8.5.2 Zone Set 2 Setup

In this example (Zone Set 2) we have selected safety zone to be a rectangle with a height of 100 cm and a width of 200 cm. The warning zone is configured as a rectangle with a height of 400 cm and a width of 300 cm. After the selections are made, press “Next”.

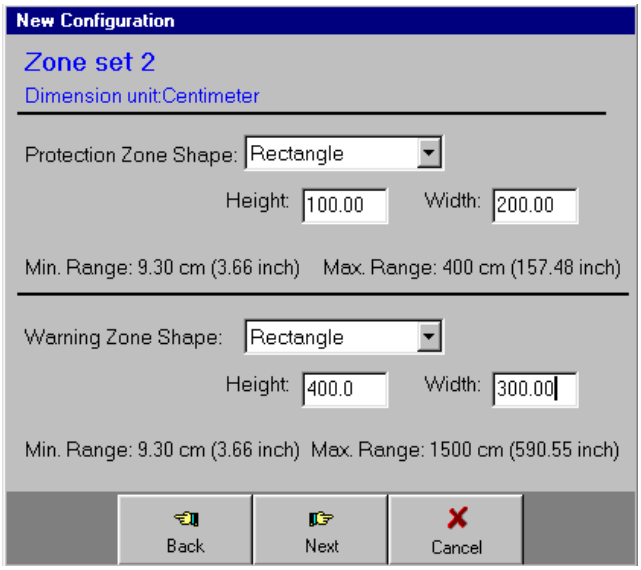


Figure 8-10 Zone Set 2 Setup

This is Zone Set 2, the safety zone is the rectangle with a height of 100 cm and a width of 200 cm. The warning zone is the rectangle with a height of 400 cm and a width of 300 cm.

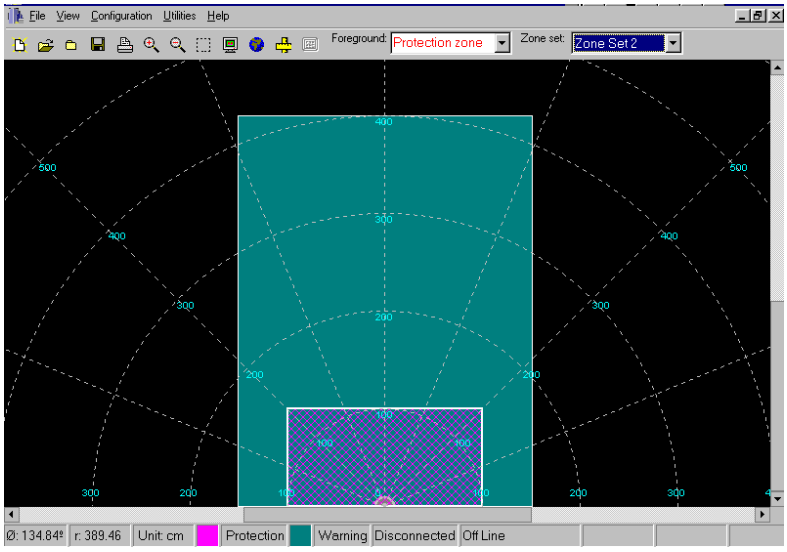


Figure 8-11 Zone Set 2 Screen Display

8.6 EDITING PROPERTIES

The OptoShield's CGF configuration software permits the user to modify the critical and non-critical properties.

The following steps will guide you:

Step 1: Go to the Configuration Heading and select Edit Properties

Step 2: Select the Properties that you intend to change and set them accordingly. The safety-critical properties that you will be able to change include EDM (MPCE), response time, operating mode and monitor zone. The non-safety-critical parameters include auxiliary output mode and warning output mode.

Once you have completed the changes you must send and register the changes. See Section 8.9—*Sending and Registering Changes*.

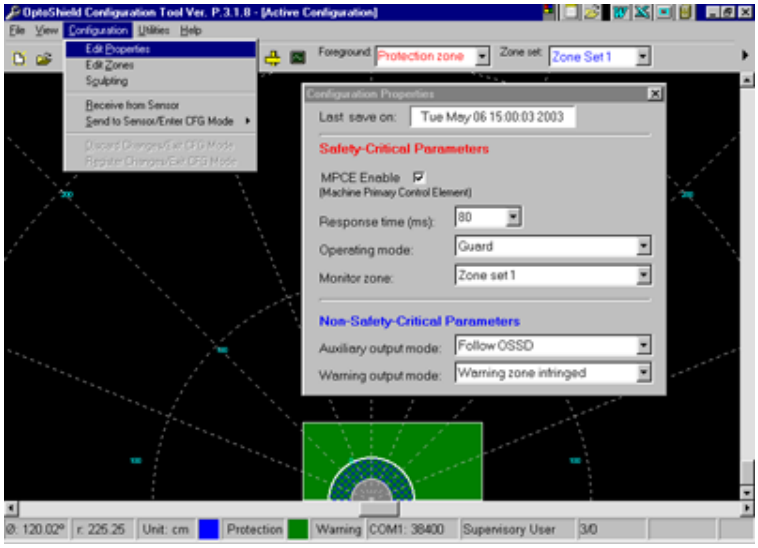


Figure 8-12 Configuration Properties

8.7 EDITING ZONES

The OptoShield's CGF configuration software permits the user to modify the protective zones. The following steps provide guidance on the zone editing process.

Step 1: Go to the Configuration heading and select Edit Zones.

Step 2: Select the zone set and the protection zone that you intend to modify, this shows the warning zone of zone set 1.

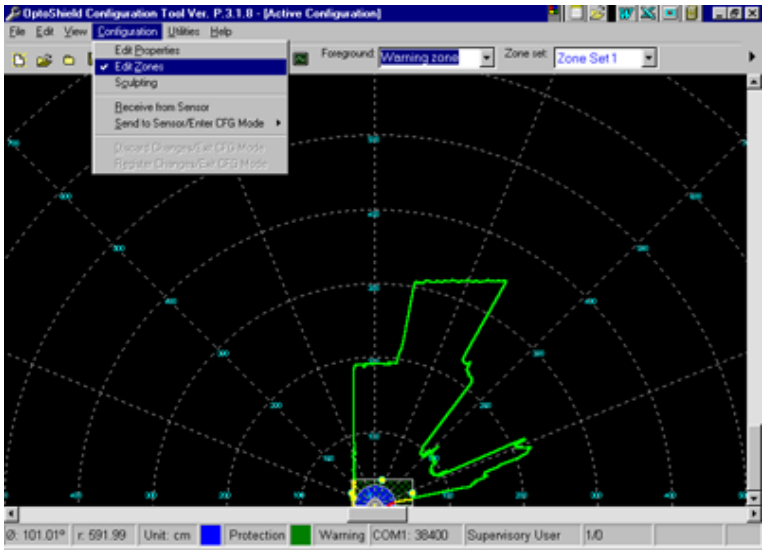


Figure 8-13 Modifying Zone Sets

Step 3: You will notice that drag points will appear on the selected zone. At this time you are permitted to change the zones configuration by clicking and dragging the points.

Once you have completed the changes you must send and register the changes. See Section 8.9—*Sending and Registering Changes*.

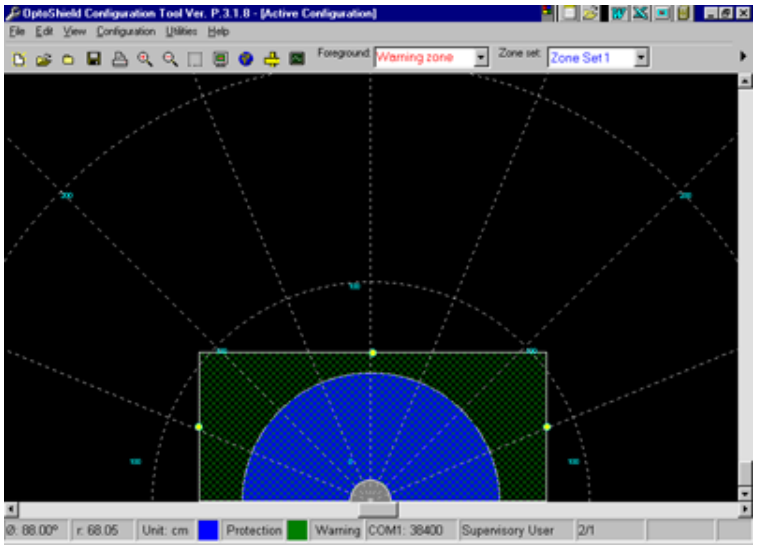


Figure 8-14 Changing the Zone Configuration

8.8 Sculpting Zones

The OptoShield's CGF configuration software permits the user to modify the protective zones. The following steps provide guidance on the sculpting editing process.

Step 1: Go to the Configuration Menu and select Sculpting.

Step 2: Select the zone set that you intend to modify, this shows zone set 1. This shows a semi-circle protective zone with a long rectangle warning zone. It also shows the contours of the overall area that the OptoShield is scanning.

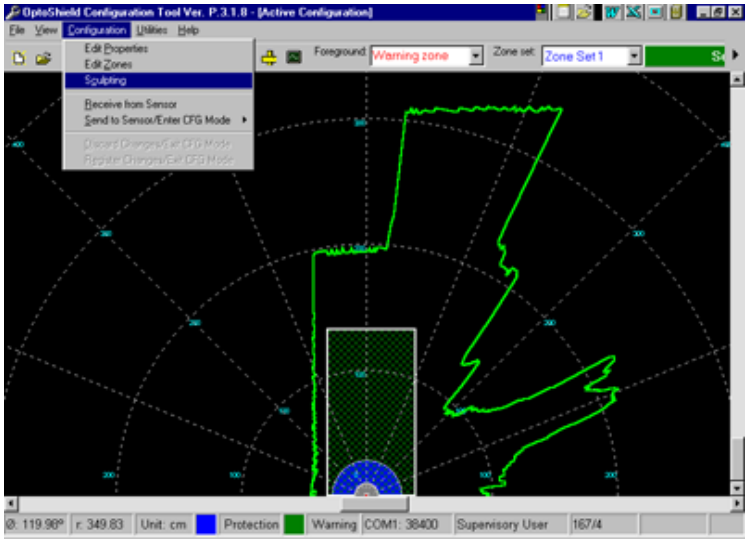


Figure 8-15 Modifying Zone Sets

Step 3: At this time you will be able to accept the scanners entire vision area as your protective zone, as shown on the previous picture. Or, you may outline a specific protective zone to meet your guarding requirements. Take a piece of cardboard and route it though the perimeter of your predetermined area. The cardboard/object needs to be placed at the same height as the OptoShield's scan plane (the window area).

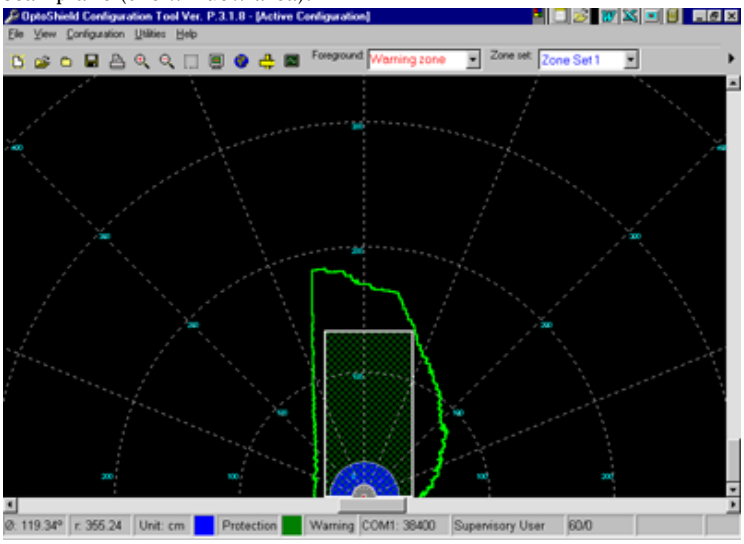


Figure 8-16 Changing the Zone Configuration

Step 4: Once you have sculpted the desired area, go to the configuration menu and select sculpting. The following window will appear, select the desired zone for the sculpted area.

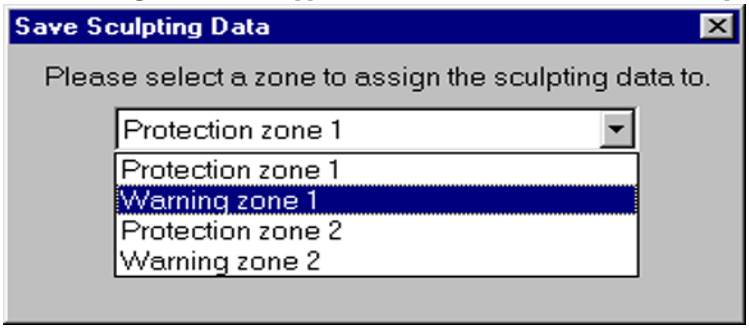


Figure 8-17 Save Sculpting Data

Here we show the new sculpted shape after the data has been sent to the sensor. See Section 8.9—*Sending and Registering Changes*.

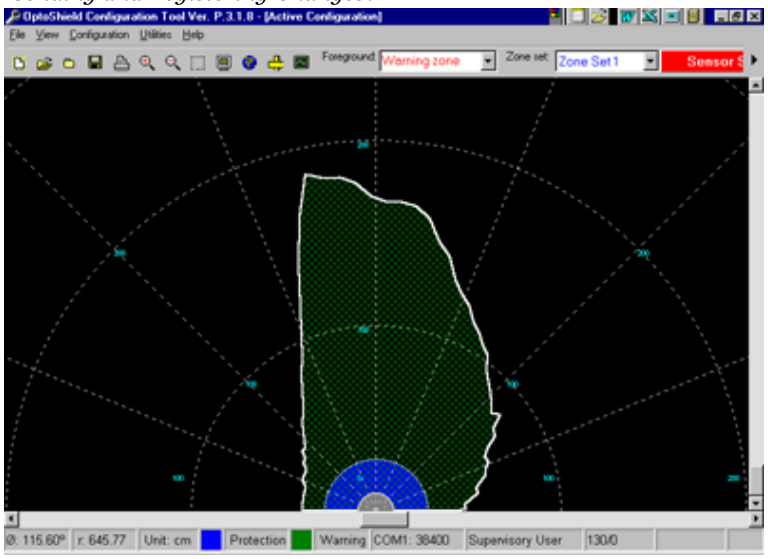


Figure 8-18 OS3101 with New Zone Configuration

8.9 Sending and Registering Changes

Step 1: When all the zone and property modifications are complete, they must be sent and registered. Go to the Configuration heading and select Send to Sensor/Enter CGF Mode. You may select All changes, Selected changes or Entire Configuration.

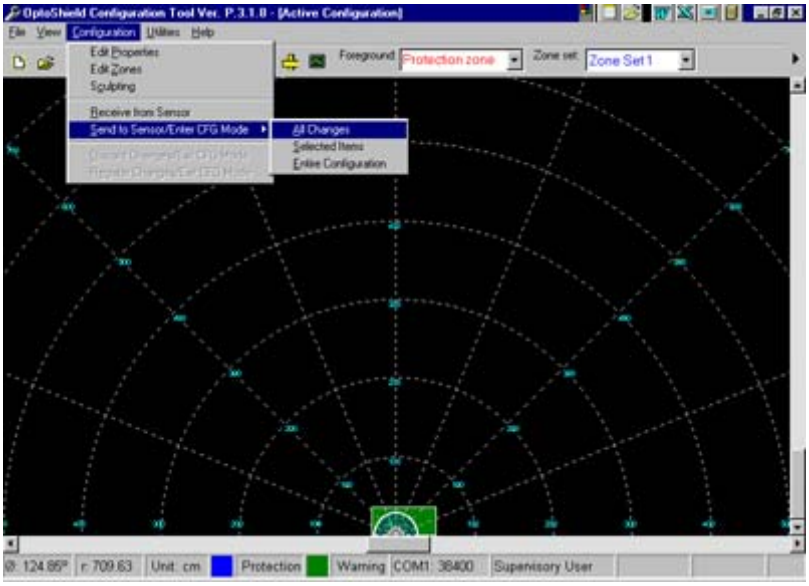


Figure 8-19 Completing Configuration

Step 2: You will be prompted and warned that the operation requested will close the current operating mode, select 'yes'.

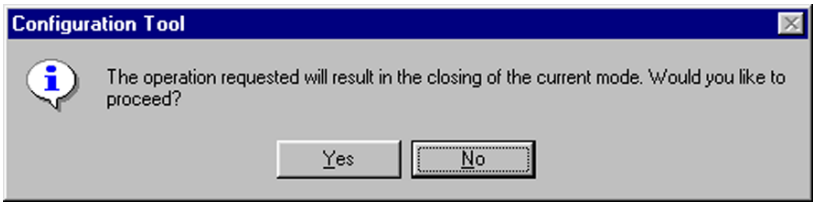


Figure 8-20 Configuration Tool - Entering CGF Mode

Step 3: You will be then warned again, select 'yes'. At this time the OptoShield will exit the Configuration Mode and the machine will come to a stop.

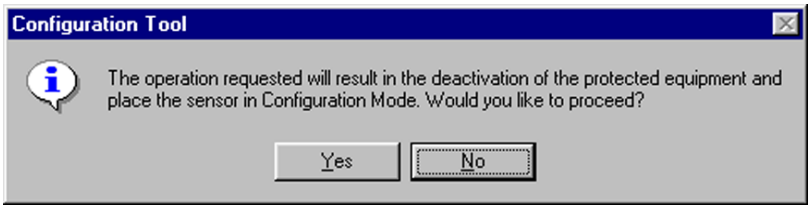


Figure 8-21 Configuration Tool- Enter CGF Mode II

Step 4: You will be prompted and asked to confirm that all the changes are correct, select 'OK'.

Figure 8-22 Configuration Tool - Confirm Changes

Step 5: Go to the Configuration heading and select Register Changes/Exit CGF Mode.

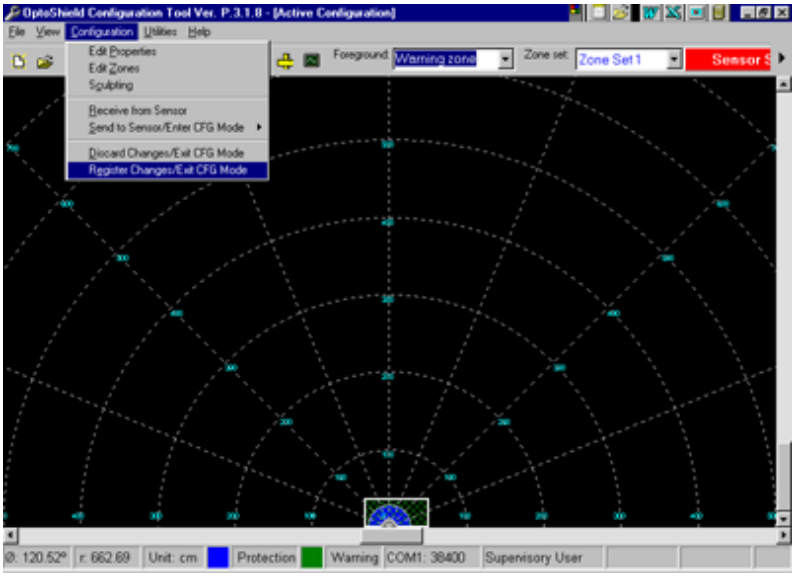


Figure 8-23 Configuration Tool - Register Changes

Step 6: You will be prompted to confirm that you would like to save the configuration, select 'Yes'.

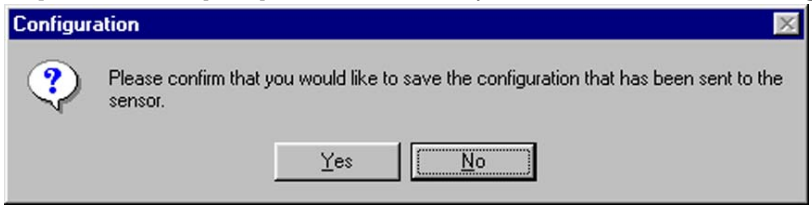


Figure 8-24 Configuration Tool - Save Configuration

Step 9: You will be prompted that all changes were sent, click 'OK'.

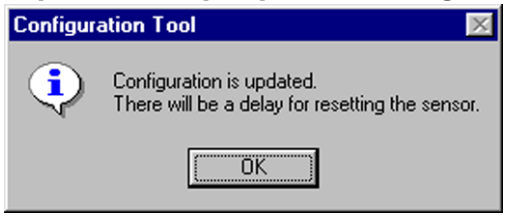


Figure 8-25 Configuration Tool - Configuration Updated

At this time the OS3101 is ready to run and will enter the operating mode to which it is configured.

8.10 ZONE SELECTION

The ZONE SELECT inputs may be used to enable the monitoring of up to two Zone Sets, a Zone Set is defined as a protection zone and a warning zone. To use this feature, the user must enable the Zone Select function in the configuration software, and configure the monitoring boundaries for the two Zone Sets.

The Zone Select interface inputs consist of three connections: Zone Select 1 (Z1), Zone Select 2 (Z2) and Zone Select Return. In order for a zone selection to be valid, Z1 and Z2 must be in opposite states, as shown in table below.

Z1 Input	Z2 Input	Zone Set
Closed	Open	1
Open	Closed	2
Open	Open	Invalid: Fault after 10 minutes
Closed	Closed	Invalid: Fault after 10 minutes

Table 8-1 Zone Selection

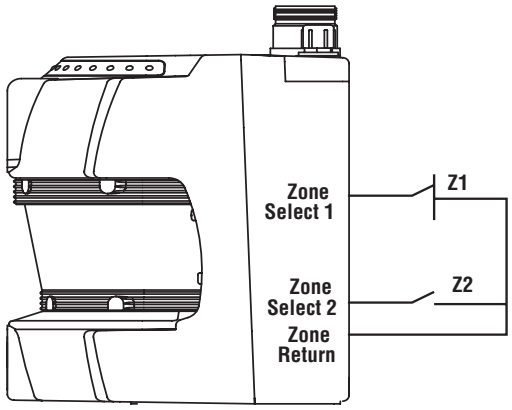


Figure 8-26 Zone Selection

The OptoShield begins monitoring a union of Zone Set 1 and Zone Set 2 within 25 ms after a change in either Z1 or Z2. If Z1 and Z2 settle into opposing states within 40 ms, the OptoShield will complete the change to a new monitored Zone Set within an additional 80 ms. The minimum time needed for a full transition from one monitored Zone Set to another is 105 ms. The maximum time permitted for such a transition is 10 minutes, after which the OptoShield will enter a Fault state if Z1 and Z2 both remain open or both closed. During this time, a union of the Zone Sets is monitored. Refer toFigure 8-27 *Zone Select Input* for more timing details.

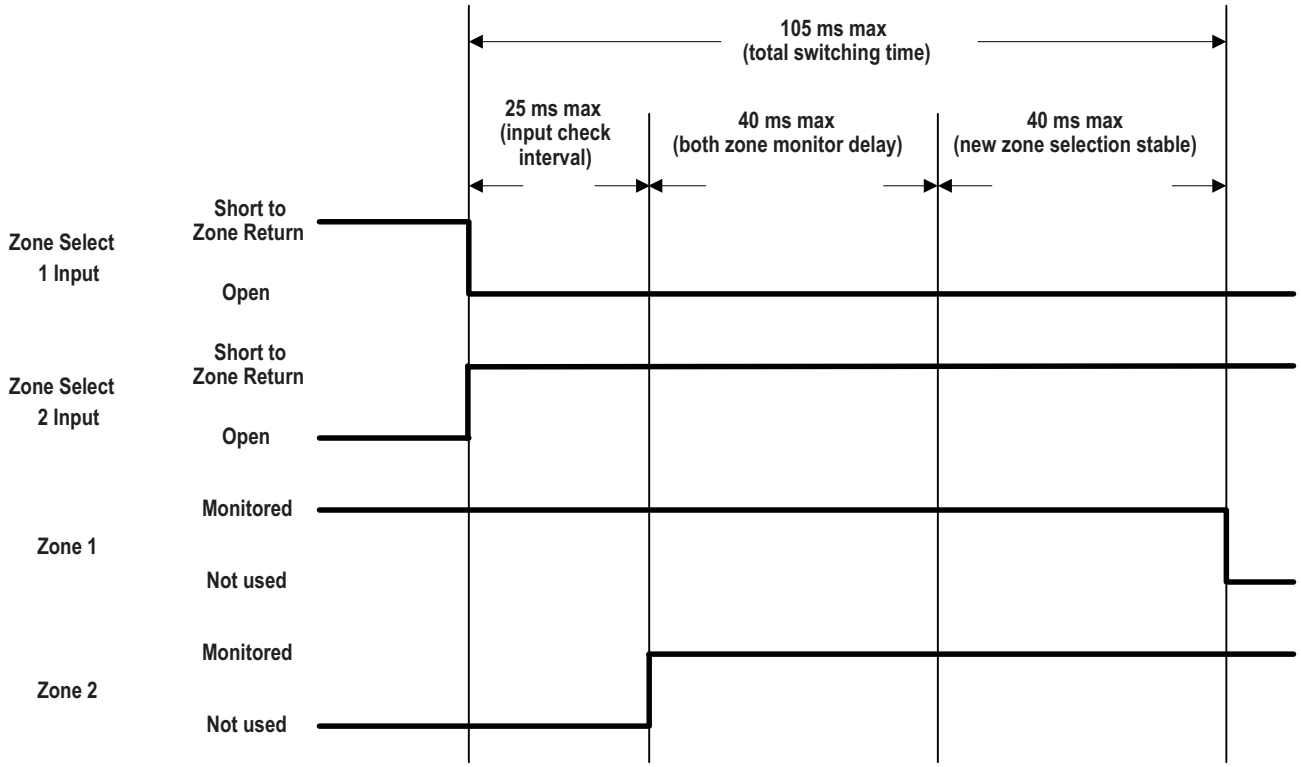


Figure 8-27 Zone Select Input

9 SYSTEM CONNECTIONS

9.1 INPUT POWER REQUIREMENTS

The OS3101 sensor operates directly from 24 VDC ± 20%. The operating power to the OptoShield must be supplied from a dedicated power supply. The power supply must meet the requirements of IEC 60204-1 and IEC 61496-1, Omron STI Part Number 40128 or equivalent. The tables below reference the connections on the OptoShield, they are identified by the pin number, input type and input name.

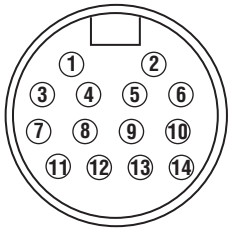


Figure 9-1 Power /Control – 14-Pin Mini-Type Connector

The table below cross-references the Power/Controls connector pin out and to the mating cable conductor color and signal description.

		60718-0xxx		
Connector	**Pin**	**Conductor Colors**	**Type**	**Signal Name**
14-Pin Male Mini-Type Connector	1	Orange/White	Input	Zone Select 1
	2	Orange/Black	Input	Zone Select 2
	3	Gray	Input	Start
	4	Pink	Input	EDM (MPCE)
	5	Black	Input	Zone Return
	6	Violet	–	Not Used
	7	Blue	Output	Auxiliary
	8	Red/Black	Output	Warning Aux.
	9	Red	Output	OSSD B
	10	Yellow	Output	OSSD A
	11	White	Power	+24V
	12	White	Power	+24V
	13	Brown	Power	24V - Ret (0V)
	14	Brown	Power	24V - Ret (0V)

Table 9-1 Power and Input/Output Connections

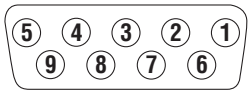


Figure 9-2 Female Shell View of Serial Port DB-9

Connector	Pin	Conductor Colors	Type	Signal Name
RS-232 DB-9	1	Black	Input	RxD+
	2	White	Output	TxD/TxD–
	3	Red	Input	RxD/RxD–
	4	Green	Output	TxD+
	5	Brown	Passive	COMM_GND
	6	Blue	Not Used	Not Used
	7	Yellow	Passive	COMM_SHIELD
	8	Orange	Not Used	Not Used
	9	Purple	Not Used	Not Used
		Braided Shield	Shield P.E.	Shield P.E.

Table 9-2 PC Interface Connections – DB9

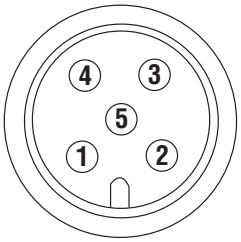


Figure 9-3 DeviceNet M12

Connector	Pin	Type	Signal Name
DeviceNet M-12	1	Passive	CAN_SHIELD
	2	Power	V+
	3	Power	V –
	4	Input/Output	CAN_HIGH
	5	Input/Output	CAN_LOW

Table 9-3 DeviceNet Connections – 5 pole M12

9.2 CONNECTING THE OPTOSHIELD TO A SAFETY MONITORING DEVICE

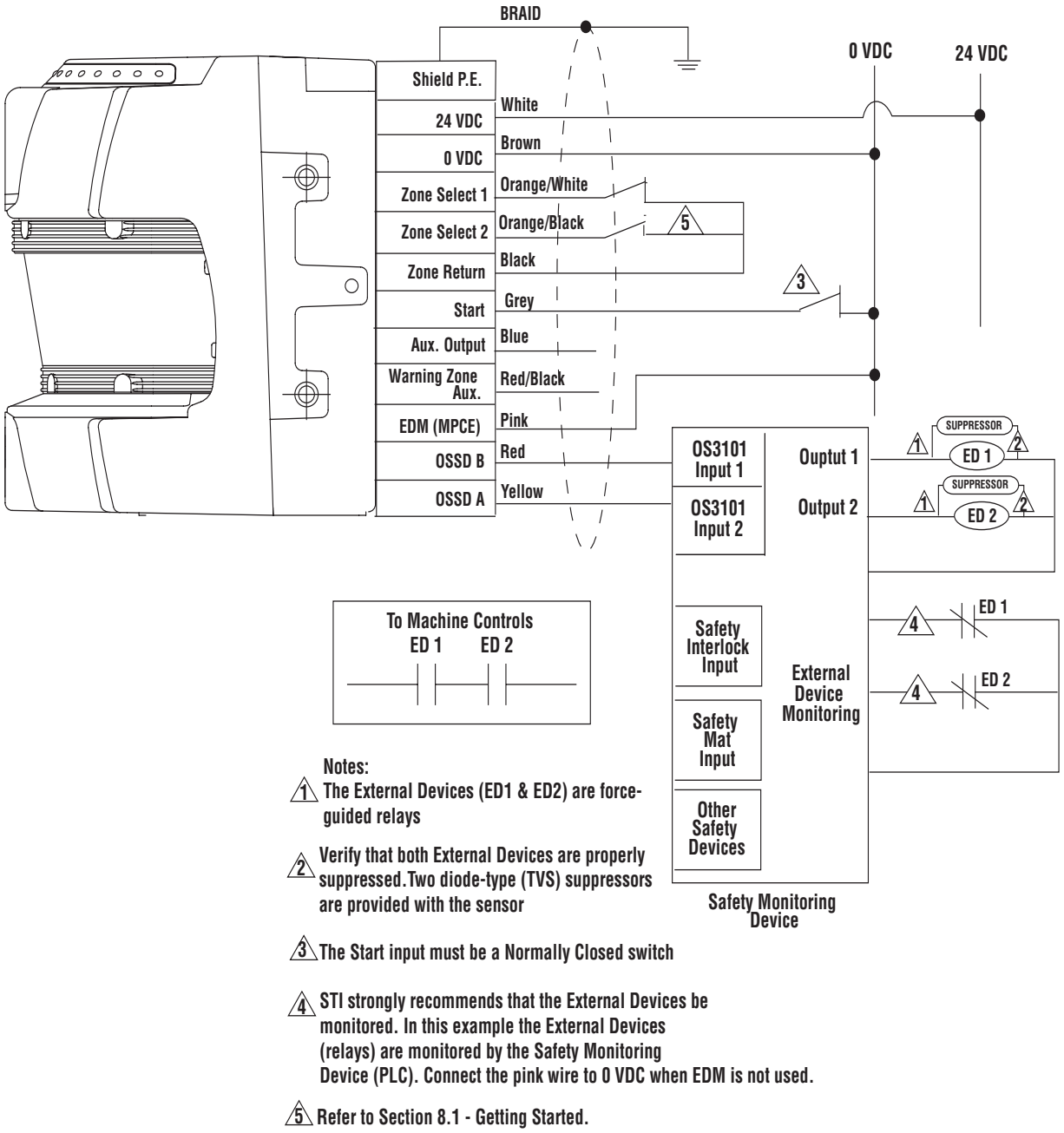


Figure 9-4 Connecting the OptoShield to a Safety Monitoring Device

9.3 Connecting the OptoShield to the RM-1 Module

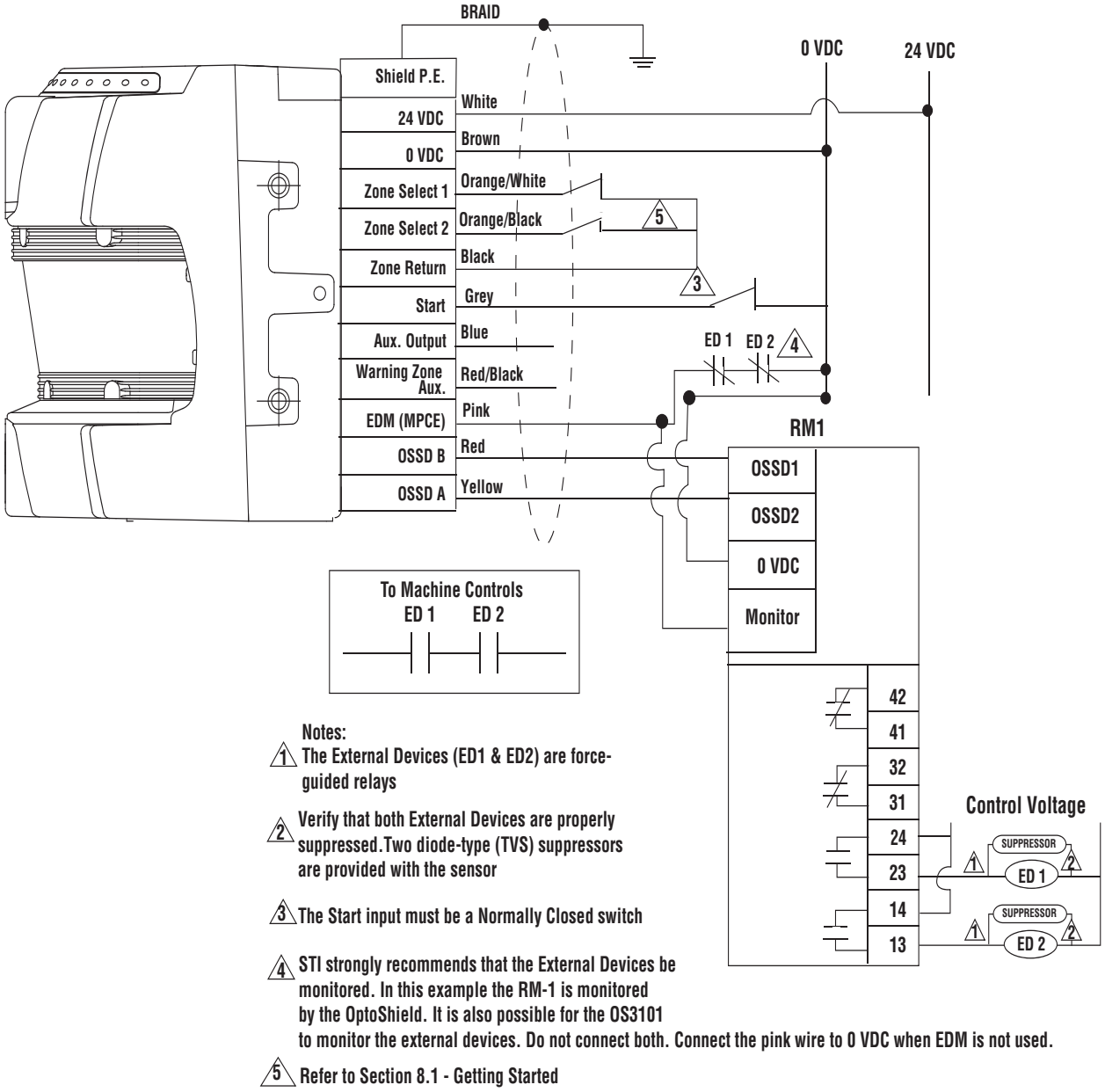
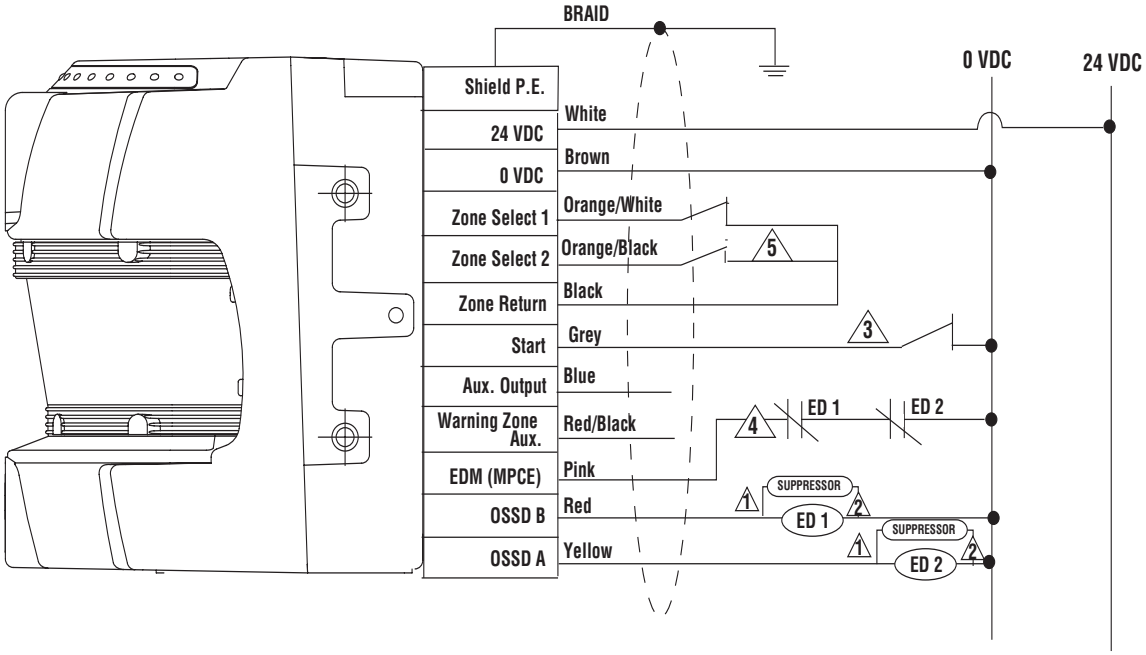


Figure 9-5 Connecting the OptoShield to the RM-1 Module

9.4 CONNECTING THE OPTOSHIELD TO TWO FORCE-GUIDED RELAYS



Notes:

1. The External Devices (ED1 & ED2) are force-guided relays
2. Verify that both External Devices are properly suppressed. Two diode-type (TVS) suppressors are provided with the sensor
3. The Start input must be a Normally Closed switch
4. STI strongly recommends that the External Devices be monitored. In this example the External Devices (relays) are monitored by the OptoShield. Connect the pink wire to 0 VDC when EDM is not used.
5. Refer to Section 8.1 - Getting Started

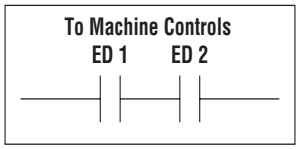
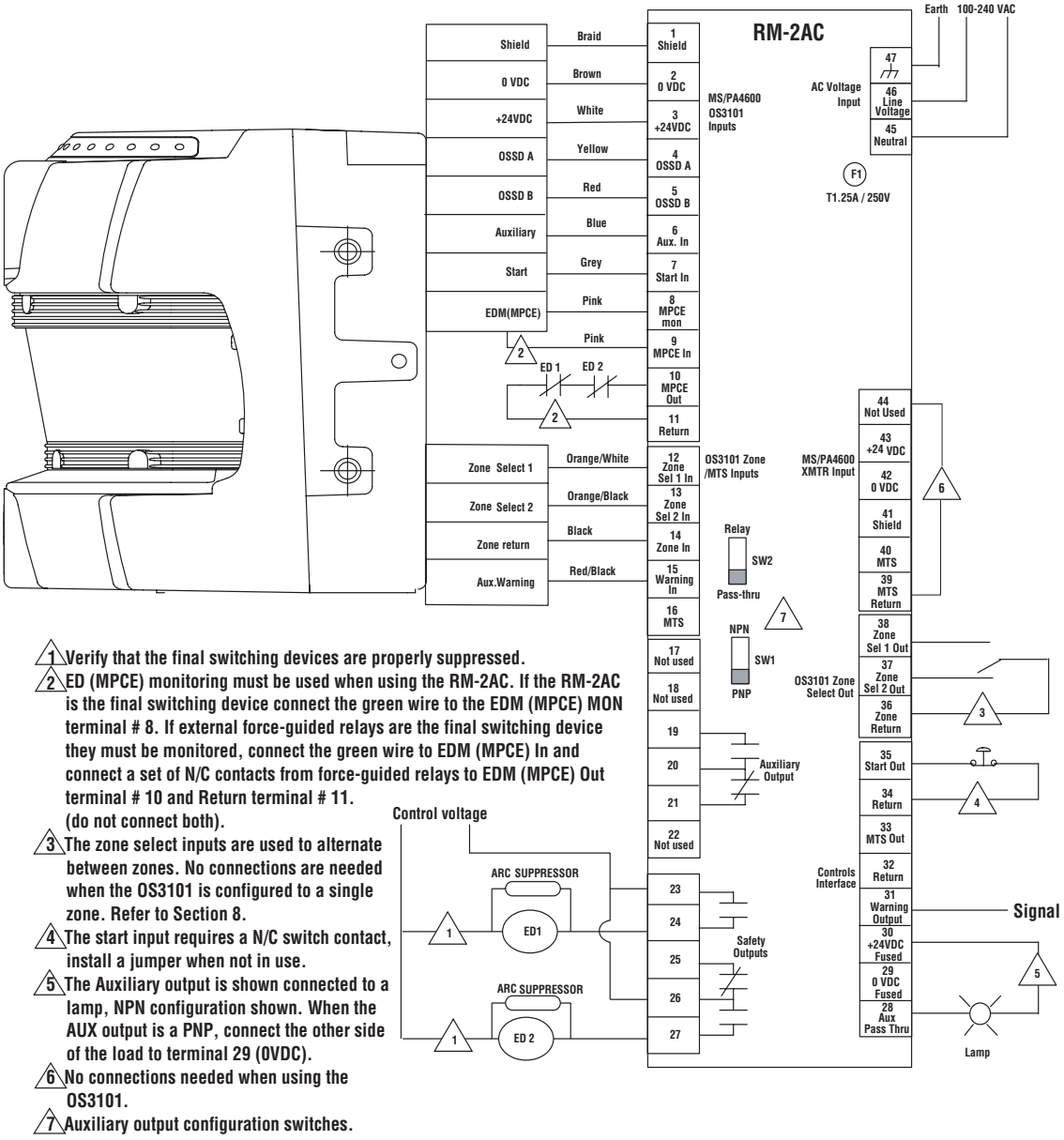


Figure 9-6 Connecting the OptoShield to Two Force-Guided Relays

9.5 CONNECTING THE OPTOSHIELD TO AN RM-2AC



1. Verify that the final switching devices are properly suppressed.
2. ED (MPCE) monitoring must be used when using the RM-2AC. If the RM-2AC is the final switching device connect the green wire to the EDM (MPCE) MON terminal # 8. If external force-guided relays are the final switching device they must be monitored, connect the green wire to EDM (MPCE) In and connect a set of N/C contacts from force-guided relays to EDM (MPCE) Out terminal # 10 and Return terminal # 11. (do not connect both).
3. The zone select inputs are used to alternate between zones. No connections are needed when the OS3101 is configured to a single zone. Refer to Section 8.
4. The start input requires a N/C switch contact, install a jumper when not in use.
5. The Auxiliary output is shown connected to a lamp, NPN configuration shown. When the AUX output is a PNP, connect the other side of the load to terminal 29 (0VDC).
6. No connections needed when using the OS3101.
7. Auxiliary output configuration switches.

Figure 9-7 Connecting the OptoShield to the RM-2AC

9.6 Checkout and Test Procedures

9.6.1 Checkout Procedure

Refer to *Appendix B* for step-by-step instruction and checkout inspection log.

Once the OptoShield has been mounted, configured, and properly connected to the machine control system, qualified personnel must perform the Checkout Procedure detailed in Appendix B. A copy of the checkout results should be kept with the machine's records.

9.6.2 Test Procedure

Refer to *Appendix C* for step-by-step instruction and test procedure log.

⚠ ***WARNING! The tests outlined in this Test Procedure (Appendix C) must be performed at time of installation, according to the employer's regular inspection program and after any maintenance, tooling change, set up, adjustment, or modification to the OS3101 system or the guarded machine. Where a guarded machine is used by multiple operators or shifts, it is suggested that the test procedure be performed at each shift or operation change and also if there is a change in the OS3101 operating mode or defined zone sets. Testing ensures that the laser safety scanner and the machine control system are working properly to stop the machine. Failure to test properly could result in serious injury to personnel.***

With the OS3101 system operating in Automatic Start Mode, verify that the machine stops and is unable to restart while the test object is in the safety zone. When the OptoShield is installed in conjunction with an Omron STI relay module, it is necessary to verify that the module's outputs properly change state. This is accomplished by causing an intentional safety zone intrusion. It is recommended that this be done at least every change of shift or 24 hours of operation.

This Test Procedure must be performed by a ***qualified*** person. A qualified person is defined as *"a person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training or experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work."* (ANSI B30.2-1983)

To test the OS3101 system use a test object dimension of 62 mm (2.33 in.) to 80 mm (3.15 in). (Test object is not supplied with the OptoShield).

9.7 Test Object Instruction

To test the OS3101's detection capability, guide the test object along the perimeter of the Safety detection zone as shown in *Figure 9-8*. The hazardous motion of the guarded equipment must stop immediately (within the pre-determined accepted stop times). While in Automatic Start Mode, the OptoShield MUST remain in the machine stop state throughout the entire test.

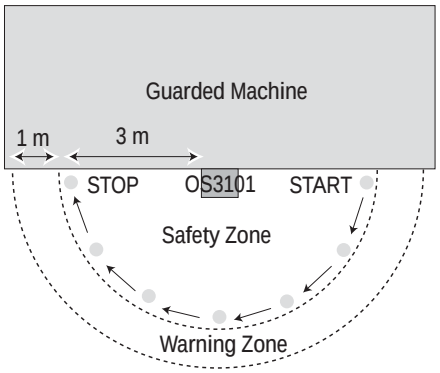


Figure 9-8 Testing the Safety Zone

Verify that all indicators and displays are operating properly and correspond to their defined functions. Inspect the OS3101 housing and the exit window for signs of damage or manipulation.

If the OS3101 is used in a stationary guarding application, ensure that the safety zone(s) are clearly marked on the floor. For mobile applications, make sure that the vehicle stops moving within the limits set in the initial configuration.

If the OS3101 fails any of these tests, lock out the guarded equipment and contact the factory supervisor immediately.

9.8 Minimum Object Resolution

The Optoshield OS3101 has a minimum Object Resolution of 62mm. This means that the OS3101 will detect an object 62mm or larger in diameter that is completely within the field of view.

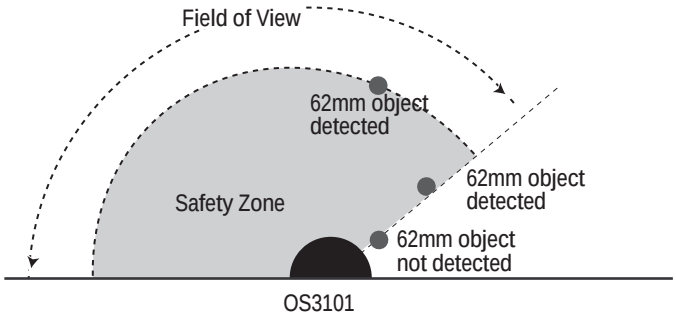


Figure 9-9 Field of View

9.9 Size Considerations when Configuring a Detection Zone

Due to the scanner's minimum object resolution criteria, it is possible to configure zones that are not considered valid. These zone configurations may contain a protrusion or intrusion that is narrower then 62mm in width within the field of view. This type of invalide zone configuration can only occur within a distance of 2.6 meters from the scanner.

Narrow protruding areas less than 62mm wide are NOT valid zone perimeters. A scanner configured with such a safety zone would see a presence within this area (if in monitor mode), but would not initiate a machine stop. The following pictures shows a possible zone configuration that contains a protrusion that is narrower then 62mm in width, since this protrusion is less than 62mm in width it will not detect a 62mm object.

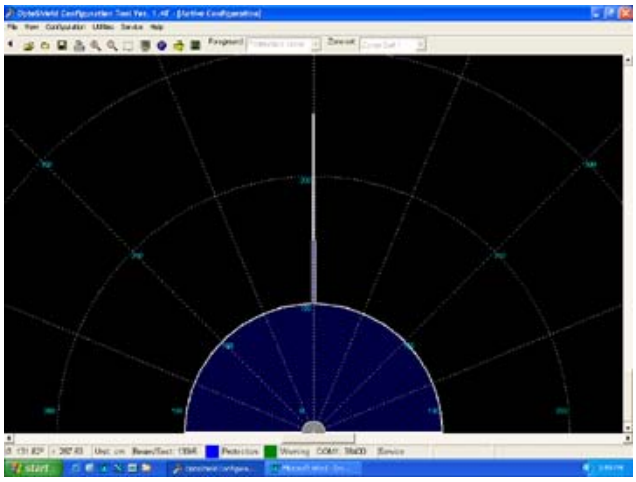


Figure 9-10 Detection Zone with Protrusion

Narrow intruding areas less than 62mm wide are NOT valid zone perimeters. A scanner configured with such a safety zone would see a presence within this area (if in monitor mode), but would not initiate a machine stop. The following pictures shows a possible zone configuration that contains an intrustion that is narrower then 62mm in width, In this case the scanner has two fields of view and the object must be entirely in the left or right field of view to be detected, therefore this narrow intrusion of less than 62mm in width is not a valid zone.

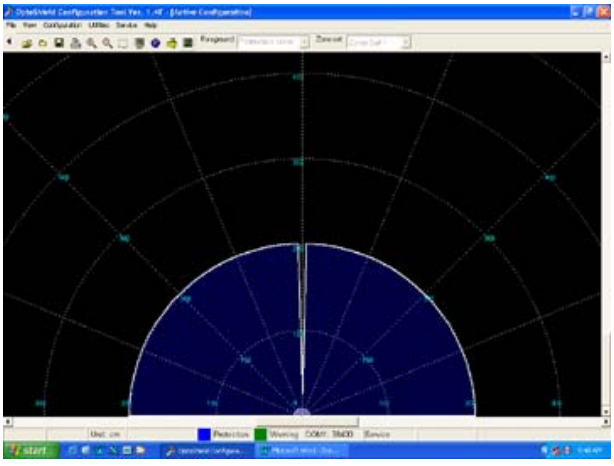


Figure 9-11 Detection Zone with Intrusion

10 TROUBLESHOOTING

10.1 TROUBLE SHOOTING

Here are a few tips that will help you identify and resolve common OS3101 issues.

10.1.1 INTERMITTENT STOP

The scanner will erratically transition from a Machine run (green) state to a Machine stop (red) state. This may happen on a regular basis or very infrequently.

The four reasons are:

- Crosstalk

Crosstalk can occur if two or more scanners are installed in view of each other and at the same height (scan plane) refer to section 5.6 for more information and mounting suggestions.

- Incorrect zone configuration

If the safety zone configuration is set too close to any objects an intermittent stop may occur. Check that the perimeter of the zone is at lease 135mm away from the closest physical object. (the measurement error of the scanner is 135mm)

- Bright lights/Lamps

Ambient light or strobe flashes will cause the OS3101 to false stop, see Section 5.5 on page 22 for more information. This is not a safety concern.

- Dust Accumulation on Window

If the intermittent stops occur with an 80 on the display, the window needs to be cleaned.

10.1.2 CONSTANT STOP

- Dirty window

In most cases a dirty/scratched window will give you a status code of 80 indicating that cleaning or replacement is needed. In some cases a dirty/scratchey window may NOT indicate 80. Check the Intrusion Indicators, they will help you determine if the scanner is detecting something.

- Layout change

Verify that the envelope of the guarded area has NOT changed. In some cases something was moved or placed within the zone. Check the Intrusion Indicators, they will help you determine if the scanner is seeing something.

10.1.3 SLOW RESPONSE TO RUN STATE

The same problems mentioned for an intermittent stop crosstalk, incorrect zone configuration and bright lights/lamps could cause a slow response to run state. In all of them the scanner finds some spurious zone violation that prevent it from going green immediately. Check that the perimeter of the zone is a least 135mm away from the closest physical object. (the measurement error of the scanner is 135mm).

10.2 Fault Condition

Check the fault code table

10.2.1 Diagnostic Codes

The OptoShield has a two-digit numeric display on the front of the scanner indicates status and system fault status. These codes are described in the table below.

Status Codes	Diagnostic Code	Description	Corrective Action
Normal Operation	88	Power Up indication	None required
	--	Normal Operation (machine stop)	None required
	01	Interlock state and waiting for Start input	Press and release Start switch
	02	The unit is in configuration mode	Go to the configuration heading and exit CGF mode
	XX	See Table 10-2	None
Maintenance	80	The unit has detected the accumulation of dust on the window	Clean the window
Fault Codes	**Diagnostic Code**	**Description**	**Corrective Action**
Safety Output (OSSD) Faults	30	General OSSD fault	Check output connections, see manual.
	32	Safety Output A tied to power.	Check output connections, see manual.
	33	Safety Output B tied to power.	Check output connections, see manual.
	34	Safety Output A shorted to Ground	Check output connections, see manual
	35	Safety Output B shorted to Ground	Check output connections, see manual.
EDM (MPCE) Faults	40	General EDM (MPCE) fault	EDM (MPCE) input incorrectly wired, see manual
	41	EDM (MPCE) monitoring signal is in incorrect state before entering the Machine Run state.	Check that EDM (MPCE) input is closed before OSSD activation, see manual
	42	EDM (MPCE) monitoring signal is in incorrect state after entering the Machine Run state	Check that EDM (MPCE) input is open after OSSD activation, see manual
	43	EDM (MPCE) monitoring signal is in incorrect state during power up.	Check that EDM (MPCE) input is closed when power is applied, see manual
Internal Fault	50	Internal fault	Consult factory
	81	The unit has detected a varience in the dust detection circuit.	Clean the window and re-start the unit. If the fault does not clear, consult factory.
	51	Possible crosstalk with other laser scanner	Refer to Section 5.5 for proper mounting information.
	52-58	Internal Fault	Consult factory.
	59	The scanner was possibly Jarred or Bumped	Reset scanner by cycling power or pressing the reset button (user supplied). If the fault does not clear, consult factory.
	70	Zone select input fault	Check zone select configuration and input connections

Table 10-1 Diagnostic Code References

- Status Code Display

The following status codes will appear on the scanner's 7-segment display during machine run state. They are representive of the zone setting and the scanners operating response time. Example: code '24' indicates zone set 2 with a response time of 160mS. **Note: Response times longer than 400mS are represented by a Zero**

Active Zone Set	First Digit
Zone Set 1	1
Zone Set 2	2
Union of Zone 1 and 2	U
Response Time (mS)	**Second Digit**
80mS	2
120mS	3
160mS	4
200mS	5
240mS	6
280mS	7
320mS	8
360mS	9
400mS	0
440mS	0
480mS	0
520mS	0
560mS	0
600mS	0
640mS	0
680mS	0

Table 10-2 Status Display Code

11 SPECIFICATIONS AND ADDITIONAL INFORMATION

11

11.1 SYSTEM SPECIFICATIONS

Mechanical	
Input Voltage (V_{in})	24 VDC ± 20%.The rating depends on the current requirements of the loads attached to the outputs (see note 3). The power supply must meet the requirements of IEC 60204-1 and 61496-1. Omron STI part number 40128 or equivalent.
Input Power	20 watts (without load on the outputs)
Response Time	≤ 80 ms (2 scans), add 40 ms with each additional scan (up to 15 additional scans max.)
Light Source (wave length)	laser diode 905 nm
Detection Sets	2
Object Resolution	62 mm @ 4m
Max. Safety Radius	4 m
Max. Warning Radius	15 m
Measurement Angle	180 degree
Angle Resolution	0.36°
Laser Safety	Class 1 per IEC-60825.1 (2001) and CFR 21 1040.10 & 1040.11
Max. Measurement Error	135 mm
Max. Measurement Error w/ reflective backgrounds	See Section 11.2—*Reflective Surface Considerations* for information.
Outputs	
Safety Outputs Ratings	Two PNP outputs sourcing 625 mA max @ V_{in} (see note 1)
Auxiliary (Non-Safety) Output Ratings	One NPN output sinking 100 mA max @ V_{in} or one PNP output sourcing 100 mA @ V_{in} (see notes 1 and 2)
Warning Zone (Non-Safety) Output Ratings	One NPN output sinking 100 mA max @ V_{in} or one PNP output sourcing 100 mA @ V_{in} (see notes 1 and 2)
Inputs	
EDM (MPCE) Monitor	50 mA @ 24 VDC
Start/Restart	20 mA @ 24 VDC
Zone Select 1 & 2	20 mA @ 24 VDC
Status Indicators	Machine Run, Machine Stop, Interlock
	Two 7-segment displays for diagnostics
	16 intrusion indicators
Data Interface	
Serial Port	RS232 or RS422; 9.6K, 19.2K, 38.4K Baud Rate and 115.2 K
DeviceNet	For diagnostic data only

Mechanical	
Environmental	
Operating Temperature	0 – 50°C
Storage Temperature	–25 to 70°C
Enclosure Rating	IP65
Relative Humidity	95% max., non condensing
Enclosure	Polyester powder-painted die-cast aluminum
Dimensions	155 x 182 x 156 mm
Vibration	In accordance with IEC 60028-2-6.
Shock	In accordance with IEC 60028-2-29
Weight	4.35 kg.
Max. Cable Limits	
RS232	15 meters
RS422	100 meters
DeviceNet	6 meters
Controls and Outputs	30 meters
Approvals	CE, TUV, UL and CSA
Conformities	Category 3 EN954-1, Type 3 IEC 61496-3, UL508
Note 1: Voltage available at the outputs is equal to Vin – 2.0 VDC. Note 2: Total current required by the two solid-state outputs, auxiliary output and the warning output should not exceed 1.45A. Note 3: Total system current requirement of the OptoShield is 2.3A max. (scanner 850 mA + OSSD1 load + OSSD2 load + auxiliary output load + warning zone output. Specifications are subject to change without notice.	

Table 11-1 OS3101 Specifications

11.2 Reflective Surface Considerations

Note: The accuracy of a laser scanner can be affected by highly reflective backgrounds. This variance must be taken into consideration during safety zone setup.

An additional safety factor is required when the following conditions exist:

— Highly reflective or retro-reflective background material or objects are present in the scanning plane and within 3m of the outer edge of the safety zone
— White, background material or objects are present in the scanning plane and within 2m of the outer edge of the safety zone.

11.2.1 Reflective Background Types

It is not feasible to produce a list of all possible reflective surfaces and their reflective properties. The term white (low reflective) background can be applied (but not limited) to many industrial paint finishes.

A retro-reflective (high reflective) background can refer to surfaces (but not limited), like acrylic plastics, polished steel, reflective tapes or mirrors.

Figure 11-1—*OS3101 as the Primary Guarding Device* shows an example of an application where the OS3101 is the primary guarding device and there is a direct approach path to the hazardous area. In this example the additional safety factor Z (z1 + z2) must be added. (z2 is only needed if reflective backgrounds exist)

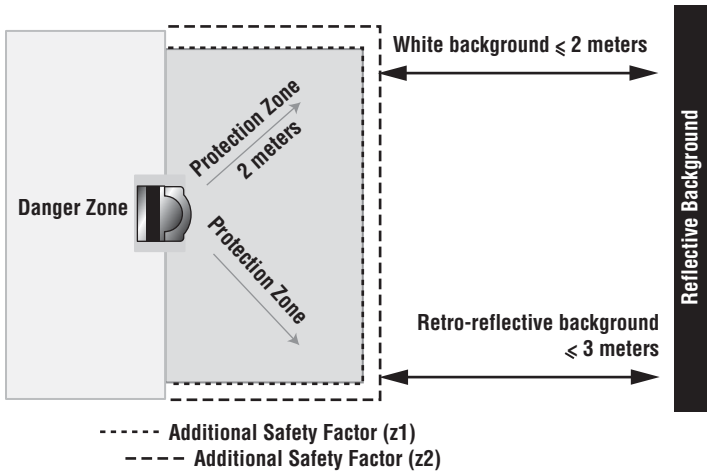


Figure 11-1 OS3101 as the Primary Guarding Device

11.2.2 Calculating the Additional Safety Factor

If any of the conditions listed above apply to your application, an additional safety factor should be added to the calculated safety zone size.

This additional safety factor (Z in the safety distance calculation) is equal to z1 + z2, where:

— z1: the scanner's maximum measurement error (135mm)
— z2: additional error, due to reflective surfaces (taken from the graph in Figure 11-2—*Additional Safety Factor*).

The example in Figure 11-1—*OS3101 as the Primary Guarding Device* will result in a z2 factor of 80mm for a white background and 220mm for a retro-reflective background. This is based on the 2 meter size of the protection field, see Figure 11-2—*Additional Safety Factor*.

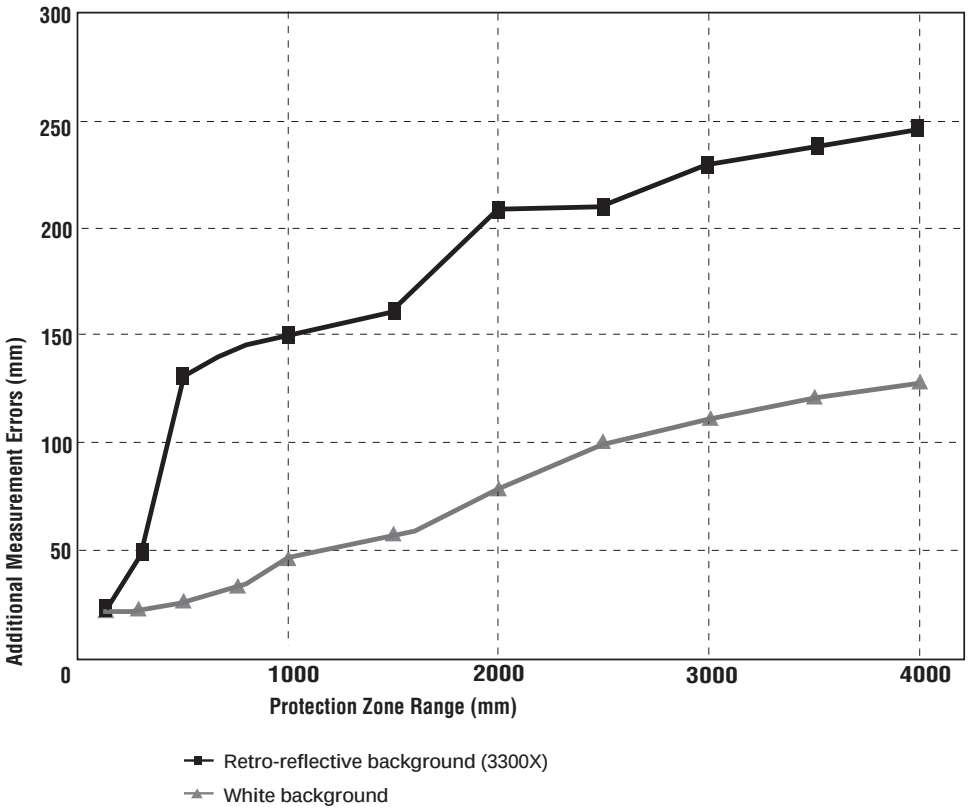


Figure 11-2 Additional Safety Factor

(changes to this graph will include, cm to mm and object range to protection zone range)

11.2.3 When to Use the Additional Safety Factor

The additional safety factor must always be considered when calculating the guarded protection zone. However, all applications differ in design, therefore every machine will have a unique restricted space. Also, if there is a direct approach path to the hazardous area, the safety factor must be applied. Other considerations include whether the scanner is the primary or secondary guarding device.

Figure 11-3 and *Figure 11-4* show examples of applications where the OS3101 is the secondary guarding device and there is no direct approach path to the hazardous area. In this example the factor z2 is NOT applied. The z2 factor (135mm) is taken into consideration and the protection field is positioned 135mm away from the restricted space boundary.

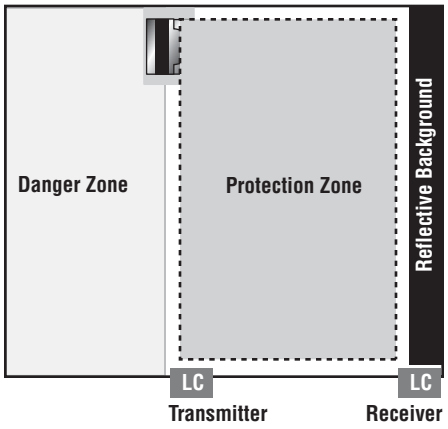


Figure 11-3 Light Curtain as the Primary Guarding Device

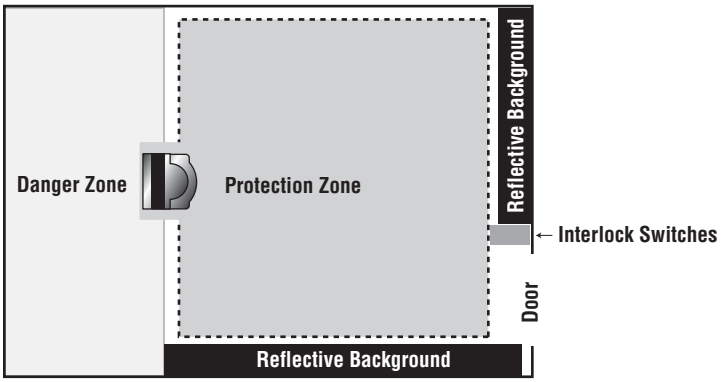


Figure 11-4 Interlock switch as the Primary Guarding Device

Note: If the Reflective Background exceeds the minimum distance from the protection zone the additional measurement error does not need to be applied, see Figure 11-4 *Interlock switch as the Primary Guarding Device*

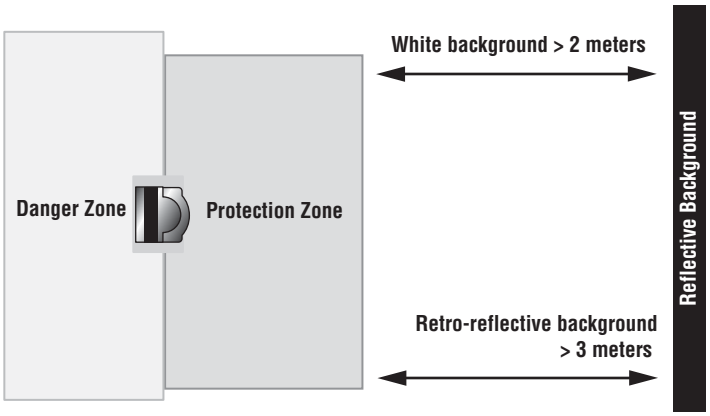


Figure 11-5 No Additional Measurement Errors

11.3 Dimensional Drawings (mm)

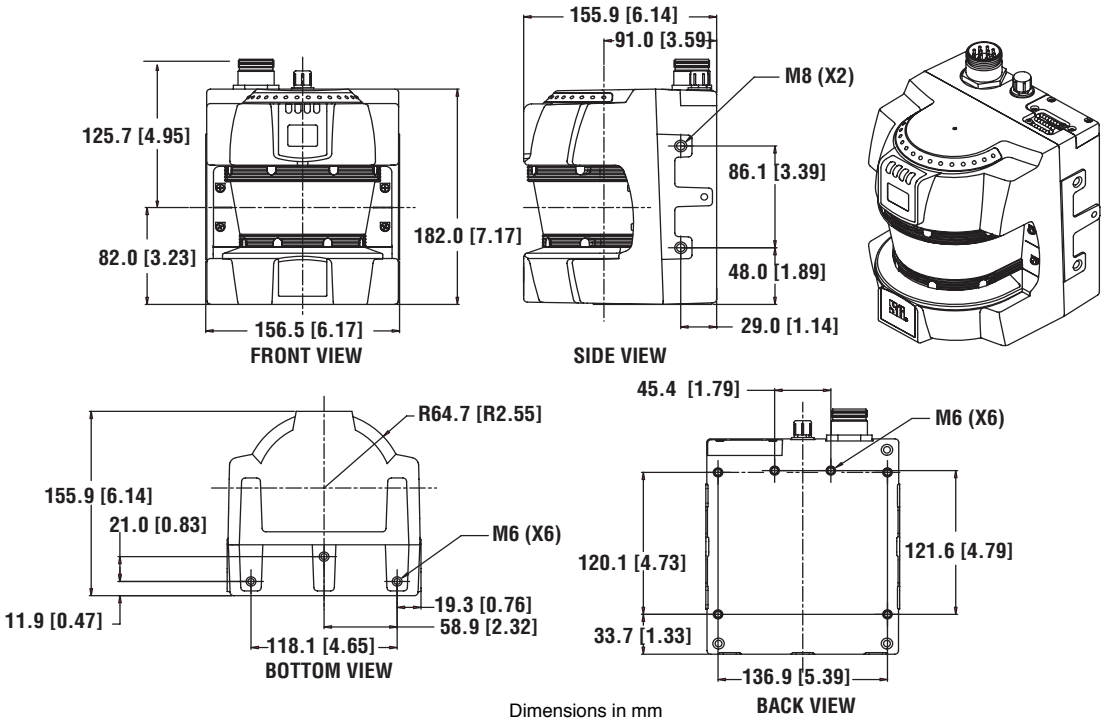


Figure 11-6 OptoShield Dimensional Drawing

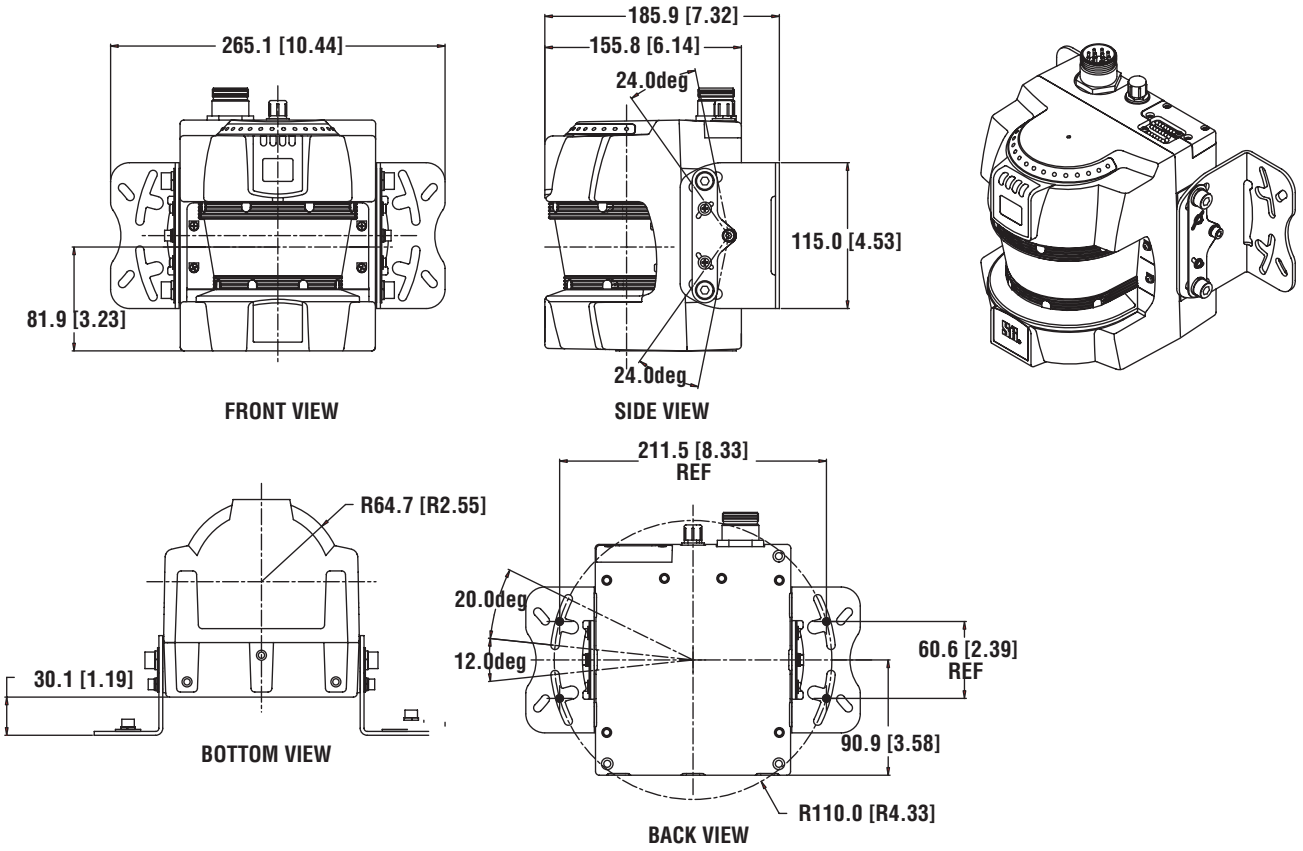


Figure 11-7 OptoShield with Outward Mounting Brackets

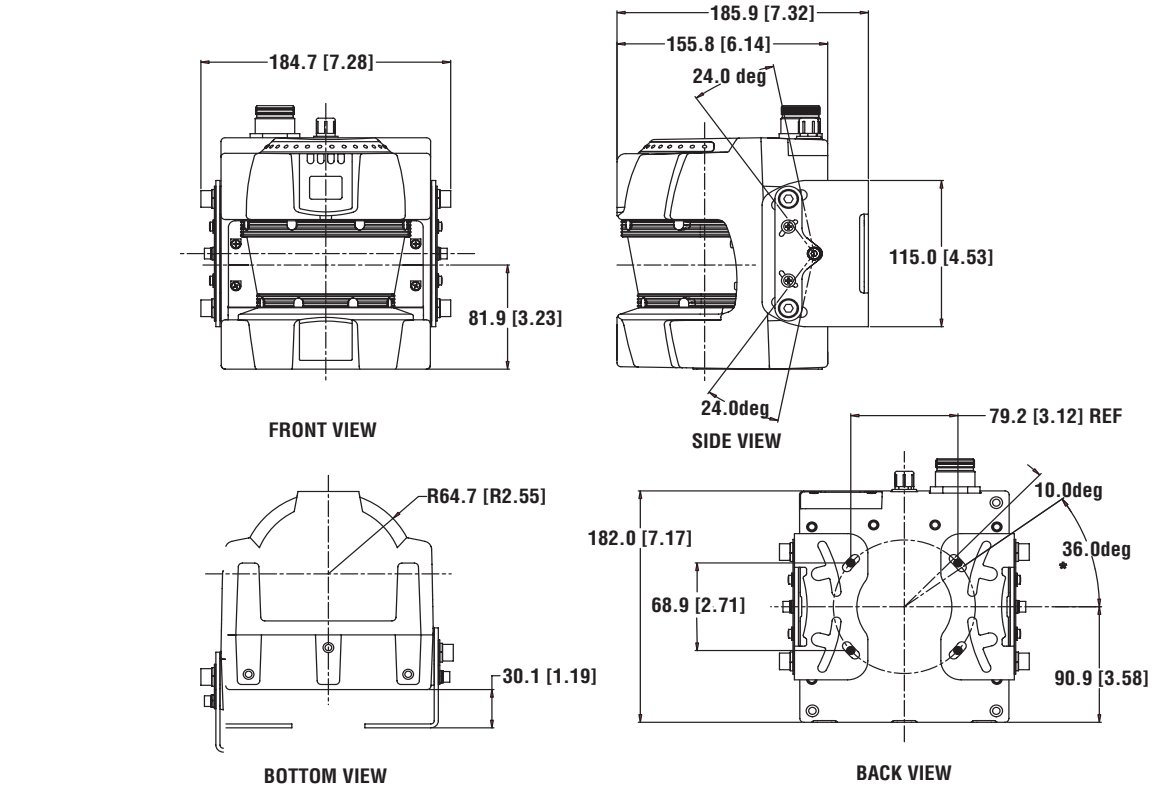


Figure 11-8 OptoShield with Inward Mounting Brackets

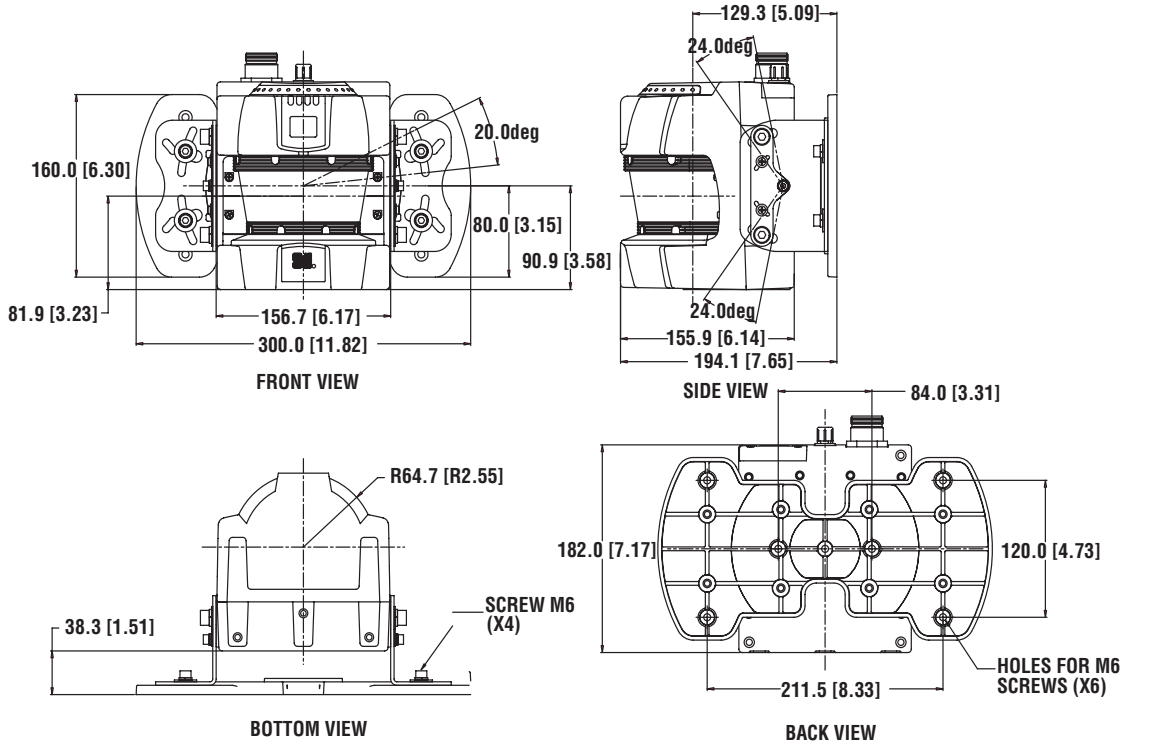


Figure 11-9 OptoShield with Bracket Kit and Mounting Plate

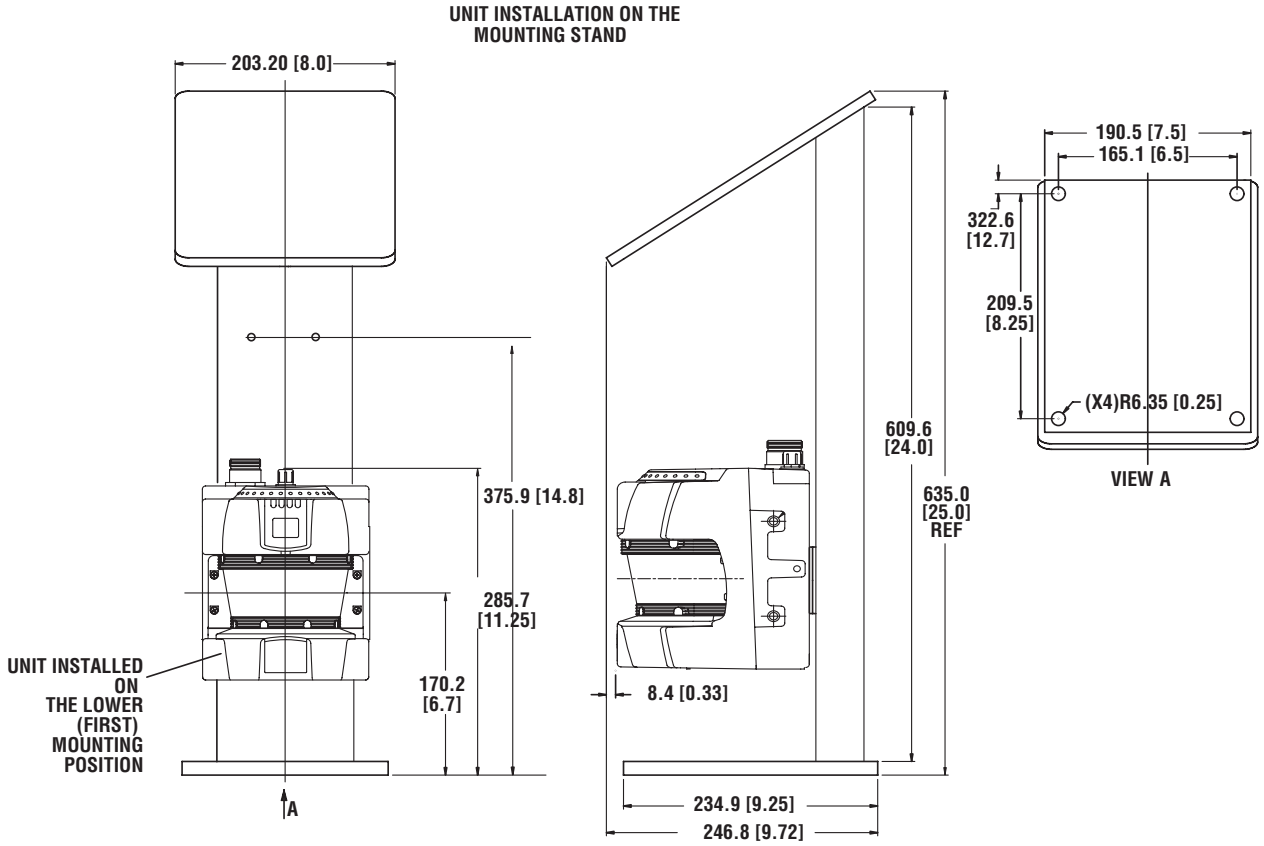


Figure 11-10 Mounting Stand

12 GLOSSARY AND OTHER INFORMATION

12.1 GLOSSARY

- Auxiliary Output

This is a non-safety output. It may be configured to follow the OSSD Safety Outputs or to indicate a fault condition.

- Auto Connect

Feature of the Configuration Tool (CFG). It establishes the serial communication between the sensor and the computer. It automatically selects the serial port and baud rate on the computer to which the OptoShield is connected. Supported baud rates: 9.6 K, 19.2 K and 38.4 K; serial ports: COM1 through COM8.

- Baud Rate (bits per second)

The speed at which your computer can transmit and receive information. The Optoshield can transmit in four baud rates: 9.6 K, 19.2 K, and 38.4 K.

- Edit Zones

When enabled the edit zones mode will allow the current configurations of the protection and warning zones to be modified. The zones are graphically displayed for editing. This feature can only be used with an access log-on level of supervisory user or higher.

- External Device Monitoring (ED) a.k.a. (MPCE)

That electrically powered element which directly controls the machine's normal operating motion in such a way that it is last (in time) to operate when motion is initiated or arrested. Redundant machine control circuits must have two external device monitoring (EDM (MPCE)). The monitoring of the machine external control devices is an important part of a safety system installation and is referred to as EDM.

- Monitoring Mode

In this mode, the continuously measured data from scanner is displayed on the screen in real time.

- Monitoring Zone

The Monitoring Zone command selects the zone set to be monitored. There are three selections for this property zone set 1, zone set 2, or multiple zones. Each zone set consists of a protection zone and a warning zone.

- MPCE (See External Devices)

- Safety-critical Settings

These are the settings that configure the safe installation of the OptoShield. Example: EDM (MPCE), response time and oeprating mode.

- Non-Safety Critical Settings

These are settings that are not related to the safe installation of the Optoshield. Example: auxiliary output, warning output and warning zone.

- OSSD

Output Signal Switching Device, this term is used when referring to the safety outputs of the sensor.

- Protection Zone

A user-defined protection area originating from the sensor and extending radially to the protection boundary. The range of the Protection Zone is a radius of 93mm to 4000mm. Within the zone, the sensor performs accident-prevention functions. This zone is a safety-critical property.

- Response Time

The maximum time between the actuation of the sensor function and the switching of the safety output of the Optoshield. The response time ranges from 80 ms (2 scans) to 680 ms (17 scan), in increments of 40 ms.

- Warning Zone

The user-defined warning area originating from the sensor and extending radially to the zone boundary. The range of the Warning Zone is a radius of 93 mm to 15 m. This zone allows a large scanning area than the Protection Zone and can be used to activate a warning function. This zone is a non-safety-critical property.

12.2 COMMANDS

- Discard Change/Exit CFG Mode command

Instructs the Optoshield to discard all the changes that have been received since the last update. In addition, the sensor then exits the CFG (configuration) Mode and reset itself.

- Edit Properties command

Enables the user to edit the existing operating properties. The properties are divided into two categories, safety critical and non-safety critical. The user must have the supervisory access or higher to make any changes.

- Receive from Sensor

This command retrieves and displays the current operating setting and zone configurations from the OS3101.

- Register Changes/Exit CFG Mode

This command saves the changes in the Optoshield's settings since the last update. The sensor then exits the CFG (configuration) Mode.

- Sculpting Command

Allows the user to specify the protection and warning zone based on the sensor's measurements of the distance to a physical boundary. This physical boundary may either be part of a static monitoring region, or an object (e.g., test piece) manually placed at the desired radius by the user. Selecting the Sculpting command instructs the sensor to send the measured profiles to the host. On each angular direction, the range will be the minimum between the current measured range and the transmitted range in the previous scan. The CFG Tool subtracts a stand-off distance of 135cm from the received profile of any protection zone before it is graphically displayed for the user. The user can shape the contour of the zone by encroaching into the scanned area at the appropriate points. Once the user is satisfied with the displayed zone, the CFG Tool will allow the user to stop Sculpting (select the command again) which will cause the sensor to cease sending profiles. At that point the user will be allowed to edit the last received profile and/or to assign it to one of the Protection or Warning zones in the displayed configuration.

- Send to Sensor/Enter CFG Mode command

This command places the sensor in Configuration Mode and sends the displayed configuration's properties to the sensor. The user logon must be supervisory use.

There are three options available:

— All Changes - to send all properties that have been changed since the last update.
— Send Selected Items - user selects the properties to be sent.
— Entire Configuration - to send the completed configuration to the sensor.

12.3 Spare Parts

Model	Description:
OS3101-2-PN-0P	Optoshield with RS232 serial port, PNP auxiliary output
OS3101-2-PN-RV-0P	Optoshield with RS232 serial port, PNP auxiliary output, Device net
Cables	
OS3101-10PT	Power cable – 10 meters long
OS3101-20PT	Power cable – 20 meters long
OS3101-30PT	Power cable – 30 meters long
RS2-C4	Serial port cable 4 meter (for temporary use only)
RS2-C2	Serial port cable 2 meter (for temporary use only)
RV-6	Device net cable 6 meter (20 ft.)
Mounting Hardware	
OS3101-BKT	Mounting bracket kit
OS31-BPT	Mounting back plate
OS31-MT	Mounting Stand
Resource Modules	
RM-1	RM-1 resource module
RM-X	RM-X resource module
RM2-AC	RM2-AC resource module
Accessories	
OS3101-WIN-KT	Window w/ gasket replacement kit
OS31-CLN-KT	Window cleaning kit, Anti-static cleaner
USB-RS2	USB to Serial adapter
OS3101-INST	OS3101 Installation and Operating Manual
OS31-CFG	OS3101 Configuration Tool CD
OS3101-DST-KT	Dust Ring w/gasket replacement kit

12.4 WARRANTY

Omron STI warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within one year from the date of installation and not to exceed 18 months from date of factory shipment.

The foregoing warranty is in lieu of and excludes all other warranties not expressly set forth herein, whether expressed or implied by operation of law or otherwise including but not limited to any implied warranties of merchantability or fitness for a particular purpose. No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of Omron STI which is not specifically set forth herein shall be binding upon Omron STI. Omron STI shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and Omron STI's liability hereunder, in any case, is expressly limited to repair or replacement (at Omron STI's option) of goods.

Warranty is specifically at the factory or an Omron STI authorized service location. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/electrical protection devices. Omron STI shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

12.5 PATENTS

Elements of the electronics and optics essential to meet the specifications and performance standards of Omron STI controls are covered by one or more of the following U.S. Patent Numbers:6,665,621; 6,753,776; 6,493,653; 6,587,811.

12.6 TRADEMARKS

OptoShield is a trademark of Omron Scientific Technologies, Inc.

12.7 REPAIRS

Omron STI offers product repair service at our factory. If you need repairs made to any Omron STI product contact our Service Department.

12.8 DOCUMENTATION CRITERIA

This publication has been carefully checked for accuracy and is believed to be fully consistent with the products it describes. However, Omron STI does not assume liability for the contents of this publication, the examples used within, or the use of any product described herein. Omron STI reserves the right to make changes to products and/or documentation without further notification.

13 Window and Dust-Ring Replacement Procedure

13

13.1 Window Kit

Window Kit model: OS31-WIN-KT

Kit contents:

- Qty. 1– Molded window
- Qty. 1– Molded gasket
- Qty. 4– fastening screws (M3 X 6)
- Qty. 4–flat washers

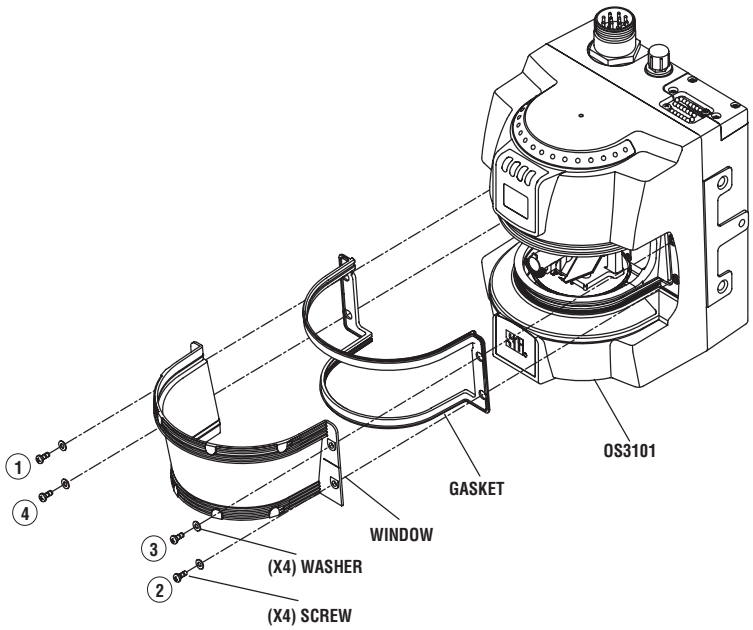


Figure 13-1 Window Replacement

Window replacement can be accomplished without factory support. This procedure will guide maintenance personnel in safely and efficiently replacing the window with minimal downtime.

1. Take precautions to prevent dirt, dust or debris from entering the internal space of the OS3101. It is recommended that this be done on a clean workstation as contaminants may degrade the performance of the OptoShield.

2. Remove power from the OS3101. It will be necessary to dismount the OptoShield from the guarded equipment.

3. Remove the serial and power connection cables.

4. Using a clean cotton cloth, gently wipe off any dirt or dust from the front of the unit that may inadvertently enter the internal space of the OS3101 while the window is removed. **(Do not use standard compressed shop air to blow off dust from inside the unit)**

5. Remove the four retaining screws and washers on the sides of the window.

6. Remove the existing window by using a small flat head screwdriver to gently pry up the window's edge. (close to the screw fastening location).

7. Remove the existing gasket and install the new gasket. To remove air-born particles from the inside of the unit only use low pressure compressed air that is suitable for optics and sensitive electronics.

8. Install the new window, care should be taken to assure that the inside of the window is clean and free of fingerprints and to obtain a snug fit of the window to the window sealing area.

9. Replace the four retaining screws in an alternating pattern, see *Figure 13-1—Window Replacement*. It is recommended that the retaining screws be tightened to a torque of 20 in-ozf (14 newton-cm). Caution: excess pressure on the edges of the window may result in cracking of the material.

10. Recalibrate the OptoShield to the new window, see window calibration procedure.

Note: If the window is damaged to a point where the housing's IP rating integrity is compromised, it is highly suggested to replace the window as soon as possible to reduce the probability for internal contamination. It is also advisable to take precautions to prevent dirt, dust or debris to enter the internal space of the OS3101.

13.2 Dust Ring Replacement Procedure

Dust-Ring Kit model: OS3101-DST-KT (Kit contents):

- Qty. 1– Molded dust ring assembly
- Qty. 2– Molded gasket O-rings
- Qty. 2 – Fastening screws
- Qty. 1– Omron STI logo label
- Qty. 1– Cover screw

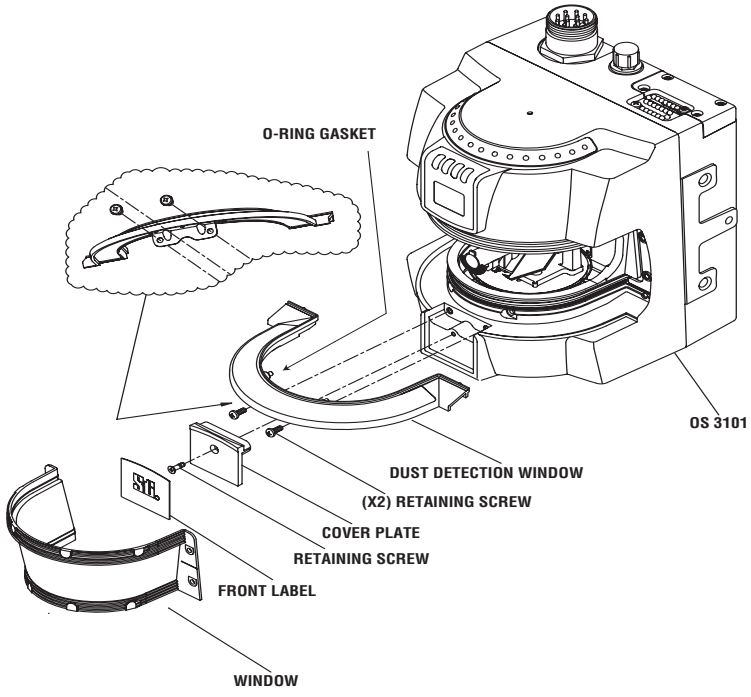


Figure 13-2 Dust-Ring Replacement

Dust Ring replacement can be accomplished without factory support. This procedure will guide maintenance personnel in safely and efficiently replacing the Dust Ring with minimal downtime.

1. Take precautions to prevent dirt, dust or debris from entering the internal space of the scanner. It is recommended that this be done on a clean workstation as contaminants will degrade the performance of the OptoShield.
2. Remove power from the OS3101. It will be necessary to dismount the OptoShield from the guarded equipment.
3. Remove the serial and power connection cables.
4. Using a clean cotton cloth, gently wipe off any dirt or dust from the front of the unit that may inadvertently enter the internal space of the OS3101 while the Dust ring is being replaced. (Do not use standard compressed shop air to blow off dust from inside the unit)
5. Remove the front Omron STI logo label.
6. Remove the one retaining screw and remove the cover plate.
7. Remove the front window assembly by removing the 4 retaining screws and washers, use a small screwdriver to gently pry up the window edge.
8. Remove the two retaining screws from the dust ring.
9. Remove the existing dust ring by using a small flat head screwdriver to gently pry up the dust ring. (close to the screw fastening location) and/or the back corners.
10. Install the new dust ring. Verify that the 2 O-rings are installed.
11. Replace the two retaining screws, see Figure 13-2—Dust Ring Replacement. It is recommended that the retaining screws be tightened to a torque of 48 in-ozf (34 newton-cm.). Caution: excess pressure on the edges of the ring may result in cracking of the assembly.
12. Reinstall the cover plate using the retaining screw and apply the front label.
13. Reinstall the front window and tighten the screws to a torque of 20 in-ozf (14 newton-cm).
14. Recalibrate the OptoShield to the new dust ring, see window calibration procedure.

Note: If the dust ring is damaged to a point where the housing's IP rating integrity is compromised, it is highly suggested to replace the ring as soon as possible to reduce the probability for internal contamination.

13.3 Window and Dust-Ring calibration procedure

The OS3101 requires that it be recalibrated every time the window or dust ring is replaced. The calibration process may only be performed by a qualified person possessing the Supervisor password.

The calibration process requires the use of a computer and the OS3101 configuration tool.

To calibrate the unit follow these steps:

— Go to the Utilities menu

— Select Window Calibration

— A warning will advise that the operation requested will result in the deactivation of the protected equipment and place the scanner in configuration mode, would you like to proceed?

— Click, Yes

— The calibration process will start, this will take about 30 seconds.

If the measured values are acceptable, the following message will appear:

— Calibration value is valid, would you like to save the data?

— Click Yes

— Confirm that you would like to save the configuration to the scanner

— Configuration is updated, there will be a delay in resetting the scanner.

If the measured values are not acceptable, the following message will appear:

— Calibration value is lower than the minimum, data will be discarded.

— Click O.K.

— All changes were discarded, there will be a delay in resetting the scanner.

— Click O.K.

— Verify that both side of the window and the dust-ring are clean and free of fingerprints on both sides.

— Repeat the calibration procedure. If still unsuccessful the scanner requires factory calibration. Call Omron STI for details.

Note: If the window is damaged to a point where the housing's IP rating integrity is compromised, it is highly suggested to replace the window as soon as possible to reduce the probability for internal contamination. It is also advisable to take precautions to prevent dirt, dust or debris to enter the internal space of the OS3101.

13.4 OS3101 Maintenance

The OS3101 will require periodic cleaning of the window. The interval of the cleanings will depend on the environment in which the scanner is used. It is recommended that the window be cleaned using a common glass/plastic cleaner. The window should be sprayed and wiped down with a soft cloth. Omron STI offers a cleaning kit OS31-CLN-KT.

APPENDIX A —DEVICENET OPERATING INSTRUCTIONS

⚠ ***WARNING!*** ***DeviceNet is not a safety-rated system and is only used to provide status information. Never use information provided by DeviceNet to control a machine.***

A.1 INTRODUCTION

The OS3101 system is available with DeviceNet which allows communication of non-safety, monitoring and diagnostic information across the DeviceNet Bus.

A.2 FEATURES

— Connects to network using simple micro-style connectors

—The following information is available on DeviceNet:

A.2.1 SYSTEM IDENTIFICATION

— Manufacturer, Product Name, Product Serial Number

A.2.2 SYSTEM STATUS

— Operating Mode

— Detection zone

— Safety Outputs

— Signal Strength

A.2.3 SYSTEM SETTINGS

— Operating Mode/Automatic Start/Start interlock

— EDM (MPCE) Monitoring Enabled/Disabled

A.2.4 DIAGNOSTIC INFORMATION

— OS3101 Diagnostic Codes

— Signal Strength

— Error Code

— Error Description

— Device Serial Number

An Electronic Data Sheet (EDS) is supplied with each segment to assist in device configuration.

Table A-1 Specifications for OS 3100 System with DeviceNet

DeviceNet Power	24 VDC, 50 mA - Supplied by deviceNet BUS Network
DeviceNet Configuration	Vendor Code: 405 (Omron Scientific Technologies Inc.) Device Type: 150 (Safety Laser Scanner AOPDDR) Product Code: 10 (OS3101 system) Connection Type Supported: Explicit Messages, Poll, Strobe, Change of State MAC ID: 0-63 (network confirmed, 63 is dealarm) Baud Rate Supported: 125K, 250K, 500K (network configured, 125K is default) EDS File Name: 3100.eds Bit Map Icon File Name: 3100.bmp, 3100.ICO EDS and Bitmap files supplied on 3-1/2” disk
Poll, Bit Strobe and COS I/O Assembly Instances	3100 device I/O assemblies consist of: —Poll and Bit Strobe: Product specific input assembly containing operating mode detection zone status, safety output status and Remote Start input status. —COS: Product specific input assembly containing operating mode.

Table A-2 OS3101 Status Information Sent in Response to Bit Strobe Commands

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Fault	Warning Zone Instrusion	Weak Signal	EDM (MPCE) Monitor Enabled	Detection Zone Intrusion (see note 4)	Machine Stop	Machine Run	Interlock
1	Warning Output Wa. Zone	Warning Output Weak Signal	Detect. Zone Set	Multizone Select Enable (see note 3)	Restart Interlock Mode	Start Interlock Mode	Auto Start Mode	Auxiliary Output
2	Leftmost beam / Blocked sectors 1 - 8							
3	Blocked sectors 9 - 16 / Rightmost beam							
4	Fault Code (see note 2)							
5	Reserved for future use				Response Time (see note 1)			
6	Reserve for future use							
7	Reserved for future use							

Table A-3 I/O Status Information Sent in Response to COS (Change of State) Commands

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Fault	Warning Zone Instrusion	Weak Signal	EDM (MPCE) Monitor Enabled	Detection Zone Intrusion	Machine Stop	Machine Run	Interlock

- Note 1

Response Time	(Byte 5, bits 0-3)
80mS	0
120mS	1
160mS	2
200mS	3
240mS	4
280mS	5
320mS	6
360mS	7
400mS	8
440mS	9
480mS	10
520mS	11
560mS	12
600mS	13
640mS	14
680mS	15

- Note 2

Fault Code	(Byte 4, bits 0-7)
30	1
32	2
33	3
34	4
35	5
40	6
41	7
42	8
43	9
50	10
60	11
70	12
80	13
90	14

- Note 3

Multi-Zone Select Enable	(Byte 1, bits 4)
Zone 1	0
Zone 2	1
both	2

- Note 4

Detection Zone Intrusion	(Byte 0, bits 3)
Alarm Mode	0
Follow Mode	1

A.3 DeviceNet Connections

Connections for DeviceNet communications are made at the OS3101 system receiver. Pin assignments for the five-pin DeviceNet connector are given in *Table A-1*.

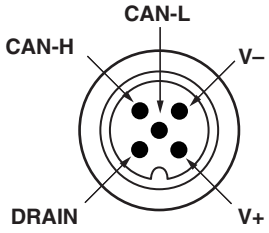


Figure A-1 DeviceNet Pin Assignment

APPENDIX B —CHECKOUT PROCEDURE LOG

The following checkout procedure must be performed by qualified personnel during OS3101 system installation and at least every three months or more frequently depending on machine usage and company guidelines.

Machine Identification: _____ Date: _____

Technician Signature: _____

Item	Condition	Comments
1. Verify that the guarded machine is compatible for use with the OS3101 system. See *Section 1 – Important Safety Warning* for further information.	❑ Pass ❑ Failed	
2. Verify that the maximum safety zone distance configuration of the OS3101 system is equal to or greater than the calculated Safety Zone from the danger point. For further information, See *Section 6.2.1 – Safety Distance*	❑ Pass ❑ Failed	
3. Determine that all access to the danger points not protected by the OptoShield system are guarded by other means, such as gates, fencing or other approved methods. Verify that all additional guarding devices are installed and operating properly.	❑ Pass ❑ Failed	
4. Make sure the operator is not able to stand between the OptoShield system safety zone and the machine danger point. Verify that the scanner can only be reset from a position outside and within view of the hazardous machine area.	❑ Pass ❑ Failed	
5. Inspect the electrical connections between the guarded machine's control system and the OS3101. Verify connections are properly wired to the machine such that a stop signal from the OS3101 system results in an immediate halt of the machine's cycle. See *Section 9 – System Connections.*	❑ Pass ❑ Failed	
6.If the EDM/MPCE monitoring feature is not used, proceed to step 7. To test the EDM/MPCE feature, verify that the feature has been enabled. Turn the machine power on. Cycle the machine. Place a temporary jumper wire between the EDM/MPCE connections. The OS3101 should enter an fault condition. Remove the temporary jumper. Press and release the start button. See *Section 9 – System Connections.*	❑ Pass ❑ Failed	
7. Record the test results in the machine's log and perform the Test Procedure.	❑ Pass ❑ Failed	

APPENDIX C —TEST PROCEDURE LOG

The following test procedure must be performed by qualified personnel:

— during initial OS3101 system installation; and
— after any maintenance, adjustments or modifications to the OS3101 or the machine it is guarding; and
— at least every three months; or
— more frequently depending on machine usage and employer guidelines.

Testing ensures that the OptoShield system and machine control system work together to properly stop the machine. Failure to properly test the equipment could result in serious injury to personnel.

WARNING: If the safety system or the machine fails any of these tests, do not run the machine. Immediately tag or lock out the machine to prevent its use and notify the appropriate supervisor.

Machine Identification: _____ Date: _____

Technician Signature: _____

Item	Condition	Comments
1. Disable the guarded machine. Apply power to the OS3101 system.	❑ Pass ❑ Failed	
2. Verify that the guarded machine is suitable for use with the OS3101 system. See Section 1 – Important Safety Warning.	❑ Pass ❑ Failed	
3. Visually inspect the machine to ensure that all access to the danger point is through the OptoShield safety detection zone. If not, additional guarding, including mechanical barriers, may be required. Verify that all other guarding devices and barriers are installed and operating properly.	❑ Pass ❑ Failed	
10. Record the results of this procedure in the machine log.	❑ Pass ❑ Failed	
5. Verify that the scanner can only be reset from a position outside and with a view of the hazardous machine area.	❑ Pass ❑ Failed	
6. Check for signs of external damage to the OptoShield system, the guarded machine, the electrical cables and wiring. .	❑ Pass ❑ Failed	
7. Verify that the connections between the control system of the guarded machine and the OS3101 are correct.	❑ Pass ❑ Failed	
8. 8. Start the machine. While the machine is in motion, intrude into the safety zone with the test object. The machine should stop immediately. Move the test object inside the perimeter of the safety zone. The machine should remain stopped. NOTE: Never insert the test object into the dangerous parts of the machine.	❑ Pass ❑ Failed	
9. Verify that the machine braking system is working properly. If the machine does not stop fast enough, adjust the braking system or increase the safety zone distance from the detection zone to the danger point.		
10. Record the results of this procedure in the machine log.		