Safety by Design

Presented by Jeff Winter
Safety By Design

- Who is Omron STI?
- Why Safeguard?
- What rules, laws, and regulations are there?
- Where and how do I start?
- What products can help?
About Omron STI

- We are Omron’s Global Safety Brand
- Safety Market Leader in North America
- 266 Employees
- 55 Engineers
- Omron added Production Capacity from Japan to Fremont for North American market

Headquarters & Manufacturing  
95,700 sq. ft.
Omron STI Provides both Products and Services

- 30+ years of experience in providing unbiased safety solutions custom designed for your particular application
- Large product selection
- Safety integration services
- Global support network
Safety By Design

✓ • Who is Omron STI?
  • Why Safeguard?
  • What rules, laws, and regulations are there?
  • Where and how do I start?
  • What products can help?
Why do we need to be safe?
Why Should you Safeguard?

Besides the Obvious......

➢ There are MANY hidden costs:
  ➢ Compliance Fines
  ➢ Worker’s Comp
  ➢ Insurance Increases
  ➢ Downtime
  ➢ Lost Productivity
Safety  Productivity
Safety By Design

✓ ➤ Who is Omron STI?
✓ ➤ Why Safeguard?
  ➤ What rules, laws, and regulations are there?
  ➤ Where and how do I start?
  ➤ What products can help?
What does the Law Say?

Do your customers NEED to Safeguard?

YES!
What does the law say about OEMs?

- Do I need to apply safety to the machines I am building?

- The correct answer is......

It Depends.....
What does it depend on?

1. Where is the machine going?
2. What are the customer’s requests?
Safety in America
What is Product Liability?

- The responsibility of a manufacturer or vendor of goods to compensate for injury caused by defective merchandise that it has provided for sale.
- When individuals are harmed by an unsafe product, they may have a Cause of Action against the persons who designed, manufactured, sold, or furnished that product.
- In most jurisdictions, a plaintiff's cause of action may be based on one or more of four different theories: Negligence, breach of Warranty, Misrepresentation, and strict tort liability.

Negligence refers to the absence of, or failure to exercise, proper or ordinary care. It means that an individual who had a legal obligation either omitted to do what should have been done or did something that should not have been done.
A new national policy was established on December 29, 1970, when President Richard Nixon signed into law the OSHAct.

For employers, the General Duty clause is used by OSHA when there are **NO** specific standards applicable to a hazard.
OSHA's purpose is to save lives, prevent workplace injuries and illnesses, and protect the health of all America's workers.

Every year:

- over 6,000 Americans die from workplace injuries
- an estimated 50,000 people die from illnesses caused by workplace chemical exposures
- 6 million people suffer non-fatal workplace injuries

Injuries alone cost the economy more than $110 billion a year.
### Part 1910: Occupational Safety and Health Standards

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<tr>
<th>Subpart A: General</th>
<th>Subpart H: Hazardous Materials</th>
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<td>Subpart I: Personal Protective Equipment</td>
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<td>Subpart J: General Environmental Controls</td>
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<td>Subpart C: Means of Egress</td>
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<td>Subpart F: Powered Platforms, Manlifts, and Work Platforms</td>
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<td>Subpart U: Reserved</td>
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<td>Subpart W: Reserved</td>
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</tr>
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<td>Subpart Y: Reserved</td>
<td>Subpart Z: Toxic and Hazardous Substances</td>
</tr>
</tbody>
</table>
1910.211: Definitions

1910.212: General Requirements for all Machinery

1910.213: Woodworking machinery requirements

1910.214: Cooperage Machinery - Reserved

1910.215: Abrasive Wheel Machinery

1910.216: Mills and Calenders in the rubber and plastics industries

1910.217: Mechanical Power Presses

1910.216: Forging Machines

1910.216: Mechanical power-transmission apparatus

Point of Operation is Defined

All cracked saws shall be removed from service.

All abrasive wheels shall be mounted between flanges which shall not be less than one-third the diameter of the wheel.

All trip and emergency switches shall not be of the automatically resetting type, but shall require manual resetting.

A pad with a nonslip contact area shall be firmly attached to the pedal.
Listed below are the standards which were cited under Division D through October 2008. Penalties shown reflect amounts paid as of September 2009. For more information, see definitions.

<table>
<thead>
<tr>
<th>Standard</th>
<th>#Cited</th>
<th>#Insp</th>
<th>Penalty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19100147</td>
<td>2841</td>
<td>1547</td>
<td>3583301</td>
<td>The control of hazardous energy (lockout/tagout).</td>
</tr>
<tr>
<td>19101200</td>
<td>2391</td>
<td>1327</td>
<td>800385</td>
<td>Hazard Communication.</td>
</tr>
<tr>
<td>19100134</td>
<td>2121</td>
<td>883</td>
<td>856985</td>
<td>Respiratory Protection.</td>
</tr>
<tr>
<td>19100212</td>
<td>2062</td>
<td>1660</td>
<td>3372003</td>
<td>General requirements for all machines.</td>
</tr>
<tr>
<td>19100205</td>
<td>2052</td>
<td>1230</td>
<td>1346039</td>
<td>Wiring methods, components, and equipment for general use.</td>
</tr>
<tr>
<td>19100178</td>
<td>1647</td>
<td>1147</td>
<td>1097177</td>
<td>Powered industrial trucks.</td>
</tr>
<tr>
<td>19100303</td>
<td>1604</td>
<td>1162</td>
<td>1208953</td>
<td>General requirements.</td>
</tr>
<tr>
<td>19100119</td>
<td>1460</td>
<td>78</td>
<td>33768369</td>
<td>Process safety management of highly hazardous chemicals.</td>
</tr>
<tr>
<td>19100219</td>
<td>1292</td>
<td>709</td>
<td>1154151</td>
<td>Mechanical power-transmission apparatus.</td>
</tr>
<tr>
<td>19100215</td>
<td>1000</td>
<td>614</td>
<td>482557</td>
<td>Abrasive wheel machinery.</td>
</tr>
<tr>
<td>19100132</td>
<td>845</td>
<td>665</td>
<td>591621</td>
<td>General requirements.</td>
</tr>
<tr>
<td>19100023</td>
<td>815</td>
<td>635</td>
<td>1137700</td>
<td>Guarding floor and wall openings and holes.</td>
</tr>
<tr>
<td>19100095</td>
<td>811</td>
<td>397</td>
<td>705078</td>
<td>Occupational noise exposure.</td>
</tr>
<tr>
<td>19100157</td>
<td>700</td>
<td>549</td>
<td>306860</td>
<td>Portable fire extinguishers.</td>
</tr>
<tr>
<td>19100022</td>
<td>663</td>
<td>589</td>
<td>710095</td>
<td>General requirements.</td>
</tr>
<tr>
<td>19100213</td>
<td>651</td>
<td>355</td>
<td>514786</td>
<td>Woodworking machinery requirements.</td>
</tr>
</tbody>
</table>
General Overview

1910.212 (a)(1):
One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips, and sparks.

1910.212(a)(3):
The guarding device shall be in conformity with any appropriate standards therefor, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.”
What happens if I don’t follow?

- Serious
  - up to $7000 per violation
- Other than Serious
  - discretionary but not more than $7000
- Repeat
  - up to $70,000 per violation
- Willful
  - up to $70,000 per violation
  - Violations resulting in death- further penalties
- Failure to abate
  - $7000/day
The problem with OSHA....

Open for interpretation....

Find X.

3cm

4cm

Here it is!
How do you PROVE you are Safe?

Follow a recognized standard to demonstrate your compliance
**ANSI Standards**

- American National Standards Institute (ANSI) are voluntary standards developed by experts in the industry.

- ANSI standards are detailed, technical documents that provide rules, guidelines or characteristics for a product or process.

- ANSI standards explain the hazards involved in operating machinery.
Voluntary Standards & The General Duty Clause

If OSHA determines that compliance with the voluntary standard would have prevented or lessened the severity of an injury, OSHA may cite the employer’s failure to follow the standard as a violation of the general duty clause.

OSHA may cite you for not following voluntary standards! Even though it is not incorporated into OSHA.
ANSI B11 Safety Standards

AMT EHS - Environmental Health and Safety
ANSI B11 ASC - Accredited Standards Committee
ANSI B11.1 - Mechanical Power Presses
ANSI B11.2 - Hydraulic Power Presses
ANSI B11.3 - Mechanical Power Press Brakes
ANSI B11.4 - Shears
ANSI B11.5 - Ironworkers
ANSI B11.6 - Lathes
ANSI B11.7 - Cold Headers and Cold Formers
ANSI B11.8 - Drilling, Milling, and Boring Machines
ANSI B11.9 - Grinding Machines
ANSI B11.10 - Sawing Machines
ANSI B11.11 - Gear and Spline Cutting Machines
ANSI B11.12 - Roll-Forming and Roll-Bending Machines
ANSI B11.13 - Chucking Machines
ANSI B11.14 - Coil Slitting Machines
ANSI B11.15 - Pipe, Tube, and Shape Bending Machines
ANSI B11.16 - Powder/Metal Compacting Presses
ANSI B11.17 - Horizontal Hydraulic Extrusion Presses
ANSI B11.18 - Plate From Coiled Configuration
ANSI B11.19 - Performance Criteria for Safeguarding
ANSI B11.20 - Integrated Manufacturing Systems
ANSI B11.21 - Lasers for Processing Materials
ANSI B11.22 - Turning Machines
ANSI B11.23 - Milling, Drilling and Boring Machines
ANSI B11.24 - Safety Requirements for Transfer Machines
ANSI B11.TR1-2004 - Ergonomic Guidelines
ANSI B11.TR2-1997 - Mist Control Considerations
ANSI B11.TR3-2000 - Risk Assessment and Risk Reduction
ANSI B11.TR4-2004 - Selection of PES/PLC) for Machine Tools
ANSI B11.TR5-2006 - Sound Level Measurement Guideline
ANSI B11.TR6-200X - Control Reliable Circuits
ANSI B11.TR7-2007 - Lean Manufacturing
ANSI B11.TR8-2000 - Mechanical Power Transmission Apparatus
ANSI B11.TR9-2005 - Printing Press Systems
ANSI B65.2-2005 - Binding and Finishing Systems
ANSI B65.3-2001 - Guillotine Paper Cutters, Mill Trimmers
ANSI B65.4-2002 - Three-Knife Trimmers
ANSI B65.5-2006 - Stand-Alone Platen Presses
ANSI B151.27 - Plastics Machinery Robots
ANSI B155.1-2006 - Packaging Machinery
ANSI B56.5 - Industrial Vehicles
ANSI/ASSE Z244.1 - Control of Hazardous Energy
ANSI/RIA R15.06 - Industrial Robots and Robot Systems
ANSI/RIA TR R15.106 - Teaching Multiple Robots
ANSI/RIA TR R15.206 - Guidelines for Implementing
Safety By Design

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✓ ➢ What rules, laws, and regulations are there?
  ➢ Where and how do I start?
  ➢ What products can help?
So.........What should I do to safeguard my machine?
ANSWER:

*Review Applicable Standards and Conduct an Assessment*
RISK ASSESSMENT
It's Not Worth It
What is it?

- **Risk Assessment**
  - The process by which the intended use of the machine, the tasks and hazards, and the level of risk are determined

- **Risk Reduction**
  - The application of protective measures to reduce the risk to a tolerable level
Why do a risk assessment?

- To create a safer working environment for employees (as required by OSHA)
- To reduce costs
- To comply with national and international consensus standards, including:
  - ANSI/RIA R15.06-1999 – For Industrial Robots and Robot Systems – Safety Requirements
  - ANSI/ASSE Z244.1-2003 – Control of Hazardous Energy – Lockout/Tagout and Alternative Methods
  - ANSI/PMMI B155.1-2006 – Standard for Packaging Machinery and Packaging-Related Converting Machinery – Safety Requirements for Construction, Care, and Use
  - CSA Z432-04 – Safeguarding of Machinery – Occupational Health and Safety
  - CSA Z434-03 – Industrial Robots and Robot Systems – General Safety Requirements
  - CSA Z460-05 – Control of Hazardous Energy – Lockout and Other Methods
How do I do it?

- Pick a standard to follow
  - ANSI, CSA, ISO
- You can create your own process, as long as it’s based on industry best practices
- You can conduct the process in house, request it from your OEM, or contract an outside service provider
# Risk Assessment Matrix

from ANSI/RIA R15.06-1999

## Table 2

<table>
<thead>
<tr>
<th>Severity of Exposure</th>
<th>Exposure</th>
<th>Avoidance</th>
<th>Risk Reduction Category</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S2</strong> Serious Injury</td>
<td>E2 Frequent Expostion</td>
<td>A2 Not Likely</td>
<td>R1</td>
</tr>
<tr>
<td>More than First-aid</td>
<td></td>
<td>A1 Likely</td>
<td>R2A</td>
</tr>
<tr>
<td><strong>S1</strong> Slight Injury</td>
<td>E1 Infrequent Exposure</td>
<td>A2 Not Likely</td>
<td>R2B</td>
</tr>
<tr>
<td>First-aid</td>
<td></td>
<td>A1 Likely</td>
<td>R2B</td>
</tr>
<tr>
<td></td>
<td>E2 Frequent Exposure</td>
<td>A2 Not Likely</td>
<td>R2C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A1 Likely</td>
<td>R3A</td>
</tr>
<tr>
<td></td>
<td>E1 Infrequent Exposure</td>
<td>A2 Not Likely</td>
<td>R3B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A1 Likely</td>
<td>R4</td>
</tr>
</tbody>
</table>

Table 2 - Risk reduction decision matrix prior to safeguard selection
## Risk Reduction Measures
from ANSI/RIA R15.06-1999

**Table 3**

<table>
<thead>
<tr>
<th>Category</th>
<th>SafeGuard Performance</th>
<th>Circuit Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Hazard Elimination or hazard substitution (9.5.1)</td>
<td>Control Reliable (4.5.4)</td>
</tr>
<tr>
<td>R2A</td>
<td>Engineering controls preventing access to the hazard, or stopping the hazard (9.5.2), e.g. interlocked barrier guards, light curtains, safety mats, or other presence sensing devices (10.4)</td>
<td>Control Reliable (4.5.4)</td>
</tr>
<tr>
<td>R2B</td>
<td></td>
<td>Single Channel with monitoring (4.5.3)</td>
</tr>
<tr>
<td>R2C</td>
<td></td>
<td>Single Channel (4.5.2)</td>
</tr>
<tr>
<td>R3A</td>
<td>Non interlocked barriers, clearance, procedures and equipment (9.5.3)</td>
<td>Single Channel (4.5.2)</td>
</tr>
<tr>
<td>R3B</td>
<td></td>
<td>Simple (4.5.1)</td>
</tr>
<tr>
<td>R4</td>
<td>Awareness means (9.5.4)</td>
<td>Simple (4.5.1)</td>
</tr>
</tbody>
</table>

*Table 3 - Safeguard Selection Matrix*
If there are Hazards, there MUST be Risk Reduction

**PROTECTIVE MEASURE EXAMPLES**

**Most Effective**
- Elimination or Substitution
  - Eliminate human interaction in the process
  - Eliminate pinch points (increase clearance)

- Automated material handling (robots, conveyors, etc.)

**Engineering Controls**
- Barriers
- Interlocks
- Presence sensing devices (light curtains, safety mats, area scanners, etc.)

- Two hand control and two hand trip devices

**Awareness Means**
- Lights, beacons, and strobes
- Computer warnings
- Signs and labels
- Beepers, horns, and sirens

**Training and Procedures**
- Safe work procedures
- Safety equipment inspections
- Training
- Lockout / Tagout / Tryout

**Least Effective**

- Personal Protective Equipment (PPE)
  - Safety glasses and face shields
  - Ear plugs
  - Gloves
  - Protective footwear
  - Respirators

**So what is the difference between these 3 sections?**

These 3 rely on human behavior!

**This can only be done by the OEM**

**Hierarchy of Control**
If there are Hazards, there MUST be Risk Reduction

<table>
<thead>
<tr>
<th>Most Effective</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elimination or Substitution</td>
<td></td>
</tr>
<tr>
<td>Engineering Controls (Safeguarding Technology / Protective Devices)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Least Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Protective Equipment (PPE)</td>
</tr>
</tbody>
</table>

- Safety glasses and face shields
- Ear plugs
- Gloves
- Protective footwear
- Respirators
Machine Detail

Applicable Vertical (Machine Specific) Standards (See page 3 for additional information):
- ANSI B11.1
- ANSI/AIME B20.1
- OSHA 1910.217
- ANSI/RIA R15.05
- ANSI B11.20

Hazards:
- Mechanical - Crushing
- Mechanical - Drawing-in or trapping
- Mechanical - Punching
- Mechanical - Stabbing or piercing
- Mechanical - Projectiles
- Mechanical - Entanglement
- Mechanical - Abrasion or friction

Description of Hazard(s):
Crushing, trapping, and pinching hazards exist from the robot and machine. Shaving, entanglement, and projectiles hazards exist at the press and assembly machine. Entanglement and abrasion hazards exist at the mechanical power transmission areas.

Risk Evaluation

The initial risk evaluation is performed assuming no safeguarding measures are in place or the existing safeguarding has failed to an unsafe condition.

<table>
<thead>
<tr>
<th>Severity</th>
<th>X. No. of People Exposed</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Certain</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Untrained Operator</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Prolonged Time in Danger Zone with Power on</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Risk Score Before Guarding: 50

Prioritized Score to Establish Corrective Actions: 27.60

Emergency Stop Recommendations

Category (per NFPA 79): 1 - Controlled stop with power to the machine actuators available to achieve the stop then remove power when the stop is achieved.

Circuit Performance: Single Channel with Monitoring

Estimated Residual Risk Level

Level A - Reduced Risk and Compliance Achieved

The residual risk level will be Low/Negligible and compliance with the appropriate standards will be achieved if the recommended risk reduction measures listed below are correctly implemented in accordance with the applicable requirements. The customer is responsible for ensuring that adequate training, supervision, and administrative controls are implemented and executed as necessary. This is based on Omron STI Machine Services' experience and interpretation of the relevant safety standards.
### Prioritization Score to Establish Corrective Actions

The Prioritization Score for this machine is 27.69 and is provided to present further information to help determine a corrective action plan. This value is based upon the following common safeguarding categories evaluated for compliance at the time of our assessment.

#### Basic Safeguarding Categories Evaluated for Compliance

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>COMPLIANCE ACHIEVED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point of Operation / Perimeter Guards</td>
<td>No</td>
</tr>
<tr>
<td>Mechanical Power Transmission Guards</td>
<td>No</td>
</tr>
<tr>
<td>Safety Control System</td>
<td>No</td>
</tr>
<tr>
<td>Safeguarding Devices</td>
<td>No</td>
</tr>
<tr>
<td>Emergency Stop Devices</td>
<td>No</td>
</tr>
<tr>
<td>Energy Isolation Devices</td>
<td>Yes</td>
</tr>
<tr>
<td>Electrical Drop-Out Protection</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Risk Reduction (Safeguarding) Recommendations

Install yellow legend plates on the existing emergency stop pushbutton devices for compliance. The existing perimeter barrier guards will be removed or augmented as necessary for compliance and to prevent contact with the hazardous moving equipment by reaching around, under, through, or over the guards. The die block plugs and non-safety-rated sensors (proximity sensors or limit switches) at the existing robot cell doors will be replaced with tamper resistant, safety-rated devices. The non-safety-rated limit switches at load and unload conveyors will be replaced with safety-rated devices and the conveyors will be guarded with light curtains and guarded guards. The load / unload area at the assembly machine will be guarded with augmented guards and Type A gates to allow the turntable to rotate during two hand control operation while preventing access during machine operation. All safety-rated devices will be integrated to a safety interface control.

The customer is responsible for the following:
- Identifying the span of control on all existing emergency stop devices for clarification.
- Completing the installation of the new die block interlock plug on the press and physically removing the existing die block for compliance.
- Confirming with the robot manufacturer that the existing limiting devices installed on the robots are safety-rated devices. (This information was not available in the existing documentation that was reviewed at the time of the assessment.)
- Confirming that the existing limiting devices installed on the robots create a restricted space which is smaller than the proposed safeguarded space to achieve compliance.

See plan view drawing for location of guards and controls.
What do you think the number of machines we conducted 10,000 Risk Assessments on were guarded correctly?

7%

Their current guards proved to be a waste of time and money when done incorrectly!
If You don’t.........

SAFETY ROPE - WHEN OTHER SYSTEMS FAIL

AUTOMATIC HIGH-VOLUME "WHOAA"

BIRD-CAGE MASK & SAFETY GOGGLES

180° REAR VIEW MIRROR

HEAD LIGHTS

PRESCRIPTION SAFETY GOGGLES TO INSURE HORSES GOOD VISION.

GRAB RAIL

SAFETY SWITCHES & "HOT LINE" TO INSURANCE COMPANY

STEEL-TOED STIRRUPS

SAFETY NET ALL AROUND

4 WHEELS TO KEEP HORSE UPRIGHT IN CASE HE SLIPS - HENCE NOT ENDANGERING THE RIDER.

FLIP-DOWN SUN GLASSES

ROLL BAR

HARD HAT WITH WIDE BRIM & E-AHR PROTECTORS

PADDED-BACK SEAT & HEAD RESTRAINT

BACK-UP LIGHTS TAIL LIGHTS & DIRECTIONAL LIGHTS

SHOULDER HARNESS

AUTOMATIC AIR-FILLED CHEST PROTECTOR

MAPS, IF YOU GET LOST & CHECK LIST BEFORE RIDING

BLUE-TAIL FLY REPELLENT

SEAT BELT

SELF STARTER (ACCESSORY)

KNEE PADS (JUST IN CASE) & QUILTED PANTS

E.P.A. EMISSIONS CONTROL SYSTEM

Cowboy after O.S.H.A. Inspection

realizing
What are Hazards on a Machine or Process?

- **Physical**
  - Falling / Moving Objects
  - Collisions
  - Collapsing Structures

- **Chemical**
  - Explosion
  - Fire
  - Toxic Material Release
  - Wrong mix of chemicals
  - Radiation

- **Electrical**
  - Flashover and Burns
  - Electrocution
  - Wrong Connection / Loose Connection

- **Mechanical / Process**
  - Pinch Points or Entanglement
  - Abrasion, Grinding, Cutting
  - Thermal
  - Pressure Releasing Effects (Bursting Vessels, Jets of Gas or Liquids)
  - Welding Torches, Gases etc.

**Hazards are physical objects or chemical substances that have the potential for causing harm to people, property or the environment.**
What methods for machine safety are there?

- Guards
  - fixed
  - interlocked
  - adjustable
  - self-adjusting

- Devices
  - robots
  - presence sensing
  - pullback

- Miscellaneous aids
  - awareness barriers
  - protective shields
  - hand-feeding tools
  - restraint
  - safety controls (tripwire cable, two-hand control, etc.)
  - gates
What methods for machine safety are there?

- Location/distance
- Guards
- Feeding and ejection methods
  - automatic and/or semi-fixed
  - interlocked
  - adjustable
  - automatic and/or semi-automatic feed and ejection
  - robots
  - adjustable
  - self-adjusting

- Devices
  - presence sensing
  - pullback
  - awareness barriers
  - protective shields
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Safety Distance Formula

From ANSI/RIA R15.06-1999 Annex B
Otherwise......
Safe Mounting Distance Formula

\[ D_s = K(T_s) + D_{pf} \]

- Safe Mounting Distance
- Hand Speed Constant 63 inc/sec
- Total Stopping Time
- Depth Penetration Factor
Safety By Design

✓ ➢ Who is Omron STI?
✓ ➢ Why Safeguard?
✓ ➢ What rules, laws, and regulations are there?
✓ ➢ Where and how do I start?
   ➢ What products can help?
Products used to safeguard

Omron STI Safety—Total Safety Solutions from Components to Consulting to Enhance Worker Safety
MS4800 – Two Box

- All models can be cascaded
- Cascade up to 4 segments (256 beams max)
- Key features: IBI’s – easy to align, diagnostics
**F3SJ – Two Box**

- You pick the resolution
- You pick the height
- Cascadable
- Key features: Sophisticated muting – single beam, bi-directional, outputs can be modified via offline editor
**Light Curtain Accessories**

- EP Enclosures available for protected heights of 10” to 48”
- IP67 enclosures - 10” to 82”
Interlock Switches: Three Basic Categories

- Traditional mechanical switch
- Non Contact
- Solenoid-locking
- Do I need a monitoring relay?
D4NS Compact Plastic Door Switch

- Optional metal operation head
- 9 different conduit entrances / M12 connector
- 6 different internal switch configurations Up to 3 contacts
- Key feature: 20% - 30% lower price than non-OSTI brands
**D4GL Keyed Solenoid Door Switch**

- Similar to new D4NL, features “in-line” construction
- up to 3 sets of safety contacts and 2 solenoid monitoring contacts
- key holding force of 1000N
- metal operation head
- Key feature: 20% - 30% lower price than non-OSTI brands
**D4GL-SK10-LK**

- Solenoid locking switch and integral slide bolt
- LEDs for open/close/locked
- Integral lock-out key
- Up to 5 contacts
- Power to lock or power to unlock
  - 24 Vdc only
  - No rear release
**D40A/G9SX-NS**

Compact Non-Contact Door Switch/
Flexible Safety Unit
Advantage over Magnetic Switches

Competitor’s 6 units max (w/LED)

D40A-(Up to 30 units w/LED)
Advantage over Magnetic Switches

On machines with a lot of doors, it is difficult to know which door is opened.

Solution

Even half-opened door is indicated by Auxiliary output

Yellow line is Auxiliary output
Safety Mats

- UMQ Quick Disconnect now available
- Send us your drawings to ensure proper dimensions
- Key features – durable, easy to configure
You give us this

Mat w/o Trim
SPACE = ± 5"

Diagram with measurements and annotations.
We give you this
**OS3101: New and Improved**

- Key features:
- Very easy to program
- LED sector indicators
- Diagnostic display
- Now has multiple zones
OptoShield Operating Principle

Distance to object determined by the “time of flight” of the light pulse.

\[ D = \frac{c \times T}{2} \]
OptoShield Operating Principle

Pulses sent out in 180°
Screen Layout

- **Menu Bar**
- **Tool Bar**
- **Info Bar**
- **Warning Zone**
- **Safety Zone**
NE1A Programmable Safety Controller

- Modern network safety technology makes it possible to instantly safety-stop a machine, easily segment an application into safety zones or quickly diagnose a safety device.

**Easy Programming**
- Safety based function Block
- Program Size: Max 128 Function Blocks
- Logic Editor contained within Configuration Software

- Local Safety and Slave I/O
- Password Security
- USB Port for Programming
- Global Safety Standards
2) **Through the Logic Program**

FAULT!
Questions?