



## **MANUAL (OPS)**

# **VARIABLE SPEED DRIVE PANEL OPERATION MANUAL**



revision v1.4

## REVISION LIST

| REV  | DATE     | AUTHOR | COMMENT                    |
|------|----------|--------|----------------------------|
| V1.0 | 17/8/17  | ZEK    | INITIAL DRAFT FOR APPROVAL |
| V1.1 | 9/12/17  | ZEK    | ADDED 3-VSD                |
| V1.2 | 7/3/18   | ZEK    | ADDED HMI OPTION           |
| V1.3 | 10/11/18 | KAH    | SPELLCHECK                 |
| V1.4 | 16/11/18 | KAH    | ADDED SENSOR WIRING DIAG.  |
|      |          |        |                            |
|      |          |        |                            |
|      |          |        |                            |

## COMPATIBILITY LIST

| NAME               | TYPE | REMARK  |
|--------------------|------|---|
| CONTROL PANEL TYPE | CP   | 1-VSD, 2-VSD, 3-VSD   |
| VSD TYPE           | VSD  | ATV-12, ATV3xx, ATV6xx, ATV9xx, VFD-L, VFD-E, VFD-EL, VFD-C2000 |
| HMI TYPE           | HMI  | HMI-GXU, HMI-GTO  |
| CONTROL TYPE       | XXX  | n, n+1, 2n+1, 3n+1  |
| SENSOR TYPE        | SENS | 0...10bar, 0...40bar @ 4...20mA                                 |
|                    |      |   |
|                    |      |   |
|                    |      |   |
|                    |      |   |
|                    |      |   |

## DISCLAIMER

- Emax Control does not warrant that the hardware will work properly in all environments and applications, and make no warranty and representation, either implied or expressed, with respect to the quality, performance, merchantability, or fitness for a particular purpose.
- Emax Control has made every effort to ensure that this Manual is accurate; Emax Control disclaims liability for any inaccuracies or omissions that may have occurred.
- Information in this Manual is subject to change without notice and does not represent a commitment on the part of Emax Control. Emax Control assumes no responsibility for any inaccuracies that may be contained in this Manual. Emax Control makes no commitment to update or keep current the information in this Manual, and reserves the right to make improvements to this Manual and/or to the products described in this Manual, at any time without notice.
- If you find information in this manual that is incorrect, misleading or incomplete, we would appreciate your comments and suggestions.
- For more information, visit <https://www.emaxcontrol.com>

## INTRODUCTION & CONTROL PHILOSOPHY

Thank you for your purchase of our VSD control panels. It has been designed for maximum performance as well as excellent system response in all situations.

Control philosophy differs greatly across panels with different amount of VSD installed. The summary of various VSDs are listed as follows;

### Single VSD Panel (1 VSD)

- Suitable for household, irrigation or general purpose usage, this panel is simple and cost effective.
- Start/Stop via pushbutton or upon power up .
- Ramp to max speed or PID upon request.
- If the frequency falls below 40Hz (sleep frequency), VSD will enter sleep mode in which if the frequency is still below sleep frequency after 1 minute, VSD will ramp to zero Hz.

### Twin VSD Panel (2 VSD)

- Suitable for booster/transfer applications, where 1 running and 1 standby configuration is preferred.
- At any time, one VSD will be master and the other VSD stays in standby mode.
- Master VSD switches duty with Slave VSD once every hour (configurable up to once per day).
- Slave VSD kicks in if Master VSD trips or fails.
- Master VSD ramps to max speed or PID upon request.
- If the frequency falls below 40Hz (sleep frequency), VSD will enter sleep mode in which if the frequency is still below sleep frequency after 1 minute, VSD will ramp to zero Hz.

### Triple VSD Panel (3 VSD) & beyond

- Suitable for booster/transfer applications, where 2 running and 1 standby configuration is preferred.
- At any time, one VSD will be master, one VSD will be slave and the other VSD stays in standby mode.
- All VSD (Master/Slave/Standby) switches duty once every hour (configurable up to once per day).
- Standby VSD kicks in if any Master or Slave VSD trips or fails.
- Master VSD ramps to max speed or PID upon request. Slave VSD matches the Master VSD frequency at all times (minus 2 Hz). For Example, if Master VSD is running at 45Hz, Slave will run at 43Hz.
- If the frequency falls below 40Hz (sleep frequency), VSD will enter sleep mode in which if the frequency is still below sleep frequency after 1 minute, VSD will ramp to zero Hz.

### Jockey+Duty Pump Panel

- Jockey pump will run first upon starting up. Depending on operation setpoint, Jockey pump will modulate its speed depending on demand.
- When Jockey pump is running in full speed for more than 60 seconds (which indicates demand is higher than Jockey capacity), Jockey pump shuts down and Duty pumps take over.
- Duty pump kicks in and start to run and modulate according to demand. When demand drops below 40hz for longer than 60 seconds, Duty pump shuts down and re-enable Jockey pump.
- Jockey pump resumes its sequence.

***Note: All VSDs in all modes (except Manual) are fully modulating while they are in operation. This prevents any pump from being "dead-heading".***

## FIRST POWER UP & OPERATION



**WARNING! ENSURE BASIC ELECTRICAL PROTECTION AND SAFETY PROCEDURES ARE FOLLOWED. SERIOUS INJURY OR DEATH MAY OCCUR!**

Before energizing the panel, these following points must be measured to check against short circuit:

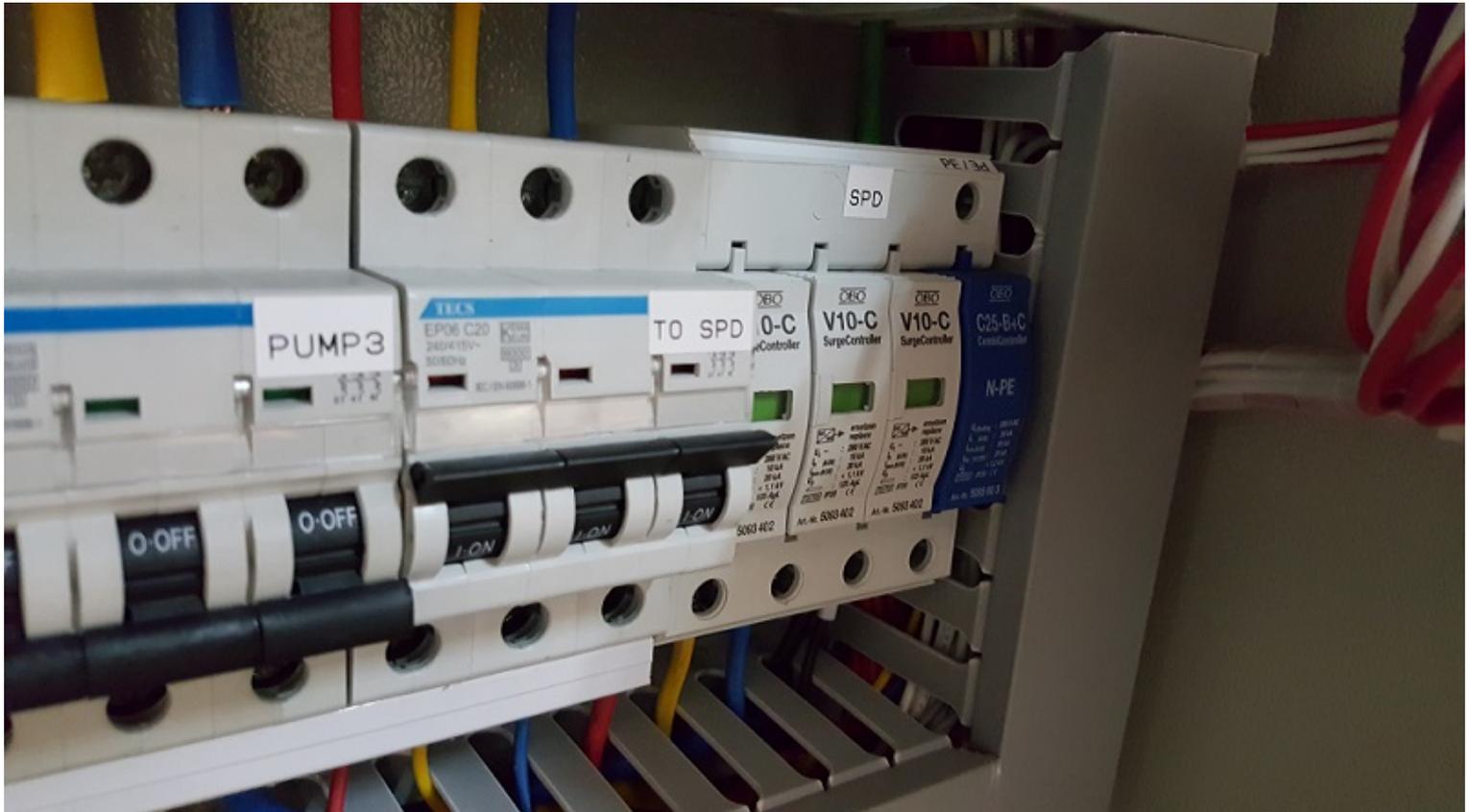
1. VSD input terminals
2. VSD output terminals
3. Input/Output terminals of all MCB/MCCB

Verify that all cables are tightened and securely fastened. Panel interior shall be relatively clean and free from dust or liquid.

Set AOM selector switch to O.

Turn off all MCB/MCCB, unplug all fuses and disconnect all incoming power cables/motor cables.

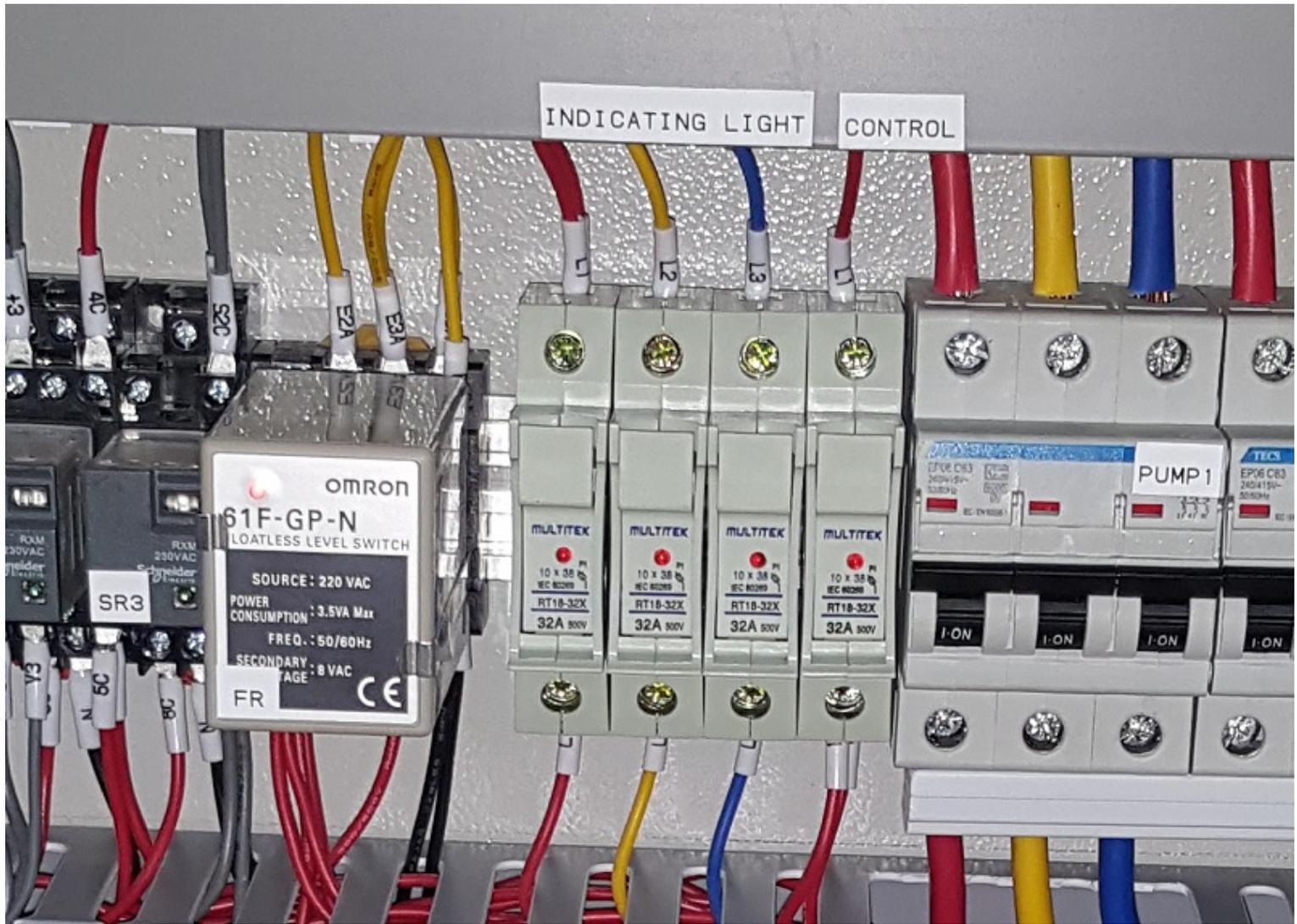
Turn on MCB labelled 'To SPD' beside the surge protector. Verify all 3 phases of the surge protector is green (refer to following image). Do not proceed if the indicator strip is red.



With the incoming MCB still OFF, connect the incoming power cables, neutral and earth. Measure and ensure that the incoming voltages are stable and falls within the nominal range. Measure phase-to-phase and phase to neutral to ensure normal condition. Nominal values are expected at 415v for phase-to-phase and 220v for phase-to-neutral.

With all other MCB OFF (except SPD), carefully turn ON the incoming MCB. Observe the SPD and if SPD switches from green to red then immediately disconnect the main incoming supply and contact your representative.

Energize control Fuses for Indicating light. Observe the incoming pilot lights light up in their respective phases. Location of Fuses are shown below;



Next, energize the fuse labelled as Control. Observe that the Trip pilot light is lit up. This is because VSDs are not powered up yet and the system treats this situation as Trip.

Energize MCB labelled as PUMP 1. After a few seconds, the Trip pilot light goes off as VSD completed its starting procedures. Repeat this step for all VSDs.

At this stage it is a good idea to verify the motor rotation. Connect all motor cables to their respective power terminals. All motors must be grounded for safety.

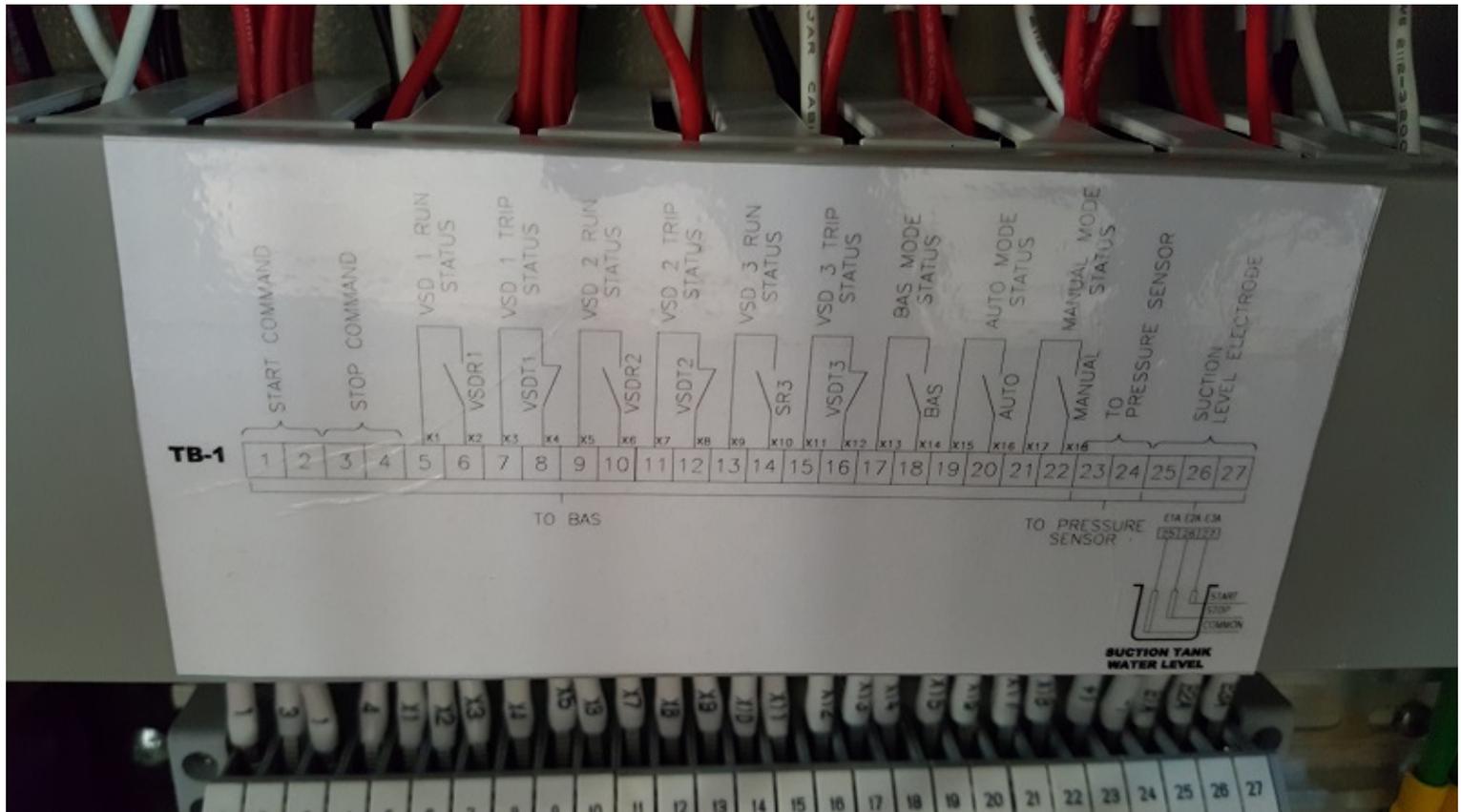
For panels equipped with suction electrode floatless relay for dry run protection, the pin diagram is as follows;

1. Terminal no 25: Common
2. Terminal no 26: "Long electrode" (VSD will stop if water falls below this level)
3. Terminal no 27: "Short electrode" (VSD will resume if water rises above this level)



**WARNING! FLOATLESS RELAYS CAN BE CONFIGURED AS EITHER START/STOP COMMAND TO FILL/EMPTY A TANK OR AS DRY RUN PROTECTION. IF YOU ARE UNSURE, CONTACT YOUR LOCAL REPRESENTATIVE**

If suction electrode has not been installed at this point, they can be bypassed by shorting terminals 25, 26 and 27 as per diagram below:



Flip the AOM selector switch to Manual.



**WARNING! ENSURE IT IS SAFE TO OPERATE MOTOR FROM THIS POINT ONWARDS!**

Press the Start pushbutton for approximately a few seconds and then Stop. Check motor direction and if motor is reversed, switch any 2 phases of the motor terminals.

Once rotation of the motor is verified, press the Start pushbutton. Observe the motor ramps up to full speed. Observe the Green pilot light is lit up and the panel ventilation fan turns on.

Repeat for all VSDs inside the panel.

## CONNECTING THE PRESSURE TRANSMITTER

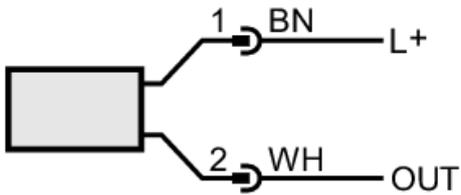
The control panel is designed for 24vdc 0...10bar 4..20mA pressure sensor by default. Other sensors ranges are available upon request.

Sensor cables should be terminate as follows:

1. To Pressure Transmitter (X): Supply voltage (24vdc)
2. To Pressure Transmitter (X+1): Sensing terminal (4...20mA)

Note: The terminal numbers connected to the pressure transmitter are not always the same. In all cases, the lower terminal number represent the voltage, and the higher terminal number represent the signal.

If you are using the default sensor (Model PT54xx and EVCxx), the terminal and signal cable colour are as follows:



1. To Pressure Transmitter (X): **BROWN** Supply voltage (24vdc)
2. To Pressure Transmitter (X+1): **WHITE** Sensing terminal (4...20mA)



**WARNING! INCORRECT TERMINATION MAY DAMAGE THE SENSOR OR VSD!  
IF UNSURE, CONTACT YOUR REPRESENTATIVE!**

## CONTROL PANEL OPERATION MODES

The control panel can operate up to 4 modes depending on configuration. Modes can be changed via the AOM selector switch. The AOM is mounted inside the control panel to prevent accidental operations or sabotage.

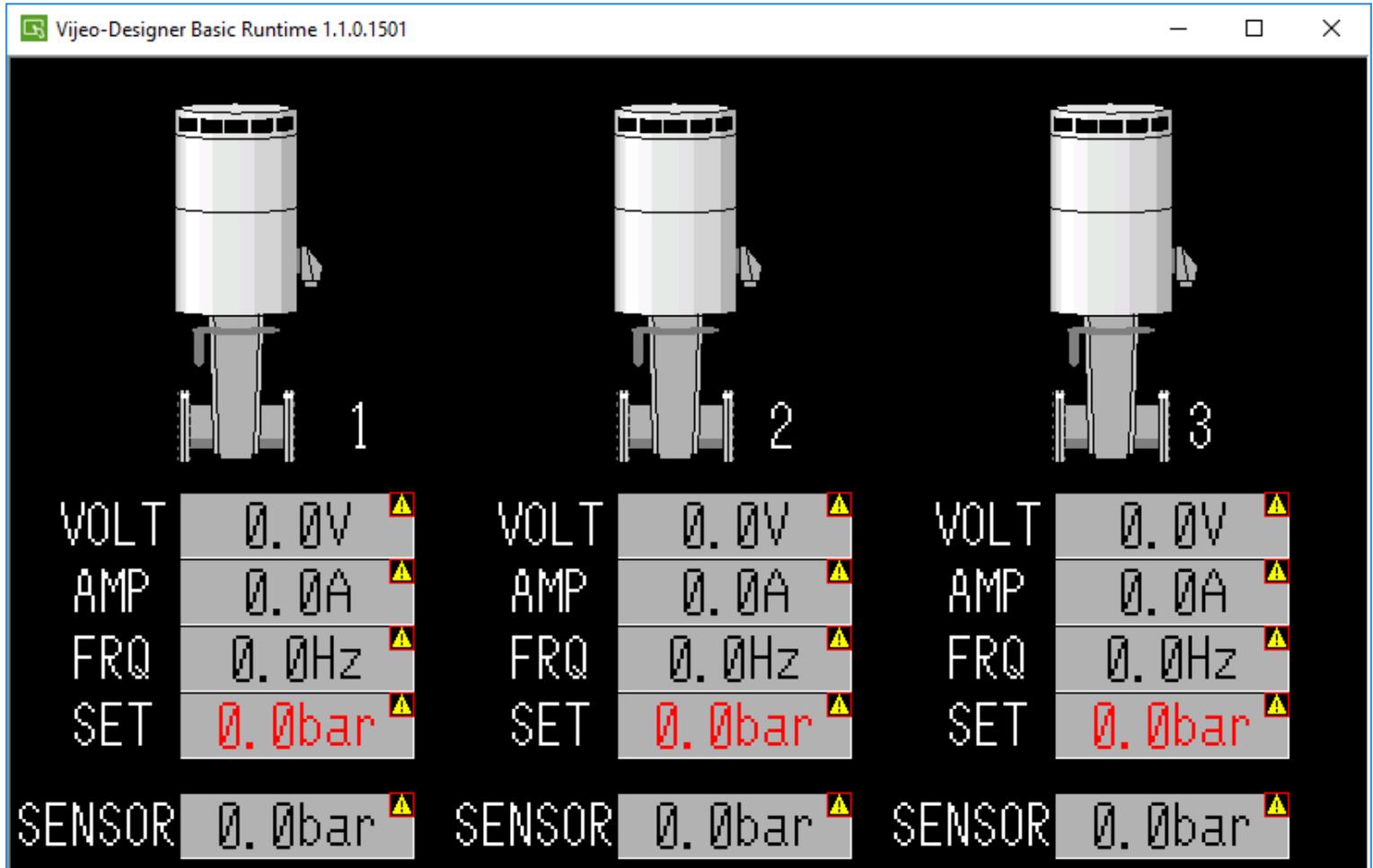


The AOM provides 4 possible modes:

1. OFF: All control signals are OFF. All pushbuttons are not responsive and all VSDs are stopped.
2. AUTO: VSD will receive a RUN command if:
  1. Timer indicates this particular VSD is on duty.
  2. Floatless relay indicates dry run protection is OK.
  3. VSD is not in TRIP status.
3. MANUAL: VSD will receive a RUN command if:
  1. Floatless relay indicates dry run protection is OK.
  2. VSD is not in TRIP status.
  3. Start pushbutton is pressed.
4. BAS (Building Automation System): VSD will receive a RUN command if:
  1. Floatless relay indicates dry run protection is OK.
  2. VSD is not in TRIP status.
  3. A rising edge 24vdc is detected across terminal 1 and 2.
  4. VSD will stop when a rising edge 24vdc is detected across terminal 3 and 4.
  5. For BAS systems utilizing a latching style signal, short terminal 3 and 4 using a jumper wire.

## HUMAN MACHINE INTERFACE (HMI)

A HMI provides an easy way to adjust setpoint as well as displaying VSD parameters in an easy-to-read fashion. The default HMI screen is shown below:



Note: This image might be different according to different specifications.

Upon starting up after a power disconnect, the default Setpoint is 5.0 bar. It is necessary to adjust this setpoint each time power loss occurs. For maximum flexibility, each pump has its own setpoint to meet different demands.

To adjust the setpoint, simply tap on the setpoint box. A keypad will pop out and the desired value can be input and saved.

Only the Master VSD will output sensor value. All other Slave/Standby VSD will show 0.0bar because only the Master VSD is connected to the sensor at one time. As Master duty rotates between the VSDs, the sensor values will rotate accordingly.



[www.emaxcontrol.com](http://www.emaxcontrol.com)