



TECHNICAL MANUAL FOR HALE SAM



BY

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Abbreviations And Acronyms

The abbreviations used in this manual (and Appendices) are limited to standard (commonly used and accepted) scientific units of measure and therefore are NOT defined or listed. The acronyms used in this manual (and Appendices) are defined in this listing (in numerical-alphabetical order) and are NOT defined within the text. The names of Hale Products Inc. specific devices are defined in the associated product literature.

AFS	Automated Flow System
AHJ	Authority Having Jurisdiction
AKA	Also Known As
AWG	American Wire Gauge
BAM	Broadcast Announce Message
CAFS	Compressed Air Foam System
CAN	Controller Area Network
DECR	Decrease
DG	Deck Gun
ECU	Engine Control Unit
EMI	Electromagnetic Interference
FAST	Factory Authorized Service Team
FNPT	Female National Pipe Thread
GPM	Gallons Per Minute
GUI	Graphical User Interface
ID	Identification
INCR	Increase
LDH	Large Diameter Hose
MFG	Manufacture
MIV-A	Main Intake Valve – Automatic
N	Negative
N/C	No Connection
NFPA	National Fire Protection Association
NLGI	National Lubrication Grease Institute
NPT	National Pipe Thread
OEM	Original Equipment Manufacturer
OD	Octal Digital (Words – Used for dump files)
P	Positive
P/N	Part Number

Abbreviations And Acronyms – CONTINUED

SAE	Society of Automotive Engineers
SAM	Scene Apparatus Management
SGX	Starter or Ground Cross-Linked Polyethylene
UID	Unit ID

1. SAFETY

This section provides definitions and a listing of the safety headings used in the SAM Operation Installation Maintenance (FSG-MNL-00210), Technical (FSG-MNL-00211), and the Parts (FSG-MNL-00212), manuals.

For added protection and before attempting installation, repair, or operation, please follow the safety guidelines listed in this section and adhere to all cautions, dangers, notices, and warnings found in the manuals.

All operators and maintainers must read the safety section carefully, understand and adhere to it strictly before attempting to install or operate the SAM system.

DANGERS, WARNINGS, CAUTIONS, or NOTICES that immediately precede a step apply directly to that step and all sub steps. DANGERS, WARNINGS, CAUTIONS, or NOTICES that precede an entire procedure apply to the entire procedure. DANGERS, WARNINGS, CAUTIONS, and NOTICES consist of two parts: a heading (that identifies possible result if disregarded) and a statement of the hazard (that provides the minimum precautions). The headings used and their definitions are.

ATTENTION ⚠ DANGER

INDICATES A HAZARDOUS SITUATION, WHICH IF NOT AVOIDED WILL RESULT IN SERIOUS INJURY OR DEATH.

ATTENTION ⚠ WARNING

INDICATES A HAZARDOUS SITUATION, WHICH IF NOT AVOIDED COULD RESULT IN SERIOUS INJURY OR DEATH.

ATTENTION ⚠ CAUTION

INDICATES A POTENTIALLY HAZARDOUS SITUATION, WHICH IF NOT AVOIDED MAY RESULT IN MINOR OR MODERATE INJURY.

IMPORTANT ⚠ NOTICE

ADDRESSES PRACTICES NOT RELATED TO PERSONAL INJURY.

NOTE

Highlights an essential aspect of an operating or maintenance procedure, condition, or statement and/or provides pertinent ancillary information.

NOTES may precede or follow the step or procedure, depending upon the information and how it pertains to the procedure/step.

1.1. PPE

ATTENTION ⚠ WARNING

NOT ALL GLOVES ALLOW THE SAM TOUCHSCREENS TO FUNCTION. TEST GLOVES ON ALL OF THE SAM TOUCHSCREENS PRIOR TO OPERATING SAM. DO NOT WEAR GLOVES THAT PREVENT THE TOUCHSCREENS FROM OPERATING.

The following is the minimum PPE required when performing maintenance.

• Safety Glasses	• Ear Protection
• Work Shoes (Steel Toe)	• Single Use



PPE required when performing maintenance – CONTINUED.

- Safety Gloves
 - General Protection
 - Chemical Resistant
- Ear Muffs

1.2. Environmental Protection

Used foam from the SAM system must be properly disposed of in accordance with your local regulations. Dispose of foam through authorized waste disposal contractors, licensed waste disposal sites, or to the waste reclamation trade. If in doubt, contact your Local Environmental Agency for advice regarding disposal policies.

1.3. Training

The Hale SAM must ONLY be operated and maintained by trained personnel. Training is available via the Hale Products Inc. website (<https://haleproducts.com>), Godiva Verified Training (godiva.co.uk), or through your local dealer or vehicle manufacturer. The Hale website provides a description of the course content and general information about the training, including an invitation to register with the EVT Certification Commission (www.evtcc.org) to take one EVT exam at the Hale facility.

NOTE

Be sure to record the contact phone number and contact person's information before completing the form.

Complete the SESSIONS, ORGANIZATION CONTACT INFORMATION, STUDENT CONTACT INFORMATION portions of the form. Check the Captcha (provides the proof of human input) and then click the SUBMIT button at the bottom of the page.

NOTES

Under the FAST buttons select No unless your facility is a FAST center. Do NOT click Yes unless you know for sure you are a FAST member requiring certification or recertification (a certification is valid for 4 years).

Initial SAM training is required if your facility is to include SAM systems and to receive a SAM USB Key from Hale.

When the Thank you for Registering page appears record the halemarketing email address (Add this address to your email address book to prevent your response from being routed to the Junk folder.) and call the contact phone number (recorded earlier) to arrange payment.

NOTE

Due to demand, classes fill far in advance of the scheduled dates. The ONLY way to hold the selected dates is to pay at the time of enrollment submission.

1.4. Safety Summary

The following WARNINGS, CAUTIONS, and NOTICES are used throughout the SAM manuals (and/or the items they reference) and are provided here as a safety summary.

ATTENTION ⚠ DANGER

ALL ELECTRICAL SYSTEMS HAVE THE POTENTIAL TO CAUSE SPARKS DURING SERVICE. TAKE CARE TO ELIMINATE EXPLOSIVE OR HAZARDOUS ENVIRONMENTS DURING SERVICE AND/OR REPAIR.

ATTENTION ⚠ DANGER

CHECK THE BILL OF LADING FOR THE WEIGHT BEFORE LIFTING. ONLY USE APPROPRIATE LIFT METHODS AND EQUIPMENT TO MOVE OR HANDLE SAM PUMP KIT OR MODULE. (TYPICAL PUMP KIT WEIGHT IS APPROXIMATELY 1200 LBS. (545 KG) TYPICAL MODULE WEIGHT IS 2800 LBS. (1270 KG)

ATTENTION ⚠ DANGER

ELECTRICAL POWER TO THE VALVE MOTOR SHOULD BE DISCONNECTED BEFORE OPERATING THE VALVE PHYSICALLY USING THE MANUAL OVERRIDE HANDWHEEL.

ATTENTION ⚠ DANGER

OPERATORS SHOULD FIRST BE TRAINED TO OPERATE THE FIRE PUMP MANUALLY (USING PUSH BUTTONS, CONTROL RODS, AND MANUAL [NOT ELECTRICAL] VALVE OVERRIDES.)

- AUTOMATION ONLY MITIGATES PROBLEMS AROUND THE PUMP AND VALVES
 - OPERATORS NEED TO UNDERSTAND HOW TO DIAGNOSE PROBLEMS
 - SAM MANAGES PROBLEMS BY HELPING TO KEEP THE PUMP SAFE BUT IF AN INADEQUATE WATER SUPPLY OR PUMP CAVITATION OCCURS THE OPERATOR MUST UNDERSTAND WHAT IS HAPPENING AND CORRECT THE PROBLEM
- SAM DOES NOT ADJUST FOR FRICTION LOSS ON HOSE LINES OR PUMPING AT ELEVATION
 - SAM MAINTAINS PRESSURE SETTINGS BASED ON SENSORS MEASURING PRESSURE NEAR THE DISCHARGE VALVE
 - THE SYSTEM CAN NOT ALLEVIATE STATIC PRESSURES
 - RESIDUAL PRESSURE IN THE SYSTEM MAY BUILD IN THE DISCHARGE LINES WHEN THAT PARTICULAR LINE IS NOT FLOWING WATER OR NOT FLOWING ENOUGH WATER TO BE GATED
 - THE OPERATOR MUST BE AWARE THAT THIS PRESSURE MAY PRESENT A DANGER TO LARGER DISCHARGES. (THEREFORE, SETTING A SMALLER DISCHARGE LINE AT A PRESSURE HIGHER THAN YOU WOULD EXPOSE A LARGER HOSE [OR LARGER DISCHARGE] TO IS NOT RECOMMENDED)

ATTENTION ⚠ WARNING

A PRESSURE HAZARD MAY EXIST EVEN WHEN THE PUMP IS NOT RUNNING. PRIOR TO REMOVING HOSES OR CAPS FROM PUMP CONNECTIONS, RELIEVE PRESSURE BY OPENING DRAINS. BLEEDER VALVES SHOULD ALSO BE USED WHEN CONNECTING TO AN INTAKE FROM A PRESSURIZED SOURCE.

ATTENTION ⚠ WARNING

ALWAYS FOLLOW LOCAL GUIDELINES FROM THE AHJ AND THE APPARATUS MANUFACTURER.

ATTENTION ⚠ WARNING

ALWAYS FOLLOW PROPER OPERATING PROCEDURES. THE PUMP OPERATOR MUST BE FAMILIAR WITH THE PUMP AND SAM OPERATING INSTRUCTIONS AS WELL AS OTHER OPERATING GUIDELINES FOR THE APPARATUS AND ACCESSORIES.

ATTENTION ⚠ WARNING

ALWAYS STOP THE ENGINE, SET THE PARKING BRAKE, AND CHOCK THE WHEELS BEFORE GOING UNDER THE TRUCK FOR ANY REASON.

ATTENTION ⚠ WARNING

AVOID CONTACT WITH HOT SURFACES. THE PACKING GLAND AND PUMP BODY MAY PRESENT A TEMPERATURE HAZARD. OVERHEATING MAY RESULT IN A SCALDING WATER HAZARD.

ATTENTION ⚠ WARNING

DISENGAGE PUMP BEFORE PERFORMING CALIBRATION, OTHERWISE UNEXPECTED/UNDESIRABLE AUTOMATED OPERATIONS MAY OCCUR DURING CALIBRATION.

ATTENTION ⚠ WARNING

DO NOT EXCEED OPERATING PRESSURE LIMITS OF PUMP, INSTALLED PLUMBING, HOSE(S), OR EQUIPMENT IN USE.

HOSE FAILURE CAN RESULT IF A HOSE IS EXPOSED TO EXCESSIVE PRESSURE.

ATTENTION ⚠ WARNING

NOT ALL GLOVES ALLOW THE SAM TOUCHSCREENS TO FUNCTION. TEST GLOVES ON ALL OF THE SAM TOUCHSCREENS PRIOR TO OPERATING SAM. DO NOT WEAR GLOVES THAT PREVENT THE TOUCHSCREENS FROM OPERATING.

ATTENTION ⚠ WARNING

OPERATORS, INSTALLERS, AND MAINTENANCE PERSONNEL MUST BE TRAINED AND QUALIFIED FOR ALL THE ACTIVITIES THEY PERFORM.

ATTENTION ⚠ WARNING

SAM TOUCHSCREENS DO NOT FUNCTION IF COMPLETELY COVERED AND/OR IMMERSED IN WATER. DO NOT ALLOW THE TOUCHSCREENS TO BE COMPLETELY COVERED/IMMERSED WITH WATER (OR ANY LIQUID). DRY THE SCREEN TO RESTORE FUNCTIONALITY.

ATTENTION ⚠ WARNING

THE PROCEDURES IN THIS SECTION PROVIDE ONLY GENERAL AND MINIMAL INSTRUCTION. DO NOT REPLACE LOCAL PROCEDURES OR POLICIES OR RECOMMENDATIONS AND PROCEDURES PROVIDED IN THE APPARATUS/TRUCK/UNIT MANUAL WITH THESE PROCEDURES.

THE PROCEDURES IN THIS SECTION ARE GENERAL OPERATING PROCEDURES BASED ONLY ON HALE EQUIPMENT. NOT ALL PROCEDURES IN THIS SECTION MAY APPLY TO YOUR SPECIFIC OPERATIONAL REQUIREMENTS OR APPARATUS CONFIGURATION. REFER TO ONLY THE INFORMATION/PROCEDURES WHICH APPLY TO YOUR OPERATIONAL REQUIREMENTS AND ONLY WHEN LOCAL PROCEDURES, POLICIES, OR GUIDELINES ESTABLISHED BY THE AHJ DO NOT EXIST.

ALWAYS REFER TO THE PROCEDURES PROVIDED BY THE AHJ FOR SETTING WHEEL CHOCKS AS WELL AS LAYOUT AND CONNECTION OF HOSES, VALVES AND DRAINS.

ATTENTION ⚠ WARNING

THE TABLET COMMUNICATES THROUGH THE SAM CONTROL CENTER LOCATED IN THE OPERATORS PANEL, IF THAT SCREEN FAILS, THE TABLET WILL NOT CONTROL THE APPARATUS.

ATTENTION ⚠ CAUTION

REMOVE SYSTEM PRESSURE BEFORE PERFORMING CALIBRATION. OPEN ALL DRAINS AND AIR BLEED VALVES TO ENSURE THE SYSTEM IS NOT PRESSURIZED AND THE VALVE(S) CAN BE OPENED AND CLOSED SAFELY BEFORE PROCEEDING WITH VALVE CALIBRATION.

ATTENTION ⚠ CAUTION

SHIPPING CONTAINERS WEIGHS VARY WIDELY FOR SAM COMPONENTS. ALWAYS CHECK THE SHIPPING INFORMATION FOR EACH CONTAINERS WEIGHT AND USE THE APPROPRIATE LIFTING METHOD AND/OR WEIGHT RATED EQUIPMENT.

ATTENTION ⚠ CAUTION

THE 4-WAY AIR VALVES ARE CONNECTED TO THE APPARATUS COMPRESSED AIR SUPPLY. DO NOT REMOVE A 4-WAY AIR VALVE, PF VALVE AIR CYLINDER, FITTINGS, OR AIR TUBES WHEN THE SYSTEM IS PRESSURIZED.

ATTENTION ⚠ CAUTION

THE SAM DRAIN VALVE BLOCK IS CONNECTED TO THE APPARATUS COMPRESSED AIR SUPPLY VIA A 4-WAY AIR VALVE. DO NOT REMOVE A 4-WAY AIR VALVE, PF VALVE AIR CYLINDER, FITTINGS, OR AIR TUBES WHEN THE SYSTEM IS PRESSURIZED.

ATTENTION ⚠ CAUTION

VALVES OPERATE AUTOMATICALLY. REMOVE POWER BEFORE OVERRIDE

IMPORTANT ⚠ NOTICE

ACTIVATING FOAM OFF FROM THE SAM CONTROL CENTER TURNS OFF THE SMART-FOAM SYSTEM, TURNING OFF FOAM TO ALL FOAM CAPABLE DISCHARGES, HOWEVER, THE DISCHARGE(S) ARE NOT CLOSED AND CONTINUE TO FLOW WATER ONLY.

IMPORTANT ⚠ NOTICE

AHJ MUST INSURE PROPER TRAINING IS IN PLACE FOR ALL OPERATORS. THIS QUICK START GUIDE DOES NOT REPLACE OR SUPERSEDE THE OPERATION INSTALLATION MAINTENANCE MANUAL OR PROPER TRAINING.

IMPORTANT ⚠ NOTICE

AKRON BRASS SWING-OUT™ VALVES FROM A DISCHARGE PORT WILL NOT FUNCTION IN THE PLACE OF ANY SPECIAL PURPOSE VALVE (TF, T2P, PONY) IN A HALE SAM SYSTEM. DO NOT USE ONE FOR SUBSTITUTION OR REPLACEMENT PURPOSES.

IMPORTANT ⚠ NOTICE

ALL SAM TOUCHSCREENS ARE WATER RESISTANT.

IMPORTANT ⚠ NOTICE

ALL SAM TOUCHSCREENS FUNCTION BETTER IF TOUCHED USING THE PAD PORTION OF THE FINGER WHILE WEARING GLOVES. THE TOUCHSCREENS OFTEN DO NOT FUNCTION WHEN TOUCHED USING THE SEAM PORTION OF A GLOVE.

IMPORTANT ⚠ NOTICE

ALTHOUGH SMARTFOAM AND SMARTCAFS BOTH UTILIZE THE FOAM LABEL, A FOAM LABELED DISCHARGE BUTTON DOES NOT OPERATE THE SAME WAY ON SAM FOR BOTH SYSTEMS.

IMPORTANT ▲ NOTICE

ALWAYS DISCONNECT THE POWER CABLE, GROUND STRAPS, ELECTRICAL WIRES AND CABLES FROM THE CONTROL UNIT OR OTHER HALE SAM EQUIPMENT BEFORE ELECTRIC ARC WELDING AT ANY POINT ON THE APPARATUS.

IMPORTANT ▲ NOTICE

ALWAYS TURN OFF CAFS FROM THE SMARTCAFS CONTROL DISPLAY.

IMPORTANT ▲ NOTICE

AN ACCURATE FLOW MEASURING DEVICE MUST BE USED TO MEASURE THE WATER FLOW WHEN CALIBRATING THE FLOW SENSOR. USE A SUITABLE SIZE, SMOOTH BORE NOZZLE AND AN ACCURATE AND CALIBRATED PITOT GAUGE INSTRUMENT OR MASTER FLOW METER. HAND HELD PITOT GAUGES ARE USUALLY NOT VERY ACCURATE. MAKE SURE THE SYSTEM IS CALIBRATED WITH AN ACCURATE FLOW MEASURING DEVICE.

IMPORTANT ▲ NOTICE

AN OFF-THE-SHELF AKRON BRASS SWING-OUT™ VALVE WILL NOT FUNCTION IN A HALE SAM SYSTEM. DO NOT USE ONE FOR SUBSTITUTION OR REPLACEMENT PURPOSES.

IMPORTANT ▲ NOTICE

DISCONNECT ELECTRICAL POWER TO THE VALVE MOTOR WHEN USING THE OVERRIDE TO OPERATE THE VALVE DIRECTLY.

IMPORTANT ▲ NOTICE

DO NOT ALTER THE CAN NETWORK COMMUNICATIONS (SAE J1939 CAN BUS) OR CONNECT OTHER DEVICES TO ANY OF THE CAFS, CAPTIUM, FOAM, OR SAM CAN BUS BACKBONE(S).

IMPORTANT ▲ NOTICE

DO NOT HARD SHUTDOWN THE TABLET (POWER OFF BY HOLDING THE POWER BUTTON FOR LONGER THAN 5 SECONDS). A HARD SHUTDOWN MAY CORRUPT THE OPERATING SYSTEM, MAKING THE TABLET UNUSABLE.

IMPORTANT ▲ NOTICE

DO NOT RUN THE PRIMER FOR MORE THAN 45 SECONDS. IF PRIME IS NOT ACHIEVED IN 30 - 45 SECONDS, STOP AND LOOK FOR AIR LEAKS OR BLOCKED SUCTION HOSE.

IMPORTANT ▲ NOTICE

DO NOT USE A DRIVER AND SOCKET TO INITIALLY MOVE A CLOCKED VALVE.

IMPORTANT ▲ NOTICE

EXCESSIVE PRESSURE LOSS MAY OCCUR IF THE DRIP RATE IS GREATER THAN AN INDIVIDUAL DRIP (A STEADY STREAM OF WATER) OR DRIP RATE EXCEEDS ONE DRIP EVERY 0.6 SECOND. THIS CONDITION DEGRADES PUMP PERFORMANCE.

IMPORTANT ▲ NOTICE

HALE MIDSHIP PUMPS ARE SHIPPED WITHOUT GEAR OIL. FILL THE GEARBOX WITH GEAR OIL SPECIFIED IN PARAGRAPH 7.4.2, RECOMMENDED GEARBOX LUBRICANTS, OF FSG-MNL-00199, OIM MANUAL FOR HALE MIDSHIP PUMPS, BEFORE OPERATING.

IMPORTANT ▲ NOTICE

IF THE DISCHARGE DOES NOT ACTIVATE VERIFY THE CAFS SYSTEM PRESETS (PRESET 1 FOR CAFS, PRESET 7 FOR FOAM ONLY ON THE SMARTCAFS DISPLAY) CONFIGURATION MATCHES THE SAM CONFIGURATION. (SAM WILL ONLY ACTIVATE MATCHING CONFIGURATIONS—WET, MED, OR DRY.) IF THE CONFIGURATIONS DO NOT MATCH, OPERATE SAM MANUALLY TO OPEN THE VALVE USING THE SAM CONTROL CENTER. THEN OPERATE THE CAFS SYSTEM FROM THE SMARTCAFS DISPLAY.

IMPORTANT ▲ NOTICE

IF THE TABLET-TO-SAM WI-FI CONNECTION IS LOST, RETURN TO A SAM CONTROL CENTER ON THE APPARATUS TO RESUME CONTROL FROM A SAM CONTROL CENTER ON THE APPARATUS.

IMPORTANT ▲ NOTICE

KEEP ALL I/O PORT COVERS IN PLACE DURING USE TO PREVENT WATER DAMAGE.

IMPORTANT ▲ NOTICE

LIFT TABS ONLY ENOUGH TO RELEASE THE PCB. LIFTING THE TABS TOO FAR CAUSES THEM TO BREAK. IF A TAB BREAKS THE MODULE IS NOT PROTECTED FROM THE ELEMENTS AND MUST BE REPLACED.

LEAVING SAM IN CONFIGURATION MODE PREVENTS SAM FROM ENTERING AUTO OR MANUAL MODES. ALWAYS TOUCH THE SEND BAM + REBOOT TO GUI OR REBOOT TO GUI BUTTON BEFORE RETURNING THE APPARATUS TO SERVICE.

IMPORTANT ▲ NOTICE

ONLY TOUCH THE SCREEN IN ONE PLACE AT A TIME. THE TOUCHSCREENS DO NOT SUPPORT MULTI-TOUCH.

IMPORTANT ▲ NOTICE

OTHER ELECTRICAL COMPONENTS MUST NOT BE SUPPLIED FROM THE SAM SYSTEM SUPPLY. DO NOT CONNECT THE PRIMER AND HALE SAM TO THE SAME POWER WIRE.

IMPORTANT ▲ NOTICE

PERFORMING ANY PROCEDURE IN THIS SECTION CAUSES SAM TO EXIT BOTH AUTO AND MANUAL MODES AND ENTER CONFIGURATION MODE.

IMPORTANT ▲ NOTICE

PERFORMING THIS PROCEDURE CAUSES SAM TO EXIT AUTO MODE.

IMPORTANT ▲ NOTICE

PUMP SEAL/PUMP SHAFT DAMAGE MAY OCCUR IF DRIP RATE IS LESS THAN ONCE EVERY 6 SECONDS. THIS CONDITION DEGRADES PUMP PERFORMANCE.

IMPORTANT ▲ NOTICE

SOME WATER ONLY OPERATIONS MAY DAMAGE THE CAFS SYSTEM IF THE CLUTCH IS ENGAGED. REFERENCE CAFS QUICKSTART GUIDE, DISENGAGING THE COMPRESSOR CLUTCH (PAGE 10 OF FSG-MNL-00176) TO ENSURE PROPER CAFS TURN OFF WHEN SAM INCLUDES A CAFS SYSTEM.

IMPORTANT ▲ NOTICE

THE CONTROLLER UNIT DEUTSCH CONNECTORS ARE KEYED TO PREVENT INTERCHANGE OR REVERSE DIRECTION INSERTION. DO NOT FORCE A CONNECTOR WITHOUT FIRST VERIFYING THE CONNECTORS ORIENTATION AND PLACEMENT.

IMPORTANT ▲ NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED TO PREVENT INTERCHANGE (ON THAT MODULE) OR REVERSE DIRECTION INSERTION. DO NOT FORCE A CONNECTOR WITHOUT FIRST VERIFYING THE CONNECTORS ORIENTATION AND THE MATING MODULES LOCATION IS CORRECT.

IMPORTANT ▲ NOTICE

THE SAM CONTROL CENTER WILL NOT FUNCTION PROPERLY WITHOUT ONE OF THE DISPLAYS CONFIGURED AS THE MASTER.

IMPORTANT ▲ NOTICE

THE STYLE 9327 NAVIGATOR MINI VALVE CONTROLLER DOES NOT SUPPORT PRESSURE INDICATION. DO NOT USE A STYLE 9327 NAVIGATOR MINI VALVE CONTROLLER FOR DISCHARGE VALVE PURPOSES OR CALIBRATIONS.

IMPORTANT ▲ NOTICE

THE WI-FI ROUTER/ANTENNA IS A 24 VDC DEVICE, REQUIRED TO BE ONLY WIRED TO THE OUTPUT OF THE DC-TO-DC CONVERTER, WHICH SUPPLIES 72 W OF POWER OVER THE POE PAIRS OF THE CAT 6 ETHERNET CABLE PORTION OF THE SAM HARNESS.

IMPORTANT ▲ NOTICE

TO PREVENT PCB DAMAGE, DO NOT REMOVE THE COVER OR CHANGE THE CAN ADDRESS WITH THE MODULE POWERED ON.

IMPORTANT ▲ NOTICE

TOUCH ONLY THE SPECIFIED BUTTON(S). FAILURE TO PERFORM THIS PROCEDURE CORRECTLY MAY CAUSE SAM TO BECOME INOPERATIVE.

IMPORTANT ▲ NOTICE

VALVE INDEX NUMBERS MUST BE UNIQUE WITHIN THAT TYPE OF VALVE (FUNCTION). NO TWO INTAKES CAN HAVE THE SAME INDEX NUMBER AND NO TWO DISCHARGES CAN HAVE THE SAME INDEX NUMBER. HOWEVER, ONE INTAKE AND ONE DISCHARGE MAY HAVE THE SAME INDEX NUMBER.

IMPORTANT ▲ NOTICE

WHEN CLOSING AN INTAKE IN MANUAL MODE, ENSURE THE PUMP HAS AN ADEQUATE WATER SUPPLY TO PREVENT OVERHEATING.

IMPORTANT ▲ NOTICE

WHILE SAM CAN REDUCE PUMP OPERATOR WORKLOAD, IT DOES NOT TAKE THE PLACE OF THE PUMP OPERATOR. THE PUMP OPERATOR STILL NEEDS TO CALCULATE THE REQUIRED LINE PRESSURE TO SUPPORT THE HOSE LAY AND NOZZLE IN USE. SAM WILL MAINTAIN THE SET PRESSURE IN AUTO MODE.

2. INTRODUCTION

This section provides a 10,000-foot-view of the SAM system and a how to use this manual explanation; including SAM network and system diagrams, interface descriptions, and very top level principles of operations.

2.1. How To Use This Manual

This manual was developed for the purposes of FAST team and OEM support. This manual provides information and procedures to perform SAM maintenance (preventive and corrective). The manual also provides information to be used to troubleshoot and R&R failed components.

The Introduction section is of interest to management for SAM familiarization, system identification documentation, and risk assessment information (an EN 1028 only requirement).

The Safety section is of interest to both management and maintainers as it provides precautions for maintenance (including operation for maintenance purposes) and definitions of dangers, warnings, cautions, notices, and notes. This section also provides a summary of both PPE and a DANGER/WARNING/CAUTION/NOTICE summary. The section provides a single point view of compiled hazards and PPE in a condensed format. The appropriate DANGER, WARNING, CAUTION, NOTICE, and PPE listed also appear at each point of use throughout the manual.

Notice that the use of this manual also requires maintenance personnel to have received Hale training prior to using it. All SAM password information (and a SAM USB Key) are ONLY provided during the SAM Training portion of the Hale Training Academy. Use Hale Training Academy (Pumping And Maintenance) and SAM training (see paragraph 1.3, Training – page 2) and the two Maintenance sections for all aspects of maintaining the SAM system. These include:

- Preventive Maintenance
- Troubleshooting
- Corrective Maintenance
- Remove And Replace Instructions

Within the two Maintenance sections, the troubleshooting provided utilizes SCR tables, which provide the list of known symptoms associated with a SAM trouble/problem/failure. To use a SCR table, locate the indicated SYMPTOM, verify the associated CAUSE (the maintainer must verify ALL the associated causes if multiple causes are listed) and then perform the associated REMEDY (or remedies). If component repair is applicable, it is treated as a bench procedure. Maintenance requires the associated repair kit be utilized. Utilizing the associated repair kit ensures all the required components are available for replacement. Utilizing the repair kits as intended prolongs system performance and supports the manufacturer's warranty.

Performing a procedure is NOT the ONLY key action in maintaining the system, documentation of the Preventive Maintenance, R&R, and SYMPTOM/REMEDY history is also key to maintaining each SAM system (including meaningful tracking of when each issue occurred). A maintenance log with meaningful entries will provide invaluable insight, time/money savings (in reduced down time and shorted troubleshooting time), and cost savings over the life cycle of the system.

Within the Maintenance section, parts identification is provided by a reference to the applicable assembly/installation drawing(s) for the SAM system.



2.2. Disclaimer

Our policy is one of continuous development. We therefore reserve the right to amend specifications without notice or obligation.

NOTE: Using the pump serial number (from your SAM system) and the Hale website (or calling Customer Service) is the best way to ensure you receive/utilize the correct replacement parts for your pump and your SAM system.

2.3. SAM Overview

SAM is designed to automate the pump operation by simplifying the man machine interface and speeding up the pumping process. The automations repeatability can reduce human error and reduce operator workload. SAMs purpose is to get water available to the fire ground faster and to allow the pump operator the freedom to control the pump from a safer location and provides the advantage of a better (more direct) view of the fire scene and other company personnel.

Reference FSG-MNL-00210 (SAM OIM), section 4 (System Overview) for SAM theory of operation, icon and screen definitions/descriptions, graphical user interface navigation, remote operation capability, and foam systems top level integration information. Also reference the SAM OIM, section 5 for general installation information and section 6 general operating instructions.

SAM uses three [3] CAN networks, each network (bus) controls the components for that functional portion of the system (discharges, engine/governor, intakes). Each CAN bus uses a separate loom color (red, blue, green) to identify the back bone and most nodes. (However, some nodes and most stubs use black loom.) Each bus utilizes and complies with J1939 protocol. Reference FSG-MNL-00210 (SAM OIM) for additional information regarding CAN bus requirements including the bus physical layer requirements.

SAM provides two types of remote control: multiple control center touchscreens and/or a fully mobile (secure wireless) tablet. These optional control center touchscreens (a screen can be located on both sides of the apparatus or on an aerial device or the rear of the apparatus) are shown on Figure 14 thru Figure 16, the Blue, Green, Red SAM network diagrams respectively.

2.3.1 SAM User Interfaces

SAM provides two separate user interfaces: the SAM Control Center touchscreen and the SAM Pump Controller touchscreen. Each is described for maintenance purposes in the applicably titled subparagraphs.

ATTENTION ⚠ WARNING

SAM TOUCHSCREENS DO NOT FUNCTION IF COMPLETELY COVERED AND/OR IMMERSED IN WATER. DO NOT ALLOW THE TOUCHSCREENS TO BE COMPLETELY COVERED/IMMERSED WITH WATER (OR ANY LIQUID). DRY THE SCREEN TO RESTORE FUNCTIONALITY.

2.3.1.1 SAM Control Center Interfaces

The SAM system is designed to simplify fire scene operation of the apparatus. Fire scene operation consists primarily of using Auto Mode with Manual Mode being a fallback. For maintenance purposes Manual Mode is the primary interface and Auto Mode primarily provides verification the system is functioning properly for firefighting purposes.

2.3.1.1.1 SAM Auto Mode Interface

Use Auto Mode to verify the existence of an indicated SYMPTOM. Then after troubleshooting, repair, and testing; use Auto Mode to verify SAM automation has been restored. Refer to the local guidelines provided by the AHJ, OEM documentation/manuals, and then if other instruction is NOT available use the SAM OIM (FSG-MNL-00210), section 6, for general operating instructions for SAM automated operation of the apparatus.

2.3.1.1.2 SAM Manual Mode Interface

Typically, for maintenance purposes, exit Auto Mode and use Manual Mode to control the SAM system. Hale also recommends exiting Auto Mode before entering any OEM/technician password on either of the touchscreen controllers.

Manual Mode can be accessed at any time. However, the default SAM Control Center is the landing screen (shown on left side of Figure 1) until the pump is engaged at which time, the Auto Mode Home screen (shown on right-side of Figure 1) is displayed.

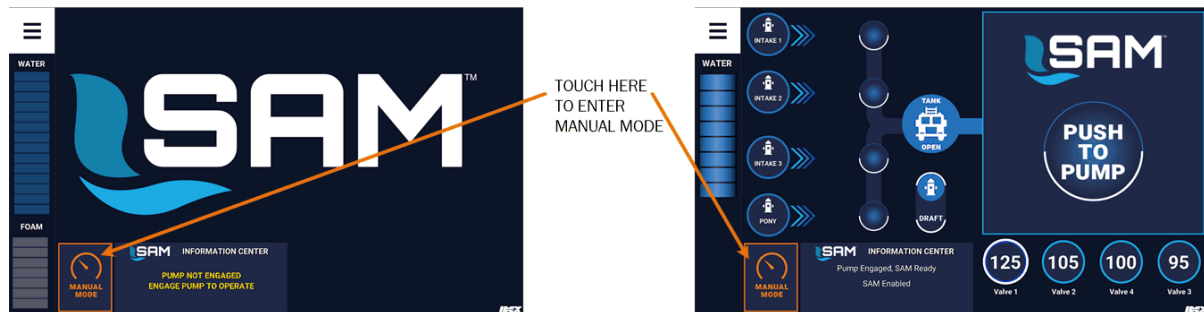


Figure 1. Entering Manual Mode (From Landing or Home Screen)

No matter which screen is displayed, touch the MANUAL MODE (orange) button and then touch YES (to confirm—see Figure 2) to access SAM Manual mode.

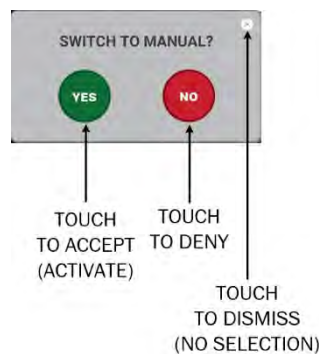


Figure 2. Popup Yes/No Buttons

2.3.1.1.3 SAM Control Center Menu Tabs

Entering an OEM/technician password displays the tabs shown on Figure 3. Entering an OEM/technician password also requires a USB Key be connected to the USB dongle on the rear of the SAM Control Center. See section 2.6 (page 33) for instructions to use the System Options button to access the SAM password screens and a list of SAM passwords for an OEM and/or a technician.

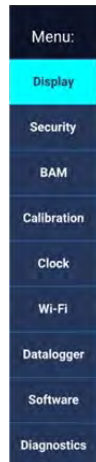


Figure 3. SAM OEM/Technician Menu Tabs

2.3.1.1.3.1 BAM

Touch the BAM tab (Figure 4) to enter the BAM Menu screen. Touch the Configuration Mode button to verify a desired devices UID, Manufactures information, Friendly name, and/or CAN address. Additional maintenance tasks (Retrieve/Send BAM, Clear/Save List, Clear/Export Data Log, Send Address Claim, and Reboot (to GUI/Bootloader) are available in Configuration Mode. Other non-configuration maintenance tasks are also accessible from the HOME MENU screen, including: Wi-fi settings, touchscreen Master assignment, and real time clock settings. See Section 6, SAM Setup/Configuration (page 187) for Configuration Mode detailed information and procedures.

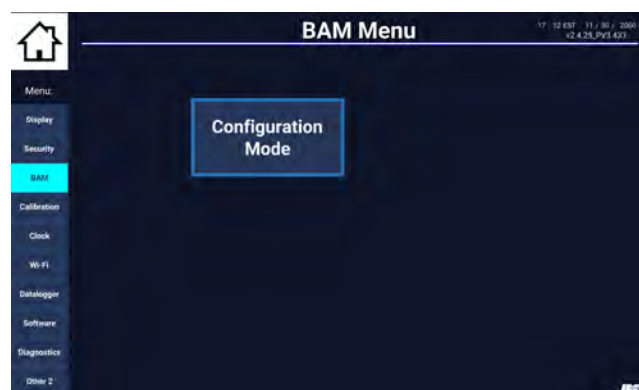


Figure 4. BAM Tab

2.3.1.1.3.2 Calibration

Touch the Calibration tab (Figure 5) to enter the CALIBRATION MENU screen. See Figure 5. See Section 5, Adjustments (page 173), for a description of each calibration and instructions to perform the desired/required calibration(s).

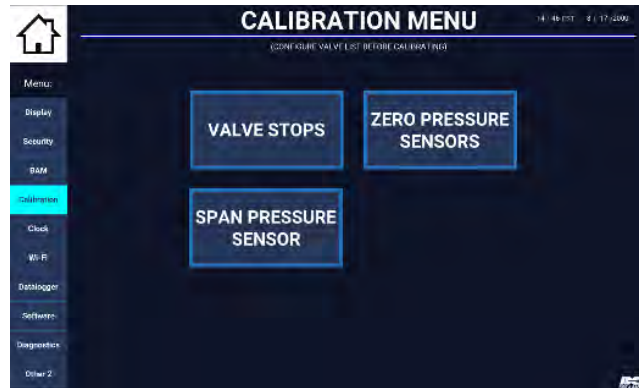


Figure 5. Calibration Tab

2.3.1.2 Pump Controller Interfaces

The Pump Controller interface will be a primary tool for maintaining a SAM system. Many of the screens provided on this interface provide annual pump testing control, support, and results storage capabilities. Additionally, numerous screens provide/support troubleshooting the system.

2.3.1.2.1 Pump Controller Tabs

Unlike the SAM Control Center, the Pump Controller tabs are available without accessing the password-controlled system options. See Figure 6.



Figure 6. Pump Controller Tabs

The Pump Controller tabs change color to indicate maintenance is required. See Figure 7.



Figure 7. Pump Controller Tabs (Indicating Maintenance Required)

2.3.1.2.1.1 TANK

The TANK tab (Figure 8) provides the following read-only SAM system information.

- Water Tank Status
- Tank Fill Valve Position
- Tank-To-Pump Valve Position
- Master Intake Pressure
- Master Discharge Pressure
- Engine Speed



Figure 8. TANK Screen

Additionally, the TANK tab (Figure 8) provides the following icon group controls. These controls allow the tank fill and/or the tank-to-pump valves to be manually closed and/or opened.

- Tank Fill Valve (Close/Open)
- Tank-To-Pump Valve (Close/Open)

Optionally, the Water Tank status can be displayed graphically (instead of the default, textually). See Figure 9.

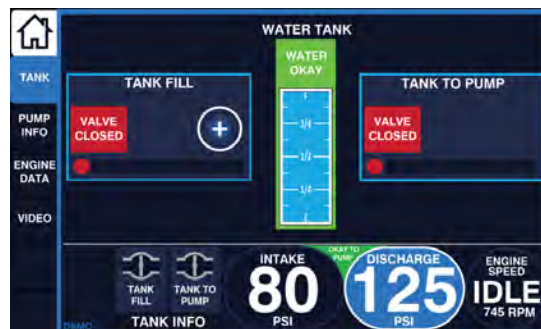


Figure 9. TANK Screen (Optional Water Tank Graphical Status)

2.3.1.2.1.2 PUMP INFO

The PUMP INFO tab (Figure 10) display varies by the pump model ordered with the SAM system. Anode status, temperature (gearbox and pump), and hours (pump and gearbox oil remaining life) status are available for all models. Unique to Q series pumps, Autolube oil status (water detection) is provided.



Figure 10. PUMP INFO Screen (No Maintenance Required)

When maintenance is required, the tab highlights red along with the applicable item requiring attention. See Figure 11 for an example.

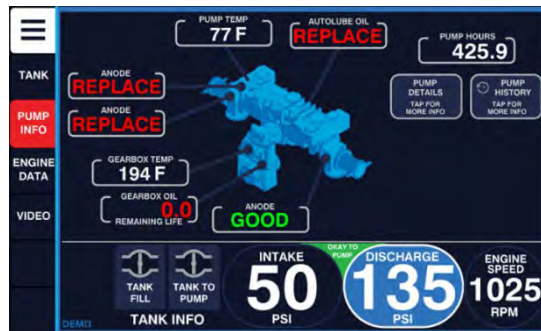


Figure 11. PUMP INFO Screen (Maintenance Required)

2.3.1.2.1.3 ENGINE DATA

The ENGINE DATA tab (Figure 12) provides read-only information and is provided for operator/maintainer convenience. This tab (and the applicable item[s]) also highlights red when attention is required.



Figure 12. ENGINE DATA Screen

2.3.1.2.1.4 VIDEO

Typically, a maintainer would not use the VIDEO tab unless one (or more) images from the installed camera(s) fails to display.

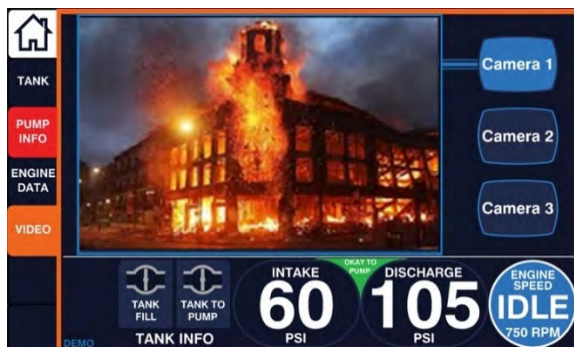


Figure 13. VIDEO Screen

2.3.2 SAM System Diagrams

Figure 14 thru Figure 18 shows the bus architecture, interface layouts, and miscellaneous diagrams of the system.

All system diagrams provided show both typical (standard) and optional equipment. Optional equipment is shown using dotted lines while non Hale equipment (NOT supplied) is shown using a combination of two dot and a dash. The CAN buss architecture diagrams show two (2) optional SAM Control Centers and show the buss in color (Blue, Green, and Red) while power and signals are designated by black and yellow (respectively). Note that the SAM Pump Controller bridges the Blue and Green CAN busses and the SAM Control Center(s) bridge the Green and Red CAN busses making CAN data available where ever it is required

Figure 14 shows the equipment (EOM/apparatus builder and Hale supplied) connected to the Blue CAN buss (an extension of the apparatus CAN buss). Additionally, the diagram shows the data path(s) to the SAM Control Center(s) and the remote SAM tablet along with the equipments supplied power and secure Wi-Fi connections.

Figure 15 shows the equipment (EOM/apparatus builder and Hale supplied) connected to the Green CAN buss (intake/inlet valves, sensors, and warning annunciation). Additionally, the diagram shows the data path(s) to the SAM Control Center(s) and the remote SAM tablet along with the equipments supplied power and secure Wi-Fi connections.

Figure 16 shows the equipment (EOM/apparatus builder and Hale supplied) connected to the Red CAN buss (discharge valves and optional Navigator valve controller(s)). Additionally, the diagram shows the data path(s) to the SAM Control Center(s) and the remote SAM tablet along with the equipments supplied power and secure Wi-Fi connections.

Figure 17 shows the equipment (EOM/apparatus builder and Hale supplied) connected to the apparatus air supply. Additionally, the diagram shows the drain lines required to protect the pump and the SAM system from damage during freezing weather.

Figure 18 shows the equipment (Hale supplied and/or EOM/apparatus builder installed) providing the apparatus with enhanced (spoken) audio alerts.

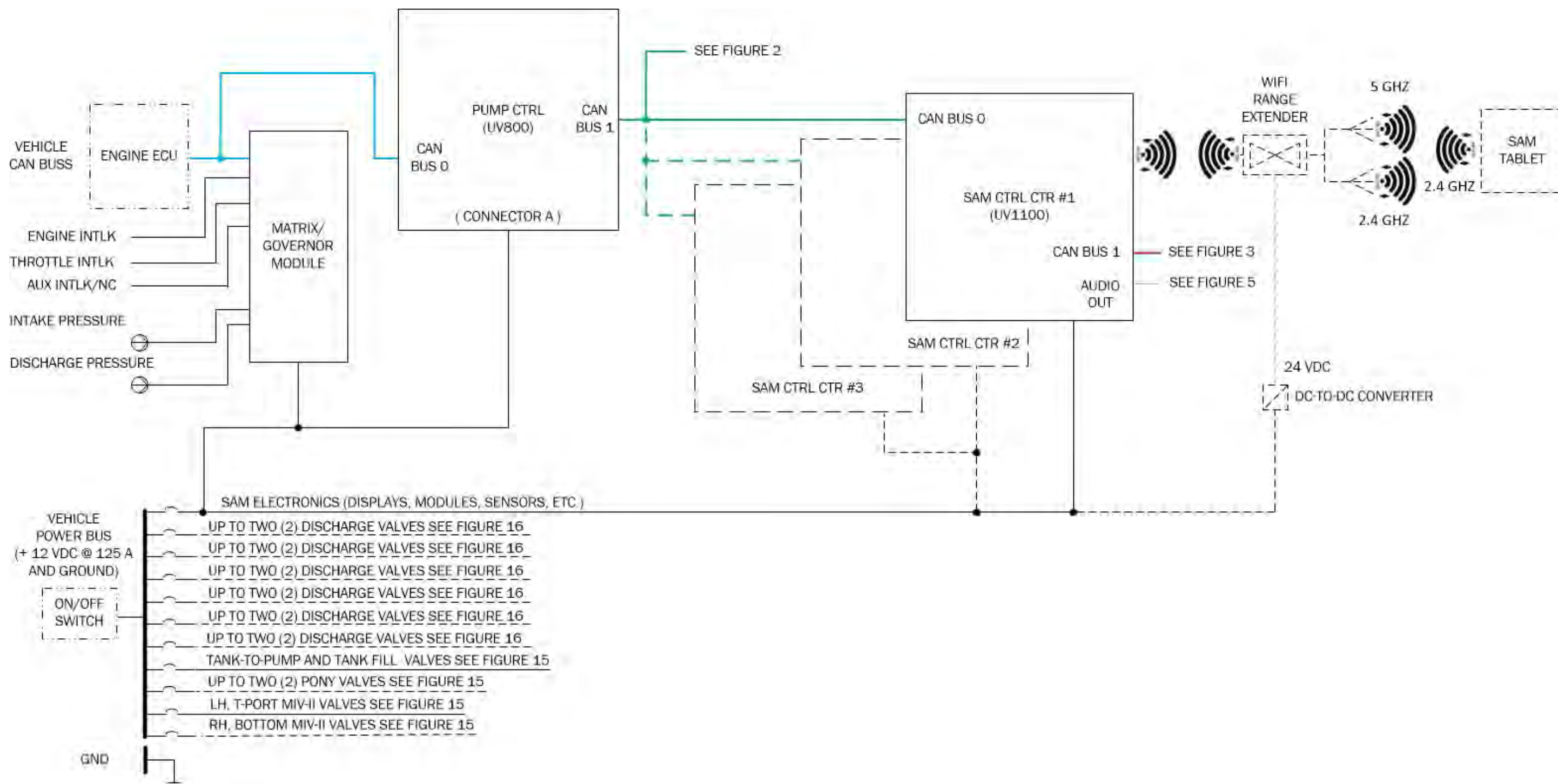


Figure 14. SAM Blue CAN Buss Architecture (With Three SAM Control Centers) Diagram

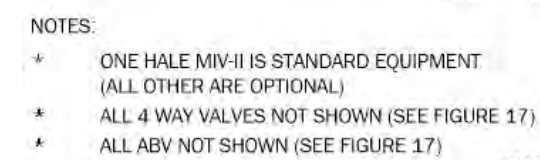


Figure 15. SAM Green CAN Buss Architecture (With Three SAM Control Centers) Diagram

NOTES:

- * ONE HALE MIV-II IS STANDARD EQUIPMENT (ALL OTHER ARE OPTIONAL) (SEE FIGURE 15)
- * ALL 4 WAY VALVES NOT SHOWN (SEE FIGURES 15 AND 17)
- * ALL ABV NOT SHOWN (SEE FIGURES 15 AND 17)

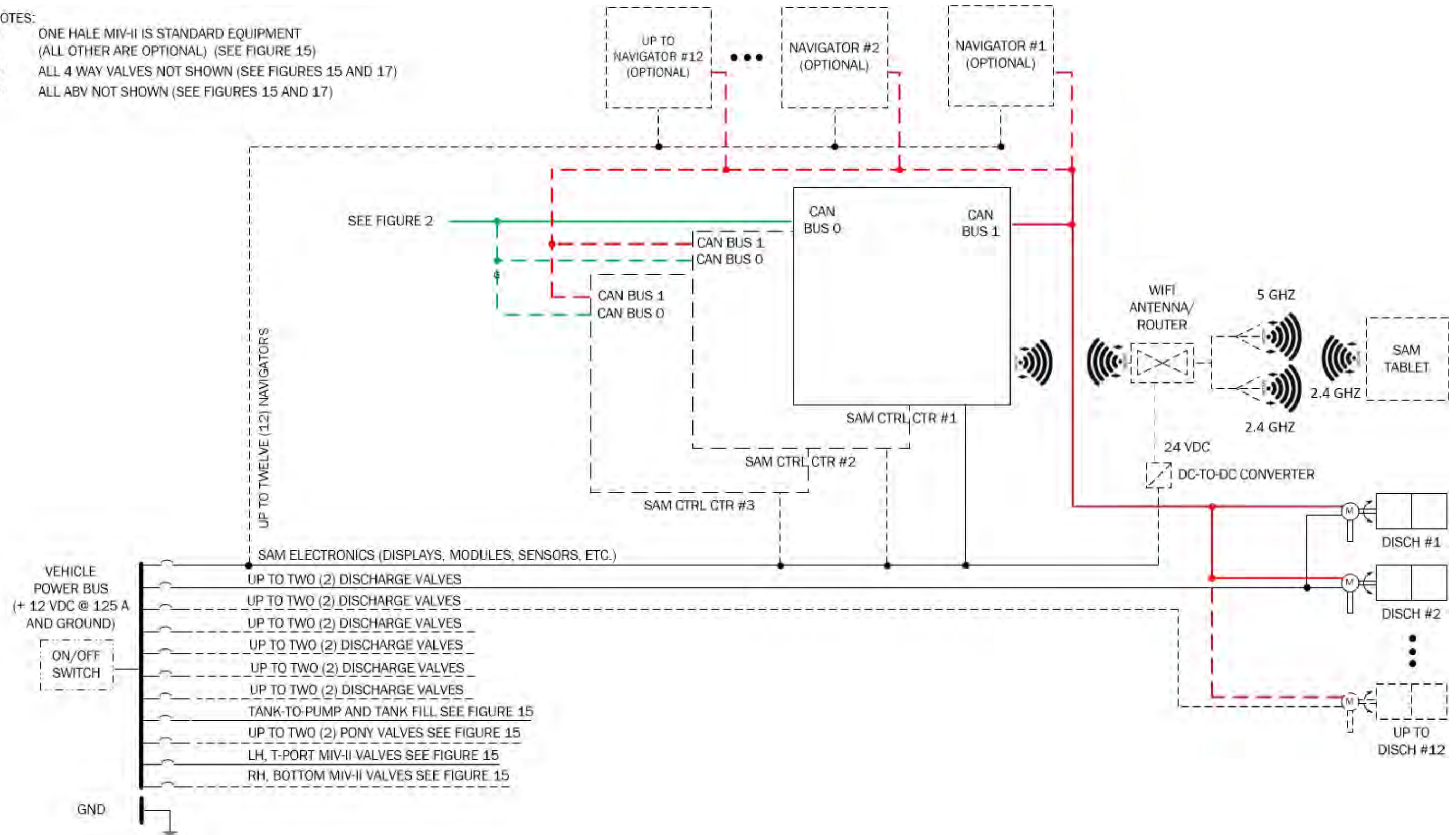


Figure 16. SAM Red CAN Buss Architecture (With Three SAM Control Centers) Diagram

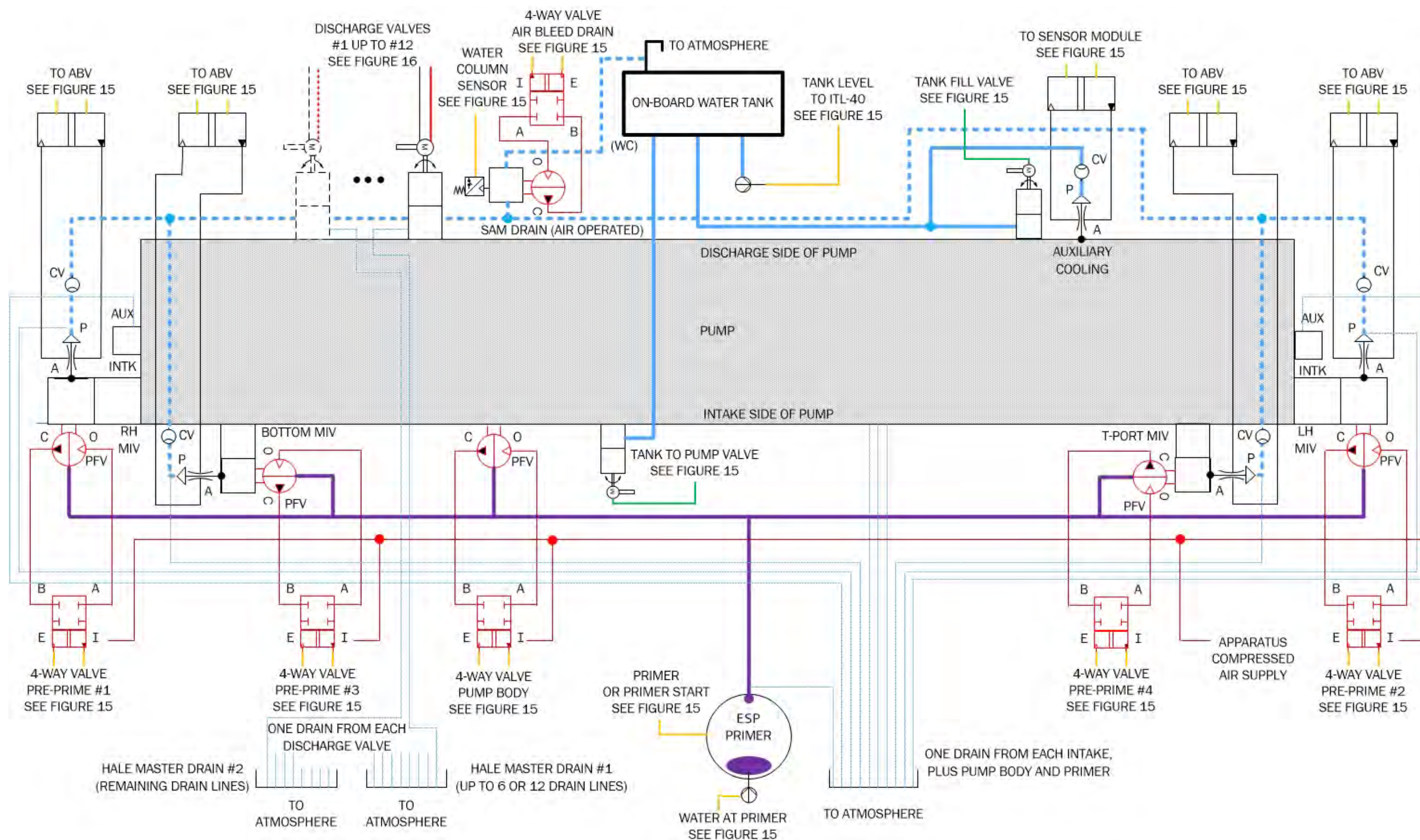
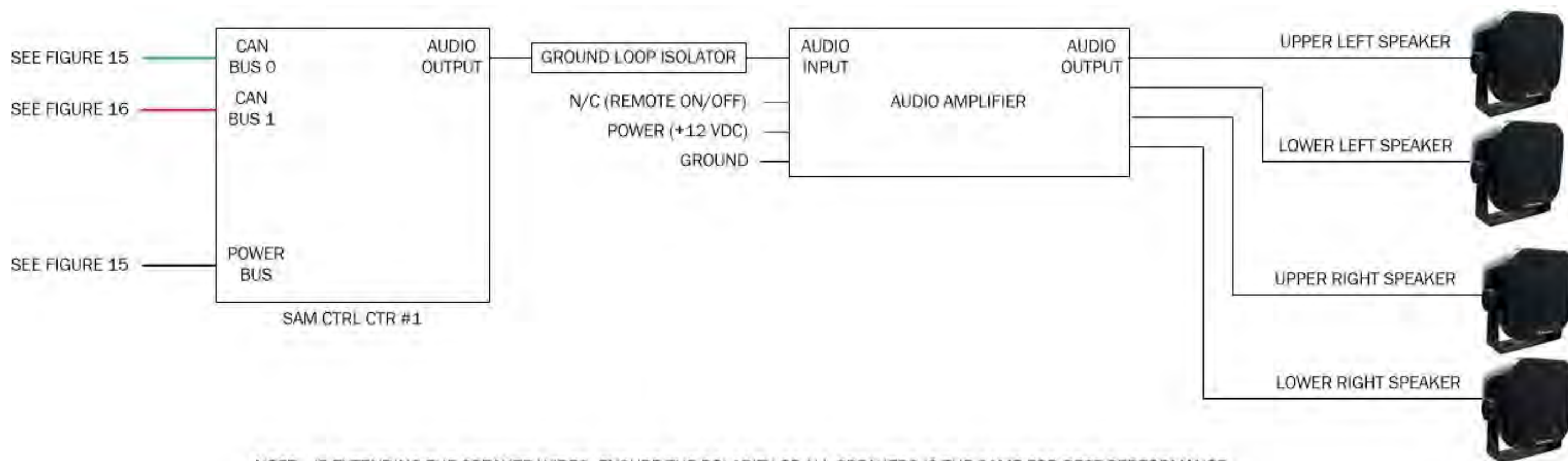


Figure 17. SAM System Drain And Pneumatic Diagram



NOTE: IF EXTENDING THE SPEAKER WIRES, ENSURE THE POLARITY OF ALL SPEAKERS IS THE SAME FOR BEST PERFORMANCE.

Figure 18. SAM Speaks Diagram



2.4. Principles Of Operation

This section provides the principles of operation (description of the key SAM components) for maintainers to use when troubleshooting or communicating with an OEM/apparatus manufacturer or a Hale Customer Support representative.

2.4.1 System Power

SAM system power consists of an OEM connection stud for battery POSITIVE (+12 VDC) and an OEM connection stud for battery NEGATIVE (ground/system ground/return). The OEM connection stud for battery NEGATIVE is located in the pump body while the stud for battery POSITIVE is located on the side of the circuit breaker box (see paragraph 4.10.6.1.1, page 118, for legacy locations). The OEM connections are required to be sized to supply 125 Amps to the SAM system.

2.4.1.1 Circuit Breaker Box

Refer to FSG-PL-01507 for connector to harness, circuit breaker to component, and circuit breaker part number information. See section 4.10.6 for all other circuit breaker assembly information.

2.4.2 System Modules

SAM system consists of the modules described in the following subparagraphs. See the following SAM system diagrams for SAM module connectivity and general system level information:

Figure 14 (page 17)

Figure 15 (page 18)

Figure 16 (page 19)

Figure 17 (page 20)

Figure 18 (page 21)

See section 4.8 (page 91) for all other module information.

2.4.2.1 AFS Sensor

The SAM system utilizes one [1] sensor module. The module's primary function is to place the analog/digital sensors' outputs on the CAN bus. The module is tested with the pump at the factory and contains the pump serial number, pump test data, and build plate information.

See paragraph 4.8.2 (page 95) for all other sensor module information.

2.4.2.2 AFS MIV-A

The SAM system utilizes one [1] MIV-A module to support the operation of up to three [3] Hale master intake valves (LH, RH and front). When the SAM system includes more than three Hale master intake valves, a second (slave) MIV-A module is required. The master MIV-A handles the hydrant and priming functions for up to three [3] Hale MIVs and the slave MIV-A is added to handle the same functions for the additional MIV(s).

See paragraph 4.8.3 (page 97) for MIV-A module R&R information.

See paragraph 4.12.5 (page 140) for instructions to address the slave MIV-A module.

2.4.2.3 MatrlIX Pressure Governor

The SAM system utilizes one [1] matrix pressure governor module. The module interfaces to the apparatus engine bus and performs governor functions.

See paragraph 4.8.1 (page 92) for all other sensor module information.

2.4.2.4 MIV Valve Drive

The SAM system utilizes one [1] MIV valve drive module to support the operation of each Hale master intake valve installed in the SAM system.

See paragraph 4.8.4 (page 100) for all other MIV valve drive module information.

2.4.3 System Sensors

The SAM system consists of the sensors described in the following subparagraphs. See the following SAM system diagrams for SAM sensor connectivity and general system level information:

Figure 14 (page 17)

Figure 15 (page 18)

Figure 16 (page 19)

Figure 17 (page 20)

See section 4.6 (page 72) for all other sensor information.

2.4.3.1 Barometric Sensor

The barometric sensor measures atmospheric pressure, which the SAM software uses to calculate the remaining pump capacity (Refer to SAM OIM (FSG-MNL-00210), Figure 36.)

Do NOT attempt to R&R the sensor before seeing paragraph 4.7.1 (page 72) to prevent sensor damage and for other sensor information.

See paragraph 4.16.2.1 (page 165) to check/test the sensor.

2.4.3.2 Flowmeters

Flowmeters measure individual discharge valve flow. The flow data is used to show flow for that discharge and the total flow for the truck.

Do NOT attempt to R&R the sensor before seeing paragraph 4.7.2 (page 74) to prevent sensor damage and for other sensor information.

2.4.3.3 Gearbox Oil Level Sensor (Single Point Level Switch)

The level sensor is physically positioned in the gearbox to alert the SAM operator of a low oil condition. Do NOT relocate or change the sensor attitude.

Do NOT attempt to R&R the sensor before seeing paragraph 4.7.4 (page 80) to prevent sensor damage and for other sensor information.

2.4.3.4 Pressure Sensors

The SAM system uses two different pressure sensors: The first is used for water and foam concentrate tank level indication and the SAM drain assembly to indicate the water column (flex tubing to the top of the onboard water tank) is full of water; The second is used for master intake and discharge pressures (pump pressure) and for all discharge valves.

Do NOT attempt to R&R the sensor before seeing section 4.7.3 (page 80) to prevent sensor damage and for other sensor information.

2.4.3.5 Temperature Sensors

The SAM system uses a temperature sensor to monitor gearbox oil and pump intakes temperature. Each sensors resulting output is displayed on the SAM Pump Controller, PUMP INFO screen.

See paragraph 4.15.1 (page 145) to check/test the sensor.

Do NOT attempt to R&R the sensor before seeing paragraph 4.7.5 (page 82) to prevent sensor damage and for other sensor information.



2.4.3.6 Water Detection Sensors

The water detection sensor detects the presence or absence of water.

Do NOT attempt to R&R the sensor before seeing paragraph 4.7.6 (page 84) to prevent sensor damage and for other sensor information.

See paragraph 4.15.2 (page 145) to check/test the sensor.

2.4.3.6.1 Autolube Water Detection Sensor Protection Solenoid

The water detection sensor protection solenoid installs in a special tap in the autolube assembly providing protection for the water detection (water in oil) sensor and an Autolube oil drain.

Do NOT attempt to R&R the solenoid before seeing paragraph 4.7.6.1 (page 86) to prevent solenoid damage and for other solenoid information.

2.4.4 Pump Priming And Air Bleed

SAM utilizes the components described below to evacuate air from the pump, MIVs, and LDH water sources. Locate and connect these components to facilitate drainage and route the associated tubing to facilitate detection of water at the primer.

IMPORTANT ⚠ NOTICE

DO NOT RUN THE PRIMER FOR MORE THAN 45 SECONDS. IF PRIME IS NOT ACHIEVED IN 30 - 45 SECONDS, STOP AND LOOK FOR AIR LEAKS OR BLOCKED SUCTION HOSE.

2.4.4.1 Pump Primer (ESP)

The Hale ESP primer operates from a separate 12 VDC (do NOT connect the ESP to the same wire as the rest of the SAM system). Hale recommends the use of a separate power switch, circuit protection/isolation, and cabling (minimum 1 AWG fine stranded copper wire – not to exceed 7.5 ft total length [pos & neg run]) capable of 300 Amps. Reference Hale 029-0810-01-0, ESP Primer System Installation, Operation and Service Maintenance Manual for primer information. Do NOT connect the ESP to a load shedding circuit.

2.4.4.2 Priming Feature Valve Assembly

The PF valve assembly is comprised of multiple components: PF air cylinders, SAM PF valves, and air lines and fittings. The pump body PF valve and SAM drain valve are always present on every SAM system. One [1] PF valve is added to the assembly for each Hale master intake valve. Each rectangular brass valve block is closed/opened by a PF air cylinder. Each air cylinder is controlled by a 4-way air valve all of which are controlled by the MIV modules to connect the system primer (the ESP) to individual components as directed by SAM automation.

Do NOT attempt to R&R any assembly before seeing paragraph 4.9.2 (page 103) to prevent assembly damage and for other assembly information.

See section 4.15 (page 145) to check/test the assembly.

2.4.4.3 Air Bleed And Check Valves

SAM automated air bleed is comprised of multiple components: SAM air bleed solenoids, check valves, and air lines and fittings. One [1] air bleed solenoid and check valve assembly is provided for each Hale master intake valve. Each solenoid is controlled by the MIV modules to connect the supply side (LDH) of the MIV to the prime detection components as directed by SAM automation.

Do NOT attempt to R&R any assembly before seeing paragraph 4.9.4 (page 106) to prevent assembly damage and for other assembly information.

See section 4.15 (page 145) to check/test the assembly.



2.4.4.4 Manual Prime/Air Bleed

In the event that SAM automated priming is inoperative, SAM provides a traditional PRIME button (wired direct to primer). To provide traditional air bleed for the Hale MIV 2.0s, each SAM MIV override panel houses a mechanical air bleed valve (Blue handle).

2.4.4.4.1 Manual Pump Priming

SAMs traditional PRIME button wiring differs slightly from typical wiring, in that blocking diodes are required. See paragraph 4.9.1 (page 102).

2.4.4.4.2 Manual Air Bleed

SAM provides an MIV override panel for each Hale MIV 2.0. The associated panel houses a mechanical air bleed valve which has a Blue handle. To prevent the valve from interfering with automated priming, a check valve is attached to each air bleed valve. Do NOT attempt to R&R any MIV override pane before seeing paragraph 4.4.7 (page 62) to prevent assembly damage and for other panel information.

2.4.5 Water Supply Management

Most Hale MIV 2.0 and auxiliary (pony) intakes are installed and all are intakes are tested at Hale. All pony intakes utilize an Akron Brass motorized Swing-Out™ valve which are also configured at Hale. Some intakes are shipped loose (NOT installed at Hale).

SAM can operate up to five (5) master intake valve intakes and up to four [4] pony intakes, however, SAM can ONLY provide automated control for a maximum of four intakes at one time. SAM allows those four valves to be any mix of master intake valve and pony intakes.

The pony intakes are optional for a SAM system and typically provide a 2.5-inch intake. (For a complete Akron Brass valve listing available for pony intakes, reference the SAM Parts Manual, FSG-MNL-00212.) SAM supports up to four [4] pony intakes, to do this each intake is controlled via a separate Akron Brass motorized Swing-Out™ valve. All the Akron Brass auxiliary intake valves utilize a unique address (static verses the default dynamic); therefore, off-the-self Akron Brass valves can NOT be used to replace these valves. See Table 1 for addressing required for Akron Brass valves utilized as a SAM pony intake.

Pony intakes do NOT utilize air bleed, automated primer suction, or pressure sensor ports. It is important to note that SAM does NOT provide automated air bleed or pre prime for pony intakes. Additionally, SAM does NOT support drafting from a pony intake in Auto Mode.

Table 1 lists the Akron Brass motorized Swing-Out™ valves available in the SAM system for water supply management (intake) purposes. The firmware in these valves is unique to each valve, do NOT utilize a valve previously programed as a discharge valve to replace a special purpose valve or interchange special purpose valve positions. The following sub paragraphs provide removal and installation and SAM configuration instructions.

Table 1. Akron Brass Valve Applications (Intake/Special)

SAM Application (Position)	Akron Brass Valve (Size) 1/	Static Address
Tank Fill	2 in (Refer to FSG-MNL-00212, Table 1, Tank Fill)	(0xA6)
	2.5 in (Refer to FSG-MNL-00212, Table 1, Tank Fill)	

Table 1. Akron Brass Valve Applications (Intake/Special) – CONTINUED

SAM Application (Position)	Akron Brass Valve (Size) <u>1</u> /	Static Address
Tank-To-Pump	3 in (Refer to FSG-MNL-00212, Table 1, Tank-To-Pump)	(0xA7)
	4 in (Refer to FSG-MNL-00212, Table 1, Tank-To-Pump)	
Auxiliary Intake (Pony) (Left Rear) <u>2</u> /	2.5 in (Refer to FSG-MNL-00212, Table 1, Auxiliary Intake [Pony])	(0xA8)
(Right Front) <u>2</u> /	2.5 in (Refer to FSG-MNL-00212, Table 1, Auxiliary Intake [Pony])	(0xA9)

NOTE 1/ Valve size/part number has NO relation to the address (only application/position). Refer to SAM PM (FSG-MNL-00212) for part numbers to ensure the correct replacement valve is obtained.

NOTE 2/ Hale Products does NOT recommend using the RR or LF Pony positions, due to MIV proximity.

2.4.5.1 SAM Pump Controller Tank Screen

The tank screen while SAM is in Auto mode provides control of the tank fill valve. To provide additional cooling for the pump or to fill the onboard water tank faster, open the valve (touch the + button). To close the valve, touch the – button.

The tank screen provides control of the tank fill or tank-to-pump valve when SAM is in Manual Mode. To open a valve, touch the + or the OPEN button. To close a valve, touch the – or the CLOSE button.

Additionally, the screen displays the status of the onboard water tank. By default, a status button is displayed, which indicates: OK, < 1/3, or EMPTY if the Tank Level is Off (see Figure 19). However optionally, if Tank Level is On a gauge icon group graphically showing the level in the tank (see Figure 20).



Figure 19. SAM Pump Controller Tank Screen – Default Water Level Status Indicator

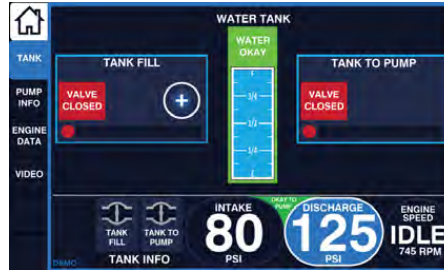


Figure 20. SAM Pump Controller Tank Screen – Optional Water Level Graphical Indicator

The tank info portion of the screen (bottom left) can show tank fill as open (green), auto (orange) or closed (no color shown). Additionally, if the auxiliary cooling solenoid is open the auxiliary cooling icon (rotating orange and green arrows) is displayed on the SAM Pump Controller (superimposed over the TANK FILL and TANK-TO-PUMP valve position icons).

2.4.6 Master Intake Valves

To support up to five (5) master intake valve intakes, SAM uses a MIV drive module for each valve and up to two [2] Hale MIV-A modules each of which receives a SAM unique address to identify the MIVs location on the pump/apparatus. These modules are NOT interchangeable due to the unique software address to physical location relationship which causes intake naming and activation to appear backwards if a module is connected/located incorrectly. An off-the-self Hale MIV 2.0 can be used to replace a failed master intake valve however, the associated Hale MIV module must be installed on the new valve.

Refer to the MIV 2.0 OIM (FSG-MNL-00216), TM (FSG-MNL-00217), and/or PM (FSG-MNL-00218) for MIV 2.0 information.

2.4.7 Discharge Management

The SAM system uses automation to control discharges individually.

2.4.7.1 Discharge Valve

Numerous sizes of discharges are available for SAM, reference FSG-MNL-00212 (SAM Parts Manual) for the replacement part number of the Akron Brass discharge valves available on SAM. Off-the-self Akron Brass valves can NOT be used to replace these valves. All valves are oriented to provide access to the physical override connection (motor shaft extension).

ATTENTION ⚠ CAUTION

VALVES OPERATE AUTOMATICALLY. REMOVE POWER BEFORE OVERRIDE

NOTE

The motor/actuator assembly for a valve may have been rotated, see the Akron Brass documents referenced in paragraph 4.5.2 (page 68) for instructions.

2.4.7.2 Pressure Sensor

Each discharge valve is fitted with a pressure sensor just downstream from the valve. Downstream pressure sensors typically use a 45-degree adapter to facilitate sensor to panel clearance. Turning the adapter is permissible, however do NOT turn the sensor.

2.4.7.3 Flowmeter

Flow sensors are located upstream from the valve.

Reference section 5, System Installation, of Style 9335 Navigator Pro With Pressure, Flow CAFS And Valve Control Installation, Operating, And Maintenance Instructions (P/N 126914) found on the flash drive provided with the system or on the Hale website (www.haleproducts.com).

2.4.8 Navigator (Optional Equipment)

One Navigator for every Akron Brass Swing-Out™ valve that is to be controlled by a Navigator. Note: Navigators are primarily for backup control of discharges or primary control of Pony intakes, when the number of intakes exceeds the automated capability of the SAM system (described below). The navigators shown on Figure 21 provide redundant electrical control for the associated (Akron Brass Swing-Out™ valve) controlled discharge. Additionally, a Navigator provides redundant pressure indication for the associated Akron valve.



Figure 21. 9323 And 9335 Navigator Pro Displays

Additionally, any Pony intake in addition to the first six intakes (with an index of greater than 4), requires a Navigator Pro for each Pony. In place of the 9323 or 9335 Navigator Pro displays (required for discharges), a Mini Navigator Pro (Figure 22) may be utilized for the added Pony intakes.



Figure 22. 9327 Mini Navigator Pro Display

IMPORTANT ▲ NOTICE

THE STYLE 9327 NAVIGATOR MINI VALVE CONTROLLER DOES NOT SUPPORT PRESSURE INDICATION. DO NOT USE A STYLE 9327 NAVIGATOR MINI VALVE CONTROLLER FOR DISCHARGE VALVE PURPOSES OR CALIBRATIONS.

2.4.9 Governor Function

The SAM Pump Controller controls engine speed automatically in SAM Auto Mode (no human interface is provided in this mode) and displays/provides the human interface for SAM Manual Mode. The SAM Pump Controller display provides input to the Matrlx Governor module to control



the pumps discharge pressure as set at SAM Pump Control (Operators) Panel similar to traditional governor operations. The following governor modes are provided by SAM:

PSI Mode

PSI mode displays the pump pressure set point and actual pressure for operator control. PSI mode is the default governor mode when SAM exits automated water only or FOAM pumping operations.

Low Intake Pressure Mode

Low Intake Pressure Mode is a subset of PSI mode that ONLY exists in Auto Mode. This mode attempts to maintain water pressures in a manner as to not place a vacuum on the intake (LDH and/or supply – hydrant).

RPM Mode

RPM mode displays the apparatus engine speed set point and actual speed for operator control. RPM mode is the default governor mode when SAM exits automated CAFS operations.

2.4.9.1 Emergency Idle Switch

The Sam system utilizes a shrouded, normally open, momentary switch collocated with every auxiliary SAM Control Center. The switch shroud is provided to prevent inadvertent activation.

Do NOT attempt to R&R an emergency idle switch before seeing paragraph 4.4.4 (page 56) to prevent assembly damage and for other panel information.

2.4.9.2 Twister Electronic Throttle

In addition to the SAM Pump Controller (Manual Mode) governor interface, SAM provides a traditional Twister electronic throttle controller on the SAM Pump Control (Operators) Panel.

Use revision 3.2 (or newer) ONLY for a SAM system, older versions require special setting or are not compatible with SAM at all.

Do NOT attempt to R&R a Twister before seeing paragraph 4.4.5 (page 57) to prevent assembly damage and for throttle revision identification.

2.4.10 SAM Speaks

SAM utilizes four (4) speakers and a four (4) channel audio amplifier to produce the spoken/enhanced audible alert/caution/warning in the form of a verbal announcement when the SAM Control Center requires operator attention. In addition, a ground loop isolator is utilized between the Pump Controller and the audio amplifier to prevent buzz and/or distortion.

See section 4.10, Removal And Replacement Of Miscellaneous SAM Components (page 108), for additional information.

2.4.10.1 Audio Amplifier And Ground Loop Isolator

The SAM Pump Controller provides audio output to the ground loop isolator and then the audio amplifier input.

Do NOT attempt to R&R the audio amplifier before seeing paragraph 4.10.1 (page 108) to prevent amplifier damage and for other amplifier information.

See section 4.15 (page 145) to check/test the amplifier.

2.4.10.2 Speakers

The audio amplifier outputs are wired to each of the four speakers. For best sound clarity/quality maintain the same polarity for all four speakers. Speakers should be mounted two on each side of the apparatus, one high and the other low, and out of the path of direct water/road splash.

Do NOT attempt to R&R an audio speaker before seeing paragraph 4.10.2 (page 110) to prevent assembly damage and for other panel information.

See section 4.15 (page 145) to check/test the speakers.

2.4.11 Remote Capability

When the optional secure Wi-Fi networked tablet is purchased, installation includes a charging/docking station, a Wi-Fi router/antenna, and a DC-to-DC (12 to 24 VDC) converter.

2.4.11.1 Secure Wi-Fi (SAM Control Center)

The master SAM Control Center provides the Wi-Fi antenna/router with a Wi-Fi connection for the SAM ruggedized tablet.

Do NOT attempt to R&R a SAM Control Center before seeing paragraph 4.4.1 (page 51) to prevent touchscreen damage and for other touchscreen information.

See paragraph 4.12.2 (page 131) to configure the master SAM Control Center Wi-Fi settings.

2.4.11.2 Wi-Fi Router

The Wi-Fi router/antenna secures to Wi-Fi network and connects the ruggedized tablet.

IMPORTANT ▲ NOTICE

THE WI-FI ROUTER/ANTENNA IS A 24 VDC DEVICE, REQUIRED TO BE ONLY WIRED TO THE OUTPUT OF THE DC-TO-DC CONVERTER, WHICH SUPPLIES 72 W OF POWER OVER THE POE PAIRS OF THE CAT 6 ETHERNET CABLE PORTION OF THE SAM HARNESS.

Do NOT attempt to R&R the router/antenna before seeing paragraph 4.10.5 (page 113) to prevent router damage and for other router information.

See paragraph 4.12.6 (page 141) to configure the routers Wi-Fi settings.

2.4.11.3 DC-To-DC Converter

The DC-to-DC converter converts the SAM system power (12 VDC) to 24 VDC to power the Wi-Fi router.

Do NOT attempt to R&R a DC-to-DC converter before seeing paragraph 4.10.4 (page 112) to prevent converter damage and for other converter information.

2.4.11.4 Ruggedized Tablet

ATTENTION ▲ WARNING

THE TABLET COMMUNICATES THROUGH THE SAM CONTROL CENTER LOCATED IN THE OPERATORS PANEL, IF THAT SCREEN FAILS, THE TABLET WILL NOT CONTROL THE APPARATUS.

IMPORTANT ▲ NOTICE

DO NOT HARD SHUTDOWN THE TABLET (POWER OFF BY HOLDING THE POWER BUTTON FOR LONGER THAN 5 SECONDS). A HARD SHUTDOWN MAY CORRUPT THE OPERATING SYSTEM, MAKING THE TABLET UNUSABLE.

The SAM tablet ONLY functions with SAM in Auto Mode; therefore, for maintenance purposes it is only used to verify the remote control features of the SAM system are functioning after a SAM

remote capability supporting component(s) has (have) been installed, configured, or removed and replaced and the apparatus is ready to be returned to the department for firefighting purposes.



Figure 23. SAM Tablet

2.4.12 SAM Auto Mode

ATTENTION ⚠ DANGER

OPERATORS SHOULD FIRST BE TRAINED TO OPERATE THE FIRE PUMP MANUALLY (USING PUSH BUTTONS, CONTROL RODS, AND MANUAL [NOT ELECTRICAL] VALVE OVERRIDES.)

- AUTOMATION ONLY MITIGATES PROBLEMS AROUND THE PUMP AND VALVES
 - OPERATORS NEED TO UNDERSTAND HOW TO DIAGNOSE PROBLEMS
 - SAM MANAGES PROBLEMS BY HELPING TO KEEP THE PUMP SAFE BUT IF AN INADEQUATE WATER SUPPLY OR PUMP CAVITATION OCCURS THE OPERATOR MUST UNDERSTAND WHAT IS HAPPENING AND CORRECT THE PROBLEM
- SAM DOES NOT ADJUST FOR FRICTION LOSS ON HOSE LINES OR PUMPING AT ELEVATION
 - SAM MAINTAINS PRESSURE SETTINGS BASED ON SENSORS MEASURING PRESSURE NEAR THE DISCHARGE VALVE
 - THE SYSTEM CAN NOT ALLEVIATE STATIC PRESSURES
 - RESIDUAL PRESSURE IN THE SYSTEM MAY BUILD IN THE DISCHARGE LINES WHEN THAT PARTICULAR LINE IS NOT FLOWING WATER OR NOT FLOWING ENOUGH WATER TO BE GATED
 - THE OPERATOR MUST BE AWARE THAT THIS PRESSURE MAY PRESENT A DANGER TO LARGER DISCHARGES. (THEREFORE, SETTING A SMALLER DISCHARGE LINE AT A PRESSURE HIGHER THAN YOU WOULD EXPOSE A LARGER HOSE [OR LARGER DISCHARGE] TO IS NOT RECOMMENDED)

SAM Auto Mode for maintenance purposes is primarily used to verify the automated features of the SAM system are functioning and the apparatus is ready to be returned to the department for firefighting purposes.

2.4.13 SAM Manual Mode

Manual mode can be accessed at any time, even before the pump is engaged. However, the default SAM Control Center screen is the landing screen (shown on left side of Figure 1, page 11) until the pump is engaged or the Auto Mode home screen (shown on right-side of Figure 1) when the pump is engaged.

No matter which screen is displayed, touch the MANUAL MODE button (orange) and then touch YES (to confirm – see Figure 2) to access SAM Manual mode.

2.5. SAM Specifications And Numbering

Refer to the SAM OIM (FSG-MNL-00210) or the SAM PM (FSG-MNL-00212), paragraph 2.1 SAM Numbering and Specifications References, for how to locate the serial number for your SAM system. Hale SAM performance per NFPA 1901 (and/or NFPA 1906 as appropriate) is provided on the Hale Products website (www.haleproducts.com) or by contacting Hale Customer Service (800- 533- 3569).

2.6. SAM Passwords

The SAM system utilizes two sets of passwords (those entered using the SAM Control Center and those entered using the SAM Pump Controller). The password entry screen is required to enter a password on either of the SAM touchscreens. The following subparagraphs provide instructions to access a SAM password screen and a separate password listing for each of the touchscreens.

2.6.1 System Options (Accessing SAM Password Screens)

Using the SAM Control Center, perform the following to access the password screen.

- A. On SAM Control Center, touch MANUAL MODE button. See Figure 1 (page 11).
- B. Touch YES button. (See Figure 2.)
- C. On rear of SAM Control Center, connect USB Key to USB dongle. See Figure 24.



Figure 24. SAM Control Center USB Dongle (USB key Connected)

- D. Touch and hold system options button until loading icon completes circle (see Figure 25) and password screen is displayed (see Figure 26).



Figure 25. SAM Control Center System Options Button And Loading Icon



Figure 26. SAM Control Center Password Screen

2.6.1.1 SAM Control Center Password Screen

Perform the following to enter a password.

- Using password icon group (with USB Key attached), touch OEM/Technician password digits.
- Touch ENTER button.
- On SAM system options default screen, select desired tab. See Figure 27.



Figure 27. SAM Control Center System Options Menu Screen

2.6.1.1.1 SAM Control Center Password List

Table 2 provides a list of the passwords for entry on a SAM Control Center.

NOTES

All technician level passwords require a Hale SAM USB Key (ONLY available thru attending a Hale SAM training class).

Refer to the Hale website (www.haleproducts.com) for videos containing password usage details.

Table 2. SAM Control Center Password List

Password	Menu/Page	Description
23456	User/Dealer (and Tablet)	Presets, Quicksets, name (intakes, discharges), colors (discharges), order of quicksets, and A1 password
26634	Technician Level 1	Allows level 1 (restricted) technician access to the SAM systems
29512	Technician Level 2	Allows level 2 (full) technician access to the SAM system
33578	Tablet Configuration Mode	Allows level 2 (full) technician access to the SAM tablet

2.6.1.2 SAM Pump Controller Password Screen Access

Perform the following to enter a SAM Pump Controller password.

- On SAM Control Center, touch MANUAL MODE button. See Figure 1 (page 11).
- Touch YES button. (See Figure 2.)
- On SAM Pump Controller, touch and hold system options button until loading icon completes circle (see Figure 28) and Menu screen (see Figure 29) is displayed.



Figure 28. SAM Pump Controller System Options Button And Loading Icon

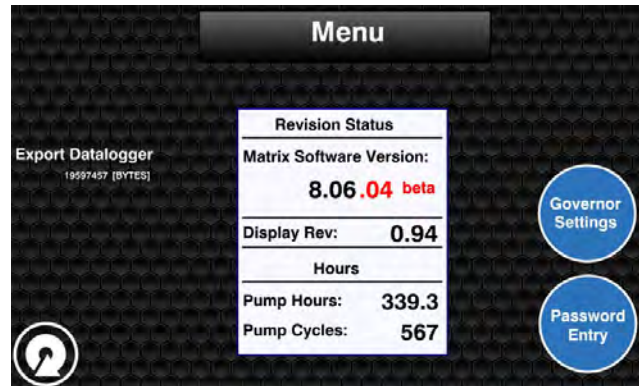


Figure 29. SAM Pump Controller Menu Screen

- D. On SAM Pump Controller menu screen, touch Password Entry button.
- E. Using password icon group (with USB Key attached) and Table 3, touch desired passwords digits.
- F. Touch ENTER button.

NOTE

Actionable passwords do NOT display an associated (different) screen, all other passwords display a separate yet associated screen (or series of screens).

2.6.1.2.1 SAM Pump Controller Password List

Table 3 provides a list of the passwords for entry on a SAM Pump Controller.

Table 3. SAM Pump Controller Password List

Password	Menu/Page	Description
311	Menu	Revision Status/Menu (Provides Governor Settings and Password Access)
5353	Write Field Data	Input Sensor Data (from Annual Test)
5454	Read Factory/Field Data	Toggles Between Factory And Field Test Data
5555	Write Field Data	Toggles Between Factory And Field Test Data
5656	Read Factory/Field Data	Displays Factory Test Data
5757	Current Date	Set Time And Date
5858	Water Flow Calibration	Water Flow Calibration
5959	Temperature Calibration	Corrects Gearbox Or Pump Temperature Readout
6060	Outputs/CAN Outputs/Inputs	MIV Test/Troubleshooting Screen
6161	Volume	Audio Volume Adjustment (For SAM Speaks)
6262	Governor Menu	Governor Menu (Select Page 1 thru 5)
6363	Current Name/Default Name	Change/Set Camera (1 up to 3) Name(s)
6464	N/A	Actionable Password (Resets Anode[s])
6565	Output/Input	CAN Test/Troubleshooting Screen

Table 3. SAM Pump Controller Password List – CONTINUED

Password	Menu/Page	Description
7474	ITL-40 Calibration	Onboard Water Tank Level Display Calibration
7575	Voltage Calibration	Match SAM Display To Apparatus Voltage (Includes Alarms Set Levels)
43275	N/A	Actionable Password (Resets Gearbox Oil Life 1)
43276	N/A	Actionable Password (Resets Gearbox Oil Life 2) *
59326	Waiting for Connection or USB	Restart to Bootloader (Allows Software Download)
78674	N/A	Actionable Password (Resets Pump Hours)
82650	N/A	Actionable Password (Sets Tank Level Display Type (Displayed On TANK Tab) To Text Box (Default)
82651	N/A	Actionable Password (Sets Tank Level Display Type (Displayed On TANK Tab) To Graphical (Optional)
84330	N/A	Actionable Password (Sets Don't Show VIDEO Tab (0 Cameras Shown)
84331	N/A	Actionable Password (Sets Show VIDEO Tab (1 Camera Shown)
84332	N/A	Actionable Password (Sets Show VIDEO Tab (2 Cameras Shown)
84333	N/A	Actionable Password (Sets Show VIDEO Tab (3 Cameras Shown)
98765	Audio Test Page	SAM Speaks Audio Test Page

* Reset for auxiliary gearbox for Prima and RME pumps only.

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3. PREVENTIVE MAINTENANCE

Regular preventive maintenance assures continued dependable operation. Hale Products recommends the preventive maintenance and inspections listed in paragraph 3.1 be performed in accordance with the Preventive Maintenance Plan And Schedule provided.

3.1. Preventive Maintenance Plan And Schedule

Hale Products recommends the preventive maintenance and inspections listed in Table 4 be performed as scheduled. SAM and the applicable pump require very little care and maintenance, however, the preventive maintenance and inspections required are important. SAM and the associated pump do NOT require any daily or weekly preventive maintenance. The listed preventive maintenance, inspections and checks are required to ensure proper and economical operation and to minimize corrective maintenance.

Table 4. Recommended Preventive Maintenance

Interval	Check/Test	Action Required	Item(s) Required
After Each Use			
	Display Cleaning	Clean display with a damp (water only) soft cloth and dry. water (Reference FSG-MNL-00210 and see the Display Cleaning paragraph.)	Water, Soft Cloth
	Flush	Flush pump thoroughly with clean water (Reference FSG-MNL-00210 and see the Flush Pump paragraph.)	Supply of Clean Water
NOTE 1/	Connections	Inspect wiring, flow sensors and connections for tightness, corrosion, leaks and/or damage.	None
Monthly			
	Packing Seal Check (Only for Optional Packing Seal)	Check the drip rate of the pump seal (ONLY applies to the optional packing style pump seal.) (See Table 5 for manuals reference and see the Packing Seal Check paragraph.)	Timer
Bi-Monthly (Every 2 Months)			
NOTE 1/	Operate System	Operate foam system to move the foam concentrate and prevent gelling.	Supply of clean water Acceptable Foam
NOTE 1/	Paddlewheel Check	Inspect and clean paddlewheels to maintain accuracy. (Reference FSG-MNL-00186 and see the Flowmeter Check paragraph.)	Soft bristle detailers brush O-ring lubricant
Quarterly (Every 3 Months)			
	Gearbox Oil Check	Check gearbox oil level using (See Table 5 for manuals reference and see the Check Gearbox Oil Level paragraph.) Perform Gearbox Oil Lever Sensor Cleaning, paragraph 4.7.4 (page 80).	7/8-in Wrench Mild Detergent Shop Rags Cable Ties Thread Sealant

Table 4. Recommended Preventive Maintenance – CONTINUED

Interval	Check/Test	Action Required	Item(s) Required
Annually (Every 12 Months)			
NOTE 1/	Calibrate	Verify foam flow calibration and water flow calibration. (Reference FSG-MNL-00186 and see the Flow Calibration paragraph.)	Supply of clean water Acceptable Foam Flowmeter
	Autolube Oil Check	Check Autolube oil level and condition, if required drain and refill with new oil (See Table 5 for manuals reference and reference Check Autolube Oil Level paragraph.)	1/4-in Allen Wrench Shop Rags 1 qt of EP 90, 80W-90
	Oil Change	Drain oil from gearbox and refill with new oil (See Table 5 for manuals reference and reference Oil Change Procedure paragraph.)	Gear Oil Required Varies By Pump Model See Table 5
	Perform NFPA 1911 Performance Level Tests	Check the pump at each capacity and compare the results to when the pump was first placed in service.	Supply of clean water
Bi-Annually (Every 24 Months)			
	Change Pump Seal (ONLY If Packing Style)	Replace Complete Pump Seal (ONLY if Packing Style) (See Table 5 for manuals reference and see Packing Seal Change paragraph.)	Refer to pump manual

NOTE 1/: Only required if SmartFoam or SmartCAFS equipped.

NOTES: Refer to Operation Installation Maintenance Manual (FSG-MNL-00210), Preventive Maintenance for instructions to perform SAM preventive maintenance tasks.

Refer to applicable pump Technical Manual (see Table 5) for instructions to perform the pumps required preventative maintenance.

Table 5. Pump Preventive Maintenance Cross References

Pump	Manual Reference
Midship Pumps	
Qmax	FSG-MNL-00200
Qmax-XS	
Qflo	
Qtwo	
8F	
(8FG, 8FK, or RME *)	
Single Stage Booster Pumps	
RSD	FSG-MNL-00184

* RME not currently covered.

3.2. Reset Gearbox Oil Life

Perform the following to reset the gearbox oil life remaining counter when the gearbox oil is changed per the schedule listed in Table 4.

- On SAM Control Center/SAM Pump Controller, access password screen.
- Sequentially, touch digits of actionable password to reset gearbox oil life 1. See Table 3 (page 36).
- Verify GEARBOX OIL LIFE REMAINING resets to 200 hours. (See Figure 30.)
- If applicable, sequentially touch digits of actionable password to reset gearbox oil life 2. See Table 3 (page 36).
- Verify GEARBOX OIL LIFE REMAINING resets to 200 hours. (See Figure 31.)

See Figure 30 for typical single gearbox pump models or Figure 31 for pumps with a second (auxiliary) gearbox.

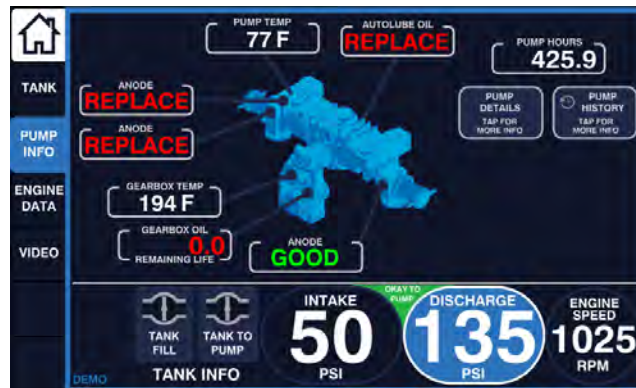


Figure 30. SAM Pump Controller Pump Info Screen (Single Gearbox)

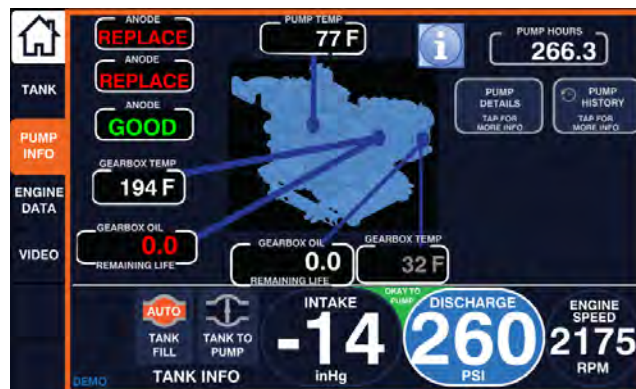


Figure 31. SAM Pump Controller Pump Info Screen (Dual Gearboxes)

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4. CORRECTIVE MAINTENANCE

This section provides general repair guidelines, SAM system troubleshooting, removal and replacement, and bench repair instructions for all SAM components. The following DANGERS, WARNINGS, CAUTIONS, or NOTICES apply to this entire section.

ATTENTION ⚠ WARNING

A PRESSURE HAZARD MAY EXIST EVEN WHEN THE PUMP IS NOT RUNNING. PRIOR TO REMOVING HOSES OR CAPS FROM PUMP CONNECTIONS, RELIEVE PRESSURE BY OPENING DRAINS. BLEEDER VALVES SHOULD ALSO BE USED WHEN CONNECTING TO AN INTAKE FROM A PRESSURIZED SOURCE.

ATTENTION ⚠ WARNING

ALWAYS FOLLOW LOCAL GUIDELINES FROM THE AHJ AND THE APPARATUS MANUFACTURER.

ATTENTION ⚠ WARNING

ALWAYS FOLLOW PROPER OPERATING PROCEDURES. THE PUMP OPERATOR MUST BE FAMILIAR WITH THE PUMP AND SAM OPERATING INSTRUCTIONS AS WELL AS OTHER OPERATING GUIDELINES FOR THE APPARATUS AND ACCESSORIES.

ATTENTION ⚠ WARNING

ALWAYS STOP THE ENGINE, SET THE PARKING BRAKE, AND CHOCK THE WHEELS BEFORE GOING UNDER THE TRUCK FOR ANY REASON.

ATTENTION ⚠ WARNING

AVOID CONTACT WITH HOT SURFACES. THE PACKING GLAND AND PUMP BODY MAY PRESENT A TEMPERATURE HAZARD. OVERHEATING MAY RESULT IN A SCALDING WATER HAZARD.

ATTENTION ⚠ WARNING

DO NOT EXCEED OPERATING PRESSURE LIMITS OF PUMP, INSTALLED PLUMBING, HOSE(S), OR EQUIPMENT IN USE.

ATTENTION ⚠ WARNING

OPERATORS, INSTALLERS, AND MAINTENANCE PERSONNEL MUST BE TRAINED AND QUALIFIED FOR ALL THE ACTIVITIES THEY PERFORM.

ATTENTION ⚠ WARNING

THE PROCEDURES IN THIS SECTION PROVIDE ONLY GENERAL AND MINIMAL INSTRUCTION. DO NOT REPLACE LOCAL PROCEDURES OR POLICIES OR RECOMMENDATIONS AND PROCEDURES PROVIDED IN THE APPARATUS/TRUCK/UNIT MANUAL WITH THESE PROCEDURES.

4.1. General Repair Guidelines

The following subparagraphs provide general guidelines to be utilized and/or followed whenever the maintenance procedure being performed is associated with the type of information/ instructions provided in these subparagraphs.

NOTE

Unless otherwise indicated, these instructions apply to all Hale SAM systems.

4.1.1 Match Mark Or Note Component Orientation

As a general maintenance practice, match mark and/or note (document/record) the orientation of a component before disconnecting or removing it.

4.1.2 Recommended Tools

Individual tool and consumable lists are NOT provided for each bench procedure. The following tools are the minimum required to perform maintenance/repairs on the SAM. Hale Products does NOT supply any of the suggested tools listed.

- Allen Wrenches (or Hex Key Socket Set)
- Shop Rags
- Wrench Set (Metric)
- Wrench Set (SAE)
- Ratchets (Multiple drive sizes)
- Sockets (Metric)
- Sockets (SAE)
- Torque Wrench(s) Or Torque Limiting Socket(s) (Capable of 1 – 150 Nm)
- Wire Cutter
- Wire Tags

4.1.3 Recommended Cleaners

Hale recommends the following:

- Safety Kleen
- Stoddard Solvent
- Loctite Clean-Up Solvent (thread locker/bonder removal for hardware and clearance rings)

4.1.4 Recommended Lubricants

Where grease is called for, use lithium based grease with 1 to 3% Molybdenum Disulfate. The following lists examples of approved greases.

- Dow Corning BR2-PLUS
- Lubriplate Fiske #3000
- Shell Super Duty Grease
- Imperial #777
- Mobil Grease Special
- Sunoco Moly #2EP

The lubricant listed in Table 6 is recommended to protect the O-ring from damage, speeds up assembly, and to ensure continued service and operation.

Table 6. Recommended O-ring Lubricant

Application	Lubricant <u>1</u> /
O-ring	Synthetic Multi-Purpose Clear O-ring Lubricant (Synthetic NLGI Grade 2 Heavy Duty, Multi-Purpose)

Note 1/ Or equivalent lubricant.

4.1.5 Thread Lock And Sealant Compounds

Loctite™ (or suitable equivalent/substitute thread locker, bonding compound, or sealant) shall be used when directed. Reference the procedures associated list of tools and/or consumables for the specific thread locker/bonding or sealant required. Loctite™ (243) and sealant (580) was used during factory assembly for all fasteners/hardware and fittings requiring the use of a thread lock, bonding, or sealant compound. Remnant compound ALWAYS causes false torque reading



when installing old and/or new fasteners/hardware. See paragraph 4.1.3 Recommended Cleaners, for thread lock compound cleaning information. The Loctite™ compounds listed in Table 7 may be used for thread lock or bonding compounds.

Table 7. Recommended Thread Lock And Sealant Compounds

Thread Lock Compounds	Used on: (Description)	Sealant Compounds	Used on: (Description)
243™	Mounting and Retaining Hardware (Medium Strength, All-Purpose, Removable, Thixotropic, Blue)	580™	Pipe Fittings (Medium Strength, High Temperature, Slow Cure, White)

4.2. Cleaning And Inspection Guidelines

Wherever a procedure calls for cleaning and inspection, these guidelines should be followed.

- A. Inspect all components for excessive or abnormal wear.
- B. Wherever a requirement for new parts is indicated, obtain new components from Hale Products Inc.
- C. Wherever procedures call for removal of gaskets, gasket should be replaced. Clean all gasket mating surfaces before installing new gaskets.
- D. Bearings and other components should be cleaned using only recommended solvents.
- E. Bearings and seals should be inspected whenever parts are disassembled. Look for signs of excessive wear or heat on bearings. Look for hardening, cracking, distortion (or out-of-round), or evidence of bypass/leakage for seals.
- F. Replace any hardware that shows signs of excessive wear, corrosion, or bolts/screws that are torqued to greater than 100 ft-lb with new hardware.

4.2.1 Cleaning Required For Thread Lock Compounds

Always clean the threads of all bolts/fasteners/screws as remnant compound causes false torque reading when installing existing hardware. Always use a clean out tap to clean old thread lock from bolt/ fastener/screw holes to prevent remnant compound causing false torque reading when installing old and/or new hardware.

To remove and clean factory installed thread lock compounds, follow the instruction provided in the applicable Loctite™ Technical Data Sheet (See the Loctite web site [<http://www.loctite.com>] or Henkel web site [<https://www.henkel.com>].)

4.3. Removal And Replacement Guidelines

R&R instructions are provided ONLY for components of SAM assemblies (in the form of bench procedures). NO procedures are provided to R&R the SAM component from the apparatus. To reduce unnecessary work and to avoid the introduction of additional/new issues, only dismantle the parts instructed and only when necessary to accomplish the target inspection and/or R&R.

The bench procedures are written to typically provide three layers of detail. The “A” steps provide an experienced technician (who is very familiar with a Hale SAM) a Top Level View of the steps required to R&R the titled component. The “A” steps along with the “1” steps provide an experienced technician (who is NOT familiar with a Hale SAM but is familiar with foam systems in general) a more detailed set of steps to R&R the titled component. Using all three levels of the steps



provides an inexperienced technician (training is required for all who work on the foam systems) very detailed steps to perform the task.

IMPORTANT ▲ NOTICE

ALWAYS DISCONNECT THE POWER CABLE, GROUND STRAPS, ELECTRICAL WIRES AND CABLES FROM THE CONTROL UNIT OR OTHER HALE SAM EQUIPMENT BEFORE ELECTRIC ARC WELDING AT ANY POINT ON THE APPARATUS.

4.3.1 Tag And Disconnect Electrical Connections

ATTENTION ▲ DANGER

ALL ELECTRICAL SYSTEMS HAVE THE POTENTIAL TO CAUSE SPARKS DURING SERVICE. TAKE CARE TO ELIMINATE EXPLOSIVE OR HAZARDOUS ENVIRONMENTS DURING SERVICE AND/OR REPAIR.

IMPORTANT ▲ NOTICE

KEEP ALL I/O PORT COVERS IN PLACE DURING USE TO PREVENT WATER DAMAGE.

IMPORTANT ▲ NOTICE

OTHER ELECTRICAL COMPONENTS MUST NOT BE SUPPLIED FROM THE SAM SYSTEM SUPPLY. DO NOT CONNECT THE PRIMER AND HALE SAM TO THE SAME POWER WIRE.

IMPORTANT ▲ NOTICE

THE CONTROLLER UNIT DEUTSCH CONNECTORS ARE KEYED TO PREVENT INTERCHANGE OR REVERSE DIRECTION INSERTION. DO NOT FORCE A CONNECTOR WITHOUT FIRST VERIFYING THE CONNECTORS ORIENTATION AND PLACEMENT.

IMPORTANT ▲ NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED; HOWEVER, ALL MODULES UTILIZE THE SAME TWO KEYS. VERIFY THE HARNESS LABEL AND THE MODULE PART NUMBER TO ENSURE THE CORRECT MODULE AND HARNESS CONNECTOR ARE BEING CONNECTED.

Never attempt to tag, disconnect, or connect an energized circuit.

As a general maintenance practice, tag (document/photograph/record) the connector orientation and location (including the mating connector) for each component before disconnecting or removing it.

From/To wire listings (pinout) listings are provided for modules, sensors, solenoids, etc., when a listing is not present herein, refer to the plate drawings located in the SAM PM (FSG-MNL-00212) for the devices signal listing and harness information. The SAM PM can be found on the Hale website (www.haleproducts.com) or on the flash drive provided with the system.

4.3.2 Tag And Disconnect Pneumatic (Air) Connections

SAM utilizes apparatus compressed air. As a general maintenance practice, tag (document/photograph/record) the connector orientation and location (including the mating connector) for each component that utilizes air pressure before disconnecting or removing it.

4.3.3 Tag And Disconnect Drain Connections

ATTENTION ▲ CAUTION

THE SAM DRAIN VALVE BLOCK IS CONNECTED TO THE APPARATUS COMPRESSED AIR SUPPLY VIA A 4-WAY AIR VALVE. DO NOT REMOVE A 4-WAY AIR VALVE, PF VALVE AIR CYLINDER, FITTINGS, OR AIR TUBES WHEN THE SYSTEM IS PRESSURIZED.

As a general maintenance practice, tag (document/photograph/record) the pipe routing and location (including the mating connector) for each drain line before disconnecting or removing it.

When replacing drain lines ensure service loops do NOT allow water to be trapped and cause damage from freezing water.

4.3.4 Datalogger Guidelines

Hale provides datalogging capability for SAM. Contact Hale Customer Service (800 533.3569) if a display or controller trouble exists. Utilize the following procedures only when instructed to do so by Hale.

4.3.4.1 Export Datalogger From SAM Control Center

When directed by Hale Customer Service, download the data log file from the SAM Control Center by performing the following.

- A. Open pump operator panel.
- B. Gain access to USB dongle.
- C. Connect a USB 2.0 flash drive to USB dongle. (See Figure 24, page 33; do NOT connect the Hale USB Key for this purpose.)
- D. Temporally, close panel.
- E. On SAM Control Center, touch MANUAL MODE button. See Figure 1 (page 11).
- F. Touch YES button. (See Figure 2, page 11.)
- G. On SAM Control Center, touch and hold system options button until loading icon completes circle (see Figure 25, page 34) and Enter Password screen is displayed (see Figure 26).
- H. Using Enter Password screen, touch OEM/Technician passwords digits.
- I. Touch ENTER button.
- J. Touch BAM tab.
- K. Touch Configuration Mode button.
- L. Touch  icon.
- M. Temporally, open panel.
- N. On rear of SAM Control Center, remove Hale USB Key.
- O. Connect a USB 2.0 flash drive to USB dongle. (See Figure 24, page 33; do NOT use the Hale USB Key for this purpose.)
- P. Touch Export Data Log To USB button.
- Q. Wait for Export Complete to display.
- R. If Export Failed displays, repeat entire procedure using a different USB 2.0 flash drive.
- S. When Export Complete displays, on rear of SAM Control Center, remove USB flash drive.
- T. On MENU screen, touch Reboot to GUI.
- U. Close pump operator panel.



4.3.4.2 Export Datalogger From SAM Pump Controller

When directed by Hale Customer Service, download the data log file from the SAM Pump Controller by performing the following.

- A. Open pump operator panel.
- B. Gain access to USB dongle on rear of SAM Pump Controller.
- C. Connect a USB 2.0 flash drive to USB dongle. (See Figure 24, page 33; do NOT connect the Hale USB Key for this purpose.)
- D. Temporally, close panel.
- E. On SAM Control Center, touch MANUAL MODE button. See Figure 1 (page 11).
- F. Touch YES button. (See Figure 2, page 11.)
- G. On SAM Pump Controller, touch and hold system options button until loading icon completes circle (see Figure 25, page 34) and Menu screen is displayed (see Figure 29, page 36).
- H. Touch Export Datalogger text.
- I. Wait while Saving file to USB stick ... is displayed.
- J. When **Data log file has been saved to the USB stick.** displays, on rear of SAM Pump Controller, remove USB flash drive.

NOTE

Reference FSG-MNL-00210 (SAM OIM), section 4 (System Overview) for icon and screen definitions/description information.

- K. On MENU screen, touch Back To Previous Screen icon.
- L. Close pump operator panel.

4.3.5 SAM Wire Harness Guidelines

SAM utilizes three SAE J1939 compliant CAN (500 kbit/s) buses: the Blue (loom color indicates the associated bus) bus interfaces the apparatus (primarily the ECU) and SAM; the Green bus provides controls and indications for the intake and sensors portion of the SAM system; and the Red bus provides controls and indications for the discharge portion of the SAM system. It is important to adhere to the following guidelines.

- Do NOT add or remove any device from SAM without first contacting Hale
- Always adhere to J1939 standards for physical length and connection
- Provide a service loop and strain relief for all harness connectors (water leakage can lead to service issues)
- Each of the three buses must be properly terminated to operate properly
- All SAM circuit breakers are auto resetting
- Most SAM bus connectors require standard Deutsch procedures and parts

Optionally, SAM may include a fourth CAN bus to support an added FOAM or CAFS system (the Orange bus). Contact Hale for all bus bridge issues or reference the following Hale manuals for other types of FOAM or CAFS issues.

- SmartFOAM Electronic Foam Proportioning Systems Models: Class A only–1.7AHP, 2.1A Class A/B–3.3, 5.0, 6.5 Description, Installation, and Operation Manual (FSG-MNL-00158)

- UV SmartCAFS Installation and Operation Manual (FSG-MNL-00157)

4.4. Removal And Replacement Of SAM Panel Components

The SAM system houses the following components on the apparatus; typically, on the pump operator panel. See Figure 32.

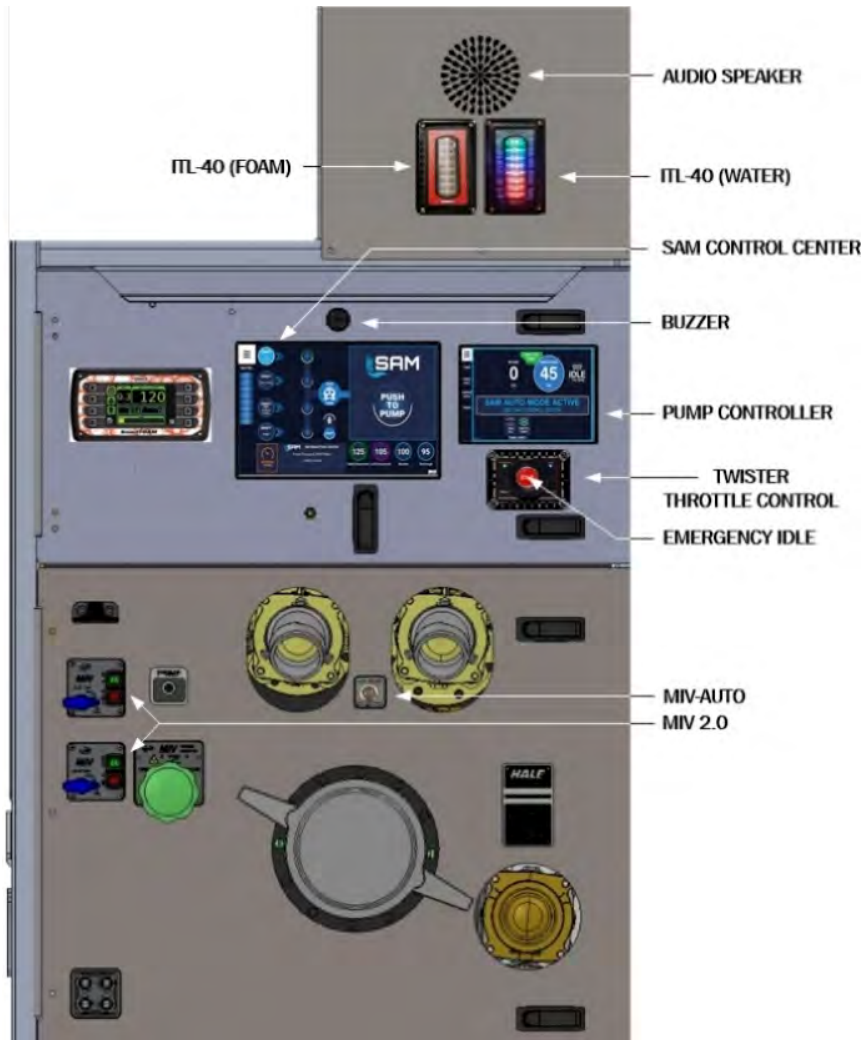


Figure 32. SAM Panel Components Locations (Operator Panel)

- Audio Speaker
- ITL-40 (FOAM)
- SAM Control Center (Master)
- MIV-Auto
- MIV 2.0
- Buzzer
- ITL-40 (WATER)
- Pump Controller
- Twister Throttle Control

The SAM system houses the following components on the apparatus; typically, on the officer side panel. See Figure 33.

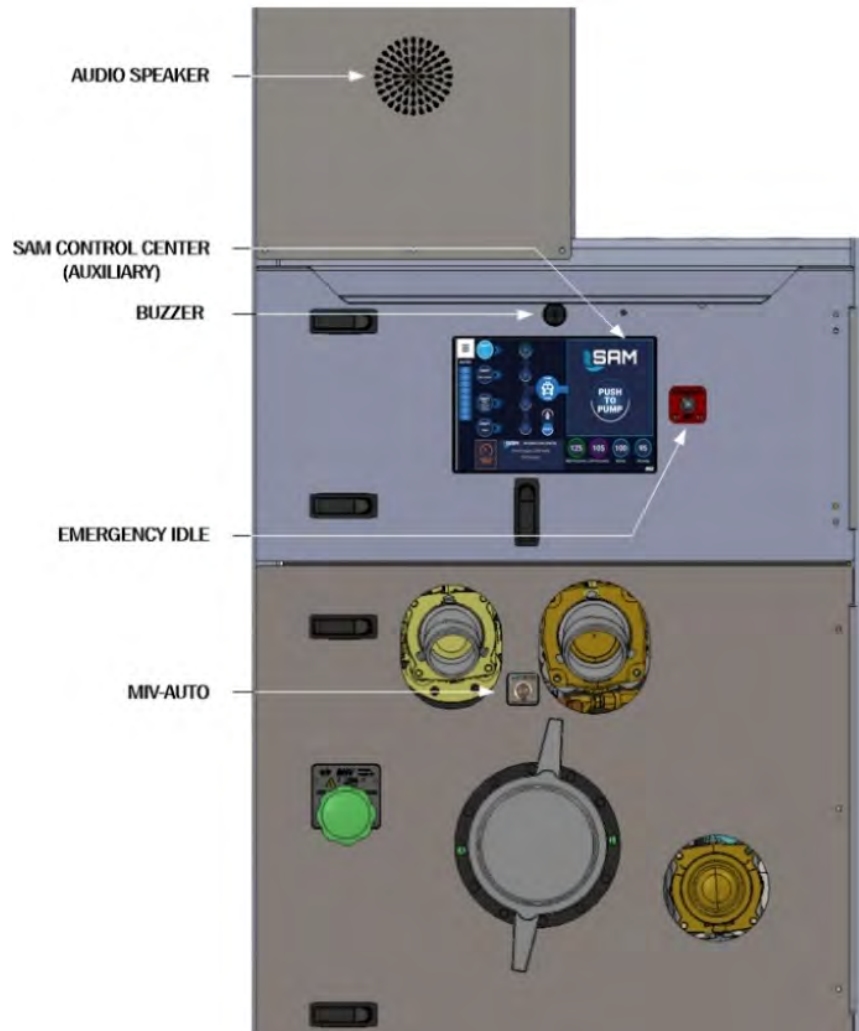


Figure 33. SAM Panel Components Locations (Officer Side)

- Audio Speaker
- SAM Control Center (Auxiliary)
- MIV-Auto
- Buzzer
- Emergency Idle

4.4.1 SAM Control Center (Master Or Auxiliary)

A SAM system always provides at least one (1) SAM Control Center touchscreen (the master, Figure 32), and optionally, up to two (2) more SAM Control Center touchscreens (the auxiliary SAM Control Centers). If the master (or an auxiliary) touchscreen (Figure 34) fails to function (the touchscreen provides program storage and execution, touch type man/machine interface, and Wi-Fi [master only] for the mobile tablet) or is damaged; replace the SAM Control Center as follows.

Refer Table 8 to for a list of tools and/or consumables required for this procedure.

Table 8. SAM Control Center (Master Or Auxiliary) Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Wire Cutter		Electrical Tags
5/64-in Hex Socket (Or Allen Key)		SAM Control Center (Master) <Refer to FSG-MNL-00212, Table 1, SAM Control Center>
Ratchet		SAM Control Center (Auxiliary) <Refer to FSG-MNL-00212, Table 1, Auxiliary SAM Control Center>
		SAM Control Center Mount <Refer to FSG-PL-001501, Sheet 1>

If the SAM Control Center touchscreen fails or is damaged; replace the touchscreen as follows.

Removal

- A. Open SAM operator panel.
- B. Note cable tie locations, cut ONLY ties required to R&R SAM Control Center.
- C. At rear of SAM Control Center, tag and disconnect electrical connectors.
(Up to four [4], some will be plugs.)
- D. Using 5/64-in hex socket and ratchet (set CCW) (or Allen key), loosen four [4] 8-32 x 1/2-in long button head hex screws. See Figure 34.

NOTE

Support the SAM Control Center and the mounting bracket to prevent both from falling while removing the mounting screws.

- E. Support SAM Control Center and bracket; remove four [4] screws (with lock washers).
- F. From rear of panel, remove SAM Control Center mounting bracket. See Figure 34.
- G. From front of panel, remove SAM Control Center. See Figure 34.

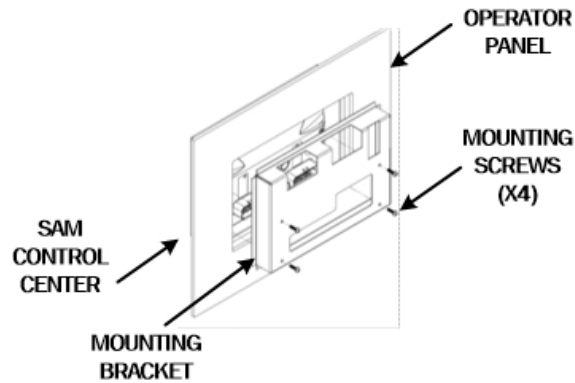


Figure 34. SAM Control Panel R&R

Installation

IMPORTANT NOTICE

THE CONTROLLER UNIT DEUTSCH CONNECTORS ARE KEYED TO PREVENT INTERCHANGE OR REVERSE DIRECTION INSERTION. DO NOT FORCE A CONNECTOR WITHOUT FIRST VERIFYING THE CONNECTORS ORIENTATION AND PLACEMENT.

NOTE

SAM Control Center orientation is connectors toward the bottom of the panel.

- A. From front of panel, align new SAM Control Center with opening in panel. See Figure 34.
- B. From rear of panel, place bracket over rear of SAM Control Center. See Figure 34.
- C. Support SAM Control Center and bracket; hand start four [4] 8-32 x 1/2-in long screws (each with a lock washer). See Figure 34.
- D. Using 5/64-in hex socket and ratchet (set CW) (or Allen key), tighten four [4] screws.
- E. Connect electrical connectors according to tags (including all plugs).
- F. Install cable ties cut to R&R SAM Control Center as noted.
- G. If master SAM Control Center, perform SAM Control Center Master Assignment. (See paragraph 4.12.2, page 132).
- H. If master SAM Control Center, perform Wi-Fi setup. (See paragraph 4.12.2, page 131.)

4.4.2 SAM Pump Controller

A SAM system provides only one (1) SAM Pump Controller touchscreen, if the touchscreen fails to function (the touchscreen provides program storage and execution, touch type man/machine interface, governor control, and engine/pump/miscellaneous statuses) or is damaged; replace the SAM Pump Controller as follows.

Refer Table 9 to for a list of tools and/or consumables required for this procedure.

Table 9. SAM Pump Controller Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
5/64-in Hex socket (Or Allen Key)		SAM Pump Controller <See FSG-PL-01505, Sheet 1>
Ratchet		

If the SAM Pump Controller touchscreen fails or is damaged; replace the touchscreen as follows.

Removal

- A. Open SAM operator panel.
- B. Note cable tie locations, cut ONLY ties required to R&R SAM Pump Controller.
- C. At rear of SAM Pump Controller, tag and disconnect electrical connectors (up to four [4]).
- D. Using 5/64-in hex socket and ratchet (set CCW) (or Allen key), remove two [2] 8-32 x 1/2-in long button head hex screws (with lock washers) and associated bracket. See Figure 35.

NOTE

Support the SAM Pump Controller to prevent the display and the remaining bracket from falling while removing the mounting screws. Removing one bracket at a time makes the R&R easier.

- E. Support SAM Pump Controller and remaining bracket; remove two [2] screws (with lock washers).
- F. Remove bracket.
- G. Remove SAM Pump Controller.

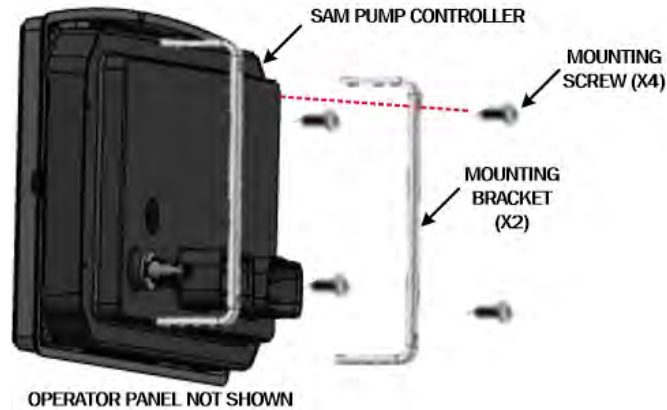


Figure 35. SAM Pump Controller R&R

Installation

IMPORTANT NOTICE

THE CONTROLLER UNIT DEUTSCH CONNECTORS ARE KEYED TO PREVENT INTER-CHANGE OR REVERSE DIRECTION INSERTION. DO NOT FORCE A CONNECTOR WITHOUT FIRST VERIFYING THE CONNECTORS ORIENTATION AND PLACEMENT.

NOTE

SAM Control Center orientation is connectors toward the bottom of the panel.
See Figure 35.

- A. Align new SAM Pump Controller with opening in panel and support SAM Pump Controller until secured by first bracket.
- B. Place one bracket over rear of SAM Pump Controller.
- C. Align new SAM Pump Controller and bracket screw holes.
- D. Hand start two [2] 8-32 x 1/2-in long button head hex screws (each with a lock washer).
- E. Align second bracket to rear of SAM Pump Controller.
- F. Hand start remaining two [2] screws (each with a lock washer).
- G. Using #5/64-in hex socket and ratchet (set CW) (or Allen key), tighten four [4] screws.
- H. Connect electrical connectors according to tags (including all plugs).
- I. Install cable ties cut to R&R SAM Pump Controller as noted.
- J. Perform SAM Pump Controller Setup (see paragraph 4.12.4, page 135) to set SAM Pump Controller stored parameters.

4.4.3 Buzzer

A SAM system provides a warning buzzer on the operators panel to notify the operator the SAM Control Center (or SAM Pump Controller) requires attention. Table 10 provides the SAM system from/to wire listing.

Table 10. Buzzer Wiring (From/To Listing)

From (Pin)	To
	System Power (+12 VDC)
	SAM Pump Controller, Connector A, Pin 22

Refer to Table 11 for a list of tools and/or consumables required for this procedure.

Table 11. Buzzer Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Wire Cutter		Buzzer <See FSG-PL-01505, Sheet 1>
Slip Joint Pliers (At Least 40 mm Jaw Opening)		

If the buzzer fails to produce sound or is damaged; replace the buzzer as follows.

Removal

- Open SAM operator panel (or Officers side panel).
- Note cable tie locations, cut ONLY ties required to R&R buzzer.
- At rear of buzzer, tag and disconnect two [2] wires.
- Using slip joint pliers, remove retaining ring from front of buzzer. See Figure 36.
- Push buzzer thru panel and remove buzzer.



Figure 36. Buzzer R&R

Installation

- If applicable, remove two [2] screws.
- Discard screws.
- Using slip joint pliers, remove ring from front of new buzzer.

- D. Align and push buzzer thru panel.
- E. Install ring. (Use slip joint pliers to tighten nut.)
- F. Connect two [2] wires according to tags.
- G. Install cable ties cut to R&R buzzer as noted.

4.4.4 Emergency Idle Switch

An emergency idle switch (Figure 37) is collocated with each auxiliary SAM Control Center. The switch is a single pole normally open momentary switch. A switch shroud is provided to prevent inadvertent activation.



Figure 37. Emergency Idle Switch Panel

If an auxiliary SAM Control Center is added to the SAM system, the switch may be mounted via a thru hole drilled (or punched) in the panel adjacent to the auxiliary SAM Control Center. Refer to FSG-PL-01505, sheet 4, for details. Table 12 provides the SAM system from/to wire listing.

Table 12. Emergency Idle Switch Wiring (From/To Listing)

From Emergency Idle Button (Pin)	To SAM Breaker Box	To SAM Control Center Connector A (Black)
1	Connector 1, Pin 3	N/C
2	N/C	1 (Engine Idle) [Input]

NOTE: Pins are NOT marked on the switch, connect as desired.

Refer to Table 13 for a list of tools and/or consumables required for this procedure.

Table 13. Emergency Idle Switch Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Slip Joint Pliers (At Least 25 mm Jaw Opening)		Switch <See FSG-PL-01505, Sheet 4>
7/8-in Wrench		
Screwdriver (Flat or Phillips)		
Wire Cutter		

If the switch fails to activate an idle or is damaged; replace the switch as follows.

Removal

- A. Open SAM panel.
- B. Note cable tie locations, cut ONLY ties required to R&R emergency idle switch.

NOTE

If switch terminals are NOT numbered/marked, there is no need to tag the wires.

- C. Using screwdriver, at rear of switch, tag and disconnect two [2] wires.
- D. Using 7/8-in wrench, loosen jam nut from rear of switch.
- E. Using slip joint pliers, remove protective shroud from front of switch.
- F. Remove switch.

NOTE

Only replace placard if required because of damage.

Installation

- A. Install jam nut on new switch.
- B. Align and push switch thru panel.
- C. On front of switch, install shroud. (Use slip joint pliers to tighten shroud.)
- D. On rear of switch, using 7/8-in wrench, tighten jam nut.

NOTE

If switch terminals are NOT numbered/marked, connect as desired.

- E. Using screwdriver, connect two [2] wires according to tags.
- F. Install cable ties cut to R&R switch as noted.

4.4.5 Twister Throttle Controller

The SAM system utilizes one [1] Hale Twister Throttle Controller (Figure 38), version 3.2 (Rev A or newer), typically mounted on the apparatus operator panel. The throttle control knob ONLY controls engine speed when SAM is in Manual Mode, however, the IDLE button is always available.

NOTE

The Twister that comes with a SAM system is auto configuring/preconfigured for SAM. Do NOT change the Twister settings as described in the Twister manual. (Used for older versions of Twister and non SAM applications.)



Figure 38. Hale Twister



Table 14 provides the SAM system from/to wire listing.

Table 14. Twister Wiring (From/To Listing)

From Twister (Pin)			To SAM Breaker Box	To Control Center Black Connector
1	(Power)	[Input]	Connector 1, Pin 3	N/C
2	(Ground)	[Input]	Main Ground Stud (On Pump Body)	
3	Interlock	[Input]	N/C	
4	(CAN High)	[Bus]		19 (CAN2 High)
5	(CAN Low)	[Bus]		18 (CAN2 Low)
6	(CAN Shield)	[Bus]		N/C

Refer to Table 15 for a list of tools and/or consumables required for this procedure.

Table 15. Twister Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
11/32-in Nut Driver (Or Wrench Or Socket With Ratchet)		Twister <See FSG-PL-01505, Sheet 1>
#1 Phillips Screwdriver		
Wire Cutter		

If the Twister fails to control engine speed (or activate an idle) or is damaged; replace the Twister as follows.

Removal

- A. Open SAM panel.
- B. Note cable tie locations, cut ONLY ties required to R&R Twister.
- C. Tag and disconnect electrical connector.
- D. Using screwdriver and nut driver (or wrench/socket), loosen four [4] machine screws (with washers) and locking nuts.
- E. Remove three [3] screws (with washers) and locking nuts.
- F. Support Twister while removing remaining screw (with washer) and locking nut.
- G. Remove Twister.

Installation

- A. Align Twister with panel opening and support Twister during installation.
- B. Hand start four [4] screws (with washers) and locking nuts.
- C. Using screwdriver and nut driver (or wrench/socket), tighten four [4] screws (with washers) and locking nuts.
- D. Connect electrical connector according to tags.
- E. Install cable ties cut to R&R Twister as noted.
- F. Close SAM panel.

4.4.6 ITL-40 Tank Level (Onboard Water or Foam Tank)

SAM utilizes the HALE ITL-40 tank level display system (Figure 39). The SAM operator panel houses the master display unit, the sensor is tank mounted, and optional remoted displays are supported. Refer to the Intelli-Tank Level Operation Manual (P/N 118253) for ITL-40 installation and integration details.



Figure 39. ITL-40 Tank Level Indicator

Optionally, additional ITL-40s are used to display the level of foam in a type A and/or type B foam concentrate tank and/or to provide remotely located displays for any or all of the master displays. If installing an ILT-40 as part of an optional FOAM or CAFS system, the ITL-40 for foam tank A must be set to CAN device address 2 (0xCC) and the ITL-40 for foam tank B must be set to CAN device address 3 (0xCD). Table 16 provides the SAM system from to wire listing.

Table 16. ITL-40 Wiring (From/To Listing) (Water)

From ITL-40 Pin (Pin) (Signal) [Type]	To Green CAN Bus	To SAM Breaker Box	To Tank Transducer (Pin)
1 (Power) [Input]	N/A	Connector 1 Pin 3	N/A
2 (CAN High) [Buss]	CAN High	N/A	N/A
3 (CAN Shield) [Buss]	CAN Shield	N/A	N/A
4 (Dim Input) [Input]	N/A	N/A	N/A
5 (Sensor Reference +) [Output]	N/A	N/A	A
6 (Sensor Signal) [Input]	N/A	N/A	C
7 (Sensor Reference -) [Output]	N/A	N/A	B
8 (Auxiliary Output) [Output]	N/A	N/A	N/A
9 (1-Wire Signal) [Output]	N/A	N/A	N/A
10 (1-Wire Ground) [Output]	N/A	N/A	N/A
11 (CAN Low) [Buss]	CAN Low	N/A	N/A
12 (Ground) [Input]	N/A	Main Ground Stud (On Pump Body)	N/A

NOTES

The ITL-40 is shipped already configured and tested to work with SAM. The ITL-40 ONLY requires calibration, do NOT reset the ITL-40 configuration.

For square (or rectangular) tanks Hale recommends a 2-point calibration, for T-shaped, oval, or round tanks Hale recommends the appropriate volume calibration (5 or 9-point).

Always calibrate the ITL then verify CAN communications.

When utilizing master/remote(s) reference section 6.3 of the manual.

When utilizing foam ITL-40s, reference Paragraph 3.7.3., Configuring a display as a Master with CAN communications, for address 2 and/or address 3 setting information.

When expanding a CAN bus always ensure shielding and proper termination.

Refer to Table 17 for a list of tools and/or consumables required for this procedure.

Table 17. ITL-40 Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
5/16-in Nut Driver (Or Wrench)		Twister <See FSG-PL-01505, Sheet 1>
#1 Phillips Screwdriver		6-32 Nyloc SS nut <P/N 102514>
Wire Cutter		

If the ITL-40 fails to display the water level or is damaged; replace the display as follows.

Removal

- Open SAM panel.
- Note cable tie locations, cut ONLY ties required to R&R ITL-40.
- Tag and disconnect electrical connector.
- Using screwdriver and nut driver (or wrench), loosen four [4] 6-32 x 3/4-in long screws and Nyloc nuts. Discard nuts.
- Remove three [3] screws and nuts.
- Support ITL-40 while removing remaining screw and nut.
- Remove ITL-40.

Installation

- Align ITL-40 with panel opening and support display during installation.
- Hand start four [4] 6-32 x 3/4-in screws and four [4] new 6-32 stainless steel Nyloc nuts.
- Using screwdriver and nut driver (or wrench/socket), tighten four [4] screws and nuts.
- Connect electrical connector according to tags.
- Install cable ties cut to R&R ITL-40 as noted.
- Close SAM panel.

4.4.6.1 Onboard Tank Water Or Foam Tank Level Sensor

Refer to the ITL-40 Tank Level Quick Start Guide (P/N 118252) or Class 1 Operation Manual, Intelli-Tank Level 40 (P/N 118253) to locate the onboard tank water level pressure transducer (see Figure 40).

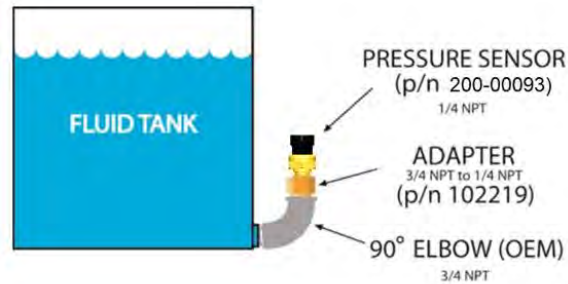


Figure 40. Onboard Water Tank Level Transducer Installation

See Figure 41 for the transducers pin layout and Table 18 for the transducer to ITL-40 pin connections.



Figure 41. Hale Pressure Transducer And Pin Layout

Table 18. Onboard Tank Water Level Sensor Wiring (From/To Listing)

From Pressure Transducer Pin	To ITL-40 Pin		
A (+ 5V Reference)	5	(+ 5V Reference)	[Output]
B (Reference Return)	7	(5V Reference Return)	[Output]
C (Pressure Signal)	6	(Pressure Signal)	[Input]

Refer to Table 19 for a list of tools and/or consumables required for this procedure.

Table 19. ITL-40 Pressure Transducer Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
1-in Wrench		Loctite 580 (or Equivalent)
Wire Cutter		Pressure Transducer <See FSG-PL-01505, Sheet 1>

If the ITL-40 fails to display the water level or the transducer is damaged; replace the transducer as follows.

Removal

- A. Locate transducer.
- B. Note cable tie locations, cut ONLY ties required to R&R ITL-40 pressure transducer.
- C. Tag and disconnect electrical connector.
- D. Using 1-in wrench, turn CCW to loosen transducer.
- E. Remove transducer.

Installation

- A. Carefully apply Loctite 580 (or equivalent) to threads.
(Do NOT allow sealant to enter the transducer opening.)
- B. Install transducer.
- C. Torque transducer to 15 lb-ft.

4.4.7 MIV-E Override Panel

A SAM MIV-E override panel (Figure 42) is provided for each MIV. Each MIV-E override panel houses an illuminated momentary contact rocker switch and a manually operated air bleed valve (with a check valve attached).

The switch illuminates green for fully open or red for fully closed (toggles green/red when MIV is between open and closed).

The switch is connected to the MIV valve drive module (see paragraph 2.4.2.4, page 24) via the placards six pin Deutsch connector (male) and the associated electric auto MIV control harness (ROCKER SWITCH connector, a six pin Deutsch female). Pressing (and holding) the OPEN side of the switch applies +12 VDC to open the MIV and pressing (and holding) the CLOSE side of the switch applies -12 VDC to close the MIV.



Figure 42. MIV-E Override Panel



Table 20 provides the SAM system from/to wire listing.

Table 20. MIV-E Override Switch Wiring (From/To Listing)

From MIV-E Override Switch Connector Pin	To MIV Valve Drive Module Pin	To Breaker Box Connector 3 Pin
1 (SYSTEM GROUND)	N/C	Main Ground Stud (On Pump Body)
2 (DIRECTION SW SIGNAL)	10 (DIRECTION SW SIGNAL) [Input]	N/C
3 (SYSTEM POWER)	N/C	LH MIV, T-Port = 1 RH MIV, BOT MIV = 4
4 (CLOSE VLV INDICATOR)	7 (CLOSE VLV INDICATOR) [Output]	N/C
5 (SYSTEM POWER)	N/C	LH MIV, T-Port = 1 RH MIV, BOT MIV = 4
6 (OPEN VLV INDICATOR)	5 (OPEN VLV INDICATOR) [Output]	N/C

Refer to Table 21 for a list of tools and/or consumables required for this procedure.

Table 21. MIV-E Override Panel Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
11/32-in Nut Driver (Or Wrench Or Socket With Ratchet)		MIV-E Override Panel <See FSG-PL-01505, Sheet 2>
#2 Phillips Screwdriver		

If the MIV-E override panel switch or bleed valve fails or the placard (or its components) is damaged; replace the assembly as follows.

Removal

- Open/remove panel housing MIV-E override.
- Note cable tie locations, cut ONLY ties required to R&R MIV-E override panel. (Air bleed/check valve tubing and switch wiring).
- Tag and disconnect electrical connector at harness.
- Tag and disconnect air bleed tubing (3/8-in POH connection).
- Using 11/32-in nut driver (or wrench or socket with ratchet) and #2 Phillips screwdriver, remove four [4] lock nuts from rear of panel and four [4] 8-32 x 0.75-in long pan head screws from placard.
- Remove placard assembly.

Installation

NOTE

If the switch from the kit requires assembly, note switch orientation (long tab at bottom) and install the new switch to match. Use new or existing placard as applicable.

NOTE

If the air bleed valve from the kit requires assembly, connect the check valve to the straight thru port on the air bleed valve with the flow indicator (arrow) pointing away from the air bleed valve and connect the adapter to the check valve output (output of adapter goes to atmosphere), then connect the 90 degree elbow to the top center port of the air bleed valve and the tubing to the input of the elbow as tagged. See Figure 43.

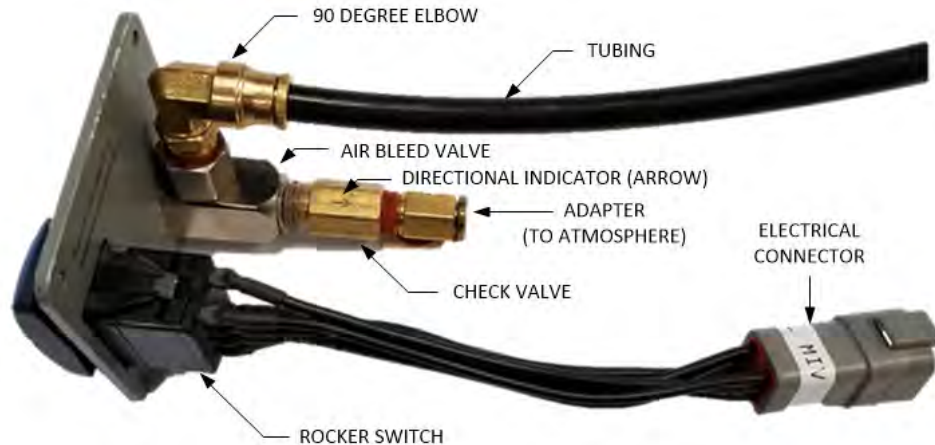


Figure 43. MIV-E Override Panel Air Bleed Valve Assembly

- A. Align placard with panel.
- B. Insert four [4] 8–32 x 0.75-in long pan head screws thru placard and panel.
- C. Install four [4] lock nuts at back of panel.
- D. Connect wire harness according to tags.
- E. Connect air bleed tubing according to tag.
- F. Install cable ties cut to R&R placard assembly as noted.

4.4.8 MIV Activation Button

A SAM MIV activation button (Figure 44) is also collocated with each MIV. Each MIV activation placard houses an illuminated momentary contact pushbutton switch. The illuminated ring illuminates solid green to indicate the associated master intake valve is closed and available, flashes while the master intake valve is opening and then extinguishes when the valve is fully open.



Figure 44. Hale MIV Activation Button



The LIGHTED PB SWT # X (X = 1 thru 3) four [4] pin Deutsch connector (female) connects to the corresponding MIV-Auto Module harness, LIGHTED PUSHBUTTON SWT # X connector (Male) and the primary MIV-A module. See Table 22 for the MIV activation button from/to wire listing.

NOTE

If equipped with a fourth master intake valve, connect the fourth MIV Activation Button per 513-00145-004 (This harness is only used when four or more master intake valves are specified.) to the slave MIV-A module.

Table 22. MIV Activation Button Wiring (From/To Listing)

From Auto MIV Button # Connector Pin	To (Primary) MIV-A Module Connector : Pin	To Breaker Box
LH MIV (PB SWT # 1)		
1 (SYSTEM POWER)	N/C	Connector 3, Pin 1
2 (SW MOMENTARY)	A : 6 (SW-1 MOMENTARY) [Input]	N/C
3 (SW LED)	B : 5 (PB SW LED #1) [Output]	N/C
4 (SYSTEM GROUND)	N/C	Main Ground Stud *
RH MIV (PB SWT # 2)		
1 (SYSTEM POWER)	N/C	Connector 3, Pin 4
2 (SW MOMENTARY)	A : 7 (SW-2 MOMENTARY) [Input]	N/C
3 (SW LED)	B : 8 (PB SW LED #2) [Output]	N/C
4 (SYSTEM GROUND)	N/C	Main Ground Stud *
Bottom MIV (PB SWT # 3)		
1 (SYSTEM POWER)	N/C	Connector 3, Pin 4
2 (SW MOMENTARY)	A : 8 (SW-3 MOMENTARY) [Input]	N/C
3 (SW LED)	B : 6 (PB SW LED #3) [Output]	N/C
4 (SYSTEM GROUND)	N/C	Main Ground Stud *
T-Port MIV (PB SWT # 4)	To Slave MIV-A Module Pin	
1 (SYSTEM POWER)	N/C	Connector 3, Pin 1
2 (SW MOMENTARY)	A : 6 (SW-1 MOMENTARY) [Input]	N/C
3 (SW LED)	B : 5 (PB SW LED #1) [Output]	N/C
4 (SYSTEM GROUND)	N/C	Main Ground Stud *

* Located on pump body.



Refer to Table 23 for a list of tools and/or consumables required for this procedure.

Table 23. MIV Activation Button Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
1-in Wrench		Cleaner (See paragraph 4.1.3, page 44.)
Wire Cutter		Cable Ties (As Required)
Non Marring Hammer		MIV Activation Button <See FSG-PL-01505, Sheet 2>
Punch		MIV Activation Placard <See FSG-PL-01505, Sheet 2>

If an MIV activation button (activation switch or indicator) fails or the placard is damaged; replace the assembly as follows.

Removal

- A. Open/remove MIV cover panel.
- B. Note cable tie locations, cut **ONLY** ties required to R&R MIV activation button.
- C. Tag and disconnect electrical connector from harness.
- D. At rear of switch, using 1-in wrench, remove nut.
- E. Remove switch.

NOTE

If the placard is NOT damaged, do NOT remove and replace the placard.

Placard Removal

- A. Open/remove MIV cover panel.

NOTE

The hole in the panel is larger than the hole in the placard.

- B. At rear of panel, place punch on rear of placard, strike punch with hammer to remove placard from panel.
- C. Clean and dry panel to remove all remaining adhesive. (See Table 23.)

Placard Installation

- A. Secure/support MIV cover panel.
- B. Remove protective paper from rear of placard.

NOTES

Do NOT let the placard touch the panel before proper alignment is achieved. (The placard is coated with a onetime use adhesive.)

The panel must be completely clean and dry before applying the new placard.

- C. Align (square and plumb) placard with panel edges and center placard hole over panel hole.
- D. Press placard on to panel firmly.
- E. Open/remove MIV cover panel.



Installation

- A. Remove nut from rear of new switch, cable assembly, and connector.
- B. Align and push switch thru panel.
- C. Install nut. (Slip nut over connector and cable assembly.)
- D. Using 1-in wrench , tighten nut. (Do NOT over tighten.)
- E. Connect wiring according to tags.
- F. Install cable ties cut to R&R switch as noted.

4.4.9 Optional Navigator Controllers

Refer to Akron Brass 126914, Style 9335 Navigator Pro With Pressure, Flow CAFS And Valve Control Installation, Operating, And Maintenance Instructions and/or 123250, Style 9325 Navigator Pro With Pressure, Flow CAFS And Valve Control Installation, Operating, And Maintenance Instructions for all aspects of maintenance for a Navigator Pro controller.

Refer to the drawings listed in FSG-MNL-00212, SAM Parts Manual, Table 1, Optional Component/Item, Navigator for connection, connector part numbers, and SAM compatible Navigator part information.

4.5. Removal And Replacement Of Akron Brass Valves

The following subparagraphs provide reference to or information and instruction for the Akron Brass motorized Swing-Out™ valves used for the SAM system. SAM utilizes both Gen 1 and/or Gen 2 valves and as long as physical space allows the valves are interchangeable.

IMPORTANT ▲ NOTICE

AN OFF-THE-SHELF AKRON BRASS SWING-OUT™ VALVE WILL NOT FUNCTION IN A HALE SAM SYSTEM. DO NOT USE ONE FOR SUBSTITUTION OR REPLACEMENT PURPOSES.

4.5.1 Recording SAM System Information Parameters

IMPORTANT ▲ NOTICE

IF THE SAM SYSTEM IS TURNED OFF IN CONFIGURATION MODE, WHEN TURNED ON, THE SYSTEM WILL RETURN TO CONFIGURATION MODE. THIS MAY CAUSE A PROBLEM FOR AN END USER (FIREFIGHTER). ALWAYS REBOOT TO THE GUI BEFORE TURNING THE SYSTEM OFF.

Prior to physically removing an Akron Brass valve, perform the following to access and record the system parameters associated with that valve.

- A. On SAM Control Center, touch MANUAL MODE button. See Figure 1 (page 11).
- B. Touch YES button. (See Figure 2.)
- C. On rear of SAM Control Center, connect USB Key to USB dongle. See Figure 24.
- D. On SAM Control Center, touch and hold system options button until loading icon completes circle. (See Figure 25, page 34.)
- E. When password screen is displayed (see Figure 26), enter OEM/Technician password. (All OEM/Technician passwords are ONLY provided at Hale training.)
- F. Touch BAM tab.
- G. Touch Configuration Menu button.



- H. When SELECT DEVICE MENU appears, touch desired valves row in list.
- I. When EDIT VALVE screen appears, note/record all parameters listed. (Friendly Name, Index, Function, MAX PSI, Preset PSI, Preset CAFS, CAFS Capable, Diameter, and Color[s]) (Up to three.)

NOTES

Refer to FSG-PL-01508, enter VALVE P/N based on table located in the drawing; enter VALVE MOTOR POSITION based on comparing physical valve to POSITION 1 thru POSITION 4 located in drawing; enter NAME ON CONTROL SCREEN based on Friendly Name from Step I (above); SCREEN LOCATION (enter D1 thru D12) based on the D number references shown on the MANUAL VALVE CONTROL screen in the drawing; enter COLOR based on Color(s) from Step I (above); and WATER ONLY/FOAM/CAFS based on Preset CAFS, CAFS Capable parameters from Step I (above).

The recorded parameters will be entered after the replacement valve is installed and ONLY if the valve requires configuration. (See section 6, SAM Setup/Configuration, page 187.)

- J. Exit EDIT VALVE screen. (Touch Home icon; top center of screen.)
- K. Reboot to GUI as follows.
 - 1. Touch MENU button (top center of screen).
 - 2. When Home MENU screen appears, touch More button.
 - 3. Touch Reboot to GUI button.

4.5.2 Discharge And Special Purpose Valve Removal And Replacement

Prior to removing an Akron Brass valve, perform paragraph 4.5.1 (above). If the valve requires clocking (for physical override access purposes), perform paragraph 4.5.3, (below) to ensure the valve physically operates correctly after reassembly.

IMPORTANT NOTICE

AKRON BRASS SWING-OUT™ VALVES FROM A DISCHARGE PORT WILL NOT FUNCTION IN THE PLACE OF ANY SPECIAL PURPOSE VALVE (TF, T2P, PONY) IN A HALE SAM SYSTEM. DO NOT USE ONE FOR SUBSTITUTION OR REPLACEMENT PURPOSES.

Tank Fill Valve

The tank fill supports water supply management (intake) even though it connects to a pump discharge port (it is used to replenish the water supply provided by the onboard water tank).

Typically, a 2-in Style 8600 Swing-Out™ valve with electric actuator and motor driver is connected to port I or port B for a Qmax-XS or port B for a Qmax to provide tank fill water flow. For Akron Brass valve address information, see paragraph 2.4.5 (page 26) and for valve size/part number reference the SAM Parts Manual (FSG-MNL-00212). Also reference the SAM PM for the Qmax-XS (refer to FSG-PL-01209) and Qmax (refer to FSG-PL-01510) port diagram located on the flash drive provided with the pump or available from the Hale Products website (www.haleproducts.com).

Tank-To-Pump Valve

Typically, a 3-in Style 8600 Swing-Out™ valve with electric actuator and motor driver is connected to port S for a Qmax-XS or Qmax to provide tank-to-pump water flow. For Akron Brass valve address information, see paragraph 2.4.5 (page 26) and for valve size/part numbers reference the SAM Parts Manual (FSG-MNL-00212). Also reference the SAM PM for the Qmax-XS



(refer to FSG-PL-01209) and Qmax (refer to FSG-PL-01510) port diagram located on the flash drive provided with the pump or available from the Hale Products website (www.hale-products.com).

Refer to Table 24 for a list of tools and/or consumables required for this procedure.

Table 24. Akron Brass Valve R&R Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
7/16-in Wrench		Cable Ties (As Required)
9/16-in Socket (Or Wrench) (All valves except 4-in)		Akron Brass Swing-Out™ Valve <See FSG-PL-01506>
3/4-in Socket (Or Wrench) (Only 4-in valves)		
Driver (Ratchet)		
Wire Cutter		
Optional (Only Required For Valve Clocking)		
3/32-in (T-Handle) Allen Wrench (Gen I and Gen II Housing Screws)		Loctite 222 (or equivalent)
5/32-in (T-Handle) Allen Wrench (Gen I Motor Driver Screws)		
7/64-in (T-Handle) Allen Wrench (Gen II Motor Driver Screws)		

Perform the following to remove and replace an Akron Brass motorized Swing-Out™ valve used in a SAM system.

Removal

- A. Tag and disconnect all electric valve actuator connections.
- B. If required, tag and disconnect all drain lines. ONLY disconnect drains required to remove valve.
- C. If required (applies to all discharge valves), tag and disconnect pressure sensor electrical connector. Note/record sensor and/or 45-degree adapter orientation.
- D. If required (applies to all discharge valves), tag and disconnect flowmeter electrical connector. (Flowmeters are optional and may NOT be present.)
- E. Remove outlet flange/adapter as follows.
 1. For all except 4-in valves, use a 9/16-in socket and driver (or socket and ratchet, or wrench), remove four [4] 3/8–16 X 1 1/2-in long screws (with lock and flat washers). For 4-in valves, use 3/4-in socket and driver (or ratchet, or wrench) to remove four [4] 1/2–13 X 1 1/2-in long screws (with lock and flat washers).
 2. Separate flange/adapter from valve.
- F. Remove valve from inlet flange/adapter as follows.
 1. Support valve while removing screws from inlet flange/adapter.



2. For all except 4-in valves, use a 9/16-in socket and driver (or socket and ratchet, or wrench), remove four [4] 3/8–16 X 1 1/2-in long screws (with lock and flat washers). For 4-in valves, use 3/4-in socket and driver (or ratchet, or wrench) to remove four [4] 1/2–13 X 1 1/2-in long screws (with lock and flat washers).
3. Separate flange/adapter from valve.

Installation

If required, clock new valve to match failed valves motor/actuator orientation. Refer to Akron Brass Installation Instructions for Style 8600 Electric Actuator With Motor Driver (P/N 123248) for a Gen I valve or 127890, Style 8600 Electric Actuator Installation Instructions for a Gen II valve and correct valves sector gear location/orientation.

Prior to installing a newly clocked valve, perform paragraph 4.5.3, Verifying Valve Operation After Valve Clocking (below). Then continue the Installation portion of this procedure.

If an Akron Brass Swing-Out™ valve requires a repair kit to rebuild it, refer to the SAM PM (FSG-MNL-00212), Repair Part Kits (paragraph 2.2.2.2).

- A. Install new valve on inlet flange/adapter as follows.

IMPORTANT ▲ NOTICE

Do not lubricate the Ball or Seats. Lubricants can collect dirt and grit, which can cause excessive wear. Water is a natural lubricant. Periodic actuation of the valve will help prevent sticking. Periodic Flushing is recommended to remove dirt and debris which may cause excessive Valve wear and premature failure.

IMPORTANT ▲ NOTICE

Reversing the inlet and outlet of an 8840 (4-in) Akron Brass Swing-Out™ Valve reduces the pressure rating of the valve.

1. Align inlet side of new valve to inlet flange/adapter.
 2. Hand start four [4] screws (each with a lock washer and a flat washer). (3/8–16 X 1 1/2-in long screws [for all valve sizes less than 3-in]) or (1/2–13 X 1 1/2-in long screws [for all valve sizes 3-in or larger])
 3. Tighten/torque four screws in accordance with Adapter Torque Requirements paragraph and figure. (Refer to 109896, Akron Swing-Out™ Valve Installation And Operating Instructions for both Gen I and Gen II valves.)
- B. Install outlet flange/adapter as follows.
 1. Align outlet flange/adapter to new valve.
 2. Hand start four [4] screws (each with a lock washer and a flat washer). (3/8–16 X 1 1/2-in long screws [for all valve sizes less than 3-in]) or (1/2–13 X 1 1/2-in long screws [for all valve sizes 3-in or larger])
 3. Tighten/torque four screws in accordance with Adapter Torque Requirements paragraph and figure. (Refer to 109896, Akron Swing-Out™ Valve Installation And Operating Instructions for both Gen I and Gen II valves.)

NOTE

All replacement Akron Brass Swing-Out™ valves, in a SAM system, require the submission of FSG-PL-01508 when ordered. (Provides the parameters of the valve being replaced so Hale Products can program the replacement valve.) If the replacement valve programming fails (or the information provided was incorrect) perform the following.

- C. If required, perform paragraph 6.1.3.1 (page 188) to update new valves memory/parameters. (The information required to perform an update [using the Device Select Menu procedure] was noted/recorded in paragraph 4.5.1 [page 67]).
- D. Perform paragraph 6.2, Identifying Which Physical Valve A UID Corresponds To, (page 187) to verify replacement valve contains correct programming/software.
- E. Perform applicable subparagraph(s) of section 5, Adjustments, page 173. See NOTES below.

NOTES

All replacement Akron Brass Swing-Out™ valves in a SAM system require the performance of the Valve Position Procedures (see paragraph 5.2.1, page 173).

Additionally, Akron Brass Swing-Out™ valves (used for discharge purposes in a SAM system) require the performance of the Pressure Procedures (see paragraph 5.2.2, page 177) in addition to the Valve Position Procedures (referenced above).

If the replacement Akron Brass Swing-Out™ valve is optionally equipped with a flowmeter, perform the Flowmeter Procedures (see paragraph 5.2.3, page 178).

4.5.3 Verifying Valve Operation After Valve Clocking

NOTE

All intake valves are clocked and tested by Hale and should NOT require clocking. If a valves clocking is changed perform the following to ensure proper valve assembly after clocking the valve.

Perform the following to verify post valve clocking reassembly operation of all disassembled Akron Brass swing-out discharge valves.

Refer to Table 25 for a list of tools and/or consumables required for this procedure.

Table 25. Akron Brass Valve Operation Verification Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
7/16-in Wrench		Cable Ties (As Required)

- A. Examine valve to determine ball portion of vales position.

IMPORTANT ⚠ NOTICE

DO NOT USE A DRIVER AND SOCKET TO INITIALLY MOVE A CLOCKED VALVE.

- B. If ball is closed (or partially closed), open valve as follows. Otherwise go to Step C.
 1. Using 7/16-in wrench, turn motor shaft CW.
 2. Verify valve ball rotates CCW and fully opens.

IMPORTANT ⚠ NOTICE

DO NOT USE A DRIVER AND SOCKET TO INITIALLY MOVE A CLOCKED VALVE.

- C. If ball is open (or partially open), close valve as follows.
 1. Using 7/16-in wrench, turn motor shaft CCW.
 2. Verify valve ball rotates CW and fully closes.

If a valve fails to rotate in the correct direction, jams, or when the motor shaft is rotated in the correct direction the valve ball rotates in the wrong direction; reference Akron Brass installation instructions for Style 8600 Electric Actuator With Motor Driver (P/N 123248) and correct valves sector gear location/orientation and then perform this procedure again.

4.6. Removal And Replacement Of SAM MIVs

Refer to the MIV 2.0 OIM (FSG-MNL-00216), TM (FSG-MNL-00217), and/or PM (FSG-MNL-00218) for MIV 2.0 information.

4.7. Removal And Replacement Of SAM Sensors

SAM sensors, modules, and displays do NOT require additional ESD protect or ESD procedures. All SAM sensors must be ordered thru Hale (or a FAST/OEM builder) to be plug and play, ready for install in the SAM system. Do NOT substitute other sourced sensors into a SAM system.

4.7.1 Barometer (Atmospheric Pressure)

The barometric sensor (Figure 45) is secured to the top of the left intake (Q series) or right intake (D series) with a mounted bracket using two (2) 1/4-20 X 1-1/4-in long washer head machine screws (use Loctite 243 on threads).

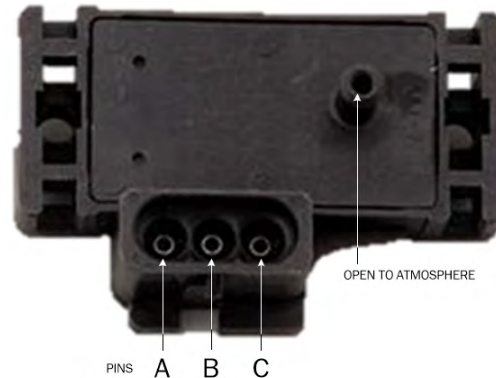


Figure 45. Barometric Sensor

The sensor houses three pins, see Figure 45 for the pin layout and Table 26 for the pin connections. Notice the atmospheric port must remain open to the atmosphere.

Table 26. Barometric Sensor Wiring (From/To Listing)

From (Pin)	To
A	System Ground (Main Ground Stud – on pump body)
B	Sensor Module / Connector B / Pin 10 (See Table 50)
C	Sensor Module / Connector B / Pin 7 (See Table 50)

The sensor measures barometric pressure according to Table 74 (page 165).

Refer to Table 27 for a list of tools and/or consumables required for this procedure.

Table 27. Barometer Sensor Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
7/16-in Wrench		Barometric Sensor <See FSG-MNL-00212, Table 1, Barometer Sensor>
		Loctite 243 (or Equivalent)
		Cable Ties (As Required)

If the barometric sensor fails or is damaged; replace the sensor as follows. See Figure 46.

Removal

- Tag and disconnect electrical connector.
- Using 7/16-in wrench, remove two (2) 1/4-20 X 1-1/2-in long machine screws (each with one lock and one flat washer).
- Remove sensor.

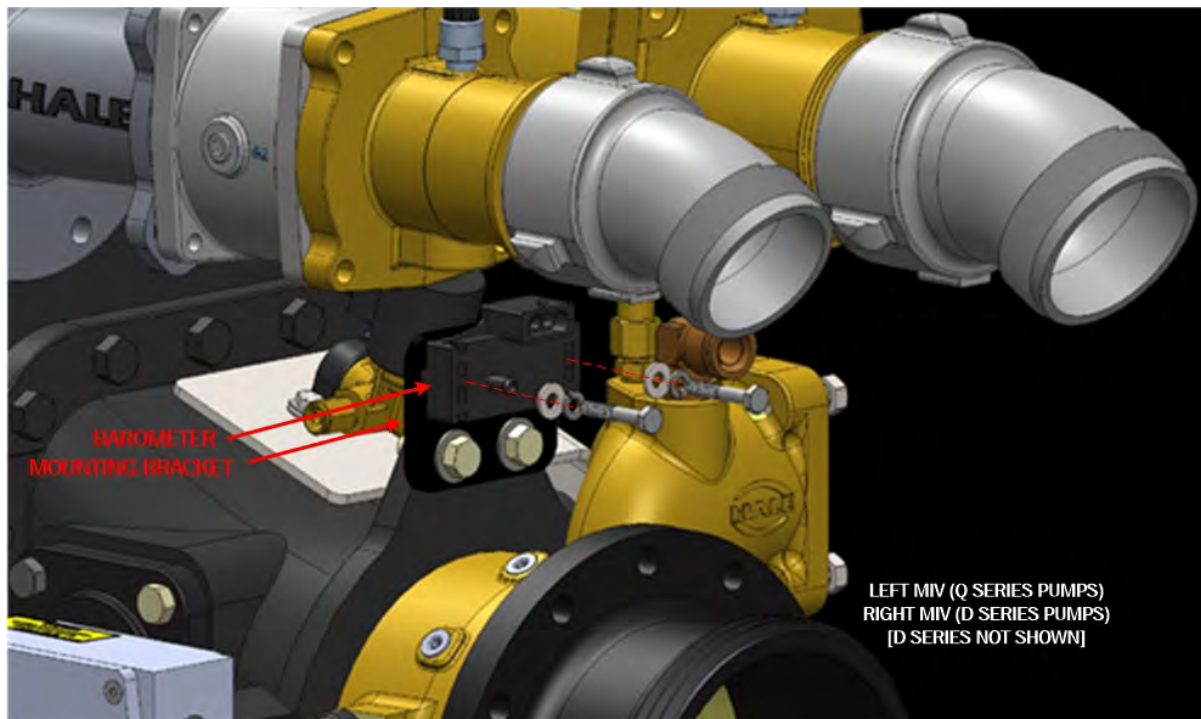


Figure 46. Barometric Sensor R&R

Installation

- Align sensor with bracket.
- Apply Loctite 243 (or equivalent) to screw threads.

- C. Install two (2) 1/4-20 X 1-1/2-in long machine screws (each with one lock and one flat washer). NOTE: Do NOT over tighten screws.
- D. Connect electrical connector according to tags.

4.7.2 Flowmeter (Optional – Used with SAM Or Navigator Pro 9335 Only)

Reference section 5, System Installation, of Style 9335 Navigator Pro With Pressure, Flow CAFS And Valve Control Installation, Operating, And Maintenance Instructions (P/N 126914) found on the flash drive provided with the system or on the Hale website (www.haleproducts.com).

Refer to Table 28 for a list of tools and/or consumables required for this procedure.

Table 28. Flowmeter Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
2-1/4-in Wrench		Cable Ties (As Required)
		Loctite 243
		Flowmeter <See FSG-PL-01506, Sheet 1 & 2, AKRON FLOW SENSOR>

Perform the following to replace a damaged flowmeter.

Removal

- A. Open SAM panel(s).
- B. Note cable tie locations, cut ONLY ties required to R&R flowmeter.
- C. At discharge valve motor controller, tag and disconnect wiring.
- D. Using a 2-1/4-in wrench, remove retaining nut. See Figure 47.

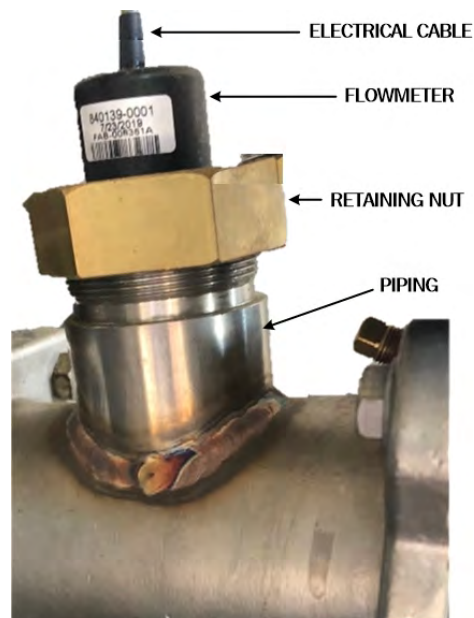


Figure 47. Flowmeter R&R

- E. Remove flowmeter from piping/manifold/spacer.
- F. Note flowmeter orientation (specifically – locator pin).

Installation

- A. Lubricate flowmeter O-rings. (See Table 6.)
- B. Install new flowmeter.
(Orient flowmeter so locator pin fits into adaptor/saddle clamp.)
- C. Install retaining nut over flowmeter (thread electrical cable thru nut) and hand start threads.
- D. Using 2-1/4-in wrench, tighten retaining nut.
- E. At discharge valve motor controller, connect electrical cable according to tags.
- F. Install cable ties cut to R&R flowmeter as noted.
- G. Close SAM panel(s).

Perform the applicable calibration (or reset) procedures IAW paragraph 5.2.3, page 178.

4.7.3 Pressure Sensors/Transducers

The SAM system utilizes two (2) types of pressure transducer: high pressure Hale transducers (up to 300 PSI) are used to take individual pressure measurements for all the discharge valves and for the pump intake and pump discharge pressure measurements; Hale low pressure transducers are used to detect prime and measure the various tank levels (ITL-40). Both pressure sensors appear similar and have the same pin layout (see Figure 48).



Figure 48. Hale Pressure Sensor/Transducer And Pin Layout

The sensors are used for multiple purposes within the SAM system: individual discharge valve pressure (displayed on the SAM Control Center) see Table 29; pump intake and discharge pressure (master pressures) see Table 30; water column pressure (part of automated air bleed) see Table 31; for the onboard tank water level sensor (or Foam Tank A/Foam Tank B), refer to the Class 1 Operation Manual, Intelli-Tank Level 40 (P/N 118253).

Table 29. Hale Discharge Valve Pressure Sensor Wiring (From/To Listing)

From Pressure Transducer Pin	To Valve Driver Pressure Connector Pin
A (Ground)	3 Ground [Output]
B (Power)	4 Power [Output]
C (Pressure Signal)	1 Pressure Signal [Input]

Table 30. Pump Intake/Discharge Pressure Sensor Wiring (From/To Listing)

From Pressure Transducer Pin	To MatrIIX/Pressure Governor Connector B Pin
Pump Intake Side	
A (Ground)	*
B (Power)	6 (Sensor Negative Reference) [Output]
C (Pressure Signal)	5 (Intake Signal) [Input]
Pump Discharge Side	
A (Ground)	*
B (Power)	7 (Sensor Positive Reference) [Output]
C (Pressure Signal)	8 (Discharge Signal) [Input]

* Connects to system ground (NOT MatrIIX/Pressure Governor Module).

Table 31. Hale Water Column Pressure Sensor Wiring (From/To Listing)

From Pressure Transducer Pin	To MIV-Auto Module Connector B Pin
A (+ 5V Reference)	11 (+ 5V Reference) [Output]
B (Reference Return)	12 (5V Reference Return) [Output]
C (Water Column Signal)	5 (Water Column Signal) [Input]

Both sensors require 5.0 VDC (called power or reference above) and system ground to operate. The nominal output signal is linear between 0.5 VDC and 4.5 VDC, where:

- 0-5 psiG sensor
 - a signal voltage of 0.5 VDC equals 0.0 psiG
 - a signal voltage of 4.5 VDC equals 5.0 psiG
- 0-300 psiA sensor
 - a signal voltage of 0.5 VDC equals 0.0 psiA
 - a signal voltage of 4.5 VDC equals 300.0 psiA

NOTE

All legacy Akron Brass Swing-Out™ Valve pressure transducers (A93001003) must be replaced with Hale sensors. See paragraph 4.7.3.1.1.

4.7.3.1 AB Swing-out Valve Pressure Sensor

The SAM system utilizes a Hale pressure sensor rated to 300 psi mounted close to each discharge valve. The sensor must be mounted 45° from horizontal therefore it is typically mounted using a 45° adapter. (Typically, a discharge valves pressure tap is either horizontal or vertical; no matter the valve position; the sensor needs to end up 45° from horizontal.) Electrically the sensor connects to the motor driver on the valve it is installed in (see Figure 49 and Table 29, above) via the AB factory cable.



Refer to Table 32 for a list of tools and/or consumables required for this procedure.

Table 32. Discharge Valve Pressure Sensor Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
3/4-in Wrench		Loctite 580 (Or Equivalent)
(Optionally, 3/4-in Extra Deep Socket and Driver)		Pressure Sensor <See FSG-PL-01506, TRANSDUCER, Sheet 1>
		AB Factory Cable

If an AB swing-out valve pressure sensor fails or is damaged; replace the sensor as follows.

Removal

- A. Open SAM panel(s).
- B. Note cable tie locations, cut ONLY ties required to R&R pressure sensor.
- C. At sensor, tag and disconnect electric connector.
- D. Using 3/4-in wrench, remove sensor.

Installation

- A. Apply Loctite 580 to threads of new sensor.
(Use sealant sparingly to prevent sensor damage.)
- B. Install sensor.

NOTE

Do NOT overtighten pressure sensor.

- C. Hand tighten sensor until snug.
- D. Using 3/4-in wrench, torque an additional 1/4 turn.

NOTE

Sensor is rated to 300 psi (~21 bar).

ATTENTION ⚠ WARNING

DO NOT EXCEED OPERATING PRESSURE LIMITS OF PUMP, INSTALLED PLUMBING, HOSE(S), OR EQUIPMENT IN USE.

- E. Connect electric connector according to tags.
- F. Install cable ties cut to R&R sensor as noted.
- G. Pressurize system to check for leaks.
- H. Using SAM Control Center, perform pressure calibration. (See paragraph 5.2.2.1, page 177.)
- I. Close SAM panel(s).

4.7.3.1.1 Legacy AB Valve Pressure Sensor

Legacy SAM systems utilized Akron Brass pressure sensors (Figure 49). When these sensors fail, replacement with the newer Hale sensor is required. The legacy and new sensor wiring is the same. See Table 29 (page 75) and Table 33.

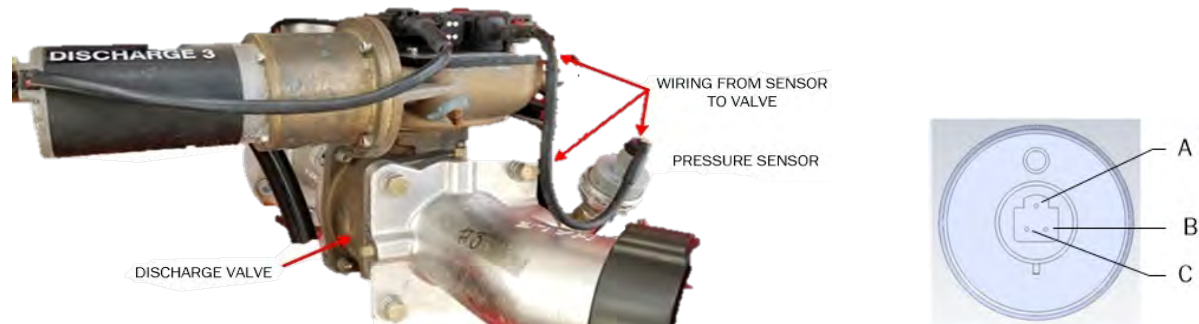


Figure 49. Legacy AB Valve Pressure Sensor And Layout

Table 33. Legacy Akron Brass Pressure Sensor Wiring (From/To Listing)

From Pressure Sensor Pin	To Valve Driver Pressure Connector Pin
A (Pressure Signal)	1 Pressure Signal [Input]
B (Power)	4 Power [Output]
C (Ground)	3 Ground [Output]

Use the AB Swing-out Valve Pressure Sensor procedure (above) for the legacy Akron Brass pressure sensors.

IMPORTANT ▲ NOTICE

Do NOT overtighten pressure sensor more than an additional 1/4 turn from hand tight.

NOTE

The legacy AB sensor is rated to 600 psi (41 bar).

4.7.3.2 Pump Master Pressure Sensors

The SAM system utilizes the same Hale pressure sensors as the discharge valves except the sensors are mounted on the operator panel or pump body.

NOTE

Hale recommends installing these sensors on the rear of the Class 1 test port adapter (PRESSURE/VACUUM) behind the operator panel. (Provides best vibration isolation.)

However, most SAM units have installed the discharge sensor in any of the upper pump body pressure taps and the intake pressure sensor in any of the upper pump body vacuum taps. (Refer to FSG-PL-01509 or FSG-PL-01510 for pressure/vacuum taps locations.) Electrically the sensor connects to the Matrlx/Pressure Governor Module (see Table 30, page 76).

NOTE

If the Matrlx Pressure Governor module was replaced perform the pressure calibration using the SAM Pump Controller instead of the SAM Control Center and configure/setup the module parameters at the same time. (See paragraph 6.17, page 195.)

If a pump pressure sensor fails or is damaged; replace the sensor using the AB Swing-out Valve Pressure Sensor procedure. (See paragraph 4.7.3.1 on page 76.)



4.7.3.3 Water Column Sensor

The SAM system water column sensor utilizes the same Hale pressure transducer as the ITL-40 tank level transducer except the transducer is mounted on the SAM drain assembly (located at the bottom of the gearbox). Electrically the transducer connects to the MIV-A module, see Table 31, page 76.

Refer to Table 34 for a list of tools and/or consumables required for this procedure.

Table 34. Water Column Sensor Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
15/16-in Wrench		Loctite 580
		Pressure Transducer <See 118253 (Operation Manual)>

If a water column sensor fails or is damaged; replace the sensor as follows.

Removal

- A. Note cable tie locations, cut ONLY ties required to R&R pressure sensor.
- B. At sensor, tag and disconnect electric connector.
- C. Using 15/16-in wrench, remove sensor.

Installation

- A. Apply Loctite 580 to threads of new sensor.
(Use sealant sparingly to prevent sensor damage.)
- B. Install sensor.

NOTE

Do NOT overtighten pressure sensor.

- C. Hand tighten sensor until snug.
- D. Using 15/16-in wrench, torque an additional 1/4 turn.
- E. Connect electric connector according to tags.
- F. Install cable ties cut to R&R sensor as noted.
- G. Pressurize system to check for leaks.

4.7.4 Gearbox Oil Level

Hale ships the gearbox with all gear oil drained and the gearbox must be filled with the correct amount of oil prior to operation. When oil covers the tip of the level sensor, the sensor outputs a +5 VDC signal. If the oil level decreases to uncover the sensor, the sensor actuates internal electronic switching to output a 0.5 VDC signal which triggers an alert. The sensor (Figure 50) must NOT be over tightened or the sensor will be damaged. If the sensor continues to indicate a false low level indication after cleaning the sensor must be replaced.

The three (3) wire sensor connects as listed in Table 35.

Table 35. Gearbox Oil Level Sensor Wiring (From/To Listing)

From (Pin)	To
A	System Power (CB1)
B	Main Ground Stud (On Pump Body)
C	Sensor Module / A Connector / Pin 1

IMPORTANT ⚠ NOTICE

Only torque the sensor one turn (maximum) past the hand tight engagement. Over torquing the sensor can result in permanent damage to the sensor.



Figure 50. Gearbox Oil Level Sensor

Refer to Table 36 for a list of tools and/or consumables required for this procedure.

Table 36. Gearbox Oil Level Sensor Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
PPE (For Handling Oil)		Cable Ties (As Required)
Wire Cutter		Loctite 580
7/8-in Wrench		Oil Level Sensor <See FSG-PL-01501/1502, Sheet 4>
		Mild Detergent
		Gear Oil (Small Amount)

Gearbox Oil Lever Sensor Cleaning

Prior to R&R, clean the gearbox oil level sensor prism surface as follows.

- A. Note cable tie locations, cut ONLY ties required to remove sensor.
- B. At sensor, tag and disconnect electric connector.
- C. Using 7/8-in wrench, remove sensor. See Figure 51.
- D. Using mild detergent, water, and shop rag(s), wash sensor prism (tip of sensor).
- E. Prior to installing sensor, test sensor as follows.
 1. Connect sensor to harness according to tags.
 2. Immerse tip of sensor in clean fresh gear oil.
 3. Turn SAM system on.
 4. Check Pump Controller, PUMP INFO tab, gearbox [REMAINING LIFE] does NOT indicate **LOW**.
 5. Turn SAM system off.
 6. Disconnect sensor.
- F. If sensor is functional, install sensor (see below).

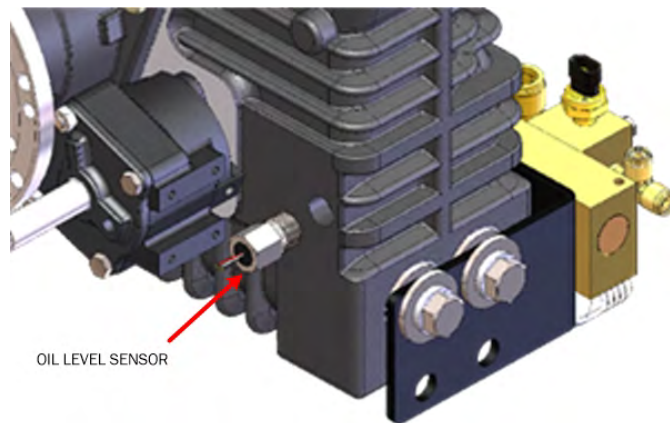


Figure 51. Gearbox Oil Level Sensor R&R

If a gearbox oil level sensor fails, is damaged, or if the gear oil is changed due to excessive metal partials; replace the sensor as follows.

Removal

- A. Note cable tie locations, cut ONLY ties required to R&R sensor.
- B. At sensor, tag and disconnect electric connector.
- C. Using 7/8-in wrench, remove sensor.

Installation

- A. Apply Loctite 580 to threads of new sensor.
(Use sealant sparingly to prevent sensor damage, do NOT allow sealant to cover tip of sensor.)
- B. Install sensor.

IMPORTANT ▲ NOTICE

Only torque the sensor one turn (maximum) past the hand tight engagement. Over torquing the sensor can result in permanent damage to the sensor.

- C. Hand tighten sensor until snug.
- D. Using 7/8-in wrench, torque an additional 1 turn.
- E. Connect electric connector according to tags.
- F. Install cable ties cut to R&R sensor as noted.

4.7.5 Temperature

The NTC (10 K Ω @ 77 °F) thermistor (Figure 52) installs directly into the 1/8-in NPT port in the gearbox housing on the output side of the gearbox. Install using Loctite 580 on sensor threads.

The sensors are used for two purposes within the SAM system: the gearbox temperature sensor pinout is provided in Table 37 and the suction water pump temperature sensor pinout is provided in Table 38.

Table 37. Gearbox Temperature Sensor Wiring (From/To Listing)

From Temperature Sensor Pin		To Sensor Module Connector B Pin	
A	(Gearbox Oil Temperature)	11	Gearbox Oil Temperature [Input]
B	System Ground	*	

* Connects to system ground.

Table 38. Suction Water Temperature Sensor Wiring (From/To Listing)

From Temperature Sensor Pin		To Sensor Module Connector B Pin	
A	(Suction Water Temperature)	12	Suction Water Temperature [Input]
B	System Ground	*	

* Connects to system ground.

NOTE

The RME utilizes two [2] gearbox temp sensors which required isolation so a 10K Ω resistor was added to the harness to provide the required isolation.

Refer to Table 39 for a list of tools and/or consumables required for this procedure.

Table 39. Temperature Sensor Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
PPE (For Handling Oil)		Cable Ties (As Required)
Wire Cutter		Loctite 580
		Temperature Sensor (Pump) <See FSG-PL-01501/1502, Sheet 3>
		Reducer Bushing Brass <See FSG-PL-01501/1502, Sheet 3>
		Temperature Sensor (Gearbox) <See FSG-PL-01501/1502, Sheet 4>

NOTE: Wrench sizes NOT provided since sensor and fitting sizes vary by manufacturer.

4.7.5.1 Gearbox Temperature Sensor

If a gearbox temperature sensor fails or is damaged, replace the sensor as follows.
See Figure 52.

Removal

- A. Note cable tie locations, cut ONLY ties required to R&R sensor.
- B. At sensor, tag and disconnect electric connector.
- C. Remove sensor.

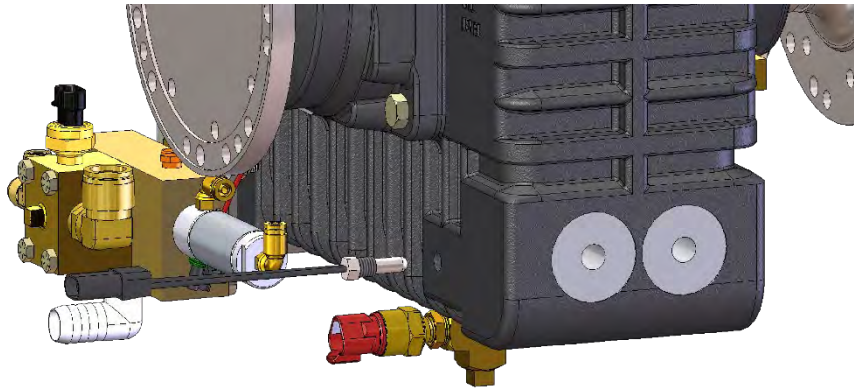


Figure 52. Gearbox Temperature Sensor

Installation

- A. Apply Loctite 580 to threads of new sensor.
- B. Install sensor.
- C. Connect electric connector according to tags.
- D. Install cable ties cut to R&R sensor as noted.

4.7.5.2 Pump Temperature Sensor

If a pump temperature sensor fails or is damaged, replace the sensor as follows.
See Figure 53.

Removal

- A. Note cable tie locations, cut ONLY ties required to R&R sensor.
- B. At sensor, tag and disconnect electric connector.

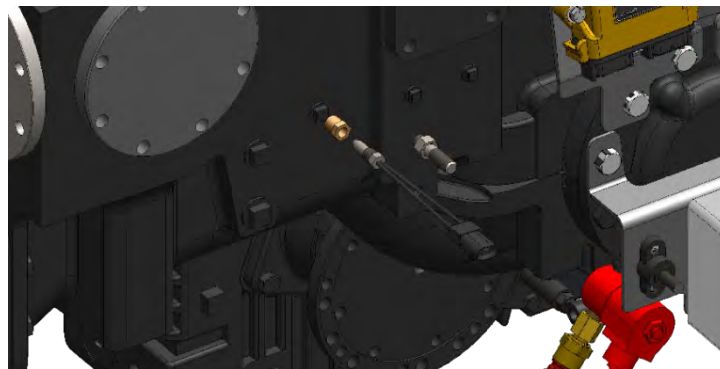


Figure 53. Pump Temperature Sensor

- C. Hold reducer bushing stationary.
- D. Remove sensor.

Installation

If the brass reducer bushing is damaged, replace the bushing. See Table 39.

- A. Apply Loctite 580 to threads of new sensor.
- B. Install sensor.
- C. Connect electric connector according to tags.
- D. Install cable ties cut to R&R sensor as noted.
- E. Perform Temperature Sensor Calibration (see paragraph 5.6, page 184).

4.7.6 Water Detection Sensors

The sensors (Figure 54) are used for three purposes within the SAM system: to detect water in the gearbox oil a sensor is collocated with the drain plug (indicating a pump seal failure); to detect water in the Autolube assembly (Q series pumps only) (indicating an Autolube seal failure); and to detect water in the priming system (indicating a successful priming operation).



Figure 54. Water Detection Sensor

See Table 40 for the water in gearbox oil pinouts, Table 41 for water in Autolube assembly pinouts, and Table 42 for the water in primer pinouts.

Table 40. Water In Gearbox Sensor Wiring (From/To Listing)

From Sensor Pin	To Sensor Module Connector B Pin	To Breaker Box
A (Power)	N/C	Connector 1 Pin 3
B (Ground)	N/C	*
C (Signal)	4 GB WATER IN OIL SIG [Input]	N/C

* Connects to system ground (NOT Sensor Module).

Table 41. Water In Autolube Assembly Sensor Wiring (From/To Listing)

From Sensor Pin	To Sensor Module Connector B Pin	To Breaker Box
A (Power)	N/C	Connector 1 Pin 3
B (Ground)	N/C	*
C (Signal)	9 A/L WATER IN OIL SIG [Input]	N/C

* Connects to system ground (NOT Sensor Module).

Table 42. Water In Primer Sensor Wiring (From/To Listing)

From Sensor Pin	To MIV-A Module Connector B Pin	To Breaker Box
A (Power)	N/C	Connector 1 Pin 3
B (Ground)	N/C	*
C (Signal)	5 WTR COLUMN SIGNAL [Input]	N/C

* Connects to system ground (NOT Sensor Module).

Refer to Table 43 for a list of tools and/or consumables required for this procedure.

Table 43. Water Detection Sensor Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
7/8-in Wrench		Loctite 580 (Or Equivalent)
		Water Detection Sensor (Autolube) <See FSG-PL-01501/1502, Sheet 3>
		Water Detection Sensor (Gearbox) <See FSG-PL-01501/1502, Sheet 4>
		Water Detection Sensor (Primer) <See FSG-PL-01501/1502, Sheet 5>
		Reducer Bushing Brass <See FSG-PL-01501/1502, Sheet 5>

NOTE: Wrench sizes NOT provided since sensor and fitting sizes vary by manufacturer.

If a water intrusion sensor fails or is damaged; replace the sensor as follows.

Removal

- Locate failed sensor (front of Autolube [Figure 55], bottom of gearbox [Figure 56], or top of primer [Figure 56]).
- Note cable tie locations, cut ONLY ties required to R&R sensor.
- At sensor, tag and disconnect electric connector.
- Hold reducer bushing stationary.
- Using 7/8-in wrench, remove sensor.

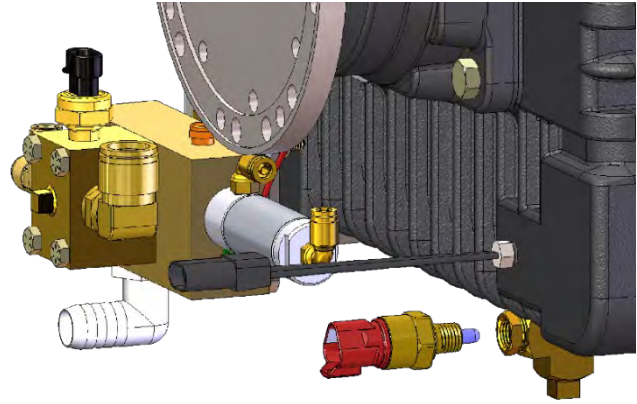
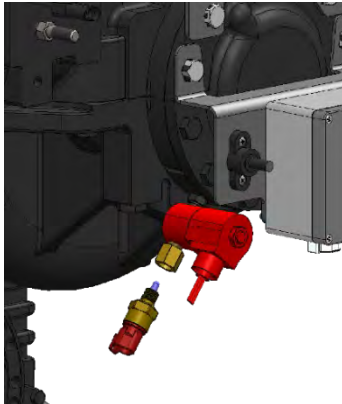


Figure 55. Water Detection Sensor R&R (Autolube And Gearbox)

Installation

If the brass reducer bushing at the primer is damaged, replace the bushing. See Table 43 and Figure 56.

- A. Apply Loctite 580 to threads of new sensor.
(Use sealant sparingly to prevent sensor damage.)
- B. Install sensor.

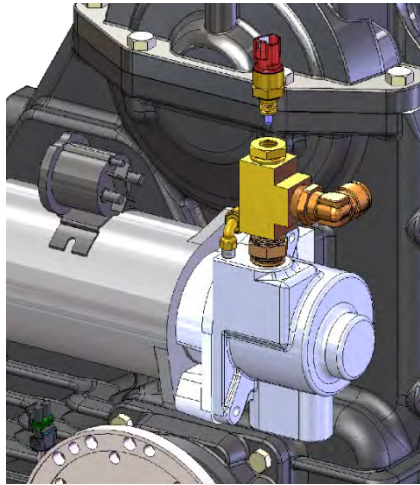


Figure 56. Water Detection Sensor R&R (Primer)

NOTE

Do NOT overtighten sensor.

- C. Connect sensor according to tags.
- D. Turn SAM system on.
- E. Test new sensor function. See paragraph 4.15.2, page 145.
- F. Turn SAM system off.
- G. Hand tighten sensor until snug.
- H. Using 7/8-in wrench, torque an additional 1 turn (2 turns maximum) past hand tight engagement.
- I. Install cable ties cut to R&R sensor as noted.

4.7.6.1 Zero Pressure Solenoid

The solenoid (Figure 57) is controlled by the sensor module to protect the water detection sensor from pressure greater than 100 psi while the system is powered on and is normally closed to also protect the water detection sensor while the system is not powered.



Figure 57. Zero Pressure Solenoid

Table 44 provides the solenoids electrical connections.

Table 44. Zero Pressure Solenoid Wiring (From/To Listing)

From	To Sensor Module, Connector A, Pin	To Breaker Box
A	N/C	Connector 1 Pin 3
B	N/C	N/C
C	7 AUTOLUBE SOL NEG [Output]	N/C

Refer to Table 45 for a list of tools and/or consumables required for this procedure.

Table 45. Zero Pressure Solenoid Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
Slip Joint Pliers		Zero Pressure Solenoid <See FSG-PL- 01501, - 01502, Sheet 3>
9/16-in Wrench		Brass Adapter
Adjustable Wrench (Optional)		Loctite 580 (Or Equivalent)

If the solenoid fails or is damaged; replace the solenoid as follows.

Access

- Note cable tie locations, cut ONLY ties required to R&R both module brackets (including modules), circuit breaker box, and solenoid.
- At modules, circuit breaker box, sensor, and solenoid, tag and disconnect electric connectors.
- At top of Autolube assembly, remove both module mounting brackets. See Figure 58.

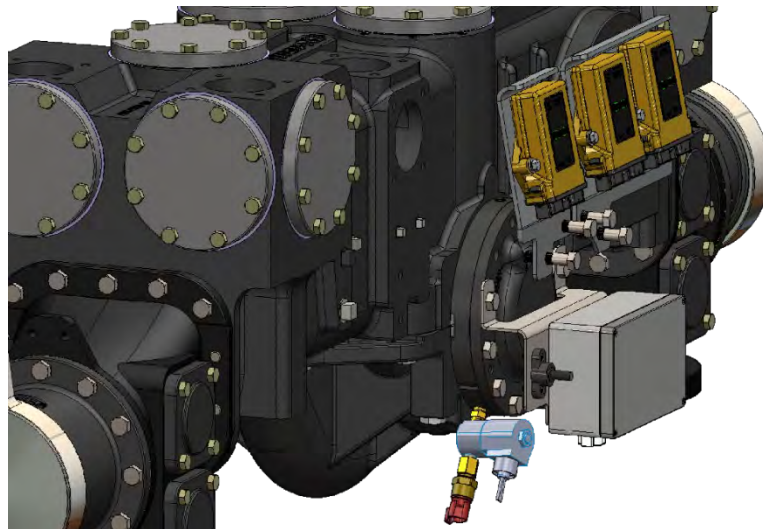


Figure 58. Removal Of The Module Mounting Brackets

- D. Perform removal portion of circuit breaker box R&R procedure.
(See Figure 59) and section 4.10.6, page 115.)

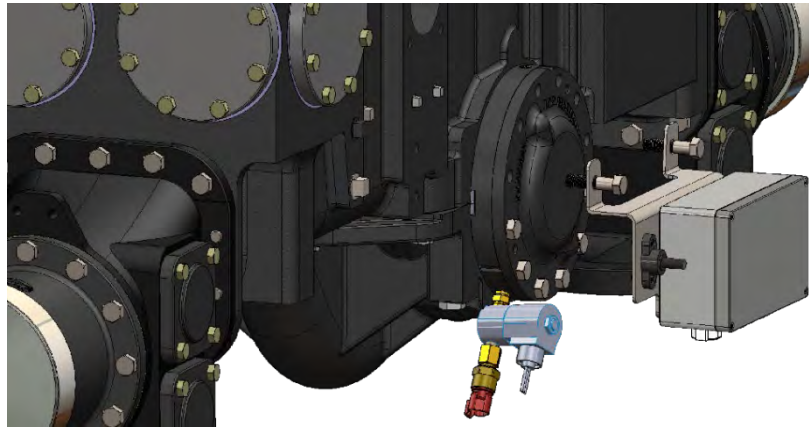


Figure 59. Circuit Breaker Box Removal

- E. Perform removal portion of Autolube assembly R&R. See Figure 60 and reference Midship Pump Technical Manual (FSG-MNL-00200).

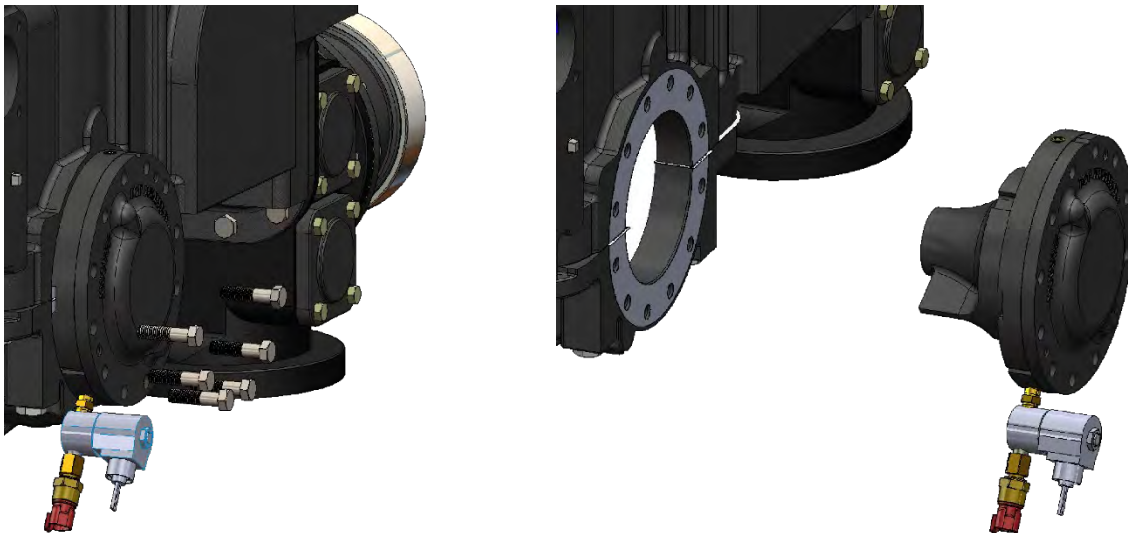


Figure 60. Autolube And Zero Pressure Solenoid Removal

Removal

- Using slip joint pliers, hold nipple (Autolube side of solenoid).
- Using adjustable wrench, remove solenoid (with water detection sensor).
- Hold solenoid and using 9/16-in wrench, remove adapter (with water detection sensor).

Installation

- Apply Loctite 580 to threads of existing adapter and nipple.
(Use sealant sparingly to prevent water in oil sensor damage.)
- Install solenoid on adapter (with water in oil sensor).

NOTE

Do NOT overtighten solenoid.

- C. Hand tighten solenoid until snug.
- D. Using slip joint pliers, torque an additional 1 turn (2 turns maximum) past hand tight engagement.
- E. Install solenoid on nipple.
- F. Perform installation portion of Autolube assembly R&R. Reference Midship Pump Technical Manual (FSG-MNL-00200).
- G. Perform installation portion of circuit breaker box R&R procedure.
- H. At top of Autolube assembly, install both module mounting brackets.
- I. At modules, circuit breaker box, sensor, and solenoid, connect electric connectors according to tags.
- J. Install cable ties cut to R&R sensor as noted.
- K. Pressurize system to check for leaks.

4.7.7 Smart Anode Removal And Replacement

The smart anode (Figure 61) protect the pump from electrolysis and corrosion. Q series pumps typically utilize three [3] anodes (refer to FSG-PL-01501 or FSG-PL-01502 Sheet 8) while other midship pumps (and booster) pumps (refer to FSG-PL-01513 Sheet 8) utilize one [1] anode (installed in the pump) and two [2] additional anodes (installed in the manifold).



Figure 61. Smart Anode

Table 46 provides the anodes electrical connections.

Table 46. Smart Anode Wiring (From/To Listing)

From	To Sensor Module, Connector B, Pin	To Pump
Anode Cable	1 ANODE 1 [Input]	N/C
	2 ANODE 2 [Input]	
	3 ANODE 3 [Input]	
Ground Screw	N/C	Any Near By Ground Point

Refer to Table 47 for a list of tools and/or consumables required for this procedure.

Table 47. Smart Anode Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
1-3/4-in Wrench (18-in Adjustable Wrench) (or larger)		Smart Anode <See FSG-PL-01501, -01502, or -01513, Sheet 8>
#2 Phillips Screwdriver		Loctite 580 (Or Equivalent)

If the anode fails (wears out) or is damaged (see Figure 62); replace the anode as follows.

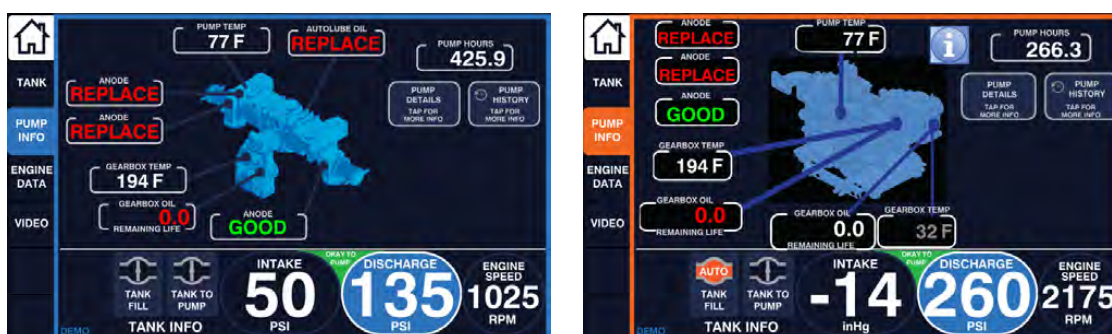


Figure 62. Indication Of Failed Smart Anode

Removal

- Locate failed anode.
- Note cable tie locations, cut ONLY ties required to R&R anode.
- At anode, tag and disconnect electric connector.
- At anode, using #2 Phillips screwdriver, remove ground screw.
- Using 1-3/4-in wrench, remove anode.

Installation

- Apply Loctite 580 to threads of new anode.
- Install anode.
- Using 1-3/4-in wrench, tighten anode.
- Connect electric connector according to tags.
- Using #2 Phillips screwdriver, install ground screw (secure ground wire to top of anode).
- Pressurize system to check for leaks.
- Turn SAM system on.
- On SAM Pump Controller, Pump Info tab, verify new anode reports **GOOD**. See Figure 63.

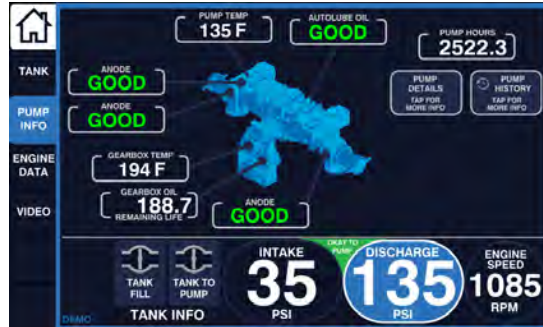


Figure 63. Indication Of Good Smart Anode

I. Install cable ties cut to R&R sensor as noted.

4.8. Removal And Replacement Of SAM Modules

All SAM modules provide a power (PWR), buss (BUS), and communication (COM) indication. See Figure 64. Verify the red PWR, amber (BUS) and Green (COM) LEDs are illuminated steady. If the Green (COM) LED is flashing slowly (2 Hz) the module is communicating with the CAN bus however the module is not receiving messages. If the Green (COM) LED is flashing fast (8 Hz) the module is NOT able to communicate with the CAN bus.



Figure 64. Module Health Indicators

IMPORTANT ⚠ NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED TO PREVENT INTERCHANGE (ON THAT MODULE) OR REVERSE DIRECTION INSERTION. DO NOT FORCE A CONNECTOR WITHOUT FIRST VERIFYING THE CONNECTORS ORIENTATION AND THE MATING MODULES LOCATION IS CORRECT.

IMPORTANT ⚠ NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED; HOWEVER, ALL MODULES UTILIZE THE SAME TWO KEYS. VERIFY THE HARNESS LABEL AND THE MODULE PART NUMBER TO ENSURE THE CORRECT MODULE AND HARNESS CONNECTOR ARE BEING CONNECTED.

The Class 1 modules utilized by the SAM/Sam system utilize keyed connectors. Each module has an A keyed connector and a B keyed connector; however, all the SAM modules use the same A and B keying. Therefore, module placement within the system (location on the mounting bracket) is critical. See Figure 65.



Figure 65. SAM Module Locations

The system is designed with this limitation in mind; harnesses are clearly labeled, routed, and split out so that only the correct harness connector reaches the correct module location (providing the correct module is installed in that position) to assure proper connections. See Figure 66 for the general appearance of the two types of SAM modules. The module on the left is provided power via select pins that are located on the two connectors while power for the module on the right is provided by the stud located between the two connectors.



Figure 66. SAM Modules General Appearance

4.8.1 Matrlx/Pressure Governor Module

The matrlx/pressure governor module (Figure 67) connects to the Blue CAN buss, allowing Sentry governor functional control of the apparatus engine and providing apparatus information to the SAM Pump Controller. Additionally, the module translates and integrates throttle, pump engaged, and OK-to-Pump interlock statuses (non CAN signaling) onto the CAN buss (see Figure 14, page 17). Discrete inputs/outputs are indicated by the direction of the arrow symbol provided with each signal name (pin) and buss connections are indicated via circles instead of arrows. See Figure 68.



Figure 67. MatrIX Pressure Governor Module

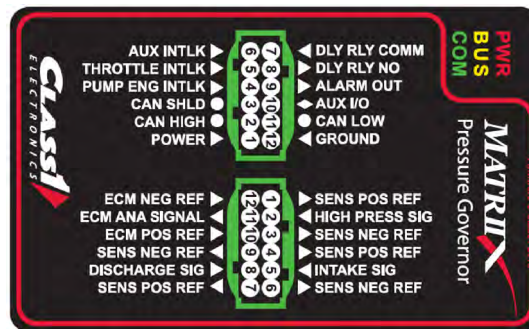


Figure 68. Governor Module Interface Layout

The matrIX/pressure governor module installs on the Hale provided bracket located on the front of the pump directly above the circuit breaker box and Autolube assemblies (right most module). Connect the module according to Table 48.

Table 48. MatrIX/Pressure Governor Module Wiring (From/To Listing)

Module Connector/Pin (From)		Sensor Connector/Pin (To)
A Keyed Connector (Mates with Grey Harness Connector)		
1	(Power) [Input]	Circuit Breaker Box, Connector 1 Pin 3
2	(CAN High) [Buss]	Green CAN Bus Connector
3	(CAN Shield) [Buss]	Green CAN Bus Connector
4	(Pump Engaged Interlock) [Input]	OEM Connection To Apparatus
5	(Throttle Interlock) [Input]	OEM Connection To Apparatus
6	(Auxiliary Interlock) [Input]	OEM Connection To Apparatus
7	(Delay Relay Common) [Input]	N/C
8	(Delay Relay Normally Open) [Output]	N/C
9	(Alarm Out) [Output]	N/C
10	(Auxiliary Input/Output) [I/O]	N/C
11	(CAN Low) [Buss]	Green CAN Bus Connector
12	(Ground) [Input]	Main Ground Stud (On Pump Body)

Table 48. Matrllx/Pressure Governor Module Wiring (From/To Listing) – CONTINUED

Module Connector/Pin (From)			Sensor Connector/Pin (To)
B Keyed Connector (Mates with Black Harness Connector)			
1	(Sensor Positive Reference)	[Output]	N/C
2	(High Pressure Signal)	[Input]	N/C
3	(Sensor Negative Reference)	[Output]	N/C
4	(Sensor Positive Reference)	[Output]	N/C
5	(Intake Signal)	[Input]	C (Intake Pressure Sensor Signal) *
6	(Sensor Negative Reference)	[Output]	B (Intake Pressure Sensor Reference) *
7	(Sensor Positive Reference)	[Output]	B (Discharge Pressure Sensor Reference) *
8	(Discharge Signal)	[Input]	C (Discharge Pressure Sensor Signal) *
9	(Sensor Negative Reference)	[Output]	N/C
10	(ECM Positive Reference)	[Input]	N/C
11	(ECM ANA Signal)	[Output]	N/C
12	(ECM Negative Reference)	[Input]	N/C

NOTE: * Pin A on intake and discharge pressure sensor connects to system ground.

Refer to Table 49 for a list of tools and/or consumables required for this procedure.

Table 49. Matrllx Pressure Governor Module Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Wire Cutter		Matrllx Pressure Governor Module <See FSG-PL-01501, -01502, or -01513, Sheet 3>
7/16-in Wrench		

If the module fails or is damaged; replace the module as follows.

Removal

- Note cable tie locations, cut ONLY ties required to R&R module.
- Tag and disconnect electrical connectors.
- Using 7/16-in wrench, remove two [2] 1/4–20 x 1.25-in hex head screws (each with one [1] lock and one [1] flat washer).
- Remove module.

Installation

- Align new module with bracket.
- Hand start two [2] 1/4–20 x 1.25-in hex head screws (each with one [1] lock and one [1] flat washer).
- Using 7/16-in wrench, tighten screws.

IMPORTANT ▲ NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED; HOWEVER, ALL MODULES UTILIZE THE SAME TWO KEYS. VERIFY THE HARNESS LABEL AND THE MODULE PART NUMBER TO ENSURE THE CORRECT MODULE AND HARNESS CONNECTOR ARE BEING CONNECTED.

D. Connect electrical connectors according to tags.

E. Install cable ties cut to R&R module as noted.

4.8.2 Sensor Module

The sensor module (Figure 69) connects to the Green CAN buss, allowing the majority of the SAM sensor outputs to be integrated on to the buss for processing of statuses and/or display of appropriate alerts (see Figure 15, page 18). Discrete inputs/outputs are indicated by the direction of the arrow symbol provided with each signal name (pin) and buss connections are indicated via circles instead of arrows. See Figure 70.



Figure 69. Sensor Module

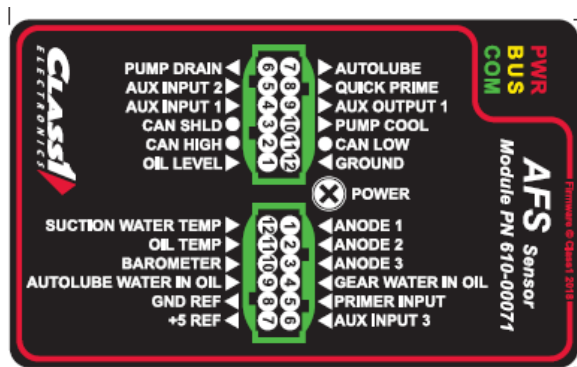


Figure 70. Sensor Module Interface Layout

NOTE

When the sensor module is replaced, the new module may NOT retain the revision history and pump information. This previously stored information may be lost.

The sensor module installs on the Hale provided bracket located on the front of the pump directly above the circuit breaker box and Autolube assemblies (left most module on its own bracket). Connect the module according to Table 50.

Table 50. Sensor Module Wiring (From/To Listing)

Module Connector/Pin (From)			Sensor Connector/Pin (To)
A Keyed Connector (Mates with Grey Harness Connector)			
1	(GB Oil Level Signal)	[Input]	Gearbox Oil Level
2	(CAN High)	[Buss]	Green CAN Bus Connector
3	(CAN Shield)	[Buss]	Green CAN Bus Connector
4	(Auxiliary Input 1)	[Input]	N/C
5	(Auxiliary Input 2)	[Input]	N/C
6	(Pump Drain)	[Output]	C (Water Column Pressure Sensor) (See Table 31)
7	(Autolube)	[Output]	C (Zero Pressure Solenoid Negative) (See Table 44)
8	(Quick Prime)	[Output]	C (Quick-Prime Solenoid Negative)
9	(Auxiliary Output 1)	[Output]	N/C
10	(Pump Cool)	[Output]	C (Pump Cool Solenoid) (See Table 61.)
11	(CAN Low)	[Buss]	Green CAN Bus Connector
12	(Ground)	[Input]	System Ground
B Keyed Connector (Mates with Black Harness Connector)			
1	(Anode 1)	[Input]	Anode 1 Lead (See Table 46)
2	(Anode 2)	[Input]	Anode 2 Lead (See Table 46)
3	(Anode 3)	[Input]	Anode 3 Lead (See Table 46)
4	(Gear Water In Oil)	[Input]	C (Gearbox Water In Oil Sensor) (See Table 40)
5	(Primer Input)	[Input]	Primer Input
6	(Auxiliary Input 3)	[Input]	N/C
7	(+5 Reference)	[Output]	C (Barometer +5 Reference) (See Table 26)
8	(Barometer Gnd Ref)	[Output]	A (Barometer System Ground) (See Table 26)
9	(Autolube Water In Oil)	[Input]	C (Autolube Water in Oil) (See Table 41)
10	(Barometer)	[Input]	B (Barometer Signal) (See Table 26)
11	(GB Oil Temperature)	[Input]	A (Temp Sensor in GB) (See Table 35)
12	(Suction Water Temperature)	[Input]	A (Temp Sensor in Pump Body) (See Table 38)

NOTE: The POWER screw between the A and B connectors connects to circuit breaker box connector 1 pin 3.

Refer to Table 51 for a list of tools and/or consumables required for this procedure.

Table 51. Sensor Module Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Wire Cutter		Sensor Module <See FSG-PL-01501, -01502, or -01513, Sheet 3>
7/16-in Wrench		
#2 Phillips Screwdriver		

If the module fails or is damaged; replace the module as follows.

Removal

- Note cable tie locations, cut ONLY ties required to R&R module.
- Tag and disconnect electrical connectors.
- Tag and disconnect (#2 Phillips screwdriver) POWER connection.
- Using 7/16-in wrench, remove two [2] 1/4–20 x 1.25-in hex head screws (each with one [1] lock and one [1] flat washer).
- Remove module.

Installation

- Align new module with bracket.
- Hand start two [2] 1/4–20 x 1.25-in hex head screws (each with one [1] lock and one [1] flat washer).
- Using 7/16-in wrench, tighten screws.

IMPORTANT ▲ NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED; HOWEVER, ALL MODULES UTILIZE THE SAME TWO KEYS. VERIFY THE HARNESS LABEL AND THE MODULE PART NUMBER TO ENSURE THE CORRECT MODULE AND HARNESS CONNECTOR ARE BEING CONNECTED.

- Connect electrical connectors according to tags.
- Install cable ties cut to R&R module as noted.

4.8.3 SAM MIV–A Module

The SAM system utilizes one [1] MIV–A module (Figure 71) for every three [3] MIVs with a maximum of two [2] MIV–A modules per system. Each MIV–A module drives up to three [3] MIV 2.0 control/drive modules (see paragraph 4.8.4, page 100 and/or Figure 15, page 18). Connection of the modules are similar (except they connect to different MIV 2.0 control/drive modules) see Table 52. The MIV–A module installs on the Hale provided bracket located on the front of the pump directly above the circuit breaker box and Autolube assemblies (middle module [or middle two modules]). Discrete inputs/outputs are indicated by the direction of the arrow symbol provided with each signal name (pin) and buss connections are indicated via circles instead of arrows. See Figure 72.



Figure 71. MIV-A Module

NOTES

When the master MIV-A module is replaced, the new modules address switch must be set to A. See paragraph 4.12.5, page 140.

When the slave MIV-A module is replaced, the new modules address switch must be set to 0. See paragraph 4.12.5, page 140.

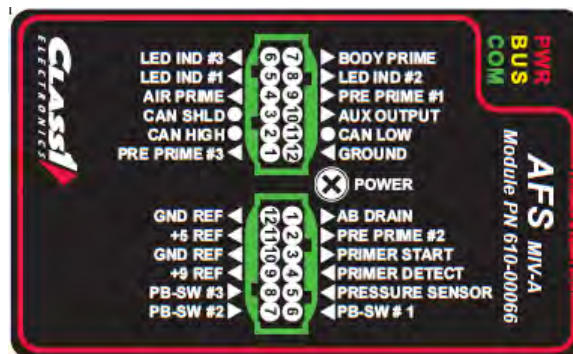


Figure 72. SAM Module (MIV-A)

The MIV-A module installs on the Hale provided bracket located on the front of the pump directly above the circuit breaker box and Autolube assemblies (middle module [or modules] left most module [or modules] on shared bracket). Connect the module according to Table 52.

Table 52. MIV-A Module Wiring (From/To Listing)

Module Connector/Pin (From)			Sensor Connector/Pin (To)		
A Keyed Connector (Mates with Grey Harness Connector)					
1	(Pre-Prime #3)	[Output]	A	4-Way Valve (Bottom MIV)	See Table 69
2	(CAN High)	[Buss]	Green CAN Bus Connector		
3	(CAN Shield)	[Buss]	Green CAN Bus Connector		
4	(Air Prime)	[Output]	N/C		
5	(PB SW LED #1)	[Output]	3	MIV-Auto Placard For RH MIV	See Table 22
6	(PB SW LED #3)	[Output]	3	MIV-Auto Placard For Bottom MIV	See Table 22

Table 52. MIV-A Module Wiring (From/To Listing) – CONTINUED

Module Connector/Pin (From)			Sensor Connector/Pin (To)		
A Keyed Connector (Mates with Grey Harness Connector) – CONTINUED					
7	(Pump Body Prime)	[Output]	A	4-Way Valve (Pump Body Prime)	See Table 69
			B	Diode 2	See Table 56
8	(PB SW LED #2)	[Output]	3	MIV-Auto Placard For LH MIV	See Table 22
9	(Pre-Prime #1)	[Output]	A	4-Way Valve (RH MIV)	See Table 69
10	(Auxiliary Output)	[Output]	N/C		
11	(CAN Low)	[Buss]	Green CAN Bus Connector		
12	(Ground)	[Input]	System Ground		
B Keyed Connector (Mates with Black Harness Connector)					
1	(AB Drain)	[Output]	A	4-Way Valve (SAM Air Bleed Drain)	See Table 69
2	(Pre-Prime #2)	[Output]	A	4-Way Valve (LH MIV)	See Table 69
3	(Primer Start)	[Output]	B	Primer Solenoid	
4	(Water In Primer Detect)	[Input]	C	Water Detection Sensor (Primer)	See Table 42
5	(Water Column Signal)	[Input]	C	Pressure Sensor (Water Column)	See Table 31
6	(SW-1 Momentary)	[Input]	2	MIV-Auto Placard For RH MIV	See Table 22
7	(SW-2 Momentary)	[Input]	2	MIV-Auto Placard For LH MIV	See Table 22
8	(SW-3 Momentary)	[Input]	2	MIV-Auto Placard For Bottom MIV	See Table 22
9	(+9 Reference)	[Output]	N/C		
12	(Ground Reference)	[Output]	N/C		
11	(+5 Reference)	[Output]	A	Pressure Sensor (Water Column)	See Table 31
12	(–5 V Reference)	[Output]	B	Pressure Sensor (Water Column)	See Table 31

NOTE: The POWER screw between the A and B connectors connects to circuit breaker box connector 1 pin 3.

Refer to Table 45 for a list of tools and/or consumables required for this procedure.

Table 53. MIV-A Module Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
7/16-in Wrench		MIV-A Module <See FSG-PL-01501, -01502, or -01513, Sheet 3>
#2 Phillips Screwdriver		Loctite 580 (Or Equivalent)

If the module fails or is damaged; replace the module as follows.

Removal

- Note cable tie locations, cut ONLY ties required to R&R module.
- Tag and disconnect electrical connectors.

- C. Tag and disconnect (#2 Phillips screwdriver) POWER connection.
- D. Using 7/16-in wrench, remove two [2] 1/4-20 x 1.25-in hex head screws (each with one [1] lock and one [1] flat washer).
- E. Remove module.

Installation

Visually inspect MIV-A module address switch as follows.

- If installing a master MIV-A module the switch pointer must point to the A position.
- If installing a slave MIV-A module the switch pointer must point to the 0 position.

Otherwise, perform Set MIV-A Module Address (Master) (Slave). See paragraph 4.12.5, page 140.

- A. Align new module with bracket.
- B. Hand start two [2] 1/4-20 x 1.25-in hex head screws (each with one [1] lock and one [1] flat washer).
- C. Using 7/16-in wrench, tighten screws.

IMPORTANT NOTICE

THE MODULE DEUTSCH CONNECTORS ARE KEYED; HOWEVER, ALL MODULES UTILIZE THE SAME TWO KEYS. VERIFY THE HARNESS LABEL AND THE MODULE PART NUMBER TO ENSURE THE CORRECT MODULE AND HARNESS CONNECTOR ARE BEING CONNECTED.

- D. Connect electrical connectors according to tags.
- E. Install cable ties cut to R&R module as noted.

4.8.4 MIV 2.0 Drive Module

The MIV 2.0 drive module, AKA MIV control module, translates and integrates discrete control signals for each MIV on to the Green CAN bus allowing other devices (and processes) to know the position of each MIV. The discrete inputs/outputs (signal name) and buss connections are shown on Figure 73.



Figure 73. MIV-A Drive Module

A module installs on each of the Hale MIV 2.0 valve assemblies. Connect the module according to Table 54.



Table 54. MIV-A Drive Module Wiring (From/To Listing)

Module Pin (From)			MIV/Harness Pin (To)	
1	(Power)	[Input]	System Power	Refer to FSG-PL-01507
2	(CAN High)	[Buss]	Green CAN Bus Connector	
3	(Motor A)	[Output]	A	(MIV Motor)
4	(Motor B)	[Output]	B	(MIV Motor)
5	(Open Indicator)	[Output]	6	(MIV-Rocker Switch) See Table 20
6	(Air Bleed)	[Output]	C	(ABV Solenoid) See Table 58
7	(Close Indicator)	[Output]	4	(MIV-Rocker Switch) See Table 20
8	(Closed Stop Switch)	[Input]	A	(Closed Stop Switch)
9	(Open Stop Switch)	[Input]	A	(Open Stop Switch)
10	(Direction)	[Input]	2	(MIV-Rocker Switch) See Table 20
11	(CAN Low)	[Buss]	Green CAN Bus Connector	
12	(Ground)	[Input]	System Ground (Pump Body)	

Refer to Table 55 for a list of tools and/or consumables required for this procedure.

Table 55. MIV-A Drive Module Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
#2 Phillips Screwdriver		MIV Control Module <See FSG-PL-01491, Sheet 3>

NOTE: The MIV Control Module has multiple names: MIV Control, MIV Valve Drive, or MIV 2.0 Drive Module.)

If the module fails or is damaged; replace the module as follows.

Removal

- Note cable tie locations, cut ONLY ties required to R&R module.
- Tag and disconnect electrical connector.
- Using #2 Phillips screwdriver, remove two [2] pan head 8-32 x 1.5-in long stainless screws (each with one lock washer).
- Remove module.

Installation

- Align new module with MIV adapter.
- Hand start two [2] pan head 8-32 x 1.5-in long stainless screws (each with one lock washer).
- Using #2 Phillips screwdriver, tighten screws.
- Connect electrical connectors according to tags.
- Install cable ties cut to R&R module as noted.

Verify drive module address, see Table 56 and refer to FSG-MNL-00162 (MIV Control Module Operation Manual).

Table 56. MIV-A Drive Module Address List

Associated MIV Location	Drive Module Address
LH MIV	0
RH MIV	1
RH Bottom MIV	2
T Port	3
Remote Mounted MIV	4

4.9. Removal And Replacement Of Pump Primer And Air Bleed Components

The following subparagraphs provide removal and installation instruction for select SAM pump primer and air bleed components.

4.9.1 Priming Feature Valve Diodes

The SAM system utilizes two blocking diodes (Figure 74) to prevent unwanted interaction between the automated (SAM) and the manual (pump panel) primer signaling. Both diodes plug into the green harness (each via a keyed two pin Deutsch connector); with one diode located between the Hale PRIME pushbutton and the AFS Sensor Module output driving the ESP priming pump; and the other diode, located between the Hale PRIME pushbutton and the MIV-A Module (and if equipped – MIV-A Module 2) output(s) driving the 4-way valves routing priming suction to each MIV. See Figure 15 (page 18).



Figure 74. PF Valve Diode

The diodes install in the MIV-Auto Module Electric Harness. The diodes connect according to Table 56. See Diode Troubleshooting (paragraph 4.16.2.8, page 169) to test a diode.

Table 57. PF Valve Diode Wiring (From/To Listing)

Diode Connector Pin (From)	Device/Pin (To)
Diode 1	
1 (Primer Override) [-]	B Primer Push Button
	A Diode 2
2 (Primer Override A) [+]	A Primer Driver
Diode 2	
1 (Primer Override) [-]	B Primer Push Button
	A Diode 1
2 (Pump Body Prime) [+]	A Pump Body Prime
	7 MIV-A Module Connector A (GRY)

4.9.2 Priming Feature Assembly

The priming feature assembly consists of a large bracket that uses multiple components to route the ESP primers vacuum to the selected MIV for drafting purposes. Refer to FSG-PL-01514 for a priming (including air bleed) tube routing diagram. The number of each component varies depending on the number of Hale MIVs order for that specific SAM system, in general the bracket houses: multiple 4-way air valves, multiple PF valve assemblies, and the pump body air bleed solenoid.

Two 4-way air valves are included with every SAM system, one controls the pump body prime PF valve and the other controls the SAM drain PF valve then one 4-way valve is added to control the PF valve associated with each of the MIVs ordered with that specific SAM system. Each 4-way valve is electrically turned on/off to provide truck (compressed) air to the appropriate end of the associated dual action air cylinder to open (or close) the PF valve for that MIV (or the pump body or SAM drain).

Two PF valve assemblies are also included with every SAM system, one controls the pump body priming (quick prime) and the other controls the SAM drain then one PF valve assembly is added to control pre-priming for each MIV ordered with that specific SAM system.

An air bleed solenoid is also always provided and is electrically controlled to support automated air bleed for the pump body.

In summary, the PF valves are activated by truck air and are turn off automatically when a prime is sensed by the system. The 4-way valves route truck air to a specific PF valves dual actuator cylinder when an intake is selected from the SAM Control Center (with Draft Mode selected for that MIV) which routes the priming port of the ESP to remove the air from the draft source up to the selected MIV. (Effectively drawing water into the LDH right up to the butterfly valve in the selected MIV when in Draft Mode.) Refer to FSG-PL-01501 (-01502 or -01513), Sheet 5 or see Figure 75 (shown for Q series pumps) for the priming feature assembly location.

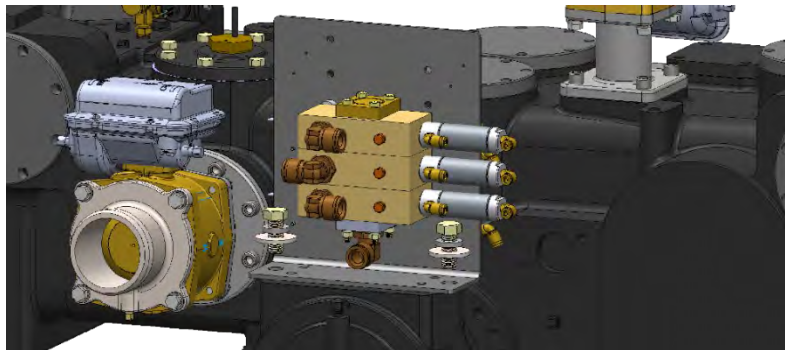


Figure 75. Priming Feature Assembly

The assembly installs on top of the gearbox (Q series pumps) or a frame rail (all other pumps) and is recommended to be removed from the apparatus with all component repairs completed as bench procedures.



Refer to Table 58 for a list of tools and/or consumables required for this procedure.

Table 58. Priming Feature Assembly Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
15/16-in Wrench (or Socket And Ratchet/Driver)		Priming Feature Assembly Bracket <See 538-00099-000>

If a component on the priming feature assembly fails or is damaged; remove the priming feature assembly as follows.

Removal

- A. Note cable tie locations, cut all ties required to R&R entire priming feature assembly.
- B. Tag and disconnect electrical connectors.

ATTENTION ⚠ CAUTION

THE 4-WAY AIR VALVES ARE CONNECTED TO THE APPARATUS COMPRESSED AIR SUPPLY. DO NOT REMOVE A 4-WAY AIR VALVE, PF VALVE AIR CYLINDER, FITTINGS, OR AIR TUBES WHEN THE SYSTEM IS PRESSURIZED.

- C. Bleed off all compressed air pressure. See OEM/apparatus builder documentation/manuals for instructions.
- D. Tag and disconnect pneumatic tubing (1/4-in tubing).
- E. Tag and disconnect priming/drain tubing (3/4-in tubing).
- F. Using 15/16-in wrench, remove two [2] 5/8–11 x 1-1/2-in long screws (each with one lock and one flat washer).
- G. Remove priming feature assembly.
- H. Relocate priming feature assembly to a stable work area or bench.

Perform applicable bench procedure (or procedures) listed below, then return to this procedure to install the repaired priming feature assembly.

- 4-Way Air Valve R&R See paragraph 4.11.2, page 123.
- PF Air Cylinder R&R See paragraph 4.11.3, page 126.
- PF Valve Assembly R&R See paragraph 4.11.4, page 126.
- PF Valve Assembly Repair Kit Installation (Contact Hale Customer Service 800-533-3569.

Installation

- A. Align priming feature assembly on top of gearbox (or frame rail).
- B. Hand start two [2] 5/8–11 x 1-1/2-in long screws (each with one lock and one flat washer).
- C. Using 15/16-in wrench, tighten screws.
- D. Torque screws to 110 ft-lbs.
- E. Connect electrical connectors according to tags.

- F. Connect pneumatic tubing (1/4-in tubing) according to tags.
- G. Restore truck air pressure to assembly and check for leaks.
- H. Connect priming/drain tubing (3/4-in tubing) according to tags.
- I. Install cable ties cut to R&R module as noted.

4.9.3 SAM Drain Valve Block Assembly

The SAM drain valve block mounts at the bottom rear of the gearbox (Figure 76) and requires flex tube plumbing, truck compressed air, and harness connection. Truck compressed air is controlled by the associated 4-way valve (see paragraph 4.11.4, page 126) to open or close the drain. As with the primer port routing valves, refer to FSG-PL-01514 for all water and pneumatic connections. The block also houses the connections for all the MIV and main pump air bleeds, the water column sensor, and the 3/4-in flex pipe that routes priming water to the onboard water tank.

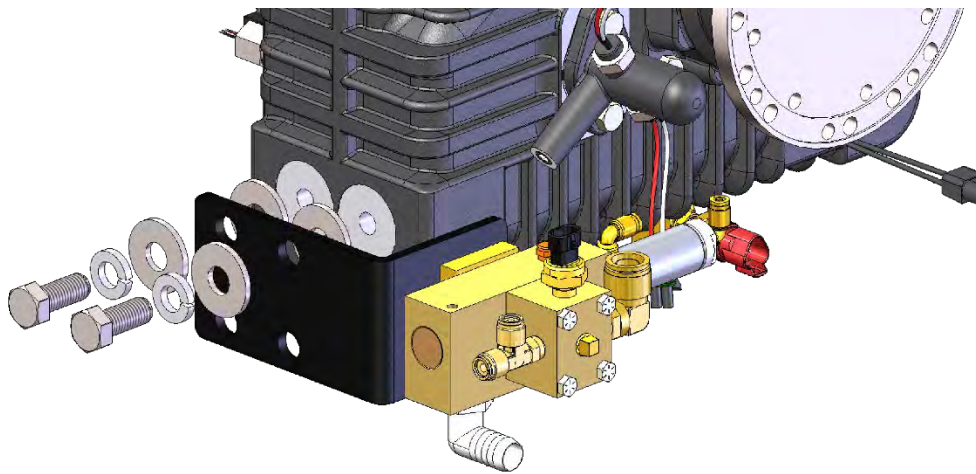


Figure 76. SAM Drain Valve Block Assembly

The SAM drain valve block is comprised of a mounting bracket and a PF valve assembly. The PF valve assembly houses an air cylinder, pressure transducer, muffler, a multiple-connection MIV air bleed fitting, the water column fitting, and a to atmosphere fitting. Refer to the bench procedure section (4.11, page 123) for info on each of these components.

If a component on the SAM drain valve block fails or is damaged; remove the SAM drain valve block as follows.

Removal

- A. Note cable tie locations, cut all ties required to R&R entire SAM drain valve block assembly.
- B. Tag and disconnect electrical connectors.

ATTENTION ⚠ CAUTION

THE SAM DRAIN VALVE BLOCK IS CONNECTED TO THE APPARATUS COMPRESSED AIR SUPPLY VIA A 4-WAY AIR VALVE. DO NOT REMOVE A 4-WAY AIR VALVE, PF VALVE AIR CYLINDER, FITTINGS, OR AIR TUBES WHEN THE SYSTEM IS PRESSURIZED.

- C. Bleed off all compressed air pressure. See OEM/apparatus builder documentation/manuals for instructions.



- D. Tag and disconnect pneumatic tubing (1/4-in tubing).
- E. Tag and disconnect priming/drain tubing (3/4-in tubing).
- F. Using 15/16-in wrench, remove two [2] 5/8–11 x 1-1/2-in long screws (each with one lock and one flat washer).
- G. Remove SAM drain valve block assembly.
- H. Relocate SAM drain valve block assembly to a stable work area or bench.

Perform applicable bench procedure (or procedures) listed below, then return to this procedure to install the repaired priming feature assembly.

- 4-Way Air Valve R&R See paragraph 4.11.2, page 123.
- PF Air Cylinder R&R See paragraph 4.11.3, page 126.
- PF Valve Assembly R&R See paragraph 4.11.4, page 126.
- PF Valve Assembly Repair Kit Installation (Contact Hale Customer Service 800-533-3569.)

Installation

- A. Align SAM drain valve block assembly to bottom of gearbox.
- B. Hand start two [2] 5/8–11 x 1-1/2-in long screws (each with one lock and one flat washer).
- C. Using 15/16-in wrench, tighten screws.
- D. Torque screws to 110 ft-lbs.
- E. Connect electrical connectors according to tags.
- F. Connect pneumatic tubing (1/4-in tubing) according to tags.
- G. Restore truck air pressure to assembly and check for leaks.
- H. Connect water column tubing (3/4-in tubing) and drains (3/8-in tubing) according to tags. Ensure elbow on bottom of PF valve assembly remains open to atmosphere.
- I. Install cable ties cut to R&R module as noted.

4.9.4 Air Bleed Valves (MIV And Pump Body)

The SAM system utilizes an ABV to remove air from the pump body and simultaneously from the selected MIV when SAM is in Auto Mode and a pressurized water source (Hydrant) is selected. The pump body ABV mounts on the bottom rear of the PF assembly and an additional ABV is mounted on a bracket located on top of LH and/or RH for each MIV ordered with the system. When a bottom MIV is ordered the associated ABV is collocated with the RH MIVs ABV and when a T-port MIV is ordered the associated ABV is collocated with the LH MIVs ABV.

A check valve attaches to the SAM drain valve block side (marked with a P) of each ABV to prevent the reverse flow of air into the system during priming or in the event an ABV sticks open. It is important to ensure the check valve is functional if the SAM system encounters problems priming and to ensure correct position/orientation after a solenoid R&R.

The ABVs connect to the Control MIV-Auto Electric Harness. The solenoids connect according to Table 59.

Table 59. Air Bleed Valve (Solenoid) Wiring (From/To Listing)

From ABV Pin	To MIV 2.0 Drive Module Pin	Circuit Breaker Box Connector 1- Pin
A System Power	N/C	4 (Bottom MIV)
		1 (LH MIV)
		4 (RH MIV)
		1 (T-Port MIV)
B Earth Ground	N/C	N/C
C ABV Solenoid —	6 ABV Solenoid — [Output]	N/C

Refer to Table 60 for a list of tools and/or consumables required for this procedure.

Table 60. Air Bleed Valve (Solenoid) Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
7/16-in Wrench		Loctite 580 (Or Equivalent)
9/16-in Wrench		Loctite 243 (Or Equivalent)
5/8-in Wrench		ABV (Solenoid) <See FSG-PL-01501, -01502, -01503, Sheet 5 thru 7>
13/16-in Wrench (Optional, see NOTES below.)		Check Valve <See FSG-PL-01501, -01502, -01503, Sheet 5 thru 7>
		Mounting Clamp <See FSG-PL-01501, -01502, -01503, Sheet 5 thru 7>

If an ABV solenoid fails or is damaged; replace the solenoid as follows.

Removal

- Note cable tie locations, cut ONLY ties required to R&R solenoid.
- At solenoid, tag and disconnect electric connector.
- Tag and disconnect air bleed tubing (3/8-in POH connections).

NOTES

If access permits, the screw securing the mounting clamp to the bracket may only need to be loosened allowing the solenoid to slide out of the mounting clamp.

If access does NOT permit the removal of the check valve and POH fitting with the solenoid in place, remove the entire assembly and then secure the solenoid in a vise or hold the solenoid by the body using the optional 13/16-in wrench.

- Using 5/8-in wrench, remove check valve (including POH adapter) from solenoid.
- Using 9/16-in wrench, remove POH adapter from solenoid.



- F. Using 7/16-in wrench, remove 1/4–20 X 0.75 in long hex head screw from mounting clamp.
- G. Remove solenoid (with clamp attached).
- H. Remove clamp.

Verify check valve is functional.

Installation

- A. Install mounting clamp on solenoid.
- B. Position solenoid/clamp on applicable MIV.
- C. Apply Loctite 243 (or equivalent) to 1/4–20 X 0.75 in long hex head screw.
- D. Hand start screw (thru mounting clamp into bracket).
- E. Using 7/16-in wrench, tighten screw
- F. Apply Loctite 580 to threads of POH adapter and check valve.
(Use sealant sparingly to prevent check valve damage.)
- G. Using 9/16-in wrench, install existing/new POH adapter on new solenoid (marked A).
- H. Using 5/8-in wrench, install verified functional/new check valve on solenoid (marked P).
- I. Connect air bleed tubing (3/8-in POH connections) according to tags.
- J. Connect electric connector according to tags.
- K. Install cable ties cut to R&R solenoid as noted.
- L. Pressurize system to check for leaks.
- M. Perform Testing Priming And Air Bleed Component CAN Outputs.
(See paragraph 4.15.7, page 150.)

Perform a NFPA pump vacuum test to verify the pump can hold the required prime.

4.10. Removal And Replacement Of Miscellaneous SAM Components

The following subparagraphs provide removal and installation instructions, parts recognition, and electrical information for select miscellaneous SAM components.

4.10.1 Audio Amplifier

The SAM four-channel audio amplifier (Figure 77) is mounted by the OEM/apparatus builder. The amplifier accepts audio signals from the Pump Controller via the ground loop isolator (Figure 78) and provides four 300 W outputs (into 4 Ω or 2 Ω for up to 1200 W max) to the speakers.

Note the amplifier utilizes an in-line 10A fuse holder, always check for a blown fuse first.

The SAM audio amplifier is installed by the OEM/apparatus builder, refer to the OEM/apparatus builder documentation for audio amplifier location, mounting, and R&R information.



Figure 77. Audio Amplifier



Figure 78. Ground Loop Isolator

Connect the amplifier according to Table 61.

Table 61. Audio Amplifier Wiring (From/To Listing)

From Audio Amplifier	To Ground Loop Isolator	To SAM Speakers	To Circuit Breaker Box
Pwr Neg (Black Wire)	N/C	N/C	Ground Stud (Pump Body)
Pwr Pos (Red Wire) (With 10A In-line Fuse)	N/C	N/C	Connector 1 Pin 3 (CB 1)
Remote On (Blue Wire)	N/C	N/C	N/C
Aux Input Left (RCA, White, Female)	Audio Left (RCA, Black, Male)	N/C	N/C
Aux Input Right (RCA, Red, Female)	Audio Right (RCA, Red, Male)	N/C	N/C
Audio Out (Wire Pair - White & White/Black)	N/C	+ White	N/C
		– White/Black	
Audio Out (Wire Pair - Gray & Gray/Black)	N/C	+ Gray	N/C
		– Gray/Black	
Audio Out (Wire Pair - Green & Green/Black)	N/C	+ Green	N/C
		– Green/Black	
Audio Out (Wire Pair - Purple & Purple/Black)	N/C	+ Purple	N/C
		– Purple/Black	

NOTES Wire all speakers using the same polarity.
Aux In uses the Waterproof 3.5 mm stereo to RCA adaptor to connect to the SAM Pump Controller RCA connectors.

4.10.2 Audio Speakers

SAM utilizes four sealed, waterproof surface mounted speakers. See Figure 79. The speakers mount (behind both pump panels and beneath the apparatus body) and provides an enhanced audible alert in the form of a verbal announcement when the SAM Control Center requires operator attention. Reference FSG-PL-01501 to mount the panel speakers. (Use the speaker bracket as a template to mount the speakers on the apparatus.) Hale has modified the audio amplifier output wiring and the speaker wires to use an eight pin Deutsch connector. The Hale drawings can be found on the flash drive provided with the system or on the Hale website (www.hale-products.com).



Figure 79. Speaker Mounting And Wiring

If the Hale speaker connection is modified, the speakers may be connected to any of the audio amplifiers four channels, however, always connect all four of the speakers using the same polarity.

4.10.3 Auxiliary Cooling Solenoid

Prior to R&R the auxiliary cooling solenoid, verify the check valve (located on the pump-to-tank valve adaptor) is functioning. The auxiliary cooling solenoid is only opened via automation with SAM in Auto Mode and pumping from the onboard water tank.

The auxiliary cooling solenoid mounts in one of the pressure ports on the top of the pump body (Q series pumps) or in the discharge manifold (for all other pumps) and connects to the Sensor Module Electric Harness. The solenoid connects according to Table 62.

Table 62. Auxiliary Cooling Solenoid Wiring (From/To Listing)

From Auxiliary Cooling Solenoid	To Sensor Module Connector A Pin	To Circuit Breaker Box Connector 1 Pin
A	N/C	3
B	N/C	N/C
C	10 (Pump Cool Solenoid) [Output]	N/C

Refer to Table 63 for a list of tools and/or consumables required for this procedure.

Table 63. Auxiliary Cooling Solenoid Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Shop Rag(s) (As Required)
Wire Cutter		Cable Ties (As Required)
9-16-in Wrench		Auxiliary Cooling Solenoid < See FSG-PL-01501, -01502, -01503, Sheet 8>
13/16-in Wrench		Loctite 580 (Or Equivalent)

If the solenoid fails or is damaged; replace the solenoid as follows.

Removal

- A. Note cable tie locations, cut ONLY ties required to R&R solenoid.
- B. Tag and disconnect cooling water tube (3/8-in tubing) as follows.
 1. Push collar to release tubing.
 2. Pull tubing out of elbow.
- C. At solenoid, tag and disconnect electric connector.
- D. Note solenoid port markings (A and P).
- E. Using 9/16-in wrench, hold nipple (below solenoid) from turning. See Figure 81.



Figure 80. Auxiliary Cooling Solenoid And Fittings

- F. Using 13/16-in wrench, remove solenoid (with elbow).
- G. Using 9/16-in wrench, remove elbow. (Use vise or 13/16-in wrench to hold solenoid.)

Installation

- A. Apply Loctite 580 to threads of existing/new elbow. (Use sealant sparingly to prevent check valve damage.)
- B. Install elbow according to noted port marking.

- C. Using 9/16-in wrench, tighten elbow. (Use vise or 13/16-in wrench to hold solenoid.)
- D. Apply Loctite 580 to threads of existing/new nipple.
(Use sealant sparingly to prevent check valve/solenoid damage.)
- E. Install solenoid.

NOTE

Do NOT overtighten solenoid.

- F. Hand tighten solenoid until snug.
- G. Using 13/16-in wrench, torque an additional 1 turn (2 turns maximum) past hand tight engagement.
- H. Connect cooling water tube (3/8-in tubing) to elbow. Push tubing until locked.
- I. Pressurize system to check for leaks.
- J. Connect electric connector according to tags.
- K. Install cable ties cut to R&R solenoid as noted.

4.10.4 DC-To-DC Converter

The DC-to-DC (12 to 24 VDC) converter (Figure 81) which connects to the SAM power bus and provides 3 Amps (72 W) of 24 VDC power to the Wi-Fi router/antenna via the ethernet POE electric harness.



Figure 81. DC-To-DC Converter

The SAM DC-to-DC converter is installed by the OEM/apparatus builder, refer to the OEM/apparatus builder documentation for converter location, mounting, and R&R information.

See Table 64 for the DC-to-DC (12 to 24 VDC) converter wiring connections.

Table 64. DC-To-DC Converter Wiring (From/To Listing)

From Converter (Wire)	To Circuit Breaker Box Connector 1 Pin	To Antenna (Twisted Pair Of CAT 6 Cable)
Red	3	N/C
Black	System Ground	N/C
Black	N/C	Brown and Brown/White
Yellow	N/C	Blue and Blue/White

Refer to FSG-PL-01505, Sheet 3 for part number and harness connection information.

4.10.5 Wi-Fi Router

The Wi-Fi router/antenna (Figure 82) utilizes the ethernet POE electric harness. Antenna placement is important for Wi-Fi reception. The antenna needs to mount high on the apparatus, however the antenna should NOT alter the trucks height. Mounting the antenna in a metal enclosed/surrounded area may result in poor Wi-Fi reception (canyon effect).

NOTE

The Wi-Fi antenna provides protection for 15 kV of ESD and 4 kV for lightening.



Figure 82. Wi-Fi Booster Antenna

The Wi-Fi router/antenna is installed by the OEM/apparatus builder, refer to the OEM/apparatus builder documentation for converter location, mounting, and R&R information.

Refer to Table 65 for a list of tools and/or consumables required for this procedure.

Table 65. Wi-Fi Router/Antenna Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Heavy Duty Cable Ties (As Required)
Wire Cutter		Wi-Fi Router/Antenna <See FSG-PL-01505, Sheet 4>
#2 Phillips Screwdriver		Ethernet POE Electric Harness <See FSG-PL-01505, Sheet 4>
Slip Joint Pliers (Optional)		

If the Wi-Fi router/antenna fails or is damaged; replace the antenna as follows.

Removal

- A. Note heavy duty cable tie locations, cut ties securing antenna to bracket.
- B. Remove antenna. (Pull antenna to snap out of bracket.)
- C. Remove cover as follows. See Figure 83. (Use the optional slip joint pliers if required to hold/loosen the cover and/or housing.)
 1. Hold antenna, turn cover CCW.
 2. Unscrew cover and slide down harness.

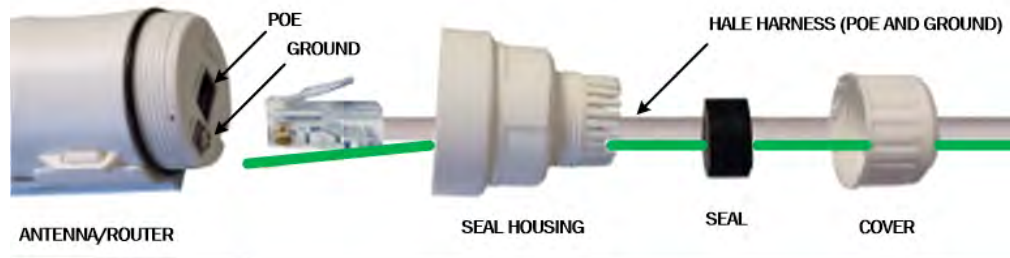


Figure 83. Wi-Fi Router/Antenna Connectors

- D. Slide seal down harness.
- E. Remove seal housing. (Same as cover, see above.)
- F. At antenna/router, tag and disconnect electric connectors.

NOTES

Hale recommends replacing the housing, seal, and cover when replacing the antenna, however, if the existing housing, seal, and cover are NOT broken/cracked/damaged /discolored/hardened/leaking/etc. for convenience (and to prevent harness damage) they may be reused.

Protect the locking tab on the RJ45 connector while removing the housing, seal, and cover.

If the locking tab is damaged or broken off, replace the Ethernet POE Electric Harness.

- G. If applicable, slide seal housing, seal, and cover off harness.
- H. If applicable, discard antennas (2.4 and 5 Ghz), antenna support, seal housing, seal, and cover.
- I. Discard antenna/router.

Installation

- A. If applicable, slide new cover on to harness.
- B. If applicable, slide new seal on to harness.
- C. If applicable, slide new housing on to harness.
- D. Connect electric connectors according to tags.
- E. Slide housing over harness on to antenna/router and hand tighten housing. (Use the optional slip joint pliers if required to hold the antenna/router.)
- F. Slide seal over harness in to rear of housing.
- G. Slide cover over harness on to housing and hand tighten. (Use the optional slip joint pliers if required to hold the housing.)
- H. Align new antenna/router with existing/new mounting bracket and push antenna/router to snap it into mount.
- I. Install heavy duty cable ties securing antenna to bracket as noted.

NOTE

The antennas are labeled (2.4 and 5 Ghz) and must be installed on the correct output stud. The antenna simultaneously outputs on the 2.4 and 5 Ghz bands (up to 600 Mbps) at 600 mW.

- J. Install new 2.4 and 5 Ghz antennas on top of new antenna/router.
 - K. Install new antenna support on to both antennas. See Figure 83, page 113.
- Configure/setup new antenna/router. See paragraph 4.12.6, page 141.

4.10.6 SAM System Power

The SAM power system consists a ground stud, a power stud, and the circuit breaker box (see Figure 84).

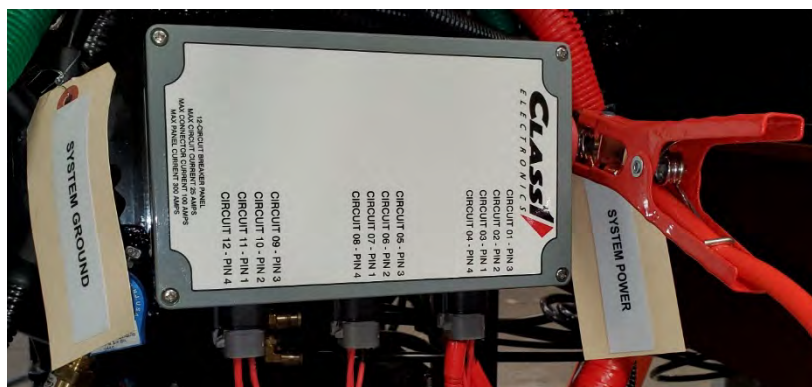


Figure 84. Circuit Breaker Box

Multiple Hale harness connect to the ground stud and the three circuit breaker box connectors which supply all of the power required by the SAM system. Additionally, the OEM/apparatus builder connects apparatus power (12 VDC, negative and positive) to the SYSTEM GROUND stud (located on the pump body, see Figure 84) and the SYSTEM POWER stud (located on the circuit breaker box, see Figure 85) respectively.

The SAM system currently utilizes the circuit breaker box covered in paragraph 4.10.6.1 (below) however information for the legacy circuit breaker box (covered in paragraph 4.10.6.1.1, page 118) is also provided.

4.10.6.1 Circuit Breaker Box

The See Figure 86 for the connector and pin layout for the circuit breaker box and Table 66 for the pinout to circuit breaker listing.

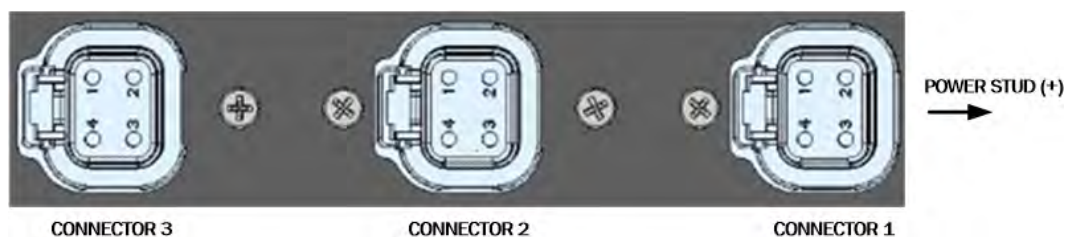


Figure 85. Circuit Breaker Box Connector/Pin Layout

Table 66. Circuit Breaker Box Wiring (From/To Listing)

Connector 3		Connector 2		Connector 1	
Pin	CB #	Pin	CB #	Pin	CB #
1	11	1	7	1	3
2	10	2	6	2	2
3	9	3	5	3	1
4	12	4	8	4	4

See Table 67 for circuit breaker number 1 connectivity details. Refer to FSG-PL-01507 for all AB Swing-out™ valve and Hale MIV circuits.

Table 67. Circuit Breaker Box Connector 1 Pin 3 Connections

From Connector 1 Pin	To
3	AFS MIV–A Module, POWER screw (All present, quantity varies)
	AFS Sensor Module, POWER screw
	Audio Amplifier (Utilizes an additional in-line 10A fuse.)
	Buzzer Alarm (+) (Harness connector pin 3.)
	ITL-40, Pin 1
	Matrlx Pressure Governor Module, Connector A, Pin 1
	MIV 2.0 Control (Valve Drive) Module, Pin 1 (All present, quantity varies)
	MIV Activation Switch, Pin 1 (All present, quantity varies)
	MIV–Rocker Switch, Pin 3 (All present, quantity varies)
	SAM Control Center, Connector A, Pin 7 and 17
	SAM Control Center, Connector A, Pin 7 and 17 (Auxiliary – Officer Panel)
	SAM Control Center, Connector A, Pin 7 and 17 (Auxiliary – Rear Panel/Aerial Panel)
	SAM Pump Controller, Connector A, Pin 7 and 17
	Twister, Pin 1
	Wi-Fi Power Supply, Black Connector, Pin 1
	Wi-Fi Antenna/Router CAT 6 Cable Plug (Pin 4 and 5)

Prior to R&R of the circuit breaker box ALWAYS verify apparatus power (including current capability), harness connections (see paragraph 4.3.5, page 48), and check for tripped/failed circuit breakers (see paragraph 4.10.6.2, page 120).



Refer to Table 68 for a list of tools and/or consumables required for this procedure.

Table 68. Circuit Breaker Box Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Heavy Duty Cable Ties (As Required)
Wire Cutter		Circuit Breaker Box <See FSG-PL-01501, or -01502, Sheet 3 or FSG-PL-01513, Sheet 5>
#2 Phillips Screwdriver (Magnetic Tip, Optional)		Circuit Breaker (15 Amp) <See FSG-PL-01507>
1/4-in Wrench		Circuit Breaker (30 Amp) <See FSG-PL-01507>
Pliers (or Fuse Puller)		Grease or Bees Wax (Optional)

If the circuit breaker box fails or is damaged; replace the circuit breaker box as follows.

Removal

- A. Disconnect/turn off apparatus power to SAM circuit breaker box.
- B. Note cable tie locations, cut ONLY ties required to R&R circuit breaker box.
- C. Tag and disconnect all circuit breaker box electrical connectors and wires.
- D. Using #2 Phillips screwdriver, remove four [4] cover screws. See Figure 85.
- E. Remove cover.
- F. Using 1/4-in wrench, hold nylon lock nut on rear of circuit breaker box mounting bracket securing screw selected for removal.
- G. Using #2 Phillips screwdriver, remove four [4] 6–32 X 1/2-in mounting screws. (Screws are recessed deeply in each corner of the box.) (Use the 1/4-in wrench to hold the lock nut for each screw while removing it.)
- H. Remove circuit breaker box from bracket.

Installation

- A. Using #2 Phillips screwdriver, remove four [4] cover screws. See Figure 85.
- B. Remove cover.
- C. If installing existing circuit breakers, ensure each circuit breaker is checked prior to installation. (See paragraph 4.10.6.2, page 120.)
- D. Install one [1] 15 Amp circuit breaker in position 1. (Refer to FSG-PL-01507.)
- E. Install a 30 Amp circuit breaker in positions 2 thru 12. (Refer to FSG-PL-01507, 11 circuit breakers required.)
- F. Install new circuit breaker box on mounting bracket as follows.

NOTE

If desired, use optional magnetic tip, grease, or bees wax to stick one of the screws to the tip of the screwdriver. Align the box to the mounting bracket and insert the screw thru the box and bracket. Place new locking nut against screw and start screw into nut, do NOT tighten. Repeat to install the other three screws and nuts. Tighten all screws.

1. Place first 6-32 X 1/2-in mounting screw in easiest to access corner of circuit breaker box.
2. Using #2 Phillips screwdriver, hold screw in place while mounting circuit breaker box onto bracket with screw thru associated hole in bracket.
3. Place new locking nut against screw and start screw into nut, do NOT tighten.
4. Place next screw into next corner of circuit breaker box, using #2 Phillips screwdriver, push screw thru box and bracket, then start new locking nut on screw.
5. Repeat to install the remaining two screws and nuts.
6. Using #2 Phillips screwdriver and 1/4-in wrench, tighten all four [4] screws.

G. Install cover.

H. Using #2 Phillips screwdriver, install four [4] cover screws.

I. Connect electrical connectors and wires according to tags.

J. Install cable ties cut to R&R circuit breaker box as noted.

Verify the SAM system is functional and ready for service. See paragraph 4.17, page 171.

4.10.6.1.1 Legacy Circuit Breaker Junction Box

The legacy circuit breaker junction box primarily applies to Q series pumps. The circuit breaker junction box is attached to the Autolube keep out bracket for these legacy SAM systems. See Figure 86.

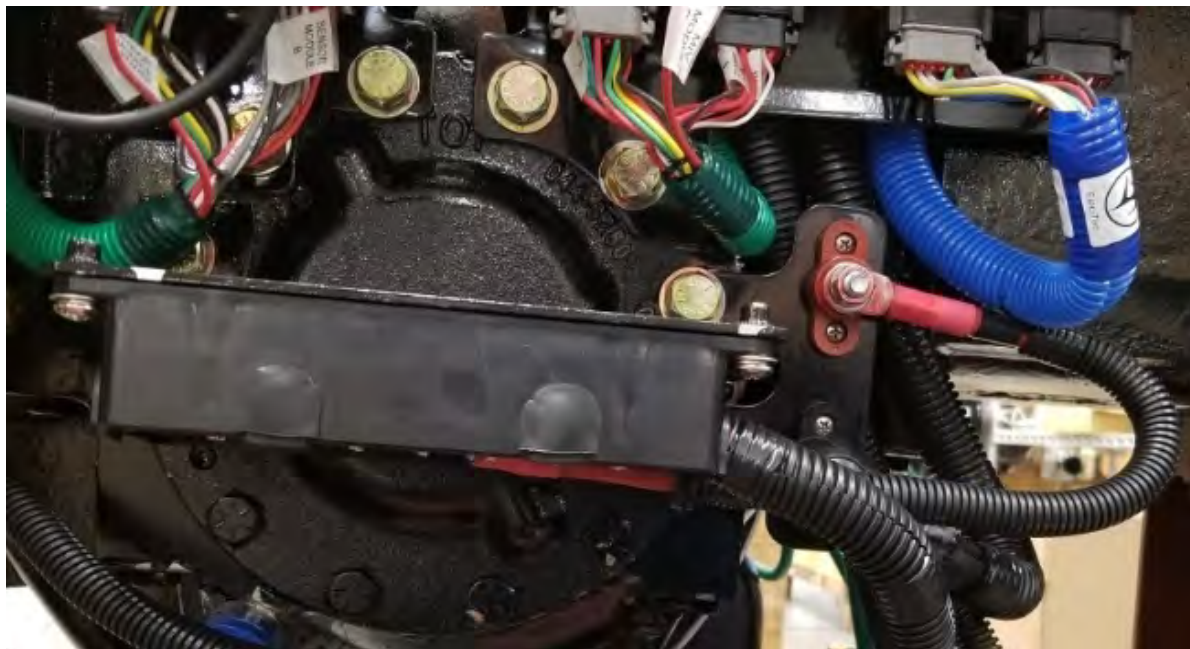


Figure 86. Legacy CB Junction Box Location

For legacy SAM systems utilizing RME or DSD pumps, the OEM locates the circuit breaker junction box utilizing the generic power stud/circuit breaker junction box bracket. See Figure 87.

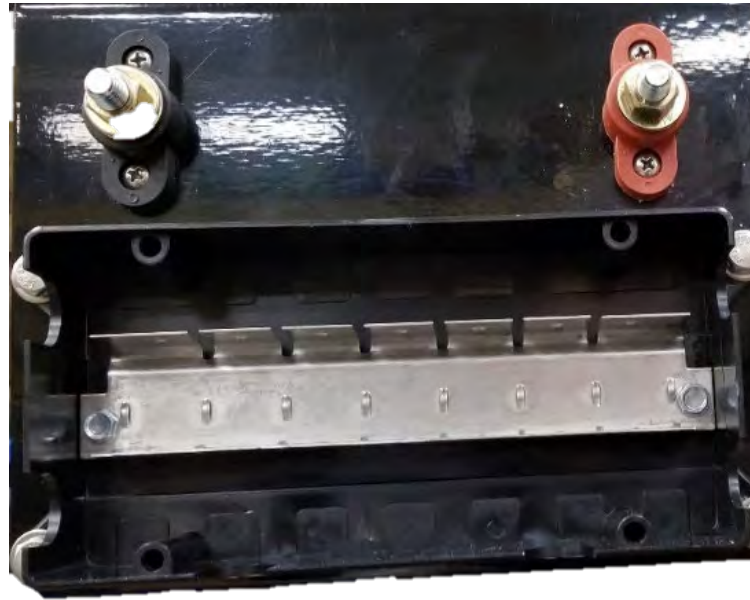


Figure 87. OEM Located Legacy CB Junction Box

For legacy circuit breaker junction boxes, a maximum of two [2] AB Swing-out™ valves are connected to each circuit breaker (MIVs may connect to the bus bar or have been externally powered by the OEM). See Figure 88.

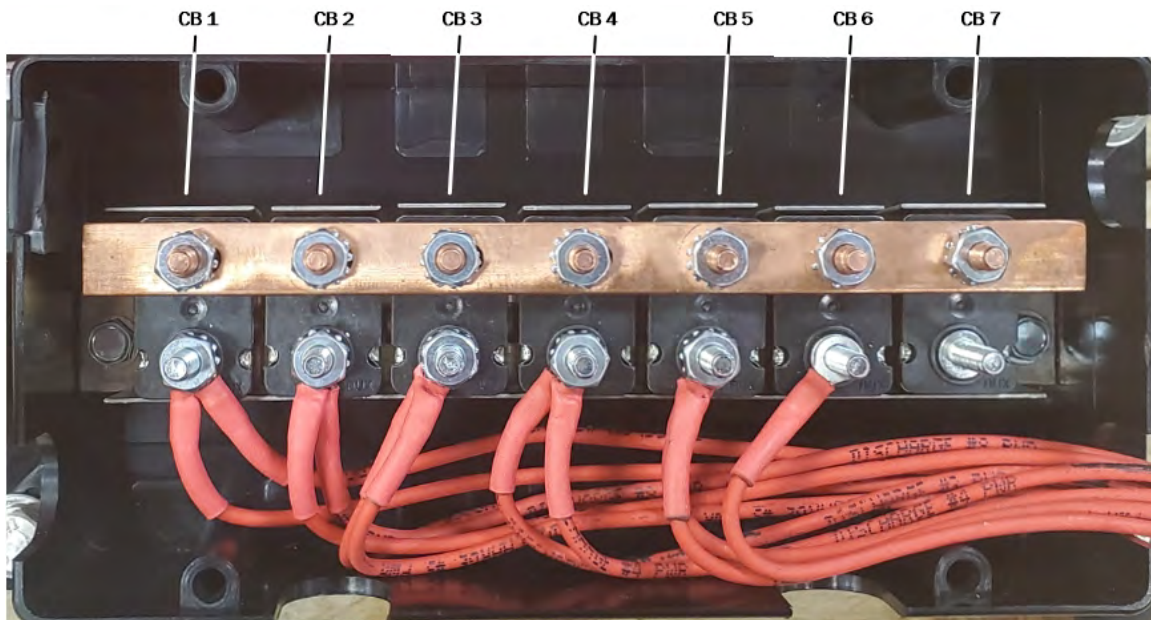


Figure 88. Legacy CB Junction Box Layout

Additionally, two in-harness circuit breakers were provided: a 15 Amp in-harness auto resetting circuit breaker (unique to the legacy power system), and the 10 Amp (non resetting) circuit breaker that is always provided to protect the audio amplifier.

The legacy circuit breaker box houses seven [7] 30 Amp auto resetting circuit breakers (always check for a failed breaker prior to replacing the entire circuit breaker box) however if the box fails it must be replaced with the current circuit breaker box. This requires a new mounting bracket and harnesses which must be ordered by contacting Hale Customer Service (800-533-3569) and providing the information from the systems ID tag. Refer to the SAM OIM (FSG-MNL-00210), SAM Numbering and Specifications References (paragraph 2.1), Hale ID Tag With Sample Markings (Figure 1.) for details.

4.10.6.2 Circuit Breaker Checks

All SAM circuit breaker box (and legacy CB junction box) use auto-reset breakers. Perform the following to check for a failed breaker verses a short circuit condition.

- A. Isolate harness wiring from circuit breaker as follows.
 1. If legacy CB junction box, perform following.
 - a) Remove junction box cover.
 - b) Tag and disconnect wires at suspect circuit breaker.
(Bus bar removal is NOT required.)
 2. If current circuit breaker box, perform following.
 - a) Tag and disconnect electrical connectors.
 - b) Use cover label (see Figure 84, page 115), Figure 85 (page 115), and Table 66 to determine associated connector pins.
- B. Set multimeter to check continuity. (The continuity setting is typically indicated by a microphone symbol.)
- C. Check for continuity as follows.
 1. Place negative multimeter probe on one circuit breaker terminal (or connector pin).
 2. Place positive multimeter probe on other circuit breaker terminal (or connector pin).
 3. Listen for tone. (Also look at the reading on the multimeter, it must be near 0 Ω s.)
- D. If there is NO tone (and much greater than 0 Ω s displayed), replace the associated circuit breaker. (See the applicable procedure above.)

4.10.7 SAM Tablet

IMPORTANT NOTICE

DO NOT HARD SHUTDOWN THE TABLET (POWER OFF BY HOLDING THE POWER BUTTON FOR LONGER THAN 5 SECONDS). A HARD SHUTDOWN MAY CORRUPT THE OPERATING SYSTEM, MAKING THE TABLET UNUSABLE.

To check the tablet charger (Figure 89), perform the following.

- Check for constant 12 VDC power and ground at source connection (location may vary).
- Check for blown fuse at tablet power supply converter.



Figure 89. Tablet Power Supply Converter/Fuse

- Check for 20 VDC at tablet docking station (Figure 90).



Figure 90. Tablet Docking Station/Mount

4.10.7.1 SAM Tablet Replacement

Refer to FSG-MNL-00210 (SAM OIM), section 6.3.1.6 (Mobile Operations – From Tablet) for SAM tablet power on and unlocking information. Then perform the following.

IMPORTANT NOTICE

DO NOT HARD SHUTDOWN THE TABLET (POWER OFF BY HOLDING THE POWER BUTTON FOR LONGER THAN 5 SECONDS). A HARD SHUTDOWN MAY CORRUPT THE OPERATING SYSTEM, MAKING THE TABLET UNUSABLE.

NOTE

SAM must be in Auto Mode for the tablet to display anything other than the manual mode warning screen.

- Press and hold menu icon (wait for circle to complete).
- Input tablet password. See Table 2 (page 35). Password screen appears. (See Figure 91.)



Figure 91. Tablet Password Screen

- C. Go to Wi-Fi settings.
- D. Input SSID and Wi-Fi password provided by Hale.
(The SSID and password may have been pre-configured before delivery.)
- E. If required, touch save.
- F. Touch home button.
- G. Power on apparatus (do not engage the pump) and wait for manual mode screen (Figure 92) to appear.

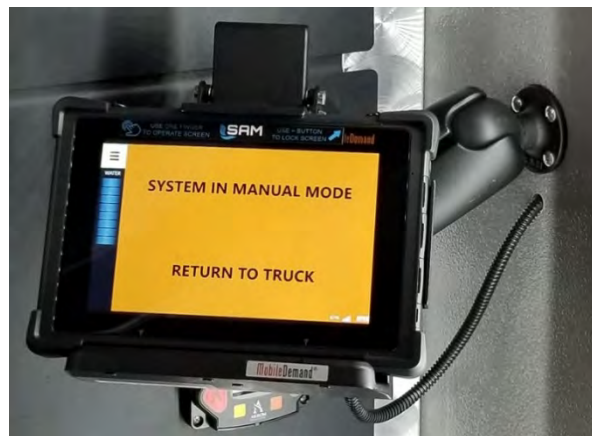


Figure 92. Tablet (Manual Mode Warning)

- H. Press and hold menu icon (wait for circle to complete).
- I. Input tablet password. See Table 2 (page 35). Password screen appears.
- J. Touch Retrieve BAM button.
- K. Wait for **DONE** to appear below button.
- L. Touch home button.

- M. Place apparatus in pump gear. SAM enters Auto Mode.
- N. Verify tablet mirrors SAM Control Center display. See Figure 93.



Figure 93. Auto Mode Screen (Tablet/SAM Control Center)

- O. Using tablet, open an intake.
- P. Then open a discharge.

If SAM functions properly, the tablet is ready for use. Place the tablet on the docking station to charge (leave the tablet powered on until fully charged).

4.11. Bench Procedures

SAM bench procedures are intended to be performed after the Removal portion of the associated (referenced or titled) R&R procedure and prior to the Installation portion of the same R&R procedure. Typically, the bench procedure entails the installation of a repair kit or R&R of the originally R&R assembly's subcomponents. When the bench procedure is complete, simply click on the link provided to return to the Installation portion of the original R&R procedure (or use the table of contents to locate the R&R procedure for the assembly of the same name).

4.11.1 AB Swing-out Valve Motor Rotation

IMPORTANT ▲ NOTICE

DO NOT USE A DRIVER AND SOCKET TO INITIALLY MOVE A CLOCKED VALVE.

To change the position of the motor on a valve to accommodate an adjacent component or structure or to provide physical access to the override connection; reference Section III of the Style 8600 Electric Actuator With Motor Driver Installation Instructions (P/N 123248) for a Gen I valve or Section II and IV of the Style 8600 Electric Actuator Installation Instructions (P/N 127890) for a Gen II valve.

4.11.2 4-Way Air Valve R&R

ATTENTION ▲ CAUTION

THE 4-WAY AIR VALVES ARE CONNECTED TO THE APPARATUS COMPRESSED AIR SUPPLY. DO NOT REMOVE A 4-WAY AIR VALVE, PF VALVE AIR CYLINDER, FITTINGS, OR AIR TUBES WHEN THE SYSTEM IS PRESSURIZED.

Four-way valves are required to route priming suction to each MIV installed on the pump (See Figure 94). The suction provides air evacuation for the rigid LDH connected to the MIV. The valves are mounted on the rear of the PVG/MAC valve bracket and require air line (refer to FSG-PL-00099), plumbing (refer to FSG-PL-01514), and harness connection (see Table 69).

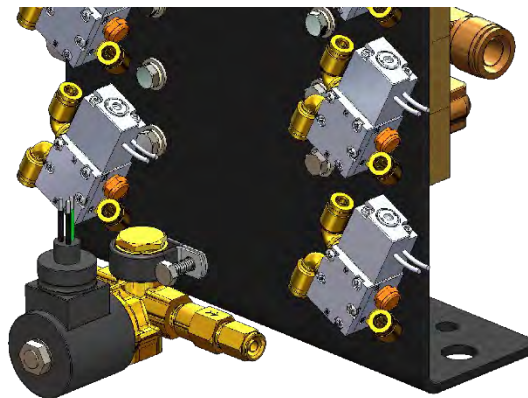


Figure 94. 4-Way Air Valve

Table 69. 4-Way Air Valve Wiring (From/To Listing)

Air Bleed Drain 4-Way Air Valve		
From 4-Way Air Valve Pin		To MIV-A Module Connector B Pin
1	AB Drain	1 (AB Drain) [Output]
2	System Ground (Blk Wire)	*
Pump Body PF Valve 4-Way Air Valve		
From 4-Way Air Valve Pin		To MIV-A Module Connector A Pin
1	PUMP BODY PRIME	7 (Pump Body Prime) [Output]
2	System Ground (Blk Wire)	*
LH MIV PF Valve 4-Way Air Valve		
From 4-Way Air Valve Pin		To MIV-A Module Connector A Pin
1	PRE-PRIME #1	9 (Pre-Prime #1) [Output]
2	System Ground (Blk Wire)	*
RH MIV PF Valve 4-Way Air Valve		
From 4-Way Air Valve Pin		To MIV-A Module Connector B Pin
1	PRE-PRIME #2	2 (Pre-Prime #2) [Output]
2	System Ground (Blk Wire)	*
Bottom MIV PF Valve 4-Way Air Valve		
From 4-Way Air Valve Pin		To MIV-A Module Connector A Pin
1	PRE-PRIME #3	1 (Pre-Prime #3) [Output]
2	System Ground (Blk Wire)	*
T-Port MIV PF Valve 4-Way Air Valve		
From 4-Way Air Valve Pin		To MIV-A (Slave) Module Connector A Pin
1	PRE-PRIME #4	9 (Pre-Prime #4) [Output]
2	System Ground (Blk Wire)	*

* Connects to system ground on pump body.

Perform the Removal portion of paragraph 4.9.2 (page 103), Priming Feature Assembly, and take the removed assembly to a stable work surface or bench.

Refer to Table 70 for a list of tools and/or consumables required for this procedure.

Table 70. 4-Way Air Valve Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Wire Cutter		Muffler, Fittings, Or Tubing <Refer To 538-00099-000, Sheet 1>
7/16-in Wrench		4-Way Air Valve <Refer To 538-00099-000, Sheet 1>

NOTE: Mounting hardware may vary, tools NOT specified.

Perform the following to R&R a 4-way air valve.

Removal

- At failed 4-way air valve, tag and disconnect all remaining air hose.
- Tag/note air hose fittings; remove fittings from ports A, B, and IN. See Figure 95.



Figure 95. 4-Way Valve Air Line Labels And Mounting

- Remove muffler (port EX) and verify muffler passes air without restriction.
- Remove two retaining screws. See Figure 95.
- Remove 4-way air valve.

Installation

- At new 4-way air valve (port EX), install existing muffler (ONLY if muffler passes air without restriction) otherwise install new muffler.
- Install fittings in ports A, B, and IN.

NOTE

If applicable, do NOT install used nylon locking nuts.

- Install two retaining screws.
- Connect all removed air hose according to tags/notes.

Perform the Installation portion of paragraph 4.9.2 (page 103), Priming Feature Assembly.

4.11.3 PF Air Cylinder R&R

Perform the Removal portion of paragraph 4.9.2 (page 103), Priming Feature Assembly, and take the removed assembly to a stable work surface or bench.

Refer to Table 71 for a list of tools and/or consumables required for this procedure.

Table 71. PF Air Cylinder R&R Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Cable Ties (As Required)
Wire Cutter		Muffler, Fittings, Or Tubing <Refer To 538-00100-000>
7/8-in Wrench		Cylinder <Refer To 538-00100-000>
* Wrench		

* Wrench sizes NOT provided since fitting sizes vary by manufacturer.

Perform the following to R&R an air cylinder.

Removal

- If required, tag and disconnect both air lines.
- Remove air fitting (elbow closest to PF valve body). See Figure 96.

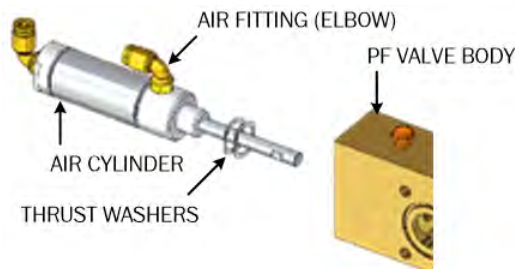


Figure 96. PF Air Cylinder R&R

- Using 7/8-in wrench, remove air cylinder (with two [2] thrust washers).

Installation

- Place thrust washers over air cylinder mounting threats. See Figure 96.
- Hand start air cylinder in PF valve.
- Using 7/8-in wrench, tighten air cylinder.
- Install air fitting (elbow closest to PF valve body), tighten fitting.
- Connect both air lines according to tags.

Perform the Installation portion of paragraph 4.9.2 (page 103), Priming Feature Assembly.

4.11.4 PF Valve Assembly R&R

To determine whether each PF assembly is functioning properly, use the SAM Pump Controller MIV Diagnostic Screen (password 6060). Select the OUTPUT screen and look for the Pre-Prime 1 thru 4, Prime Body, or AB Drain icons. With the 4-way air valve connected to the SAM harness, touch the applicable icon. On the diagnostic screen, each time the icon toggles state, listen/feel for a distinctive click on the corresponding 4-way air valve and visually monitor for movement of the air cylinder at the PF valve assembly.

Once a PF valve failure has been determined use this procedure to R&R the failed valve.

Refer to Table 72 for a list of tools and/or consumables required for this procedure.

Table 72. PF Valve R&R Tools And Consumables List

Standard Tools	Special Tools	Consumables
PPE (Eye and Hand Protection)	None	Muffler or Fittings <Refer To 538-00097-000 and/or 538-00099-000>
Wire Cutter		O-ring (Square Seal Type) <Refer To 538-00097-000>
7/16-in Wrench		O-ring Lubricant <See Table 6 (page 44)>
* Wrench		PF Valve Assembly <Refer To 538-00099-000>
No. 2 Philips Screwdriver		Cable Ties (As Required)
Needle Nose Pliers		

*** Wrench sizes NOT provided since fitting sizes vary by manufacturer.**

Perform the Removal portion of paragraph 4.9.2 (page 103), Priming Feature Assembly, and take the removed assembly to a stable work surface or bench.

Perform the following to R&R a PF valve.

NOTES

The top most PF valve can be replaced without removing the PF valve block from the PVG/MAC valve bracket. In some cases, the bottom most PF valve can also be replaced without removing the block from the bracket.

Never install a used O-ring between PF valves. Always use new O-rings and lubricate the O-ring to prevent damage.

A PF valve rebuild kit is available, contact Hale Customer Service (800 533.3569) for the part number.

Access

- Note all cable tie locations, cut cable ties.
- Note/tag and disconnect all air lines.
- Remove ONLY 4-way air valves required to access PF valve mounting screws.
See paragraph 4.11.2, 4-Way Air Valve R&R (page 123) and Figure 97.

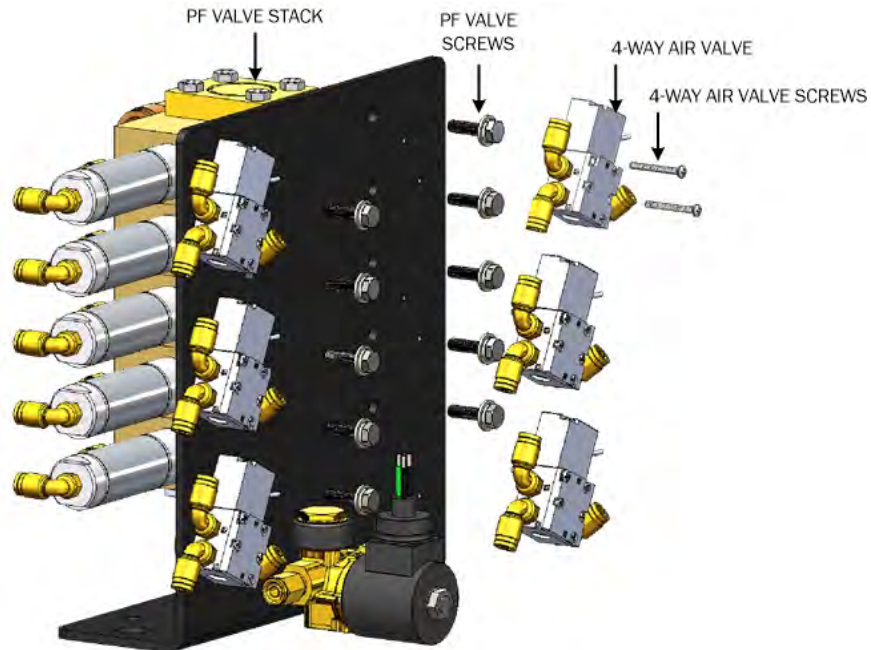


Figure 97. PF Valve Block Mounting Screw Access

Removal

- A. Match mark blank plate to top PF valve, and cover to bottom PF valve.
- B. Using two 7-16-in wrenches, remove PF valve block, blank plate, and cover retaining bolts. Hold nut (with washers), remove bolt (with washer). See Figure 98.

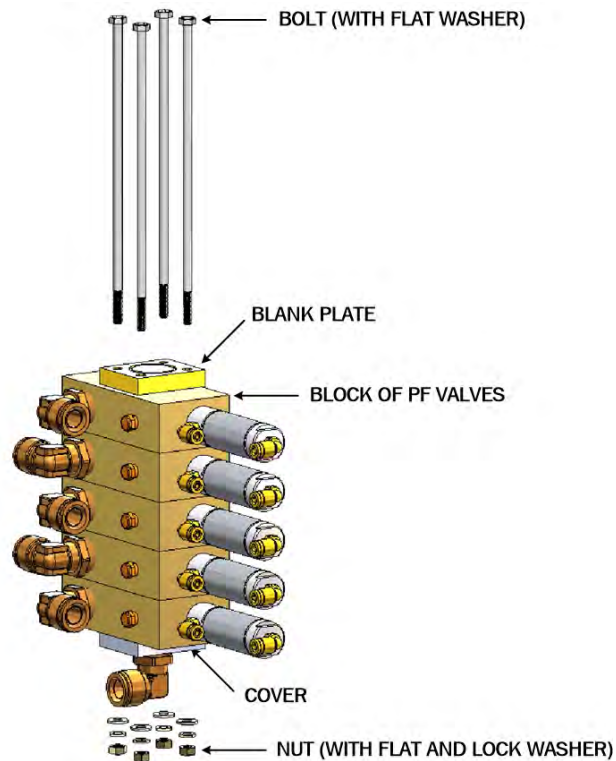


Figure 98. PF Valve Block Disassembly

NOTE

If **ONLY** replacing the top or bottom most PF valve, **ONLY** remove that valve's mounting hardware. Otherwise, remove all mounting hardware. There is one spacer for each mounting screw, the spacers are located between the valve body and the bracket.

- C. If **ONLY** replacing top or bottom most PF valve, remove failed valve as follows.
1. If **ONLY** removing top most PF valve, at top of valve stack, remove blank plate.
 2. Remove O-ring. (The O-ring may be on the blank plate or on the failed valve; see Figure 100.)
 3. Simultaneously using 7-16-in wrench and needle nose pliers, remove **ONLY** top most PF valve mounting screws and spacers. See Figure 100.
 4. Remove failed valve from valve stack.
 5. Remove O-ring. (The O-ring may be on the failed valve or on the valve at the top of the stack; see Figure 100.)
 6. If **ONLY** removing bottom most PF valve, at bottom of valve stack, remove cover (with fitting in place).
 7. Remove O-ring. (The O-ring may be on the cover or on the failed valve; see Figure 100.)
 8. Simultaneously using 7-16-in wrench and needle nose pliers, remove **ONLY** bottom most PF valve mounting screws and spacers. See Figure 100.
 9. Remove failed valve from valve stack.
 10. Remove O-ring. (The O-ring may be on the failed valve or on the valve at the bottom of the stack.) See Figure 100.
- D. Otherwise, simultaneously using 7-16-in wrench and needle nose pliers, remove all PF valve mounting screws and spacers. See Figure 99.

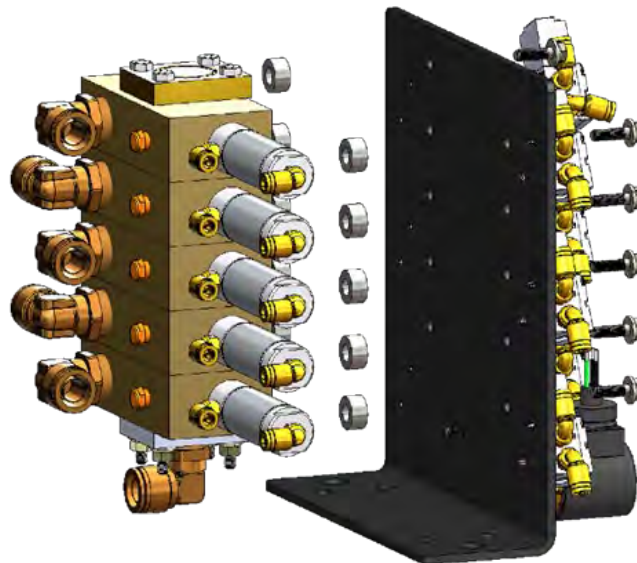


Figure 99. PF Valve Block Removal From Bracket

- E. Perform Removal, Step A (above).
- F. At top of valve stack, remove blank plate.

- G. At bottom of valve stack, remove cover (with fitting in place).

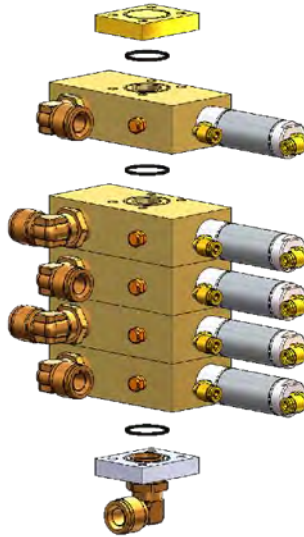


Figure 100. PF Valve R&R

- H. Remove top and bottom O-rings. (The top O-ring may be on the blank plate or on the top valve; the other O-ring may be on the cover or on the bottom valve; see Figure 100.)
- I. Separate failed PF valve from stack.

Installation

- A. Apply O-ring lubricant to four [4] new O-rings. See Table 6 (page 44).
- B. Install a new O-ring on each side of new PF valve. (Discard existing O-rings.)
- C. Align new PF valve with rest of stack.
- D. At top of stack, install a new O-ring on PF valve. See Figure 100.
- E. Align blank plate to top PF valve.
- F. At bottom of stack, install a new O-ring on PF valve.
- G. Align cover to bottom PF valve.
- H. Install four [4] bolts (one [1] flat washer on each) thru PF valve stack and four [4] nuts (with one [1] flat and one [1] lock washer on threads of each bolt). See Figure 98.
- I. Using two [2] 7/16-in wrenches, tighten bolts and nuts.
- J. Align PF valve stack to bracket.
- K. Using needle nose pliers, install all PF valve mounting spacers and hand start mounting screws. See Figure 99.
- L. Using 7-16-in wrench, tighten mounting screws.
- M. Install all 4-way air valves removed for access to PF valve mounting screws. See paragraph 4.11.2, 4-Way Air Valve R&R (page 123) and Figure 97.

N. Connect all air lines according to notes/tags.

O. Install all cable ties cut to R&R PF valve.

Perform the Installation portion of paragraph 4.9.2 (page 103), Priming Feature Assembly.

4.12. Post Removal And Replacement Configuration Procedures

Following the R&R of specific SAM components, configuration/settings require change/update. Perform the referenced configuration procedure, then perform all referenced adjustments, SAM setup/configuration, and/or post R&R Testing before returning the apparatus to service.

4.12.1 Enable Master SAM Control Center Wi-Fi

Perform all of paragraph 4.12.1 (above) prior to performing the following.

NOTES

If replacing the SAM Control Center on the main pump panel (the only Wi-Fi capable screen), the new touchscreen comes from Hale preconfigured to pair with your router. Please contact Hale Customer Service (800-533-3569) and provide the information from your Hale ID tag.

Reference the SAM OIM (FSG-MNL-00210), SAM Numbering and Specifications References (paragraph 2.1), Hale ID Tag With Sample Markings (Figure 1) for detailed Hale ID tag information.

Perform the following to enable the SAM Control Center Wi-Fi.

- A. Power SAM system on.
- B. Go to Systems Options screen as follows.
 - 1. Perform Accessing SAM Password Screens (see paragraph 2.6.1, page 33).
 - 2. Perform SAM Control Center Password Screen (see paragraph 2.6.1.1, page 34).
 - 3. Enter user/dealer password. (See Table 2, page 35.)
- C. Touch BAM tab.
- D. Touch Configuration Mode button. (The Select DEVICE MENU screen is displayed, see Figure 148, page 188.)

IMPORTANT NOTICE

TOUCH ONLY THE SPECIFIED BUTTON(S). FAILURE TO PERFORM THIS PROCEDURE CORRECTLY MAY CAUSE SAM TO BECOME INOPERATIVE.

- E. At top center of screen, touch  icon. (MENU screen is displayed, see Figure 101.)
- F. At bottom right of screen, touch This Screen is Wi-Fi Capable check box. (Ensure check mark appears in check box.)

NOTES

If the This Screen is Wi-Fi Capable check box is NOT displayed, verify the touchscreen is the correct P/N. Inspect the touchscreen serial number to verify it ends with -TCLS.

Contact Hale Customer Service (800-533-3569), if the new SAM Control Center serial number does NOT end with -TCLS, or if the This Screen is Wi-Fi Capable check box is NOT displayed.

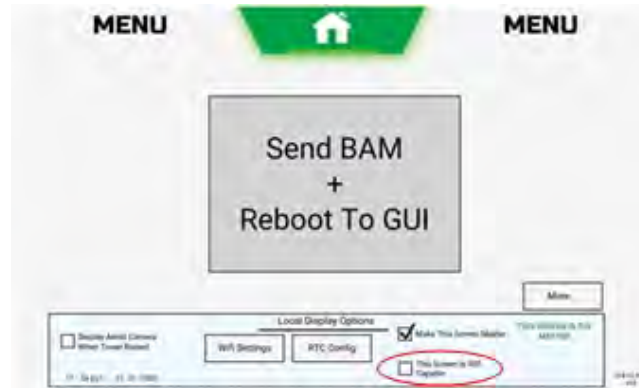


Figure 101. MENU Screen

- G. Touch Send BAM + Reboot To GUI button. Wait for SAM Landing Screen to display.
- H. Perform Updating The Tablet After SAM Setup/Configuration Changes (see paragraph 4.13, page 143) to verify secure Wi-Fi connection/communication with SAM Tablet.

If the SAM tablet does NOT connect/communicate with the SAM Control Center, contact Hale Customer Service (800-533-3569) to verify the SAM Control Center Wi-Fi settings.

NOTES

The SAM Control Center, Wi-Fi settings are configured by Hale prior to shipment.

Contact Hale Customer Service (800-533-3569), if the new SAM Control Center serial number does NOT end with -TCLS, or if the This Screen is Wi-Fi Capable check box is NOT displayed.

4.12.2 Auxiliary SAM Control Center Setup

When replacing a faulty Auxiliary Sam Control Center see the following steps to configure the Control Center to work with the system and import your settings. These steps MUST be followed and only touch the buttons required as listed below.

- A. On desired SAM Control Center enter Home MENU as follows:
 1. If SAM Auto Mode or Landing screen is displayed (see Figure 1, page 11), touch System Options icon (touch and hold icon if required).
 2. SAM displays Enter Password screen. (See Figure 102).



Figure 102. Enter Password Screen

NOTE

If the Loading Icon (see Table 1) is displayed when the System Options button is touched, hold the System Options button until the Loading Icon completes the circle and the Enter Password screen is displayed.

3. Enter technician level 2 password (See Table 2, page 35).
4. On System Options screen (Figure 103) Touch BAM menu tab.
5. Touch Configuration Mode button. (The SELECT DEVICE MENU, see Figure 104, is displayed.)



Figure 103. System Option Screen (BAM Tab Selected)

- B. If SELECT DEVICE MENU (Figure 104) is displayed, touch MENU icon (top center of screen).

SELECT DEVICE		MENU		RETRIEVE BOM	
UID	MFG Year	MFG Code	Friendly Name	Addr.	PORT
9210	16	0x146	INTAKE1	0xA0	Green
9211	16	0x146	INTAKE	0xA1	Green
9212	16	0x146	INTAKE	0xA2	Green
9213	16	0x146	INTAKE	0xA3	Green
8915	16	0x146	Valve	0x80	Red
8920	16	0x146	Valve	0x85	Red
8921	16	0x146	Valve	0x86	Red
8922	16	0x146	Valve	0x87	Red
8923	16	0x146	Valve	0x88	Red
8924	16	0x146	Valve	0x89	Red
8925	16	0x146	Valve	0x8A	Red
8926	16	0x146	Valve	0x8B	Red

Figure 104. SELECT DEVICE MENU Screen

- C. When Home MENU is displayed (Figure 105), if **THIS SCREEN IS THE MASTER** is displayed (in lower right-hand corner of the screen), touch ☐ Make This Screen Master checkbox. The screen should now read **THIS SCREEN IS A SLAVE**.

NOTES

If multiple SAM Control Centers are present in the Sam system, the SAM Control Center with the highest serial number is selected as the master by the system.

The steps above also change the master assignment to another SAM Control Center. Changing the assignment changes the previously master touchscreen to an auxiliary.

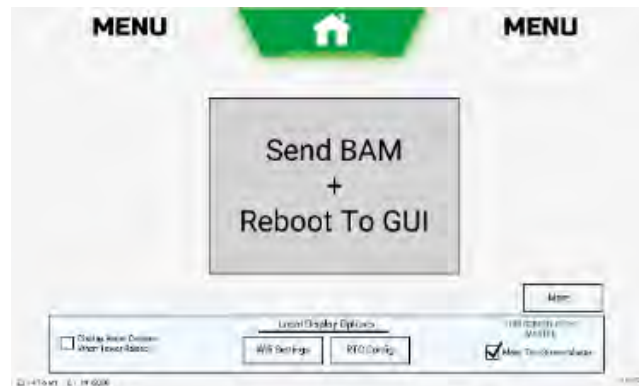


Figure 105. Configuration Mode MENU Screen

D. Exit Configuration Mode as follows.

1. At top center of screen, touch home icon. DEVICE SELECT screen is displayed.
2. At top right of screen, touch Retrieve BAM button.
3. At top center of screen, touch Menu icon. Configuration Mode MENU Screen is displayed.
4. At bottom right of screen, touch More ... button. Configuration Mode More Settings screen is displayed.

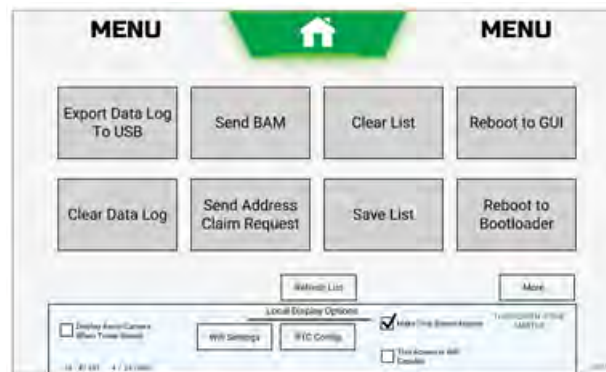


Figure 106. Configuration Mode More Settings Screen

5. Touch Save List button. (If the button grays out, wait until it returns to normal again.)
 6. Touch Reboot to GUI button.
- E. Wait for SAM Control center to reboot.
- F. Perform pressure sensor calibration. See section 5.2, Akron Brass Swing-Out™ Valve Calibrations (page 173).
- G. If SAM system is equipped with optional flowmeters, perform flowmeter calibration. See section 5.3, Flowmeter Calibration Procedures (page 178).

4.12.3 Configuration/Setup For SAM Pump Controller

See applicable titled paragraph below for instructions for each item.

- Set Date
- Set Time
- Set Language
- Set Units
- Setup Governor Presets
- Set Voltage

4.12.3.1 How To Set Time And Date

Perform the following to set the time and date for SAM.

- A. On SAM Pump Controller (Figure 28, page 35), display SAM Pump Controller Menu screen (see paragraph 2.6.1.2, SAM Pump Controller Password Screen Access, page 35).
- B. Touch Enter Password button.
- C. Enter Current Date password (see Table 3, page 36) and then touch ENTER button. Set Time And Date Screen (Figure 107) is displayed.

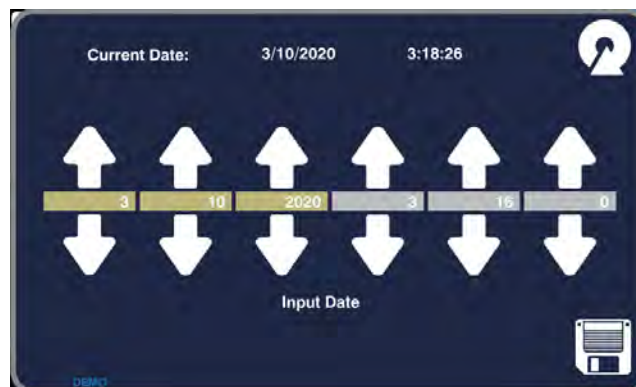


Figure 107. Set Time And Date Screen

- D. Touch arrow to set current date and time (MONTH/DAY/YEAR/HOUR/MIN/ SEC-OND).
- E. Touch save button (disk icon in lower right-hand corner).
- F. Touch Return To Home Screen button (circular arrow icon in upper right-hand corner).

4.12.3.2 How To Set Units

Perform the following to set the time and date for SAM.

- G. On SAM Pump Controller (Figure 28, page 35), display SAM Pump Controller Menu screen (see paragraph 2.6.1.2, SAM Pump Controller Password Screen Access, page 35).
- H. Touch Governor Settings button. Governor Menu screen (Figure 108) is displayed.

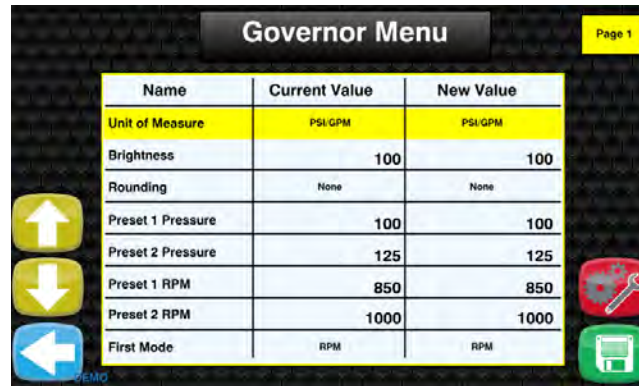


Figure 108. Governor Menu Screen (Set Units)

- I. Touch Unit of Measure row.
- J. Touch wrench and gears button (lower right-hand corner).

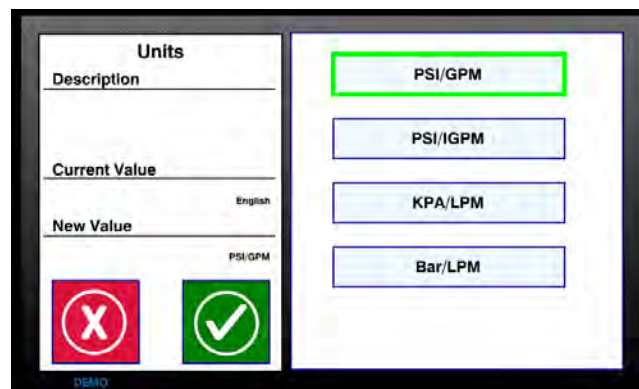


Figure 109. Select Units Screen

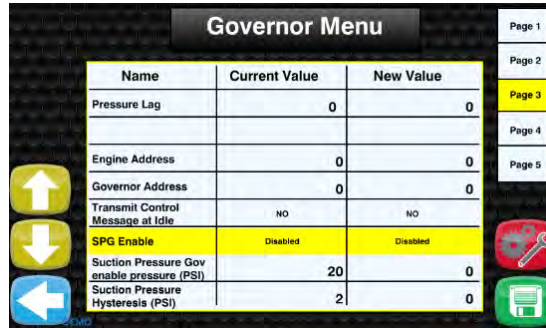
- K. Touch applicable text box (right-hand half of screen).
- L. Touch check mark button (lower right side of left-hand half of screen). Governor Menu screen (Figure 108) is displayed.
- M. Touch Save button (lower right-hand corner of screen).
- N. Touch Back Arrow button (lower left-hand corner of screen).

4.12.3.3 Enable/Disable Suction Pressure Governor

Prior to setting the Suction Pressure Governor enable pressure (and Hysteresis), enable the Suction Pressure Governor by performing the following.

- A. On SAM Pump Controller (Figure 28, page 35), display SAM Pump Controller Menu screen (see paragraph 2.6.1.2, SAM Pump Controller Password Screen Access, page 35).
- B. Touch Governor Settings button. Governor Menu screen (Figure 108) is displayed.
- C. On Governor Menu screen, touch Page Down button (lower left-hand side of screen) until Page 4 is displayed (highlighted) in upper right-hand corner of screen.

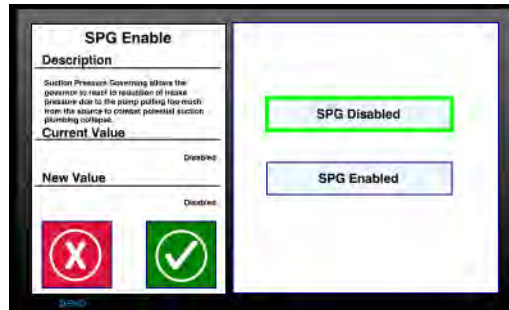
D. Touch SPG Enable row (see Figure 110).



Name	Current Value	New Value
Pressure Lag	0	0
Engine Address	0	0
Governor Address	0	0
Transmit Control Message at Idle	NO	NO
SPG Enable	Disabled	Disabled
Suction Pressure Governor enable pressure (PSI)	20	0
Suction Pressure Hysteresis (PSI)	2	0

Figure 110. Suction Pressure Governor Enable Row Selected

- E. Touch wrench and gears button (lower right-hand corner).
- F. On Suction Pressure Governor Enable Setting screen (Figure 111), touch Suction Pressure Governor Enabled button (Figure 112).



SPG Enable

Description

Suction Pressure Governor allows the governor to react to reduction of inlet pressure due to the pump pulling too much from the source to prevent potential suction plumbing collapse.

Current Value

Disabled

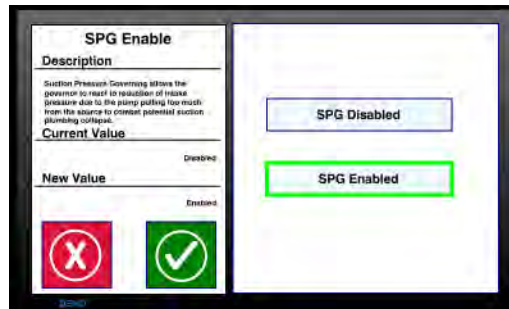
New Value

Disabled

Buttons: [X] [Checkmark]

Options: [SPG Disabled] [SPG Enabled]

Figure 111. SPG Enable Settings Screen



SPG Enable

Description

Suction Pressure Governor allows the governor to react to reduction of inlet pressure due to the pump pulling too much from the source to prevent potential suction plumbing collapse.

Current Value

Disabled

New Value

Enabled

Buttons: [X] [Checkmark]

Options: [SPG Disabled] [SPG Enabled]

Figure 112. SPG Enable Settings Screen – Enable Button Selected

- G. Touch check mark button (lower right side of left-hand half of screen). Updated Governor Menu screen (Figure 110) is displayed.

NOTE

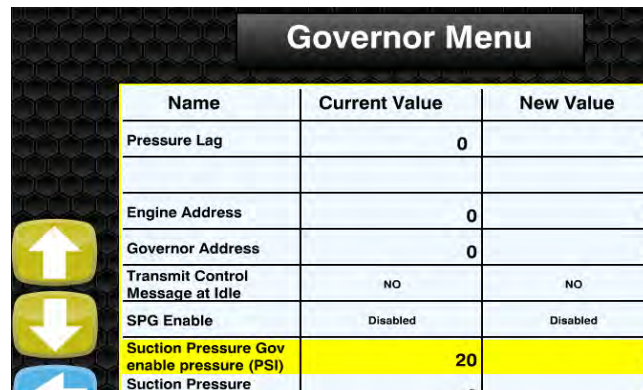
The New Value column must display Enabled, otherwise repeat Step E thru Step G (above) before proceeding.

- H. Touch Save button (lower right-hand corner of screen).
- I. Touch Back Arrow button (lower left-hand corner of screen).

4.12.3.4 How To Change/Set Low Intake Alert Trigger Point

The low intake alert trigger point is set from the Pump Controller, Governor Menu, page 4 screen (see Figure 157) by setting the suction pressure governor enable pressure (PSI). Perform the following to change or set the low intake alert trigger point for SAM.

- A. On SAM Pump Controller (Figure 28, page 35), display SAM Pump Controller Menu screen (see paragraph 2.6.1.2, SAM Pump Controller Password Screen Access, page 35).
- B. Touch Governor Settings button. Governor Menu screen (Figure 113) is displayed.
- C. On Governor Menu screen, touch Page Down button (lower left-hand side of screen) until Page 4 is displayed (highlighted) in upper right-hand corner of screen.
- D. Touch Suction Pressure Governor Enable pressure (PSI) row (see Figure 113).



Name	Current Value	New Value
Pressure Lag	0	
Engine Address	0	
Governor Address	0	
Transmit Control Message at Idle	NO	NO
SPG Enable	Disabled	Disabled
Suction Pressure Gov enable pressure (PSI)	20	
Suction Pressure		

Figure 113. Suction Pressure Governor Enable Row Selected

- E. Touch wrench and gears button (lower right-hand side of screen).
- F. On SPG User Set Point screen (Figure 114), set New Value as follows.
 1. Touch desired value (use number buttons on right-hand side of screen).
 2. Touch ENTER button. (Touch CLEAR ALL or BACK SPACE button to delete all text box data or delete only last data entry.)



SPG User Set Point

Description
This is the value the intake pressure must drop below before the Suction Pressure Governing routine activates.

Current Value: 20

New Value: 20

Buttons: CLEAR ALL, BACK SPACE, 0-9, ENTER

Icons: Red X (Cancel), Green Checkmark (Confirm)

Figure 114. SPG User Set Point Screen

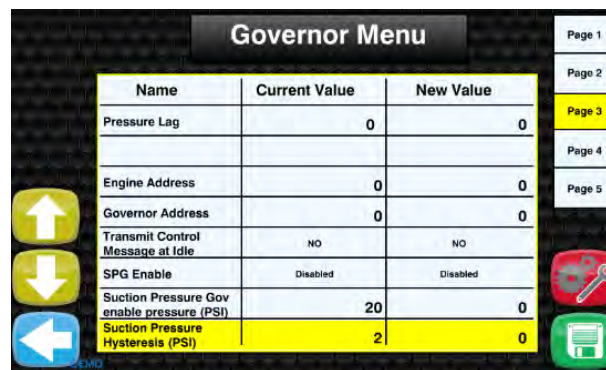
- G. Touch check mark button (lower right-hand corner of SPG User Set Point portion of screen).
- H. Touch Save button (lower right-hand corner of screen).
- I. Touch Back Arrow button (lower left-hand corner of screen).

4.12.3.5 Suction Pressure Hysteresis (PSI)

Increase the Suction Pressure Governor Hysteresis pressure to prevent undesirable toggling in and out of Suction Pressure Governor mode due to small changes in pump pressure.

To change or set the Suction Pressure Governor Hysteresis pressure, perform the following.

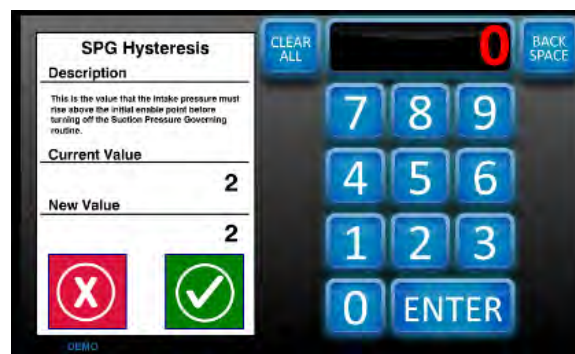
- A. On SAM Pump Controller (Figure 28, page 35), display SAM Pump Controller Menu screen (see paragraph 2.6.1.2, SAM Pump Controller Password Screen Access, page 35).
- B. Touch Governor Settings button. Governor Menu screen (Figure 108) is displayed.
- C. On Governor Menu screen, touch Page Down button (lower left-hand side of screen) until Page 4 is displayed (highlighted) in upper right-hand corner of screen.
- D. Touch Suction Pressure Hysteresis (PSI) row (see Figure 115).



Governor Menu		
Name	Current Value	New Value
Pressure Lag	0	0
Engine Address	0	0
Governor Address	0	0
Transmit Control Message at Idle	NO	NO
SPG Enable	Disabled	Disabled
Suction Pressure Gov enable pressure (PSI)	20	0
Suction Pressure Hysteresis (PSI)	2	0

Figure 115. Suction Pressure Hysteresis (PSI) Row Selected

- E. Touch wrench and gears button (lower right-hand side of screen).
- F. On SPG Hysteresis screen (Figure 116), set New Value as follows.



SPG Hysteresis

Description

This is the value that the intake pressure must rise above the initial enable point before turning off the Suction Pressure Governing routine.

Current Value

2

New Value

2

CLEAR ALL

0

BACK SPACE

7 8 9

4 5 6

1 2 3

0 ENTER

Figure 116. SPG Hysteresis Screen

1. Touch desired value (use number buttons on right-hand side of screen).
 2. Touch ENTER button. (Touch CLEAR ALL or BACK SPACE button to delete all text box data or delete only last data entry.)
- G. Touch check mark button (lower right side of left-hand half of screen). Updated Governor Menu screen (Figure 115) is displayed.

NOTE

The New Value column must display the new pressure change setting, otherwise repeat Step E thru Step G (above) before proceeding.

- H. Touch Save button (lower right-hand corner of screen).
- I. Touch Back Arrow button (lower left-hand corner of screen).

4.12.4 Set MIV-A Module Address (Master) (Slave)

When the SAM system includes more than three Hale MIVs, two MIV-A modules are required. When two MIV-A modules are present, the left most MIV-A module must be addressed to be a master and the right most MIV-A module must be addressed to be a slave.

NOTES

If replacing a MIV-A order a master if replacing a master or a slave if replacing a slave.

If the CAN bus is stable (normal PWR, BUS, and COM indications) and the MIVs do NOT function then typically there is an address issue.

The module does NOT have to be removed if access permits setting the address with the module in place.

Prior to setting the address, perform the Removal portion of the R&R procedure. See paragraph 4.8.3 (page 93) and NOTES above.

To verify or set the address of a MIV-A module, perform the following.

- A. Place module on flat stable work surface. (See NOTES above.)

IMPORTANT ⚠ NOTICE

TO PREVENT PCB DAMAGE, DO NOT REMOVE THE COVER OR CHANGE THE CAN ADDRESS WITH THE MODULE POWERED ON.

- B. Remove PCB from protective case as follows.

IMPORTANT ⚠ NOTICE

LIFT TABS ONLY ENOUGH TO RELEASE THE PCB. LIFTING THE TABS TOO FAR CAUSES THEM TO BREAK. IF A TAB BREAKS THE MODULE IS NOT PROTECTED FROM THE ELEMENTS AND MUST BE REPLACED.

1. Using a 1/4-in straight blade screwdriver, lift tab on one side of protective case.
2. Pull connectors away from case to keep tab lifted.
3. Using screwdriver, lift tab on other side of protective case.
4. Pull connectors away from case to remove PCB.
5. If PCB does not slide out of case, repeat Step 1 thru Step 4 using two people. (One person spreads the tabs while the other pulls the PCB out of the case by the connectors.)

C. Set dial to required address as follows. See Figure 117.

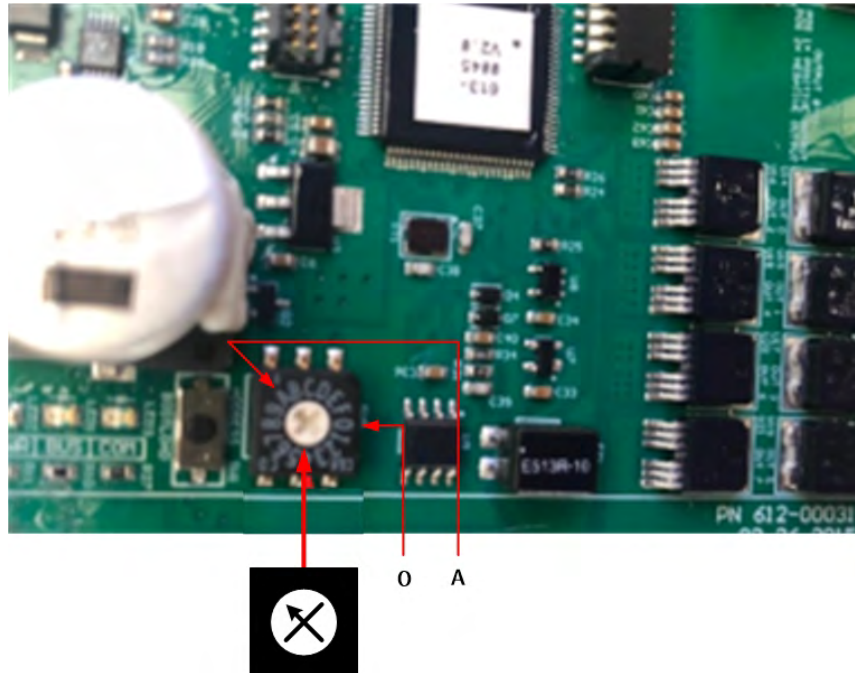


Figure 117. MIV-A Module Address Switch

1. If Master: using a 1/16-in straight blade screwdriver, turn center of address switch until arrow points to position A. (Switch is shown in position A on Figure 117.)
 2. If Slave: using a 1/16-in straight blade screwdriver, turn center of address switch until arrow points to position 0.
- D. Return PCB to case as follows.
1. Place case label up.
 2. Place PCB components up.
 3. Carefully insert PCB into case opening.

NOTE

Ensure the PCB is between the two raised guides on both sides of the case. If the PCB does NOT stay between the guides it will jam. A jammed PCB will NOT go into the case and can be very hard to remove from the case.

4. Only after ensuring PCB is between guides, push PCB into case until tabs lock.

Perform the Installation portion of the R&R procedure. (See paragraph 4.8.3, page 97.)

4.12.5 Wi-Fi Router Configuration

If replacing an antenna/router, contact Hale Customer Service (800-533-3569) and provide the information from the systems ID tag. Refer to the SAM OIM (FSG-MNL-00210), SAM Numbering and Specifications References (paragraph 2.1), Hale ID Tag With Sample Markings (Figure 1.) for details. The secure Wi-Fi antenna/router must be configured to pair with your SAM system so the Wi-Fi antenna/router you receive (see paragraph 4.10.5, page 113 for R&R instructions) will automatically pair with your SAM Control Center and your SAM tablet as long as the OEM, apparatus builder, and/or end user have NOT changed any of the secure Wi-Fi settings.

If the Wi-Fi antenna/router you received does NOT automatically pair with your SAM Control Center and/or your SAM tablet contact Hale Customer Service (800-533-3569) and inform Hale of the problem.

4.12.6 ITL-40 Configuration Procedures

SAM uses the ITL-40 CAN address to display the tank level data of that ITL-40. The water tank, foam tank A, and foam tank B should all have different addresses. Hale ships each SAM ITL-40 preaddressed and labeled appropriately (WATER, FOAM A, or FOAM B). For current production, all ITL-40 addresses are set by the SAM software. If the ILT-40 was NOT provided directly by Hale performing the applicable labeled procedure may allow the ITL-40 to communicate with SAM.



Figure 118. ITL-40 Address Switch Locations

The target areas are marked with a very small white dot on each side of the label (highlighted by the red circles on Figure 118). Enter a L/R command string as provided in the following applicable labeled subparagraphs. Note the following information for entering a L/R command string.

- The lights in the left-hand column will flash when an L is triggered.
- The lights in the right-hand column will flash when an R is triggered.
- An X pattern of lights will appear if an incorrect password is entered.

SAM is NOT compatible with any ITL-40 AutoFill configuration, do NOT configure a SAM (or foam system installed on a SAM system) using an AutoFill password. Hale recommends using the calibration procedures herein (NOT the Class 1 Operation Manual procedures) for ITL-40 read out calibration. (See paragraph 5.4, page 181.)

4.12.6.1 Water Tank

For current production, all ITL-40 addresses are set by the SAM software. If the ILT-40 was NOT provided directly by Hale performing the following may allow the ITL-40 to communicate with SAM.

- A. Power SAM system on.

NOTE

The magnet must be touched to the face of the ITL-40 straight on and from at least a couple of inches away and be removed in the same way (but opposite direction) the same distance. Sliding the magnet from side to side without lowering and lifting it straight on and off a couple of inches each time will NOT work.

- B. Using a magnet, touch appropriate white dots (see red circles on Figure 118) in sequence to enter a LRRLLLLL command string.

4.12.6.2 Foam Tank A

For current production, all ITL-40 addresses are set by the SAM software. If the ITL-40 was NOT provided directly by Hale performing the following may allow the ITL-40 to communicate with SAM.

- A. Power SAM system on.

NOTE

The magnet must be touched to the face of the ITL-40 straight on and from at least a couple of inches away and be removed in the same way (but opposite direction) the same distance. Sliding the magnet from side to side without lowering and lifting it straight on and off a couple of inches each time will NOT work.

- B. Using a magnet, touch appropriate white dots (see red circles on Figure 118) in sequence to enter a LRRLLLLR command string.

4.12.6.3 Foam Tank B

The foam tank B ITL-40 address is set manually for the SAM system. Perform the following for the ITL-40 to communicate with SAM.

- A. Power SAM system on.

NOTE

The magnet must be touched to the face of the ITL-40 straight on and from at least a couple of inches away and be removed in the same way (but opposite direction) the same distance. Sliding the magnet from side to side without lowering and lifting it straight on and off a couple of inches each time will NOT work.

- B. Using a magnet, touch appropriate white dots (see red circles on Figure 118) in sequence to enter a LRRRLRRR command string.

4.13. Updating The Tablet After SAM Setup/Configuration Changes

Changes to Quicksets or other SAM customizable/configurable items (valve names and colors, foam presets, etc.) must be updated for the tablet or the changes made on a SAM Control Center will not appear on the tablet screens. To update the tablet, perform the following.

- A. Touch System Options button (or touch and hold if loading icon appears, see Figure 119). System Options screen (Figure 120) is displayed.



Figure 119. System Options Loading Icon

- B. When System Options screen (Figure 120) displays, enter BAM/Wi-Fi password. (This password is ONLY available via attending the Hale SAM Training course.)



Figure 120. System Options Screen

- C. On BAM Request/Wi-Fi Options screen (Figure 121), touch BAM REQUEST button. Wait for progress bar (black bar below button turns green to indicate progress) to complete.



Figure 121. BAM Request Screen

- D. When complete, DONE is displayed (replaces progress bar) to indicate update was successful.

4.14. Updating Another SAM Control Center After SAM Setup/Configuration Changes

Changes to Quicksets or other SAM customizable/configurable items (valve names and colors, foam presets, etc.) must be updated for the remaining SAM Control Centers or the changes made on one of the SAM Control Centers will not appear on the auxiliary (or master if update was to an auxiliary) screen(s). To update the remaining SAM Control Centers, perform the following.

- Place updated SAM Control Center in Manual Mode. See Figure 25 (page 34).
- Place all other SAM Control Centers in Manual Mode.

- C. On updated SAM Control Center, touch System Options button (or touch and hold if loading icon appears). See Figure 25 (page 34). Wait for Enter Password screen to be displayed.
- D. On Enter Password screen, enter Level 2 password. (All OEM/Technician passwords are ONLY provided at Hale training.)
- E. Touch ENTER button. Configuration Mode Menu page is displayed.
- F. Touch RETRIEVE BAM on the top right of the screen. List will populate to current settings.
- G. Touch Menu button (top of page).
- H. Touch More bottom (right-hand side of page).
- I. Touch SAVE LIST button.
- J. Touch REBOOT TO GUI button.

4.15. Post Removal And Replacement Testing

The following testing is provided to troubleshoot/diagnose select failed SAM components.

4.15.1 4-Way Air Valve Test

Measure the resistance of a temperature sensor according to Table 73.

Table 73. 4-Way Air Valve Resistance Per °C (°F)

Temperature °C (°F)	0 (32)	10 (50)	20 (68)	25 (77)	30 (86)	40 (104)	50 (122)	100 (212)
Resistance Ohms	20,000	18,476	12,185	10,000	8,260	5,740	4,080	973

NOTE Temperature sensor accuracy is typically $\pm 2\%$.

4.15.2 Water Detection Sensor Tests

The SAM system uses three [3] water detection sensors (Figure 55, page 84): the gearbox water detector, the Autolube water detector, and the prime detector.

NOTE

Prior to performing the associated test(s), verify that power (+12 VDC) and ground are present (see Table 40, page 84 thru Table 42, page 85) at the sensor.

The gearbox and autolube water in oil detection can be tested (status is displayed) on the SAM Pump Controller by entering the Output/Input (CAN Test/Troubleshooting Screen, see Table 3, page 36) password. See section 2.6, page 33.

The water at primer (prime detection for SAM Auto Mode) can be tested (status is also displayed) on the SAM Pump Controller by entering the Outputs/CAN Outputs/Inputs (MIV Test/Troubleshooting Screen, see Table 3, page 36) password. (Again, see section 2.6.)

4.15.2.1 Using SAM Pump Controller To Test Sensor

Any water detection sensor can be tested by accessing the appropriate screen (listed in paragraph 4.15.2, page 145), dipping the tip of the sensor into water (a small cup will do), and then observing the change in status on the screen. Perform the following to test a gearbox or Autolube water detection sensor.

- A. Using the SAM Pump Controller, access the SAM Pump Controller Menu and Password Enter screens. See paragraph 2.6.1.2, page 35.
- B. On Password Enter screen, touch Output/Input password digits (see Table 3, page 36) and then touch Enter button. Input screen displays (see Figure 122).

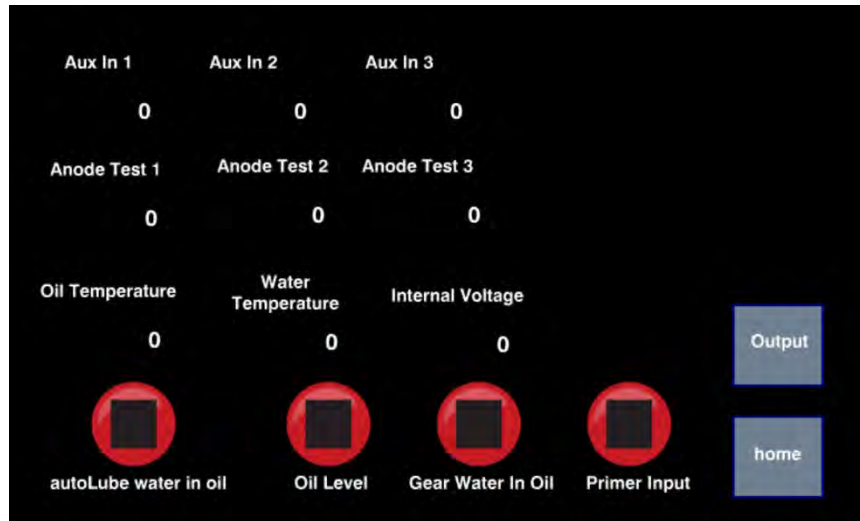


Figure 122. Input Screen (Red Balloons)

- C. Unplug water detection sensor under test.
- D. Remove sensor. See Removal portion of paragraph 4.7.6 (page 84).
- E. Test sensor as follows.
 1. Dip tip of sensor in water (a small cup will do).
 2. On Input screen, observe associated balloon (Gear Water In Oil or autoLube water in oil). turns green.
 3. Dry sensor and observe associated balloon (Gear Water In Oil or autoLube water in oil). turns red.
- F. If sensor test is successful, perform Installation portion of paragraph 4.7.6 using existing sensor. (See page 85.)
- G. If sensor test fails, perform Installation portion of paragraph 4.7.6 using a new sensor. (See page 85.)

Perform the Verify SAM Ready To Return To Service procedure (see paragraph 4.17, page 171) to determine if the apparatus maintenance is complete.

4.15.3 Testing Master Intake Valve Inputs/Outputs

Use the SAM Pump Controller to test MIV inputs/outputs. Display the SAM Pump Controller Enter Password screen (see paragraph 2.6.1.2, page 35) and then enter the Outputs/CAN Outputs/Inputs password (see Table 3, page 36). Use the following buttons to select the desired tests and/or test targets.

- Start/Stop (Toggles)
- Send
- Input/Output (Toggles)
- Home

- CAN Outputs

The MIV-A Outputs/Inputs can be individually controlled and tested.
See Figure 123 thru Figure 126.



Figure 123. SAM Pump Controller I/O Testing (Outputs Screen)

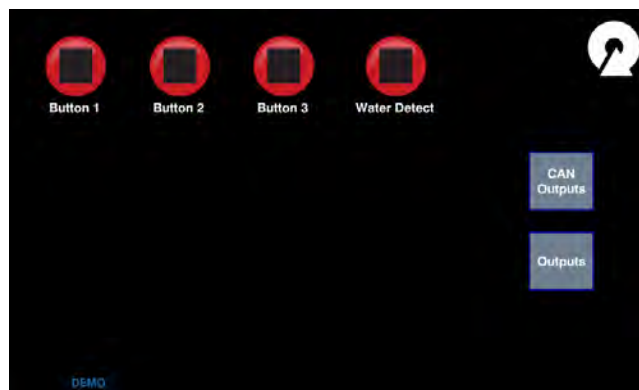


Figure 124. SAM Pump Controller I/O Testing (Inputs Screen)

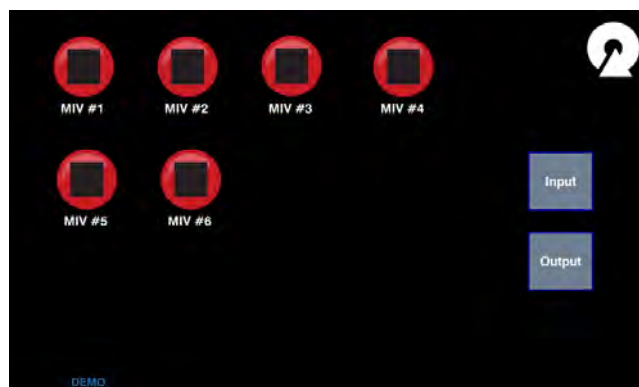


Figure 125. SAM Pump Controller I/O Testing (CAN Outputs Screen)



Figure 126. SAM Pump Controller I/O Testing (With Active Output)

Touch the red bubble to activate the desired output and it will turn from red to green to show that the output signal is being sent. Touch again to turn off signal. Note that the output buttons are not getting feedback from the corresponding SAM component so the device must be checked for activation. On the input page the MIV-A is receiving feedback and the bubble will automatically turn green when the device is activated.

4.15.3.1 Testing MIV Outputs

Touch the toggle Input/Output button on the screen to actuate the following outputs. See Table 74 and Figure 127.

Table 74. MIV-A Output Testing

Button Name	Function	Special Comments
Pre Prime #3	RH Bot MIV PF Valve	Air Pressure Required
AUX Output	N/A	
Air Prime	Optional Air Primer	
Pre Prime #1	LH MIV PF Valve	Air Pressure Required
LED #1	LH Auto MIV Button	Ring will turn green
LED #2	RH Auto MIV Button	Ring will turn green
LED #3	RH BOT Auto MIV Button	Ring will turn green
Prime Body	Prime Body PF Valve	Air Pressure Required
AB Drain	AB Drain Manifold (bottom of gearbox)	Air Pressure Required
Pre Prime #2	RH MIV PF Valve	Air Pressure Required
Primer Start	Primer Solenoid	Primer will run (do not leave on >45s)
Not Used	N/A	

If the desired function does not work verify power, harness connection, air pressure, and CAN connection to the component. If all four items listed are good, replace the component under test.



Figure 127. TS Outputs Screen – Pre-Prime #1 Active

4.15.3.2 Testing MIV Inputs

When an Input is triggered, the red bubble turns green. See Table 75 below for how to trigger the corresponding inputs.

Table 75. MIV–A Input Testing

Button Name	Function	Comments
Button 1	LH MIV Button Input	Press and hold button
Button 2	RH MIV Button Input	Press and hold button
Button 3	RH BOT MIV Button Input	Press and hold button
Water Detect	Water Detect Input	See section 4.15.2 for water detect testing

If the desired function does not work verify power, harness connection, and CAN connection to the component. If all three items are good, replace the component under test.

4.15.4 Testing Priming And Air Bleed Component (CAN Inputs)

Test ABV solenoid valves (CAN outputs) as follows.

- Select CAN Outputs.
- Select corresponding output to be tested. See Table 76 and Figure 128.

Table 76. Priming And Air Bleed Component Testing

Name	Air Bleed Output
MIV #1	Left Side MIV
MIV #2	Right-Side MIV
MIV # 3	Right Bottom MIV
MIV # 4	T-port MIV
MIV # 5	Left Bottom MIV
MIV # 6	Remote Mounted MIV

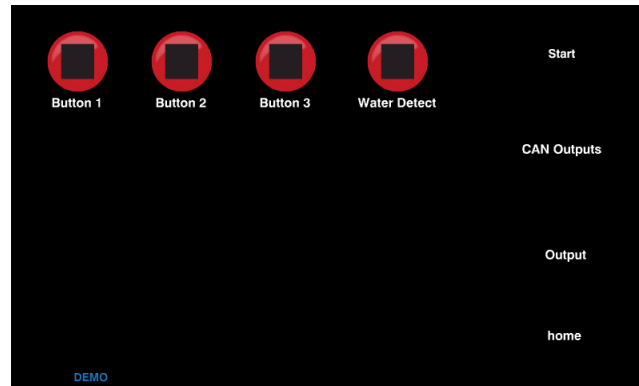


Figure 128. TS Input Screen

- C. Observe solenoid activates. (When button is pressed a small click can be heard and felt.)
- D. Verify solenoid clicking (under test) is plumbed to desired MIV.
- E. If successful, cycle SAM power.

Otherwise, verify power and CAN status on Green bus. If both are good, replace the solenoid under test.

4.15.5 Testing Priming And Air Bleed Component (CAN Outputs)

Output testing is performed in the same manner. See Figure 129.

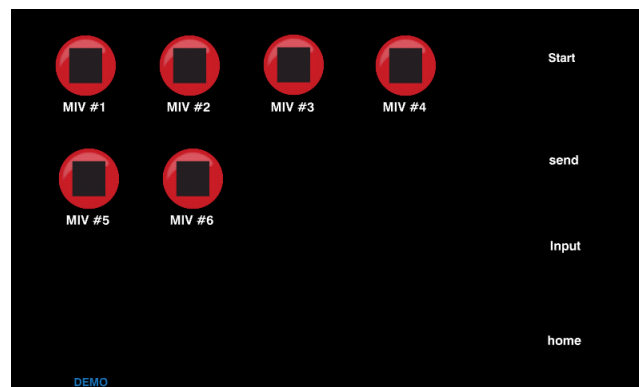


Figure 129. TS CAN Output Screen

4.15.6 Testing MIV-E Override Panel (Manually Operated ABV)

To test the Manual MIV overrides for the SAM system locate the override placard on the Operator Panel. See Figure 42, page 62.

- A. Verify holding OPEN switch, opens associated MIV.
- B. Verify when valve is full open, Green indicator remain on steady (toggling stops).
- C. Verify holding CLOSE switch, closes associated MIV.
- D. Verify when valve is full closed, Red indicator remain on steady (toggling stops).
- E. Apply hydrant pressure, verify opening air bleed knob (turns CCW) discharges water. (The water comes out the bottom of the pump house.)

4.15.7 Testing SAM Speaks (Audio Alerts)

The TEST AUDIO page is (or pages are- there are two) used to verify the audio portion of SAM is functioning correctly, when activated the alarms, warnings and spoken audio files will broadcast through the speakers. This page is useful after replacing an audio system component.

This page is also useful to check audio volume adjustment. If you want to ensure the volume level set is sufficiently loud, you can use this screen to force any listed audio file to play.

4.15.7.1 Test Audio Page

The SAM Pump Controller is the source of SAM audio and can be used to test the audio output and components. Display the SAM Pump Controller Enter Password screen (see paragraph 2.6.1.2, page 35) and then enter the Audio Test Page password (see Table 3, page 36). Use the files listed to test the output of the audio system.

By alternating back and forth between the Audio Test Page and Volume password the audio volume can be set and then verified.

After the audio test pages (Figure 130 and/or Figure 131) display, touch any SAM Speaks file name listed to activate the alert.

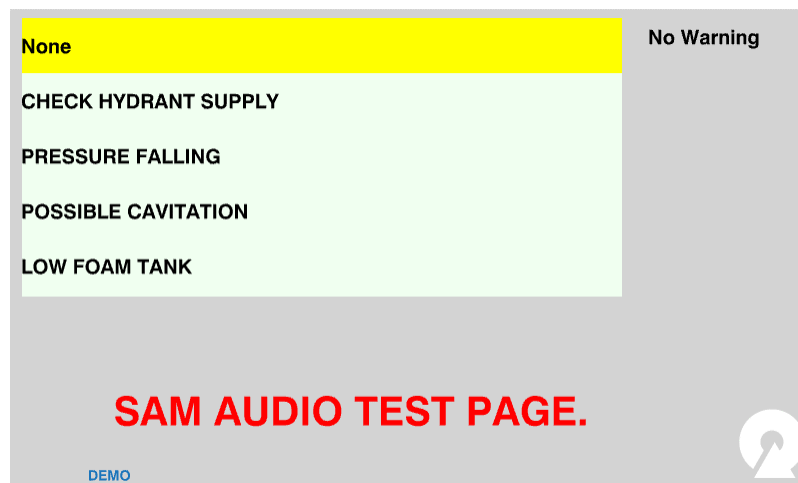


Figure 130. SAM Speaks Verbal Alerts (Page 1)

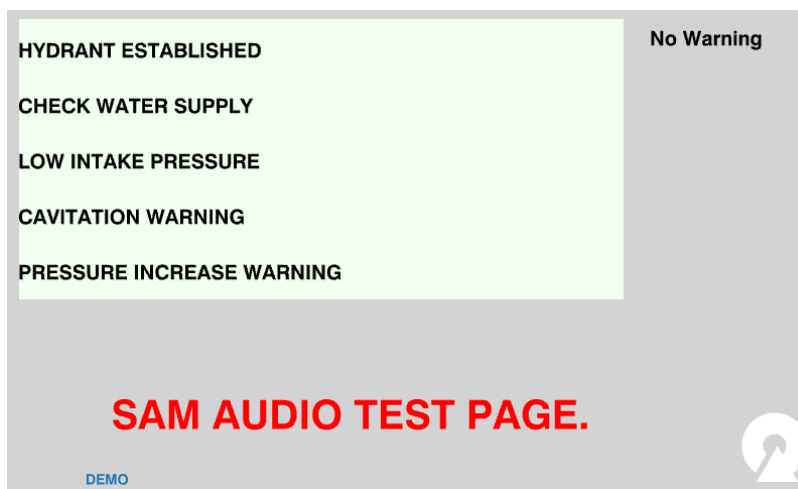


Figure 131. SAM Speaks Verbal Alerts (Page 2)



Table 77 provides a list (by file name and audio type) for use in selecting the files that are useful for checking the audio components and setting the SAM volume level.

Table 77. Audio Files Useful For Audio Testing/Adjustment

File Name	Audio Type
LOW FOAM TANK	Spoken Audio
HYDRANT ESTABLISHED	Spoken Audio
LOW INTAKE PRESSURE	Spoken Audio
DISCHARGE OPENING	Spoken Audio – No Banner
PRESSURE EXCEEDS LDH LIMITS	Spoken Audio
LOW TANK WATER	Spoken Audio
WATER TANK IS EMPTY	Spoken Audio
PUMP ENGAGED – SAM READY	Spoken Audio

4.16. Troubleshooting

The following section gives a detailed breakdown of how to troubleshoot SAM components and system errors. Contact Hale customer service if your issue is not covered in this manual.

4.16.1 Special Tools

SAM does NOT require any special tools for maintenance or operation. However, the following subparagraphs provide

4.16.1.1 CAN Bus Capture Tool

A CAN capture tool is not recommended or typically considered a special tool. However, if available, a CAN bus capture tool (along with the expertise to effectively use the tool) can pinpoint failed components, failed calibrations, communications errors, and many other SAM issues.

4.16.1.2 Akroview

Akroview software on a laptop is not required or typically considered a special tool. (It can be purchased from the Akron Brass website or you may already own it.) However, if available, Akroview (along with the expertise to effectively use the tool) can pinpoint failed components, failed calibrations, communications errors, and many other SAM issues.

4.16.2 Error Messages And System Level SCR Table

To troubleshoot the system, locate in the SCR table (Table 78) the indicated SYMPTOM, verify the associated CAUSE (verify ALL if multiple are listed) and perform the associated REMEDY.

The SCR tables assume a single fault and the SYMPTOM, CAUSE, and REMEDY columns have been listed in a hierarchy order. Treat each SYMPTOM as the result of a single CAUSE, trace through the SCR table until a single REMEDY is indicated. Perform the REMEDY, and then check the system again. Determine if the same SYMPTOM exists, or a different SYMPTOM is now indicated, or no symptoms exist.

If multiple faults exist, repeat following the table using multiple passes unless the REMEDY is always the same and does NOT eliminate/fix the symptom. When this occurs contact Hale Customer Support (800-533-3569 or www.haleproducts.com) for further assistance.

Table 78. Hale SAM System Level SCR Table

SYMPTOM	CAUSE	REMEDY
AUXILIARY INTAKE LOST USE MANUAL OVERRIDE	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed AB valve. See section 4.5 (page 67).
		Ponys address incorrect. See Table 1 (page 26) and if required contact Hale Customer Service (800-533-3569) for instructions.
CAFS COMM LOSS, USE SMARTCAFS DISPLAY	CAFS Module Power Is Off	Power cycle the CAFS module and confirm the module lights are active. Refer to FSG-MNL-00157 CAFS manual.
	Wire Harness Disconnected/Damaged.	Check wiring continuity. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
	Equipment Failure	Failed SmartCAFS display. Refer to UV SmartCAFS Installation and Operation Manual (FSG-MNL-00157).
		Failed Foam Controller. Refer to UV SmartCAFS Installation and Operation Manual (FSG-MNL-00157).
CHECK WATER SUPPLY (Similar to WARNING LOW INTAKE PRESSURE)	SAM reported not receiving enough water flow from off-board water source	See LOW INTAKE PRESSURE remedy.
		Check suction strainers/hoses for blockage and/or leaks.
COOLANT TEMPERATURE HIGH CRITICAL	Pass Thru Message From Apparatus ECU	Refer to apparatus/chassis/engine manuals/documentation.
	Pass Thru Message From Apparatus ECU	Refer to apparatus/chassis/engine manuals/documentation.
DISCHARGE COMM ERROR (Command Sent, No Valve Response)	Valve Requires Service	Ball/gears could be jammed. See section 4.5 (page 67).
	Equipment Failure	R&R failed discharge valve. See section 4.5 (page 67).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
DISCHARGE VALVE NETWORK ERROR, USE MANUAL OVERRIDE (CAN Communication Lost With Multiple Discharges)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Red CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Red CAN bus resistance. See paragraph 4.16.3 (page 170).
DISCHARGE VALVE SIGNAL LOST USE MANUAL OVERRIDE (CAN Communications Lost)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Red CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
DISCHARGE VALVE SIGNAL LOST USE MANUAL OVERRIDE – CONTINUED	Wire Harness Disconnected/Damaged – CONTINUED	Check harness Red CAN bus resistance. See paragraph 4.16.3 (page 170).
		Confirm Sam Control Center CAN bus 1 is operational.
	Equipment Failure	R&R failed SAM Control Center. See paragraph 4.4.1 (page 51).
		Confirm SAM discharge valve is operational. Optionally, see paragraph 2.4.8 (page 29).
		R&R failed discharge valve. See section 4.5 (page 67).
DRAFT PROBLEM - CHECK CONNECTIONS	Prime Failed	See POSSIBLE VACUUM LEAK above.
	Equipment Failure	Test and if required, R&R ESP primer.
FOAM COMM LOSS, USE SMART-FOAM DISPLAY (SAM Lost Communication With Foam System Control)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
FOAM COMM LOSS, USE SMART-FOAM DISPLAY – CONTINUED	Wire Harness Disconnected/Damaged – CONTINUED	Check Foam System harness power connections. Refer to SmartFOAM manual (FSG-MNL-00158).
		Check harness Orange CAN bus connections. Refer to SmartFOAM manual (FSG-MNL-00158).
		Check harness Orange CAN bus resistance. Refer to SmartFOAM manual (FSG-MNL-00158).
	SmartFOAM Motor Controller Failure	Refer to SmartFOAM manual (FSG-MNL-00158).
	SmartCAFS Motor Controller Failure	Refer to SmartFOAM manual (FSG-MNL-00158).
	SAM Pump Controller Failure	R&R failed SAM Pump Controller. Refer to SmartFOAM manual (FSG-MNL-00158).
	SAM Control Center Failure	R&R failed SAM Control Center. Refer to SmartFOAM manual (FSG-MNL-00158).
FRONT INTAKE MIV MODULE SIGNAL LOST - OPERATE FRONT MIV WITH MANUAL OVERRIDE KNOB	Bottom MIV Valve Drive Module Lost Comm	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Verify Bottom MIV Valve Drive module is addressed correctly. See paragraph 4.8.4 (page 100).
		R&R failed Bottom MIV Valve Drive module. See paragraph 4.8.4 (page 100).
		Confirm master MIV–A module is operational.
		If failed, R&R failed SAM master MIV–A module. See paragraph 4.8.3 (page 97).
		Confirm Bottom MIV is operational. Refer to FSG-MNL-00217 (MIV 2.0 TM).
		If failed R&R failed Bottom MIV. Refer to FSG-MNL-00217 (MIV 2.0 TM).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
HIGH GEARBOX TEMPERATURE (SAM reported gearbox oil temperature exceeded 215 °F [102 °C])	Equipment Failure	Verify gearbox cooling tubes are connected and flowing water. Install or repair as required. See applicable pump TM.
HYDRANT DETECTION SENSOR LOST, USE OVERRIDE (Water Column Sensor Lost)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
	Equipment Failure	R&R failed Sensor Module. See paragraph 4.8.2 (page 95).
		R&R failed Pressure Sensor. See paragraph 4.7.3.3 (page 79).
INTAKE MIV MODULE SIGNAL LOST (MIV–A CAN Lost CAN Connection)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed MIV–A Module. See paragraph 4.8.3 (page 97).
INTAKE MODULE SIGNAL LOST - OPERATE LH, RH, AND FRONT INTAKES WITH PANEL SWITCHES	MIV–A Master Lost Comm	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Confirm MIV–A module is operational. See paragraph 4.8.3 (page 97).
		R&R failed SAM master MIV–A module. See paragraph 4.8.3 (page 97).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
INTAKE MODULE SIGNAL LOST - OPERATE REAR AND IN-LINE INTAKES WITH PANEL SWITCHES	MIV-A Slave Lost Comm (Controls Bottom And T-port MIVs)	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Confirm both MIV-A modules are operational and addressed correctly. See paragraph 4.8.3 (page 97).
		R&R failed SAM slave MIV-A module. See paragraph 4.8.3 (page 97).
		R&R failed SAM Valve Drive module. See paragraph 4.8.4 (page 100).
INTAKE MODULE SIGNAL LOST (MIV H-bridge Lost CAN Connection)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed MIV Drive Module. See paragraph 4.8.4 (page 100).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
LH INTAKE MIV MODULE SIGNAL LOST - OPERATE LH MIV WITH MANUAL OVERRIDE KNOB	LH MIV Valve Drive Module Lost Comm	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed LH MIV Valve Drive module. See paragraph 4.8.4 (page 100).
		Confirm master MIV–A module is operational. See paragraph 4.8.3 (page 97).
		R&R failed SAM master MIV–A module. See paragraph 4.8.3 (page 97).
		R&R failed LH MIV. Refer to MIV 2.0 TM (FSG-MNL-00217).
LOSS OF INTAKE - RETURNING TO TANK (Similar to above)	SAM reported not receiving enough water flow from off-board water source	See LOW INTAKE PRESSURE or CHECK WATER SUPPLY above.
LOW INTAKE PRESSURE	CAUTION – SAM reported that hydrant intake pressure was low.	Replace supply hose with a larger size and/or increase number of lines available on the apparatus.
		Check LDH/seals for leaks and hoses for restrictions.
	WARNING – SAM reported that hydrant intake pressure was critically low	Replace supply hose with a larger size and/or increase number of lines available on the apparatus.
		Check LDH/seals for leaks and hoses for restrictions.
LOW OIL PRESSURE CRITICAL	Pass Thru Message From Apparatus ECU	Refer to apparatus/chassis/engine manuals/documentation.
LOW OIL PRESSURE WARNING	Pass Thru Message From Apparatus ECU	Refer to apparatus/chassis/engine manuals/documentation.

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
LOW VOLTAGE CRITICAL	Apparatus Charging System	Check system voltage with multimeter:
		If voltage is low, troubleshoot and repair apparatus charging system.
		If voltage is fine, perform Voltage Calibration (see paragraph 5.6, page 184)
	Equipment Failure	SAM Pump Controller (analog to digital conversion circuit failed) See paragraph 4.4.2 (page 53).
LOW VOLTAGE WARNING	Apparatus Charging System	Check system voltage with multimeter.
		If voltage is low, troubleshoot and repair apparatus charging system.
		If voltage is fine, perform Voltage Calibration (see paragraph 5.6, page 184)
	Wire Harness Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
	Equipment Failure	SAM Pump Controller (analog to digital conversion circuit failed) See paragraph 4.4.2 (page 53).
POSSIBLE CAVITATION	During drafting, SAM detected cavitation (SAM detected an increase in rpm and no change in discharge pressure and/or flow. The pump is not receiving enough intake water flow for the desired discharge condition.)	Check suction hose/seals for leaks.
		Replace suction hose with a larger size and/or increase number of suction lines available on the apparatus.
	During pumping from tank, SAM detected cavitation	Perform Water Tank-to-Pump Flow Test (per NFPA 1901). Repair apparatus as required.
	During pumping from hydrant, SAM detected cavitation	Check LDH/seals for leaks.
		Verify SAM Bypass Venting functions
POSSIBLE VACUUM LEAK (SAM Detected A Continued Decrease In Suction Line Vacuum.)	Equipment Failure	Check LDH/seals for leaks and hoses for leaks and/or restrictions.
		Perform NFPA pump vacuum test.

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
PRESSURE CONTROL SIGNAL LOST (Matrix Governor Signal Lost) Does Twister work?	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Blue CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Blue CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed SAM Pump Controller. See paragraph 4.4.2 (page 53).
		R&R failed MatrIxx Pressure Governor Module. See paragraph 4.8.1 (page 92).
PRESSURE EXCEEDS LDH LIMITS	Reported pressure on an LDH discharge exceeded the preset limit. (Default limit is 185 psi.)	Check preset pressure limits for all LDH (4 and 5 in.) discharges. NOTE: Operating pressure limit is NOT 185 psi for all LDHs. Set limit per AHJ.
		Calibrate all SAM pressure readings. See section 5.2 (page 173).
PRESSURE FALLING	SAM Reported Pressure Falling	Check pump for catastrophic failures (pump seal/impeller damage). Repair as required.
REAR INTAKE MODULE SIGNAL LOST - OPERATE REAR MIV WITH MANUAL OVERRIDE KNOB	T-port MIV Valve Drive Module Lost Comm	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Verify T-port MIV Valve Drive module is addressed correctly. See paragraph 4.8.4 (page 100).
		R&R failed T-port MIV Valve Drive module. See paragraph 4.8.4 (page 100).
		Confirm slave MIV-A module is operational.

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
REAR INTAKE MODULE SIGNAL LOST - OPERATE REAR MIV WITH MANUAL OVERRIDE KNOB – CONTINUED	Equipment Failure – CONTINUED	If failed, R&R failed SAM slave MIV–A module. See paragraph 4.8.3 (page 97).
		Confirm T-port MIV is operational. Refer to FSG-MNL-00217 (MIV 2.0 TM).
		If failed R&R failed T-port MIV. Refer to FSG-MNL-00217 (MIV 2.0 TM).
RH INTAKE MIV MODULE SIGNAL LOST - OPERATE RH MIV WITH MAN- UAL OVERRIDE KNOB	RH MIV Valve Drive Module Lost Comm	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Verify RH MIV Valve Drive module is addressed correctly. See paragraph 4.8.4 (page 100).
		R&R failed RH MIV Valve Drive module. See paragraph 4.8.4 (page 100).
		Confirm master MIV–A module is operational.
		If failed, R&R failed SAM master MIV–A module. See paragraph 4.8.3 (page 97).
		Confirm RH MIV is operational. Refer to FSG-MNL-00217 (MIV 2.0 TM).
		If failed R&R failed RH MIV. Refer to FSG-MNL-00217 (MIV 2.0 TM).
SAM SCREEN SIGNAL LOST (SAM Control Center Signal Lost)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green and Red CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green and Red CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed SAM Control Center. See paragraph 4.4.1 (page 51).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
SENSOR MODULE SIGNAL LOST (The SAM sensor module has lost power or the communication to the module has failed.)	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Confirm Sam Sensor Module is operational. R&R failed Sensor Module. See paragraph 4.8.2 (page 95).
SIGNAL LOST- OPERATE IN MANUAL MODE OR USE REMOTE SCREEN (CAN Communications Lost)	CAN Communication Lost Due To Wire Harness Disconnected/Damaged.	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green and Red CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green and Red CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	Confirm MIV–A module is operational. R&R failed SAM module (MIV–A) See paragraph 4.8.3 (page 97).
		Confirm MIV Valve Drive module is operational. See paragraph 4.8.4 (page 100).
		R&R failed SAM module (MIV Valve Drive) See paragraph 4.8.4 (page 100).
		Confirm Sam Control Center CAN bus 0 is operational. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115), paragraph 4.16.3 (page 170), and refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
SIGNAL LOST- OPERATE IN MANUAL MODE OR USE REMOTE SCREEN (CAN Communications Lost) – CONTINUED	Equipment Failure – CONTINUED	R&R Sam Control Center See paragraph 4.4.1 (page 51).
		Confirm Sam Pump Controller CAN bus 1 is operational. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115), paragraph 4.16.3 (page 170), and refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		R&R Sam Pump Controller See paragraph 4.4.2 (page 53).
TANK FILL COMM LOST USE MANUAL OVERRIDE	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Red CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Red CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed discharge valve. See section 4.5 (page 67).
TANK-TO-PUMP COM LOST USE MANUAL OVERRIDE,	Wire Harness Disconnected/Damaged	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
	Equipment Failure	R&R failed discharge valve. See section 4.5 (page 67).

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
TWISTER SIGNAL LOST- OPERATE WITH SCREEN	SAM communication with the Twister control has been lost.	Confirm Twister is operational.
		Confirm MatrlIX Pressure Governor is operational.
	Wire Harness Disconnected/Damaged.	Check wiring continuity.
	Equipment Failure	R&R failed Twister. See paragraph 4.4.5 (page 57).
		R&R failed MatrlIX Pressure Governor. See paragraph 4.8.1 (page 92).
WARNING LOW FOAM TANK (Foam Tank Level Has Reached The Low Limit)	Associated Foam Concentrate Tank Is Empty	Fill the correct foam concentrate tank. (Foam A and/or Foam B)
	Foam Level Transducer Requires Calibration	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)
	Foam Level Transducer Failure	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)
	SmartFOAM Display Failure	Refer to FSG-MNL-00158 (Smart-FOAM manual).
	SmartCAFS Display Failure	Refer to FSG-MNL-00157 (CAFS manual).
	SAM Pump Controller Failure	R&R failed SAM Pump Controller. See paragraph 4.4.2 (page 53).
	SAM Control Center Failure	R&R failed SAM Control Center. See paragraph 4.4.1 (page 51).
WARNING LOW TANK WATER	SAM Reports Water Tank Level Incorrectly Or ONLY At Low Limit	Check ITL-40 harness connections.
	Water Tank Level Transducer Requires Calibration	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)
	Water Tank Level Transducer Failure	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)
WATER LEVEL SIGNAL LOST- FILL WATER TANK MANUALLY	ITL-40 Lost Power Or CAN Communication	Check harness power connections and circuit breakers. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).
		Check harness Green CAN bus connections. Refer to FSG-PL-01503/ FSG-PL-01504 and industry standard Deutsch connector practices.
		Check harness Green CAN bus resistance. See paragraph 4.16.3 (page 170).
		Check ITL-40 harness connections.
	Equipment Failure	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)

Table 78. Hale SAM System Level SCR Table – CONTINUED

SYMPTOM	CAUSE	REMEDY
WATER TANK IS EMPTY	SAM Reports Water Tank Level Incorrectly Or ONLY As Empty	Check ITL-40 harness connections.
	Water Tank Level Transducer Requires Calibration	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)
	Water Tank Level Transducer Failure	Refer to Intelli-Tank Level 40 (ITL-40) Operation Manual (P/N 118253)

4.16.2.1 Barometric Sensor Troubleshooting

Check/test the barometric sensor using a Multimeter and a test harness (see Figure 123). Disconnect the SAM harness connector from the barometric sensor and insert the test harness between the harness connector the sensor. (Refer to SAM PM [FSG-MNL-00212] for SAM connector part numbers.) Set the Multimeter to measure VDC (~ 0 to 5) and turn on the SAM system.

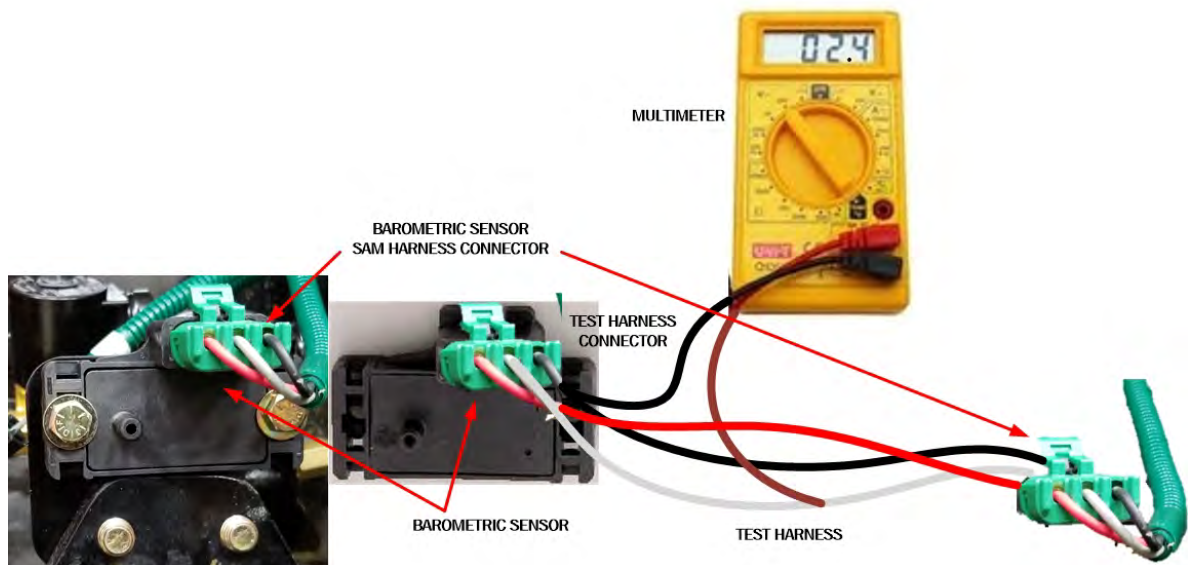


Figure 132. Barometric Sensor Check/Test

Compare the measurement to Table 79. If the measurement corresponds to the associated value in Table 74 ± 0.12 VDC the sensor is functioning correctly.

Table 79. Barometric Sensor Output

Atmospheric Pressure inHg (mb)	Output Voltage VDC
28.0 (948.2)	2.21
28.2 (955.0)	2.23
28.4 (961.7)	2.25
28.6 (968.5)	2.27
28.8 (975.3)	2.28

Table 79 Barometric Sensor Output – CONTINUED

Atmospheric Pressure inHg (mb)	Output Voltage VDC
29.0 (982.1)	2.30
29.2 (988.8)	2.32
29.4 (995.6)	2.33
29.6 (1002.4)	2.35
29.8 (1009.1)	2.37
30.0 (1015.9)	2.39
30.2 (1022.7)	2.40
30.4 (1029.5)	2.42
30.6 (1036.2)	2.44
30.8 (1043.0)	2.46
31.0 (1049.8)	2.47

4.16.2.2 Flowmeter Troubleshooting

If having issues with a flowmeter go to the calibration tab and select flowmeter calibration (see Figure 133).

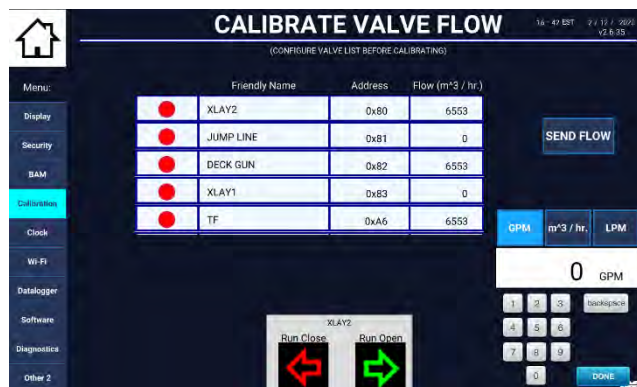


Figure 133. Calibrate Valve Flow Screen

Flowrate Is Erroneous

- Remove flowmeter paddlewheel and verify paddlewheel is clean and spins freely.
- Recalibrate flowmeter see section 5.3 (page 178).

No Flowrate Is Displayed

- Observe Flow column readings:
 - If there is an issue with connection to flowmeter, Flow column reading will be 6553.
 - If there is no issue with flowmeter connection, Flow column reading will be 0. (When there is no flow on the system.)
 - If Flow column reading is reading 6553 and associated valve has a flowmeter, verify harness connections.
- If SAM displays a COMM loss for associated valve (in Auto Mode) , check power and/or CAN connections to valve. See paragraph 4.3.5 (page 48) and section 4.10.6 (page 115).

4.16.2.3 Level Sensor Troubleshooting

The gearbox oil level sensor is an optical fluid level switch. It is positioned on SAM gearboxes to alert the operator if a low- or no oil condition is active. The gearbox must initially be filled with the correct amount of oil, checked through the fill plug. When oil is detected, the sensor outputs a signal to SAM to communicate that the minimally required amount of oil is present in the gearbox.

On the SAM Pump Controller, CAN TS Diagnostic Screen (use Output/Input password, Table 3, page 36), select the INPUTS screen and look for the Oil Level button. While keeping the sensor connected to the SAM harness, remove the sensor from the gearbox body. Immerse the sensor tip (see Figure 134) completely in gearbox oil to change the icon from red to green, indicating that the sensor is working correctly.

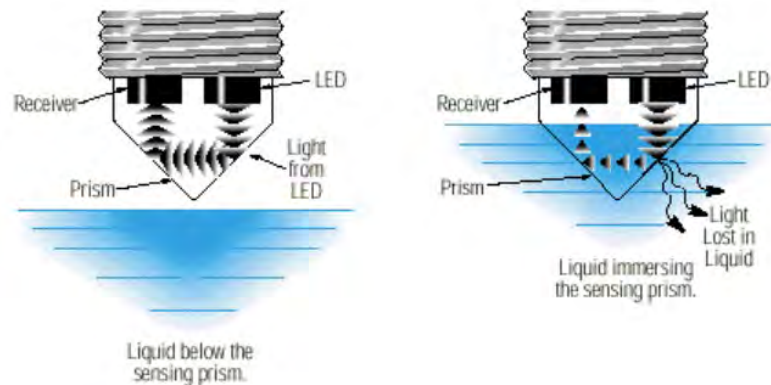


Figure 134. Level Sensor Troubleshooting

The input supply voltage for this sensor is equal to the system voltage. This sensor uses light in a prism to detect the presence or absence of oil and actuates a solid-state switched output voltage to SAM. When no-oil or liquid is detected, the sensor outputs zero voltage. Once oil or liquid is detected, the sensor outputs a signal voltage that is equal to the input voltage.

4.16.2.4 PF Valve Troubleshooting

The following subparagraphs provide PF valve troubleshooting information.

4.16.2.5 Pressure Sensor Troubleshooting

- The SAM system uses two different pressure sensors:
 - 5 psiG sensor – used on water & foam tanks and also the SAM drain assembly
 - 300 psiA sensor – used on intake & discharge sections of the pump and also all intake & discharge valves
- The input power supply for both types is 5.0 VDC. Measure the signal using a voltmeter with the red lead on the signal wire and the black lead in the ground wire while the system is powered, and the sensor is connected to the harness. You may need to back probe the connector. Do not pierce the wire insulation as this will create a point at which corrosion will start. The nominal output signal varies between 0.5 VDC and 4.5 VDC, where:
 - 0-5 psiG sensor
 - an average signal voltage of 0.5 VDC equals 0.0 psiG
 - an average signal voltage of 4.5 VDC equals 5.0 psiG

- 0-300 psiA sensor
 - an average signal voltage of 0.5 VDC equals 0.0 psiA
 - an average signal voltage of 4.5 VDC equals 300.0 psiA

4.16.2.6 Temperature Sensor Troubleshooting

There are two [2] temperature sensor on a SAM system. One for gearbox temperature and one for pump water temperature. See FSG-PL-01501/-01502/- 01513 (Sheet 1) for temperature sensor locations. The two potential issues with a temperature sensor are: One it is NOT giving feedback or, Two the feedback is incorrect.

No Temperature

If the temperature sensor is NOT providing feedback (an output), the Oil or Water readings (Output/Input password, Table 3, page 36) on the Input screen (Figure 135) will display a value of 450.

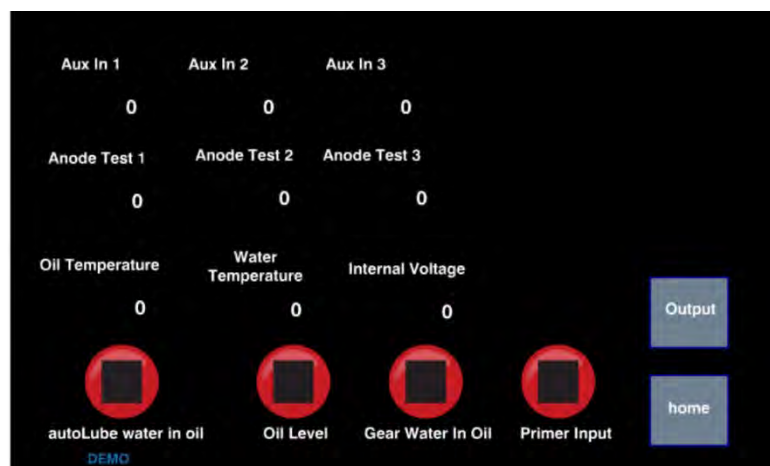


Figure 135. Output/Input Screen

Check the harness connections and ensure the sensor is receiving power. If both are true, the sensor may need replaced. See Table 78 (page 153), HIGH GEARBOX TEMPERATURE under the SYMPTOM column.

Erroneous Temperature

Ensure engine exhaust is NOT blowing directly on sensor.

Recalibrate the sensor using the Pump Controller (Gearbox Temperature Calibration password, Table 3, page 36). Refer to paragraph 5.6 (page 184) to calibrate a temperature sensor.

4.16.2.7 Water Present Sensor Troubleshooting

- The water detection sensor uses a black electrode to detect the presence or absence of water and actuates a solid-state switched output voltage to SAM. The input supply voltage for this sensor is equal to the system voltage. When no water is sensed, the sensor outputs zero voltage. Once water is detected, the sensor outputs a signal voltage that is equal to the input voltage. This sensor is used in the SAM system to:
 - Detect water in the gearbox and indicate a faulty operating condition
 - Detect water in the Q Series pump autolube and indicate a faulty operating condition
 - Detect water in the priming system and indicate a successful priming operation

On the SAM Pump Controller, CAN troubleshooting diagnostic screen (Output/Input password), select the INPUTS screen and look for the autoLube Water in Oil and “Gear Water in Oil” icons. On the SAM Pump Controller MIV TS Diagnostic Screen (password 6060), select the INPUT screen and look for the “Water Detect” icon. While keeping the sensor connected to the SAM harness, remove the sensor from the gearbox body. Immerse the sensor tip completely in water to change the icon from red to green, indicating that

4.16.2.8 Diode Troubleshooting

Set multimeter to test a diode.

Plug test connector into multimeter (black lead to common input).

Ensure SAM power is OFF (no voltage at diode).

Plug test connector into diode connector. Multimeter displays ~ 0.679.



Figure 136. Forward Bias Test

Reverse test leads. Multimeter displays OL.

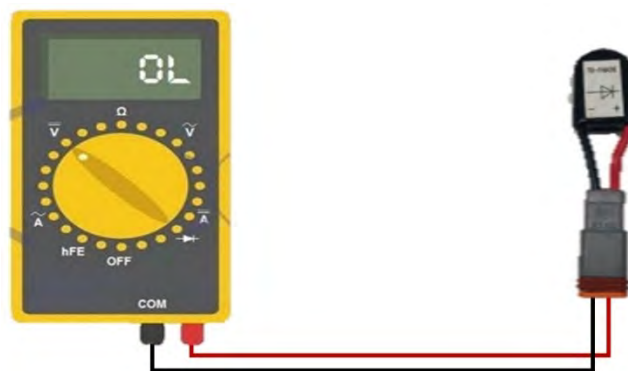


Figure 137. Reverse (or Forward ??) Bias Test

Otherwise, diode is failed. Replace diode, see Table 57 (page 102) for part number information.

NOTES

Open Diode

If the diode reads high resistance in both directions, this is a sign that the diode is open. A diode should not measure very high resistance in the forward biased direction. The diode should be replaced in the circuit.

Shorted Diode

If the diode reads low resistances in both directions, this is a sign that the diode is shorted. A diode should not measure low resistance in the reverse biased direction. The diode should be replaced in the circuit.

4.16.3 General CAN Troubleshooting

IMPORTANT NOTICE

DO NOT ALTER THE CAN NETWORK COMMUNICATIONS (SAE J1939 CAN BUS) OR CONNECT OTHER DEVICES TO ANY OF THE CAFS, CAPTIUM, FOAM, OR SAM CAN BUS BACKBONE(S).

Perform the following to troubleshoot CAN connectors/connections.

- A. Verify all connectors are secure and correct.
 1. PIN A – CAN HIGH – Yellow
 2. PIN B – CAN LOW – Green
 3. PIN C – CAN SHIELD – BLACK
- B. Verify there are no missing/unplugged terminating resistors (Figure 138).



Figure 138. Terminating Resistor

- C. Measure resistance between CAN H and CAN L. See Figure 139.

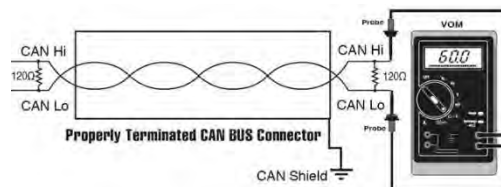


Figure 139. Bus Termination Test Setup

- D. Verify multimeter indicates $60 \pm 10 \Omega$ s.

NOTE

Measure at multiple points (middle as a minimum) of the network, if possible. The measured value should be nearly the same at each point within the network.

If the reading is below 50Ω : ensure there is NOT a short circuit between CAN H and CAN L wiring, and there are NOT more than two terminating resistors in the bus under test.

If the reading is higher than 70Ω : ensure there are NOT any open circuits (broken wires or bad connectors) in the CAN H or CAN L wiring path for the bus under test, and your bus has both terminating resistors (one connected at each end) and each terminator measures 120Ω (when connected directly to the multimeter).

4.17. Verify SAM Ready To Return To Service

Prior to returning the apparatus to service the maintainer must meet NFPA 1901 and 1911 requirements for testing an apparatus after a major repair. Utilize the following listing as a minimum checklist when returning a SAM system to service.

ATTENTION ⚠ WARNING

ALWAYS STOP THE ENGINE, SET THE PARKING BRAKE, AND CHOCK THE WHEELS BEFORE GOING UNDER THE TRUCK FOR ANY REASON.

- Operate all intake valves from manual valve control screen.
- Operate all discharge valves from manual valve control.
- Operate tank fill and tank-to-pump from SAM pump controller.
- Verify there are no errors or missing information on the SAM Pump Controllers PUMP INFO screen (based expected items on the purchased SAM system including options).
- Verify SAM Pump Controller does NOT continuously cycle power (an indication of a baud rate check failure) while apparatus ignition is on.
- Verify required ITL-40 communication (water tank level indication) is present on both the SAM Control Center and the SAM Pump Controller (display should NOT be RED).
- Verify SAM system (red tubing) is connected to apparatus compressed air supply.
- Verify SAM system water column sensor hose (10 feet of 3/4-in flex tubing provided) is connected to onboard water tank.
- Verify SAM system interlock wiring is connected to the apparatus.
- Shift into pump gear and 4th gear lockup. Then verify there are no SIGNAL LOST and/or COMM LOSS messages displayed (or popped up) on the SAM Control Center and verify SAM goes into Auto Mode.
- SAM can draft in Auto Mode.
- SAM can pump from Hydrant in Auto Mode.

Verify optional SAM equipment, if specified, is present and correctly interconnected.

- Verify if optional Navigator Pro (up to two) are present and plugged into the Green CAN bus, that each Navigator operates the associated auxiliary intake (Pony – an AB Swing-out™ valve operated as an intake). (A Navigator operating a Pony must function in both Manual and Auto Mode.)
- Verify if optional Navigator Pro (up to twelve) are present and plugged into the Red CAN bus, that each Navigator operates the associated AB Swing-out™ discharge valve. A Navigator operating a discharge must ONLY function in SAM Manual Mode. (The Navigator must be locked out in SAM Auto Mode.)
- Verify that if the optional wireless tablet, wi-fi antenna/router, DC-to-DC converter (converts 12 VDC to 24 VDC for the router), and wi-fi SAM Control Center are present, that they communicate and function to allow the SAM system to operate in Auto Mode from the tablet.

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5. ADJUSTMENTS

All significant calibrations for the SAM system can be performed from the SAM Control Center or the SAM Pump Controller. The SAM Control Center can perform any Akron Valve calibration required, while the SAM Pump Controller can calibrate the ITL-40 sensor and perform Governor calibrations.

5.1. Akron Valve Firmware Information (S/N and USB Update)

Using an Akron Brass Swing-Out™ valve with a Navigator Pro (or Akroview) requires knowing the valve's serial number. Figure 140 shows an example of the serial number markings.



Figure 140. Akron Valve Serial Number

5.2. Akron Brass Swing-Out™ Valve Calibrations

ATTENTION ⚠ WARNING

DISENGAGE PUMP BEFORE PERFORMING CALIBRATION, OTHERWISE UNEXPECTED/ UNDESIRABLE AUTOMATED OPERATIONS MAY OCCUR DURING CALIBRATION.

ATTENTION ⚠ CAUTION

REMOVE SYSTEM PRESSURE BEFORE PERFORMING CALIBRATION. OPEN ALL DRAINS AND AIR BLEED VALVES TO ENSURE THE SYSTEM IS NOT PRESSURIZED AND THE VALVE(S) CAN BE OPENED AND CLOSED SAFELY BEFORE PROCEEDING WITH VALVE CALIBRATION.

Reference paragraph 8.1.2.3, Akron Valve Firmware Information (S/N and USB update), when calibrating an AB Swing-Out™ valve with a Navigator Pro (or Akroview) as this process requires knowing the valve's serial number. Reference Figure 118 for an example of the serial number markings.

Reference section 8.1, Calibration Of AB Swing-Out™ Valves, in the OIM Manual For Hale SAM (Generation 2) (P/N FSG-MNL-00210) to calibrate the SAM electric valves.

5.2.1 Valve Position Procedures (SAM Control Center)

Three separate calibrations are available from the SAM System Options, Calibration tab, CALIBRATION MENU screen (Figure 141): Valve Stops, Calibrate Pressure Sensors, or Flowmeter Calibration. Each of the calibrations must be run for every Akron Brass Swing-Out™ valve on the Red (discharge valves) and GREEN (auxiliary intake valves, tank fill, and tank-to-pump valves CAN) bus.

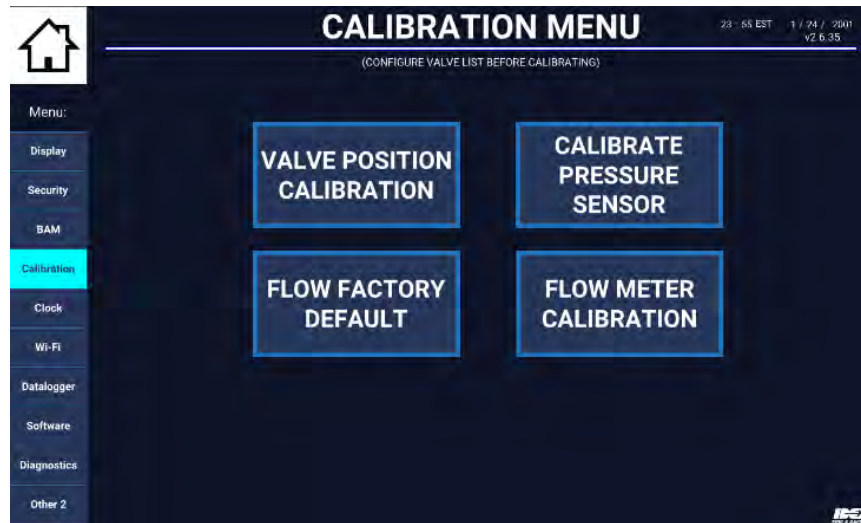


Figure 141. Valve Calibrate Menu

The VALVE POSITION CALIBRATION button calibrates the valves position sensor. (See below.) The CALIBRATE PRESSURE SENSOR button calibrates discharge and master pressure sensors. The FLOW METER CALIBRATION calibrates the flowmeters and the FLOW FACTORY DEFAULT resets the flow meter calibration back to default calibration for the valve size.

The OEM, apparatus builder, or FAST center must calibrate all Akron Brass Swing-Out™ valves that are disassemble for clocking or other purposes. Calibration may be accomplished using the SAM Control Center. Hale recommends the calibrations be performed in the order listed in the paragraphs below.

The VALVE STOPS button calibrates the valves position sensor. (See below.) The ZERO PRESSURE SENSORS button calibrates the low-end pressure accuracy of the pressure sensor associated with the selected valve. While the SPAN PRESSURE SENSOR calibrates the high-end accuracy of the pressure sensor associated with the selected valve. Touch the button for the desired calibration (to run the routine) or touch the Calibration tab to return to the CALIBRATION MENU screen.

The OEM, apparatus builder, or FAST center must calibrate all Akron Brass Swing-Out™ valves that are disassemble for clocking or other purposes. Calibration may be accomplished using the SAM Control Center.

Hale recommends the calibrations be performed in the order listed in the paragraphs below.

5.2.1.1 SAM Control Center

Perform valve calibrations as follows.

ATTENTION ⚠ WARNING

DISENGAGE PUMP BEFORE PERFORMING CALIBRATION, OTHERWISE UNEXPECTED/ UNDESIRABLE AUTOMATED OPERATIONS MAY OCCUR DURING CALIBRATION.

ATTENTION ⚠ CAUTION

REMOVE SYSTEM PRESSURE BEFORE PERFORMING CALIBRATION. OPEN ALL DRAINS AND AIR BLEED VALVES TO ENSURE THE SYSTEM IS NOT PRESSURIZED AND THE VALVE(S) CAN BE OPENED AND CLOSED SAFELY BEFORE PROCEEDING WITH VALVE CALIBRATION.

IMPORTANT NOTICE

PERFORMING THIS PROCEDURE CAUSES SAM TO EXIT AUTO MODE.

One, multiple, or all valves on the selected bus may be calibrated at one time (multiple calibrations occur in sequence). Always select any valve with a Not Calibrated status.

Perform the following to calibrate the valve position sensor for the selected valve(s).

NOTES

The Valve Stops calibration should be performed with NO water in the valves, open all drains before touching the START button.

During the calibration each selected valve will open and close twice.

The routine will run one valve at a time in sequence until all selected valves have been calibrated.

- Touch desired bus button (Red or Green) (Green is the default selection). See Figure 141 thru Figure 144.
- Verify status of each valve, touch Select box for each valve displaying a Not Calibrated status (and any additional desired valve or valves). See Figure 144.
- Ensure all selected valves are free of water. (See NOTES above.)
- Touch START button. Monitor Status of each selected valve. See Figure 144.

NOTE

When the Valve Stops calibrations are complete, close all drains opened to perform the calibration.

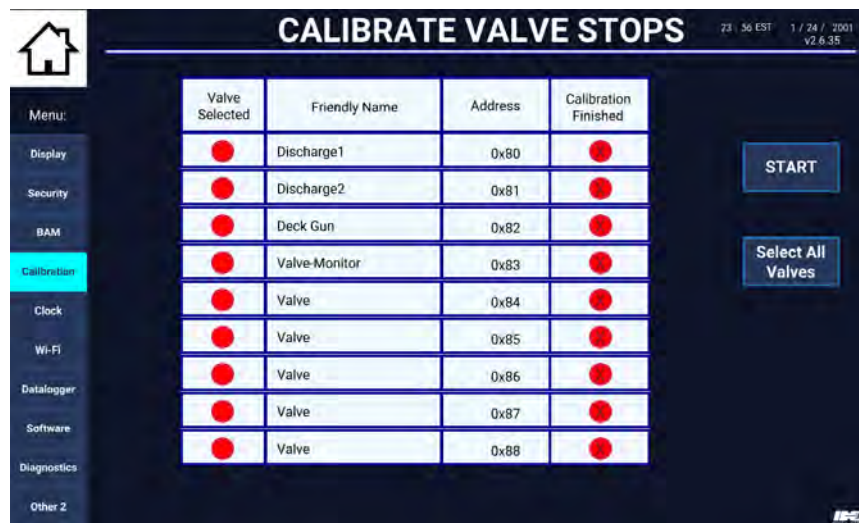


Figure 142. Calibrate Valve Stops Screen-Red Bus

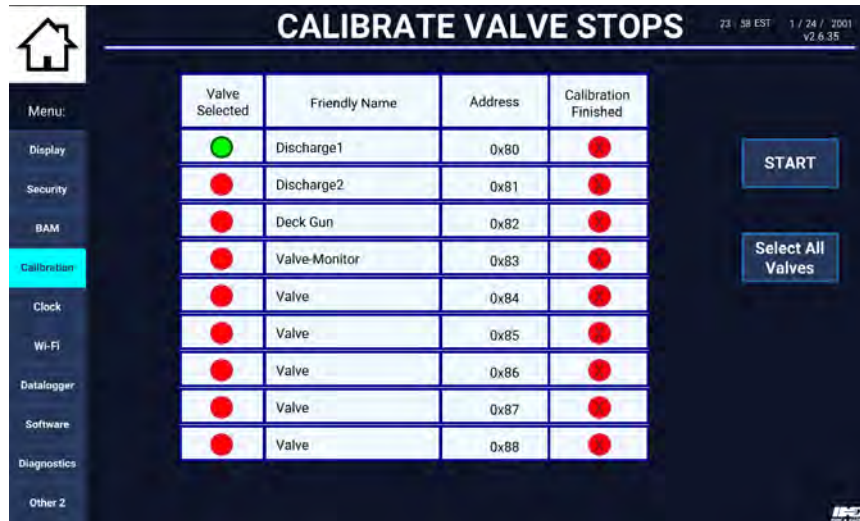


Figure 143. Calibrate Valve Stops Screen–Green Bus

4.5

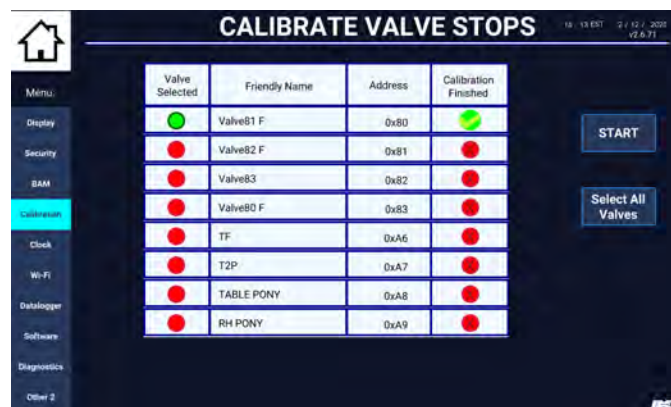


Figure 144. Calibrate Valve Stops Screen–Selected And Active

- E. When selected valve(s) indicate Calibrated, perform one of following:
 1. Touch Red dot next to another valve, and repeat steps above to calibrate another valve.
 2. Or, return to CALIBRATION MENU screen (touch Calibration tab) to select opposite bus.
 3. Or, if calibrations are complete, go to Step F.
- F. Touch Home button.
- G. Cycle SAM system power.

5.2.2 Pressure Procedures (SAM Control Center)

ATTENTION ⚠ WARNING

DISENGAGE PUMP BEFORE PERFORMING CALIBRATION, OTHERWISE UNEXPECTED/UNDESIRABLE AUTOMATED OPERATIONS MAY OCCUR DURING CALIBRATION.

ATTENTION ⚠ WARNING

DO NOT EXCEED OPERATING PRESSURE LIMITS OF PUMP, INSTALLED PLUMBING, HOSE(S), OR EQUIPMENT IN USE DURING CALIBRATION.

NOTES

The Valve Pressure calibration will calibrate all pressure sensors in the system at the same time, including the intake and discharge pressure sensors.

The Akron Brass Style 9327 Navigator Mini Valve Controller does NOT support pressure calibration.

A. Open all drains and valves to ensure pump is empty. (No water.)

1. Touch ZERO PRESSURES BUTTON.

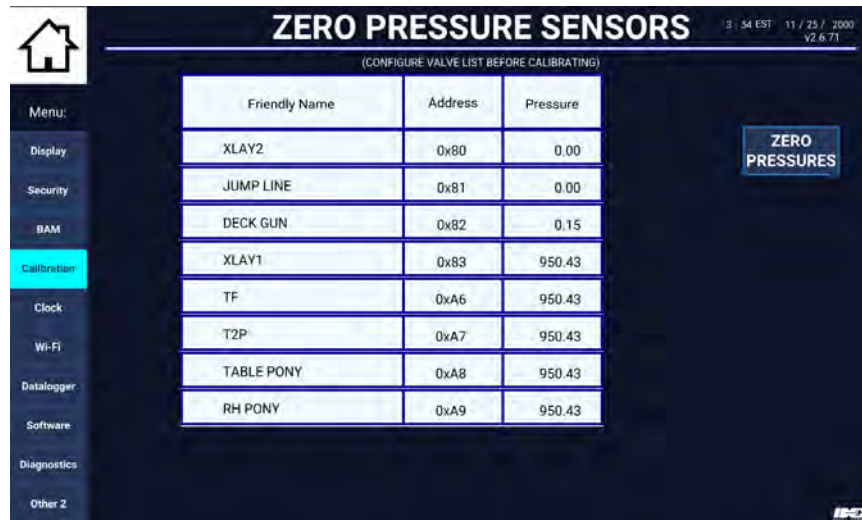


Figure 145. Zero Pressure Sensor Screen

2. Close all drains and valves.
 - a) Fill pump with water and increase pressure to 200 psi.
 - b) Touch SPAN PRESSURES button.
3. Touch Home button.
4. Cycle SAM system power.

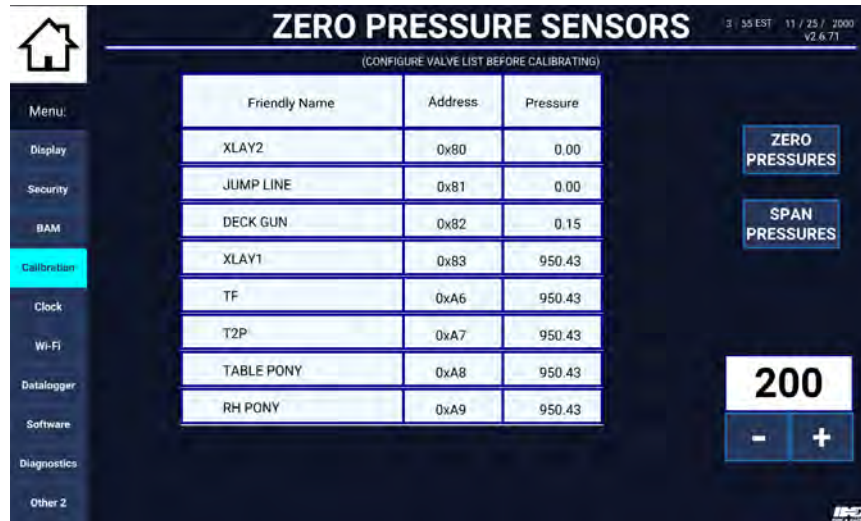


Figure 146. Span Pressure Sensor Screen

5.3. Flowmeter Calibration Procedures

The following subparagraphs provide flowmeter calibration and reset procedures.

5.3.1 Set Flow To Factory Defaults

NOTES

This procedure is only required if a valves flow calibration errors/fails (becomes unresponsive or gives obviously abnormal values). (All flows readings are displayed using m³/hr units.)

An OEM/Technician password is required to access the screens to perform this procedure. Contact the AHJ for applicable OEM/Technician information.

The value size should be verified by checking the physical valve marking and then checking the Diameter (2.5, 4, 6) text box. (Located on bottom of the EDIT VALVE screen in the SELECT DEVICE MENU).

Refer to FSG-MNL-00211 for passwords, screen navigation, and detailed instructions.

Use this procedure to assign (or reset to) the default flow value for the desire discharge valve. Default flow values represent expected/known flow rates based on valve diameter/size (under typically good flow design conditions).

5.3.2 Flow Calibration

ATTENTION ⚠ WARNING

DO NOT EXCEED OPERATING PRESSURE LIMITS OF PUMP, INSTALLED PLUMBING, HOSE(S), OR EQUIPMENT IN USE DURING CALIBRATION.

IMPORTANT ⚠ NOTICE

AN ACCURATE FLOW MEASURING DEVICE MUST BE USED TO MEASURE THE WATER FLOW WHEN CALIBRATING THE FLOW SENSOR. USE A SUITABLE SIZE, SMOOTH BORE NOZZLE AND AN ACCURATE AND CALIBRATED PITOT GAUGE INSTRUMENT OR MASTER FLOW METER. HAND HELD PITOT GAUGES ARE USUALLY NOT VERY ACCURATE. MAKE SURE THE SYSTEM IS CALIBRATED WITH AN ACCURATE FLOW MEASURING DEVICE.

The SAM discharge flow calibration requires each discharge be calibrated individually (only one open discharge at one time) using an external calibrated Pitot gauge (or a calibrated flowmeter) to determine the actual water flow. This procedure does NOT include setup for the calibrated Pitot or flowmeter.

NOTES

The flow reading are always displayed in m³/hr (the J1939 standard unit).

An OEM/Technician password is required to access the screens to perform this procedure. Contact the AHJ for applicable OEM/Technician information.

Perform the following to calibrate the valve position sensor for the selected discharge valve.

- A. Close all discharge valves.
- B. On SAM Control Center Home screen, touch System Options icon (touch and hold icon if required).
- C. When Enter Password screen is displayed, enter OEM/ Technician password as follows.
 1. Connect USB key to USB dongle (rear of SAM Control Center).
 2. Sequentially, touch password digits.
 3. Touch ENTER button.
- D. On Display Menu screen, touch Calibration tab. (Refer to FSG-MNL-00211.)
- E. Touch FLOWMETER CALIBRATION button.
CALIBRATE VALVE FLOW screen appears (Figure 147).

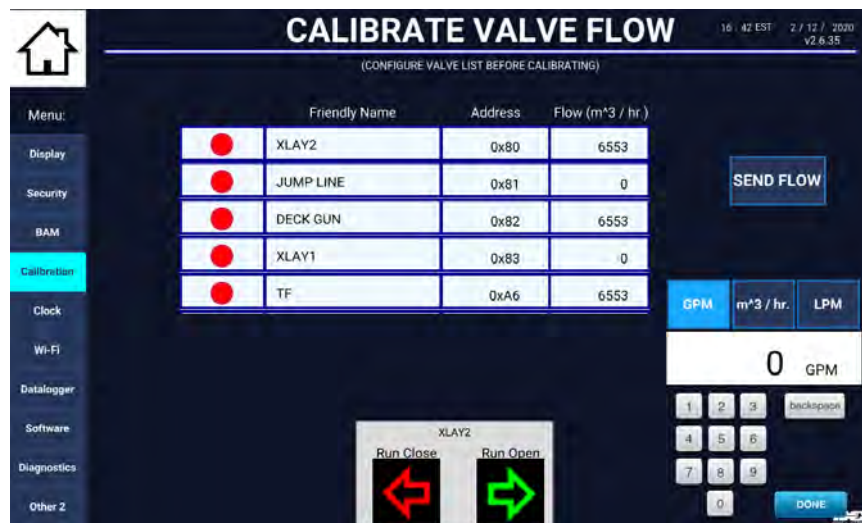


Figure 147. Calibrate Valve Flow Screen

- F. Touch red dot (next to Friendly Name) to select valve for testing.
(See Figure 148.)

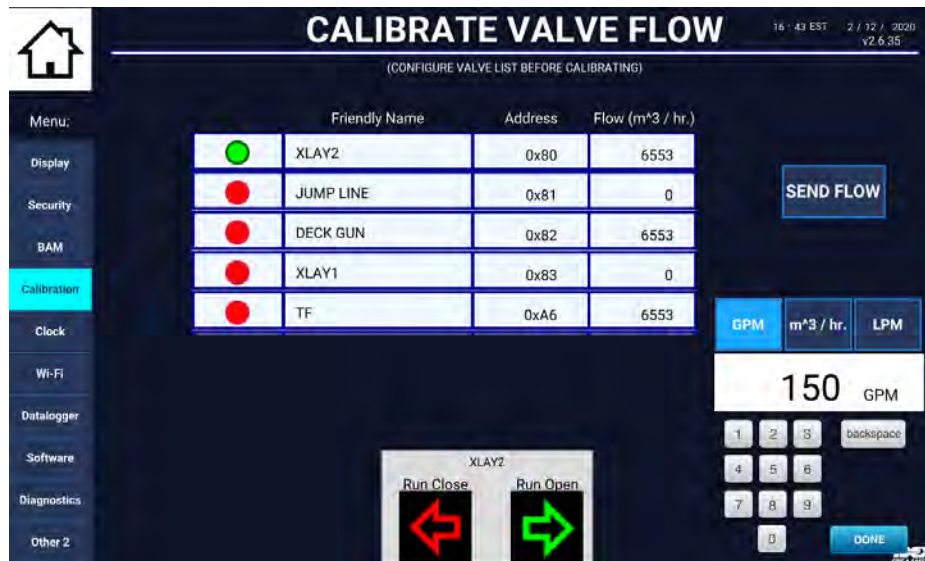


Figure 148. Enter Externally Determined Flow Rate

- G. Touch and hold Run Open button (see bottom of Figure 148) to fully open valve under test.
- H. On external flow test equipment, determine actual flow of valve under test.
- I. On CALIBRATE VALVE FLOW screen (right-hand side), enter the results of the flow test as follows.
1. Touch applicable units. (Match units for the flow value from previous step.)
 2. Using key pad, sequentially touch digits of flow value.
 3. Touch DONE button
 4. Touch SEND FLOW button.

NOTE

If entry errors are made that cause the calibration to fail (or become unresponsive), touch the perform Set Flow (Factory Default) procedure (see paragraph 5.3.1, page 178).

- J. Repeat Step F thru Step I.4 until all desired/required discharge flows have been calibrated.
- K. Touch Home button.
- L. Cycle SAM system power.

5.3.3 Calibration With AKROVIEW Diagnostic Software

IMPORTANT NOTICE

PERFORMING THIS PROCEDURE CAUSES SAM TO EXIT AUTO MODE.

If already using Akroview or Akroview II the discharge valves may be calibrated using a computer, a USB to CAN adapter, and the software. Reference the Akron Brass 6046 Diagnostic Interface

Kit (P/N 60460001) documentation and contact Customer Service (800-228-1161) for SAM specific instructions/methodology. Be ready to provide the serial numbers of the valve(s) that require connection to/interface with Akroview.

5.4. ITL-40 Calibration Procedure

The ITL-40 tank level gauges must be calibrated in order for the SAM Control Center to show accurate tank level. The ITL-40 is used for Water, Foam A, and Foam B tank levels. Refer to ITL-40 manual (P/N118253).

5.4.1 Water Tank

The ITL-40 can be calibrated the traditional way using the 1, 2, or 9 point calibration (refer to ITL-40 manual [P/N 118253]). Alternatively, the water tank level can be calibrated automatically using the SAM Pump Controller and the following steps.

On the SAM Pump Controller, enter ITL-40 Calibration password (see Table 3, page 36.)

- A. Fill water tank.
- B. Touch check box when tank is full.
- C. Drain water tank. (Using a discharge.)
- D. Touch stop when pump starts to cavitate. (It is recommended to perform the calibration while running the NFPA tank-to-pump flow-rate check/test.)



Figure 149. Water Tank Calibration Step 1

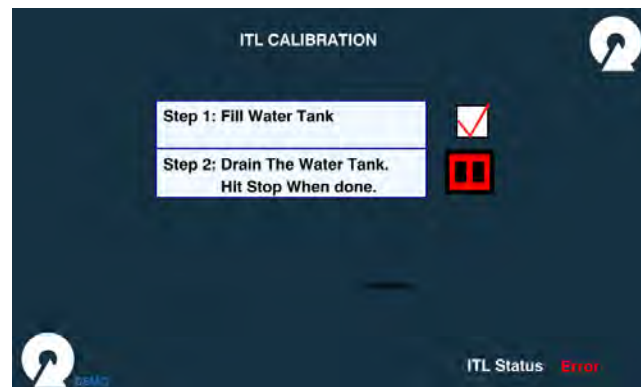


Figure 150. Water Tank Calibration Step 2

- E. Touch save button. (Saves and sends calibration data to the ITL-40 when complete.)

NOTES

If calibration fails, touch redo button (top right) of screen).

If there is no communication with ITL or if the calibration was done improperly, the status will say **ERROR** in the bottom right corner of the screen.

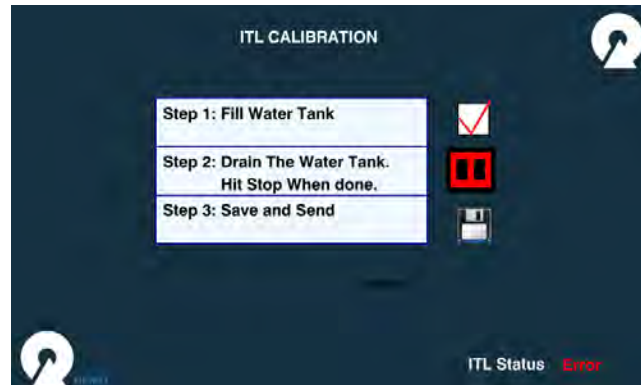


Figure 151. Water Tank Calibration Step 3

5.4.2 Foam Tank A

The Foam A ITL-40 can only be calibrated the traditional way using the 1, 2, or 9 point calibration in the ITL-40 manual (P/N 118253).

5.4.3 Foam Tank B

The Foam ITL-40 can only be calibrated the traditional way using the 1, 2, and 9 point calibration in the ITL-40 manual (P/N 118253).

5.5. Pump (Master Intake And Discharge) Pressure Alternate Calibration

Only use this procedure following Matrlx pressure governor module replacement, otherwise calibrate the pump (master intake and discharge) pressure sensors using the Pressure Procedures, SAM Control Center (paragraph 5.2.2.1, page 177)

ATTENTION ⚠ WARNING

DISENGAGE PUMP BEFORE PERFORMING CALIBRATION, OTHERWISE UNEXPECTED/UNDESIRABLE AUTOMATED OPERATIONS MAY OCCUR DURING CALIBRATION.

ATTENTION ⚠ WARNING

DO NOT EXCEED OPERATING PRESSURE LIMITS OF PUMP, INSTALLED PLUMBING, HOSE(S), OR EQUIPMENT IN USE DURING CALIBRATION.

Always calibrate the pump (master intake and discharge) pressure sensors using a known good and in-calibration calibrated pressure gauge to set the span. The sensors specification is $\pm 1.5\%$ from 0 to 85 °C and ranges (linearly) from 1.5% to 2 % from 0 to -40 °C and from 85 to 125 °C. Adjust the readout accordingly with respect to the actual pump temperature.

Perform the following to calibrate the pump (master intake and discharge) pressure.

- A. On SAM Pump Controller, touch and hold System Options icon until circle completes and Menu screen (Figure 152) appears.

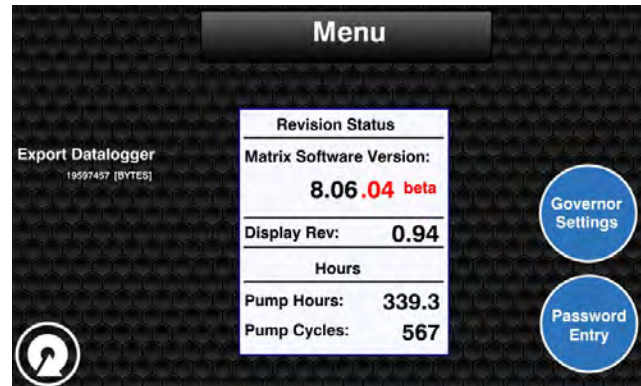


Figure 152. SAM Pump Controller System Options Menu Screen

- B. Touch Password Entry button.
- C. When password screen appears, enter Governor Settings password (see Table 3, page 36) as follows.
 1. Using key pad, sequentially touch digits of password.
 2. Touch Enter button.
- D. When Governor Menu (Figure 153) appears, touch Page 2 button.

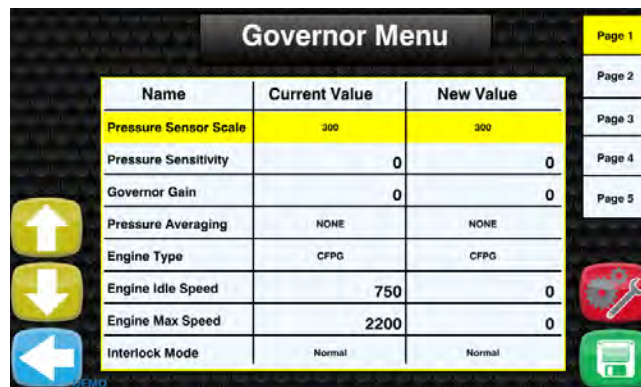


Figure 153. Governor Menu Screen

- E. Zero pressure sensors as follows.
 - a. Select Zero pressures.
 - b. Touch settings button (red button with gears and wrench).
 - c. Touch desired sensor.
 - d. Touch green check mark to accept new value.
- F. Touch Page 4 to set discharge or intake high calibration as follows.
 - a. Using water, pressurize pump to approximately 200 psi. Do NOT exceed 200 psi.
 - b. Under New Value column, enter pressure reading from test gauges into Pressure Sensor Scale row.
 - c. Touch green checkmark (pop up) to accept changes.

- G. Touch Home button.
- H. Cycle SAM system power.

5.6. Temperature Sensor Calibration

To correct the SAM temperature readout (calibrate temperature), perform the following.

- A. On SAM Pump Controller, touch and hold System Options button until loading icon completes circle and Menu screen is displayed.
- B. Touch Password Entry button.
- C. Enter Temperature Calibration password. See Table 3 (page 36).
- D. Select temperature location as follows. See Figure 154.
 - 1. To select gearbox temperature sensor, touch Gearbox button. (top-most right-hand button; gear encircling a thermometer)
 - 2. To select pump temperature sensor, touch Pump button. (middle right-hand button; pump encircling a thermometer)

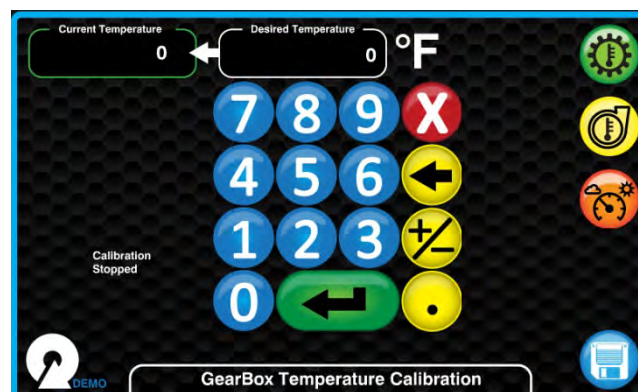


Figure 154. Temperature Calibration Screen (Pump Shown)

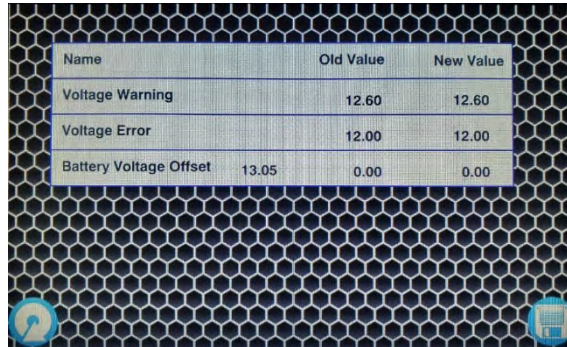
- E. Using digits pad, enter correct temperature (from test equipment or calibrated thermometer) into Desired Temperature.
- F. Touch enter button (green left arrow).
- G. Touch Save button (disk icon at bottom right of screen).
- H. Touch System Options Menu button. (Exits the screen).

5.7. Voltage Calibration

As part of the voltage calibration, the voltage warning, voltage error, and battery offset can be set. To calibrate the SAM voltage read out, perform the following.

- A. On SAM Pump Controller, touch and hold System Options button until loading icon completes circle and Menu screen is displayed.
- B. Touch Password Entry button.
- C. Enter Voltage Calibration password. See Table 3 (page 36).
- D. Select Battery Offset Voltage (or other value requiring change) as follows.
 - 1. If required, touch row to select Voltage Warning. (Set by NFPA/AHJ.)
 - 2. If required, touch row to select Voltage Error. (Set by NFPA/AHJ.)
 - 3. Touch Battery Voltage Offset row.

The purpose here is to adjust for voltage drop SAM is experiencing. To correct for the drop, input the difference in voltage readings between the SAM displayed voltage (left-most column) and the desired voltage (displayed on the test equipment or other voltage readout from apparatus) under the New Value column (right-most column). Do NOT enter the readout, only the difference between the two readouts. See Figure 155.



Name	Old Value	New Value
Voltage Warning	12.60	12.60
Voltage Error	12.00	12.00
Battery Voltage Offset	13.05	0.00

Figure 155. Voltage Adjustment Screen

E. Touch Save button. (Disk icon; bottom right of screen).

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6. SAM SETUP/CONFIGURATION

The following subparagraphs explain the advanced settings available on the SAM Control Center and the SAM Pump Controller.

IMPORTANT NOTICE

PERFORMING ANY PROCEDURE IN THIS SECTION CAUSES SAM TO EXIT BOTH AUTO AND MANUAL MODES AND ENTER CONFIGURATION MODE.

LEAVING SAM IN CONFIGURATION MODE PREVENTS SAM FROM ENTERING AUTO OR MANUAL MODES. ALWAYS TOUCH THE SEND BAM + REBOOT TO GUI OR REBOOT TO GUI BUTTON BEFORE RETURNING THE APPARATUS TO SERVICE.

6.1. SAM Control Center Setup/Configuration

To access advanced settings for the SAM Control Center, enter the Technician Level 2 password (see Table 3, page 36). Touch the BAM TAB and then touch the Configuration Settings button.

NOTE

The touchscreen will reboot into Configuration Mode.

6.1.1 How To Set Time And Date

While in SAM Configuration Mode (Figure 156), touch the RTC Config button and enter the current date and time. See Figure 157.

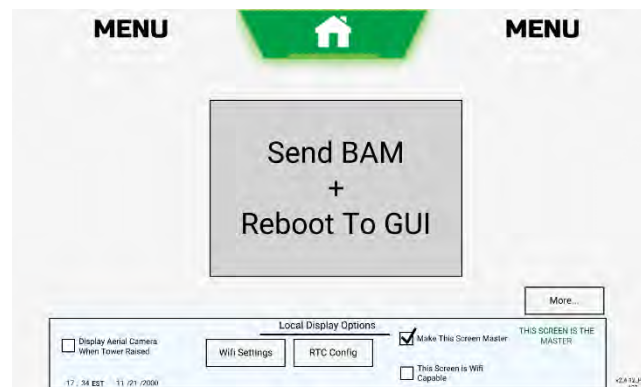


Figure 156. SAM Configuration Mode MENU Screen



Figure 157. Real Time Clock Screen

B. Touch row of desired device. Edit Valve screen (Figure 159) appears.

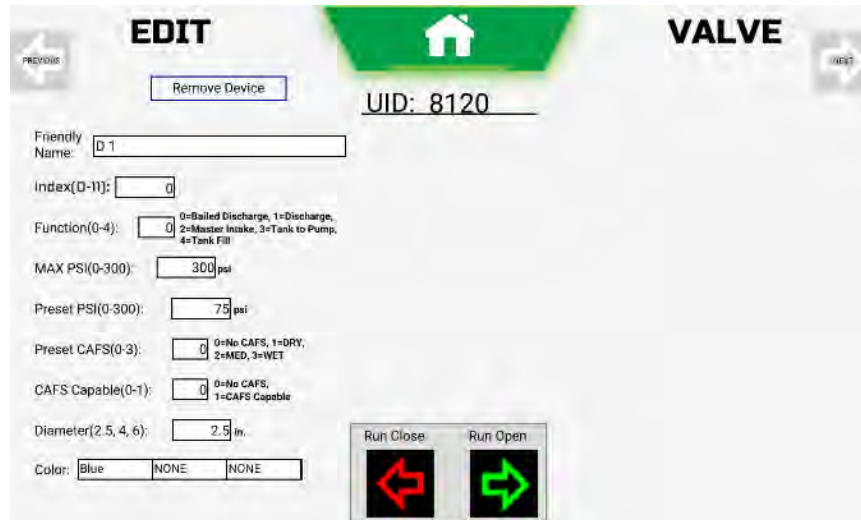


Figure 159. Edit Valve Screen

Perform the appropriate/desired procedure (or procedures) from the following subparagraphs.

6.2. Identifying Which Physical Valve A UID Corresponds To

Touch the Run Close Run or Open button while physically monitoring the valve(s) for movement to identify/verify valve and entry item association.

NOTE

Monitor expected valve for movement first. If expected valve is NOT moving, monitor remaining valves for movement until the associated physical valve is located. Update associated edit valve data/entries according to the physical valve identified.

6.3. Assigning Quicksets To The Home Screen

Reference the SAM OIM (FSG-MNL-00210).

6.4. How To Change The Order Of (Or Delete) Quicksets On The Home Screen

Reference the SAM OIM (FSG-MNL-00210).

6.5. Change User/Dealer Password

Reference the SAM OIM (FSG-MNL-00210).

6.6. How To Assign/Change Low Tank Water Alarm Trigger Level

Reference the SAM OIM (FSG-MNL-00210).

6.7. How To Assign/Change A Valves Friendly Name

After selecting the desired valve, touch the Friendly Name text box (see Figure 86). Keyboard, number pad, and DONE buttons appear (Figure 160).

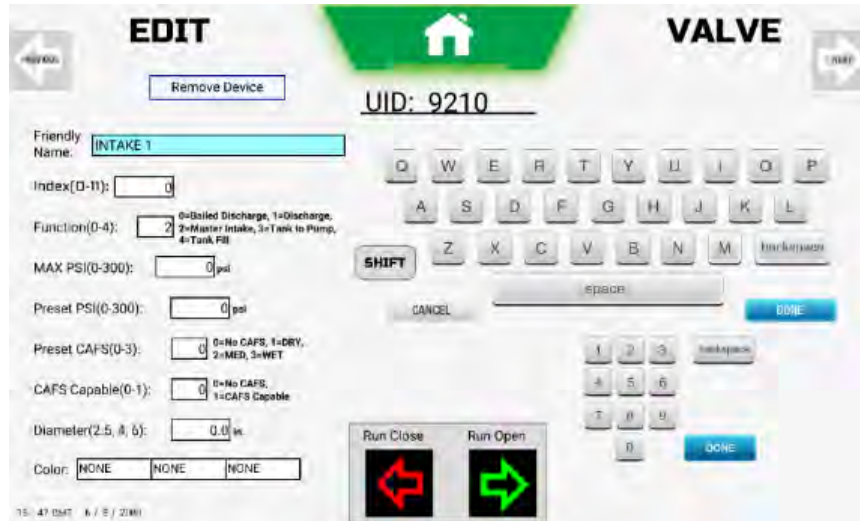


Figure 160. Edit Valve Screen – Keyboard, Number Pad, And DONE Buttons

The existing (default or previously entered) Friendly Name may be appended to (adds on to existing text) by simply typing. To delete the existing name, use the backspace key.

6.7.1 How To Change A Friendly Name

Perform the following to change the friendly name of a discharge valve or an intake valve displayed on any of the SAM Control Center screens (quicksets, discharge settings, or manual valve control screens).

- A. Perform Setup And Configurations Using The Device Select Menu (see paragraph 6.1.3.1, page 188) to access SELECT DEVICE screen (Figure 158).
- B. On SELECT DEVICE screen, touch desired Friendly Name (the one to be changed) to navigate to EDIT VALVE screen.
- C. On EDIT VALVE screen, touch Friendly Name: text box.

NOTE

A keyboard, number pad, and DONE buttons appear (See Figure 87).

- D. Using keyboard and/or number pad, type desired friendly name.
- E. Touch current Friendly Name, wait for display to transition to EDIT VALVE screen. (See Figure 159, page 189)
- F. Touch Friendly Name: text box. Keyboard, number pad, and DONE buttons appear (See Figure 160).
- G. Using keyboard and/or number pad, type desired friendly name.
- H. Touch DONE button. (Either one.)
- I. Perform Saving The Configuration Changes, paragraph 6.19 (page 197).

6.8. How To Assign/Change A Valves Index Number

After selecting the desired valve, touch the Index (0-11) text box (see Figure 161). The number pad, CLEAR, and ENTER buttons appear (on the right-hand side of the screen).

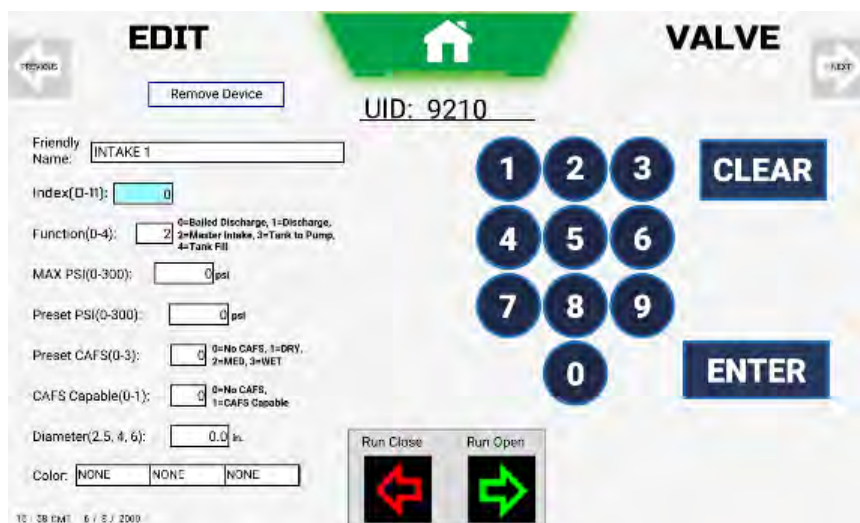


Figure 161. Edit Valve Screen –Number Pad, CLEAR And ENTER Buttons

Touch the desired index number digit(s) then touch ENTER button. (Touch CLEAR button to delete text box data.)

NOTES

Index numbering effects other features, placement, and organization within groups on the SAM system. I.E. A maximum of four intakes can be displayed on the SAM Auto Mode Home screen, those indexed 0 thru 3. Any intake indexed 4 or 5 can ONLY be operated from the Manual Mode screens. Discharge valves are listed in the DISCHARGE SETTINGS screen in index order.

Do NOT index an auxiliary intake (Pony) as 0 thru 3. These valves can ONLY be draft operated in Manual Mode. Additionally, pony valves are NOT opened by SAM in the same way as MIVs in Auto Mode (no automatic priming or air bleed). Pony valves also require unique CAN addresses (static).

IMPORTANT NOTICE

VALVE INDEX NUMBERS MUST BE UNIQUE WITHIN THAT TYPE OF VALVE (FUNCTION). NO TWO INTAKES CAN HAVE THE SAME INDEX NUMBER AND NO TWO DISCHARGES CAN HAVE THE SAME INDEX NUMBER. HOWEVER, ONE INTAKE AND ONE DISCHARGE MAY HAVE THE SAME INDEX NUMBER.

6.9. How To Assign/Change A Valves Function

After selecting the desired valve, touch the Function (0 – 4) text box. (see Figure 161, except Function (0 – 4) is highlighted). The number pad, CLEAR, and ENTER buttons appear. The following are SAM conventions for function assignment.

- Assign a 0 to a discharge valve that will have a bailed nozzle attached to its hose. (Most common type of discharge.)
- Assign a 1 to all non-bailed discharges. (Monitors, turrets, etc.)



- Assign a 2 to all Hale MIVs and Akron Brass Swing-Out™ valves used as an auxiliary intake (Pony).
- Assign a 3 to the Tank-To-Pump valve. (Special purpose there is only one.)
- Assign a 4 to the Tank Fill valve. (Also a special purpose valve and again there is only one.)

Table 80 lists the Hale recommended function (factory defaults) for SAM discharges.

Table 80. SAM Discharge Valve Function Defaults

Akron Brass Swing-out Valve Size (Inches)	Default/Recommended Function Setting
1.5	Bailed
2	Bailed
2.5	Bailed
3	Bailed *
4	Non Bailed
5	Non Bailed
6	Non Bailed

* Non Bailed for a deck gun.

6.10. How To Assign/Change A Valves MAX PSI

After selecting the desired valve, touch the MAX PSI (0 to 300) text box. (see Figure 161, except MAX PSI (0 to 300) is highlighted). The number pad, CLEAR, and ENTER buttons appear, touch the number(s) for the desired pressure then touch ENTER button. (Touch CLEAR button to delete text box data.)

Table 81 lists the default maximum pressure setting for SAM discharge valves and provides recommended preset pressure assignment for water/foam and CAFS.

Table 81. SAM Discharge Valve Max PSI Defaults

Akron Brass Swing-out Valve Size (Inches)	MAX PSI Setting (Hale Default)	Foam Or Water Preset Setting (Hale Default)	CAFS Preset Setting (Hale Default)
1.5	300	150	100
2	300	125	100
2.5	275	100	100
3	250	95	95
4	200	90	95
5	185	90	95
6	175	90	95

6.11. How To Assign/Change A Valves Preset Pressure (Preset PSI)

After selecting the desired valve, touch the Preset PSI (0-300) text box (see Figure 161, except Preset PSI (0 to 300) is highlighted). The number pad, CLEAR, and ENTER buttons appear. touch the number(s) for the desired pressure then touch ENTER button. (Touch CLEAR button to delete text box data.) Default preset pressure setting for SAM discharge valves for water/foam and CAFS are also listed in Table 81 (above).

6.12. How To Assign/Change The SCC Balloon Types

After selecting the desired valve, touch the preset CAFS box and select a value of 0 to 4. See Table 82 for a description of each value (0 to 4).

Table 82. SAM SCC Balloon Types

Preset Valve	Description
0	Valve will have a water preset.
1	Valve will have a Dry preset (CAFS ONLY).
2	Valve will have a MED preset (CAFS ONLY).
3	Valve will have a WET Preset (CAFS ONLY).
4	Valve will have a FOAM Preset.

6.13. How To Assign/Change A Valves CAFS/FOAM Capability

After selecting the desired valve, touch the CAFS Capable box and select a value of 0 to 4. See Table 83 for a description of each value (0 to 4).

Table 83. SAM Valve Capability Settings

CAFS Valve	VALVE CAPABILITY
0	WATER ONLY
1	N/A
2	FOAM AND WATER
3	CAFS, FOAM, AND WATER

6.14. How To Assign/Change A Valves Size (Diameter)

After selecting the desired valve, touch the diameter box and select the applicable diameter for the valve being set. See Table 81 for listing of available diameters.

6.15. How To Change/Set Discharge Colors

After selecting the desired valve, touch any one of the three (3) color text boxes (Figure 162). The colors for the icons boarder and/or the solid fill can be assigned. Additionally, a stripe of color can be assigned. Any of the colors to be assigned may be selected from the color swatches when displayed (Figure 163).

Perform the following to change the colors associated with a discharge valves icon displayed on any of the SAM Control Center screens (quicksets, discharge settings, or manual valve control screens).

- A. After selecting desired valve, touch text box of desired area of icon to assign/change a color. Color swatches and NONE buttons are displayed.

NOTE

Left-most box = solid fill color; Center box = border color; Right-most box = stripe color.

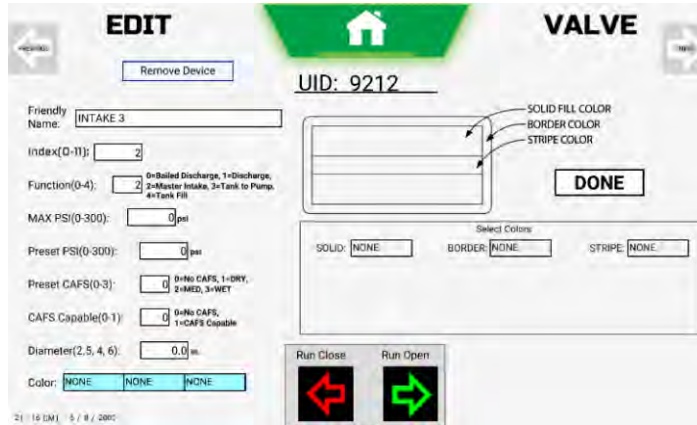


Figure 162. Valve Edit – Color Assignments

- B. Assign colors as follows.
- If solid portion of icon is desired, touch SOLID box and assign/change color as follows.
 - If a color is desired, touch desired swatch.
 - If a change to no color is desired, touch NONE button.
 - If border portion of icon is desired, touch BORDER box and assign/change color as follows.
 - If a color is desired, touch desired swatch.
 - If a change to no color is desired, touch NONE button.
 - If border portion of icon is desired, touch BORDER box and assign/change color as follows.
 - If a color is desired, touch desired swatch.
 - If a change to no color is desired, touch NONE button.

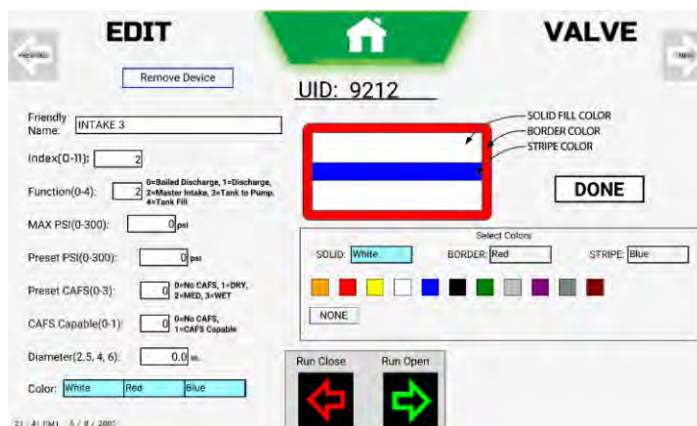


Figure 163. Color Assignment Swatches

- C. Touch DONE button.
- D. Verify text representing color/none is displayed in associated Color: text box (left-hand bottom of screen),
- E. Perform Saving The Configuration Changes, paragraph 6.19 (page 197).

6.16. How To Change The Order Of Intakes On The Home Screen

Perform the following to change the order in which the friendly name of an intake valve is displayed on any of the SAM Control Center screens (quicksets, discharge settings, or manual valve control screens).

- A. Use paragraph 6.8 (page 191) to access the Index (0-11) box.
- B. Touch Index: text box. Number pad, CLEAR and DONE buttons appear. (See Figure 161, page 191.)
- C. Using number pad, type desired index number.

NOTES

Only intakes with index numbers 0 thru 3 appear on the home screen. Intakes appear ordered top to bottom (0 = top, 3= bottom).

Do NOT assign duplicate index numbers for the same device Function (Intakes are assigned a function number of two [2]).

- D. Touch DONE button.
- E. Perform Saving The Configuration Changes, paragraph 6.19 (page 197).

6.17. Configuring SAM For A Foam System

The SAM system is always Foam Capable. To turn on foam the user must enable the valves to be foam capable. The sections below describe how to enable each valve to be foam capable.

6.17.1 Configuring A Foam Preset

If a discharge is to be used for foam and initialized by SAM create a foam preset for the discharge as follows.

- A. Enter system options.
 - 1. Touch (and hold if required) until loading icon completes a circle.
 - 2. Enter appropriate password to access BAM tab (see Table 6).
 - 3. Touch BAM tab.
- B. Touch Configuration Menu button.
- C. Add foam preset to desired discharge as follows.
 - 1. On Select Device Menu, touch desired discharge.
 - 2. On Edit Valve screen, touch Preset CAFS (0-4): text box.
 - 3. Using pop up number pad, touch 4.
 - 4. Touch ENTER.
 - 5. On Edit Valve screen, touch CAFS Capable (0-3): text box.
 - 6. Using pop up number pad, touch 2.
 - 7. Touch ENTER.



- D. If applicable, assign color(s) to discharge icon, see paragraph 6.7, How To Change/Set Discharge Colors (page 189).
- E. Perform Saving The Configuration Changes, paragraph 6.19 (page 197).

6.17.2 Configuring A Foam Quickset

If a foam discharge is used often and is typically initialized by SAM create a foam Quickset for the discharge as follows.

- A. Enter system options.
 - 1. Touch (and hold if required) until loading icon completes a circle.
 - 2. Enter appropriate password to access Display Menu (see Table 6).
Display tab is displayed by default.
- B. If required, touch Display tab. If displayed, touch DISCHARGE QUICKSETS button.
- C. If Quickset(s) already exist, perform How To Change The Order Of (Or Delete) Quicksets On The Home Screen (paragraph 6.2.2.2, page 189).
- D. Perform Assigning Quicksets To The Home Screen (paragraph 6.2.2.1, page 189).

6.17.3 Configuring A CAFS Preset

If a discharge is to be used for CAFS and initialized by SAM create a foam preset for the discharge as follows.

- A. Enter system options.
 - 1. Touch (and hold if required) until loading icon completes a circle.
 - 2. Enter appropriate password to access BAM tab (see Table 6).
 - 3. Touch BAM tab.
- B. Touch Configuration Menu button.
- C. Add foam preset to desired discharge as follows.
 - 1. On Select Device Menu, touch desired discharge.
 - 2. On Edit Valve screen, touch Preset CAFS (0-4): text box.
 - 3. Using pop up number pad, touch 1, 2, or 3 (as required to set dry, medium, or wet CAFS).
 - 4. Touch ENTER.
 - 5. On Edit Valve screen, touch CAFS Capable (0-3): text box.
 - 6. Using pop up number pad, touch 3.
 - 7. Touch ENTER.
- D. If applicable, assign color(s) to discharge icon, see paragraph 6.7, How To Change/Set Discharge Colors (page 189).
- E. Perform Saving The Configuration Changes, paragraph 6.19 (page 197).

6.17.4 Configuring A Foam Quickset

If a foam discharge is used often and is typically initialized by SAM create a foam Quickset for the discharge as follows.

- A. Enter system options.
 1. Touch (and hold if required) until loading icon completes a circle.
 2. Enter appropriate password to access Display Menu (see Table 6).
Display tab is displayed by default.
- B. If required, touch Display tab. When displayed, touch DISCHARGE QUICKSETS button.
- C. If Quickset(s) already exist, perform How To Change The Order Of (Or Delete) Quicksets On The Home Screen (paragraph 6.2.2.2, page 189).
- D. Perform Assigning Quicksets To The Home Screen (paragraph 6.2.2.1, page 189).

6.18. Connecting Captium To SAM

To connect SAM to Captium, connect the following SAM CAN buses to the associated Captium CAN bus. See Table 77 for details.

- SAM Blue CAN bus to Captium CAN bus 1.
- SAM Green CAN bus to Captium CAN bus 2.
- SAM Red CAN bus to Captium CAN bus 3.

Use a CAN extension cable [M – M] (P/N 116971) to interconnect each bus.
(Relocate the termination resistor(s) if required.)

Table 84. Captium To SAM Wiring (From/To Listing)

Captium Display (Green) Connector 1 (Pin)	To SAM Control Center Black Connector	To Pump Controller Connector A (Black)
12 (CAN1 Low) [Bus]	N/A	5 (CAN1 Low) [Bus]
1 (CAN1 High) [Bus]	N/A	6 (CAN1 High) [Bus]
10 (CAN2 Low) [Bus]	5 (CAN1 Low) [Bus]	18 (CAN2 Low) [Bus]
3 (CAN2 High) [Bus]	6 (CAN1 High) [Bus]	19 (CAN2 High) [Bus]
9 (CAN3 Low) [Bus]	18 (CAN2 Low) [Bus]	N/A
4 (CAN3 High) [Bus]	19 (CAN2 High) [Bus]	N/A

Pins 2, 11, and 8 are shields. CAN shield pins NOT provided. CAN shields NOT provided.

6.18.1 Configuring Captium For SAM

Hale Captium is configured and tested by Hale before it is shipped loose. See the subparagraph below for details.

6.19. Saving The Configuration Changes

Perform the following to save the configuration changes including friendly name and/or colors associated with a discharge valves icon displayed on any of the SAM Control Center screens (quicksets, discharge settings, or manual valve control screens).

- A. On EDIT VALVE screen, touch HOME icon/button.
(top center of screen, see Figure 159, page 189).
- B. On SELECT DEVICE screen, touch MENU icon/button
(top center of screen, see Figure 158, page 188).

- C. Touch Send BAM + Reboot To GUI button (Figure 164) to reboot system to user interface.

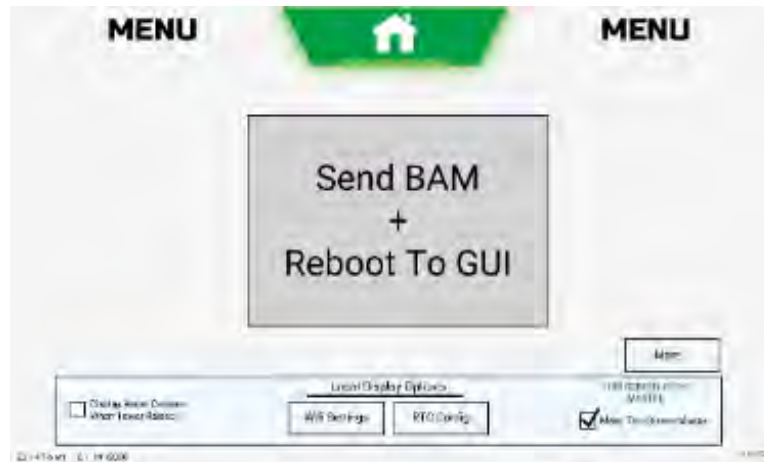


Figure 164. Update Network With New Configuration Information Screen

The button remains highlighted (see Figure 165) until the user interface reboots and displays the SAM Auto Mode Home or Landing screen (Figure 1, page 11).



Figure 165. Screen During Network Update



7. SOFTWARE UPDATES

The SAM system software is subject to periodically updated to account for any of the following:

- New Features
- Current Feature Enhancements
- Minor Bug Fixes

When a new software update is available, Hale Products will post a news bulletin. The bulletin will provide information about the changes in software the update provides along with how to acquire and install the new update.

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APPENDIX A. TORQUE SPECIFICATION

A.1 Hale General Torque Recommendations

When a specific torque value is NOT specified in a procedure, Hale recommends following the recommendations in Table 85. Always utilize a minimum of Grade 8 (SAE) or class 10.9 (metric) for all flange and/or drive line mounting fasteners.

Unless otherwise specified, 1/4-in diameter and larger steel screws are to be SAE grade 5 steel. Chemical and mechanical properties are to conform to grade 5 per SAE J429.

Unless otherwise specified, steel screws smaller than 1/4-in diameter are to be SAE grade 2 steel. Chemical and mechanical properties are to conform to grade 2 per SAE J429.

Some threaded fasteners used at Hale are treated with a 360° coating of nylon or similar material to provide sealing and self-locking properties. Do NOT reuse fasteners with self-locking properties. This coating conforms to MIL-F-18240, MIL-N-25207, and Industrial Fastener Institute IFI 124 and IFI 524. The torque value listed in the 360° nylon lock column of the table is added to the listed torque value for that bolt size. For example, a 5/8–11 SAE grade 5 bolt treated with 360° nylon lock would have a maximum torque value of 150 + 10 = 160 ft-lbs.

Table 85. Hale General Torque Recommendations

Bolt Size	Carbon Steel			SS		AL 2024-T4	Brass	Silicon Bronze	Nylon Lock
	GRD 2	GRD 5	GRD 8	18-8	316				
Values are stated in Inch- Pounds									
2-56	-	-	-	2.5	2.6	1.4	2	2.3	-
2-64	-	-	-	3	3.2	1.7	2.5	2.8	-
3-48	-	-	-	3.9	4	2.1	3.2	3.6	-
3-56	-	-	-	4.4	4.6	2.4	3.6	4.1	-
4-40	5	8	12	5.2	5.5	2.9	4.3	4.8	-
4-48	6	9	13	6.6	6.9	3.6	5.4	6.1	-
5-40	8	12	18	7.7	8.1	4.2	6.3	7.1	-
5-44	9	14	19	9.4	9.8	5.1	7.7	8.7	-
6-32	10	16	23	9.6	10.1	5.3	7.9	8.9	-
6-40	12	18	25	12.1	12.7	6.6	9.9	11.2	-
8-32	19	30	41	19.8	20.7	10.8	16.2	18.4	-
8-36	20	31	43	22	23	12	18	20.4	-



Table 85. Hale General Torque Recommendations – CONTINUED

Bolt Size	Carbon Steel			SS		AL 2024-T 4	Brass	Silicon Bronze	Nylon Lock
	GRD 2	GRD 5	GRD 8	18-8	316				
Values are stated in Inch- Pounds – CONTINUED									
10-24	27	43	60	22.8	23.8	13.8	18.6	21.2	-
10-32	31	49	68	31.7	33.1	19.2	25.9	29.3	-
1/4-20	66	96	144	75.2	78.8	45.6	61.5	68.8	+12
1/4-28	76	120	168	94	99	57	77	87	+12
Values are stated in Foot- Pounds									
5/16- 18	11	17	25	11	11.5	6.7	8.9	10.3	+2
5/16- 24	12	19	25	11.8	12.3	7.2	9.7	10.9	+2
3/8- 16	20	30	45	19.7	20.6	11.9	16	18.3	+2.7
3/8- 24	23	35	50	21.6	22.6	13.1	17.7	20	+2.7
7/16- 14	30	50	70	31.3	32.8	19	26.4	29.1	+3.3
7/16- 20	35	55	80	33.3	34.8	20.2	27.3	30.9	+3.3
1/2- 13	50	75	110	43.1	45.2	26.1	35.2	40	+5
1/2- 20	55	90	120	45.1	47	27.3	36.9	41.8	+5
9/16- 12	70	110	150	56.8	59.4	34.4	46.5	52.7	+7.5
9/16- 18	80	120	170	62.7	65.6	38	51.3	58.1	+7.5
5/8- 11	100	150	220	92.5	96.7	59.6	75.6	85.8	+10
5/8- 18	110	170	240	103.7	108.4	66.5	84.7	96.2	+10
3/4- 10	165	260	380	124.2	129.8	79.8	101.7	115.2	+13.3
3/4- 16	185	300	420	127.5	131.8	81.7	104.1	118	+13.3
7/8- 9	175	430	600	193.2	201.7	124.2	157.9	177.5	+20
7/8- 14	195	470	660	194	202.5	124.6	158.8	178.3	+20
1- 8	250	640	900	259.2	270.8	166.3	212.1	240.4	+26.7
1- 12	270	700	1000	286.7	299.6	183.8	234.6	265.4	+26.7



APPENDIX B. MANUFACTURER'S INFORMATION

This section provides a list that includes the name, address, and telephone number of the manufacturer's points of contact. Each provides the name address and telephone number of the manufacturer's representative and/or service organization that can provide replacements and is most convenient to the project sight.

Additionally, included herein is warranty information.

B.1. MANUFACTURER'S INFORMATION

Division	Address	Telephone
Class 1	Mailing: 607 NW 27th Ave, Ocala, FL 34475 Email: https://www.haleproducts.com	(800) 533-3569
Hale Products	Mailing: 607 NW 27th Ave, Ocala, FL 34475 Email: https://www.haleproducts.com	(800) 533-3569
Godiva LTD (A Unit of IDEX Corp.)	Mailing: Charles Street, Warwick, England, CV34 5LR Email: godiva@idexcorp.com	Tel: +44 (0) 1926 623600 FAX: +44 (0) 1926 623666

B.2. WARRANTY

See the Hale website (www.haleproducts.com) for product specific warranty and warranty procedures.