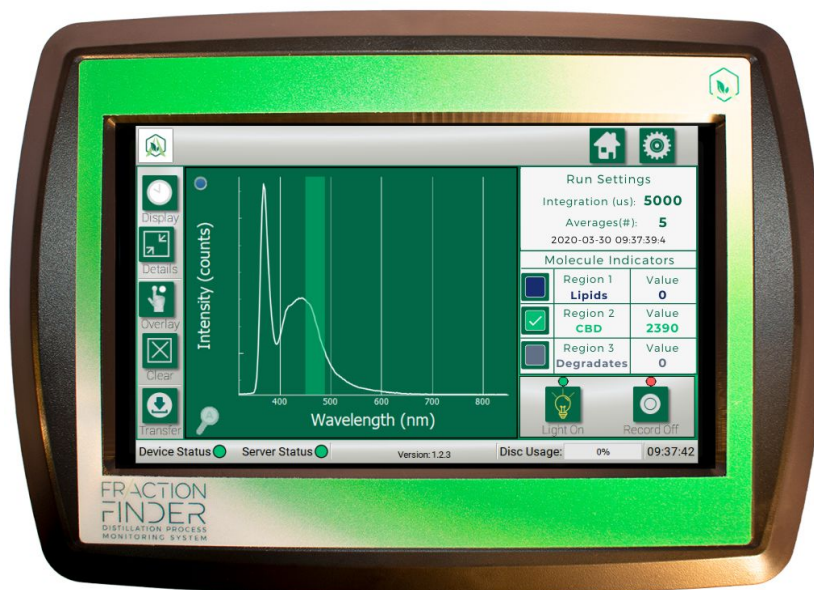




FRACTION FINDER

APPLICATION GUIDE FOR
WIPED/THIN FILM EVAPORATION



YOU MUST READ THIS MANUAL BEFORE USE

WARNING: NEVER LOOK DIRECTLY INTO THE LIGHT SOURCE

A° Ł1" '5' † 53A" 3A@

@ZV{bnl 'ÜÇ ZyWku{bnl 'MIX'<xb VbuJZyn_5uZxMlbnl	P'
@ZV{bnl 'Ý@xZZI yan{y'1'ž ZybnMljZy	B'
@ZV{bnl 'P@xZZI yan{y'1'BI XZybnMljZy	à'
@ZV{bnl 'B@AZxuZI Z'@xub` `<My'1'H aM'{'n" .uZV{	á'
@ZV{bnl 'à@ MI Mby?Z_b b `<My'1'H aM'{'n" .uZV{	â'
@ZV{bnl 'á@BI uMl b ` MIX'1 yuZV{b`	ã'
@ZV{bnl 'ä@ y{NjMlbnl 'nxH buZX' bjk " fMnxMlbnl	ä'
@ZV{bnl 'ä@Zyn xVZy	ÜÜ'
@ZV{bnl 'ä@uZVbMlbnl y	ÜÜ'



How the Fraction Finder works

The Fraction Finder detects the presence of distillation molecules via induced fluorescence. While many molecules can show fluorescence simultaneously, looking at the wavelength of the fluorescence peaks helps inform the distillation operator what molecule is being detected.

Purpose of using the Fraction Finder for wiped film evaporation (WFE):

- WFE parameters and setpoints are not adjusted often; however, they might be adjusted when first setting up the WFE, when changing source material, when the seasons change, or when changing pre-processing methods. The Fraction Finder's readings can provide parameter feedback for temperature and wiper speed.
- The Fraction Finder's readings can provide quality assurance and indicate oddities. Users can recognize in real-time if there are "undesirables" in their line. This is especially useful if there is no in-house HPLC.
- The Fraction Finder's readings can indicate if cannabinoids are being rejected in the residue stream; this information can be used to adjust parameters in order to minimize rejected cannabinoids, therefore, optimizing efficiency.

The relevant molecules that the Fraction Finder can detect during WFE, and their respective wavelength regions are:

- 360-370 nm
 - The Reference/Excitation peak is from the sensor device and is not indicative of any distillation fractions or molecules.
- 440-500 nm
- 450-490 nm
 - CBD and THC fluoresce at similar wavelengths, but have different waveforms. Note: The FRACTION FINDER does not distinguish between CBD and THC simultaneously.
- 510-550 nm, centered at 490 nm
- 680 nm and 710 nm
- 550-620 nm
 - Lipids aren't one chemical, but a class of chemicals. For the purpose of this document, a lipid that exhibits fluorescence at 535 nm is shown.
- 405-435 nm
 - "Fool's Gold" is a colloquial term for a chemical component commonly seen during distillation which is golden in color and looks like a desirable cannabinoid. The molecular species that is "Fool's Gold" is currently unknown.

35A" @ZZ n| x-t azk BMJH aZM @ZZ{ @nxMI | uXMZXjby{ n_vazk BMJy{aM|{aZ| | k'VMi XZ{ZM^a

Wavelength: 450-490 nm

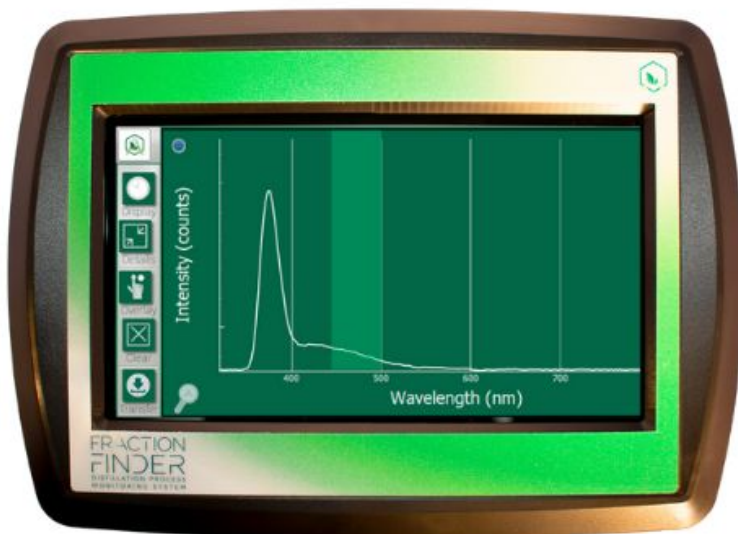
Wavelength: 450-490 nm



A*: WFE of hemp oil with the goal of producing CBD-dominant distillate is becoming increasingly popular. The Fraction Finder can provide an indication of when CBD is passing through.

The CBD Indicator appears as a **yellow** peak.

Wavelength: 440-500 nm



A*: Similarly to CBD, Delta-9 THC is considered a “desirable” during WFE of THC. In these processes, the Fraction Finder can assist operators in collecting the most amount of this molecule as possible by indicating when it is passing through.

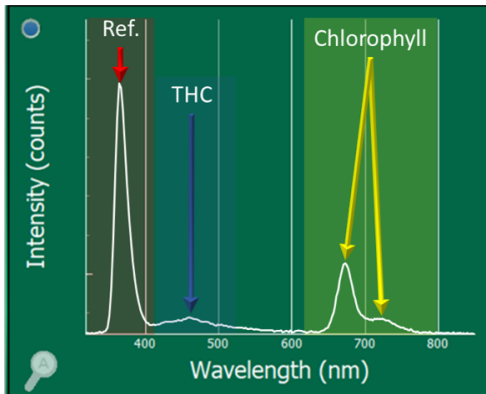
The THC Indicator appears as a **yellow** peak.

3n{Z@aZ" ?" t A*53 " *3ž"? XnZyl n{ Xby{b` | byaUZ{, ZZI t tž MIX'A) t ytk | j{MIZn| yjt", atjZ {aZt' aMfZ Xb_ZzZI {, MfZ_nk yS{aZt' j| nxZyVZ M{aZ yNk Z; MfZjZl` {ajnvM{bnl a) n, ZfZxSb_nl Z' xN{bnl` Vhk Zy'n| {UZ_nxZ {aZ'n{aZxSj| Va MfX| xtb` t axnk M{n` xN{atSk' by unyykUjZ {n XZ{Zxk b Z {aZ VaMI` Z'a

@ZV{bl 'pC@xZZI yan{y}' BI XZybMjZy'

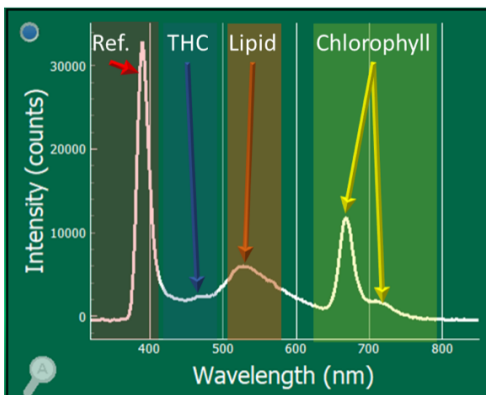
As you will learn in this section, other molecules can fluoresce at the same time that the main cannabinoid fluoresces. This is when parameter feedback is most relevant. For these examples, we use THC as the desired cannabinoid.

A) † Mx† ajnxuatjj'



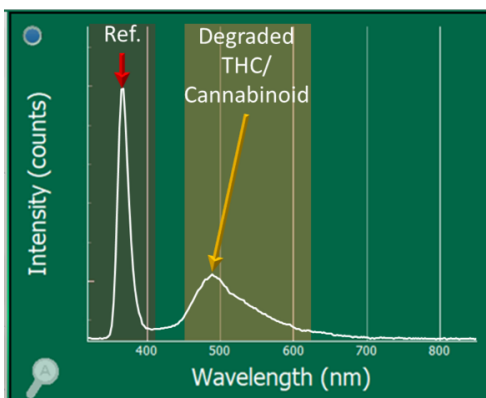
A*:<: If a WFE operator sees the Chlorophyll signal, s/he should perform a carbon scrub (or other chlorophyll remediation) before starting distillation or on the distilled product. If Chlorophyll is detected on the distillate line of the cannabis refining pass, wiper speed should likely be increased or WFE internal chamber temperature decreased.

A) † † ajnxuatjjSM X'1b1X'



A*:<: If a WFE operator sees the signal for Lipid (a peak that is centered between 530-620 nm), this indicates that their lipids removal is not removing all the fats.

ž Z` xXZX† Ml MjB nbY'



A*:<: Degraded THC/cannabinoids are typically considered "undesirables" and should not be collected.

9-THC distillation

The relatively low-temperature terpene-stripping pass is typically performed before trying to distill the desired cannabinoid. During this pass of a WFE, the temperature is intentionally set slightly lower than the boiling point of the desired cannabinoid, so that only terpenes, degraded terpenes, residual solvents, and other undesirables boil off. In this example, it is assumed this is a 9-THC distillation.

Figure 1: Fraction Finder spectrum for 9-THC distillation

This side should not have terpenes, degraded terpenes, etc. What is left is all the molecular species from the crude, and as such, the majority of the spectra will be cannabinoids, degraded cannabinoids, and chlorophyll/lipids if they were present in the crude material. The THC signal should be very low in intensity. A labeled example of what to expect from the Fraction Finder is given.

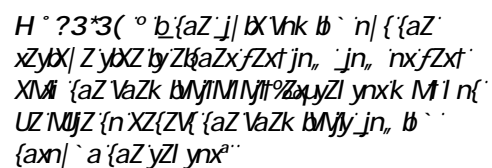


Figure 2: Fraction Finder spectrum for terpene stripping

This side should have only terpenes, degraded terpenes, etc... This line may also contain some "Fool's Gold" at 410 nm if it is present in the crude; it should be ejected with the terpenes as it is typically not wanted in the final product. As the Fraction Finder is insensitive to the majority of solvents and terpenes, only the reference peak will likely be observed. A labeled example of what to expect from the Fraction Finder is given.

Section 5: Cannabis Refining Pass - What to Expect

The relatively high-temperature cannabinoid refining pass is typically performed after a terpene stripping pass. Only the desired cannabinoids are distilled while all other molecular components get rejected to the residue side of the WFE. In this example, it is assumed this is a ⁹-THC distillation.

?ZyX| Z'@XZ'jH MjZ" _j| ZI {A

This side should have everything but the desired cannabinoid. While during SPD, this would typically include a lot of degraded cannabinoids, the heating time for the crude in WFE is low enough that it is atypical to see a significant presence of degraded cannabinoids. A labeled example of what to expect from the Fraction Finder is given.

35A" ° *_{aZxZ byMlyk NjAU| k u'Mi
YaU'PUU| k S(aM'by'50° k by{aZ VaZk BMjI
yb| M| xZ MjynVMZX,, k a XZ' xVZX'
WII NUb nXy''

ž by{bjMZ '@XZ' ž ZybxZ' <xnX| V{
" _j| ZI {A

This side should have just the desired cannabinoid. A labeled example of what to expect from the Fraction Finder is given. If Chlorophyll is detected on the distillate line of the cannabis refining pass, wiper speed should likely be increased or WFE internal chamber temperature decreased.

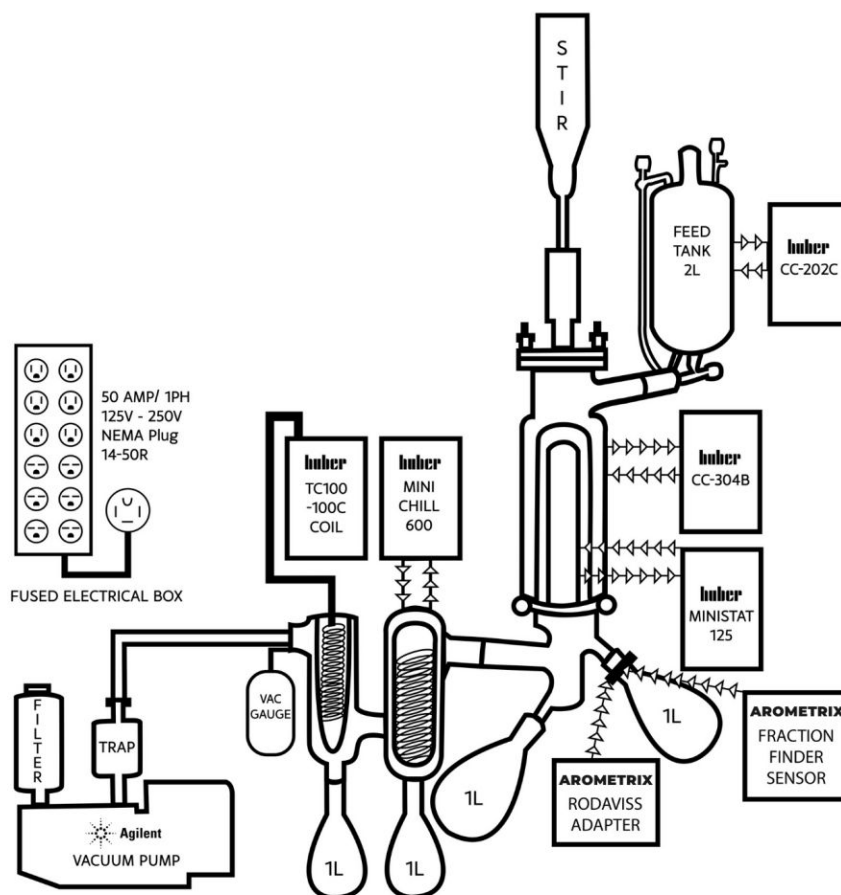
35A" ° AaZ yuZV{xM| yZx'aZxZ by'
xZuxZyZl {MbfZ M'X| yZx'aZxZ' nxjZNI b`
u| xunyZy° Aaby'A) t' b' {Zl yk'f'yan| jXl n{UZ'
MIMy'ZaSM' b' {Zl yk'Zy,, bj fVt'°5l {aZ'
Xby{bjMZ ybXZ n_{aZ WII NUb xZ b' b' uMjyS
{aZ A) t' yb| Nj,, bj UZ b' {Zl yZ'k nxZ b' {Zl yZ'
{aMl k,, NjX| x b' {aZ {Zxu y{XuA'

Section 6: Unpacking and Inspecting

After the instrument is received, it should be carefully unpacked and inspected for damage during shipment and to confirm that all components are present.

"Ma" ? " A*53" *3ž" ? Vhk Zy, kã©

- Fraction Finder Sensor
- Display
- Sensor Cable, USB, 2 feet
- Light-Blocking Tape
- International Power Supply
- Warranty Card
- Glass Adapter (optional)
 - *?nn{ @kzi Vzy,GA° S<xZYWh{{S<nuZSnxH' " ; kã~ ZM'u/ k u Collection Jar Bundle
 - *<| xZ<MaÜÜ PUREPATH Rodaviss Adapter OR PUREPATH Rodaviss Neck Flask
 - *ž Z| {yVaZ'nxH' " ; kã'k Z{NjVhI ZV{btl y 1.5" or 2" Sanitary Flange Sight Glass
 - *_1NW@VZ{t) G' Aab ' kã KF25 to 35/25 Ball Joint Adapter



' ZMj xZx@ NjVhZ @kzi Vzy<B?" <° A) ÜÜ, kã' xV{btl ' b xZxì ?nxVjby" xVh{Zx

Section 7: Installation for Wiped Film Evaporation

Users can select if they would like to operate with *ÚnxÚ* Fraction Finder systems.

† y{NjMlbnl , kã'Ú' xNw{bnl ' b XZx	† y{NjMlbnl , kã'Ú' xNw{bnl ' b XZxy
<p>If operating with ÚFraction Finder, Arometrix recommends that users:</p> <ul style="list-style-type: none"> • Install the sensor on the xZyb Z line during {ZxuZl Z y{xuub` uMyy` • Swap the sensor to the Xby{bjMZ line during VMI MbyxZ_b b` uMyy` 	<p>If operating with ÚFraction Finders, Arometrix recommends that users:</p> <ul style="list-style-type: none"> • Install the sensor on the xZyb Z line during Un{a`uMyyZy` • Install the sensor on the Xby{bjMZ line during Un{a`uMyyZy`
<p>3n{Z@*tn yZjZV{n`nuZMMZ, kã'53" xNw{bnl ' b XZxS ujZMZ XbyxZ` Mx{aZ`AZxul Z @xuub` <Njy`z by{bjMZ` @xZ@MIX`-I MI Mby?Z_b b` <Njy`?Zyb Z @xZ@ yZV{bnl y`{aZt, bjl n{UZ`xjZAMI`a</p>	<p>3n{Z@AaZ`MXXZ`fYj Z`n`nuZMMb` , kã'AH 5` 'xNw{bnl ' b XZxyby{aZ`-} b a" bMZl Vt@U jZ{`unb {` k Zl {bnl ZX`b {aZ`-5fZxAZ, @SMj yZxyVMI` MXX{bnl Nj † k nl kãrx`nxVMI Mub n{X`xZjZV{bnl` a</p>

(Zl ZxNj† y{NjMlbnl '† y{x| V{bnl y`

1. Apply the light-blocking tape to the glassware apparatus. This is *ZyuZVj†* important in labs with a lot of ambient light, as it will block the light from saturating your sensor's readings.
2. Install the optical sensor with the thicker part of the sensor down. The sensor should be installed on, or directly above, the collection vessel. *z@Z`k MZn`* 'xNw{bnl ' b XZxMIX† njjZV{bnl `NkL|I XjZ` b y{NjZXnl {aZ`GA` a`
3. Plug the sensor cable into the sensor and the display. Give the sensor ~2-5 minutes to boot up.
4. Mount the display to a lab pole using the mounting bracket screw.
5. Use the supplied AC adapter to power your display. Allow it to boot.
6. Ensure: (1) That the Device Status and Server Status indicator; (2) that the "Light On/Light Off" toggle button is turned on
7. In Settings: (1) Set Scans to Average to 5; (2) Turn AutoIntegration (AID) on by tapping the checkbox



Section 8: Resources

If you haven't already, we encourage you to:

- Read the full FRACTION FINDER user manual to learn more about the interface, software updates, troubleshooting issues, and more
 - All sections in the user manual ARE relevant and useful to wiped film evaporation processes, except perhaps, the "Installation for Short Path Distillation" section
- Visit arometrix.com/resources for a full list of resources for each FRACTION FINDER application
- For further assistance, please contact our Technical Support team:
 - brains@arometrix.com
 - (240) 492-6556 (call or text)

Section 9: Specifications

Creator	Arometrix, Inc.
Application(s)	Distillation (short path; wiped film; thin film)
State of Materials	Distillates
Expected Life Span	10+ years
Shipping Weight	5 lbs
Shipping Dimensions	10" x10" x8"
Technology Validation Reference	"In Situ Fluorescence Spectroscopy for InLine Distillation Process Monitoring", published by Cannabis Science & Technology
Type	Standard
Technology	In-situ fluorescence spectroscopy sensor (contains an optical light pulse and UV fluorescence detector)
UV Domain	Near UV
Size(s)	Size 29; Size 34
Interface Requirements	Size 29 Glass (28-30mm outer diameter) Size 34 Glass (31-34mm outer diameter) *Do not use with double-jacketed glass
Cable Length	2'-30'
Max Temp	100 C
Min Temp	5C
Optical Detection Range	300 – 1000 nanometers

Lower Detection Limit	1 mg/mL (at a volume of 1 cubic centimeter of oil)
Accuracy	Spectral resolution: 15 nm max
Margin for Error	3n{ MujbMjZ {n v\ NkMjZ k ZNj\ xZk Zl fy
Reading Speed	> 1 second
Flow Rate Limits	No flow rate limit
Min Fill Level	1/8 volume
Calibration	No
ž *@1° J`	
Type	7 inch LCD TFT display (contains a compute module with advanced software)
Power	100-240VAC 50/60 Hz CE Rated (12 Volt 1 Amp into Display)
Power Supply	Yes
Mount	Mounts to a laboratory stand bracket (pole up to ½" thick)
Units	Wavelength Nanometers (nanometers); Wavelength Intensity Values (arbitrary units)
Plots	Spectrogram; Wavelength Intensity graph
Metric Type	Qualitative
Telemetry Options	USB
PLC Communication Type	Serial UART (BAUD: 115200, DATABITS: 8, STOPBITS: 1, PARITY: NONE)

