The universal fluid flow monitoring system

DDS3 v10

User manual DDS3v10

WHAT DDS3v10 will do for you

The DDS3 turbine based flow monitoring system has been serving the water/alcohol injection market for many years. It gives added protection to a tuned engine should the system fails to deliver fluid correctly.

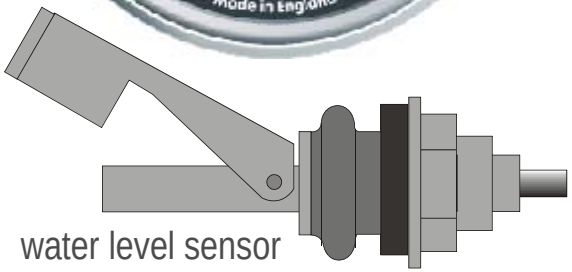
The DDS3v10 is equipped with a new flow sensor. The redesigned internals allow wider flow range and better transient response. The sensor element is now placed in a metal housing rather in plastic.

The electronics department has also been extensively revised to ease connectivity with third party systems. In most cases, only a single wire is needed. There are three Fail-safe output options to protect your engine.

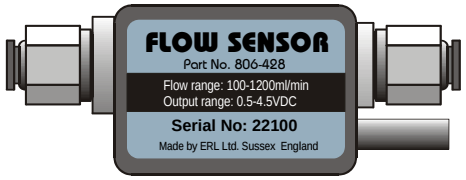
Contents:

Dash Gauge	Page	
	4	Checking the DDS3v10 box contents
	5	Installation for long term reliability
Flow sensor		
	6-7	DDS3v10 Dash Gauge functions
Junction Box		
	8-9	Junction board pinout descriptions
	10-11	Junction board function index
	12-13	Junction board pinout descriptions
Advanced		
	14-15	Advance system configuration
Wiring guides		
	16	Interfacing other Aquamist systems
	17	Non-Aquamist system interface
Appendix		
	18	Simple DIY system
	19	Wiring details Guarantee and Warranty

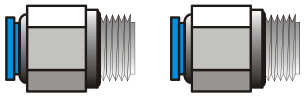
Checking the DDS3 contents



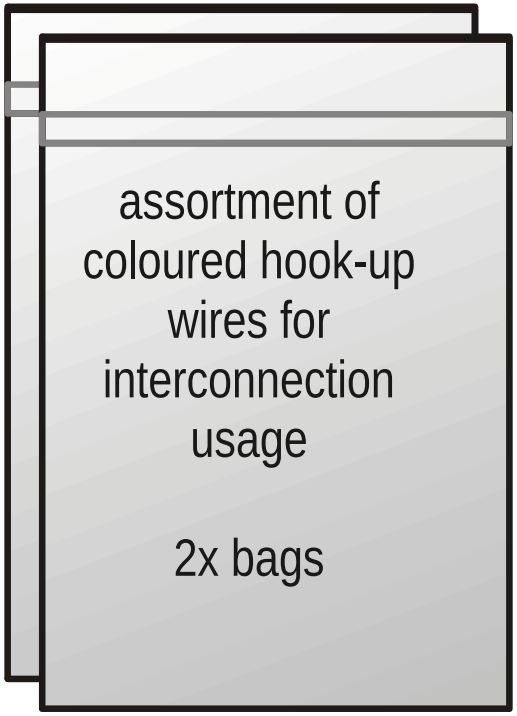
water level sensor



3A FUSE



2x 1/8BSP to 1/4" hose
(for third party system)



Please check and ensure all the above contents are in the box

Installation for long-term reliability

This is the most important section of the DDS3 chapter. Please do not skip reading this part.

The 52mm Dash Gauge:
Location is not too critical as long as it is in view of the driver. There isn't too many pitfall on this.

The Junction box:
This is the heart of the system and must be installed in a dry location, preferably sited close to the glove compartment. Do not install it in the engine compartment, (It has been done !)
Assuming all cables from various locations are routed to the junction box neatly. Please label the flow sensor cable to prevent it from wrongly identified with the 4-core cable from the truck area, Once marked, the cables and wires can be cable tided.

The most common mistake at this point is cutting the bundled cables very short to improve tidiness. Please don't. Allow a minimum of 2 feet so that the junction box is accessible when a problem occurs, Longer cable length will not degrade the system performance at all.

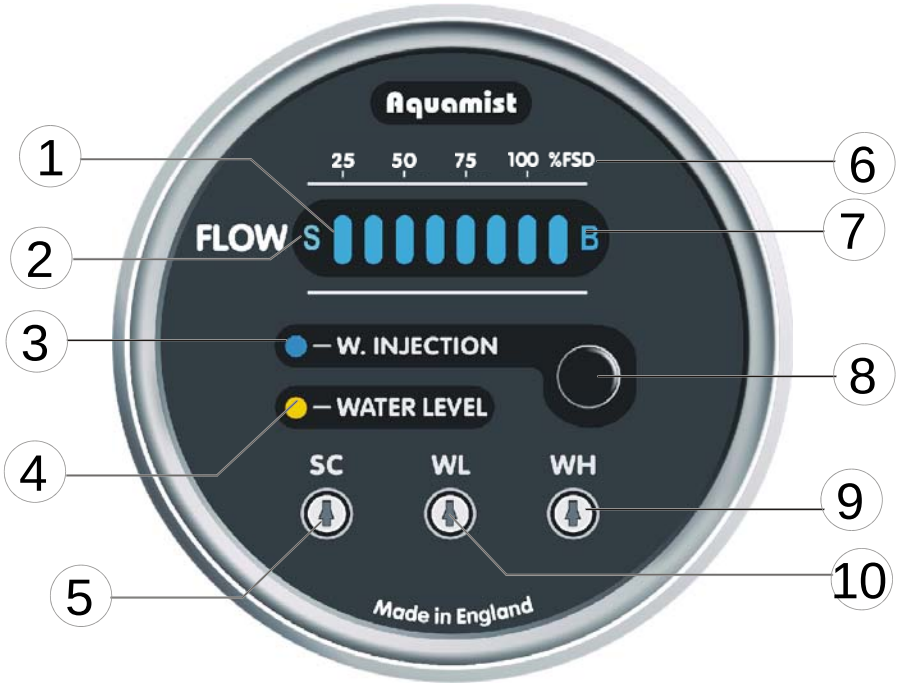
The Flow sensor:
The location of this sensor is most critical to overall system reliability. It is normally located it in the engine compartment. But there is no reason why it can't be spliced into any where between the pump outlet and jets/nozzles.

The sensor must be installed in a cool area, well away from the a heat source. Bulkhead/fire wall is not a good location as most heat is flowing towards it during motoring. Avoid location near any electromagnetic components such as the ignition coil, solenoid valves and electronic motors.

It is very important that the hose is cut cleanly with a razor blade to retain the "roundness". Side cutter produces a semi-round hose end, major leak will result sooner or later. The hose exiting the fitting must be straight so that the hose is not distorted and will be badly affected in a hot environment. Again, in time it will develop a leak.

The Tank level sensor:
Avoid locating the sensor tip close to a washer motor. The motor magnet will affect the sensor to read properly. The sensor can be installed 3/4 way down the tank, Preferably at the rear facing wall of the tank. A 23mm burr-free hole must be used to ensure good seal. Never over tighten or the seal will split, just tight enough to prevent leakage, no more.

DDS3v10 Dash Gauge Functions



1. 8-element Bargraph Display (80-1800ml/min)
Each segment is equivalent to a percentage of the total flow of the sensor scaled by the SC potentiometer.

2. "S" indicates the presence of sensor.
The letter "S" (sensor) must be lit after power up and stay on to show the sensor is functioning correctly.

3. Water injection system ON led
This led comes on the when the system is switched on and in readiness to inject. .

4. Water Level led (yellow)
(This LED has three functions)

a. During "power on delay" period:
This LED will activate for approximate for 10 seconds during the system-on delay (v10) before the main system turns on.

b. During normal operation period:
- This LED is on during the safe-fail activation
- Water level low (intermittent flashes)

c. Led lit after the gauge is switched off:
- If the water level sensor is activated for over 20 seconds.
- Fail-safe output is in the active state (10.6).

5. SC (Sensor Calibration)
20-stepped potentiometer allow user to scale the flow sensor to give an ideal visual indication of a given flow rate. Ideally set the led to display 5-6 bars at full flow.

6. Backlit flow legend
Legend displays % of full scale of 8-bars

7. "B" Boost Enabled led
When the flow falls inside the fail-safe window after system trigger, this "B" led will activated. Useful indicator of the WL and WH setting.

8. Water injection enable button

Due to extra power level achieved under WI, user may want to reduce the power to the wheels in less than ideal driving conditions. Disabling the WI will reduce boost to wastegate bleed valve setting (if fitted) as well as switching to a less aggressive MAP on custom engine management.

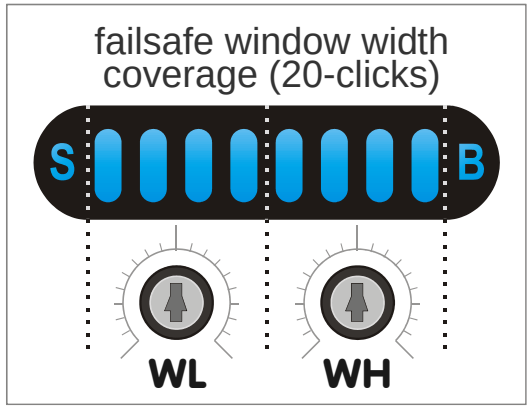
9. Over-range setting potentiometer (WH)

It is just as important to monitor over-range conditions as well as under-range flow conditions. If a leak develops close to the water jet and starves the engine of the water, the user must know this condition. A 20-stepped potentiometer allows accurate and repeatable adjustment range.

10. Under-range setting potentiometer (WL)

This setting can indicate partial blockage and trapped air inside a delivery hose. Again 20-stepped potentiometer is employed. Each click represents a fixed portion of the window width of 8-bars.

WL covers the lower 4 bars and the WH covers the upper 4 bars. Figure on the right illustrates the span of the coverage. Setting is very simple once SC is calibrated.



NOTE:
In order to make the fail-safe adjustment easier, it is recommended to set the bargraph to display 5-6 bars at maximum flow. This way, the fail-safe window can span from the centre outwards.

If the WL and WH is set at 12 O'clock, the fail-safe window is approximately spanned between 2-7bars. A good starting point.

Minor trimming for the WL is necessary if the water injection trigger point is set to commence earlier.

The v10 gauge will display the activation of the "fail-safe" with two leds:

Further useful hints:
"B" led (right of the bargraph) will active if the flow is inside the fail-safe window during injection period.

The yellow led (water level) will activate if the flow is outside the fail-safe window during injection.

As soon as the "fail-safe " is tripped, there will be a 4 second reset period before it resets. If the fail-safe drops boost, expect 4 seconds of low boost. The same will apply for fail-safe-induced map switch.

When gauge is off, expect low boost and safe map unless the board is re- configured. (page15.B).

DDS3 junction board pinout descriptions

1. RJ-45 socket for dash gauge:
The DDS3v10 uses a RJ45 connector to link up with the Dash gauge,

2. Inline flow control valve:
This output can be used to switch an inline solenoid valve to control flow. Output current is limited to 1 Amp. It is activated by the signal applied to the PWM (pin17) or MAP (pin18) input.
User can set the triggering point by using the "Trip-adj" potentiometer near the bottom of the junction board.

3. External Anti-CEL dummy load resistor:
A more powerful anti-CEL dummy resistor can be connected to this output when excessive heat is produced by the on-board dummy resistor. This option only applies if pin 9-10 is used for cutting the PWM signal to a boost control solenoid valve in the event of fail-safe or prolonged "gauge-off period".

4. MAP switching signal output:
Fail-safe output for map switching usage. This output is about 5V and switch to 0v upon fail-safe activation. The signal is short circuit proof with a current limit of 5mA. If an alternative or an inverted output signal is required. this output pin can be reprogrammed via a set of soldering pad on the underside of the circuit board.
Please go to page 15, section C/D for a more detailed description of how this can be done.

5. Fail-safe window output (SW GND)
When flow signal falls inside the fail-safe window, pin7 will switch to ground immediately. This output can be used to activate a solenoid valve to increase boost pressure. This output can also be used to switch MAP (GND active) on an ECU.

6. Voltage free relay outputs
There are three terminals representing a set of voltage-free "change-over" contacts from a relay if anti-CEL -dummy resistor jumper link is un-used. (p10.6). M-SW1 is the "wiper" or "common" pin.

M-SW1 and M-SW-0 contacts are opened normally until fail-safe is triggered or gauge is switched off

M-SW1 and M-SW-3 contacts are closed normally until fail-safe is triggered or gauge is switched off.

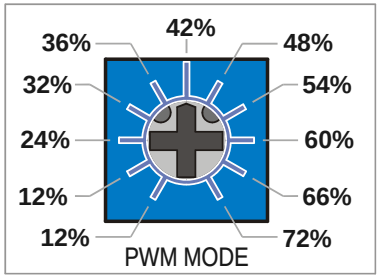
7. Led brightness for night driving (p.9)

When pin 19 is linked to the headlamp switch, this potentiometer enables user to adjust the brightness level of the gauge leds.

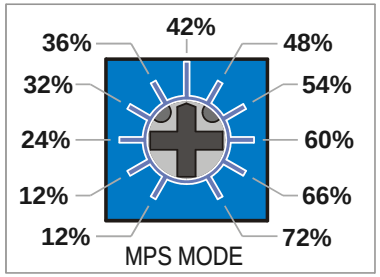
8. System trigger point adjustment (p.9)

This potentiometer sets the triggering point of the injection system.

In PWM mode, the figure on the left indicates the IDC trip point in 6% steps.
Most common onset point is 42%, (12'o'clock).



In MPS mode, the figure on the left will help to identify the trip point of a 12 to 72% Manifold Pressure Sensor. To translate the signal % to PSI, please see the table below:



Trip-adj	12	18	24	30	36	42	48	54	60	66	72	%
2-bar	-11	-9.3	-7.6	-5.8	-4.1	-2.3	-0.6	1.2	2.9	4.6	5.6	PSI
3-bar	-9.3	-6.7	-4.1	-1.5	1.7	3.8	6.4	9.0	11.6	14.2	16.8	PSI

MAP sensor conversion table: from % to PSI (shaded = vacuum)

9. LED (green) to monitor IDC

This led will active when a PWM signal is successfully detected on pin17. It should pulse in unison with the frequency and grows brighter as the duty cyle % increases. This led should not be lit before cranking. After the engine has started, it should pulse in time with engine speed,

If the DDS3 is used as a failsafe to a third party WAI system, this led will only pulse when the PWM pump is activated under normal injection events.

10. Selecting external dummy resistor

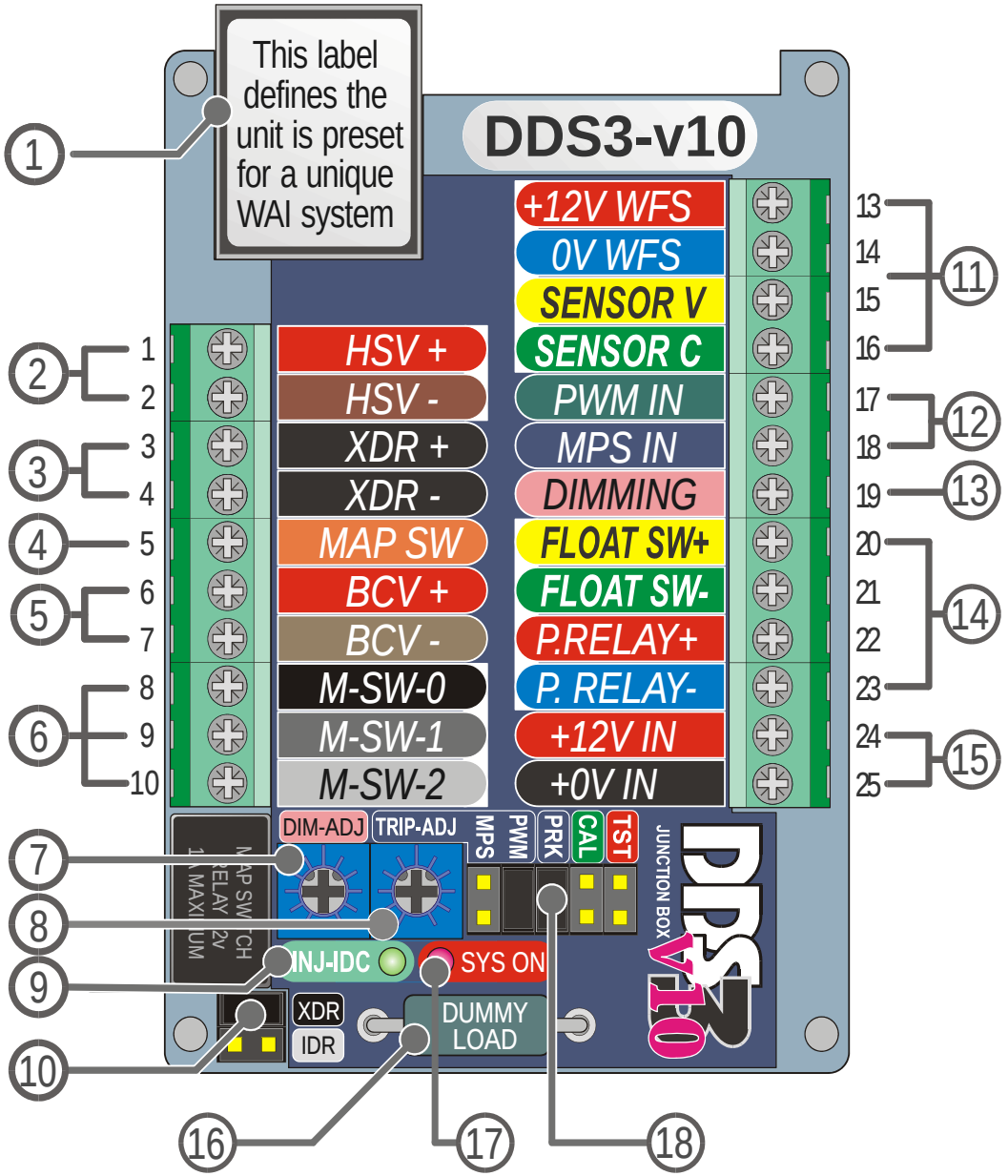
Selecting ext/int dummy resistor. The on-board Anti-CEL resistor is rated for intermittent usage during fail-safe activation. In the event of prolong activation, it will get very warm. To avoid excessive heat build up, it is recommended to use an external dummy resistor for this purpose,

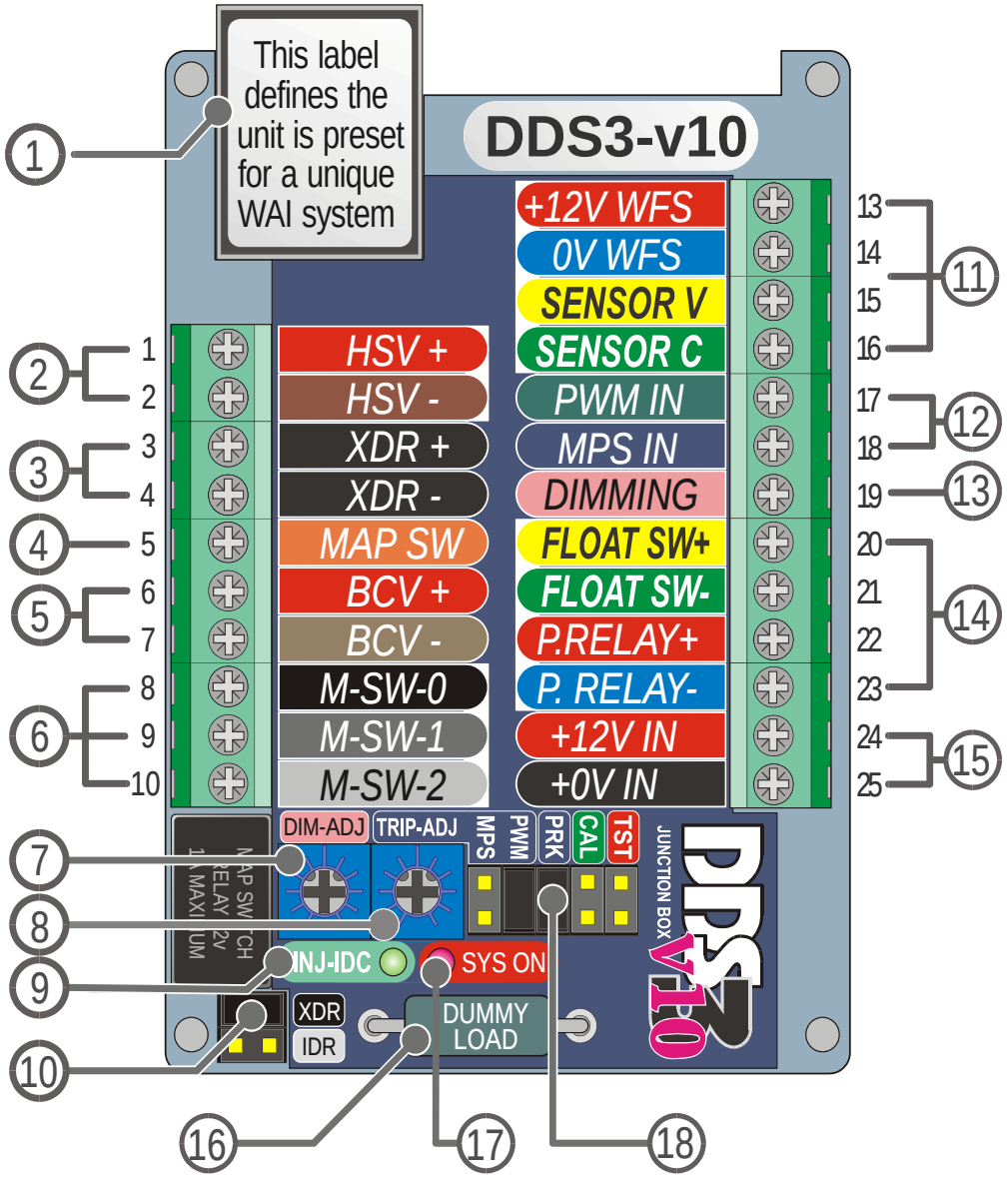
The external resistor is not supplied with the kit but it is widely available in electronics store. The resistor should be 39 ohms, 10W-25W in metal body.

NOTE: If anti-cel is not necessary, please leave it on the XDR position or remove the link completely.

DDS3 Junction board

Pin function directory





1, RJ-45 socket for dash gauge (p.8)
2. Inline flow control valve (p.8)
3. External Anti-CEL dummy load resistor (p.8)
4. MAP switching signal output (p8)
5. Boost Control valve output (p.8)
6. Voltage free relay outputs (p.8)
7. Led brightness for night driving (p.9)
8. System trigger point adjustment (p.9)
9. LED (green) to monitor IDC (p.9)
10. Selecting external dummy resistor (p.9)
11. 4-core cable to turbine flow sensor (p.12)
12. System trigger signal input (p.12)
13. +12V input to enable led dimming (p.12)
14. Tank level/pump control output (p.12)
15. Main power input (fused), IGN.SW #2 (p.12)
16. Internal Anti-CEL dummy resistor (p.12)
17. LED (red) to show system activation (p.13)
18. User selectable system configuration (p.13)

11. 4-core cable to turbine flow sensor

Please ensure the stripped wires are twisted without any loose strands before insertion into the terminal block connector.

12. System trigger signal input

Choice of two system triggering signal inputs. Selectable by jumper links (page13.18)

PWM IN (pin17): It reads and translates any negative going pulses such as fuel injector or PWM based pump speed controller in to a reference signal to trigger the system and fail-safe circuitry.

The system is factory set to detect negative PWM signals. Some pump speed controller uses a positive PWM switching driver, you need to re-configure the DDS3 circuit board manually, (p15.F).

MPS-IN (pin18): 0-5V input signal for triggering the system instead of PWM. This type of signal is normally associated with MAP, MAF and TPS sensors.
The trigger point of the above is set by the Trip-adj potentiometer (#8).

13. +12V input to enable led dimming

A 12V signal at this input enables the uses to set the brightness of gauge (p12.7). It is normally wired to the head lamp switch so the gauge will automatically dim during night driving.

14. Tank level/pump control output

These four connections control the delivery pump and detects water tank fluid level. Control signals are transmitted via a ~5M of 4-core cable to the trunk area.

15. Main power input (fused), IGN.SW#2

It is important the 12V power is only active at ignition switch position #2. Ideally, it should be wired to the same +12V supply to the fuel injectors.

16. Internal Anti-CEL Dummy resistor

If the stock ECU-controlled boost valve is disconnected by the DDS3 during a fail-safe activation, a CEL (check engine light) is often illuminated.
To prevent this from happening, A dummy resistor is used to create an artificial load of a boost control valve.

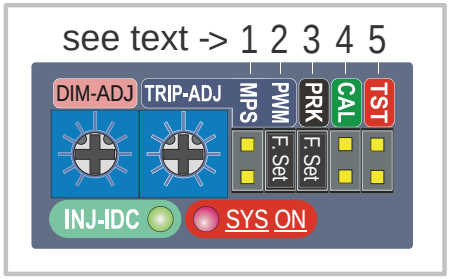
During this period, the resistor will warm up. If heat is a concern, use an external resistor, (see page8.3)

17. LED (red) to show system activation

This "SYS ON" red led actives when the PWM/MPS input signal reaches the "trip adj" setting. The system will commence injection.

18. User selectable system configuration

Figure on the right shows a set of default user selectable jumper links for setting up the triggering mode and manual system test. Read on for further details



1. MPS (Manifold Pressure Sensor) MODE link:
Selecting this link instead of the default "PWM" link changes the system's triggering mode. Now the system will be looking at the MPS signal (0-5V) at pin 18 to turn the system on.

2. PWM (Pulse Width Modulation) MODE link:
PWM MODE (Factory set). The system looks for "switch to ground" PWM signal from the pin17 to turn the fail-safe circuitry and W/A injection on. For "positive edge trigger" see "Advance setting" (Page15.F). Upon successful detection of PWM pulses, the Green led will pulse in time with the incoming PWM signal.

3. PRK (Parking unused jumper link)
This link space is for parking an un-used jumper link socket. No other usage.

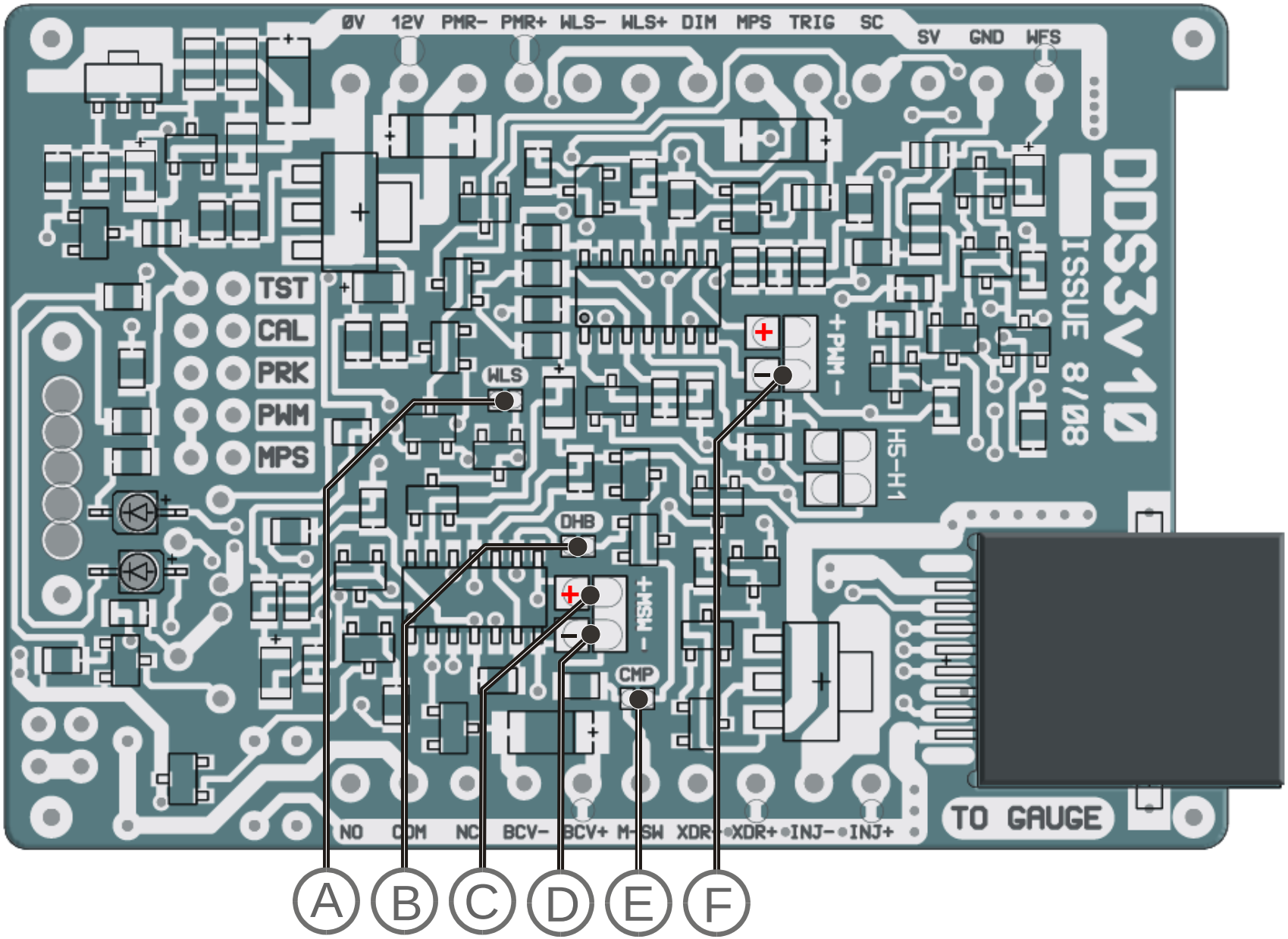
4. CAL (Calibration Simulation. Default = unlinked)
Linking this pin turns the "SC" potentiometer into a flow sensor simulator. Fully clockwise for minimum water flow. Useful to check the fail-safe window width. "B" led will activate when the simulated flow is inside the window

5. TST (Manually test. Default= unlinked)
This link is useful for testing the system without driving the car at full boost and RPM. When this link is shorted, it simulates a 100% IDC signal appearing at the PWM input terminal (pin17).

Warning!!! Linking this pin will start the pump and energise the Inline valve, resulting in 100% maximum fluid delivery to the water jet/jets.
Do not activate this link for more than 5-10 seconds at a time for risk of burning up a solenoid valve designed for pulsing purpose use only.

Remove this link as soon as the manual system test is completed.

Advance system configuration (solder link)



Advance system configuration (solder link)

The DDS3v10 is pre-configured at the factory for a specific application. When in doubt, please check the round label on the lid of the box or the small label on the RJ45 socket at the top right of the junction board. (factory default: "for Universal fail-safe use")

If the user wishes to change the original setting, this is the section to explain it all. You will require a small tipped soldering iron and a small pointed tool.

As seen from the PCB figure on the left. All the user configurable links are marked with alphabetised circles.

Some pads are pre-linked from factory. If you need to change those, pick off the thin track (pointed tool) and solder link the alternative solder pads.

A: WLS - Water Level Sensor (default=linked)
Pick off the thin circuit track if you do not wish the tank level sensor to disable the system after 10-20 seconds of low level reading. (not recommended),

B: DHB - Disable High Boost (default=linked)
Pick off the thin circuit track if you want to retain high boost or "Aggressive MAP" after the system is switched off at the gauge, only if you are using pin 9/10 to reduce boost to wastegate setting after fail-safe activation,.

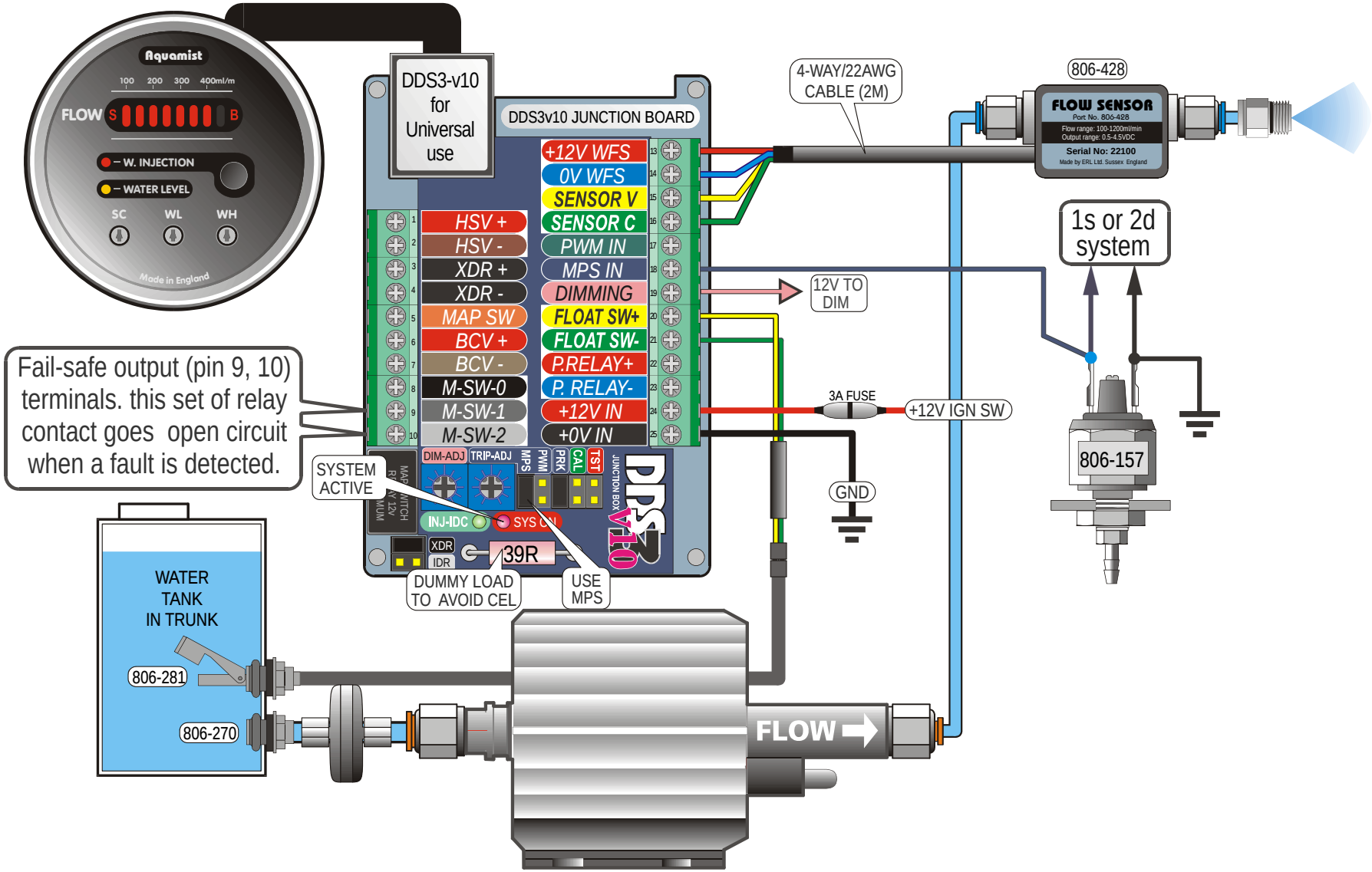
C/D: MSW - Map Switch polarity (default= D-linked)
The factory default output is preset to give a 0V output upon a fail-safe activation. Otherwise the output will stay at ~8V.

To invert this output to give out a +8v signal upon a fail-safe activation, un-solder the pad D(-) and solder link pad C(+) to the long soldering pad.

E: CMP Clamping MSW signal (default=clamped)
Solder linking this pin will clamp the above MSW signal down to 4.7V, suitable for most digital devices. It is factory linked to give 4.7V.

F: PWM MODE polarity (default=negative switched)
To change the PWM detection polarity to positive, pick off the thin track and solder-link the "+" pad to the long pad. This mode is rarely used except the DDS3 is used for monitoring WAI system using a positive PWM signal to control the water pump speed. (For example, Snow and Devilsown system)

DDSS3v10 to Aquamist System1s and System2d

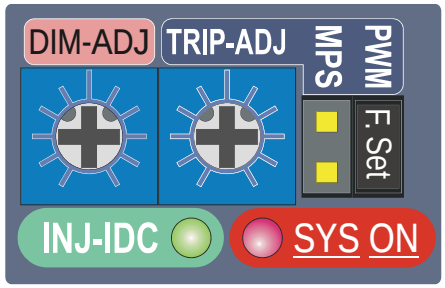


The DDS3 Bargraph will read and display the flow of any WI system on the market providing the flow sensor is coupled up properly. But if you want it to detect problems such as low or excessive flow, you must tell it when to look. Equipped with two triggering modes, it is just a matter of choosing which mode is better for your system.

Fail-safe triggered by MAP / MAF sensor:

Ensure the jumper link is set to "MPS" Mode.

The DDS3 will now detect MAP/MAF sensor voltage. Adjustable triggering point between 12% to 72% of the 0-5V range, For a 2-bar map sensor, atmospheric is about 2.5V.(see page 9.8 for details).

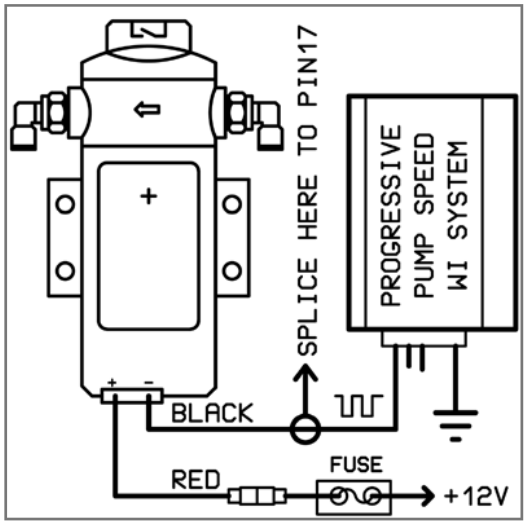


Fail-safe triggered by Fuel injection %:

This mode is very useful because it is looking for a point on your power curve where the engine is most stressed, Monitoring the presence of water/alcohol flow in this area is very important. As the Fuel duty cycle % more or less mirroring the power output of the engine, This mode is more suitable for high power applications. Set the jumper link to "PWM" Mode

Fails-afe triggered by pump speed signal:

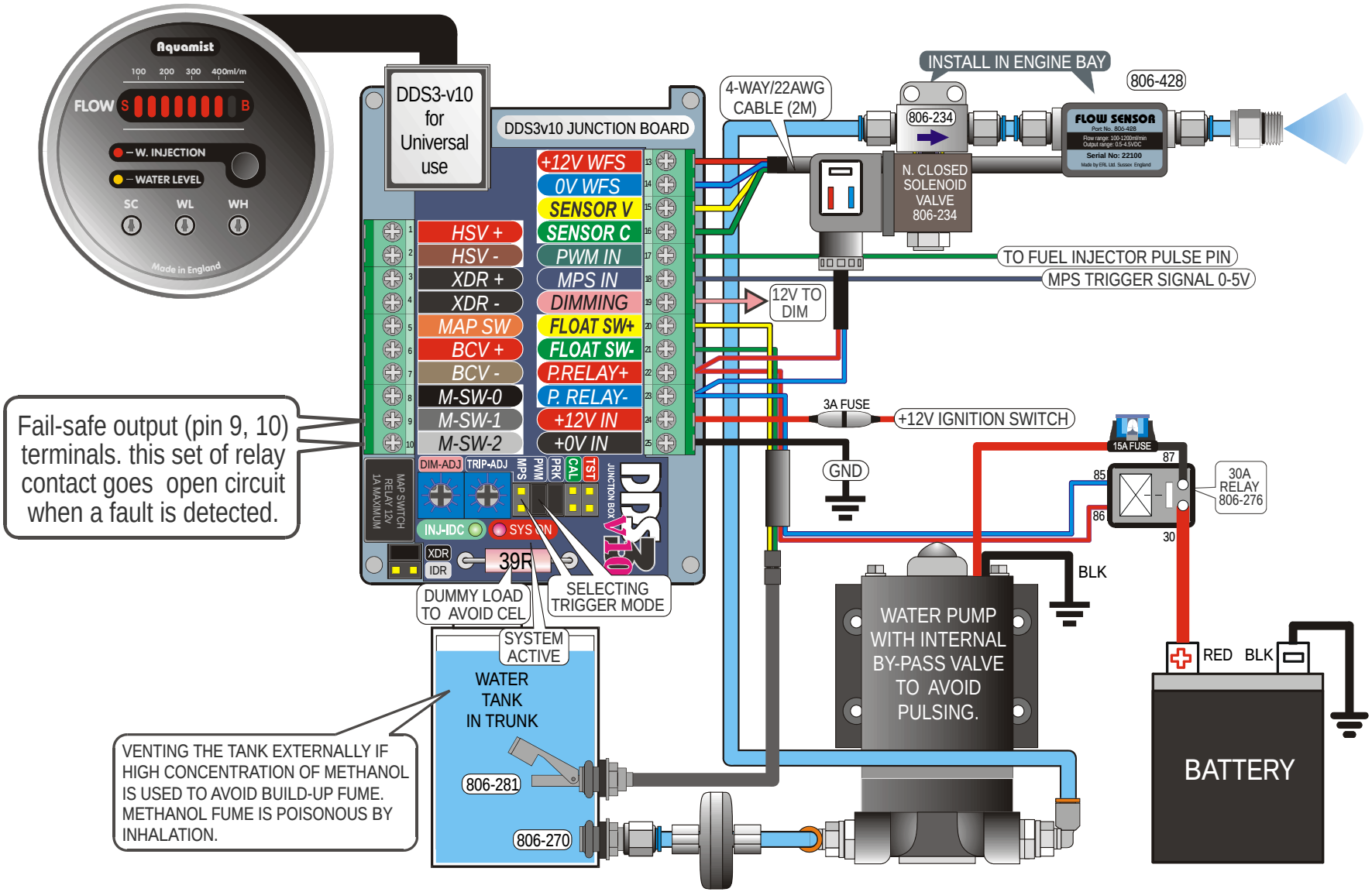
Most progressive WI system controls the pump speed via the negative terminal, by setting the DDS3 to 'PWM' mode, fail-safe circuitry can activated at any rpm of the pump. Just splice the trigger wire (pin17) into the negative terminal of the pump. This is the best way to confirm the system is working properly.



For systems that control the pump speed via the positive terminal of the pump, for example Snow Performance and Devilsown, you need to re-configure the DDS3's circuit board for this. See page 15.F .

Simple DIY system

DIY system example with fail-safe using the DDS3v10



Appendix

In Car Dash Gauge (8-core cable)

Pin	Colour	Size	Description	Electrical parameter
1	-	24awg	+12V power supply to gauge	250mAmax@12v
2	-	24awg	Flow Sensor output voltage	0-5 VDC @10mA
3	-	24awg	0V power supply to gauge	250mAmax@12v
4	-	24awg	Internal communication signal	-
5	-	24awg	Float Sensor from water tank	Ground active
6	-	24awg	Flow Sensor calibration output voltage	5-0 VDC @1mA
7	-	24awg	Night driving dimming connection	+12V active
8	-	24awg	Wastegate bleed valve option (SW-)	1A

@12V max.

Flow Sensor (4-core cable)

Pin	Colour	Size	Description	Electrical parameter
1	Red	24awg	+12V power supply of Flow Sensor	30mA @ 12v
2	Blue	24awg	0V power supply of Flow Sensor	0V Ground
3	Yellow	24awg	Flow Sensor output voltage	0-5VDC@10mA
4	Green	24awg	Flow Sensor calibration input voltage	5-0VDC@1mA

DDS3 Junction Box (25-ways - Pin 1= top left corner. Pin 25 bottom right corner)

Pin	Colour	Size	Description	Electrical parameter
RJ45	------	8-core	Same as Dash Gauge Above	------
1	Red	22awg	+12V power supply to Solenoid valve	+12V, 1A fused
2	Brown	22awg	Switching to ground for Solenoid Valve	1A maximum
3	D.Grey	22awg	Extending Dummy resistor (+12V side)	1A maximum
4	D,Grey	22awg	Extending Dummy resistor (EMS)	1A maximum
5	Orange	22awg	Programmable Map switch signal	5mA signal
6	Red	22awg	Boost control valve +12V supply	1A max
7	Brown	22awg	Boost control valve switch to ground	600mA max
8	Black	22awg	Normally closed relay contact (fail-safe)	1A max
9	Grey	22awg	Wiper/common relay contact	1A max
10	White	22awg	Normally opened relay contact	1A max
11-14	------	4-core	See 4-core cable description above	------
15	Green	22awg	FIDC detect or MAP sensor	Wave input
16	Blue	22awg	MAPsensor or 0-5v based sensor	0 to 5V input
17	Pink	22awg	Night driving dimming connection	+12V active
18	Yellow	22awg	To ground when tank is empty	0.25A maximum
19	Green	22awg	Common ground	0.25A maximum
20	Red	22awg	Priming pump +12V supply (0.5A FUSED)	0.5A maximum
21	Blue	22awg	Priming pump ground switch (active)	1A maximum
22	Red	20awg	+12V switched power supply for all	3A maximum
23	Black	20awg	0V ground supply for all	3A maximum

GUARANTEE

ERL guarantees, at our option, to replace faulty goods supplied or repair the same, subject to the claim made in writing to us within 12 months after the sale by us, or for such other period as may be indicated by us for specific products in lieu of any warranty or condition implied by law as to the quality or fitness for any particular purpose of the goods.

Any claim against us must be made to us in writing within the period of 12 months after the sale by us , or our agents, or our distributors of goods in question (or such other period as may be indicated by us) and any goods to which the claim relates must be returned to us within that period suitably packaged and cleaned and, with any particular instructions which we may have notified to you at the time of supply. Original invoice, the nature of any claimed defect must accompany the goods in question prior to despatch to us.

If these requirements are not complied with our Guarantee shall not apply and we shall be discharged from all liability arising from the supply of defective goods.

LIABILITY

We shall not be under any liability whether in contract, or tort or otherwise and whether or not resulting from our negligence or that of our employees, in respect of defects in goods supplied or for any damage or loss resulting from such defects.

We shall not be under any liability for damage, loss of expense resulting from failures to give advice or information or giving the incorrect advice or information whether or not due to our negligence or that of our employees.

In no event shall any breach of contract on our part or tort (including negligence) or failure of any time on our part that of our employee give rise to liability for loss of revenue or consequential loss or damages arising from any cause whatsoever.

Note: ERL reserves the right to make changes to our products without notice in order to improve design performance and reliability.

THE END

ERL ltd Iroko House Bolney Ave Peacehaven East Sussex BN10 8HF England