



Internet of Things Sensors and Actuators

Catarina Oliveira

DCT DEPARTAMENTO CIÊNCIA
E TECNOLOGIA

CONTENT

1. Sensors and Actuators
2. Types of sensors :
 1. Temperature
 2. Humidity
 3. Luminosity
 4. Acoustic and noise
 5. Water level
 6. Presence and proximity
 7. Movement
 8. Gyroscope
 9. Chemical
 10. Image
3. Types of actuators :
 1. Linear
 2. Engines
 3. Relays
 4. Solenoids
4. Tinkercad Components
 1. General
 2. Input
 3. Output

Sensors and Actuators

Sensor

Device whose function is to detect events or changes in the environment and convert these physical phenomena into electrical impulses that can then be interpreted.

Example of phenomena :

- Temperature
- Light
- Air humidity
- Movement
- Presence of chemical substances
- ...

Actuator

Tool that works in reverse to the sensor. When interpreting the electrical impulses sent by the control system and converting them into actions, it induces changes to its surroundings through simple actions.

Example actions :

- Open / close valves
- Change position or angle of other devices
- Enable or emit sound / light
- ...

Temperature Sensor

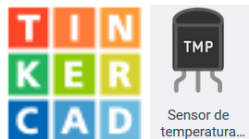
Useful when it is necessary to register thermal conditions of:

- Air
- Workplace
- Machinery
- ...



Where it can be used

- Factories
- Warehouses
- Weather stations
- Agriculture
- ...



Humidity Sensor

Where it can be used

- Weather stations
- Agriculture
- Environment monitoring
- Food supply chain
- HVAC (HVAC technology)
- Health monitoring



Sensor de Humidade do Solo T...
electrofun.pt · Em stock



Comprar Sensor de Humidade ...
boxelectronica.com · Em stock



Sensor de Humidade de Solo (*1010200...
electronicaembajadores.com · Em stock



Sensor de Humidade e Temper...
electrofun.pt · Em stock



Sensor de humidade no Solo - ...
botroll.com · Em stock



Sensor Temperatura e Humida...
botroll.com



Jet7Store.Sensor de humidade...
jet7store.com · Em stock



Compre Solo Umidade E Temper...
pt.dhgate.com · Em stock



bme280 digital sensor temperatu...
pt.banggood.com · Em stock



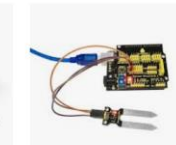
Sensor de Temperatura e H...
mixtronica.com · Em stock



Módulo De Sensor De Água + S...
aquario.pt · Em stock



Sensor de Umidade e Temperat...
filipeflopp.com · Em stock



Módulo sensor de humidade do s...
abrobotica.pt · Em stock



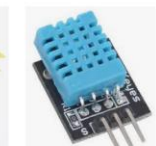
Sensor de humidade no solo - Lo...
abcescolar.pt · Em stock



Sensor de Humidade HIH-40...
botroll.com · Em stock



Compre Módulo Sensor De H...
pt.dhgate.com



Módulo Sensor DHT11 H...
harrytech.com.br · Em stock



RXW-SMD-868 Sensor de Hu...
alphaomega-electronics.com



Comprar Sensor De Tempera...
boxelectronica.com · Em stock



Módulo Grove - Sensor de humidade capacit...
mauser.pt · Em stock

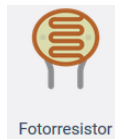
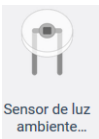
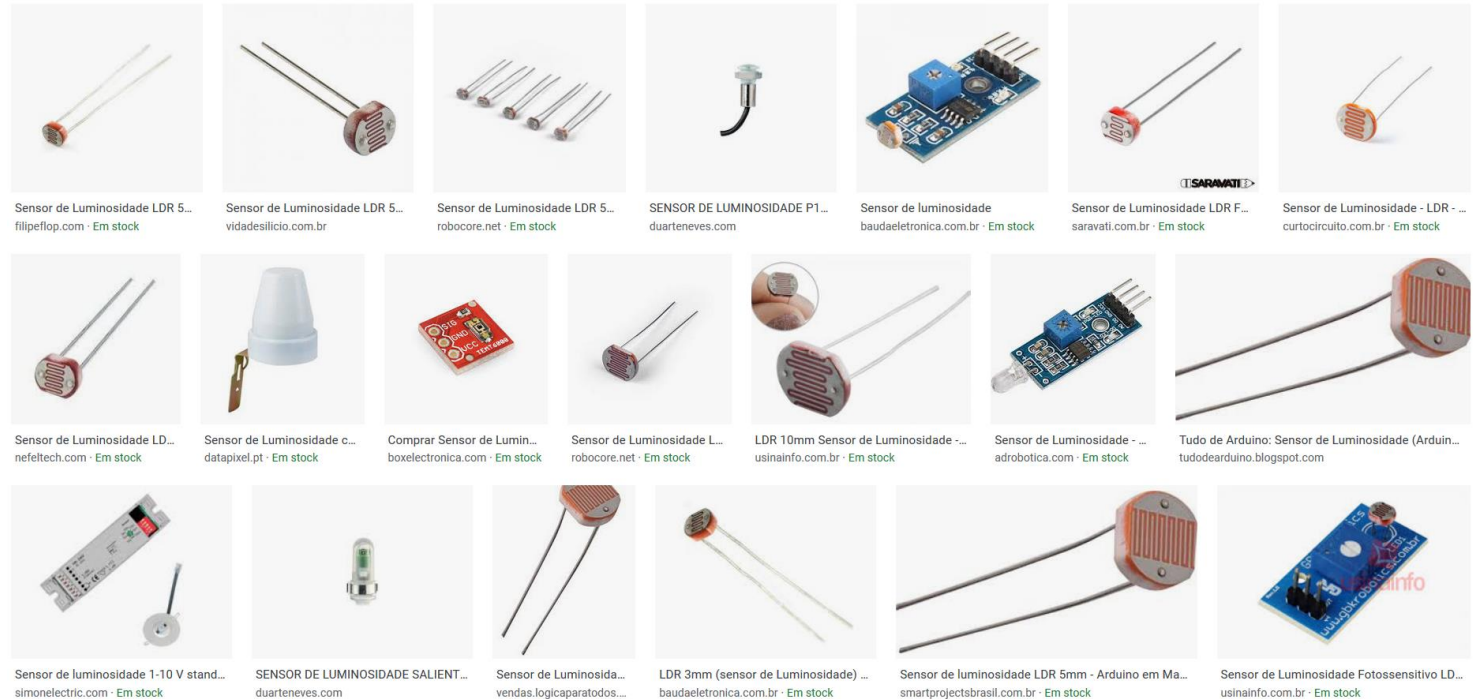


Sensor Humidade e Temperatura Indust...
electronicaembajadores.com · Em stock

Light Sensor

Where it can be used

- Smart TVs
- Mobile Phones
- Tablets
- Computers
- Urban lighting
- Automobiles



Acoustic and noise sensors

Useful for monitoring ambient noise levels



Sensor de Som para Arduino
electrofun.pt · Em stock



Sensor de Som com Microfone!
usainfo.com.br · Em stock



Comprar Sensor de Som KY-038 / KY-03...
usainfo.com.br · Em stock



Módulo Sensor de Som - Eletr...
eletrogate.com · Em stock



Módulo Sensor de Detecção d...
autocorerobotica.com.br · Em st...



SENSOR DE SOM / RUÍD...
arduoelatro.com · Em stock



Sensor de Som KY-038 Microf...
filipeflop.com · Em stock



modulo-sensor-de-som-para-ard...
rrrod.com



som
huinfinito.com.br · Em stock



Módulo Sensor de Som
baudaeletronica.com.br · Em stock



Som/Voz Módulo Sensor Módul...
pt.aliexpress.com · Em stock



Sound Detection Sensor Module LM393
Sensor De Detecção De som Mô...
pt.aliexpress.com · Em stock



Módulo Sensor De Som Detecto...
kitgames.com.br · Em stock



Sensor de Som para Arduino
onshop.pt · Em stock



Sensor de Som - Sensores - RoboCore
robocore.net · Em stock



Como usar com Arduino - Sensor (D...
blogmasterwalkershop.com.br



Sensor de Som Grove - FilipeFlop
filipeflop.com · Em stock



Sensor de Som - Curto Circuito | ...
curtocircuito.com.br · Em stock



Usando um sensor de som para acender a luz bate...
filipeflop.com



Compre Venda Quente Mini Alta Sen...
pt.dhgate.com

Water level sensor

Useful for

- Monitor rivers / dams
- Monitor levels in industrial processes



Sensor de Nivel de Água - Fili...
filipeflopp.com · Em stock



Sensor de Nivel de Líquidos ...
electrofun.pt · Em stock



Sensor de Nivel de Água Inte...
electrofun.pt · Em stock



Sensor de Nivel de Água hori...
filipeflopp.com · Em stock



Sensor de Nivel de Água para Arduino - U...
usinainfo.com.br · Em stock



Sensor de Nivel de Água 180° - Eletro...
eletrogate.com · Em stock



sensor de nível de água para a...
portuguese.alibaba.com



Sensor de Nivel LF122E-40: R\$66,00 - Sen...
eicos.com.br · Em stock



sensor de nível água para de...
damiasolar.com



Fabricantes De Sensores De ...
portuguese.alibaba.com



Sensor de Nivel de Água
baudaelectronica.com.br · Em st...



Sensor de Nivel LA16M-40: R\$52,00 - Senso...
eicos.com.br · Em stock



Sensor de Nivel de Água...
electrofun.pt · Em stock



Sensor Nivel de Água - Boia ...
saravati.com.br · Em stock



Sensor de Nivel de Água Horizontal t...
usinainfo.com.br · Em stock



Sensor De Nivel De Água, Óleo, Mod. La16 M-40 Origin...
produto.mercadolivre.com.br



Sensor de nível para líquidos - YouTube
youtube.com



Boia Sensor Nivel Lateral ...
tecnotonics.com.br · Em sto...



Sensor De Nivel De Água D...
portuguese.alibaba.com



Sensor/Medidor de nível para reserv...
youtube.com

Presence and proximity sensor

How it works

- Emits a beam of electromagnetic radiation, can determine the presence and distance of the object

Where it can be used

- Smart cars
- Robotics
- Industry
- Aviation
- Smart parking



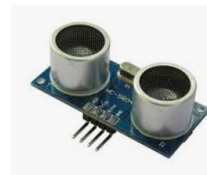
Comprar Sensor de Proxim...
boxelectronica.com · Em stock



Sensor de Proximidade Infr...
filipeflopp.com · Em stock



Módulo Sensor de Proximid...
botnroll.com



Sensor de proximidade por Ultra-Son...
electronicaembajadores.com · Em stock



Sensor de proximidade - Wikipédia, a enciclopédi...
pt.wikipedia.org



Sensor de Proximidade IR 2...
electrofun.pt · Em stock



Sensor de Proximidade Ind...
filipeflopp.com · Em stock



Sensor de Proximidade IR 100-5...
electrofun.pt · Em stock



Sensor de proximidade USB - Pr...
botnroll.com · Em stock



Sensor de proximidade M8 2m...
joliveira.pt · Em stock



Compre OEM Novo Sensor De P...
pt.dhgate.com



Reposto Sensor de Proximidade...
discoazul.pt · Em stock



Flex sensor de proximidade Sa...
teksector.pt · Em stock



Sensor de proximidade rail angu...
solostocks.pt · Em stock



Comprar Plastico para Sensor de...
powerplanetonline.com · Em stock



Deteção
ffonseca.com



Sensor de Proximidade Infraver...
electrofun.pt · Em stock



Reposto Sensor de Proximidade ...
discoazul.pt · Em stock



Marcas Chinesas M18 Sensor De Proximidade Elevador...
portuguese.alibaba.com



Sensor Indutivo : O que é e como funcio...
citisystems.com.br



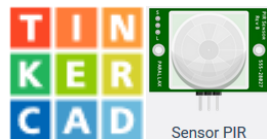
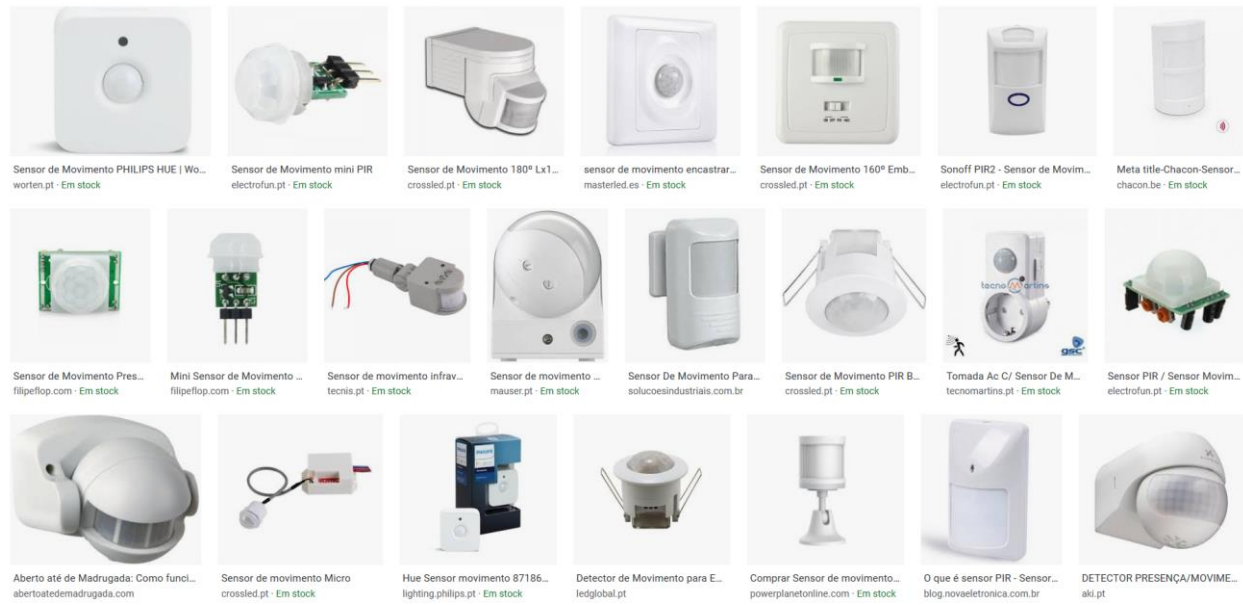
Sensor Indutivo : O que é e como funcio...
citisystems.com.br



Motion sensor

Where it can be used

- Smart buildings
- Monitoring of public and private spaces
- Energy saving solutions
- Smart cameras
- Automated devices



Gyroscope

Function

- Detect rotation
- Measure angular velocity

Where it can be used

- Navigation systems
- Robotics
- Electronic consumables
- Industrial processes
- Body measurements (athletes)



Chemical sensor

Useful for detecting chemical components

- Solids
- Liquids
- Gases

Where it can be used

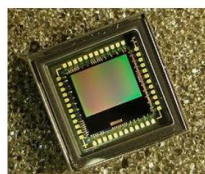
- Industrial security systems
- Environmental protection solutions
- Scientific investigation
- Pollution control solutions



Image sensor

Where it can be used:

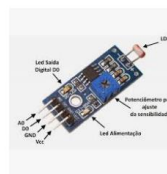
- Smart vehicles
- Security systems
- Military equipment (radar, sonar)
- Medical imaging devices
- Digital cameras



Sensor de Imagem – Wikipédia, a en...
pt.wikipedia.org



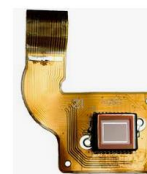
Sensor de Distância Ultrassôn...
filipeflo.com · Em stock



Comprar LDR Photosensitive ...
boxeelectronica.com · Em stock



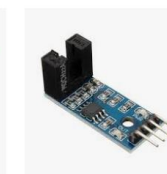
Sensor de Umidade de Solo
usainfo.com.br · Em stock



Sensor de Imagem – Wikip...
pt.wikipedia.org



Sensor de Chuva · Sensores · ...
robocore.net · Em stock



Sensor de Velocidade Encoder...
filipeflo.com · Em stock



Sensor de Humidade do Sol...
electrofun.pt · Em stock



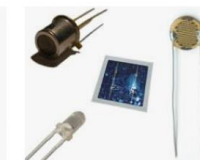
Sensor Dióxido de Carbono ...
botnroll.com · Em stock



Sensor de Corrente ACS712...
filipeflo.com · Em stock



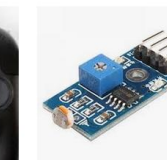
Sensor de Som com Microfone!
usainfo.com.br · Em stock



Sensor – Wikipédia, a enciclopédi...
pt.wikipedia.org



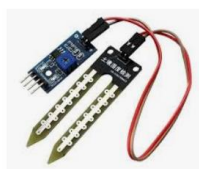
Sensor de Imagens (CMOS) - Fotografia - In...
infoescola.com



Sensor de luminosidade
baudaelectronica.com.br · Em s...



Sensor genuino da cremalheira da direção ...
pt.aliexpress.com · Em stock



Módulo Sensor De Umidade De Solo...
eletrogate.com · Em stock



Sensor De Pressão e Temperatura B...
filipeflo.com · Em stock



Sensor de pH Arduino / Medidor de pH + M...
usainfo.com.br · Em stock



Sensor de Corrente ACS712 AC / DC...
electrofun.pt · Em stock



Módulo Sensor de Movimento p/ Pe...
botnroll.com · Em stock

Linear actuators

Allow movement of an object in a straight line



100N 200mm Stroke 60mm/Sec 12V Linear ...
motiondynamics.com.au · Em stock



RA-47 2500N Linear Actuator with Feedback | RE...
regner.es · Em stock



RA-47X 1500N High Speed Linear Actuator...
regner.es · Em stock



C-Beam® Linear Actuator Bundle - OpenBu...
openbuildspartstore.com · Em stock



Heavy Duty Linear Actuator...
ato.com



Linear Actuator, 12 Volt Motor...
speedwaymotors.com · Em stock



LINEAR ACTUATOR at Rs 25000 /piece | Heavy...
indiamart.com



Mechanical Linear Actuator, 12V/...
ato.com



Classic Rod Linear Actuators - Firgelli...
firgelliauto.ca · Em stock

Original Version



SlickStick™ Linear Actuator (Original...
oldsite.bwc.com



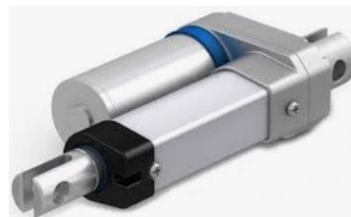
Linear Actuators & Cylinder, Maxi...
indiamart.com



Pololu - Glideforce LACT2P-12V-10 Light-Duty...
pololu.com · Em stock



200N 150mm Stroke 35mm/Sec 12V Linear Actuator...
motiondynamics.com.au · Em stock



CAHB-10-A3A-100209AAA000-000 SKF | SKF Lin...
br.rsdelivers.com



Standard Speed Linear Actuator...
frightprops.com · Em stock



Festo Electromechanical Linear Actuator...
indiamart.com

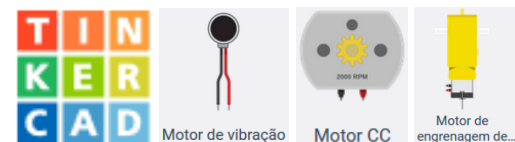


Linear Actuators-MA1 Series-TIMOTION Technology...
timotion.com



C-Beam® Linear Actuator Bundle...
makersupplies.dk

Motor actuators



Allow rotational movement of device components or devices



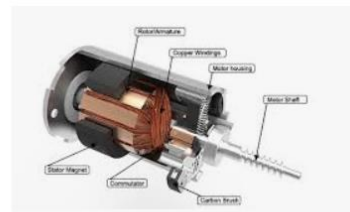
Linear Actuator, Linear Mo...
linear-actuator.com.cn



Electrical Motors and Actuators - CIRCUITMIX
circuitmix.com



Stepper Motors Linear Actuat...
jvl.dk



Part 2: Components of an Electric Linear Actuat...
timotion.com



HVAC Motor & Actuator, What's Th...
blog.micrometl.com



Stepper Motor Linear Actuators | Made To Fit Y...
linengineering.com



Untitled Document
bertda.com



Hydraulic Motors or Actuators or Dri...
pt.slideshare.net



Thomson's electromechanical linear actuators n...
motioncontroltips.com



NEMA Stepper Motor Linea...
electromate.com



Continental Aftermarket - Actuators and m...
continental-aftermarket.com



Stepper Motors Linear Actuators by jvl.dk



hybrid-linear-stepper-motors-actuator - ...
motioncontrolproducts.com



China Explosion Proof Motors for Va...
m.nyexmotor.com



Low Price Linear Actuator 12v Dc Lin...
alibaba.com



35mm PM linear Stepper motor linea...
ldomotors.en.alibaba.com



Motor elétrico de corrente contínua / s...
directindustry.com



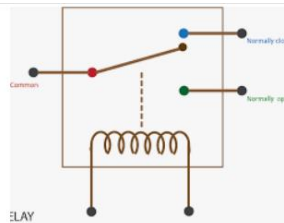
Linear Stepper Motor - Linear Actuator | P...
portescap.com

Relays

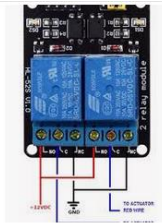


Operate switches on lamps, heaters, or smart vehicles.

Can be electromagnetic



Relays and Actuators - OpenLabPro.com
openlabpro.com



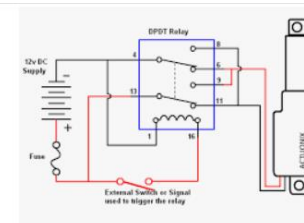
arduino 12v relay linear...
forum.arduino.cc



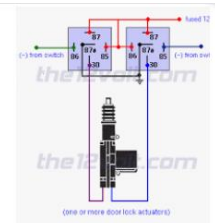
How to use Relays to Control Linear Actuators - Yo...
youtube.com



How To Use Relays To Control Linear Actuato...
pinterest.com



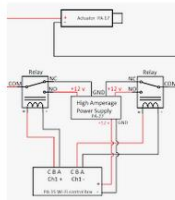
Actuators Relay Wiring - Tips Electrical Wirli...
14.tail.call4sale.de



Negative Door Lock Relay ...
17.30.favour.theviable.de



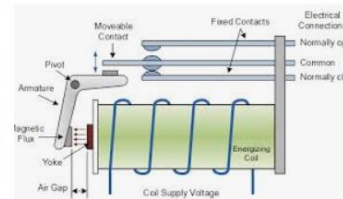
How To Control Linear Actuators with DC Rela...
youtube.com



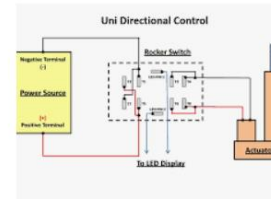
A Linear Actuator Wirin...
167.39.mira.anspack.de



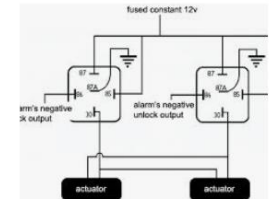
Using Relay Boards to Control Line...
instructables.com



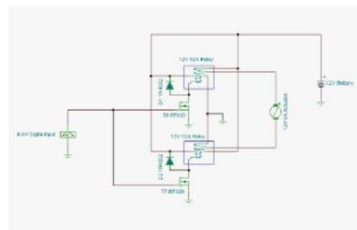
Electrical Relay and Solid State Relays for Switching
electronics-tutorials.ws



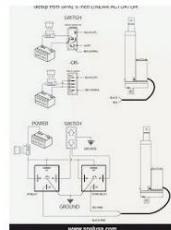
Wiring Actuator | Wiring Diagram
feuerwehr-kleinpau.de



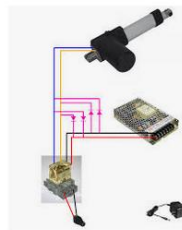
Door Actuator Wiring | Wiring Diagram...
feuerwehr-kleinpau.de



Linear Actuator Control Circuit | Download Scientific ...
researchgate.net



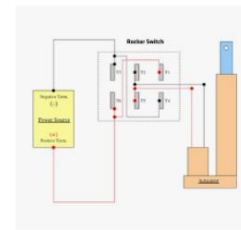
Wiring Diagram For Act...
187.39.mira.anspack.de



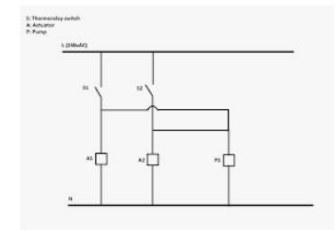
How do I wire Solid State ...
electronics.stackexchange.com



How to control a linear actuator with an Arduino ...
shiftautomation.com



Actuator Wiring Diagram - Automot...
6.joke.kardieft.de

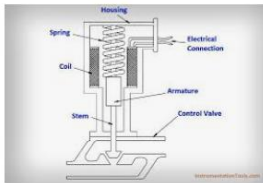


Relay circuit for circulator pump and actuators...
electronics.stackexchange.com

Solenoids

Part of locking or actuating mechanisms

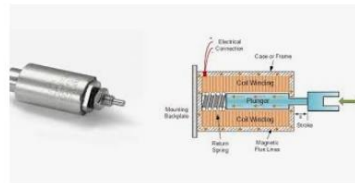
Controllers in gas and water leak monitoring systems



What is a Electric Solenoid Actuator ? ...
instrumentationtools.com



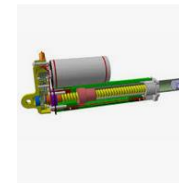
Solenoid Actuator – Tink...
tinkery.com.au · Em stock



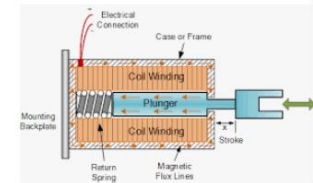
Linear Solenoid Actuator
emworks.com



195222-234 | Saia-Burgess STA Linear Solenoi...
au.rs-online.com · Em stock



12v Electric Solenoid Act...
alibaba.com



Linear Solenoid Actuator Theory and Tutorial
electronics-tutorials.ws



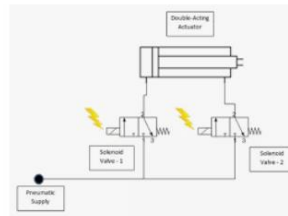
China Shengboai Air Torque Pne...
wuxishba.en.made-in-china.com · E...



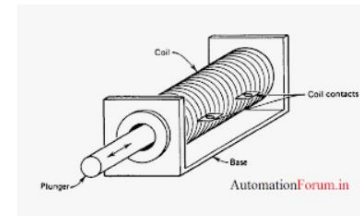
Replacement Solenoid Valve for ...
ebay.com · Em stock



Kalyan Engineers Solenoid Actuators, ...
indiamart.com



Can we use a 3/2 solenoid valve for a dou...
quora.com



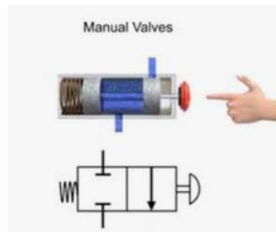
Electrical actuators - Field Instrumentation - Industrial...
automationforum.in



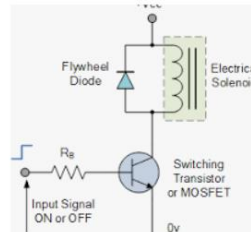
Amelec Australia | Product Cate...
amelec.com.au



Amazon.com: uxcell Push Pull Type ...
amazon.com



Valve Control using Solenoid actuators, ...
automationforum.in



Linear Solenoid Actuator Theory an...
pinterest.com



DEI 524N DOOR LOCK SOLENOID ACTUATORS ...
ebay.com



Bistable Latching Electric Solenoid ...
alibaba.com



12V/24V Pull Hold/Release 10mm S...
aliexpress.com · Em stock

Tinkercad Components: General

Example projects



Resistor

Resistor + LED: <https://www.instructables.com/id/Blink-an-LED-With-Arduino-in-Tinkercad/>



Capacitor



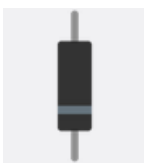
Capacitor polarizado

Capacitor: <https://www.tinkercad.com/things/4QKDcmpgQlk-capacitor-chargedischage>

Capacitor (polarized): <https://www.tinkercad.com/things/4niX4dzMpxb-demonstracao-de-capacitor>



Diodo



Diodo Zener

Diode: <https://www.tinkercad.com/things/gtjQR1zD7tA-diode-example>

Zener Diode: <https://www.tinkercad.com/things/0lRoAnQ1gTR-regulated-18-led-circuit-w-zener-diode>

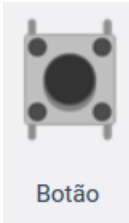


Indutor

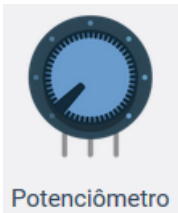
Inductor: <https://www.tinkercad.com/things/fCPIb9LSnTR-inductive-kickback-blips-led>

Tinkercad Components: Input (1)

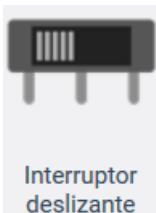
Example projects



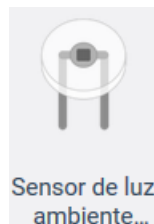
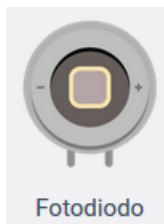
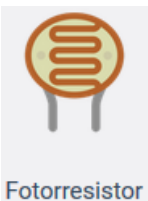
Button: <https://www.tinkercad.com/things/3jehtIfGzaJ-button-for-led>



Potentiometer : <https://www.tinkercad.com/things/9A8tB58pTAB-potentiometer>



Sliding switch: <https://www.tinkercad.com/things/aYLV3snbIXV-slide-switch>



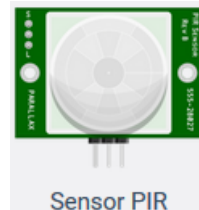
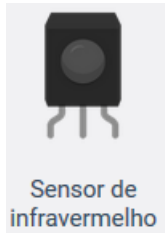
Fotoresistor: <https://blog.tinkercad.com/2018/08/15/light-sensor-photoresistor-with-arduino-in-tinkercad-circuits>

Fotodiode + Ambient light sensor : <https://www.tinkercad.com/things/8ZnKEw2V9Np-sensor-grd-fotodiodo-fototransistor>

Tinkercad Components: Input (2)

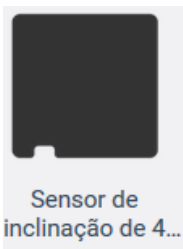
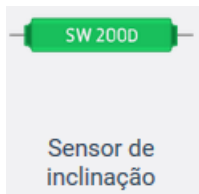
Example projects

Infrared sensor + control : <https://www.tinkercad.com/things/0n2VuaSIEZV-ir-sensor>



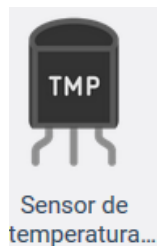
Distance sensor : <https://www.instructables.com/id/Ultrasonic-Distance-Sensor-Arduino-Tinkercad/>

PIR Sensor: <https://www.tinkercad.com/things/b4uKrapCcuJ-if-else-pir-sensor-leds>



Tilt sensor: <https://www.tinkercad.com/things/3892gwElzqP-tilt-sensor-led-onoff>

4-pin tilt sensor: <https://www.tinkercad.com/things/ddxzmUfN0Wb>

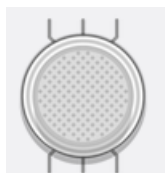


Temperature sensor: <https://www.instructables.com/id/TMP36-Temperature-Sensor-Arduino-Tinkercad/>

<https://www.bc-robotics.com/tutorials/using-a-tmp36-temperature-sensor-with-arduino/>

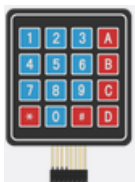
Tinkercad Components: Input (3)

Projetos exemplo



Sensor de gás

Gas sensor : <https://www.tinkercad.com/things/1Sg0hWGQjIU-gas-sensor>



Teclado 4x4

4x4 keypad: <https://www.tinkercad.com/things/8iDg0ZuguN8-using-keypad-4x4-with-arduino>



Interruptor DIP
DPST



Interruptor DIP
DPST x 4

DIP switches: <https://www.tinkercad.com/things/jV5lPiuggGJ-dip-switches>



Interruptor DIP
DPST x 6

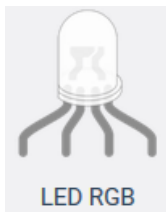
IMP.GE.190.0

Tinkercad Components: Output (1)

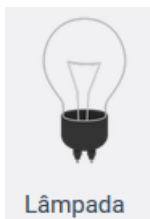
Example projects



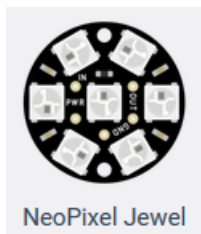
LED



LED RGB



Lâmpada



NeoPixel Jewel



NeoPixel Ring 12



NeoPixel Ring 16



NeoPixel Ring 24

Resistor + LED: <https://www.instructables.com/id/Blink-an-LED-With-Arduino-in-Tinkercad/>
 RGB LED: <https://www.tinkercad.com/things/a8KMGOddc8F-copy-of-rgb-led/editel?tenant=circuits>

Lamp: <https://www.tinkercad.com/things/ivLmpnMZU8n-turn-on-an-ac-lamp-using-arduino-5v-relay-and-motion-sensor>

NeoPixel Jewel: <https://www.tinkercad.com/things/iXodLbBNs2f-neopixel-jewel-to-arduino-wiring-diagram>

NeoPixel Ring: <https://www.tinkercad.com/things/4o7RbhTtDIK-neopixel-ring>

Tinkercad Components: Output (2)

Example projects

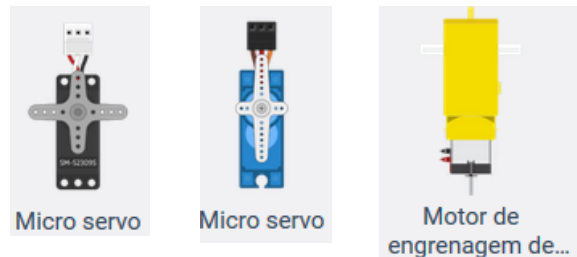


NeoPixel string: <https://www.tinkercad.com/things/hMoLHIEK0Ny-neopixel-strip>



Vibrating motor: <https://www.tinkercad.com/things/j8FgQLQ93wa-vibration-motor>

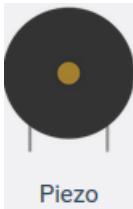
CC Motor: <https://www.tinkercad.com/things/3z3Xc8Bp3go-motor-corrente-continua-arduino>



Micro servo: <https://www.tinkercad.com/things/eLrPl4KgIF1-servo-motor>

Tinkercad Components: Output (3)

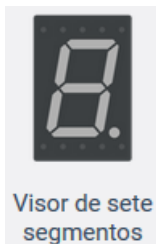
Example projects



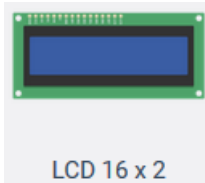
Piezo buzzer: <https://www.tinkercad.com/things/d4URImkqGYu-piezo>



Infrared sensor + control : <https://www.tinkercad.com/things/0n2VuaSIEZV-ir-sensor>



7-segment display : <https://www.tinkercad.com/things/exdo9N933Wf-test-7-segment-display-hookup-common-anode>



LCD 16x2: <https://www.tinkercad.com/things/dGiMrTYFn9R-copy-of-16x2-lcd-display/editel?tenant=circuits>



UNIVERSIDADE
PORTUCALENSE

Do conhecimento à prática.