GUIDANT

Mono-Block II+™ Additive Injector

Installation & Operation Manual

MN06311 Issue/Rev. 0.0 (8/25)

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1 Mono-Block II+ Functional Description

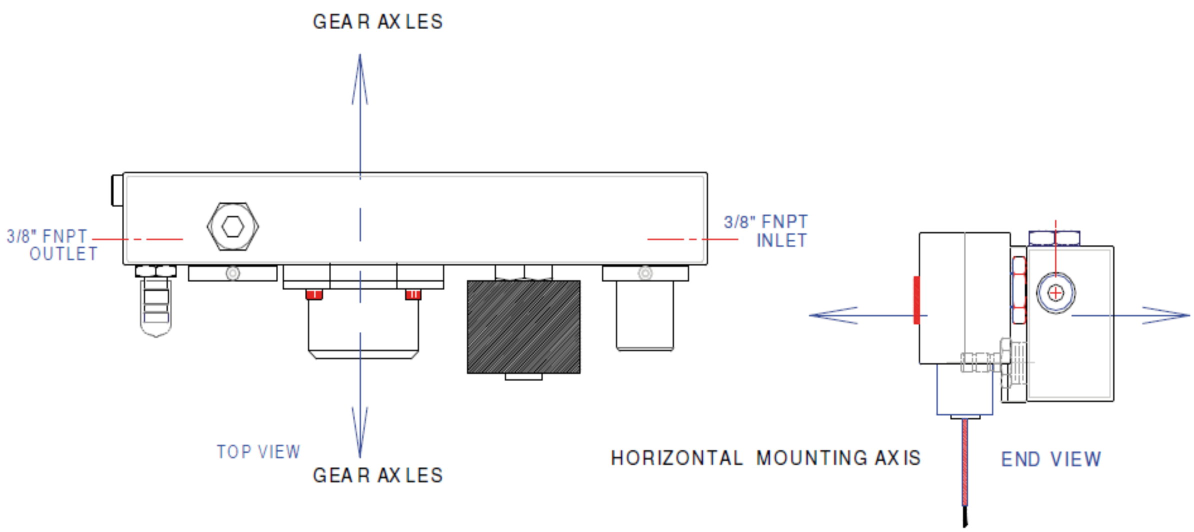
The MonoBlock II+ is a cost effective solution to chemical additive injection in the petroleum terminal industry. This manifold design meets the entire standard requirements for metering and control of a cyclical injection chemical stream. The MonoBlock II+ provides an electrically operated solenoid valve and a precision fluid meter in a common manifold. In addition, the manifold includes an inlet strainer, inlet valve, a calibration security diverter valve with integral flow control and an outlet check valve. Combining this functionality into a single manifold block reduces the size of the instrumentation. This is critical in the limited spaces available on loading racks. Additionally, combining the solenoid, meter, and test port into a single manifold eliminates most potential leak points common to component built injectors assembled in the field by system integrators.

This manifold block provides the physical instrument needed to allow a Terminal Automation System (TAS), Preset (Load Computer, BCU), or PLC System to directly control chemical additive injection. This manifold does not include the control electronics necessary to pace the chemical injected into a fuel stream, nor does it contain the logic necessary to accumulate additive volume passing through it.

AC line voltage is typically used to energize the solenoid valve and allow flow. The controlling device (e.g. Fusion4 MiniPak, MP 3000, MP6, BlendPak 3000+) then accumulates flow volume in the form of pulses transmitted from the meter sensor. When sufficient volume of additive chemical has moved through the manifold, the controlling device then turns off the solenoid valve in order to stop flow. It is the task of the controlling device, Terminal Automation System, Preset, or PLC System, to execute the ratio control algorithms necessary for precise dosage of chemicals into the fuel stream. Functionality for recipe, injection interval, tolerance, alarm annunciation, shutdown, etc. are all the responsibility of the controlling system. If the controlling system is not capable of this level of function, manifold blocks alone are not the solution. The user should consult our factory for information on complete injection panels that include microprocessor based SMART controllers having the capability of complete injection control.

1.1 Mono-Block II+ Mounting

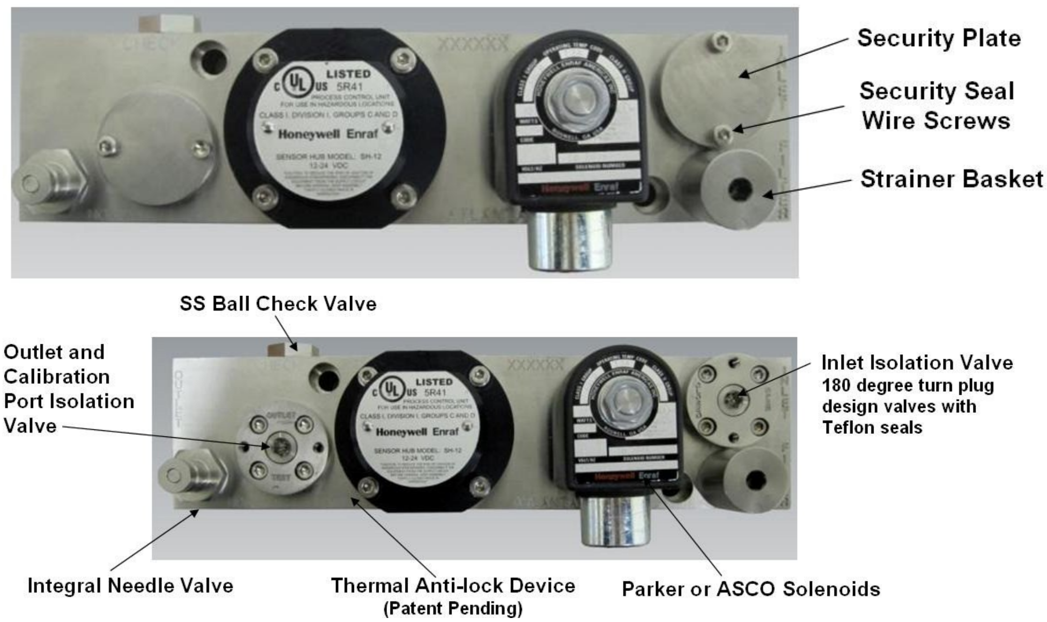
The MonoBlock II+ manifold may be mounted in any orientation provided the gear axles remain horizontal. The inlet and outlet ports can be up, down, left, or right. The arrowed line in the sketch below depicts the horizontal axis of the gear axles in the block. When choosing a mounting position, make certain that the arrowed line remains orientated horizontally.



1.2 Mono-Block II+ Solenoid Input

The MonoBlock II+ manifold has a single control input. That input is the electrical connections to the actuator coil of the solenoid valve. The coil is typically operated from AC line voltage (110V-240V) and frequency (50/60Hz) common to the area of the world where the block is used. Optionally, DC coils in 12V and 24V models are available. Coil voltage is model dependent and should be specified when placing the equipment order.

The solenoid valve is normally closed. This means that when the coil is de-energized (no voltage applied) the valve is closed. Applying the rated voltage to the coil opens the fluid flow path through the MonoBlock™ II+.



1.3 Mono-Block II+ Sensor Output

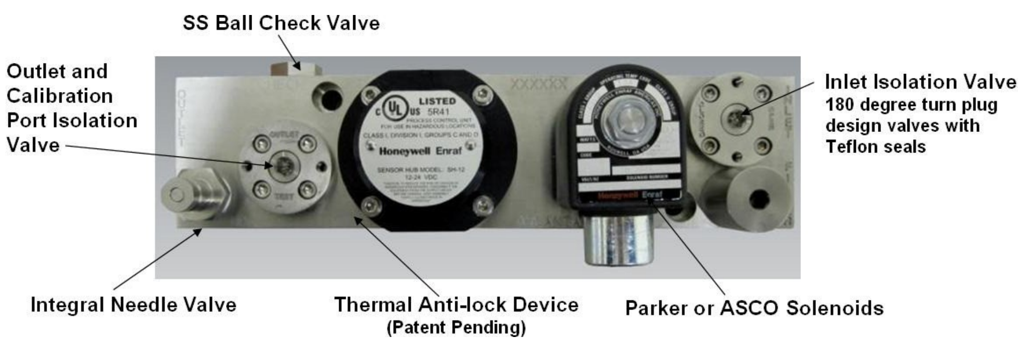
The MonoBlock II+ meters the fluid flowing through it. Two high precision oval gears are mounted in a measuring chamber machined into the block. As fluid passes through the measuring chamber, the fluid force rotates the gears. Imbedded into the gears are four high field strength rare earth magnets. As the gears rotate, these magnets pass beneath a Hall-Effect pickup mounted in the sensor housing. The magnetic field from the gear magnets causes the Hall-Effect pickup to change state (off-on-off) as each magnet passes. Approximately 5000 pulses (Nominal K-factor) are generated for each gallon of fluid passing through the meter (or1320 pulses/liter; nominal resolution).

The customer's equipment is responsible for providing a means of calibration of the meter. That is, a method of determining the exact number of pulses per gallon, liter, etc. of fluid. This calibration factor is normally referred to as the "K-Factor" for the meter. The K-factor is then used by the customer's equipment for conversion of pulses received to volume dispensed.

1.4 Mono-Block II+ 3-Way Diverter Valve

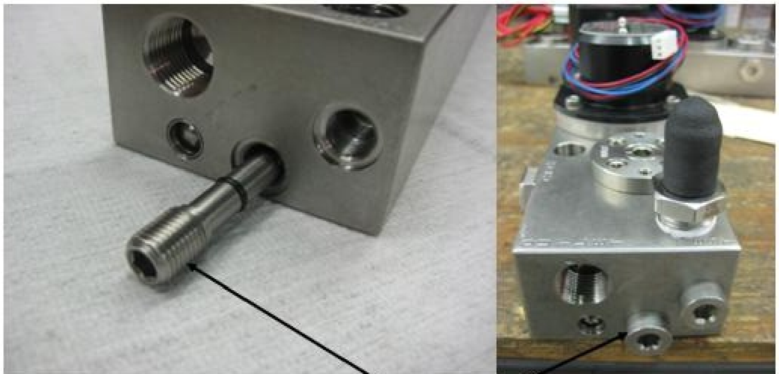
Mounted on the discharge side of the MonoBlock II+ is the Allen Wrench adjustable 3-Way Diverter Valve with position indicators. The valve can be positioned to 'OUTLET' or 'TEST' positions. 'OUTLET' directs flow to the discharge port of the MonoBlock and on to the point of injection, whilst positively isolating the TEST port.

Conversely 'TEST' directs flow to the calibration port whilst positively isolating the discharge port. This operation ensures that additive flow can only ever be in one direction.



Mounted on the inlet side of MBII+ is an Allen Wrench adjustable inlet isolation valve to positively isolate the block during maintenance. The "inlet isolation valve" and "outlet & calibration port isolation valve" can be operated only after removing the security plates.

Located on outlet side (as shown below) of the MBII+ is an Allen Wrench adjustable integral needle valve for flow control adjustments (fine tuning of the flow-rate). The factory default position being fully open, the adjustment is most commonly made to reduce the flow-rate of the additive at very low injection rates, there-by elongating the injection period and enhancing flow control.



Integral Needle Valve
Flow Control Adjuster

The integral needle valve is made tamper-proof with an Allen head screw as shown below. This screw needs to be completely removed to access the needle valve.

Tamper-proof screw

2 Mono-Block II+ Wiring

2.1 Control Solenoid

The solenoid wiring should be a minimum of #16 AWG/1.5mm^2 and a maximum of #14 AWG/2.5mm^2, type THHN or THWN wire. Good practice dictates AC and DC wiring should be run in separate conduits or multi- core cables for extended distances. Follow local, state, and federal codes and practices applicable to your area.

> WARNING: The solenoid coil presents an inductive load to the switching device controlling it. High counter EMF voltages may be produced when removing the voltage source from such loads. Steps should be taken to ensure these high surge voltages are properly dissipated, or damage to the controlling device may occur.

Consult with the manufacturer of the controlling equipment for guidance regarding the control of inductive loads. Triac switching is recommended.

2.2 Meter Sensor (General)

The sensor wiring can be three conductor #18-22 AWG/0.5-1mm^2 shielded instrument cable, with a foil or braided wire shield. Use Belden number 9363 or similar. Drain or screen wires should be terminated on a DC COMMON or on a specifically assigned shield termination at the controller end only. Do not terminate shields to AC earth ground. Tape off and isolate the shield at the sensor end. Refer to wiring diagrams in this document for specific connection details.

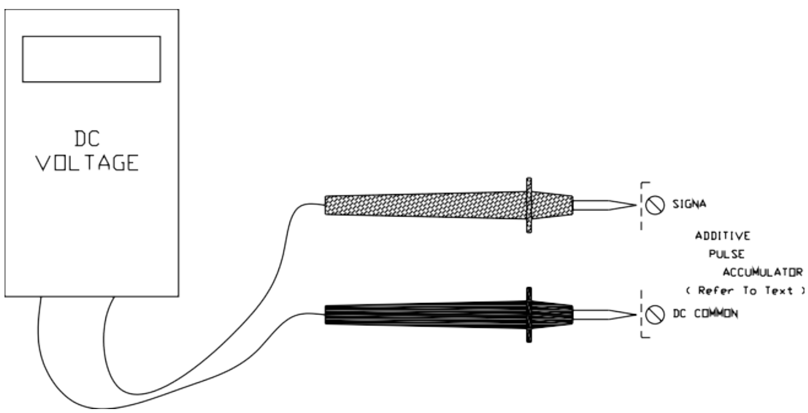
2.3 Meter Sensor -- Pulse Signal Input

The MonoBlock II+ meter sensor output is an un-sourced, open collector, NPN transistor output. The blue sensor wire is connected to the transistor collector. The emitter of the transistor is connected to the black wire, or DC COMMON connection. The term “un-sourced” means that no voltage is applied to the output from within the sensor. It must be pulled to a ‘high’ or ‘on’ or ‘true’ state by voltage supplied from an external source. The sensor electronics then drives the collector ‘low’ or ‘off’ or ‘false’ with each pulse transmitted. The output is NOT driven high internally within the sensor. This industry common scheme allows the sensor to drive external equipment supplied by its own internal transmitter power. There must be a common connection between the DC negative of the sensor supply and the DC COMMON of the signal accumulating device. Refer to the wiring diagrams at the end of this manual for specific connection details.

2.4 Customer Equipment for Sensor Input

The controlling equipment used for capturing pulses from the MonoBlock II+ may be of two general categories; Un-sourced Inputs, having no voltage present normally on the input connection; Sourced Inputs, having a DC pull-up voltage supplied to the input connection. Two different wiring methods are used for the two types of pulse inputs. Wiring diagrams are provided at the end of this document for each type of input. Refer to the documentation for the controlling equipment for a description of the inputs to determine the type. If the documentation still does not resolve the issue, the following test can be performed.

A digital Volt-Ohm meter is used to test the equipment input for the presence of voltage. Use the setup in the sketch below. Place the meter in the DC Voltage mode. Disconnect any wires on the DC Pulse Input. Power the controller. Measure the voltage from the DC COMMON terminal (black voltmeter lead) to the DC Pulse Input (red voltmeter lead). If the voltage reading is greater than +5.0 volts, the input is considered a sourced input. If the voltage reading is less than +5.0 volts, the input is considered an un-sourced input. Refer to the corresponding wiring diagram for connections.



Test setup for determining customer equipment input type.

> +5.0 Volts = Sourced Input

< +5.0 Volts = Un-sourced Input

3 Mono-Block II+ Fluid Connections

The fluid inlet and outlet of the MonoBlock II+ manifold is marked with engraved text on the block. The inlet pressure should always be higher than the outlet pressure to ensure proper operation.

> NOTE: differential pressure vs. solenoid rating needs to be taken into account for optimal performance.

> NOTE: manifold block maximum working pressure is 400 PSI (27 Bar)

3.1 Fluid Inlet Piping

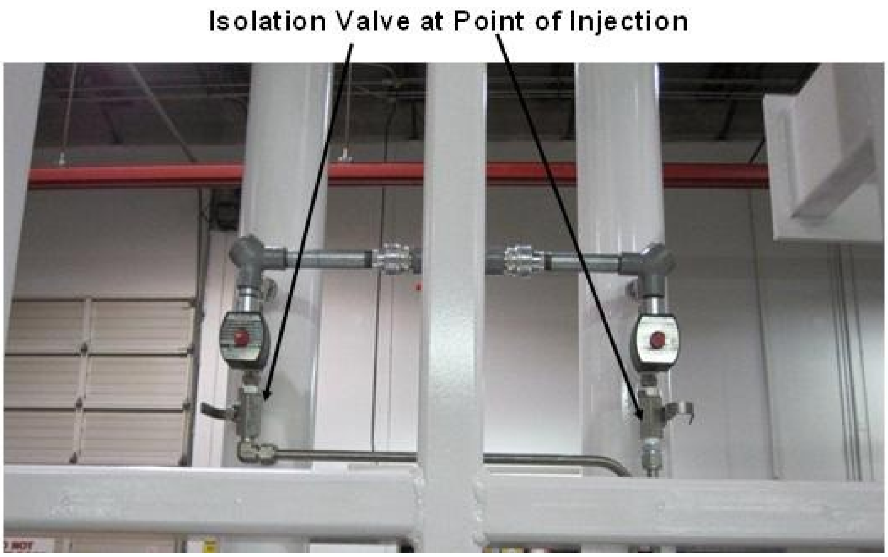
Attention should be given to flow dynamics when sizing the tubing, isolation valve and strainer components feeding the injector inlet. The minimum tubing size for flows approaching the 2.5 Gal/min (9.5 Liters/min) maximum flow rate through the MonoBlock II+ is ½". The isolation valve, feed pipe and strainer size must be increased to handle the flow required for the number of blocks being fed.

3.2 Fluid Outlet Piping

Stainless steel tubing is also used for piping the outlet of the MonoBlock II+ manifold to the point of injection.

> WARNING: A check valve and an isolation valve MUST be installed between the manifold and the point of injection! Failure to install an isolation valve will require complete fuel delivery system shutdown in the event of a need for service on the injector manifold. Failure to install a check valve in the line may result in fuel backing up into the additive chemical delivery system and may cause contamination or spill.

Good design practice dictates that an isolation valve, usually a quarter turn ball valve, be installed at the point of chemical injection into the fuel piping. This valve should meet the needs of local policies and practices regarding piping system valves.



An injection point check valve is required. This check valve should be a positive shut-off, spring closed check such as a plug or ball type. A small opening or 'cracking' pressure is acceptable, generally limited to a maximum of 15 PSI/1Bar. Cracking pressures of 1 PSI to 10 PSI/0.06 to 0.6 Bar are common in the industry. Ensure the flow characteristic (Cv) of the check valve is adequate to handle the maximum flow rate expected through the injector manifold. Although the location is not critical, it is common practice to place the check valve near the isolation valve at the point of injection.

Remember, pressure differentials across the isolation valve, check valve, tubing, manifold, strainer, etc. all accumulate and ultimately dictate the required supply pump pressure. Minimizing the individual pressure drops allow the lowering of the supply pump pressure and effectively reduces the load and wear on the system.

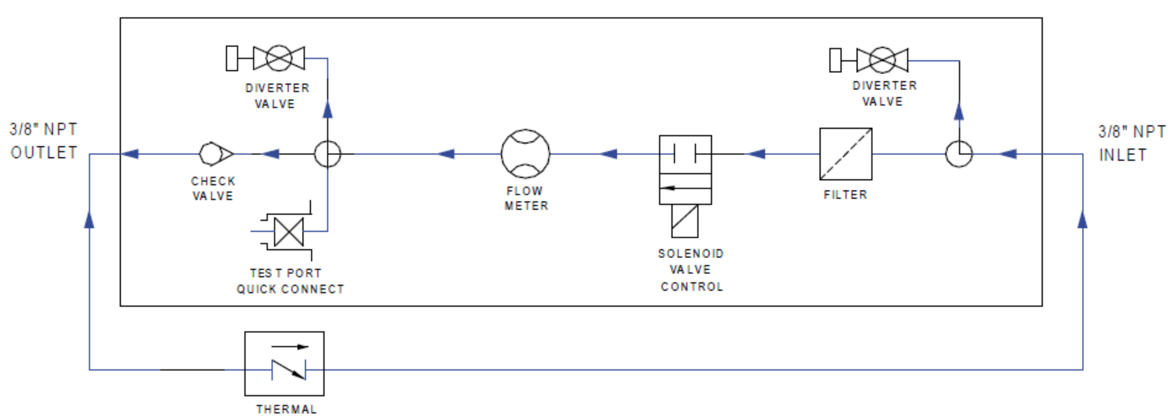
> WARNING: Care should be exercised when connecting multiple injector manifold blocks to one common point of injection. Each manifold line MUST have its own check valve to prevent cross contamination. The length of common piping should be minimized to ensure all additive chemical being injected reaches the fuel line. Not all chemicals are compatible. If multiple additives are used simultaneously, be certain to size common piping for the combined flow.

3.3 Thermal Expansion Relief

Thermal relief bypass kits may be required with the MonoBlock II+ manifold when installed with a point-of- injection actuated valve. This includes a solenoid valve or electric or pneumatic actuated ball valve.

The MonoBlock II+ manifold will stop flow in the reverse direction when the solenoid is de-energized. The check valve in the block prevents reverse flow. When the additive chemical injection system is idle, any fluid expansion that occurs between the block and the point of injection MUST be relieved, usually back to additive storage. When designing the pumping system, provision should be made to allow this thermal expansion volume to return to the additive chemical storage tank.

Figure 3-1: MonoBlock™ II+ Process and Instrumentation Diagram (P&ID)



3.4 Equipment Connections

3.4.1 Solenoid

Two Red Wires - Actuator Coil

Green Wire w/ Yellow Stripe - Earth Ground

3.4.2 Meter Pickup Sensor

(3-wire, Hall-Effect pickup, Open Collector Output)

Red Wire - Sensor Power

Black Wire - Power & Signal Common

Blue Wire - Pulse Signal

3.4.3 Fluid

Inlet - 3/8" Female NPT

Outlet - 3/8" Female NPT

4 Specifications

4.1 Control Solenoid

4.1.1 General Data:

Orifice Sizes: 5/32” (Consult Factory for non-standard orifice sizes) Max Differential Pressure: 100 PSI, 10Bar (with standard solenoid & standard orifice;

Consult Factory for higher pressure differentials)

Certifications: UL/CSA

4.1.2 Coil Data:

- Parker 22.0 Watts @ 120 VAC, 11 Watts @ 240VAC
- ASCO 17.1 Watts @ 120 VAC, 8.6 Watts @ 240VAC

4.2 Meter & Pickup Sensor

4.2.1 Manifold Block Physical:

Fluid Port Sizes: 3/8” FNPT

Material (Body): 303 Stainless Steel

Material (Elastomers): Teflon/ FEP Encapsulated VITON/FF500-75 Max Working Pressure: 400 PSI, 27Bar

4.2.2 Fluid Metering Gears:

Nominal Pulse Resolution: 5000 pulses/gallon (1320 pulses/liter) in water (Half Height Gear) Material (Gears): Ryton™ (Phillips Petroleum Co.)

4.2.3 Sensor Physical:

Sensor Thread: 1/2” FNPT per Electrical Standards

Material: Aluminum

4.2.4 Sensor Electrical:

Type: Solid-state, bi-polar magnetic gated, open collector output

Sensor Power: 5vdc to 25vdc, 20 mA maximum

Open Collector Output: 5vdc to 25dc, 100 mA maximum (un-sourced) 3-wire Connection -

Red Wire Function: Sensor power

Black Wire Function: Sensor power common & emitter (signal common) Blue Wire Function: Sensor signal, open collector output (un-sourced)

4.2.5 Environmental:

Ambient Operating Range: -4°F to 150°F, -20ºC to 66ºC

5 Mono-Block II+ Parts Assembly

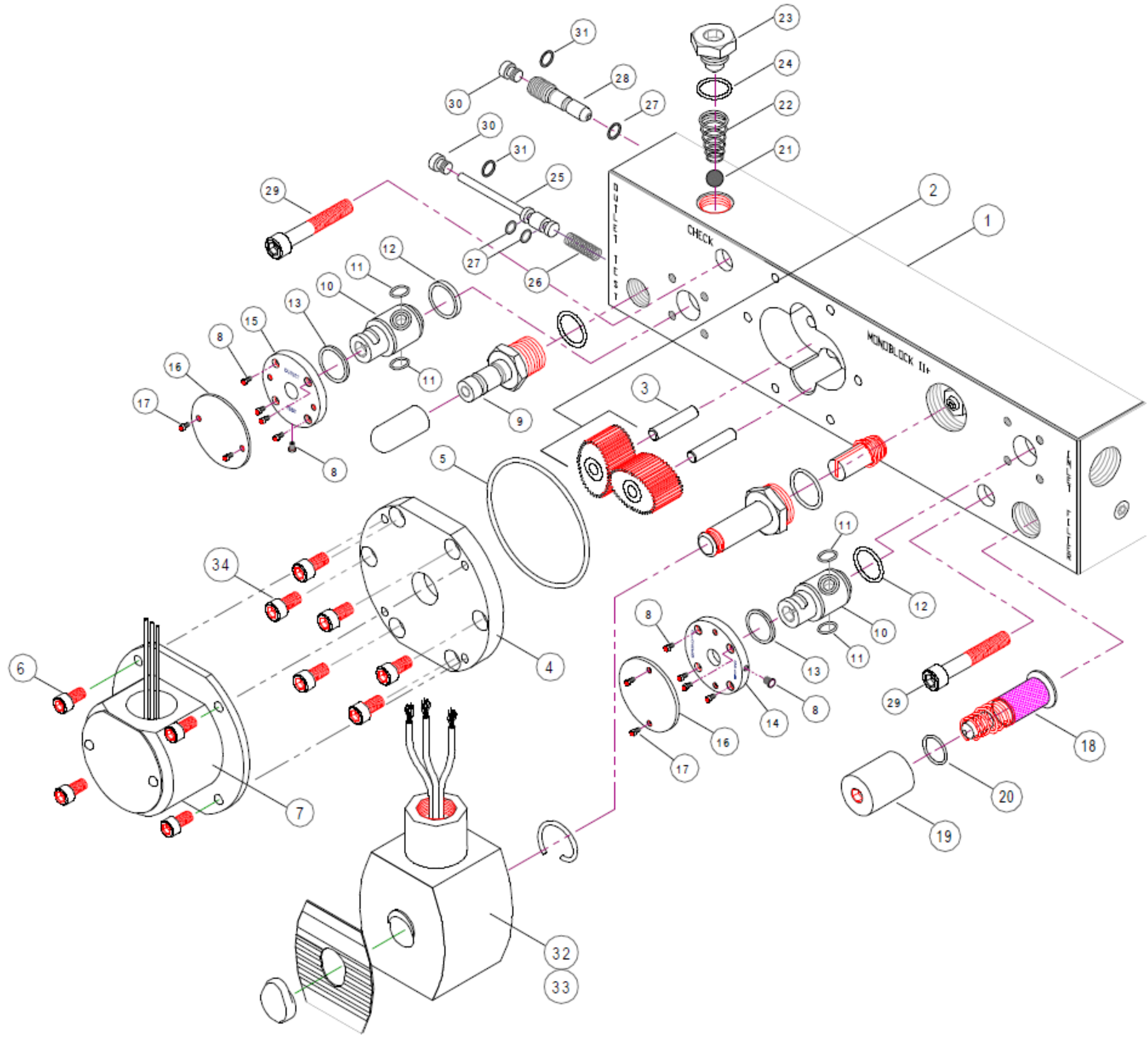


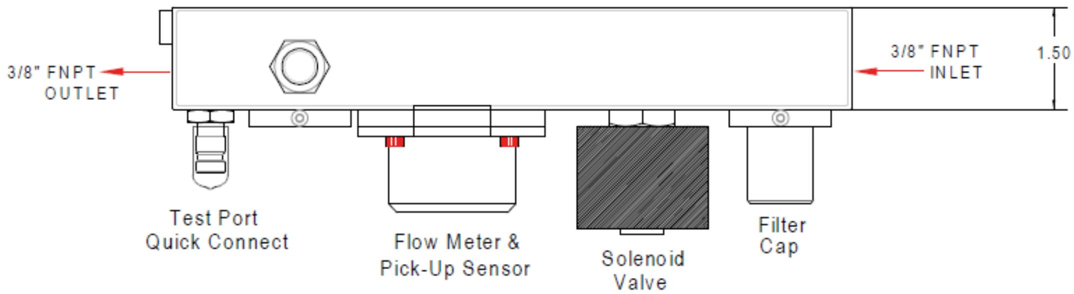
Table 5-1: Parts List(UL)

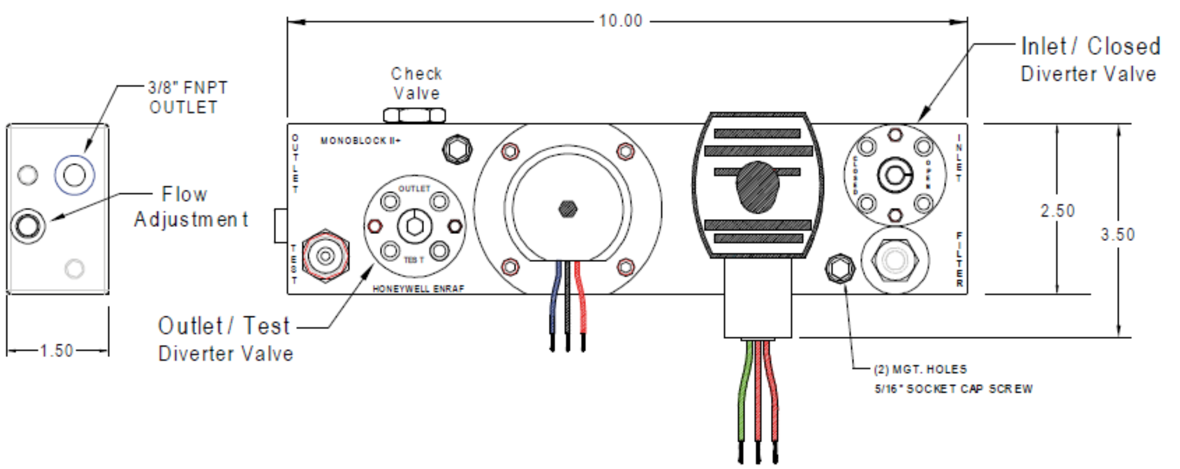
	Component Number	Object Description
1	10-31700	MBII+, Block Half Height 303SS
2	10-31411	Gear Set Ryton Oval Half Height
3	10-31444	PIN 3/16" x 7/8"18-8SS DOWEL (set or each)

	Component Number	Object Description
4	10-31701	MBII+, Meter Cover
5	10-31616	O-Ring, Meter Cover, MBII+ TEF-032
6	10-31460	(M) Bolt Socket Cap, #8-32 x 3/8"SS (set or each)
7	10-31556	Sensor Assembly For MB II+
8	10-31717	Screw, 6-32 x 3/8" Socket head (set or each)
9	10-50000	Test Port For MBII+ Male NS
10	10-31702	MBII+, Diverter body
11	10-31623	O-Ring, Port TEF-012 (set or each)
12	10-31624	O-Ring, Bottom TEF #205
13	10-31625	O-Ring, Top TEF-016
14	10-31703	MBII+, Valve Retainer, Open/Closed
15	10-31704	MBII+, Valve Retainer, Outlet/Test
16	10-31705	MBII+, Security plate
17	10-31718	Screw, 6-32 x ¼"Socket head, Security wire hl (set or each)
18	10-30011	Filter 80 Mesh
19	10-31706	MBII+, Filter cap
20	10-31711	O-Ring, filter cap, encapsulated, (017)
21	10-31712	Check ball, SS, 5/16"
22	10-31633	Check Valve Spring
23	10-31707	MBII+, Check Valve Cap
24	10-31713	O-Ring, Check Valve Cap, encapsulated, (014)
25	10-31708	MBII+, Expansion plug
26	10-31714	Expansion spring
27	10-31719	NINV O ring, exp plug flow stem Zalac (007) (set or each)
28	10-31709	MBII+, Flow stem
29	##	Screw, Mounting, 5/16-18 x 1-3/4" Socket Cap
30	10-31710	MBII+, Flow stem cap
31	10-31716	O-Ring, Flow stem cap, encapsulated (012)
32	10-20172	SOL VLV MB2 120V KAL OR CHEM (PKR)
33	10-20172-1	SOL VLV MB2 120V KAL OR CHEM (ASCO)

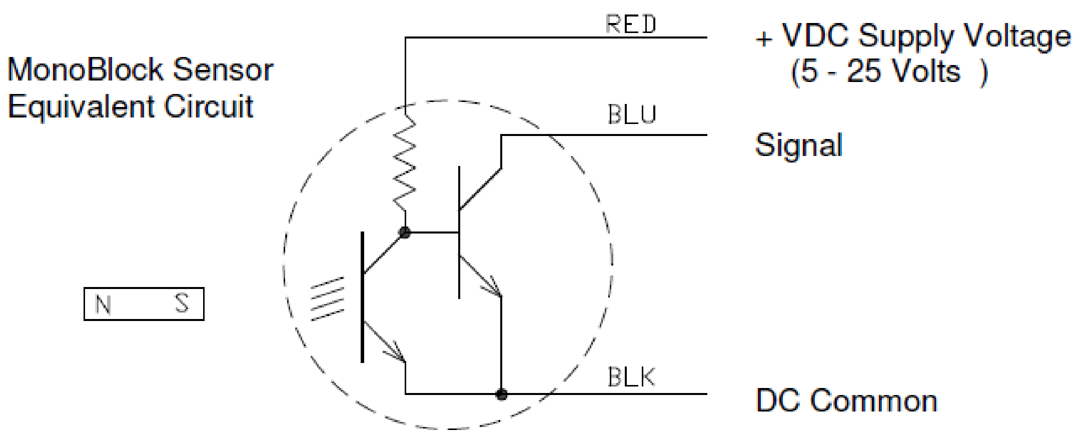
	Component Number	Object Description
34	10-31455	Screw, Meter Cover, #10-32 x 3/8" Socket Cap

5.1 Mono-Block II+ General Arrangement

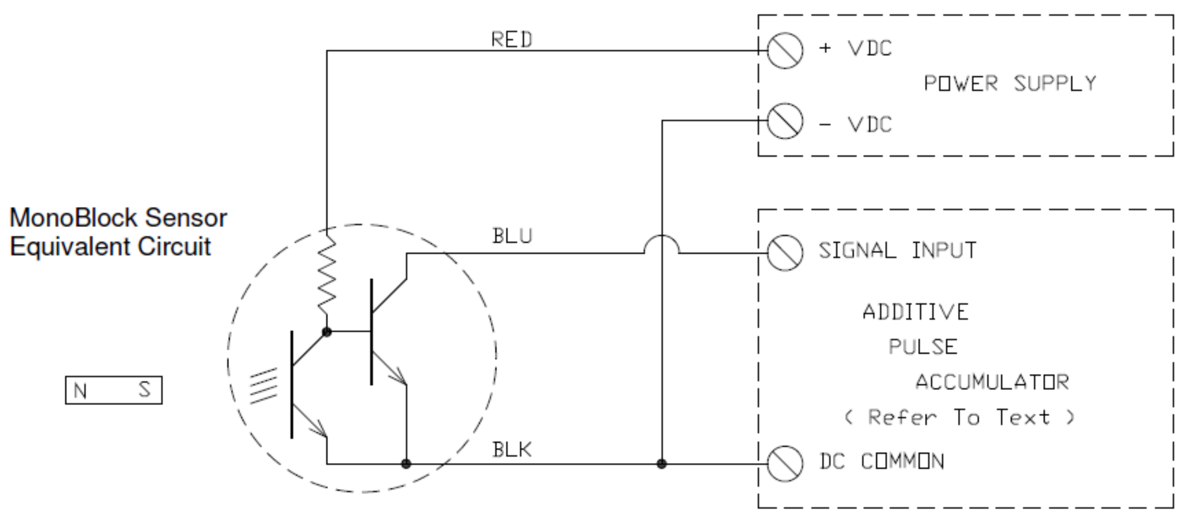




6 Electrical Connection Drawings

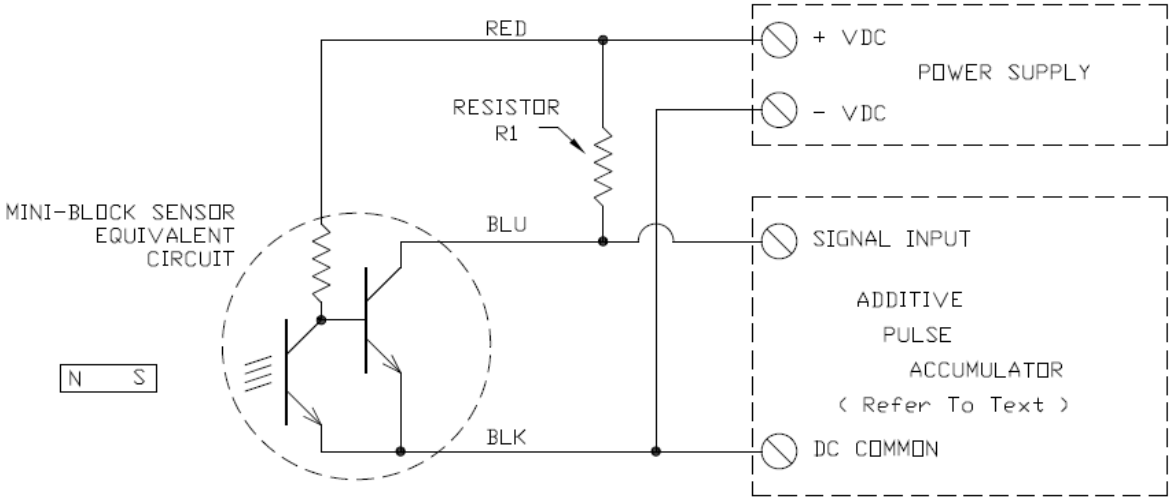


6.1 Mono-Block II+ Sensor Lead Identification



NOTE: The power supply pictured above may be a separate supply or part of the controller / additive pulse accumulator electronics.

6.2 Wiring Diagram for Source Inputs



6.3 Wiring Diagram for Unscourced Inputs

> **NOTE:** The power supply pictured above may be a separate supply or part of the controller / additive pulse accumulator electronics.

Resistor R1 value varies with the Power Supply voltage.

For 5 - 12 volts use 1500 ohms.

For 12.1 - 18 volts use 2200 ohms.

For 18.1 - 25 volts use 2700 ohms.

For all voltages, ½ watt, 10% or better precision resistors are satisfactory.

7 Mono-Block II+ Standard Features

- 303 Stainless steel block.
- 3/8" FNPT inlet and outlet ports
- Inlet and outlet tapered plug style isolation valves with 180°operation
- Allen wrench access bolts to provide tamper resistance
- Valve cover plates with seal wire screws for added security
- Patent pending thermal relief device
- Allen adjustable integral needle for precise flow throttling
- Oval gear meter cavity machined into block
- Strainer basket positioned perpendicular to flow in face of block
- SS ball check valve, machined and polished to achieve optimum sealing
- Meter, solenoid, mounting holes and component heights are identical to legacy MBII ensuring seamless integration
- New Male Test P/N Port 10-50000 (Parker)
- New Calibration Kit P/N 10-31565-PKR
- Explosion proof solenoid machined into block
- Explosion proof Hall-Effect meter sensor
- High resolution gears 5000 pulses/gallon (1320 Pulses/Liter) output
- Meter accuracy of 0.5%
- Meter repeatability 0.25%
- Max. flow rate 2.5 Gal/min (9.5 Liters/min)

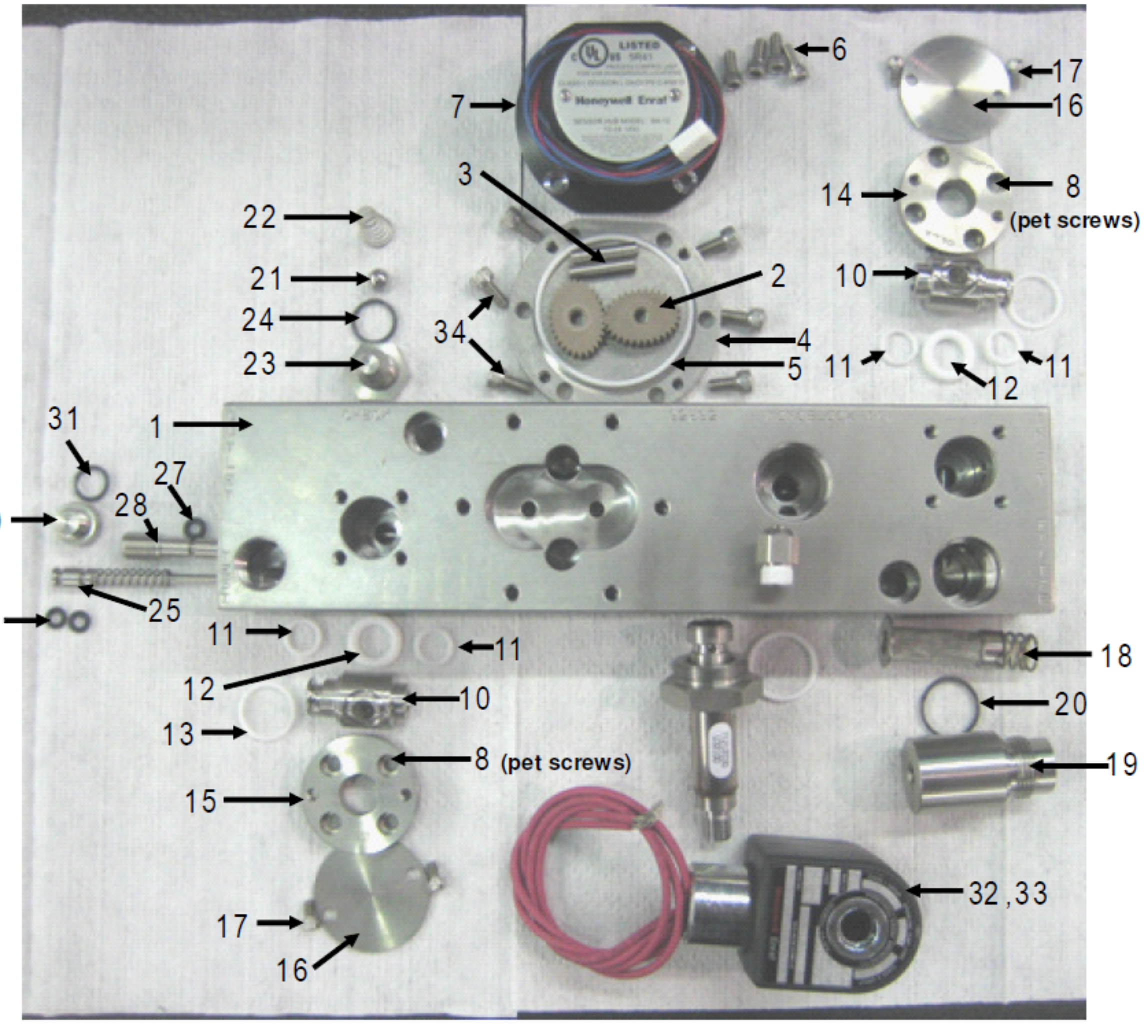
- Min. flow rate 0.1 Gal/min (0.38 Liters/min)
- Oval Gear material 538 Ryton
- Sensor is 3-wire type with power (12VDC), common, and pulse signal connections
- Sensor carries UL listing for Class1, Div1, Group C & D
- UL solenoid, machined into manifold block
- Solenoid 120 VAC, 240 VAC, 24 VDC or 12 VDC powered
- Weight 11lbs (5kgs) approx. unmounted

7.1 Options & Accessories

- New Calibration Kit P/N 10-31565-PKR
- Thermal Relief Kit
  - P/N 10-31572
  - P/N 10-31572-MP (for MP6 Multi-pack)

8 Service Cheat Sheet

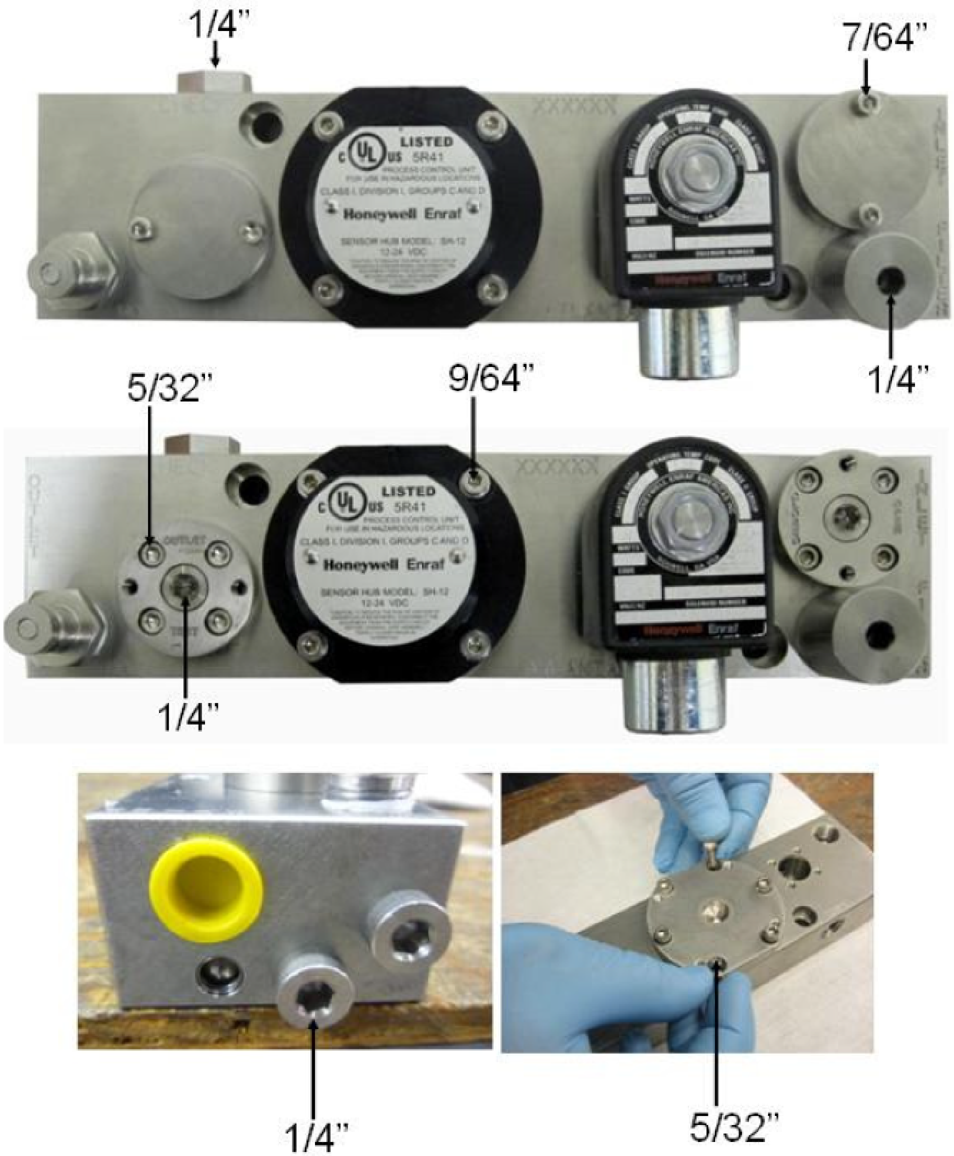
8.1 Mono-Block II+ Photograph with Indexed Components



Refer to the parts list for details.

8.2 Service Tools

Allen Wrench sizes to consider when servicing MBII+:



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