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Diagnostic and Troubleshoot

Hydraulic Pump

Revision: A

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Diagnostics

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

The 1311 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 1311 displays the faults by name.

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 yellow LED identifies the specific fault; one or two flashes by red LED indicate whether first or second code digit will follow.

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 once to indicate that the first digit of the code will follow; the yellow LED then flashes the appropriate number of times for the

first digit. The red LED flashes twice to indicate that the second digit of the code will follow; the yellow LED flashes the appropriate number of times for the second digit.

Example: Battery Undervoltage (code 23).

In the Fault menu of the 1311 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	RED	YELLOW
✳	✳ ✳	✳ ✳	✳ ✳ ✳
(first digit)	(2)	(second digit)	(3)

 With this software package, not all of the codes below will be displayed on the Spyglass. We have only utilized faults that are pertinent to our software package.

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

Code	Programmer Display (Effect or Fault)	Possible Cause	Set/Clear Conditions
12	Controller Overcurrent	1) External short of phase U, V, or W motor connections 2) Motor parameters are mis-tuned 3) Controller defective	**Set:** Phase current exceeded the current measurement limit **Clear:** Cycle KSI
13	Current Sensor Fault	1) Leakage to vehicle frame from phase U, V, or W (short in motor stator) 2) Controller defective	**Set**: Controller current sensors have invalid reading **Clear**: Cycle KSI

14	Precharge Failed	1) External load on capacitor bank (B+ connection terminal) that prevents the capacitor bank from charging 2) See Monitor menu >> Battery: Capacitor Voltage	**Set**: Precharge failed to charge the capacitor bank to KSI voltage **Clear**: Cycle Interlock input or use VCL function *Precharge()*
16	Controller Severe Overtemp *ShutdownMotor;* *ShutdownMainContactor;* *ShutdownEMBrake;* *ShutdownThrottle;* *FullBrake;* *ShutdownPump.*	1. See Monitor menu » Controller: Temperature. 2. Controller is operating in an extreme environment. 3. Excessive load on vehicle. 4. Improper mounting of controller.	*Set:*Heatsink temperature above +95°C. *Clear*: Bring heatsink temperature below +95°C, and cycle interlock or KSI.
17	Severe Undervoltage	1) Battery Menu parameters are misadjusted 2) Non-controller system drain on battery 3) Battery resistance 4) Battery disconnected while driving 5) See Monitor Menu >> Battery: Capacitor voltage 6) Blown B+ fuse or main contactor did not close	**Set:** Capacitor bank voltage dropped below the Severe Undervoltage limit with FET bridge enabled **Clear**: Bring capacitor voltage above Severe Undervoltage limit
18	Severe Overvoltage	1) See Monitor menu >> Battery: Capacitor Voltage 2) Battery menu parameters are misadjusted 3) Battery resistance too high for given regen current 4) Battery disconnected while regen braking	**Set:** Capacitor bank voltage exceeded the Severe Overvoltage limit with FET bridge enabled **Clear**: Bring capacitor voltage below Severe Overvoltage limit and then cycle KSI

22	Controller Overtemp Cutback	1) See Monitor menu >> Controller: Temperature 2) Controller is performance-limited at this temperature 3) Controller is operating in an extreme environment 4) Excessive load on vehicle 5) Improper mounting of controller	**Set**: Heatsink temperature exceeded by 85°C **Clear**: Bring heatsink temperature below 85°C
23	Undervoltage Cutback	1) Normal operation. Fault shows that the batteries need recharging. Controller performance is 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) See Monitor Menu >> Battery: Capacitor voltage 7) Blown B+ fuse or main contactor did not close	**Set**: Capacitor bank voltage dropped below the Undervoltage limit with the FET bridge enabled **Clear**: Bring capacitor voltage below the undervoltage limit

24	Overvoltage cutback	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 Monitor Menu >> Battery: Capacitor voltage	**Set:** Capacitor bank voltage exceeded the Overvoltage limit with the FET bridge enabled **Clear:** Bring capacitor voltage below the Overvoltage limit
25	(+) 5V Supply Failure	1) External load impedance on the +5V supply (pin 26) is too low 2) See Monitor menu >> outputs: 5 Volts and Ext Supply Current	**Set**: +5V supply (pin 26) outside the +5V +/- 10% range **Clear**: Bring voltage within range

28	Motor Temp Hot Cutback	1) Motor temperature is at or above the programmed Temperature Hot setting, and the requested current is being cut back 2) Motor Temperature Control Menu parameters are mis-tuned 3) See Monitor Menu >> Motor: Temperature and >> Inputs: Analog2 4) If the application doesn't use a motor thermistor, Temp Compensation and Temp Cutback should be programmed Off.	**Set**: Motor temperature is at or above the Temperature Hot parameter setting. **Clear**: Bring the motor temperature within range
29	Motor Temp Sensor Fault	1) Motor thermistor is not connected properly 2) If the application doesn't use a motor thermistor. Motor Temp Sensor Enable should be programmed OFF 3) See Monitor Menu >> Motor: Temperature and >> Inputs: Analog2	**Set**: Motor thermistor input (pin 8) is at the voltage rail (0 or 10V) **Clear**: Bring the motor thermistor input voltage within range
31	Coil1 Driver Open/Short	1) Open or short on driver load 2) Dirty connector pins 3) Bad crimps or faulty wiring	**Set:** Driver 1 (pin 6) is either open or shorted. This fault can be set only when Main Enable = OFF **Clear**: Correct open or short and cycle driver

31	Main Open/Short	1) Open or short on driver load 2) Dirty connector pins 3) Bad crimps or faulty wiring	**Set:** Main contactor driver (pin 6) is either open or shorted. This fault can be set only when Main Enable = ON **Clear:** Correct open or short, and cycle driver
36	Encoder Fault	1) Motor encoder failure 2) Bad crimps or faulty wiring 3) See Monitor menu >> Motor: Motor RPM	**Set**: Motor encoder phase failure detected. **Clear**: Cycle KSI
37	Motor Open	1) Motor phase is open 2) Bad crimps or faulty wiring	**Set**: Motor phase U, V or W detected open **Clear**: Cycle KSI
38	Main Contactor Welded	1) Main contactor tips are welded closed 2) Motor phase U or V is disconnected or open 3) An alternative voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal)	**Set**: Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded for a short time and the voltage did not discharge **Clear**: Cycle KSI
39	Main Contactor Did Not Close	1) Main contactor did not close 2) Main contactor tips are oxidized, burned, or not making good contact 3) External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging 4) Blown B+ fuse	**Set:** With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+ **Clear**: Cycle KSI

46	EEPROM Failure	1) Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the programmer, or by loading new software into the controller	**Set**: Controller operating system tried to write to EEPROM memory and failed. **Clear**: Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI
49	Parameter Change Fault	1) This is a safely fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate.	**Set:** Adjustment of a parameter setting that requires cycling of KSI **Clear:** Cycle KSI
54	Acuity Fault	1) No CAN Bus communication. 2) Broken wire in the CAN BUS wiring. 3) Acuity not powered.	**Set**: CAN Bus communication not present. Broken wire within the CAN BUS wiring harness. **Clear:** Check wiring and the fuse. Check the CAN BUS wiring for continuity. Check to make sure that there is power to the Acuity.

55	Acuity Initialization Fault	1) The Acuity did not respond in a timely manner to a request for parameter comparison. 2) CAN communication error.	**Set:** Acuity not communicating on the CAN BUS CAN communication failed **Clear:** Check the Acuity for functionality, replace bad wiring, restore power to the Acuity, make sure that the CAN BUS is isolated from the vehicles ground.
68	VCL Run Time Error	1) VCL code encountered a runtime VCL error 2) See Monitor Menu >> Controller: VCL Error Module and VCL Error. This error can then be compared to the runtime VCL module ID and error code definitions found in the specific OS system information file.	**Set:** Runtime VCL code error condition **Clear**: Edit VCL application software to fix this error condition; flash the new complied software and matching parameter defaults; cycle KSI
69	External Supply Out of Range	1) External load on the 5V and 12V supplies draws either too much or too little current 2) Fault Checking Menu parameters Ext Supply Max and Ext Supply Min are mis-tuned 3) See Monitor Menu >> Options: Ext Supply Current	**Set:** The external supply current (combined current used by the 5V supply [pin 26] and the 12V supply [pin 25]) is either greater than the upper current threshold or lower than the lower current threshold. **Clear:** Bring the external supply current within range

73	Stall Detected *ShutdownEMBrake*; *Control Mode changed to LOS (Limited Operating Strategy).*	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Monitor menu» Motor: Motor RPM.	**Set:** No motor encoder movement detected. *Clear*: Either cycle KSI, or detect valid motor encoder signals while operating in LOS mode and return Throttle Command = 0 and Motor RPM = 0.
93	Encoder LOS (Limited Operating Strategy)	1) Limited Operating Strategy (LOS) control mode has been activated, as a result of either an Encoder Fault (Code 36) or Stall Detect Fault (Code 73) 2) Motor encoder failure 3) Bad crimps or faulty wiring 4) Vehicle is stalled	**Set**: Encoder Fault (Code 36) or Stall Detect Fault (Code 73) was activated, and Brake or Interlock has been applied to activate LOS control mode, allowing limited motor control **Clear:** Cycle KSI, or if LOS mode was activated by the Stall Fault, clear by ensuring encoder senses proper operation, Motor RPM = 0 and Throttle Command = 0