CHAPTER 5 ATTACHMENTS

5.1 Information Available from Error Storage

ERROR	DATA 1	DATA 2	DATA 3
Power Outage	W/S	Down	Date/Hr Power Back
Manual Mode	W/S	Down	"
Excess Speed Failure	W/S	Peak RPM	"
Overspeed Warning	W/S	Peak RPM	"
Main Power	W/S	Voltage	Date/Hr of Message
Vibration Failure	W/S	RPM	"
RPM Sensor Failure	W/S	RPM	"
Excess Wrap Failure	W/S	RPM	"
Cable Wrap Error	W/S	RPM	"
Yaw Drive Failure	W/S	RPM	"
Firing Board Warning	W/S	Peak RPM	"
Brake Error W/S	RPM		"
Brake Solenoid Failure	W/S	RPM	"
Brake Wear Sw Error	W/S	RPM	"
Excess Yaw Error	W/S	RPM	"
Memory Failure	W/S	RPM	"
Primary Fuse Warning	W/S	RPM	"
Over Temp Switch Error	W/S	Gen Temp	"
Over Power Error	W/S	Ave KW over set KW	"
Phase Balance Error	ΔCurrent	Current A	"
Over Voltage Warning	KW	Voltage	"
Low Voltage Warning	KW	Voltage	"
Line Frequency Warning	W/S	RPM	"
Timer Failure	W/S	RPM	"
High Wind Warning	W/S	RPM	"
Manual Stop W/S	RPM		"
Blade Position Error	W/S	RPM	"
Weak Clutch W/S	RPM		"
Efficiency Warning	W/S	RPM	"
Yaw Brake Warning	W/S	RPM	
Automatic Reset	Avg W/S	Down Time Min	"
Manual Reset	Avg W/S	DOWN Time Min	"
Special Reset	Avg W/S	DOWN Time Min	"

5.1 Information Available from Error Storage

OTHER NON-STORED MESSAGES

System Run	Shows that all errors have been cleared
Blades Up	Shows that blades are not back to run position
Blades Back	Shows that blades are back and brake has released
On Line	Shows that the machine is connected to the grid

5.2 Description of Errors

Key to Types of Events

mr - Manual reset required for restart
or - Will automatically restart when error clears one time in a 1 hr period
ar - Will automatically restart when error clears
ns - Machine will not stop for these conditions
bi - Brake sets immediately instead of waiting till RPM < 100

Error	Possible Causes
Power Outage PO - ar	Power has been off or power to controller has been lost. Check fuses 1 and 2 (1 amp) and controller power fuse (2 amp). If controller fuse was open, check varistor (130L20).
Manual Mode PO - ar	Controller has been in Manual Mode.
Excess Speed Failure XS - bi	Machine accelerated violently and 2800 RPM was exceeded.
Overspeed Warning OS - ar	RPM exceeded overspeed setting as a result of pitch-up after an error. This overspeed condition is normal and the purpose of the warning is to have a record of the peak overspeed RPM and windspeed at that time.
Main Breaker MB - ar	Main breaker is open or tripped or Out of Balance circuit is open.
Vibration Failure VB - mr - bi	Out of balance switch has opened 6 times within 3 seconds. Switch opens with approximately 0.5 g acceleration.
RPM Sensor Failure RS - mr - bi	Wires running from TB1-37 and 38 to RPM sensor are open or shorted. Check to see that there is about 1.5 to 3 volts DC from TB1-37 to TB1-38 with controller power on and 900 to 1300 ohms with power off.
Excess Wrap Failure XW - mr	A wrapped up cable of over 2.25 turns has been sensed on the cable wrap pot. The machine is not allowed to yaw any more. This condition will occur if a wire to the pot breaks or shorts out, or the fuses on either the +5 or-5 volt supply on the I/O Board to the yaw pot are bad.

5.2 Description of Errors

Cable Wrap Error CW - or	A wrapped up cable of over 2.0 turns has been sensed on the cable wrap pot. The machine will shut down and attempt to unwind the cable. It will continue to try until a wrap of less than 0.5 turns is sensed or until it is determined that the machine is not yawing. It will then stop and continue to try every 1/2 hour for 24 hrs or until 0.5 wrap turns is sensed. After unsuccessful tries for 24 hrs, a yaw drive error will occur. Note: If the cable wraps over 1.1 turns and the generator RPM is < 100 or if the wrap count shows over 1.5 turns with < 1800 RPM, the controller will signal the yaw motor to unwind.
Yaw Drive Error YD - mr	Controller has tried unsuccessfully to yaw machine to correct wind heading with brake released for 160 continuous seconds in the same direction or fails to see correct movement after 30 seconds of yaw drive. If an unsuccessful attempt is made to yaw with brake set, the controller will stop trying to yaw, wait for brake release in the normal course of events and then make a second attempt. This will provide for the cases where the controller has shut the machine down in a moderate to high wind and the blades happened to stop vertical so that the machine has a strong yawing moment. When this error occurs, first check the yaw circuit breaker. Check the Yaw Position parameter to see that it changes as the flag moves 15° off center. If it is not, the flag or the flag power supply on the I/O Board or an associated circuit is bad. Try yawing the machine by pushing the Yaw button on the I/O Board. If no yaw, check fuses 3,4,5 and Yaw breaker. If the flag checks out, the yaw clutch is probably weak.
Firing Board Error UO - or	Controller saw an overspeed condition with no prior error. Check SCR operation in manual mode. If this is OK, bring machine back on line and check that voltage from TB1-37 to TB1-38 is at least 6 volts AC with RPM at around 1800. This is the RPM transducer signal. If this signal is weak, the transducer must be adjusted. Also check that the shield on TB1-39 has high resistance to cabinet ground. If all this checks out, visually inspect RPM cable and connections in nacelle.

5.2 Description of Errors

Brake Error BK - or	Signal from brake motor position switch to controller was lost at a time when the controller had not removed power to the brake. Check Brake circuit breaker. Check brake operation in the manual mode. If brake fails to operate, visually inspect brake assembly in nacelle.
Brk Solenoid Failure BS - mr	Brake solenoid failed to latch brake motor when brake motor position switch was momentarily closed. Visually inspect brake assembly and solenoid.
Wear Switch Warning BW - mr	Controller never received signal from brake motor position switch after sending power to brake. Check the Brake circuit breaker before inspecting the brake wear switch.
Excess Yaw Error XY - ar - bi	Implies a weak yaw clutch. It occurs if more than 50 degrees (variable) of yaw movement are detected in any consecutive 5 second period. This is determined by observation of the yaw pot. Unit will restart after 2 minutes. A quick check of the yaw clutch is to set the blades horizontal in a 20-25 MPH wind and try to manually yaw the machine 90 degrees. The definitive test is to lower the machine with the blades vertical to a point where it is not quite touching the ground; by engaging the yaw contactors back and forth, the spinner should move 11 to 24 inches (total travel).
Memory DC - ns	Possible bad controller or bad EPROMs. Check all parameters for accuracy. If error repeats, replace controller.
Primary Fuse Warning PF - ar	Voltage has gone to between 200 and 300 volts AC. This condition might exist if a primary fuse in the main transformer was blown.
Overpower Error OP - or	Controller sensed that generator KW exceeded Overpower parameter by kw-seconds in KW-Sec parameter. Check blade pitch and ambient temperature. Unit may overproduce if blade pitch is set incorrectly or if ambient temperature is below freezing. Lower temperatures cause the air to be more dense.

5.2 Description of Errors

Phase Balance Error PB - or	One of the phases of current was grossly different from the other two. Possible single phasing problem caused by faulty SCR controller or generator or loss of CT circuit to controller. This error may erroneously be seen when bumping for long periods on SCR's.
Over Voltage Warning OV - ar	Incoming voltage too high for a given KW output, or controller out of calibration.
Low Voltage Warning UV - ar	Incoming voltage too low for a given KW output, or controller out of calibration.
Line Freq Warning LF - ar	Line frequency was out of spec. This is rare and may imply a controller problem.
Timer TM - ns	Possible bad controller. If error repeats, replace the controller.
High Wind Warning HW - ar	Two consecutive w/s readings both exceeded High Wind Cutout parameter. When this happens controller will wait until w/s drops below the Pitch-Up W/S parameter before pitching the blades. Brake will be released after 10 minutes of continuous winds below 50 mph.
Manual Stop MS - mr	Someone touched the stop button or Run Status was set to a non-zero number. Machine will restart only after Run Status is zero and manual reset is done.
Blade Position Error BP - or	Blades have spontaneously pitched up when RPM was above 500. Check blade circuit breaker. If breaker trips repeatedly check for blown diode bridge or short circuit from snubber to wire going to hub terminal block. If this is all OK check for less than 300 ohms through the snubbers. If open check for loose or broken wires using the nacelle and cabinet schematics as a guide.
Weak Clutch Warning WC - ns	Occurs when controller tries unsuccessfully to unwrap the cable or bring the machine down wind. This is detected when the wrap pot fails to show correct movement after 30 seconds of yaw drive.

5.2 Description of Errors

Efficiency Warning
EF - ns

Overall efficiency of the machine dropped below the Efficiency Limit parameter with more than 1000 KWH in the Recent KWH parameter.

Yaw Brake Warning
YB - ns

Indicates that either of the yaw contactors has been engaged five times in a 5 minute period. This implies that the yaw brake may be powered constantly so that it is not holding yaw position during low wind conditions. With the machine off and neither yaw contactor engaged, check that the voltage at TB1-35 shows low voltage with respect to tower common.

Resets

Automatic Reset
A*

Machine restarted automatically after some error condition cleared.

Manual Reset
M*

Someone pressed the 8 * sequence to manually restart the machine after some error.

Special Notes

Startup after error

Unit will not automatically restart after any error until windspeed has been below 50 mph for 10 consecutive minutes.

Tie on & tie off

Unit will tie on line as the machine is accelerating when the instantaneous RPM (determined by taking the reciprocal of the time required for 4 teeth on the RPM detection spline to pass the tachometer transducer) is 30 times the line frequency in Hz. This is nominally 1800 RPM. When tie on occurs the SCRs are set to their highest firing angle (high voltage level) then the angle is lowered if the KW remains below 40.

Tie off will occur when the one second average RPM drops below 30 times the line frequency. For a period of 8 seconds thereafter the one second average is monitored and tie on will reoccur if 1800 relative RPM is exceeded; normal tie-on is disallowed for this 8 second period to avoid oscillating on and off line due to the time constants associated with the mass of the generator and rotor against the spring constants of the shaft and blade spar.

5.3 PC Board Replacement - - CWT 300 Control Cabinet

There are five printed circuit boards in the control cabinet which have the potential of needing to be replaced by a spare while the original is being repaired. These include:

HSC-11	Controller Board	Door
SPI	Serial Peripheral Interface Board	Door
I/O	Input / Output Interface Board	Door
F/O	Fiber Optic Interface Board	Door
CT-2	Current Transformer Board	Cabinet

500 Parameters

At the time of installation, when the calibration of voltages and headings is done, all of the 500 level parameters in the controller should be saved. These are the "Personality" parameters and are those which compensate in software for inaccuracies and inversions in hardware. These parameters should ordinarily never change.

Controller

When the controller is changed due to some malfunction which usually will be obvious (no display, frozen display, key-board won't work, etc.) all the historical parameters will have to be reentered. This can be done easily if the controller can still be accessed through the Keypad or through the RS-232 port by logging the historical parameters and then replacing them in the new controller. The System Reset should be done first with the red jumper on both pins. The following 500 parameters can be entered directly from the sheet which was recorded at installation:

500	Machine Number
505	Current A Sign
506	Current B Sign
507	Flag Direction
508	Wrap Direction
509	Yaw Direction
510	Gin Heading
511	Windspeed Shadow
512	Wrap Factor
513	Wrap Offset
514	Altitude
515	Start Date

The voltage and current calibration must be redone which will set the remaining 500 parameters.

5.3 PC Board Replacement - - CWT 300 Control Cabinet

I/O Interface Board

When the I/O Interface Board has to be replaced, no historical data will have to be replaced. Malfunction is usually due to lightning damage: Temp sensors or flag or wrap may not register properly. Drives to Relay Panel or Inputs from Brake, Blade, Oil Level, or Klixon Switch may not operate. It is also possible that the voltage or current readings may be affected. The nacelle calibration procedure will have to be redone which will cause the following 500 parameters to change:

512 Wrap Factor
513 Wrap Offset

SPI Interface Board

When the SPI Interface Board has to be replaced, no parameters will have to be replaced. Malfunction is usually due to lightning damage coming through the I/O Board. Temp sensors or flag or wrap may not register properly. RPM or Windspeed may not read right or not full range.

Fiber Optics Board

When the Fiber Optics Board has to be replaced, no parameters will have to be replaced. Malfunction is usually due to lightning damage coming through the modem or ground potential rise between machines. Communications with the controllers will be interrupted in full or in part.

CT Board

The CT Board should never need to be replaced. However,the possibility of a malfunction exists. A CT could open up or a resistor could be damaged. This would show up as invalid current readings. No parameters will need to be changed following board replacement.