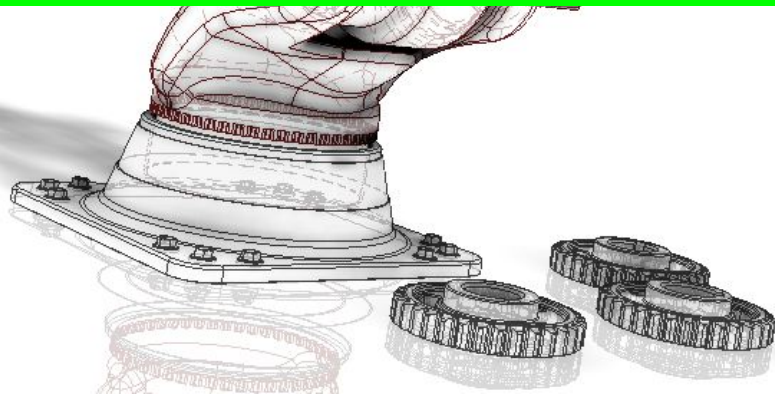


**Communication**

# Robotics in Industry

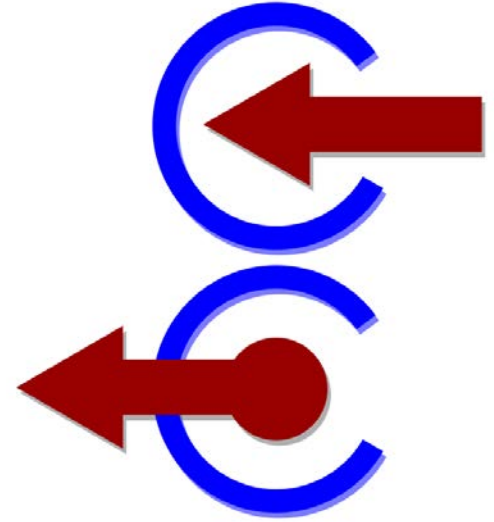


[www.ChrisandJimCIM.com](http://www.ChrisandJimCIM.com)

# Robots Communication

## Inputs and Outputs:

- Industrial robots are designed to send and receive a wide variety of signals and instructions.
- These signals can be as simple as informing the robot when a task is complete or as complex as helping the robot find a particular part, identify its orientation, and even help it make intelligent decisions such as should the robot retrieve the part or choose a different part.
- These signals can come from a wide variety of internal and external sources



# Robots Communication

## Handshaking:

-When communicating with industrial robots, one of the biggest concerns is how to safely communicate when different voltages and currents can be present and could result in signals that could damage equipment.

-Handshaking is defined as safe communication between two or more, like or unlike, pieces of technology.

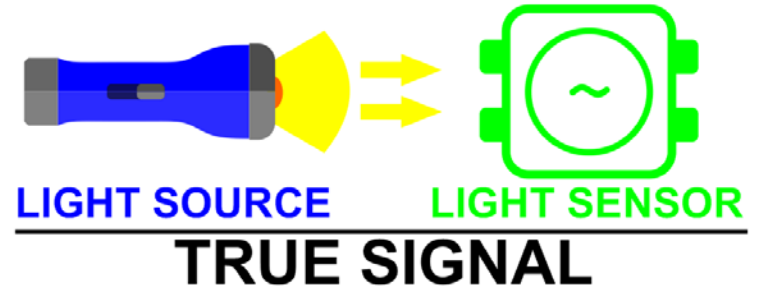
-This is done with special electronics that have no physical wiring or connections.



# Robots Communication

## Handshaking:

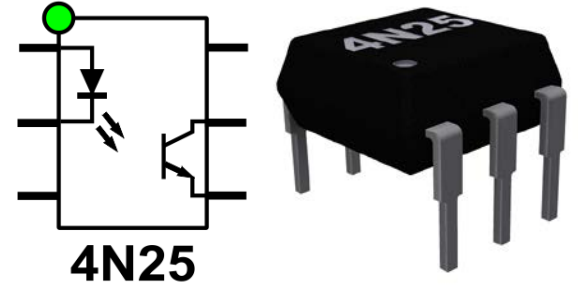
- Handshaking signals (questions and answers) need to be broken down into simple yes or no, true/false questions.
- The example to the right shows a signal being sent with a light and a sensor
- No physical connection is needed



# Robots Communication

## Handshaking:

- Electrical Components Examples
  - Solid State Relay or Optocoupler/Optical Isolator  
(Infrared LED & Photo Sensor)
  - Mechanical Relay or Electromagnetic Relay  
(Electro Magnet & Mechanical Switch)



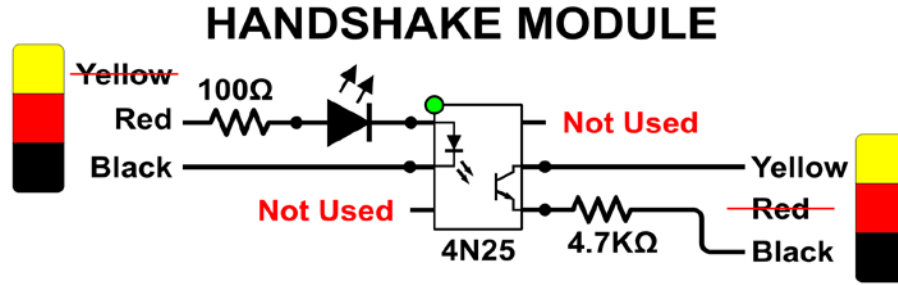
**Solid State Relay**



**Mechanical Relay**

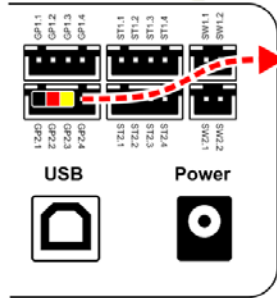


# Handshaking Example

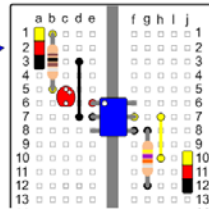


**SCHEMATIC**

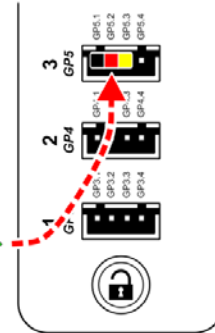
**ROBOT1**  
Send Signal



INPUT



OUTPUT



**ROBOT2**  
Receive Signal

**BREADBOARD**

# Robots Communication

## Sensors:

- Sensors are inputs that provide feedback and bring in a variety of data into the robot.

- Sensors can be broken up into two main categories; passive and active

- Active Sensors

- Require an external power source to operate*

- Passive Sensors

- Respond and detect inputs from the physical environment without external power*



# Robots Communication

## Sensors:

-Sensors are further divided into several different classifications and types

-**Means of Detection** - *Electrical, Chemical, Light, Sound, Motion...*

-**How they Operate** - *Photoelectric, Thermoelectric, Electrochemical, Electromagnetic...*

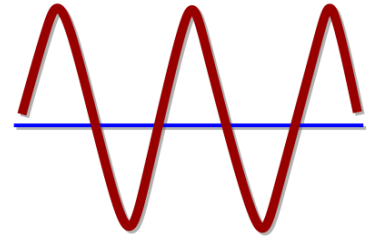
-**Analog or Digital**

*-Analog Signals contain a range value*

*-Digital Signals are on or off, with no in between values*

011011001

**Digital**



**Analog**





# Robots Communication

## Sensors:

### -Sensor Examples

- Temperature (*Measures Change in Temperature*)
- Proximity (*Non-Contact Presence of and Object*)
- Accelerometer (*Measures Acceleration*)
- Infrared (IR) (*Light Based Sensor used to Detect Objects or Proximity*)
- Ultrasonic (*Non-Contact used to Measure Distance or Velocity*)
- Inductive (*Non-Contact used to Detect the presence of Metal*)
- Light or PhotoCell (*Detect varying amounts of Light*)
- Phototransistor (*Detects the presence of Intense Light*)



**IR Sensor**



# Robots Communication

## Color Sensor



## Sensors:

### -Sensor Examples

- Potentiometer (pots) *(Used for Rotational Positioning)*
- Limit Switch or Touch *(Contact Sensor used to Detect Proximity)*
- Color *(Detects Color or Reflected Color.)*
- Encoder - Incremental or Absolute *(Used for Rotational Positioning)*
- Gyroscope *(Used to Detect Rotation on each Axis)*



# Robots Communication

## Sensors:

-Vision System - The eyes of an industrial robot

- Locate parts to be picked up*
- Inspect parts for quality control*
- Determine orientation*
- Detect the presence or absence of an object*



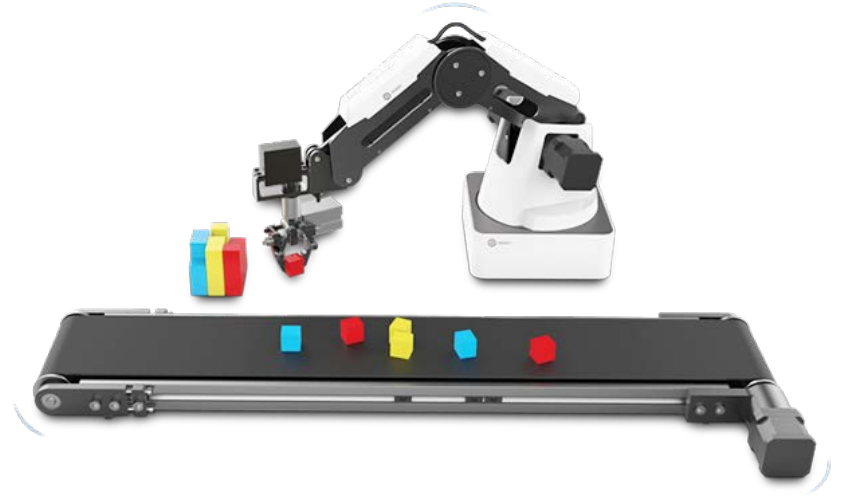
**Vision System**



# Robots Communication

## Outputs:

- Robots can be used to send signals to a wide variety of devices.
- Robots send digital output signals through handshaking or direct connections and can be connected directly to machines and equipment that they interact with.
- Industrial robots can also communicate digitally with a Programmable Logic Controller (PLC) or microcontroller and have them control various outputs.



# Robots Communication

## Outputs:

-Industrial robot can also control various outputs that are part of their End of Arm Tooling (EoAT)

Turn on and Off

- Pneumatic Air for a Vacuum Suction Cup
- Pneumatic Air for a Pneumatic Gripper
- Feed and Heat for a Prototyping Head
- Laser or Plasma Cutter
- Feed for a MIG Welding Torch
- Closing and Power for a Spot Welder

## END of ARM TOOLING (EoAT) OUTPUTS

PNEUMATIC  
GRIPPER

LASER  
ENGRAVER

3D PRINT HEAD

QUICK CHANGE  
ROLL ANGLE  
SERVO

VACUUM  
GRIPPER

TOOL  
HOLDER



# Resources

All photos, graphics, images & icons included in this presentation are the intellectual property of [ChrisandJimCIM.com](http://ChrisandJimCIM.com).