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# **ZEUS Dual Compressor**

## ***USER'S MANUAL***



**Programmable  
Solar Powered  
Air Compressor**

## INTRODUCTION

This document addresses operation of the ZEUS with application program version "Charger6K.rgd". Note that for this version to operate correctly you must first install Axiom OS version 138 or later (see instructions near the end of this document).



### **WARNING – EXPLOSION HAZARD**

- **ONLY INSTALL THE ZEUS IN AREAS KNOWN TO BE NON-HAZARDOUS**

## GENERAL OPERATION

Upon power application, the charger unit will immediately begin measuring pressure on compressor #1 & #2 and controlling the compressor drivers output to maintain pressures between the call and off setpoints. It will also begin monitoring battery voltage, solar panel voltage and charging current and controlling battery charging.

## ACCESSING MENUS

Charger operation is controlled by employing a series of setpoints using the onboard keyboard and LCD display. In order to access the main menu, press the minus (-) key on the unit's keyboard. The following menu should appear:

```
*** SYSTEM MENU ***
1 Display 5 Set Clk
2 Setpts  7 Contrast
3 Logon   8 Show I/O
```

From this menu, pressing the appropriate key will transfer you to a menu that addresses the specific selection. Below we will discuss the displays, setpoints and logon/logoff as these are specific to this application.

## LOGGING ON/OFF

You will need to log on for some of the operations below so we'll present the logon/logoff process first. If the main menu indicates '3 logon', then you are not logged on and will be blocked from changing setpoints and some values directly accessible on the displays. To logon, press key '3' from the main menu. You will get the following request:

```
Logon code?
=
```

You must now type in the correct numeric logon code (factory default is "0") followed by the ENTER key. The system menu will now be the following:

```
*** SYSTEM MENU ***
1 Display 5 Set Clk
2 Setpts  7 Contrast
4 Logoff  8 Show I/O
```

To log off, press key '4' from this menu. Also, if you do not alter a setpoint for 30 minutes, the system will automatically log off.

## ALTERING SETPOINTS

From the main menu, if you press key '2', you will enter the setpoint altering menu. Be sure to log on if you wish to change any setpoints. The setpoints in this system along with default values are the following:

```
Coul eff(0 to 1.0)= 0.85
Batt capacity, AHr=360.0
Compr1CyclesToDrain=50.0
Compr1DrainSec=1.0
```

```
Compr2CyclesToDrain=50.0  
Compr2DrainSec=1.0  
Drain holdoff tempF=45.  
Drain restore, Hr:6.  
Max address to poll=0.0  
TempF now=68.0  
Logon code:0
```

When you press key '2' from the main menu, you will be presented with the first setpoint in the list as shown below:

```
*** SETPOINT ***  
Coul eff (0 to 1.0)=  
0.85  
Hit CLR to change...
```

To move to the next setpoint in the list, press down arrow or the ENTER key. If you wish to change this setpoint, press the CLR key. After you do that, the 'Hit CLR to change...' line will blank out and you may begin typing your new value. Your entry will appear on that line. Press ENTER after your entry to install your new value.

## HOW THE SETPOINTS ARE USED

The setpoints are used as follows in this application:

**Coul eff:** The ratio between the energy removed from a battery during discharge compared with the energy used during charging to restore the original capacity. This is used in the calculation of remaining charge. Default is 0.85

**Batt capacity, AHr:** sets the assumed battery capacity for calculations of remaining charge.

**Compr 1 Cycles To Drain:** when the auto drain option is chosen, this sets the number of cycles between water dumps.

**Compr 1 Drain Sec:** when the auto drain option is chosen, this sets the duration of the dumping cycle.

**Compr 2 Cycles To Drain:** when the auto drain option is chosen, this sets the number of cycles between water dumps.

**Compr 2 Drain Sec:** when the auto drain option is chosen, this sets the duration of the dumping cycle.

**Drain holdoff tempF:** temperature below which drain cycles are paused

**Drain restore, Hr:** time after temperature rises above "Drain holdoff tempF" before drain cycles are resumed.

**Max address to poll:** Not used with ZEUS Compressor – Should be Set to 0

**TempF now:** sets temperature for temperature transducer calibration. This controls the maximum and minimum charge voltages (See Housekeeping display).

**Logon code:** Allows the user to change the logon code.

## ACCESSING DISPLAYS

Pressing key '1' from the main menu will get you the displays menu. The following displays are available with this version (6K) of the charger application program:

```
Summary
Charger
Compressor #1
Compressor #2
ComprStats
Housekeeping
Cal pressure XD
Station 2 (Not used for the ZEUS Compressor)
Station 3 (Not used for the ZEUS Compressor)
Station 4 (Not used for the ZEUS Compressor)
Station 5 (Not used for the ZEUS Compressor)
```

Since the LCD has only four lines, only four lines at a time can be shown. Therefore, when first accessed, the display menu will appear as below showing the first four displays available:

```
0 Summary
1 Charger
2 Compressor #1
3 Compressor #2
```

If you press the down arrow or ENTER key, the menu will shift down to present two more display choices as shown below:

```
0 Compressor #1
1 Compressor #2
2 ComprStats
3 Housekeeping
```

If you keep pressing the down arrow or ENTER key the display list will rotate until it rotates back to the top of the list. The specific displays will be discussed below.

## GENERAL DISPLAY OPERATION

The onboard LCD display has four lines of 20 characters each; therefore, only four lines by 20 characters can be observed at any one time. When a display is accessed, the topmost four lines will initially be presented. To see the next four lines, press the down arrow key. If you keep pressing the down arrow key, you will eventually rotate back to the top of the display. In order to move to a different display, either press the ENTER key to rotate to the next display in the display list; or, press the minus(-) key to go back to the main menu.

Some displays will contain keystroke prompts to indicate that pressing one of the numeric keys will result in some action. These are always presented as a numeral followed by a right

parenthesis. For example, in the following hypothetical display, keys 1, 3, 4 and 9 will result in the listed actions:

#### Hypothetical Display

```
.  
1)Lamp test  
3)Setpt A=12.34  
4)Setpt B=56.78  
9)Alarm ACK
```

- key 1 will cause the alarm lamps to turn on for 2 seconds
- key 3 will enable you to change setpoint A
- key 4 will enable you to change setpoint B
- key 9 will acknowledge alarms

If you press key 1 or key 9 in the above example, the indicated action will be taken with no change in the display. However, if you press a key associated with a setpoint such as key 3 or key 4 in the above example, the display will blank and you will be prompted for a new value. After entering the new value followed by the ENTER key, the new value will take effect and the display will return to normal. The main thing to remember is that when a display presents a numeral followed by a right parenthesis, pressing that key will result in additional action.

#### SUMMARY DISPLAY

The summary display provides an overview of unit condition:

```
*** SUMMARY ***  
PV=13.5   BV=12.4  
PSI#1=96  PSI#2=35  
No alarms  
1)Lamp test  
9)Alarm ACK
```

PV presents the measured solar panel voltage.

BV presents the measured battery voltage.

PSI #1 displays the measured pressure from compressors #1 in PSI.

Line 4 summarizes alarms presently active. If there are no alarms, then 'No alarms' will be shown on line 4. If one or more alarms exist then the alarm messages will be shown in rotation once per second on line 4. The possible list is as follows:

```
Compr1 Lo Alarm ON  
Compr1 Hi Alarm ON  
Compr1 Hi Amps Fail
```

Pressing the down arrow key on the above summary display will present the last two lines. As shown, pressing key 1) Lamp test will turn on the alarm lamp driver outputs for two seconds.

Pressing key 9) Alarm ACK will acknowledge alarms and stop the alarm outputs from flashing and turn off the audible alarm output.

## CHARGER DISPLAY

The charger display presents information involving battery charging and the solar panel. The first four lines will be shown first; press the down arrow key to view the next 3 lines:

```
*CHARGER*  SHNT=OFF
Pan V=13.5  I=3.4
Bat V=12.4  I=1.4
No Alarms
Shunt ON   at BV=14.0
Shunt OFF  at BV=13.6
Bat charg %=71.2
```

On line 1, SHNT=OFF indicates that the shunt is off and battery charging is enabled. If battery terminal voltage exceeds the shunt ON setpoint, then the shunt will be turned on, shorting the panel to ground and prohibiting charging. If battery terminal voltage falls below the shunt OFF setpoint, then the shunt will be turned off allowing the panel to charge the battery.

Lines 2 and 3 present panel and battery voltage and current, respectively. For currents, positive current indicates current from the panel and to the battery. A negative current (battery only) indicates battery discharge current.

Line 4 presents any alarms involving the charger. Possible alarms are:

Low Batt alarm  
Low Batt Cutoff ON

Pressing the down arrow key when the first 4 lines are shown will display the last 3 lines:

Shunt ON at BV=14.0 indicates that at a battery voltage of 14.0 volts or above, the shunt will turn on to terminate charging.

Shunt OFF at BV=13.6 indicates that at a battery voltage of 13.6 volts or below, the shunt will turn off to allow charging. These values are shown here to indicate the shunt thresholds after temperature compensation.

Bat charg %=71.2 indicates the calculated state of battery charge as percent of amp hour capacity.

## COMPRESSOR DISPLAYS

The next two displays present information relating to the two compressors and are identical, except that the header will read "Compressor #2"

```
** COMPRESSOR #1 **
PSI=96  Amps=21.0
1)Call=90  2)Off=97
3)HOA=AUTO  NOW=ON
```

4)Hi alarm PSI=150  
5)Lo alarm PSI=0  
6)Overcurrent A=45  
7)Reset fail now=0

Line 2 presents pressure in PSI being measured and current in amps being sent to the compressor.

The next 6 lines present seven setpoints related to compressor #1 that can be altered while viewing the compressor display:

1)Call=90 indicates that the present compressor call setpoint (pressure below which the compressor will be turned on) is presently 90 PSI and pressing key '1' will enable you to change the call pressure. If you press key '1', the display will change to:

Call PSI=  
=

You may now type in a new value followed by the ENTER key to alter the setpoint. If you do not want to change the setpoint, press the ENTER key to return to the compressor display. Other setpoints that you can change:

2)Off=97 indicates the pressure above which the compressor will be turned off. Press key '2' to change it.

3)HOA=AUTO NOW ON indicates that pressing key '3' enables you to change the HOA (Hand/Off/Auto) state of control of the compressor and that it is presently set to AUTO and the compressor is presently called (ON). If you press key '3' you will get a prompt:

0=Off, 1=On, 2=Auto  
=

This indicates that entering a value of 0 will turn off the compressor, a value of 1 will turn on the compressor, and a value of 2 will set the compressor for AUTO operation wherein the measured pressure will govern the on/off call to the compressor.

4)Hi alarm PSI=100 indicates that key '4' allows you to set the pressure high alarm setpoint which is presently set to 100 PSI.

5)Lo alarm PSI=85 indicates that key '5' allows you to set the pressure low alarm setpoint which is presently set to 85 PSI.

6)Overcurrent A=45 indicates that key '6' allows you to set the overcurrent setpoint. If the compressor draws more than this current for more than 10 seconds, the compressor will be shut down for 20 seconds then retried. After 3 tries, the overcurrent alarm will be declared and the compressor held off until manually reset.

7)Reset fail now=0 indicates that compressor overcurrent alarm is 0 (off) and pressing key '7' will clear the alarm if it was on.

## HOUSEKEEPING DISPLAY

The housekeeping display is the following:

```
*** HOUSEKEEPING ***
09/28/2015 21:05:49
TmpF=70.5 C=21.4
Scans/sec=89
Items logged=949
5)=Clear com fails
6)=Dump log nxt=0
7)=Clear log
8)=install tempF cal
9)=install defaults
```

Line 2 presents the present date and time of the realtime clock. It is used to time tag logged data. Line 3 presents onboard temperature in degrees F and C. Temperature is used to temperature compensate battery charge completion.

Line 4 indicates the processor scan rate in complete program scans per second.

Line 5 indicates number of lines logged. The onboard logger samples an array of data once per minute and can store 1000 records.

Line 6 ...5)=Clear com fails clears Station 2 – Station 5 communication failure alarms

Line 7 ...6)=Dump log nxt=0 indicates that pressing key '6' will send the entire log out the programming port. The dump has the following form. Each line presents:

Date Time, BattV, BattAmps, TempF, Compr#1Amps, Compr#2Amps, Compr#1PSI, ...Compr#2PSI, PanelAmps, PanelV,Bat%Charge

LOG! DUMP

```
09/28/2012 21:15:38,12.31,-0.15,72.64,4.74,5.09,35.09,0.00,0.00,0.00,0.00
```

Line8 ...7)=Clear log Indicates that pressing key '7' will erase the logged data.

Line 9 ...8)=install temp F cal Indicates that pressing key '8' will calibrate the temperature transducer to the temperature contained in the setpoint list.

Line 10 ...9)=install defaults Indicates that pressing key '9' will install default values to all setpoints.

## CALIBRATING PRESSURE TRANSDUCER

The display below is the gateway to the pressure calibration procedure. You must be logged on to perform this procedure. Transducer calibration must be performed before accurate pressure calibration will be obtained, as this program revision relies on calibration constants stored in flash memory to provide proper offset and span for the transducers. This will be done before the compressors leave the factory, but would need to be repeated if a transducer was replaced in the field. The procedure will start by asking the user to identify which channel they wish to calibrate (for the ZEUS Jr., this will always be channel 1. Then it will ask the user to apply a high pressure to the transducer and type in the pressure that was applied. Usually this will be a pressure near the expected operating point for that channel. The actual pressure you use is not

important; only that it is accurately measured and typed in correctly. It will then ask the user to apply a low pressure to the selected channel and then type in the pressure applied. Usually, the air tank would be vented and 0.0 would be entered. Then the user will be asked to press a key to save the calibration. After that, the pressure measurement should be accurate.

```
*** Press XD Cal ***  
Key 2=START  
Must be logged on
```

If this display is not presented, press key 1 to back up the procedure until it appears. From this display, pressing key 2 will start the procedure and present the following display:

```
Key 3=toggle channel  
Channel=1
```

```
Key1=Back, Key2=Next
```

Here, key '3' will toggle between channels 1 and 2. Once the channel to be calibrated is selected, press key '2' to proceed to the next display:

```
Apply high PSI  
To channel=1  
Then hit key 4  
Key1=Back, Key2=Next
```

Here the user must apply a known high pressure to the transducer and then press key '4'. After that a prompt will appear to enter the pressure applied:

```
High PSI applied=  
=
```

Now type in the pressure you applied followed by the ENTER key. The display will transition to the next step:

```
Apply low PSI  
To channel=1  
Then hit key 5  
Key1=Back, Key2=Next
```

Now apply a known low pressure to the transducer (usually open the transducer to atmospheric pressure) and press key '5'. After that a prompt will appear to enter the pressure applied:

```
Low PSI applied=  
=
```

Now type in the pressure you applied followed by the ENTER key. The display will transition to the next step:

Hit key 6 to save  
New calibration  
Channel=1  
Key1=Back, Key2=Next

Now press key '6' to save the new calibration. End of procedure; the transducer should now accurately measure pressure.

## CALIBRATING ONBOARD TEMPERATURE

The onboard temperature measurement is used to offset the battery charge completion voltage so as to neither over-charge nor under-charge the lead acid battery whose terminal voltage is dependent upon temperature. To set the temperature calibration takes two steps:

- 1) Log on and access the setpoint list (key 2 from the main menu) and use the down arrow to traverse down to the setpoint labeled 'TempF now='. Then press the CLR key and type in the present temperature in degrees F at the site followed by the ENTER key.
- 2) Press the minus key to exit the setpoint screen and get the main menu. Press key 1 to access the display list and traverse over to access the Housekeeping display. On the Housekeeping display, press key 8. This will install the temperature that you entered as the present calibration for the temperature channel

## ALARM and AUDIO OUTPUTS

The charger has AUDIO, FAIL, OK and STROBE outputs. These are pull to ground outputs capable of sinking up to 100 ma. Whenever a new alarm is detected after no alarms have been present both the AUDIO and FAIL outputs will begin flashing ON/OFF once per second and the OK output will turn off. This will continue even if the alarm condition goes away. To acknowledge the alarm(s), access the summary display and press key '9'. The flashing should stop and the audible turn off. If an alarm is still present, the FAIL output will stay on and the OK output will stay off. Once the alarms are all corrected, then the FAIL output will turn off and the OK output will turn on. The STROBE output is presently unused.

## LOADING A NEW APPLICATION PROGRAM

To load a new program, make sure that the new program is located on your PC or laptop, that the charger unit is powered from its battery terminals, a serial cable is connected from the PC to the charger programming port and the support software (BCsetupd) is running on the PC. Make sure that the support software has the program that you want to install by clicking the 'File' menu item and navigating over to the program that you wish to install. The program should be 'ChargerNX.rgd', where N and X are the latest revision (presently NX=6K). Next, click the 'Compile' button and make sure the program compiles without error. On the support software, click the 'Terminal' button on the top tool bar to open the communications terminal. Confirm communications between the PC and charger by pressing the minus (-) key on the PC keyboard and observe the response from the charger. The charger should respond with the system menu. If there is no response, double check that the unit has power (the 'BAT' LED next to the reset

button should be on), and that the serial cable is connected correctly. Also, on the support software, click the 'Setup' menu item and then 'Com Port' to access the communications setup panel. Settings should be 38,400 baud, no parity, 8 bit word length, and one stop bit. If all appears correct but no response is seen, remove and reapply power to the charger unit with the PC still connected and the terminal page visible. If the unit responds that it is waiting for an operating system (OS) load, follow the procedure in the next section to reload the OS. If there is still no response, replace the unit.

If you observe the system menu on the terminal then you have confirmed communications between the PC and the charger and can proceed. Now, on the terminal panel, click the 'Send Pgm' button to start the download. A progress bar will appear. The process should complete in less than 30 seconds after which the program will start running immediately.

## LOADING A NEW OPERATING SYSTEM

To load a new OS, make sure that the charger unit is powered from its battery terminals, a serial cable is connected from the PC to the charger programming port and the support software (BCsetupD) is running on the PC. The OS revision that will be loaded is indicated in the upper left hand corner of the support software just to the right of the BC icon. As of this date, the revision should be 'V138' indicating version 138. On the support software, click the 'Terminal' button on the top tool bar to open the communications terminal. Confirm communications between the PC and charger by pressing the minus (-) key on the PC keyboard and observe the response from the charger. The charger should respond with the system menu. If there is no response, double check that the unit has power (the 'BAT' LED next to the reset button should be on), and that the serial cable is connected correctly. Also, on the support software, click the 'Setup' menu item and then 'Com Port' to access the communications setup panel. Settings should be 38,400 baud, no parity, 8 bit word length, and one stop bit. If all appears correct but no response is seen, remove and reapply power to the charger unit with the PC still connected and the terminal page visible. If the unit responds that it is waiting for an operating system (OS) load, follow the rest of this procedure to reload the OS. If there is still no response, replace the unit.

If you observe either the system menu or a message saying to reload the OS on the terminal then you have confirmed communications between the PC and the charger and can proceed with the load.

**NOTE: Make sure that power is not removed during the loading process or the unit will have to be returned to the factory for installation of a new OS. If communications is interrupted during the load or if the load does not startup properly, click the 'Send OS' button again to retry the load.**

Now, on the terminal panel, click the 'Send OS' button. A new small panel will appear asking that you confirm that you wish to reload the OS. Click 'Yes' to start the download. A progress bar will appear. The process should complete in less than 3 minutes after which the OS will start running immediately and should indicate that the program has failed (it was erased at the same time that the OS was erased). Now follow the procedure above for loading a new application program.





