DIGITAL MOTION DETECTOR MODULE MANUAL

DP-001A

GLOLAB
CORPORATION

Thank you for buying our DP-001A module

The goal of Glolab is to produce top quality electronic products and components. All of our products are designed by Glolab engineers and tested in our laboratory. Mechanical devices, prototypes and enclosures are fabricated in our precision machine shop.

Glolab Corporation has been in business since 1994 and has two locations in New York's Hudson Valley. Both our electronics laboratory and kit packaging and our machine shop are located in Wappingers Falls.

The DP-001A Is an improved version of the DP-001. Additional features are: reverse polarity protection, logic level output, relay driver with Zener diode load dump protection, ten programmable dwell times.

Technical help is available by email from lab@glolab.com.

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Introduction_____

The DP-001A digital pyroelectric infrared motion detector module is designed to detect infrared radiation (IR) from a moving human or animal both in daylight and at night. It will only respond to a moving source of infrared radiation. It will not detect a static IR source.

The module is a basic building block designed for use in the construction of a motion detector device. It includes a digital pyroelectric infrared sensor, a microprocessor and a relay driver. An on-board voltage regulator powers the circuits. The DP-001A is RoHS compliant.

The DP-001A eliminates the need to design and build the complex amplifier and comparator circuits that must follow a typical analog pyroelectric infrared sensor. The relay driver within the DP-001A can sink up to 200 milliamperes to directly drive a relay, motor, light emitting diode or other load. The logic output can also be fed into a logic or timing circuit. A direction sensing function can indicate the direction of motion.

Features_____

- **Small 3/4 inch (19mm) diameter, 3/8 inch (9.6mm) thick module**
- **On board voltage regulator**
  - **Can be powered by 4 to 15 volts DC**
- **Micropower circuits for low current drain**
  - **Average current < 50 microamperes**
  - **Long battery life**
- **0 to 3.5 volt, 25 milliampere logic output**
  - **Can drive a microprocessor, logic circuit or LED**
- **High current output driver**
  - **200 milliampere, 28 volt current sink**
  - **Can directly drive a remote relay**
- **Programmable sensitivity setting**
  - **Adjusts detection range**
- **Programmable dwell setting**
  - **Adjusts output ON time from 200 ms to 10 minutes**
- **Only three wire connections needed**
  - **Two for power**
  - **One for output**

Digital Technology

The Glolab DP-001A module uses a Digital infrared detector. This new technology incorporates a sensor, amplifier, filter, A/D converter in one TO5 package.

Unlike typical analog pyroelectric sensors, the digital sensor outputs serial data pulses that represent the amplitude of detected infrared radiation in digital form. Since all of the amplification and signal processing is done within the sensor package, the detector has very high immunity to RF radiation from cell phones and other sources.

Figure 1 is a block diagram of the DP-001A module. Power is supplied to the digital pyroelectric sensor and the processor through a micropower voltage regulator. The processor decodes the serial bits from the digital sensor and turns a logic output and relay driver on when motion is detected. The amount of time that the outputs remain on (dwell) can be programmed by an external resistor and can be set to one of five times from 200 milliseconds to 10 minutes. Detection sensitivity that affects detection range can be programmed by an external resistor to one of five sensitivity levels. The module is supplied with default settings of medium sensitivity and one second dwell time.

The relay driver includes internal Zener diode load dump protection to clamp transient voltage spikes generated by inductive loads.

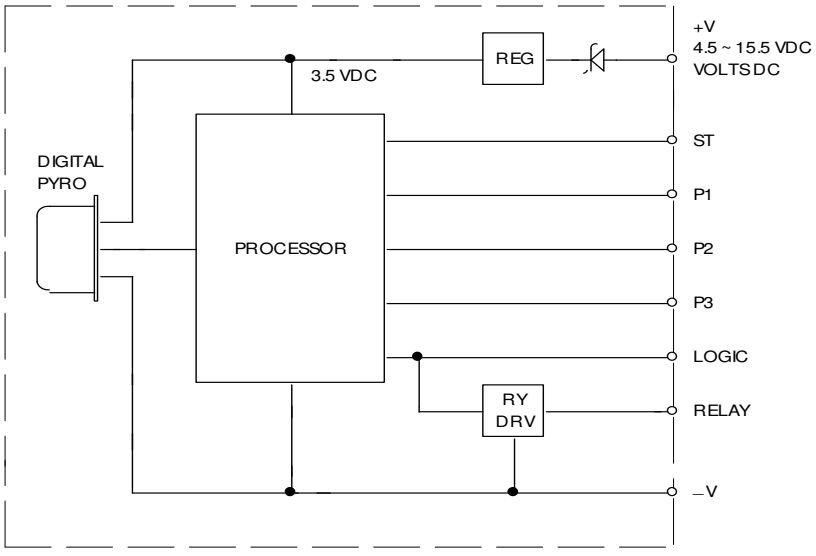


Figure 1

Sensitivity

Sensitivity and therefore range (detection distance) can be programmed to one of five levels. Sensitivity default is set to medium.

Dwell

Dwell time or the amount of time the output remains on after motion is detected can be programmed to one of ten dwell times from 200 milliseconds to ten minutes. Dwell default is set to one second.

Mode

Retriggerable mode will reset the dwell timer to zero whenever more motion is detected during dwell timeout. This will cause the output to remain ON for an additional dwell period. Retriggering will continue and the output will remain ON as long as motion is detected before the dwell timeout expires. The 200 millisecond dwell time will not retrigger even if retriggerable mode is programmed.

Single event mode will inhibit multiple outputs from occurring in rapid succession The output will turn ON when motion is detected and will stay ON for only the dwell timeout. The output will then turn OFF and remain OFF until no more motion is detected for about one second or more. The OFF time will be longer at higher sensitivity settings. This mode is somewhat similar to an inverted version of retriggerable mode.

Outputs

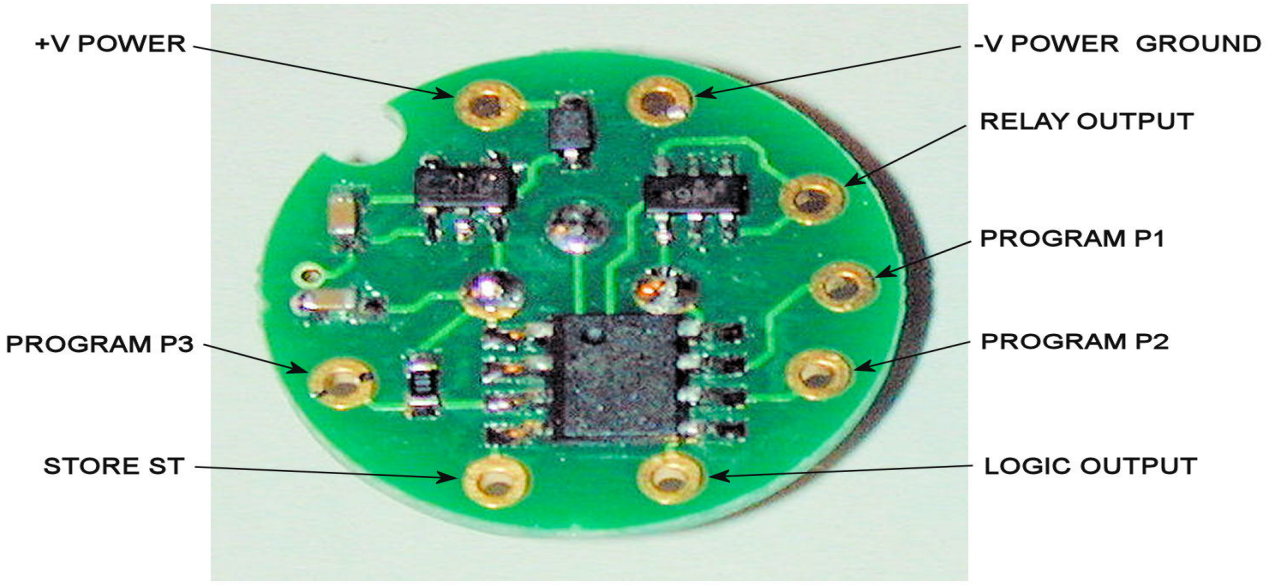
The logic output is directly from the internal microprocessor and is at 0 volts when no motion is detected and at +3.5 volts when motion is detected. The logic output can source and sink up to 25 milliamperes. The relay output is from a relay driver circuit. When no motion is detected the output is off and in a non-conducting state. When motion is detected the output turns on and can conduct up to 200 milliamperes to –V (ground). Zener diode load dump protection within the driver circuit allows a relay or other inductive load to be connected directly from any positive voltage up to 28 volts and to the relay output. Relay outputs from two or more DP-001A modules can be connected together as shown in Fig AP5 on page 14

Power

A 4 to 15 volt battery will power the DP-001A at less than 50 microamperes current draw when no motion is detected. The power system is reverse polarity protected to prevent damage to the circuits from a reversed polarity power connection. A DC wall transformer may also power the DP-001A, however most wall transformers output much higher than their rated voltage when lightly loaded so the transformer output should be measured to be sure that the 15 volt maximum power supply input is not exceeded.

Description

The DP-001A is 3/4 inch (19mm) in diameter and 3/8 inch (9.6mm) thick with surface mount circuit components on one side and a digital pyroelectric infrared sensor on the other side. A Fresnel lens or other focusing device can be placed in front of the sensor to increase sensing distance by focusing infrared radiation onto the sensor elements.



BACK VIEW SHOWING CONNECTION PADS
WITH 0.035 INCH (0.89mm) DIAMETER HOLES

ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNITS
Power supply voltage [1]	15.5	Volts
Logic output current [2]	25	Milliamperes
Relay output current	200	Milliamperes
Voltage applied to relay output	28	Volts

Notes:

1. Voltage from + to – power terminals on PC board
2. Both source and sink

TYPICAL OPERATION

PARAMETER	MIN	TYPICAL	MAX	UNITS
Power supply voltage [3]	4.0	9.0	15.0	Volts
Module current [4]	-	45	-	Microamperes
Logic output current [5]	-	20	25	Milliamperes
Relay output current [6]	-	100	200	Milliamperes
Relay output voltage [7]	-	12	24	Volts
Operating temperature	-40ºC	-	+85ºC	
Field of view [8]	-	100	-	Degrees

Notes:

3. Voltage from + to – power terminals on PC board
4. Not including external load on output
5. Both source and sink
6. Load connected from positive voltage to output
7. External voltage applied through relay or other load
8. Without a lens

Ordering information_____

PART NUMBER	DESCRIPTION
DP-001A	Digital motion detector module

Optional accessory parts_____

PART NUMBER	DESCRIPTION	SOURCE
FL25	0.25 inch (6.35mm) focal length Fresnel lens	Glolab
FL40	0.4 inch (10.16mm) focal length Fresnel lens	Glolab
FL65	0.65 inch (16.51mm) focal length Fresnel lens	Glolab

Programming resistors _____

Programming of sensitivity, dwell time and output mode is done by temporarily connecting P1 and P2 to ground and an external resistor from P3 to ground as shown in the tables on page 7, and then grounding the store pad ST for one second. Sensitivity programming needs only a resistor from P3 to ground while other program functions also need either P1 or P2, or both P1 and P2 grounded.

A programmed function is stored in non-volatile memory when the store pad ST is grounded for one second and then opened. A programmed function will not change until re-programmed and will not be lost when power is removed from the module. Sensitivity, output mode and dwell time programming are independent of each other and must be individually programmed.

The programming resistor can be any size or wattage and can have a 5% resistance tolerance. Ground connections should be removed from P1, P2 and the resistor from P3 after programming has been completed.

Sensitivity, Dwell and Mode are all simultaneously reset to defaults by grounding P1, P2 and P3 and then grounding ST for one second. This is useful as a quick way to return to defaults when existing programming is unknown.

Programming sensitivity, mode and dwell

One of five sensitivity levels, one of ten dwell times and one of two output modes can be programmed. Follow the steps below for table 1 to program sensitivity. Repeat the steps below for table 2 to program dwell time and for table 3 to program mode. A power source must be connected before programming. Ground (GND) is the –V terminal.70

1. **Leave P1, P2 open or connect to ground (GND) as shown in the table**
2. **Connect a resistor of the value shown in the table to P3 and to ground**
3. **Ground ST for 1 second (stores data in memory)**
4. **Remove ground and resistor from P1, P2, P3**

TABLE 1 SENSITIVITY LEVEL	P1	P2	P3	ST
MINIMUM	OPEN	OPEN	2.7 KOHMS TO GND	GND-OPEN
LOW	OPEN	OPEN	6.8 KOHMS TO GND	GND-OPEN
MEDIUM (DEFAULT)	OPEN	OPEN	GND	GND-OPEN
HIGH	OPEN	OPEN	15 KOHMS TO GND	GND-OPEN
MAXIMUM	OPEN	OPEN	39 KOHMS TO GND	GND-OPEN

TABLE 2 DWELL TIME	P1	P2	P3	ST
0.2 SECOND	GND	OPEN	2.7 KOHMS TO GND	GND-OPEN
1 SECOND (DEFAULT)	GND	OPEN	GND	GND-OPEN
2 SECOND	GND	OPEN	6.8 KOHMS TO GND	GND-OPEN
5 SECOND	GND	OPEN	15 KOHMS TO GND	GND-OPEN
10 SECOND	GND	OPEN	39 KOHMS TO GND	GND-OPEN
30 SECOND	OPEN	GND	GND	GND-OPEN
1 MINUTE	OPEN	GND	2.7 KOHMS TO GND	GND-OPEN
2 MINUTE	OPEN	GND	6.8 KOHMS TO GND	GND-OPEN
5 MINUTE	OPEN	GND	15 KOHMS TO GND	GND-OPEN
10 MINUTE	OPEN	GND	39 KOHMS TO GND	GND-OPEN

TABLE 3 MODE	P1	P2	P3	ST
RETRIGGERABLE (DEFAULT)	GND	GND	2.7 KOHMS TO GND	GND-OPEN
SINGLE PULSE	GND	GND	6.8 KOHMS TO GND	GND-OPEN
RESTORE ALL DEFAULTS	**GND**	**GND**	**GND**	**GND-OPEN**

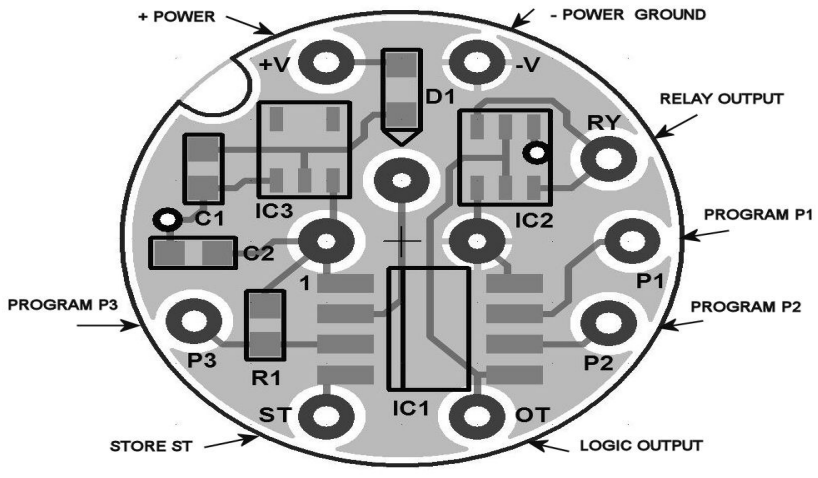
Soldering_____

When soldering to the PC board, use a small soldering iron of about 25 watts and small diameter solder with rosin core or no-clean flux. Touch the tip of the iron against both the wire and the board metal where the wire touches the metal and apply solder between the tip of the iron and the board metal. The solder will melt where it touches the iron and immediately flow onto the wire and the board metal and it will then help to transfer heat to the joint. You can now apply a little more solder to other areas of the joint if necessary.

Do not apply just heat to one side of the joint and solder to other side as some soldering instructions tell you to do as this will result in overheating of the joint before the solder melts, burning the flux and oxidizing the solder. Use lead free solder for applications that require RoHS compliance.

Assembly instructions _____

If high output current to a remote load is not required, a modular telephone jack having wire leads can be connected to the DP-001A so that a standard four or six-conductor telephone cable can be plugged into it. A similar jack on the other end of the cable will make a completely pluggable system with changeable cable length.



The backside of the module is shown with the power terminals at the top.

Use #22 or smaller wire for power and output conductors. Solid wires can be used for short interconnects to another circuit board. Stranded wire is preferred for longer cables and remote mounting of the module.

Connections to program terminals are required only during programming.

Installation

The small < 3/4 inch round shape of the DP-001A module allows it to be mounted in a 3/4 inch (19mm) ID tube or cylinder, however it can be mounted in any type of enclosure. It can be held in place by a flange, a rubber grommet around the sensor or by adhesive. A notch on the edge of the module board indicates the position of the sensor. The notch should be positioned at either the top or bottom so that the sensor window is horizontal for high sensitivity to horizontal motion. A Fresnel lens can also be mounted in a cylinder, making a very compact motion-sensing device that can be located remotely from the load or circuit that it drives. A plastic Fresnel lens that can be purchased separately will extend detection range

Power and output can be through a cable with a minimum of three conductors, two for power and one for output. Eight conductors will provide all remote functions including programming.

Testing

Connect a power source to the PC board power terminals +V and -V. Connect a light emitting diode in series with a 150 ohm resistor from the logic output terminal OT to –V (ground). The LED will light when motion is sensed. Allow at least 15 seconds for the circuits to stabilize after applying power. The sensor will detect a hand moving toward either side of center at a distance of about eight inches without a lens and with medium sensitivity. Range can be extended with a Fresnel lens. See www.glolab.com/focusdevices/focus.html.

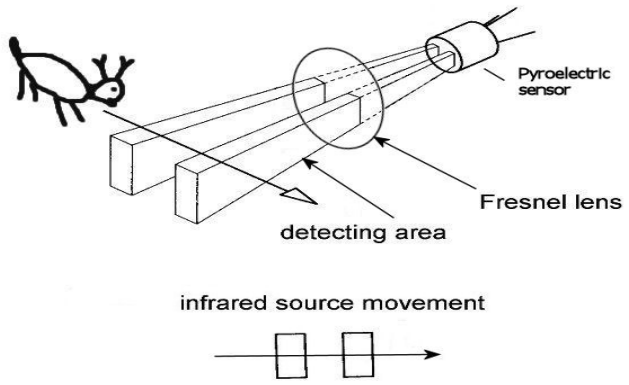
The PIR sensor is sensitive to fast temperature changes especially at high sensitivity settings and will produce multiple outputs after it is touched or otherwise exposed to heat or cold. It should be protected from warm or cold air movement from an air conditioner, heating system, open window or other moving air sources. The sensor will stabilize in about one minute after the source of temperature change has been removed.

DP-001A applications

1. **General security devices and motion detection of humans or animals**
2. **Video camera and recorder activation**
3. **Camera shutter trigger**
4. **Child or animal monitoring**
5. **Automatic lighting**
6. **Annunciation**
7. **Direction sensing**

Pyroelectric Sensor

The Digital Pyro® pyroelectric infrared sensor in the module has two elements connected in a voltage-bucking configuration. This arrangement cancels signals caused by vibration, temperature changes within the sensor and sunlight. An animal or human passing in front of the sensor will activate first one and then the other element as shown in figure 1 whereas other sources will affect both elements simultaneously and be cancelled. The radiation source should pass in a horizontal direction so the elements are sequentially exposed to the IR source. The sensor also has a built-in infrared filter window. Detection angle without a lens is 100 degrees. A lens will reduce or increase this angle, depending on the type used.



The Digital Pyro will produce an output when one of its sensing elements is exposed to infrared radiation more than the other.

This occurs when a radiating body moves in a horizontal direction in front of the sensor and the sensor is placed with pins 1 and 2 on a horizontal plane.

FIGURE 1

The sensor will respond to a moving body only; it will not detect a stationary infrared source, however it is sensitive to fast temperature changes and might produce false responses if not covered by a lens or IR transparent window. The detection range can be extended by placing an infrared Fresnel lens in front of the sensor. The lens can be mounted in an enclosure with its grooves facing inside. A lens might reduce the sensor's detection angle. **The front of the sensing elements within the TO5 housing are spaced an optical distance of 0.026 inch (0.7mm) from the outside face of the sensor window**.

Detection range depends partly on environmental conditions. The pyroelectric sensor in the module will detect a human or animal more easily at lower ambient temperatures when there is a greater difference between the human or animal body temperature and surrounding objects. Sensitivity can be programmed to meet application requirements.

Applications_____

Driving a LED from the logic output. LED will light when the output is at a logic high level. The LED will be off when no motion is detected and will go on when motion is detected. A piezo buzzer that will operate at 3 volts can also be connected from the logic output to –V.

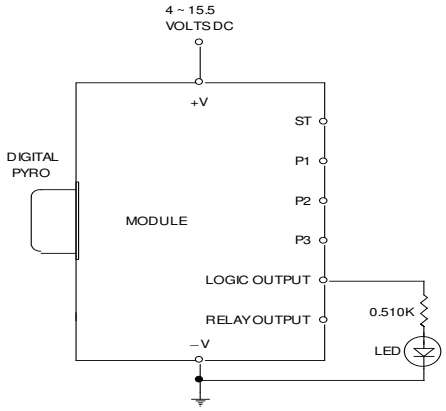


Fig AP1

Driving a microprocessor or other circuit. The logic output will be at 0 volts with no motion and will go to +3.5 volts when motion is detected. It will remain at +3.5 volts during the dwell timeout.

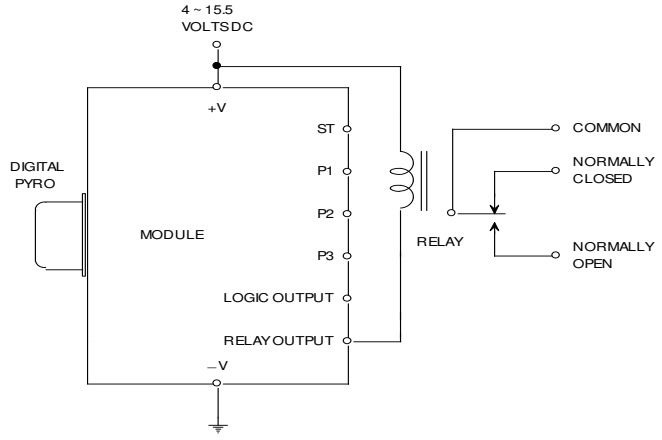


Fig AP2

Driving a relay. The relay can be powered by the same source as the DP-001A module or by a separate source of voltage either lower or higher than the voltage that powers the DP-001A. If separate power sources are used, the negative side of both should be connected together and to –V (ground). The maximum voltage that can power a relay or other load is 28 volts.

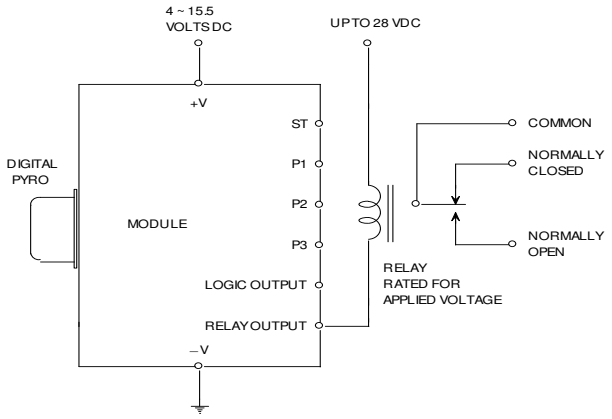


Fig AP3

Driving a vibrating motor to provide a physical annunciation of a motion event. The vibrating motor can be remote from the DP-001A module, connected by wires. This is useful where an audible or visible indicator is not appropriate such as when detecting an approaching animal.

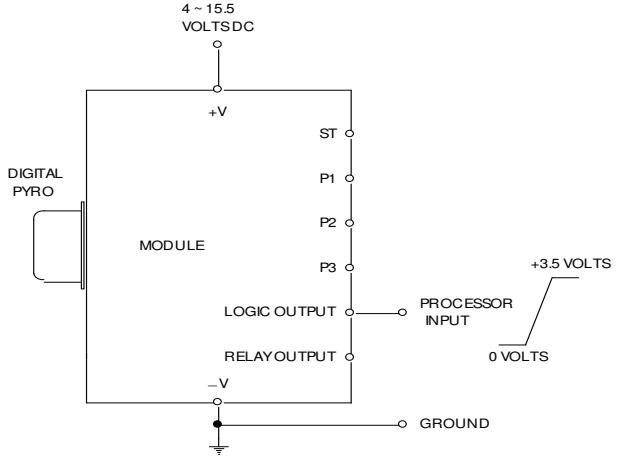


Fig AP4

Driving one relay with three DP-001A motion detector modules. Multiple modules can be used to look in different directions and activate one relay or other type of load. The relay will be energized when any one or more of the DP-001A modules detects motion. The diagram shows a relay powered by the same voltage as the module. However, the relay can be powered by a separate power source of up to 28 volts. Only the relay outputs from two or more modules can be connected together. Logic outputs cannot be connected together.

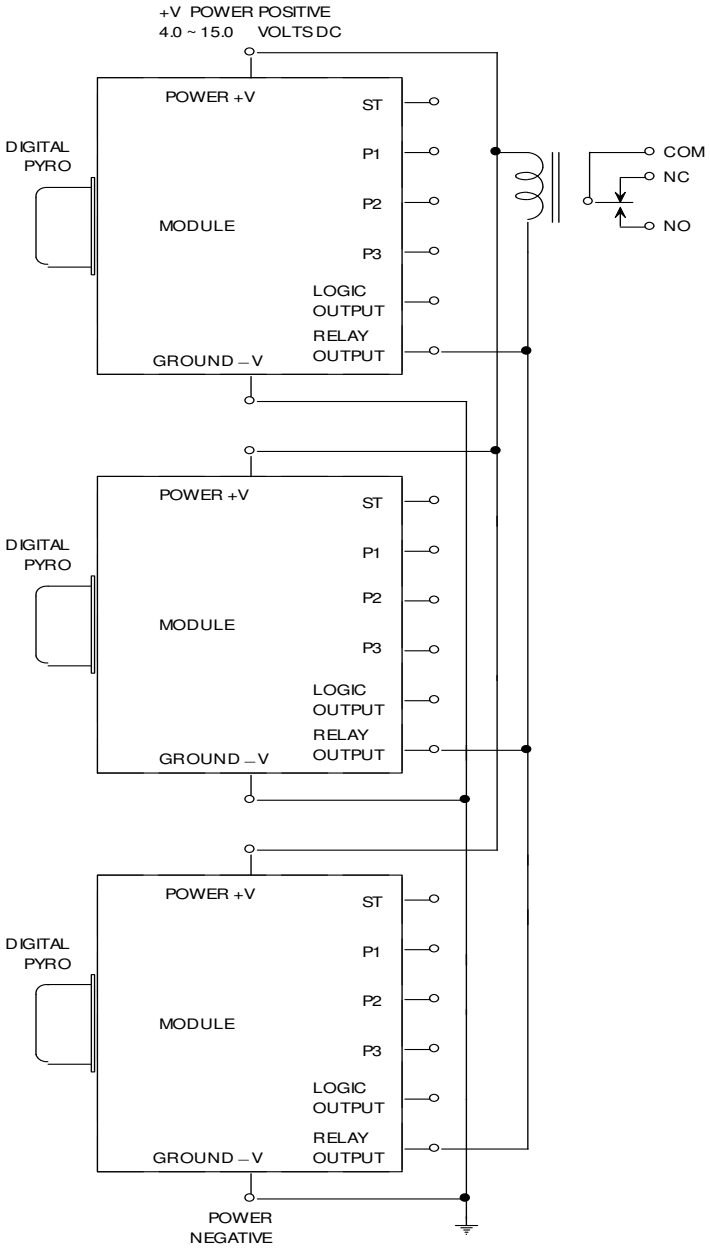


Fig AP5

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