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C-A OPERATIONS PROCEDURES MANUAL

17.5.2 ODH Main PCB Bench Calibration Procedure

(Board Part #C1010003-1, Rev. B)

Text Pages 2 through 5

Note: This document was formerly a C-A Group Procedure. The content of the group procedure was reviewed by the Technical Supervisor. All approvals and/or issue dates of the original group procedure are maintained for present use.

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Approved: _____ Signature on File _____
Collider-Accelerator Department Chairman Date

J. Reich

17.5.2 ODH Main PCB Bench Calibration Procedure (Board Part #C1010003-1, Rev. B)

Test Box Switch Info:

S1	Main Power
S2/Batt	Selects internal or external battery
S3 (rotary)	Selects monitor point of rear voltmeter jack (voltage, contact resistance, etc.)
S4	Connects backup battery
S5	Selects a normal or alarm mode condition
S6	Selects a 20 Ohm load to check charge current
S7	Selects either backup battery or external test with 12 V Power Supply
S8	Selects optional ODH Pre-amp board (switch S9 must be in position 2)
S9 (rotary)	Selects optional Pre-amp board or internal 1.393 V reference voltage

Initial Switch Conditions:

S1	“off”
S2/Batt “ext”	(using an external battery)
S3	“7” (monitor 12.0 Vdc supply)
S4	“off”
S5	“normal”
S6	“off”
S7	“battery”
S8	“off”
S9	“3” (1.393 V ref in)

1. Connect main ODH PCB to the test box connectors P1, P2 and P3
2. Connect:
 - external 24Vdc Supply
 - external 12 Vdc Supply
 - external 12 Vdc Lead Acid Battery
 - current meter capable of reading +/-500 mA to the rear + and – “I” posts
 - DMM “#1” voltmeter to rear voltmeter posts
3. Turn on all power supplies
4. Connect a 2nd DMM voltmeter (DMM “#2”) to TP3 (+) and TPD (gnd)

Powering up ODH Main Board / Regulator Adjustment / Voltage Checks

5. Turn on switches S1 and S4 and observe voltmeter reading at TP3
6. Adjust R34 on PCB for an indication of 18.0 Vdc on the DVM. At this point the “% Oxygen” LCD should give some kind of indication that the board is powered up (0.00 to 30.0%)
7. Set rotary switch S3 to “1” and record the 9.0 Vdc regulator voltage as read on DVM #1 (9.0 +/- 0.1 V). **Note: Record and replace 9.0 Vdc regulator if out of tolerance.**
8. Set rotary switch S3 to “2” and record the 5.0 Vdc regulator voltage as read on DVM #1 (5.0 +/- 0.05 V). **Note: Record and replace 5.0 Vdc regulator if out of tolerance.**

9. Set rotary switch S3 to “3” and record the -5.0 Vdc regulator voltage as read on DVM #1 (-5.0 +/- .05 V)
10. Connect DVM #2’s positive lead to TP2 to make sure the oxygen calibration voltage = 1.393 Vdc +/- .001
Adjust R33 for an indication of “20.9%” on the LCD display. If the TP2 voltage is out of calibration, it can be adjusted by removing the bottom cover to access a small PCB with a 20-T potentiometer.
11. Connect DVM #2’s positive lead to TP1 and adjust R35 for 1.199 +/- Vdc (18.0% oxygen trip level)
12. Push test button SW2 on PCB and check hysteresis voltage reading at TP1 for an indication of 1.245 +/- .015 Vdc as long as button is held down. Release button.

Testing ODH Relay U10

13. Set rotary switch to S3 to 4 (U10 relay contacts) and DVM #1 to Ohms scale. Resistance should be 0-1 Ohms with a normal (no alarm) condition. Push test button SW2 on PCB. Resistance should now indicate an open condition and the blue strobe should be on. Release SW2.
14. Set switch S5 to “Alarm”. Blue strobe should activate and U10’s relay contacts (as observed on the Ohm meter) should still indicate 0-1 Ohms maximum. Check relay U11 if strobe does not come on.
15. While Blue strobe is ON, set Bypass switch to Bypass position and observe that the strobe light goes OFF. Set Bypass switch to OFF Bypass position and observe the strobe light comes ON.

Checking Battery Charging Current

16. Make sure switch S1 is “on”, S4 is “on” (batt in), and switch S6 to “on” (20 Ohm load). Observe DMM current meter for an indication of 400 +/- 25 mA. Current should remain at this level as long as load is in. When S6 is switched off, battery voltage will slowly recover (depending on batteries charge level), and current will taper off as battery voltage approaches 14.0 V. Voltage should eventually drop to approximately 13.6 V with a trickle charge current (when battery is fully charged). Trickle charge current to the battery will be around 30 mA, with a total current on the main supply about 180 mA (depending on switch settings) to the board. This protects the battery from a deep discharge, where it may not recover.

Low Voltage Dropout Test

U2 (a TL084ACN IC) compares the backup battery voltage to a reference (+VREF). If main power is lost to the board, the backup battery will still power the ODH circuitry until the battery voltage drops to 11.2 Vdc +/- 0.5V. At this point, U2 pin 14 will go low and turn off Q6, which will open U16 (protection relay), cutting backup power to the board.

17. Make sure S1 is “on”, Batt “EXT”, S3 rotary at “7”, S4 “on”, S5 “normal”, S6 “off”, S7 “batt”, S8 “off”, and rotary S9 at “3”.
18. First switch S4 to “off” (batt out), followed by S7 to “test” (to 12 V PS), and then turn the main power S1 to off. The ODH board should still have power with the LCD indicating a

normal % oxygen level. The board is now powered by the external 12 Vdc Supply, which is simulating a connected battery. The #1 DMM should now be reading this supply voltage. Slowly adjust the external 12V supplies potentiometer to lower the supplied voltage, while monitoring the DVM and LCD Display. Make a note and record when the LCD goes out and at what supply voltage (11.2 +/- 0.5 Vdc). You may also want to record this voltage on the PCB for future reference. Test complete.

Optional ODH Pre-Amp Tests (Board Part #C1015008)

This test requires a known good main ODH Board

Initial switch positions:

S1	“on”	
S2/batt	“ext”	
S3	“6”	(Oxy level voltage on DVM #1)
S4	“on”	
S5	“normal”	
S6	“off”	
S7	“batt”	
S8	“off”	

1. Connect ODH Pre-amp board to the test fixture. J1 should be connected to a known good KE-25 Oxygen Sensor. Connect J2 to the test fixture. To switch the pre-amp board in – place S8 “on” and rotary switch S9 to position “2” (Pre-amp board in). Adjust potentiometer R6 on pre-amp board for a reference level of 1.393 V dc at TP2 on the main ODH PCB. The LCD display should now read 19.5%.
2. Disconnect KE-25 Oxygen sensor at J1. LCD should now indicate “00.0%”, and the blue strobe should be on. Test complete.

ODH Main PCB Connector Info.

Strobe / Alarm / Meter

P1 –	1	NC
	2	strobe / alarm –
	3	meter +Vcc (5 V)
	4	meter + input
	5	meter – input
	6	meter gnd
	7	NC
	8	Strobe / arlam +

To ODH Pre-amp Board

P2 -	1	Oxy level (1.393 V = 20.9%) from pre-amp
	2	NC
	3	+Vcc (9.0 V) to pre-amp pcb
	4	NC
	5	-Vcc (-5.0 V) to pre-amp pcb
	6	NC
	7	Analog gnd

Main power / relay contacts / alarm

P3 -	1	+24 – 29 Vdc main supply voltage
	2	ODH signal from PLC
	3	+12.0 Vdc from backup battery
	4	Gnd
	5	NC
	6	ODH Relay / Alarm contact + (30 mA ODH loop U10-1)
	7	ODH Relay / Alarm contact – (30 mA ODH loop U10-7)
	8	NC
	9	NC
	10	Interlock Relay Contact + (U13-1 not currently used)
	11	Interlock Relay Contact – (U13-7 not currently used)
	12	NC