

# COMMERCIAL ACU DRIVE™ XS

## VARIABLE FREQUENCY DRIVE

Save Energy • Save Costs • Save Space • Save Time



### INCREASED PUMP PERFORMANCE

The Acu Drive XS offers built-in intelligence for increased performance in all aquatic pump applications. Specified to save energy, space, costs and time, the Acu Drive XS is built to be the heart of the pump room. With minimal payback time due to energy savings, the Acu Drive XS is equipped with a feature

which continuously displays the time remaining until the drive pays for itself. Built with powerful standard and optional features specifically designed for energy optimization, the Acu Drive XS is perfectly matched with the full line of pumps by Pentair Commercial Aquatics.

### STANDARD FEATURES

- High efficiency up to 98%
- Automatic energy optimization
- Flow compensation of setpoint
- Built-in DC link reactors for harmonic suppression - no need for external AC input line reactors
- Integrated disconnects and fusing
- Sensorless control
- Dry pump and end of curve detection
- 2-step ramps (initial ramp)
- Real-time clock
- Overload trip protection
- Outdoor-rated enclosures
- Intuitive user interface with local control panel
- One drive type for the full power range

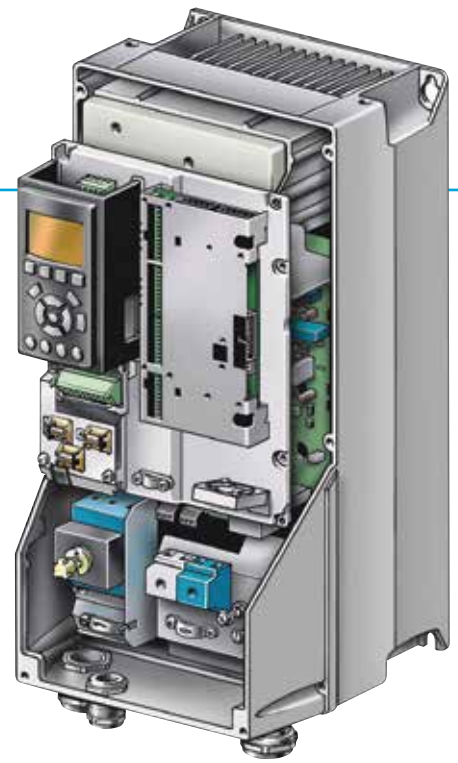


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## VARIABLE FREQUENCY DRIVE

### Modular Design

- Cooling concept improves efficiency
- Reduces contaminants in electronics
- Fieldbus options (A-options)  
Select any common fieldbus protocols
- Local Control Panel (LCP)  
Six-line graphical LCP display
- Up to 6 digital inputs
- Two 0-10 analog inputs
- 24V supply option (D-option)
- Conformally coated PCBs (optional)  
Durable in aggressive environments
- AC main disconnect (optional)
- Every Acu Drive XS, regardless of horse power size, has the same user interface and basic features
- Every Acu Drive XS is produced and factory tested with a load connected, as a complete assembly
- Built in DC-link reactors reduce harmonic noise and protect the drive. Integrated EMC filters are also available to minimize RFI interference (meets EN55011 A2, A1 or B)
- Energy savings using an Acu Drive XS are achieved with even a modest reduction in speed



### Acu Drive XS Specification

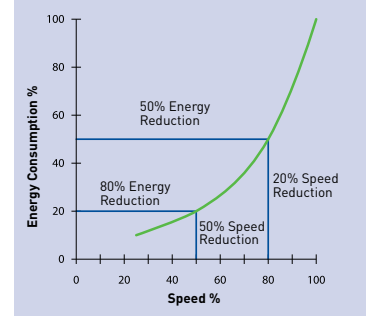
- Main supply (L1, L2,L3):
 

Supply voltage	200-240V±10%
Supply voltage	380-480V±10%
Supply voltage	525-690V±10%
Supply frequency	50/60Hz
- Digital Inputs:
 

Programmable digital inputs (standard)	6
Additional digital inputs with MCB101	2
- Output data (U,V,W):
 

Output voltage	0-100% supply
Output frequency	0-120Hz
Rated motor frequency	50/60Hz
Ramp times	1-3600 sec.

Ideal Energy Consumption at Varying Speed



The Acu Drive XS has a Local Control Panel (LCP) that was designed based on user feedback. With a well-structured menu system, the Acu Drive XS ensures fast commissioning and easy access to its many powerful functions.

### User-Friendly Display

#### Graphical Display

- Informative overview
- Six lines of display
- Graphical or numerical display of information
- Readout in user-selectable engineering units
- Select from up to 27 languages
- Backlit for increase visibility

#### Quick Menus

- User-personalized Quick Menu
- Changes Made Menu displays the parameters to which changes have been made
- Function Setup Menu provides quick set-up for specific applications
- Logging Menu provides access to operation history

### Illumination

- Illuminated LED lights indicate which function is active

### Menu Structure

- Based on the field-proven matrix system used in previous series drives
- Menu shortcuts access specific functions
- Edit and operate in different setups simultaneously

### Additional Buttons

- Info: an "onboard manual" that provides specific information about each parameter
- Cancel: exits the current parameter without saving changes
- Alarm log: easy access to a list of all previous alarm conditions

## INTELLIGENCE DRIVEN

## INCREASE PERFORMANCE

## MAXIMUM PERFORMANCE & SYSTEM PROTECTION

The AcuDrive XS helps maximize system reliability with built-in protection against:

- System overloads
- Motor failures
- Motor and drive overheating
- Voltage disturbances
- Power surges
- Loss of phase
- Phase-to-phase and phase-to-ground
- Short circuit
- Ground fault
- Switching on input/output
- Electrical disturbances
- Over-voltage
- Over-current
- Under-voltage
- External fault
- Over-temperature

### Minimize motor noise and heating with ASFM

- With the ASFM (Adjustable Switching Frequency Modulation) function, the switching frequency is adjusted automatically in relation to the speed of the motor. As speed is reduced, the switching frequency increases to ensure optimally low noise and reduce motor heating
- Input line protection from extreme running conditions

### Short circuit

- The Acu Drive XS is protected against short circuits by measuring the current in each of the three motor phases. A short circuit between two output phases will shut down the drive as soon as the current exceeds the maximum value

### Line disturbances and transients

- To protect itself from AC line voltage disturbances, the drive monitors all three phases and interrupts drive operation in the event of phase loss or imbalance

### Voltage sags and surges

- The Acu Drive XS is designed for a wide range of operating conditions. The 480 volt drive will operate from 342-528VAC. The 230 volt drives will operate on 180-264VAC

### Maximum protection features

- Output protection for longer motor life
- Acu Drive XS incorporates both DC-link reactors or motor output protection as standard design features

### Thermal protection for the drive and motor

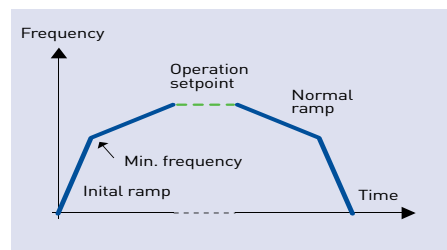
- The ETR (Electronic Thermal Relay) is an open loop method built into the Acu Drive XS software to guard against motor overheating, requiring no additional sensors or wiring
- This function is UL recognized (Class 20) as an effective guard against motor thermal overload

The Acu Drive XS has built-in thermal protection and also accepts thermistor signal input from the motor to create closed loop thermal protection for the entire system.

### Initial final ramp

Initial ramp provides rapid acceleration of pumps to a desired minimum speed, at which time the normal ramp takes over. This prevents damage to thrust bearings and overheating of the pump.

The final ramp decelerates pumps to avoid unintended closure of check valves and water hammer.



Compatible with Pentair® pumps with premium efficient motors.

Aurora® Pump 342A



CSP Pump



Aurora 341A Pump



Pentair EQ Pump



Berkeley Flanged Pump



# COMMERCIAL ACU DRIVE™ XS

## VARIABLE FREQUENCY DRIVE

### Acu Drive XS Specifications

- Acceptable Manufacturers: Danfoss® VLT® AQUA Series VFD (Variable Frequency Drive) for Pentair Commercial Aquatics.
- General: Furnish complete VFD as specified herein or in the equipment schedule for loads designated to be variable speed. VFD's shall be user-selectable for either constant or variable torque loads. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC induction motors. The VFD shall be a six-pulse input design, and the input voltage rectifier shall employ a full wave diode bridge; VFD's utilizing controlled SCR rectifiers shall not be acceptable. The output waveform shall closely approximate a sine wave. The VFD shall be of a PWM output design utilizing current IGBT inverter technology and voltage vector control of the output PWM waveform. The VFD shall produce an output waveform capable of handling maximum motor cable distances of up to 1,000 ft. (unshielded) without tripping or derating. WCPPLUS provides rated RMS fundamental voltage from the VFD. This allows the motor to operate at a lower temperature rise, extending its thermal life. The VFD selected must be able to source the motor's full load nameplate amperage (fundamental RMS) on a continuous basis, and be capable of running the motor at its nameplate RPM, voltage, current, and slip without having to utilize the service factor of the motor. The VFD shall offer a programmable motor parameter that allows the total number of poles of a motor to be programmed to optimize motor performance. VFD shall automatically boost power factor at lower speeds. The VFD will be capable of running either variable or constant torque loads. In either CT or VT mode, the VFD shall be able to provide its full rated output current continuously and 110% of rated current for 60 seconds. An Automatic Energy Optimization (AEO) selection feature shall be provided in the VFD to minimize energy consumption in variable torque applications. VFD shall offer a motor spinning test that will run the motor at 5 Hz until the OK button is pressed to allow the user to determine if the motor is running in the correct direction. Switching of the input power to the VFD shall be possible without inter locks or damage to the VFD at a minimum interval of 2 minutes. Switching of power on the output side between the VFD and the motor shall be possible with no limitation or damage to the VFD and shall require no additional interlocks. The VFD shall have temperature controlled cooling fans for quiet operation, minimized internal losses, and greatly increased fan life. VFD shall provide full torque to the motor given input voltage fluctuations of up to +10% to -15% of the rated input voltage.
- Harmonics: The VFD shall be provided with line-side harmonic reduction, as required, to insure that the current distortion limits, as defined in table 10.3 of IEEE 519-1992, are met. Harmonic solutions shall be designed to withstand up to 2% line imbalances with the maximum Current Distortion not to exceed 11% at 100% load. Harmonic solutions shall be capable of withstanding up to 2% ambient voltage distortion with the maximum Current Distortion not to exceed 12% at 100% load.
- Protective Features: VFD shall have input surge protection utilizing MOV's, spark gaps and Zener diodes to withstand surges of 2.3 times line voltage for 1.3 msec. VFD shall include circuitry to detect phase imbalance and phase loss on the input side of the VFD. End-of-Pump curve detection shall stop motor when the pump is operating outside of its programmed pump curve. VFD shall provide flow compensation to reduce energy by adjusting the Setpoint to match changes in flow (friction loss). VFD shall include current sensors on all three-output phases to detect and report phase loss to the motor.
- Interface Features: VFD shall provide an alphanumeric backlit display keypad (LCP) which may be remotely mounted using standard 9-pin cable. VFD may be operated with keypad disconnected or removed entirely. Keypad may be disconnected during normal operation without the need to stop the motor or disconnect power to the VFD. VFD Keypad shall offer an INFO key that, when pressed, shall offer the contents of the programming manual for the feature that is currently in the display. VFD Display shall have the ability to display 5 different parameters about the VFD or load including: current, speed, DC bus voltage, output voltage, input signal in mA, or other values from a list of 92 different parameters. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed. Two-level password protection shall be provided to prevent unauthorized changes to the programming of the VFD. VFD shall offer as standard an internal clock. The internal clock can be used for: timed actions, energy meter, trend analysis, date/time stamps on alarms, logged data, preventive maintenance, or other uses. There shall be six fully programmable digital inputs for interfacing with the systems external control and safety interlock circuitry. Two of these inputs shall be programmable as inputs or outputs. The VFD shall have two analog signal inputs. Inputs shall be programmable for either 0-10V or 0/4-20 mA. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start. The VFD shall be equipped with a standard RS-485 serial communications port and front-of-drive accessible USB port.
- Adjustments: The VFD shall have an adjustable output switching frequency. The VFD shall have four programmable "skip frequencies" with adjustable bandwidths to prevent the driven equipment from running at a mechanically resonant frequency. VFD shall include an automatic acceleration and deceleration ramp-time function to prevent nuisance tripping and simplify start-up. The VFD will include a user selectable Reset function, which enables the selection of between zero and twenty restart attempts after any self-clearing fault condition (under-voltage, over-voltage, current limit, inverter overload and motor overload), or the selection of an infinite number of attempts. The time between attempts shall be adjustable from 0 through 600 seconds. An automatic "on delay" function may be selected from 0 to 120 seconds. The VFD will include a user-selectable Auto-Restart function that enables the VFD to power up in a running condition after a power loss, to prevent the need to manually reset and restart the VFD. VFD shall catch a rotating motor operating either in forward or reverse at up to full speed. VFD and all required options will be incorporated by the VFD manufacturer into an integrated package, with a single input feed and main disconnect. All enclosures shall be UL Listed, and assembled by the VFD manufacturer in an ISO 9001 registered facility. VFD shall offer the ability to have back-up 24 VDC power to keep control logic powered in the event of a power failure.
- Service Conditions: Ambient Temperature of the VFD, -10 to 45°C (14 to 113°F) 0 to 95% relative humidity, non-condensing. Elevation to 1,000 meters (3,300 feet) without derating. VFD's shall be rated for line voltage of 525 to 690VAC, 380 to 480VAC, or 200 to 240VAC; with +10% to -15% variations. Line frequency variation of ± 2% shall be acceptable. No side clearance shall be required for cooling of the units.
- EXECUTION: Submittals: This specification lists the minimum VFD performance requirements for this project. Each supplier shall list any exceptions to the specification. If no departures from the specification are identified, the supplier shall be bound by the specification.
- All products shall be CE marked; UL labeled, and meet the requirements of UL-508C. To ensure quality and minimize infantile failures on the jobsite, all VFD's shall be completely tested by the manufacturer. The VFD shall operate a dynamometer at full load and speed under elevated temperature conditions. All optional features shall be functionally tested at the factory for proper operation. Factory test documentation shall be available upon request.
- Examination: Contractor to verify that job site conditions for installation meet factory recommended and code-required conditions for VFD installation prior to start-up, including clearance spacing, temperature, contamination, dust and moisture of the environment. Separate conduit installation of the motor wiring, power wiring and control wiring and installation per the manufacturer's recommendations shall be verified. The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD shall not be operated while the unit is covered.
- Start-up and Warranty: A factory-authorized service technician shall perform start-up on each drive if purchased from supplier. ("Start up" shall not include installation or termination of either power or control wiring). The service technician shall perform start-up on up to 8 drives per day. Start-up costs provided with the bid shall include time and travel for the estimated number of visits required, but shall not be less than at least one half-day with travel. Upon completion, a start up service report shall be provided. A 1-year on-site warranty shall be provided such that the owner is not responsible for any warranty costs including travel, labor, parts, or other costs for a full 1 year from the date of installation. An additional warranty of up to 6 years is offered as an option. The cost of the warranty shall be included in the bid. Technical questions regarding drive installation and functions may be answered by contacting the Dan Foss Tech Support department, available 24 hours a day.
- Complete specifications available on request.



1620 HAWKINS AVE, SANFORD, NC 27330 800.831.7133 WWW.PENTAIRCOMMERCIAL.COM

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