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# **v3000 FC**

Wireless AC Voltage

## Calibration Manual

July 2014

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## ***Introduction***

### **Warning**

**Read "Safety Information" before you use the Product.**

This manual has the verification and calibration adjustment procedures for the v3000 FC Wireless AC Voltage module (the Product). Please see the *v3000 FC Quick Reference Guide* for usage information.

## Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

### Warning

To prevent possible electrical shock, fire, or personal injury:

- Carefully read all instructions.
- Use the Product only as specified, or the protection supplied by the Product can be compromised.
- Limit operation to the specified measurement category, voltage, or amperage ratings.
- Do not touch voltages > 30 V ac rms, 42 V ac peak, or 60 V dc.
- Do not use the Product around explosive gas, vapor, or in damp or wet environments.
- Do not use the Product if it is damaged.
- Disable the Product if it is damaged.
- Do not use the Product if it operates incorrectly.
- The battery door must be closed and locked before you operate the Product.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.
- Have an approved technician repair the Product.
- Use only specified replacement parts.
- Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.
- Measure a known voltage first to make sure that the Product operates correctly.
- Do not work alone.
- Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.
- Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.
- Use only correct measurement category (CAT), voltage, and amperage rated probes, test leads, and adapters for the measurement.
- Do not use test leads if they are damaged. Examine the test leads for damaged insulation, exposed metal, or if the wear indicator shows. Check test lead continuity.
- Keep fingers behind the finger guards on the probes.

- Connect the common test lead before the live test lead and remove the live test lead before the common test lead.
- Remove the input signals before you clean the Product.
- Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.











For safe operation and maintenance of the Product:

- Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.
- Repair the Product before use if the battery leaks.
- Be sure that the battery polarity is correct to prevent battery leakage.
- Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.

## Symbols

The symbols in Table 1 are used on the Product or in this manual.

Table 1. Symbols

Symbol	Meaning
	Risk of Danger. Important information. See Manual.
	Hazardous voltage
	Double insulation
	Battery
	Earth ground
	Conforms to relevant South Korean EMC standards.
CAT III	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.
CAT IV	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.
	Conforms to European Union directives.
	Conforms to relevant North American Safety Standards.
	Conforms to relevant Australian EMC requirements.
	This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.

## Specifications

Accuracy is specified as  $\pm$ ( [% of reading] + [number of least significant digits] ). All ranges are autoranging. Accuracy is specified from 1 % to 100 % of the range obtained by autoranging, from 18 °C to 28 °C.

### AC Voltage

Range	Resolution	Accuracy <sup>[1][2][3]</sup>	
		45 Hz to 500 Hz	500 Hz to 1 kHz
6.000 V	0.001 V	1.0 % + 3	2.0 % + 3
60.00 V	0.01 V		
600.0 V	0.1 V		
1000 V	1 V		
[1] Crest factor of $\leq 3$ at full scale to a maximum of 4000 counts, decreasing linearly to crest factor $\leq 1.5$ at full scale. [2] For non-sinusoidal waveforms, add $-2\%$ of reading + $2\%$ full scale) typical, for crest factor to a maximum of 3. [3] Do not exceed $10^6$ V-Hz			

### General

LCD w/Backlight.....	3 ½ digits, 6000 counts, 4/sec update rate
Log Rate/Interval.....	adjustable by PC from 1 second to 1 hour, default is 1 minute
Memory.....	Record up to 65 000 readings
Battery Type.....	2 AA, NEDA 15 A, IEC LR6
Battery Life.....	400 hours
Radio Frequency Communications.....	2.4 GHz ISM Band
Radio Frequency Communication Range.....	20 m (66 ft)
Operating Temperature.....	-10 °C to +50 °C, (14 °F to 122 °F)
Storage Temperature.....	-40 °C to +60 °C, (-40 °F to 140 °F) with batteries removed
Operating Humidity .....	90 % from 0 °C to 35 °C, 45 % to 40 °C, 45 % to 50 °C (90 % from 32 °F to 95 °F, 45 % to 104 °F, 45 % to 122 °F)
Operating Altitude .....	2 000 m (6 561 ft)
Storage Altitude .....	12 000 m (39 370 ft)
Ingress Protection (IP) rating .....	IP42
Safety.....	IEC 61010-1, Pollution Degree 2 IEC 61010-2-033:Measurement 1000V CAT III/600V CATIV
Electromagnetic Compatibility.....	Radio Frequency Emissions, IEC CISPR 11: Group 1, Class A. Group 1 have intentionally generated and/or use conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.  Class A equipment is suitable for use in non-domestic locations and/or directly connected to a low-voltage power supply network. Class A equipment may have potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbances.  Applies to use in Korea only ..... Class A Equipment (Industrial Broadcasting & Communication Equipment)  This product meets requirements for industrial (Class A) electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and is not to be used in homes.
Electromagnetic Environment.....	IEC 61326-1: Portable
Temperature Coefficient .....	0.1 X (specified accuracy)/ °C (<18 °C or >28 °C)
Size.....	160 mm x 66 mm x 38 mm (6.3 in x 2.6 in x 1.5 in)
Weight.....	0.255 kg (9 oz)

## Required Equipment

The equipment in Table 2 is necessary for performance tests and calibration adjustment.

Table 2. Required Equipment

Recommended Equipment	Function	Required Characteristics
Fluke 5522A Calibrator (or equivalent)	AC Volts	6 mV to 1000 V ±0.25 % @ 45 Hz to 1 kHz

## Performance Tests

### ⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, do not perform the performance test procedures unless the Product is fully assembled.

The performance tests verify the full operation of the Product and measure the accuracy of each function against Product specifications. If the Product fails a part of the test, calibration adjustment and/or repair is necessary. See “Calibration Adjustment”.

### Test the Display

To verify that all segments of the display function:

1. With the Product off, push and hold **LOG**.
2. Push **⏏** while you keep **LOG** pushed until all of the display segments are shown. See Figure 1.

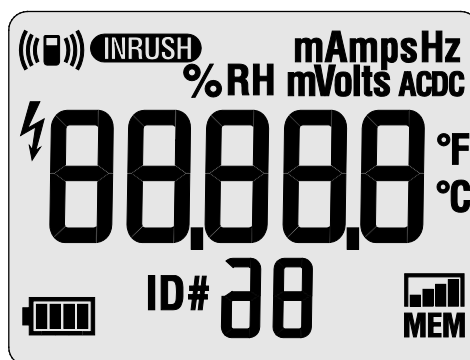



Figure 1. All Segments of the Display

hby002.eps

If segments of the display are missing, repair is necessary. See “Contact Fluke”.

### Backlight

To verify that the backlight functions:

1. With the Product on, push .
2. The backlight will come on. If it does not, repair is necessary. See “Contact Fluke”.

### Keypad Test

To verify that the keypad functions, turn on the Product and push each button separately. Each button push will turn on a display annunciator. If the buttons do nothing, repair is necessary. See “Contact Fluke”.

### AC Voltage Test

Before you do the ac voltage test:

1. Make sure that you have the necessary equipment. See Table 2.
2. Make sure the Product battery is good and replace it if necessary. See “Battery Replacement”.
3. Warm up the Calibrator as necessary. Refer to its specifications.
4. Let the temperature of the unit under test (UUT) become stable to room temperature.

To do the ac voltage test:

1. Connect the Product to Calibrator COM and VAC jacks. See Figure 2.
2. Apply the input level for each step shown in Table 3.
3. Compare the indication on the Product display with the UUT reading limits in Table 3.
4. If the display indication falls outside of the range shown in Table 3, calibration adjustment or repair of the Product is necessary. See “Calibration Adjustment”.

**Table 3. Performance Tests**

Test	Calibrator Output	Resolution	Specification	Low	High
AC Volts	0.060 V, 45 Hz	0.001 V	$\pm[1.0 \% + 3]$	0.056	0.064
	0.600 V, 500 Hz	0.001 V	$\pm[1.0 \% + 3]$	0.591	0.609
	6.000 V, 1000 Hz	0.001 V	$\pm[2.0 \% + 3]$	5.877	6.123
	35.00 V, 45 Hz	0.01 V	$\pm[1.0 \% + 3]$	34.62	35.38
	60.00 V, 1000 Hz	0.01 V	$\pm[2.0 \% + 3]$	58.77	61.23
	75.0 V, 500 Hz	0.1 V	$\pm[1.0 \% + 3]$	74.0	76.0
	600.0 V, 1000 Hz	0.1 V	$\pm[2.0 \% + 3]$	587.7	612.3
	1000 V, 1000 Hz	1 V	$\pm[2.0 \% + 3]$	977	1023

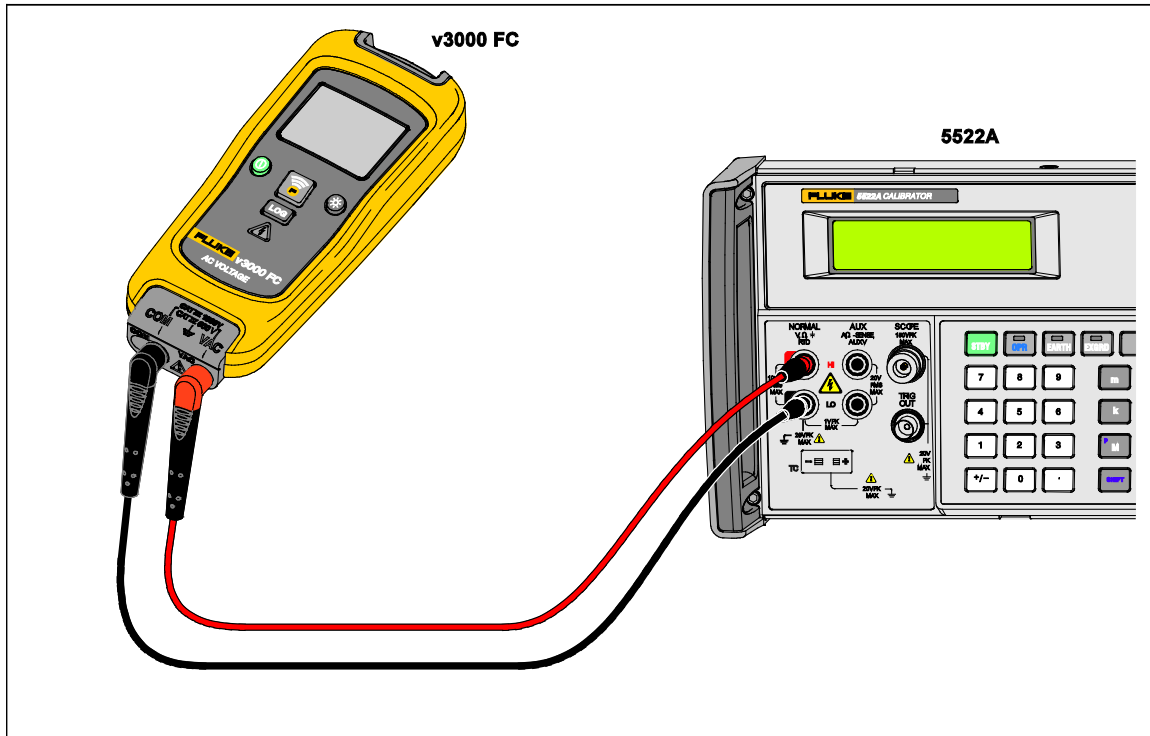


Figure 2. Performance Test Connections

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## Before Calibration Adjustment

Before the Product calibration can be adjusted, you must go through the maintenance mode menu and enter your password.

### Maintenance Mode

The Product maintenance mode can be used to set different parameters on the Product that include auto power off, backlight adjustment, and calibration. To use the maintenance mode:





1. With the Product on, push and hold **LOG**.
2. Push **ENTR**. Keep **LOG** pushed until all the display segments are shown.
3. Release **LOG** and **ENTR**.

The Product is now in maintenance mode.

### Password Entry

To go to the calibration mode, push **LOG** five times until **CAL** is shown. You will need to enter a password to access calibration mode.

To enter the password:

1. Push  and the CAL counter is shown. For example **n002**.
2. Push  to show “????”.
3. Push **LOG** to change the first digit of your password (default: 1234).
4. Push  to confirm your choice. The subsequent “?” changes to “\_”.
5. Do steps 3 and 4 again to enter the subsequent digits of the four-number password.
6. When all of the correct digits are entered, push  to confirm the input.





If the correct password is entered, “**C-01**” is shown. If the incorrect password is entered, “????” is shown and the password must be correctly entered.

### Change the Password

#### Note

*If you change the password and then lose it, see the “Restore the Default Password” section.*

To change the password:

1. Do steps 1 through 5 in the “Password Entry” section.
2. Before you push  to confirm your final input (step 6), push  to show “----” on the display.
3. Push **LOG** to change the first “-” to the first digit of your new password.
4. Push  to confirm your choice.
5. Repeat steps 3 and 4 to enter the subsequent digits of the new four-number password.
6. When the correct digits are entered, push  to confirm the input and change the password. If the Product has been calibrated, it will go to normal measurement mode.



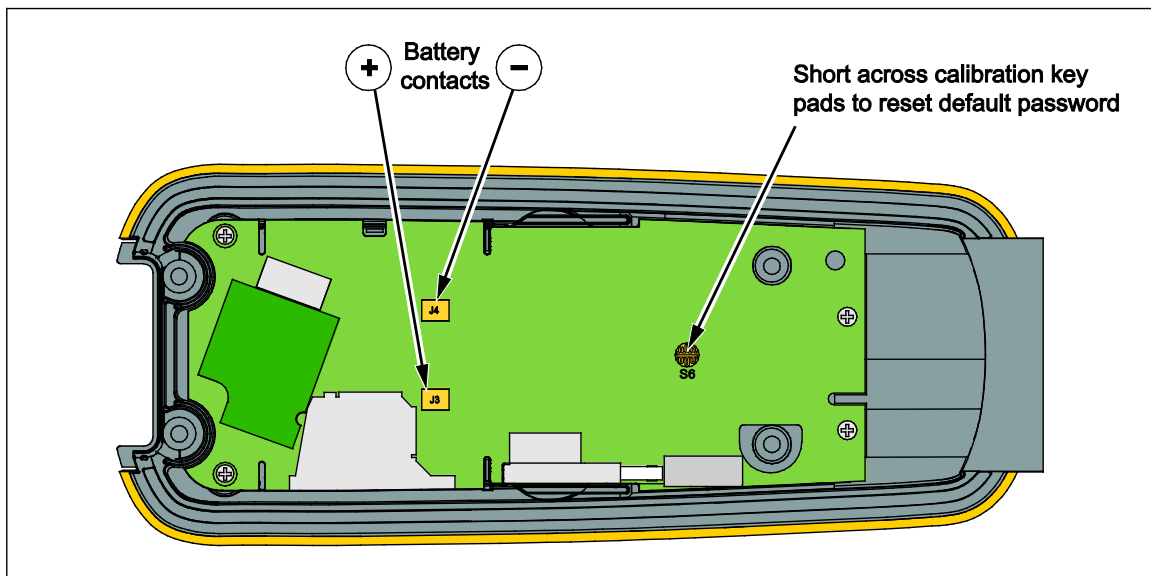
### **Restore the Default Password**

If the calibration password is lost, the default password (1234) can be manually restored with the subsequent steps:

#### **⚠️⚠️ Warning**

**To prevent electric shock or personal injury, remove all input signals before you open the Product.**

1. Remove the Product battery door. See “Battery Replacement”.
2. With a Phillips screwdriver, remove the bottom case screws. Two of the screws are inside of the battery door.
3. Keep the pca in the top case.
4. Apply 3.0 V across the battery contacts on the pca. Note the polarity that is shown in Figure 3.
5. Push on the front of the Product.
6. Short across the CAL keypad on the pca. See Figure 3. The default password is now restored.
7. Remove the 3.0 V supply and replace the bottom case, batteries, and battery door.





**Figure 3. Calibration Password Reset**

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## Calibration Adjustment


The Product features closed-case calibration adjustment and uses known reference sources. The Product measures the applied reference source, calculates correction factors, and stores the correction factors in nonvolatile memory.

Should the Product fail any of the performance tests, do the calibration adjustment procedure.

When “**C-01**” is shown on the display, apply the correct input signal shown in Table 4 to the Product. Then push  to confirm the calibration step. If the input signal does not satisfy the calibration requirement, “**Err**” is shown. If the signal is not stable, it can be necessary to push  several times to confirm the calibration.

After confirmation, the Product goes to the subsequent calibration step.

### Note

*After you push , wait until the calibration step number advances before you change the Calibrator source. Some adjustment steps can take several seconds to execute before the Product goes to the subsequent step.*

*Set the calibrator to Standby after you complete adjustment of each function.*

Input each signal to the Product in the sequence shown in Table 4. When the last calibration point is recorded, “**End**” shows on the display.

### Note

*While the calibration adjustment points are shown in Table 4, the Product also can show the necessary inputs. For each step, push **LOG** to see the necessary voltage input. The necessary frequency for all steps is 55 Hz.*

Table 4. Calibration Adjustment

Calibration Step	Calibrator Output Signal
C-01	60 mV ac, 55 Hz
C-02	600 mV ac, 55 Hz
C-03	6 V ac, 55 Hz
C-04	60 V ac, 55 Hz
C-05	600 V ac, 55 Hz

## **Maintenance**

### **Clean the Product**

#### **⚠ Caution**

To prevent possible damage to the Product or to equipment under test, do not use abrasive cleaners. They will damage the case.

To clean the Product, use a cloth with a mild cleaning solution.

### **Battery Replacement**

#### **⚠⚠ Warning**

To prevent possible explosion, fire, or personal injury, replace the batteries when the low battery indicator ( ) shows to prevent incorrect measurements.

#### **⚠ Caution**

To prevent possible damage to the Product or to equipment under test:

- Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.
- Be sure that the battery polarity is correct to prevent battery leakage.

To change the batteries, see Figure 4:

1. Make sure the Product is OFF.
2. Turn over the Product to access the battery compartment door screw.
3. Use a Phillips screwdriver to loosen the battery compartment door screw and lift off the battery compartment door.
4. Replace the two AA batteries. Make sure to use the correct polarity when you put the batteries into the battery compartment door.
5. Reattach the battery compartment door.
6. Tighten the battery compartment door screw.

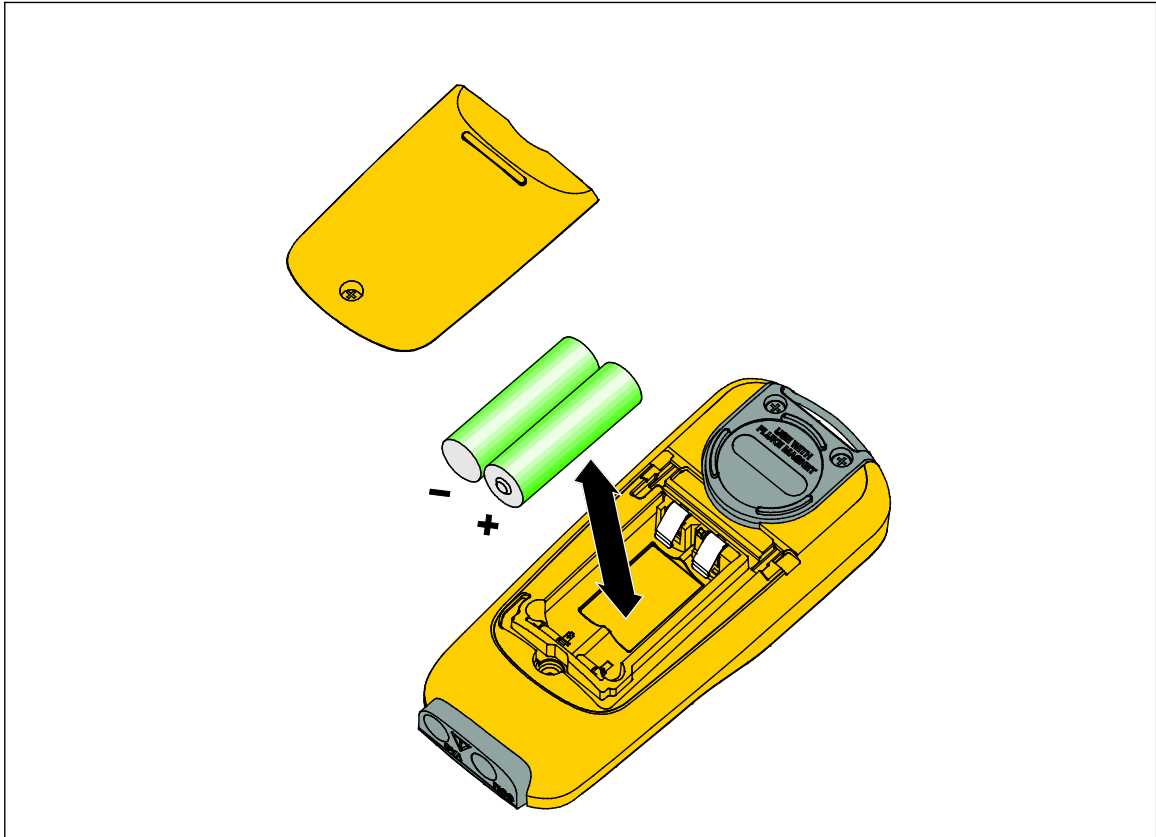


Figure 4. Battery Replacement

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## User-Replaceable Parts

User-replaceable parts are shown in Table 5.

Table 5. User-Replaceable Parts

Fluke Part Number	Description	Qty
4130305	FLK-3000-2003, DOOR, BATTERY	1
1881997	TPAK Meter Hanging Kit	1
variable <sup>[1]</sup>	TEST LEADS	2
variable <sup>[1]</sup>	LARGE ALLIGATOR CLIP BLACK, BULK	1
variable <sup>[1]</sup>	LARGE ALLIGATOR CLIP RED, BULK	1
376756	Battery, AA 1.5 V, NEDA 15 A, IEC LR6	2
4466335	INFORMATION PACK, FLK-V3000/V3001 FC	1