

# SERIES 5000 FAULT CODES

## Package Faults

### Overview

Series 5000 fault codes are assigned to faults related to the package. The following table shows the fault number, fault description, system severity level (SSL), isolation message, and comment for each fault. The troubleshooting procedure for each message follows the table.

Fault No	Fault Description	SSL	Isolation Message	Comment
5000	FUEL SUBSYSTEM	3	Fuel Fault	
5001	NO FUEL DEVICE	3	Fuel Fault	
5002	ENG EEPROM RD	2	Internal Warning	
5003	ENG EEPROM WR	2	Internal Warning	
5004	ENG EEPROM CSUM	7	Internal Fault	
5005	BEARING ASSY	5	Internal Fault	Not Used
5006	ENG ASSY	5	Internal Fault	Not Used
5007	COMBSTR ASSY	5	Internal Fault	Not Used
5008	STATOR ASSY	5	Internal Fault	Not Used
5009	PLD SPD FB	7	Internal Fault	
5010	FRM EEPROM RD	2	Internal Warning	
5011	FRM EEPROM WR	2	Internal Warning	
5012	FRM EEPROM CSUM	7	Internal Fault	
5013	DIS EEPROM CSUM	7	Internal Fault	Not Used
5014	SPV EEPROM CSUM	7	Internal Fault	Not Used
5015	RFC EEPROM CSUM	7	Internal Fault	Not Used
5016	BCT EEPROM CSUM	7	Internal Fault	
5017	ITA EEPROM CSUM	7	Internal Fault	Not Used
5018	STUCK FUEL VLV	3	Fuel Fault	
5019	MULT FUEL DEV	3	Fuel Fault	Not Used
5020	LFC CSUM	7	Internal Fault	
5021	FUEL DEV INIT	3	Fuel Fault	Not Used
5022	NO AIR ASST DEV	3	Fuel Fault	

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

## 5000 Fuel Fault FUEL SUBSYSTEM

Fuel Subsystem is Reporting Fault

System Severity Level 3

<b>NOTE</b>	After troubleshooting the 5000 faults, always reboot system to clear faults.
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This fault appears when the fuel subsystem reports that an error occurred in the device's operation. The fault is reported by any of the three fuel controllers - Smart Proportional Valve (SPV), Rotary Flow Compressor (RFC), or Liquid Fuel Controller (LFC).

Each fuel controller has 32 different faults that it can declare. Every one of these faults is displayed by the DPC as a fault "5000 FUEL SUBSYSTEM". If a 5000 fault occurs, the fuel controller must be asked to report its internal faults. Use the Capstone Remote Monitoring Software (CRMS) to obtain the fuel controller fault code. In the maintenance edition of CRMS Version 4.1x or higher, this can be done by clicking on the 'Display' menu and then choosing 'Intra Device Faults'. This version decodes the fault word for you. Look up the reported fuel device and fault bit(s) in the tables in this section. In earlier versions of CRMS, the same information may be obtained using the command 'ITASTR' in the CRMS command line. Alternatively, this information may be obtained from the Incident Log on the Display Panel.

The syntax for this command is: ITASTR=X

Where, X = 1 For SPV    X = 2 For RFC    X = 3 For Display    X = 5 For LFC    X = 7 For GSPV

The returned data will be formatted as follows:

ITASTR, 0=0x000X, 0xNNNNNNNN

Where, x (lower case) means the number returned is a hexadecimal (base 16) number

X (upper case) is as described above

N stands for each digit of an 8-digit fault word.

This fault word must be converted from hex to binary in order to decode the fuel subsystem faults that are present. Each digit in the fault word is represented below by the letter N, each having its own number that indicates the order in which they appear. Each of these digits is a hex number or letter that can be decoded into a 4-bit binary number. This results in a 32 bit number (8 digits x 4 bits per digit), and each bit represents a different fault.

The following table shows each hexadecimal digit (N) and its corresponding 4-bit binary number (BBBB). For example, N<sub>0</sub>= B<sub>3</sub>B<sub>2</sub>B<sub>1</sub>B<sub>0</sub>.

N <sub>7</sub>	N <sub>6</sub>	N <sub>5</sub>	N <sub>4</sub>	N <sub>3</sub>	N <sub>2</sub>	N <sub>1</sub>	N <sub>0</sub>
B <sub>31</sub> B <sub>30</sub> B <sub>29</sub> B <sub>28</sub>	B <sub>27</sub> B <sub>26</sub> B <sub>25</sub> B <sub>24</sub>	B <sub>23</sub> B <sub>22</sub> B <sub>21</sub> B <sub>20</sub>	B <sub>19</sub> B <sub>18</sub> B <sub>17</sub> B <sub>16</sub>	B <sub>15</sub> B <sub>14</sub> B <sub>13</sub> B <sub>12</sub>	B <sub>11</sub> B <sub>10</sub> B <sub>9</sub> B <sub>8</sub>	B <sub>7</sub> B <sub>6</sub> B <sub>5</sub> B <sub>4</sub>	B <sub>3</sub> B <sub>2</sub> B <sub>1</sub> B <sub>0</sub>

Refer to the following table for a list of all 16 hexadecimal digits (0 to F) and their corresponding 4-bit binary numbers to aid in making the conversion.

Hex	Binary	Hex	Binary	Hex	Binary	Hex	Binary
0	0000	4	0100	8	1000	C	1100
1	0001	5	0101	9	1001	D	1101
2	0010	6	0110	A	1010	E	1110
3	0011	7	0111	B	1011	F	1111

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### Fault/Bit Conversion - Example

If  $N_6 = D$ , then its corresponding binary number  $B_{27}B_{26}B_{25}B_{24} = 1101$ . A '1' in any location means that a fault has been declared. The particular fault can be determined using the following table which lists all 32 bits/faults for each of the three fuel controllers.

**List of Bits/Faults for Fuel Controllers**

Bit #	SPV/GSPV FAULT	RFC/AIR ASSIST FAULT	LFC FAULT (For V4.8x and Higher)	LFC FAULT (For V4.7x and Lower)
31	Communication Timeout	Communication Timeout	Communication Timeout	Communication Timeout
30	Pressure Low Fault	DC fault	Not Used	Not Used
29	Pressure High Fault	Not Used	Not Used	Not Used
28	DC Under Voltage	Pressure Sensor Low	Not Used	Not Used
27	Solenoid Under Voltage	Pressure Sensor High/ Vacuum Switch Fault (FB RFC)	Not Used	Not Used
26	Not Used	Not Used	Not Used	Not Used
25	Proportional Valve Undervoltage	Not Used	Not Used	Not Used
24	Not Used	Not Used	Board Overtemperature	Board Overtemperature
23	LVDT Position Feedback Fault	Not Used	Not Used	Not Used
22	Not Used	Fan Fault	Not Used	Not Used
21	Control Valve Over-temperature	Overtemperature	Drain Solenoid Fault	Drain Solenoid Fault
20	Not Used	Not Used	Fuel Shutoff Solenoid	Fuel Shutoff Valve
19	Combustor Valve #4/ Premix Injector Valve	Combustor Valve #4/ Premix Injector Valve	Start Air Solenoid Fault	Start Air Solenoid
18	Combustor Valve #3/ Pilot Injector #3 Valve	Combustor Valve #3/ Pilot Injector #3 Valve/ Priming Solenoid (Liquid)	Not Used	Not Used
17	Combustor Valve #2/ Pilot Injector #2 Valve	Combustor Valve #2/ Pilot Injector #2 Valve	Fuel Purge Solenoid	Fuel Purge Solenoid
16	Combustor Valve #1/ Pilot Injector #1 Valve Fault	Combustor Valve #1/ Pilot Injector #1 Valve Fault	Not Used	Not Used
15	Not Used	Not Used	Not Used	Not Used
14	Not Used	Not Used	Not Used	Not Used
13	Not Used	Not Used	Not Used	Not Used
12	Not Used	Not Used	Fail Line Fill	Not Used

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

**List of Bits/Faults for Fuel Controllers (Cont'd)**

Bit #	SPV/GSPV FAULT	RFC/AIR ASSIST FAULT	LFC FAULT (For V4.8x and Higher)	LFC FAULT (For V4.7x and Lower)
11	Not Used	Not Used	Drain Tank High Level Sensor	Not Used
10	Not Used	Self Test: Header Error/ Data CRC	Drain Tank Low Level Sensor	Not Used
9	Not Used	Self Test: Phase C Motor Undercurrent	Not Used	Not Used
8	Not Used	Self Test: Phase C Motor Overcurrent	Pressure Transducer Open	Not Used
7	Self Test: Header/ Data CRC	Self Test: Phase B Motor Undercurrent	Pressure Transducer Short	Not Used
6	Self Test: Temp Sensor	Self Test: Phase B Motor Overcurrent	Not Used	Not Used
5	Not Used	Self Test: Phase A Motor Undercurrent	Board Thermocouple Open/Short	Self Test: Board Temperature Sensor
4	Not Used	Self Test: Phase A Motor Overcurrent	Not Used	Not Used
3	Self Test: LVDT Position Feedback	Self Test: A/D Converter Fault	Not Used	Self Test: A/D Converter
2	Self Test: A/D Converter Fault	Self Test: Personality Module - EEPROM Checksum	Not Used	Self Test: ROM Fail
1	Self Test: Personality Module - EEPROM Checksum	Self Test: CPU RAM Fail	Not Used	Not Used
0	Self Test: PIC RAM Fail	Not Used	Not Used	Self Test: RAM Fail

### Fault Decoding Process - Example

The following example illustrates the decoding process for fuel subsystem faults. For this example we assume that the system is running on high pressure natural gas and therefore, has an SPV as the fuel control device.

At the command line type **ITASTR=1**

The response is **ITASTR, 0=0x0001 0x00800008**

The number of interest is 00800008. Converting this number to binary using the conversion table yields the number: 0000 0000 1000 0000 0000 0000 0000 1000

Counting from right to left and starting with bit 0 we see that there is a "1" in the location for bit 3 and bit 23. Referring to the fault conversion table above, this means that the SPV declared a Position Feedback fault in both the self-test mode (bit 3) and normal operation (bit 23). Once the bit numbers are identified, then refer to tables on following pages for detailed analysis of the faults identified by each bit.

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### SPV/GSPV Faults

Bit #	SPV/GSPV FAULT	Analysis	Repair Solution
31	Communication Timeout	Check Intra Harness Connections at DPC and Device	Secure Intra Harness
		Check Intra Harness Cable for Water or Damage	Replace Intra Harness
		Communications circuits on fuel controller must have failed	Replace Fuel Controller
30	Pressure Low Fault	Check Pressure Harness is secure to both transducers	Secure Pressure Harness
		Check Pressure Harness for Water or Damage	Replace Pressure Harness
		Check Pressure Transducer reading Normal	Replace Pressure Transducer
		Pressure sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
29	Pressure High Fault	Check Pressure Harness is secure to both transducers	Secure Pressure Harness
		Check Pressure Harness for Water or Damage	Replace Pressure Harness
		Check Pressure Transducer reading Normal	Replace Pressure Transducer
		Pressure sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
28	DC Under Voltage	Check Intra Harness Connections at DPC and Device	Secure Intra Harness
		Check Intra Harness Cable for Water or Damage	Replace Intra Harness
		Verify 12V on Intra A Power measured during start/ No12V replace DPC Control Board	Replace DPC Control Board (See Work Instr. 513176)
		Voltage sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
27	Solenoid Under Voltage	Check Intra Harness Connections at DPC and Device	Secure Intra Harness
		Check Intra Harness Cable for Water or Damage	Replace Intra Harness
		Verify 12V on Intra A Power measured during start/ No12V replace DPC Control Board	Replace DPC Control Board (See Work Instr. 513176)
		Voltage sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
26	Not Used	Not Used	Not Used

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### SPV/GSPV Faults (Cont'd)

Bit #	SPV/GSPV FAULT	Analysis	Repair Solution
25	Proportional Valve Undervoltage	Check Intra Harness Connections at DPC and Device	Secure Intra Harness
		Check Intra Harness Cable for Water or Damage	Replace Intra Harness
		Verify 12V on Intra B Power measured during start/ If no12V, replace DPC Control Board	Replace DPC Control Board (See Work Instr. 513176)
		Voltage sensing circuitry on fuel controller must have failed	Replace Fuel Controller
24	Not Used	Not Used	Not Used
23	LVDT Position Feedback Fault	Verify connectors from valve body to fuel controller are secure, not wet, and not damaged	Secure LVDT Connections
		LVDT voltage from valve or sensing circuitry on fuel controller must have failed.	Replace Valve/Controller
22	Not Used	Not Used	Not Used
21	Control Valve Overtemperature	Verify that hot fuel is not being delivered to unit	Cool Fuel System
		Ensure thermistor connected on fuel control board	Secure thermistor connection to fuel control board
		Thermistor or sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
		TET is too low. Injector may have failed. Visually check the injector.	Replace Injector (See Work Instr. 440006)
20	Not Used	Not Used	Not Used
19	Combustor Valve #4/ Premix Injector Valve	Inspect Solenoid Harness at fuel controller and premix solenoid for water, damage, and secure connection	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12 Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller
18	Combustor Valve #3/ Pilot Injector #3 Valve	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts is measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### SPV/GSPV Faults (Cont'd)

Bit #	SPV/GSPV FAULT	Analysis	Repair Solution
17	Combustor Valve #2/ Pilot Injector #2 Valve	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller
16	Combustor Valve #1/ Pilot Injector #1 Valve	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller
15	Not used	Not Used	Not Used
14	Not used	Not Used	Not Used
13	Not used	Not Used	Not Used
12	Not used	Not Used	Not Used
11	Not used	Not Used	Not Used
10	Not used	Not Used	Not Used
9	Not used	Not Used	Not Used
8	Not used	Not Used	Not Used
7	Self Test: Header/ Data CRC	Reboot	Cycling power may clear an intermittent fault
		PM may not have been programmed correctly or has become corrupted.	Reprogram Fuel Controller PM
		Memory device circuitry on fuel controller must have failed.	Replace Fuel Controller
6	Self Test: Temp Sensor	Verify that hot fuel is not being delivered to unit	Cool Fuel System
		Ensure thermistor connected on fuel control board	Secure thermistor connection to fuel control board
		Thermistor or sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
5	Not Used	Not Used	Not Used

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### SPV/GSPV Faults (Cont'd)

Bit #	SPV/GSPV FAULT	Analysis	Repair Solution
4	Not Used	Not Used	Not Used
3	Self Test: LVDT Position Feedback	Verify connectors from valve body to fuel controller are secure, not wet, and not damaged	Secure LVDT Connections
		LVDT voltage from valve or sensing circuitry on fuel controller must have failed.	Replace Valve/Controller
2	Self Test: A/D Converter Fault	Analog to Digital converter on fuel controller must have failed.	Replace Fuel Controller
1	Self Test: Personality Module - EEPROM Checksum	Reboot	Cycling power may clear an intermittent fault
		PM may not have been programmed correctly or has become corrupted.	Reprogram Fuel Controller PM
		Memory device circuitry on fuel controller must have failed.	Replace Fuel Controller
0	Self Test: PIC RAM Fail	RAM memory on fuel controller must have failed.	Replace Fuel Controller

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### RFC/Air Assist Faults

Bit #	RFC FAULT	Analysis	Repair Solution
31	Communication Timeout	Check Intra Harness Connections at DPC and Device	Secure Intra Harness
		Check Intra Harness Cable for Water or Damage	Replace Intra Harness
		Communications circuits on fuel controller must have failed	Replace Fuel Controller
30	DC fault	Check fuses in DPC to determine if they are open and require replacing.	Replace Fuses in DPC
		Ensure power connections between DPC and RFC Controllers are secure.	Secure or Replace High Power Cable Connections
		Sensing circuitry on fuel controller must have failed.	Replace Fuel Controller.
29	Not Used	Not Used	Not Used
28	Pressure Sensor Low	Check Pressure Harness is secure to both transducers	Secure Pressure Harness
		Check Pressure Harness for Water or Damage	Replace Pressure Harness
		Check Pressure Transducer reading Normal	Replace Pressure Transducer
		Pressure sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
27	Pressure Sensor High/ Vacuum Switch Fault (FB RFC)	On FB RFC systems, check the inlet fuel supply. Note: Vacuum Switch/Low Pressure fault gets reported as a Pressure High fault.	Open external fuel shut-off/ Verify fuel supply
		Check Pressure Harness is secure to both transducers.	Secure Pressure Harness
		Check Pressure Harness for Water or Damage	Replace Pressure Harness
		Check Pressure Transducer reading Normal/Replace Pressure Transducer.	Replace Pressure Transducer
		Pressure sensing circuitry on fuel controller must have failed.	Replace Fuel Controller
26	Not Used	Not Used	Not Used
25	Not Used	Not Used	Not Used
24	Not Used	Not Used	Not Used
23	Not Used	Not Used	Not Used

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### RFC/Air Assist Faults (Cont'd)

Bit #	RFC FAULT	Analysis	Repair Solution
22	Fan Fault	Check fan connector for water, damage and secure connections at fan and fuel controller.	Secure or Replace Fan Harness
		Check Intra Harness connection for water, damage, and secure at fuel controller and DPC.	Secure or Replace Intra Harness
		Replace DPC control board if 12VDC is not provided on Intra C Pins during start.	Replace DPC Control Board (See Work Instr. 513176)
		Replace fan if 12VDC is applied to fan when started, but fan is not rotating.	Replace Fan
		Drive circuitry on fuel controller must have failed.	Replace Fuel Controller
21	Overtemperature	Gas pressure within specification (not too low)	Check fuel supply temperature
		Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace Motor cable
		Thermistor in pump may have failed.	Replace RFC Pump (See Work Instr. 440017).
		Temperature sensing circuitry on the fuel controller must have failed.	Replace Fuel Controller
		TET is too low. Injector may have failed. Visually check the injector.	Replace Injector (See Work Instr. 440006)
20	Not Used	Not Used	Not Used
19	Combustor Valve #4/ Premix Injector Valve	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller
18	Combustor Valve #3/ Pilot Injector #3 Valve/ Priming Solenoid (Liquid)	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### RFC/Air Assist Faults (Cont'd)

Bit #	RFC FAULT	Analysis	Repair Solution
17	Combustor Valve #2/ Pilot Injector #2 Valve	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller
16	Combustor Valve #1/ Pilot Injector #1 Valve	Inspect Solenoid cable for water, loose connections, or damage	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller
15	Not used	Not Used	Not Used
14	Not used	Not Used	Not Used
13	Not used	Not Used	Not Used
12	Not used	Not Used	Not Used
11	Not used	Not Used	Not Used
10	Self Test: Header Error/ Data CRC	Reboot	Cycling power may clear an intermittent fault
		PM may not have been programmed correctly or has become corrupted.	Reprogram Fuel Controller PM
		Memory device circuitry on fuel controller must have failed.	Replace Fuel Controller
9	Self Test: Phase C Motor Undercurrent	Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace RFC Motor Harness
		Current sensors have failed	Replace RFC Pump (See Work Instr. 440017)
		Sensing circuitry in fuel controller must have failed.	Replace Fuel Controller
8	Self Test: Phase C Motor Overcurrent	Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace RFC Motor Harness
		Current sensors have failed	Replace RFC Pump (See Work Instr. 440017)
		Sensing circuitry in fuel controller has failed.	Replace Fuel Controller

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### RFC/Air Assist Faults (Cont'd)

Bit #	RFC FAULT	Analysis	Repair Solution
7	Self Test: phase B motor undercurrent	Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace RFC Motor Harness
		Current sensors have failed	Replace RFC Pump (See Work Instr. 440017)
		Sensing circuitry in fuel controller must have failed.	Replace Fuel Controller
6	Self Test: Phase B Motor Overcurrent	Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace RFC Motor Harness
		Current sensors have failed	Replace RFC Pump (See Work Instr. 440017)
		Sensing circuitry in fuel controller must have failed.	Replace Fuel Controller
5	Self Test: Phase A Motor Undercurrent	Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace RFC Motor Harness
		Current sensors have failed	Replace RFC Pump (See Work Instr. 440017)
		Sensing circuitry in fuel controller must have failed.	Replace Fuel Controller
4	Self Test: Phase A Motor Overcurrent	Check cable between RFC motor and controller for water, damage, and secure connections.	Secure or Replace RFC Motor Harness
		Current sensors have failed	Replace RFC Pump (See Work Instr. 440017)
		Sensing circuitry in fuel controller must have failed.	Replace Fuel Controller
3	Self Test: A/D Converter Fault	Analog to Digital converter on fuel controller must have failed.	Replace Fuel Controller
2	Self Test: Personality Module - EEPROM Checksum	Reboot	Cycling power may clear an intermittent fault
		PM may not have been programmed correctly or has become corrupted.	Reprogram Fuel Controller PM
		Memory device circuitry on fuel controller must have failed.	Replace Fuel Controller
1	Self Test: CPU RAM Fail	RAM memory on fuel controller must have failed.	Replace Fuel Controller
0	Not Used	Not Used	Not Used

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### LFC Faults - Software Version 4.8x and Higher

Refer to the following table and Fault Code Series 16000 for LFC fault analysis and repair solutions for systems with Software Version 4.8x and higher.

#### LFC Faults - Software Version 4.8x and Higher

Bit #	LFC FAULT	Analysis	Repair Solution
31	Communication Timeout	Refer to Fault Code 16012	Refer to Fault Code 16012
30	Not Used	Not Used	Not Used
29	Not Used	Not Used	Not Used
28	Not Used	Not Used	Not Used
27	Not Used	Not Used	Not Used
26	Not Used	Not Used	Not Used
25	Not Used	Not Used	Not Used
24	Board Overtemperature	Refer to Fault Code 16010	Refer to Fault Code 16010
23	Not Used	Not Used	Not Used
22	Not Used	Not Used	Not Used
21	Drain Solenoid Fault	Refer to Fault Code 16007	Refer to Fault Code 16007
20	Fuel Shutoff Solenoid	Refer to Fault Code 16006	Refer to Fault Code 16006
19	Start Air Solenoid Fault	Refer to Fault Code 16009	Refer to Fault Code 16009
18	Not Used	Not Used	Not Used
17	Fuel Purge Solenoid Fault	Refer to Fault Code 16008	Refer to Fault Code 16008
16	Not Used	Not Used	Not Used
15	Not Used	Not Used	Not Used
14	Not Used	Not Used	Not Used
13	Not Used	Not Used	Not Used
12	Fail Line Fill	Refer to Fault Code 16004	Refer to Fault Code 16004
11	Drain Tank High Level Sensor	Refer to Fault Code 16003	Refer to Fault Code 16003
10	Drain Tank Low Level Sensor	Refer to Fault Code 16002	Refer to Fault Code 16002
9	Not Used	Not Used	Not Used
8	Pressure Transducer Open	Refer to Fault Code 16013	Refer to Fault Code 16013
7	Pressure Transducer Short	Refer to Fault Code 16014	Refer to Fault Code 16014
6	Not Used	Not Used	Not Used
5	Board Thermocouple Open/short	Refer to Fault Code 16011	Refer to Fault Code 16011
4	Not Used	Not Used	Not Used
3	Not Used	Not Used	Not Used
2	Not Used	Not Used	Not Used
1	Not Used	Not Used	Not Used
0	Not Used	Not Used	Not Used

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## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### LFC Faults - Software Version 4.7x and Lower

Refer to the following table for LFC fault analysis and repair solutions for Software Version 4.7x and lower.

#### LFC Faults - Software Version 4.7x and Lower

Bit #	LFC FAULT	Analysis	Repair Solution
31	Communication Timeout	Check Intra Harness Connections at DPC and Device	Secure Intra Harness
		Check Intra Harness Cable for Water or Damage	Replace Intra Harness
		Communications circuits on fuel controller must have failed	Replace Fuel Controller (See Work Instr. 440009)
30	Not Used	Not Used	Not Used
29	Not Used	Not Used	Not Used
28	Not Used	Not Used	Not Used
27	Not Used	Not Used	Not Used
26	Not Used	Not Used	Not Used
25	Not Used	Not Used	Not Used
24	Board Overtemperature	Make sure board is installed in operating environment greater than 80 °C	Provide Adequate Cooling to Fuel System
		Thermistor or sensing circuitry on fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)
23	Not Used	Not Used	Not Used
22	Not Used	Not Used	Not Used
21	Drain Solenoid Fault	Inspect Solenoid Harness at fuel controller and drain solenoid for water, damage, and secure connection	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)
20	Fuel Shutoff Solenoid	Inspect Solenoid Harness at fuel controller and main fuel shutoff solenoid for water, damage, and secure connection	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)

Continued on next pages

#### Observe Safety Precautions - Refer to Safety Instructions for Details

## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### LFC Faults - Software Version 4.7x and Lower (Cont'd)

Bit #	LFC FAULT	Analysis	Repair Solution
19	Start Air Solenoid Fault	Inspect Solenoid Harness at fuel controller and start air solenoid for water, damage, and secure connection	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts are measured in harness during a start sequence.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)
18	Not Used	Not Used	Not Used
17	Fuel Purge Solenoid Fault	Inspect Solenoid Harness at fuel controller and purge solenoid for water, damage, and secure connection	Secure or Replace Solenoid Harness
		Replace solenoid if coil resistance reads open.	Replace Solenoid Block
		Replace solenoid if 12Volts is measured in harness during a shutdown purge event.	Replace Solenoid Block
		Drive circuitry on the fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)
16	Not Used	Not Used	Not Used
15	Not Used	Not Used	Not Used
14	Not Used	Not Used	Not Used
13	Not Used	Not Used	Not Used
12	Not Used	Not Used	Not Used
11	Not Used	Not Used	Not Used
10	Not Used	Not Used	Not Used
9	Not Used	Not Used	Not Used
8	Not Used	Not Used	Not Used
7	Not Used	Not Used	Not Used
6	Not Used	Not Used	Not Used
5	Board Thermocouple Open/Short	Make sure board is installed in operating environment greater than 80°C	Provide Adequate Cooling to Fuel System
		Thermistor or sensing circuitry on fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)
4	Not Used	Not Used	Not Used
3	Self Test: A/D Converter	Analog to Digital converter on fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)

Continued on next page

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5000 Fuel Fault FUEL SUBSYSTEM (Cont'd)

### LFC Faults - Software Version 4.7x and Lower (Cont'd)

Bit #	LFC FAULT	Analysis	Repair Solution
2	EEPROM	Reboot	Cycling power may clear an intermittent fault
		Program may not have been installed correctly or has become corrupted.	Download LFC Code
		Memory device circuitry on fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)
1	Not Used	Not Used	Not Used
0	Self Test: RAM Fail	RAM memory on fuel controller must have failed.	Replace Fuel Controller (See Work Instr. 440009)

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

## 5001 Fuel Fault NO FUEL DEVICE

No Fuel Device Installed

System Severity Level 3

Software declares this fault when a start command is issued and a fuel device has not responded.

<b>NOTE</b>	Use the ITALST command to determine whether or not the fuel device is locked.
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Symptom	Probable Cause	Analysis	Repair Solution
Fuel Device not found	Water in Intra Controller Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry IntraController Harness.
	Loose Intra Controller Harness connection	Check the IntraController Harness connection between the Main Controller and Fuel Controller.	Secure IntraController Harness Connections.
	Device shorting communication	Unplug the display panel and see if problem goes away. Unplug Intra-Controller Harness in Grid Connect mode, if possible, and see if problem goes away.	Replace Device Controller Causing Harness to short.
	Failed Intra Controller Harness	No IntraController device is locked (display, battery when enabled, fuel device, or assist device).	Replace IntraController Harness.
	DPC Control Board	IntraController harness has been replaced and still no IntraController device is locked (display, battery when enabled, fuel device, or assist device).	Replace DPC Control Board (See Work Instr. 513176).
	Bad Data Structure	Device data does not appear on the menu or hardware configuration (HWCNFG) RS232 command.	Program fuel device data structures.
	Fuel Device Controller	Check to see if the heartbeat light in controller is functioning. Even if the heartbeat light is functioning, communication chip may have failed in controller.	Replace Fuel Device Controller.

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5002 Internal Warning ENG EEPROM RD

Engine EEPROM Read

System Severity Level 2

This fault is declared when due to hardware failure the Engine EEPROM may not respond with the value expected within 20 msec.

### Recommended Spare Parts

- Engine Personality Module
- DPC Control Board
- Engine Harness

Symptom	Probable Cause	Analysis	Repair Solution
Unable to read EEPROM data	Water in Engine Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Engine Harness.
	Loose Harness connection	Connections can come loose through handling of device or during component changing.	Secure Engine Harness Connection to Main Controller and Engine Personality Module.
	Data Structures CRC error	Recycling system should cause a 5004 fault to be generated.	Troubleshoot 5004 fault code.
		Data may have been corrupted	Reprogram Engine PM.
	Engine EEPROM device has failed	Device has intermittent problem that causes data errors when reading.	Replace Engine Personality Module. Note: The new PM must be programmed with appropriate P/N and S/N.
	Engine Harness failed	Problem persists even when PM is replaced with programmed module.	Replace Engine Harness.
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace DPC Control Board (See Work Instr. 513176).

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5003 Internal Warning ENG EEPROM WR

Engine EEPROM Write

System Severity Level 2

This fault is declared when the Engine EEPROM is not updated with the desired value within 20 msec.

Symptom	Probable Cause	Analysis	Repair Solution
Unable to write EEPROM data	Water in Engine Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Engine Harness.
	Loose Harness connection	Connections can come loose through handling of device or during component changing.	Secure Engine Harness Connection to Main Controller and Engine Personality Module.
	Data Structures CRC error	Recycling system should cause a 5004 fault to be generated.	Troubleshoot 5004 fault code.
	Engine EEPROM device has failed	Device has intermittent problem that causes data errors when reading.	Replace Engine Personality Module (See Work Instr. 440091). Note: The new PM must be programmed with appropriate P/N and S/N.
	Engine Harness failed	Problem persists even when PM is replaced with programmed module.	Replace Engine Harness.
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace DPC Control Board (See Work Instr. 513176).

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

## 5004 Internal Fault ENG EEPROM CSUM

Engine EEPROM Checksum

System Severity Level 7

A fault is declared when the checksum calculation used to verify the data stored in the Engine EEPROM personality module is not correct.

### Recommended Spare Parts

- Engine Personality Module
- DPC Control Board
- Engine Harness

Symptom	Probable Cause	Analysis	Repair Solution
CRC of engine data structures can not be verified.	Water in Engine Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Engine Harness.
	Loose Harness connection	Connections can come loose through handling of device or during component changing.	Secure Engine Harness connection to Main Controller and Engine Personality Module.
	Data has become corrupted	Data structures may have become corrupted during operation.	Reprogram Engine EEPROM data structures.
	Engine EEPROM device has failed	Device has intermittent problem that causes data errors when reading. Problem persists even when PM is reprogrammed.	Replace Engine Personality Module (See Work Instr. 440091). Note: The new PM must be programmed with appropriate P/N and S/N.
	Engine Harness failed	Problem persists even when PM is replaced with programmed module.	Replace Engine Harness. Replace DPC Control Board (See Work Instr. 513176).
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace DPC Control Board (See Work Instr. 513176).

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5009 Internal Fault PLD SPD FB

Programmable Logic Device Speed Feedback Error

System Severity Level 7

The hardware provides for a speed check circuit that determines if the engine is operating in an overspeed or underspeed condition. The overspeed check is always enabled in the hardware. The software enables the underspeed check once the engine reaches the no-load run condition. The underspeed check is disabled by the software once the system enters the cooldown state. Software reports the PLD Speed Feedback fault when the above conditions are not met.

Symptom	Probable Cause	Analysis	Repair Solution
Report from hardware that speed sensing is out of range	Engine Under Speed	Fault can be triggered if an excessive engine underspeed condition has occurred. Troubleshoot underspeed fault if detected.	Troubleshoot Engine Under Speed Fault (6008).
	Engine Over Speed	Fault can be triggered if an excessive engine overspeed condition has occurred. Troubleshoot overspeed fault if detected.	Troubleshoot Engine Over Speed Fault (6007).
	Grounding problem	Noise on this feedback signal can be generated due to inadequate grounding.	Ground system according to installation guidelines.
	Generator harness connections	Speed is measured from the generator voltage. Loose connections to the generator can cause intermittent signals.	Tighten Generator terminal block connections.
	Speed sensing circuitry	Speed sensing circuitry in the Controller has failed.	Contact Capstone Technical Support.

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

## 5010 Internal Warning FRM EEPROM RD

Frame EEPROM Read

System Severity Level 2

This fault is declared when due to hardware failure, the Frame EEPROM does not respond with the value expected within 20 msec.

### Recommended Spare Parts

- Frame Personality Module
- DPC Control Board
- Engine Harness

Symptom	Probable Cause	Analysis	Repair Solution
Unable to read EEPROM data	Water in Engine Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Engine Harness.
	Loose Harness connection	Connections can come loose through handling of device or during component changing.	Secure Engine Harness Connection to Main Controller and Frame Personality Module.
	Data Structures CRC error	Recycling system should cause a 5012 fault to be generated.	Troubleshoot 5012 fault code.
		Data has been corrupted.	Reprogram Frame PM.
	Frame EEPROM device has failed	Device has intermittent problem that causes data errors when reading.	Replace Frame Personality Module (See Work Instr. 440092). Note: The new PM must be programmed with appropriate P/N and S/N.
	Engine Harness failed	Problem persists even when PM is replaced with programmed module.	Replace Engine Harness.
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace DPC Control Board (See Work Instr. 513176).

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5011 Internal Warning FRM EEPROM WR

Frame EEPROM Write

System Severity Level 2

This fault is declared when the Frame EEPROM is not updated with the desired value within 20 msec.

Symptom	Probable Cause	Analysis	Repair Solution
Unable to write EEPROM data	Water in Engine Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Engine Harness.
	Loose Harness connection	Connections can come loose through handling of device or during component changing.	Secure Engine Harness connection to Main Controller and Frame Personality Module.
	Data Structures CRC error	Recycling system should cause a 5012 fault to be generated.	Troubleshoot 5012 fault code.
	Frame EEPROM device has failed	Device has intermittent problem that causes data errors when reading.	Replace Frame Personality Module (See Work Instr. 440092). Note: The new PM must be programmed with appropriate P/N and S/N.
	Engine Harness failed	Problem persists even when PM is replaced with programmed module.	Replace Engine Harness.
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace DPC Control Board (See Work Instr. 513176).

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

## 5012 Internal Fault FRM EEPROM CSUM

Frame EEPROM Checksum

System Severity Level 7

A fault is declared when the checksum calculation used to verify the data stored in the Frame EEPROM personality module is not correct within 20 msec.

### Recommended Spare Parts

- Frame Personality Module
- Engine Personality Module
- DPC Control Board
- Engine Harness

Symptom	Probable Cause	Analysis	Repair Solution
CRC of Frame Data Structures Can Not Be Verified.	Water in Engine Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Engine Harness.
	Loose Harness connection	Connections can come loose through handling of device or during component changing.	Secure Engine Harness connection to Main Controller and Frame Personality Module.
	Data has become corrupted	Data structures may have become corrupted during operation.	Reprogram Frame EEPROM data structures.
	Frame EEPROM device has failed	Device has intermittent problem that causes data errors when reading. Problem persists even when the PM is reprogrammed.	Replace Frame Personality Module (See Work Instr. 440092). Note: The new PM must be programmed with appropriate P/N and S/N.
	Engine Harness failed	Problem persists even when the PM is replaced with programmed module.	Replace Engine Harness. Replace DPC Control Board (See Work Instr. 513176).
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace DPC Control Board (See Work Instr. 513176).

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5016 Internal Fault BCT EEPROM CSUM

Battery Controller Transient EEPROM Checksum

System Severity Level 7

A fault is declared when the checksum calculation used to verify the data stored in the BCT EEPROM personality module is not correct.

Symptom	Probable Cause	Analysis	Repair Solution
Error reading data from Battery Pack PM	Water in Battery PM Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the communication bus wires.	Dry Battery PM Harness.
	Loose PM Harness connection	Connections can come loose through handling of device or during component changing.	Secure Battery PM harness connection to Battery Controller and Battery Pack Personality Module.
	Data has become corrupted	Data structures may have become corrupted during operation.	Reprogram Battery Pack EEPROM data structures.
	Battery EEPROM device has failed	Device has intermittent problem that causes data errors when reading.	Replace Battery Personality Module. Note: The new PM must be programmed with appropriate P/N and S/N.
	Battery PM harness failed	Problem persists even when PM is replaced with programmed module.	Replace Battery PM harness
	Communication Driver Chip	If multiple EEPROM faults are reported in system, then the problem must reside in the communication driver.	Replace BCT Control Board (See Work Instr. 513175).
Error reading data from Battery Power Board PM	Ribbon cable not connected	Ribbon cable between BCT Control Board and Power board is not secure.	Secure Ribbon Cable connections.
	Ribbon cable damaged	A loose wire at cable connector or in wire is creating an open or short circuit.	Replace Ribbon Cable.
	Data has become corrupted	Some data structure in the device is unable to have its CRC verified correctly.	Program DPC Power Board EEPROM structures.
	DPC Power Board EEPROM device has failed	Structures can be downloaded over the communication link successfully, but fail when executing burn command.	Replace BCT.

**Observe Safety Precautions - Refer to Safety Instructions for Details**

## 5018 Internal Fault STUCK FUEL VLV

Stuck Fuel Valve

System Severity Level 3

The software performs a test during the prepare-to-start sequence to determine if the valve has failed in the open position. It commands “open” the shutoff solenoid and records the inlet pressure (Fuel Inlet PHP). It also commands “open” pilot solenoids, and if the difference of (Fuel Inlet PHP - Present Value) is greater than 17 psig, a stuck fuel valve fault is reported.

Symptom	Probable Cause	Analysis	Repair Solution
Valve does not maintain a Delta-P across the valve during leak check at start.	Fuel supply	Logic uses pressure readings to verify valve is not stuck open. Delta-P reading is not accurately measured when no fuel is supplied.	Verify proper fuel pressure is applied to the valve.
	Water in Transducer Harness	In humid environments temperatures near the MicroTurbine can reach the dew point. Water in the back of the connector will short the signal wires.	Dry Pressure Harness.
	Loose Transducer connections	Connections can come loose through handling of device or during component changing.	Secure Pressure Harness at Inlet and Exit Transducer and at Fuel Controller.
	Debris in valve	Valve can have debris that causes it to become temporarily stuck open.	Lightly tap valve body and attempt restart.
	Fuel Control Valve Stuck Open	Fault is continuously reported after several start attempts.	Replace Fuel Control Valve.
	Inlet Pressure Transducer reading	Situation persists and inlet pressure is never measured during the start sequence.	Replace Inlet Pressure Transducer.
	Closed Fuel shutoff valve	Inlet pressure is still not read during start sequence after inlet transducer is replaced.	Replace Fuel Shutoff Valve (See Work Instr. 440003).
	Exit Pressure Transducer reading	Situation persists and exit pressure never goes to zero during start sequence.	Replace Exit Pressure Transducer.
	Pressure Transducer Harness	After replacing pressure transducers, pressure readings still do not provide correct readings during start.	Replace pressure transducer harness.

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

## 5020 Internal Fault LFC CSUM

Liquid Fuel Controller Checksum

System Severity Level 7

<b>NOTE</b>	This fault is not currently detected by the system. Data structure is not required in Liquid Fuel Controller.
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## 5022 Internal Fault NO AIR ASST DEV

No Air Assist Device

System Severity Level 3

This fault applies to liquid fuel systems. The fault is reported during start-up and indicates that no Air Assist device (RFC) is present.

Symptom	Probable Cause	Analysis	Repair Solution
No Air Assist device is present during start-up	Intra-Harness/RFC Controller	Check to see that the Intra harness is plugged into RFC Controller.	Plug Intra harness to RFC Controller.
	RFC Controller connections	Check RFC Controller wiring connections.	Tighten wiring connections.
	RFC controller	RFC Controller may be faulty.	Replace RFC Controller (See Work Instr. 440018).

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**

# NOTES

**Observe Safety Precautions - Refer to *Safety Instructions* for Details**