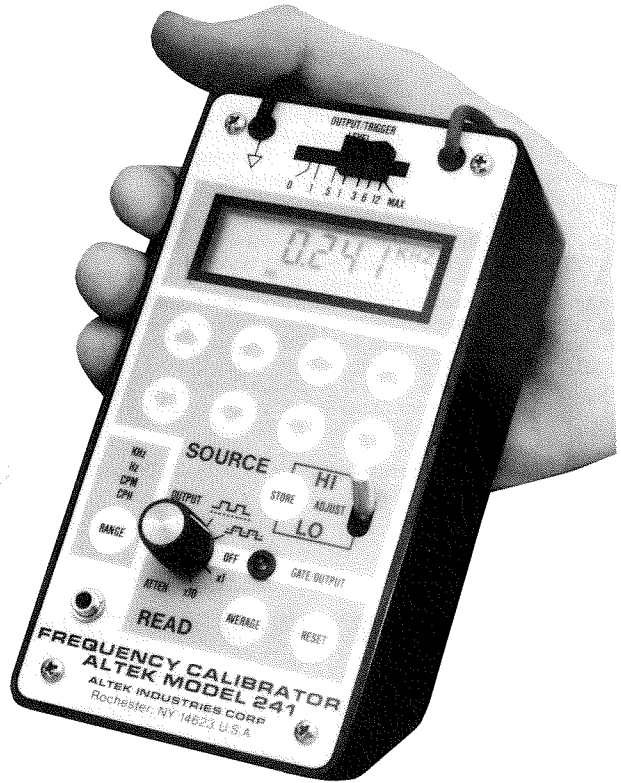


# INDUSTRIAL FREQUENCY CALIBRATOR SOURCES - READS - AVERAGES

- PROCESS CONTROL RANGES
- 3 CYCLES/HOUR TO 200 KHz
- TOOLBOX TOUGH
- "QUIK-CHEK™" SWITCH

**DESIGNED FOR INDUSTRY**

- Chemical Plants
- Refineries
- Food Processing
- Pipelines
- Utilities
- Water & Waste Treatment
- Public Works
- Steel Mills
- Paper Mills
- Textile Mills
- Automotive Plants
- Aerospace
- Pharmaceutical
- Glass & Ceramics
- Metrology
- Beverages
- Plastics
- Machinery
- Ordinance



**APPLICATIONS**

**FREQUENCY OUTPUT SOURCE MODE**

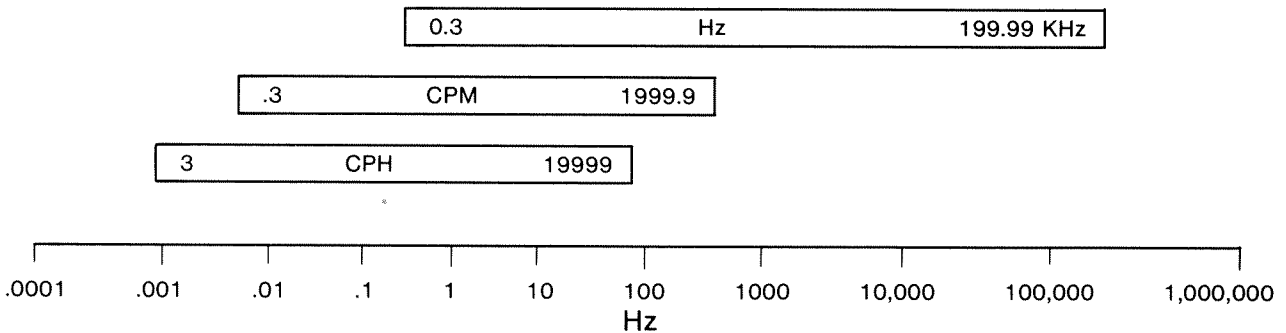
For low frequency applications such as positive displacement flowmeters, Watt-hour meters, slow rate integrators and assembly line counting, the Model 241 sources signals as slow as 0.3 Counts per Minute (0.005 Hz) and 3 Counts per Hour (0.00083 Hz) in the period ranges.

Any frequency from 0.3 Hz to 163.83 KHz can be sourced in three frequency ranges to calibrate tachometers, counters, data loggers, turbine flowmeters and frequency transmitters. Frequency receivers that provide DC power to pickups can also be calibrated. Four decade adjustments allow speedy, precise setting of output frequency.

**FREQUENCY COUNTER READ MODE**

To calibrate devices that require extremely low frequencies (< 1 Hz) the Model 241 reads signals as slow as 4 Counts per Minute (0.0666 Hz) and 120 Counts per Hour (0.0333 Hz) in the period ranges. Period ranges allow you to measure low frequencies without using a stopwatch and events counter or totalizer. You can now calibrate integrators, energy monitors and any other low frequency processes in minutes.

Frequencies can be directly measured from 0.1 Hz to 199.99 KHz in three frequency ranges. V to F converters, accelerometers, velocity detectors, flowmeters and magnetic pickups can all be checked and calibrated.



## GENERAL DESCRIPTION

### ● FIVE REAL-WORLD RANGES

Counts-per-Hour  
Counts-per-Minute  
2000 Hertz  
20 kilohertz  
200 kilohertz

### ● "QUIK-CHEK" SWITCH

Store three values for instant recall

### ● MEASURE AND AVERAGE

0.1 Hz to 200 Hz  
4 CPM to 20,000 CPH

### ● ZERO BASE AND ZERO CENTER

Choose the output to match your process

### ● PHASE LOCK LOOP

Locks on high stability crystal

ALTEK'S Handheld Model 241 Frequency Calibrator combines an ultra stable frequency source with a 4½ digit, laboratory accurate counter.

The Model 241 is ideal for calibrating turbine meters, frequency counters, tachometers, vortex shedders, integrators and any other frequency devices in the shop, plant or field. Three frequency ranges measure from 0.1 Hz to 199.99 KHz with resolution down to 0.1 Hz. Two unique period ranges measure from 4.0 to 1999.9 Counts per Minute and 120 to 19999 Counts per Hour. Quickly indicate process signals... no more waiting around with stopwatch and calculator.

A single 9 Volt alkaline battery provides more than 50 hours of output into high impedance loads.

An optional AC adaptor may be plugged into the jack on the faceplate. The adaptor can be used when the battery is low or for continuous bench and field use.

SOURCE MODE output provides a choice of Zero Based or Zero Crossing square waves. Amplitude is continuously adjustable from millivolts to over 12 Volts peak-to-peak. Each decade is adjusted individually for fast setting. A continuous ramp is provided by holding any up or down key. User adjustable QUIK-CHEK switch stores instant HI and LO outputs in any range. Third value stores automatically in ADJUST position. LED pulses with the output for calibration of optical and fiber optic devices. All ranges and values are retained in any mode of operation... even with the power off.

READ MODE utilizes a rising edge detection circuit for precise readings. Square, sine, triangle or complex waveforms can be measured. Frequency measurement gate times are selected for maximum resolution. Period measurements of Counts-per-Minute and Counts-per-Hour measure the time between successive rising edges for accurate reading every time. AVERAGE Key selects a rolling average of five readings. Dual purpose attenuator system allows adjustment of trigger level for reading true signals, not noise. Signals from less than 30 mV to 240 V peak-to-peak can be measured.

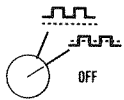
HIGH ACCURACY is maintained using an ultra stable crystal and phase lock loop circuitry. All functions are under microprocessor control for reliable operation.

SELF DIAGNOSTICS are built into the Model 241. If the microprocessor detects any discrepancy between the value displayed and the actual output frequency, ERROR will be indicated on the LCD. Turn the unit off and back on and check the display. If ERROR appears again, service is required.

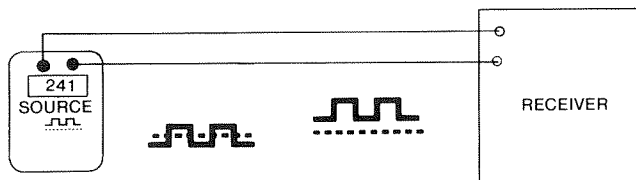
## OPERATING INSTRUCTIONS

### SOURCE MODE

#### SOURCE



- 1) Disconnect one or both input wires from the device to be calibrated or checked
- 2) Turn power on the Model 241 for either Zero Crossing or Zero Based output
- 3) Set the OUTPUT LEVEL with the Slide Potentiometer
- 4) Press the RANGE Key until the desired range appears in the display
- 5) Press the  $\blacktriangle$  or  $\blacktriangledown$  Key for each Digit to select the desired value
- 6) Connect the Model 241 to the device to be calibrated

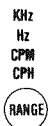


#### OUTPUT



To change the output frequency, press the up or down key which corresponds to the minimum digit to be changed. Output and display will carry to (or borrow from) the next decade(s) for up or down ramping.

#### RANGES



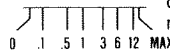
To change the Range, press the RANGE Key until the desired range appears in the display. The order of the five ranges is 200 KHz, 20 KHz, 2000 Hz, CPM and CPH. The digits on the display will remain the same while the output will track as the range changes. To store values for recall, follow the QUICK-CHECK instructions.

#### PERIOD RANGES



Select Counts-per-Minute (CPM) or Counts-per-Hour (CPH) ranges to generate low frequencies. Frequencies as low as 0.3 CPM (0.005 Hz) and 3 CPH (0.00083 Hz) can be sourced.\*

#### OUTPUT/TRIGGER LEVEL



Adjust the OUTPUT LEVEL slide pot to the value required by the receiver. Any value from 50 mV to over 12 Volts p-p may be set. The output level will remain fixed over the entire frequency range.

#### RAMPING



Each decade (1's, 10's, 100's & 1000's) can be ramped at a rate of 4 digits per second by pressing the  $\blacktriangle$  or  $\blacktriangledown$  Key for that digit. Holding any key will cause a continuous ramp. Output and display will carry to (or borrow from) the next decade(s) for smooth ramping.

#### RESET



Output pulses can be stopped and re-initiated by using the RESET Key. Pressing and holding the RESET Key halts the output. Releasing the RESET Key will enable the next rising pulse. Maximum delay is one period. This is especially useful when sourcing low frequencies (< 1 Hz).

#### QUICK CHECK



- 1) Switch to HI (or LO).
- 2) Select RANGE and press  $\blacktriangle$ / $\blacktriangledown$  Keys to desired value
- 3) Press STORE

Any time you need a stored value and range, just throw the switch. Any value in any range may be stored in HI or LO. The Model 241 remembers the HI, LO and ADJUST values for you with the power on or off. (Even remembers while the batteries are being changed.)

If you have a value in the ADJUST position and you want that value in HI or LO, press and hold the STORE Key while moving the switch to HI or LO.

#### OPTICAL DEVICES



#### OUTPUT

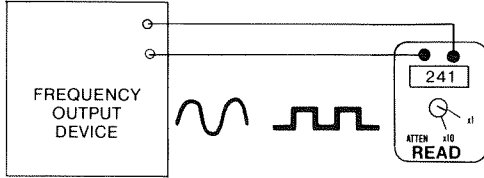
- 1) Set the Model 241 to output the desired frequency
- 2) Place the optical or fiber optic pickup over the GATE/OUTPUT LED
- 3) The LED pulses when the output goes positive
- 4) Use RESET to re-trigger the output

## OPERATING INSTRUCTIONS

### READ MODE



- 1) Turn power on with ATTENUATOR at x10 for signals from 12 to 120 Volts p-p or x1 for signals from 30 mV to 12 Volts p-p
- 2) Press the RANGE Key until the required range appears in the display
- 3) Connect the Model 241 to the device to be measured
- 4) Adjust the TRIGGER LEVEL slide pot until gate LED lights and stable readings are obtained
- 5) Press AVERAGE to start a rolling average of five readings, if desired



The LED will light after detecting the first rising edge to indicate GATE and stays lit until the first reading is displayed. Until the next rising edge is detected, the display will indicate the previous reading. Pressing and releasing RESET will clear the display and enable a new GATE. If the next rising edge is not detected within 30 seconds, the display will change to "0.0". Out-of-range frequency inputs are indicated by OVER or UNDER on the LCD.

PERIOD READINGS



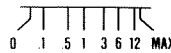
Select Counts-per-Minute (CPM) or Counts-per-Hour (CPH) ranges to measure the time between rising edges and compute the long term reading. Two periods are measured for CPM and one period for CPH. Frequencies as low as 4 CPM (0.0666 Hz) and 120 CPH (0.0333 Hz) can be measured.\*

AVERAGE

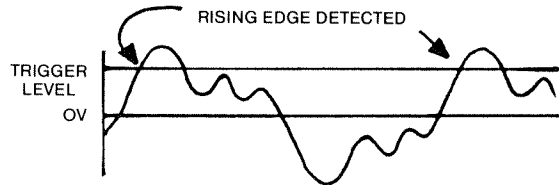


Press the AVERAGE Key to start a rolling average of five readings. After the first five readings have been averaged, each new measurement is averaged with the preceding four and displayed. Press RESET to start a new average at the next rising edge. To cancel averaging, press the AVERAGE Key again.

OUTPUT/TRIGGER LEVEL

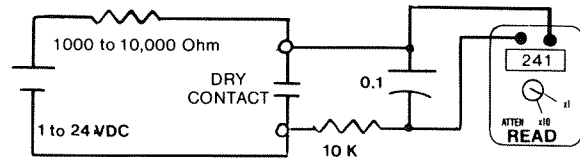


The continuously adjustable TRIGGER LEVEL is used in measurement of noisy signals, AC signals superimposed on DC levels, and to select Voltage threshold for all other signals. TRIGGER LEVEL scale reads 0 to over 12 Volts with ATTEN at x1. The scale should be read as 0 to over 120 Volts with ATTEN at x10. For quickest readings, determine or estimate the Voltage level to be detected and set the ATTENUATOR and TRIGGER LEVEL to match.



READING CONTACTS

Isolated dry contact, open collector transistor or opto-isolated frequencies may be measured with the Model 241. In order to detect contact opening or closing, an external 1½ Volt battery, in series with a 1000 to 10,000 Ohm resistor, may be used. Select connection polarity to provide desired signal upon contact transfer. Relay or switch contacts may require a resistor-capacitor filter in order to eliminate contact bounce errors. Typical filter values for mechanical contacts are 10 K Ohms and 0.1 microfarads.



## OPERATING HINTS

### READ MODE

In order for the Model 241 to obtain the most accurate readings you must correctly set the ATTENUATOR, INPUT LEVEL and RANGE. Signals from 30mV to over 120 Volts p-p, with or without DC offsets can be displayed.

SYMPTOM	CHECK	SOLUTION
Gate LED unlit, Display shows 0.0	Connections	Make sure all power and signals are properly connected.
	Attenuator	Set at x1 for signals from 30 mV to 12 Volts p-p, x10 for signals over 12 Volts p-p.
	Input level	Adjust slide pot until GATE LED pulses and readings are displayed.
	DC Offset	Small signals with large DC offsets may require a series capacitor.
Over/Under Range indicated	Range	Press the RANGE Key until the correct range appears in the LCD.
Unstable reading	Input level	Adjust slide pot until stable readings are displayed.
	Average	Press AVERAGE Key to start a rolling average of five readings. Press again to cancel averaging.

### SOURCE MODE

Some receivers can only detect signals that go from positive to negative (Zero Crossing) while other receivers require only positive signals (Zero Based). The Model 241 provides a choice of these outputs.

SYMPTOM	CHECK	SOLUTION
Lack of Response	Connections	Make sure all power and signals are properly connected.
	Source switch setting	Switch to Zero Based or Zero Crossing.
Wrong Range	Range	Press the RANGE Key until the correct range appears in the LCD.
Lack of response or jittery signal	Peak Voltage	Adjust the OUTPUT LEVEL slide pot up or down to match the input level of the device being calibrated.

#### ★ CONVERSIONS

To Convert	From:	To:	Divide By
CPM	Hz	Hz	60
	CPH	Hz	3600
To Convert	From:	To:	Multiply By
Hz	CPM	Hz	60
	CPH	Hz	3600

## TYPICAL APPLICATIONS

Turbine Flowmeters	Telemetry Systems
Vortex Shedders	Event Recorders
Positive Displacement Flowmeters	Vibration Monitors
Watt-hour Meters	Totalizers
V to F and F to V Converters	Data Loggers
Integrators	Velocity Detectors
Tachometers	Magnetic Pickups
Uninterruptable Power Supplies	Motion Detectors
Counters	Flowmeter Pickups
Frequency Transmitters	DC Contact Closures
Variable Speed Drives	

## TYPICAL INDUSTRIES

Chemical Plants	Automotive Plants
Petroleum Refineries	Aerospace
Food Processing	Pharmaceutical
Pipelines	Glass & Ceramics
Utilities	Metrology
Water & Waste Treatment	Beverages
Public Works	Plastics
Steel Mills	Machinery
Paper Mills	Ordinance
Textile Mills	Computers

## SPECIFICATIONS

(Unless otherwise indicated, specifications are in  $\pm\%$  of Reading @ 25°C)

### READ MODE

Accuracy:  $\pm 0.005\% \pm \frac{1}{2}$  Least Significant Digit (LSD)  
 Sensitivity: Triggers down to 30mV, DC coupled. (CPH Range triggers down to 100mV)  
 Maximum input voltage: 240 Volts peak-to-peak  
 Minimum pulse width: 2 microseconds  
 Input resistance: >1 Meg Ohm  
 Trigger Level Adjustment: x1 & x10 Attenuator plus continuous logarithmic control  
 Digital filtering: Push button selected rolling average of last five readings (Direct measurement of each cycle if not selected)

### SOURCE MODE

Accuracy:  $\pm 0.001\%$   
 Outputs: Square waves, adjustable from 50 mV to 14 V p-p, Zero based or Zero centered, 50%  $\pm$  1% Duty Cycle  
 Risetime: < 1 usec  
 Output impedance: 600 Ohms  
 Output adjust rate: 4 Digits/sec  
 Switched values: Two user adjustable "QUIK-CHEKS" (HI & LO) plus ADJUST position  
 Source Current: 8mA max  
 Short Circuit Duration: Infinite  
 Optical output: LED calibrates Optical pickups  
 Voltage protection: Protected against accidental misconnection to 120 Volts AC/DC

### GENERAL

Internal crystal: <20 PPM/Year drift  
 Battery: Operates from one 9 Volt Battery (Alkaline supplied and recommended)  
 Battery Life: Minimum 50 hours READ Mode or with high impedance loads  
 Low Battery: "BAT" indication on LCD at 7 Volts nominal (approx. 10 hours left). Unit will shut down at 6 Volts to preserve memory  
 Memory: Retains output and QUIK-CHEK values, power on or off. Memory is preserved for 4 Hours without battery  
 Optional AC Adaptors: 120VAC and 240VAC, 50/60 Hz inputs  
 Slide Attenuator: Logarithmic for smooth input/output signal control  
 Temperature Effect:  $\pm 0.0001\%/^{\circ}\text{C}$  based on 25°C  $\pm 25^{\circ}$   
 Operating Temperature Range: Plus 5 to plus 140°F (minus 20 to plus 60°C)  
 Storage Temperature Range: minus 22 to plus 175°F (minus 30 to plus 80°C)  
 Relative Humidity: 10 to 90%, non-condensing  
 Warm up time: 5 seconds to rated accuracy  
 Overall Size: 6x3x2 inches (15.2x7.6x5.1 cm)  
 Weight: 14 oz. (0.4 kg)

## RANGES

RANGE	SOURCE	RESOLUTION	RANGE	READ	GATE TIME	RESOLUTION
KHz	0.03 to 163.83 KHz	10 Hz	KHz	0.01 to 199.99 KHz	0.1 seconds	10 Hz
KHz	0.003 to 16.383 KHz	1 Hz	KHz	0.001 to 19.999 KHz	1 second	1 Hz
Hz	0.3 to 1638.3 Hz	0.1 Hz	Hz	0.1 to 1999.9 Hz	10 seconds	0.1 Hz
CPM	0.3 to 1638.3 CPM	0.1 CPM	CPM	4.0 to 1999.9 CPM	Period x2	0.1 CPM
CPH	3 to 16383 CPH	1 CPH	CPH	120 to 19999 CPH	Period x1	1 CPH

### WARRANTY

Our equipment is guaranteed against defective material and workmanship (excluding batteries) for a period of three years from date of shipment.

Claims under guarantee can be made by returning the equipment prepaid to our factory. The equipment will be replaced, repaired or adjusted at our option.

The liability of Altek is restricted to that given under our guarantee. No responsibility is accepted for damage, loss or other expense incurred through sale or use of our equipment. Under no condition shall Altek be liable for any special, incidental or consequential damage.

### ORDERING INFORMATION:

MODEL 241 Frequency Calibrator  
 Carrying Case (included)  
 AC Adaptor: 120VAC  
 AC Adaptor: 240VAC

### Part No.

241-6383  
 09-3782  
 28-0120  
 28-0240

### OTHER PRODUCTS

Altek designs and manufactures fast, accurate instruments for measurement, generation and simulation of virtually every process control signal.

Contact our factory directly or your local stocking representative to order precise, low cost Milliamp Calibrators, Voltage Sources, Direct Thermocouple Sources, RTD Simulators and Frequency Sources. Altek also produces calibrators for custom ranges and unique applications.

Additional models and ranges are frequently added to the Altek instrument family to meet all of your critical calibration requirements.

### AVAILABLE FROM: