Systems Operation
Digital Voltage Regulator
Media Number -SENR5833-07 **Publication Date -01/02/2009** **Date Updated -11/02/2009**

i03470025

Fault Codes

SMCS - 4467

Table 1

Active Shutdown Faults (Parameter :92)		
Fault Code	**Description**	**Classification (1)**
0000	No Fault Present	-
701	Undervoltage	Resettable Shutdown Fault
702	Overvoltage	Resettable Shutdown Fault
703	Overexcitation	Resettable Shutdown Fault
704	Reverse VAR (2)	Resettable Shutdown Fault
705	Reverse Power	Resettable Shutdown Fault
801	Instantaneous Trip	Non-Resettable Shutdown Fault
802	Loss Of Sensing	Non-Resettable Shutdown Fault
803	Loss Of Frequency	Non-Resettable Shutdown Fault

(1) Resettable shutdown faults are reset by selecting parameter :96 (shutdown fault reset) on the display and pressing the function key or with the fault reset switch (external attachment) or through J1 connector. Non-resettable shutdown faults are reset by powering down the digital voltage regulator (removing 24 VDC).

(2) The digital voltage regulator looks for 0.4 and greater leading power factor for shutdown.

Table 2

Alarm Faults (Parameter :95)		

Fault Code	Description	Classification (1)
0000	No Fault Present	-
601	Internal Memory Failure	Alarm Fault
602	Internal Watchdog Failure	Alarm Fault
603	Rotating Diode Fault	Alarm Fault
604	Reverse VAR (2) (3)	Alarm Fault

(1) Alarm faults are cleared by selecting parameter :94 (fault clear) on the display and pressing the function key.

(2) The digital voltage regulator looks for 0.4 and greater leading power factor for shutdown.

(3) Available only on part numbers 155-xxxx and newer.

Each fault is assigned a unique three digit code that is called the fault code. Fault codes are the values of parameter :92. Parameter :92 shows the latest fault.

Note: An additional fault (fault code 901) exists. Fault code 901 indicates a significant failure of the internal memory that stores current parameter data. This fault can only occur at power-up and when making changes to configurable parameter values. This is a shutdown fault, and the digital voltage regulator will prohibit power generation. Fault code 901 is classified as a severe fault. This fault code can not be reset. Therefore, the digital voltage regulator must be replaced.

Note: Parameter :95 only appears on the earlier digital voltage regulator. Parameter :95 shows an alarm fault. See System Operation, "Parameters" in order to determine the serial number break.

A fault is a condition that does not conform (an abnormal condition) to the rules (program) by which the digital voltage regulator operates. Some examples of a fault are listed below.

Undervoltage - Generator voltage is less than specified for too long a time.

Overexcitation - The measured field current is too high for too long a time.

When a fault occurs, the digital voltage regulator automatically flashes the corresponding fault code on the display and takes the necessary preventive action. For shutdown faults, the digital voltage regulator disables the output to the exciter. While a fault is present, the fault code information shown on the display will be flashing. If a shutdown fault occurs, the shutdown fault MUST BE RESET in order for the digital voltage regulator to begin operation again. The method to reset a shutdown fault depends upon the classification of the fault. When a fault code is reset, the display will stop flashing. The digital voltage regulator will begin generator output regulation again, according to generator/engine speed and the mode selected. For more information, see System Operation, "Fault Classifications".

Fault code 601 - Internal Memory Failure. This fault is an alarm fault. The EEPROM failed during a read action.

Note: Reset the fault. Clear the fault. If the alarm reoccurs, check all parameter values between 1 and 38 by using the function keys on the face of the digital voltage regulator or remote communications. This refreshes the programmed values and should eliminate the alarm condition. If the alarm persists, verify

that proper grounding, shielding, and electromagnetic noise reduction practices have been followed in the installation before replacing the digital voltage regulator.

Fault code 602 - **Internal Watchdog Failure.** This fault is an alarm fault. A microprocessor watchdog is intended to detect when the microprocessor gets "lost" and to restart the microprocessor again. The watchdog alarm indicates that the digital voltage regulator just came out of a watchdog-induced microprocessor restart.

Note: A possible cause is electro magnetic interference (EMI). It may be necessary to provide shielded cable, grounded on one end, for all potentiometers. Another possible cause is the battery voltage being too low (less than 18 VDC). See watchdog alarm, fault code 602. Refer to Testing And Adjusting, "Watchdog Alarm - Troubleshoot".

Fault code 603 - **Rotating Diode.** Check the diodes as per the generator service manual. This fault is a resettable shutdown fault. The digital voltage regulator detects that the variation (ripple) of exciter field current exceeds the diode monitor trip point (parameter :19) for a period of five seconds. A large variation in the exciter field current will occur if a rotating diode fails, shorted or open. This may also occur with good diodes under varying loads if the diode monitor trip point is set too low (too sensitive).

Note: For troubleshooting purposes it is useful to know that this alarm fault is often followed by an overexcitation shutdown fault. If an overexcitation shutdown fault (fault code 703) is found in parameter :92, check parameter :93 (or the alarm parameter :95 if it exists) for the presence of the rotating diode monitor alarm code.

Fault code 604 - **Reverse VAR (only available on 155-xxxx and later regulators).** This fault is an alarm fault. The fault code 604 will occur when the digital voltage regulator detects 0.4 Per Unit or greater leading reactive power for a time greater than the value entered in reverse VAR trip time (parameter :20). This fault is only active if parameter :21 is set to 1, which means that reverse VAR fault selection is set to an alarm. The fault code 604 will not be active if parameter :22 is set to 1, which means that droop/CCC select is set to CCC.

Note: A current measuring CT must be present for this feature to operate. Possible causes for erroneous 604 codes are incorrect CT/PT polarity or large circulating currents due to incorrect voltage droop adjustment. See Testing And Adjusting, "Reverse VAR Shutdowns - Troubleshoot".

Fault code 701 - **Undervoltage.** This fault is a resettable shutdown fault. The digital voltage regulator detected that the generator voltage has been less than the undervoltage trip point (parameter :13) for the amount of time specified by the undervoltage trip time (parameter :14). This fault is disabled when the excitation disable switch at terminal 42 has been enabled and when the digital voltage regulator is in the startup profile. Refer to System Operation, "Customer Options". See also System Operation, "Startup Profile Function".

Note: This fault may be caused by a decline in utility voltage or incorrect parameter settings. Check parameters :01, :02, :06, :13, and :30. This fault also may be caused by the remote voltage adjust potentiometer setting being too low.

Fault code 702 - **Overvoltage.** This fault is a resettable shutdown fault. The digital voltage regulator detected that the generator voltage has been greater than the overvoltage trip point (parameter :11) for the amount of time specified by the overvoltage trip time (parameter :12).

Note: This fault may be caused by an increasing utility voltage or incorrect parameter settings. Check parameters :01, :02, :09, :11, and :15. This fault may also be caused by the remote voltage adjust potentiometer setting being too high.

Fault code 703 - Overexcitation. This fault is a resettable shutdown fault. The digital voltage regulator has measured that the exciter field current has been at a high current level for too long a time. If field current is not removed, high current may cause permanent overheating damage to the regulator, generator, or wiring. When exciter field current is greater than 12 amps, the digital voltage regulator will shut off the exciter field current and declare a fault after a timeout determined by the excitation current level.

This shutdown will occur between 14 and 120 seconds after the detection of a sustained overcurrent in the field circuit, depending on the level of overexcitation.

Note: Possible causes are the loss of all three phases of sensing, failed diodes, short in exciter stator or rotor, short in the main rotor, or a downstream line/load fault.

Fault code 704 - Reverse VAR. This fault is a resettable shutdown fault. A Reverse VAR fault code will occur when the digital voltage regulator detects 0.4 Per Unit or greater leading reactive power for greater than 0.5 seconds. For regulator part numbers of 155-xxxx and newer, 0.4 Per Unit or greater leading reactive power must be detected for a time longer that the reverse VAR trip time (parameter :20) to activate this fault. This fault will shutdown the digital voltage regulator and remove excitation to the field. The fault output driver can be used to activate the shunt trip of the generator circuit breaker to remove the generator set from the system to provide protection against a sustained reverse VAR condition. For regulators with part number 155-xxxx and newer, this fault is only active if parameter :21 is set to 2 (reverse VAR fault selection is set to shutdown) and will not be active if parameter :22 is set to 1 (droop/CCC select is set to CCC).

Note: A current measuring CT must be present for this feature to operate. Possible causes for erroneous 704 codes are incorrect CT/PT polarity or large circulating currents due to incorrect voltage droop adjustment. See Testing And Adjusting, "Reverse VAR Shutdowns - Troubleshoot".

Fault code 705 - Reverse Power. This fault is a resettable shutdown fault. The digital voltage regulator detected that the generator real power output has been greater than the reverse power trip point (parameter :34) for the amount of time specified by the reverse power trip time (parameter :35). This fault only considers the real portion of the generator output. This shutdown fault is active only when the auxiliary contact (terminal 41) is closed in order to enable the PF/KVAR operating mode. There is an exception. On regulators with part number 155-xxxx and newer it is active in voltage regulation/droop and PF/KVAR operating modes but not active in cross current compensation mode (parameter :22 set to 1).

Note: Possible causes for erroneous 705 codes are incorrect CT/PT polarity, the engine/generator set shed (removed) load but the breaker did not shunt trip, or parameter :35 (reverse power trip time) was set too low for the loading scheme.

Fault code 801 - Instantaneous Trip. This fault is a non-resettable shutdown fault. The digital voltage regulator detects that the exciter field current is greater than approximately 28 amps. If this occurs, the digital voltage regulator instantaneously shuts off the exciter field current.

Note: Possible cause is a short in the exciter stator. This fault code can also be generated due to high

levels of electromagnetic noise. The noise can be present on the wires or in the cabinet were the regulator is mounted. See Testing And Adjusting, "Instantaneous Trip Shutdown - Troubleshoot".

Fault code 802 - Loss Of Sensing. This fault is a non-resettable shutdown fault. The digital voltage regulator detects that one of the sense inputs (terminals 20, 22, 24) has been open (disconnected) or shorted to another input.

Note: Possible causes are blown customer fuse or faulty wiring. A severe load imbalance may also cause this fault to occur. If the digital voltage regulator sees a 20% voltage unbalance between phases for 750 ms or longer, it will generate the loss of sensing shutdown fault.

Fault code 803 - Loss Of Frequency. This fault is a non-resettable shutdown fault. The digital voltage regulator detects that there is no AC frequency present for 200 msec while the measured voltage is greater than 50% of nominal. The frequency is measured from the PM inputs, NOT from the sensing inputs.

Note: Another possible cause is electro magnetic interference (EMI). It is necessary to provide shielded cable, grounded on one end, for all customer optional wiring. This fault may also be caused by a microprocessor restart after the digital voltage regulator has obtained rated voltage. See Testing And Adjusting, "Loss of Frequency Shutdown - Troubleshoot".

Fault code 901 - Digital Voltage Regulator Memory Failure. This fault is a severe fault. The EEPROM device, within the digital voltage regulator, failed the power-up test and the digital voltage regulator will no longer function properly. The EEPROM stores the parameter values of all the program parameters. This fault can also occur after writing (storing) a new parameter value if the EEPROM device has just failed.

Note: The EEPROM will no longer accept new values. This means that the EEPROM is inoperable and the digital voltage regulator must be replaced.

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