Sensor Integration

Application Note

Introduction

Many projects will require the ability to link to realworld sensors e.g. temperature, ambient light or presence. These sensors can all be integrated in some way with a Pharos Control System.

Connectivity

There are various ways that sensors can be integrated, such as analog voltage, serial communications and DALI. Each communication protocol has certain strengths and weaknesses and typically the protocol chosen will be determined by the components in the Pharos System and availability of sensors.

Voltage Inputs

Pharos LPCs, EXTs and RIO 44/80s feature voltage inputs. These can be configured to receive either a digital voltage (On or Off) or an analog voltage (varying between a high and low). The exact voltages can be specified within Designer.
These inputs can be used with any sensor that outputs a voltage, or can adjust a voltage that is applied.

Examples:
A dimmer switch can be used to vary a supplied voltage such that the voltage received by another device (Pharos controller or remote device) with receive a varying voltage. This would be configured as an analog input.
Some sensors will output a voltage when a condition is true (e.g. presence is detected) and stop outputting when the condition is false. This would be configured as a digital input.

Contact Closure

The inputs on Pharos LPCs, EXTs and RIO 44/80s can also be configured as Contact Closure. In this mode the inputs will use a sensing voltage (5V) to determine the resistance between the two contacts of the input. The device can determine when there is an open circuit because the resistance is high (∞Ω) and a closed circuit when the resistance is low (0 Ω).

Example:
A standard light switch connected to an input (that is configured as Contact Closure) can be used as a trigger, the input will be high when the switch is open and low when it is closed.
Often simple presence sensors (PIRs) use a relay as their output. This relay could be connected to a Pharos controller as a contact closure type input.

Serial Communications

Pharos LPCs and RIOs are able to communicate using RS232 or RS485 and Pharos LPC Xs, EXTs, VLCs and VLC+s only support RS232.
There is no standard syntax for serial communications with a Pharos System, the exact commands to send and receive are configured within the Triggering for the project. As such the communications can be easily configured to match the other system or sensor involved in the communication.
There are many sensors and control systems available that communicate using a serial protocol.

Example:
Some RFID systems are available which can be configured to output a serial message when a nearby RFID tag is detected. Examples of these systems are door entry cards, meaning that the lighting in a room could be changed based upon the person whose entry card was used to open the door. The Pharos controller would be configured to receive a string from the entry system that identifies the RFID tag and then outputs the corresponding lighting state.

Ethernet Communications

All Pharos Controllers can be configured to communicate over TCP/IP, UDP or Multicast protocols. This enables the controller to communicate with other systems or sensors that can use these protocols.

Example:
Temperature sensors are available which can be configured to output the current temperature over an ethernet protocol to a receiver. The Pharos controller could be configured to receive the temperature and capture it to vary the colour of the lighting on the building that the temperature sensor is attached to.

DALI

DALI is a command based protocol that can be used to tell lighting fixtures to turn on or off or change levels. It can also be used to transfer data from a sensor or light fixture to the DALI controller. This DALI controller could be a Pharos Controls System containing a RIO D.
The DALI system could consist entirely of sensors reporting back to the Pharos system.

Example:
DALI ambient light sensors are available which can send a 0-254 value on the DALI bus as a Light Sensor message when the ambient light level changes. A DALI Input trigger within the Pharos system can be configured to receive the incoming light level value and use that to adjust the brightness of the lights within the installation.

Application Examples

The following are some sensor applications that have been encountered before, and the sort of sensors that were used.
Due to the ever changing nature of the market and variation between the exact requirements of a project, we cannot recommend any specific sensors for your situation, but we included are notes on what to look for when searching for a sensor.
If you require any further assistance, please contact Pharos Support.

I want to change the colour of my lighting based upon the temperature outside.

This application can be split into two parts:
1. Getting the data into the controller
2. Using the data to change the colour

1. There are many temperature sensors available, though many are components rather than fully formed devices that can be used externally. An examples of a sensor that has been used in the past is the Ethernet Thermometer made by TME, which can be setup to automatically send a HTTP request containing the temperature at regular intervals. Typically a sensor that can send a message to the controller would be preferable as that way the controller can receive the actual level and compare that against a range or specific values to determine how to proceed.

2. Once the temperature has been sent to the controller, it needs to be configured to receive the data, using a Serial or Ethernet input trigger. These can both be setup so that the level value is captured and it can then be used by a piece of Lua script to determine which colour to change the lights to, e.g. 0°-10° = Blue, 10°-20° = Purple, 20°-30° = Red. Obviously these ranges could be narrowed to increase the number of colours available, and the colours changed.

I want the lights along a path to light up as people pass certain points.

This application would require a series of sensors along the path to detect when people reach each point. Typically the sort of sensors used would be a break beam sensor (contact closure or digital input when a laser beam is interrupted) or a motion sensor/PIR (contact closure when an IR (heat) source is detected).

There are many appropriate sensors available for this scenario. When looking for a break beam sensor, the important specification to check is the rating of the output (and whether it is a relay/contact closure or digital output), as the inputs on Pharos controllers or Remote devices are rated to a maximum of 24VDC. Contact closures/relays must be rated at 5V 2.5mA or higher.

To configure this scenario within the Pharos programming, you would create a Digital Input trigger for each input which causes the required light/s to turn on when the trigger is fired.

I want to change my lighting based on the current weather.

There are fundamentally two ways to deal with this application.
1. A series of sensors that can be used together to determine whether it is raining, sunny, cloudy etc.
2. Integrating with an online weather API

We will cover solution 1 in this document.
You would need the sensors to cover the range of weather effects that you want the system to be aware of to change the lighting (e.g. rainfall, wind speed, wind direction etc.). These could be separate sensors, each connected into the Pharos system, or a weather station such as the Weatherhawk 232, which features wind speed, wind direction, air temperature, relative humidity, barometric pressure, solar radiation and rainfall sensors and ouputs the data over a single RS232 connection.
This data can be received by the Pharos system and analysed to determine the current weather, and affect the lighting based upon that.

Things to look out for

The main thing to be aware of is making sure that the sensor you are looking at can communicate in a way that the Pharos System can use.

Voltage Inputs

Ensure that your sensor's output rating is less than 24VDC, as this is the maximum voltage rating of the Pharos Inputs.

Contact Closure/Relays

Ensure that the sensor output is rated to receive 5VDC at 2.5mA. This is the sensing voltage used by the Controller or remote device.

Serial

The sensor or system should use RS232 or RS485 (exact requirements vary based on the controller being used), most Baud Rates, Stop bits etc. are supported by the Pharos controller.
Also be aware that LPCs, EXTs and RIOs use a 3 pin terminal connector for serial communications, while the LPC X, VLC and VLC+ use a 9 pin D-Sub connector.
Be wary of communications protocols that use checksums, handshakes or other additional requirements, as this increases the complexity of the communications.

Ethernet Communications

The sensor or other control system should use TCP, UDP or multicast based protocols for their ethernet communications. Examples of protocols that have been used in the past include HTTP, Telnet, PJLink and JSON.
Be wary of communications protocols that use checksums, handshakes or other additional requirements, as this increases the complexity of the communications.

Final Notes

If you come across a sensor that doesn't use any of these protocols or falls outside of the required voltage range, then you can generally find a converter to change from one protocol to another e.g. KNX to RS232 converters.
Please contact Pharos Support if you need any further assistance.