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CL535
Frequency Calibrator with Totalizer

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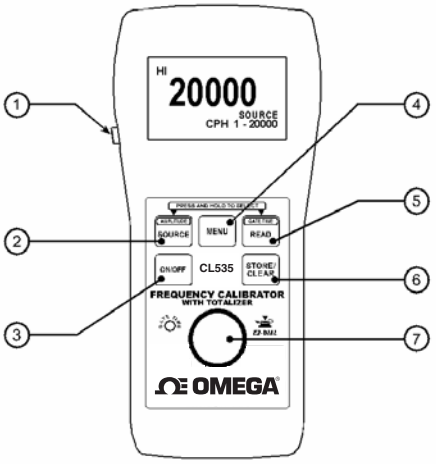
A. Basic Keypad Operations

1 EZ-Check™ Switch/EZ-Step™ Pushbutton

Slide the switch to select the user stored values for calibration points.

Push the EZ-Step™ pushbutton like a stop Watch to Run or Stop Totalizing.



2 SOURCE/AMPLITUDE Button

Press and release **SOURCE/AMPLITUDE** to change source modes. These are:

- Source CPH 1 - 20000
- Source CPM 0.1 – 2000.0
- Source HZ 0.01 – 200.00
- Source HZ 0.1 – 2000.0
- Source KHZ 0.001 – 20.000
- Totalizer

Press and hold **SOURCE/AMPLITUDE** to change amplitude voltage from 0.1-12Vp.

Then press the SOURCE/AMPLITUDE or STORE/CLEAR button to save selections and to exit.

3 ON/OFF Button

Press **ON/OFF** to turn the CL535 on or off.

4 MENU Button

Press and release the menu button and a mode of operation menu will appear with all the selections for operation mode.

REFER TO SECTION B.

5 READ/GATE TIME Button

Press and release **READ/GATE TIME** to change read modes. These are:

- Read Source CPH 1 – 20000
- Read CPM 0.1 – 2000.0
- Read HZ 0.01 – 200.00
- Read HZ 0.1 – 2000.0
- Read KHZ 0.001 – 20.000
- Totalizer

Press and hold **READ/GATE TIME** to select gate time adjustment for Source & Read Totalize mode.

Then press the SOURCE/AMPLITUDE or STORE/CLEAR button to save selections and to exit.

⑥ STORE/CLEAR Button

In source mode press the **STORE/CLEAR** to save the calibration values. The display will flash "STORED" to confirm.

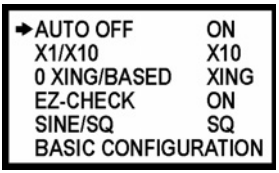
In read mode press **STORE/CLEAR** to clear the values saved in the EZ-Check™ HI and LO positions. The display will flash "CLEARED" to confirm.

⑦ EZ-Dial™ Knob

Source mode -Turn the EZ-Dial™ knob to adjust the output level. Press and turn to adjust 100X faster.

Read mode – Turn the EZ-Dial™ knob to adjust the trigger level.

B. CL535 Configuration



Press the MENU BUTTON on the CL535 after you turn the unit on to access the configuration mode. Turn the EZ-Dial™ Knob to select configuration items. Press the EZ-Dial™ Knob to change configuration items. Then press the Menu or STORE/CLEAR button to save selections and to exit.

Auto Off - **ON (default)/OFF**

Auto Off is ON, by default, to save battery life by turning the unit off after 30 minutes of inactivity. Turn Auto Off to OFF to prevent automatic shutdown. This is typically useful for manual loading or continuous use.

X1/X10 - **X1 (default)**

This selection is for attenuation of input signals factored by X1 or by X10, X1 for voltage between1 -12Vpk or X10 for voltages between1 - 120Vp.

0 XING/BASED **Based (default)**

This selection gives the users the ability to change output signals between Zero Based and Zero Crossing. This gives the user the ability to select 0 XING for Zero Crossing Square or Sine waves to be able to output signals that go from positive to negative. Zero Based Square Wave to output only positive signals.

NOTE: FOR SIMULATING NEGATIVE ONLY SIGNALS, SWAP THE BLACK AND RED LEAD WIRES IN ZERO BASED MODE.

EZ-Check™ HI/LO Readings **ON (default)**

If the EZ-Check™ HI/LO Readings option is ON, the highest and lowest readings will automatically be saved in the HI and LO EZ-Check™ positions.

If this option is OFF the HI and LO positions will show the current reading.

SINE/SQ **SQ (default)**

This selection gives the users two choices to choose from for an output signal:
Sign Wave Signal or Square Wave Signal

BASIC CONFIGURATION

If Basic Configuration is selected, the unit will restore all factory defaults. This will reset any changes made in the CL535 Configuration options, returning the unit to its simplest factory configuration. Which means Auto Off is on, range at x1, Zero Based Square Wave, EZ-Check is on and Square wave is selected.

C. EZ-Dial™ Knob

Source mode - Adjust the output up and down with the EZ-Dial™ knob. The increment is the far right digit (XXXX1). Press while turning to adjust 100X faster (XX1XX)
Read mode – Trigger level adjustment. Adjust knob until LED Blinks and Reading is displayed.

D. EZ-Check™ Switch

The EZ-Check™ switch has three positions -- high, set, and low. Its position is shown at the left edge of the LCD display with "HI" and "LO" indicators. Use of the EZ-Check™ switch depends on mode:

Source Modes:

Slide the EZ-Check™ switch to the HI and LO positions to recall the settings stored in those positions. While in the HI and LO positions, dial the EZ-Dial™ knob to change the display. Press **STORE/CLEAR** to save new settings in the HI and LO positions. The display will flash "STORED" to confirm.

Hint: For faster calibrations, the position of the switch can be felt. This feature allows continuous monitoring of the device being calibrated without looking back at the CL541 display. This is also useful in poor lighting or under difficult operating conditions.

Read Modes:

In read modes, with the EZ-Check™ switch in the middle position, the CL535 calibrator records the maximum and minimum readings observed in each mode. Slide the EZ-Check™ switch to the HI and LO positions to display the readings. Press **STORE/CLEAR** to clear the readings. The display will flash "CLEARED" to confirm.

E. TOTALIZE Pushbutton

The EZ-Step™ Switch pushbutton is a feature for read and source modes.

Push the EZ-Step™ like a stop watch to run or stop Totalizing.

F. FREQUENCY OUTPUT (SOURCE MODE)

Press the SOURCE button to select the Frequency output mode, the word Source will appear on the LCD Display. Press the SOURCE button to select the desired frequency range. Press and hold the Source/Amplitude button to enter the Amplitude adjustment screen. Then turn the EZ-Dial™ knob to select the desired Level (amplitude) this will be indicated on the LCD. Levels are indicated in Vp and Vpp with respect to the black lead (-). Then press the SOURCE/AMPLITUDE or STORE/CLEAR button to save selections and to exit.

You are able to setup three desired set points for quick calibration. Use the **EZ-Check**™ slide switch. Slide the EZ-Check™ switch to the HI and dial the EZ-Dial™ to the desired set point. Press the STORE/CLEAR button to save settings. Do the same in the LO positions. For the mid range just dial it to the set point. It will stay at that point unless you move the EZ-Dial™. This is so you may test linearity in the mid range while maintaining the 0% and 100% end points.

Connect the CL535 to the output of the equipment or sensor to being calibrated then slide the EZ-Check™ switch to the HI, MIDDLE and LO positions to recall the settings stored in those positions.

If you need to change set points, while in the HI and LO positions, dial the EZ-Dial™ knob to change the display. Press **STORE/CLEAR** to save new settings in the HI and LO positions. The display will flash "STORED" to confirm.

G. FREQUENCY COUNTER (READ MODE)

Press the READ button to select the READ mode, the word READ will appear on the LCD Display. Press the READ button to select the desired frequency range. Press the Menu button and select the Level (amplitude) X1 for signals 0.1 to 12Vp or X10 for signals from 1 to 120Vp. Then press the READ/GATE TIME or STORE/CLEAR button to save selections and to exit.

In read modes, the CL535 calibrator records the maximum and minimum readings observed in each mode. Connect the CL535 to the equipment or sensor being measured and use the **EZ-Check**™ slide switch in the center position to monitor the frequency. Slide the EZ-Check™ switch to the HI and LO positions to display the min. & max. readings. Press **STORE/CLEAR** to clear the readings. The display will flash "CLEARED" to confirm.

H. FUNCTION OF THE GREEN LED

The CL535 is equipped with a GREEN LED light. It is being used in the Read mode to let the user know that their signal is being detected by the calibrator when the LED is flashing. If the LED is not lit, the user must adjust the trigger level. NOTE: Led will appear solid above Frequency of 60Hz.

I. TOTALIZE (READ MODE)

The CL535 will count pulses with-in the users defined period. Press the Menu button and select the Level (amplitude) X1 for signals 0.1 - 12Vp or X10 for signals from 1V to 140Vp. Then press the Menu or STORE/CLEAR button to save selections and to exit. Press the READ/GATE TIME button and select the TOTALIZER mode. Press and hold the READ/GATE TIME button and adjust the number of minutes (1-100) that you want the CL535 to count pulses. Then press the READ/GATE TIME or STORE/CLEAR button to save selections and to exit. Then turn the EZ-Dial™ knob to adjust the trigger time. This will be indicated on the LCD.

Connect the CL535 to the output of the equipment or sensor being measured and push the EZ-Step™ push button on the side of the unit, similar to a Stop Watch, to run or stop Totalizing. The words RUN or STOP will appear on the LCD display.

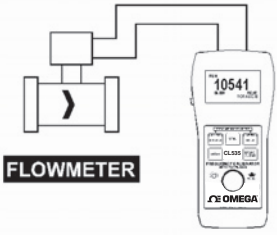
See Totalizer Connections on next page.

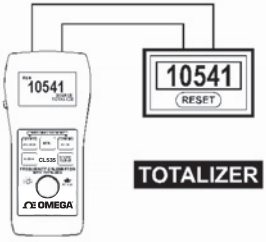
J. CALIBRATE TOTALIZE RS (SOURCE MODE)

The CL535 will count pulses with-in a selected time frame. Press the SOURCE/AMPLITUDE button and select the TOTALIZER mode. Press and hold the READ/GATE TIME button and adjust the number of minutes (1-100) that you want the CL535 to output pulses. Then press the SOURCE/AMPLITUDE or STORE/CLEAR button to save selections and to exit. Then turn the EZ-Dial™ knob to adjust the number of pulses required during the time period defined. This will be indicated on the LCD.

Connect the CL535 to the output of the equipment or sensor to be calibrated then Press the Slide the EZ-Check™ Switch to start.

See Calibrate Totalizers Connection diagram on next page.

TOTALIZE CONNECTIONS	
Connect the CL535 to the output of the equipment or sensor to be measured and push the EZ-Step™ pushbutton like a stop watch to run or stop Totalizing. The words RUN or STOP will appear on the LCD display.	

CALIBRATE TOTALIZERS	
	Connect the CL535 to the input of the equipment or sensor to be calibrated. Slide the EZ-Check™ switch to the HI and LO positions to recall the settings stored in those positions.

K. Specifications

General Specifications:(Unless otherwise indicated all specifications are rated from a nominal 23 °C, 70 % RH *for 1 year from calibration*)

Operating Temperature Range	-20 to 60 °C (-5 to 140 °F)
Storage Temperature Range	-30 to 60 °C (-22 to 140 °F)
Relative Humidity Range	10 % ≤RH ≤90 % (0 to 35 °C), Non-condensing 10 % ≤RH≤ 70 % (35 to 60 °C), Non-condensing
Size	7.00 X 3.30 X 2.21 inches (177.8 x 83.8 x 56.1mm)
Weight	12.0 oz (340 grams)
Battery	9V Alkaline
Miscellaneous	Low battery indication with nominal 1 hour of operation left Over-voltage protection to 120 Vrms (rated for 30 seconds) or 240 Vrms (rated for 15 seconds) High contrast graphic liquid crystal display with *0.45" (11.4 mm)* high digits

Common Specifications for all Frequency Modes:

Frequency Ranges	1CPH to 20.000Khz
Accuracy	± 0.005% of range
Temperature Effect	≤ 10ppm/°C of range

Frequency Ranges Specifications:

1	1 CPH< CPH Range < 20000 CPH
2	0.1 CPM (0.0167Hz)< CPM Range < 2000.0 CPM (33.33Hz)
3	0.01Hz < Hz < 200.00Hz
4	0.1Hz < Hz Range < 2000.0Hz
5	0.001KHz < KHz Range < 20.000KHz
6	Totalize inputs/outputs from 1 to 99999 counts in 1 minutes to 100.0 minutes

Read Inputs Specifications:

Read	**x1 attenuation range:** 0.1Vpk to 12Vpk **x10 attenuation range:** 1Vpk to 120V peak – Limit of attenuation is 120Vpk
Input Impedance	> 1 Meg Ω + 100pF
Adjustable Signal Attenuation	Adjustable trigger level with X1 and X10 attenuation ranges
Miscellaneous	Battery life ≥ 24 hour typical
Fuse-less protection	240Vrms

Waveforms Source Specifications:

Output current	>6mApp at 12Vpp output, 20KHz
Output Impedance	< 25Ω
Square Wave:	
Zero Crossing, Zero Based	Selectable
Rise/Fall Time	< 0.0001% of output Vpk per Second
Frequency Jitter	< 0.5LSB of frequency range
Duty cycle	50% ± 2%
Sine Wave:	
Offset and Zero Crossing	<± 10% of Vpk Output amplitude setting
Symmetry	
Amplitude Adjustment	100mV < Nominal Output < 12Vpp ± 10% of setting

Calibration Certificate:

Option:	NIST Traceable Certificate provided Test data available upon request at additional charge.

Available Options:

Option:	Part Number:
CL535-BNC	With a BNC connector ADDED CHARGE OF $50.00 to the list of the CL535
Carrying Case	SC-530

CL535 Field Test Procedure

Equipment Needed:

1. Universal Counter Timer with an accuracy of ± 10 PPM RDG.
2. Digitizing Oscilloscope.
3. Frequency Source with an accuracy of ± 10 PPM RDG.

CALIBRATION:

No Calibration is required.

Final Test:

Source Mode:

Connect the CL535 to the Universal Counter Timer. Press the SOURCE Button to switch to different source modes. Set the CL535 to the settings below and verify the CL535 is properly functioning within specification.

UUT Setting	Counter Timer Reading
20000 CPH	5.5555 Hz ± 0.0003 Hz
2000.0 CPM	33.3333 Hz ± 0.0017 Hz
200.00 Hz	200.00 Hz ± 0.01 Hz
2000.0 Hz	2000.0 Hz ± 0.1 Hz
20.000 kHz	20.000 kHz ± 1.000 kHz

Read Mode:

Connect the CL535 to a Frequency Source. Press the READ Button to switch to the different read modes. Set the frequency calibrator to the settings in the table below and verify the UUT is reading within specification.

Frequency Calibrator Setting	UUT Reading
5.5556 Hz	2000.0 CPH ± 0.1 CPH
33.3333 Hz	2000.0 CPM ± 0.1 CPM
200.00 Hz	200.00 Hz ± 0.01 Hz
2000.0 Hz	2000.0 Hz ± 0.1 Hz
20.000 kHz	20.000 kHz ± 1.000 kHz

Source Mode:

1. Check that the Output impedance is < 25Ω.
2. Check that the Duty cycle is 50% ± 2%.
3. Check that the Amplitude Adjustment is ± 10% of setting.
4. Check the Zero crossing Symmetry is < ±10% of Vpk Output amplitude setting.

Completion of Field Test:

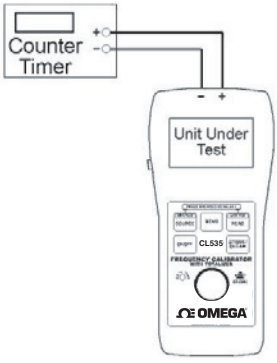


FIGURE 1 (Source Modes)

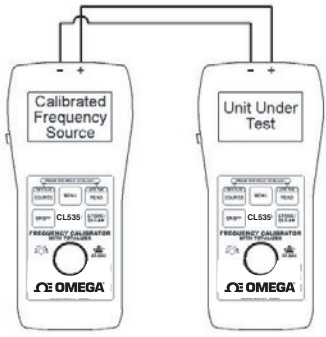


FIGURE 2 (Read Modes)

NOTES

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **37 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **three (3) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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