INSTALLATION INSTRUCTIONS

Wide-Band Exhaust Gas Oxygen Sensor Interface

ST994 / ST996

IMPORTANT WEAR SAFETY GLASSES

CAUTION: CAREFULLY READ INSTRUCTIONS BEFORE PROCEEDING

OVERVIEW

The Control Unit is a dual channel air/fuel ratio (AFR) metering system designed to be used with an existing data acquisition system. The system has two 0-5 volt analog AFR outputs. The compact size and wide supply voltage range also allow operation from small rechargeable batteries in a broad range of applications.

By utilizing miniature surface mount electronics technology, digital signal processing techniques, and a switching power supply for the sensor heater, the Control Unit provides the same level of accuracy as lab systems costing much more.

REPLACEMENT SENSORS AND ACCESSORIES

We offer replacement sensors with Deutsch connector installed: ST269552.

If you plan to terminate your own sensors, use the following color chart:

Terminal	Wire Color
1	Red
2	Black
3	Yellow
4	White
5	Gray
6	Seal

INSTALLATION

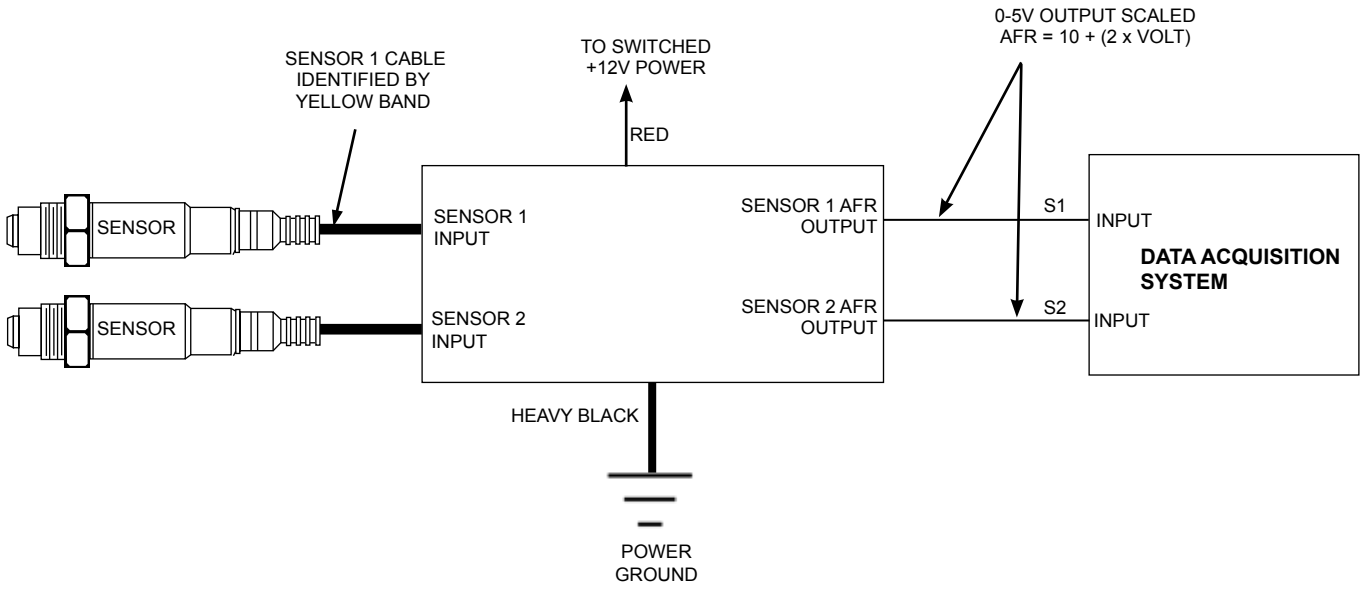
1. Turn off the ignition switch and disconnect the battery ground cable before proceeding.

2. The Bosch LSU 4.2 sensors should be located on the header pipe about 6-8 inches from the head flange. Ideally the sensor tip should face down to avoid accumulation of condensation. When choosing a mounting location, allow several inches clearance for the sensor wire harness. The wire harness must exit straight out from the sensor. Do not loop the harness back onto the sensor body.

3. 18 x 1.5 mm weld nuts must be welded onto the exhaust pipe. After welding, run an 18 x 1.5 mm tap through the threads. Failure to clean the threads may result in sensor damage. Note that most automotive muffler shops are familiar with oxygen sensor weld nut installation on custom pipes. Do not install the sensors until after the free air calibration procedure described in

Figure 1 – Control Unit

Figure 2 - Controller Hookup



5. Connect the Bosch sensors to the 6 pin mating connectors on the Control Unit wire harness. Extension cables are available. The cable for sensor 1 exits at the top of the Control Unit and is identified with a yellow band.

6. Refer to Figure 2. Connect the heavy black wire to a good chassis ground location. Keep the ground connection as short as possible.

7. If your race vehicle uses any type of CD (capacitive discharge) ignition such as the MSD 6, 7, or 8 series, you must properly ground and filter the ignition unit. Unless your ignition unit is directly connected to the battery terminals, you must install a filter capacitor such as MSD P/N 8830.

8. Connect the red wire to switched +12 volt power.

9. Reconnect the battery ground cable.

SENSOR LIFE AND CALIBRATION

When used in a racing application with leaded petrol, sensor life will probably be less than 10 hours. Free air calibration should be performed on a regular basis, such as before the start of every test session or race event. If free air calibration fails, the sensor should be replaced. Free air calibration must be performed in an environment free of hydrocarbon vapors. Typical race shop environments may prove to be too contaminated. Even outdoors, free air calibration can fail if a carburetor bowl has recently been removed or another vehicle is running nearby. In general, sensors that are at the end of their useful life will fail free air calibration.

OPERATION

The Control Unit has red status LEDs for each channel. When power is turned on, the LEDs blink at a slow rate until the corresponding sensor has reached normal operating temperature.

After installation, the Control Unit requires free air calibration. This should be done with the sensors dangling in free air. The environment must be free of hydrocarbon vapors. We suggest that you perform the free air calibration outdoors. Turn the free air calibration trimpots on the Control Unit full counterclockwise. Turn on power and wait for 60 seconds so the system can fully stabilize. Then slowly turn each free air calibration trimpot clockwise until the corresponding LED starts flashing at a rapid rate. Try to set each trimpot at the point where its LED just starts to flash.

The free air calibration procedure should be performed at reasonable intervals (every 250-500 hours if using unleaded petrol or every 2-5 hours if using leaded racing petrol) or whenever a sensor is replaced. If you cannot get an LED to flash when its trimpot is turned full clockwise, you either have a damaged sensor or very high hydrocarbon levels in your environment.

The Control Unit includes internal diagnostics for abnormal battery voltage (less than 11 volts or greater than 16.5 volts), sensor open circuit, and sensor short circuit conditions. A fault condition causes the status LEDs to blink at the slow rate.

EXHAUST CONSIDERATIONS

The Control Unit system may give inaccurate results in certain situations:

Excessive exhaust back pressure. Wide-band sensors are affected by back pressure. Excessive back pressure causes exaggerated AFR indications under rich and lean conditions, but has little effect at 14.7 AFR (stoichiometric). Race vehicle exhaust systems are free flowing and problems with exhaust back pressure are not likely.

Exhaust reversion. Reversion is the term for a negative pressure wave that can suck ambient air back into the exhaust and cause an erroneous lean AFR indication. Open “drag pipes” usually suffer from reversion effects and may not be suitable for use with the this system except at or near wide open throttle. Reversion effects will be most noticeable at idle, part throttle low RPM, and deceleration.

Excessive scavenging. Tuned exhausts in combination with a high overlap camshaft profile can pull unburned air and fuel mixture through the cylinder into the exhaust and cause an erroneous rich AFR indication. The same effect can occur with high boost turbo/supercharger applications.

Misfiring. If the AFR is so rich that the engine misfires, high levels of oxygen will remain in the exhaust gas and result in an erroneous lean indication.

ENGINE TUNING GUIDELINES

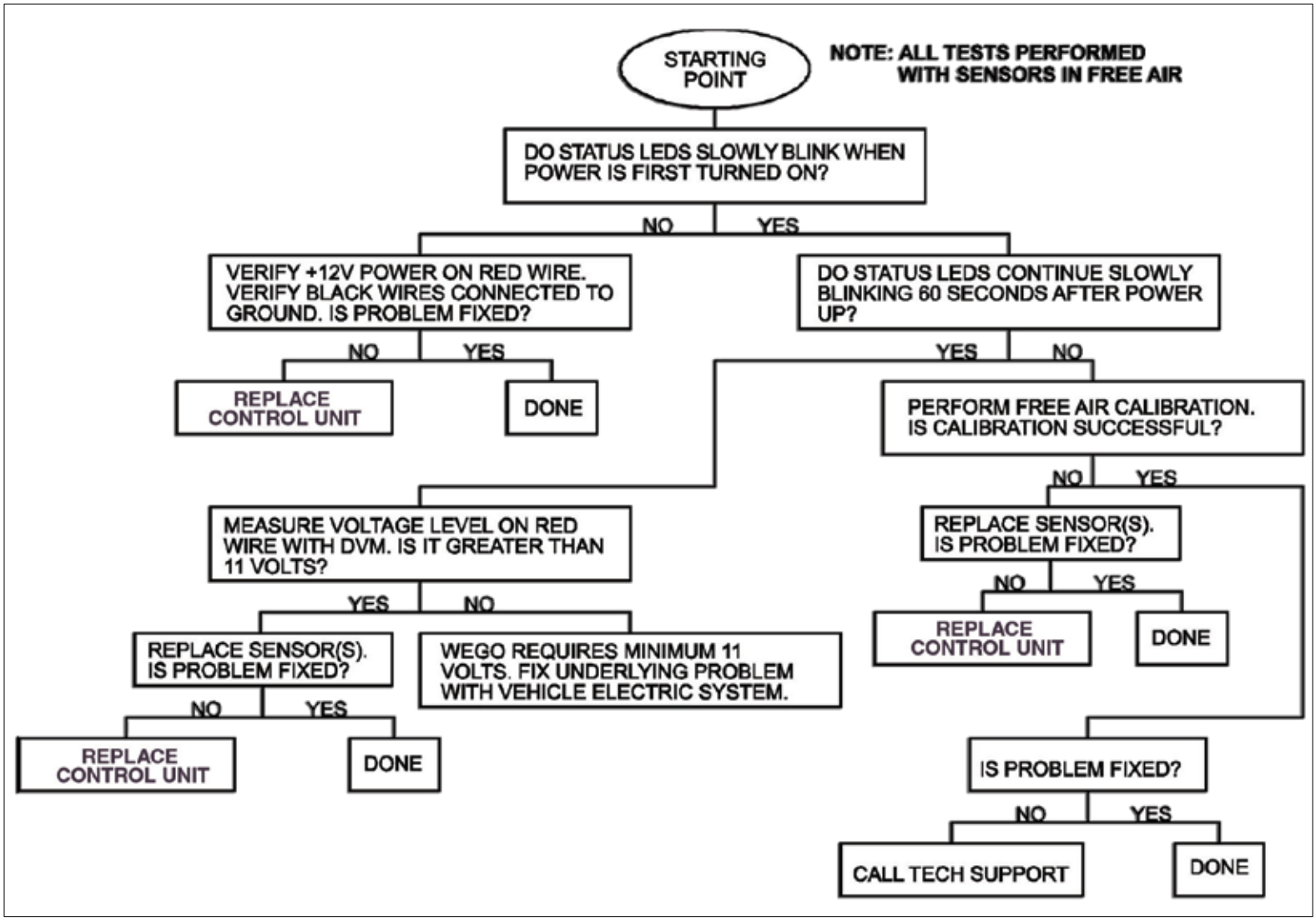
Higher AFR values correspond to a leaner (less fuel) condition. The practical operating range for most engines using gasoline fuel is from approximately 11.5 to 14.7 AFR. Combustion of a stoichiometric mixture (exactly enough air to burn all the fuel) results in 14.7 AFR indication. Automotive engines with catalytic converters operate near 14.7 AFR during cruise and idle. Race engines usually require a richer mixture to limit cylinder head temperature and prevent detonation. The table below lists reasonable AFR values for race engines without emission controls.

CAUTION: Racing petrol containing lead will quickly degrade the sensors. Under these conditions, expected sensor life is less than 10 hours. There is no warranty on sensors.

Operating Mode	Recommended AFR
Cold Start (first 30 sec)	11.5-12.5
Idle	12.8-13.5
Part Throttle Cruise	13.0-14.0
Wide Open Throttle	12.5-12.8 (values down to 11.5 may be used to reduce detonation)

TROUBLESHOOTING FLOWCHART

Follow the troubleshooting flowchart shown on the next page. Experience has shown that most units returned for warranty are OK and another problem, such as user error, degraded sensors, or bad power connections is later identified.



WARRANTY

Stack Limited warrants this product (excepting associated sensors which are consumable items - there is no warranty on sensors.) to be free from defects caused by faulty materials or poor workmanship for 1 year from the date of consumer purchase. This warranty applies only to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said warranty periods above. Breaking the instrument seal, improper use or installation, accident, water damage, abuse, unauthorized repairs or alterations voids this warranty. Stack Limited disclaims any liability for consequential damages due to breach of any written or implied warranty on all products manufactured by Stack Limited.

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