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User Manual

CHEMICAL TRANSFORMATION UNIT / BIOFUEL MICRO-FACTORY

Research Prototype - Research Use Only (RUO)

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1. Document Properties

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2. Identification Notice

ARTICLE: Chemical Transformation Unit / Biofuel Micro-Factory
MODEL: Research Prototype - Research Use Only (RUO)
LOT: AUT26-01
SERIAL NUMBER: 000 000 005
MANUFACTURING DATE: November 2026
MANUFACTURING PLACE: Lévis, Québec

3. Regulatory Notice

STANDARDS & SPECIFICATIONS

FOR RESEARCH USE ONLY (RUO).
NOT FOR DIAGNOSTIC, CLINICAL OR COMMERCIAL USE.
INDIVIDUAL COMPONENTS COMPLY WITH APPLICABLE STANDARDS; HOWEVER, THE GLOBAL ASSEMBLY IS NOT CERTIFIED.
FOR COMPONENTS TECHNICAL SPECIFICATIONS AND APPLICABLE STANDARDS, REFER TO SECTION 6 AND 15 OF THIS MANUAL.

PATENTED

USE PERMITTED UNDER LICENSE ONLY.
UNAUTHORIZED REPRODUCTION IS PROHIBITED.
UNAUTHORIZED USE IS PROHIBITED.

4. Safety Notice

SAFETY NOTICE

CAUTION

IMMOBILIZE BEFORE USE. READ THE USER MANUAL BEFORE USE OR SERVICING.

ELECTROSTATIC HAZARD

GROUND ALL SYSTEM COMPONENTS BEFORE USE OR SERVICING.

ELECTRICAL HAZARD

DISCONNECT AND LOCK OUT ALL POWER SOURCES BEFORE SERVICING.

HIGH TEMPERATURE

HOT LIQUIDS INSIDE. READ THE USER MANUAL BEFORE USE OR SERVICING.

HIGH PRESSURE

PRESSURIZED LIQUIDS INSIDE. READ THE USER MANUAL BEFORE USE OR SERVICING.

CHEMICAL HAZARD

READ THE SDS OF ALL CHEMICALS USED AND PRODUCED BEFORE USE OR SERVICING.

SAFETY NOTICE

FOR RESEARCH USE ONLY (RUO). THIS UNIT IS INTENDED FOR RESEARCH AND DEVELOPMENT ONLY. IT IS NOT INTENDED FOR CLINICAL, DIAGNOSTIC OR THERAPEUTIC USE, OR FOR THE COMMERCIAL PRODUCTION OF FUEL OR OTHER PRODUCTS, UNLESS ALL REQUIRED APPROVALS HAVE BEEN OBTAINED AND AUTARCYCLE INC. HAS CONFIRMED IN WRITING THAT THE CONFIGURATION IS SUITABLE FOR THAT USE.

THIS MICRO-FACTORY WAS CAREFULLY INSPECTED AND TESTED BEFORE LEAVING OUR FACILITY. AUTARCYCLE INC. CANNOT CONTROL HOW THE UNIT IS HANDLED, TRANSPORTED, INSTALLED OR USED AFTER SHIPMENT. UPON RECEIPT, INSPECT THE UNIT AND REPORT ANY DAMAGE TO AUTARCYCLE INC. BEFORE USE. READ AND UNDERSTAND THE ENTIRE USER MANUAL BEFORE INSTALLING OR OPERATING THIS UNIT. ONLY QUALIFIED PERSONNEL MAY OPERATE IT. CONTACT AUTARCYCLE INC. WITH ANY QUESTIONS.

WARNING: THIS UNIT OPERATES AT HIGH TEMPERATURE (UP TO 400 °C) AND HIGH PRESSURE (UP TO 3700 PSI IN NORMAL OPERATION) AND MAY PROCESS HAZARDOUS OR FLAMMABLE CHEMICALS. IMPROPER USE MAY CAUSE SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, AUTARCYCLE INC. IS NOT RESPONSIBLE FOR DAMAGE RESULTING FROM MISUSE, UNAUTHORIZED MODIFICATION, OR FAILURE TO FOLLOW THE USER MANUAL.

5. Conditions of Use

This unit is for Research Use Only (RUO). The user is responsible for operating the unit safely and for handling, storing and using its output products in accordance with applicable regulations. To the extent permitted by applicable law, Autarcycle Inc. is not responsible for damage, loss or injury resulting from misuse of this unit or its output products, unauthorized modification, or failure to follow this user manual. The buyer may not duplicate the micro-factory or any of its proprietary components. Any modification to the unit requires prior authorization from Autarcycle Inc. Intellectual property, license fees, royalties and reporting obligations are governed by the purchase and license agreement between the buyer and Autarcycle Inc.

6. Related Documentation

The following documents must be read together with this user manual.

RELATED DOCUMENTS TO BE READ WITH USER MANUAL	
DIMETHYL CARBONATE SDS	
METHANOL SDS	
BHT SDS	
TRIGLYCERIDES SDS	-
BIOFUEL FROM MICRO-FACTORY SDS	
ATEX LEVEL DETECTOR USER GUIDE	NOT INCLUDED IN THIS UNIT
ECP 2200 USER GUIDE	INCLUDED
2 WAY VALVE USER GUIDE	NOT INCLUDED IN THIS UNIT
3 WAY VALVE USER GUIDE	INCLUDED
THERMOCOUPLE USER GUIDE	INCLUDED
HEATING TAPE USER GUIDE	INCLUDED
INSULATION BLANKET USER GUIDE	INCLUDED
PRESSURE TRANSMITTER USER GUIDE	NOT INCLUDED IN THIS UNIT
ACTUATOR USER GUIDE	NOT INCLUDED IN THIS UNIT
MICRO-VIBRATOR USER GUIDE	INCLUDED
FLOW METER USER GUIDE	NOT INCLUDED IN THIS UNIT
AUTOMATON COMPONENT USER GUIDES	INCLUDED
EWON USER GUIDE	NOT INCLUDED IN THIS UNIT
BUBBLE DETECTOR USER GUIDE	NOT INCLUDED IN THIS UNIT
ECOM SS Nut 1/8'' 5/16 - 24 threads with ferrule, Specification Sheet	INCLUDED
Swagelok complete catalog for SS-200-61, SS-T2-S-028, SS-200-R-2, SS-400-03, SS-400-R-8BT, SS-810-3, SS-T8-S-065, SS-400-R-8, SS-T4-S-049, SS-4R3A, SS-4R3A-KZ, SS-1KS4, SS-4-TA-1-4, SS-400-61, SS-400-6, SS-400-9	INCLUDED
Shield Air Fan Specifications	INCLUDED

7.General Information

7.1 Product Function

This Chemical Transformation Unit / Biofuel Micro-Factory, developed by Autarcycle Inc., is a Research Use Only (RUO) Prototype. It is designed to efficiently produce various bioproducts. It can operate up to 400 °C, up to 3700 psi and at flow up to 24 L/hour. These values are the unit's maximum operating limits; actual throughput depends on the chemical transformation and the recipe used. Only qualified personnel may operate it. It is composed of two ECP 2200 High pressure pumps, a tubular setting, and an automaton.

Some components required for full automation are not included in this unit: three level detectors, one pressure transmitter, one actuator, one flow meter, one Ewon remote-access module and one bubble detector. The unit is, however, ready to receive these components.

7.2 Key Operations

This Chemical Transformation Unit / Biofuel Micro-Factory have three inlets: Inlets 1 and 2 feed Pump 1, and Inlet 3 feeds Pump 2. The Autarcycle's proprietary process enable transformation of Triglycerides into Fatty Acid Methyl Ester and Glycerol Carbonate Derivatives homogeneous solution that can be used, among other applications, as biodiesel-like biofuel. For this use **Inlets 1 and 2 are fed with liquid triglycerides, and Inlet 3 is fed with a 1.5% v/v alkyl alcohol in dialkyl carbonate solution.**

This Chemical Transformation Unit / Biofuel Micro-Factory has three outlets: the **Production Line (Outlet 1)**, **Recirculation Line (Outlet 2) and Purge & Safety Line (Outlet 3)**.

The primary function of the micro-factory is to transform triglycerides and dialkyl carbonate into a high-quality **biodiesel-like biofuel**. However, it is also highly adaptable and can be programmed to produce a wide variety of other bioproducts including, not limited to, those used for cosmetics, solvents, lubricants or pharmaceuticals.

7.3 Customizable Recipes

Autarcycle Inc. develops and provides personalized recipes to meet customer needs. These recipes are available on the unit's menu. Any modifications to these recipes must be authorized by Autarcycle Inc. to ensure quality and safety.

7.4 Product Version

CTU-RUO Cat. No. CTU-RUO

8.General Operation Instructions

8.1 Cautions

Caution:	If the unit is used in a manner not specified by the manufacturer, the protection provided by the unit may be impaired.
Caution:	The unit must not be used if it is leaking.
Caution:	Do not replace detachable power supply cables with inadequately rated cables.
Caution:	Keep the power cable accessible so it can be disconnected in an emergency.
Caution:	The unit must only be used in accordance with the precautions associated with the liquids used. Information on safety precautions at work for each chemical entities used should be consult before using them in this unit – refer to the safety data sheets for each chemical entities.
Caution:	Liquid feeding the unit must be filtered below 0.5 micron to protect the pumps.
Caution:	Strictly follow the maintenance schedule (see Section 11).

8.2 Safety Symbols

	FLAMMABLE: Dimethyl carbonate and the biofuel produced by the micro-factory using Autarcycle's transesterification process must be considered Class 3 flammable liquids. They must be stored, handled and transported accordingly. Containers holding Class 3 flammable liquids must be grounded and placed in a separate room from the micro-factory and at the distance prescribed by Autarcycle Inc. during installation.
	HIGH PRESSURE: The liquid within the micro-factory’s tubular setting is pressurized. The micro-factory’s tubular setting enclosure should be opened only under the supervision of Autarcycle Inc. personnel and only after the system has been depressurized.
	DANGER: Electrical hazard. Disconnect and lockout all power sources before servicing.

	WARNING: Consult the operational guide for the correct fuse type and replacement procedure. Using the wrong fuse can cause equipment damage or create a fire hazard.
	HIGH TEMPERATURE: The liquid within the micro-factory's tubular setting is heated to a high temperature. The micro-factory's tubular setting enclosure should be opened only under the supervision of Autarcycle Inc. personnel and only after the system has cooled down completely.

Caution: As a safety cut-off, the pumps stop automatically if the pressure reaches 4,200 psi. This shutdown is normal and is not a malfunction.

9. Description

See figures 1, 2, 3 and table 1 for Unit Components.

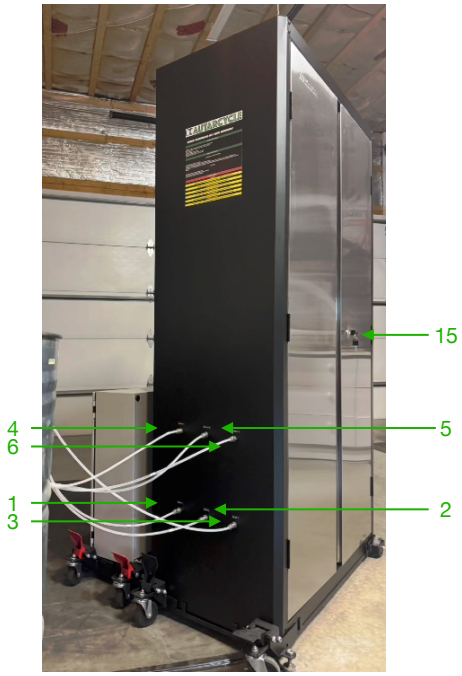


Figure 1 CTU Fluids Connection Side

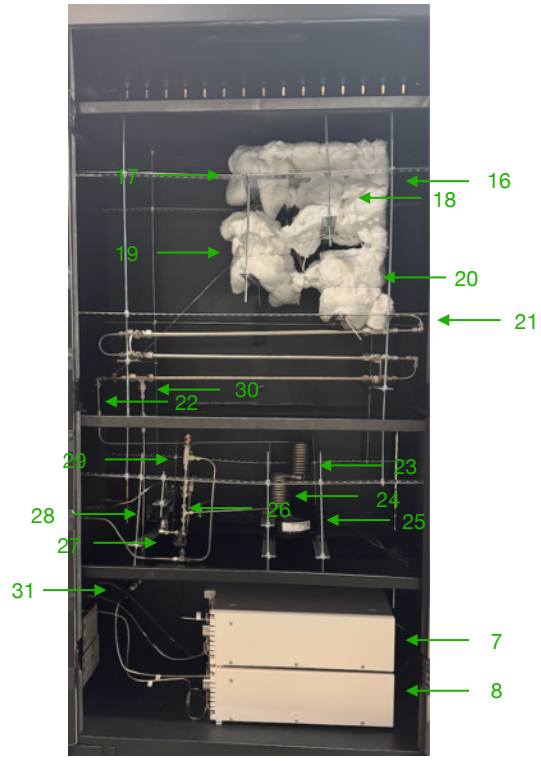


Figure 2 CTU Tubular Settings and Pump

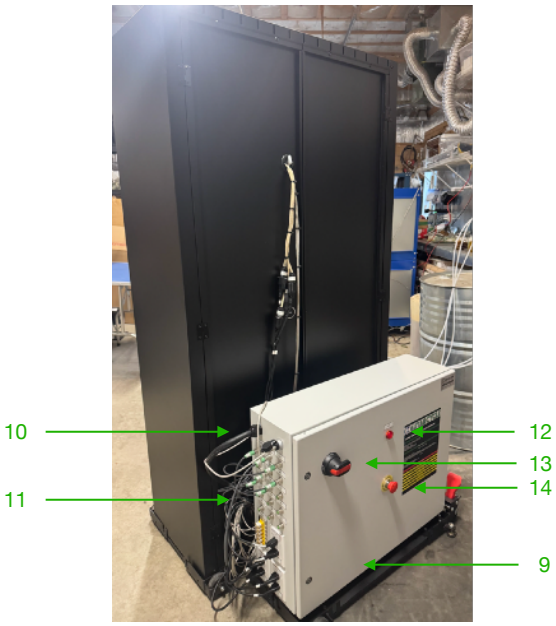


Figure 3 Automaton

Table 1 Figures 1, 2 and 3 description.

No	Description
1	Inlet 1: 1/4” Swagelok connection. Connected to Pump 1.
2	Inlet 2: 1/4” Swagelok connection. Connected to Pump 1.
3	Inlet 3: 1/4” Swagelok connection. Connected to Pump 2.
4	Outlet 1: 1/4” Swagelok connection. Production Line.
5	Outlet 2: 1/4” Swagelok connection. Recirculation Line.
6	Outlet 3: 1/4” Swagelok connection. Purge and Safety Line.
7	Pump 1: ECP 2200. Connected to Inlet 1 and Inlet 2.
8	Pump 2: ECP 2200. Connected to Inlet 3.
9	Automaton
10	Automaton power supply
11	Connections panel
12	Alarm Light
13	Main Power Switch
14	Emergency Stop Button
15	Chemical Transformation Unit Locking Door
16	Exchanger to Reactor 1 Transition
17	Reactor 1
18	Reactor 2
19	Reactor 3
20	Reactor 4
21	Reactor 4 to Exchanger Transition
22	Exchanger to Cooler Transition
23	Cooler 1
24	Cooler 2
25	Cooling Air Fan
26	Production Back Pressure Valve (set to open @ 3000 psi)
27	Carbon Trap Valve For Purge - Maintenance. Connected to **Output 3**.
28	Three Way Valve. Connected to **Output 1** and **Output 2**.
29	Safety Back Pressure Valve (set to open @ 5000 psi). Connected to **Output 3**.
30	Exchanger inlet
31	Mixing tee

10. Installation and First Start

10.1 Installation

Place the Chemical Transformation Unit in a suitable location that meets these conditions:

- Liquids fed into the Chemical Transformation Unit must be filtered below 0.5 micron and form a homogeneous solution to ensure proper pump operation.
- The unit must be located in a dedicated area, separate from the rooms where its inputs and outputs are stored.
- Both rooms must be **adequately ventilated** and **temperature-controlled**.
- Inputs and outputs must be kept in secure containers suited to their physicochemical properties (e.g., flammability) for use, production and storage.
- The Chemical Transformation Unit, along with its input and output containers, must be **grounded**.
- Connections between the Chemical Transformation Unit and the inputs and outputs containers should be made with adequate tubing. 1/4 OD PE tubing with adequate insert can be used when using Autarcycle's transesterification process. (Inlets 1 and 2 fed with triglycerides, Inlet 3 fed with dialkyl carbonate solution) For other processes, the tubing must be compatible with the expected products.
- The biofuel produced with the Autarcycle's transesterification process is classified as a **flammable liquid (Class 3)** since its flash point is usually below 60°C (140°F) in a closed-cup test.

10.2 Chemical Transformation Unit Environment Diagram

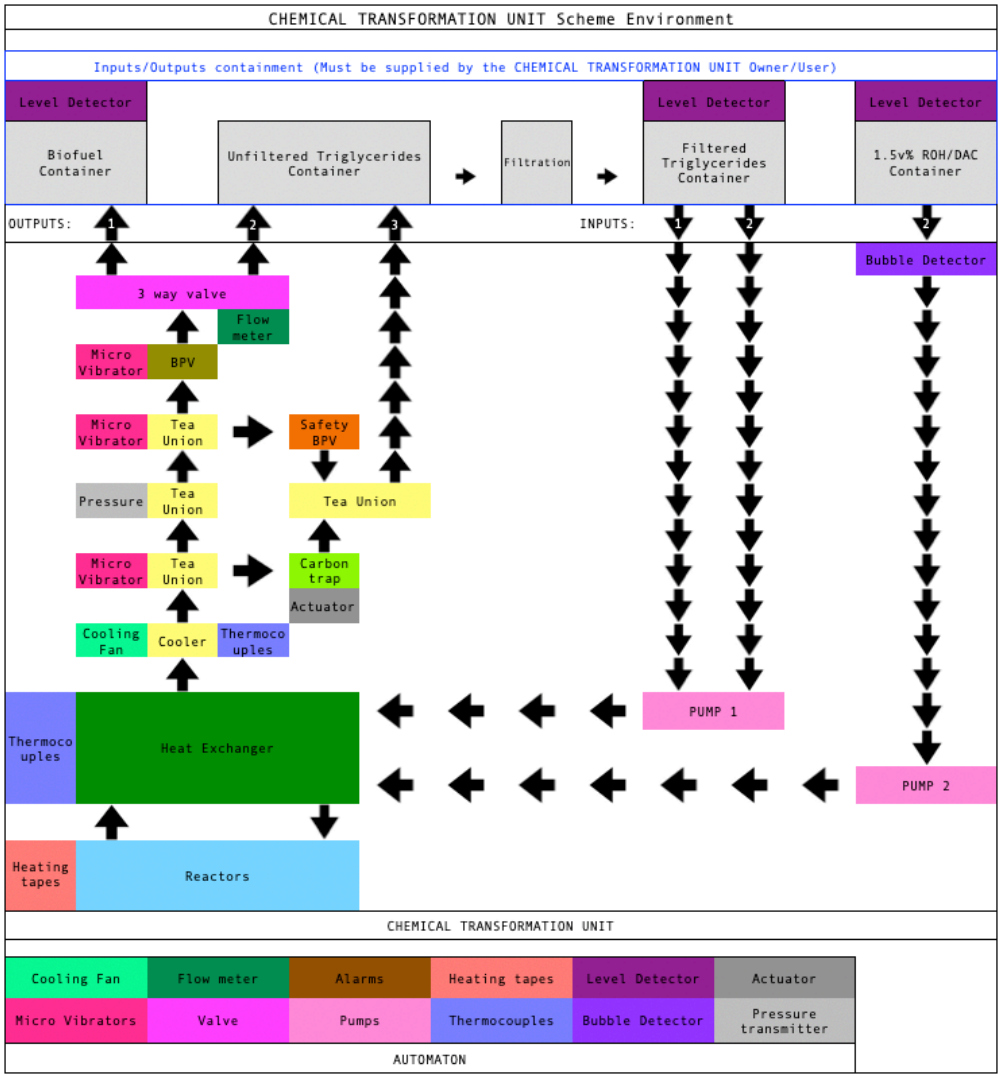


Figure 4. Chemical Transformation Unit Scheme Environment

10.3 Inputs/Outputs Containers (Not Included)

All input and output containers must adhere to regulations for the storage that apply to their physicochemical properties. (i.e. **Class 3 flammable products**). If Output 2 and Output 3 return to the unfiltered triglycerides container, this container should also be considered to hold a **Class 3 flammable liquid** due to the potential for contamination. (See section 8.2)

Using the Proprietary Autarcycle's transesterification process with this unit, a total of four containers are necessary to operate the Chemical Transformation Unit:

1. **Biofuel Container:** This container receives the output from the production line (**Output 1**) and is used to store the finished biofuel. A level detector can be installed and connected to the automaton to prevent overflow. (NOT INCLUDED IN THIS UNIT)
2. **Unfiltered Triglycerides Container:** This container holds the raw triglycerides to be transformed into biofuel. It also receives the recirculation, maintenance, and safety line outputs (**Output 2** and **Output 3**).
3. **Filtered Triglycerides Container:** This container holds liquid triglycerides that have been filtered to below 0.5 microns. It supplies **Input 1** and **Input 2** of the Chemical Transformation Unit. A level detector can be installed and connected to the automaton to prevent low level. (NOT INCLUDED IN THIS UNIT)
4. **Dialkyl Carbonate Solution Container:** This container holds a 1.5% v/v alkyl alcohol in dialkyl carbonate solution. It supplies **Input 3** of the Chemical Transformation Unit. A level detector can be installed and connected to the automaton to prevent low level. (NOT INCLUDED IN THIS UNIT)

All input and output containers must be secured in a manner that accounts for the use, production, and storage of **Class 3 flammable liquids**. The Chemical Transformation Unit and all of its input and output containers must also be **grounded**.

10.4 Connections on Automaton Panel



Figure 5 Automaton connection panel.

- **Input 1 and Input 2** must be connected to the filtered triglycerides containment using appropriate piping approved by Autarcycle Inc. 1/4 OD PE tubing with adequate insert can be used when using Autarcycle's transesterification process.

- **Flowline ATEX Level Detector #1** should be installed and calibrated on the container according to Flowline's recommendations (see Related Documents, p.7). This detector connects to the Chemical Transformation Unit Automaton Panel to prevent the machine from operating with no **Input 1 and Input 2**. (NOT INCLUDED IN THIS UNIT)

- **Input 3** must be connected to the dialkyl carbonate solution containment using appropriate piping approved by Autarcycle Inc. 1/4 OD PE tubing with adequate insert can be used when using Autarcycle's transesterification process.

- **Flowline ATEX Level Detector #2** should be installed and calibrated on the container according to Flowline's recommendations (see Related Documents, p. 7). This detector connects to the Chemical Transformation Unit Automaton Panel for safety, preventing the machine from operating with no **Input 3**. (NOT INCLUDED IN THIS UNIT)

- **Output 1** must be connected to the biofuel containment using appropriate piping approved by Autarcycle Inc. 1/4 OD PE tubing with adequate insert can be used when using Autarcycle's transesterification process.

- **Flowline ATEX Level Detector #3** should be installed and calibrated on the container according to Flowline's recommendations (see Related Documents, p. 7). This detector connects to the micro-factory's control panel for safety, stopping the unit when the biofuel container is full.

- **Outputs 2 and 3** must be connected to the unfiltered triglycerides containment ((or another suitable container) using appropriate piping approved by Autarcycle Inc. 1/4 OD PE tubing with adequate insert can be used when using Autarcycle's transesterification process.

- The unfiltered triglycerides containment must always be kept at least 10% empty to accommodate recirculation, purge - maintenance, or safety line outputs when output 2 and 3 are reintroduced in unfiltered triglycerides.

- Pump 1 must be connected to « P1 » position and to « pompe doseuse 1 » position on **Automaton Panel.**

- Pump 2 must be connected to « P2 » position and to « pompe doseuse 2 » position on **Automaton Panel**.

- Cable identify labelled « Sol1 » (3-way Valve) from the Chemical Transformation Unit must be connected to « Sol1 » position on **Automaton Panel**.

- Cable identify labelled« Sol2 » (2-way Valve) from the Chemical Transformation Unit must be connected to « Sol2 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled « Fan1 » (Cooling Fan) from the Chemical Transformation Unit must be connected to « Fan1 » position on **Automaton Panel**.

- Cable identify labelled « MOT1 » (Micro-Vibrator) from the Chemical Transformation Unit must be connected to « MOT1 » position on **Automaton Panel**.

- Cable identify labelled « MOT2 » (Micro-Vibrator) from the Chemical Transformation Unit must be connected to « MOT2 » position on **Automaton Panel**.

- Cable identify labelled « MOT3 » (Micro-Vibrator) from the Chemical Transformation Unit must be connected to « MOT3 » position on **Automaton Panel**.

- Cable identify a labelled « LVS1 » (Level Detector 1) from the Chemical Transformation Unit must be connected to « LVS1 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled « LVS2 » (Level Detector 2) from the Chemical Transformation Unit must be connected to « LVS2 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled « LVS3 » (Level Detector 3) from the Chemical Transformation Unit must be connected to « LVS3 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled « PST1 » (Pressure Detector 1) from the Chemical Transformation Unit must be connected to « PST1 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled« ACT1 » (Actuator) from the Chemical Transformation Unit must be connected to « PJ19 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled «FM1 » (Flow Meter) from the Chemical Transformation Unit must be connected to « PJ21 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled « BD1 » (Bubble Detector) from the Chemical Transformation Unit must be connected to « PJ20 » position on **Automaton Panel**. (NOT INCLUDED IN THIS UNIT)

- Cable identify labelled « T1 », « T2 », « T3 », « T4 », « T5 », « T6 » (Thermocouples PJ1 to PJ6) from the Chemical Transformation Unit must be connected their respective « Thermocouples » position on **Automaton Panel**.

- Cable identify labelled « HE1 » (Heater 1) from the Chemical Transformation Unit must be connected to « HE1 » position on **Automaton Panel**.

- Cable identify labelled « HE2 » (Heater 2) from the Chemical Transformation Unit must be connected to « HE2 » position on **Automaton Panel**.

- Cable identify labelled « HE3 » (Heater 3) from the Chemical Transformation Unit must be connected to « HE3 » position on **Automaton Panel**.

- Cable identify labelled « HE4 » (Heater 4) from the Chemical Transformation Unit must be connected to « HE4 » position on **Automaton Panel**.

- Connect a computer or an isolated, secured network to the « RJ451 » port with a suitable cable (not included) to access the controls. Do not connect the automaton to a public or shared network.

- Connect the 20 A / 240 V power cable to a suitable power supply.

10.5 Automaton Front

The contact switch powers the system and gives access to the automaton's electronics. The Fault indicator light illuminates when the system is faulty. The emergency stop button can be activated to stop the micro-machine by putting it in a faulty state. When in the faulty state, heating and pumping is automatically stopped.

10.6 Chemical Transformation Unit Menus

The unit can be operated in two ways. With an Ewon module, the automaton is connected to the computer network through the « RJ451 » port and can be accessed securely from anywhere. Without an Ewon module, as on this RUO unit, connect the automaton only to an isolated, secured network, or directly to a personal computer through the « RJ451 » port with a manual IP configuration (contact Autarcycle Inc. for the IP address). Once connected, open the unit's interface in any web browser using the automaton's IP address.

The menus are located in the upper right corner of the interface.

Table 2 Interface Menus

MENUS		
	ALARMS	Give access to alarms listing. There are two types of alarms. The critical one is triggered when one High-High or Low-Low Limit is reached and a notification alarm is triggered when one High or Low Limit is reached. Limits for each reactors, heat exchanger and coolers can be set in the settings menu. When the unit is connected to a network with internet access, alarms can be sent by e-mail to inform user. When a critical alarm is issued the unit initiates shutdown. When alarm is about one of the ECP 2200 Pumps, their interfaces can be consulted for troubleshooting (see ECP 2200 User Manual)
	UNIT STATUS	Shows the loaded recipe, the CTU status, and thermocouple readings.
	RECIPES	Sets the flow rate of each pump, the reactor temperatures and the recirculation time. Activates, loads and saves recipes. When developing a recipe, **make sure the cooler temperature never exceeds 80 °C.**
	SETTINGS	Programs the PID controllers, set High-High and Low-Low alarm, final stopping temperature and purge flow rates.
	DIAGNOSTICS	Shows the operating status of the CTU components.

10.7 Nature of Inputs for Autarcycle's Transesterification Process

Input 1 and 2: The **triglycerides** used must meet the specifications determined during recipe development. If the supplier or method of production changes, the user must ensure that the material still meets these specifications. The triglycerides should be filtered to below 5 micron. Outputs 2 can be connected to the unfiltered triglycerides container, but **never** to the filtered triglycerides container, as solid carbon may be discharged from these outlets during purge or maintenance.

Input 3: The **dialkyl carbonate** solution used must meet the specifications determined during recipe development. For a list of pre-qualified suppliers, contact Autarcycle Inc.

10.8 Nature of Outputs

- **Outlet 1:** Produced Biofuel. This biofuel should be filtered through a standard fuel filter before use.

- **Outlet 2:** Recirculation mixture, which is discharged during the machine's start-up or shut-down phases.

- **Outlet 3:** Mixture obtained from Purge-Maintenance and Safety Valve. **Purge and maintenance can be automated on units equipped with an actuator; this unit is not.**

10.9 Production

This is a Research Use Only (RUO) unit. No recipe was purchased with it.

Recipes developed for your specific use are saved in the unit's menu. To start a production run, first, ensure that the inlet containers have enough liquid and that the biofuel container has sufficient capacity to receive the final product. Then, follow these steps:

Step 1: Make sure all system components are properly immobilized.

Step 2: Make sure all system components are properly grounded.

Step 3: Make sure all connections between the unit and the automaton are made to the correct positions. (See section 10.4)

Step 4: Make sure every container is filled and connected appropriately to the Chemical Transformation (Unit Inlets 1, 2 and 3 and Outlets 1,2 and 3) and to the Automaton (Level Detectors 1,2 and 3).

Step 5: If the process requires it, make sure the feed liquids are kept under an inert atmosphere.

Step 6: Make sure there are no gas bubbles in the feed lines by **purging** pump 1 and pump 2 directly on pumps terminals as described in the Ecom ECP 2200 User Manuel.

Step 7: In the Recipe Menu select the desired recipe and click the **Activate** button.

Step 8: In the Unit Status Menu make sure the proper recipe is activated (Upper Left).

Step 9: In the Unit Status Menu Press the Start Production button.

Step 10: Confirm the composition of Inputs 1 and 2 by clicking the **Confirm** button.

Step 11: To stop the production Press the Stop Production button. **DO NOT push the Emergency push-button as it will shut the flow that is necessary to cool down and flush the mixture contained in the tubular setting.** By pressing the Stop Production button you ensure cooling of the system since the pumps keep running while the heaters stop, until the coolers reach the **stopping sequence temperature threshold**, set in the Settings menu, preventing unwanted precipitation in the tubular settings.

Step 12: If the unit will be out of operation for more than 24 consecutive hours, purge the tubular setting and pumps with 99.9% isopropanol (iPrOH), using three times the internal volume (total internal volume: approximately 300 mL).

10.10 Production Oversight

When the unit is connected to a network with internet access, High-High alarms are sent by email. While the machine is running, daily safety oversight is recommended. **If the micro-factory is not connected to the Internet, remote monitoring is unavailable. An operator must therefore supervise it on site at all times while it is in operation.**

10.11 Troubleshooting

Contact Autarcycle Inc. for any problem with the unit.

11. Maintenance

On fully equipped units, maintenance is scheduled automatically based on the recipe developed for your specific starting materials and the required physicochemical properties of your product. The machine will perform this maintenance autonomously.

There is no fixed schedule for maintenance. The micro-factory's automated maintenance is based on pressure elevation within the tubular system. If the system is unable to restore adequate pressure on its own, please contact **Autarcycle Inc.**

This RUO model is not equipped with an actuator or an additional pressure sensor and cannot perform automatic maintenance. Maintenance must be performed manually as follows:

1. Monitor the pressure of each pump.
2. Initiate maintenance if the pressure rises more than 500 psi above the initial pressure setting, or exceeds 3,700 psi.
3. Stop production by setting the cooler temperature below the boiling point of the inlet components.
4. Once production has stopped, activate the purge at the preset flow rate.
5. When the pressure has stabilized, release it by opening the bonnet valve.
6. Close the bonnet valve.
7. Repeat steps 5 and 6 until the pressure returns to its initial setting.

12. Replacement Parts

Contact Autarcycle Inc. for any question about replacement parts.

13. Warranty and post-warranty repairs

No warranty is offered with this RUO unit. To the extent permitted by applicable law, Autarcycle Inc. is not responsible for leaks or for damage to the environment, property or persons resulting from misuse, unauthorized modification, or failure to follow this user manual.

14. Technical Parameters

Parameter	CTU-RUO
Maximum flow capacity	24 L/h (approximately 210,000 L/year)
Maximum normal operating pressure	3,700 psi
Pump safety cut-off pressure	4,200 psi
Maximum normal operating temperature	400 °C
Power supply	20A - 240V
Dimensions (w x h x d)	CTU: 36 3/4” x 71 1/4” x 18 3/8”
	AUTOMATON: 30” x 26 3/4” x 9”
Operational environment conditions	Indoor and ATEX use only.
	Altitude: up to 2000 m
	Temperature: 5 to 40 ºC
	Humidity: maximum relative humidity 80 % for temperatures up to 31°C decreasing linearly to 50 % rel. humidity at 40°C.
	Voltage fluctuations: up to ±10 % of nominal voltage. Overvoltage: category II. Pollution degree: 2.

Maximum values are the unit's operating limits; actual throughput depends on the chemical transformation and the recipe used.

15. Declaration of Conformity

This unit can only be acquired for Research Use Only (RUO). Certification of the complete assembly is underway.

Automated Biodiesel-Like Biofuel Micro-Factory Components Certifications

Components	CE	RoHS	CSA	ASME B31.3	ATEX
ATEX LEVEL DETECTOR	CSA for Canada: Class I, Division 1, Groups A, B, C and D T4; Class II, Division 1, Groups E, F and G T4; Class III, T135C; Ex ia IIC T4 Ga; Ex ia IIIC, T135C Da; CSA for U.S.: Class I, Division 1, Groups A, B, C and D T4; Class II, Division 1, Groups E, F and G T4; Class III, T135C; Class I, Zone 0, IIC AEx ia T4 Ga; Class II, Zone 20, IIIC AEx ia, T135C Da. Compliance: CE, RoHS				
Degasser	Yes	-	-	-	-
Preparative Pump	Yes	-	-	-	-
Automaton		-	Yes	-	-
Ewon	-	-	Yes	-	-
Tubular Settings	-	-	-	Yes	Yes
3 way direct acting	-	-	-	-	Yes
Type-K Thermocouple	Prop 65 NA (no Prop 65 chemicals)				
Heating Tapes	-	Yes	-	-	-
Insulation bankets	-	-	-	-	-
Pressure transmitter	DIN EN 175801-803-C / NEMA 4X (IP66)				
Actuator	Class I Div. I Groups B, C, D housing (Hazloc)				
Micro Vibrators	-	-	-	-	-
Flow meter	-	-	-	-	-
Casing	-	-	-	-	-
Level transmitter	CSA for U.S.: Class I, Div 1, Groups A, B, C and D T4; Class II, Div 1, Groups E, F, G T4; Class III, T135°C; Class I, Zone 0, IIC AEx ia T4 Ga, Class II, Zone 20, IIIC AEx ia, T135°C, Da CSA for Canada: Class I, Division 1, Groups A, B, C and D T4; Class II, Division 1, Groups E, F, G T4; Class III, T135°C; Ex ia IIC T4 Ga; Ex ia IIIC T135°C Da; IECEx: Ex ia IIC T4 Ga; Ex ia IIIC T135°C Da Tamb: -40°C tp 80°C				

16. Pre-delivery checklist

Bill	000000003
	DOCUMENTATIONS
MICRO-FACTORY USER GUIDE	
PRE-DELIVERY INSPECTION CHECKLIST	
PUMPS USER GUIDE	
	COMPONENTS
MODULE 1 TUBULAR SETTING	
MODULE 2 PUMPS	
MODULE 3 AUTOMATE	
	AUTOMATON
CONNEXION IP	
ALARMS	
UNIT STATUS	
PRESET RECIPES	
PRESET SETTINGS	
DIAGNOSTICS	
PUMP 1 CONTROL	
PUMP 2 CONTROL	
THERMOCOUPLES FEEDBACK (T1 - T6)	
HEATERS (H1 - H4)	
MICRO-VIBRATORS (M1 -M3)	
FAN	
3-WAY VALVE	
2 WAY VALVE	Not Include
LEVEL DETECTOR (L1 - L3)	Not Include
PRESSURE DETECTOR	Not Include
ACTUATOR	Not Include
BUBBLE DETECTOR	Not Include
FLOW METER	Not Include
	QUALITY TEST
PRESSURE TEST (iPrOH)	
FLOW TEST (iPrOH)	
LEAK FREE VISUAL iPrOH)	
LEAK FREE PRESSURE DROP (iPrOH)	
CRARBON TRAP TEST (iPrOH)	
	RELEASE APPROVAL
AUTORIZED SIGNATURE	
	Alain Rouillard, CEO AUTARCYCLE INC.
DATE	