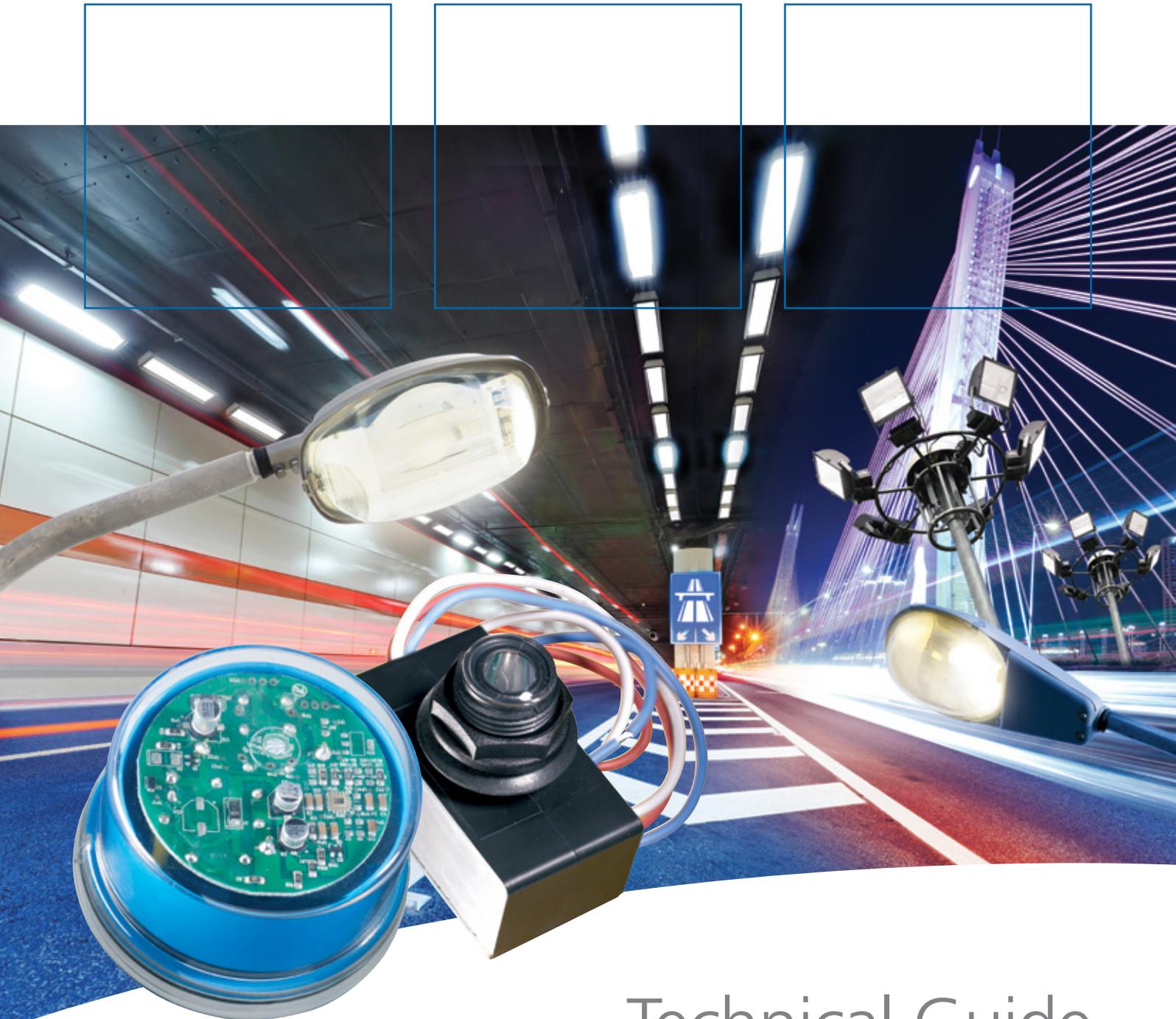




ROYCE THOMPSON
LIGHTING TECHNOLOGY IN CONTROL



Technical Guide

Photo-electronic Controls for
Amenity, Street & Highway Lighting



Thomas & Betts
A Member of the ABB Group



Introduction

Royce Thompson Photocells



Royce Thompson is the leading photo-electronic lighting controls brand from Thomas & Betts, supporting the street and amenity lighting industry since 1963.

Within those fifty years at the forefront of the photo-electronic lighting controls market, the Royce Thompson brand has achieved many firsts, including the first solid state photocell in the 1970's, followed by the first use of synchronous switching and ASIC microprocessor control technology in the 1990's.

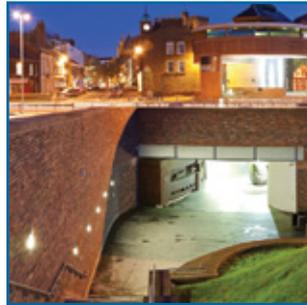
Continuous focus on the provision of high quality, innovative products to the market ensures Royce Thompson photocells offer the best possible value in terms of low energy consumption, reliability and long service life - helping you, the customer, achieve optimum performance whilst keeping your carbon footprint to a minimum.

Royce Thompson Photocells

A photocell (or Photo-Electronic Control Unit - 'PECU') is an electronic switch which is triggered at a specific light level. Based on thermal, electronic or microprocessor technology, photocells operate in a number of ways depending of the level of accuracy required. These are:

- **Dusk to dawn sensing** - generally inaccurate light detection where the lamp switches 'ON' as night falls and switches 'OFF' shortly after sunrise.
- **Light level detection** - more accurate light detection where the photocell switches at pre-set light levels both at sunset and sunrise, typically 70/35, 55/28, 35/18 or 20/20 lux. Negative switching sets the lamp to 'OFF' at a lower level than 'ON', with positive switching acting in reverse.
- **Part Night operation** - uses the same technology as photocells with light level detection, but also includes an in-built clock for midnight switching 'OFF' and BST/GMT seasonal changes.

Royce Thompson Photocell Configurations



Royce Thompson photocells are available in a number of configurations, with light level detection or Part Night operation, to meet the various needs of the street and amenity lighting market, including:

- **One Part NEMA photocell** - the photo-electronic control is housed in a polycarbonate casing with a UV stabilised plastic cone, with base fixing to a NEMA socket as standard, or with optional flying leads.
- **One Part miniature photocell** - including a standard miniature casing, ideal for use where installation space is limited or minimum aesthetic impact is specified.
- **Two Part remote photocell** - enables placement of the lens to monitor light levels, whilst the controller is placed within reach in the lighting unit to permit functional testing.
- **Two Part miniature photocell** - allows both remote placement of the lens, and installation of the miniature controller in lamps where space is limited.

For controlling photocell switching, the Royce Thompson range is further divided into two types, with two relay options:

- **Microprocessor based photocell** - ensures highly accurate switching, positive and negative switch differential and a controlled 'OFF' level, from a choice of monostable or bi-stable switching relay.
- **Photocell control by discrete component** - for a low cost, simple solution to photo-electronic control, with suitability for positive switch differential only and an uncontrolled 'OFF' level, from a monostable relay.

A **monostable relay** is energised within the photocell throughout the time that the load is switched 'ON'. This results in higher power consumption.

A **bi-stable relay** delivers a voltage pulse to change the load state from 'ON' to 'OFF' and vice versa. This reduces the overall power consumption and results in a lower overall cost to the user.



Generally, selection of the most appropriate photocell for the installation is determined by the performance, energy savings and value for money required from the photocell.



The benefits of Royce Thompson microprocessor technology

Royce Thompson microprocessor technology has been specifically designed for photocell control, with integral filtered photodiodes and control circuitry.

This ensures changes in temperature have minimal effect, and individual tolerances can be closely controlled.

The microprocessor further includes stabilising technology for voltage supply and temperature, synchronous switching to extend the life of the contacts, and a state machine to prevent spurious switching.

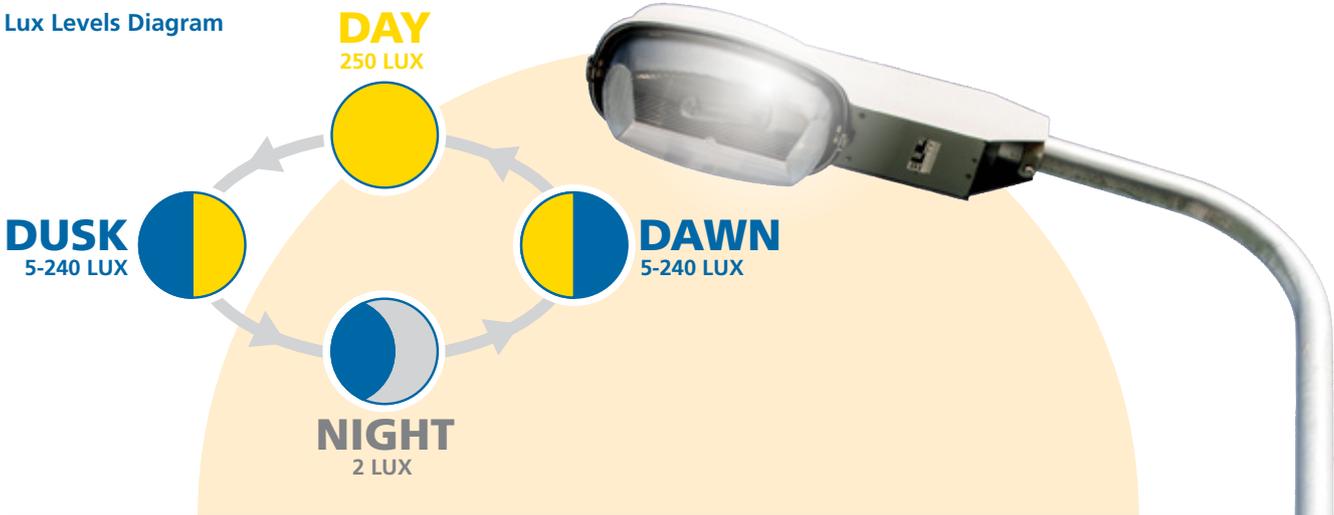
Fundamentally, the state machine ensures exact control of the lighting unit providing an instant switch 'ON' when the specified light level is reached, for highly accurate switching to pre-programmed lux levels (see diagram below).

Microprocessor technology in Royce Thompson photocells delivers significant benefits:

- Greater load handling capacity - up to 3 x 400 W
- No contact arcing
- Positive/negative switching differential (1:1.5 positive, 1:0.5 negative or 1:1 ON/OFF switching)
- Instant switch-on for greater accuracy
- Inverted use, close to a Sodium light source
- Very low power consumption for clear energy savings (e.g. 0.25 W for Oasis & Microstar).

For the vast majority of applications, such as street and underpass lighting, Royce Thompson photocells are connected to the distribution network via an unmetered supply, without their energy consumption being recorded.

Pre-programmed Lux Levels Diagram



Photocell Programming



State setting

- When daylight falls to preset DUSK STATE**
- For load to switch back OFF**
- When night STATE is reached**
- When pre-set dawn STATE is reached**
- To switch load back ON**
- At Day STATE**

Outcome

- Load switches ON
- Cell must return to DAY STATE
- The unit is set to switch at dawn
- After a pre-set delay load switches OFF
- Level must drop back to night STATE
- Level must reach dusk to Switch ON

Creating value through energy efficiency



In order to confirm their energy consumption, photocells must be tested, inventoried and provided with a charge code by the relevant authority for unmetered equipment (ELEXON/UMSUG - the Unmetered Supplies User Group).

The charge code defines the circuit Watts of the equipment and confirms that load testing has been undertaken by the manufacturer, thus ensuring energy consumption has been recorded as accurately as possible.

Photocell energy consumption charges are based on average power consumption over a 24 hour period with further charges for the lamp and control gear used, and the photocell switch setting.

Selecting the most appropriate photocell and switch setting can therefore deliver significant energy and cost saving benefits (see comparison below).

Photocell cost comparison

Photocell Type	Thermal	Electronic	Microprocessor (Oasis)
Power/Hours	3 W 12 hours	1 W 24 hours	0.25 W 24 hours
Annual energy consumption (KWh)	13.14	8.76	2.19
Cost of energy (£0.10/KWh)	£1.314	£0.876	£0.219
Cost of energy for 10K Photocells	£13,140.00	£8,760.00	£2,190.00
At Day STATE	£10,950.00	£6,570.00	-

Based on this comparison, assuming an Oasis 0.25 W photocell is installed into a 70 W SON-T luminaire, the following costs can be estimated based on different switch regimes and part night operation:

Photocell Type	70/35	35/18	70/35 Part night	35/18 Part night
Average annual hours	4154	3984	2147	1977
Annual consumption at 70 W (KWh)	290.78	278.88	150.29	138.39
Cost of energy (£0.10/KWh)	£29.08	£27.88	£15.03	£13.84
Cost of energy for 10K x 70 W SON-T	£290,800.00	£278,800.00	£150,300.00	£138,400.00
Cost of energy for 10K x Oasis	£2,190.00	£2,190.00	£2,190.00	£2,190.00
Total cost of energy (£)	£292,990.00	£280,990.00	£152,490.00	£140,590.00
Switch Regime Savings	-	£12,000.00	-	£11,900.00
Part Night Savings	-	-	£140,500.00	£140,400.00

Note: Part night savings based on 5.30 hour saving per night, although during summer months this may not be accurate as light may not need to switch on during dawn conditions. Costings for example only & savings within particular installations may vary. Contact Thomas & Betts for a project savings estimate.



Royce Thompson Photocell Range Overview

Photocell specification & load rating chart



Oasis 2000
One Part
NEMA Photocell



Oasis 1000
One Part
NEMA Photocell



Monostar 2000
One Part
NEMA Photocell



Monostar 1000
One Part
NEMA Photocell



Nightstar
Part Night
NEMA Photocell



Nightstar
Miniature
Part Night
Photocell



Microstar 2000
Miniature
Photocell

Switching Current

Amps	10 A	8 A	5 A	5 A	5 A	5 A	10 A
Watts	3 x 400 W	3 x 400 W	2 x 400 W	2 x 250 W	2 x 400 W	2 x 400 W	3 x 400 W

Maximum No. of Lamps Powered

Incandescent 100 W	12	12	8	5	8	8	12
Incandescent 500 W	2	2	1	1	1	1	2
SON 70 W	5	5	4	3	4	4	5
SON 250 W	4	4	3	2	3	3	4
SON 400 W	3	3	2	1	2	2	3

Photocells also suitable for LED lamp types.

Product Characteristics

Sensor Type	Filtered Silicon Photodiode	Filtered Silicon Photodiode					
Power Consumption	< 0.25 W	< 0.25 W	< 0.5 W	0.5 W	0.25 W	0.25 W	< 0.25 W
Temperature Range	-20 °C to +60 °C	-20 °C to +60 °C					
Dimensions	Dia. x D 85.5 x 72 mm	Dia. x D 85.5 x 72 mm	Dia. x D 81 x 75 mm	Dia. x D 81 x 75 mm	Dia. x D 85.5 x 72 mm	L x W x D 57 x 31 x 25 mm Lens Dia. 20 mm Lens Projection 25 mm	L x W x D 57 x 31 x 25 mm Lens Dia. 20 mm Lens Projection 17 or 25 mm

220-240 V products shown as standard.
Other voltages are available on request.

Photocell Range Overview



								
Microstar Ultra-HT Miniature Photocell	P42E Two Part Photocell	V400 Two Part Photocell	P12HE Miniature Photocell	P12RE Two Part Photocell	ER4N Two Part Photocell	V16 Adjustable Photocell	Q18 Hazardous Area Photocell	Astra Nova City Astronomic Time Switch
10 A	5 A	5 A	5 A	5 A	10 A	5 A	10 A	2 x 16 A (resistive) 2 x 10 A (inductive)
3 x 400 W	2 x 250 W	2 x 250 W	2 x 250 W	2 x 250 W	3 x 400 W	2 x 250 W	3 x 400 W	3000 W (incandescent) 2500 W (halogen) 1200 W (fluorescent)
12	5	5	5	5	12	5	12	–
2	1	1	1	1	2	1	2	–
5	3	3	3	3	5	3	5	–
4	2	2	2	2	4	2	4	–
3	0	0	0	0	3	1	3	–
Filtered Silicon Photodiode	CDS Detector	CDS Detector	CDS Detector	CDS Detector	Filtered Silicon Photodiode	Phototransistor	Filtered Silicon Photodiode	–
< 0.25 W	0.6 W	0.9 W	0.6 W	0.6 W	0.25 W	2.5 W	<0.25 W	< 1.0 W
-40 °C to +80 °C	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +60 °C	-20 °C to +45 °C	-40 °C to +80 °C	-10 °C to +45 °C
L x W x D 57 x 31 x 25 mm Lens Dia. 20 mm Lens Projection 17 or 25 mm	L x W x D 77 x 75 x 74 mm Photocell Dia. x D 20 x 52 mm	Controller L x W x D 68 x 75 x 92 mm Detector L x W x D 68 x 68 x 86 mm	L x W x D 57 x 31 x 25 mm Lens Dia. 20 mm Lens Projection 17 or 25mm	Controller L x W x D 57 x 31 x 25 mm Photocell Dia. x D 25 x 26 mm	Controller L x W x D 68 x 75 x 92 mm Photocell Dia. x D 25 x 35 mm	L x W x D 93 x 67 x 50 mm	L x W x D 195 x 130 x 109 mm	L x W x D 65 x 35 x 88 mm

Note on photocell capacity: Although a photocell may be rated at 3 x 400 W this does not always mean that a single 1000 W load can be connected to the photocell and work correctly. In-rush currents, types of lamp and control gear need to be considered when specifying permitted loads. Higher wattage lamps tend to have higher value PFC capacitors whilst larger quantities of lower wattage lamps can have a higher total in-rush power. Refer to the load/rating chart above or contact Thomas & Betts for advice on the lamp combinations that can be connected to specific photocells.

Abbreviations:

NEMA - National Electrical Manufacturers Association



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