



HITACHI

Application Note: SJ300
Closed Loop Vector
Control - Electronic
Gearing (Master/Slave)

Please refer also to the
Inverter Instruction Manual

AN110602-1

Hitachi America, Ltd.

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SJ300 Closed Loop Vector Control

Electronic Gearing (Master/Slave)



1. Scope

- 1.1. The scope of this document is to provide a step-by-step procedure for setting up a SJ300 for closed loop vector control (electronic gearing).

2. Parts

- 2.1. SJ300-XXXXFU– quantity 2
- 2.2. DOP-PRO (optional) – quantity 1
- 2.3. SJ-FB – quantity 2
- 2.4. 5 vdc quadrature differential encoder – quantity 2
- 2.5. Drive rated motor – quantity 2

3. Tools

- 3.1. Flat blade screwdriver
- 3.2. Philips screwdriver
- 3.3. Diagonal cutters
- 3.4. Wire strippers

4. Reference material

- 4.1. NB613X Hitachi SJ300 manual
- 4.2. NB616X Hitachi SJ-FB manual
- 4.3. NEC article 430
- 4.4. Nation Electrical Installation Standards (NEIS)
- 4.5. NEMA ICS 2.3
- 4.6. EASA Understanding Energy Efficient Motors

5. Definitions

- 5.1. Vector control – the magnitude and phase of the ac motor’s stator current vector is to be controlled by producing constant magnetic flux while generating the necessary component of torque producing current.
- 5.2. Closed loop vector control – vector control using an external feedback device like an encoder or resolver.
- 5.3. Open loop control – Any control that does not use a feedback device.
- 5.4. Velocity – accurate speed regulation through closed loop vector control.
- 5.5. Electronic Gearing – Master drive controlling slave drive(s) through feedback loop.

6. Hardware set-up (performed on both master and slave drives)

- 6.1. Power-up testing procedure should have been performed prior to SJ-FB set-up reference SJ300 manual page 2-17.
- 6.2. Gain access to inside front cover of SJ300 following directions on page 9 of SJ-FB manual.
- 6.3. Install encoder cable following channel pin-out to terminal one of SJ-FB board.
 - 6.3.1. Pay attention to the torque of the terminals to ensure proper installation.
- 6.4. The closed loop vector set-up does not require any additional configuration of the SJ-FB including dipswitches and wiring at this time in the set-up process.

7. Drive parameter set-up (performed on both master and slave drives)

7.1. Preliminary test.

7.1.1. The goal is to set-up both master and slave drive as a standard closed loop vector drives first before making the minor changes for electronic gearing.

7.1.2. Parameter changes.

A081	00 – AVR Always on
A082	XX – Motor nameplate voltage
A001	00 – Speed reference local control
A002	02 – Run enable local control

7.1.2.1. These parameters will allow the drive to be driven locally to verify the operation of the system in constant torque mode prior to closed loop control.

7.2. Run test.

7.2.1. Parameter changes.

A044	05 – closed loop vector control
P010	01 – option card valid

7.2.1.1. The drive is now in closed loop vector mode; and must be tuned prior to run.

7.2.2. Tuning.

7.2.2.1. Follow auto-tuning procedure on page 4-67 of SJ300 manual.

7.2.2.1.1. It is recommended to perform auto-tune procedure with active rotation (H001 – 02)

7.2.2.2. H002 must be set to 01 or 02 after tuning is complete.

7.2.3. Run.

7.2.3.1. Ensure speed pot on front of keypad is turned to 0%.

7.2.3.2. Press the run button and see if run indicator is illuminated.

7.2.3.3. Slowly bring up speed reference and verify rotation.

7.2.3.3.1. Note – If the motor acts erratic or trips out (over-current) quickly, then swap the poles of the B channel on the SJ-FB card.

7.2.4. Test completion.

8. Electronic Gearing

8.1. Feedback set-up.

8.1.1. Hardware

8.1.1.1. Install pulse output cable from last 4 terminal screws on terminal 2 of master SJ-FB to the first 4 terminal screws on terminal 2 of the slave SJ-FB (see page 25 of SJ-FB manual).

8.2. Master drive set-up.

8.2.1. It is no different than the standard SJ300 closed loop vector control scheme for velocity already set-up.

8.2.1.1. The pulse output from the last 4 terminal screws on terminal 2 is always present regardless of set-up if SJ-FB is plugged in.

8.3. Slave set-up.

8.3.1. Parameter changes.

P012	01 – APR mode (position)
C001-C008 (any single address)	48 – STAT pulse train input valid
C001-C008 (any single address)	47 – PCLR position deviation clear
C001-C008 (any single address)	46 – LAC LAD cancel
A001	04 – pulse speed reference

8.3.2. Switches must be installed for the 3 smart terminals assigned to 46, 47, and 48.

8.3.2.1. STAT pulse train input valid is the on/off switch that tells the slave to accept the pulse train from the master source.

8.3.2.2. PCLR pulse train clears the register that holds the count value of pulses accumulated from the master source.

8.3.2.3. LAC (LAD cancel) this switch eliminates the acceleration and deceleration time of the slave drive (be very cautious with this function).

8.4. Electronic gearing fine-tuning.

8.4.1. The initial set-up is for straight 1 to 1 gear ratio.

8.4.1.1. The parameters P020 and P021 allow the user to adjust the ratio to accommodate the requirements that the process dictates.

8.4.2. The slave gear is a little off adjustment for speed matching.

8.4.2.1. Adjust P022 and P023 for fine tuned speed adjustments.

9. Tips

9.1. When using DOP-PRO and getting “com” errors periodically, instead of cycling power to the drive, try selecting online monitor. Once online monitor is established, exit and try to upload/download again.

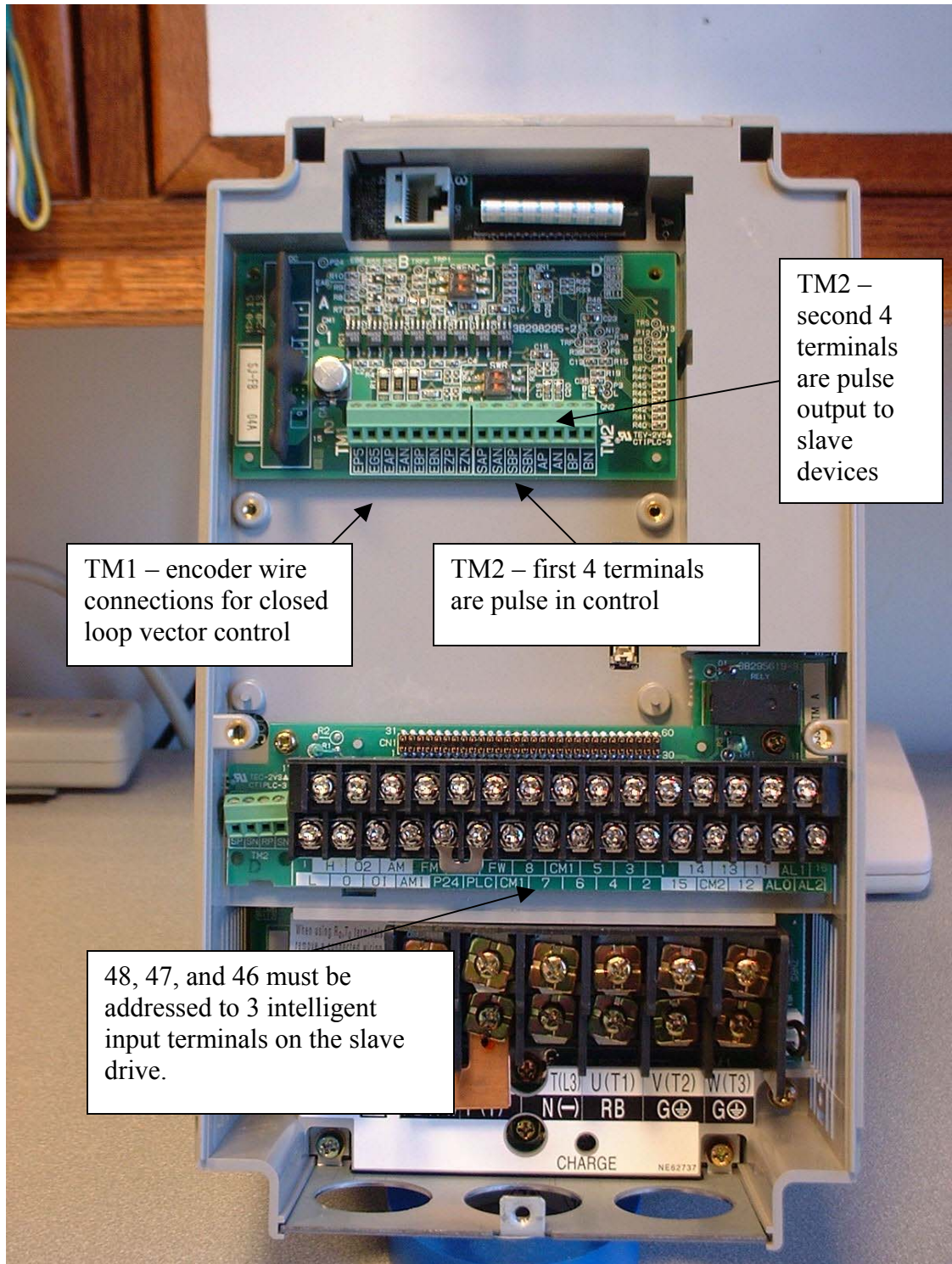
9.2. If the hertz display (D001) shows increasing hertz, but the motor does not move, try the following tips:

9.2.1. Cycle power to drive and resume run test.

9.2.2. Connect to Trend on the DOP-PRO software.

9.2.2.1. You may get an E11 alarm, clear and resume run test.

9.2.3. Conduct a second auto-tune and ensure H002 is set to 01 or 02.

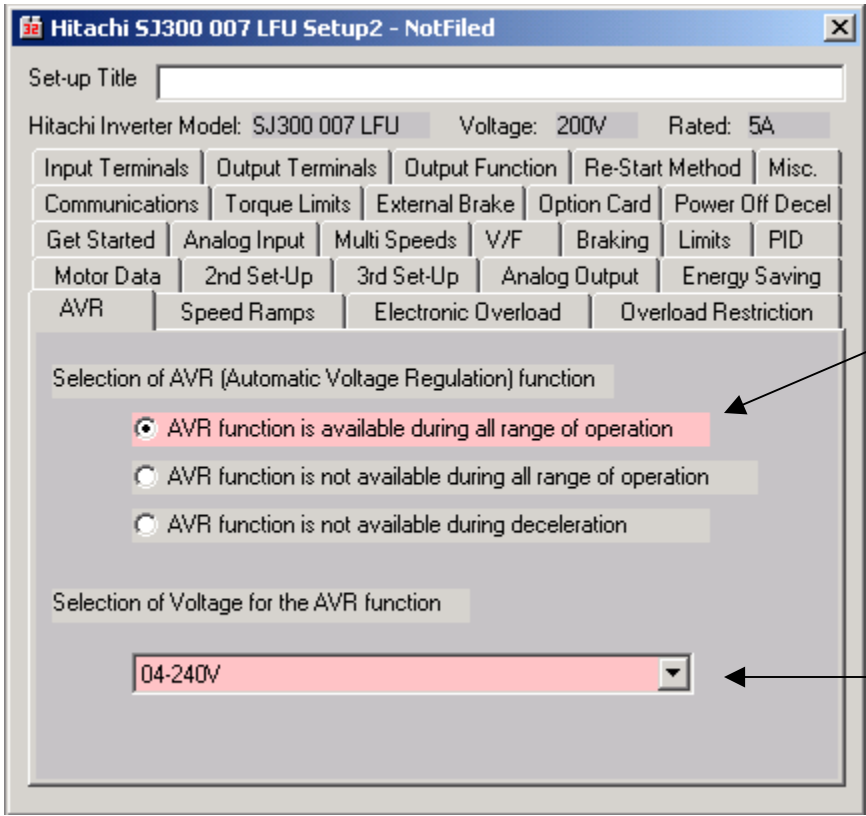


TM1 – encoder wire connections for closed loop vector control

TM2 – first 4 terminals are pulse in control

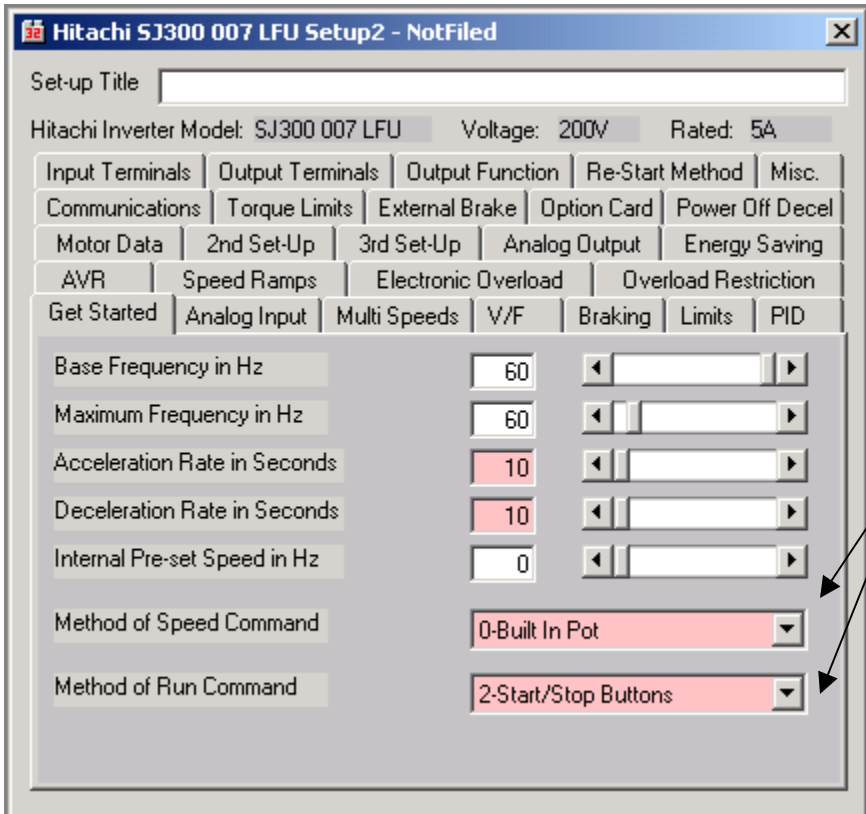
TM2 – second 4 terminals are pulse output to slave devices

48, 47, and 46 must be addressed to 3 intelligent input terminals on the slave drive.



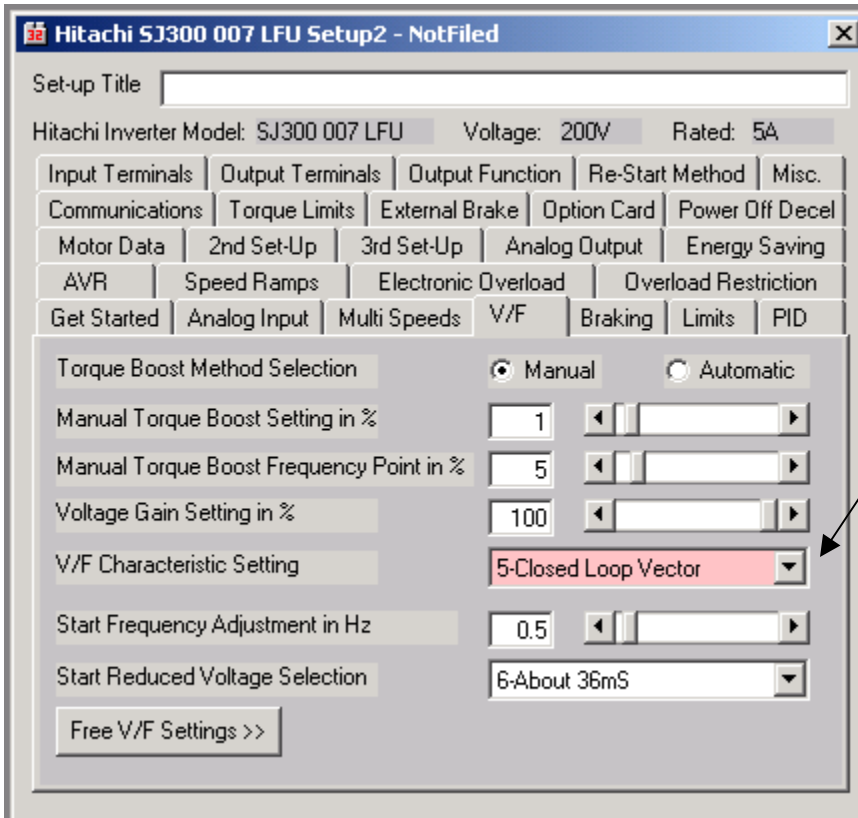
A081 – set to 00

A082 – set to value to motor nameplate voltage

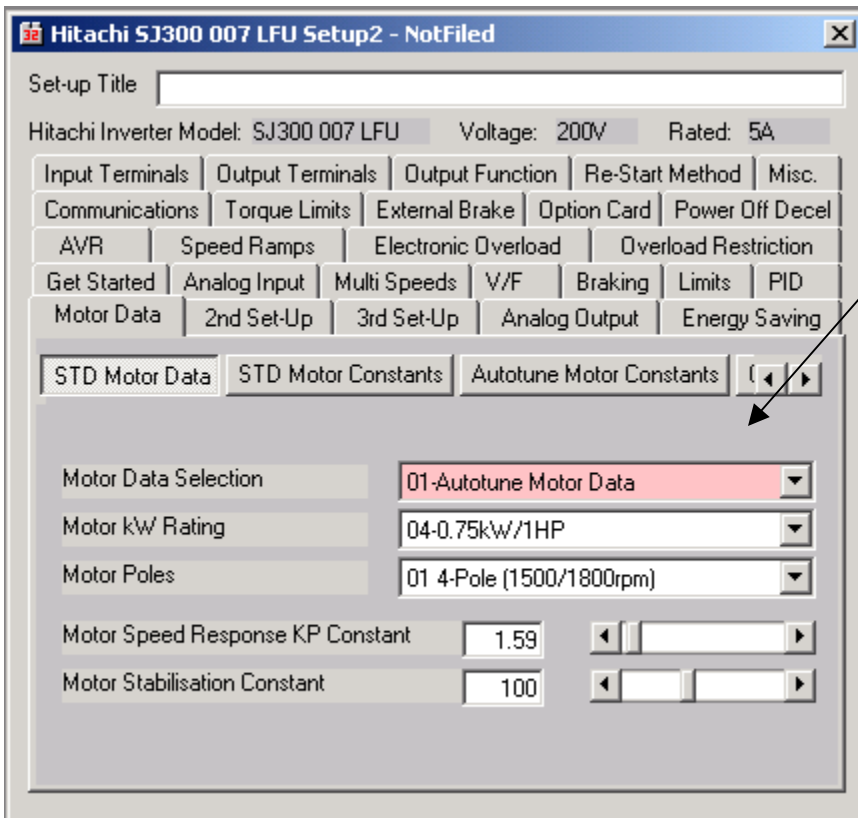


A001 and A002 set to local control for initial testing purposes

Note: A001 of slave must be set to 04 after initial testing is performed (refer to part 8.3 of this document).

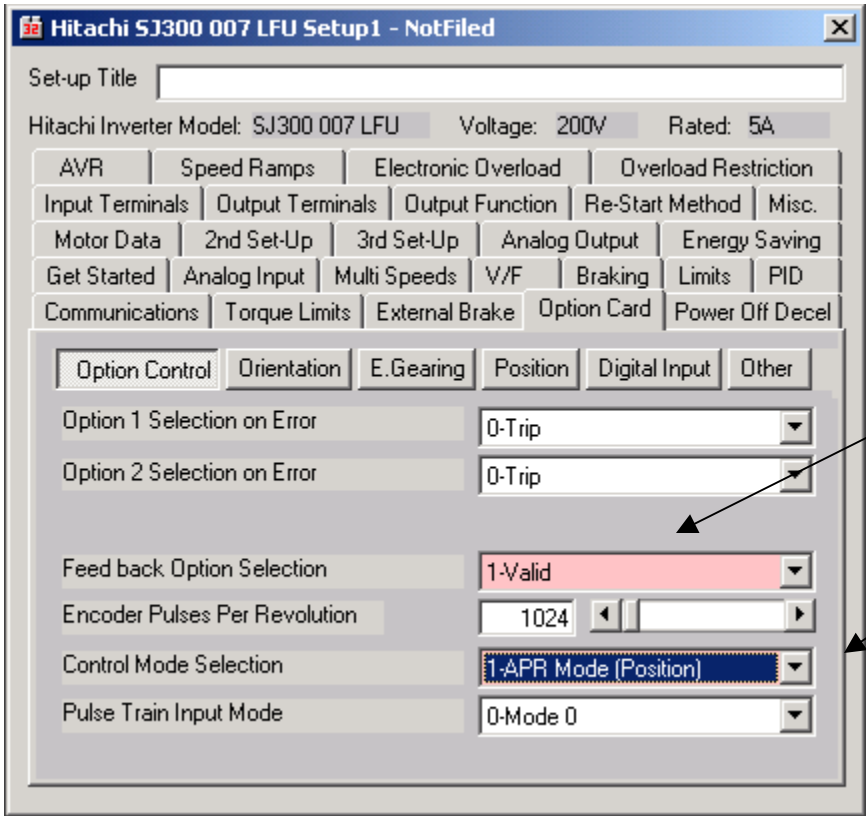


A044 – set to 05 for closed loop vector control



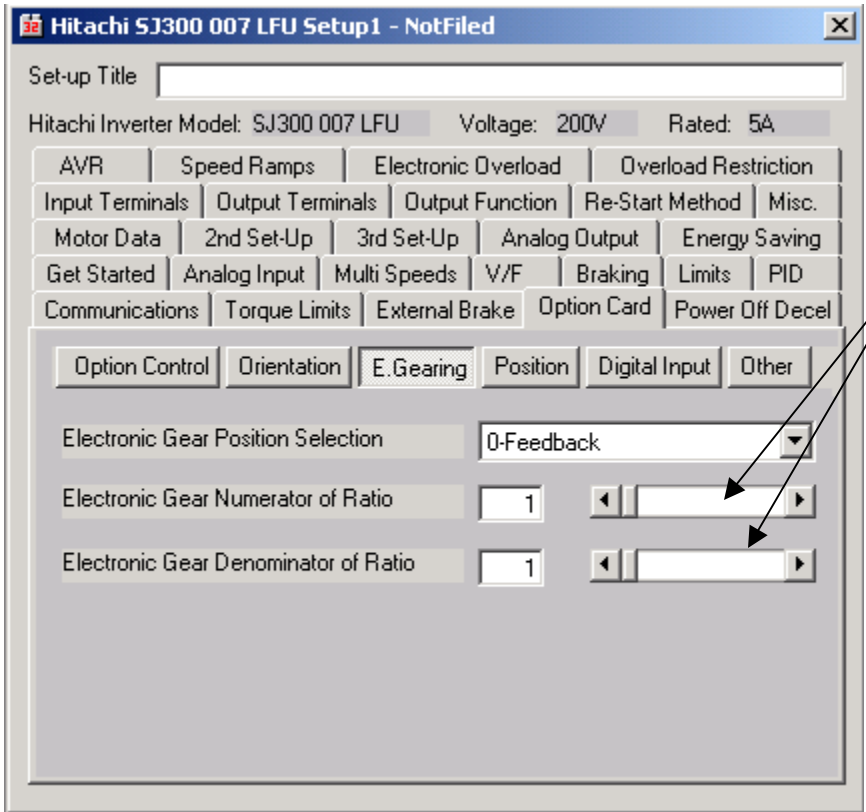
Note: It is suggested to go through the local auto-tune procedure versus using the software wizard.

After auto-tune is complete (symbol __0) Ensure that H002 is set to 01 or 02



P010 – set to 01 for both velocity and electronic gearing.

P012 – set to 01 on slave ONLY! (refer to 8.3 of this document).



After initial electronic gearing tests are performed, the gearing ratio can be changed by these parameters (P20 & P21).