

5.4 System Reset - 300 kW Wind Turbine Controller

Controller may automatically do a system reset if it senses something is wrong with the controller. Also, it may be necessary to do a system reset if the technician suspects that the controller is not performing correctly. This reset will erase all historical data. Technician may want to write down Parameters he wants to save and reload after the system reset.

NOTE: 500 series Parameter will not be erased and reprogrammed with defaults unless the red jumper on back of the controller is on both pins; but, they should be checked and verified that they are correct.

To do a System Reset, set Run Status #402 to 222. Set Set Key #401 to 43086 and then push reset button on back of controller.

- Change Key Code #400 to 43086.
- Check that time and date are correct (Parameter 1 & 2) and reset if necessary.
- Check that temperatures (Parameter #15,16, & 17) are working - reading seems reasonable.
- Enter kWhr from mechanical kWhr meter into Parameter 100. Be sure and multiply the meter value by 10 or 20 as the case may be.
- Enter on-line hours (Parameter 101) as 3/4 of available mechanical hour meter.
- Enter data into Parameter 102, 103, & 104 from mechanical meters.
- Enter cleared date and time into Parameter 124, 125 and cleared date into 130 & 136. Enter start date into Parameter 135. NOTE that Parameters 107 through 125 will automatically clear and enter a new clear date and time at midnight at the end of each month.
- Check that Control Parameters (200 series) and Supervisory Parameters (300 series) have downloaded the correct values. Change if default numbers have been updated.
- Be sure and enter altitude of site so controller can calculate accurate wind kWhr and unit efficiency.

5.5 Calibration of Pod Nacelle Sensors and Controls

1. Make sure main breaker is on.
2. Please wear the electronic grounding strap and connect to cabinet.
3. Put red jumper on both pins (OS2) on back of controller.
4. Set time and date (parameters 1 & 2).
5. Check that the 500 Series RAM parameters have original default values; if not, enter original default values before starting. Do a system reset for a new machine or new controller board.
6. Set Yaw Limits (#211) to 255.
7. Remove the I/O board connector P9 (directly to the right of the push buttons). Check parameter #21 and manually yaw unit in the direction that will result in a wrap angle as close to zero as possible when the pod and spinner are aligned with the aft guy cable as closely as possible. Use the manual yaw & yaw direction push buttons on the I/O board to yaw unit.
8. Enter 1 at Wrap Cal (#408) (Goes back to 0 automatically in approximately 5 seconds).
9. Note Wrap Angle (#21) should read 0.
10. Use "Yaw" button on I/O board to rotate nacelle in counter-clockwise direction exactly 2 turns. Counterclockwise is viewed by standing at the bottom with your back to the tower and the gin pole behind you. The blades, when on the side of the tower opposite the gin pole, should move to your right.
11. If Wrap Angle (#21) reads negative after steps 8 and 9, change Wrap Direction (#508) from 0 to 1. Note red jumper must be on to make this change. Note that Wrap Angle now reads positive.
12. Enter 2 at Wrap Cal (#408) (Goes back to 0 automatically in approximately 5 seconds).
13. Plug P9 back in on I/O board.

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Calibration of Pod Nacelle Sensors and Controls

14. Press 8* on controller. Presently nacelle should unwrap. If machine yaws in the wrong direction, change Yaw Direction (#509) from 0 to 1 or 1 to 0. Note red jumper must be on to make this change. If pass 720, will move a little and stop wrap error or excess stop.
15. Enter true Gin Pole Heading (#510). Use compass to determine heading of gin pole. See description of parameters.
16. Enter Windspeed Shadow Heading (#511). See description of parameters.
17. Set Key Code (parameter 400) to 43086.
18. Enter altitude and check that start date is correct.
19. Yaw unit 90° to wind direction.
20. Set Yaw Limits (#211) to 15.
21. Again press 8* on controller. If machine yaws the wrong way to align with the wind, change Flag Direction (#507) from 0 to 1. Note red jumper must be on to make this change.
22. When finished with calibration, remove red jumper from both pins and place on one pin for storage.

5.6 Wind Turbine Cabinet Controls

- 1 Make sure main breaker is off for steps 2-12.
- 2 Make sure COP (Controller Operating Properly) has been performed on board. If it has not, do so at this point (See Appendix 5.14).
- 3 Put red jumper on both pins (OS2) on back of controller.
- 4 Check that RAM parameters have original default values; if not, enter original default values before starting.
- 5 View Line Voltage (11) and compare to voltmeter (Red/Yel/Blue).
- 6 Modify Line Voltage Adj (501) until they match. This is done by dividing the parameter reading (11) into the actual fluke meter reading. Example: parameter 11 reads 426, fluke reading reads 433. $(433/426 = 1.016)$ Alter (501) data to 1016. Re-enter (11), its data should now read 433.
- 7 Unplug P4 on the I/O board. Plug in the current calibrator, then plug in P4 connector into the current calibrator.
- 8 Measure the AC voltage between pins 3 and 6 of P4 with a voltmeter.
- 9 With the above voltage reading from Step 8, multiply by ⁴⁴⁶800. Now divide the results into the reading of parameter 6 (Phase A current). _{1.71}
- 10 Modify Phase A Current Adj. (503) until the current in the controller reads the results of step 9. Alter the data of parameter (503) with the results of step 9.
- 11 Measure the AC voltage between pins 3 and 6 of P4 with a voltmeter and compare to Phase C Current (8).
- 12 Modify Phase C Current Adj (504) as in steps 9 and 10 above.
- 13 Remove current calibrator.
- 14 Check that the polarity marks on the Main CTs white dots (which are mounted on the large wires on the left side of the Main Breaker) are in the same position: either toward or away from the breaker. If they are then skip to step 16.

5.6 Wind Turbine Cabinet Controls

- 15 Swap the white and black wires at TB2-10, above transformers and 11 on one side of TB2.
- 16 Turn breaker on. Press 8*.
- 17 Bump the machine. If while performing steps 14 thru 23 the generator RPM gets above 400, press 3* and then 0* to stop unit. Press 8* to clear controller so unit can be bumped again.
- 18 Check that the kWh meter is running in the reverse direction. If so then skip to step 23.
- 19 Shut the machine down.
- 20 Swap the white and black wires At TB2-10 and 11 on one side of TB2.
- 21 Swap the white and black wires At TB2-12 and 13 on one side of TB2.
- 22 Again, bump the machine. kWh meter should now be running in a reverse direction.
- 23 Bump again and confirm that Phase A Current (6) reads positive. If so, skip to step 25.
- 24 Toggle Phase A Current Sign (505) from 0 to 1.
- 25 Check that Phase B Current (7) is reading within 20% of Phase A and Phase C Currents (6,8) when unit is generating over 20kW. Review all 3 parameters as rapidly as possible. If the currents are the same within 20%, then skip to step 27.
- 26 Toggle Phase C Current Sign (506) from 0 to 1.
- 27 When unit is producing over 80 kW, use a voltmeter to monitor voltage between two of the lugs on the Main Terminal Block and compare to Generator Voltage (10).
- 28 Modify Gen Voltage Adj (502) until they match. See description of parameters.
- 29 Set Proper Machine number into Machine Number (500).
- 30 Record all of 500 series parameter from installation check list.

5.6 Wind Turbine Cabinet Controls

- 31 On the machine with the modem, set the number 13 into Modem Setup (407). Watch the lights on the modem and verify that they blink occasionally for about 10 seconds immediately after entering the 13 into 407. The 13 will automatically count back down to 0.
- 32 When finished with calibration, remove red jumper from both pins and place on one pin for storage.
- 33 Check that overloads have been added to capacitor contractor and that contractor works.
- 34 Check that current flows through generator heater coils (approximately 0.8 amps). Remember to change leads on fluke back from amps to volts.
- 35 Make sure cabinet receptacle works.

CWT CONTROLLER

Parameters

Manual Mode

Set run status (402) to 9
Push reset button on back
of controller
Control of machine is now
manual

Input bits are displayed if
to rt

GF Ground Fault
0=No Ground Fault
OB Out of Balance
1=Not OB
BL Blade Position
1=BL Back
MB Main Breaker Status
1=MB Closed
BR Brake Released
1=BR Released
BS Brake Set
1=BS
OT Over Temp Switch
1=Not OT
OL Oil Level Switch
0=Oil level OK

To activate or deactivate
devices, press the following:

Device	On	Off
Blade Snubbers	3	Clear
Brake	8	Enter
Yaw Direction RT	9	Hold
Yaw Motor Drive	*	Momentary
SCRs Low	1	Momentary
SCRs High	2	Momentary
Dump Brk Soln	5	Momentary
Warming Voltage	7	8
Cap Contactor	0	Momentary
Trip Enable	Alt	Momentary
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.

Immediate Conditions

0 Status, WS, KW, RPM
1 Time
2 Date
3 Wind Speed
4 Kilowatts
5 Generator RPM
6 Current @ A
7 Current @ B
8 Current @ C
9 Phase Angle
10 Generator Voltage
11 Line Voltage
12 Yaw Flag Angle
13 Yaw Heading/Wind Direction
14 Yaw Rate
15 Generator Temp °C
16 Gear Box Temp °C
17 Ambient Temp °C
18 60 Hz Period
19 60 Hz Adjust
20 SCR Drive
21 Wrap Angle

Performance Data

100 Kilowatt Hours To Date
101 On Line Hours
102 Available Hours
103 Grid Hot Hours
104 Over 200 KW Hours
105 All Time Hi W/S
106 At Date
107 Highest Wind Speed
108 High Date
109 High Time
110 Wind KWH - 15 min avg.
111 Metered KWH
112 Calc'd KWH
113 Availability (%)
114 Efficiency (%)
115 Capacity Factor
116 Average Wind Speed
117 Highest KW
118 Hi Q Hour KW
119 Hi 1 Hour KW
120 Hi 1 Day KW
121 Hi Q Hour WS
122 Hi 1 Hour WS
123 Hi 1 Day WS
124 Cleared
125 At
126 Hi 7 Day KW
127 Hi 4 Week KW
128 Hi 7 Day WS
129 Hi 4 Week WS
130 Since
131 Peak Temp Generator °C
132 Ambient Peak Generator °C
133 Peak Temp Gear Box °C
134 Ambient Peak Gear Box °C
135 System Reset
136 Elapsed Hrs Since Res
137 Available Hrs Since Res

Control Parameters

Control Parameters	Default #
200 Machine Tie on RPM	1500/1800 RPM
201 Cutout RPM	1500/1800 RPM
202 Cutout Wind Speed	75 MPH
203 Pitch Up Wind Speed	50 MPH
204 Motoring Kilowatts	0 KW
205 Low to High Kilowatts	80 KW
206 High to Low Kilowatts	40 KW
207 Motoring Seconds	5 SEC
208 Low to High KWS	0 KW/SEC
209 High to Low KWS	80 KW/SEC
210 Brake Speed	100 RPM
211 Yaw Limits	15°
212 SCRs Low D/A	50
213 SCRs Med D/A	125
214 SCRs High D/A	125
215 SCRs Bump D/A	50

Supervisory Parameters

300 Overspeed RPM	1600/1900 RPM
301 Over Power KW	330 KW
302 KW-Seconds	1000 KW/SEC
303 Current Imbalance	100 AMPS
304 Set Voltage	420/480 VOLTS
305 Delta Voltage	80 VOLTS
306 Efficiency Limit	85 %
307 Yaw Rate Limit	50°/sec
308 Generator Temp Max	120° C
309 Gear Box Temp Max	95° C
310 Over Temp Switch	0/1

Maintenance Numbers

400 Key Code
401 Set Key
402 Run Status
403 EPROM Version Number
404 Rotate 1
405 Rotate 2
406 Rotate 3
407 Modem Setup
408 Wrap Calibration
409 Historical Day Number

NV RAM Personality Parameters

500 Machine Number	0
501 Line Voltage Adjust	1000
502 Gen Voltage Adjust	1000
503 Phase A Current Adjust	1000
504 Phase C Current Adjust	1000
505 Phase A Current Sign	0/1
506 Phase C Current Sign	0/1
507 Flag Direction	0/1
508 Wrap Direction	0/1
509 Yaw Direction	0/1
610 Gin Heading	0
611 Windspeed Shadow	0
612 Wrap Factor	100
613 Wrap Offset	0
614 Altitude	0
615 Start Date	YYMMDD

Special Functions

1 * Bump machine at
Bump Level
2 * Bump machine at
Boost Level
3 * Manual Stop Allow
Blade P/U
8 * Reset Error Starts
machine
9 * Display Event History
0 * Set Brake Immediately
after manual stop

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

Notes:

Pressing HOLD will change
from hold mode to rotate
or from rotate to hold.

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

To do a System Reset set
run status #402 to 222,
set Set Key #401 to 43088,
push reset button on back
of controller.

Revision Date 5-25-93

Revision No. C

5.8 Controller Parameter & Default Descriptions

Immediate Conditions

- 0 Status, WS, KW, RPM
This is the default parameter. Here Wind speed, KW and RPM are all updated once a second. Also shown is the current machine status.
- 1 Time
This shows present time. The time may be altered by entering a 5 or 6 digit number (HHMMSS).
- 2 Date
This shows present date. The date may be altered by entering a 6 digit number (YYMMDD).
- 3 Wind Speed
This shows present wind speed.
- 4 Kilowatts
This shows present power production. If it is negative then the machine is motoring.
- 5 Gen RPM
This shows Generator RPM relative to measured line frequency. This means that on a 60 Hz system if the display shows 1800 and the line frequency is 59.9 Hz, the actual RPM is 1797.
- 6 Current ϕA
This shows current in Phase A as measured by a 500:1 CT whose primary is the secondary of a 400:5 CT which is around the main Phase A conductor. The 500:1 CT has a 50 ohm shunt resistor therefore the voltage measured will be 1 volt per 800 amps in the generator. The current measurement is direction sensitive so the reading will be positive when generating and negative when motoring. If either CT is connected backward the sign may be toggled by setting the Phase A Current Adjust parameter (503) to a 1.
- 7 Current ϕB
This shows current in Phase B as calculated by taking the instantaneous sums of Phase A and Phase C currents. If for any reason the signs of the Phase A and Phase C currents are not correct this reading will be grossly inaccurate. After determining that the Phase A Current sign is correct, the Phase C sign may be changed to achieve accurate reading in Phase B.

5.8 Controller Parameter & Default Descriptions

- 8 Current ϕC
This shows current in Phase C as measured by a 500:1 CT whose primary is the secondary of a 400:5 CT which is around the main Phase C conductor. The 500:1 CT has a 50 ohm shunt resistor, therefore, the voltage measured will be 1 volt per 800 amps in the generator. The current measurement is direction sensitive but the reading will reflect the sign of phase A.
- 9 Phase Angle
This shows the phase angle between Voltage and Current in degrees. Power factor is the cosine of this angle.
- 10 Gen Voltage
This shows phase to phase RMS Generator Voltage. It is monitored with a pair of 240 volt primary transformers which are connected in series between phases A and B.
- 11 Line Voltage
This shows phase to phase RMS Line Voltage. It is monitored with a 240 volt primary transformer which is connected from phase A to neutral. The reading is then multiplied by the square root of 3 before being displayed.
- 12 Flag Angle
This gives the angle in degrees of the flag relative to the nacelle heading. This reading can be positive or negative and the sign can be inverted by setting Flag Direction (507) to a 1.
- 13 Yaw Heading/Wind Direction
This shows true nacelle heading in degrees. If the unit is pointed into the wind, this reading is also the wind direction. This reading can be positive or negative and the sign can be inverted by changing Wrap Direction (508) from 0 to 1 or 1 to 0. Before this number can be accurate, the wrap calibration must be done. This parameter is affected by the following parameters:
- | | |
|----------------------|--|
| Wrap Direction (508) | [Sign] |
| Gin Heading (510) | [Offset of gin pole from North in degrees] |
| Wrap Factor (512) | [Multiplier (100 = times 1)] |
| Wrap Offset (513) | [Offset from lay down (1 \approx 9 degrees)] |
- 14 Yaw Rate
This shows rate of change of nacelle heading in degrees / second. It will be the highest one second average rate within the last 5 seconds.

5.8 Controller Parameter & Default Descriptions

- 15 Generator Temp
This shows the present Generator Temperature in degrees C.
- 16 Gear Box Temp
This shows the present Gear Box Temperature in degrees C.
- 17 Ambient Temp
This shows the present Ambient Temperature in degrees C.
- 18 60 Hz Per
This shows the current 60 Hz period in micro seconds. It is used primarily for maintenance purposes.
- 19 60 Hz Adj
This shows an internally used number which is used for frequency calculations. It is used for checkout and maintenance.
- 20 SCR Drive
This shows the present SCR drive output value. It is used primarily for maintenance purposes.
- 21 Wrap Angle
This gives the angle in degrees of the wrap pot. The reading can be positive or negative and the sign can be inverted by setting Wrap Direction (508) to a 1. It is affected also by Wrap factor (512) and Wrap Offset (513). This parameter is used primarily for maintenance purposes.

Performance Data

- 100 KWH to Date
This shows accumulated kilowatt hours. It is derived from pulses originated by the KWH meter. This number should read the same as the KWH meter.
- 101 On Line
This is the total amount of time in hours that the machine has been generating.
- 102 Available
This is the total amount of time in hours that the machine has been available to generate whether there was wind or not. It includes On Line time. It should match the mechanical Available Clock.

5.8 Controller Parameter & Default Descriptions

103 Grid Hot

This is the total amount of time in hours that the machine has had power applied from the grid. It should match the mechanical Grid Hot Clock.

104 Over 200 KW

This is the total amount of time in hours that the machine was producing power above 200 KW. It should match the mechanical Over 200 KW Clock.

NOTE: Parameter 100 - 104 can be changed through the controller keyboard - Key Code must be set at 43086.

105 All Time Hi W/S

106 At Date

These two parameters show the highest wind speed observed by the controller since the machine was installed and the date it occurred. This peak is always the lower of any two consecutive W/S readings.

107 Highest WS

108 High Date

109 High Time

These three parameters show the highest wind speed observed by the controller since the monthly reset and the date & time it occurred. This peak is always the lower of any two consecutive W/S readings.

110 Wind KWH

This is an indication of the amount of energy in the wind that could have been accumulated by the machine under good conditions since the monthly reset. It is modified for density-altitude by the Altitude parameter (210) and the Ambient Temperature (17).

111 Metered KWH

This shows the actual amount of energy accumulated since the monthly reset. It is derived from the pulses coming from the KWH meter.

112 Calc'd KWH

This shows the actual amount of energy accumulated since the monthly reset. It is derived electrically using the signals from the Line Voltage PT and the Phase A Current CT. It should be close to the reading in Metered KWH (111). This parameter is affected by Line Voltage Adjust (501) and Phase A Current Adjust (503).