



Users Manual

18 Foot Clamshell Dome with Powered Shutters Revision C

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1 General

1.1 Welcome

Thank you for purchasing your new 18-foot dome! Astro Haven Enterprises, Inc. (AHE) strives to produce the best quality product and is continuously inventing new concepts to expand the functionality. The 18-foot dome represents 5-shutter design and is produced with the latest closed mold infusion method. We invite you to participate in this continuous process on our web site at www.astrohaven.com.

1.2 Introduction to the Clamshell Dome

Your AHE dome is fiberglass construction and most of the accessory hardware is stainless steel. The dome is powered by a pair of electric motors that lift the shutters on each side with a series of belts and pulleys. The power to each electric motor is “conditioned” using a motor drive. We call the motor drive herein an **Inverter** to help distinguish it from the motor. The Inverters receive commands from a Programmable Logic Controller (**PLC**) that gets its input from the Human Machine Interface (**HMI**) unit or via serial communication (RS-232). The HMI and PLC reside in the same hardware so we will refer to it as the **HMI/PLC**. The HMI/PLC is powered by a 24 VDC power supply from a transformer. The HMI/PLC, 24VDC power supply, and optional DIN rail mounted devices reside in an Electronic Enclosure (**EE**) inside the dome.

There are a number of options that will interrupt power to either or both of the Inverters including Bumper Guard (**BG**) a door sensor and switch on the manual shutter crank. Note: The Inverters will not work properly if a Ground Fault Isolater (**GFI**) is in the power supply (“NO GFI”)

1.3 Safety and Security

Do not mishandle the components before or during assembly including leaving them exposed to the elements. Be particularly careful when handling the Bumper Guard (BG) to avoid damaging the internal sensor. Don’t lift, maneuver, or handle the shutters in a way that puts pressure on the BG.

Ensure that no obstruction is placed under the shutters preventing them from coming down when the dome is commanded open. The removal or failure of the obstruction will cause the shutters to fall potentially causing extreme damage to dome.

The primary power for the dome may be 230VAC three-phase or 230VAC single-phase. If the primary power is three-phase the 24VDC power transformer will require a separate single-phase 230VAC or 115VAC electrical supply.

Power should be removed whenever any connections are made or any work is performed on the dome and one should not rely on the power interrupt sensors but remove power from the source. Care should be exercised to keep the electrical components and the electrical power source free from contaminants, particularly water or other conductive fluid. To ensure proper grounding, connections should be made with a three-prong plug for single phase and a four-prong plug for three phase power.

The operator should always ensure that the doors and shutters are unobstructed and no one is in a position where they may contact the shutters before commanding the shutters to move in open or closed directions.

Note that the motors may be de-rated in the Inverters and power should not be applied directly to the motors or the parameters in the Inverters modified. Such modifications may cause physical damage to the dome. The motors can be operated from the inverter face if the HMI/PLC fails.

The logic in the HMI/PLC includes a single command for full closure. This single command is given via remote control or a button on the HMI/PLC. This command should only be used if the BG is fully operational. If the BG is disabled, contact AHE for a version of HMI/PLC logic that disables single command closure.

1.4 Site Preparation

Assembly and installation of the AHE 18-foot dome is very simple but the user must prepare for delivery of the dome and have the site ready for installation.

The AHE 18-foot dome is not very heavy for its size but it is large so the components have considerable weight and must be handled with care. Each of the ten half-shutter components is approximately 120 lb and the base quadrants are about 180 lb. (230 lb. with accessories). The components will arrive on a pair of skids 7.5 ft by 15 ft and will require a forklift with 8 foot extended forks or some other type of lifting equipment. The components can be removed from the truck individually but another option is to transfer the dome from the over-the-road semi-trailer to a local truck. One approach that is particularly well suited to residential areas is to transfer the dome from the semi-trailer to rollback flatbed tow truck. The tow truck is about the same height as the semi-trailer and can winch the dome off. At the destination it tilts and rolls back to deposit the crate on the ground.

When the components are removed from the skid ensure there is a suitable place for them in addition to the area needed for assembly. **Ensure that the alpha-numeric labels are not removed until the dome is fully assembled and tested.**

If the dome is to be placed on a pad, ensure that a level site is selected and provision is made to bring power and communication into the interior of the dome.

If the dome is placed on top of a structure permitting access from below, plans to transport the components up to an area permitting assembly or a crane to lift the entire dome are required.

When designing of the pad or supporting structure, separate the power and control cables in cableways if possible.

Plan on having four or more people available for uncrating and assembly (we recommend **four people** for handling the shutters, two in the middle and one at each end).

The following tools are required for assembly:

- 1) Two (2) 7/16" open end wrenches;
- 2) One (1) 7/16" socket and ratchet;
- 3) Two (2) 9/16" open end wrenches;
- 4) One (1) 9/16" socket and ratchet;
- 5) One (1) standard screw driver, and one (1) Phillips screw driver;
- 6) One (1) 5/16" Allen (Hex) wrench;

- 7) Two (2) 4" Hose Clamps;
- 8) One (1) tube of white (clear for colored domes) silicone sealant and caulking gun;
- 9) One (1) rubber mallet or hammer and block of wood (2"x4" about 18" long ok);
- 10) Two (2) step ladders to gain access to the inside of the dome as may be required;
- 11) One (1) Rivet Gun for attaching the seals.
- 12) One (1) Rivet Gun Head for 1/8" rivet;
- 13) One (1) Rivet Gun Head for 3/16" rivet;
- 14) Two (2) 2" x 2" planks about 3' long;
- 15) Tools for attaching the dome to the structure or pad.

2 Uncrating and Assembly

2.1 Uncrating the Dome components

The dome will arrive on two crates as indicated in **Figure 1**. The small assembly components and documents are stored in a compartment indicated on the diagram.

Uncrate the dome as follows:

- 1) Remove the ten (10) shutter halves and set aside noting the letters where halves will join on each part and keeping shutters with the same lettering together;
- 2) Remove the four (4) base riser parts (if applicable);
- 3) Remove the four (4) base quadrants and set aside avoiding damage to the motors that may occur if they tip over;
- 4) Inspect the base quadrants with motors for any damage in-transit;
- 5) Inspect the base quadrant with the four limit switches to ensure the wires are intact and note that if the optional limit switch covers are installed you should remove them to do the inspection and then reinstall them;
- 6) Remove the small assembly components from the compartment indicated in **Figure 1** including:
 - a) Bags of base and shutter bolts, seal rivets, and cable ties;
 - b) Two (2) pivot tube kits;
 - c) A bag of documentation including One (1) User Manual and One (1) Packing List.

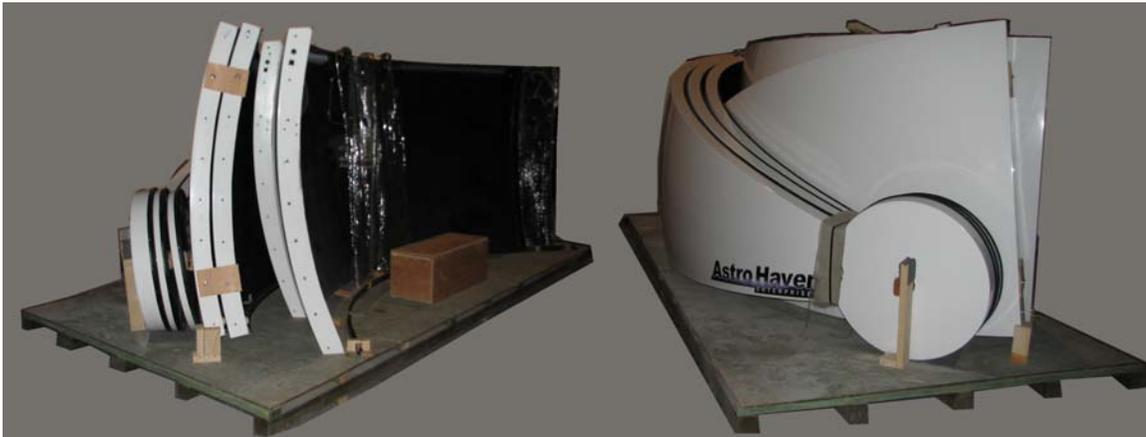


Figure 1

2.2 Assembly

For typical viewing of celestial bodies, orienting the pivot axis True East-West will allow a body to be observed all night without changing shutter opening configuration.

All of the parts are labeled for easy installation and the convention for this labeling is clockwise when looking at the HMI/PLC from inside the dome. The base quadrants are labeled on the top side such that they fit A/A, B/B etc. The reference base quadrant is the one to the right of the Electronic Enclosure (**EE**), that is, the base quadrant with the “Right” motor. Looking from the center of the dome the letters progress clockwise from the reference base quadrant. The reference base quadrant therefore has D on the left side and A on the right side when facing the motor from inside the dome. The clockwise base quadrant from the reference base quadrant (i.e. the A-B base quadrant) is the reference pivot point for the numbering on the shutters. Note that this is the base quadrant opposite to the one with the EE.

The shutter halves are also labeled A/A, B/B, etc. when they are mated. When a pair of shutter halves is mated each full shutter also has a number referencing the full shutter. The shutter formed mating halves A and A is shutter number 1; B/B forms shutter number 2 etc.

The full shutters are numbered on the top and when assembled with the base they progress from the inside out: 1, 2, 3, 4, 5. Preposition the base quadrants and shutter halves in preparation for assembly. As you pre-position the shutters for installation ensure the numbered sides are on your right as you face the “Right” motor from inside dome and will mount on the A-B base quadrant. **Figure 2** shows the base quadrant labeling, shutter numbering, and 5th shutter E/E label. As a confirmation of proper shutter orientation, note that the magnets on the shutters should be adjacent to the limit switches on the base quadrants.

Figure 2 shows the conventional placement of the door and Electronic Enclosure (EE) housing the HMI/PLC on the “D” side of the pivot bracket on the C-D quadrant. An alternative location is on the “C” side of the pivot bracket.

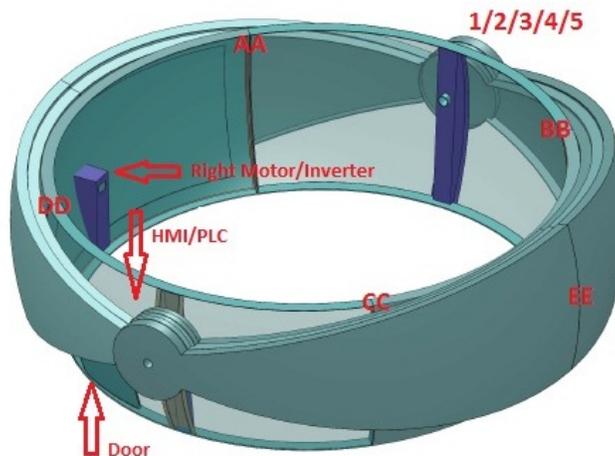


Figure 2

Assemble the dome base quadrants according to the following steps:

- 1) Position the four quadrants on a level site foundation matching the labels A-A, B-B, C-C, and D-D with the labels up and position the dome to a center point on your site with pivot axis True East-West if desired;
- 2) Remove some bolts from the bag and “dry fit” the four base quadrants together with two or three bolts at each flange interface (A-A, B-B etc) loosely tightened with a washer on each side;
- 3) Add a bead of silicone caulking the length of each flange interface, insert the remaining bolts with washers on both sides and loosely tighten;
- 4) Tighten all bolts as in **Figure 3**.

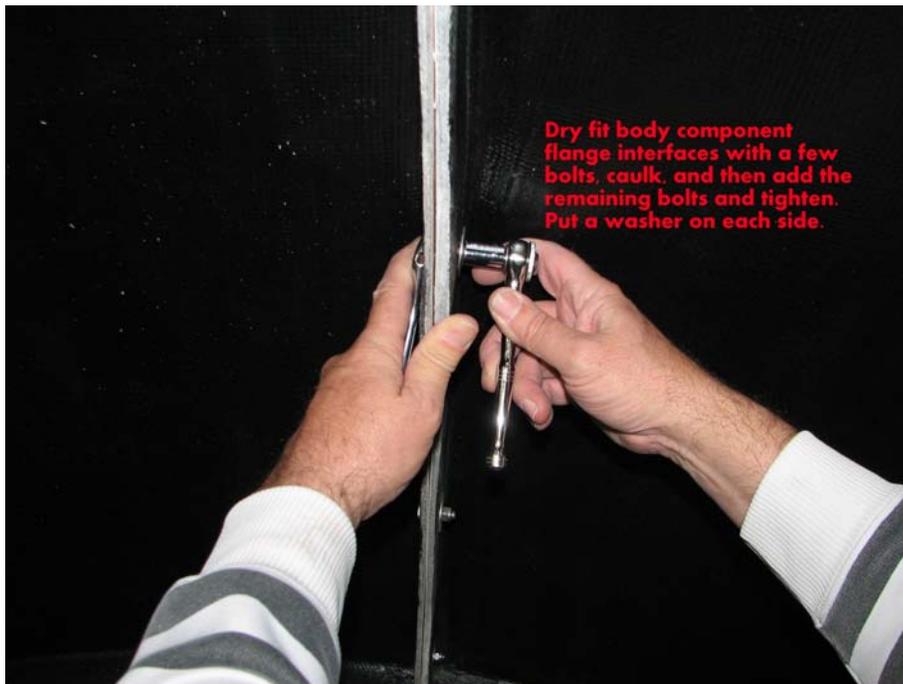


Figure 3

Attach the dome to the foundation according to the following steps:

- 1) Position the base accurately on the level foundation and drill holes at approximately 24” centers through the bottom flanges (the actual location of the holes and size will be determined by your specific foundation and choice of fasteners but use bolts or fasteners at least 3/8” in diameter, see Appendix A for a dome schematic showing the fastening holes);
- 2) Before fastening run a bead of silicone caulking between the bottom flanges and the foundation;
- 3) If you have a white dome run a bead of white silicone caulking up each external flange joint and across the top to cosmetically hide the joint seams.

Insert the pivot tubes for the dome shutter components according to the following steps:

- 1) Remove the stainless steel pivot tubes from the skid compartment and remove and set aside the bolts and retaining collar. Make sure the retaining collar is kept with its respective pivot tube;
- 2) Insert the pivot tubes into pivot brackets from inside the dome just far enough to protrude about two (2) inches on the outside of the base quadrant. The tubes and the pivot brackets are labeled. Insert the end of the pivot tube opposite its label. When inserted properly both labels on the pivot tube and pivot bracket should match and both be visible from inside the dome when the tube is fully inserted. The bolt holes in the tube and pivot bracket must be aligned when the tube is fully inserted so keep them aligned as the tube is tapped in as it may be difficult to turn the tube when fully inserted. You will have to use a block of wood with mallet or hammer to gently tap the pivot tube into the pivot bracket. Note: YOU MUST USE A BLOCK OF WOOD. IF YOU STRIKE THE TUBE WITH A HAMMER IT WILL BEND THE ENDS OR CAUSE THEM TO GO OUT OF ROUND. See **Figure 4**.

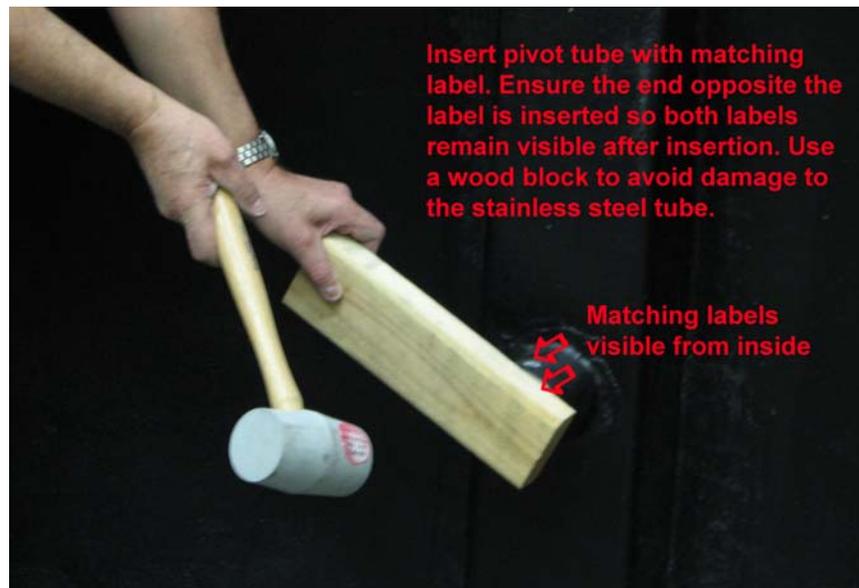


Figure 4

Mount the Inner Shutters according to the following steps:

- 1) Join the Shutter halves A/A, B/B, C/C, D/D, and E/E to form Shutters 1,2,3, 4, and 5 respectively;
- 2) Bolt the halves together with bolts, nuts, and washers in a similar way to the Base quadrants; the weather seal should be on the bottom and the Shutter number on the top. Note the 5th Shutter has weather seal on both sides so be careful that the shutter number is showing on top when installing. See **Figure 5**;
- 3) For each shutter fit the weather seal onto the adjoining shutter half around the circular end, insert the rivets in the pre-drilled holes and rivet the seal in place using your rivet gun and the smaller size rivets. See **Figure 6**;
- 4) For the 5th shutter, the seal wraps all the way around the circular end and attaches on both sides;

- 5) Bring the shutter labeled “1” into position against the base ensuring that label “1” is up and will be mounted on the A-B base quadrant. If there is a shutter stop lift and set the shutter on top of it (again, we recommend four (4) people to handle the shutters, one on each side and two in the middle);
- 6) With two (2) people, one on each side, pull the shutters apart until they slip over the stainless steel tube which should be protruding about two inches. Release them so the shutter springs into place on the tube. You may need a person inside the dome to keep the tube in place using the block of wood and rubber mallet. See **Figure 7**;
- 7) From inside the dome tap the stainless steel tubes until they protrudes two (2) inches outside the first shutter using a wood block and keeping the bolt holes aligned as above. See **Figure 8**;
- 8) Install shutter labeled “2” on the opposite side of the dome in a similar fashion. From inside the dome once again tap the stainless steel tubes until they protrudes two (2) inches outside the first shutter using a wood block and keeping the bolt holes aligned as above. See **Figure 8**;
- 9) Install the hose clamps about one (1) inch inboard on the pivot pipe to prevent the shutters from springing off the pipe while the belts are attached and tighten securely with your screw driver.



Figure 5

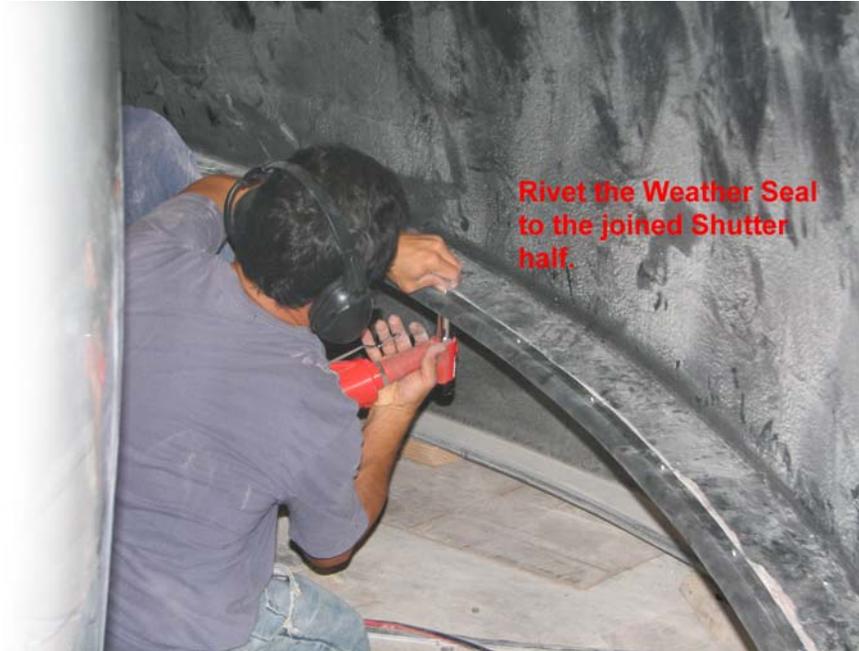


Figure 6

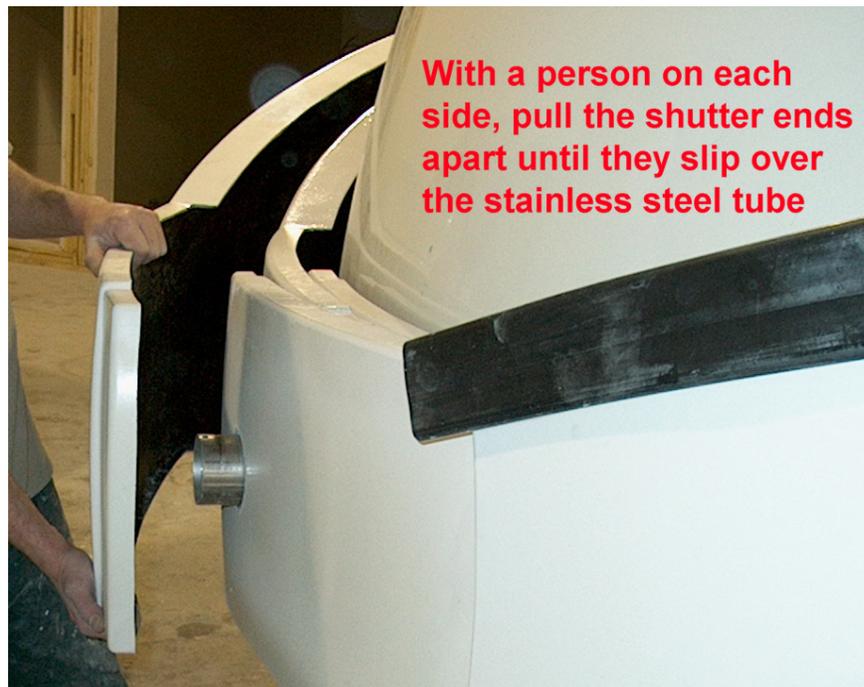


Figure 7



Figure 8

For each of the two belts lifting the Inner Shutter, connect the belts of the powered shutter system to the Inner Shuttters according to the following steps:

- 1) With at least four (4) people, one (1) inside and three (3) outside, lift the inner shutter until the bottom edge is near or above the top of the body flange and brace with a secure support. See **Figure 10**. A person standing by to guard the support may be helpful;
- 2) Remove the nuts from the end connector of the belt attached to the pulley and insert the bolts into the holes in the in the flange of the inner shutter as shown in **Figure 9**. Ensure the belt is not twisted;
- 3) From the inside hold the bolts and tighten the nuts from the outside as shown in **Figure 10**;
- 4) Remove the support and gently lower the shutter ensuring that the belt is centered on the base flange pulley bracket;
- 5) Repeat steps 1) through 4) for the belt attachment to the shutters on the opposite side.

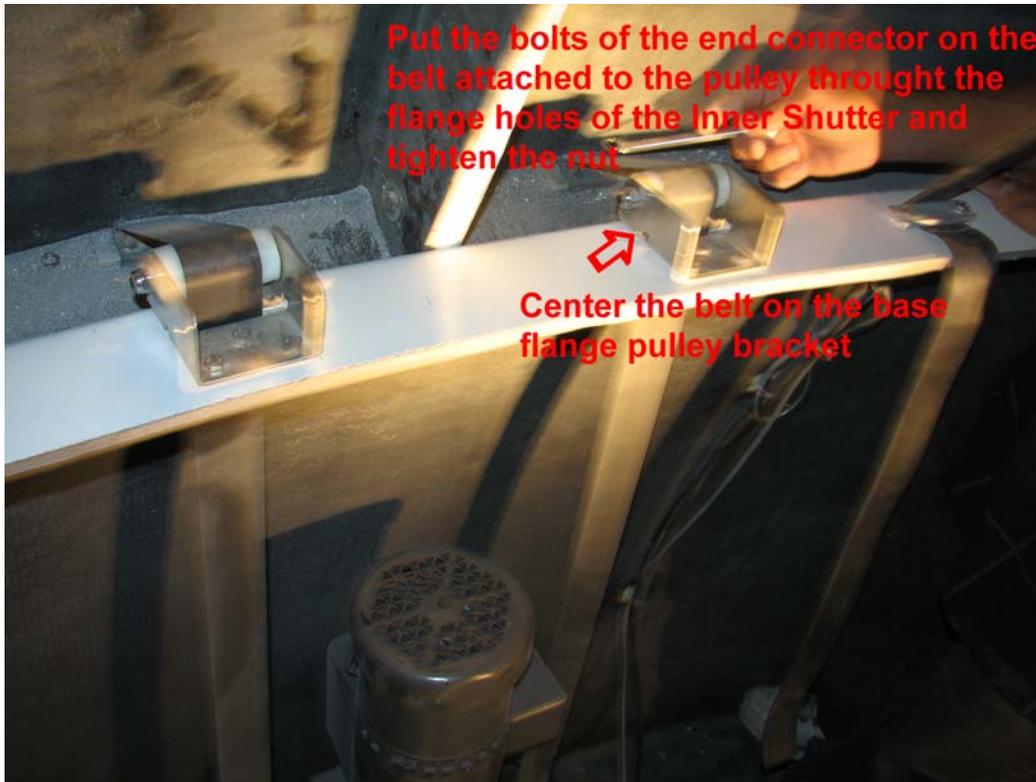


Figure 9



Figure 10

Mount the Outer Shutters according to the following steps:

- 1) Remove the hose clamps on the pivot pipe;
- 2) Install the Outer Shutters "3" and 4" precisely as you did for the Inner Shutters, pulling the ends apart, fitting over the pivot pipe, and tapping the pivot pipe out about two (2) inches.

For each of the two belts lifting the Outer Shutters, connect the belts of the powered shutter system to the Outer Shutters according to the following steps:

- 1) Raise and secure the Outer Shutter to a position near or above the top of the base just as was done installing the Inner Shutter as in **Figure 10**;
- 2) Remove the nuts from the end connector of the belt attached to the body flange, the end of the belt extending out of the dome and insert into the holes in the flange of the outer shutter as shown in **Figure 11**;
- 3) From the inside hold the bolts and tighten the nuts from the outside as was done installing the Inner Shutter;
- 4) Remove the support and lower the shutter ensuring that the belt is centered on the inner shutter pulley bracket;
- 5) Repeat steps 1) through 4) for the belt attachment to the shutters on the opposite side.

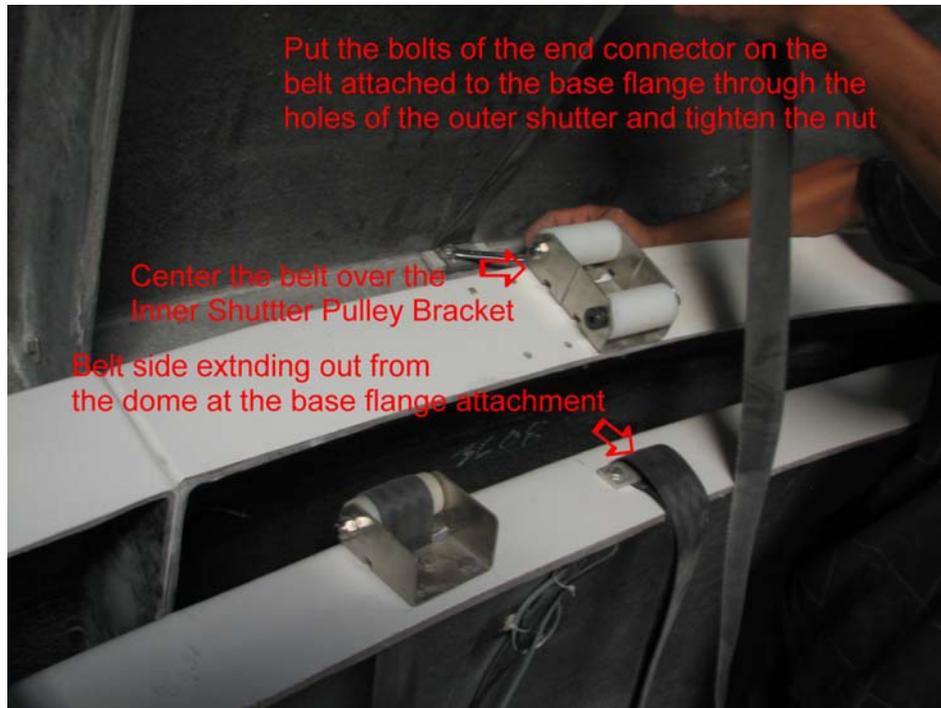


Figure 11

The 5th shutter is installed precisely the same way as the Outer Shutters except that before raising the shutter to attach the belts, attach the gas spring that drives the 5th Shutter when it is at the top of its travel as follows:

- 1) When mounting the 5th Shutter on the pivot pipe insert a short piece of 2x2, about 3 feet long, into the pivot pipe and hang the shutter on the 2x2 to allow enough room to work between the 5th shutter and the Outer Shutter;
- 2) Lift the 5th Shutter up about 2 feet so the top flange is just above Outer Shutter top flange and prop it in place;
- 3) On each side of the shutter at the pivot pipe attach the end of the gas spring on the 5th Shutter to the guide connector on the Outer Shutter as in **Figure 12**;
- 4) Remove a spring clip from the bag and attach the gas spring to the guide;
- 5) Slide the 5th Shutter onto the pivot pipe, remove the 2x2, and proceed to attach the belts as for the Outer Shutters.



Figure 12

Secure the all the shutters at the pivot tube the dome according to the following steps:

- 1) Tap the stainless steel pivot tube on either side as required to align the bolt holes of the pivot tube and pivot bracket inside the dome, insert the bolts and tighten. See **Figure 13**;
- 2) Outside the dome, install the retaining collar and secure with two bolts as shown in **Figure 14**. You will have to apply some force to the shutters to make them snug so the bolt holes align;
- 3) Install the end cap as shown in **Figure 15**.

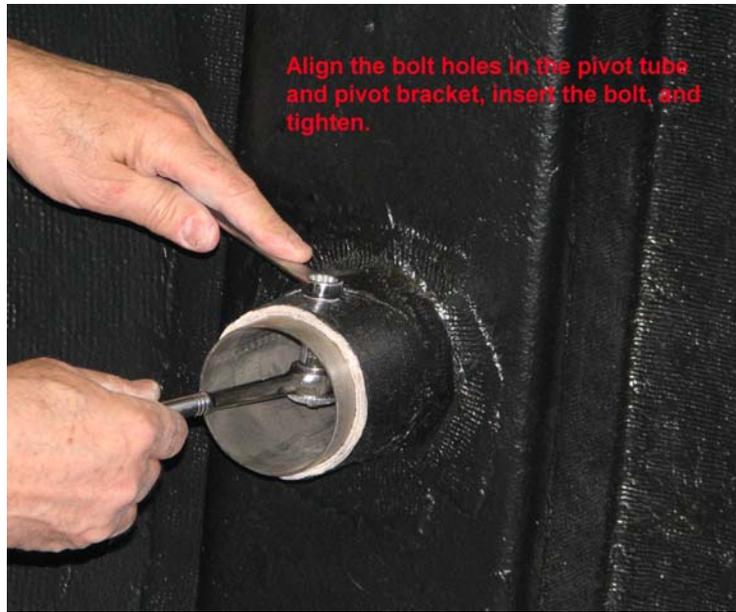


Figure 13

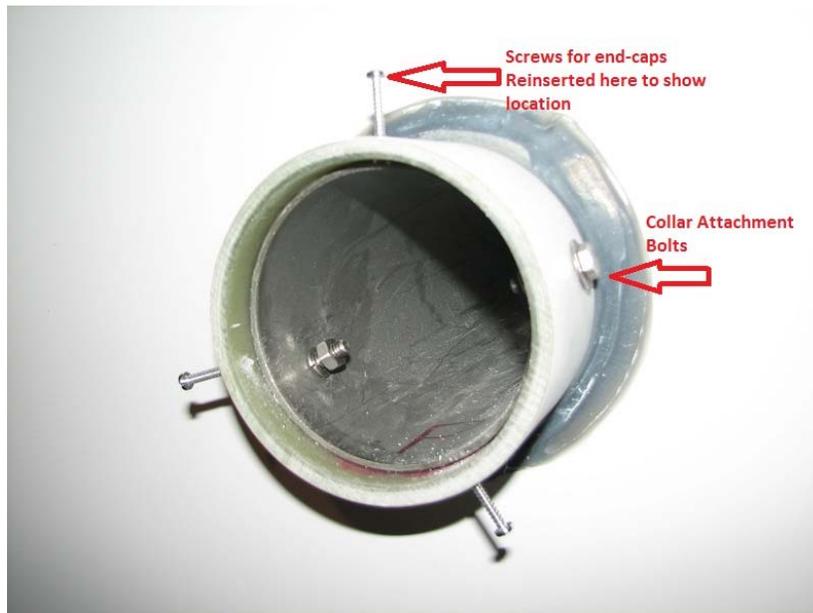


Figure 14



Figure 15

Connect the power cables according to the following steps:

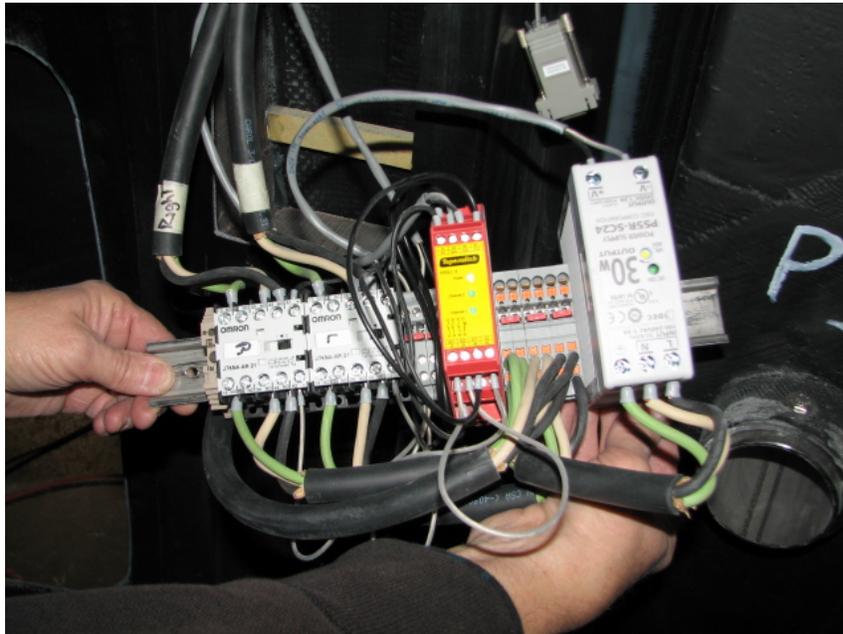
- 1) Remove the Plexiglas cover on the EE and remove the screws on the top and bottom of the DIN rail so that DIN rail can be extracted from the EE;
- 2) Unwind the power cable from the "Left" motor and Inverter and feed to the EE through the conduit under the upper flange on the "C" side of base quadrant C-D as in **Figure 16** and **Figure 17**;
- 3) Insert the cable into the top of the EE and out the front so it can be easily attached to the terminal blocks on the DIN rail as in **Figure 17** and **Figure 18**;
- 4) Matching the colors of wires of the pigtail attached to the bottom of the relay or terminal block insert the wires into the opposite side of the relay or terminal block (**Note** if your dome configuration includes any of the options that interrupt power, you will insert the wires from the "Left" Inverter into the relay associated with the "Left" motor matching the pigtail colors as in **Figure 19**, and if your dome does not have relays put one wire of the same color from the "Left" Inverter into one of the receptacles on the top of the terminal block with the lower wire of the same color as in **Figure 20**);
- 5) Tighten the screws in the relay or terminal block (or relay) to retain the wires;
- 6) Repeat this process for the cable from the "Right" motor and Inverter inserting the wires into the second receptacle in the terminal block or the other relay as in **Figure 19** or **Figure 20**;
- 7) Replace the DIN Rail, tighten the screws holding it in the EE and replace the Plexiglas panel;
- 8) Tighten the cord grips around the cable where they enter the control panel.



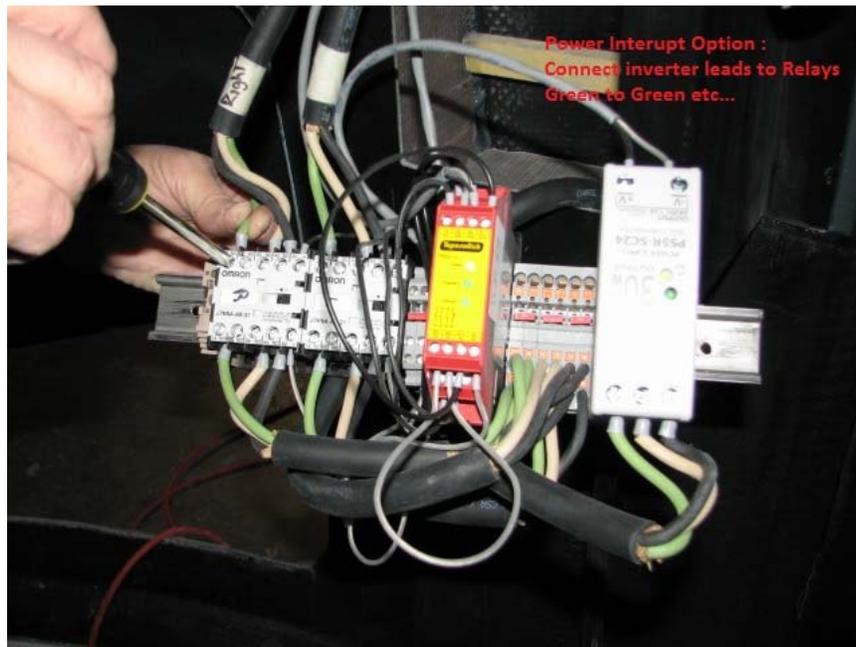
Figure 16



Figure 17



Figures 18



Figures 19



Figures 20

The BG Comprises of the following:

- 1) BG Switch mounted on the Fifth Shutter.
- 2) A Torsion Cable connected from the BG Switch to internal wiring; and
- 3) AG Controller to trip the power relays.

BG Switch Installation;

- 1) Review the BG Switch making sure it is installed correctly and firmly in place in the Track see **Figure 21**;
- 2) Insert the Torsion Cable through the Cap located at P1 Pivot see **Figure 22**;
- 3) While inside the dome pull the Torsion Cable from inside P1 Pivot and insert it through the Cord Grip, located at the bottom of the E.E. leaving enough cable to attach wire leads to the BG Switch Controller, as in **Figure 23**;
- 4) Note the labels on the wires of the Torsion Cable for the BG connections to the controller, see **Figure 24** ;
- 5) The Torsion Cable wires should be labeled with tape with corresponding numbers but in case the labels are removed or otherwise unreadable, make connections as follows;
- 6) One pair of wires attach wire (Black) #1 to S12 and wire (White) #2 to S21;
- 7) The other pair of wires attach Wire (Black) #3 to S11 and Wire (White) #4 to S22;

- 8) There are also three extra wires to put electrical power to the shutter for lighting labeled #5 power and #6 common and a green and yellow wire for the ground.
- 9) Once all connections are done then the power can be turned on and the BG Controller reset by pressing the “6” button on the HMI keypad, This button must be pressed or the corresponding “R” given to reset the BG any time power is terminated and turned back on;
- 10) Test the BG Switch by running the right side shutter up and then bumping the Switch should stop and will require the pressing of the reset switch “6” button on the HMI panel to reset the BG Controller and allow shutter motion. The BG Controller lights will extinguish when the BG Switch is bumped and re-light when the BG Controller is reset.



Figure 21



Figure 22



Figure 23



Figure 24

Connect the control cables according to the following steps at the B/B flange, the C/C flange, and at the D/D flange:

- 1) Plug the control wire connectors together as shown in **Figure 25**;



Figure 25

With the foregoing setup complete, and the following steps will check out the normal operation:

- 1) Connect the 120 VAC power cord for 24 VDC power supply to the appropriate power outlet and connect the one or two 240 VAC power cords to the double or single outlet for 240 VAC single phase or three phase power as appropriate;
- 2) Ensure that all power interrupt sensors are in RUN mode, for example, close the door if a door switch is present, ensure both Manual shutter Cranks are disengaged, and ensure no object is depressing the bump sensor;
- 3) Observe that the HMI/PLC displays the control screen after it initializes and observe that both Inverters are display "STOP" in the LED window;
- 4) Check that each interrupt sensor that will cause the Inverters to shut-down and go blank (note that with a load on the Inverter they will shutdown immediately but with no load on the Inverters they will take perhaps 30 seconds to shutdown);
- 5) Test the shutter operation with the **Soft Keys** on the HMI/PLC (see **Figure 26**):
 - a) Raise one side to fully closed, monitoring belt and pulley operation, and verify that the outer shutter or fifth shutter stops at the appropriate vertical position and note that the "Top" limit is annunciated on the HMI/PLC;

- b) Lower the shutters on that side to the fully open position, monitoring belt and pulley operation, and verify the doors stop prior to striking the ground or the door stop with the “Bottom” limit annunciated on the HMI/PLC;
 - c) Repeat the procedure for the other side;
 - d) Try operating both sides in the same direction and opposite directions at the same time:
- 6) Test the door operation with the **Arrow Keys** on the HMI/PLC:
- a) Use the left or right arrow key to move the cursor to the “LEFT” or “RIGHT” titles on the HMI/PLC;
 - b) Use the Up and Down cursor to cause the appropriate shutters to move
 - c) Repeat a) and b) to verify the other side also moves.
- 7) Test the other operations Keys on the HMI/PLC:
- a) Use the “0” key to turn Back light on the HMI/PLC off and on:
 - b) Use the “9” key for full open single action, both sides at same time:
 - c) Use the “8” key for full close single action, both sides at same time:
 - d) Use the “6” key to reset the BG Controller after the BG Switch has been bumped:



Figure 26

Verify the operation of the serial (RS-232) interface of the powered shutter system according to the following steps:

- 1) Connect the serial cable supplied to the controller box and to a computer supporting serial communication as shown in **Figure 27**. Note: for new computers you may need to acquire a USB to Serial dongle as shown in the figure.

- 2) Using a serial communication program like Microsoft Windows HyperTerminal set for 9600 baud, eight bit, no parity, and hardware control = off; type “A” or “a” to make the side opposite the controller box go up and down. Similarly type “B” or “b” to make the side of the controller box go up and down. You will note that the controller replies with your command until the limit switches are encountered. For the side opposite the controller encountering the upper limit switch will result in replies of “X” while the encountering the lower limit switch will result in replies of “x”. You will not similar replies for the side with the controller box except they will be “Y” and “y”.
- 3) Test the full Close and full Open commands using “C” and “O” as inputs. Test also that the “R” command will reset the BG Controller after the BG Switch has been bumped

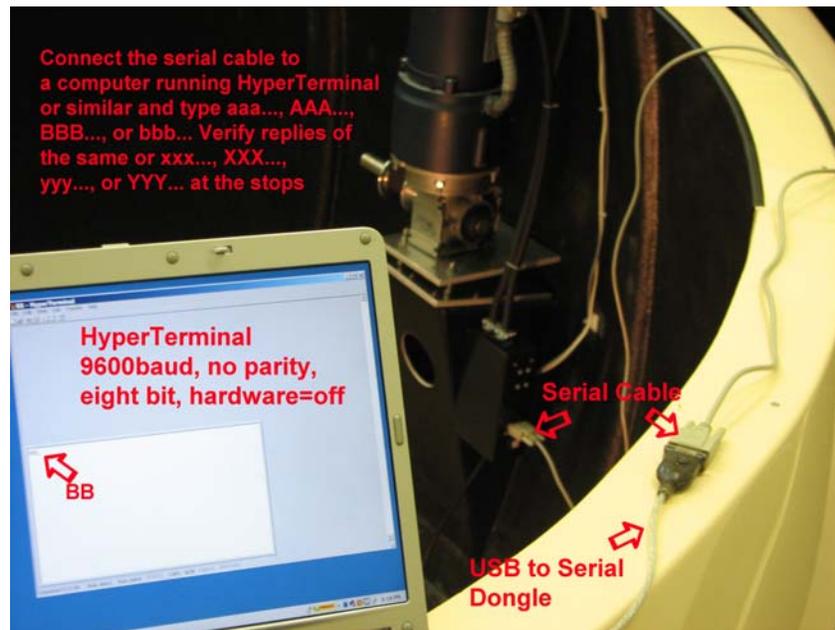


Figure 27

If your dome has the manual shutter closure option, test the unit on each motor according to the following steps:

- 1) Turn the butterfly nut until the torque shaft is fully inserted and the gears are seated;
- 2) Verify that the cut-off switch has removed power from the Inverter by observing the LED go blank (Note this can take over 30 seconds with no load on the Inverter);
- 3) Install the hand crank and observe incremental belt motion as you turn the crank (note the ration is 100:1 so movement will be subtle) as shown in **Figure 28**;
- 4) Remove the hand crank and fit a cordless drill over the shaft;
- 5) Being careful to handle the initial torque, squeeze the trigger and observe the shutters close at a steady rate as shown in **Figure 29**;

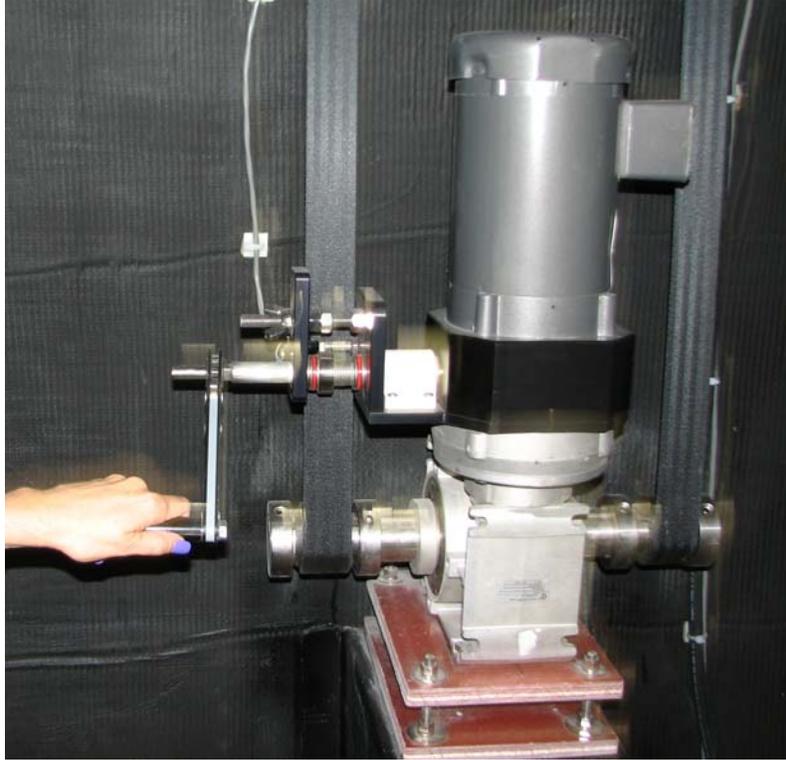


Figure 28



Figure 29

Operation and Maintenance

2.3 Normal Operation

Simplicity of operation is a feature of the AHE clamshell dome that makes viewing easy and keeps cost of ownership low. For viewing celestial bodies with the axis oriented East-West, one need only open the North or South side to expose the appropriate elevation and forget about it. For pointing at a variety of bodies North and South or if you just want to enjoy the night sky you can open up both sides and have a panoramic view of the heavens.

The Serial (RS-232) interface allows remote operation or external opening. For external opening you can run the Serial Cable outside or install a Bluetooth dongle on the RS-232 port and communicate from a Blue Tooth device. A computer inside the dome or close by communicating the via the serial connection could be a gateway for broader communication such as Ethernet cable or wireless. The dome may then be operated over the Internet if desired. Note: if you are replacing the Serial Cable use a straight-through serial cable sometimes called a monitor extension cable.

The procedures below require a pair of 7/16" wrenches and a flash light but it is recommended you keep these together with a small compliment of other tools you might need in the dome and ensure the flash light always has fresh batteries.

2.4 Abnormal Procedures

For powered domes that are not accessed from below and do not have the optional access door, the following procedures allow ingress and egress in the event of a power failure.

If inside the dome and unable to exit, use the 7/16" wrenches above to release the belt at the base flange attachment (see **Figure 11**) and lower the Outer Shutter on the two shutter side, being careful not to let it drop as it starts to descend.

If outside the dome and need to gain access to repair the power failure, use 7/16" wrenches to remove the nuts holding the upper shutter belt end connector. Note that **Figure 10** shows this with the shutter bottom at the base height but the shutter in the closed position will be higher and one must exercise CAUTION to brace and support the shutter so it does not fall when the belt is released. This should only be accomplished with two or more people to support and lower the shutter.

2.5 Normal Maintenance

The AHE clamshell dome requires little maintenance other than periodic visual inspections.

Inspection of the dome structure should include the caulking in the seams, the weather stripping and the edge trim. Once every few years the tracking wheels should be inspected and spun to check the bearings. The tracking wheels are on the lower flange of all the shutters and also on the top flange of the fifth shutter. They are visible when the shutters are full closed. See **Figure 30**. Similarly, the rollers can be removed and the bearings visually inspected for damage also in **Figure 30**.



Figure 30

Periodic inspection of the belts should look for fraying particularly with regard to contact with the bracket side walls.

To check the rollers or replace belts it is convenient to build a 3 tier support that just takes the weight off each shutter as the shutters are lowered on that side to the fully opened position.

If the belts need to be replaced, adjust the top closure as follows:

- 1) With both shutters open, use the HMI/PLC to bring the 5th shutter to the full up position incrementally at the top watching that tracking wheels on the 5th and Outer Shutters not come off the shutter interior to them;
- 2) Use a plumb bob attached to the center of the 5th shutter to test vertical alignment and verify the all the shutters have about 3 inches of overlap at the center point;
- 3) If the overlap is not correct lower the shutters onto a support to slack the belts and adjust the length of belt passing thought the adjustable anchors on the base and Inner Shutter;
- 4) If the 5th shutter face does not finish vertical, with appropriate overlap, adjust the limit switch.
- 5) Repeat the process with the two shutter side to achieve adequate overlap between the shutters on that side.
- 6) If adequate overlap between the shutters on the two shutter side is achieved but the Outer Shutter on that side does not achieve adequate overlap with the 5th Shutter, adjust the limit switch.

If the belts are not tracking on a roller, adjust as follows:

- 1) If the belt pulls to one side or the other when the shutter comes fully open, ensure the belt has not moved laterally under the anchor plate of the base or adjacent shutter;
- 2) If the belt tracks to one side when the shutter is midway up, place a small shim under the bracket on the same side.
- 3) If both belts are tracking to one side on the base rollers, adjust the motor plate to tilt the shaft plane slightly downward on the same side.

Inspection of the control cables and limit switches should look for damage, loose connections or evidence that the limit switch brackets may detach. If they must be replaced carefully mark their position per the instructions that come with the limit switch kit.

2.6 Troubleshooting

The powered 18 foot AHE clamshell dome is fully assembled and checked for proper operation before it leaves the factory. This includes checking the Serial (RS-232) interface for proper control. If the dome is free from damage during transit and experiences no subsequent damage during assembly or operation, it should work as it did prior to shipment.

If the shutters do not respond properly to HMI/PLC, first check that the system is powered and any power interrupt sensors have not tripped. Check also the control cable junction blocks at flanges B/B, C/C, and D/D as in **Figure 25**.

If one side does not respond to either the up or down command on one the side of the controller the most likely cause is an open circuit in the control wire leading to the limit switch which will be indicated by a “Top” or “Bottom” limit switch annunciation on the HMI/PLC. The limit switch stops motor operation by opening so any break in the line will inhibit any motor action in the respective direction. Perform the following actions to verify and correct.

- 1) **Trouble shoot “Top” or “Bottom” annunciations.** If a “Top” or “Bottom” annunciation appears when the shutter is not at the top or Bottom respectively, find the open circuit by jumping the appropriate wire pair in the connector at the C/C flange (i.e. closest to the HMI/PLC) and then move progressively out jumping at the B/B flange connector and finally at the limit switch;
- 2) **Inspect the switch and control cable for breaks.** If the down button is inactive concentrate on the black and white wires. Similarly if the up button is inactive concentrate on the red and green wires but in either case check all wires for breaks or disconnects particularly at spade connectors at the limit switch itself. Avoid handling the limit switch as it may be dislodged. If the problem is evident reconnect the spade to the switch or mark the bad cable with tape and contact AHE for a new cable. Otherwise proceed to step 3)
- 3) **Inspect control box cable for breaks.** To inspect the control cable leading to the HMI/PLC, remove the controller box cover and remove the DIN rail as described previously. Access the HMI/PLC and associated terminal blocks to check the connections. See Appendix B for a wiring diagram. If these inspections do not reveal the source of the problem contact AHE for further diagnostic methods.

If the shutters do not stop at the open or closed limits, first check that the control cable junction blocks at flange interfaces as before. Check also that the limit switches have not become detached and that the magnets on the shutters are still in place.

To Remove the HMI/PLC

- 1) Do the following;
- 2) Using the Phillips head screw driver Remove the two screws from the Plexi Glass No the front of the E. E. Shell;
- 1) Using the Phillips Screw Driver remove the vertical Din Rail as per the User's Manual;
- 2) Using the Phillips Screw Driver and the 7/16" Wrench, Loosen the mounting hardware on the front of the E. E. Shell by reaching inside the E. E. with the 7/16" Wrench up behind the back of the face to the 1/4 – 20 nut, then take the phillips Screw Driver and hold Screw in the front of the E. E. and turn the nut with the wrench, repeat this to the other screw until both are loose;
- 3) At this time you should be able to loosen the nuts with your fingers until the HMI/PLC is able to be pulled forward about one inch from the face of the E.E. ;
- 4) Holding the HMI/PLC with one hand and using the other hand to reach in behind the HMI/PLC to pull the retaining clip to release it from the DIN rail as described in the (Vision OPLC Installation Guide on Page 4);
- 5) Once the unit is released it will pull forward and allow access to the RS-232 Jack on the left side so it can be disconnected;
- 6) Using the 1/8" Standard Screw Driver Disconnect Green Terminal Block on top by placing the screw driver under the terminal block and lifting it up gently until it is out of the socket;
- 7) Repeat the previous step on the bottom Green Terminal Block until it is out of its socket;
- 8) The HMI/PLC can now be removed by tilting it forward and lifting it out;
- 9) Replace the preprogramed HMI/PLC after the weather seal has been installed on the back of the HMI/PLC face plate;
- 10) Tilt the unit forward so the bottom goes in first, insert the bottom Green Terminal Block by aligning it in the socket and pressing it in;
- 11) Reinsert the RS-232 Jack into the left side of the HMI/PLC;
- 12) While holding the HMI/PLC in one hand reach into the E. E. and insert the top Green Terminal Block into the top socket;
- 13) Verify all connection are in firm and nothing has been missed;
- 14) At this time the power can be connected for testing before the HMI/PLC is put in permanently;
- 15) If all functions are good, disconnect the power;
- 16) Reinsert the HMI/PLC onto the DIN rail by placing the top of the unit on first and then the bottom until the retaining clip locks into place;
- 17) Using one hand press the face of the HMI/PLC into the E. E. and using the other hand reach in behind the face of the E.E. and tighten the nuts until the HMI/PLC is flush on the front of the E.E.;
- 18) Using the 7/16" Wrench tighten the nuts while holding the screws with the Phillips Screw Driver;
- 19) Replace the Plexi Glass on front of the E.E. using the Phillips Screw Driver;
Reconnect the power and verify all function are operational;

3 Contact Information

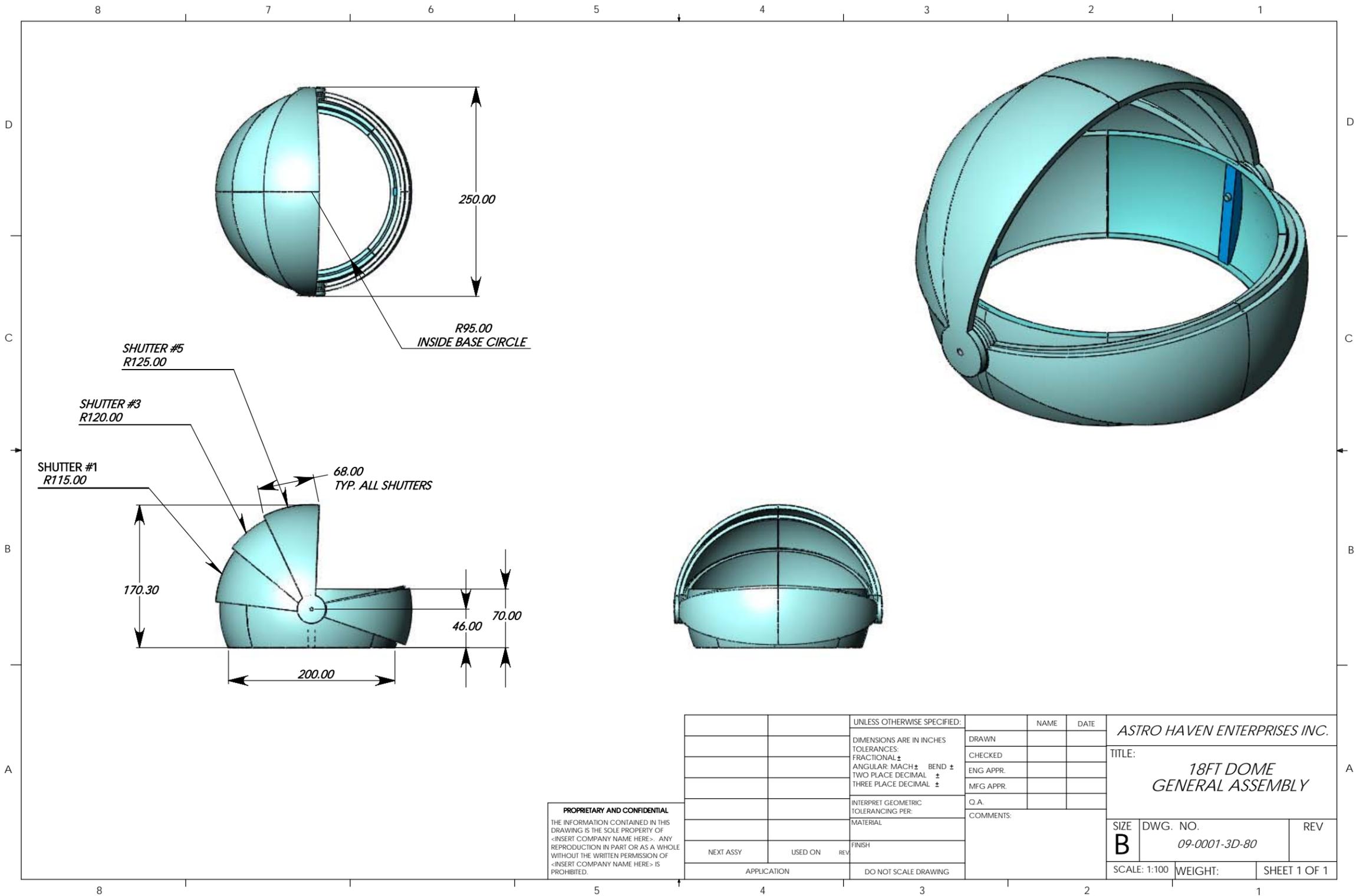
3.1 Customer Support on the Web Site

Customer support is available on our web site at www.astrohaven.com or via email at domesales@astrohaven.com.

3.2 Customer Support via Telephone

If you are unable to contact us via the Internet above please call 949-215-3777 between the hours of 8:00 am and 5:00 pm Pacific Time.

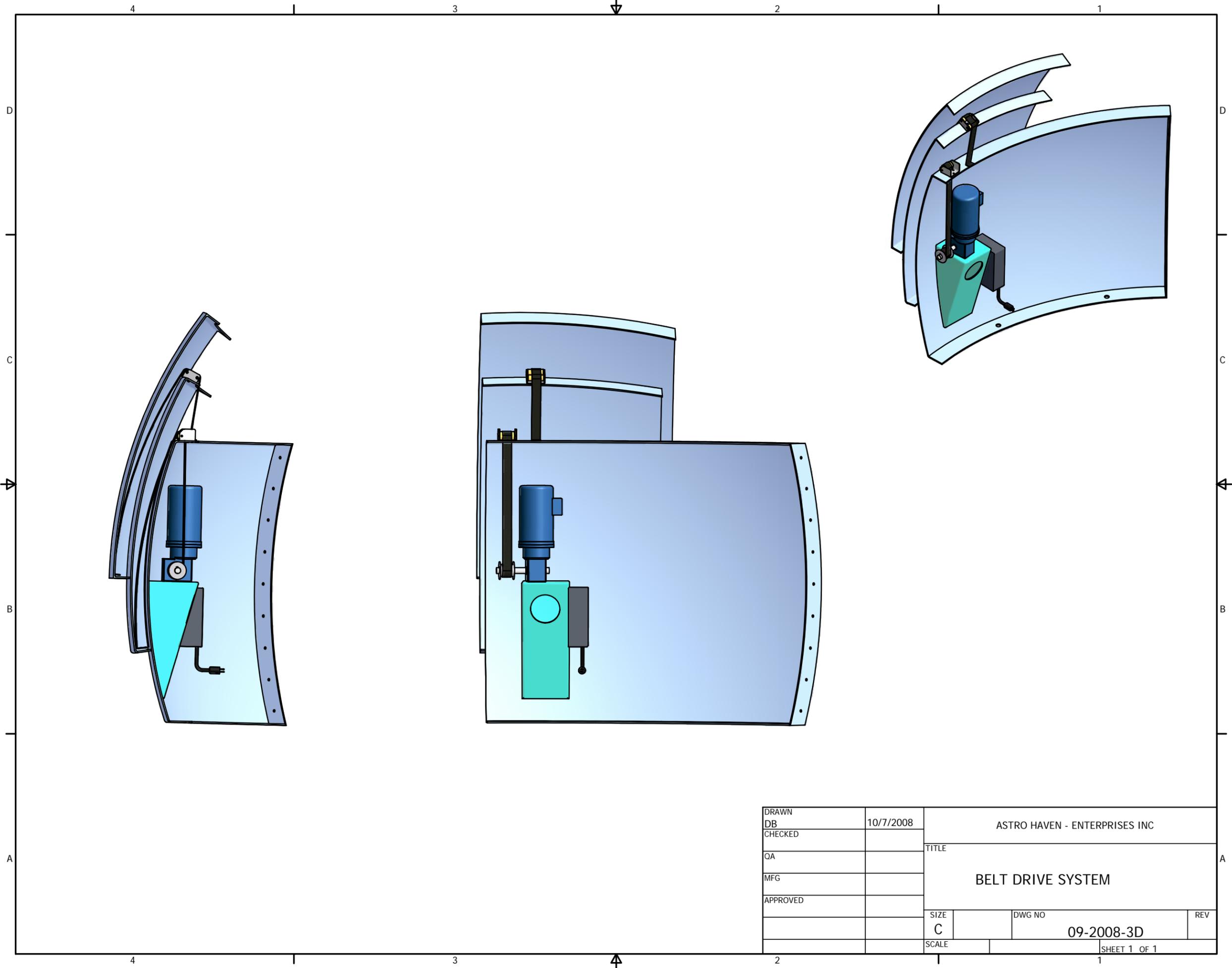
Appendix A
Dome Structural Data



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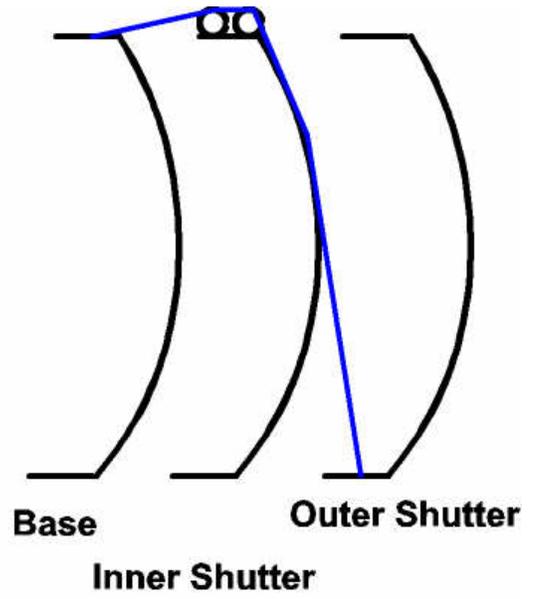
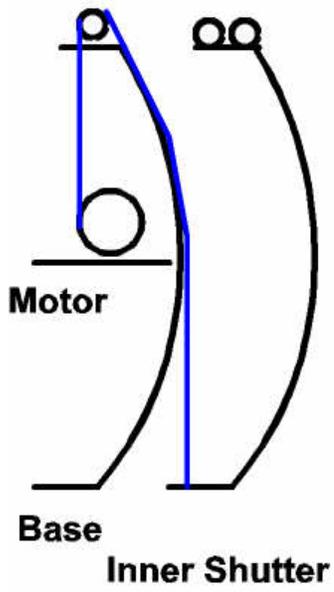
		UNLESS OTHERWISE SPECIFIED:	NAME	DATE	ASTRO HAVEN ENTERPRISES INC.	
		DIMENSIONS ARE IN INCHES	DRAWN		TITLE: 18FT DOME GENERAL ASSEMBLY	
		TOLERANCES:	CHECKED			
		FRACTIONAL ±	ENG APPR.			
		ANGULAR: MACH ± BEND ±	MFG APPR.			
		TWO PLACE DECIMAL ±	Q.A.		SIZE B	DWG. NO. 09-0001-3D-80
		THREE PLACE DECIMAL ±	COMMENTS:		REV	
		INTERPRET GEOMETRIC TOLERANCING PER:			SCALE: 1:100	WEIGHT:
		MATERIAL			SHEET 1 OF 1	
NEXT ASSY	USED ON	REV	FINISH			
APPLICATION		DO NOT SCALE DRAWING				

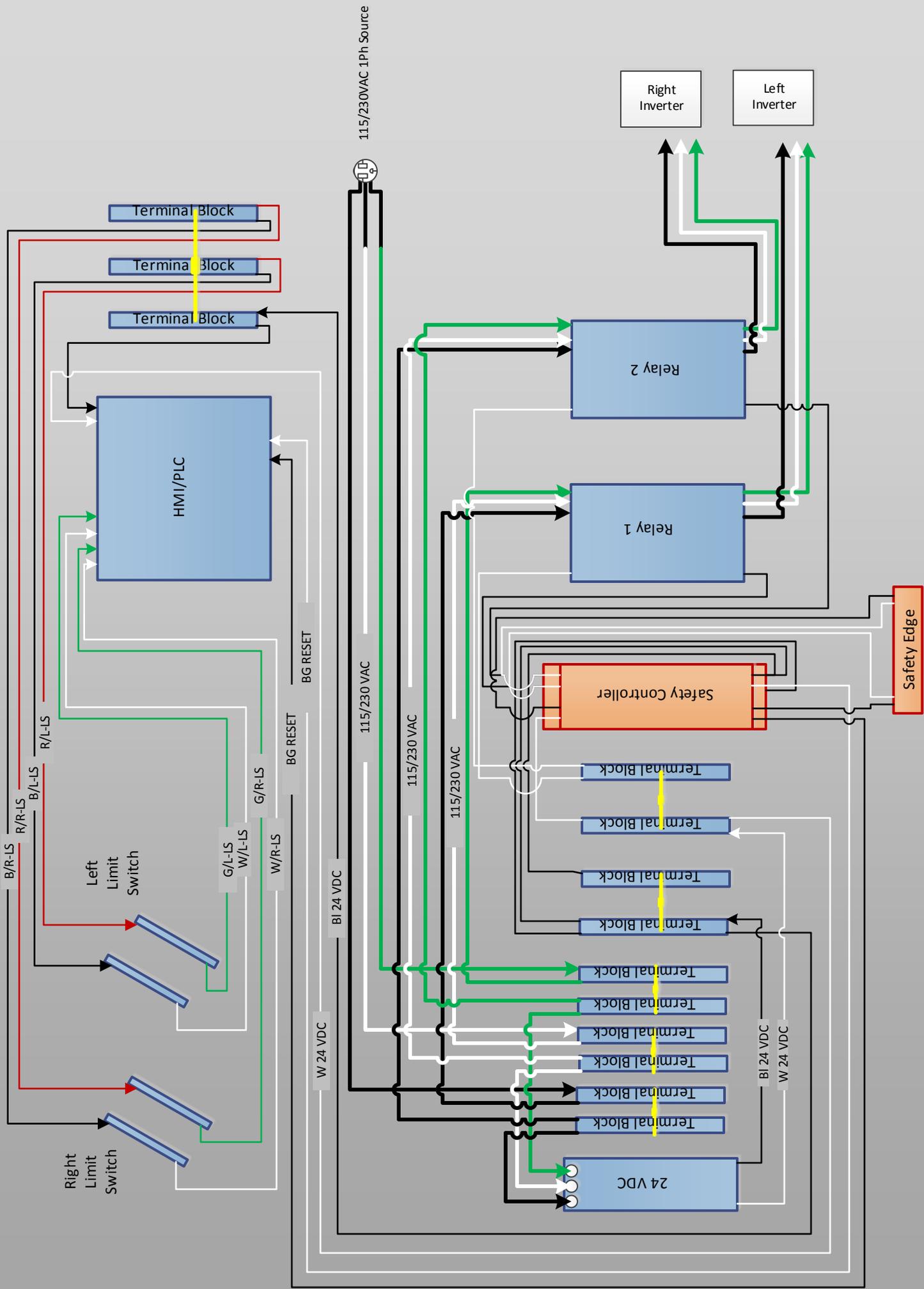
Appendix B
Dome System Data



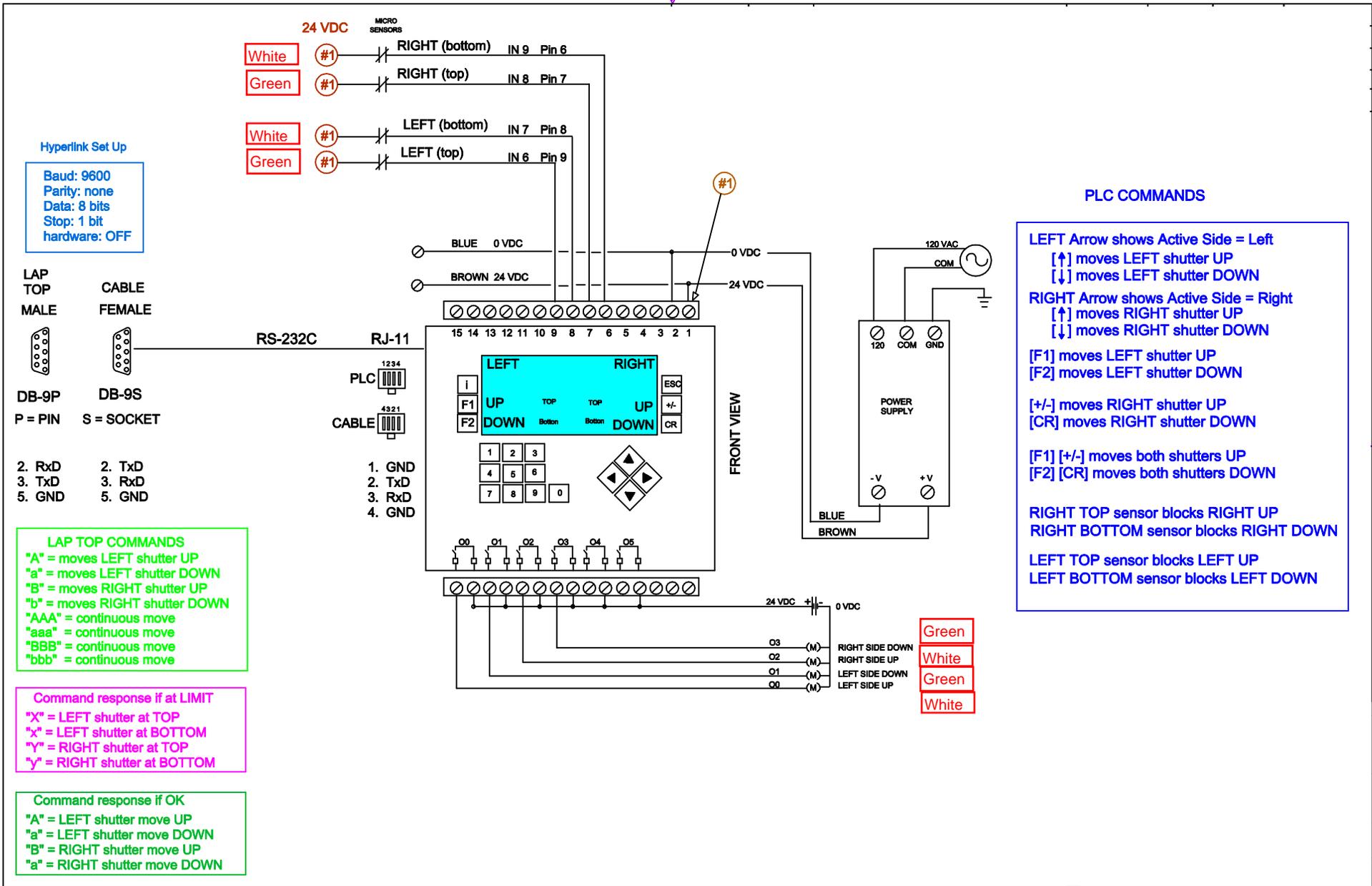
DRAWN	DB	10/7/2008	ASTRO HAVEN - ENTERPRISES INC	
CHECKED			TITLE	
QA			Belt Drive System	
MFG			DWG NO	
APPROVED			09-2008-3D	REV
			SCALE	SHEET 1 OF 1

Belt Attachment Schematic



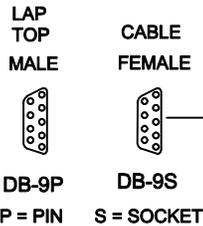


E-Relay 115/230VAC 1Ph 1Plug Safety Edge



Hyperlink Set Up

Baud: 9600
 Parity: none
 Data: 8 bits
 Stop: 1 bit
 hardware: OFF



- 2. RxD
- 3. TxD
- 5. GND
- 2. TxD
- 3. RxD
- 5. GND

LAP TOP COMMANDS
 "A" = moves LEFT shutter UP
 "a" = moves LEFT shutter DOWN
 "B" = moves RIGHT shutter UP
 "b" = moves RIGHT shutter DOWN
 "AAA" = continuous move
 "aaa" = continuous move
 "BBB" = continuous move
 "bbb" = continuous move

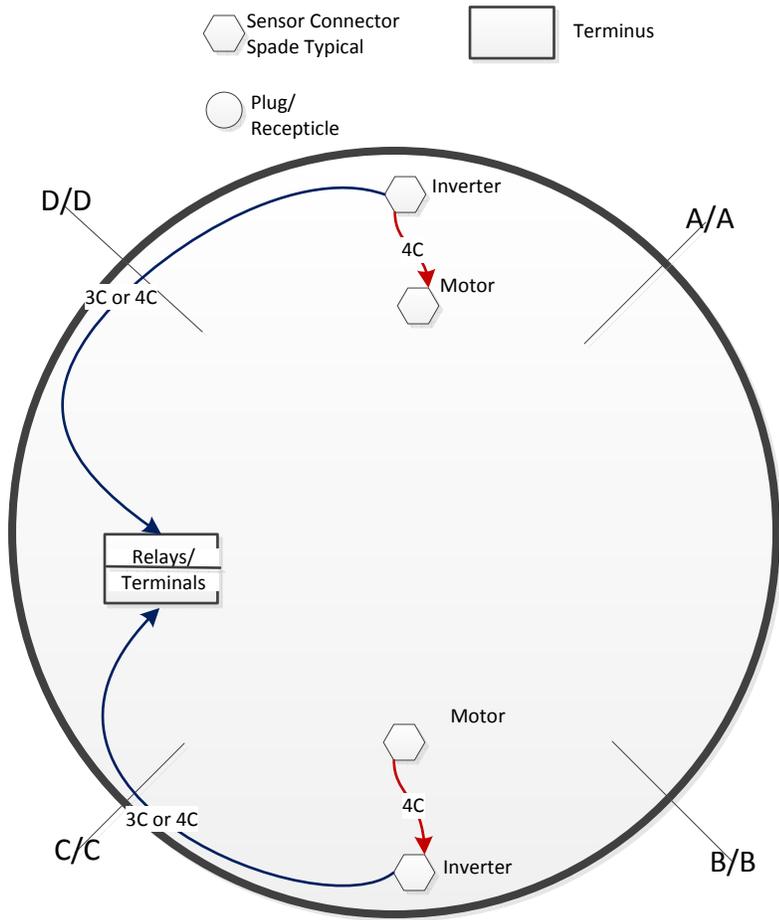
Command response if at LIMIT
 "X" = LEFT shutter at TOP
 "x" = LEFT shutter at BOTTOM
 "Y" = RIGHT shutter at TOP
 "y" = RIGHT shutter at BOTTOM

Command response if OK
 "A" = LEFT shutter move UP
 "a" = LEFT shutter move DOWN
 "B" = RIGHT shutter move UP
 "a" = RIGHT shutter move DOWN

PLC COMMANDS

LEFT Arrow shows Active Side = Left
 [↑] moves LEFT shutter UP
 [↓] moves LEFT shutter DOWN
 RIGHT Arrow shows Active Side = Right
 [↑] moves RIGHT shutter UP
 [↓] moves RIGHT shutter DOWN
 [F1] moves LEFT shutter UP
 [F2] moves LEFT shutter DOWN
 [+/-] moves RIGHT shutter UP
 [CR] moves RIGHT shutter DOWN
 [F1] [+/-] moves both shutters UP
 [F2] [CR] moves both shutters DOWN
 RIGHT TOP sensor blocks RIGHT UP
 RIGHT BOTTOM sensor blocks RIGHT DOWN
 LEFT TOP sensor blocks LEFT UP
 LEFT BOTTOM sensor blocks LEFT DOWN

- Green
- White
- Green
- White

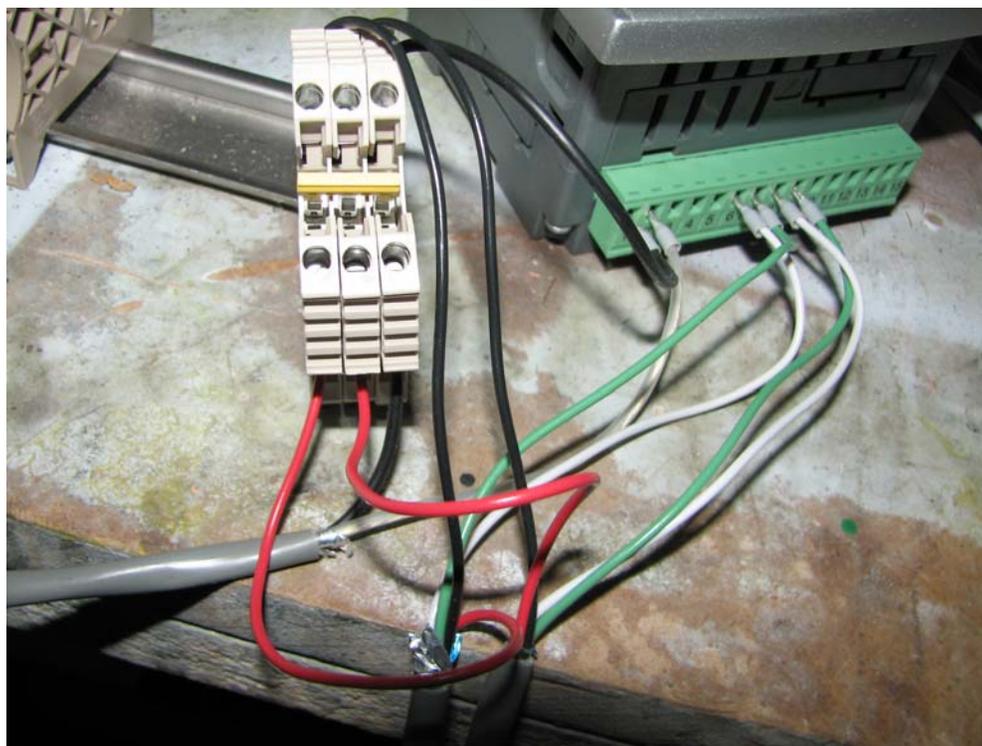


Power Conduit Runs

Electrical Schematics

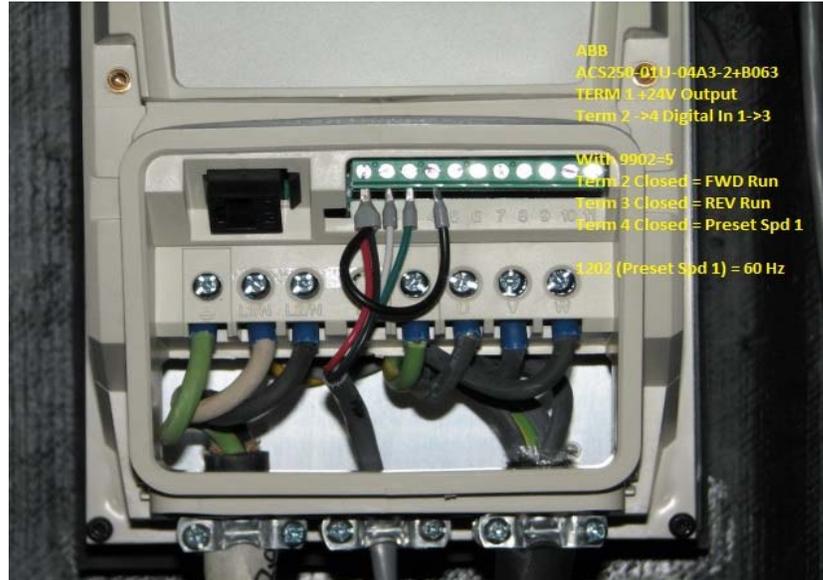


Example of System Components with Door Switch



PLC Power and Sensors

Inverter Subsystem



Mfg Name ABB
ACS250-01U-04A3-2+B063

Terminals	Description	Notes
Term 0	24 VDC+	
Term 1	Digital1 In; Closed FWD	
Term 2	Digital2 In; Closed REV	
Term 3	Digital3 In; Closed 60 Hz Spd	

Modified Parameters	Description	Setting	Default	Notes
9905	Rated Volts	230	✓	(used to be P-01)
9906	Rated Current	1.6 Right side	✗	Set to motor plate full load Amps (FLA) (used to be P-02)
9907	Rated Frequency	60 Hz	✓	(used to be -03)
9908	Rated Speed	0	✓	Displays Freq. (used to be P-04)
2008	Max Speed	60 Hz	✓	(used to be P-06)
1103	Start/Stop Source	0	✓	Keypad (used to be P-07)
9902	Input Configurations Table 8.2	5	✗	Jumper 1 and 4 for Preset Spd1 2: FWD, 3: REV (used to be P-08)
2102	Stop Mode	0	✓	Ramp (used to be P-09)
2202	Accel Time	1.0 sec	✗	(used to be P-10)
2203	Decel Time	0.5 sec	✗	(used to be P-11)
1202	Preset Spd 1	60 Hz	✗	See 9902 (used to be P-12)

1203	Preset Spd 2	0	✓	(used to be P-13)
1204	Preset Spd 3	0	✓	(used to be P-14)
1205	Preset Spd 4	0	✓	(used to be P-15)
1302	Spd Scaling	100%	✓	(used to be P-16)
1304	Analog Input Format	U0-10	✓	(used to be P-17)
2603	Voltage Boost	3.00%	✓	0 Freq. Voltage Increase if required (used to be P-18)