IR Linear Distance Measuring Sensor Technology (IRLI)
Functional Description:
The ultimate high performance infrared proximity sensor, providing better accuracy and wider range

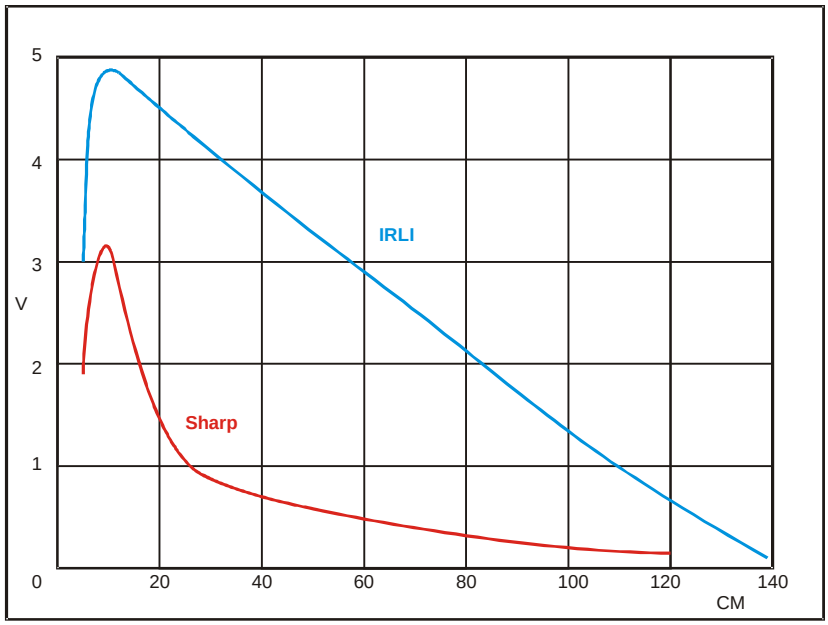
IRLI technology was developed to enhance standard Sharp analog infrared distance sensor technology.

The Sharp models and specifications indicated below are available with the IRLI upgrades for the improved distance measurement ranges indicated:

Sharp Model	Range	XJ Design Model	Range
GP2D120XJ00F	4-30 CM	IRLI-60	4-60 CM
GP2D12	10-80 CM	IRLI-D140	10-140 CM
GP2Y0A21YK	10-80 CM	IRLI-140	10-140 CM
GP2Y0A02YK	20-150 CM	IRLI-300	20-300 CM

Sharp GP2Y0A21YK

Sharp GP2Y0A02YK



Signal Comparison Graph

Autonobot Control Systems, 10 Capella Court, Suite 200, Ottawa, Ontario, K2E 7V6
Tel: 613.228.6833, Fax: 613.729.1536,
email: solutions@autonobot.ca, www.autonobot.ca

Features

IRLI-300P

Outstanding Range:
IRLI technology provides double the useful range of a similar standard Sharp sensor.

Excellent Resolution:
At long range IRLI technology provides at least 10 times the resolution and sensitivity of a similar Sharp sensor.

Improved Linearity:
The analog output of IRLI technology provides dramatically linear compared to a similar standard Sharp sensor (voltage is directly proportional to distance).

Increased Signal Voltage:
The output signal from IRLI technology is increase twofold when compared to the output of a standard Sharp sensor, allowing A/D converters to use their full resolution.

Flexible Connection:
IRLI sensors have 3 alternative connector choices:

- 3-pin metric connector compatible with Sharp sensors
- 3-pin connector on .1" centers compatible with Phidget cables
- Standard stereo audio jack for use with off-the-shelf audio cables

Drop-In Replacement:
The IRLI integrated sensors are direct replacement for similar standard Sharp sensors. Simply plug it into the same cable for improved performance.

Impervious to High Ambient Light Levels:
Performance is not affected by ambient light, sun, incandescent or fluorescent

Analog Output Signal:
Analog signals are:

- Usually easy to handle in software where no communications protocol is needed.
- Always available for instantaneous reading. This can improve processing speed in time sensitive algorithms such as wall following.
- Easy to troubleshoot and calibrate using a simple voltmeter
- Easy to connect as they only need 3 wires; power, ground and signal.

Autonobot Control Systems, 10 Capella Court, Suite 200, Ottawa, Ontario, K2E 7V6
Tel: 613.228.6833, Fax: 613.729.1536,
email: solutions@autonobot.ca, www.autonobot.ca

IRLI Specifications:

The IRLI Infrared Linear distance sensor is based on beam triangulation technology. Its output is an analogue voltage roughly linearly proportional to distance.

0 V = 10 cm
5 V = 300 cm

IRLI-300P

Electrical Characteristics

Parameter	Min	Nominal	Max	Units
Sensor Distance Range IRLI-140	10		140	cm
Sensor Distance Range IRLI-300	20		300	cm
Signal Voltage Range	0		5	V
Sensitivity		36		mV/cm
Power Supply Voltage Requirements	4.5	5.0	5.5	V
Power Supply Current Requirements		.02	0.03	A
Output Current			10	mA
Frequency Response – filtered		50		Hz

Physical Characteristics

Parameter	Description
Interface	3-pin connector 2mm pitch
Size IRLI-140	44.5mm L x 25mm W x 20mm H
Size IRLI-300	44.5mm L x 25mm W x 25mm H
Size IRLI-140P	67.3mm L x 35mm W x 25mm H
Size IRLI-300P	67.3mm L x 35mm W x 30mm H
Mounting Method	Two 3.2mm Holes 37 mm apart
Mounting Method (P versions)	Two 15mm x 3.5mm Slots 57.8mm apart
Shock Survival	50g
Operating Temperature Range	-10 to +60 deg C

Autonobot Control Systems, 10 Capella Court, Suite 200, Ottawa, Ontario, K2E 7V6
Tel: 613.228.6833, Fax: 613.729.1536,
email: solutions@autonobot.ca, www.autonobot.ca

IRLI Technology FAQ

1. Why is increased range important in robotics?

- IRLI technology allows the sensor to determine the distance to the furthest possible obstacle or wall. With shorter-range sensors, a full-scale reading may result in ambiguous data. For example, in a robotic application located in an 8' maze, a full-scale reading could indicate that the wall is far away or it may also mean the light beam has reflected away from the sensor. With an IRLI sensor, a full-scale reading can only mean the wall is at too acute an angle to reflect back to the sensor. This eliminates one uncertainty in interpreting the data.

- The ability to measure the length of any corridor or room up to 3 meters, as provided by IRLI technology, makes it much easier to map an unknown maze.

- Obstacles and objects can be located by simply scanning an IRLI sensor around a room

2. Why is high resolution important?

- Low resolution limits the accuracy of distance measurements. Using a Sharp sensor at its rated range, feeding a 10-bit A/D, results in an uncertainty of 40 mm. The sensor may be getting closer to a wall, but the A/D reading doesn't change at all for 40 mm. IRLI technology reduces this uncertainty to about 1mm.

- If you want to determine whether a vehicle is parallel to a wall by measuring the distance at the front and the rear of the vehicle, and there is an uncertainty of 4 cm in each reading, it results in a possible angular error of +- 11 degrees. You could actually be moving towards a wall at 11 degrees when calculations tell you the vehicle is moving away at 11 degrees. This could easily confuse a wall following algorithm. IRLI technology reduces this uncertainty to about 0.3 degrees.

- If you use multiple readings from a single sensor to determine if you are running parallel to a wall, the error is reduced by half, but the uncertainty is still large enough to make accurate wall following difficult. Again, IRLI technology solves the problem.

- If you need to be able to follow either the left or right wall in a relatively wide room, having good accuracy at long range is vital. IRLI technology allows a single sensor to be used for all wall following requirements.

3. Why is improved linearity important?

- Calculating distance in engineering units (in, mm) is much easier to perform when the signal is directly proportional to distance. With the linearity of IRLI technology programming is dramatically simplified.

- If the signal is non-linear, readings lose precision at one end of the range. Compensating for this by using a higher resolution A/D can be expensive and electrical noise becomes a

Autonobot Control Systems, 10 Capella Court, Suite 200, Ottawa, Ontario, K2E 7V6
Tel: 613.228.6833, Fax: 613.729.1536,
email: solutions@autonobot.ca, www.autonobot.ca

bigger problem. IRLI technology improves performance of any A/D, including high resolution A/D's.

- In robotic algorithms such as "wall following", the error from desired position is not symmetrical for non-linear sensors. This means that an optimal algorithm might correct in different ways when traveling too close to a wall vs. to far. Since IRLI technology is symmetrical, it simplifies programming by allowing either error to be handled the same way with just a sign change (+/-).

4. Why is increased signal voltage important?

- If the maximum signal voltage is only half of what the A/D is capable of measuring, the accuracy of the reading is also only half what it could be. The sensor power supply is 5V and is typically used in systems where the A/D can read 5V signals. It is much easier to attenuate the signal if it is too large, than to amplify it if it is too low. IRLI technology provides a standard 5V signal range.

Application Tips

Mounting the sensor vertically allows it to be mounted as far forward as possible to detect the end of a wall at the earliest time.

Since the sensor is not very useful at very short range, the sensor may be mounted back from a vehicle edge, so the non-usable range is taken up across the vehicle and the sensor can detect objects or walls very close to the edge of the vehicle.

For example, if the vehicle is 20 cm wide and the deadband is 20 cm, the sensor may be mounted on the left side of the vehicle, but pointing to the right. This allows measurement right up to the edge of the vehicle.