

Porsche 928 LH Module 928.618.123.03 ISR Driver Circuit Evaluation

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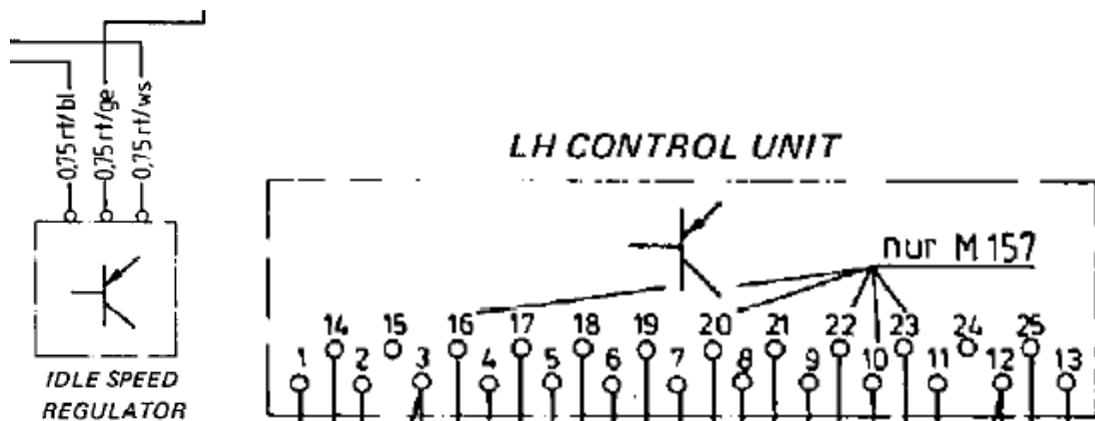
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The US/North American 1985 to 1986 32-valve Porsche 928s use an idle speed regulator (ISR) with three inputs. The part number is 928 606 161 00.



The 16 valve EURO/ROW 1984 – 1986 Porsche 928 (with no catalytic converter) do not implement idle speed regulation. There was a fairly rare 1985 - 1986 Porsche 928 Euro/ROW option for a lead-free fuel gasoline engine; those cars used the 32 valve US/North American engines.

Please note that the idle speed regulation system used in the 1987 and newer Porsche 928s differs from the operation outlined in this document.



The LH fuel injection module pins 10 and 23 connect to the ISR. The ISR center pin is powered by 12V supplied by the same circuit that powers the fuel injectors (switched by the fuel pump relay). The fuel pump circuit is not energized until the engine RPM is greater than 50 (cranking speed).

The 1985 – 1986 Porsche 928s have an ISR that maintains the idle speed necessary for the proper operation of the engine. For automatic idle speed regulation, it is first necessary to set the baseline air/fuel ratio (CO 0.6% +/- 0.2% with O2 sensor disconnected & equal to or less than 300 PPM HC) and idle speed (680 +/- 20 RPM). The procedure to establish baseline operation is outlined in the Porsche

Workshop Manual Pages 24-204 to 24-207. An accurate measurement of CO% requires that the exhaust be sampled before the catalytic converter, not at the tail pipe. If the base idle RPM cannot be adjusted per the factory workshop instructions, the fault must be corrected or automatic idle control may not be possible.

The LH fuel injection module computes the opening of the ISR valve based upon several inputs:

- a) Engine RPM
- b) Engine throttle idle switch “on” (via LH pin 3)
- c) A/C on (via LH pin 16)
- d) Engine temperature (via LH pin 2)
- e) Air conditioning on/off (LH pin 16)

If the idle speed regulation is not functioning properly, it is first necessary to ensure that the items b – e above functioning correctly and the connections secure are not corroded.

There is no easy access to the ISR valve signals for sampling. If you wish to be able to tap into them, a “breakout” connector must be made that allows access to the LH injector pins 10 and 23 signals while the ISV is connected. The waveforms illustrated in this document are obtained from a functioning ISR valve connected to the LH fuel injection module.

The causes of ISR valve of failure are:

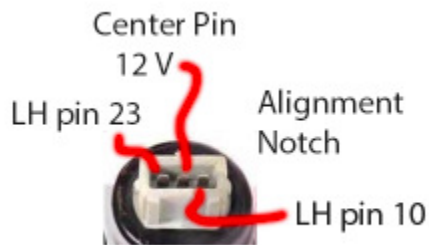
- a) Valve movement jammed. It could be caused by excessive carbon build-up in the valve or a seized movement. Cleaning the valve with a solvent may free up rotation.
- b) Actuator electrical element damage. There is no user repair if the electrical portion of the valve has failed.
- c) Corroded electrical contacts. Inspect both sides of the electrical connection to the ISR and clean as necessary.

The modes of ISR valve operation illustrated in this document are:

- a) When the LH begins control, with no RPM the ISR valve opens to the ½ position.
- b) When the engine is at cranking speed before starting, the ISR valve closes.
- c) When the engine starts, the ISR valve opening is controlled by the LH fuel injection module via LH pins 10 and 23.

Basic testing of the ISR valve:

There are three electrical connections to the ISR valve 928 606 161 00.

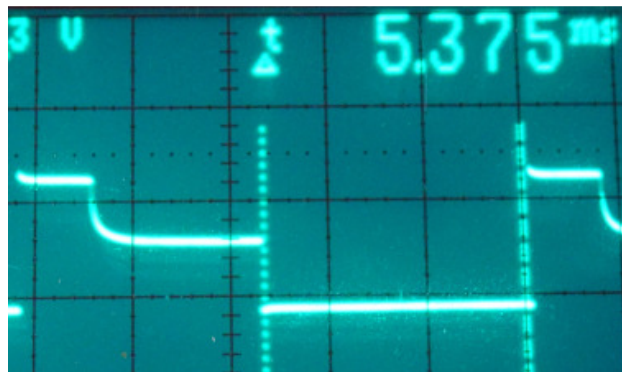


Note the notch orientation for pin identification, one notch at the top, two notches at the bottom.

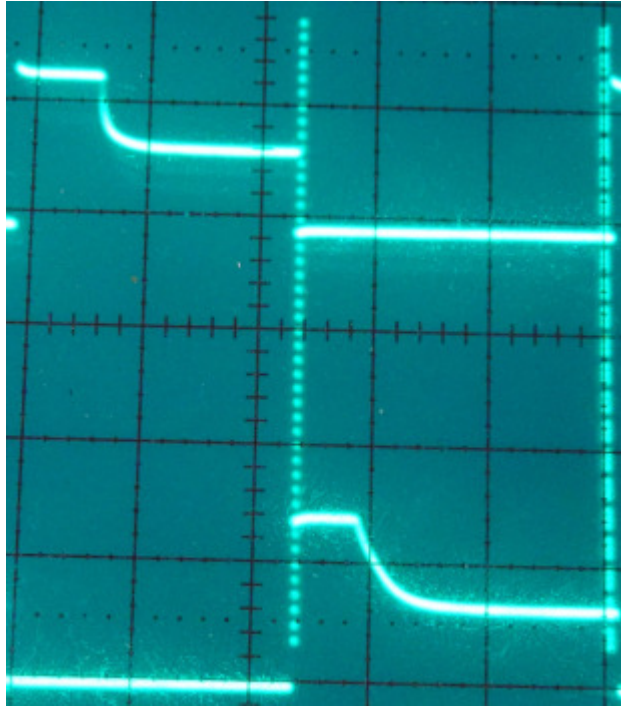
To determine if the electrical portion of the valve is working, separately measure the resistance between the center pin and each of the two other pins, each should measure $\sim 20 \Omega$. If the resistance is very high (infinite) there is an open circuit. If the resistance is significantly less, there is a short circuit.

I do not recommend running 12 V directly between the center pin and the other two pins (as some do to test it), as 600 mA steady DC current will flow which may be enough to damage the ISR internals. Less current flows during normal operation because it is a 100 Hz variable duty cycle driven valve.

The ISR “on cycle” is when the LH fuel injection module switches the pin 10 or 23 to ground, allowing current to flow which powers the ISR valve actuation motor.



This is an oscilloscope photo of the ISR “on” period. The 5.375 mS “on” period is the horizontal line between the dashed vertical lines.



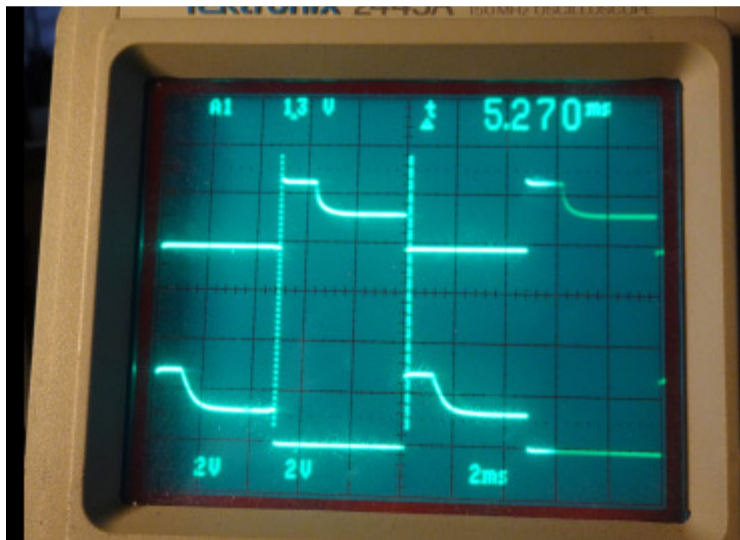
Oscilloscope photo two signals; LH pin 10 "on" (upper) and LH pin 23 "off" (lower) signal traces

When the voltage is low on pin 23, the voltage is high on pin 10; next the voltage is low on pin 10 and high on pin 23. The sum of the "on-off" cycle of pins 10 and 23 is a constant 10 ms. The drive circuit is designed such that LH pin 10 is actuated via input from the 8039 microcontroller management of a timer counter. The respective "on" (voltage low) period of LH pin 23 is always 10 ms minus the "on" (voltage low) period of LH pin 10.

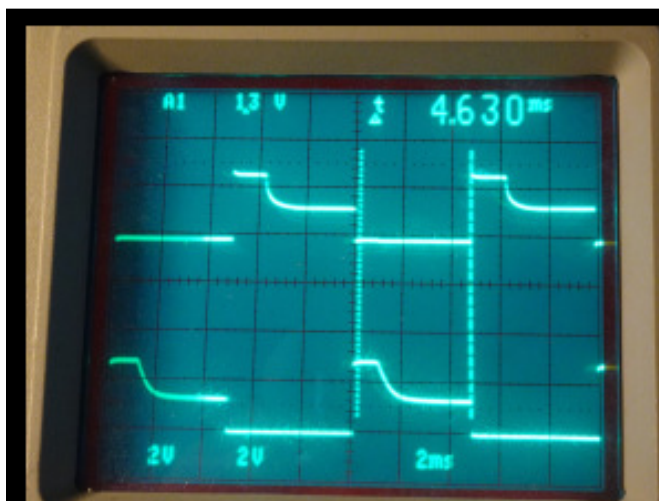
1. ISR Valve ~3/4 open

The ISR valve is opened as a function of the "on" time of LH pins 10 and 23.





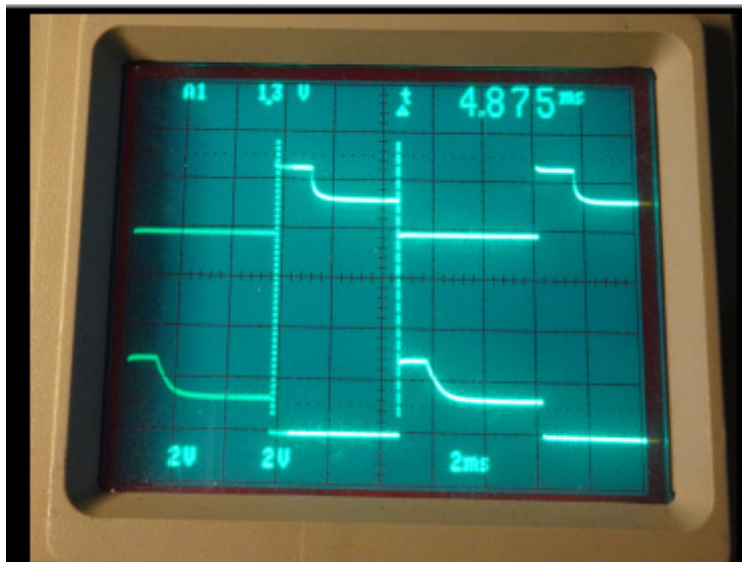
LH Pin 10 Voltage Low Period 5.27 mS (Bottom Trace)



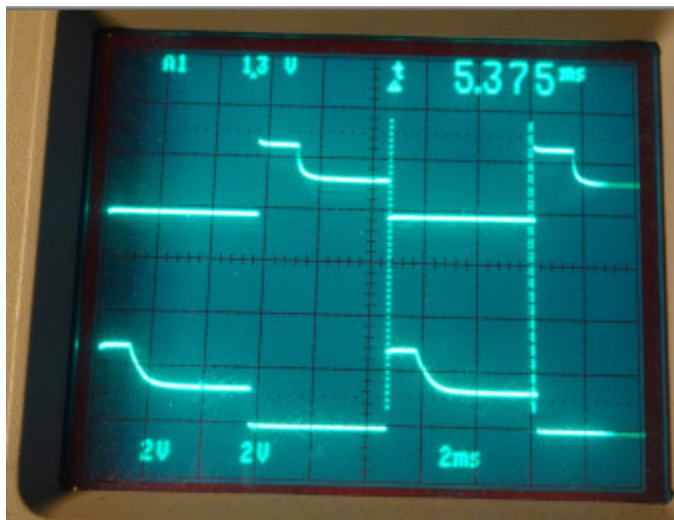
LH Pin 23 Voltage Low Period 4.63 mS (Top Trace)

2. ISR Half Open





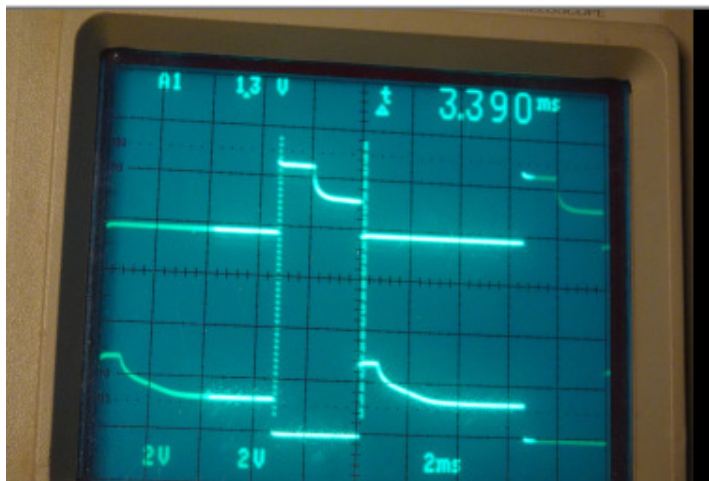
LH Pin 10 Voltage Low Period 5.875 mS (Bottom Trace)



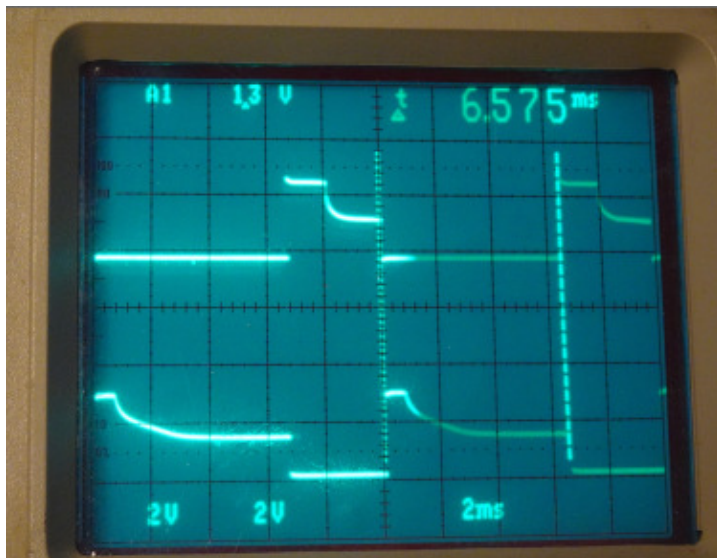
LH Pin 23 Voltage Low period 5.375 mS (Top Trace)

3. ISR Valve Closed





LH Pin 10 Voltage Low Period 3.39 mS (Bottom Trace)



LH Pin 23 Voltage Low Period 6.575 mS (Top Trace)

In summary:

There must be an ISR connected to LH pins 10 and 23 to observe the wave patterns. If there are no waveforms as illustrated at one or both of the LH fuel injection module pins 10 or 23 with a functioning ISR connected, this indicates that the ISR drive circuits in the LH fuel injection module have failed, or there is an open or short circuit in the associated cables.

Shorted circuits inside the ISR could damage the LH fuel injection module circuits.