Troubleshooting
TH220B, TH330B, TH340B, TH350B, TH355B, TH360B, TH460B, TH560B and TH580B Telehandlers

Diagnostic Code List

SMCS - 7569

Use the monitoring system or the Caterpillar Electronic Technician (Cat ET) in order to determine the diagnostic codes for the electronic control modules (ECM). After determining the diagnostic codes, refer to the corresponding test procedure for more information. Perform the procedure that corresponds to the Module Identifier (MID), the Component Identifier (CID) and the Failure Mode Identifier (FMI) of the diagnostic code.

Module Identifier (MID)

The module identifier (MID) identifies the electronic control module that detected the fault. Each electronic control module on the machine has a unique MID. Use the following chart in order to match the MID for each diagnostic code to a specific electronic control module. The chart for the Module Identifier (MID) is located on the Electrical System Schematic for your machine. See the chart if the MID is not shown on the display of your machine. After the operator determines the electronic control module that has detected the failure, see the service manual module for that particular ECM for more troubleshooting information. The service manual for each ECM is part of the machine's Service Manual.

Table 1

Description of the Module Identifier	
MID	**Description**
036	Engine ECM
082	Access Platform ECM
039	Machine ECM
117	Shift Lever ECM

Component Identifier (CID)

The following table is a list of possible diagnostic codes for the machine ECM.

Table 2

Diagnostic Codes For the Machine ECM Module Identifier (MID 039) and Shift Lever ECM (MID 117) [1]	
Perform the procedure that corresponds to the CID and the FMI of the diagnostic code during troubleshooting.	
Component Identifier (CID)	**Component Description**
0041	8V sensor supply
0070	Limit switch (parking brake)
0096	Sender (fuel level)
0110	Temperature sensor (engine coolant)
0168	System voltage
0177	Temperature sensor (transmission oil)
0191	Transmission Output Speed Sensor
0246	PHS CAN data link
0262	5V sensor supply
0271	Action alarm
0368	Rocker switch (autoshift)
0444	Relay (starter)
0489	Trigger switch (auxiliary) of joystick control
0490	Rocker switch (implement lockout)
0590	Engine ECM
0629	Switch (transmission neutralizer)
0668	Transmission control (shift lever)
0672	Torque Converter Output Speed Sensor
0702	Position sensor (shift lever)
0750	Switch (steering mode)
0811	Display module (instrument cluster)
0817	ECM (internal backup battery)

0826	Temperature sensor (torque converter oil)
0882	Solenoid valve (implement lockout)
1127	Position sensor (forward/backward lever) of the joystick control
1128	Position sensor (left and right) of the joystick control
1138	Boom Cylinder Rod Retract Solenoid
1187	Switch (continuous flow)
1189	Position switch (auxiliary hydraulics) (right thumb) of the joystick control
1193	Boom Cylinder Rod Extension Solenoid
1251	Alternator R terminal
1326	ECM Location Code
1401	Modulating valve (reverse)
1402	Modulating valve (forward)
1403	Modulating valve (No. 3)
1404	Modulating valve (No. 4)
1405	Modulating valve (No. 5)
1406	Modulating valve (No. 6)
1407	Modulating valve (No. 7)
1410	Modulating valve (transmission synchronization)
1482	10 volt PHS power supply
1529	Switch (quick coupler)
1603	Data Link
1639	Machine security system (MSS) ECM swap suspected
1658	Position sensor (left thumb lever) of the joystick control
1718	Mode select switch (implement fine modulation)
1740	Solenoid (crab steer)
1741	Solenoid (circle steer)
1763	Switch (operator station)
1788	Switch (right stabilizer)
1789	Switch (left stabilizer)

1820	Relay (auxiliary diverter valve)
1823	Position sensor (shift rail) (No. 1)
1824	Position sensor (shift rail) (No. 2)
1825	Position sensor (shift rail) (No. 3)
1826	Strain sensor (longitudinal stability)
1827	Longitudinal stability system
1828	Proximity switch (critical angle)
1829	Proximity switch (boom lower)
1830	Proximity switch (boom retract)
1831	Solenoid valve (rear axle lock)
1832	Pressure switch (right stabilizer)
1833	Pressure switch (left stabilizer)
1834	Key start switch
1845	PHS module 1
1846	PHS module 2
1847 (2)	PHS module 3
1930	Relay (quick coupler)
1935	Select switch (aux hydraulic flow)
1960	ECM cannot communicate with the key reader
2101	PHS address line
2197	Limit switch (Boom extend)
2240	Tilt Cylinder Extend Solenoid
2241	Tilt Cylinder Retract Solenoid
2242	Loader Auxiliary Valve Solenoid #1
2243	Loader Auxiliary Valve Solenoid #2
2281	Boom Telescope Cylinder Extend Solenoid
2282	Boom Telescope Cylinder Retract Solenoid
2287	Left Stabilizer Cylinder Extend Solenoid
2288	Left Stabilizer Cylinder Retract Solenoid
2289	Right Stabilizer Cylinder Extend Solenoid

2290	Right Stabilizer Cylinder Retract Solenoid
2525	P-LS (Load Sense) Control Solenoid
2670	Stabilizer Flow Control Solenoid

(1) For the Machine ECM, the MID is 039. For the Shift Lever ECM, the MID is 117. This table pertains only to codes with a MID 039 and MID 117.

(2) This Diagnostic Code applies only to the following machines: SLA1-849, , SLB1-1499, , SLC1-849, , SLD1-1399, , SLE1-4499, , SLF1-2099, , SLG1-1299, , SLH1-899, , JRK1-UP

The following table is a list of possible diagnostic codes for the access panel ECM.

Table 3

Diagnostic Codes For the Access Panel ECM Module Identifier (MID 082) (1)	
Perform the procedure that corresponds to the CID and the FMI of the diagnostic code during troubleshooting.	
Component Identifier (CID)	**Component Description**
0271	Action alarm
0324	Action lamp
0337	Switch (emergency stop)
1125	Position sensor (handle control) (boom raise/lower)
1127	Position sensor (handle control) (platform rotate)
1763	Switch (operator station select)
1772	Switch (operator station lockout)
1879	Position sensor (handle control) (boom extend/retract)

(1) For the Access Panel ECM, the MID is 082. This table pertains only to faults with a MID of 082.

Failure Mode Identifier (FMI)

The codes for the Failure Mode Identifier are defined by the SAE standards. The following list contains a CAT version of definitions. The diagram that follows will help you understand the use of FMI with sensors.

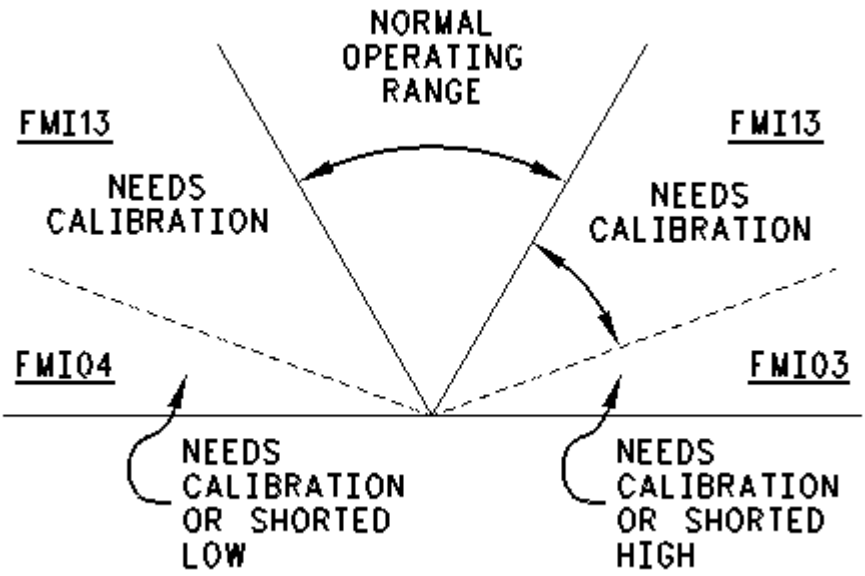

Illustration 1 g00493694

Table 4

Failure Mode Identifier and Message Center Displays	
FMI	**"Failure Description"**
00	"Data valid but above normal operating range"
01	"Data valid but below normal operating range"
02	"Data erratic, intermittent or incorrect"
03	"Voltage above normal or shorted high"
04	"Voltage below normal or shorted low"
05	"Current below normal or open circuit"
06	"Current above normal or grounded circuit"
07	"Mechanical system not responding properly"
08	"Abnormal frequency, pulse, or period"
09	"Abnormal update"
10	"Abnormal rate of change"
11	"Failure mode not identifiable"
12	"Bad device or component"
13	"Out of calibration"
14	N/A
15	N/A

16	"Parameter not available"
17	"Module not responding"
18	"Sensor supply fault"
19	"Condition not met"
20	N/A

Detailed FMI Explanation

FMI 00 "Data Valid But Above Normal Operating Range" - Every electronic control system sets a high limit for the expected operating range of the signal. This could be a high temperature. A sensor that is still operating but sending a signal above the expected limit will cause a FMI 00 to be stored.

Some of the possible causes of a FMI 00 are listed below.

- The signal is above normal.
- The signal is shorted to the +battery circuit.
- The sensor needs to be calibrated.

This is an example of a sensor that needs calibration. A PWM signal that is at a duty cycle of 80 percent is a valid signal. If the PWM signal has a duty cycle of 81 percent the sensor is still working, but the sensor signal is above the expected signal limits.

FMI 01 "Data Valid But Below Normal Operating Range" - Every electronic control system sets a low limit for the expected operating range of the signal. The limit includes signals that are under the lower limit. The low signal could be the oil pressure signal. The sensor is still working but sending a signal below the expected limit will cause a FMI 01 to be stored.

Some of the possible causes of a FMI 01 are listed below.

- The signal is below the normal range.
- The timing is retarded.

This is an example of a PWM sensor. This sensor is not expected to generate a PWM signal below a duty cycle of 5 percent with zero air pressure. If the sensor generates a signal with a duty cycle of 4 percent when the engine is shutdown. The sensor is still working but sending a signal below the expected limit will cause a FMI 01 to be stored.

FMI 02 "Data Erratic, Intermittent or Incorrect" - The signal from a component is present. The control that reads the diagnostic information can not read the signal properly. The signal appears to be gone, unstable or invalid. The data can be correct or incorrect intermittently. Also, this condition relates to communication between controls. This is an example of communication between controls. When the monitoring system is looking for the engine speed from the engine ECM over the CAT data link.

- There is a failed connection.
- The signal is intermittent or erratic.

- The software has been changed.
- The signal is noisy.
- The signal is out of range.

FMI 03 "Voltage Above Normal or Shorted High" - The component or system voltage is higher than the limit. FMI 03 most often relates to a signal circuit.

Some of the components that could cause a FMI 03 are listed below.

- The sensor or the switch has failed.
- The harness is damaged.
- The electronic control module has failed.

Some of the possible causes of a FMI 03 are listed below.

- A sensor that has failed and the voltage output is high.
- Any wiring harness that has a sensor signal wire shorted to a high voltage. A high voltage is any voltage that is greater than the sensor supply voltage.
- A wiring harness that has an open circuit in the sensor signal wire will cause the control to pull up. When this occurs the input circuit is pulled up to the supply voltage.
- A control that has failed will also cause a FMI 03. This is very unlikely.

FMI 04 "The Voltage is Below Normal or the Voltage is Shorted Low" - The component or system voltage is lower than the limit. FMI 04 most often relates to a signal circuit.

Some of the components that could cause a FMI 04 are listed below.

- The sensor or the switch has failed.
- The harness is damaged.
- The electronic control has failed.

Some of the possible causes of a FMI 04 are listed below.

- A sensor that has failed and the voltage output is low.
- Any wiring harness that has a sensor signal wire shorted to ground.
- A failed ECM will also cause a FMI 04. This is very unlikely.

FMI 05 "Current Below Normal or Open Circuit" - The current through the component or the system is lower than the limit. FMI 05 is most often related to a driver circuit.

Some of the possible causes of a FMI 05 are listed below.

- There is an open circuit or a poor harness connection.
- There is an open relay.

- There is a switch in the open position.

FMI 06 "Current Above Normal or Grounded Circuit" - The current through the component or the system is higher than the limit. FMI 06 is most often related to a driver circuit. This fault is very similar to FMI 04.

Some of the possible causes of a FMI 06 are listed below.

- There is a short to ground in the harness connection.
- There is a shorted relay.
- A failed control will also cause a FMI "06". This is very unlikely.

FMI 07 "Mechanical System Not Responding Properly" - The control detects a signal that is sent to a mechanical system and the response is not correct.

Some of the possible causes of a FMI 07 are listed below.

- The component responds improperly.
- The component is stuck in a position.
- The component has failed.
- The engine is shut down.
- The machine is being used improperly.

FMI 08 "Abnormal Frequency, Pulse Width or Period" - This occurs when the signal is not in the expected range. FMI 08 can also relate to a faulty sensor.

Some of the possible causes of a FMI 08 are listed below.

- The harness connections are intermittent or poor.
- The engine misfired.
- The signal is noisy due to nearby interference.
- There are loose mechanical devices.

FMI 09 "Abnormal Update" - This relates to communications on the data link. FMI 09 occurs when a control is not able to get information from another control.

Some of the possible causes of a FMI 09 are listed below.

- The control module is not communicating on the data link correctly.
- The rate of data transmission is abnormal.
- The data link has failed.
- There is a mismatch of software.

FMI 10 "Abnormal Rate of Change" - This relates to a signal that changes too fast. The rate of change is outside of the expected limit.

FMI 11 "Failure Mode Not Identifiable" - The control identifies more than one FMI as being responsible for a single failure.

Some of the possible causes of a FMI 11 are listed below.

- There is a mechanical failure.
- There is damage to multiple circuits.

FMI 12 "Bad Device or Component" - The electronic control sends a signal and the electronic control expects a response. The control receives no response or the response is incorrect.

Some of the possible causes of a FMI 12 are listed below.

- There is a failure of the electronic control.
- There is a failure on the data link.
- There are one or more controls with mismatched software.

FMI 13 "Out of Calibration" - The electrical signal is not within limits for a specific mechanical condition.

Some of the possible causes of a FMI 13 are listed below.

- Calibration is required.
- The data is out of range.

FMI 14, 15, and 20 - These codes are not active.

FMI 16 "Parameter Not Available" - The control does not support the requested parameter.

FMI 17 "Module Not Responding" - The control does not respond to the request for data.

FMI 18 "Sensor Supply Failure" - The sensor power supply in the control has failed.

FMI 19 "Condition Not Met" - The conditions that are defined by the software were not met.
