Lathes　[Machine tools]

Features of lathes

"Lathes" have the following machines:
1. Rotating tables
2. Motors for table rotation
3. Materials (Round stick or Square stick)
4. Cutters

A Material is put on the rotating table of lathes, and they are rotated by the motor. The cutter whittles the material into slim shape or round shape.
This rotating table is heavy to keep constant speed at any load.

Merits of inverter drives

Lathes with inverters have the following merits:

- Stable speed
Inverters can control rotation tables to be stable speed at any load by sensor-less control methods.

- Heavier rotation tables
Lathes with inverters can be used heavier rotation tables. Because inverters control motors with low speed and low frequency when motors start to move. In this case, it is necessary to set an acceleration time to a long setting value.

- Cost reducing of mechanical brakes
Inverters can decrease motor speed instead of mechanical brakes. Therefore maintenance costs of mechanical brakes are reduced. In this case, it is necessary to install a braking resistor to an inverter.

Notices regarding the use of inverter drives

- **Vector control without sensor**
Setting AU2 to 2 (vector control + auto-tuning) provides high starting torque bringing out the maximum in motor characteristics from the low-speed range. This suppresses changes in motor speed caused by fluctuations in load to provide high precision operation. This is an optimum feature for elevators and other load transporting machinery.

Default settings of inverters are for 4 poles, 60Hz, 200/400V motors as produced by TIPM.
(TIPM: Toshiba Industrial Products Manufacturing Corporation)
If motors are not made by TIPM, please set the following parameters before executing AU2.

In case of VF-S15

vL: Base frequency [Hz]

vLv: Voltage at base frequency [V]

F405: Motor rated capacity [kW]

F415: Motor rated current [A]

F417: Motor rated rotation [min^{-1}]

In case of VF-AS1

vL: Base frequency [Hz]

vLv: Voltage at base frequency [V]

F405: Motor rated capacity [kW]

F406: Motor rated current [A]

F407: Motor rated rotation [min^{-1}]

NOTICE: After setting these parameter, please execute F400=4.

Point Conduct auto-tuning only after the motor has been connected and operation completely stopped. If auto-tuning is conducted immediately after operation stops, the presence of a residual voltage may result in abnormal tuning.
Voltage is applied to the motor during tuning even though it barely rotates. During tuning, "Atn1" is displayed on the operation panel.

- Electromagnetic noise

The inverter is generating "electromagnetic noise".

If there are some high accuracy sensors or other sensitive equipment near the inverter drive, the inverter's noise may cause some trouble or a malfunction.

Electromagnetic noise can be avoided by installing an external noise filter or using a different wiring method.

- Harmonics

The inverter is generating "harmonics".

These harmonics sometimes cause a malfunction in other control equipment that is connected to the same power source.

Harmonics can be avoided by installing an external "reactor".

To decrease "harmonics", we recommend to install DC reactors in all our inverter models.
(NOTE: 100V input models require AC reactors.)

🔴 Selection

In almost all cases, the capacity of the inverter is the same as the motor capacity.

However the following cases, the inverter capacity should be larger than the motor capacity:

- Lathes require a fixed acceleration/deceleration time.

- The inertia of rotation tables is larger than the allowance inertia of its motor.

Point **Conditions that require an inverter capacity increase:**
- Large starting torque over 200%.
- Short acceleration/deceleration time settings.

🔴 Application samples

In case of Lathes, motors can be controlled by the inverter using the following methods:
- Speed adjustment by an analog input
- 3 wire type operations with momentary switches
- Emergency stop signal input
- Braking resistor installation

🔵 Connection of inverters (VF-S15)
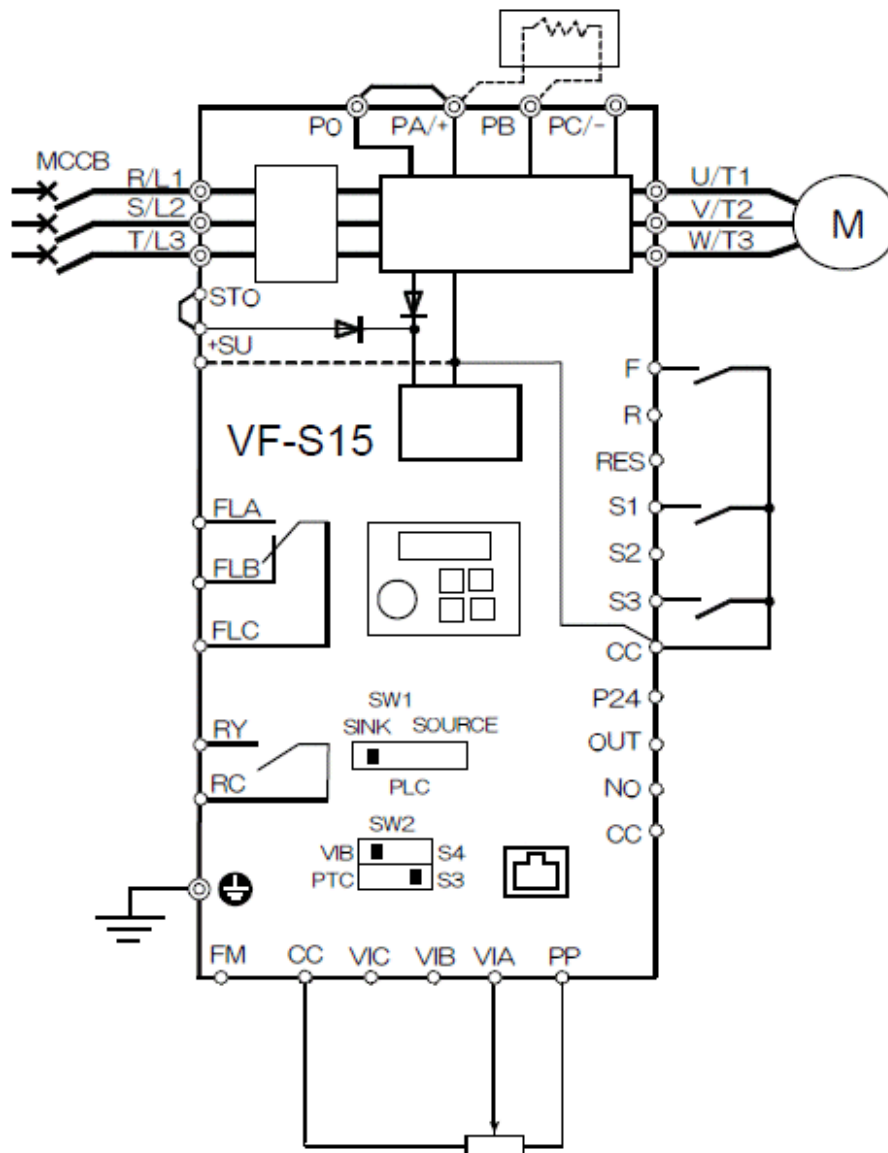
🌐 Setting table for inverters (VF-S15)

Title	Function	Setting range	Recommended setting
CNOd	Command mode selection	0: Remote, 1: Local, etc.	0
FNOd	Frequency setting mode selection	0: Built-in potentiometer, 1: VIA, 2: VIB, etc.	1
ACC	Acceleration time 1	0.0 ~ 3600	Depends on the system
dEC	Deceleration time 1	0.0 ~ 3600	Depends on the system
F114	Input terminal selection 4 (S1)	0 ~ 203	20 (Emergency stop)
F116	Input terminal selection 6 (S3)	0 ~ 203	50 (HOLD)
F304	Dynamic braking selection	0: Disabled, 1: Enabled, etc.	1

🌐 Explanation of three-wire operations (one-touch operations)

You can carry out operation by simply pressing the ON/OFF button.
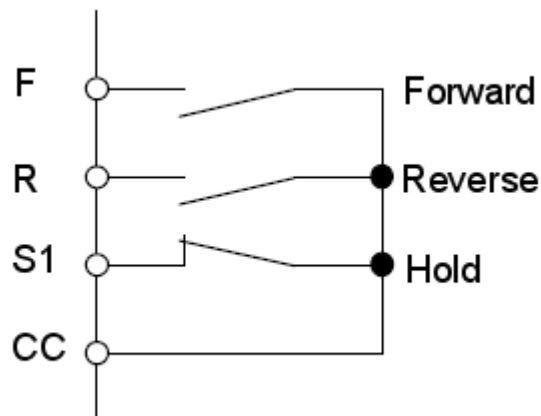
Selecting HD (operation holding) with the input terminal selection parameter.
Select HD (operation holding) using the input terminal selection parameter and turn HD on to get the inverter ready or operation or turn HD off to stop operation.