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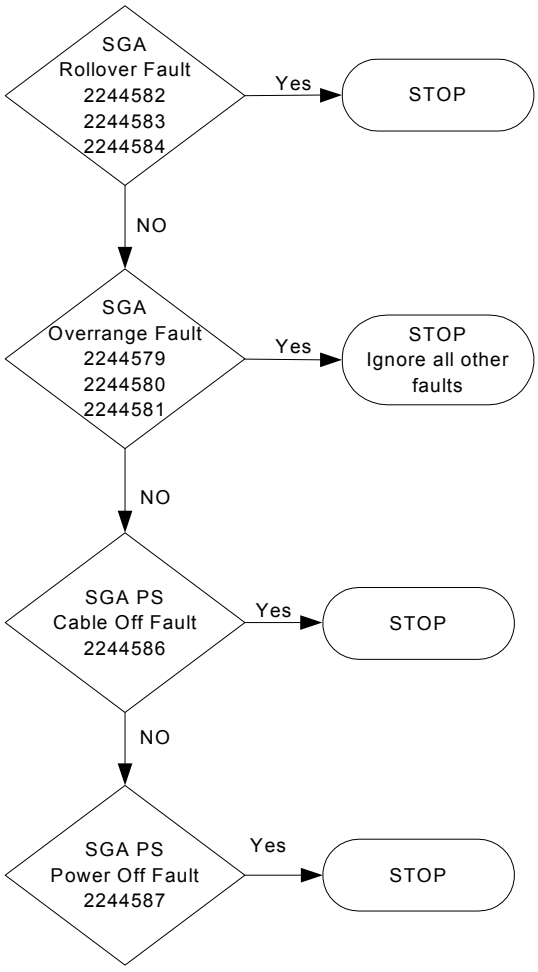
1- OVERVIEW

The following document is a troubleshooting guide for the ACGD Cabinet. It is broken down by fault trees and error messages. The flowcharts are based on the faults and error messages. Each fault is listed in the diamonds followed by the error message number. When the faults occur follow the directions given in the message. A list of the error messages follows the charts.

2- TROUBLESHOOTING FLOWCHARTS

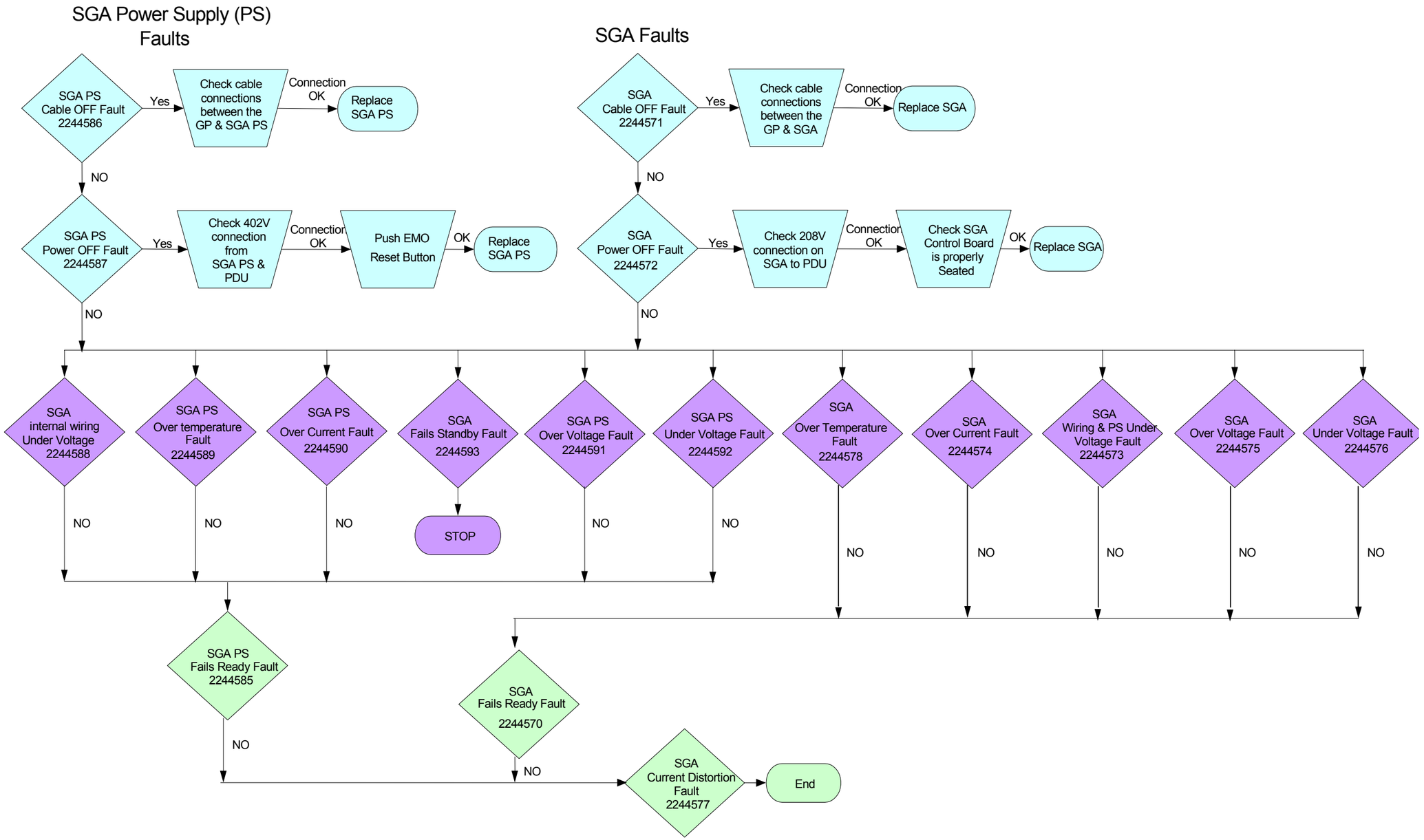
2-1 Hardware Faults

The first flowchart lists the faults that follow the probability of occurrence. Check the error message log for the following faults. Follow directions given in the error message if you have received any of the errors listed in Illustration 1-1.



SGA & SGA PS LIMITED FAULT TREE
ILLUSTRATION 1-1

The following flowchart lists the bulk of the faults for the ACGD Cabinet. The faults are grouped by color/shading in the order of priority. The first group charted, are power/cabling errors and the methods to clear faults. The second grouping (middle section), are operational errors, each is listed by fault and the error message number. Follow the directions in the error code. The last grouping, current distortion, is the lowest priority. Refer to Section 3- Error Messages for the detailed error message and recommended actions.



ACGD FAULT TREE
ILLUSTRATION 1-2

2-2 Software Faults

The following table lists the software faults that may occur. The errors are listed numerically only.

Fault and Error Number	Symptom:	Actions:
Invalid Update Error 2244500	Internal GP software error. Invalid selection for an update mode.	• Check MDS Link Connection • Software bug, write CQA.
Undef_Interrupt 2244501	Internal GP software error.	• Check GP Board, LED is blinking with a period of 5 seconds. • Software bug, write CQA
Invalid_TP 224502	Internal GP software error.	• Check GP Board, LED is blinking with a period of 5 seconds. • Software bug, write CQA
Undef_MDS_OPCODE 224530	Internal GP software error. GP received an undefined opcode from a SPI MDS Packet.	• Check MDS Link Connection • Software bug, write CQA.
Invalid_Axis 2244540	Internal GP software error. Number of axis is not between Value and Value.	• If you are using SMOD or a debugger you requested invalid information. • Software bug, write CQA.
Bad_PS_Level 2244541	Internal GP software error. Invalid selection for Gradient Power Supply level. SPI specified an undefined value in a MDS packet.	• Check MDS Link Connection • Software bug, write CQA.
No_PS_Level_Stdby 2244542	IPG attempted to command the _ gradient axis to Standby before sending a GIP_CONFIG packet to the GP.	• Check IPG
No_PS_Level_Rdy 2244543	IPG attempted to command the _ gradient axis to Ready before sending a GIP_CONFIG packet to the GP.	• Check IPG
ADC Error 224607	Internal GP Software error. Unavailable signal for selection on ADC Multiplexor _.	If this error is seen in the field please write CQA.

2-3 Hardware Errors

Fault & Error Number:	Symptom:	Action:
GRAM_Tune_Verify 2244544	The GP was unsuccessful loading/verifying GP digital tuning values for the _ Axis.	• Replace GP
Framing Error 2244605	Hardware Error - Gradient data framing error. The GP reported a data framing error.	• Check the fiber optic clock cable between the Systems Cabinet and GP. • Check the IPG, TYME, and GP. • Run fiber optic diagnostics.
Clock Stop Error 2244606	Hardware Error - No Gradient Clock. A gradient clock stop occurred. The GP stopped receiving the gradient clock from the IPG.	• Check connection between TYME Board and GP Board. • Check the IPG, TYME, and GP. • Run fiber optic diagnostics.

3- ERROR MESSAGES

These messages are cited in the flowcharts.

Fault & Error Number:	Symptom:	Action:
SGA_Failed_Ready 2244570	The _ Axis of the SGA Failed to go to Ready when commanded.	• G_Enable Test point on the front of SGA J2 is high replace the SGA Axis. • Check cable between GP & SGA. • Replace the GP.
SGA_Cable_Off_Fault 2244571	The GP is reporting a SGA _ Axis cable off Fault.	• Check cable between GP & SGA • Replace GP • Swap SGAs and replace appropriate axis.
SGA_Power_Off_Fault 2244572	The GP is reporting _ Axis SGA Power Off.	• Check 208 V line cable is fully seated between SGA & PDU. • Replace SGA.
SGA_WF_PSUV_Fault 2244573	The GP is reporting _ Axis SGA internal wiring fault and internal Power Supply undervoltage.	• TPS Reset • Replace SGA
SGA_OC_Fault 2244574	The GP reported a _ Axis SGA OverCurrent Fault.	• Check Output cabling to the coil. • Replace the SGA
SGA_OV_Fault 2244575	The GP reported a _ Axis SGA OverVoltage Fault.	• If no other faults reported, replace SGA. • See other faults.
SGA_UV_Fault 2244576	The GP reported a _ Axis UnderVoltage fault.	• If no other faults reported, replace SGA. • See other faults.
SGA_IDIST_Fault 2244577	The GP reported a _ Axis Current Distortion Fault.	• Check LCoil Calibration. • Run Gradient Driver Tests to isolate FRU. • If diagnostics pass, write CQA.

Fault & Error Number:	Symptom:	Action:
SGA_OT_Fault 2244578	The GP reported a _ Axis SGA OverTemp Fault.	• Wait at least for 5 minutes for cabinet to cool. • Check Fan phase rotation, fan filter, and gradient cabinet rear door is closed. • Check SGA.
X_SGA_OVRANGE_Fault 2244579	X Axis Gradient Data Overrange Occurred. The GP detected an error in the incoming high speed data from the IPG.	• Usually a PSD problem, ignore all other faults except Rollover 2244582.
Y_SGA_OVRANGE_Fault 2244580	Y Axis Gradient Data Overrange Occurred. The GP detected an error in the incoming high speed data from the IPG.	• Usually a PSD problem, ignore all other faults except Rollover 2244582.
Z_SGA_OVRANGE_Fault 2244581	Z Axis Gradient Data Overrange Occurred. The GP detected an error in the incoming high speed data from the IPG.	• Usually a PSD problem, ignore all other faults except Rollover 2244582.
X_SGA_RollOver_Fault 2244582	X Axis Gradient data rollover occurred. Application of the digital DC Offset compensation caused the gradient data to rollover.	• Check DC Offset Calibration. • Check PSD Application. • Write CQA.
Y_SGA_RollOver_Fault 2244583	Y Axis Gradient data rollover occurred. Application of the digital DC Offset compensation caused the gradient data to rollover.	• Check DC Offset Calibration. • Check PSD Application. • Write CQA.
Z_SGA_RollOver_Fault 2244584	Z Axis Gradient data rollover occurred. Application of the digital DC Offset compensation caused the gradient data to rollover.	• Check DC Offset Calibration. • Check PSD Application. • Write CQA.

Fault & Error Number:	Symptom:	Action:
SGAPS_Ready_Fault 2244585	The SGA Power Supply failed to go to ready when commanded or came out of Ready.	• Press the Reset Button on SGA PS • If ENABLE test point on the SGA-PS J2 connector is HIGH, replace the SGA-PS. • Check Cable from GP to SGA-PS. • Replace GP.
SGAPS_Cable_Off_Fault 2244586	The GP is reporting a SGA Power Supply Cable Off Fault.	• Check the cable between the GP and SGA-PS. • Replace the SGA-PS.
SGAPS_Power_Off_Fault 2244587	The GP is reporting SGA-PS Power Off	• Check 420V power breaker on the PDU, if tripped replace SGA-PS--DO NOT CYCLE POWER. • Check the 420V power line is fully seated between PDU & SGA-PS. • Push EMO Reset Switch on PDU. • Replace SGA-PS.
SGAPS_WF_PSUV_Fault 2244588	The GP is reporting SGA-PS internal wiring fault or internal power supply undervoltage.	• Reseat SGA-PS connectors. • Replace the SGA-PS.
SGAPS_OT_Fault 2244589	The GP reported a SGA-PS Overtemp Fault.	• Wait at least for 5 minutes for cabinet to cool. • Check Fan phase rotation, fan filter, and gradient cabinet rear door is closed. • Check SGA-PS.

Fault & Error Number:	Symptom:	Action:
SGAPS_OC_Fault 2244590	SGA-PS Over Current Fault.	• Check SGA-PS LEDs to determine which axis is source of problem, replace that SGA axis. • Replace the SGA-PS • Power cycle ACGD Power breaker on PDU to recover.
SGAPS_OV_Fault 2244591	SGA-PS Over Voltage Fault.	• Check SGA-PS LEDs, if BUS_OV LED is lit, check PDU 420V output. If primary, replace SGA-PS. If secondary, • IF OV_X, Y, Z LED lit, swap military connectors to isolate SGA vs SGA-PS. • Replace SGA-PS. • Power cycle ACGD Power breaker on PDU to recover.
SGAPS_UV_Fault 2244592	SGA-PS Under Voltage Fault.	• Check SGA-PS LEDs, if BUS_UV LED is lit, check PDU 420V output. If primary, replace SGA-PS. • IF UV_X, Y, Z LED lit, swap military connectors to isolate SGA vs SGA-PS. • Replace SGA-PS. • Power cycle ACGD Power breaker on PDU to recover.
SGA_Failed_Standby 2244593	The _ Axis SGA failed to go to Standby when commanded.	• If G_ENABLE test point on the front of SGA J2 connector is LOW, replace the SGA Axis. • Check cable between GP & SGA. • Replace GP.

Fault & Error Number:	Symptom:	Action:
X_Failed_Recovery 2244594	X Axis gradient error detected; recovery in progress.	• Ignore
Y_Failed_Recovery 2244595	Y Axis gradient error detected; recovery in progress.	• Ignore
Z_Failed_Recovery 2244596	Z Axis gradient error detected; recovery in progress.	• Ignore
Recovery_Done 2244597	The gradient system on the _ axis recovered successfully. There are no faults at the present time.	• Ignore
Current Driver Tests 2245044	The GP reported an X Axis SGA Internal Wiring or Internal Power Supply Under Voltage fault.	• Cycle two breakers on the PDU. • Replace the SGA.

4- TROUBLESHOOTING-PDU

The following table lists the faults that may occur.

TABLE 4-1
PDU FAULT SYMPTOMS AND POSSIBLE CAUSES:

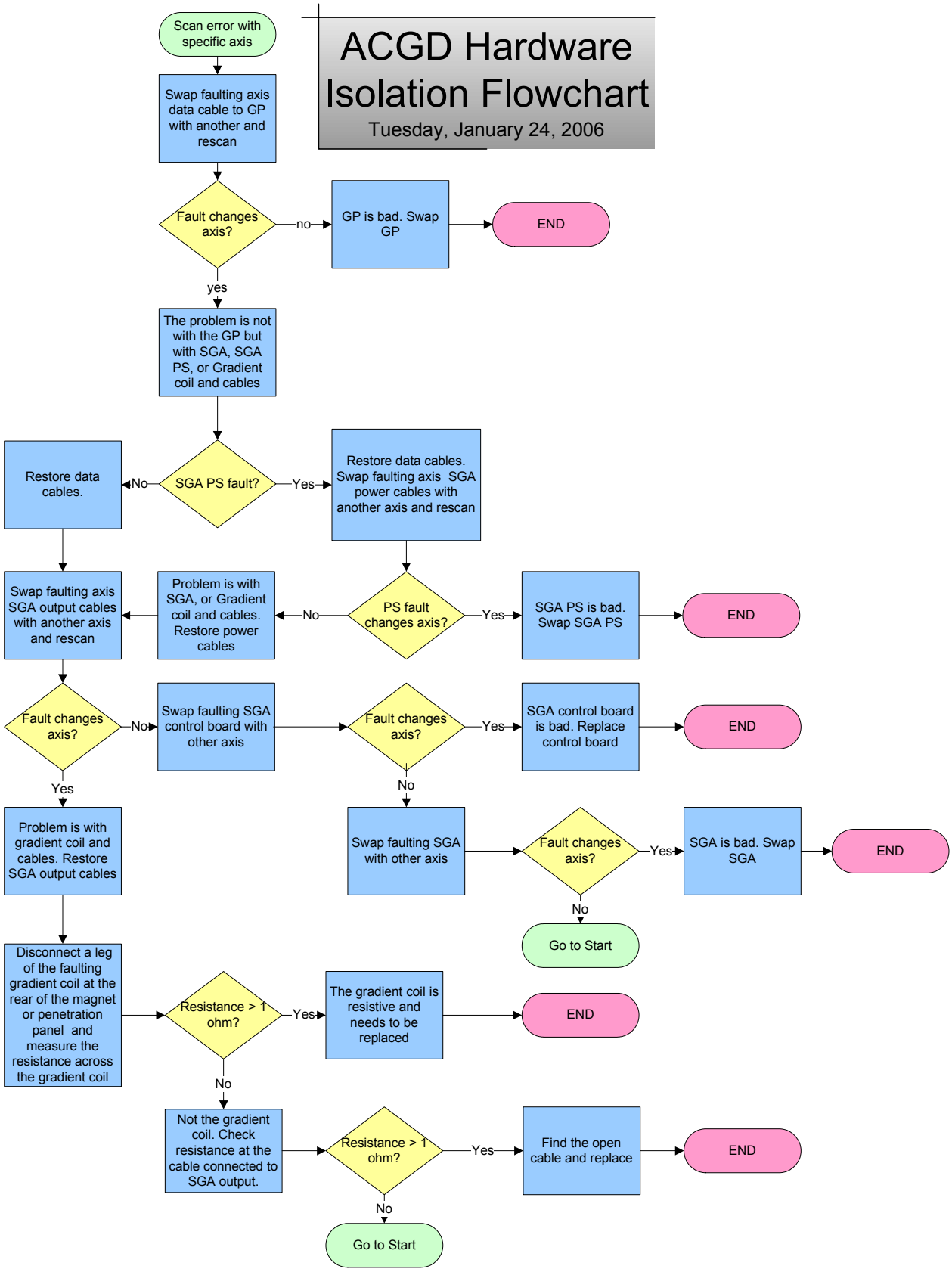
Symptom:	Possible Cause(s):
Bus OV, Bus UV and PSUV Faults in Power Supply.	• PDU tapped wrong. • Inadequate power feed/UPS/.
Power Supply IGBT failure, PSUV faults.	• Unbalanced voltages or missing phases indicates a feeder, PDU transformer or internal wiring problem.
E-off not working or E-stop contactor won't pick up.	• A connector may be loose on the PDU control board. • Board may be bad.

Note

MR has just recommended that a 160kVA UPS from Powerware be used for the system. Other UPSs or line regulators can cause PDU or PS Problems.

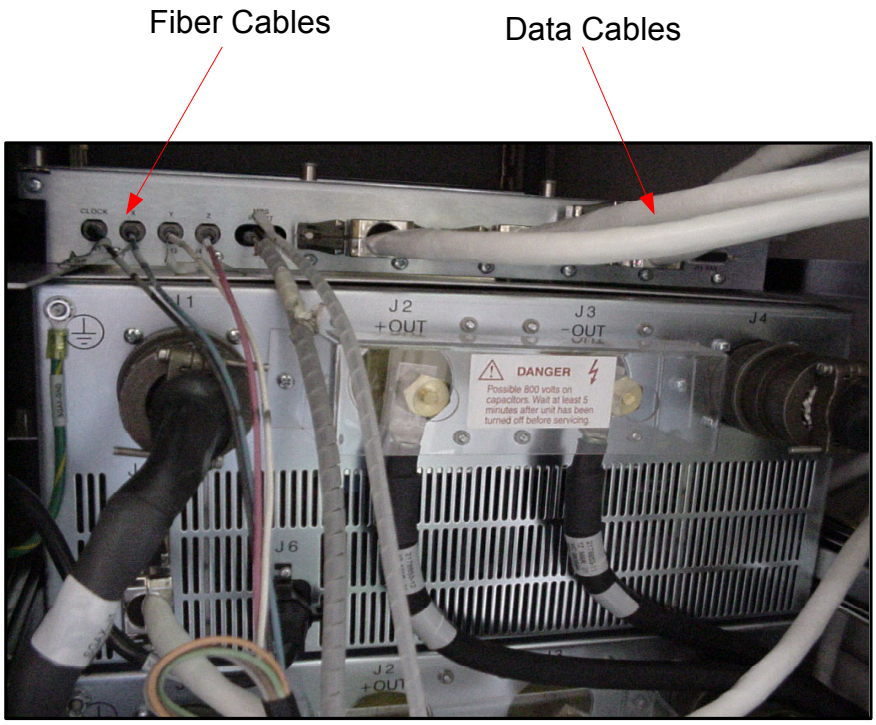
5- HARDWARE FAULT ISOLATION

Please refer to the flowchart shown below. All following subsections address the flowchart.



5-1 GP Fault Isolation

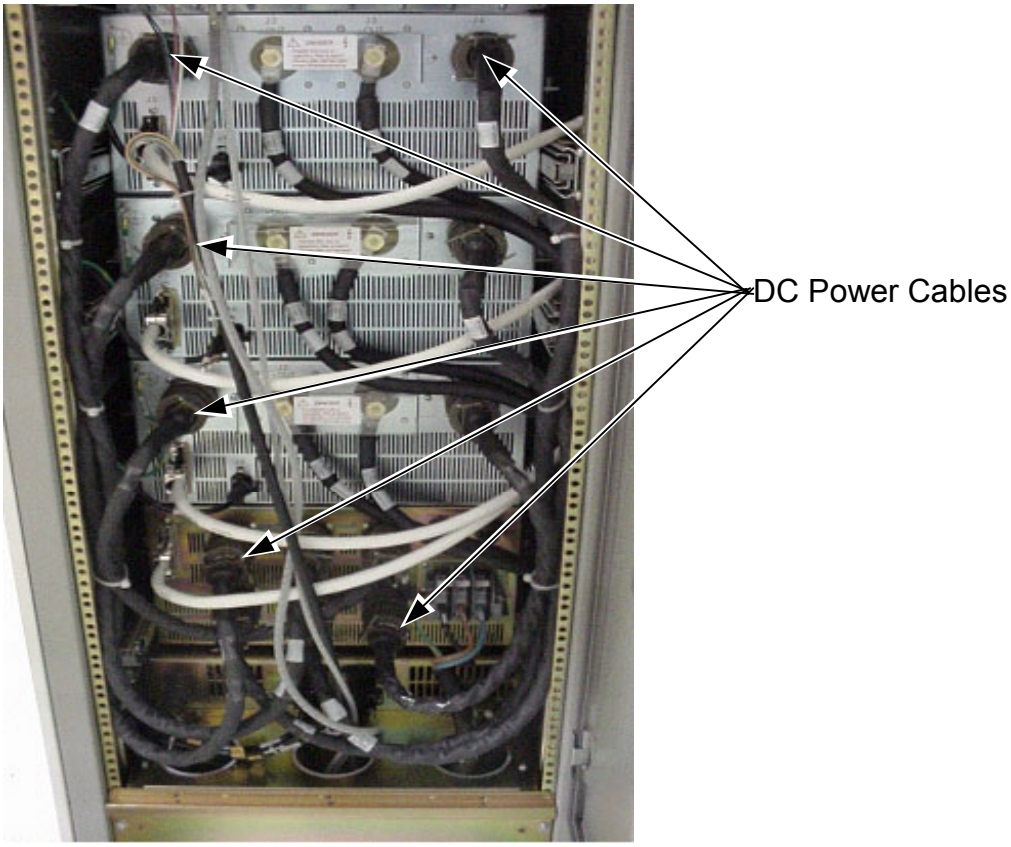
In order to isolate problems in a particular axis of the GP, swap the suspect axis' fiber cable with another axis. In turn, swap the corresponding data cables at the GP (or at the SGA). Refer to Illustration 5-1 for GP Cables.



GP CABLES
ILLUSTRATION 5-1

5-2 Power Supply Fault Isolation

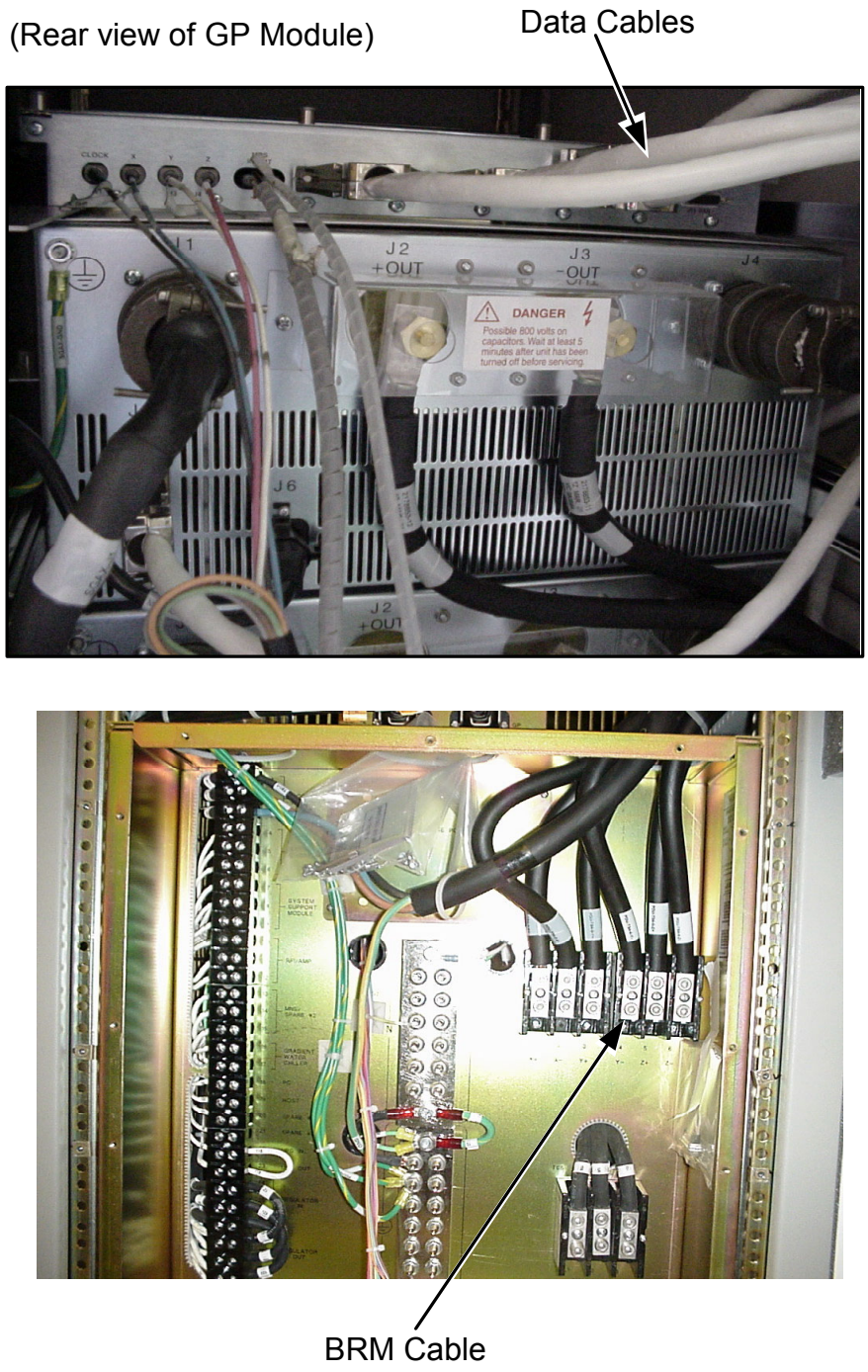
In order to isolate problems caused by a particular power supply output, swap one or both of the cables of the suspect axis with the cable(s) of another axis. All 6 outputs are identical and will work on either connector of any SGA. DO NOT move data or fiber cables for this test. Refer to Illustration 5-2 for DC Power Cables.



DC POWER CABLES
ILLUSTRATION 5-2

5-3 SGA Fault Isolation

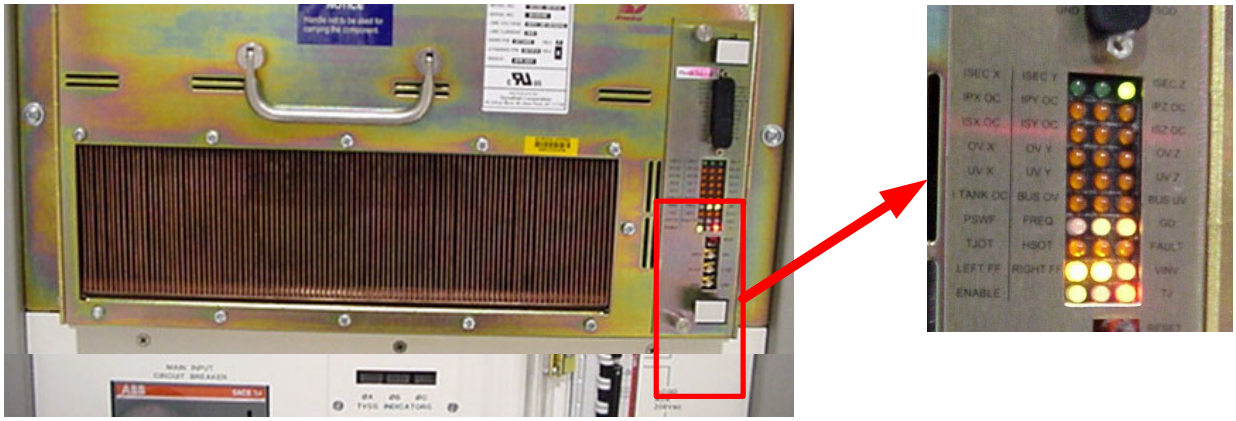
In order to isolate problems in a particular SGA, swap the BRM cables of the suspect axis with another axis at the terminal board at the back of the PDU and swap the corresponding data cables at the GP (or at the SGA). If this indicates a bad SGA, try swapping the control boards. Refer to Illustration 5-3 for BRM Cable.



BRM CABLE
ILLUSTRATION 5-3

5- POWER SUPPLY LED'S

Power supply LED's indicate SGA faults too. See Illustration 5-1 for LED location. For further detail on the SGA-Power Supply (PS) LEDs refer to Service Document, *SGA-PS LEDs, gd4tsc2.doc*.



POWER SUPPLY LED'S
ILLUSTRATION 5-1

The following table lists the different LED types and their function(s).

TABLE 5-1
LED DESCRIPTIONS

LED(s)	Function(s)
ISECX, ISECY, ISECZ	Indicate the secondary currents in the power supply for each axis. They will light up when the SGA for that axis pulls current from the power supply.
IPX OC, IPY OC, IPZ OC	Indicate over currents in the transformer primaries. This is an uncommon fault that would indicate a shorted transformer primary.
ISX OC, ISY OC, ISZ OC	Indicate over currents in the transformer secondary. 2 causes are are a blown IGBT in the SGA or a shorted diode module in the power supply.
OVX, OVY, OVZ	Indicate over voltages on the output of the power supply. Loose connectors cause this problem.
UVX, UVY, UVZ	Indicate under voltages on the output of the power supply. Can be caused by shorted semiconductors in the SGA or power supply.
ITANK OC	Indicates that the sum of the transformer primary currents is too large. Heavy loads on all 3 axes at once.
BUS OV	Indicates an over voltage on the input bus of the power supply. Check the tapping of the PDU and measure the 420 VAC on the terminal block in the back of the power supply.

TABLE 5-1 (CONTINUED)
LED DESCRIPTIONS

LED(s)	Function(s)
BUS UV	Same as for BUS OV but for under voltage. Can be caused by mistapping the PDU or line sags.
PSWF	Indicates 1 of 3 faults: • under voltage on the 5 or 15V control board • wire fault
FREQ	Indicates the frequency that the IGBT's are switching at. It is a control signal.
GD (YELLOW)	Shows the switching of the gate drive power supply. RED or GREEN illumination indicates a problem on the control board or gate driver. Power supply should be switched.
TJOT	Ignore-not used.
HSOT	Indicates heat sink or over temperature. Check if cabinet fan is running in the correct direction and the back door of the cabinet is closed.
FAULT	Lights whenever one of the faults described above is true, or when the RESET pushbutton is pressed.
LEFT FF, RIGHT FF	Indicate IGBT switching.
VINV	Indicates IGBT switching. It is a control signal.
ENABLE	Lights when the power supply is enabled by the GP.
TJ	RED all of the time. Ignore.

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
A	January 23, 2001	K. Keshena	Preliminary release.
0	May 22, 2001	K.Keshena	Initial release.
1	May 28, 2002	C. Garcia	Hardware fault isolation-GP & LED addition.
2	June 12, 2002	C. Garcia	PS, SGA Fault Isolation & PDU Troubleshooting additions.
3	February 7, 2006	K. Keshena	Updated the ACGD Fault Tree Illustration, information was missing. Updated the paragraph introducing the illustration per design engineering and added the Hardware Isolation Flowchart.