

# TekLink™

TL100 with Passive Infrared Sensing  
System Overview

Control Systems

CS



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## 1.0 Introduction

The **TekLink TL100 (with Passive Infrared Sensing)** coordinates luminaire light output based on daylight contribution and occupancy detection. The system offers the ability to meet ASHRAE 90.1-2010 requirements. This manual details the basic operating principles, features, component specifications, and wiring guide for TL100.



**2.0**

**Basic Operating Principles**

Kenall's TekLink TL100 control system with passive-infrared detection, reduces luminaire energy consumption via zonal occupancy detection and daylight harvesting by following these basic steps:

1. Mount sensors at vehicular and pedestrian entry/egress points
2. Run sensor wires to the lighting control module(s)
3. Run 0-10V dimming signal wires to the luminaires

System components briefly described below:

**Sensor**

Delivers daylight measurements and occupancy detection to control module



**Control Module**

Receives daylight and occupancy input from sensor(s), then dims the luminaire(s) accordingly

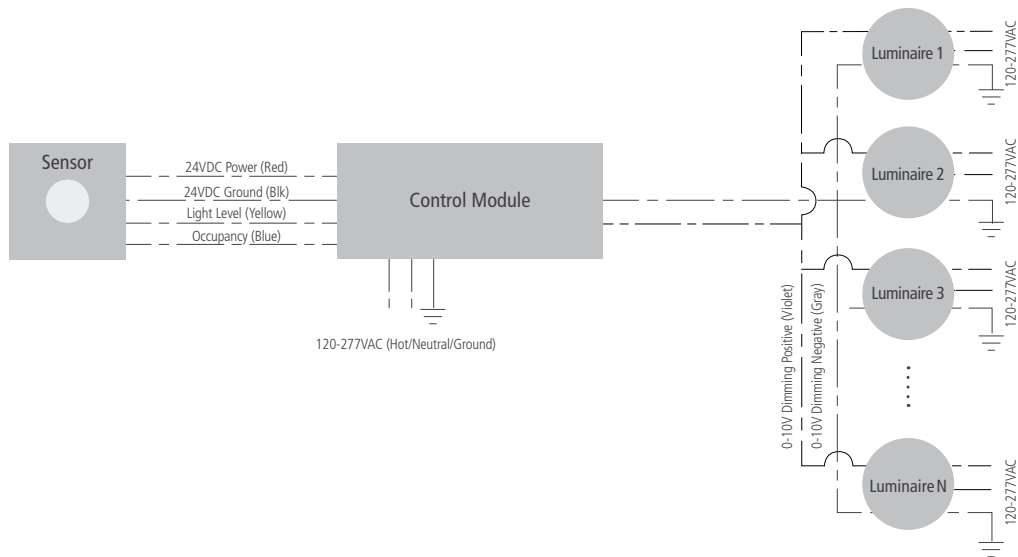


**Luminaire**

Light output adjusts to 0-10V dimming signal received from the control module

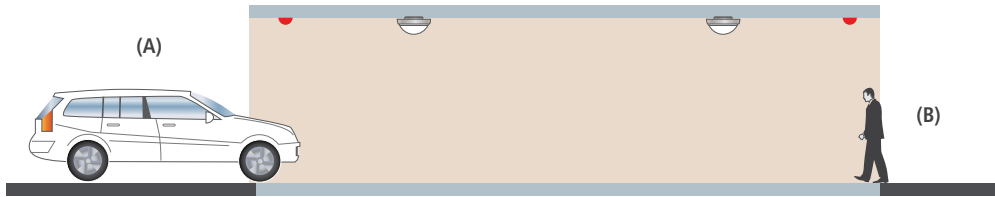


**Wiring Diagram**





### Brief illustration of general operation:



1. A vehicle (A) or pedestrian (B) enters the space
2. The system detects occupancy
3. Immediately, the tripped zonal light level is brought to the commissioned level (*further details in the following sections*)

**Note: Occupancy Only program will bring luminaires to 100% light output regardless of daylight contribution to the space**

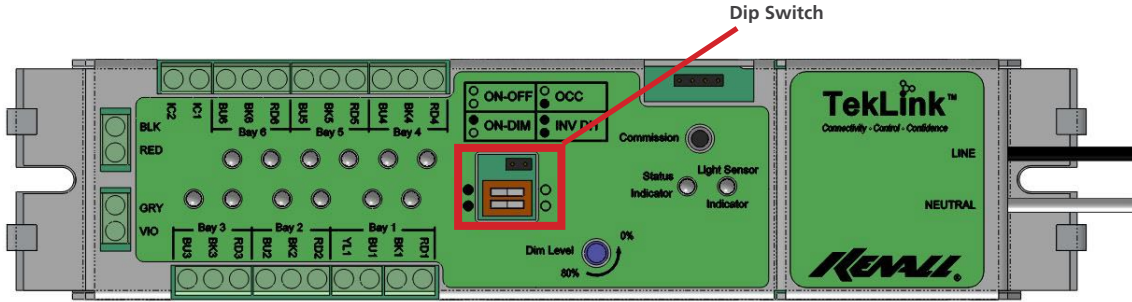


1. A vehicle (A) or pedestrian (B) exits the space
2. TekLink-IR system keeps the space illuminated at the commissioned light level until the sensor time-out period expires
3. The light level is brought into a Low-Level Standby Mode as the system enters a state of non-occupancy

**3.0**

**Normal Operation**

The TekLink TL100 control system offers four different programs to select from via a dip switch, each with a unique way of handling the system’s occupancy detection response to daylight.



Note: The Occupancy Only program is the default setting.

**Program #1: ON to Dim Daylighting**

During periods of occupancy, this program ensures the light level of the space (daylight and electric light combined) meets the commission light level. If daylight, by itself, lights the space above the commission line, then the luminaire(s) will dim to the **user selected dim-level setting** to save energy. During periods of non-occupancy, the Low-Level Standby Mode of this program can be summed up by the following equation:

$$\text{Low-Level Standby Mode} = \text{Dim Level Setting}$$

**Program #2: ON to OFF Daylighting**

During periods of occupancy, this program ensures the light level of the space (daylight and electric light combined) meets the commission light level. If daylight, by itself, lights the space above the commission line, then the luminaire(s) will dim to **0% light output** to save energy. During periods of non-occupancy, the Low-Level Standby Mode of this program can be summed up by the following equations:

$$\text{Low-Level Standby Mode} = \text{Dim Level Setting if } < \text{ Present Dim Level}$$

Or

$$\text{Low-Level Standby Mode} = \text{Present Dim Level if } < \text{ Dim Level Setting}$$

### Program #3: Occupancy Only

This program acknowledges occupancy detection but does not respond to daylight contribution into the space. During periods of occupancy, the luminaire(s) will deliver 100% light output. During periods of non-occupancy, the luminaire(s) will dim to the user selected dim-level setting to save energy. This program does not require commissioning.

### Program #4: Inverse Daylighting

This program is intended for vehicular entryways into parking decks. During daytime, the system will push the luminaires to 100% light output. At night, the system will dim the luminaires to the dim-level setting. This function is intended to help the eye adjust as the vehicle operator moves from an outdoor space into a covered space. Occupancy events are ignored in this mode.

Program Options

|          |   | On-Dim Daylighting | On-Off Daylighting | Occupancy Only | Inverse Daylighting |
|----------|---|--------------------|--------------------|----------------|---------------------|
| Features | Occupancy Detection                                   | X                  | X                  | X              |                     |
|          | Daylight Harvesting                                   | X                  | X                  |                |                     |
|          | Inverse Daylight Harvesting                           |                    |                    |                | X                   |
|          | Luminaires Always 'ON'<br>(Dim-Level Setting to 100%) | X                  |                    | X              | X                   |
|          | Sensor Time-Out<br>Adjustment                         | X                  | X                  | X              |                     |
|          | Sweep-Off Function                                    | X                  | X                  | X              |                     |
|          | Override-On Input                                     | X                  | X                  | X              |                     |
|          | L70 Lifetime Indication                               | X                  | X                  |                |                     |

**4.0**

**System Components**

**4.1**

**Sensor**

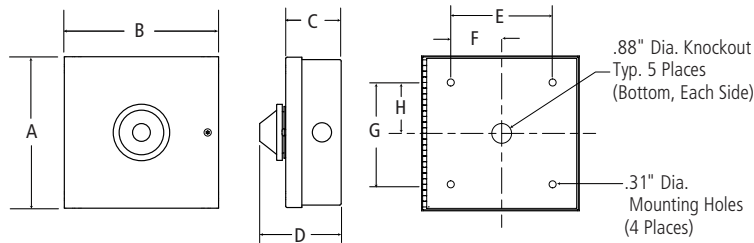
The TL100 sensor uses passive infrared (PIR) technology for occupancy detection and also contains a photocell for daylight control and LED L70 lifetime detection.

**4.1.1**

**Sensor Housing**

Single and dual sensor housing units are available (see below for dimensional data). The sensor housing units are IP65, Wet Location rated for outdoor use. See the specification sheet for further details.

**Dimensional Data (in inches) Sensor Housing**



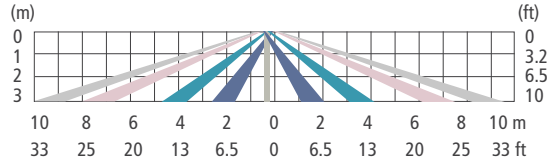
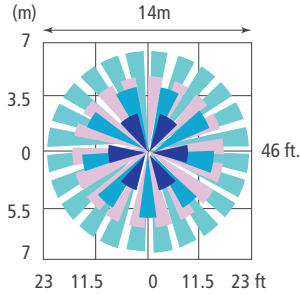
|          | A    | B     | C    | D    | E     | F    | G    | H    |
|----------|------|-------|------|------|-------|------|------|------|
| 1 Sensor | 6.85 | 6.97  | 2.53 | 3.61 | 4.50  | 2.25 | 4.50 | 2.25 |
| 2 Sensor | 6.85 | 15.35 | 2.53 | 3.61 | 12.00 | 6.00 | 4.50 | 2.25 |

Wiring connections for the sensor unit are made within the sensor housing. Wires run between the sensor unit and lighting controller shall be a minimum of 18AWG, 600V TFFN using Class I wiring methods. Additional wiring details can be found in the [Control Module Inputs and Outputs](#) section below or in the [TL100 Installation Instructions](#) document.

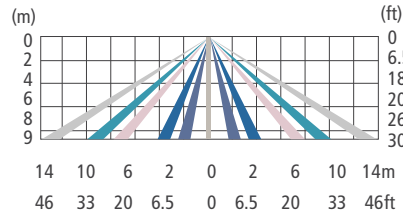
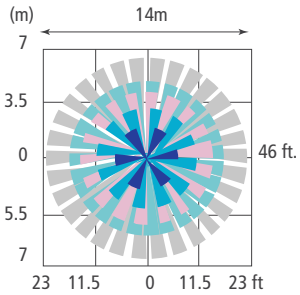


**4.1.2 Lens Options**

Multiple lens options are available to provide 360 degree coverage at various mounting heights and coverage areas. Available lenses and their respective coverage area can be seen in the figures below:



**L488 Lens**



**L6020 Lens**

| Lens Option | Description   |
|-------------|---|
| L488        | 360° lens. maximum coverage 48' diameter from 8' height (IP65, Wet Location)  |
| L6020       | 360° lens. maximum coverage 60' diameter from 20' height (IP65, Wet Location) |

### 4.1.3 General Sensor Position Recommendations

The following are general recommendations that would apply to all layouts:

- Sensors should be positioned at all entry/egress points into the space
- Sensors used for occupancy detection (near doors, vehicular entry points, etc) should be placed with a direct line of sight to the area of focused Light
- Light level sensors should be ceiling mounted and located in an area:
  - Out of direct sunlight, but with open visibility to the surrounding area
  - Within 15' of a controlled luminaire without any obstructions in between
  - Away from the window/opening at a distance of 50%-75% of the zone size
  - That will most likely experience the lowest light levels in the zone due to daylight contribution alone, so that the entire zone will meet the light level requirements
  - Centralized within the zone if both eastern and western daylighting exposure is available
- Wire lengths between the sensor(s) and controller should be less than 3000'

A daylighting circuit will typically require an additional sensor within the system, other than at the typical entry and egress points, due to its positioning recommendations listed above. This sensor is not different than other sensors except that its purpose is primarily dedicated to light level sensing.

## 4.2 Control Module

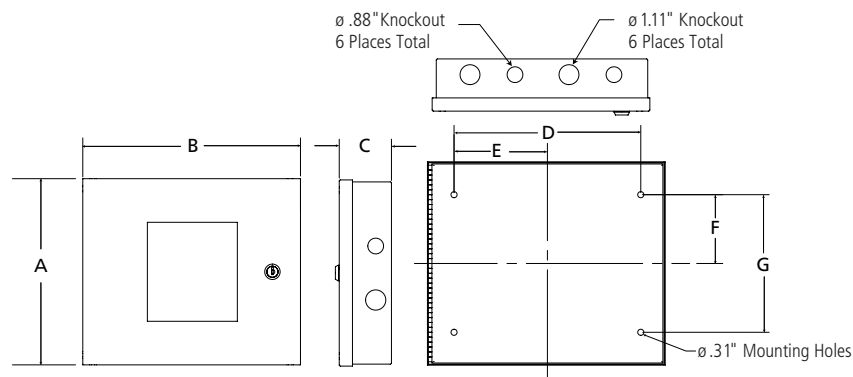
The control module (or controller) is the centralized control hub for the TekLink TL100 system. It contains all of the control logic for interpreting the occupancy and light-level information received from the sensor units for zonal luminaire control along with additional capabilities detailed in this section.

### 4.2.1 Control Module Housing

The TekLink TL100 controller is contained within a lockable, IP65 rated enclosure that is available in the following configurations:

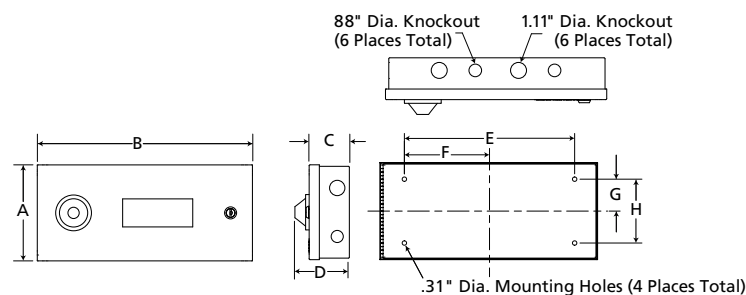
- A) 'Control module only' style containing one, two or four individual controllers  
 Typically used when centralized location for all control modules desired (E.g. electrical room)

Dimensional Data (in inches) Control Module Housing



|                          | A    | B     | C    | D    | E    | F    | G     |
|--------------------------|------|-------|------|------|------|------|-------|
| 1 Control Module Housing | 6.85 | 12.10 | 2.90 | 9.50 | 4.75 | 2.25 | 4.50  |
| 2 Control Module Housing | 6.85 | 12.10 | 2.90 | 9.50 | 4.75 | 3.50 | 7.00  |
| 4 Control Module Housing | 6.85 | 12.10 | 2.90 | 9.50 | 4.75 | 7.50 | 15.00 |

- B) Sensor/control module combination unit  
 Typically used when control module located within control zone desired

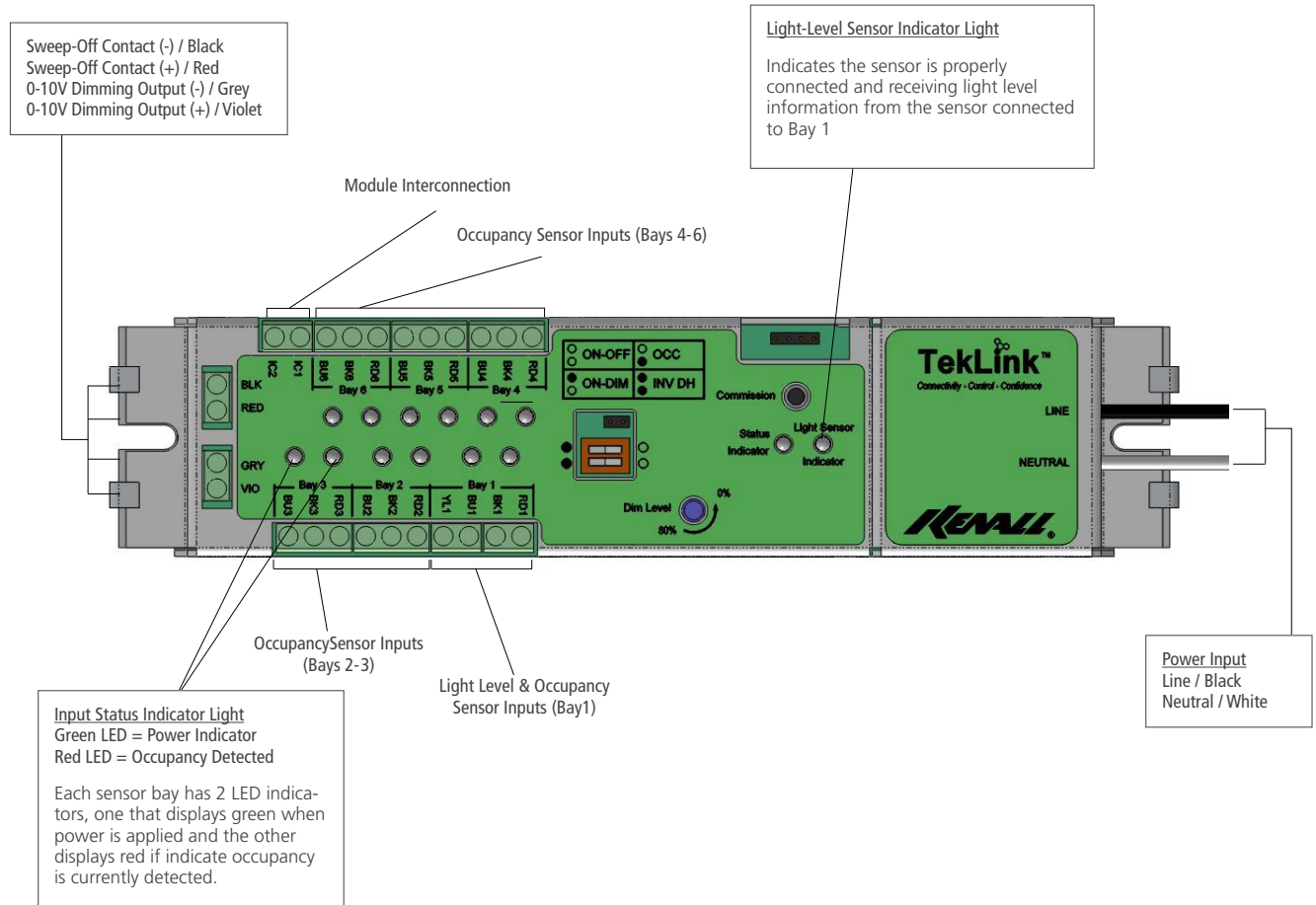


|             | A    | B     | C    | D    | E     | F    | G    | H    |
|-------------|------|-------|------|------|-------|------|------|------|
| 1 Set Combo | 6.85 | 15.35 | 2.90 | 3.61 | 12.00 | 6.00 | 2.25 | 4.50 |

#### 4.2.2 Control Module Inputs and Outputs

The control module requires an AC line input of 120/277V, 50/60Hz. Each control module is capable of interfacing with sensors, luminaires, momentary switches, and other control modules. Descriptions of the interactions are listed below:

##### Control Module Sensor Input Information



#### A) Sensors

- Control module provides power (24 Vdc) to each sensor
- Control module receives occupancy/light level information from up to 6 sensors
  - One occupancy & light level sensor (Bay 1)
  - Five occupancy only sensors (Bay 2-6)

#### B) Luminaires

- Control module provides 0 – 10V dimming signal for up to 32 luminaires

**NOTE: NEC 300.4.C.1 – 600 volts nominal or less (Class 1 wiring methods). Conductors of AC or DC circuits rated 600 volts nominal or less shall be permitted to occupy the same wiring enclosure, cable or raceway. All conductors shall have the same insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable or raceway.**

C) Momentary Switch

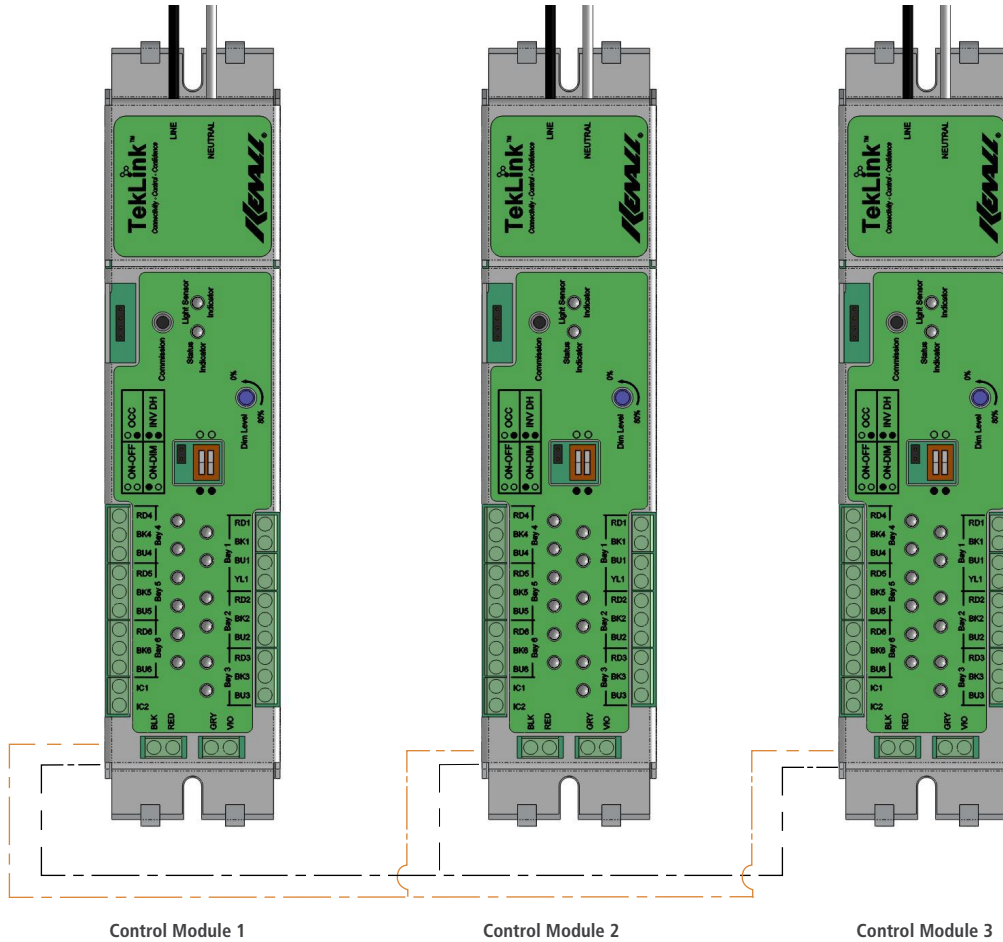
- A momentary switch connected between the Red and Black leads on the control module enables the 'Sweep-Off' function (see Sweep-Off section of this manual for details)

D) Control Modules

- Multiple control modules can be interconnected via 18 AWG wires through the I1 and I2 terminal slots as seen in the diagram below.

**NOTE:** Interconnecting control modules will repeat the occupancy detection signal across all connected controllers and their respective zones, meaning that all sensors need to time-out in order to move into the Low-Level Standby Mode. However, light-level monitoring information for daylighting and self-commissioning are kept to the individual controller. That information is not shared between control modules.

Control Module Interconnection Schematic



**NOTE:** Even if the sensor is not located in a day-lighting zone, the light-level signal wire must be run between the sensor and controller. This is required for the self-commissioning and LED L70 lifetime function and only applies to the "On to Dim" and "On to Off" Daylight programs.

### 4.2.3 Electrical Specifications

| TekLink TL100 Control Module Electrical Specifications |                      |                |                 |                 |                             |
|--|----------------------|----------------|-----------------|-----------------|-----------------------------|
| Ordering Code  |                      | TL100-IRC-1    | TL100-IRC-2     | TL100-IRC-4     | TL100-IRC-IRS               |
| Description  |                      | (1) Controller | (2) Controllers | (4) Controllers | (1) Controller + (1) Sensor |
| Input  | Voltage              | 120-277 VAC    |                 |                 |                             |
|  | Frequency            | 50/60 Hz       |                 |                 |                             |
|  | Max Current @120 VAC | 0.04 A         | 0.08 A          | 0.16 A          | 0.04 A                      |
|  | Max Current @277 VAC | 0.03 A         | 0.05 A          | 0.10 A          | 0.03 A                      |

### 4.2.4 General Control Module Position Recommendations

The following are general recommendations that would apply to all layouts:

- Location of the lighting controller has no effect on the operation of the system, but controller should be positioned in a location convenient during installation (one which minimizes wire and conduit runs)
- Wire distances from sensor-to-controller and controller-to-luminaires should be kept under 3000'
- The lighting control box can be ceiling or wall mounted in any orientation and should be securely fastened using hardware appropriate for the mounting surface
- Although not position-related, the controllers must be on a non-switched branch circuit; regular removal of power will interrupt the internal timer that is monitoring the L70 lifetime indicator



## 5.0 System Features

### 5.1 Self-Commissioning

TekLink TL100 features a unique self-commissioning system that establishes the system parameters needed to incorporate daylight contribution into the space. Once power is applied to the system, pressing and holding the commissioning button for 3 seconds will start the following process:

1. Status Indicator light (see figure) will go from a flashing amber to solid amber  
**What it means: The system is in commissioning (i.e. daylight calibration) mode**
2. The luminaires will stay at 100% output for 24 hours  
**What it means: The system will capture the lowest light level in one 24-hour time period, which is when only electric light is available (i.e. at night)**
3. After 24 hours, the Status Indicator light will go from solid amber to solid green  
**What it means: The system has established a commission light level and is now in service**

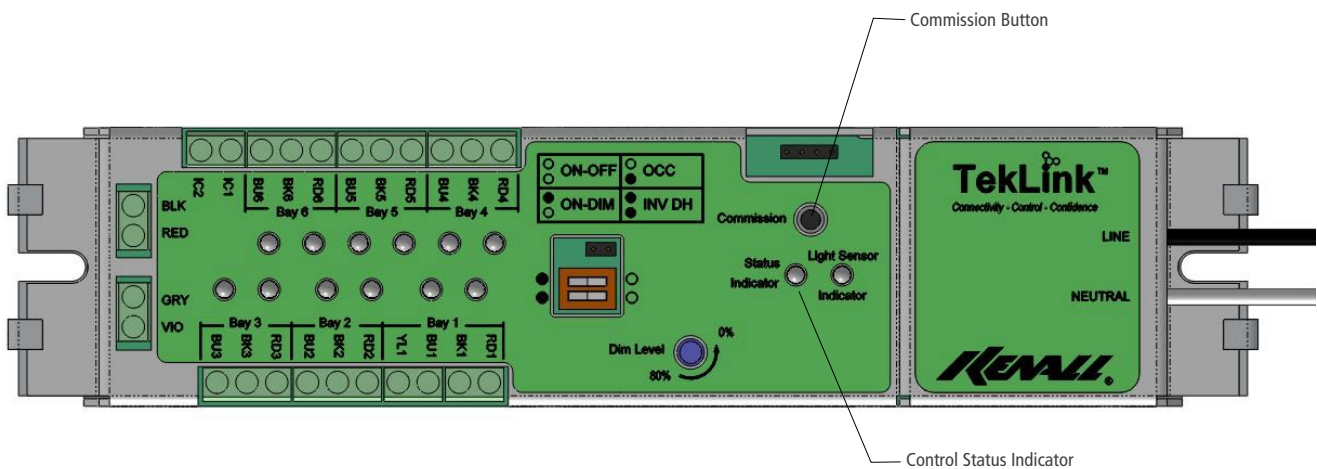
The “commission light level” can also be referred to as the occupancy light level; the system will maintain this level of light in the space whenever occupancy is detected.

**NOTE: This feature does NOT apply to the Occupancy-Only program option.**

To remove short-term environmental variations that may bias the light level measurements during the initial commissioning process, an internal algorithm will enter the system into another 24 hour commissioning process every 2 months (total of 6 times) for the first year the system is in service. The system will factor in measurements taken over the first year and establish the true commission light level for the remaining life of the system. The automatic commissioning periods can be identified by a steady-amber Status Indicator light, as well as the luminaires on 100% during periods that normally wouldn't experience those levels (daytime).

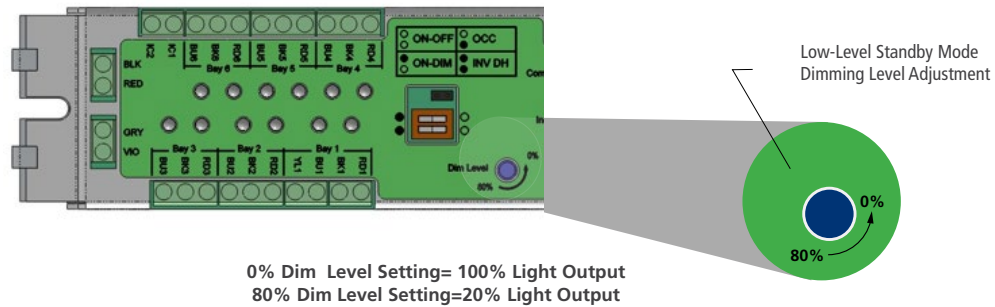
**NOTE: Since the actual commission level is determined approximately one year after the initial system installation, it isn't critical to have the lighting space perfect at time of initial commission. The time of day that the commission button is pushed is also irrelevant.**

Commission Button and Status Indicator



## 5.2 Low-Level Standby Mode

When the TekLink TL100 system is in a state of non-occupancy, the control module will ensure the system maintains a minimum light level called the Low-Level Standby Mode. This light level is determined by the user, and can be changed by adjusting the dial (0-80% dim) on the control module as shown below:



**NOTE:** Kenall recommends that the non-occupied (dim) state is set above the IESNA recommended minimum value for the particular application. This ensures that the area is always safely lit for an occupant.

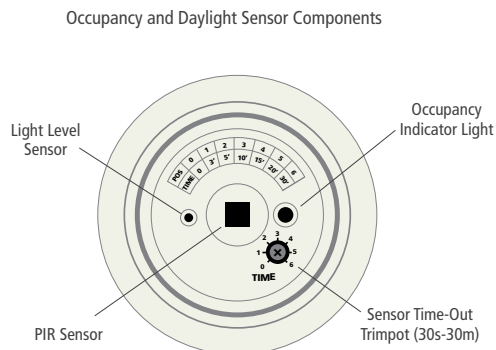
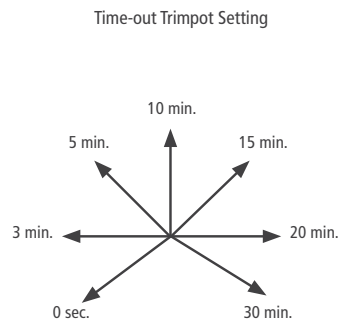
## 5.3 Sensor Time-Out Adjustment

Occupancy detection time-out, when the luminaires within the zone will revert back to their “Low-Level Standby Mode”, is individually settable at each sensor. The available time-out range is 30 seconds to 30 minutes. To adjust the time-out setting:

1. Remove the sensor lens (unthread counterclockwise)
2. Access the trim pot with a small screwdriver (shown below)
3. Turn the trim pot position to the desired time period

The sensor is factory set at a timeout period of 10 minutes.

**NOTE:** The TL100 lighting controller will not begin to dim the luminaires within the zone until ALL connected sensors have met their timeout period. This feature does not apply to inverse daylighting mode.



## 5.4 Sweep-Off Function

The Sweep-Off Function allows all the luminaires connected to a control module to be brought down to 0% light output while the parking structure is not in use. Here are the steps to implement and execute this feature:

1. Connect a momentary switch (provided by others) between the Sweep-Off leads displayed in the "Control Module Inputs and Outputs" section of this manual
2. After everyone has left the space, press and hold the switch for 3 seconds (green LED indicator will blink), then leave the area
3. Once the system detects no-occupancy, it will dim the luminaires down to 0% light output

The lighting system will remain at 0% light output until occupancy is detected, at which point the system will resume normal operation.

**NOTE: The system will wait a minimum of 3 minutes before the sweep-off is executed.**

## 5.5 Override-On Input

Each TekLink TL100 sensor has an input that allows for a remote trigger of "occupancy". When connected to a remote momentary switch, this function allows someone to bring the system out of non-occupancy mode without entering the space to trigger the sensors. The length of time that the system will remain in an occupied state is the time-out period. This may be a function that can be useful for installation into a security office or emergency call box.

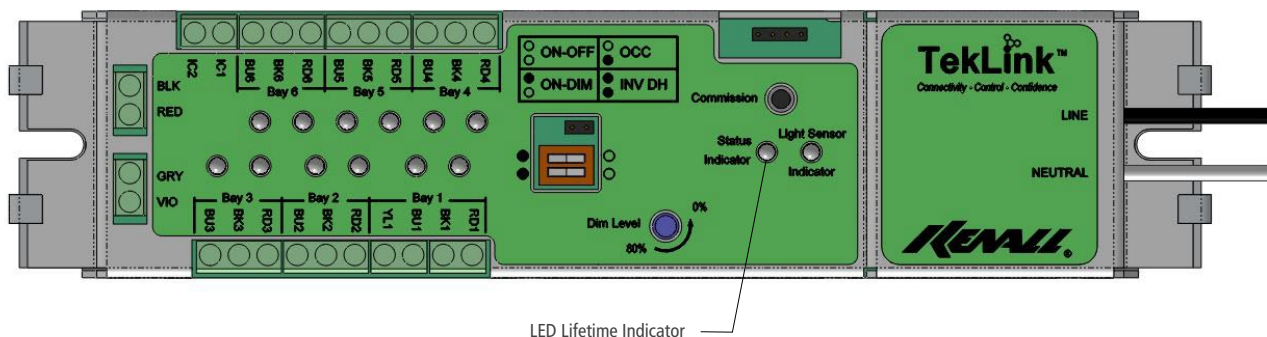
**Note: If sufficient daylight is present, the lighting controller will not put the luminaires to full light output if the momentary switch for the Override-On Input is pressed. The controller will simply see that occupancy has been detected, and then ensure the measured light in the space meets or exceeds the commissioning level.**

See TekLink TL100 Installation Instructions for wiring diagram.

## 5.6 LED L70 Lifetime Indication

LED luminaire lifetime has been characterized as the point at which the light output from the luminaire drops to 70% of its original light level. Through the Self-Commissioning feature outlined earlier in this manual, the TekLink TL100 system can determine the initial light output of the luminaire(s). After the first year of operation, the system will go into an automatic commissioning mode every 6 months to compare the current light level to the initial light output. Once the light level is measured below 70% of the initial light output, the status indicator (shown below) will flash red.

**NOTE: This feature is not available for the Occupancy Only program option**



**NOTE: To ensure that light depreciation isn't simply due to dirt accumulation on the sensor lens and /or luminaire optics, Kenall advises that all sensor lenses and luminaires be wiped clean with a soft cloth and mild detergent. All non-LED supplemental lights within the sensor space (HID wall packs, etc) should also undergo a lamp replacement. Once these items are addressed, initiate one more comparative measurement by pressing (hold for 3 seconds) the commissioning button. If the Status Indicator is flashing red after 24 hours, the LED luminaire(s) have reached end of life and need to be replaced.**

## 5.7 'Safe On' Failure Mode

The TL100 control system is designed to maintain occupant safety in the case of system component failure. Loss of power, damage or other failure types of the control module will result in the luminaires moving to full brightness. Because the luminaires are controlled by a 0-10V dimming protocol, a loss of signal has the same effect as an open circuit on the dimming input lines of the luminaire.

The system will resume normal operation when power is restored. The commission values are retained in the memory of the control module.

## 5.8 TekLink TL100 Troubleshooting Guide

| Situation  | Possible Cause   | Possible Solution   |
|--|--|---|
| At night, luminaires do not appear to be dimming   | <ul style="list-style-type: none"> <li>The control zone(s) in question are occupied</li> <li>The control zones are not occupied, but cannot reach the set Time-Out period before occupancy is re-detected</li> <li>Dim-Level setting on lighting controller is set very low, or even 0%</li> <li>System is undergoing a periodic 24-hour assessment of light levels (every 2 mo after initial commissioning for the first year, then every 6 mo thereafter)</li> </ul> | <ul style="list-style-type: none"> <li>The zones are not intended to dim while the space is occupied</li> <li>Adjust Time-Out setting to a shorter duration</li> <li>Increase non-occupied Dim Level (i.e. 50-80%) for each lighting control module</li> <li>System will automatically resume normal operation within 24 hours</li> </ul>   |
| The Dim Level setting is set at 50%, but the fixtures still appear too bright.                       | <ul style="list-style-type: none"> <li>System hasn't completed the initial Commissioning process</li> <li>Contrast issues at night due to a limited frame of reference</li> </ul>  | <ul style="list-style-type: none"> <li>Commission system</li> <li>Run through System Operation checklist and verify system components are fully functioning</li> <li>Use a multi-meter to measure DC voltage across the gray-violet dimming wires at the lighting controller; &lt;1.2V = 100% dimming, 4.0V = 50% dimming, &gt;8.0V = 0% dimming</li> <li>Increase Dim Level setting to an acceptable level from a standpoint of safety, energy savings and comfort.</li> </ul> |
| At night during non-occupied conditions, interconnected zones are at noticeably different dim levels | <ul style="list-style-type: none"> <li>Dim Level settings are set at different levels between each zone.</li> </ul>  | <ul style="list-style-type: none"> <li>Adjust Dim Level setting for each interconnected zone to the same level.</li> </ul>  |
| During the daytime, luminaires remain lit  | <ul style="list-style-type: none"> <li>System is undergoing a periodic 24-hour assessment of light levels (every 2 mo after initial commissioning for the first year, then every 6 mo thereafter)</li> <li>Insufficient sunlight is being received by the zone's light level sensor based upon the Commission level requirements</li> </ul>  | <ul style="list-style-type: none"> <li>System will automatically resume normal operation within 24 hours</li> <li>This system is dynamic and subject to changing lighting conditions throughout the day, seasonality, weather patterns and occupancy</li> <li>Check for sensor damage and clear any obstructions</li> </ul>   |
| The status indicator on the lighting control module is flashing RED                                  | <ul style="list-style-type: none"> <li>Dirt depreciation of the luminaires and/or garage floor</li> <li>LEDs have reached their end-of life</li> </ul>   | <ul style="list-style-type: none"> <li>Clean the luminaires, sensor lenses and garage floor</li> <li>Replace the LED module inside the luminaires</li> <li>See L70 Indicator note within <a href="#">Application Guide</a></li> </ul>   |



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