Hydrogen Dispenser Installation, Operation, and Service Manual
November 2023

Introduction

Purpose

This manual provides comprehensive information necessary for the safe installation and operation of ANGI 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.

Table of Contents

Related Documents

Title	GOLD℠ Library
ANGI Hydrogen Dispenser Installation Checklist	-
ANGI Hydrogen Dispenser Start-up Checklist	-
ANGI Hydrogen Dispenser Final Inspection/Training Checklist	-
ANGI Hydrogen Dispenser Accuracy Test Form	-
ANGI Hydrogen Dispenser Zoning Diagram	-

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
BIOS	Basic Input/Output System
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	TelecommunicationsIndustry 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.**

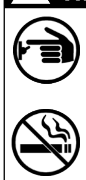
Preliminary Precautions

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 National Fire Protection Association (NFPA) 30A; *Code for Motor Fuel Dispensing Facilities and Repair Garages*, NFPA 70; *National Electrical Code (NEC)*, Occupational Safety and Health Administration (OSHA) 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 ANIGI 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.

Federal Communications Commission (FCC) Warning

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

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.

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.

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 OSHA 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.

WARNING

The pump/dispenser contains a chemical known to the State of California to cause birth defects or other reproductive harm.

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.

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.

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-Frame
	C-Frame
	Transit
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
Filling Pressure	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
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
	Apollo Multimedia - 15” Color Display
	EMV Ready Card Ready
	High-Speed USB Printer
	Optional alphanumeric keypad
	Optional EMV-ready contactless card reader
	Optional barcode reader
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	Brandview canopy (available with full wrap graphics) and Customizable branding and graphics

Configuration Options	Description
	General Specification
Power	North America: 110 VAC, 60 Hz, 10A
	Europe: 220 VAC, 50 Hz, 10A
Operation Temperature	-40 °C to 50 °C
	-40 °F to 122 °F
Humidity	20-95% Rh (non-condensing)
Dimensions	C-Frame • Height: 2388 mm/94.02 inches • Width: 1202 mm/47.32 inches (1360 mm/53.51 in. including canopy) • Depth: 583 mm/22.95 inches (643 mm/25.32 in. including canopy)
	H-Frame • Height: 2434 mm/95.81 inches • Width: 1491 mm/58.7 inches (1679 mm/66.1 in. including canopy) • Depth: 611 mm/24.06 inches (884 mm/34.82 in. including canopy)
	Regulatory and Safety
Industry	• 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 • ISO 19880-2 • Machinery Directive • FCC • ADA
Regional	Weights and Measures

Installing Conduit and Wiring in Dispenser Unit

Connecting J-Box Conduit

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 if a seal-off Y fitting has been installed and sealed as a first connection where the conduit leaves the ground. This fitting must be in place and sealed before proceeding further.
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 conduit as the power and two communication wiring to the unit. They should be in a separate conduit routed to the DC box, as shown in Figure 1 on page 9, and should not contain any high voltage wiring.

Installing Field Wiring

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 1 on page 9 and Figure 2 on page 10.

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	131 °F (55 °C) *
**Electronics have been evaluated and are rated for use at a maximum of 131 °F (55 °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 and sealing fitting.

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 fuel/vapors.
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 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 1: DC Junction Box

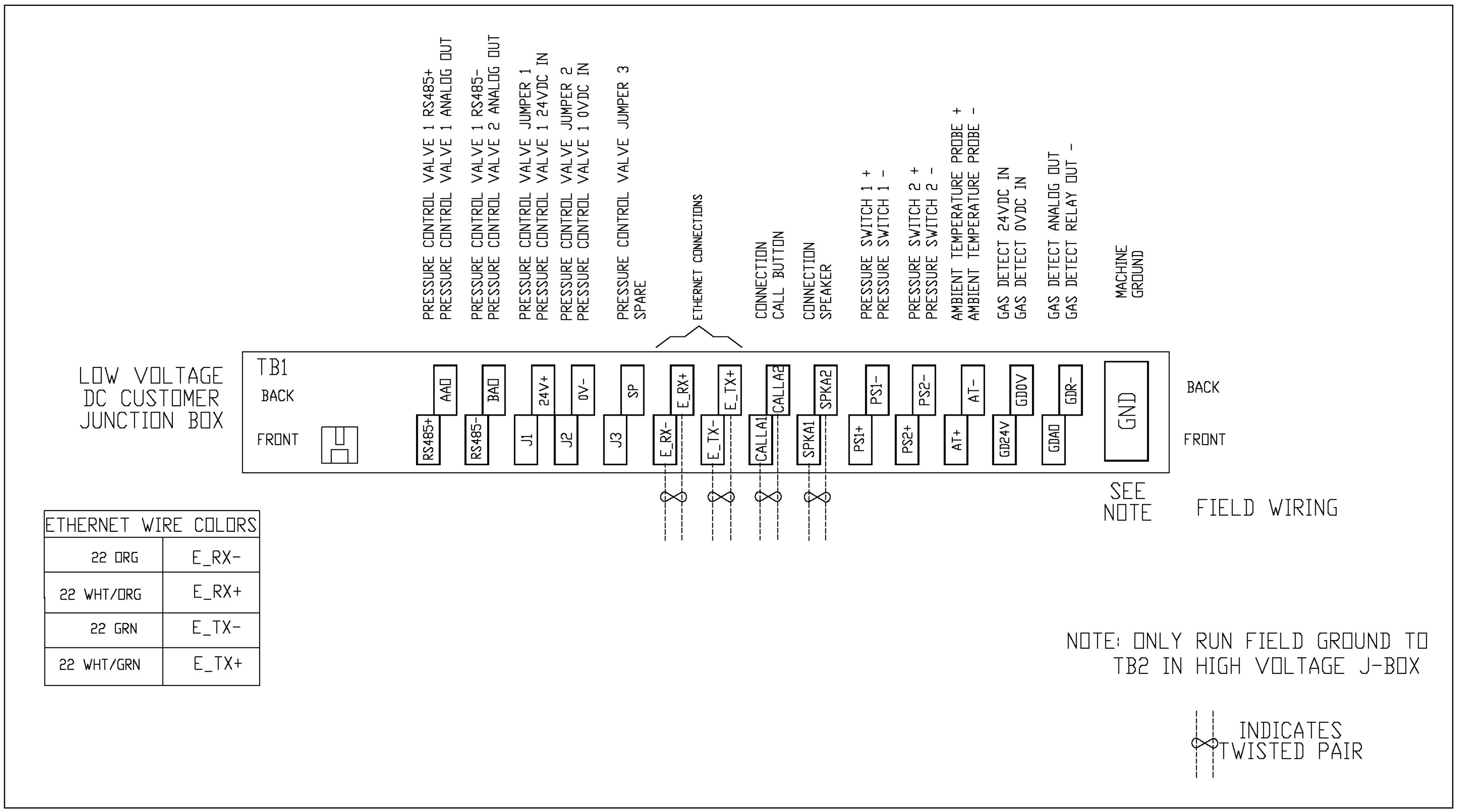
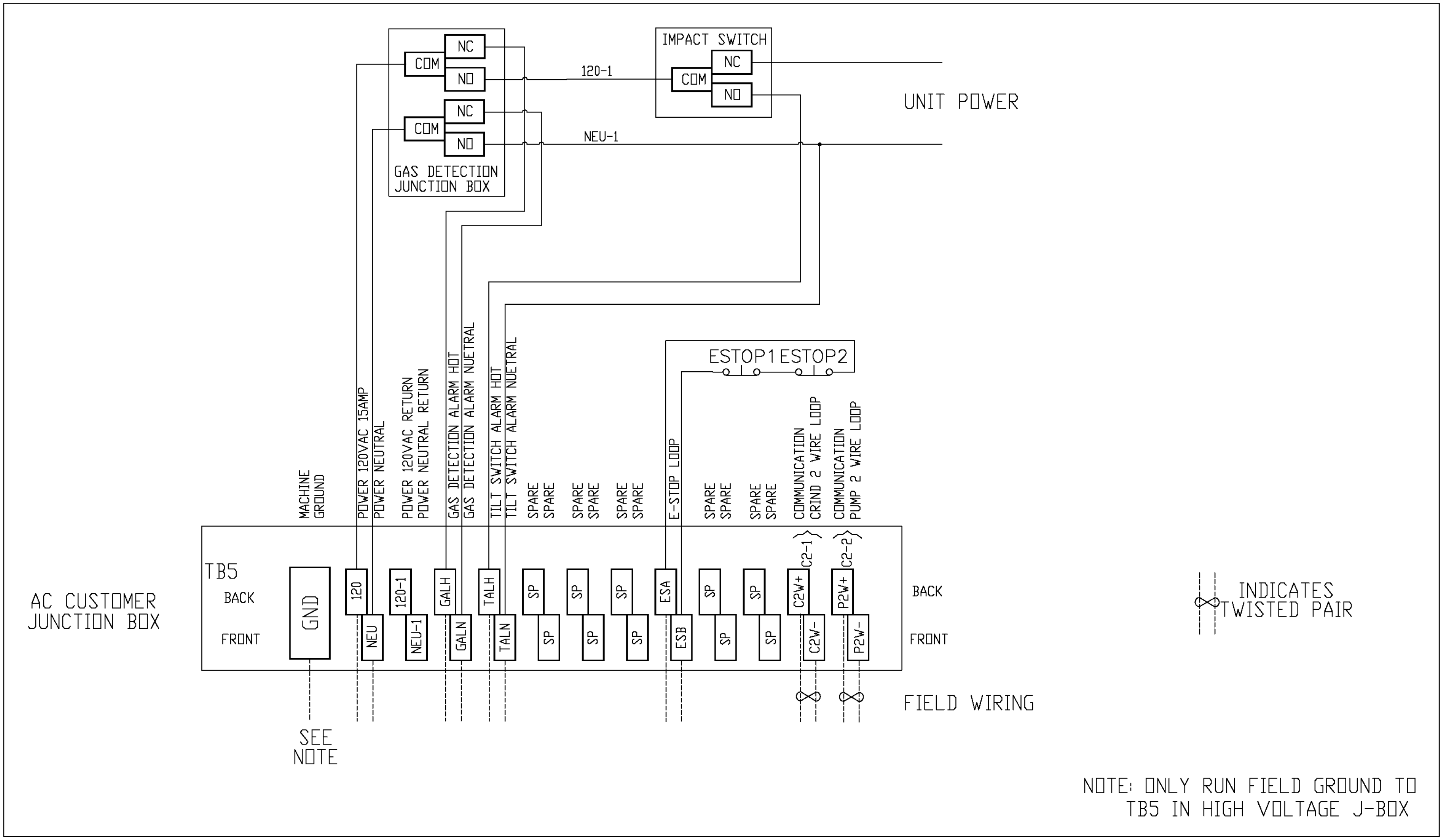


Figure 2: AC Junction Box



Dispenser Inputs and Outputs

Signal Description	Required/ Optional	Junction Box	Terminal Label	Signal Type
Incoming Power	Required	AC	120	120 VAC 60 Hz Power (15 Amps Max)
			NEU	VAC Neutral
			GND	Ground
ESD Signal	Required	AC	ESA	ESD Signal Out NC Relay
			ESB	ESD Signal In NC Relay
Tilt Switch Alarm	Required	AC	TAHL	Tilt Switch Alarm 120 VAC
			TALN	Tilt Switch Alarm Neutral
Gas Detect Alarm	Required	AC	GALH	Gas Detect Alarm 120 VAC
			GALN	Gas Detect Alarm Neutral
Pump Two Wire Authorization*	Optional	AC	P2W+	Pump 2 Wire Current Loop +
			P2W-	Pump 2 Wire Current Loop -
CRIND® Two Wire Authorization*	Optional	AC	C2W+	CRIND 2 Wire Current Loop +
			C2W-	CRIND 2 Wire Current Loop -
LON Authorization*	Optional	AC	LON+	LON RS485 +
			LON-	LON RS485 -
Modbus Data Collection**	Optional	DC	E_RX+	Ethernet Rx+
			E_RX-	Ethernet Rx-
			E_TX+	Ethernet Tx+
			E_TX-	Ethernet Tx-
Multimedia Configuration**	Optional	DC	E_RX+	Ethernet Rx+
			E_RX-	Ethernet Rx-
			E_TX+	Ethernet Tx+
			E_TX-	Ethernet Tx-
Payment**	Optional	DC	E_RX+	Ethernet Rx+
			E_RX-	Ethernet Rx-
			E_TX+	Ethernet Tx+
			E_TX-	Ethernet Tx-
Intercom Speaker	Optional	DC	SPKA1	Intercom Speaker 1
			SPKA2	Intercom Speaker 2
Intercom Call Button	Optional	DC	CALLA1	Intercom Call Button 1
			CALLA2	Intercom Call Button 2

*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 in 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 shown in the *"Command Codes Reference Table" on page 18**. The reason for this is to allow room for future expansion of SK700 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 Hydrogen 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 3, Figure 4, and Figure 5).

Figure 3: Jumper J4 is Open (Initial State)

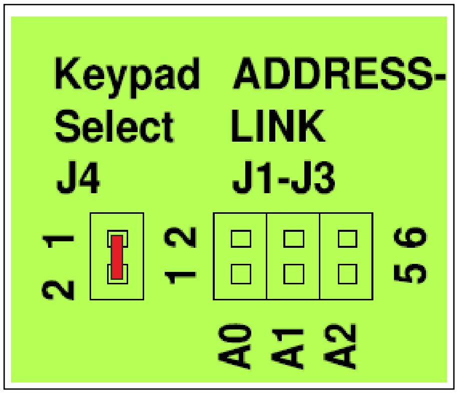


Figure 4: Jumper J4 is Closed (When Using the Manager Keypad)

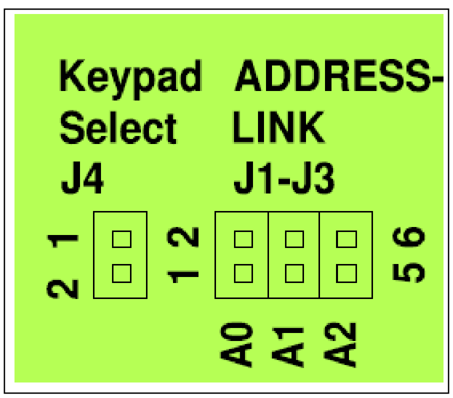
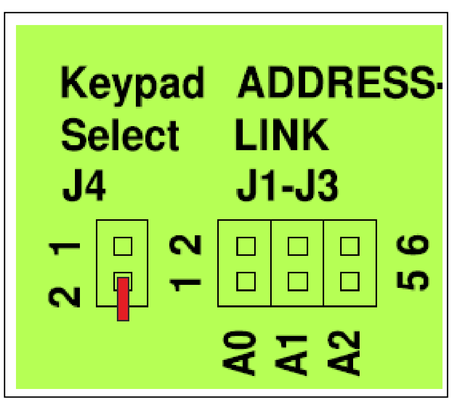


Figure 5: Let the Jumper Stuck on One Pin After Programming (For Reuse)



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 6: 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.

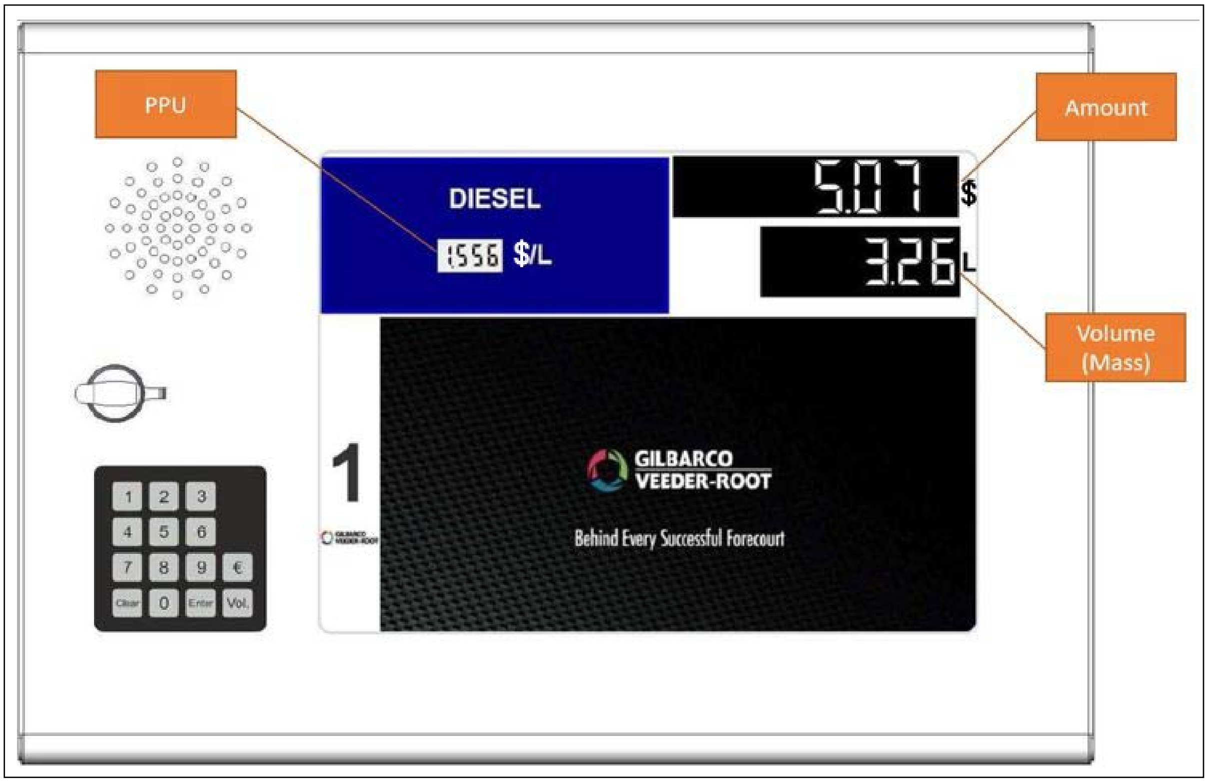
How to Configure Command Codes

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

Multimedia Display Fields

The Hydrogen dispenser does not use segment displays; it uses a large multimedia display. Figure 7 displays the Amount, Volume, and PPU locations on the Hydrogen dispenser that are described in the manual.

Figure 7: 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 8 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 8: Security Switch

Command Codes Required for Hydrogen Dispensers

Following are the General Hydrogen command codes to set.

- CC54.1 = 2 (Enables MC Formula based algorithm)
- CC54.17 = 1 or 2 (1 is for single nozzle and 2 is for double nozzle)
- CC91.29 = 6 (Enables the H_2 meter)
- CC97.x.y = Sets the pressure class of each nozzle
  See the description in the below "Command Codes Reference Table".
- CC54.19 = Activates serial devices
  See the description in the below "Command Codes Reference Table"

Testing Hydrogen Valves with Command Codes

Refer command code 18 in the below "Command Codes Reference Table".

Command Codes Reference Table

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
H-Hub Display Sensor Value	11	4			1	1 - 11	Display selected sensor value (MPa or Kelvin). 1 - 10 = 4-20mA channels. 11 = PT100
Manual Valve Control	18	1	1		0	0 - 1	Fueling Position 1 Inlet Valve (0: Closed, 1: Open)
		1	2		0	0 - 1	Fueling Position 1 Supply Valve (0: Closed, 1: Open)
		1	3		0	0 - 1	Fueling Position 1 Vent Valve (0: Closed, 1: Open)
		1	4		0	0 - 1	Fueling Position 1 Purge Valve (0: Closed, 1: Open)
		1	5		0	0 - 1	Fueling Position 1 IR Relay (0: Closed, 1: Open)
		1	6		0	0 - 1	Fueling Position 1 Pressure Control Valve (0: Closed, 1: Open)
		1	7		0	0-1	Fueling Position 1 All Valves (0: Closed, 1: Open)
		2	1		0	0 - 1	Fueling Position 2 Inlet Valve (0: Closed, 1: Open)
		2	2		0	0 - 1	Fueling Position 2 Supply Valve (0: Closed, 1: Open)
		2	3		0	0 - 1	Fueling Position 2 Vent Valve (0: Closed, 1: Open)
		2	4		0	0 - 1	Fueling Position 2 Purge Valve (0: Closed, 1: Open)
		2	5		0	0 - 1	Fueling Position 2 IR Relay (0: Closed, 1: Open)
		2	6		0	0 - 1	Fueling Position 2 Pressure Control Valve (0: Closed, 1: Open)
		2	7		0	0-1	Fueling Position 2 All Valves (0: Closed, 1: Open)

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
Set Price Per Unit	20	1	1	1	0	0 - 99999	PPU Side 1 Grade 1 (decimal point location is set in CC 85)
		1	2	1	0	0 - 99999	PPU Side 1 Grade 2 (decimal point location is set in CC 85)
		2	1	1	0	0 - 99999	PPU Side 2 Grade 1 (decimal point location is set in CC 85)
		2	2	1	0	0 - 99999	PPU Side 2 Grade 2 (decimal point location is set in CC 85)
Set Mode of Operation	24				2	1	2-Wire
						2	Stand Alone
						3	IFSF
H-Hub Sensor Configuration	37	1	0 - 1		1034	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		2	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		3	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		4	0 - 1		1034	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		5	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
H-Hub Sensor Configuration		6	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		7	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		8	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		9	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		10	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
		11	0 - 1		80	0 - 9999	Level Three 0 = Disabled, Level Three 1 = Enabled. Value for a pressure transmitter is max pressure in bar. Lower value assumed to be 0 bar. Value for temperature sensor is upper temperature value in degrees Celsius. Lowe value assumed to be -50 C.
Set 2-Wire Address	40	1	1		0	0 - 32	Protocol Address Side 1 - FP 1
		1	2		0	0 - 32	Protocol Address Side 2 - FP 2

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
Set 2-Wire Baud Rate	40	2			1	1	Baud Rate 5787 bps
						2	Baud Rate 4800 bps
						3	Baud Rate 1200 bps
						4	Baud Rate 9600 bps
						5	Baud Rate 19200 bps
						6	Baud Rate 2400 bps
						7	Baud Rate 10 bps
						8	Baud Rate 100 bps
Set IFSF - LON Node Address	40	3			27	1 - 127	IFSF LON Node Address
Set DHCP On/Off	40	19			2	1	DHCP Enabled
						2	DHCP Disabled
Dispenser IP Address	40	20	1		172	0 - 255	IP address first value
			2		20	0 - 255	IP address second value
			3		100	0 - 255	IP address third value
			4		5	0 - 255	IP address fourth value
Subnet-Mask	40	21	1		255	0 - 255	Subnet-mask first value
			2		255	0 - 255	Subnet-mask second value
			3		255	0 - 255	Subnet-mask third value
			4		0	0 - 255	Subnet-mask fourth value
2-Wire Reported Money Size	40	23			2	1	2-Wire reported money size 5 digit
						2	2-Wire reported money size 6 digit
						3	2-Wire reported money size 7 digit
						4	2-Wire reported money size 8 digit
2-Wire Reported Volume Decimal Point Location	40	24			1	1	Same as on the volume display
						2	3 decimal figures: XXX.XXX
Modbus TCP Port Number	40	31			0	0 - 64000	Modbus TCP Port Number (Normally set to 502)
Hydrogen Fueling Protocol	54	1			1	1	Disabled
						2	Enabled MC Formula
Vehicle Communications	54	2			1	1	Disabled
						2	Enabled
Cold Dispenser	54	3			1	1	Disabled
						2	Enabled
Leak Check	54	4			2	1	Disabled
						2	Enabled
Leak Check Minimum Flowrate	54	5			5	0-60	Grams per second
Leak Check Pressure Difference	54	6			50	1 - 999	1/100 MPa

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
Leak Check Timeout	54	7			10	1 - 255	Seconds
Measure VCHSS	54	8			2	1	Disabled
						2	Enabled
Measure VCHSS Pulse Mass	54	9			20	1 - 255	Grams
Hydraulic Type	54	17			1	1	Single Hose
						2	Double Hose
Connection Pulse Mass	54	18			20	1 - 255	Grams
Initialize Serial Devices	54	19			0	0	Do nothing
						1	Activate Fueling Position 1 PCV
						2	Activate Fueling Position 2 PCV
						3	Activate Fueling Position 1 Meter
						4	Activate Fueling Position 2 Meter
Fuel Temperature Sensor Error	54	20			50	1 - 255	1/100 Degrees C
Pressure Sensor Error	54	21			26	1 - 255	1/100 MPa
PRR Cap Factor	54	22			100	90 - 110	Percent
Station Pressure Offset	54	23			0	0 - 999	1/100 MPa
Control Pressure Offset	54	24			0	0 - 700	1/100 MPa
Activate Start Button Time	54	25			10	0 - 255	Seconds (0: instantly)
SOC Target	54	26			100	95 - 100	Percent
MAT Expected	54	27			36	18 - 36	Negative Degrees C
Simulate Pulses	54	28			1	1	Disabled
						2	Enabled
Sensor Hub Selection	54	29			1	1	H-Hub
						2	CNG-Hub
Minimum Ambient Temperature	54	30			40	1 - 40	Negative Degrees C
Maxium Ambient Temperature	54	31			50	1 - 50	Positive Degrees C
Fuel Temperature Allowed Difference	54	32			500	0-999	1/100 Degrees C
Pressure Sensor Allowed Difference	54	33			500	0-999	1/100 MPa
Leak Check Delay Time	54	34			5	0-255	Seconds

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
Failure Mode Test	54	35			0	0	No Failure Mode Test
						1	Max CHSS Pressure Test
						2	Max Flowrate Test
						3	Station Pressure Upper Limit < 5MPa Test
						4	Station Pressure Upper Limit > 5MPa Test
						5	Station Pressure Lower Limit Test
						6	MAT30 Test
Pulse Method	54	36			0	0	Constant Pulse
						1	Dynamic Pulse
						2	Supply Valve Pulse
Constant Pulse Amount	54	37			8000	1-9999	1/100 MPa
Pulse Timeout	54	38			10	1-9999	50 ms intervals
Dynamic Pulse Pressure Step	54	39			50	1-9999	1/100 MPa
Dynamic Pulse Flowrate	54	40			5	1-255	g/s
Supply Pulse Timeout	54	41			10	1-9999	50 ms intervals
Control Pressure Offset Initial	54	42			0	0-9999	1/100 Mpa
Control Pressure Offset Initial Timeout	54	43			12	1-99	seconds
IR Comms Errors Allowed	54	44			20	1 - 255	Number of IR Comms Errors received before failing comms
Pressure Limit Check Timeout	54	45			0	0 - 9999	Timeout to ignore pressure limit check before/after intended non fueling events (50 ms intervals)
MAT30 Check Timeout	54	46			0	0 - 255	Timeout for MAT30 to come back within allowed range (seconds)
MAT30 Max Value	60	47			25565	0 - 65535	Max allowed MAT30 value (1/100 Kelvin)
Set Dispenser Date and Time	60	1				0 - 9999	Time HHMM
		2				0 - 999999	Date MMDDYY
Set Money Decimal Point Position for Display	85	1			3	1	XXXXXX
						2	XXXXX.X
						3	XXXX.XX
						4	XXX.XXX
Set Volume Decimal Point Position for Display	85	2			3	1	XXXXXX
						2	XXXXX.X
						3	XXXX.XX
						4	XXX.XXX

Command Code Description	Level One	Level Two	Level Three	Level Four	Default Value	Value	Value Description
Set PPU Decimal Point Position for Calculations	85	3			4	1	XXXX
						2	XXX.X
						3	XX.XX
						4	X.XXX
Set PPU Decimal Point Position for Display	85	4			4	1	XXXX
						2	XXX.X
						3	XX.XX
						4	X.XXX
Set Comma/ Decimal Point	86					1	Decimal Point
						2	Comma
Modbus TCP Data Reporting	89	76			1	1 - 3	3 = Enable H2 Modbus TCP Data Reporting
Dispenser Type	90				1	1	1 Hose on a side
						2	2 Hoses on a side
Hydrogen Flowmeter Selection	91	29			1	1 - 6	6 = Enable H2 meter
Nozzle Switch Configuration	91	34			3	1	IS Pump Handles (Set to this when using CNG-Hub, CC54.29 = 2)
						2	PPU Pump Handles (Set to this when using H-Hub, CC54.29 = 1)
						3	Either IS or PPU pump handles (both are valid) (Do not use)
Dispenser Side Exists	92	1			1	1	Both Sides
						2	Single Side Left
						3	Single Side Right
Configure H2 Nozzles	97	1	1		1	17	Side 1, Hose 1, H35
		1	1			18	Side 1, Hose 1, H70
		1	2			17	Side 1, Hose 2, H35
		1	2			18	Side 1, Hose 2, H70
		2	1			17	Side 2, Hose 1, H35
		2	1			18	Side 2, Hose 1, H70
		2	2			17	Side 2, Hose 2, H35
		2	2			18	Side 2, Hose 2, H70

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.

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
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 point 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	Intialization routine before startup routine.
6	Startup	Startup routine to validate and intialize fueling parameters.
7	Wait For Startup Time	Waiting for minimum required amount of time spent during startup before going to Main Fueling state
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

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

Register Number	Description	Units/Value Explanation	Data Type/Range	PID Tag/MC Validator Tag
Registers 30001 to 30099: Fueling Position 1 Real-Time Statuses and Data				
30001	Fueling Point	1 = Fueling Position 1	UINT16: 0 to 65535	
30002	State	See "State Register" on page 27.	UINT16: 0 to 65535	
30003	Active Nozzle Number	0 = None, 1 = Hose 1 Lifted, 2 = Hose 2 Lifted	UINT16: 0 to 65535	
30004	Hose 1 Pressure	1/100 MPa	UINT16: 0 to 65535	PT 50A
30005	Hose 2 Pressure	1/100 MPa	UINT16: 0 to 65535	PT 50B
30006	Hose 1 Fuel Temperature	1/100 Kelvin	UINT16: 0 to 65535	TT 50A
30007	Hose 2 Fuel Temperature	1/100 Kelvin	UINT16: 0 to 65535	TT 50B
30008	Heat Exchanger Coolant Inlet Temperature	1/100 Kelvin	UINT16: 0 to 65535	
30009	Heat Exchanger Coolant Outlet Temperature	1/100 Kelvin	UINT16: 0 to 65535	
30010	Ambient Temperature	1/100 Kelvin	UINT16: 0 to 65535	TT 100
30011	PCV Reference Pressure 1	1/100 MPa	UINT16: 0 to 65535	PT 51A
30012	PCV Reference Pressure 2	1/100 MPa	UINT16: 0 to 65535	PT 51B
30013	PCV Feedback	1/100 MPa	UINT16: 0 to 65535	
30014	PCV Setpoint	1/100 MPa	UINT16: 0 to 65535	
30015	Meter Fuel Temperature	1/100 Kelvin	UINT16: 0 to 65535	FT 20A
30016	Meter Flowrate	1/100 kg/min	UINT16: 0 to 65535	FT 20A
30017	Meter Pressure	1/100 MPa	UINT16: 0 to 65535	FT 20A
30018	IR TV	1/100 Liters	UINT16: 0 to 65535	
30019	IR RT	1 = H25, 2 = H35, 3 = H50, 4 = H70	UINT16: 0 to 65535	
30020	IR FC	1 = DYNA, 2 = STAT, 3 = HALT, 4 = ABORT	UINT16: 0 to 65535	
30021	IR MP	1/100 MPa	UINT16: 0 to 65535	
30022	IR MT	1/100 Kelvin	UINT16: 0 to 65535	
30023	IR Error	0 = No Comms, 1 = Comms OK	UINT16: 0 to 65535	
30024	Dispenser Error Code	See error code table	UINT16: 0 to 65535	
Registers 30101 to 30199: Fueling Position 1 Active Fueling Event Inforamation (cleared to 0 when no transaction is in process)				
30101	Time Elapsed	Seconds	UINT16: 0 to 65535	TIME
30102	Fueling Time Indicator	0 = Not Fueling Time, 1 = Fueling Time	UINT16: 0 to 65535	FTI
30103	Mass Dispensed MSB	Grams	UINT16: 0 to 65535	MASSDIS
30104	Mass Dispensed LSB	Grams	UINT16: 0 to 65535	MASSDIS

Register Number	Description	Units/Value Explanation	Data Type/Range	PID Tag/MC Validator Tag
30105	Ambient Temperature	1/100 Kelvin (convert to Celsius for MC Validator)	UINT16: 0 to 65535	AMBT
30106	Startup Pressure	1/100 MPa	UINT16: 0 to 65535	PSTARTUP
30107	Initial Pressure	1/100 MPa	UINT16: 0 to 65535	PINIT
30108	Station Pressure	1/100 MPa	UINT16: 0 to 65535	PSTATION
30109	Delta P Offset	1/100 MPa	UINT16: 0 to 65535	DPOFFSET
30110	MAT Expected	1/100 Kelvin	UINT16: 0 to 65535	MATEXP
30111	T Fuel A for MAT	1/100 Kelvin	UINT16: 0 to 65535	TFAMAT
30112	T Fuel B for MAT	1/100 Kelvin	UINT16: 0 to 65535	TFBMAT
30113	T Fuel A For H Ave	1/100 Kelvin	UINT16: 0 to 65535	TFAHAV
30114	T Fuel B For H Ave	1/100 Kelvin	UINT16: 0 to 65535	TFBHAV
30115	Indicator Cons RR	0 = Not Conservative, 1 = Conservative	UINT16: 0 to 65535	INDCONSRR
30116	Indicator Communications	0 = No Comms, 1 = Comms	UINT16: 0 to 65535	INDCOMM
30117	CHSS Volume	1/100 Liters	UINT16: 0 to 65535	CHSSVOL
30118	MP	1/100 MPa	UINT16: 0 to 65535	MP
30119	MT	1/100 Kelvin	UINT16: 0 to 65535	MT
30120	FC	1 = DYNA, 2 = STAT, 3 = HALT, 4 = ABORT	UINT16: 0 to 65535	FC
30121	Flag Variable Cold Dispenser	0 = No Cold Dispenser, 1 = Cold Dispenser	UINT16: 0 to 65535	FVCD
30122	Pressure Limit High	1/100 MPa	UINT16: 0 to 65535	PLIMITH
30123	Pressure Limit Low	1/100 MPa	UINT16: 0 to 65535	PLIMITL
30124	Pressure Target Non Comm	1/100 MPa	UINT16: 0 to 65535	PTNONCOMM
30125	Pressure Target Comm	1/100 MPa	UINT16: 0 to 65535	PTCOMM
30126	Pressure Limit Comm	1/100 MPa	UINT16: 0 to 65535	PLCOMM
30127	Ramp Pressure	1/100 MPa	UINT16: 0 to 65535	PRAMP
30128	Mass Average Fuel Temperature 0 A	1/100 Kelvin	UINT16: 0 to 65535	MAT0A
30129	Mass Average Fuel Temperature 0 B	1/100 Kelvin	UINT16: 0 to 65535	MAT0B
30130	Mass Average Fuel Temperature 30 A	1/100 Kelvin	UINT16: 0 to 65535	MAT30A
30131	Mass Average Fuel Temperature 30 B	1/100 Kelvin	UINT16: 0 to 65535	MAT30B
30132	Mass Average Fuel Temperature Used	1/100 Kelvin	UINT16: 0 to 65535	MATC
30133	H A	kJ/kg	UINT16: 0 to 65535	HA
30134	H B	kJ/kg	UINT16: 0 to 65535	HB
30135	H Ave A	kJ/kg	UINT16: 0 to 65535	HAVEA
30136	H Ave B	kJ/kg	UINT16: 0 to 65535	HAVEB
30137	T Final	Seconds	UINT16: 0 to 65535	TFINAL
30138	Next Leak Check Target	1/100 MPa	UINT16: 0 to 65535	

Register Number	Description	Units/Value Explanation	Data Type/Range	PID Tag/MC Validator Tag
30139	Nozzle Pressure Class	1 = H35, 2 = H70	UINT16: 0 to 65535	PRESSCLASS
30140	Flag Variable Top Off Used	0 = No Top Off, 1 = Top Off	UINT16: 0 to 65535	FVTOPOFF
30141	Pressure Ramp Rate	1/100 Mpa/second	UINT16: 0 to 65535	
30142	SOC Target	%	UINT16: 0 to 65535	
Registers 30201 to 30299: Fueling Postion 1 Last Fueling Event Information				
30201	Total Fueling Time	Seconds	UINT16: 0 to 65535	
30202	Final Amount MSB	Configured currency and decimal position	UINT16: 0 to 65535	
30203	Final Amount LSB	Configured currency and decimal position	UINT16: 0 to 65535	
30204	Final Mass Dispensed MSB	Grams	UINT16: 0 to 65535	
30205	Final Mass Dispensed LSB	Grams	UINT16: 0 to 65535	
30206	Final Pressure	1/100 Mpa	UINT16: 0 to 65535	
30207	Final SOC	%	UINT16: 0 to 65535	
30208	Comms Used or Failed (like state register)	0 = No Comms, 1 = Comms Used, 2 = Comms used but failed	UINT16: 0 to 65535	
Registers 31001 to 31099: Fueling Position 2 Real-Time Statuses and Data				
31001	Fueling Point	2 = Fueling Position 2	UINT16: 0 to 65535	
31002	State	See "State Register"on page 27.	UINT16: 0 to 65535	
31003	Active Nozzle Number	0 = None, 1 = Hose 1 Lifted, 2 = Hose 2 Lifted	UINT16: 0 to 65535	
31004	Hose 1 Pressure	1/100 MPa	UINT16: 0 to 65535	PT 50A
31005	Hose 2 Pressure	1/100 MPa	UINT16: 0 to 65535	PT 50B
31006	Hose 1 Fuel Temperature	1/100 Kelvin	UINT16: 0 to 65535	TT 50A
31007	Hose 2 Fuel Temperature	1/100 Kelvin	UINT16: 0 to 65535	TT 50B
31008	Heat Exchanger Coolant Inlet Temperature	1/100 Kelvin	UINT16: 0 to 65535	
31009	Heat Exchanger Coolant Outlet Temperature	1/100 Kelvin	UINT16: 0 to 65535	
31010	Ambient Temperature	1/100 Kelvin	UINT16: 0 to 65535	TT 100
31011	PCV Reference Pressure 1	1/100 MPa	UINT16: 0 to 65535	PT 51A
31012	PCV Reference Pressure 2	1/100 MPa	UINT16: 0 to 65535	PT 51B
31013	Meter Fuel Temperature	1/100 Kelvin	UINT16: 0 to 65535	FT 20A
31014	PCV Feedback	1/100 MPa	UINT16: 0 to 65535	
31015	PCV Setpoint	1/100 MPa	UINT16: 0 to 65535	
31016	Meter Flowrate	1/100 kg/min	UINT16: 0 to 65535	FT 20A

Register Number	Description	Units/Value Explanation	Data Type/Range	PID Tag/MC Validator Tag
31017	Meter Pressure	1/100 MPa	UINT16: 0 to 65535	FT 20A
31018	IR TV	1/100 Liters	UINT16: 0 to 65535	
31019	IR RT	1 = H25, 2 = H35, 3 = H50, 4 = H70	UINT16: 0 to 65535	
31020	IR FC	1 = DYNA, 2 = STAT, 3 = HALT, 4 = ABORT	UINT16: 0 to 65535	
31021	IR MP	1/100 MPa	UINT16: 0 to 65535	
31022	IR MT	1/100 Kelvin	UINT16: 0 to 65535	
31023	IR Error	0 = No Comms, 1 = Comms OK	UINT16: 0 to 65535	
31024	Dispenser Error Code	See "Error Code Reference Table" on page 25.	UINT16: 0 to 65535	
Registers 31101 to 31199: Fueling Position 2 Active Fueling Event Inforamation (cleared to 0 when no transaction is in process)				
31101	Time Elapsed	Seconds	UINT16: 0 to 65535	TIME
31102	Fueling Time Indicator	0 = Not Fueling Time, 1 = Fueling Time	UINT16: 0 to 65535	FTI
31103	Mass Dispensed MSB	Grams	UINT16: 0 to 65535	MASSDIS
31104	Mass Dispensed LSB	Grams	UINT16: 0 to 65535	MASSDIS
31105	Ambient Temperature	1/100 Kelvin (convert to Celsius for MC Validator)	UINT16: 0 to 65535	AMBT
31106	Startup Pressure	1/100 MPa	UINT16: 0 to 65535	PSTARTUP
31107	Initial Pressure	1/100 MPa	UINT16: 0 to 65535	PINIT
31108	Station Pressure	1/100 MPa	UINT16: 0 to 65535	PSTATION
31109	Delta P Offset	1/100 MPa	UINT16: 0 to 65535	DPOFFSET
31110	MAT Expected	1/100 Kelvin	UINT16: 0 to 65535	MATEXP
31111	T Fuel A for MAT	1/100 Kelvin	UINT16: 0 to 65535	TFAMAT
31112	T Fuel B for MAT	1/100 Kelvin	UINT16: 0 to 65535	TFBMAT
31113	T Fuel A For H Ave	1/100 Kelvin	UINT16: 0 to 65535	TFAHAV
31114	T Fuel B For H Ave	1/100 Kelvin	UINT16: 0 to 65535	TFBHAV
31115	Indicator Cons RR	0 = Not Conservative, 1 = Conservative	UINT16: 0 to 65535	INDCONSRR
31116	Indicator Communications	0 = No Comms, 1 = Comms	UINT16: 0 to 65535	INDCOMM
31117	CHSS Volume	1/100 Liters	UINT16: 0 to 65535	CHSSVOL
31118	MP	1/100 MPa	UINT16: 0 to 65535	MP
31119	MT	1/100 Kelvin	UINT16: 0 to 65535	MT
31120	FC	1 = DYNA, 2 = STAT, 3 = HALT, 4 = ABORT	UINT16: 0 to 65535	FC
31121	Flag Variable Cold Dispenser	0 = No Cold Dispenser, 1 = Cold Dispenser	UINT16: 0 to 65535	FVCD
31122	Pressure Limit High	1/100 MPa	UINT16: 0 to 65535	PLIMITH
31123	Pressure Limit Low	1/100 MPa	UINT16: 0 to 65535	PLIMITL
31124	Pressure Target Non Comm	1/100 MPa	UINT16: 0 to 65535	PTNONCOMM
31125	Pressure Target Comm	1/100 MPa	UINT16: 0 to 65535	PTCOMM
31126	Pressure Limit Comm	1/100 MPa	UINT16: 0 to 65535	PLCOMM

Register Number	Description	Units/Value Explanation	Data Type/Range	PID Tag/MC Validator Tag
31127	Ramp Pressure	1/100 MPa	UINT16: 0 to 65535	PRAMP
31128	Mass Average Fuel Temperature 0 A	1/100 Kelvin	UINT16: 0 to 65535	MAT0A
31129	Mass Average Fuel Temperature 0 B	1/100 Kelvin	UINT16: 0 to 65535	MAT0B
31130	Mass Average Fuel Temperature 30 A	1/100 Kelvin	UINT16: 0 to 65535	MAT30A
31131	Mass Average Fuel Temperature 30 B	1/100 Kelvin	UINT16: 0 to 65535	MAT30B
31132	Mass Average Fuel Temperature Used	1/100 Kelvin	UINT16: 0 to 65535	MATC
31133	H A	1/100 kJ/kg	UINT16: 0 to 65535	HA
31134	H B	1/100 kJ/kg	UINT16: 0 to 65535	HB
31135	H Ave A	1/100 kJ/kg	UINT16: 0 to 65535	HAVEA
31136	H Ave B	1/100 kJ/kg	UINT16: 0 to 65535	HAVEB
31137	T Final	Seconds	UINT16: 0 to 65535	TFINAL
31138	Next Leak Check Target	1/100 MPa	UINT16: 0 to 65535	
31139	Nozzle Pressure Class	1 = H35, 2 = H70	UINT16: 0 to 65535	PRESSCLASS
31140	Flag Variable Top Off Used	0 = No Top Off, 1 = Top Off	UINT16: 0 to 65535	FVTOPOFF
31141	Pressure Ramp Rate	1/100 Mpa/second	UINT16: 0 to 65535	
31142	SOC Target	%	UINT16: 0 to 65535	
Registers 31201 to 31299: Fueling Postion 2 Last Fueling Event Information				
31201	Total Fueling Time	Seconds	UINT16: 0 to 65535	
31202	Final Amount MSB	Configured currency and decimal position	UINT16: 0 to 65535	
31203	Final Amount LSB	Configured currency and decimal position	UINT16: 0 to 65535	
31204	Final Mass Dispensed MSB	Grams	UINT16: 0 to 65535	
31205	Final Mass Dispensed LSB	Grams	UINT16: 0 to 65535	
31206	Final Pressure	1/100 Mpa	UINT16: 0 to 65535	
31207	Final SOC	%	UINT16: 0 to 65535	
31208	Comms Used or Failed (like state register)	0 = No Comms, 1 = Comms Used, 2 = Comms used but failed	UINT16: 0 to 65535	

Electrical Requirements

Following are the electrical requirements for installing the unit:

- Sites must be prepared according to NFPA 2, NFPA 30A, NFPA 70, and applicable national, state, and local codes/regulations.
- All circuit breaker panels and relay boxes must be mounted securely to the wall.
- Only Nationally Recognized Testing Laboratory (NRTL) recognized/approved components and/or systems may be used.
- 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

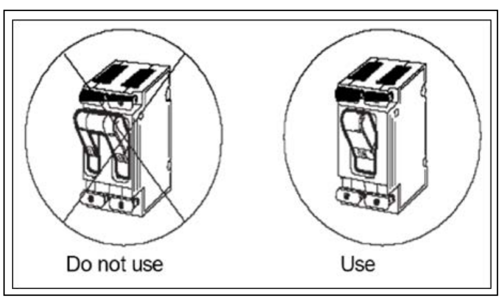
Following are the emergency power cutoff switch requirements for the unit:

- NFPA regulations and ANGI design guidelines require the installation of two or more emergency power cutoff switches.
- 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 9)].
- 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 9: Switched Neutral Circuit Breaker



- 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.
- Only UL/CUL/CSA listed circuit breaker panels are permitted for use.
- 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 Hydrogen dispenser.

Conduit

ANGI recommends that spare conduits be run for future high-speed communications. For details, refer to "Twisted Pair in Low Voltage Class 2 Conduit" on page 35.

- 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 manufacturer's 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" on page 35.

- All dispensers must be wired according to NFPA 30A, NFPA 70, and applicable national, state, and local codes/regulations.
- All circuits must be Class 1 E.C wired except the speaker (intercom) circuit, which must be Class 2 N.E.C. All Class 2 wiring must be in separate conduit from Class 1. The speaker (intercom) circuit requires a separate 1-inch conduit along with the ANGI monitor COMM and pulser wiring.
- 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.

Twisted-Pair Wiring - Data Wire Lengths

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

For this D-Box	The Distance Between the D-Box and Dispenser	The Distance Between the D-Box 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.

Do not use daisy chain communications wiring for Class 1 wiring (the high voltage conduit is considered Class 1).

Insulation Specifications

Polyvinyl chloride (PVC) insulation of type Thermoplastic Flexible Fixture Wire Nylon Jacketed (TFFN) or Machine Tool Wire (MTW), UL-approved 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

ANGI recommends the use of a 1-inch rigid conduit and fittings (refer to “Conduit” on page 34) 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

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	UL-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 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 40.

Ethernet or CAT-5 Cable Installation

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

Safety Information

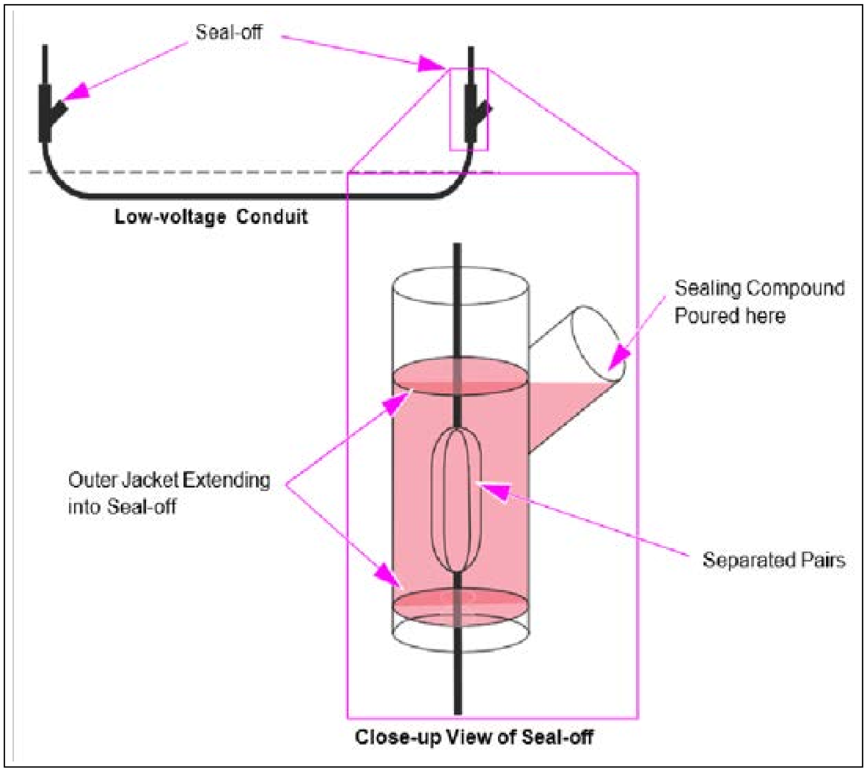
Hydrogen gas may migrate inside the cable insulation between conductors and sheathing of various cables, including 10 Base-T or CAT-5E cable. Hydrogen gas may ignite, leading to serious injury or death.

It is crucial that the installer follow NECs, article 501 requirements by removing the outer jacket and spreading the wire pairs at the seal-off points of the CAT-5E cable, so that a good vapor seal is achieved. This is required because all CAT-5E cables will conduct vapors inside their outer jacket.

Use gas-oil resistant CAT-5 or CAT-5E. For example, Belden® 7928a.

Conduit seal-offs required as per NEC, section 514.9. As the outer jacket defeats the seal-off, the jacket must be removed, and the conductor pairs separated to allow a good seal (see Figure 10 on page 38).
For non-US installations, consult local regulations.

Figure 10: 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

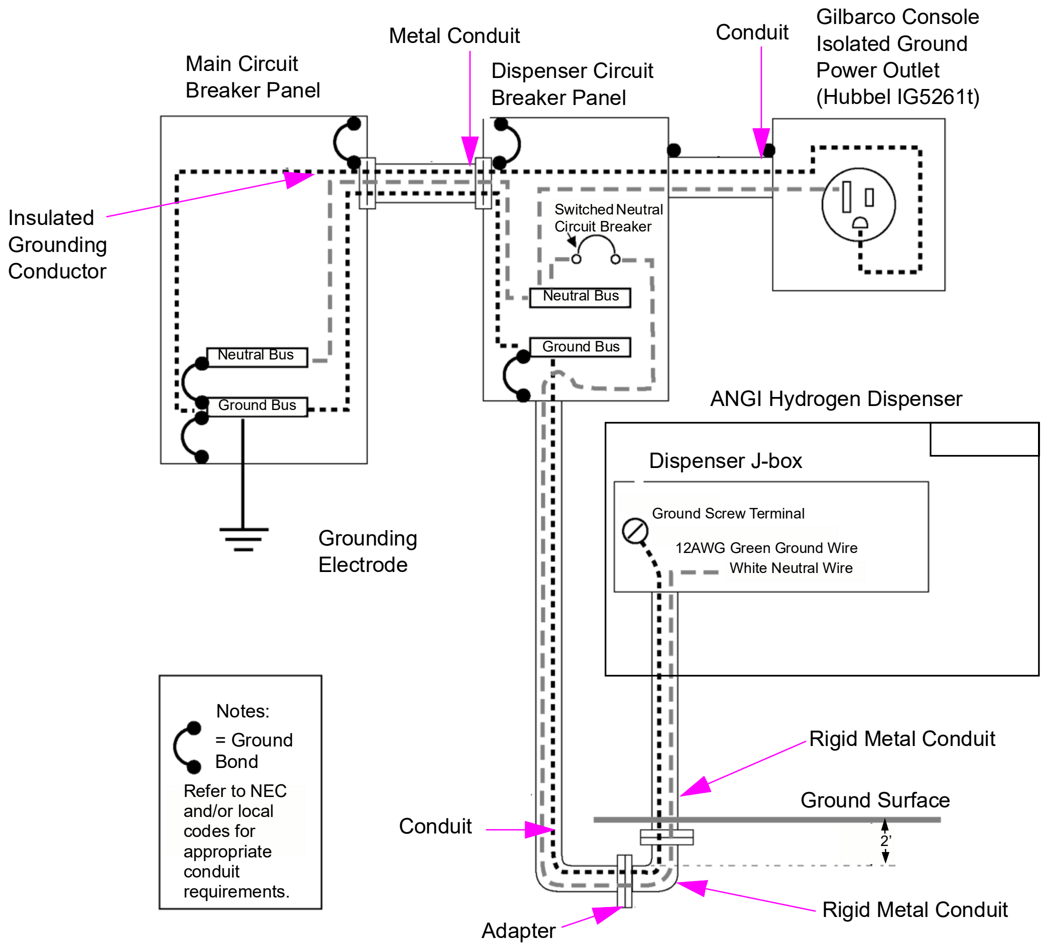
Following are the grounding requirements for the unit.
NFPA 70 requires connecting the following to the system ground.

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

ANGI requires connecting each dispenser to an equipment grounding conductor (see Figure 11 on page 39) located in the conduit per NFPA 70, Article 250. 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.
- Grounding the providing power under NFPA 70, Article 250.
- Bonding the neutral bus to an approved grounding electrode.

Figure 11: Grounding Plan



Grounding Plan (Typical)

Connectivity

Figure 12, Figure 13, Figure 14 on page 41, and Figure 15 on page 41 displays the various site configurations to provide dispenser authorization from a POS system. The dispenser can be operated in standalone mode without any authorization, but if a site chooses to require dispenser authorization from an external controller, one (and only one) of the following options could be implemented.

Figure 12: Passport POS Over Ethernet to Omnia

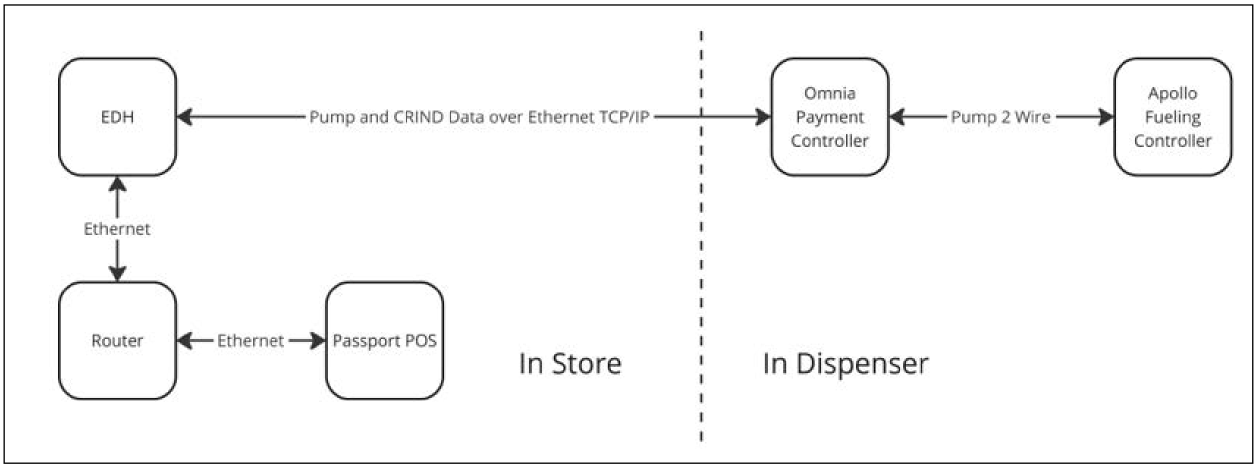


Figure 13: Third-Party POS Requiring Current Loop Pass-Through to DCM3/Omnia

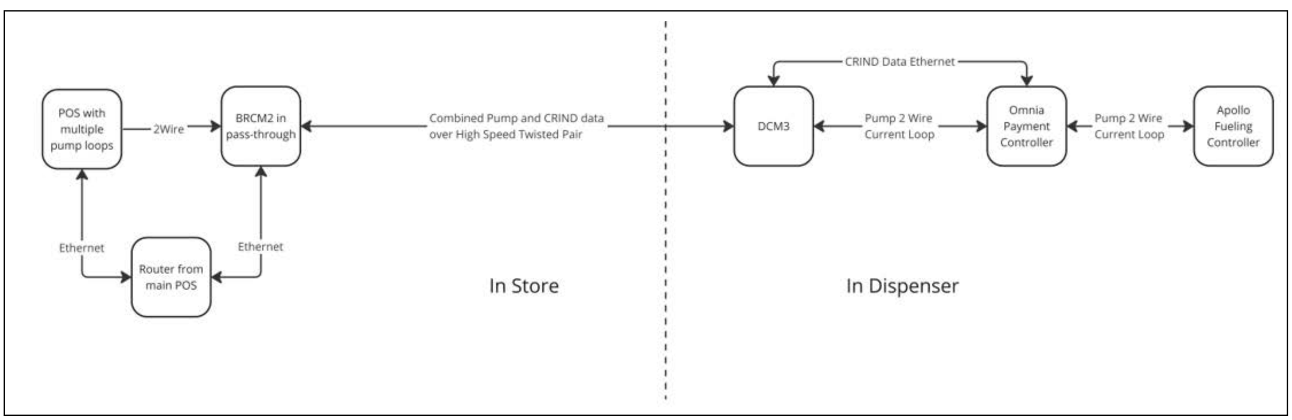


Figure 14: Third-Party POS Requiring Current Loop Non-Pass-Through to DCM3/Omnia

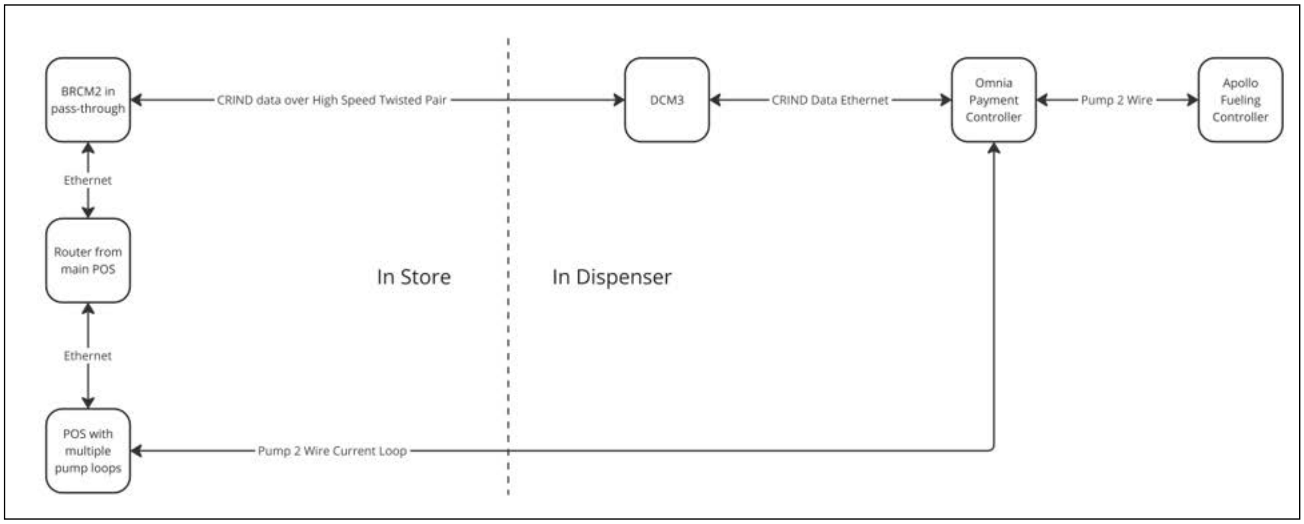
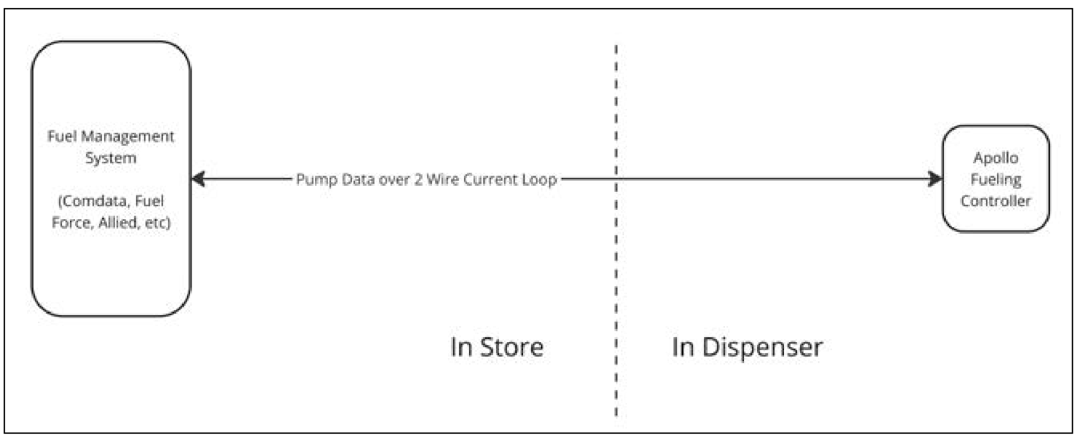


Figure 15: Third-Party Fuel Management System, No Dispenser CRIND



Operating Instructions

To operate the Hydrogen dispenser, proceed as follows:

1. Ensure that no ignition source is present (switch off engines and no smoking).
2. Locate the emergency shutdown button (located on the dispenser).
3. Start processes for payment, credit card, pro-key, etc.
4. After the payment is accepted, remove the nozzle from the dispenser holster and connect the nozzle to an approved tank connection. Depending on nozzle type, squeeze trigger and latch, or turn nozzle to on/fill position.
5. After the nozzle is connected to the receptacle, press the start button.
6. To end the transaction, press the stop button or wait for automatic end of transaction.
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.

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

Gas and Impact Detector (GID)

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 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 a vehicle collision with the dispenser.

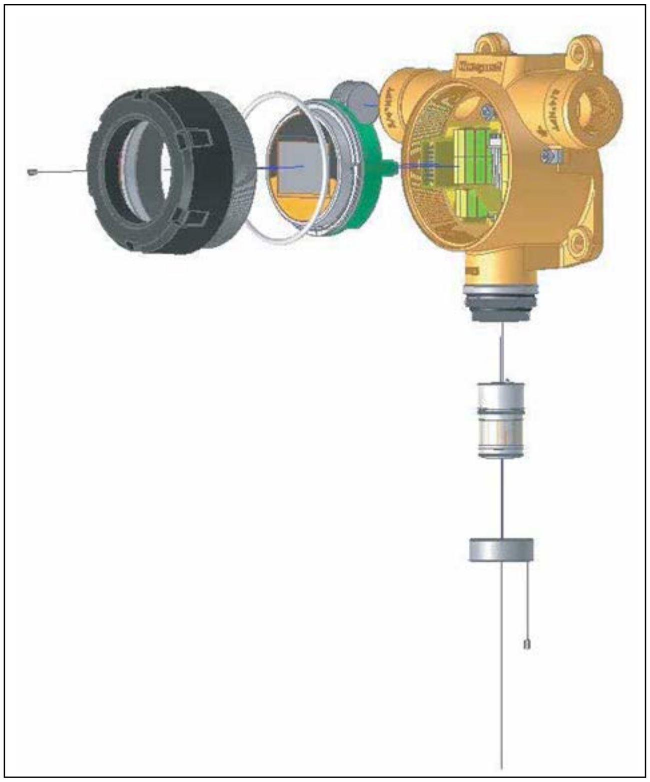
There are two methods to capture alarm signals. The dispenser is OK to dispense if the gas and impact detector are not activated or optional alarm signals of 110 VAV output are activated, specific to either the gas, or impact sensor when tripped. Both signals could be used to power relays in the HRS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

For connection details, refer to “Installing Conduit and Wiring in Dispenser Unit” on page 7.

GID Detector

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 16: 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 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 (H_2), Hydrogen Cyanide (HCN) or Hydrogen Sulphide (H_2S), Ethylene (CH_2), 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 as given below:

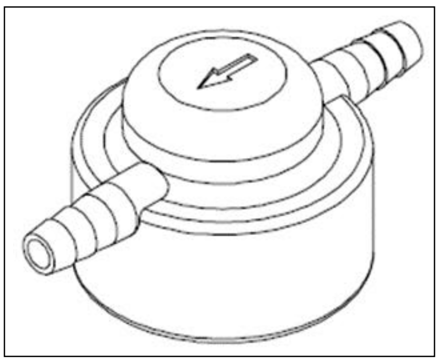
1 The display shows the current calibration span gas concentration while flashing the gas canister icon. Use ‘▲ ▼’to change the calibration span gas concentration, and ✅ when required span calibration level is set.

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 17: 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).

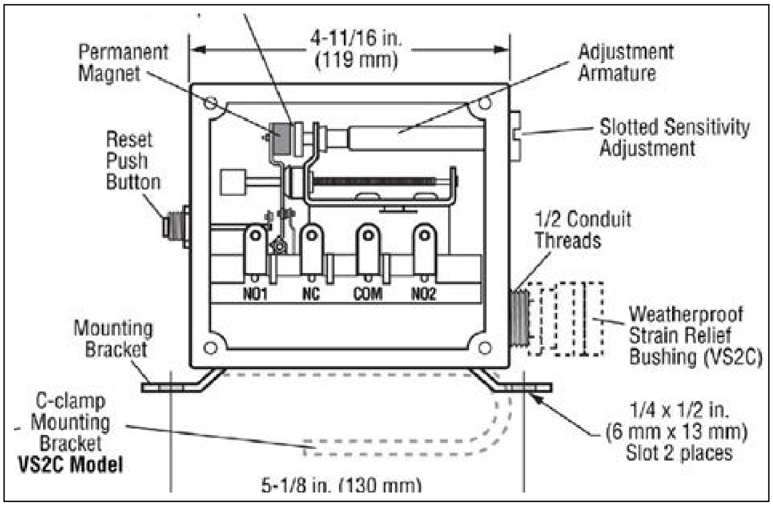
11 When the countdown is finished, the calibration procedure is complete.

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 18: 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 come on. If the electronics fail to power on, go to "Adjustment" on page 47.

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 no, then go to "Adjustment" on page 47.

   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 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.

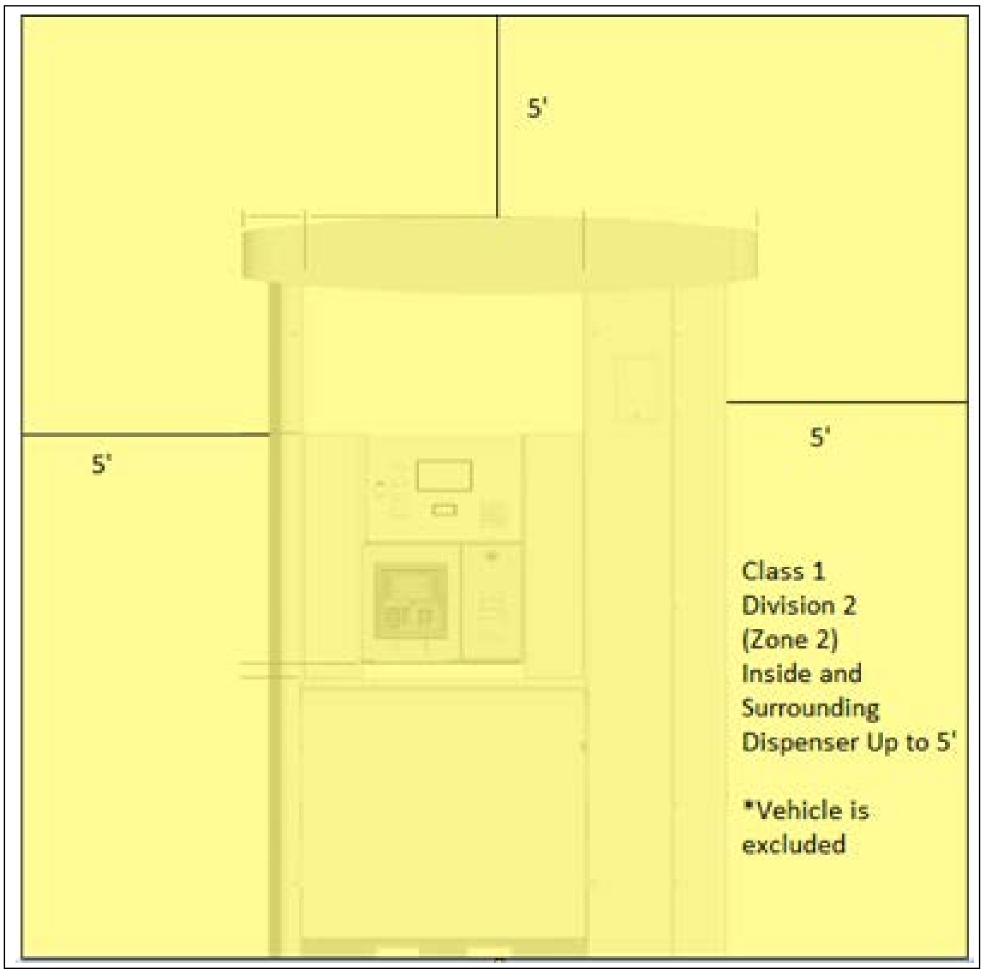
Hazardous Locations

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 specified in Figure 19.

Figure 19 is based on NFPA 2, NFPA 30A, NFPA 70, and CSA HGV4.1.

Figure 19: Hazardous Locations Diagram (Typical)



Preliminary Installation Information

Required Equipment and Materials

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
- Pit box cover plates. Use when required to adapt the unit to pre-existing pit boxes
- Lifting device (crane, backhoe, forklift, etc.) to move and lift the dispenser
- Nylon slings (with a safety lift factor of 5) and screw-pin anchor shackles to lift high-hose pump/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
- Any kits required for upgrading the unit to the customer's requirements
- Gas sniffer, leak test solution, and snoop spray

Read NFPA 2, NFPA 30A, and NFPA 70 (Latest Version)

WARNING

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

Failure to install this equipment in accordance with NFPA 30A, NFPA 2, and NFPA 70 could result in severe injury or death. Read, understand, and follow NFPA 30A, NFPA 2, and NFPA 70.

Before installing the equipment, the installer must read, understand, and follow:
- The NEC (NFPA 70)
- The Automotive and Marine Service Code (NFPA 30A)
- Hydrogen Technologies Code (NFPA 2)
- Any national, state, and local codes that may apply.

Failure to install the equipment in accordance with NFPA 30A, NFPA 70, and NFPA 2 with regard to Hydrogen may adversely affect the safe use and operation of the system.

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 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 Hydrogen Dispenser Installation Checklist
- ANGI Hydrogen Dispenser Start-up Checklist
- ANGI Hydrogen Dispenser Final Inspection/Training Checklist
- ANGI Hydrogen Dispenser Accuracy Test Form

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

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 Hydrogen 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 lower panels (doors) of the dispenser.

Gaining Access to and from ANGI Hydrogen Dispenser Cabinet

ANGI Hydrogen 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. 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 Hydrogen 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.

Ensure that there are protective bollards around the dispenser to avoid the possibility of physical damage from a vehicle as stated in NFPA 2.

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 Hydrogen Dispenser cabinet to the potentially longer pit box opening for The Advantage Series wide frame or other units. Seal as required.

Lifting ANGI Hydrogen Dispenser Units

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

Use lifting equipment or 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 Hydrogen Dispenser unit on the plate. If the ANGI 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 51.

To lift ANGI Hydrogen Dispenser units, proceed as follows:

Note: ANGI Hydrogen Dispenser series units have hoisting brackets mounted on top of the upper housing. These instructions are only applicable to dispensers that do not have a heat exchanger installed. Refer to project General Arrangement Drawing and PID.

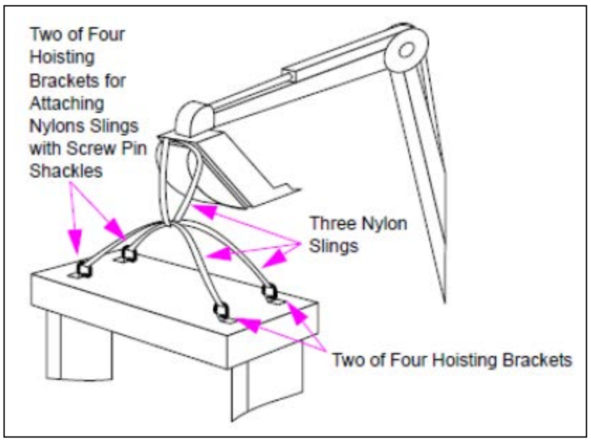
1 Verify if the hoisting brackets are tight. Use the bolts provided with the brackets or grade 8 bolts.

2 Use three nylon slings (safety lift factor of 5) and four screw pin shackles along with hoisting brackets to lift the unit onto the island (see Figure 20).

CAUTION

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

Figure 20: Lifting with Hoisting Brackets



3 Lift and position the unit to the work area for modification or onto the island.

Note: If a side column conduit is used, take special care to avoid damage to the conduit when lowering the dispenser to the island.

4 Remove the slings and shackles.

For ANGI Hydrogen Dispensers with heat exchangers, proceed as follows:

Note: Dispensers with heat exchangers are not rated to be lifted from the canopy of the dispenser. Using integrated fork pockets per instructions below is a requirement.

1 Remove lower access doors.

2 Utilize integrated fork lift pockets and fork lift to lift and move dispenser into mounting location.

3 Once positioned, remove fork lift and complete installation of dispenser.

Refer to project General Arrangement Drawing for installation dimensions for anchor bolts, piping, and electrical connections.

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