

PLS1000CM CALIBRATION

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OVERVIEW

The calibration of the PLS1000CM (and other testers in the PLS family) consists of verifying the scale factors of the voltage readout scales by direct comparison with an accurate certified DC Voltmeter. Also verify the power supply scales by measuring the voltage across accurate certified resistors and calculating the current by Ohm's Law. The lower current scales can use the standard voltmeter to measure across the resistors. The higher current scales use the pulse reading voltmeter contained in the tester, which has first been verified by comparison with the standard DC voltmeter.

There are provisions for adjusting the zero offsets of some pulse current scales and one voltage scale by setting offset values in the tester's firmware.

Except for these offset adjustments, there are no other adjustments to be made. The tester is designed to stay within its specified accuracy indefinitely and failure to do so is considered a failure that needs to be repaired.

The resistors used should be certified to be correct within 0.1%. Otherwise you need to make corrections for the known deviations of the resistors.

DETAILED PROCEDURE. First, set the offsets in the firmware, Voltage first, then current using the procedures described below.

VOLTAGE OFFSET. Using an accurate 4 terminal 10hm resistor as the DUT, setup a VF test at 1A with a 1mS pulse width. Record the reading here _____. The reading should be approximately 1.000V but the actual observed reading is what you will use. Now replace the 1 Ohm with a 0.01 Ohm (10mOhm) 4 terminal resistor. Repeat the VF test. The average reading should be 1/100th of the reading recorded above within ± 1 digit. Of course there may be some rounding related to dividing by 100. Use the nearest digit. For example, if the first reading is 0.998V the expected low reading to average 0.010 Volts. The readings will normally bounce +/- 2 mV so use the average. If the average is off greater than 1 digit then the Voltage offset should be adjusted.

To access the offset adjustments, first press the "reset" button on the front panel or cycle the power off then on. Then press the "1" key on the keypad. First you will see offsets labeled "Offset_1, the 2, then 3. Skip over these by pressing the # key to accept the current setting. Then you will come to "Read offset". Note the current setting then press * to indicate you wish to change it. Then enter a new value to correct the error noted above. Each digit changes the reading by 1mV. Press # to accept your new setting and then repeat the test above to confirm that you have corrected the offset. You will use this procedure again later with some minor changes to correct current offsets 1, 2, and 3.

CURRENT OFFSETS 1, 2. For currents between 6A and 25A, the tester uses pulser 1 and pulser 2 alternately. It is important to keep track of which pulser is being used so that the correct offset is being adjusted. After a "reset", pulser # 1 will be used first. These tests will use VF tests with pulse widths of 1mS. The DUT will be a 100mOhm resistor. The currents will be 6.1A and 24.4A.

First reset the tester (or cycle the power off/on) the set up VF at 24.4A, 1mS. <3V using the 100mOhm resistor. Take and record 2 readings #1 _____ #2 _____. Now reset the tester again and set up VF at 6.1A, 1mS <3V.

Take 2 more readings. #1 _____ #2 _____

The second set of readings should be 25% of the first set ± 4 digits. If not you should perform a firmware offset adjustment similar to the voltage offset except adjust Offset 1 and/or Offset 2. Be sure to run the tests above again to check your adjustments and repeat if necessary.

CURRENT OFFSET 3. Above 25A, both pulsers are used in parallel. The offset adjustment is similar. Use a VF test with a width of 1mS with 10mOhm, and 100mOhm resistors. First set up VF at 300A, 1mS, <3V with the 10mOhm resistor. Record the reading _____.

Now change to 30A, 1mS, <3V with the 100mOhm resistor. Record the reading _____.

The readings should be the same within 10mV. If not, perform the firmware adjustment for Offset 3 and then recheck and repeat if necessary.

CALIBRATION CHECK. After successfully completing the preceding Offset adjustment the operation of the tester should be checked using the form found on the next 6 pages. The offset numbers that you have set using this procedure should be recorded in case they are changed or lost in some kind of hardware failure.

PLS1000 SERIES VR and IF CALIBRATION CHECK

From LCD Keypad

Following this procedure on an annual basis will insure that the Voltage Readout and Current programming of the PLS1000 series is calibrated and functioning normally. Standard components with recorded readings should be kept and tested at a frequent basis to insure the tester is working properly. This is not meant as a procedure for calibration. See the **manual and perform the worksheet on VR and IF offset trimming before doing this Calibration check**. Any major Deviation from the expected reading is usually caused by a component failure. Call or email Frothingham Electronics if any deviations considered a problem occur.

Voltage Readout Check

Connect an accurate calibrated DVM to the sense terminals of the resistors and perform these tests using accurate plug in resistors provided by FEC. Take note of the % difference between what the tester reads and what the reading is on the DVM. The readings should agree to within 2mV or 0.5% of the reading.

Choose Test VF Current 1A Pulse width 3000Ms	Expected reading	Reading at keypad	Reading at DVM	% or mV Deviation
	DUT 10 milli Ohm 4 terminal	0.010V		
	DUT 1.0 Ohm 4 terminal	1.00V		

Choose Test VF Current 0.5A Pulse width 3000mS	Expected reading	Reading at keypad	Reading at DVM	% Deviation
	DUT 10 Ohm 4 terminal*	5.00V		

Choose Test VF Current 0.8A Pulse width 3000mS	Expected reading	Reading at keypad	Reading at DVM	% Deviation
	DUT 10 Ohm 4 terminal*	8.00V		

* An accurate calibrated Decade box can be substituted for a 10ohm plug in resistor. Be sure to use 4 wires to connect the tester terminals to the Decade box. Do not connect Force to Sense at the tester. Remember the point here isn't the accuracy of the reading according to ohm's law, but the ability of the voltage readout of the tester to agree with your standard DVM.

Now that you have checked the Voltmeter of the PLS to read accurately with long pulses you will check its ability to read short pulses. The tests are the same as above except you will change the pulse width to 1ms and disconnect your DVM. Expect the readings to repeat the earlier readings within 2mV or 1.0%.

Choose Test VF Current 1A Pulse width 1mS	Expected reading	Reading at keypad	Previous reading at 3000ms	% Deviation
	DUT 10 milli Ohm 4 terminal	0.010V		
DUT 1.0 Ohm 4 terminal	1.00V			

Choose Test VF Current 0.5A Pulse width 1mS	Expected reading	Reading at keypad	Previous reading at 3000ms	% Deviation
	DUT 10 Ohm 4 terminal*	5.00V		

Choose Test VF Current 0.8A Pulse width 1mS	Expected reading	Reading at keypad	Previous reading at 3000ms	% Deviation
	DUT 10 Ohm 4 terminal*	8.00V		

The remaining tests will check the forcing currents assuming the voltmeter in the PLS has been confirmed with the preceding tests. You will not need the DVM connected to the DUT, as you will use much shorter pulse widths

Current Check 400mA range

Expect readings to be within 2mV or 1.0%

Choose Test VF Current 10mA Pulse width 3mS	Expected reading	Reading at keypad	% Deviation
	Decade Box 10 Ohm setting	0.100V	

Choose Test VF Current 400mA Pulse width 3mS	Expected reading	Reading at keypad	% Deviation
	DUT 1.0 Ohm 4 terminal	0.400V	

Current Check 4A range

Expect readings to be within 2mV 1.0%

Choose Test VF Current 0.50A Pulse width 3mS	Expected reading	Reading at keypad	% Deviation
	DUT 1.00 Ohm 4 terminal	0.500V	

Choose Test VF Current 2.00A Pulse width 3mS	Expected reading	Reading at keypad	% Deviation
	DUT 1.00 Ohm 4 terminal	2.00V	

Choose Test VF Current 4.00A Pulse width 3mS	Expected reading	Reading at keypad	% Deviation
	DUT 1.00 Ohm 4 terminal	4.0V	

Current Check 40A range (note: only used to 6A)

Expect readings to be within 2mV or 1.0%

Choose Test VF Current 6.0A Pulse width 3mS	Expected reading	Reading at keypad	% Deviation
	DUT 100 milli Ohm 4 terminal	0.600V	

Current Check 8A / 24A

The next 2 tests will use the 2 high current output modules alternately with each test. Take several readings noting the difference as each module is used alternately. Expect each reading to be within 1.0% of each other and the expected reading. Take the exact value of the standard resistor into account when it is known.

Choose Test VF Current 8A Pulse width 1mS	Expected reading	2 Readings at keypad		Worst case Deviation
	DUT 100 milli Ohm 4 terminal	0.800V		

Choose Test VF Current 24A Pulse width 1mS	Expected reading	2 Readings at keypad		Worst case Deviation
	DUT 100 milli Ohm 4 terminal	2.40V		

Current Check 1000A

The next tests will use the 2 high current output modules in parallel. Expect each reading to be within 1.0% of the expected reading. Take the exact value of the standard resistor into account when it is known.

Choose Test VF Current 100A Pulse width 1mS	Expected reading	Reading at keypad	% Deviation
	DUT 5.0 milli Ohm 4 terminal	0.50V	

Choose Test VF Current 400A Pulse width 1mS	Expected reading	Reading at keypad	% Deviation
	DUT 5.0 milli Ohm 4 terminal	2.00V	

Choose Test VF Current 1000A Pulse width 1mS	Expected reading	Reading at keypad	% Deviation
	DUT 5.0 milli Ohm 4 terminal	5.00V	

IM Current Check PLS1000C and earlier

Expect readings to be within 1.0% or 1mV

Decade box setting 100 Ohm			
IM setting	Expected reading	Reading at keypad	% Deviation
10 mA	1.00 V		
15 mA	1.50 V		

Decade box setting 10 Ohm			
IM setting			
25 Ma	0.250 V		

IM Current Check PLS1000CM

Expect readings to be within 1.0% or 1mV

Choose Test IMCHK			
DUT 10 Ohm			
IM setting			
1mA	0.010V		
10mA	0.100V		
50 Ma	0.500 V		
100 mA	1.00 V		
150 mA	1.50 V		

DUT 1 Ohm			
IM setting			
250 mA	0.250 V		