P.M. Lighting, LLC
QUALITY LANDSCAPE LIGHTING

Dealer Training Program

Technical & Installation Module

P.M. Lighting, LLC
QUALITY LANDSCAPE LIGHTING

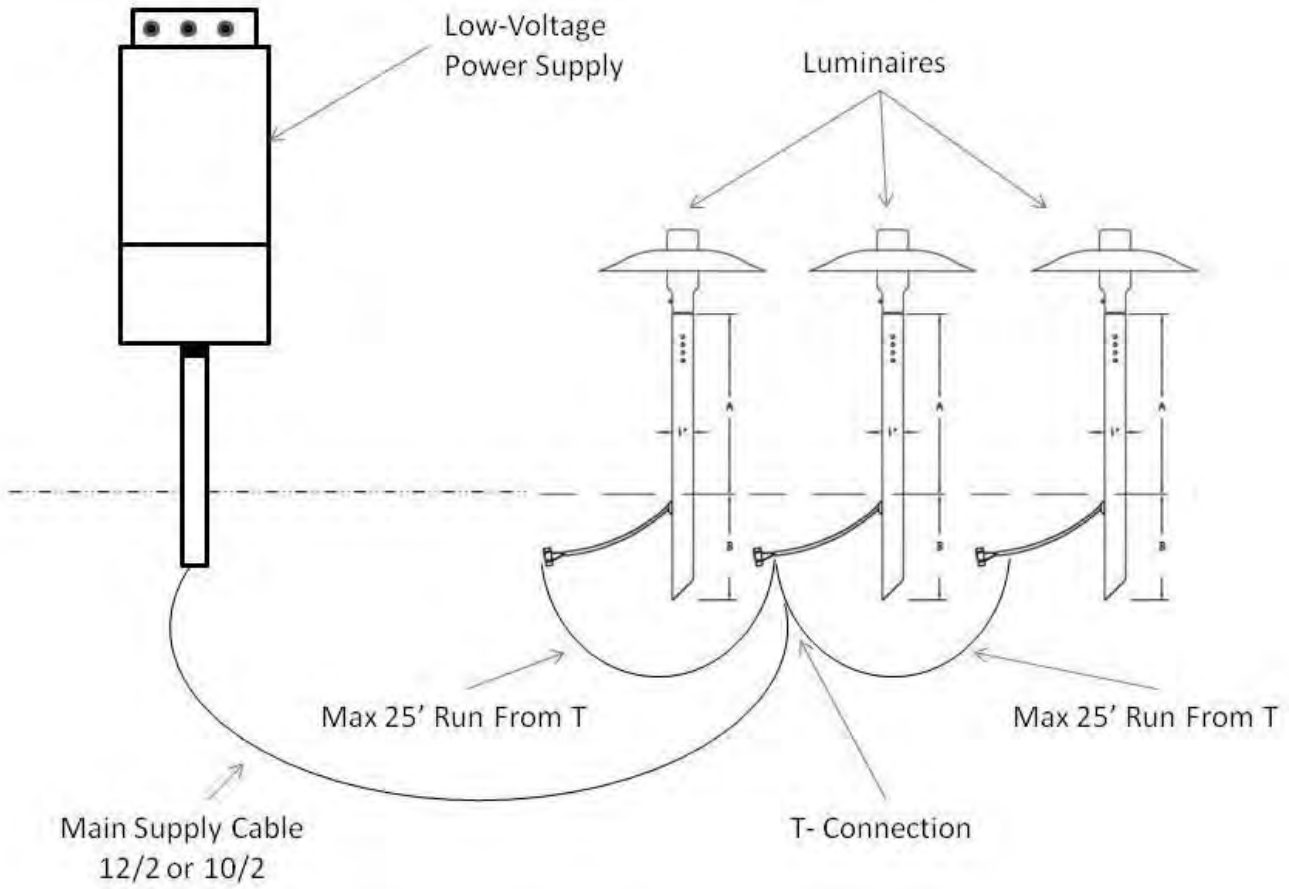
Dealer Training Program

AGENDA

- System Design and Wiring
- Transformer Wiring, Balancing, & Loading
- Installation Techniques
- Fixture Installation

Technical & Installation Module

System Design & Wiring



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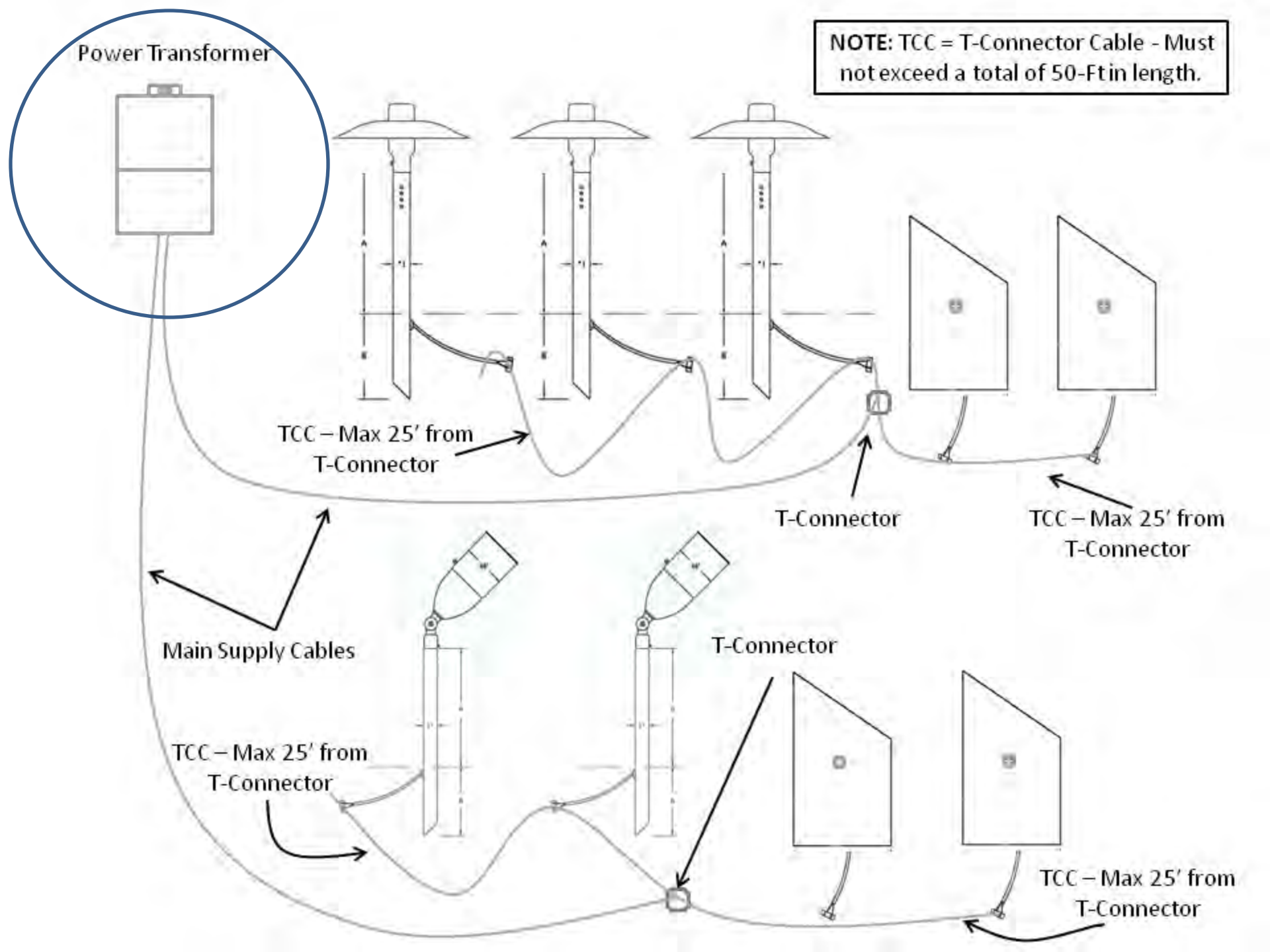
Power Transformer
NOTE: TCC = T-Connector Cable - Must not exceed a total of 50-Ft in length.
TCC – Max 25' from T-Connector
T-Connector
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Main Supply Cables
T-Connector
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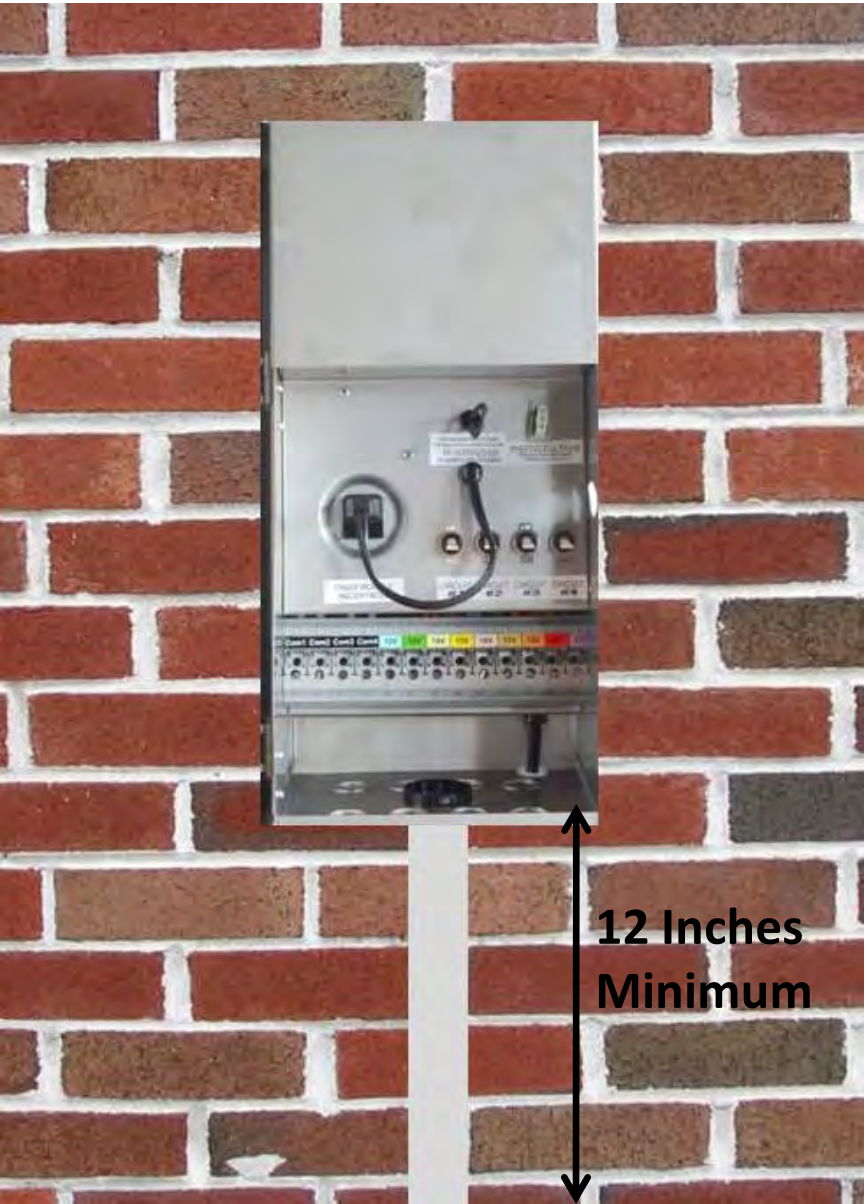
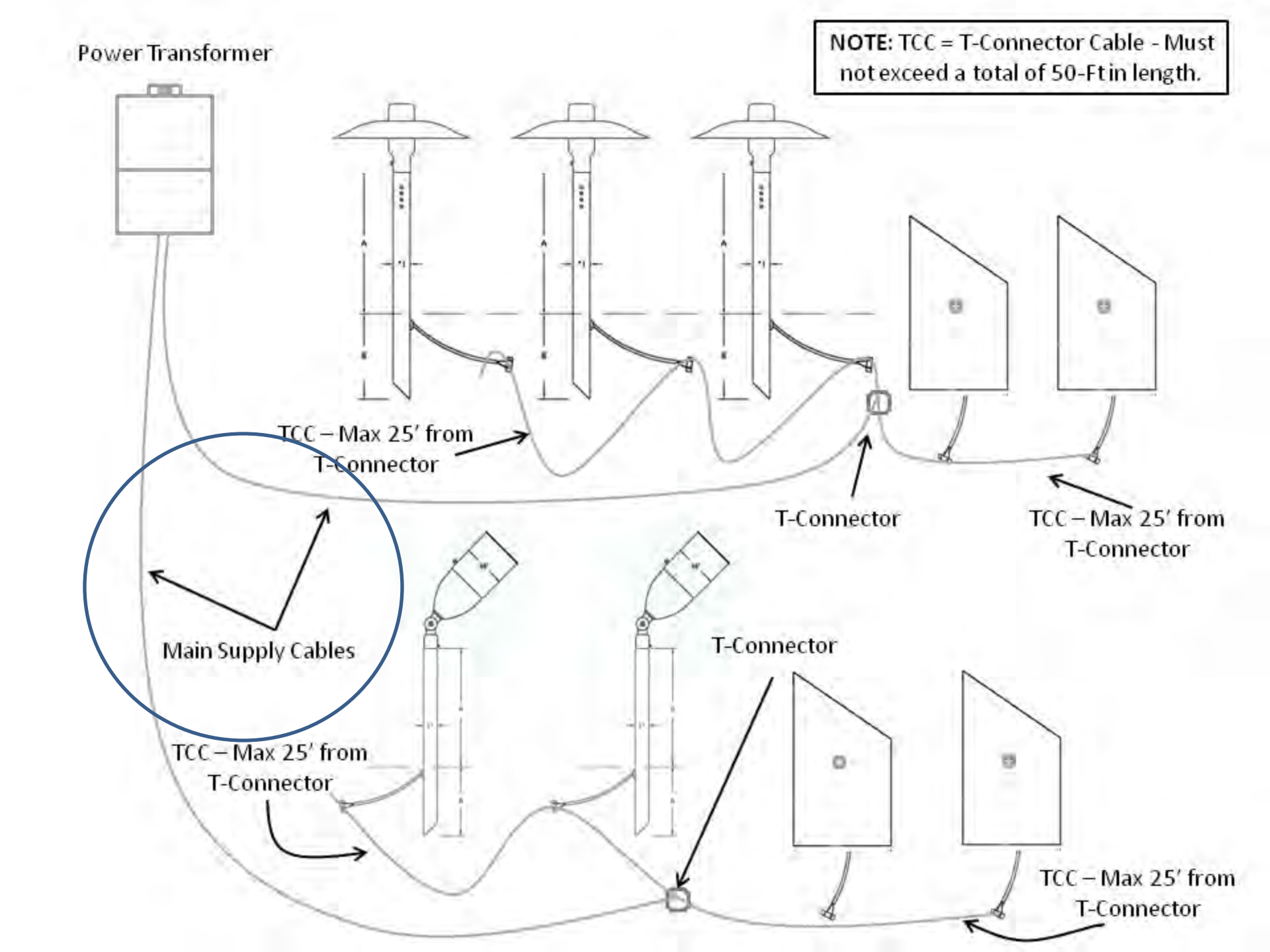
Transformer Basics

- Size and type of transformer determined by:
  - Total wattage of fixtures
  - Complexity / length of runs
- Electronic vs. Magnetic?
  - Professional Systems – Magnetic
- Stacked Plate vs. Toroidal Coil
  - Stacked Plate = Lower Cost
  - Toroidal Coil = Longer Life & Energy Efficient
- Standard or Extended Multi-Tap?
  - Standard – 12V through 15V taps
  - Extended – 12V through 18V + 20V, 22V

Transformer Basics



- Determine transformer location ***FIRST***!
- Install transformer a minimum of 12 inches above the ground
- Locate near an approved GFCI outlet
- Use screws and /or anchors to mount to any wall or fence
- Timer or Photocell options for both internal and external installation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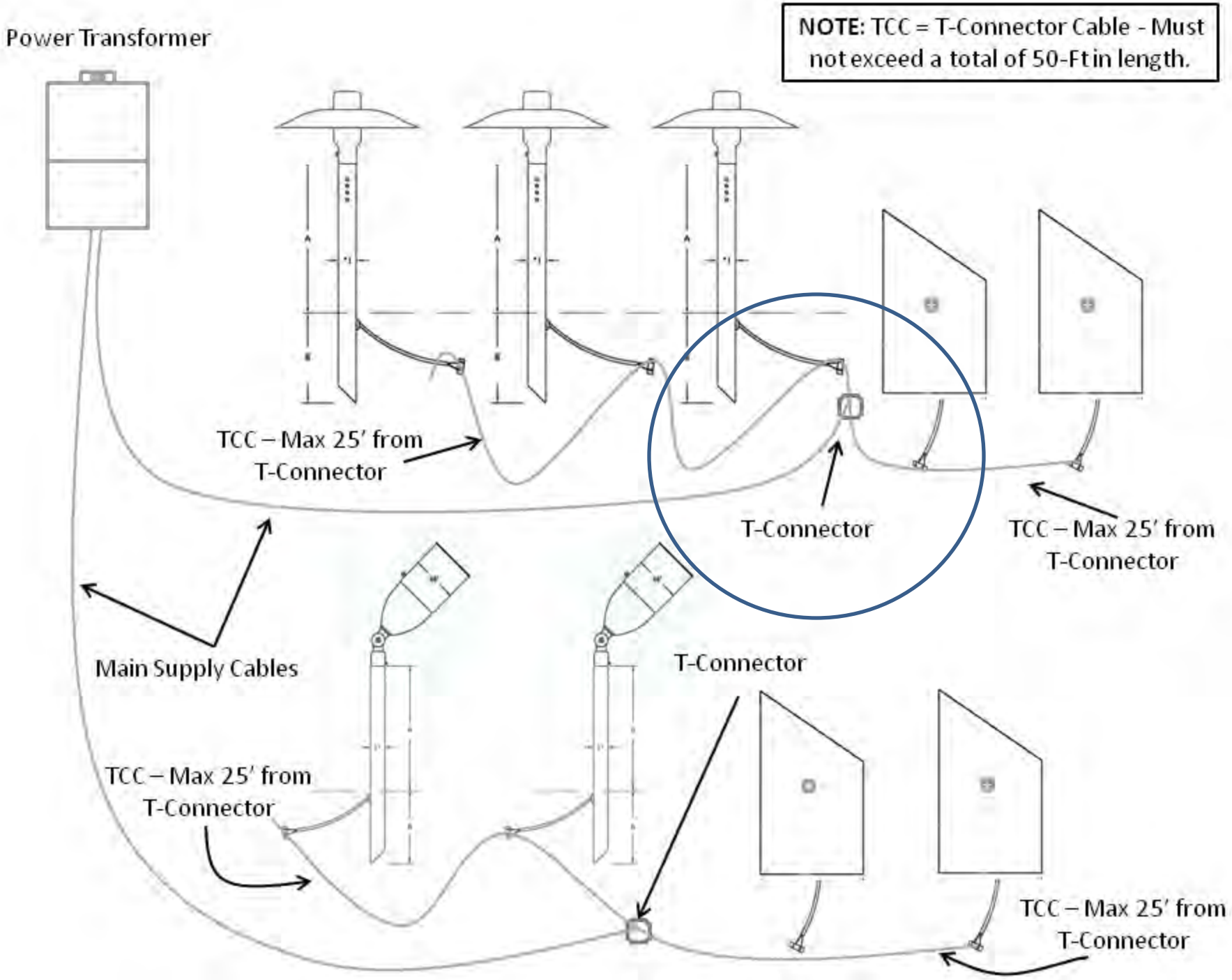
Main Supply Cables

- Use 12/2 or 10/2 direct burial landscape cable
- Use 10/2 for runs over 100’ in length
- Do not exceed cable ratings

Cable	Rated Amps	Rated Watts
12/2	16A	192W
10/2	24A	288W
8/2	32A	384W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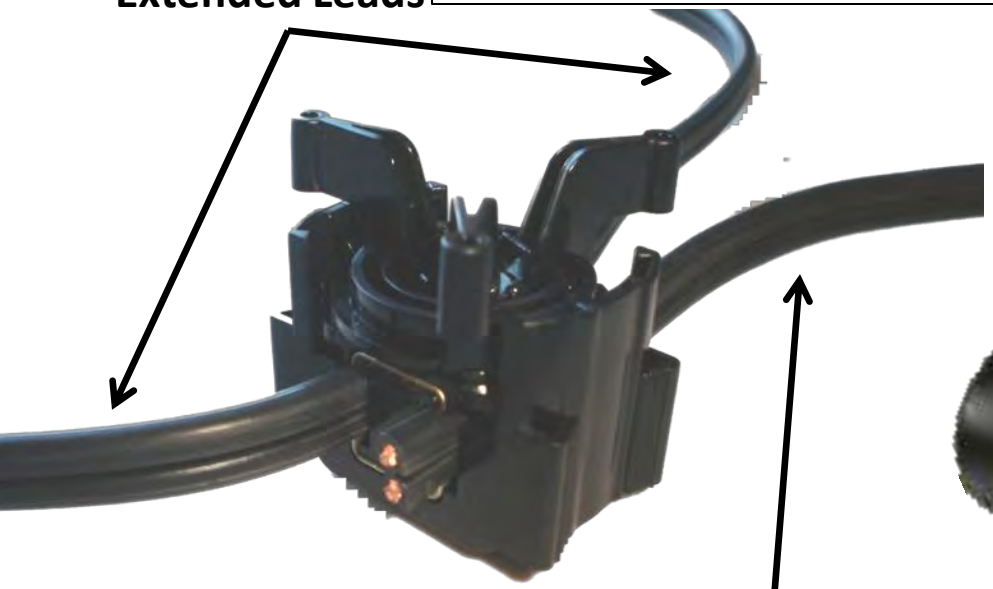
T-Connector / Hub Basics

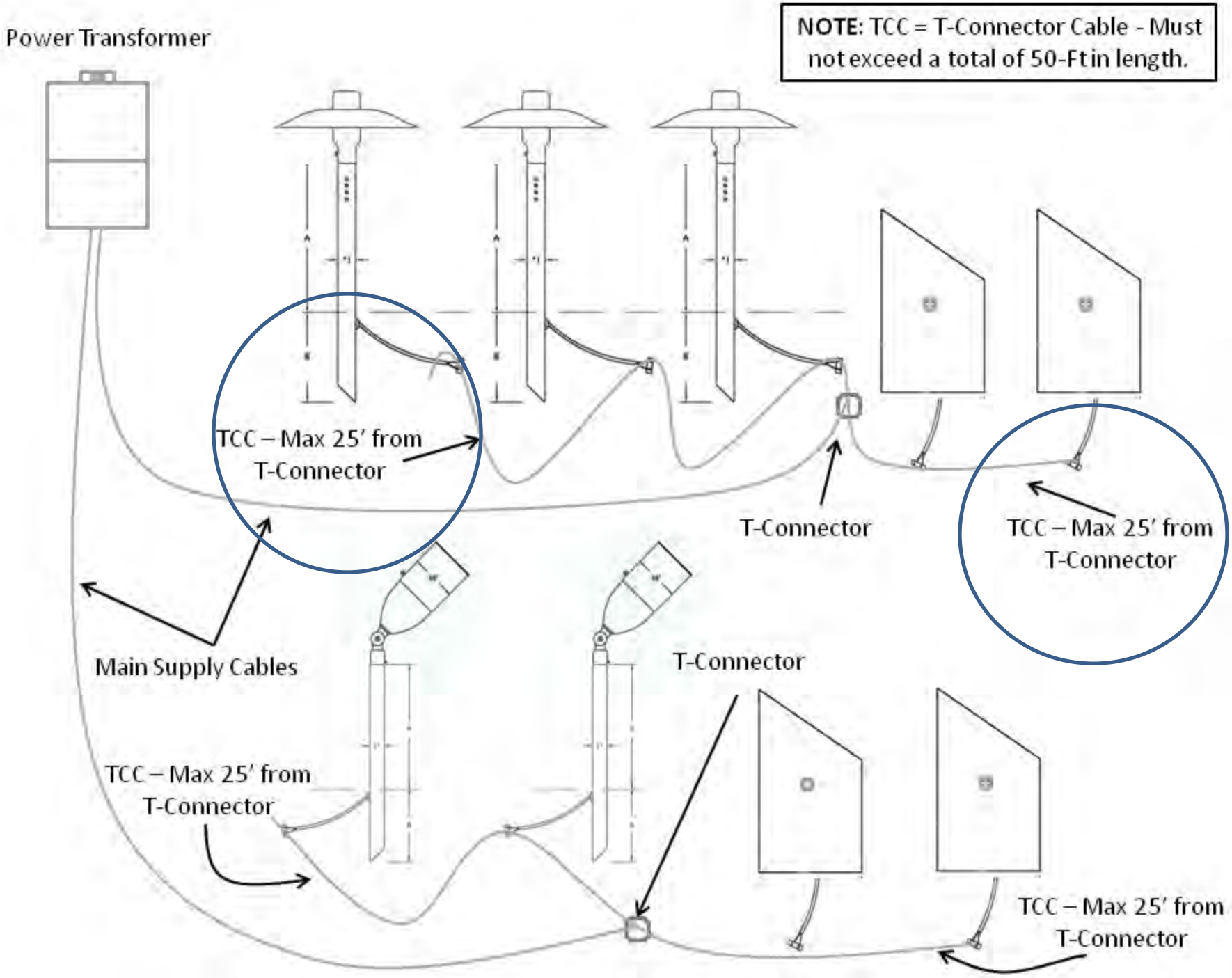
T-Connection using 2-Piece Screw Connector (not recommended for professional systems)

T-Connector Cable or Extended Leads



Main Supply Cable 12/2 minimum

Hub or T-Connection using Sealed LV-CON (Hard Wired)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Fixture Connections

Standard Option – Quick Connectors

- **Connect each fixture to the TCC**
- **Use slip-joint pliers to squeeze parts together to secure**

Fixture Connections

Option 2 – Hard Wired

Step 1 – Strip Wire & Twist

Step 2 - Crimp Copper Barrel on Wire

Hub Method using Sealed LV-CON (Hard Wired)

Fixture Connections

Option 2 – Hard Wired

Step 3 - Fold wire into V-slot and slide on silicone filled cover

Step 4 - Snap both sections together until rings lock on ratchet teeth

Hub Method using Sealed LV-CON (Hard Wired)

Fixture Connections

Other Options

Silicone Filled Wire Nuts

Specialty Connectors (ACE)

Soldered Connections

Transformer Wiring & Technical Info

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Use the 80/20 Rule

Limit each power bank to a maximum of 80% total wattage from all FIXTURES on each COMMON

Example:

300 watt transformer = 240 watt max
600 watt transformer = 480 watt max
900 watt transformer = 720 watt max
1200 watt transformer = 960 watt max

* Additional wattage (up to rated amount) may be achieved as long as amperage on commons do not exceed 25 amps.

Fixture Voltage Range

- Halogen fixtures should generate a voltage reading between 10.8V – 11.8V (never over 12V)
- LED fixtures operate in a voltage range, but optimal is closer to 12V

EFFECT OF VOLTAGE ON LAMP LIFE / LIGHT OUTPUT		
Voltage Lamp	**Life Expectancy of lamp**	**% of Rated Candlepower**
13.2	2/3 rated life	350
12.6	3/4 rated life	180
12	As Rated	100
11.5	2 x rated life	80
11	3 x rated life	75
10.75	4 x rated life	70
10.5	5 x rated life	65
10	9 x rated life	50

Voltage Drop

Low voltage fixtures experience voltage drop depending on total wattage, cable gauge, and home run length

VOLT DROP FORMULA

Step 1 – Calculate AMPs on Run

AMPs = watts divided by 12V (A = W/12V)

Step 2 – Calculate Volt Drop

AMPs x Length of Run x 2 x Constant (A x L x 2 x C)

Example: 120 watts / 12V = 10 AMPs

10 AMPS x 100 feet x 2 x .00162 = **3.24 Volt Drop**

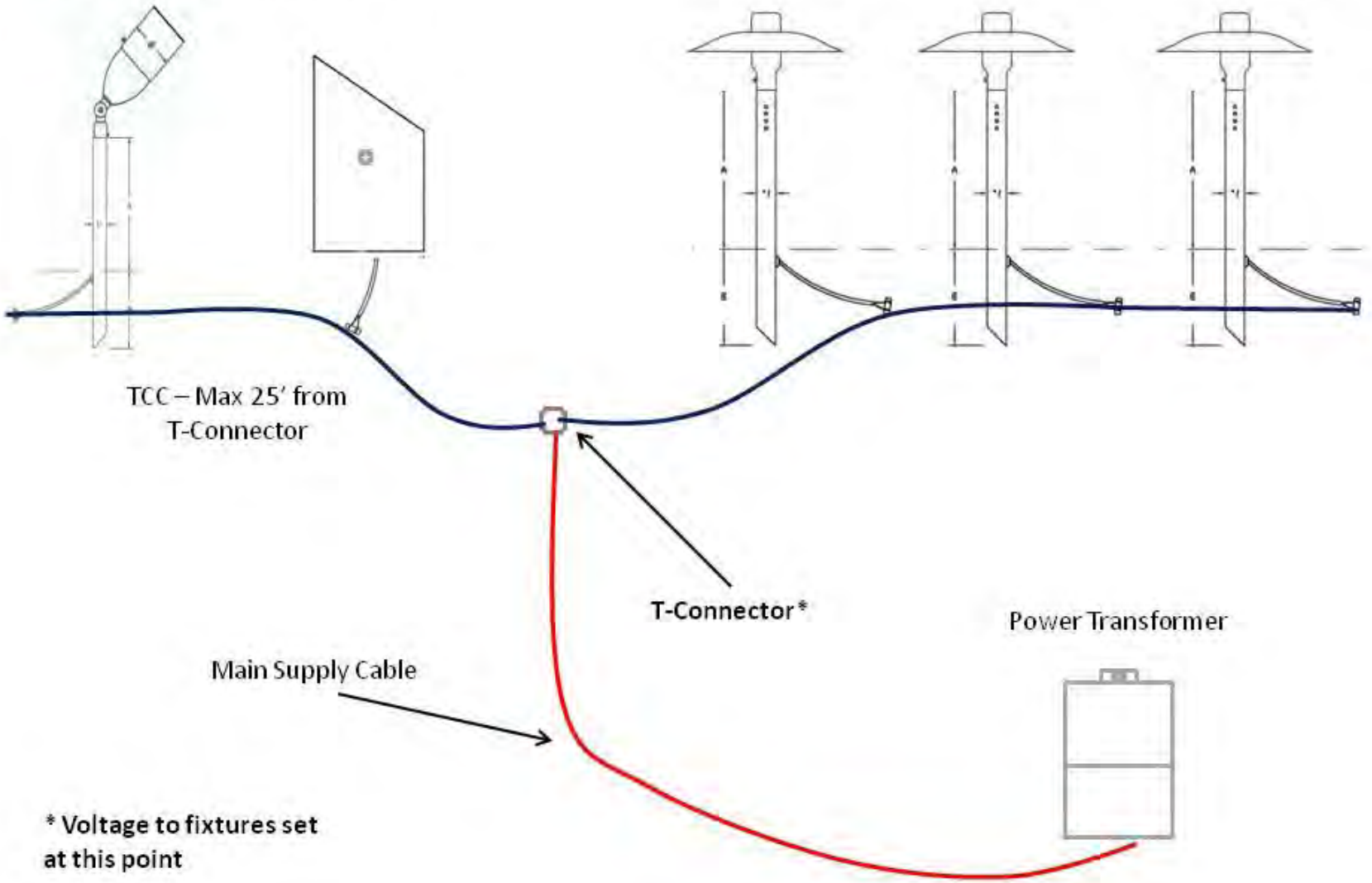
12V + 3.24 VD = 15V Tap

Constant Values (R) : 12/2 = .00162	10/2 = .00108

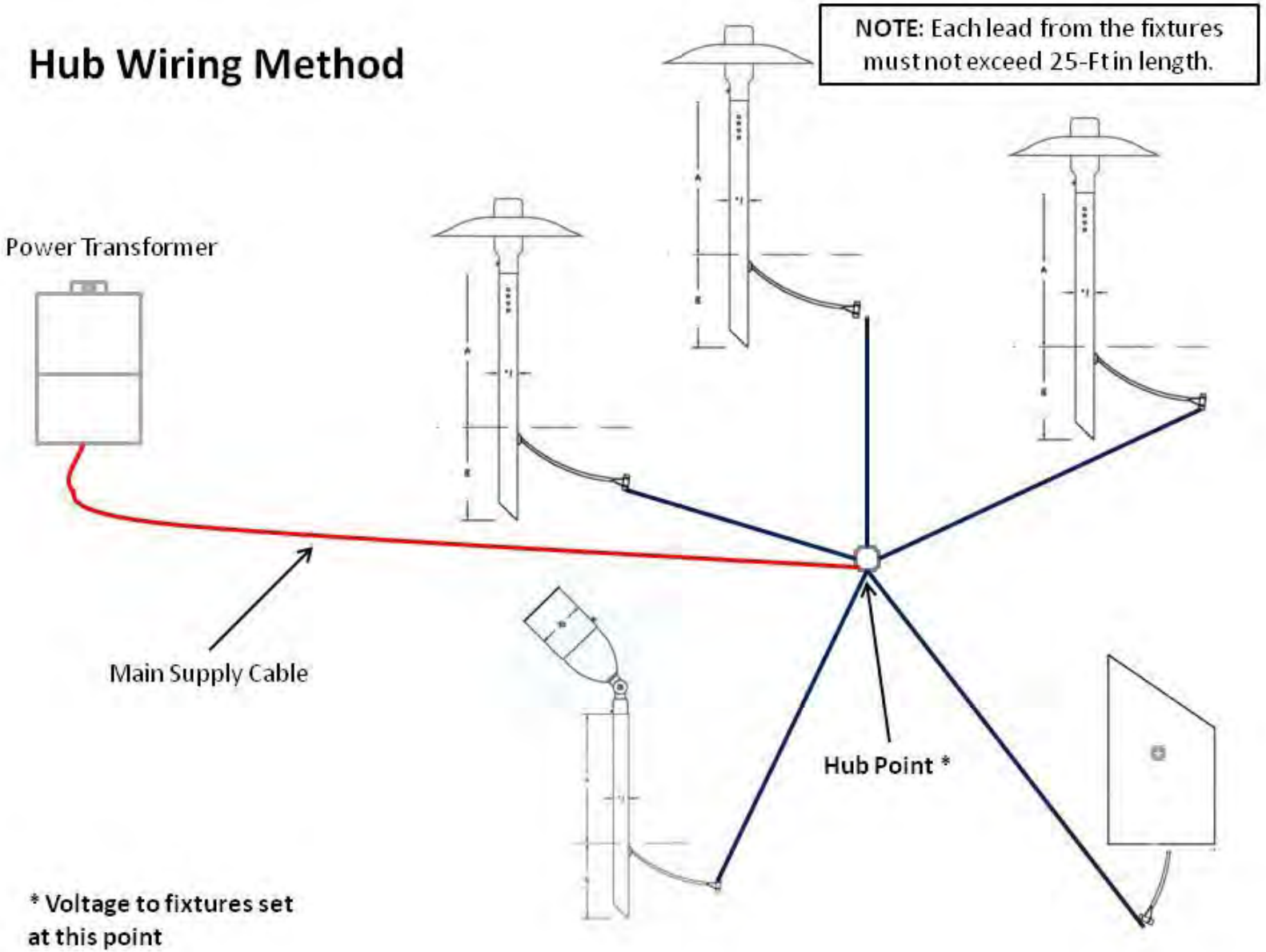
Wiring Methods

NOTE: TCC = T-Connector Cable - Must not exceed a total of 50-Ft in length.

T- Wiring Method



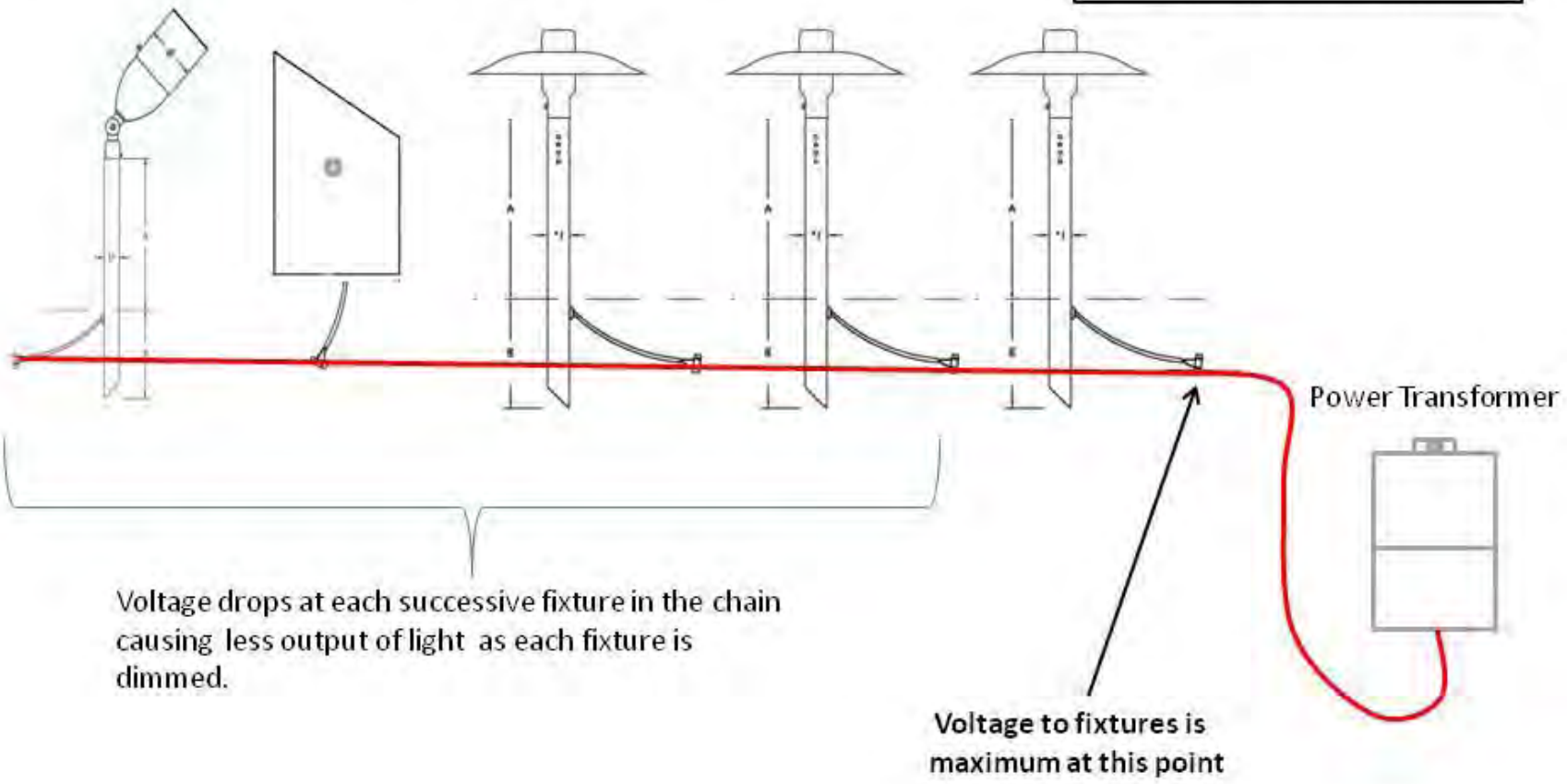
Wiring Methods



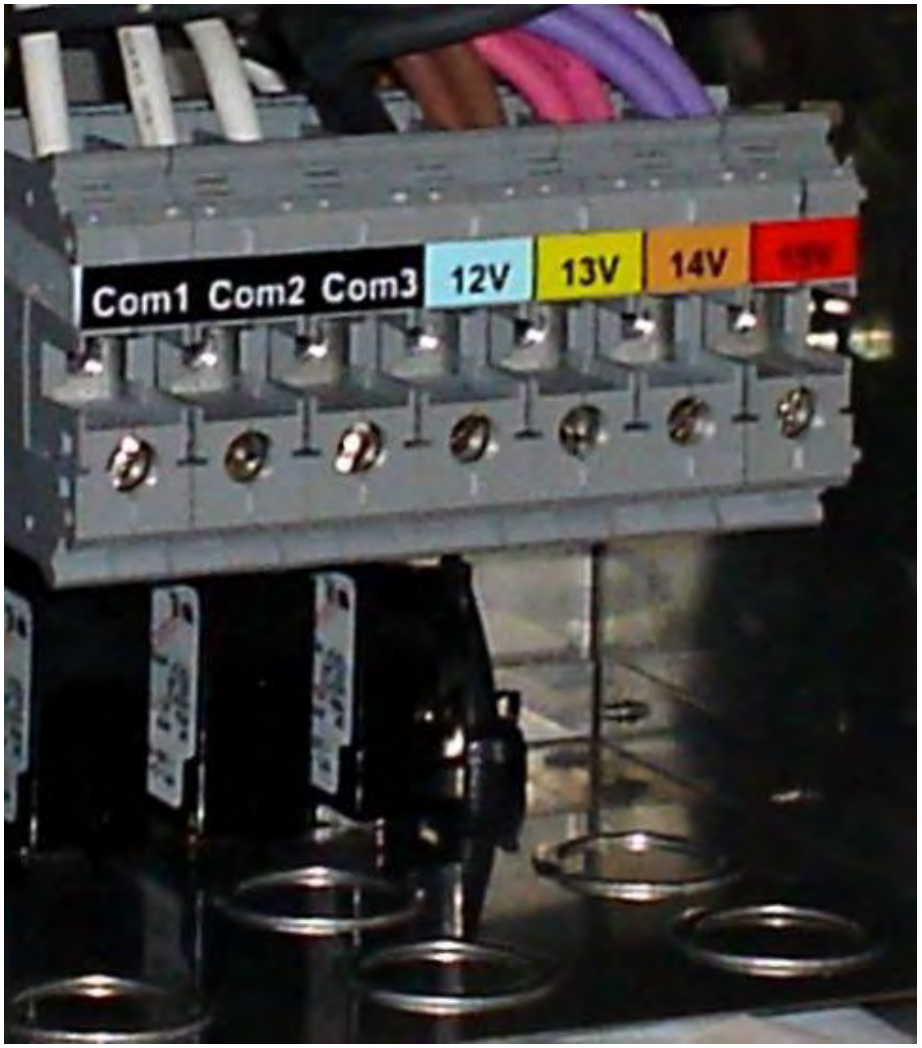
Wiring Methods

Daisy Chain Wiring Method

NOTE: Daisy Chain Method is ***NOT*** recommended for halogen lighting installations.



Transformer Principals



- Each common handles a maximum load of 300 watts (see 80/20 rule)
- Maximum AMPs on secondary is 25A per common
- Maximum AMPs on primary is C x 2.5A

EACH COMMON:

2.5A x 120V = 300 watts

25A x 12V = 300 watts

Transformer Principals

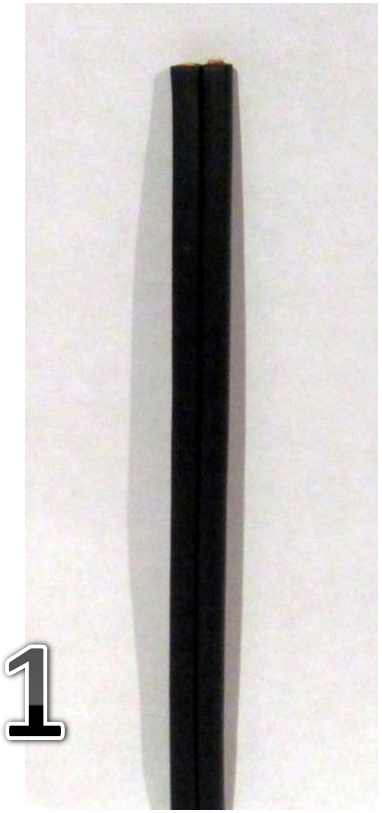
Multi-Meter w/Amp Clamp

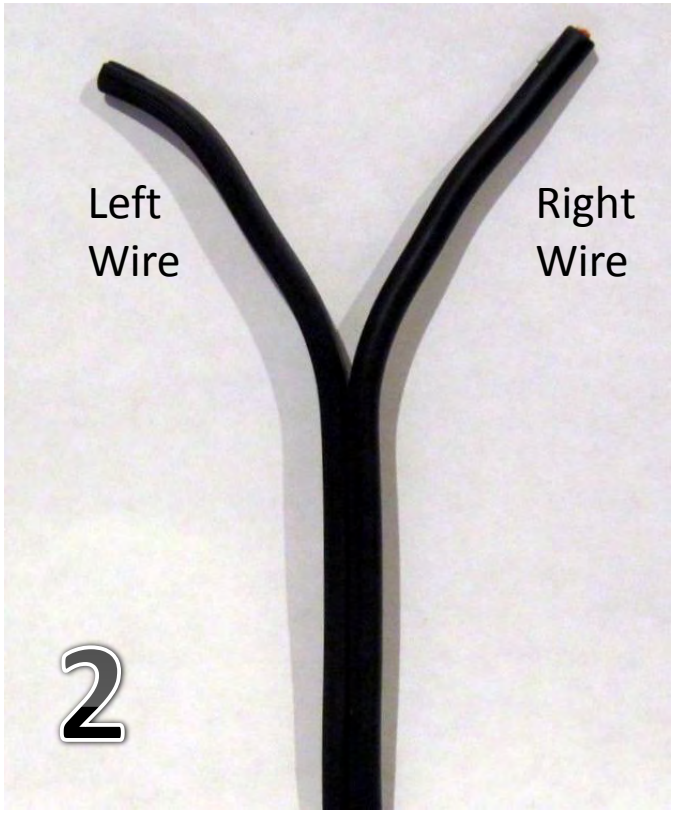
Primary Loop

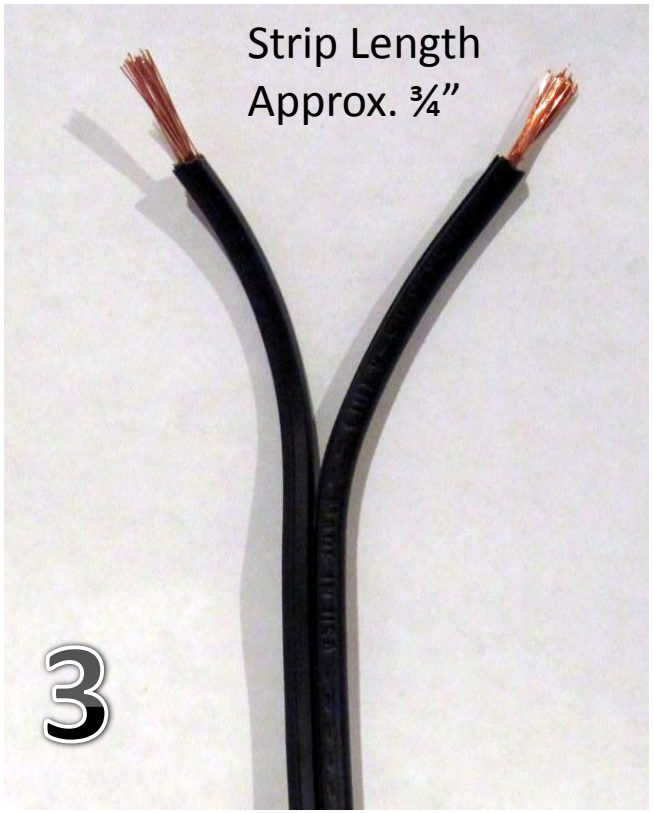
Secondary Loops
(Commons)

Use Amp Clamp to check each common and primary to avoid overloading circuits.

Cable Preparation

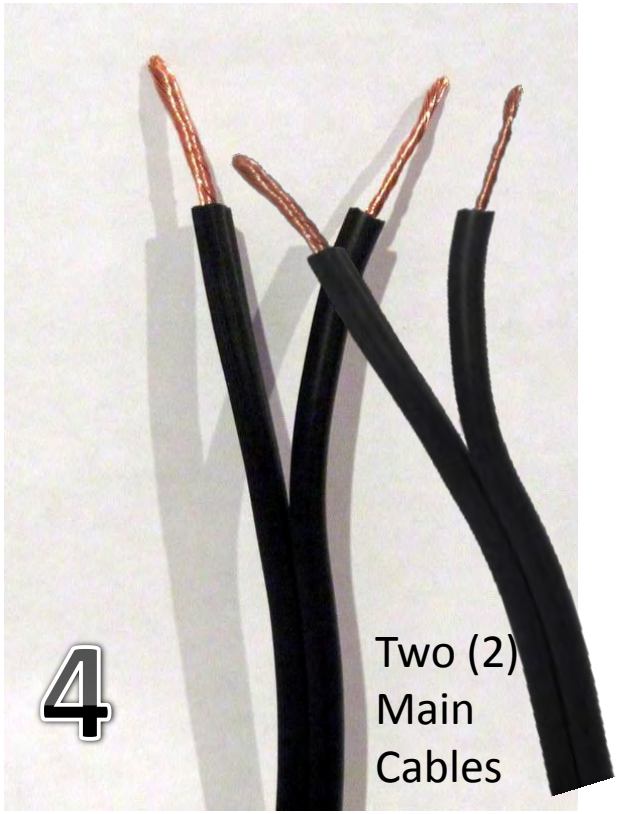


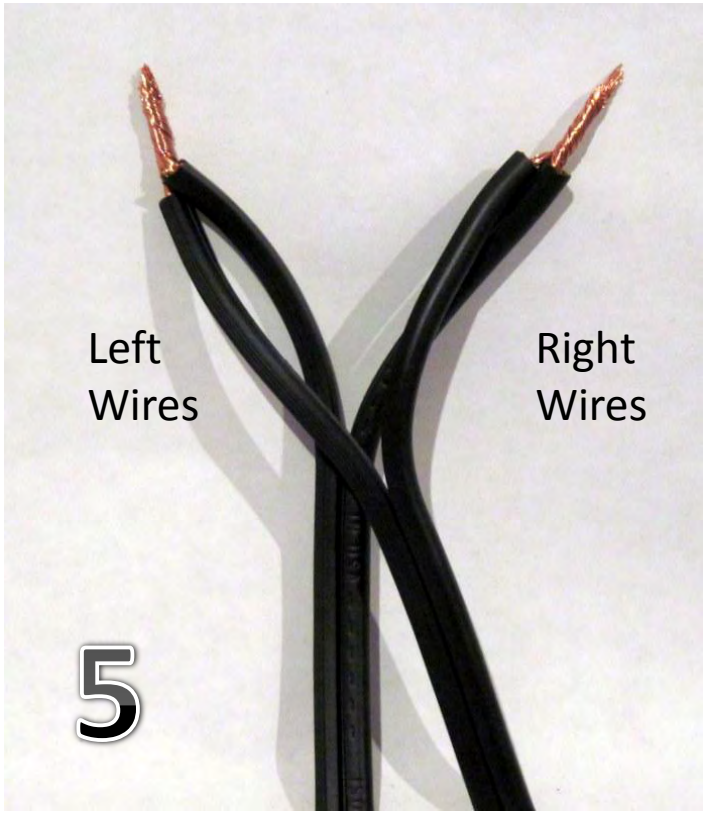




- Each 12/2 main cable must be split in the middle to create a left and right side.
- Strip the outer insulation from each wire approximately ¾” of an inch to expose the copper stranded wires

Cable Preparation

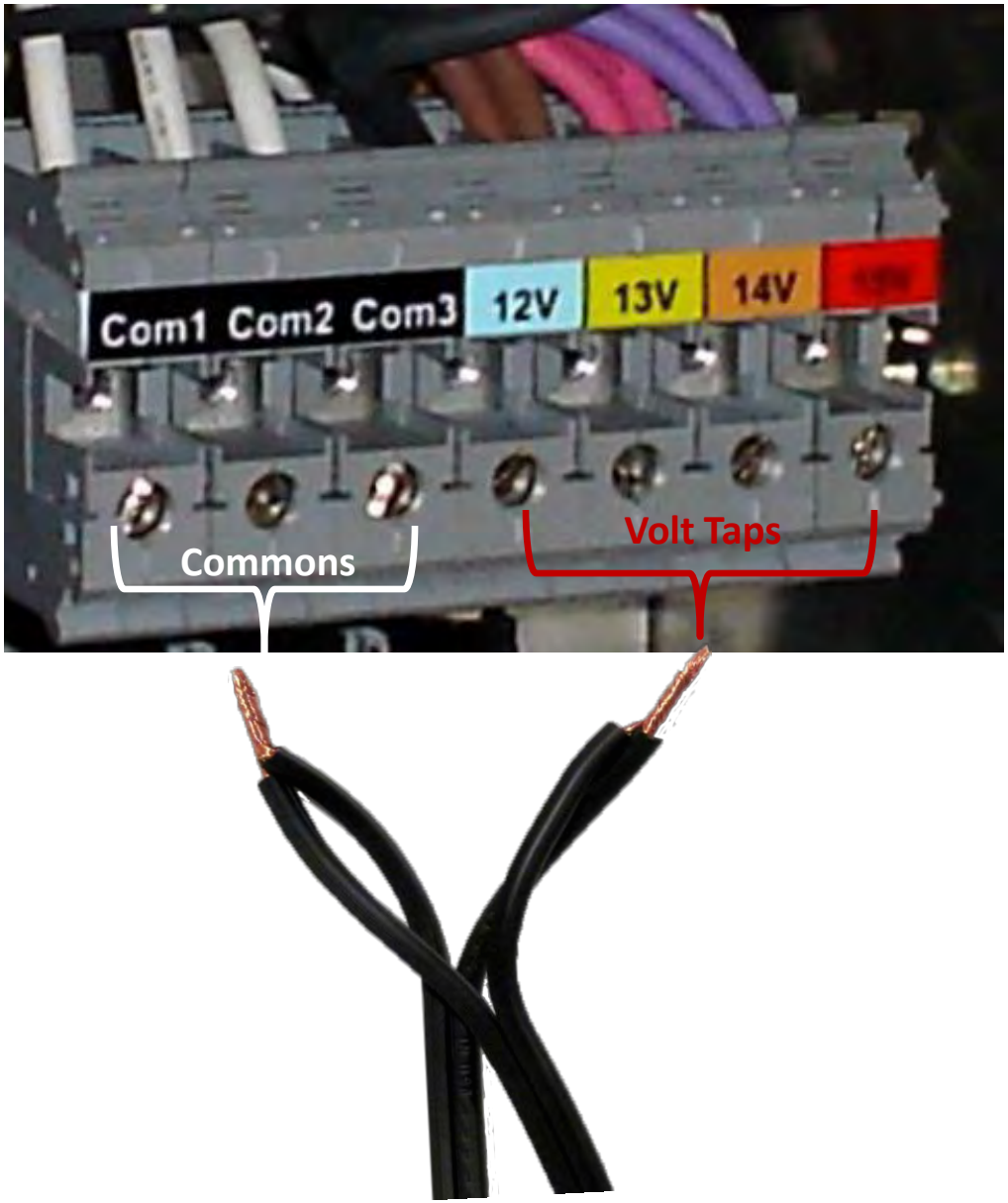




• For a single home run cable, twist the strands of copper wire together tightly for each side.

•For more than one home run cable, twist the strands of copper wire together, combining each side together tightly as shown in #5 to make a completed wire harness. Make sure the left and right sides of each cable are separated.

Adding Cable Harness to Terminal Blocks



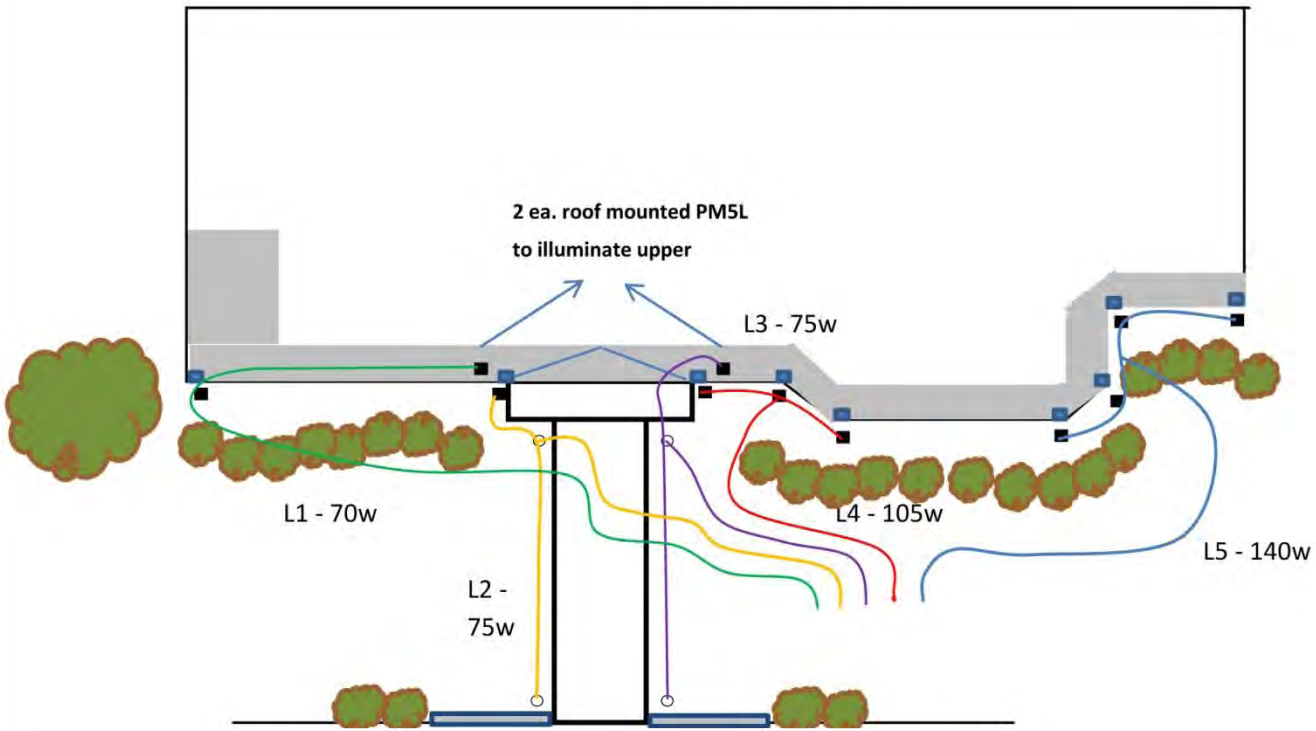
- Attach one side of the cable harness to the desired common terminal.
- Attach the 2nd side of the harness to one of the voltage tap terminals.
- Increase or decrease the voltage as needed according to the voltage reading at the fixtures.

Installation Schematic

Customer Name:	
Address:	
City:	
State: TN	Zip: 37027

Customer #	
Estimate #	
Date Installed:	
Technician:	

PHASE I - House Front



LEGEND		
Qty		Type
	◙	3CL
	▲	PM8
11	■	PM5L/SM4
4	○	PM7/202
	◊	PM12
	●	

TRANSFORMER				
Cir	Run	Tap	Watts	Volts
1	1		70	
1	2		75	
1	3		75	
		TTL	220	
2	4		105	
2	5		140	
		TTL	245	

RUN	LENGTH	WATTS	DROP 12/2	TAP	DROP 10/2	TAP
1	75	70				
2	165	75				
3	225	75				
4	100	105				
5	155	140				

NOTES
T-1 is a 600 Watt MTS Stainless Steel transformer, mounting TBD. Will need to access left side through sidewalk sleeve.

Installation Schematic

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Address:	
City:	
State: TN	Zip: 37027

Customer #	
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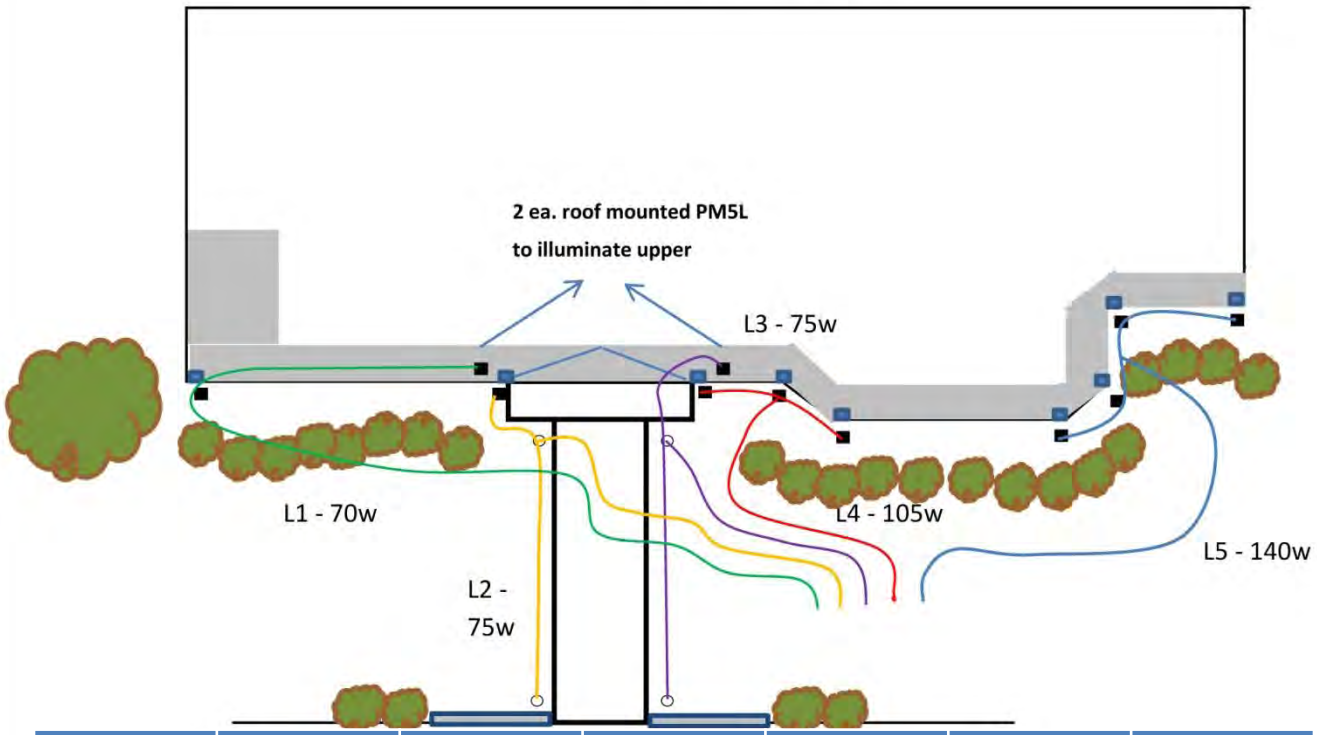
PHASE I - House Front



LEGEND		
Qty		Type
	◙	3CL
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	◊	PM12
	●	

TRANSFORMER				
Cir	Run	Tap	Watts	Volts
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2	5		140	
		TTL	245	

NOTES
T-1 is a 600 Watt MTS Stainless Steel transformer, mounting TBD. Will need to access left side through sidewalk sleeve.

RUN	LENGTH	WATTS	DROP 12/2	TAP	DROP 10/2	TAP
1	75	70	1.42	13	.95	12
2	165	75	3.34	15	2.23	14
3	225	75	4.56	17	3.04	15
4	100	105	2.84	14	1.89	13
5	155	140	5.86	17	3.91	15

Installation Techniques

- Running Cable
- Burying Cable
- Sidewalks & Driveways
- Transition from Gardens to Grass
- Roof Mounted Fixtures
- Tracing Lines

Running Cable

- Run all lines and connect fixtures before burying cable
- Bury cable 6” under ground
- Use multiple cable reels to run more than one line at a time

Burying Cable

- Use a “flap cut method” in lawn areas
- Use a hand pickaxe to trench in garden beds
- Secure lines in trench with ground staples

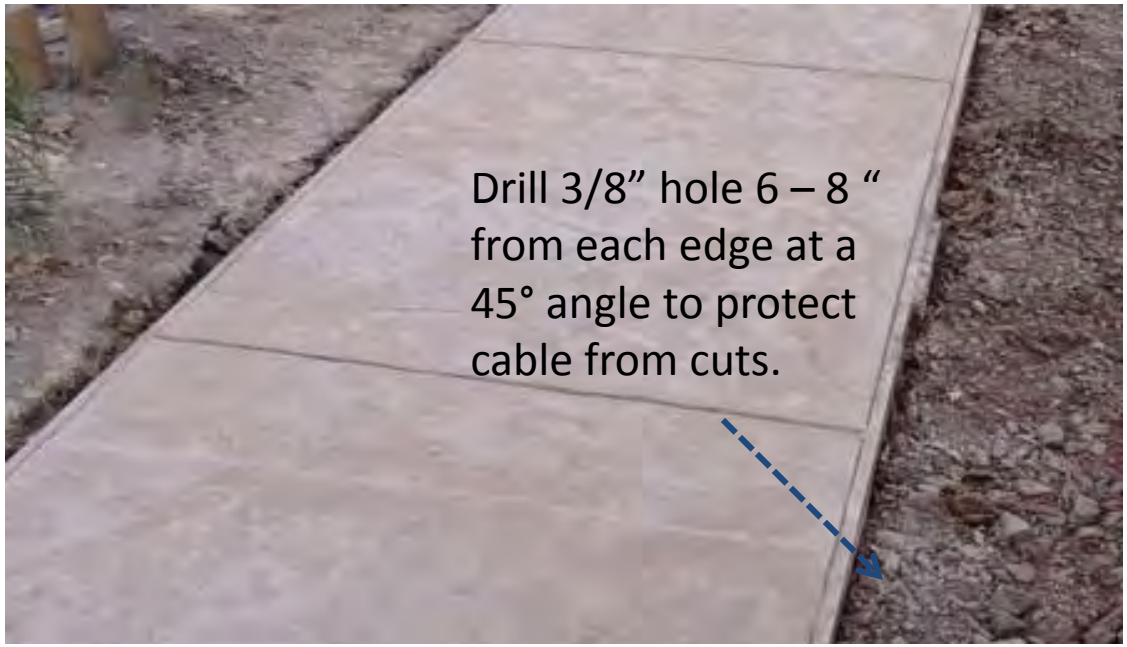
Push tool is helpful to slip cable into flap cut

Sidewalks & Driveways

- Sidewalk Sleeve Tool available
- Dig trench on one side of walkway
- Place 1” PVC Pipe on tool (6” longer than width of sidewalk
- Drive under sidewalk with sledgehammer
- Remove tool to leave PVC sleeve in place

Sidewalks & Driveways

- Use expansion joints to run cable across when sleeves are not feasible
  - Cut the expansion joint with a masonry blade to widen the joint for the cable.
  - Use the masonry dust with a little cement powder to sweep into the masonry joint to hide cable.
- Drill hole in concrete at an angle to run cable back under ground to protect against cuts



Transition Between Gardens & Grass

- Cut 12” lengths of PVC pipe in half to make inexpensive transition pieces.
- Drill holes in PVC to accept Ground Staples

Roof Mounted Fixtures

- Mount fixtures on soffits, fascias, trim
- Use gutters to mount fixtures for peak or dormer lighting.
  - If hanger brackets, mount on top of bracket
  - If spikes, mount in bottom with cement or silicone and exterior cable ties
- Run cable in gutter and downspouts to hide from view

Pro290 is low-cost unit for tracing lines!

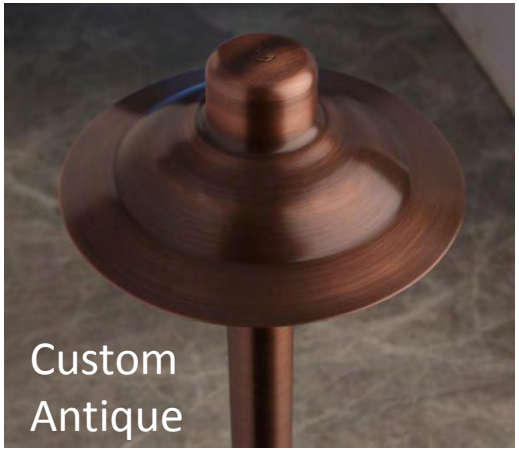
Fixtures & Basic Installation

Fixture Applications & Installation

- Copper Basics & Finishes
- Well Light Installation
- Basic Stake Installation
- Fixtures
  - Path Lights
  - Adjustable Path/Directional Light (swivel arm)
  - Directional Lights
  - Deck Lights
  - Step Lights
  - Hanging Lights

Copper Basics & Finishes

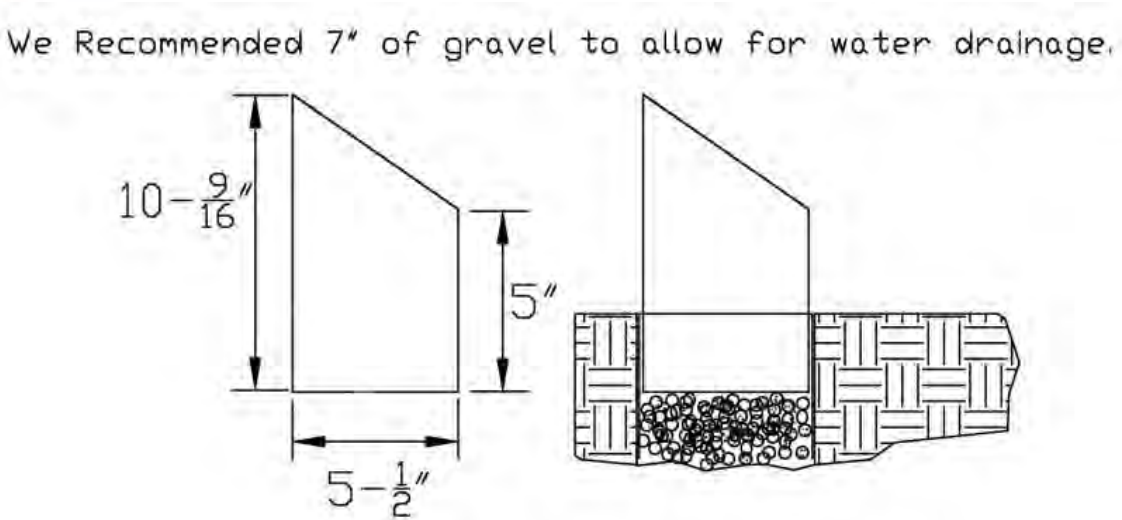
Copper Basics & Finishes



- All finishes are natural raw copper
- All will eventually patina over time
- Patina is determined by environmental factors and elements
    - Location
    - Humidity
    - Acid Rain
    - Salt
- Antique and Black finishes are varying stages of acid washing treatment.
    - Labor intensive
    - Artificial patination
    - Will continue to patina
    - Finish dependent on reaction of copper and acid wash

PM3 Series Well Lights

- Dig hole 12” Deep x 6” Wide
- Add 7” gravel for drainage
- Adjust lamp position
- Tighten wing nuts to secure
- Use lens cover to keep out debris (i.e. mulch, leaves)

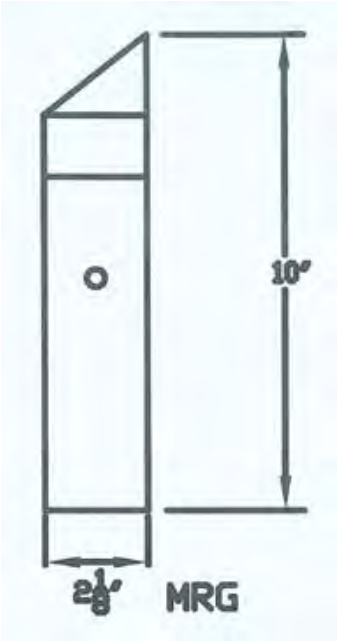


Wrap approx. 16” of extra cable loosely and place in bottom of fixture.

Peel protective cover from lens and place on top of fixture using Locking Tab.

MRH Series Well Lights

- Dig hole 12” Deep x 4” Wide
- Add 7” gravel for drainage
- Available in both shielded (EB) and flat styles
- Use on ornamental trees and object lighting



- Add drop-in filters for special effects
- Add hex louver for additional shielding

Stake Installation

Power (PS)

Ground (GS)

2 Types of mounting stakes

A. Power Stakes
B. Ground Stakes

With Socket

Without Socket

Stake Installation (cont'd)

- Three (3) Types of Installation Options

A. Drive Stake w/o stabilizer fins
B. Drive Stake w/ stabilizer fins
C. Stake with NPT thread (PS only)

#1 w/o fins

#2 w/ fins

#3 NPT

Stake Installation (cont'd)

- Our STEEL DRIVER CAP makes installations easy

- Use a DEAD BLOW HAMMER to reduce risk of damage to sockets

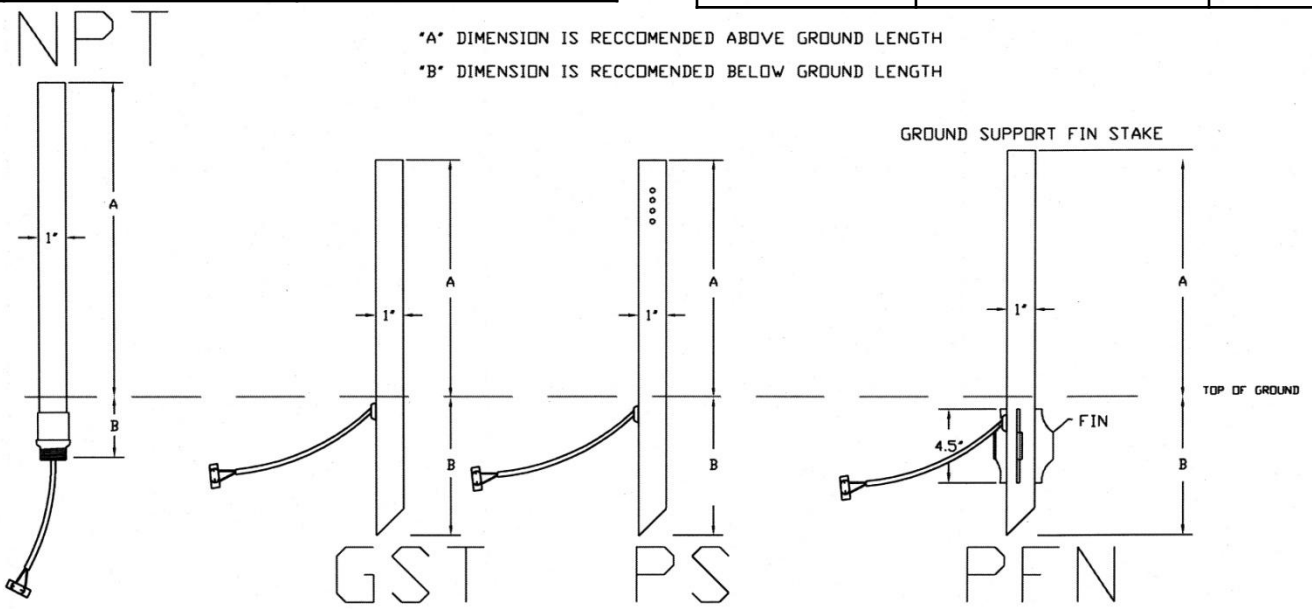
Stake Depth Installation

#1 Style w/o Fins

Stake Length	Measurement "A" (above ground)	Measurement "B" (below ground)
12"	8"	4"
16"	11"	5"
20"	14"	6"
24"	17"	7"
30"	22"	8"
40"	31"	9"

#2 Style with Fins

Stake Length	Measurement "A" (above ground)	Measurement "B" (below ground)
12"	5"	7"
16"	9"	7"
20"	13"	7"
24"	17"	7"
30"	22"	8"
40"	31"	9"



Adding Tops to Complete the Path Lights

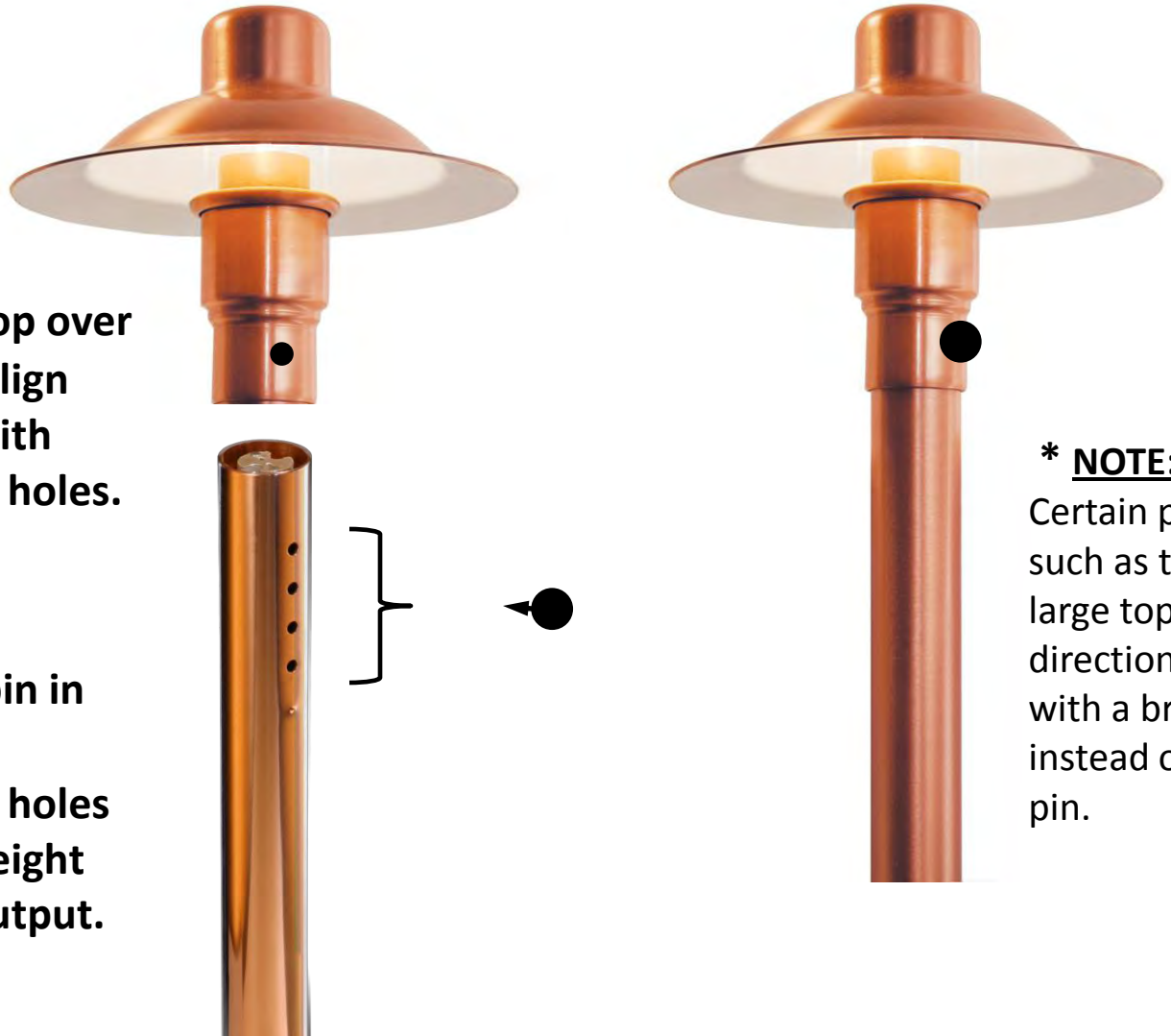
- All path light tops are interchangeable
- Will install on the same power stake or surface mount
- Push Pin or Brass Screw on 4” and 6” Tops
- Brass Screw on all Half Tops and larger size Tops
- Use a Swivel Arm on Ground Stake for adjustable Path Light

Adding Tops to Complete the Path Lights Cont'd

Put in BULB or LED before installing the Path Top.

NOTE: When inserting the halogen bi-pin bulb into the socket, do not touch the bulb with your bare hand.

Slide top onto stake and insert holding pin into hole for desired height when using Push Pin*.



A – Slide top over stake and align side hole with positioning holes.

B - Insert pin in one of 4 positioning holes to adjust height and light output.

*** <u>NOTE:</u>**
Certain path lights such as the half top, large tops, and 180° directional tops come with a brass screw instead of the push pin.

P. M. LIGHTING, LLC - PATH LIGHT TOPS

PM7XL Series Tops
PM7XLC

= BEST SELLER

PM7L Series Tops
PM7L2T, PM7LH, and PM7L

PM7-DX

PM7 and PM5 COPPER TOP SERIES
All tops are designed to fit the same Power Stake and are constructed from solid copper with a 1 1/2" or 2" glass borosilicate globe cemented in place with special HIGH HEAT cement. Tops are secured on the Power Stake using either a plastic push-pin or brass screw.

Recommended Lamp:
20 watt halogen or 2 watt LED G4 base bi-pin lamp . 35 watt maximum (except PM7XLC and PM5L= 50 watt maximum)

Suggested Applications:
Walkways, paths, ground cover, Steps, Low flower beds. Can also be mounted on surface mounts for deck railings, etc.

PM7 Series Tops
PM7, PM7H, and PM7M

PM5 Series Tops
PM5L and PM5

PM8 Series Tops
PM8-STM

Notes:

Swivel Arms

- Convert a Ground Stake to an adjustable Power Stake

Directional Stake Mounted Fixtures

- All stake mounted lights are interchangeable
- Will install on the same ground stake or surface mount
- Easy male/female terminals to connect

Connect the male terminals on the fixture to the female terminals on the Ground Stake.

- Slide fixture on stake and tuck wires into recess in stake

- Brass Knuckles for maximum adjustment options.

Other Mounting Options

- Power Surface Mount
- Standard Surface Mount
- NPT Surface Mount Flange
- SM-NPT slim Surface Mount
- Decorative Cover Option

Direct Mount Fixtures

- Lowest profile
- Knuckle fastened direct to mounting plate
- Fixed horizontal movement
- Only offers vertical adjustment

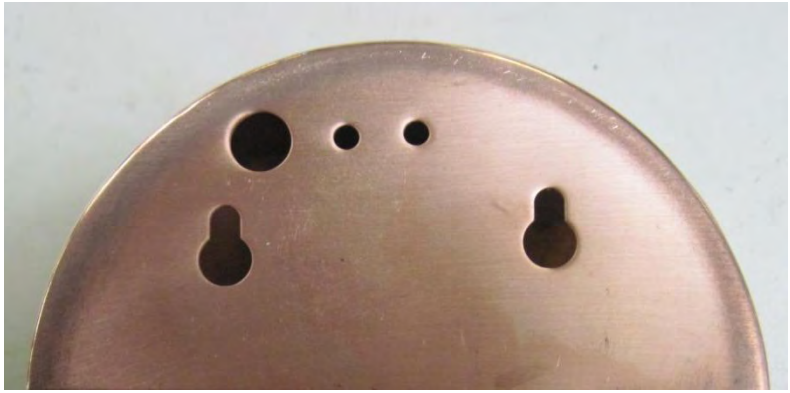
Deck & Accent Lighting

- Options for 4” and 6” posts
- Mount on posts or walls
- Optional lens covers

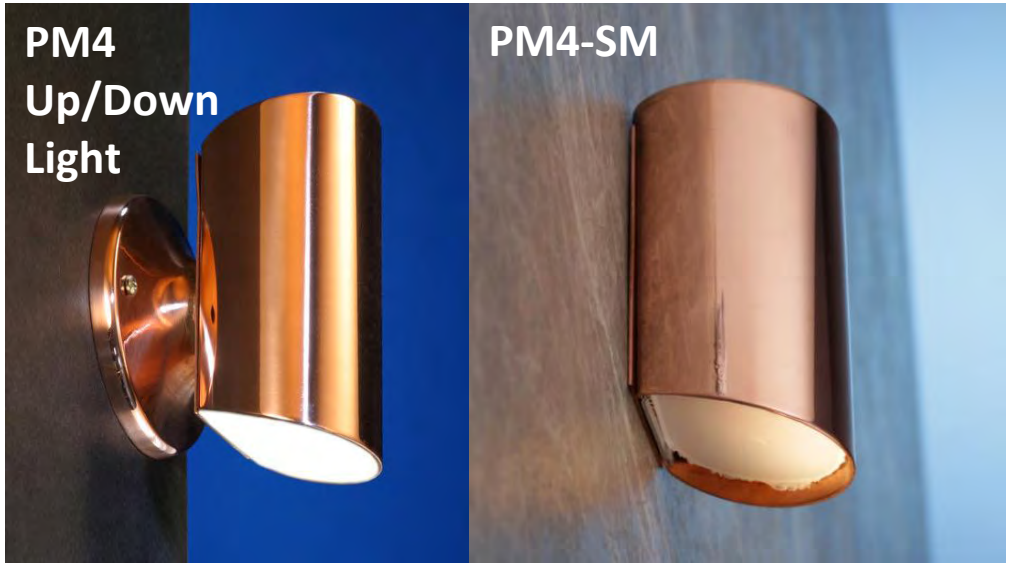
Deck & Accent Lighting cont'd

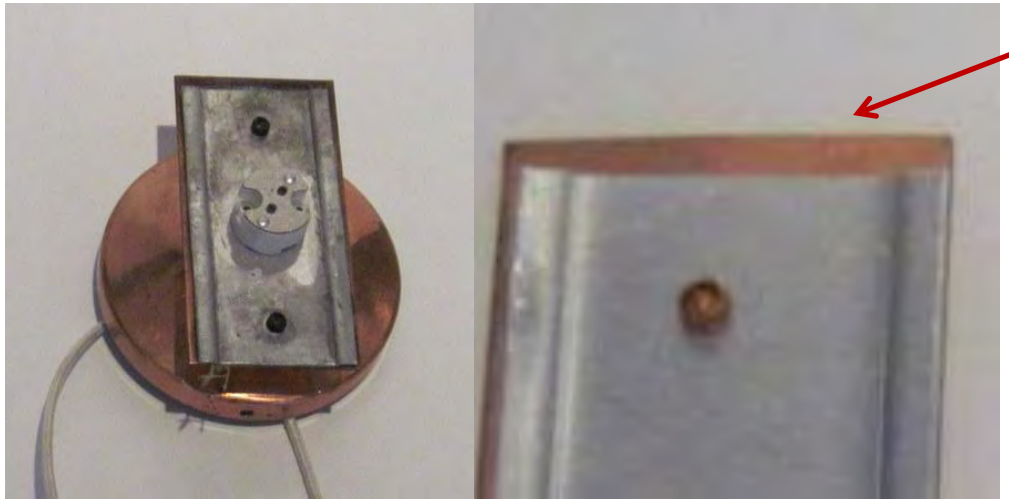
- Use template to mark hole locations
- Drill ¼" hole through post to run cable
- Hide cable on back side of post

Template has hole locators for **cable hole** and **mounting screws**



Deck & Accent Lighting cont'd



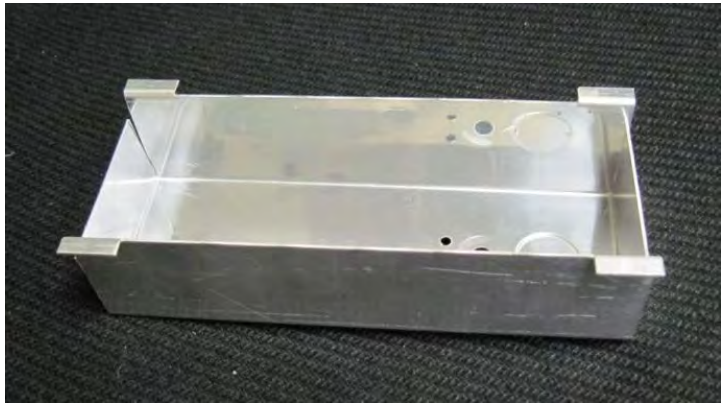


- PM4 Up-down Light available on round base or surface mount.
- PM4-SM fits on as small as 1-1/2" post.
- Install with top of bracket UP as shown.
- Aluminum bracket is shorter than copper back plate on top.
- Only available in halogen. For LED, order the PM4 or PM4-SM in Capped down light version

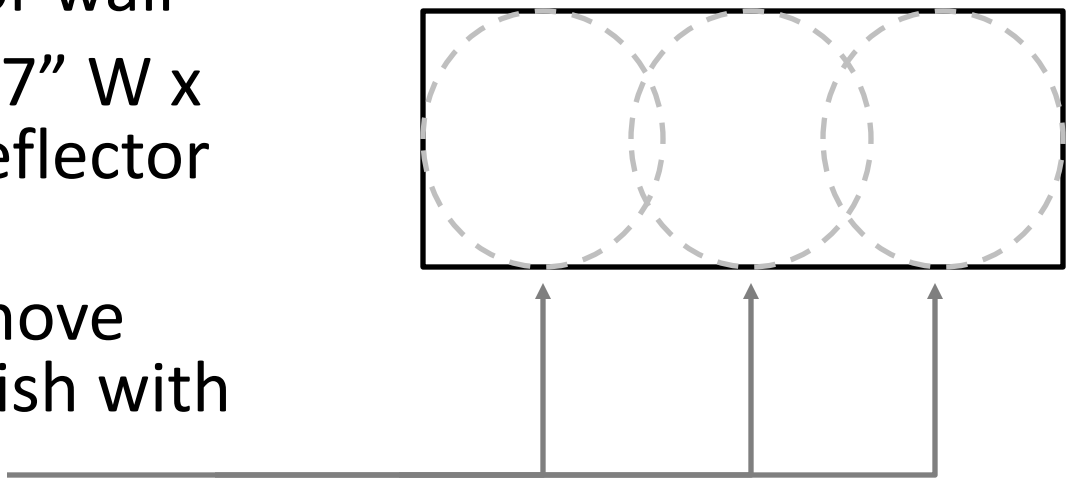
Brick & Stone Wall Lighting

- Mounts under the capstone of stone or brick walls
- Glue down with cap or use anchors
- 15’ lead for easy installation
- Lens cover available

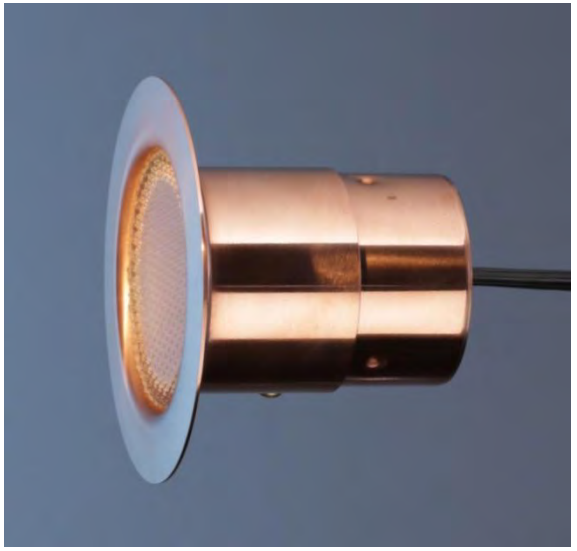
Brick & Step Lighting



- Mounts in step riser or wall
- Requires opening for 7” W x 2-5/8” H x 1-3/4” D reflector box
- Use a hole saw to remove most material and finish with straight saw or chisel



Brick & Step Lighting cont'd

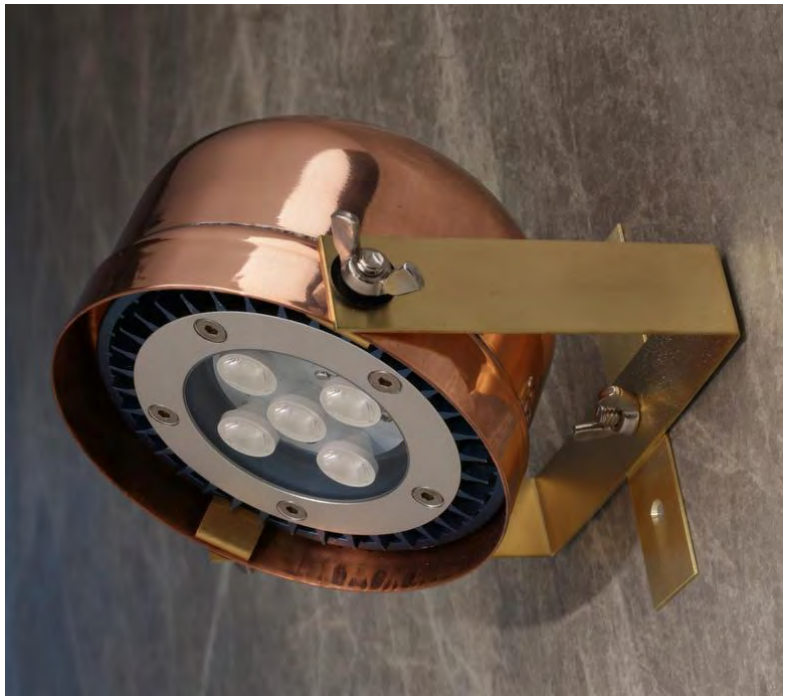


- An easy and beautiful way to add lights to step risers or sidewalls
- Fits into a 2 7/8" hole drilled at least 3 ½" deep.
- Mount vertically (as shown) or under a header

Hanging Lights

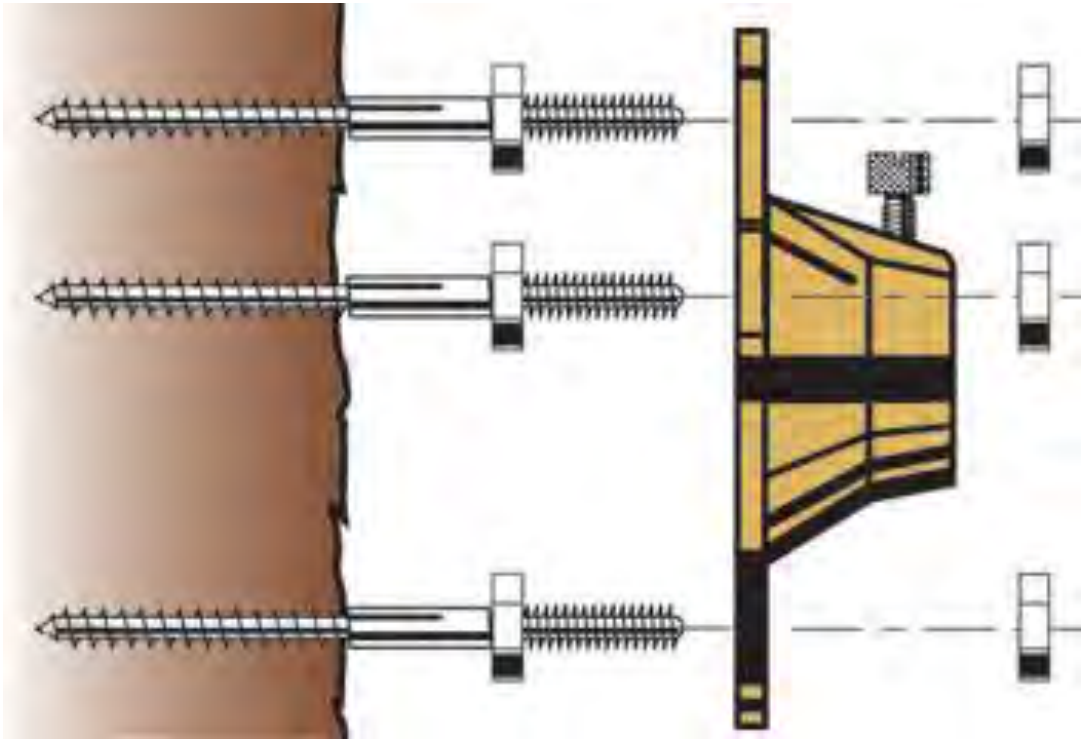
- Hang overhead on arbors and limbs
- PM7LG includes 5’ chain and frosted lens (G4 bi-pin lamp)
- PM2 has flexible mounting stem to bend into a J-Hook

Moonlighting



- PM1 Tree Mount includes brass bracket for easy installation
- MRH spot lights can be mounted on trees or posts
- Use standoffs to avoid tree growth around brackets

Tree Mounts – Using standoffs



- Drive hanger screw into tree trunk and thread nut on bolt end. Use washer if needed
- Place mount over bolts and thread 2nd nut. Tighten nuts to secure

P.M. Lighting, LLC
QUALITY LANDSCAPE LIGHTING

Please don't hesitate to call with any questions?

615.792.6884

Technical & Installation Module

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