international light INC.

DEXTER INDUSTRIAL GREEN, NEWBURYPORT, MASS. 01950
Tel. 617-465-5923 Telex 94-7135

PHOTODETECTOR CALIBRATION CERTIFICATE

International Light certifies that the instrument described below has been compared with laboratory working standards whose calibrations are traceable to the US National Bureau of Standards and are in accordance with the requirements of Mil-STD-45662 Rev. 10 June 1980.

Rendered To: COMERCIAL RAFER

Detector: INS250 #37 Diffuser: ____

Filter: ____ Attenuator: ____

Spectral Response (half power points): SEE CHART

SENSITIVITY FACTOR:

____ (A)(cm²)(W⁻¹) assuming monochromatic irradiance at ____ nm.

____ (A)(Sr)(cm²)(W⁻¹) assuming monochromatic radiance at ____ nm.

____ (A)(W⁻¹) assuming monochromatic source with beam diameter less than sensitive surface diameter, at ____ nm wavelength.

____ (A)(cm²)(nm)(W⁻¹) assuming continuous spectral irradiance over a calibration bandwidth of ____ nm centered at ____ nm.

____ (A)(ft²)(lm⁻¹) assuming ____ K color temperature source.

____ (A)(fL⁻¹) assuming ____ K color temperature luminance.

OTHER CALIBRATIONS OR REMARKS: NOTE: YIN CALIBRATION: The "Grain of Wheat" Lamp for INS250 #37 has an output of 5.12 X 10-1 (LM) or 40.76 millicandela.

REFERENCE PLANE:

___ Scribe Line ___ Front surface of diffuser
___ Groove No. ____, formed by filter or diffuser elements and next element, counted from front surface of assembly.

X Other SEE NOTE ABOVE.

PRIMARY STANDARD: US National Bureau of Standards Detector Response & Intercomparison package (D.R.I.P.), DR #10 - June 1980
INTERNATIONAL LIGHT PRIMARY TRANSFER STANDARD(S):
IL D.R.I.P. #01. IL D.R.I.P. #02, IL D.R.I.P. #03 30 July 1980

LIGHT SOURCE: INS250 #14

INSTRUMENTATION: #519 Radiometer

TEMPERATURE: 22 degrees C RELATIVE HUMIDITY: 40%

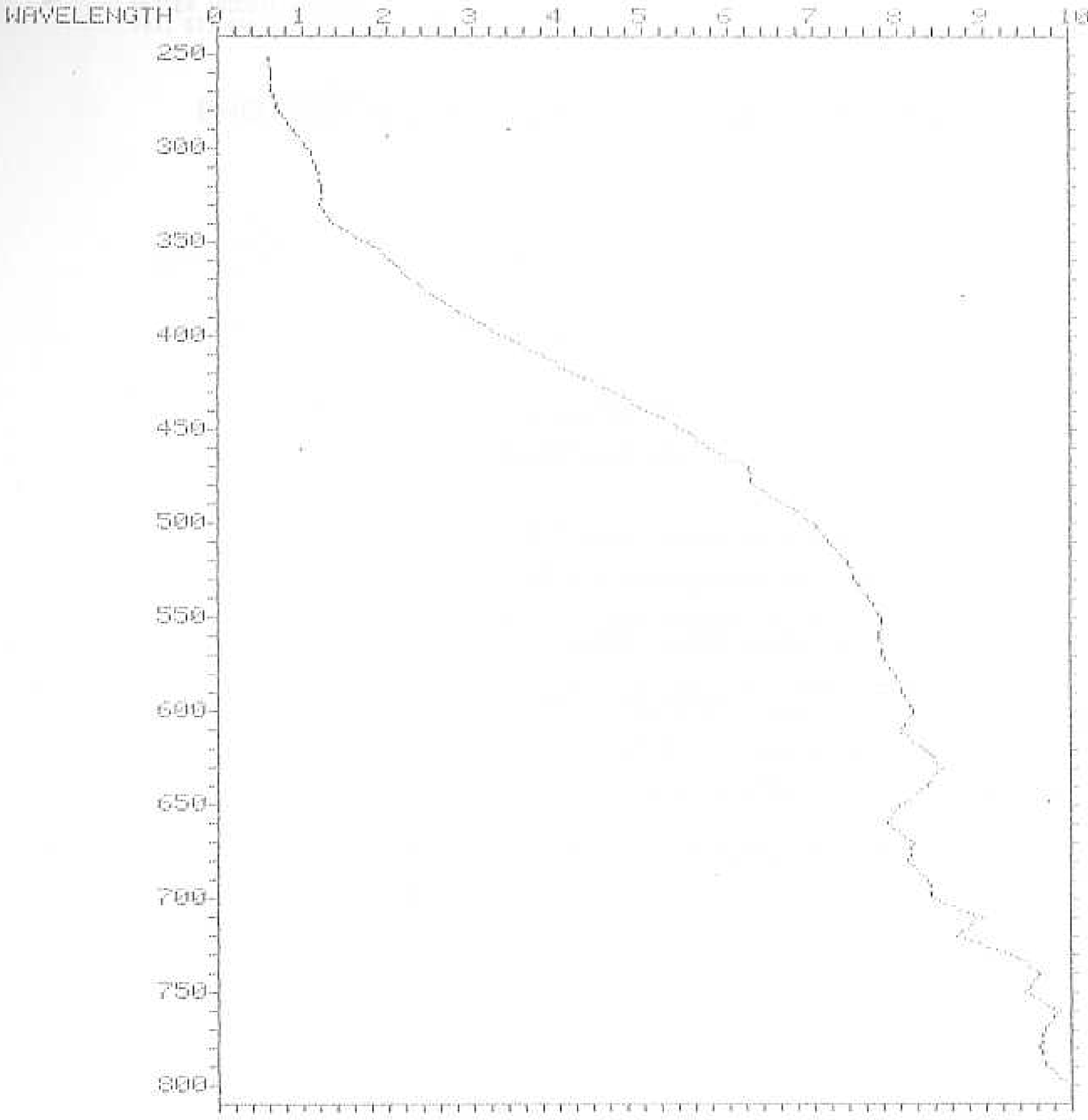
CALIBRATED BY: ____ CHECKED BY: ____

FOR COPIES OF THIS CERTIFICATE OR OTHER INFORMATION PLEASE REFER TO THESE NUMBERS

Date: 04JAN88 Certificate # 801040105 FO # 22318A

SHR INS250 #20 1/03/86 .

This is a spectral plot of file 'INS250#20' normalized to 10



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Rendered To: COMERCIAL RAFER

Detector: SED100 #1153 Diffuser: W #4031

Filter: F #5744 Attenuator: ________

Spectral Response (half power points): SEE CHART

SENSITIVITY FACTOR:

2.23 X 10-2 (A)(cm²)(W⁻¹) assuming monochromatic irradiance at 600 nm.

________ (A)(Sr)(cm²)(W⁻¹) assuming monochromatic radiance at ________ nm.

________ (A)(W⁻¹) assuming monochromatic source with beam diameter less than sensitive surface diameter, at ________ nm wavelength.

________ (A)(cm²)(nm)(W⁻¹) assuming continuous spectral irradiance over a calibration bandwidth of ________ nm centered at ________ nm.

________ (A)(ft²)(lm⁻¹) assuming ________ K color temperature source.

________ (A)(fL⁻¹) assuming ________ K color temperature luminance.

OTHER CALIBRATIONS OR REMARKS: Unit will read directly in watts per square centimeter when used with an IL1700.

REFERENCE PLANE:

__ Scribe Line

X Groove No. ONE , formed by filter or diffuser elements and next element, counted from front surface of assembly.

__ Front surface of diffuser

__ Other ________

PRIMARY STANDARD: US National Bureau of Standards Detector Response & Intercomparison package (D.R.I.P.), DR #10 - June 1980

INTERNATIONAL LIGHT PRIMARY TRANSFER STANDARD(S):
IL D.R.I.P. #01. IL D.R.I.P. #02, IL D.R.I.P. #03 30 July 1980

LIGHT SOURCE: IP Tungsten Halogen

INSTRUMENTATION: #IL #01 Radiometer

TEMPERATURE: 22 degrees C RELATIVE HUMIDITY: 40%

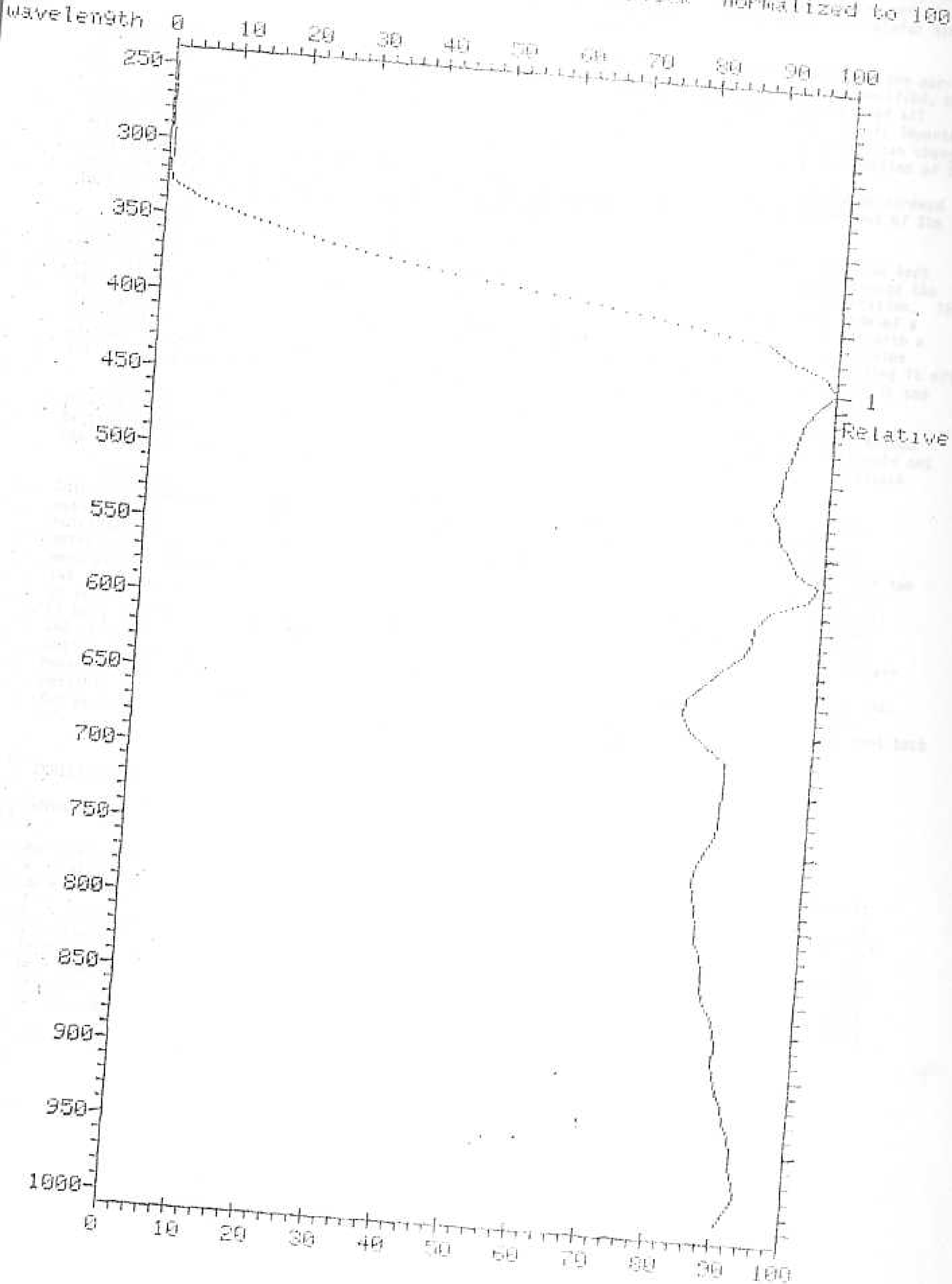
CALIBRATED BY: [signature] CHECKED BY: [signature]

FOR COPIES OF THIS CERTIFICATE OR OTHER INFORMATION PLEASE REFER TO THESE NUMBERS

Date: 04JAN88 Certificate # 801048103 FO # 22318A

SED038 F TYPICAL RESPONSIVITY 1/27/87

this is a spectral plot of file 'u38/f.stock' normalized to 100



The photodetector described on the front of this certificate is a delicate precision instrument and should be handled very, very carefully. Unusual stresses or sudden shocks can permanently damage the detector or at the least, render the calibration void. Discoloration, chips, cracks, and other physically evident signs of change should be checked out immediately. Below are a few helpful hints meant to aid in prolonging the quality and life of your detector.

PHOTODETECTOR ELEMENT PLACEMENT, DIFFUSERS, ATTENUATORS & FILTERS! All calibrations are performed with diffusers, attenuators and filters in a specific order. Unless otherwise specified, the light flux should first come in contact with the diffuser, then the attenuator, and last of all the filters before coming in contact with the sensitive surface of the cell or tube. It is important that the above order be followed for two reasons: (1) Changing the order of the elements can change the calibration slightly. (2) Placing an attenuator after a filter can accelerate degradation of that filter.
SPECIAL NOTE: For the PT100 and PT170 series detectors, filters and attenuators should be screwed into the diffuser cap (attenuators first) so that the stamped serial numbers are facing out of the back of the cap toward the sensitive area of the detector.

CLEANING DIFFUSERS: The diffuser surface (sandblasted side) on all diffusers should be kept as clean and dust free as possible. Dust, finger prints, or any other contaminates can change the transmission and/or spectral response of a diffuser drastically: This can void the calibration. The best way to care for a diffuser is not to handle it at all. If, however, the diffuser side of a diffuser does become contaminated you can reasonably restore the surface by washing it off with a high grade Freon (Trichlorotrifloroethane) solvent or methanol alcohol. DO NOT attempt to wipe the surface dry, but allow it to dry on its own. NOTE: The process can be improved by drying it off with an air hose. Before using an air hose, check the air system that you are about to use to see that it has a moisture oil filter which keeps the air free of any contaminants.

FILTERS: Filters and the polished side of a diffuser, may be cleaned using the above method or with a more readily available glass and/or plastic cleaner. In all cases the cleaner should not be the type that will leave behind a film of its own or contain strong solvents which can attack the filter and its cementing compounds.

CALIBRATION SCHEDULE: In most cases detectors should be calibrated at leat once yearly. Detectors that are used daily on production line or for quality control and health hazard measurements should be checked and/or calibrated more often (usually once every six months).
ALTERNATE METHOD: One method for checking detector calibrations which is used, it to purchase two detectors. One detector is kept stored in an out of the way place while the second is used to work with. Whenever the calibration of the "work" detector is to be checked or is in question, the "stored" detector is then taken out of storage and the results from the two are compared. If they compare, it is reasonable to assume that both detectors still have valid calibrations. If both detectors do not compare, the two detectors and instrument should be sent back for repair and calibration.
(NOTE: The above check does not tell you which detector has changed, only that one detector has. However, when one is familiar with the detectors and the source he is measuring, it is highly possible to determine which detector has changed. The detector that has changed now can be sent back for repair and calibration while the second detector is used to take its place).

TYPICAL SYMBOLS AND PREFIXES

SYMBOLS & PREFIXES

nm = nanometers = (mμ) = 10(Å)
W = Watts
cm = centimeters
Å = Angstroms
sr = Steradian
ft = feet
lm = lumens
lx = lux
cd = candela

A = Amperes
mμ = Millimicrons
sec = second
fc = foot-candle
s = distance source to detector
J = Joules
μ = Micron
$\bar{y}$ = Standard Observer Curve

fL = Foot Lamberts
m = Meter
m = Milli = (10^{-3})
k = kilo = (10^{+3})
μ = micro = (10^{-6})
M = Mega = (10^{+6})
n = nano = (10^{-9})
G = Giga = (10^{+9})

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Rendered To: COMERCIAL RAFER

Detector: SED100 #1153 Diffuser: W #4091

Filter: ZCIE #5905 Attenuator: ______

Spectral Response (half power points): SEE CHART

SENSITIVITY FACTOR:

______ (A)(cm²)(W⁻¹) assuming monochromatic irradiance at ______ nm.

______ (A)(Sr)(cm²)(W⁻¹) assuming monochromatic radiance at ______ nm.

______ (A)(W⁻¹) assuming monochromatic source with beam diameter less than sensitive surface diameter, at ______ nm wavelength.

______ (A)(cm²)(nm)(W⁻¹) assuming continuous spectral irradiance over a calibration bandwidth of ______ nm centered at ______ nm.

______ (A)(ft²)(lm⁻¹) assuming ______ K color temperature source.

______ (A)(fL⁻¹) assuming ______ K color temperature luminance.

OTHER CALIBRATIONS OR REMARKS: NOTE: To read directly in scotopic lumens per square foot (foot-candles), use the sensitivity factor 3.61 X 10-8 (A)(FT2)(LM-1).

REFERENCE PLANE:

__ Scribe Line
X Groove No. ONE, formed by filter or diffuser elements and next element, counted from front surface of assembly.
__ Front surface of diffuser
X Other SEE NOTE ABOVE.

PRIMARY STANDARD: US National Bureau of Standards Detector Response & Intercomparison package (D.R.I.P.), DR #10 - June 1980
INTERNATIONAL LIGHT PRIMARY TRANSFER STANDARD(S):
IL D.R.I.P. #01, IL D.R.I.P. #02, IL D.R.I.P. #03

30 July 1980

LIGHT SOURCE: 1P Tungsten Halogen

INSTRUMENTATION: #519 Radiometer

TEMPERATURE: 22 degrees C RELATIVE HUMIDITY: 40%

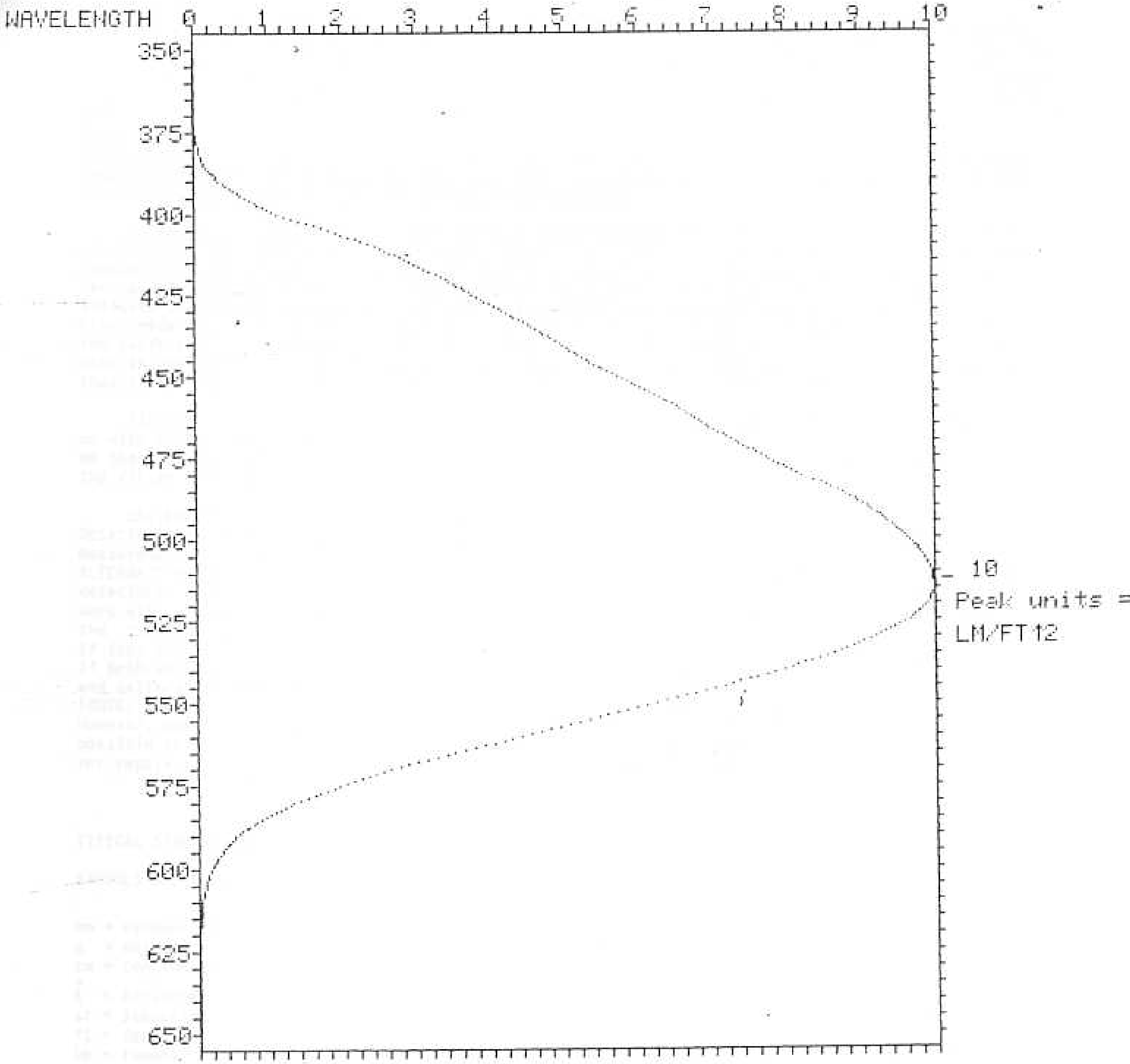
CALIBRATED BY: Cathy Olson CHECKED BY: [signature]

FOR COPIES OF THIS CERTIFICATE OR OTHER INFORMATION PLEASE REFER TO THESE NUMBERS

Date: 04JAN88 Certificate # 801040106 PO # 22318A

SEE015/CZIE/W 106064501 6/17/81

This is a spectral plot, normalized in relative units.



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