Long Road Racing
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Global MX-5 Cup Car Technical Service Bulletin #4-13-16
AiM MXL2 Default Configuration

Purpose for this TSB:
To describe the items available for logging within the AiM MXL2 dash with the GEMS Global MX-5 Cup ECU, and the alarm conditions set in the default MXL2 configuration.

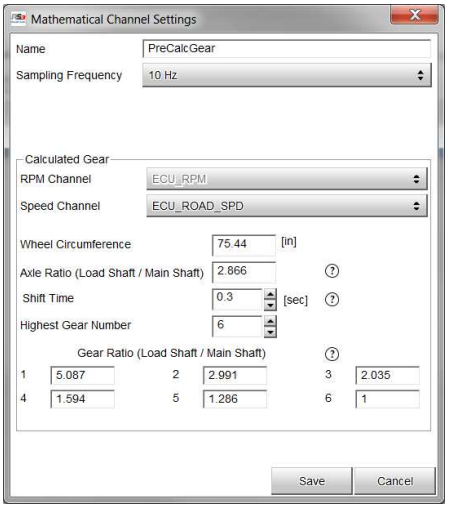
Items Available in GEMS ECU Stream: Note all items must be logged during on official practice, qualifying and race sessions.

Description	Function	Notes
Engine RPM	rpm	
Engine Load	pressure	
Coolant Temperature	temperature	Coolant temperature over 225 deg F triggers the "Water Temp" warning screen in the default configuration from LRR.
Oil Pressure Switch	number	0 = normal, 1 = abnormal. A value of 1 when the engine is above 2000 rpm triggers the "Oil Pressure Warning" in the default configuration from LRR.
Actual Throttle Position	percentage	
Air Intake Temperature	temperature	
Fuel High Pressure Pump	pressure	
Fuel Pump On	number	Indicates Tank Lift Pump is switched on, does not confirm its working. 0=Off, 1 = On
Battery Voltage	voltage	Voltage less than 10.0 volts over 800 rpm triggers the "Low Voltage" warning in the default configuration from LRR.
Overall Vehicle Speed	speed	
Front Left Wheel Speed	speed	
Front Right Wheel Speed	speed	
Rear Left Wheel Speed	speed	
Rear Right Wheel Speed	speed	
Longitudinal Acceleration	acceleration	From ABS Yaw Sensor, Extreme value may indicate yaw sensor ungrounded causing ABS Failure.
Brake Pressure	pressure	
Lateral Acceleration	acceleration	From ABS Yaw Sensor, Extreme value may indicate yaw sensor ungrounded causing ABS Failure.

ECU switch input from reverse engaged switch	number	0 = not in Reverse, 1 = in Reverse Gear
ECU switch input from Brake on switch	number	0 = Brake Engaged, 1 = No Brake
ECU switch input from Gearbox in Neutral switch	number	0 = in Gear, 1 = in Neutral
Not Used	number	
Radiator Fan Fast Flag	number	0 = Off, 1 = On, Fan is set to turn on at 199 F Coolant Temperature.
Lambda Heat Flag	number	0 = ok, 1 = error
Main Relay Flag	number	0 = off, 1 = on
Engine Error Light	number	0 = no errors, 1 = error with one of the following: Throttle Body, AIT Sensor, ECU calibration checksum, Lambda Value, Lambda Heater, MAP Sensor, Throttle Pedal, ABS System, Loss of CAN signal from ABS. Triggers Alarm "Engine Error" in default configuration from LRR.
Radiator Fan Slow	number	0 = Off, 1 = On, Fan is set to go straight to full speed.
Disabled	number	
Throttle Pedal Demand	percentage	
Steering Angle	angle	Resets to zero with each power cycle
Air Fuel Ratio	ratio	
Advance	angle	
Clutch Switch	number	0 = Clutch Engaged, 1 = Clutch Disengaged
Knock Peak	number	
Knock Peak Above Threshold	number	Threshold varies with RPM
Knock Peak Channel	number	
ABS Failure Indicator	number	0 = ABS Working, 1 = ABS Failure

Pre Calculated Gear:

The gear indicator used in the default configuration “GMX-5 GEMS AiM v6.0” is set up in the Math Channels tab. The stock gear ratios and tire circumference are indicated below.



Stock Dash Lights and ABS Failure indication:
Once the GEMS ECU is installed, there will be many error lights present on the stock dash. These can all be ignored with the exception of the ABS error light. The stock ABS error light still accurately displays because ABS is a separate module from the ECU and it sends the ABS error signal directly to the stock dash. The base configuration for the AiM MXL2 titled "GMX-5 GEMS AiM v6.0" is set up to include an ABS ERROR warning, however a complete loss of CAN signal from the ABS system will not trigger the ABS ERROR Warning, it will only trigger the Engine Error warning in the AiM MXL2. Anytime you investigate an Engine Error Warning be certain to check the stock dash for the ABS Failure Light to ensure the ABS system is not the cause of the Engine Error Warning in the AiM MXL2.

The Alarms for ABS ERROR and Engine Error are both described in detail below. If either of these are present immediately after start up, allow the vehicle to warm up to operating temperature, then cycle power and restart. If either error is still present, trouble shoot the appropriate systems.

Photo Showing Stock ABS Failure Light and other typical Failure Lights present with GEMS ECU:

Photo Showing Stock Error Lights with GEMS ECU, no ABS Failure Present:

Alarm Descriptions for Default Configuration from LRR for the GEMS ECU:

1. **ABS ERROR:**
    a. Display: LED 1 Fast Blinking Red, Red Display Screen with "ABS ERROR" message.
    b. Message set to not clear until the condition is no longer met.
    c. Alarm is activated when the value for "ECU_FLAG_ABS" = 1. This is caused when any wheel speed sensor fails or becomes unplugged, the yaw sensor fails, becomes unplugged or ungrounded, or when any problem causing the ABS module to send an error signal occurs.
    d. **Note:** If the entire CAN signal from ABS is lost, this will not trigger an ABS error because the system cannot send the message; this will however trigger the Engine Error. If you have an Engine Error or ABS Error on start up, let the vehicle warmup to operating temperature, then cycle power and restart vehicle. If Engine Error or ABS Error is still present begin trouble shooting items that contribute to ABS System and Engine Error described in the Engine Error Alarm description.

2. **Engine Error:**
    a. Display: LED 2 solid yellow, White Display Screen with "Engine Error" message. Message set to clear after 30 seconds, LED 2 will show solid yellow until the condition is no longer met.
    b. Alarm is activated when the value for "ECU_ERR_LIGHT" = 1. Failure with any of the following items may cause the ECU_ERR_LIGHT value to equal 1.
        i. Throttle Body,
        ii. AIT Sensor,
        iii. ECU calibration checksum,
        iv. Lambda Value,
        v. Lambda Heater,
        vi. MAP Sensor,
        vii. Throttle Pedal,
        viii. ABS System Error (ABS ERROR alarm display takes priority over Engine Error)
        ix. Loss of CAN signal from ABS
    c. Note that if there is an ABS system Error, or CAN signal error from ABS this will trigger the stock ABS warning light as shown above in the Stock Dash Lights and ABS Failure Indication section above. This can help you determine if your engine error is from ABS or one of the other components that contribute to Engine Error.
3. **Trans Diff Cool Control:**
    a. Display: No change in display. You will hear the Differential Cooling Pump, Transmission Cooling Pump and Fan turn on.
    b. Pumps and Fan are activated when the Diff Temp sensor (Channel 01) reaches 100 deg F, and the Vehicle is moving more than 5 mph. Pumps and Fan will turn off when the Diff Temp reaches 96 deg F, or the vehicle slows to less than 5 mph.
    c. The Pumps and Fans are controlled through the Digital Outputs of the AiM MXL2 Dash.
4. **Water Temp:**
    a. Display: LED 4 solid Blue, White Display Screen with "Water Temp" message. Message set to clear after 30 seconds, LED 4 will show solid Blue until the condition is no longer met.
    b. Alarm is activated with Engine Coolant Temperature reaches 225 deg F, LED 4 and Message will turn off when temperature reaches 223 deg F.
5. **Oil Pressure:**
    a. Display: LED 5 solid Red, White Display Screen with "Oil Pressure Warning" message. Message set to clear after 30 seconds, LED 5 will show solid Red until the condition is no longer met.
    b. Alarm is activated when "ECU_OIL_P_SW" = 1 and ECU_RPM is greater than 2000 rpm. LED 5 and Message will turn off when either ECU_OIL_P_SWS is = to 0 or ECU_RPM is less than 2000 rpm.

6. **Diff Temp Warning:**
    a. Display: LED 6 solid Yellow, White Display Screen with “Diff Temp Warning” message. Message set to clear after 30 seconds, LED 6 will show solid Yellow until the condition is no longer met.
    b. Alarm is activated when Diff Temp Sensor (Channel 01) is greater than 270 deg F. LED 6 and Message will turn off when Diff Temp becomes less than 265 deg F.
7. **Low Voltage:**
    a. Display: LED 3 solid Yellow, White Display Screen with “Low Voltage” message. Message set to clear after 30 seconds, LED 3 will show solid Yellow until the condition is no longer met.
    b. Alarm is activated when “Battery” is less than 10.0 volts and ECU_RPM is greater than 800 rpm. LED 3 and Message will turn off when either Battery is greater than 10.0 volts or ECU_RPM is less than 800 rpm.
8. **Emergency Diff Cool:**
    a. Display: LED 6 Slow Blinking Yellow, White Display Screen with “Diff Temp Unplugged” message. Message set to clear after 30 seconds, LED 6 will show Slow Blinking Yellow until the condition is no longer met.
    b. Alarm is activated when Diff Temp Sensor (Channel 01) is less than 0 deg F indicating a sensor failure or sensor being unplugged. LED 6 and Message will turn off when Diff Temp becomes greater than 0 deg F and less than 265 deg F.

Allowable modifications:
Please refer to Article 9 – Telemetry, Dash and Data Collection in the 2016 Global MX-5 Technical Rules for information on allowable modifications.

Shift Lights:
Shift lights can be customized, they are currently set as follows. Peak power is achieved around 6200 rpm. Max RPM is approximately 6550.

Gear	Shift Light 1	2	3	4	5	6	7	8	9	10	
All	4600	5000	5400	5800	6200	6200	5800	5400	5000	4600	