



SMART SOLUTIONS TO SAFEGUARD ROBOTS

SICK
Sensor Intelligence.

Werner Zipperer

Productmanagement „Industrial Safety & Motion
Control Sensors“

April 2020

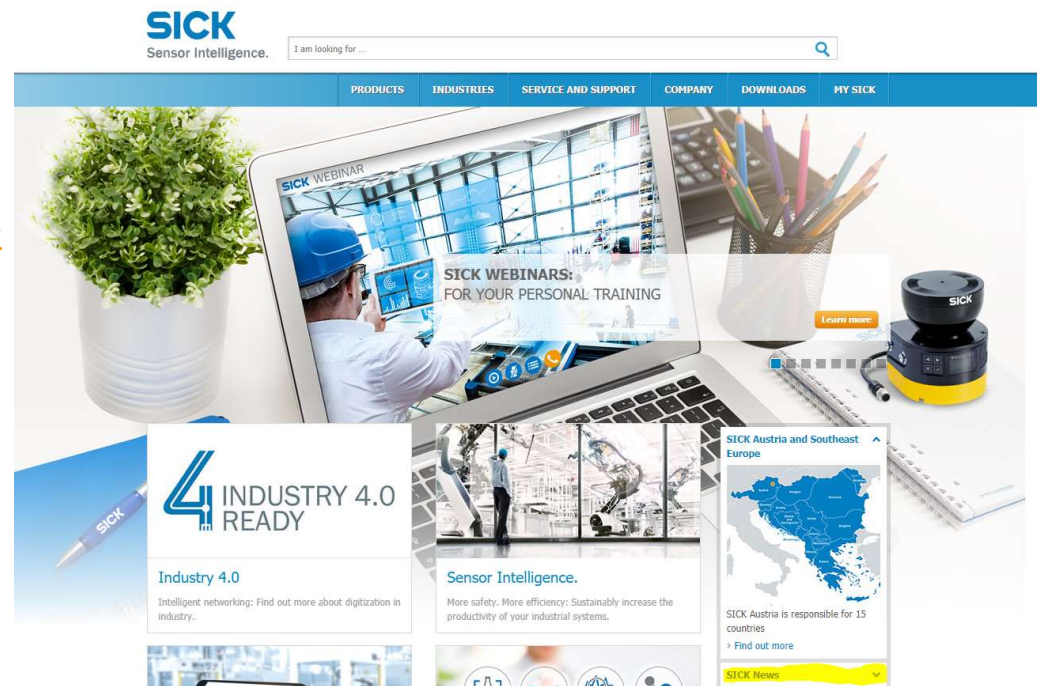


HINWEISE ZU DIESEM WEBINAR

- This webinar will be recorded!
- If you would like to receive the **presentation** and / or the **recording** afterwards, we ask for your **consent in accordance with the GDPR!**



https://s.sick.com/newsletter_registration_at-de





WHAT IS PRODUCTIVITY?



SAFE PRODUCTIVITY

OVERALL EQUIPMENT EFFICIENCY (OEE)



TOTAL AVAILABLE TIME

PLANNED PRODUCTION TIME

PLANNED
SHUTDOWN

OPERATING TIME

DOWNTIME
LOSSES

NET OPERATING TIME

SPEED
LOSSES

PRODUCTIVE
TIME

QUALITY
LOSSES

OEE LOSSES

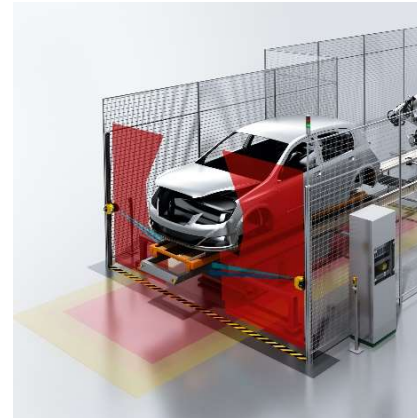
SAFE PRODUCTIVITY

DOWNTIME LOSSES

DOWNTIME LOSSES

- Unplanned line downtimes caused by the investigation to identify the muting issue and restart the production line

SAFE PRODUCTIVITY
||
SAFE PORTAL



- Less Muting issues
- Faster config. of new cars

DOWNTIME LOSSES

- Unplanned robot downtime caused by entering the hazardous zone and time to restart the robot

SAFE PRODUCTIVITY
||
SBot Speed



- Less downtime due to automatic restart

CREATING SAFE PRODUCTIVITY

DOWNTIME LOSSES



OUR TASK

- Improve the customers **OEE!**
- Create **Safe Productivity** for our customer!
- Use our **Intelligent Safety Solutions** to support our customers with their productivity goals!



Customer



Safety SOLUTIONS



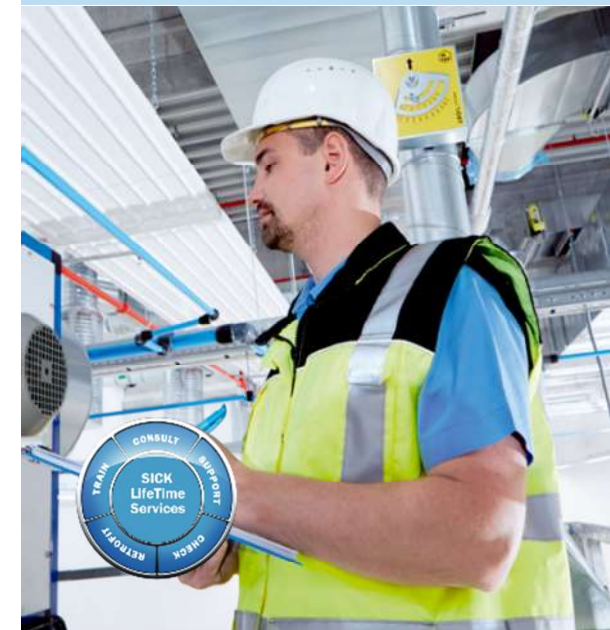
Safety PRODUCTS



Safety Concept & Logic



Safety SERVICE



SAFE ROBOTICS FROM SICK

INTRODUCTION



- Are you looking for an easy way to **increase the productivity** of your robot applications?
- Do you need **free access to your robot application** to control the process?
- Are you looking for a partner who can
 - ▶ **easily integrate** their safety products into your robot?
 - ▶ **support you** to ensure your robot applications are safe and comply with the relevant norms and standards?



The solution: Safe Robotics Area Protection from SICK

SAFE ROBOTICS AREA PROTECTION

NEW SAFETY SYSTEM SPECIFIC TO KUKA ROBOTS



We have extended the Safe Robotics Area Protection product family to include a new safety system for **cooperative human robot applications**



Safety and flexibility

The intelligent combination of our new microScan3 Core EFI-Pro laser scanner with our safety controller via an EtherNet IP/CIP safety interface provides free access to your robot application



Don't waste time

The safety system and the robot controller can be easily integrated thanks to tried-and-tested logic functions, pre-configuration files and detailed documentation. The safety system triggers the safety functions of the robot controller and covers the KUKA robot features



Increase the productivity

of the manufacturing process with less downtime and an optimized working process

SAFE ROBOTICS AREA PROTECTION

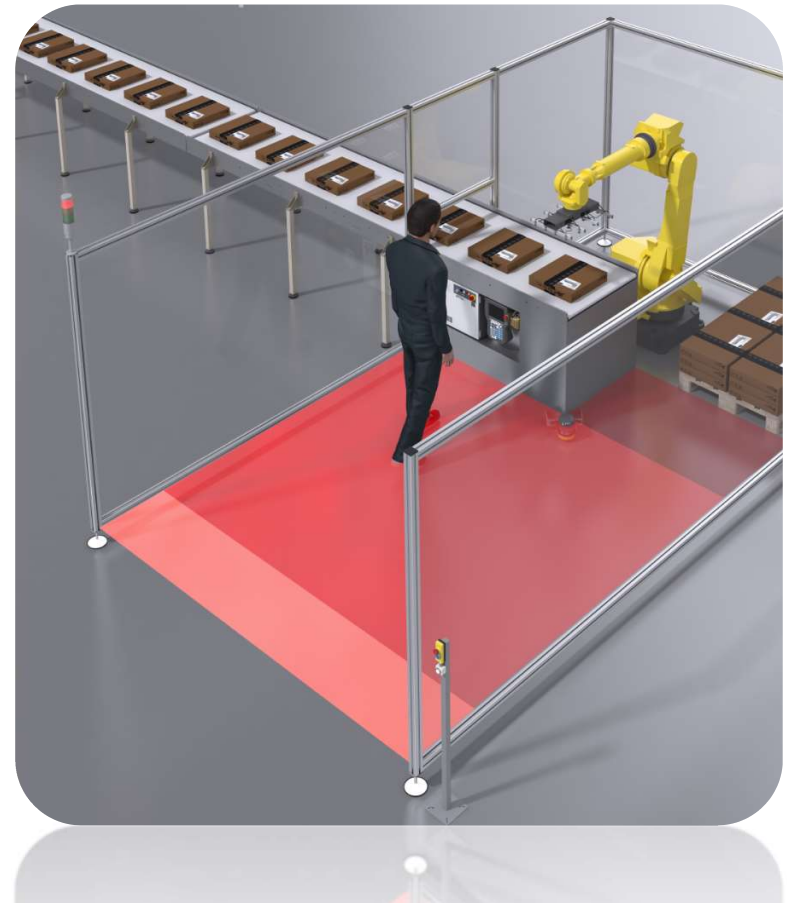
SBOT SPEED CIP - SAFETY SYSTEM SPECIFIC TO KUKA ROBOTS

What do our customers want?

- ▶ A system that allows **safe**, **cooperative** and **freely accessible** robot applications using possibly only one laser scanner, even in applications where the worker can step behind the scanned area

As the **KUKA robot** with CIP safety functionality acts only as the **target/slave**, the safety system should act as the **originator/master** with the robot controller and has the advantage of being **compact**, **scaleable** and **easy to integrate**

- ▶ To maintain the **productivity** of their robot applications at the **highest level**



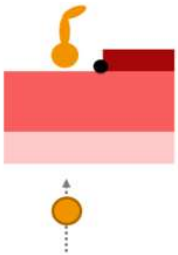
The solution: sBot Speed CIP

The first safety logic based on a safe EFI-pro safety system

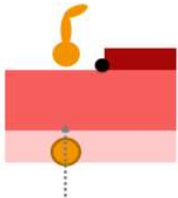
SBOT SPEED CIP

PRINCIPLE OF OPERATION – ROBOT ACCESS

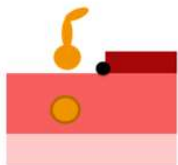
- The safety system detects people entering the safeguarded area
 - ▶ When a worker approaches the robot, the safety system slows down and stops the robot



- The safety system monitors the access area to the hazardous area using three protective fields simultaneously
 - ▶ The third field is optional* and is only used for presence detection



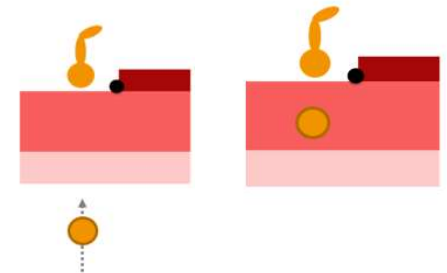
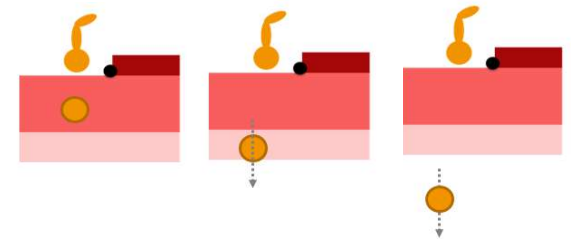
- When the first protective field is infringed, the robot slows down
 - ▶ Our system triggers the safety-rated monitored speed function of the robot



- When the second protective field is infringed, the robot stops
 - ▶ Our system triggers the protective stop function of the robot

(*) The use of our safety system requires a risk assessment. Depending on your application, the third field can be de-selected using our Safety Designer tool.

- When the worker moves away from the robot, protective fields 1 and 2 are freed again one after the other
- When all the fields are free, the robot will restart automatically*
 - ▶ The automatic restart is only possible when the **exit sequence is fulfilled**
- A manual reset/restart will be requested if the sequence monitoring based on protective fields 1 and 2 is violated
 - ▶ If there is a sequence error, it is not possible to ensure that the worker has moved away again
- The **sequence monitoring** prevents an **automatic restart**
- The **sequence monitoring** also monitors the **access sequence**
 - ▶ If the worker jumps over the first protective field, a manual reset/restart will be requested
 - The robot is working at full speed when the worker infringes the second protective field and our system triggers the robot stop immediately

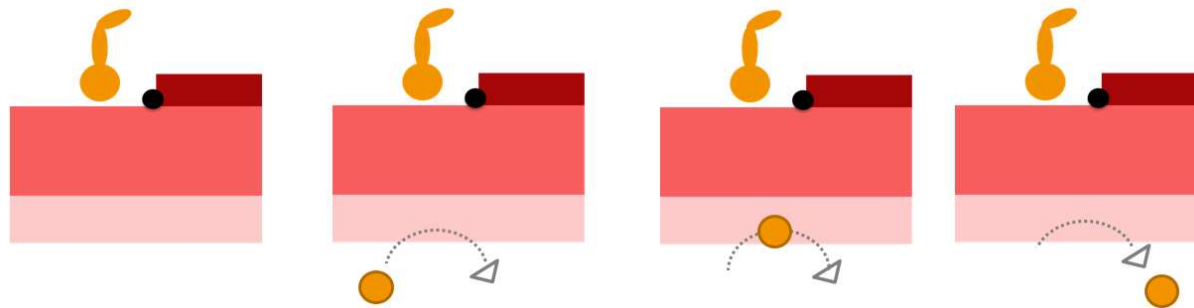


(*) The possibility to implement automatic restart depends on the risk assessment

SBOT SPEED CIP

PRINCIPLE OF OPERATION

- When the worker is passing by and only infringing the first protective field
- ▶ The robot slows down and accelerates again when all the fields are free



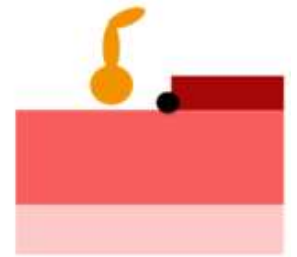
SBOT SPEED CIP

PRINCIPLE OF OPERATION – PURPOSE OF THE THIRD PROTECTIVE FIELD

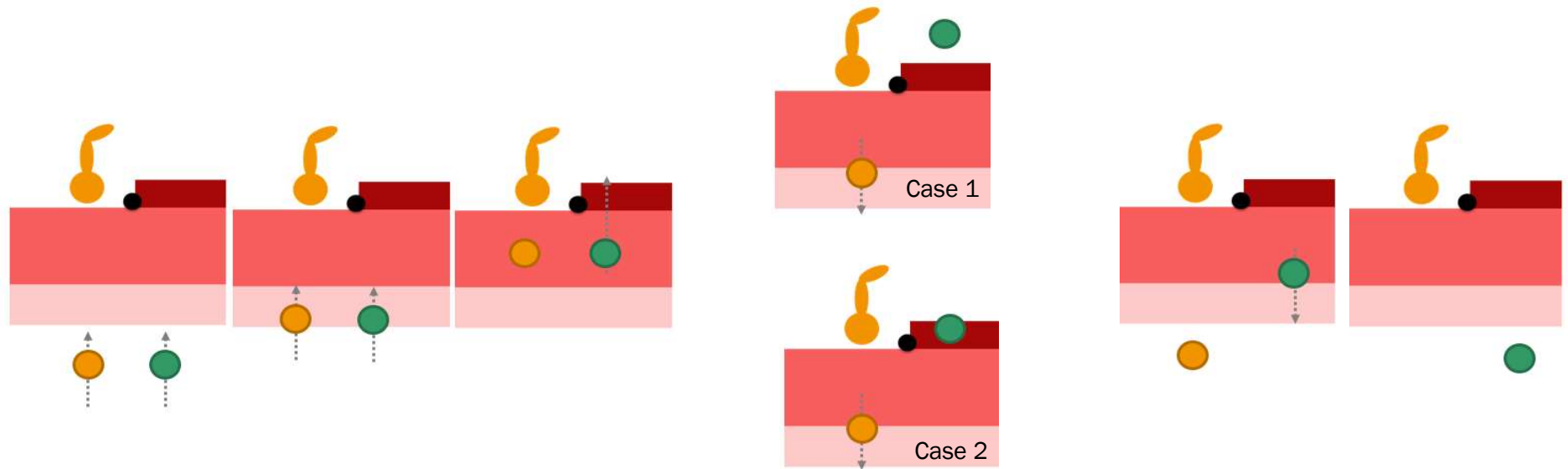


- The third protective field, directly in front of the hazardous area, provides protection in the event of presence detection
 - ▶ When this protective field is infringed, our system triggers the robot stop immediately
 - A manual reset/restart is requested in that case

- The third protective field makes it possible for more than one person to access the robot safely

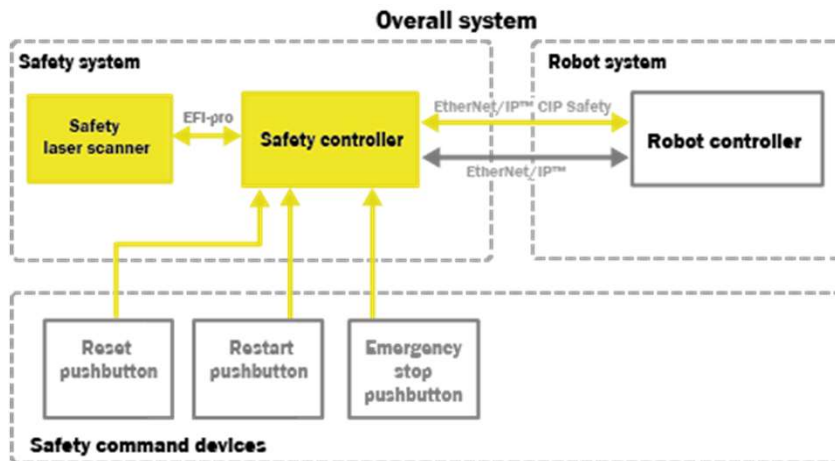


- When more than one worker moves toward the robot, even if one worker is stepping behind the safeguarded area (case 1) or only infringing the third field (case 2), a manual reset/restart is requested.
 - ▶ In case 1, even when the worker who stepped behind the safeguarded area moves away from the robot using the right exit sequence, the robot will remain stopped and require a manual reset/restart to resume its activities



SBOT SPEED CIP ANIMATION

SBOT SPEED CIP OVERALL SYSTEM



Our software control logic running on the Flexi Soft safety controller interacts with the command devices and FANUC robot controller to create the safety system

- The overall system consists of three components:



sBot Speed CIP - FA
Hardware + Software



Robot System
Robot Mechanics + Controller

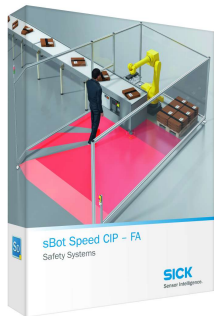


Safety command devices

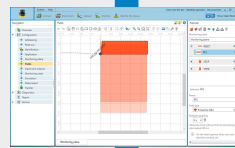
SBOT SPEED CIP

SAFETY SYSTEM CONTENT – OVERVIEW

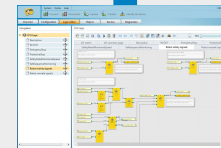
Software package



NEW Software sales



Safety laser scanner
pre-configuration file



Software logic and
communication settings



SISTEMA file and
wiring diagram

Hardware set



microScan3 Core
EFI-pro (5.5m)



Programmable safety
controller CPU0, I/O
module



EFI-pro
gateway



Operating instructions (incl.
robot specific settings)

SAFE ROBOTICS AREA PROTECTION OVERVIEW

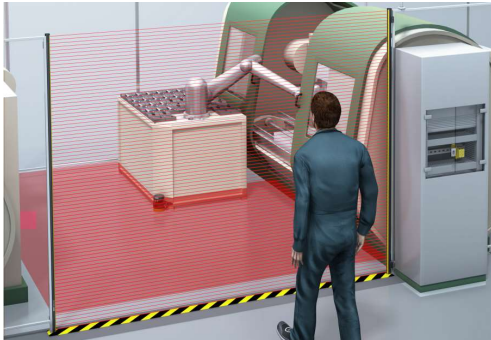
SAFE ROBOTICS AREA PROTECTION

sBot Stop

sBot Speed

Discrete IO based

CIP-safety based



- Safe Stop
- Manual/ Automatic Restart

- sBot Speed (generic)
- sBot Speed – UR
- **sBot Speed – YA (Yaskawa)**

NEW

**NEW sBot Speed CIP – KU
(KUKA)**

**NEW sBot Speed CIP – FA
(FANUC)**

SBOT SPEED CIP – FA

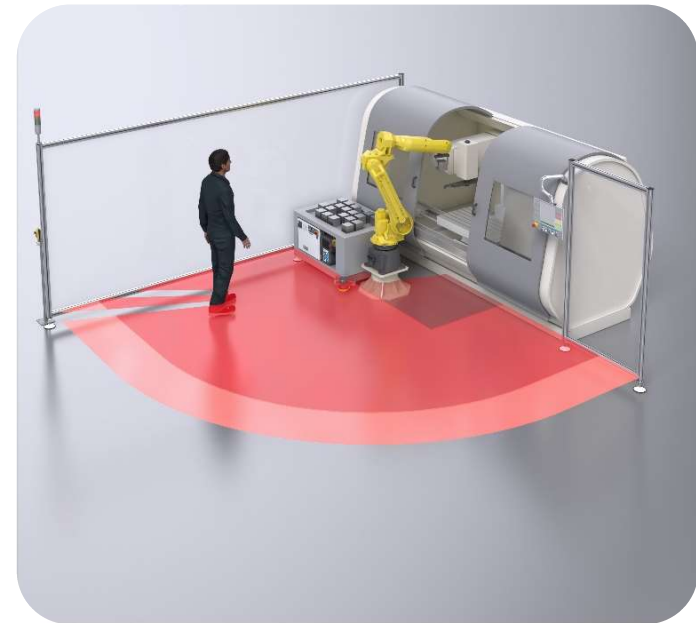
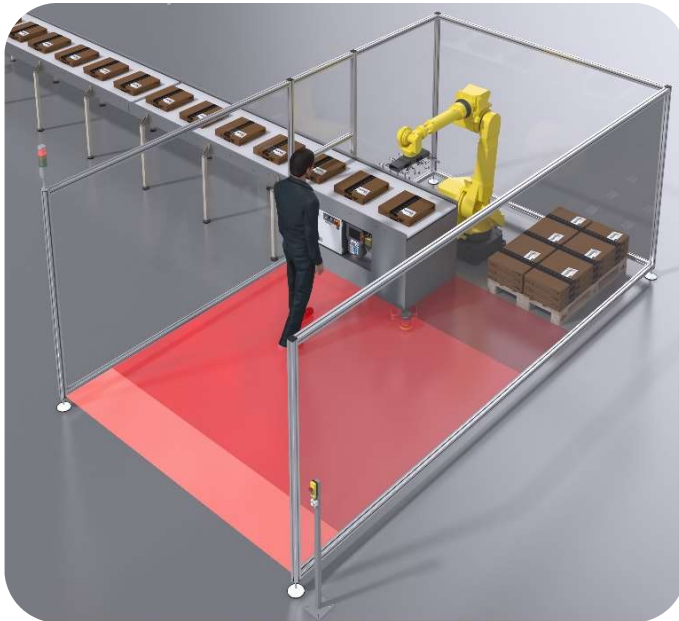
WHAT ARE THE TYPICAL APPLICATIONS?

PALLETIZING

TENDING

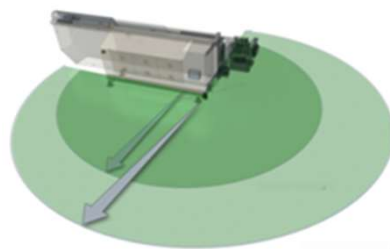
Simultaneous field monitoring results in:

- Increased productivity – less downtime thanks to automatic restart
- Possibility of detecting the worker stepping behind the scanned area to prevent automatic restart
 - ▶ In that case a manual reset/restart is requested
- Possibility of detecting the worker coming too close to the machine and of requesting a manual reset/restart



microScan3 family – 9 m Versions

COMPARISON SHORT/NORMAL RANGE TO LONG RANGE






Comparison of the optical features

Range	4 m / 5,5 m		9 m	
Scan technology	safeHDDM™			
Scan angle	275°			
Protective field range	4 m/ 5,5 m		9 m	
Warning field range / measurement data range	40 m		64 m	
Scan cycle times	30 ms	40 ms	40 ms	50 ms
Angular resolution	0,51°	0,39°	0,125 °	0,1°
Resolution	30/40/70/150/200 mm (selectable)		30/40/60/70/150/200 mm (selectable)	
Response time (I/O)	min. 70 ms	min. 90 ms	min. 90 ms	min. 110 ms

microScan3 family

COMPARISON VARIANTS

Function	Core					Pro		
Picture								
Integration	I/O	I/O AIDA	EtherNet/IP, CIP Safety	EFI-pro	PROFINET, PROFIsafe	EtherNet/I P, CIP Safety	EFI-pro	PROFINET, PROFIsafe
Fields	4		8			128		
Monitoring cases	2	-	8			128		
Safety outputs and simultaneous fields	1 pair OSSDs		4 (via network)			4 m & 5,5 m Version: 8 9 m Version: 4 (via network)		
Dimensions (mm)	112 x 135 x 111		112 x 151 x 111		112 x 161 x 111	112 x 151 x 111		
Data output	no		yes			yes		
Connectors	M12, 8 Pin	M12, 5 Pin	2 x M12, 4 Pin (Network) 1 x M12, 4 Pin (Power)		2 x RJ45- Push-Pull (Network) M12, 5 Pin L-coded (Power)	2 x M12, 4 Pin (Network) 1 x M12, 4 Pin (Power)		



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