

Introduction

Purpose

This manual provides comprehensive information necessary for the safe installation and operation of ANGI H-Series hydrogen dispensers. However, for maintenance and repair procedures, additional information is required and will be covered in the corresponding product training. It is important to comply with national laws, provisions, and regulations related to dispensing systems during the installation and operation processes.

Intended Users

The dispenser is only intended for use within the operating limits specified in this manual.

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Related Documents

Title	Reference Number
ANGI H-Series Hydrogen Dispenser Installation Checklist	FRM00302CST
ANGI H-Series Hydrogen Dispenser Start-up Checklist	FRM00386CST
ANGI H-Series Hydrogen Dispenser Zoning Diagram	<ul style="list-style-type: none"> • H70 ENG - 2149 • H35 ENG - 2150
Error Codes	E25-00-005
Command Codes	E25-00-001
ModBus Registers	E25-00-006

Abbreviations and Acronyms

Terms	Description
ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
ASC	Authorized Service Contractor
ATEX	Atmosphere Explosibles
AWG	American Wire Gauge
CSA	Canadian Standards Association
CUL	Canadian Underwriters Laboratory
DEF	Diesel Exhaust Fluid
EIA	Electronic Industries Alliance
EMV	Europay®, MasterCard®, and Visa®
FCC	Federal Communications Commission
FNPT	Female National Pipe Tapered
GID	Gas and Impact Detector
GOLD	Gilbarco Online Documentation
HRS	Hydrogen Refueling Station
IFSF	International Forecourt Standards Forum
LEL	Lower Explosive Limit
MTW	Machine Tool Wire
NEC®	National Electrical Code
NFPA®	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
OSHA	Occupational Safety and Health Administration
PCA	Printed Circuit Assembly
POS	Point of Sale
PPE	Personal Protective Equipment
PPU	Price Per Unit
PSI	Pounds (of Pressure) per Square Inch
PVC	Polyvinyl Chloride
STP	Submersible Turbine Pump
TAC	Technical Assistance Center
TCP/IP	Transmission Control Protocol/Internet Protocol
TFFN	Thermoplastic Flexible Fixture Wire Nylon Jacketed
TIA	Telecommunications Industry Association
USB	Universal Serial Bus

Important Safety Information

Notes: 1) Save this Important Safety Information section in a readily accessible location.

2) Although DEF is non-flammable, Hydrogen is flammable. Therefore, for DEF cabinets that are attached to Hydrogen dispensers, follow all the notes in this section that pertain to flammable fuels.




This section introduces the hazards and safety precautions associated with installing, inspecting, maintaining, or servicing this product. Before performing any task on this product, read this safety information and the applicable sections in this manual, where additional hazards and safety precautions for your task will be found. Fire, explosion, electrical shock, or pressure release could occur and cause death or serious injury, if these safe service procedures are not followed. **Only trained and authorized personnel should operate the hydrogen dispenser.**

Preliminary Precautions

You are working in a potentially dangerous environment of flammable fuels, vapors, and high voltage or pressures. Only trained or authorized individuals knowledgeable in the related procedures should install, inspect, maintain, or service this equipment.

Emergency Total Electrical Shut-Off

The first and most important information you must know is how to stop all fuel flow to the pump/dispenser and island. Locate the switch or circuit breakers that shut off all power to all fueling equipment and dispensing devices.

 WARNING	
	The EMERGENCY STOP, ALL STOP, and PUMP STOP buttons at the cashier's station WILL NOT shut off electrical power to the pump/dispenser. This means that even if you activate these stops, fuel may continue to flow uncontrolled.
	You must use the TOTAL ELECTRICAL SHUT-OFF in the case of an emergency and not the console's ALL STOP and PUMP STOP or similar keys.

Total Electrical Shut-Off Before Access

Any procedure that requires access to electrical components or the electronics of the dispenser requires total electrical shut off of that unit. Understand the function and location of this switch or circuit breaker before inspecting, installing, maintaining, or servicing ANGI equipment.

Evacuating, Barricading, and Shutting Off

Any procedure that requires access to the pump/dispenser requires the following actions:



- An evacuation of all unauthorized persons and vehicles from the work area
- Use of safety tape, cones, or barricades at the affected unit(s)
- A total electrical shut-off of the affected unit(s)

Read the Manual

Read, understand, and follow this manual and any other labels or related materials supplied with this equipment. If you do not understand a procedure, call the ANGI Technical Assistance Center (ATAC) at 1-800-934-5219. It is imperative to your safety and the safety of others to understand the procedures before beginning work.

Follow the Regulations

Applicable information is available in regulations and federal, state, and local codes. All these regulations must be followed. Failure to install, inspect, maintain, or service this equipment in accordance with these codes, regulations, and standards may lead to legal citations with penalties or affect the safe use and operation of the equipment.

Replacement Parts

Use only genuine ANGI replacement parts and retrofit kits on your pump/dispenser. Using parts other than genuine ANGI replacement parts could create a safety hazard and violate local regulations.

Electromagnetic Compatibility (EMC) Notice - IEC 61000 Compliance

This equipment is designed to comply with the electromagnetic compatibility requirements outlined in the IEC 61000 series of standards. It has been tested and meets the applicable limits for electromagnetic emissions and immunity in industrial and/or commercial environments.

To maintain compliance:

- The equipment must be installed and operated in accordance with the instructions provided in this manual.
- Use only shielded cables and properly grounded connections as specified.
- Avoid modifications or changes to the equipment that are not approved by the manufacturer, as these may affect EMC performance and void compliance.

In environments with high electromagnetic disturbances, additional mitigation measures such as surge protection, filtering, or shielding may be required to ensure continued reliable operation.

Safety Symbols and Warning Words

This section provides important information about warning symbols and boxes.

Alert Symbol



This safety alert symbol is used in this manual and on warning labels to alert you to a precaution which must be followed to prevent potential personal safety hazards. Obey safety directives that follow this symbol to avoid possible injury or death.

Signal Words

These signal words used in this manual and on warning labels tell you the seriousness of particular safety hazards. The precautions below must be followed to prevent death, injury, or damage to the equipment:



DANGER: Alerts you to a hazard or unsafe practice which will result in death or serious injury.



WARNING: Alerts you to a hazard or unsafe practice that could result in death or serious injury.



CAUTION with Alert symbol: Designates a hazard or unsafe practice which may result in minor injury.

CAUTION without Alert symbol: Designates a hazard or unsafe practice which may result in property or equipment damage.

Working With Fuels and Electrical Energy Prevent Explosions and Fires

Fuels and their vapors will explode or burn, if ignited. Spilled or leaking fuels cause vapors. Even filling customer tanks will cause potentially dangerous vapors in the vicinity of the dispenser or island.

Important Safety Information

No Open Fire



Open flames from matches, lighters, welding torches or other sources can ignite fuels and their vapors.

No Sparks - No Smoking



Sparks from starting vehicles, starting or using power tools, burning cigarettes, cigars or pipes can also ignite fuels and their vapors. Static electricity, including an electrostatic charge on your body, can cause a spark sufficient to ignite fuel vapors. Every time you get out of a vehicle, touch the metal of your vehicle, to discharge any electrostatic charge before you approach the dispenser island.

Dispenser is not designed for external fire case scenarios. Follow local and industry standards for required fire protection measures.

Working Alone

It is highly recommended that someone who is capable of rendering first aid be present during servicing. Familiarize yourself with Cardiopulmonary Resuscitation (CPR) methods, if you work with or around high voltages. This information is available from the American Red Cross. Always advise the station personnel about where you will be working and caution them not to activate power while you are working on the equipment. Use the OSHA Lockout/Tagout procedures. If you are not familiar with this requirement, refer to this information in the service manual and OSHA documentation.

Working With Electricity Safely

Ensure that you use safe and established practices in working with electrical devices. Poorly wired devices may cause a fire, explosion or electrical shock. Ensure that grounding connections are properly made. Take care that sealing devices and compounds are in place. Ensure that you do not pinch wires when replacing covers. Follow regional Lockout/Tagout requirements. Station employees and service contractors need to understand and comply with this program completely to ensure safety while the equipment is down.

Hazardous Materials

Some materials present inside electronic enclosures may present a health hazard if not handled correctly. Ensure that you clean hands after handling equipment. Do not place any equipment in the mouth.

WARNING

In the event of inclement weather, including snow, ice, or flooding that makes driving conditions dangerous, please avoid servicing units. Always use available door stops to secure upper doors against unwanted/unexpected movement, especially during high winds. If necessary, reschedule service to avoid damage to the equipment. Weather may change unexpectedly; be aware of local weather conditions. During service, if conditions develop making service unsafe, close the unit(s) and proceed to a safe location.

WARNING

The pump/dispenser contains a chemical known to the State of California to cause cancer.



ANGI encourages the recycling of our products. Some products contain electronics, batteries, or other materials that may require special management practices depending on your location. Please refer to your local, state, or country regulations for these requirements.

In an Emergency

In case of an emergency, follow these steps:

- Shutdown and turn off all the equipments.
- Evacuate to a safe area.
- Call for help and wait for assistance.

Inform Emergency Personnel

Compile the following information and inform emergency personnel:

- Location of accident (for example, address, front/back of building, and so on)
- Nature of accident (for example, possible heart attack, run over by car, burns, and so on)
- Age of victim (for example, baby, teenager, middle-age, elderly)
- Whether or not victim has received first aid (for example, stopped bleeding by pressure, and so on)
- Whether or not a victim has vomited (for example, if swallowed or inhaled something, and so on)

WARNING

It is unlawful and potentially hazardous to dispense hydrogen into unapproved containers.

WARNING

Hydrogen — No Smoking
Compressed flammable gas-Hydrogen has no odor
If a fire or leak starts, do not remove nozzle immediately.

Lockout/Tagout

Lockout/Tagout covers servicing and maintenance of machines and equipment in which the unexpected energization or start-up of the machine(s) or equipment or release of stored energy could cause injury to employees or personnel. Lockout/Tagout applies to all mechanical, hydraulic, chemical, or other energy, but does not cover electrical hazards. Subpart S of 29 CFR Part 1910 - Electrical Hazards, 29 CFR Part 1910.333 contains specific Lockout/Tagout provision for electrical hazards.

Depressurization

Equipment must be depressurized prior to all maintenance events. Utilize manual purge valves to remove gas from each pressure containing section. Use pressure transducers and gauges to ensure pressure has been removed. For any depressurization questions, reference equipment PID or reach out to ANGI Service team for guidance (1-800-934-5219).

Inert Gas Purging

After each maintenance event in which the pressurized hydrogen system is exposed to external atmosphere, inert gas purging is required prior to equipment start up. Operators should use a validated purging process that ensures O₂ levels are below 1% by volume. Reach out to the ANGI Service team for additional guidance (1-800-934-5219).

****NOTE**** Nozzle purging with inert gas is normal and not an indication of a leak. This occurs during and after fueling events for up to 15 minutes to prevent the nozzle from freezing on the receptacle.

Personal Protective Equipment (PPE)

Operators that are servicing or performing maintenance must wear proper PPE including, but not limited to:

- Safety glasses
- Gloves
- Flame-resistant clothing
- Hearing protection

Ventilation

Maintain adequate ventilation in the dispensing area to prevent hydrogen gas accumulation. Dispensers is intended for Outdoor Use Only.

Gas Properties

Hydrogen gas is colorless and odorless. Leaks may be difficult to detect.

Regulatory Compliance

Ensure compliance with local, national, and international regulations and standards related to hydrogen dispensing.

Product Specification

Configuration Options	Description
Cabinet	H-Series
Number of Sides Single Filtration One hydrogen filter included per hose	Single sided or dual sided
Hose Orientation	Lane Island
Number of Inlet Lines	Single line inlet configuration (available in buffer or one inlet per hose configuration)
Number of Hoses per side	One Two
Max Configurable filling Pressures	H35 - 350 BAR (5,000 PSI) H70 - 700 BAR (10,000 PSI)
Flow Capacity	Standard flow (3.6 kg/min) High flow (7.2 kg/min) - H35 filling pressure only
Meter Technology	Coriolis mass flow metering
Cooling Technology	Diffusion-bonded internal heat exchanger - single or dual channel
Flow Control	Emerson flow control valve
Fueling Protocols	SAE J2601-1 SAE J2601-2
Nozzle Options	WEH Product Line Walther® Product Line Oasis Product Line Others available upon request
Dispenser-to-Vehicle Communications	Communicative and non-communicative fueling (compliant to requirements of applicable fueling protocol)
Filtration	One hydrogen filter included per hose
Communications and User Interface Options	
User Interface	Invenco Payment Solution (Optional) EMV Ready Card Ready High-Speed USB Printer Alphanumeric keypad EMV-ready contactless card reader Barcode reader Apollo Multimedia - 15" Color Display
Point Of Sales (POS) Connection Protocols	Standard 2-wire protocol International Forecourt Standards Forum (IFSF) Gilbarco POS/Payment Terminal Protocol
Communications	Modbus over Ethernet for SCADA and remote monitoring connections
Branding Options	Customizable branding and graphics

Product Specification

Configuration Options	Description
General Specification	
Max Input Power	120 VAC, 60 Hz, 2A 240 VAC, 50 Hz, 1A
Operation Temperature (Hydrogen)	-40 °C to 50 °C -40 °F to 122 °F
Humidity	20-95% Rh (non-condensing)
Dimensions	H-Series <ul style="list-style-type: none">• Height: 2276 mm/89.6 inches• Width: 1740 mm/68.5 inches (1869 mm/73.6 in. including canopy)• Depth: 610 mm/24 inches (686 mm/27 in. including canopy)
Regulatory and Safety	
Industry	<ul style="list-style-type: none">• ATEX• PED• CSA HGV 4.1• CSA HGV 4.3• SAE J2601-1• SAE J2601-2• SAE J2799• UL 121201/CSA C22.2 No. 213• NFPA 2• NFPA 70• US NCWM• RoHS• OIML• Machinery Directive• FCC• ADA
Regional	Weights and Measures (W&M)

Part Number and Ordering Configuration

This dispenser model number is based on the configuration in table below:

Gas	Cabinet	Flow	Sides	House Per Side	Max Pressure	Heat Exchanger	Region
H Hydrogen	R Retail	S 60 /120 g/s H70/H35	L1 Single Lane	1 1 hose	350 350 har	X1 Include	USA United States
	M Mobile	H 120 g/s	L2 Double Lane	2 2 hose	700 700	X0 Not Included	EUR Europe
	T Trailer	U 166 g/s	IS Island		357 Dual Pressure		CAN Canda
	F Fleet						(etc.) (etc.)

Installation

Before installation, always consult the foundation dimensions of the respective dispenser type, subframe drawing dimensions, and power requirements. Installation instructions for all additional devices must be available and followed. Before installing the dispenser, properly lay all necessary cables and pipes. If necessary, hoists must be used for heavy loads.

Requirements Prior to Dispenser Installation

- Keep pipes, storage tank and compressor free of dirt and moisture by sealing them until the dispenser is installed.
- Build the foundation or the base plate for the respective dispenser type with the necessary ducts and connections. Observe the according foundation dimensions.
- Check and clarify the connection to existing forecourt controllers. In certain cases, an adaptation of the forecourt controller is necessary.

Foundation

The surface of the dispenser island must be designed in such a way that there is a slope of at least 5° from the dispenser to the outer edges of the island. Let the concrete foundation harden for sufficient time before installing the dispenser.

Subframe (Option)

Gilbarco recommends installing the dispenser on a subframe. The holes for the foundation bolts must be free of contamination.

- Mount the subframe in such a way that the upper edge of the subframe fits flush with the surface of the dispenser island.
- Mount the subframe within the dispenser island at right angles and horizontally.
- Seal the subframe to the ground with a suitable permanently water and fuel resistant sealant.

Connection Details

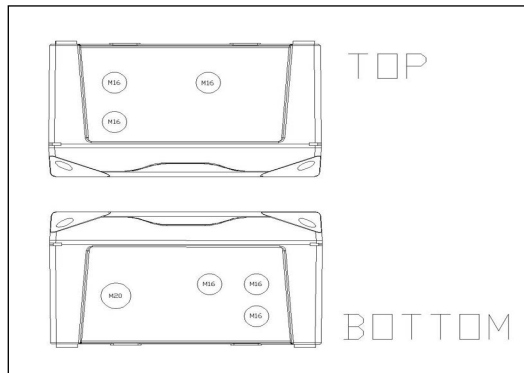
A copy of the General Arrangement Drawing (GAD) and Piping and Instrumentation Diagram (PID) is provided with each dispenser. Reference this document for detailed dimension of gas lines, electrical, and subframe installation.

Connecting J-box

To connect the Junction box (J-box) conduit, proceed as follows:

- 1 Open the dispenser door and remove panels.
- 2 Remove the J-box covers and retain for reassembly.
Note: Be careful of mating surfaces on J-box; nicks or scratches can lead to ways gases can enter the J-box.
- 3 Verify that glands are provided with the J-box for the field wiring connection cable to seal off at the box penetration.

Figure 1: Possible Gland Locations



- 4 In all units, it is mandatory that the connection of the conduit to the J-box must be made with a clearance of at least nine-inches from the dispenser base to the bottom of the J-box connection stub.

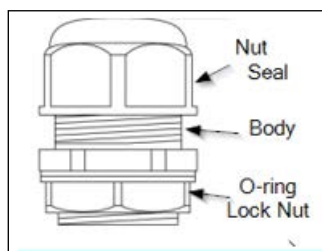
IMPORTANT INFORMATION

Call button, Ethernet, speaker wires, pulser wires, and ANGI monitor communication wires cannot be in the same high voltage cable as the power and two communication wiring to the unit. They should be in a separate cable or conduit routed to the DC box and should not contain any high voltage wiring.

Installing Field Wiring

Cables are to be routed through J-box penetrations in the lower cabinet of the electronics area. Glands are provided for sealing the cables as shown in [Figure 2](#). The table below provides a likely distribution of the penetrations through the J-box.

Figure 2: J-box Gland Detail



Signal	Gland Size
Ethernet	M16
ESD Wiring	M16
Impact and Gas Alarm	M16
2-wire and POS signals	M16
AC Power	M20

For North American installation, conduit is used instead of glands; refer to the “[Conduit](#)” on [page 24](#).

- Notes:*
- 1) *The wiring must be color-coded, or tagged for identification purposes, and rated for 300 volts or higher. Data wires for new installations must be a twisted pair (unshielded) with 10 to 12 twists per foot. Data wires used for RS-485 communication (ANGI monitor) can be shielded cable of a low capacitance type.*
 - 2) *For more information, refer to [Figure 2](#) on [page 9](#).*

Operating Environment

Environment	Range
Relative Humidity	20 to 95% (non-condensing)
Minimum outside ambient temperature	-22 °F (-30 °C) [-40 °F (-40 °C) with electronic cabinet heater fitted]
Maximum outside ambient temperature	122 °F (50 °C) *

**Electronics have been evaluated and are rated for use at a maximum of 121 °F (50 °C) outside ambient temperature.*

To ensure proper unit performance, operation under severe environmental conditions may require special options such as card reader heaters, etc.

External Wiring to Dispenser

To install the external wiring to the dispenser, pull the wiring through the stub up.

- Notes:*
- 1) *Ensure that enough extra wire length (minimum of 5-feet or 1.53-meters) is provided to make the run to the stub up location at the bottom of the electronics cabinet.*
 - 2) *Remember that the conduit may be routed over to come up at the stub up to the field interconnect J-boxes provided. Depending on which end of the unit the stub up is on, route across the entire unit length. Routing up to the electronics cabinet is prohibited along with installing any other equipment or adding new conduit penetrations.*

Testing New Field Wiring



Safety Information



Sparks can ignite gas.

Fire/explosion can result in severe injury or death.

Use caution when testing wires. Do not test when exposed fuel and vapors are present.



Only use a Megger® tester on new field wiring.

For existing wiring, use a digital multimeter to test for continuity/resistance.

Test the insulation of the new wiring from the station to the electronics cabinet for damage, before connecting the wires. Refer to the warning above. The damage can occur while pulling wires through the conduit.

To test the new field wiring, proceed as follows:

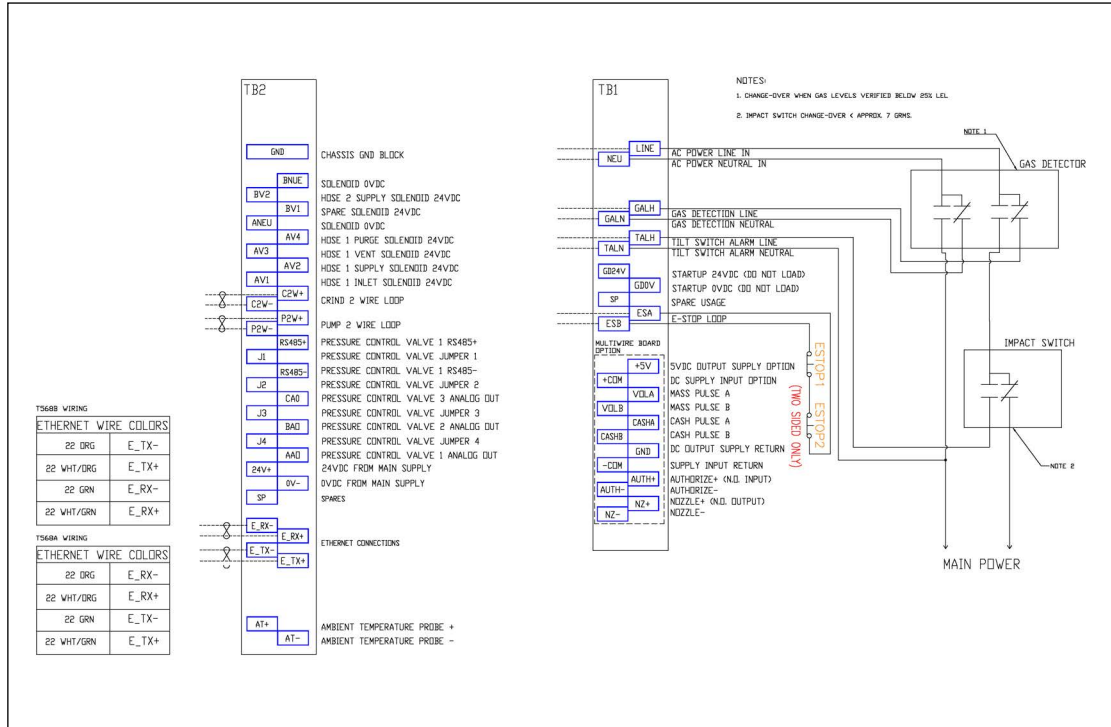
- 1 Ensure that the wires are disconnected at both ends. If the wires are not disconnected at both the ends, it can damage the dispenser electronics.
- 2 Test the conduit wiring ends by using an insulation/Megger tester.
- 3 Connect one tester lead to the wire under test.
- 4 Connect the other tester lead to the ground.
- 5 Measure the resistance and follow the test equipment manufacturer's instructions. The insulation resistance of more than 50 mega ohms is adequate. Check the local authority requirements.
- 6 Repeat steps 1 to 5 on [page 11](#) for all the new wires.
- 7 Ensure that the wiring is within specified requirements.
- 8 When all wiring tests are complete, the wiring may be potted.

Completing Field Wiring

To complete field wiring, proceed as follows:

- 1 Verify all wiring connections for wire nuts, lugs, caps, etc.
- 2 Reinstall the J-box cover. Use all J-box bolts and ensure that the wires are not pinched.
- 3 Replace the lower doors and close the doors to the electronics cabinet.

Figure 3: J-box



Dispenser Inputs and Outputs

Signal Description	Required/ Optional	Terminal Label	Signal Type
Incoming Power	Required	L	240/120 VAC, 60/50 Hz, 230 VA max
		NEU	VAC Neutral
		GND	Ground
ESD Signal	Required	ESA	ESD Signal Out NC Relay
		ESB	ESD Signal In NC Relay
Tilt Switch Alarm	Required	TAHL	Tilt Switch Alarm 120 VAC
		TALN	Tilt Switch Alarm Neutral
Gas Detect Alarm	Required	GALH	Gas Detect Alarm 120 VAC
		GALN	Gas Detect Alarm Neutral
Pump Two-Wire Authorization*	Optional	P2W+	Pump 2 Wire Current Loop +/- IFSF+
		P2W-	Pump 2 Wire Current Loop +/- IFSF-
CRIND® Two-Wire Authorization*	Optional	C2W+	CRIND 2 Wire Current Loop +
		C2W-	CRIND 2 Wire Current Loop -
Trunked Ethernet, ModBus, Multimedia, Payment	Optional	E_RX+	Ethernet Rx+
		E_RX-	Ethernet Rx-
		E_TX+	Ethernet Tx+
		E_TX-	Ethernet Tx-
Multi-Wire	Optional	+5V	5VDC out
		+COM	Pulse voltage in +
		VOLA	Mass Pulse A
		VOLB	Mass pulse B
		CASHA	Cash Pulse A
		CASHB	Cash Pulse B
		COM	Pulse Voltage in -
		GND	ISO Ground for the 5VDC
		NZ+	Nozzle Switch +
		NZ-	Nozzle Switch -

- Notes: 1) ***Authorization Methods:** An authorization method is not required. The dispenser can be configured to run in standalone mode.
- 2) ****Ethernet Connectivity:** If multiple Ethernet/fiber connections are required, they must be merged and sent over a single cable by a managed switch. The dispenser contains a managed switch to connect all Ethernet enabled devices within the dispenser to a single cable back to the site. Optional fiber to Ethernet converter available within the dispenser.

Command Codes

Dispenser programming mode can only be entered when both sides of the dispenser are in a **non-delivery** mode (nozzles are not lifted). Dispenser programming results in the unit being placed offline from external communications. To start programming, press the **F1** key on the manager keypad. The following sub-sections describe general dispenser operation while in programming mode.

Programming Errors

If the data entered (command code, function code, and parameter) is invalid, the data field will go blank for two seconds and a double beep will be heard. After two seconds, the invalid value will resume flashing. This error cycle will be repeated until a valid code is entered.

General Programming Operation

- 1 After the F1 key is pressed, the dispenser will go offline, and all main display LCDs will go blank; then, the money display will show 8888.
- 2 Enter the four-digit security code for the required security level. As each digit of the security code is entered, a dash '-' will be displayed on the main money display for that digit.
- 3 After all security digits are entered, press and release the ENTER key. If the security code is acceptable, the main money display will change to flashing 0000. Otherwise, the money display will show flashing 8888 to indicate an invalid security code.
- 4 If a valid security code is entered, the user may then enter the command code and proceed with dispenser programming as described in the sections that follow. If an invalid security code is entered, the user needs to re-enter the security codes again and then press ENTER. Otherwise, the user may press the F2 key to exit programming mode or wait to allow the dispenser to timeout (5 minutes) and return to normal mode automatically.
- 5 After a valid security code is entered, the display will show 0000 until the first digit of a command code is entered. After entering the first digit, the display will blink, showing the entered digit flashing and left justified to position 6. As each new digit is entered, the digits flash and follow in positions 5, 4, etc.
- 6 When a complete command code is entered, it will flash until the ENTER key is pressed.
- 7 Once a programming mode is activated, the default or first selectable entry for that mode will be shown as flashing. Defaults and further keypad entries will show as flashing digits and will update the display as they are keyed in. This action continues until the ENTER key is pressed. After the ENTER key is pressed, the next programming field will start flashing to indicate that an operator action is required. This keypad/display functionality will continue until the programming mode is exited.

Notes: 1) Each programming level utilizes a unique set of programming codes as given in this document. The reason for this is to allow room for future expansion of H-Series programming features. Function codes within a command code begin with the numeral 1.

2) Entry into a command code will present data in either DEFAULT format or the last programmed values for that command code. Only one command code and function code/parameter may be programmed or changed at a time.

Programming Levels

Three basic programming levels are maintained for the H-Series dispenser. A new level 4 and the configuration level are added to consolidate the programming options that affect basic dispenser functionality.

The current selected programming level will allow access to all command codes for the selected level and all levels of lesser security without additional security code entries. Thus, if the configuration level 4 security code is entered, then all configuration, level 3, level 2, and level 1 command codes are allowed. During the use of the manager keypad, ensure that none of the nozzles is lifted.

Display Conventions

The programming digit positions for the main money and volume displays are shown in the table below. This applies even in cases where more than six display digits are available for display purposes. The information will be displayed on all grade Price Per Unit (PPU) when necessary and will be restricted to digits 4 through 1 unless otherwise noted.

Amount (\$ or €)	6	5	4	3	2	1
Volume	6	5	4	3	2	1
PPU		4	3	2	1	

During programming, command codes are always shown left justified in the main money display starting at digit position 6. Other display information will be dependent upon the specific programming command code and function code within the command code.

Programming parameters are shown in the LCD displays as soon as the parameter selection key is pressed. Selected parameters continue to flash until either the ENTER or F1/F2 key is pressed. Parameters are entered into the pump control system only after the ENTER or F1 key is pressed.

Note: For both \$TOTAL and VOL TOTAL keys, you can press the ENTER key to toggle between grade and side selection.

Manager Keypad Operation

Jumper Selection

To ensure the function of the Manager keypad, set a jumper on the compact display board (see [Figure 4](#), [Figure 5](#), and [Figure 6](#)).

Figure 4: Jumper J4 is Open (Initial State)

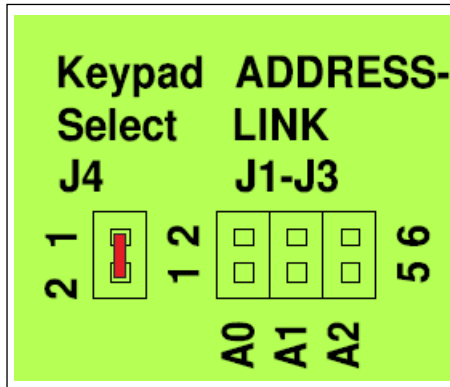


Figure 5: Jumper J4 is Closed (When Using the Manager Keypad)

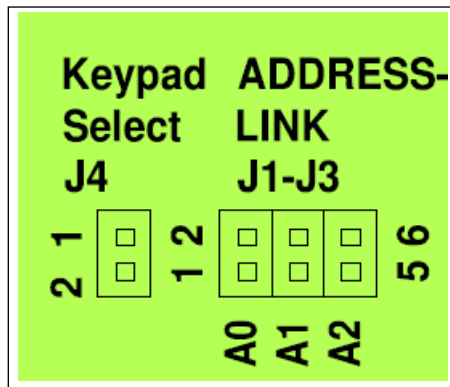
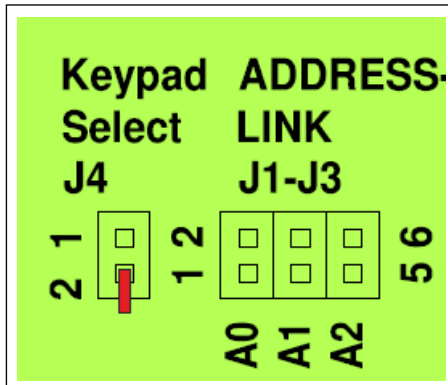


Figure 6: Let the Jumper Stuck on One Pin After Programming (For Reuse)



Note: The pre-selection has priority always. After a reset/switch off, the pre-selection is automatically selected again.

Manager Keypad

The Manager Keypad is located on the inside of the display housing door.

Figure 7: Manager Keypad



Key	Description
0-9	Displays Numerical values.
F1	Displays start of calculator configuration, one step back in the configuration level.
F2	Exit the configuration mode.
\$ Total	Displays the total amount per hose.
Vol Total	Displays the total quantity per hose.
Enter	Confirm the entered values.
Clear	Delete last entry, exit the quantity, or amount mode.

How to Configure Command Codes

This section includes a description about the Multimedia display as well as Command codes required for programming the H-Series dispenser.

Multimedia Display Fields

The H-Series dispenser does not use segment displays; it uses a large multimedia display. [Figure 8](#) displays the Amount, Volume, and PPU locations on the H-Series dispenser that are described in the manual.

Figure 8: Multimedia Display Fields



Security Switch

Some command codes require the security switch on the Apollo CPU PCA to be flipped in order to change them. These command codes are considered legally relevant parameters and therefore are more heavily protected by this physical switch. It would require someone with knowledge and access to the switch to be present at the dispenser to change these parameters. The security switch SW1 is mounted directly on the **Apollo CPU PCA**. [Figure 9](#) displays identified switch. There are two positions of the switch, normal and calibrate. Normal mode is when the switch is away from the USB port. Calibrate mode is when the switch is closest to the USB port. When changing one of the legally relevant parameters, the switch must be moved to the calibrate location. After the parameter is changed, the switch must be returned to the normal position before the dispenser can be operated. If the switch is left in the calibrate position, error code 5056 will be displayed if someone tries to operate the dispenser.

Figure 9: Security Switch



Command Codes Required for Hydrogen Dispensers

For a list of relevant H2 configuration command codes and the passkey for leveled access, obtain a latest copy of the document “E25-00-001: Command Codes.”

Error Codes

This section describes how the error codes are handled and displayed on the Hydrogen dispenser.

Error Code Reference Table

This section provides a list of all error codes for Sandpiper and Apollo electronics. The hydrogen dispenser uses the Apollo electronics. A controlled copy of the latest SW error codes can be obtained from the document “E25-00-005: 5945.”

Error Code	Severity	Description	Notes
	Supermajor	Blinking in the price display	Massive CPU Error. Reset by power reset or warm start (F1 then F2).
	Major	Blinking in the price display	Stops a transaction on all fueling positions. Reset by owner reset or warm start (F1 then F2).
	Medium	Blinking in the price display	Stops a transaction on relative fueling position. Reset by returning nozzle to dispenser.
	Minor	Logged in event log	Does not stop a transaction.
	Info	Logged in event log	Does not stop a transaction.
Error Codes Reference Table			
E1	Supermajor	W&M RAM database corrupted	Warm start (press F1 then F2).
E4	Supermajor	One or more tasks not started	Warm start (press F1 then F2).
E9	Supermajor	Hardware cold start	Power down, remove cold start jumper on CPU, and power up.
E10	Supermajor	New software version detected	Open the CPU Security Switch, warm start (press F1 then F2).
44	Medium	Nozzle out during power up	Return nozzle to nozzle holder. Check nozzle switch functionality.
50	Medium	POS communication lost (disconnected)	Check wiring to the POS system. Check the shielding of the cable connection. Contact POS supplier.
4323	Medium	POB Board not detected	Check command code 97. Check connection to POB-DC board.
5056	Medium	CPU Security Switch is open	Cannot have a transaction with the Security Switch open. Close the switch then start again.
5150	Medium	Too many nozzle signals at the same time	Only one nozzle should be removed at once. Check nozzle switch functionality. Check nozzle switch connectivity to H-Hub.
5911	Medium	Overpressure	Pressure above upper limit.
5912	Medium	Ambient pressure out of range	Fueling only allowed when ambient temperature is within -40 to 50 degrees C.
5913	Medium	Pressure control valve malfunction	Initialize the valve using command code 54.19. Check connectivity to pressure control valve.
5914	Medium	Under pressure	Pressure below lower limit.
5917	Medium	Initial tank pressure out of range	CHSS initial pressure must be greater than 0.5 MPa to begin a transaction.
5918	Medium	Startup mass out of range	Cannot dispenser more than 200g during startup routine.
5919	Medium	Fuel temperature out of range	Fuel temperature out of range.
5920	Medium	Over flow rate	Flow rate above upper limit.

Error Code	Severity	Description	Notes
5921	Medium	Hose pressure designator invalid	If using vehicle communications, ensure vehicle pressure class matches the nozzle pressure class.
5924	Medium	Invalid state	Dispenser fueling algorithm entered an invalid state.
5925	Medium	Leak check failed	Check integrity of hose and nozzle assembly. Look for leaks in process lines.
5933	Medium	Flowmeter communication error	Initialize the flowmeter using command code 54.19. Check connectivity to flowmeter.
5934	Medium	Pressure sensor error	Check integrity of pressure sensors. The measurements are not equal.
5935	Medium	Temperature sensor error	Check integrity of temperature sensors. The measurements are not equal.
5936	Medium	Flow cycle error	Dispenser paused fueling more than 10 times in a single transaction.
5942	Medium	H-Hub error	Check that jumper JP4 on H-Hub is set. Check connectivity to H-Hub.
5943	Medium	CHSS capacity out of range	CHSS is not within allowable size range.
5944	Medium	CHSS temperature out of range	CHSS temperature above 85 degrees C.
5945	Medium	IR Receptical Type error	IR receptical type not H35 or H70
5946	Medium	IR Abort Signal	Received Abort signal for vehicle comms
5949	Medium	Modbus authorization timeout	Failed to receive an authorization from the Site Controller via the Modbus connection. See command code 54.48 and 54.49.
5950	Medium	Mass pulse timeout	Mass pulse did not complete before timeout. Time out is set with command code 54.50. Ensure site supply is available and high enough to overcome pressure in vehicle. Check if there is a leak in PCV dome regulator. If PCV Inner Pressure (Modbus register 30032) is not responding as expected and appears to be constant, replace PCV controller. Check for leaks in H2 process piping and valves.
5951	Major	Station reported error	Dispenser received station error state from Site Controller via the Modbus connection.
5952	Major	Station reported offline	Dispenser received station offline state from Site Controller via the Modbus connection.
5954	Medium	Station stopped dispense	Dispenser received station stop dispense state from Site Controller via the Modbus connection.
5955	Medium	Vehicle tank is full	Dispenser is at a state where fueling cannot start because there is sufficient pressure in the tank to already meet the fueling pressure target.
5956	Major	Gas detection error	Gas detector is either faulted or %LEL was exceeded.
5056	Medium	ECAL Switch open	Security switch on Apollo CPU cannot be in calibrate position during a transaction.
6002	Major	IS Board not connected	Configure dispenser command codes for hydrogen.

Modbus Data Reporting

Overview

The Hydrogen dispenser provides a TCP Server Modbus Slave interface for an external TCP Client Modbus Master device to retrieve data from the dispenser. This data reporting connection can be used to retrieve real time values for sensor, target pressure set points, and end of transactional data.

Addresses

The dispenser data server provides a list of input registers that can be retrieved by a Modbus request read input register function code 4. The fueling points 1 and 2 have separate register addresses.

- Fueling Point 1 Starting Address 30000
- Fueling Point 2 Starting Address 31000

State Register

The state register can be used to determine the status of the dispenser. The table below is corresponding to the values returned by the state register to the dispenser status.

Value	State	Description
0	Idle	Waiting for a user to remove the nozzle.
1	Wait For Start Button	Waiting for a user to press the start button after removing the nozzle.
2	Connection Pulse	Initial mass pulse to equalize pressure between the dispenser and the vehicle.
3	Measure Static Pressure	Pausing fueling to measure the static pressure.
4	Dispense CHSS Measurement Mass	Mass pulse to measure the CHSS size.
5	Pre-Startup	Initialization routine before startup routine.
6	Startup	Startup routine to validate and initialize fueling parameters.
7	Wait For Startup Time	Waiting for minimum required amount of time spent during startup before going to Main Fueling states.
8	Main Fueling	Main fueling routine.
9	Stop	Terminate fueling due to reaching final pressure or an error. User must return nozzle for dispenser to go back to Idle state.

Command Codes to Enable Data Reporting

The following are the Command Codes that enable Data Reporting:

- Command Code 89.76 2 (Enable Modbus-TCP)
- Command Code 40.20 XXX.XXX.XXX.XXX (Set dispensers IPv4 address)
- Command Code 40.31 Set TCP/IP port number used for Modbus TCP (example 502)

Modbus Register Table

The latest ModBus register mapping can be obtained from the document “E25-00-006: ModBus Registers.”

Electrical Requirements

Following are the electrical requirements for installing the unit:

- Sites must be prepared according to applicable national, state, and local codes/regulations.
- All circuit breaker panels and relay boxes must be mounted securely to the wall.
- Licensed electricians experienced with dispenser installations must be used to make all electrical connections.
- Installation requires a dedicated circuit phase system. All electronic units must be wired to the same power leg.
- An earth ground is required for all circuits.

Emergency Power Cut-off Switch

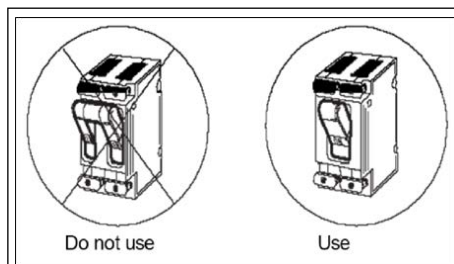
Following are the emergency power cutoff switch requirements for the unit:

- Dispensers installed for indoor use must include an emergency cutoff device on the dispenser.
- An emergency power cutoff switch is a single control that removes AC power to all island equipment [dispensers, canopies, lights, etc. (see [Figure 10](#)).
- The emergency power cutoff switches must be accessible, labeled clearly, and installed away from any hazard that may occur at the dispensers. Cutoff switches must not be located more than 100 feet away from the dispensers.

Circuit Breakers

Following are the circuit breaker requirements for the unit:

Figure 10: Switched Neutral Circuit Breaker



- If installing in a CSA or UL regulatory country, a dedicated UL/Canadian Underwriters Laboratory (CUL)/Canadian Standards Association (CSA) listed switched neutral breaker is required for each circuit leading to a dispenser, or a dispenser and its associated equipment. It must be able to disconnect hot and neutral conductors simultaneously. Single-pole breakers with handle ties cannot be used.
- Circuit breakers must be installed away from the dispensers, readily accessible and clearly marked.
- A separate circuit breaker is required for each dispenser.
- One circuit breaker is required for each dispenser to allow the isolation of the H-series dispenser.
- To meet the fault current rating of the dispenser, the breaking capacity (AIC) must not be less than 4kA.

Conduit

For North America installations, ANGI recommends that spare conduits be run for future high-speed communications. For details, refer to [“Twisted Pair in Low Voltage Class 2 Conduit \(North America\)”](#) on page 25.

- 3/4” Female National Pipe Tapered (FNPT) connections use a minimum of 1-inch conduit for all Hydrogen dispensers. Two-wire data wires share this conduit.
- Use separate 3/4” conduit for e-CRIND™ or intercom wiring, pulser wires, or ANGI monitor COMM wiring. This is required for higher data rate Transmission Control Protocol/Internet Protocol (TCP/IP) communication.
- Run all power and light wires in threaded, rigid metal conduit, or in a rigid non-metallic conduit. The conduit must conform to national and local electrical codes. If non-metallic conduit is used, it must be at least 2 feet underground. The last 2-feet of the underground run to the J-box must be a rigid metal conduit or threaded steel intermediate metal conduit.
- Never share the conduit or wire troughs with other manufacturers’ equipment (For example, speaker wires, etc.).

Note: The same conduit may be used for routing power to the Hydrogen dispenser and the two-wire data loop. The two-wire data loop is a Class 1 circuit.

- Metal conduit is not sufficient to provide an equipment ground. A separate ground wire must be used.
- Knock-out boxes or flexible conduit are not permitted for installation.
Note: Extra J-boxes added to the dispenser must be listed as Class 1, Division 2, and Group B explosion-proof.
- All electrical fittings must be listed for Class 1 Division 2, Group B hazardous locations, as required by NFPA 2, NFPA 30A, and NFPA 70.
- A seal-off ‘Y’ fitting (for example, Killark® Type EY) must be installed on all units as a first connection where the conduit leaves the ground.

Wiring

For high-speed communications information, refer to [“Twisted Pair in Low Voltage Class 2 Conduit \(North America\)”](#) on page 25.

- All dispensers must be wired according to applicable national, state, and local codes/regulations.
- Only stranded gas and oil-resistant copper wire rated for 300 Volts (up to 240 VAC source) and 176 °F (80 °C) may be used.
- In the main conduit, for communications, only twisted-pair, two-wire data pairs may be used.
- Only listed wire nuts may be used for connections. Tape is not permitted.
- Seal-off Y fitting(s) must be potted after all wires are run and tested to termination points (if using conduit).

Twisted-Pair Wiring - Data Wire Lengths

Refer to the following table to determine maximum data wire lengths:

For this Forecourt Controller	The Distance Between the Forecourt Controller and Dispenser	The Distance Between the Forecourt Controller and Console/Controller
PA0133, PA0187 G-SITE®	"Total" data wire system runs no more than 2,600' with 14 AWG	
PA0242 Transac® System 1000	No more than 2,600' with 14 AWG	No more than 2,600' with 14 AWG
PA0261 Universal D-Box (Two-wire Mode)	No more than 2,600' with 14 AWG	No more than 2,600' with 14 AWG
PA0306 D-Box	No more than 2,600' with 14 AWG	No more than 2,600' with 14 AWG
PA0409 D-Box	No more than 2,600' with 14 AWG	No more than 2,600' with 14 AWG
PA0261 (RS-422 Mode)	No more than 50' with 14 AWG	No more than 2,600' with 14 AWG
PA0409 (RS-422 Mode)	No more than 50' with 14 AWG	No more than 2,600' with 14 AWG

When installing new two-wire communication wiring, use unshielded twisted-pair data wires.
Note: Do not use shielded wires.

Wiring Specifications

Two-wire twisted-pair (UTP) with 10 to 12 twists per foot, stranded annealed copper tinned with 18 AWG minimum required for runs up to 1,000 feet or 14 AWG minimum for runs up to 2,600 feet.

Insulation Specifications

Polyvinyl chloride (PVC) insulation of type Thermoplastic Flexible Fixture Wire Nylon Jacketed (TFFN) or Machine Tool Wire (MTW), gasoline and oil-resistant.

Refer to C&M Corporation Part #27525 (18 AWG) or equivalent and ANGI part number for the wire is 170-07399.




Twisted Pair in Low Voltage Class 2 Conduit (North America)

ANGI recommends the use of a 1-inch rigid conduit and fittings (refer to ["Conduit"](#) on [page 24](#)) for twisted-pair cable(s). This will allow up to one speaker and one call/stop button per side, plus Ethernet.

Note: Terminate the conduit consistent with all national and local electrical codes.

Twisted-Pair Cable (Europe)

ANGI-specified cable must be used to permit the issuance of a Certificate of Conformance (CoC) and/or warranty. The use of cables of other types may also create a hazardous situation.

 Safety Information	
	Hydrogen gas may migrate inside the cable insulation between conductors and sheathing of various cables, including twisted-pair cables. Hydrogen gas may ignite, leading to serious injury or death.
	Use only twisted-pair cables specified by ANGI.

Cable Ordering Information

Type	Comments
Q13221-02	Wire - 600 Volt Stranded, Annealed Copper Tinned with PVC Insulation
	~OR~
Type TFFN or NTW, 18 AWG	Approved Gasoline and Oil-resistant, Wire with 10-12 twists per foot

Ethernet Cable

ANGI requires use of 10 Base-T or CAT-5E cable as specified in this manual.

IMPORTANT INFORMATION

A copy of the American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA) TSB 67 CoC from the wiring personnel must be provided to the ASC before the site can be commissioned. The certificate is part of the documentation that must be on the file at the installation site. A certification of the field test will be required at equipment start-up. For any questions regarding this procedure, contact ANGI.

Ethernet cables must be installed by certified telecommunications technicians in accordance with “ANSI/TIA/EIA 568-A Commercial Building Telecommunication Cabling Standards (and Amendments)”. The installing technician must read and understand the following:

Document	Title
ANSI/IEEE 142-1991	Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book).
ANSI/IEEE 1100	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book).
ANSI/TIA/EIATSB67	Transmission Performance Specification for Field Testing of Unshielded Twisted-pair Cabling Systems.
ANSI/TIA/EIA568-A	Commercial Building Telecommunication Cabling Standards (with amendments).

There are two ways to connect high-speed data to the dispenser:

- 1 An Ethernet or Category-5 (CAT-5) cable installation
- 2 FlexPay Highspeed 2-wire connect.

a POS controls CRIND on dedicated twisted-pair.

b POS controls CRIND with pump data on same wire.

For site-level connectivity drawings, refer the “[Connectivity](#)” section on [page 29](#).

Ethernet or CAT-5 in Conduit

Note: An Ethernet or CAT-5 cable cannot be installed in power conduit as the maximum cable length is 300 feet.




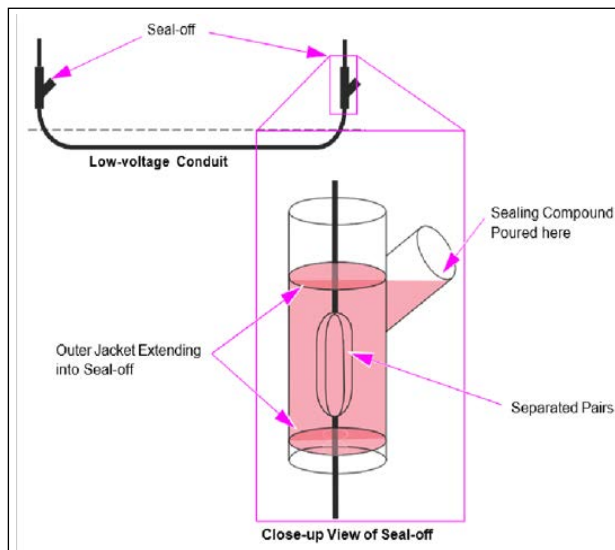
 Safety Information	
	<p>Hydrogen gas may migrate inside the cable insulation between conductors and sheathing of various cables, including 10 Base-T or CAT-5E cable. Hydrogen gas may ignite, leading to serious injury or death.</p>
	<p>Use gas-oil resistant CAT-5 or CAT-5E. For example, Belden® 7928a.</p>
<p>If conduit is used in regions where allowed, the outer jacket can defeat the seal-off, the CAT-5 jacket must be removed, and the conductor pairs separated to allow a good seal (see Figure 11).</p>	

Figure 11: Low-Voltage Conduit



Note: Jacketed and/or shielded cable must have the jackets and shielding removed where the wire passes through the seal-off material.

Grounding

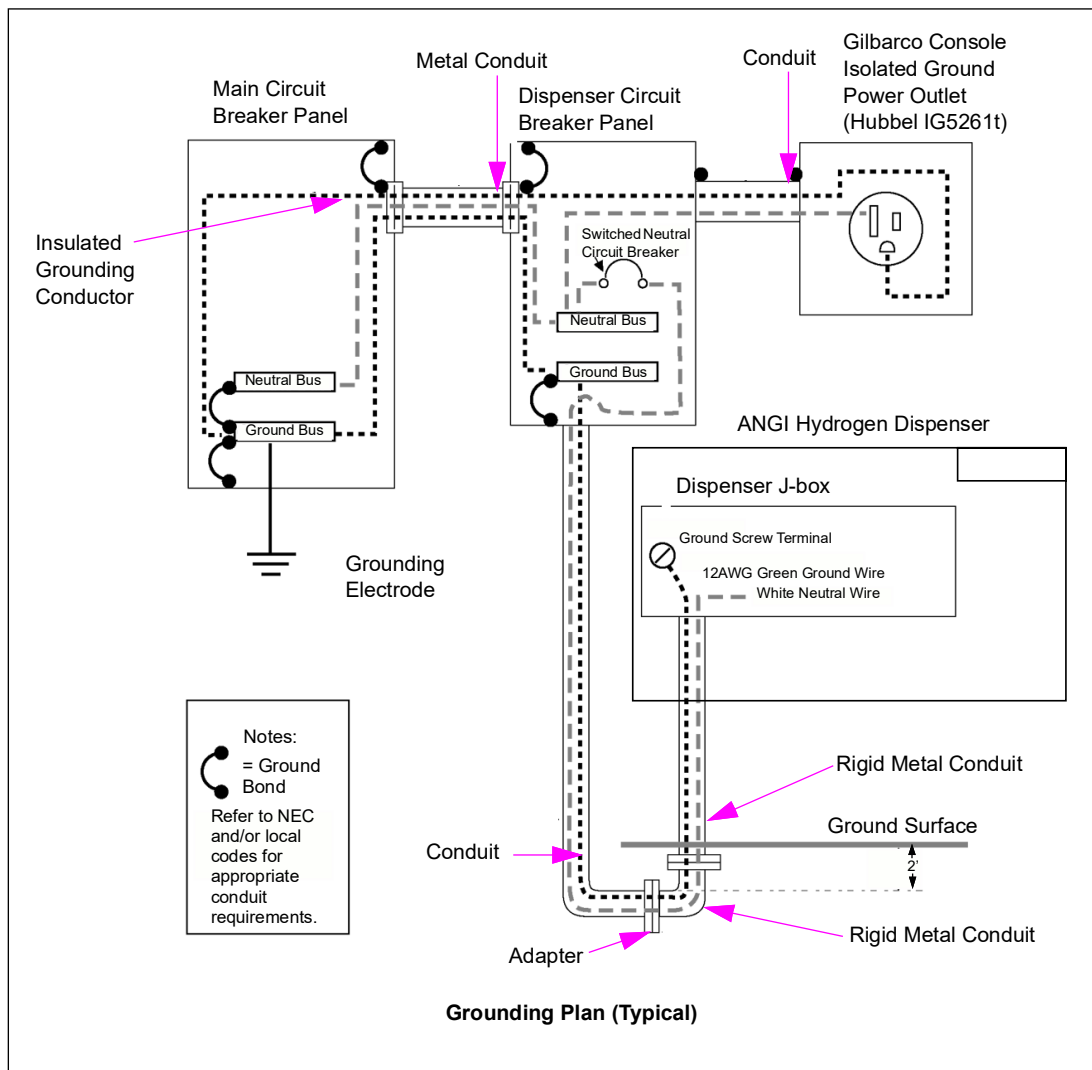
The following are the grounding requirements for connecting the following to the system ground.

- Consoles
- Relay control boxes
- Dispensers
- Circuit breaker panel
- Electronic leak detectors

ANGI requires connecting each dispenser to an equipment grounding conductor (see [Figure 12](#)) located in the conduit. The following applies to ground conductor:

- Use of wire no smaller than 12 AWG.
- Use of wire with green or green-and-yellow striped insulation.
- Connection to green grounding screw or terminal in the J-box.
- Bonding the neutral bus to an approved grounding electrode.

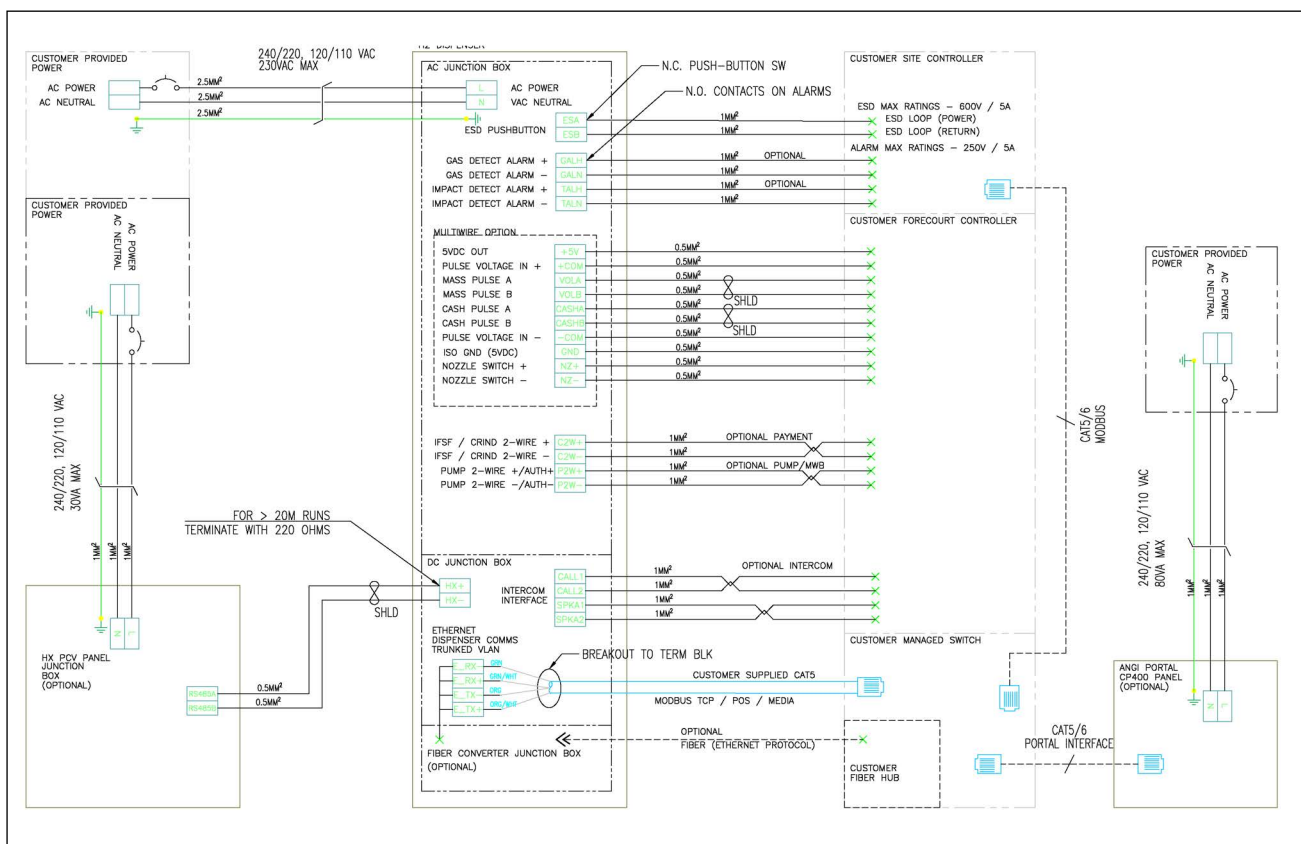
Figure 12: Grounding Plan



Connectivity

Connections to the dispenser include different modules for authorization and data acquisition. Refer to [Figure 13](#) for all required and optional connections to the dispenser. For connection to a POS or Forecourt controller, 2-wire, IFSF, and Ethernet are supported. Consult your POS or controller documentation for connectivity.

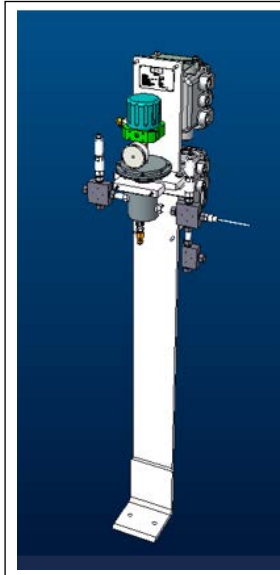
Figure 13: H2 Dispenser Connections



Heat Exchanger Pressure Reduction Panel (HEX Panel)

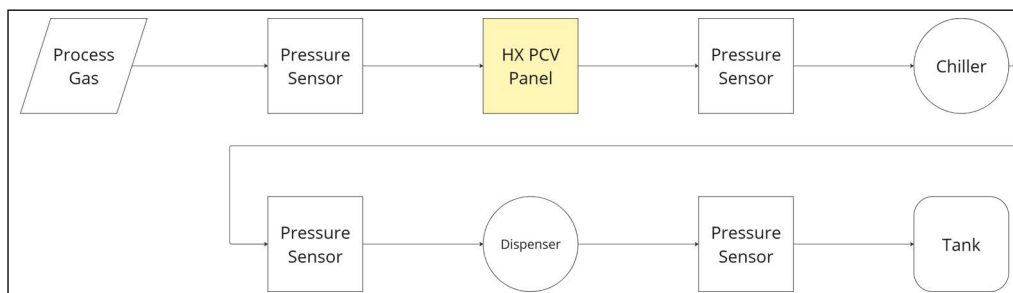
Review the following information before installing the HEX panel.

Figure 14: HEX Panel



The HEX panel provides pressure regulation to the process gas input of a heat exchanger that requires it. This panel houses a PCV and Controller, which regulate the input gas to the heat exchanger in order to reduce the pressure drop and therefore heat gain in the exchanger. The HEX Panel controls pressure with a PID loop to set the desired output pressure and thereby the desired input pressure to the dispenser. The dispenser controls command the setpoint of the HEX Panel using wiring that goes between the equipment as shown in “[Connectivity](#)” on [page 29](#).

Figure 15: HEX PCV Panel



The dispenser controls a PCV that regulates the nozzle pressure to the vehicle and, in addition, controls the HEX PCV that regulates the pressure to the dispenser gas inlet. Therefore, the HEX pressure setpoint should be maintained above the setpoint of the internal dispenser PCV to compensate for pressure drop across the dispenser. There are three modes of operation controlled by the dispenser controls:

- 1 Setpoint fixed offset - the HEX Panel pressure setpoint maintains a fixed value above the dispenser internal PCV setpoint.
- 2 Percent fixed - the HEX Panel setpoint is a certain % above the dispenser internal PCV setpoint.
- 3 Dynamic offset:
 - a The HEX Panel maintains a minimum offset above the dispenser PCV setpoint.
 - b When the pressure at the dispenser hose cannot be maintained, the dispenser goes into “request for pressure” RFP mode.
 - c In RFP mode, the HEX Panel increases the setpoint above the minimum offset by the amount that the pressure has fallen off at the dispenser hose.
 - d When the hose pressure is back at the required value, the RFP flag is cleared. The HEX Panel will incrementally bring its setpoint back down to keep the pressure drop across the chiller as low as possible.

The site must adjust these settings through trial and error, according to its unique fueling strategy, for a workable solution.

Connecting

The HEX Panel only requires connections to AC power and Serial twisted pair back to the Dispenser J-box. This is illustrated in “[Connectivity](#)” on [page 29](#).

Configuration and Startup

HEX Panel address configuration is required one time, and to be done by production. If the PCV controller is replaced in the field, then it must be done by field service.

PCV controller address configuration is done by the dispenser and requires a sequence of events so that the dispenser internal controller and the PCV panel controller do not conflict.

- 1 Disconnect power from the HEX Panel.
- 2 Power on the dispenser and configure the dispenser PCV as normal (Command Code 19.19 = 1).
- 3 After a power-on reboot, power the HEX Panel.
- 4 Invoke Command Code 54.75 = 2, and then restart the dispenser (F1->F2).
- 5 Invoke Command Code 54.19 = 5, and then power-on reboot the HEX Panel.

This procedure sets the internal dispenser address to 1 and the HEX PCV Panel address to 100. As a result, the dispenser controls can identify the device. In the case of dual PCVs for two-sided fueling, refer to the address mapping in the table below:

PCV Device	Serial Address
Dispenser PCV 1	1
Dispenser PCV 2	2
HEX Panel 1	100
HEX Panel 2	200

Finally, configure the HEX Panel mode behavior as described above. The command codes are described below (refer to document “E25-00-001 Command Codes”):

- 54.75 - Enable/Disable
- 54.76 - Control Method
- 54.77 - Offset Amount
- 54.81 - Setpoint Decay time

After configuration, ensure that there is no 5913 error code. The 5913 error code indicates that the HEX Panel is not communicating.

Testing can be done by forcing the HEX Panel valve to be fully open with Command Code 18.1.1.8 = 1.

Note: Reference the General Arrangement Drawing (GAD) provided with each HEX Panel for mechanical dimensions.

Operating Instructions

To operate the Hydrogen dispenser after installation, proceed as follows:

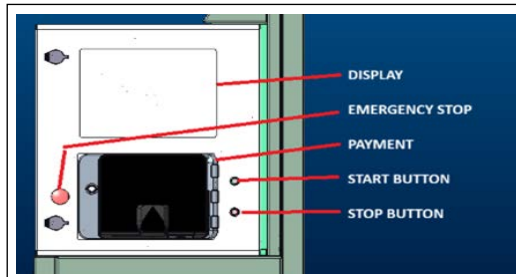
- 1 Ensure that no ignition source is present (switch off engines and no smoking).

Figure 16: No Ignition Source



- 2 Locate the emergency shutdown button (located on the dispenser), start, and stop buttons on the display cabinet.

Figure 17: Locate Emergency Shutdown, Start, and Stop Buttons



Ensure that the message on the display reflects as shown in [Figure 18](#). If not, the dispenser may not fuel properly.

Figure 18: Welcome Screen



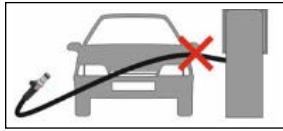
- 3 Start processes for payment, credit card, pro-key, etc., with the available outdoor payment terminal (OPT), if installed. If no OPT is installed, then lifting the nozzle should start a transaction.
- 4 After the payment is accepted, remove the nozzle from the dispenser holster and connect the nozzle to an approved tank connection. For pistol grip nozzles, insert and pull the trigger to latch. For straight nozzles, insert and rotate the latch handle to the ON position as shown in [Figure 19](#).

Figure 19: Remove Nozzle



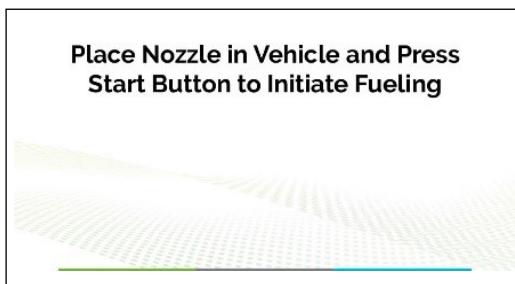
Do not stretch the hose across the vehicle to reach a fill neck. Orient the vehicle so the filler neck is facing the dispenser.

Figure 20: Do Not Stretch the Hose



- 5 After the nozzle is connected to the receptacle, the display shows the appropriate message as shown in [Figure 21](#). Press the start button, which is flashing in green, to start fueling.

Figure 21: Initiate Fueling Display



Note the PPU, Mass, and Money being transacted are displayed above the message frame. These are displayed in the appropriate units. If they are blank, the dispenser may still transact properly, but the display function has failed; contact the site management if this happens.

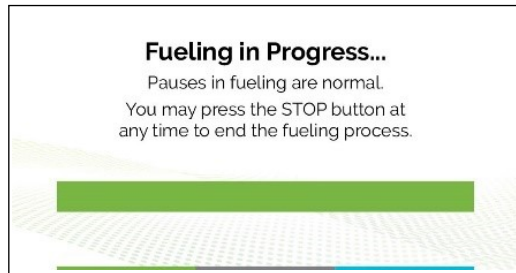
Next, the display may show that the station is preparing, depending on the station operating rules. Some patience may be required here, especially if the station is precooling the fuel. The dispenser also pulses the initial mass into the vehicle to detect the starting pressure.

Figure 22: Station Preparing Display



Main fueling of the vehicle storage begins with the display changes as shown in [Figure 23](#).

Figure 23: Fueling Progress Display

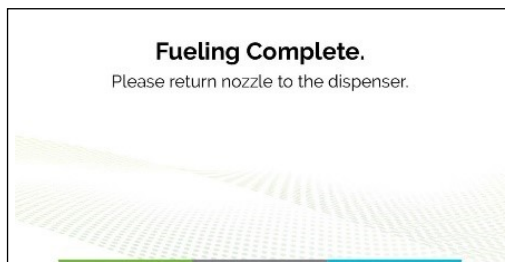


A percentage in the green ribbon will show the fueling progress based on the end target pressure or the final state of charge in the tank. When this is 100%, the dispenser will automatically stop fueling. Periodically, the dispenser will perform a leak check in the middle of fueling. This should not take more than a few seconds.

Note: Pauses in fueling are common, depending on the site procedure for pressure requesting and bank switching.

- 6 At any time, to end the transaction, press the stop button, which flashes in red, or wait for automatic end of transaction. The display should then change as shown in [Figure 24](#).

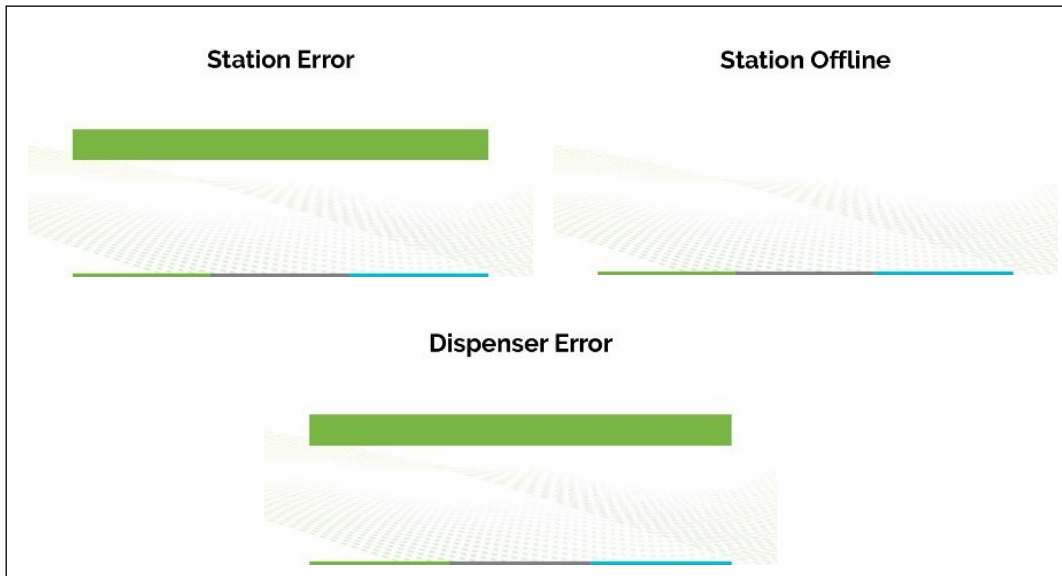
Figure 24: Fueling Complete Message



- 7 After the transaction is completed, release the nozzle trigger or turn the nozzle to the vent position, disconnect, and replace in the dispenser holster.

- 8 If any of the messages in [Figure 25](#) is displayed, put the nozzle back in place and contact site management immediately.

Figure 25: Fault and Error Displays



IMPORTANT INFORMATION

In the event of an emergency, press the emergency shutdown button and evacuate the area.

Meter Calibration

The dispenser is calibrated in the factory prior to delivery and does not typically need any calibration. Check on site the measuring accuracy of all meters and recalibrate if necessary. The calibration is performed by the setting of the correction factor in the Coriolis meter.

- 1 Carry out a calibration filling.
- 2 Compare the measured value with the one shown on the display. If this deviates too much, proceed as follows:
 - i Determine the correction factor. The default value for the correction factor is calculated as follows: $\text{By pressure cylinder with scale determined value} / \text{value on the display} = \text{correction factor}$ Example: 1) Filled value determined with the scale: 9,99 kg. 2) Value shown on display: 10 kg. 3) Calculation: $9,99\text{kg} / 10,00\text{kg} = 0,999$.
 - ii Open the calibration switch on the Apollo CPU board.
 - iii Enter the parameters Command Code 76.2. Then enter the meter number (1 or 2), which is associated with the Coriolis meter, and confirm with Enter.

- iv Enter the determined correction factor. The factor must always be 6 digits, with the comma after the first digit. Confirm with [Enter] to save the value.

To read out the meter details, use the following commands:

- Command Code 15.1 = serial number of the meter
- Command Code 15.2 = software version
- Command Code 15.3 = checksum

Gas and Impact Detectors

As an additional safety precaution to the vapor barriers that restrict zoning, ANGI has a safety system that includes a hydrocarbon sensor and an impact sensor. The gas detectors are located in the Apollo electrical cabinet and the process gas enclosure. The hydrocarbon sensor disables all electronics and electrical circuits powered through the sensor J-box in the dispenser above 25% of the Lower Explosive Limit (LEL), and the impact sensor disables all electronics and electrical circuits powered through the sensor J-box if the dispenser undergoes shock and impact, such as in case of a vehicle collision with the dispenser.

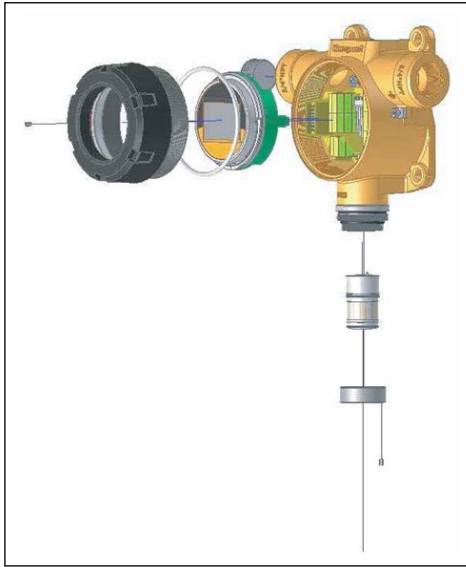
There are two methods to capture alarm signals. The dispenser is OK to dispense if the gas and impact detector are not activated or optional alarm signals of 110 VAV output are activated, specific to either the gas or impact sensor when tripped. Both signals could be used to power relays in the HRS control system to disable a dispenser, compressor feed, or the site, depending on preference.

For connection details, refer to [“Installation”](#) on [page 8](#).

H2 Gas Dectector

The following sections provide the information on the Honeywell XCD gas detector. These tests require a gas calibration kit (XCDCOMB Kit) and a test-gas cylinder containing 25% LEL hydrogen.

Figure 26: Breakout of XCD Gas Detector



Gas Detector Response Test

To conduct the Gas Detector Response Test, follow the steps given below.

- 1 Ensure that the gas supply to the dispenser is turned off.
- 2 Open the computer housing and insert the gas cylinder hose into the bottom of the Weather Protection cover.
- 3 Connect one end of the hose to the test gas cylinder.
- 4 With the dispenser powered, apply test gas at a rate of 0.5-1 liter per minute using the gas cylinder regulator.
- 5 Confirm that the dispenser shuts down within two minutes and any alarm devices activate. Ensure that this shutdown happens after and not before 25% LEL is reached on the XCD display.
- 6 Turn off the test gas and remove the gas sampling adapter from the sensor housing.
- 7 Switch off the dispenser supply and wait for two minutes before switching back on.
- 8 Confirm that the dispenser powers up normally following a delay.
Note: If the dispenser fails to shut down or shuts down before a reading of 25% on the display, the gas sensor may be out of calibration.

Gas Sensor Zero and Span Calibration





Perform this test for new Gas detector and sensor pairs or if the dispenser fails to shut down in the section above.

Notes: 1) Ensure that the surrounding humidity is not greater than 90% RH when performing calibrations.

2) For the zero calibration, this procedure assumes there is < 1ppm of Hydrogen (H₂), Hydrogen Cyanide (HCN) or Hydrogen Sulphide (H₂S), Ethylene (CH₂), Carbon Monoxide (CO), and Nitrogen Monoxide (NO) in the calibration environment.


Zero Calibration

To perform Zero Calibration, follow the steps given below:

- 1 Switch on the dispenser power and allow the detector to stabilize for 30 minutes.
- 2 Use a magnetic wand or small magnet to hover over the three key controls for the menu operations (3 sec. hold to active controls).
- 3 Hold the magnet over  for 3 seconds.
- 4 The display will indicate the first configuration mode menu 'Set CAL'.
- 5 Put the magnet over the  switch again and move to enter the Calibration menu.
- 6 The display will show the current gas reading, and the gas canister icon flashes.
- 7 When the zero-gas reading is stable, use  to confirm zero calibration.
- 8 If successful, the display shows 'ZERO PASS' (if not successful, the display shows 'ZERO FAIL' and returns to the configuration mode).
- 9 The display shows 'SPAN' with 'YES' flashing.
- 10 Use  proceed to the next step.

Span Calibration

To perform Span Calibration, proceed with the following steps:

- 1 The display shows the current calibration span gas concentration while flashing the gas canister icon. Use '▲▼' to change the calibration span gas concentration, and  when the required span calibration level is set.
- 2 The display will show the current gas reading and the gas canister icon flashes.
- 3 Connect the regulator to the gas cylinder.


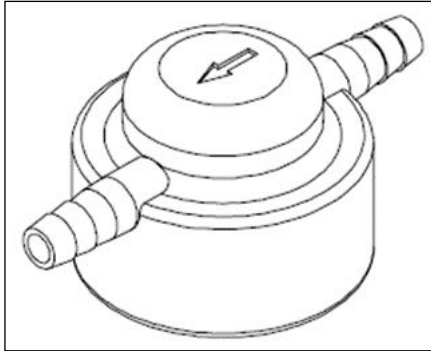
- 4 Apply the span gas to the sensor using the Sensepoint XCD Gassing Cap. The live gas reading is displayed. When the reading is stable, use  to confirm span calibration.

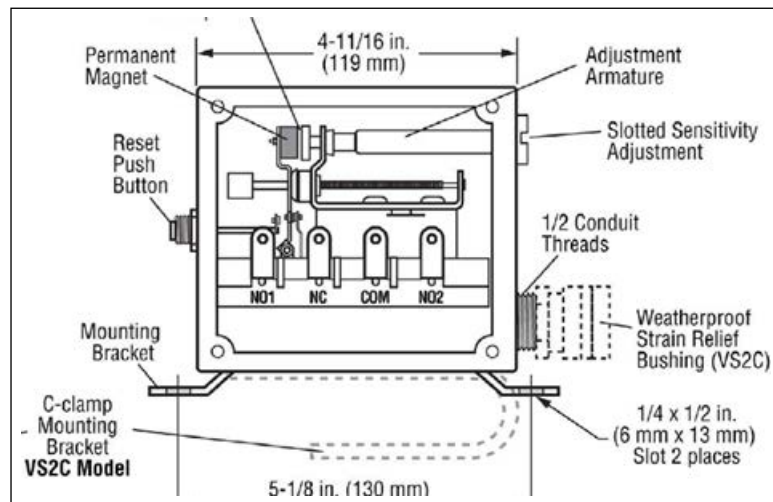
Figure 27: Gassing Cap (S3KCAL)



- 5 If the sensor has been replaced, the 'SENS REPL' display may be shown.
- 6 Use '▲▼' to select 'YES' if the sensor has been replaced or 'No' if it has not been replaced.
- 7 If the span calibration is successful, the instrument will briefly display 'SPAN PASS' (if fails, 'SPAN FAIL' is displayed and returns to the configuration mode).
- 8 The display alternates between 'PURG GAS' and the gas reading to indicate that the unit is expecting the span gas to be removed from the sensor.
- 9 Promptly switch off the calibration span gas and remove the Sensepoint XCD Gassing Cap from the sensor to allow the gas to disperse.
- 10 When the reading falls below 50% of the calibration gas level, the display indicates a countdown (up to 180 seconds dependent on gas type).
- 11 When the countdown is finished, the calibration procedure is complete.
- 12 The instrument returns to the 'Set CAL' menu. Activate the '▲' or '▼' switch to select another menu or select 'QUIT' to return to normal monitoring mode.
- 13 Proceed to the Gas Detector Response Test above.

Impact Detector

Figure 28: VS2 Series Shock and Vibration Switch



Function Test

To perform an Impact Detector test, proceed as follows:

- 1 Ensure that the gas supply to the dispenser is turned off and the front cover of the detector is in place.
- 2 Press the Reset Push button on the detector.
- 3 Power on the dispenser and make sure the cabinet electronics power on. If the electronics fail to power on, go to [“Adjustment”](#) on [page 42](#).
- 4 Use a rubber mallet and tap firmly on the detector side above the reset button, drawing back on the mallet no more than 1-inch.
- 5 Confirm that the dispenser shuts down and any alarm devices activate.
 - a If the dispenser fails to shut down, investigate the detector window and verify that the magnet arm is contacting the adjustment arm. If not, then go to [“Adjustment”](#) on [page 42](#).
 - b If the magnet arm does not make contact (and power is still out), verify the voltage between NO2 and Neutral to be 120VAC.
 - i If yes, then the diagnosis is downstream of the detector.
 - ii If no, then replace the detector.
- 6 Unplug the dispenser power and wait for 30 seconds. In the meantime, press the Reset Push button on the detector again.
- 7 Confirm that the dispenser powers up normally following a delay.

Adjustment

Perform an adjustment if the functional test has failed or if the device is brand new.

- 1 Ensure that the gas supply to the dispenser is turned off.
- 2 Power off the dispenser.
- 3 Press the Reset Push Button on the detector. Look through the window and ensure that the magnet arm is separated from the adjustment arm.
- 4 If this is the first adjustment or the detector trips with power on: With a flat-head screwdriver, turn the Slotted Sensitivity Adjustment clockwise to the end of the turn. Then turn counterclockwise 1/4 turn.
- 5 If this is the second adjustment (functional test failed): With a flat-head screwdriver, turn the Slotted Sensitivity Adjustment from its current position counterclockwise for 1/4 turn.
- 6 Remove the front cover and measure the impedance across NO1 and NO2. Ensure that it is less than 5 ohms. If not, then replace the detector.
- 7 Proceed to the functional test.

Hazardous Locations

Classifying Hazardous Locations

Any activity (such as smoking, welding, grinding, or drilling) that can be a source of ignition must not be conducted within the hazardous areas. Contact ANGI for specific hazardous area classification for your project.

Preliminary Installation Information

Required Equipment and Materials

The following items are required to properly install the equipment:

- Anchor bolts
- U-bolts/clamps for fastening piping to braces
- Sealant that is UL-approved for use with fuels being encountered (North America).
- Pit box cover plates. Use when required to adapt the unit to pre-existing pit boxes.
- Lifting device (forklift, fork truck, etc.) to move and lift the dispenser
- Breakaways, hoses, nozzles, and swivels
- Barricades
- Potting compound and fiber dam material to allow potting of the conduit in accordance with Class 1, Division 2 locations as specified in the NEC (North America).
- Any kits required for upgrading the unit to the customer's requirements
- Gas sniffer, leak test solution, and snoop spray

Hazards of Hydrogen Gas



WARNING

Where fuels are involved, you are working in a dangerous environment of H₂ gas and electricity.

Before installing the equipment, the installer must read, understand, and follow any national, state, and local codes that may apply.

Accurate, sound installations reduce service calls. Experienced and licensed contractors must perform the installation and follow accurate and safe installation techniques. A careful installation can eliminate potential problems.

The equipment manufacturer must provide instructions for other equipment, such as storage tanks, priority panels, gas compressor, compressor systems, filter, and dryers. ANGI does not provide complete installation instructions for other manufacturers' equipment.

Installation Checklists

The checklists for installation, start-up, and commissioning are provided in the documentation package supplied with each unit. The installer must complete the checklist for each unit installed and insert it inside the unit's electronics cabinet. Ensure that the checklists are placed in an area away from electrical devices and wiring.

The installation checklist requires certain critical inspections by the installer to verify that the installation was performed properly. Properly completed forms will help verify the safe installation for certain critical areas and is required to obtain warranty coverage, to help ensure proper operation of the equipment, and to provide some liability protection for the installer, manufacturer, and customer. Instructions are included in the forms. Not all requirements are found in this manual, making it important for the installer to read, understand, and follow all recommendations in this manual to ensure safe and proper operation.

Following are the ANGI Hydrogen Dispenser installation, start-up, final inspection/training checklists, and test form:

- ANGI H-Series Dispenser Installation Checklist
- ANGI H-Series Dispenser Start-up Checklist

To see examples of these forms, request ANGI Service Team to provide them.

Preparing for Installation

To prepare for the installation, proceed as follows:

- 1 Read all instructions before beginning. It may be helpful to have a copy of ANGI H-Series Dispenser Installation Checklist in hand during the installation.
- 2 Follow all safety precautions:
 - a Barricade the area.
 - b Do not allow vehicles in the work area.
 - c Do not smoke or allow open flames in the work area.
 - d Do not use power tools in the work area.
 - e Do not allow unauthorized people into the work area.
 - f Wear eye protection during the installation.
 - g Ensure that there is no power supplied to the units until required, as per later installation steps.
 - h Check for pressure within a hydrogen dispenser; each dispenser is shipped with low (air) pressure in the system to prevent condensation.
- 3 Use circuit breakers to turn off all power to dispensers and compressors. Multiple disconnects may be required.

- 4 Check the following for proper installation:
 - Emergency power cutoff switch
 - Circuit breakers
 - Isolation relays
 - Conduit and wiring
 - Grounding
 - Piping and fittings
 - Fuel storage tanks
 - Pressure regulating valves
 - Tank and/or line leak detectors
 - Pit boxes
 - Components must be compatible with hydrogen pressures being dispensed. For more information, refer to the manufacturer's instructions.
- 5 Inspect the dispenser cartons and contents for shipping damage. Gilbarco does not cover shipping damage under its warranty policy. Notify the shipper of any damage.
Note: If any damage is found, document it with pictures and save the original shipping carton.
- 6 Remove the maintenance panels (doors) of the dispenser.

Gaining Access to and from ANGI Hydrogen Dispenser Cabinet

ANGI H-Series Dispenser cabinets are designed to protect the equipment inside the unit from the elements. The doors and covers must be installed as directed. Keys will be provided with shipment of the dispenser.

Before Mounting Unit on Fuel Island

Note: Before mounting the unit on the fuel island, read and understand this section completely. This information is essential to avoiding installation errors.

Verifying and Determining Plumbing Requirements

Before placing a unit on an island, determine the correct location of piping for the unit involved and the proper orientation of the unit, refer to project General Arrangement Drawing (GAD). A common installation error is to install the units backward, which will require expensive modifications. This section contains information regarding plumbing requirements for various models of ANGI H-Series Dispensers.

IMPORTANT INFORMATION

DO NOT make assumptions about configurations based on previous experience, hose positions, or layout of the unit that you are replacing, whether it is a Gilbarco unit or that of any other manufacturer.

Incorrect matching of unit piping to supply lines can cause costly rework and time delays.

Mounting Unit on Fuel Island

Following guidelines must be followed when installing the unit:

- Special care must be taken when lowering the dispenser over the conduit to avoid damage to the conduit or any pulled wiring. Temporary removal of the side panel is recommended to aid in visualizing, and for later installation of an additional conduit segment. Preferably, the wiring must be pulled after the dispenser is placed over the conduit.
- Routing the wiring to the electronics cabinet (if required): Through the column to the side of the electronics cabinet and then into the electronics cabinet using one or more of the knock out holes provided.

Follow regional industry standards for guidance on required site collision protection from vehicles.

Installing Units on Island

Mounting Unit to Island

Before placing the unit on an island, determine the correct location of piping for the unit involved and verify the proper orientation of the unit. A common installation error is to install the unit backwards, resulting in required modifications or delay in installation.

Mount the unit using mounting bolt locations specified.

If installing on existing island and previous dispenser position, fill in any openings from the smaller length ANGI H-Series Hydrogen Dispenser cabinet to the potentially longer pit box opening for The Advantage Series wide frame or other units. Seal as required.

Lifting ANGI H-Series Hydrogen Dispenser Units

ANGI H-Series Hydrogen Dispenser units weigh up to 2200 lbs and lifting heavy equipment can be hazardous. Equipment could fall and cause severe injury or death. Use lifting equipment of proper capacity and factor of safety when moving or positioning the unit. Stand clear from pump/dispenser when lifting and lowering.



WARNING

ANGI H-Series Hydrogen Dispenser units weigh up to 2200 lbs and lifting heavy equipments can be hazardous. Equipment could fall and cause severe injury or death.

Use lifting equipment of proper capacity and factor of safety when moving or positioning the unit; stand clear from pump/dispenser when lifting and lowering.

Before mounting the unit to the island, verify if the pit box or foundation frame and unit base are compatible. Some pit box plates have rain lips that require modifications before placing the ANGI H-Series Hydrogen Dispenser unit on the plate. If the ANGI H-Series Hydrogen Dispenser unit does not fit properly onto the pit box plate or foundation frame, the unit will have to be lifted according to the instructions in this section and moved to a safe work area. If this modification is not required, do the following, and then proceed to [“Before Mounting Unit on Fuel Island”](#) on [page 45](#).

To lift ANGI H-Series Dispenser units, proceed as follows:

Note: H-Series Hydrogen Dispensers are fitted with integrated fork pockets for lifting. A properly rated forklift or lift truck is required for installation of the dispenser. If a forklift or lift truck is not available, an authorized hoisting and rigging operator and ANGI engineering should be consulted for safe lifting of the dispenser.

CAUTION

DO NOT run slings around columns or under the upper piping housing. This will damage the columns or sheathing.

- 1 Remove integrated fork pocket covers.
- 2 Verify the fork pockets are clear of any potential interference when utilizing the integrated fork pockets.
- 3 Using a properly rated forklift or fork truck for the load, lift the dispenser and place it in position.

CAUTION

Ensure the hose assembly is properly fastened and protected when lifting the dispenser to avoid damage.

- 4 Once positioned, replace the forklift covers and proceed with the installation instructions provided in the manual.

Refer to project GAD for installation dimensions for anchor bolts, piping, and electrical connections.

Preventive Maintenance

The preventive maintenance schedule provided below provides guidance for maintaining the equipment to reduce the risk of an unexpected maintenance event. Follow depressurization and inert gas purging before and after each maintenance event (see “[Important Safety Information](#)” on [page 3](#)). Reach out to the ANGI Service department (1-800-934-5219) for additional guidance on maintenance questions.

Hydrogen Dispenser Maintenance					
Equipment	Check	100 Hours Post Commission	1 Month	6 Months	Every 2 Years
Hoses	Outer visual check	X	X	-	-
	Check for cracks and wear	-	X	-	-
	Replace hose set	-	-	-	X
	Leak test with operating pressure	-	X	-	-
	Continuity Check	-	X	-	-
Hose Breakaway	Function test (check firm seat of breaking coupling)	-	X	-	-
Nozzles	Check for leak tightness and damage	-	X	-	-
	Maintenance/clean/lubricate	-	X	-	-
	Go/No-go	-	X	-	-
Complete Unit	Leak test under operating pressure	-	X	-	-
Valves	Check Operation	-	X	-	-
Solenoid Valves	Check for inner leak tightness	-	-	X	-
Filters	Clean, replace as needed	-	X	-	-
Pressure Transmitter	Verify calibration	-	-	X	-
Overpressure Valve (SRV)	Check opening pressure (minimum 3 years NFPA 2)	-	X	-	-
Gas Detector	Check Operation	-	X	-	-
Vibration Switch	Check Operation	-	-	X	-
CRIND System	Card reader cleaning	-	X	-	-
	Receipt paper check	-	X	-	-
Fueling Algorithm and Vehicle Communications	Dispensing system fueling protocol (SAE J2601)	-	X	X	-
	Dispensing system fueling limit test (SAE J2601)	-	-	X	-
	Vehicle to dispenser communications (SAE J2799 and SAE J2601)	-	-	X	-
Safety Systems	Verify emergency and safety functions (ESD)	-	-	X	-
	Verify emergency communications according to the risk assessment.	-	-	X	-

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