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PILZ

THE SPIRIT OF SAFETY

- Intro to PowerSafe Automation and Pilz Safety
Engineer-Led Machine Safety Solutions

Standards & Regulations

Standards & Regulations

Current and Future Landscape

ANSI/ RIA R15.06:2012
Robot systems and Integration
(=) ISO 10218

EN 775
Manipulating industrial robots - Safety

ISO/TS 15066:2016
Robots and robotic devices - Collaborative robots

Influence

Update

Evolution

ISO 10218-1:2025
Robot

ISO 10218-2:2025
Robot systems and Integration

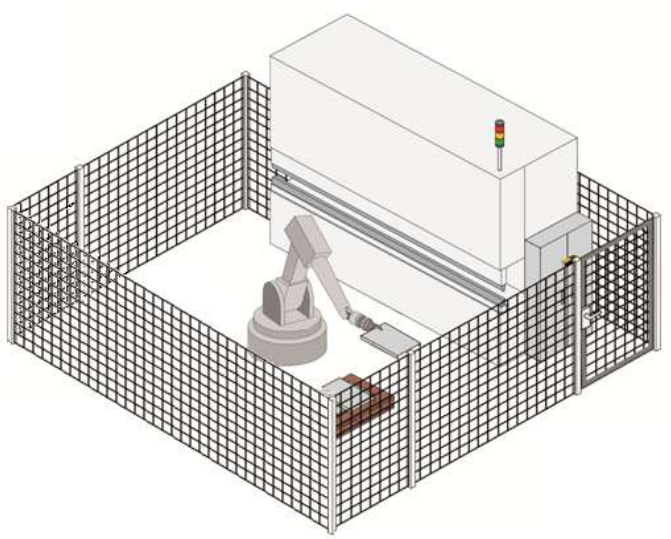
Incorporated

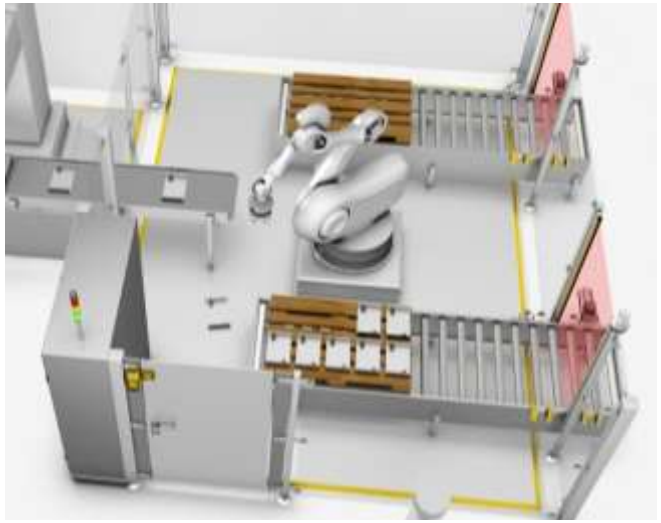


Introduction
Traditional industrial robot

Normative EN ISO 10218-2

- Risk reduction by – avoiding a collision!
  - Fixed guard
  - Opto electronic protection devices





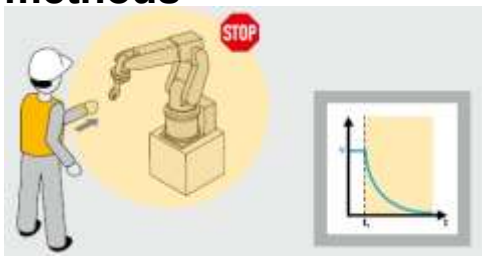
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- PRMS and Measurement

Basics collision measurement

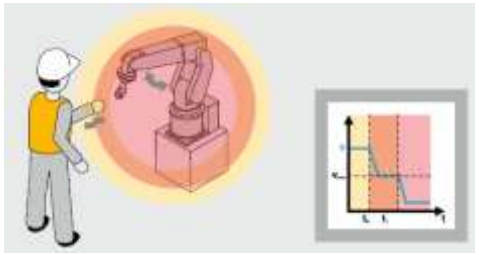
Methods according to EN ISO 10218-2/ TS 15066

Overview of the methods



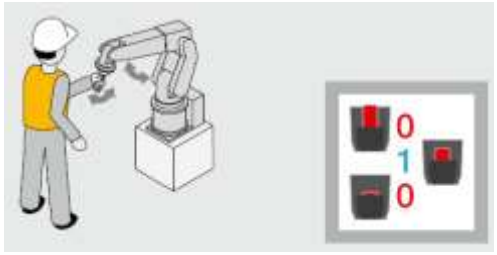
Safety-rated monitored stop

No collision Measurement not relevant



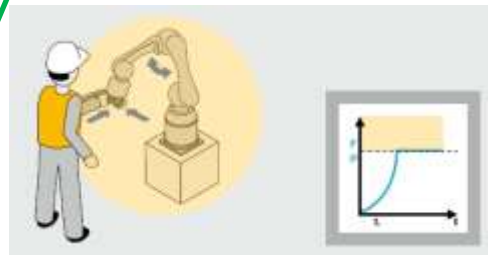
Speed an separation monitoring

No collision Measurement not relevant



Hand guiding

No collision Measurement not relevant



Power and force limiting

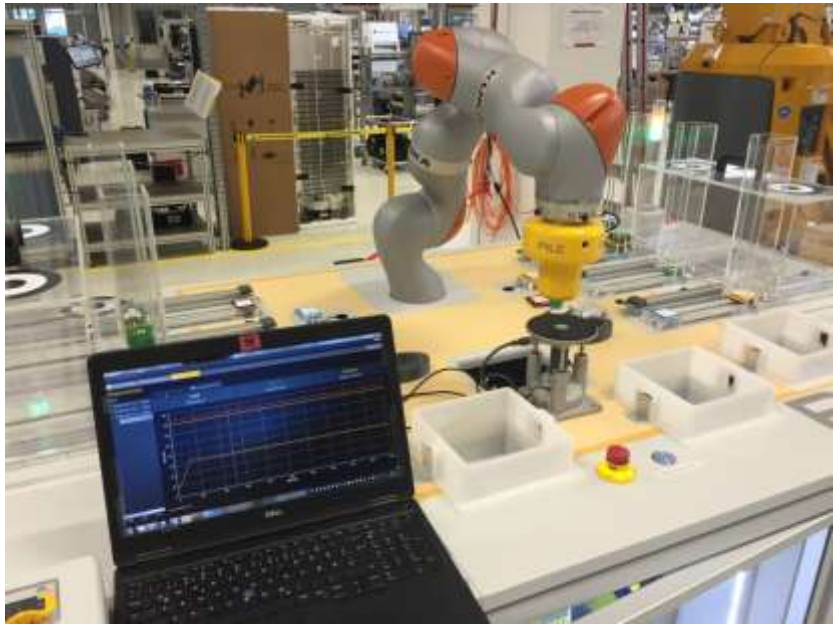
collision is possible Measurement is necessary

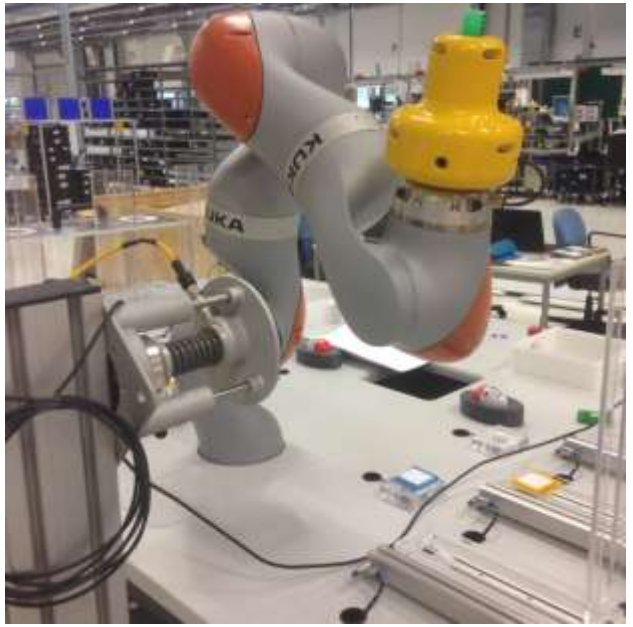
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Introduction
Reality

How to verify it?

- Real check of the collision!
- Collision measurement!



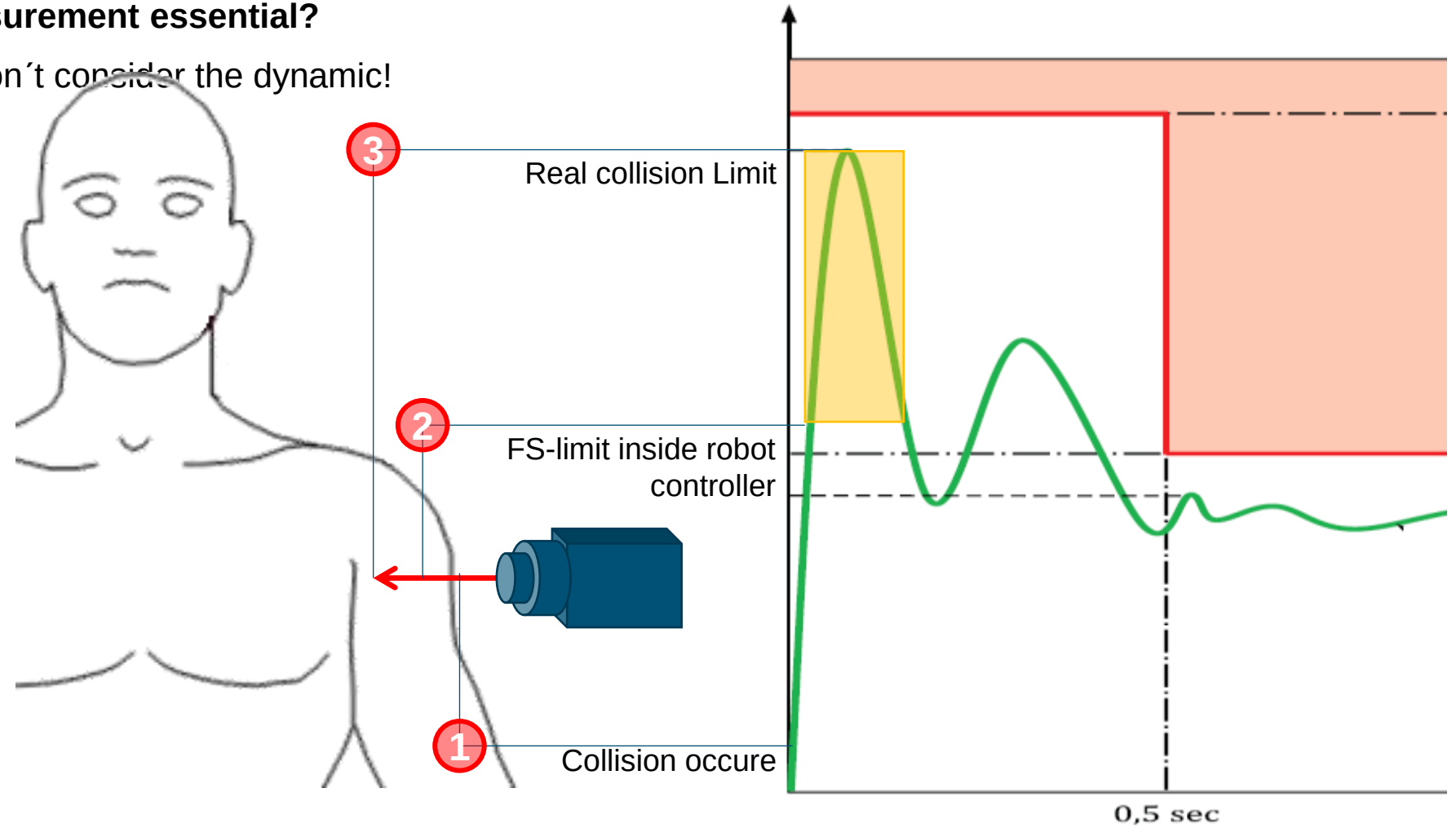


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Introduction
Why?

Why is a measurement essential?

→ The robot don´t consider the dynamic!



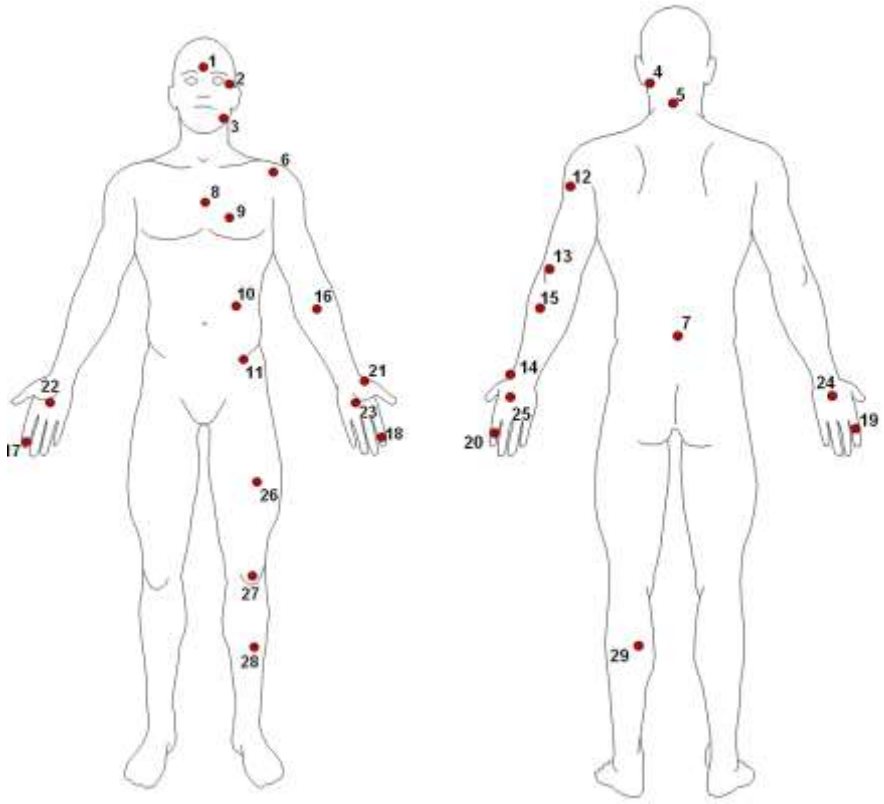
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Basics ISO/TS 15066 – body model
Annex A.3.1 - General

- Body regions

Body region		Specific body area	Front/Rear
Skull and forehead	1	Middle of forehead	Front
	2	Temple	Front
Face	3	Masticatory muscle	Front
Neck	4	Neck muscle	Rear
	5	Seventh neck vertebra	Rear
Back and shoulders	6	Shoulder joint	Front
	7	Fifth lumbar vertebra	Rear
Chest	8	Sternum	Front
	9	Pectoral muscle	Front
Abdomen	10	Abdominal muscle	Front
Pelvis	11	Pelvic bone	Front
Upper arms and elbow joints	12	Deltoid muscle	Rear
	13	Humerus	Rear
Lower arms and wrist joints	14	Radial bone	Rear
	15	Forearm muscle	Rear
	16	Arm nerve	Front
Hands and fingers	17	Forefinger pad D [a]	Front
	18	Forefinger pad ND [a]	Front
	19	Forefinger end joint D [a]	Rear
	20	Forefinger end joint ND [a]	Rear
	21	Thenar eminence	Front
	22	Palm D [a]	Front
	23	Palm ND [a]	Front
	24	Back of the hand D [a]	Rear
	25	Back of the hand ND [a]	Rear
Thighs and knees	26	Thigh muscle	Front
	27	Kneecap	Front
Lower legs	28	Middle of shin	Front
	29	Calf muscle	Rear

[a] D = dominant body side; ND = non-dominant body side.

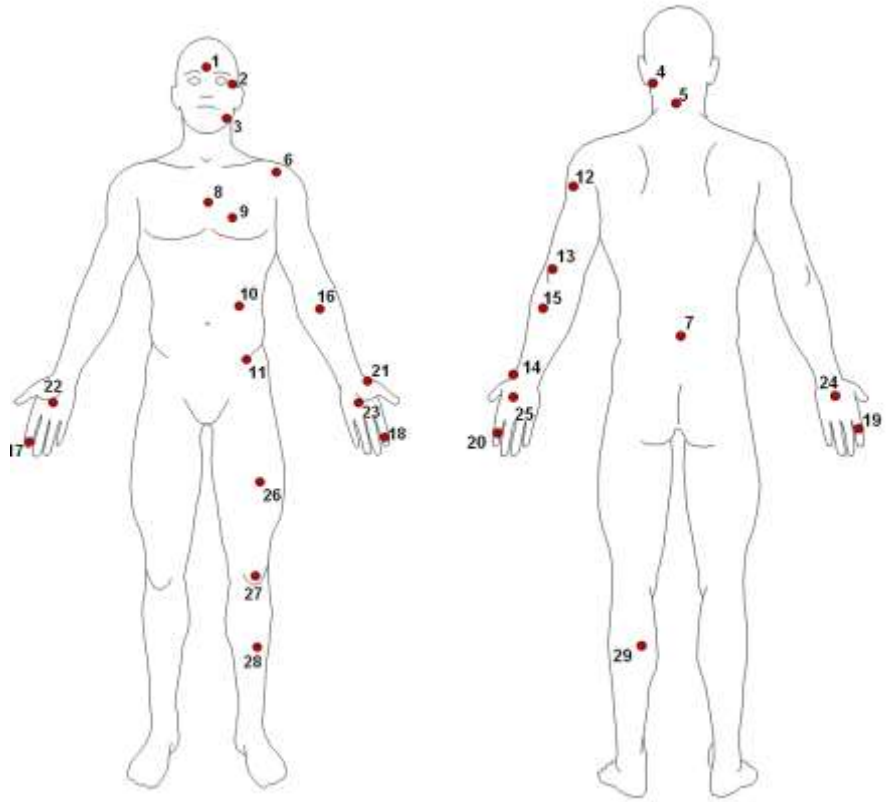


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Basics ISO/TS 15066 – spring constant
Annex A.3.4

- Every body region has a defined spring constant
- The spring constant represent the flexibility of the body region

Body region	Effective spring constant K N/mm
Skull and forehead	150
Face	75
Neck	50
Back and shoulders	35
Chest	25
Abdomen	10
Pelvis	25
Upper arms and elbow joints	30
Lower arms and wrist joints	40
Hands and fingers	75
Thighs and knees	50
Lower legs	60

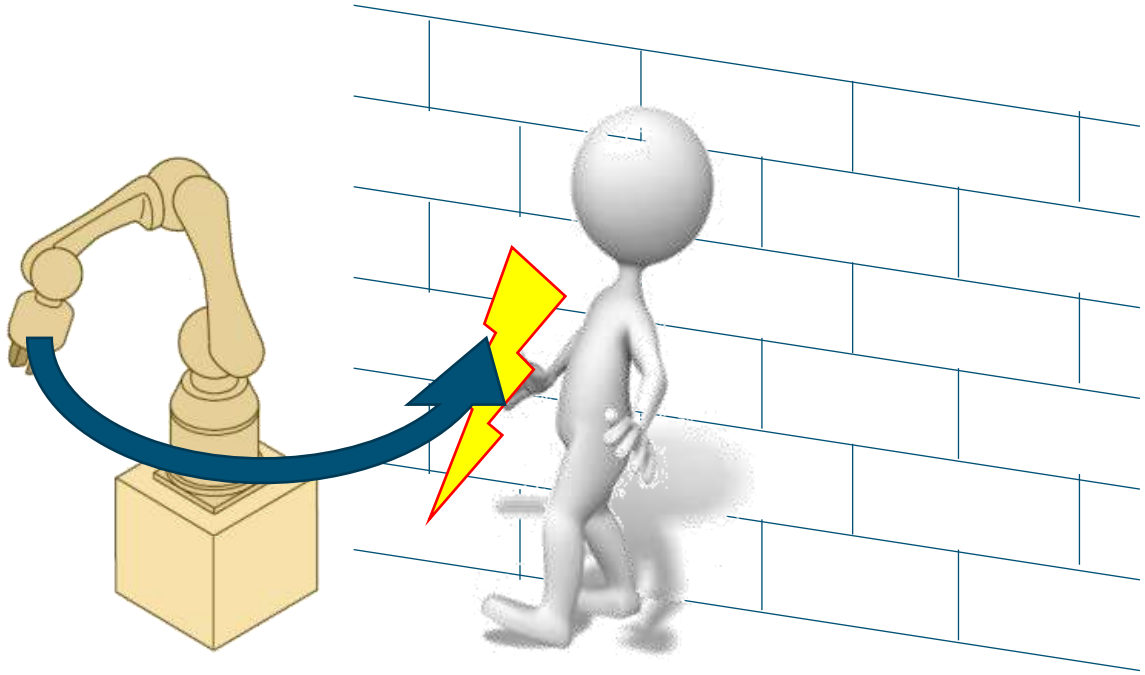


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Basics ISO/TS 15066 – Threshold values Annex A.3.1 - General

- The biomechanical limits (threshold values) depend on the **kind of contact**

Quasi-static-contact (**clamping**)
Contact between an operator and part of a robot system, where the operator body part can be clamped between a moving part of a robot system and another fixed or moving part of the robot cell.

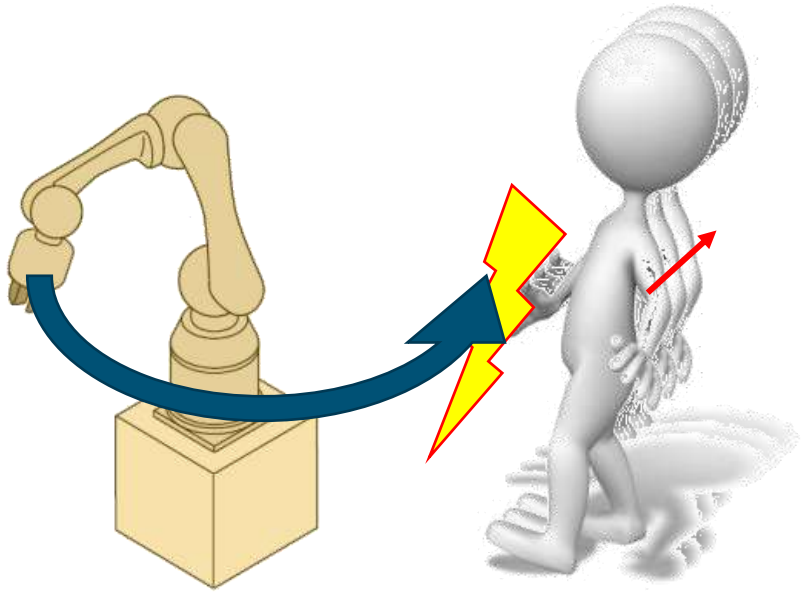


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Basics ISO/TS 15066 – Threshold values Annex A.3.1 - General

- The biomechanical limits (threshold values) depend on the **kind of contact**

Transient contact (**pushing**)
contact between an operator and part of a robot system, where the operator body part is **not clamped** and can recoil or retract from the moving part of the robot system



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Pilz PRMS
Complete System

- The Pilz PRMSmeasurement system is used to investigate a collision at collaborative robot systems

- The mainly parts of the measurement system are:

- force measurement
  - Force measurement tool
  - Spring set
  - Evaluation software

- pressure measurement
  - Prescale measurement film
  - Scanner
  - Calibration sheet
  - Evaluation software



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