IN-LINE ECM CIRCULATING PUMPS | MODELS S55, 57, 69 AND H53, 54, 63 TO H67 | INSTALLATION AND OPERATING INSTRUCTIONS

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1.0 INSTALLATION	1	**6.0 0V TO 10V DC CONTROL**	2
2.0 SYSTEM CLEANLINESS	1	**7.0 LUBRICATION**	2
3.0 STARTING UP	1	**8.0 SEAL REPLACEMENT**	2
4.0 ELECTRICAL WIRING	1	**9.0 APPENDIX 1**	3
5.0 SPEED SETTING	2		

CAUTION

Always disconnect power supply from motor before servicing.

The S&H ECM series are for indoor use only.

1.0 INSTALLATION

For convenience, Armstrong circulators generally are installed in vertical pipelines, but may be changed easily on the job for horizontal pipelines or for opposite flow directions. To make the change, remove the body capscrews, taking care body gasket is kept in position, and rotate body to desired direction at 90° or 180° from the original position.

With the arrow on the body pointing in direction of the flow, insert body capscrews and tighten evenly. On models S55 and S57 a gap between the bearing bracket and pump body (volute) is normal. Do no over tighten body capscrews! Turn pump shaft manually at coupler to make sure shaft turns freely and impeller does not rub in body. Always install with motor shaft in a horizontal position. For **non maintenance free** models the oil cups or oil well cover must be facing up.

All ECM models are shipped for upward discharge as pumps of this size usually are installed in an upward direction on hydronic systems, so the point of zero pressure change - namely, the compression tank connection - can be made easily to the system on the suction side of the circulator.

The pump should be installed in a position to permit proper lubrication and servicing. Motor and bearing brackets are to be kept free of insulation. Pump and motor unit are designed to be supported by the in-line piping only. Do not support in any other manner. A height of approximately four feet above the floor is recommended. When placing the pump between flanges, tighten flange bolts evenly and do not tighten excessively.

Gate valves should be installed on the discharge and suction side of the pump to facilitate service. On larger pump sizes, a check valve should be located on the discharge side of pump between the pump body and the gate valve to prevent damage due to water hammer.

2.0 SYSTEM CLEANLINESS

Before starting the pump, the system must be thoroughly cleaned, flushed and drained, then replenished with clean liquid. Welding slag and other foreign materials, 'stopleak' and cleaning compounds, excessive or improper water treatment - all are detrimental to the pump. Warranty will be void if any of these conditions are allowed to exist. (Refer to **File no. 6090.645** design and care of closed hydronic systems.)

3.0 STARTING UP

The pump must be fully primed on start-up. Fill system piping and pump body with liquid and vent complete system, turning pump by hand to dislodge air from body. Make sure fittings and drain valves are airtight, then add any additional fill required.

Check motor against available electric supply, then start pump making sure rotation is correct. When viewed from motor end, rotation is clockwise. If pressure does not develop, stop pump, re-check, vent and fill. Never attempt to fill the system when the pump is running.

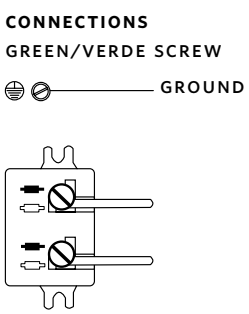
NOTE: ECM motors have a 15 second soft start-up time once plugged in, and a 30 second time to achieve full speed (thus different from standard induction motors)

4.0 ELECTRICAL WIRING

The electrical wiring must be installed in strict accordance with the Canadian Electrical Code (Canada) or the U.S. National Electrical Code (USA),or BS7671 (Europe) as well as local codes and regulations.

1. Electrical installation should be conducted by a qualified electrician. Installers should be equipped with proper personal protective equipment.
2. Always make sure the electric power is disconnected and locked out before wiring the circulator.

115V or 208-230V 1ph wiring - see Appendix 1 for more details



5.0 SPEED SETTING

The ECM motor operates in speed mode when connected to the pump. You can adjust the demand of the motor manually using the HMI Interface. The motor information and error code are displayed in the Interface.

All interface details and future explanation can be seen in Appendix 1.

6.0 0V TO 10V DC CONTROL

0V to 10V DC control is available where the system allow, using an external source and wiring. This input is for a linear closed-loop speed control and a speed signal for speed monitoring, which can greatly save on Energy consumption.

For more details please see Appendix 1.

7.0 LUBRICATION

CAUTION

Do not put oil in the **maintenance free** circulators. These models contain MF in their item numbers and are labelled: **this bearing assembly contains permanently lubricated bearings and does not need any oiling or greasing.**

Stop motor before lubricating, do not over-oil or spill oil on resilient motor rings. Do not force oil into cups, and stop if cup fills before addition of specified amount.

Pump lubrication

Only applicable for pumps those are with sleeve bearing SBA and have oil cup for lubrication.

Immediately after pump is installed and before running, slowly add the oil (SAE 30 non-detergent regular, supplied with pump) to pump oil cup, located on top of bearing bracket:

S69, H63 to H67 . . . . . .2 oz.

At the start of each following heating season, lubricate with SAE 30 oil. Lubricate every six months for high temperature or constant operation. Be sure oil is visible at the top and center of window on side of bracket and maintain this level at all times.

Motor lubrication

CAUTION

Stop motor before lubricating. Do not over-oil or spill oil on resilient motor rings.

This motor has been lubricated properly at the factory. At the start of each following heating season, however, on motors with oil cups, add 15 drops SAE 30 non-detergent oil to each motor cup.

If the motor is fitted with grease fittings, follow the motor manufacturer's recommended procedure. Motors without oil cups or grease fittings are custom-greased for several years operation and require little or no attention.

8.0 SEAL REPLACEMENT

Remove the pump bracket from the body. Remove the impeller, damaged seal assembly, ceramic insert and rubber cup. Clean the recess in bearing bracket cover plate and install a new retainer cup and ceramic insert. Check the condition of the shaft sleeve. If scored, replace the shaft assembly. Otherwise, clean shaft extension and polish sleeve with a fine crocus cloth, using a rotating motion, if required.

Press against the coupler end of the shaft to take up play while pressing new seal firmly against the stationary face. A slight amount of clean vaseline may be put on shaft sleeve to assist installation. Press down firmly and evenly, using two screwdrivers and pushing against the four ears of driving band (the metal ring around rubber bellows), or around top outer edge of driving band on models S53, S57 and H53, H54.

Continue pressing against coupler end of shaft, re-mount impeller and re-assemble the seal bearing assembly into body. If necessary, install a new body gasket and clean gasket surface of both volute and bracket.

CAUTION

Before operating pump, carefully check:

1. Is the pump primed?
2. Is rotation correct?
3. Is pump properly lubricated?
4. Does the power supply agree with data on motor name plate?
5. Is overload protection provided?
6. Is the system clean?

For domestic water systems use bronze body pumps.

For all other ECM motor details, troubleshooting, etc please see Appendix 1.

9.0 APPENDIX 1

S&H ECM PUMP MOTOR WITH USER INTERFACE

1 PERFECTSPEED® MOTOR

The PerfectSpeed® ECM user interface developed by Armstrong easily integrates into non-communicating systems using state-of-the-art technology. The motor is a high-efficient Brushless DC (BLDC) permanent magnet motor that offers variable speed. Sensorless sine wave control assures quiet and ultra-smooth performance.

IMPORTANT SAFETY INFORMATION

WARNING

SHOCK HAZARD

To reduce the risk of fire or electric shock:

- **Do not** expose the motor or control unit to rain or moisture.
- **Do not** separate the motor and control unit while the motor is in operation.

WARNING

- Only trained and qualified professionals familiar with PerfectSpeed® motors should service the motor and control unit.
- Before connecting or disconnecting cables or other electrical connections, verify that the power to the system is removed. Failure to comply may cause serious damage to the motor or injury to personnel.
- Because of the risk of electric shock, only individuals thoroughly trained in the use of multimeters should conduct voltage tests.
- Never touch the metal contacts on the multimeter during a test.
- Always check testing equipment for proper operation before use.

WARNING

Installation, operation, and maintenance must be performed by qualified personnel. Familiarization with and adherence to the National Electrical Code (NEC) and National Fire Protection Association (NFPA) standards and to local codes are required. It is important to observe safety precautions to protect personnel from possible injury. Personnel should be instructed for handling each of the following:

- Insulate all connections carefully to prevent grounding or short circuits. Reinstall all conduit and terminal box covers. To avoid overheating and loss of performance, voltage to the motor control unit must be within plus or minus 10% of the nameplate voltage.
- Make sure the unit is electrically grounded and that proper electrical installation wiring and controls are used consistent with local and national electric codes. Refer to National Electrical Code Handbook and NFPA No. 70. Employ qualified electricians.
- Code requirements differ from state to state. Install equipment in accordance with the applicable codes and ordinances in your area and in accordance with NEC. All electrical connections should be made and maintained by a qualified or licensed electrician.
- Make sure there are no unusual noises or vibrations when the motor is running.
- If noise and vibration are observed, refer to the appropriate Troubleshooting section.
- Avoid contact with energized circuits or rotating parts.
- Provide proper safeguards for personnel against rotating parts.
- All aspects of the installation must conform to the applicable requirements of the NEC, including Article 430 (Motor Circuits and Controllers), as well as all local codes.

WARNING

Always disconnect electrical power at the fuse box or circuit breaker before handling electrical connections or performing maintenance on this unit. Allow the motor to come to a complete stop and wait four (4) minutes. This allows the capacitors to discharge any residual voltage for safety.

Double-check to make sure the power is removed, and that it is locked out while you are working on the equipment.

WARNING

A poor electrical connection can overheat and cause terminal and/or terminal board failures. Examine the wiring harness quick-connect terminals carefully for any signs of physical deterioration or loose fit to the terminals on the motor terminal board.

Care must be taken to assure connections are made to the proper terminals and adequate electrical clearances are maintained.

WARNING

The control unit on the motor contains potentially hazardous voltage.

CAUTION

Wear safety glasses to inspect the equipment while it is running, especially if cover plates are removed.

NOTICE

- Voltage symbols vary among different multimeters and may be displayed as V AC, AC, V, or a V beneath a wavy line. Select the correct symbol and set the multimeter to the voltage closest to the voltage you are measuring.
- Read all instructions thoroughly and be familiar with the equipment before installing or working on it.
- The PerfectSpeed® motor is properly packaged for shipment and storage and should be kept in a clean and dry indoor area.

Overview

The interface board communicates with the motor control to operate the motor in speed mode. The operating parameters are programmed in the EEPROM of the motor control, not the PerfectSpeed® User Interface. On power up the interface board extracts the operating parameters from the motor control. Parameter categories include:

- Motor direction
- Motor mode of operation
- Motor output display
- Motor profile

PerfectSpeed® user interface box

The PerfectSpeed® operates in speed mode when connected to the pump. You can adjust the demand of the motor manually using the PerfectSpeed® User Interface. The motor information displayed in the User Interface is outlined in **Table 1**. If the motor encounters a problem, the User Interface displays a corresponding error code. These are outlined in **Table 1** as well.

Table 1 – User interface display information

Control mode	Data displayed
Speed (speed feedback)	**Spd** – followed by the instantaneous speed in RPM **dE** – followed by S + demand in %
Error Codes	**E1** – No communications **E2** – Under Voltage **E4** – Non- PerfectSpeed(r) Motor

Minimum and maximum operating parameters

The PerfectSpeed® motor operates properly within minimum and maximum parameters. Your settings must be within these ranges.

Table 2 – Armstrong centrifugal pump & motor operating parameters

Control mode	Minimum	Maximum
Speed	300 RPM	S&H 5&6 series

Input demand

There are two methods of setting the input demand using the PerfectSpeed® User Interface box.

Table 3 – Input demand options

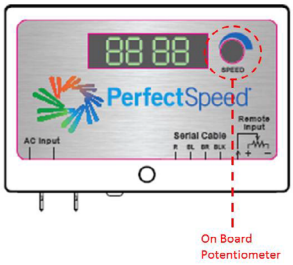
Input demand setting method	Definition
Set with On-Board Potentiometer	The input demand can be set via the On-Board Potentiometer. An external input is not necessary.
Set with 0V to 10V DC control signal	When an external controller is connected, the On-Board Potentiometer should be set fully CCW (0%). Otherwise, the actual demand seen by the pump is offset by the setting of the On-Board Potentiometer.

Connection diagrams

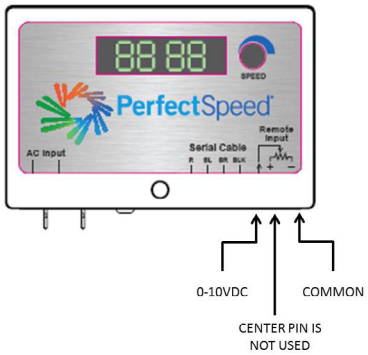
There are two methods of setting the Input Demand. See **Table 3** for definitions of the two options.

Table 4 – Setting input demands options

SET WITH ON-BOARD POTENTIOMETER



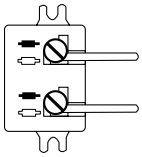
SET WITH 0 V TO 10V DC CONTROL SIGNAL



AC line connections

Check to see if the line voltage matches the nameplate voltage.

CONNECTIONS
GREEN/VERDE SCREW
GROUND

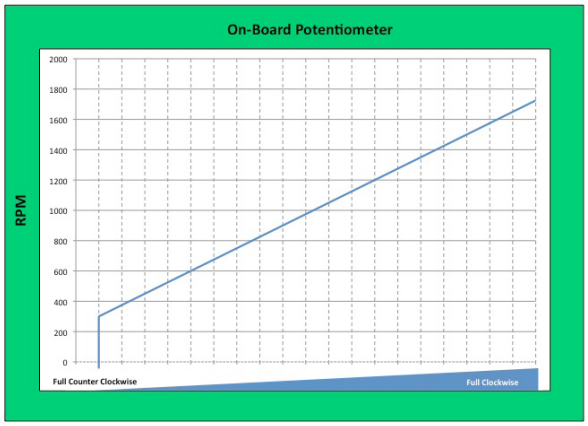


Configuration scenarios

This section provides examples of different configurations and briefly describes how the motor operates under those conditions.

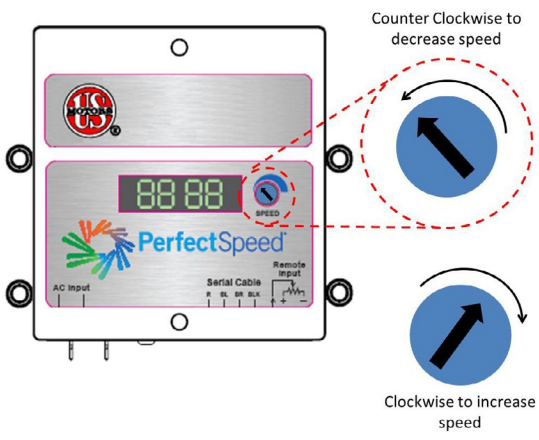
Operating parameters

Speed will change linearly based on the On-Board Potentiometer or remote 0V to 10V DC signal. The graph below illustrates the operation of a motor adjusted with the On-Board Potentiometer.

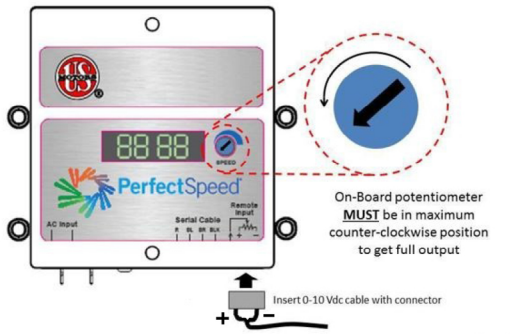


At 0.5V DC signal, the motor will come on at 300 RPM and ramp linearly to 1800 rpm for ECM series circulators.

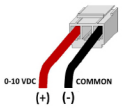
Adjusting pump speed (RPM) with on-board potentiometer



Using 0 V to 10V DC signal



0-10Vdc Connector
part # D500400-301



2 TROUBLESHOOTING

This section provides field technicians with a step-by-step process for accurately diagnosing and troubleshooting difficulties that may be experienced by NMC PerfectSpeed® motors and the PerfectSpeed User Interface box. It does not override or replace instructions suggested by the manufacturer of the fluid circulating system.

To prevent misdiagnosis and unneeded repairs of the motor, operators should try the steps listed in the Basic Troubleshooting of the Motor section first. If a problem still exists or there is an ongoing issue after following the outline in that section, then proceed to the Motor and Control Unit Diagnostics section for additional testing instructions.

Basic troubleshooting of the motor

NOTICE

- Always begin your inspection of the motor by stepping through this section.

Motor is not spinning or runs abnormally

- Check the circuit breaker for trips or accidental shutoff.
- Verify that the cables and power cord are securely connected to the control unit connectors.
- Inspect for shorts, detached wiring, or loose connections.
- Inspect the control unit for broken or loose connectors, moisture, excessive dirt, or other damage.

Motor rattles or makes excessive noise

- Inspect the motor and pump for accumulated dirt, internal debris, or other signs of damage.
- Inspect the shaft and verify that the motor shaft spins freely by hand in both directions without effort.

PerfectSpeed® motor and user interface

Motor is not running

If the PerfectSpeed® motor with User Interface isn't running, perform the following checks:

1. Ensure that both the PerfectSpeed® motor and User Interface have proper line voltage for intended application.
2. Turn the User Interface on-board potentiometer fully clock wise (100% demand) and check to see if the motor runs.
3. If 0V to 10V DC input is in use, disconnect the external input from the User Interface and perform **Check 2**.
4. Check the digital read-out of User Interface for an error code:

Table 5 – User interface error codes

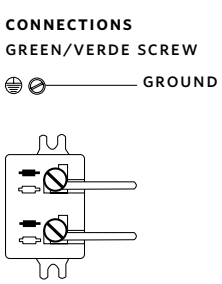
ERROR CODE	REASON	ACTION
E1	No Communication	Remove power from both the PerfectSpeed® motor and user interface for four (4) minutes, then reconnect power and test again. Check the communication cable connection between the PerfectSpeed® motor and user interface. Check the continuity of the communication cable (pin 1-1, pin 2-2 pin 3-4, and pin 4-3).
E2	Low Voltage	This is a reading from the PerfectSpeed® motor itself. Ensure that there is at least 71V AC (for 115V AC applications) or 142V AC (for 208-230V AC applications).
E4	Not a NMC Motor	Connect to a NMC motor.

Motor and control unit diagnostics

Check 2: Electrical troubleshooting

1. Disconnect or remove power to the equipment being serviced and allow four (4) minutes for the capacitors to discharge any residual voltage.
2. Check the rotation and speed of the motor. Determine if the motor can spin freely by hand without effort or assisted means. If any binding occurs, replace the motor and control unit.
3. Determine whether the system is wired for 120V AC power or 240V AC power.
4. Disconnect the power cord from the connector on the control unit. Inspect the power cord for bent, damaged, or recessed wired and terminals [**FIG 1**].

FIG 1



5 Disconnect or remove AC power to the equipment being serviced and allow four (4) minutes for the capacitors to discharge any residual voltage.

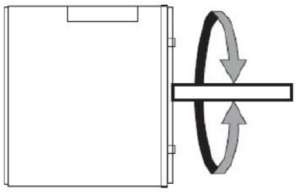
6 Proceed to **Check 3**.

Check 3: Motor verification

1 Disconnect or remove AC power to the equipment serviced and allow four (4) minutes for the capacitors to discharge any residual voltage.

2 Make sure that the motor shaft spins freely by hand without effort in both directions [**FIG 2**].

FIG 2



NOTE: Replace the motor and control unit if the shaft does not spin freely by hand without effort.

Final checks of the motor

- Check the mounting and fastening of the motor and control unit. Make sure the motor and the control unit are securely attached together and mounted tightly in the system.
- Check the control unit connectors. Inspect for shorts, detached wiring, or loose connections
- Check the motor and verify the rotation of the driven load. Make sure it spins freely by hand in both directions without effort or assisted means.
- Check all circuit breakers.

3 GLOSSARY

The glossary contains definitions for acronyms and terms occurring in the Operation, Configuration, and Troubleshooting Manual or in the PerfectSpeed® User Interface.

CCW

Counter-clockwise direction. Motor rotation is viewed from the lead end of the motor, not the shaft.

CW

Clockwise direction. Motor rotation is viewed from the lead end of the motor, not the shaft.

dE

Demand. The set point of the motor.

ECM

Electronically Commutated Motor.

EEPROM

Electronically Erasable Programmable Read Only Memory. A memory chip in the control capable of retaining data when the power supply is removed.

Inch Pounds (lb-in)

A unit of pressure resulting from a force of one pound-force applied to an area.

init

Appears in the digital display on the PerfectSpeed® User Interface when the motor is in the process of initializing.

Input

The controlling device, 0 to 10 volts (DC).

LE

The end of the motor opposite the shaft extension from which the rotation of the shaft and driven load are determined.

Max Power

The horsepower rating in watts delivered by the motor.

Max Speed

Maximum functioning speed of motor in Speed Mode.

Min Speed

Minimum functioning speed of motor in Speed Mode.

Max Torque

The torque point at the highest speed just below power limiting of the motor.

Maximum Demand (%)

The highest value of operation relating to motor limits as defined in the Motor Mode of Operation. It is represented as the upper limit of the Y-axis in the Motor Profile graph.

Maximum Input (%)

The highest value of control method (on-board potentiometer, or 0 – 10 vDC). It is represented as the upper limit of the X-axis in the Motor Profile graph.

Minimum Demand (%)

The lowest value of operation relating to motor limits as defined in the Motor Mode of Operation. It is represented as the lower limit of the Y-axis in the Motor Profile graph.

Minimum Input (%)

The lowest value of control method (on-board potentiometer, or 0V to 10V DC). It is represented as the lower limit of the X-axis in the Motor Profile graph.

Message Timeout

A message referring to a communication failure between the computer and motor.

Motor HP

The horsepower rating of the motor.

Motor flow Limit

A user-defined limit (in gpm) equating to 100% demand in flow Mode of Operation.

Motor Ramp Rate

The time (in seconds) it takes the motor to go from 0 to maximum rpm as defined by the maximum operating parameters. Also called motor slew rate.

Motor Speed Limit

A user-defined limit (in rpm) equating to 100% demand in Speed Mode of Operation.

Motor Power Limit

A user-defined limit (in Watts) of output power. The parameter cannot be less than 25% of the value in the Motor Table. Refer to Appendix A: Motor Charts.

Motor Torque Limit

A user-defined limit (in lb – in) equating to 100% demand in Torque Mode of Operation. The parameter cannot be less than 25% of the value in the Motor Table. Refer to Appendix A: Motor Charts.

NEC

National Electric Code

NFPA

National Fire Protection Association

NTC

Negative temperature coefficient

OEM

Original Equipment Manufacturer

On-Board Potentiometer

The adjustment feature on the PerfectSpeed® User Interface.

PWM

Pulse Width Modulation.

Software Version

The version of the software in the motor.

Speed

The speed level measured in RPM.

Torque

The measure of how much a force acting on an object causes that object to rotate.

V AC

Voltage in Alternating Current

V DC

Voltage in Direct Current

4 APPENDIX A: MOTOR CHARTS

Maximum Speed/ hp depending on the model of the motor and the horsepower rating.

ECM MODEL	MOTOR
H-63	½ hp / 1800 rpm
H-64	¾ hp / 1800 rpm
H-65	1 hp / 1800 rpm
H-66	¾ hp / 1800 rpm
H-67	1 hp / 1800 rpm
S-55	½ hp / 1800 rpm
S-57	¾ hp / 1800 rpm
S-69	1 hp / 1800 rpm

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