

Multi-Valve Controller

MVC-100

Installation, Configuration, & Operation Manual



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PRODUCT SAFETY INFORMATION

- All personnel who may be expected to use this equipment must be thoroughly trained in its safe and proper use and maintenance procedure.
- Before flowing water from this device, check that all personnel (service and civilian) are out of the water path. Also, check to make sure stream direction will not cause avoidable property damage.
- Become thoroughly familiar with the hydraulic characteristics of this equipment, and the pumping system used to supply it. To produce effective water streams, operating personnel must be properly trained.
- Before each use, after each use, and on a scheduled basis, inspect equipment per instructions in the Maintenance section.
- Any modifications to the electrical enclosures, components, wiring harnesses, and/or connectors will destroy the water/dust ingress ratings and void warranty coverage of that which was modified and all components connected to or within that which was modified.
- Use the recommended connectors for all electrical connections to avoid water/dust ingress. Using the wrong connectors or omitting connections will destroy the water/dust ingress ratings and void warranty coverage of the connectors and connected components.
- Do not exceed the touchscreen temperature range of -40°F to 185°F (-40°C to 85°C) to avoid damage. If the max temperature range is exceeded, it will void the warranty.
- Do not allow periods of exposure to direct sunlight because this can elevate the internal temperature above 85°C which may cause permanent degradation of the LCD display.
- As much as possible of the welding work on the chassis should be done before the installation of the system. If welding has to be done afterwards, the electrical connections on the system must be disconnected from other equipment and from the battery. If welding is to be done close to electrical devices, remove the devices from the chassis before welding. For welding, the negative cable must always be disconnected from the battery before disconnecting the positive cable. The ground wire of the welder shall be positioned as close as possible to the place of the welding. The cables on the welding unit shall never be placed near the electrical wires of the control system.
- Do not use the chassis as the negative terminal for powering electrical components.
- An error message could indicate that a hazardous situation exists. If precautions are not taken, this could result in serious injury or major property damage.
- Do not allow liquid droplets to collect on the MVC touchscreen display. Excessive amounts of water or other liquid droplets can interfere with or limit the touch interface control.
- To avoid scratches, do not wipe or clean a dry MVC touchscreen display.
- Keep fingers and hands clear of moving parts.
- Do not use lubrication on the valve ball or seats.
- Do not wrench on the valve body or the opposite adapters.
- Disconnect power before servicing the equipment.
- Foreign materials such as metal chips could jeopardize the sealing capability of the valve. Any drilled holes required in the plumbing should be added, and the chips removed from the waterway, prior to installation of the valve.
- Remove all dirt and water from electrical connections before connecting or disconnecting. This will keep water and dirt out of the electrical connections and avoid corrosion and short-circuits that could damage equipment.



Important: Before installing and operating provided equipment, read this manual thoroughly. Proper installation is essential to safe operation.

OVERVIEW

The Multi-Valve Controller (MVC) is a simple to use integrated control system for spraying water from multiple discharge ports on a vehicle. The system allows full control from a single touchscreen display. The basic control methods include:

- Automatic Control: An integrated controller automatically controls water flow by monitoring vehicle speed and adjusting valve position to continuously maintain a desired flow rate.

NOTE: Automatic flow control is only available when using a ground speed sensor.

- Manual Control: The operator controls water flow by opening and closing valves

MVC System Contents

- Butterfly valves with electric actuators
- Flow sensor (paddlewheel style)
- MVC touchscreen control display with pedestal mount
- Ground speed sensor with mounting hardware
- Power distribution boxes¹
- Component cabling¹

An overview of an MVC system is shown in Figure 2.

¹ Provided with the full system package, 08700100, only.

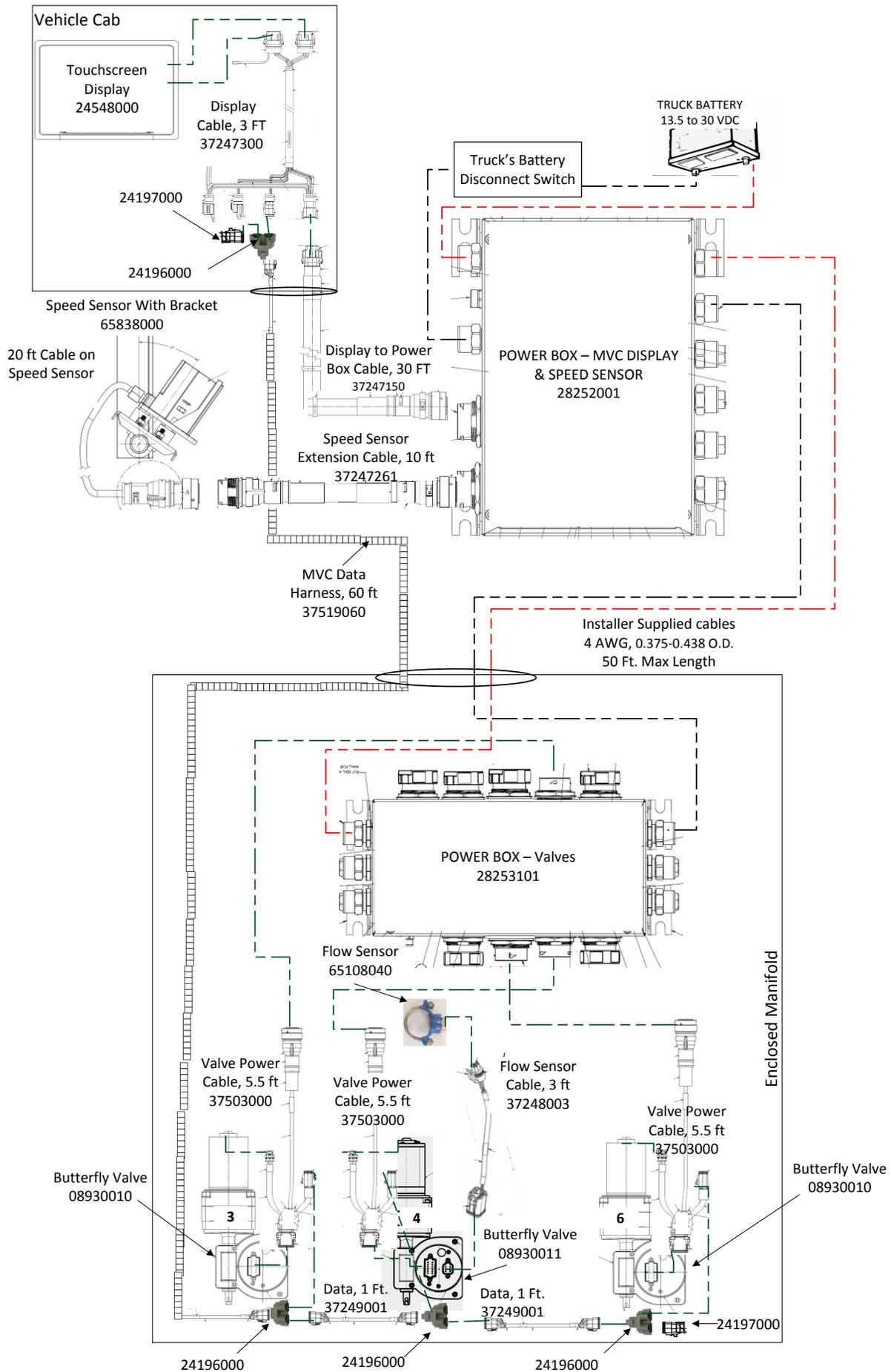


Figure 2. Overall MVC System

INSTALLATION INSTRUCTIONS

As much as possible, the welding work on the chassis should be done before the installation of the system. If welding has to be done afterwards, the electrical connections on the system must be disconnected from other equipment. The negative cable must always be disconnected from the battery before disconnecting the positive cable. The ground wire of the welder shall be positioned as close as possible to the place of the welding. The cables on the welding unit shall never be placed near the electrical wires of the MVC system.

Read this section and reference documents in their entirety before beginning the installation. This will help to avoid installation issues which could lead to part damage, rework, or reduced system performance.

Installer-Supplied Enclosed Manifold Construction and Installer-Supplied Plumbing

All MVC components must be installed in an area protected from industrial wash-down and from continual water spray. Typically, components near the vehicle's rear are mounted in an installer-supplied enclosure. To minimize this enclosure's size, the installer can construct a pipe manifold to mount the valves and flow sensor. This manifold is enclosed with a lid to for maintenance access. An example of an installer-supplied enclosed manifold is shown in Figure 3².

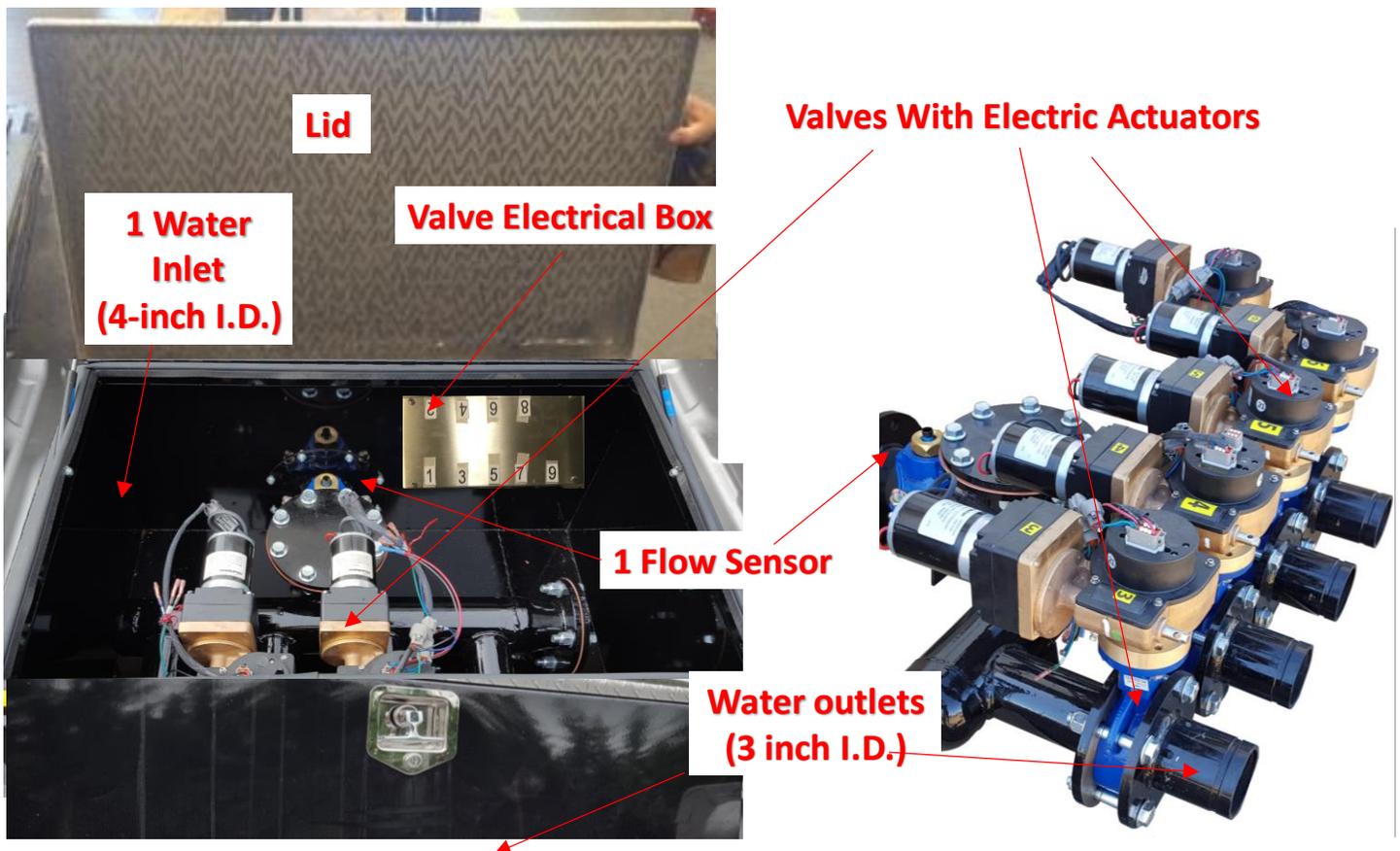


Figure 3. Installer-Supplied Enclosed Manifold Example



Warning! An installer-supplied recirculate valve is required for safe operation. The valve must automatically open to recirculate water to the pump when system pressure is close to the maximum pressure rating for the piping and apparatus. Do not exceed 250 PSI static pressure for butterfly valves. Do not exceed 300 PSI static pressure for the saddle clamp flow sensor.

² The Valve Electrical Box is only provided with a full system, 08700100.

The recirculate pipe branch should be located between the pump output and the system flow sensor. See example of system piping in Figure 4.

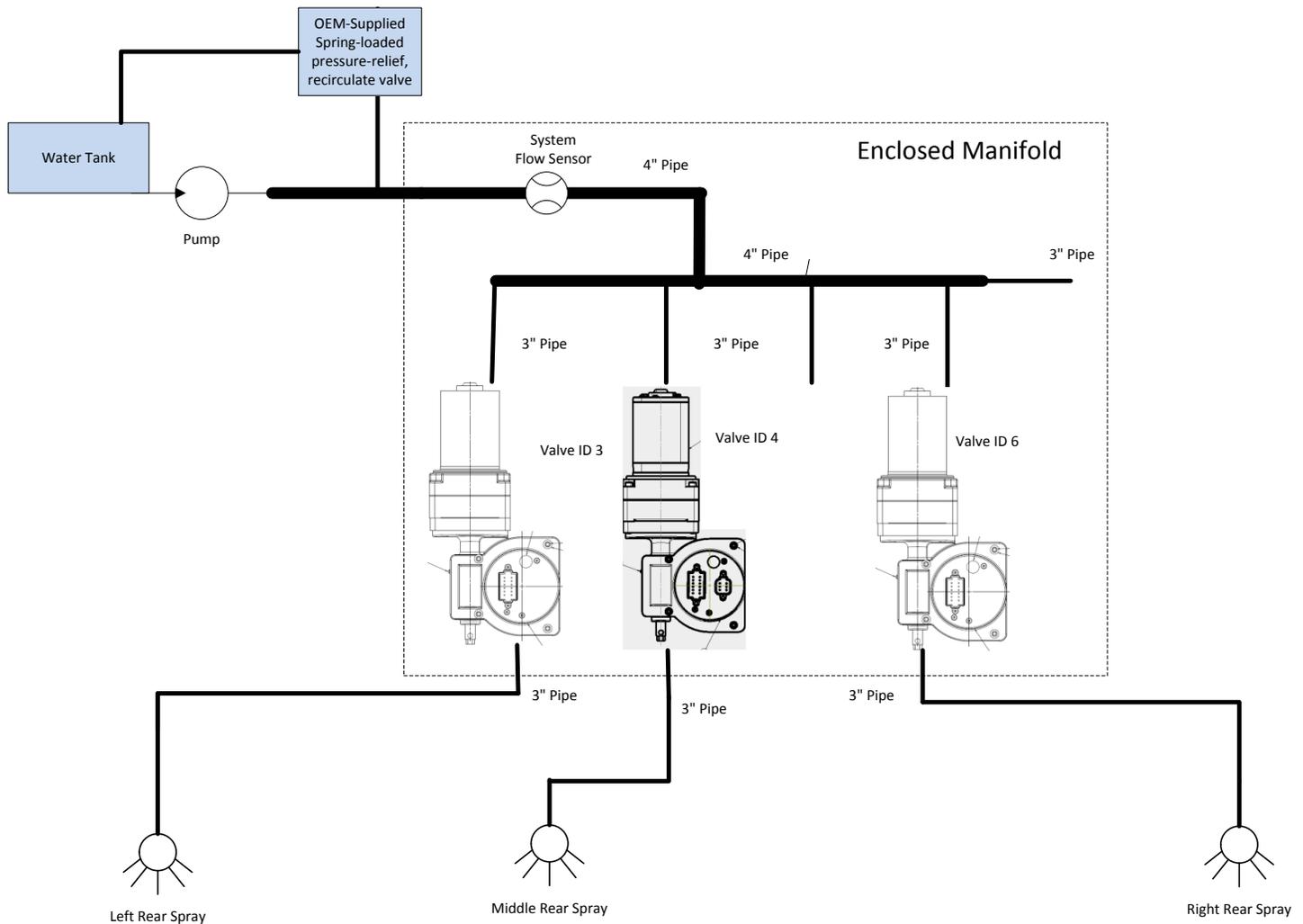


Figure 4: System Piping Example

Other considerations and precautions to take for the installer-supplied enclosed manifold include:

- If components will be welded while on the vehicle, be sure proper welding precautions are taken before welding. Refer to the PRODUCT SAFETY INFORMATION section. As described in that section, it may be necessary to remove electronics from the Enclosed manifold before welding it.
- Be sure the mounting provides good electrical continuity between the enclosure walls and the vehicle chassis. This helps ensure that breakers/fuses will properly trip and keep the manifold enclosure walls de-energized in the event of a short circuit³.
- Be sure that a cable entry into the manifold is will be readily accessible after the Enclosed Manifold is installed on the vehicle.
- Be sure installer-supplied drains in the plumbing are at a lower installed height than the enclosed manifold plumbing. Drain valves are necessary to prevent damage to the pipes and valves by drain the system in freezing weather. Failure to do so could void the warranty.

³ A short circuit under normal operations is unlikely. Higher than normal impacts to the cabling or electronics due to vehicle accidents or other incidents may cause shorts.

Flow Sensor

Refer to Installation section in the Butterfly/Unibody valve manual, 98311000, for additional flow sensor installation guidelines. Flow sensor dimensions are shown in Figure 5.

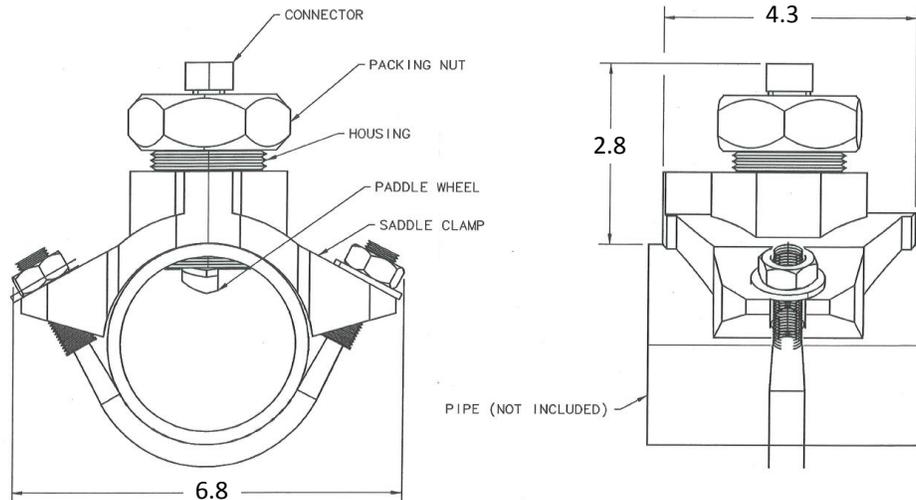


Figure 5. Flow Sensor Dimensions (inches) for a 4-inch Pipe

The location of the flow sensor in the installer-supplied enclosed manifold plumbing is critical: **there must be plenty of straight pipe run before and after the flow sensor.** Guidelines for selecting flow sensor locations are outlined in Figure 6. (The first guideline does not apply if the pipe containing the flow sensor is mounted vertically. All other guidelines apply regardless of pipe orientation.)

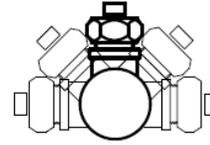
Additionally, the flow sensor location relative the MVC's System Flow Valve's actuator top needs to be no farther than 3 ft. because the flow sensor cable is only 3 ft. long. The MVC's System Flow Valve is identifiable by the electric actuator controller with the extra 6-pin connection (pre-configured as valve number 4). This valve should be the one mounted closest to the system flow sensor. See the "Butterfly Valves" heading in this section for valve installation guidelines.

The MVC system uses the flow sensor to measure the TOTAL system flow. So the flow sensor must be installed in the pipe from the pump output prior to any branches or discharges that contain MVC electric-actuated valves. Allow a minimum of 2 inches of clearance at the sensor top for removal/installation of the connector. The flow of water in the pipe at and around the sensor must be laminar, or smooth, to ensure accurate flow rate measurement. There must be enough straight pipe run to allow the water stream to stabilize into a uniform flow. When the sensor is mounted in an area in the plumbing that tends to increase water stream turbulence (a valve, increase in pipe diameter, etc.), it is critical that steps are taken to stabilize the flow:

- When a pipe is reduced in diameter the water stream tends to be squeezed into a more uniform flow. This can be used to help stabilize flow when there is not a sufficient pipe run upstream.
- Elkhart Brass offers an optional⁴ flow sensor with conditioner that replaces the standard flow sensor housing. The conditioner protrudes into the water stream at the sensor location and is specially shaped to reduce local turbulence.

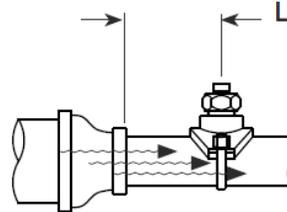
⁴ MVC-100 system packages do come with a standard flow sensor. If a flow sensor with conditioner is needed, it must be purchased, separately.

The preferred location for the mounting of a flow sensor is on the top half of the pipe. The best orientation is vertical. If the sensor is mounted on the bottom of the pipe, it may be susceptible to the accumulation of dirt.



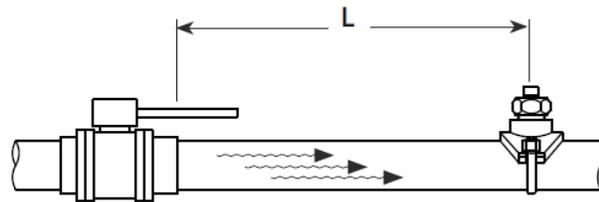
Best Orientation is Vertical

When mounting the sensor after the pipe diameter is reduced the length L must be at least 2 times the pipe diameter.



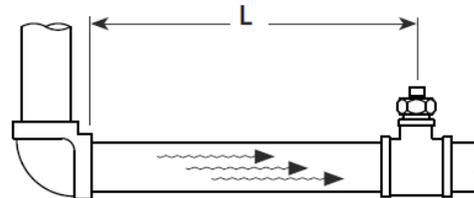
**After Reduction
L > 2 X PIPE DIA.**

When mounting the sensor after a valve the length L must be at least 14 times the pipe diameter.



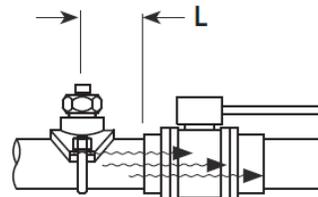
**After Valve
L > 14 X PIPE DIA.**

When mounting the sensor after an elbow the length L must be at least 6 times the pipe diameter.



**After Elbow
L > 6 X PIPE DIA.**

When mounting the sensor before a valve, elbow, "T", or branch the length L must be at least 2 times the pipe diameter.



**Before Valve, Elbow, "T", or Branch
L > 2 X PIPE DIA.**

Figure 6. Flow Sensor Location Guide

Steps for a saddle clamp flow sensor installation are as follows:

1. Drill and deburr a 1 11/16" to 1 3/4" diameter hole at mounting location.
2. Clean pipe surface in the area where saddle clamp gasket will seal.
Note: The sensor housing is epoxied in the saddle clamp with the alignment tab in the correct position and is not meant to be removed.
3. Place saddle clamp over hole with sensor housing centered.
4. Tighten the 1 1/16" saddle clamp nuts progressively and uniformly to 60-70 ft-lbs of torque.

Butterfly Valves

Refer to Installation section in the Butterfly/Unibody valve manual, 98311000, for additional Butterfly valve installation guidelines. Valve dimensions are shown in Figure 7.

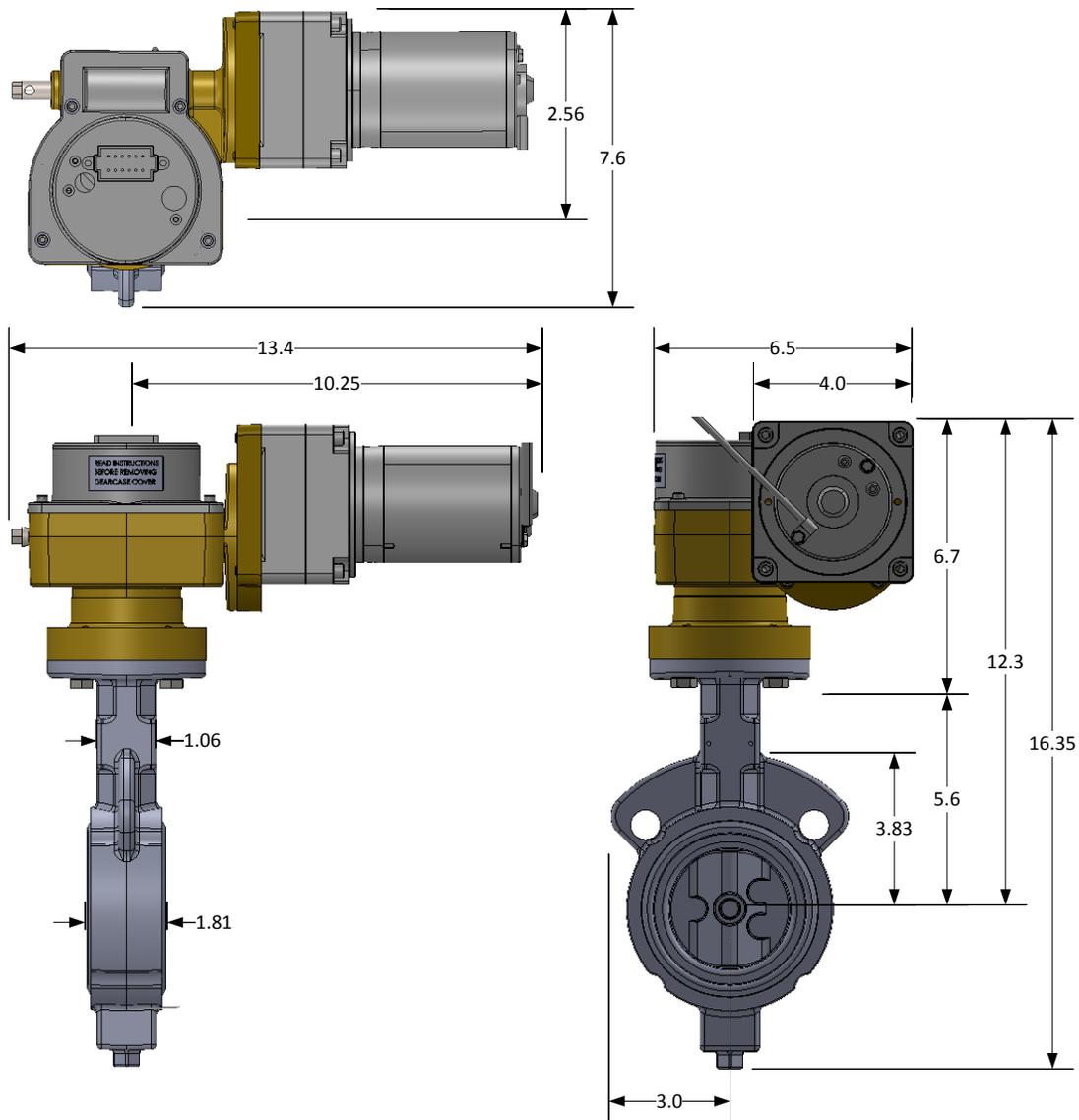


Figure 7. Valve Dimensions (inches) for 3-inch, 150# ANSI flange

An MVC electric-actuated Butterfly valve must be installed before the outlet on any manifold/pipe branch that will be used for the automatic flow control function.

Prior to installing the valves in the enclosed manifold, determine which valve will be used to gate a particular sprayer.

- Each valve in a 3-valve MVC package comes pre-assigned to a particular number (3, 4 or 6) as identified by the label on the valve. Add-On valves are not pre-assigned. See Figure 8.

- The sprayer location on the truck determines which valve should be used for that sprayer. The numbered quick-select buttons, , on the Touchscreen's Display's Auto Control main page are arranged to represent a truck as viewed from the top. See Figure 9. It's recommended that the valves that operate the corresponding spray location be plumbed to the appropriate sprayer. For example, the sprayer located on the rear bumper on the left corner should be plumbed to valve number "3".
- Add-On valves should be plumbed to sprayers other than locations 3, 4, or 6. These valves will then be configured to the appropriate number after installation. See the section, CONFIGURATION & CALIBRATION INSTRUCTIONS. Adhesive-backed numbered labels to stick to Add-On valves are in the touchscreen box.



Figure 8. Assigned Valve Numbers

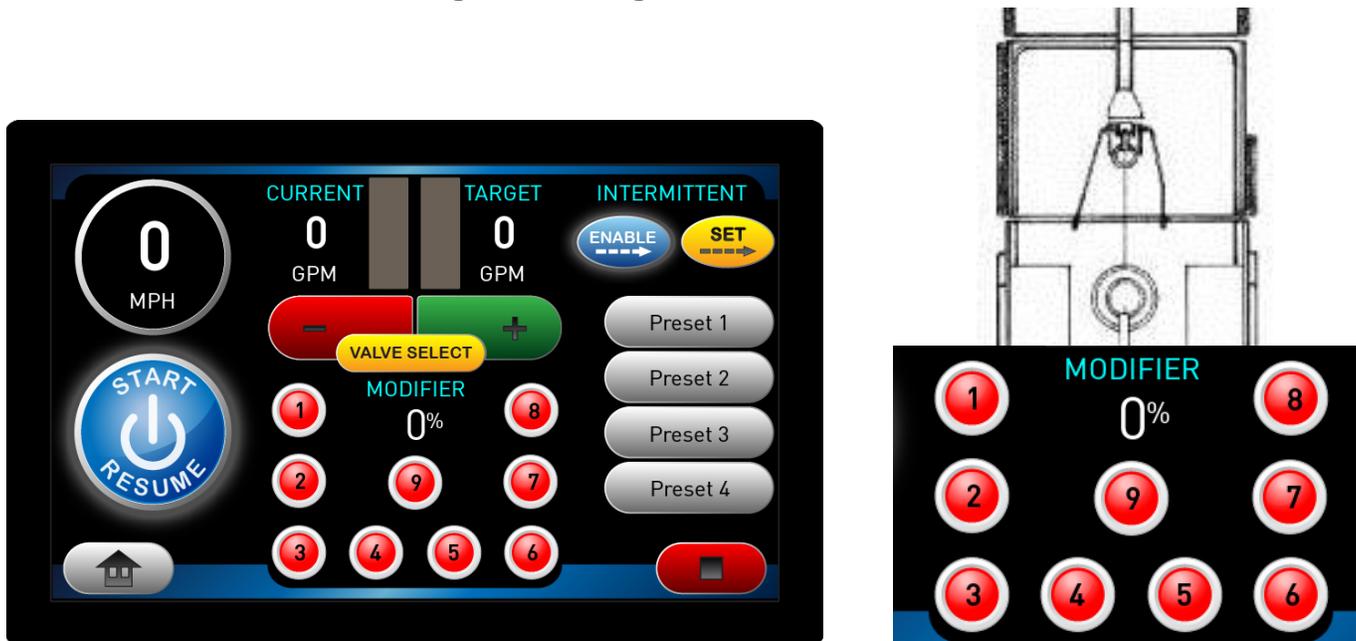


Figure 9. Spray Location on Truck Corresponds to Numbered Circles

- The valves in the installer-supplied enclosed manifold should be mounted such that either
- water flows horizontally through the valves and the actuators are on top of the valve bodies or
 - water flows vertically through the valves.

Valve Electrical Box (Full System Only)

The Valve Electrical Box⁵ shown in Figure 10 needs to be installed as close to the valves as possible: no more than 5 feet (1 m) away from any valve. **It must be installed in an enclosed area.** So, inside of an installer-supplied Enclosed Manifold is best. This will protect the connections from high-pressure wash-downs. Exposed installation may void the warranty.

- Identify a surface on which to mount the box such that drilling holes does not compromise any sealing of the Enclosed Manifold.
- Drill the four (4) 0.377" (8.2 mm) dia. holes through the surface intended for mounting.
- Mount the Valve Electrical Box using four (4) 3/8" (8 mm) dia. fasteners secured with nuts and lock washers or blue Loctite 242. The fasteners should be at least 1/2" long. This will allow the fasteners to extend at least 3/8" into the mounting surface.

Other considerations and precautions to take when installing the Valve Electrical Box include:

- Do not weld the Electrical Box to the vehicle. This risks damage to the enclosed electronics.
- Be sure the mounting provides good electrical continuity between the Valve Electrical Box and the vehicle chassis through the manifold enclosure. This helps ensure that breakers/fuses will properly trip and keep the enclosure walls de-energized in the event of a short circuit⁶.
- Be sure that the Valve Electrical Box connectors and the Valve Electrical Box lid removal will be readily accessible after it's installed.
 - At least 1.5-inch (38-mm) clearance for lid removal.
 - At least 8.0-inch (203-mm) clearance for connections.

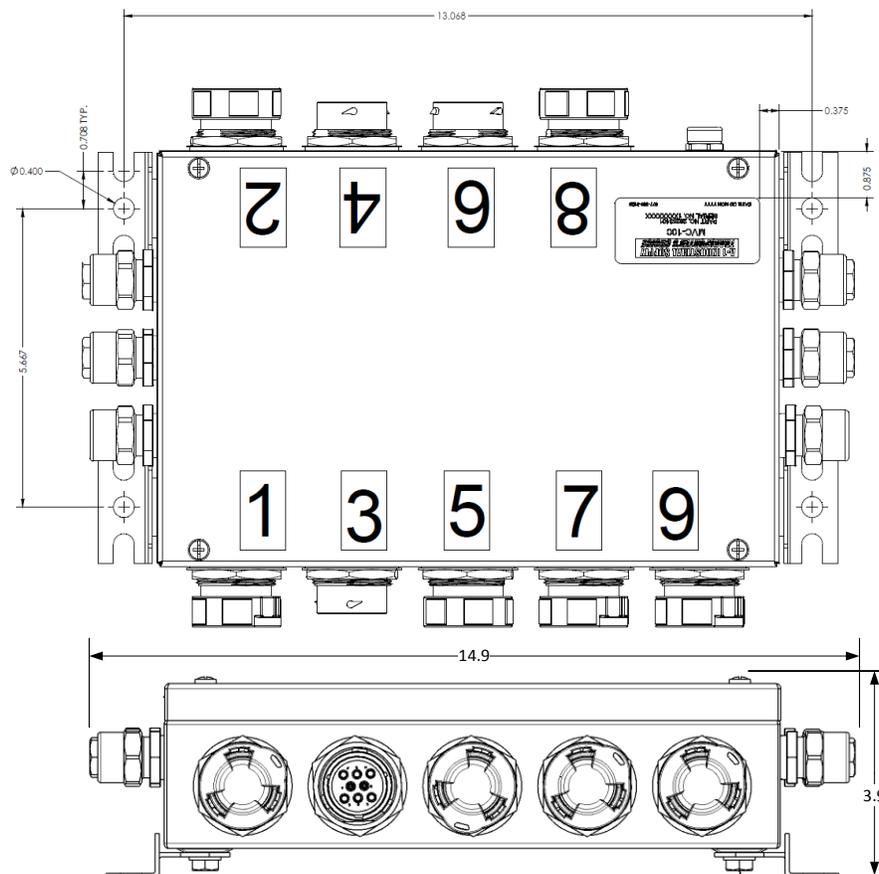


Figure 10. Valve Electrical Box (Dimensions in Inches)

⁵ Provided with the full system package, 08700100, only

⁶ A short circuit under normal operations is unlikely. Higher than normal impacts to the cabling or electronics due to vehicle accidents or other incidents may cause shorts.

Ground Speed Sensor

The ground speed sensor is a DICKEY-john® Radar Velocity Sensor III (RVS III). Refer to the installation instructions provided with the sensor for manufacturer installation procedure. Both the RVS III Mounting Bracket Kit and the RVS III Pipe Mounting Bracket Kit are provided with the RVS III.

If the mounting bracket(s) will be welded to the vehicle chassis, be sure the Speed Sensor is removed from the brackets before welding. Note that it is not recommended to weld the mounting brackets to the chassis because it can increase the amount of speed sensor vibration causing erroneous speed readings.

Mount the speed sensor under the vehicle if at all possible to avoid false readings from rain or falling water. It should also be mounted in a location that minimizes mud, dirt, and debris from hitting the sensor face. The speed sensor may be mounted facing either forward or backwards. Rear facing orientation is the preferred mount for more physical protection of the radar.

As described in the Ground Speed Sensor installation manual, the speed sensor must be installed between two (2) and four (4) feet from the ground.

As described in the Ground Speed Sensor installation manual, the Speed Sensor needs to be tilted a 35° angle with the horizontal. The brackets come pre-assembled at the needed 35° angle if the “L” bracket is mounted with the angle bracket side running vertical above the round pipe. For this case, the speed sensor simply needs to be mounted to the bracket after the bracket is installed on the truck. See Figure 11. If the bracket or Speed Sensor is mounted differently, use the angle setting template provided with the Speed Sensor installation manual to align the speed sensor at a 35° angle. The use of this angle setting template with the pipe mount bracket is shown in Figure 12.

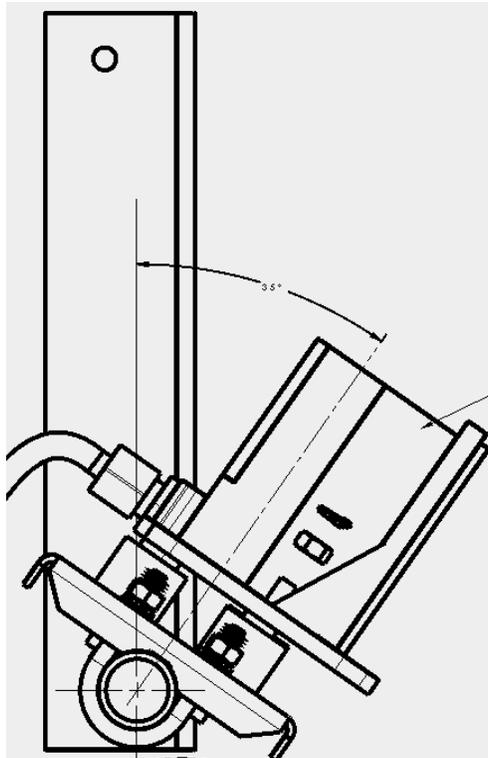


Figure 11. Speed Sensor on Pre-Aligned “L” Bracket

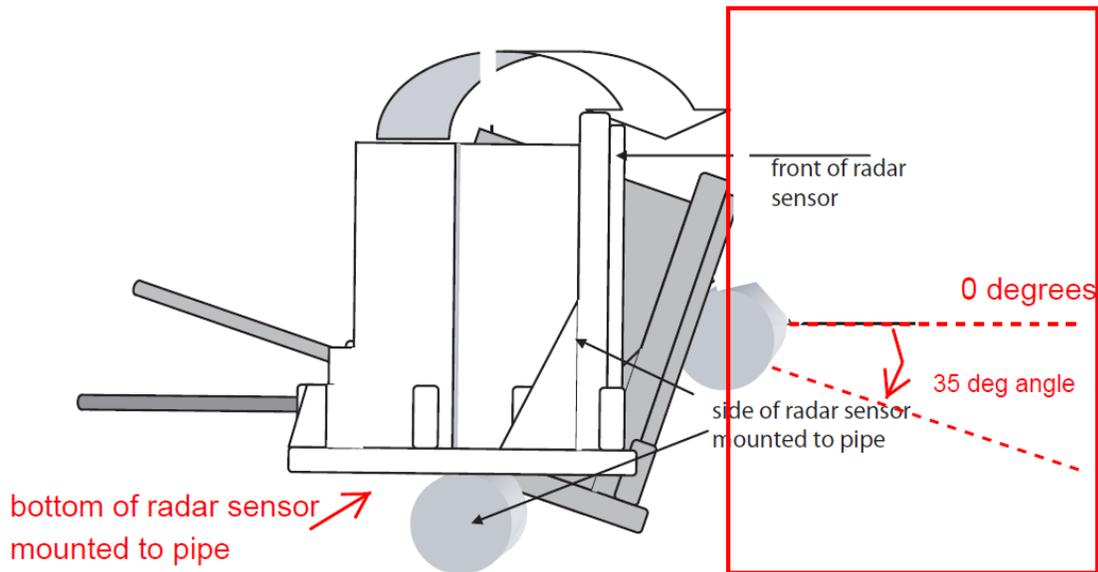


Figure 12. Speed Sensor Alignment with the Angle Setting Template

Refer to the installation instructions provided with the sensor for additional installation details.

MVC Touchscreen Display

The touchscreen display may be installed as a flush panel mount or using a pedestal mount.



Caution: If the max storage temperature range of -40°F to 185°F (-40°C to 85°C) may be exceeded, it is recommended that the display be pedestal mounted in order to remove from the vehicle while not in use to avoid damage. If the max temperature range is exceeded, it will void the warranty.

MVC Touchscreen Display must be positioned in the machine per the following instructions:

- Position the unit in desired location and make sure that it is not exposed to mechanical damage.
- The connectors on the reverse side of the unit should be accessible.
- Position the unit so there is no risk that the cabling can be folded, crushed, worn or damaged in any way.
- Leave sufficient room behind the unit to insert connectors. Less than 3 inches (75 mm) clearance will stress the cabling and distort the seals in the connectors. This can cause the environmental specification not to be met.
- Position the unit so there is no risk to be exposed to external heat, e.g. from the engine or heater.
- The best readability will be achieved by positioning the front face of the unit directly towards the operator.
- Position the display to avoid extended periods of exposure to direct sunlight which can cause an excessive internal temperature exceeding and may cause permanent degradation of the LCD display.

It is recommended to place the display in a vertical position so that water droplets (or other liquid droplets) that hit the display roll off the display glass. The display will not be damaged by water, but the touch sensor has been tuned to reduce the risk of unintentional activation of buttons from water drops. The touch interface can have limited functionality if an excessive amount of water droplets remains on the screen. If the MD4 display is placed in exposed locations where water spray can hit the display, additional OEM-supplied splash protection could be used.

Pedestal Mount

The MVC system comes with RAM Mounts® pedestal components that can be used for pedestal mounting. The provided custom mounting bracket connects the touchscreen to the RAM Mounts® components. The RAM Mounts® pedestal components use 1.5-inch diameter balls with a 3.5-inch arm. Overall Pedestal dimensions are shown in Figure 13.

1. Install the pedestal mount's ball base to the panel in the vehicle cab. Use pedestal base template in the COMPONENT MOUNTING TEMPLATES section.
2. Install the Touchscreen Display into the pedestal mount using the four (4) mounting screws provided with the Display. (steel clips are not used)

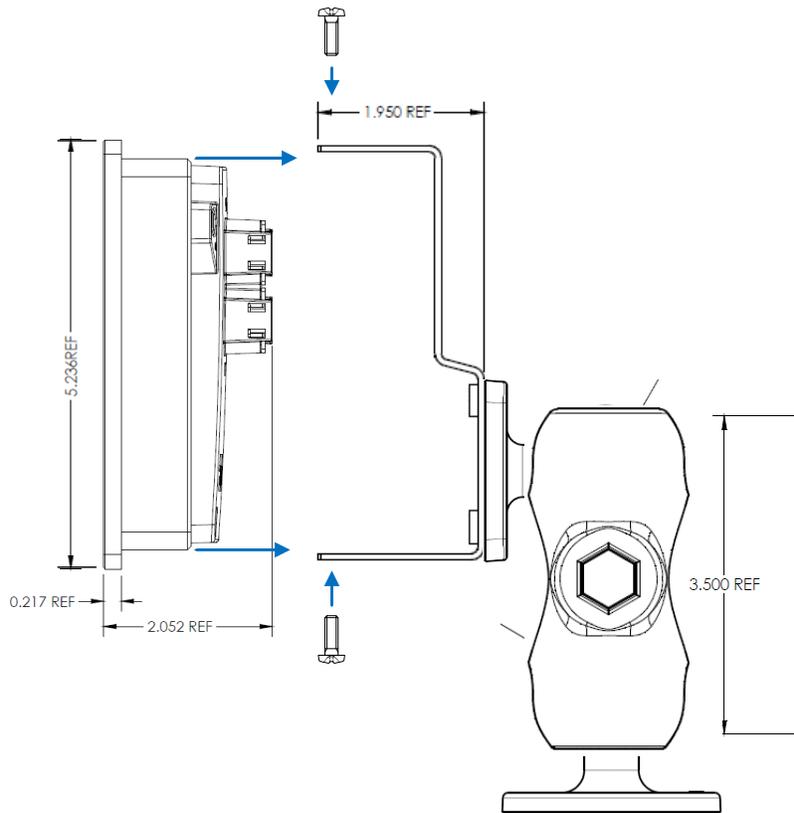


Figure 13. Pedestal Mount Dimensions (inches) and Touchscreen Installation

Panel Mount or Dashboard⁷

The recommended panel thickness for installing into a panel or dash is 1/32" - 1/8" (1.0 – 3.5 mm). See Figure 14 for touchscreen dimensions.

1. After cutting the mounting hole, insert the MVC Touchscreen Display into the panel.
2. Use M4 screws to attach the supplied steel clips to the Display to secure to the panel.



⁷ When mounting in a panel or dashboard, RAM Mounts® pedestal components and mounting bracket provided with the MVC system are not used.

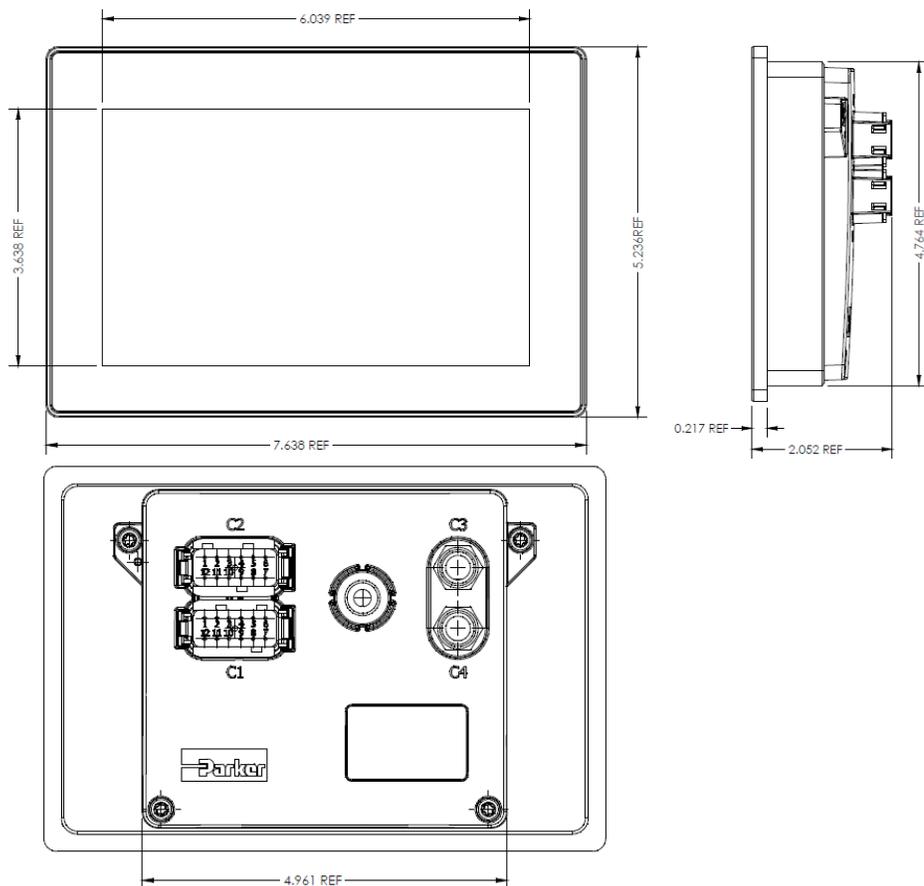


Figure 14. Touchscreen Display Dimensions (inches)

INSTALLATION - FULL SYSTEM

The installation described in this section must be done if the system with full cabling and electrical boxes is being installed (Elkhart Brass Part Number 08700100).

Display/Speed Sensor Electrical Box

The Display/Speed Sensor Electrical Box shown in Figure 15 needs to be installed as close to the vehicle battery and battery disconnect as possible: no more than 5 feet (1.5 m) away. **It must be installed in an enclosed area.** This will protect the connections from high-pressure wash-downs. Exposed installation may void the warranty.

- Drill the four (4) 0.377" (8.2 mm) dia. holes through the surface intended for mounting.
- Mount the Display/Speed Sensor Electrical Box using four (4) 3/8" (8 mm) dia. fasteners secured with nuts and lock washers or blue Loctite 242. The fasteners should be at least 1/2" long. This will allow the fasteners to extend at least 3/8" into the mounting surface.

Other considerations and precautions to take when installing the Display/Speed Sensor Electrical Box include:

- Do not weld the Display/Speed Sensor Electrical Box to the vehicle. This risks damage to the electronics in the enclosure. Refer to the PRODUCT SAFETY INFORMATION section.
- Be sure the mounting provides good electrical continuity between the Display/Speed Sensor Electrical Box and the vehicle chassis. This helps ensure that breakers/fuses will properly trip and keep the enclosure walls de-energized in the event of a short circuit⁸.

⁸ A short circuit under normal operations is unlikely. Higher than normal impacts to the cabling or electronics due to vehicle accidents or other incidents may cause shorts.

- Be sure that the cable entry and electrical connections into the Display/Speed Sensor Electrical Box will be readily accessible after it's installed.
 - At least 1.5-inch (38-mm) clearance for lid removal.
 - At least 8.0-inch (203-mm) clearance for connections.

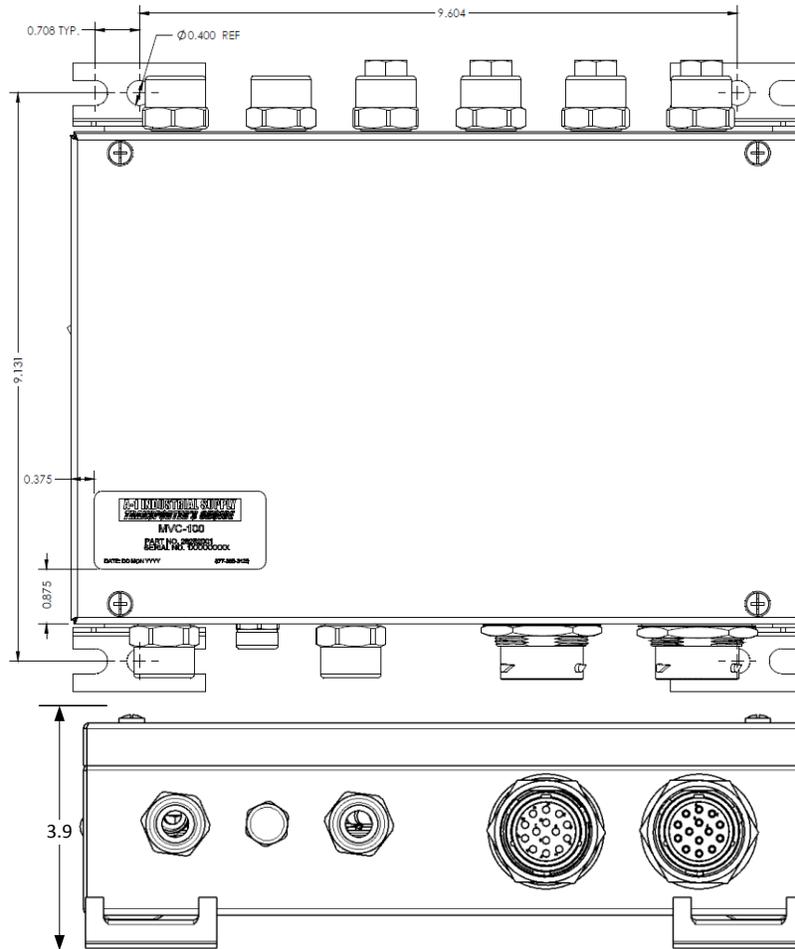


Figure 15. Display/Speed Sensor Electrical Box (Dimensions in Inches)

INSTALLATION - PARTIAL SYSTEM

The installation described in this section must be done if the system consisting of only components and cable pigtails are being installed (Elkhart Brass Part Number 08700110).

Speed Sensor Signal Conditioner

The speed sensor signal conditioner needs to be installed between the Speed Sensor and the MVC Touchscreen Display. Ensure the signal conditioner is installed in a location that is shielded from direct weather exposure.

- Using the Speed Sensor Signal Conditioner template shown in the Component Mounting Templates section, drill the two (2) 1/4" dia. holes through the surface intended for mounting.
- Mount the Speed Sensor Signal Conditioner using two (2) 1/4" dia. fasteners secured with blue Loctite 242 or equivalent. The fasteners should be at least 1" long. This will allow it to extend at least 3/8" into the mounting surface.

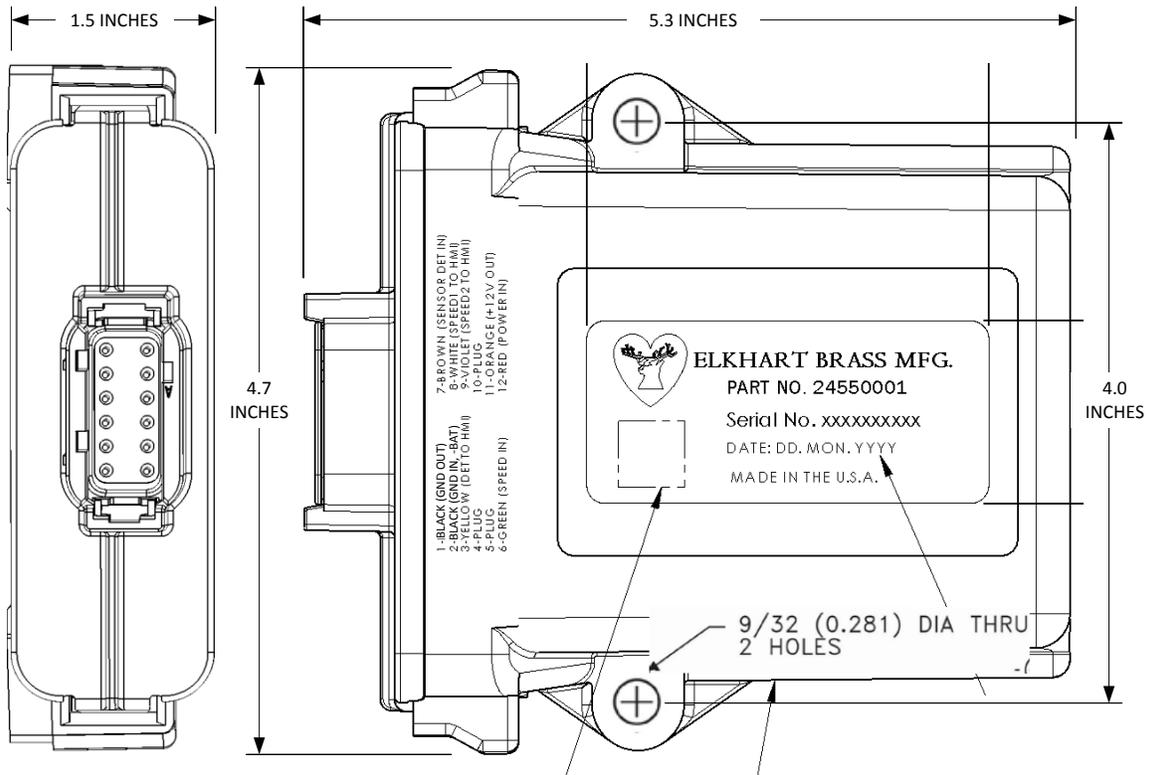


Figure 16. Speed Signal Conditioner (Dimensions in Inches)

WIRING INSTRUCTIONS - FULL SYSTEM

The wiring described in this section must be done if the system with full cabling and electrical boxes is being installed (Elkhart Brass Part Number 08700100).

All wire connectors/connections/wire splices must be in an enclosed area or installer-supplied junction box. This will protect the system from high-pressure wash-downs. Exposed wire connections may void the warranty.

Remove dirt and water from all electrical connections before connecting or disconnecting. This keeps water and dirt out of connections and avoids corrosion and shorts that could damage equipment

System Wiring Overview

An overview of connections for installing the full system (08700100) is shown in Figure 18. Note the following about the wiring shown:

- Wiring standards (NEC, NFPA, MSHA, etc.) for the vehicle application take precedence over any wiring recommendations in this manual if a conflict exists.
- The installer is responsible for providing the main power and ground cables.
 - Figure 18 shows the recommended copper cable minimum size and minimum number of pairs with the recommended maximum cable length.
 - This recommendation should provide enough power to the MVC components. Refer to the SYSTEM SPECIFICATIONS for component power requirements.
 - The power/ground cables must have an outside diameter of 0.375 to 0.438 inches to ensure proper sealing of the cable glands on the supplied electrical boxes.
 - The cables must have proper insulation and environmental protection for the areas in which it will be routed through the vehicle.
- The cables completely internal to the enclosed manifold come pre-installed.
- Additional holes with cable glands/grommets may need to be installed to route cables into the vehicle cab and into the enclosed manifold.
- The wiring shown relies on the vehicle battery disconnect to switch power on/off to the MVC system. So, the MVC system will remain powered so long as the battery disconnect is “on”, regardless of the ignition switch state. If power on/off needs to be controlled through the ignition switch, it is the installer’s responsibility to design an appropriate circuit for the particular truck.
- Do not use the chassis as the negative terminal (ground connection). Ground wires should be run from the MVC components to the negative battery terminal to ensure a good connection.
- All cables and wires must be fully secured, including any coiled portions.
- When routing and securing cables and wires, do not bend them too much. The minimum MVC cable bend radiuses allowed are shown in Figure 17.

MVC CABLE		Min Bend Radius	
PART NO.	DESCRIPTION	inches	mm
37247150	HMI POWER BOX TO CAB, 30 FT	2.25	57.2
37247261	SPEED SENSOR EXTENSION, 10 FT	2.23	56.6
37247300	TOUCHSCREEN, 3FT	5.75	146.1
37248003	FLOW SENSOR, 3FT MVC	2.25	57.2
37249001 & 7519060	CAN DATA, 1 FT & 60 FT	1.14	29

Figure 17. Minimum Cable Bend Radius

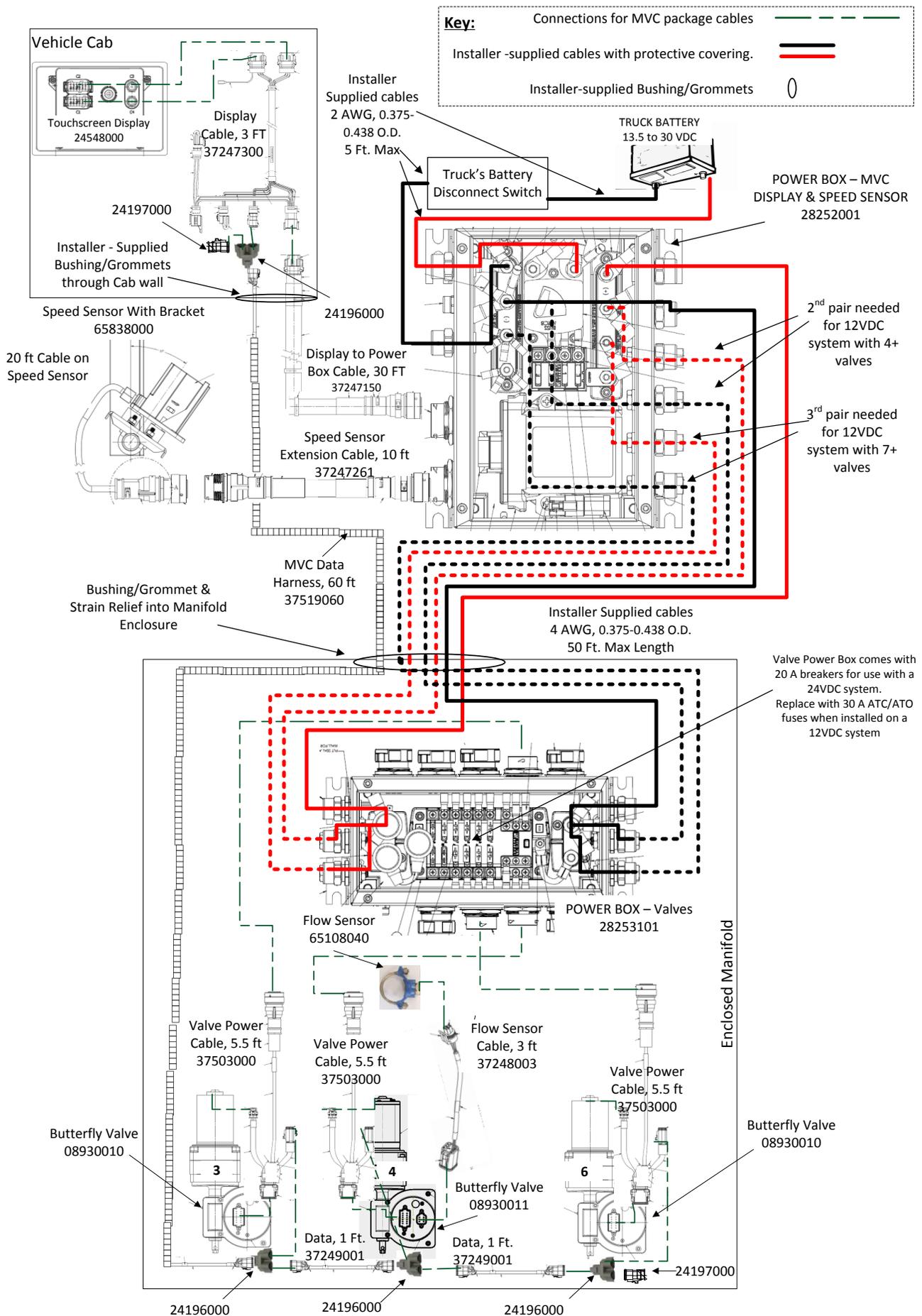


Figure 18. MVC Wiring for a Full System

Full System Wiring Steps

1. Determine or create a cable entry location into the vehicle cab.
 - a. Opening must be at least 2.25 inches in diameter to push the supplied cables through.
 - b. The opening must have an abrasion resistant surface (i.e. using a cable grommet/bushing/gland). Ideally it should provide some strain relief.
 - c. Choose an entry point where water/dust ingress into the vehicle cab is minimized.
2. Determine or create a cable entry location into the enclosed manifold.
 - a. Opening must be the following minimum diameter to push the CAN and power/ground cables through
 - i. If 1 power/ground pair: 2 inches
 - ii. If 2 power/ground pairs: 3 inches
 - iii. If 3 power/ground pairs: 4 inches.
 - b. The opening must have an abrasion resistant surface (i.e. using a cable grommet/bushing/gland). Ideally it should provide some strain relief.
 - c. Choose an entry point where water/dust ingress into the enclosed manifold is minimized.
3. Connect the flow sensor to the system flow valve actuator that receives flow information (typically, valve 4). Use a 3-ft, flow sensor cable 3724803. The 6-position connector connects to the valve. The 3-position connector connects to the flow sensor.
4. For each valve, connect the supplied, 5.5-ft. valve power/data harness, 37503000 between the valve and the Valve Electrical Box according to Figure 18. Match the numbered valve to the numbered connector on the valve power box for easy maintenance.
5. Connect a supplied, 1-ft CAN cable between each valve. Refer to Figure 18 and Figure 19 for examples of how the valve CAN connections are daisy-chained.
 - a. Connect each valve to a CAN splitter.
 - b. Wire the CAN bus from the first valve to the second valve via CAN splitters using a 1-ft CAN cable between each valve.
 - c. Continue to daisy-chain valves together until all valves are connected together on the same CAN bus via the splitters.
 - d. Install the provided 120 Ohm termination plug into the CAN splitter of the last valve.
6. Push one end of the 60-ft MVC CAN/data harness (37519060) through the enclosed manifold opening, then connect it to CAN splitter (24196000) on the first valve.
 - a. Ensure that the maximum bend radius of the CAN wire is at least 4 times (4x) the wire diameter.
 - b. An extra coil of wire or a cable gland for strain relief to avoid accidentally breaking the CAN bus communications link between the valves and the MVC Touchscreen Display.
7. Provide power and ground cables to the MVC Valve Power Box (28253101).
 - a. Remove the Valve Power Box lid. Do not allow the lid to dangle by the lid ground wire.
 - b. If the vehicle is a 12-V system, replace the 20A breakers in the Valve Power box with 30A (slow) fuses or breakers. (replacement fuses are not provided with the MVC system).
 - c. Push the installer-supplied power and ground cables into the enclosed manifold.
 - d. Push the installer-supplied power and ground cables through the Valve Power Box cord grips. Figure 18 shows recommended Power Box cord grips to use for power and ground. When using multiple cable pairs, it is necessary to open some cord grips by removing the screw/nut plug.
 - e. Slide the terminal insulator over the power cable.
 - f. Strip the cables
 - g. Crimp the supplied stackable ring terminals onto the cable ends in the valve power box. Apply heat shrink as necessary to cover any exposed copper.

- h. Connect the ring terminals to the appropriate power/ground bus inside of the valve power box. Tighten the 3/8-16 terminal nuts to 80 (+/-5) in-lbs.
 - i. Route and secure the power/ground cables neatly inside the box.
 - j. Apply blue Loctite 242 to cord grips. hand tighten, then, tighten ¼ turn more with wrench.
 - k. Replace the Valve Power Box lid being sure the lid seal is not pinched. Tighten down the lid screws, well.
8. Connect other end of the power and ground cables to the MVC Display & Speed Sensor Power Box (28252001). The Display & Speed Sensor Power Box also has an overall system circuit breaker.
- a. Remove the MVC Display & Speed Sensor Power Box lid. Do not allow the lid to dangle by the lid ground wire.
 - b. Push the installer-supplied power and ground cables through the MVC Display & Speed Sensor Power Box cord grips. Figure 18 shows recommended Power Box cord grips to use for power and ground. When using multiple cable pairs, it is necessary to open some cord grips by removing the screw/nut plug.
 - c. Slide the terminal insulator over the power cable.
 - d. Strip the cables.
 - e. Crimp the supplied stackable ring terminals onto the cable ends in the valve power box. Apply heat shrink as necessary to cover any exposed copper.
 - f. Connect the ring terminals to the appropriate power/ground bus inside of the power box. Tighten the 1/4-inch stud terminal nuts to 60 (+/-10) in-lbs.
 - g. Route and secure the power/ground cables neatly inside the box.
 - h. Apply blue Loctite 242 to cord grips. hand tighten, then, tighten ¼ turn more with wrench.
9. Connect the MVC Display & Speed Sensor Power Box to the vehicle power using installer-supplied power/ground cables.
- a. Push the installer-supplied power and ground cables through the MVC Display & Speed Sensor Power Box cord grips. Figure 18 shows recommended Power Box cord grips to use for power and ground.
 - b. Slide the terminal insulator over the power cable.
 - c. Strip the cables.
 - d. Crimp the supplied stackable ring terminals onto the cable ends in the valve power box. Apply heat shrink as necessary to cover any exposed copper.
 - e. Connect the ground terminals to the ground bus inside of the power box. Tighten the 1/4-inch stud terminal nuts to 60 (+/-10) in-lbs.
 - f. Connect the power terminal to the LINE side of the circuit breaker inside of the power box. Tighten the nut, well.
 - g. Replace the MVC Display & Speed Sensor Power Box lid being sure the lid seal is not pinched. Tighten down the lid screws, well.
 - h. Connect the other side of the power/ground supply cables to the battery disconnect switch and vehicle battery as appropriate.
10. Push the unconnected end of the 60-ft MVC CAN/data harness (37519060) through the vehicle cab opening.
- a. Ensure that the maximum bend radius of the CAN wire is at least 4 times (4x) the wire diameter.
 - b. An extra coil of wire or a cable gland for strain relief to avoid accidentally breaking the CAN bus communications link between the valves and the MVC Touchscreen Display.
11. Push the rectangular, 8-socket connector of the Display-to-Power-Box cable (37247150) through the vehicle cab opening.
12. Connect the round connector of the Display-to-Power-Box cable (37247150) to the MVC Display & Speed Sensor Power Box as shown in Figure 18.

13. Connect the 3-ft MVC Display cable (37247300) in the vehicle cab.
 - a. Connect the two 12-socket rectangle connectors to the back of the MVC display
 - b. Connect the 8-pin rectangle connector to the Display-to-Power-Box cable.
 - c. Connect the uncapped 3-socket triangle connector to a CAN splitter (2419600).
 - d. Connect the 60-ft CAN data harness (37159060) to the same CAN splitter.
 - e. Plug the open end of the CAN splitter with the provided 120 Ohm CAN terminator, 24197000.
14. Connect the Speed Sensor to the Display & Speed Sensor Power Box.
 - a. If the Speed Sensor's 20-ft cable reaches to the Display & Speed Sensor Power Box, connect it directly to the open connection.
 - b. Otherwise, connect the 10-ft extension cable (37247261) to the speed sensor, then connect the other end of the extension cable to the Display & Speed Sensor Power Box.
15. Secure all cables routed throughout the vehicle. Provide strain relief as necessary.
16. Protect any cable friction points with appropriate cushioning.
17. Provide any additional protective cable coverings necessary for the the vehicle environment.

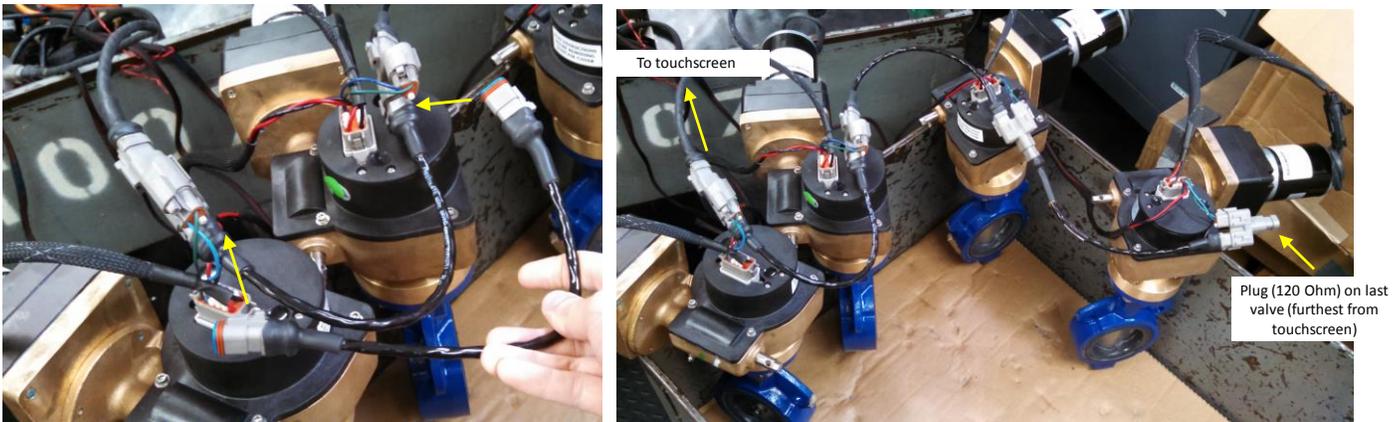


Figure 19. Connecting CAN cables between valves

WIRING INSTRUCTIONS - PARTIAL SYSTEM

The wiring described in this section must be done if the system *without* full cabling and electrical boxes is being installed (Elkhart Brass Part Number 08700110).

Wiring standards (NEC, NFPA, MSHA, etc.) for the vehicle application take precedence over any wiring recommendations in this manual if a conflict exists.

All wire connectors/connections/wire splices must be in an enclosed area or installer-supplied junction box. This will protect the system from high-pressure wash-downs. Exposed wire connections may void the warranty.

Remove dirt and water from all electrical connections before connecting or disconnecting. This will keep water and dirt out of the electrical connections and avoid corrosion and short-circuits that could damage equipment.

All installer-supplied wire harnesses and cables must be capable of withstanding the operating environment and high-pressure wash-downs.

An overview of the wiring for 08700110 is shown in Figure 20.

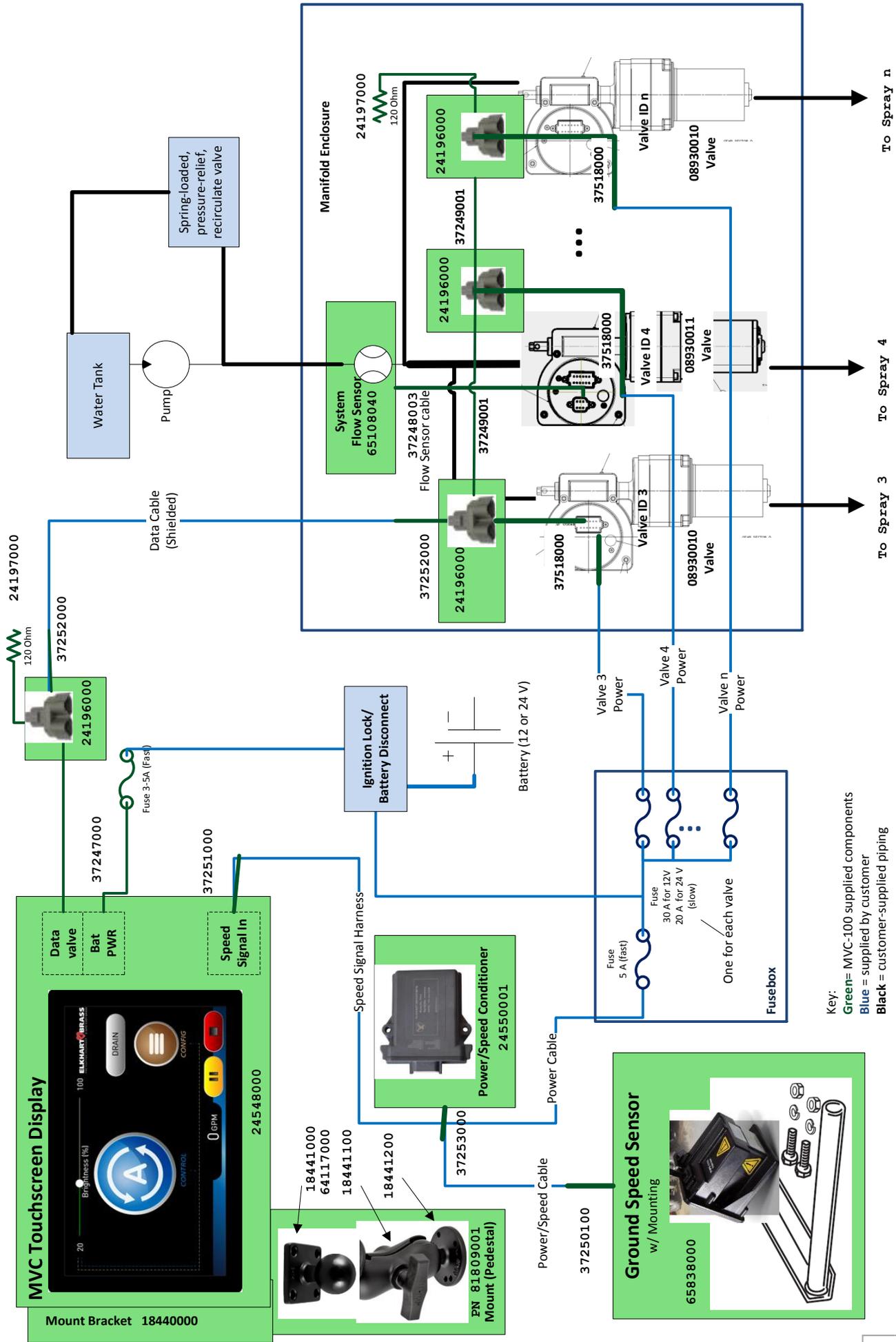


Figure 20. MVC Wiring for a Partial System

General Power Considerations

Each MVC component needs to be wired through its own fuse. The power leads for the MVC Touchscreen Display is provided with an inline fuse holder with fuse. Fuses and fuse holders for other components are customer-supplied. Failure to install the components with fuses will void the warranty. Refer to Figure 20 for fuse sizing.

Power is normally provided to components through the vehicle's ignition lock or through a battery disconnect switch. This way the power is turned off to the components when the vehicle is turned off. If powered through the ignition lock, be sure that the ignition can handle the max current draw of all MVC components/valves plus the current draw any other vehicle electronics powered through the switch. If the current draw expected exceeds what the switch can handle, relays and fuses can be used to power the MVC components and valves. Refer to Figure 21 for example.

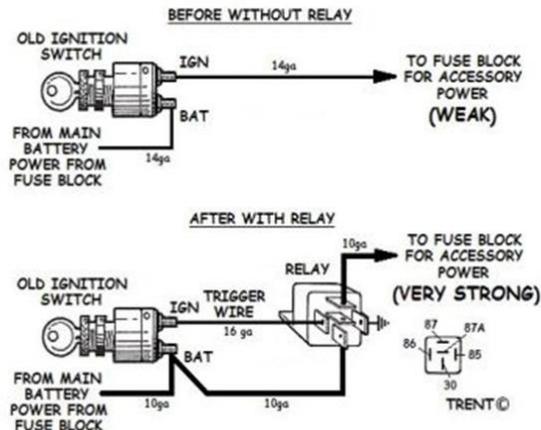


Figure 21: Example Wiring Using Relays

The following are general power and circuit protection guidelines for the MVC-100.

1. Size conductor to ensure enough current and voltage is delivered to all components during full load operating conditions. Specifically, consider the current draw required if all valves are moving at once (automatic operations). Power requirements are provided in the System Specifications section.
2. For valves, you should have a minimum of 12.4 VDC under load at a power distribution point no more than 15 ft. away from the valve (5 to 10 ft. would be preferred).
3. The large conductors should be run from the battery to as close to the valve as possible before reducing the size to accommodate the valve power harness.
4. Each component should be independently fused, with the exception of the speed sensor/signal conditioner: a single fuse may be used for both of these since the signal conditioner provides power to the speed sensor.
5. The provided touchscreen cable pigtail has a built-in fuse holder with fuse. This fuse holder is only splash-proof, not waterproof. So, it should be located in the vehicle's cab.
6. If a power distribution/fuse box is located some distance away from the battery, a circuit breaker is recommended in the battery compartment to protect the branch.
7. The components should be wired through a battery disconnect switch to the battery. This will keep components from drawing power when the vehicle is not in use. A main circuit breaker could alternatively be used as the battery disconnect switch. Be sure the battery disconnect properly disconnects all electrical components well enough so arc welding will not damage components.
8. When selecting circuit protection and power distribution wires and components consider the environment they will be exposed to (dust, water, heat, cold, corrosive chemicals, sun, etc.)

An example of the **minimum** sized wiring that would be required for a 3 valve, 12V system with a battery/alternator operating at 13.5 VDC is shown in Figure 22. This could also be used for a 24V system if valve fuse sizes are reduced to 20 A.

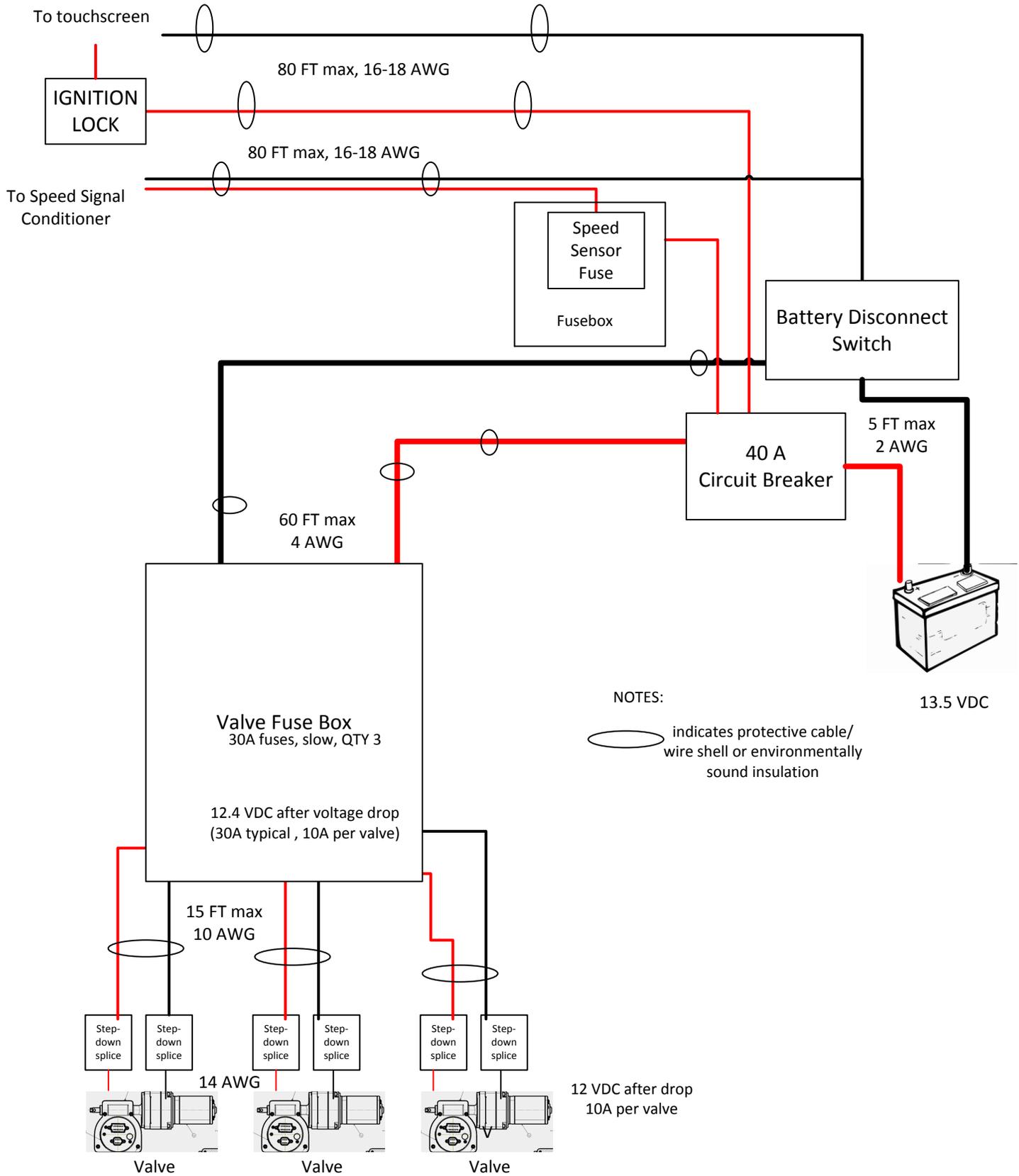


Figure 22. Minimum Sized Wiring for 12V System with 3 Valves

An example of the **minimum** sized wiring that would be required for a 9 valve, 12V system with a battery operating at 13.5 VDC is shown in Figure 23. This could also be used for a 24V system if the valve fuse size is reduced to 20A. This wiring assumes all 9 valves would be used during automatic operations.

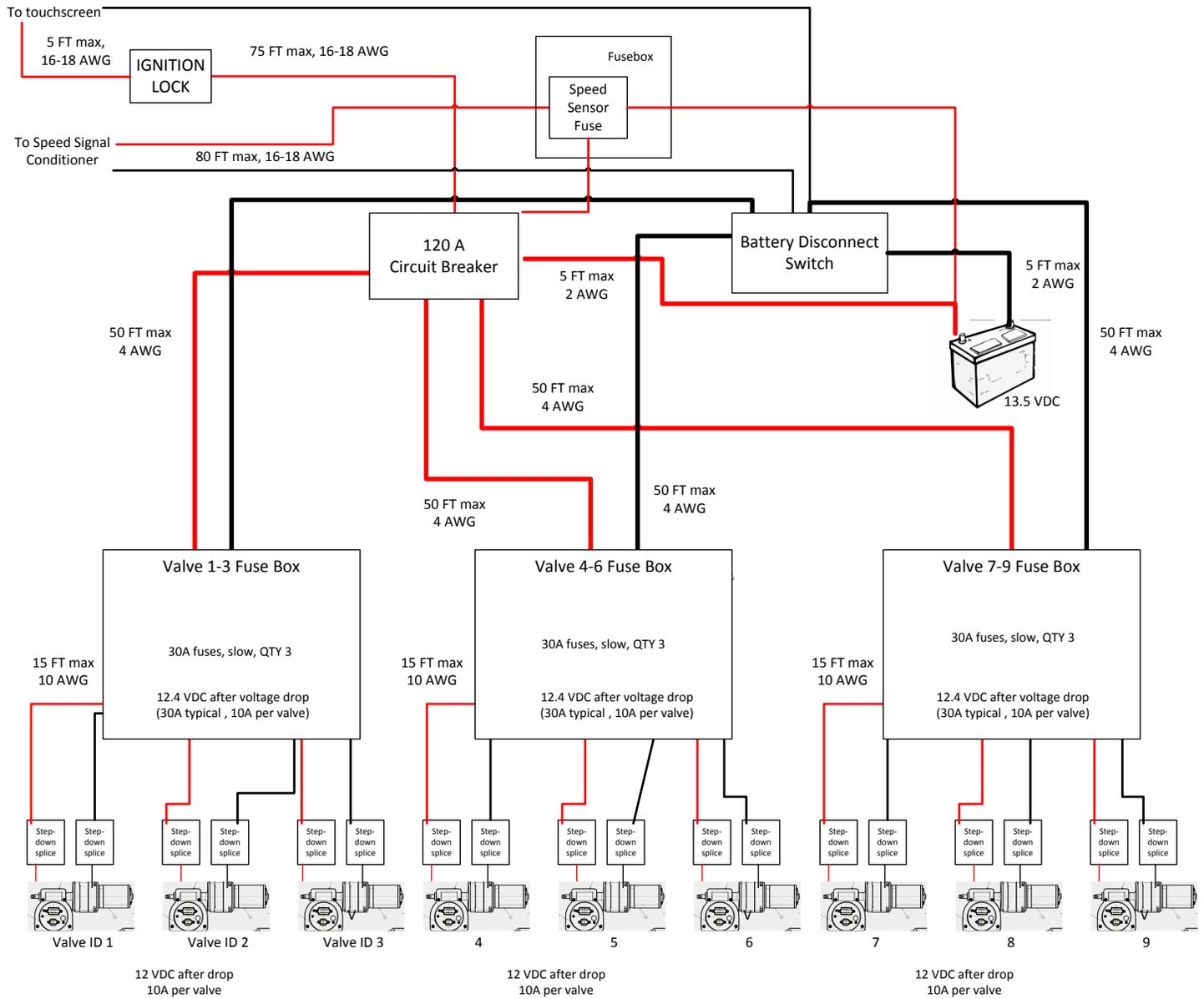


Figure 23. Minimum Sized Wiring for 12V System with 9 Valves

If the vehicle's battery-disconnect switch disconnects the power instead of the ground, then a different configuration is needed than that shown in the previous wiring examples. Example wiring for a three-valve, 12VDC system with the battery disconnect switch attached to power is shown in Figure 24. This can be applied for more valves and/or a 24VDC system.

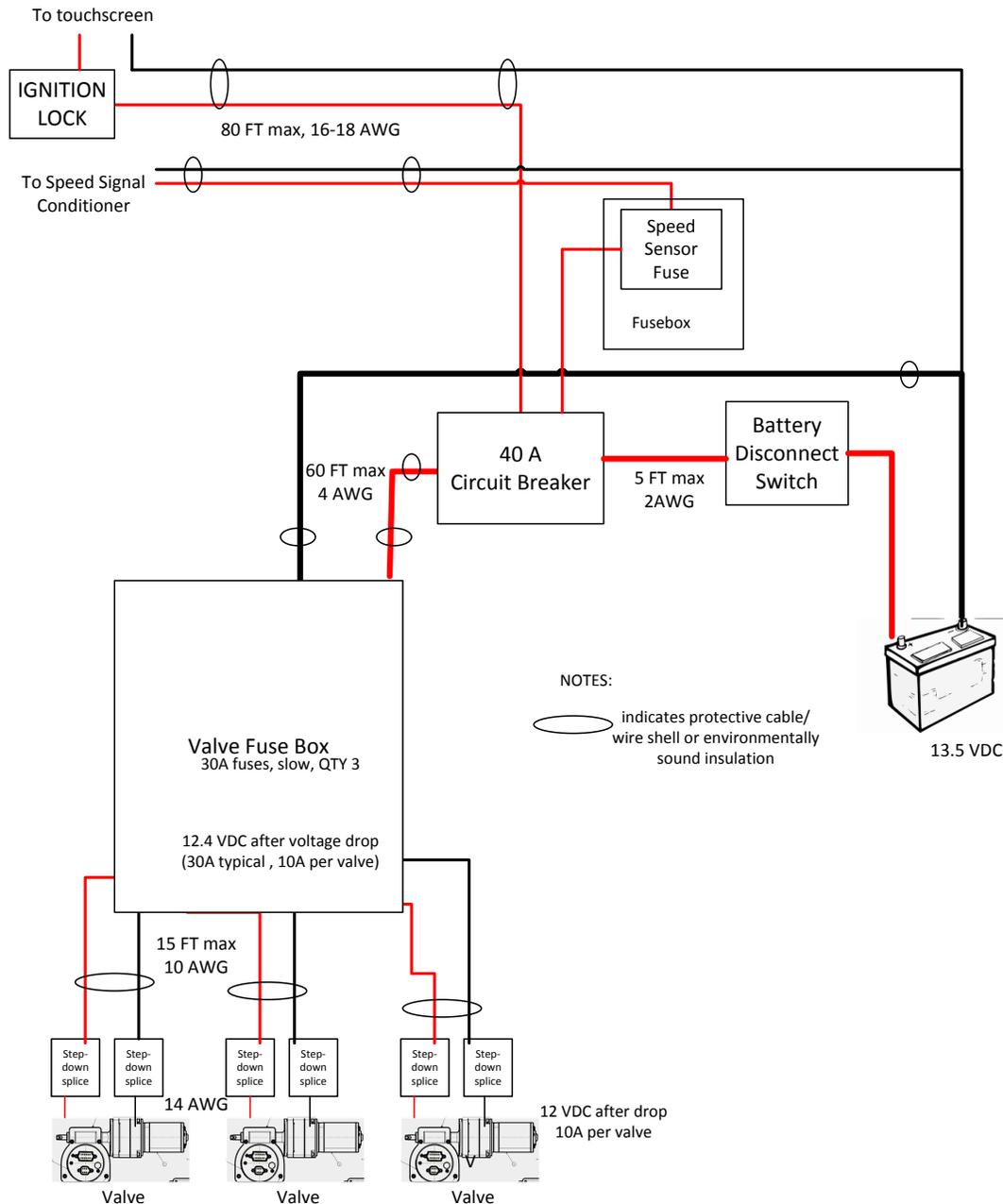


Figure 24. Wiring when the Battery Disconnect Switches Power

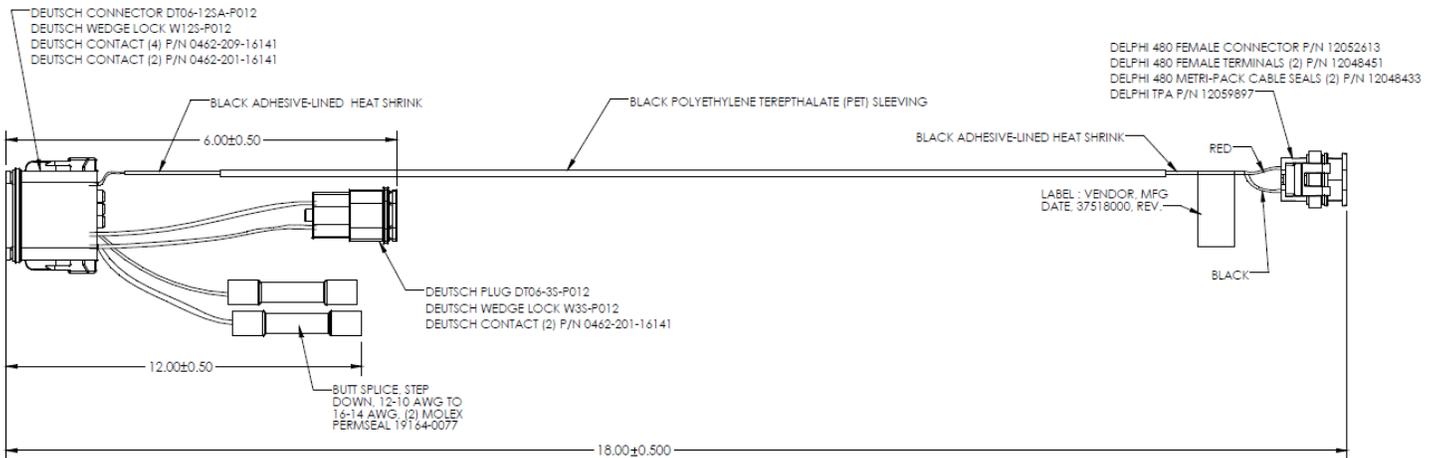
Other General Wiring Considerations

- No pin or standard splice may be "double crimped". That means only one wire may be attached to any given pin or standard splice. Failure to follow this instruction will cause the component to not meet the environmental specification.
- Do not use the chassis as the negative terminal (ground connection). Ground wires should be run from the MVC components to the negative battery terminal to ensure a good connection.
- All cables and wires must be fully secured, including any coiled portions.

Valve Power

The provided valve power/CAN cable pigtail (37518000) is shown in Figure 25.

- Connect each valve's POWER (red) lead independently to the vehicle power through the ignition lock (or battery disconnect switch that switches power) using an appropriately-sized, slow-blow fuse for each valve. Use a 20A fuse for a 24 VDC system or a 30A fuse for a 12VDC system.
- Connect each valve's GROUND (black) lead to the negative battery (or battery disconnect switch that switches ground).
- Refer to the previous wiring diagrams, Figure 20, Figure 22, Figure 23, and Figure 24 for overall and example power/ground connections.



FROM CONNECTOR	FROM POS'N	WIRE COLOR	FUNCTION	TO CONNECTOR	TO POS'N	LABEL
DT06-12SA	1	RED	+ 12 to 30 VDC POWER IN (FUSE AT 30A TO 20A SLOW)	BUTT SPLICE	14 AWG	POWER
DT06-12SA	2	BLACK	TRUCK GROUND (-BAT)	BUTT SPLICE	14 AWG	GROUND
DT06-12SA	3	PLUG	CLOSE INDICATOR LIGHT (switches in power)			
DT06-12SA	4	PLUG	OPEN INDICATOR LIGHT (switches in ground)			
DT06-12SA	5	PLUG	AUTO CALIBRATE (switch to power for 10s to initiate)			
DT06-12SA	6	BLACK	VALVE CONTROL (-)	DELPHI 480 12052613	B	MOTOR (-)
DT06-12SA	7	RED	VALVE CONTROL (+)	DELPHI 480 12052613	A	MOTOR (+)
DT06-12SA	8	PLUG	EXTERNAL CLOSE SWITCH (switch to ground)			
DT06-12SA	9	PLUG	EXTERNAL PRESET SWITCH (switch to ground)			
DT06-12SA	10	PLUG	EXTERNAL OPEN SWITCH (switch to ground)			
DT06-12SA	11	YELLOW	DATALINK CAN HIGH	DT06-3S-P012	A	CAN HIGH
DT06-12SA	12	GREEN	DATALINK CAN LOW	DT06-3S-P012	B	CAN LOW
		PLUG	CAN SHIELD	DT06-3S-P012	C	

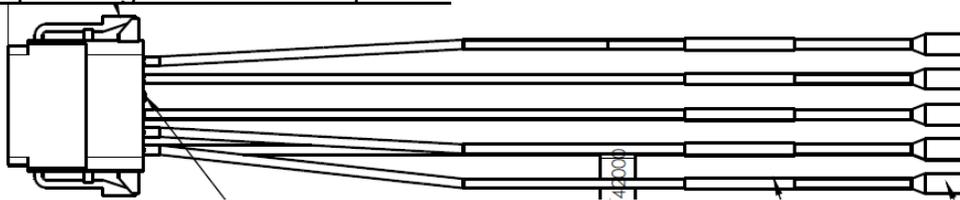
Figure 25. Valve Power/CAN Harness Pigtail (37518000)

Speed Sensor Wiring

Both the speed sensor and the speed signal conditioner come with pigtail harnesses that will need wired by the installer. All connections/splices must be made in a location that is shielded from direct weather and wash-down exposure. Failure to do so will void the product warranty. Refer to Figure 27 and Figure 26 for diagrams of the pin-out and harness pigtails.

1. Wire the speed sensor's round 4-pin connector harness pigtail to the speed signal conditioner's harness pigtail (12-socket). Connect this newly wired harness between the speed sensor and speed sensor signal conditioner.
2. Connect the signal conditioner's power lead through a 3-5A (fast) fuse to the ignition lock or to battery (+) or to battery disconnect (if the disconnect switches power). Connect the speed signal conditioner's ground to battery (-) or to battery disconnect (if the disconnect switches ground).
3. Connect the signal conditioner's output SPEED1 and SPEED2 signals to the respective inputs on the Touchscreen Display C2 connector.
4. Connect the signal conditioner's sensor present signal to the sensor present input on the Touchscreen Display C2 connector.

Speed signal conditioner pin-out



		DEUTSCH PLUG DTM06-12SA			NOTES 1,2,3
PIN NUMBER	WIRE COLOR	LABEL	FUNCTION	MATERIAL	
1	BLACK	GND	TRUCK GROUND TO SPEED SENSOR	CROSS LINK WIRE CU 20 AWG GXL 125°C	
2	BLACK	GND	TRUCK GROUND (0 VDC)	CROSS LINK WIRE CU 20 AWG GXL 125°C	
3	YELLOW	SPEED DET TO HMI	SENSOR DETECTED OUTPUT TO DISPLAY 0V = NOT DETECTED, +5V = DETECTED	CROSS LINK WIRE CU 20 AWG GXL 125°C	
4	PLUG	N/A	RESERVED		
5	PLUG	N/A	RESERVED		
6	GREEN	SPEED SIGNAL IN	SPEED SIGNAL FROM SENSOR SQUARE WAVE INPUT WITH 0 VDC TO +12 VDC AMPLITUDE	CROSS LINK WIRE CU 20 AWG GXL 125°C	
7	BROWN	SENSOR PRESENT IN	SENSOR PRESENT SIGNAL FROM SPEED SENSOR 0 VDC = NO SENSOR PRESENT +12 VDC = SENSOR PRESENT	CROSS LINK WIRE CU 20 AWG GXL 125°C	
8	WHITE	SPEED1 TO HMI	CONDITIONED SPEED SENSOR SIGNAL OUT TO DISPLAY SQUARE WAVE OUTPUT WITH 0 VDC TO +5 VDC AMPLITUDE	CROSS LINK WIRE CU 20 AWG GXL 125°C	
9	VIOLET	SPEED2 TO HMI	DELAYED SPEED SENSOR SIGNAL OUT TO DISPLAY SQUARE WAVE OUTPUT WITH 0 VDC TO +5 AMPLITUDE	CROSS LINK WIRE CU 20 AWG GXL 125°C	
10	PLUG	N/A	RESERVED		
11	ORANGE	+12 VDC OUT	+12 VDC POWER TO SPEED SENSOR	CROSS LINK WIRE CU 20 AWG GXL 125°C	
12	RED	POWER	TRUCK POWER (10-30 VDC) (FUSE 3A FAST)	CROSS LINK WIRE CU 20 AWG GXL 125°C	

VIEW FROM
WIRE SIDE

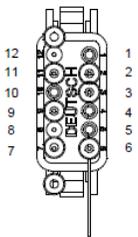
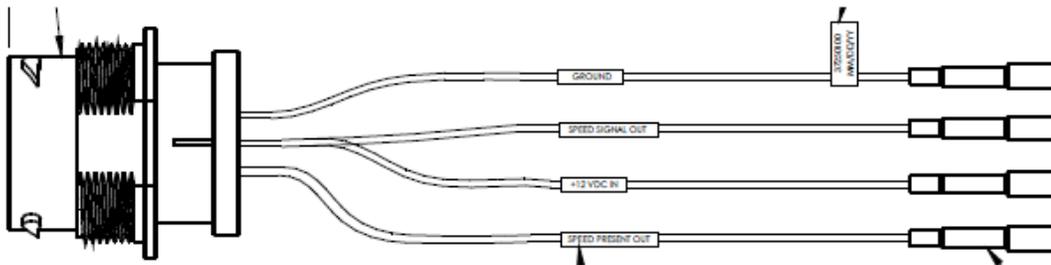


Figure 26. Speed Signal Conditioner Harness Pigtail (37253000)

Speed sensor pin-out

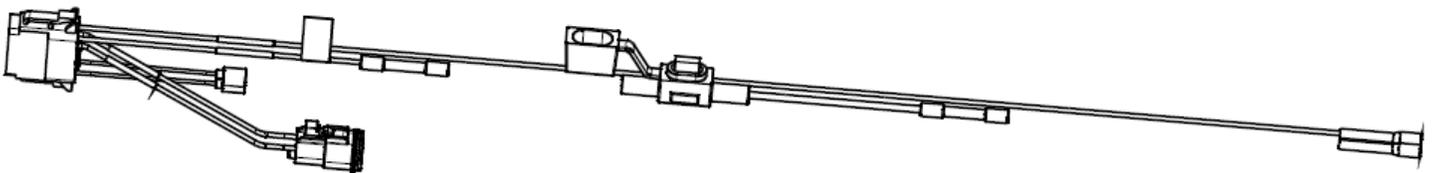


HDP24-18-14PE-L017	WIRE COLOR	LABEL	FUNCTION
A	GREEN	SPEED SIGNAL OUT	SPEED SIGNAL FROM SENSOR TO SPEED SIGNAL CONDITIONER. SQUARE WAVE WITH 0 TO 12 VDC AMPLITUDE
B	BLACK	GROUND	TRUCK GROUND (FROM SPEED SIGNAL CONDITIONER)
C	ORANGE	+12 VDC IN	+12 VDC FROM SPEED SIGNAL CONDITIONER
D	BROWN	SENSOR PRESENT OUT	SENSOR PRESENT SIGNAL TO SPEED SIGNAL CONDITIONER: 0 VDC = NO SENSOR PRESENT +12 VDC = SENSOR PRESENT
E to P	PLUG	N/A	N/A

Figure 27. Speed Sensor Harness Pigtail (37250100)

MVC Touchscreen Display Wiring

Power/CAN connector (C1)



VIEW FROM WIRE SIDE		DEUTSCH PLUG DTM06-12SA		NOTES 1, 2, :
PIN NUMBER	WIRE COLOR	LABEL	FUNCTION	
1	BLACK	GND	TRUCK GND (0 VDC)	
2	GREEN	DATA LO	VALVE CAN BUS - LOW SIGNAL	
3	PLUG	RESERVED	RESERVED	
4	PLUG	RESERVED	RESERVED	
5	PLUG	RESERVED	RESERVED	
6	BLACK	----	ADDRESS TAG - LOW SIDE	
7	BLACK	----	ADDRESS TAG - HIGH SIDE	
8	PLUG	RESERVED	RESERVED	
9	PLUG	RESERVED	RESERVED	
10	PLUG	RESERVED	RESERVED	
11	YELLOW	DATA HI	VALVE CAN BUS - HIGH SIGNAL	
12	RED	POWER	TRUCK POWER (10-30 VDC) (FUSE 3-5A FAST)	

Figure 28. Touchscreen C1 Harness Pigtail (37247000)

1. Connect the power/ground lines through the ignition lock. Be sure the MVC Touchscreen Display is properly fused using the supplied 3A (fast) fuse with holder.

2. Connect the C1 triangle CAN connector to a CAN bus splitter. If the MVC Touchscreen Display is at the farthest end of the CAN bus (which is typical), connect a 120 termination plug in the splitter as well. Use the remaining end of the CAN splitter to run CAN bus to the valves. The triangle CAN connector on the C1 pigtail is shown in Figure 29. Be sure the CAN bus cable is constructed in accordance with the recommendations that follow Figure 29.

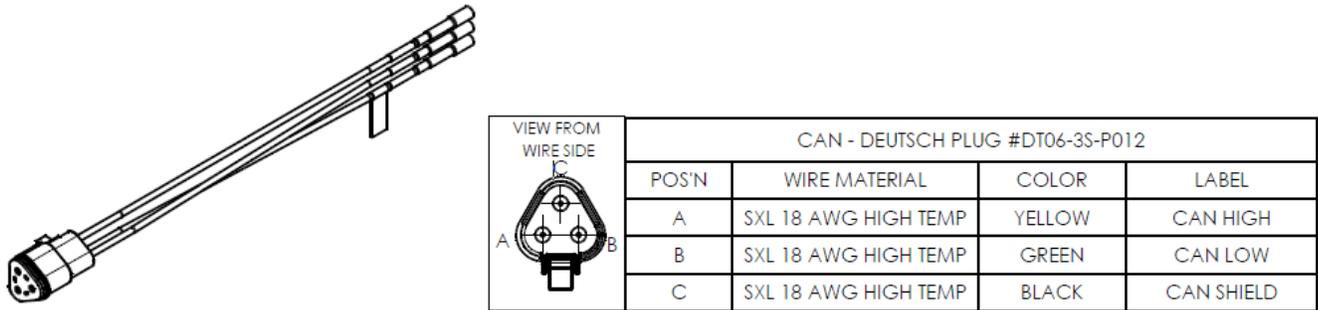


Figure 29. CAN Data Harness Pigtail (37252000)

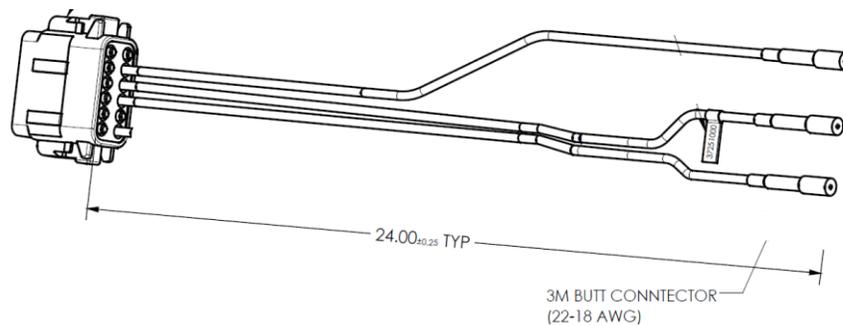
Recommended CAN cable properties (if not using the supplied cables)

- CAN wire gauge and length:
 - Main Line: 131 ft. (40 m) – 18-20 AWG (Must meet SAE J1939 specification)
 - Branch (node) Line: 3 ft. (1 m) – 18-20 AWG (Must meet SAE J1939 specification)
- CAN wire type and shielding: Twisted/shielded pair, -40°C to 105°C (Must meet SAE J1939-11 specification)
 - Shield Drain (pin C of J1939 3-position triangle connector): The touchscreen’s wiring harness provides connection of the shield drain to the vehicle’s ground. If the provided touchscreen’s wiring harness is modified or a different harness is used, then be sure to connect the CAN shield drain to the negative battery terminal (vehicle ground) at one location per J1939-11 recommendations.

The maximum total length of the main CAN bus should not exceed 131 feet (40 meters). Exceeding this length may cause faulty communications on the CAN bus in some operating environments leading to reduced ability or no ability to control valves.

When wiring the CAN bus, ensure that the maximum bend radius of the CAN wire is at least 4 times (4x) the wire diameter. Use an extra coil of wire for strain relief to avoid accidentally breaking the CAN bus communications link between the valves and the MVC Touchscreen Display.

I/O connector (C2)



POS'N	WIRE SIZE	COLOR	LABEL	WIRE TYPE
1	PLUG			
2	PLUG			
3	PLUG			
4	PLUG			
5	PLUG			
6	PLUG			
7	PLUG			
8	20 AWG	YELLOW	SPEED DET IN	CROSS LINK CU GXL 125° C
9	20 AWG	VIOLET	SPEED2 IN	CROSS LINK CU GXL 125° C
10	20 AWG	WHITE	SPEED1 IN	CROSS LINK CU GXL 125° C
11	PLUG			
12	PLUG			

Figure 30. Touchscreen C2 Harness Pigtail (37251000)

If not already done so, wire the speed sensor conditioner SPEED1, SPEED2, and SPEED DET signals to the Touchscreen Display C2 connector. Refer to Figure 30 and Figure 26.

Do not connect two wires to a single standard butt splice connector. Also, do not connect two wires to a single Deutsch connector pin.

USING OTHER CONTROLLERS WITH THE MVC VALVES

EXM

The following should be done to use an EXM system on the same vehicle with the MVC.

- A valve controlled by an EXM system cannot also be controlled by the MVC Touchscreen.
- The valve controlled by the EXM system must remain closed while operating the MVC system in Automatic mode if the EXM valve is in the same manifold as the valves used by the MVC system. If the valve controlled by the EXM is opened while in Auto mode, the MVC system will receive a faulty flow rate and it will be ineffective in regulating water based on vehicle speed.
- If the valve controlled by the EXM system may be opened while operating the MVC system in Automatic mode, the valve should be plumbed/installed separately from the MVC manifold.
- Wiring the valve/EXM system on a separate CAN bus from the MVC's CAN bus is preferred.
- If the EXM components are on the same CAN bus as the MVC, adhere to the following:
 - Maximum total length of the main CAN bus should not exceed 131 feet (40 meters).
 - The CAN bus should only be terminated at the two end points. Consider this as you set up the EXM termination points with the EXM Configuration Tool.

- The triangle CAN connector into the EXM components wiring harnesses may have CAN High and CAN Low different than the MVC components. Review installation manuals and connector pin-outs, then wire the systems, accordingly.
- EXM system configuration using a USB drive through the EXM input controller must only be done when the valve controlled by the EXM controller is the only valve attached to the CAN bus. Other valves can be re-connected to the CAN bus after the EXM configured components have completed at least one power-cycle.

UBEC1C, UBEC1, UBEC2, and UBEC3

The following should be done to use one of these CAN-enabled UBEC valve controllers on the same vehicle with the MVC.

- A valve controlled by a UBEC cannot also be controlled by the MVC.
- The valve ID used with UBEC and valve must be 0 (factory default).
- Wiring the valve/UBEC on a separate CAN bus from the MVC's CAN bus is preferred.
- If a UBEC is on the same CAN bus as the MVC, adhere to the following:
 - Only one UBEC-controlled valve may be on the same CAN bus as the MVC.
 - Maximum total length of the main CAN bus should not exceed 131 feet (40 meters).
 - The CAN bus should only be terminated at the two end points. A UBEC has to be at one of the CAN bus because it is always terminated.
 - The triangle CAN connector into the UBEC wiring harness may have CAN High and CAN Low different than the MVC components. Review installation manuals and connector pin-outs, then wire the systems, accordingly.

UBEC1S

The following should be done to use a UBEC1S valve controller on the same vehicle with the MVC Touchscreen Display.

- A valve controlled by a UBEC1S cannot also be controlled by the MVC Touchscreen Display.
- Wire the UBEC1S control wires to the valve separately from the MVC Touchscreen Display control wires. The UBEC1S uses switched controls, while the MVC Touchscreen Display uses a CAN bus control. Do not wire the MVC Touchscreen's valve control CAN bus to the valve controlled by the UBEC1S. Refer to the UBEC1S manual, 98329000, for how to wire the UBEC1S control signals.
- Additional connections will need made to the 12-pin Deutsch valve connector beyond those supplied with the valve harness pigtail that was shown in Figure 25. Refer to the UBEC1S manual, 98329000, for the connections required.

Installer-Supplied Controls

An MVC valve could be controlled by installer-supplied custom controls that use the switched inputs on the valve. For example, switches or push-buttons could be used to open/close the valve. The following should be done to use custom controls on the same vehicle with the MVC Touchscreen Display.

- A valve controlled by custom controls cannot also be controlled by the MVC.
- Wire the custom control wires to the valve separately from the MVC Touchscreen Display control wires. The MVC Touchscreen Display uses CAN bus control, not switched control. Do not wire the MVC Touchscreen's valve control CAN bus to the valve controlled by custom controls.
- Additional connections will need made to the 12-pin Deutsch valve connector beyond those supplied with the valve harness or pigtail. Refer to the table in Figure 25 for pin locations for switched controls.



Warning! Water must not be flowing or in the piping when configuring and calibrating the valves. Flowing water during valve calibration may cause the valves to be mis-calibrated leading to the inability to properly regulate water flow. Water in the piping may be discharged during configuration and calibration.

Add-On Valve Configuration

The Add-On Valve configuration only needs done if more valves are installed in addition to the packaged 3-valve MVC system.

Prior to configuring the valves, confirm the following:

- Confirm the sprayer location on the truck that is gated by an MVC valve. The location on the truck determines which valve should be assigned to which number on the Touchscreen Display. The numbered quick-select buttons, , on the Auto Control main page are arranged to represent a truck as viewed from the top. See Figure 9 in the INSTALLATION INSTRUCTIONS. So, it's recommended that the valves that operate the corresponding spray location be assigned to the appropriate number. For example, a valve that controls a spray installed on the front right of the truck might be assigned to number 8. Add-On valves are not pre-assigned a number, so an appropriate number needs to be configured by the installer.
- Record the serial number of each valve and the number 1-9 to which it will be assigned (see previous bullet). The valve serial number is located on the valve actuator controller. See Figure 31.

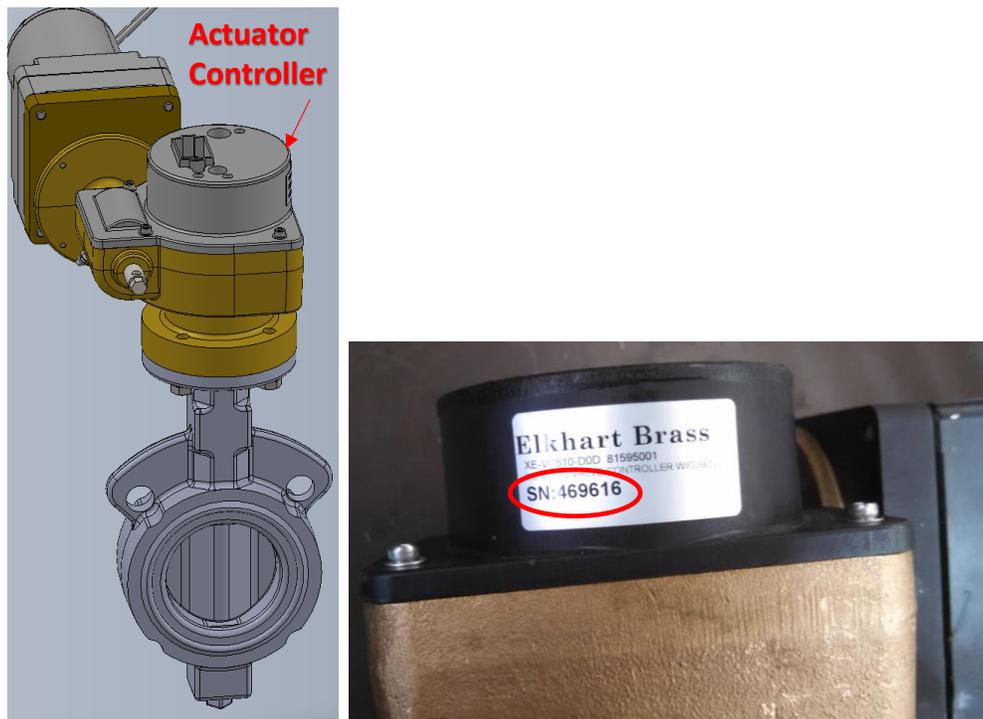


Figure 31: Valve Serial Number Location

Configure the Add-On valves using the Touchscreen Display by following these steps:

- Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).

- Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
- Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
- Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the button. The Additional Settings Configuration page will now be displayed (Figure 35).

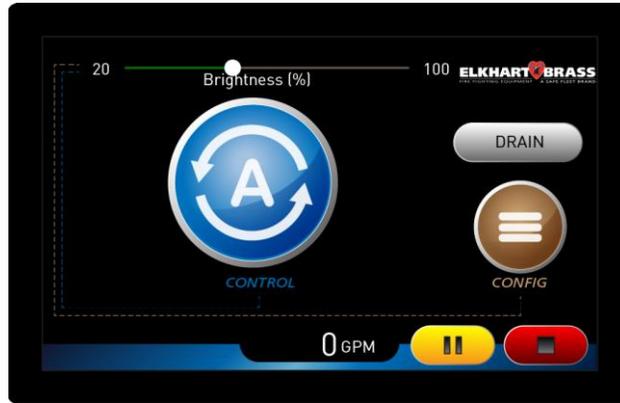


Figure 32: Home page

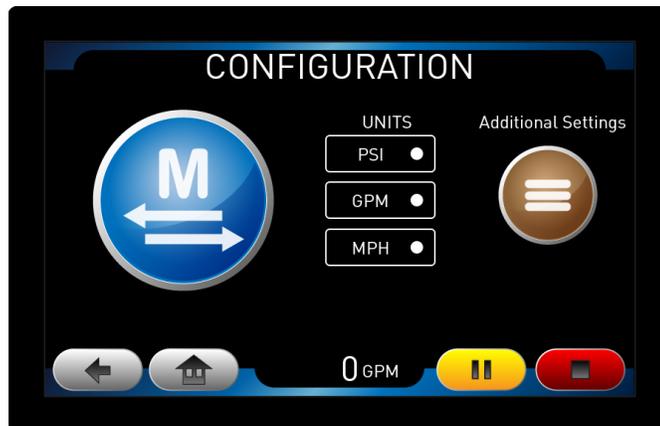


Figure 33: Main Configuration page

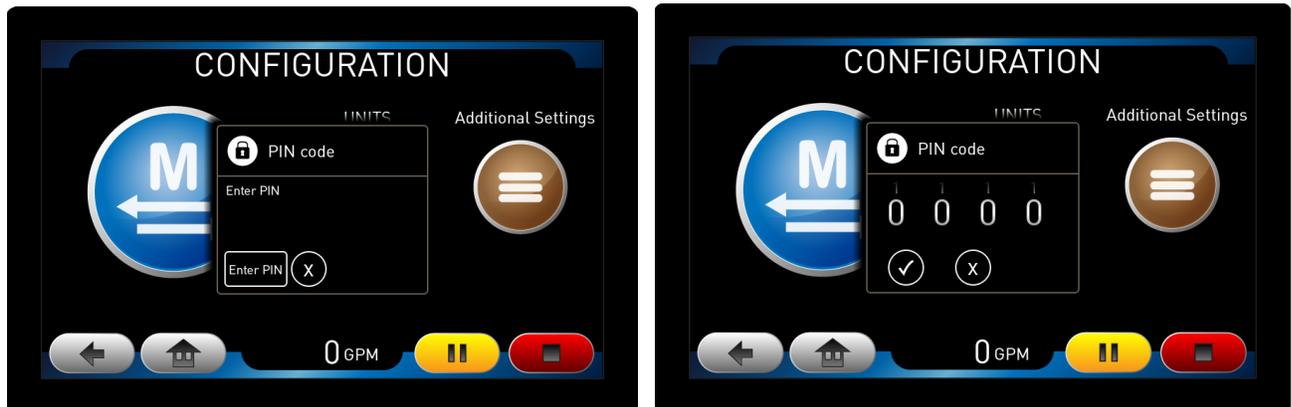


Figure 34: PIN Code dialog box

- Select the “Valves” button on the Additional Settings Configuration page (Figure 35) to get to the Valve Setup page (Figure 36).

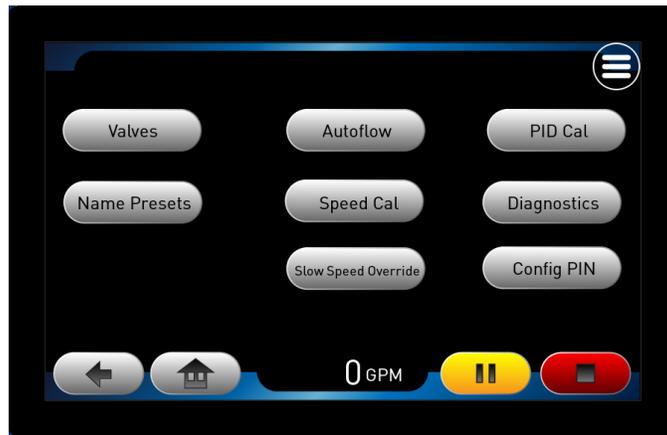


Figure 35: Additional Settings Configuration page

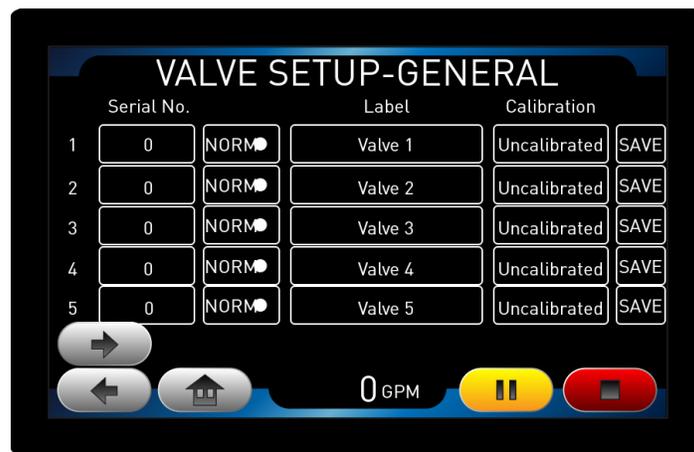


Figure 36: Valve Setup page

- On the Valve Setup page (Figure 36), fill in the information for each valve in the system. Each rectangle on this page is selectable. Descriptions of each field are described below. The numbers correspond to the numbers on the main control pages. Select the slot where you want a particular valve based on how the system was installed. Use the right arrow  button to access numbers 6-9 if desired.
 - Serial Number** - Select the Serial No. field to enter the valve serial number. See Figure 37. The valve's serial number is found on a label on the electric actuator controller (See Figure 31). Once all digits are entered, push the **ENTER** button on the displayed keypad to save the new serial number. Use the  button to return to the Valve Setup page. Confirm that the Serial No. field shows the new serial number.

Note that once the serial number is entered, but before **SAVE is pushed (next step), it is possible that an error is displayed saying that the valve is not present. This error can be dismissed for now.**
 - Save** – Once the Serial Number is entered for the valve, press the **SAVE** button for the valve number that was just completed. The field in the “Calibration” field should change to read “Calibrated” within 5 seconds after pushing the **SAVE** button. If the field does

not say “Calibrated”, try pushing the  button, again. If it still does not change, confirm that the Serial No. matches the valve serial number label. If it does match, then push the  button, again, then position calibrate the valve using the instructions located in VALVE CALIBRATION INSTRUCTIONS. If it still shows “Uncalibrated”, then troubleshoot the system wiring according to the TROUBLESHOOTING section.

- **Valve Direction** (to the right of the Serial No. column) – If the valve is supposed to be reversed, change the direction from “NORM” (normal) to “REV” (reversed). Otherwise, leave this selected as “NORM” (normal). The valve direction is based on the type of valve installed. For most valves, the direction does not need to be reversed. See the valve manual, 98311000 to determine if the valve direction should be reversed. If the

valve direction is changed, press the  button to save.

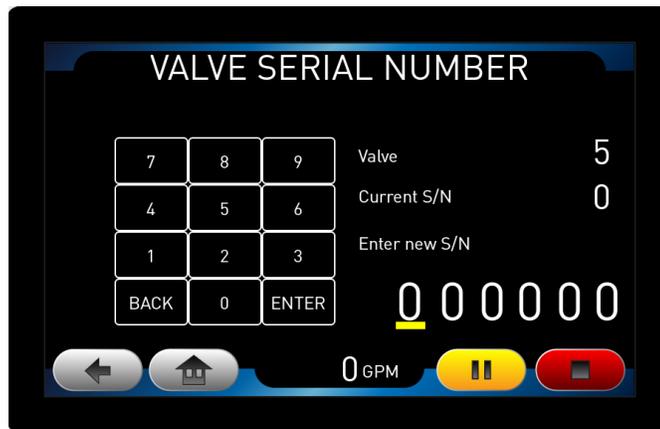


Figure 37: Valve Serial Number Entry page

- Repeat the Valve Setup for the remaining add-on valves.
- Once all valves are configured, push the  button to return to the Home page (Figure 32).
- Confirm all valves are operational.
 - Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).

- Press the  button to go to the Manual Control Main page (Figure 38).
- Use the white circle sliders to adjust the “percent open” valve positions. The slider is located beneath the particular valve’s label (“Valve 1”, “Valve 2”, etc. in Figure 38).

- Slide right = valve open
- Slide left = valve close

The green position bar will track behind the position of the white circle.

- The green position bar always indicates the valve “percent open” *actual* position.
- The white circle position indicates the valve “percent open” *commanded* position.

- Confirm that as a particular valve is commanded to open or close, that the green bar tracks to the new slider position WITH A DELAY. If the green bar does not go to the new position or if the green bar tracks without a delay, then the valve is not properly configured or wired. Troubleshoot according to the TROUBLESHOOTING section.

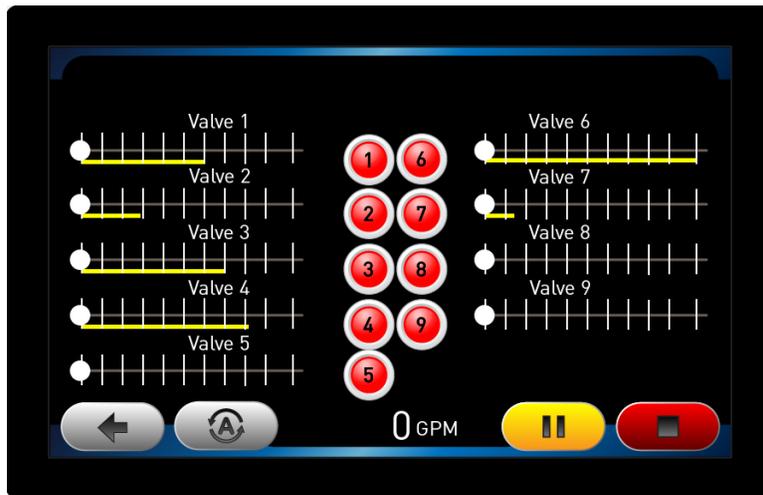


Figure 38: Manual Control Main page

Setup the Flow-by-Speed Parameters

The automatic flow control uses these parameters to regulate the water spray output (flow rate) based on the vehicle speed. This ensures proper water distribution regardless of vehicle speed. The default flow-by-speed parameters are shown in Figure 39. A description of the values is in the following instructions. If the default values are acceptable, then leave the parameters unchanged and move on to the configuration step. Otherwise, follow the instructions below to change the values.

- Turn on the system. You should see the Home page (Figure 32).
- Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
- Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
- Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the button. The Additional Settings Configuration page will now be displayed (Figure 35).
- Select the “Autoflow” button on the Additional Settings Configuration page (Figure 35) to get to the Flow-by-Speed Parameters page (Figure 39).

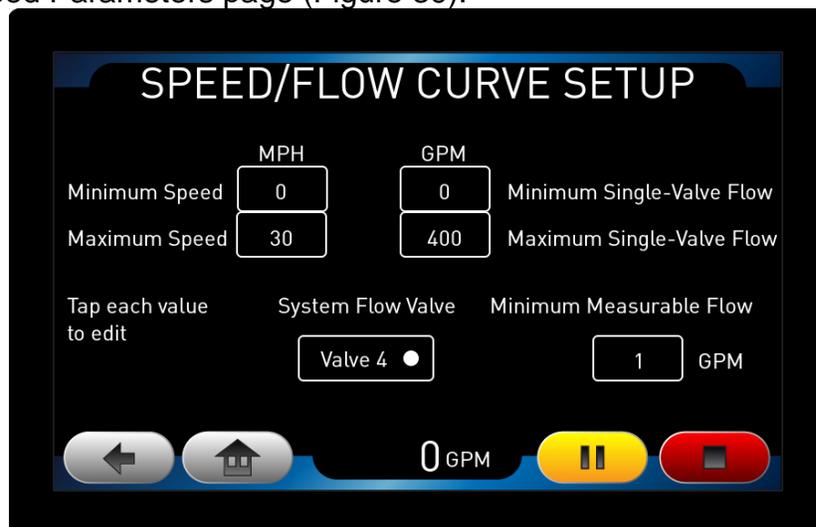


Figure 39. Flow-by-Speed Parameters page

Each value with a white rectangle can be changed by touching that value. When a value is pressed, use the displayed keypad to enter all of the digits. If you need to back up to a previous digit, use the **BACK** button. Once all digits are entered, push the **ENTER** button on the displayed keypad to save the new value. Use the  button to return to Flow-by-Speed Parameters page (Figure 39).

Configure the Flow-by-Speed points as follows:

- Enter the vehicle's Minimum Speed for which to spray water in Automatic Control mode. If the vehicle travels slower than this speed with Automatic Control mode engaged, then the target flow rate will be zero (0).
- Enter the Minimum Single-Valve Flow rate desired for when the vehicle is traveling at the Minimum Speed. The flow rate value entered is used when a single valve is selected in Automatic Control mode. When two (2) or more valves are used for Automatic Control mode, the Single-Valve Flow rate value is multiplied by the number of valves in use to determine the total target flow for the Automatic Control mode session. So, for example, if the vehicle is traveling at the Minimum Speed and the Minimum Single-Valve Flow rate is 100 GPM and 3 valves are selected for operation, the target flow will be approximately 300 GPM (100 GPM * 3 valves). (Note that the target flow may not be exactly this value in this scenario due to filtering/rounding in the Auto flow control algorithm).
- Enter the vehicle's Maximum Speed⁹ for which to spray water in Automatic Control mode. This just has to be a second speed point, greater than the Minimum Speed, for which the desired single-valve flow rate is known. If the vehicle travels faster than this speed with Automatic Control mode engaged, then the target flow rate will automatically be increased in proportion (up to the pump capacity).
- Enter the Maximum Single-Valve Flow rate desired for when the vehicle is traveling at the Maximum Speed that was previously entered. The flow rate value entered is used when a single valve is selected in Automatic Control mode. When two (2) or more valves are used for Automatic Control mode, the Single-Valve Flow rate value is multiplied by the number of valves in use to determine the total target flow for the Automatic Control mode session.
- Enter the Minimum Measureable Flow rate: this is the minimum flow rate value that will be reported from the flow sensor. Any reported flow rate less than this will be displayed as 0. Thus, this parameter can also be used to eliminate false flow readings due to sensor movement when no water is actually being sprayed.
- Confirm System Flow Valve: if the flow sensor is connected to a valve numbered different from what's displayed on the Flow-by-Speed page, then select the correct valve number.

Calibrate the Speed Sensor

Note: Two people are recommended for speed sensor calibration: one person to safely drive the vehicle and the other to ride in the vehicle and calibrate the speed sensor.

Speed sensor calibration may be necessary to adjust for variations due to its mounting location and angle. The MVC system may work all right without performing speed sensor calibration, but the speed reported by the MVC may be different from that reported from the vehicle's speedometer.

Calibration is done by driving the vehicle at two different speeds. Speed can be calibrated once the speed sensor, speed signal conditioner, and touchscreen have been installed and wired.

⁹ The MVC system accurately acquires vehicle speed up to 30 MPH (48 KPH). The MVC's automatic water control may be ineffective for speeds greater than 30 MPH (48 KPH).

Decide on two speed points for calibration: a low speed point and a high speed point. During calibration the vehicle will have to be driven at each of these speeds. Typically, these speeds would be the slowest and fastest speeds during which Auto Control would be used¹⁰. If it is not safe or practical to drive the vehicle at these speeds for calibration, different speeds can be used. The MVC will extrapolate/interpolate for other speeds based on the speeds used for calibration.

To get to the Speed Calibration setting in the touchscreen:

- Power up the system. You should see the Home page (Figure 32).
- Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
- Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
- Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
- Select the “Speed Cal” button on the Additional Settings Configuration page (Figure 35) to get to the Vehicle Speed Calibration page (Figure 40).

To Calibrate Speed:

1. If the speeds now shown on the touchscreen’s Vehicle Speed Calibration page (Figure 40) are fine to use for calibration, move on to step 2. Otherwise, select the two speeds at which the vehicle will be driven to calibrate the speed sensor by pressing the white-rectangle button that contains the speed value in the Speed column. This will take you to a screen that looks like

Figure 41. Use the  and  buttons to change the speed value. Once complete for one value, push the  to save the value. If you want to discard any changes, press the 

button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page.

Now, modify the other speed value in a similar fashion. Keep in mind the following:

- a. The Low value must be set less than the High value.
 - b. The units for the speed values are the same as what is set on the Main Configuration page (Figure 33).
2. Drive the vehicle to maintain its speed the same as the Low speed value. While maintaining vehicle speed, press the “Set” button that is to the right of the Low speed value.
 3. Drive the vehicle to maintain its speed the same as the High speed value. While maintaining vehicle speed, press the “Set” button that is to the right of the High speed value.

(The Reset button on the Vehicle Speed Calibration page can be pressed to change the speed sensor calibration back to its default values).

¹⁰ The MVC system accurately acquires vehicle speed up to 30 MPH (48 KPH). The MVC’s automatic water control may be ineffective for speeds greater than 30 MPH (48 KPH).

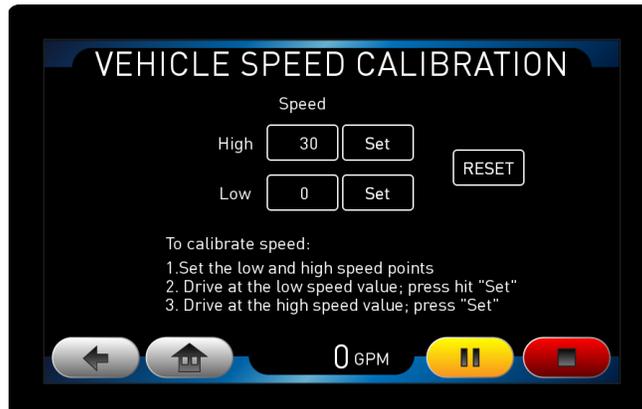


Figure 40. Vehicle Speed Calibration page

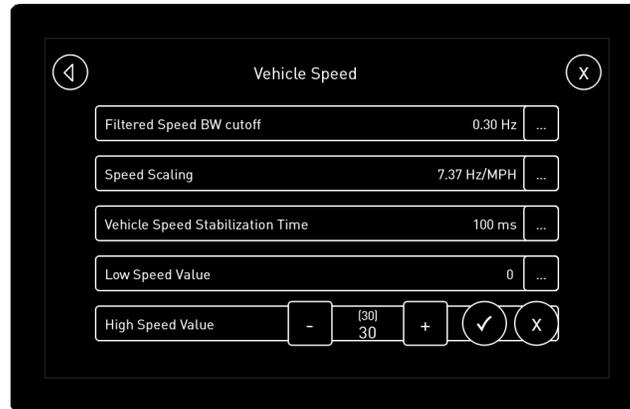


Figure 41. Adjusting Speed Calibration Values page

Set the System Date and Time

The date and time need to be set to accurately save system diagnostic and troubleshooting information in the touchscreen. The date and time are stored with a description of errors/warning are stored in the event logs for post-analysis. If a date/time is not set, an error dialog will continually be displayed at system start-up. Instructions for setting the date/time are below.

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Preferences” by touching the bottom white-outlined bar on to get to the Preferences configuration page (Figure 43).
7. Select “Date/Time” by touching the middle white-outlined bar on to get to the Date/Time configuration page (Figure 44)

8. Select the Date by touching on one of the date values. Use the  and  buttons to change the Year, Month, and Day. Push the  to save the value. If you want to discard a change, press the  button next to the value being modified.
9. Select the Time by touching on one of the date values. Use the  and  buttons to change the Hour and Minute. Push the  to save the value. If you want to discard a change, press the  button next to the value being modified.
10. Once complete, touch the  button in the upper right of the screen to exit to The Additional Settings Configuration page (Figure 35).
11. Push the  button on the touchscreen to return to the Home page (Figure 32).



Figure 42. System configuration page



Figure 43. Preferences configuration page

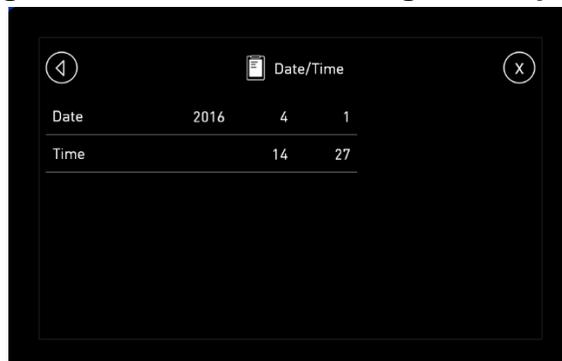


Figure 44. Date/Time configuration page

Change Config Menu Passkey

It is important to change the Passkey (PIN) from the default settings. Changing it from the default will prevent unauthorized personnel from making modifications that could cause the MVC to malfunction. The passkey used to access the Configuration Menu Additional Settings can be changed using the following steps:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the Config PIN button to display a keypad used to change the Configuration PIN (Figure 45).
6. Use the displayed keypad to enter in the new PIN code. Use the **BACK** button to return to a previous digit if needed.
7. Once all digits are entered, push the **ENTER** button on the displayed keypad to save. Use the  button to return to the Additional Settings Configuration page (Figure 35).
8. Write down the new Passkey and place it in a secure location in case the Passkey is forgotten. *If the passkey is forgotten and lost, contact your dealer for assistance.*
9. Push the  button on the touchscreen to return to the Home page (Figure 32).

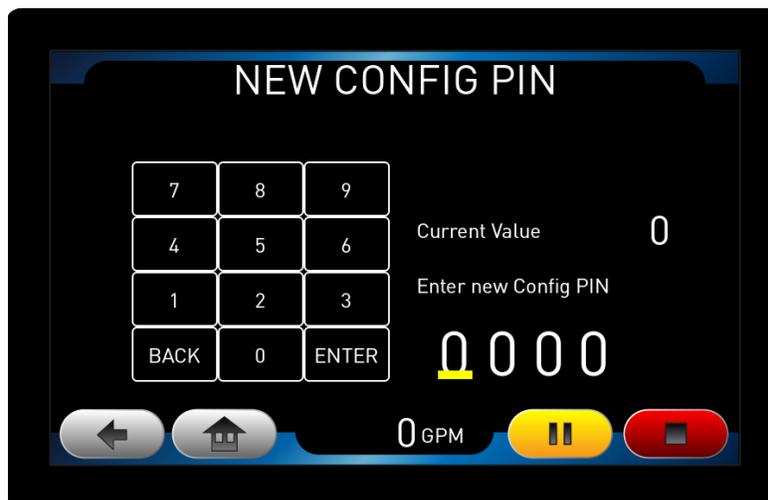


Figure 45. Change Config passkey page

CUSTOMIZATION

Units of Measurement

The displayed units of measurement can be selected among the following options (default listed first):

- Flow Rate: US Gallons Per Minute (GPM) or Liters Per Minute (LPM)
- Speed: Miles Per Hour (MPH) or Kilometers Per Hour (KPH).

When MPH is selected, the intermittent distance is set in feet. When KPH is selected, the intermittent distance is set in meters. Use the following these steps to change the units:

- Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
- Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
- In the “UNITS” column in the center of the page, select the value you want to change. A drop-down list will appear.
- Select the new value from the drop-down list.

Re-Label Valves

The descriptive text that is displayed on the Touchscreen Display valve controls during Manual operating modes or on the Valve Select page for Auto operations can be customized for the particular truck. These labels that default to “Valve 3”, “Valve 8”, etc. can be changed to more descriptive labels like “Left Rear”, “Front Spray”, etc. Changing the valve labels can be performed following these steps:

- Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
- Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
- Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
- Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
- Select the “Valves” button on the Additional Settings Configuration page (Figure 35) to get to the Valve Setup page (Figure 36).
- Each rectangle on the Valve Setup page (Figure 36) is selectable. The valve numbers correspond to the numbers on the main control pages. Find the valve that you want to re-label. Use the right arrow  button to access numbers 6-9 if desired.
- Select the Label field to display a keyboard used change the label (Figure 46). The old label needs to be deleted by pushing the backspace button  to delete the old text. Then use the displayed keyboard to enter new text. The  button can be used to switch between upper/lower-case letters. Once you have the valve label as desired, then push the  button to save your changes and go back to the Valve Setup page (Figure 36). If you do not want to save your changes, push the  button instead. Note that the  and  buttons are NOT active controls on this page. Once the Valve Setup page is displayed again, confirm that the valve label has been changed.

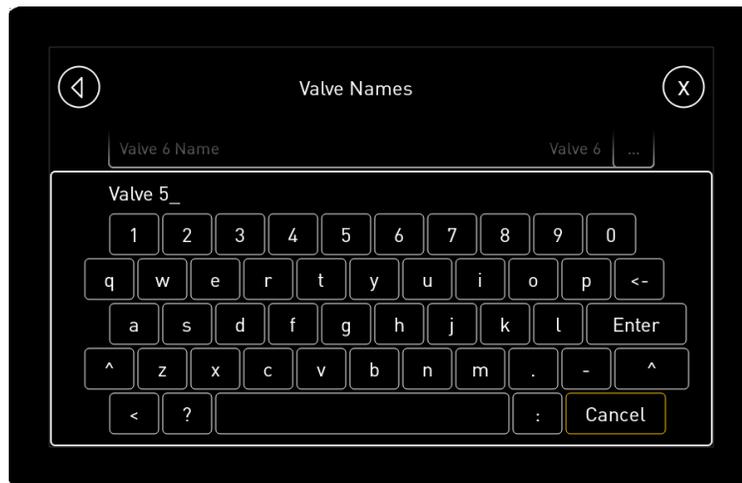


Figure 46: Valve Label Entry page

- Repeat the re-labeling for the remaining valves as desired.
- Once all valves have been configured, push the  button to return to the Home page (Figure 32).

Rename System Presets

The System Preset buttons at the side of the Auto Control page can be renamed to something more descriptive of their function. This can be done as follows:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the “Name Presets” button to get to the Name Presets page (Figure 47).
6. Select the Preset button you want to rename. This brings up a keyboard page.
7. Use the displayed keyboard to change the preset name. The existing preset name needs to be deleted by pushing the backspace button . The  button can be used to switch between upper/lower-case letters. Once you have the name as desired, then push the  button to save your changes. If you do not want to save your changes, push the  button instead. Note that the  and  buttons are NOT active controls when changing the value.
8. Select another Preset to button to change its name, or push the  button on the to return to the Home page (Figure 32)

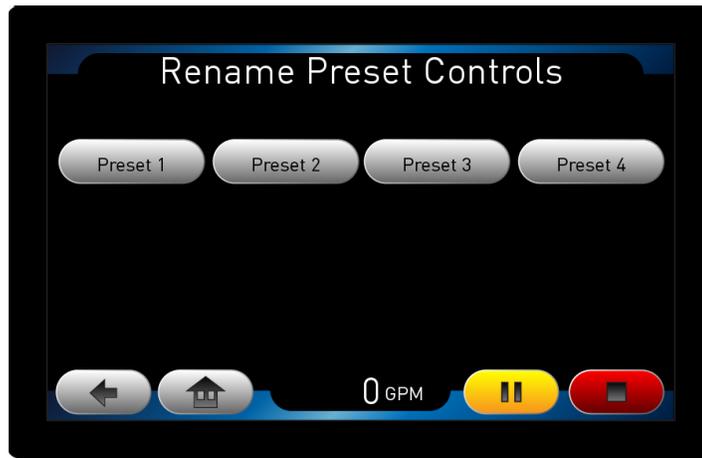


Figure 47. Name Presets page

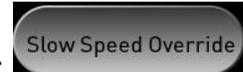
Slow Speed Override

In Auto Control mode, the MVC system closes all valves when the vehicle speed is less than 3 MPH. This prevents over-watering when the vehicle is stopped or approaching a stop. If this is not desired, it can be turned off as follows:

1. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
2. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
3. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the button. The Additional Settings Configuration page will now be displayed (Figure 35).
4. On the Additional Settings Configuration page, press the “Slow Speed Override” button:



The button will now show up on that page as depressed:



This means that in Auto Mode, the valves will continue to automatically adjust to meet the target flow rate even while the vehicle speed is less than 3 MPH.

Note that when using manual control mode, the valves go to the set positions regardless of vehicle speed or the “Slow Speed Override” button.

Re-Calibrate the Flow Sensor

The system flow sensor comes with a default calibration. So, typically re-calibrating should not be necessary. Situations where re-calibrating flow is necessary include:

1. The system flow sensor is installed in a pipe with an internal diameter different than 4 inches.
2. The enclosed manifold installation and associated plumbing is such that not all Flow Sensor Location Guidelines (Figure 6) could not be met.
3. The reported flow rates are not accurate enough.

For item #1, the flow sensor can be re-calibrated using the “Basic Method” described below. The other situations will require the “High Accuracy Method”.

There are two methods available for calibrating the flow sensor; basic and high accuracy. The basic method doesn’t require flowing water, but could have as much as a 15% error in flow. The high accuracy method requires water to be flowing.

Basic Method

- Navigate to the Valve Setup Page (Figure 36).
 - Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
 - Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
 - Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
 - Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
 - Select the “Valves” button on the Additional Settings Configuration page (Figure 35) to get to the Valve Setup page (Figure 36).
- Press the right arrow button  until the top of the screen says “VALVE SETUP - FLOW”.
- Find the row for the valve that has the system flow sensor attached. This is typically the 4th row. If it’s not shown here, press the right arrow button once more to show the remaining valves.
- Press the “Pipe Size Cal” button next to the valve that has the flow sensor installed to get to the Flow Calibration by Pipe Size page (Figure 48).
- Confirm the unit of measure (inch or millimeter), shown, then press the button that has the diameter value displayed (i.e. ). Use the  and  buttons to change the value until it matches the internal pipe diameter for the pipe that has the paddlewheel flow sensor installed. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page.
- Press the “Save” button to write the value to the valve. It is recommended to press “Save” even if the diameter value was not changed. This ensures the value shown is written to the valve that has the flow sensor attached.
- Press the Back or Home buttons to exit.

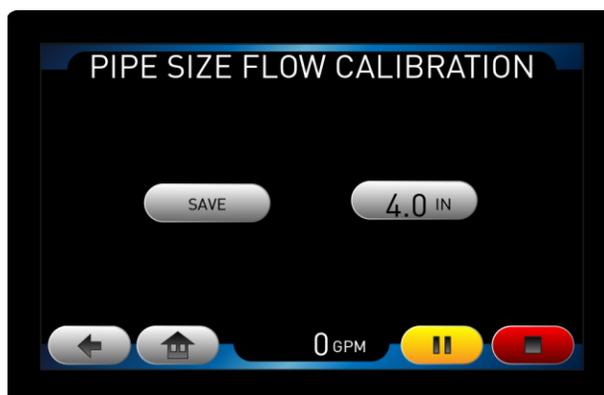


Figure 48: Flow Calibration By Pipe Size page

High Accuracy Method

To achieve a more accurate flow calibration multiple flow reference points must be entered. It corrects for nonlinear flow in difficult to plumb locations. This process requires water to be flowing and may require the vehicle to be moving depending on the pump being used. It is recommended that two or more people perform this type of calibration. A reference flow meter is also required to measure the flow of a single discharge. Elkhart Brass offers the EB-500 portable, digital flow meter.

Up to nine (9) flow reference points may be entered to accurately calibrate the flow sensor. The system will accept two (2) points minimum, however it is recommended to use as many as possible.

The calibration points must be entered in order from lowest to highest. There must be at least a 5% difference between each calibration point. If a selected calibration point is too close to the previous point, an error code will show on the display.

- Connect the reference flow meter to the discharge you plan to open for calibration. (Note that this does not have to be controlled by the same valve that has the system flow sensor attached.)
- Navigate to the Valve Setup page (Figure 36).
 - Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
 - Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
 - Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
 - Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
 - Select the “Valves” button on the Additional Settings Configuration page (Figure 35) to get to the Valve Setup page (Figure 36).
- Use the right arrow button  to navigate until the top of the screen says “VALVE SETUP - FLOW”.
- Find the row for the valve that has the system flow sensor attached. This is typically the 4th row. If it’s not shown here, press the right arrow button once more to show the remaining valves.
- Press the button in the “Multi-Point Cal” column in the row for the valve that has the flow sensor installed. This button should say “Normal”. You should now see the Multi-Point Flow Calibration page (Figure 49) that reads “Ready to Start”.
- On the drop-down selection menu (Figure 50), select the valve number that controls the water flow out of the discharge to which the reference flow meter is attached. The slider (also Figure 50) to the right of this dropdown menu will now be used to open and close the valve (0 to 100%).
- Be sure no water is flowing before starting calibration.

- Confirm that the page reads “Ready to Start”, then press the “Start” button. The page should now read “Cal in Progress”
- Start flowing water by opening the valve slightly to get the lowest flow rate possible while maintaining a regular flow pattern. Ensure no other valves are open.
- Press the button that contains a flow value on the Multi-Point Flow Calibration page to display the next Calibration value (Figure 51). Use the  and  buttons to change the value until it matches the flow value shown on the reference flowmeter. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page.
- Press the “Save” button.
- Use the touchscreen slider to open the valve a little further and increase flow. Adjust pump pressure as necessary.
- Enter the next stable flow value shown on the flowmeter the same way as previously described and press the “Save” button.
- Continue this process until all desired reference points are entered.
- Press the “Done” button once all reference points have been entered, then exit the page using the  button.
- Confirm that the button next to the valve that has the system flow sensor attached in the Multi-Point Cal column reads “Normal”. If it says “Flow Cal Error”, an invalid value was entered during the calibration process: power-cycle the system and retry the multi-point flow calibration.
- Confirm that it was correctly calibrated by flowing water at various rates and checking that the value displayed on the MVC touchscreen relatively matches the reference flowmeter.

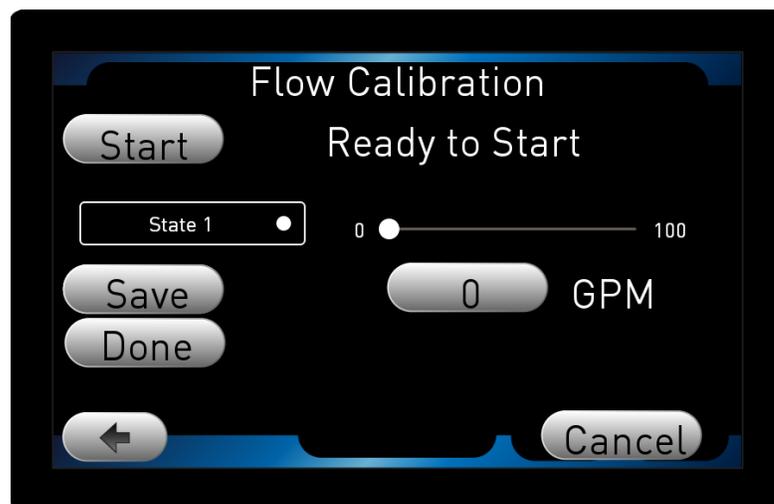


Figure 49: Multi-Point Flow Calibration page



Figure 50. Multi-Point Flow Calibration Drop-down Menu & Slider

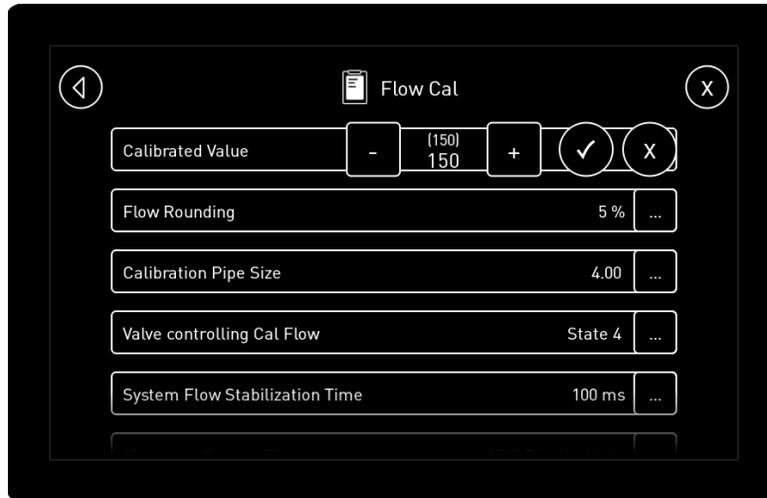


Figure 51. Flow Calibration Adjustment

Screensaver

The MVC touchscreen screensaver is disabled by default, but can be enabled if desired:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Preferences” by touching the bottom white-outlined bar on to get to the Preferences configuration page (Figure 43).
7. Select “Display” to get to the screensaver settings (Figure 52)
8. Use the “Timeout” +/- adjustment to change the idle time (number of seconds) before the screensaver dims the screen.

9. Use the “Dimmed light” +/- adjustment to change the percentage that the backlight is dimmed when the screensaver starts. For example, if the Backlight is currently set to 80% during operation and the “Dimmed light” is set to 50%, then the Backlight will be reduced to 40% when the screensaver is running.
10. Once complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
11. Push the  button on the touchscreen to return to the Home page (Figure 32).

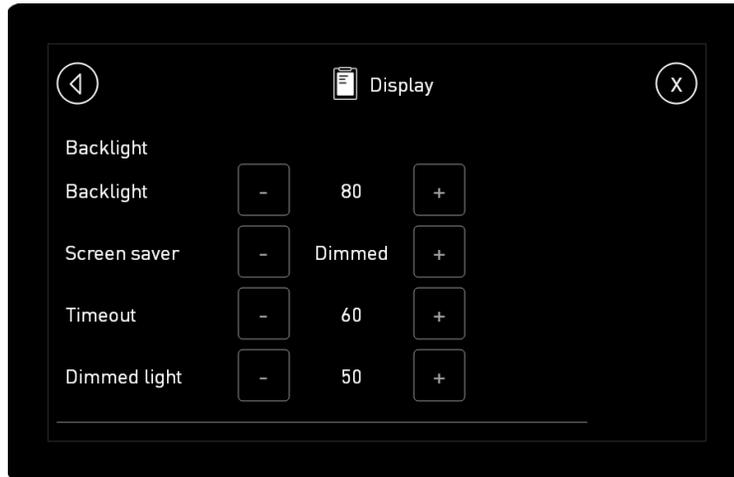


Figure 52. Display configuration page

Valve Position Deadband

The MVC system does not attempt to change a valve’s percent-opened position if the valve is within +/- the Valve Position Deadband. This deadband is used to keep the valve motors from unnecessarily moving when the valve is close enough to the desired position. This helps increase motor life. If the MVC is not opening the valve close enough to the desired position to get the flow rate needed, the deadband can be reduced to get better precision. Conversely, if the valve motor is continually moving (when not in interval operations mode), the deadband can be increased to reduce motor movement. Change the Valve Position Deadband as follows:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Adjust”, then select “Auto Flow” to show the Auto Flow parameters (Figure 53).
7. Select “Valve Position Deadband”.

8. Use the  and  buttons to change the Valve Position Deadband %. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page's upper corners are NOT active controls on this page.
9. Once complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
10. Push the  button on the touchscreen to return to the Home page (Figure 32).

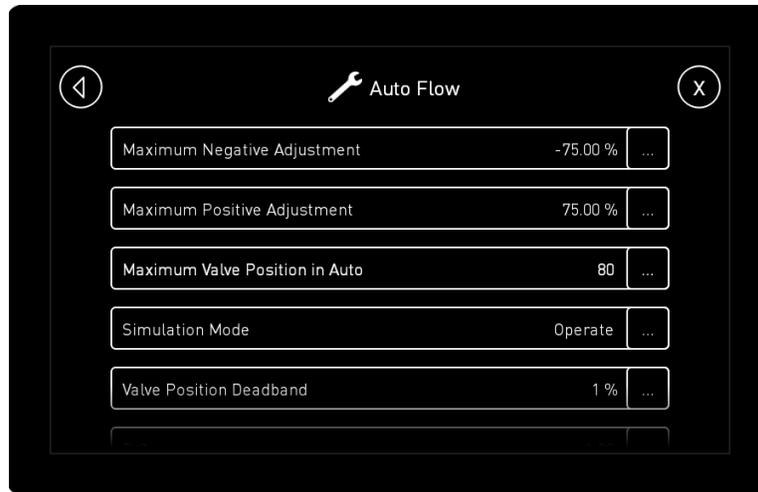


Figure 53. Auto Flow Additional Settings page

Maximum Valve Position in Auto Control Mode

The MVC system does not normally open the valves completely because normally a 100% open valve would cause too much water from a single spray head or cause the valve to not fully close if intermittent auto operations are used. However, it may become necessary to adjust the maximum amount that the valve is allowed to open to get more water at the maximum.

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Adjust”.
7. Select “Auto Flow” to show the Auto Flow related adjustment parameters (Figure 53).
8. Select “Maximum Valve Position”.

9. Use the  and  buttons to change the Maximum Valve Position %. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page's upper corners are NOT active controls on this page while the value is being modified.
 - a. If the valves are not opening far enough in Auto Control mode, then make this value larger.
 - b. If the valves are not fully closing during interval operations, make this value smaller.
10. Once complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
11. Push the  button on the touchscreen to return to the Home page (Figure 32).

Maximum Valve Position in Auto Control Mode

The MVC system does not normally close the valves completely when running in *intermittent* Auto mode because normally with the valves fully stop water flow at 10% open. So, by not fully closing, the system reduces wear on the valves and makes intermittent operations possible at faster speeds. However, it may become necessary to adjust the minimum amount if the valves are not fully stopping water flow. (Note that manual control mode allows the valves to fully close regardless of this setting).

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Adjust”.
7. Select “Auto Flow” to show the Auto Flow related adjustment parameters (Figure 53).
8. Select “Minimum Valve Position”.
9. Use the  and  buttons to change the Minimum Valve Position %. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page's upper corners are NOT active controls on this page while the value is being modified.
 - a. If the valves are not fully closing during interval operations, make this value smaller.
10. Once complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
11. Push the  button on the touchscreen to return to the Home page (Figure 32).

Maximum Flow Rate

The MVC uses a maximum flow rate to scale the flow bar graphs on the auto-flow screen. This maximum flow defaults 1200 GPM (4542 LPM). This maximum flow can be changed to be change to represent the maximum capacity of the particular water truck using the following steps:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Adjust”.
7. Select “Flow Cal” to show the Flow Calibration related adjustment parameters (Figure 54).
8. Select “Maximum System Flow”.
9. Use the  and  buttons to change the Maximum System Flow (in display units). Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page while the value is being modified.
10. Once complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
11. Push the  button on the touchscreen to return to the Home page (Figure 32).

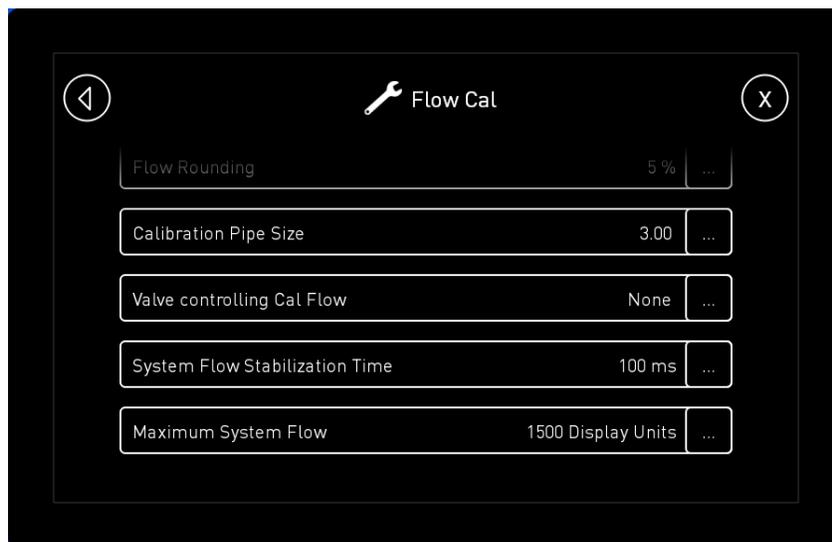


Figure 54. Flow Cal Additional Settings page

Positive/Negative Adjustment in Auto Control Mode

To change the maximum flow adjustment allowed during auto-flow perform the following steps:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Adjust”.
7. Select “Auto Flow” to show the Auto Flow related adjustment parameters (Figure 53).
8. Select “Maximum Negative Adjustment”.
9. Use the  and  buttons to change the maximum % amount allowed in the negative direction. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page while the value is being modified.
10. Select “Maximum Positive Adjustment”.
11. Use the  and  buttons to change the maximum % amount allowed in the positive direction. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page while the value is being modified.
12. Once changes are complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
13. Push the  button on the touchscreen to return to the Home page (Figure 32).

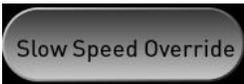
Adjusting the Auto Control Gains (Basic)

The Auto Control mode uses a feedback algorithm consisting of Proportional (P), Integral (I), and Derivative (D) gains. In some applications these parameters may need adjusted from their default values (variances in plumbing, different pumps, varying terrain, etc.). In order to get better Auto mode performance a PID Calibration may be performed for the particular system. This requires flowing water with the pump running at a typical RPM. This may require at least two people: one in the truck cab operating the touchscreen and one person watching the spray pattern, reporting the water flow characteristics to the touchscreen operator. For safety, this should be done with the vehicle not moving. If this is not possible (due to road conditions, pump-to-transmission characteristics, etc.), then a third person is needed to operate the truck.

Steps to Calibrate the PID Control:

1. If not done so already, set up the Auto-flow parameters according to the heading “Setup the Flow-by-Speed Parameters” in the CONFIGURATION & CALIBRATION INSTRUCTIONS section.
2. Adjust the maximum system flow rate to be the max expected through the MVC valves being used for PID Control calibration. See previous customization item, “Maximum Flow Rate.
3. From the Home Page, select the  button to go the Auto Control Main page (Figure 57). Select the valves that would typically be used in Auto mode for operation. Refer to the “Auto Control Main Page” in the OPERATING INSTRUCTIONS section for how to do this. Also, be sure that the Interval “Start” button is currently toggled off.

4. Push the  button start Auto operations (which is what uses the PID loop).
5. Press the  button to return to the Home Page.
6. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
7. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
8. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).

9. Verify on this page that the  button is depressed. If it is not, push it to toggle it active. This button allows the valves to open while the vehicle is not moving.
10. Press the button labeled “PID Cal” to access the PID Loop Calibration page. (Figure 55).
11. Slide both sliders on this page all the way to the left (0.00) to initialize both P and I gains to 0.
12. Press the “Calibrate” button. This will set the target flow to 50% of the maximum flow available for the selected valves. (Maximum flow is based on the Auto-flow parameter settings). (STEP 1 on the PID Loop Calibration page).
13. Starting with the slider all the way left (0.00), slowly increase the P gain by moving the slider right until the valve starts to oscillate (continuously opening-closing-opening-closing). This can be seen another person looking at the spray pattern or by watching valve movement on the Manual Control Main page. (STEP 2 on the PID Loop Calibration page). Note: oscillation may not be close to the target flow.
14. Now, reduce the P gain to about 25% to 50% of the value in the previous step by sliding the control back to the left some. (still STEP 2 on the PID Loop Calibration page).
15. Slowly increase the I gain by sliding its slider to the right until the measured flow matches the target flow. (STEP 3 on the PID Loop Calibration page).
16. Press the “Calibrate” button again on the PID Loop Calibration page to complete calibration. Water may still be flowing if the vehicle is moving.
17. Push the  button to go back to the Additional Settings Configuration page (Figure 35).

18. If necessary, return the  back to its original state by pressing it.
19. Press the  button to return to the Home page
20. Press the  button to stop Auto Mode operations. This will close the valves.

21. Test the system by driving the truck on typical terrain in Auto Mode (without Interval watering engaged) to see that the truck properly sprays water for various speeds. Refer to the “Auto Control Main Page” in the OPERATING INSTRUCTIONS section for how to use Auto mode.

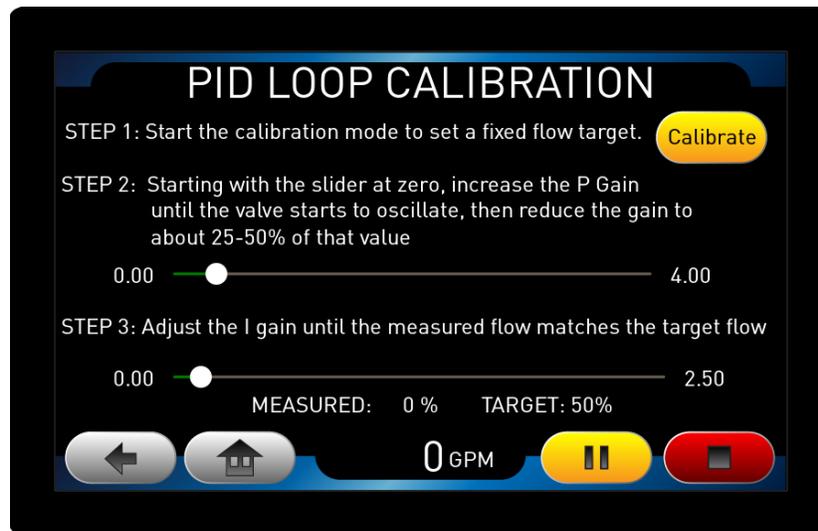


Figure 55. PID Loop Calibration page

Adjusting the Auto Control Gains (Advanced)

People knowledgeable with tuning PID control loops may adjust the gains directly for further fine tuning. The gains are adjusted as follows:

1. Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
2. Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
3. Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).
4. Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
5. Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42).
6. Select “Adjust”.
7. Select “Auto Flow” to show the Auto Flow related adjustment parameters (Figure 53).
8. Scroll down to find the “P Gain”, “I Gain”, and “D Gain” parameters.
9. Select the gain that you want to change.
10. Use the  and  buttons to change the value. Once complete, push the  to save the value. If you want to discard any changes, press the  button next to the value being modified. Note that the  and  buttons on the page’s upper corners are NOT active controls on this page while the value is being modified.

11. Once changes are complete, touch the  button in the upper right of the screen to exit to the Additional Settings Configuration page (Figure 35).
12. Push the  button on the touchscreen to return to the Home page (Figure 32).

General considerations for adjusting the gains are as follows:

- If the P and/or I gains are set too high for the particular piping/pump configuration for the vehicle, it may cause the valves to oscillate in trying to reach the target flow.
- P should be at least twice as large as I.
- If the MVC is taking too long to reach the target flow, increase the P and I. If this causes the valves to oscillate on and off, then try increasing the D just a little to smooth the reaction.

OPERATING INSTRUCTIONS

Prior to operating the MVC perform any recommended maintenance (found in the Maintenance section of this manual). Make sure no one is in dangerous proximity to the vehicle to avoid injuries when it starts.

Home

The Home page (Figure 56) is displayed when the MVC first powers up.

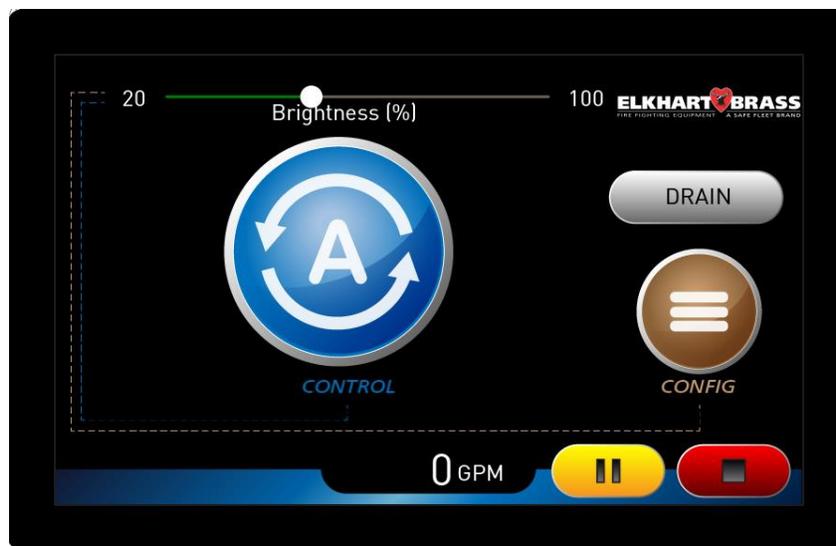


Figure 56: Home page

The MVC controls water flow through the touchscreen controls using either Automatic or Manual modes. Automatic mode is typical and preferred method of operation: it conserves water, evenly distributes water, and allows the operator to remain focused on driving. Both methods control flow by opening or closing discharge valves to a percentage of fully open. The MVC does not control the vehicle's water pump.

- Select the  button to go to the Auto Control Main page (Figure 57) to set the MVC control water flow through manual operations. This provides controls to initiate the MVC to automatically open/close valves to maintain a certain flow rate based on the vehicle's speed.
- Select the  button to go to the Main Configuration Menu page (Figure 33) to get to the Manual Control settings (control water flow through manual operations) or to modify the MVC system settings.

The slider  on the top of the Home page (Figure 56) controls the screen's brightness.

- Slide right will brighten the screen
- Slide left will dim the screen.

The screen always defaults to 50% brightness on power-up.

The buttons on the bottom of the Home page (Figure 56) perform the following functions:

- Select the Pause/Resume button  /  to
 - Close all valves, but remember the valve control settings (when Pause  is selected).
 - Resume valve control as it was before it was paused (when Resume  is selected)
 - If Auto Control was running before being paused, then the Auto control will resume. (Refer to Auto Control Main in the Operating Instructions section).
 - If the valves were set to particular “percent open” positions in Manual mode, they will be commanded back to those positions.
- Select the Stop  button to close all valves and clear the current valve control settings. (Position presets are still saved and can be recalled again through the appropriate preset button).

The current total system water flow rate is also displayed at the bottom of the page .

In freezing climates, be sure to push the  button on the Home page to set all valves to partially opened for draining the valves when parking the vehicle for an extended period.

Auto Control Main

The MVC touchscreen display can automatically control water flow by monitoring vehicle speed and adjusting valve position to continuously maintain a desired flow rate through the Auto Control Main page.

From the Home page Figure 56, select the  button to go to the Auto Control Main page. (Figure 57).

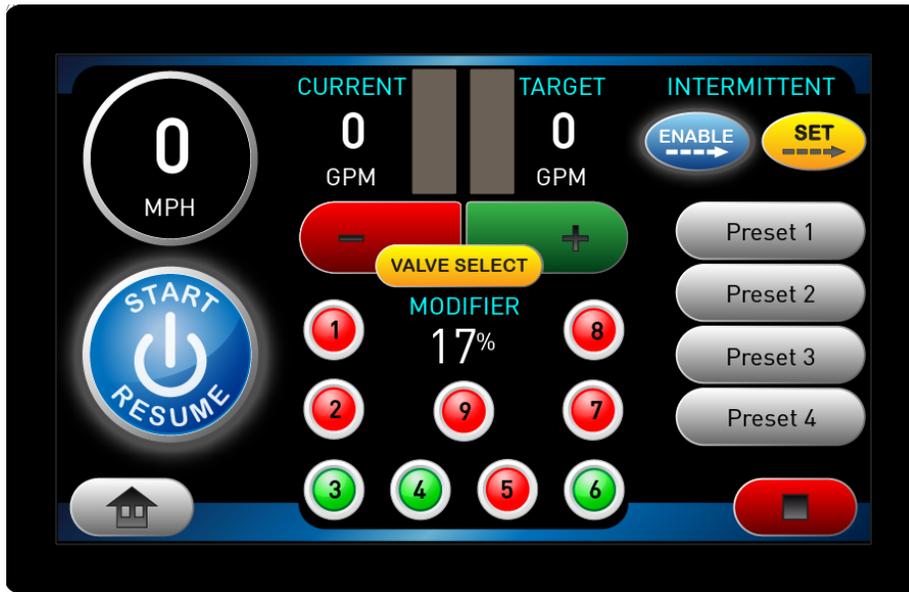
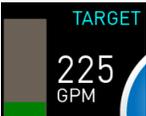


Figure 57: Auto Control Main page

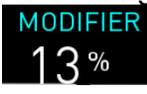
The current vehicle speed is shown in the Speed Circle on the left side of the page. The current total water flow rate from the vehicle is shown as a number under the “Current” heading

and as graphical representation on the bar graph to the right of the number . The portion of green on the bar indicates relatively how much water is flowing. The more it’s green, the more water is flowing. (The maximum corresponds with the maximum value set in the configuration settings. Refer to the Configuration section for more details.)

The target water flow rate that the MVC touchscreen controller is trying to achieve is shown as a number under the “Target” heading and as graphical representation on the bar graph to the left of the

number . The portion of green on the bar indicates relatively how much water is desired. The more it’s green, the more water is desired. (The maximum corresponds with the maximum value set in the configuration settings. Refer to the Configuration section for more details.)

The target water flow is based on speed, number of valves currently in use for Auto Control, the percent modifier, and the Auto Flow configuration settings. Auto Flow configuration settings are

changed through the Configuration screen. The percent modifier  is applied to the Auto Flow configuration settings to allow the operator to adjust for the particular dust conditions of the moment. This modifier can be positive or negative.

Before automatic operations can begin, select the valves to control automatically. It may be that not all valves are desired to be used for automatic flow control. The numbered red/green/gray circles 

  around the Modifier indicate which valves are currently selected for automatic control. Tapping on a red/green will select or deselect the particular valve (toggles between red and green).

-  Red indicates the valve is not currently selected for Auto Control operations.

-  Green indicates the valve is currently selected for Auto Control operations.
-  Gray indicates that valve is not available (not installed or communication is lost).

Alternatively, press the  button to go to the Valve Select page (Figure 58). This page provides bigger switches for enabling or disabling valves.



After valves are selected for automatic operations, the Auto Start/Resume button  on the left of the screen is used to start and stop automatic operations.

Intermittent watering is another option in Auto Control mode. As the vehicle travels, this option will automatically start/pause Auto Control mode based on how far the vehicle has traveled. This will produce strips of wet/dry areas across the travel route. To use intermittent watering, first set up the distance the vehicle will travel for a single wet patch. Press the  button to go to the configuration option to adjust this distance. This distance is also used for a single dry patch (and the

alternating wet/dry areas that follow). Finally, press the  button to enable the interval

operations (the button will now show up as depressed with a green border ). Watering will not start until the Auto Start/Resume button is pressed (see the next paragraph). To turn off interval

watering, press the  button. (The button will return to its original state: ).

Select the valves to be used for automatic operations, then initiate automatic operations by pressing

the Auto Start/Resume button . The Auto Start/Resume button will then change to .

-  indicates that automatic controls are not currently running. Pressing the button will start Automatic operations.
-  indicates that automatic controls are currently running Pressing the button will stop Automatic operations.

When automatic control is initiated, the target water flow rate will increase as the vehicle's speed increases and decrease as the vehicle speed decreases. The change is linear. Refer to the CONFIGURATION & CALIBRATION INSTRUCTIONS for Setting up the Flow-by-Speed parameters. The MVC will then automatically open/close the selected valves to meet and maintain the target flow. This allows the MVC to provide even water distribution regardless of vehicle speed¹¹.

¹¹ The MVC system accurately acquires vehicle speed up to 30 MPH (48 KPH). The MVC's automatic water regulation may be ineffective for speeds greater than 30 MPH (48 KPH).

Automatic control can be easily stopped in several ways:



- Press the  button. It will change from green back to .
- Press the red Stop  button at the bottom of the screen (this will also clear selected valves).
- Use manual valve controls through the touchscreen to move any of the valves.

The MVC has several Auto presets . Each Auto preset allows a pre-defined group of valves to be selected for Auto flow with a single touch. Before an Auto preset can be initiated it must be set. Follow these steps to set an Auto preset:

1. Select the valves to use for Auto flow as described above. (Auto mode can be running or paused).
2. Press the desired Auto preset button, hold it until a dialog box pops-up stating that the preset has been saved. (The button press for saving is approximately 10 seconds). Release the preset button and dismiss the dialog box. This saves the Auto preset.

Once an Auto preset is saved, it can be recalled by pressing the appropriate Preset button on the Auto Control Main page. Selecting this button selects the same group of valves to be used for auto flow as was saved. Pushing the preset does not start Auto flow: this still needs to be done by pushing



The buttons on the bottom of the Auto Control Main page (Figure 57) perform the following functions:

- Select the  button to go to the Home page.
- Select the Stop  button to close all valves and clear the current valve control settings. (Presets are still saved and can be recalled again through the appropriate preset button).

Valve Select

The valves to be used for automatic operations can be selected using switch soft-controls on the

Valve Select page (Figure 58). Press the  button on the Auto Control Main page (Figure 57) to access the Valve Select page (Figure 58).

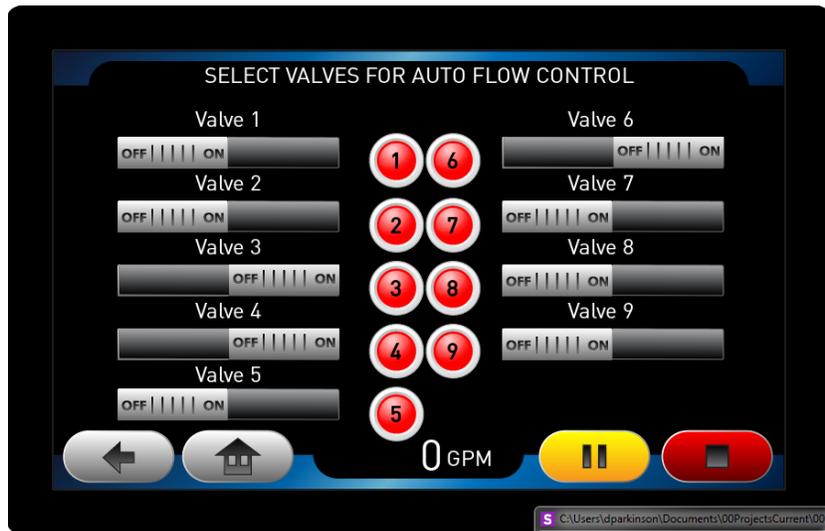


Figure 58: Valve Select page

Tap on the particular switch  to enable or disable a valve. The switch will move left or right.

- Right (ON) = valve is selected for automatic flow control
- Left (OFF) = valve is not selected for automatic flow control

The numbered red/green/gray circles    indicate which valves are currently selected for automatic control. Pressing one of these circles does nothing on this screen

-  Red indicates the valve is not currently selected for Auto Control operations.
-  Green indicates the valve is currently selected for Auto Control operations.
-  Gray indicates that valve is not available (not installed or communication is lost).

The buttons on the bottom of the Valve Select page (Figure 58) perform the following functions:

- Select the  button to go back to the Auto Control Main page (Figure 57).
- Select the  button to go to the Home page (Figure 56).
- Select the Pause/Resume   button to
 - Close all valves, but remember the valve control settings (triggered when you touch ).
 - Resume valve control as it was before being paused (triggered when you touch )
 - If Auto Control was running before being paused, then the Auto control will resume. (Refer to Auto Control Main in the Operating Instructions section).
 - If the valves were set to particular “percent open” positions using Manual mode, they will be commanded back to those positions.
- Select the  button to close all valves and clear the current valve control settings. (Presets are still saved and can be recalled again through the appropriate preset button).

The current total system water flow rate is also displayed at the bottom of the page. 

Manual Control Main

Manual flow control allows the operator to set each valve’s “percent open” position to regulate flow.

- From the home page, Press the “CONFIG”  menu button to get to the Main Configuration page (Figure 59).
- Press the  button to go to the Manual Control Main page. (Figure 60).

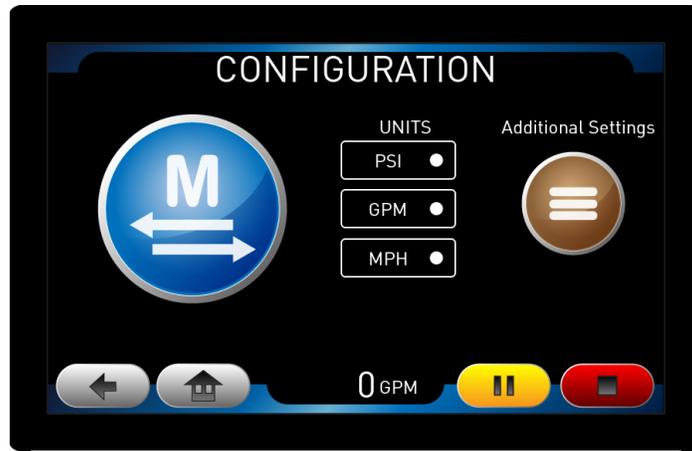


Figure 59: Main Configuration page

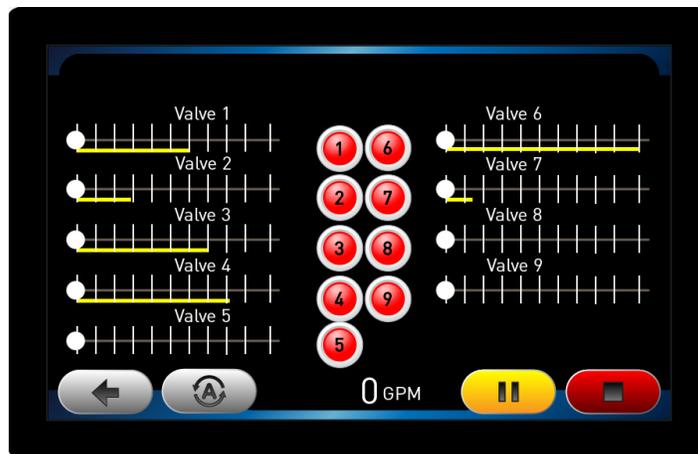
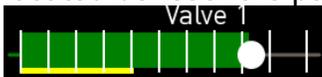


Figure 60: Manual Control Main page

Use the white circle sliders  to quickly adjust the “percent open” valve positions. The slider is located beneath the particular valve’s label (“Valve 1”, “Valve 2”, etc. in Figure 60).



- Slide right = valve open
- Slide left = valve close

The green position bar will track behind the position of the white circle.

- The green position bar always indicates the valve “percent open” *actual* position.
- The white circle position indicates the valve “percent open” *commanded* position.

It takes seven to eight seconds for a valve to open from 0 to 100 percent or close from 100 to 0 percent.

Finer valve position adjustments or individual position preset settings are done on the Manual Control Detail page (Figure 61). Select the red/green circle    next to a valve slider to access the valve's Manual Control Detail page. A gray circle also indicates which valves are currently "online".

-  Red indicates the valve is not currently selected for Auto Control operations.
-  Green indicates the valve is currently selected for Auto Control operations.
-  Gray indicates that valve is not available (not installed or communication is lost).

A valve's saved individual position preset is signified by the yellow bar beneath the green position bar for a given valve. The individual position preset is set and recalled through the valve's Manual Control Detail page (Figure 61).



The buttons on the bottom of the Manual Control Main page (Figure 60) perform the following functions:

- Select the  button to go back to the previous page.
- Select the  button to go to the Auto Control Main page.
- Select the Pause/Resume   button to
 - Close all valves, but remember the valve control settings (triggered when you touch ).
 - Resume valve control as it was before being paused (triggered when you touch ).
 - If Auto Control was running before being paused, then the Auto control will resume. (Refer to Auto Control Main in the Operating Instructions section).
 - If the valves were set to particular "percent open" positions using Manual mode, they will be commanded back to those positions.
- Select the  button to close all valves and clear the current valve control settings. (Presets are still saved and can be recalled again through the appropriate preset button).

The current total system water flow rate is also displayed at the bottom of the page. 

Manual Control Detail

On the Manual Control Main page, select the red/green circle   next to a valve slider to access the valve's Manual Control Detail page (Figure 61). Note that only valves with a green circle  are actually able to be controlled.

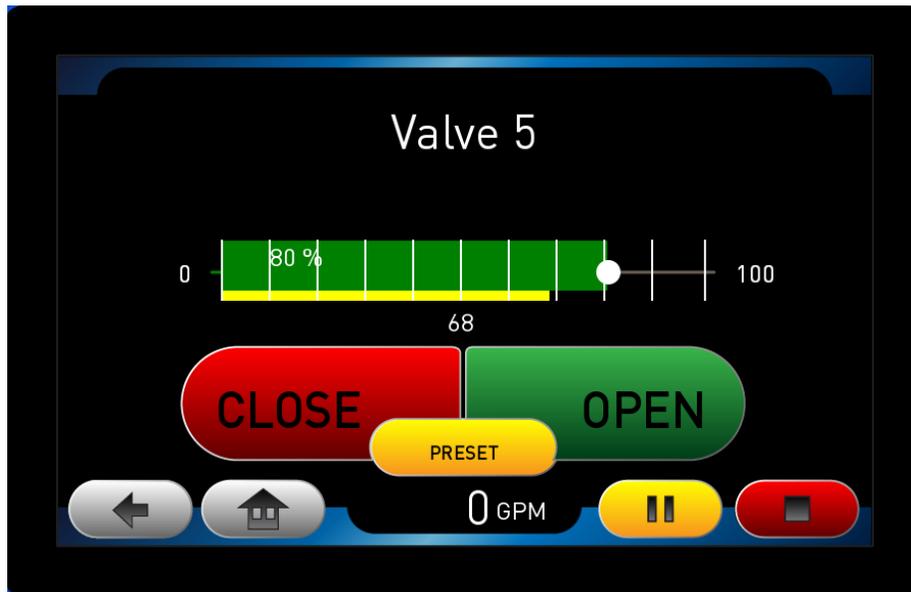
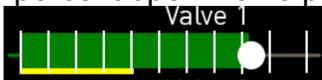


Figure 61: Manual Control Detail page

The slider in the middle of Manual Control Detail page (Figure 61) operates like the valve's slider on the Manual Control Main page (Figure 60). Use the white circle slider  to quickly adjust the "percent open" valve position.



- Slide right = valve open
- Slide left = valve close

The green position bar will track behind the position of the white circle.

- The green position bar always indicates the valve "percent open" *actual* position.
- The white circle position indicates the valve "percent open" *commanded* position.

It takes seven to eight seconds for a valve to open from 0 to 100 percent or close from 100 to 0 percent.

A valve's saved individual position preset is signified by the yellow bar beneath the green position bar for a given valve.

The numbers associated with the slider and yellow/green position bars mean the following:

- Number on the slider or green bar indicates "percent open" *commanded* position.
- Number below bar indicates the valve individual *preset* position.

Press the red CLOSE or green OPEN button to fine tune the valve's position:



- Press and hold the button to gradually change the desired position. Release when it is at the desired position.
- Tap the button once to change the desired position by 1%.
Note that the valve may not move with a single tap due to the "deadband" control algorithm. Two or three taps may be necessary depending on the particular configuration settings.

The valve's individual position preset is set and recalled through the  button. The valve's individual position preset allows a valve to be moved to a pre-defined position with a single button

press. Before a position system preset can be initiated it must be set. Follow these steps to set a system preset:

1. Set the valve to the desired “percent open” position using the white circle slider  or   buttons.

2. Press the  button in the middle of the Manual Control Detail page, hold it until the yellow bar beneath the slider moves to the set position (about 10 seconds).



Now, release the  button. This saves the valve’s individual position preset.

Once an individual position preset is saved, it can be recalled by pressing the  button in the middle of the Manual Control Detail page. Selecting this button commands the valve to go back to the “percent open” position it was in when the preset was saved.

The buttons on the bottom of the Manual Control Detail page (Figure 61) perform the following functions:

- Select the  button to go back to the Manual Control Main page (Figure 60).
- Select the  button to go to the Home page (Figure 56).
- Select the Pause/Resume   button to
 - Close all valves, but remember the valve control settings (triggered when you touch ).
 - Resume valve control as it was before being paused (triggered when you touch )
 - If Auto Control was running before being paused, then the Auto control will resume. (Refer to Auto Control Main in the Operating Instructions section).
 - If the valves were set to particular “percent open” positions using Manual mode, they will be commanded back to those positions.
- Select the  button to close all valves and clear the current valve control settings. (Presets are still saved and can be recalled again through the appropriate preset button).

The current total system water flow rate is also displayed at the bottom of the page.



MVC TOUCHSCREEN CONTROL ICON REFERENCE

Table 1. Home Page Icon & Button Reference

Control	Function
	Go to Automatic Control screen (Press button)
	Go to Configuration Settings (Press button)
	Change Display Brightness (Slide white dot left or right)
	Set all valves to partially opened for draining valves (Press button) <ul style="list-style-type: none"> • A pressed button icon indicates valves are currently opened for draining • Un-pressed button icon indicates valves are not in draining position.
	Current system flow rate out. (info only)
	Pause/Resume programmed control. (Press button) Closes all valves. Commanded valve positions and auto-command settings restarted after resume.
	Stop. (Press button) Closes all valves. Commanded valve positions and auto-command settings cleared.

Table 2. Auto Control Page Icon Reference

Control	Function
	Activate Auto Control preset (Press button) Or save current valve selections as Auto Control preset by pressing for 10 seconds.
	Displays current speed that is reported from the speed sensor. (info only)
	Press to select or deselect valve for use in auto operations <ul style="list-style-type: none"> • Green indicates currently selected • Red indicates not currently selected • Gray indicates not available
	Current system flow rate out. (info only) Bar graph is relative to maximum flow rate capacity.
	Target flow rate based on the speed and number of valves selected for Auto Control. (info only) Bar graph is relative to maximum flow rate capacity (1200 default)
	Press to start/pause valve Auto Control. Green indicates Auto Control is active and the touchscreen is automatically adjusting selected valves to achieve the target flow.
	Shows modifier applied to the configured target flow rate settings for the current Auto Control session. (info only)
	Press to decrease the target flow rate modifier percent

Table 2. Auto Control Page Icon Reference

Control	Function
	Press to increase the target flow rate modifier percent
	Go to Valve Select screen (Press button)
	Go to the configuration option to adjust distance (feet) for the wet strip of intermittent.
	Press to start/stop intermittent watering. <ul style="list-style-type: none"> Depressed with green ring indicates interval watering in progress Not depressed indicates continuous watering (no wet/dry stripping)
	Go to Home page (Press button)
	Current system flow rate out. (info only)
	Stop. (Press button) Closes all valves. Commanded valve positions and auto-command settings cleared.

Table 3. Valve Select Page Icon Reference

Control	Function
	Press to select or de-select valve for auto flow control: <ul style="list-style-type: none"> Right (ON) = valve is selected for automatic flow control Left (OFF) = valve is not selected for automatic flow control
	Shows number associated with a particular valve. (info only) <ul style="list-style-type: none"> Green indicates currently selected Red indicates not currently selected Gray indicates not available
	Go back to previous screen (Press button)
	Go to Home page (Press button)
	Current system flow rate out. (info only)
	Pause/Resume programmed control. (Press button) Closes all valves. Commanded valve positions and auto-command settings restarted after resume.
	Stop. (Press button) Closes all valves. Commanded valve positions and auto-command settings cleared.

Table 4. Manual Control Main Page Icon Reference

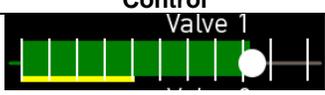
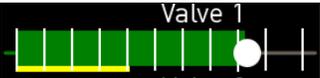
Control	Function
	Manual control for valve and percent open indicator <ul style="list-style-type: none"> Slide white circle left to close or right to open Yellow bar indicates saved preset % open relative to max open % Green bar indicates current valve % open relative to max open % Vertical lines indicate 10% open increments relative to max open %
	Select to go to Manual Control Detail page for a particular valve <ul style="list-style-type: none"> Green indicates currently selected for Auto Red indicates not currently selected for Auto Gray indicates not available
	Go back to previous screen. (Press button)
	Go to Automatic Control screen. (Press button)
	Current system flow rate out. (info only)
	Pause/Resume programmed control. (Press button) Closes all valves. Commanded valve positions and auto-command settings restarted after resume.
	Stop. (Press button) Closes all valves. Commanded valve positions and auto-command settings cleared.

Table 5. Manual Control Detail Page Icon Reference

Control	Function
	<p>Manual control for valve and percent open indicator</p> <ul style="list-style-type: none"> • Slide white circle left to close or right to open • Yellow bar indicates saved preset % open relative to max open % • Green bar indicates current valve % open relative to max open % • Vertical lines indicate 10% open increments relative to max open % • Number on the slider or green bar indicates “percent open” commanded position relative to max open %. • Number below bar indicates the valve individual preset position relative to max open %.
	<p>Press and release to slightly close the valve. Press and hold the button to gradually close the valve.</p>
	<p>Press and release to slightly close the valve. Press and hold the button to gradually close the valve.</p>
	<p>Activate the valve’s individual preset (Press button) Or save current valve position as preset by pressing for 10 seconds.</p>
	<p>Go back to previous screen (Press button)</p>
	<p>Go to Home page (Press button)</p>
	<p>Current system flow rate out. (info only)</p>
	<p>Pause/Resume programmed control. (Press button) Closes all valves. Commanded valve positions and auto-command settings restarted after resume.</p>
	<p>Stop. (Press button) Closes all valves. Commanded valve positions and auto-command settings cleared.</p>

MAINTENANCE INSTRUCTIONS

Caution: DO NOT use high pressure spray to clean any components of the MVC System. Using high pressure spray can damage seals and lead to serious damage of electrical components.

MVC Touchscreen Display

- Before and after every work shift, clean the MVC touchscreen display with a mild LCD cleaning solution found in many stores. Use a lightly dampened lint-free, non-abrasive cloth when cleaning the display. To avoid scratches, do not wipe or clean a dry display.
- Before and after every work shift, inspect the MVC touchscreen display, mounting, and cabling for damage.
- Before, after, and regularly during every work shift, remove liquid droplets from the touchscreen with a lint-free, non-abrasive cloth. Excessive amounts of water or other liquid droplets can interfere with or limit the touch interface control.
- Before each work shift, adjust the brightness of the touchscreen display to easily see it.
- Before each work shift, adjust the viewing angle of the touchscreen display to easily see it (if the MVC touchscreen display mounting position is adjustable). Do not try to operate the MVC touchscreen display in a “portrait” orientation (non-default) while wearing polarized glasses. The effect is that the screen can be unreadable due to the conflicting polarizations.
- Do not operate the touchscreen outside the temperature range of -22°F to 149°F (-30°C to 65°C) to avoid damage. If the max temperature range is exceeded, it will void the warranty.
- Do not allow periods of exposure to direct sunlight because this can elevate the internal temperature above 85°C which may cause permanent degradation of the LCD display.

Ground Speed Sensor and Signal Conditioner

- Before and after every work shift
 - With the system off, inspect the speed sensor for dirt, mud, or debris. Clean off all mud, dirt, and debris that is found. Do not use a high pressure spray to clean the sensor.
 - Inspect the sensor and cabling for damage.
 - Inspect that the sensor is still mounted in the correct orientation.
 - Confirm that no fluids are dripping on the speed sensor.

Butterfly Valves

- Disconnect power before servicing an electric valve.
- Grease the actuator gearbox with Chevron Starplex EP2 every two weeks or every 200 hours of vehicle operation (whichever comes first).
 - Use a manual grease gun.
 - DO NOT use a high pressure grease gun, nor connect the gearbox to an auto-grease canister. Doing so will over-grease the gearbox and lead to damage to the actuator.
 - Do not use lubrication on the valve discs or seats.
 - Fill the gearbox until grease is expelled.
 - Wipe off any expelled grease.
- Before and after every work shift, inspect the valves and cabling for damage.
- Daily clean excess dirt and debris from the gearbox and motor. DO NOT use high pressure spray to clean the valves. Using high pressure spray can damage seals and lead to serious damage.
- If the valves are leaking, uninstall the leaking valve(s) from the flange per instructions in the valve manual, 98311000. Inspect the seats and discs for wear.
 - Do not try to remove/disassemble actuators from the valve bodies because it may permanently damage the valve or actuator. Uninstall/replace a valve as a complete unit.
 - If the seats or disc are worn, the valve with actuator will need to be replaced.

Flow Sensor

- Before and after every work shift, inspect the flow sensor mount and cabling for damage.
- If during operations the reported flow rate is erratic or not reported, the flow sensor may be clogged with debris. After shutting down the vehicle, perform the following maintenance:
 1. Remove dirt and water from around the flow sensor electrical connector.
 2. Disconnect the flow sensor cable from the saddle-clamp flow sensor.
 3. Unscrew and remove the hex retainer nut by hand.
 4. Remove the paddlewheel flow sensor.
 5. Carefully clean the paddlewheel with a soft-bristle brush using water and a mild detergent.
 6. Inspect for damage.
 7. Spin the flow sensor paddlewheel by blowing on it. Confirm that the flow sensor turns freely and continues turning for a short while after you stop blowing. If it does not, the flow sensor is either still clogged or the axle is bent. If further cleaning doesn't fix it, then the flow sensor should be replaced.
 8. Insert flow sensor into sensor housing. Align flat spot on sensor rim with alignment tab and make sure O-ring is in its groove. Refer to Figure 62.

Note: The retainer nut only needs to be hand tightened. There is an inside lip that will stop the cap from turning when it makes contact with the alignment tab. This provides the correct pressure to make the seal at the O-ring. Make sure the flow sensor does not disengage from the alignment tab and rotate.
 9. Install retainer nut and **HAND TIGHTEN. DO NOT OVER-TIGHTEN THE RETAINER NUT.**
 10. Remove dirt and water from around the flow sensor electrical connectors.

11. Connect the flow sensor cable to the saddle-clamp flow sensor.
12. If the reported flow rate is still erratic, then the flow sensor should be replaced.

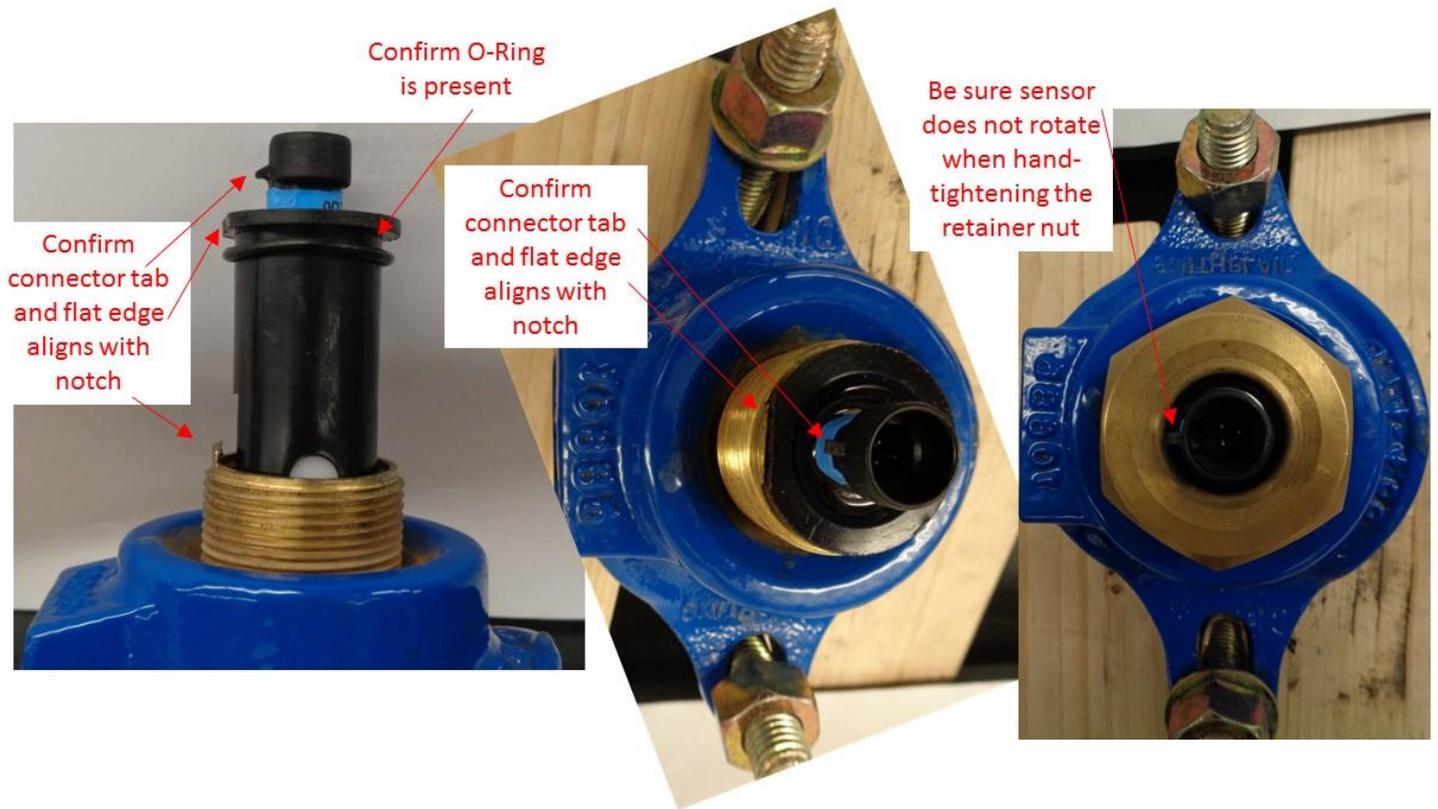


Figure 62. Flow Sensor Alignment

VALVE CALIBRATION INSTRUCTIONS



Warning! Water must not be flowing or in the piping when configuring and calibrating the valves. Flowing water during valve calibration may cause the valves to be mis-calibrated leading to the inability to properly regulate water flow. Water in the piping may be discharged during calibration.

Valve position calibration during initial system installation and configuration is NOT normally needed. However, during system use, the valves may need to be re-calibrated. The TROUBLESHOOTING section describes times when valve position calibration may be needed. Follow the steps below to complete valve position calibration.

- Turn on the system or push the  button on the touchscreen. You should see the Home page (Figure 32).
- Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
- Press the “Additional Settings” menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34).

- Push the “Enter PIN” Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35).
- Select the “Valves” button on the Additional Settings Configuration page (Figure 35) to get to the Valve Setup page (Figure 36). The Valve Setup page has information for each valve in the system. Each rectangle on this page is selectable. The valve numbers correspond to the numbers on the main control pages.
- Find the row for the particular valve that you want to calibrate. Use the right arrow  button to access numbers 6-9 if desired.
- Press the calibrate button to calibrate the valve. This is the button labeled either “Calibrated” or “Uncalibrated” in the Calibration column. **ONLY ONE VALVE SHOULD BE CALIBRATED AT A TIME.** This will avoid excessive electrical load on the vehicle’s alternator. Please wait for position calibration to finish (approximately 15 seconds) before starting calibration on another valve. The valve should be partially opened in order to calibrate properly. The valve can be manually opened or closed using the override nut on the valve actuator. The calibrate button should change from “Uncalibrated” to “Calibrated” once the valve calibration is complete.
- Once the valve has been calibrated, push the  button to return to the Home page (Figure 32).
- Confirm all valves are operational.
 - Press the “CONFIG” menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33).
 - Press the  button to go to the Manual Control Main page (Figure 38).
 - Use the white circle sliders to adjust the “percent open” valve positions. The slider is located beneath the particular valve’s label (“Valve 1”, “Valve 2”, etc. in Figure 60).
 - Slide right = valve open
 - Slide left = valve close
 The green position bar will track behind the position of the white circle.
 - The green position bar always indicates the valve “percent open” *actual* position.
 - The white circle position indicates the valve “percent open” *commanded* position.
 - Confirm that as a particular valve is commanded to open or close, that the green bar tracks to the new slider position **WITH A DELAY**. If the green bar does not go to the new slider position or if the green bar tracks without a delay, then the valve is not properly configured or wired. Refer to the TROUBLESHOOTING section.

SYSTEM SPECIFICATIONS

Touchscreen Display

- | | |
|-------------------------------|----------------------------------|
| • Screen Size | 7” (18cm) Widescreen |
| • Resolution (pixels) | 800 x 480 (16:9) |
| • Touchscreen Type | PCAP (capacitive), LED backlit |
| • Voltage | 10-30 VDC |
| • Typical Current Draw | 300 mA (28Vdc), 600 mA(14Vdc) |
| • Fuse Recommendation | 3-5 Amps, Fast |
| • Operating temperature range | -22°F to +149°F (-30°C to +65°C) |
| • Storage temperature range | -40°F to +185°F (-40°C to +85°C) |

- CE Conformity Yes (2004/108/EC)
- Environmental Rating IP65
- Communication CAN data bus
- Dimensions 7.63" x 5.23" x 2.10" (194mm x 133mm x 53.5mm)
- Weight 2 lbs. (0.93 kg)

Speed Sensor with Signal Conditioner

- Voltage 11-30 VDC
- Max Current Draw 600 mA (14Vdc)
- Fuse Recommendation 3-5 A, Fast
- Operating temperature range -40°F to +185°F (-40°C to +85°C)
- Storage temperature range -40°F to +185°F (-40°C to +85°C)
- Speed Measurement Range 0 to 30 MPH (48 KPH)
- CE Conformity Yes (e-mark certification # e24_021030)
- Environmental Rating IP66
- Signal Conditioner Dimensions 5.25" x 4.70" x 1.42" (133mm x 120mm x 36.1mm)
- Sensor on Plate Dimensions 5.88" x 5.35" x 4.75" (150mm x 140mm x 121mm)
- "L" Bracket Dimensions 10.25" x 10.0" x 2.25" (260mm x 254mm x 57.2mm)
- Overall Weight 2 lbs. (0.93 kg)

3.0" Butterfly Valve with Electric Actuator

- Voltage 12-30 VDC
- Max Current Draw (only during calibration or motor stall due to debris) 24A (12VDC), 18A (24VDC)
- Typical Current Draw (250 PSI max) 10A (12 VDC), 6A (24 VDC)
- Fuse Recommendation 30A (12VDC), 20A (24VDC), Slow
- Max Static Pressure 250 PSI
- Dimensions 16.33" x 7.00" x 13.40" (415mm x 178mm x 340mm)
- Weight 35 lbs. (15.9 kg)

Valve Electrical Box

- Operating/Storage temperature range -40°F to +185°F (-40°C to +85°C)
- Environmental Rating IP66
- Dimensions 14.9" x 10.3" x 3.9" (379mm x 262mm x 99mm)
- Weight 16 lbs. (7.3 kg)

Display/Speed Sensor Electrical Box

- Operating/Storage temperature range -40°F to +185°F (-40°C to +85°C)
- Environmental Rating IP66
- Dimensions 11.8" x 10.3" x 3.9" (300mm x 262mm x 99mm)
- Weight 17 lbs. (7.7 kg)

TROUBLESHOOTING

Remove dirt and water from all electrical connections before connecting or disconnecting. This will keep water and dirt out of the electrical connections and avoid corrosion and short-circuits that could damage equipment.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
Water is spraying, but the touchscreen always shows 0 GPM/LPM flow or the reported flow rate is erratic.	1. The touchscreen may not be correctly configured.	<ul style="list-style-type: none"> a. Confirm that the “System Flow Valve” that is selected matches the slot number valve to which the flow sensor is connected. The “System Flow Valve” selection is on the Speed/Flow Curve Setup page in the Configuration menu. Refer to CONFIGURATION & CALIBRATION INSTRUCTIONS. b. Verify that the valve to which the flow sensor is connected can be opened and closed using the touchscreen’s manual mode. Verify that the position updates on the touchscreen as the valve moves. This shows that the touchscreen is properly configured and communicating to the valve that is providing the flow information. If this was unsuccessful, then <ul style="list-style-type: none"> i. Re-configure the valve according to Add-On Valve Configuration in the CONFIGURATION & CALIBRATION INSTRUCTIONS section, then try opening/closing it again. ii. Check the Valve power and CAN data connections using the Recommended Actions for Potential Causes 6 and 7.
“ “	2. The flow sensor may be clogged with debris.	<ul style="list-style-type: none"> a. Drain water from the pipe where the flow sensor is mounted. Remove the flow sensor retainer cap and the flow sensor. See MAINTENANCE INSTRUCTIONS. b. Clean the paddlewheel flow sensor according to the MAINTENANCE INSTRUCTIONS.
“ “	3. The flow sensor may not be working properly.	<ul style="list-style-type: none"> c. Drain water from the pipe where the flow sensor is mounted. Remove the flow sensor retainer cap and the flow sensor. See MAINTENANCE INSTRUCTIONS. a. Blow on the flow sensor get the flow sensor to turn continuously. Confirm that a flow is reported on the MVC touchscreen. Note, it may take 10-20 seconds of continuous flow sensor motion for a flow reading to be displayed. If there is no flow reading and the previous causes have been checked, then the flow sensor or the sensor cable may be faulty. <ul style="list-style-type: none"> i. Remove dirt and water from the electrical connection, then disconnect the sensor cable from the flow sensor. Inspect both the sensor and cable connector for debris or a signs of damage. ii. Remove dirt and water from the electrical connection, then reconnect the sensor cable to the flow sensor and try the continuous movement test again. b. If there is still no flow reading when manually moving the sensor, then continue to step 4 to check the cable.
“ “	4. The flow sensor cable may have been damaged.	<ul style="list-style-type: none"> a. Remove dirt and water from the flow sensor electrical connection at the valve electronics. Refer to the Wiring (E3F, E4F, etc.) section of the Butterfly manual, 98311000. b. Disconnect the flow sensor cable from the flow sensor and from the valve electronics. c. Inspect the cable, cable connectors, sensor connector, and valve electronics connector for debris or a signs of damage. d. Use a multi-meter to confirm electric continuity through the cable. Refer to Flow Sensor Wiring (Figure 63) at the end of this section for the cable connections. e. If the cable continuity is fine, then continue to step 5 to check that the valve electronics are supplying power to the sensor.
“ “	5. The valve electronics’ flow sensor connection may have been damaged.	<ul style="list-style-type: none"> a. Remove dirt and water from the flow sensor electrical connection at the valve electronics. Refer to the Wiring (E3F, E4F, etc.) section of the Butterfly manual, 98311000. b. Disconnect the sensor cable from the valve electronics. c. With the valve powered, use a voltmeter to confirm that the valve electronics are supplying +5VDC on both pin 4 and pin 6 on its 6-pin connector on the valve electronics (Pin 5 is ground). Refer to Flow Sensor Wiring (Figure 63) at the end of this section for the 6-pin connector pin assignments. If there is no voltage, then the valve electronics have been damaged and should be replaced.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
“ “	6. The power connection wiring to the system flow valve may be faulty.	<ul style="list-style-type: none"> a. Remove dirt and water from the electrical connections at the valve fuse box before opening. b. Check that the fuse for the valve is intact. Replace as necessary. c. Inspect the valve wiring for any damage or shorts. Remove dirt and water from the electrical connections, then repair and replace as necessary. d. Remove dirt and water from the electrical connection at the 12-pin connector from the valve that also has the flow sensor connected to it. e. With power turned on, use a voltmeter to confirm that there is +V_{BAT} (+12/+24 VDC) power on Pin 1 of the cable's 12-pin connector. (Pin 2 is ground). Refer to the Wiring (E3F, E4F, etc.) section of the Butterfly manual, 98311000 for the 12-pin connector pin assignments. If there is no voltage or intermittent voltage, then the power connection wiring is faulty.
“ “	7. The CAN data cabling may have been damaged.	<ul style="list-style-type: none"> a. Turn off power to the system. b. Remove dirt and water from the electrical connections at all valve electronics c. Disconnect the 12 pin connectors from all valves. d. Disconnect the gray 12-pin, Power/CAN connector (C1) from the MVC touchscreen. e. Refer to the MVC Touchscreen Display Wiring section under the WIRING INSTRUCTIONS heading for the touchscreen's Power/CAN (C1) connector pin assignments. Refer to the Wiring (E3F, E4F, etc.) section of the Butterfly manual, 98311000 for the valve connector pin assignments. f. With all other MVC CAN data connections still intact, use a multimeter to confirm there is 60 Ohms between the Data-High and Data-Low data bus signals. These are pins 11 & 2 on the MVC touchscreen Power/CAN connector (C1) or pins 11 & 12 on the valve's 12-pin connector. If there is not 60 Ohms, then the CAN data cabling or connections have been damaged. g. Repeat this check at every 12-pin valve connection. h. With all other MVC CAN data connections still intact, use a multimeter to confirm there is an open circuit between Data-High and the vehicle's Chassis ground. This is pin 11 on the MVC touchscreen Power/CAN connector (C1) or pin 11 on the valve's 12-pin connector. If there is not an open circuit, then the CAN data cabling or connections have been damaged: the Data-high is shorted to the vehicle chassis. i. With all other MVC CAN data connections still intact, use a multimeter to confirm there is an open circuit between Data-Low and the vehicle's chassis ground. This is pin 2 on the MVC touchscreen Power/CAN connector (C1) or pin 12 on the valve's 12-pin connector. If there is not an open circuit, then the CAN data cabling or connections have been damaged: the Data-low is shorted to the vehicle chassis. j. Disconnect one (1) triangle CAN connector from the CAN data bus. This can be from any one of the 12-pin Valve connectors or from the MVC touchscreen's 12-pin Power/CAN connector (C1). k. With all other MVC CAN data connections still intact, use a multimeter to confirm there is continuity between the CAN data bus shield (triangle connector pin C) and the vehicle's chassis ground. If there is not continuity, then the CAN data cabling or connections have been damaged: the CAN bus shield is not properly connected to the vehicle chassis ground.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p><u>Touchscreen Display Error Dialog Box:</u> Speed Sensor Not Present. Automatic Operation is disabled when the speed sensor is not present.</p> <p>(This will cause Auto Mode not to work. Manual Mode will still work through touchscreen controls).</p>	<p>8. The touchscreen display does not detect the Speed Sensor.</p>	<p>a. Dismiss the dialog box. b. Inspect the speed sensor for damage. Replace if significant damage is found. c. Remove dirt and water from any electrical connectors before connecting or disconnecting. d. Use a voltmeter to confirm that there is +5VDC voltage to the MVC touchscreen display's C2:8 input. This is position 8 on the 37251000 harness. e. If there is not a significant voltage, then the connection between the touchscreen display and the Speed Sensor Signal Conditioner may have been damaged. i. Disconnect the cable from the MVC touchscreen's C2 input and from the Speed Signal Conditioner. Use a multimeter to confirm continuity from the signal conditioner connector position 9 to the C2 connector position 8. ii. If there is not continuity, then the speed detect wire needs replaced or repaired. f. If the speed detect wire is fine, then confirm that the Speed Signal Conditioner is getting power. i. With the Speed Signal Conditioner cable (harness 37253000) connected to truck power, confirm that there is truck voltage on position 12 of the connector to the Speed Signal Conditioner. ii. If truck power is not present, then there may be a break in the power supplied to the Speed Signal Conditioner and Speed Sensor. ▪ Confirm that the fuse has not blown. ▪ If the fuse is not blown, then troubleshoot the power connection. g. If the Speed Signal Conditioner power is fine, then confirm that the Speed Signal Conditioner is supplying correct power to the Speed Sensor. i. Connect the 37253000 harness 12-pin connector back into the Speed Signal Conditioner. Disconnect the 37250100 harness 4-pin connector from the Speed Sensor cable. Apply truck power to the 37253000 harness. Confirm that there is +12 VDC on pin C of the 37250100 harness 4-pin connector. ii. If there is not +12 VDC, then the Speed Signal Conditioner may be damaged. Replace it with a known good Speed Signal Conditioner. h. If the Speed Signal Conditioner is supplying correct power to the Speed Sensor, then inspect the cable to the speed sensor for damage. Repair/replace the speed sensor cable as necessary then re-test.</p>
<p><u>Touchscreen Display Warning Dialog Box:</u> MD4-7 Int. Temp. XX.X °C The MD4-7 is approaching its high temperature limit.</p>	<p>9. The MVC Touchscreen Display is measuring a high temperature inside the display.</p>	<p>a. Dismiss the dialog box. A "HIGH TEMPERATURE WARNING" will still be showing on the screen. b. Turn up vehicle air-conditioning and wait for the "HIGH TEMPERATURE WARNING" to be removed. It is still ok to use the touchscreen when "HIGH TEMPERATURE WARNING" is displayed. c. If a "HIGH TEMPERATURE ALARM" is displayed, i. Remove dirt and water from any electrical connectors, then ii. Remove the touchscreen display from the vehicle and take to a cool environment. Use the touchscreen display only in vehicles where the ambient temperature is maintained below 55 °C. iii. Remove dirt and water from the electrical connectors before re-installing.</p>
<p>This message appears: HIGH TEMPERATURE WARNING</p>	<p>10. The MVC Touchscreen Display is measuring a high temperature inside the display.</p>	<p>a. Troubleshoot using the same recommended actions as "Potential Cause" number 9.</p>
<p><u>Touchscreen Display Alarm Dialog Box:</u> MD4-7 Int. Temp. XX.X °C The MD4-7 has exceeded its high temperature limit.</p>	<p>11. The MVC Touchscreen Display is measuring a hot temperature inside the display. Continued use may cause permanent damage to the display</p>	<p>a. Dismiss the dialog box. A "HIGH TEMPERATURE ALARM" will still be showing on the screen. (Note that the screen will automatically go blank after 30 seconds to reduce power and help cool the display). b. Remove dirt and water from the electrical connectors to the touchscreen c. Remove the touchscreen display from the vehicle and take to a cool environment. Use the touchscreen display only in vehicles where the ambient temperature is maintained below 55 °C. d. Remove dirt and water from electrical connectors before re-installing.</p>

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p>This message appears: HIGH TEMPERATURE ALARM</p>	<p>12. The MVC Touchscreen Display is measuring a hot temperature inside the display. Continued use may cause permanent damage to the display.</p>	<p>a. Troubleshoot using the same recommended actions as “Potential Cause” number 11.</p>
<p><u>Touchscreen Display Warning Dialog Box:</u> MD4-7 Int. Temp. XX.X °C The MD4-7 is approaching its low temperature limit.</p>	<p>13. The MVC Touchscreen Display is measuring a low temperature inside the display.</p>	<p>a. Dismiss the dialog box. A “LOW TEMPERATURE WARNING” will still be showing on the screen. b. Turn up vehicle heat and wait for the “LOW TEMPERATURE WARNING” to be removed. It is still ok to use the touchscreen when “LOW TEMPERATURE WARNING” is displayed. c. If a “LOW TEMPERATURE ALARM” is displayed, i. Remove dirt and water from all electrical connectors, then ii. remove the touchscreen display from the vehicle and take to a warm environment. Use the touchscreen display only in vehicles where the ambient temperature is maintained above -25 °C. iii. Remove dirt and water from the electrical connectors before re-installing.</p>
<p>This message appears: LOW TEMPERATURE WARNING</p>	<p>14. The MVC Touchscreen Display is measuring a low temperature inside the display.</p>	<p>a. Troubleshoot using the same recommended actions as “Potential Cause” number 13.</p>
<p><u>Touchscreen Display Alarm Dialog Box:</u> MD4-7 Int. Temp. XX.X °C The MD4-7 has exceeded its low temperature limit.</p>	<p>15. The MVC Touchscreen Display is measuring an extreme cold temperature inside the display. Continued use may cause permanent damage to the display</p>	<p>a. Dismiss the dialog box. A “LOW TEMPERATURE ALARM” will still be showing on the screen. b. Remove dirt and water from the touchscreen electrical connectors. c. Remove the touchscreen display from the vehicle and take to a warm environment. Use the touchscreen display only in vehicles where the ambient temperature is maintained above -25 °C. d. Remove dirt and water from the electrical connectors before re-installation.</p>
<p>This message appears: LOW TEMPERATURE ALARM</p>	<p>16. The MVC Touchscreen Display is measuring an extreme cold temperature inside the display. Continued use may cause permanent damage to the display</p>	<p>a. Troubleshoot using the same recommended actions as “Potential Cause” number 15.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Overcurrent at closing. (Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>17. The valve labeled [Valve n Label]¹² on the touchscreen had to stop opening due to extended overcurrent. >24A on 12 VDC trucks >18A on 24 VDC trucks</p>	<p>b. If this only happens once or very rarely and the valve seems to otherwise function, no action is required. If it occurs multiple times or the touchscreen disables the valve, power-cycle the touchscreen then try the following. c. Confirm that the valve position is properly calibrated. Try to re-calibrate the valve position according to the VALVE CALIBRATION INSTRUCTIONS. d. Remove dirt and water from the valve’s electrical connections, then e. Disconnect the valve motor wire and confirm that the valve can be opened/closed using the override nut. If it can’t, disassemble the valve and remove any debris from inside. Remove dirt and water from the electrical connections, then re-assemble and test. f. Confirm that the valve harness is not shorted or making electrical contact with the truck chassis. Repair and replace wiring as necessary.</p>

¹² [Valve n Label] is the descriptive label given to the particular valve control on the touchscreen. This defaults to “Valve 1”, “Valve 2”, etc. It may be set to a description that matches the valve location on the truck such as “Left Rear”, “Center Spray”, etc.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Overcurrent at opening.</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>18. The valve labeled [Valve n Label]¹² on the touchscreen had to stop opening due to extended overcurrent.</p> <p>>24A on 12 VDC trucks >18A on 24 VDC trucks</p>	<p>a. If this only happens once or very rarely and the valve seems to otherwise function, no action is required. If it occurs multiple times or the touchscreen disables the valve, power-cycle the touchscreen then try the following.</p> <p>b. Confirm that the valve position is properly calibrated. Try to re-calibrate the valve position according to the VALVE CALIBRATION INSTRUCTIONS.</p> <p>c. Remove dirt and water from the electrical connections, then</p> <p>d. Disconnect the valve motor wire and confirm that the valve can be opened/closed using the override nut. If it can't, disassemble the valve and remove any debris from inside. Remove dirt and water from the electrical connections, then re-assemble and test.</p> <p>e. Confirm that the valve harness is not shorted or making electrical contact with the truck chassis. Repair and replace wiring as necessary.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Sensor Fail, Normal Current</p>	<p>19. The valve electronics (for the valve labeled [Valve n Label]¹² on the touchscreen) is not receiving position sensor information, but the valve is not drawing excessive current.</p>	<p>a. Remove dirt and water from the valve electrical connections</p> <p>b. Remove the valve electronics from the actuator gear case. Confirm that the magnet is still properly mounted on the ball axis nut. Replace if missing or misaligned then re-test.</p> <p>c. If the magnet is still properly mounted, then replace the valve electronics with known good electronics</p> <p>i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics.</p> <p>d. Remove dirt and water from the electrical connections before re-connecting.</p> <p>e. Re-calibrate the valve through the touchscreen valve configuration.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Sensor Fail, High Current</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>20. The valve electronics (for the valve labeled [Valve n Label]¹² on the touchscreen) is not receiving position sensor information, and the valve is drawing a high current perhaps due to reaching a mechanical stop.</p> <p>18A to 24A on 12V trucks 10A to 18A on 24V trucks</p>	<p>a. Remove dirt and water from the electrical connections before disconnecting any cables.</p> <p>b. Remove the valve electronics from the actuator gear case. Confirm that the magnet is still properly mounted on the ball axis nut. Replace if missing or misaligned then re-test.</p> <p>c. If the magnet is still properly mounted, then replace the valve electronics with known good electronics</p> <p>i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics.</p> <p>d. Remove dirt and water from the electrical connections before re-connecting.</p> <p>e. Re-calibrate the valve through the touchscreen valve configuration.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Sensor Fail, Motor Stall</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>21. The valve electronics (for the valve labeled [Valve n Label]¹² on the touchscreen) is not receiving position sensor information, and the valve stopped due to detecting extended overcurrent.</p> <p>>24A on 12 VDC trucks >18A on 24 VDC trucks</p>	<p>a. Remove dirt and water from the electrical connections before disconnecting any cables.</p> <p>b. Remove the valve electronics from the actuator gear case. Confirm that the magnet is still properly mounted on the ball axis nut. Replace if missing or misaligned then re-test.</p> <p>c. If the magnet is still properly mounted, then replace the valve electronics with known good electronics</p> <p>i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics.</p> <p>d. Disconnect the valve motor wire and confirm that the valve can be opened/closed using the override nut. If it can't, disassemble the valve and remove any debris from inside. Re-assemble and test.</p> <p>e. Confirm that the valve harness is not shorted or making electrical contact with the truck chassis. Repair and replace wiring as necessary</p> <p>f. Remove dirt and water from the electrical connections before re-connecting cables.</p> <p>g. Re-calibrate the valve through the touchscreen valve configuration.</p>

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: No Motion, Normal Current</p>	<p>22. The valve electronics (for the valve labeled [Valve n Label]¹² on the touchscreen) is not sensing change in %open position when the motor is energized, and the valve motor is not drawing excessive current.</p>	<ul style="list-style-type: none"> a. If this only happens once or very rarely and the valve seems to otherwise function, no action is required. If it occurs multiple times or the touchscreen disables the valve, power-cycle the touchscreen then try the following: b. Remove dirt and water from the electrical connections before disconnecting any cables. c. Inspect the valve and confirm that the motor connection and wire is not damaged or disconnected. Repair and replace as necessary. d. Inspect the valve actuator to confirm that it is still securely attached to the valve body: it should not be loose. If it is loose remove the actuator, apply more Loctite 242 to the actuator mounting screws, and then re-assemble. e. Re-calibrate the valve through the touchscreen valve configuration. f. If it is not resolved in the above steps, then the motor could be worn-out. <ul style="list-style-type: none"> i. Remove dirt and water from the electrical connections before disconnecting or re-connecting any cables. ii. Disconnect the valve motor power from wiring harness. iii. Confirm that the valve can be open/closed using the manual override nut. <ul style="list-style-type: none"> ▪ If the valve is stuck, disassemble the valve and remove any debris from inside. Re-assemble and test. ▪ If the valve moves, freely, leave the valve partially opened and continue with below instructions iv. Apply a properly over-current protected +12 VDC independent power source to the valve motor. If the motor does not move the valve, then the motor may have worn-out. Replace the valve motor with a known good motor. v. Re-calibrate the valve through the touchscreen valve configuration and test. g. If it is not resolved in the above steps, then replace the valve electronics with known good electronics. Remove dirt and water from the electrical connections before disconnecting or re-connecting cables. <ul style="list-style-type: none"> i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics ii. Re-calibrate the valve through the touchscreen valve configuration and test.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: No Motion, High Current</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>23. The valve electronics (for the valve labeled [Valve n Label]¹² on the touchscreen) is not sensing change in %open position when the motor is energized, and the valve motor is drawing a high current.</p> <p>18A to 24A on 12V trucks 10A to 18A on 24V trucks</p>	<p>a. If this only happens once or very rarely and the valve seems to otherwise function, no action is required. If it occurs multiple times or the touchscreen disables the valve, power-cycle the touchscreen then try the following:</p> <p>b. Remove dirt and water from the electrical connections before disconnecting any cables.</p> <p>c. Inspect the valve and confirm that the motor connection and wire is not damaged or disconnected. Repair and replace as necessary.</p> <p>d. Inspect the valve actuator to confirm that it is still securely attached to the valve body; it should not be loose. If it is loose remove the actuator, apply more Loctite 242 to the actuator mounting screws, and then re-assemble.</p> <p>e. Re-calibrate the valve through the touchscreen valve configuration.</p> <p>f. If it is not resolved in the above steps, then the motor could be worn-out.</p> <ol style="list-style-type: none"> i. Remove dirt and water from the electrical connections before disconnecting or re-connecting any cables. ii. Disconnect the valve motor power from the wiring harness. iii. Confirm that the valve can be open/closed using the manual override nut. <ol style="list-style-type: none"> 1. If the valve is stuck, disassemble the valve and remove any debris from inside. Re-assemble and test. 2. If the valve moves, freely, leave the valve partially opened and continue with below instructions iv. Apply a properly over-current protected +12 VDC independent power source to the valve motor. If the motor does not move the valve, then the motor may have worn-out. Replace the valve motor with a known good motor. v. Re-calibrate the valve through the touchscreen valve configuration and test. <p>g. If it is not resolved in the above steps, then replace the valve electronics with known good electronics. Remove dirt and water from the electrical connections before disconnecting or re-connecting any cables.</p> <ol style="list-style-type: none"> i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics ii. Re-calibrate the valve through the touchscreen valve configuration and test.
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: No Motion, Motor Stall</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>24. The valve electronics (for the valve labeled [Valve n Label]¹² on the touchscreen) is not sensing change in %open position when the motor is energized, and the valve motor is drawing a very high current. The motor has been stopped to prevent motor damage.</p> <p>>24A on 12 VDC trucks >18A on 24 VDC trucks</p>	<p>a. Inspect the valve and confirm that the motor connection and wire is not damaged or disconnected. Repair and replace as necessary.</p> <p>b. Inspect the valve actuator to confirm that it is still securely attached to the valve body; it should not be loose. If it is loose remove the actuator, apply more Loctite 242 to the actuator mounting screws, and then re-assemble.</p> <p>c. Re-calibrate the valve through the touchscreen valve configuration.</p> <p>d. If it is not resolved in the above steps, then the motor could be worn-out.</p> <ol style="list-style-type: none"> i. Remove dirt and water from the electrical connections before disconnecting or re-connecting any cables. ii. Disconnect the valve motor power from the wiring harness. iii. Confirm that the valve can be open/closed using the manual override nut. <ol style="list-style-type: none"> 1. If the valve is stuck, disassemble the valve and remove any debris from inside. Re-assemble and test. 2. If the valve moves, freely, leave the valve partially opened and continue with below instructions iv. Apply a properly over-current protected +12 VDC independent power source to the valve motor. If the motor does not move the valve, then the motor may have worn-out. Replace the valve motor with a known good motor. v. Re-calibrate the valve through the touchscreen valve configuration and test. <p>e. If it is not resolved in the above steps, then replace the valve electronics with known good electronics. Remove dirt and water from the electrical connections before disconnecting and re-connecting any cables.</p> <ol style="list-style-type: none"> i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics ii. Re-calibrate the valve through the touchscreen valve configuration and test.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Normal Operation, High Current</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>25. The valve labeled [Valve n Label]¹² on the touchscreen is drawing a high current, but seems to otherwise operate, normally.</p> <p>18A to 24A on 12V trucks 10A to 18A on 24V trucks</p>	<p>a. If this only happens once or very rarely and the valve seems to otherwise function, no action is required. If it occurs multiple times or the touchscreen disables the valve, power-cycle the touchscreen then try the following:</p> <p>b. Re-calibrate the valve through the touchscreen valve configuration.</p> <p>c. Remove dirt and water from the electrical connections before connecting or disconnecting cables.</p> <p>d. If the issue is not resolved through re-calibration, disconnect the valve motor power from the wiring harness and confirm that the valve can be open/closed easily using the manual override nut. If there seems to be excessive mechanical resistance, disassemble the valve and remove any debris from inside. Re-assemble, re-calibrate, and test</p> <p>e. If it is not resolved in the above steps, then the motor could be wearing out. Replace the valve motor with a known good motor. Re-calibrate the valve through the touchscreen valve configuration and test.</p> <p>f. If it is not resolved in the above steps, then replace the valve electronics with known good electronics. Remove dirt and water from the electrical connections before connecting or disconnecting cables.</p> <p>i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics</p> <p>ii. Re-calibrate the valve through the touchscreen valve configuration and test.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> [Valve n Label]¹²: Normal Operation, Motor Stall</p> <p>(Multiple errors within a short period will disable this valve until the next power-cycle.)</p>	<p>26. The valve labeled [Valve n Label]¹² on the touchscreen is drawing a very high current. The motor has been stopped to prevent motor damage.</p> <p>>24A on 12 VDC trucks >18A on 24 VDC trucks</p>	<p>a. Power-cycle the touchscreen then try the following:</p> <p>b. Re-calibrate the valve through the touchscreen valve configuration.</p> <p>c. Remove dirt and water from the electrical connections before connecting or disconnecting cables.</p> <p>d. If the issue is not resolved through re-calibration, disconnect the valve motor power from the wiring harness and confirm that the valve can be open/closed easily using the manual override nut. If there seems to be excessive mechanical resistance, disassemble the valve and remove any debris from inside. Re-assemble, re-calibrate, and test</p> <p>e. If it is not resolved in the above steps, then the motor could be wearing out. Replace the valve motor with a known good motor. Re-calibrate the valve through the touchscreen valve configuration and test.</p> <p>f. If it is not resolved in the above steps, then replace the valve electronics with known good electronics</p> <p>i. The valve serial number will have to be changed in the touchscreen valve configuration to match the new electronics</p> <p>ii. Re-calibrate the valve through the touchscreen valve configuration and test.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> No Contact Valve n¹³</p>	<p>27. The touchscreen display cannot communicate with valve numbered n¹³</p>	<p>a. Remove dirt and water from the electrical connections before connecting or disconnecting cables.</p> <p>b. Check that the fuse for the valve is intact. Replace as necessary.</p> <p>c. Inspect the valve wiring for any damage or shorts. Repair and replace as necessary.</p> <p>d. Disconnect the 12-pin connector from the valve.</p> <p>e. With power turned on, use a voltmeter to confirm that there is +V_{BAT} (+12/+24 VDC) power on Pin 1 of the cable's 12-pin connector. (Pin 2 is ground). Refer to the Wiring (E3F, E4F, etc.) section of the Butterfly manual, 98311000, for the valve connector pin assignments. If there is no voltage or intermittent voltage, then the power connection wiring is faulty.</p> <p>f. If the valve is receiving power, then there may be an issue with the data bus to the valve. Troubleshoot using the same recommended actions as "Potential Cause" number 7.</p>
<p><u>Touchscreen Display Error Dialog Box:</u> CAN bus error</p>	<p>28. The touchscreen display cannot communicate on the CAN data bus.</p>	<p>a. Power-cycle the touchscreen to clear the error.</p> <p>b. If the error persists or is regularly occurring, troubleshoot the CAN data bus wiring using the same recommended actions as "Potential Cause" number 7.</p>

¹³ n is the number listed on the red/green LED icons next to the valve slider in the touchscreen's manual control page. It will be a value of  to .

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
<p><u>Touchscreen Display Warning Dialog Box:</u> Low Supply Voltage</p>	<p>29. The touchscreen display power is approaching the low voltage limit to where it can operate.</p>	<ol style="list-style-type: none"> Confirm that the vehicle battery is supplying adequate power of 10 to 30 VDC. Remove dirt and water from the electrical connections before connecting or disconnecting cables. Inspect the touchscreen display power and ground wiring for any damage or shorts. Repair and replace as necessary. Disconnect the C1 connector from the back of the touchscreen. Use a voltmeter to confirm that there is 10 to 30 VDC power between positions 12 and 1 on the cable to the C1 connector.
<p><u>Touchscreen Display Warning Dialog Box:</u> High Supply Voltage</p>	<p>30. The touchscreen display power is approaching the high voltage limit to where it can operate.</p>	<ol style="list-style-type: none"> Remove dirt and water from the electrical connections before connecting or disconnecting cables. Confirm that the vehicle battery is supplying adequate power of 10 to 30 VDC. Inspect the touchscreen display power and ground wiring for any damage or shorts. Repair and replace as necessary. Disconnect the C1 connector from the back of the touchscreen. Use a voltmeter to confirm that there is 10 to 30 VDC power between positions 12 and 1 on the cable to the C1 connector.
<p><u>Touchscreen Display Warning Dialog Box:</u> Date and time not set</p>	<p>31. The date and time internal to the touchscreen display has not been set or its clock's battery fully drained since the last set.</p>	<ol style="list-style-type: none"> Remove dirt and water from the electrical connections before connecting or disconnecting cables. Set the Date and Time through the touchscreen configuration menu using the instructions in CONFIGURATION & CALIBRATION INSTRUCTIONS section of this manual.
<p>The word "SIMULATED" appears on the Manual Control Detail page.</p>	<p>32. The valve is configured for simulation mode. It currently won't control a valve.</p>	<ol style="list-style-type: none"> In the valve configuration, set the Valve's serial number to correspond to the valve using the Add-On Valve Configuration in the CONFIGURATION & CALIBRATION INSTRUCTIONS section, then push "Save" If the valve ID was already non-zero, then the MVC touchscreen display is not receiving information from the via the CAN datalink. Troubleshoot using the same recommended actions as those for "Potential Cause" number 27.
<p>The word "SIM FLOW" or "SIM SPEED" appear on the Auto Control Main page,</p> <p>or</p> <p>the reported speed on the Auto Control Main page slowly increases to 30 MPH then back to 0 MPH without the vehicle actually moving.</p>	<p>33. The Auto Control operations have been configured for simulation mode.</p>	<p>In the Auto Flow submenu of the Adjust settings of Additional Settings in the MVC Touchscreen Configuration menu, change the Simulation Mode parameter to "Operate" via the following instructions:</p> <ol style="list-style-type: none"> Power up the system or push the  button on the touchscreen. You should see the Home page (Figure 32). Press the "CONFIG" menu button on the Home page (Figure 32) to get to the Main Configuration page (Figure 33). Press the "Additional Settings" menu button on the Main Configuration page (Figure 33). You should see the PIN Code dialog box appear, asking you to Enter PIN (Figure 34). Push the "Enter PIN" Button, then enter the Passkey code (0000 is the default). Once complete, push the  button. The Additional Settings Configuration page will now be displayed (Figure 35). Select the  button on the upper right corner of the Additional Settings Configuration page (Figure 35) to get to the System configuration page (Figure 42). Select "Adjust". Select "Auto Flow" to show the Auto Flow related adjustment parameters (Figure 53). Select "Simulation Mode", then select "Operate".
<p>Water leaks from the valve when closed.</p>	<p>34. The valve is out of calibration.</p>	<ol style="list-style-type: none"> Try to re-calibrate the valve position according to the VALVE CALIBRATION INSTRUCTIONS.
<p>""</p>	<p>35. The seats or disc are worn.</p>	<ol style="list-style-type: none"> Uninstall the valve and inspect these wear items according to the MAINTENANCE INSTRUCTIONS section.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
The valve appears to open or close instantly in the touchscreen manual controls.	36. The valve is configured for simulation mode. It currently won't control a valve.	a. Troubleshoot using the same recommended actions as those for "Potential Cause" number 32.
The valve appears to open or close too quickly in the touchscreen manual controls.	37. The valve is not properly position calibrated.	a. Try to re-calibrate the valve position according to the VALVE CALIBRATION INSTRUCTIONS.
The valve rotates in the opposite direction in which it should: when commanded open, it closes, and vice versa.	38. The valve polarity direction is not configured correctly.	a. Change the valve direction using the MVC touchscreen display as described in the Add-On Valve Configuration in the CONFIGURATION & CALIBRATION INSTRUCTIONS section.
The flow reading is inaccurate or accuracy degrades with flow rate	39. The system requires flow calibration.	a. Calibrate the flow sensor as described in the CUSTOMIZATION section.
" "	40. The flow sensor is contaminated, worn-out, or has an intermittent signal.	b. Troubleshoot using the same recommended actions as those for "Potential Cause" numbers 2, 3, 4, and 5.
There is a reported flow rate when all valves are closed.	41. The valves are actually open or excessively leaking.	a. Try to re-calibrate the valve position according to the VALVE CALIBRATION INSTRUCTIONS. b. If the valves are still leaking, uninstall the valve, inspect the wear items, and replace according to the MAINTENANCE INSTRUCTIONS section.
" "	42. Turbulence in the flow sensor pipe is causing erroneous flow readings.	a. Adjust the low-flow cutoff value in the touchscreen according to "Setup the Flow-by-Speed Parameters" section of the CONFIGURATION & CALIBRATION INSTRUCTIONS.
The reported speed is not accurate.	43. The speed sensor is covered with debris or there is debris between the speed sensor and the ground or there is fluid dripping in the speed sensor's line-of-sight.	a. Inspect the speed sensor for dirt, mud, or debris. Clean off all mud, dirt, and debris that is found. Do not use a high pressure spray to clean the sensor. b. Inspect that the sensor is still mounted in the correct orientation. c. Stop any fluids from dripping on the speed sensor or in the speed sensor's line of sight.
" "	44. The speed sensor's sight to the ground is obstructed with high stubble and debris.	a. Remove any stubble or debris from the speed sensor's line-of-sight to the ground. b. If high stubble and debris is prevalent over the vehicle's travel path, the MVC will need to be operated in manual mode in those areas.
" "	45. The speed sensor cable or speed signal conditioner may be damaged.	a. Inspect the speed sensor cable for damage between the MVC and the speed signal conditioner. b. Inspect the speed signal conditioner for damage. c. Inspect the speed sensor cable for damage between the speed signal conditioner and the speed sensor. d. If no damage is apparent, i. Turn off vehicle power ii. Remove dirt and water from the speed sensor's electrical connections iii. Disconnect the speed sensor and speed signal conditioner cables. iv. Use a multimeter to confirm continuity in the speed sensor and speed signal conditioner cables. Refer to the speed sensor wiring in the WIRING INSTRUCTIONS. e. Remove dirt and water from the electrical connections. f. Repair/Replace any damaged wiring that is found.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
“ “	46. The speed sensor is mounted too high or too low.	a. Confirm that the speed sensor is mounted between two and four feet from the ground. Adjust sensor height to be within this range.
“ “	47. The speed needs to be calibrated	a. Calibrate the speed. Refer to the “Calibrate the Speed Sensor” subheading in under CONFIGURATION & CALIBRATION INSTRUCTIONS.
The reported speed is non-zero when the vehicle is stopped.	48. The speed sensor is experiencing excessive vehicle vibration.	a. Verify that the vibration Isolation mounts have been properly installed and that the nuts have not been over-tightened b. Verify that speed sensor mounting bracket has NOT been welded to the vehicle. c. Move the speed sensor to a location on the vehicle that experiences less vibration.
“ “	49. There is rain or tall, waving grass in the speed sensor’s line of sight.	a. Move the speed sensor to a location where to where line of sight is free of rain or tall, waving grass. b. If it is not possible to move it, then the system will have to be operated in manual mode when there is rain or tall, waving grass.
“ “	50. The speed sensor is mounted too close to the ground.	a. Confirm that the speed sensor is mounted between two and four feet from the ground. Adjust sensor height to be within this range.
“ “	51. The speed needs to be calibrated	a. Calibrate the speed. Refer to the “Calibrate the Speed Sensor” subheading in under CONFIGURATION & CALIBRATION INSTRUCTIONS.
The MVC touchscreen has a blank screen.	52. There is no power to the MVC touchscreen.	a. Inspect the fuse for the MVC display. Replace it if is blown. b. Disconnect the Power/CAN connector (C1) from the MVC Touchscreen. With the vehicle on, use a voltmeter to confirm that there is power (10-30 VDC) between pins 12 and 1 of the C1 connector. Troubleshoot the power connection as necessary.
“ “	53. The display brightness is set too low.	a. Turn the vehicle off, then back on (or disconnect the C1 connector and replace) to power-cycle the touchscreen. The screen should come at 50% brightness. Adjust the brightness using the controls on the home screen to suit the current environmental conditions.
“ “	54. The MVC touchscreen’s internal temperature has exceeded the allowed temperature range.	a. Touch the screen. The touchscreen should turn on. If there is a temperature warning, troubleshoot using the same recommended actions as Potential Cause 10.
“ “	55. The screensaver has initiated. (The screen saver could dim the screen, but it should be readable in indoor lighting).	a. Touch the screen. The brightness should return to the operator setting. b. If the screensaver is making the screen too dim, it can be adjusted or disabled in the configuration settings refer to the CUSTOMIZATION section.
“ “	56. The MVC touchscreen has been damaged.	a. Inspect the outside of the touchscreen and touchscreen housing for damage. b. Replace with a known-good touchscreen and confirm that it turns on correctly.
The MVC touchscreen won’t respond to touches	57. The user’s hands have excessive dust or are gloved.	a. Operate the touchscreen without gloves. b. Clean excessive dust from hands before operating touchscreen.
“ “	58. There is water or excessive dirt/dust on the touchscreen	a. Clean the MVC touchscreen display with a mild LCD cleaning solution using a lightly dampened lint-free, non-abrasive cloth. To avoid scratches, do not wipe or clean a dry display. b. Remove excess water and liquid from the display using a lightly dampened lint-free, non-abrasive cloth.
Pressing a Preset button does not change the valve settings	59. The preset is not configured or the valve is already at the preset position	a. Configure the Preset button according to the OPERATING INSTRUCTIONS. b. Press the stop button on the touchscreen display to close all valves. Press the Preset button and confirm that the valve(s) go to the newly set preset position.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
Pressing the Open/Close button on the Manual Control Details page changes the desired % open, but the valve's actual position does not change.	60. The position change was too slight to initiate valve movement.	<ul style="list-style-type: none"> a. Check what the "Valve Position Deadband" value is set to in the configuration settings. Refer to the CUSTOMIZATION section for accessing and changing this parameter. b. Move the desired % open for the valve farther than the "Valve Position Deadband" setting. For example, if the valve's actual position is 10% open and the Valve Position Deadband is set to 2%, change the desired valve position to a value of 13% or greater ($> 10\% + 2\%$) or a value of 7% or less ($< 10\% - 2\%$). Confirm that the valve moves to within +/- the Valve Position Deadband of the desired valve position. c. The Valve Position Deadband can be adjusted lower if finer valve position control is desired. Refer to the CUSTOMIZATION section for accessing and changing this parameter. A Valve Position Deadband of 2% is recommended. Finer valve position control may cause the following negative consequences: <ul style="list-style-type: none"> i. Auto Control may be less stable, causing the valves to overshoot/undershoot the desired target flow. ii. Valve motors may wear out faster than normal.
Start/Resume button on the Auto Control page does not cause water to flow	61. The speed sensor is not detected by the MVC touchscreen.	a. Troubleshoot using the same Recommended Action as Potential Cause 8.
" "	62. The wrong valves were selected to use for auto flow control	<ul style="list-style-type: none"> a. Go to the Valve Select page. Refer to the OPERATING INSTRUCTIONS section to navigate to the Valve Select page. b. Confirm that the valves that you want to spray with in Auto Control have their slider pushed to the "On" position. c. Re-adjust as necessary then retry the start/resume button on the Auto Control page.
" "	63. The Auto flow control parameters need set up or adjusted.	<ul style="list-style-type: none"> a. Confirm that the Flow-by-Speed points are set up and adjusted for the flow desired. Refer to the "Setup the Flow-by-Speed Parameters" subheading in the CONFIGURATION & CALIBRATION INSTRUCTIONS. b. Adjust the Proportional (P), Integral (I), or Derivative (D) Auto Flow parameters. Refer to the CUSTOMIZATION section. If the P and/or I gains are set to low for the particular piping/pump configuration for the vehicle, the MVC may not react fast enough and delay starting to spray water. c. The "Maximum Valve Position in Auto" needs to be adjusted higher. If set too low, the valves may not open far enough for water to flow. Refer to the CUSTOMIZATION section for instructions to adjust.
" "	64. The vehicle is stopped or traveling less than 3 MPH (4.8 KPH).	a. If watering is desired when traveling less than 3 MPH, refer to the CUSTOMIZATION section for instructions to allow watering at slow speeds.
" "	65. The Auto Control is set for Interval operations and the cycle is currently in the off interval.	<ul style="list-style-type: none"> a. If intermittent operations are not desired, disable the intermittent operations according to the OPERATING INSTRUCTIONS section. b. Continue operations. Flow should resume automatically once the vehicle travels farther than the set interval length. Refer to the OPERATING INSTRUCTIONS section for instructions on changing the interval length.
" "	66. The water level in the tank is low.	a. Refill the truck's water tank.
Interval spraying is applying water inappropriately (wet/dry sections are too big or small).	67. The interval distance needs to be adjusted.	a. Refer to the OPERATING INSTRUCTIONS section for instructions on changing the interval length.
" "	68. The wrong valves were selected to use for auto flow control	a. Troubleshoot using the same Recommended Action as Potential Cause 62.
" "	69. The Auto flow control parameters need set up or adjusted.	a. Troubleshoot using the same Recommended Action as Potential Cause 63.

Table 6 Troubleshooting Tips

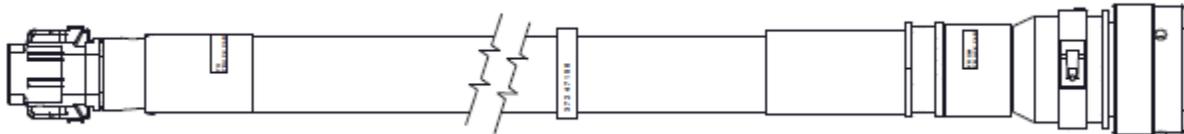
Problem / Symptom	Potential Cause	Recommended Action
“ “	70. The desired interval distance is too short for the speed at which the vehicle is traveling.	<ul style="list-style-type: none"> a. The valves could take 2 to 5 seconds to close or open to get the desired flow. So, if the interval is set short and the vehicle is traveling relatively fast, the valves may not fully close or open far enough to get the correctly sized wet/dry patch. To fix, drive at a slower speed when using a short interval. b. An alternative to be able to maintain faster speeds is to adjust the interval bigger and change the Flow-by-speed parameters such that less water is being sprayed for the given speed. This will make bigger intervals, but not as much water will be sprayed during the wet intervals. BE SURE CURRENT ROAD CONDITIONS AND COMPANY OPERATING PROCEDURES ALLOW THIS. Refer to the OPERATING INSTRUCTIONS section for instructions on changing the interval length. Refer to the “Setup the Flow-by-Speed Parameters” subheading in the CONFIGURATION & CALIBRATION INSTRUCTIONS to reduce water flow for a given vehicle speed.
The Auto Control is applying water inappropriately (too much/too little) for the current speed.	71. The wrong valves were selected to use for auto flow control	<ul style="list-style-type: none"> a. Troubleshoot using the same Recommended Action as Potential Cause 62.
“ “	72. The Auto flow control parameters need set up or adjusted.	<ul style="list-style-type: none"> a. Troubleshoot using the same Recommended Action as Potential Cause 63.
Valve are not commanded to change fast enough for changes in speed when in Auto Control mode.	73. The Auto flow control parameters need set up or adjusted.	<ul style="list-style-type: none"> a. Troubleshoot using the same Recommended Action as Potential Cause 63.
Even with interval spraying turned off, valves continually open and close when in Auto mode when the vehicle speed is relatively constant.	74. The Auto flow control parameters need adjusted.	<ul style="list-style-type: none"> a. Adjust the Proportional (P), Integral (I), or Derivative (D) Auto Flow parameters. Refer to the CUSTOMIZATION section. If the P and/or I gains are set too high for the particular piping/pump configuration for the vehicle, it may cause the valves to oscillate in trying to reach the target flow. Try reducing P and I while maintaining the same relative proportion (i.e. P about twice as large as I). <ul style="list-style-type: none"> i. If this causes the MVC to take too long to reach the target flow, increase the P and I again, then also try increasing the D.
In Auto Mode, the current flow is not reaching to the target flow	75. The Auto flow control parameters need adjusted.	<ul style="list-style-type: none"> a. Troubleshoot using the same Recommended Action as Potential Cause 63.
“ “	76. If interval spraying is enabled, the desired interval distance is too short for the speed at which the vehicle is traveling.	<ul style="list-style-type: none"> a. Troubleshoot using the same Recommended Action as Potential Cause 70.
“ “	77. The pump is not capable of the target flow at the vehicle’s current RPM.	<ul style="list-style-type: none"> a. Confirm that the pump is capable of the desired flow rate. b. Drive in reduced gear if possible. This will increase the vehicle RPM for the same vehicle speed.
“ “	78. The water level in the truck’s tank is low.	<ul style="list-style-type: none"> a. Refill the truck’s water tank.
In the configuration settings, the button in the valve setup in the Multi-point flow Cal column reads “Flow Cal Error”	79. There was a non-valid flow calibration value entered during the multi-point calibration process.	<ul style="list-style-type: none"> a. Power-cycle the MVC system. b. Perform Multi-point flow calibration, again. Refer to “Configure and Calibrate the Flow Sensor” subheading in the CUSTOMIZATION.

Table 6 Troubleshooting Tips

Problem / Symptom	Potential Cause	Recommended Action
"Wrong PIN" is displayed after entering the Passkey code	80. An incorrect number was entered.	a. The default Passkey code is 0000. If that does not work, consult with your supervisor or vehicle manufacturer for the new Passkey code. b. If the Passkey code is not known, then contact your dealer for additional assistance.

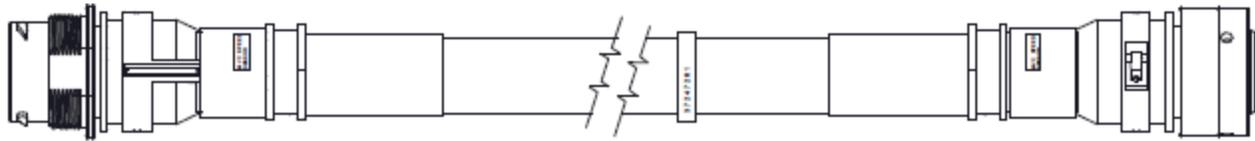
DEUTSCH 6 PIN PLUG			3 PIN FLOW SENSOR CONNECTOR		
PIN	WIRE COLOR	DESCRIPTION	PIN	WIRE COLOR	DESCRIPTION
1	PLUG		A	BLACK	FLOW SENSOR GROUND
2	PLUG		B	RED	FLOW SENSOR POWER +5 VDC
3	PLUG		C	WHITE	FLOW SIGNAL
4	RED	5V DC POWER SUPPLY			
5	BLACK	GROUND SUPPLY			
6	WHITE	FLOW SIGNAL			

Figure 63. Flow Sensor Cable connections, 3 Ft. (3724803)



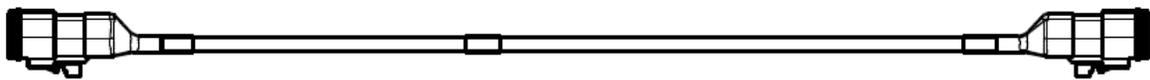
FROM CONNECTOR	FROM POSITION	MATERIAL	WIRE COLOR	FUNCTION	TO CONNECTOR	TO POSITION
DTM06-08SA-E007	1	BELDEN 9364	RED	SPEED SIGNAL	HDP26-18-14PE-L017	E
DTM06-08SA-E007	2	BELDEN 9364	WHITE	SPEED SIGNAL	HDP26-18-14PE-L017	F
DTM06-08SA-E007	3	BELDEN 9364	DRAIN	SHIELD DRAIN	HDP26-18-14PE-L017	G
DTM06-08SA-E007	4	XLPE, TINNED COPPER, 20 AWG, 0.053-0.120 INSULATION O.D., -30C TO 125C	YELLOW	SPEED SENSOR PRESENT	HDP26-18-14PE-L017	H
DTM06-08SA-E007	5	XLPE, TINNED COPPER, 20 AWG, 0.053-0.120 INSULATION O.D., -30C TO 125C	BROWN	DISPLAY GROUND	HDP26-18-14PE-L017	J
DTM06-08SA-E007	6	XLPE, TINNED COPPER, 20 AWG, 0.053-0.120 INSULATION O.D., -30C TO 125C	ORANGE	DISPLAY POWER	HDP26-18-14PE-L017	K
DTM06-08SA-E007	7	BELDEN 9364	BLACK	MODEM GROUND	HDP26-18-14PE-L017	L
DTM06-08SA-E007	8	XLPE, TINNED COPPER, 20 AWG, 0.053-0.120 INSULATION O.D., -30C TO 125C	VIOLET	MODEM POWER	HDP26-18-14PE-L017	M

Figure 64. Display to Power Box Cable connections, 30 Ft. (37247150)



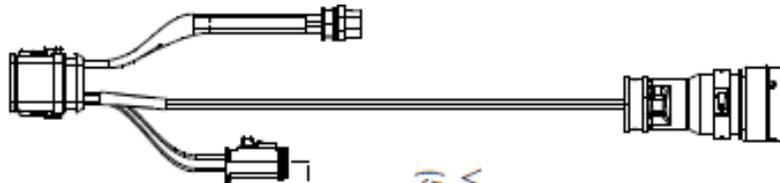
FROM CONNECTOR	FROM POSITION	MATERIAL	WIRE COLOR	WIRE PAIR NUMBER	FUNCTION	TO CONNECTOR	TO POSITION
HDP24-18-14PE-L017	A	Belden 9318	RED	1	SPEED SIGNAL FROM SENSOR SQUARE WAVE WITH 0 TO 12 VDC AMPLITUDE	HDP26-18-14SE-L017	A
"	B	Belden 9318	BLACK	1	TRUCK GROUND (-BAT)	"	B
"	C	XLPE, TINNED COPPER, 20 AWG, 0.053-0.120 INSULATION O.D., -30C to 125C	ORANGE	N/A	+12 VDC TO SPEED SENSOR	"	C
"	D	XLPE, TINNED COPPER, 20 AWG, 0.053-0.120 INSULATION O.D., -30C to 125C	WHITE	N/A	SENSOR PRESENT SIGNAL FROM SPEED SENSOR: 0 VDC = NO SENSOR PRESENT +12 VDC = SENSOR PRESENT	"	D
"	P	Belden 9318	DRAIN	N/A	SHIELD DRAIN	"	P

Figure 65. Speed Sensor Extension Cable connections, 10 Ft. (37247261)



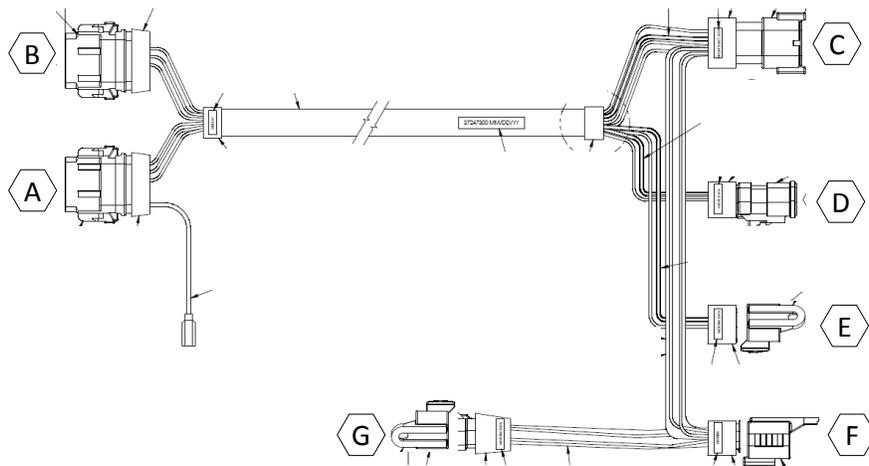
VIEW FROM WIRE SIDE	CAN - DEUTSCH PLUG #DT06-3S-P012			
	POS'N	WIRE MATERIAL	COLOR	LABEL
A	SXL 18 AWG HIGH TEMP	YELLOW	CAN HIGH	
B	SXL 18 AWG HIGH TEMP	GREEN	CAN LOW	
C	SXL 18 AWG HIGH TEMP	BLACK	CAN SHIELD	

Figure 66. CAN Data Cable connections, 1 Ft. & 60 Ft (37249001 & 37519060)



FROM CONNECTOR	FROM POSITION	CABLE	WIRE COLOR	FUNCTION	TO CONNECTOR	TO POSITION
DT06-12SA-P012	1	66-inch, UL1426, 14 AWG	WHITE	+ 11 to 28 VDC POWER IN (FUSE AT 30 TO 20A SLOW)	HDP26-18-8SE-L017	B
DT06-12SA-P012	2	66-inch, UL1426, 14 AWG	BLACK	TRUCK GROUND (-BAT)	HDP26-18-8SE-L017	A
DT06-12SA-P012	6	18-inch, UL1426, 14 AWG	BLACK	VALVE CONTROL (-)	DELPHI 480 12052613	B
DT06-12SA-P012	7	18-inch, UL1426, 14 AWG	WHITE	VALVE CONTROL (+)	DELPHI 480 12052613	A
DT06-12SA-P012	11	CAN BUS (PRESTOLITE)	YELLOW	DATALINK CAN HIGH	DT06-3S-P032	A
DT06-12SA-P012	12	CAN BUS (PRESTOLITE)	GREEN	DATALINK CAN LOW	DT06-3S-P032	B
N/A	N/A	CAN BUS (PRESTOLITE)	DRAIN	CAN SHIELD	DT06-3S-P032	C

Figure 67. Valve Power/Data Cable connections, 5.5 Ft. (37503000)



Connector	Deutsch Part
A	DTM06-12SA-E007
B	DTM06-12SB-E007
C	DTM04-08PA-E003
D	DT06-3S-CE13
E	DT06-3S-CE04
F	DT06-4S-CE13
G	DT06-3S-CE13

FROM CONNECTOR	FROM POSITION	MATERIAL	PAIR No.	WIRE COLOR	FUNCTION	TO CONNECTOR	TO POSITION
A	1	BELDEN 9774	1	BLACK	TRUCK GND (0 VDC)	C	5
"	2	BELDEN 9774	5	BLACK	VALVE CAN BUS - LOW SIGNAL	D	B
"	3	BELDEN 9774	4	BLACK	MODEM CAN BUS - LOW SIGNAL	E	B
"	6	Parker 5030160	N/A	BLACK	ADDRESS TAG - LOW SIDE	N/A	N/A
"	7	Parker 5030160	N/A	BLACK	ADDRESS TAG - HIGH SIDE	N/A	N/A
"	10	BELDEN 9774	4	BLUE	MODEM CAN BUS - HIGH SIGNAL	E	A
"	11	BELDEN 9774	5	YELLOW	VALVE CAN BUS - HIGH SIGNAL	D	A
"	12	BELDEN 9774	1	RED	TRUCK POWER (10-30 VDC, FUSE 3-5A FAST)	C	6
B	8	BELDEN 9774	3	GREEN	SENSOR PRESENT	C	4
"	9	BELDEN 9774	2	BLACK	SPEED SIGNAL	C	2
"	10	BELDEN 9774	2	WHITE	SPEED SIGNAL	C	1
N/A	N/A	BELDEN 9774	2	DRAIN	SPEED SIGNAL SHIELD DRAIN	C	3
N/A	N/A	BELDEN 9774	5	DRAIN	VALVE CAN BUS SHIELD DRAIN	D	C
N/A	N/A	BELDEN 9774	4	DRAIN	MODEM CAN BUS SHIELD DRAIN	E	C
F	1	XPLE CU WIRE	N/A	BLACK	MODEM GROUND	C	7
F	2	XPLE CU WIRE	N/A	RED	MODEM POWER	C	8
F	3	XPLE CU WIRE	N/A	GREEN	MODEM CAN BUS - LOW SIGNAL	G	B
F	4	XPLE CU WIRE	N/A	YELLOW	MODEM CAN BUS - HIGH SIGNAL	G	A

Figure 68. Display Cable connections, 3 Ft. (37247300)

MVC LIMITED WARRANTY

Elkhart Brass Manufacturing Company, Inc., 1302 West Beardsley Avenue, Elkhart, Indiana 46514 (“Warrantor”), warrants to the original purchaser of the new MVC-100 series equipment manufactured by Warrantor and to any person to whom such equipment is transferred, that such equipment shall be free from defects in materials and workmanship during the one (1) year period or 2500 operating hours, whichever occurs first, commencing upon the receipt of such equipment by the original purchaser thereof (“warranty period”).

This Limited Warranty does not cover

- valve discs, valve balls, and valve seats (wear items).
- valve mounting fasteners
- manifold, pipes, hoses, or related mounting hardware
- manifold enclosure or manifold enclosure mounting hardware
- sprayers
- other Elkhart Brass products not part of the MVC model, regardless of whether or not they are compatible with the MVC system.

Warrantor’s obligation under this warranty is specifically limited to replacing or repairing its equipment or parts thereof which are shown by Warrantor’s examination to be in a defective condition attributable hereunder to Warrantor. To qualify for this warranty, alleged defective equipment MUST be returned to Warrantor at its above address, transportation charges prepaid, within a reasonable time after discovery of an alleged defect, and in no event later than thirty (30) days beyond the expiration of the warranty period. In no case will labor associated with removal and replacement/repair of defective components be reimbursed without prior written approval, from a Director or Officer representative, of Elkhart Brass. If, as a result of Warrantor’s examination of the returned equipment, Warrantor concludes that a product defect attributable hereunder to Warrantor exists, Warrantor shall cure such defect within a reasonable time, not to exceed forty-five (45) days after such examination. Workmanship related to non-warranty repairs shall be warranted for a ninety-day period.

In the event that a defect in such equipment is found to be attributable hereunder to Warrantor and Warrantor is unable to provide replacement and repair is not commercially practicable or cannot be timely made, Warrantor may elect to refund to claimant the purchase price of such equipment actually received by warrantor, less reasonable depreciation, in complete discharge of its obligations hereunder. If Warrantor elects to comply with this warranty by means of such refund, as a condition precedent to such compliance, the claimant shall return such equipment to Warrantor free and clear of liens and other encumbrances.

THE ORIGINAL PURCHASER OF SUCH EQUIPMENT, ANY PERSON TO WHOM SUCH EQUIPMENT IS TRANSFERRED, AND ANY PERSON WHO IS AN INTENDED OR UNINTENDED BENEFICIARY OF SUCH EQUIPMENT, SHALL NOT BE ENTITLED TO RECOVER FROM WARRANTOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR INJURY TO PERSON AND/OR PROPERTY RESULTING FROM ANY DEFECTIVE EQUIPMENT MANUFACTURED BY WARRANTOR.

Misuse (including installing or wiring the components differently from the recommendations in this manual) or neglect (including failure to provide reasonable maintenance) of, or accident or unauthorized repairs or alterations to, such equipment, shall release and discharge Warrantor from any obligation under this warranty or otherwise.

WARRANTOR EXPRESSLY LIMITS WITH RESPECT TO SUCH EQUIPMENT ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE TO THE WARRANTY PERIOD. AFTER EXPIRATION OF THE WARRANTY PERIOD, WARRANTOR EXPRESSLY DISCLAIMS WITH RESPECT TO SUCH EQUIPMENT ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. THERE IS NO WARRANTY OF ANY NATURE MADE BY WARRANTOR BEYOND THAT WHICH IS CONTAINED HEREIN.

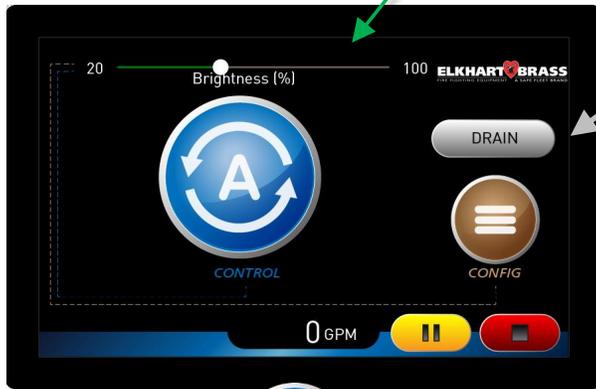
Should Warrantor fail to meet its obligations under this warranty, a claimant may sue Warrantor to secure its compliance with this warranty. No action to enforce this warranty or to otherwise secure recovery from Warrantor for any damages arising out of the equipment manufactured by Warrantor shall be commenced later than two (2) years from and after the date of the receipt of such equipment by the original purchaser thereof.

NO PERSON HAS AUTHORITY TO ENLARGE, AMEND, OR MODIFY THIS WARRANTY.

Warrantor reserves the right to change the parts or design of its products from time to time without notice, and with no obligation to maintain spare parts or to make corresponding changes in the products previously manufactured.

TOUCHSCREEN OPERATING QUICK REFERENCE

HOME



Display brightness adjustment
Defaults to 50% on power-up.

Toggle switch sets all valves partially open for draining plumbing

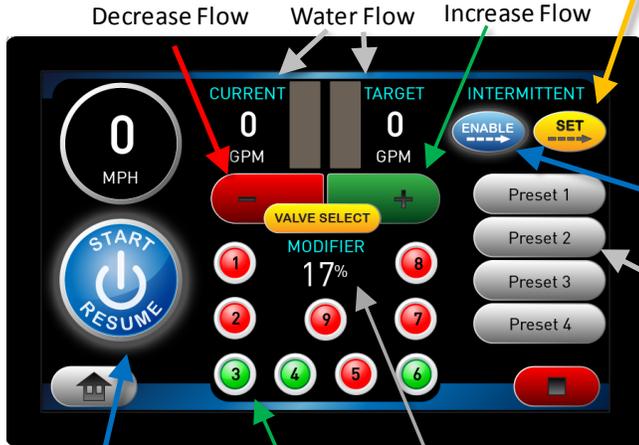
Additional Configuration Settings

Configuration Main



Press "Set" for a keypad to set travel distance with valves opening / opened (& closing / closed). Always 50% duty cycle.

Auto Control

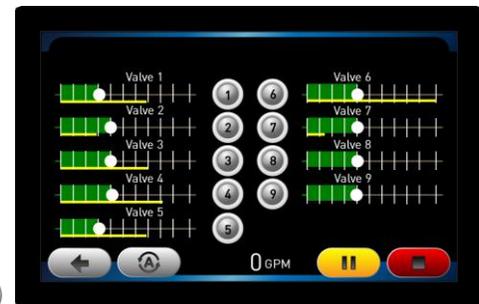


Decrease Flow Water Flow Increase Flow

Toggle switch enables / disables intermittent spray

Quick-Select a saved valve group

Manual Control Main

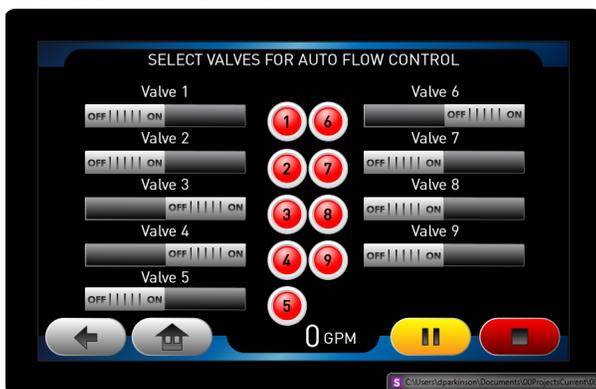


Toggle switch starts/stop spray Valves selected Flow Rate Adjustment

Tapping each select button brings up manual control detail screen for fine adjustments

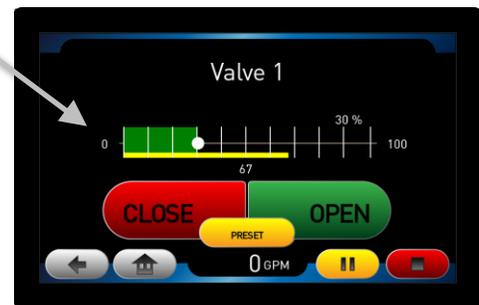


Valve Select



Valve manual control and % open bar
* Slide circle left to close or right to open
* Yellow bar is saved preset % open
* Green bar is current % open

Manual Control Detail

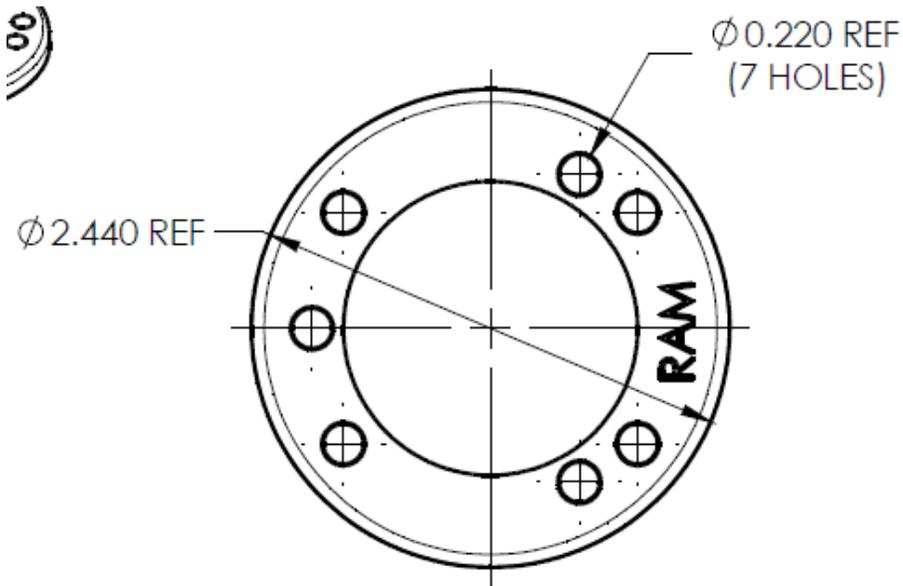


- currently selected for Auto
- not currently selected for Auto
- not available

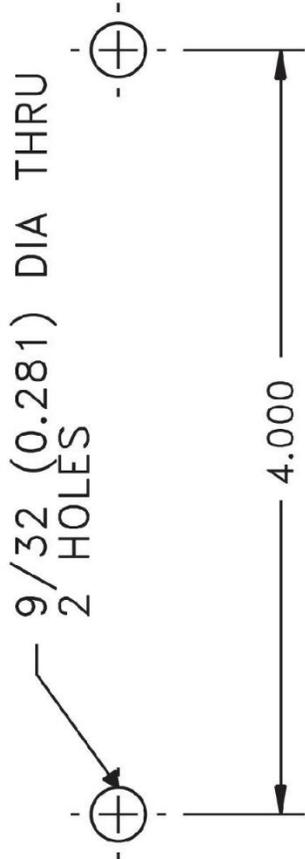
- Pause/Resume programmed control.
- Closes all valves. Settings cleared.
- Go back to previous screen.
- Go to Home page.

COMPONENT MOUNTING TEMPLATES

MVC Touchscreen Display



Speed Sensor Signal Conditioner



Speed Sensor

Refer to the installation instructions provided with the sensor for mounting templates



ELKHART BRASS
PHYSICAL: 1302 WEST BEARDSLEY AVE • ELKHART, IN 46514
MAILING: P.O. BOX 1127 • ELKHART, IN 46515
PHONE: 1-574-295-8330 • 1-800-346-0250
FAX: 1-574-293-9914
WWW.ELKHARTBRASS.COM

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MVC-100
INSTALLATION, OPERATION, AND CONFIGURATION MANUAL
98552130 REV. A
