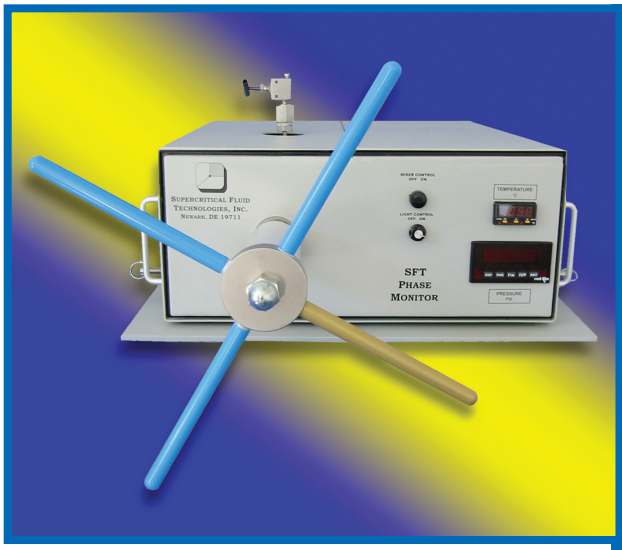
# Phase Monitor II




▲ *SFT Phase Monitor II*

## For Supercritical Fluid Phase and Solubility Studies

- 30 ml Capacity View Cell
- Operation to 10,000 psi (68.9 MPa) and 150°C
- Variable Speed Mixer
- Captive Holder for Powder Samples
- Vertical Position for Solid Samples
- Horizontal Position for Liquid Samples
- Video Archival System

The SFT Phase Monitor II is a powerful analytical tool for determining the solubility parameters of compounds and mixtures in subcritical and supercritical fluids. It provides direct, visual observation of materials under conditions precisely controlled by the researcher. Experiments can be performed in liquid or supercritical carbon dioxide and in other liquified gases. Additionally, the effect of co-solvents on the solubility of compounds in supercritical carbon dioxide can be investigated with this instrument. It allows the end user to view dissolution, precipitation, and crystallization of compounds over a wide range of pressures and temperatures. Experiments may be performed from a few hundred psi to 10,000 psi (68.9 MPa) and from ambient temperature to 150° Celsius.

The Phase Monitor II is extremely useful for determining the critical point of binary, tertiary, and complex mixtures. The changes in phase behavior as a function of temperature, pressure, and sample concentration can be investigated rapidly, saving time in the scale-up of supercritical fluid processes. The phase monitor can be utilized to determine the processing conditions in which each compound in a homologous mixture solubilizes and/or precipitates. This data is useful for determining processing conditions for selective extraction, reaction, and/or fractionation of compounds of interest. Additionally, supercritical "anti-solvent" applications are possible.

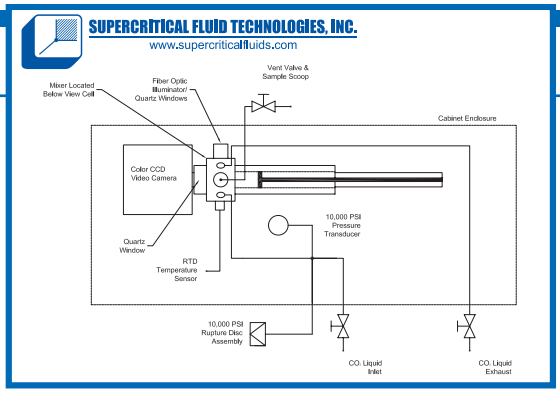
The Phase Monitor II is useful for other supercritical fluid processing operations, such as crystallizations and reactions. For example, the Phase Monitor can be utilized to determine the solubility of reactants and products so that the conditions for running supercritical reactions can be determined. It is possible to perform small-scale batch reactions within the Phase Monitor II.

Other useful applications for the Phase Monitor II include determining the cloud point of polymers and the degree of polymer swelling in carbon dioxide and other liquified gases. More sophisticated applications include the determination of processing conditions for impregnating materials into swollen polymers and surface deposition experiments.

The SFT Phase Monitor II consists of a manually controlled syringe pump integrated within a 30 ml view cell. A CCD camera with a fiber optic light source allows clear viewing of the cell's interior. The view cell can be oriented in a horizontal position for solubility work with liquid materials and in a vertical configuration for solubility work with solid materials. The sample holder accomodates liquid, solid and powder samples. Materials such as fine powders and liquids may be placed in a small glass capillary tube which mounts in a holder recessed in the sample platform. Here, samples are held securely in the optimal viewing position for solubility and melting point studies.

Fluid mixing is achieved through rare earth magnets coupled to an internally mounted impeller. An internal RTD accurately and uniformly controls the heating of the view cell up to 150°C. All visual data acquired can be archived onto video tape. The temperature, pressure, time, and date, along with a text message can be displayed on the TV/VCR monitor by adding the optional Video Panel Display Module.

# Phase Monitor Specifications




*Phase Monitor II Flow Diagram ▲*

## Pressure Vessel

| | |
|---|---|
| **Cell Body:** | 316 Stainless Steel |
| **Windows:** | 3/8" Quartz |
| **Max. Pressure:** | 10,000 psi (68.9 MPa) |
| **Burst Disk Pressure:** | 11,500 psi (79.3 MPa) |
| **Compression Ratio:** | 10:1 |
| **Cell Volume:** | Variable, 3 ml to 30 ml |
| **Pressure Precision:** | +/- 2 psi (13.8 kPa) |
| **Temperature Range:** | Ambient to 150°C |
| **Temperature Precision:** | +/- 0.5°C |
| **Heating Band Power:** | 500 Watts |

## Programmable Heater

User may set a heating rate and dwell time through a Fuzzy Logic Controller. Temperature is monitored and controlled by an internally mounted RTD. Temperature range: ambient to 150°C.

## Viewing

A variable focus, color CCD camera is attached directly to a quartz window. Illumination is provided by a variable intensity, fiber optic light source through a second window. The image may be displayed on a TV monitor or on a computer monitor if the optional digital imaging software is purchased.

## Video

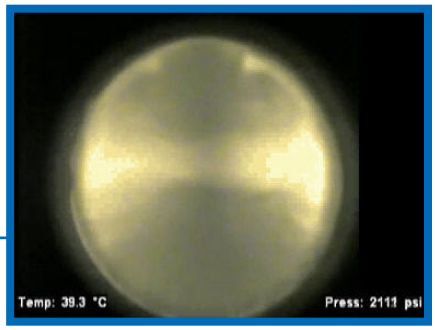
| | |
|---|---|
| **Camera:** | Color 1/3" CCD camera (85 mm) |
| **Iris:** | Auto, 5 lux |
| **Focus:** | 12 mm manual lens |

## Optional Digital Imaging Software

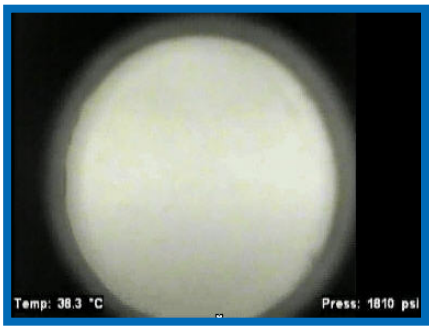
Real time video from the phase monitor may be converted into MPEG or AVI digital movies that can then be further digitally manipulated. Includes hardware, software and interface cables. Temperature and pressure are displayed along with the image inside the cell.

## System Requirements

| | |
|---|---|
| **Power Requirements:** | 120 VAC., Single Phase, 10 Amps (International power available). |
| **Gas Supply:** | Helium head space liquid $CO_2$ cylinder with dip tube. |
| **Weight:** | 60 lbs. (27.2 kg) |
| **Dimensions:** | Width: 47cm, Depth: 43 cm, Height: 21cm |




Naphthalene dissolved in SF $CO_2$




"Cloud Point" occurs as pressure drops

# Areas of Investigation

## Polymers

- Solubility determinations
- Extracting monomers and oligomers from polymers
- Infusion of materials into a polymer matrix
- Potential for polymer synthesis in supercritical fluids

## Foods

- Solubility of flavors and nutraceutical compounds
- Extraction of selected compounds

## Cleaning of Electronic Parts

- Cleaning chips, circuit boards and electronic components
- Supercritical and liquid carbon dioxide as an alternative to CFC and solvent cleaning methods

## Pharmaceuticals

- Solubility of pharmaceutical compounds in supercritical fluids
- Extraction of biologically active compounds from natural materials
- Improving reaction yields in supercritical fluids
- Infusion of drugs into delivery systems

▲ *超临界相平衡仪 II*

用于超临界流体相位和溶解程度的研究工作

- **30ml** 观察池
- 操作压力达 **10,000 psi (68.9 mPa)**，温度 **150℃**
- 不同速度的搅拌装置
- 用于粉末状样品的样品平台
- 固体样品可以在垂直位
- 液体样品可以在水平位
- 录像系统

超临界相平衡仪 II 是在超临界流体中确定化合物溶解性的有效的分析工具。研究人员可以在精确控制下直接观察相的变化。实验可以在液体、超临界二氧化碳或其它液化气体中进行。另外，利用该仪器还可以用来研究共溶剂的存在对超临界流体中化合物溶解性的影响。研究人员可以在较大的压力和温度范围内观察化合物的分解、沉淀和结晶等过程。实验可以从几百个 Psi 到 10,000Psi，温度从常温到 150$^{O}$C。

超临界相平衡仪 II 对确定二元，三元和复杂混合物的临界点是很有用的。例如温度、压力和浓缩样本等相变化可以迅速被研究，在扩大超临界流体处理方面节省时间。相平衡仪可以被用来确定在每个化合物的类似混合溶解和沉淀。这些数据对确定处理过程中选择萃取、反应和化合物的分馏很有用。另外，也可用于超临界非溶剂的应用。

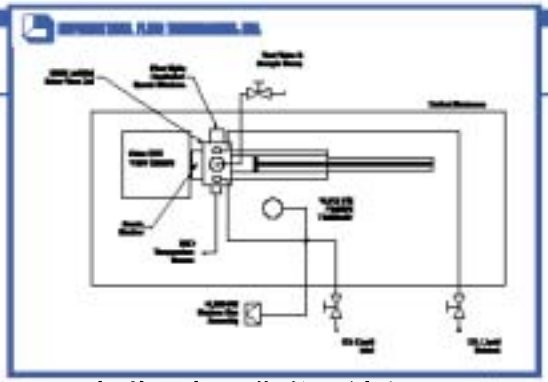
超临界相平衡仪 II 对超临界流体处理是很有用的，例如结晶和反应。例如，相平衡仪可以被用来确定化合物和产品的溶解性，运行的超临界反应可以被确定。可以用超临界相平衡仪 II 执行小规模的反应。

超临界相平衡仪 II 其他的用途包括确定聚合体的浊点，聚合体在超临界二氧化碳以及其它液化气体中的膨胀度。更为复杂的应用包括确定向膨胀聚合物中注入新材料以及表面沉积实验等的过程参数。

超临界相平衡仪 II 由一个手动的注射泵和一只 30m 的观察池构成。带有光纤光源的 CCD 相机可以清晰地观察观察池的内部。对于液体样品溶解度的观察，观察池可以在水平位置，对于固体样品则可以放在垂直位置。样品的放置装置适用于液体，固体和粉状样本。细粉和流体类的物料可以被放到一个小的玻璃毛细管中，它在一个样本平台上放置。样本被理想地放置以备进行溶解和熔点的研究。

通过对内置叶轮的磁力驱动，实现流体混合。内部的 RTD 正确统一的控制观察池的温度到 150℃。获得的信号被保存在录影带上。温度，压力，时间，数据，可以在 TV/VCR 上通过添加录象显示模块进行显示。

# 超临界相平衡仪技术配置



*超临界相平衡仪 II 流程图* ▲

**压力容器：**

**观察池体：** 316 不锈钢
**视窗：** 3/8” 石英
**最大压力：** 10,000psi
**爆破压力：** 11,500psi
**压缩比：** 10：1

**观察池的尺寸** :可变, 3 到 30ml
**压力精确值：** ±2psi
**温度范围：** 常温到 150 $^{O}$C
**温度精确值：** ±0.5$^{O}$C
**功率：** 500W

**加热器：** 用户可以通过 Fuzzy Logic 控制器设定加热比和时间。温度被内部设置的 RTD 控制和监控。温度范围：常温到 150 $^{O}$C

**观察：** 变焦，CCD 彩色相机被安放在石英窗上。使用可变密度的光纤光源在第二个窗口闪光。彩色监视器/VCR 包含在内。

**录象和监控：**

**照相机：** 彩色 1/3”CCD 相机
**彩虹：** 自动，5lux
**焦距：** 12mm 手动
**监控器：** 13”彩色
**兼容性：** NTSC

**可选择的录象面板显示：** 超临界相平衡仪 II 的压力和温度输出在监控器上被显示。这些数据和时间，日期和用户意见被记录在 VDR 上，使您的实验有完整的记录。

**数字成相软件：** 从超临界相平衡仪 II 上的录象可以被转换成 MPEG 或 AVI 数字电影，以便更长远的被利用。包括硬件，软件和连线。

**系统要求：**

**电源：** 120V，单相，10A
**提供气体：** 带汲液管的液体 CO2 钢瓶
**重量：** 60 lbs.(27.2Kg)
**尺寸：** 长：47cm，宽：43 cm，高：21 cm

溶解在超临界 CO2 中的萘

压力下降时产生的“ 云状点 ”

# 研究领域

**聚合体：**
溶解确定
从聚合体中萃取单体和低聚物
向聚合物矩阵灌输物料
超临界流体潜在的聚合体合成。

**食品：**
香料和营养素的溶解
精选化合物的萃取

**电子元件的清洗：**
清洗芯片、电路板、电子成分
超临界液体 CO2 替代 CFC 和溶剂清洗

**制药：**
在超临界流体中药物化合物的溶解性
生物活性的萃取
天然物成份的萃取
在超临界流体方面提高反应领域
在传输系统中灌输药物