

The Electro-Motive Division radar speed sensing system was developed to provide a stable, true ground speed reference for use on board railroad locomotives, from 2 to 125 miles per hour.

The radar speed sensor is an integral part of the "super series" locomotive traction control system, and is not marketed separately for other purposes. There is no advertising literature or other sales promotional articles for the radar transceiver. For new locomotives or service parts requirements, the transceiver is ordered as GM part number 40081692. All devices are returned to the factory for repairs, customer service information is not provided. Engineering Test Instruction (ETI) # 0908 is an internal GMLG test and repair document. The radar assembly build, test and repair is contracted to Tooh Dineh Industries, Leupp, Arizona, USA. They are ISO9002 certified. GMLG does not currently authorize or license any other party to build, repair or test the locomotive radar speed sensor.

The radar speed sensing system consists of two primary components; the radar transceiver and the traction control computer system. The two are linked together by a four wire shielded cable assembly.

The traction control computer is located in the cab of the locomotive and the radar transceiver is located under the locomotive. The transceiver is located approximately 200 mm to the left of the track centerline. The transceiver waveguide is mounted at an angle of 37.5 ± 0.25 degrees to the horizontal, facing the opposite end of the locomotive, at the height of approximately 300 mm above the top of rail. Refer to Engineering Apparatus Instruction (AI) 2458, Figure 1 for further mounting details.

The transceiver consists of the following main components:

<u>Radar Assembly</u>	<u>Part No. 40081692</u>
Housing	40033657
Rear cover assembly	40034796
Front lens cap	40048758
Gunn diode assembly	40078530
Identification nameplate	40082672
Circuit module assembly	40082637

The RF antenna is incorporated as part of the main housing. The main housing, lens cap, and Gunn diode assembly comprise the RF section of the radar transceiver. The Gunn diode operates in continuous wave (CW) mode and is used in the self-detecting configuration. The CW center frequency is 24.160 GHz., and is not modulated. The Gunn diode operates at a power level of approximately 5 mW. The RF section is fixed tuned, there is no provision for any field adjustment.

The CW microwave beam is aimed at the roadbed, between the rails. The reflected energy produces Doppler effect signals in the Gunn diode which are proportional to the absolute speed of the incident beam over the roadbed.

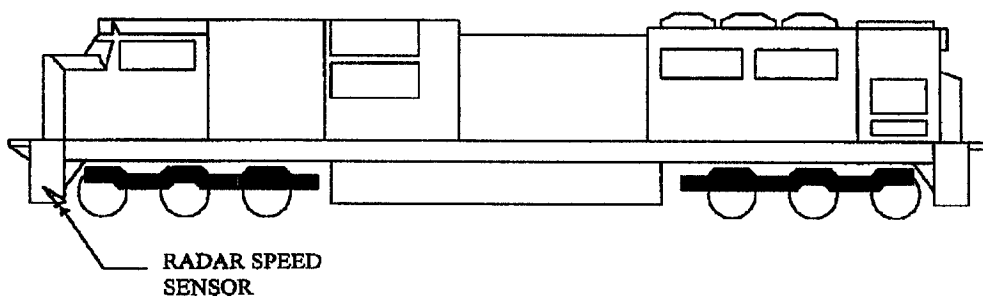
The Doppler signals are processed by an internal microprocessor system which operates at a data switching frequency of 2 Mhz. (crystal controlled). The Doppler shift frequency is converted to a frequency modulated square wave signal (15 Vpp, 50 % duty cycle) with a relationship of 22.2 Hz. per mph of ground speed. The microprocessor system, amplifiers, and power supply are located on a circuit board housed inside the cast aluminum housing. There is an additional circuit board, mounted directly behind a 4 pole water tight bayonet plug assembly, which provides attenuation for RF signals. This filtered plug assembly provides the only access for electrical signals in to and out of the transceiver assembly.

The radar speed sensor is power from a 15 VDC (+/-0.25) power supply, which is connected to the locomotive 64 Volt battery system. It draws a maximum of 0.5 Amps. The electrical signals involved are 15 VDC positive, 15 Volt common, Self test (+15 VDC) and ground speed (22.2 Hz./mph). When the self test signal (+ 15 VDC) is received, the microprocessor outputs approximately 900 Hz. signal back to the locomotive traction control system. This test signal does not modulate the RF section. It is used to verify correct operation of the signal processing circuitry.

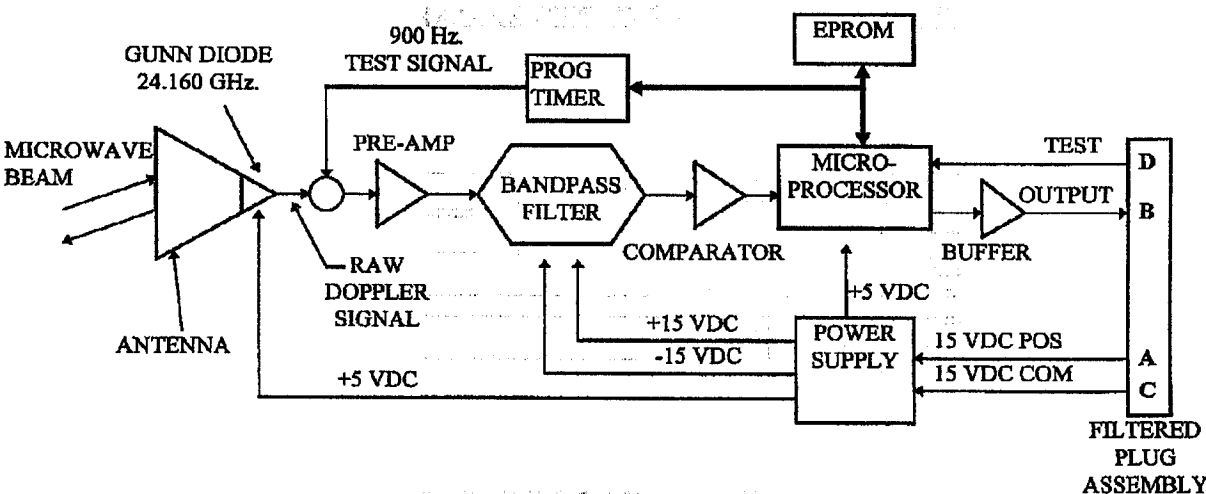
The traction control computer system uses the true ground speed as a reference. It allows the drive wheels to creep in a controlled manner, running faster than the ground speed reference. This proprietary controlled creep process was developed by GMLG, and enables locomotives to reach much greater adhesion levels than traditional wheel slip control systems.

PHYSICAL CHARACTERISTICS

Size	Approx. 12 x 6.5 x 6 in. (305 x 165 x 153 mm)
Weight	Approx. 8.5 pounds (3.9 kg)
Antenna	Integral



**RADAR SPEED SENSOR
TYPICAL LOCATION**



**LOCOMOTIVE RADAR SPEED SENSOR
BLOCK DIAGRAM**