BRUCONTROL

Process Automation Made Personal

Model UF (v1 and v2)
UniFlex Brewing Control System
30A and 50A Models
Updated May 6, 2023

Description

The UniFlex Control System is a turnkey 240VAC "plug-and-brew" controller for brewing or distillation applications. It is available in 30A and 50A models, for single or dual simultaneous heating element applications. This is the first control system of its kind, allowing for both user selectable options during order and a future upgrades via a modular based architecture. For example, the controller can be made initially or later upgraded to include the following options: choice of power feed and plug(s), single or dual vessel power (30A models), single or dual pump/accessory power, integrated user I/O, proportional power control, DIN rail mount, internal cooling option (30A models), and plug-and-play temperature probes.

The UniFlex is built on a foundation of BruControl technology and integrates into the BruControl application's ecosphere. The UniFlex's core is an ESP32 micro-controller, which communicates with the BruControl application via Wi-Fi network. BruControl, along with UniFlex, UniCon, UniShield, or DIY-built control interfaces facilitates a continuous upgrade and integration path across the whole brewery including brewing, fermentation, refrigeration, dispensing, and cleaning. This means a brewery can be incrementally upgraded or updated over time to include more devices and/or more advanced degrees of control, monitoring, data logging, and automation.

⚠ This Product Note provides information specific to the UniFlex. Features, functions, and operations associated with the BruControl application is provided in the BruControl User Manual. Before using the UniFlex, the user must review both this Product Note and the [BruControl User Manual](#) in their entirety.

IMPORTANT SAFETY INFORMATION

This section, and warnings noted by warning icons can lead to serious injury or death, equipment damage, or unexpected system performance if not followed. The user must read these sections and understand them completely before use. Any questions or concerns must be directed to BruControl technical support before use.

⚠ The UniFlex 120VAC power (NEMA 5-15P plug) MUST be plugged into a 15A GFCI (Ground Fault Circuit Interrupt) protected receptacle. For 30A UniFlex models, the 240VAC power (NEMA 14-30P, 6-30P, 10-30P, or L6-30P plugs) MUST be plugged into a 30A GFCI (Ground Fault Circuit Interrupt) protected receptacle. For 50A UniFlex models, the 240VAC power (NEMA 14-50P, 6-50P, or 10-50P plugs) MUST be plugged into a 50A GFCI (Ground Fault Circuit Interrupt) protected receptacle. Consult a certified licensed electrician familiar with National Electric Code and local building code standards to ensure the receptacle being used is appropriately equipped and suited for this application.

⚠ Operating the UniFlex in any manner other than described in these documents or explicit guidance from BruControl Technical Support can result in property damage, injury, electrocution, or death.

⚠ The operation of the UniFlex MUST fall within the specifications listed below. For example, exceeding the specified current limits may cause damage to the unit or associated equipment.

⚠ Do not use the UniFlex for any application other than its intended use for brewing or distillation. Always ensure the powered devices are properly set-up and prepared to receive power. For example, heating elements must be submerged in liquid. Failing to do so could result in damage of user's equipment, parts, materials, and/or processes, including but not limited to, damage, discoloration, corrosion, down time, equipment stoppages, process system failure, and/or damage to adjacent and/or area of use or storage locations.

⚠ The UniFlex must be located safely away from sources of heat or liquid. It must be mounted horizontally with the rubber feet down or vertically with the power cords hanging down. It must be located in an area of adequate ventilation and the bottom vent ports must remain free of obstruction. For passive cooling option models which contain an external heatsink, the heatsink must not make contact with any other objects and must not have any restrictions of its convective airflow.

⚠ Always handle power plugs and receptacles, temperature probe plugs, and Input/Output connectors gently. Do not disconnect any connection by pulling on the cable or cord. Always gently grasp the handle of the plug and pull straight in line with the plug direction.

⚠ The UniFlex must only be connected to equipment or devices which are purpose-suited and have been installed by qualified personnel. Failing to do so may result in property damage, injury, electrocution, or death.

⚠ Do not power-on or operate the UniFlex without the Wi-Fi antenna connected. Doing so may damage the internal microprocessor or render it permanently incapable of communication.

⚠ Do not use the UniFlex if any abnormal operation is suspected. Immediately power down and unplug the input power plugs if the unit is generating any unexpected sounds, heat, or odor.

⚠ The UniFlex has no serviceable components inside. Opening the controller enclosure may render the unit inoperable and will void the warranty.

⚠ This product uses FDA and/or NSF approved food grade materials anywhere product components make contact with edible / potable media, such as the distal end of the temperature probes.

⚠ Warning: This product contains or may contain chemical(s) known to the State of California to cause cancer, birth defects, or other reproductive harm.

Specifications

- Power Input Supply Requirements
  - Single feed option
    - 30A models: 240VAC, 30A via 4-conductor NEMA 14-30R receptacle (includes ground and neutral)
    - 50A models: 240VAC, 50A via 4-conductor NEMA 14-50R receptacle (includes ground and neutral)
  - Dual feed option
    - 30A models: 240VAC, 30A via 3-conductor NEMA 14-30R, 6-30R, L6-30R, or 10-30R receptacle (no neutrals) and 120VAC, 5A via NEMA 5-15R receptacle
    - 50A models: 240VAC, 50A via 3-conductor NEMA 14-50R, 6-50R, or 10-50R receptacle (no neutrals) and 120VAC, 5A via NEMA 5-15R receptacle
  - Circuit protection required
    - 30A models: 30A dual pole GFCI circuit breaker

- - - 50A models: 50A or 60A dual pole GFCI
- Power Input
  - 30A models:
    - Single feed option: NEMA 14-30P plug
    - Dual feed option: NEMA 14-30P or 6-30P or L6-30P or 10-30P plug, and NEMA 5-15P plug
  - 50A models:
    - Single feed option: NEMA 14-50P plug
    - Dual feed option: NEMA 14-50P or 6-50P or 10-50P plug, and NEMA 5-15P plug
  - 2m (6' / 72 inches) power cord length(s) included
- Vessel Power Output(s)
  - 240 VAC, 25 amps maximum (5500W heater) per output
  - Single vessel (30A models only): 1x NEMA L6-30R receptacles on 230 mm (9 inches) pigtail
  - Dual vessel: 2x NEMA L6-30R receptacles on 230 mm (9 inches) pigtails
  - 50A models: include internal 25A circuit breakers for each output
- Pump / Accessory Power Output(s)
  - 120VAC, 5 amps total, via NEMA 5-15R receptacle(s) on 230 mm (9 inches) pigtail(s)
  - Circuit breaker integrated in controller
  - 30A models: Single receptacle is included, dual receptacle is optional
  - 50A models: Dual receptacle is included
- Enclosure
  - Aluminum, with internal cooling fan (not splash proof)
  - Front panel includes Wi-Fi antenna, 2x temperature probe receptacle(s), I/O connector (optional), I/O power (v1 only), power switch
  - Rear panel includes pass-through connectors for power and pump/accessory wires and circuit breaker
  - Cooling:
    - 30A models :Aluminum heat sink (without internal cooling option)
    - 50A models: Aluminum heat sink
  - Rubber feet on bottom (30A models: optional DIN rail mounting kit)
  - Mounting: horizontal or vertical (power cords down)
  - Dimensions
    - 30A models: 290 x 170 x 100 mm (11.4 x 6.7 x 3.9 inches) L x W x H, excluding wires
    - 50A models: 320 x 195 x 120 mm (12.6 x 7.7 x 4.7 inches) L x W x H, excluding wires
- Temperature Probe(s)
  - 100 mm (4 inch) length, 6 mm (1/4 inch) diameter probe, with 3 m (10' / 120 inches) cord and right-angle plug

- o Universal probe design, allows for brewery integration via compression fittings (not included)
  - o Probes are waterproof (can be submerged) and use shielded cable for noise reduction
  - o 1-wire technology, allows for up to 10 probes simultaneously plugged in (requires separate adapter, not included)
  - o 1 probe included with single vessel output controller, 2 probes with dual vessel output controller
  - o Temperature range -55°C to +125°C (-67°F to +257°F)
  - o ±0.5°C (1°F) accuracy from -10°C to +85°C (14°F to 185°F)
- BruControl Interface
  - o ESP32 based microcontroller with Wi-Fi and external antenna
  - o Firmware software upgradeable OTA (over-the-air)
- Solid State Relay Option
  - o Standard (binary) SSR for duty-cycle type modulated control
  - o Optional proportional SSR for step-less type modulated control
- Cooling configurations
  - o External, passive heat sink option (required for proportional SSR and/or 50A models)
  - o Internal, active (fan cooled) option (30A binary SSR only)
- Power Switch
  - o Latching illuminated circular switch on front panel
  - o Interlock design ensures vessel Power Outputs are disconnected from mains power
- Integrated Input/Output Option
  - o 17 total I/O
  - o 12 high current outputs (max limits: 12 amps total, 5 amps per bank, 2 amps per output)
  - o 4 inputs (digital or 12-bit analog)
  - o 1 analog output (0 – 5VDC)
  - o I2C bus pins
  - o Internal 12VDC power available, up to 1 amp maximum
  - o Front panel connectors for I/O and external power (12 or 24 VDC)

Models

Versions

Version 1: UniFlex v1 contains circular ports for the optional integrated I/O connectors. The power switch LED is green. This model requires the use of the setup dongle to enter Network Setup mode. 30A only. This model is no longer available following update to Version 2 in early 2022.

Version 2: UniFlex v2 contains a rectangular port for the optional integrated I/O connector. The power switch LED is blue. This model does not require the use of a setup dongle to enter

Network Setup mode. Leaving the right probe empty during power-up will cause the unit to enter Network Setup mode.

Base Models

| MODEL	DESCRIPTION
UF-14S	Single Vessel, 30A with single feed power (NEMA 14-30P plug)
UF-14D	Single Vessel, 30A with dual feed power (NEMA 14-30P and 5-15P plugs)
UF-6D	Single Vessel, 30A with dual feed power (NEMA 6-30P and 5-15P plugs)
UF-L6D	Single Vessel, 30A with dual feed power (NEMA L6-30P and 5-15P plugs)
UF-10D	Single Vessel, 30A with dual feed power (NEMA 10-30P and 5-15P plugs)
UF-S14-2	Dual Vessel, 50A with single feed power (NEMA 14-50P plug)
UF-D14-2	Dual Vessel, 50A with single feed power (NEMA 14-50P and 5-15P plugs)
UF-D6-2	Dual Vessel, 50A with single feed power (NEMA 6-50P and 5-15P plugs)
UF-D10-2	Dual Vessel, 50A with single feed power (NEMA 10-50P and 5-15P plugs)

UniFlex Options

OPTION	DESCRIPTION
Dual Vessel Power	Second L6-30R to power a second vessel heater (includes second temperature probe). 30A models only.
Dual Accessory Outlet	Second Pump / Accessory Outlet to power pump or other 120VAC accessory (5A max). 30A models only.
Integrated I/O	Integrated user input/output bus with 17 I/O points to connect accessories such as flowmeters, valves, volume sensors, pH sensors, etc.
Proportional Control	Proportional SSR which modulates power to vessels (rather than binary ON/OFF type SSR).
DIN Rail Mount Kit	Replaces enclosure base's rubber feet with DIN rail mounting clips, allowing for mounting to dual DIN rails (vertically or horizontally). 30A models only.
BruControl Advanced License	Discounted BruControl software application (with UniFlex purchase) for multiple/network interface integration.
Additional Temperature Probes	Plug and play, waterproof, 10' temperature probes (up to 10 per UniFlex).

UniFlex Components

Front Panel (v1)
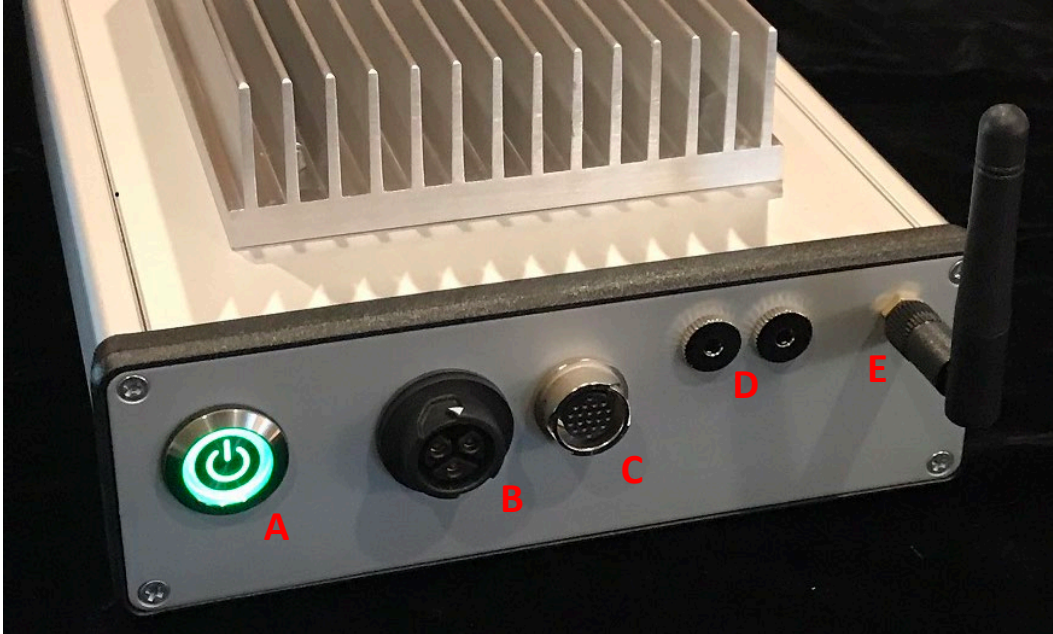
A – Power Button (green LED)
B – I/O Power Connector (option)
C – I/O Connector (option)
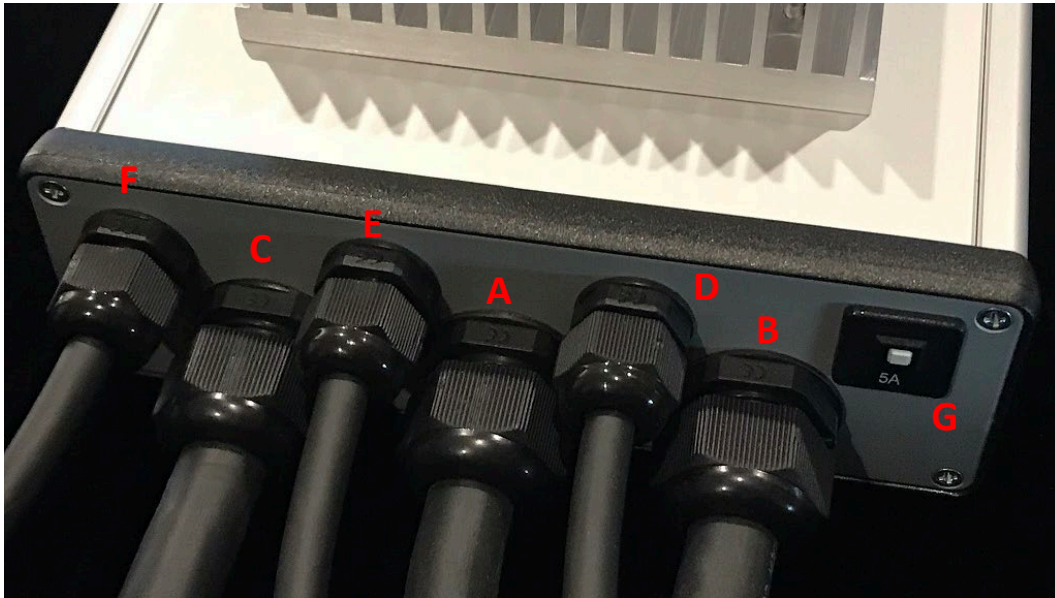D – Temperature Probe Jack(s)
E – Wi-Fi Antenna jack & antenna

Front Panel (v2)

A – Power Button (blue LED)
B – I/O Connector (option)

C – Temperature Probe Jack(s). Note: right jack (marked by asterisk) is primary
D – Wi-Fi Antenna jack & antenna

Rear Panel

A – 240VAC Power Input, 30A or 50A depending on model
B – Vessel Power Output #1
C – Vessel Power Output #2 (if dual vessel output equipped)
D – 120VAC Power Input (dual power feed models only)
E – Pump/Accessory Power Output #1
F – Pump/Accessory Power Output #2 (option on 30A model)
G – 5A Circuit Breaker for 120VAC Pump/Accessory outputs
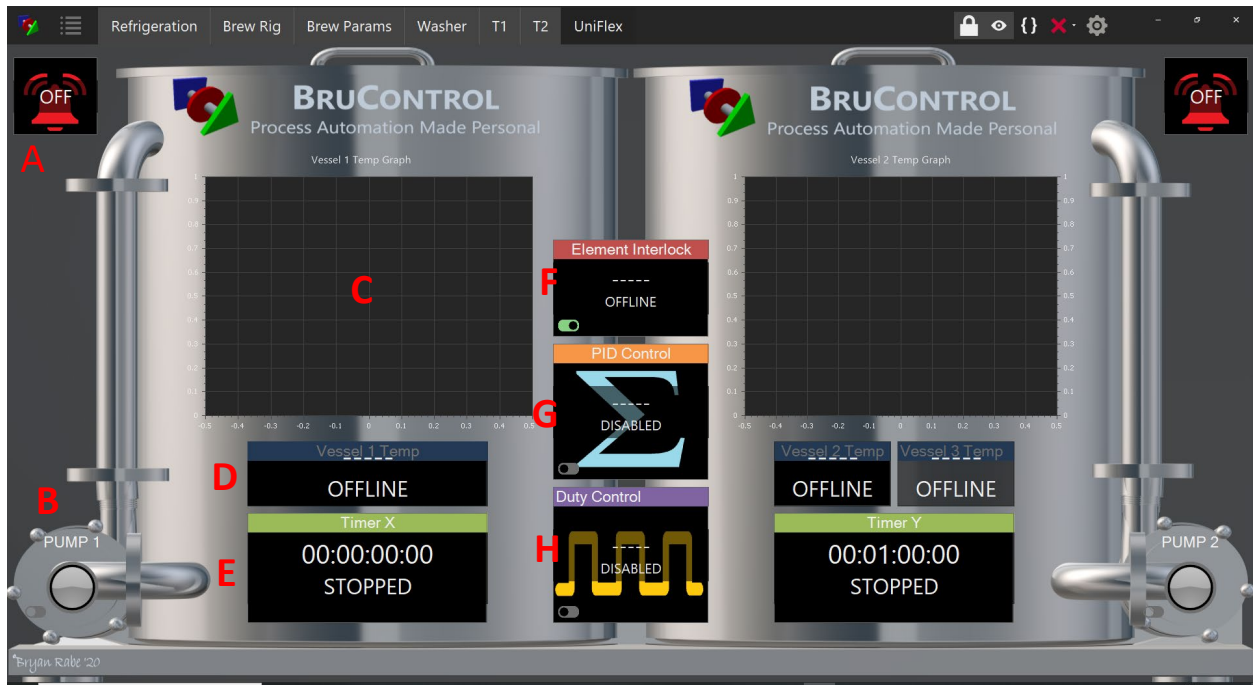
Bottom Panel, 50A Models
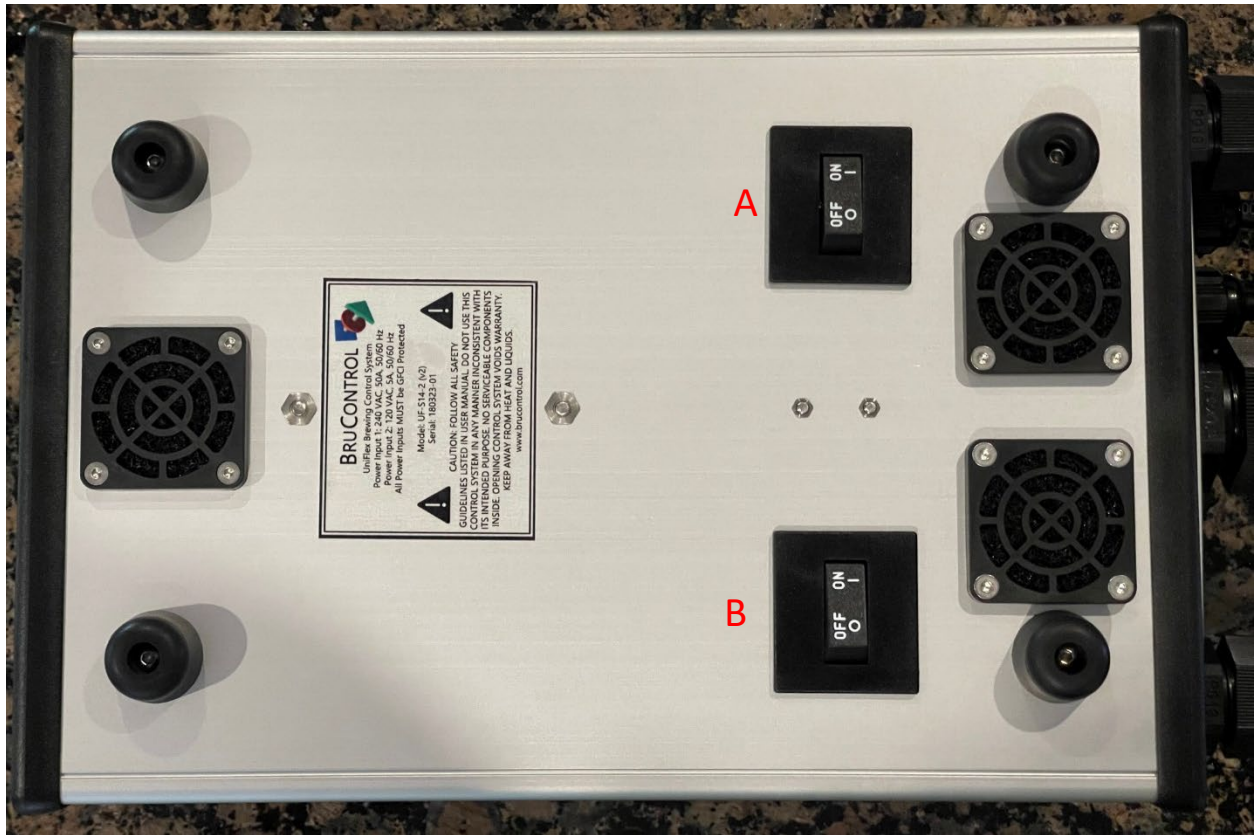
50A UniFlex models include internal Circuit Breakers for each Vessel Power Output. Should either output be overloaded beyond 25A, the breaker will trip and require manual reset. The breaker enabled when toggled to the ON position.

A – Vessel Power Output #2 Circuit Breaker
B – Vessel Power Output #1 Circuit Breaker

BruControl Workspace

BruControl uses Configurations to define a system's functional operation, current status, graphical layout, and system settings. Different configuration templates are provided as a starting point for UniFlex users, and these can be edited as desired to achieve the user's system goals. Alternatively, a configuration can be created from scratch, as long as the user understands how to do so, as is documented in the BruControl User Manual.

The BruControl application utilizes graphical controls to represent a physical brewing or process system. Each control item in a BruControl Workspace is called an Element (e.g. Alarm Element, Temperature Probe Device Element, etc.) and these represent either functions (e.g. Alarms) or devices (Temperature Probes). These should not be confused with heating elements. Workspaces and other settings are stored in a Configuration

A – Alarm(s)
B – Accessory/Pump(s)
C – Vessel Temperature Graph(s)
D – Vessel Temperature Device(s)
E – Timer(s)
F – Element Interlock (if dual vessel equipped)
G – PID Control
H – Duty Control

Initial Set Up

Unpacking

1. Carefully unpack the UniFlex, taking precautions <u>not to place any undue stress on the cables by torquing, pushing, or pulling on the cords or plugs</u>. Inspect the unit, cables, plugs and receptacles for damage.
2. For 50A models, ensure both Vessel Power Output circuit breakers are switched ON.
3. Place the UniFlex on a horizontal, flat surface with rubber feet facing down, and ensure nothing underneath interferes with the vents on the bottom side. See below for DIN rail mount installations.
4. Carefully unpack the temperature probe(s), taking precautions not to place any undue stress on the cables.
5. Carefully unpack the accessory kit and gently screw the Wi-Fi rubber antenna onto the gold threaded male antenna jack at the upper-right of the front panel. Fold the antenna so it is vertical and pointed up.
6. Plug in the UniFlex power.
   a. If single-feed (14-30P or 14-50P plugs only), plug this plug into an appropriate 30A or 50A GFCI-backed receptacle. If dual-feed, plug only the NEMA 5-15P plug into an appropriate 15 amp, 120VAC receptacle. Do not plug in any vessel or accessory power devices yet.

Network Set-up

7. The UniFlex ships with Wi-Fi SSID and password set to "default". Follow steps below to change these parameters and connect the UniFlex to the desired Wi-Fi network for communication with BruControl. Note that both the UniFlex and the BruControl computer must be connected to the same network.
8. <u>For UniFlex v1 only</u>: Locate the 5-port splitter and the UniFlex Setup Dongle in the accessory kit and gently insert it straight and fully into the temperature probe jack. Do not force it, twist it, or insert it in on an angle. Insert the 3.5mm Setup Dongle into a splitter port.
9. <u>For UniFlex v2 only</u>: The right temperature probe jack, marked by an asterisk, is the primary jack. When this jack is empty, the UniFlex will enter Network Setup mode following power-on. Therefore, do not plug anything, including the 5-port splitter, during this process.
10. Power-on the UniFlex via the Power Button. Ensure the button glows green (v1) or blue (v2) and the fan(s) are heard functioning.
11. After a few seconds, the UniFlex will enter Access Point mode. Using a Wi-Fi enabled computer, phone, or tablet, browse for a Wi-Fi access point with a "BruControl_######" prefix. Connect to this access point and provide password "BruControl" if requested.
12. Open the computer, phone, or tablet's internet browser, and open a new web page at http://192.168.10.1. An "Interface Wi-Fi Config" configuration page will appear where network parameters are stored. These are the settings for the Wi-Fi network BruControl

and the UniFlex will communicate through. This must be completed within 3 minutes of power-up, otherwise the UniFlex will return to normal operation.

    a. Enter the SSID and password of the Wi-Fi network.

    b. If using a static IP address, enter the IP, GW (gateway), and SN (subnet) addresses into the appropriate fields, using xxx.xxx.xxx.xxx notation.

    c. Conversely, if using a server-assigned IP address via DHCP, leave IP, GW, and SN fields blank.

    d. Save the settings and ensure they are accurately reported back with a "Settings Saved" message.

13. Power off the UniFlex via the Power Button. Ensure the button ceases to glow and the fans go silent. For v1 only: gently remove the Setup Dongle from the splitter and store it for future use.

Temperature Probe Setup

14. Plug the temp probe(s) into the temperature probe jack on the UniFlex front panel. If using one or two probes, plug them in directly. If using multiple probes, use the 6-port splitter and plug it into the jack, then plug the temperature probes into the splitter.

15. Carefully un-wind the temperature probe cables and route them toward their installation locations. Ensure the cables are kept routed away from heat and other power cables to reduce the possibility of electromagnetic interference (EMI).

16. Insert the temperature probes ends into their respective vessel compression fittings. Insert the probe as far as possible for the mounting location, ensuring the tip does not contact any fitting or vessel wall. Gently tighten the fittings to ensure a good seal.

BruControl Installation

17. Download and install the BruControl application via the license Authorization email included with the UniFlex purchase. Follow the directions included there, including the SQL database installation steps. Alternatively, [download here](#).

18. Download the and unzip the UniFlex Configuration files ("BruControlUniFlexConfigurations.zip") into the same folder as the BruControl application files in the above step.

19. Make a folder on the installation computer: "C:\BruControlUniFlex\"

20. Download and unzip (extract) the UniFlex Images file ("BruControlUniflex.zip") into the folder made in the step above. There should be nine image files there now, which can be moved later if desired.

21. Run BruControl (brucontrol.exe), then Activate the license via Settings (gear icon)… License.

22. Also, via Settings, select the configuration best associated with the UniFlex model and number of vessels in the target brewery. For example, "UniFlex_3V_BinarySSR" is a UniFlex with a binary SSR, to be used in a 3-vessel brewery.

23. The background and images should be displayed. These configurations are pre-created examples – these may be modified as desired, however making backup copies of the original configuration files is recommended.

24. For UniFlex software configurations which do not match the physical configurations, the different Device Elements will need to be added or removed per standard methods used in the BruControl application.

UniFlex Connection to BruControl

25. Review the BruControl User Manual to understand how the application works.
26. Identify the UniFlex's IP address. If using a Static IP address, it is known. If using a server-assigned IP address (via DHCP), scan the network for it. Do this by logging into the router/server and review the DHCP assignment or Wi-Fi clients list. The UniFlex device will be noted with a prefix of "esspressif". Alternatively, use an app such as 'Fing' or 'Discovery' to identify the UniFlex IP address on the network.
27. Edit the interface in BruControl's Settings (gear icon). Change the IP address to match the UniFlex's IP address above. The Status should change from a red X to a green checkmark, indicating the UniFlex is connected to BruControl.

UniFlex Power & Accessories

28. Once the above steps have been completed successfully, continue to connect brewery devices via the steps below.
29. Ensure the UniFlex is powered down via the Power Button.
30. Plug in vessel device(s) (e.g., vessel heating elements). These will have L6-30P locking plugs and will connect to the UniFlex L6-30R vessel power output receptacle(s). Fully insert and turn the plug into the receptacle to ensure it is locked and properly connected. When looking at the back of the UniFlex, the pigtail cable for vessel power output #1 is on the right is #1 and #2 (if dual vessel equipped) is on the left.
31. Plug in accessory device(s) (e.g., pumps). These will have 5-15P plugs and will connect to the UniFlex 5-15R accessory power output receptacle(s). Fully insert the plug into the receptacle to ensure it is properly connected. When looking at the back of the UniFlex, the pigtail cable for accessory power output #1 is on the right is #1 and #2 (if dual accessory equipped) is on the left.

Initial Testing

32. Prior to connecting and testing vessel devices (Mash Tun, Hot Liquor Tank, Boil Kettle RIMs tube, etc.), it is highly recommended to fill all vessels with water. This will ensure that activation of the heating elements does not incur damage.
33. Power on the UniFlex via the front power switch and ensure that BruControl application reports it as connected.
34. Enable the UniFlex Device Elements to test functionality. First, enable the Vessel Temperature Device Element(s). They should report a temperature(s).
    a. The temperature probes index on startup. The first time a system is used, or when probes are changed, the indexing order may need to be updated.
    b. Temporarily touch the tip of each probe to heat it slightly, then identify which Vessel Temp Device Element in the Workspace is responding. If the incorrect Element is responding, the desired Element's index number should be changed to the one which actually showed the temperature response. For example, if

Vessel 1 has an index of 0 and Vessel 2 has an index of 1, and the probe inside Vessel 1 causes the reading of Vessel 2 to respond, Vessel 1's index should be changed to 1.

35. Enable the 'Element Interlock' Device Element. A click sound from the relay(s) inside should be heard. Selecting it to switch elements (if equipped) should result in two concurrent click sounds.
36. Enable the Pump (accessory) Device Element(s) and select them to turn them ON. The connected accessory(s) should run appropriately.
37. If the Vessel Power devices (heating elements) are in a condition they can be powered (e.g., under liquid), enable the Duty Cycle Device Element and set its output to 100% to check that they are functioning properly. Do this for both outputs if equipped by changing the Element Interlock from one vessel to the other.

Operation

The BruControl application and the UniFlex are two components in a functioning BruControl integration and operate like all BruControl systems. Therefore, it is critical that the user review the BruControl User Manual in its entirety before operating the UniFlex. The operation instructions to follow assume awareness and understanding of the User Manual content and will not be repeated here for consistency.

Power Flow & Control, 30A Models

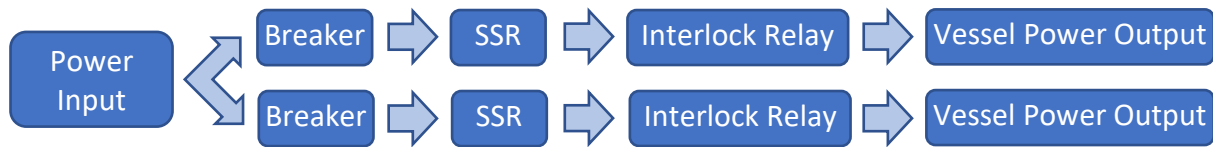For 30A Models, 240VAC power routes through the UniFlex as follows:
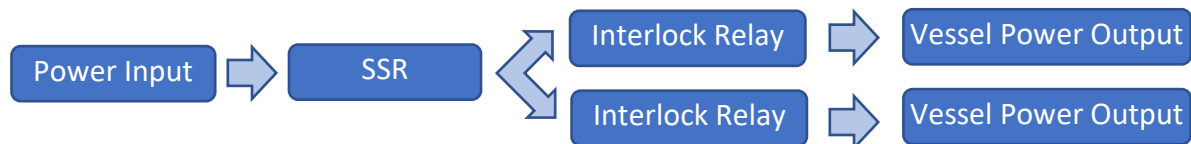
This power flow requires both the SSR (Solid State Relay) and Interlock Relay to be ON in order for the output to be powered. Note: For single vessel configurations, only one Interlock Relay and Power Output Receptacle are included.

⚠ For dual vessel configurations, BOTH Interlock Relays MUST NEVER be ON at the same time. Should this occur, an over-current situation will be created which will cause the upstream 30A circuit breaker to trip. For this reason, 30A is the maximum allowable value for the breaker. In the pre-defined configurations provided, the "Dual Throw" function of the Interlock Relays and a safety script are implemented to prevent both Interlock Relays from being on simultaneously. If however, a manual configuration is created or used by a user, failure to ensure that only one Interlock Relay is ON at a time will create this current overload.

Power Flow & Control, 50A Models

For 50A Models, 240VAC power routes through the UniFlex as follows:

This power flow requires both the SSR (Solid State Relay) and Interlock Relay to be ON in order for the output to be powered. One or both Interlock Relays can be on at the same time.

Control Modes

⚠ It is best practice to ensure that the SSR preceding an Interlock Relay has been turned off (either its BruControl Device Element is disabled or its output is set to off/zero) before turning off (either disabling or setting output to OFF) the Interlock Relay. While the Interlock Relays are rated to handle a current break, the longevity of their mechanical contacts will best be maintained if the current through them is terminated prior to being switched open.

Depending on what type of SSR was configured upon UniFlex order, the SSR(s) will be either of binary type or proportional type. Binary SSRs turn fully on or fully off, and this switching can occur fast enough to modulate overall power into a heating element. This switching is conducted by the BruControl software. Proportional SSRs

The SSR(s) is controlled both by the "PID Control" PID Device Element or by the "Manual Control" Device Element. PID Devices uses a PID (Proportional Integral Derivative) algorithm to achieve and maintain a set temperature by comparing it to the current actual temperature. Its output varies from cycle to cycle, creating a net power output from 0 to 100%. It uses an input temperature to reference the actual temperature, which is selectable from the various temperature probes established. The power output will be either duty cycle or PWM, depending on the respective setting in the PID Device Element properties, which should match the SSR type built into the UniFlex: Duty Cycle for standard binary type SSRs or PWM/analog Output for proportional SSRs.

"Manual Control" will be a Duty Cycle Device Element for standard (binary) SSR or a PWM Output Device Element for proportional SSR configurations. This device also generates a net power output from 0 to 100%, but this output is set by the user and remains fixed.

When the PID Control or Manual Control is enabled, the other automatically becomes disabled. When a user enables and uses the PID control, they must make sure the Input control reference in its properties is correct. For example, if the goal is to heat Mash water to a target temperature, the input temperature probe must be in the mash tun, otherwise the mash heater will continue heating indefinitely.

Brewing Sequence

⚠ Prior to completing an actual brewing sequence, a simulated brewing session should be conducted with water to ensure proper operation and understanding of the system.

When brewing manually, the user changes the Elements' properties on the Workspace as needed. For example, if the user wants to set a Timer, they interact with a Timer Element by setting or resetting a time, stopping or starting the Timer, etc. When brewing automatically, the user runs a Script, which makes changes according to its conditions and definitions.

Here is an example brew day with the UniFlex, using a 30A two-vessel no-sparge, direct heat system with counterflow chiller:

1. Power on the UniFlex and ensure all probes are reading correctly.
2. Fill Vessel 1 (Mash Tun) with water to the appropriate level and modify it with salts as desired.
3. Enable Pump 1 and turn it ON to start recirculation.
4. Enable the Element Interlock and ensure it is ON ("#1 ENABLED"). Enable the PID Control and set it to strike temperature of 161 degrees F. Start Timer X.
5. After strike temp is reached, turn PID Control OFF, turn Pump 1 OFF and dough in.
6. Restart Pump 1 and reset Timer X. Set Timer X to issue Alarm 1 when it reaches 1 hour. Set PID Control to 152 degrees F. Monitor for stuck mash, adjust the pump rate as needed, and check for pH in 10 minutes. Add acid or base if needed. Monitor the temperature graph.
7. Once the timer reaches an hour and Alarm 1 sounds, turn off the Alarm, turn PID Control OFF, turn Pump 1 OFF, and arrange the tubing to drain from the Mash Tun to Vessel 2 (Boil Kettle). Turn Pump 1 ON and begin the transfer.
8. Once the wort in the Boil Kettle covers the heating element, change Element Interlock to be OFF ("#2 ENABLED"). Enable Manual Control and set it to 100% to begin heating the wort in the Boil Kettle. Turn Pump 1 OFF when done transferring.
9. When the temperature in the Boil Kettle reaches 210 degrees F, turn the Manual Control power down to ~75% and monitor for boiling. Once it starts simmering, turn the Manual Control power down again to ~60%.
10. Set Timer Y for 1 hour countdown and to issue Alarm 2 when it reaches 10 minutes.
11. Add hops/adjuncts per recipe schedule along the way. When Alarm 2 sounds, turn it off and connect the chiller, recirculating back to the boil kettle. Enable and turn on Pump 2. Increase the Manual Control back to 100% to re-establish the boil, then reduce it again.
12. Once Timer Y reaches zero, disable Manual Control to cease heating and initiate flush water to begin chilling. Monitor Vessel 2 (Boil Kettle) temp to reach transfer temperature.
13. Turn Pump 2 OFF, connect the tubing to the fermenter, and Turn Pump 2 ON to intiate transfer.
14. Once done transferring (or running a clean cycle) disable all Device Elements prior to powering off the UniFlex.

Firmware Updates

The UniFlex contains a micro-controller which runs BruControl specific firmware. This firmware can be updated as new versions are published. New versions will add new functionality and/or remedy bugs. Firmware and the installation tool can be downloaded from brucontrol.com/download/firmware/.

The firmware is installed via OTA (Over-the-Air), therefore the UniFlex needs to be connected to the Wi-Fi network prior to updating. BruControl should be closed or disconnected from the UniFlex interface prior to updating the firmware.

UniFlex Interface Wiring Map

Per the BruControl User Manual , the application and firmware utilizes "ports" to identify which micro-controller's connections are made to the internal devices. The ports and connections for the UniFlex, are as follows. Note: this is called an Interface Wiring Map.

UniFlex v1

BruControl Interface Wiring Map: ESP32 (Firmware v46)		
Connection ->	TCP (Network)	<- Connection
Wiring Map ->	Default	<- Wiring Map
Firmware Prefix ->	BruControl.45_.ESP32.	<- Firmware Prefix
Firmware Suffix ->	W	<- Firmware Suffix
BruControl port #	Functions	UniFlex
0	D, P	Integrated I/O Pin 7: Driver output, Bank #2
N/A	N/C	None
2	D, P	Integrated I/O Pin 18: Driver output, Bank #3
N/A	N/C	Integrated I/O Pin 4: Driver output, Bank #1
4	D, P	Integrated I/O Pin 17: Driver output, Bank #2
5	O	Temperature Probe Input (with 2.2k pull-up)
12	D	Pump/Accessory 1
13	D	Pump/Accessory 2
14	D, P	Integrated I/O Pin 9: Driver output, Bank #3
15	D, P	Integrated I/O Pin 8: Driver output, Bank #3
16	D, P	Integrated I/O Pin 6: Driver output, Bank #2
17	D, P	Integrated I/O Pin 16: Driver output, Bank #2
18	D	Integrated I/O Pin 5: Driver output, Bank #1
19	D	Integrated I/O Pin 15: Driver output, Bank #1
N/A	[SDA]	Integrated I/O Pin 13 (w/internal 2.2k pull-up)
N/A	[SCL]	Integrated I/O Pin 3 (w/internal 2.2k pull-up)
23	D, P	Integrated I/O Pin 14: Driver output, Bank #1

25	D, P	Integrated I/O Pin 19: Driver output, Bank #3
26	D	Vessel 1 Power Output Interlock Relay
27	D	Vessel 2 Power Output Interlock Relay
32	P	Integrated I/O Pin 10: Analog output, 0-10VDC
33	D, P	Vessel Power Solid State Relay
34	D*, A, C	Integrated I/O Pin 11 (input only)
35	D*, A, C	Integrated I/O Pin 12 (input only)
36	D*, A, C	Integrated I/O Pin 1 (input only)
39	D*, A, C	Integrated I/O Pin 2 (input only)

UniFlex v2

BruControl Interface Wiring Map: ESP32 (Firmware v45)		
Connection ->	TCP (Network)	<- Connection
Wiring Map ->	Default	<- Wiring Map
Firmware Prefix ->	BruControl.45_.ESP32.	<- Firmware Prefix
Firmware Suffix ->	W	<- Firmware Suffix
BruControl port #	Functions	UniFlex
0	D, P	I/O Pin 17 (driver output only, Bank #2)
N/A	N/C	None
2	D, P	I/O Pin 5 (driver output only, Bank #3)
N/A	N/C	I/O Pin 20 (driver output only, Bank #1)
4	D, P	I/O Pin 6 (driver output only, Bank #2)
5	O	Temperature Probe Input (with 2.2k pull-up)
12	D	Pump/Accessory 1
13	D	Pump/Accessory 2
14	D, P	I/O Pin 15 (driver output only, Bank #3)
15	D, P	I/O Pin 16 (driver output only, Bank #3)
16	D, P	I/O Pin 18 (driver output only, Bank #2)
17	D, P	I/O Pin 7 (driver output only, Bank #2)
18	D	I/O Pin 19 (driver output only, Bank #1)
19	D	I/O Pin 8 (driver output only, Bank #1)
N/A	[SDA]	I/O Pin 12 (with 2.2k pull-up)
N/A	[SCL]	I/O Pin 24 (with 2.2k pull-up)
23	D, P	I/O Pin 9 (driver output only, Bank #1)
25	D, P	I/O Pin 4 (driver output only, Bank #3)
26	D	Vessel 1 Interlock Relay
27	D	Vessel 2 Interlock Relay
32	P	30A models: I/O Pin 23 (analog output, 0-10VDC) 50A models: Solid State Relay #2
33	D, P	Solid State Relay #1
34	D*, A, C	I/O Pin 10 (digital or analog input only)
35	D*, A, C	I/O Pin 21 (digital or analog input only)

| 36 | D*, A, C | I/O Pin 22 (digital or analog input only) |
| 39 | D*, A, C | I/O Pin 11 (digital or analog input only) |

Interface Wiring Map Function Codes:

- D = Digital Input or Output. Ports marked D* indicates Digital Input only and can be active low or 3.3V active high (max).
- P = PWM Output (Note: Frequency is ~1000 Hz.) Note: Port 32 is connected to internal analog converter, 0-10VDC.
- C = Counter Input (Note: trigger is falling edge. Sensor must pull up/down 3.3V, otherwise an external resistor is required).
- A = Analog Input (Note: range is compared to 3.3V, referenced to ground). 3.3V maximum input.
- O = 1-Wire Input (Note: All sensors are addressed by virtual ports 200 - 209 in BruControl).

Integrated I/O

UniFlex v1

The Integrated I/O option includes two connectors on the front panel: the I/O Connector and the output driver Power Connector for it. The mating connectors for these two are included in the accessory kit.

The I/O Connector is a 20-pin connector that provides connections to the 17 I/O (12 high current driver outputs, 1 analog output of 0-10V range, and 4 inputs which are digital or analog) and 2 I2C pins. The remaining pin, #20, is ground. The user should these pins to appropriate devices (for example, valves, flow meters, sensors, etc.). The pin mapping of these is provided in the Interface Wiring Map (above). The user should consult the User Manual to understand how the Interface Wiring Map translates to Device Elements in BruControl.

The Power Connector contains 3 pins: Power In (S), Power Out (P), and Ground (G). By default, the Power Connector power in and power out pins are jumpered (connected) in the mating connector. This takes the internal 12V (up to 1A) supply power (power out) and redirects it back to the output driver channels (via power in). Therefore, the Power Connector mate must be installed for any of the 12 high current driver output channels to work correctly. The combined current output of all 12 channels ON when using the internal supply power must not exceed this 1A limit.

Should the user need a higher current supply or prefer to power the output drivers with a different voltage, this jumper needs be disconnected, and output driver pin would be connected to a discrete power supply. Voltage supplied can range from 5V to 24 VDC. This does not affect the other channels such as the analog output or the inputs. The limits per high current driver output pin are 2 amps per driver output pin, 5 amps per driver output pin bank, and 12 amps total.
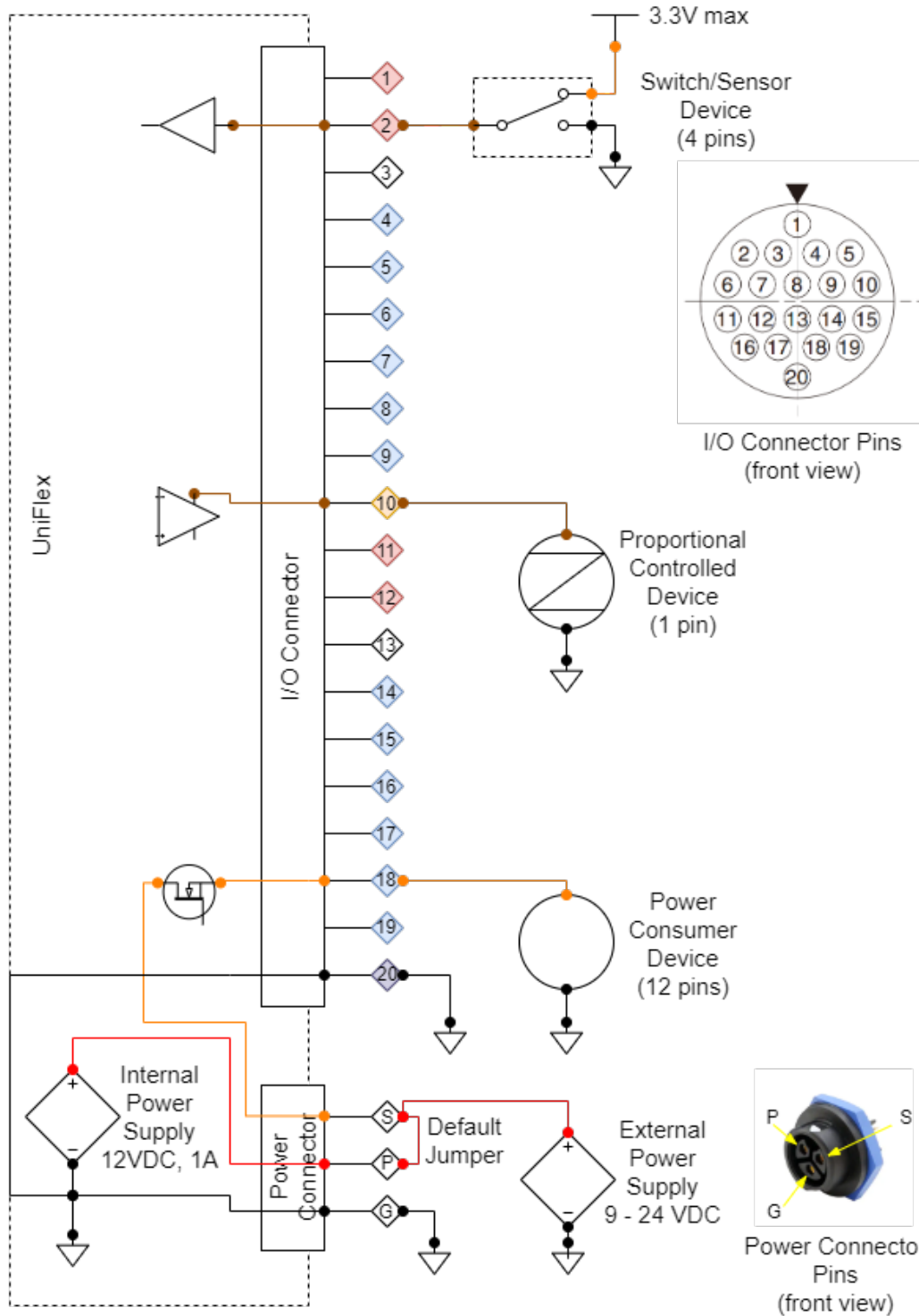
Note: The mating I/O and Power Connectors require wires soldered to their pins. This should only be conducted by someone with adequate experience / skills soldering fine-pitch electronics. Solder flux is highly recommended to ensure adequate bonding of wires in the connector solder cups.

The following is a schematic example of Integrated I/O wiring:

BruControl UniFlex Integrated I/O Wiring Examples

3.3V max

Switch/Sensor Device (4 pins)

I/O Connector Pins (front view)

UniFlex

I/O Connector

Proportional Controlled Device (1 pin)

Power Consumer Device (12 pins)

Internal Power Supply 12VDC, 1A

Power Connector

Default Jumper

External Power Supply 9 - 24 VDC

Power Connector Pins (front view)

Pin	I/O Connector Description
1	Digital / analog input, port 36, 3.3V max
2	Digital / analog input, port 39, 3.3V max
3	I2C SCL
4	Driver output, bank 1, port N/A
5	Driver output, bank 1, port 18
6	Driver output, bank 2, port 16
7	Driver output, bank 2, port 0
8	Driver output, bank 3, port 15
9	Driver output, bank 3, port 14
10	Analog output, 0-10V, port 32
11	Digital / analog input, port 34, 3.3V max
12	Digital / analog input, port 35, 3.3V max
13	I2C SDA
14	Driver output, bank 1, port 23
15	Driver output, bank 1, port 19
16	Driver output, bank 2, port 17
17	Driver output, bank 2, port 4
18	Driver output, bank 3, port 2
19	Driver output, bank 3, port 25
20	Ground

Notes:
1. I/O Driver default: internal power supply (12VDC, 1A maximum). Use default jumper in connector.
2. I/O Driver option: external power supply (9-24 VDC). Remove default jumper in connector and wire external power supply.
3. Power Consumer, Proportional Controlled, or Switch/Sensor devices are examples. Like colors represent same signals and connection to like device types.
4. Power Consumer Device (example: relay, solenoid, motor): Power is sourced via driver output pins. Voltage must match power supply voltage. Current limits: up to 2A per pin, OR 5A total per bank, OR 12A total maximum.
5. Proportional Controlled Device (example: proportional valve): Signal is 0-10 VDC analog, 50mA maximum.
6. Digital or analog inputs (example: flowmeter, switch float switch, pressure sensor): Sinking or sourcing signal, digtal 0 or 3.3VDC. Analog 0-3.3VDC. DO NOT EXCEED 3.3VDC.

The Integrated I/O option includes a rectangular 24-pin connector on the front panel which contains connections for the I/O pins and the output driver power. The mating connector for this is included in the accessory kit. The mating connector is a screw-free design, only requiring a depress of a spring button to install a wire into it or release it.

The I/O Connector provides connections to the 17 I/O: 12 high current driver outputs, 1 analog output of 0-10V range, 4 inputs (digital or analog, 3.3VDC max), 2 I2C pins, output driver power, and ground. The user should connect these pins to appropriate devices (for example, valves, flow meters, sensors, etc.). The pin mapping of these is provided in the Interface Wiring Map (above). The user should consult the User Manual to understand how the Interface Wiring Map translates to Device Elements in BruControl.

22 AWG wire or equivalent should be used with the I/O connector. To install a wire, strip off ½" (12 mm) of insulation and optionally crimp on a wire ferrule. While depressing in the corresponding pin button, insert the wire fully until it stops, then release the pin button. To remove a wire, depress the pin button, remove the wire, and release the pin button.

The 12 high current driver outputs in the UniFlex can power external devices (power consumers) such as relays or solenoids. These drivers are electronic switches, and require a power source to switch to the power consumers. This source can either be the UniFlex internal power supply or an external, user supplied one. The internal power supply is limited to 12VDC, 1A maximum, whereas an external power supply can range 5-24 VDC, and can have as much current capability as needed for the application, so long as the driver output current limits (below) aren't exceeded.

There are 3 output driver power sets of pin on the I/O Connector: Internal Power Supply Out is on pin 1, Power Supply In is on pins 2, 3, and 14 (all three must be used simultaneously as pin as each pin is limited to 5A), and Ground is on pin 13. Connecting the Power Supply In pins and Power Supply Out pin via jumper wires (between pins 1 and 2) takes the internal 12V supply power and redirects it back to the output driver channels. The combined current output of all 12 channels ON when using the internal supply power <u>must not exceed the 1A limit</u>.
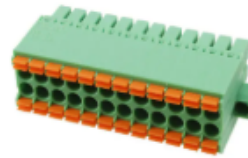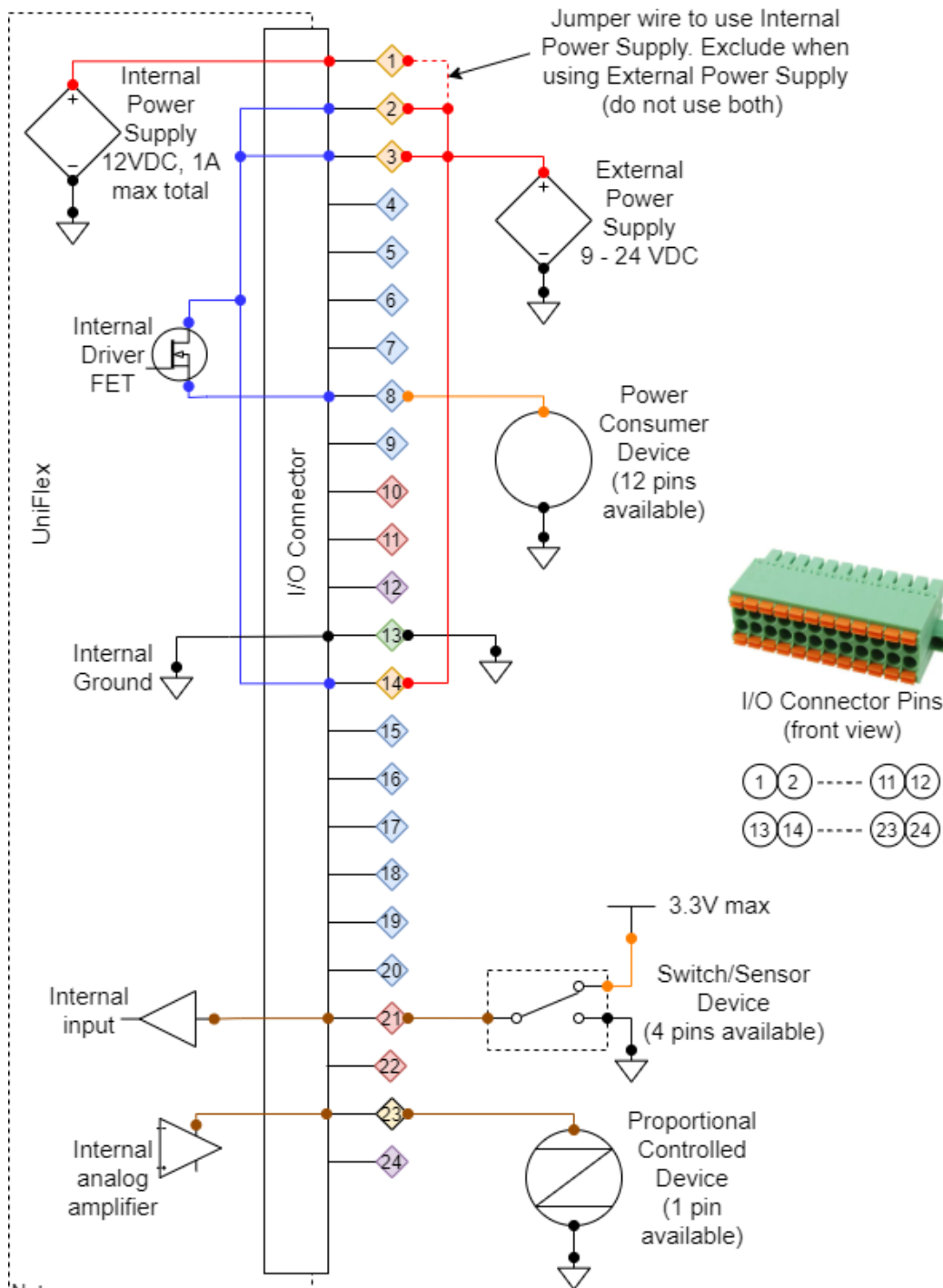
Alternatively, an external power supply may be used by leaving pin 1 disconnected and connecting the external power supply positive output to pins 2, 3, and 14, and ground to pin 13. This does not affect the other channels such as the analog output or the inputs.

The limits per high current driver output pin are 2 amps per driver output pin, 5 amps per driver output pin bank, and 12 amps total.
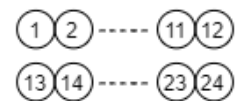
The following is a schematic example of Integrated I/O wiring:

BruControl UniFlex Integrated I/O Wiring Examples

Jumper wire to use Internal Power Supply. Exclude when using External Power Supply (do not use both)

Internal Power Supply 12VDC, 1A max total

External Power Supply 9 - 24 VDC

Internal Driver FET

Power Consumer Device (12 pins available)

Internal Ground

UniFlex

I/O Connector

I/O Connector Pins (front view)

1 2 ----- 11 12
13 14 ----- 23 24

3.3V max

Switch/Sensor Device (4 pins available)

Internal input

Internal analog amplifier

Proportional Controlled Device (1 pin available)

Pin	I/O Connector Description
1	12VDC Power Out (1A maximum)
2	Driver Power Input (5-24 VDC) (see note 2)
3	Driver Power Input (5-24 VDC) (see note 2)
4	Driver output, bank 3, port 25 (see note 4)
5	Driver output, bank 3, port 2 (see note 4)
6	Driver output, bank 2, port 4 (see note 4)
7	Driver output, bank 2, port 17 (see note 4)
8	Driver output, bank 1, port 19 (see note 4)
9	Driver output, bank 1, port 23 (see note 4)
10	Digital / analog input, port 34, 3.3V max
11	Digital / analog input, port 39, 3.3V max
12	I2C SDA
13	Ground
14	Driver Power Input (5-24 VDC) (see note 2)
15	Driver output, bank 3, port 14 (see note 4)
16	Driver output, bank 3, port 15 (see note 4)
17	Driver output, bank 2, port 0 (see note 4)
18	Driver output, bank 1, port 16 (see note 4)
19	Driver output, bank 1, port 18 (see note 4)
20	Driver output, bank 1, port 3 (see note 4)
21	Digital / analog input, port 35, 3.3V max
22	Digital / analog input, port 36, 3.3V max
23	See Note #5
24	I2C SCL

Notes:
1. If using I/O driver power via Internal Power Supply (12VDC, 1A maximum): connect I/O Connector pins 1 and 2. If other voltage or >1A needed for Power Consumers, use External Power Supply.
2. If using I/O driver power External Power supply (5-24 VDC): Do not connect I/O Connector pin 1. Connect pins 2, 3, and 14 to external power supply +, as I/O connector current limit is 5A per pin.
3. Power Consumer, Proportional Controlled, or Switch/Sensor Devices are examples. Like colors represent same signals and connection to like device types.
4. Power Consumer Devices (example: relay, solenoid, motor): Power is sourced via driver output pins from the selected power supply. Voltage of these devices must match power supply voltage. Current limits: up to 2A per pin, 5A total per bank, or 12A total maximum.
5. Analog output, port 32. 30A models: Analog output for proportional device (eg: proportional valve). Signal is 0-10 VDC analog, 50mA max.Contact BruControl if 0-5 VDC range is required. 50A models: N/C as this signal is internally used for SSR#2
6. Digital or analog inputs (example:flowmeter, switch float switch, pressure sensor): Sinking or sourcing signal, digtal 0 or 3.3VDC. Analog 0-3.3VDC. DO NOT EXCEED 3.3VDC on these pins.

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Digital or Analog Inputs

Should a 5V output switch or sensor need to be input the UniFlex via one of the input pins (ports 34, 35, 36, 39), it can be divided with a pair of resistors: 1k and 2k. This will apply to both digital and analog switches or sensors. For example, where Vdd is 5VDC output of the switch/sensor, and V1 is the signal to be tied to the UniFlex input pin. Here, the 5V signal will be divided down to 3.3V:
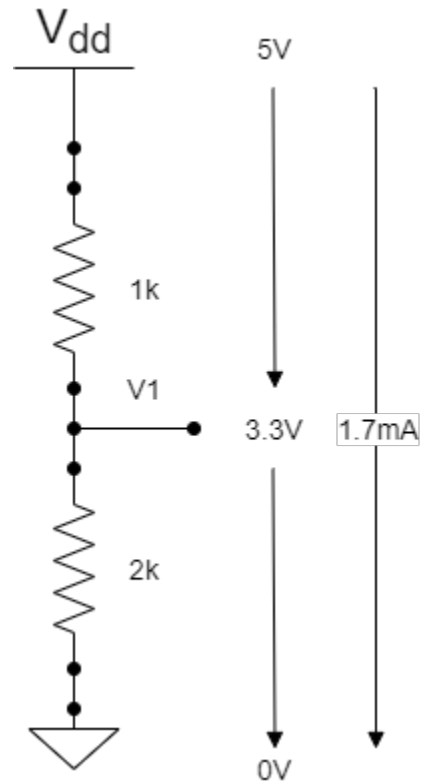
Note: The input pins (ports 34, 35, 36, 39) do not have capability for internal software-driven pull-up resistors, therefore the "Active Low" property will not function correctly without external pull-up resistors. To implement external pull-up resistors, tie a ~10k resistor between a 3.3V (NOT 5v) source and the input pin. Since the UniFlex does not expose a 3.3V signal, this voltage must be generated externally.

Temperature Probe Design

The temperature probes included with the UniFlex are of universal design, permitting installation into vessels, fittings, RIMs tubes, etc. via thermowells or compression fittings. The probe diameter is 6 mm (1/4 inch), so appropriate compression fittings should be used.

The temperature sensor is a 1-wire DS18B20, which operates on a bus-type communication system. This allows the UniFlex user to plug in multiple probes (up to 10) as needed for the application. Multiple probes can be plugged into the Temperature Probe Jack via universal 3.5mm splitters (headphone style). A 6-port splitter is included with dual-vessel configurations.

The probes are waterproof and may be submerged, however the wire jacket is made of PVC and is not food compatible, therefore should not make contact with any food products.

When inserting a probe plug into the Temperature Probe Jack on the front panel of the UniFlex, it is important that the plug is inserted straight and slowly. If any resistance is met, it should be retracted and tried again.

As noted above in Initial Set-Up, the probes are indexed during initial power-up of the UniFlex, therefore the temperature probes are not hot-swappable. Probes should therefore not be plugged or unplugged while the UniFlex is powered on.

It is highly recommended that additional temperature probes be purchased from BruControl. While not recommended, if a user needs to purchase a different probe or create their own, the connections are as follows:
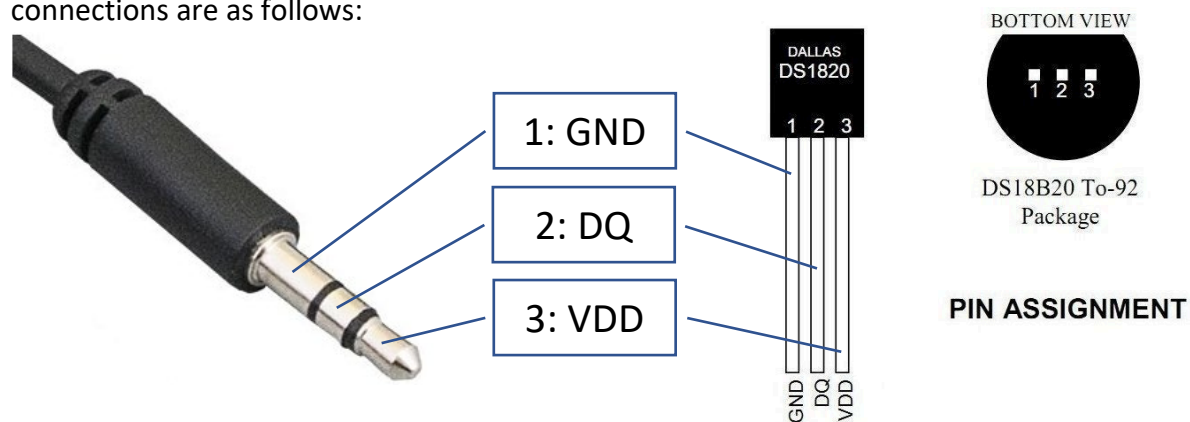
⚠ Inserting probes which are not provided or qualified by BruControl may cause damage to the UniFlex as the VDD output is not fused.

DIN Rail Mounting (30A Models only)

The DIN Rail Mount option provides the ability to mount the UniFlex to dual 35mm DIN rails. This prevents the UniFlex from being accidentally moved and facilitates vertical mounting if desired.

⚠ The UniFlex may be mounted horizontally, with the DIN rail clips facing down, or vertically, with the pigtail power cords hanging down. Do not mount the unit in any other orientation.

The DIN Rail Mount option replaces the four-standard rubber-feet with DIN rail clips. Two 200mm lengths of DIN rails are also included. To use, mount the DIN rails in parallel, 164mm apart, center-to-center. Then press the UniFlex with DIN rail clips down until all four click in place. To remove, firmly and slowly pull up on the UniFlex main body lifting on one row of clips at a time until they disengage.

Warranty

A. Limited Warranty

    1. BruControl LLC warrants to the original purchaser that this product will be free from manufacturing defects in material and workmanship for a period of one (1) year from the date of purchase by the customer. Proof of purchase is required. BruControl LLC's obligation to repair or replace defective materials or workmanship is the sole obligation of BruControl LLC under this limited warranty.

    2. This product is for home use only. The limited warranty covers only those defects that arise as a result of normal use of the product and does not cover any other problems, including, but not limited to, those that arise as a result of:

        a. Improper maintenance or modification;

        b. Damage due to incorrect voltage or improper wiring by customer;

        c. Operation outside of the product's specifications;

        d. Carelessness or neglect to operate the product in accordance with instructions provided with the product;

        e. Damaging the tamper label on the product;

        f. Damage by over-tightening the fasteners;

        g. Failure to follow cleaning and / or maintenance procedures; or

        h. Exceeding published operational temperatures.

    3. BruControl LLC reserves the right to request delivery of the defective component for inspection before processing the warranty claim. If BruControl LLC receives, during the applicable warranty period, notice of a defect in any component that is covered by the warranty, BruControl LLC shall either repair or replace the defective component with a new or rebuilt component at BruControl LLC's option.

    4. BruControl must be notified within seven (7) days of the delivery date of any shipping damage. Customer is responsible for shipping damage outside of this time period. Approval for return must be provided by BruControl LLC prior to any return. Customer is responsible for keeping all original packaging material for warranty returns. BruControl LLC is not responsible for damage from improperly packaged warranty returns, and these repair costs will be the sole responsibility of the customer. Shipping costs for warrantee returns are covered only for the contiguous United States.

    5. BruControl LLC's limited warranty is valid in any country where the product is distributed.

B. Limitations of Warranty

    1. Any implied warranty that is found to arise by way of state or federal law, including any implied warranty of merchantability or any implied warranty of fitness, is limited in duration to the terms of this limited warranty and is limited in scope of coverage to this warranty. BruControl LLC disclaims any express or

implied warranty, including any implied warranty of fitness for a particular purpose or merchantability, on items excluded from coverage as set forth in this limited warranty.

2. BruControl LLC makes no warranty of any nature beyond that contained in this limited warranty. No one has authority to enlarge, amend, or modify this limited warranty, and BruControl LLC does not authorize anyone to create any other obligation for it regarding this product.

3. BruControl LLC is not responsible for any representation, promise, or warranty made by any independent dealer or other person beyond what is expressly stated in this limited warranty. Any selling or servicing dealer is not BruControl LLC's agent, but an independent entity.

C. Limitations of Liability

1. The remedies provided in this warranty are the customer's sole and exclusive remedies.

2. Except for the obligations specifically set forth in this warranty, in no event shall BruControl LLC be liable for direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory and whether or not advised of the possibility of such damages.

3. This warranty does not cover, and in no event shall BruControl LLC be liable for, travel, lodging, or any other expense incurred due to manufacturing defects in material and workmanship, or any other reason.

4. Any performance of repairs after the warranty coverage period has expired or performance of repairs regarding anything excluded from coverage after this limited warranty shall be considered good-will repairs and they will not alter the terms of this limited warranty, or extend any warranty coverage period.

5. Venue for any legal proceedings relating to or arising out of this warranty shall be in Palm Beach County, Florida, United States, which courts will have exclusive jurisdiction.

D. Local Law

1. This warranty gives the customer specific legal rights. The customer may also have other rights that vary from state to state in the United States or other countries.

2. To the extent that this warranty is inconsistent with local law, it shall be deemed modified, only to the extent necessary to be consistent with such local law.

Contact BruControl at info@brucontrol.com with any questions or concerns.