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Diagnostic and Troubleshooting

For Golf Car with “F” Controller

Software Version 1.10 and UP

Date: 9-10-24

Diagnostics

Diagnostics information can be obtained by observing the fault codes issued by the Status LED's on the motor controller or as displayed on the Curtis 3140 Display. See Table below for a summary of LED display formats.

The 1313 handheld programmer will display all faults that are currently set as well as a history of the faults that have been set since the history log was last cleared. The 1313 displays the faults by name.

When connected to the motor controller with the Curtis 1313 handheld, the current faults will be located at the top of the "Programmer" list.



The installed Curtis 3140 display will also display current faults. When a fault is active, the display will show the letter "C" followed by the two digit fault code; i.e., for a main contactor did not close fault, the fault code will be C39. If there are multiple faults, the faults will display in succession.

Summary of LED display formats

The two LEDs have four different display modes, indicating the type of information they are providing.

Display	Status
Neither LED Illuminated	Controller is not powered on; or vehicle has dead battery; or severe damage
Yellow LED flashing	Controller is operating normally.
Yellow and red LEDs both on solid	Controller is in Flash program mode
Red LED on solid	Watchdog failure or no software loaded. Cycle KSI to restart, and if necessary load software.
Red LED and yellow LED flashing alternately	Controller has detected a fault. 2-digit code flashed by both red and yellow LED identifies the specific fault; the Red LED flashes indicate the first digit error code while the yellow LED indicates the second digit error code.

The pair of LEDs built into the controller (one red, one yellow) produce flash codes displaying all the currently set faults in a repeating cycle. Each code consists of two digits. The red LED flashes the first digit in the error code while the yellow LED flashes the second digit in the error code.

Example: Battery Undervoltage (code 23).

Located at the top of the Program List of the Curtis Handheld 1313 programmer, the words Undervoltage Cutback will be displayed; the real-time battery voltage is displayed in the Monitor menu ("Keyswitch Voltage"). The controller's two LEDs will display this repeating pattern:

RED	YELLOW
* *	* * *
(2)	(3)

Troubleshooting

The troubleshooting chart below provides the following information on all the controller faults:

- fault code
- fault name as displayed on the programmer's LCD
- the effect of the fault
- possible causes of the fault
- fault set conditions
- fault clear conditions

Whenever a fault is encountered and no wiring or vehicle fault can be found, shut off KSI and turn it back on to see if the fault clears. If it does not, shut off KSI and remove the 35-pin connector. Check the connector for corrosion or damage, clean it if necessary, and re-insert it.

Troubleshooting Chart

HPEVS DEFINED GOLF CAR FAULTS			
FLASH CODE	POSSIBLE CAUSES	SET AND CLEAR CONDITIONS	FAULT ACTIONS
5-1 Code 51 Display: C51	Charger Plugged In	Set: Charger cord is plugged into golf car. Clear: 1) Unplug power cord from golf car. 2) Cycle key switch power to clear fault.	1. Throttle Shutdown 2. Interlock Shutdown
5-2 Code 52 Display: C52	FNR Fault	Set: Bad or wet forward/reverse switch is either wet or bad. Clear: Dry or replace the forward/reverse switch	NONE, vehicle will not run in either direction
5-3 Code 53 Display: C53	Charging	Set: Charger cord is plugged into golf car and the battery is charging. Clear: 1) Unplug power cord from golf car. 2) Cycle key switch power to clear fault.	1. Throttle Shutdown 2. Interlock Shutdown
5-4 Code 54 Display: C54	Tow Mode	Set: Tow mode switch to tow or the tow/run switch has failed to an active state. Clear: Switch the Run/Tow switch to Run if desired. Check switch to make sure it is operating properly.	1. Throttle Shutdown
5-5 Code 55 Display: C55	NO BMS CAN Fault	Set: BMS communication fault detected Clear: Check CAN BUS wiring and connectors for loose or recessed pins in the connector or cut/broken wires. Restart system.	1. Vehicle goes into cutback mode

5-6 Code 56 Display: C56	Motor Type Not Set	Set: Motor type not set from the onset. Clear: Set the motor type in the programmer: User Settings>Motor Type. Cycle key switch to clear fault	1. Throttle Shutdown 2. Interlock Shutdown
5-7 Code 57 Display: C57	No CAN 3140 Display Fault	Set: None or lost CAN communication to the Curtis 3140 Display. Clear: Check CAN BUS wiring and connectors for loose or recessed pins in the connector or cut/broken wires. Restart system. Verify that the 6 pin connector is fully seated	NONE
5-8 Code 58 Display: C58	Software License Violation	Set: The license of the installed software package does not match the license of the controller. Clear: Contact HPEVS	1. Throttle Shutdown 2. Interlock Shutdown
5-9 Code 59 Display: C59	No CAN E7 Fault	Set: None or lost CAN communication to the Curtis Engage VII Display. Clear: Check CAN BUS wiring and connectors for loose or recessed pins in the connector or cut/broken wires. Restart system. Verify that the 6 pin connector is fully seated	NONE
6-1 Code 61 Display: C61	Orion BMS Temp Sensor Fault	Set: The Orion BMS from the HPEVS battery pack is reporting this fault Clear: Contact HPEVS	NONE

6-2 Code 62 Display: C62	Orion BMS Weak Cell Fault	Set: The Orion BMS from the HPEVS battery pack is reporting this fault Clear: Contact HPEVS	NONE
6-3 Code 63 Display: C63	Orion BMS Low Cell Fault	Set: The Orion BMS from the HPEVS battery pack is reporting this fault Clear: Contact HPEVS	NONE
6-4 Code 64 Display: C64	Orion BMS Open Cell Fault	Set: The Orion BMS from the HPEVS battery pack is reporting this fault Clear: Contact HPEVS	NONE
6-5 Code 65 Display: C65	Orion BMS Current Sensor Fault	Set: The Orion BMS from the HPEVS battery pack is reporting this fault Clear: Contact HPEVS	NONE
6-6 Code 66 Display: C66	Orion BMS Cell Over 5 Volt Fault	Set: The Orion BMS from the HPEVS battery pack is reporting this fault Clear: Contact HPEVS	NONE

6-7 Code 67 Display: C67	Pedal Interlock Fault	Set: The Pedal Interlock Type is incorrectly set based on the installed throttle pedal in the golf car. This fault is strictly around the new APPS (electronic throttle) installed in the 2022 and newer Club Car vehicles. Clear: Make sure that the throttle wiring is correct. Perform the throttle setup procedure	1. Throttle Shutdown
5-10 Code 5A Display: C5A	Program Mode	Set: The motor controller is in program mode. Clear: Cycle key switch.	1. Throttle Shutdown 2. Interlock Shutdown
5-11 Code 5B Display: C5B	Throttle Not Programmed Fault	Set: The motor controller needs the throttle programmed. This fault usually happens at initial first start up or if a throttle change has been made. Clear: Program Throttle to motor controller. Contact HPEVS with questions.	1. Throttle Shutdown
7-13 Code 7D Display: C7D	VCL Parameter Change Fault	Set: If the Throttle Type has been changed or if Reset Throttle Parameters to Default parameter has been set to ON. Clear: Program Throttle to motor controller.	1. Throttle Shutdown 2. Interlock Shutdown 3. Main Shutdown

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
1-2 0x12 Display: C12	Controller Overcurrent <i>Controller_Overcurrent</i> 0x2510 Fault Type(s): 1 = Controller Overcurrent Phase U 2 = Controller Overcurrent Phase W 3 = Controller Overcurrent Phase V 4 = Irms > 120% Current Limit 5 = PMAC motor speed exceeds controller's ability to safely regulate voltage. 6 = PMAC motor speed causes back emf to exceed controller voltage rating and controller cannot enable the bridge because KSI voltage is below brownout. 7 = Reserved. 8 = PMAC motor speed causes back emf to exceed controller voltage rating and controller cannot enable the bridge because no weakening is available for the selected motor type.	1. External short of phase U, V, or W motor connections. 2. Speed encoder noise problems. 3. Motor parameters are mistuned. 4. Controller defective.	Set: Phase current exceeded the current measurement limit. Clear: <i>Reset Controller.</i>	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
1-3 0x13 Display: C13	Current Sensor <i>Current_Sensor</i> 0x2832 Fault Type(s): 1 = Controller current reading failed to stabilize at startup. 2 = Controller current reading failed to stabilize after startup. 3 = Controller current reading outside calibrated limits while acquiring offset.	1. Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2. Controller defective.	Set: Controller current sensors have invalid offset reading. Clear: <i>Reset Controller.</i>	<u>ShutdownVehicle (except pump):</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
1-4 0x14 Display: C14	Precharge Failed <i>Precharge_Failed 0x2223</i> Fault Type(s): 1 = Abort 2 = Energy Limit Exceeded 3 = Time Limit Exceeded	1. An external load on the capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging. 2. See Programmer » System Monitor menu » Controller » Capacitor Voltage.	<i>Set:</i> The precharge failed to charge the capacitor bank. <i>Clear:</i> Cycle Interlock or <i>Reset Controller</i> .	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
1-5 0x15 Display: C15	Controller Severe Undertemp <i>Controller_Severe_Undertemp 0x2141</i> Fault Type(s): 1	1. Controller is operating in an extreme environment. 2. See Programmer » System Monitor menu » Controller » Controller Temperature.	<i>Set:</i> Heatsink temperature below -40°C (-40°F). <i>Clear:</i> Bring the heatsink temperature above -40°C (-40°F) and then <i>Reset Controller</i> .	<u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
1-6 0x16 Display: C16	Controller Severe Overtemp <i>Controller_Severe_Overtemp 0x2142</i> Fault Type(s): 1	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller. 4. See Programmer » System Monitor menu » Controller » Controller Temperature.	<i>Set:</i> Heatsink temperature above $+95^{\circ}\text{C}$. <i>Clear:</i> Bring heatsink temperature below $+95^{\circ}\text{C}$, and then <i>Reset Controller</i> .	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
1-7 0x17 Display: C17	Severe B+ Undervoltage <i>Severe_B_Plus_Undervoltage 0x2120</i> Fault Type(s): 1 = Undervoltage cutback (0x343B = 0%) or capacitor voltage below safe limits for 64 ms. 2 = Commanded voltage could not be achieved due to low capacitor voltage, see also phase PWM mismatch.	1. Non-controller system drain on battery. 2. Battery resistance too high. 3. Battery disconnected while driving. 4. Blown B+ fuse or main contactor did not close. 5. Battery parameters are misadjusted. 6. See Programmer » Monitor menu » Controller » Capacitor Voltage. 7. See the Voltage Limits in Chapter 3.	<i>Set:</i> When Main is closed and the FET Bridge is enabled, either the undervoltage drive current cut back = 0% for 64 ms or the Brownout Voltage is reached. <i>Clear:</i> Undervoltage drive current cut back > 0% for 100 ms and capacitor voltage > brownout voltage, or if phase PWM mismatch also present, cycle keyswitch.	No drive torque. <u>Fault Action:</u> <i>ShutdownPump</i> <i>ShutdownMotor</i> <u>Dual Drive</u> This Motor: <i>TrimDisable</i> <i>ShutdownPump</i> <i>ShutdownMotor</i> Other Motor: <i>TrimDisable</i>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
1-7 0x17 Display: C17	Severe KSI Undervoltage <i>Severe_KSI_Undervoltage 0x2122</i> Fault Type(s): 1 = Brownout is disabled due to invalid product data configuration. 2 = Keyswitch_Voltage below brownout threshold at bootup. 3 = Keyswitch_Voltage below low brownout threshold for 5 ms. 4 = Keyswitch_Voltage below high brownout threshold for 64 ms.	1. Non-controller system drain on battery/keyswitch circuit wiring. 2. Resistance in low-power (KSI) circuit is too high. 3. KSI disconnected while driving. 4. Blown fuse. 5. See Programmer » System Monitor menu » Battery » Keyswitch Voltage. 6. See the Voltage Limits in Chapter 3.	Set: The KSI voltage dropped into the Brownout Voltage regions. Clear: Bring KSI voltage above Brownout Voltage.	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors
1-8 0x18 Display: C18	Severe B+ Overvoltage <i>Severe_B_Plus_Overvoltage 0x2130</i> Fault Type(s): 1	1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 5. See the Voltage Limits in Chapter 3.	Set: Capacitor bank voltage exceeded the Severe Overvoltage limit with the FET bridge enabled. Clear: Bring capacitor voltage below Severe Overvoltage limit, and then <i>Reset Controller</i> .	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> This Motor: <i>ShutdownMotor</i> <i>SevereDual</i> Other Motor: <i>SevereDual</i> <i>LOSDual</i> <i>TrimDisable</i>

1-8 0x18 Display: C18	Severe KSI Overvoltage <i>Severe_KSI_Overvoltage 0x2132</i> Fault Type(s): 1	1. Battery-voltage applied to KSI (pin 1) exceeds the Severe Overvoltage limit. 2. See Programmer » Monitor menu » Battery » Keyswitch Voltage. 3. See the Voltage Limits in Chapter 3.	Set: KSI voltage exceeded the Severe Overvoltage limit. Clear: Bring KSI voltage below the Severe Overvoltage limit, and then <i>Reset Controller</i> .	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> This Motor: <i>ShutdownMotor</i> <i>SevereDual</i> Other Motor: <i>SevereDual</i> <i>LOSDual</i> <i>TrimDisable</i>
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FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
1-9 0x19 Display: C19	Speed Limit Supervision <i>Speed_Limit_Supervision</i> 0x2133 Fault Type(s): 1	<ol style="list-style-type: none"> 1. Motor speed detected that exceeds the limit set by the Max Speed Supervision parameter. 2. Misadjusted Max Speed Supervision parameters. 3. See: Programmer » Application Setup » Max Speed Supervision menu. 	<p>Set: Motor rpm has exceeded the Max Speed Limit setting for the Max Speed Time Limit setting's duration.</p> <p>Clear: <i>Reset Controller.</i></p>	<p><i>ShutdownInterlock</i> <i>ShutdownEMBrake</i></p> <p><u>Dual Drive</u> Same, both motors</p>
1-10 0x1A Display: C1A	Motor Not Stopped <i>Motor_Not_Stopped</i> 0x2134 Fault Type(s): 1 = The motor moved more revolutions than the parameter, <i>Motor_Not_Stopped_Position_Error</i> setting. 2 = The motor moved faster than the parameter, <i>Motor_Not_Stopped_Speed_Error</i> (RPM) for 160 ms. 3 = The three-phase drive has applied an electrical frequency greater than the <i>Motor_Not_Stopped_Max_Frequency</i> parameter, and applied an RMS current greater than the <i>Motor_Not_Stopped_Max_Current</i> parameter for 64 ms.	<ol style="list-style-type: none"> 1. Misadjusted Motor Not Stopped parameters. 2. See: Programmer » Application Setup » Motor Not Stopped menu. 3. Internal Controller fault or conflict allowing the motor to rotate when in the stopped state. 	<p>Set: Motor Not Stopped is a safety function implemented in the Primary microprocessor on a category 2 architecture per ISO 13849. The purpose of this function is to detect hazardous movement when the AC motor is stopped and expected to stay stopped (i.e., no throttle command). There are three main checks done when the motor is in the stopped state, each of which can be independently enabled and each of which has a unique fault type.</p> <p>Clear: <i>Reset Controller.</i></p>	<p><u>ShutdownVehicle:</u></p> <p><i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i></p> <p><u>Dual Drive</u> Same, both motors</p>

1-11 0x1B Display: C1B	Critical OS General <i>Critical_OS_General</i> 0x2109 Fault Type(s): (1-100) Internal Fault, kindly contact your Curtis representative immediately. (101-200) Ill-formed or corrupted application package was loaded into controller. (>200) Internal Fault, kindly contact your Curtis representative immediately.	(1–100) Internal Fault. (101–200) CIT version is too old to fully support the FOS version. (>200) Internal Fault.	Set: Program execution within the controller encountered a serious problem and could not recover (from it). Clear: (1–100) Internal Fault. (101–200) Update CIT version, re-package the project, and re-flash the application package. (>200) Internal Fault.	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors
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FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
1-12 0x1C Display: C1C	OS General 2 <i>OS_General_2</i> 0x210A Fault Type(s): (<100) Internal Fault. Contact Curtis support. (>100) An ill-formed or corrupted application package was loaded into controller.	1. (<100) Internal Fault. 2. (>100) CIT version is too old to fully support the FOS version.	Set: Program execution within the controller encountered a serious problem and could not recover. Clear: (<100) Internal Fault. (>100) Update CIT version, re-package the project, and re-flash the application package.	NO ACTION (controller is not operable) <u>Dual Drive</u> Same, both motors
1-13 0x1D Display: C1D	Reset Rejected <i>Reset_Rejected</i> 0x2110 Fault Type(s): 1	This occurs if a controller is commanded to reset while controlling a PMAC motor that is not stationary. Examples of resets include sending an NMT reset or calling <i>reset_controller()</i> in VCL. Note, the controller will NOT reset when the controller later does enter a safe state unless the NMT is resent or <i>reset_controller()</i> is called again. If legacy brownout is set to Off, the user may see this fault if the controller is turned off and on again at an unsafe time, but in this instance the controller will reset as soon as it is safe to do so. Consult Curtis Support for further assistance using non legacy brownout.	Set: A reset was called at a time unsafe for the controller. Clear: Cycle KSI.	<i>ShutdownInterlock</i> <i>ShutdownThrottle</i> <u>Dual Drive</u> Same, both motors
1-14 0x1E Display: C1E	Motor Short <i>Motor_Short</i> 0x210E Fault Type(s): 1	Check Motor Type and Parameters. See the PMAC considerations. Indicates whether the fault is presently active or not.	Set: Indicates the motor was shorted to avoid dangerous voltage levels. Clear: <i>Reset controller.</i>	NO ACTION (controller is not operable) <u>Dual Drive</u> Same, both motors
2-2 0x22 Display: C22	Controller Overtemp Cutback <i>Controler_Overtemp_Cutback</i> 0x2140 Fault Type(s): 1 = Controller heatsink high temperature (affecting AC phases) 2 = Controller heatsink high temperature (affecting pump phase) 3 = Capacitor bank high temperature 4 = AC phase FET high temperature 5 = Pump phase FET high temperature 6 = Low Frequency single phase high temperature.	1. Controller is operating in an extreme environment. 2. Excessive load on vehicle. 3. Improper mounting of controller which is preventing controller cooling. 4. Controller is performance-limited at this temperature. 5. See Programmer » System Monitor menu » Controller: Controller Temperature. Capacitor Bank Temperature. » Cutbacks menu.	Set: The controller's temperature exceeded temperature cutback threshold. Clear: Bring controller temperature below overtemperature threshold.	Reduced drive torque. Reduced regen-braking torque. <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> This Motor: <i>TrimDisable</i> Other Motor: <i>TrimDisable</i>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
2-3 0x23 Display: C23	Undervoltage Cutback <i>Undervoltage_Cutback</i> 0x2121 Fault Type(s): 1	<ol style="list-style-type: none"> 1. Batteries need recharging. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Non-controller system-drain on battery. 4. Battery resistance too high. 5. Battery disconnected while driving. 6. Blown B+ fuse or main contactor did not close. 7. See Programmer » System Monitor menu » Controller » <i>Cutbacks</i> » <i>Undervoltage Cutback</i>. 8. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 	<p><i>Set:</i> Capacitor bank voltage dropped below the <i>Undervoltage Cutback</i> limit with the FET bridge enabled.</p> <p><i>Clear:</i> Bring the capacitor voltage above the controller's <i>Undervoltage Cutback</i> limit.</p>	<p>Reduced drive torque. Reduced regen braking torque.</p> <p><u>Fault Action:</u> None, unless a fault action is programmed in VCL.</p> <p><u>Dual Drive</u> This Motor: <i>TrimDisable</i> Other Motor: <i>TrimDisable</i></p>
2-4 0x24 Display: C24	Overvoltage Cutback <i>Overvoltage_Cutback</i> 0x2131 Fault Type(s): 1	<ol style="list-style-type: none"> 1. Normal operation. Fault shows that regen braking currents elevated the battery voltage during regen braking. Controller is performance limited at this voltage. 2. Battery parameters are misadjusted. 3. Battery resistance too high for given regen current. 4. Battery disconnected while regen braking. 5. See Programmer » System Monitor menu » Controller » <i>Cutbacks</i> » <i>Overvoltage Cutback</i>. 6. See Programmer » System Monitor menu » Controller » Capacitor Voltage. 	<p><i>Set:</i> The controller's capacitor bank voltage exceeded the <i>Overvoltage Cutback</i> limit with the FET bridge enabled.</p> <p><i>Clear:</i> Bring controller's capacitor voltage below the <i>Overvoltage Cutback</i> limit.</p>	<p>Reduced brake torque. Note: This fault is declared only when the controller is running in regen.</p> <p><u>Fault Action:</u> None, unless a fault action is programmed in VCL.</p> <p><u>Dual Drive</u> This Motor: <i>TrimDisable</i> Other Motor: <i>TrimDisable</i></p>
2-5 0x25 Display: C25	Ext 5V Supply Failure <i>Ext_5V_Supply_Failure</i> 0x2531 Fault Type(s): 1 = The 5V supply is outside 5V ± 10%. 2 = The current is outside the limits defined by: - <i>Ext_5V_Supply_Min</i> . - <i>Ext_5V_Supply_Max</i> .	<ol style="list-style-type: none"> 1. External load impedance on the +5V supply is too low (i.e., a short circuit). 2. See the <i>System Monitor</i> » <i>Outputs</i> menu: <i>External_5V_Supply</i>, <i>Ext_5V_Current</i>. 	<p><i>Set:</i> Triggered by the Fault Type indicated.</p> <p><i>Clear:</i> <i>Reset Controller</i>, or Reset using the VCL variable <i>Ext_5V_Output_Enable</i>.</p>	<p>Disables the 5V Supply.</p> <p><u>Fault Action:</u> None, unless a fault action is programmed in VCL.</p> <p><u>Dual Drive</u> Same, both motors</p>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
2-6 0x26 Display: C26	Ext 12V Supply Failure <i>Ext_12V_Supply_Failure</i> 0x2532 Fault Type(s): 1 = The 12V supply is outside 12V ± 15%. 2 = The current is outside the limits defined by: - Ext_12V_Supply_Min. - Ext_12V_Supply_Max.	1. External load impedance on the +12V supply is too low (i.e., a short circuit). 2. See Programmer » System Monitor menu » Outputs: <i>External_12V_Supply,</i> <i>Ext_12V_Current.</i>	<i>Set:</i> Triggered by the Fault Type indicated. <i>Clear: Reset Controller. Or Reset using the VCL variable Ext_12V_Output_Enable.</i>	Disables the 12V Supply. <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
2-8 0x28 Display: C28	Motor Temp Hot Cutback <i>Motor_Temp_Hot_Cutback</i> 0x2151 Fault Type(s): 1	1. Motor temperature is at or above the programmed Temperature Hot setting—resulting in a reduction of controller drive current. 2. The motor temperature and sensor control parameters are misadjusted. 3. See Programmer » AC Motor Setup » Temperature Sensor.	<i>Set:</i> Motor temperature is at or above the Temperature Hot parameter setting. <i>Clear:</i> Bring the motor temperature within range.	Reduced Drive Torque. If MotorBrakingThermalCutBack_Enable = On, then Regen Braking Torque is reduced. <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> This Motor: <i>TrimDisable</i> Other Motor: <i>TrimDisable</i>
2-9 0x29 Display: C29	Motor Temp Sensor <i>Motor_Temp_Sensor</i> 0x2150 Fault Type(s): 1	1. Motor thermistor is not connected properly. 2. Sensor polarity (between Motor- temp pin and ground) is incorrect. See wiring diagrams. 3. The motor temperature and sensor parameters are misadjusted. 4. See Programmer » System Monitor menu » AC Motor » Temperature.	<i>Set:</i> Motor thermistor input is at the voltage rail. <i>Clear:</i> Bring the motor thermistor input voltage within range.	Motor temperature cutback disabled. <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> This Motor: <i>LOSDual</i> Other Motor: <i>LOSDual</i>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-1 0x31 Display: C31	MAIN DRIVER <i>Main_Driver_Fault</i> 0x2222 Fault Type(s): 1 = Driver current exceeded hardware limits. 2 = Driver current exceeded configured overcurrent limits. 3 = Driver commanded PWM active, using diagnostic pulses. Voltage measured high, should be low. Typically caused by driver failure, or driver pin short to high. 4 = Driver commanded PWM active, using diagnostic pulses. Voltage measured low, should be high. Either open circuit, or driver pin short to ground. 5 = Driver commanded PWM is 0, and voltage measured low (should be high). Either open circuit, or driver pin short to ground. 6 = Driver current DC offset out of range. 7 = Driver undercurrent — Monitored current is below undercurrent threshold. 8 = Driver following — Driver in current control is not within error bounds. Fault types 1-2 are always checked. Fault types 3-5 are only checked if driver checks are enabled.	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver x Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver x » Driver x Overcurrent.	Set: Main Contactor driver is either open or shorted. This fault can be set only when Main Enable = On. Clear: Restore/repair any external wiring or device-coil to their correct state, Correct the open or short, then <i>Reset Controller</i> .	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-2 0x32 Display: C32	EM Brake Driver Fault <i>EM_Brake_Driver_fault 0x2320</i> Fault Type(s): 1 = Driver current exceeded hardware limits. 2 = Driver current exceeded configured overcurrent limits. 3 = Driver commanded PWM active, using diagnostic pulses. Voltage measured high, should be low. Typically caused by driver failure, or driver pin short to high. 4 = Driver commanded PWM active, using diagnostic pulses. Voltage measured low, should be high. Either open circuit, or driver pin short to ground. 5 = Driver commanded PWM is 0, and voltage measured low (should be high). Either open circuit, or driver pin short to ground. 7 = Driver undercurrent — Monitored current is below undercurrent threshold. 8 = Driver following — Driver in current control is not within error bounds. Fault types 1-2 are always checked. Fault types 3-5 are only checked if driver checks are enabled.	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver x Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver x » Driver x Overcurrent.	Set: Electromagnetic brake driver (pin 4) is either open or shorted. This fault can be set only when EM Brake Type >0. Clear: Restore/repair any external wiring or device-coil to their correct state, then <i>Reset Controller</i> .	<i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-3 0x33 Display: C33	Pump Driver Fault <i>Pump_Driver_fault</i> 0x2420 Fault Type(s): 1 = Driver current exceeded hardware limits. 2 = Driver current exceeded configured overcurrent limits. 3 = Driver commanded PWM active, using diagnostic pulses. Voltage measured high, should be low. Typically caused by driver failure, or driver pin short to high. 4 = Driver commanded PWM active, using diagnostic pulses. Voltage measured low, should be high. Either open circuit, or driver pin short to ground. 5 = Driver commanded PWM is 0, and voltage measured low (should be high). Either open circuit, or driver pin short to ground. 6 = Driver current DC offset out of range. 7 = Driver undercurrent — Monitored current is below undercurrent threshold. 8 = Driver following — Driver in current control is not within error bounds. Fault types 1-2 are always checked. Fault types 3-5 are only checked if driver checks are enabled.	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver x Overcurrent parameter. 5. See Programmer » <i>Controller Setup</i> » <i>Outputs</i> » <i>Driver x</i> » <i>Driver x Overcurrent</i> .	Set: The assigned pump-contactor driver is either open or shorted, or exceeded its overcurrent setting. Note: This fault is typically associated with non-pump controllers operating a DC pump contactor via a Driver, yet can apply to controllers with the pump (e.g., the F2-T/F2-C) if also so configured. Clear: Correct the open or short, and then <i>Reset Controller</i> .	<i>Shutdownpump</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-4 0x34 Display: C34	Load-Hold Driver Fault <i>Load_Hold_Driver_Fault</i> 0x2430 Fault Type(s): 1 = Driver current exceeded hardware limits. 2 = Driver current exceeded configured overcurrent limits. 3 = Driver commanded PWM active, using diagnostic pulses. Voltage measured high, should be low. Typically caused by driver failure, or driver pin short to high. 4 = Driver commanded PWM active, using diagnostic pulses. Voltage measured low, should be high. Either open circuit, or driver pin short to ground. 5 = Driver commanded PWM is 0, and voltage measured low (should be high). Either open circuit, or driver pin short to ground. 6 = Driver current DC offset out of range. 7 = Driver undercurrent — Monitored current is below undercurrent threshold. 8 = Driver following — Driver in current control is not within error bounds. Fault types 1-2 are always checked. Fault types 3-5 are only checked if driver checks are enabled.	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver x Overcurrent parameter. 5. See Programmer » <i>Controller Setup » Outputs » Driver x » Driver x Overcurrent.</i>	<i>Set:</i> The assigned load-hold driver is either open or shorted, or exceeded its overcurrent setting. <i>Clear:</i> Correct the open or short, and then <i>Reset Controller</i> .	NO ACTION <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-5 0x35 Display: C35	Lower Driver Fault <i>Lower_Driver_Fault</i> 0x2440 Fault Type(s): 1 = Driver current exceeded hardware limits. 2 = Driver current exceeded configured overcurrent limits. 3 = Driver commanded PWM active, using diagnostic pulses. Voltage measured high, should be low. Typically caused by driver failure, or driver pin short to high. 4 = Driver commanded PWM active, using diagnostic pulses. Voltage measured low, should be high. Either open circuit, or driver pin short to ground. 5 = Driver commanded PWM is 0, and voltage measured low (should be high). Either open circuit, or driver pin short to ground. 6 = Driver current DC offset out of range. 7 = Driver undercurrent — Monitored current is below undercurrent threshold. 8 = Driver following — Driver in current control is not within error bounds. Fault types 1-2 are always checked. Fault types 3-5 are only checked if driver checks are enabled.	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver x Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver x » Driver x Overcurrent. Note: See Driver 1* Fault * <i>Driver 1 is the PD Driver, therefore the Lower Driver fault cascades to the Driver 1 fault (see flash code 10-1).</i>	<i>Set:</i> The assigned lower driver is either open or shorted, or exceeded its overcurrent setting. <i>Clear:</i> Correct the open or short, and then <i>Reset Controller</i> .	<i>ShutdownLower</i> <u>Dual Drive</u> Same, both motors
3-6 0x36 Display: C36	IM MOTOR FEEDBACK <i>IM_Motor_Feedback</i> 0x2230 Fault Type(s): 1. Controller saw a fast transition to zero speed. 2. Encoder supply failed. 3. Sine or Cosine input differs from expected. 4. Controller saw sensor failure at speed. 5. Unrealistic motor acceleration seen. 6. Resolver loss of signal. 7. Resolver degradation of signal. 8. Resolver loss of tracking.	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. See Programmer » System Monitor menu » AC Motor: Motor RPM. 4. See Programmer » AC Motor Setup » Quadrature Encoder » Encoder Fault Setup. 5. See Programmer » System Monitor menu » Hardware Inputs: Analog 3 and 4.	<i>Set:</i> Motor position/speed sensor fault. <i>Clear:</i> Either <i>Reset Controller</i> , or if parameter <i>LOS Upon Encoder Fault = On</i> and <i>Interlock</i> has been cycled, then the <i>Encoder Fault</i> is cleared and <i>Encoder LOS fault (flash code 9-3)</i> is set, allowing limited motor control.	<i>ShutdownEMBrake</i> <i>ShutdownMotor</i> <u>Dual Drive</u> This Motor: <i>SevereDual</i> <i>ShutdownMotor</i> Other Motor: <i>SevereDual</i> <i>LOSDual</i> <i>TrimDisable</i>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-6 0x36 Display: C36	PM Motor Feedback <i>PM_Motor_Feedback</i> 0x2232 Fault Type(s): 1. Controller saw a fast transition to zero speed. 2. Encoder supply failed. 3. Sine or Cosine input differs from expected. 4. Controller saw sensor failure at speed. 5. Unrealistic motor acceleration seen. 6. Resolver loss of signal. 7. Resolver degradation of signal. 8. Resolver loss of tracking. 9. PMAC motor stalled.	1. Motor encoder failure. 2. Bad crimps or faulty wiring. 3. EMC induced signal corruption by poor wire routing and/or shielding. 4. See Programmer » System Monitor menu » Hardware Inputs: Analog 3 and 4.	<i>Set:</i> Motor position/speed Sin/Cos sensor fault. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
3-7 0x37 Display: C37	Motor Open <i>Motor_Open</i> 0x2240 Fault Type(s): 1. Current mismatch while running. 2. Reserved. 3. Weld check failed to achieve commanded current. 4. Voltage mismatch during startup.	1. Motor phase is open. 2. Bad crimps or faulty wiring.	<i>Set:</i> Motor phase U, V, or W detected open. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> This Motor: <i>ShutdownMotor</i> <i>SevereDual</i> Other Motor: <i>SevereDual</i> <i>LOSDual</i> <i>TrimDisable</i>
3-8 0x38 Display: C38	Main Contactor Welded <i>Main_Contactor_Welded</i> 0x2220 Fault Type(s): 1	1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external circuit to B+) is providing a current to the capacitor bank (B+ connection terminal).	<i>Set:</i> Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded (via the motor) for a short time and the voltage did not discharge, indicating a direct-contact to the battery (i.e., Main tips are welded closed). <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
3-9 0x39 Display: C39	Main Contactor Did Not Close <i>Main_Contactor_Did_Not_Close</i> 0x2221 Fault Type(s): 1 = Main did not close when commanded. 2 = Main disconnected during operation. 3 = Battery disconnected with main enable off.	Type 1: 1. Main contactor did not close. 2. Main contactor tips are oxidized, burned, or not making good contact. 3. An external load on the capacitor bank (B+ connection terminal) is preventing the capacitor bank from charging. 4. Blown B+ fuse. 5. Main Contactor parameters mistuned; • Main Pull-in Voltage, • Main Holding Voltage. Type 2: 1. Main contactor opened during operation (while commanded closed). 2. Driver wiring to contactor's coil (e.g., pin wiring) removed during operation. 3. Contactor/coil defective. Type 3: Main Enable is false, expect B+ supply controlled externally. Interlock applied, ready to enable the power stage. B+ capacitor voltage is below 95% of the KSI voltage.	<i>Set:</i> With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
3-10 0x3A Display: C3A	Motor Setup Needed <i>Motor_Setup_Needed</i> 0x2103 Fault Type(s): Bit 1 = Current regulator needs to be configured. Bit 2 = Slip gain test needs to be run. Bit 3 = Base speed test needs to be run. Bit 4 = Automated test needs to be run. ----- Hex# = bit 1– 4 Binary 0000 => bits 4 3 2 1	Motor setup incomplete. Run the appropriate motor commissioning sequences. Note: The Fault Type number in CIT is in hex (h), which is correct. See/Used bits as described.	<i>Set:</i> Motor setup is required. Please refer to fault type. <i>Clear:</i> Motor commissioning completed successfully.	<u>Fault Action:</u> None. Yet, the motor will not operate until the motor configuration and/or commissioning tests are complete.
3-11 0x3B Display: C3B	Misalignment Error <i>Misalignment_Error</i> 0x2102 Fault Type(s): 1	1. This fault is only for PMAC, indicating the position sensor (e.g., Sin/Cos) is not in alignment. 2. Possible motor setup and/or commissioning errors. 3. If the sensor is continuously becoming misaligned, the likely cause is motor damage. Consult with the motor manufacturer.	<i>Set:</i> The motor offset has shifted so controller is producing torque in an uncommanded direction. <i>Clear:</i> Reset the controller. If the fault persists, try rerunning the PMAC (field) commissioning (Chapter 6, PMAC Commissioning Procedure).	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
4-2 0x42 Display: C42	Throttle Input <i>Throttle_Input</i> 0x2210 Fault Type(s): 4* 1. Outside the Low or High parameter. 2. Throttle voltage exceeded the <i>Analog Low</i> parameter. 3. <i>Analog High</i> parameters for the analog input defined for the throttle input. 4. Input 1 fault diagnostics may be either out of range if it is configured as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot. * based upon the associated Analog Input faults.	1. Throttle voltage exceeded the Analog Low or Analog High parameters for the analog input defined for the throttle input. 2. See Programmer » Controller Setup » Inputs » Analog 1 Type. 3. See Programmer » Controller Setup » Inputs » Configure.	Set: This fault is triggered by the respective fault diagnostic associated with the throttle input source. For example, if <i>Throttle_Source</i> is set to Input 1, then any faults detected by the Input 1 fault diagnostics are reported in this fault code. Clear: Bring throttle input voltage within the Min and Max thresholds, then Reset the Controller.	<i>ShutdownThrottle</i> <u>Dual Drive</u> This Motor: <i>ShutdownThrottle</i> Other Motor: No Action
4-4 0x44 Display: C44	Brake Input <i>Brake_Input</i> 0x2310 Fault Type(s): 1*	*Triggered by the respective fault diagnostic associated with the brake input source (assigned Analog X input).	Set: See Throttle Input. Note: An Input 1 fault diagnostics may be out of range if it is configured as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot. Clear: Bring Brake Input voltage within the Min and Max thresholds. <i>Reset Controller.</i>	<i>FullBrake</i> <u>Dual Drive</u> Same, both motors. Any additional fault action that is programmed in VCL (see Analog X).
4-6 0x46 Display: C46	NV Memory Failure <i>NV_Memory_Failure</i> 0x2830 Fault Type(s): 1 = Invalid checksum. 2 = NV write failed. 3 = NV read failed. 4 = NV write did not complete during power down.	1. Failure to read or write to non-volatile (NV) memory. 2. Internal controller fault.	Set: Controller operating system tried to read or write to EEPROM memory and failed. Clear: Download the correct software and matching parameter default settings into the controller and <i>Reset Controller.</i>	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
4-7 0x47 Display: C47	HPD Sequencing <i>Hpd_Sequencing</i> 0x2211 Fault Type(s): Type 1 through 9 — HPD depends on HPD_SRO_Type Type 10 — Interlock Anti-Tiedown	<ol style="list-style-type: none"> 1. Incorrect sequence in application of Keyswitch, Interlock, Direction, or Throttle. 2. Faulty wiring, crimps, or switches at KSI, Interlock, Direction, or Throttle. 3. Moisture in above-noted digital input switches causing invalid (real) On/Off state. 4. Verify input switch status. See Programmer » System Monitor menu » Hardware Inputs » Switch Status. 5. Verify Throttle. See Programmer » System Monitor menu » Hardware Inputs » Throttle Command. 	<p><i>Set:</i> HPD (High Pedal Disable) or SRO (Static Return to Off) sequencing fault caused by incorrect sequence of KSI, interlock, direction, and throttle inputs.</p> <p><i>Clear:</i> Reapply inputs in correct sequence.</p>	<p><i>ShutdownThrottle</i></p> <p><u>Dual Drive</u> Same, both motors</p>
4-7 0x47 Display: C47	EMER Rev HPD <i>Emer_Rev_Hpd</i> 0x2331 Fault Type(s): 1	Emergency Reverse operation has concluded, but the throttle, forward and reverse, and interlock inputs have not been returned to neutral.	<p><i>Set:</i> At the conclusion of Emergency Reverse, the fault was set because various inputs were not returned to neutral.</p> <p><i>Clear:</i> If EMR_Interlock = On, clear the interlock, throttle, and direction inputs. If EMR_Interlock = Off, clear the throttle and direction inputs.</p>	<p><i>ShutdownThrottle</i> <i>ShutdownEMBrake</i></p> <p><u>Dual Drive</u> Same, both motors</p>
4-7 0x47 Display: C47	Hydraulic HPD SRO Lower <i>Hydraulic_HPD_SRO_Lower</i> 0x2124 Fault Type(s): 1	Review the hydraulic parameters and application setup and usage.	<p><i>Set:</i> This fault is triggered if the Lower throttle is non-zero when Hydraulic Interlock transitions to ON.</p> <p><i>Clear:</i> Return both hydraulic throttle inputs to zero.</p>	<p><i>ShutdownLower</i></p> <p><u>Dual Drive</u> This Motor: <i>ShutdownLower</i> Other Motor: None</p>
4-7 0x47 Display: C47	Hydraulic HPD SRO Lift <i>Hydraulic_HPD_SRO_Lift</i> 0x2125 Fault Type(s): 1	Review the hydraulic parameters and application setup and usage.	<p><i>Set:</i> This fault is triggered if the Lift throttle is non-zero when Hydraulic Interlock transitions to ON.</p> <p><i>Clear:</i> Return both hydraulic throttle inputs to zero.</p>	<p><i>ShutdownLift</i></p> <p><u>Dual Drive</u> This Motor: <i>ShutdownLift</i> Other Motor: None</p>
4-7 0x47 Display: C47	LHS Throttle Conflict <i>LHS_Throttle_Conflict</i> 0x2126 Fault Type(s): 1	Review the hydraulic parameters and application setup and usage.	<p><i>Set:</i> The hydraulic lift and lower inputs were both non-zero simultaneously.</p> <p><i>Clear:</i> Return both hydraulic throttle inputs to zero.</p> <p>If lower throttle is returned to zero prior to lift throttle, the lower throttle may be used to control the Hydraulic Lowering Proportional Valve while LHS Throttle Conflict is still active.</p>	<p><i>ShutdownLift</i></p> <p><u>Dual Drive</u> This Motor: <i>ShutdownLift</i> Other Motor: None</p>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS															
4-9 0x49 Display: C49	Parameter Change <i>Parameter_Change</i> 0x2813 Fault Type(s): Reports the CAN Object ID of parameter.	While the Interlock was On, a safety-based parameter was changed. Parameters with this property are marked with a [PCF] (Parameter Change Fault) in the Parameter menu listings.	<i>Set:</i> Adjustment of a parameter setting that requires cycling of KSI. <i>Clear:</i> <i>Reset Controller.</i>	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors															
4-10 0x4A Display: C4A	EMR Switch <i>EMR_Switch_Fault</i> 0x2817 Fault Type(s): 3 1. The Emergency Reverse Switch NO input does not agree with the Emergency Reverse Switch NC input. They are opposites: NO and NC. 2. EMR Switch input(s) are active within EMR_Anti_Tiedown_Time (ms) of Key-Switch Input. 3. EMR Switch input(s) are active while Interlock Switch input(s) is not active.	1. Either or both Emergency Reverse input switches are inoperative, resulting in an invalid state. <table><tr><th>NO</th><th>NC</th><th>State</th></tr><tr><td>On</td><td>Off</td><td>valid</td></tr><tr><td>Off</td><td>On</td><td>valid</td></tr><tr><td>On</td><td>On</td><td>invalid</td></tr><tr><td>Off</td><td>Off</td><td>invalid</td></tr></table> 2. Ingress of dirt or moisture in switch(es).	NO	NC	State	On	Off	valid	Off	On	valid	On	On	invalid	Off	Off	invalid	<i>Set:</i> Indicates a fault originating from the EMR switch inputs. <i>Clear:</i> Correct the two switch states. Deactivate Interlock and EMR Switch. <i>Reset Controller.</i>	<i>ShutdownInterlock</i> <i>ShutdownEMBrake</i> <u>Dual Drive</u> Same, both motors
NO	NC	State																	
On	Off	valid																	
Off	On	valid																	
On	On	invalid																	
Off	Off	invalid																	
5-1 0x51	USER 1 FAULT <i>User_{1, 2 ... 32}_Fault</i> 0x2710 Fault Type(s): OEM Definable.	1. These faults (and fault actions) can be defined by the User/OEM and are implemented in the application-specific VCL software. 2. See User/OEM documentation.	<i>Set:</i> See User/OEM documentation. <i>Clear:</i> See User/OEM documentation.	See User/OEM documentation.															
5-2 0x52	USER 2 FAULT 0x2711	See User 1 fault (above).	<i>Set:</i> See User/OEM documentation. <i>Clear:</i> See User/OEM documentation.	See User/OEM documentation.															
5-3 0x53	USER 3 FAULT 0x2712																		
5-4 0x54	USER 4 FAULT 0x2713																		
5-5 0x55	USER 5 FAULT 0x2720																		
5-6 0x56	USER 6 FAULT 0x2721																		
5-7 0x57	USER 7 FAULT 0x2722																		
5-8 0x58	USER 8 FAULT 0x2723																		
5-9 0x59	USER 9 FAULT 0x2730																		
6-1 0x61	USER 10 FAULT 0x2731																		
6-2 0x62	USER 11 FAULT 0x2732																		

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
6-3 0x63	USER 12 FAULT 0x2733	See User 1 fault (above).	<i>Set:</i> See User/OEM documentation. <i>Clear:</i> See User/OEM documentation.	See User/OEM documentation.
6-4 0x64	USER 13 FAULT 0x2740			
6-5 0x65	USER 14 FAULT 0X2741			
6-6 0x66	USER 15 FAULT 0X2742			
6-7 0x67	USER 16 FAULT 0X2743			
5-10 0x5A	USER 17 FAULT 0X2750			
5-11 0x5B	USER 18 FAULT 0X2751			
5-12 0x5C	USER 19 FAULT 0x2752			
5-13 0x5D	USER 20 FAULT 0x2753			
5-14 0x5E	USER 21 FAULT 0x2760			
5-15 0x5F	USER 22 FAULT 0x2761			
6-10 0x6A	USER 23 FAULT 0x2762			
6-11 0x6B	USER 24 FAULT 0x2763			
6-12 0x6C	USER 25 FAULT 0x2770			
6-13 0x6D	USER 26 FAULT 0x2771			
6-14 0x6E	USER 27 FAULT 0x2772			
6-15 0x6F	USER 28 FAULT 0x2773			
7-10 0x7A	USER 29 FAULT 0x2780			
7-11 0x7B	USER 30 FAULT 0x2781			
7-12 0x7C	USER 31 FAULT 0x2782			
7-13 0x7D	USER 32 FAULT 0x2783			

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
6-8 0x68 Display: C68	VCL Run Time Error <i>VCL_Run_Time_Error</i> 0x2820 Fault Type(s): 1	<ol style="list-style-type: none"> Runtime errors are defined using the VCL Error Module and VCL Error. See the System Information file: <ul style="list-style-type: none"> Curtis Integrated Toolkit™ » VCL Studio » Help » System Information. Using driver control commands in VCL can lead to VCL runtime errors if the VCL command and the driver assignment do not match. 	<p><i>Set:</i> VCL Run Time Error detected.</p> <p><i>Clear:</i> Edit the VCL application software to fix this error condition; flash the new compiled software and matching parameter settings; <i>Reset Controller.</i></p>	<p><u>ShutdownAll:</u></p> <p><i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i></p> <p><u>Dual Drive</u> Same, both motors</p>
6-8 0x68 Display: C69	ECC_RUN_TIME_ERROR <i>ECC_Run_Time_Error</i> 0x2871 Fault Type(s): 0 = Hard Fault. 1 = Memory Violation. 2 = Bus Fault. 3 = Usage Fault. 4 = Stack Fault. 5 = CPU Usage Fault. 100 = Heap Fault. 101 = Unhandled Exception. 10000 (and above) ccapi exception exit. All other codes are app-specific application exit codes.	Programming Error	<p><i>Set:</i> An embedded C application has encountered a runtime error.</p> <p><i>Clear:</i> Edit the ECC application software to fix this error condition; flash the new compiled software and matching parameter settings; <i>Reset Controller.</i></p>	<p><u>ShutdownAll:</u></p> <p><i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>ShutdownLower</i> <i>ShutdownLift</i></p> <p><u>Dual Drive</u> Same, both motors</p>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
7-1 0x71 Display: C71	OS General <i>OS_General</i> 0x2831 Fault Type(s): 1	Physical damage from external sources/events.	<i>Set:</i> Internal controller fault detected. <i>Clear:</i> Reset Controller.	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors
7-2 0x72 Display: C72	PDO Timeout <i>PDO_Timeout</i> 0x2541 Fault Type(s): 1	1. The time between CAN PDO messages received exceeded the PDO Timeout Period as defined by the Event Timer parameter. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.	<i>Set:</i> Time between CAN PDO messages received exceeded the PDO Timeout Period. <i>Clear:</i> Receive CAN NMT message, or <i>Reset Controller</i> .	<i>ShutdownInterlock</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
7-3 0x73 Display: C73	Stall Detected <i>Stall_Detected</i> 0x2231 Fault Type(s): 1 <u>Set Conditions</u> – Motor speed is less than <i>Enc_Fault_Stall_Speed</i> for <i>Enc_Fault_Stall_Time</i> and <i>Brake_Command</i> is zero and <i>Throttle_Command</i> is active. – For Speed and Torque Modes, current is greater than 90 percent of available. – For Direct Torque Mode, torque request is greater than 90 percent.	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Programmer » System Monitor menu » AC Motor » Motor RPM.	Set: No motor encoder movement detected. Clear: Either <i>Reset Controller</i> , or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Stall Detected fault is cleared and the Encoder LOS fault (flash code 9-3) is set, allowing limited motor control.	<i>ShutdownEMBrake</i> <i>ShutdownMotor</i> Control Mode changed to LOS (Limited Operating Strategy). <u>Dual Drive</u> This Motor: <i>SevereDual</i> <i>ShutdownMotor</i> Other Motor: <i>SevereDual</i> <i>LOSDual</i> <i>TrimDisable</i>
7-7 0x77 Display: C77	Supervision <i>Supervision</i> 0x2840 Fault Type(s): 1-4 = Primary Init Error 10 = Primary Task Queue Check 12 = Primary ALU Check 13 = Primary Message Watchdog 100-103 = Supervisor Init Error 104-108 = Supervisor Write Error 109 = Supervisor Task Queue Check 110 = Supervisor ALU Check 111 = Supervisor Message Watchdog 113-118 = Supervisor Firmware Update Failure 119 = Supervisor CRC Check	Internal controller fault.	Set: Internal controller failure. Clear: <i>Reset Controller</i> .	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
7-9 0x79 Display: C79	Supervision Input Check <i>Supervision_Input_Check</i> 0x2841 Fault Type(s): 1	Internal controller fault.	<i>Set:</i> Damaged Controller. <i>Clear:</i> Reset Controller.	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors
8-2 0x82 Display: C82	PDO Mapping Error <i>PDO_Mapping_Error</i> 0x2542 Fault Type(s): 1	1. The PDO Map has too many data bytes assigned or has objects mapped that are not compatible. 2. Adjust PDO Settings. See Programmer » Application Setup » CAN Interface » PDO Setups.	<i>Set:</i> Incorrect PDO map detected. <i>Clear:</i> Reset Controller.	PDO message disabled. <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
8-3 0x83 Display: C83	Internal Hardware <i>Internal_Hardware</i> 0x2835 Fault Type(s): Curtis hardware code.	Internal controller fault detected.	<i>Set:</i> Internal controller fault detected. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
8-4 0x84 Display: C84	Motor Braking Impaired <i>Motor_Braking_Impaired</i> 0x211A Fault Type(s): 1	Motor braking was impaired beyond a safe threshold. 1. Battery overcharged. 2. Excessive motor or controller heating. 3. Misadjusted parameters.	<i>Set:</i> OverallCutback (0x32D9) fell below <i>Motor_Braking_Impaired_Threshold</i> for <i>Motor_Braking_Impaired_Time</i> during regen (braking). <i>Clear:</i> Reset interlock.	<u>ShutdownInterlock:</u> <u>Dual Drive</u> This Motor: <i>ShutdownMotor</i> <i>SevereDual</i> Other Motor: <i>TrimDisable</i> <i>SevereDual</i> <i>LOSDual</i>

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
8-7 0x87 Display: C87	Motor Characterization Error <i>Motor_Characterization</i> 0x2850	Motor characterization failed during characterization process. The fault type indicates the cause.	<i>Set:</i> Motor characterization failed during the motor characterization process. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
		Type 84: During commissioning, if the Type 84 fault occurs, check that the Sin/Cos signal voltages at their maximums and minimums have differences less than 78 mV. (i.e., that $ \text{Sinmax} \Delta \text{Cosmax} < 78 \text{ mV}$ and the $ \text{Sinmin} \Delta \text{Cosmin} < 78 \text{ mV}$). If the differences are greater than 78 mV (e.g., 100 mV), it will trigger the Type 84 fault and abort the motor characterization routine.		
		Types are also listed in Chapter 6, Table 6-2.		
	Fault Type(s): 71 Failure to determine encoder pulses. Must be set manually. 72 Temp sensor fault. 73 Motor hot. 74 Controller temperature cutback. 76 Undervoltage cutback. 77 Overvoltage cutback. 78 Encoder not reading properly. 79 Current Regulator Tuning out of range. 80 Current Regulator Tuning out of range. 81 Encoder signal seen but step size not auto-detected, it must be set manually. 82 Aborted commissioning. 83 Sensor signal too noisy for characterization. 84 Motor not rotating, Sin/Cos sensor voltages out of spec, or Multiturn Sensor setting incorrect. 85 Sensor signal too noisy for characterization. 86 Sin/Cos sensor missing or sensor voltage out of range. 87 PMAC Motor Type must be set before commissioning. 88 PMAC motor fell to zero speed, check your system for excessive friction or loading, retry with a higher test speed, or consult Curtis. 91 PMAC motor not rotating or motor type incorrect. 92 PMAC motor not accelerating. Low acceleration. 93 Started motor characterization while motor was spinning. 94-98 PMAC lag compensation out of range. 99 PMAC motor not accelerating. Low acceleration. 102 PMAC motor temp sensor. 103 PMAC motor temp hot cutback. 104 PMAC controller temp cutback. 106 PMAC undervoltage cutback. 107 PMAC overvoltage cutback. 108 Commissioning stopped by user. 500 The Hall patterns do not match the pattern table during refining process. 501 Hall patterns and angles are not consistent during rebuilding of sectors in reverse direction. 502 The rebuilt angle in reverse direction does not align to the calibrated angle. 503 Hall patterns and angles are not consistent during rebuilding of sectors in forward direction. 504 The rebuilt angle in forward direction does not align to the calibrated angle. 504 The controller does not get enough Hall switch pulses. 505 The Hall switch patterns are not consistent. 506 Invalid patterns are detected.			

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
8-8 0x88 Display: C88	Encoder Pulse Error <i>Encoder_Pulse_Error</i> 0x2234 Fault Type(s): 1	1. Encoder Steps parameter does not match the actual motor encoder. 2. Verify parameter settings: AC Motor Setup » Quadrature Encoder » Encoder Steps.	<i>Set:</i> Detected wrong setting of the Encoder Steps parameter. <i>Clear:</i> Ensure the Encoder Steps parameter matches the actual encoder. <i>Reset Controller.</i>	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
8-9 0x89 Display: C89	Parameter Out of Range <i>Parameter_Out_Of_Range</i> 0x2811 Fault Type(s): Reports the CAN Object ID of parameter.	1. Parameter value detected outside of the limits. 2. Use CIT or the 1313 HHP to view the parameter's range and adjust the parameter's value.	<i>Set:</i> Parameter detected outside of limits. <i>Clear:</i> Bring parameter within its limits.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
9-1 0x91 Display: C91	Bad Firmware <i>Bad_Firmware</i> 0x2815 Fault Type(s): 1	The firmware in the controller is incorrect. 1. The CRC of the application or OS does not match. 2. The application was built with an incompatible OS version.	<i>Set:</i> The loaded software is not compatible with the controller hardware. <i>Clear:</i> Load the matching software. Verify that the controller model matches the cdev version for the project and the CIT VCL Studio application.	<u>ShutdownAll:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
9-2 0x92 Display: C92	EM Brake Failed To Set <i>EM_Brake_Failed_to_Set</i> 0x2321 Fault Type(s): 1 = Vehicle movement sensed after the EM Brake has been commanded to set. 2 = Vehicle movement more than EM_Brake_Test_Threshold sensed during EM Brake Test. 3 = Vehicle not reaching 90% of the requested torque target, forward direction. 4 = Vehicle not reaching 90% of the requested torque target, reverse direction.	1. Vehicle movement sensed after the EM Brake has been commanded to set. 2. EM Brake will not hold the motor from rotating.	<i>Set:</i> After the EM Brake was commanded to set and time has elapsed to allow the brake to fully engage, vehicle movement has been sensed. <i>Clear:</i> Cycle KSI	Position Hold is engaged when Interlock = On. <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
9-3 0x93 Display: C93	Encoder LOS <i>Encoder_LOS</i> 0x2233 Fault Type(s): 1	1. Limited Operating Strategy (LOS) control mode has been activated as a result of either an Encoder Fault (flash code 3-6) or a Stall Detected fault (flash code 7-3). 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Vehicle has stalled.	<i>Set:</i> Either the Encoder Fault (flash code 3-6) or Stall Detected (flash code 7-3) was detected. If the parameter LOS Upon Encoder Fault = On and the Interlock has been cycled, then the Encoder LOS (flash code 9-3) control mode is activated, allowing limited motor control (limp home mode). <i>Clear:</i> Cycle KSI or, if LOS Mode was activated by the Stall Detected fault, clear by ensuring the encoder senses the proper operation, Motor RPM = 0, and Throttle Command = 0.	LOS Mode <u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
9-4 0x94 Display: C94	Emer Rev Timeout <i>Emer_Rev_Timeout</i> 0x2330 Fault Type(s): 1	1. Emergency Reverse was activated and concluded because the EMR Timeout timer expired. 2. The emergency reverse input is stuck On.	<i>Set:</i> Emergency Reverse was activated and ran until the EMR Timeout timer expired. <i>Clear:</i> Turn the emergency reverse input (switch) to Off.	<i>ShutdownThrottle</i> <i>ShutdownEMBrake</i> <u>Dual Drive</u> Same, both motors
9-6 0x96 Display: C96	Pump BDI <i>Pump_BDI</i> 0x2450 Fault Type(s): 1	1. The BDI is below the <i>Lift_BDI_Lockout</i> setting. 2. BDI parameters are mistuned.	<i>Set:</i> Pump deactivated when BDI Percentage below Lift lockout setting. <i>Clear:</i> Charge Battery; Cycle KSI.	No Fault Action. Yet, the pump is deactivated. <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
9-9 0x99 Display: C99	Parameter Mismatch <i>Parameter_Mismatch</i> 0x2812	<ol style="list-style-type: none"> 1. A parameter with the [PCF] label was changed. 2. Incorrect position feedback type chosen for motor technology in use. 3. Dual drive is enabled in torque mode. 4. Dual drive enabled on only one controller. <p>Note: There are two conditions that can set that Parameter_Mismatch type 4.</p> <ol style="list-style-type: none"> 1. When in the Torque mode simplified, direct torque mode, servo mode or generator mode then the EM Brake type must be = 0. 2. If have an EM Brake type other than 0 with a PMAC motor and EM Brake Set Upon Fault is set to 0. 	<p>Set: Two or more parameter settings conflict and cannot both be honored.</p> <p>Clear: Adjust parameters to appropriate values and then <i>Reset Controller</i>. Cycle KSI.</p>	<p><u>ShutdownVehicle:</u></p> <p><i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i></p> <p><u>Dual Drive</u> Same, both motors</p>
<p>Fault Type(s):</p> <ol style="list-style-type: none"> 0) Dual Drive is set up incorrectly. Speed Mode or Speed Mode Express must be used, EM Brake Type must be 2, <i>Dual_Drive_Mode_Type</i> must be 1. Dual DC Motor Technology does not support AC dual drive. 4) EM Brake type must be 0 for selected control mode and motor technology. 5) Interlock Brake Control Mode is invalid. 6) PMAC Short Circuit Current if <i>PMAC_Short_Circuit_Current</i> set above <i>Base_Current_Limit</i> in a non-test mode. 7) In a differential steer system, fault actions are misconfigured. 8) Dual motor type must be Differential. 9) PMAC EMF Restriction — In a PMAC application configured for restricted mode operation, the back EMF per speed value is not configured. 10) PMAC Release — A restricted and test mode for PMAC is being used in released software. 11) Torque preload is configured to be saved across key-cycles, but EM Brake preload torque is not set. 12) Invalid Torque Estimate — Configured torque estimation type is incompatible with the selected "Direct Torque" control mode. 13) Command Map Stop — [STEERING] <i>CommandMapLeftStop</i> or <i>CommandMapRightStop</i> equals zero. 14) [STEERING] Improper sequence of the redundant Command Analog map points. 15) Analog Feedback Maps — [STEERING] Primary or Secondary Analog Feedback maps do not have continuous slope. 16) Sawtooth Command — [STEERING] For Sin/Cos or Sawtooth Command device selection, the primary and secondary types do not match. 17) Sawtooth Feedback — [STEERING] For Sin/Cos or Sawtooth Feedback device selection, the primary and secondary types do not match. 18) Feedback Type — [STEERING] Autocenter is declared as Never and the feedback device type is a relative position device type. 19) Interlock braking supervision must be enabled in PMAC if interlock braking is on. 20) The selected motor type has not been fully characterized and should only be used for development. 21) <i>R_sys</i> did not commission properly, contact CCA support. 22) Product Data Code not found in database. 23) Incompatible Motor Technology and Control Mode. 24) Invalid Feedback Type for selected Motor Technology. 25) External supply max current set above hardware limit. 26) Metric off in servo mode. 27) EM brake enabled in servo mode. 28) Travel control supervision not supported in selected control mode. 29) HPD enabled in servo mode. 30) Dual drive enabled in servo mode. 				

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
9-9 0x99 Display: C99	31) Emergency reverse enabled in servo mode. 32) Selected control mode is incompatible with controller model. 33) Selected Feedback Type is incompatible with controller model. 34) Emergency Reverse not supported for Motor Technology. 35) Selected encoder power source is not enabled. 36) Interlock Braking selected in torque mode. 37) There are duplicated patterns in Switch Hall Pattern table. 38) External supply type is not supported. 39) Supervisor or Primary input has not been assigned to the appropriate input. 100) Parameter Integrity.			
9-10 0x9A Display: C9A	Interlock Braking Supervision <i>Interlock_Braking_Supervision</i> 0x2332 Fault Type(s): 1 = MotorSpeed did not ramp down fast enough to meet configuration (set by <i>Interlock_Brake_Supervision_Ramp_Delay</i> and <i>Interlock_Brake_Supervision_Ramp_Rate</i>). 2 = Vehicle brought to stop, but then EM brake (if configured) failed to set. 3 = Vehicle brought to stop, but then traversed a distance beyond that set by <i>Interlock_Brake_Supervision_Position_Setting_Limit</i> .	1. For 1, ramp rate/time set too conservatively (needs to be set for worst case braking (full load) to prevent false trip). 2. The vehicle could have a full battery due to which regen is limited and cannot decelerate fast enough. 3. For 2, check EM Brake for failures/wear.	Set: The interlock brake supervision function, when enabled, monitors the vehicle speed during interlock braking to ensure the vehicle is decelerating and stops within the stopping distance. Clear: Reset Controller.	<i>ShutdownMotor</i> <i>ShutdownEMBrake</i> <i>ShutdownMainContactor</i> <u>Dual Drive</u> Same, both motors
9-11 0x9B Display: C9B	EMR Supervision <i>Emr_Supervision</i> 0x2333 Fault Type(s): 1	1. During an EMR event, the motor speed exceeded the limit set by the Emergency Reverse Supervision parameters. 2. See Programmer » Application Setup » Emergency Reverse » Emergency Reverse Supervision.	Set: During an EMR event, the motor speed exceeded the limit set by the Emergency Reverse Supervision parameters. Clear: Reset Controller.	<i>ShutdownMotor</i> <i>ShutdownEMBrake</i> <i>ShutdownMainContactor</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
10-1 0xA1 Display: CA1	Driver 1 Fault <i>Driver_1_Fault</i> 0x2160 Fault Type(s): 1 = Driver current exceeded hardware limits. 2 = Driver current exceeded configured overcurrent limits. 3 = Driver commanded PWM active, using diagnostic pulses. Voltage measured high, should be low. Typically caused by driver failure, or driver pin short to high. 4 = Driver commanded PWM active, using diagnostic pulses. Voltage measured low, should be high. Either open circuit, or driver pin short to ground. 5 = Driver commanded PWM is 0, and voltage measured low (should be high). Either open circuit, or driver pin short to ground. 6 = Driver current DC offset out of range. 7 = Driver undercurrent - Monitored current is below undercurrent threshold. 8 = Driver following - Driver in current control is not within error bounds. Fault types 1-2 are always checked. Fault types 3-5 are only checked if driver checks are enabled.	1. Open or short on driver load. 2. Dirty connector pins at controller or contactor coil. 3. Bad connector crimps or faulty wiring. 4. Driver overcurrent, as set by the Driver 1 Overcurrent parameter. 5. See Programmer » Controller Setup » Outputs » Driver 1 » Driver 1 Overcurrent.	<i>Set:</i> Driver 1 is either open or shorted, or Driver 1 exceeded its overcurrent setting. <i>Clear:</i> Correct the open or short, and then <i>Reset Controller</i> .	Use the variable <i>System_Action</i> (0x4E00) to determine the fault_action(s). See Fault Actions section and Table 7-2. <u>Dual Drive</u> Same, both motors
10-X 0xAX Display: CAX	Driver X Fault <i>Driver_X_Fault</i> 0x2161 Fault Type(s): See Driver 1 X = 2-7 2 = 0x2161 3 = 0x2162 4 = 0x2163 5 = 0x2164 6 = 0x2165 7 = 0x2166	See Driver 1	See Driver 1	See Driver 1

10-8 0xA8 Display: CA8	Driver Assignment <i>Driver_Assignment</i> 0x2632 Fault Type(s): 5 {X} = Driver number that caused the fault.	1. A Driver Output is used for two or more functions. 2. See Programmer » Controller Setup » IO Assignments » Coil Drivers: Main Contactor Driver, EM Brake Driver, Hydraulic Contactor Driver.	Set: Driver assignment conflict (i.e., duplicate items assigned to the same driver). Clear: Resolve the conflicted driver assignment, then <i>Reset Controller</i> .	<u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
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FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
10-9 0xA9 Display: CA9	Coil Supply <i>Coil_Supply_Fault</i> 0x2169 Fault Type(s): 1 = Short to B- or hardware fault. 2 = One or more drivers that have the drivers checks configured as “Safety Designated” did not shut down when commanded to do so. 3 = Coil Supply startup enable check failed. 4 = Coil Supply startup disable check failed.	1. Short on driver loads. 2. Shorted to B+/KSI/external voltage source at startup or runtime. 3. A driver load may be wired to an external source, not coil supply, being supplied during startup checks. 4. Dirty connector pins at controller or device. 5. Bad connector crimps or faulty wiring. 6. Controller is defective. Note: 1. When using a driver as a switch input (i.e., a switch to KSI/B+), if the Driver input has the switch applied (KSI/B+) at startup/power-on, it will trigger a Type 4 fault. 2. If the driver (as a switch) is connected to an external B+ voltage (within the model's voltage range), such a condition at startup/power-on, it will trigger a Type 4 fault. Either method allows power to feed through the driver pin and the flyback diode back to the coil supply, causing the coil supply startup check to fail. It will also defeat the safety aspect of turning off the Coil Supply in a safety related fault condition.	Set: Short detected after the startup check has passed. A low side driver short is detected and the respective fault action fails to cut off driver current. Coil supply startup test fails. Clear: Reset Controller.	ShutdownAll: <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>ShutdownInterlock</i> <i>ShutdownDriver1</i> <i>ShutdownDriver2</i> <i>ShutdownDriver3</i> <i>ShutdownDriver4</i> <i>ShutdownDriver5</i> <i>ShutdownDriver6</i> <i>ShutdownDriver7</i> <i>ShutdownPD</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <i>ShutdownVehicle</i> <i>RequestTractionStop</i> <i>ShutdownLower</i> <i>ShutdownLift</i> <i>TrimDisable (Dual Drive)</i> <i>SevereDual (Dual Drive)</i> <i>LOSDual (Dual Drive)</i> <u>Dual Drive</u> Same, both motors
11-1 0xB1 Display: CB1	ANALOG 1 OUT OF RANGE <i>Analog_1_Out_Of_Range</i> 0x2620 <i>Analog_X_Out_of_Range</i> Fault Type(s): 1 = Above High limit. 2 = Below Low limit.	1. Analog 1 input voltage is above the parameter setting of Analog 1 High. 2. Analog 1 input voltage is below the parameter setting of Analog 1 Low. 3. See Programmer » Controller Setup » Inputs » Analog 1. 4. See Programmer » Controller Setup » Inputs » Configure » Analog 1 Low / Analog 1 High.	Set: (1) Input voltage (on pin) is above the parameter's set-point threshold. (2) Input voltage (on pin) is below the parameter's set-point threshold. Clear: Return the voltage to within the allowed range, then <i>Reset Controller</i> .	Fault Action: None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
11-2 0xB2 Display: CB2	ANALOG 2 OUT OF RANGE <i>Analog_2_Out_Of_Range</i> 0x2621	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-3 0xB3 Display: CB3	ANALOG 3 OUT OF RANGE <i>Analog_3_Out_Of_Range</i> 0x2622	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-4 0xB4 Display: CB4	ANALOG 4 OUT OF RANGE <i>Analog_4_Out_Of_Range</i> 0x2623	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-5 0xB5 Display: CB5	ANALOG 5 OUT OF RANGE <i>Analog_5_Out_Of_Range</i> 0x2624	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-6 0xB6 Display: CB6	ANALOG 6 OUT OF RANGE <i>Analog_6_Out_Of_Range</i> 0x2625	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
11-7 0xB7 Display: CB7	ANALOG 7 OUT OF RANGE <i>Analog_7_Out_Of_Range</i> 0x2626	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-8 0xB8 Display: CB8	ANALOG 8 OUT OF RANGE <i>Analog_8_Out_Of_Range</i> 0x2627	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-9 0xB9 Display: CB9	ANALOG 9 OUT OF RANGE <i>Analog_9_Out_Of_Range</i> 0x2628	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-11 0xBB Display: CBB	ANALOG 14 OUT OF RANGE <i>Analog_14_Out_Of_Range</i> 0x262A	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-13 0xBD Display: CBD	Analog 18 Out of Range <i>Analog_18_Out_Of_Range</i> 0x262B	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-14 0xBE Display: CBE	Analog 19 Out of Range <i>Analog_19_Out_Of_Range</i> 0x262C	See Analog 1 Out of Range.	See Analog 1 Out of Range.	See Analog 1 Out of Range.
11-12 0xBC Display: CBC	Analog Assignment <i>Analog_Assignment</i> 0x2631 Fault Type(s): 13 {X = 1-9, 14, 18-19, 31} X = Analog Input number that caused the fault.	1. An Analog input is used for two or more functions (for example, throttle and brake). 2. Analog Inputs are misconfigured for a potentiometer (pot). 3. See Programmer » Controller Setup » IO Assignments » Controls.	Set: An Analog input is used for two or more functions or is misconfigured for a potentiometer. Clear: Resolve assignment conflict, and then <i>Reset Controller</i> .	Fault Action: None, unless a fault action is programmed in VCL. Dual Drive Same, both motors
12-1 0xC1 Display: CC1	Branding Error <i>Branding_Error</i> 0x2860 Fault Type(s): 1	1. Software and hardware branding mismatch. 2. For technical support on this fault, contact the Curtis distributor where you obtained your controller or the Curtis sales-support office in your region.	Set: Software/hardware incompatibility. Clear: As applicable: Load Branded software, or use Branded controller with the correct device profile and the correct Curtis Software Suite toolkit key.	ShutdownVehicle: <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> Dual Drive Same, both motors
12-2 0xC2 Display: CC2	BMS Cutback <i>BMS_Cutback</i> 0x2861 Fault Type(s): 1 = Battery Current Cutback. 2 = Low Cell Cutback. 3 = High Cell Cutback.	A cutback based on cell loading has occurred.	Set: See Fault Type. Clear: Resolve battery or battery cell issue.	Fault Action: None, unless a fault action is programmed in VCL. Dual Drive Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
12-5 0xC5 Display: CC5	PWM Input 10 Out of Range <i>PWM_Input_10_Out_Of_Range</i> 0x2629	<ol style="list-style-type: none"> 1. This fault diagnostic execution cycles every 4 ms. The input is considered disconnected if no PWM signal occurs for 16 ms or the measurements are not updated every 16 ms. 2. Mistuned parameters. 3. Faulty wiring. 	<p><i>Set:</i> The input frequency and/or duty cycle on Input 10 exceeds the configured limits set by <i>PWM_Input_10_x_Duty_Cycle</i> and <i>PWM_Input_10_x_Frequency</i>, where x = {Low, High}.</p> <p><i>Clear:</i> Reset controller.</p>	<p><u>Fault Action:</u></p> <p>None, unless a fault action is programmed in VCL.</p> <p><u>Dual Drive</u></p> <p>Same, both motors</p>
	<p>Fault Type(s):</p> <ol style="list-style-type: none"> 1. The input is disconnected. 2. The measured input frequency is below the (<i>PWM_Input_10_Low_Frequency</i>) – (<i>PWM_Input_10_Frequency_Fault_Tolerance</i>). 3. The measured input frequency is above the (<i>PWM_Input_10_High_Frequency</i>) + (<i>PWM_Input_10_Frequency_Fault_Tolerance</i>). 4. The measured duty cycle is below set limits, (<i>PWM_Input_10_Low_Duty_Cycle</i>) – (<i>PWM_Input_10_Duty_Cycle_Fault_Tolerance</i>). 5. The measured duty cycle is above set limits, (<i>PWM_Input_10_High_Duty_Cycle</i>) + (<i>PWM_Input_10_Duty_Cycle_Fault_Tolerance</i>) 			
12-7 0xC7 Display: CC7	Analog 31 Out of Range <i>Analog_31_Out_Of_Range</i> 0x2106	See Analog 1 Out of Range.	See Analog 1 Out of Range.	<p>See Analog 1 Out of Range.</p> <p><u>Dual Drive</u></p> <p>Same, both motors</p>
12-8 0xC8 Display: CC8	Invalid CAN Port <i>Invalid_CAN_Port</i> 0x2107 Fault Type(s): The condition is checked at startup, (i.e. during the dual drive initialization).	<ol style="list-style-type: none"> 1. Mistuned Dual Drive CAN parameters. 2. Conflicting CAN Node IDs for Dual Drive. 	<p><i>Set:</i> This fault is triggered when the Dual CAN Port (<i>DualMotorCanPort</i>) parameter is set to a CAN port that does not exist on a controller setup for Dual Drive.</p> <p><i>Clear:</i> Reset controller.</p>	<p>NO ACTION</p> <p><u>Dual Drive</u></p> <p>Same, both motors</p>
12-9 0xC9 Display: CC9	VCL Watchdog <i>VCL_Watchdog</i> 0x2108	<p>See the associated VCL Functions,</p> <ul style="list-style-type: none"> • <i>Set_Watchdog_Timeout()</i>. • <i>Set_Watchdog_Fault_Action()</i>. • <i>Kick_Watchdog()</i>. <p>The fault actions can be defined by the User/OEM in the application-specific VCL software.</p>	<p><i>Set:</i> The time interval of the VCL watchdog (<i>WD#</i>) exceeded the timeout value.</p> <p><i>Clear:</i> <i>Kick_Watchdog()</i>.</p> <p>Start and reset the specified watchdog timer.</p>	<p>NO ACTION</p> <p><u>Dual Drive</u></p> <p>Same, both motors</p>
12-11 0xCB Display: CCB	Primary State Error <i>Primary_State_Error</i> 0x2113	If the fault persists, contact Curtis.	<p><i>Set:</i> These are internal issues either occurring during startup, parameter initialization, secondary micro update or other runtime issues.</p> <p><i>Clear:</i> Reset controller.</p>	<p>NO_ACTION (controller is not operable)</p> <p><u>Dual Drive</u></p> <p>Same, both motors</p>
	<p>Fault Type(s):</p> <p>0 = PRIMARY_DEVICE_STARTUP 1 = PRIMARY_WAIT_KSI_STABLE 2 = PRIMARY_DEVICE_STARTUP_VALID 3 = PRIMARY_INITIALIZE_PARAMETERS 4 = PRIMARY_WAIT_FOR_FIRST_SIGNALS 5 = PRIMARY_WAIT_FOR_SUPERVISOR 6 = PRIMARY_RESTORE_PARAMETER_FAIL 7 = PRIMARY_SUPERVISOR_FIRST_SIGNALS_ERROR 8 = PRIMARY_SUPERVISOR_STARTUP_ERROR 9 = PRIMARY_STARTUP_TIMER_FAILURE 10 = PRIMARY_WAIT_CAN_HANDSHAKING_DONE 11 = PRIMARY_RUNNING</p>			

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
12-12 0xCC Display: CCC	PWM Input 29 Out of Range <i>PWM_Input_29_Out_of_Range</i> 0x210D	1. This fault diagnostic execution cycles every 4 ms. The input is considered disconnected if no PWM signal occurs for 16 ms or the measurements are not updated every 16 ms. 2. Mistuned parameters. 3. Faulty wiring.	<i>Set:</i> The input frequency and/or duty cycle on Input 29 exceeds the configured limits set by <i>PWM_Input_29_x_Duty_Cycle</i> and <i>PWM_Input_29_x_Frequency</i> , where $x = \{Low, High\}$. <i>Clear:</i> Reset Controller.	<u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
	Fault Type(s): 1 = The input is disconnected. 2 = The measured input frequency is below the $(PWM_Input_29_Low_Frequency) - (PWM_Input_29_Frequency_Fault_Tolerance)$. 3 = The measured input frequency is above the $(PWM_Input_29_High_Frequency) + (PWM_Input_29_Frequency_Fault_Tolerance)$. 4 = The measured duty cycle is below set limits, $(PWM_Input_29_Low_Duty_Cycle) - (PWM_Input_29_Duty_Cycle_Fault_Tolerance)$. 5 = The measured duty cycle is above set limits, $(PWM_Input_29_High_Duty_Cycle) + (PWM_Input_29_Duty_Cycle_Fault_Tolerance)$.			
12-13 0xCD Display: CCD	PWM Input 28 Out of Range <i>PWM_Input_28_Out_of_Range</i> 0x210C	1. This fault diagnostic execution cycles every 4 ms. The input is considered disconnected if no PWM signal occurs for 16 ms or the measurements are not updated every 16 ms. 2. Mistuned parameters. 3. Faulty wiring.	<i>Set:</i> The input frequency and/or duty cycle on Input 28 exceeds the configured limits set by <i>PWM_Input_28_x_Duty_Cycle</i> and <i>PWM_Input_28_x_Frequency</i> , where $x = \{Low, High\}$. <i>Clear:</i> Reset Controller.	<u>Fault Action:</u> None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
	Fault Type(s): 1 = The input is disconnected. 2 = The measured input frequency is below the $(PWM_Input_28_Low_Frequency) - (PWM_Input_28_Frequency_Fault_Tolerance)$. 3 = The measured input frequency is above the $(PWM_Input_28_High_Frequency) + (PWM_Input_28_Frequency_Fault_Tolerance)$. 4 = The measured duty cycle is below set limits, $(PWM_Input_28_Low_Duty_Cycle) - (PWM_Input_28_Duty_Cycle_Fault_Tolerance)$. 5 = The measured duty cycle is above set limits, $(PWM_Input_28_High_Duty_Cycle) + (PWM_Input_28_Duty_Cycle_Fault_Tolerance)$.			
13-1 0xD1 Display: CD1	Lift Input Fault <i>Lift_Input</i> 0x2104 Fault Type(s): 1	The associated fault diagnostic with the assigned lift-input source triggers this fault. For example: If the <i>Lift_Input_Source</i> is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Note: An analog input fault diagnostics may be out of range when set as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot.	<i>Set:</i> Faults from the respective/assigned "Lift_Input_Source" are cascaded and reported. <i>Clear:</i> Resolve any input assignment conflict, or out-of-range faults, then Reset Controller.	<u>ShutdownLift</u> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
13-2 0xD2 Display: CD2	Phase PWM Mismatch <i>Phase_PWM_Mismatch</i> 0x2101 Fault Type(s): 0 = U phase. 1 = V phase. 2 = W phase.	Internal to Controller Motor Phase PWM.	<i>Set:</i> The difference between the commanded phase PWM duty cycle and the measured is greater than allowed. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
13-3 0xD3 Display: CD3	Hardware Compatibility <i>Hardware_Compatibility</i> 0x2870 Fault Type(s): 1	The OS (device profile, .cdev file) is incompatible with the controller. The loaded software (.cdev) is not compatible with the controller hardware.	<i>Set:</i> Incorrect OS (device profile). <i>Clear:</i> Load the matching OS (device profile).	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <i>ShutdownCoilSupply</i> <u>Dual Drive</u> Same, both motors
13-4 0xD4 Display: CD4	Lower Input Fault <i>Lower_Input</i> 0x2105 Fault Type(s): 1	The associated fault diagnostic with the assigned lower-input source triggers this fault. For example: If the <i>Lower_Input_Source</i> is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Note: An analog input fault diagnostics may be out of range when set as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot.	<i>Set:</i> Faults from the respective/assigned " <i>Lower_Input_Source</i> " are cascaded and reported. <i>Clear:</i> Resolve any input assignment conflict, or out-of-range faults, <i>then</i> Reset Controller.	<i>ShutdownLower</i> <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
13-6 0xD6 Display: CD6	Hazardous Movement <i>Hazardous_Movement</i> 0x211C Fault Type(s): 1 = The motor speed is in the opposite direction of the speed request and the motor fails to accelerate in the correct direction for a programmed time. In the event of a change to neutral, this hazard will be detected if the motor fails to accelerate toward zero speed for a programmed time. 2 = The acceleration is in the opposite direction of the difference between the operator speed request and the motor speed. The speed in the commanded direction is greater than the commanded speed by more than a parameter (<i>Hazardous_Speed</i>) for a programmed time (<i>Hazardous_Throttle_Response_Time</i>).	(1) Mistuned <i>Hazardous_Direction_Response_Time</i> parameter. (2) Mistuned <i>Hazardous_Accel</i> parameter. (2) Mistuned <i>Hazardous_Speed_Error</i> parameter. (2) Mistuned <i>Hazardous_Throttle_Response_Time</i> parameter.	Set: This fault detects hazardous movement when the motor is requested to be moving. The first hazard is a motor that is not able to slow down if the throttle goes to zero or the direction switch is not in the direction of travel. The second hazard is a motor that accelerates the wrong way or goes too fast. Note: This fault only occurs when the Control Mode Select is in <i>Speed_Mode</i> , <i>Speed_Mode_Express</i> , or <i>Servo_Mode</i> . Clear: Reset Controller. Setting <i>Hazardous_Direction_Response_Time</i> = 0 will disable these checks.	Shutdown/Interlock <u>Dual Drive</u> Same, both motors
13-8 0xD8 Display: CD8	Estop Mismatch <i>Estop_Mismatch</i> 0x2892 Fault Type(s): 1 1 = Mismatch Detected.	Wiring Error (incorrect inputs). External Switch (moisture).	Set: A mismatch exists between the primary and supervisor micro ESTOP inputs. Clear: Mismatch resolved — wiring corrected. Then, Reset controller.	Fault Action: None, unless a fault action is programmed in VCL. <u>Dual Drive</u> Same, both motors
13-9 0xD9 Display: CD9	Estop SRO <i>Estop_SRO</i> 0x2893 Fault Type(s): 1 1 = Fault Detected.	Interlock on when estop is deactivated.	Set: Interlock was on when ESTOP transitioned from active to inactive. Clear: Interlock Off. Then, Reset controller.	Fault Action: <i>Shutdown/Interlock</i> <i>Shutdown/Pump</i> <i>Shutdown/Lift</i> <i>Shutdown/Lower</i> <u>Dual Drive</u> Same, both motors
13-10 0xDA Display: CDA	Lift Limit <i>Lift_Limit_Fault</i> 0x2127 Fault Type(s): 1	1. The associated fault diagnostic with the assigned lift-limit source triggers this fault. For example: If the <i>Lift_Limit_Source</i> (0x3C3E) is an analog input, then any faults detected by the respective Input fault diagnostics are cascaded and reported within this fault code. Note: An analog input fault diagnostics may be out of range when set as a voltage input or may include potentiometer faults if configured as a 2/3-wire pot.	Set: Faults from the respective/assigned " <i>Lift_Limit_Source</i> " are cascaded and reported. Clear: Resolve any input assignment conflict, or out of range faults, then Reset Controller.	Shutdown/Lift <u>Dual Drive</u> Same, both motors

FLASH CODE	FAULT NAME (Curtis Integrated Toolkit™)	POSSIBLE CAUSES	SET/CLEAR CONDITIONS	FAULT ACTIONS
13-13 0xDD Display: CDD	IMU Failure <i>IMU_Failure</i> 0x2114 Fault Type(s): 1 = SPI Communication Failure. 2 = Curtis Factory Self Test Failure. 3 = Reserved. 4 = Gyro Cal out of range, maximum calibration offset exceeded.	Interlock on when estop is deactivated.	<i>Set:</i> Internally set as per fault type. <i>Clear:</i> Cycle KSI.	NO_ACTION <u>Dual Drive</u> Same, both motors
15-1 0xF1 Display: CF1	MEMORY PARITY <i>MEMORY_PARITY</i> 0x212A Fault Type(s): 1. PSRAM Memory 2. DSRAM1 Memory 3. DSRAM2 Memory 4. USIC0 Memory 5. USIC1 Memory 6. USIC2 Memory 7. MultiCAN Memory 8. PMU Prefetch Memory 9. USB Memory 10. ETH TX Memory 11. ETH RX Memory 12. SDMMC0 Memory 13. SDMMC1 Memory	1. An electromagnetic transient may have caused a bit to change state. 2. Possible damage to the microcontroller may have caused a memory cell to not operate properly.	<i>Set:</i> Fault Type: Indicates in which memory or peripheral the fault occurred. <i>Clear:</i> Reset Controller.	<u>ShutdownVehicle:</u> <i>ShutdownMotor</i> <i>ShutdownMainContactor</i> <i>ShutdownEMBrake</i> <i>ShutdownThrottle</i> <i>FullBrake</i> <i>ShutdownPump</i> <u>Dual Drive</u> Same, both motors