GRAINVUE™

Cable Monitoring System

Installation Manual

PNEG-2392

Version 1.0

Date: 05-25-23

PNEG-2392

Scan the QR Code to access the Cable Monitoring Hub user manual (PNEG-2407) or visit the below website.

GSI: http://www.grainsystems.com

Scan the QR Code to access the Fan Control Module user manual (PNEG-2394) or visit the below website.

GSI: http://www.grainsystems.com

All information, illustrations, photos, and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

Contents

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1 Safety Precautions

Topics Covered in this Chapter

- Safety Guidelines
- Incorrect Reading Hazard
- Product Usage
- Cautionary Symbol Definitions
- Safety Cautions
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- Safety Sign-off Sheet

Safety Guidelines

Safety guidelines are general-to-specific safety rules that must be followed at all times. This manual is written to help you understand safe operating procedures and problems that can be encountered by the operator and other personnel when using this equipment. Read and save these instructions.

As owner or operator, you are responsible for understanding the requirements, hazards, and precautions that exist and to inform others as required. Unqualified persons must stay out of the work area at all times.

Alterations must not be made to the equipment. Alterations can produce dangerous situations resulting in SERIOUS INJURY or DEATH.

This equipment must be installed in accordance with the current installation codes and applicable regulations, which must be carefully followed in all cases. Authorities having jurisdiction must be consulted before installations are made.

When necessary, you must consider the installation location relative to electrical, fuel and water utilities.

Personnel operating or working around equipment must read this manual. This manual must be delivered with equipment to its owner. Failure to read this manual and its safety instructions is a misuse of the equipment.

ST-0001–4

Incorrect Reading Hazard

HAZARD could be caused by incorrect reading

NOTICE

Warranty is void if this product is used in a manner not specified by the manufacturer. Every effort has been made to make sure that this manual is complete, accurate and up to date. The information contained in this manual is subject to change without notice.

Product Usage

Using the product according to your function

- A responsible body is an individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.
- Operators use the product for its intended function.
- Maintenance personnel perform routine procedures on the product to keep it operating properly. The maintenance personnel can work on high voltage only if they have the competencies as an electrician.
- Service personnel are trained to work on live circuits, perform safe installations and repair products. Only properly trained service personnel may perform installation and service procedures. (ie. electricians, service personnel employed by or active in an organization, business or service).

Cautionary Symbol Definitions

Cautionary symbols appear in this manual and on product decals. The symbols alert the user of potential safety hazards, prohibited activities and mandatory actions. To help you recognize this information, we use the symbols that are defined below.

Table 1-1 *Description of the different cautionary symbols*

Symbol	Description
	This symbol indicates an imminently hazardous situation which, if not avoided, **will result in serious injury or death.**
	This symbol indicates a potentially hazardous situation which, if not avoided, **can result in serious injury or death.**
	This symbol indicates a potentially hazardous situation which, if not avoided, **can result in minor or moderate injury.**
	This symbol is used to address practices not related to personal injury.
	This symbol indicates a general hazard.
	This symbol indicates a prohibited activity.
	This symbol indicates a mandatory action.

ST-0005–2

Safety Cautions

Use Personal Protective Equipment

- Use appropriate personal protective equipment:

Eye Protection

Respiratory Protection

Foot Protection

Hearing Protection

Head Protection

Fall Protection

Hand Protection

- Wear clothing appropriate to the job.
- Remove all jewelry.
- Tie long hair up and back.

ST-0004–1

Follow Safety Instructions

- Carefully read all safety messages in this manual and safety signs on your machine. Keep signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from the manufacturer.
- Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.
- If you do not understand any part of this manual or need assistance, contact your dealer.

ST-0002–1

Maintain Equipment and Work Area

- Understand service procedures before doing work. Keep area clean and dry.
- Never service equipment while it is operating. Keep hands, feet, and clothing away from moving parts.
- Keep your equipment in proper working condition. Replace worn or broken parts immediately.

ST-0003–1

Sharp Edge Hazard

- This product has sharp edges, which can cause serious injury.
- To avoid injury, handle sharp edges with caution and always use proper protective clothing and equipment.

ST-0036–2

Fall Hazard

- Ladders, stairways and platforms are for use by competent and trained personnel only. Do not allow children or other unauthorized persons to have access to the equipment.
- Access to the equipment must be restricted by the use of security fencing and lockable gates.
- Lower sections of ladders must be fitted with a lockable safety gate to prevent unauthorized access.
- Make sure that hot surfaces have had adequate time to cool before working on or in the equipment.
- Lock out and tag out power supplies and fuel supplies to all equipment.
- Do not attach lifting equipment to ladders or platforms.
- Do not go outside of the safety rails provided on elevated platforms.
- Do not work at heights during high winds, rain, snow, or ice storms.

ST-0056–1

Confined Space Hazards and Entry Procedures

- Note that the interior of this equipment is considered a confined space. Maintenance of this equipment can require access to the confined space.
- Access doors must be shut and locked except when access is required.
- Doors giving access to dangerous equipment must be safety interlocked.
- The following entry procedures must be followed:
  - — Be aware of all possible hazards present inside the confined space and wear personal protective equipment (PPE) as needed.
  - — Complete a permit to work and follow all permit required confined space entry procedures defined by the site manager.
  - — Make sure that the area has been purged of any hazardous products or gases. Check the atmosphere for harmful gases or vapors with a suitable gas analyzer and make sure levels are safe before entering.
  - — Do not smoke or use naked flames.
  - — Lock out and tag out power supplies and fuel supplies to all equipment.
  - — Do not work alone. Work in teams of at least three so that help is immediately available in the event of an emergency.
  - — Confirm that all personnel have safely exited the equipment and tools have been recovered once work is complete.

ST-0055–1

Install and Operate Electrical Equipment Properly

- Electrical controls must be installed by a qualified electrician and must meet the standards set by applicable local codes (National Electrical Code for the US, Canadian Electric Code, or EN60204 along with applicable European Directives for Europe).
- Lock-out power source before making adjustments, cleaning, or maintaining equipment.
- Make sure all equipment and bins are properly grounded.

ST-0075–1

Do Not Enter Bin

- Rotating flighting will kill or dismember.
- Flowing material will trap and suffocate.
- Crusted material will collapse and suffocate.

— If you must enter the bin:

1. Shut off and lock out all power sources.
2. Use a safety harness and safety line.
3. Station another person outside the bin.
4. Avoid the center of the bin.
5. Wear proper breathing equipment or respirator.

ST-0061–1

Fan Starts and Stops Automatically

- Fan is equipped with a remote start feature. Fan can start at any time.
- Fan is supplied by multiple power sources. Lock out all power sources before servicing.
- Moving fan parts can crush and cut. Do not operate fan with guarding removed.
- Debris may exit fan at start-up and during operation. Wear proper PPE.

ST-0098–1

Safety Decals

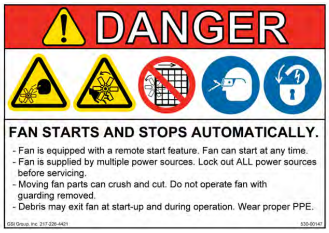
The safety decals on your equipment are safety indicators which must be carefully read and understood by all personnel involved in the installation, operation, service and maintenance of the equipment.

To replace a damaged of missing decal, contact us to receive a free replacement.

GSI Decals

1004 E. Illinois Street
Assumption, IL 62510
Phone: 1–217–226–4421

Location	Decal No.	Decal	Description
Located next to aeration system.	DC-969		Caution Vacuum Pressure
On bin doors and roof hatch covers	DC-2483		Warning Entrapment Hazard

Location	Decal No.	Decal	Description
On bin door covers	DC-GBC-1A		Warning Keep Clear of Augers
On bin door covers	DC-GBC-2A		Warning Unload Instructions
Fan Control	530-00147		Danger Fan Safety Text

Safety Sign-off Sheet

Below is a sign-off sheet that can be used to verify that all personnel have read and understood the safety instructions. This sign-off sheet is provided for your convenience and personal record keeping.

Date	Employee Name	Supervisor Name

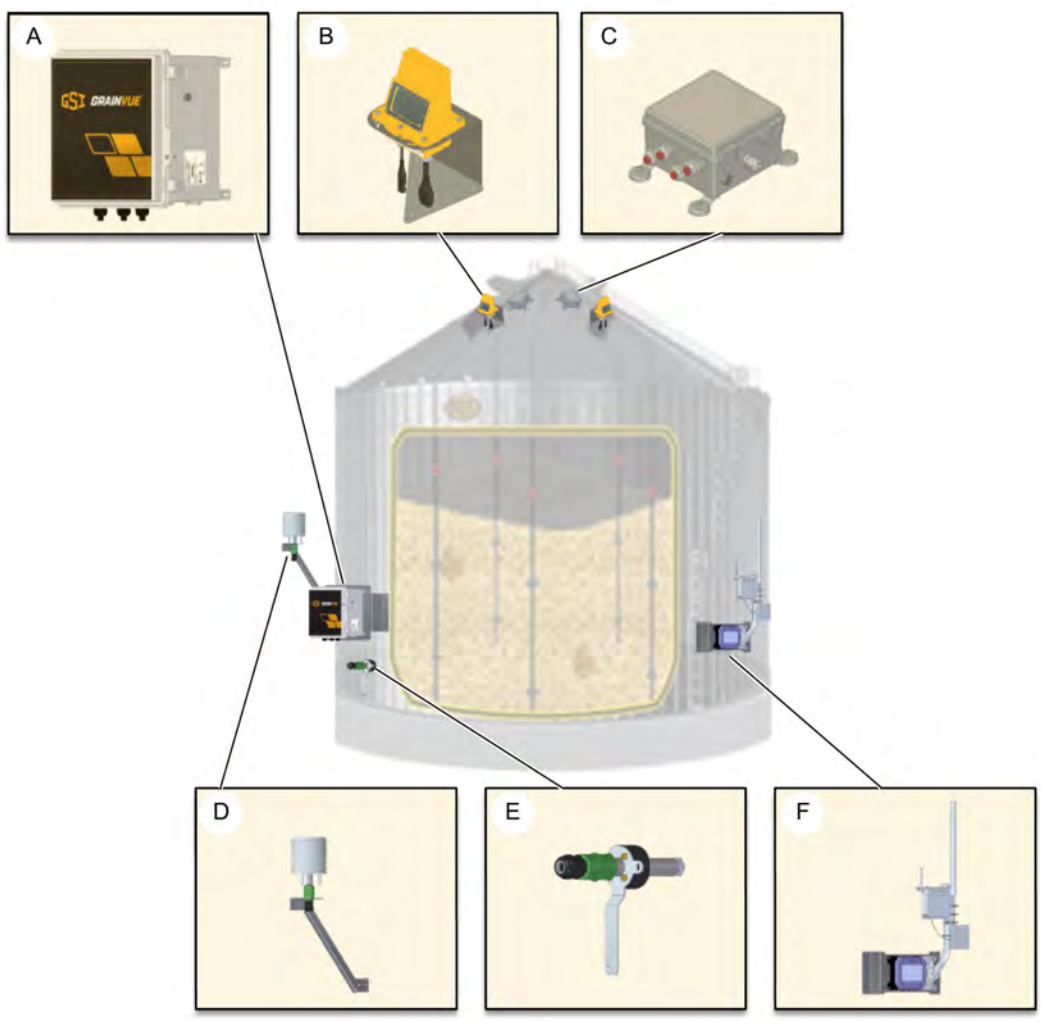
ST-0007

NOTES

2 System Overview and Commissioning

There are touch points required to make sure GrainVue installations are completed quickly, successfully and to connect new customers with their GrainVue portal access. Please review the details below, before hardware installation to know what will be required before, during and at installation completion. Please refer to the installation manual provided with the GrainVue system for all other installation and hardware details.

Figure 2-1 *GrainVue system overview*



A	Fan Control Module (FCM)	D	Weather Station
B	GrainVue Hub	E	Plenum Sensor
C	Mux Box	F	Gateway

Before Installation

*Provide the following to our support staff to make sure we are able to provide assistance and customer portal access immediately after installation.

1. Estimated time and date of the install.
2. Site Name and Name of the bins.
3. Customer Details: Name, Address, Phone Number and E-mail.

During the Installation

Provide the following information during the installation to *GrainVue Support. Utilize the spreadsheet in *Appendix-C: Cable Connection Ports, page 88* of this manual to capture the information below.

1. Gateway's serial number (found on the back of the gateway).

   NOTE: *Provide this while unpacking the shipment if possible.*

Figure 2-2 *Gateway's serial number*

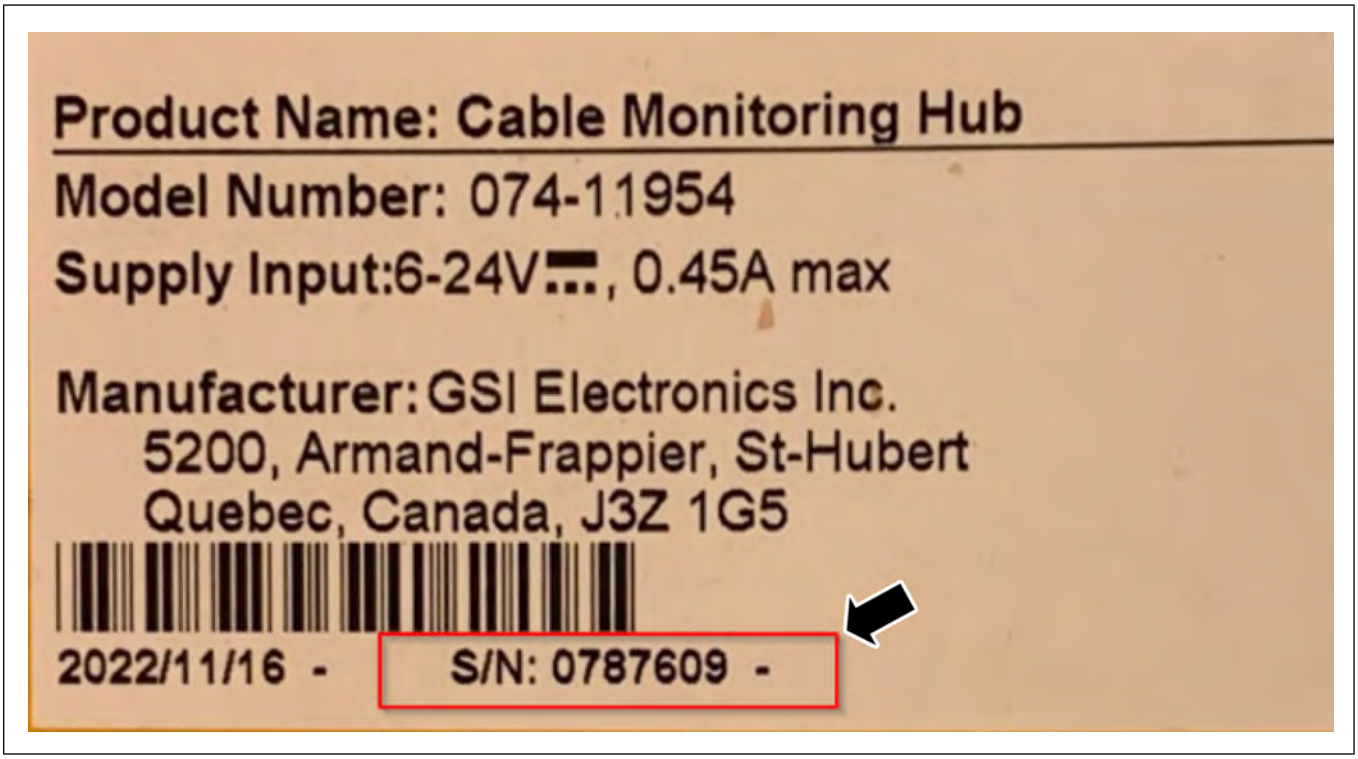
2. Make sure the GrainVue Gateway has been installed and powered on before the installation of GrainVue Hubs.

   NOTE: *This will allow the newly installed GrainVue Hubs to immediately connect once powered ON.*

3. GrainVue Hub serial numbers and their assigned bin name (refer to *Figure 2-3, page 17* to identify the serial number).

   NOTE: *Provide this while unpacking the shipment if possible.*

Figure 2-3 *GrainVue Hub's serial number*



4. The fans and heaters (per bin) and the output relay they are wired to (if Fan Control Modules are part of the installation).
5. Cable Positions on the bin and their associate port on the Mux Box.

NOTE: *Follow the cable layout drawing provided within the quote for cable placement.*

Installation Completion

Contact GrainVue support after installation (while still on site) for final confirmation that the setup has been completed successfully. We will confirm the following.

1. Cable readings (from all cables).
2. Plenum and outdoor readings.
3. $C0_2$ reading (if part of installation).
4. Fan Control (if part of installation).

*Support Contact Information

Primary Contact: Nikolai Santos
Phone: (217) 226-4421 or (306) 490-2446
E-mail: grainvuesupport@agcocorp.com

NOTE: *Support staff are available between Monday - Friday, 8 am - 5 pm CST. Installations can be done outside of support staff hours, however commissioning confirmation and customer portal user setup will occur during regular support staff hours.*

NOTES

3 Gateway Installation

Topics Covered in this Chapter

- Gateway Installation - Overview
- Installing the Gateway Mounting Bracket Kit
- Installing the Power Supply Unit (PSU)
- Installing the Gateway
- Wire Termination

Gateway Installation - Overview

The GrainVue outdoor communications gateway system comes with a pre-built and mounted MikroTik LtAP unit. Throughout this section, various antennas will need to be installed and connected to this base unit. A Gateway Power Supply Unit (PSU) is also provided to supply power remotely to the gateway over standard, shielded category 5e data cable.

A mounting bracket kit comes included with the system to allow the PSU and gateway to be mounted together. The maximum distance for gateway communications in a typical environment, with a clear line of sight, should be no more than 6500' or 2000 m. If you have any questions on equipment placement, please reach out to a GSI representative.

Installing the Gateway Mounting Bracket Kit

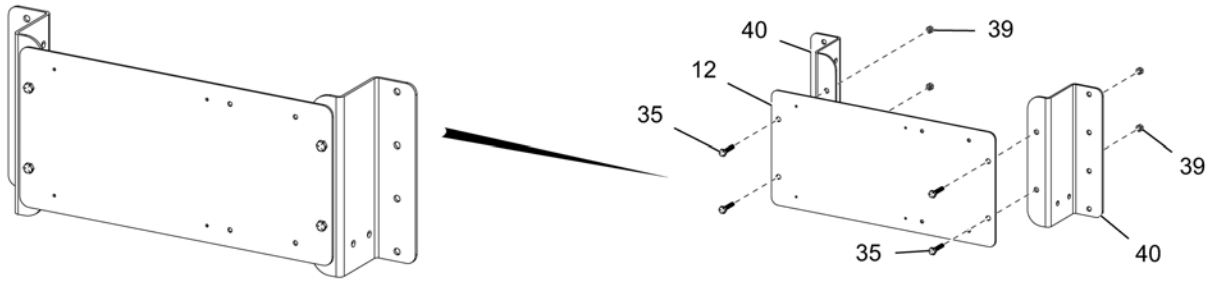
Typical installation location for this bracket is on the side of the bin but can be on any other structure that is centrally located to communicate with the Cable Monitoring Hub(s) if needed. It will need to be located near an AC power source or if you have a Fan Control Module with your GrainVue system, it can be mounted next to that. Mount the bracket assembly at eye level for easy installation and service.

NOTE: *Do not mount the gateway mounting assembly in a location that would allow the gateway and antennas to hit obstructions.*

1. Fasten the two Z-brackets (40) to the gateway mounting plate (12) using the provided 5/16" x 1" HHCS bolts (35) and 5/16" flange nuts (39).

   NOTE: *GVG-MOUNT-KIT is the kit part number for Z-brackets (40), plate (12) and hardware.*

Figure 3-1 *Assembling the Z-brackets to the mounting plate*



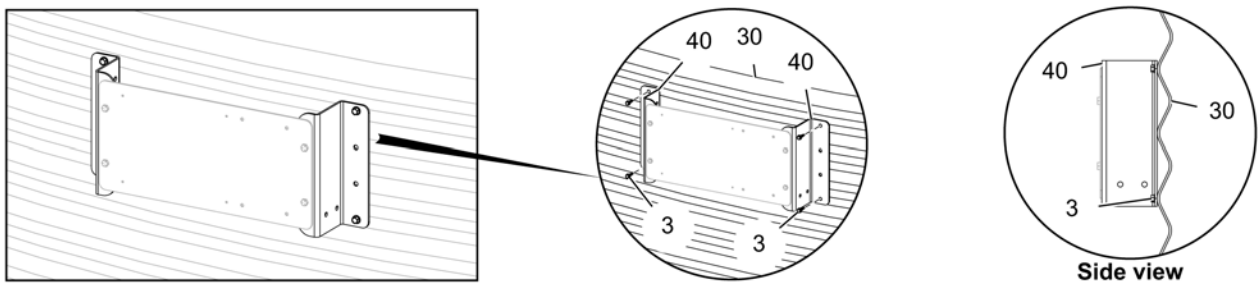
12	Gateway mounting plate (GVG-MOUNT)	39	5/16" flange nut (S-3611)
35	5/16" x 1" HHCS bolt (S-1196)	40	Z-bracket (GV-Z-BRACKET)

2. Once the appropriate location has been chosen on the bin, level the bracket assembly and line up the holes in the Z-brackets (40) with the peaks of the corrugation of the sidewall (30) and use the supplied 1/4" x 1" self-drilling screws (3) to fasten the assembly to the sidewall (30).

   NOTE: *If the bin is empty and bolting the assembly to the sidewall (30) is desired, drill 5/16" holes in the bin wall through the Z-bracket (40) holes and mount with the correct hardware.*

   NOTE: *If mounting on a concrete pad, level the gateway mounting bracket kit at eye level and mark the four holes on the concrete. Drill out the four holes and use a #10 anchor and screw to fasten the gateway mounting bracket kit to the concrete.*

Figure 3-2 *Installing the Z-brackets to the bin sidewall*



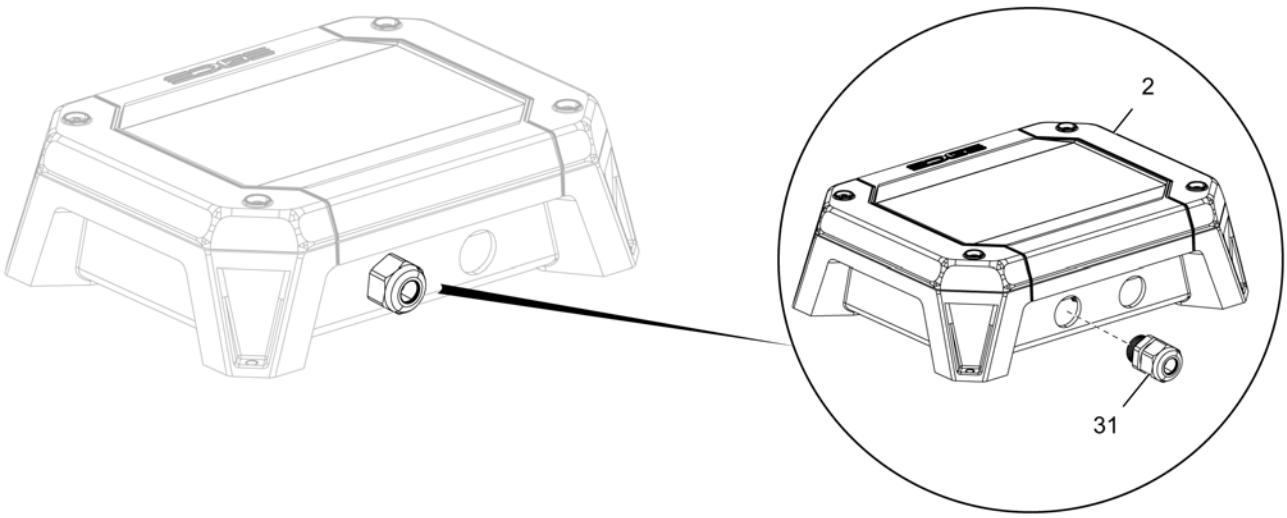
3	1/4" x 1" self-drilling screw (S-7229)	40	Z-bracket (GV-Z-BRACKET)
30	Sidewall		

Installing the Power Supply Unit (PSU)

1. Fasten one cable gland (31) into the left pre-drilled hole in the Gateway PSU (2) enclosure.

   NOTE: *The cable gland (31) can be found packaged inside the enclosure.*

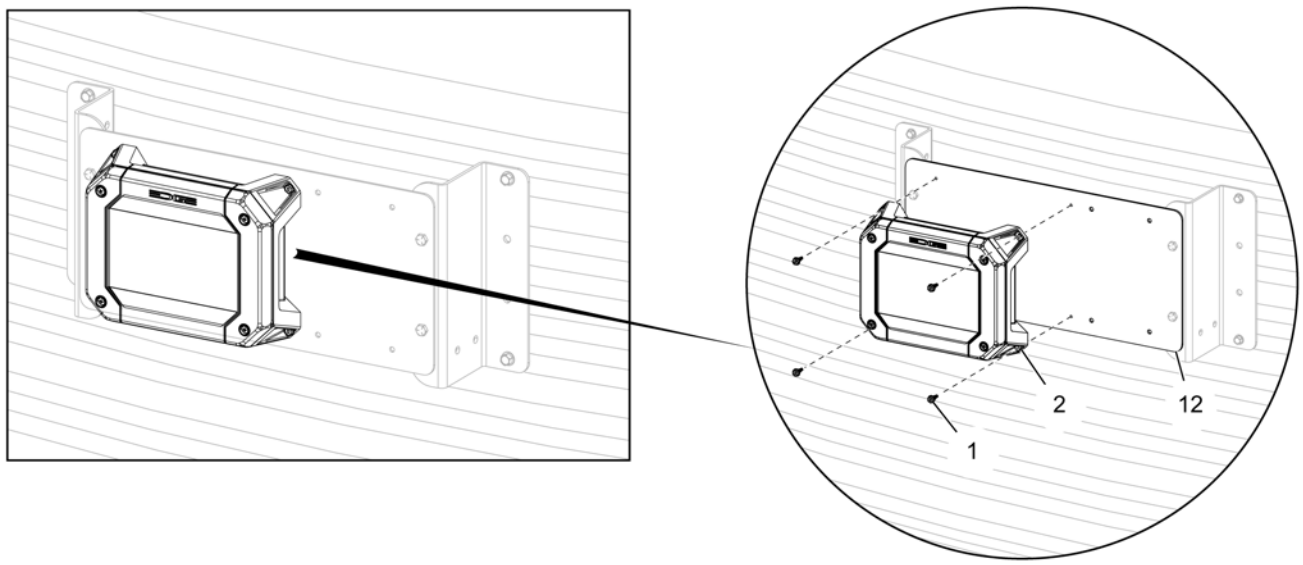
Figure 3-3 *Installing the cable gland to the Gateway PSU enclosure*



2	Gateway PSU	31	Cable gland

2. Mount the Gateway PSU (2) to the gateway mounting plate (12) with the supplied #10-16 x 5/8" self-drilling screws (1), drilling into the four matched pre-drilled pilot holes.

Figure 3-4 *Mounting the Gateway PSU to the gateway mounting plate*

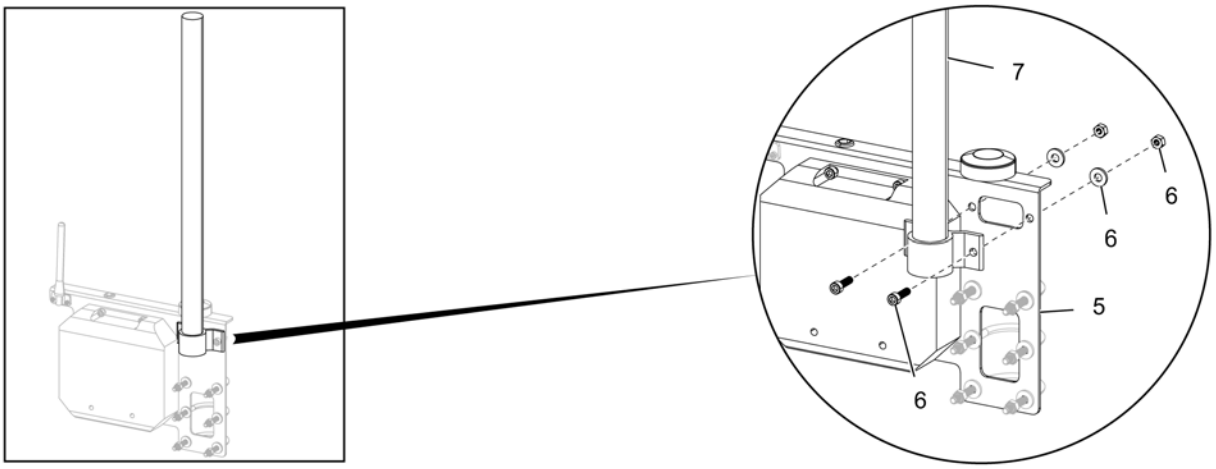


1	#10-16 x 5/8" self-drilling screw (S-280)	12	Gateway mounting plate (GVG-MOUNT)
2	Gateway PSU		

Installing the Gateway

1. Install the LoRa antenna kit (7) onto the gateway top bracket (5) using the two pre-installed bolt, washer and nut sets (6).

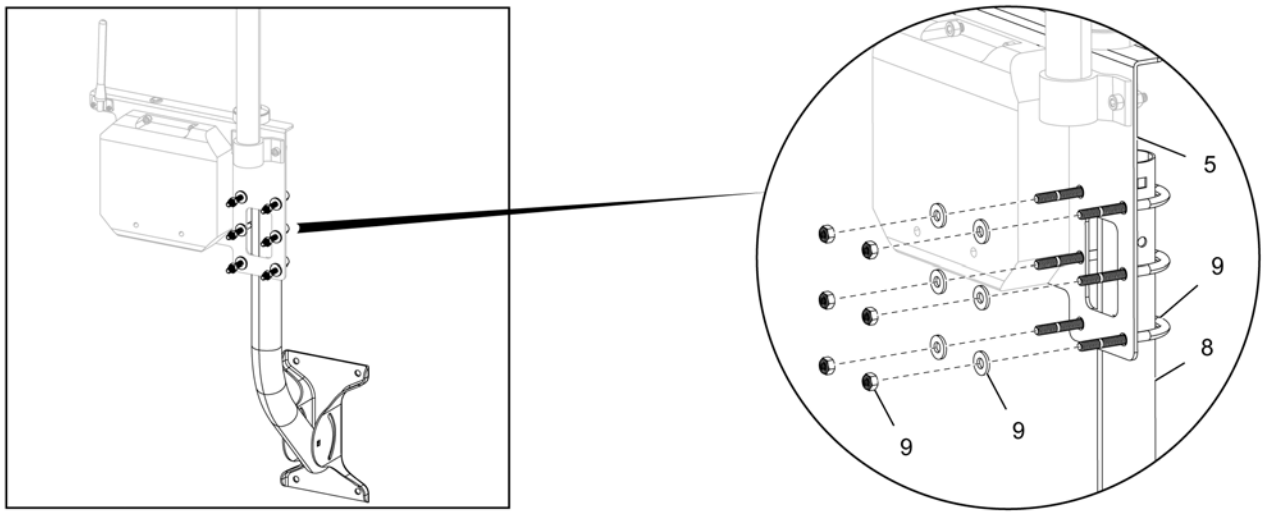
Figure 3-5 *Installing the LoRa antenna kit*



5	Gateway top bracket	7	LoRa antenna
6	Bolt, washer and nut set		

2. Install the ubiquiti pole (8) onto the gateway top bracket (5) using the three pre-installed U-bolt sets (9).

Figure 3-6 *Installing the ubiquiti pole*

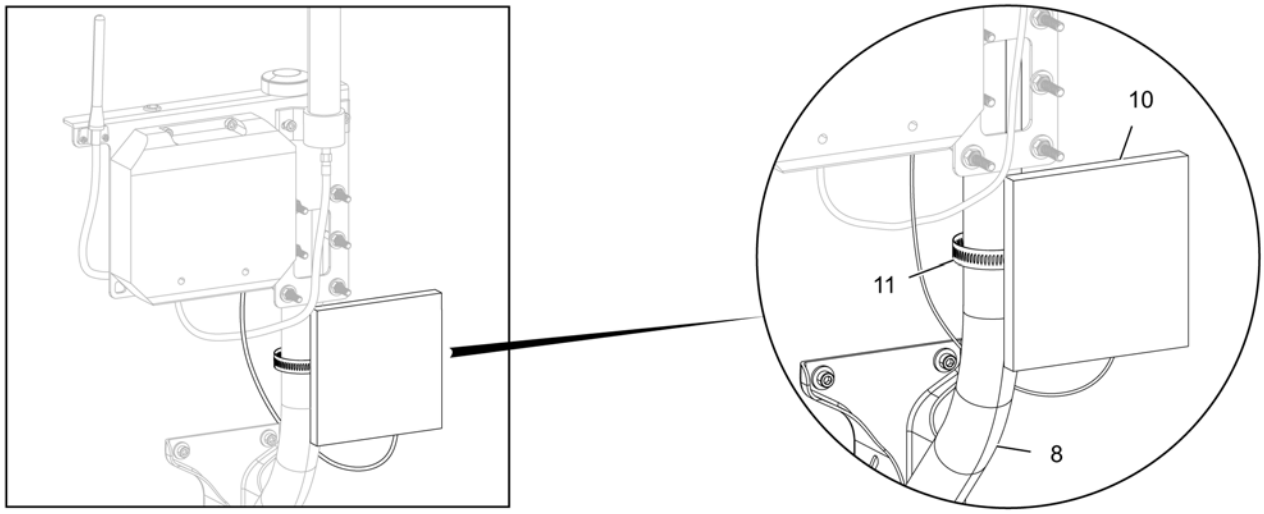


5	Gateway top bracket	9	U-bolt set
8	Ubiquiti pole		

3. Install the cell communication antenna.

   NOTE: *Install the LTE omnidirectional cell antenna (10) onto the ubiquiti pole (8) using the pre-installed gear clamp (11).*

Figure 3-7 *Installing the LTE cell antenna*

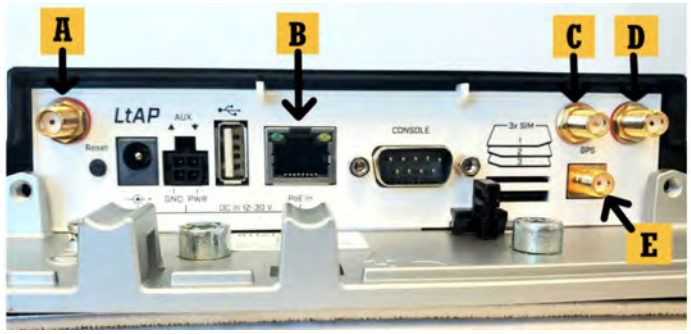


8	Ubiquiti pole	11	Gear clamp
10	LTE omnidirectional cell antenna		

4. Remove the bottom access door of the gateway and connect all installed antennas according to the key below.

   - PORT A <—> LoRa Antenna: Use the provided LoRa transmission line for connection
   - PORT B <—> Provided Ethernet cable to PSU: Connection will be done after all components are mounted on the Gateway mounting plate
   - PORT C <—> Wifi Antenna: Connected prior to shipping or not used
   - PORT D <—> LTE Omnidirectional Antenna: Use the provided SMA Male to SMA Male cable for connection
   - PORT E <—> Active GPS Antenna: Connected prior to shipping

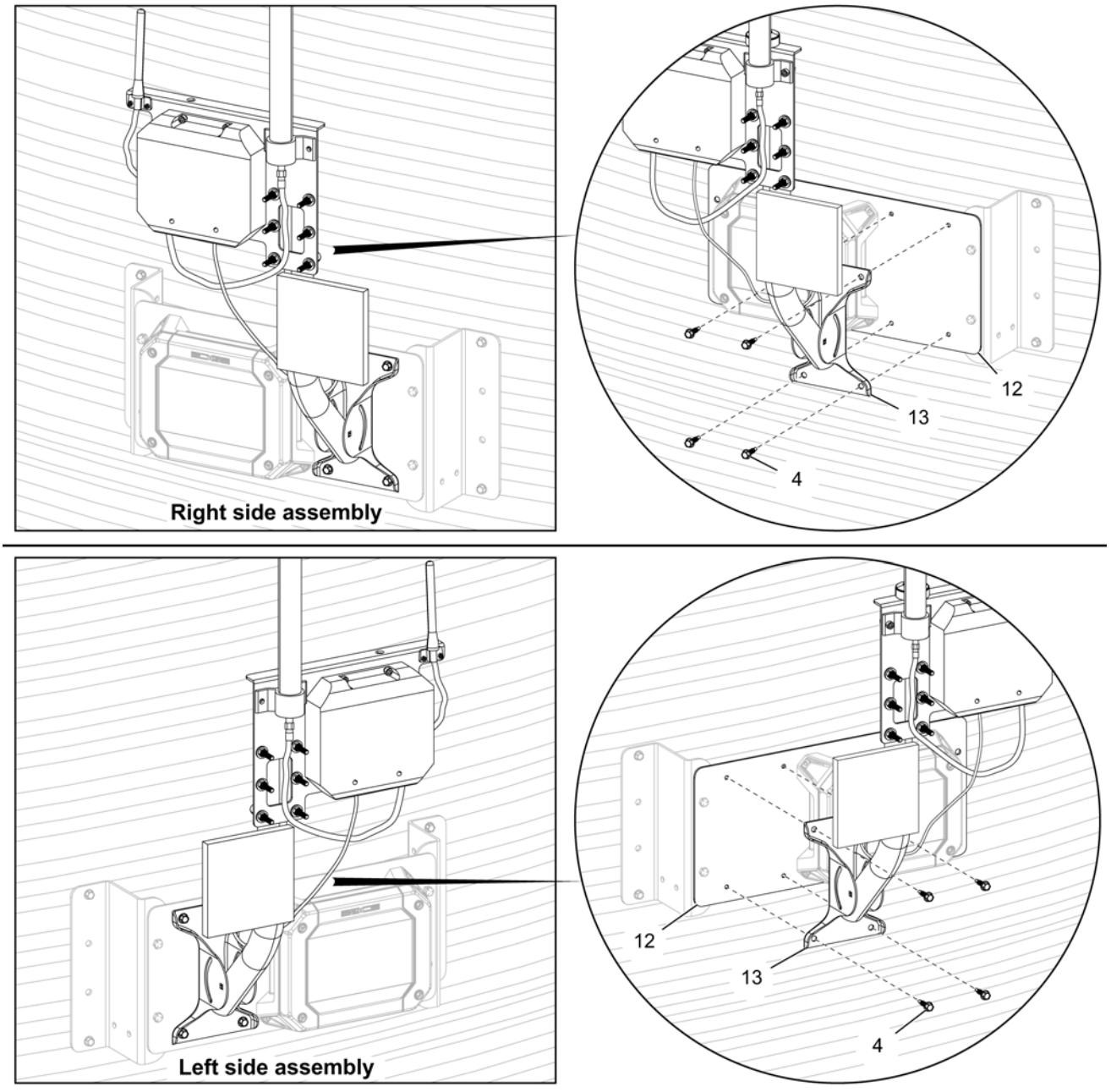
Figure 3-8 *Gateway port layout*



5. Mount the gateway bracket assembly (13) to the gateway mounting plate (12) with the supplied 1/4" x 3/4" self-drilling screws (4), drilling into the four matched pre-drilled pilot holes.

NOTE: *The gateway bracket assembly (13) can be mounted either to the left side or the right side of the gateway mounting plate (12), depending on the location of the Gateway PSU.*

Figure 3-9 *Gateway bracket assembly mounting positions*



4	1/4" x 3/4" self-drilling screw (S-6497)	13	Gateway bracket assembly
12	Gateway mounting plate (GVG-MOUNT)		

Wire Termination

WARNING

Only a certified electrician can complete the power supply installation. Make sure all power sources are disconnected before performing any maintenance or service. Always follow all national and local electrical and safety regulation for your area.

1. Connect the supplied ethernet cable (14) to the Gateway PoE port (Port B) using the pre-terminated ethernet connector. Route the cable (14) cleanly to the Gateway PSU (2) and through the cable gland (31) that was installed and cut the ethernet cable (14) to length. Tighten the cord grip down to secure the ethernet cable (14) and strip the outer jacket of the cable 2" to 3" (55-75 mm) and remove. Isolate the blue and blue/white, brown and brown/white wires and cut the remaining wires flush with the outer jacket. Strip each end of the four wires approximately 3/8" and twist the blue and blue/white wires together. Twist the brown and brown/white wires together and use the wiring diagram below to terminate the two groups.

Figure 3-10 *Gateway PSU PCBA terminal blocks*

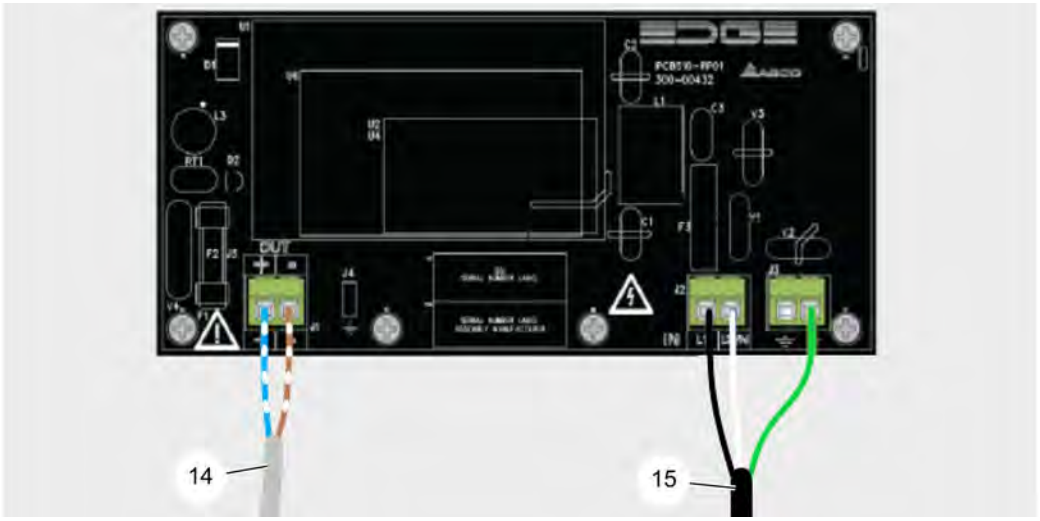


Table 3-1 *Ethernet cable and power cable mapping details*

Ethernet Cable (14)	Blue/White + Blue	+
	Brown/White + Brown	-
Power Cable (15)	Black	L1
	White	N
	Green	Ground

NOTE: *Secure the cable (14) with zip ties as needed to the gateway support.*

2. Install an outdoor rated conduit fitting into the right pre-drilled hole on the Gateway PSU (2) enclosure and supply a 120 VAC power source with #14-12 AWG wire to the Gateway PSU (2). Connect the power source to a circuit protected 15 Amp breaker. Refer to *Figure 3-10, page 25* and *Table 3-1, page 25* for correct termination.

NOTE: *If your GrainVue system has a Fan Control Module, you may power the Gateway PSU (2) from the bottom side of the line breaker, neutral and ground terminals inside the Fan Control Module. This will allow your complete system to be powered from one breaker and can be all shut down with one breaker if needed.*

NOTES

4 Installing the Roof Bracket Temperature Cables

Topics Covered in this Chapter

- Cable Installation - Overview
- Installing the Center Cable
- Installing the Radius Cable(s)

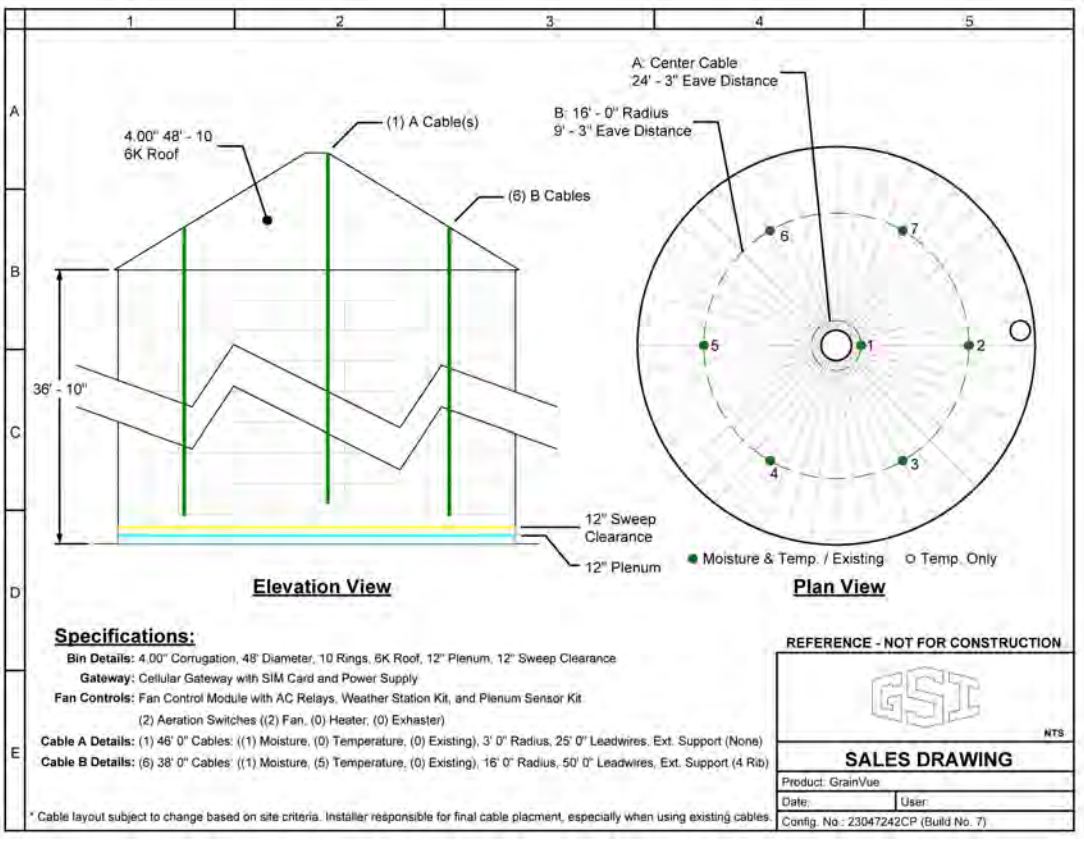
Cable Installation - Overview

When installing the moisture and/or temperature cable(s) in the bin, refer to the sales drawing that was provided at the time of quoting to reference exact cable placement. The drawing should look similar to the one below.

A few things to avoid when placing the cables on the roof:

- Do not install a peak cable where it will come under additional force from the angle of grain flow from a portable auger.
- Do not install the sensor cable or any other monitoring equipment at a location that will be impacted by the bin roof cap when opened.
- Do not install a perimeter cable on a roof sheet that contains an access hatch (often the sheet to the right of the roof ladder).
- Do not install a perimeter cable and a peak cable on the same sheet.

Figure 4-1 *Cable layout sales drawing (example only)*



WARNING

Extreme care and caution must be used when climbing up a bin. Make sure to use approved safety procedures and materials such as ladders and a safety harness. When working above 4', wear a safety harness or personal protective equipment. An approved tool belt must be worn to keep both hands free when climbing up and down a ladder. Refer to the bin manual for additional safety information.

Recommended Cable Arrangement

All radius measurements below are horizontal measurements from the center of the bin. All eave distance measurements are calculated with the angle of the roof from the eave of the bin to the cable placement. All cable numbering for each radius uses the roof manhole as reference in a clockwise pattern and should be the order in which cables are hung, terminated and labeled.

Table 4-1 *Cable arrangement - Less than 24' and 24'*

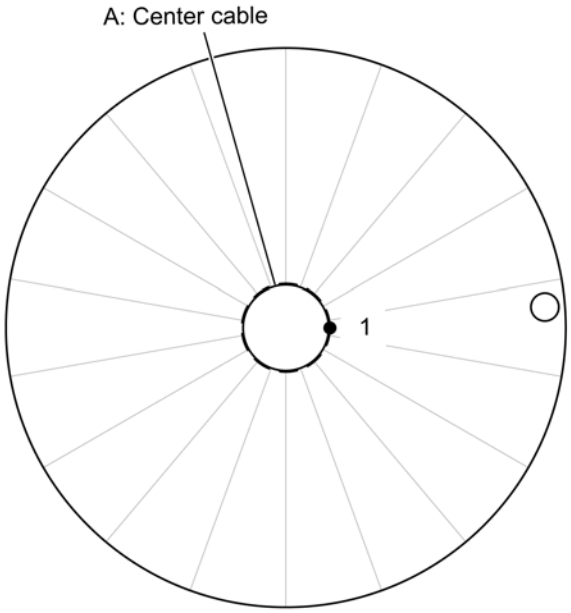
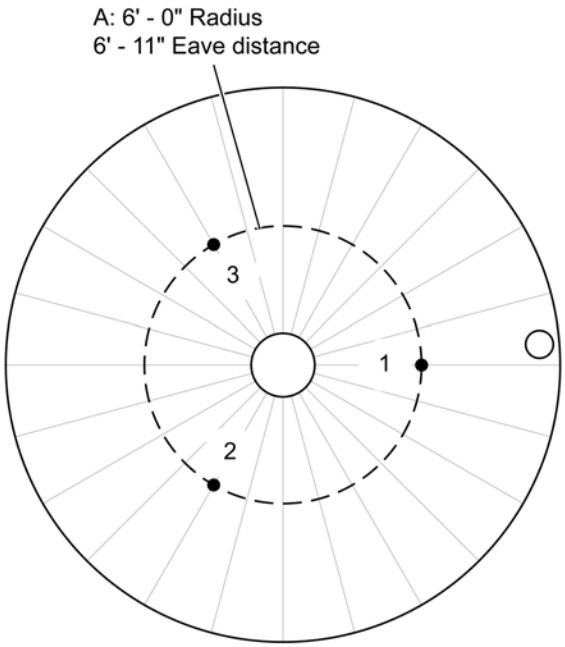
Bin Diameter	Less than 24'	24'
Cable Position Arrangement		

Table 4-2 *Cable arrangement - 27' and 30'*

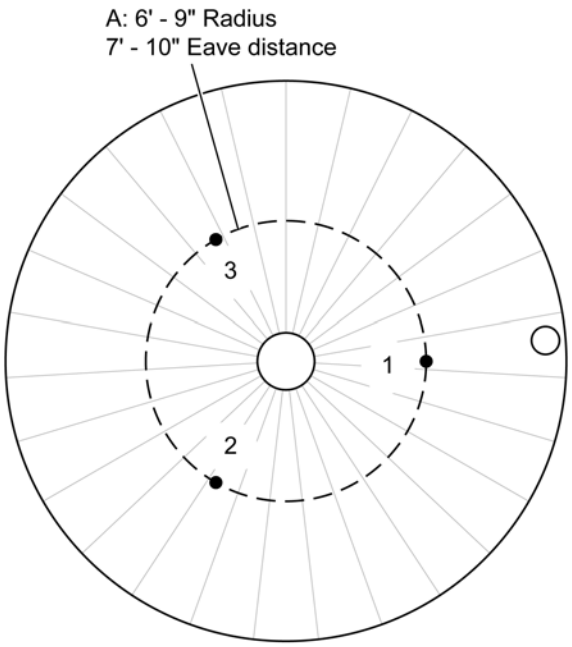
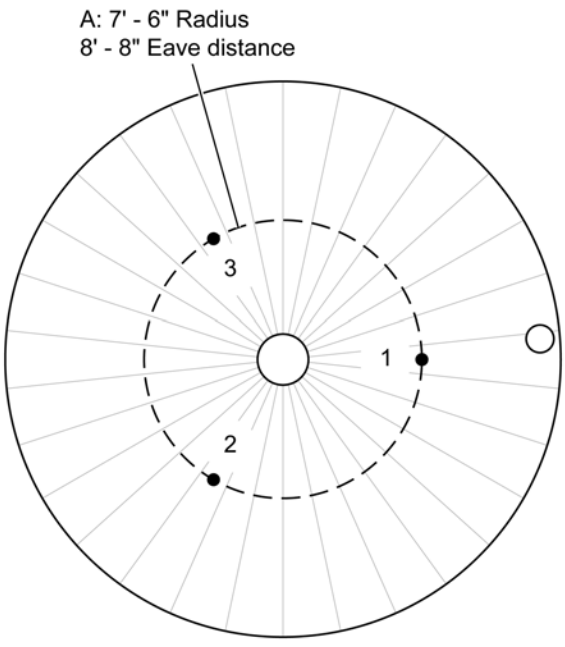
Bin Diameter	27'	30'
Cable Position Arrangement		

Table 4-3 *Cable arrangement - 33' and 36'*

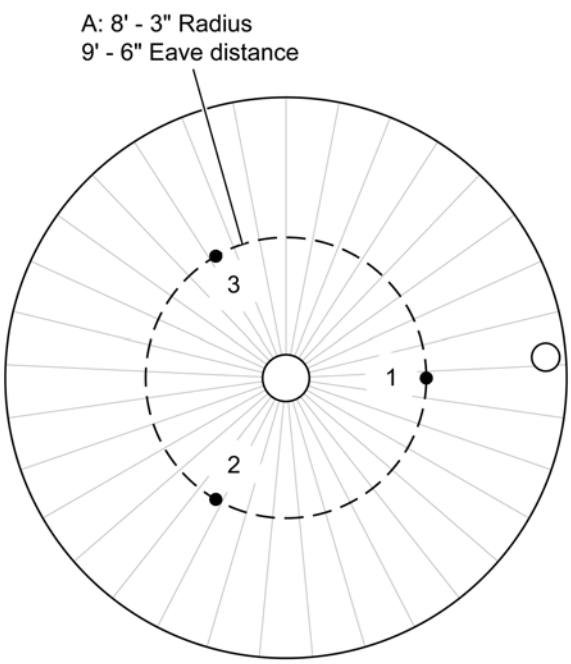
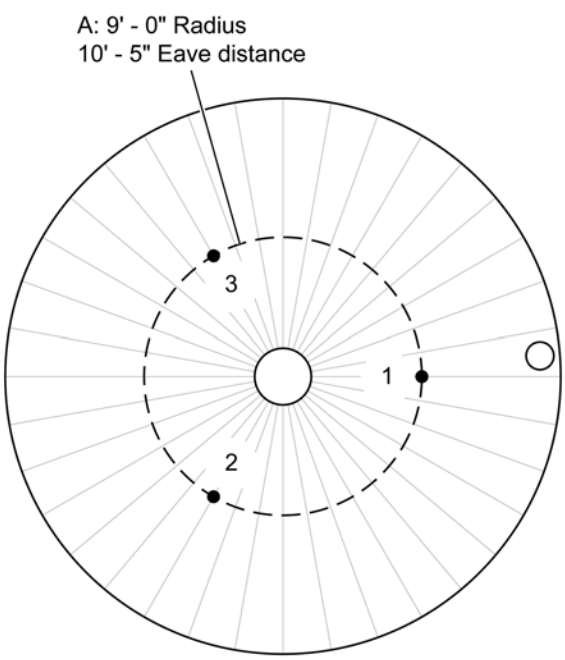
Bin Diameter	33'	36'
Cable Position Arrangement		

Table 4-4 *Cable arrangement - 42' and 48'*

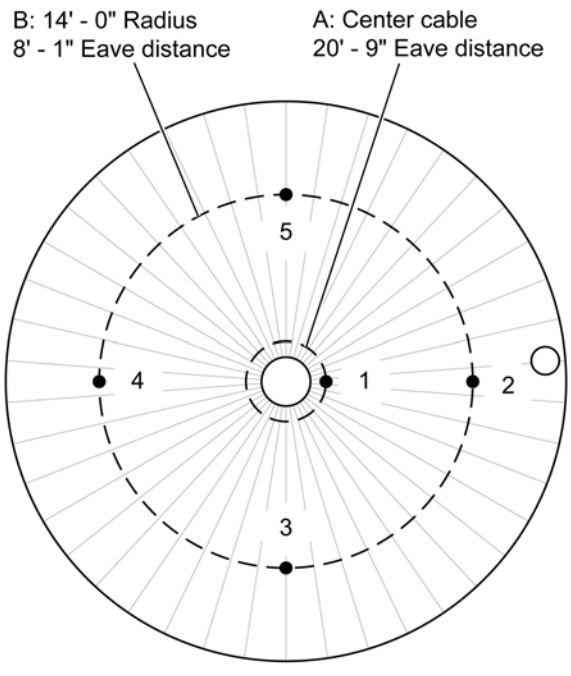
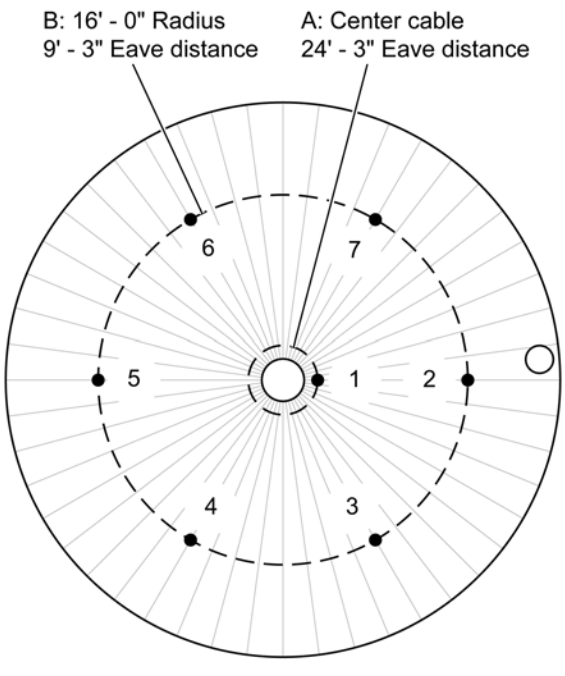
Bin Diameter	42'	48'
Cable Position Arrangement		

Table 4-5 *Cable arrangement - 54' and 60'*

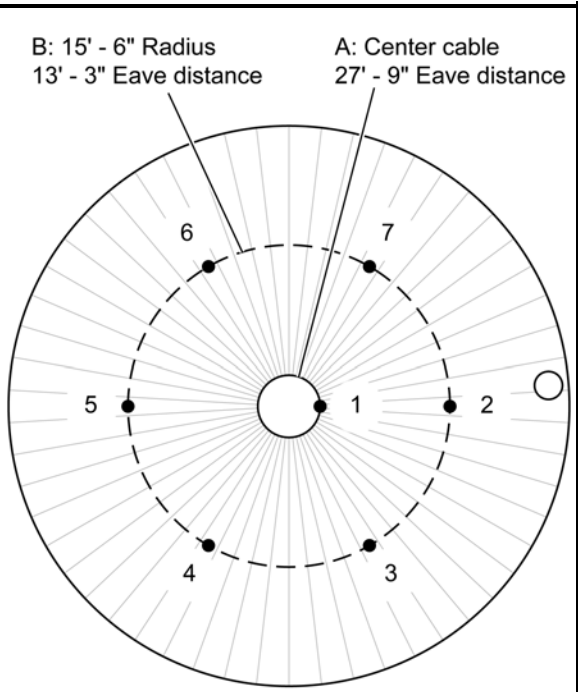
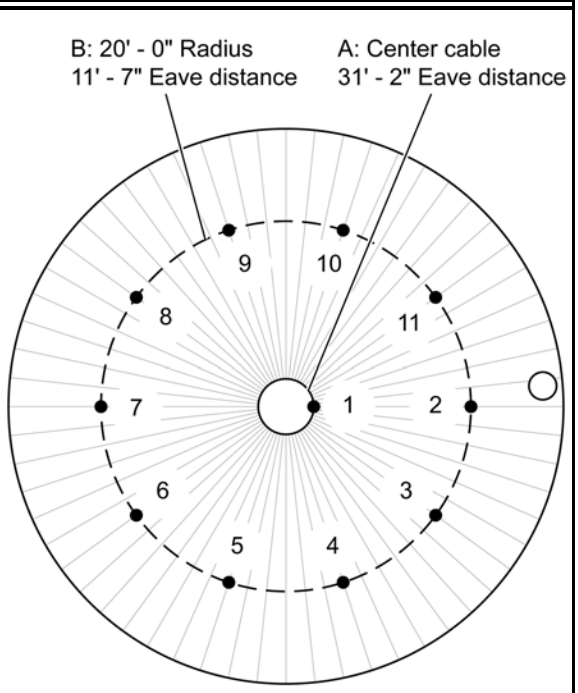
Bin Diameter	54'	60'
Cable Position Arrangement		

Table 4-6 *Cable arrangement - 66' and 72'*

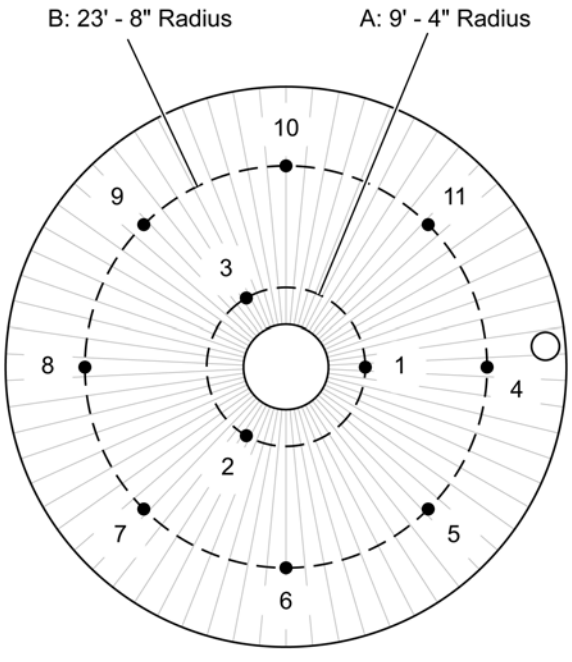
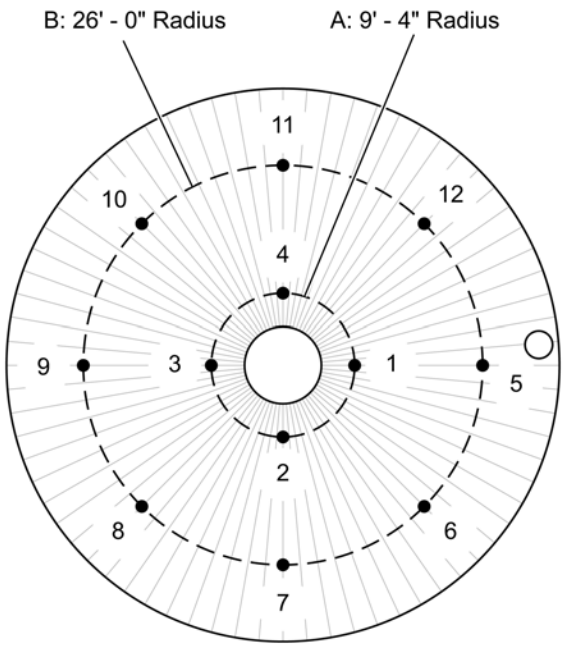
Bin Diameter	66'	72'
Cable Position Arrangement		

Table 4-7 *Cable arrangement - 75' and 78'*

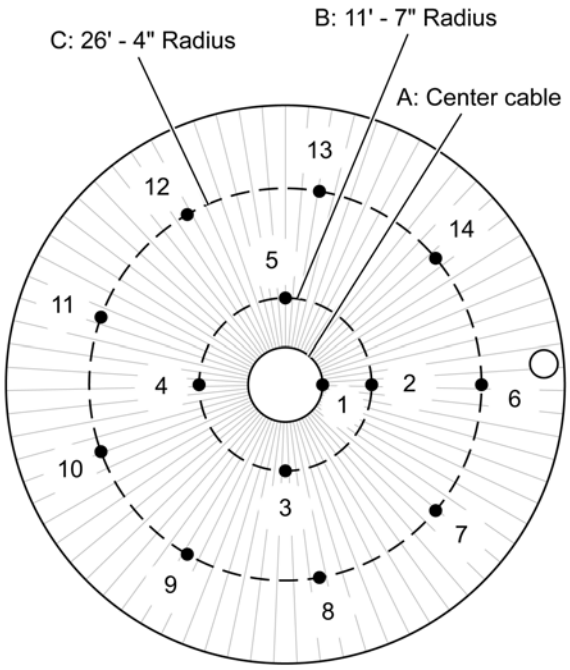
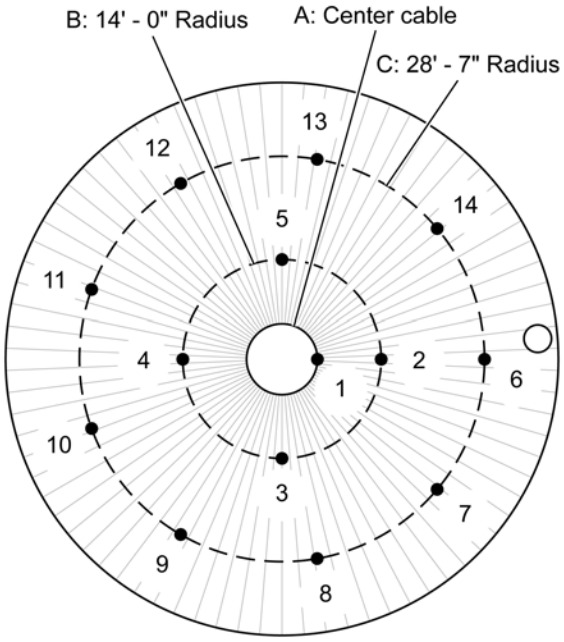
Bin Diameter	75'	78'
Cable Position Arrangement		

Table 4-8 *Cable arrangement - 90' and 105'*

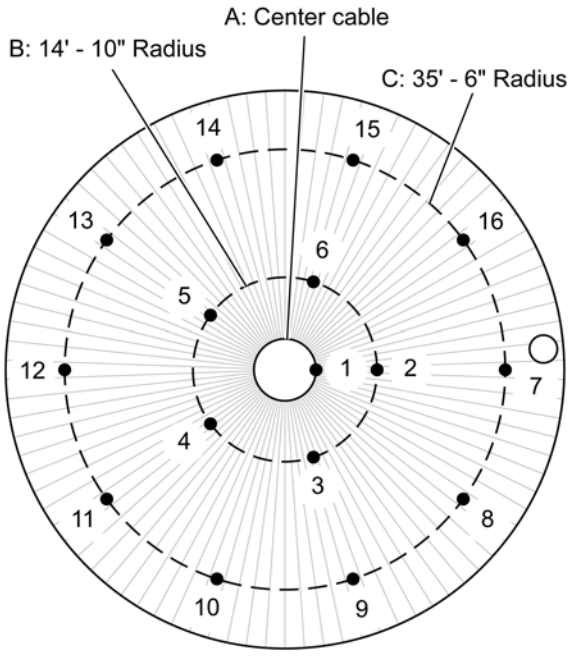
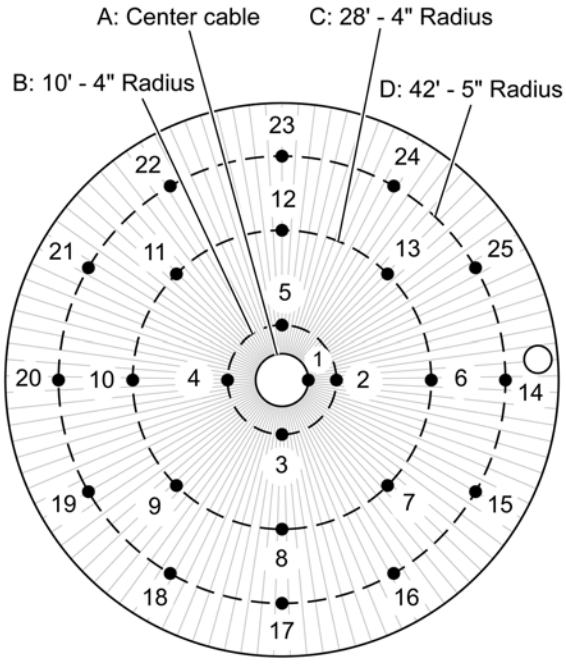
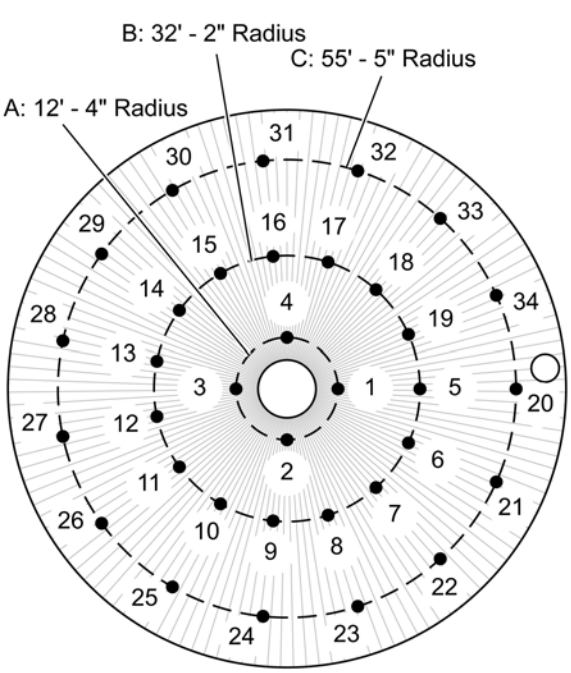
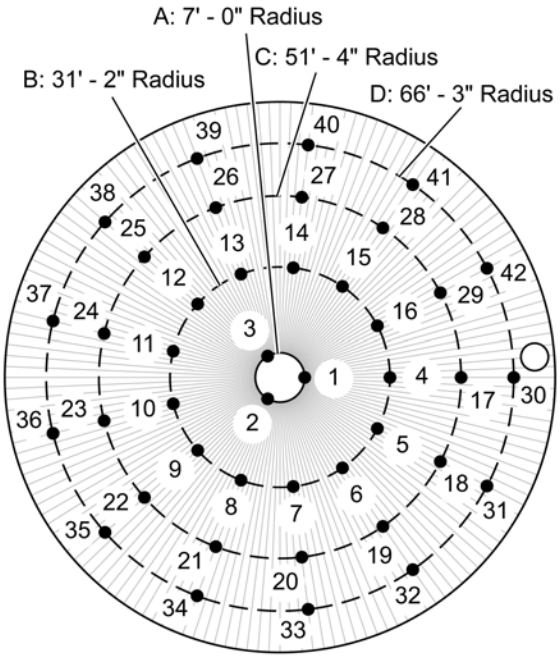
Bin Diameter	90'	105'
Cable Position Arrangement		

Table 4-9 *Cable arrangement - 135' and 156'*

Bin Diameter	135'	156'
Cable Position Arrangement		

Installing the Center Cable

If your GrainVue system was sold with a center cable, refer to the following instructions.

NOTE: *If your system only has radius cable placement, refer to Installing the Radius Cable(s), page 37 for details.*

Tools Required for Cable Installation

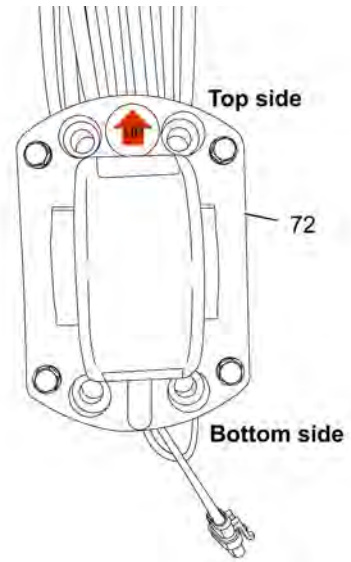
The following tools are required to install the sensing cable.

- Cordless drill
- 3/8" nut driver bit
- 1-1/2" hole saw
- Tape measure
- Side cutters
- Outdoor rated caulk

Installing the Angle Mount Cable Head

For an angle mount cable head style as shown in *Figure 4-2, page 34*, choose a location for the cable between two roof ribs near the center of the bin. It works well if the center cable is near the same side of the bin where the Cable Monitoring Hub and/or the Mux Box will be placed to keep shorter Lead Wire connection. Refer to *Installing the Cable Monitoring Hub, page 50* for details.

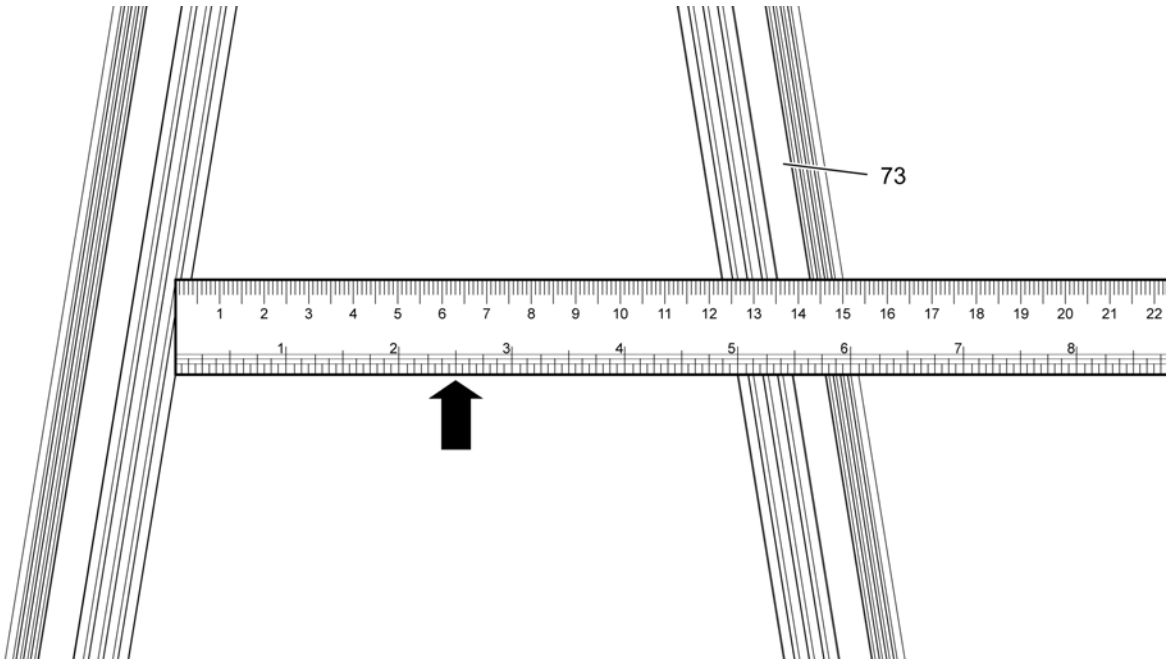
Figure 4-2 *Angle mount cable head*



72	Cable head

1. Measure out the location where the roof ribs (73) are 5" apart and mark the 2-1/2" center point. Make sure the cable head (72) fits between the roof ribs when centered over the marked point.

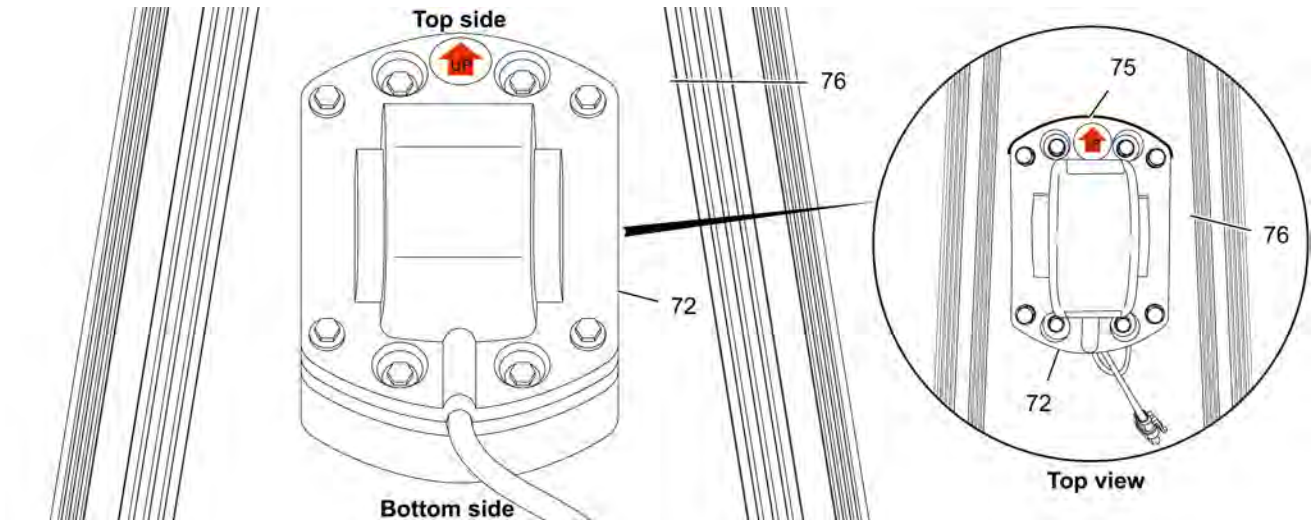
Figure 4-3 *Measuring distance between ribs to determine location*



73	Roof rib

2. Drill a 1-1/2" hole with the hole saw at the marked point while angling the hole saw so that it is perpendicular to the roof panel (76) of the bin.
3. Use the side cutters to remove the zip ties from the cable.
4. Feed the cable through the hole and into the bin. Avoid over-bending or kinking the cable. If installing a moisture cable, use caution when passing the nodes through the hole.
5. Set the cable head (72) flat on the roof panel (76) so that the green plastic guide under the cable head (72) is lined up with the hole in the roof panel (76). Note the marking on the cable head (72) for which side is up (pointed to the bin peak) and the black cable lead should point down the bin roof.
6. Install the four 1-1/2" long self-tapping screws (supplied with the cable) through the holes in the cable head (72) to secure the cable head (72) to the roof panel (76). Make sure it compresses the cable head (72) foam to the roof panel (76) but be careful and not strip the screws in the roof panel (76).
7. To prevent any future leaks, apply a bead of caulk (75) where the cable head (72) and roof panel (76) meet on the top side only.

Figure 4-4 *Installing the cable head onto the roof panel*



72	Cable head	76	Roof panel
75	Caulking (S-4458)		

Installing the Hanger Mount Cable Head

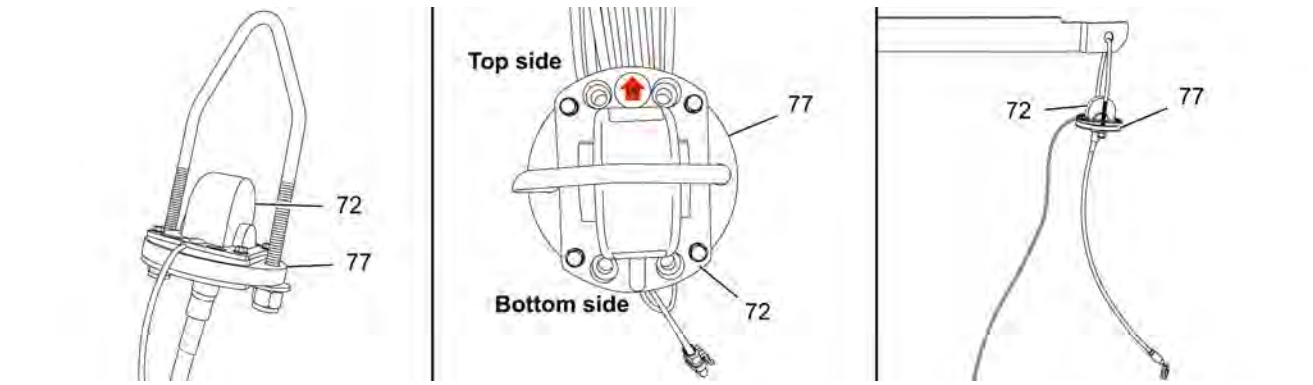
For a hanger mount cable head style as shown in *Figure 4-5, page 36*, install under the roof at the bin manufacturer's specified support location.

For Roofs with Internal Access:

1. Insert the cable hanger bracket (77) through the bin temperature cable bracket or bin support structure hole and through the two holes on the cable head (72).
2. Install the washers and nylock nuts onto the hanger bracket (77) and tighten with a 3/4" impact socket or wrench until the nuts have used up all the hanger bracket threads.

3. The cable can be let down at this time and connecting the black pigtail to the Lead Wire will be in the *Installing the Cable Monitoring Equipment Chapter, page 57*.

Figure 4-5 *Hanger mount cable head*



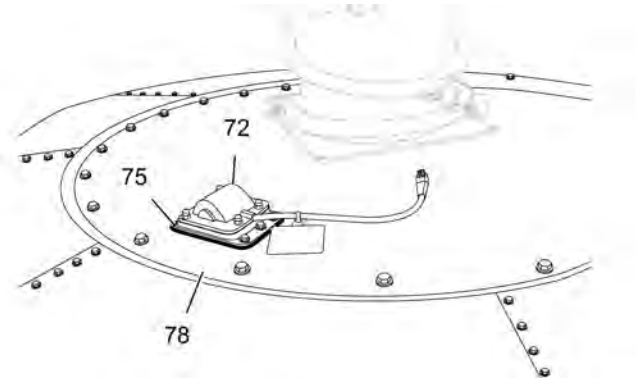
72	Cable head	77	Cable hanger bracket

NOTE: *If installation is being done on an existing bin and access under the roof cannot be achieved, you may install the cable through the bin's heavy peak plate (if applicable) from the outside of the bin as shown in Figure 4-6, page 36. Reach out to a GSI representative if you have questions.*

For Roofs with External Access Only:

1. Choose a location where the cable will not be directly in the grain stream during the fill process and drill a 1-1/2" hole through the peak plate (78) with a hole saw.
2. Feed the cable through the hole and into the bin. Avoid over-bending or kinking the cable. If installing a moisture cable, use caution when passing the nodes through the hole.
3. Before setting the cable head (72) flat on the peak plate (78), apply a bead of outdoor rated caulk around the hole under the cable head (72) and then set in place.
4. Secure the cable head (72) to the peak plate (78) through the two cable head (72) holes by using 3/8" thread forming bolts or similar. Apply a bead of outdoor rated caulk (75) around the cable head (72) to prevent moisture intrusion.

Figure 4-6 *Installing the cable head onto peak plate*



72	Cable head	78	Peak plate
75	Caulking (S-4458)		

Installing the Radius Cable(s)

A radius cable can be externally mounted on the bin roof if the total length of the cable is 50' or less. Roof brackets are used to support the radius cables by moving the weight of the cable from the center of the roof panel to the roof ribs.

NOTE: *If the radius cable is longer than 50' in length, refer to* *Installing an Internal Mounted Radius Cable, page 47* *for details.*

2-Rib and 4-Rib Roof Brackets

- 2-Rib roof brackets are required for sensing cables less than 35' in length.
- 4-Rib roof brackets are required for sensing cables between 35' and 50' in length.

Tools Required for Cable Installation

The following tools are required to install the sensing cable.

- Cordless drill
- 3/8" nut driver bit
- 1-1/2" hole saw
- Tape measure
- Side cutters
- Outdoor rated caulk

Tools Required for Roof Bracket Installation

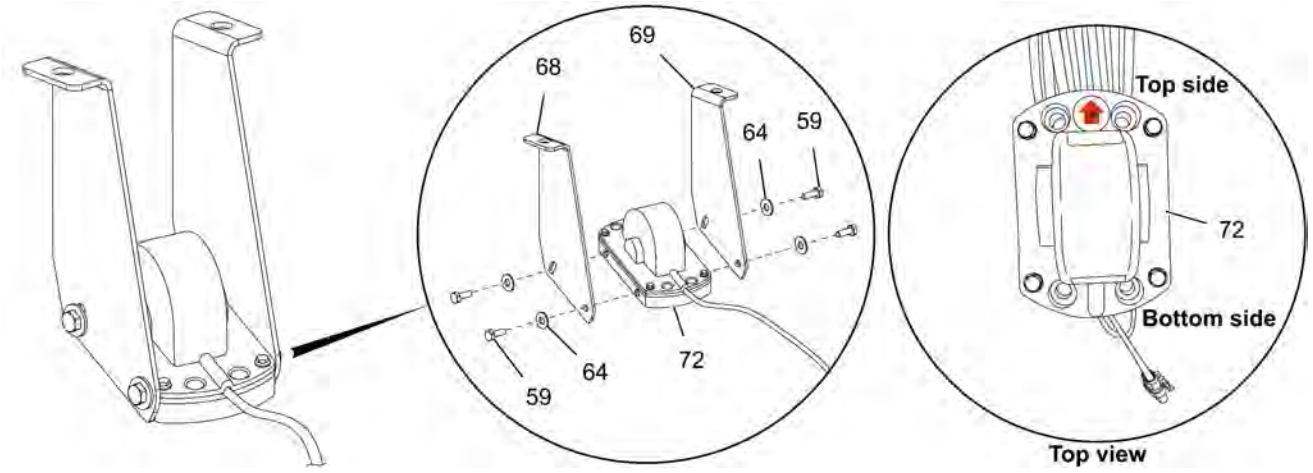
In addition to the above tools required for sensing cable installation, the following tools are also required to install the roof brackets.

- Two 9/16" wrenches
- 7/16" nut driver bit

Installing the 2-Rib Roof Bracket

1. Attach the L.H. and R.H. angle brackets (68 and 69) to the cable head (72) using four 1/4" x 3/4" HHCS bolts (59) and 1/4" flat washers (64).

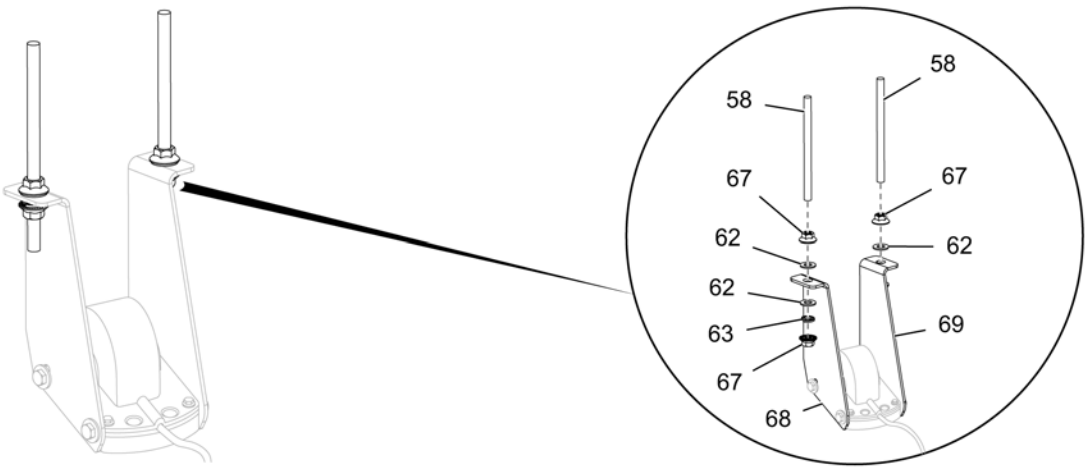
Figure 4-7 *Attaching the angle brackets to the cable head*



59	1/4" x 3/4" HHCS bolt (S-8244)	69	R.H. angle bracket (CRP-7383)
64	1/4" flat washer (S-1430)	72	Cable head
68	L.H. angle bracket (CRP-7382)		

2. Attach one 3/8" x 8" threaded rod (58) to each angle bracket (68 and 69) using 3/8" flat washers (62), 3/8" lock washers (63) and 3/8" flange nuts (67).

Figure 4-8 *Attaching the threaded rods to the angle brackets*

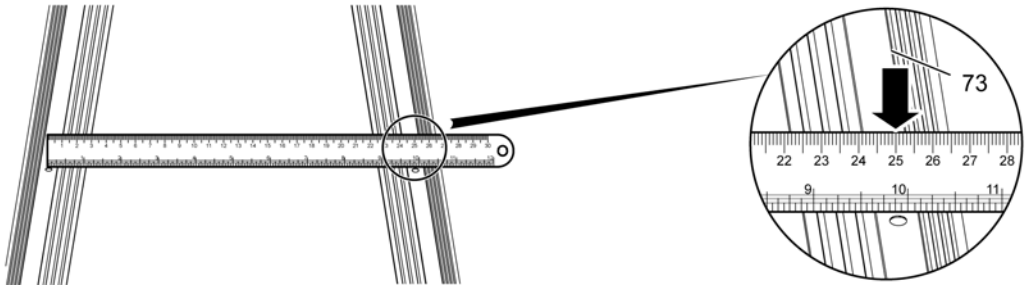


58	3/8" x 8" Threaded rod (CE-01122)	67	3/8" flange nut (S-9426)
62	3/8" flat washer (S-248)	68	L.H. angle bracket (CRP-7382)
63	3/8" lock washer (S-1054)	69	R.H. angle bracket (CRP-7383)

3. Mark the location on the bin roof centered between the ribs (73) on the roof panels where the radius cable will be installed.

   NOTE: *Roof brackets can reach about 25" between the ribs (73) so you may have to move up the roof for the brackets to fit properly.*

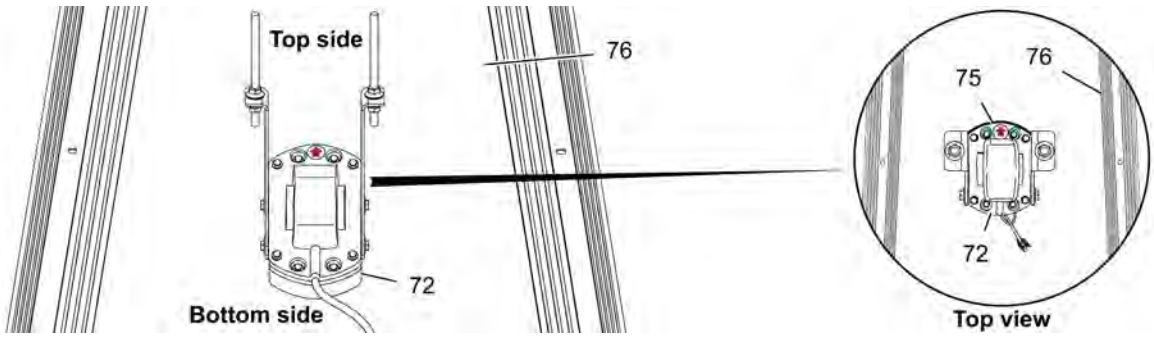
Figure 4-9 *Measuring between the ribs to determine the location*



73	Roof rib

4. Drill a 1-1/2" hole with the hole saw at the marked point while angling the hole saw so that it is perpendicular to the roof panel (76) of the bin.
5. Use the side cutters to remove the zip ties from the cable.
6. Feed the cable through the hole and into the bin. Avoid over-bending or kinking the cable. If installing a moisture cable, use caution when passing the nodes through the hole.
7. Set the cable head (72) flat on the roof panel (76) so that the green plastic guide under the cable head (72) is lined up with the hole in the roof panel (76). Note the marking on the cable head (72) for which side is up (pointed to the bin peak) and the black cable lead should point down the bin roof.
8. Install the four 1-1/2" long self-tapping screws (supplied with the cable) through the holes in the cable head (72) to secure the cable to the roof panel (76). Make sure it compresses the cable head (72) foam to the roof panel (76) but be careful and not strip the screws in the roof panel (76).
9. To prevent any future leaks, apply a bead of caulk (75) where the cable head (72) and roof panel (76) meet on the top side only.

Figure 4-10 *Installing the cable head onto the roof panel*

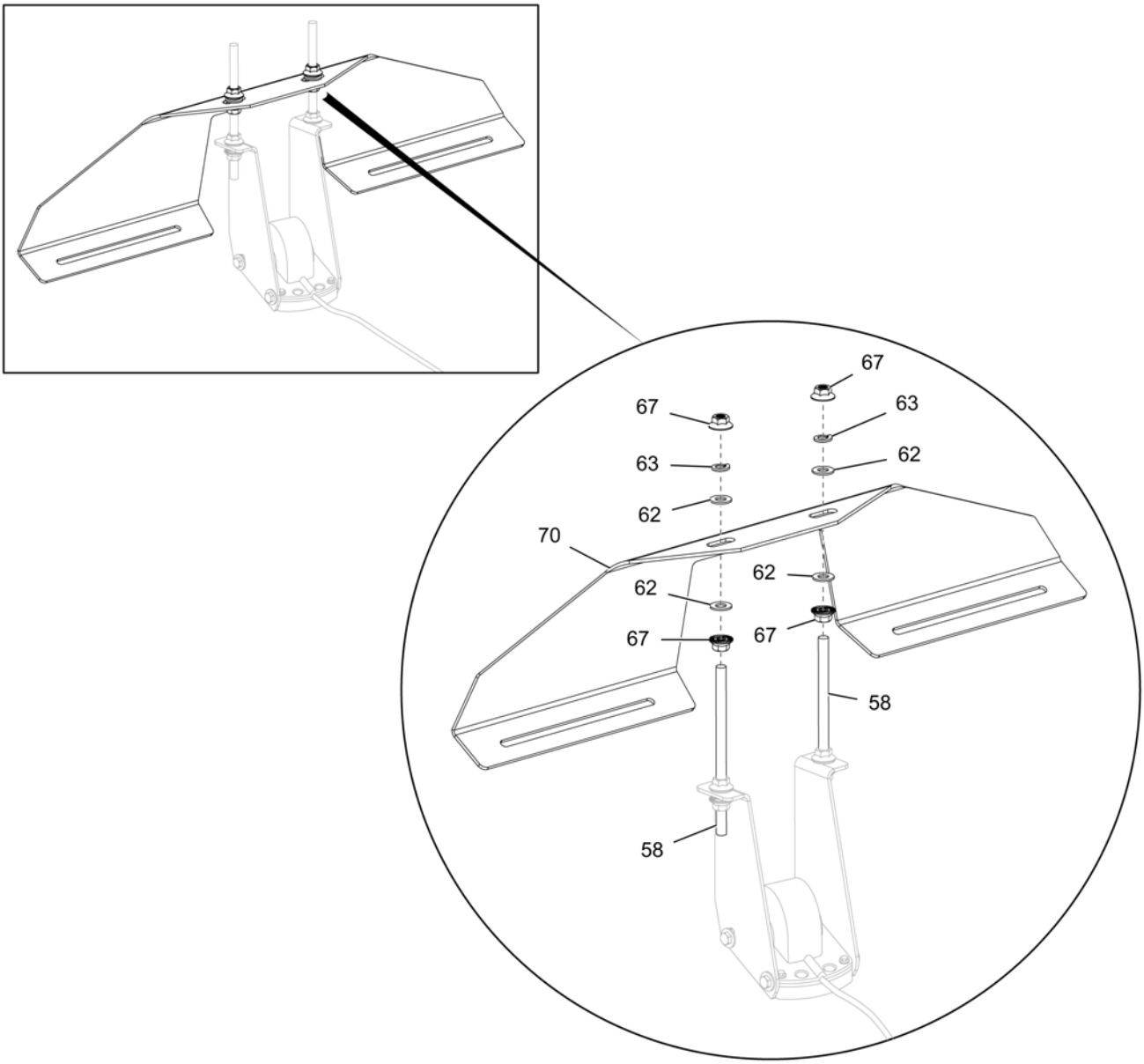


72	Cable head	76	Roof panel
75	Caulking (S-4458)		

10. Attach the roof bracket (70) to both 3/8" x 8" threaded rods (58) using 3/8" flat washers (62), 3/8" lock washers (63) and 3/8" flange nuts (67).

NOTE: *Make sure the washers (62) and nuts (67) below the roof bracket (70) are low enough to allow the roof bracket (70) to contact the roof ribs at the correct angle. Also, leave all hardware loose until the roof bracket (70) is fastened to the roof ribs.*

Figure 4-11 *Attaching the roof brackets to the threaded rods*



58	3/8" x 8" Threaded rod (CE-01122)	67	3/8" flange nut (S-9426)
62	3/8" flat washer (S-248)	70	Roof bracket (CRP-7381)
63	3/8" lock washer (S-1054)		

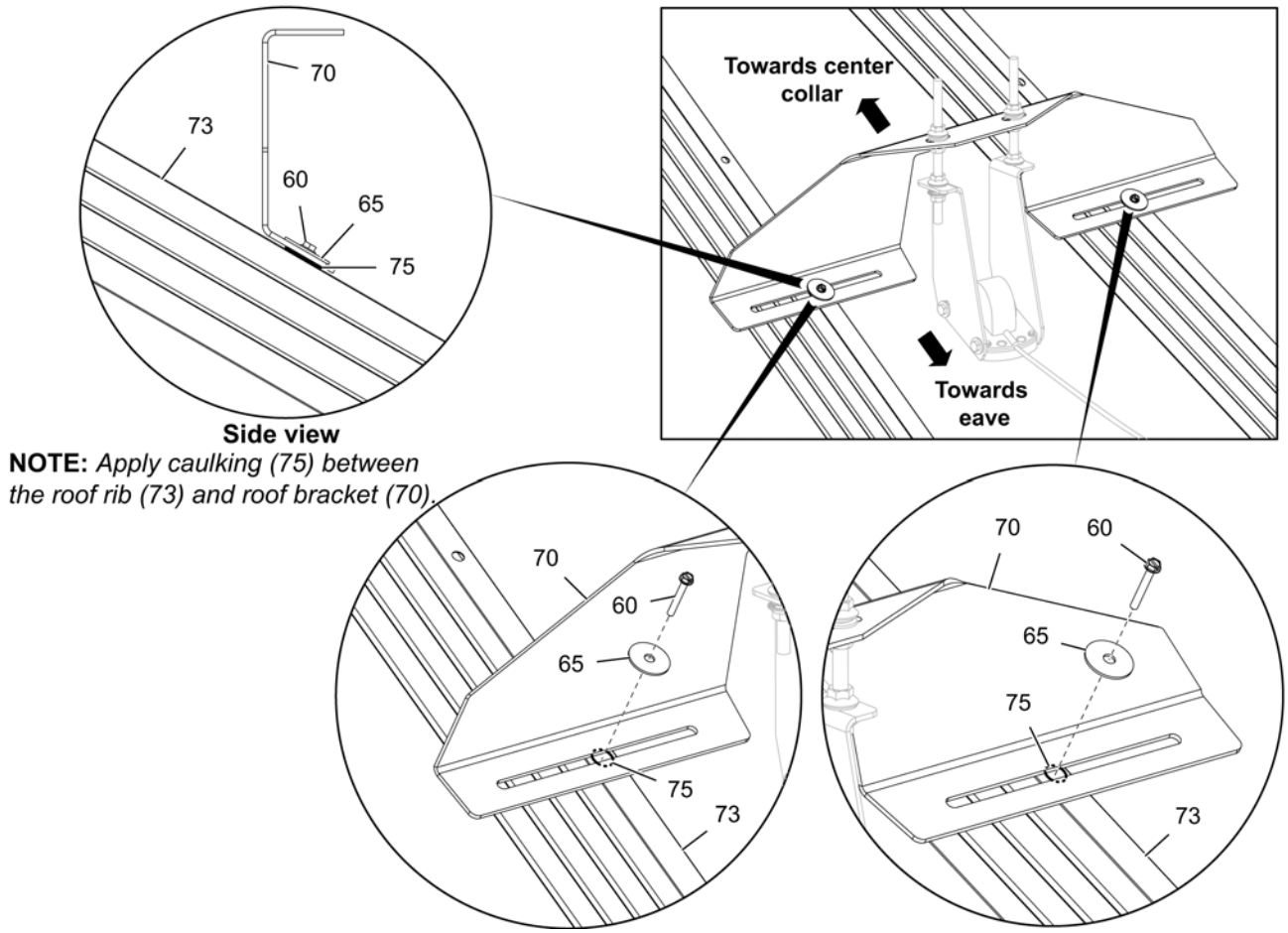
11. Position the roof bracket (70) onto the roof ribs (73) and install using two 1/4" x 1-1/2" self-drilling screws (60) and 5/16" fender washers (65).

NOTICE ***When installing roof brackets (70), make sure that the hanger holes of the roof bracket (70) are positioned directly above the cable head so that the threaded rods (58) are vertical. Failure to do so could result in roof damage.***

NOTE: *Apply non-reactive caulking (75) on the roof rib (73) at the screw (60) attachment location. Make sure the caulking (75) is spread all around the screw (60) between the roof rib (73) and roof bracket (70) flange.*

NOTE: *If a bolt is used to attach, apply caulking (75) around the bolt attachment location or use a sealing washer between the roof rib (73) and roof bracket (70) flange.*

Figure 4-12 *Attaching the roof bracket to the bin roof*



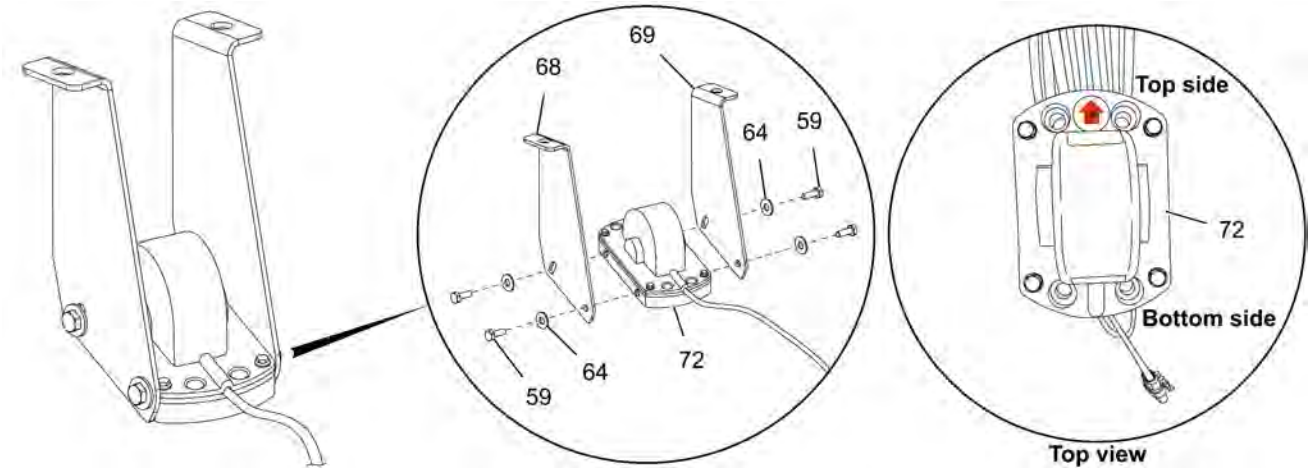
60	1/4" x 1-1/2" self-drilling screw (S-10505)	73	Roof rib
65	5/16" x 1-1/4" fender washer (S-8199)	75	Caulking (S-4458)
70	Roof bracket (CRP-7381)		

12. Using the 3/8" flange nuts (67) on the 3/8" x 8" threaded rods (58), adjust the gap between the roof bracket and angle brackets to support the cable head appropriately. Tighten down the 3/8" flange nuts (67) on both sides of the roof bracket (70) to secure.

Installing the 4-Rib Roof Bracket

1. Attach the L.H. and R.H. angle brackets (68 and 69) to the cable head (72) using four 1/4" x 3/4" HHCS bolts (59) and 1/4" flat washers (64).

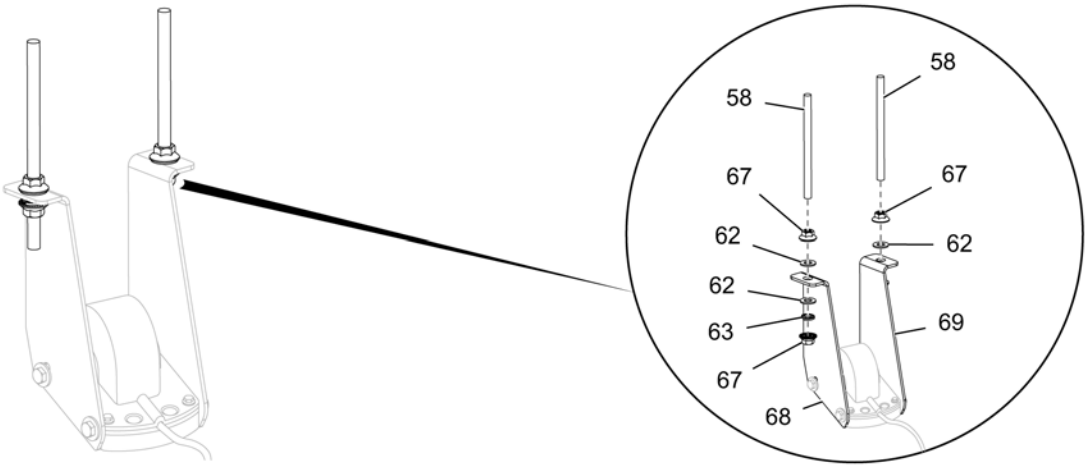
Figure 4-13 *Attaching the angle brackets to the cable head*



59	1/4" x 3/4" HHCS bolt (S-8244)	69	R.H. angle bracket (CRP-7383)
64	1/4" flat washer (S-1430)	72	Cable head
68	L.H. angle bracket (CRP-7382)		

2. Attach one 3/8" x 8" threaded rod (58) to each angle bracket (68 and 69) using 3/8" flat washers (62), 3/8" lock washers (63) and 3/8" flange nuts (67).

Figure 4-14 *Attaching the threaded rods to the angle brackets*

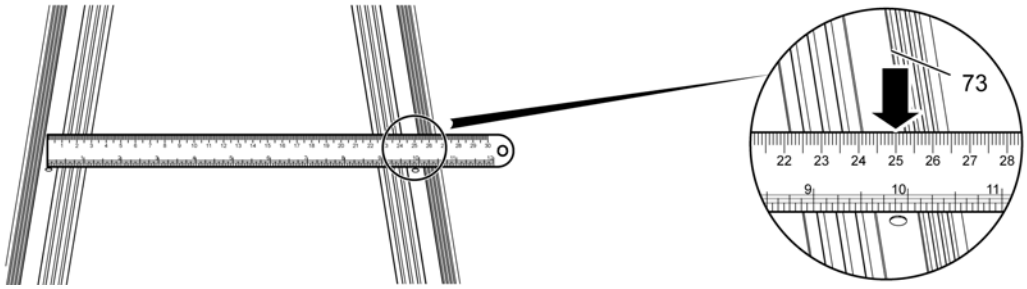


58	3/8" x 8" Threaded rod (CE-01122)	67	3/8" flange nut (S-9426)
62	3/8" flat washer (S-248)	68	L.H. angle bracket (CRP-7382)
63	3/8" lock washer (S-1054)	69	R.H. angle bracket (CRP-7383)

3. Mark the location on the bin roof centered between the ribs (73) on the roof panels where the radius cable will be installed.

   NOTE: *Roof brackets can reach about 25" between the ribs (73) so you may have to move up the roof for the brackets to fit properly.*

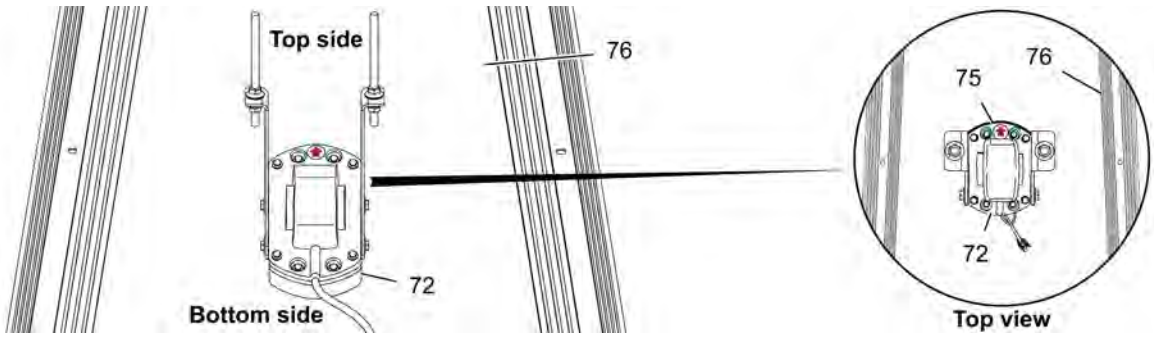
Figure 4-15 *Measuring between the ribs to determine the location*



73	Roof rib

4. Drill a 1-1/2" hole with the hole saw at the marked point while angling the hole saw so that it is perpendicular to the roof panel (76) of the bin.
5. Use the side cutters to remove the zip ties from the cable.
6. Feed the cable through the hole and into the bin. Avoid over-bending or kinking the cable. If installing a moisture cable, use caution when passing the nodes through the hole.
7. Set the cable head (72) flat on the roof panel (76) so that the green plastic guide under the cable head (72) is lined up with the hole in the roof panel (76). Note the marking on the cable head (72) for which side is up (pointed to the bin peak) and the black cable lead should point down the bin roof.
8. Install the four 1-1/2" long self-tapping screws (supplied with the cable) through the holes in the cable head (72) to secure the cable to the roof panel (76). Make sure it compresses the cable head (72) foam to the roof panel (76) but be careful and not strip the screws in the roof panel (76).
9. To prevent any future leaks, apply a bead of caulk (75) where the cable head (72) and roof panel (76) meet on the top side only.

Figure 4-16 *Installing the cable head onto the roof panel*

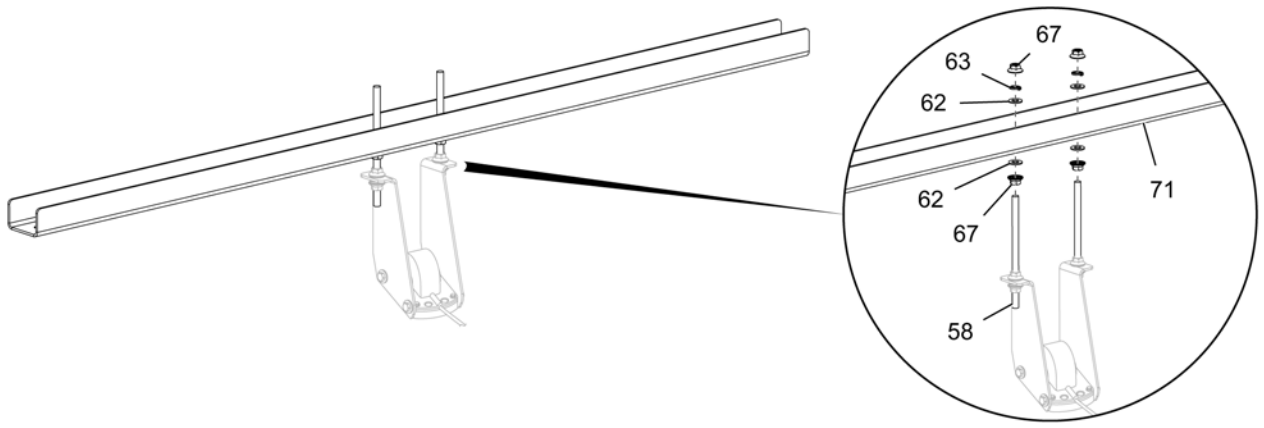


72	Cable head	76	Roof panel
75	Caulking (S-4458)		

10. Attach the C-channel (71) to both 3/8" x 8" threaded rods (58) using 3/8" flat washers (62), 3/8" lock washers (63) and 3/8" flange nuts (67).

NOTE: *Make sure the washers (62) and nuts (67) below the C-channel (71) are low enough to allow the roof brackets to contact the roof ribs when installed. Also, leave all hardware loose until the roof brackets are fastened to the roof panels.*

Figure 4-17 *Attaching the C-channel to the threaded rods*

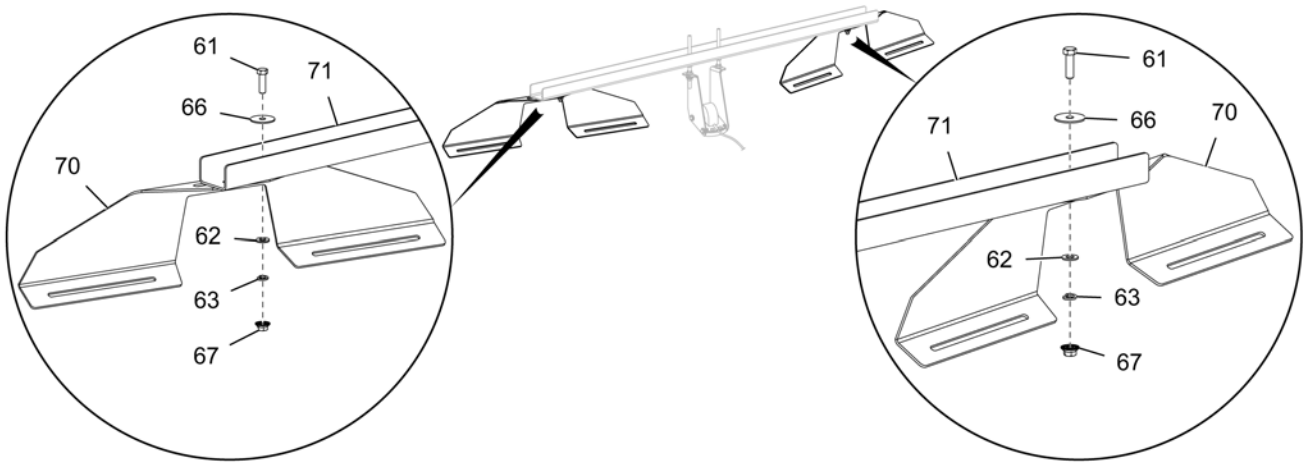


58	3/8" x 8" Threaded rod (CE-01122)	67	3/8" flange nut (S-9426)
62	3/8" flat washer (S-248)	71	C-channel (CRP-7380)
63	3/8" lock washer (S-1054)		

11. Position the top flange of both roof brackets (70) below the C-channel (71) and install one roof bracket (70) to each end of the C-channel (71) using 3/8" x 1-1/4" HHCS bolts (61), 3/8" fender washers (66), 3/8" flat washers (62), 3/8" lock washers (63) and 3/8" flange nuts (67).

NOTE: *Do not over-tighten the nuts (67) as the roof brackets (70) should pivot freely.*

Figure 4-18 *Attaching the roof brackets to the C-channel*



61	3/8" x 1-1/2" flange bolt (S-7486)	67	3/8" flange nut (S-9426)
62	3/8" flat washer (S-248)	70	Roof bracket (CRP-7381)
63	3/8" lock washer (S-1054)	71	C-channel (CRP-7380)
66	3/8" fender washer (S-10200)		

12. Position both the roof bracket (70) onto the roof ribs (73). Install the inner end of each roof bracket (70) that is closer to the cable head (72) using two 1/4" x 1-1/2" self-drilling screws (60) and 5/16" fender washers (65).

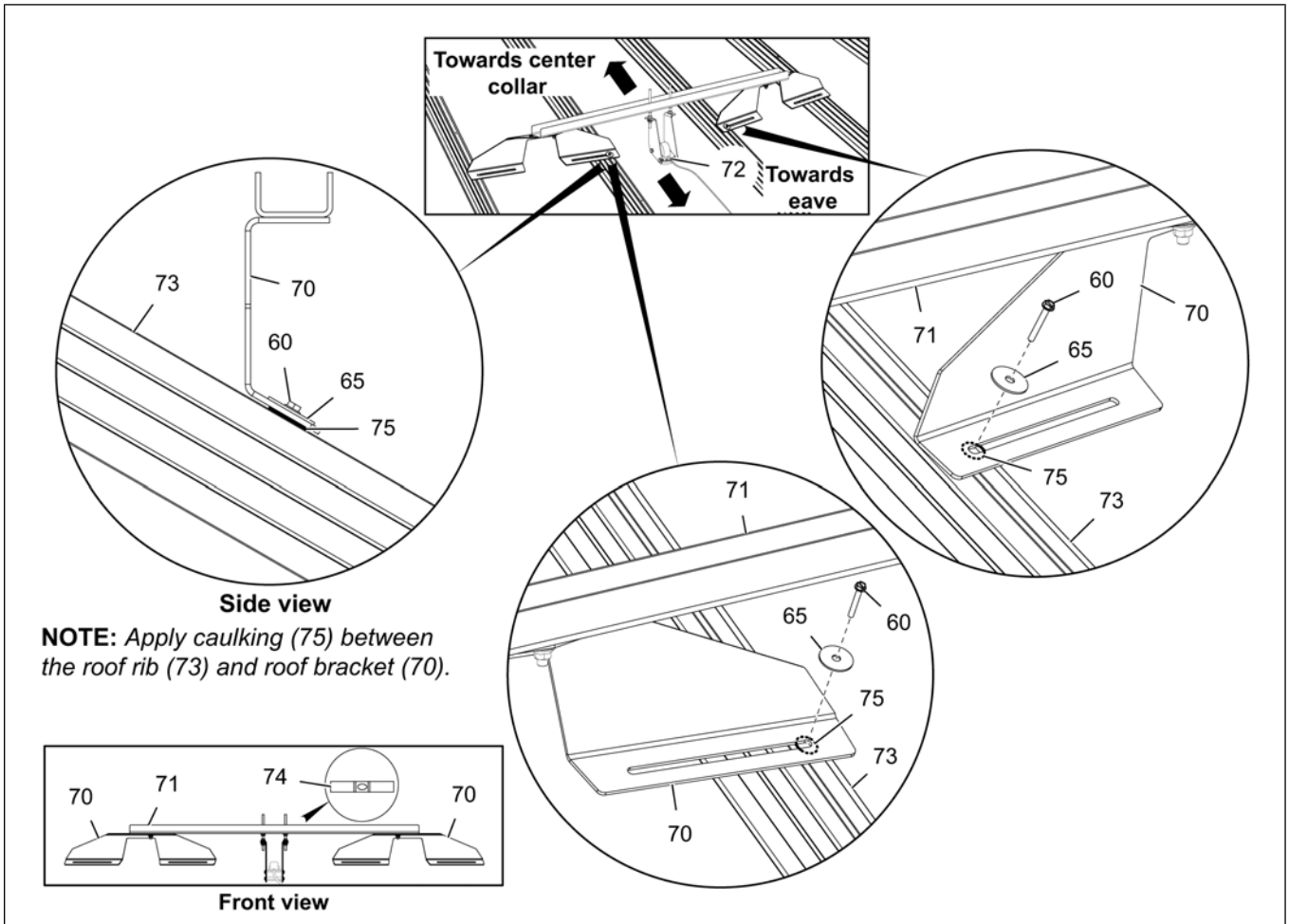
> **NOTICE** ***When installing roof brackets (70), make sure that the hanger holes of the roof bracket (70) are positioned directly above the cable head so that the threaded rods (58) are vertical. Failure to do so could result in roof damage.***

NOTE: *Loosely attach both self-drilling screws (60) at the same distance up the roof rib (73) so that the C-channel sits level across its length. Measuring from the same roof bolts on each roof rib (73) helps with this process.*

NOTE: *Apply non-reactive caulking (75) on the roof rib (73) at the screw (60) attachment location. Make sure the caulking (75) is spread all around the screw (60) between the roof rib (73) and roof bracket (70) flange.*

NOTE: *If a bolt is used to attach, apply caulking around the bolt attachment location or use a sealing washer between the roof rib (73) and roof bracket (70) flange.*

Figure 4-19 *Installing the inner ends of the roof bracket to the roof ribs*



60	1/4" x 1-1/2" self-drilling screw (S-10505)	72	Cable head
65	5/16" x 1-1/4" fender washer (S-8199)	73	Roof rib
70	Roof bracket (CRP-7381)	74	Level
71	C-channel (CRP-7380)	75	Caulking (S-4458)

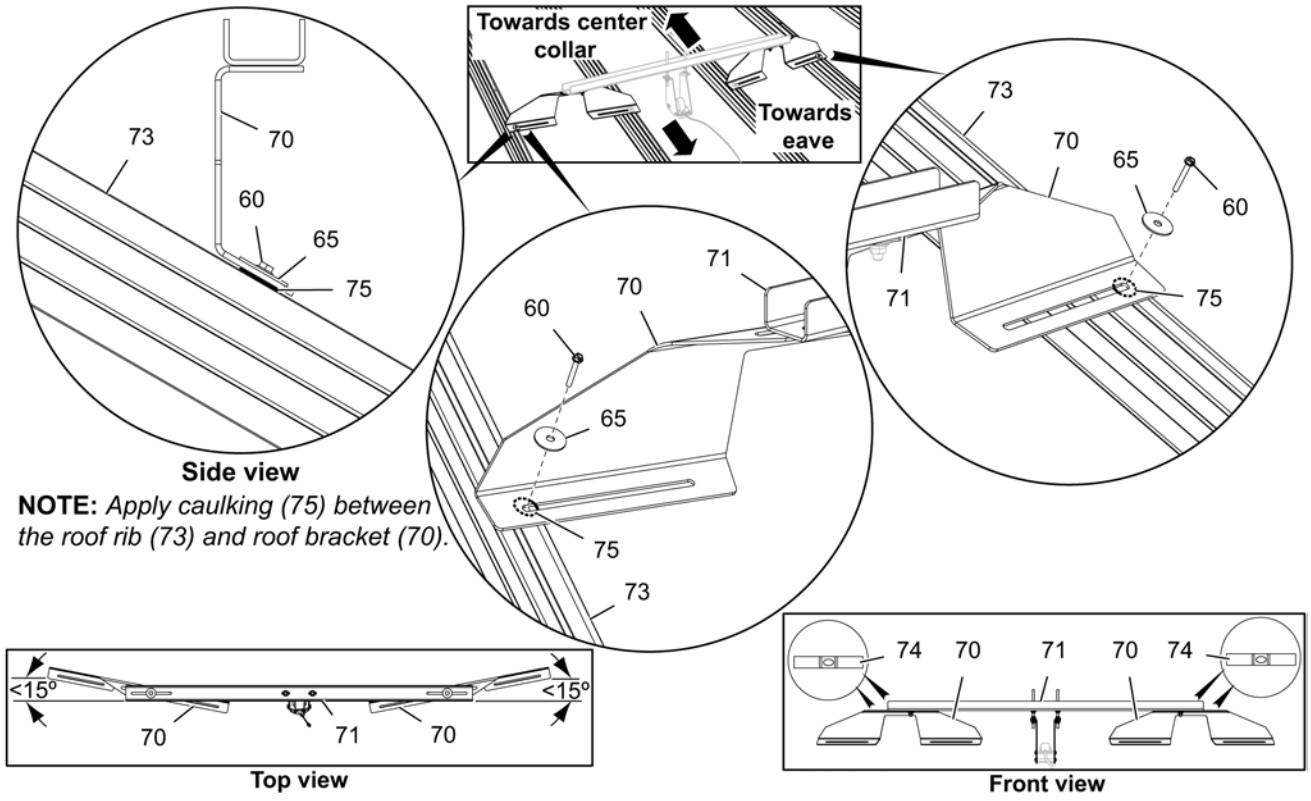
13. Pivot the outer edges of the roof brackets (70) until the top flange of the roof brackets (70) and top of the C-channel (71) are level. Once the roof brackets (70) are in place, secure the outer edges to the roof ribs (73) using two 1/4" x 1-1/2" self-drilling screws (60) and 5/16" fender washers (65).

NOTE: *When viewed from top, there should only be a slight angle (less than 15°) between the C-channel (71) and the roof brackets (70) as shown in Figure 4-20, page 46.*

NOTE: *Apply non-reactive caulking (75) on the roof rib (73) at the screw (60) attachment location. Make sure the caulking (75) is spread all around the screw (60) between the roof rib (73) and roof bracket (70) flange.*

NOTE: *If a bolt is used to attach, apply caulking around the bolt attachment location or use a sealing washer between the roof rib (73) and roof bracket (70) flange.*

Figure 4-20 *Installing the outer ends of the roof bracket to the roof ribs*



60	1/4" x 1-1/2" self-drilling screw (S-10505)	73	Roof rib
65	5/16" x 1-1/4" fender washer (S-8199)	74	Level
70	Roof bracket (CRP-7381)	75	Caulking (S-4458)
71	C-channel (CRP-7380)		

14. Tighten all the 1/4" x 1-1/2" self-drilling screws (60) securing the roof brackets (70) to the roof ribs (73). Tighten all the 3/8" x 1-1/4" HHCS bolts (61) securing the C-channel (71) to the roof brackets (70).

15. Using the 3/8" flange nuts (67) on the 3/8" x 8" threaded rods (58), adjust the gap between the C-channel and angle brackets to support the cable head appropriately. Tighten down the 3/8" flange nuts (67) on both sides of the C-channel bracket (70) to secure.

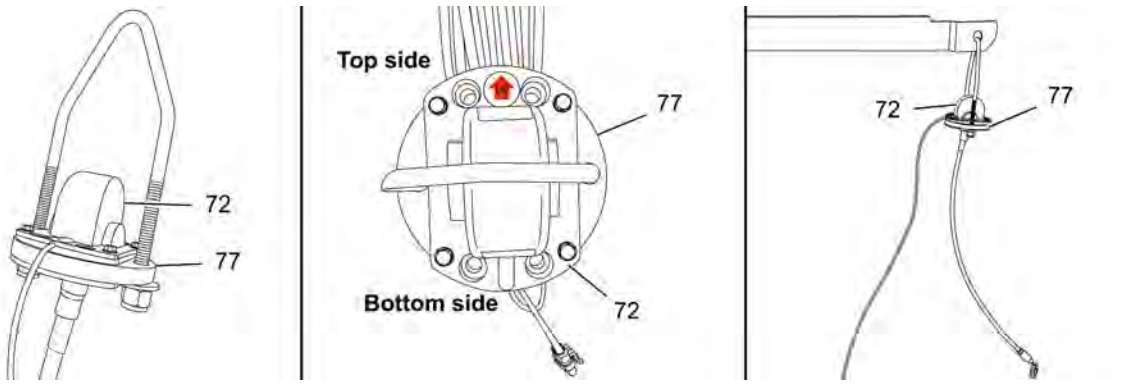
Installing an Internal Mounted Radius Cable

For bins that have cable mounting brackets under the roof or if the radius cable(s) is longer than 50', use the cable hanger bracket and instructions below.

NOTE: *For sensing cables longer than 50', check with your bin manufacturer for roof truss support recommendations and in general follow the recommendations of your bin manufacturer for temperature cable support from the roof.*

1. Insert the cable hanger bracket (77) through the bin temperature cable bracket or bin support structure hole and through the two holes on the cable head (72).
2. Install the washers and nylock nuts onto the hanger bracket (77) and tighten with a 3/4" impact socket or wrench until the nuts have used up all the hanger bracket threads.
3. The cable can be let down at this time and connecting the black pigtail to the Lead Wire will be in the hub installation section.

Figure 4-21 *Hanger mount cable head for internal mounted radius cable*



72	Cable head	77	Cable hanger bracket

NOTES

5 Installing the Cable Monitoring Equipment

Topics Covered in this Chapter

- Installation Overview
- Installing the Cable Monitoring Hub
- Installing the Mux Box (Multiple T/RH Cables Only)
- Multiple Mux Box/Hub Connections
- Installing the Lead Wire
- Internal Bin Mounted Cable(s)

Installation Overview

There are two options on how the Cable Monitoring Hub can be powered and the quantity of T/RH cables in the bin will determine how the cable(s) connects to the Cable Monitoring Hub. Corresponding hardware will be provided for the installation, based on the system options selected at the time of order.

Power Supply Options

1. **Battery (Solar) Powered:** This method requires no supplemental power to the Cable Monitoring Hub and is used when no fan control is desired with the system. The battery and solar panel that are included in the Hub assembly will provide the necessary power.
2. **Fan Control Module (FCM):** This method requires the installation of the Fan Control Module as it will provide the adequate power to the Cable Monitoring Hub through a cable connection. This power supply is installed in the case where fan control is included as a feature of the system. In the event the Fan Control Module loses power and stops sending power to the Cable Monitoring Hub, the battery and solar panel that are included in the Hub assembly can still allow data transmission as backup power.

T/RH Cable Connection Options

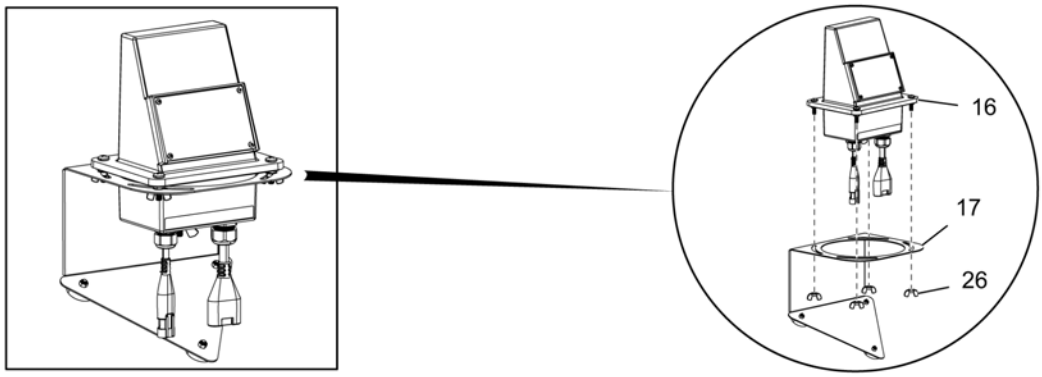
1. **Single Cable:** This method simply requires the connection of a single T/RH cable directly to the Cable Monitoring Hub. If close enough, the connector equipped on the cable can directly connect to the Cable Monitoring Hub, otherwise an included 20' (6 m) extension Lead Wire with quick connectors on each end can be used.
2. **Multiple Cables:** This method requires the installation of the Mux Box which is used to connect multiple T/RH cables to the Cable Monitoring Hub. Each cable will require a single ended Lead Wire extension cable to reach the Mux Box for termination.

Installing the Cable Monitoring Hub

WARNING ***Do not turn ON the Cable Monitoring Hub until all the necessary connections are done.***

1. Remove the wing nuts (26) that are pre-assembled on the Hub (16).
2. Align the Hub (16) with the curved slots in the mounting bracket (17) and re-install using the wing nuts (26).

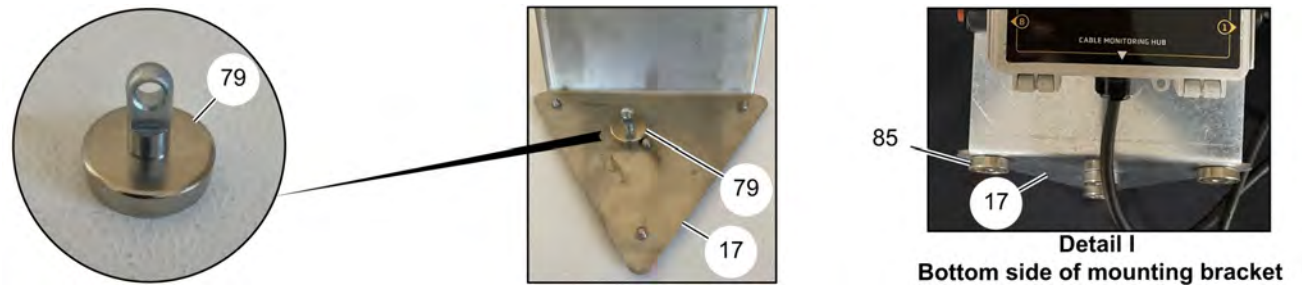
Figure 5-1 *Assembling the Hub onto the mounting bracket*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	26	Wing nuts
17	Cable Monitoring Hub Mounting Bracket (GV-HUB-BRACKET)		

3. Install the provided magnet (79) to the mounting bracket (17) as this magnet (79) will be used in the commissioning process and will stay with the Hub (16) permanently.

Figure 5-2 *Installing the magnet onto the mounting bracket*



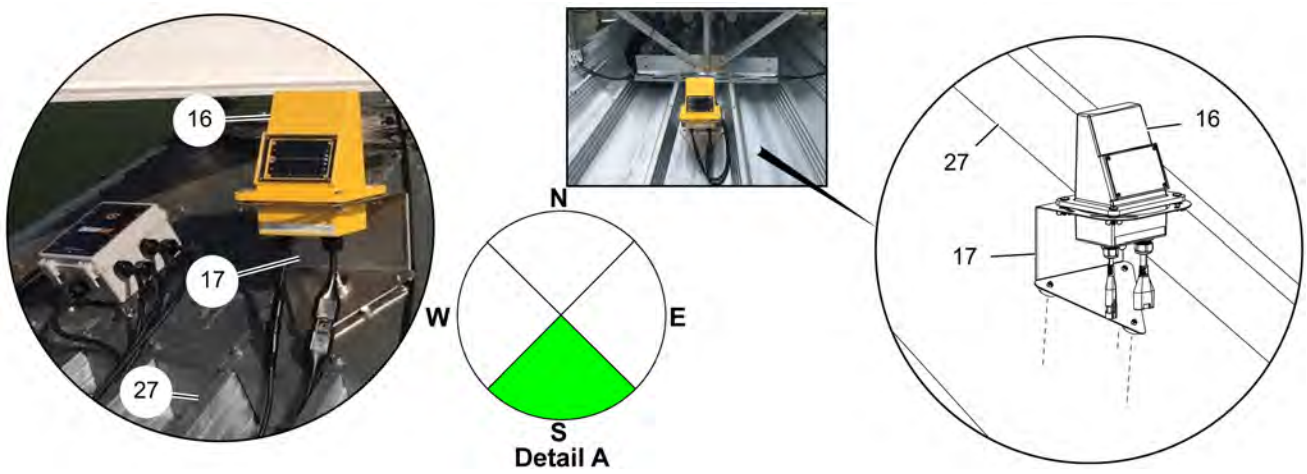
17	Cable Monitoring Hub Mounting Bracket (GV-HUB-BRACKET)	85	Pre-installed magnet
79	Magnet		

4. If the Cable Monitoring Hub mounting bracket (17) does not have the pre-installed magnets (85), install the four supplied magnets (85) and hardware to the bottom of the mounting bracket (17) (as shown in detail I of *Figure 5-2, page 50*).

5. Install the mounting bracket (17) (with Hub (16) assembled) onto the angled part of the bin roof (27) that will be easy to access, yet out of the walking area as shown below. Exact placement of the Hub (16) will depend on where the cable Lead Wire(s) will be coming from and where the Hub (16) to Fan Control Module Cable will be coming from, if powering from the Fan Control Module.
6. Make sure that all the pre-installed magnetic feet on the bracket (17) attach securely to the roof (27).

   NOTE: *The bracket (17) is designed to position the Hub (16) vertical when installed on a 30 degree roof (27) or similar, this helps prevent water intrusion into the Hub (16) and prevent data error messages.*

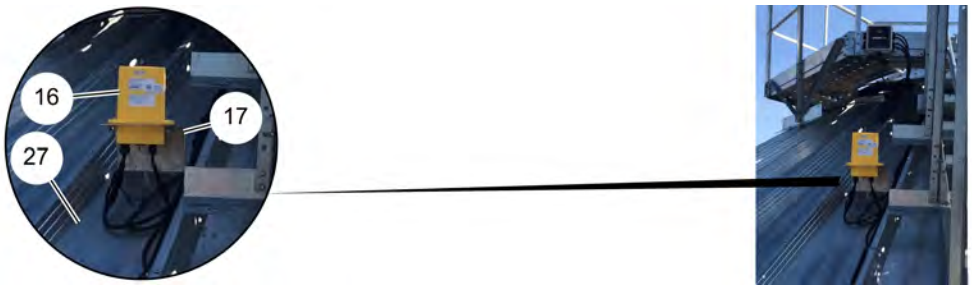
Figure 5-3 *Installing the Hub assembly onto the bin roof*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	27	Bin roof
17	Cable Monitoring Hub Mounting Bracket (GV-HUB-BRACKET)		

No matter if the Hub (16) will be solar powered or powered from the Fan Control Module, it's crucial for the solar panel on the Hub (16) to face a southern direction. This will maximize the sun exposure to keep the internal battery charged. Mounting the Hub (16) on the southern side of the bin works well (as shown in detail A of *Figure 5-3, page 51* like prior if you want), however if another side of the bin makes more sense for installation, the Hub (16) can be rotated on the bracket (17) to the southern direction as shown below.

Figure 5-4 *Hub rotated to face the southern direction*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	27	Bin roof
17	Cable Monitoring Hub Mounting Bracket (GV-HUB-BRACKET)		

7. Power Supply Port Connection.

- **Battery (Solar) Powered Hub:** If installing a battery (solar) powered Hub (16), install the provided Power Port Sealing Plug (22) into the power supply port (29) to prevent moisture intrusion.

  NOTE: *If the provided Power Port Sealing Plug (22) is not supplied, covering the open pins on the power supply port (29) with electrical tape will be sufficient.*

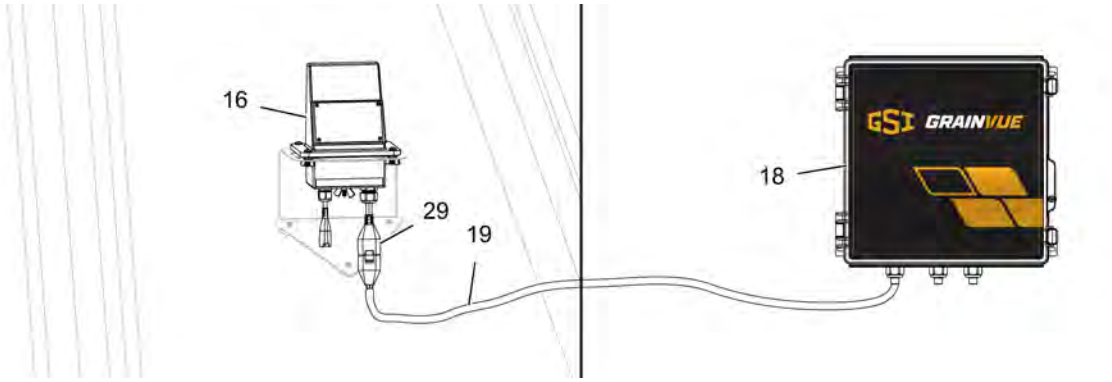
Figure 5-5 *Plugging Power Port Sealing Plug into the cable hub power supply port*

16	Cable Monitoring Hub Kit (GV-HUB-KIT)	29	Power supply port (four pin connector)
22	Power Port Sealing Plug		

- **Fan Control Module (FCM) Powered Hub:** If the Hub (16) will be powered from the Fan Control Module (18), connect the Hub to Fan Control Module Cable (19) to the power supply port (29) on the Cable Monitoring Hub (16) (push the connectors together until the tab clicks and locks in place). Route the cable (19) from the Hub (16) to the Fan Control Module (18) in an orderly fashion and secure the cable (19) to the bin every 3'-5' using P-clips or similar.

NOTE: *Make sure the cable (19) is not pulled tight over the eave of the bin and has sufficient slack, then properly secure to prevent damage to the cable (19).*

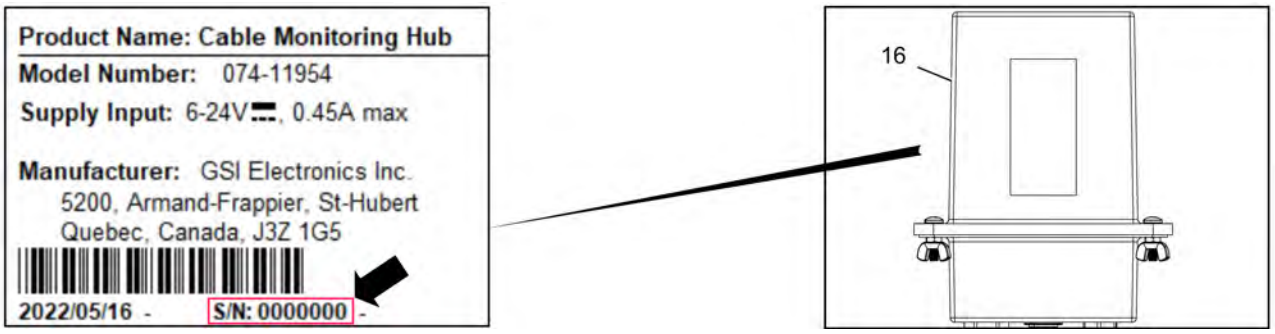
Figure 5-6 *Connecting the Fan Control Module cable to the Cable Monitoring Hub*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	19	Hub to Fan Control Module Cable - 59' (18 m) (GV-FCM2-18)
			Hub to Fan Control Module Cable - 108' (33 m) (GV-FCM2-33)
			Hub to Fan Control Module Cable - 172' (52 m) (GV-FCM2-52)
18	Fan Control Module (GV-FCM2R)	29	Power supply port (four pin connector)

8. Capture a picture or document the Cable Monitoring Hub (16) S/N that is located on the label found on the back face of the Hub (16) to be used in the commission process. Refer to *Chapter 2, System Overview and Commissioning, page 15* for details.

Figure 5-7 *Cable Monitoring Hub - electrical specifications*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)

9. The Cable Monitoring Hub(s) (16) will need to be powered after all Lead Wire connections and Fan Control Module cable connections are complete. Refer to *Chapter 7, Activating the Cable Monitoring Hub, page 83* for the step-by-step instructions on this procedure.

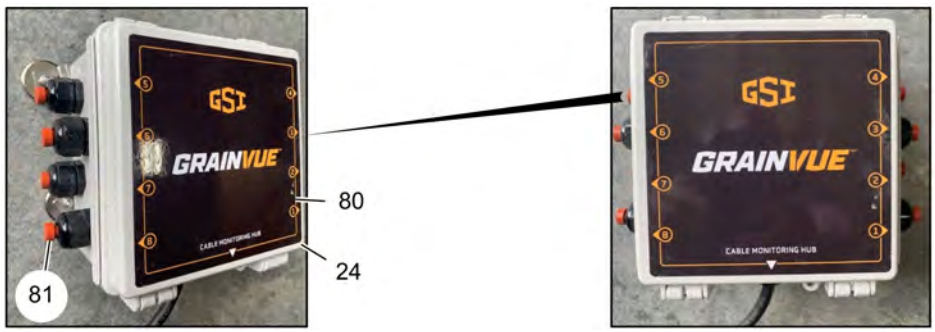
Installing the Mux Box (Multiple T/RH Cables Only)

Systems that have multiple T/RH cables in the bin will include at least one Mux Box to connect the cables.

1. Prepare the Mux Box (24) by removing the needed cable gland plugs (81) to match the number of cables being connected, notice the cable numbering (80) on the Mux Box (24) lid to align with the designated numerical order.

   NOTE: *Make sure the other cable glands that are not being used have the plug (81) installed and cable gland nut tightly secured to prevent water intrusion.*

Figure 5-8 *Removing the plugs from the Mux Box*



24	Mux Box (GV-MUXB)	81	Plug
80	Cable numbering label		

2. The Mux Box (24) comes equipped with an interconnect cable that is 6.5' (2 m) long so it needs placed within that distance to the Cable Monitoring Hub (16). The Cable Monitoring Hub mounting bracket (17) is large enough to allow the Mux Box (24) to be magnetized vertical to the back. If this method is not desired, proceed to the next step.

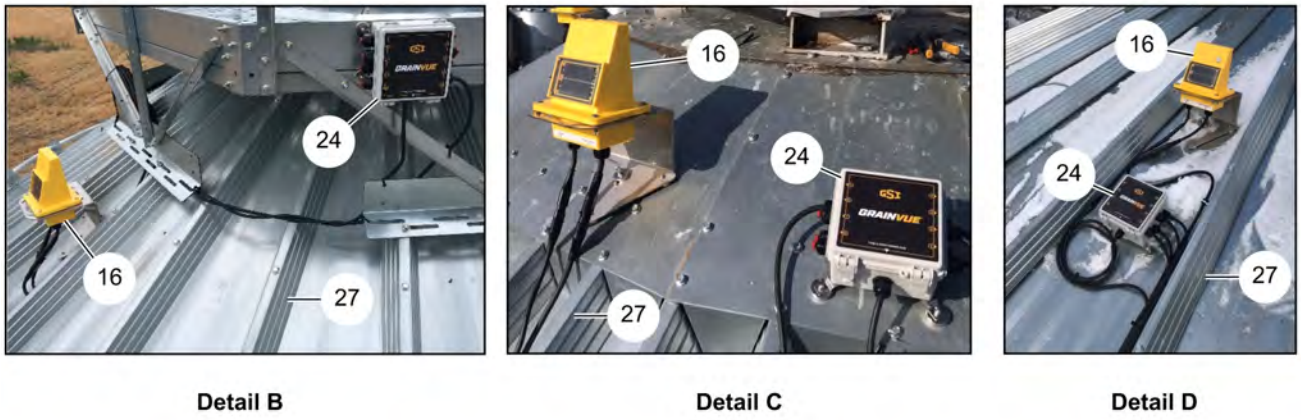
Figure 5-9 *Installing the Mux Box onto the Hub bracket*

16	Cable Monitoring Hub Kit (GV-HUB-KIT)	24	Mux Box (GV-MUXB)
17	Cable Monitoring Hub Mounting Bracket (GV-HUB-BRACKET)		

3. If the above method is not desired and the bin has a flat area to mount the Mux Box (24) vertical, this method works well for installation and wire termination (as shown in Detail B). Otherwise, mounting the Mux Box (24) directly to the roof (27) is acceptable (as shown in Details C and D). Make sure the Mux Box (24) interconnect cable is pointed downward to prevent water intrusion.

   NOTE: *Make sure the Mux Box (24) will be easy to access, yet out of the walking area and that all four pre-installed magnetic feet are attached against the metal surface.*

Figure 5-10 *Installing the Mux Box onto the bin*



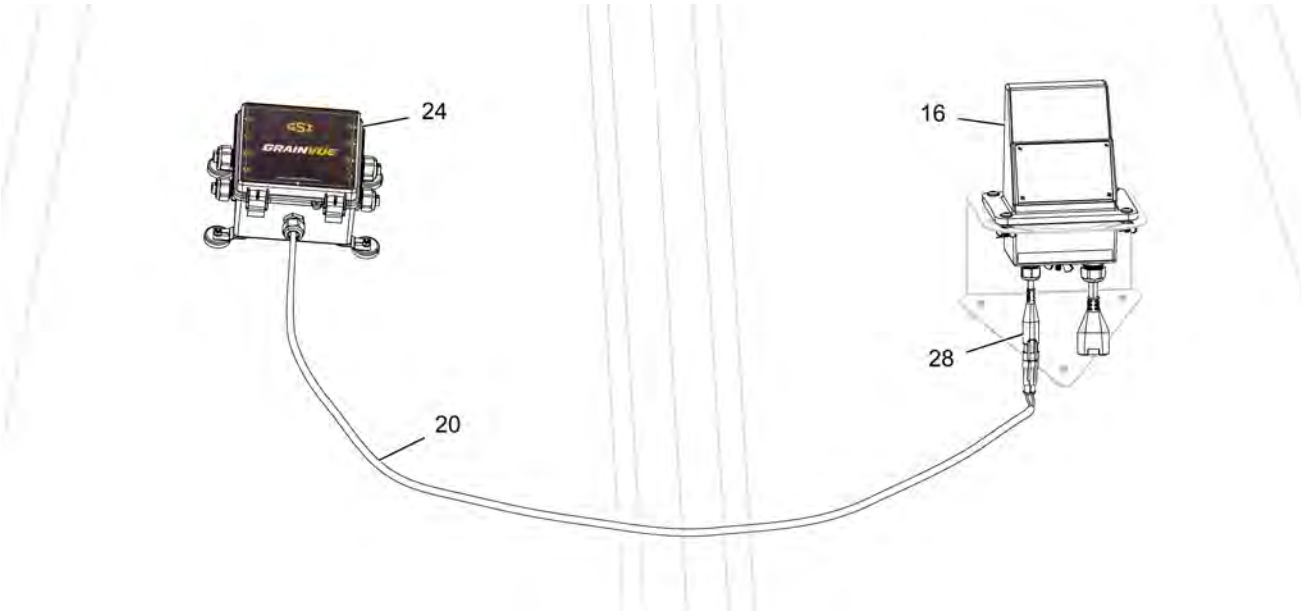
Detail B Detail C Detail D

16	Cable Monitoring Hub Kit (GV-HUB-KIT)	27	Bin roof
24	Mux Box (GV-MUXB)		

4. Route, secure, and connect the interconnect cable (20) from the Mux Box (24) to the port labeled Cables on the Cable Monitoring Hub (16) (push the connectors together until the tab clicks and locks in place).

   NOTE: *Make sure to secure the interconnect cable every 3' by using P-clips or similar.*

Figure 5-11 *Connecting the Mux Box to the Cable Monitoring Hub*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	24	Mux Box (GV-MUXB)
20	Mux Box Interconnect Cable	28	Cable connection port

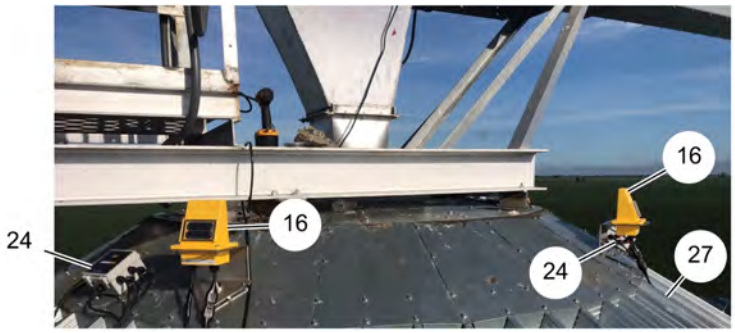
Multiple Mux Box/Hub Connections

Each Mux Box and Cable Monitoring Hub handles a maximum of eight total T/RH cables. If the system will have more than eight cables, additional Mux Box(es) and Cable Monitoring Hub(s) will be included in the order. Follow the installation instructions above for the Cable Monitoring Hub and Mux Box that pertain to the install at hand. Note the below points before installing multiple Mux Boxes and Cable Monitoring Hubs:

- It does not matter how many T/RH cables are terminated in each Mux Box (24), it will be the discretion of the installer on what makes sense routing which Lead Wires to each Mux Box (24).

  NOTE: *For external mounted cables and lead wires coming from all sides of the bin, it does work well to segregate each half of the bin with its own components near that side to reduce the lead wire lengths as shown below.*

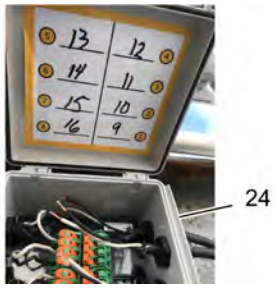
Figure 5-12 *Separating cables and lead wires on each side of the bin*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	27	Bin roof
24	Mux Box (GV-MUXB)		

- To make the commissioning process easier, it helps if the cable lead wires are terminated in the Mux Boxes (24) in the same numbering and layout as the sales drawing identifies. The cable numbering on the sales drawing in reference to the center of the bin and the manhole location needs to be consistent to the sequential number termination in the Mux Box (24) cable positions as shown below.

Figure 5-13 *Separating cables and lead wires based on sequential number*



24	Mux Box (GV-MUXB)

- The serial number for each Cable Monitoring Hub will need to be documented with what Mux Box (and what cables) each is connected to for the commissioning process.
- If the GrainVue system is getting fan control with the Fan Control Module, only one Cable Monitoring Hub will be connected to the Fan Control Module with the Hub to Fan Control Module cable. It is critical to document what serial number Hub is connected to the Fan Control Module for commissioning and before powering the devices. All other Cable Monitoring Hubs will be battery (solar) powered.

Installing the Lead Wire

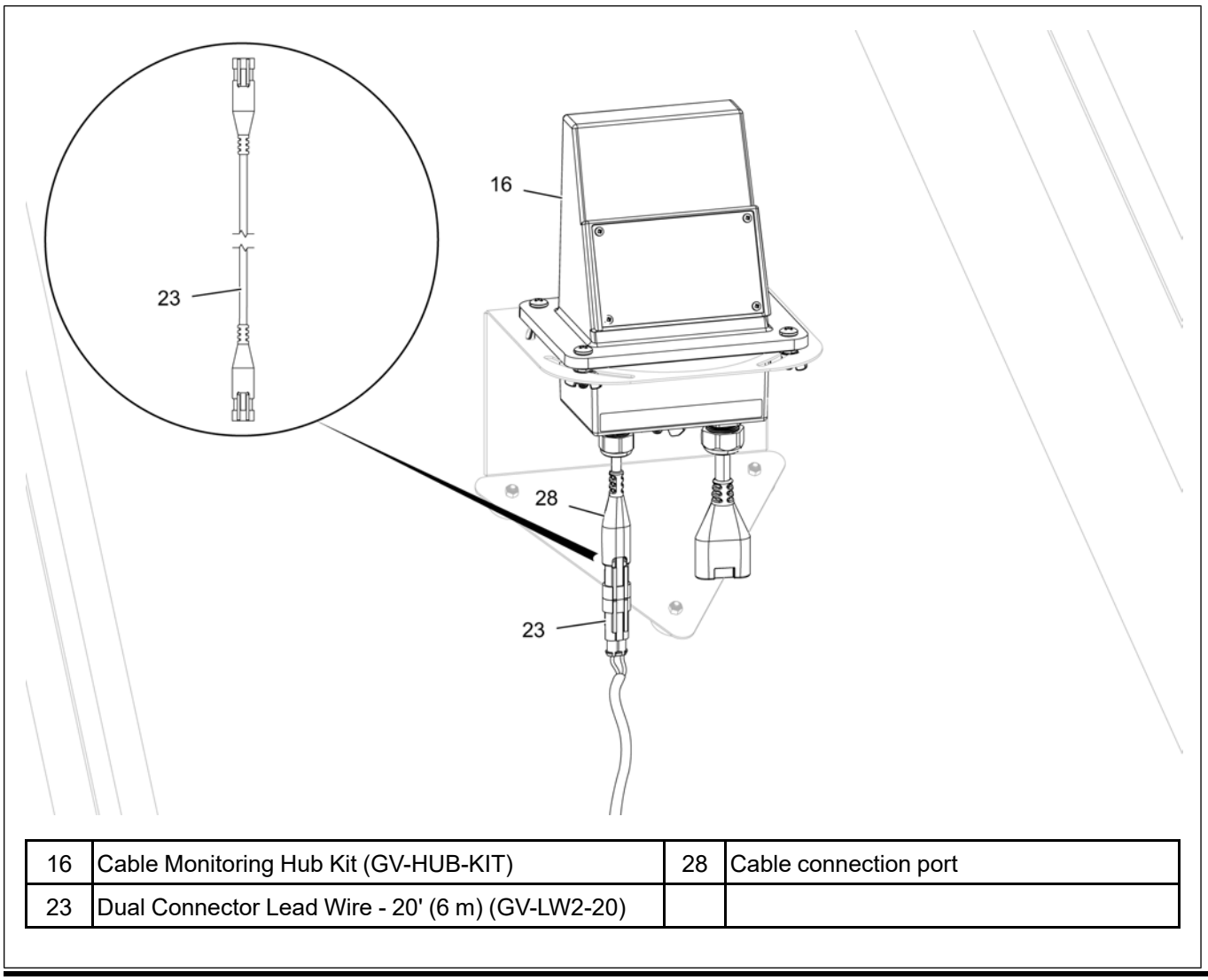
A specific length Lead Wire will be sent with each cable, detailed information of this will be located with the cable details on the sales drawing at the time of quoting. Refer to *Figure 4-1, page 28* for details.

Single Cable Connection

If the T/RH cable is close enough to the Cable Monitoring Hub (16), the connector equipped on the cable can directly connect to the cable connection port (28) on the Cable Monitoring Hub (16). Otherwise use the supplied 20' (6 m) extension Lead Wire (23) to connect to the Cable Monitoring Hub (16) (push the connectors together until the tab clicks and locks in place).

NOTE: *If using the extension Lead Wire (23), secure the wire every 3'-5' by using P-clips or similar.*

Figure 5-14 *Connecting a Dual Connector Lead Wire to the Cable Monitoring Hub*



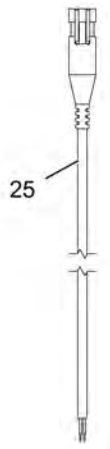
16	Cable Monitoring Hub Kit (GV-HUB-KIT)	28	Cable connection port
23	Dual Connector Lead Wire - 20' (6 m) (GV-LW2-20)		

Multiple Cable Connection

1. Connect each designated Lead Wire (25) to each cable connector by pushing the connectors together until the tab clicks and locks in place. Route the Lead Wires (25) along the roof ribs, safety rings, or similar back to the Mux Box (24) keeping each Lead Wire identified as what cable it represents.

   NOTE: *Secure all Lead Wires every 3'-5' with P-clips to the roof ribs or zip ties to roof safety rings.*

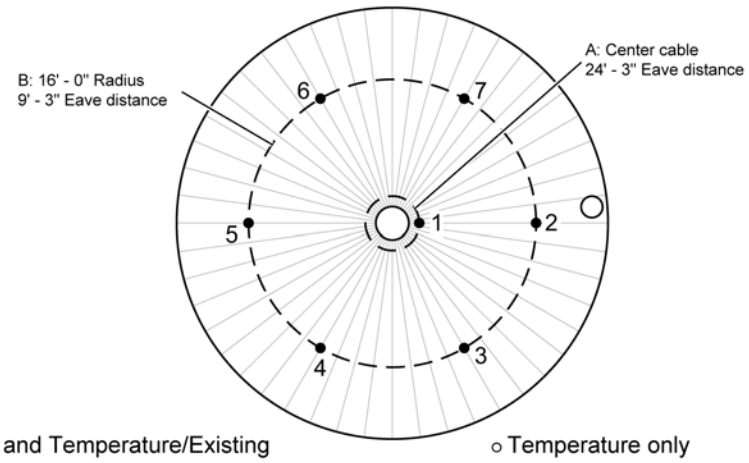
Figure 5-15 *Single Connector Lead Wire for Mux Box*



24	Mux Box (GV-MUXB)	25	Single Connector Lead Wire – 25' (8 m) (GV-LW1-25)
			Single Connector Lead Wire – 50' (16 m) (GV-LW1-50)
			Single Connector Lead Wire – 75' (24 m) (GV-LW1-75)
			Single Connector Lead Wire – 100' (32 m) (GV-LW1-100)

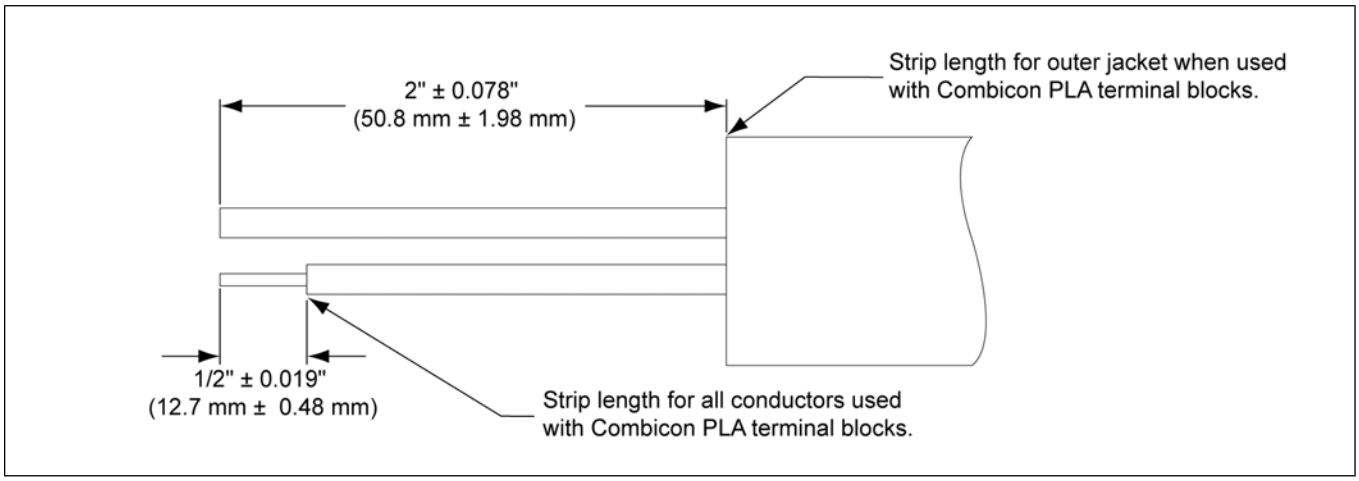
NOTE: *The cables in the bin need to be identified and numbered to match the sales drawing that was acquired at the time of quoting. The cable numbering on the sales drawing in reference to the center of the bin and the manhole location needs to be consistent to the sequential number termination in the Mux Box cable positions.*

Figure 5-16 *Cable numbering from sales drawing (example only)*



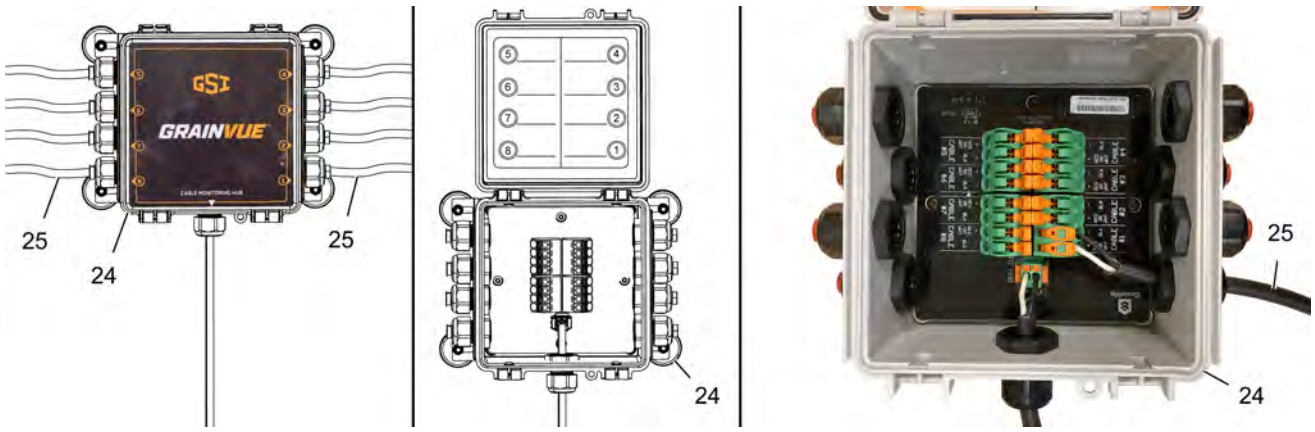
2. Form a drip loop with some slack in the Lead Wire (25) before it enters the Mux Box (24) and insert through the designated cable gland. Tighten down the cable gland nut until very tight around the Lead Wire (25) and cut the Lead Wire (25) to length. Strip the outer jacket 2" back from the end and strip each wire 1/2" back.

Figure 5-17 *Stripping specification for Lead Wire*



3. Terminate the stripped ends of the Lead Wire (25) into the Mux Box (24) terminals, connecting the white to the port labeled “+” and black to “-“. Fully insert the wire and press down on the orange lever until it lays flat as shown below. Pull on each wire to ensure it is securely held in the terminal. Refer to *Figure 5-18, page 59* for an example of a Lead Wire (25) is terminated into the cable #1 port of the Mux Box (24).

Figure 5-18 *Connecting T/RH cables to the Mux Box*



24	Mux Box (GV-MUXB)	25	Single Connector Lead Wire – 25' (8 m) (GV-LW1-25)
			Single Connector Lead Wire – 50' (16 m) (GV-LW1-50)
			Single Connector Lead Wire – 75' (24 m) (GV-LW1-75)
			Single Connector Lead Wire – 100' (32 m) (GV-LW1-100)

4. Document the cable termination chart on the inside of the Mux Box (24) lid that will be used in the commissioning process and is helpful for field service in the future. The chart needs to display the matched sales drawing numbering sequence cable location (as shown in detail E) or location or direction of cable(s), what type of cable (temperature or moisture) in each terminal (as shown in detail F).

Figure 5-19 *Cable termination chart*

Detail E

Detail F

Internal Bin Mounted Cable(s)

Follow the installation instructions above for the Single or Multiple Cable Connection that pertain to the install at hand. Note the below points before installing internal bin mounted cable(s).

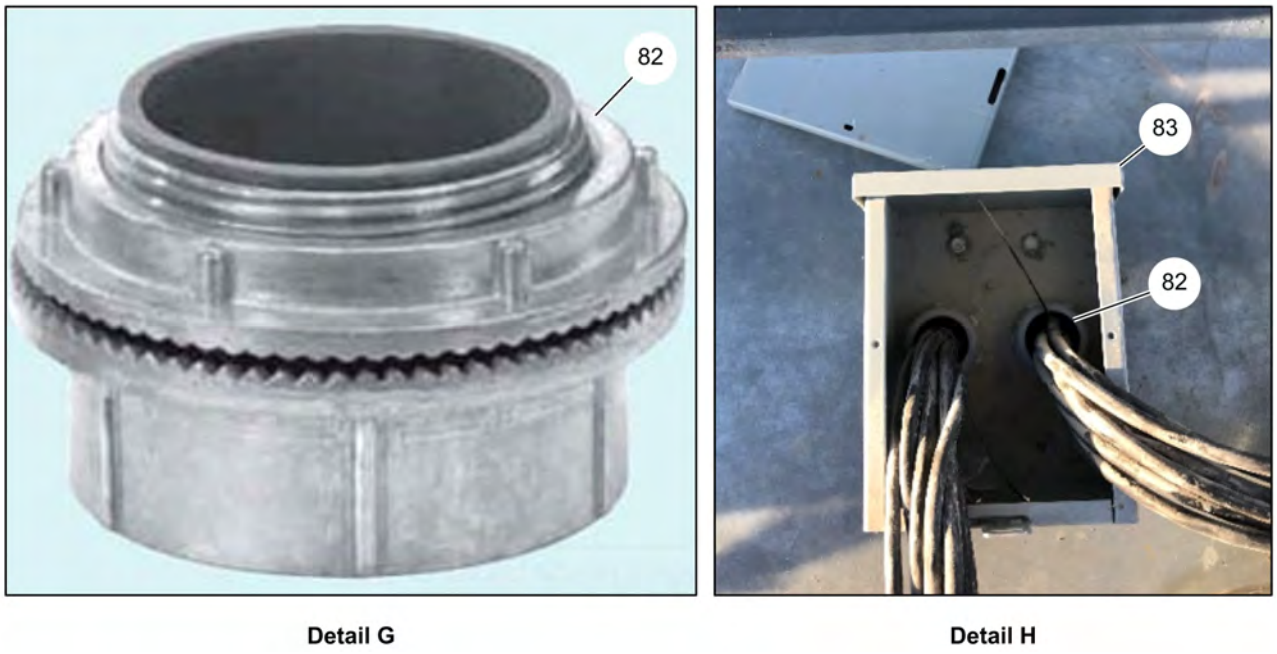
- Secure all Lead Wires up under the roof by attaching to the roof structure or running over roof truss supports to prevent droop.
- Route all Lead Wires to one exit point out of the bin roof at the peak - this will be close to where the Cable Monitoring Hub and/or Mux Box will be located.
- Pass the Lead Wires through the bin roof with an outdoor rated conduit hub (82) (as shown in detail G) sized to the number of Lead Wires (see table below for reference on how many Lead Wires fit in each size conduit). From this conduit hub, attach fittings and flexible conduit to connect either directly to the Mux Box (if small enough) or to a pass through junction box (83) (as shown in detail H) where the individual Lead Wires then can be routed to the Mux Box (24). The Mux Box (24) will accept up to a 1-1/4" conduit placed in the bottom center (the existing Mux Box interconnect cable (20) and cable gland would need removed and placed through one of the side cable glands).

  NOTE: *Make sure all areas where water intrusion could be possible are sealed.*

Table 5-1 *Conduit sizes based on Lead Wire count*

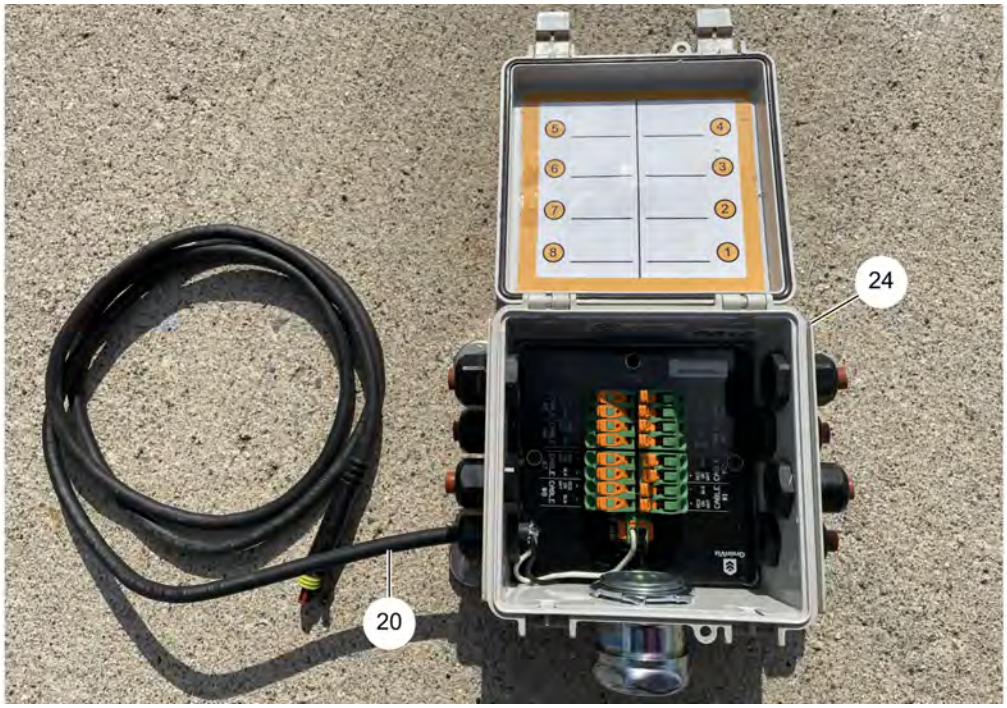
Conduit Size	Lead Wires
3/4"	4
1"	5
1-1/4"	8
1-1/2"	12

Figure 5-20 *Securing the lead wires*



82	Conduit hub	83	Junction box

Figure 5-21 *Routing the Mux Box interconnect cable through side cable gland*



20	Mux Box Interconnect Cable	24	Mux Box (GV-MUXB)

NOTES

6 Fan Control Module Installation

Topics Covered in this Chapter

- Intended Use of Equipment
- Fan Control Module Installation
- Connecting the Fan Control Module to the Cable Monitoring Hub
- Fan Control Module Main Power Connection
- Fan/Heater Connection
- Plenum Sensor Installation
- Outdoor Weather Sensor Installation

Intended Use of Equipment

The Fan Control Module is intended to be used with the GrainVue Cable Monitoring System. When connected to a GrainVue Cable Monitoring Hub, the Fan Control Module provides electrical power to the Cable Monitoring Hub and features eight control channels for use with aeration fans and/or heaters. In addition to the main Fan Control Module unit, a Plenum and Outdoor Sensor are also included to measure environmental conditions in the plenum space and outside of a grain storage bin.

Only devices and sensors sold by GSI Group may be used with the Fan Control Module.

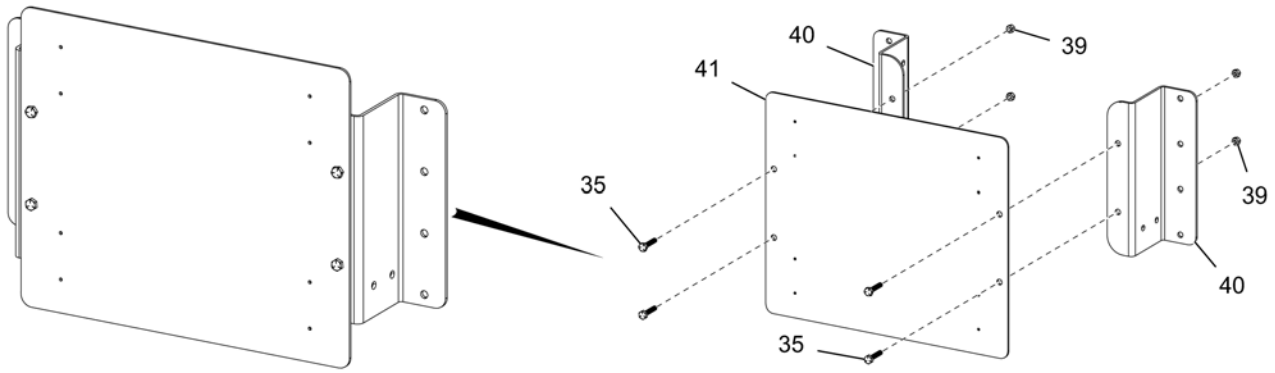
Fan Control Module Installation

The Fan Control Module can be mounted almost anywhere on the bin by using the provided Z-brackets and mounting plate to secure it to the bin. Keeping the lengths of wire, conduit and supplies for installation to a minimum would be top priority and help in determining where it is placed. Below mentioned points help to decide this mounting location:

- Locate the Fan Control Module and components in an area that is easy to access for installation and for future purposes. Do not install the Fan Control Module in a location which obscures the module or prevents the lid from opening. It is essential that a qualified person be able to access the main disconnect breaker inside the Fan Control Module if needed.
- Location of the Hub to Fan Control Module cable will be coming down the side of the bin - the cable will need to be secured down the side of the bin so shorter bins may be reached with an extension ladder and give more flexibility for location. Taller bins may require following the bin ladder or stairs down to secure the cable.
- Location of the fan contactor(s) and how to get the control wires from the Fan Control Module to them – for example, route through existing conduit with junction boxes, etc. or install new conduit from the Fan Control Module to the fan and/or heater controls. The Fan Control Module needs two 16-18 AWG wires for each fan and/or heater.
- Location where the 120 VAC supply power is located to power the Fan Control Module, a separate 15 amp power source is recommended. Again, the wires may route through existing conduit or junction boxes if applicable or new conduit can be run to the source. The Fan Control Module needs three – 14 AWG wires; each for line voltage, neutral and ground.

1. Fasten the two Z-brackets (40) to the mounting plate (41) using the provided 5/16" x 1" HHCS bolts (35) and 5/16" flange nuts (39).

Figure 6-1 *Assembling the Z-brackets to the mounting plate*



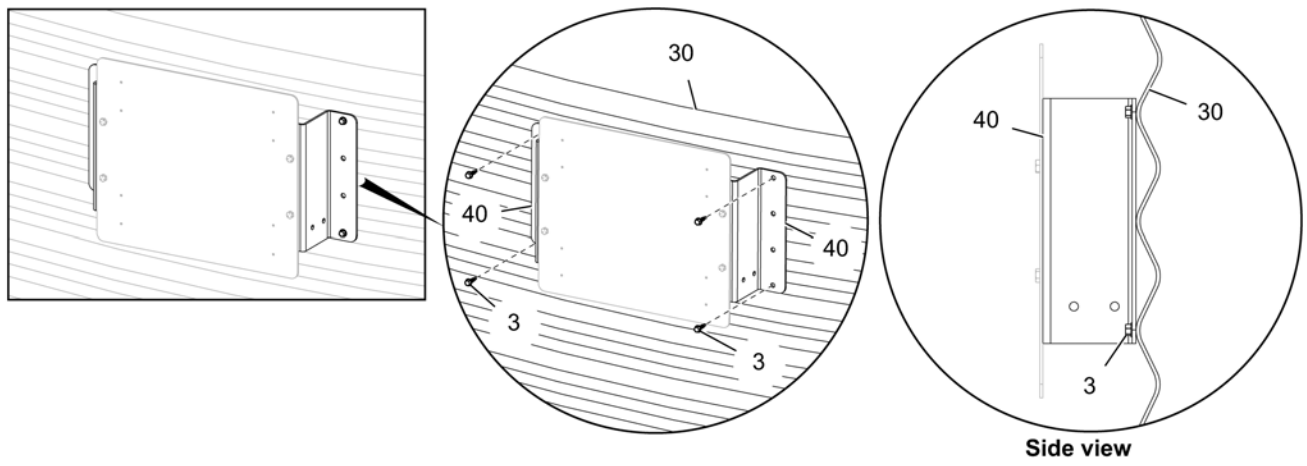
35	5/16" x 1" HHCS bolt (S-1196)	40	Z-bracket (GV-Z-BRACKET)
39	5/16" flange nut (S-3611)	41	Mounting plate (GV-FCM-MOUNT)

2. At the desired location and at eye level for easy installation, level the bracket assembly and line up the holes in the Z-brackets (40) with the peaks of the corrugation of the sidewall (30) and use the supplied 1/4" x 1" self-drilling screws (3) to fasten the assembly to the sidewall.

   NOTE: *If the bin is empty and bolting the assembly to the sidewall (30) is desired, drill 5/16" holes in the sidewall (30) through the Z-bracket (40) holes and mount with the correct hardware.*

   NOTE: *If mounting on a concrete pad, level the Fan Control Module mounting plate at eye level and mark the four holes on the concrete. Drill out the four holes and use a #10 anchor and screw to fasten the Fan Control Module mounting plate to the concrete.*

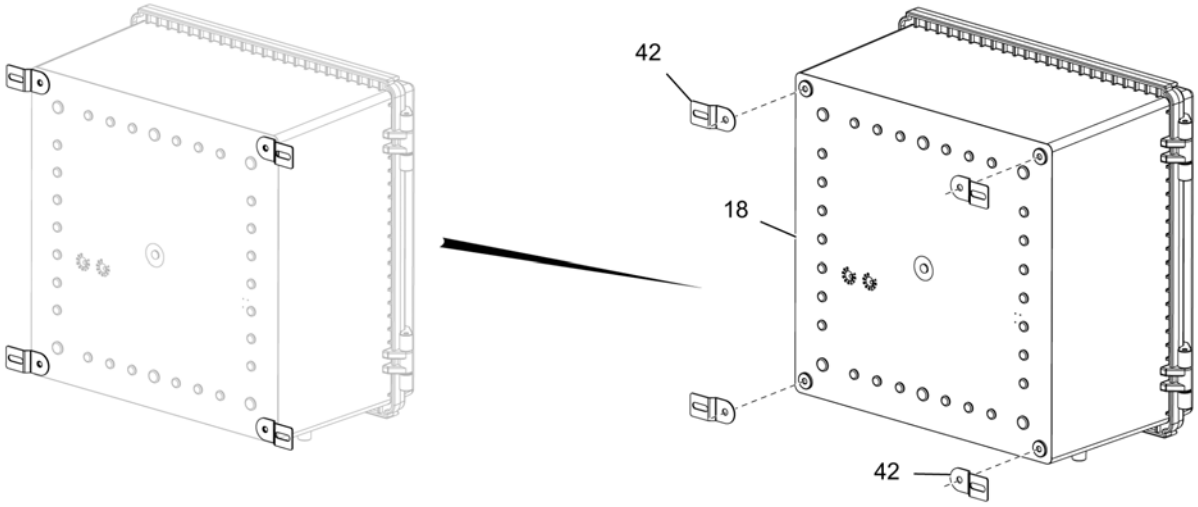
Figure 6-2 *Installing the Z-brackets to the bin sidewall*



3	1/4" x 1" self-drilling screw (S-7229)	40	Z-bracket (GV-Z-BRACKET)
30	Sidewall		

3. Install the provided metal legs (42) onto the backside of the Fan Control Module (18). Make sure the legs are facing sideways as shown below.

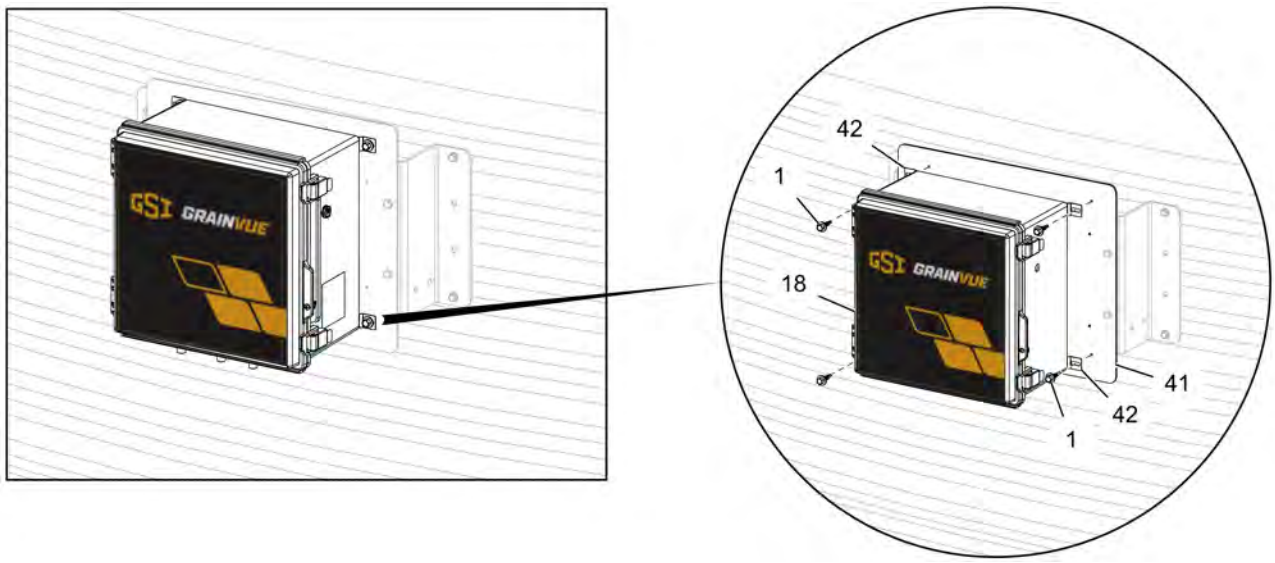
Figure 6-3 *Installing the metal legs to the Fan Control Module*



18	Fan Control Module (GV-FCM2R)	42	Metal leg

4. Align the metal legs (42) with the pilot holes on the mounting plate (41) and use the provided #10-16 x 5/8" self-drilling screws (1) to fasten them together.

Figure 6-4 *Installing the Fan Control Module to the mounting plate*



1	#10-16 x 5/8" self-drilling screw (S-280)	41	Mounting plate (GV-FCM-MOUNT)
18	Fan Control Module (GV-FCM2R)	42	Metal leg

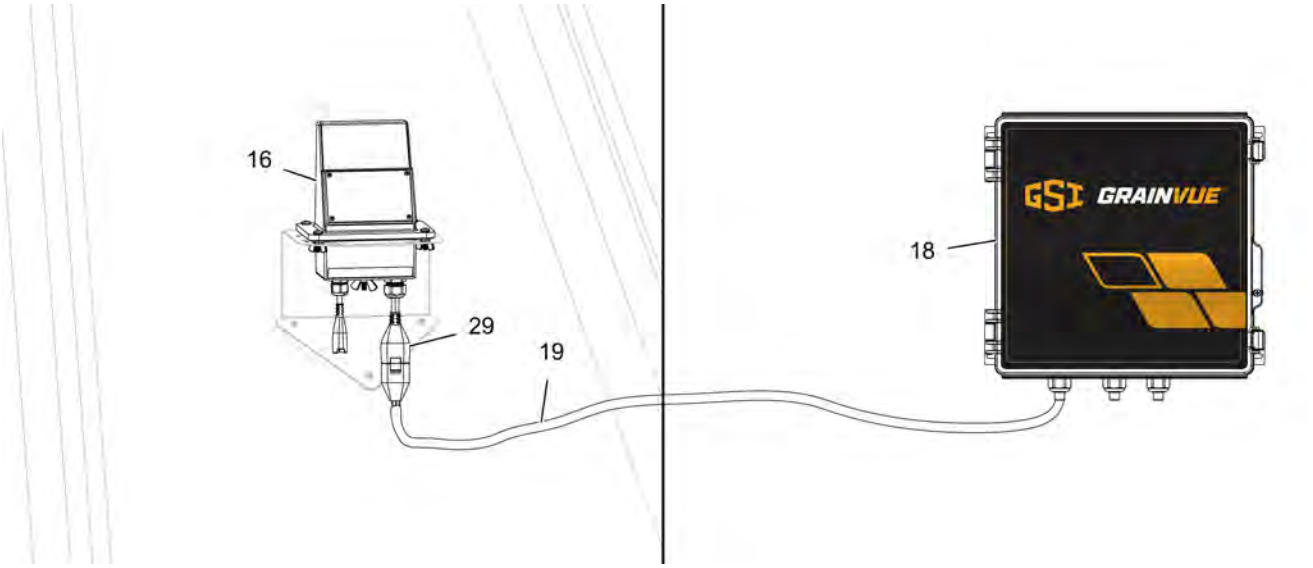
Connecting the Fan Control Module to the Cable Monitoring Hub

The Cable Monitoring Hub (16) will be connected to the Fan Control Module (18) with the Cable Hub to Fan Control Module Cable (19). Once the cable is connected to the Hub (16) and secured and routed to the Fan Control Module (18) as shown in *Cable Monitoring Hub installation, page 48*, the free end of the cable (19) can be terminated inside the Fan Control Module (18).

Tools Required:

- 1/8" wide tip flat screwdriver
- Side cutters
- Wire strippers

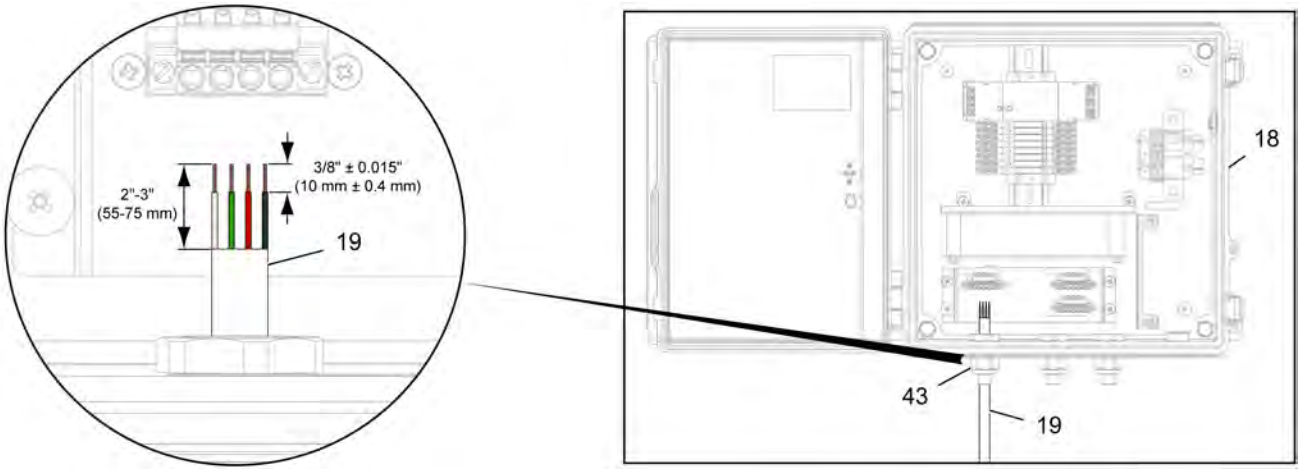
Figure 6-5 *Connecting the Fan Control Module to the Cable Monitoring Hub*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	19	Hub to Fan Control Module Cable - 59' (18 m) (GV-FCM2-18)
			Hub to Fan Control Module Cable - 108' (33 m) (GV-FCM2-33)
			Hub to Fan Control Module Cable - 172' (52 m) (GV-FCM2-52)
18	Fan Control Module (GV-FCM2R)	29	Power supply port (four pin connector)

1. The free end of the cable (19) will enter the Fan Control Module (18) through the left most cord grip (43). Before running the cable (19) through the cord grip (43), excess length of cable (19) can be cut off. Do not cut the cable (19) too short, and leave a few feet of extra cable (19) should any re-work or re-routing be required.
2. Open the lid of the Fan Control Module (18) and loosen off the left most cord grip (43) external compression nut. Remove the cord grip sealing plug. Route the cable (19) through the cord grip (43). Pull a working length of cable (19) through the cord grip (43).
3. Strip the outer jacket of the cable (19) back by 2" to 3" (55 mm to 75 mm). Cut away the internal grey stranded material.
4. Using wire strippers with an 18 AWG stranded wire stripping hole, strip off 3/8" (10 mm) of insulation from each of the four conductors.

Figure 6-6 *Stripping the cable inside the Fan Control Module*



18	Fan Control Module (GV-FCM2R)	43	Cord grip
19	Cable Hub to Fan Control Module Cable		

5. Locate the green 4 position terminal block (44) marked “HUB” above the cord grip (43). Starting with the white wire and the left most position on the terminal block (44), depress the orange locking tab (45) using a flat head screwdriver with blade width of 1/8" (3.5 mm). Insert the stripped end of the wire into the wire hole and release the locking tab (45). Inspect the connection and make sure that no copper wire is visible, and gently pull on the wire to ensure the connection is secure. Repeat the process for each of the remaining wires, in order: green, red, black.
6. Pull excess cable (19) back through the cord grip (43) so that there is not too much excess cable (19) in the box. Make sure that the cord grip (43) is entirely filled with jacketed cable.
7. Tighten the external compression nut of the cord grip (43). It is tight enough when the cable (19) does not move when pulled with moderate force. An example image of a properly completed connection is shown in *Figure 6-7, page 67*.

Figure 6-7 *Connecting the wires to the terminal block*

18	Fan Control Module (GV-FCM2R)	44	Terminal block (for Hub)
19	Cable Hub to Fan Control Module Cable	45	Locking tab
43	Cord grip		

Fan Control Module Main Power Connection

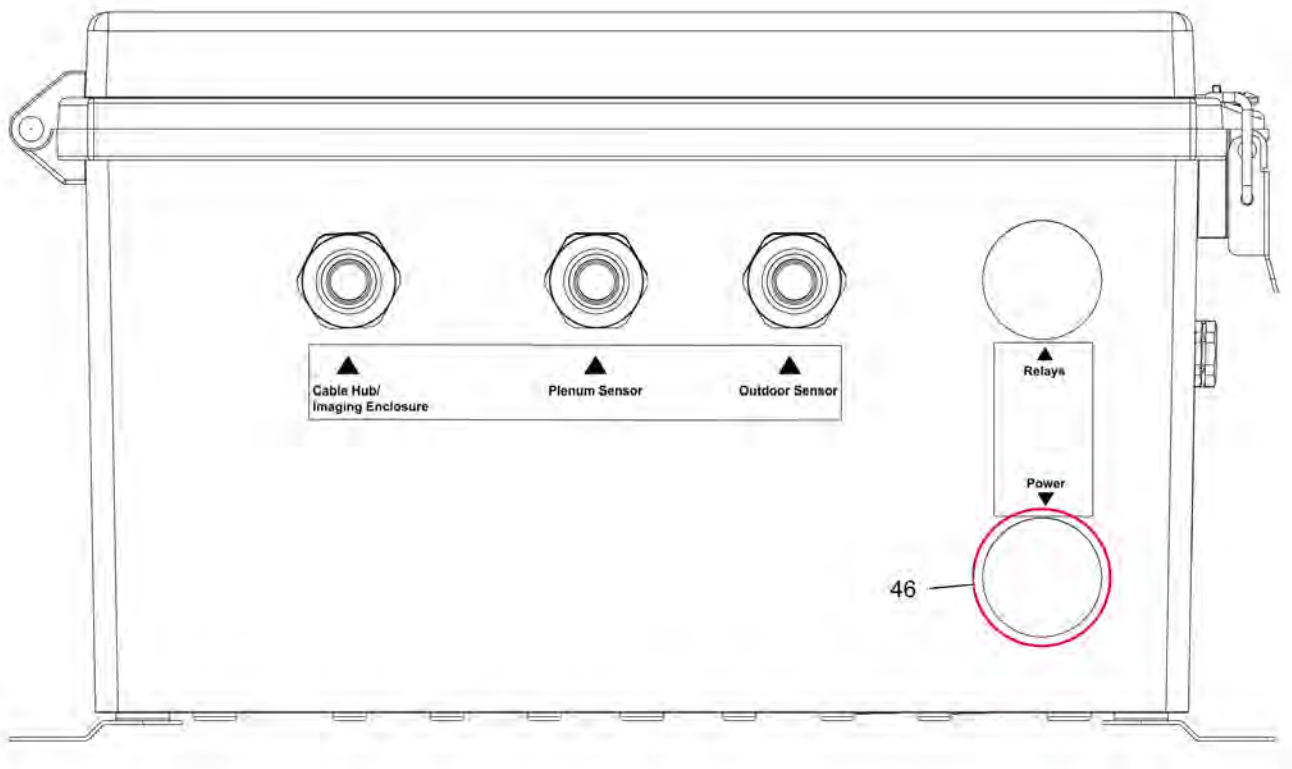
It is recommended that the Fan Control Module is supplied with a separate 15 amp, 120 VAC power source. This will require three – 14 AWG wires; each for line voltage, neutral and ground.

WARNING

Only a certified electrician can complete the power supply installation. Make sure all power sources are disconnected before performing any maintenance or service. Always follow all national and local electrical and safety regulation for your area.

1. Remove the pre-installed knockout plug (46) in the power cable location (circled in red) and replace with an outdoor rated conduit fitting.

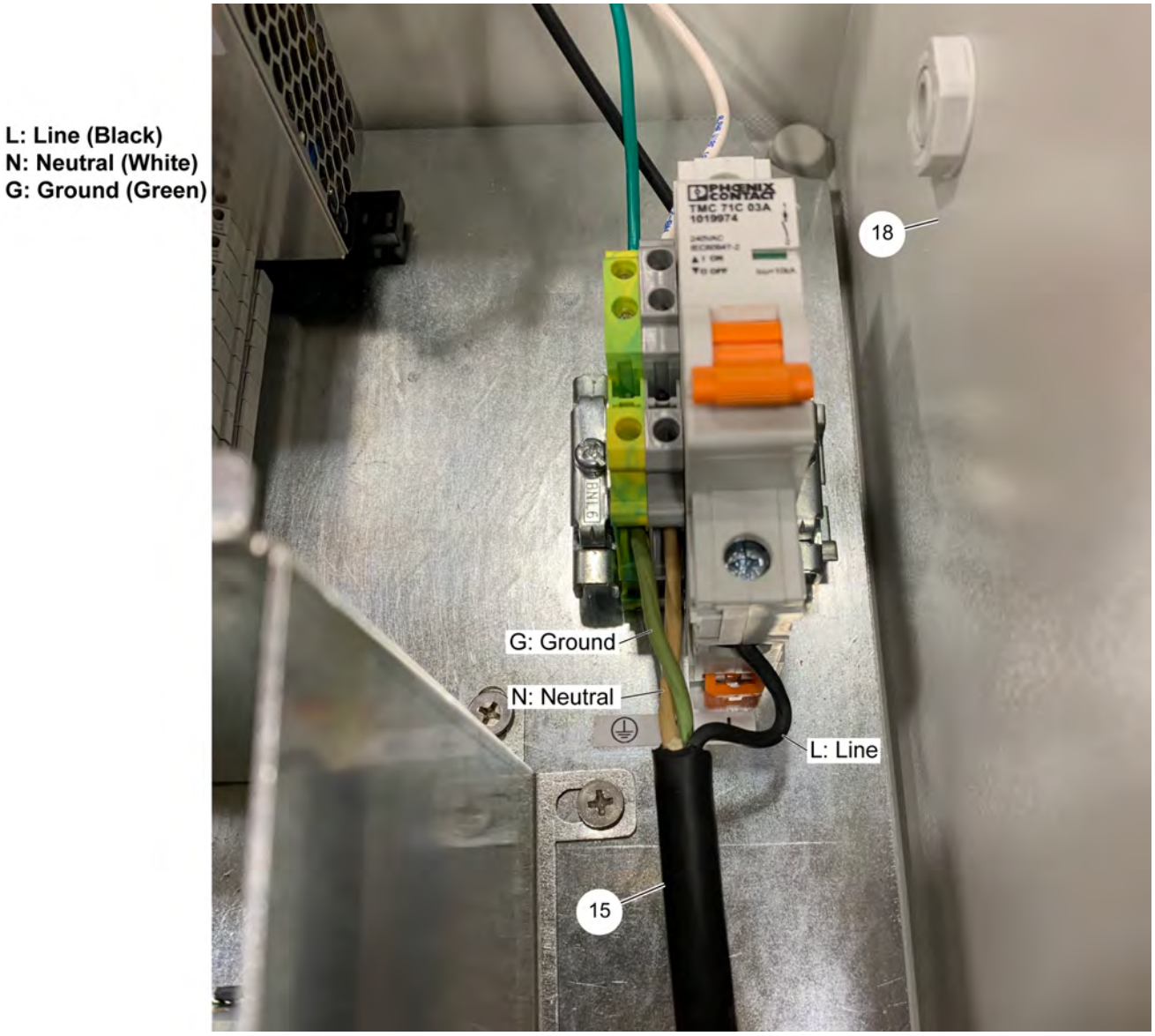
Figure 6-8 *Removing the knockout plug*



46	Knockout plug (for power cable)

2. Once the wires are inside the Fan Control Module (18), terminate the wires to the breaker and terminals as shown in *Figure 6-9, page 69*

Figure 6-9 *Fan control module main power termination*



15	Power cable	18	Fan Control Module (GV-FCM2R)

3. Connect the wires to a circuit protected by a 120 VAC, 15A circuit breaker. Label the circuit breaker to indicate that it is used to power the GrainVue system.

   NOTE: *Do not power the GrainVue system until all terminations are complete for the entire system and the commissioning process is ready to be started.*

Fan/Heater Connection

Only a certified electrician can complete the power supply installation. Make sure all power sources are disconnected before performing any maintenance or service. Always follow all national and local electrical and safety regulation for your area.

Connecting the Fan Control Module to Fan Controls

Two 16-18 AWG wires need to be routed to each fan contactor from the Fan Control Module. The Fan Control Module has no manual shut OFF or bypass for fan control, therefore, a HOA (Hand/Off/Auto) selector switch kit is included for each fan and will need to be installed at the fan contactor location.

NOTE: *Refer to the fan wiring diagrams in Appendix-G: Fan Schematics, page 92 for proper fan control wiring with the inclusion of the HOA switch that matches the site voltage.*

NOTE: *The Fan Control Module output relays can also switch DC volts that could be in VFD or PLC fan control. Criteria for DC switching circuits are listed below. If the DC circuit does not meet the below criteria, an isolated relay will need to be added at the VFD or PLC with the N/O contact controlling the DC input signal and the output relay in the Fan Control Module triggering the 120 VAC coil on the isolated relay.*

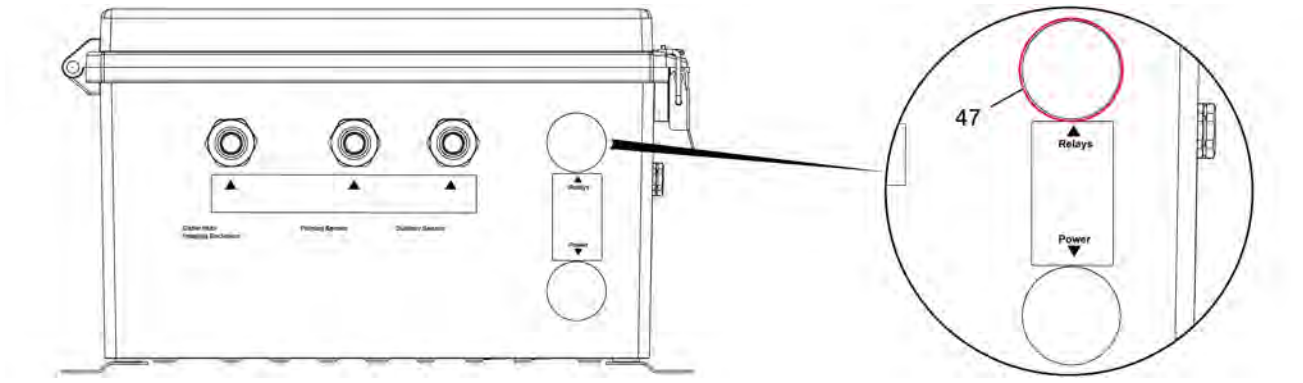
- *Minimum switchable voltage: 5 VDC*
- *Maximum switchable voltage: 250 VDC*
- *Minimum switching current: 100 mA @ 5 VDC, 10 mA @ 12 VDC*

Tools Required:

- 22 mm knockout punch or 7/8" drill bit
- Phillips screwdriver
- 1/8" wide tip flat screwdriver
- Side cutters
- Wire strippers

1. Remove the pre-installed knockout plug (47) in the relay cable location (circled in red) and replace with an outdoor rated conduit fitting.

Figure 6-10 *Removing the knockout plug*



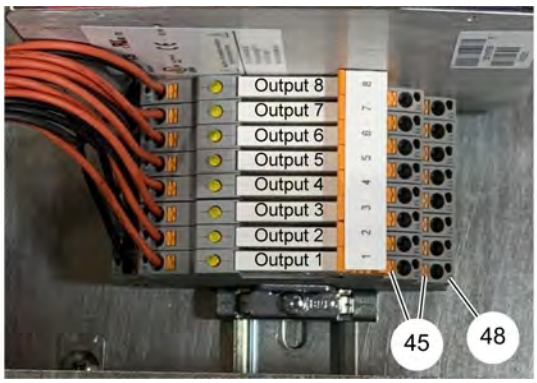
47	Knockout plug (for relay cable)

2. Connect the conduit to the Fan Control Module and run to each fan contactor box or fan control device.
3. Pull two 16-18 AWG wires from the Fan Control Module to each fan contactor box or fan control device.
4. Inside the Fan Control Module, strip off 3/8" (10 mm) of insulation from each conductor.
5. Using the fan wiring diagrams in *Appendix-G: Fan Schematics, page 92* as reference, connect the two wires to terminals #13 and #14 on the output relay (48). Depress the orange locking tab (45) using a flat head screwdriver with blade width of 1/8" (3.5 mm). Insert the stripped end of the wire into the wire hole and release the locking tab (45). Inspect the connection and make sure that no copper wire is visible, and gently pull on the wire to ensure the connection is secure. Repeat the process for the remaining wire(s).

   NOTE: *Start with Output 1 Relay for the first fan. It is best practice to proceed in sequential order for remaining fans and/or heaters, although there is no set or mandatory ordering to the use of relays (48).*

   NOTE: *Fill out the Fan Control Module relay assignment chart in Appendix-C: Cable Connection Ports, page 88 to document what each output is connected to. This will be needed for completing the commissioning process at the end of the install.*

Figure 6-11 *Running AWG wire to the DIN mounted relays*



45	Locking tab	48	Fan Control Module relay

6. Install the HOA switch (84) in a location on the fan contactor box that is easy to access, doesn't obstruct with other components or labels and doesn't allow water intrusion into the box. The HOA kit comes with a decal to identify selector positions, wires, wire ties, and anchors.
7. Install and connect all necessary wires inside the fan contactor box - all wires are identified on the schematics as dashed lines.

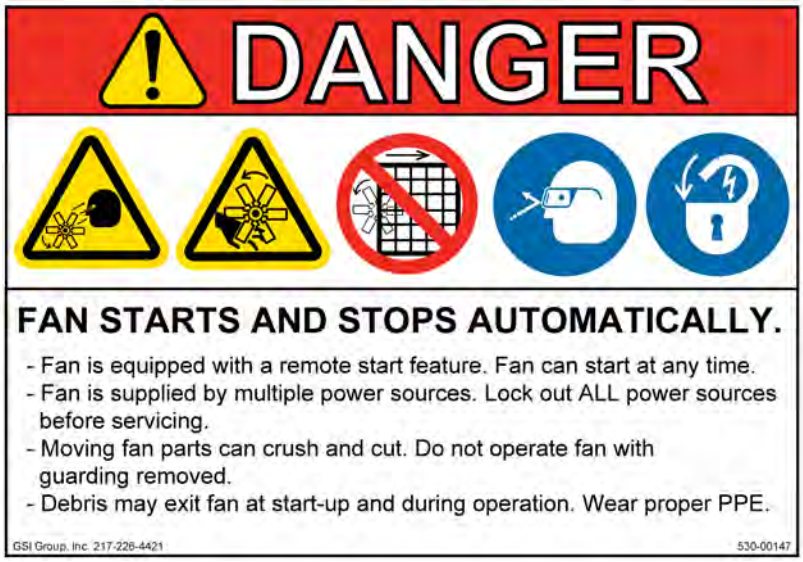
   NOTE: *If connecting to a VFD or PLC control, an added HOA switch (84) may not be needed as those controls typically have a way to start the fan manually and bypass the GrainVue Fan Control Module if needed.*

Figure 6-12 *Installing the HOA switch*

84	HOA Switch Kit (GVHOA-KIT)

8. Place the warning decal included in the HOA kit onto all fans with GrainVue fan control wiring connected to them.

Figure 6-13 *Fan control warning decal*



Connecting the Fan Control Module to Low Temperature Heater Controls

Two 16-18 AWG wires need to be routed to each heater control box from the Fan Control Module. Running the wires in the same conduit as the fan wires is the best option to allow the wires to enter the Fan Control Module in the relay cable location. Refer to *Figure 6-10, page 71*.

NOTE: *Refer to the heater wiring diagrams in Appendix-F: Heater Schematic, page 91 for proper heater control wiring. Make sure to use a separate HOA switch kit.*

NOTE: *If the bin has multiple heaters and they are connected together as master and slave with one existing thermostat control, running two 16-18 AWG wires from the Fan Control Module to the master heater would only be required.*

Tools Required:

- 22 mm knockout punch or 7/8" drill bit
- Phillips screwdriver
- 1/8" wide tip flat screwdriver
- Side cutters
- Wire strippers

1. Once the heater control wires have been pulled inside the Fan Control Module, strip off 3/8" (10 mm) of insulation from each conductor.
2. Using the heater wiring schematic in *Appendix-F: Heater Schematic, page 91* as reference, connect the two wires to terminals #13 and #14 on the output relay (48). Depress the orange locking tab (45) using a flat head screwdriver with blade width of 1/8" (3.5 mm). Insert the stripped end of the wire into the wire hole and release the locking tab (45). Inspect the connection and make sure that no copper wire is visible, and gently pull on the wire to ensure the connection is secure. Repeat the process for the remaining wire(s). Refer to *Figure 6-11, page 71* for details.

   NOTE: *It is best practice to use next available output relay in sequential order, although there is no set or mandatory ordering to the use of relays (48). Proceed in sequential order for remaining heaters if needed.*

   NOTE: *Fill out the Fan Control Module relay assignment chart in Appendix-C: Cable Connection Ports, page 88 to document what each output is connected to. This will be needed for completing the commissioning process at the end of the install.*
3. Install the HOA switch (84) in a location on the heater control box that is easy to access, doesn't obstruct with other components or labels and doesn't allow water intrusion into the box. The HOA kit comes with a decal to identify selector positions, wires, wire ties, and anchors.
4. Install and connect all necessary wires inside the heater control box – all wires are identified on the schematic as dashed lines.

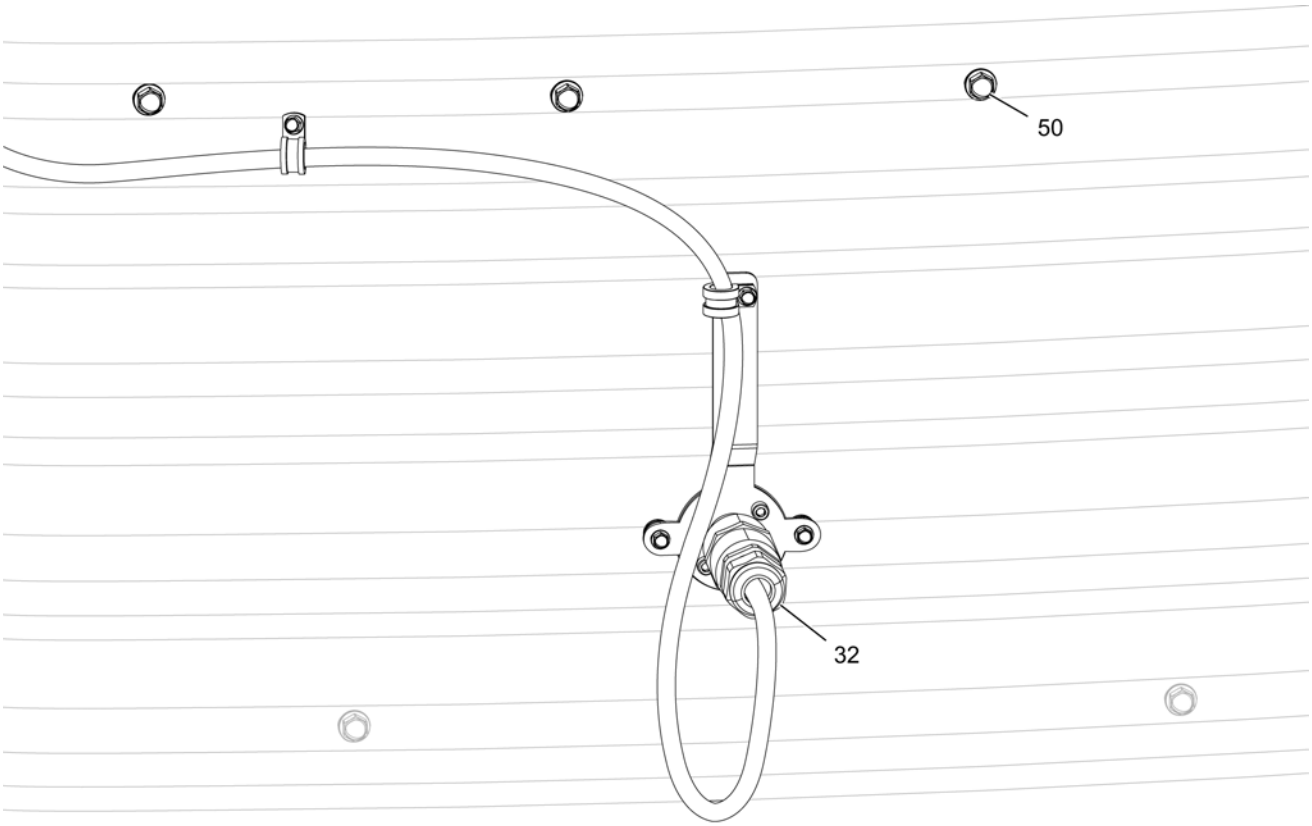
Plenum Sensor Installation

Bin with Full Aeration Floor

1. Drill a 2-1/2" hole, approximately in the middle between the bin's foundation and the plenum floor's horizontal bolt line (50). Note that the location of the hole should be on the peak of the corrugation (not in the valley).

   NOTE: *It does work better to keep the Plenum Sensor (32) on a lower corrugation as shown below to help avoid the floor supports on the inside of the bin.*

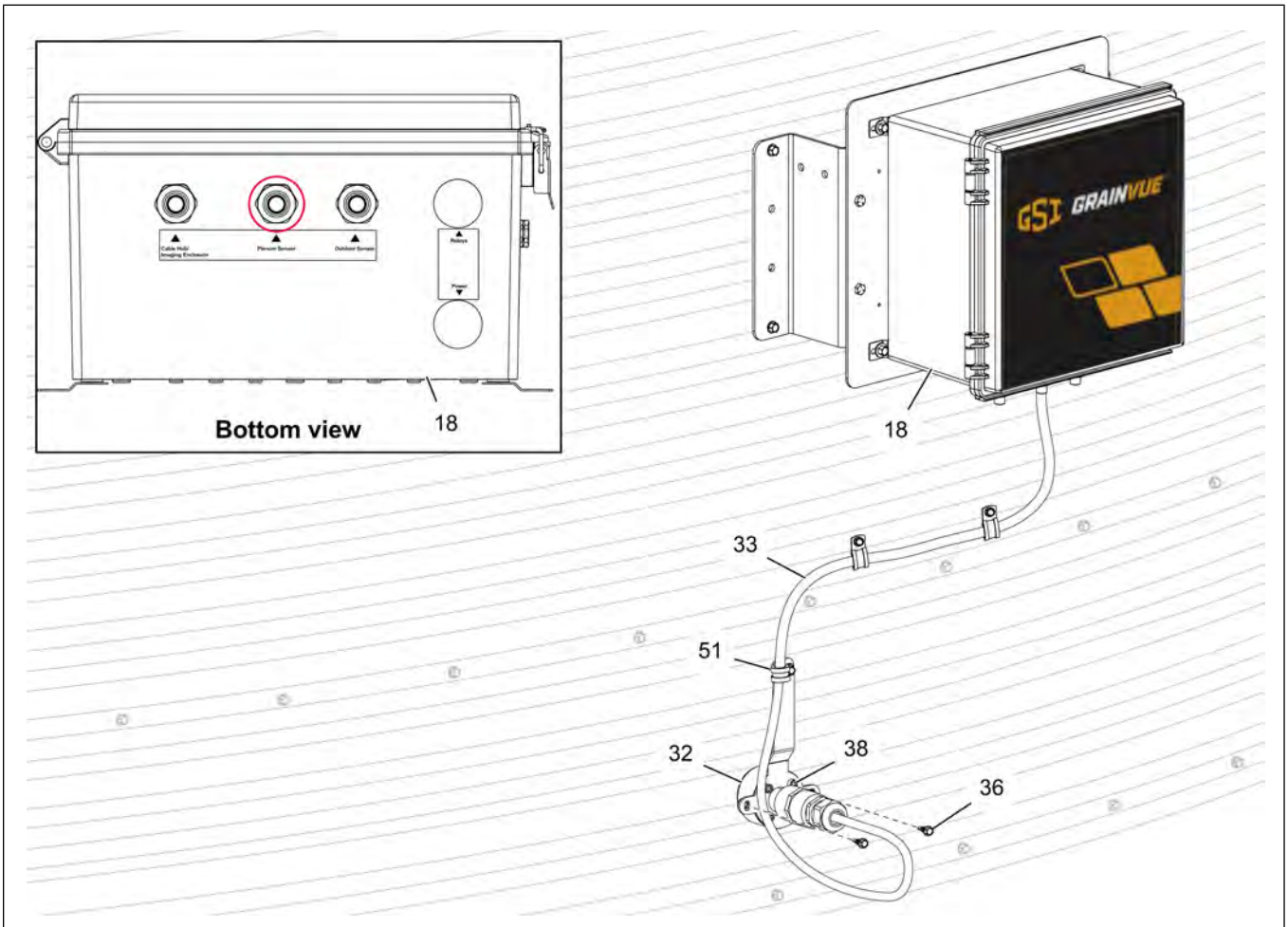
Figure 6-14 *Positioning the Plenum Sensor*



32	Plenum Sensor	50	Bolt line

2. Insert the Plenum Sensor (32) into the 2-1/2" hole with the handle in the downward position if possible. The handle can go in the upward position if the sensor is too close to the foundation. Push the foam core of the Plenum Sensor (32) into the hole, sealing all edges of the hole.
3. Using two 1/4" self-drilling screws (36), fasten the Plenum Sensor (32) mounting plate to the bin wall. Then tighten the socket head cap screws (38) until the foam core has expanded and is firmly set into the hole. Do not overtighten the screws (38) for risk of damaging the foam core.
4. With the handle in the downward position, install the provided P-clip (51) around the plenum sensor cable (33) and anchor the P-clip (51) to the pre-drilled hole at the bottom of the handle with the supplied self-drilling screw. If the handle is in the upward position, form a downward drip loop with the plenum sensor cable (33) and then route up and anchor to the handle with the provided P-clip (51) and screw.
5. Route the Plenum Sensor cable (33) from the Plenum Sensor (32) along the bin to the Fan Control Module (18). Manage the cable every 3' using P-clips (51).

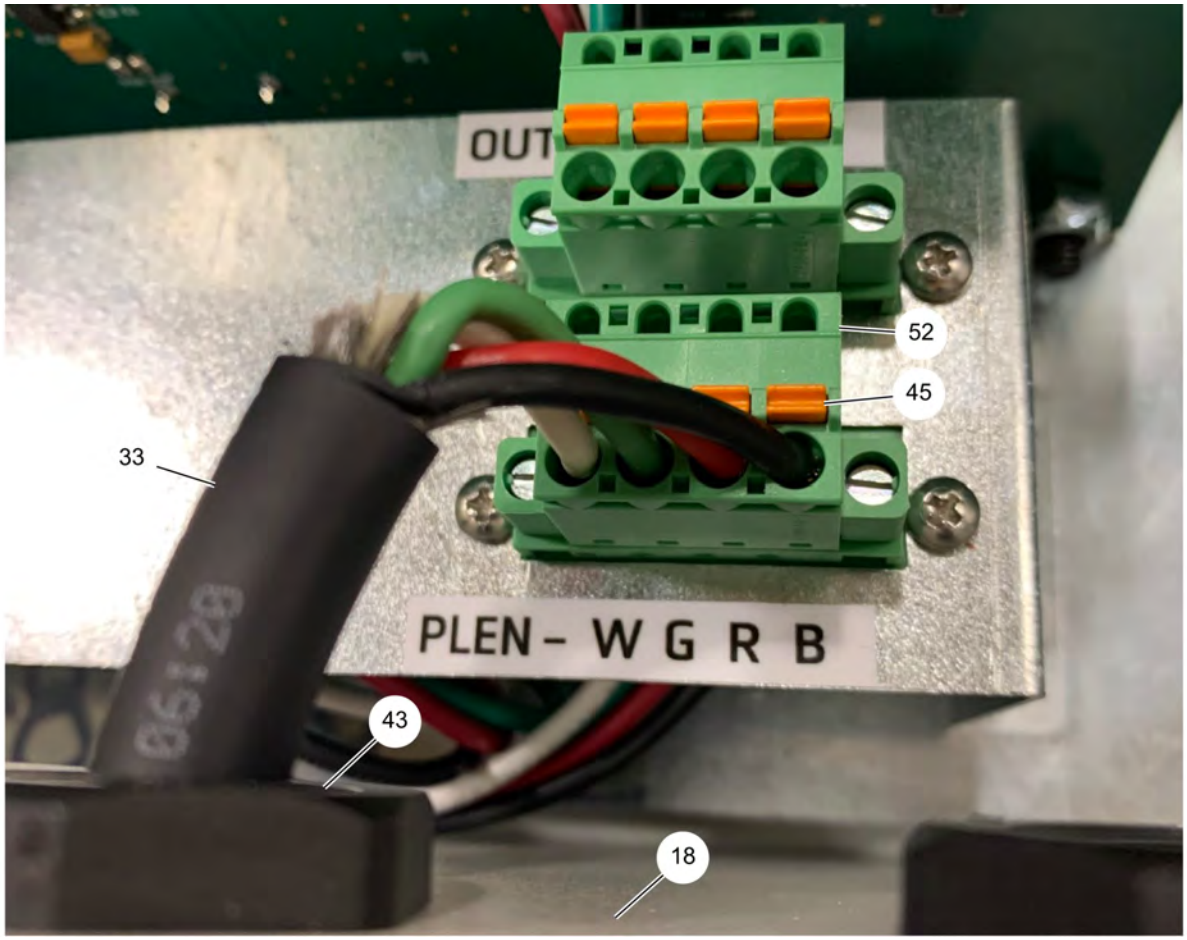
Figure 6-15 *Installing the Plenum Sensor*



18	Fan Control Module (GV-FCM2R)	36	1/4" self-drilling screw
32	Plenum Sensor	38	Socket head cap screw
33	Plenum Sensor cable (GV-PLEN-SHORT)	51	P-clip

6. Open the lid of the Fan Control Module (18) and loosen off the external compression nut on the center cord grip (43) marked “Plenum Sensor”. Remove the cord grip (43) sealing plug.
7. Route the Plenum Sensor cable (33) through the cord grip providing a working length of cable inside the Fan Control Module (18). Remove the pre-cut installation ends from each of the wires to expose the copper wire.
8. Locate the green 4 position terminal block (52) marked “PLEN” above the cord grip (43). Starting with the white wire and the left most position on the terminal block (52), depress the orange locking tab (45) using a flat head screwdriver with blade width of 1/8" (3.5 mm). Insert the stripped end of the wire into the wire hole and release the locking tab (45). Inspect the connection and make sure that no copper wire is visible, and gently pull on the wire to ensure the connection is secure. Repeat the process for each of the remaining wires, in order: green, red, black.
9. Pull excess cable (33) back through the cord grip (43) so that there is not too much excess cable (33) in the box. Make sure that the cord grip (43) is entirely filled with jacketed cable (33).
10. Tighten the external compression nut of the cord grip (43). It is tight enough when the cable (33) does not move when pulled with moderate force. An example image of a properly completed connection is shown in *Figure 6-19, page 79*.

Figure 6-16 *Connecting the wires to the terminal block*



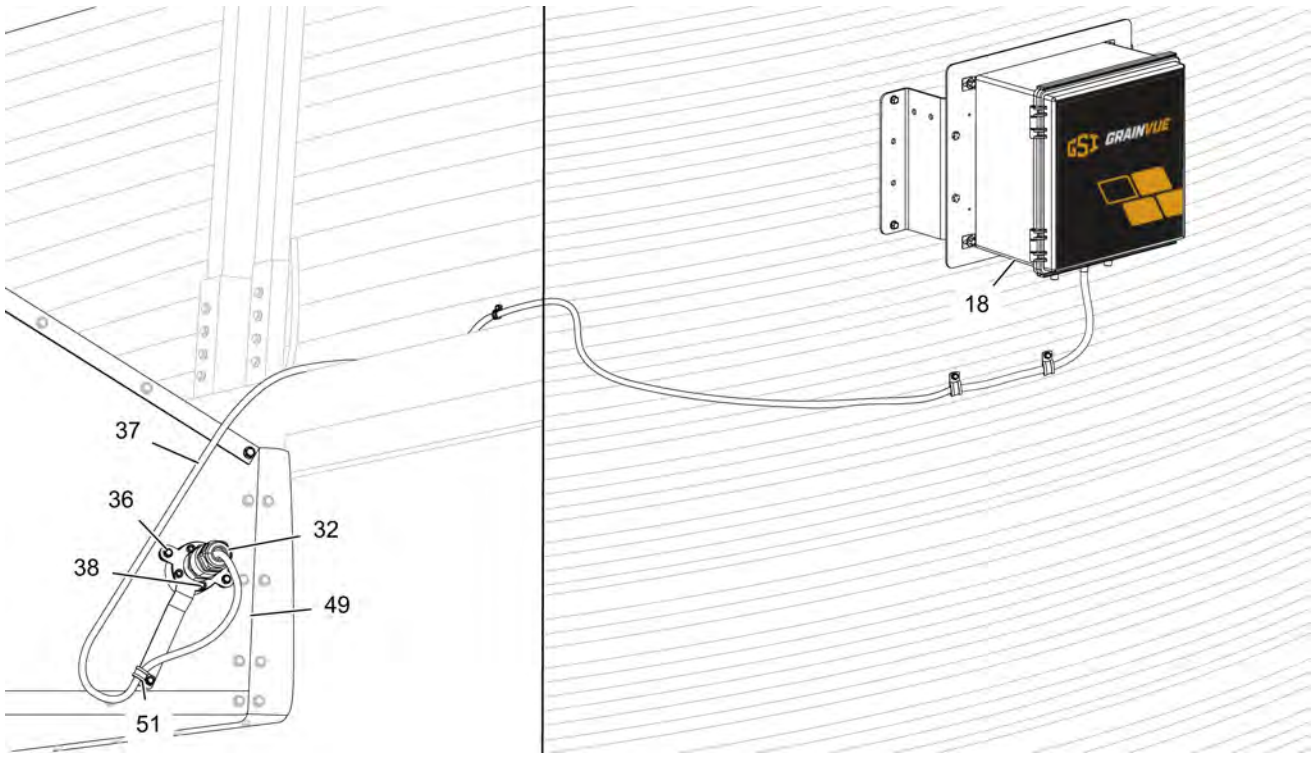
18	Fan Control Module (GV-FCM2R)	45	Locking tab
33	Plenum Sensor cable (GV-PLEN-SHORT)	52	Terminal block (for Plenum Sensor)
43	Cord grip		

Bin with Tunnel Aeration

NOTE: *If the bin does not have a full aeration floor, the plenum sensor will need to be placed in the nearest fan transition to the Fan Control Module to monitor the plenum air.*

1. Drill a 2-1/2" hole, in the side of the fan transition (49). It should be placed in a location to angle the Plenum Sensor (32) slightly towards the bin if possible.
2. Insert the Plenum Sensor (32) into the 2-1/2" hole with the handle in the downward position if possible. The handle can go in the upward position if there is something that obstructs the orientation.
3. Using two 1/4" self-drilling screws (36), fasten the Plenum Sensor (32) mounting plate to the fan transition (49). Then tighten the socket head cap screws (38) until the foam core has expanded and is firmly set into the hole. Do not overtighten the screws (38) for risk of damaging the foam core.
4. With the handle in the downward position, install the provided P-clip (51) around the Plenum Sensor cable (37) and anchor the P-clip (51) to the pre-drilled hole at the bottom of the handle with the supplied self-drilling screw. If the handle is in the upward position, form a downward drip loop with the Plenum Sensor cable (37) and then route up and anchor to the handle with the provided P-clip (51) and screw.
5. Route the Plenum Sensor cable (37) from the Plenum Sensor (32) along the bin to the Fan Control Module (18). Manage the cable every 3' using P-clips (51).

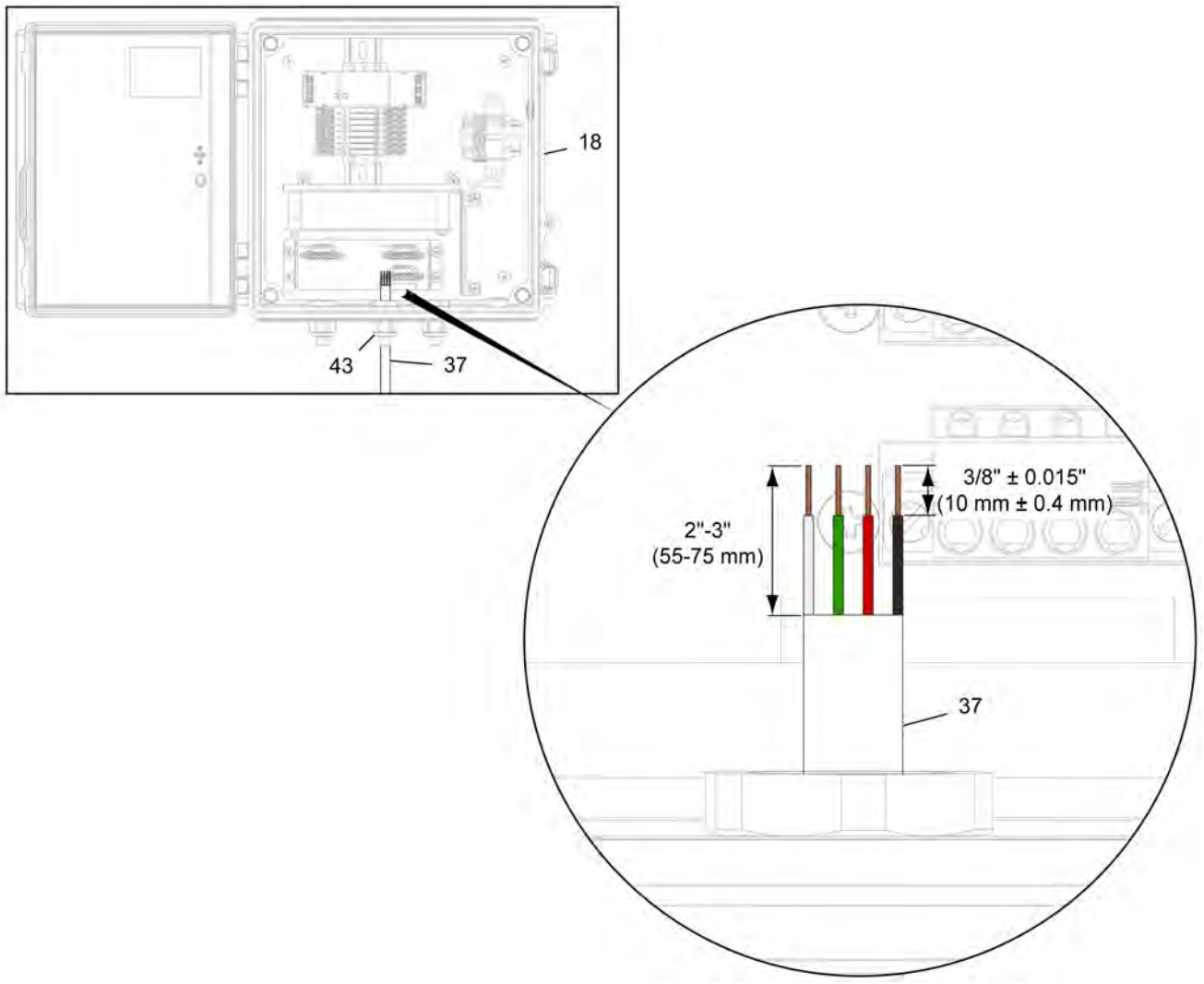
Figure 6-17 *Installing the Plenum Sensor to the fan transition*



18	Fan Control Module (GV-FCM2R)	38	Socket head cap screw
32	Plenum Sensor	49	Fan transition
36	1/4" self-drilling screw	51	P-clip
37	Plenum Sensor cable (GV-PLEN-LONG)		

6. Open the lid of the Fan Control Module (18) and loosen off the external compression nut on the center cord grip (43) marked “Plenum Sensor”. Remove the cord grip (43) sealing plug.
7. Before running the Plenum Sensor cable (37) through the cord grip (43), excess cable can be cut off if applicable. Do not cut the cable (37) too short, leave a few feet of extra cable (37) should any re-work or re-routing be required. Route the Plenum Sensor cable (37) through the cord grip (43) providing a working length of cable inside the Fan Control Module (18).
8. If using the factory stripped end, remove the pre-cut installation ends from each of the wires to expose the copper wire. Otherwise, strip the outer jacket of the Plenum Sensor cable (37) back by 2"-3" (55 mm-75 mm). Cut away the internal grey stranded material. Use wire strippers with an 18 AWG stranded wire stripping hole, strip off 3/8" (10 mm) of insulation from each of the four conductors.

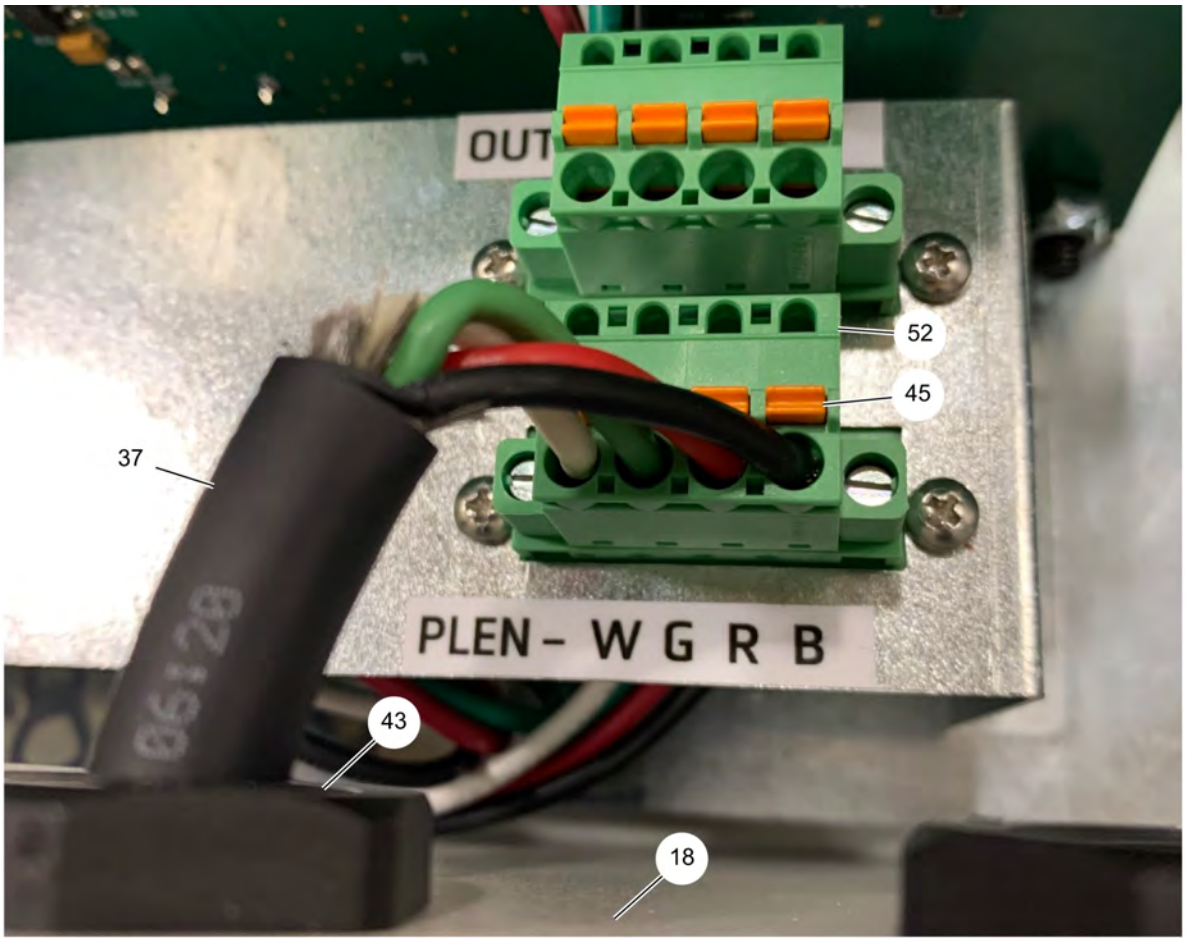
Figure 6-18 *Connecting the wires to the terminal block*



18	Fan Control Module (GV-FCM2R)	43	Cord grip
37	Plenum Sensor cable (GV-PLEN-LONG)		

9. Locate the green 4 position terminal block (52) marked “PLEN” above the cord grip (43). Starting with the white wire and the left most position on the terminal block (52), depress the orange locking tab (45) using a flat head screwdriver with blade width of 1/8" (3.5 mm). Insert the stripped end of the wire into the wire hole and release the locking tab (45). Inspect the connection and make sure that no copper wire is visible, and gently pull on the wire to ensure the connection is secure. Repeat the process for each of the remaining wires, in order: green, red, black.
10. Pull excess cable (37) back through the cord grip (43) so that there is not too much excess cable (37) in the box. Make sure that the cord grip (43) is entirely filled with jacketed cable (37).
11. Tighten the external compression nut of the cord grip (43). It is tight enough when the cable (37) does not move when pulled with moderate force. An example image of a properly completed connection is shown in *Figure 6-19, page 79*.

Figure 6-19 *Connecting the wires to the terminal block*

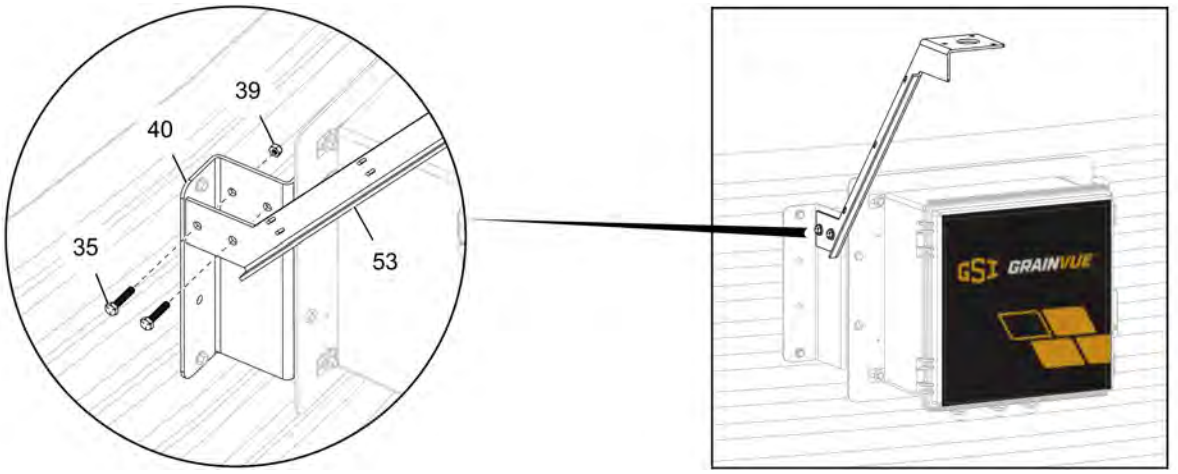


18	Fan Control Module (GV-FCM2R)	45	Locking tab
37	Plenum Sensor cable (GV-PLEN-LONG)	52	Terminal block (for Plenum Sensor)
43	Cord grip		

Outdoor Weather Sensor Installation

1. Mount the provided Outdoor Sensor bracket (53) onto the already installed Z-brackets (40) for the Fan Control Module using 5/16" x 1" HHCS bolts (35) and 5/16" flange nuts (39).

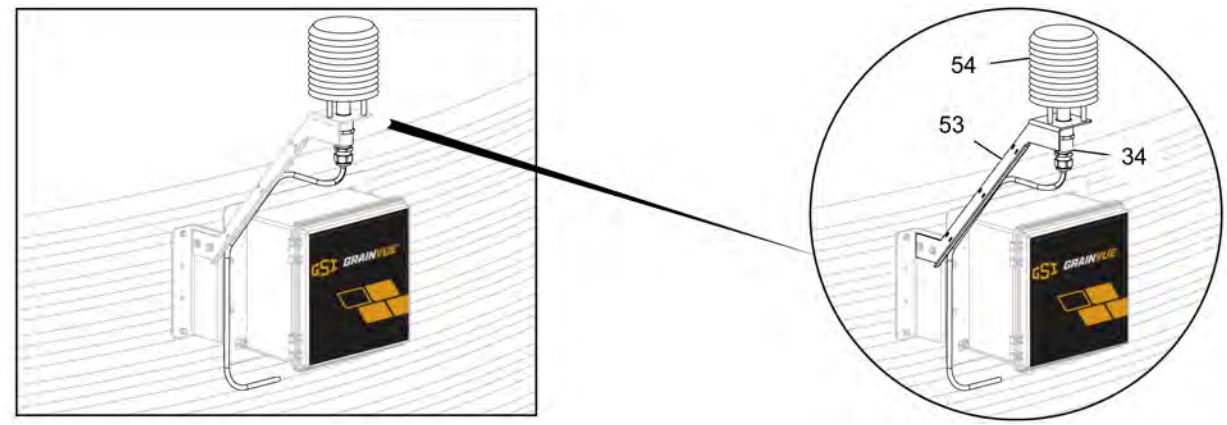
Figure 6-20 *Installing the Outdoor Sensor bracket*



35	5/16" x 1" HHCS bolt (S-1196)	40	Z-bracket (GV-Z-BRACKET)
39	5/16" flange nut (S-3611)	53	Outdoor Sensor bracket

2. Slide the studs of the Rika Solar Shield (54) through the holes on the top of the Outdoor Sensor bracket (53). Use the provided wing nuts to fasten the two together.
3. Slide the Outdoor Sensor (34) through the center hole of the Outdoor Sensor bracket (53) and tighten the cable gland on the Rika Solar Shield (54) to hold the Outdoor Sensor (34) in place.

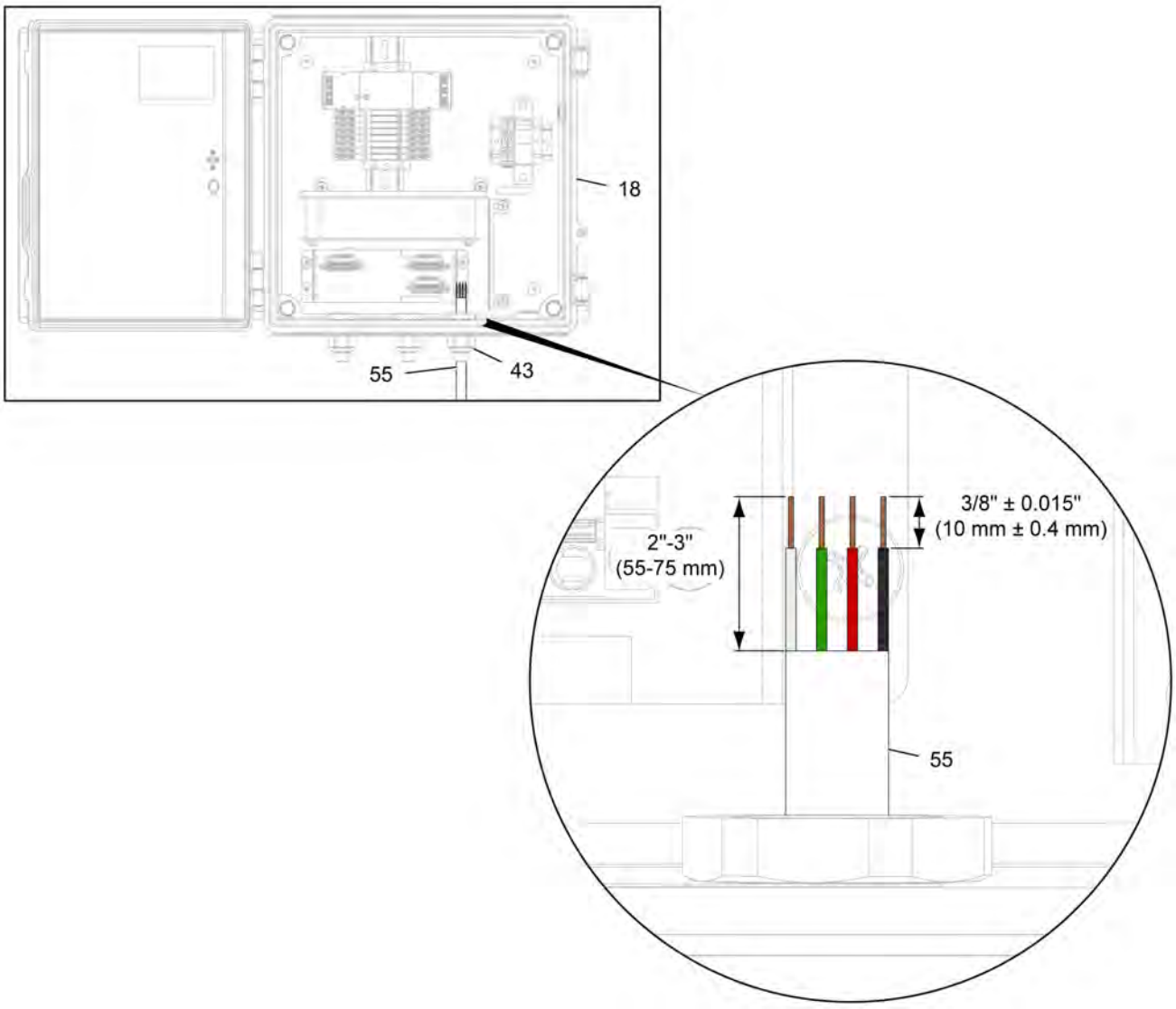
Figure 6-21 *Installing the Outdoor Sensor*



34	Outdoor Sensor (GV-OUT-SENS)	54	Rika Solar Shield
53	Outdoor Sensor bracket		

4. Use zip ties to secure the Outdoor Sensor cable (55) to the Outdoor Sensor bracket (53) using the slots on the bracket.
5. Open the lid of the Fan Control Module (18) and loosen off the right most cord grip (43) external compression nut marked “Outdoor Sensor”. Remove the cord grip sealing plug. Route the Outdoor Sensor cable (55) through the cord grip (43). Pull a working length of cable (55) through the cord grip (43).
6. Remove the pre-cut insulation ends from each of the wires to expose the copper wire. If the wires are damaged, you can re-strip the wire ends. Using wire strippers with an 18 AWG stranded wire stripping hole, strip off 3/8" (10 mm) of insulation from each of the four conductors.

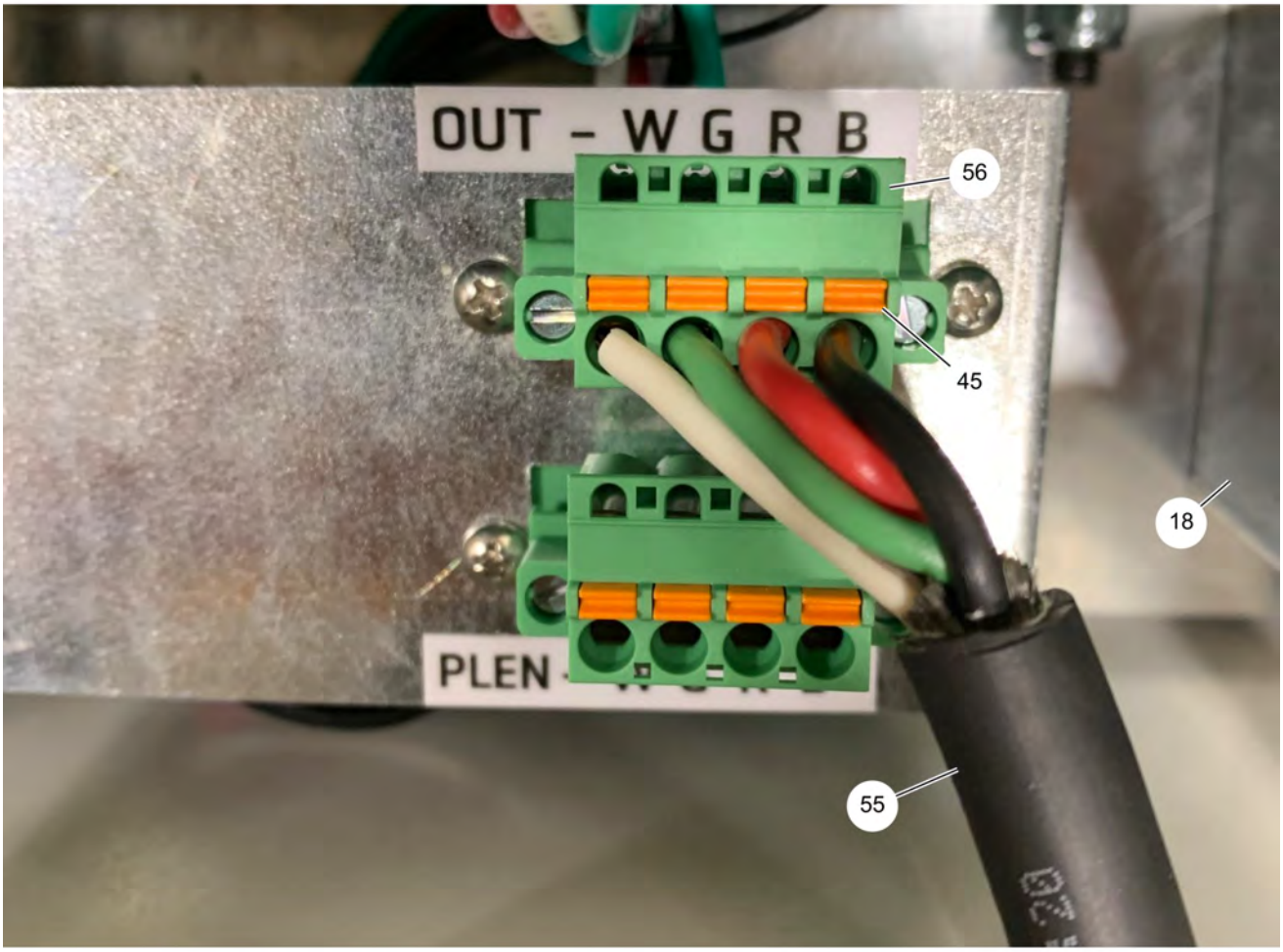
Figure 6-22 *Stripping the cable inside the Fan Control Module*



18	Fan Control Module (GV-FCM2R)	55	Outdoor Sensor cable
43	Cord grip		

7. Locate the green 4 position terminal block (56) marked “OUT” above the cord grip (43). Starting with the white wire and the left most position on the terminal block (56), depress the orange locking tab (45) using a flat head screwdriver with blade width of 1/8" (3.5 mm). Insert the stripped end of the wire into the wire hole and release the locking tab (45). Inspect the connection and make sure that no copper wire is visible, and gently pull on the wire to ensure the connection is secure. Repeat the process for each of the remaining wires, in order: green, red, black.
8. Pull excess cable (55) back through the cord grip (43) so that there is not too much excess cable (55) in the box. Make sure that the cord grip (43) is entirely filled with jacketed cable.
9. Tighten the external compression nut of the cord grip (43). It is tight enough when the cable (55) does not move when pulled with moderate force. An example image of a properly completed connection is shown in *Figure 6-23, page 82*.

Figure 6-23 *Connecting the wires to the terminal block*



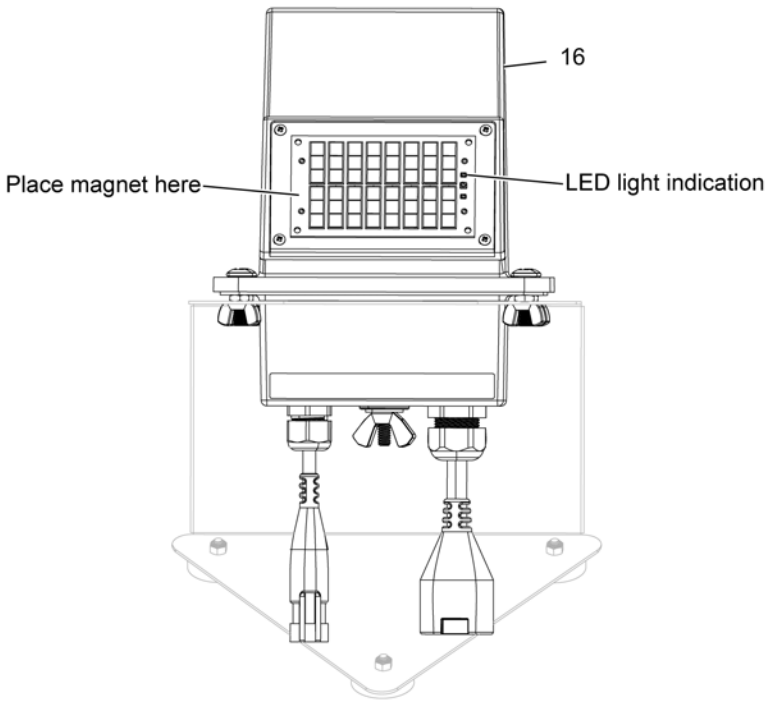
18	Fan Control Module (GV-FCM2R)	55	Outdoor Sensor cable
45	Locking tab	56	Terminal block (for Outdoor Sensor)

7 Activating the Cable Monitoring Hub

1. The Cable Monitoring Hub (16) will be delivered to site turned OFF. You can use the provided magnetic key to turn ON the Cable Monitoring Hub (16).
2. Before turning ON the hub please contact GrainVue support (mentioned below) to provide the Cable Hub Serial Number.

   Email: grainvuesupport@agcocorp.com or
   Phone: 1-306-490-2446
3. To turn the Hub ON, place the magnetic key over the left side of the Solar Array Shield. On the right side of the Solar Array, a green LED light will turn on indicating the system is now ON.
4. Once the green LED light is on, remove the magnetic key and notice a red LED light turn on. The red LED will remain on for 30 seconds and will then turn off to save power. The system will continue to remain ON even after the red LED turns off.
5. To turn OFF the Cable Monitoring Hub (16), place the magnetic key over the left side of the Solar Array Shield. Once placed, the same green LED light will begin to flash.
6. Once the light begins to flash, you have three seconds to remove the magnetic key to turn OFF the Cable Monitoring Hub (16).

Figure 7-1 *Activating the Cable Monitoring Hub*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)

NOTES

8 Appendix

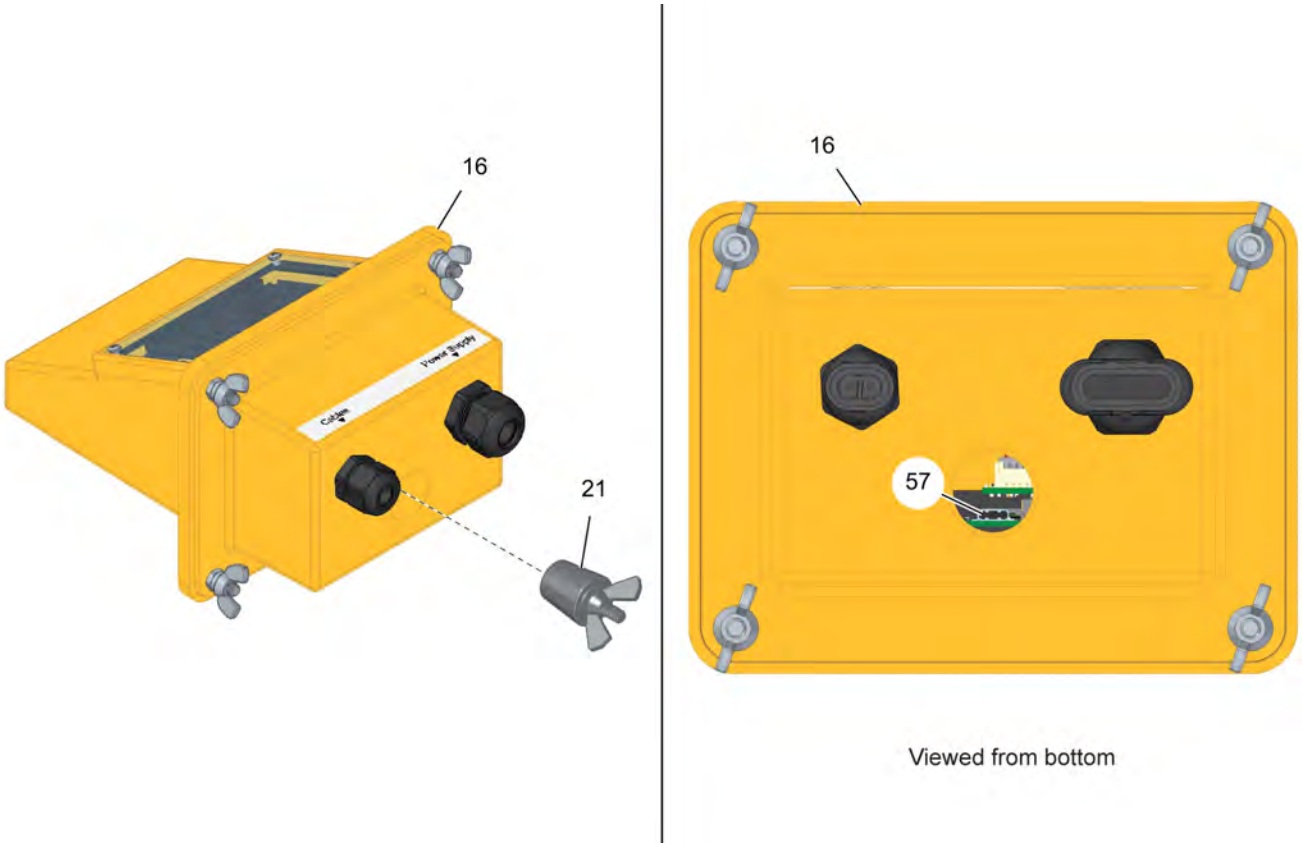
Topics Covered in this Chapter

- Appendix-A: Firmware Upgrade Procedure
- Appendix-B: Cable Position Details
- Appendix-C: Cable Connection Ports
- Appendix-D: Risk Analysis
- Appendix-E: Troubleshooting and Maintenance
- Appendix-F: Heater Schematic
- Appendix-G: Fan Schematics

Appendix-A: Firmware Upgrade Procedure

1. Turn the Hub (16) OFF, refer to *Chapter 7, Activating the Cable Monitoring Hub, page 83* section of this guide.
2. Remove the expansion plug (21) from the base of the Cable Monitoring Hub (16).
3. Plug the provided firmware upgrade USB into the Hub's USB-C port (57).

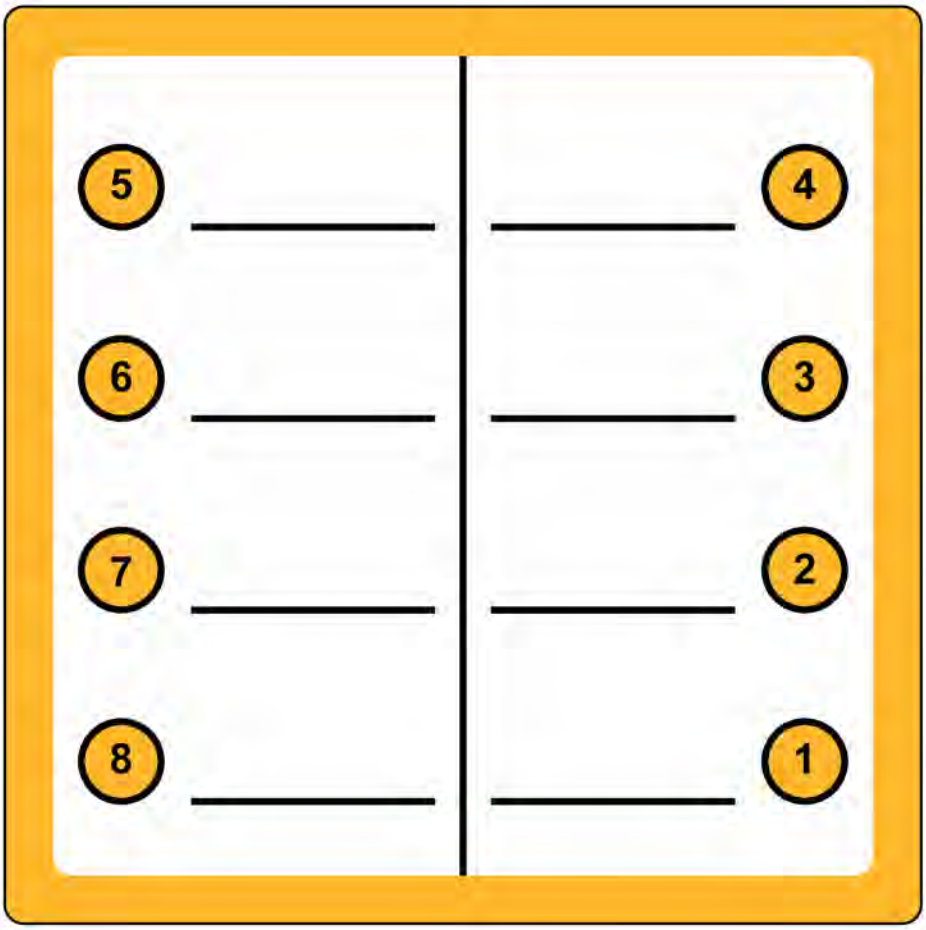
Figure 8-1 *Accessing the micro-USB port*



16	Cable Monitoring Hub Kit (GV-HUB-KIT)	57	USB-C
21	Expansion plug		

4. Turn the Hub (16) ON, refer to *Chapter 7, Activating the Cable Monitoring Hub, page 83* section of this guide.
5. Once the Hub (16) is turned back ON, the red LED on the Hub's solar panel will turn ON for the next 50 seconds, with some intermittent flashing.
6. If the firmware upgrade procedure was successful, the green LED on the Hub's solar panel will then turn ON for 10 seconds (the red LED will also remain on during this time).
7. If no green LED is seen after one minute, restart this procedure from Step 1.
8. If the procedure fails again, contact GrainVue support.

Appendix-B: Cable Position Details



Appendix-C: Cable Connection Ports

Once the table below has been completed, please send along with photos taken of installed components to grainvuesupport@agcocorp.com or text it to 1-306-490-2446. The table below and other photos of installation will be utilized for final commissioning and validation steps. Failure to provide the required details may result in the inability of the customer to have access to view and or control aspects of the GrainVue system.

Table 8-1 *Cable details*

Table #	GrainVue Bins						
	Example	**Bin 1**	**Bin 2**	**Bin 3**	**Bin 4**	**Bin 5**	**Bin 6**
Bin Name*							
Cable Hub Serial Number(s)							
FCM Relay Assign.							
FCM Output 1	Fan 1						
FCM Output 2	Fan 2						
FCM Output 3	-						
FCM Output 4							
FCM Output 5							
FCM Output 6							
FCM Output 7							
FCM Output 8							
Mux Box Cable Assign.*							
Slot 1	Cable 1						
Slot 2	Cable 2						
Slot 3	Cable 3						
Slot 4	Cable 4						
Slot 5	Cable 5						
Slot 6	-						
Slot 7	-						
Slot 8							

***Fields or sections are mandatory regardless of the GrainVue installation Type. Other fields you may leave blank based on the usage of relays and number of cables. If you are installing more than 6 systems on a site, please complete additional tables as required marking the table # in the top left hand corner. (ie. #1, #2, #3)

Appendix-D: Risk Analysis

Risk	Risk Assessment	Risk Mitigation
Electric Shock	In normal operation the system is connected to mains AC voltage 120 VAC to 240 VAC, this voltage is potentially dangerous to operators.	• The Power Supply Unit is labeled with the warning marking below to indicate potential risk.  • The Fan Control Module is equipped with a lockable door to prevent unwanted access. • The user is instructed to removing the AC voltage before opening the box.
Operating in Explosive Atmosphere	Parts of the system are not designed to be installed in an environment where explosive gas or dust may be present.	• Users are instructed NOT to install the Fan Control Module and the Cable Monitoring Hub itself inside of grain bins. • Users are instructed NOT to power on the system until every component is fully installed. • Warning sign is used to remind the operator of potential risk. 
Unwanted Access to Inside of Equipment	The equipment is designed for outdoor operation, opening the equipment may compromise the operation, and potentially cause electric shock risk.	• All external terminals have locking mechanisms to prevent accidental disconnection. • All external terminals have proper outdoor ratings. • The Fan Control Module is equipped with a lockable door to prevent unwanted access. • The Plenum Sensor, Outdoor Sensor and Cable Monitoring Hub itself are not designed to be user serviceable. Tools are required to open the unit.

Appendix-E: Troubleshooting and Maintenance

Troubleshooting

Problem	Possible Causes	Solution
Fan Control Module does not power up, indicated by the blue LED “DON” being off.	AC Mains input wired incorrectly.	Check and confirm that the wiring on the unit is correct.
	External breaker is OFF.	Turn ON the external breaker.
	Internal circuit breaker is OFF.	Switch the orange lever on the internal breaker into the ON position.

Maintenance

Before performing any maintenance, make sure that the Fan Control Module is disconnected from power by turning OFF the breaker supplying power to the device.

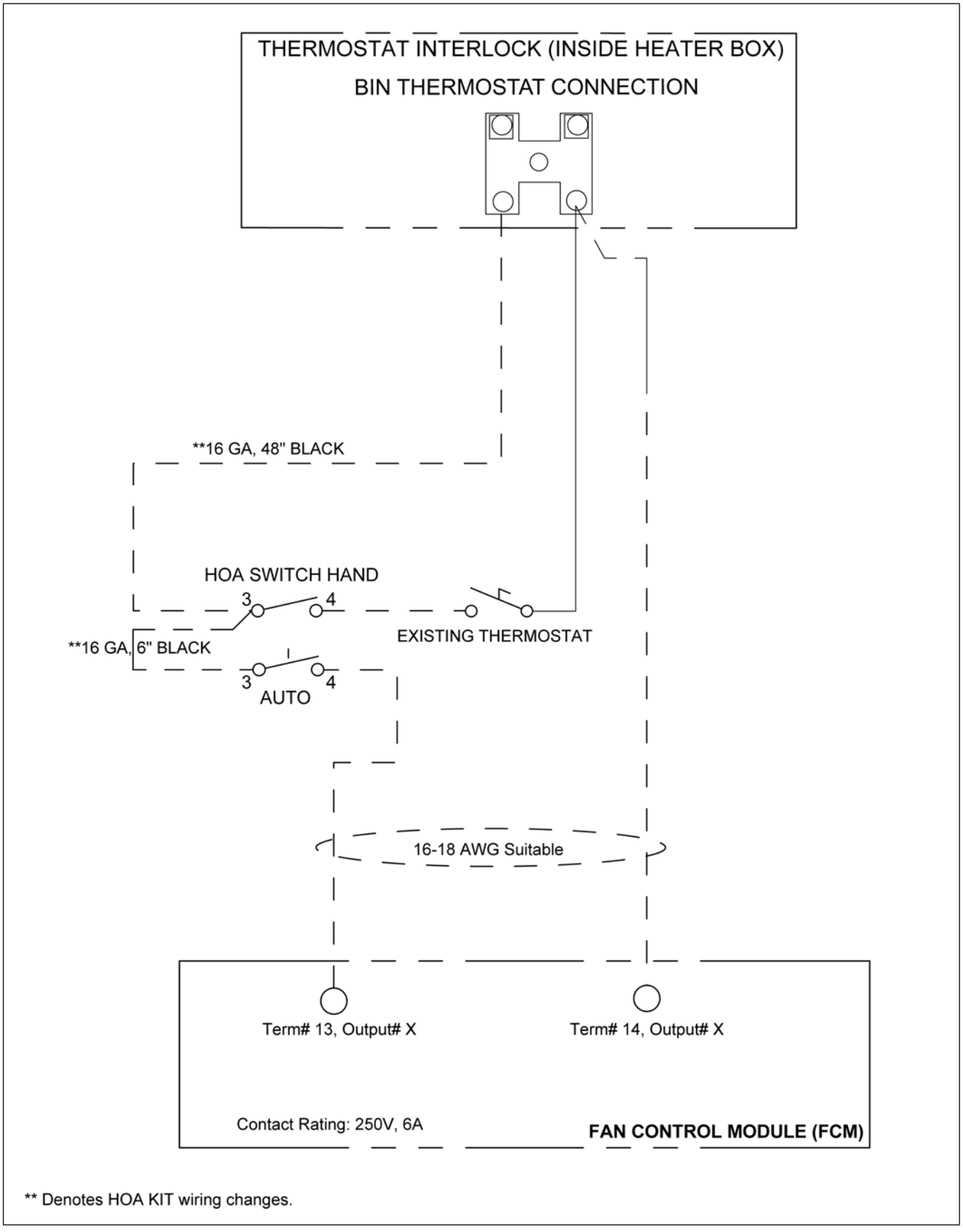
At least once a year, the Fan Control Module should be inspected for maintenance and cleaning. This includes the following:

- Cleaning dust and any other buildup on the exterior of the Fan Control Module.
- Opening the lid and inspecting the internal parts for any signs of moisture or dust ingression.
- Inspecting the three cord grips on the enclosure. Make sure that the cord grips are tight and that pulling on cables does not cause them to move. Also make sure the panel mounting nut on the grips is tight and that the cord grips cannot spin freely under manual rotation. If there is any movement, tighten the panel mount nut and/or the cord grip nut.
- Inspect the entire enclosure for any signs of damage, especially any that could compromise the sealing of the enclosure.

There are no user serviceable fuses inside the Fan Control Module.

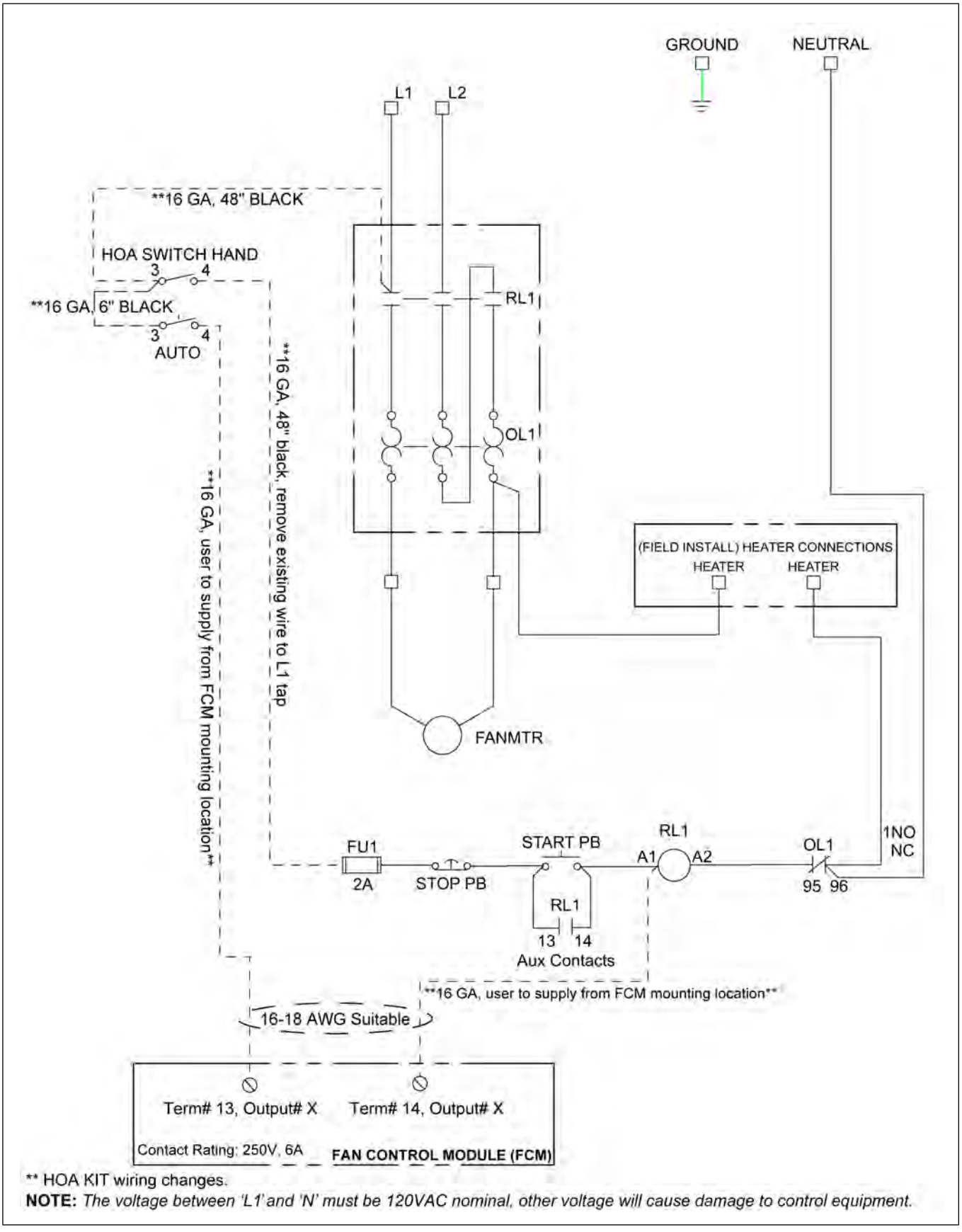
Appendix-F: Heater Schematic

Figure 8-2 *Fan/Heater kit - Heater control wiring*



Appendix-G: Fan Schematics

Figure 8-3 *240 Volt 1 Phase - 120V control circuit*



** HOA KIT wiring changes.

NOTE: *The voltage between 'L1' and 'N' must be 120VAC nominal, other voltage will cause damage to control equipment.*

Figure 8-4 *240 Volt 3 Phase - 120V control circuit*

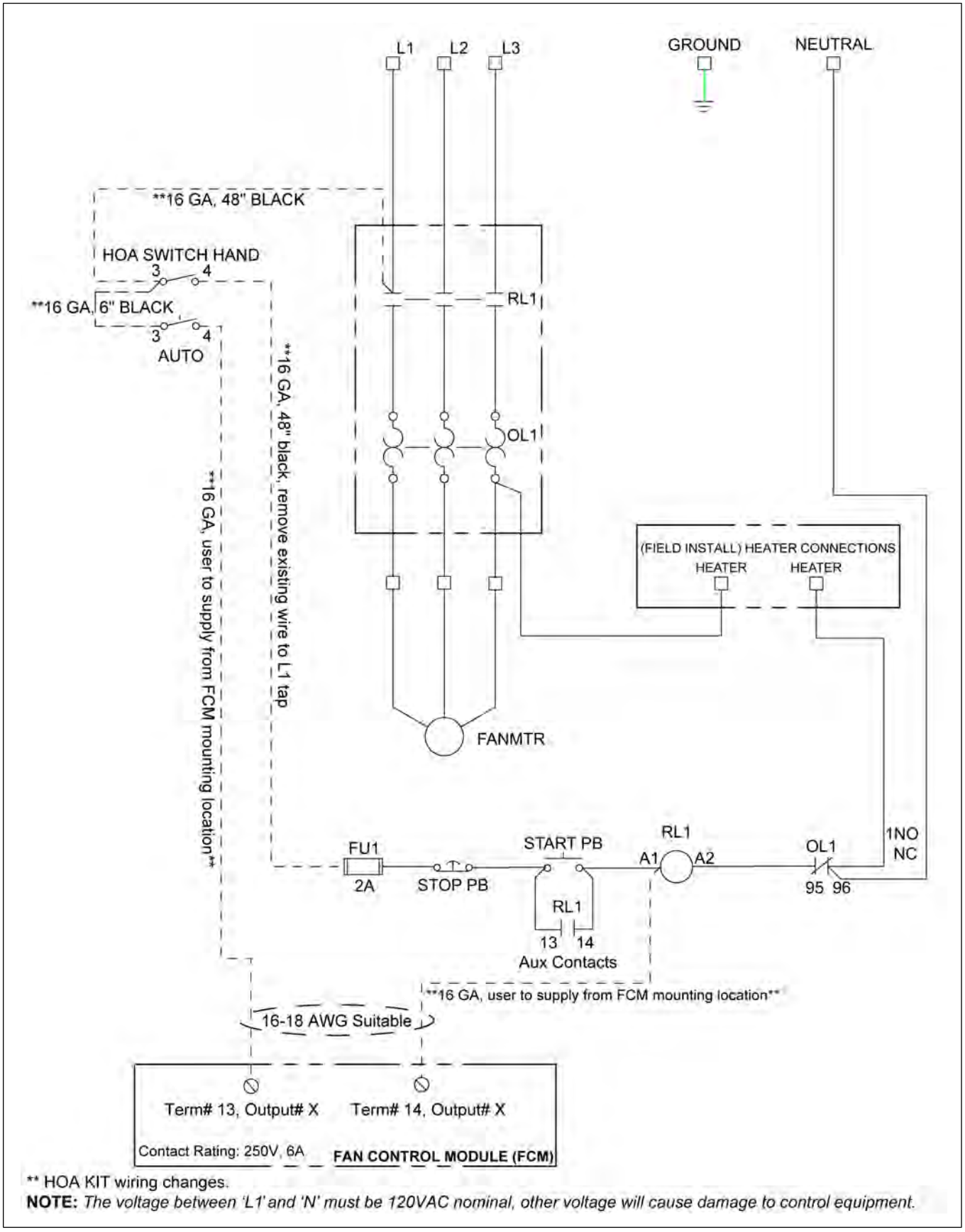
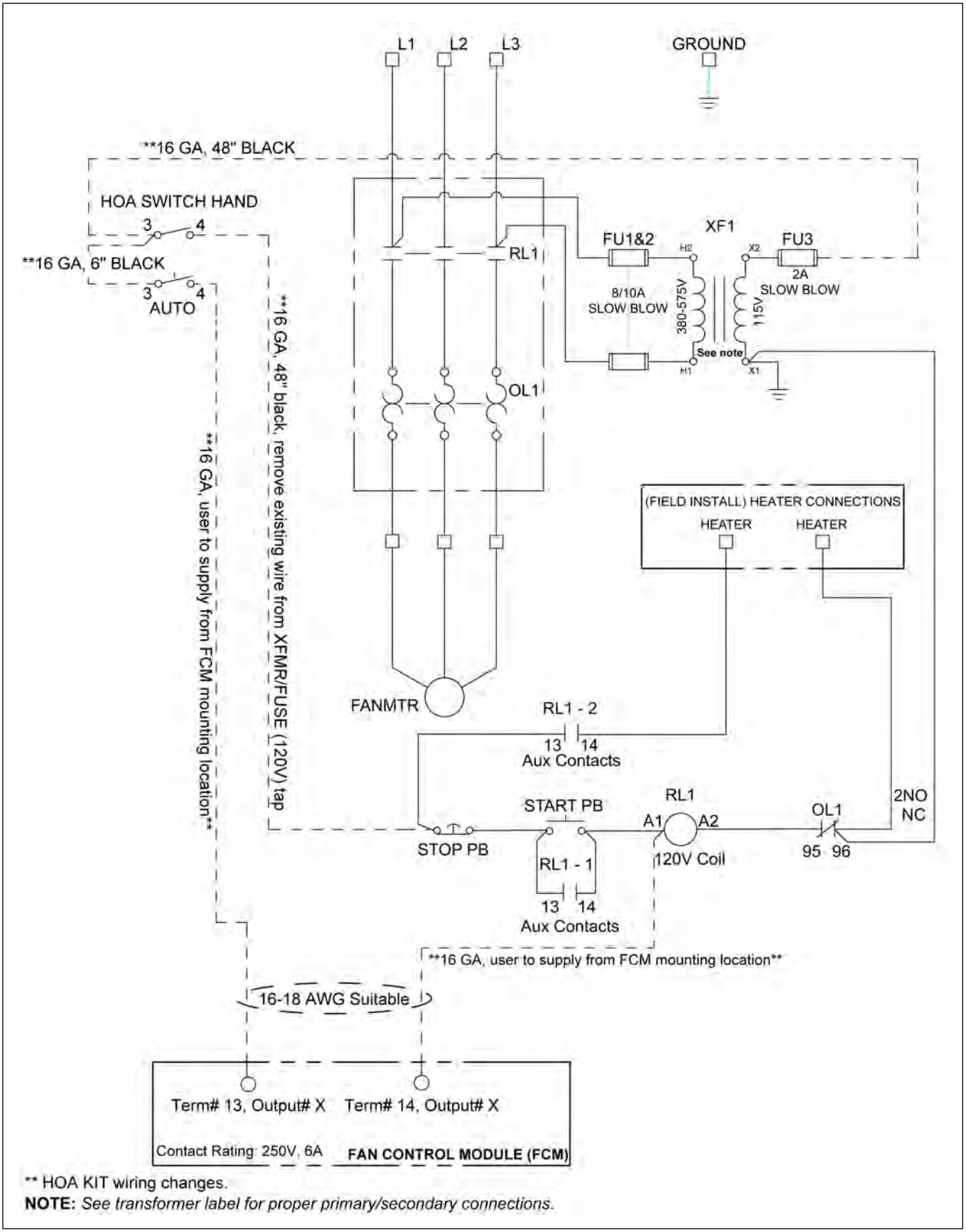


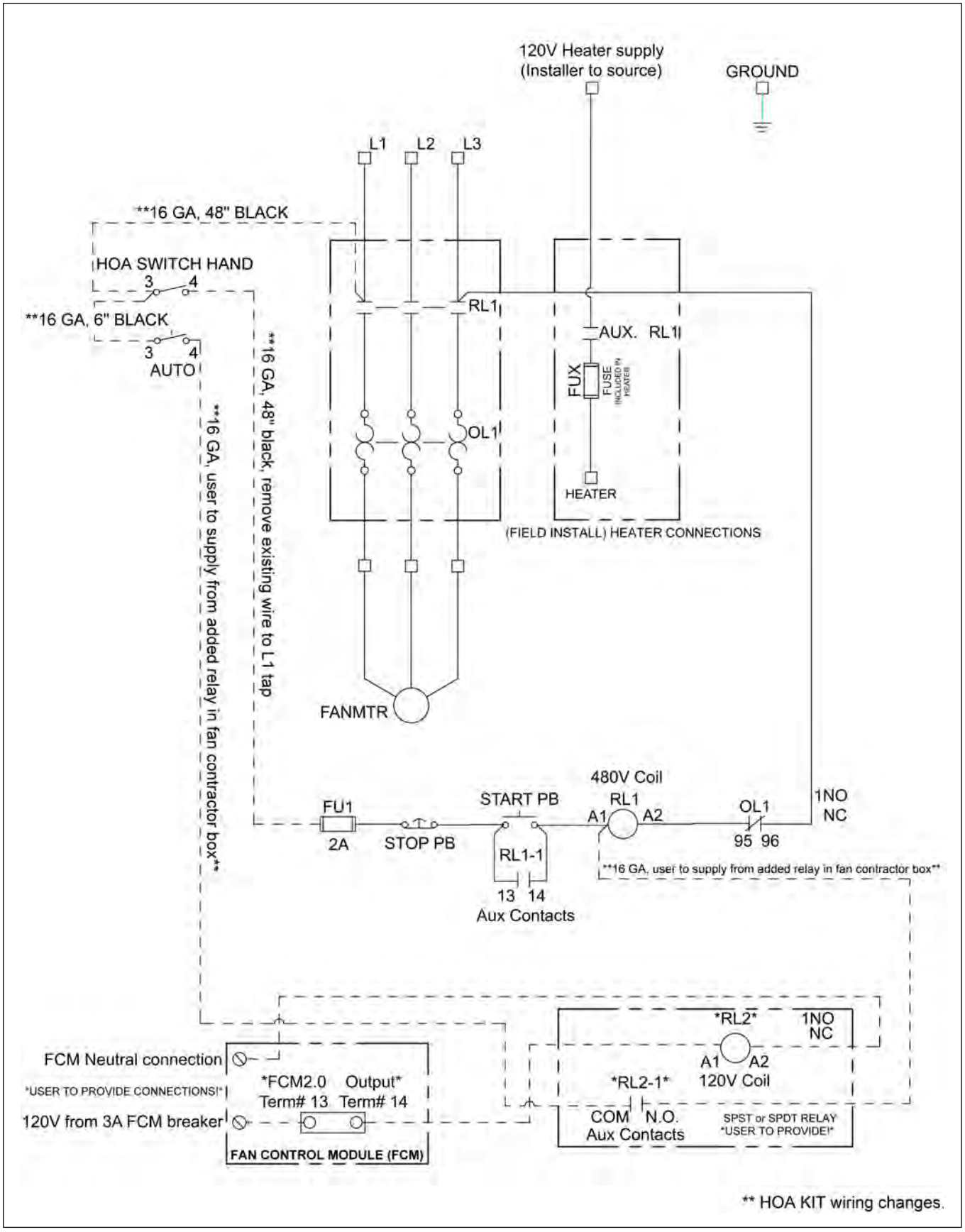
Figure 8-5 *480 Volt 3 Phase - 120V control circuit*



** HOA KIT wiring changes.

NOTE: *See transformer label for proper primary/secondary connections.*

Figure 8-6 *480 Volt 3 Phase - 480V control circuit*



NOTES

Limited Warranty — N.A. Grain Products

The GSI Group, LLC. (“GSI”) warrants products which it manufactures, to be free of defects in materials and workmanship under normal usage and conditions for a period of 12 months from the date of shipment (or, if shipped by vessel, 14 months from the date of arrival at the port of discharge). If, in GSI’s sole judgment, a product is found to have a defect in materials and/or workmanship, GSI will, at its own option and expense, repair or replace the product or refund the purchase price. This Limited Warranty is subject to extension and other terms as set forth below.

Warranty Enhancements: The warranty period for the following products is enhanced as shown below and is in lieu of (and not in addition to) the above stated warranty period. (Warranty Period is from date of shipment.)

	Product	Warranty Period
Storage	Grain Bin Structural Design ▪ Sidewall, roof, doors, platforms and walkarounds ▪ Flooring (when installed using GSI specified floor support system for that floor) ▪ Hopper tanks (BFT, GHT, NCHT, and FCHT)	5 Years
Conditioning	Dryer Structural Design – (Tower, Portable and TopDry) ▪ Includes (frame, portable dryer screens, ladders, access doors and platforms)	5 Years
	All other Dryer parts including: ▪ Electrical (controls, sensors, switches and internal wiring)	2 Years
	All Non-PTO Driven Centrifugal and Axial Fans	3 Years
	Bullseye Controllers	2 Years
	GrainViz Controllers, Electrical Boxes, Sensor Arrays, and Gateways	2 Years
	Cable Monitoring Hub	2 Years
Material Handling	Bucket Elevators Structural Design	5 Years
	Towers Structural Design	5 Years
	Catwalks Structural Design	5 Years
	Accessories (stairs, ladders and platforms) Structural Design	5 Years

Conditions and Limitations:

THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE LIMITED WARRANTY DESCRIPTION SET FORTH HEREIN; SPECIFICALLY, GSI DISCLAIMS ANY AND ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE IN CONNECTION WITH: (I) ANY PRODUCT MANUFACTURED OR SOLD BY GSI, OR (II) ANY ADVICE, INSTRUCTION, RECOMMENDATION OR SUGGESTION PROVIDED BY AN AGENT, REPRESENTATIVE OR EMPLOYEE OF GSI REGARDING OR RELATED TO THE CONFIGURATION, INSTALLATION, LAYOUT, SUITABILITY FOR A PARTICULAR PURPOSE, OR DESIGN OF SUCH PRODUCTS.

The sole and exclusive remedy for any claimant is set forth in this Limited Warranty and shall not exceed the amount paid for the product purchased. This Warranty only covers the value of the warranted parts and equipment, and does not cover labor charges for removing or installing defective parts, shipping charges with respect to such parts, any applicable sales or other taxes, or any other charges or expenses not specified in this Warranty. GSI shall not be liable for any other direct, indirect, incidental or consequential damages, including, without limitation, loss of anticipated profits or benefits. Expenses incurred by or on behalf of a claimant without prior written authorization from the GSI warranty department shall not be reimbursed. This warranty is not transferable and applies only to the original end-user. GSI shall have no obligation or responsibility for any representations or warranties made by or on behalf of any dealer, agent or distributor. Prior to installation, the end-user bears all responsibility to comply with federal, state and local codes which apply to the location and installation of the products.

This Limited Warranty extends solely to products sold by GSI and does not cover any parts, components or materials used in conjunction with the product, that are not sold by GSI. GSI assumes no responsibility for claims resulting from construction defects, unauthorized modifications, corrosion or other cosmetic issues caused by storage, application or environmental conditions. Modifications to products not specifically delineated in the manual accompanying the product at initial sale will void all warranties. This Limited Warranty shall not extend to products or parts which have been damaged by negligent use, misuse, alteration, accident or which have been improperly/inadequately maintained.

Notice Procedure:
In order to make a valid warranty claim a written notice of the claim must be submitted, using the RMA form, within 60 days of discovery of a warrantable nonconformance. The RMA form is found on the OneGSI portal.

Service Parts:
GSI warrants, subject to all other conditions described in this Warranty, Service Parts which it manufactures for a period of 12 months from the date of purchase unless specified in Enhancements above.

(Limited Warranty - N.A. Grain Products_ revised 01 Feb 2021)

This equipment shall be installed in accordance with the current installation codes and applicable regulations which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

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