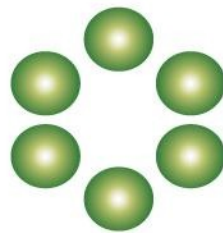


Models RL28Q / RL16Q Ring Light with Quadrant Controller

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MEDICAL & INDUSTRIAL MANUFACTURING | GEMOLOGY | ELECTRONICS | FORENSICS

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Introduction

Orled's models RL16Q/RL28Q are compact, rugged ring lights with 16 or 28 high-output LEDs organized into four independent quadrants. The LED light is refracted through an innovative optical system to provide up to 85,000 lux at a working distance of 3" (RL16Q). Fresnel optics are used to evenly distribute the light and minimize reflections from shiny surfaces. The body has an IP 65 rating, protecting the ring light from splattering fluids, corrosive fumes and damaging dust particles.

An advanced controller (model QD01) is included with both ring light models. The QD01 allows each quadrant to be independently turned on or off to achieve uniform illumination, or to create and control shadows to define surface details without moving the subject. It digitally modulates the LED power to provide eight intensity levels, resulting in excellent efficiency and consistent color at all brightness settings. It has a solid-state touchpad for manual control and a serial communication interface for remote control.



The ring light's state-of-the-art, high-intensity LEDs are cooled by a high performance heat exchanger and operated below rated maximum power to ensure they meet or exceed specified lifetime. Excellent reliability, flexible lighting control, and environmentally sealed construction make these ring lights ideally suited for a broad range of lighting applications.

Included equipment

- Model RL16Q or RL28Q ring light with integral cable and three soft-point set screws.
- Model QD01 ring light controller.
- AC adapter with cable.

Optional accessories

Polarizer

The ring light can be supplied with built-in polarizer film and an analyzer filter. This feature reduces glare from shiny surfaces and allows inspection of details and defects that would otherwise be concealed by reflected light. The analyzer filter screws into the standard lens filter threads in the ring light body. The polarizer film must be factory installed; please specify this option when ordering.

Dark field adapter

Orled's dark field adapter refracts the light from the ring light so as to illuminate the subject from the edge. As a result, the viewer will see a subject with illuminated edges on a black background. This is an excellent and indispensable tool for inspecting edge detail and viewing defects within transparent objects.

Remote control cable

A computer can be connected to the ring light controller with a 9014C1 communication cable. The computer can then change the light intensity and turn light ring quadrants on and off under software control – a powerful capability that is essential in automated inspection applications or when a custom interface is needed.

Installation

Mounting

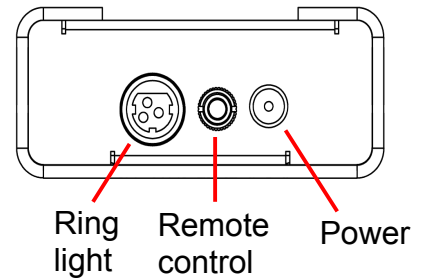
In many cases, the ring light can be mounted to a microscope or other optical system with three soft-point set screws. These screws are designed to hold the ring light securely to the optical system without damaging it. This method accommodates a range of optical system mounting diameters. The end of the ring light body is threaded and sized to accept a standard lens filter (e.g., to protect the microscope objective).

Ring light	Mounting diameter	Lens diameter
RL16Q	2.1" to 3.0"	62 mm
RL28Q	3.8" to 4.7"	105 mm

Additionally, there are four #4-40 threaded holes on the dark side of the ring light that can be used for custom mounting solutions. Please contact Orled technical support for detailed information and instructions.

Electrical connections

- Plug the ring light cable into the controller's *Ring light* connector.
- Plug the power supply cable into the controller's *Power* connector.
- If the ring light will be controlled by a computer, connect the computer to the *Remote control* connector with an Orled 9014C1 cable. See "Remote control" section for details.
- Plug the power supply into a 120 VAC power outlet.



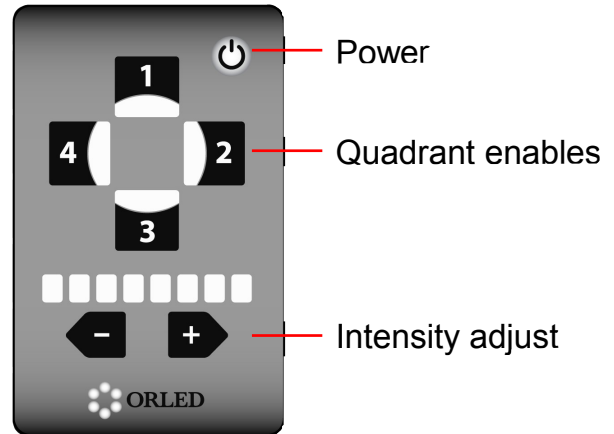
Operation

Controller keypad

Power – This lighted key toggles ring light power on/off. It lights when ring light power is turned on. Note: the controller will respond to remote control commands even when power is turned off.

Quadrant enables – These lighted keys toggle power on/off for the four ring light quadrants. Each key lights when the associated quadrant is powered.

Intensity adjust – These two keys increase (+) or decrease (-) the intensity of all enabled quadrants. The light bar above these indicates the current intensity level.



Working with cameras

The QD01 ring light controller controls light intensity by digitally modulating the LED power. This has several advantages over analog control methods, including reduced power consumption, extended LED life, and stable color spectrum.

Digital modulation causes the LEDs to rapidly flash on and off. The flashing is too fast to be seen by the human eye (due to persistence of vision), but cameras will sometimes be sensitive to it. For example, video camera sensitivity may show up as “flicker” in displayed video. This sensitivity can usually be reduced or eliminated by adjusting camera settings and lighting:

- Enable the camera's flicker reduction mode. Different cameras may use different methods to reduce flicker, so results can vary. Some manufacturers use alternative terminology for this function, and some cameras don't support this feature at all; refer to your camera documentation for details.
- Increase the ring light intensity and close the camera's iris as much as possible.

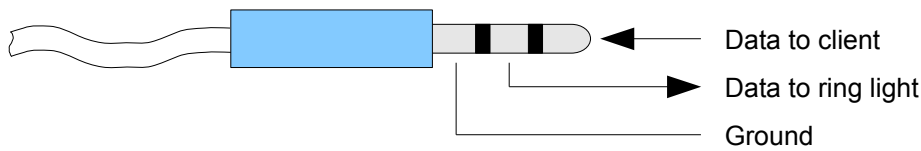
Remote Control

Overview

Orled's QD01 ring light controller includes a communication interface that enables an external computer (the "client") to control the ring light and monitor its status. Through this interface, the client can control light intensity and quadrant enables and monitor control settings, fault conditions, and keypad activity.

Communication interface

The communication interface has a serial RS-232 physical layer with a fixed configuration of 1200 baud, no parity, 8 data bits, and 1 stop bit. The interface is accessible via a 3.5 mm TRS socket, which is designed to mate to a TRS plug:



An optional cable, Orled part number 9014C1, can be used to adapt the controller's TRS connector to a DB-9. The cable has a mating TRS plug (as shown above) at one end and a DB-9 female connector at the other end. The cable can be used to connect the controller to an external computer that has an RS-232 serial communication port.

Message protocol

The client controls and monitors the ring light by sending command messages to and receiving notification messages from the controller. The controller acknowledges receipt of each command message by sending a notification message back to the client.

By default, notification messages are only sent in response to commands, to acknowledge the commands. A special command, ASYNC, can be sent to the controller to cause it to autonomously send messages when keypad buttons are pressed or fault status changes.

The controller allows the client to issue the next command before the current command has finished executing. Consequently, the client can either wait for each command acknowledgment before issuing the next command or it can issue the next command before it receives acknowledgment of the current command. The latter case will result in faster execution of a sequence of commands, but the client's software will be more complex because it must handle notification messages asynchronously.

Terminology

Some command and notification messages include a byte that specifies ring light control state as "pqqqiii", where each letter represents one bit:

Bit	Function	Description
p	Power enable	Ring light power: 1 = enabled, 0 = disabled.
qqqq	Quadrant enables	Each of these four bits is associated with a ring light quadrant: 1 = quadrant on, 0 = quadrant off (e.g., 1101 indicates quadrants 4, 3 and 1 turned on).
iii	Intensity	3-bit integer that specifies light intensity (applies to all quadrants). May have any value from 0 (dim) to 7 (bright).

Command messages

The client sends command messages to the controller to program ring light settings and query its condition. A command message consists of three ordered bytes:

CMD								DATA								END							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Z	OPCODE							D7	D6	D5	D4	D3	D2	D1	D0	0	0	0	0	0	0	0	0

Only the END byte is allowed to contain all zeros. If the value to be conveyed in DATA equals 0x00, the Z bit must be '1' and DATA must contain 0xFF. In all other cases Z must be '0' and DATA contains the actual value.

Commands

Name	OPCODE	DATA	Description
QUERY	1	0xFF	Request ring light status. Status is returned in command acknowledgment message.
CONTROL	2	pqqqqiii	Program ring light control state.
ASync	3	val	Enable/disable asynchronous notification messages. When enabled, keypress and fault events (changes in fault status) will cause notification messages to be sent to the client. When disabled, notification messages will not be sent in response to keypresses or change of controller's fault status. 0x01 = enable. 0x00 = disable (default).

Notification messages

The ring light controller sends notification messages to the client to acknowledge commands. Every properly framed command message (two non-zero bytes followed by 0x00) will cause the controller to send a notification message of type CMDACK or CMDNAK (see Message Types below). If asynchronous notifications are enabled (see ASYNC command), the controller will also send a notification message when a pushbutton is pressed or there is a change in fault condition.

A notification message consists of three ordered bytes: INFO, DATA, and END:

INFO								DATA								END																
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0									
Z	PF	KF	MTYPE														D7	D6	D5	D4	D3	D2	D1	D0	0	0	0	0	0	0	0	0

INFO

Field	Description
Z	Indicates DATA value is 0x00, regardless of the value present in the DATA byte. Only the END byte is allowed to contain all zeros. If the value to be conveyed in DATA equals 0x00, the Z bit is set to indicate that and DATA must contain a nonzero value. In all other cases Z is reset and DATA contains the actual value.
PF	Power fault status. This indicates a problem related to the connection between ring light and controller. The ring light may have become disconnected from the controller, or a cable or ring light fault may exist. Note: the keypad intensity indicator LEDs flash when PF is asserted. 1 = fault. 0 = no fault.
KF	Keyboard fault status. When asserted, this indicates an internal problem with the ring light controller's keypad. Note: all keypad indicator LEDs flash when KF is asserted. 1 = fault. 0 = no fault.
MTYPE	Message type (see table below).

Message types

Symbolic Name	MTYPE	DATA	Async*	Description
KEYUP	1	pqqqqiii	Y	Brighter pushbutton pressed.
KEYDOWN	2	pqqqqiii	Y	Dimmer pushbutton pressed.
KEYPOWER	3	pqqqqiii	Y	Power pushbutton pressed.
KEYQUAD0	4	pqqqqiii	Y	Quadrant 0 pushbutton pressed.
KEYQUAD1	5	pqqqqiii	Y	Quadrant 1 pushbutton pressed.
KEYQUAD2	6	pqqqqiii	Y	Quadrant 2 pushbutton pressed.
KEYQUAD3	7	pqqqqiii	Y	Quadrant 3 pushbutton pressed.
CMDACK	8	pqqqqiii	N	Valid command message was received and executed.
CMDNAK	9	pqqqqiii	N	Invalid command message was received.
FAULT	10	pqqqqiii	Y	Change in power or keyboard fault status.

* Message types marked "Y" will be sent only if asynchronous notifications are enabled. See ASYNC command for details.

Specifications

Ring light	RL28Q	RL16Q
High output LEDs	28	16
Light output	990 lumens	540 lumens
Color temperature (specify when ordering)	2700, 4300 or 6000K	2700, 4300 or 6000K
Working distance range	4.5" – 8"	2.5" – 6"
Spot size	2" dia @ wd=6.0"	1.50" dia @ wd=3.0"
Spot illumination	65000 lux @ wd=3.0"	85000 lux @ wd=3.0"
Inside diameter	4.05"	2.45"
Mounting diameter	4.70"	3.05"
Outside diameter	5.45"	3.74"
Cable length	34"	34"
LED power	11 W	6 W
Quadrant controller		
Keypad type	Solid-state, capacitive touch sensing	
Remote control interface	RS-232 @ 1200 baud, no parity, 8 data, 1 stop	
Mechanical dimensions	3.0" x 4.0" x 1.25" (W x H x D)	
AC power adapter		
Input power	120 VAC, 60 Hz	120 VAC, 60 Hz
Output power (max)	12V, 2A	9V, 2A