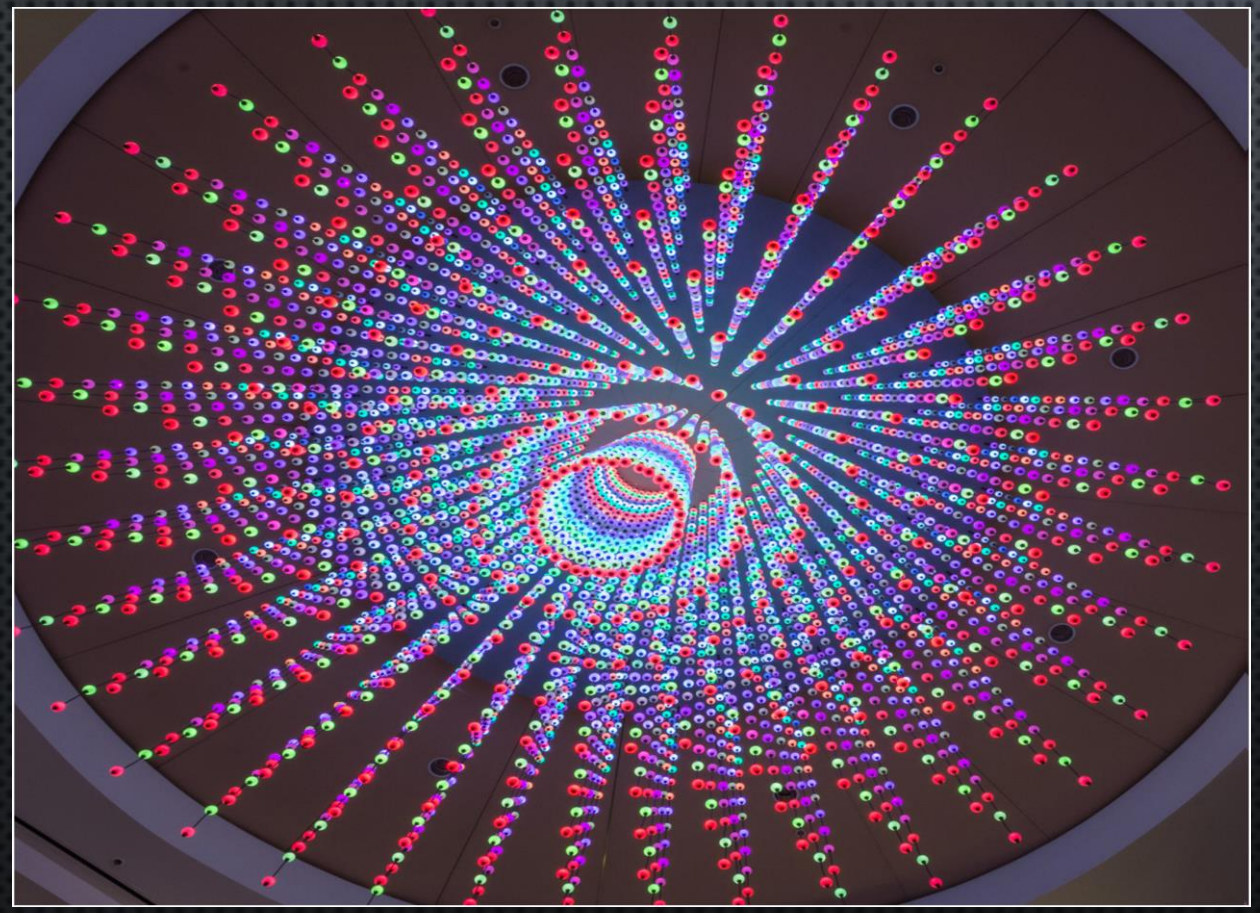
A FIELD GUIDE TO...

POWER & DATA MANAGEMENT



Presented by

Illuminations Lighting Inc.

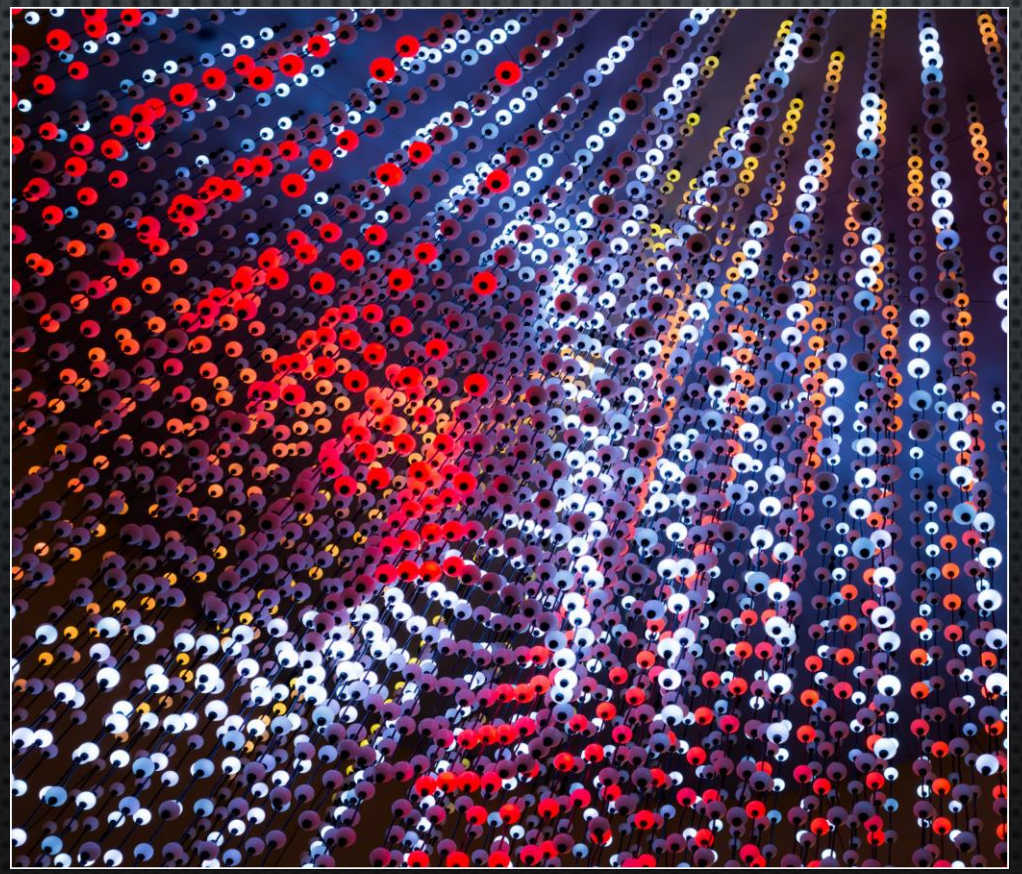
illuminations

HOLIDAY, EVENT & LANDSCAPE LIGHTING

2018 POWER & DATA MANAGEMENT

Properly managing power & data in your RGB installation is the difference between a winning design & a project ripe with issues.
In this tutorial we lay out proven methods & Best Practices for a successful & timely installation & light show.

Note: Guidelines herein are for *Minleon-Rainmin's RGB Plus Line (Gen3)*. But these rules also will apply to Minleon's 2011-17 legacy RGB Line (Gen2). Variations will be slight & work to our advantage, as the Plus Line will take slightly less power & allow for slightly longer runs between power injections.



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POWER & DATA MANAGEMENT

CONNECTING LIGHTS

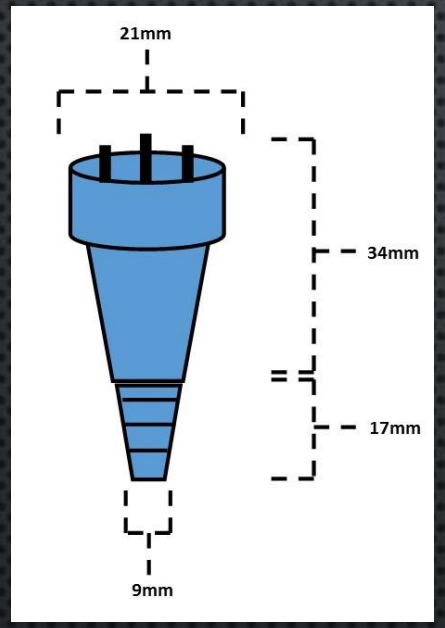
RULE #1: ALWAYS DISCONNECT POWER BEFORE ADDING OR REMOVING LIGHTS

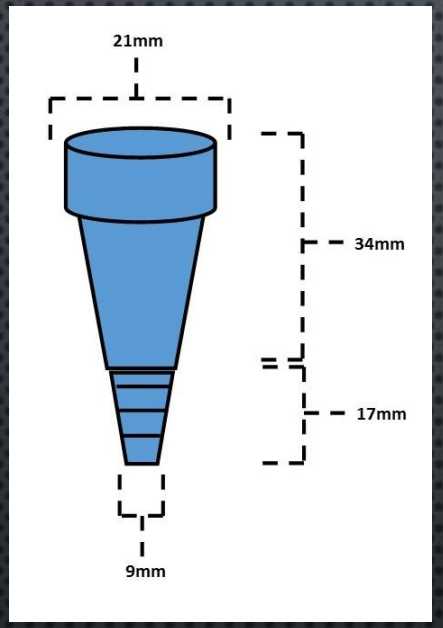
THIS GUIDELINE APPLIES TO 2011-2017 *LEGACY* RGB LINE. WITH THE 2018 RGB PLUS LINE, IN MOST CASES WE CAN ADD STRINGS WITH THE POWER CONNECTED WITHOUT EFFECTING THE DATA. IF DATA LOCKS UP, SIMPLY RE-CYCLE POWER TO THE SYSTEM.

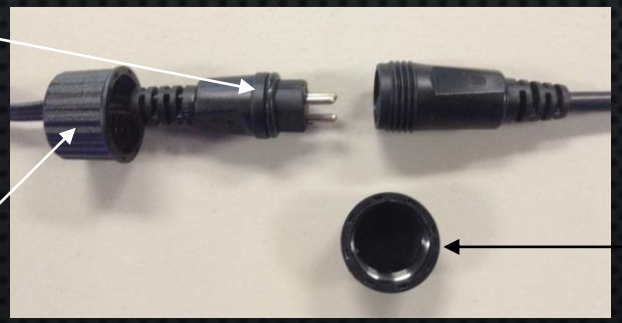
- IF POWER IS NOT DISCONNECTED PRIOR TO MAKING NEW CONNECTIONS, DATA MAY LOCK UP IN THE STRINGS REQUIRING A FULL POWER RECYCLE AFTER THE CONNECTIONS ARE MADE; THIS MAY DAMAGE THE STRING OVER TIME
- EACH STRING OF MINLEON RGB LIGHTS HAS BOTH A MALE AND A FEMALE PLUG; THE MALE IS THE INPUT SIDE AND THE FEMALE IS THE OUTPUT SIDE
- TO CONNECT, REMOVE THE WEATHERPROOF PLUG FROM THE FEMALE END OF THE FIRST STRING & CONNECT THE MALE INPUT PLUG OF THE SECOND STRING— ENSURING THAT THE LOCK NUT IS FIRMLY TIGHTENED, BUT NOT OVER-TIGHTENED* (ALWAYS KEEP THE END CAP IN PLACE ON THE FINAL STRING OF EVERY RUN. IT'S ALSO A GOOD HABIT TO SAVE THE EXTRA END CAPS FOR FUTURE USE.)

***PRO TIP**: WHEN MAKING CONNECTIONS, CHECK FOR THE RUBBER RING ON THE MALE CONNECTOR. THIS PIECE, ALONG WITH THE RUBBER DISC INSIDE (AND ALONG WITH) THE FEMALE CAP NEED TO BE IN PLACE TO MAINTAIN THE IP65 OUTDOOR, WEATHERPROOF RATING. MOISTURE IN THESE CONNECTIONS WILL SHORT THE RGB STRING & NOT BE COVERED IN THE MANUFACTURE'S WARRANTY.

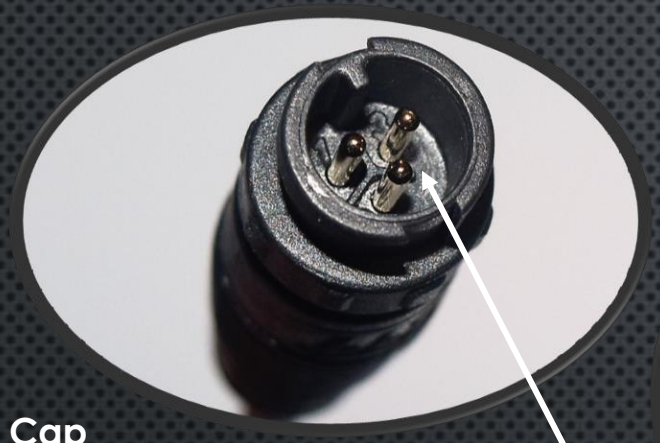
Legacy RGB connector measurements



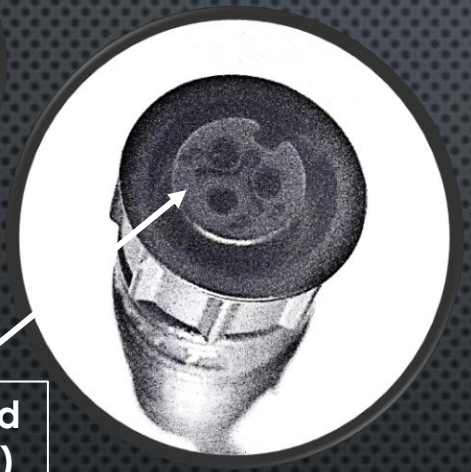




CONNECTING LIGHTS CONT.

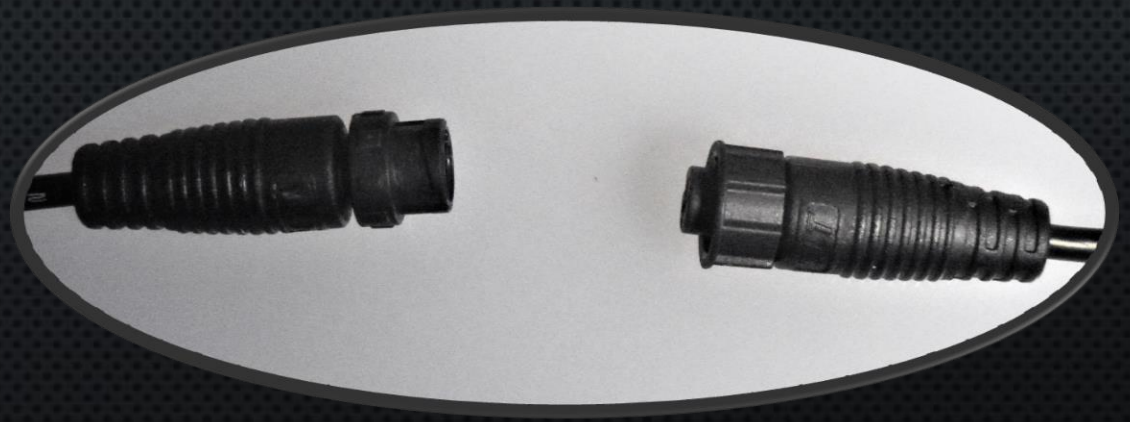


RGB Plus connectors



End Cap

Pins are labeled 1 (+), 2 (-), 3 (s)

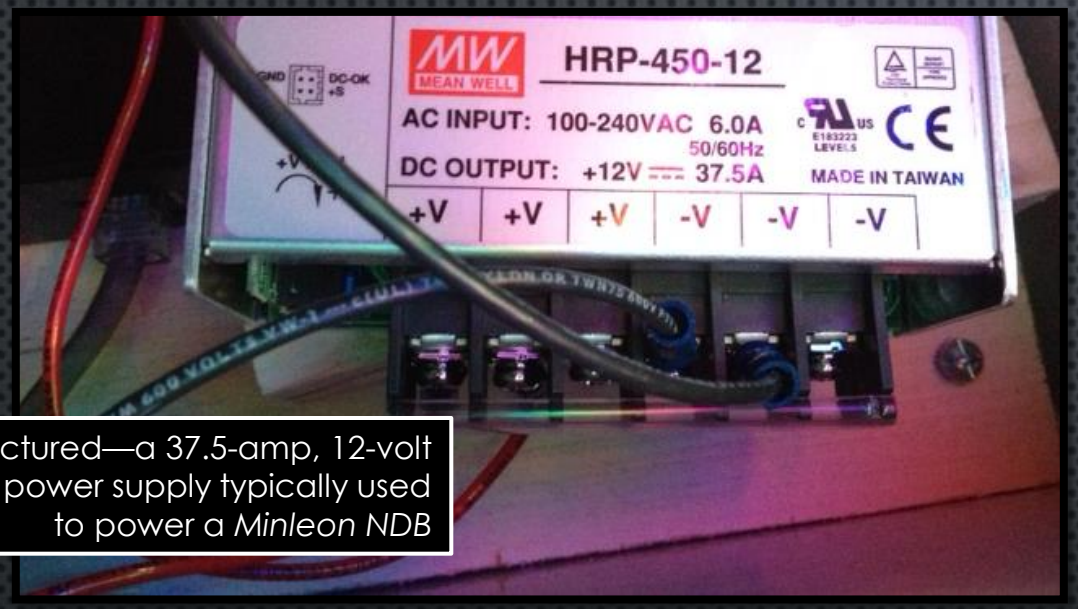


RGB Plus Connector Notes

- RGB Plus Line connectors Twist-and-Lock, as opposed to the legacy screw-down connectors—enhancing water-tightness
- The Lock Nut is now on the female end
- End Caps are standard with *every* RGB Plus string, and need to be used to keep the IP65 weatherproof rating—even with Smart T's. These do not feature a rubber disc as in previous versions
- When measuring voltage, **Pin 1 is + VCC, Pin 2 is – GND, Pin 3 is Signal**
- Slimmer Design: **Diameter 5/8-inch**
- Connector Length **1 7/8-inches** (both male & female ends)
- Tightest Pixel resolution when connecting strings: **3.25" x 6.5" x 3.25"**

***Pro Tip**: RGB Plus connectors will not function with legacy RGB's (if spliced), as the chips in each RGB bulb are not compatible. But legacy RGB's and Plus Line RGB's can be controlled together in the same network at the RGB Controller level—via network switch (with NDB's) or Master-Slave WEC network.

POWER CONSIDERATIONS



Pictured—a 37.5-amp, 12-volt power supply typically used to power a *Minleon NDB*

***PRO TIP**: WHEN DECIDING HOW MUCH OVERALL POWER YOUR DISPLAY WILL NEED ON SITE, REMEMBER TO CHECK THE SPECS OF THE AC/DC TRANSFORMERS (POWER SUPPLIES) YOU WILL BE USING. THIS VALUE WILL LIE DIRECTLY IN WHAT YOUR AC TRANSFORMERS ARE PULLING, AND ONLY INDIRECTLY FROM WHAT YOUR DC RGB-LED'S ARE USING.

RULE #2: ACCOUNT FOR VOLTAGE DROP ACROSS DISTANCE — ASSIGN 0.035 AMPS PER LEGACY RGB / 0.03 PER PLUS LINE RGB

- MOST **LEGACY MINLEON RGB'S DRAW 0.030 AMPS** OF 12-VOLT POWER & MOST **RGB PLUS BULBS DRAW 0.028 AMPS.** PLEASE CHECK POWER SPECS ON LARGER BULBS SUCH AS RGB SPHERES, ORBS, DOMES & 100MM TRIKLITS.
- WE RECOMMEND ACCOUNTING FOR VOLTAGE DROP ACROSS DISTANCE IN DESIGN PHASE ONE BY SLIGHTLY INCREASING THIS POWER DRAW VALUE
- WE ALSO RECOMMEND RUNNING POWER SUPPLIES TO 90% CAPACITY, LEAVING 10% HEADROOM TO ACCOMMODATE FOR INFRASTRUCTURE POWER SPIKES
- USE THIS BASIC EQUATION TO DECIDE THE PLACEMENT & TYPE OF POWER SUPPLIES NEEDED FOR YOUR RGB LIGHT PROJECT:

0.035 x (# of RGB's*)
=
Amperage Needed for your project

POWER & DATA MANAGEMENT

POWER CONSIDERATIONS

Both the **Length of Wire** & the **Number of RGB's** in a strand must be accounted for when deciding the placement & amperage of 12-volt power supplies.

High Reliability MeanWell HRP -- 37.5-amp, 12-volt power supply used to power a *Minleon*.

Legacy RGB 5 Amp/12 Vdc PSU's can also be used in the RGB Plus Line. Simply call us for a new adapter cable.

RULE #3: ACCOUNT FOR VOLTAGE DROP ACROSS DISTANCE— INJECT POWER EVERY 100 LIGHTS OR 100-FEET, WHICHEVER COMES FIRST

- IN GENERAL, WE CAN RUN MORE PIXELS (BULBS) PER STRING EFFICIENTLY WITH SHORTER & TIGHTER PIXEL SPACING
- DESIGNS WITH BULB SPACING GREATER THAN 12-INCHES SHOULD BE LIMITED TO 100-FEET (INCLUDING SPACER CABLES) BEFORE TERMINATING OR INJECTING ADDITIONAL POWER
- WHEN IN DOUBT, MEASURE END-OF-LINE VOLTAGE (SEE RULE 9, SLIDE 13)

RULE #4: UNLESS A MINLEON NDB OR 16-PORT MC AMPLIFIER IS USED, POWER SUPPLIES GREATER THAN 5 AMPS ARE OF NO BENEFIT

- MINLEON USES #20AWG WIRING IN MOST RGB PRODUCTS (#22AWG FOR TRIKLITS), WHICH ALLOWS FOR A MAXIMUM RECOMMENDED FLOW OF 5 AMPS

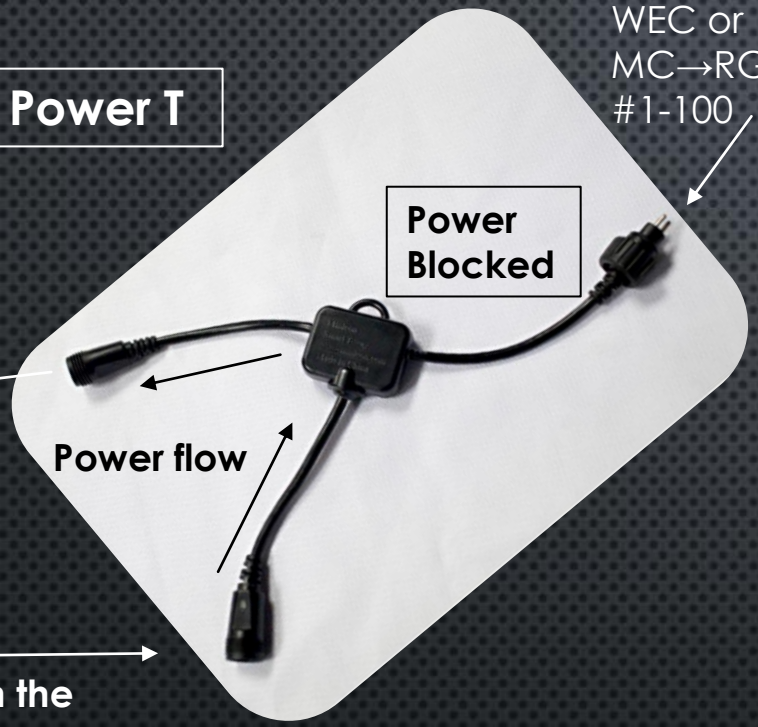
POWER CONSIDERATIONS

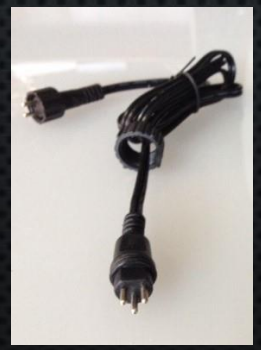
RULE #5: TRIKLITS WILL TAKE SLIGHTLY MORE POWER THAN OTHER MINLEON RGB STRINGS.

- TRIKLITS ARE MANUFACTURED WITH 22 AWG, AND WILL INCUR MORE **VOLTAGE DROP ACROSS DISTANCE** WHEN COMPARED TO MINLEON C7'S, C9'S, G40'S, PEBBLE LIGHTS, LIGHT TUBES & FLEX STRIP WHICH ARE MANUFACTURED WITH 20 AWG WIRE
- WHERE WE RECOMMEND 5 AMPS OF POWER FOR EVERY 100 LIGHTS OR 100 FEET, WHICHEVER COMES FIRST, WITH TRIKLITS THIS NUMBER IS 100 TRIKLITS OR 80 FEET, WHICHEVER COMES FIRST—KEEP THIS IN MIND THROUGHOUT THIS TUTORIAL & OTHER MINLEON TUTORIALS (SEE DIAGRAM ON SLIDE 11)
- 100 G42 TRIKLITS CAN BE POWERED EFFICIENTLY WITH 5 AMPS AT 6-INCH SPACING OR LESS, WHICH IS A MAX DISTANCE OF 50-FEET—HERE THE VOLTAGE READING AFTER BULB 100 IS 9.2 VDC
- WHEN TESTING THE POWER DRAW OF TRIKLITS, KEEP THE READING AT THE END OF THE LINE AT 8-9 VDC MINIMUM

POWER INJECTORS: THE POWER T

Minleon Power T





Use 3-pin adapter w/ 5 Amp power supply

RULE #6: Always Isolate Power in your Light Design—Never Cross Voltage

CARELESS PLACEMENT OF POWER IS THE MOST COMMON REASON FOR FAILURE IN RGB SYSTEMS. MINLEON RGB LIGHTS & CONTROLLERS CAN BE DAMAGED IF THEY RECEIVE POWER FEEDING IN BOTH FORWARD AND BACKWARD DIRECTIONS SIMULTANEOUSLY. THIS MAY NOT OCCUR IMMEDIATELY, BUT OVER TIME THIS WILL INTERFERE WITH THE DATA FLOW, COMPROMISE THE LIFE SPAN OF THE PRODUCTS & VOID THE MANUFACTURE'S WARRANTY.

- **POWER T'S (RGB+PT)** ISOLATE POWER IN ONE DIRECTION THROUGH THE FEMALE END AT THE TOP OF THE T-WAY—AND BLOCK POWER FROM TRAVELING THROUGH THE T FROM THE MALE CONNECTION
- POWER MUST ALWAYS BE INJECTED FROM THE BOTTOM OF THE POWER T, OR IT WILL BE DAMAGED &/OR MALFUNCTION, AND NOT BE WARRANTED
- POWER T'S ALSO CONDITION THE DATA SIGNAL AND SHOULD ALWAYS BE PLACED WITH 75-100 LIGHTS PRECEDING IT AND ***NEVER*** BE PLACED NEXT TO THE WEC OR MINI-CONTROLLER (SEE SLIDE 16)*
- BECAUSE OF THIS CONDITIONING ASPECT, POWER T'S ARE NOT COMPATIBLE, WITH THE LEGACY NDB CONTROL SYSTEM—SUCH USE WILL CAUSE THE LIGHTS TO MALFUNCTION AS THESE CONTROL SYSTEMS SPEAK DIFFERENT LANGUAGES
- *BUT POWER T+'S ARE COMPATIBLE WITH NDB+'S – A BIG BENEFIT IN THE RGB PLUS LINE (GEN3) – AS THE CONDITIONING FUNCTION IS NOT NECESSARY WITH RGB PLUS

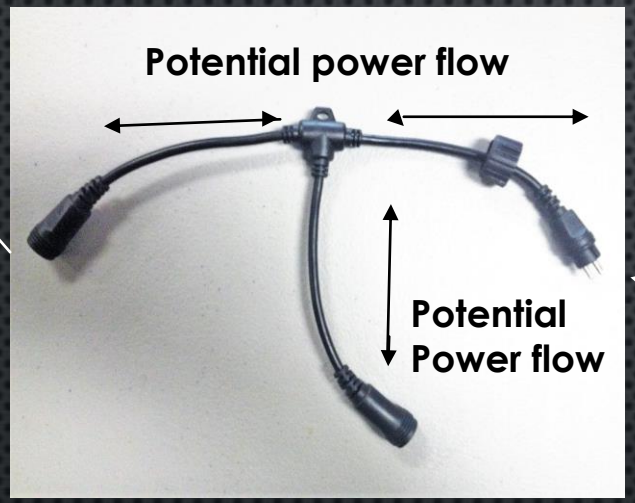
POWER & DATA MANAGEMENT
POWER INJECTORS: BASIC T'S & POWER BLOCKERS

RULE #6 (cont.): Always Isolate Power in your Light Design—Never Cross Voltage

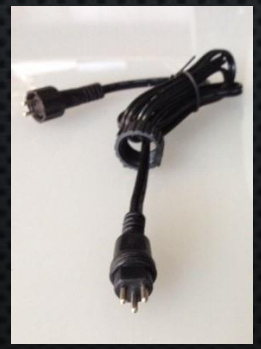
- Multiple Power Injections off a Legacy-Gen2 NDB can add inefficiencies, but is possible in certain circumstances by using a **Power Blocker (RGBPBX)** & a **Basic T (RGBTW)** ***in the Legacy RGB line or a Power T+ in the RGB Plus Line***
- Minleon's RGB Power Blocker (Legacy RGB only) stops power from flowing in either direction
- Power can be injected with a Basic T, but ***only*** when there is no threat in crossing voltage—for example, when powering a WEC at the beginning of a light run (below) or when paired with a Power Blocker (at left)*

Minleon Basic T

RGB's 101-200



5-amp input on the bottom



Use 3-pin adapter w/ 5 Amp power supply

RGB Legacy Power Blocker (a.k.a Data Only Spacer)

RGB's 1-100 out of a powered NDB output

***Pro Tip**: In lieu of the Legacy Power Blocker, cap the bottom of a Power T+ and use it to block the flow of power inline where you may not need a power injection.

RGB Lights

1A-5A power input on the bottom

POWER & DATA MANAGEMENT
DATA CONSIDERATIONS

If greater than 15 feet

then

Sender Card

4-Wire Booster cables

Receiver Card

5-amp power

Power T

RULE #7: KEEP THE SPACE BETWEEN THE CONTROLLER & FIRST LIGHT AS SHORT AS POSSIBLE FOR ALL APPLICATIONS, AS THERE IS LESS CHANCE OF DATA DISTORTION

- IF THE DISTANCE BETWEEN THE CONTROLLER AND FIRST SET OF LIGHTS IS GREATER THAN 15 FEET, OR THE DISTANCE BETWEEN ANY CONSECUTIVE LIGHTS IN YOUR LIGHT DESIGN IS GREATER THAN 15 FEET, YOU MUST CONNECT **DATA BOOSTERS (RGB+SR—SENDER/RECEIVER CARDS)***
- WITH **DATA BOOSTERS, 4-WIRE EXTENDERS & 5-AMP POWER INJECTION**, CONTROLLERS CAN BE CONNECTED UP TO 300 FEET AWAY FROM LIGHTS

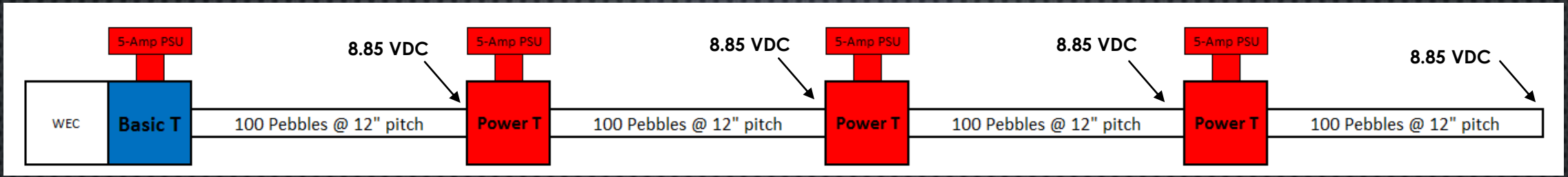
*NOTE: 15-FEET IS CONSERVATIVE. WITH HIGH CHANNEL COUNTS & DISTANCES, WE RECOMMEND 20-FOOT, 4-WIRE SPACER; WITH SHORTER BULB SPACING & SMALLER CHANNEL COUNTS, A 3-WIRE MAY SUFFICE. CUSTOM DESIGNS SHOULD ALWAYS BE TESTED FOR EFFICIENCY FIRST. THIS IS TRUE WITH LEGACY AND PLUS RGB ITEMS.

POWER & DATA MANAGEMENT

DRAFT A WIRING DIAGRAM

If you aren't available to be on-site to troubleshoot, a well-drafted, pre-installation wiring diagram can be indispensable

RULE #8: DRAFT A WIRING DIAGRAM



- FOR INSTALLATION, TROUBLESHOOTING & TRAINING PURPOSES, AN ACCURATE WIRING DIAGRAM WILL SAVE TIME, MONEY & REPUTATIONS
- CHARTING THE TYPE OF LIGHTS, BULB SPACING, THE SIZE & LOCATION OF POWER SUPPLIES & ACCESSORIES, ALONG WITH THE DISTANCES BETWEEN EACH WILL GREATLY EXPEDITE POTENTIAL SERVICE CALLS TO THE MANUFACTURER
- BE SURE TO INCLUDE ANY THIRD PARTY ARTNET CONTROLS OR NETWORKING GEAR IN THE DIAGRAM—THOUGH MINLEON CANNOT GUARANTEE SUPPORT FOR THIRD PARTY COMPONENTS & INTEGRATION
- RECORDING VOLTAGE READINGS AT THE END OF EACH LINE, OR RGB RUN, BEST HELPS LONG-TERM, PERMANENT INSTALLATIONS

NOTE: MINLEON USA WILL HELP WITH YOUR WIRING DIAGRAM IN THE DESIGN PHASE, IF YOU AS A LICENSED DISTRIBUTOR OR INSTALLER TAKE THE FIRST SHOT AT A PROPER LAYOUT.

POWER & DATA MANAGEMENT
TESTING ON THE GROUND

It's better to be on the ground wishing you were in the air…

…Than in the air wishing you were on the ground.

Service calls can be costly & risky. Don't be this guy. Follow these simple recommendations.

Rule #8: Test all Custom Designs on the Ground *Before* Installation

- The most efficient designs use the fewest accessories—and the fewest connections
- Accessories serve an important purpose in an RGB design, but when over-used or over-relied upon they may distort the Data Signal
- Run power supplies at 90% capacity (with at least 10% headroom) to prevent overheating & ensure longevity
- Be aware of the climate & weather conditions both in the design phase & during installation
- Avoid pushing RGB Controller Light Counts to the max when possible—especially when using bulb spacings over 6-inches—as controllers work more efficiently*

*For example, instead of pushing the NEC to its 8000 RGB limit for individual bulb control, a design using two NEC's in Master-Slave configuration—each set to 4000 RGB's—will run much more efficiently, esp. when using the .WAV player & synching to music.

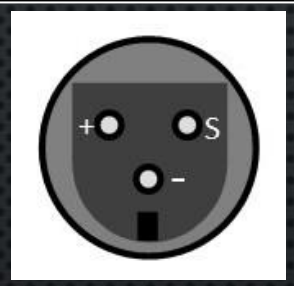
POWER & DATA MANAGEMENT

MEASURING VOLTAGE

When testing voltage with a Volt Meter, look for the Positive (+), Negative (-) and Data Signal (S) stamps on the connectors. These are visible on all light strings & accessories.

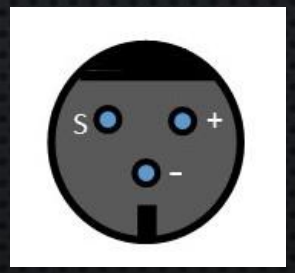
In the RGB Plus Line **PIN 1 IS + VCC, PIN 2 IS – GND, PIN 3 IS SIGNAL**

Legacy male connector



Plus Line female connector

Legacy female connectors



RULE #9: USE A VOLT METER TO MEASURE THE POWER DRAW AT THE END OF EACH RUN

- MOST MINLEON RGB'S RUN ON 12 VDC POWER
- TO RUN EFFICIENTLY, THE REMAINING VOLTAGE AT THE END OF A TRIKLIT RUN SHOULD BE 9 VDC WHEN SET TO PURE/COOL WHITE & 100% INTENSITY
- THE REMAINING VOLTAGE AT THE END OF RGB PEBBLES, LIGHT TUBES, C7'S AND THE LIKE, SHOULD BE 8 VDC FOR MAXIMUM EFFICIENCY WHEN SET TO PURE/COOL WHITE & 100% INTENSITY
- KEEP IN MIND THAT A SIMPLE 10-FOOT SPACER CABLE AT THE BEGINNING OF YOUR LIGHT RUN COULD REDUCE THE VOLTAGE AT THE END OF THE RUN BY 0.50 VOLTS
- LOG THE VOLTAGE AT KEY POINTS IN YOUR DESIGN IN YOUR WIRING DIAGRAM—THIS WILL HELP IN TROUBLESHOOTING, ESP. IF YOU ARE OFF-SITE & OUT-OF-TOWN

POWERING DOWN THE SYSTEM

RULE #10: RE-CYCLE THE POWER TO NDB'S & WEC'S ON A DAILY BASIS

MINLEON RGB SYSTEMS WORK LIKE MOST OTHER TECHNOLOGY & COMPUTER SYSTEMS—THEY LIKE TO BE POWERED DOWN ON OCCASION. IF YOU EXPERIENCE FREQUENT DATA LOCKUPS, PREVENT THEM BY POWERING DOWN THE NDB & WEC PERIODICALLY WHILE INSTALLED. IF DATA LOCK-UPS HAPPEN WHEN THE LIGHTS ARE POWERED, RE-BOOT THE SYSTEM.

When using third-party timers, be sure to check the timer's max power load.

- Hook up third party timers for each NDB and WEC*
- **Delay power to the controller (Legacy Gen2 RGB)**: Have the power turn ON down a line of RGB's (whether a 5-amp power injection, or additional NDB's) ***before*** the controller is powered—
- If the controller turns ON before power injections or NDB's, those lights will fail to initialize & a power re-cycle is in order** (This is only true for 2014-17 Legacy RGB, not the 2017-18 Plus Line.)
- Be sure the third party timer can handle the amperage of the lights you are connecting by reading the specs on the third party device—many third party timers cannot handle the power load on an entire surge protector

*If the RGB's are turned off in the WEC's interface, the WEC will still send out a wireless signal. The power should be cut off periodically for efficiency.
**The WEC and Mini-Controller systems have a 4-second power up delay option. Refer to those User Guides for details

POWER & DATA MANAGEMENT
LAYOUT OPTIONS

1.5 Amp

Mini-Controller or WEC w/ Basic T

40 RGB Lights ≤ 12" pitch or 40 TrikLits ≤ 6" pitch max

5 Amp

Mini-Controller or WEC w/ Basic T

100 RGB Lights ≤ 12" or 100-feet max, whichever comes first…or 100 TrikLits ≤ 6" pitch or 80-feet max

1. Basic Linear

- A single string connected to the controller with lights supplied by a 1.5 amp power supply. (top graphic)

Maximum of 40 lights/40 feet, or 40 TrikLits/30 feet whichever comes first.

- *100-light RGB Strings connected & powered with a 5 Amp supply (bottom graphic)*

Maximum of 100 lights/100-feet, or 100 TrikLits/80-feet whichever comes first.

***Note**: Generally speaking, adding a 5-foot lead spacer will subtract 0.2 VDC by the end of the line & a 10-foot lead, 0.4 VDC due to voltage drop across distance.*

LAYOUT OPTIONS

2. Power Injectors in the Basic Linear Run

- A 5-Amp Power Supply (**RGB+5A**) is sufficient for 100 C7's, C9's, G40's, Pebbles, Flex Strip (count the chips, not LED's) or 80 TrikLits at 12" spacing or less
- Pixel & bulb spacings over 12" are custom designs & may power less lights—Test Data & Power in advance
- 100 TrikLits can be powered with a pitch ≤ 6", or at 12" spacing with an advanced Center-Out design (see next slide)
- Additional power supplies with Power-T's (**RGB+PT**) can be connected to make a longer string *(shown below)*

Mini-Controller or WEC w/ Basic T

5 Amp Power

5 Amp Power Injection

100 lights or 80 TrikLits @ 12" spacing or less

Power T

100 more lights or 80 more TrikLits @ 12" spacing or less

INTERMEDIATE LAYOUT OPTIONS

3. CENTER-OUT, LINEAR RUN

FOR A DIFFERENT LOOK, THE CONTROLLER CAN BE PLACED IN THE CENTER OF A LIGHT DESIGN WITH A BASIC T-WAY. IN THIS SCENARIO, THE DATA IS SPLIT SO THE EFFECTS WILL RUN IN PARALLEL IN BOTH DIRECTIONS. WITH CENTER-OUT LAYOUTS WE MUST TAKE EXTRA CARE NOT TO OVER-DRAW THE POWER SUPPLY. REMEMBER 0.035 AMPS PER RGB.

Pro Tips:

- Since the data is split, set the controller's light count to half the number of lights—in this example the light count would be 50
- End-of-line volt readings will not account for division of power in Center-Out designs—so take extra care to run PSU's at 90% draw

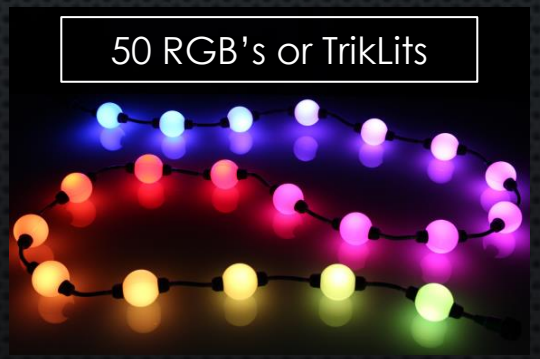
Mini-Controller or WEC w/ Basic T

5 Amp Power

Basic T-Way

50 RGB's or TrikLits

50 RGB's or TrikLits

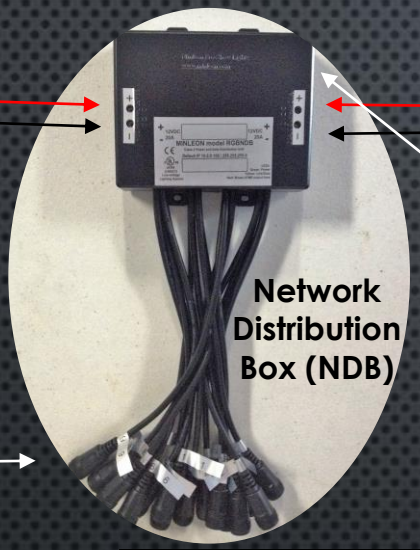


Remember, a 10-foot lead spacer will use about 0.5 VDC (when measured at the end of the string) and will reduce the amount of RGB's we can run efficiently.

POWER & DATA MANAGEMENT

INTERMEDIATE LAYOUT OPTION

40Amp max power—hardwired to both sides of NDB



Ethernet input for ArtNet or Minleon NEC

Output 1

Linked Smart T's

4. The NDB & Smart T's

The Network Distribution Box (NDB) manages both Power & Data, with an RJ45 Ethernet jack & 16 light connection ports. Linking 3-4 Smart T's per NDB Output is the basis for **Individually Controlled, RGB Grid, Chandelier, Light-Line Tree & Mega-Tree Designs.**

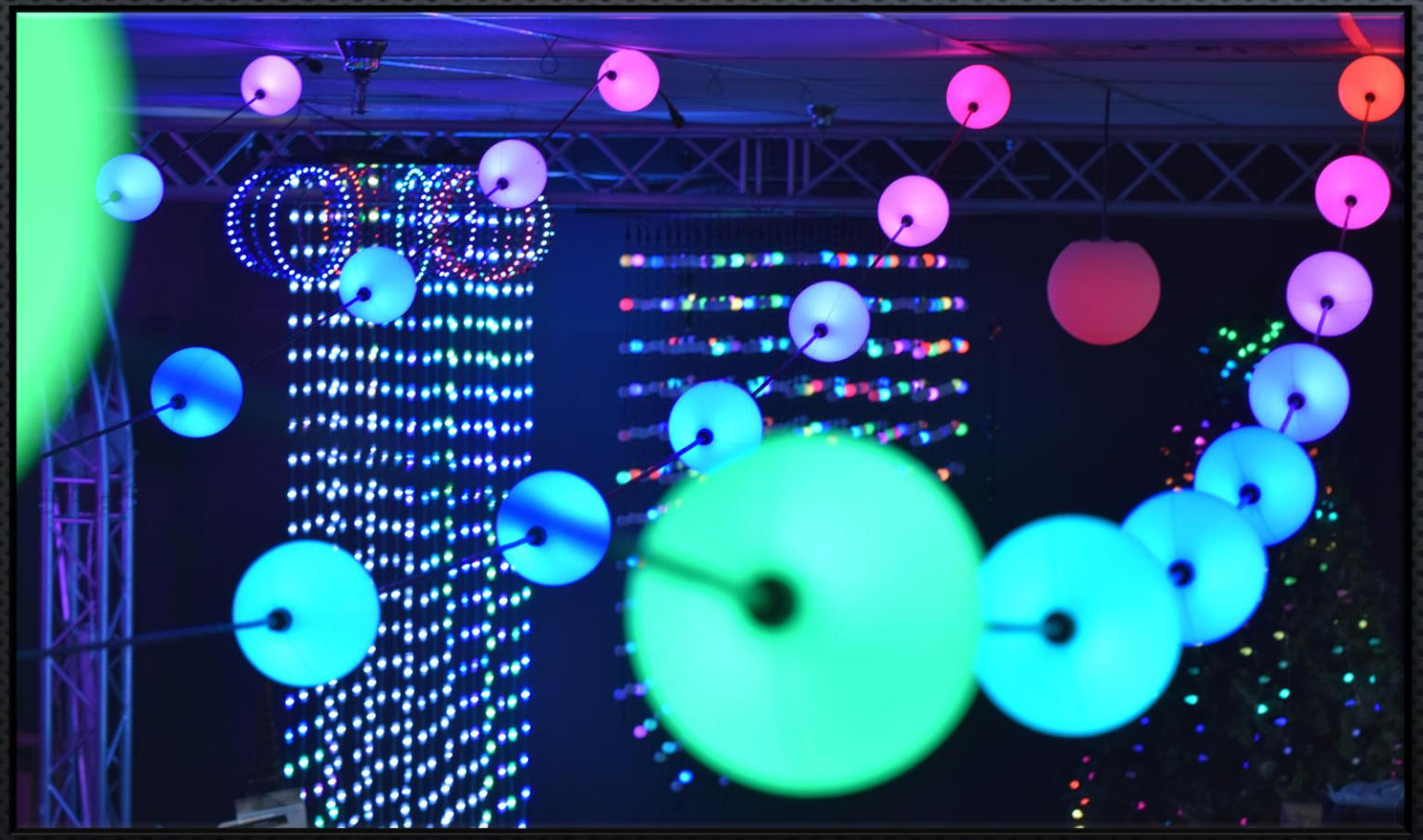
- NDB outputs do not run in parallel & are controlled individually
- To save time & wiring, Smart T's can be linked to control multiple strings individually from the same output, so long as we keep in mind the 100-light/100-foot rule (Slide 6)

General Guidelines:

- Think of each NDB output as the start of a 5-Amp Power Injection within a Linear Light Design (see Slide 15)
- We recommend to Limit the distance from the NDB Output to the final light to 100-feet
- We recommend to Limit 1000 RGB's per NDB when using a 37.5 Amp power supply & bulbs at 12-inch spacing (pitch), for maximum efficiency & longevity
- Never use a Smart T to inject power
- We recommend Powering NDB's with the *Meanwell 12VDC HRP Series*
- Refer to the ***NDB+ User Guide*** video for more information

Power & Data Management

QUESTIONS & RESOURCES



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