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# START-UP PROCEDURE

# FOR THE VG5

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# Start-Up Procedure for the VG5

The following procedure is to assist in the start-up of the VG5 inverter by providing a step by step guide to installation, programming and basic operation of the VG5 inverter. The procedure is based on several common configurations used in the industry. For more detailed configurations and applIcations, refer to the VG5 Technical Manual (Part # 027-2040) available at www.saftronics.com.

## Installation

1. Verify that the input voltage of the supply, motor and the drive model number are all marked with the same voltage. Caution: If improper voltage is applied to the inverter, severe damage will result.

2. Mount the inverter on a vertical surface with adequate space for proper air circulation (minimum 1.18 inches on each side and 4.72 inches above and below; Instruction Manual Page 19).

3. Remove the front cover, connect conduit to the bottom plate, and connect power and ground wires to the correct terminals. Caution: Connect correct input voltage to terminal L1, L2, and L3. Connect Motor to terminals T1, T2 and T3 only or severe damage will result.

4. Replace the cover and apply voltage to the inverter. The keypad will display “Frequency Ref. U1- 01=0.00Hz”; *Drive, SEQ, REF* & *Stop* LED’s should be illuminated on the keypad. Pressing the Local/Remote key will turn off the *SEQ* and *REF* LED’s and put the inverter into local control (keypad control). By pressing the JOG key you can check the rotation on the motor. If the rotation is incorrect, remove power from the inverter, wait for the *Charge* LED to go, then swap motor leads T1 and T2, and then repeat step 4 to verify the rotation is correct on the application.

5. Keypad - Parameters that start with “A” (example A1-03) are found under the “Initialize” group under the Menu key. The parameters B-L are found under the “Programming” group under the Menu key. Before the drive will accept a RUN command, the *DRIVE* LED must be illuminated. Press the MENU key, then the DATA/ENTER key to turn on the *DRIVE* LED . For additional programming instructions on the keypad, see the VG5 Technical Manual part # 027-2040 or download a copy from our website, www.saftronics.com.

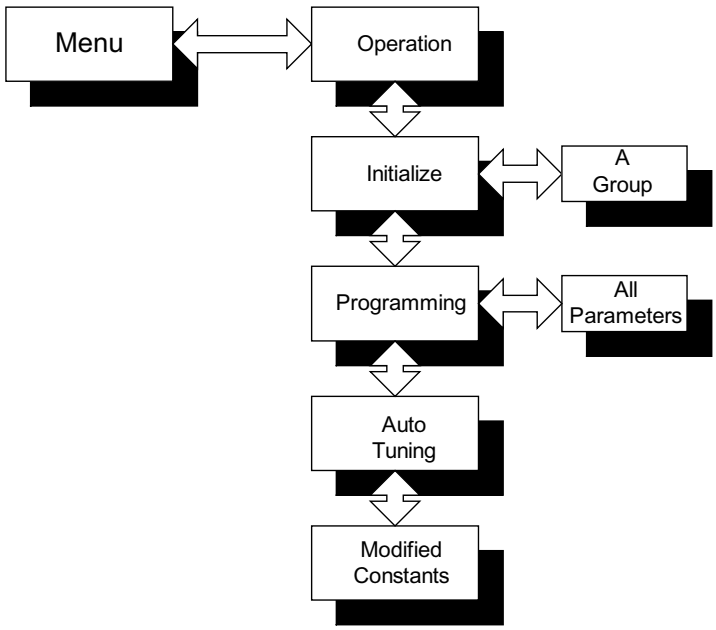



**Fig. 1 VG5 Parameter Tree**

6. Choose a Configuration from the table below, each example listed below contains a control wiring diagram, operation explanation, and all the necessary programming (associated with that mode). The VG5 can be controlled in several more modes than explained in the start-up guide. The following configu rations are generally considered the most commonly used in the field. For a more complete explanation, please refer to the VG5 Technical Manual part # 027-2040 or download a copy from our website, ww.w.saftronics.com.

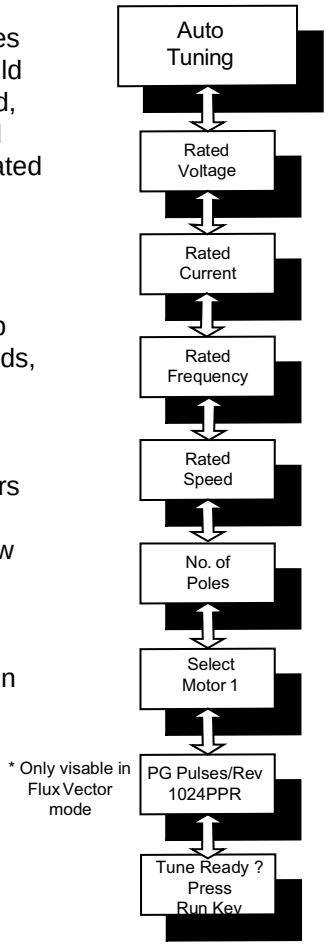
## Inverter Configuration Examples

| Sequence (Start/Stop) | Reference (Speed Changes) | Description | Example Page |
|---|---|---|---|
| Keypad | Keypad | No Control wiring need used to perform inital start-up and check rotation of the motor. | Example 1 Page 3 |
| 2-wire | Keypad | Start/Stop via the remote contact (PLC), speed changes via the keypad . | Example 2 Page 4 |
| 3-wire | Keypad | Start/Stop via the remote pushbuttons, speed changes via the keypad. | Example 3 Page 5 |
| 2-wire | 4 to 20mA | Start/Stop and Speed changes from a remote source such as a PLC. | Example 4 Page 6 |
| 3-wire | 0 to 10Vdc (Speed Pot.) | Start/Stop via the remote pushbuttons, speed changes via a remote speed pot. or external source (0 to10Vdc). | Example 5 Page 7 |
| 2-wire | Contact Closures | Start/Stop via the remote contact (PLC) and speed changes via present speeds or analog reference. | Example 6 Page 9 |

7. Control Terminal Wiring - Remove power and wait until the *Charge* LED goes out, before making control connections. The size of the control wiring should be between 16AWG and 20AWG wire. All control wiring should be shielded, with the shield grounded to the inverter's chassis ground and the other end left unconnected. All the control wiring terminates on the terminal strip located on the control card (the card that plugs into the keypad).

8. Control Method - The VG5 is capable of running in four different control methods (V/F, V/F Closed loop, Open Loop Vector and Flux Vector). To simplify the start-up document, this document is written around Open Loop vector control method. For a complete explanation of all four control methods, please refer to VG5 Technical Manual part # 027-2040 or download a copy from our website, www.saftronics.com.

9. Auto-Tuning of the Motor - The inverter automatically sets all the parameters associated with the motor characteristics. The autotune will increase the performance of the inverter by increasing speed regulation and torque at low speed range. To access the auto-tune function refer to the parameter tree, Fig. 1 and then input the required info from the motor's nameplate (Motor rated voltage, FLA, Frequency, RPM and Number of Poles). The auto-tune procedure will take approximately 2 minutes to complete and motor will run to 80% speed.




***Note:*** *The Auto-tune must be performed with no load on the shaft of the motor.*

## Example 1: Start/Stop & Speed Changes via Keypad (Out of Box)

When the inverter is set up with the sequence (start/stop) and the reference (speed changes) via the keypad, that is considered local mode. Local mode is generally used during initial start up or to check the rotationof the motor. The inverter can be easily put in into local mode by pressing the LO/RE key. When the inverter is in local mode the *SEQ* and *REF* LED's are not illuminated on the keypad. If power is removed and then restored, the inverter will come up in remote mode (*SEQ* and *REF* LED's are illuminated).

***Note:*** *The inverter can be placed in local mode by changing the programming (B1-01 and B1-02). For a more detailed explanation, refer to the instruction manual (Page 48 part # 027-2007F).*

## Operation

The frequency ref. (speed change) is programmed into parameter U1-01 (Frequency Ref.).

The inverter can be started by pressing the RUN key on the keypad.

The inverter can be stopped by pressing the STOP key on the keypad.

The direction of the motor can be changed, regardless of the motor speed, by pressing the FWD/REV key on the keypad.

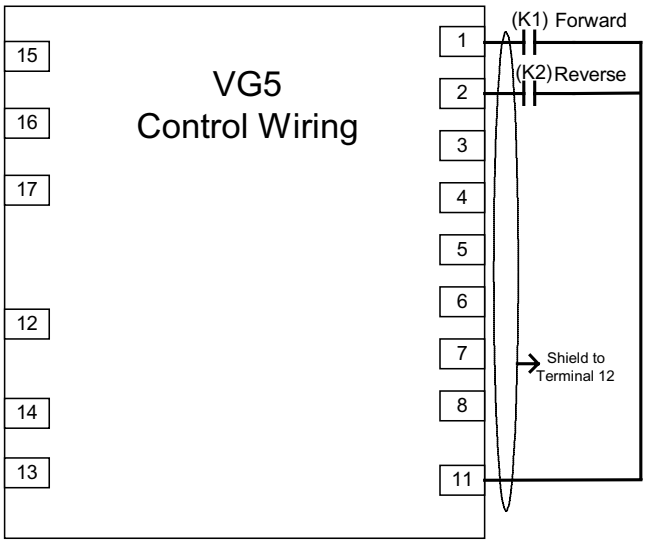
Pressing the JOG key will cause the motor to run to the jog frequency (D1-09). Factory setting is 6 Hz. (Jog overrides Frequency Ref. U1-01).

### Table 1: Programming needed for Local Mode (Keypad control)

| Parameter | Display Text | Setting | Description |
|---|---|---|---|
| B1-01 | Reference Source Operator | 0 | Sets the frequency via the keypad . |
| B1-02 | Run Source Operator | 0 | Sets the start/stop via the keypad. |
| C1-01/02 | Accel /Decel Time | xx Sec. | Acceleration Time and Deceleration Time/ From stop to Full speed. |
| E2-01 | Motor Rated FLA E2-01 X.XA | Motor FLA | Sets the motor full load amps. Note: If auto tune was performed this value is set . |
| U1-01 | Frequency Ref U1-01=XX.Hz | User Setting | Sets the desired frequency reference (speed). Settable by pressing MENU, DATA/ENTER again. Use the ▲ and ▼ arrow keys to set the frequency and then press DATA/ENTER. |

***Note:*** *After the changes are made, the DRIVE, SEQ and STOP LED's will be lit.*

## Example 2: Remote Start/Stop (2-wire) & Speed Changes via Keypad




This configuration is used when the Start/Stop is via an external source such as a PLC or relay. It can also be used with a maintained switch when it is desirable to have the inverter restart on the return of power. It should not be used where safety of personnel might be threatened by the restart of the machine.

### Operation

Frequency reference (speed change) is programmed into parameter U1-01 ( see table 3 for details).

Close (K1) to run in the forward direction at the speed set in U1-01.

Close (K2) to run in the reverse direction at the speed set in U1-01.

When both relays (input) are closed, the inverter will display an EF (External Fault) error.

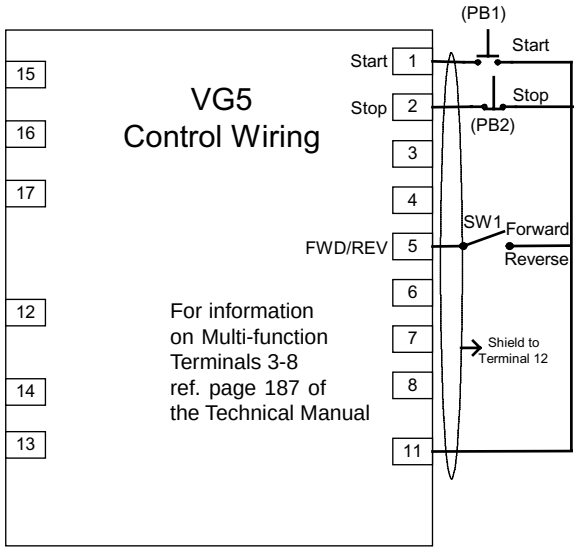
When the LOCAL/REMOTE key is pressed, the inverter will act as Example 1.

### Table 2: Programming needed for remote Start/Stop (2-wire) and Speed Changes via the Keypad

| Parameter | Display Text | Setting | Description |
|---|---|---|---|
| B1-01 | Reference Source Operator | 0 | Sets the frequency via the keypad . |
| B1-02 | Run Source Operator | 0 | Sets the start/stop via the keypad. |
| C1-01/02 | Accel /Decel Time | xx Sec. | Acceleration Time and Deceleration Time/ From stop to Full speed. |
| E2-01 | Motor Rated FLA E2-01 X.XA | Motor FLA | Sets the motor full load amps. Note: If auto tune was performed this value is set . |
| U1-01 | Frequency Ref U1-01=XX.Hz | User Setting | Sets the desired frequency reference (speed). Settable by pressing MENU, DATA/ENTER again. Use the up and down arrow keys to set the frequency and then press DATA/ENTER. |

***Note:*** *After the changes are made, the DRIVE, SEQ and STOP LED's will be lit.*

## Example 3: Remote Start/Stop (3-wire) & Speed changes via Keypad




This mode is commonly used when a inverter is replacing existing equipment such as an across the line starter and the application requires minimal to no speed changes.

### Operation

The frequency reference (speed change) is programmed into parameter U1-01.

By momentarily closing push-button (PB1), while push-button (PB2) is closed, the inverter will run up to the frequency reference set into U1-01.

By opening push-button (PB2) at any time, the inverter will stop.

When switch (SW1) is in the open position, the motor will run in the forward direction. If the switch (SW1) is closed, the motor will reverse direction.

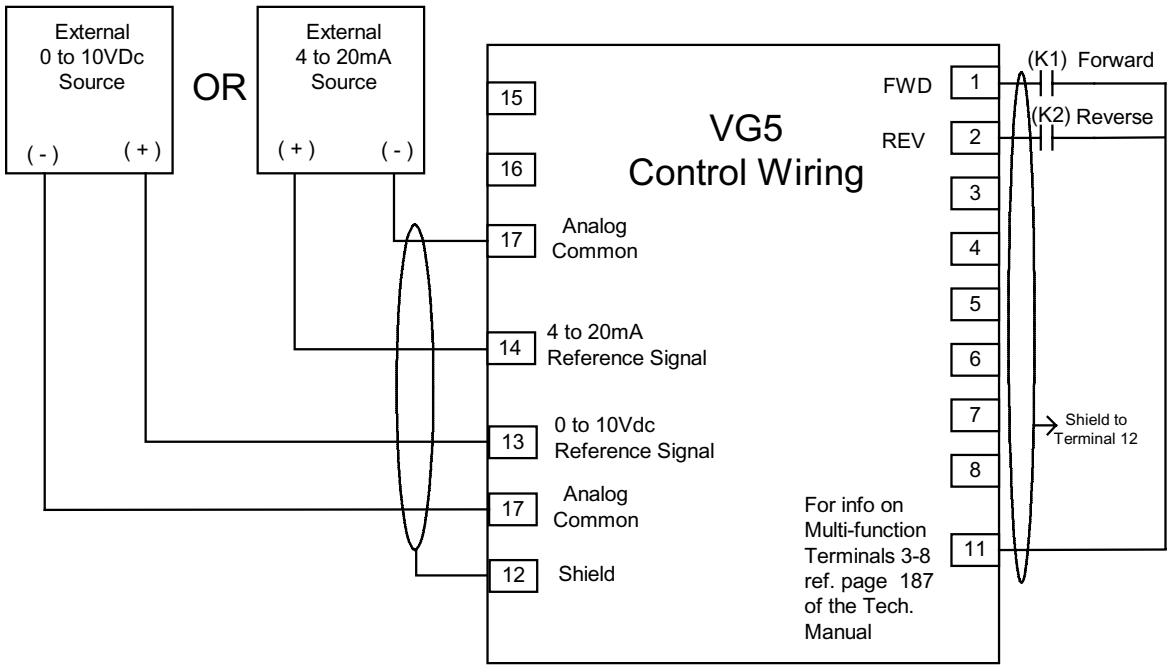
When the LOCAL/REMOTE key is pressed, the inverter will act as Example 1.

### Table 3: Programming Needed for Start/Stop (3-wire) and Speed Changes via the Keypad

| Parameter | Display Text | Setting | Description |
|---|---|---|---|
| A1-03 | Init Parameters<br>No initialize | 2220 | The parameter is found under "Initialize" menu (Ref. page 1 for Fig. 1)<br>CAUTION: *This parameter sets all parameters to their factory setting and all previous settings will be lost, including the auto-tune values.* |
| B1-01 | Reference<br>Source Operator | 0 | Sets the frequency (speed) via the keypad . |
| C1-01/02 | Accel /Decel<br>Time | xx<br>Sec. | Acceleration Time and Deceleration Time/<br>From stop to Full speed. |
| E2-01 | Motor Rated FLA<br>E2-01 X.XA | Motor<br>FLA | Sets the motor full load amps . |
| U1-01 | Frequency Ref<br>U1-01=XX.Hz | User<br>Setting | Sets the desired frequency reference (speed). Settable by pressing MENU, DATA/ENTER again. Use the UP and DOWN keys to set the frequency and then press DATA/ENTER. |

***Note:*** *After the changes are made, the DRIVE, SEQ and STOP LED's will be lit.*

## Example 4: Remote Start/Stop (2-wire) & Speed Changes via Remote Source




This configuration is used when the start & stop signals and the speed changes originate from a remote source such as a controller or PLC. It can also be used with a maintained switch, when it is desirable to have the drive restart on restoration of power. It should not be used where the safety of the attending personnel might be injured by the automatic restart of the motor.

### Operation

Close (K1) to run in the forward direction.

Close (K2) to run in the reverse direction.

When both relays are closed the inverter will fault on a External Fault and stop operation of the motor.

The frequency of the inverter will be proportional to the signal level on terminal 14 ( 4mA=0Hz. 12mA=30Hz & 20mA =60Hz.).

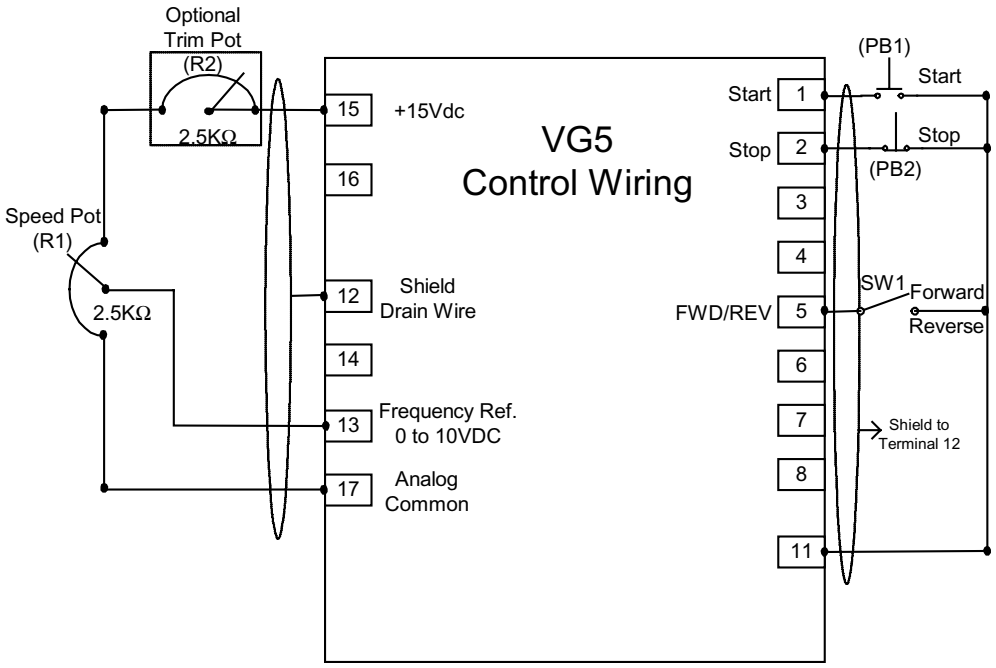
When the LOCAL/REMOTE key is pressed, the inverter will act as Example 1.

### Table 4: Programming needed for Remote Start/Stop (2-wire) with Speed Changes Remote Source

| Parameter | Display Text | Setting | Description |
|---|---|---|---|
| A1-03 | Init Parameters<br>No initialize | 2220 | The parameter is found under "Initialize" menu ( ref. page 1 for Fig.1)<br>CAUTION: *This parameter set all parameter to their factory setting and all previous setting will be lost including the auto tune values.* |
| C01/02 | Accel Time<br>Decel Time | xx.x Sec | Acceleration Time and Deceleration Time / from stop to full speed |
| E2-01 | Motor Rated<br>FLA E2-01<br>X.XA | Motor<br>FLA | Sets the motor full load amps |

***Note:*** *After the changes are made, the DRIVE, SEQ and STOP LED's will be lit.*

## Example 5: Remote Start/Stop (3-wire) & Speed Changes via Speed Potentiometer




This configuration is best utilized when a person has control of the inverter and the application. Both potentiometers should be rated between 2kΩ and 5kΩ of resistance and rated at least 1/4 watt each. The trim pot. is optional, but without it the manual speed pot. will run the inverter at full speed when the pot. is only turned 2/3 of a full turn.

### Operation

By momentarily closing push-button (PB1), while push-button (PB2) is closed, the inverter will run up to the frequency (speed) set into U1-01Frequency Ref.

By opening push-button (PB2) at any time, the inverter will stop.

When switch (SW1) is in the open position, the motor will run in the forward direction. If the switch (SW1) is closed, the motor will reverse direction.

The frequency reference (speed) is proportional to the signal level present on terminal 13 0V=0Hz., 5V=30Hz. and 10v=60Hz.

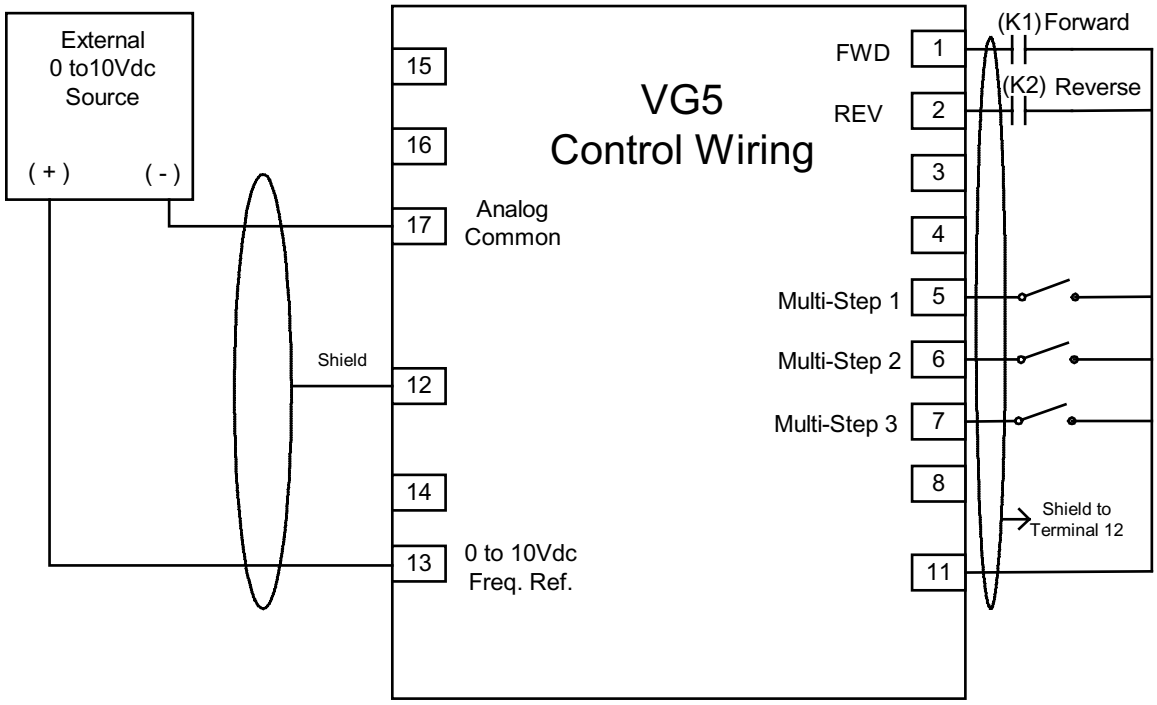
When the LOCAL/REMOTE key is pressed, the inverter will act as Example 1.

### Table 5: Programming needed for Remote (3-wire) & Speed Changes via Speed Potentiometer

| Parameter | Display Text | Setting | Description |
|---|---|---|---|
| A1-03 | Init Parameters<br>No initialize | 3330 | The parameter is found under "Initialize" menu (Ref. page 1 for Fig. 1).<br>CAUTION: *This parameter sets all parameters to their factory setting and all previous settings will be lost including the auto tune values.* |
| C01/02 | Accel time<br>Decel Time | xx.x Sec | Acceleration Time and Deceleration Time / from stop to full speed |
| E2-01 | Motor Rated FLA<br>E2-01 X.XA | Motor FLA | Sets the motor full load amps. |

***Note:*** *After the changes are made, the DRIVE, SEQ and STOP LED's will be lit.*

## Example 6: Remote Start/Stop (2-wire) & Speed Changes via 0 to 10Vdc with 3 Present Speeds




This configuration is generally used when the inverter is controlled via a remote source such as a PLC. It can also be used with a maintained switch when it is desirable to have the drive restart on restoration of power. It should not be used where the safety of the attending personnel might be injured by automatic restart. Up to three speeds can be selected by using the switches SW1-SW3 to select the desired speed.

### Operation

Close (K1) to run in the forward direction.

Close (K2) to run in the reverse direction.

When both relays are closed, the inverter will fault on a External Fault and stop operation of the motor.

The frequency of the inverter will be proportional to the signal level on terminal 13 ( 0Vdc=0Hz., 5Vdc=30Hz & 10Vdc =60Hz.).

By closing any of the switches (SW1-SW3) and closing either (K1) or( K2) to determine the direction the inverter will run at a present speed.

When the LOCAL/REMOTE key is pressed, the inverter will act as Example 1.

## Table 6: Programming needed for Remote Start/Stop (2-wire) & Multiple Inputs for Speed Changes

| Parameter | Display Text | Setting | Description |
|---|---|---|---|
| A1-03 | Init Parameters<br>No initialize | 2220 | The parameter is found under "Initialize" menu (ref. page 1 Fig.1)<br>CAUTION: *This parameter set all parameters to their factory setting and all previous settings will be lost including the auto-tune values.* |
| E2-01 | Motor Rated FLA<br>E2-01 X.XA | Motor FLA | Sets the motor full load amps. |
| D1-03 | Reference 3<br>D1-03 = XX.XHz | User Setting | Sets the frequency reference when SW1 is open and SW2 is closed. |
| D1-04 | Reference 4<br>D1-04 = XX.XHz | User Setting | Sets the frequency reference when SW1 and SW2 is closed. |
| D1-09 | Jog Reference<br>D1-09 = XX.XHz | User Setting | Sets the frequency reference when SW3 is closed. The jog input overrides all other frequency references such as an analog input or a present speed. |

## Table 7 : Truth Table for Present Speeds

| SW1 Status | SW2 Status | SW3 Status | Reference Source |
|---|---|---|---|
| Open | Open | Open | Analog value present on Terminal 13 |
| Open | Closed | Open | Frequency stored in Parameter D1-03 |
| Closed | Closed | Open | Frequency stored in Parameter D1-04 |
| N/A | N/A | Closed | Jog Frequency stored in Parameter D1-09 |

## Adjusting the Trim Pot.

Turn the main speed pot. all the way up (fully clockwise), then adjust the trim pot. until the frequency ref. display drops below 60Hz. and that completes the calibration of the trim potentiometer.

***Notes:*** Underlined words indicate a key on the keypad.

*Italic words indicate an LED on the keypad.*

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