

### Winders [Metalworking machines]

#### Features of winders

Winders in metalworking machines use for molding/processing of coils and electric wires. They are controlled by tension controls or speed controls.

#### Merits of inverter drives

Winders with inverters have the following merits:

##### [Winding side]

- Speed control

The vector control without sensor can support stable operation at any speed.

##### [Sending side]

- Torque control

The VF-AS1 can control the torque of an induction motor instead of a torque motor.

- Torque stability and accuracy

The vector control with sensor can control a stable torque with an accuracy of +/-10% or less.

#### 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 [ $\text{min}^{-1}$ ]

### 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 [ $\text{min}^{-1}$ ]

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



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

"Winders" are utilize following mechanics:

- Winding rollers: Motoring

(The force is not the same direction as motor rotation.)

- Sending rollers: Regenerating

(The force is the same direction as motor rotation.)

#### - Winding rollers

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

However, if you have a fixed acceleration/deceleration time or over 200% starting torque, The inverter capacity should be larger than the motor capacity.

#### - Sending rollers

Please install braking resistors or regenerating converters (RC7 series), because sending rollers are always in regenerating mode.

If the regenerating torque is larger than 80% of the motor rated torque, you have to increase the inverter capacity.

## Application samples

The control methods in winders are different for winding rollers and sending rollers.

### [Winding rollers: Speed control]

- Vector control without sensors
- RUN and STOP by remote control
- Speed adjustment by analog input
- Speed adjustment by over-ride function

### [Sending rollers: Torque control]

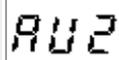
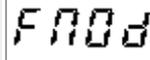
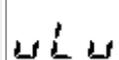
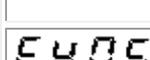
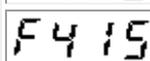
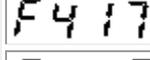
- Vector control with sensors
- RUN and STOP by remote control
- Torque adjustment by analog input
- Torque/Speed control switching by contact input
- Torque bias input
- Regenerating power control by braking resistor

## Setting table for inverters

### [Winding rollers: Speed control] (VF-S15)

The over-ride function is using the following analog input.

- Frequency reference: VIA terminal (0 to 10Vdc input)
- Over-ride value: VIB terminal (0 to 10Vdc input)
- Actual output frequency: VIA reference + VIB reference

Title	Function	Setting range	Recommended setting
	Automatic torque boost	0 to 3	2 (Vector control and auto-tuning)
	Command mode selection	0 to 4	0 (Remote)
	Frequency setting mode selection 1	0 to 14	1 (VIA)
	Base frequency 1	25 to 500Hz	Depends on the motor
	Base frequency voltage 1	50-330 (240V class) 50-660 (500/600V class)	Depends on the motor
	Motor rated capacity	0.01 to 22kW	Depends on the motor
	Motor rated current	0.1 to 100A	Depends on the motor
	Motor rated speed	100 to 64000min <sup>-1</sup>	Depends on the motor
	Override function	0 to 4	2 (VIB)

Note

After setting these parameters, please perform the following steps.

- (1) Connect the motor wiring.
- (2) Turn on the start signal.

### [Sending rollers: Torque control] (VF-AS1)

It is necessary to set related parameters for motor constant and torque control.

The torque/speed switching signal is to smooth start-up.

- At start up (Speed control): The S3 terminal turns off with the frequency reference of the RR terminal.

- During continuous operation (Torque control): The S3 terminal turns on with the torque reference of the RX terminal.

The torque bias input(VI) is for compensation of machine losses.

Title	Function	Setting range	Recommended setting
Pt	V/f control mode selection	0: Constant torque characteristics ~ 8: PG feedback vector control	8
uL	Base frequency 1	25 to 500Hz	Depends on the motor
uLv	Base frequency voltage 1	200V class:50~330V 400V class:50~660V	Depends on the motor
Pb	Dynamic braking selection	0 to 2	1 (Enabled)
Pbr	Dynamic braking resistance	0.5 to 1000 ohm	Depends on the resistor
PbCP	Allowable continuous braking resistance	0.01 to 600.0 kW	Depends on the resistor
F117	Input terminal function selection 7 (S3)	0 to 135	112
F375	Number of PG input pulses	12 to 9999	Depends on the PG
F405	Motor rated capacity (motor name plate)	0.10 to 500.0 kW	Depends on the motor
F406	Motor rated current (motor name plate)	0.1 to 2000 A	Depends on the motor
F407	Motor rated rotational speed (motor name plate)	100 to 60000 min <sup>-1</sup>	Depends on the motor
F420	Torque command selection	1 to 8	3 (RX)
F423	Tension torque bias input selection (torque control)	1 to 8	1 (VI/II)

#### Note

After setting these parameters, please perform the following steps.

- (1) Set F400 (Auto-tuning 1) = 4 (Motor constant auto calculation).
- (2) Connect the motor wiring.
- (3) Set F400 = 2 (Continue operation after auto-tuning).
- (4) Turn on the start signal.