



Office ASHRAE 90.1-2016 Solutions

Design Guide
Crestron Electronics, Inc.

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TOTAL ENERGY CONSUMPTION

Per capita usage; 10⁹ BTU per person

	OIL	COAL	SOLAR
Temperate climates	2.50b	3.1b	0.25
Subtropical climates	1.23b	0.55b	1.18
Hot climates	0.09b	0.19b	3.73
Cold climates	1.15b	1.30b	2.21
	0.20b	0.82b	1.32
	Total: 5.17	Total: 5.96	Total: 5.17



About ASHRAE 90.1-2016

ASHRAE 90.1-2016 is a residential and commercial building energy code that is designed to reduce energy consumption. The goal of this code is to reduce energy consumption by providing design and construction requirements for lighting controls.

Lighting controls such as occupancy status sensors, multi-level controls, and demand response provisions allow you to synchronize indoor light levels with daylight levels in accordance with ASHRAE 90.1-2016.

Design Guide Information

Crestron® offers this Design Guide for Office - ASHRAE 90.1-2016 solutions to use as a reference for typical layouts. Use it as guidance to make code compliance quick and easy. The Crestron team is also available to support with detailed design, submittal, and installation requirements. For additional information, please contact your Crestron representative at CLCDesign@crestron.com or (888) 330-1502.

ASHRAE 90.1-2016 Code Standards

Summary

ASHRAE 90.1-2016 Code Standards

	Code Provision	Minimum Control Requirement	Code Description
ON/OFF CONTROLS	9.4.1.1	Automatic Full On (Occupancy Sensing Mode)	Lighting is permitted to automatically turn to full on.
	9.4.1.1.a	Local Control	There should be one or more readily accessible manual lighting controls in each space.
	9.4.1.1.b/c	Manual On / Partial Auto On (Vacancy Sensing Mode)	The general lighting can be manually turned on or automatically turned on up to 50%.
	9.4.1.1.g	Automatic Partial Off	Lighting power should be automatically reduced by at least 50% within 20 minutes of vacancy.
	9.4.1.1.h	Automatic Full Off	All lighting must be shut off within 20 minutes of vacancy.
	9.4.1.1.i	Scheduled Shutoff (Programmable Timeclock)	All lighting should be automatically shut off during periods when the space is scheduled to be unoccupied using a programmable timeclock or signal from another control device (i.e. security system).
LIGHT LEVEL CONTROL	9.4.1.1.d	Bi-level Control (0-10v Dimming)	The general lighting should use continuous dimming or have at least one intermediate step between 30-70% power in addition to full on and full off.
	9.4.1.1.e/f	Automatic Daylight Control (Photocontrol)	In primary side daylit general lighting zones using more than 150W (or using more than 300W within the primary and secondary daylit zones), daylight must be harvested using photocontrols. In top daylit general lighting zones using more than 150W, daylight must be harvested using photocontrols.
PLUG LOAD CONTROL	8.4.2	Automatic Receptacle Control	50% of all receptacles and 25% of modular furniture feeders must be turned off 20 minutes after vacancy.

Primary Solutions

Zūm™ Wireless Light Control

GLPP

GLPAC

Steinel

* Optional

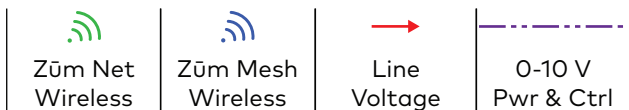
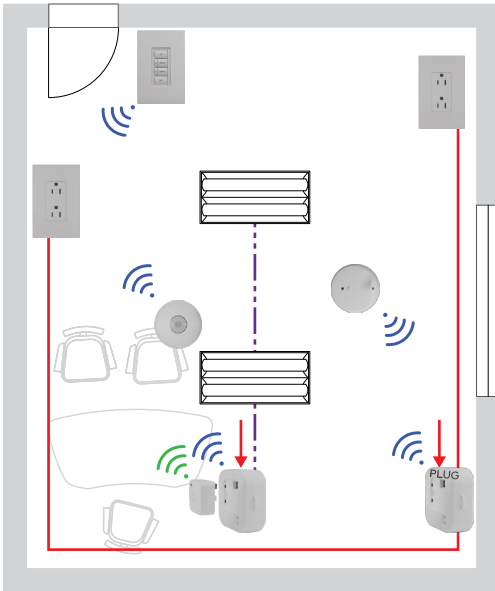
** Lighting in open-plan office spaces can be allowed to turn on automatically to more than 50%, as long as the control zone is no larger than 600 sq. ft.

*** 9.4.1.1.g permits automatic partial off so that lighting can be automatically reduced by at least 50% ("night light" mode). Full off is also acceptable.

Space Type				
Private Office/ Huddle Space ≤250 sq. ft.	Open Office Space/ Large Private Office ≥250 sq. ft.	Conference Room	Corridor	Restroom
			✓	✓
✓	✓	✓	✓	✓*
✓	✓**	✓		
			✓***	
✓	✓	✓	✓	✓
	or		or	
	✓		✓	
✓	✓	✓		
✓	✓	✓	✓	✓
✓	✓	✓	✓	
✓	✓	✓	✓	✓
✓			✓	
	✓	✓		
				✓

Private Office Space / Huddle Space

Zūm



ASHRAE 90.1-2016 Code Compliance:

- ▶ Local Control (9.4.1.1.a)
- ▶ Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- ▶ Automatic Full Off (9.4.1.1.h)
- ▶ Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- ▶ Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- ▶ Automatic Receptacle Control (8.4.2)

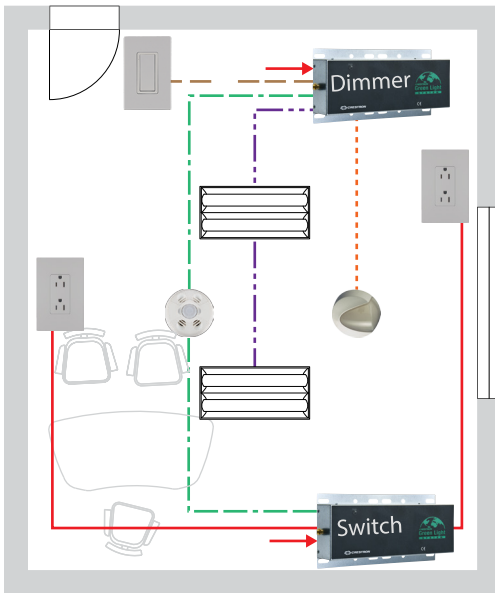
Local Control:



Symbol	Qty.	Product	Description
	1	ZUMMESH-JBOX-5A-LV	Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
	1	ZUMMESH-JBOX-20A-PLUG	Zūm™ J-Box Load Controller, Plug Load Switch
	1	ZUMMESH-NETBRIDGE	Zūm™ Network Bridge
	1	ZUMMESH-KP10CBATT	6-Button Battery Powered Keypad
	1	ZUMMESH-PIR-VACANCY-BATT	PIR Vacancy Sensor (AUTO-OFF)
	1	ZUMMESH-OL-PHOTOCELL	Open Loop Daylight Sensor

Private Office Space / Huddle Space

GLPP



ASHRAE 90.1-2016 Code Compliance:

- ▶ Local Control (9.4.1.1.a)
- ▶ Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- ▶ Automatic Full Off (9.4.1.1.h)
- ▶ Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- ▶ Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- ▶ Automatic Receptacle Control (8.4.2)

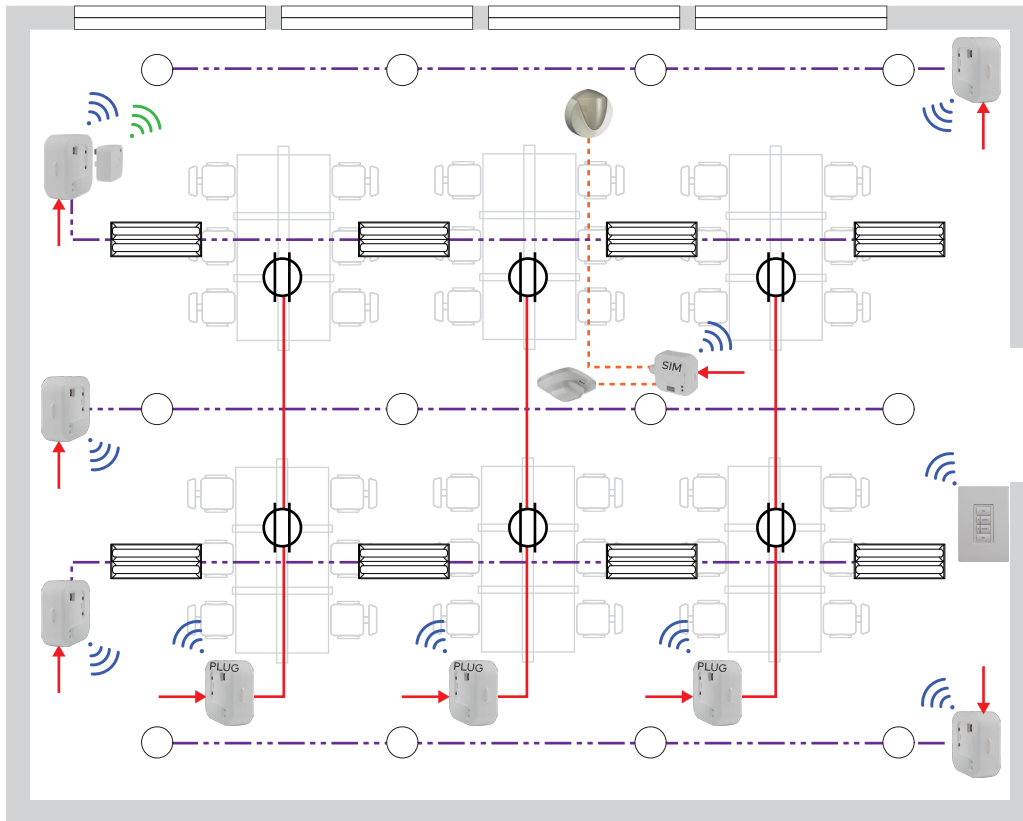
Local Control:



Product	Qty.	Product	Description
	1	GLPP-DIMFLVCN-PM	1-Ch 0-10V Dimmer with Cresnet® Control
	1	GLPP-SWCN	Crestron Green Light® Power Pack, 1-Channel Switch with Cresnet® Control
	1	GLPPA-KP	In-Wall Keypad for GLPP
	1	GLS-ODT-C-NS	Dual-Technology Ceiling Mount Occupancy Sensor
	1	GLS-LOL	Crestron Green Light® Photosensor, Open-Loop

Open Office Space

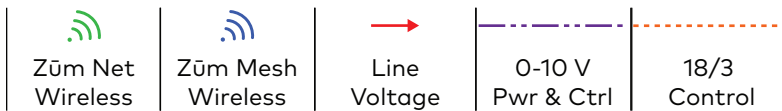
Zūm



ASHRAE 90.1-2016 Code Compliance:

- ▶ Local Control (9.4.1.1.a)
- ▶ Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- ▶ Automatic Full Off (9.4.1.1.h)
- ▶ Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- ▶ Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- ▶ Automatic Receptacle Control (8.4.2)

Local Control:

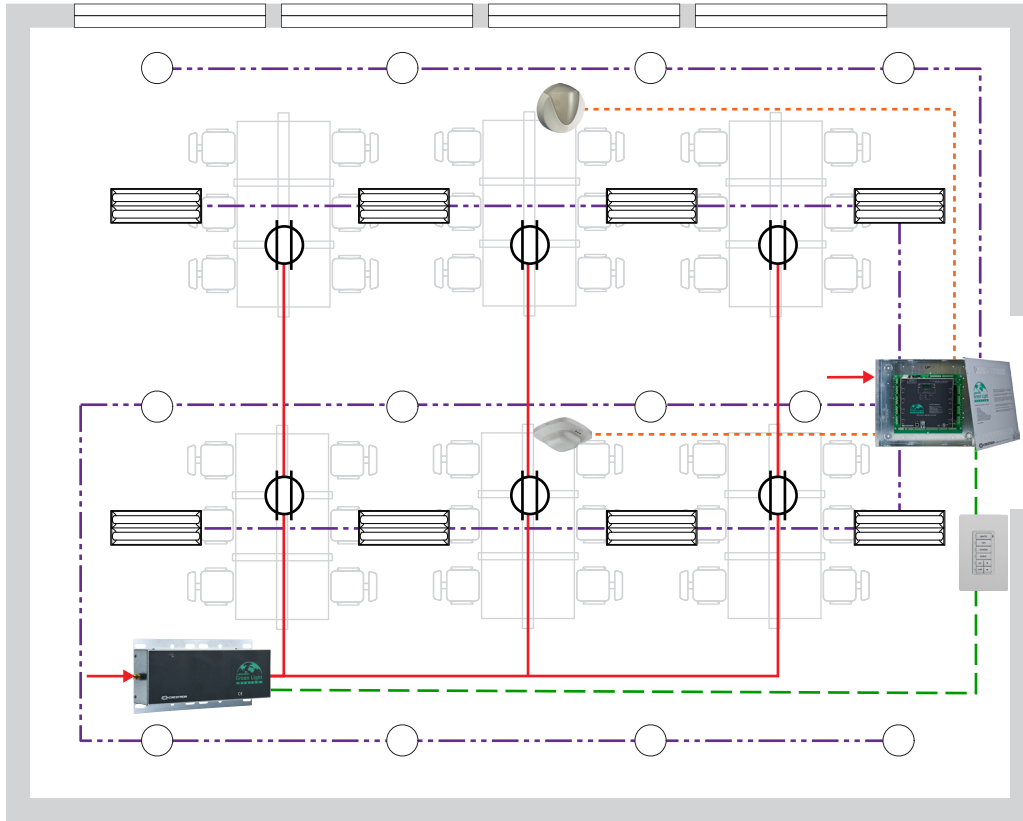


- ▶ Use Crestron GLS-ODT-C-NS motion sensors when full height modular furniture is present in an open office space.
- ▶ Add a ZUM-FLOOR-HUB and ZUMNET-GATEWAY for scheduled shutoff (9.4.1.1.i).

Symbol	Qty.	Product	Description
	5	ZUMMESH-JBOX-5A-LV	Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
	3	ZUMMESH-JBOX-20A-PLUG	Zūm™ J-Box Load Controller, Plug Load Switch
	1	ZUMMESH-JBOX-SIM	Zūm™ Junction Box Sensor Integration Module
	1	ZUMMESH-NETBRIDGE	Zūm™ Network Bridge
	1	ZUMMESH-KP10CBATT	6-Button Battery Powered Keypad
	1	GLA-IR-QUATTRO-HD-COM1-24	STEINEL IR Quattro HD COM1-24 Presence Detector
	1	GLS-LOL	Crestron Green Light® Photosensor, Open-Loop

Open Office Space

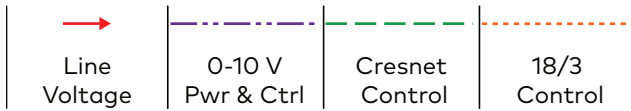
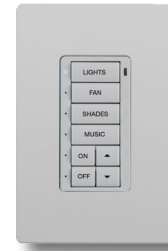
GLPAC



ASHRAE 90.1-2016 Code Compliance:

- ▶ Local Control (9.4.1.1.a)
- ▶ Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- ▶ Automatic Full Off (9.4.1.1.h)
- ▶ Scheduled Shutoff (Programmable Timeclock) (9.4.1.1.i)
- ▶ Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- ▶ Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- ▶ Automatic Receptacle Control (8.4.2)

Local Control:

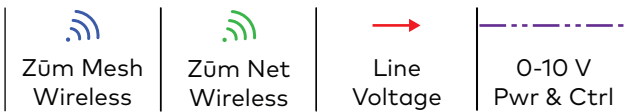
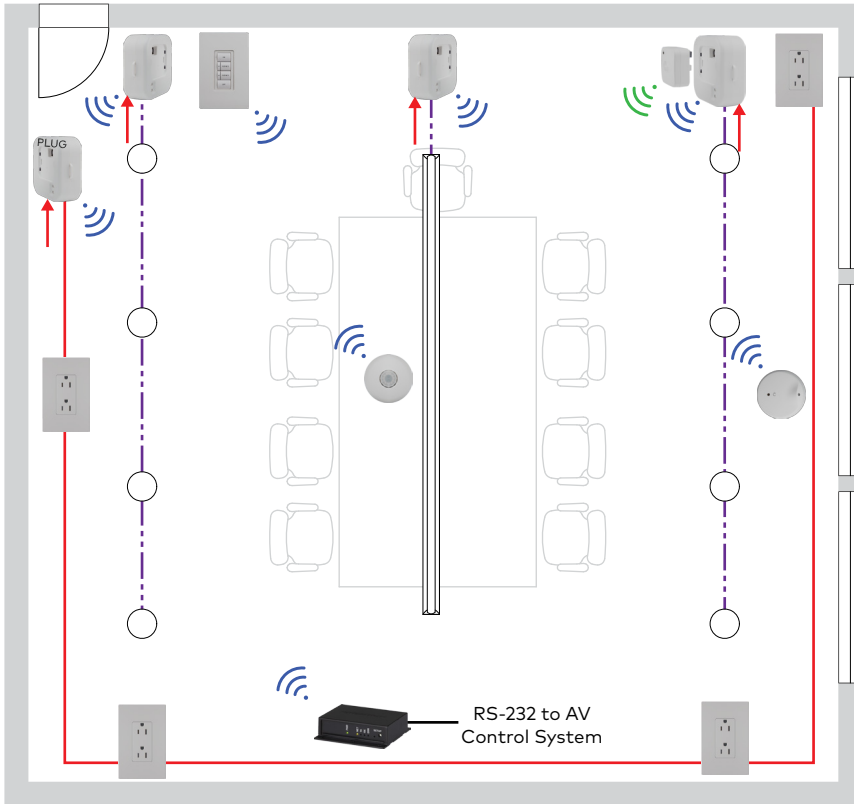


- ▶ Use Crestron GLS-ODT-C-NS motion sensors when full height modular furniture is present in an open office space.
- ▶ Motion sensing or time clock can be used to shut the lights off.

Symbol	Qty.	Product	Description
	1	GLPAC-DIMFLV4	Crestron Green Light® Integrated Lighting System, 4-Channel
	1	GLPP-SWCN	Crestron Green Light® Power Pack, 1-Channel with Cresnet® Control
	1	C2N-CBD-P	Cameo® Keypad, Standard Mount
	1	GLA-IR-QUATTRO-HD-COM1-24	STEINEL IR Quattro HD COM1-24 Presence Detector
	1	GLS-LOL	Crestron Green Light® Photosensor, Open-Loop

Conference Room

Zūm



ASHRAE 90.1-2016 Code Compliance:

- ▶ Local Control (9.4.1.1.a)
- ▶ Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- ▶ Automatic Full Off (9.4.1.1.h)
- ▶ Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- ▶ Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- ▶ Automatic Receptacle Control (8.4.2)

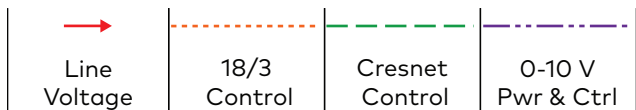
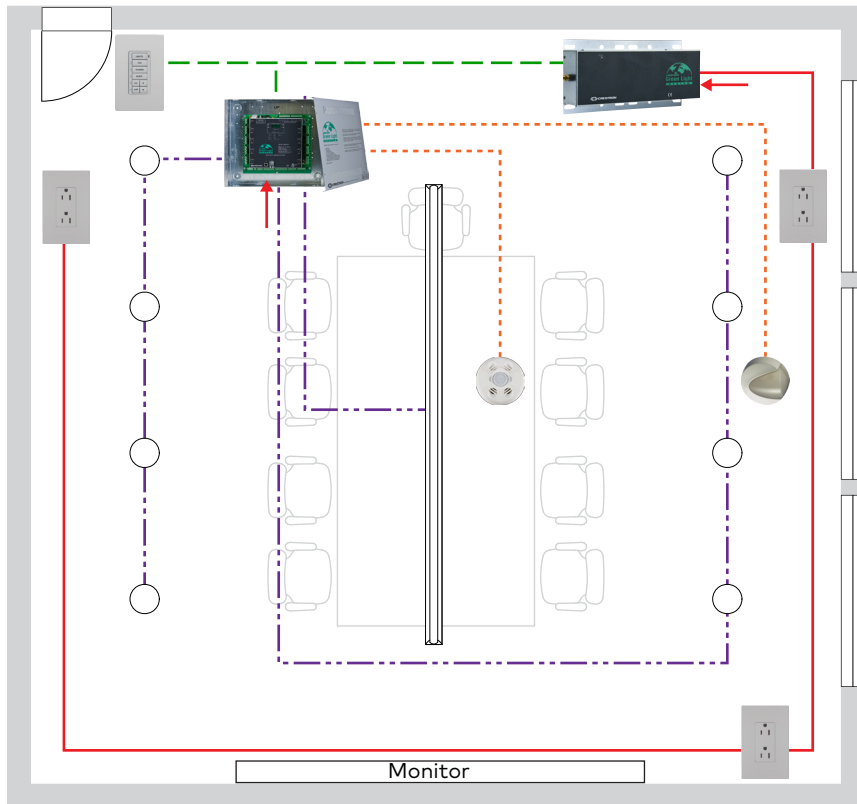
Local Control:



Symbol	Qty.	Product	Description
	3	ZUMMESH-JBOX-5A-LV	Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
	1	ZUMMESH-JBOX-20A-PLUG	Zūm™ J-Box Load Controller, Plug Load Switch
	1	ZUMMESH-NETBRIDGE	Zūm™ Network Bridge
	1	ZUMMESH-AVBRIDGE	AV Bridge – Wireless Control Integration Module
	1	ZUMMESH-KP10CBATT	6-Button Battery Powered Keypad
	1	ZUMMESH-PIR-VACANCY-BATT	PIR Vacancy Sensor (AUTO-OFF)
	1	ZUMMESH-OL-PHOTOCELL	Open Loop Daylight Sensor

Conference Room

GLPAC

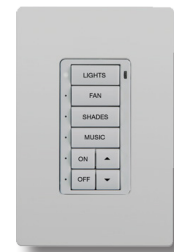







► Motion sensing or time clock can be used to shut the lights off.

ASHRAE 90.1-2016 Code Compliance:

- Local Control (9.4.1.1.a)
- Manual On / Partial Auto On (Vacancy Sensing Mode) (9.4.1.1.b/c)
- Automatic Full Off (9.4.1.1.h)
- Bi-level Control (0-10v Dimming) (9.4.1.1.d)
- Automatic Daylight Control (Photocontrol) (9.4.1.1.e/f)
- Automatic Receptacle Control (8.4.2)

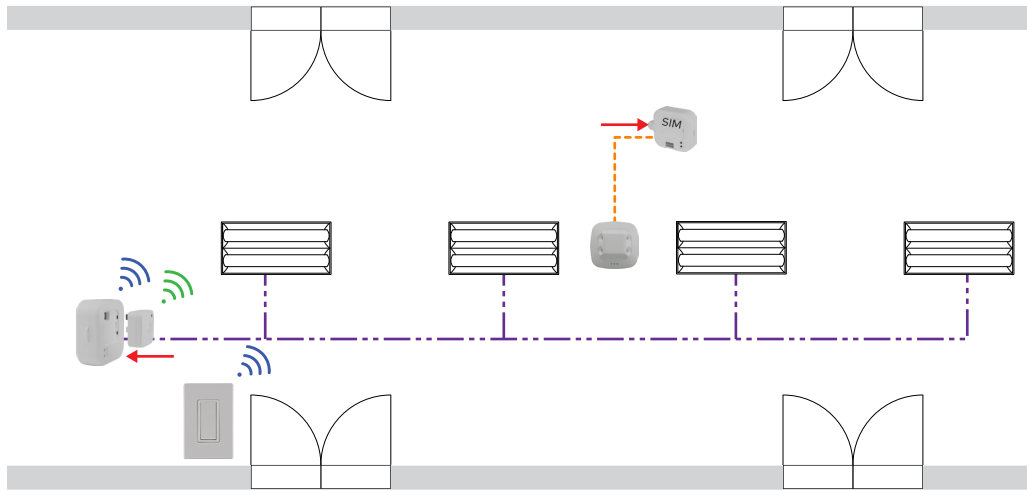
Local Control:



Symbol	Qty.	Product	Description
	1	GLPAC-DIMFLV4	Crestron Green Light® Integrated Lighting System, 4-Channel
	1	GLPP-SWCN	Crestron Green Light® Power Pack, 1-Channel Switch with Cresnet® Control
	1	C2N-CBD-P	Cameo® Keypad, Standard Mount
	1	GLS-ODT-C-NS	Dual-Technology Ceiling Mount Occupancy Sensor
	1	GLS-LOL	Crestron Green Light® Photosensor, Open-Loop

Corridor

Zūm



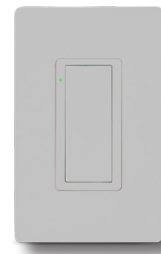
ASHRAE 90.1-2016 Code Compliance:

- ▶ Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- ▶ Local Control (9.4.1.1.a)
- ▶ Automatic Partial Off (9.4.1.1.g)
- ▶ Automatic Full Off (9.4.1.1.h)



- ▶ UL924 emergency lighting devices are available for life safety.
- ▶ Add a ZUM-FLOOR-HUB and ZUMNET-GATEWAY for scheduled shutoff (9.4.1.1.i).
- ▶ Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

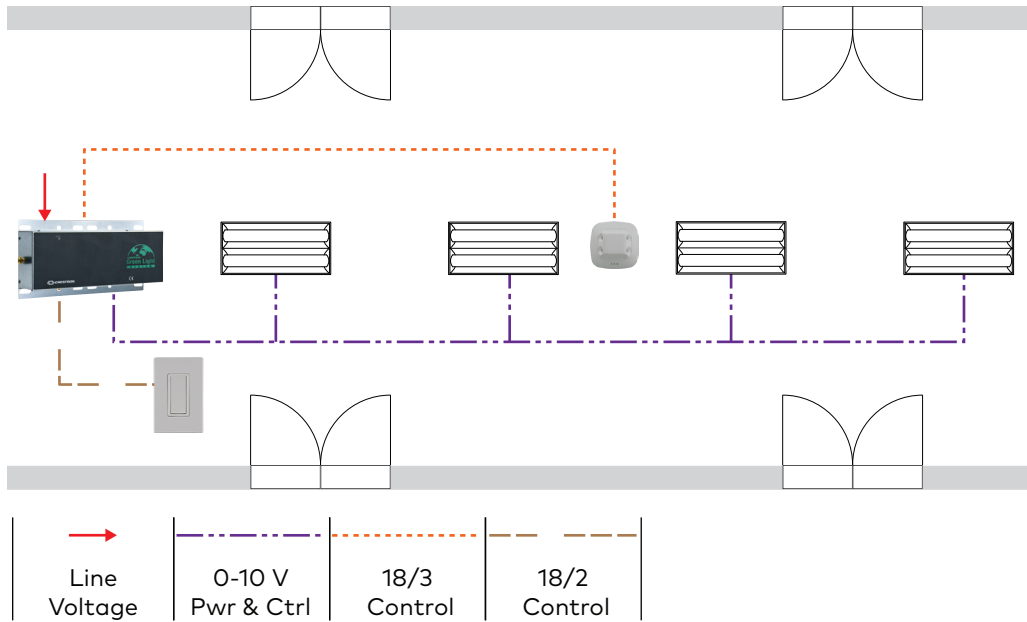
Local Control:



Symbol	Qty.	Product	Description
	1	ZUMMESH-JBOX-5A-LV	Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
	1	ZUMMESH-JBOX-SIM	Zūm™ Junction Box Sensor Integration Module
	1	ZUMMESH-NETBRIDGE	Zūm™ Network Bridge
	1	ZUMMESH-KP10ABATT	Rocker-Button Battery Powered Keypad
	1	GLA-US-HALLWAY-COM1-24	40 kHz Ultrasonic Presence Detector, Ceiling Mount, Hallway Coverage, 18-24 VAC/VDC, 33 ft corridor coverage, up to 8 hallway sensors per SIM

Corridor

GLPP






ASHRAE 90.1-2016 Code Compliance:

- ▶ Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- ▶ Local Control (9.4.1.1.a)
- ▶ Automatic Partial Off (9.4.1.1.g)
- ▶ Automatic Full Off (9.4.1.1.h)

- ▶ UL924 emergency lighting devices are available for life safety.
- ▶ Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

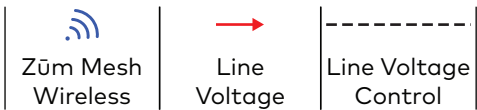
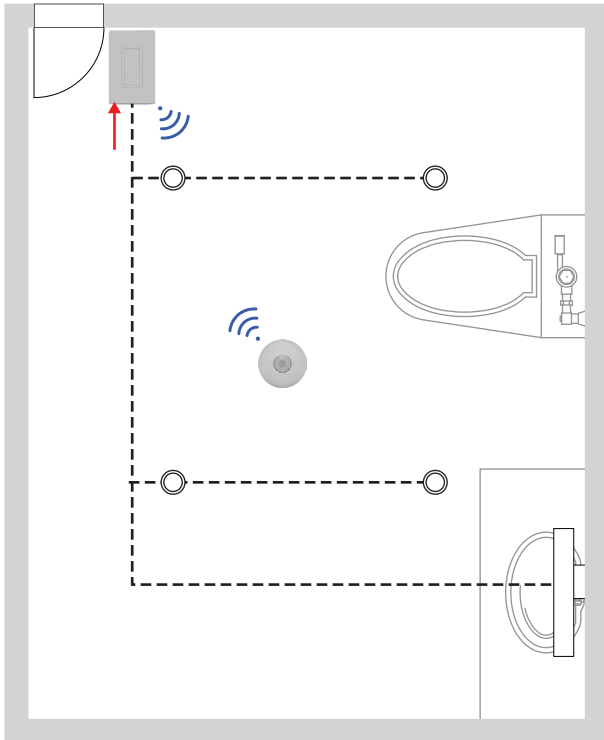
Local Control:



Product	Qty.	Product	Description
	1	GLPP-1DIMFLVCN-PM	1-Ch 0-10V Dimmer with Cresnet® Control
	1	GLPPA-KP	In-Wall Keypad for GLPP
	1	GLA-US-HALLWAY-COM1-24	40 kHz Ultrasonic Presence Detector, Ceiling Mount, Hallway Coverage, 18-24 VAC/VDC

Private Restroom

Zūm

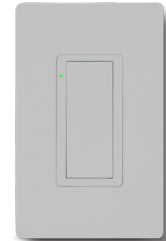




- ▶ Local control (9.4.1.1.a) is optional.
- ▶ Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

ASHRAE 90.1-2016 Code Compliance:

- ▶ Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- ▶ Local Control (9.4.1.1.a)
- ▶ Automatic Full Off (9.4.1.1.h)

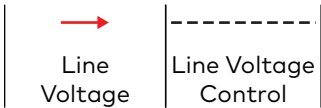
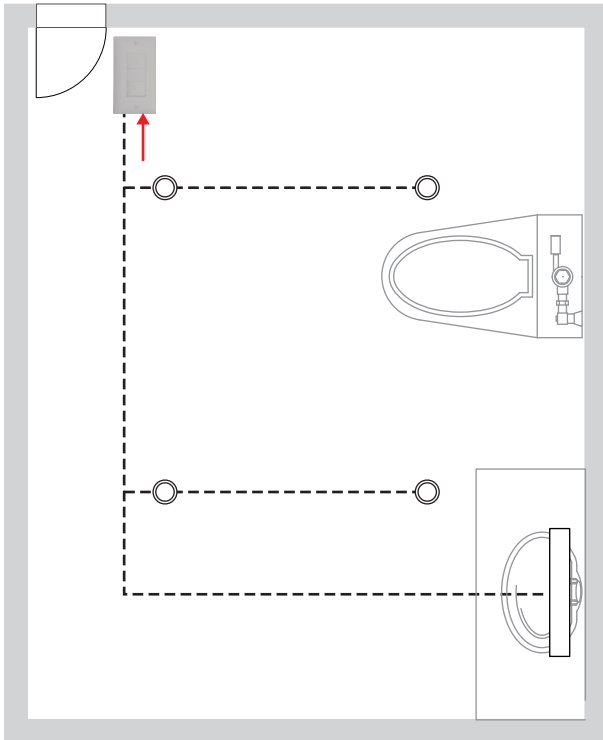
Local Control:



Symbol	Qty.	Product	Description
	1	ZUMMESH-5A-SW	Zūm™ Wall-Box Switch, 5A
	1	ZUMMESH-PIR-OCCUPANCY-BATT	PIR Occupancy Sensor (AUTO-ON, AUTO-OFF)

Private Restroom

Steinel




- ▶ Local control (9.4.1.1.a) is optional.
- ▶ Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

ASHRAE 90.1-2016 Code Compliance:

- ▶ Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- ▶ Local Control (9.4.1.1.a)
- ▶ Automatic Full Off (9.4.1.1.h)

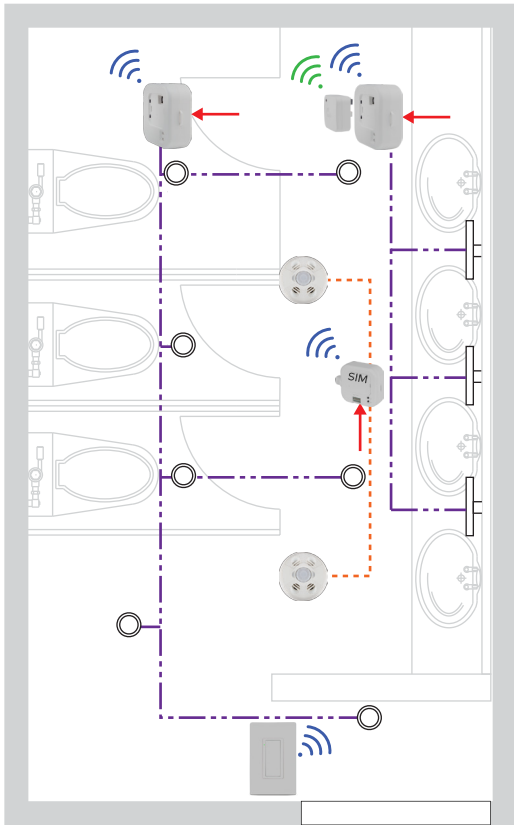
Local Control:



Symbol	Qty.	Product	Description
	1	GLA-IR-VS-1	STEINEL IR VS 1 Passive Infrared Wall Switch Vacancy Sensor, White

Public Restroom

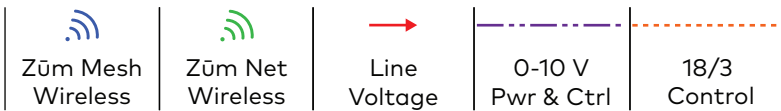
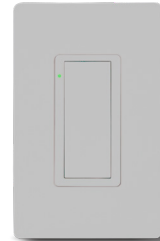
Zūm








ASHRAE 90.1-2016 Code Compliance:

- ▶ Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- ▶ Local Control (9.4.1.1.a)
- ▶ Automatic Full Off (9.4.1.1.h)

Local Control:

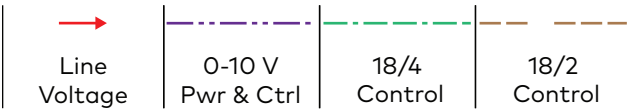
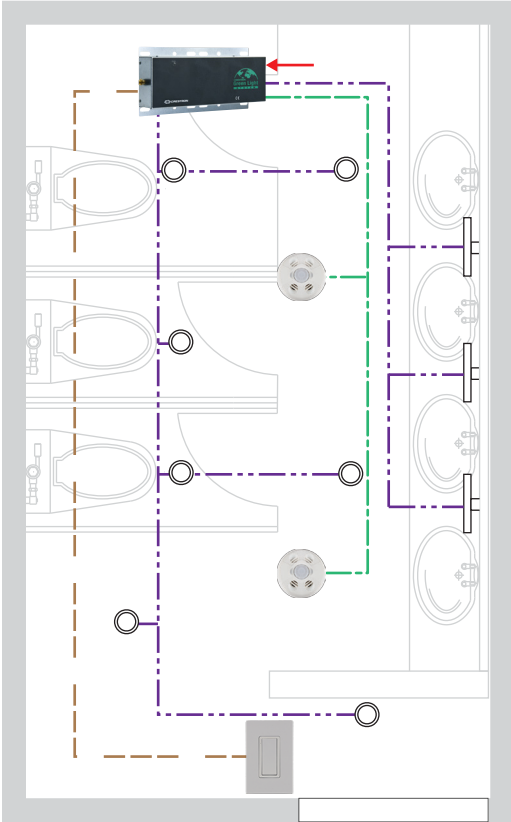


- ▶ Local control (9.4.1.1.a) is optional.
- ▶ Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

Symbol	Qty.	Product	Description
	2	ZUMMESH-JBOX-5A-LV	Zūm™ Junction Box Zone Controller, 0-10V Dimming, 5A
	1	ZUMMESH-JBOX-SIM	Zūm™ Junction Box Sensor Integration Module
	1	ZUMMESH-NETBRIDGE	Zūm™ Network Bridge
	1	ZUMMESH-KP10ABATT	Rocker-Button Battery Powered Keypad
	2	GLS-ODT-C-NS	Dual-Technology Ceiling Mount Occupancy Sensor

Public Restroom

GLPP






- ▶ Local control (9.4.1.1.a) is optional.
- ▶ Automatic daylight control (photocontrol) (9.4.1.1.e/f) may be required if windows are present.

ASHRAE 90.1-2016 Code Compliance:

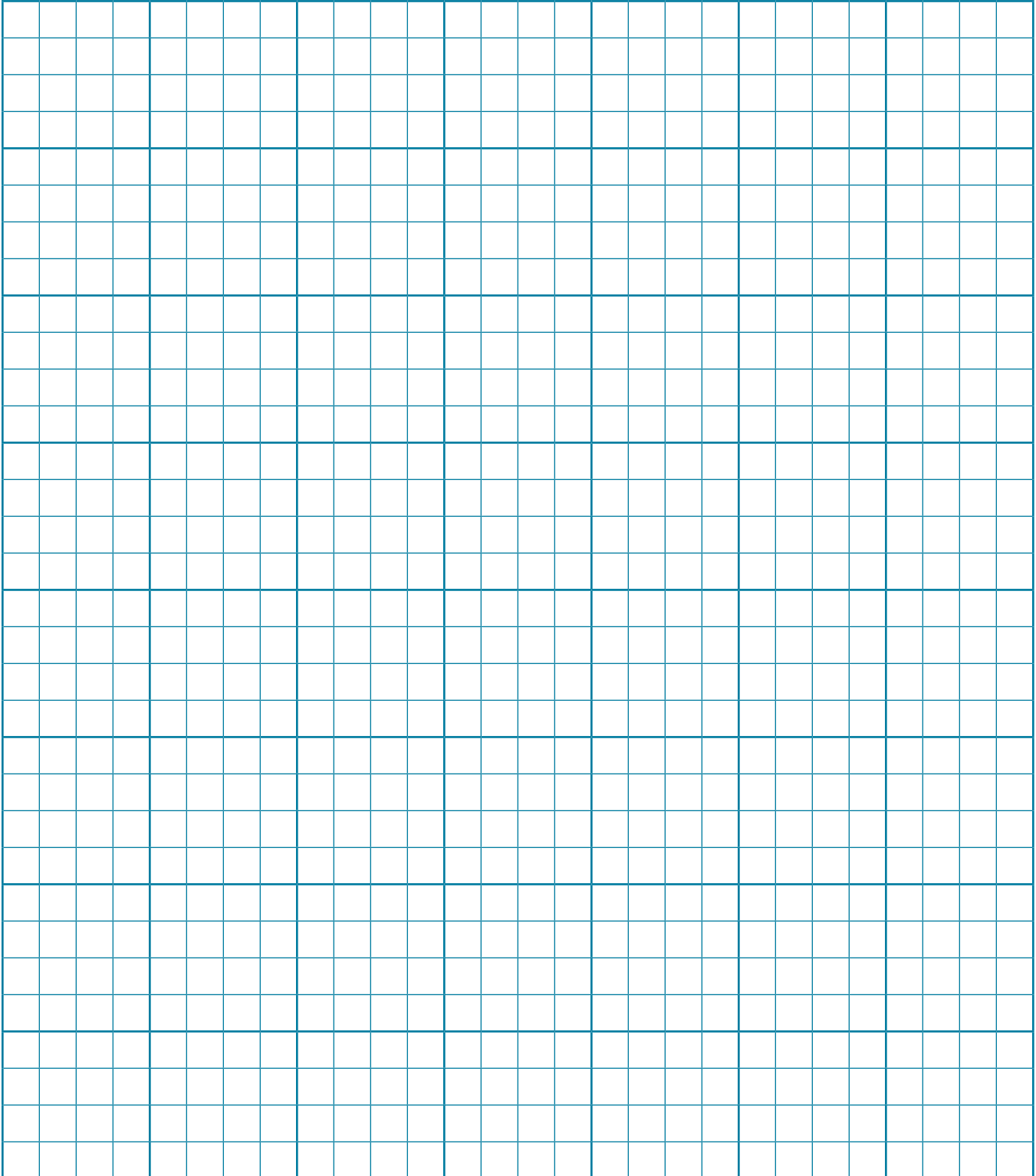
- ▶ Automatic Full On (Occupancy Sensing Mode) (9.4.1.1)
- ▶ Local Control (9.4.1.1.a)
- ▶ Automatic Full Off (9.4.1.1.h)

Local Control:

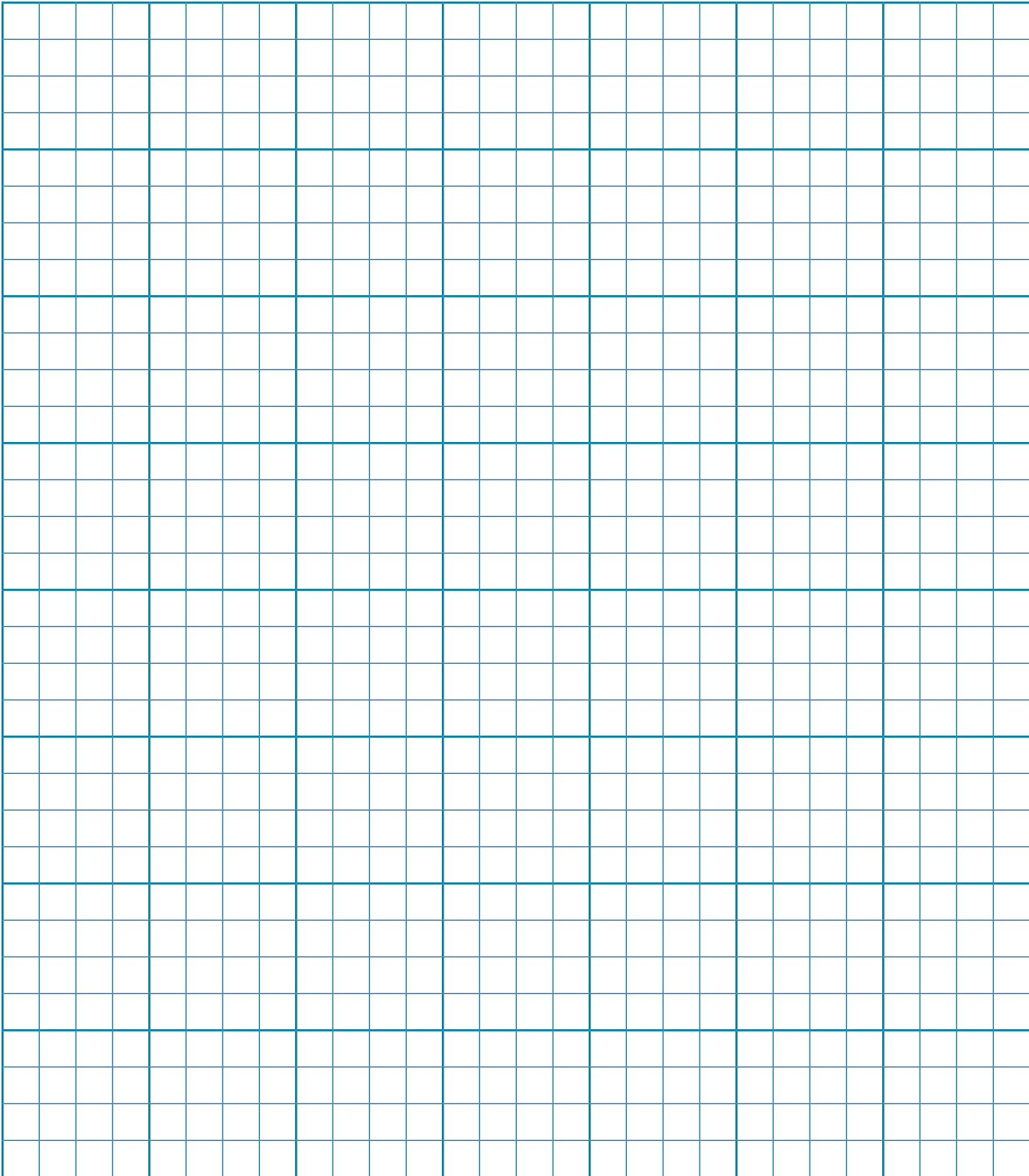


Product	Qty.	Product	Description
	1	GLPP-1DIMFLV2CN-PM	2-Ch 0-10V Dimmer with Cresnet® Control
	1	GLPPA-KP	In-Wall Keypad for GLPP
	2	GLS-ODT-C-NS	Dual-Technology Ceiling Mount Occupancy Sensor

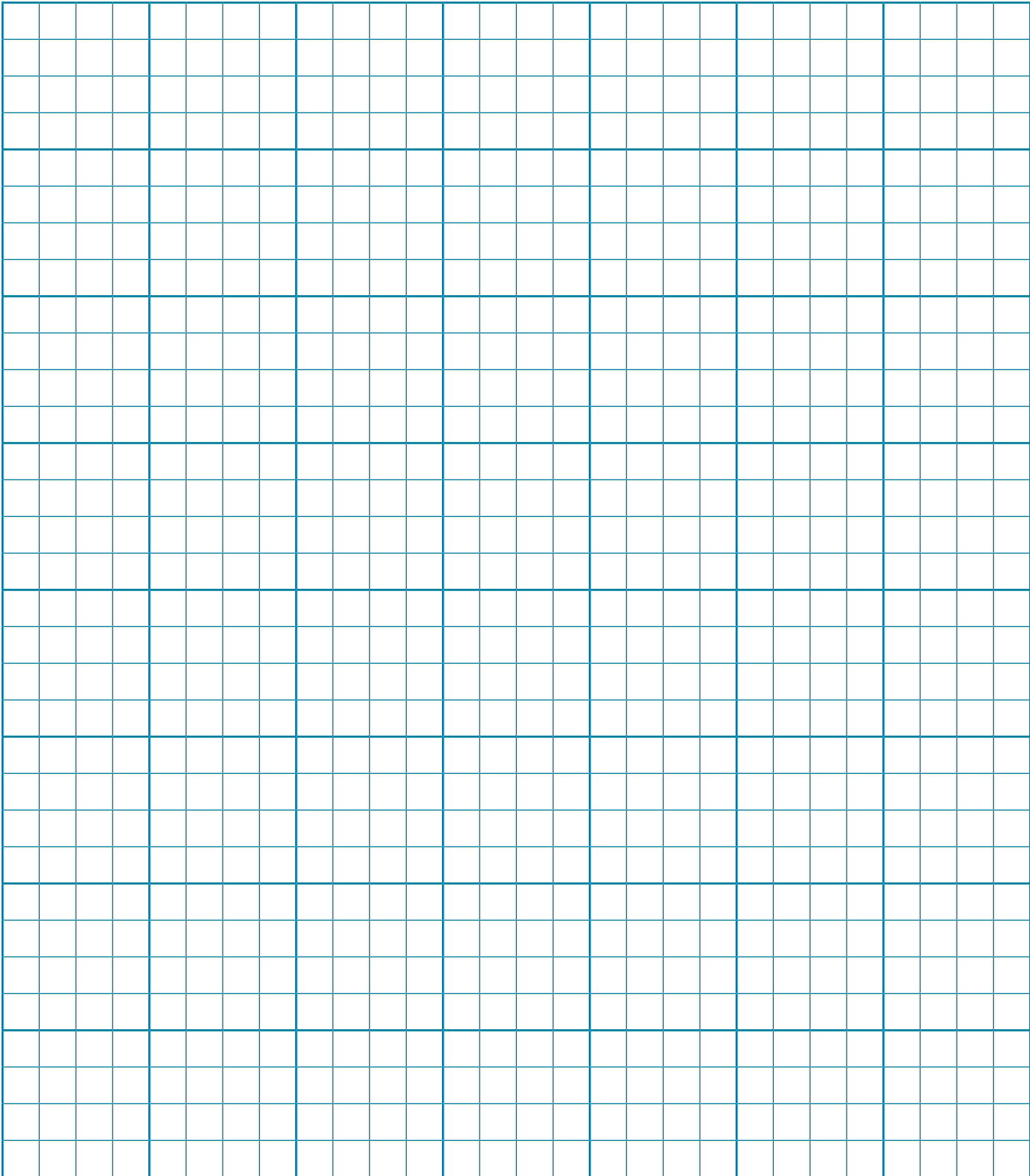
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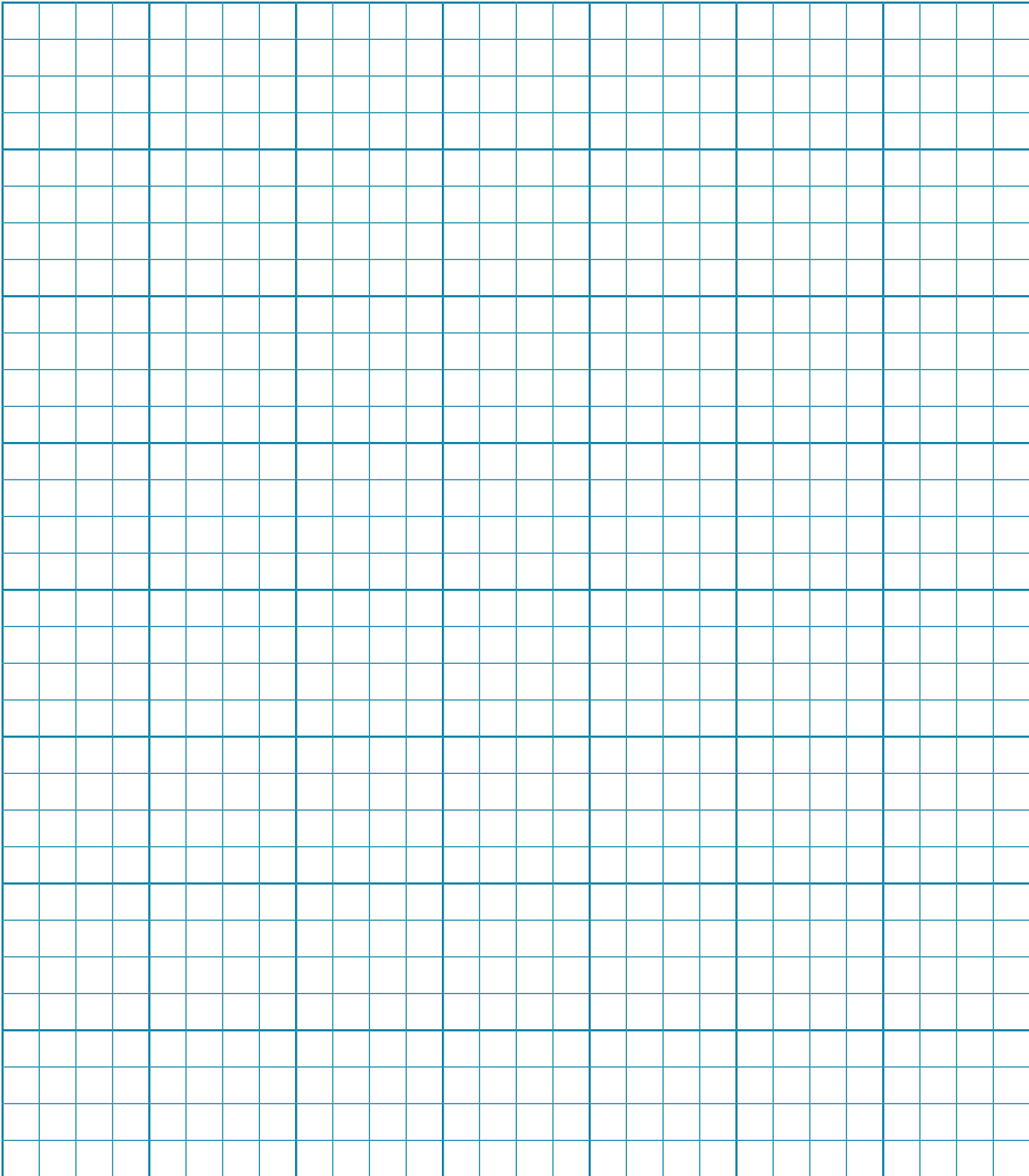
Notes



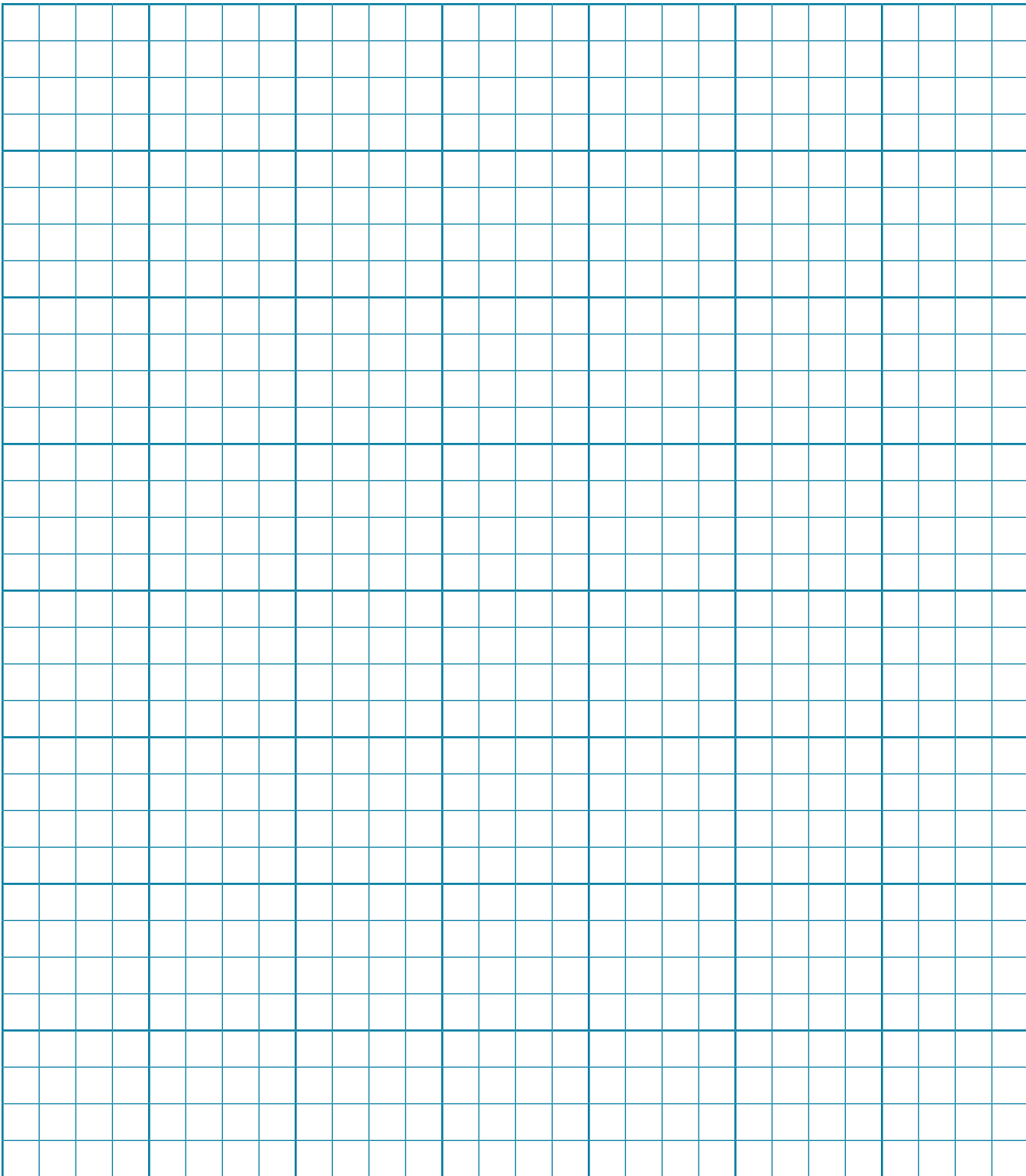
Notes



Notes



Notes



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