Pool & Spa
Products Division

Eco-Flow - C

VARIABLE FREQUENCY DRIVE

for Commercial Swimming Pools &
Water Feature Pumps

PRODUCT BROCHURE

Tel: 888 635 0296
www.h2flow.net

We don't make Pool Pumps, we make them more energy efficient!

With more than 80 years of combined knowledge in monitoring and controlling pumps, H_2flow is the only manufacturer in the pool industry that is totally dedicated to this technology. We cannot supply you with heaters, filters and pool cleaners, but we can supply you a first class product and unparalleled knowledge relating to applying VFD's to pumps.

Experts in Variable Speed

What is a Variable Frequency Drive?

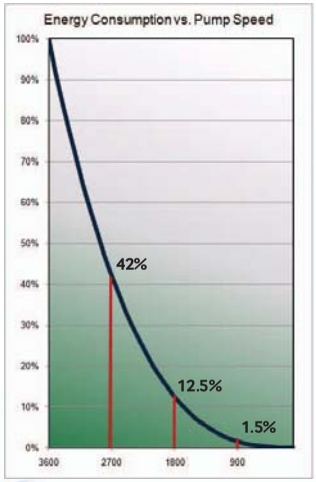
A Variable Frequency Drive (VFD), is an electronic device used to control the speed of a pump motor. The motor's speed can be varied by adjusting its supply frequency. Reducing the pump's speed saves significant energy as compared with flow control using a valve.

How a VFD saves energy - the Affinity Laws!

Electrical energy is billed to the consumer in Kilowatt Hours (kWh), i.e., how many kilowatts are used in one hour. A 'watt' is a measurement of power that is derived from calculating the voltage, current, and power factor. A kilowatt is 1,000 watts and 1kW is equal to 1.341 HP. Whereas a typical residential pool pump is rated at just 1 kW, commercial pool pumps tend to be much larger, i.e., 5 to 20 kW is not unusual.

Centrifugal pumps use far less power when they run slower. The decrease in power is due to the Affinity Laws, and the results are staggering. A **speed** reduction of just 20% would equate to an **energy** reduction of approximately 50%.

If a pool's flow rate is being throttled back with a **control valve**, from say 490 GPM to 400 GPM (a reduction of just 18.3%), a reduction in electrical energy of just 10% could be expected. However, using **Eco-Flow - C** to achieve the same flow rate will reduce the energy by a staggering 45%.



Why use Variable Speed?

For many years, the pool industry has sold 'Horsepower' as opposed to sizing the pump for the actual requirements. A 'bigger is better' mentality has resulted in many pools being turned over too many times per day and energy costs being far higher than they need to be. Simply using a discharge valve to throttle back the flow rate is not the answer as it does little to reduce energy consumption. Other factors resulting from too much flow are:

- Higher than necessary operating costs
- Reduced equipment life
- Cavitation

A VFD will significantly reduce the pump's energy costs – typically by 30% - 50%. The Eco-Flow - C can be quickly and easily retrofitted to existing pumps and energy savings are realized from day one. A return on investment is typically less than one year!

Built for Purpose

The hostile environment of a pool equipment room is not ideal for a Variable Frequency Drive - unless it's an Eco-Flow - C!

Over time, chemical gases will destroy electronic circuits that are not fully sealed and protected from such an unforgiving environment. With more than 30 years of exposing VFDs to some of the harshest industrial environments around, you can be sure that your investment will withstand the test of time - hence our unparalleled 3-year warranty on the NEMA 12 model.

For environments that are completely free of chemical gases, the NEMA 1 model is an economical alternative.

What makes Eco-Flow - C different?

Eco-Flow - C is a VFD system specifically designed for commercial pools and water features. Pumps ranging from 1 to 1500 HP can benefit from the Eco-Flow - C's many unique features.

Traditional methods of flow control are via control valves installed on the discharge side of the pump. Pumps are frequently over-sized and deliver too much flow when run wide-open and at full-speed. Using a flow control valve to partially dead head the pump not only wastes energy but can often reduce the pump's life.

With Eco-Flow - C, Flow Control Valves can be set to their fully open position and the pump's speed adjusted to meet the flow requirements mandated by State Code. Alternatively, the system can be configured to maintain a 'constant flow-rate'. This so-called PID control will maintain the required flow rate, even as the filter starts to become dirty and where flow would normally decrease.

Adjusting the pump's speed to the exact flow rate required will:

1. Significantly reduce consumed electrical energy
2. Reduce equipment wear
3. Reduce operating noise
4. Ensure state-mandated turnover rates are met

Configurable...

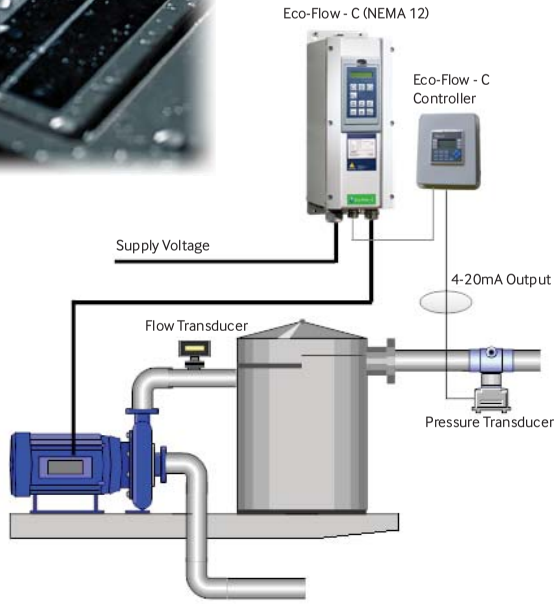
Eco-Flow - C is a configurable system that can be customized to meet the exact needs of any given pool or water feature.

For typical Pool Equipment rooms, the NEMA 12 version will be the product of choice. Designed to withstand the harshest of environments, the system will endure the effects of chemical gases that would normally destroy electronic components.

When the installation environment is completely free of chemical gases (even simply storing chemicals in the same room), the NEMA 1 system can be selected.

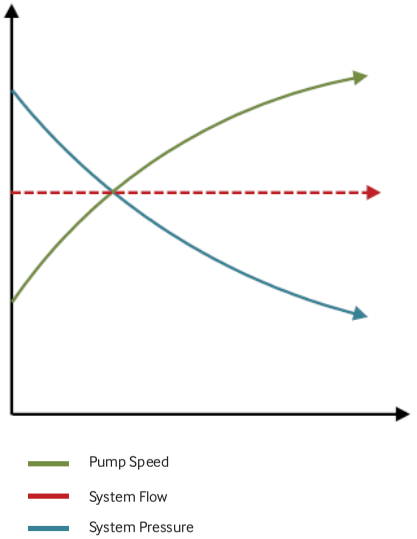
Each system is supplied with a purposely designed aquatic controller that comprises a real-time clock and an operated keypad / display. Setup is achieved by an "intuitive wizard" menu structure. Options such as Bypass Control and a Lightning Arrestor, can be specified if required.

Above: Eco-Flow - C Controller Keypad



Constant Flow

While running the pump at a lower speed will achieve a significant reduction in operating costs, Eco-Flow - C can further optimize the circulation system's performance by utilizing its powerful 'Constant Flow' feature. Precise control of the flow rate will ensure that the state's mandated turnover rate is maintained - even as the filter becomes dirty. As an added safety measure, the system will not allow the pump to over-speed and will go into a visual alarm condition should it determine that the filter needs to be backwashed.



In the example shown to the left, a Pressure Transducer with a 4-20mA output has been installed in the discharge (return) line to the pool. The transducer's analog output is connected to the Eco-Flow - C.

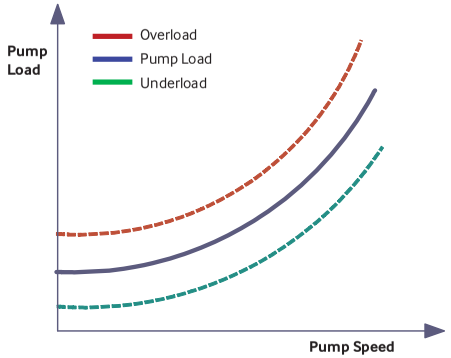
As the filter becomes dirty, the pressure in a system will gradually drop and the Eco-Flow - C will automatically increase the pump's speed proportional to this change.

Note: If desired, Eco-Flow - C will also accommodate the 4-20mA analog output of a Flow Transducer.

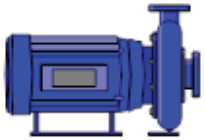
Protect your investment

Pump Protection

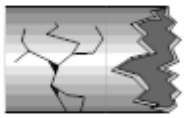
The NEMA 12 version of Eco-Flow - C includes a unique and patented 'Load Curve' monitoring feature that protects the pump and system from abnormal operating conditions. During its 'AutoSet' procedure, the system automatically measures the shaft power taken at nine incremental points between the minimum and maximum speeds to be used. From these measured data points, the system creates a 'normal' pump curve and applies both overload and underload protection in order to detect abnormalities such as closed valves, cavitation, worn impeller, run dry, loss of prime, bad bearings, etc.



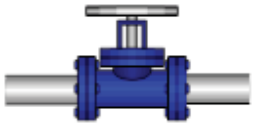
System Protection - NEMA 12 only



- Run Dry
- Cavitation
- Worn Impeller
- Blocked Impeller
- Damaged Bearings



Cracked or broken pipes



Detection of closed valves

Elimination of water hammer

Starting and stopping pumps often results in 'water hammer' a phenomena associated with a pressure surge or wave caused when a water motion is forced to stop or change direction.

Water hammer commonly occurs when a pump is started or stopped and a pressure wave propagates in the pipe. It may also be known as 'hydraulic shock'. This pressure wave can cause major problems, from noise and vibration to pipe collapse.

By 'soft starting' and 'soft stopping' the pump, Eco-Flow - C will completely eliminate water hammer.

Controlled ramping for safe start-up

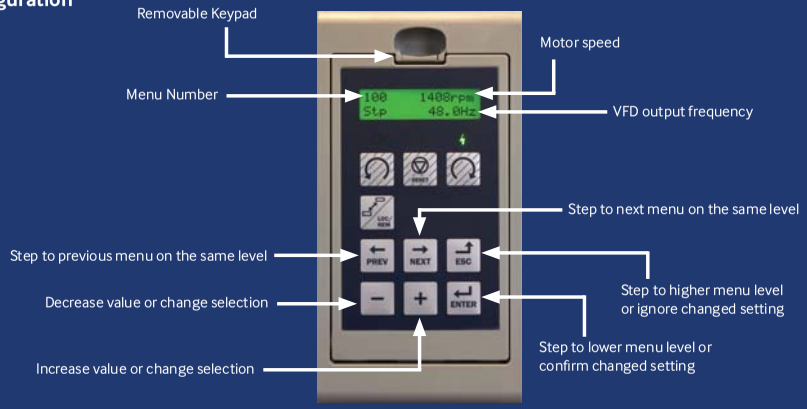
Eco-Flow - C offers a unique function that protects the VFD by ensuring a controlled ramping up of the DC link voltage. This so-called HCB ramping (Half Controlled Bridge) offers a safe start-up, and detects phase failure and asymmetries. As there are no built-in resistors or bulky contactors, both size and maintenance are reduced.

You can safely turn the Eco-Flow - C on and off with an external contactor, as often as needed. In other VFD's this could cause breakdowns or serious damage.

Above: cavitated impeller from commercial pool pump

Eco-Flow - C: So smart, yet so simple . . .

NEMA 12 Configuration



NEMA 1 Configuration

Additional Display Features of Eco-Flow - C

In addition to displaying Pump Speed (shown in the keypad image above), the NEMA 12 version of Eco-Flow - C can also display the following alternative values:

- Torque
- Shaft Power
- Electrical Power
- Current
- Output Voltage
- DC Voltage
- Heatsink Temperature
- Run Time
- Energy Used
- Mains on time

You can easily connect a large number and a wide range of cables to H$_2$flow Eco-Flow - C

How much money can be saved using Eco-Flow - C?

The following example demonstrates annual costs both with and without Eco-Flow - C speed control:

Pool Capacity: 160,000 gallons
Utility cost: $0.16 per kilowatt hour (kWh)
Pump size: 15HP
Required system flow rate to achieve state mandated 6-hour turnover: 444 GPM (160,000 / 360)
Actual system flow rate with discharge valve wide open: 580 GPM
Calculated speed to meet required turnover: 77% (444 / 580) x 100
Reduced energy: 0.77 x 0.77 x 0.77 = 0.46 or 46% of the full speed energy **(a 54% savings)**

Note: In comparison, using the discharge valve to reduce the flow would have resulted in only a 13% saving.

Annual Energy cost without a VFD: $17,420
Annual Energy cost using discharge valve to throttle flow rate: $15,172
Annual Energy cost using Eco-Flow - C: $7,972
Minimum annual savings: $7,200
Typical Return on Investment: Less than 1 year

Note: Utility kWh costs are determined by taking the total utility bill and dividing it by the number of kWh used in the billing period. This method will ensure that all costs including transmission, surcharges and taxes are included.

Eco-Flow - C NEMA 1 & NEMA 12 System Options

Part Number	Description
PS-30	Pressure Sensor, 0-30psi, 1/4"NPT male thread and with 4-20mA output and 10' cable
PS-100	Pressure Sensor, 0-100psi, 1/4"NPT male thread and with 4-20mA output and 10' cable
LA	Lightning Arrestor
BP-A	NEMA 12 Bypass Panel for Frame Size A
BP-B	NEMA Bypass Panel for Frame Size B

Notes:

1. If a Bypass Panel is purchased, the Aquatic Controller will be mounted in its door
2. Pump Motor must have a minimum Class F insulation
3. Product warranty of NEMA 1 version invalidated if unit used in Chemical gas area

Above & Right: NEMA 12 Bypass Panel

Eco-Flow - C Features

Feature	NEMA 12	NEMA 1
Can be used in Pool Rooms with Chemical Gas Present	✓	X
Includes Aquatic Controller with Modbus Communication	✓	✓
Two Programmable Speeds based on Real Time Clock Setting	✓	✓
Constant Flow based on either Pressure or Flow Sensor input	✓	✓
Programmable Backwash for Manual Systems	✓	✓
Programmable Backwash for Automatic Systems	✓	✓
Pump Dry Run Protection	✓	X
Pump Cavitation Protection	✓	X
Worn Pump Impeller Detection	✓	X
Closed Suction / Discharge Valve Detection	✓	X
Loss of Prime Detection	✓	X
Soft Start / Stop	✓	✓
Supply Voltage: 3 x 208-230	✓	✓
Supply Voltage: 3 x 480	✓	✓
Single Phase input / 3-Phase output	X	✓
Bypass Panel available (except for single phase supply)	✓	✓
Lightning Arrestor available	✓	✓
VFD Power Loss Protection	✓	X
Built in DC Bus Filter	✓	X
Copying of VFD setting via detachable keypad	✓	X
Multi function readout (i.e., run time, consumed power, speed, etc.)	✓	X

Specifications

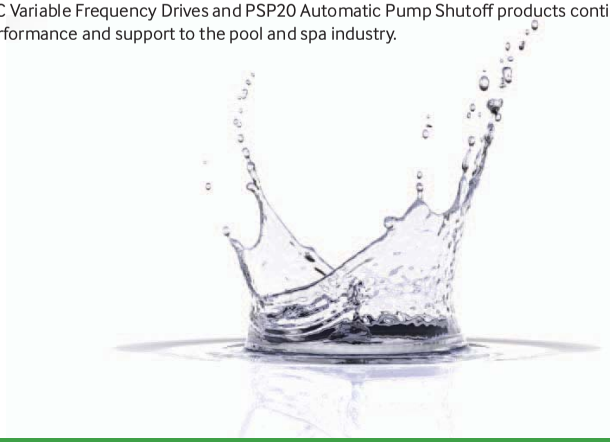
	NEMA 12	NEMA 1 (3 Phase Supply)	NEMA 1 (1 Phase Supply)
Installation Environment	Indoor, wash down, corrosive gases possible	Indoor, clean, dry, no possibility of corrosive gases (See Note 1)	Indoor, clean, dry, no possibility of corrosive gases (See Note 1)
Mains Supply Voltage	3 x 208 - 230V + 10% / -10% 3 x 480V + 10% / -15%	3 x 200 - 230V + 10% / -15% 3 x 380 - 480V + 10% / -15%	1 x 200 - 230V + 10% / -15%
HP Range	1 - 1500 HP	1 - 25 HP (230V) 1 - 30HP (480V)	1 - 15 HP
Operating Temperature	32 - 104°F (122°F with de-rating)	14 - 122°F	14 - 122°F
Mains Frequency	50 - 60 Hz		
Output Frequency	0.01 - 120 Hz		
Relative Humidity	90% or less		
Max Altitude without de-rating	3,300 ft. De-rate by 1% for every 100 ft. above this. Max 6,000 ft.		
Output Voltage	0 - Mains Supply Voltage		
Rated Output Current	Current Rating of VFD, 120% overload for 1 minute		
VFD efficiency at nominal Load	97%		
Speed Control	Via Eco-Flow - C Controller. Programmable speeds based on time or Constant Flow		

Note 1: Installing a NEMA 1 drive in an environment containing chlorine gases will invalidate product warranty.

About H_2flow

H_2flow is a privately held corporation located in Maumee, Ohio that was formed out of the long established company Emotron. With roots going back over 30 years, our Industrial Products Division is recognized as a respected leader in starting, stopping, controlling, and protecting motor operated machines and processes. Our Pool & Spa Products Division, which accounts for a rapidly growing segment of our business, has developed innovative new safety devices for compliance with the Virginia Graeme Baker Act and Variable Frequency Drives for energy saving.

Indeed, it was an Emotron-owned company that invented the first Variable Frequency Drives more than 30 years ago - no other VFD supplier to the pool industry has this pedigree. Under our new identity (H_2flow Controls, Inc.), our Eco-Flow - C Variable Frequency Drives and PSP20 Automatic Pump Shutoff products continue to deliver unparalleled product performance and support to the pool and spa industry.



Notes:

For more information about our products, call **888 635 0296** or visit us online at **www.h2flow.net**

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