

Lab I: Sensors

Objectives

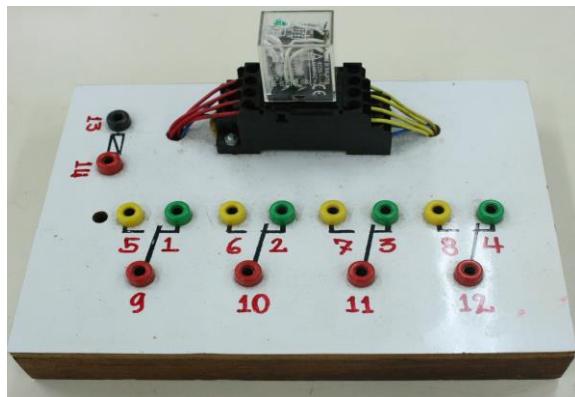
1. To understand principles of operation of commonly-used industrial automation sensors.
2. To understand how to connect different types of sensor outputs.

Warnings

1. Read the lab sheets before coming into the lab.
2. Tidy up your cloth and your hairs before coming into the lab. Only Cushe shoes are allowed.
3. Food and drinks are not allowed in the lab.
4. Strictly follow the instructions.

Common Items

1. Familiarize yourself with the frequently used items shown in Figure 1. Make sure you know what they are and how to use them.



(a)



(b)

Lab I: Sensors

Objectives

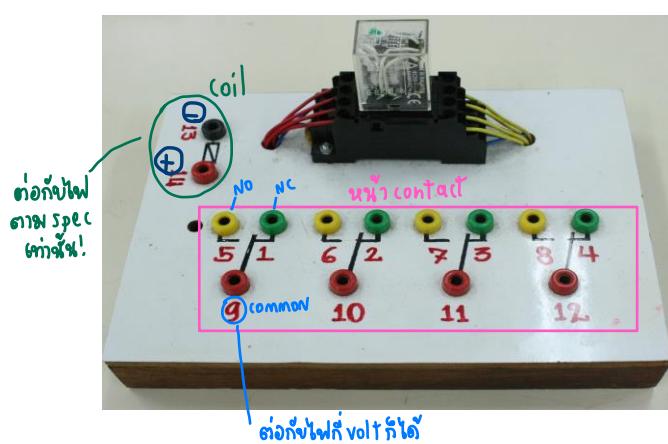
1. To understand principles of operation of commonly-used industrial automation sensors.
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Warnings

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Common Items

1. Familiarize yourself with the frequently used items shown in Figure 1. Make sure you know what they are and how to use them.



(a)



(b)

Group Members

1) ឧបនគរក្រុតា	ទាញរាយ	63070501208
2) ឧបស៊ីវិចិក	ឯធម៌សុខ	63070501216
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(c)

Figure 1: Common lab equipment, (a) relay board, (b) control panel and (c) connection panel

Part 1: Limit Switch

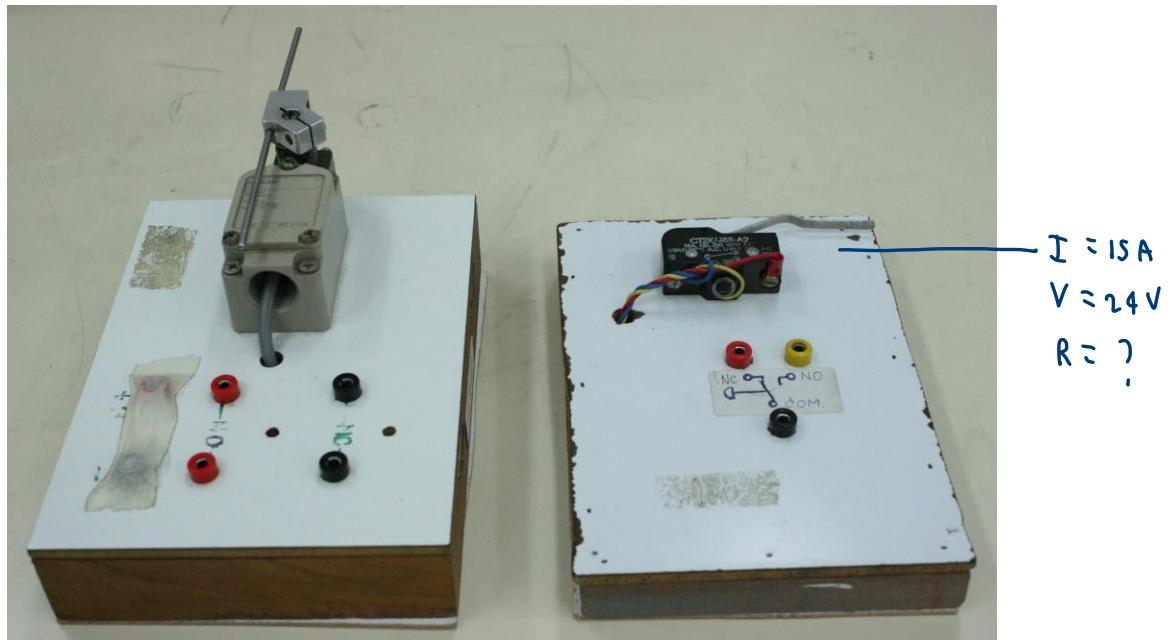


Figure 2: Limit switch boards

Instruction

1. Make a circuit according to the circuit diagram shown in Figure 3.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Activate the limit switch, record the results.
4. Change the output contact to NC mode and repeat the experiment.
5. Answer the questions in the next section.

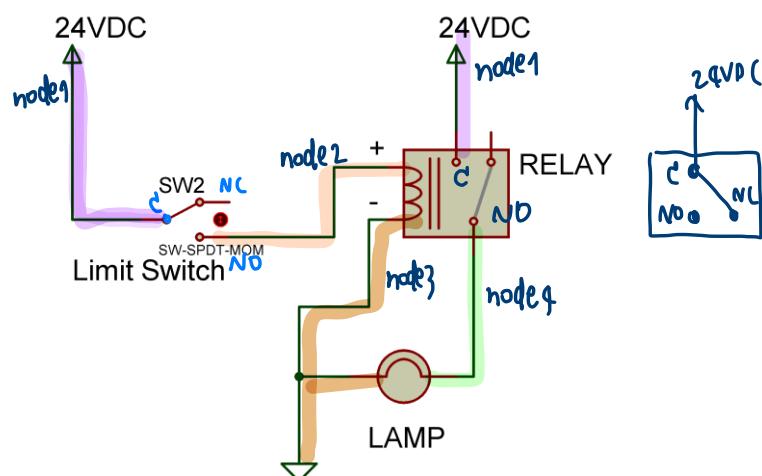


Figure 3: Circuit diagram of limit switch circuit

Conclusions

Limit switch ເປັນອຸປະກອນທີ່ມີຜົນລຳຂຶ້ນເປົາ-ປິດອອກຈາກທີ່ໄປ ໂດຍຈະນີ້ລັກຄະນີ່ເປັນແນວຍື່ນອອກໄປເພື່ອໃຫ້ໄປສັນຕິພົກປໍ່ກໍວ່າຄຸງ ໂດຍເພື່ອຈຳກັດຮະບະທາງ ແລະ ຄົດຕ່ວອງຈາກທຳມະນຸຍາຂອງຮະບບວັດທະນີ ທີ່ຈະ Limit switch ສັນຕິການຕ່ອງໃຫ້ຈານ ວ່າ ອ່ານ common, NO (Normal open) ແລະ NC (Normal close) ຮົດ ລົມ Limit switch ເປັນ switch ແລ້ວ dry contact ຕື່ມີໄສຕ່ອງໃຫ້ໄຟເລັ້ນ ແຕ່ໃຫ້ຮັບຢາກໄກໃຫ້ການທຳມະນຸຍາຂອງລົມຜົນສັນຕິພົກປໍ່ກໍວ່າຄຸງ

Limit switch ສັນຕິການທຳມະນຸຍາເປັນ 2 ລັກຄະນີ່ ຕົ້ນທີ່ກຳເນົາແນວຢ່າງປົກຕິປົດ (NO) ນັ້ນຳສັນຜົນສົຈະໄມ້ເຊື່ອມຕ່ອງກັນ ທີ່ໃຫ້ຮັບຢາກໄກໃຫ້ລົມຜົນໄໝໄວ້ໄຕ ແລະ ກະແນວໄຫ້ໄລພັ່ນໄໝໄວ້ໄຕ ແລະ ກະແນວໄຫ້ໄລພັ່ນໄໝໄວ້ໄຕ ຕົ້ນທີ່ໄໝເຊັ່ນຈຳກົດທີ່ໄໝໄວ້ໄຕ ຖໍ່ມີກຳມົດກົດຮັບຢາກໄກໃຫ້ລົມຜົນໄໝໄວ້ໄຕ ເຊື່ອນີ້-ແຮງລາຍຫອກນາກຄະກຳໃຫ້ຂ້ອງຈຣເປົາ ກະແນວໄຫ້ພັກກົດຈົດໃຫ້ລົມຜົນໄໝໄວ້ໄຕ ທີ່ຈະເລີຍໃຫ້ Limit switch ໄປຕ່ອງໃຫ້ຈານ ເຮັດວຽກ ເລື້ອກໄວ້ຈ່າຍຕົວການໃຫ້ສຳຄັນການທຳມະນຸຍາຂອງລົມຜົນ NC NO ຂອບ NC

ຈີ່ຕື່ອງການທຳມະນຸຍາ ເຮັດວຽກ Limit switch ທີ່ມີ NO ທີ່ໃຫ້ຢັ້ງຢືນໃຫ້ມີກໍາ ລົມ Limit switch ອອຈະເລືອດຢູ່ກະແນວໄຫ້ພັກກົດ-ໄໝໄວ້ສຳຄັນໃຫ້ລົມຜົນໄໝໄວ້ໄຕ ຈະຈະຍື່ຍື່ຈົບຈັດຈົດຢັ້ງຢືນໃຫ້ມີກໍາ ລົມ Limit switch ມີມີມືອງສຳຄັນໃຫ້ມີກໍາ ດີເລີຍກົດຮັບຢາກໄກໃຫ້ລົມຜົນ NC ກະແນວໄຫ້ພັກກົດຈະສຳຄັນໄຫ້ລົມຜົນໄໝໄວ້ໄຕ ໂອດໄຕ້ ວ່າຈະຕ່າງກົດຮັບຢາກໄກໃຫ້ລົມຜົນ NC

Questions

- What is the type of output of each limit switch? (dry contact, current sinking or current sourcing)

dry contact #

- What is the minimum load resistance (i.e. maximum load) you can connect to the limit switch?

Hints: look for the maximum current the switch can hold.

<u>(NO)</u> $R = \frac{V}{I}$ & $V = IR$	<u>(NC)</u> ລາກ datasheet $\rightarrow I_{max} = 3 A$
$R = \frac{24}{15}$	$R = \frac{24}{3}$
$R = 1.6 \Omega \#$	$R = 8 \Omega \#$

Part 2: Inductive Proximity Switch

Instruction

1. Make an inductive proximity circuit according to the circuit diagram shown in Figure 6.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Try each of the provided specimens on the proximity, record the results and answer the questions in the next section.

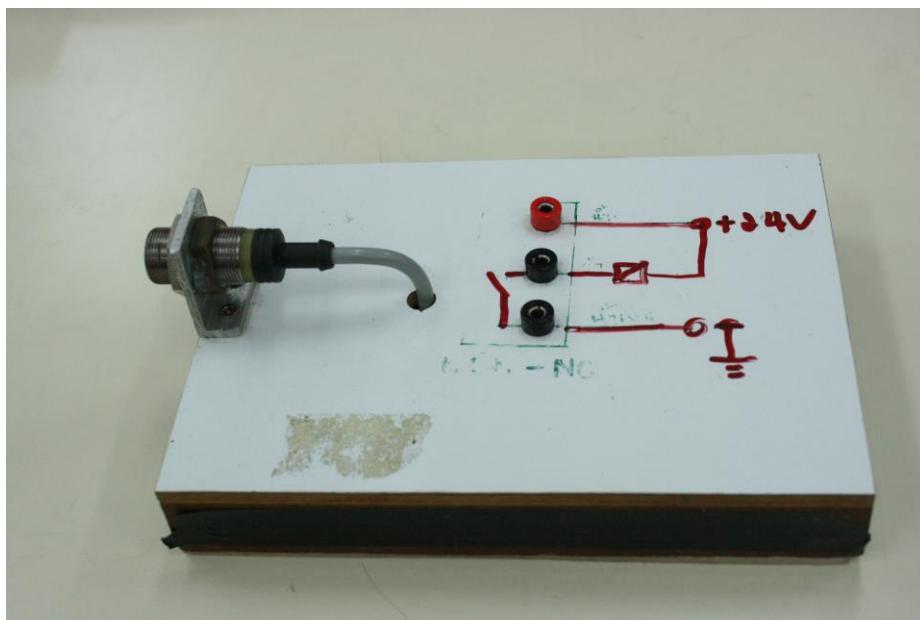


Figure 6: Inductive proximity switch board

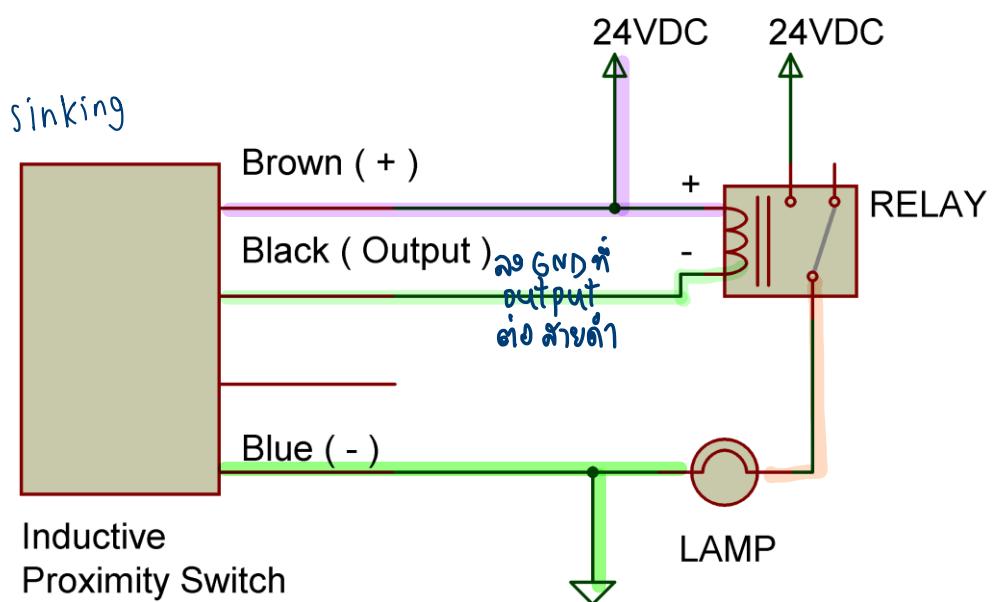


Figure 7: Circuit diagram of inductive proximity switch circuit

Group Members

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2) ឧបយស៊ុនុយ	ឱ្យឈរសុខ	63070501216
3) អារសារពិភពល័យ	ផែនខ្មែរ	63070501221

Object	Sensing distance (mm)	Comments
Aluminum sheet	3	
Wooden pad	—	
Opaque acrylic sheet	—	ទរទងចុះបញ្ជាក់ថាអាមីនីក្រុម្ភៃបានបានបាន
Transparent acrylic sheet	—	
Stainless steel sheet	4	
Cardboard sheet	—	

Conclusions

Inductive proximity sensor ដោយអាជីវកិច្ចដើម្បីបង្កើតការងារដើម្បីរកឃាតសង្គមនៃផ្ទាល់ទិន្នន័យនៅក្នុងការបង្កើតបញ្ហានៃការងារនេះទៅលាស់នូវការងារនៅក្នុងការងារនេះមានរឿងចំណាំជាបន្ទាល់នូវការងារនេះ។

នឹងមែនជាបន្ទាល់ដែលអាចក្លែងសង្គមនេះដោយក្នុងការងារនេះ គឺត្រូវត្រួតពិនិត្យពីការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ ដែលបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។

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Questions

- What is the type of output of the inductive proximity switch? (dry contact, current sinking or current sourcing)

..... current sinking. #

- How does the material type affect the sensing distance of the sensor?

នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។ នឹងបានបញ្ជាក់ថ្មីនៃការងារនេះ។

Part 3: Capacitive Proximity Switch ຕະລະຈິບນິ້ຕູກອໜ້າ ພາວັນ ອາກາະ ສິພລາສົກ

Instruction

1. Make a capacitive proximity circuit according to the circuit diagram shown in Figure 9.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Try each of the provided specimens on the proximity, record the results and answer the questions in the next section.

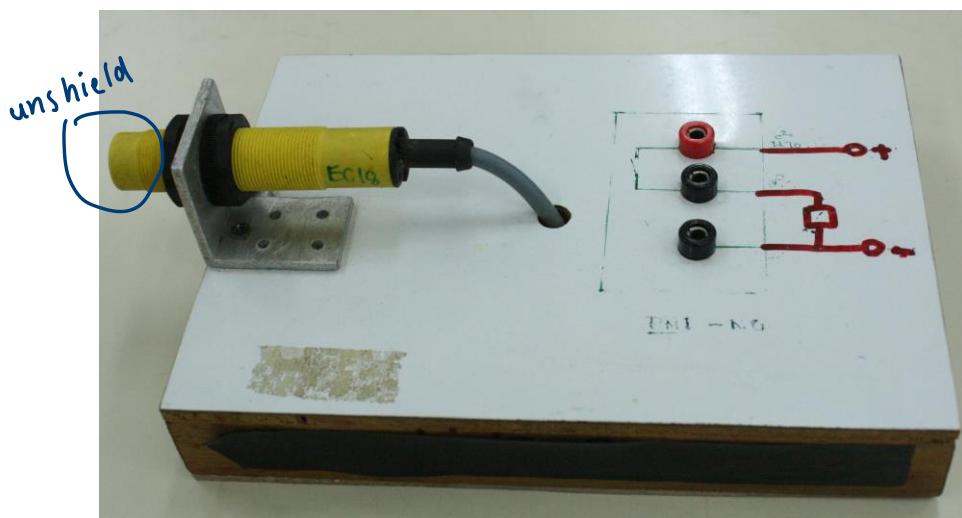


Figure 8: Capacitive proximity switch board

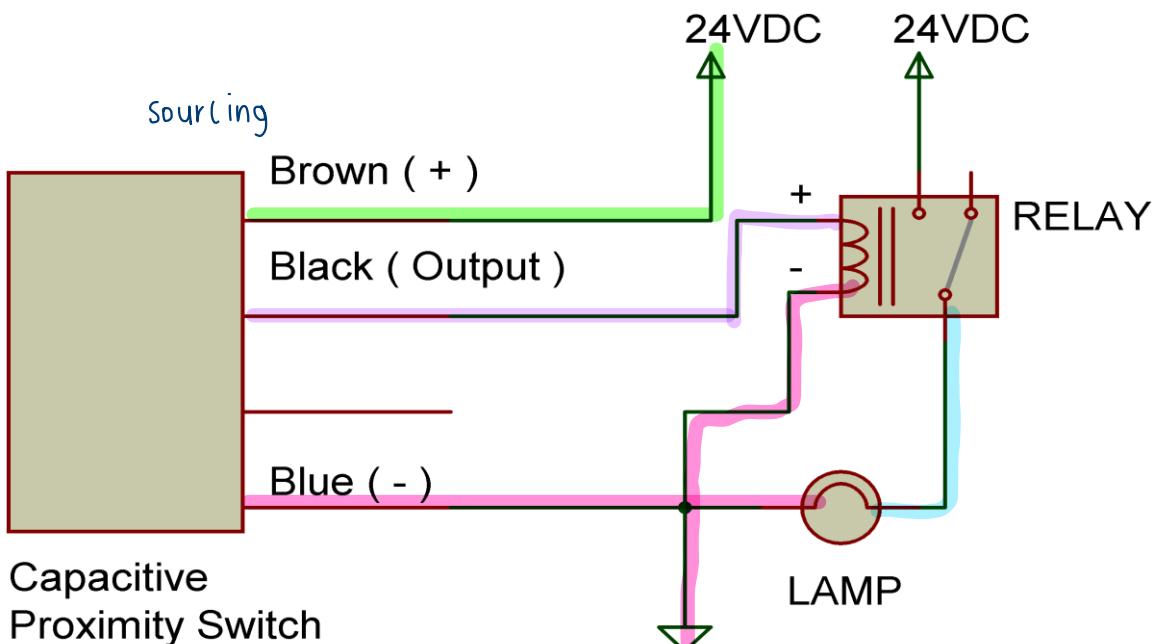


Figure 9: Circuit diagram of capacitive proximity switch circuit

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 3) ឧបយន្តុករូន ឈុំ 63070501221

Object	Sensing distance (mm)	Comments
Aluminum sheet	7	
Wooden pad	2	
Opaque acrylic sheet <u>/</u>	-	• គោរពតីអ៊ីតាត dielectric មិនស្នើសុំចិញទាន់ឡើងដែលបែងចាយក្នុងការបង្កើត
Transparent acrylic sheet <u>/</u>	-	• ចារចាយផលាសតិកនឹងបែងចាយក្នុងការបង្កើត
Stainless steel sheet	7	• នៅក្នុងការបង្កើតបានបែងចាយក្នុងការបង្កើត
Filled glass bottle	6	
Empty glass bottle	2	
Filled plastic bottle	7	
Empty plastic bottle <u>/</u>	-	
Filled aluminium can	8	
Empty aluminium can	7	
Cardboard Sheet	-	

Group Members
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 3) ດາວລາວເໜັກສິນ ເພື່ອງເຊີງ 63070501221

Conclusions

Capacitive proximity sensor ມີລົກຜະຫຼາຍກຳນົກົນ Inductive proximity sensor ຮຶອພື້ນຄລວດທີ່ສ້າງສ່າງຟ້າໃຫ້ເປົ້າແລ້ວຈະແນກຕາກ່າວກຳນົກົນ Capacitive າຄີ່ງກາຮຕວຈຳກາຮເສີ່ນແປໄລງ ຂອງຄ່າຄວາມຈຸ່ງທີ່ໃຫ້ລົກຮາຄຕວຈສອບວິຕຸຖຸເປົ້າໂລຢະແລະລົກຮູ໌ໄດ້ ເໜື່ອງຈາກວິຕຸຖຸຂີ້ນຄໍາມີຄ່າຄົງທີ່ dielectric ແຕກຕາກ່າວກຳວິຕຸຖຸໄປ ປີ່ຄ່າໃໝ່ປ່ອງບອກດິງຄວາມນີ້ຂ້າ ທີ່ເປັ້ນຄວາມສ່າມາດຕາມການດອກລື່ນໄຈໄວໃໝ່ທີ່ຈອງວິຕຸຖຸ ໂອຍວິຕຸຖຸນີ້ມີຄ່າ dielectric ສູງ ກ່ອະລູດກັບກ່ຽວກັບໄລ່ມາກັນນີ້ ນອກນີ້ ກ່ອະນຸມາ ທັງລົບດັບຕົ້ນໄດ້ ແລະຈ່າຍຕ່ອງກາຮຕວຈຳບໍ່

ອອກຈາກນີ້ ຄ່າ dielectric ຂອງວິຕຸຖຸເມື່ອລະຫັດນີ້ຈະເປັນຕົວວ່ອນ່ອກວ່າ sensor ຈະສ່າມາດກຳກາຮຕວຈຳບໍ່ວິຕຸຖຸນີ້ໄດ້ນີ້ໄວ້ ແລ້ວສໍາຄັນໂດຍໜີເກົ່າວິຕຸຖຸນີ້ ບໍ່ສິ່ງຄ່ອງ ດ້ວຍເກົ່າວິຕຸຖຸນີ້ໃນຕົວວິຕຸຖຸທີ່ຈະກຳນົດຕ້ວງ ນອກນີ້ ມີຄ່າຈາກກ່າວ ຄ່າ dielectric ຂອງວິຕຸຖຸທີ່ຈະກຳນົດຕ້ວງໃນ Sensor ກ່ອະນຸມາດຕາມຕາຈົບວິຕຸຖຸທີ່ອີ່ນໄດ້ ເຖິງ Sensor ຕວລອຈົບລອາພລາສີຕິກໍໄມ້ໄລ້ ແຕ່ສ່າງຮອດຕວຈຳຈວດພລາສີຕິກໍໃສ່ສິ້ນໄດ້ ເໜື່ອງຈາກຕວຈຳຈົບນີ້ທີ່ອີ່ນໄດ້ ດັ່ງນີ້ອງ

Questions

- What is the type of output of the capacitive proximity switch? (dry contact, current sinking or current sourcing)

current sourcing #

- How does the material type affect the sensing distance of the sensor?

ໜີ້ອີ່ນວິຕຸຖຸສີພລຕ່ວະບະຂອງກາຮຕວຈຳບໍ່ ອີ້ວິຕຸຖຸທີ່ມີ dielectric constant ພາກກໍລະກ່າຍຕ່ອກກາຮຕວຈຳບໍ່ ແລະ ສ່າມາດຕາມຕາຈົບໄດ້ວຽກຮະນະທີ່ໄກລກ່າວວິຕຸຖຸນີ້ມີ dielectric constant ນ້ອຍ #

Part 4: Ultrasonic Sensor

output $\rightarrow I = 4 - 20 \text{ mA}$
 $\downarrow R$
 $V = 1 - 5 \text{ V}$

Instruction

1. Make an ultrasonic sensor circuit according to the circuit diagram shown in Figure 11.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Try each of the provided specimens on the sensor by varying the distance and record the output current and voltage according to the table below. (Try to divide the sensing range evenly.)
4. Answer the questions in the next section.

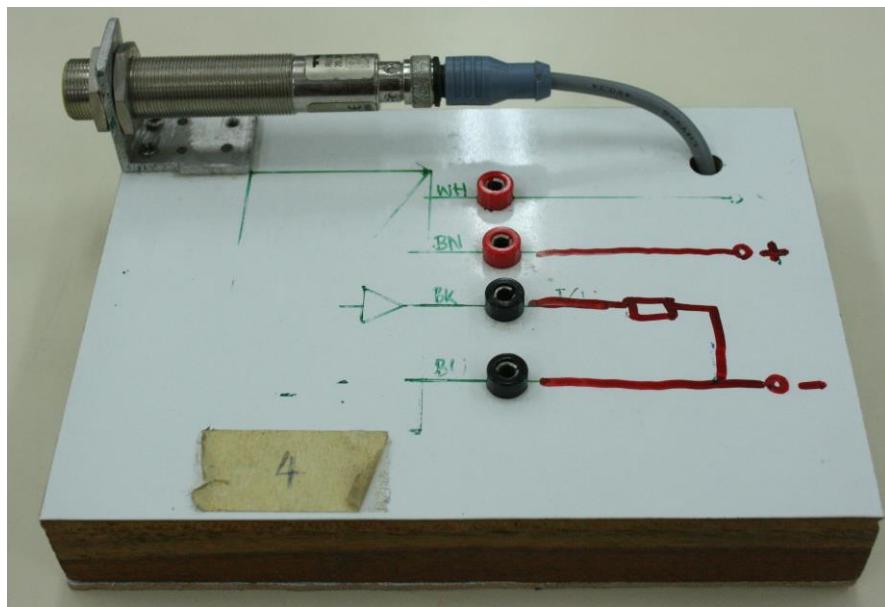


Figure 10: Ultrasonic sensor circuit

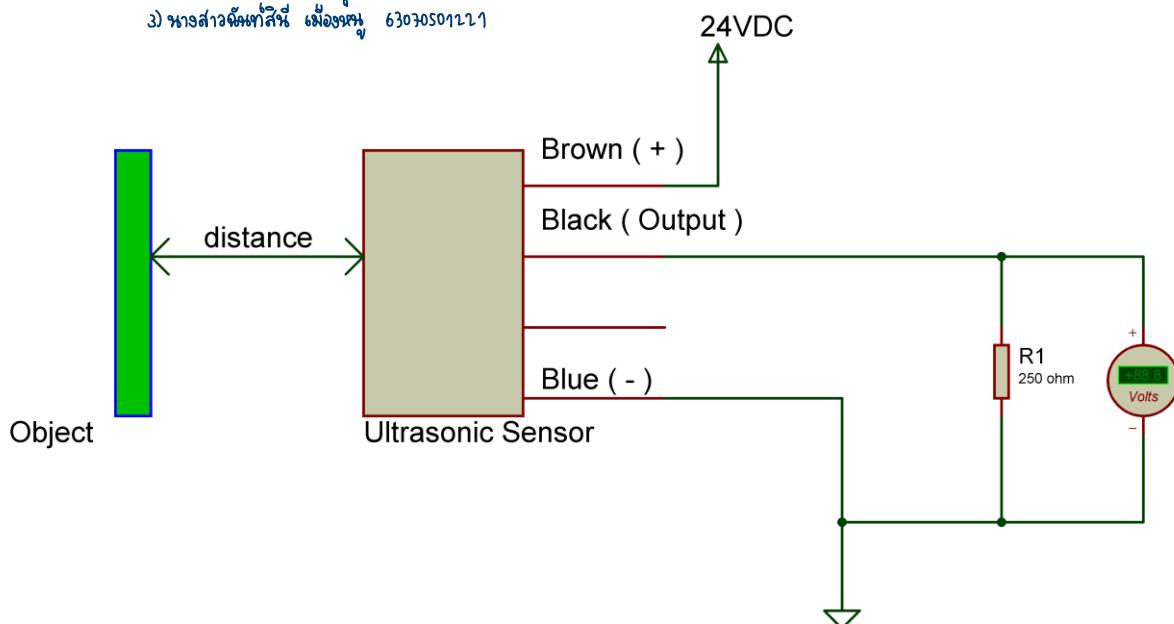


Figure 11: Circuit diagram of ultrasonic sensor circuit

→ ឈុតិចង្គប់ → 5V
 → ផ្លូវតុលាកម្ម (មុនរាងបំបាត់) → គ្រាប 4.99V

Object	សហគ័ន្យភាពខ្លះលើនឹង Blind zone (cm)	Sensing distance (cm) តួនាទី	Comments
Aluminum sheet	14.9	101.0	
Wooden pad	14.7	100.8	
Opaque acrylic sheet	15.2	100.3	
Transparent acrylic sheet	15.0	100.0	
Stainless steel sheet	14.6	98.5	
Sponge	14.4	97.5	

Object : Stainless steel sheet Distance from the sensor (cm)	Output current (mA)	Output voltage (V)
14.5	4	1
36.2	8	2
56.5	12	3
78.0	16	4
98.5	20	5

note : R = 250 Ω

Conclusions

Ultrasonic sensor ໃຫຍ່ໄດ້ໂຄຍສົ່ງຄວາມຄື່ສືບຂອງໜ້າ ultrasonic ທີ່ເນື້ອສົ່ງຄລິ່ນເລີ່ມຈອກກາກຮ້າກບັນຫຼັດທີ່ຕ່ວງຈຳບົບຄລິ່ນທີ່ກົງຈະສະຫຼັບໜ້າກົບໝາຍທີ່sensor ໂດຍກາຍໃຫ້ sensor ກົງຈະຟື້ວ່າຈົບເລາວບູ້ ທີ່ກິ່ນເສົາມາຮອດຈົບວ່າຕຸກຟິໄລ້ ແລະຂາກ-ໜໍາຮ່ວຍບະເລາວຂອງຄລິ່ນທີ່ໃນປະລັບ ພາກົານວຍການ ກົງຈະກາປະຮະບະຈ່າງຂອງວ່າຕຸກຟິໃນ sensor ໂດຍ Ultrasonic sensor ນັ້ນຈະມີ output ມາດການເຫັນກະຮະສີ ແລະຈີອົງທຶນທີ່ກຳກັນການແປດງຈາກກະຮະສີເບີ່ງເຮັດວຽກເນື້ອໃຈ້ສ້າງຮ່າວຄົດໄດ້ ໂດຍການທີ່ຕ່ວງກັນທາງໄຟປ່າຕົວ ກົງຈຳວ່າ sensor ຈາກໜີເຮັດວຽກໃຊ້ multimeter ໄປກັບເຮັດວຽກຄວາມຕົກຄລົມທີ່ຕ້ານທາງ ແລະຈາກກູ້ຂອງໂອໜໍ້ມ ($V = IR$; $R = 250\Omega$) ກົງຈຳຄົ້ນຄ່າເຮັດວຽກທີ່ໃໝ່ເປົ້າມາຮະບະຈ່າງຂອງວ່າຕຸກຟິໃນ sensor ໂດຍຮ່ວຍເວກທີ່ຕ່ວງຈົບວ່າຕຸກຟິຈະວິດເຮັດວຽກນີ້ 1V ແລະຮະບະທີ່ກຳໃຫ້ເກີດເຮັດວຽກ 5V ຄວັງເຮັດວຽກ ດື່ອຈະໄກລສຸດທິ່ກະຍົກງານ ສ້າມາຮອດຈົບວ່າຕຸກຟິໄດ້ ທີ່ກຳລັວວ່າຕຸກຟິບັນຫຼັດທີ່ນ້ຳກຳໄດ້

Ultrasonic sensor ສົ່ງຈຳກັດຄົດໄໝໄໝສ້າມາຮອດຈົບວ່າຕຸກຟິທີ່ຖຸດັກລື່ນຄລິ່ນເລີ່ມ ນີ້ວ່າຕຸກຟິທີ່ໄຟສ້າມາຮອດສະຫຼັບໜ້າຄລິ່ນເລີ່ມໄດ້ ອີກທີ່ມີຮູບແບບ Blind zone ທີ່ເນື້ອຮະບະຂອງວ່າຕຸກຟິທີ່ໃກລື່ກິ່ນກ່າວ sensor ຈະຕ່ວງຈົບໄດ້ ທີ່ຈະຈາກກາກຮ້າກລອງຫຼຸກວ່າ Aluminum sheet , Wooden pad , Opaque acrylic sheet , Transparent acrylic sheet , Stainless steel sheet : sensor ສ້າມາຮອດຈົບໄດ້ໄລ້ ແຕ່ພອດໃໝ່ມາຕ່າງຈົບພອງນໍາ ພົບຈໍາເກີດການແກວ່າງຂອງຄ່າເຮັດວຽກ ເພື່ອຈາກຫອນໃໝ່ກຳກັນການຄຸງຫຼັບຄລິ່ນເລີ່ມ ຈີ່ກິ່ນ sensor ໄຟສ້າມາຮອດຈົບໄດ້ໄລ້ຢ່າງແນ່ງໆຍໍາ

Questions

- What is the type of output of the ultrasonic sensor? (dry contact, current sinking or current sourcing)

current sourcing #

- How far is the blind zone of this sensor?

14.5 cm #

Part 5: Diffuse Photoelectric Sensor

Instruction

1. Make a photoelectric sensor circuit according to the circuit diagram shown in Figure 13.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Try each of the provided specimens on the sensor, record the results and answer the questions in the next section.

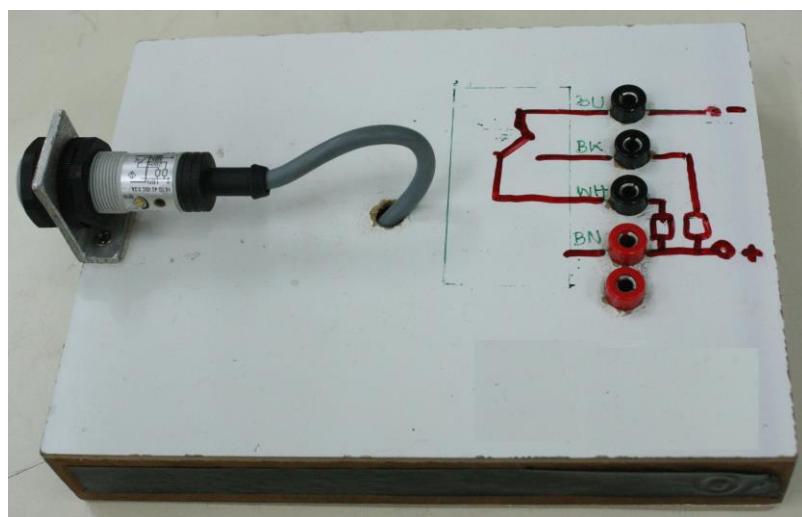


Figure 12 diffuse photoelectric sensor board

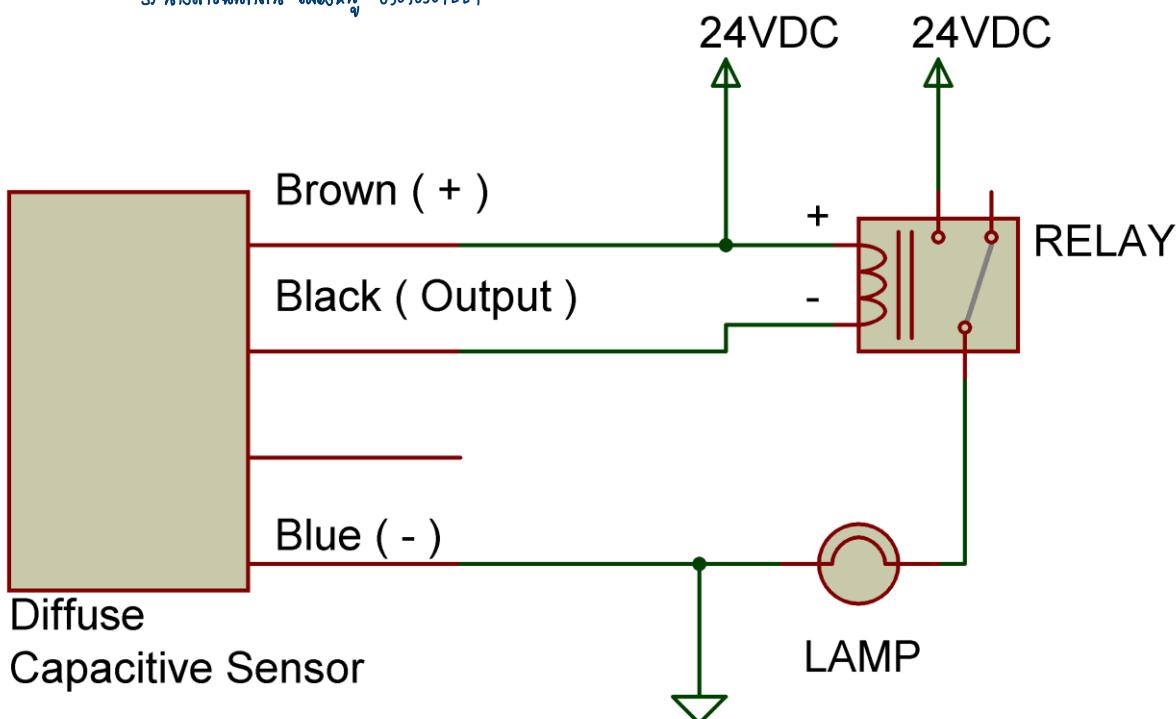


Figure 13 circuit diagram of diffuse photoelectric sensor circuit

Type of object	Shape and size	Sensing distance (mm)	Comments
Aluminum sheet	តិចតិចខ្លួនឈើ	670	- Aluminum sheet តិចតិចខ្លួនឈើ
Wooden pad	តិចតិចខ្លួនឈើ	233	- Transparent acrylic sheet
Opaque acrylic sheet	តិចតិចខ្លួនឈើ	228	ឃុំពាក្យទីនៅក្នុងក្រុងក្រុង
Transparent acrylic sheet	តិចតិចខ្លួនឈើ	256	(តិចតិចខ្លួនឈើ)
Stainless steel sheet	តិចតិចខ្លួនឈើ	605	
Cardboard Sheet	តិចតិចខ្លួនឈើ	230	

Part 6: Reflective Photoelectric Sensor

Instruction

1. Make a photoelectric sensor circuit according to the circuit diagram shown in Figure 15.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Try each of the provided specimens on the sensor, record the results and answer the questions in the next section.

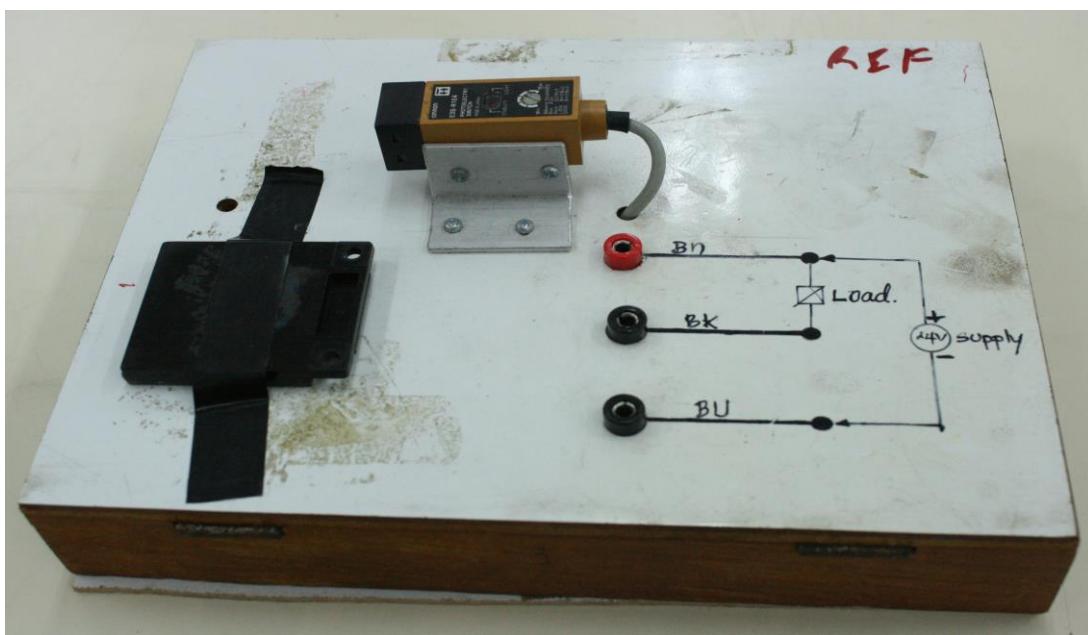


Figure 14: Reflective photoelectric sensor board

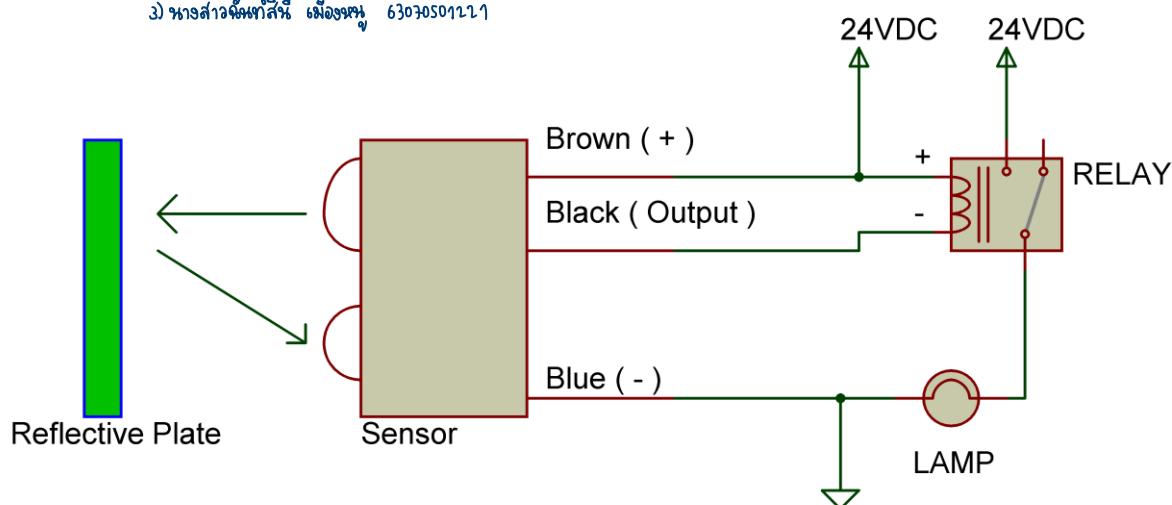


Figure 15: Circuit diagram of reflective photoelectric sensor circuit

Type of object	detection	Comments
Aluminum sheet	✓	
Wooden pad	✓	
Opaque acrylic sheet	✓	- mirror ត្រឡប់បានទៅក្រោមឱ្យមូល
Transparent acrylic sheet	✗	
Stainless steel sheet	✓	
Cardboard sheet	✓	
Mirror	✓	

Conclusions

Reflective photoelectric sensor เป็น sensor แสงที่ใช้หลักการ反射ห้องกลับของลำแสง โดยมีตัวรับแสงและตัวส่งแสงที่อยู่ภายใต้เดียวกัน แต่ต้องให้ผู้ส่งแสงหันไปทาง reflector เนื่อมจากเพื่อทำการรวมแสง แสงส่องห้องแสงที่มาจากการกลับของ sensor จะกลับไปยังตัวรับแสงที่อยู่ใน sensor

ปกติถ้าไม่มีวัตถุเคลื่อนที่ผ่าน ตัวส่งแสงจะส่งแสงไปยัง reflector และ reflector ก็จะส่งห้องแสงกลับมาอย่างตัวรับแสงที่อยู่ใน sensor ได้ แต่เมื่อมีวัตถุเคลื่อนที่ผ่านระหว่างตัว sensor กับ reflector แสงก็จะถูกบดบังโดยวัตถุ ทำให้ sensor ตรวจไม่ได้ว่าวัตถุเคลื่อนที่ผ่าน แล้วจากแสงที่ส่องห้องกลับมาอย่างตัวรับแสงหายไป ซึ่งการที่มี reflector เพิ่มเข้ามา จะทำให้ sensor สามารถตรวจจับวัตถุได้ระยะไกลมากขึ้น แห่งนี้ reflector ทำหน้าที่รวมแสงที่รับมาจากตัวส่งไว้ ทำให้มีความแม่นยำและแม่น้ำยำมากขึ้น หากพื้นที่ส่องกลับไปยังตัวรับได้ ถึงแม่ว่าจะอยู่ในระยะไกล

โดย Reflective photoelectric sensor หมายความว่าห้องกลับวัตถุที่บ้านแสง ถูกกลืนแสง และต้องไม่สามารถส่องห้องแสงที่อยู่ตัวรับได้ (เนื่องจากถ้าวัตถุส่องมาสู่ห้องแสงแล้วกลับไปยังตัวรับได้ sensor ก็จะตรวจจับไม่ได้ว่าวัตถุเคลื่อนที่ผ่าน พอเราเอาตัวถ้าไม่มีวัตถุเคลื่อนที่ผ่าน reflector จะส่องห้องแสงกลับไปยังตัวรับตลอดเวลาอยู่แล้ว) ดังนั้น sensor ที่ไม่สามารถตรวจจับวัตถุที่ส่องห้องแสง มีดีไซน์นี้เป็น แสงที่ส่องไปได้

ซึ่งจากการทดลองพบว่าตัวถูกที่ห้องแสง เช่น Aluminum sheet, wooden pad และ opaque acrylic sheet; sensor - สามารถตรวจจับได้ และ Transparent acrylic sheet; sensor ไม่สามารถตรวจจับได้ เนื่องจากเป็นวัตถุที่โปร่งแสง และ ฐานส่วนห้องแสง Stainless steel sheet และ mirror ซึ่งเป็นวัตถุส่องห้องแสง พนับในบางกรณี sensor ไม่สามารถตรวจจับได้ ถ้าวัตถุผิดเพี้ยน เช่น เปราชเกิดการส่องห้องแสงจากวัตถุกลับไปยังตัวรับแสง ทำให้เกิดความผิดพลาดในการตรวจจับ ดังนั้น เราจึงควรเลือกใช้วัตถุในเชิงมุมส่วนเพื่อให้ sensor ตรวจจับวัตถุได้อย่างถูกต้อง

Questions

- What is the type of output of the photoelectric sensor? (dry contact, current sinking or current sourcing)

current sinking #

- What type of object is best for reflective photoelectric sensor?

วัตถุที่ส่องแสง #

- What is the minimum load resistance (i.e. maximum load) you can connect to the sensor?

จาก $V = IR$

$$R_{min} = \frac{V}{I_{max}}$$

$$R_{min} = \frac{24}{80mA}$$

$$R_{min} = 300\Omega \#$$

Part 7: Thru-Beam Photoelectric Sensor

Instruction

1. Make photoelectric sensor circuits according to the circuit diagrams shown in Figure 17.
2. Ask a laboratory supervisor to verify your circuits before connecting to the power supply.
3. Connect the power supply. Try each of the provided specimens on the sensor, record the results and answer the questions in the next section.

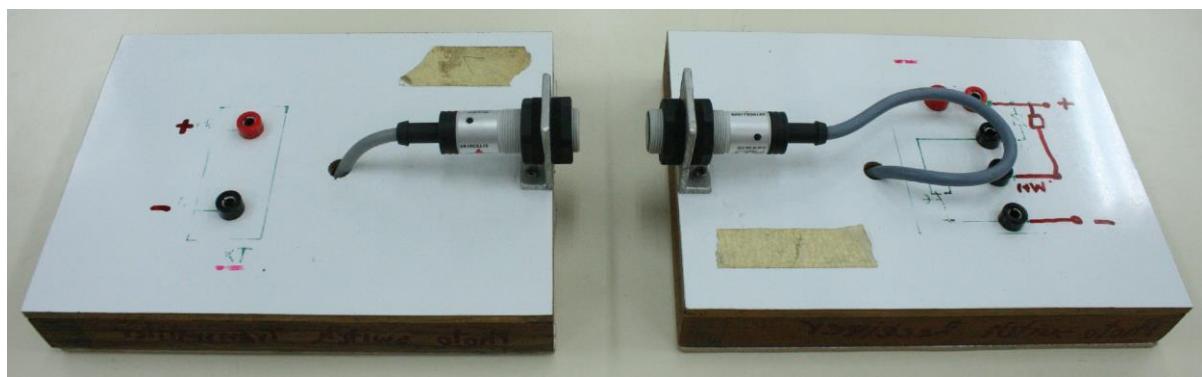


Figure 16: Thru-beam photoelectric boards

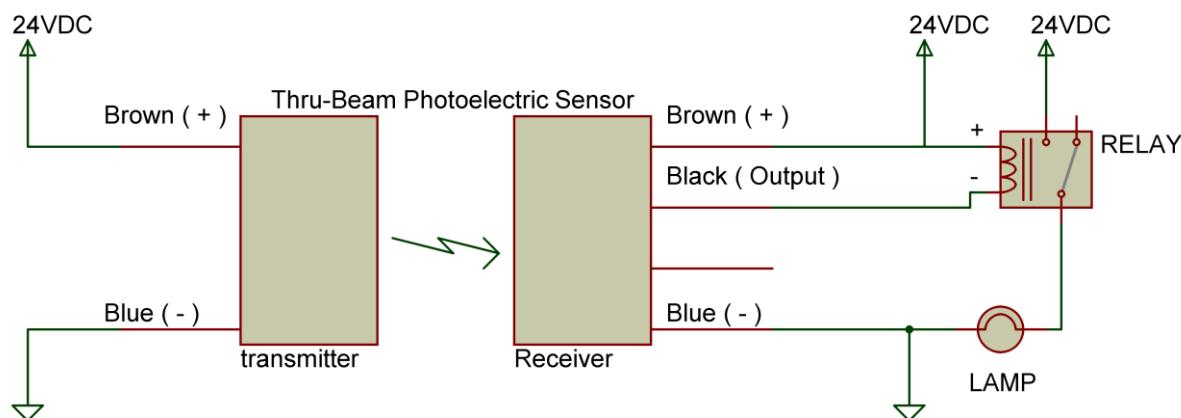


Figure 17 circuit diagram of thru-beam photoelectric sensor circuit

Type of object	Detection	Comments
Aluminum sheet	✓	
Wooden pad	✓	
Opaque acrylic sheet	✓	- ຕາງຈະຈຳປັບໄດ້ ແຕ່ກ່ຽວຂ້າງທີ່ ບໍ່ໄດ້ສຳເນົາ
Transparent acrylic sheet	X	
Stainless steel sheet	✓	
Cardboard sheet	✓	

Conclusions

Through- Beam photoelectric sensor ឱ្យការណែនាំផែនក្នុងបច្ចេកទេននៃពីរភ្លើងនៃការរាយការណែនាំដែលត្រូវបានបង្កើតឡើង។ ក្នុងការរាយការណែនាំនេះ ត្រូវបានបង្កើតឡើងថាពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន។ ក្នុងការរាយការណែនាំ នៅពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងបានបង្កើតឡើងថាទីតាំងនៃការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងត្រូវបានបង្កើតឡើង។ ក្នុងការរាយការណែនាំ នៅពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងបានបង្កើតឡើងថាទីតាំងនៃការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងត្រូវបានបង្កើតឡើង។

ឱ្យការណែនាំនេះ ត្រូវបានបង្កើតឡើងជាប្រព័ន្ធផ្លូវការណែនាំ ដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន។ ក្នុងការរាយការណែនាំ នៅពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងត្រូវបានបង្កើតឡើងជាប្រព័ន្ធផ្លូវការណែនាំ ដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន។ ក្នុងការរាយការណែនាំ នៅពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងត្រូវបានបង្កើតឡើងជាប្រព័ន្ធផ្លូវការណែនាំ ដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន។

Through- Beam photoelectric sensor សារធានាភាសាអង់គ្លេស និងការណែនាំ នៅពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងត្រូវបានបង្កើតឡើងជាប្រព័ន្ធផ្លូវការណែនាំ ដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន។ ក្នុងការរាយការណែនាំ នៅពេលវេលាដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន នឹងត្រូវបានបង្កើតឡើងជាប្រព័ន្ធផ្លូវការណែនាំ ដែលមានការបញ្ចប់នៅក្នុងបច្ចេកទេន។

Questions

- What is the type of output of the photoelectric sensor? (dry contact, current sinking or current sourcing)

current sinking #

- What types of object are best for thru-beam photoelectric sensor?

វ៉ាត្រូវការណែនាំ #

- What is the minimum load resistance you can connect to the sensor?

តារាង $V = IR$

$$R_{min} = \frac{V}{I_{max}} \quad ; \quad I_{max} = 0,2 \text{ A}$$

$$R_{min} = \frac{24}{0,2}$$

$$R_{min} = 120 \text{ } \Omega \#$$

Part 8: NPN Sensor Connections

Instruction

1. Make a photoelectric sensor circuit according to the circuit diagram shown in Figure 19.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Activate the sensors and record the results.

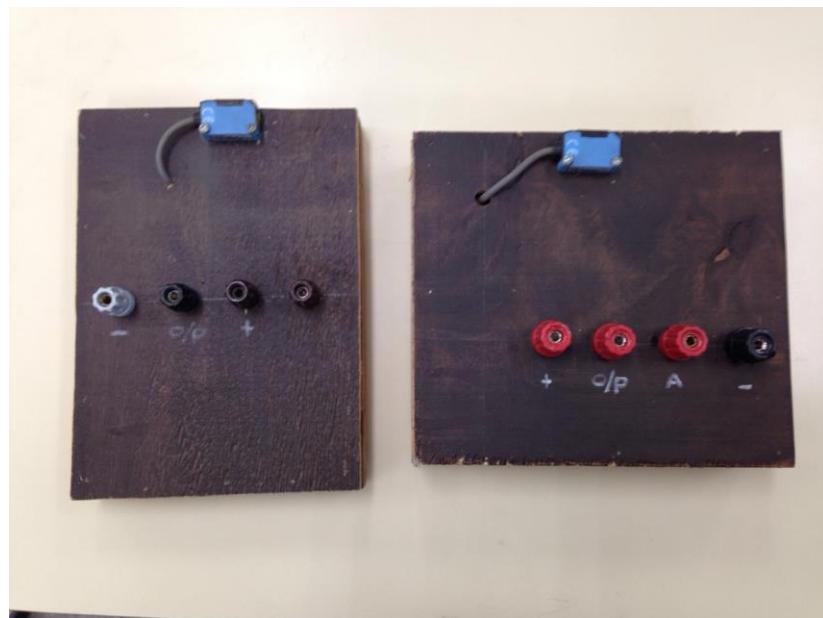


Figure: 18: NPN sensor boards

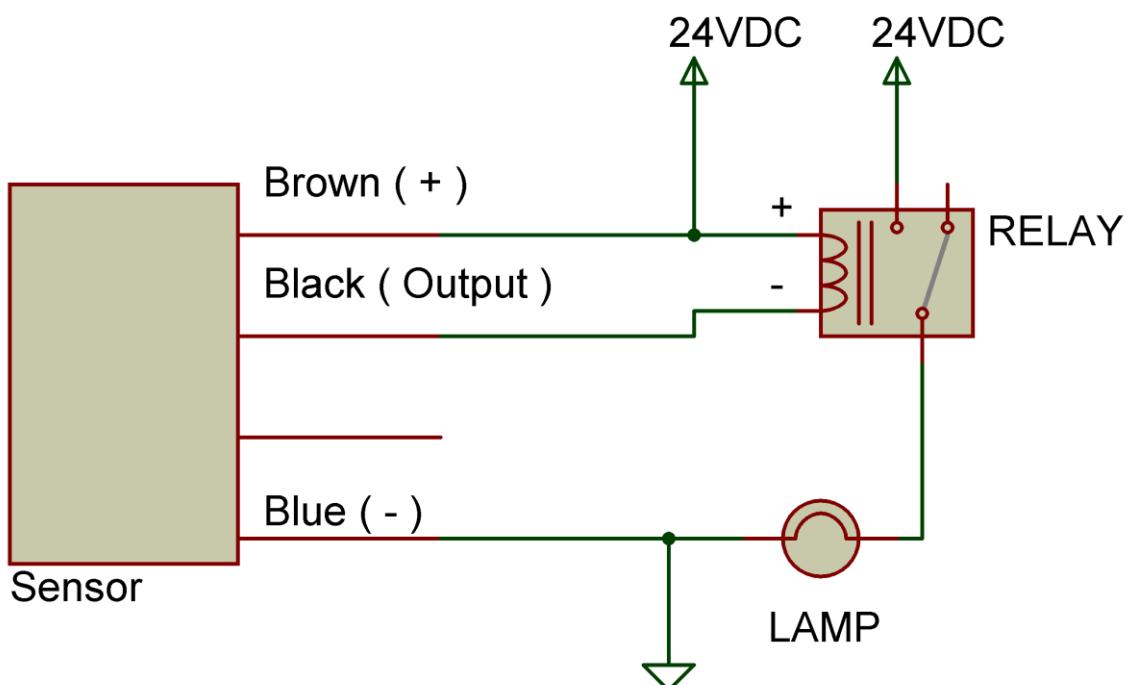


Figure 19: NPN Sensor circuit diagram (1 Sensor)

4. Repeat steps 1-3 using each of the circuit diagrams shown in Figures 20 (a) and (b) accordingly.
5. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
6. Connect the power supply. Activate the sensors and record the results.

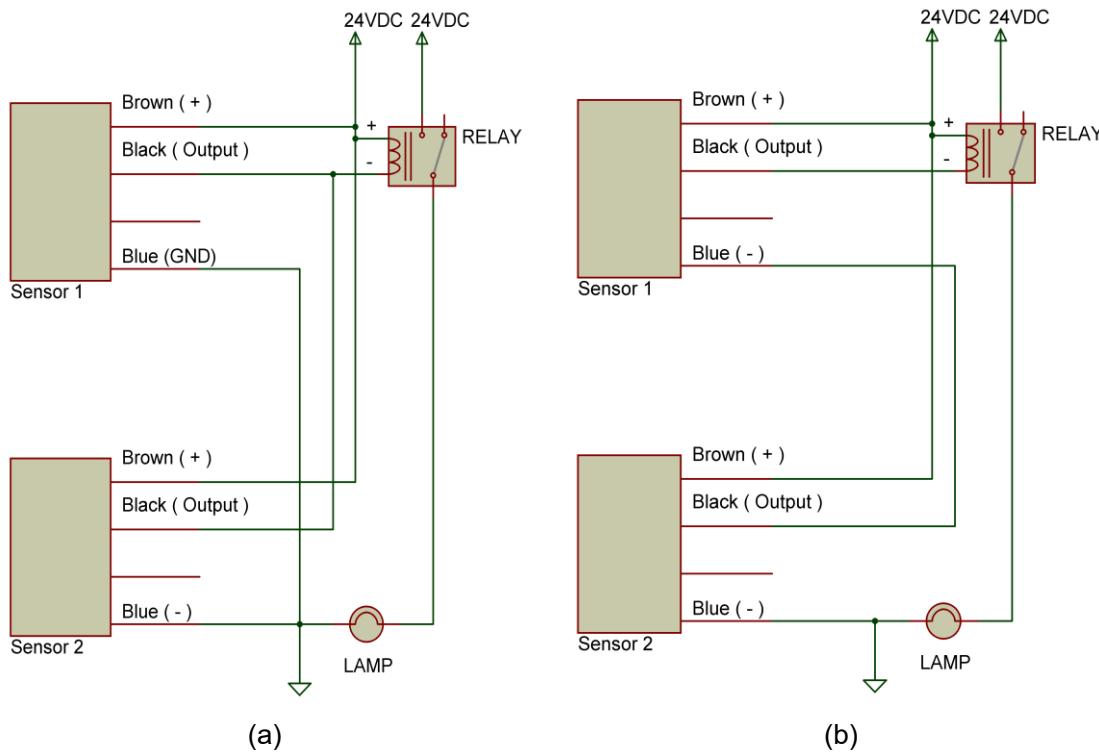


Figure 20: Circuit diagrams of combining NPN sensors (a) “ORing” and (b) “ANDing”

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3) ຊາວສ່າວຕັ້ນທໍາສັນ ເພື່ອງອະນຸ ດຳເນີນ 63070501221

Section ihCA1

Conclusions

Questions

1. What kind of photoelectric sensors used in the experiment?

Part 9: PNP Sensor Connections

Instruction

1. Make a photoelectric sensor circuit according to the circuit diagram shown in Figure 22.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply. Activate the sensors and record the results.

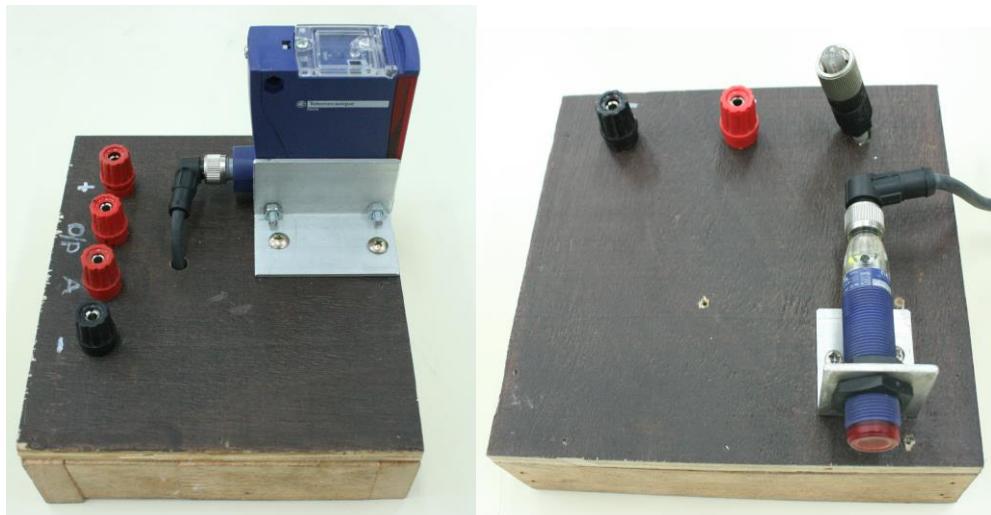


Figure 21: PNP sensor boards

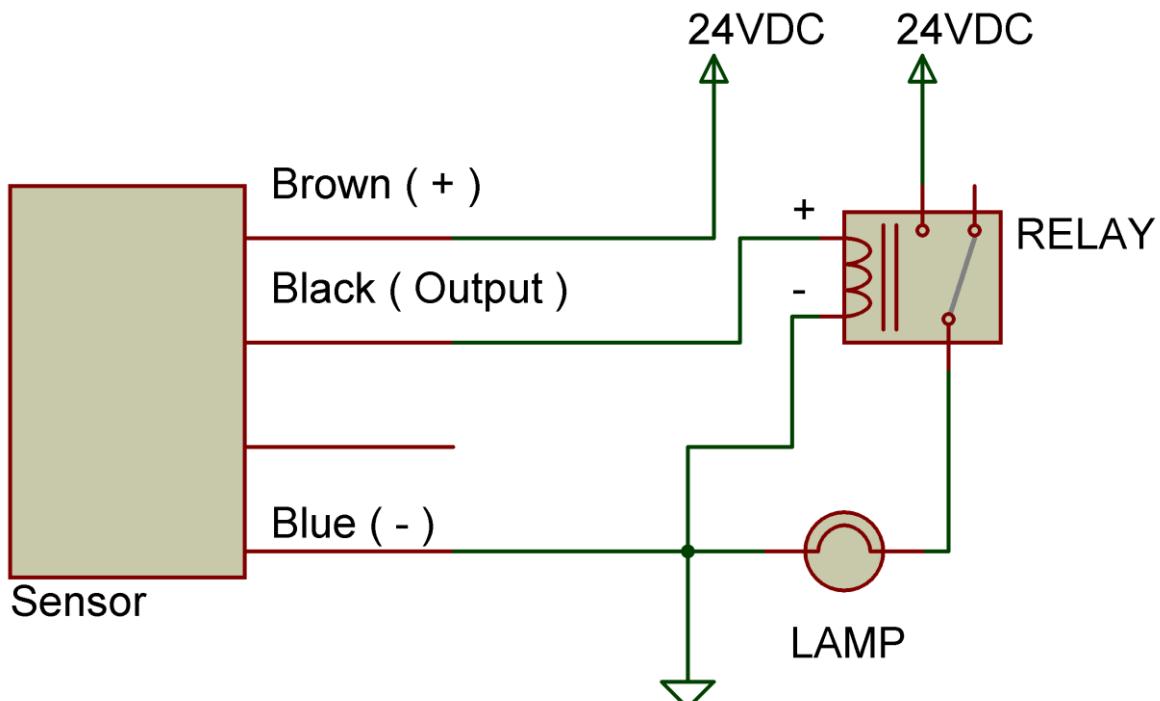


Figure 22: PNP Sensor circuit diagram

4. Repeat steps 1-3 using each of the circuit diagrams shown in Figures 23 (a) and (b) accordingly.
5. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
6. Connect the power supply. Activate the sensors and record the results.

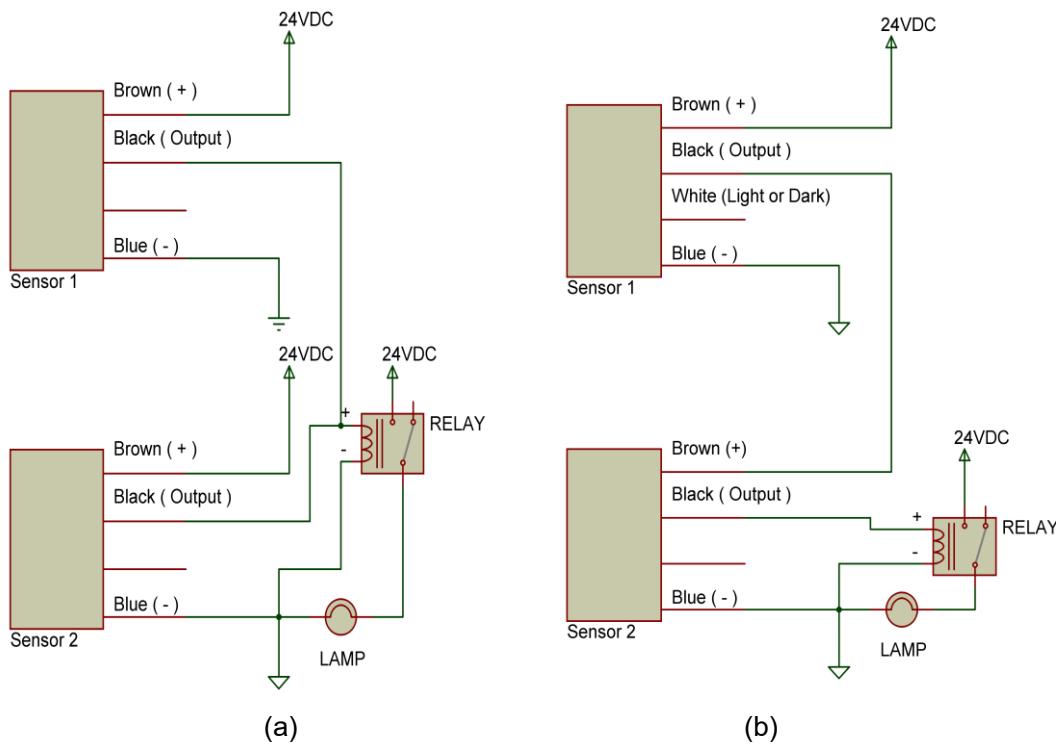


Figure 23: Circuit diagrams of combining PNP sensors (a) “ORing” and (b) “ANDing”

Name _____ 1

Section inCA1

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Conclusions

Questions

1. What kind of photoelectric sensors used in the experiment?

Part 10: Settings Up Sensor

Instruction

1. Make light curtain sensor circuits according to the circuit diagrams shown in Figure 25.
2. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
3. Connect the power supply.
4. Align the sensor to make an application to detect any intrusion into its area.
5. Record the results and answer the questions in the next section.



Figure 24: Light curtain sensor boards

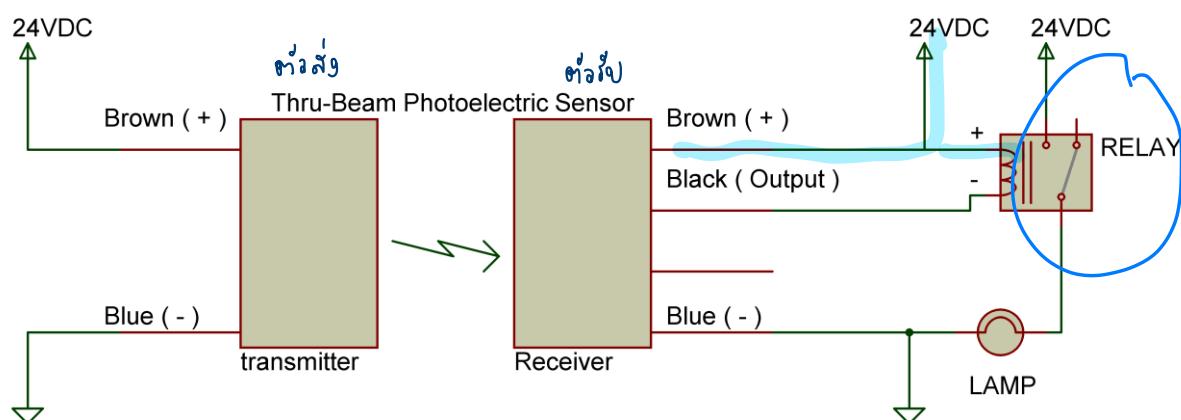


Figure 25: Circuit diagram of ultrasonic sensor

6. Make an ultrasonic sensor circuit according to the circuit diagram shown in Figure 24
7. To start setting up the sensor, push and hold the pushbutton switch at the end of the sensor for 4-5 seconds. Make sure that the light turns from blinking orange into green.

8. To set the first distance, place a plate (perpendicularly to the sensor axis) at the first distance then push the switch. Allow the light to go from green to orange.
9. To set the second distance, place a plate (perpendicularly to the sensor axis) at the second distance then push the switch. Allow the light to go from orange to red.
10. Ask a laboratory supervisor to verify your circuit before connecting to the power supply.
11. Connect the power supply. Try to move an object to the sensor at various distances, record the results and answer the questions in the next section.



Figure 26: Ultrasonic sensor board

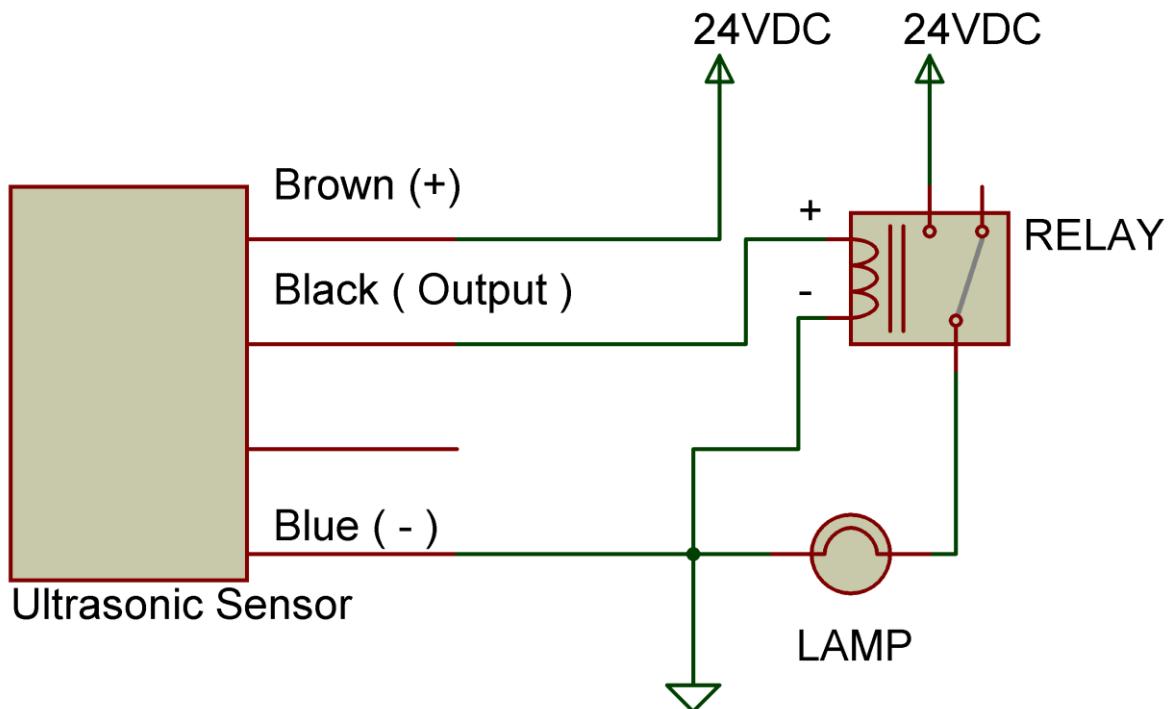


Figure 27: Circuit diagram of ultrasonic sensor

Conclusions

Part 1: Through-beam sensor ឬ sensor តារាងជូនវិនិច្ឆ័យនៃការតរាង គឺជាប្រភពដែលត្រូវតាមដៃតែង ដើម្បីធ្វើប្រព័ន្ធដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងទីតាំងនេះទីតាំងនេះ នឹងធ្វើបានតារាងដែលត្រូវនៅក្នុងទីតាំងនេះ តារាងនេះមិនអាចនិន្ត់បានបានឡើង ដូចនេះនៅពេលតារាងត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ នឹងធ្វើបានតារាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ និងសារតរាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ នឹងធ្វើបានតារាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ

Part 2: Ultrasonic sensor ការងារនេះបានរាយការណានៃការងារនេះនៅក្នុងព្រឹកបាយក៖តារាងនេះជាប្រភពដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ តារាងនេះជាប្រភពដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ និងសារតរាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ និងសារតរាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ និងសារតរាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ និងសារតរាងដែលត្រូវបានរក្សាទុកឡើង នៅក្នុងទីតាំងនេះ

- What is the type of output of the ultrasonic sensor? (dry contact, current sinking or current sourcing)

current Sourcing. #

- How far is the blind zone of this sensor?

0-12.8 cm. #