



Illuminating
ENGINEERING SOCIETY

IES LEM-7-13

Lighting Controls for **Energy Management**

This is a preview. [Click here to purchase the full publication.](#)

Lighting Controls for Energy Management

Publication of this Lighting Energy
Management document has
been approved by the IES.
Suggestions for revisions should
be directed to the IES.

Prepared by:
IES Energy Management Committee

[This is a preview. Click here to purchase the full publication.](#)

Copyright 2013 by the Illuminating Engineering Society of North America.

Approved by the IES Board of Directors, May 15, 2013, as a Transaction of the Illuminating Engineering Society.

All rights reserved. No part of this publication may be reproduced in any form, in any electronic retrieval system or otherwise, without prior written permission of the IES.

Published by the Illuminating Engineering Society of North America, 120 Wall Street, New York, New York 10005.

IES Standards and Guides are developed through committee consensus and produced by the IES Office in New York. Careful attention is given to style and accuracy. If any errors are noted in this document, please forward them to Rita Harrold, Director of Technology, at the above address for verification and correction. The IES welcomes and urges feedback and comments.

Printed in the United States of America.

ISBN# 978-0-87995-279-2

DISCLAIMER

IES publications are developed through the consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on lighting recommendations. While the IES administers the process and establishes policies and procedures to promote fairness in the development of consensus, it makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

The IES disclaims liability for any injury to persons or property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document.

In issuing and making this document available, the IES is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the IES undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The IES has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does the IES list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or statement of compliance with the requirements of this document shall not be attributable to the IES and is solely the responsibility of the certifier or maker of the statement.

Prepared by the Lighting Controls Sub-Committee of the IES Energy Management Committee

Lighting Controls Sub-Committee

Joseph Briscoe – Chair

J. Black*	M. Hefter*	D. Paulin
C. Brink*	E. Lai*	S. Pay
P. Brown*	B. Leach	B. Schoch *
L. Davis	S. Mende *	B. Smith*
C. DiLouie	A. Mor	J. Yorgey
W. Ellis*	D. Pandya *	
E. Gillmor	M. Pasini	*Advisory Members

Energy Management Committee

Maggie DeJong, Chair

Howard Wolfman, Vice-Chair

J. Amann*	K. Hemmi*	M. Myer
S. Anderson	J. Howley	K. Nielsen
H. Arvidsson*	T. Jackson*	M. Pak*
P. Ashar*	W. Johnson*	M. Pasini
B. Atkinson	C. Jones*	D. Paulin*
J. Benya*	D. Kack*	S. Pay*
F. Berryman*	H. Kaplan*	W. Bertelsen
C. Bloomfield*	D. Katzenberger*	A. Reyes*
J. Bond*	H. Kessler*	E. Richman*
S. Bramley*	R. Kurtz*	S. Silverstein*
J. Briscoe	S. LaFleur*	N. Smirnov*
T. Brown*	M. Lane	B. Smith
W. Brown*	M. Lasse*	D. Vail*
L. Cordell*	B. Leach*	D. Viveiros*
L. Davis	R. Lindemann*	D. Walsh*
G. Flamm	J. Lindsley	J. Wenman*
J. Frazer*	J. Ludyjan*	J. White*
E. Gillmor	S. Machhiwala*	R. Wyton*
D. Goldstein*	H. McKay*	H. Yaphe*
S. Guthrie*	S. Mesh*	J. Yorgey
F. Hauber	G. Miller*	
G. Hauser*	A. Mor*	*Advisory Member
R. Heinisch*	J. Mota*	
R. Heller	J. Muramudalige*	

ACKNOWLEDGMENTS

Special thanks to Craig DiLouie, LC for his editing and writing assistance with this document, and to the Lighting Controls Association (www.lightingcontrolsassociation.org) for co-sponsorship.

Contents

1.0	Introduction	1
2.0	Lighting Control Strategies	1
2.1	Personal Tuning	2
2.2	Occupancy Sensing	2
2.3	Time Scheduling	4
2.4	Daylight Harvesting	4
2.5	Lumen Maintenance Dimming	5
2.6	Institutional Tuning	8
2.7	Demand Response	8
2.8	Adaptive Compensation	8
3.0	Design Considerations	9
3.1	Owner Project Requirements	9
3.2	Economic Considerations	10
3.3	Energy Codes	11
3.4	High-Performance Green Buildings	13
3.4.1	Green Building Rating Systems	14
3.4.2	Green Building Codes	14
3.5	Ease of Maintenance	15
3.6	User Expectations	15
3.7	Layering	15
3.8	Control Zoning	16
3.8.1	Precision	17
3.8.2	Similar Characteristics	18
3.8.3	Analog Vs. Digital	19
3.8.4	Daylight Zones	19
3.9	Flexibility	19
3.10	Integration	20
4.0	Design Deliverables	20
4.1	Control Narrative	20
4.2	Control Zone Plan	21
4.3	Equipment Specifications	21

4.4	Single-Line Riser Diagrams	22
4.5	Lighting and Relay Panel Schedules	22
4.6	Device Settings and Programming	24
4.7	Performance Testing and Acceptance Criteria	24
4.8	Energy Modeling	24
4.8.1	Setting the Baseline	24
4.8.2	Energy Modeling Rules	25
4.8.3	Modeling Energy Savings from Lighting Controls	25
5.0	Controlling Light Sources	27
5.1	Line-Voltage Incandescent/Halogen	27
5.2	Low-Voltage Incandescent/Halogen	28
5.3	Fluorescent	29
5.4	High-Intensity Discharge (HID)	30
5.5	Solid-State Lighting (SSL)	31
5.6	Neon and Cold Cathode	32
5.7	Induction and Plasma	32
6.0	Lighting Control Equipment	33
6.1	Wiring Methods	33
6.1.1	Line Voltage	33
6.1.2	Low Voltage	33
6.1.3	Wireless	34
6.2	Standalone Controls: Switches and Dimmers	35
6.2.1	Switches	35
6.2.2	Dimmers	35
6.3	Multizone Systems: Relay Switching and Programmable Dimming Systems	35
6.3.1	Low-Voltage Relays	35
6.4	Central Computer/Software-Based Systems	36
6.5	Sensors: Occupancy Sensors and Photosensors	37
6.5.1	Occupancy Sensors	37
6.5.2	Photosensors	38
6.6	Dimmable Ballasts and Drivers	40
6.7	Shade Control	40
6.8	Emergency Lighting Control	40