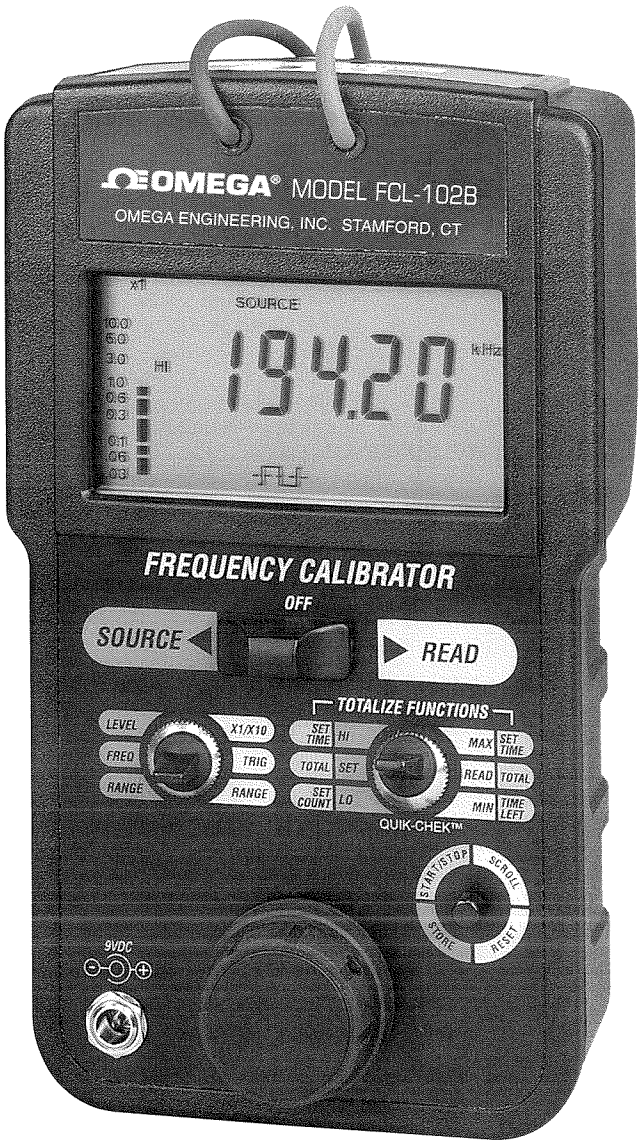

User's Guide

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CE

FCL102B
Frequency Calibrator With Totalizer

OPERATING INSTRUCTIONS

GENERAL

TURN-ON

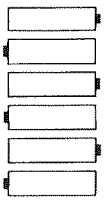
Each time the FCL102B is turned on, the LCD will display all segments for about 1 second. It then displays the currently selected waveform (Source Mode) for approximately 3 seconds.

1) Move the power switch to SOURCE or READ. All segments on the LCD are turned on during self test.
2) (SOURCE MODE ONLY) The display will indicate the selected waveform for 3 seconds. Repeatedly press or press and hold the SCROLL/STORE pushbutton to change to the desired waveform.
3) (SOURCE MODE ONLY) The three QUIK-CHEK frequency outputs will be the same as previously stored. Each time a different range is selected, the three QUIK-CHEK outputs for that range will be recalled.
4) Move the mode switch to RANGE and repeatedly press or press and hold the SCROLL pushbutton to change to the desired frequency range.
5) Return the mode switch to FREQ/TRIG to source or read frequency signals.

CONNECTIONS

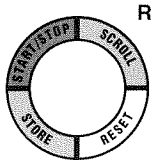
The FCL102B has built-in test leads with alligator clips for attachment to instruments or sensors with terminal blocks or flying leads. An optional BNC connector attaches to instruments or sensors equipped with BNCs for fast connections.

CHANGING BATTERY



Low battery is indicated by BAT on the LCD Display. Approximately 10 Hours of operation remain before the LCD goes blank and the FCL 102B shuts itself down. Turn the FCL 102B off, loosen the three captive screws securing the battery compartment cover. The six "AA" batteries are easily removed and replaced. Replace the battery compartment cover, tighten the screws and turn on when ready to use.

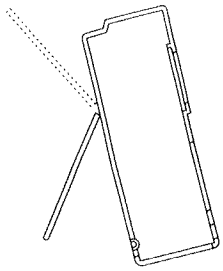
RESET



The FCL102B may be reset from the front panel to factory default settings. This will reset all the "QUIK-CHEK" memories to display 1000 and will set the output and trigger levels to 1 V p-p.

1) Press and hold the SCROLL/RESET pushbutton while turning the FCL 102B on to SOURCE or READ
2) Keep pressing the STORE pushbutton for 10 seconds
3) All segments on the LCD will remain displayed until the FCL102B has been reset

FIELD & BENCH USE



The FCL102B comes with a carrying case and a built-in tilt stand/hanger. The FCL102B is held securely in the case by Velcro® even with the carrying case open. The carrying case also has a snap-on belt loop which can also be looped around a pipe or rail.

The tilt stand is easily raised by pulling the stand until it locks into place. The stand can also be reversed for use as a hanger to suspend the FCL 102B.

OPERATING HINTS

READ MODE

In order for the FCL102B to obtain the most accurate readings you must correctly set the ATTENUATOR, TRIGGER LEVEL and RANGE. Signals from 50mV to over 240 Volts p-p, with or without DC offsets can be displayed.

SYMPTOM	CHECK	SOLUTION
GATE on LCD, Display shows 0.0	Connections	Make sure all power and signals are properly connected.
	Attenuator	Set at x1 for signals from 50mV to 12 Volts p-p, x10 for signals over 12 V p-p.
	Input level	Turn knob until GATE pulses and readings are displayed.
	DC Offset	Small signals with large DC offsets may require a series capacitor.
OVER/UNDER Range on LCD	Range	Move the mode switch to RANGE and press the SCROLL/RESET pushbutton until the correct range appears in the LCD.
Unstable reading	Trigger Level	Turn knob until GATE pulses and readings are displayed.

SOURCE MODE

Some receivers can only detect signals that go from positive to negative (Sine Wave or Zero Crossing Square Waves) while other receivers require only positive signals (Zero Based Square Waves). The FCL 102B provides a choice of these outputs.

SYMPTOM	CHECK	SOLUTION
Lack of Response	Connections	Make sure all power and signals are properly connected.
	Waveform	Turn FCL 102B OFF and back on to SOURCE. Repeatedly press the SCROLL/STORE pushbutton until the correct waveform is displayed.
Wrong Range	Range	Move the mode switch to RANGE and press the SCROLL/RESET pushbutton until the correct range appears in the LCD.
Lack of response or jittery signal	Peak Voltage	Move the mode switch to LEVEL and turn the knob while observing the logarithmic bar graph to match the input level of the device being calibrated. Return the mode switch to FREQ.

CPM/CPH CONVERSIONS

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

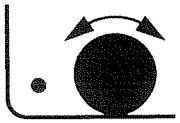
To Convert	From:	To:	Multiply By:
	Hz	CPM	60
	Hz	CPH	3600

OPERATING INSTRUCTIONS

FREQUENCY OUTPUT (SOURCE MODE)

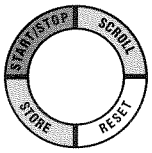
SOURCE

1) Move the POWER switch to SOURCE
2) Move the mode switch to RANGE and repeatedly press or press and hold the SCROLL/STORE pushbutton to change to the desired frequency range. Return the mode switch to FREQ.
3) Move the mode switch to LEVEL (AMPLITUDE) and turn the Digipot (Knob) until the logrithmic bargraph on the display reaches the desired level.Return the mode switch to FREQ.
4) Connect the FCL102B to the input terminals of the instrument or meter to be calibrated
5) Adjust the digital pot to the desired output value or QUIK-CHEK with previously stored frequency outputs (see below)



Whenever SOURCE mode is selected the word SOURCE will appear on the LCD display. To change the output value, turn the speed sensitive digital pot. Turning the pot slowly will cause a gradual change in the output. A faster change will occur when the pot is turned faster. This function operates in all three output positions (HI, SET & LO).

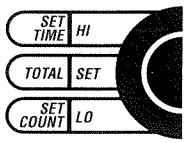
STORE



1) Switch to HI or LO
2) Turn the digital pot to desired value
3) Press the STORE/SCROLL pushbutton
   The LCD will flash once to show that the value was saved

If a value is in the SET position and you want that value stored in HI or LO, press and hold the STORE/SCROLL pushbutton while moving the switch to HI or LO. The display will flash once to indicate the value has been stored. Then release the STORE/SCROLL button.

QUIK-CHEK



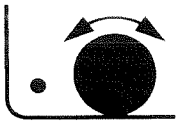
Any time you need a stored value just throw the QUIK-CHEK switch. Any value in the frequency range may be stored in HI & LO. The FCL102B remembers the HI, LO and SET values for all ranges (18 memories) for you with the power on or off. Each time a different frequency range is selected, the last three QUIK-CHEK values for that type will be recalled.

Hint: Pressing the STORE/SCROLL pushbutton will disable the FCL102B frequency generator. Releasing the pushbutton will re-enable the output. This is useful for synchronizing with displays for slow (< 1 Hz) signals

FREQUENCY COUNTER (READ MODE)

READ

1) Move the POWER switch to READ
2) Move the mode switch to RANGE and repeatedly press or press and hold the SCROLL/RESET pushbutton to change to the desired frequency range. Return the mode switch to TRIG.
3) Switch the MODE switch to LEVEL (AMPLITUDE) to toggle between x1 & x10 attenuation (Use x1 for signals from 30 mV to 12 V p-p, x10 for signals from 12 V to 240V p-p). Return the mode switch to TRIG.



4) Connect the FCL102B to the output of the instrument or sensor to be measured.
5) Adjust the trigger level to obtain a stable frequency reading by turning the Digipot (knob). A bargraph on the display will show the approximate trigger level.
6) Use the "QUIK-CHEK" switch to display present reading, MAXimum or MINimum frequency.

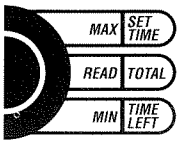
The word GATE will appear on the display whenever the FCL102B is measuring the frequency signal and will flash each time the displayed reading is updated.

PERIOD READINGS

CPM
CPH

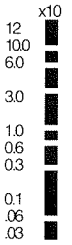
Select Counts-per-Minute (CPM) or Counts-per-Hour (CPH) to measure slow frequency signals. Frequencies as low as 0.1 CPM (0.001666 Hz) and 10 CPH (0.002777 Hz) can be measured (See CPM/CPH CONVERSIONS for conversion factors).

MIN/MAX



To read the Maximum or Minimum frequencies since READ mode was entered, simply switch to MAX or MIN. The value will appear on the LCD along with the word MAX or MIN. The MAX/MIN values are automatically updated and may be viewed at any time without disturbing the other values. Pressing the RESET/SCROLL pushbutton will cause the FCL102B to stop counting frequencies and will display zeros. Upon releasing the RESET/SCROLL the FCL102B will display GATE, resume counting frequencies and update the MAX & MIN values as the measured frequency changes.

TRIGGER LEVEL



The adjustable TRIGGER LEVEL is used in measurements of noisy signals, AC signals superimposed on DC levels and to select Voltage threshold for all other signals. The bargraph on the display shows the approximate level from 0 to over 12 V positive peak with the attenuator set at x1. This bargraph should be read as 0 to over 120 V positive peak with the attenuator set at x10. For quickest readings, determine or estimate the voltage level to be detected and set the ATTENUATOR and TRIGGER LEVEL to match.

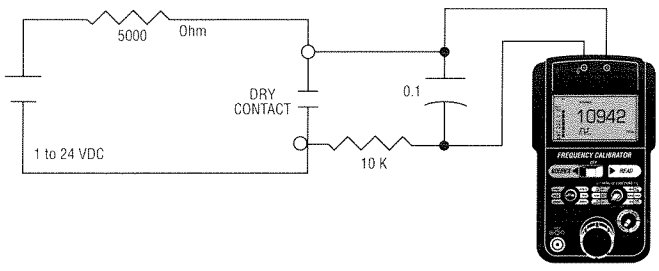
OUT OF RANGE SIGNALS

OVER
UNDER

Frequencies above or below those available for the currently selected range will be indicated by OVER and UNDER on the display (See OPERATING HINTS).

READING DRY CONTACTS

Isolated dry contact, open collector transistor or opto-isolated frequencies may be measured with the circuit shown. In order to detect contact opening or closing, an external battery or power supply, in series with a 5000 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 INSTRUCTIONS

CALIBRATE TOTALIZERS (SOURCE MODE)

CALIBRATE TOTALIZERS (OUTPUT PULSES)

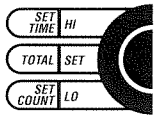
1) Move the POWER switch to SOURCE
2) Move the mode switch to RANGE and repeatedly press or press and hold the SCROLL pushbutton until the word TOTAL appears on the LCD. The ouput waveform will automatically change to a zero based square wave. Return the mode switch to FREQ.
3) Move the mode switch to LEVEL (AMPLITUDE) and turn the Digipot (Knob) until the logrithmic bargraph on the display reaches the desired level. Return the mode switch to FREQ.
4) Move the TOTALIZE FUNCTIONS switch to SET TIME. Adjust the digital pot to the number of minutes (1 to 99) that you require the FCL102B to output pulses.
5) Move the TOTALIZE FUNCTIONS switch to SET COUNT. Adjust the digital pot to the number of pulses (1 to 99999) that you require the 942 to output. Return the TOTALIZE FUNCTIONS switch to TOTAL.
6) Connect the FCL102B to the input terminals of the instrument or meter to be calibrated.
7) Reset to zero or record the value from the readout of the totalizer or device being calibrated.
8) Press the START/STOP pushbutton to start outputting pulses. The display of the FCL102B will increment with each output pulse. The FCL 102B will automatically stop outputting pulses when the selected time has elapsed.

Whenever CALIBRATE TOTALIZER mode is selected the words SOURCE and TOTAL appear on the LCD display. You can recall the settings for TIME and COUNTS without interrupting the output pulses by moving the TOTALIZE FUNCTIONS switch to SET TIME and SET COUNTS.

RESTARTING CALIBRATE TOTALIZERS

The FCL102B will automatically stop outputting pulses when the selected time has elapsed. To restart CALIBRATING TOTALIZERS press the START/STOP bushbutton while the QUIK-CHEK switch is in the TOTAL position. The display on the FCL102B will reset to 0 and will automatically begin outputting pulses.

CHANGING CALIBRATE TOTALIZER SETTINGS



The settings for TIME and COUNTS can be changed whenever the FCL102B isn't outputting pulses. Move the TOTALIZE FUNCTIONS switch to SET TIME and SET COUNTS and turn the digital pot to set the new values as in steps 4 and 5.

INTERRUPTING CALIBRATE TOTALIZER

Press the START/STOP pushbutton while the QUIK-CHEK switch is in the TOTAL position to interrupt the output pulses at any time. The FCL102B will stop sending the pulses and will display the number of pulses which have been put out. This can be done to verify the device being calibrated without waiting the entire selected number of minutes.

TOTALIZE (READ MODE)

TOTALIZE (COUNT PULSES)

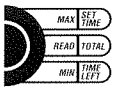
1) Move the POWER switch to READ
2) Move the mode switch to RANGE and repeatedly press or press and hold the SCROLL pushbutton until the word TOTAL appears on the LCD. Return the mode switch to FREQ.
3) Switch the MODE switch to LEVEL (AMPLITUDE) to toggle between x1 & x10 attenuation (Use x1 for signals from 30 mV to 12 Vp-p, x10 for signals from 12 V to 240 Vp-p). Return the mode switch to TRIG.
4) Adjust the trigger level by turning the Digital pot (knob). A bargraph on the display will show the approximate trigger level.
5) Move the TOTALIZE FUNCTIONS switch to SET TIME. Adjust the digital pot to the number of minutes (1 to 99) that you require the FCL102B to count pulses. Return the TOTALIZE FUNCTIONS switch to TOTAL.
6) Connect the FCL102B to the output of the instrument or sensor to be measured.
7) Press the START/STOP pushbutton to begin counting pulses.
8) If the FCL102B doesn't increment the LCD display adjust the trigger level by turning the Digital pot until the display starts incrementing. A bargraph on the display will show the approximate trigger level. Press the Start/Stop pushbutton twice to restart totalizing.

Whenever TOTALIZER mode is selected the words READ and TOTAL appear on the LCD display. You can recall the settings for the SET TIME without interrupting the output pulses by moving the TOTALIZE FUNCTIONS switch to SET TIME. You can also see how much time is remaining by moving the TOTALIZE FUNCTIONS switch to TIME LEFT.

RESTARTING TOTALIZE

The FCL102B will automatically stop counting pulses when the selected time has elapsed. To restart TOTALIZE press the START/STOP pushbutton while the QUIK-CHEK switch is in the TOTAL position. The display on the FCL102B will reset to 0 and will automatically begin counting pulses.

CHANGING TOTALIZE SETTINGS



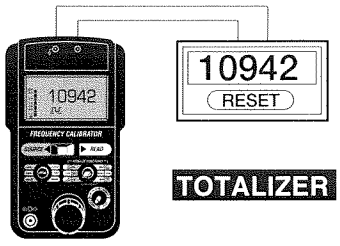
The setting for TIMEcan be changed whenever the FCL102B isn't counting pulses. Move the TOTALIZE FUNCTIONS switch to SET TIME and turn the digital pot to set the new value as in step 5.

INTERRUPTING TOTALIZE MODE

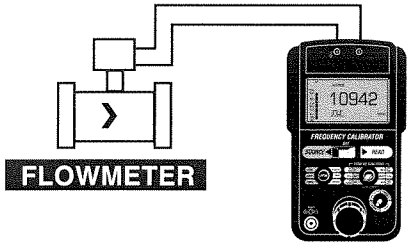
Press the START/STOP pushbutton while the QUIK-CHEK switch is in the TOTAL position to interrupt the pulse counting at any time. The FCL102B will stop counting the pulses and will display the number of pulses which have been counted. This can be done to verify the device being calibrated without waiting the entire selected number of minutes. To restart TOTALIZE press the START/STOP pushbutton while the QUIK-CHEK switch is in the TOTAL position (see RESTARTING TOTALIZE above).

CONNECTIONS

CALIBRATE TOTALIZERS



TOTALIZE



SPECIFICATIONS

(Unless otherwise indicated, specifications are in ±% of Reading @ 23°C)

GENERAL

FREQUENCY STABILITY: <10 PPM/Year drift
TEMPERATURE EFFECT: ±0.001%/°C based on 23°C±25°C
BATTERIES: Six "AA" batteries (Alkaline supplied and recommended)
BATTERY LIFE:
READ MODE: >80 hours, nominal
SOURCE MODE: >50 hours, nominal at 250 KHz at 12V p-p
LOW BATTERY: "BAT" indication on the display at6.5 V nominal, approximate 10 hours left
ATTENUATOR: Logarithmic for smooth input/output signal level control
OPERATING TEMPERATURE RANGE: -5 to +140°F (-20 to +60°C)
STORAGE TEMPERATURE RANGE: -13 to +149°F (-25 to +65°C)
RELATIVE HUMIDITY: 10 to 90%, non-condensing, for 24 hours
WARM UP TIME: 5 seconds to rated accuracy
OVERALL SIZE: $7^{3}/_{16}$ x 4 x $2^{7}/_{16}$ inches (183 x 102 x 62 mm)
WEIGHT: 1lb, 7oz (0.650 kg)

READ MODE

ACCURACY: ±(0.001% of reading + 1 LSD)
SENSITIVITY: Triggers on positive peaks down to 40 mV peak, DC coupled
MAXIMUM USABLE INPUT VOLTAGE: 240 VAC
MINIMUM PULSE WIDTH: 2 microseconds
MINIMUM TIME BETWEEN PULSES: 2 microseconds
TOTALIZER: Incremental counter to 99999 counts, timed operation from1 to 99 minutes at a maximum rate of 1666.65 Hz
INPUT IMPEDANCE: > 1 Meg Ohm + 60pF
TRIGGER LEVEL ADJUSTMENT: x1 & x10 Attenuator plus logarithmic control
NOTE: High signal noise and low slew rate (Volts-per-second) may affect reading uncertainty

SOURCE MODE

ACCURACY: ±0.001% of reading
OUTPUT WAVEFORMS:
Sine, Zero Based Square, and Zero Centered Square Waves
TOTALIZER OUTPUT: from 1 to 99999 pulses for a period from 1 to 99 minutes up to a maximum rate of 1666.65 Hz
OUTPUT AMPLITUDE: 50 mV to 12 V p-p, 50% ±1% duty cycle
RISETIME: <1microsecond @ 12V peak-to-peak
OUTPUT IMPEDANCE: 600 Ohms
SOURCE CURRENT: 8 mA maximum
SHORT CIRCUIT DURATION: Infinite
VOLTAGE PROTECTION: Protected against misconnection to 240 Volts peak AC/DC without fuses for 30 seconds

Specifications subject to change without notice

RANGES

RANGE	SOURCE	READ	GATE TIME
KHz	0.01 TO 250.00	0.01 TO 250.00	0.2 seconds
KHz	0.001 TO 99.999	0.001 TO 99.999	1 second
Hz	0.1 TO 9999.9	0.1 TO 9999.9	1 full cycle
Hz	0.01 TO 999.99	0.01 TO 999.99	1 full cycle
CPM	0.1 TO 2000.0	0.1 TO 2000.0	1 full cycle
CPH	1 TO 20000	10 TO 20000	1 full cycle
TOTAL	Up to 99999 counts in 99 minutes	Up to 99999 counts	1 full cycle

TYPICAL APPLICATIONS

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

TYPICAL INDUSTRIES

Chemical Plants
Petroleum 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
Computers

ORDERING INFORMATION

	Part No.
FCL102B FREQUENCY CALIBRATOR	**FCL102B**
WITH OPTIONAL BNC CONNECTOR	**FCL102B-BNC**

Included with each FCL102B are:
Carrying Case
NIST Traceable Certificate

OPTIONAL ACCESSORIES

	Part No.
AC ADAPTOR: 120 VAC, 50/60 Hz	FCL1-AD1
AC ADAPTOR: 240 VAC, 50/60 Hz	FCL1-AD2

MADE IN USA

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, 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 which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

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 product, and
3. Repair instructions and/or specific problems relative to the product.

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