

SITE INSPECTION  
AND EVALUATION  
FOR INDOOR INSTALLATION  
OF  
NEW UNIVISION  
UPLINK SYSTEMS  
DORAL, FLORIDA  
JANUARY, 2017

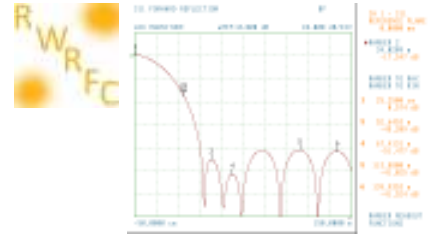


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November 23, 2016

Gentlemen,

I have been asked to return to the Univision campus in Doral, Florida to continue to evaluate options for the installation of the new uplink systems proposed for this facility. This evaluation is geared toward understanding the factors related to the historic, high degree of up-time that this indoor installation has enjoyed despite the newly discovered installation deficiencies that the current installation has that seem to fly in the face of good Engineering practices.

The current indoor installation utilizes solid state amplifiers that are connected to the three uplink dishes with differing kinds of Heliax and Elliptical cables. Accessory control wiring, power and other connective items also run in and out of the building.

We have discovered that though most of the power to the dishes is shut off outside, new power systems have been run that are hot and tied to the HPA/SSA power distribution panels, and are also not surge suppressed. Only dish 8 has any grounded R.F. cables. All of the other related accessory cables are run and connected to racked controllers but are also not grounded or surge suppressed in any way.

After discussing the new proposed installation with the Univision staff, new R.F. configurations have been discussed and a better picture of what is possible from a new installation point of view is now in place. We get to start mostly over again.

In keeping continuity with the previous investigation in to mounting this proposed equipment outdoors, the same considerations will apply to this indoor study (if or where applicable).

Grounding Considerations  
Power Feeder Considerations  
Surge Arrestor Discussions  
R.F. Considerations  
Dehydrator Notes  
Air Conditioning  
Lightning Dissipation Arrays and Components

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As this is a new consideration of cable paths and installation, some of the concerns and constraints of the previous report will not apply.

The existing room and installation conform to the old building model of a mat or homogeneous distributed ground with all points attached to the under floor bus bar design. Rack grounds, and all power and other considerations are bonded together in a well planned but helter skelter implemented (or now degraded) fashion mostly due to the age of the plant and the numerous layers of change that have been applied. Needless to reiterate, this system has been successful.

The goal of this new design consideration is to protect both the assets of the room and the building behind it. This can be achieved in a layered approach that is designed to be installed as a complete unit with tiers of defense. There are no suggestions in this proposal that should be considered as "optional", only layered and tiered. This suggested implementation will be a compartmentalized approach. The new HPA/SSA room will stand alone in its rebuilt space and configuration. Any changes to the remaining half of the room for compression equipment or other racked support equipment will be fiber fed and electrically isolated from this new space and the other building spaces. This compartmentalized approach will create a successfully isolated electrical environment that can be surge suppressed and isolated from problems that may plague another area within the plant. Though commonly fed from the twin redundant UPS systems, Each of these areas is stand alone through K rated isolation transformers and in-line series surge suppression (TVSS)

Assumptions are going to be made such that the room will be essentially empty and only consist of a space and a raised floor.

If you have any questions about this work, please feel free to call my office at any time.

Thank you,

Gary A. Minker

## GROUNDING CONSIDERATIONS:

In this iteration a number of suggestions from the outdoor installation will still apply:

ALL ELECTRICAL CLAMPED CONNECTIONS, REPLACE WITH CADWELD OR GREASE FILLED, 2 HOLE / 3 BAND CRIMPS

ALL GROUND CONDUCTOR MECHANICAL CONNECTIONS ARE TO BE APPROPRIATELY CRIMPED OR STAINLESS, BRONZE/PHOSPHOR CLAMP SYSTEMS AND THEN THOROUGHLY COLD GALVANIZE SPRAYED

ALL ABANDONED FACILITIES ARE TO BE REMOVED

ALL ABANDONED CONDUIT TO BUILDING GET DRIED OUT AND PLUMBERS PLUGGED

ALL DISHES GET STATIC HINGE DRAINS WITH WELDED TABS

ALL DISHES GET 5 NEW AIR TERMINALS ON UPPER DISH RIM RADIUS

ALL DISHES GET 1 NEW AIR TERMINAL ON THE PRIME FEED APEX

ALL DISHES GET NEW AIR TERMINAL DRAIN LINE TAILS

ALL DISHES GET HARGER STYLE GROUND BARS AS COLLECTORS ON INSULATOR CHERRIES

GROUNDING CONDUCTORS CAN NOT RUN IN CONDUIT WITH ANY OTHER CABLES OR CONDUCTORS

GROUNDING CONDUCTORS MUST FOLLOW BEND AND DIRECTIONALITY OF SWEEP FOR BEST CURRENT FLOW WHERE POSSIBLE

CORE EXISTING SLABS FOR NEW GROUND RODS, 4" DIAMETER

CLAMP GROUNDING CONDUCTORS TO SLAB WITH 2 HOLE 1/2" GALVANIZED CONDUIT CLIP AND TAPCON REMOVABLE FASTENERS

ALL EXPOSED CADWELDED GROUND ROD CONNECTIONS TO REMAIN ABOVE SLABS FOR TESTING AND INSPECTION

ALL CADWELDED JOINTS THAT ARE ABOVE THE SLAB TO BE A MINIMUM OF 5 INCHES CLEARANCE ABOVE SLAB GRADE TOP SURFACES TO ALLOW FOR INSERTION OF TEST CLAMP DEVICES

ALL CRIMPED AND BOLTED CONNECTIONS TO USE EITHER STAINLESS OR GALVANIZED HARDWARE OF A MINIMUM 3/8" DIAMETER WITH BOLT, LOCK WASHER AND NUT WITH FLAT WASHERS WHERE NEEDED

ALL OUTDOOR BOLTED CONNECTIONS ARE TO BE SATURATED WITH COLD GALVANIZING SPRAY. NO SPRAY GALVANIZING IS TO BE USED INDOORS

INSTALL CHOKE PIPES ON WAVEGUIDE, HANG WITH BRONZE/STAINLESS CLAMPS FROM BEAMS

ABB MODEL 3904BU\* CLAMPS, SEE ASSEMBLY DRAWING. CHOKE PIPE SLEEVES ARE TO BE 3 ID INCH GALVANIZED CONDUIT WITH PVC SLEEVER. THE PVC SLEEVE IS TO BE TABLE SAW SLIT TO COMPRESS IN TO THE GALVANIZED CONDUIT AND EXTEND A MINIMUM OF 2 INCHES FROM BOTH ENDS. USE WORM CLAMPS TO COMPRESS PVC TUBE. ALL CUT EDGES ARE TO BE COLD GALVANIZE TREATED. WHERE POSSIBLE, DO NOT SPLIT THE CHOKE TUBES AND INSTALL IN TACT

HANG CHOKE PIPES WITH 2 ABB MODEL 3904BU\* CLAMPS ATTACHED TO THE STEEL SLEEVE, SPACE CHOKE PIPES A MINIMUM OF 12 INCHES OF GAP EDGE TO EDGE

ALL MAJOR BEAM AND DISH GROUNDING WIRE TO BE NUMBER 4/0 THHN, BLACK INSULATED. ELECTRONICS MAY USE NUMBER #4 OR NUMBER #2 GAUGE WITH APPROPRIATE HARDWARE

ALL GROUND RODS THAT ARE LONGER THAN 1 SECTION ARE TO BE COUPLER SCREWED TOGETHER AND THEN TORCH BRAZED TOGETHER PRIOR TO DRIVING TO THE INDICATED DEPTH

Soil conductivity in the Doral Florida area is traditionally quite good. Ohmic values for driven rods is often under 100 Ohms for one 10 foot rod. While this value can change quickly from one location to another, it is safe to say that values of a driven rod array, on a per drive basis can hover around 5 Ohms per rod.

Ground rods for this system are to be driven to a depth of fifty (50) feet where possible. Due to the varying geology, any particular rod that is stopped by rock or other issues can be left at that depth but any variance in depth must be noted for the as built and final clamp testing. All rods are to be copper clad and a minimum of 5/8" in diameter with threaded ends. These rod ends are thread coupled together with appropriate bronze or brass joiners and these wrench tightened joints are then torch brazed with proper filler material. Each joint is then driven to depth and another rod and joiner are applied until the drive tip depth of 50 feet is achieved. The rods come in ten (10) foot lengths. All connections to the driven ground rods are to be either CadWeld mold melted with an "H" type or "T" type mold. All grounding conductors are to be insulated THHN copper strand wire. Black insulation is allowed. In the case of buried ground rings, the wires are to be encased inside of 1-1/2" or 2" PVC piping and the driven rods available for inspection by water valve grade boxes. Rods not driven to depth are to be annotated on a rod drive Excel sheet that catalogs all driven rods.

A new rod that fails to proceed at least 1 inch in 1 minute will be considered fully driven and shall be annotated on the ground rod Excel sheet as a failed rod. Rods driven less than 20 feet shall have a companion rod driven within the same box or proximity.

In open grass, gravel or dirt locations, water valve/meter inspection boxes are to be installed to facilitate installation of the driven ground rods and for ease of future inspection. These valve boxes are to be side drilled for the appropriate diameter hole for a PVC male adaptor and lock nut to allow wiring ease within the box. PVC sweep 45 degree or 90 degree bends will be used where needed. The 90 and 45 degree turns can be performed by drilling the inspection box. All wire shall be in conduit with no sharp bends.

All PVC pipe joints are to be glued. It is recommended that the conduit enter the boxes about 10 inches below the top surface of the box. The top surface of the box is to be flush with the surrounding dirt level. ( not the grass )

The bottoms of the boxes do not need to be sealed or closed. Rods are to be driven centrally to the opening to allow access for the CadWeld molds and testing clamp on apparatus. Care should be taken to not dig or drive rods through existing underground systems or services.

This new bond halo (curtain array) for the Elliptical and Heliac system where the Coax and Cables enter the room South side wall is to be built and installed in the same manner as all dish grounds utilizing meter boxes as installation and inspection points. This curtain is to consist of 5 driven, screwed and brazed ground rods that are "T" taps exothermically welded to the rods. "T" taps are to be used on the end rods also. Any rod not driven to a full 50 feet is to be annotated on a spread sheet as to the actual driven length. This is a stand alone curtain array. It is NOT to be interconnected to any other ground system or source. It is to be driven approximately 24 inches ( if possible ) outside of the wall of the target room and parallel to the wall with the installation and inspection boxes buried along the long axis of the curtain array run. All connection are to be exothermic with exceptions for the Harger bar connections.

The Harger bar connections are to have stainless steel hardware that is no less than 3/8" class with hex bolts, flats, locks and nuts. The Harger bars are to be mounted inside, on to the outside wall just under the floor level and isolated with the conventional "cherry" insulators.

New grounding connections made to the body plates or beams of the uplinks is to be done by CadWeld plate type molds. All grounds on the apparatus should be developed toward a common rod box. This will avoid circulating currents and tie all of the Harger bar accumulator grounding tails to a common point. All ground conductors are to be run in 3/4" PVC with sweeps and couplings and attached to the slab with 2 hole clips and Tapcon fasteners. All fasteners are to be painted with cold galvanizing spray. Grounds are not to be daisy chained or run to multiple ground points.

With this new installation consideration, Line Sweeping is recommended for the existing runs of Elliptical and Heliac products to ascertain if they are to be re-used, repaired or replaced. Line sweeping should consist of a full characterization of each line independently with an open/short (as applicable) and a load in both Time (frequency) Domain and Return Loss. Each line should receive 6 traces of recorded data in all in order to form a correct opinion as to the health of each run.

The above grounding recommendations still apply from the outdoor installation and must be augmented by the considerations continued below.

THE EXISTING GROUNDING BUS BAR THAT IS UNDER THE FLOOR IS TO BE ISOLATED FROM THE SURROUNDING BUILDING

BOND TAILS MADE OF 4/0 THHN STRANDED WIRE ARE TO BE PROPERLY BOLTED TO EACH RACK WITHIN THIS SPACE AND RUN DIRECTLY TO THE UNDER FLOOR ROOM BONDING BUS BAR IN AS SHORT AND STRAIGHT A RUN AS PERMISSIBLE

THE UNDER FLOOR BONDING BAR IS TO BE ISOLATED FROM THE REMAINDER OF THE BUILDING GROUND TIE

THE RAISED COMPUTER FLOOR IS TO BE ISOLATED FROM THE REST OF THE BUILDING GROUNDING SYSTEM AS IS PRACTICAL

ALL UNUSED CONDUIT AND WIRING IS TO BE REMOVED FROM UNDER THE FLOOR

THE ROOM FARADAY COPPER SCREEN IS TO REMAIN IN TACT AND UN-MOLESTED. IT MAY REMAIN CONNECTED TO THE BUILDING BONDING SYSTEM

GROUND EACH ELLIPTICAL OR HELIAX WITH DUAL GROUND TAILS THAT ARE APPLIED AS DIRECTED BY THE MANUFACTURER AND ON OPPOSING SIDES OF THE TARGET CABLE. EACH TAIL IS TO FASTEN WITH A 2 HOLE, 3 BAND CRIMP TO A HARGER TYPE BAR THAT IS INCORPORATED IN TO A DEDICATED CURTAIN ARRAY POSITIONED OUTSIDE THE ADJACENT WALL OF THE TARGET ROOM. DRAWINGS ARE SUPPLIED BELOW. THE HARGER BARS ARE CONNECTED TO THE NEW CURTAIN GROUND VIA TWIN RUNS OF 4/0 THHN STRANDED WIRE OUTSIDE TO THE CURTAIN AND ARE EXOTHERMICALLY BONDED WITH A "H" TYPE TAP.

ALL BONDS, BARS, AND ROOM GROUNDS RETURN TO THE GROUNDED SERVICE POINT FEEDS WITHIN THE SPACE. THIS IS TO BE A STAR TYPE COLLECTOR

GROUND ORIGINATES WITH THE ISOLATION TRANSFORMER ALONG WITH A NEW AND ORIGINAL NEUTRAL FOR THE SERVICE FEEDER PANELS.

#### **POWER FEEDER CONSIDERATIONS:**

K RATED ISOLATION TRANSFORMERS SHALL BE CONSIDERED WITH A MINIMUM K-13 DESIGNATION

PARALLEL AND SERIES SURGE ARRESTING SHALL BE CONSIDERED

<http://www.emerson.com/resource/blob/163692/601b2614ecf3d2d2905efd7b29ebb14f/shdbro-indpwrsolution-data.pdf>

## ISOLATION TRANSFORMERS LINK SELECTED FOR HARMONIC DUTY AND FUSE CIRCUIT SIZE

[http://www.schneider-electric.us/en/product-range/60303-low-voltage-drive-isolation-transformers?N=4211628487+432570243&Nr=AND%28P\\_visibility%3A1%2COR%28product.catalogId%3Acatalog10005%29%2Cproduct.siteId%3A100003%29&filter=business-7-Solar+and+Energy+Storage&parent-category-id=53700&parent-subcategory-id=53720#tabs](http://www.schneider-electric.us/en/product-range/60303-low-voltage-drive-isolation-transformers?N=4211628487+432570243&Nr=AND%28P_visibility%3A1%2COR%28product.catalogId%3Acatalog10005%29%2Cproduct.siteId%3A100003%29&filter=business-7-Solar+and+Energy+Storage&parent-category-id=53700&parent-subcategory-id=53720#tabs)

NO SPLICING OF FEEDER WIRING IS TO BE PERFORMED. ALL RUNS ARE TO BE CONTINUOUS WITH NO WIRE NUTS, SPLICES, OR CRIMPS.

Installation of the new connective power delivery ground run between the Uplinks and the building rely on strategic low resistance / high inductance paths to operate correctly. For the power feeders, these ground paths show a coil of wire to be inserted where possible due to the pre-existing conditions. Any surge induced in to the buried ground, or the installation outside will be shunted to earth and not allowed to enter the building. Surges caught by the arrestors on the outside portion of the reactive coil installation will be shunted to earth by the embedded grounding system.

Surges caught by the building side surge devices will be shunted to earth by the ground bus bar system within the building distribution system. This directional sourcing of a surge is part of the isolation of the surge. A surge from outside will have tremendous difficulty traversing in to the building where any remnant of the surge will be snubbed by the building side system. A surge originating from the outside equipment from either EMP or direct strike will be shunted by the outside system. This logic applies to electrical power paths, control cables and R.F. cables.

The ground wire connecting the service ends conforms to the NEC code required size and be installed in a specific manner. The wire is to be coiled in to an 8 inch circle consisting of 8 turns of wire that is tightly and concentrically held in place with heavy Black Nylon Tie Wraps spaced every 2 inches around the circumference of the circle. This ground choke is to be placed in a pull box of sufficient size so as to accommodate all of the service conductors. The choke coil is to be fastened with 2 hole plastic PVC conduit clips to the rear of the pull box with stainless fasteners.

An indication of direct strike will be the distortion of the coil, or destruction of the coil and Tie Wraps. To hold the choke coil, install four, 1/4-20 bolts inward from the rear of the box and secure with hex nuts. Use the remaining protruding bolt studs and additional hex nuts to secure the choke coil with rubber covered "P" type stainless steel straps.

Power for this HPA/SSA space comes from the parallel redundant UPS systems. These split systems will essentially feed one half of the room electronics and the other UPS system will feed the remaining half. These power feeds come in to the room from other locations within the main building and should terminate in new mains disconnect safety switches that are fused for the new panels that also contain embedded main disconnect circuit breakers. These panels are to be sized for growth of systems and should be rated for 200% of the original design anticipated load factor. This will allow for a growth of an additional 30 percent in accord with the National Electrical Code load factor of 80 percent.



The new space will serve loads that are both 120VAC and 208VAC single phase, though 3 phase loads are possible. These loads are to be balanced in the load calculation sheet. The inbound service from other locations in the building will enter the safety switch.

This switch will feed a K-13 rated isolation transformer that is set up to emulate a delta to WYE 208 / 208 conversion so that an original neutral can be derived for the room loads. If it is available, the isolation transformers should be fed with 480 DELTA. Leaving the isolation transformer, the power will feed an Islatrol surge suppression device which will then feed the new main circuit breaker panel. All electrical grounding is to be connected backward to the serving panels. This cascade of protective devices will keep surge problems out of the isolation transformer and the building. All circuit breakers that feed power outside to the dish farm in any way are to also have Islatrol TVSS surge systems installed on these feeders. These are the first line of defense for the inbound wiring to protect from EMP. Grounds will originate from the isolation transformer.

## **SURGE ARRESTOR DISCUSSIONS:**

Emerson is currently revising the Islatrol series of surge arrestor TVSS systems. This link is the temporary access to the new product line. The new list of actual devices should be available shortly. This series is based on series inserted surge arresting systems as opposed to just tapping a parallel system on to a circuit and hoping for the best. Emerson will need to be contacted to ascertain the delivery and availability of the new product line that replaces Islatrol.

Series surge Systems TVSS

<http://www.emerson.com/resource/blob/163692/601b2614ecf3d2d2905efd7b29ebb14f/shdbro-indpwrsolution-data.pdf>

Parallel surge systems TVSS

[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwujm6i50tHRAhXC7iYKHU8BCk8QFgguMAA&url=http%3A%2F%2Fwww.eaton.com%2Fecm%2Fidcplg%3FIdcService%3DGET\\_FILE%26allowInterrupt%3D1%26RevisionSelectionMethod%3DLatestReleased%26Rendition%3DPrimary%26%26DocName%3DPS01006050E&usq=AfQjCNFX93omtZSrHkbPty\\_6OOWG6IyFzA&sig2=sLkIBhcuG9-mLANjLjJBaQ](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwujm6i50tHRAhXC7iYKHU8BCk8QFgguMAA&url=http%3A%2F%2Fwww.eaton.com%2Fecm%2Fidcplg%3FIdcService%3DGET_FILE%26allowInterrupt%3D1%26RevisionSelectionMethod%3DLatestReleased%26Rendition%3DPrimary%26%26DocName%3DPS01006050E&usq=AfQjCNFX93omtZSrHkbPty_6OOWG6IyFzA&sig2=sLkIBhcuG9-mLANjLjJBaQ)

With new installations where series inserted TVSS is possible and practical, this method of surge suppression is recommended. Where systems are in place and re-wiring is not an option, parallel TVSS systems are the next line of reasonable defense. Emerson vends both of these lines of equipment.

## **R.F. CONSIDERATIONS:**

Before plans can be made to keep or replace the transmission lines, a full characterization of all R.F. lines will need to be performed with a Vector Network Analyzer or equivalent. If these systems are to be replaced, the criteria from the outdoor installation will need to be followed. If the systems are to be kept, implementation of the surge choke tubes and enhanced grounding will need to be implemented. In either case, full Line Sweeping will need to be performed with contingent plans in place for either decision. EW-63, and connectors along with hanger systems and ground kits are usually available on short notice from several sources.

If Andrew (now Commscope) is not able to cooperate, I recommend that Eupen be contacted in Sarasota, Florida. This new manufacturer location is a stocking distributor for the entire Eupen line of products. I have swept over 100,000 feet of Eupen line, including the Elliptical products and had found them to be very high quality.

Keeping the set up "as is" in the vein of running the Elliptical products in to the building through the existing steel sweeps is a good idea. These elliptical lines intercept the waveguide switching networks through short twist flex line sections. These flexible line sections assist with surge arresting. The construction of these twist flex sections exhibits a very low inductive path at the design frequencies but with lightning, the sections impose a reasonably high inductive reactance. This sudden change in reactance will usually blow out a twist flex section which will save the downstream apparatus. I recommend that the switching networks remain in place. These highly reactive metallic constructions along with the potential of keeping the rigid feeder system in place serves to assist with grounding of the apparatus and inserts high elements of inductive reactance in to the circuits which enhance the new ground systems ability to operate as designed and shunt the surge energy to earth.

LINE SWEEPING IS RECOMMENDED FOR BASE LINE REFERENCES ON ALL R.F. LINES BOTH TRANSMIT AND RECEIVE

RE-DESIGN TWIST FLEX FEEDERS ON THE DISHES TO MINIMIZE LENGTH, TWIST, AND DAMAGE

RE-CONFIGURE RECEIVE LINES FOR PROPER CONNECTORS AND ADAPTORLESS JUMPERS

DESIGN GROUND KIT SELECTION, PATHS AND ATTACHMENTS FOR ALL R.F. LINES AND LOCATIONS

ALL R.F. LINES ARE TO BE SELECTED FOR MINIMAL INSERTION LOSS, PROPER CONNECTOR MATING WITHOUT GENDER OR TYPE ADAPTATIONS

ALL R.F. CONDUCTOR JOINTS ARE TO BE EITHER GASKETED OR SEALED TO CURRENT CONVENTIONS

ALL R.F. CONDUCTORS AND ASSOCIATED CABLING IS TO BE MOUNTED AND SUPPORTED BY APPROPRIATE COMMERCIAL HANGER CLIPS OR CLAMPS

TIE WRAPS ARE NOT TO BE USED ON ANY R.F. OR CONTROL CONDUCTORS AS A METHOD OF ATTACHMENT

DESIGN R.F. LINES HANGER SYSTEMS WITH CORRECT HANGER GRIP TYPES, THIS INCLUDES CONTROLLER CABLES

INSTALLATION OF ALL CABLES MUST CONFORM TO A MINIMUM RADIUS FOR BENDS OF EACH TYPE OF CONDUCTOR

ALL EXPOSED SCREW TYPE JOINTS ON R.F. CABLES ARE TO BE TAPED AND THEN GLUE SHRUNK. SKOTCHKOTE IS NOT TO BE USED

A HOT AIR GUN IS TO BE USED FOR SHRINK OPERATIONS. A TORCH IS NOT PERMITTED

BRASS EMBOSSED TAGS AND WIRE TIES ARE TO BE USED TO IDENTIFY ALL CABLES

ALL R.F. CONNECTORS AND FLANGES ARE TO BE PROPERLY TORQUED

The Elliptical Waveguide and associated Coaxial connections will be installed in a similar manner as the ground connection of the electrical service. Advantages will be taken to minimize the Ohmic and length of the resistive path to earth of the ground connections while maximizing the Inductive Reactance of the various Coax runs. Because the run lengths of the various Coax are so short relative to the co-located electronic packages, every trick will need to be used to assist with surge channeling on the outer conductors by increasing the reactance of the grounded outer conductors. A drawing of a design called Surge Sleeve (one of my designs) will be used in multiple locations on each of the Coaxial and Waveguide runs.

One Waveguide and two Coax can be run inside of one surge sleeve. The sleeves are about two feet long and are attached to the support frame of the dish with special rust resistant clamps from ABB, Blackburn, or Burndy.

Ground kits are installed at the last available point of a cable and are attached to an isolated Harger type bus bar. Two ground kits should be installed on the Elliptical lines. They should be located nearest to the upper and lower ends of the actual Elliptical runs just prior to the installation of the twist flex pieces that traverse to the dish feed horns and the amplifier racking. These isolated bus bars are run in a dedicated and insulated path inside of PVC to the earthing connection that is closest and most appropriate. An additional ground kit is installed on the various Coax near the destination of each run.

This ground kit also feeds to an isolated Harger type grounding bar that feeds through an insulated PVC run to the closest available earthing location. The runs of cables are to have multiple inserted bends and are to be firmly held and affixed in place with the specified clamping mechanisms approved for each type of cable.

While in this new design resistance is always kept to a low Ohmic value, Reactance is often played as high or low values to steer and manager strike energy. Interstitial insertion of grounding kits on Helix is NOT recommended. Grounds are to only be attached at the ends of the line runs.

## DEHYDRATOR NOTES:

The current thinking is to keep the existing dehydrator systems in place. Though Nitrogen helps to preserve the cables and other related apparatus due to the lack of oxygen that limits tarnish and corrosion, these separated systems can allow for back up of the pressurization systems in the event that one of the dehydrators fails. I recommend that a tie vale be inserted in to the manifold systems so that in the event of a failure of a dehydrator, air may be drawn from an adjacent unit. I also recommend that the floater tube visual flow systems be installed. In the event of a leaker, the corresponding flow tube will show an indication of gas usage and a leak can be addressed long before damage can be done to a dehydrator due to excess run time.



[http://www.commscope.com/catalog/wireless/product\\_details.aspx?id=6329](http://www.commscope.com/catalog/wireless/product_details.aspx?id=6329)

I also recommend that low pressure alarm switches be installed in the various manifolds so that in the event of a failure or dramatic leak, a technician can be notified immediately to remedy the situation. All air dielectric lines are to be pressurized to 3psi due to the sensitive nature of the pressure windows.

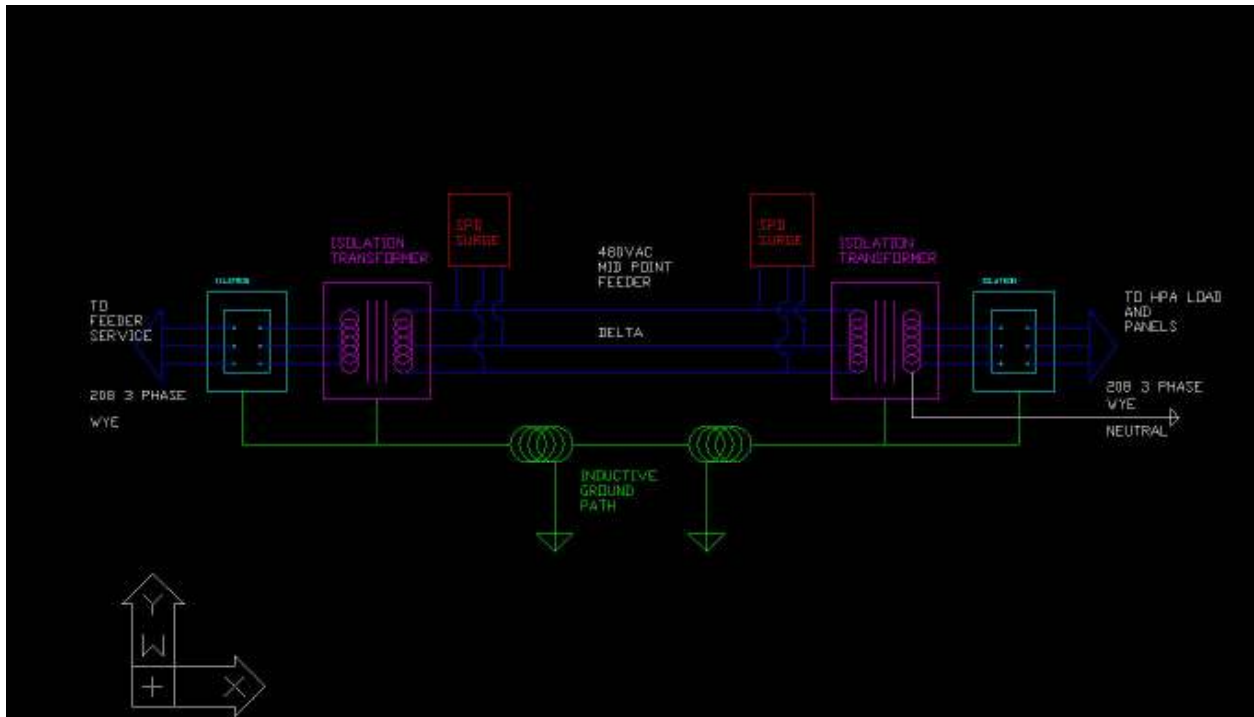
### AIR CONDITIONING:

This new HPA/SSA space will be climate controlled by an existing Liebert redundant air conditioning system. This Liebert unit has excessive ability to flow cooling air to these proposed areas and a Variable Frequency Drive (VFD) is recommended to control cooling and air flow needs. If this area is split with a wall, I recommend that a multi level approach be used to consider the cooling design.

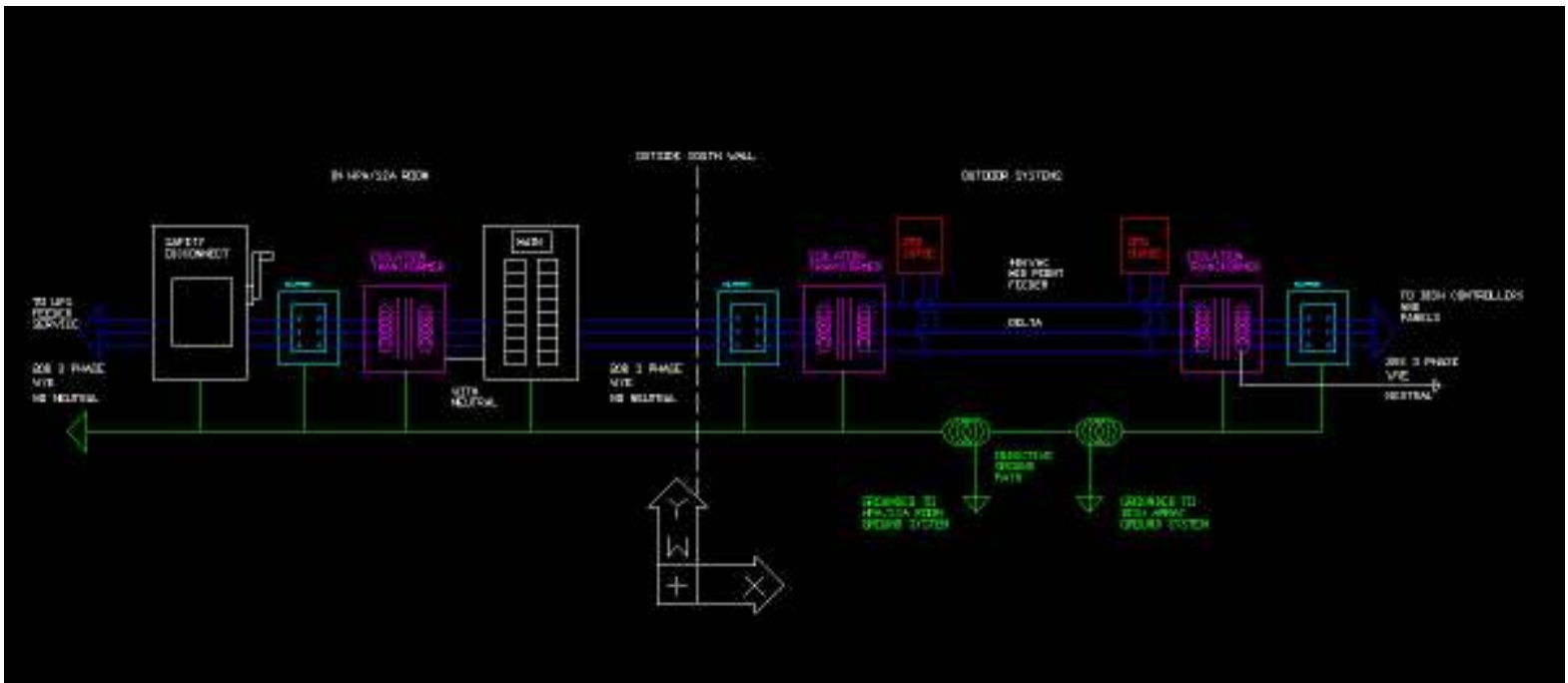
Variable Frequency Drives can moderate the amount of air that the primary space (HPA/SSA) will need as determined by a thermal sensor in the discharge area (return) of the room. Care must be taken to not over chill or cool the room. The elimination of humidity is key and a humidistat should be installed. Levels of humidity that are too high, create corrosive environments for the equipment, while humidity levels that are too low, create static discharge conditions. Air flow rate, Temperature, and Humidity can be controlled easily while the other room can be controlled largely with an air flow damper system. Both areas should have their temperature and humidity monitored and adjustments be made accordingly. The current scavenger air system that expels waste heat from the room is to be discontinued and sealed. This system pulls between 2,000 and 3,000 cubic feet of air per minute from the area and though the Liebert is keeping up with this demand, the negative pressure scavenging can take a toll on the remaining building systems. Excessive discharge of air from a building also pulls in dirt, moisture and bugs which are an un-necessary maintenance problem.

In the new space, I recommend that the VFD be used in a programmed mode to control the temperature. If additional cooling is called for, the volume of air can be increased. If the space becomes too cool, the volume can decrease on a programmed basis.

*Specific Topics  
.JPG's Of AutoCAD  
Works*



SUGGESTED POWER FEEDER SURGE SUPPRESSION SYSTEM OUTSIDE CONFIGURATION



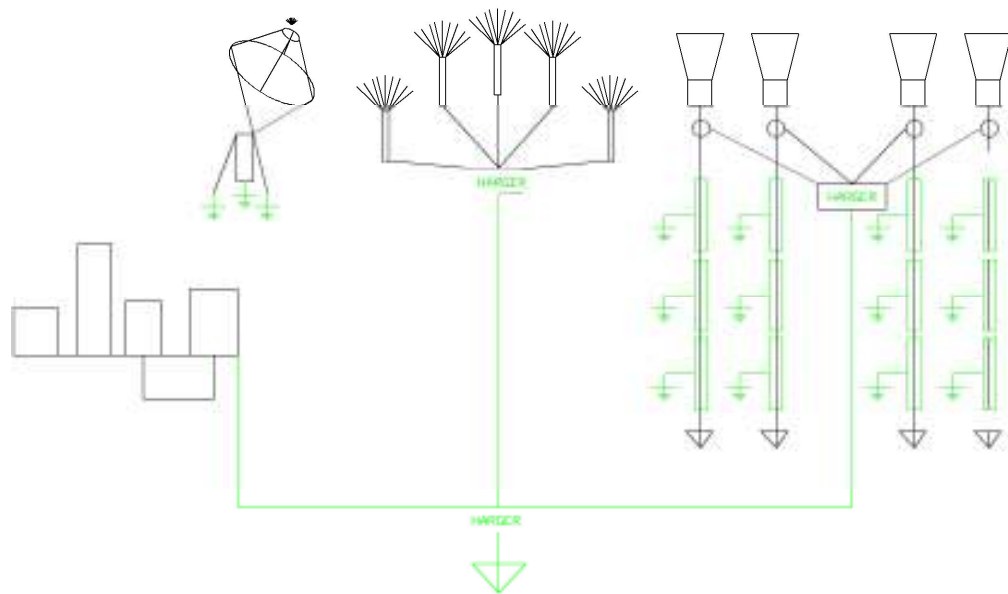
SUGGESTED POWER FEEDER SURGE SUPPRESSION SYSTEM COMPLETE CONFIGURATION



GROUND ROD ASSEMBLY SUGGESTION

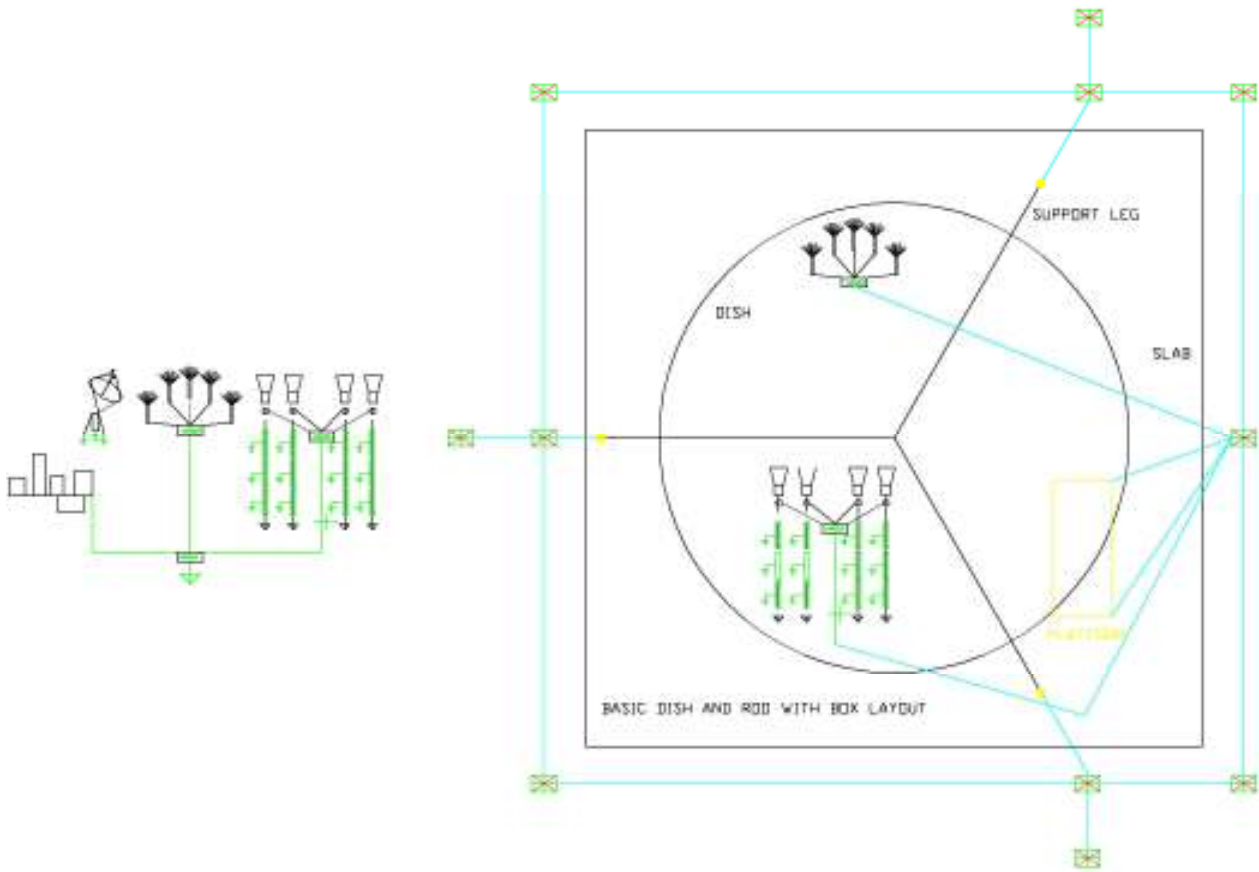


CONCEPT DRAWING OF PVC SLEEVED STEEL SURGE CHOKER SLEEVE



BASIC GROUNDING OUTLINE





BASIC GROUNDING WITH SLAB 1

*MATERIAL LINKS AND  
PHOTOS*

All materials suggested are for examples. Equivalent substitutes may be used once discussed

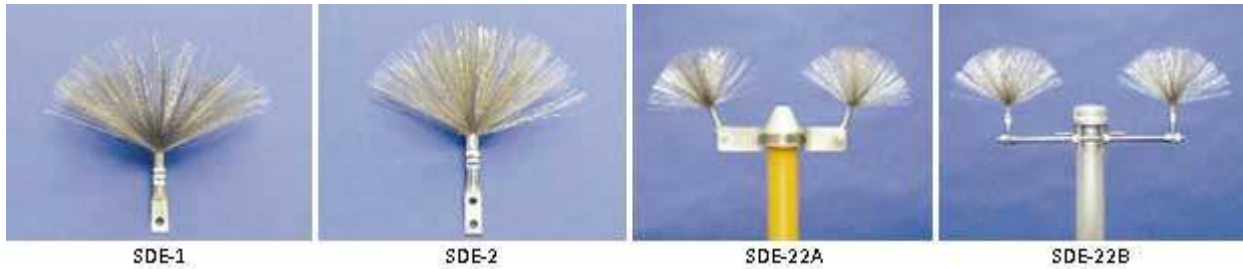
#### ISOLATION TRANSFORMER:

[http://www.schneider-electric.us/en/product-range/60303-low-voltage-drive-isolation-transformers?N=4211628487+432570243&Nr=AND%28P\\_visibility%3A1%2COR%28product.catalogId%3Acatalog10005%29%2Cproduct.siteId%3A100003%29&filter=business-7-Solar+and+Energy+Storage&parent-category-id=53700&parent-subcategory-id=53720#tabs](http://www.schneider-electric.us/en/product-range/60303-low-voltage-drive-isolation-transformers?N=4211628487+432570243&Nr=AND%28P_visibility%3A1%2COR%28product.catalogId%3Acatalog10005%29%2Cproduct.siteId%3A100003%29&filter=business-7-Solar+and+Energy+Storage&parent-category-id=53700&parent-subcategory-id=53720#tabs)



#### AIR TERMINALS:

<https://www.lbagroup.com/products/lightning-protection-masts-dissipators#tower>



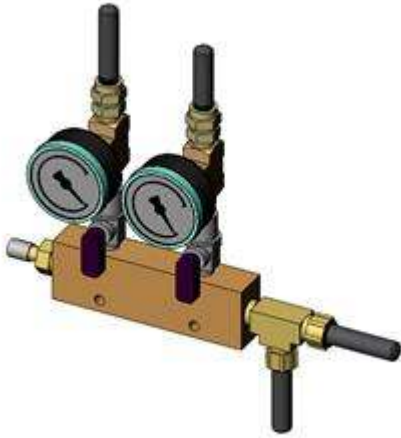
#### NITROGEN GENERATION SYSTEM:

<http://www.southteksystems.com/n2-gen-tl-series.asp>



**AIR DISTRIBUTION MANIFOLDS:  
2 PORT UP TO 6 PORT**

[http://www.commscope.com/catalog/wireless/product\\_details.aspx?id=6322](http://www.commscope.com/catalog/wireless/product_details.aspx?id=6322)



[http://www.commscope.com/catalog/wireless/product\\_details.aspx?id=6324](http://www.commscope.com/catalog/wireless/product_details.aspx?id=6324)



**AIR PRESSURE MONITOR SWITCHES:**

[http://www.commscope.com/catalog/wireless/product\\_details.aspx?id=3](http://www.commscope.com/catalog/wireless/product_details.aspx?id=3)



**AIR PRESSURE FLOW RATE MONITOR:**

[http://www.commscope.com/catalog/wireless/product\\_details.aspx?id=6330](http://www.commscope.com/catalog/wireless/product_details.aspx?id=6330)



**AIR FLOW CHECK VALVES:**

[http://www.coastpneumatics.com/1-4-npt-3-8-npt-check-valves-gcv-series/clippard-GCV-5?\\_vsrefdom=ppcgoogle](http://www.coastpneumatics.com/1-4-npt-3-8-npt-check-valves-gcv-series/clippard-GCV-5?_vsrefdom=ppcgoogle)



**ISLATRON SURGE ARRESTOR:**

<http://www.emersonnetworkpower.com/en-US/Products/SurgeProtection/Point-of-Use/Pages/islatrolbcseries.aspx>

[http://www.emersonnetworkpower.com/documents/en-US/Products/SurgeProtection/Documents/IO-30100\\_ISLATROL\\_Series.pdf](http://www.emersonnetworkpower.com/documents/en-US/Products/SurgeProtection/Documents/IO-30100_ISLATROL_Series.pdf)



EMERSON SPD SURGE ARRESTOR:  
440 HF 15 L N C J 1 S NEW NUMBER, 480 VOLT 3 PHASE DELTA  
SPD SURGE IO-70106\_430-440\_manual.pdf



TIE WRAPS:

<http://www-public.tnb.com/ps/fulltilt/index.cgi?part=CSS135>



ABB STYLE PIPE HANG CLAMPS:  
MODEL 3904BU\*

<https://west.westburne.ca/clamp-grounding/thomas-betts/3904bu/th3-3904bu-2-1-2-3-1-2-ground-clamp/product/THS3904BU>



GROUNDING CONDUCTOR REACTIVE LOOP PULL BOX:

[http://www.cantexinc.com/Products/NM\\_Fittings\\_Accessories/Junction\\_Box/Cover.php](http://www.cantexinc.com/Products/NM_Fittings_Accessories/Junction_Box/Cover.php)



**GROUND ROD INSPECTION BOXES:**

<http://www.homedepot.com/p/NDS-13-in-x-20-in-Standard-Jumbo-Valve-Box-with-ICV-Overlapping-Cover-117BC/100377391>



**CADWELD MOLDS:**

**H TYPE**

<https://www.erico.com/category.asp?category=R2716>

<https://www.erico.com/part.asp?part=HDPTD2Q2Q>



**T TYPE**

<https://www.erico.com/category.asp?category=R2550>

<https://www.erico.com/part.asp?part=HDGRC162Q>



### PLATE TYPE

<https://www.erico.com/category.asp?category=R2705>

<https://www.erico.com/part.asp?part=HDHSC2QW>



### HARGER TYPE GROUNDING BAR

<http://www.harger.com/products/idx.cfm?subc4id=168&p=1&oid=741&thid=529&footid=2&footinfoid=42>



### PLUMBER PLUGS

[http://www.homedepot.com/p/Gripper-3-in-ABS-Mechanical-Plug-270237/100115355?cm\\_mmc=Shopping%7cTHD%7cG%7c0%7cG-BASE-PLA-D26P-Plumbing%7c&gclid=COut6tnUutACFdgWgQodTKMMbQ&gclsrc=aw.ds](http://www.homedepot.com/p/Gripper-3-in-ABS-Mechanical-Plug-270237/100115355?cm_mmc=Shopping%7cTHD%7cG%7c0%7cG-BASE-PLA-D26P-Plumbing%7c&gclid=COut6tnUutACFdgWgQodTKMMbQ&gclsrc=aw.ds)





## HILTI HEAVY HEX BOLT SYSTEM

<http://www.homedepot.com/p/Hilti-3-8-in-x-4-in-Kwik-Hus-EZ-Concrete-and-Masonry-Screw-Anchors-50-Piece-418059/204670940>



END OF DOCUMENT: