PLUMBING SUBMITTALS

Addendum (07/21/14)

Project: Integra Cove Apartments

Location: Orlando, FL

Project Number: 14-012

Architect: CHARLAN BROCK ASSOCIATES INC.
1770 Fennel Street
Maitland, FL 32751

Engineer: KTD CONSULTING ENGINEERS
237 South Westmonte Drive
Suite 300
Altamonte Springs, FL 32714

General Contractor: Landsouth
1680 The Greensway
Jacksonville Beach, FL 32250

Plumbing Contractor: J. A. CROSON, L.L.C.
31550 County Road 437
Sorrento, FL 32776

Contact: Steve Lewis
Phone: 352-729-7128
slewis@jacroson.com

SHOP DRAWING REVIEW

Review of shop drawings or samples shall not relieve the contractor for any deviation from the requirements of the contract documents unless the contractor has informed the Engineer in writing of such deviation at the time of submission and has obtained written approval of the specific deviation; nor shall the review relieve the contractor from responsibility for errors or omissions in the shop drawings or samples. Review does not authorize any changes involving additional cost unless stated in separate letter or change order.

<table>
<thead>
<tr>
<th>NO EXCEPTIONS TAKEN</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKE CORRECTIONS NOTED</td>
<td></td>
</tr>
<tr>
<td>AMEND &amp; RESUBMIT</td>
<td></td>
</tr>
<tr>
<td>REJECTED - SEE REMARKS</td>
<td></td>
</tr>
</tbody>
</table>

KTD Consulting Engineers, Inc.

Date: 08/08/2014

Celebrating 50 Years!
Integra Cove Apartments

EQUIPMENT
Addendum 07/21/14

FD-1  Sioux Chief #832-35PNR adjustable on-grade floor drain
FD-2  Sioux Chief #832-35PNR adjustable on-grade floor drain
WCO-1 Sioux Chief #875-8340P cleanout cover kit
FCO-1 Sioux Chief #834-3PRN adjustable floor cleanout
WMB-1 LSP #OB-353 washer box less integral arrestors
       Sioux Chief #660-V82 in-wall mini resters
IMB-1 LSP #OB-807 icemaker box less integral arrestors
       Sioux Chief #660-V82 in-wall mini resters
WH-1  Woodford #25 automatic draining freezeless wall faucet
EWH-1 321 A.O.Smith #ECLN-40 40 gallon lowboy 208V 4.5kW dual elements water heater
       Mainline (or equal) metal heater pan
       Legend #T-50 pressure relief valve
EWH-2 17  A.O.Smith #ECL-50 50 gallon lowboy 208V 4.5kW dual elements water heater
       Mainline (or equal) metal heater pan
       Legend #T-50 pressure relief valve
EWC-1 Elkay #EZSTL8C bi-level barrier free water coolers
MS-1  Fiat #MSB-2424 molded stone mop service basin
       T&S #B-0665-BSTR service sink faucet
       White
BFP   Wilkins #975XL backflow preventer
SP    SeeWater #OSS-100 oil smart system
       Liberty Pumps #280 series submersible effluent pump
Recirc. Pump Grundfos #UP-15-10-BP circulator pump
P-1 & 2 VC Systems #2VC-ECO-V-7.5-425-208 duplex booster pump
P-1 & 2
Addendum (07/21/14)
SUBMITTAL DATA

VC Systems & Controls, Inc.

8811 Venture Cove
Tampa, Florida 33637
Phone 813-987-2151 Fax 813-985-6536
sales@vcsystems.net

PROPOSAL NUMBER: VC071614V-IC
July 16, 2014
NSF 372 CERTIFIED
CERTIFIED LEAD FREE

PROJECT NAME: INTEGRA COVE
DISTRIBUTOR: VC SYSTEMS & CONROLS, INC.
MODEL NUMBER: 2VC-ECO-V-7.5-425-208
TYPE: DUPLEX ECO SERIES

P1 8A2525-7.5 - 195 GPM - 102' TDH - 7.5 HP
P2 8A2525-7.5 - 195 GPM - 102' TDH - 7.5 HP

NOTE: PUMPS ARE FLANGED DUCTILE IRON WITH 304 S/S IMPELLERS

SYSTEM
CAPACITY: 300 GPM VOLTAGE: 208 /60/3
PRESSURE: 56 PSI MOTOR SPEED: 3500 RPM
BOOST: 45 PSI ENCLOSURE: ODP HIGH EFF
MIN SUCTION: 11 PSI HEADER SIZE: 4" MANIFOLD
MAX SUCTION: 50 PSI HEADER MAT: 304L SS PIPE

CONTROL PANEL: 50 FLA 56 MCA 5K SCCR
VARIABLE SPEED CONTROLLER (UL508A) - ECO 1.0
UL LISTED, INDUSTRIAL CONTROL PANEL
NEMA 4, UL TYPE 1, POWDER COATED ENCLOSURE
MAIN DISCONNECT SWITCH
INDIVIDUAL PUMP FUSE BLOCKS, WITH FUSES
MANUAL & AUTOMATIC ALTERNATION
DUAL TRANSUCERS, SUCTION & DISCHARGE
COLOR TOUCH SCREEN INTERFACE, STANDARD
RS485 MODBUS OPEN PROTOCOL INTERFACE INCLUDED
VARIABLE FREQUENCY DRIVES, EACH PUMP

ACCESSORIES / OPTIONS:
SINGLE SPHERE RUBBER FLEX CONNECTORS
RUBBER AND SHEAR VIBRATION ISOLATION
NOTES:
1. Not to be used for construction. Dimensions may vary. See factory for construction drawing.
2. Provide 18" space around system for service and NEC clearance in front of control panel.

<table>
<thead>
<tr>
<th>KEY</th>
<th>HEADER</th>
<th>MOTOR</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.5&quot;</td>
<td>2 - 7.5 HP</td>
<td>60&quot;</td>
<td>34&quot;</td>
<td>30&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td>2</td>
<td>3&quot;</td>
<td>2 - 10 HP</td>
<td>60&quot;</td>
<td>34&quot;</td>
<td>32&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td>3</td>
<td>4&quot;</td>
<td>3 - 15 HP</td>
<td>70&quot;</td>
<td>34&quot;</td>
<td>32&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td>4</td>
<td>6&quot;</td>
<td>5 - 15 HP</td>
<td>70&quot;</td>
<td>34&quot;</td>
<td>38&quot;</td>
<td>40&quot;</td>
</tr>
</tbody>
</table>
VC Systems ECO Series system combines our high quality and energy efficiency with a new design that maximizes the life cycle cost and savings.

The ECO Series is ideal for hospitality, condominium, apartments, and office buildings due to its low upfront cost, energy efficiency, long life cycle, and industry leading serviceability.

**SYSTEM FEATURES**
- Color Touch Screen Controls
- 304 Stainless Steel Impellers
- 304 Stainless Steel Manifolds
- All ANSI Flanged Design
- Bladder Tank Not Required
- Dual - 316 Stainless Transducers
- ABB ACH550 Drives
- Single Source Responsibility
- UL Listed & ARRA Certified
- 1 Year Warranty on Package

**CONTROLLER FEATURES**
- UL508A Listed
- NEMA 4, UL Type 1, Enclosure
- Door Mounted Disconnect Switch
- Single Point Power Connection
- Common Alarm Contact
- Event Log, 100 Events
- System Trending
- Modbus RS485

**PRODUCT RANGE**
- 1 to 3 Pumps
- 1 to 20 HP Motors
- 1750 / 3500 RPM
- 208/230/460, Single & 3 Phase
- Class 150 & 300 Systems
- Indoor & Outdoor Applications

www.vcsystems.net
CLOSE COUPLED END SUCTION

VC8A-SS
3500 RPM

- Ductile Iron/Stainless Fitted
- 150# Flanged - 200PSI W.P.

END SUCTION PUMPS
 SERIES C

NOTES/JOB NAME
INTEGRA COVE
ORLANDO, FL

U.S. GALLONS PER MINUTE

P-1 & P-2 VC8A-SS-2525-7.5 195 GPM AT 102' TDH, 7.5 HP, 3450 RPM, ODP, 208/60/3

VC Systems & Controls, Inc.
8811 Venture Cove Tampa, FL 33637
Phone: (813)987-2151 Fax: (813)987-2112
www.vcsystems.net

DESCRIPTION:
CLOSE COUPLED END SUCTION

JANUARY 1, 2004 SCALE: NONE DRAWN BY: HGV PAGE NO: 3.06.05
VC ES SERIES
END SUCTION PUMP

Construction:
- Case: Ductile Iron
- Impeller: Cast 304 Stainless Steel
- Mechanical Seal: Ceramic / EPDM
- Trim: 304 Stainless Steel
- Close Coupled
- Flanged, Class 150 (2”, 2.5”, & 3”)

Specifications:
- Working Pressure: 225 PSI
- Temperature: 225 Deg F
- NSF / ANSI 61 Annex G Certified
- NSF / ANSI 372 Certified
- Impeller has 5 year warranty
LIMITED WARRANTY

VC System's are warranted for a period of eighteen (18) months from shipment or twelve (12) months from start up, whichever comes first. The warranty is limited to failure due to material defects or workmanship. For warranty to be in effect, the equipment must be installed, operated, serviced, and maintained with the manufacturers operation and maintenance manual and standard mechanical practice. The obligation of the manufacturer is limited to the repair or replacement of defective material or part, FOB the factory, not inclusive of freight charges.

VC System's is not responsible for normal labor charges, transportation, rigging, and handling. Damage resulting to normal wear parts or mechanical seals or damage from pumping product not covered. Further damages due to flooding, fire, wind, lightning, or acts of God are not covered. Damage that is result of maintenance neglect, misuse, or lack of normal service will not be covered. VC Systems reserves the right to inspect all "defects" or failure before final determination of warranty credit. Defective materials must be returned to factory with preauthorized Return Material Authorization number (RMA), via prepaid freight.

VC Systems disclaims any other warranty either implied or expressed and disclaims liability for property damage, loss of time, loss of income, loss of profit, or liability for liquidated or consequential damages. The maximum liability shall not exceed the cost of the authorized defective materials.

VC Systems extends no warranty, expressed or implied, beyond that outlined here, or those specifically agreed to, in writing, at the time of the order entry.
UL CERTIFICATION

Packaged pumping systems by VC Systems & Controls, Inc. carry the UL Listing for Third Party Certification as a system built in conformance with its intended use. This certification for packaged pumping systems insures that the equipment meets OSHA and NEC requirements, and include a UL 508A Listed industrial control panel.
BUY AMERICAN CERTIFICATION

In response to the Buy American Provisions regarding ARRA Project Administration and Reporting Handbook, Version 3.0, the packaged pump station supplied by VC Systems, meets buy American. In compliance with Section 2.2, "Making Substantial Transformation Determination," see the following:

1 Question: Were all of the components of the manufactured good manufactured in the United States, and were all the components assembled into final product in the US?
Answer: No. The pumping station consists of fabricated steel base, pump and motor units, AWWA isolation butterfly valves, dual disc check valves, fabricated S/S piping and fittings, automatic air release valves, pressure gauges with isolation cocks, and miscellaneous nuts, bolts, and hardware, all of which are made in America or made of parts of both domestic and other origin, but assembled in the United States.

2 Question: Was there a change in character or use of the good or the components in the United States (America)?
Answer: Yes, the pump/motor units, the piping system, the fabricated steel base and the prepackaged pumping station utilizing these components are manufactured to meet the unique specifications, function, and spatial requirements of this job, making it very unique to the requirement and use of this customer.

3 Question: Was the process or processes performed in the US, including but not limited to assembly?
Answer: Yes, the design, layout and assembly of the pumping station utilizes highly skilled personnel and manufacturing processes to assemble the components into a functional "system". These processes include layout and AutoCad design drawings, plasma cutting and welding of stainless steel piping, machining of individual pump and motor units, assembly of the pumps, valves, piping on the support frame and both hydrostatically tested and flow tested prior to shipment, all with American Labor.

CONCLUSION: The combination of American (domestic) and foreign materials have been substantially transformed in the Unites States and by United States Labor, and with a YES answer to 2 of the 3 questions, qualifies for "Made in America" by ARRA funding guidelines.

DATE: JANUARY 2010

VC Systems & Controls, Inc.

CERTIFICATIONS

ARRA
Construction:
- Body: Ductile Iron
- Disc: 316 Stainless Steel
  - Nylon Coated DI Optional
- Stem: 416 Stainless Steel
- Seat: EPDM
- Class 125/150, Full Lug

Specifications:
- Working Pressure: 225/250 PSI
- Temperature: -40 to 250 Deg F
### Construction:
- Body: Epoxy Coated Ductile Iron
- Seat: EPDM
- Non-Slam / Silent Check
- Globe & Angle Configuration
- Flanged, Class 150 & 300

### Specifications:
- Working Pressure: (Class 150) 240 PSI
- Working Pressure: (Class 300) 640 PSI
- Temperature:-20 to 250 Deg F
- NSF / ANSI 61 Annex G Certified

<table>
<thead>
<tr>
<th>Size</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td></td>
</tr>
<tr>
<td>2.5&quot;</td>
<td>✓</td>
</tr>
<tr>
<td>3&quot;</td>
<td></td>
</tr>
<tr>
<td>4&quot;</td>
<td></td>
</tr>
<tr>
<td>6&quot;</td>
<td></td>
</tr>
</tbody>
</table>
### Vibration Isolator

**Rubber-in-Shear**

<table>
<thead>
<tr>
<th>Size</th>
<th>Max Load (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RVD-2-C</td>
<td>380</td>
</tr>
<tr>
<td>RVD-2-D</td>
<td>700</td>
</tr>
<tr>
<td>RVD-3-A</td>
<td>550</td>
</tr>
<tr>
<td>RVD-3-B</td>
<td>930</td>
</tr>
<tr>
<td>RVD-3-C</td>
<td>1540</td>
</tr>
</tbody>
</table>

*Note: Isolators are not supplied on high pressure and split base systems.*

---

### Flexible Connector

**Single Sphere Style**

**ANSI Flanged**

<table>
<thead>
<tr>
<th>Size</th>
<th>EPDM Body</th>
<th>250 Degree MAX</th>
<th>225 PSI MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Flex connectors are not supplied on high pressure systems.*

---

### Thermal Relief Valve

**Model - 95-105**

**Data:**
- Thermal safety valve for casing protection
- Modulating type
- All 316 stainless construction
- 95 - 105 deg. F range to full open
- 400 PSI working pressure
- Non-electric style
- Two piece construction
- Redundant safety, one for each pump

---

2012

Systems & Controls, Inc.
VC Basic Control System Features

- 1-3 Equal Sized Variable Speed Pumps.
- Possible to add pumps in the future without reprogramming.
- Configurable for suction pressure sensor or level switch. If suction switch input is not used, it can be configured for a system remote disable or generator lockout to limit number of pumps running under emergency power.
- Percent System Flow Capacity Indication
- Each alarm can be independently configured for behavior of pump shutdown, and reset modes.
- Advanced PID controls with “Kickstart” and “Stabilization” controls provide fast recovery upon starting the first pump.
- Power up restart delay and pressure recovery mode upon severe pressure loss. Safely and automatically refill empty pipes without water hammer.
- Interstage sequence timer provides better performance and fewer false starts and stops.
- Native MODBUS RTU RS485 2 Wire standard or Native BACNET MS/TP or IP via optional network module.
- 4.3” Color Touch Screen.
- Wide Screen Format provides with full interactive and animated graphics for a clear picture of the system operation.
- X-Y Plot of system operation. 1 plot sample per minute for up to 90 days.
- Event and History log with time date stamps and filter controls. Up to 1000 events
- Parameter backup and restore utility. Quickly restore all settings to the last known working values at the touch of a button.
- Maintenance reminder message.

Basic Sequence

Controller can be configured for 1 to 3 pumps (variable or constant speed). This guide is universal for any number of pumps installed. All pressure and timer settings are user adjustable. Pressure is monitored and processed using an enhanced PID algorithm. The result of this calculation generates a speed signal that will modulate the pump speed to maintain a constant system pressure. Pumps are added and rejected based on the speed. The pump speed has a direct relationship to the flow capacity of the pump. This ultimately stages pumps on and off at the most effective points with minimal disturbance to the system pressure. It will inherently adapt as the pump impeller wears or clogs.

To prevent false starting and premature stopping of the pumps all timed sequences are interlocked. This means that a lag pump will not begin any start delay timers if the lead pump is not running. Similarly the lead pump stop delay timer will not begin timing out until the lag pump has stopped. By interlocking the pumps in this manner it is impossible for any pump to start or stop simultaneously under normal operating conditions. This also provides an orderly staging sequence upon power up or when returning to operation form a shutdown such as low suction. An interstage timer is also provided that allows the user to create a short time gap where pumps cannot be added or removed until the timer expires. This allows some setting time when pumps start and stop. The interstage timer is activated once with each pump start or stop event.

Typical operation example:

As the flow demand on the system increases the PID will speed the pump up to compensate. When the PID output reaches 100% (adjustable) the pump has achieved maximum capacity. Because we know that the pump is at full capacity we do not need to continue flowing beyond this point to induce a pump start via a pressure drop. Instead we begin the time delay (triggered by the PID output) for starting the next pump in line. When the next pump starts the PID will begin slowing as the next pump ramps up to speed and absorbs a portion of the system flow.

As the system flow reduces, the PID will begin reducing the pump speed to accommodate the reduction in system flow. When the speed drops below the minimum speed we know that the pump can no longer make enough pressure to open the check valve. At this point it is running at or near dead head. If we set the “PUMP REJECT SETPOINT” at this point then we can reject a pump and let the other pump(s) speed up to compensate for the change in the flow division. Obviously, speeding the pumps up again would cause the “PUMP REJECT SETPOINT” to be exceeded and therefore no additional pumps would be stopped.

Because the drives ramp the speed up and down slowly the PID will have time to adjust the speed of the drives as pumps are added or rejected from operation. For this reason there is little or no change in system pressure when pumps are added or removed.

Secondary control method

In the event a sudden pressure drop is detected and the pump has not already started from the primary sequence, the pressure drop would stage pumps on using traditional pressure based sequencing. These settings will be based on building minimums to allow more adjustable range on the primary system.

Lead pump Sleep Mode - Maximizing energy savings

A special sleep mode feature is provided that will constantly test for a zero flow condition. When no flow is detected, the lead pump will enter sleep mode, reducing the speed to 0% and effectively stopping the pump. Once the sleep mode has been entered, the pump will remain at 0 speed until a pressure drop is detected. In this way, the building static pressure can sustain small demands similar to the way hydro-pneumatic storage tanks work in many constant speed systems. If a pressure drop is detected, generally set several pounds below the normal operating pressure, the lead pump will ramp up and restore the system pressure. If the building demand is still low enough, the lead pump will return to sleep mode to conserve energy. Sleep mode is compatible on systems with or without hydro-pneumatic storage tanks. In some cases, a hydro-pneumatic storage tanks can be added to increase the amount of time the lead pump can remain in sleep mode.

One common problem with variable speed system is that they are very sluggish upon “waking” from a sleep state and that results in undesirable pressure fluctuations, often for 30 seconds or more. This is because in most cases, the first 50-70% of the pump speed has no impact on the system pressure. It simply requires that much speed to open the check valve and begin flowing water. While a PID is an excellent choice for speed control when everything is up and
running, it is blinded during the initial start of the lead pump. The PID will see no change as it speeds up the pump and react more aggressively to compensate. Then suddenly the pressure will spike as the pump crosses the threshold and begins flowing water. It's too late to do much at this point because the PID has ramped way beyond the speed required to make the minimum pressure and now has to reduce the speed to correct the huge error. If the water demand is very low, the excess pressure is often trapped and can even cause a high system pressure shutdown in severe cases. This problem requires a very careful and complex mathematical approach to resolve. VC Controls has developed a solution to this age old problem by creating a modified PID algorithm that transparently eliminates this overshoot. The software handles all the complex issues of getting the pump speed up to the threshold as quickly as mechanically possible, then seamlessly transitions into a full PID control scheme once the initial threshold has been overcome. In this way, the system response time is fast, accurate and produces no overshoot, even when starting into a closed valve (no flow) situation.

**Pressure Recovery mode**

When the pumps are offline for an extended period of time such as after a power outage or a system shutdown, the pressure can drop significantly and potentially create a dangerous hydraulic situation. If the pipes have drained and air has entered the system, simply restarting the system would cause the water to rush in at high velocities to refill the pipe. The very nature of the controller is to restore the pressure as quickly as possible. If the pipes are full, this is desirable, but if the pipes are empty, this can be disastrous. High velocities will eventually slam into the end of the pipe. Water does not compress like air and when it hits the end of the pipe, severe water hammer will occur. If the pipes are new and strong, everything may be fine, but over time as the pipes and fixtures weaken, this water hammer could cause serious damage and pipe breaks. This system has a pressure recovery mode feature that can be enabled to monitor the pressure while the pumps are off. In the event the pressure drops to unsafe levels, the recovery mode will refill the system slowly by ramping the lead pump speed up 1/2% per second until the system pressure returns to a normal operating range. In most cases the velocities will remain well under 1 foot per second until the pipes are refilled.

**Alternation of pumps**

The controller will change the order in which pumps start depending on programmed settings. This controller employs 3 different types of alternation than can be used independent or together as desired. Failed pumps are automatically removed from the sequence and a new alternation sequence is generated using the remaining pumps.

**Duty Cycle (1st on 1st Off)**

When pumps are added or removed from operation, this alternation mode will always attempt to remove the pump that has been operating the longest. In other words, the first pump started will be the first pump stopped. This alternation will generally keep a steady rotation through the pumps under normal circumstances. Actual run time is not controlled or balanced in this mode, but rather the objective of this alternator is to ensure a fresh pump is always used when adding and the pump that has been running longest is stopped first.

**Time of Day Alternation**

This alternation will automatically alternate the pumps at the preset time of day. This alternation causes a forced alternation regardless of any run time or stop/start cycles of the pumps. In the scenario where one pump runs continuously, a simple duty cycle alternation may never be induced. The Time of Day alternation will guarantee alternation one time per day minimum.

**Excessive Run Time Alternation**

Duty Cycle and Time of Day alternation cycle do little to balance the run time of the pumps but do a good job of making sure no pump gets all of the run time. In some cases it is desirable to limit the run time of a pump by switching to a new pump after the current pump has run for a preset time. This is very useful for system that have continuous and relatively stable demands that might cause a single pump to operate alone most of the time. Using the Run Time alternation would cause a new pump to be used every so often. The user may choose to set the run time so a new pump starts every 8 hours of actual continuous running time. This method of alternation can equalize the run time across the pumps if that is the desired goal.

**Display Screens**

The controller is provided with a 4.3” Wide Screen Format touch sensitive operator interface screen. Actual screens may vary slightly based on number of pumps or special features ordered, however this overview covers typical concepts and features provided with every system. The back light is automatically turned on when any part of the screen is pressed and will remain on for approximately 30 minutes if no buttons are pressed.

Under normal operation the display will show system operational data such as system and suction pressures or levels, PID output speed, pumps running, elapsed run time etc.

Many screens will have buttons that allow access to more help or information windows. Some icon such as the speaker in the bottom right hand corner are also buttons. Touching the speaker will mute the beeping sounds heard when pressing buttons. When muted, this icon changes to show if the sound is on or off. Screens that contain sensitive information such as configuration and parameter settings are protected by a password. Take some time to familiarize yourself with the screens available. The Menu button provides access to all major screens such as the main screen, the trending screen, the event log and parameters. Refer to “Controller Setup” for details on changing system settings.
**Trending and Event Logs**

This controller is provided with special data logging capabilities. These logs can be very useful when troubleshooting system operation. All events such as pump alarms and actual pump run status are logged as they occur. The time that they occurred and the time that they ended are also recorded. Normal system events appear in a bold print as they occur and fade to a lighter color as they end. Active events can be double clicked to change the color so it is easy to identify new alarms that occur after current alarms are acknowledged. Alarm events will appear in the scrolling banner at the top of the screen that turns red when alarms exist, otherwise it will be green. All alarms will appear in the log as well. The first screen shows current alarms and events. A button on this screen opens a window that allows viewing of older events and alarms. To simplify viewing, alarms are indented and preceded with ![1]. All events and alarms are backed up in EEPROM memory so they are retained even after a power loss.

In addition to the event log, a real-time chart recorder is provided that will show the trend history of the system and suction pressures as well as the pump speed over the past 90 days or more. Each screen displays about 60 minutes of data and samples are approximately 1 minute apart.

Data from the current day can be accessed by simply using the arrow keys at the bottom of the chart recorder to scroll back and forth through time. You can skip from day to day using the DATE arrow buttons located near the right edge of the chart. Touching the chart will cause the date in the upper left corner of the chart to change to the date and time of the point you touched.

Event history logs and x-y data plots share EEPROM memory so both are retained through a loss of power. When the memory is full, the oldest data is deleted as new data comes in. The ample storage should be enough to track down issues even if they have spanned over long periods of time.

**Alarms and Indicators and other controls**

The system will monitor the supply and discharge pressures as well as drives for proper operation. In the event of abnormal operation the controller will illuminate a common alarm lamp and display a message indicating the source of the problem. All systems are provided with a form C common alarm “dry” contact for remote monitoring. This contact will change state in the event of any alarm including loss of power. The “Silence” button may be pressed to quiet the audible alarm while problems are resolved. The local and remote alarms will remain active until the condition ceases.

Note: Each alarm can be configured as needed to cause a pump shutdown, manual or automatic restart of pumps as well as manual or automatic reset of the alarm. The configuration is limited to factory authorized personnel due to the possible dangers involved in some scenarios and to ensure warranties are not void.

All systems are provided with the following alarms and messages. Additional alarms and messages are provided in addition to those listed here. Related information to each alarm is provided at the touchscreen for all alarms.

**LOW SYSTEM ALARM**

If the pressure (level) fails to rise above the low pressure (level) alarm setting within the alarm delay timer setting, this alarm will be engaged to notify an operator of the condition. This alarm will automatically reset when the condition ceases to exist. Possible causes include pumps left in the off position, motor overloads or drives tripped or clogged pump impellers.

**HIGH SYSTEM ALARM**

If the discharge pressure (level) rises above the alarm pressure (level) setting for the duration of the alarm delay timer, all pumps in “AUTO” will be stopped to prevent damage to system piping. Some possible causes include a failure of a pressure sensor or excessively high supply pressure to the system, improper PID tuning or manual operation of the pump above the high pressure alarm setting. A pressure display that is higher than the range printed on the sensor can indicate a sensor failure or wiring problem. Note that it is more common for a sensor to fail to negative pressure than a high pressure.

**LOW SUCTION ALARM**

The water source to the system should have some positive pressure (level). If this pressure (level) is lost there is danger of damage to the pump caused by a lack of water to properly lubricate the pump bearings. If the pressure (level) drops below the alarm pressure (level) setting for the duration of the time delay then the pumps in “AUTO” will be stopped. The pumps will automatically return to operation when the water supply pressure returns. The alarm must be manually reset.
ENERGY EFFICIENT VARIABLE SPEED PUMP CONTROLLERS

Note: The suction alarm can be configured for a variety of sensors. Systems that pump from a pressurized city water main will generally have a pressure sensor, where as a system that is fed from a reservoir tank might use a level sensor or possibly a level switch. This controller can be configured for each of these possibilities.

**PUMP##[s] FAIL TO START** (Where [s] = the pump number that has failed)
If any motor starter fails to engage when the controller calls it, this alarm is engaged to alert the operator that the system capacity is now reduced. System will continue to operate with the remaining pumps. This alarm can occur under drive failure, Drive Keypad switch in "OFF" or if the drive has failed to start when called. On constant speed pumps or drive bypasses, this can also occur when an overload trips. The fail to start alarm must be manually reset.

**Starting the system up for the first time**
Each pump is provided with “HAND-OFF-AUTO” selector switches and run indication lamps. The “HAND” position is intended for attended use only. This mode will over-ride all alarms except the motor overload or drive trip. This can be useful for operating a system manually with failed components or for testing pump operation during startup. The “OFF” position will prevent a pump from being started in any mode. This is not a service lockout position. Always disable the power source to a pump before performing service. Failure to do so may result in personal injury or death. When preparing to start a system for the first time there are many things to be aware of. You need to familiarize your self with the controller, the required connections and the piping that the system is connected to. Never just walk up to a panel and throw the switch on and expect it to work. Doing so can cause serious damage to the system piping as well as the people around. Always assume all wires are live and practice safe electrical technique. Startup should only be performed by trained factory authorized personnel.

**Controller Setup**
All controller settings can be adjusted from the local control panel display only. Remote displays are not permitted to change parameters as this could cause a hazardous situation if a person is not present to monitor the reaction of the system to parameter changes.

To change parameters you will need to log in first to prevent unwanted tampering of the system parameters. Several security login levels are possible. Each parameter is assigned a security level. If your login level is not high enough, you will be prompted to log in at a higher level when a parameter is touched. It is not necessary to be logged in to view parameters, only to make changes.

The panel is shipped with the password set as follows

User Levels allow changes to most parameters.
USER: 1111

Factory Representative Level can access all parameters except “Factory only” parameters and can view and change all passwords except Factory level.

Factory Reps are given their password by the factory.

Factory Level grants access to all parameters and all passwords. Factory level passwords are not published for obvious reasons.

To access the parameters simply touch the menu button and select the desired setup after you have logged in. You will be logged out automatically after 10 minutes, or if you press any of the logout buttons found in many locations. If you attempt to change a parameter that you do not have privileges to change, the login screen will pop up and prompt you to log in at a level that will permit changes. User passwords can be changed by logging in as a user with a higher or equal level or permissions. For example someone logging in as a Factory Representative would be able to change the password for "User" as the User is a lower level permission. Also note that there are 2 Factory levels that are for use only by factory authorized persons. It is suggested that new passwords be entered at startup to improve security. Simple default parameters are shown in the parameter lists below. A factory representative or factory person can change any password in the event all passwords are lost. For security reasons, the Factory passwords are not shown in this manual.

Touch the value of any parameter and a keypad will pop up to allow you to change that value.

<table>
<thead>
<tr>
<th>Parameter Group [Screen ID]</th>
<th>Description</th>
<th>Login Level Required</th>
<th>Field Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>User [102.x]</td>
<td>[102.1] Wake Lead/Add Lag Dev. [-5] Seconds Setpoint {___}</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This delays the start of the lead pump. It is generally set to zero except when pressure swings are common when pumps are not running.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[102.2] Delay on adding lag pumps (5) Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This delay is common to all lag pumps. The timer is not enabled until the interstage timer has expired, the next lag pump will then be available after this delay time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[102.3] Interstage Delay (5) Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This timer creates a gap between any start or stop pump action. By using this timer, it allows shorter start delays to be used for lag pumps as this timer will not require that the following pumps account for the ramp up and stabilization time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User [103.x]</td>
<td>[103.1] Stop Delay (5) Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This only applies to lag pumps. Rejection happens based upon speed assuming pressure setpoint is satisfied. Since pump is ramped, there is no need to run ten minutes to ensure cooling time.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page 4 of 7 | Type “VQV-Click V2.0” Controllers 04/10/2013
<table>
<thead>
<tr>
<th>Parameter Group [Screen ID]</th>
<th>Description</th>
<th>Login Level Required</th>
<th>Field Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>User [104.x]</td>
<td>[104.1] Pump Overlap on Alternation (5)</td>
<td>USER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[104.2] Alternation Modes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 1st On 1st Off {On}</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Time of Day {On} {Hr=22}</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; Run Time {On} {8 hrs}</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Refer to Alternation section of this sequence for details.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User [105.x]</td>
<td>[105.1] Low Discharge Pressure</td>
<td>USER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[105.2] Alarm Delays - Seconds (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User [106.x]</td>
<td>[106.1] High Discharge Pressure</td>
<td>USER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[106.2] Alarm Delays - Seconds (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User [107.x]</td>
<td>[107.1] Low Suction Pressure</td>
<td>USER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[107.2] Alarm Delays - Seconds (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User [108.x]</td>
<td>[108.1] High Suction Pressure</td>
<td>USER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[108.2] Alarm Delays - Seconds (5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User [109.x]</td>
<td>[109.1] Exercise pumps that have not run for {24hrs}</td>
<td>USER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This feature will cause pumps that have no operated for a long time to be run for the time set in [102.2]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[109.2] Exercise period {1min}</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This value is only used if the alarm is configured for automatic reset.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Factory [151.x]**

<table>
<thead>
<tr>
<th>Description</th>
<th>Login Level Required</th>
<th>Field Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>PID Config</td>
<td>Factory Configuration 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>151.1 Proportional (0.04)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>151.2 Integral (0.09)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>151.3 Derivative (0.00)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>151.4 Sample Time (1x100ms)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>151.5 Min Out (50%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>151.6 Max Out (100%)</td>
<td></td>
</tr>
<tr>
<td>PID Config</td>
<td>Factory Configuration 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.1 Wake Dev (-5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.2 Wake Speed (60%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.3 Wake Hold (5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.4 Reject Speed (70%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.5 Default Speed (65%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.6 Stpt Limit (0 min) (300 max)</td>
<td></td>
</tr>
<tr>
<td>Scale Sys</td>
<td>Scale System Sensor</td>
<td></td>
</tr>
<tr>
<td>Sensor</td>
<td>152.1 Sensor Span (300)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.2 Offset (0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust as needed to correct zero pressure reading</td>
<td></td>
</tr>
<tr>
<td>Scale Sys</td>
<td>Scale Supply Sensor</td>
<td></td>
</tr>
<tr>
<td>Sensor</td>
<td>152.1 Sensor Type (Analog or Switch)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.2 Sensor Span (300)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.3 Offset (0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjust as needed to correct zero pressure reading</td>
<td></td>
</tr>
<tr>
<td>Scale Sys</td>
<td>Scale Supply Sensor</td>
<td></td>
</tr>
<tr>
<td>Sensor</td>
<td>156.1 System Low (0) High (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>156.2 Suction Low (3) High (0)</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Pump Stop</td>
<td>Pump Restart</td>
</tr>
<tr>
<td></td>
<td>0 No</td>
<td>Auto</td>
</tr>
<tr>
<td></td>
<td>1 No</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>2 Yes</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>3 Yes</td>
<td>Auto</td>
</tr>
<tr>
<td></td>
<td>4 Yes</td>
<td>Auto</td>
</tr>
</tbody>
</table>
### Parameter Group [Screen ID]

**Description**

*Value shown in brackets are factory default {###}*

**Login Level Required**

**Field Setting**

---

**Factory[157.x]**

Configure Pumps
- 157.1 Qty Pump Installed {__}  
- 157.2 Pump Fail to Start Delay {5}  
- 157.3 Generator Limit Qty Pumps Run {0}  

*Note: Set = 0 for remote disable*

**Factory[158.x]**

Pump ETM's
- 158.1 Pump#1 Elapsed Run Time {0hrs}  
- 158.2 Pump#2 Elapsed Run Time {0hrs}  
- 158.3 Pump#1 Elapsed Run Time {0hrs}  

**Factory[159.x]**

System Restart and Pressure Recovery
- 159.1 System Delay on Restart {25sec}  
- 159.2 Enter Pressure Recovery Mode Below __. Set to 0 to disable  

**Factory[165.x]**

Passwords
- 165.1 User  
- 165.2 Factory Representative  
- 165.3 Factory 1 & Factory 2.  

**Factory[166.x]**

Factory Representative Information  
Name, Cisty, Static, Zip & Phone  

**Factory[167.x]**

Maintenance Reminder  
167.1 Date for Popup Reminder {Month = 0} {Day=0}  
Set to 0/0 to disable  

**Factory[168.x]**

Backup Utility  
Use this utility to make a copy of PLC parameters in the color touch screen. If the PLC ever replaced or loses it's parameters, the screen can be used to restore them instantly.  

**Factory[169.x]**

PLC Information  
General information about PLC operation and installed program.  

**Factory[170.x]**

HMI Information  
General information about the color touchscreen operation and installed program as well as an adjustable field for changing the backlight timeout delay.

---

### Remote Monitoring and Interface

The controller is provided with a network connection for MODBUS RTU via RS485 (2-wire) to monitor the system operation. The default network settings are 9600,N,8,1 address 5 but they can be changed from the color touch screen as needed. The PLC is equipped with two MODBUS ports. One is dedicated to the operator interface and the other is for customer BAS connection. The open customer port is labeled Port 3 and is a screw terminal connection that is clearly labeled with connection details. The PLC does not have terminating resistors. If they are required, they must be installed externally.

An **OPTIONAL** BACnet communications gateway is available preconfigured per the table below. BACnet MS/TP communication parameters can only be downloaded into the gateway by the factory. BACnet IP settings can be configured through the network port using a web browser.

Refer to the wiring diagram on the enclosure door for connection details.  

The following data can be read over the MODBUS connection.

<table>
<thead>
<tr>
<th>MODBUS ADDRESS</th>
<th>BACNET ADDRESS</th>
<th>DATA</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001</td>
<td>AV0</td>
<td>SYSTEM PRESSURE OR LEVEL</td>
<td></td>
</tr>
<tr>
<td>40002</td>
<td>AV1</td>
<td>SUCTION PRESSURE OR LEVEL</td>
<td></td>
</tr>
<tr>
<td>40003</td>
<td>AV2</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40004</td>
<td>AV3</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>
| 40005          | AV4            | PUMP #1 STATUS WORD  
0 = Stopped [Enabled]  
1 = Running  
3 = Failed [Offline]  
4 = Not installed or present |       |
| 40006          | AV5            | PUMP #2 STATUS WORD  
See Pump#1 Status word for description |       |
| 40007          | AV6            | PUMP #3 STATUS WORD  
See Pump#1 Status word for description |       |
<table>
<thead>
<tr>
<th>MODBUS ADDRESS</th>
<th>BACNET ADDRESS</th>
<th>DATA</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>40008</td>
<td>AV7</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40009</td>
<td>AV8</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40010</td>
<td>AV9</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40011</td>
<td>AV10</td>
<td>PUMP#1 ETM [HRS x100]</td>
<td>Example: 100 hours will return a value of 1</td>
</tr>
<tr>
<td>40012</td>
<td>AV11</td>
<td>PUMP#2 ETM [HRS x100]</td>
<td>Example: 100 hours will return a value of 1</td>
</tr>
<tr>
<td>40013</td>
<td>AV12</td>
<td>PUMP#3 ETM [HRS x100]</td>
<td>Example: 100 hours will return a value of 1</td>
</tr>
<tr>
<td>40014</td>
<td>AV13</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40015</td>
<td>AV14</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40016</td>
<td>AV15</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40017</td>
<td>AV16</td>
<td>COMMON ALARM STATUS</td>
<td>0 = No alarms present  1 = Alarms Exist</td>
</tr>
<tr>
<td>40018</td>
<td>AV17</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40019</td>
<td>AV18</td>
<td>SYSTEM SENSOR STATUS (Discharge pressure/level sensor)</td>
<td>0 = OK  1 = Short Circuit [Failed]  2 = Open Circuit [Failed or not present]</td>
</tr>
<tr>
<td>40020</td>
<td>AV19</td>
<td>SUCTION SENSOR STATUS (Supply pressure/level sensor)</td>
<td>Not used when suction sensor type is configured for “Switch Input”  0 = OK  1 = Short Circuit [Failed]  2 = Open Circuit [Failed or not present]</td>
</tr>
<tr>
<td>40021</td>
<td>AV20</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>40022</td>
<td>AV21</td>
<td>DISCHARGE PRESSURE/LEVEL ALARM</td>
<td>0 = No Alarm (Pressure/Level is normal)  1 = Low alarm (Pressure/Level is below normal limits)  2 = High Alarm (Pressure/Level is above normal limits)</td>
</tr>
<tr>
<td>40023</td>
<td>AV22</td>
<td>SUCTION PRESSURE/LEVEL ALARM</td>
<td>0 = No Alarm (Pressure/Level is normal)  1 = Low alarm (Pressure/Level is below normal limits)  2 = High Alarm (Pressure/Level is above normal limits)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Depending on user configuration this alarm status can be common to all pumps or reflect one or more pumps.</td>
<td></td>
</tr>
<tr>
<td>40024</td>
<td>AV23</td>
<td>EXTERNAL SYSTEM DISABLE</td>
<td>Not used when suction sensor type is configured for “Switch Input”  0 = System enabled  1 = System disabled or limited due to generator power (wired input to panel)  2 = System is disabled due to remote lockout (wired input to panel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: System can be user configured to limit system operation to any number of pumps or a complete shutdown under generator power.</td>
<td></td>
</tr>
<tr>
<td>40025</td>
<td>AV24</td>
<td>PID OUTPUT (Pump) SPEED IN PERCENT (0-100%)</td>
<td></td>
</tr>
<tr>
<td>40026-40032</td>
<td>AV25-AV31</td>
<td>Unused - Reserved for future use.</td>
<td></td>
</tr>
</tbody>
</table>

Note: A loss of communications indicates an active loss of power to the panel.
VQV2 CLICK V2.0

MARIETTA, GEORGIA 30066

CONTROLS INC

UL LISTED

VQV2_VOLT_AMP

03/05/2013

PAGE: 2 OF 4
**POWER SOURCE**

<table>
<thead>
<tr>
<th>Volts</th>
<th>Phase</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>###</td>
<td>3</td>
<td>60</td>
</tr>
</tbody>
</table>

**FULL LOAD AMPS**

###

**MIN CIRCUIT AMPS**

###

**SHORT CIRCUIT CURRENT**

RMS Symmetrical 5 kA Maximum

**TERMINAL TORQUE**

###-### AWG #in-lb (###Nm)

---

**ENCLOSURE DATA**

UL TYPE

NEMA RATING

1

12

**NOTE:** UL TYPE RATING MAY DIFFER FROM THE NEMA TYPE RATING DUE TO AN EXTERNALLY MOUNTED DEVICE THAT HAS NOT BEEN EVALUATED BY UL FOR A TYPE RATING. UL TYPE RATING IS IN ACCORDANCE WITH UL STANDARD 508A SECTION 19.

USE ONLY HUBS AND CONDUCT FITTINGS WITH SAME OR BETTER RATINGS OF THE LISTED PANEL TYPE SHOWN ABOVE.

---

**REQUIRED DRIVE PARAMETERS**

|-------------------|-------------------|-------------------|-------------------|--------|-------------------|-----------|------|-------------------|--------|--------------|-------|-----------|--------|-------------------|--------|-------|--------|--------|----------|----------|-------------------|-----------------------------|-----------------------------|-----------------------------|

---

**CONNECTED LOAD(S)**

FU1-FU6

<table>
<thead>
<tr>
<th>VFD Input</th>
<th>VFD Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>###</td>
<td>###</td>
</tr>
</tbody>
</table>

**TERMINAL TORQUE**

###-### AWG #in-lb (###Nm)

CONNECT TO ABB #ACH550-UH-MOTORS WIRED DIRECT TO VFD'S REFER TO DRIVE NAMEPLATE FOR DRIVE OUTPUT RATINGS (BY OTHERS)

---

**NETWORK MONITOR CONNECTION**

PLC1- PORT 3 REMOVABLE SCREW TERMINAL

PLC1 PORT3 MODBUS PORT FOR REMOTE MONITOR

RS485 2 WIRE DEFAULT=9600,8,N,2 ADDR 5

SEE MANUAL FOR ADDRESS TABLE.

---

**REPLACEMENT FUSE INFORMATION**

| MAIN DISCONNECT FUSES: MF1-MF3 | A | LITTLE FUSE TYPE "JTD" OR EQUAL |
| VARIABLE SPEED FUSES: FU1 - FU6 | A | LITTLE FUSE TYPE "JLS" OR EQUAL |
| TRANSFORMER PRIMARY: XF1-XF2 | 1.5A | LITTLE FUSE TYPE "KLD" OR EQUAL |
| TRANSFORMER SECONDARY: XF3 | 1.5A | LITTLE FUSE TYPE "FLM" OR EQUAL |

---

**WARNING! Risk of Fire or Electric Shock.**

The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. All current-carrying parts and other components protected by this device should be examined and replaced if damaged. If burnout of a current element of an overload relay occurs, the complete overload relay must be replaced.
PILOT DEVICES ON 3" GRID UNLESS OTHERWISE NOTED

SILENCE

PB1 AA

CLASS J 60AMP CLASS J 60AMP CLASS J 60AMP

4" MINIMUM BENDING SPACE

MAIN DISCONNECT

SUCTION PRESSURE SYSTEM

FU1 FU2 FU3 FU4 FU5 FU6

TB2

PSP1

T1 XF2 XF1 XF3 DS1

PT2 PT1

GROUND

VFD#1 VFD#2

CO-02DR-D CLICK Koyo PWR RUN ERR RUN STOP PORT1 TX1 RX1 PORT2 TX2 RX2 PORT3 TX3 RX3 RS-485 + - LG

COLOR TOUCH SCREEN

FIELD CONNECTION DIAGRAM LOCATION (INSIDE PANEL)

WARNING

KEEP A 36" AREA CLEAR IN FRONT OF THIS PANEL PER OSHA AND NEC REGULATIONS

DISCONNECT ALL POWER SOURCES PRIOR TO SERVICING PANEL SERVICE SHOULD BE ONLY BY QUALIFIED PERSONNEL DO NOT OPERATE THIS SYSTEM WITHOUT WATER

MAXIMUM SIZE DRIVES FOR THIS ENCLOSURE SIZE 208-240 / 460 VOLT

ABB550 SERIES DRIVES UP TO -031A-2 / 038A-4

VQV2_VOLT_AMP

VQV2_CLICK_V2.0

CONTROLS INC
MARIETTA, GEORGIA 30066

UL LISTED

508A FILE#E237818

03/05/2013 REV: 0 PAGE: 4 OF 4
ACH550 Product Overview

Description
The ACH550 series is a microprocessor based Pulse Width Modulated (PWM) adjustable speed AC drive. The ACH550 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for a wide range of HVAC applications.

With drives ranging from 1 to 550 HP, the ACH550 series features a universal full graphic interface that “speaks” to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis. The ACH550 is also programmable in fourteen other languages.

Each ACH550 drive comes equipped with an extensive library of pre-programmed HVAC application macros which, at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for specific HVAC applications to maximize convenience and minimize start-up time. The ACH550 series can handle the most demanding commercial applications in an efficient, dependable, and economic manner.
**ACH550 Standard Features**

- UL, cUL labeled and CE marked
- EMI/RFI Filter (1st Environment, Restricted Distribution)
- Start-Up Assistants
- Maintenance Assistants
- Diagnostic Assistants
- Real Time Clock
  - Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Full Graphic and Multilingual Display for Operator Control, Parameter Set-Up and Operating
- Data Display:
  - Output Frequency (Hz)
  - Speed (RPM)
  - Motor Current
  - Calculated % Motor Torque
  - Calculated Motor Power (kW)
  - DC Bus Voltage
  - Output Voltage
  - Heatsink Temperature
  - Elapsed Time Meter (reset-able)
  - KWh (reset-able)
  - Input / Output Terminal Monitor
- PID Actual Value (Feedback) & Error
- Fault Text
- Warning Text
- Three (3) Scalable Process Variable Displays
- User Definable Engineering Units
- Two (2) Programmable Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Up to six (6) Programmable Relay Outputs (Three (3) Standard)
- Adjustable Filters on Analog Inputs and Outputs
- Mathematical Functions on Analog Reference Signals
- All Control Inputs Isolated from Ground and Power
- Four (4) Resident Serial Communication Protocols
  - Johnson Controls N2
  - Siemens Building Technologies FLN (P1)
  - Modbus RTU
  - BAConet (MS/TP)
- Input Speed Signals
  - Current 0 (4) to 20 mA
  - Voltage 0 (2) to 10 VDC
  - Increase/Decrease Reference Contacts (Floating Point)
  - Serial Communications
- Start/Stop
  - 2 Wire (Dry Contact Closure)
  - 3 Wire (Momentary Contact)
  - Application of Input Power
  - Application of Reference Signal (PID Sleep/Wake-Up)
- Serial Communications
- Start Functions
  - Ramp
  - Flying Start
  - Premagnetization on Start
  - Automatic Torque Boost
  - Automatic Torque Boost with Flying Start
  - Auto Restart (Reset) – Customer Selectable and Adjustable
- Stop Functions
  - Ramp or Coast to Stop
  - Emergency Stop
  - DC Braking / Hold at Stop
  - Flux Braking
  - Accel/Decel
    - Two (2) sets of Independently Ramps
    - Linear or Adjustable ‘S’ Curve Accel/Decel Ramps
  - HVAC Specific Application Macros
  - Separate Safeties (2) and Run Permissive Inputs
  - Damper Control
  - Override Input (Fire Mode)
  - Timer Functions
    - Four (4) Daily Start/Stop Time Periods
    - Four (4) Weekly Start/Stop Time Periods
    - Four Timers for Collecting Time Periods and Overrides
  - Seven (7) Preset Speeds
  - Supervision Functions
  - Adjustable Current Limit
  - Electronic Reverse
  - Automatic Extended Power Loss Ride Through (Selectable)
  - Programmable Maximum Frequency to 500 Hz
  - PID Control
    - Two (2) Integral Independent Programmable PID Setpoint Controllers (Process and External)
    - External Selection between Two (2) Sets of Process
  - PID Controller Parameters
  - PID Sleep/Wake-Up
  - Motor Control Features
    - Scalar (V/Hz) and Vector Modes of Motor Control
    - V/Hz Shapes
      - Linear
      - Squared
    - Energy Optimization
    - IR Compensation
    - Slip Compensation
    - Three (3) Critical Frequency Lockout Bands
  - Preprogrammed Protection Circuits
    - Overcurrent
    - Short Circuit
    - Ground Fault
    - Overvoltage
    - Undervoltage
    - Input Phase Loss
    - Output Device (IGBT) Overtemperature
    - Adjustable Current Limit Regulator
    - UL508C approved Electronic Motor Overload (I^2T)
  - Programmable Fault Functions for Protection Include
    - Loss of Analog Input
    - Panel Loss
    - External Fault
    - Motor Thermal Protection
    - Stall
    - Underload
    - Motor Phase Loss
    - Ground Fault
  - 5% Input Impedance
    - Equivalent 5% Impedance with Internal Reactor(s)
  - Patented Swinging Choke Design for Superior Harmonic Mitigation (R1 to R4)
**ACH550 Specifications**

**Input Connection**

- Input Voltage ($U_1$): 208/220/230/240 VAC 3-phase +/-10%
- Frequency: 48 - 63 Hz
- Line Limitations: Max +/-3% of nominal phase to phase input voltage
- Fundamental Power Factor ($\cos \phi$): 0.98 at nominal load

**Output (Motor) Connection**

- Output Voltage: 0 to $U_1$, 3-phase symmetrical, $U_2$ at the field weakening point
- Output Frequency: -500 to 500 Hz
- Frequency Resolution: 0.01 Hz
- Continuous Output Current: 1.0 * $I_{IN}$ (Nominal rated output current, Variable Torque)
- Short Term Overload Capacity: 1.1 * $I_{IN}$, (1 min/10 min)
- Peak Overload Capacity: 1.35 * $I_{IN}$, (2 sec/1 min)

**Base Motor Frequency Range:** 10 to 500 Hz

**Switching Frequency:** 1, 4, 8 or 12 kHz

**Acceleration Time:** 0.1 to 1800 s

**Deceleration Time:** 0.1 to 1800 s

**Efficiency:** 0.98 at nominal power level

**Short Circuit Withstand Rating:** 100,000 AIC (UL) w/o fuses

**Connection:** $U_1$, $V_1$, $W_1$ ($U_2$, $V_2$, $W_2$)

**Enclosure**

- Style: UL (NEMA Type 1, Type 12, or Type 3R)
- Agency Approval: UL Plenum Rated Type 1, Type 12

**Listing and Compliance:** UL, cUL, CE

**Ambient Conditions, Operation**

- Air Temperature: 0° to 40°C (32° to 104°F), above 40°C the maximum output current is de-rated 1% for every additional 1°C (up to 50°C (122°F)) maximum limit.
- Relative Humidity: 5 to 95%, no condensation allowed, maximum relative humidity is 60% in the presence of corrosive gasses
- Contamination Levels:
  - IEC: 60721-3-1, 60721-3-2 and 60721-3-3
  - Chemical Gasses: 3C1 and 3C2
  - Solid Particles: 3S2
- Installation Site Altitude: 0 to 1000 m (3300 ft) above sea level. At sites over 1000 m (3300 ft) above sea level, the maximum power is de-rated 1% for every additional 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or representative for further information
- Vibration: Maximum 3.0 mm (0.12 in) to 2 Hz, Max 10 m/s² (33 ft/s²) 9 to 200 Hz sinusoidal

**Ambient Conditions, Storage (in Protective Shipping Package)**

- Air Temperature: 40° to 70°C (-40° to 158°F)
- Relative Humidity: Less than 95%, no condensation allowed
- Vibration Tested to (IEC 60068-2-6): In accordance with ISTA 1A and 1B specifications
- Bump Tested to (IEC 60068-2-29): Max 100 m/s² (330 ft/s²) 11 ms (Tested 500 times each axis, each pole; 3000 times total)

**Ambient Conditions, Transportation (in Protective Shipping Package)**

- Air Temperature: 40° to 70°C (-40° to 158°F)
- Relative Humidity: Less than 95%, no condensation allowed
- Atmospheric Pressure: 60 to 106 kPa (8.7 to 15.4 PSI)
- Vibration Tested to (IEC 60068-2-6): Max 3.0 mm (0.14 in) to 2 Hz, Max 15 m/s² (49 ft/s²) 9 to 200 Hz sinusoidal
- Bump Tested to (IEC 60068-2-29): Max 100 m/s² (330 ft/s²) 11 ms (Tested 500 times each axis, each pole; 3000 times total)

**Shock Tested to (IEC 60068-2-27)**

- R1: 76 cm (30 in)
- R2: 61 cm (24 in)
- R3: 46 cm (18 in)
- R4: 31 cm (12 in)
- R5 & 6: 25 cm (10 in)
**ACH550 Specifications (continued)**

### Cooling Information
- **Cooling Method:** Integral fan(s)
- **Power Loss:** Approximately 3% of rated power

### Analog Inputs
- **Quantity:** Two (2) programmable
- **Voltage Reference:** 0 (2) to 10 V, 250kOhm, single ended
- **Current Reference:** 0 (4) to 20 mA, 100Ohm, single ended
- **Potentiometer:** 10 VDC, 10 mA (1K to 10kOhms)
- **Input Updating Time:** 8 ms
- **Terminal Block Size:** 2.3mm² / 14AWG

### Reference Power Supply
- **Reference Voltage:** +10 VDC, 1% at 25°C (77°F)
- **Maximum Load:** 10 mA
- **Applicable Potentiometer:** 1 kOhm to 10 kOhm
- **Terminal Block Size:** 2.3mm² / 14AWG

### Analog Outputs
- **Quantity:** Two (2) programmable current outputs
- **Signal Level:** 0 (4) to 20 mA
- **Accuracy:** +/- 1% full scale range at 25°C (77°F)
- **Maximum Load Impedance:** 500 Ohms
- **Output Updating Time:** 2 ms
- **Terminal Block Size:** 2.3mm² / 14AWG

### Digital Inputs
- **Quantity:** Six (6) programmable digital inputs
- **Isolation:** Isolated as one group
- **Signal Level:** 24 VDC, (10V Logic 0)
- **Input Current:** 15 mA at 24 VDC
- **Input Updating Time:** 4 ms
- **Terminal Block Size:** 2.3mm² / 14AWG

### Internal Power Supply
- **Primary Use:** Internal supply for digital inputs
- **Voltage:** +24 VDC, max 250 mA
- **Maximum Current:** 250 mA
- **Protection:** Short circuit protected

### Relay Outputs
- **Quantity:** Three (3) programmable relay (Form C) outputs
- **Switching Capacity:** 8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
- **Max Continuous Current:** 2A RMS
- **Contact Material:** Silver Cadmium Oxide (AgCdO)
- **Isolation Test Voltage:** 4 kVAC, 1 minute
- **Output Updating Time:** 12 ms
- **Terminal Block Size:** 2.3mm² / 14AWG

### Protections
- **Single Phase:** Protected (input & output)
- **Overcurrent Trip Limit:** 3.5 x I²n instantaneous
- **Adjustable Current Regulation Limit:** 1.1 x I²n (RMS) max.
- **Overvoltage Trip Limit:** 1.30 x U
- **Undervoltage Trip Limit:** 0.65 x U
- **Overtemperature (Heatsink):** +115°C (+239°F)
- **Auxiliary Voltage:** Short Circuit Protected
- **Ground Fault:** Protected
- **Short Circuit:** Protected
- **Microprocessor fault:** Protected
- **Motor Stall Protection:** Protected
- **Motor Overtemperature Protection (I²t):** Protected
- **Input Power Loss of Phase:** Protected
- **Loss of Reference:** Protected
- **Short Circuit Current Rating:** 100,000 RMS symmetrical Amperes
- **Input Line Impedance:** Swinging choke 5% equivalent R1-R6, 3% equivalent R8

\[ U_1 = \text{Input Voltage} \quad U_n = \text{Nominal Motor Voltage} \]
\[ U_2 = \text{Output Voltage} \quad f_n = \text{Nominal Motor Frequency} \]
\[ P_n = \text{Power – Normal Duty (HP)} \quad I_{2n} = \text{Nominal Motor Current – Normal Duty} \]

Specifications are subject to change without notice. Please consult the factory when specifications are critical.