

2.6.5 Breaker Panel

The Breaker Panel performs the following functions:

- * Allows operator interruption of power to various sub-systems.
- * Provides electrical protection at the subsystem level.
- * Provides elapsed time information.
- * Handles shutdown of system in the event of Umbilical Cable over-wrap.

The following is a list of the Breakers:

SCR Firing Board	2 Amp		
Yaw Motor (Phase A)	5 Amp	} These operate together	
Yaw Motor (Phase B)	5 Amp		
Blade Snubbers	2 Amp		
Brake	5 Amp		
Warming	2 Amp		
Capacitor Contactor	10 Amp		
AC Outlet	10 Amp		

The following is a list of the Elapsed Time Clocks:

Grid Hot	Amount of time System was powered
Available	Amount of time Brake was released
Over 200KW	Amount of time generating over 200 KW

There is also a mechanical relay (RY9) on this Panel which is energized whenever the system is powered and the pull apart connection is connected inside the tower at the base. This connection will pull apart and remove neutral from this relay if the Umbilical Cable wraps up too much. When this happens, the normally closed contact of RY9 energizes the Trip Mechanism in the Main Breaker (if the Main Breaker is on) causing it to open, thus removing control power from the system.

2.6.6 Emergency Switch

Pressing the Emergency Switch will have exactly the same effect as the Cable Wrap switch opening. It will cause the Main Breaker to Trip to an open state.

3.1 Controller Keypad & Display

The purpose of having a Keypad and Display on the Controller is to aid the operator in checking out the machine, observing performance, debugging problems, and altering operation parameters. This section is a guide to using the Keypad and Display.

Please refer to the Parameter List. The parameters available through the display are divided into four categories. These are:

* Performance Parameters	Present & Historical
* Control Parameters	Normal Operation
* Supervisory Parameters	Problem Diagnostics
* Maintenance Parameters	Non Operating

One of these category descriptions will show in the upper left corner of the Display when viewing a Parameter. A typical Display screen might look like this:

402	Alter = OK Maintenance
Run	Status 222

Here Run Status is viewed. This is Parameter Number 402 and it is a Maintenance Parameter. Its present value is 222 and it is OK to Alter it.

3.1.1 Viewing Parameters

To see any parameter, press the number(s) corresponding to the parameter, (the numbers will appear in the display on the left as you touch the keypads) then press <ENTER>. The parameter message and the data will appear. If you accidentally press the wrong numbers, press <CLEAR> instead of (not after) <ENTER>. This will put the number on the left back to zero and you can try again. So, in cryptic terms: ## <ENTER>.

To step through parameters, keep pressing <ENTER> over and over. If you press <ALTER> then <ENTER>, parameter order will reverse.

3.1.2 Altering Parameters

To change any parameter (that is changeable) first do the above procedure then press <ALTER>, data numbers (<CLEAR> if mistake), <ENTER>.

Thus: ## <ENTER> <ALTER> ###...<ENTER>.

Parameter number Data Number

3.1.3 Parameter Alterability

There are three kinds of parameters: Changeable, Changeable with Key Only, and Not Changeable. These are indicated on the parameter list. Changeable with Key means that Key Code and Set Key must be the same. Set Key always shows a "*" except when its data numbers are being entered. This functions as a combination lock on the control parameters.

3.1.4 Display Modes

There are three modes of display operation: rotate, hold, and freeze. In the rotate mode the three parameters programmed into the Controller continuously circulate through the display. In the hold mode, the display holds one parameter and updates its data once a second. The freeze mode occurs generally when an error occurs and a message indicating this is displayed. The effect is that whatever is in the display stays and no change or update occurs.

The hold key affects these modes. Pressing HOLD will change from hold mode to rotate or from rotate to hold. If the display is frozen, HOLD will put the mode back to what it was before the freeze mode was caused.

3.1.5 Special Functions

The special function key blank <*> will bring machine status to the display. This will be either the error that has stopped the machine, "Blades Pitched", "Brake Released" if not up to speed, or "On Line" if on line. Pressing a number then <*> will do the following:

- 1 <*> Bump machine at Bump Level
- 2 <*> Bump machine at Boost Level
- 3 <*> Manual stop machine - allows blades to pitch up
- 8 <*> Reset error condition (clears freeze mode)
- 9 <*> Display functional history (causes freeze mode)
- 0 <*> Set brake immediately when blades are pitched up

Time and Date are viewed as HR MN and MO/DA YR but must be entered in Set Time and Set Date as 6 digit numbers: HHMMSS and YYMMDD.

3.2

Line Connection Description

When all systems of the machine are functioning within acceptable limits, the blades are at normal position and previous errors are cleared, the controller will energize the Brake relay RY1 and RY2 causing the brake to release and with sufficient wind the rotor will begin to accelerate. (The RY3 Snubber Relay stays energized at all times except for ten seconds when deactivating snubbers to stop the machine. This keeps the snubbers warm to facilitate the pitch back process.) As the generator passes through Cut In RPM (compensated by line frequency measurement) the controller will energize the SCR Firing Board in Boost Mode with high acceleration or Normal Mode with low. When the controller sees the RPM drop below the Cutout RPM for a continuous number of kilowatt-seconds (specified by Motoring kWS), it will disengage SCRs. If within the next 8 seconds, a 256 tooth average of RPM exceeds 1802 then controller will reconnect the generator to the line. After this 8 seconds the normal acceleration routine will take over. If an error condition should occur, the controller will de-energize the RY3 relay and disengage from the line, causing the blades to pitch up. As soon as the generator RPM drops below 100 RPM, the controller will set the brake with the Brake Dump Relay in the I/O Board.

3.3

Yaw System Control Philosophy

The controller averages the yaw flag direction by low pass filtering the signal with a 2 second time constant. This eliminates detection of the quick movements of the flag caused by turbulence. When this average (shown in Yaw Position) has differed from 0° (center position set by operator when flag was installed) by more than the Yaw Limits for 15 consecutive seconds, the controller will energize RY4 and RY5, the Yaw SSRs to rotate the machine until the difference gets below 1/2 the limit setting. RY8 sets the direction of yaw. The Yaw routine is active at all times except when a Yaw Drive Failure or Yaw Clutch Warning exists.

3.4

Errors

There are three types of error conditions which will cause the controller to shut down the machine. They are "Failures" most of which require manual restart (8 < * >), "Errors" which will automatically restart 2 minutes after the error condition is gone unless two of the same kind happen within a one hour period, and "Warnings" which will always restart 2 minutes after the condition is cleared. See the Description of Errors that accompanies this manual. A record is kept in the controller's memory of the errors and resets that have occurred. This information is shown in more detail on the error sheet.

3.5

111 Manual Mode

This is a manual operation by which AC signal inputs can be observed and all relays and contactors can be operated. To enter this mode, set Run Status to 9. Manual Stop may appear in the display and the machine will do a normal stop if running. Then push the reset button on the back of the Controller. The display should show the following:

GF	OB	BL	MB	BR	BS	OT	OL
0	1	1	1	1	1	1	0

3.5.1 Status Indications

From left to right the digits indicate status of sensors:

Ground Fault	0 = No Ground Fault	
Out of Balance	1 = Not out of Balance	
Blade Position	1 = Blades Back	
Main Breaker Status	1 = Breaker Closed	
Brake Released	1 = Brake Released] See Truth Table in Section 2.4.8
Brake Set	1 = Brake Set	
Over Temp Switch	1 = Not Over Temp	
Oil Level Switch	0 = Oil Level OK	

3.5.2 Peripheral Activation

To activate or deactivate devices, press the following:

<u>Device</u>	<u>On</u>	<u>Off</u>	
Blade Snubbers	3	Clear	
Brake	6	Enter	
Yaw Direction (Right)	9	Hold	
Yaw Motor Drive	*		Momentary
SCRs Low	1		Momentary
SCRs High	2		Momentary
Dump Brake Solenoid	5		Momentary
Warming Voltage	7	8	
Capacitor Contactor	0		Momentary
Trip Enable	Alter		Momentary
Over 200 KW Clock	4		Momentary
All Devices Off		Stop	

To get out of manual mode push the reset button on the back of the controller.

3.6 Data Collection and Communications

The controller can be communicated with through the RS-232 Port using a proprietary protocol. This protocol is used by the Data Collection and Real Time Program provided by Active Control. Refer to the Protocol Documentation for further details.

3.7 Communications Protocol

- 00 Read Parameter - Reads the 4 byte parameter specified.

Addr 00 Parameter CS
|-----|-----|-----|-----|

Response

Addr 00 Parameter MSB ----- LSB CS
|-----|-----|-----|-----|-----|-----|-----|

- 01 Read Sequential Parameters - Reads quantity N sequential parameters starting with the specified 1st parameter.

Addr 01 1st Parm N CS
|-----|-----|-----|-----|

(N = Number of Parameters)

Response

Addr 01 1st Parm N MSB -----
|-----|-----|-----|-----|-----|-----|

LSB MSB----- LSB
|-----|-----|-----|-----|

..... MSB ----- LSB CS
|-----|-----|-----|-----|

- 02 Read Memory - Reads the specified quantity of sequential bytes starting at the specified memory address.

Addr 02 Mem Addr Num Bytes CS
|-----|-----|-----|-----|-----|

Response

Addr 02 Mem Addr Num Bytes Data Data ...
| | | | | | | |

Data CS
| |

- 03 Read Functional Memory - Reads sequential memory bytes specified by a software table which correlates to the specified function.

Addr 03 Func CS
| | | |

Response

Addr 03 Func Num Bytes Data Data
| | | | | | | |

Data CS
| |

- 04 Clear Functional Memory - Clears sequential memory bytes specified by a software table which correlates to the specified function.

Addr 04 Func CS
| | | |

Response

Addr 04 Func CS
| | | |

- 05 Read Status - Reads system status

Addr 05 Code CS
| | | |

Response

Addr 05 Stat CS
| | | |

- 06 Alter Parameter - Modifies the specified parameter with the 4 byte data.

Addr 06 Parameter MSB ----- LSB CS
| | | | | | | | | | | | | | | |

Response

Addr 06 Parameter MSB ----- LSB CS
| | | | | | | | | | | | | | | |

- 07 Arm Stop - Arms the unit for the Remote Stop Command.

Addr 07 CS
| | |

Response

Addr 07 Stat CS
| | | |

- 08 Arm Start - Arms the unit for the Remote Start Command.

Addr 08 CS
| | |

Response

Addr 08 Stat CS
| | | |

- 09 Remote Stop - Stops the machine if Cmd 07 has been issued within the last 7 seconds.

Addr 09 CS
| | |

Response

Addr 09 Stat CS
| | | |

0A Remote Start - Starts the machine if Cmd 08 has been issued within the last 7 seconds.

Addr 0A CS
| | |

Response

Addr 0A Stat CS
| | | |

0B Set Bits in Mask - Set bits corresponding to ones in the spec'd mask.

Addr 0B Mask Data CS
| | | | |

Response

Addr 0B Mask Data CS
| | | | |

0C Clear Bits in Mask - Clear bits corresponding to ones in the spec'd mask.

Addr 0C Mask Data CS
| | | | |

Response

Addr 0C Mask Data CS
| | | | |

0D Bump - Bumps the machine for 7 seconds.

Addr 0D CS
| | |

Response

Addr 0D CS
| | |

CHAPTER 4

SPECIFICATIONS

4.1 Ranges

Power Requirements	95 - 139 VAC @ 1/8 amp
Operating Temperature Range	-20 to 140 degrees F
RPM Range	0 to 4000 RPM
Windspeed Range	0 to 205 mph
Lithium Battery Life	8 years
Electrical Measurement Accuracy	0.5 percent
RPM Measurement Accuracy	0.05 percent