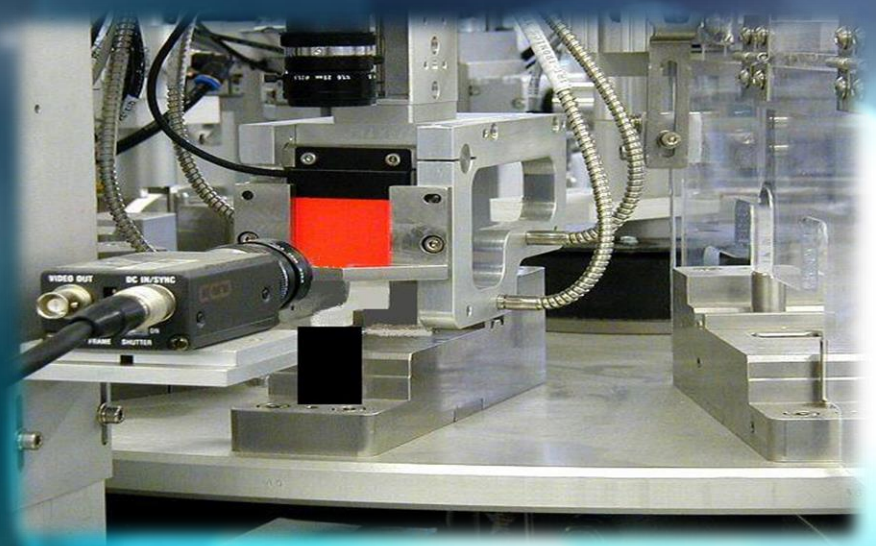
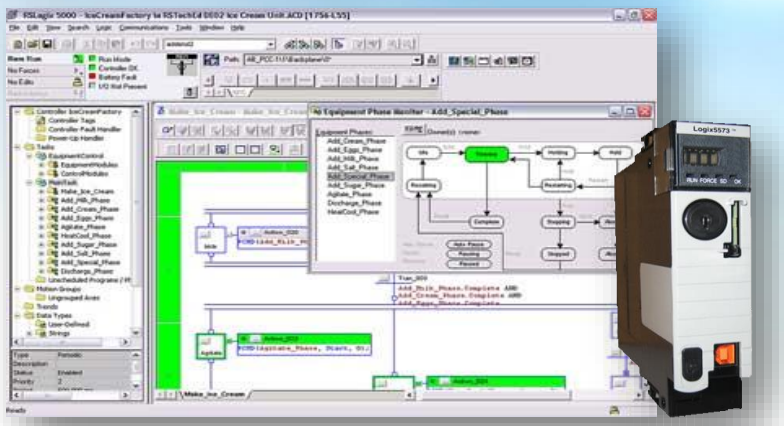


Sensores Industriais

Automação Semestre 02/2015

Engenharia de Controle e Automação



Introdução

- Sensores são dispositivos amplamente utilizados na automação industrial que transformam variáveis físicas, como posição, velocidade, temperatura, nível, pH etc., em variáveis convenientes (unidades de engenharia). Se estas são elétricas, a informação pode ser associada ou à tensão ou à corrente, sendo o segundo caso mais usual, porque implica em um receptor de baixa impedância e, portanto, maior imunidade à captação de ruídos eletromagnéticos. Atualmente, em ambientes mais ruidosos e com distâncias maiores é amplamente utilizada a transmissão por fibras óticas.

Introdução

- Sensores Discretos: seu sinal elétrico de saída são do tipo 0-1, “*on*”-”*off*”, *isto é, binárias. São utilizados para detecção de eventos, por exemplo, chegada de um objeto a uma posição, um nível de um fluído a um valor etc.*

- Sensores de medição ou transdutores: seu sinal elétrico de saída reproduz a amplitude do seu sinal de entrada. Seu sinal de saída pode ser analógico ou digital. Utilizados em controle dinâmico de processos.

Sensores Discretos

- Sensores Discretos: Entre os sensores discretos existem duas grandes classes:
  - De contato mecânico

Fim de curso →

  - Sensores de Proximidade

Indutivo

Fotoelétrico

Capacitivo

Ultrassônico

Magnético

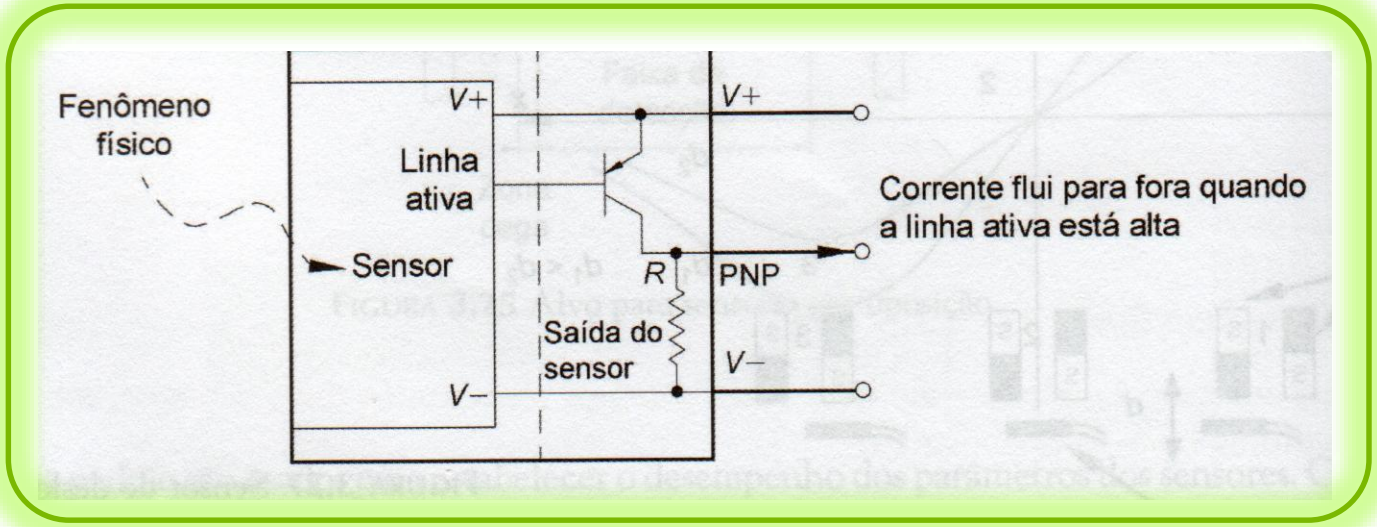
RFID

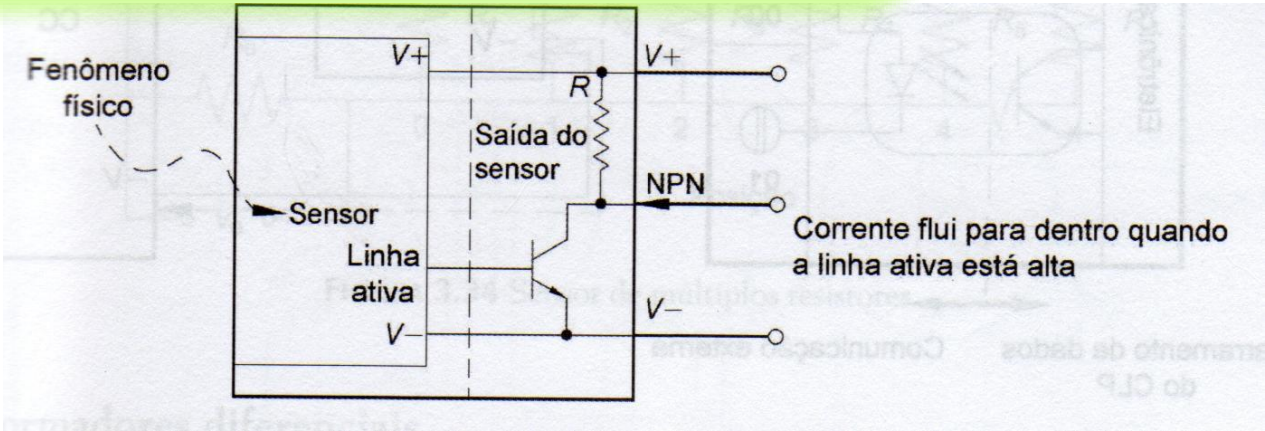
Interfaceamento dos Sensores Discretos com os Controladores

- A ligação dos sensores digitais nos Controladores Industriais e fontes podem ser de dois, três ou quatro fios. Aqueles a dois fios são, por exemplo, do tipo contato seco, ao passo que aqueles com três ou quatro fios são transistorizados PNP ou NPN. Em qualquer caso a corrente poderá fluir para a entrada do Controlador, caracterizando a montagem do tipo *sourcing* ou, então, fluir para o sensor, caracterizando a montagem tipo *sinking.*

- Nos sensores *sourcing* o transistor interno é PNP e nos sensores *sinking* o transistor interno é o NPN.

Interfaceamento dos Sensores Discretos com os Controladores





Sensores Discretos – Contato Mecânico

- Sensores de contato Mecânico: Nestes sensores, uma força entre o sensor e o objeto é necessária para efetuar a detecção do objeto. Estes dispositivos tem o corpo reforçado para suportar as forças mecânicas decorrentes do contato com objetos.

- Configurações:
  - Chaves de contato elétrico normalmente aberto (NA/NO) ou normalmente fechado (NF/NC);
  - Contatos que após acionados podem ser momentâneos ou permanentes;
  - Dois ou quatro pares de contatos elétricos;
  - Atuação por pressão;
  - Abertura e fechamento lento de contatos;
  - Para aplicações de segurança ou aplicações normais.







Sensores Discretos – Contato Mecânico

- Chaves eletromecânicas: detecção de um evento.
  - Botões de Comando

  - Chaves Fim-deCurso

Para aplicações de Segurança

Para aplicações Normais

- Chaves de Nível: detecção do nível de um líquido.
- Chaves de Vazão: detectar vazão de um fluído.
- Chaves de Temperatura: medir temperatura de um fluído
- Chaves de Pressão: medir a pressão de um fluído

Sensores Discretos - Proximidade

- Sensores de Proximidade: nestes sensores, o objeto é detectado pela proximidade ao sensor.

- Princípios de funcionamento:
  - Indutivo: detecta alterações em um campo eletromagnético, é próprio para objetos metálicos;
  - Capacitivo: detecta alterações em um campo eletrostático, é próprio para materiais não metálicos;
  - Ultrassônico: usa ondas acústicas e ecos, é próprio para objetos de grandes proporções;
  - Fotoelétrico: detecta variações de luz infravermelha recebida;
  - Magnético - Efeito Hall: detecta alterações de campo magnético;
  - RFID : Identificação por rádio frequência – três partes: Interface, tranceivers e tag.






Sensores Discretos - Proximidade

- Sensores Indutivos: campo eletromagnético –metais

- Sensores Capacitivos: eletrostático –metais e não metais

- Sensores Óticos –Fotoelétricos: feixe de luz –praticamente todos os materiais
  - Difuso, Emissor/Receptor (barreira), Retro reflexivo (com espelho prismático), com Fibra Ótica, Encoders e LASER.

- Sensores Ultrassônicos: transdutor piezoelético – objetos grandes

- Sensores magnéticos – Efeito Hall: semelhante ao sensor Reed, porém com maior resistência à vibração e ao choque.

- Sensores RFID: Sensores de identificação por rádio frequência.
  - Interface
  - Tranceivers
  - Tag: Descartável e Regravável

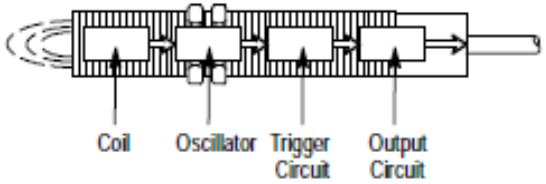
Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos - modelos

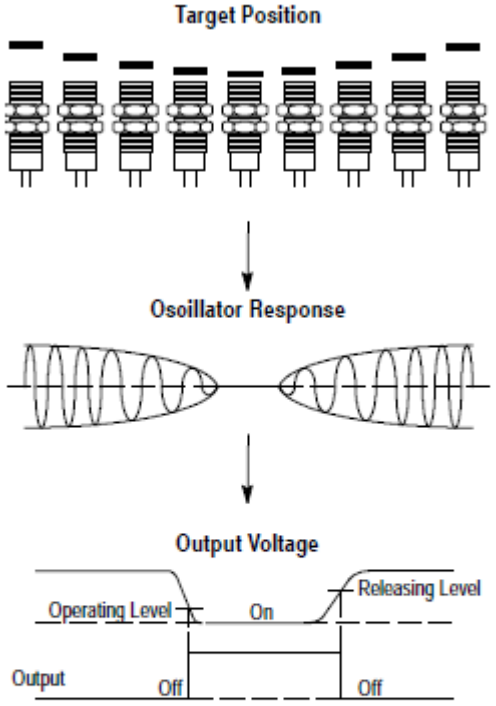
Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos – anatomia:

Principles of Operation for Inductive Proximity Sensors



Inductive proximity sensors are designed to operate by generating an electromagnetic field and detecting the eddy current losses generated when ferrous and nonferrous metal target objects enter the field. The sensor consists of a coil on a ferrite core, an oscillator, a trigger-signal level detector and an output circuit. As a metal object advances into the field, eddy currents are induced in the target. The result is a loss of energy and a smaller amplitude of oscillation. The detector circuit then recognizes a specific change in amplitude and generates a signal which will turn the solid-state output "ON" or "OFF."



A metal target approaching an inductive proximity sensor (above) absorbs energy generated by the oscillator. When the target is in close range, the energy drain stops the oscillator and changes the output state.

Correotion Faotors

Target Material	Approximate Correotion Faotor
Mild Steel	1.0
Stainless Steel	0.85
Brass	0.50
Aluminum	0.45
Copper	0.40

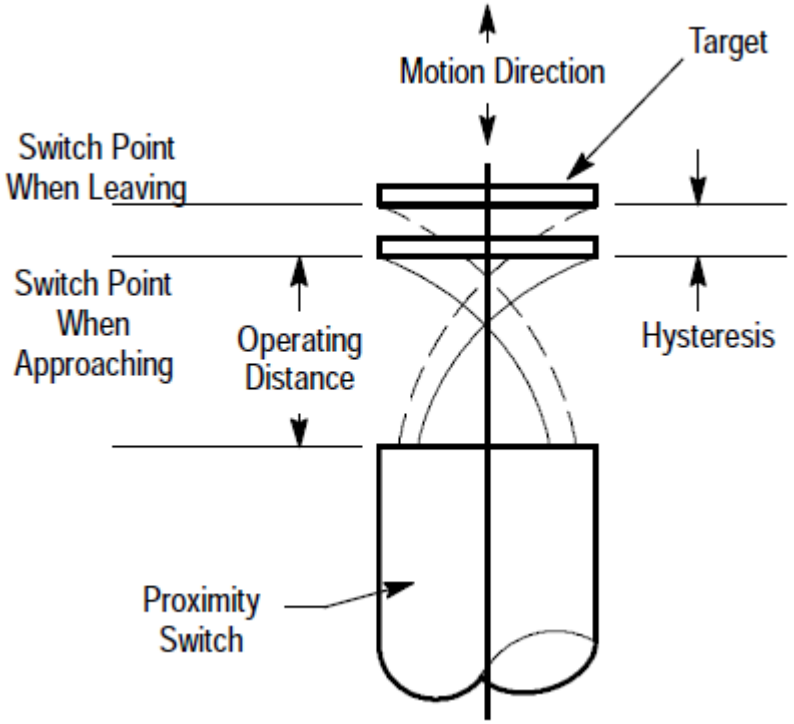
Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos – anatomia:

Hysteresis (Differential Travel)

The difference between the operate and the release points is called hysteresis or differential travel. The amount of target travel required for release after operation must be accounted for when selecting target and sensor locations. Hysteresis is needed to help prevent chattering (turning on and off rapidly) when the sensor is subjected to shock and vibration or when the target is stationary at the nominal sensing distance.

Vibration amplitudes must be smaller than the hysteresis band to avoid chatter.

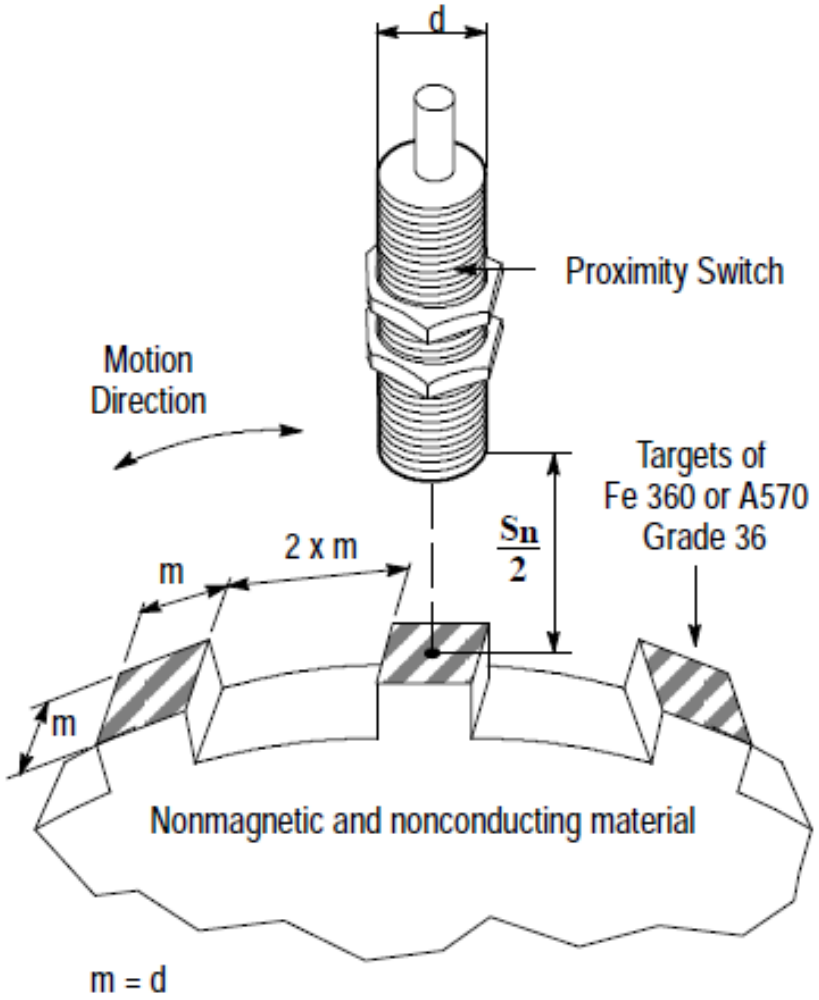


Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos – anatomia:

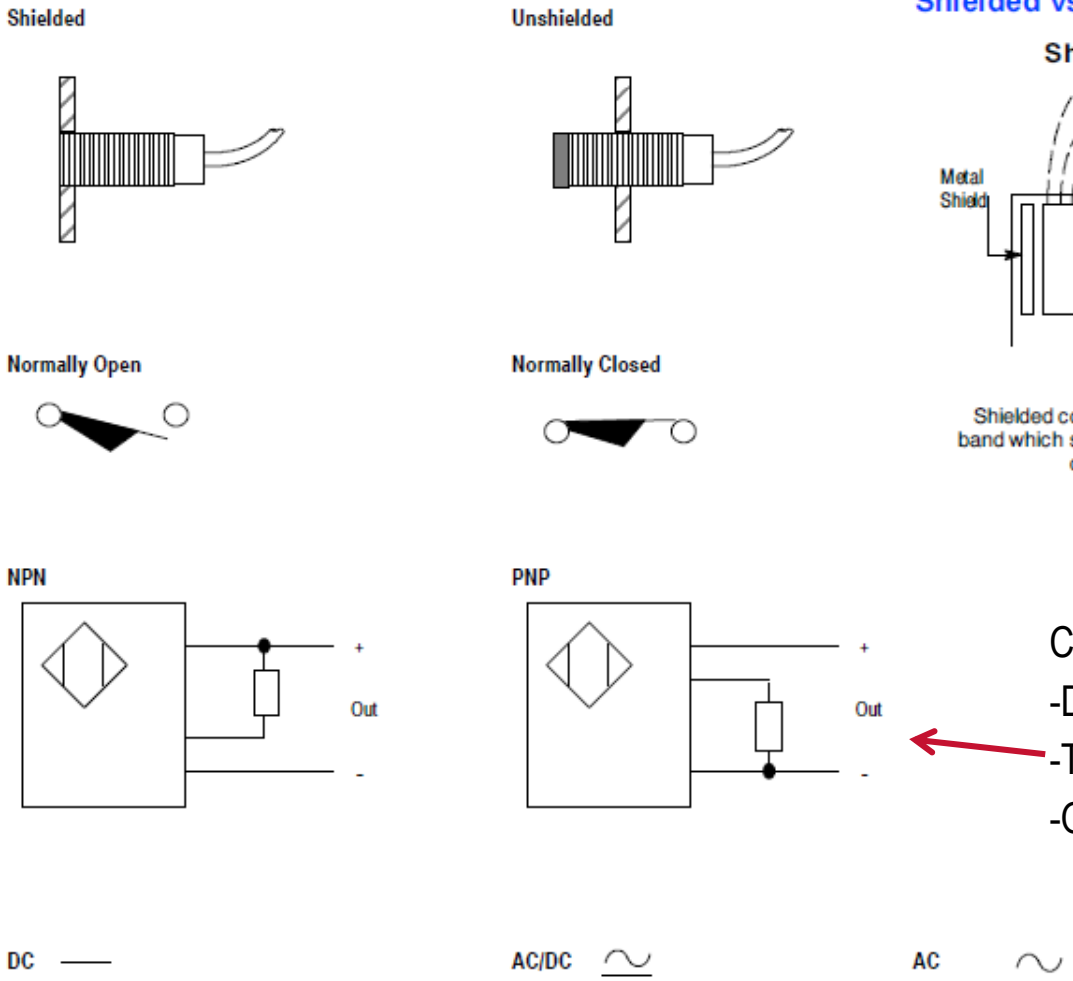
Switching Frequency

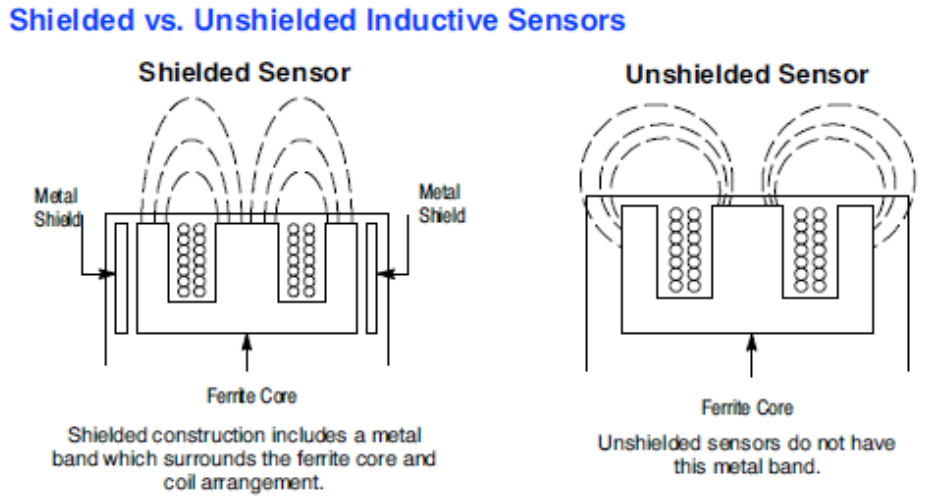
The switching frequency is the maximum speed at which a sensor will deliver discrete individual pulses as the target enters and leaves the sensing field. This value is always dependent on target size, distance from sensing face, speed of target and switch type. This indicates the maximum possible number of switching operations per second. The measuring method for determining switching frequency with standard targets is specified by IEC60947-5-2.



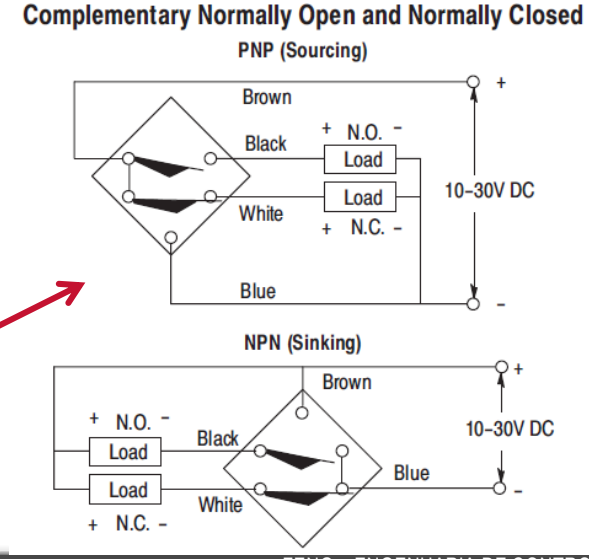
Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos





Conexão:
-Dois fios
-Três fios
-Quatro fios



Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos

NPN: The sensor switches the load to the negative terminal. The load should be connected between the sensor output and positive terminal.

PNP: The sensor switches the load to the positive terminal. The load should be connected between the sensor output and negative terminal.

Sinking: See NPN.

Sourcing: See PNP.

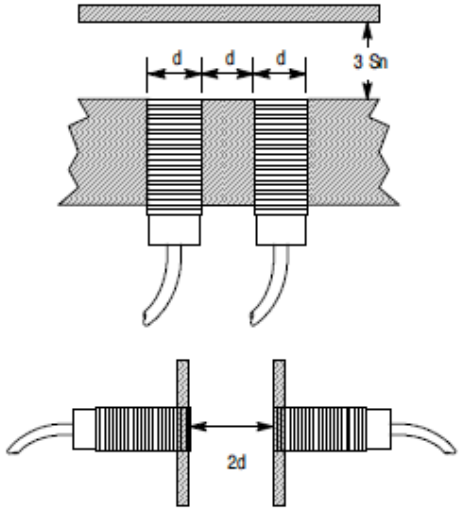
Sensores Discretos – Proximidade

- Sensores de Proximidade Indutivos

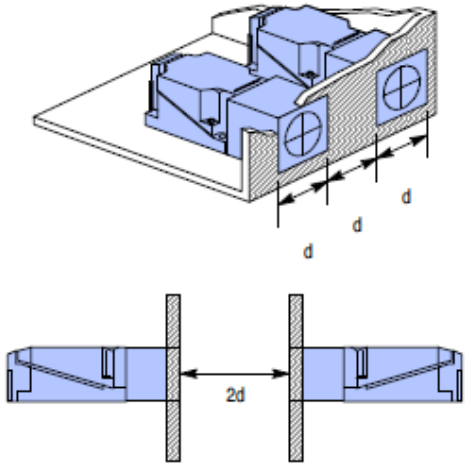
Spacing Between Shielded Sensors (Flush-Mountable) and Nearby Metal Surfaces

Shielded proximity sensors allow the electro-magnetic field to be concentrated to the front of the sensor face. Shielded construction allows the proximity to be mounted flush in surrounding metal without causing a false trigger.

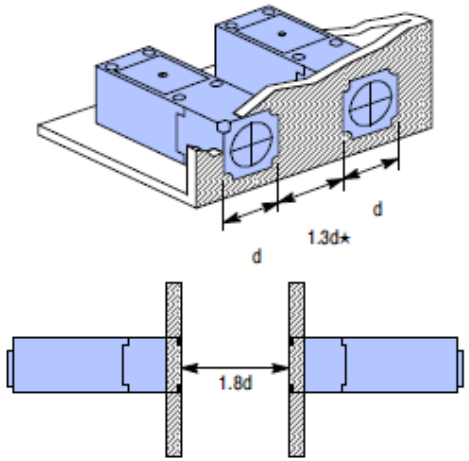
Tubular Style



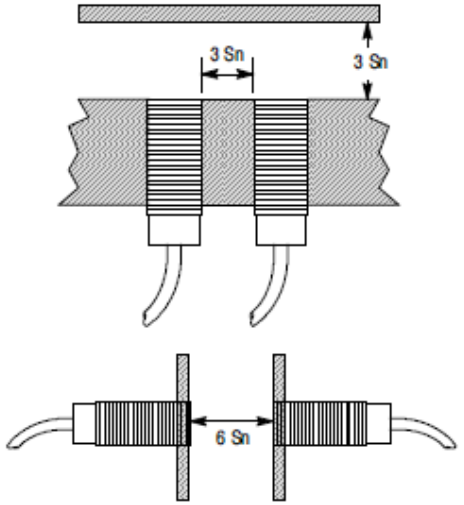
Limit Switch Style (871L and 872L)



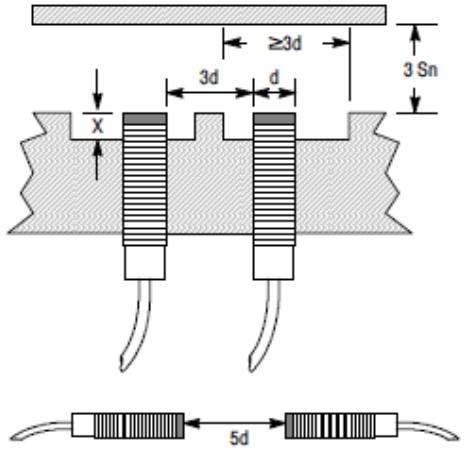
Limit Switch Style (802PR)



Tubular Style Extended Sensing (872C)



Tubular Style Long Range Sensing (872C)



Housing Diameter	Dimension X
6.5 mm	1 mm
12 mm	2 mm
18 mm	4 mm
30 mm	6 mm

d = diameter or width of active sensing face
Sn = nominal sensing distance

★ 802PR-LB or 802PR-XB can be mounted side by side.

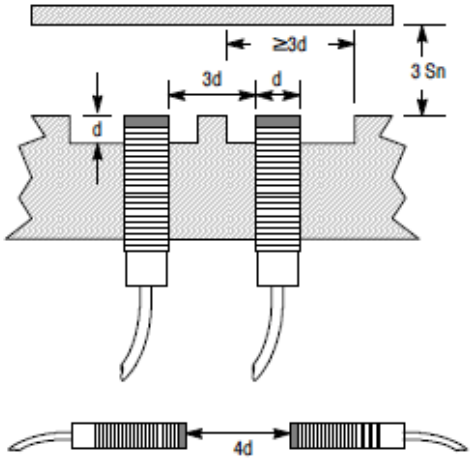
Sensores Discretos – Proximidade

- Sensores de Proximidade Indutivos

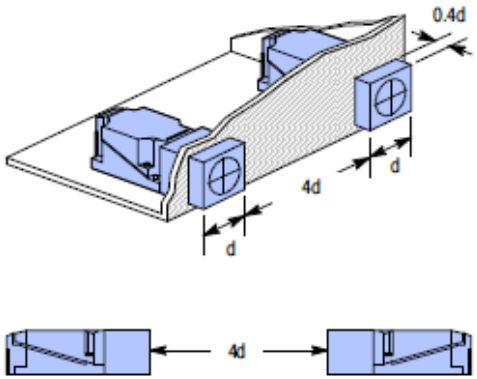
Spacing Between Unshielded Sensors (Nonflush-Mountable) and Nearby Metal Surfaces

Longer sensing distances can be obtained by using an unshielded sensor. Unshielded proximity sensors require a metal-free zone around the sensing face. Metal immediately opposite the sensing face should be no closer than three times the rated nominal sensing distance of the sensor.

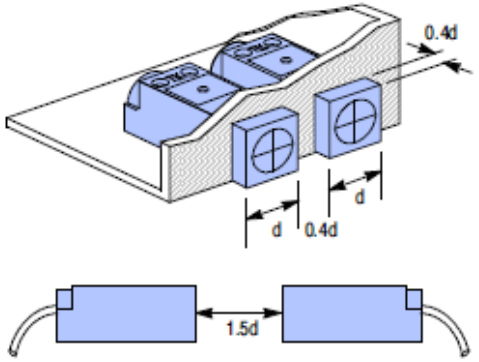
Tubular Style



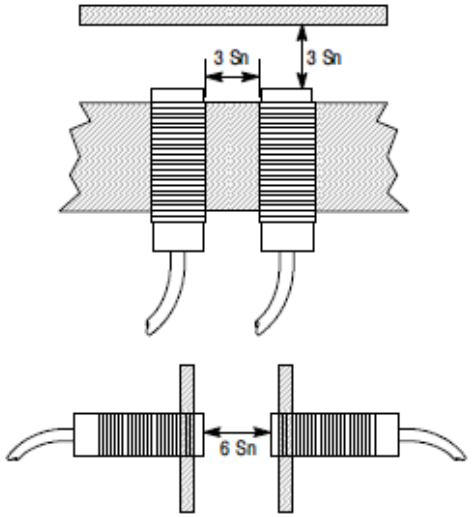
Limit Switch Style (871L and 872L)



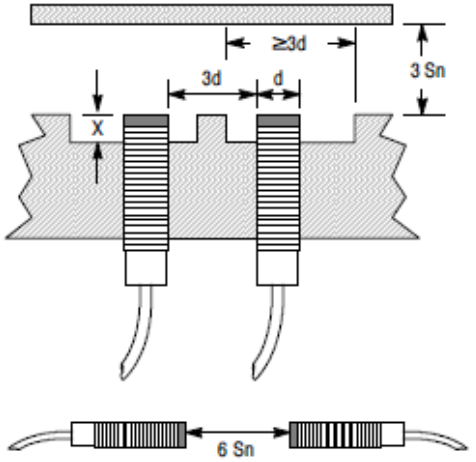
Limit Switch Style (802PR)



Tubular Style Extended Sensing (872C)



Tubular Style Long Range Sensing (872C)

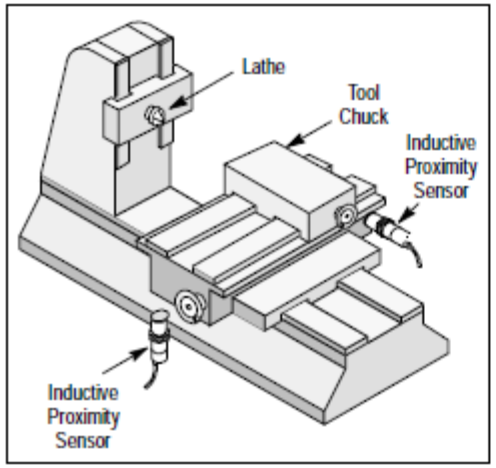


Housing Diameter	Dimension X
8 mm	8 mm
12 mm	13 mm
18 mm	20 mm
30 mm	35 mm

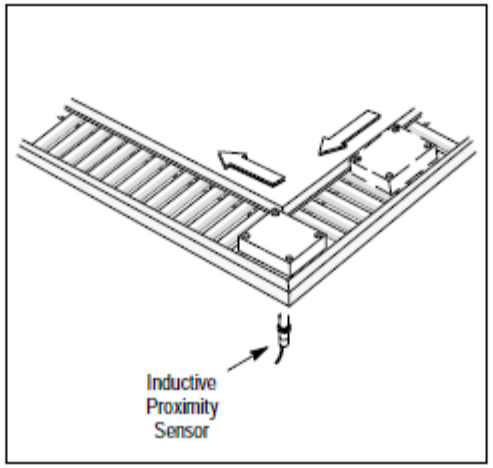
Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos - Aplicações:

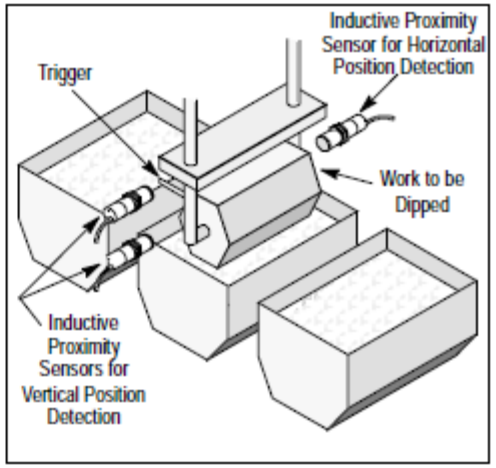
Machine Tools



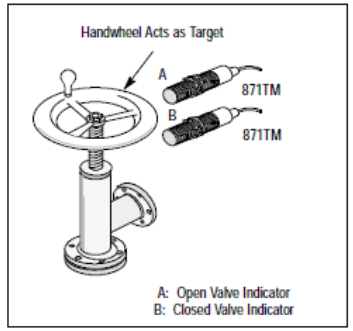
Plating Line



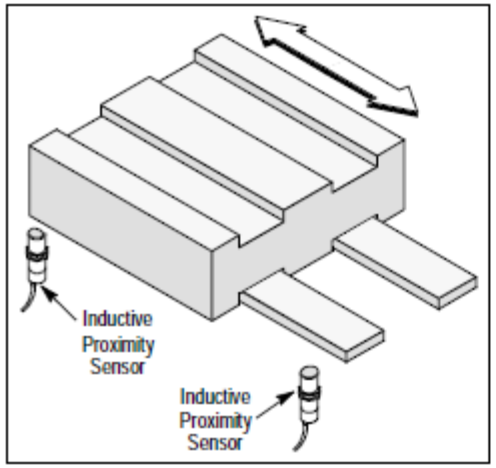
Plating Line



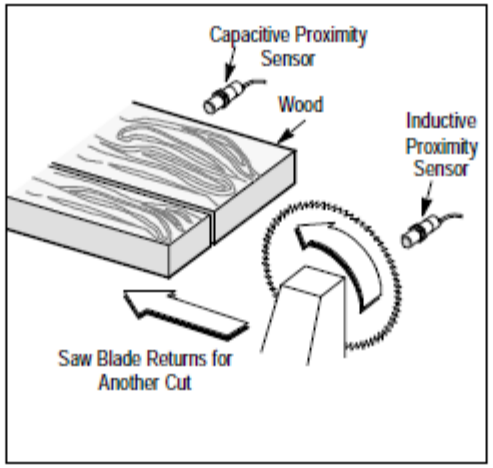
Petroleum Industry— Valve Position



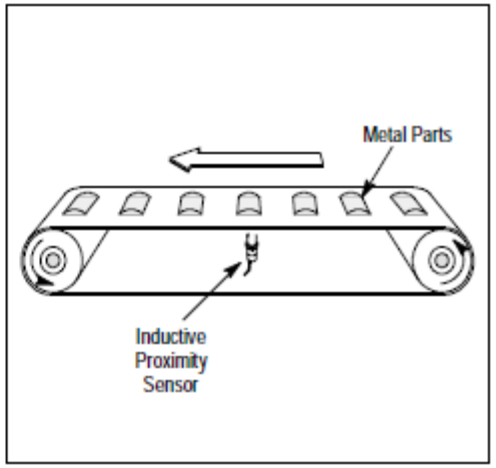
Grinding Machines



Wood Industry

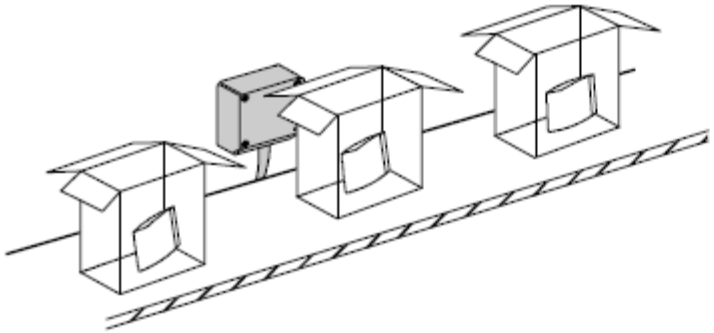


Conveyor Belts

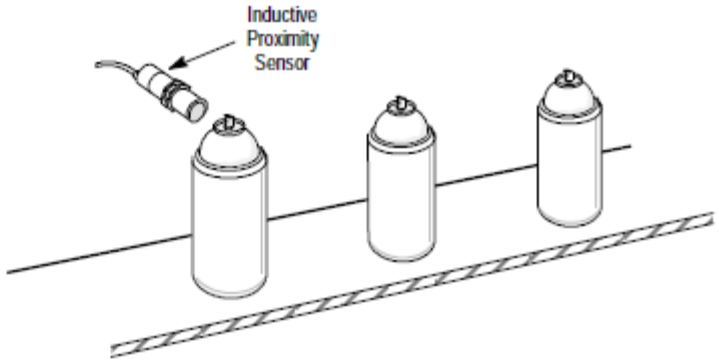


Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos - Aplicações:

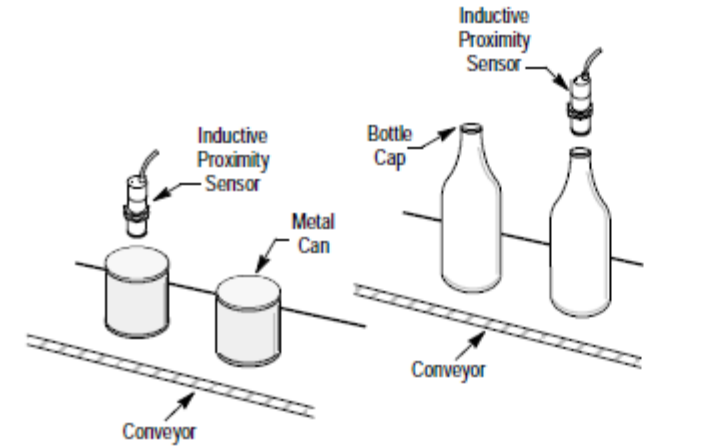


Inductive proximity sensor used to detect a foil seasoning bag inside of a cardboard container.

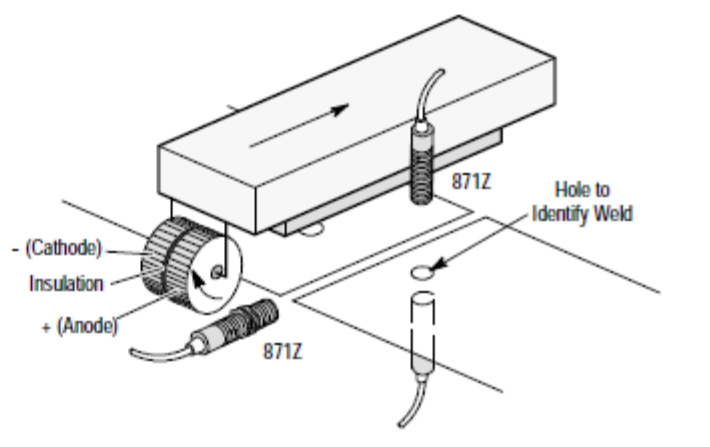


Ferrous selective inductive proximity sensor used to sort ferrous and nonferrous can tops.

Food Industry



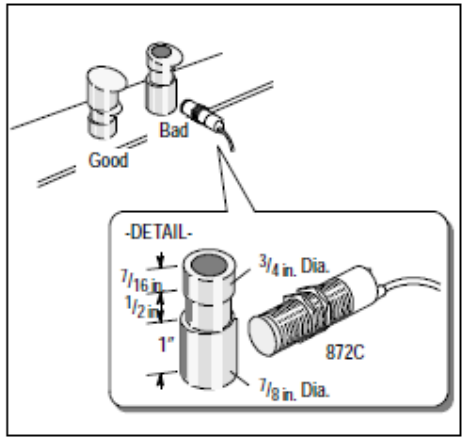
Stainless Steel Sheet Welder



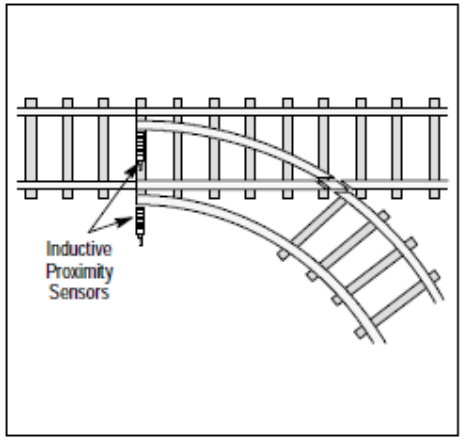
Sensores Discretos - Proximidade

- Sensores de Proximidade Indutivos - Aplicações:

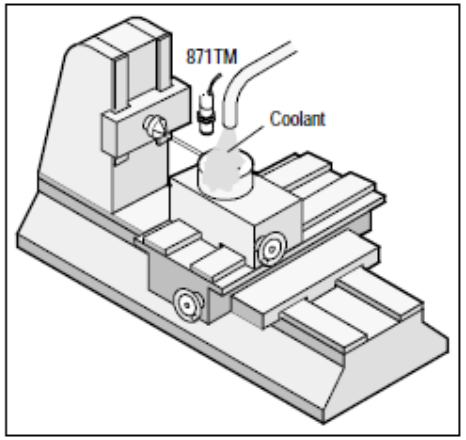
On Line Parts Sorting



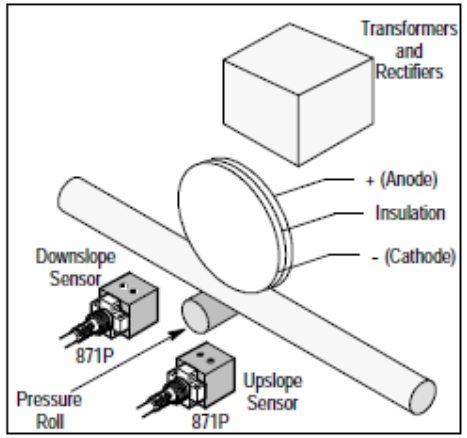
Railroad Yard Position Sensing



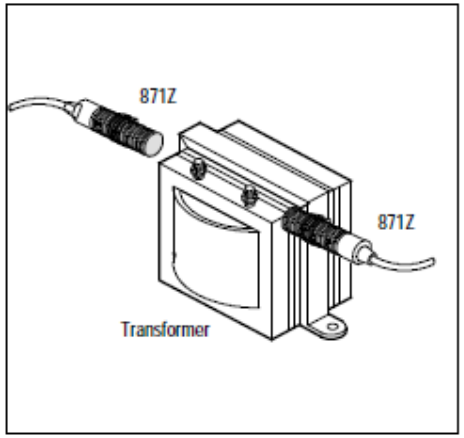
Coolant Resistant Sensing



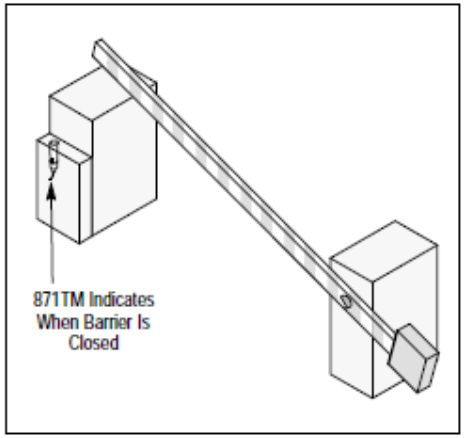
Up and Downslope Control of Continous Tube Welder



Nut Placement on Transformer



Closed Barrier Indicator



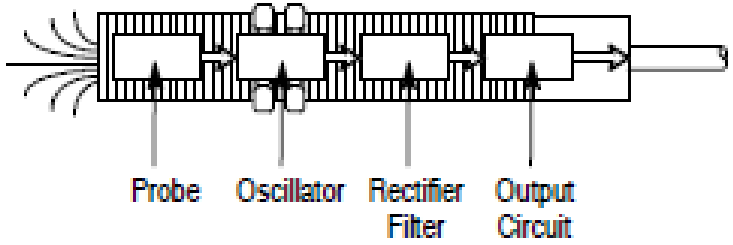
Sensores Discretos - Proximidade

- Sensores de Proximidade Capacitivos - modelos

Sensores Discretos - Proximidade

- Sensores de Proximidade Capacitivo – anatomia:

Principles of Operation for Capacitive Proximity Sensors



Capacitive proximity sensors are designed to operate by generating an electrostatic field and detecting changes in this field caused when a target approaches the sensing face. The sensor's internal workings consist of a capacitive probe, an oscillator, a signal rectifier, a filter circuit and an output circuit.

In the absence of a target, the oscillator is inactive. As a target approaches, it raises the capacitance of the probe system. When the capacitance reaches a specified threshold, the oscillator is activated which triggers the output circuit to change between "on" and "off."

The capacitance of the probe system is determined by the target's size, dielectric constant and distance from the probe. The larger the size and dielectric constant of a target, the more it increases capacitance. The shorter the distance between target and probe, the more the target increases capacitance.

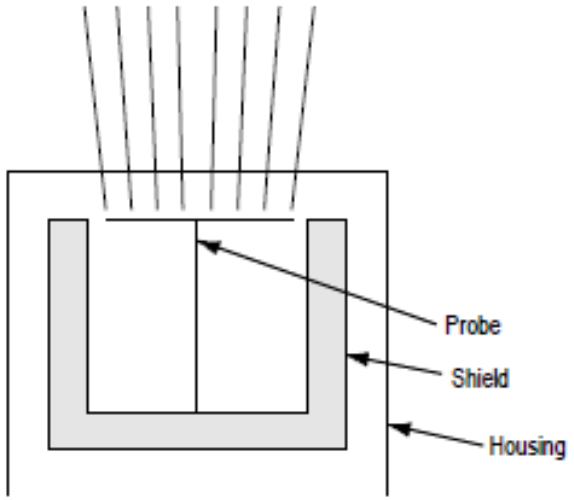
Sensores Discretos - Proximidade

- Sensores de Proximidade Capacitivo

Shielded Probe

Shielded sensors are constructed with a metal band surrounding the probe. This helps to direct the electrostatic field to the front of the sensor and results in a more concentrated field.

Shielded Probe

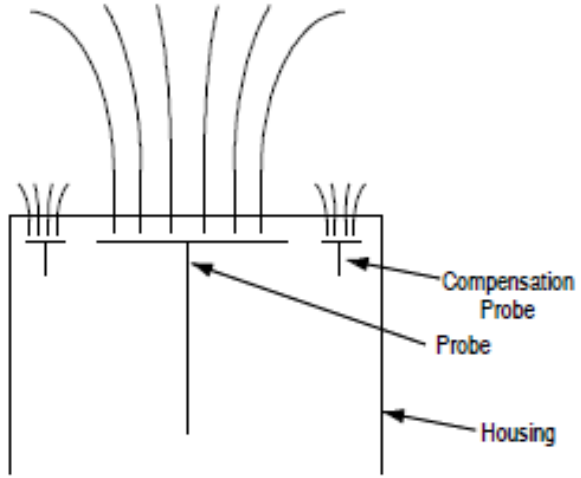


Shielded construction allows the sensor to be mounted flush in surrounding material without causing false trigger.

Unshielded Probe

Unshielded sensors do not have a metal band surrounding the probe and hence have a less concentrated electrostatic field. Many unshielded models are equipped with compensation probes, which provide increased stability for the sensor. Compensation probes are discussed later in this section.

Unshielded Probe



Unshielded capacitive sensors are also more suitable than shielded types for use with plastic sensor wells, an accessory designed for liquid level

Sensores Discretos - Proximidade

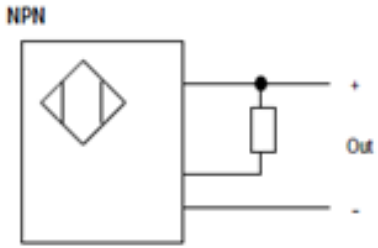
- Sensores de Proximidade Capacitivo

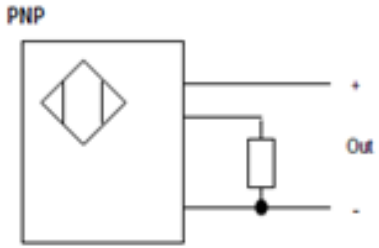
NPN: The sensor switches the load to the negative terminal. The load should be connected between the sensor output and positive terminal.

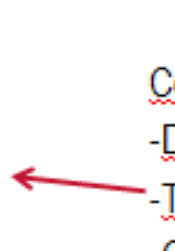
PNP: The sensor switches the load to the positive terminal. The load should be connected between the sensor output and negative terminal.

Sinking: See NPN.

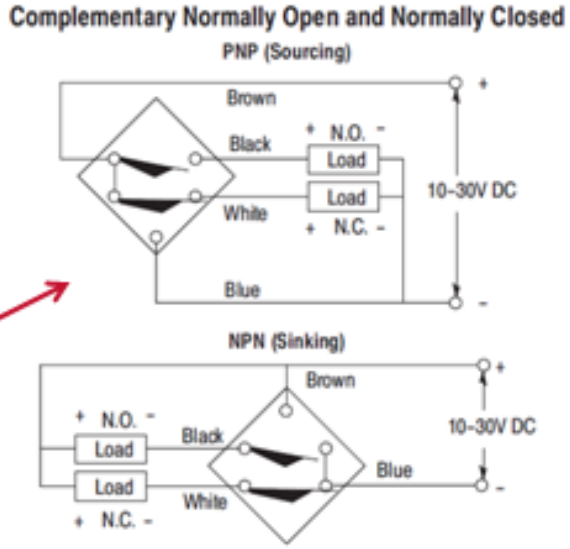
Sourcing: See PNP.







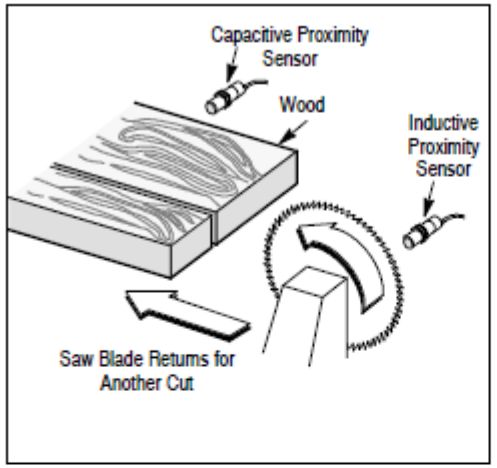
Conexão:
-Dois fios
-Três fios
-Quatro fios



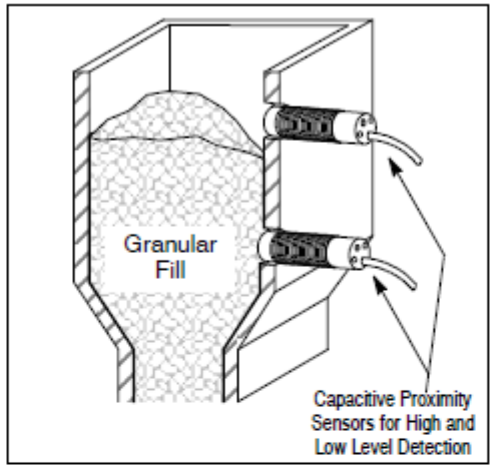
Sensores Discretos - Proximidade

- Sensores de Proximidade Capacitivos - Aplicações:

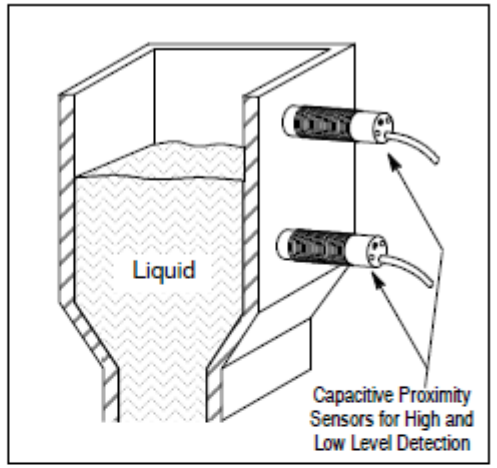
Wood Industry



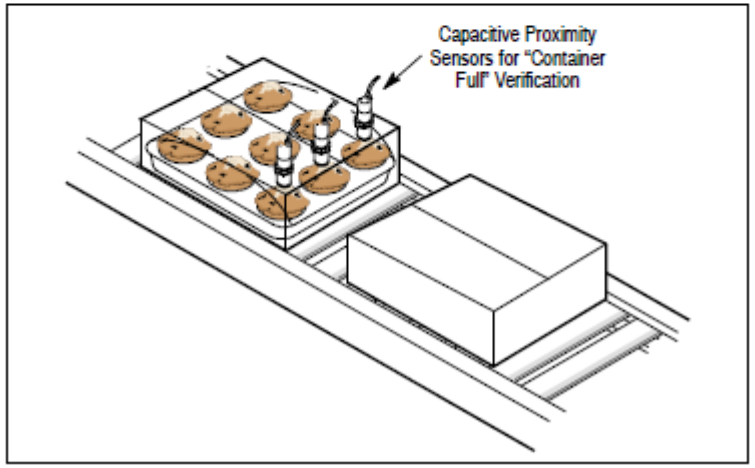
Level Detection



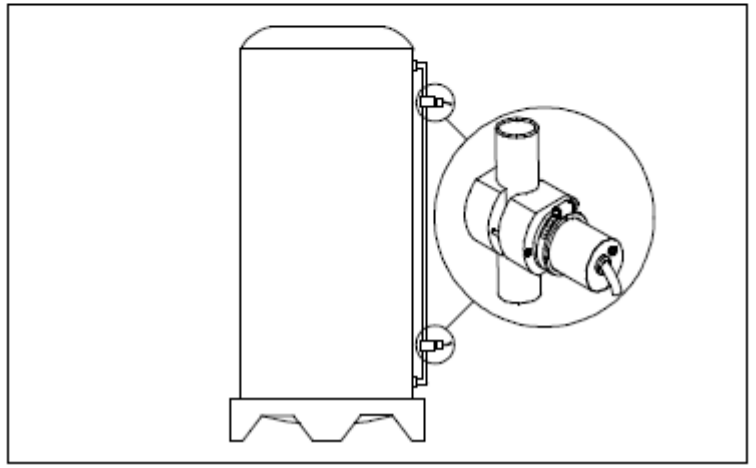
Liquid Level Detection



Food Processing



Sight-Tube Level Detection



Sensores Discretos - Proximidade

- Sensores de Proximidade Fotoelétricos - modelos

Supressão de fundo

Detecção de objetos claros

Sensores Miniatura

Detecção de cor e contraste

Uso geral

Controle de zona de transportadores

Fibra ótica

Laser

Forquilha

Cortinas de luz

Sistemas de visão

Área classificada

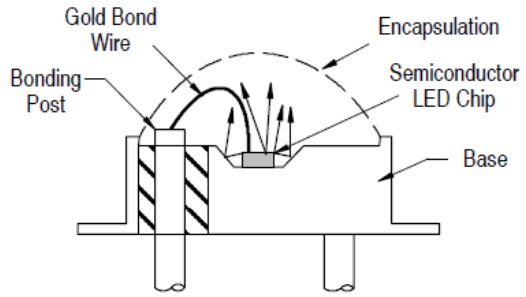
Sensores para etiquetas

Sensores especializados

Sensores Discretos - Proximidade

- Sensores de Proximidade Fotoelétricos

Figure 1
LED Light-Emitting Diode



Visible red, blue, and yellow LEDs are also used in special applications where specific colors or color contrasts must be detected. These LEDs are also used as status indicators on photoelectric sensors.

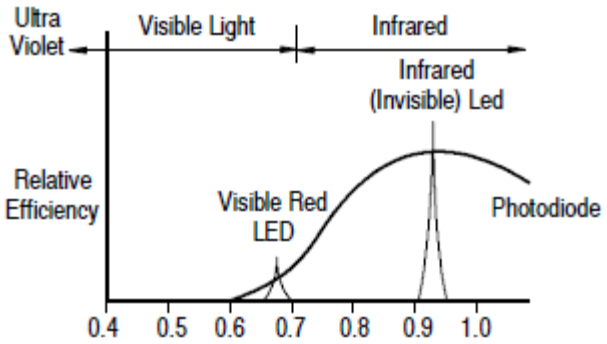
LEDs are rugged and reliable components, making them ideal for use in photoelectric sensors. They operate over a wide temperature range and are very resistant to damage from shock and vibration.

Light Detector

A photodetector is the component used to detect the light source. A photodiode or phototransistor is a robust solid-state component that provides a change in conducted current depending on the amount of light detected.

Photodetectors are more sensitive to certain wavelengths of light. The spectral response of a photodetector determines its sensitivity to different wavelengths in the light spectrum. To improve sensing efficiency, the LED and photodetector are often spectrally matched. An example is shown in *Figure 2*.

Figure 2
Spectral Response



The invisible (infrared) LED is a spectral match for this silicon phototransistor, and has much greater efficiency than a visible (red) LED.

The photodetector and associated circuitry are referred to as the receiver.

Sensores Discretos - Proximidade

- Sensores de Proximidade Fotoelétricos

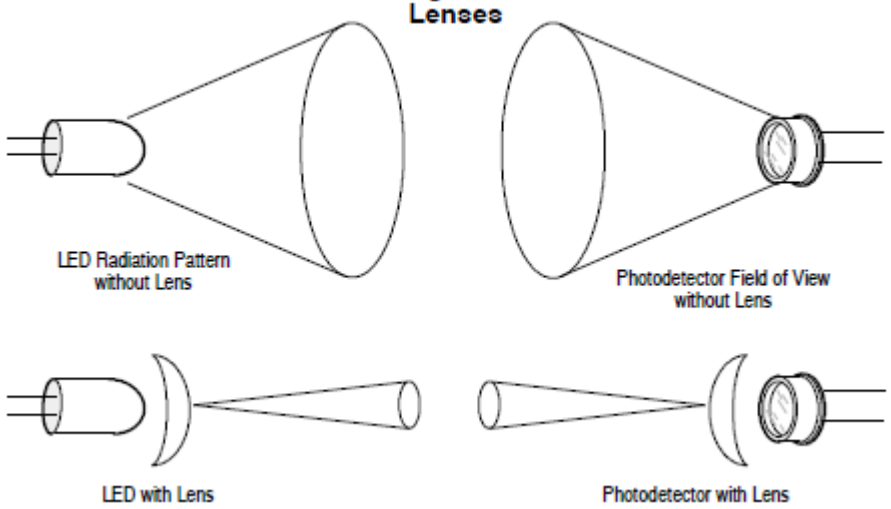
Lens

LEDs typically emit light and photodetectors are sensitive to light over a broad area. Lenses are used with LED light sources and photodetectors to narrow this area. As the area is narrowed, the range of the LED or photodetector increases. As a result, lenses also increase the sensing distance of photoelectric sensors (see *Figure 3*).

The light beam from an LED and lens combination is typically conical in shape. The area of the cone increases with distance.

Some photoelectric sensors are optimized for extra sensing distance. The light beam (or field of view) emitted by these sensors is fairly narrow. However, alignment can be difficult if the field of view is too narrow. Other photoelectric sensors are designed for detection of objects within a broad area. These sensors have a wider field of view, but a shorter overall range.

Figure 3
Lenses



Sensores Discretos – Proximidade

- Sensores de Proximidade Fotoelétricos

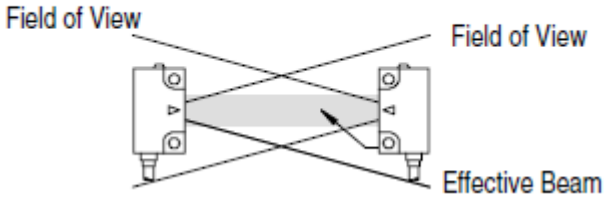
Table 1
Photoelectric Sensing Modes Advantages and Cautions

Sensing Mode	Applications	Advantages	Cautions
Transmitted Beam	General purpose sensing Parts counting	• High margin for contaminated environments • Longest sensing distances • Not affected by second surface reflections • Probably most reliable when you have highly reflective objects	• More expensive because of separate light source and receiver required, more costly wiring • Alignment important • Avoid detecting objects of clear material
Retroreflective	General purpose sensing	• Moderate sensing distances • Less expensive than transmitted beam because simpler wiring • Ease of alignment	• Shorter sensing distance than transmitted beam • Less margin than transmitted beam • May detect reflections from shiny objects (use polarized instead)
Polarized Retroreflective	General purpose sensing of shiny objects	• Ignores first surface reflections • Uses visible red beam for ease of alignment	• Shorter sensing distance than standard retroreflective • May see second surface reflections
Standard Diffuse	Applications where both sides of the object cannot be accessed	• Access to both sides of the object not required • No reflector needed • Ease of alignment	• Can be difficult to apply if the background behind the object is sufficiently reflective and close to the object
Sharp Cutoff Diffuse	Short-range detection of objects with the need to ignore backgrounds that are close to the object.	• Access to both sides of the object not required • Provides some protection against sensing of close backgrounds • Detects objects regardless of color within specified distance	• Only useful for very short distance sensing • Not used with backgrounds close to object
Background Suppression Diffuse	General purpose sensing Areas where you need to ignore backgrounds that are close to the object	• Access to both sides of the target not required • Ignores backgrounds beyond rated sensing distance regardless of reflectivity • Detect objects regardless of color at specified distance	• More expensive than other types of diffuse sensors • Limited maximum sensing distance
Fixed Focus Diffuse	Detection of small targets Detects objects at a specific distance from sensor Detection of color marks	• Accurate detection of small objects in a specific location	• Very short distance sensing • Not suitable for general purpose sensing • Object must be accurately positioned
Wide Angle Diffuse	Detection of objects not accurately positioned Detection of very fine threads over a broad area	• Good at ignoring background reflections • Detecting objects that are not accurately positioned • No reflector needed	• Short distance sensing
Fiber Optics	Allows photoelectric sensing in areas where a sensor cannot be mounted because of size or environment considerations	• Glass fiber optic cables available for high ambient temperature applications • Shock and vibration resistant • Plastic fiber optic cables can be used in areas where continuous movement is required • Insert in limited space • Noise immunity • Corrosive areas placement	• More expensive than lensed sensors • Short distance sensing

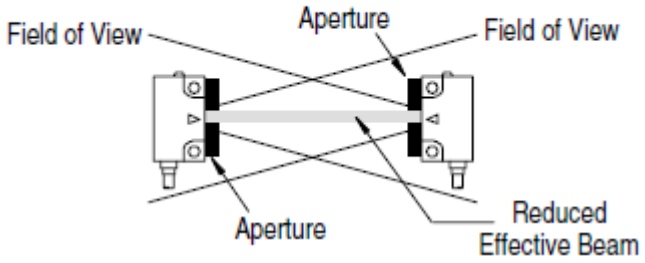
Sensores Discretos - Proximidade

- Sensores de Proximidade Fotoelétricos tipos de feixes:

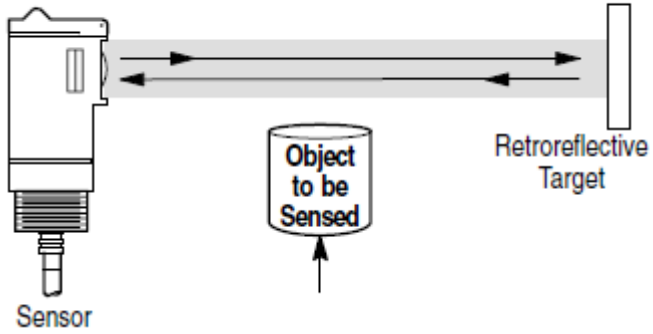
Effective Beam



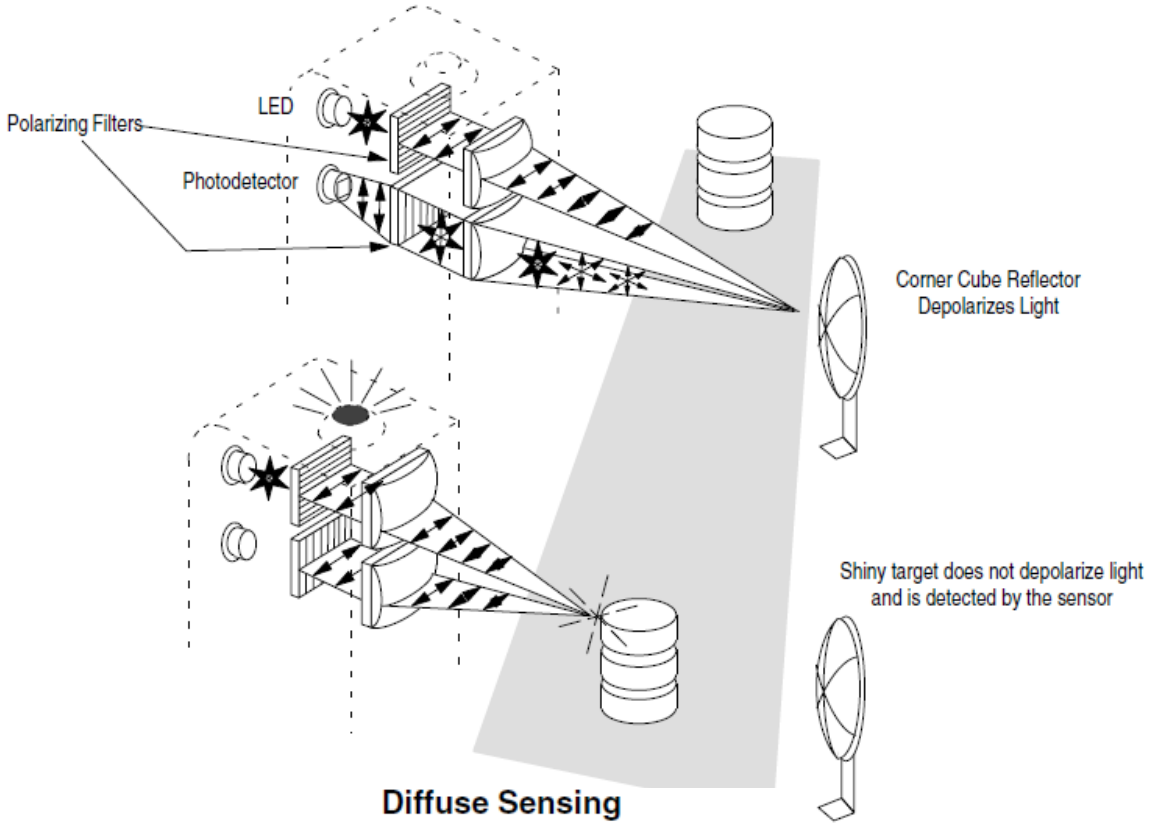
Effective Beam with Apertures



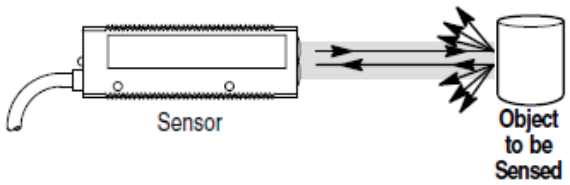
Retroreflective Sensing



Polarized Retroreflective Sensing

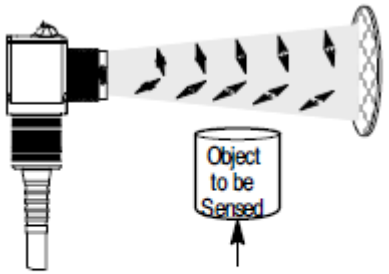


Diffuse Sensing

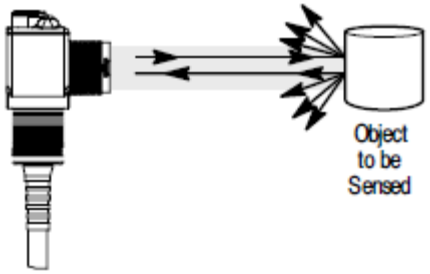


Sensores Discretos - Proximidade

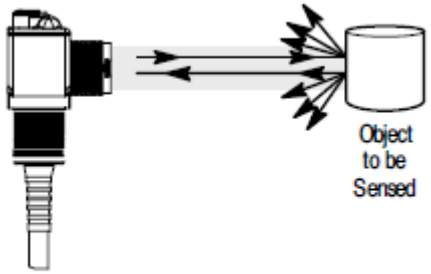
- Sensores de Proximidade Fotoelétricos



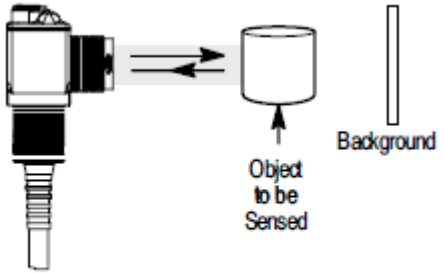
Polarized Retroreflective



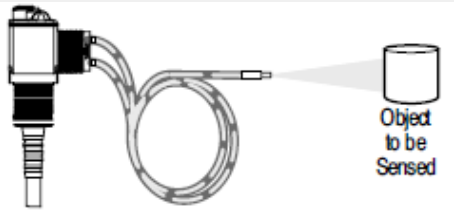
Sharp Cutoff Diffuse



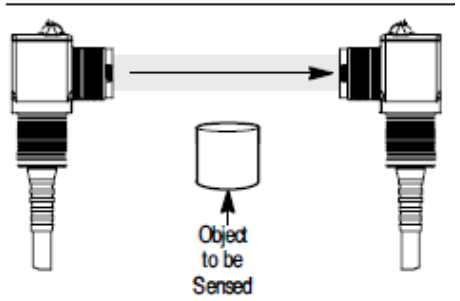
Standard Diffuse



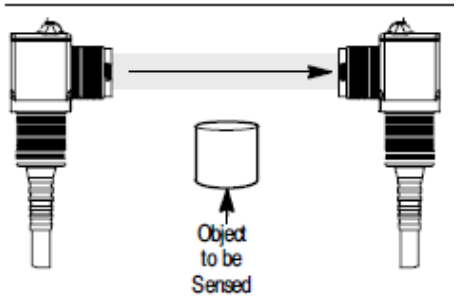
Background Suppression



Infrared Glass Fiber Optic



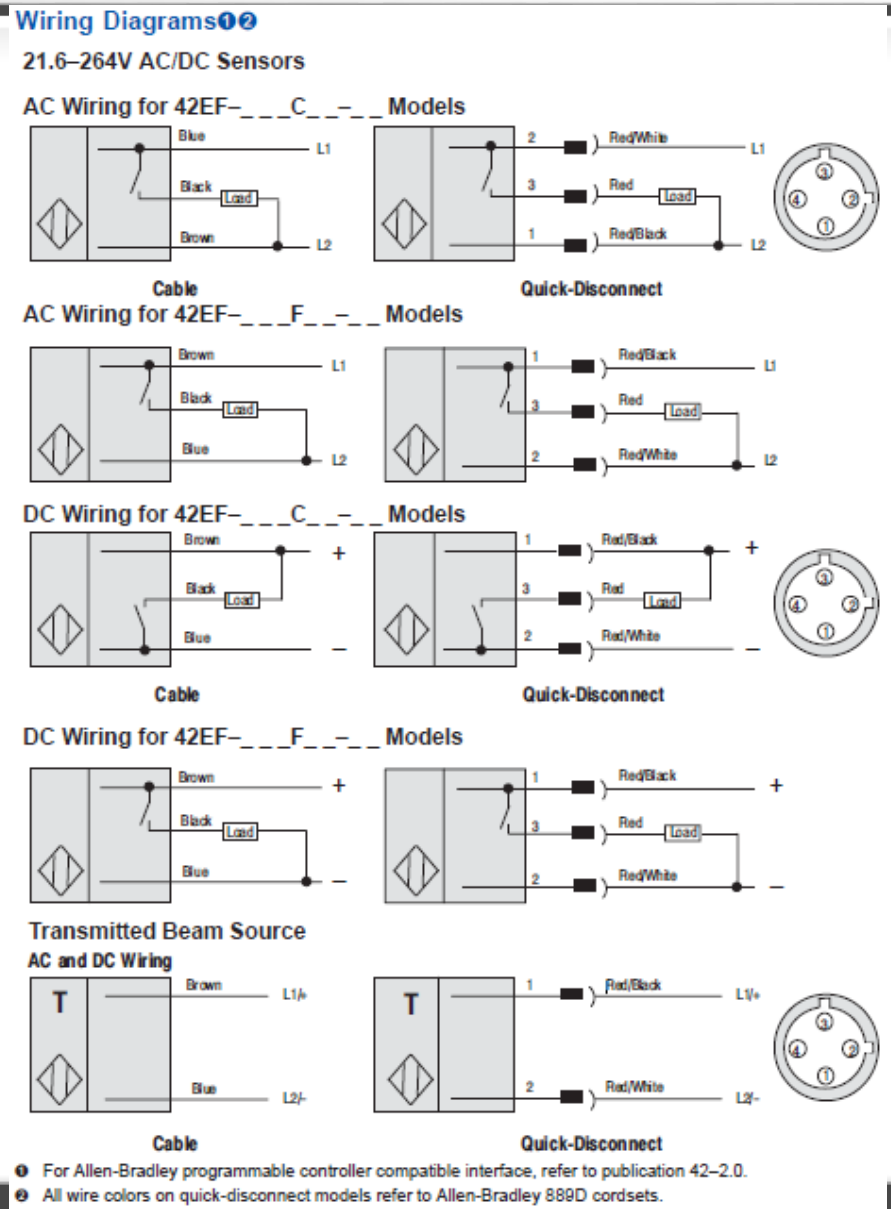
Transmitted Beam Light Source



Transmitted Beam Receiver

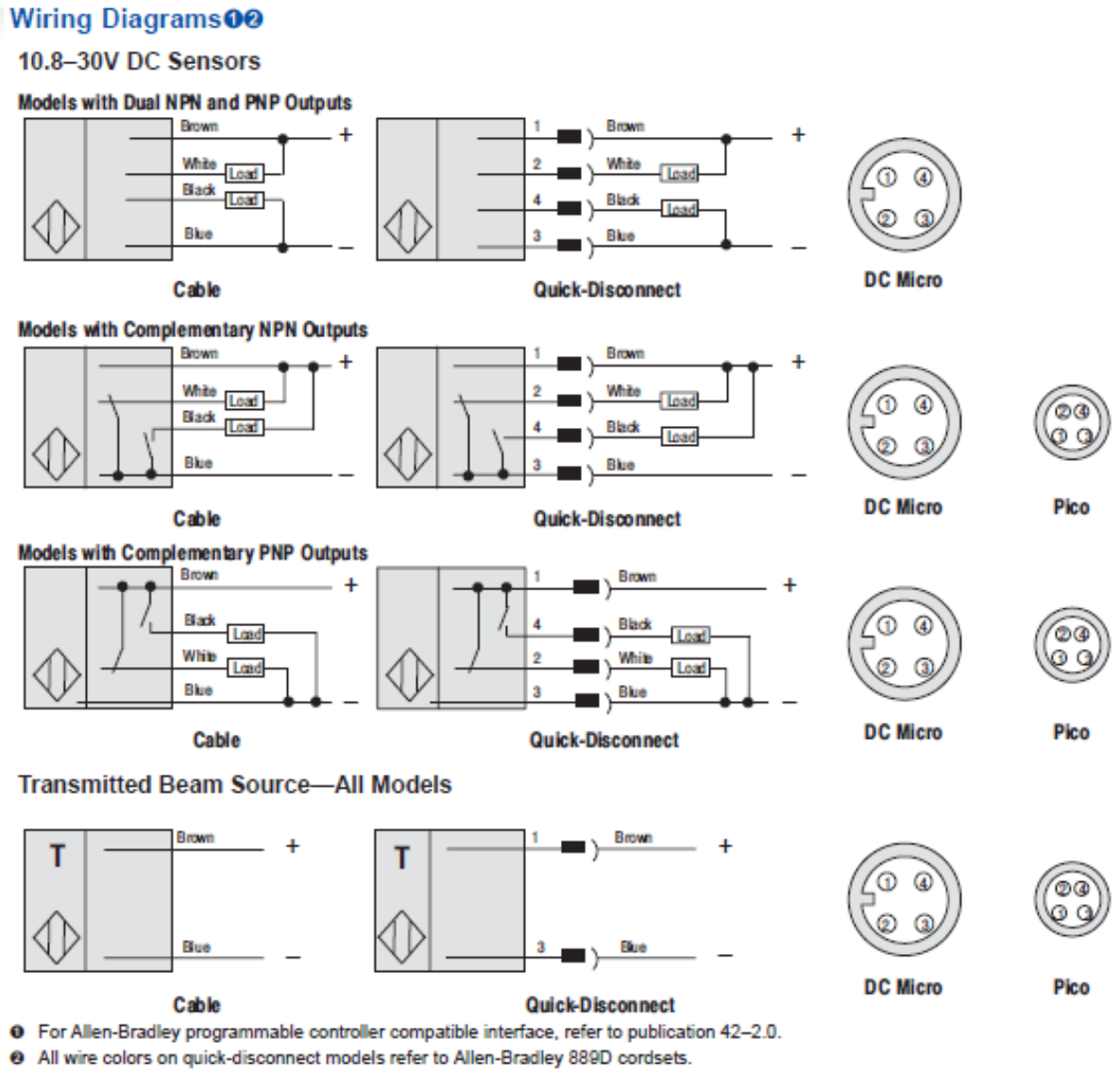
Sensores Discretos - Proximidade

- Sensores de Proximidade Fotoelétricos



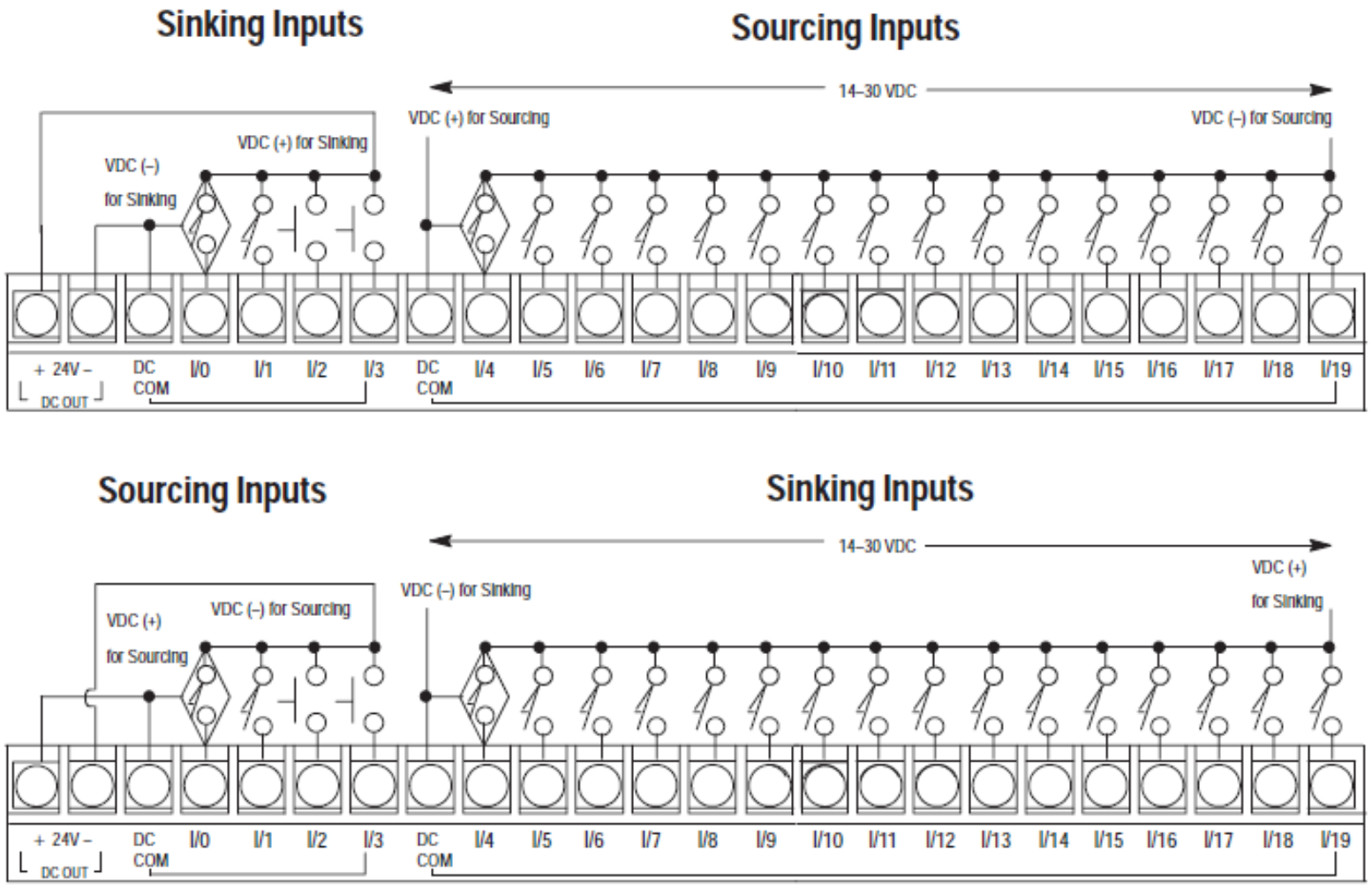
Sensores Discretos - Proximidade

- Sensores de Proximidade Fotoelétricos



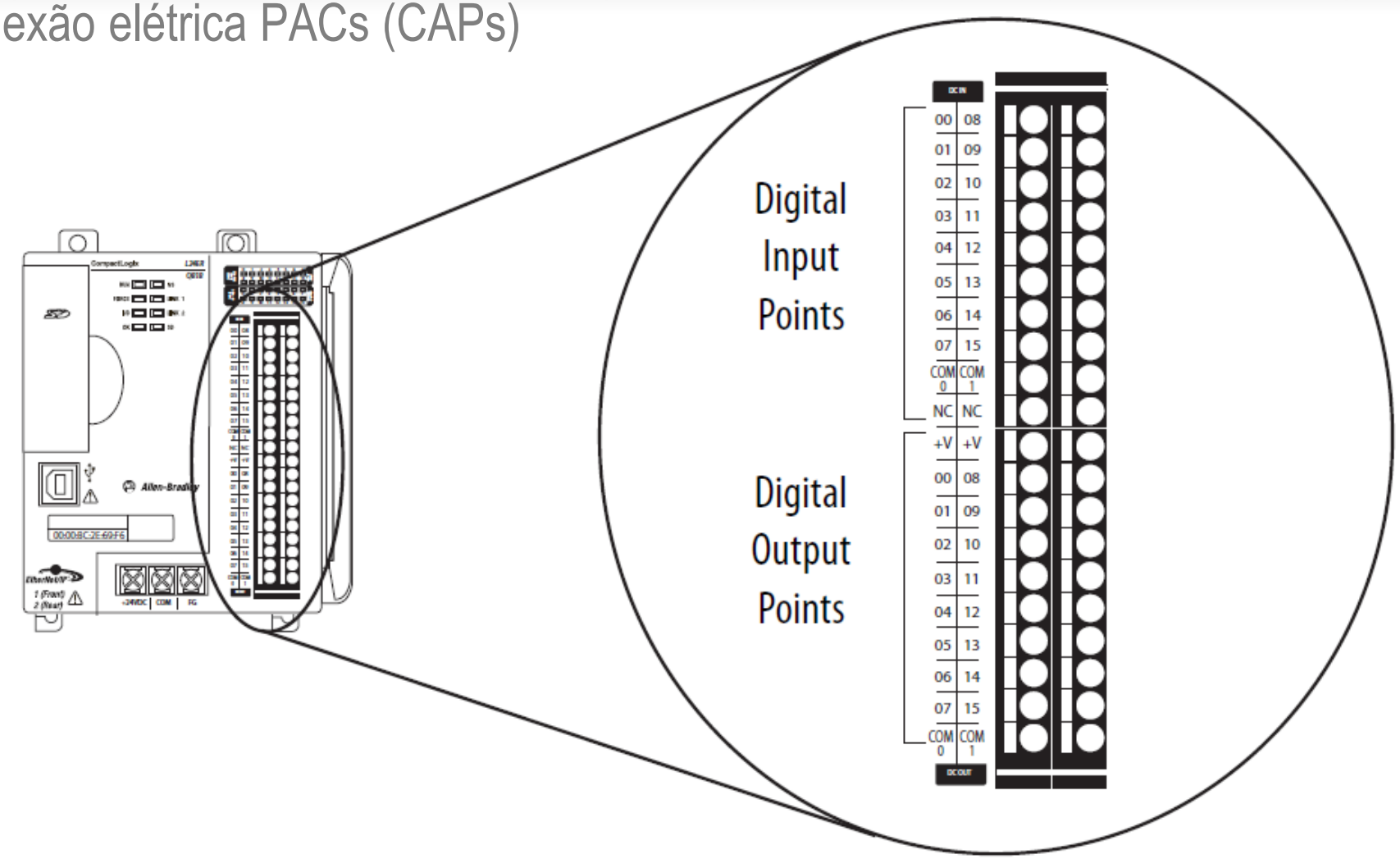
Sensores Discretos

- Conexão elétrica PLCs (CLPs)



Sensores Discretos

- Conexão elétrica PACs (CAPs)



Fonte: Manual de Instalação http://literature.rockwellautomation.com/idc/groups/literature/documents/in/1769-in090_-en-p.pdf

Sensores Discretos - Proximidade

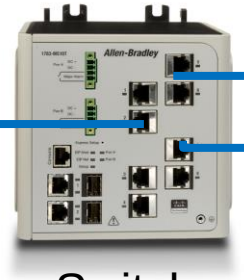
- Sensores de Proximidade RFID

CompactLogix
ControlLogix

Add-On-Profile for RSLogix5000 Software

Visualization

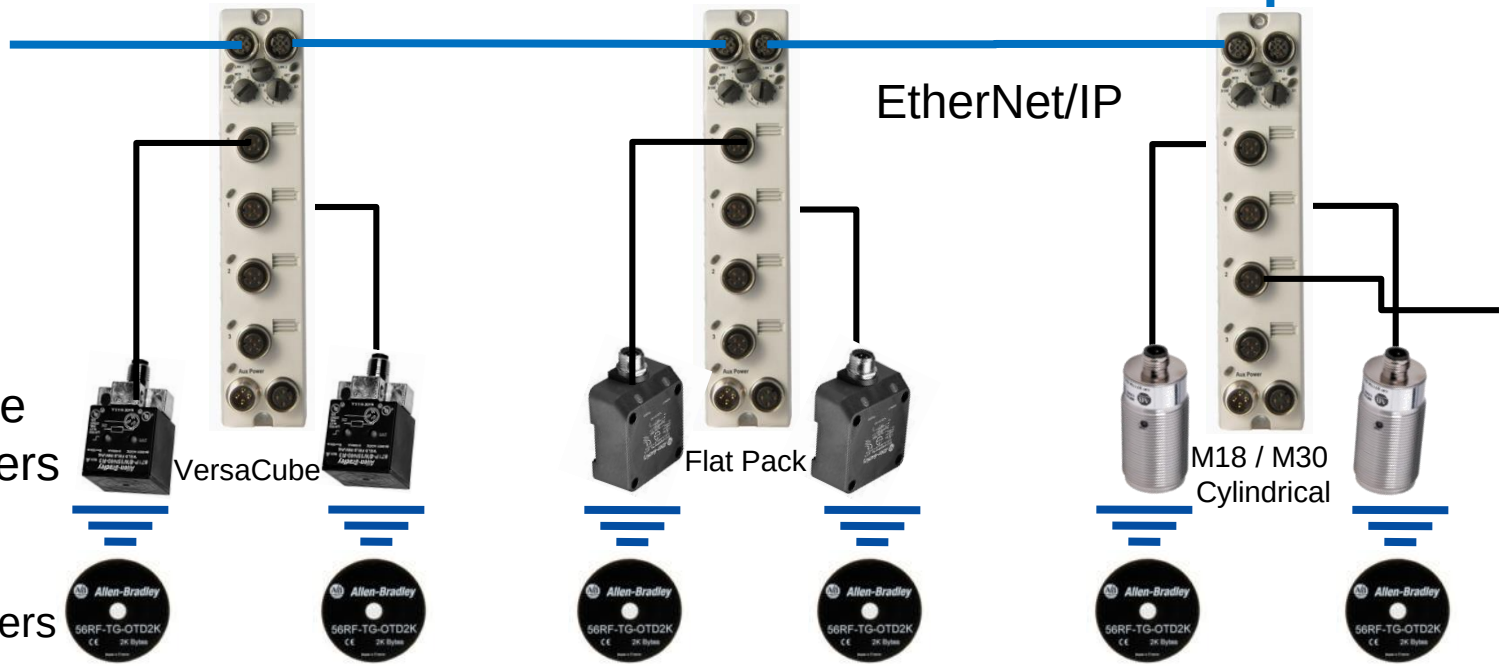
Upload EDS files from the Armor Block



Switch

- RFID Interface with dual port switch incl. DLR
- 1 or 2 RFID Channels
- 2 I/O's for sensors

EtherNet/IP

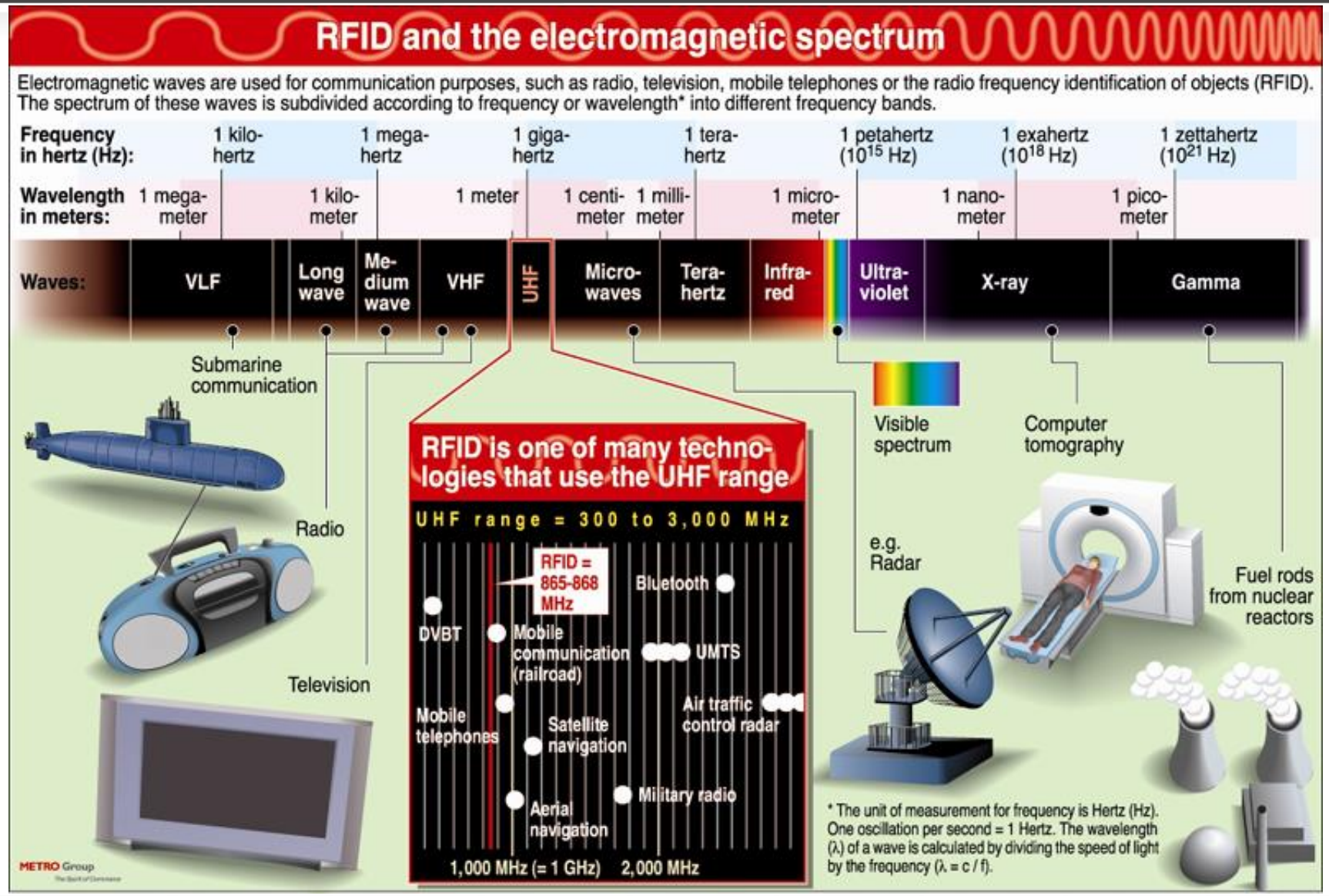


Read/Write Transceivers

Tags
Data Carriers

Sensores Discretos - Proximidade

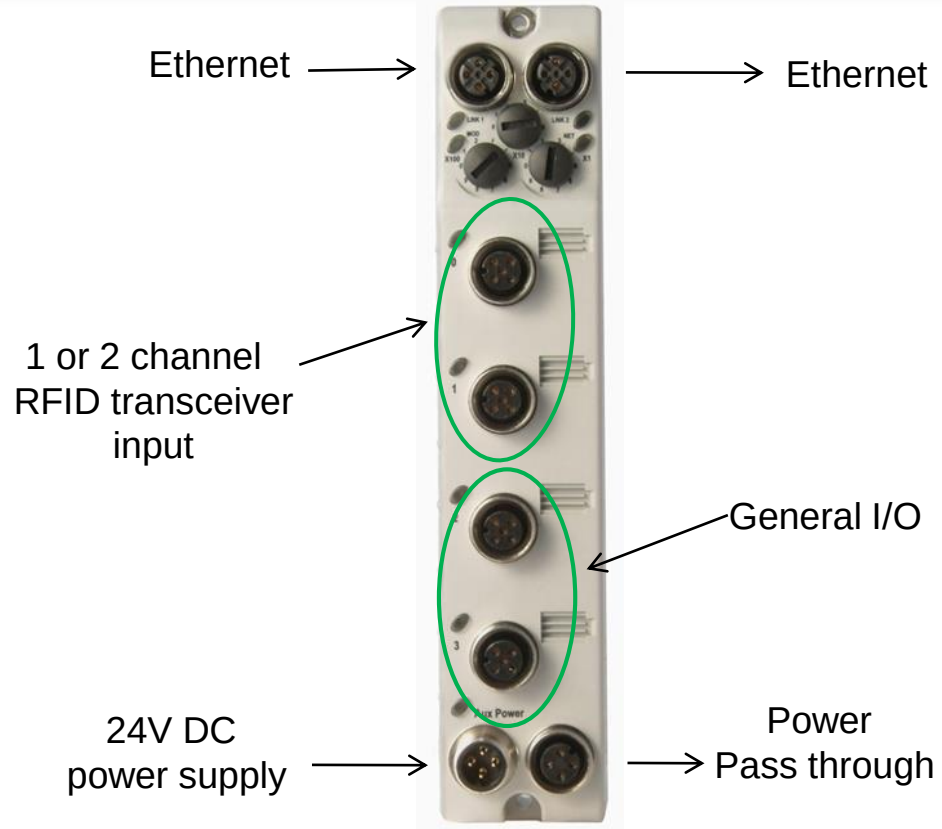
- Sensores de Proximidade RFID



Sensores Discretos - Proximidade

- Sensores de Proximidade RFID
  - Interface Ethernet/IP

- Embedded switch, w/DLR
- 13.56 MHz
- ISO 15693 / ISO 18000-3 M1
- Read/write ICODE tags SLI, SL2
- 1 and 2 channel interface offered
- M12 connectors
- IP67
- Operating temperature -25…+70°C
- Supply voltage: 24V DC
- Compatible with all transceivers



Sensores Discretos - Proximidade

- Sensores de Proximidade RFID
  - Tranceivers

- 13.56 MHz
- ISO 15693 / ISO 18000-3 M1
- Read/write ICODE tags SLI, SL2
- M12 connector
- IP67
- Max. distance from E/IP interface is 300 ft
- Max sensing range (50mm Tag)
  - Rectangular: 168 mm
  - Square: 85 mm
  - M30: 60 mm
  - M18: 30 mm

Sensores Discretos - Proximidade

- Sensores de Proximidade RFID
  - Tags

- ICODE ISO 15693 Compliant
- EEPROM / FRAM Memory
- 64,112,128,256, 2Kbyte read/write tags
- Read/write speeds up to 500 bytes/s
- Passive tags (no battery)
- Reliable performance in harsh environments
- Different style tags
  - Label, Smart card, Disc, Square
- High temperature tags
- Mount on metal tags
- High impact resistant tags

Sensores de medição ou transdutores

- Seu sinal de saída pode ser analógico ou digital. Utilizados em controle dinâmico de processos.

- Sensores de Nível: detecção do nível de um líquido.

- Sensores de Vazão: detectar vazão de um fluído.

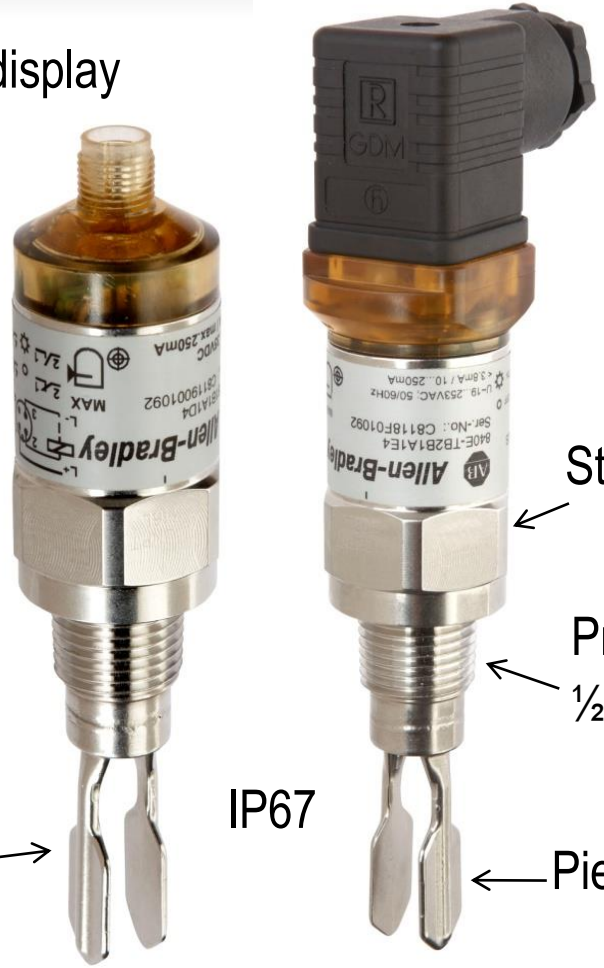
- Sensores de Temperatura: medir temperatura de um fluído

- Sensores de Pressão: medir a pressão de um fluído

Sensores de Nível

On-site control using external LED display

PNP switch output (NO or NC)



Stainless steel housing (316L)

Process connection
½" NPT, ¾" NPT, G1/2

Process temperature -40…100° C
Process pressure -14.5…580 psi

IP67

Piezoelectric technology

DC-PNP with
M12 connector

AC with
Valve connector

Sensores de Vazão

Measure both flow and temperature

Display can be inverted for upside-down mounting

Selectable units °C, °F, K or %

Cap can be rotated up to 310°

Outputs: 2PNP or 1PNP+4-20mA

4-20mA either flow or temperature

All stainless steel 316L housing

Four Process Connections

Male: ¼ NPT, ½ NPT, G1/4 BSPP, G1/2 BSPP

Hysteresis or Analog switching modes

IP66

Different probe insertion lengths

30mm, 100mm

6 mm diameter

Calorimetric Flow Technology

Flow rates 0.03 to 3 m/s (0.1 to 9.8 ft/s)

Temperature (RTD) -20 to 85°C (-4 to 185°F)

Sensores de Temperatura

Programmable Temperature range

-50°..150°C (-58°…302°F)

Selectable units °C, °F, or K

Four Process Connection Options
Male: ¼ NPT, ½ NPT, G1/4 BSPP, G1/2 BSPP

Different probe insertion lengths
50mm, 100mm, 200mm
6 mm diameter

Sanitary connections
1- 1½” and 2” standard clamp sizes
Flush fittings for contact with consumables
Food, Beverage, and pharmaceutical applications 3-A approved

Sensores de Pressão

Six Different Pressure Ranges

-15 ..15 PSI

0 ..60 PSI

0 ..150 PSI

0 ..600 PSI

0 ..1,500 PSI

0 ..6,000 PSI

PC programmable via USB communication port

Six Different Process Connections

Female and Male: ¼ NPT, SAE 7/16-20, G1/4 BSPP

Accessory process connection bases available

Selectable units PSI, BAR, kPa, % of range

Sanitary connections

¾”, 1- 1 ½” and 2” clamp sizes

3-A approved

Standard tri-clamp configurations

Flush fittings for contact with consumables

Interfaceamento dos Transdutores com os Controladores

- Transdutores de Entrada
  - Tipos de ligação: 2, 3 e 4 fios tanto em tensão como em corrente

Tipos de sinais mais utilizados:

0 a 10Vdc

0 a 5Vdc

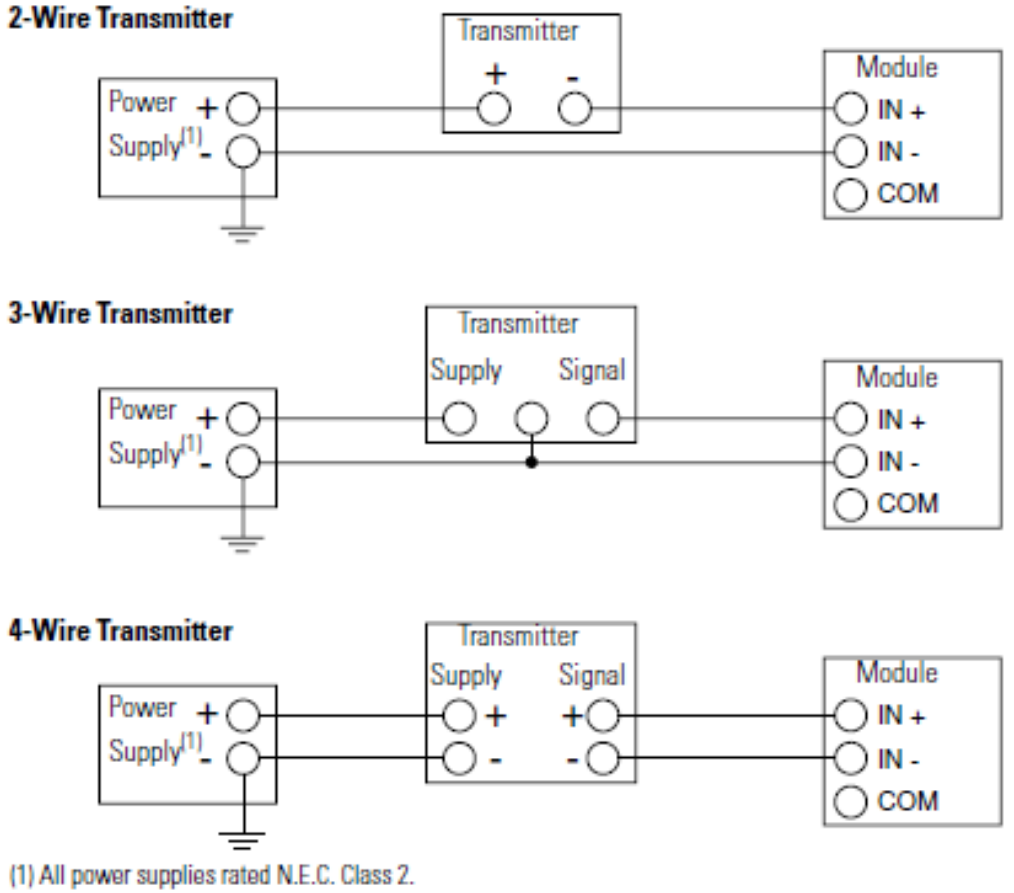
1 a 5Vdc

-10 a +10Vdc

4 a 20 mA

0 a 20 mA

-20 a +20mA



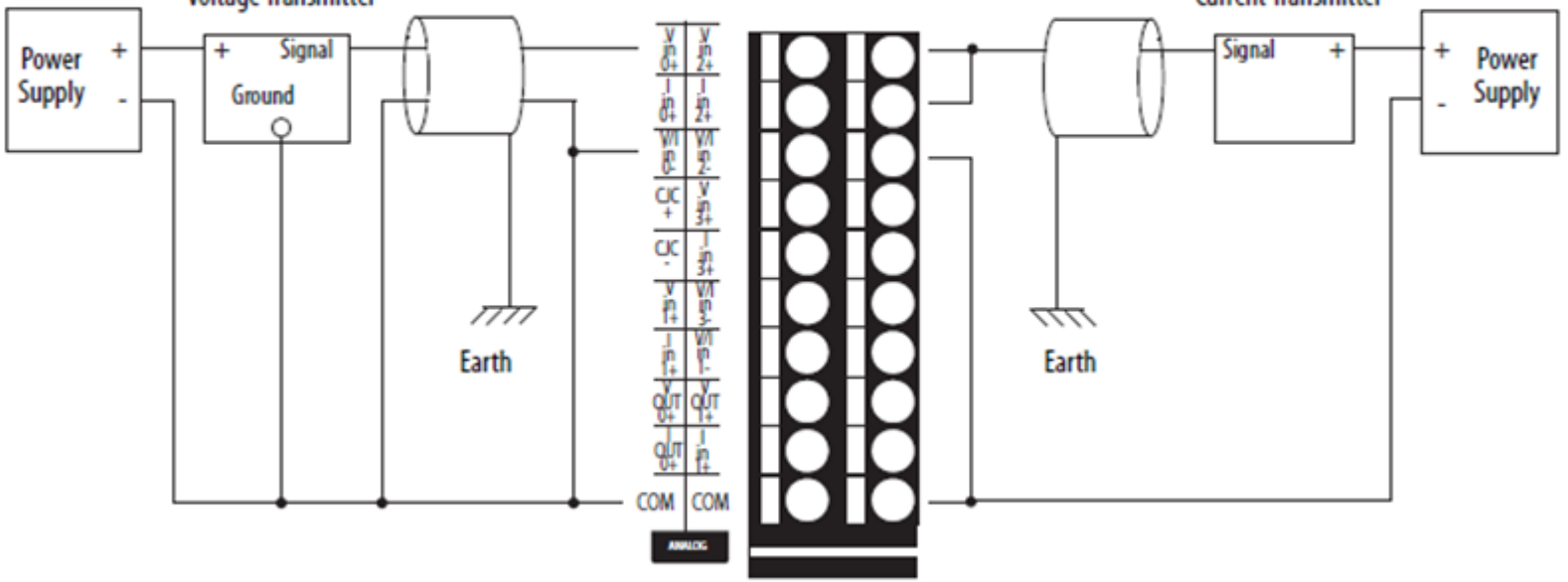
(1) All power supplies rated N.E.C. Class 2.

Interfaceamento dos Transdutores com os Controladores

- Transdutores de Entrada PACs:

1769-L27ERM-QBF1B Controller Single-ended Connections Wiring Diagrams

Voltage Input Type Single-ended Voltage Connections



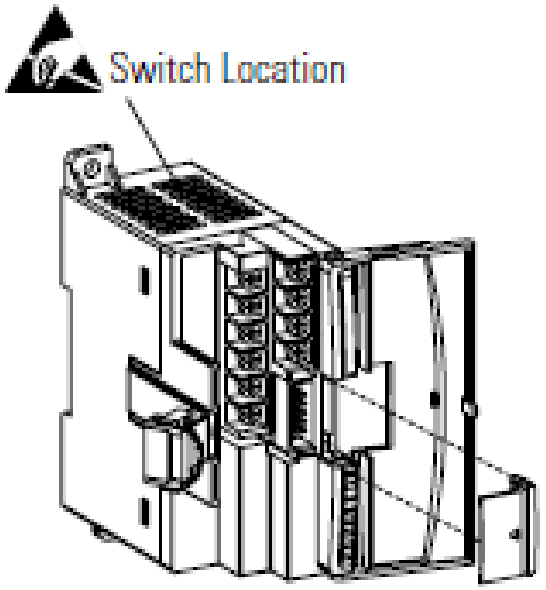
Current Input Type Single-ended Current Connections

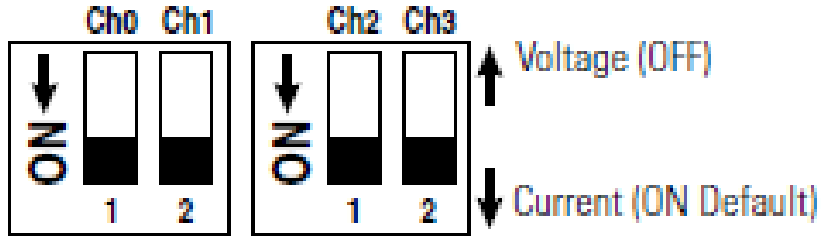
IMPORTANT: For single-ended connections, remember the following:

- For both input types, we recommend that you use Belden #8761or equivalent cable.
- The mV ranges with the Voltage input type do not support single-ended encoder wiring.

Interfaceamento dos Transdutores com os Controladores

- Tipo do sinal elétrico:
  - A configuração do tipo de sinal de tensão ou corrente pode ser pelos switches e/ou software de programação do controlador ou do cartão e I/O remoto.





Tipos de sinais mais utilizados:

0 a 10Vdc

0 a 5Vdc

1 a 5Vdc

-10 a +10Vdc

4 a 20 mA

0 a 20 mA

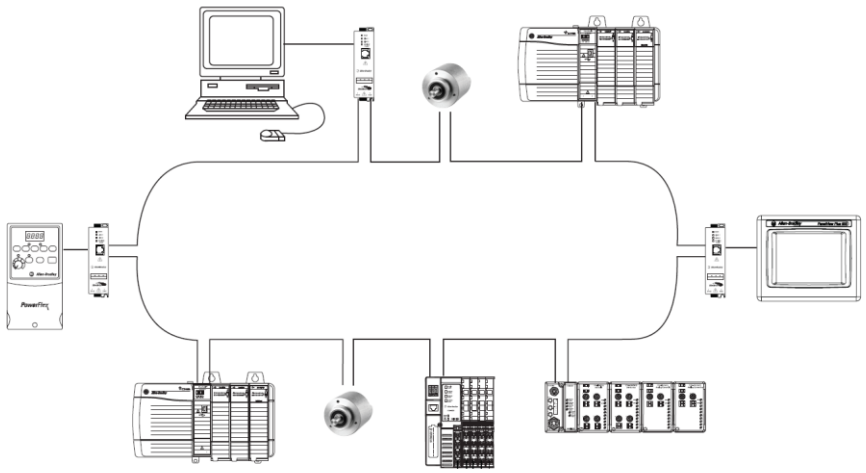
-20 a +20mA

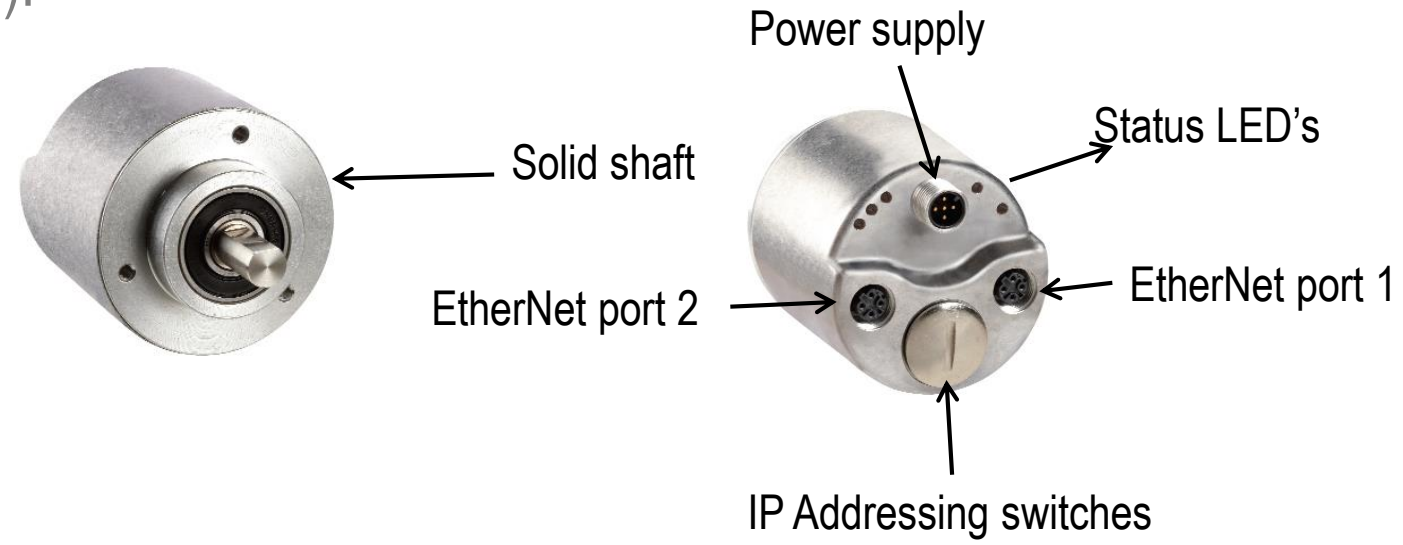
Sensores Especiais

- Encoders:
  - De pulsos (Incremental ou Absoluto):
    - Incremetal:
    - - Unidirecional: Canal A
    - - Bi-direcional: Canal A e B

    Necessita de controladores com HSC nas entradas digitais

  - De rede de comunicação (Absoluto):





Sensores Especiais

- Encoders Incremetais e Absolutos:

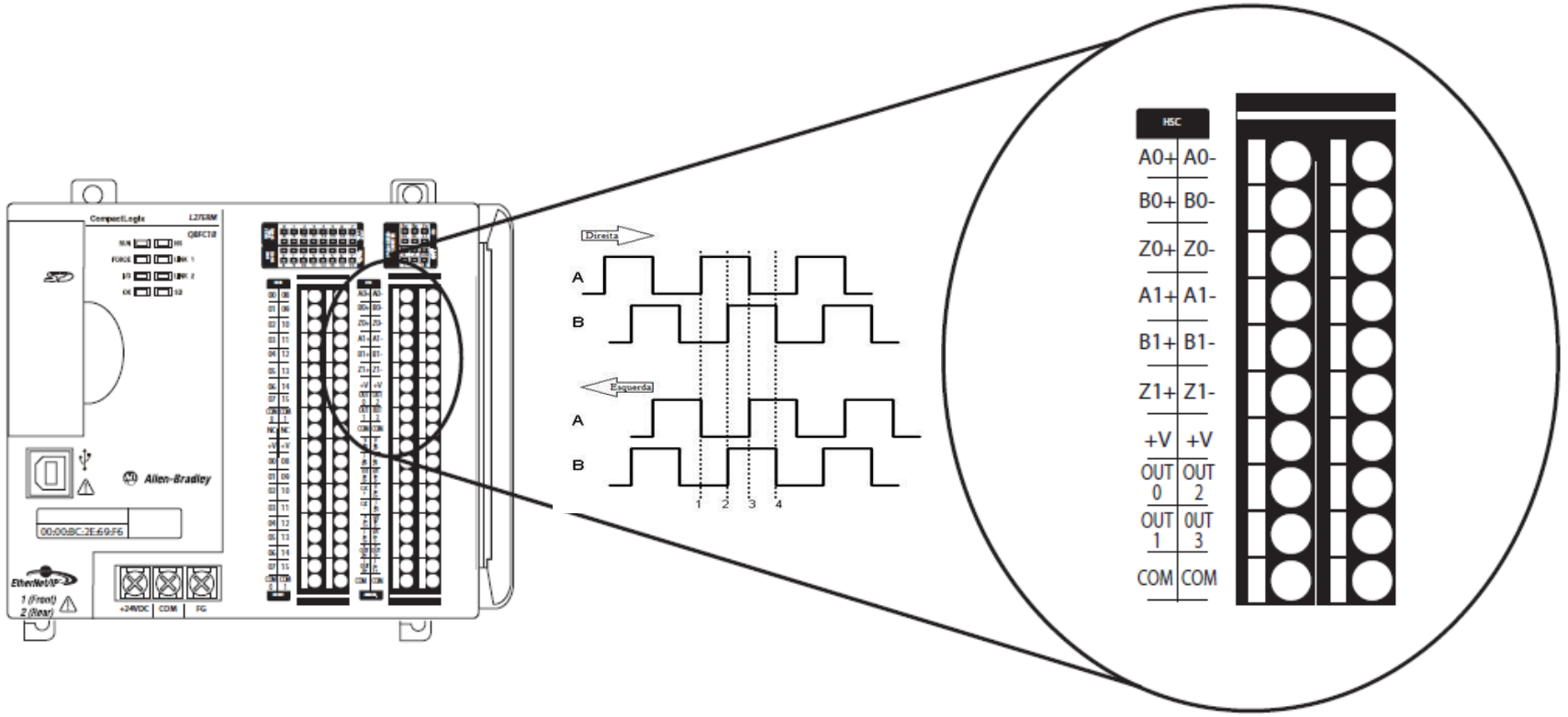
Specifications

Electrical	
Code Format	Incremental, 2 channels with zero index
Quadrature	90° ±22°, Channel A leads B CCW
Symmetry	50% ±10%
Zero Index Channel	1/2 cycle, gated to channel B
Power Requirements	Determined by catalog number: 5V DC ±5% @ 150mA maximum 8–24V DC @ 150mA maximum
Frequency Response	Data: 210 kHz Zero index: 125 kHz
Operating Speed (Data)	(210 kHz x 60)/pulses per revolution = RPM or 6000 RPM, whichever is lower
Resolution	Up to 5000 PPR on code disk
Output Drive Capability	PNP current source = 20mA NPN current sink = 20mA Differential line driver = ±20mA NPN open collector = 20mA
Mechanical	
Starting & Running Torque	2.5Ncm typical (3.5in-oz)
Moment of Inertia	$15gcm^2$ (2.1×10^{-4}oz-in-sec^2)
Slew Speed	6000 RPM
Shaft Loading (3/8″ & 10mm Dia.)	Axial 89N (20 lbs) (10 lbs 5000 PPR) Radial 178N (40 lbs) (20 lbs 5000 PPR)
Shaft Size	6mm, 10mm, 6.4mm (1/4in) 9.517mm (3/8in) diameter
Environmental	
Housing	NEMA Type 4, 13, IP66 (IEC 529)
Temperature	0°C to +60°C (+32°F to +140°F)—operating –25°C to +90°C (–13°F to +194°F)—storage
Humidity	98%, noncondensing
Shock	50g (11ms duration)
Vibration	20g (58 to 2000Hz), 1.5mm displacement (5 to 58Hz)
Approximate Shipping Weight	0.91kg (2lbs)

Interfaceamento dos Transdutores com os Controladores

- Entradas HSC nos PACs (CAPs)

The following graphic shows the **embedded high-speed counter module terminations** on the 1769-L27ER-QB1B controller. The embedded high-speed counter module terminations on the 1769-L24ER-QBFC1B controller are the same.



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Perguntas?