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CAST LIGHTING LLC

LANDSCAPE LIGHTING INSTALLATION

Transformer and System Installation Guide

Order # CTRANSMANUAL

Old world craftsmanship...today's technology™

Dear Landscape Professional,

This guide will assist you in undertaking the installation of 12-volt Landscape Lighting Systems using the advanced features of CAST multi-tap transformers, "Spider Splices®", and "Fixture Record Tags" (patent pending). Keep this guide as a handy reference.

CAST Multi-tap Transformers utilize advanced engineering and rugged components to ensure a power supply that will operate flawlessly for years to come. The installation of these transformers is easily learned and requires a basic knowledge of electrical wiring techniques and voltage/amperage testing using a digital multimeter.

The following guide will teach you these fundamentals:

- Selecting the right size transformer
- Selecting the right gauge wire
- Calculating voltage loss
- Selecting voltage taps
- Measuring voltage and amperage
- Building the transformer stand
- Use of CAST "Fixture Record Tags"
- Use of CAST "Spider Splice®" Junctions

CAST Lighting is committed to manufacturing products that you can count on to operate optimally and withstand the harsh conditions of the outdoor environment for years to come. We are also committed to providing the training required to ensure the highest standards of professional installation.

Yours Truly,

David Beausoleil
President, CAST Lighting LLC.

P.S. Make sure not to miss our hands-on training seminars held in your area. Give us a call (1-973-423-2303) or visit our web site at www.cast-lighting.com and check for upcoming seminar dates.

CAST LANDSCAPE LIGHTING INSTALLATION

Transformer and System Installation Guide

Contents

Important Note to Installers:
While Low Voltage Landscape Lighting Installation is simple and safe, the lighting professional should always comply with local rules and regulations that may apply to this type of installation. Guidelines for safety appear on page 18 of this manual.

Changing the way the world installs landscape lighting®

Visit www.cast-lighting.com

Contents of the Manual

The following manual presents all the basic skills and knowledge required for installation of a landscape lighting system using CAST Lighting transformers and other system components:

1. **Planning**. Simple worksheets and formulas to correctly select wire and transformers.
2. **Fixture Installation and Wiring.** Simple steps for system installation.
3. **Spider Splice® Connections**. Instructions for the use of this preferred CAST method of wire connections.
4. **Transformer Stand**. Assembly instructions for transformer mounts.
5. **Voltage Adjustment**. Steps for using CAST's proven method of field testing and adjustments for delivering the right voltage to each fixture.
6. **Documentation**. CAST "Fixture Record Tag" and record form system for trouble-free system maintenance.
7. **Appendix.** Useful worksheets for planning and documentation.

Online System Calculation Support

Calculate voltage loss, wire size, transformer needs, energy costs, and more – a great planning, sales and learning tool. Visit the CAST website for this and other valuable tools.

www.cast-lighting.com

PLANNING STEPS

Step 1 Requirements

Start by using the "Preliminary System Requirements Worksheet" (Fig. 1) to record all the information needed to make the following calculations.

Step 2 Wire Sizing

Use either #10/2 or #12/2 direct burial wire to connect transformers to Spider Splices®. The selection is based on wire run distances and wattage of fixtures on each run. This determination can be made using the "Quick Wire Sizing Guide" (Fig. 2).

Step 3 Transformer Sizing

Selecting the correct transformer(s) is a two-step process.

1. Determine total load on the system. This can be estimated by adding the total wattage of all lamps. Or, the load can be more precisely calculated using the "Transformer and Wire Sizing Calculations" worksheet (Fig. 4). You can also use the CAST System Calculator at www.cast-lighting.com.
2. Select the transformer(s) based on the total load using the "Quick Transformer Sizing Guide" (Fig. 3) If you are working with the total lamp wattage, compare that number with the "75% Lamp Load" column. If you calculate load using the longer worksheet then compare that value with the "Capacity" column. In both cases, select a transformer with a capacity exceeding these numbers to allow for future additions to the system.

The following worksheets and sketches on this and following pages depict a typical residential lighting installation from start to finish.

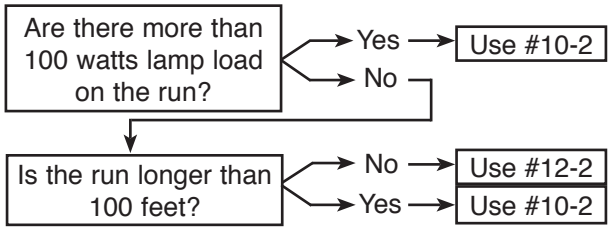
PRELIMINARY SYSTEM REQUIREMENTS WORKSHEET

WIRE RUN	LOCATION	FIXTURE TYPE	QTY.	X	LAMP WATTAGE	=	TOTAL WATTAGE	DISTANCE FROM SPIDER SPLICE TO TRANSFORMER	
								#12-2 WIRE PER RUN	#10-2 WIRE PER RUN
1	Grove	Bullet	1	X	35w	=	35w	50'	
1	Grove	Small Mushroom	3	X	20w	=	60w		
2	Front Walkway	Small Mushroom	5	X	20w	=	100w	85'	
3	Side Garden	Bullet	4	X	35w	=	140w		120'
4	Side Walkway	Small Mushroom	5	X	20w	=	100w		29'
4	Side Walkway	Bullet	1	X	35w	=	35w		
5	Back Garden	Well Light	4	X	35w	=	140w		150'
6	Pond	Bullet	2	X	35w	=	70w		200'
6	Pond	Well Light	2	X	35w	=	70w		
						TOTALS	750w	135'	499'

Fig. 1. Preliminary System Requirements Worksheet — used to initially record planned system details. Blank worksheet for copying on page 15.

QUICK WIRE SIZING GUIDE

Use this guide to select wire sizes for each run (from transformer to "Spider Splice®"):



WIRE AMP RATINGS

Wire Size	Recommended	Maximum
#12/2	100w/8.3A	192w/16A
#10/2	140w/12.0A	288w/24A

Fig. 2. Quick Wire Sizing Guide. In this example wire run 1 and 2 require #12/2 while the others need #10/2.

QUICK TRANSFORMER SIZING GUIDE

Model #	Capacity (Watts)	75% Lamp Load (watts)
CAST "Journeymen Series" (12-15v taps)		
CJ300PSMT, CJ300SSMT	300	225
CJ600PSMT, CJ600SSMT	600	450
CJ900PSMT, CJ900SSMT	900	675
CAST "Master Series" (12-18v taps)		
CM900SSMT	900	675
CM1200SSMT	1200	900
CM1500SSMT	1500	1125
CAST "Power Pro Series" (12-22v taps)		
CP900SSMT	900	675
CP1200SSMT	1200	900

Fig 3. Quick Transformer Sizing Guide. In this example the 1200 watt transformer is needed because the calculated 750 watt lamp load exceeds the capacity of the 900 watt transformer. It's always a good idea to have a slightly larger transformer in case the job requires higher wattage lamps or extra fixtures.

It's easy! Go to www.cast-lighting.com to find voltage loss, correct tap, wire size, transformer model and operating costs!

TRANSFORMER AND WIRE SIZING CALCULATIONS FOR LANDSCAPE LIGHTING

CAST LIGHTING LLC

Guidelines for selecting wire size to maximize the efficiency of a low voltage lighting system:		
	#12-2	Total combined lamp wattage of 100 watts or less. Total wire run of 100 ft. or less to the Spider Splice .
	#10-2	Total combined lamp wattage of 140 watts or less. Total wire run in excess of 100 ft. to the Spider Splice .
	#8-2	Very expensive wire–better to run two pieces of #10-2 wire than one #8-2 wire.

SYSTEM REQUIREMENT

Optimal operating range of halogen lamps is 10.8 to 11.3 volts.

WIRING AND LAMP INFO				TO DETERMINE VOLTAGE TAPS REQUIRED												TO FIND TRANSFORMER WATTAGE				
RUN #	WIRING METHOD (SPIDER OR TEE)	WIRE SIZE	TOTAL LAMP WATTAGE ON THE WIRE RUN (See Example Below)	AMP LOAD (Lamp Wattage Divided by 12)	x	WIRE LENGTH (To Spider Splice or Tee Connection)	x	2	x	RESISTANCE PER FOOT (See Chart Below)	=	VOLTAGE DROP	+12	=	TAP NEEDED (Round up to nearest whole number)	AMP LOAD (From previous AMP LOAD column)	x	TAP NEEDED (From Previous TAP NEEDED Column)	=	TOTAL WATTS
1	Spider	12-2	3@20w 1@35w =95w	7.917	x	50'	x	2	x	.00162	=	1.28	+12	=	13	7.917	x	13	=	102.92
2	Spider	12-2	5@20w =100w	8.33	x	85'	x	2	x	.00162	=	2.29	+12	=	14	8.33	x	14	=	116.62
3	Spider	10-2	4@35w =140w	11.667	x	120'	x	2	x	.00108	=	3.02	+12	=	15	11.667	x	15	=	175.00
4	Spider	10-2	5@20w 1@35w =135w	11.25	x	29'	x	2	x	.00108	=	0.70*	+12	=	12	11.25	x	12	=	135.00
5	Spider	10-2	4@35w =140w	11.667	x	150'	x	2	x	.00108	=	3.78	+12	=	16	11.667	x	16	=	186.67
6	Spider	10-2	4@35w =140w	11.66	x	200'	x	2	x	.00108	=	5.037	+12	=	17	11.667	x	17	=	198.83
7					x		x	2	x		=		+12	=			x		=	
8					x		x	2	x		=		+12	=			x		=	
9					x		x	2	x		=		+12	=			x		=	
10					x		x	2	x		=		+12	=			x		=	

TRANSFER AMP LOAD VALUES FOR EACH RUN TO THIS COLUMN

GRAND TOTAL (Min. Transformer Wattage) 915.04

TYPICAL EXAMPLE

1	Spider	#10/2	4@35w=140w	11.66 amps	x	150 ft.	x	2	x	.00108	=	3.77	+12	=	15.77	11.66	x	16	=	186.56

Distance to Spider Splice Connection

Voltage drop to Spider Splice

140 watts is divided by 12 volts = 11.66 amps

#10-2 Wire Resistance per ft. from chart below

Tap Required (Round up to 16 volts)

Actual Transformer Watts Required

REFERENCE TABLES

RULE OF THUMB

Since Wire Loss can be as high as 20%, the Lamp Load should never exceed 80% of the transformer s rated wattage capacity.

WIRE AMP RATINGS

Wire Size	Recommended	Maximum
#12/2	100w/8.3A	192w/16A
#10/2	140w/12.0A	288w/24A

Formula for Voltage Drop is 2 x Length of Wire x Amps x Resistance per Foot

AWG RESISTANCE PER FOOT (According to Wire Size)

#18	.006385	#14	.002525	#10	.00108	#6	.000395
#16	.004016	#12	.00162	#8	.00064	#4	.000249

Fig. 4. "Transformer and Wire Sizing Calculations". Blank form for copying can be found on p.16.

*No change is required; use 12 volt tap. Operating range of lamp is within acceptable range.

INSTALLATION and WIRING STEPS

Step 1 Fixture Preparation

After unloading all materials, remove fixtures from boxes. Attach stakes and stems if necessary. Lay each fixture at its proper location.

Step 2 Trenching

Low voltage lighting wire requires a minimum of 6 inches burial and can be run without conduits. Use slit trenching technique (use CAST trenching tool CWTT) to dig narrow trenches along each wire run and between fixtures and Spider Splices®. (See photos on this page.)

Step 3 Running Wire

Place correct wire size on spool or spinner (use CAST Wire Spinner CSPIN). Then, starting at the transformer, pull each wire run ending at the Spider Splice®. Leave about 10 extra feet for each run at the transformer and 2 feet extra at the Spider Splice®. Label each wire run with wire markers (CMPAD) at both ends. Run lead wire from each fixture to the Spider Splice® leaving excess wire coiled and buried at the base of the fixture. For above-grade fixtures, leave excess wire coiled at the Spider Splice®.

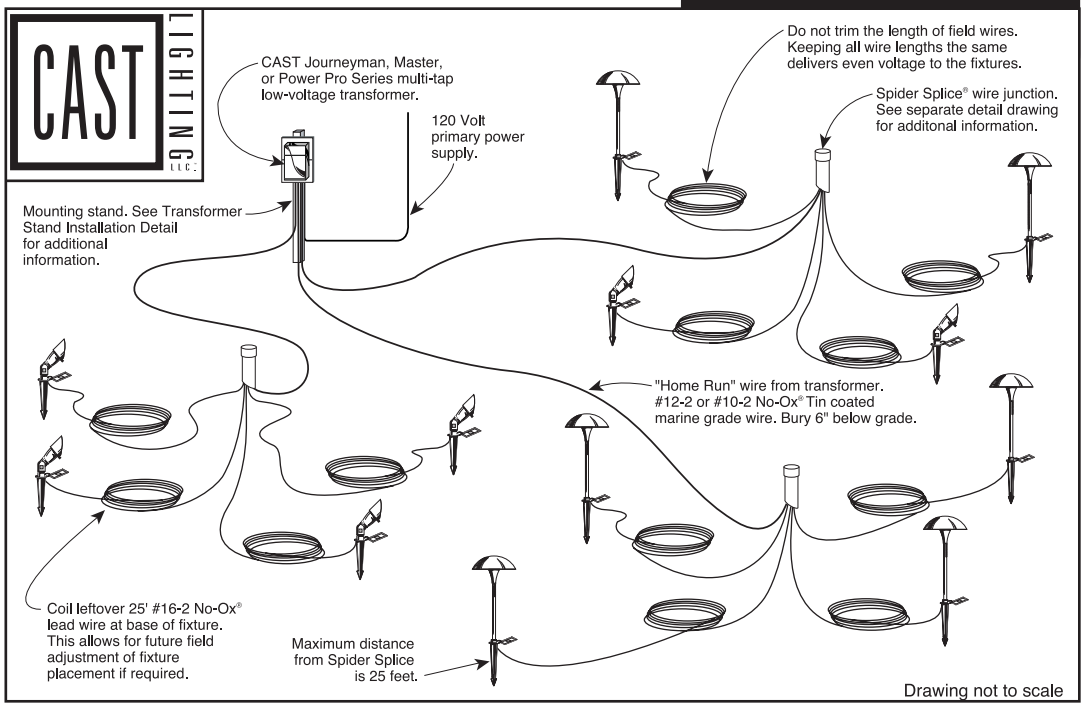
Step 4 Lamping Fixtures

Install the fixture into the ground or mount to the appropriate surface.

Lamp each fixture with the correct lamp according to type, wattage and beam spread. Leave the lamp box at the base of the fixture so you can refer to it when you punch the “Fixture Record Tag” at the end of installation. Leaving the box also facilitates changing the lamp if that becomes necessary during the final adjustment stage.

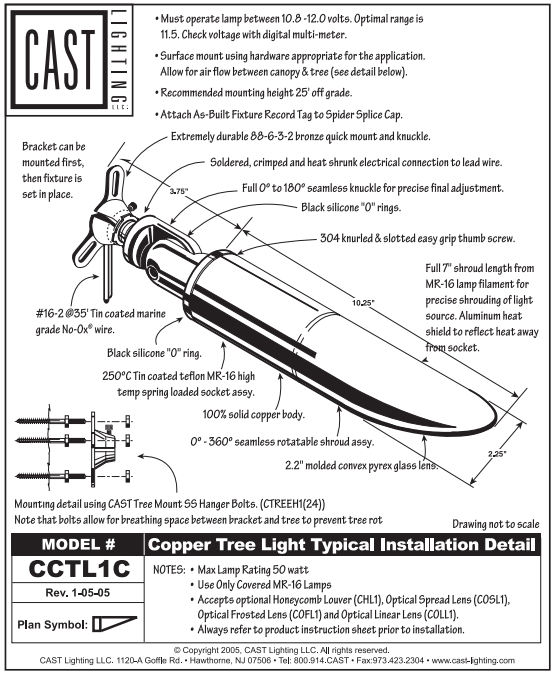
*** Make sure to comply with local electric codes for electrical installations.**

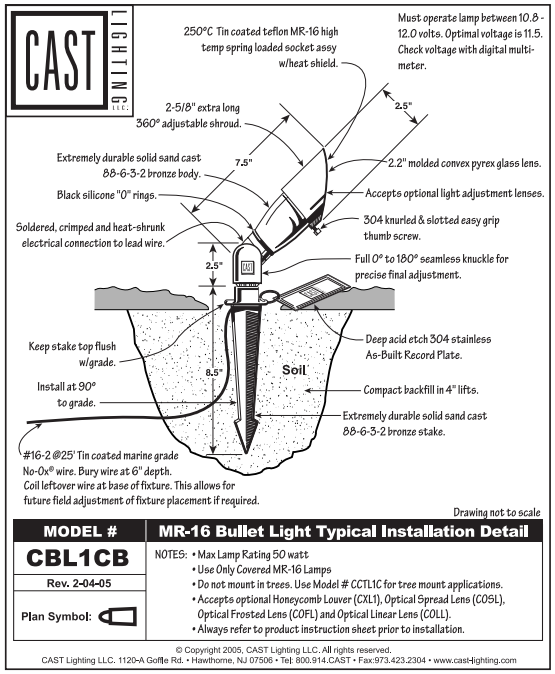
TYPICAL WIRE RUN



The CAST Trenching Tool (CWTT) cuts a narrow 8” deep trench ideal for laying wire.

Pushing the tool back and forth widens the trench and creates a channel for the wire.





ATTENTION ARCHITECTS AND DESIGNERS

Here is a sampling of installation details for CAST fixtures. These illustrations are especially useful for designers and architects. They can be inserted into lighting plans and bids, specifying the desired CAST fixtures. All drawings are available on CD or can be downloaded from www.cast-lighting.com.

THE IMPORTANCE OF DELIVERING THE RIGHT VOLTAGE TO THE LAMP

Halogen lamps must operate at 10.8 to 12.0 volts. Lamps not operating in this range will fail prematurely. To ensure that lamps receive the correct voltage, a high quality multi-tap transformer is required. The multi-tap allows you to compensate for voltage loss in the cable by selecting higher voltage taps when needed.

THE OPTIMAL VOLTAGE IS 10.8 –11.3 VOLTS. THIS IS THE PERFECT RANGE!!!

TOOLS AND MATERIALS REQUIRED FOR INSTALLATION

- Digital Clamp-on Amp/Volt Multimeter (CMETER)
- Wire Strippers (CASTRIP1)
- Wire Labeling Pad (CMPAD)
- Numbered Stamping Set and Hand Punch (CSTAMP & CPUNCH)
- CAST Black/White C61135 Wire Nuts
- 4 3/4” Romex Strain Relief Connectors
- Phillips Screwdriver and Hammer
- Time clock (CTTC, CTDC), Photo Cell (CTPC, CTRPC) (note–don’t use Photo Cell alone), or X-10 Control System

Wires are pushed firmly into the trench.

In turf, the trench is easily closed by gently pushing in from both sides.

SPIDER SPLICE® STEPS

Step 1 Preparation

At each Spider Splice®, pull wire leads through Spider Splice® body and pack into hole with soil or gravel. Allow wires to extend 12” outside the Spider Splice® body. (Fig. 5)

Step 2 Wire Stripping

Separate the two wires from each fixture lead and home run wire to a length of 12”. Strip the ends 1”, being careful not to cut or nick wire strands. Cut two additional pieces of #16-2 wire to 6” and 8” lengths for test leads. Strip both ends of these wires.

Step 3 Wire Connections

For connections that are fast, easy on the fingers and that never fail, follow the instructions for the CAST Soldering Method (Fig. 6) . This method requires setting up a portable soldering station that you use in the field. Once your soldering pot is plugged in and ready, proceed to make the Spider Splice® connections. Take one wire from each fixture lead, one wire from the home run, and one of the short test leads, twist them together into a silicon-filled wire nut. Repeat with the remaining wires, twisting them into the second wire nut. Cap off the two test leads with black/white wire nuts.

Step 4 Finishing and Stamping

Gather all wires together and carefully fold them into the Spider Splice® body. Be sure to position test leads for easy access.

Using a stamping set, stamp the wire run number on the Spider Splice® Cap.

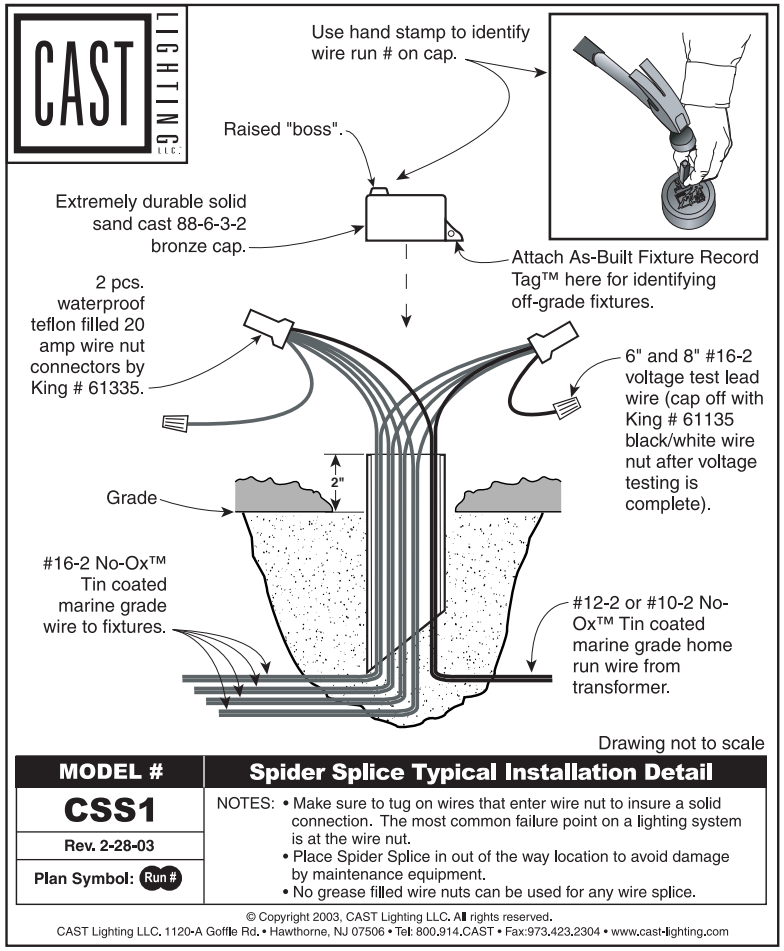


Fig. 5. CAST Spider Splice® connections.

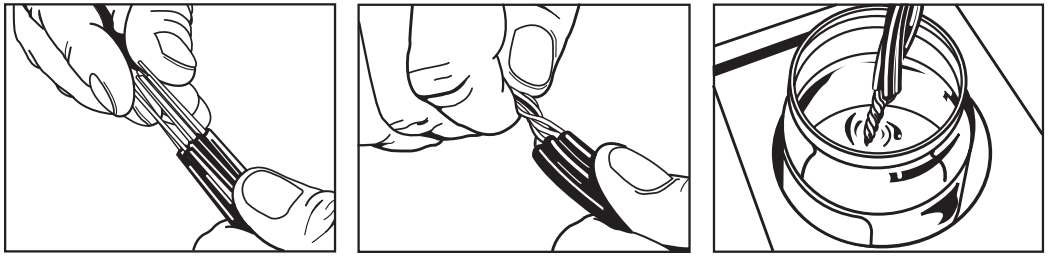
SPIDER SPLICE® ADVANTAGES

- Lightning fast installation.
- Reduces labor costs, saves money.
- Less field splices, reduces the chance of splice failures by 80% over other methods of wiring.
- Even voltage distribution to each fixture. Lamps operate at the same voltage — same light output.
- Lamps burn out at the same rate. Maintenance is more predictable.
- Adjustment of the fixtures in the field requires no additional wire splicing since the extra lead wire is placed at the base of the fixture.
- Individually troubleshoot each fixture at Spider Splice® to eliminate guesswork.
- Reduces Repetitive Strain Injury (RSI) with employees installing wire splices.
- Spider Splice® identifies the wire run # from the transformer.
- If a Spider Splices® becomes buried, it can be located with a metal detector.

The CAST Soldering Method

Fig. 6. CAST Soldering Kit & Tote available from your CAST Distributor.

Strip wires 1 1/4”, twist each exposed wire, line up wires → Twist wires together → Dip into flux



⚠ Caution: Solder is extremely hot; wear eye protection and keep away from children.

120 VOLT PRIMARY POWER

Guide for Electricians

- ✓ All primary 120 volt electric must be done by a licensed electrician.
- ✓ Install nothing smaller than a #10 gauge wire from the breaker panel to the outdoor transformer outlet locations.
- ✓ Install either:
  1. #10-3 (with ground) direct burial wire to the outlet locations, or
  2. 1" Schedule 40 PVC conduit installed with five #10 stranded THHN wires. Green, Black, White, Yellow & Red to each transformer stand location.
- ✓ Install a dedicated 20 amp primary breaker in the breaker panel with a 20 amp outlet receptacle. Either the breaker or the receptacle must be GFCI protected.
- ✓ Install waterproof exterior boxes.
- ✓ Install Tay-Mac or equivalent outlet covers that are approved "water-proof while in use" UL Listed outlet covers.
- ✓ Follow all local electric and building codes.

Fig. 7. 120 Volt Primary Power Guidelines

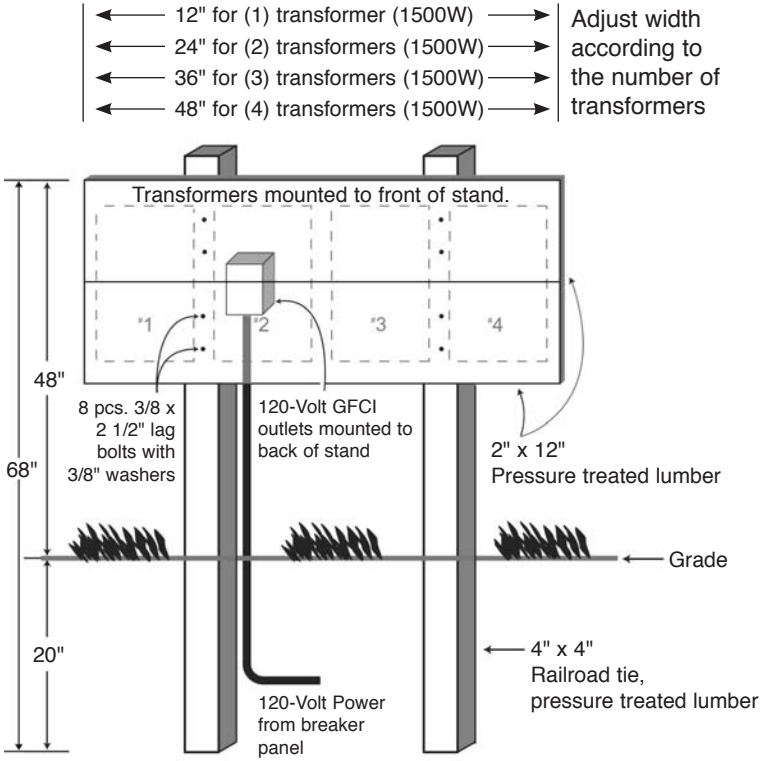


Fig. 8. Transformer Stand Assembly

TRANSFORMER STAND STEPS

Cut Lumber — Step 1

Determine width of stand according to the number of transformers (Fig. 8). Cut lumber to indicated lengths.

Assemble Stand — Step 2

Pre-drill bolt holes and securely bolt cross pieces to legs.

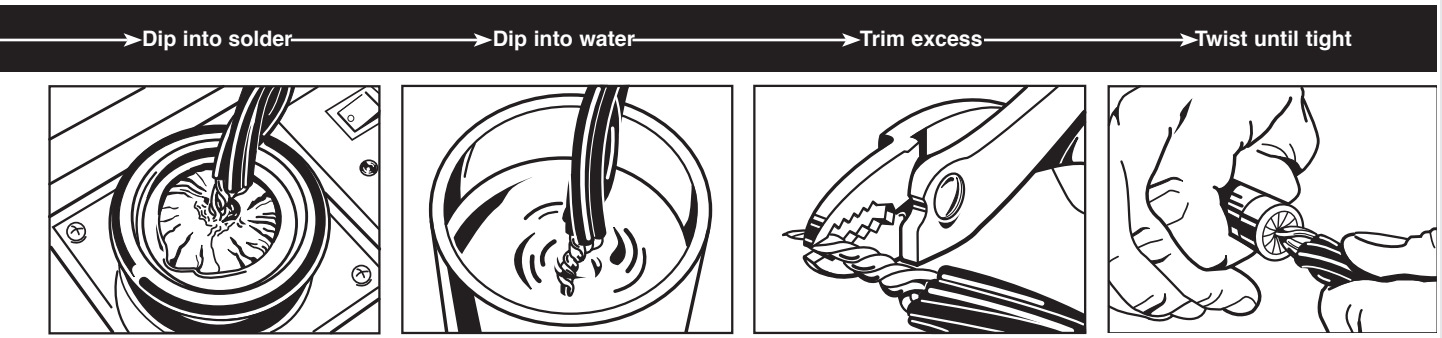
Insert Stand — Step 3

Insert stand into holes. Use a level to ensure that the stand is both vertically and horizontally level. Pack legs tightly with soil or gravel.

Mount Transformer(s) — Step 4

Using screws provided, mount transformer(s) onto stand.

Note – transformers can also be mounted to existing structures, but should never be mounted to vinyl siding or in areas where a fire hazard exists.



This method is quick, easy, reduces finger strain and results in a connection that will never fail!

ADJUSTMENT STEPS

Step 1 Connect All Wire Runs to 12V Tap

After all Spider Splices® are connected and lamps installed, return to the transformer and connect all tap leads to the 12 volt terminal (Fig. 9). (More than seven #10-2 wires on a terminal will require a test lug (CTESTLUG) connected with jump wire.)

Distribute the commons across the common terminals keeping in mind that the capacity of each common terminal is 25 amps.

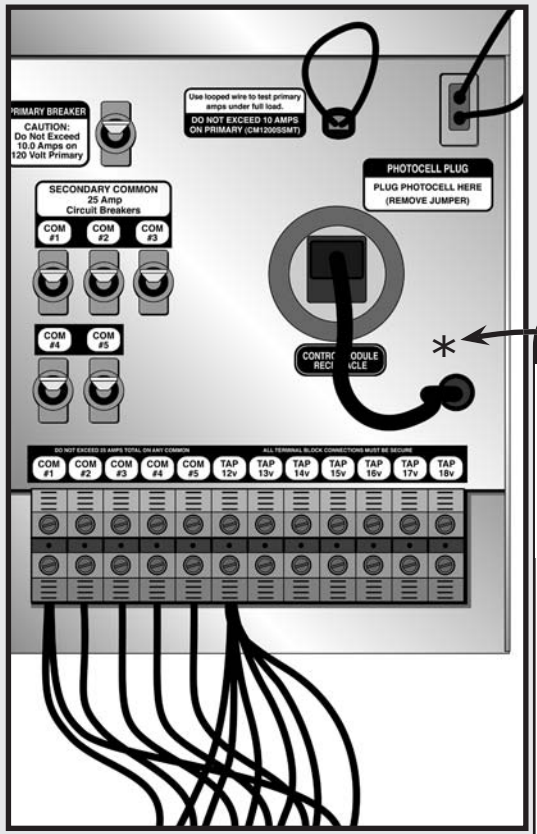
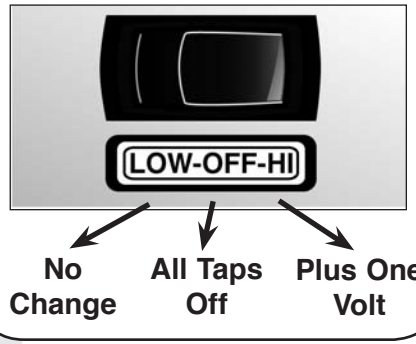


Fig. 9. Transformer with all runs connected to the 12 volt tap. (CAST Model # CM1200SSMT)

NOTE FOR "JOURNEYMEN SERIES"

Illustration at left shows "Master Series" transformer. The "Journeymen Series" has a Hi-Low Power Switch. **This switch can be used to add one volt to all voltage taps.**



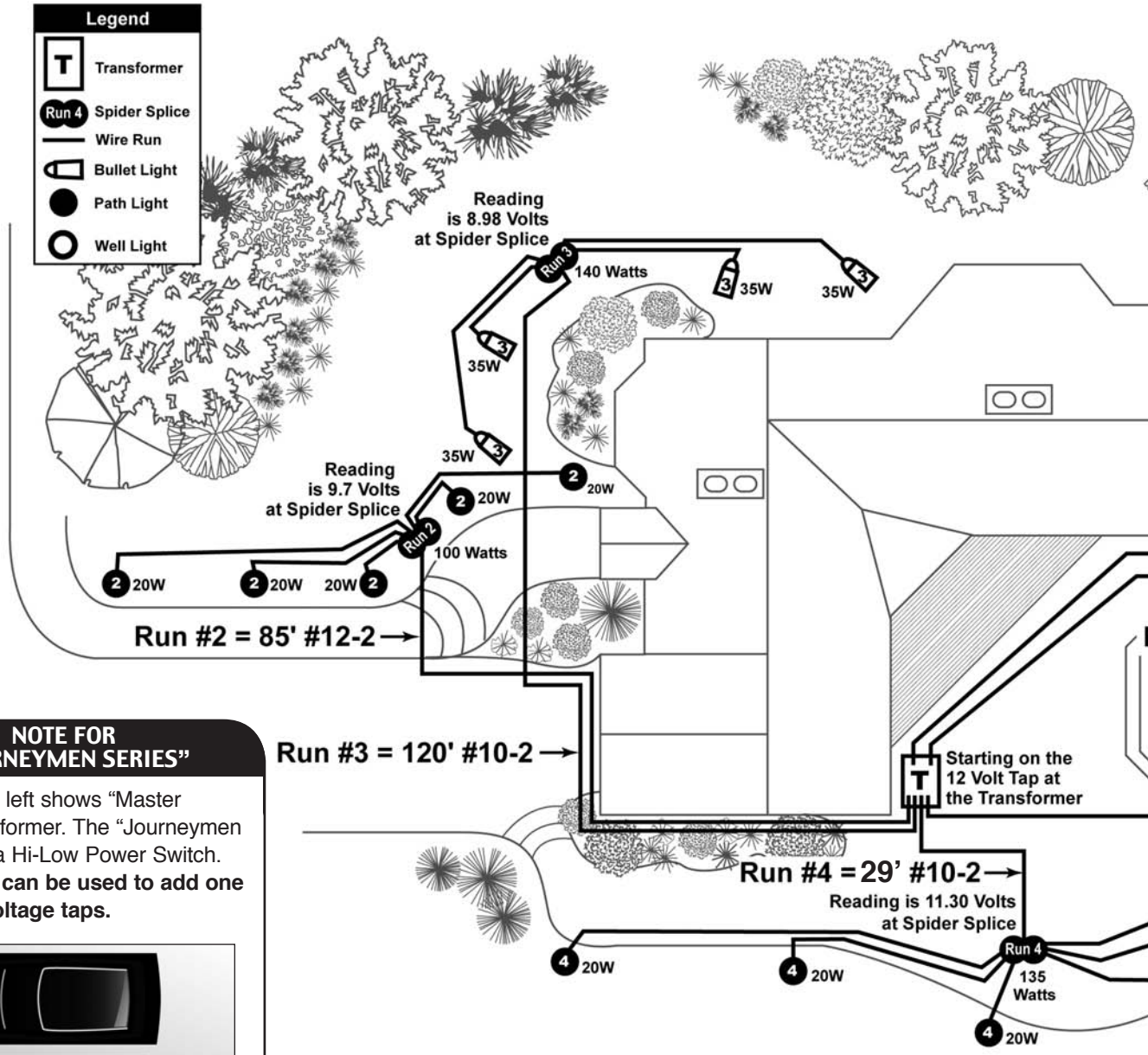
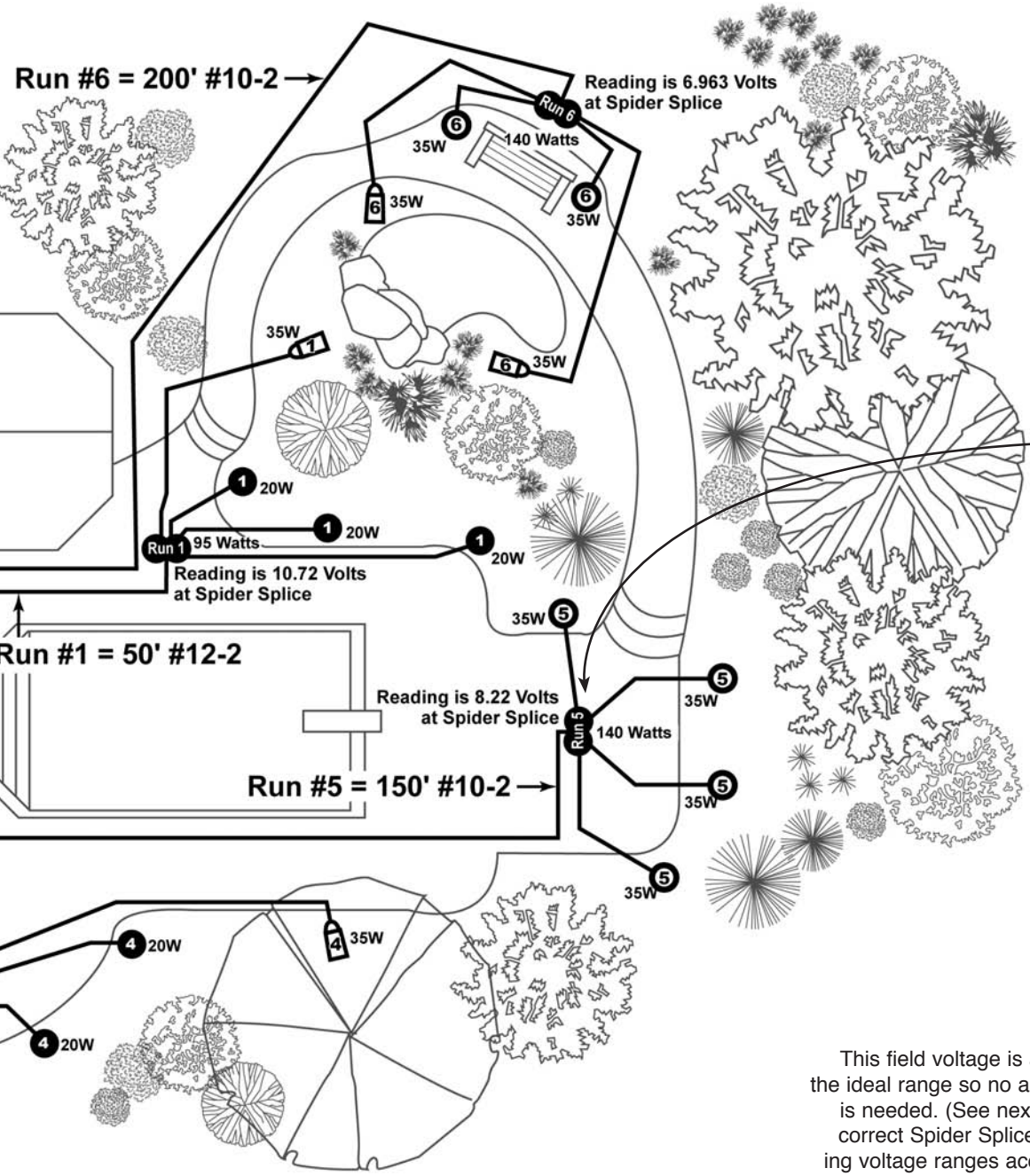


Fig. 10. Plan view of example lighting system including operating voltage values when all wire runs are connected to the 12 volt tap.



Test Field Voltages **Step 2**

Using a digital multimeter, test the voltage at each Spider Splice® junction (or fixture) (Fig. 11) and record the values on the "Field Voltage Adjustments" form (Fig. 12). Then complete the form to arrive at the taps needed to adjust the voltages to the acceptable lamp operating range.

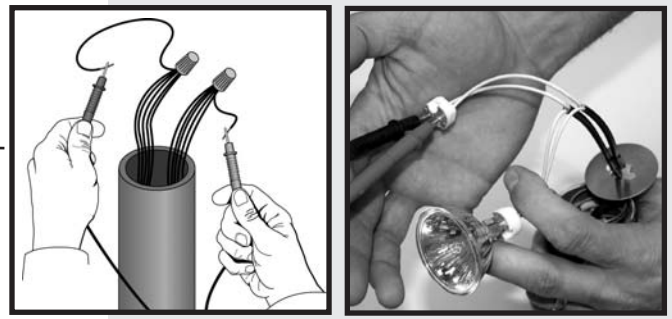


Fig. 11. Testing the voltage at the Spider Splice® or directly at the lamp (using the CAST CTESTMR16 or CTESTS8 - for path lights).

FIELD VOLTAGE ADJUSTMENTS

Test the voltage at the test leads in each "Spider Splice®" junction. Using these values, round the numbers up or down to the nearest whole number. Take the difference between these numbers and 12 volts to find the actual voltage loss. Add this to 12 volts to determine the correct voltage tap. (See below example from illustration.)

Wire Run	Field Voltage	Voltage Rounded Up or Down	Voltage Difference from 12V	Correct Voltage Tap (Difference + 12V)
1	10.72	11	1	13
2	9.71	10	2	14
3	8.98	9	3	15
4	11.30	11	0	12
5	8.22	8	4	16
6	6.96	7	5	17

This field voltage is already in the ideal range so no adjustment is needed. (See next page for correct Spider Splice® operating voltage ranges according to lamp wattage.)

Fig. 12. Field Voltage Adjustment form. Blank form for copying can be found on p. 17.

Step 3 Connect All Wire Runs to Adjusted Taps

After calculating the correct taps for each run, return to the transformer and connect the wire runs to their appropriate voltage taps (Fig. 13).

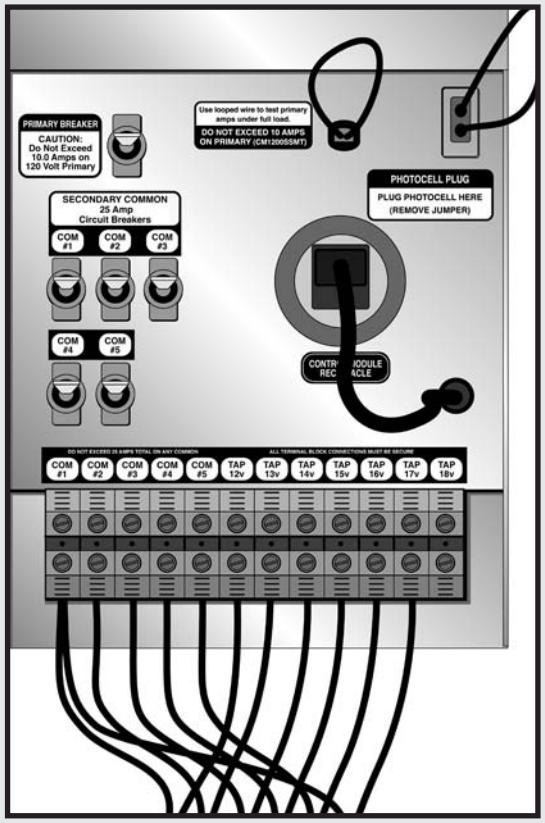
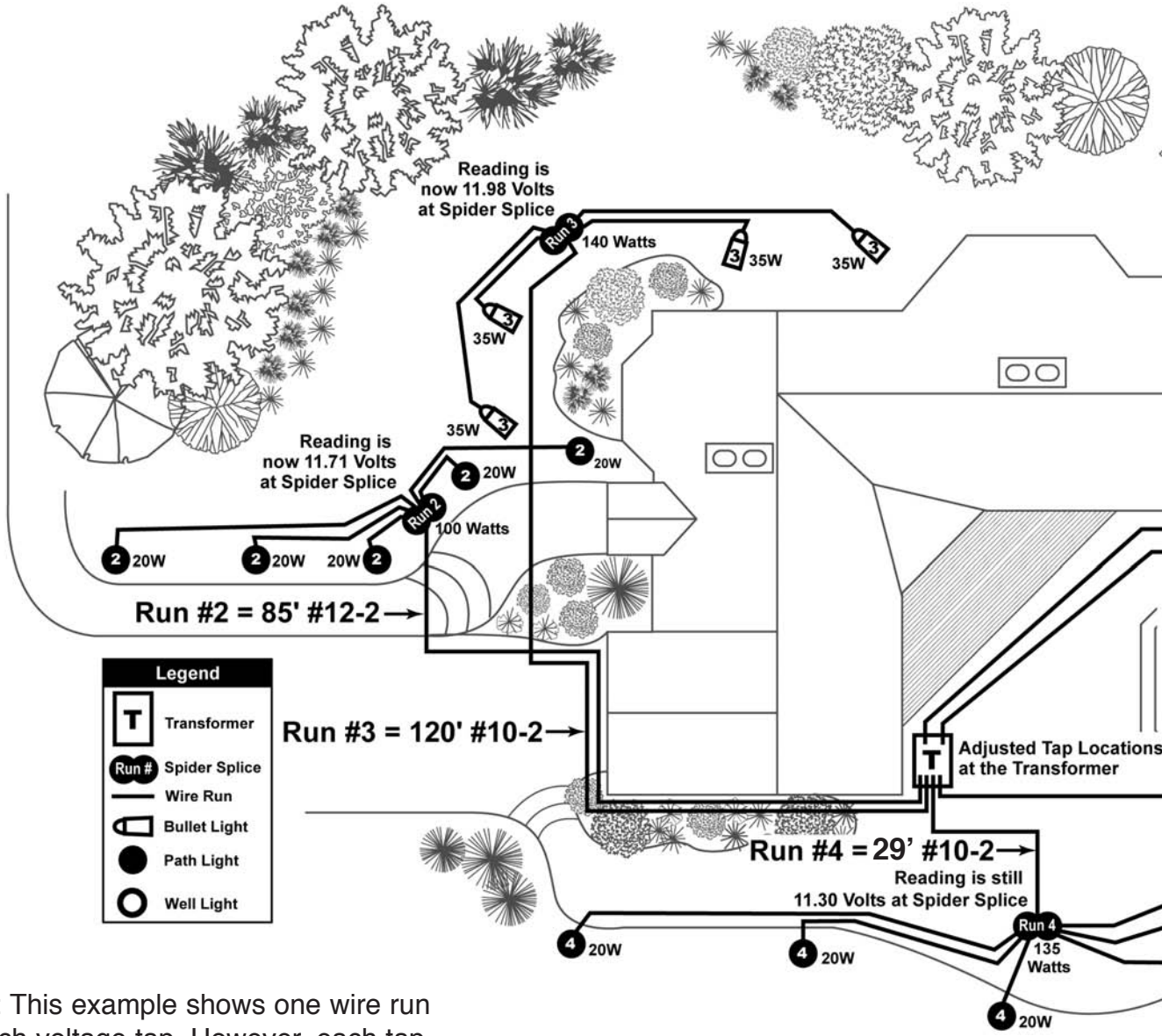
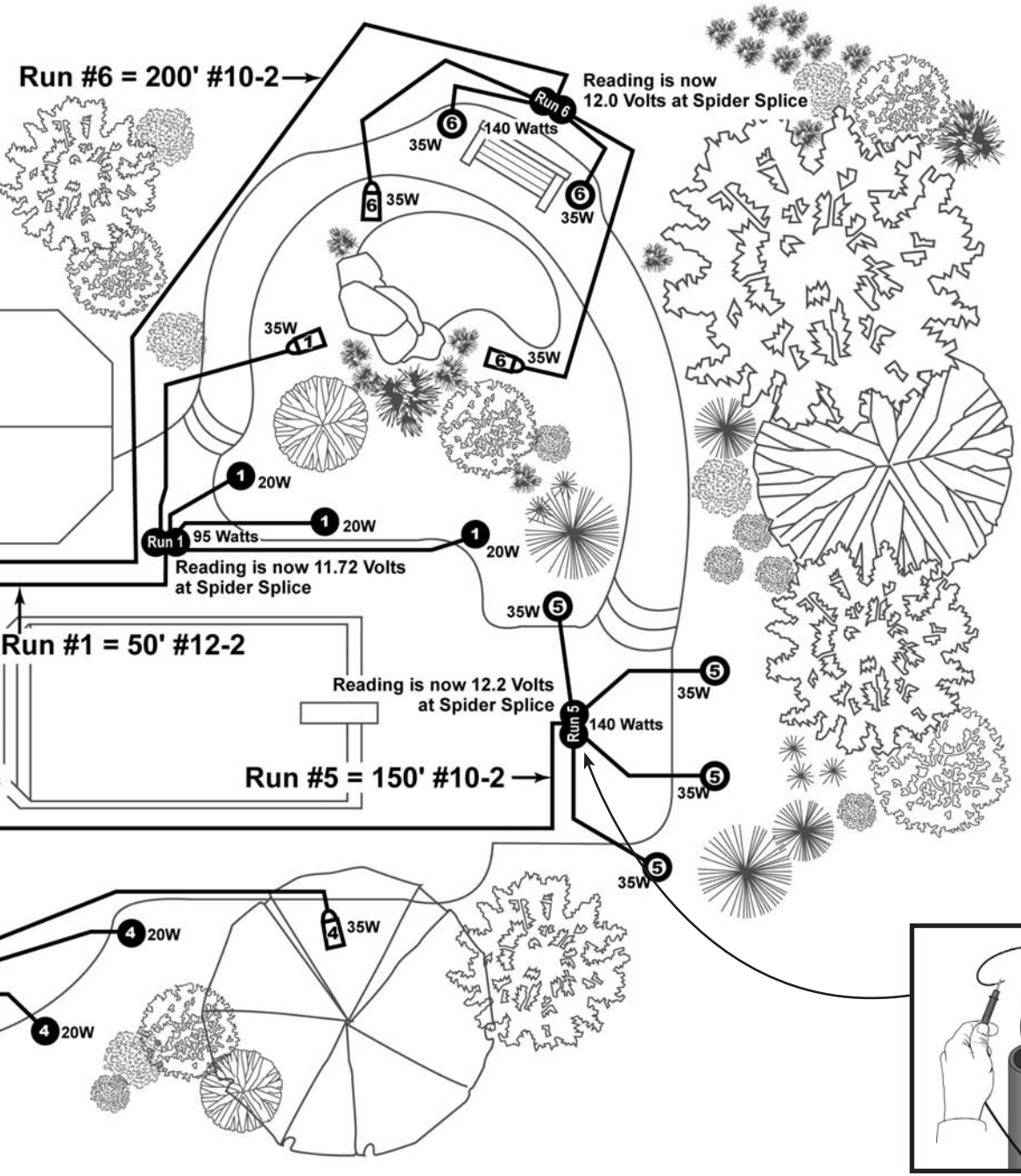


Fig. 13. Transformer with wire runs connected to their appropriate taps.



Note: This example shows one wire run to each voltage tap. However, each tap can accommodate up to seven #10 wires or 125 amps/1500 watts.

Fig. 14. Plan view of example lighting system including values after field adjustments have been made.



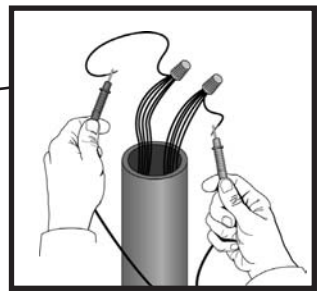


Fig. 15. Retest Voltage at all Spider Splice connections or directly at the lamp.

Retest Field Voltages — Step 4

After connecting to the correct taps and powering up the transformer, retest the voltage at each Spider Splice® to ensure that all lamps are receiving between 10.8 and 12 volts (Fig. 14 and 15).

Since there is some voltage loss between the Spider Splice® and the fixture through the #16-2 lead wire, the correct voltage at the Spider Splice® is between 0.3 and 0.8 volts greater than at the lamp. The extent of this difference depends on lamp wattage.

Acceptable ranges at the Spider Splice® according to lamp wattage are as follows (note: if there are mixed wattage lamps on a single Spider Splice®, then use the lowest lamp wattage to select the voltage range.)

- For 20w lamps – 11.1 to 12.3 volts.
- For 35w lamps – 11.3 to 12.5 volts.
- For 50w lamps – 11.6 to 12.8 volts.

If necessary, change taps until all readings are within the acceptable values.

WIRE RUN	TESTED FIELD VOLTAGE	LOWEST LAMP WATTAGE ON RUN	ACCEPTABLE VOLTAGE RANGE	OK?
1	11.72	20	11.1-12.3	YES
2	11.71	20	11.1-12.3	YES
3	11.98	35	11.3-12.5	YES
4	11.30	20	11.1-12.3	YES
5	12.2	35	11.3-12.5	YES
6	11.96	35	11.3-12.5	YES

Fig. 16. Final voltage readings at each Spider Splice®. Blank form for copying can be found on p. 17.

Step 5 Make Final Readings

To thoroughly check the system and to arrive at the final amperage readings, use a digital clamp-on amp/volt multimeter, following the steps outlined to the right.

Record all readings from the voltage taps and primary on the inside sticker of the transformer (Fig. 21).

FINAL AMPERAGE MEASUREMENTS

1. **Amp the total load on each common terminal.** (Fig. 18.)
Each common terminal has a capacity of 25 amps. If the amp reading is greater than 25 amps, redistribute the wires to spread the load evenly across the commons provided.

2. **Amp the secondary wire runs at each voltage tap.** (Fig. 19.)

This accomplishes two things:

A. Ensures you have not overloaded the wire. (#12-2 wire is rated for a maximum of 16 amps. #10-2 wire is rated for a maximum of 24 amps.)

B. Provides a baseline for future troubleshooting. Any wire run problems that may arise can be diagnosed by comparing amp readings with original values.

If the amp reading at any voltage tap is greater than the rated capacity, then either the wire size needs to be increased, the circuit needs to be split by running another wire and Spider, or the Spider Splice® connections need to be checked for shorts.

3. **Amp the Primary at the Photocell Plug (for 300 to 600 Watt transformers) or Testing Loop (for 900 to 1500 watt transformers).** (Fig. 20.)
Use the jumper wire at the Photocell Plug or Testing Loop to measure the total load on the transformer. The reading should not exceed the transformer's rating (see chart below.)

TRANSFORMER CAPACITY	MAXIMUM PRIMARY 120V AMPERAGE	TRANSFORMER CAPACITY	MAXIMUM PRIMARY 120V AMPERAGE
300 watts	3.0 amps	1200 watts	10.0 amps
600 watts	6.25 amps	1500 watts	12.0 amps
900 watts	8.0 amps		

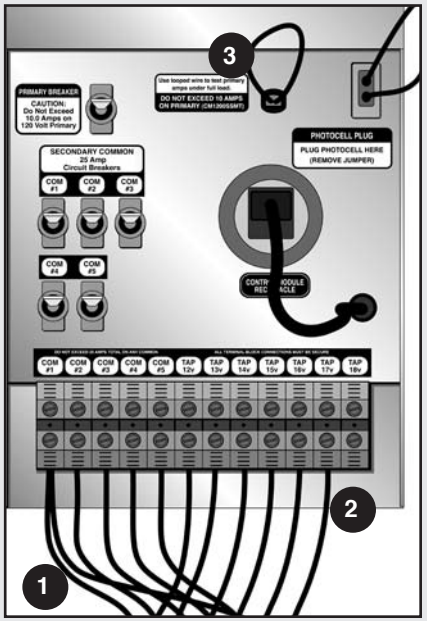


Fig. 17. Final wiring of transformer with test points indicated.

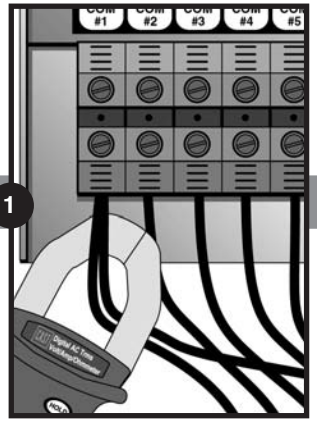


Fig. 18. Amping the common terminals.

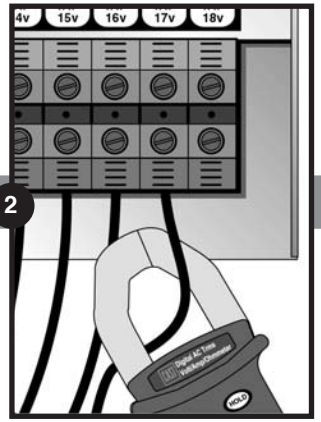
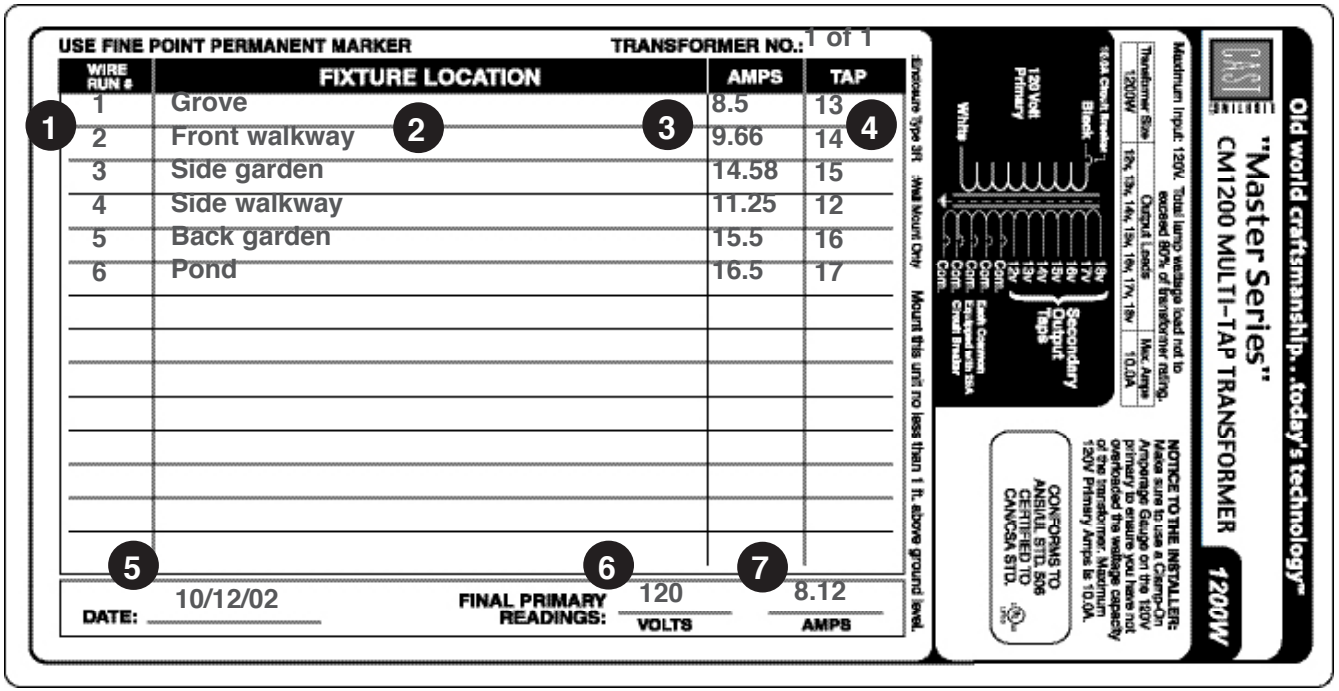


Fig. 19. Amping the voltage taps.

Fig. 20. Amping the primary.


USE FINE POINT PERMANENT MARKER

TRANSFORMER NO.: 1 of 1

WIRE RUN #	FIXTURE LOCATION	AMPS	TAP
1	Grove	8.5	13
2	Front walkway	9.66	14
3	Side garden	14.58	15
4	Side walkway	11.25	12
5	Back garden	15.5	16
6	Pond	16.5	17

DATE: 10/12/02

FINAL PRIMARY READINGS: 120 VOLTS 8.12 AMPS

"Master Series" CM1200 MULTI-TAP TRANSFORMER 1200W

Old world craftsmanship...today's technology

INSTRUCTIONS FOR COMPLETING THE TRANSFORMER LID FORM

1 WIRE RUN #
Identifies the "Spider Splice®" Wire Run #.

2 FIXTURE LOCATION
Description of the fixture location.

3 AMPS
Using a clamp-on amperage gauge measure the operating amperage of each wire run and record the number in the allotted space. (It is extremely important to do this; if you ever need to check for system problems you need these readings.)

4 TAP
The tap selected that compensated for the wire loss and delivered the correct operating voltage to the lamps (10.8 – 12.0 volts.)

5 DATE OF INSTALLATION

6 FINAL PRIMARY READINGS: VOLTS
Voltage under full load measured at primary 120 volt power receptacle (optional.)

7 FINAL PRIMARY READINGS: AMPS
Amperage under full load measured using clamp-on gauge around the photocell plug-in wire or Testing Loop.

DOCUMENTATION STEPS

Record Final Readings — Step 1

Complete the form on the inside lid of the transformer using system information and final voltage and amperage readings. (Fig. 21) Instructions are below. This permanent record is used in conjunction with the CAST Fixture Record Tags and CAST Spider Splices® to completely record all system details. This ensures that all future servicing and maintenance will be trouble free.

Fig. 21. Transformer Lid Form.

⚠ Warning: Use caution when testing high voltage outlets.

The CAST “Fixture Record Tag” is an exclusive patent pending feature of CAST Lighting. Manufactured of rugged copper, the “Fixture Record Tag” allows installers to record vital information at the fixture. This simplifies long-term maintenance and troubleshooting.

Step 2 Mark Fixture Record Tags*

Mark all the Fixture Record Tags with the appropriate information (Fig. 22 and 23).

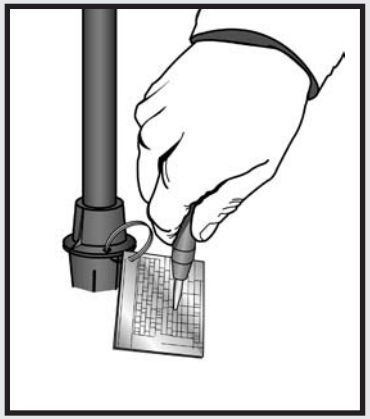


Fig. 22. Marking the Fixture Record Tag with the CAST Center Punch Marking Tool (Model# CPUNCH). Place tag on a scrap of wood when marking.

Step 3 Finishing the Job

After recording all system information on the appropriate forms, stickers, and tags, secure the lid on the transformer and clean up the site.

Return to the site in the evening to power up the system, make final fixture adjustments and enjoy the beauty of this professionally installed Landscape Lighting System.

“CAST Fixture Record Tag” ensures ease of maintenance by providing a lasting record of Lamp Type, Wire Run Number and Transformer Number.

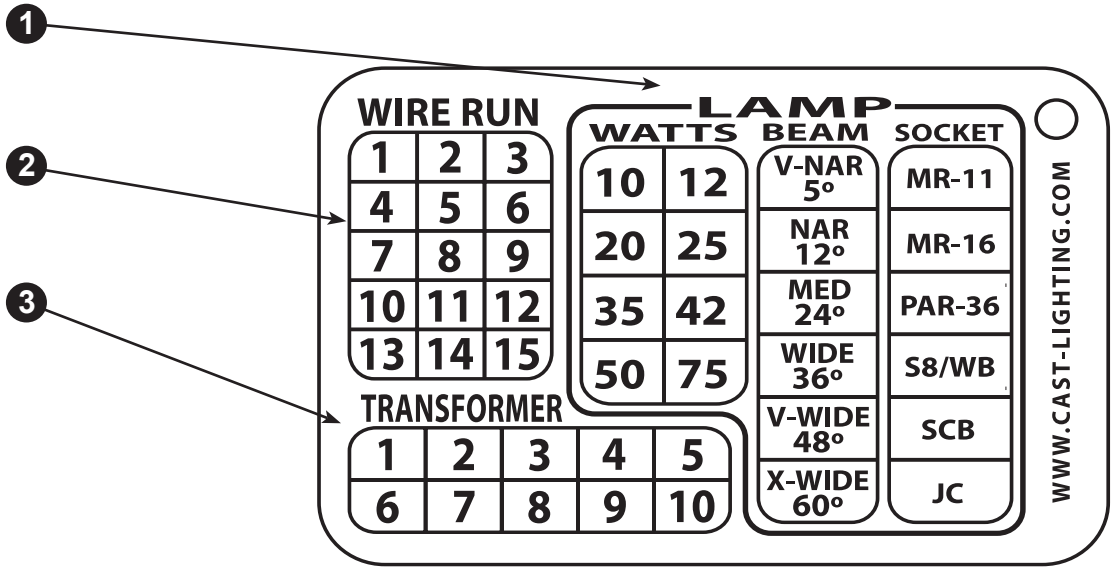


Fig. 23. CAST Fixture Record Tag (CABFR).

FIXTURE TAG MARKING INSTRUCTIONS

Using the CAST Center Punch (CPUNCH), mark the tag with the following information:

1. **Lamp Type.**
   Includes wattage, beam angle and socket type.
2. **Wire Run Number.**
3. **Transformer Number.**

(Note: For fixtures with off grade locations, attach the Fixture Record Tag to the Spider Splice cap.)

* “Fixture Record Tag” is a registered trademark of CAST Lighting LLC.

Project:____________________ Worksheet #: ____ of ____ Date:____________

PRELIMINARY SYSTEM REQUIREMENTS WORKSHEET

WIRE RUN	LOCATION	FIXTURE TYPE	QTY.	X	LAMP WATTAGE	=	TOTAL WATTAGE	DISTANCE FROM SPIDER SPLICE TO TRANSFORMER	
								#12-2 WIRE	#10-2 WIRE
				X		=			
				X		=			
				X		=			
				X		=			
				X		=			
				X		=			
				X		=			
				X		=			
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				X		=			
				X		=			
				X		=			
				X		=			
						TOTALS			

LAMP REQUIREMENTS

STYLE	LAMP WATTAGE	BEAM SPREAD	QTY.

FIXTURE REQUIREMENTS

TYPE	QTY.

TRANSFORMER AND WIRE SIZING CALCULATIONS FOR LANDSCAPE LIGHTING

CAST LIGHTING LLC

Guidelines for selecting wire size to maximize the efficiency of a low voltage lighting system:		
	#12-2	Total combined lamp wattage of 100 watts or less. Total wire run of 100 ft. or less to the Spider Splice®.
	#10-2	Total combined lamp wattage of 140 watts or less. Total wire run in excess of 100 ft. to the Spider Splice®.
	#8-2	Very expensive wire–better to run two pieces of #10-2 wire than one #8-2 wire.

SYSTEM REQUIREMENT

Optimal operating range of halogen lamps is 10.8 to 11.3 volts.

WIRING AND LAMP INFO				TO DETERMINE VOLTAGE TAPS REQUIRED													TO FIND TRANSFORMER WATTAGE				
RUN #	WIRING METHOD (SPIDER OR TEE)	WIRE SIZE	TOTAL LAMP WATTAGE ON THE WIRE RUN (See Example Below)	AMP LOAD (Lamp Wattage Divided by 12)	x	WIRE LENGTH (To Spider Splice or Tee Connection)	x	2	x	RESISTANCE PER FOOT (See Chart Below)	=	VOLTAGE DROP	+12	=	TAP NEEDED (Round up to nearest whole number)		AMP LOAD (From previous AMP LOAD column)	x	TAP NEEDED (From Previous TAP NEEDED Column)	=	TOTAL WATTS
1					x		x	2	x		=		+12	=				x		=	
2					x		x	2	x		=		+12	=				x		=	
3					x		x	2	x		=		+12	=				x		=	
4					x		x	2	x		=		+12	=				x		=	
5					x		x	2	x		=		+12	=				x		=	
6					x		x	2	x		=		+12	=				x		=	
7					x		x	2	x		=		+12	=				x		=	
8					x		x	2	x		=		+12	=				x		=	
9					x		x	2	x		=		+12	=				x		=	
10					x		x	2	x		=		+12	=				x		=	

TRANSFER AMP LOAD VALUES FOR EACH RUN TO THIS COLUMN

GRAND TOTAL (Min. Transformer Wattage)

TYPICAL EXAMPLE

1	Spider	#10/2	4@35w=140w	11.66 amps	x	150 ft.	x	2	x	.00108	=	3.77	+12	=	15.77		11.66	x	16	=	186.56

Distance to Spider Splice Connection

Voltage drop to Spider Splice

140 watts is divided by 12 volts = 11.66 amps

#10-2 Wire Resistance per ft. from chart below

Tap Required (Round up to 16 volts)

Actual Transformer Watts Required

REFERENCE TABLES

RULE OF THUMB

Since Wire Loss can be as high as 20%, the Lamp Load should never exceed 80% of the transformer's rated wattage capacity.

WIRE AMP RATINGS

Wire Size	Recommended	Maximum
#12/2	100w/8.3A	192w/16A
#10/2	140w/12.0A	288w/24A

Formula for Voltage Drop is 2 x Length of Wire x Amps x Resistance per Foot

RESISTANCE PER FOOT (According to Wire Size)

#18	.006385	#14	.002525	#10	.00108	#6	.000395
#16	.004016	#12	.00162	#8	.00064	#4	.000249

Project:_____ Worksheet #: ____ of ____ Date:_____

FIELD VOLTAGE ADJUSTMENT WORKSHEET

FIELD VOLTAGE TESTING AND TAP SELECTION					FIELD VOLTAGE RETESTING		
WIRE RUN	FIXTURE SOCKET VOLTAGE	VOLTAGE ROUNDED UP	VOLTAGE DIFFERENCE FROM 12V	CORRECT VOLTAGE TAP	ADJUSTED FIELD VOLTAGE*	ACCEPTABLE VOLTAGE RANGE	OK?

*If voltage is measured at the Spider Splice, add the following values to the field voltage:

- For 20w lamps – Add 0.3 volts.
- For 35w lamps – Add 0.5 volts.
- For 50w lamps – Add 0.8 volts.

SAFETY GUIDELINES

NEC Code-Related and Other Safety Guidelines

Out of over 800 sections of code, only one (Article 411) specifically applies to Low Voltage Landscape Lighting. The following code-related guidelines are meant to be a general guide to a safe installation. It should be noted, however, that only licensed electricians and electrical inspectors are qualified to determine how NEC code is interpreted and applied; specific questions on NEC codes and compliance should be directed to these authorities.

1. Use only listed products. The best assurance of landscape lighting product safety is the use of UL listed products. All CAST fixtures, transformers and wire are UL listed.
2. Plug the transformer into a GFCI receptacle or GFCI-protected circuit. GFCI protection is achieved through use of an approved outdoor covered GFCI receptacle or through use of a GFCI protected circuit breaker at the breaker panel. A licensed electrician must install and test the GFCI receptacle or breaker.
3. Bury wires at least 6 inches deep (18 inches under driveways). While the use of underground conduits is not required, such conduits provide extra protection under mulch beds, edgings and other areas where digging or damage may occur.
4. Do not install fixtures within 10 ft. of a water feature.
5. Use properly rated wire: If wire run is over 100 watts or over 100 ft., use #10-2 No-Ox® wire; otherwise, use #12-2.
6. Do not run low voltage wires in the same conduit as higher voltage wires.
7. While CAST transformers are rated for both outdoor and indoor installation, we highly recommend that transformers be mounted outdoors (on a transformer stand - see p. 7). If the transformer is mounted indoors, a properly rated metal conduit should be used to run wires through an exterior wall. Consulting with an electrician is highly advised when undertaking an indoor installation.
8. If well lights are installed in mulch beds and turf areas, do the following to prevent plant material from contacting the bare lamp: Consider using well light grates (CWLG1CB and CWLGLENS) or lenses (CWLR1CB) and instruct the homeowner to remove leaves and mulch that may accumulate on the fixtures.
9. Periodically maintain the system - clean fixtures; trim plant material; remove debris; check the integrity of wire and splices; and re-tighten transformer terminal block screws.
10. Unplug the transformer before relamping. Avoid touching a hot lamp with bare fingers.

CAST LIGHTING LIMITED WARRANTY

CAST Lighting warrants its products against defects in material and workmanship. Without charge, CAST Lighting will either repair or replace (CAST Lighting reserves the right to decide between repair or replacement) any properly installed CAST Lighting product which fails under normal operating conditions and has not undergone abuse beyond normal wear-and-tear within the specified warranty period.

- **Transformers** (does not include Electronic Mini-Transformers)
  - **Windings and Stainless Steel (SS Series) Enclosures: Lifetime Warranty**
  - **Mild Steel (PS Series) Enclosures: 3-Year Warranty**
  - **Electrical Components: 3-Year Warranty**
  - **Photocells and Timers: 3-Year Warranty**
- **Electronic Mini-Transformers: 3-Year Warranty**
- **No-Ox® Wire: 25-Year Warranty**
- **Tools and Meters: 1-Year Warranty**
- **Demo Kit Components: 90-Day Warranty**
- **Lamps: No Warranty**
- **Lighting Fixtures** (does not include Demo Kit components)
  - **Bodies, Castings, Housings, Stakes, Stems and Lenses**: Lifetime Warranty
  - **O-Rings and Socket Components**: 3-Year Warranty

NOTE – FIELD REPAIRS RECOMMENDED

All CAST Lighting products are designed to be field repairable by a qualified installer. All service parts are readily available and we encourage field repairs as a significant cost and labor saving can be realized by the installer. All warranted components, as stated in the above warranty, which are installed in the field, will be honored.

Note: Before CAST Lighting will accept suspect transformers, they must be bench-tested at the distributor to confirm malfunction. Warranty will not be honored for transformers with cut wires or other modifications.

All products are warranted from the date of invoice, provided it is returned to the factory, transportation prepaid and our factory inspection determines it to be defective under the terms of the warranty.

This warranty covers only equipment manufactured by CAST Lighting and does not extend to transportation, installation, labor compensation or replacement charges, nor does it apply to any equipment of another manufacturer used in conjunction with CAST Lighting equipment.