Delaying Pulse Counts During Fuel Hose Pressurization

NOTE Pulse Delay Circuits have sufficient delay to delay pulse inputs while the fuel hose is pressurizing. They may not have sufficient delay to delay pulse inputs while the hose is filling. The fuel hose should not be emptied if properly equipped with check valves per Weights & Measures requirements.

Problem

The problem is the fuel dispensing equipment is registering quantity while the fuel hose is being pressurized, and before any fuel is delivered from the fuel nozzle. Paying customers are being charged for fuel they aren't receiving. Where noted, Weights & Measures inspectors won't certify such a system for self-service retail fuel sales.

Background

The problem is inherent with long fuel hoses and high-pressure fuel pumps such as found at airports and marinas. A properly equipped fuel site will have valves on both ends of the fueling hose to keep it from being drained (this is a Weights & Measures requirement). These valves maintain a very low pressure on the fuel hose to keep the hose full while preventing fuel hose distortion and fuel pump seal damage. When a fuel transaction ends, the high pressure in the fuel lines gradually leaks down back through the pump or through a bypass circuit until pressure drops to the minimum maintained by the valves to keep the hose full. Longer intervals between fuel transactions will see the greatest pressure drops. When the fuel pump is turned on, the pressure increases. The increased pressure also delivers additional quantity. Pulses from this additional quantity are displayed on the dispensing equipment, but the fuel is not being delivered out the nozzle.

The problem becomes more noticeable when looked at from another perspective. Assume a customer is making a purchase with a credit card. They use their credit card to start a transaction, but must leave before any fuel is pumped. They are charged for the cost of pressurizing the hose. The quantity could be as much as a half-gallon.

Solution

the solution is dependent upon the dispensing equipment, and basically requires that quantity (and cost) counting be delayed until the fuel hose is fully pressurized. It must be approached differently for different types of equipment: 1) electronic automotive type dispensers, 2) mechanical automotive type dispensers, and 3) mechanical or electronic aviation or marina dispensers.

1) Some electronic automotive type dispensers can be programmed to delay counting fuel flow until the hose is fully charged. They do this by putting a selectable time delay on pulses used to display quantity and cost, and pulses being sent to a control device like the FMU. Example: it might take 2 seconds to pressurize the fuel hose. A 2 second delay is set in the dispenser. The dispenser readout does not start displaying any quantity (or cost) until the 2 seconds has lapsed and the hose is pressurized. These electronic dispensers' interface FuelMaster through an electronic (P.I.E.) dispenser interface. Once the interface is made and the dispenser is correctly programmed, no other fixes are required.

2) Mechanical automotive type dispensers are the most difficult to work with to fix this problem. The analog quantity and dollar display on these dispensers is mechanical, and cannot be delayed. They will display quantity and cost for whatever volume of fuel passes through its meters, and all fuel has to pass through its meters before entering the hose.

   Most Weights & Measures (W&M) criteria will allow the dispenser display to be replaced with another "primary" display. Syntech's solution is to add a remote display (see Product Bulletins 232 or 224) and Pulse Delay Circuit(s). In doing so, the quantity and cost on the dispenser is covered up (except for the totalizer, a W&M requirement), and the remote display is the new quantity counting device. A Pulse Delay Circuit is put in-line between the pulser in the dispenser and the remote display and FMU. The Pulse Delay Circuit has selectable delays to delay pulse outputs until the hose is fully charged. The remote display and FMU don't start counting until the delay has expired.

3) Mechanical dispensers specifically made for aviation or marina applications can be a little less difficult to work with if the fix is needed solely to satisfy paying customers. Most mechanical aviation type dispensers utilize Veeder-Root registers on Liquid Control meters. The Veeder-Root register can be reset to zero whenever fuel flow is paused. When a transaction has been started and the hose has pressurized, the register can be reset to zero so the quantity indication restarts when fuel starts to flow from the fuel nozzle. A Pulse Delay Circuit is still required in the FMU to delay counting pulses from the pulser, but the Large Remote Display is not necessary.

If a W&M inspector must be satisfied, a remote display as well as a Pulse Delay Circuit must be added as described in 2), above. To satisfy W&M requirements, the quantity indicator must be automatically resettable. The remote displays are. The Veeder-Root register must be manually reset.

Installation and Operation of the Remote Displays

Installation and operation of the remote displays is covered in Product Bulletin 232 for the Three Line Large Remote Display and Product Bulletin 224 for the newest generation Single Line Remote Display.

Installation and Operation of the Pulse Delay Circuit

NOTE Wire color codes shown in the attached wiring diagrams may not match every application. Before adding the Pulse Delay Circuit, verify the wire color codes shown match the pulser requirements.

Although there is only one Pulse Delay Circuit (Figure 1), there are several different ways to wire it into the FMU and dispenser interface depending upon the type pulser being used. Attached to these instructions are diagrams to assist with wiring the Pulse Delay Circuit to various pulser applications. To determine which diagram should be used, compare the wires and wire colors of your application to the applications in the attached wiring diagrams. Some will be obvious by the title of the application. If still not sure which application to use, call our Customer Satisfaction Center at 800-888-9136, ext. 1500. They will assist in determining the application.

The Pulse Delay Circuit is installed between the dispenser pulse generator and FMU pulse input. A connection is made to the FMU authorization signal so the Pulse Delay Circuit knows when to begin delay timing. The figure below illustrates a Pulse Delay Circuit. The inset is the end opposite the wires showing the 8-position dipswitch. Positioning the dipswitches UP (towards the numbers) turns the switch ON.

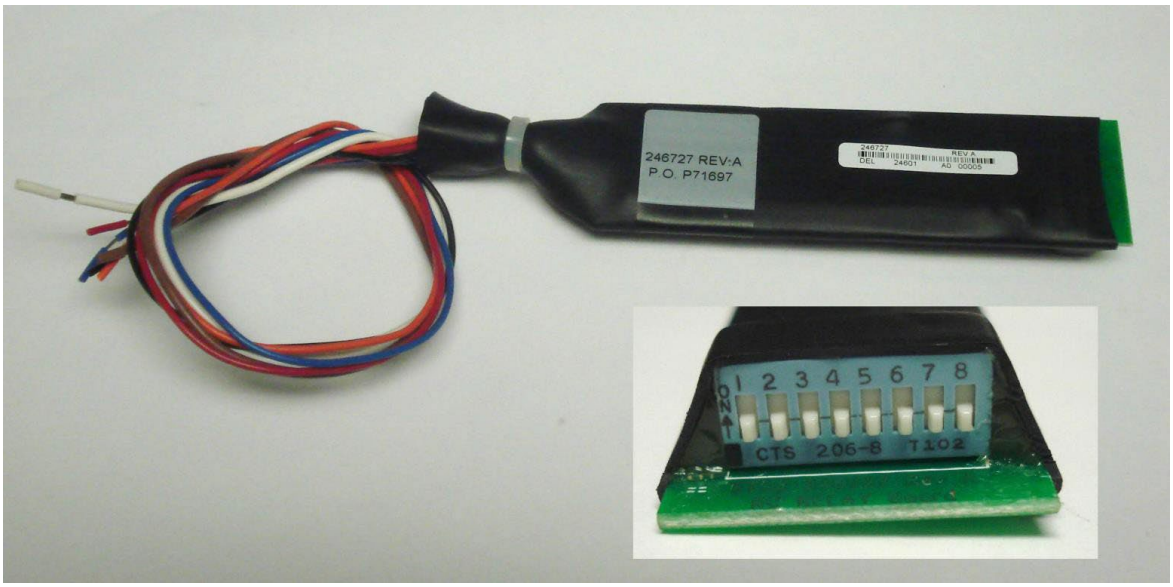


Figure 1. Pulse Delay Circuit

The primary purpose of the Pulse Delay Circuit is to delay the delivery of pulses to the FMU and, if applicable, the Large Remote Display. To determine the amount of delay required, an estimate must be made as to how long it takes to fully pressurize the fueling hose. The least amount of pressure on the hose as this test is performed, the more quantity will be recorded. If there is a counter that counts as the hose is pressurized, turn on the pump to pressurize the hose and watch the counter and the second hand of your watch. When the counter stops counting, the hose is fully pressurized. The timing doesn't have to be precise, but it shouldn't be far off. When the hose stops pressurizing, it is full of fuel and squeezing the nozzle trigger will deliver fuel.

If the delay is too long, fuel will flow before pulses start recording. The delay selected should be timed as close as possible to the time it takes to pressurize the hose without exceeding it. A few test transactions at different delay settings should be tried to determine the best delay setting.

Setting the 8 Dipswitches

Reference the photo, page 3, for dipswitch on and off positions.

IMPORTANT	The PULSE FILTERING dipswitches on the FMU Satellite I/O Control Board must be turned off for any hose position which is using a Pulse Delay Circuit. If not turned off, the Pulse Delay Circuit will not function correctly.

Positions 1 through 4

The first 4 dipswitches are to set delay timing between 50 milliseconds and 7.5 seconds. A 50-millisecond delay exists when positions 1 through 4 are turned off. When position 1 is turned on, a 0.5 second delay exists. Position 2 provides a 1 second delay. Position 3 provides a 2 second delay. Position 4 provides a 4 second delay. The delays are additive. If all 4 positions were turned on, the delay would equal 0.5 + 1 + 2 + 4 = 7.5. If only 1 and 2 were on, the delay would be 0.5 + 1 = 1.5, etc. Any combination of dipswitches 1 through 4 may be turned on or off.

Position 5

Position 5 is a times 2 function. Prior to the Electronic Dispenser Interface, opto-isolators were developed for some common electronic dispensers such as the Gilbarco Advantage and Legacy, Tokheim 262, and some selected Dresser Wayne and Schlumberger dispensers. Pulses have rising and falling edges similar to a sine wave. These applications only count the rising edge, which is half the pulses. To restore as much accuracy, as possible, position 5 should be turned ON for the “times two” application. In the wiring examples that follow this product bulletin, the diagram for the Gilbarco Opto-Isolator should have position 5 turned on to attain as much accuracy as possible.

Position 6

Position 6 permits the customer to bypass the delay settings when performing a Counts Test. Rather than resetting all delay settings to 0, just turn ON position 6 to perform a Counts Test, then turn it off when finished. No other changes are necessary.

Position 7

Position 7 provides a 50 Hz pulse noise filter. Mechanical pulsers such as the Veeder Root 1871 10:1 pulser, or 110VAC pulsers with two wires of the same color connecting to +12V and P1, should have this position turned ON. Without the filter, extra pulses may be detected which will skew the pulse count. When this position is turned ON, the FMU cannot count more than 3000 pulses per minute. Example: the pulse rate is determined by multiplying the number of pulses per gallon times the flow rate (gallons per minute). If a Veeder Root 1871 10:1 pulser is being used, a flow rate of 3000/10, or 300 gallons per minute or less may be used without exceeding 3000 pulses per minute.

Position 8

Position 8 provides a 580 ohm pullup resistor for open collector pulsers when turned ON. Since the open collector pulser is not wired directly to the FMU Pedestal I/O Board pulser connectors, the pullup resistor is built into the Pulse Delay Circuit, and enabled when position 8 is turned on. A good example where this applies is the pulser wiring for the Gasboy 9800 series dispensers. For this application, the pullup resistor is not installed across +12V and P1 for open collector pulsers. For all other applications, position 8 should be turned off.

Pulse Delay Circuit Applications

Gasboy 9800

for a Gasboy 9800 or any other open collector pulse output which normally requires a pullup resistor to be installed on the Pedestal I/O Board J4, J5, J6, or J7 receptacles between +12V and P1. When using this application, omit the pullup resistor between +12V and P1. Turn on dipswitch #8 to enable the pullup resistor. Turn off dipswitches #5 and #7.

Gilbarco Opto-Isolator

for a Gilbarco Advantage or Legacy electronic without the electronic dispenser interface. Turn on dipswitch #5 for best accuracy. Turn off dipswitches #7 and #8.

ICS Pulser

for applications using 12VDC ICS pulsers. Turn off dipswitches #5, #7, and #8.

Mechanical Pulser

for applications using two wire Veeder Root 1871, or 110VAC versions of ICS or OPW pulsers. Connect the black and white AC and neutral wires as directed by the pulser installation instructions. Connect the +12V and P1 as shown in the delay circuit diagram. Dipswitch #7 must be on. Dipswitches #5 and #8 must be off.

Open Collector Pulser

similar to Gasboy 9800 (above) application. Connect emitter to 0V. Connect collector to DELAY CIRCUIT blue. #5 must be off. #8 must be on.

Powered Pulser

for applications like the Veeder Root 7671. Pulser wire colors may not always match the attached diagram. If they don’t, compare the connections for +12V, P1,

and 0V. Match according to the application. Dipswitches #5, #7, and #8 must be off.

Summary

These solutions have been installed at self-service retail fueling sites, and approved by the applicable state Weights and Measures inspectors. Test transactions were performed for the inspectors to their satisfaction.

National Institute of Standards and Technology Handbook 44, SPECIFICATIONS, TOLERANCES, AND OTHER TECHNICAL REQUIREMENTS FOR WEIGHING AND MEASURING DEVICES, was referenced in the preparation of these solutions. In addition, the FuelMaster FMU-2500 and FMU-3000 series (to include 2500 Classic and Plus, and 3500) fixed fuel management units have received a Certificate of Conformance for Weighing and Measuring Devices from the National Type Evaluation Program

If you are having problems satisfying your fueling customers, or the Weights and Measures inspectors, call us to discuss the solutions possible. Syntech will likely have experienced your problem, and have a solution that will work for you.

TIP	If any questions arise, contact Syntech Systems, Inc.'s Customer Satisfaction Center (CSC) at 1-800-888-9136, ext. 2, or email support@myfuelmaster.com.

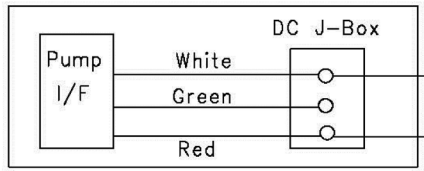
Change Log

Date:	Description:
9/5/2008	Original
7/23/2012	Revised to illustrate new installation diagrams
7/16/2013	Revised to illustrate new installation diagrams, and operating procedures
10/7/2015	Revised to cover new Single Line Remote Display and Three Line Large Remote Display Revised to place emphasis on use of Pulse Delay Circuits for delaying pulses while pressurizing the fuel hose, and not while filling the fuel hose Revised wire color codes in wiring diagram page 11 to match more common applications
11/24/2020	Reformatted/rebranded
08/02/2021	Updated internal listing of associated Product Bulletins referenced throughout

Pulse Delay

24 Aug 2012

GASBOY 9800 Pulser



NOTE

Turn off PULSE FILTERING on the FMU Satellite I/O Control Board for each hose position receiving a Pulse Delay Circuit.

The Delay Circuit ignores pulses at the start of a transaction for a selectable amount of time. After that time, pulses are sent to FuelMaster.

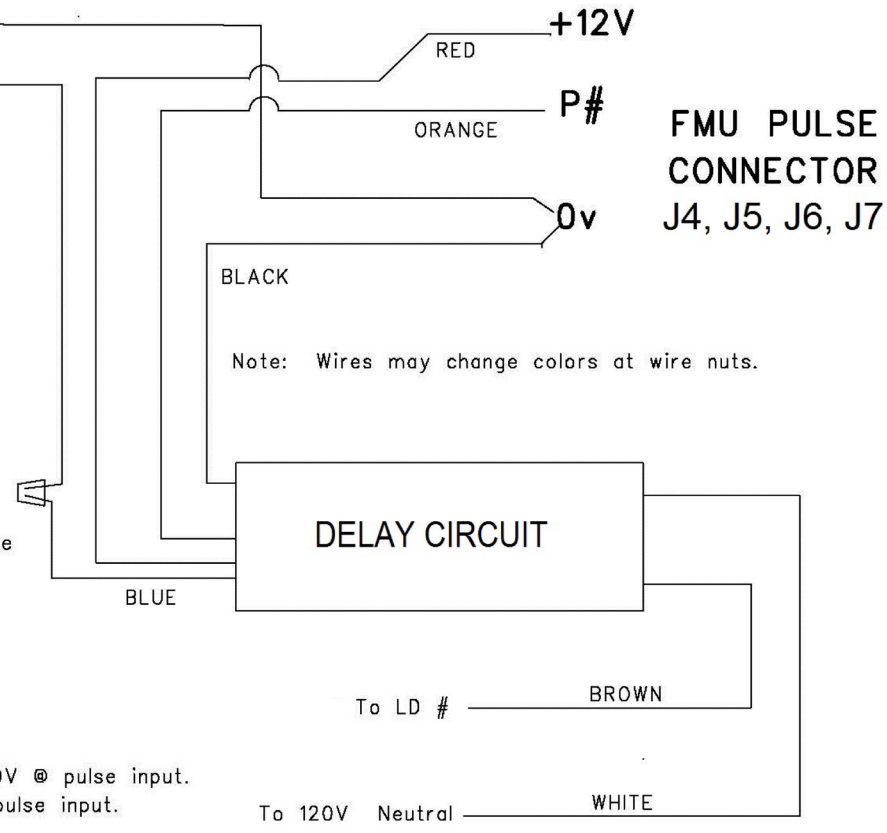
Dip Switch Settings: Time settings add.
#1 ON provides 0.5 seconds of delay
#2 ON provides 1.0 seconds of delay
#3 ON provides 2.0 Seconds of delay
#4 ON provides 4.0 seconds of delay

#5 ON causes each input pulse to generate two output pulses. #5 OFF generates one output pulse per input pulse.

#6 ON disables the delay function.
All input pulses go to the FuelMaster unit.

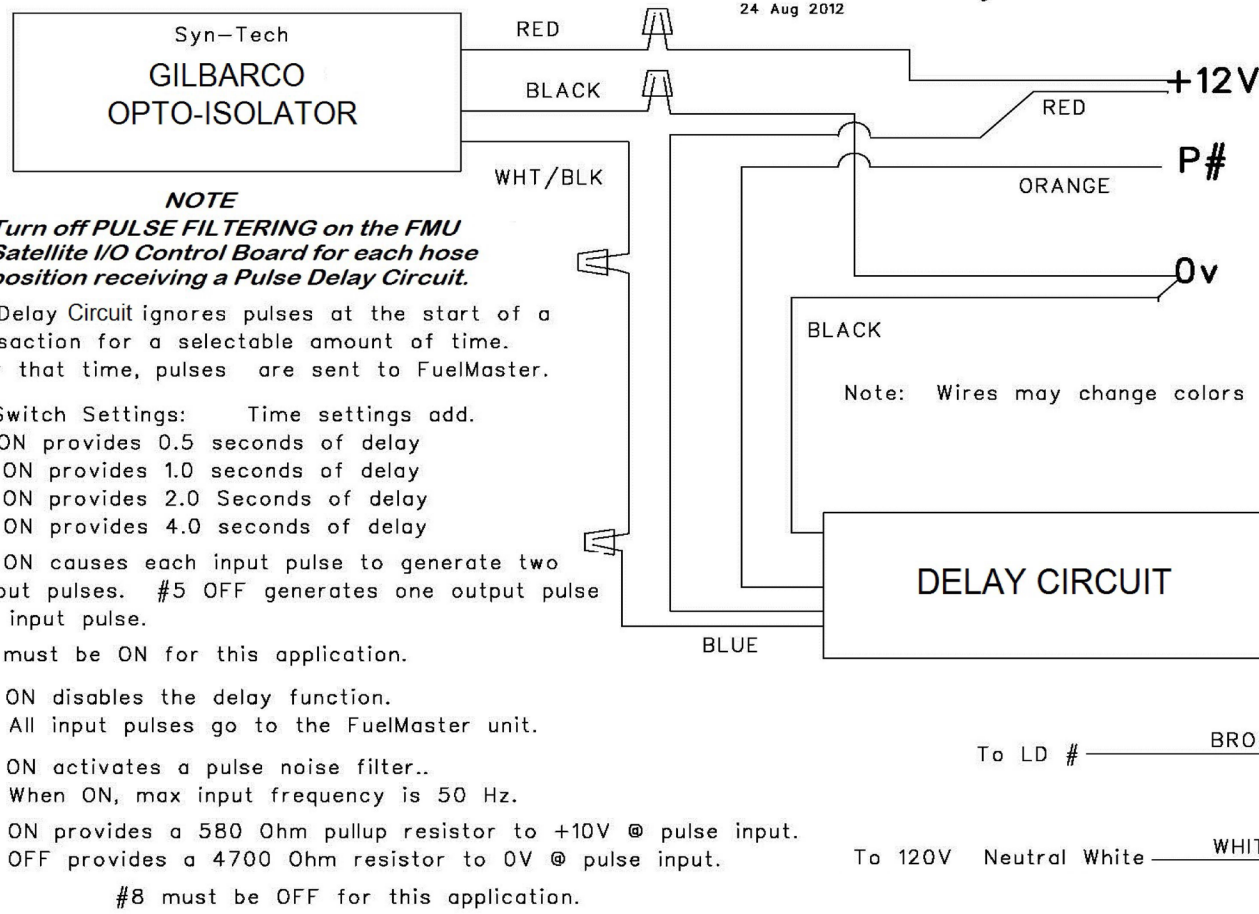
#7 ON activates a pulse noise filter..
When ON, max input frequency is 50 Hz.

#8 ON provides a 580 Ohm pullup resistor to +10V @ pulse input.
#8 OFF provides a 4700 Ohm resistor to 0V @ pulse input.
#8 must be ON for this application.



Pulse Delay

24 Aug 2012



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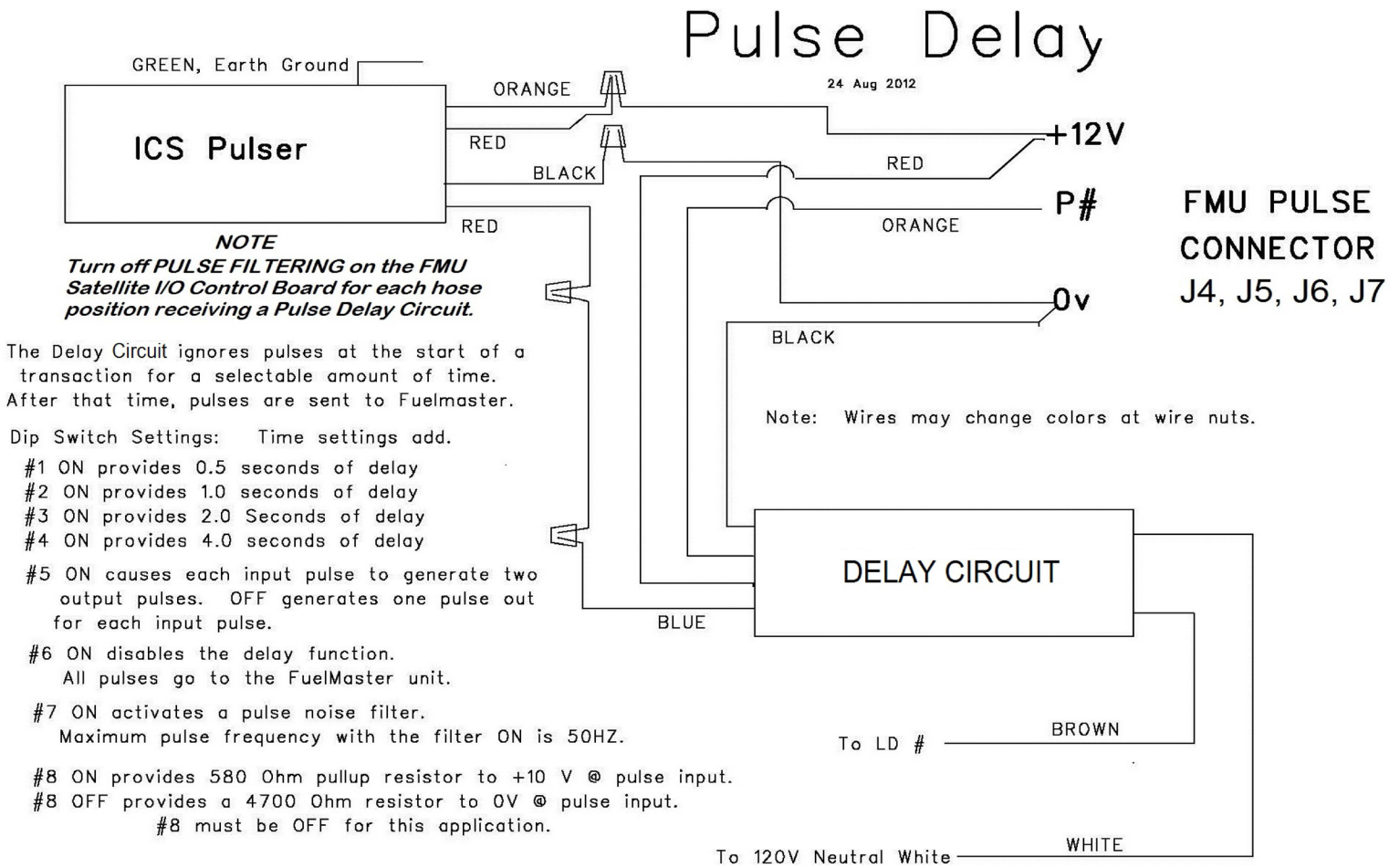
All input pulses go to the FuelMaster unit.

#7 ON activates a pulse noise filter..
When ON, max input frequency is 50 Hz.

#8 ON provides a 580 Ohm pullup resistor to +10V @ pulse input.
#8 OFF provides a 4700 Ohm resistor to 0V @ pulse input.

#8 must be OFF for this application.


Pulse Delay
24 Aug 2012
GREEN, Earth Ground
ICS Pulser
ORANGE
RED
BLACK
RED
+12V
RED
P#
ORANGE
0v
BLACK
FMU PULSE CONNECTOR
J4, J5, J6, J7
NOTE
Turn off PULSE FILTERING on the FMU Satellite I/O Control Board for each hose position receiving a Pulse Delay Circuit.
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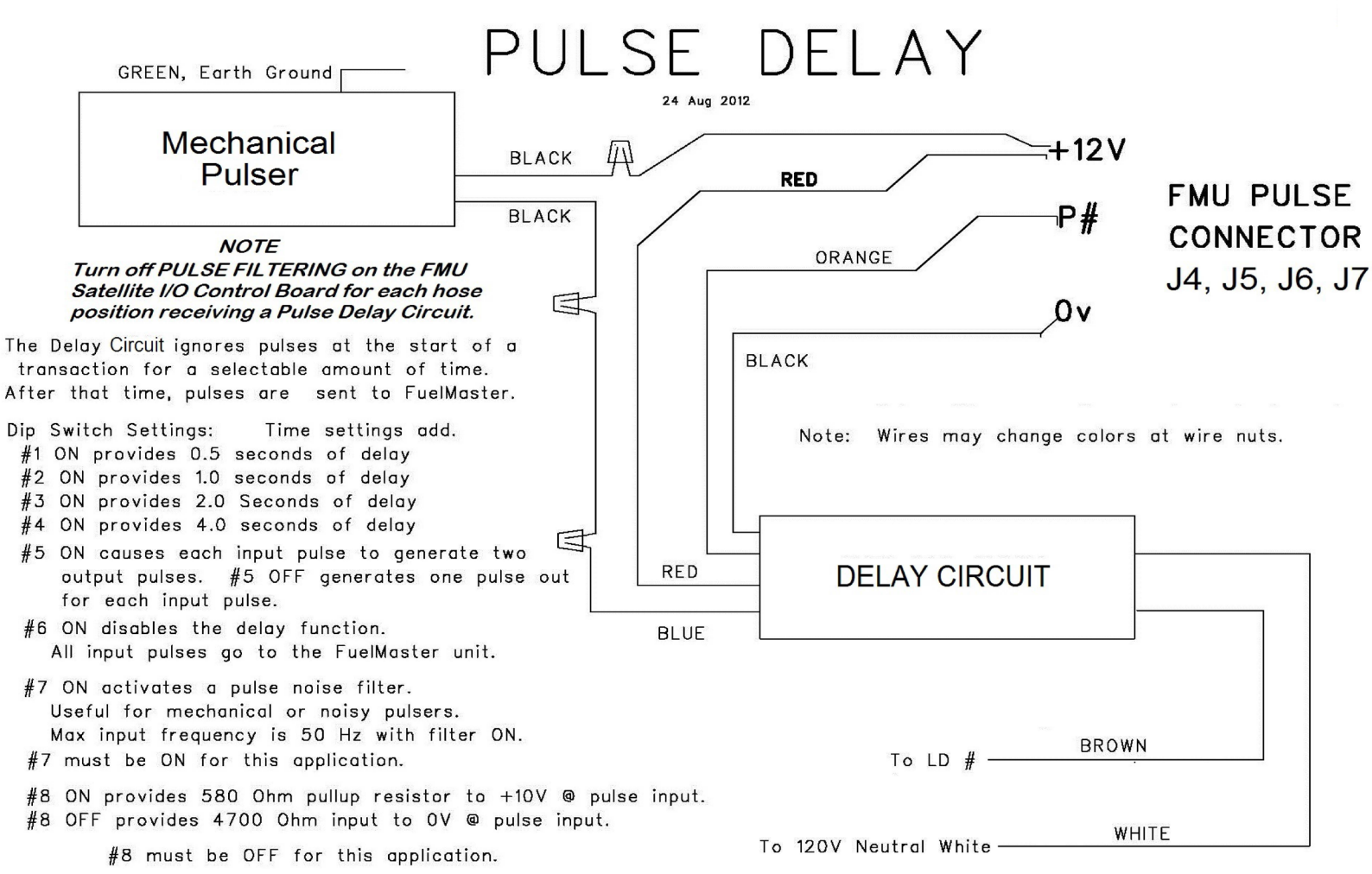
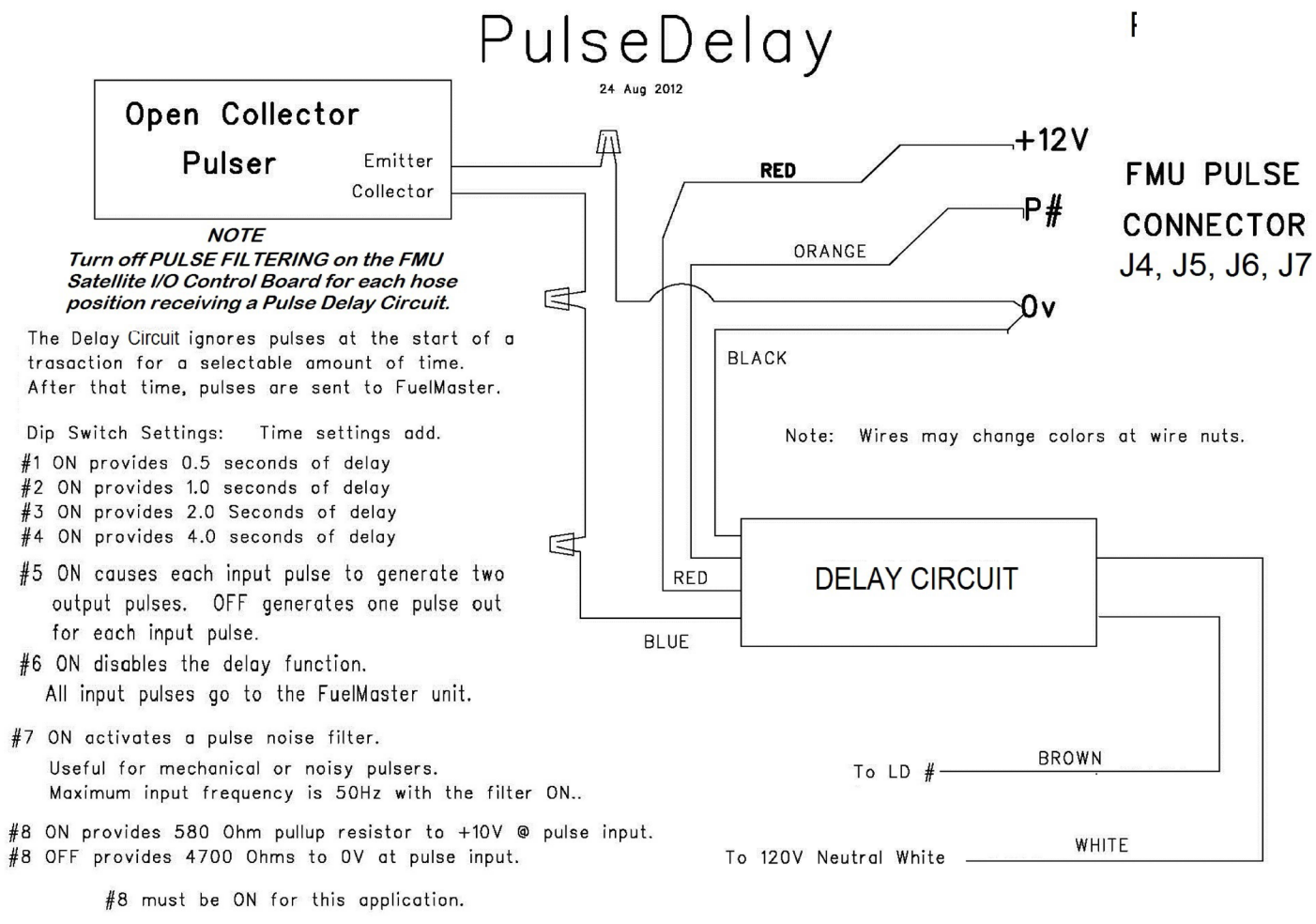
#2 ON provides 1.0 seconds of delay
#3 ON provides 2.0 Seconds of delay
#4 ON provides 4.0 seconds of delay
#5 ON causes each input pulse to generate two output pulses. OFF generates one pulse out for each input pulse.
#6 ON disables the delay function. All pulses go to the FuelMaster unit.
#7 ON activates a pulse noise filter. Maximum pulse frequency with the filter ON is 50HZ.
#8 ON provides 580 Ohm pullup resistor to +10 V @ pulse input.
#8 OFF provides a 4700 Ohm resistor to 0V @ pulse input.
#8 must be OFF for this application.
Note: Wires may change colors at wire nuts.
DELAY CIRCUIT
BLUE
To LD #
BROWN
To 120V Neutral White
WHITE


PULSE DELAY
24 Aug 2012
GREEN, Earth Ground
Mechanical Pulser
BLACK
BLACK
+12V
RED
P#
ORANGE
0v
BLACK
FMU PULSE CONNECTOR
J4, J5, J6, J7
NOTE
Turn off PULSE FILTERING on the FMU Satellite I/O Control Board for each hose position receiving a Pulse Delay Circuit.
The Delay Circuit ignores pulses at the start of a transaction for a selectable amount of time. After that time, pulses are sent to FuelMaster.
Dip Switch Settings: Time settings add.
#1 ON provides 0.5 seconds of delay
#2 ON provides 1.0 seconds of delay
#3 ON provides 2.0 Seconds of delay
#4 ON provides 4.0 seconds of delay
#5 ON causes each input pulse to generate two output pulses. #5 OFF generates one pulse out for each input pulse.
#6 ON disables the delay function. All input pulses go to the FuelMaster unit.
#7 ON activates a pulse noise filter. Useful for mechanical or noisy pulsers. Max input frequency is 50 Hz with filter ON.
#7 must be ON for this application.
#8 ON provides 580 Ohm pullup resistor to +10V @ pulse input.
#8 OFF provides 4700 Ohm input to 0V @ pulse input.
#8 must be OFF for this application.
Note: Wires may change colors at wire nuts.
RED
BLUE
DELAY CIRCUIT
To LD #
BROWN
To 120V Neutral White
WHITE


PulseDelay
24 Aug 2012
Open Collector
Pulser
Emitter
Collector
NOTE
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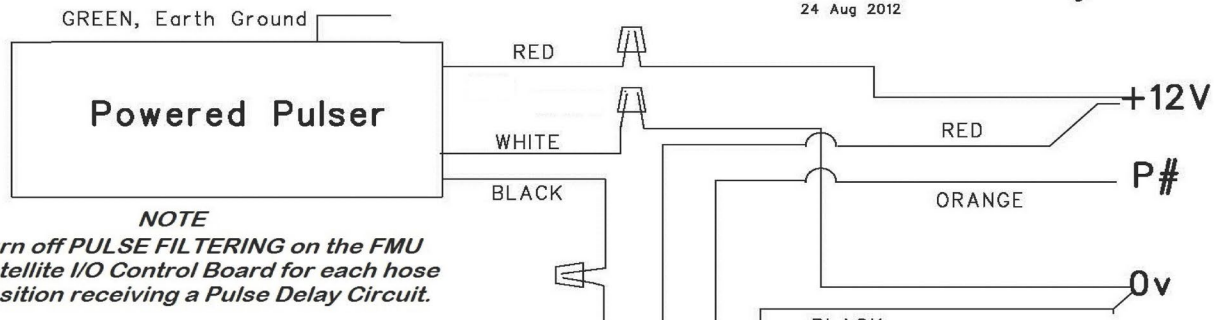
#7 ON activates a pulse noise filter. Useful for mechanical or noisy pulsers. Maximum input frequency is 50Hz with the filter ON..
#8 ON provides 580 Ohm pullup resistor to +10V @ pulse input.
#8 OFF provides 4700 Ohms to 0V at pulse input.
#8 must be ON for this application.
+12V
RED
P#
ORANGE
0v
BLACK
FMU PULSE CONNECTOR J4, J5, J6, J7
Note: Wires may change colors at wire nuts.
RED
BLUE
DELAY CIRCUIT
To LD #
BROWN
To 120V Neutral White
WHITE

Pulse Delay

24 Aug 2012



FMU PULSE CONNECTOR
J4, J5, J6, J7

NOTE
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Dip Switch Settings: Time settings add.

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#2 ON provides 1.0 seconds of delay
#3 ON provides 2.0 Seconds of delay
#4 ON provides 4.0 seconds of delay

#5 ON causes each input pulse to generate two output pulses. OFF generates one pulse out for each input pulse.

#6 ON disables the delay function. All pulses go to the FuelMaster unit.

#7 ON activates a pulse noise filter. Maximum pulse input frequency with filter ON is 50 Hz.

#8 ON provides 580 Ohm pull up resistor to 10 V @ pulse input.
#8 OFF provides 4700 Ohm resistor to 0V @ pulse input.
#8 must be OFF for this application.

Note: Wires may change colors at wire nuts.