# SJ300 Closed loop vector control (Electronic Gearing)



## 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.<u>H002 must be set to 01 or 02 after tuning is complete.</u>
- 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 in 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.

6.5.1. Turumeter enanges.				
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			

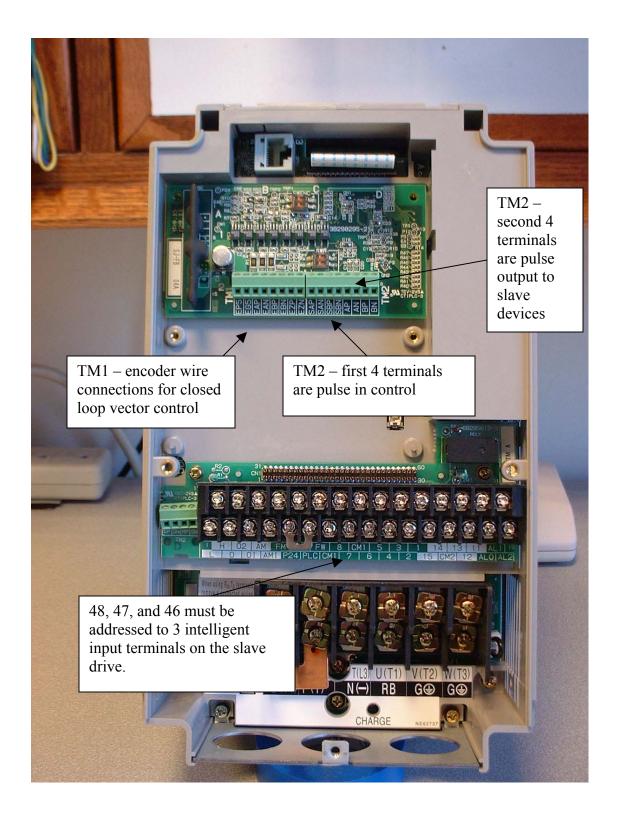
8.3.2. Switches must be installed for the 3 smart terminals assigned to 46, 47, and 48.

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.



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Set-up Title	
Hitachi Inverter Model: SJ300 007 LFU Voltage: 200V Rated: 5A	
Input Terminals         Output Terminals         Output Function         Re-Start Method         Misc.           Communications         Torque Limits         External Brake         Option Card         Power Off Decel           Get Started         Analog Input         Multi Speeds         V/F         Braking         Limits         PID           Motor Data         2nd Set-Up         3rd Set-Up         Analog Output         Energy Saving	
AVR Speed Ramps Electronic Overload Overload Restriction	A081 – set to 00
Selection of AVR (Automatic Voltage Regulation) function	
AVR function is available during all range of operation	
C AVR function is not available during all range of operation	
AVR function is not available during deceleration	
Selection of Voltage for the AVR function	
	A082 – set to value to notor nameplate
	voltage
Interpretation Interpretatio Interpretation Interpretation Interpretation Int	
Hitachi 5J300 007 LFU Setup2 - NotFiled	
Image: Hitachi SJ300 007 LFU Setup2 - NotFiled         Set-up Title	
Image: Set-up Title       Image: Set-up Title         Hitachi Inverter Model: SJ300 007 LFU       Voltage: 200V       Rated: 5A         Input Terminals       Output Terminals       Output Function       Re-Start Method       Misc.         Communications       Torque Limits       External Brake       Option Card       Power Off Decel         Motor Data       2nd Set-Up       3rd Set-Up       Analog Output       Energy Saving         AVR       Speed Ramps       Electronic Overload       Overload Restriction	
Image: Set-up Title       Image: Set-up Title         Hitachi Inverter Model: SJ300 007 LFU       Voltage: 200V       Rated: 5A         Input Terminals       Output Terminals       Output Function       Re-Start Method       Misc.         Communications       Torque Limits       External Brake       Option Card       Power Off Decel         Motor Data       2nd Set-Up       3rd Set-Up       Analog Output       Energy Saving         AVR       Speed Ramps       Electronic Overload       Overload Restriction         Get Started       Analog Input       Multi Speeds       V/F       Braking       Limits       PID	A001 and A002 set
Hitachi SJ300 007 LFU Setup2 - NotFiled       X         Set-up Title	to local control for
Image: Set-up Title       Image: Set-up Title         Hitachi Inverter Model: SJ300 007 LFU       Voltage: 200V       Rated: 5A         Input Terminals       Output Terminals       Output Function       Re-Start Method       Misc.         Communications       Torque Limits       External Brake       Option Card       Power Off Decel         Motor Data       2nd Set-Up       3rd Set-Up       Analog Output       Energy Saving         AVR       Speed Ramps       Electronic Overload       Overload Restriction         Get Started       Analog Input       Multi Speeds       V/F       Braking       Limits       PID         Base Frequency in Hz       60       Image: Set	
Image: Set-up Title       Image: Set-up Title         Hitachi Inverter Model: SJ300 007 LFU       Voltage: 200V       Rated: 5A         Input Terminals       Output Terminals       Output Function       Re-Start Method       Misc.         Communications       Torque Limits       External Brake       Option Card       Power Off Decell         Motor Data       2nd Set-Up       3rd Set-Up       Analog Output       Energy Saving         AVR       Speed Ramps       Electronic Overload       Overload Restriction         Get Started       Analog Input       Multi Speeds       V/F       Braking       Limits       PID         Base Frequency in Hz       60       Image: Get Partice Provided Participant Proversion       Image: Proversion Proversion       Image: Proversion Proversion       Image: Proversion Proversion         Acceleration Rate in Seconds       10       Image: Proversion Proversion Proversion       Image: Proversion Proversion Proversion       Image: Proversion Proversion	to local control for initial testing purposes
Image: Set-up Title       Image: Suture Terminals       Output Terminals	to local control for initial testing

🛱 Hitachi 5J300 007 LFU Setup2 - NotFiled 🔀	
Set-up Title	
Hitachi Inverter Model:       SJ300 007 LFU       Voltage:       200V       Rated:       5A         Input Terminals       Output Terminals       Output Function       Re-Start Method       Misc.         Communications       Torque Limits       External Brake       Option Card       Power Off Decel         Motor Data       2nd Set-Up       3rd Set-Up       Analog Output       Energy Saving         AVR       Speed Ramps       Electronic Overload       Overload Restriction         Get Started       Analog Input       Multi Speeds       V/F         Torque Boost Method Selection <ul> <li>Manual Torque Boost Setting in %</li> <li>Voltage Gain Setting in %</li> <li>100</li> <li>V/F Characteristic Setting</li> </ul> V/F Characteristic Setting <ul> <li>S-Closed Loop Vector</li> <li>Manual Control</li> <li>Manual Control</li></ul>	A044 – set to 05 for closed loop vector control
Start Frequency Adjustment in Hz 0.5	
Start Reduced Voltage Selection 6-About 36mS	
Free V/F Settings >>	
撞 Hitachi 5J300 007 LFU Setup2 - NotFiled	
Set-up Title         Hitachi Inverter Model:       SJ300 007 LFU       Voltage:       200V       Rated:       5A         Input Terminals       Output Terminals       Output Function       Re-Start Method       Misc.         Communications       Torque Limits       External Brake       Option Card       Power Off Decel         AVR       Speed Ramps       Electronic Overload       Overload Restriction         Get Started       Analog Input       Multi Speeds       V/F       Braking       Limits       PID         Motor Data       2nd Set-Up       3rd Set-Up       Analog Output       Energy Saving         STD Motor Data       STD Motor Constants       Autotune Motor Constants       Image:       Image:	Note: It is suggested to go through the local auto- tune procedure versus using the software wizard. After auto-tune is complete (symbol0) Ensure that H002 is set to 01 or 02
Motor Data Selection     01-Autotune Motor Data       Motor kW Rating     04-0.75kW/1HP       Motor Poles     01 4-Pole (1500/1800rpm)	

撞 Hitachi 53300 007 LFU Setup1 - NotFil	ed	×	
Set-up Title			
Hitachi Inverter Model: SJ300 007 LFU			
AVR Speed Ramps Electronic Input Terminals Output Terminals Output Motor Data 2nd Set-Up 3rd Set-Up Get Started Analog Input Multi Speeds Communications Torque Limits External B	Function Re-Start Method Misc Analog Output Energy Saving V/F Braking Limits PID		
Option Control Orientation E.Gearing	Position Digital Input Other		P010 – set to 01 for both
Option 1 Selection on Error	0-Trip		velocity and electronic
Option 2 Selection on Error	O-Trip		gearing.
			P012 - set to 01 on slave
Feed back Option Selection Encoder Pulses Per Revolution	1-Valid		only (refer to 8.3 of this
Control Mode Selection	1024 1.4PR Mode (Position)		document).
Pulse Train Input Mode	0-Mode 0		
	,		
🧰 Hitachi SJ300 007 LFU Setup1 - NotFil	ed	×	
Set-up Title		_	
Hitachi Inverter Model: SJ300 007 LFU	/oltage: 200V Rated: 5A		
AVR     Speed Ramps     Electronic       Input Terminals     Output Terminals     Output       Motor Data     2nd Set-Up     3rd Set-Up       Get Started     Analog Input     Multi Speeds       Communications     Torque Limits     External B       Option Control     Orientation     E.Gearing	Function Re-Start Method Misc Analog Output Energy Saving V/F Braking Limits PID rake Option Card Power Off Dec		After initial electronic gearing tests are performed, the gearing ratio can be changed by these parameters.
Electronic Gear Position Selection	0-Feedback		
Electronic Gear Numerator of Ratio			
Electronic Gear Denominator of Ratio			