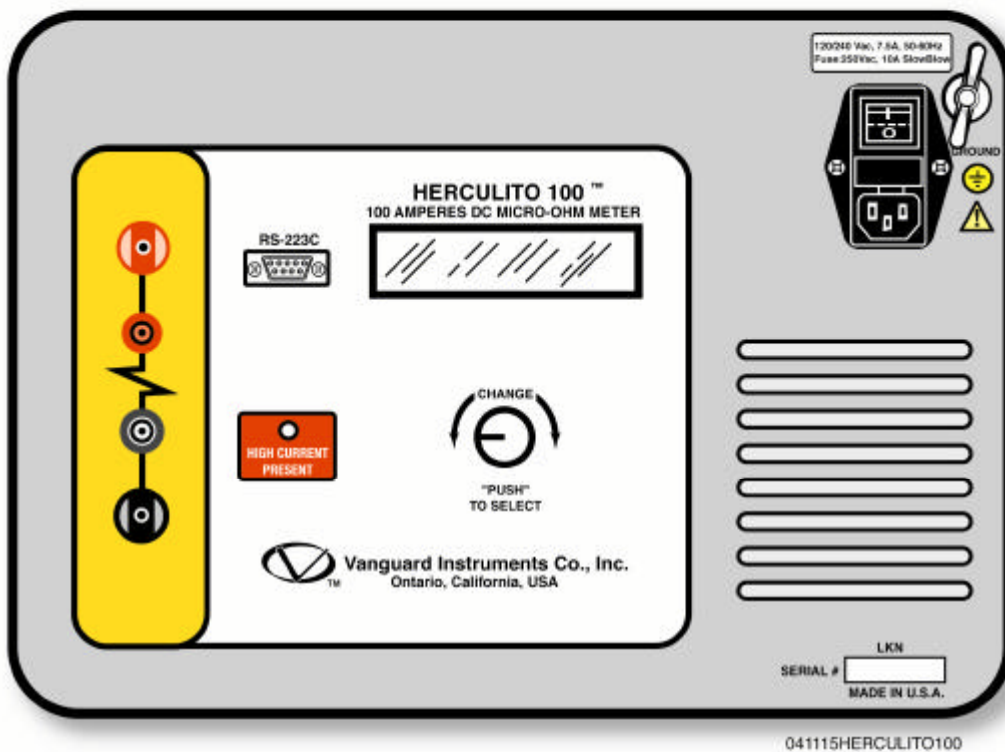

OPERATING INSTRUCTIONS
for the
HERCULITO
100 Amperes True DC
Digital Micro Ohm Meter



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SAFETY SUMMARY

SAFETY WARNINGS AND CAUTIONS

This device shall be used only by **trained operators**.
All circuit breakers under test shall be off line and fully isolated.

Follow Exact Operating Procedures

Any deviation from the procedures described in this operator's manual may create one or more safety hazards, damage the HERCULITO, or cause errors in the test results. Vanguard Instruments Co., Inc. assumes no liability for unsafe or improper use of the HERCULITO. The following safety precautions must be observed during all phases of test set-up, test hookups, testing, and test-lead disconnects.

Do Not Modify Test Equipment

Because of the risk of introducing unknown hazards, do not install substitute parts or perform any unauthorized modification to any Model HERCULITO Test unit. To ensure that all designed safety features are maintained, it is recommended that repairs be performed only by Vanguard Instruments Co. factory personnel or by an authorized repair service. Unauthorized modifications can cause serious safety hazards and will nullify the manufacturer's warranty.

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Herculito Operating Procedures

1.0 INTRODUCTION

1.1 Applicability

This manual applies to the Model Herculito, made by Vanguard Instruments Company.

1.2 General Description

The Herculito features microprocessor-controlled low resistance meter. The Herculito was designed to measure very low resistances ranging from 1 micro-ohm to 300 milli-ohms with high accuracy. The Herculito is light weight, rugged, and is easily operated by first-time users having a minimum of training. It features one-knob control and an LCD alpha/numeric display. The one-knob control operation is logical and simple: **Turning the knob** scrolls through a menu of possible options (which display in sequence) and **pressing the knob** activates the selected function. The Herculito operation is automatic, only requiring the user to connect it to an unknown resistance and selecting the desired functions and its options. The Herculito stores the last 3 resistance measurements, which can be displayed after a test.

1.3 Functional Description

The Herculito's operation is based on the electrical relationships described by Ohm's law: $R=V/I$, where I is a known current and V is the dc voltage measured across the unknown resistance (typically, a circuit breaker's contacts). Since the current flowing through the unknown resistance is known and the voltage across the unknown resistance is read by a precision voltmeter, the resistance read-out can be calculated using Ohm's law.

The Herculito's 5 Vdc test voltage is supplied by a true DC power supply. The test current is regulated by the test load and the test cables. Test current varies slightly from 80 to 100 Ampere depending on the resistance of the load.

Voltmeter test leads run separately from the current-bearing test leads to the resistive load; thus, voltages are measured at the terminals of the resistance being tested, eliminating any $I \cdot R$ voltage drop error in the current cables. This feature makes possible very precise micro-ohm measurements without having to calculate compensations for current lead resistance errors.

Note

Since the test current rise and fall time is not controlled by a current regulator circuit, precaution should be taken to eliminate any CT sensing that might inadvertently trip *Substation Bus Differential Relays*.

Herculito Operating Procedures

1.4 Furnished Test Accessories

The Herculito is supplied with two 45-foot #8 AWG test cables with heavy-duty alligator clamps. A Ground cable, power cord and a cable bag are also included with each Herculito.

1.5 Optional Accessories

An optional shipping case (which holds the Herculito and its cables) is also available.

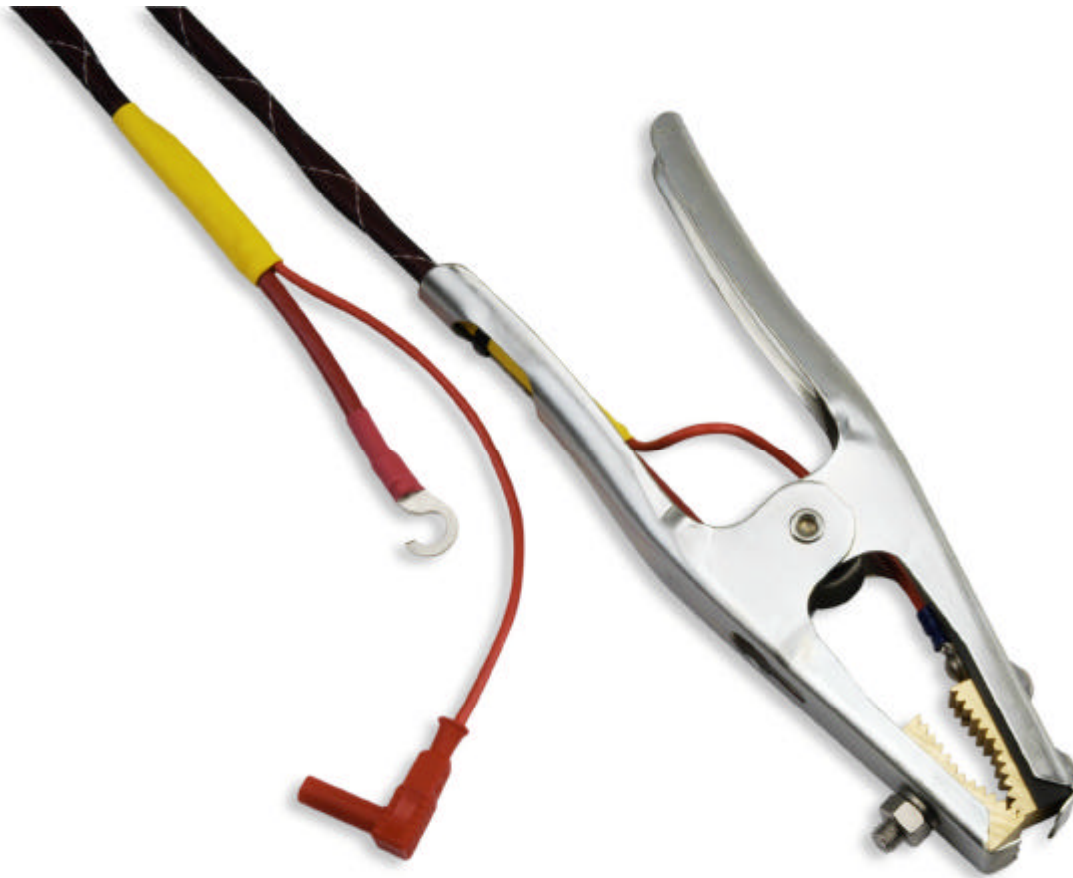


Figure 1 Herculito Current Cable

Herculito Operating Procedures

2.0 HERCULITO SPECIFICATIONS

Herculito specifications and leading particulars are listed in Table 1.

Table 1 Herculito Specifications

MODEL	Herculito
TYPE	Special-Purpose Test Equipment, Portable, Low Resistance-Ohmmeter
SIZE (inches)	17" L by 13" W by 7" H (43.2 Cm x 33 Cm x 18.8 Cm)
WEIGHT	Less than 15 pounds (6.8 Kg)
RESISTANCE RANGE	1 micro-ohm to 300 milli-ohms
TEST CURRENT RANGE	80 Amperes to 100 Amperes, Auto ranging
DISPLAY	Backlit LCD, 2-lines high by 16 characters Wide
ACCURACY	± 1 % Reading, ± 1 Count
MEMORY	Retain last 3 readings in memory during test
OPERATING POWER ...	5 amps, 90-230 Vac, 50/60 Hz.
PROTECTION	thermal-overload sensor and cutoff
COMPUTER INTERFACE	RS-232C; 19200 Baud (Diagnostic Testing)
ENVIRONMENT	Operating: 0°C to 55°C; Storage: -40°C to 65°C
FURNISHED ITEMS	One power cord, one ground cable, two 45-ft. test lead cables, and one test-cable carrying bag
WARRANTY	One-Year Parts & Labor (Post-Warranty Service Contracts Available)

HERCULITO SPECIFICATIONS ARE SUBJECT TO UPGRADES AND MAY BE CHANGED WITHOUT PRIOR NOTICE.

Herculito Operating Procedures

3.0 CONTROL AND DISPLAY

3.1 Herculito Front Panel

The Herculito controls and displays are shown in the control-panel illustration, Figure 2. Pointing leader lines reference each item with an index number. Each index number is cross-referenced to a functional description in Table 2, which describes the function and purpose of each item on the control panel. Although the purpose of these controls and the display may seem obvious and intuitive, users should become familiar with them before attempting to use the Herculito. First-time users should also review and become familiar with the Safety Summary on the front page.

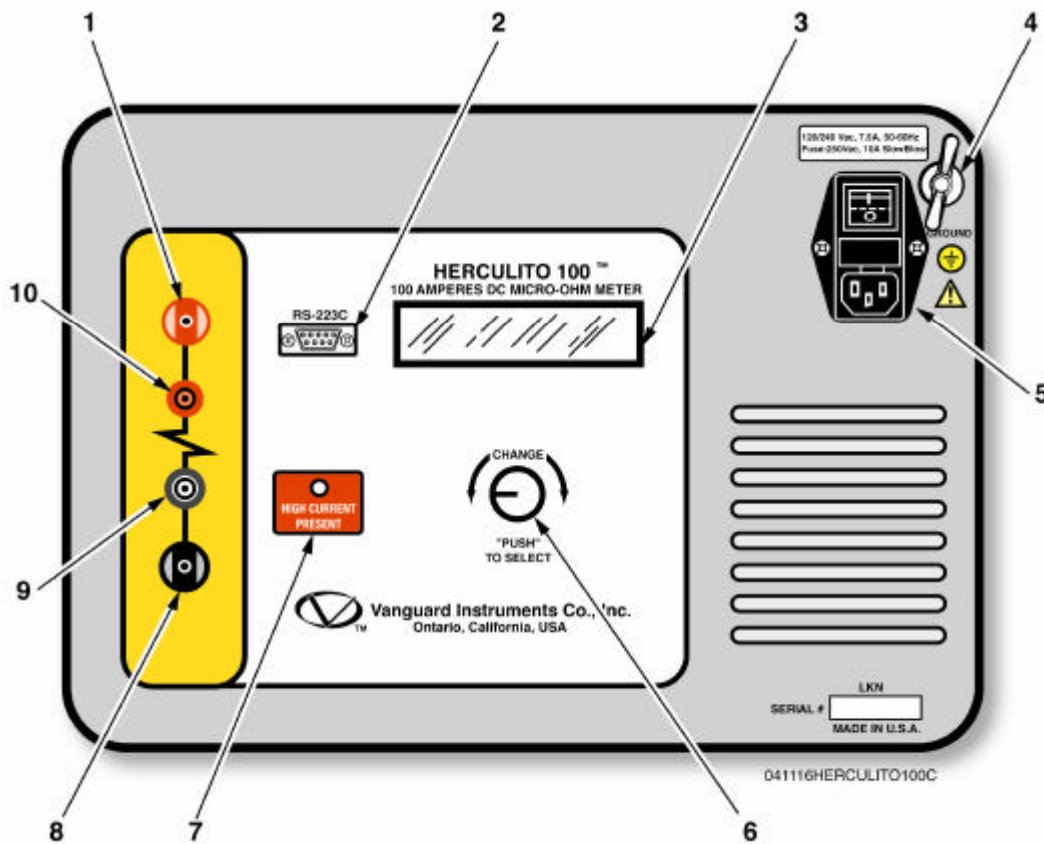


Figure 2 Herculito Front Panel

Table 2 Functional Description of Herculito Controls and Display

Figure 1 Index #	Adjacent Panel Marking	Functional Description
1,8	None	Current connector jacks.
2	RS-232C	RS-232C interface port; 9-pin connector; female DB type. The data are set to 19,200 baud, 1 start bit, 8 data bits, and no parity bit; <u>PIN</u> <u>SIGNAL</u> 2 Rx 3 Tx 5 Signal Gnd This serial port is dedicated for factory calibration and software update.
3	no marking	LCD; 2-line by 16-character; back-lighted; displays menus of selections, operator entries, and test-measurement results.
4	GROUND (Wing Nut)	Herculito ground stud. Connect ground stud to substation ground using provided cable.
5	90-230 Vac, 8A, 50- 60 Hz	Input power connector with third-wire safety ground, power switch and, fuse holder.
6	CHANGE "PUSH" TO SELECT	One-knob control (all Herculito menus and selections are controlled by this one control knob). <i>Turning this control knob scrolls through different menu options</i> (shown on the LCD), which display. <i>Pressing the knob selects</i> the displayed function, usually producing a new menu of selectable options. See Figure 8 for a summary of the step-by-step operating procedures.
7	HIGH CURRENT PRESENT	LED indicator, red; Lights when high-test-current is going through the test leads.
9 & 10	(resistor symbol)	Voltage-sensing connector jacks.

Herculito Operating Procedures

4.0 OPERATING VOLTAGES

The Herculito operates with voltages between 90-240Vac, 50/60Hz.

5.0 CABLE CONNECTION

The Herculito is supplied with two 45-foot test cables. Both cables are terminated with heavy-duty alligator clamps to connect to the device being tested. A typical cable connection for the Herculito to a device under test is shown in figure 3 and 4. To protect the Herculito against static discharge in the substation, always connect the unit's ground stud to the substation ground. It is also highly recommended to ground one side of the circuit breaker bushing during testing to eliminate any static discharge through the Herculito.

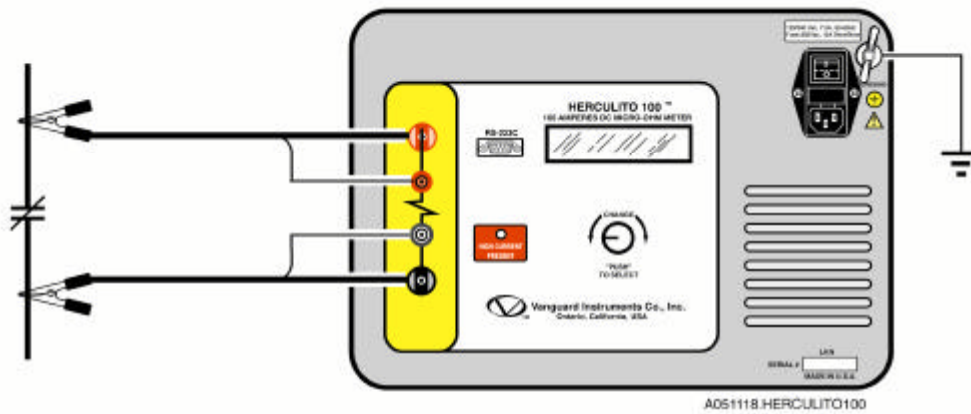


Figure 3 Herculito Connection Diagram 1

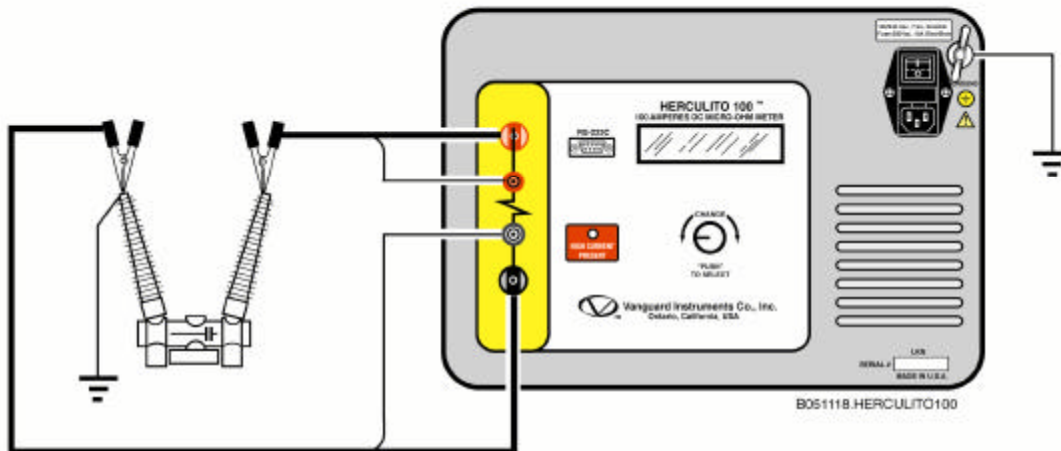


Figure 4 Herculito Connection Diagram 2

Herculito Operating Procedures

6.0 OPERATING THE HERCULITO

The Herculito is operated with one control knob. The operator turns the control knob to scroll through different menu selections on the display. When the desired option appears, it is selected by pressing the control knob like a pushbutton.

6.1 Step-by-Step Procedures

6.1.1 Precautions

CAUTION

Do not measure the resistance of inductive devices. This can generate unsafe high-voltage spikes (created by a collapsing magnetic field) if the test current is interrupted by detaching a test lead during a test. Do not touch or disconnect any test lead that is connected to a device under test while current is being conducted. ***Failure to heed this warning can result injury to the user and/or damage to the Herculito.*** The Herculito measures low, non-inductive resistances (e.g., breaker contacts and bus-bar junctions); If the resistance of an inductive device is required to be measured, then the use of an instrument designed for that purpose is recommended (such as the WRM made by the Vanguard Instruments Company).

6.1.2 Preparations

- a. Ground Herculito to Substation ground.
- b. Plug the Herculito power cable into a power outlet.
- c. Connect current-cable lugs and voltage-sensing cable plugs to control-panel (Figure 2).
- d. Attach current test-cable clamps to opposite terminals of the resistive load being tested (Figure 3 & 4).
- e. Turn on Herculito power, by pressing the rocker switch to ON.

NOTE

All Herculito operations begin at the MAIN MENU, which appears after the initial boot-up (after configuration and software revision data display briefly.) The Main Menu display is shown below:



Figure 5 Main Menu

f. The main menu displays a list of four options, which appear in sequence as the control knob is turned. The four options of the Main-Menu list are: RUN TEST, ADJ CONTRAST, CAL. CHECK.

g. When the option of choice appears in the Main Menu, press (or “Push”) the control knob to enter the selection and start that sequence. The step-by-step operating procedures that follow describe each of the selected options in the order listed above.

Herculito Operating Procedures

6.1.3 Run Test Procedure

To run a test, *turn the control knob* until RUN TEST appears on the display, *then press the control knob* to begin the procedures for running a test. The following menus prompt the user to run a test.

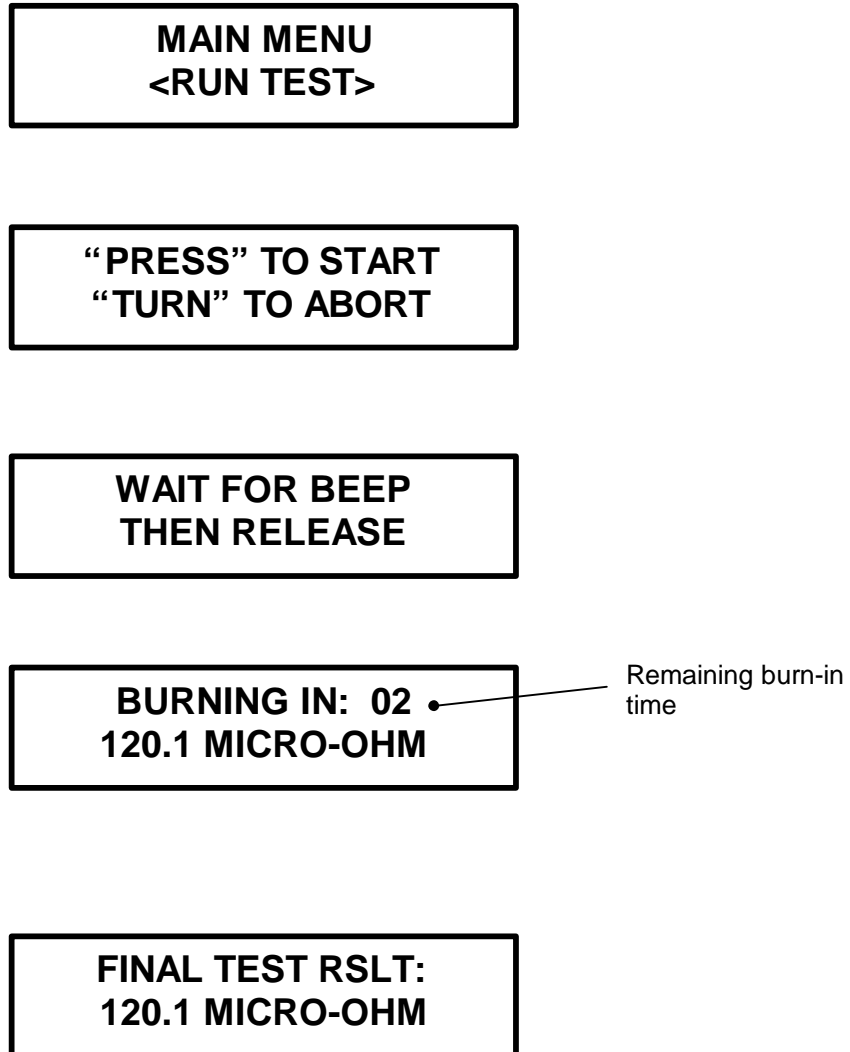


Figure 6 Run Test Menu Prompts

The above menu shows the final resistance measurement and the test current at which the resistance was measured. After the result is examined, press or turn the control knob for to return to the “MAIN MENU” menu.



Figure 7..Main menu

Herculito Operating Procedures

From the Main Menu another test can be run. If all test have been completed, turn off power to the Herculito, disconnect test leads ground cable and power cable, and stow them. This completes the procedure for performing the Herculitotest procedure.

NOTE

A “Over-Range” message may appear on the Herculito LCD if the current cables or sense cables are not connected as shown in figure 3 & 4.



FINAL TEST RSLT:
OVER-RANGE

Figure 8 Over-Range Message

6.1.6 Contrast Adjustment

The purpose of this procedure is to adjust the darkness level of the alpha-numeric characters shown on the LCD display, in order to produce the best readability for the ambient light in the testing area. To adjust the contrast, turn the control knob to select the ADJ. CONTRAST option from the Main Menu.



MAIN MENU
<ADJ. CONTRAST>

Figure 9 Select Adjust Contrast Menu

- a. Press knob to select “ADJ. CONTRAST” mode. The following menu will be shown.



ADJUST CONTRAST
“PRESS” = DONE

Figure 10 Contrast Menu

- b. Turn the control knob for the desired contrast. Press the control knob to set the contrast. The display will return to the Main Menu. The contrast setting will be recalled each time the Herculito is turned on and remain until it is changed again using this procedure.

Herculito Operating Procedures

6.1.7 Herculito Cal Check

The purpose of the Calibration Check is to verify that the Herculito is operating within acceptable specifications by running a functional check on the Herculito electronics. To Run a CAL CHECK, turn the control knob to select the CAL CHECK option from the Main Menu (see Figure11).



Figure 11 Cal Check Menu

a. Press the control knob to begin the calibration check. The following display appears.



Figure 12 Attach Short Bar Prompt

b. Attach the test leads to an unused bus bar (several inches apart, the spacing is not critical, since this is a functional check). See figure 12 for connection illustration. Press the control knob to start the test.

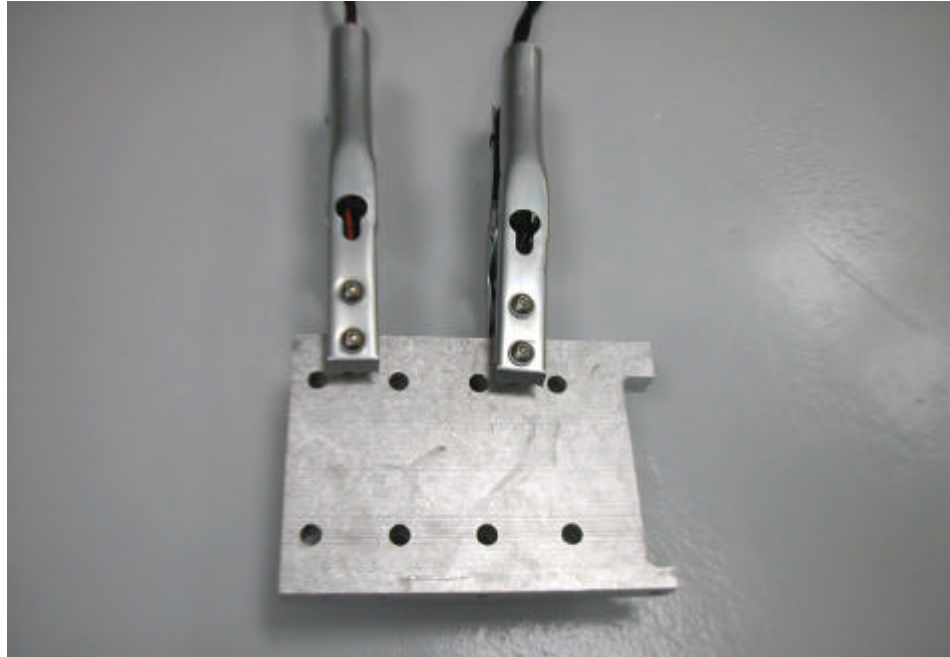


Figure 13 Calibration Connection

Herculito Operating Procedures

The following menus will be displayed when the Herculito is going through the Calibration Check

**CAL CHECK
IN PROGRESS >>>**

Cal Check in Progress

**ZERO CKT CHECK
<PASS>**

Zero Circuit Check

**FSCALE CKT CHECK
<PASS>**

Full Scale Circuit Check

**MEAS CKT CHECK
<PASS>**

Measure Circuit Check

**CAL CHECK DONE!
PRESS KEY ...**

Figure 13 Cal Check Menus

Press knob to return to main menu.

Herculito Operating Procedures

6.1.8 Display Previous Results

The purpose of this procedure is to let an operator view the last 3 readings stored in the Herculito. To view previous results, turn the control knob to select the PREV RESULTS option from the Main Menu.



Figure 14 Previous Results Menu

a. Press control knob to select this option. The user now can select any of the last three readings to be displayed. To select the reading, turn the control knob to one of the menus.



Figure 15 Select Reading Menus

b. When one of the prompts above displays, press the control knob to display its reading.



Figure 16 Test Record Readout

c. The above display shows the recorded test resistance (120.2 Micro-ohms). When the displayed record is reviewed and noted, press the control knob to return to the Main Menu. This ends the PREVIOUS RESULTS procedure.

This concludes the operating procedures for all of the Herculito functions.



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