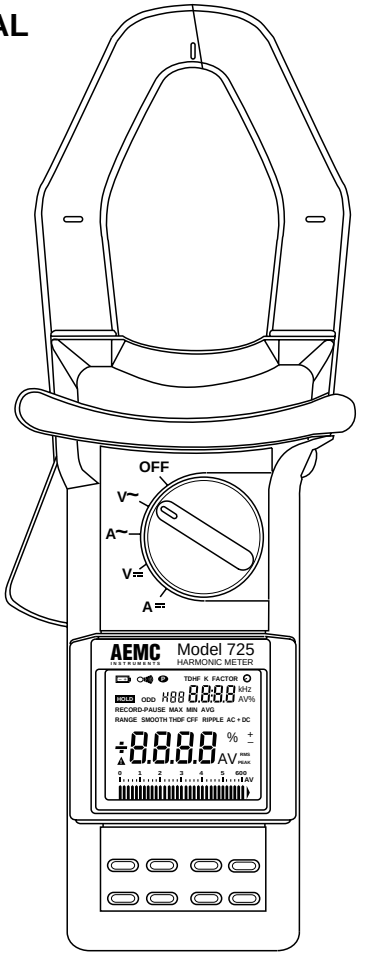
Clamp-On Harmonic Probe
Model 725

USER MANUAL



AEMC®
INSTRUMENTS

Owner's Record

The serial number is located inside the battery compartment of your instrument. Please record this number and purchase date for your records.

MODEL #725

CATALOG #2111.39

SERIAL #:_____

PURCHASE DATE:_____

DISTRIBUTOR:_____

Table Of Contents

Warning

These safety warnings are provided to ensure the safety of personnel and proper operation of the instrument.

- Read this instruction manual completely before attempting to use or service this instrument, and follow all the safety information.
- Use caution on any circuit: Potentially high voltages and currents may be present and may pose a shock hazard.
- The instrument must not be operated beyond its specified operating range. **Never exceed 1000 Arms/1500 A DC or 600 Volts.**
- Safety is the responsibility of the operator.
- Never open the back of the instrument while connected to any circuit or input.
- ALWAYS make connections ***from*** the instrument ***to*** the circuit under test.
- ALWAYS inspect the instrument and accessory leads for serviceability prior to use, and replace defective parts immediately.
- Never use the Model 725 on electrical conductors rated above 600 Vrms.

International Electrical Symbols

⧈ This symbol signifies that the Model 725 is protected throughout by double or reinforced insulation. Only use specified replacement parts when servicing the meter.

⚠ This symbol signifies CAUTION! and requests that the user refer to the user manual before using the meter.

Receiving Your Shipment

Upon receiving your shipment, be sure that the contents are consistent with the packing list. Notify your distributor of any missing items. If the equipment appears to be damaged, file a claim immediately with the carrier and notify your distributor at once, giving a detailed description of any damage.

Packaging

The Clamp-On Harmonic Meter Model 725 (Cat. #2111.39) includes four 1.5 V "AA" alkaline batteries, two 5 ft (1.5 m) leads, two test probes, two grip probes, user manual and a hard carrying case.

Description

The Clamp-On Harmonic Probe Model 725 is a portable, battery operated power quality instrument. The Model 725 combines the simplicity and familiarity of digital clamp-ons with today's critical information on power quality and harmonics.

Operation is simple and direct. Select Amps/Volts, AC or DC on the rotary dial, connect, and measure. The push of a button gives additional or more specific information. You can troubleshoot and measure power quality with the ease of using a digital clamp-on, simply, safely, and economically.

The Model 725 performs current and voltage measurements in True RMS as well as current and voltage in DC, and provides immediate readings of Total Harmonic Distortion (%THD), Individual Harmonic orders through the 25th, Distortion Factor (%DF), Crest Factor (CF) and Peak of distorted currents and complex voltages. It also gives the minimum, maximum, maximum Peak and average measurement values so you can record for over 24 hours with an internal clock logging record time. Frequency (Hz) can be measured through either the current or the voltage at any time for the fundamental as well as the individual harmonic orders.

The Model 725 incorporates True RMS electronics and measurement techniques to ensure correct and accurate readings on distorted waveforms. The DC functions incorporate the latest in Hall effect technology. Use the Model 725 as a comprehensive tool for troubleshooting as well as for daily measurements on circuits supplying traditional and today's non-linear loads.

The Model 725 provides:

- Smooth for a 3-second measurement running average for stable readings
- Range selection for auto or manual ranging
- Peak AC & DC measurements (positive & negative)
- % Ripple for DC measurements
- Crest Factor for half cycle peaks
- Hold function for "locking" displayed value
- Display selection of AC or DC + AC measurements
- Transformer Harmonic Derating Factor (THDF)
- Selection of even & odd or odd individual harmonics
- Identifies proper (K-Factor) rating for transformers
- Auto-OFF shuts off the instrument after 10 minutes of non-use
- A 31-segment analog bar graph provides indications to track fast variations
- Beeper function for verification of control, new MIN/MAX capture
- Battery voltage test indicates current battery status
- Low battery indicator indicates when battery replacement is required

Beyond the absolute product ruggedness and overall design qualities — the Model 725 is built with GE Lexan® and meets specific physical standards — the instrument features a high level of safety. The Model 725 meets or exceeds UL 1244 safety standards as well as IEC 1010-1 Category III for 600 V ratings (UL®, CSA, VDE, GS and CE approvals pending).

The Model 725 is comfortable to hold, compact and easy to maneuver in crowded breaker panels. Yet the hooked jaw design facilitates clamping and accommodates two 500 MCM conductors.

The high sensitivity Model 725 allows low input levels (300 mA and 50 mV), permitting power quality measurements on low power or idling equipment — an advantage not common to many instruments.

Specifications

ELECTRICAL SPECIFICATIONS

Reference Conditions:
Accuracies are provided under the following reference conditions: Temperature 23°C ± 3K, 45% to 75% RH; battery voltage 6 V ± 0.1 V; conductor centered in the probe jaws; DC magnetic field: earth's field (<40 A/m); no external AC magnetic field; no external electrical field; sine wave 45 to 65 Hz; signal present <30s above 50 A. In THD and DF, the basic accuracy is provided for a square wave and a triangular wave with 50% duty cycle at 50 or 60 Hz. Particular reference conditions: In DC amperes, the AC component <0.1% of total signal, zeroed core remanence and signal magnitude >5 A; in AC amperes the signal is a sine wave of magnitude >5 A.

R refers to Reading and ct(s) to count(s). Counts may also be referred to as the least significant digits (LSD).

AC CURRENT (TRMS)

Input Range:
0.3 to 1000.0 Arms
± 0.5 to ± 1500.0 A peak

Basic Accuracy:
0.3 to 59.99 A: 2% R ± 20 cts
60 to 1500 Apeak: 2% R ± 2 cts

Crest Factor: > 5 below 300 A

Frequency Range: 0.5 Hz to 5 kHz

AC VOLTAGE (TRMS)

Input Range: 0.05 to 600 Vrms
± 0.05 to ±1500 V Peak

Basic Accuracy: 0.05 to 59.99 V: 1% R ±10 cts
60 to 1500 V peak: 1%R ±2 cts

Input Impedance: 1 MΩ

Frequency Range: 0.5 Hz to 5 kHz

DC CURRENT

Input Range: ± 0.03 to ± 1500 A DC
± 0.05 to ± 1500 A Peak

Basic Accuracy: ± 0.3 to ± 59.99 A: 2% R ± 20 cts
± 60 to ± 1500 A: 2% R ± 2 cts

DC VOLTAGE

Input Range: ± 0.05 to ±600 V

Basic Accuracy: 0.05 to 59.99 V: 1% R ±10 cts
60 to 1500 V peak: 1% R ±2 cts

Input Impedance: 1 MΩ

TOTAL HARMONIC DISTORTION (%THD)

Range: 0.2% to 1000%

Resolution: 0.1%

Basic Accuracy: 0.2% to 600% THD: 5%R ± 2cts

Frequency Range: Fundamental 40 Hz to 70 Hz

Display: Digital: %THD and True RMS (A or V)
Bar graph: True RMS (A or V)

DISTORTION FACTOR (%DF)

Range: 0.2% to 100%

Resolution: 0.1%

Minimum Input: 10 V or 10 A

Basic Accuracy: 5% R ± 2 cts

Frequency Range: Fundamental 40 Hz to 70 Hz

Display: Digital: %DF and True RMS (A or V)
Bar graph: True RMS (A or V)

INDIVIDUAL HARMONICS

Range: 0.2% to 300% (%THD or %DF)

Rank: Hdc (DC component), H01 to H25

Resolution: 0.1%

Accuracy: Distortion>10% and rank<H13: 5% R ±2 cts
Distortion>10% and rank>H13: 10% R ±2 cts
Distortion<10% and rank<H13: 10% R ±2 cts
Distortion<10% and rank>H13: 15% R ±2 cts

Frequency Range: Fundamental 40 Hz to 70 Hz, 25th order

Display: Digital: %THD and Individual Harmonic value (A or V)
Bar graph: True RMS (A or V)

TRANSFORMER HARMONIC DERATING FACTOR (CBEMA THDF)

Range: 0.10 to 1.00

Resolution: 0.01

Basic Accuracy: 2% R ± 2 cts

Display: Digital: THDF, Bar graph: Arms

TRANSFORMER K-FACTOR RATING

Range: 1 to 30

Resolution: 0.1

Basic Accuracy:
1 to 10: 5% R ± 2 cts
> 10: 10% R ± 2 cts

Display: Digital: %THD or K Factor, Bar graph: Arms

RIPPLE

Range: .1% to 999.9%

Resolution: 0.1%

Basic Accuracy:
2 to 99.9%: 5% R ±10 cts
100 to 999.9%: 5% R ± 2 cts

Display: Digital: % Ripple, Bar graph: DC (A or V)

CREST FACTOR (CF)

Range: 1.00 to 10.00

Resolution: 0.01

Minimum Input: >5 V or >5 A

Accuracy (40 to 70 Hz):
1.00 to 3.50: 2% ± 2 cts
3.51 to 5.99: 5% ±2 cts
6.0 to 10.0: 10% ±2 cts

Display: Digital: CF, Bar graph: True RMS (A or V)

FREQUENCY (HZ)

Range: 0.5 Hz to 20,000 Hz

Minimum Input: 2 A or 2 V

Accuracy: 0.5 Hz to 999.9 Hz: 0.1% R ± 2 cts
1000 Hz to 9999 Hz: 0.2% R ± 2 cts
10 kHz to 20 kHz: 0.5% ± 2 cts

Display: Digital: Hz, Bar graph: DC (A or V), True RMS (A or V)

GENERAL SPECIFICATIONS

Battery: 4 x 1.5 V "AA" alkaline (NEDA 15A, IEC LR6)
Life: approx. 40 hrs continuous use

Dimensions: 10.8 x 4 x 2" (275 x 103 x 52 mm)

Weight: 1.5 lbs (670 g)

Display: Quadriplexed LCD, dual digital display (10 mm, 5 mm), 4 digits 10,000 counts, 31-segment bar graph

Temperature:
Operating: -10° to 55°C (14° to 131°F)
Storage: -40° to 70°C (-40° to 158°F)

Humidity:
Operating: 0 to 90% RH to +40°C (75% RH @ +55°C)
Storage: 0 to 95% RH

Material:
Case: Gray Lexan® 920A, UL 94 V2
Jaws: Red Lexan® 500R, 10% fiberglass, UL 94 V0
LCD lens: Crystal Lexan® 920A, UL 94 V1

Mechanical:
Envelope Protection: IEC 529: IP 40
Drop Test: IEC 1010: 1m
Vibration: IEC 68-2-6
Shocks: IEC 817

SAFETY

Protection Level:
Double insulation IEC 1010-1, 600 V Category III, Pollution degree 2.

Max. Working Voltage: 600 Vrms

Dielectric Test: 5.5 kV, 50/60 Hz, 1 minute

Overload Protection:
Voltage: 1.5 kV Peak permanent
Current: 1000 A AC (50/60 Hz) permanent

Agency Approvals: CSA, GS, VDE, CE pending

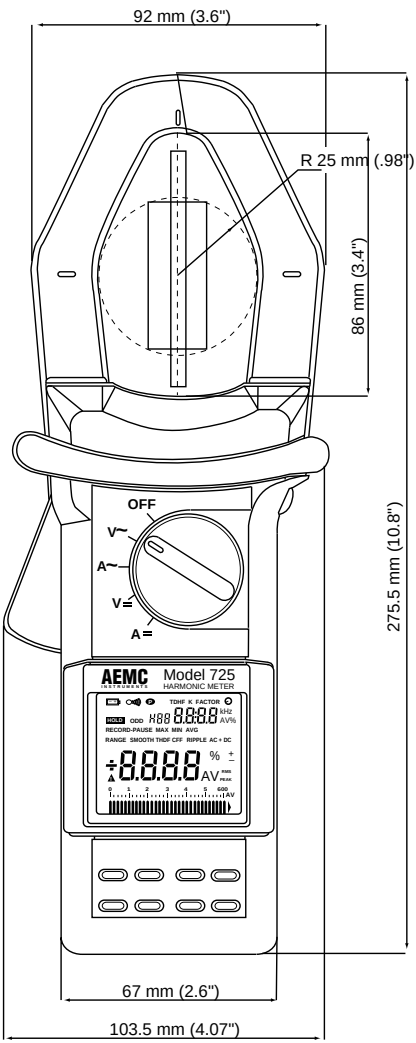
ELECTROMAGNETIC COMPATIBILITY

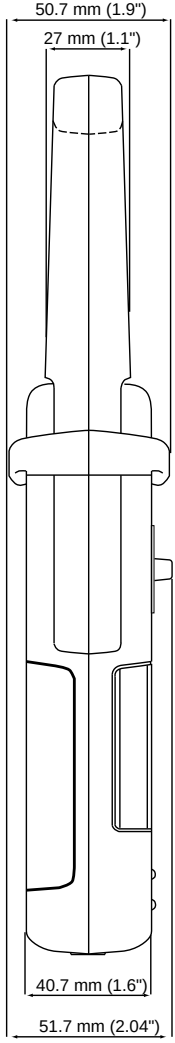
Electrostatic Discharge:
IEC 801-2: No influence: 4 kV class 2
Non-destructive: 15 kV class 4

RF: IEC 801-3: No influence: 3 V/m class 2
Minor influence: 10 V/m class 3

Transients: IEC 801-4: No influence: 2 kV class 4

Electric shocks: IEC 801-5: No influence: 6 kV class 3


92 mm (3.6")
R 25 mm (.98")
86 mm (3.4")
275.5 mm (10.8")
OFF
V~
A~
V⎓
A⎓
AEMC
Model 725
HARMONIC METER
67 mm (2.6")
103.5 mm (4.07")

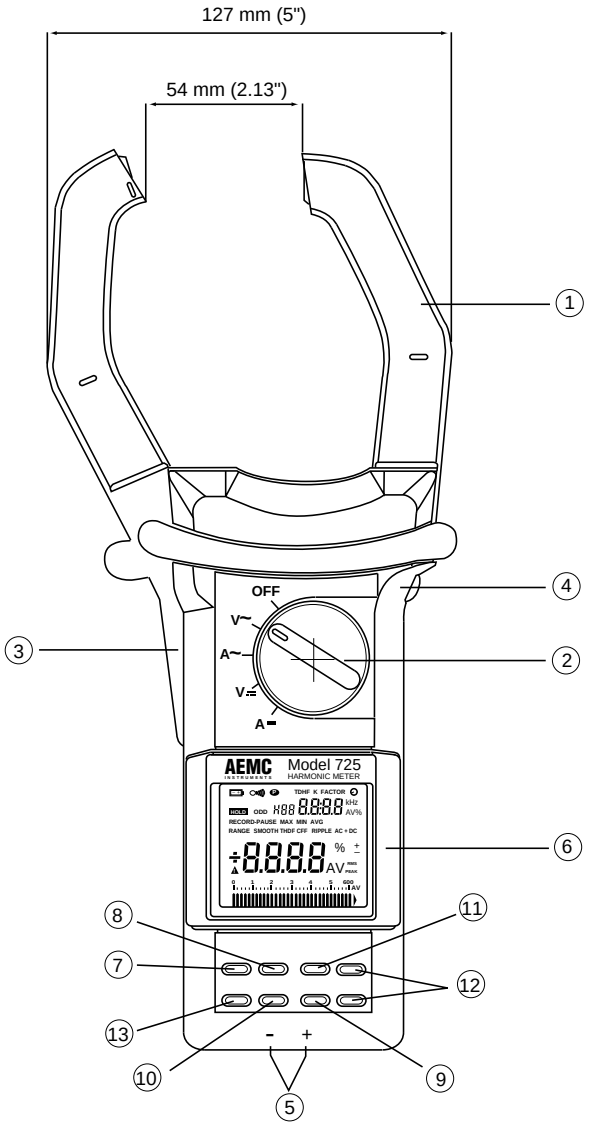

50.7 mm (1.9")
27 mm (1.1")
40.7 mm (1.6")
51.7 mm (2.04")

Model 725 Controls

1. **Jaw assembly:**
   Transformer jaws opens to 1 1/8" (54 mm); accepts two 500 MCM
2. **Rotary selection switch:** OFF, V~ , A~, V⎓ , A⎓
3. **Lever/trigger:** Opens or closes jaws
4. **HOLD:**
   Freezes last measured value on display (excluding bar graph)
   Zeroes instrument during DC measurements
5. **Input:** Color-coded voltage input connectors
6. **Display:** Dual liquid crystal display, 4-digit 10,000 counts
7. **MIN/MAX:**
   • Selects Record mode for A, V, %THD, Individual harmonics, %DF, CF, THDF, Ripple and Peak (+/-)
   • Accesses the following functions: MAX, MIN, AVG
8. **SMOOTH:** 3-sec averaging for easy readings on fluctuating signals
9. **Hz:** Selects frequency measurement (A or V input)
10. **RANGE:** Selects Auto or Manual Ranging measurement ranges (A or V)
11. **HARM:** Accesses (in A or V) the following measurement modes:
    • %THD (Total Harmonic Distortion referenced to the fundamental)
    • %DF (Distortion Factor - Total Harmonic Distortion referenced to RMS)
    • CF (Crest Factor)
    • K Factor (Transformer Derating Factor [A~])
12. **▲▼: Hdc, H 01-H 25**: Individual Harmonics (from dc - 25th order) and +/- Peak
13. **Shift:** Yellow Shift key selects different measurement modes dependent upon rotary switch position:

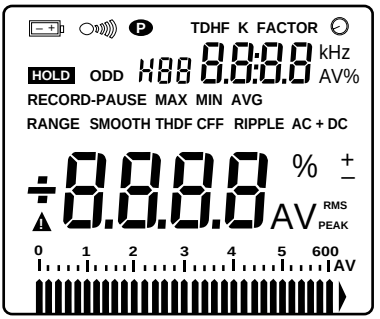
V~	A~	V⎓	A⎓
Vrms Peak CF	Arms Peak CF THDF or K factor (in HARM mode)	V⎓ Peak % Ripple	A⎓ Peak % Ripple

To measure **battery voltage level status,** press and hold the yellow **Shift** push button for >3 seconds during any measurement mode.


127 mm (5")
54 mm (2.13")
1
OFF
V~
A~
V⎓
A⎓
2
3
4
AEMC
INSTRUMENTS
Model 725
HARMONIC METER
TDHF K FACTOR
kHz
AV%
RECORD-PAUSE MAX MIN AVG
RANGE SMOOTH THDF CFF RIPPLE AC + DC
%
AV
6
8
7
11
12
13
10
9
- +
5

Digital Display Features

The combination digital/analog display gives measurements on a large 4-digit LCD display. A fast responding analog bar graph display indicates trends or surges. To view full function display, continuously depress the HOLD push button while turning the rotary selector switch on.



A ~	True RMS amperes
V~	True RMS volts
V ⎓	DC volts
A ⎓	DC amperes
▭	Low battery indication
SMOOTH	Indicates three-second measurement averaging to smooth fluctuating signals
RANGE	Manual range selection
HOLD	Hold function is activated
RECORD	Record mode is activated
PAUSE	Interrupts recording mode when Hold is activated in the Record mode
MAX	Maximum measurement value
MIN	Minimum measurement value

AVG.	Average measurement value
%THD	% Total Harmonic Distortion
THDF	Transformer Harmonic Derating Factor (CBEMA)
K Factor	Transformer Derating Factor
%DF	% Distortion Factor
% Ripple	Percent ripple on DC signal
CF	Crest Factor
PEAK	Peak (1 ms) measurement with ± sign
H xx	Individual harmonic order (Hdc to H25)
ODD	Displays odd order harmonics only
	Relative time indication for recording function is activated
AC + DC	Measurement includes both AC and & components
	Indicates beeper function is activated
	Auto-Off feature disabled
Bar Graph	Analog bar graph for trend measurements A or V

Display and Error Indications

OL	Input overload: > 1500 Vpeak or > 1500 Apeak
---	Input signal below measurement range
	Input exceeds safety, measurement or operating range. Discontinue measurement and refer to the specific function and specification section in user manual.

The primary (larger)/secondary (smaller) display allows dual monitoring of measured values with the selection of the HARM push button. These locations may also be reversed with: ON & ▲ .

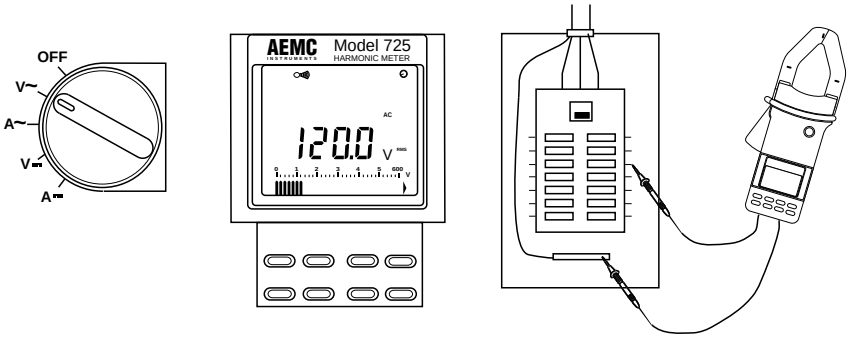
General Measurement Notes

- Validation of push button control is verified with a short beep (2 kHz). Invalid push button control is warned with a higher pitch beep (4kHz). Overload indication is a constant tone.
- Maximum accuracy is achieved when the current carrying conductors are centered within the jaw assembly of the instrument.
- When the instrument is turned on, all display segments appear while the instrument performs a brief self-test. At the completion of the test the instrument beeps once and begins measurements.
- Verify that the arrow indicator on the jaws of the instrument points toward the load.

Several control functions are turned on and off by holding down a specific push button (see below) while turning the rotary selector switch from the OFF position. The selected program function will blink on the display; releasing the push button will then activate control, verified by a short beep.

Function	Control Push Button	Display Symbol
• Beeper On/Off	ON & MIN/MAX	•ıll
• AC or DC+AC	ON & SMOOTH	AC/DC+AC
• Odd/all harmonics	ON & HARM	ODD
• Auto power off	ON & RANGE	Ⓟ
• Record clock function	ON & Hz	◴
• Primary/secondary display location	ON & ▲	
• Full function display	ON & HOLD	All LCD
• Reset to default conditions	ON & Yellow (Shift)	Default conditions

AC Voltage Measurements



OBSERVE ALL SAFETY PRECAUTIONS AND WARNINGS

Operating Procedure

1. The voltage input connectors are color-coded 4 mm banana jacks located on the base of the instrument. When making voltage connections, be sure to observe the proper polarity and connection integrity.

Select the appropriate termination (test probe or clips) for the application. Insert the **RED** test lead into the (+) jack and the **BLACK** test lead into the (COM) jack.

2. Turn on the instrument using the rotary selector to the voltage measurement function **V~.** Selection is confirmed with a short beep when exiting OFF.

3. Touch or connect the voltage test leads to the circuit under test.

4. Take a reading from the display. **Voltage measurements are possible from 50 mV to 600 Vrms, and to 1500 V Peak**

Warning

Though the meter can display to 1499 V in Auto Range and in the 600 V manual range, the warning triangle ⚠ will be displayed above 600 Vrms. This indicates that the input exceeds the specified safety and operating range. The displayed value is only indicative and not specified.

Do not continue to operate the instrument when the input value exceeds the meter safety and operating specifications.

OL is displayed above 1499 V peak in the Peak mode and may also be accompanied by the warning triangle if the RMS value exceeds 600 V.

The warning triangle ⚠ may also be displayed if the input signal is too low (<50 mV) or if the fundamental is not 50 or 60 Hz.

Selecting AC and AC + DC Measurements

Voltage measurements may be displayed as AC only or as AC+DC, indicating that the measurement includes the DC component. Selection can be made with (ON & SMOOTH) during initial ON. Please note that AC+DC RMS value is not equal to the AC RMS reading plus the DC reading.

AC Voltage: Related Measurement Functions

In the voltage measurement mode, further power quality analysis for voltage is possible by pushing the following keys:

HARM Activation will change operating mode and split screen for simultaneous measurements of:

Voltage → (AC or DC+AC) %THD → %DF → Voltage (AC or DC+AC)

- Bar graph display.

▲▼ Select individual harmonics from Hdc, H01 to H25. The instrument will display the True RMS amplitude of the individual voltage harmonic as well as the percentage relative to the fundamental signal (%THD) or percentage relative to the RMS value (%DF), whichever is selected prior to ▲ or ▼ .

Hz — Displays the voltage frequency measurement. In HARM mode, Hz will also indicate the individual harmonic frequencies in the secondary portion of the display.

RANGE — Selects manual range on the digital display and bar graph:

Digital Display:	0 – 100	0 – 1000	0 – 9999
Bar graph:	0 —60	0 – 600*	0 – 600*

* Note: the bar graph is locked beyond 600 counts when in manual range.

Push HOLD for three seconds to return to Auto Ranging. Volts or amps must be in primary portion of display.

Shift (yellow) — In AC or DC + AC: V → Peak → Crest Factor → V (primary display only).

Push and hold (3 s) for battery life and voltage level check.

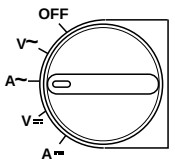
MIN/MAX — Selects record function for MIN/MAX/AVG. values.

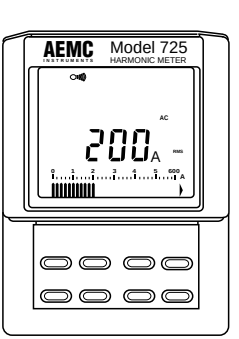
SMOOTH — Displays 3-second running average of measured value.

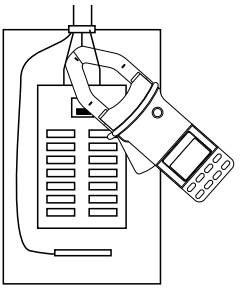
HOLD — Freezes displayed measured value; bar graph will continue to respond.

Bar graph — The analog bar graph continues to display voltage values while other measurement power quality functions are dis played. The bar graph ranges are 60 Vrms and 600 Vrms. Overrange on the bar graph is indicated with  .

AC Current Measurements







OBSERVE ALL SAFETY PRECAUTIONS AND WARNINGS

Operating Procedure

1. Turn the rotary selection switch to the current measurement function **A~.** Selection is confirmed with a short beep when exiting OFF.

2. Squeeze the trigger to open the jaws. Clamp the jaws around the conductor. The most accurate readings are obtained with the conductor aligned with the centering marks on the jaws.

3. Take the reading from the display. **AC Current measurements are possible from 300 mA to 1000 Arms, and to 1500 Apeak.**

Warning

The instrument can display up to 1000 Arms in Manual range and 1499 Arms in Auto range. Above this level, OL (Overload) will be displayed, indicating that the input exceeds the specified safety and operating range.

Do not continue to operate the instrument when the input value exceeds the meter safety and operating specifications.

Selecting AC and DC + AC

Current measurements may be displayed as AC only or AC +DC, which indicates that the measurement includes the DC component. Selection can be made with (On & Smooth) during initial ON. Please note that the AC + DC RMS value is not equal to the AC RMS reading plus the DC reading.

AC Current: Related Measurement Functions

In the current measurement mode further power quality analysis for current is possible by pushing the following keys:

HARM Push button activation will change operating mode and split screen for simultaneous measurements of:
- current,
- %THD or %DF
- bar graph display

▲▼ Select individual harmonics from Hdc, H01 to H25. The Model 725 will display the True RMS amplitude of the individual current harmonic as well as the percentage relative to the fundamental signal (%THD) or relative to the RMS value (%DF) whichever is selected prior to ▲ or ▼.

Hz Displays frequency measurements. In the HARM mode Hz displays individual harmonic frequencies in the secondary portion of the display.

RANGE Selects manual range of (0 - 60) or (0 - 600) amps.

Shift (yellow) In AC or DC+AC: A → Peak → Crest Factor → THDF → A.
In HARM mode: A → K Factor → A.
Push and hold (3 s) for battery life and voltage level check.

MIN/MAX Selects record function for MIN/MAX/AVG values.

SMOOTH Displays 3-second running average of measured value.

THDF Displays value for Transformer Harmonic Derating Factor (yellow Shift push button 3 times).

K Factor Transformer K factor rating (HARM mode, yellow Shift push button).

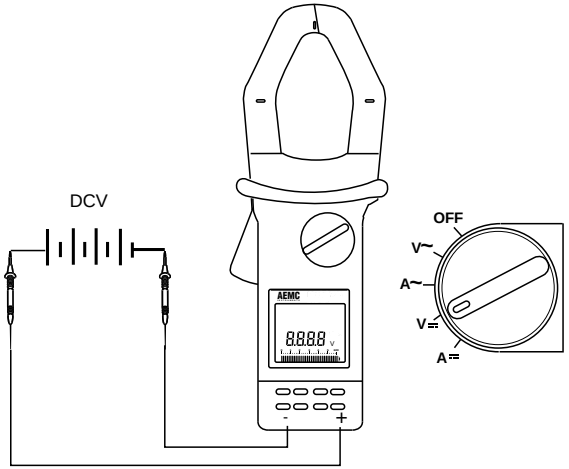
CF Crest Factor (yellow Shift push button twice).

Peak ▲▼ Half cycle peak values (+ or -) Shift (yellow).
In Peak mode: displays highest and lowest peak.

Analog bar graph

The analog bar graph will continue to display current Arms values while other measurement functions are displayed. The bar graph ranges are 60 Arms and 600 Arms. Overrange on the bar graph is indicated with ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▶ .

DC Voltage Measurements



OBSERVE ALL SAFETY PRECAUTIONS AND WARNINGS

Operating Procedure

1) The voltage input connectors are color-coded 4 mm banana jacks located on the base of the instrument. When making voltage connections, be sure to observe the proper polarity and connection integrity.

Select the appropriate lead termination (test probe or clips) for the application. Insert the RED test lead into the (+) jack and the BLACK test lead into the (COM) jack.

2) Turn on the instrument using the rotary selector to the voltage measurement function V⎓. Selection is confirmed with a short beep when exiting OFF.

3) Touch or connect the voltage test leads to the circuit under test.

4) Take a reading from the display. **Voltage measurements are possible from 50 mV to 600 V DC.**

Warning

Though the meter can display to 1499 V in Auto Range and in the 600 V manual range, the warning triangle ⚠ will be displayed above 600 V. This indicates that the input exceeds the specified safety and operating range. The displayed value is only indicative and not specified.

Do not continue to operate the instrument when the input value exceeds the meter safety and operating specifications.

OL is displayed above 1499 V peak in the Peak mode and may also be accompanied by the warning triangle if the value exceeds 600 V.

The warning triangle ⚠ may also be displayed if the input signal is too low (<50 mV).

Harmonic measurements are not operative in the DC voltage mode. During DC voltage measurements the HARM and ▲▼ push buttons are inoperative.

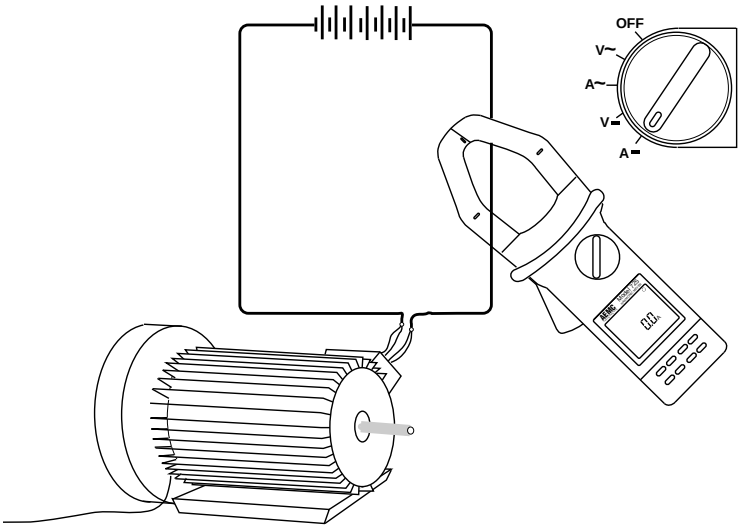
Analog Bar Graph

The analog bar graph continues to display voltage values while other measurement functions are displayed. The bar graph ranges are 60 V and 600 V. Overrange on the bar graph is indicated with ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▶.

DC Voltage: Related Measurement Functions

Shift (yellow)	V → Peak → Ripple → V Push and hold (3 s) for battery life and voltage level check.
Hz	Displays frequency measurements in the secondary portion of the display.
RANGE	Selects manual range of (0 - 60) or (0 - 600) volts DC.
MIN/MAX	Selects record function for MIN/MAX/AVG values.
SMOOTH	Displays 3-second average of measured value.
PEAK	Displays maximum DC amplitude.
% Ripple	Percentage AC ripple on DC signal.
▲▼	Displays the highest & lowest peak values (Peak mode).

DC Current Measurements



OBSERVE ALL SAFETY PRECAUTIONS AND WARNINGS

Operating Procedure

1. Turn the rotary selection switch to the current measurement function A⎓. Selection is confirmed with a short beep when exiting OFF.

2. Push and hold/DC zero.* Selection is confirmed with a short beep. After 3 seconds, a second beep will confirm (ZERO). The display will indicate dc 0.

3. Squeeze the trigger to open the jaws. Clamp the jaws around the conductor. The most accurate readings are obtained with the conductor centered within the jaws.

4. Take the reading from the display. **DC current measurements are possible from 300 mA to 1500.0 A.**

*DC zero compensates for temperature variations and residual magnetism in the transformer core. A beep will verify selection of DC zero. A second confirmation beep will be heard when the display indicates dc 0.

Warning

The instrument can display up to 1000 A DC in manual range and 1499 A DC in Auto range. Above this level, OL (Overload) will be displayed indicating that the input exceeds the specified safety and operating range.

Do not continue to operate the instrument when the input value exceeds the meter safety and operating specifications.

The analog bar graph continues to display current values while other measurement functions are displayed. The bar graph ranges are 60 A and 600 A. Overrange on the bar graph is indicated with ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▶ .

The Model 725 incorporates the latest in DC Hall effect technology. Two Hall effect sensors mounted in a gap in the transformer core sense the magnetic field produced by the current being measured.

Harmonic measurements are not operative in the DC current mode. During DC voltage measurements the HARM push button is inoperative.

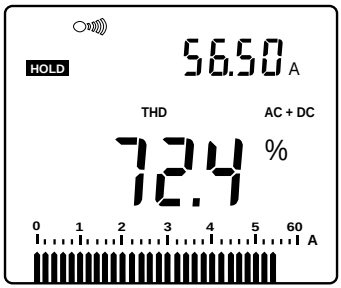
DC Current: Related Measurement Functions

The following functions can be accessed in DC amps:

Hz	Displays frequency measurements in the secondary portion of the display.
RANGE	Selects manual range of (0 – 60) or (0 – 600) amps.
Shift (yellow)	A → Peak → Ripple → A. Push and hold (3 s) for battery life and voltage level check.
MIN/MAX	Selects record function for MIN/MAX/AVG values.
SMOOTH	Displays 3-second running average of measured value.

Peak	Maximum DC value (+ or -), (yellow Shift push button).
% Ripple	Percentage AC ripple on DC signal (yellow Shift push but ton twice).
▲▼	Displays the highest and lowest peak values (Peak mode)

HARM Push Button: Harmonic Measurements

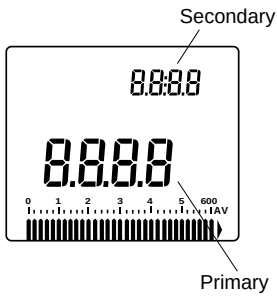


For a current of 56.50 Arms (AC + DC) on second display and bar graph measurement of the total harmonic distortion (THD): 72.4%

Harmonic measurements are initiated by pressing the HARM push button. Measurements are possible for either AC voltage or current. The LCD display will indicate:

- Rotary switch selection: **A~** or **V~**
- Harmonic information:
  - RMS value of each harmonic order
  - The percentage of each harmonic as referenced to the fundamental or as referenced to the total RMS
  - The Total Harmonic Distortion as referenced to the fundamental (%THD) or as referenced to the total RMS (%DF)
- Analog bar graph

Display Location: Primary/Secondary



Pressing the HARM push button will provide access to power quality functions by providing dual numeric display. Primary information in central display window and secondary information in the upper right display. Primary and secondary information display locations can be toggled with (ON & ▲). The push button sequence is:

V~ or A~ → %THD → %DF → V~ or A~

The HARM push button is disabled in A DC and V DC.

Measuring Individual Harmonics

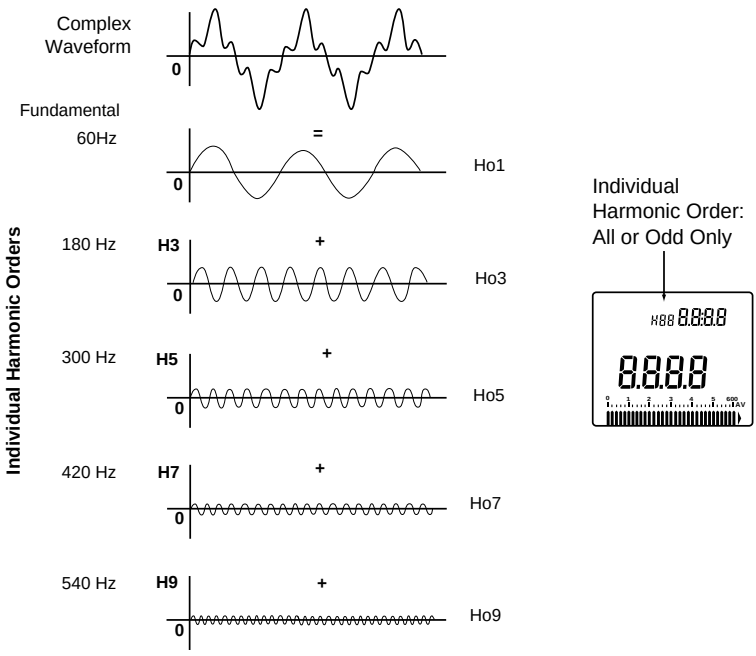
While in %THD or %DF, individual harmonic values may be accessed. Each harmonic is expressed in terms of it RMS magnitude and as a percentage of the fundamental signal for %THD, and as a percentage of the RMS value for %DF.

▲▼ push buttons select harmonics from Hdc, H01-H25.

▲ accesses individual harmonics in an increasing order (H01, H02, H03...).

▼ accesses individual harmonics in a decreasing order (H15, H13, H11...).

▲▼ push buttons may be held down, which permits the individual harmonics to be sequenced continuously (25 orders in 5 seconds).



Displaying Odd & Even Harmonics or Odd Harmonics Only

The Model 725 may be set up to display odd & even harmonics or only odd harmonics. Pressing HARM while turning the Model 725 ON will select either odd + even or odd harmonic orders only. When only odd harmonics are set up, ODD is displayed on the LCD to the left of the harmonic order Hxx.

The Model 725 will display the amplitude or frequency of each individual harmonic as well as the percentage relative to the fundamental signal or to the RMS.

Measuring the K Factor (see p. 39)

While measuring Harmonics, and only in A AC, pressing the yellow Shift button gives access to the K Factor. The push button sequence is:

Harmonic measurement → K factor → Harmonic measurement

Total Harmonic Distortion (%THD)

%THD is the Total Harmonic Distortion, referenced to the fundamental (50/60 Hz) signal. The THD is expressed as a percentage and may be greater than the fundamental. A reading greater than 100% is possible. The %THD is also referred to as the Harmonic Factor or %THD-F.

%THD Application Example:

Calculating the amount of total harmonic current: It is possible to calculate total harmonic current from a %THD reading when fundamental (60 Hz) current or voltage is measured (H01).

Example
The Model 725 measures fundamental current (H01) of 150 A and a THD of 130%. This means that the harmonic content is 130% of the fundamental (60 Hz).

150 A x 1.3 = 195 A

Harmonic current = 195 A

Note: The values for fundamental (60 Hz) current and harmonic may not add to equal RMS current. It is because of this relationship that %THD readings of up to 600% are possible with the Model 725.

Distortion Factor (%DF)

Distortion Factor, or %DF, is the total harmonic distortion referenced to the total RMS signal. Distortion Factor is expressed as a percentage and may not be greater than the fundamental. The %DF never exceeds 100%. The %DF is sometimes referred to as the %THD-R.

Please note that our %DF is not the same value as the Distortion Factor as expressed in the IEEE standard 519-1992 (in which Distortion Factor is the same as THD).

Mathematically the Distortion Factor, or %DF, is the ratio of the sum of the root-mean-square of all the harmonics (including the DC component) to the root-mean-square value (RMS) of the total signal.

%DF Application Example:

The Model 725 measures an RMS value of 100 A and a DF of 30%. This means that the harmonic content is 30% of the total RMS, or in other terms:

Harmonics=% Distortion Factor x RMS

Harmonics = 30% RMS = 30% (100 Arms) = 30 Arms

▲▼ push buttons select harmonic amplitudes from Hdc, H01-H25 and will display percentage relative to the RMS signal.

CF: Crest Factor

Crest Factor measurements are possible for A AC and V AC by depressing the yellow Shift push button twice.

The crest factor is the ratio of the Peak value of the sinusoidal waveform to its RMS value.

$$\text{Crest Factor (CF)} = \frac{\text{Peak value}}{\text{RMS value}}$$

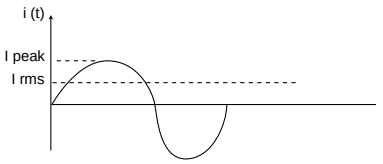
For a perfect sine wave the crest factor would be 1.414. This relates to the Peak amplitude of a particular waveform. Typical crest factor ratings are from 2.0 to 6.0. When harmonics are present crest factors may be less than (CF of a square wave = 1) or greater than 1.414.

Crest Factor is the ratio of the Peak value of a waveform to its RMS value. A perfect sine wave has a crest factor of 1.414. In distorted waveforms, the crest factor is typically greater than 1.414 and gives an indication of the harmonic content.

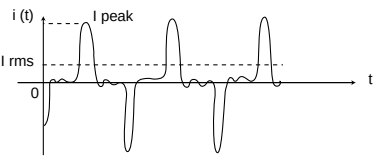
The CF may also be used to determine the CBEMA (Computer & Business Equipment Manufacturers Association) Derating Factor. The CBEMA Derating Factor is used for evaluating the survivability of existing conventional transformers in service and servicing single-phase nonlinear loads such as PCs, computer terminals or other office equipment. For further use of the CBEMA derating factor contact the CBEMA directly. Note that there is no direct or useful relationship between the CBEMA Derating Factor, the %THD and Transformer K Factor (IEEE C57.110-1986).

Crest Factor: CF = Peak/ RMS

CBEMA Derating Factor = 1.414 x RMS/Peak = 1.414/CF



CF = 1.414

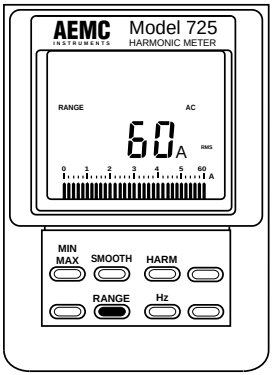


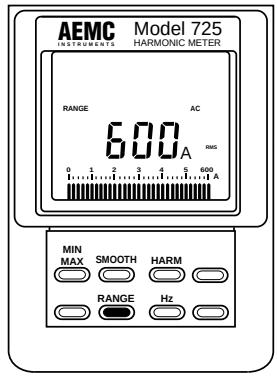
CF = 2.5

Range Push Button: Manual Ranges

The RANGE push button enables you to exit the Auto Ranging mode and to enter manual ranges. RANGE operates on all measurement modes. RANGE will be displayed during manual ranging.

In Amps





Pushing the RANGE push button selects a fixed manual range: 60 A first and 600 A on the second push. The digital display and the bar graph indicate the selected range. RANGE is displayed at the top of the display indicating a manual range selection. Selection is also confirmed with audible tone.

To sequence back to Auto Ranging, push and hold the RANGE push button for approximately 3 seconds. The displayed RANGE indicator will disappear, confirmed with an audible tone.

The bar graph ranges are 60 A and 600 A and are also manually selected. The analog bar graph will continue to display current values while other measurement functions are displayed (i.e., %THD, %DF, %CF).

In manual range, the ranges (60 A) and (600 A) are extended respectively to 100 A and 1000 A for a better resolution of 1000 counts.

In Volts

Pushing the RANGE push button will select a fixed manual range: 60 V first and 600 V on the second push. The digital display and the bar graph indicate the selected range. RANGE is displayed at the top of the display indicating a manual range selection. Selection is also confirmed with audible tone.

To sequence back to Auto Ranging, push and hold the RANGE push button for approximately 3 seconds. The displayed RANGE indicator will disappear, confirmed with an audible tone.

The bar graph ranges are 60 V and 600 V and are also manually selected. The analog bar graph will continue to display current values while other measurement functions are displayed (i.e., %THD, %DF, CF).

In manual range, the ranges (60 V) and (600 V) are extended respectively to 100 V and 1000 V for a better resolution of 1000 counts.

NOTE: Range selections are not possible if A~ or V~ are displayed in the secondary display location

Hz Push Button: Frequency Measurement

The Hz push button accesses the frequency function in either current or voltage. Frequency measurements are possible from 0.5 Hz to 20,000 Hz. The analog bar graph will continue to display current or voltage depending upon which function is selected.

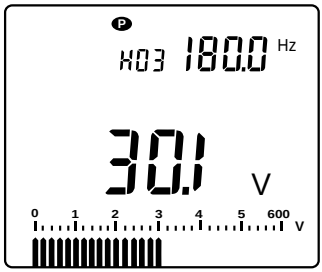
The SMOOTH (3-second averaging) push button is also active in frequency measurements (Hz).

Harmonic Frequency Measurements

In the HARM mode, frequency measurements are possible for the individual harmonic orders in the secondary portion of the display.

Press the HARM push button, followed by the Hz push button

▲▼ select Individual Harmonic frequencies (from H01 to 25th order), which are displayed along with primary display information (A or V AC).



Frequency of Individual Harmonics

Peak/Smooth

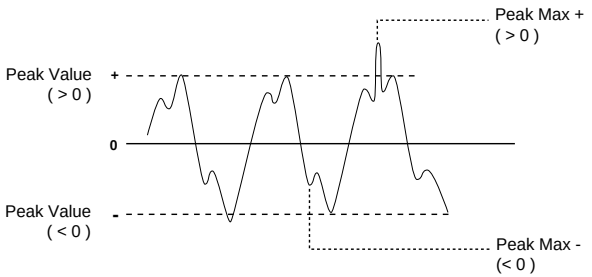
Peak

Peak is a fast responding function which measures the instantaneous (1 ms) Peak values of the measured signal. This function is often used for half cycle in-rush signals. Peak measurements are accessed with a single push of the yellow (Shift) push button. The Peak function is displayed in the lower right-hand corner of the display next to the measurement symbol. Control is verified with a short beep.

Peak may also be accessed when recording. In recording MIN/MAX, depressing PEAK gives the MAX Peak.

The bar graph also indicates the Peak values. When a Peak value exceeds the bar graph scale, an arrow at the end of the scale is displayed.

▲▼ will select either positive (+) or negative (-) peaks.



Smooth

Smooth stabilizes the digital readings when measurements fluctuate. In this mode, the Model 725 calculates and displays a three-second average reading. Smooth may be used in volts, amps, and frequency, as well as power quality functions (%THD, %DF, CF).

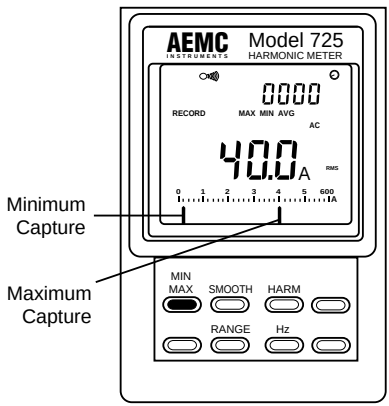
Use the SMOOTH push button. Control is verified with a short beep. Smooth may be used while in the MIN/MAX recording mode. The analog bar graph will not be affected by the Peak/Smooth functions, and continues to display Arms or Vrms.

MIN/MAX Push Button: Recording Function

The recording feature allows the user to record the Minimum (MIN), Maximum (MAX), and Average (AVG.) measurement values in all measurement functions. By pressing the MIN/MAX push button sequentially, the measurements are displayed during measurement or after HOLD.

Recording is initiated with the MIN/MAX push button during the selected measurement function. Control is verified with a short beep. Press the MIN/MAX push button to begin recording; RECORD will be displayed.

During Harmonics Recording mode, individual harmonic amplitude values, the relative %, amplitudes or frequencies can be accessed after the HOLD button is depressed by sequencing through using the up/down arrows ▲▼.



Stop Recording mode manually at any time by pushing the HOLD button. RECORD-PAUSE will then be displayed, and the RECORD indication will no longer blink. At this point, recorded measurement can be read by pushing the MIN/ MAX push button sequentially.

During Record mode, a double 2 kHz beep indicates the capture of each new minimum, and a double 4 kHz beep indicates the capture of each new maximum value.

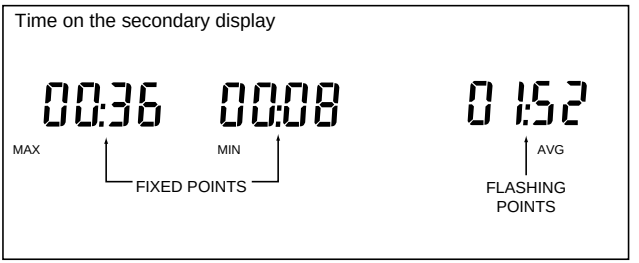
To exit the Record mode, push and hold the MIN/MAX push button for approximately two seconds. A long beep will indicate the mode change and displayed RECORD will be removed.

Current status of MIN/MAX/AVG measurement values can be accessed during Record mode by sequentially pushing MIN/MAX.

Recording With Time Indication

The clock function ⏲ may be toggled ON/OFF with ON and Hz. The time format indicator is displayed in the upper right corner in the following format: 00:00 (HH:MM). The clock is stopped by using the HOLD key.

The relative time function indicates elapsed time of the Record mode as well as the time of capture of each new MIN and MAX. The time clock is accessed and initiated by pushing the Hz push button twice, provided the clock is in the secondary display.



For example, the time that has passed since RECORD mode has been entered is 1 hour 52 minutes, with a minimum at the 8th minute and a maximum at the 36th minute.

At any time during recording, sequence through the MIN/MAX push button to display the capture time of MAX then MIN then AVG. Time indications are the elapsed time of the captured event. The AVG value is the total record time.

If the HOLD button is pushed to stop record time, MIN/MAX/AVG will only display the total elapsed time of recording.

K Factor

K-Factor information can be accessed while measuring AC current with the rotary switch set to A~ in the HARM mode by pushing the yellow (Shift) key.

The K factor can be thought of as an index of the transformer's ability to handle nonlinear load current without abnormal heating. The K factor is determined by measuring the True RMS current of each harmonic, multiplied by the harmonic order and squared.

K-Factor information can be used to select the proper "K-rated" transformer that properly matches your nonlinear electric load. Typical ratings would be:

K=1: No derating necessary
K=4: Typical value for most commercial buildings
K=9: Upper limit for commercial buildings

A "K-4" rating indicates the ability of a transformer to accommodate four times the eddy current losses of a K-1 transformer.

Most generators and transformers base their operating characteristics on undisturbed 60 Hz waveforms. When the waveforms are rich in harmonics, shortened service or complete failure of non-K-rated transformers is sure to follow. The derating K factor can be applied specifically to dry-type transformers to ensure that dangerous heating will not result due to the transformer supplying load currents which are rich in harmonic content.

Existing transformer derating is not recognized by the National Electrical Code®. Therefore, it is recommended that ANSI/IEEE C57.110-1986 be used as a guidance document before applying derating to an existing transformer. This document is the "Recommended practice for establishing transformer capability when supplying non-sinusoidal load currents."

Transformer parasitic heating due to harmonic currents is frequency-dependent; higher frequency harmonic currents cause a higher degree of transformer heating and failure. K-rated distribution transformers today are being specifically designed with magnetic cores and windings to accommodate harmonic contents.

THDF (Transformer Harmonic Derating Factor)

THDF is accessed through A~. Push the (yellow) Shift button three times to sequence to THDF.

THDF is a method of calculating transformer derating established by the Computer and Business Equipment Manufacturers Association (CBEMA) for phase-to-neutral loads. This derating factor can be applied to electrical systems with high third harmonic current and high crest factor, and can be helpful where large portions of the load consist of single-phase switch mode power supplies.

THDF= (1.414 x RMS current) ÷ Peak current

kVA (derated) = kVA (nameplate rating) x THDF value

This equation will provide a value between 0 and 1.0. This method is based on the fact that most complex waveforms have a crest factor greater than 1.414.

THDF Example:

Measurements indicate actual phase currents to be 250 Arms. The Peak currents indicate values of 400. THDF will indicate a value of .88, indicating that the specific transformer should not be loaded to any more than 88% of its nameplate kVA rating.

For more detailed information about this derating factor, contact CBEMA.

Battery Test & Replacement

To determine useful battery life, a self-test may be initiated by pressing the Shift (yellow) push button and holding for longer than 3 seconds. Current battery voltage is displayed along with an indication, in hours, of approximate battery life remaining.

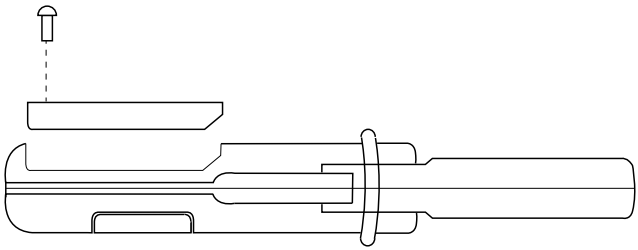
The battery symbol will blink when approximately one hour of useful battery life remains. When the symbol illuminates continuously, the batteries must be replaced.

Battery: Four 1.5 V "AA" alkaline batteries, Energizer E91 or equivalent.
Life: Approx. 40 hours continuous use (approx. 2500 one-minute measurements)

Battery Replacement

1. The instrument must be OFF and disconnected from any conductor.

2. Place the meter face down and remove the one slotted screw on the back of the instrument.



3. Remove the battery compartment cover by pulling up and away from the instrument.

4. Lift the batteries away from the case.

5. Install new batteries, being sure to observe the polarity indications.

6. Replace the battery compartment cover, noting that it slips beneath the hold-down lip and fits securely into position.

7. Install and tighten compartment screw.

Auto-Off

To conserve battery life, the Model 725 automatically shuts itself off after 10 minutes under the following conditions:

- No push button action
- No rotary switch (A, V) action
- Not in Record mode

Six short beeps will be heard prior to shutdown. Any control action will repower the instrument.

The Auto-Off feature may be disabled by holding down the RANGE push button, while turning the rotary selection switch from OFF to either Amps or Volts. Ⓟ will be displayed in the upper left-hand corner of the LCD when the Auto-Off feature has been disabled.

The Auto-Off feature will reset when the Model 725 is turned Off.

Troubleshooting

From time to time, a minor malfunction may occur due to normal operating events. Below is a list common events and solutions which should help you troubleshoot your Model 725.

Symptom	*Recommended Action*
Instrument will not turn on	Low battery; replacement required
Missing or inaccurate readings	Check that minimum input level is present
No function control action	Exit existing mode
Inaccurate or unstable DC readings	Be sure to zero prior to measurement
Constant audible tone	Measurement range exceeded; discontinue test

Repair, Maintenance & Calibration

WARNING

• To avoid electrical shock, do not attempt to perform any servicing unless you are qualified to do so.

• To avoid electrical shock and/or damage to the probe, do not get water or other foreign agents into the case. Turn the Model 725 OFF and disconnect the meter from all circuits and inputs before opening the case.

Maintenance

To clean the Model 725, wipe the case and jaw covers with a damp cloth and mild detergent. Do not use any abrasives or solvents.

Repair and Calibration

To guarantee that your instrument complies with the factory specifications, we recommend that the Model 725 be submitted to our factory service center at one-year intervals for recalibration.

Estimates for repairs, normal recalibration, and calibration traceable to NIST are available upon request. Overseas customers must receive authorization by fax or letter before returning any instrument.

For all servicing, please contact our factory:

Chauvin Arnoux, Inc., d.b.a AEMC Instruments
15 Faraday Drive
Dover, NH 03820, USA
(603)749-6434 • Fax (603)742-2346

Technical Assistance

If you are experiencing any technical problems, or require any assistance with the proper use or application of this instrument, please call our technical hotline:

(800)343-1391 • Fax (508)698-2118

Clamp-On Harmonic Probe
Model 725

AEMC® INSTRUMENTS

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