

## Technical Release

# Mitsubishi EVO VII-IX Intercooler Waterspray System

### The Standard Car

The Mitsubishi EVO is a fantastic car – originally conceived and designed with motor sport in mind, there are lots of smaller features built into the car in standard trim that are designed to assist Ralliart for competitive use in Group N rallying etc. The later model VII-IX's are no exception, and one of the most often misunderstood features is the Intercooler Water Spray system.

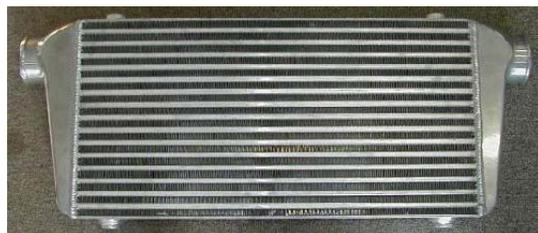


However, like many things fitted to homologated or road going versions of cars used in motor sport applications, the factory setup is very conservative. But this just leaves lots of room for improvement for owners looking to optimize the performance of their car – and we are more than happy to assist. ☺

As part of our extensive R&D on the EVO range, we have spent a heap of time working out exactly how the system is setup and controlled – and how it is best modified to extract its optimum potential. But before we get into the finer details of the setup, you need to understand how and why it works – a lot of people know that pushing the button makes water spray over the intercooler, but what is the point of it?

### Intercooling Basics – Forced Induction Engines

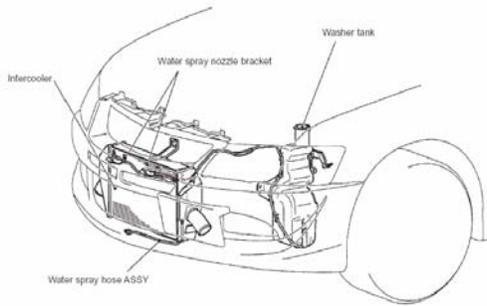
When a turbo or supercharger compresses air, the temperature of this air increases dramatically. The hotter the air temperature, the less dense it becomes meaning the less power/torque your vehicle will produce. The more the air is compressed (ie the higher the boost pressure), the greater the temperature increases.



Use of an intercooler means lower intake air temps, and more power/torque as a result (this is why your car always feels like it is at its best on a cool Winter evening!). Lower intake temperatures also reduce the risk of detonation or pre-ignition occurring. Most late model turbo charged

vehicles are fitted with an intercooler to help lower the intake air temperature. The more efficient the intercooler, the lower the intake air temperature and the better performance your car will have as a result.

New (Lancer Evolution IX)



In many cases fitting a larger intercooler with well designed core is the best way to achieve lower intake temps, however this can also prove to be relatively expensive depending on application. Often a good compromise is to improve the efficiency of the existing intercooler already fitted. The best results come from doing both, but making what you already have function better is an excellent starting point!

The two most effective ways of improving intercooler efficiency are improving the flow of air through the core, and by spraying the core with a fine mist of water. Location of core for good air flow is obvious, but spraying an intercooler with a fine mist of water helps aid the heat rejection qualities of the intercooler core. How I hear you ask? When the water evaporates it takes additional heat away from the surface of the core, more so than just air passing through the core alone. Taking more heat away from the intercooler core means the intake charge air temperature is lowered further than what was possible with the ambient air flowing through alone.

The best demonstration of this is when you are next driving along, put your finger out the window. Then lick your finger and put it out the window again, and you will notice it feels much cooler. As the moisture evaporates from your finger it cools the surface down much lower than was possible with the air flow alone previously. The same principle applies to your intercooler.

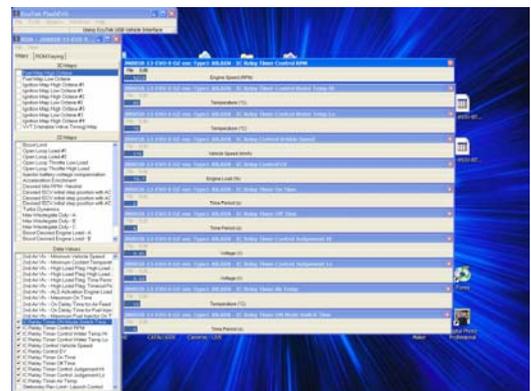
## Mitsubishi EVO VII-IX Waterspray System – Technical Specifications

The diagram at the top of this page shows an outline of the system on the EVO VII-IX. Fitted with 3 nozzles and a decent pump in standard trim, the OEM water tank (located at the LH front of the engine bay within the inner guard) has a capacity of 4.5L. The overflow hose at this level can be modified slightly, giving an increase in capacity to just on 5.0L as required.

In standard trim if the system is run constantly (triggered via the manual switch for example), it will take 2min 37sec to completely empty a full 4.5L tank. Modifications to the overflow pipe on the OEM tank as mentioned above increases the time taken to completely empty the system to 2min 55sec. If this doesn't sound like a lot of time you are right, but you don't need to spray the intercooler all of the time – if you did, much of it would be wasted.

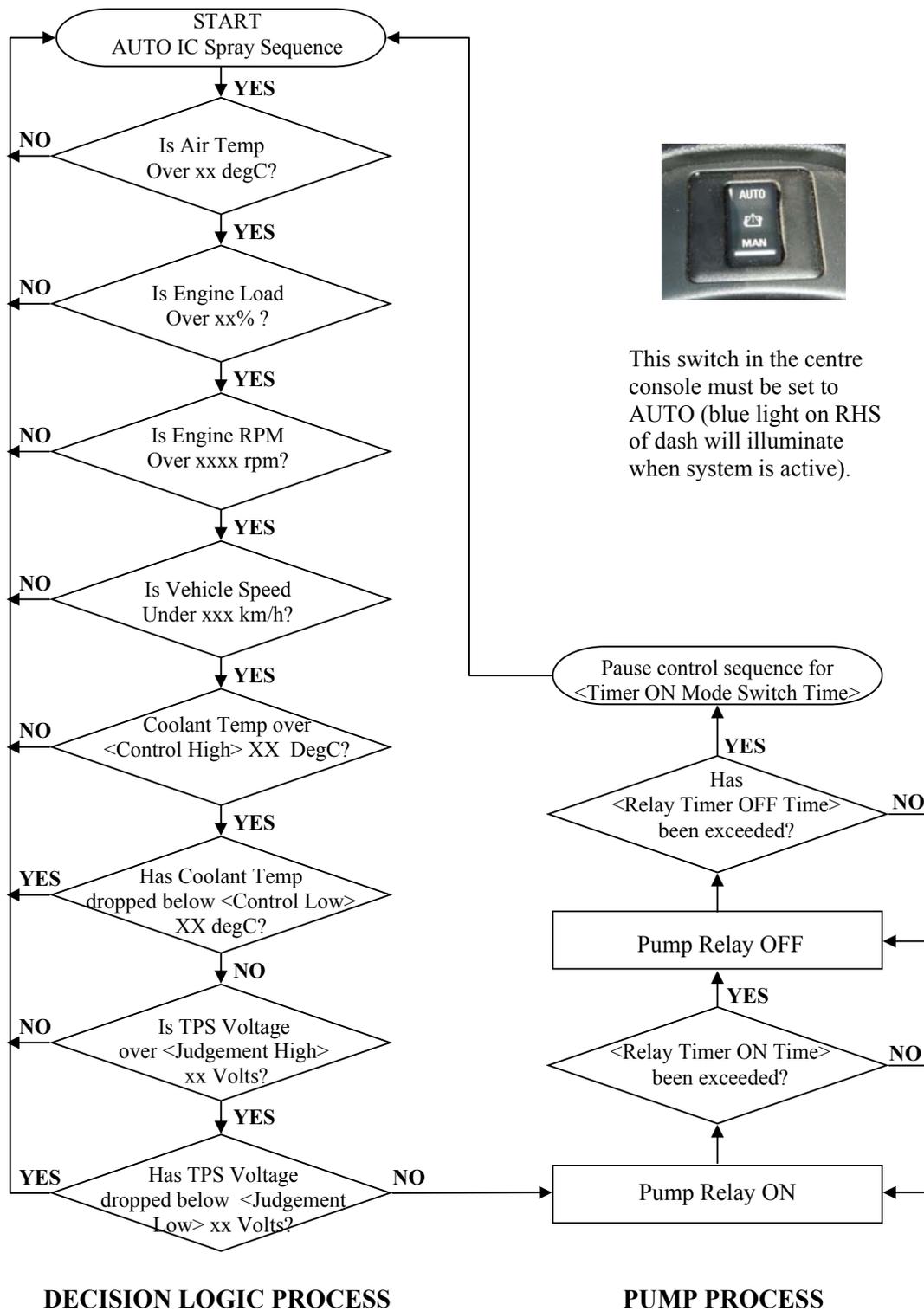
The intercooler needs to be at its most efficient when the engine is under full load at peak torque through mid to high rpm ranges (ie when the turbo is compressing air as best it can). For this reason, the automatic function of the spray system is triggered via the factory ECU using a fairly complex decision process (designed to ensure the most efficient use of water possible).

Using EcuTek software we have full access to the OEM ECU parameters used to trigger the intercooler spray system, just the same as we have access to fuelling, ignition timing and Mivec control maps (among other things).



All EVO's tuned by MRT or their resellers using EcuTek run our updated settings as part of the work completed. ☺

# Mitsubishi EVO VII-IX Waterspray Control/Decision Logic



This switch in the centre console must be set to AUTO (blue light on RHS of dash will illuminate when system is active).

Fortunately with our access to the factory ECU, we can modify all of the factory control parameters in order to set the system up for the best compromise between performance and efficient water consumption.

## Recommended Settings

The table below shows a comparison between the factory ECU settings, settings used in some Ralliart modified ECU's, and our preferred settings based on extensive testing. Of course if you have a specific application in mind and prefer altered settings, we are more than happy to use your preferred settings when tuning your car with EcuTek software.

EVO ROM File 1D Map Function IC Spray System Inputs	Base GSR/RS EVO ROM File Settings	RALLIART RA9246 example EVO ROM File	MRT Recommended EVO ROM File Settings
Inlet Air Temp (as measured from sensor in factory airbox, min reqd before system operation enabled)	5 DegC	5 DegC	15 DegC
Calculated Engine Load (in % as seen on X-axis of Fuel/Ignition maps with normal scale approx 0-300 %, max figure that can be set in ROM is 80%)	50 %	50%	80%
Engine RPM (minimum RPM required to operate)	3500 rpm	3000 rpm	4200 rpm
Vehicle Speed Max (Speed at which pump relay operation disabled)	100 km/h	130 km/h	150 km/h
Coolant Temp High (Temp which must be exceeded before operation enabled)	105 DegC	92 DegC	80 DegC
Coolant Temp Low (Temp which must be met before system operation ceases)	100 DegC	90 DegC	75 DegC
TPS Voltage High (TPS voltage which throttle must exceed for spray system operation to be enabled).	4.00v	2.50v	3.61v (approx 70% throttle)
TPS Voltage Low (TPS voltage which throttle must drop below before system operation ceases).	3.59v	2.40v	3.52v (approx 68% throttle)
Relay Timer ON Mode Switch Time (time that must expire before control system is re-enabled after the last time all conditions were met).	0 sec	0 sec	0 sec
Relay Timer ON Time (time that pump runs for while all above conditions are being met - if conditions cease being met control process is reset).	2 sec	1 sec	2 sec
Relay Timer OFF Delay (time after ON time expires that the pump relay is switched off while all conditions are still being met - if conditions cease being met control process is reset).	5 sec	5 sec	4 sec

A key point to note here is that the Australian delivered EVO IX (and imported EVO VII-VIII models) running factory water spray specifications (ECU 8858-13 and 8858-14) **will NOT trigger the system when running AUTO mode in OEM specification** under normal circumstances. This means that when your factory setup is switched to the auto mode, it WON'T operate in all but extreme circumstances!

The reason for this is that the decision process that the ECU uses to determine when to active the spray system is simply set too conservative in standard trim. Although there are many factors that need to be satisfied for the system to trigger (see decision logic flow chart on the next page), the coolant temp thresholds used are too high in OEM form. 105degC coolant temps are required before operation commences (with the highest coolant temps seen in testing to date, including hard race use, only 96degC and regular road operating temps at 82-86degC!).



With the MRT suggested control sequence above used the 4.5L tank will empty in 7min 51sec. With modifications to the tank overflow mentioned earlier (increasing tank capacity to 5.0L), the time until empty increases to 8min 45sec. The base of the OEM tank and pump assembly can be seen in the photo to the left (in addition to picture of system in action).



Of course this time frame assumes that you meet ALL the required conditions constantly as once any condition ceases to be met, the control sequence starts again!

In track testing (where the system is utilised most due to the loads that the engine is placed under), we have been achieving around 20 mins use (enough for most regular track sessions of 5-6 laps). Normal road use will see the system only used when required, and unless you have a “drive it like you stole it” driving style, the tank will only require filling at the same time you stop for a tank of fuel.

## Additional Information And Resources

If you have any queries after reading the above and require further assistance, then the below should be of use to you!

Further details of ECU upgrades (including full recalibration of many OEM settings in the interests of gaining additional torque and performance) can be found on the MRT Performance website at [http://www.mrtperformance.com.au/power\\_kits.htm](http://www.mrtperformance.com.au/power_kits.htm). Additional information on our various power kit upgrades is also available there and well worth the read if you are looking at getting the best possible performance and reliability from your EVO.

For your convenience, pricing, parts orders or installation of power kits can also be arranged through your local authorised MRT reseller. Details of resellers can be found on our website as needed at <http://www.mrtperformance.com.au/performance/dealers.htm>.

If you want further information on other water spray kits work on other models then you can also check out our article on the MY02-07 Subaru Impreza STi system (among other technical data documents) on the website at [http://www.mrtperformance.com.au/magazine-technical\\_data.htm](http://www.mrtperformance.com.au/magazine-technical_data.htm).

Of course for further information on any of our products, just give us a yell. We are only a phone call or email away and too happy to help.