



Overview

Distech Controls distributes an innovative line of wireless battery-less sensors and switches intended for use with its Open-to-Wireless ready controllers. Distech Controls also offers a Wireless Receiver, which enables these controllers to receive wireless input signals. With wireless communication, users have the freedom and convenience to place and move sensors and switches anywhere within the receiver range limits without worrying about wiring, drilling, or disrupting the visual look of a space.

Distech Controls' wireless battery-less devices can "harvest" the smallest amounts of energy from a variety of sources. Most sensors create energy from ambient building light sources, through solar cells. These cells require only 4 hrs/day of charging to operate in total darkness for over 72 hours making them a perfect solution to reduce operational energy and maintenance costs. If necessary, batteries can be used as a backup precaution (battery lifetime can vary from 5-10 years depending on battery aging and self-discharge rate). Switches on the other hand, are powered by the actual pushing of the switch button, otherwise known as a motion converter.

Applications

- Perform building retrofits with minimal impact on architecture and materials.
- Install wireless devices on any surface, such as glass, brick and stone.
- Support open spaces that undergo frequent changes in layout or require seasonal displacement.
- Expand controller input count.

Features & Benefits

- A wide variety of wireless battery-less sensors and switches suited to many applications.
- Latest in energy harvesting technology to take full advantage of pre-existing latent building energy sources for power. This environmentally sound solution requires no external power source for sensor operation.
- Designed to work reliably to communicate with the controller through a low-power wireless communication protocol, reducing its power consumption and extending its operational lifetime.
- Easily installed since there is no need for external wiring or associated drilling.
- Easy to configure & commission thus requiring minimal training.
- Multiple cost savings, such as in:
 - Installation costs (wiring, drilling, and time)
 - Operational costs (no power supply)
 - Maintenance costs (maintenance-free)
 - Displacement costs (can be easily moved from one location to another)

Energy Harvesting

Energy harvesting is the process of procuring small amounts of energy from various sources to be converted as a source of power or energy by one element. This process of energy conversion can take the form of motion conversion, solar conversion, thermal conversion, rotation conversion and vibration conversion.

Most of the sensors offered use solar conversion through small solar cells. These solar cells use the light absorbed from nature – the sun – and artificial sources, such as lamps, etc. Light switches use motion conversion through an electrodynamic energy converter.

Mounting Location for Radio Transmission

When installing the wireless equipment, it is important to ensure that distances and obstructions do not impede transmission. Metallic parts, such as reinforcement in walls, machinery, office furniture, etc. are major sources of field strength damping. Furthermore, fire-safety walls, elevator shafts, staircases and supply areas should be considered as complete transmission screens (*Figure 1*). As a rule of thumb and in normal conditions, the equipment will transmit over a distance of 30 meters (98 feet) in a normal environment. Also, it is important to note that radio transmission shapes an ellipsoid and therefore the transmission range is greater in wide halls than in narrow corridors.

Even under those conditions, Distech Controls strongly advises to check actual transmission quality using a “field strength meter”. One such meter is the EPM300 field strength meter. This unit tests the actual transmission strength and the quality of the received data. Field strength tests are ideally conducted with two installers (one sending a signal from a transmitter such as a light switch and one receiving the signal with the EPM300), however the EPM300 can also be set to hold a received signal so that a single installer can send a signal and then go to the EPM300 and check if it was received. Ideally installers use a pair of EPM300 meters to take advantage of their Repeater and Radio Link Test modes. The tests previously described are for determining a suitable location for a wireless receiver, however the EPM300 can also be used to determine the optimal location of a repeater and transmitter. Please check the EPM300 datasheet for further information on using this device.

In addition to obstructions, the angle with which the transmission travels through the obstructions has a major influence on the field strength. So the steeper the angle through an obstruction the more the field strength dampens (*Figure 2*). Therefore it is preferable that the transmission should be arranged so that it travels straight and perpendicularly through the obstruction. Wall niches should be avoided as well. Other factors that restrict transmission range include:

- Sensors or switches mounted on metal surfaces (up to 30% loss of transmission range)
- Hollow, lightweight walls filled with insulating wool on metal foil
- False ceilings with panels of metal or carbon fiber
- Lead glass or glass with metal coating, steel furniture

The sensor mounting location should not be on the same wall or plane as the receiver. Radio waves are rather subject to interfering leaks or reflections (*Figure 3*). Side or opposite walls are better locations.

Unrelated transmitters such as computers, audio and video equipment that also emit high-frequency signals, should be more than 0.5 meters (1.7 feet) from the receiver to avoid possible interference (*Figure 4*).

Repeaters are wireless devices that help deal with the problems mentioned above. A repeater receives transmissions and resends an amplified transmission to the receiver (*Figure 5* & *Figure 6*). This way, the transmission range can be increased and obstacles can be bypassed.

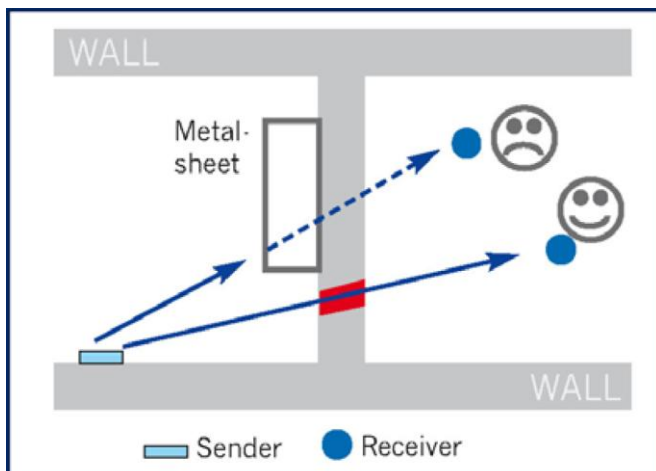


Figure 1: Screening of radio wave

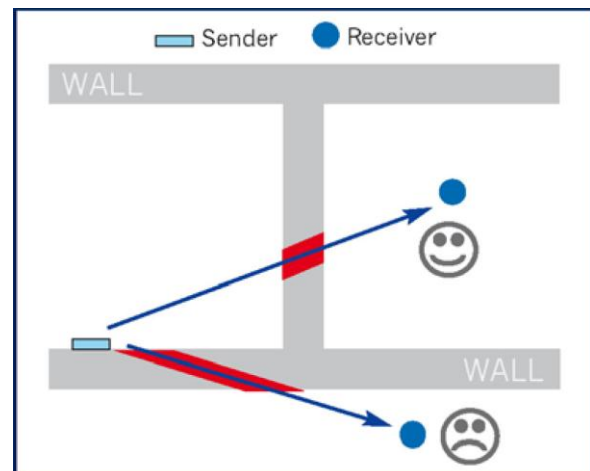


Figure 2: Angle of radio wave

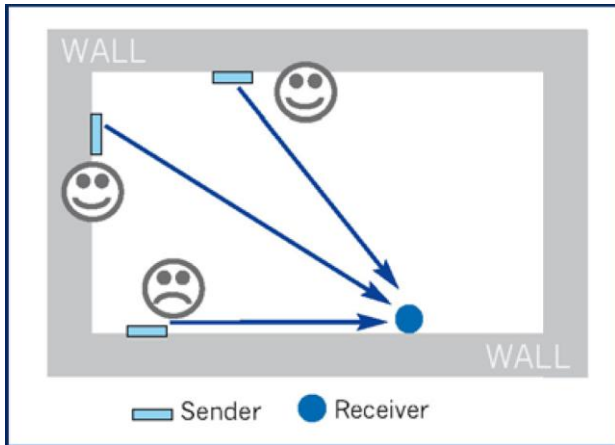


Figure 3: Radio wave along the wall

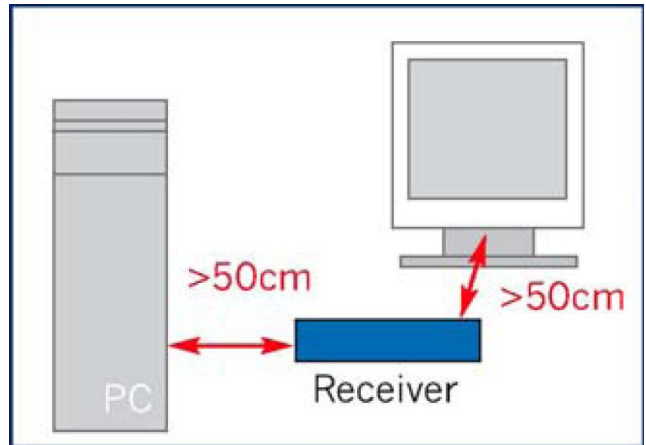


Figure 4: Distance to interference sources

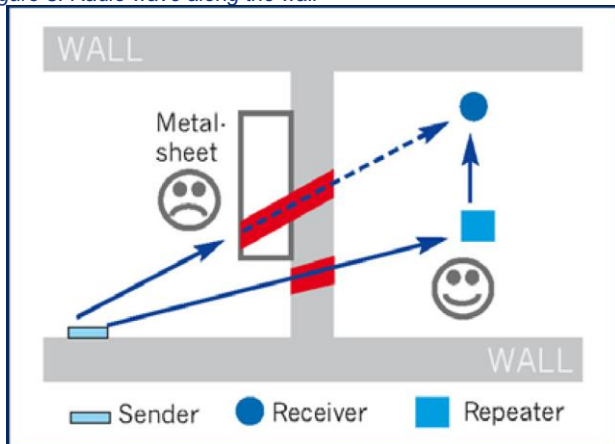


Figure 5: Use of repeaters

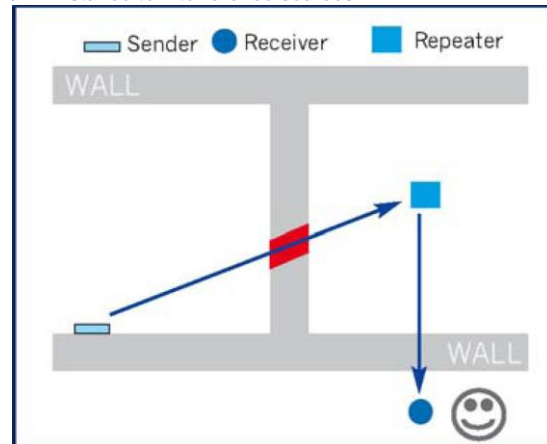


Figure 6: Use of repeaters

Average Transmission Range

Line of site in building	Typically 30m (98 feet) in corridors and 100m (328 feet) in halls
Gypsum/wood walls	Typically 30m (98 feet) through maximum 5 walls
Ferroconcrete walls/ceilings	Typically 10m (32 feet) through maximum 1 wall/ceiling

Since wireless temperature sensors are not required to update the controller at high rates, the 868.3MHz and 315MHz radio channels are selected for short-term data transmission. The information is transmitted using incoherent amplitude modulation (ASK) to enable the implementation of very efficient energy-saving transmitters since only the "1"-bits are transferred.

Using very short messages enable the operation of a large number of senders within the same radio cell; the error rate caused by collisions remains extremely low. Statistically viewed, the transmission reliability is still greater than 99.99% in the case of 100 radio sensors that transmit once every minute. This means that even large office buildings or industrial facilities can be equipped with a large number of wireless battery-less sensors.



Any metallic obstruction should be avoided. Elevator shafts, electric risers and metal enclosures, for example, are major obstacles for wireless transmission.

Mounting Instructions

Wall mounting is accomplished by fastening the sensor base plate to a flat wall surface by means of the adhesive tape included. If required, the base plate can also be installed using appropriate screws. Finally, the sensor is put on the sensor base plate.

The sensor, as supplied, is operational. However, it may be necessary to recharge the solar cell accumulator after an extended time in darkness. In principle, the recharging process is done automatically during the first operating hours in daylight.

Mounting Location for Solar Energy Storage

Wireless sensors enabled with solar cells utilize energy converted from natural and artificial light for their daily operation. All sensors, except for the motion detector model #41-580, store energy so they can continue to operate in the absence of sufficient light. Due to energy-optimized wireless technology, our wireless devices use a solar cell to supply the necessary energy to operate. To meet special requirements concerning correct and sufficient ambient brightness, it is necessary to observe certain basic conditions when selecting the mounting location:

- A minimum illumination of 200lx should be available to the sensor for at least 4 hours everyday with artificial lighting (fluorescent light) or for at least 3 hours everyday with natural light (sun light). Or, a minimum illumination of 260lx should be available to the sensor for at least 3 hours everyday with artificial lighting (fluorescent light). Most health and safety workplace standards require a minimum illumination of 500lx in office workplaces. Refer to the table below for a typical brightness level at different establishments. A Lux-Meter is highly recommended to be used for selecting the location that best meets this requirement.
- Total illumination should not exceed 1000lx for long periods.
- When illuminating the sensor with direct artificial light such as spotlights, the angle of incidence relative to the solar cell should not be too steep.
- Placing the sensor under direct sunlight must be avoided if it leads to inaccurate temperature measurements caused by heating from the sunlight.
- The sensor should be positioned in keeping with the use of the room and it should be mounted in such a way that no obstructions come between it and the light source.
- The sensor should be positioned within reception range of the intended controller.
- An increase in the sending rate of the wireless device will require more energy and thus more illumination.



The 41-580 motion detector is equipped with a solar cell, but does not store energy. It requires 80lx continuous illumination to operate. Refer to the datasheet for more information.

Typical Brightness Levels (lx)

Illumination Area	Type Destination / Workspace	Typical Brightness (lx)
Home	Usually	100 – 500lx
Schools	Corridor	100 – 300lx
	Classroom in general	300 – 750lx
Offices	Reading room, laboratory	500 – 1500lx
	PC room, working at PC	200 – 500lx
	Meeting room	300 – 700lx
	Canteen	150 – 300lx
	Corridors	50 – 100lx
	Reception	300 – 700lx
	Restroom	100 – 300lx
Factories	Production hall	500 – 1500lx
	Development, office	300 – 750lx
	Design CAD	500 – 1500lx
	Laboratory, inspection work	750 – 1500lx
	Packaging of products	150 – 500lx
	Storage	100 – 300lx
Hospitals	Visitor room	300 – 500lx
	First aid, surgery	500 – 1500lx
	Bedroom	100 – 300lx
	Pharmacies	500 – 1000lx
Hotels	Wash rooms	150 – 300lx
	Reception	200 – 500lx
	Entrance area	100 – 300lx
	Restaurant	150 – 300lx
	Restroom	100 – 300lx
	Bars	50 – 150lx
	Corridors	50 – 100lx
Stores	Staircases	50 – 150lx
	Saleroom	300 – 1000lx
	Show room	500 – 1500lx
	Packaging area	200 – 300lx
	Lounge	300 – 500lx
Trade Show	Conference room	300 – 700lx
	Booth	300 – 500lx
Sports Arena	Indoor area	200 – 500lx

Charging Guidelines of the Solar Energy Storage

For devices with solar energy storage:

When these devices are stored in darkness for a long period, the solar-powered energy storage will be drained and must be fully charged prior to use. In principle, this can be done by either fully charging the device in a single day (refer to the table below) or by placing it in operation (at an environment where light is available 7 hours @ 200lx) for 3 consecutive days. Notice that the device might take some charge time (30-60min) before it is able to transmit its first signal. Once the device is charged, maintaining it would only require a daily exposure of 4 hours at 200lx.

After initially charging the wireless sensor, it is ready to be used. It is recommended that the sensor be exposed to a minimum of 4 hours at 200lx daily, which is sufficient to last for the next 72 hours under darkroom operation. Non-compliance with the minimum daily recharge requirement may result in the wireless sensor's complete discharge and its inability to continuously update the controller.

For locations where the minimum daily exposure is not always ensured, it is recommended to use a 3.6V Lithium battery (3.6V SAFT Type LS 14250, 1/2AA) to maintain constant communication between the sensor and the controller. Unlike other products on the market, the battery is only utilized as a back-up that is engaged when the sensor is discharged while operating in the absence of light.

Approximate Initial Full-Charging Time

Number of Continuous Hours	Brightness Level (lx)	Number of Continuous Hours	Brightness Level (lx)
18	200lx	7	600lx
11	300lx	5	800lx
9	400lx		

Open-to-Wireless Wireless Receiver



Wireless Receiver (868)	Receiver for 868.3MHz wireless-enabled sensors and switches
Wireless Receiver (315)	Receiver for 315MHz wireless-enabled sensors and switches

Compatible Sensors and Switches




When connected to the Wireless Receiver, Distech Controls' LONWORKS® and BACnet® Open-to-Wireless ready controllers can receive wireless input signals, in both 315MHz and 868.3MHz frequencies, from the devices listed in the table below. Many other devices not listed below can also be supported. For the LONWORKS controllers to support other devices, they have to use the same data telegram format. For details on how the BACnet controllers can support other devices, refer to the *EC-gfxProgram User Guide*.

Model	Description	LONWORKS	BACnet
ECW-Sensor	Room temperature sensor, wireless and solar cell powered.	■	■
ECW-Sensor-O	Room temperature sensor, wireless and solar cell powered with occupancy override.	■	■
ECW-Sensor-S	Room temperature sensor, wireless and solar cell powered with setpoint adjustment.	■	■
ECW-Sensor-SO	Room temperature sensor, wireless and solar cell powered with setpoint adjustment and occupancy override.	■	■
ECW-Sensor-SOF	Room temperature sensor, wireless and solar cell powered with setpoint adjustment, occupancy override, and fan speed selection.	■	■
SR04 RH	Room humidity and temperature sensor, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■
SR04P RH	Room humidity and temperature sensor, wireless, solar cell powered with setpoint adjustment. Complete with battery holder (battery can be ordered separately).	■	■
SR04PT RH	Room humidity and temperature sensor, wireless, solar cell powered with setpoint adjustment and override. Complete with battery holder (battery can be ordered separately).	■	■
SR04P MS RH	Room humidity and temperature sensor, wireless, solar cell powered with setpoint adjustment and slide switch O/I (on/off). Complete with battery holder (battery can be ordered separately).	■	■
SR65 AKF Series	Duct temperature sensor, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■


Compatible Sensors and Switches (continued)

	Model	Description	LONWORKS	BACnet
	SR65 TF Series	Cable temperature sensor, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■
	SR65 VFG	Surface temperature contact sensor, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■
	SR65	Outdoor temperature sensor, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■
	PTM 265	2 channel light switch, wireless, powered by electrodynamic conversion, white, North American style.	■	■
	PTM 265D	4 channel light switch, wireless, powered by electrodynamic conversion, white, North American style.	■	■
	2-channel light	2 channel light switch, wireless, powered by electrodynamic conversion, white, European style.	■	■
	4-channel light	4 channel light switch, wireless, powered by electrodynamic conversion, white, European style.	■	■
	S2HWH	4 button handheld remote, wireless, powered by electrodynamic conversion, white.	■	■
	SRW01 ¹	Door/window contact sensor, wireless, solar cell powered.	■	■
	MC-17	Door/window contact sensor, wireless, solar cell powered.		■
	C2AWH	Key card holder, wireless, powered by electrodynamic conversion. When the key card is inserted into the dock or removed from it, a wireless signal is transmitted to enable or disable power consuming services in a room (HVAC, lights, etc.).		■
	SR-MDS	Motion detector and light sensor, wireless, solar-cell powered, for room occupancy detection and/or lighting applications.		■
	MOS-17	360° motion detector, wireless, solar cell powered. For auto lights on and off. Complete with battery holder (battery can be ordered separately).	■	■
	41-580 ¹	360° motion detector, wireless, solar cell powered (no energy storage – requires minimum 80lx continuous to operate). For auto lights off only.	■	■
	41-301 ¹	360° motion detector, wireless, powered by 24VAC or 230VAC. For auto lights on and off.	■	■
	SR65 LI	Outdoor light sensor, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■
	SR65 DI	Digital input (2-wire dry contact) for potential-free contacts, wireless, solar cell powered. Complete with battery holder (battery can be ordered separately).	■	■

Compatible Sensors and Switches (continued)

	Model	Description	LONWORKS	BACnet
	R12GP	Plug-in relay (120VAC), wireless.	■	■
	ERPT Repeater Series	Low voltage & high voltage repeaters for out-of-range sensors, wireless, powered by 24V or 120/277V or 120/347V. Due to high voltage, check with local authorities before installation.	■	■
	SRE Repeater ¹	Low level amplifier for out-of-range sensors, wireless, powered by 230VAC. Due to high voltage, check with local authorities before installation.	■	■

Test and Validation Tools

	EPM 300	Field strength meter for finding optimal mounting place for transmitter and receiver.	■	■
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1. Only supported in 868.3MHz transmission frequency.

Countries Where Wireless Devices Meet Transmission Norms

Region	868.3MHz	315MHz	Additional notes
America			
– USA, Canada ¹		Yes (every 6.5s)	868.3MHz meets transmission norms, but is not supported. Refer to <i>Tech Note # 123</i> for more details.
– Brazil, Colombia	Yes (every 6.5s) ²	Yes (every 6.5s)	
– Mexico	Yes (every 6.5s)		
– Argentina			Convergence to FCC expected
Europe			
– European Union: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom	Yes (every 0.4s) ³		
– Rest of Europe: Albania, Bosnia-Herzegovina, Croatia, Georgia, Monaco, Serbia, Turkey, Ukraine	■		
– Russia	In the process		Following R&TTE in process
Asia Pacific			
– New Zealand	■	■	
– Australia	■		Special license & fee necessary: www.acma.gov.au
– French Polynesia, Papua New Guinea, Tonga	■		
– China, Hong Kong, Taiwan		■	
– Bangladesh	■	■	
– India		■	FCC compliant equipment is accepted for type approval
– Japan		■	PTM200C does have MIC grant
– Malaysia	■		On special license, approval necessary: www.sirim.my
– Singapore	■	■	
– South Korea		■	Convergence to Japan expected
– Thailand		■	
– Vietnam	■	■	
Middle East			
– Saudi Arabia, Lebanon	■	■	
– UAE (Dubai, Abu Dhabi)	■	■	PTM200 does have TRA grant (868MHz)
– Israel		■	
– Kuwait, Oman, Jordan, Tajikistan	■		
– Bahrain		■	
Africa			
– Burkina Faso, Djibouti, Malawi, Mauritius, South Africa, Swaziland, Togo, Uganda, Zambia, Zimbabwe	■		
– Egypt			Approval necessary: www.ntra.gov.eg
1.	Distech Controls attained FCC and IC approvals for its 315MHz Wireless Receiver and recommends using this transmission frequency in North America. In fact, transmission in 868.3MHz must be avoided in North America because of a potential source of interference from trunk radio stations. Depending on the distance to the wireless installation, this interference may cause some disturbances to the wireless transmission. For more details, refer to <i>Tech Note #123</i> .		
2.	This is an FCC duty cycle regulation; 1 radio packet of a transmitter should not be sent within 6.5 seconds of the previous one.		
3.	This is an R&TTE duty cycle regulation; 1 radio packet of a transmitter should not be sent within 0.4 seconds of the previous one.		



This table should only be used as a guideline; it is not meant to be all-inclusive. Before starting an installation, please contact the proper local authorities.

General Specifications

Operating Temperature	-25°C to 65°C; -13°F to 149°F	Frequency	868.3MHz / 315MHz
Data Rate	120-125kbps	Transmission Power	Max. 10mW
Channel Bandwidth	280kHz	Transmission Range	100m line of sight; 30m between walls
Modulation Type	ASK		

Please take note that this document is intended to provide only an overview of the products included. Refer to the relevant documentation for more detailed information regarding these products. Distech Controls is not responsible or legally liable for any information contained in this document.

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Open-to-Wireless Solution Guide

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