TOSHIBA

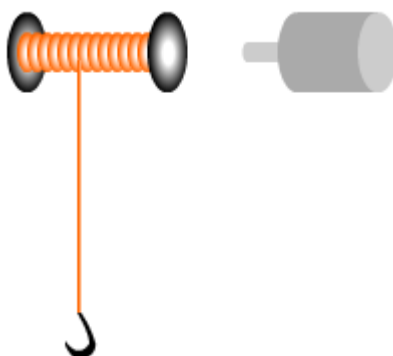# TOSVERT VF-AS1

Functions for lift application

- Contents-

1. About using inverter to lifts application

The lift application such as crane and hoists is composed a gear motor with mechanical brake and lift equipment.   It works by "winding up and down" and " inching" operation.

Fig.1 Outline chart of list application

The lift application with inverter drive, it has next merits compared than commercial power supply drive.

- To avoid shaking by starting shock.

- By braking at low speed, the maintenance of brake will be easy.

- Excessive power is not impressed to the wire rope.   Therefore the maintenance of the wire rope will be easy.

2. Functions of VFAS1's for lift application

The TOSVERT VF-AS1 has next functions in stadard model.

- Braking function

- Light-load high-speed operation function

Braking function:

This function can be used as brake sequences for lifts and similar equipment.

To ensure smooth operation, the motor produces enough torque before the brake is released.

Light-load high-speed operation function:

The light-load high-speed operation is used to improve the operating efficiency of the machine by

increasing the rotational speed of the motor when it is operated under light load.

This function is useful for constant-torque load application which repeatedly drives light and heavy loads,

such as lifts and transfer equipment.

3. Standard connection
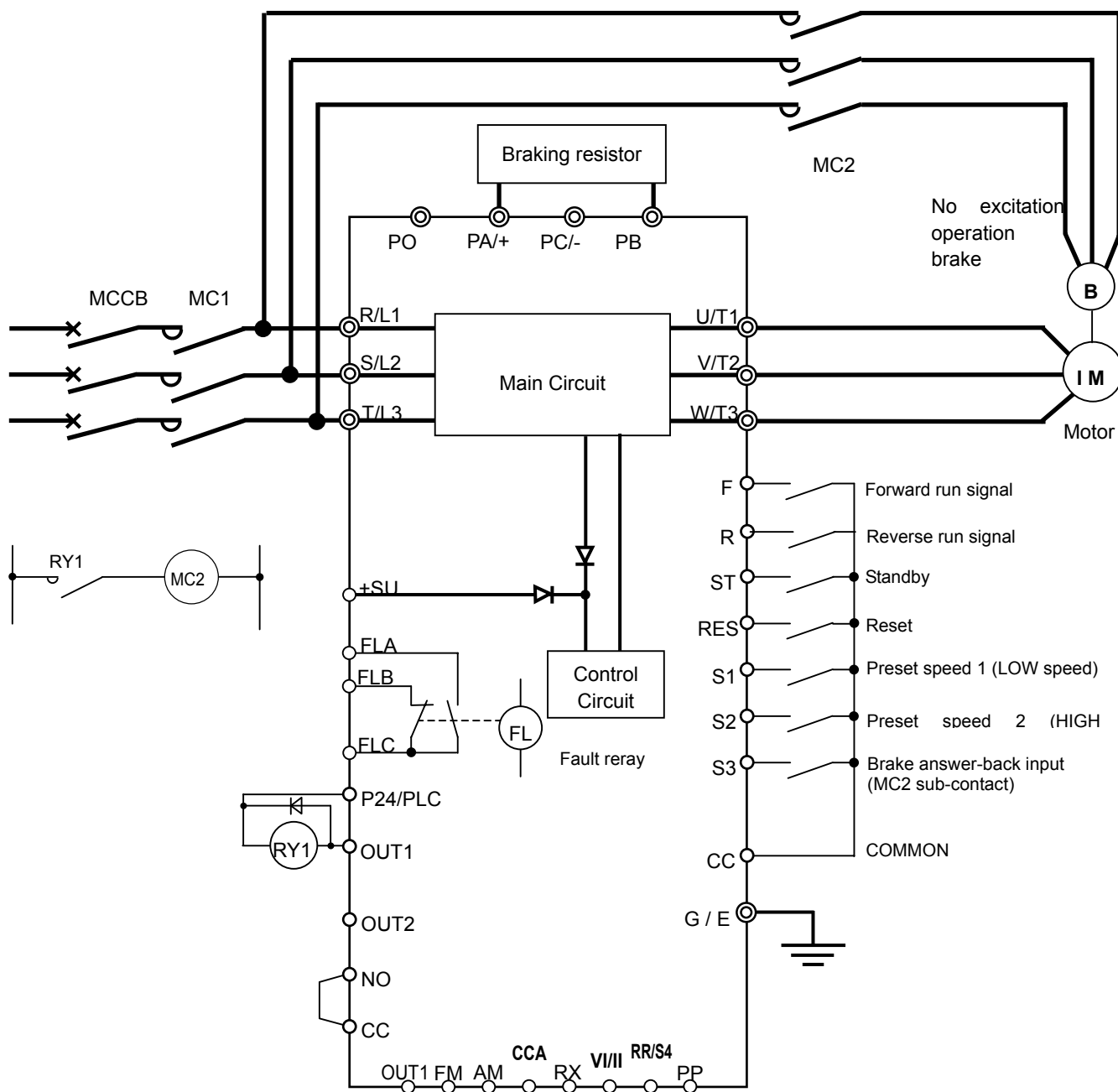
[Operation]   By terminal signal

[Speed reference]   Preset speed 1 and 2, Operation panel ➔ 3 preset speed

4. Parameter settings

At chapter 3, it is necessary to set next parameters.

Title	Functions	Setting range	Setting sample
CMOd	Command mode selection	0:Terminal input enabled 1:Operation panel input enabled (including LED/LCD option input) 2:2-wire RS485 communication input 3:4-wireRS485 communication input 4:Communication option input	0
FMOd	Frequency setting mode selection 1	1:VI/II (voltage/current input) 2:RR/S4 (potentiometer/voltage input) 3:RX (voltage input) 4:Operation panel input enabled (including LED/LCD option input) 5:2-wire RS485 communication input 6:4-wire RS485 communication input	4
LL	Lower limit frequency	0.0 ~ Upper limit frequency	6.0
ACC	Acceleration time 1	0.1 ~ 6000 sec.	1.0
dEC	Deceleration time 1	0.1 ~ 6000 sec.	1.0
Sr1	Preset speed operation frequency 1	Lower limit frequency ~ Upper limit frequency	10.0
Sr2	Preset speed operation frequency 2	Lower limit frequency ~ Upper limit frequency	60.0
Pb	Dynamic braking selection	0:Deselect 1:Select (braking resistance overload detect) 2:Select (braking resistance overload not detect)	1
Pbr	Dynamic braking resistance	0.5 ~ 1000 ohm	Depends on capacity
PbCP	Allowable continuous braking resistance	0.01 ~ 600.0kW	Depends on capacity
F117	Input terminal function (S3)	0 ~ 135	130(Brake answer-back)
F130	Output terminal function (OUT1)	0 ~ 255	68(Brake release signal)
F452	Power running stall continuous trip detection time	0.0 ~ 1.0 sec.	0.5
F453	Regenerative braking stall prevention mode selection	0:Stall during regenerative braking 1:Not stall during regenerative braking	1
F630	Braking answer waiting time	0.0 ~ 10.0 sec.	0.5
F305	Overvoltage limit operation	0:Select 1:Deselect 2:Select (quick deceleration) 3:Select (dynamic quick deceleration)	1
AU2	Automatic torque boost	0:Deselect 1:Automatic torque boost + auto-tuning 1 2: Sensorless vector control 1+ auto-tuning 1	Refere chapter 5 note1)
uL	Base frequency 1	25.0 ~ 500Hz	Possible to use
uLu	Base frequency voltage 1	200V class:50~330V 400V class:50~660V	AU2=2(Pt=3) in the following capacity range.
Pt	V/f control mode selection	3: Sensorless vector control 1 note1) 4: Sensorless vector control 2 8: PG feedback vector control 1	- up to 200V 45kW - up to 400V 75kW
F400	Auto-tuning 1	0:No auto-tuning 1:Initialize motor constant (0 after execution) 2:Continue operation continued after auto-tuning (0 after execution) 3:Auto-tuning by input terminal signal 4:Motor constant auto calculation (0 after execution)	
F405	Motor rated capacity	0.10 ~ 500.0 kW	
F406	Motor rated current	0.1 ~ 2000A	
F407	Motor rated capacity evolutions	100 ~ 60000min^{-1}	

Title	Functions	Setting range	Setting sample
$F328$	Light-load high-speed operation selection	0:Deselect 1:High-speed operation speed set automatically (Power running at F command: Increase) 2:High-speed operation speed set automatically (Power running at R command: Increase) 3:High-speed operation speed set with $F330$ (Power running at F command: Increase) 4:High-speed operation speed set with $F330$ (Power running at R command: Increase)	Refere chapter 7
$F329$	Light-load high-speed learning function	0:No learning, 1:Forward run learning 2:Reverse run learning	
$F330$	Automatic light-load high-speed operation frequency	30.0 ~ Upper limit frequency Hz	
$F331$	Light-load high-speed operation switching lower limit frequency	30.0 ~ Upper limit frequency Hz	
$F332$	Light-load high-speed operation load waiting time	0.0 ~ 10.0 sec.	
$F333$	Light-load high-speed operation load detection time	0.0 ~ 10.0 sec.	
$F334$	Light-load high-speed operation heavy load detection time	0.0 ~ 10.0 sec.	
$F335$	Switching load torque during power running	-250 ~ 250%	
$F336$	Heavy-load torque during power running	-250 ~ 250%	
$F337$	Heavy-load torque during constant power running	-250 ~ 250%	
$F338$	Switching load torque during regenerative braking	-250 ~ 250%	
$F341$	Braking mode selection	0:Deselect, 1:Forward winding up 2:Reverse winding up 3:Horizontal operation (counter weight)	Refere chapter 6
$F342$	Load portion torque input selection	0:Disabled, 1:VI/II (voltage/current input) 2:RR/S4 (potentiometer/voltage input) 3:RX (voltage input) 4:. 343 enabled 5:2-wire RS485 communication input 6:4-wire RS485 communication input 7:Communications option input enabled 8:Optional AI1 (differential current input)	
$F343$	Hoisting torque bias input (valid only when $F342=4$)	-250 ~ 250%	
$F344$	Lowering torque bias multiplier	0 ~ 100%	
$F345$	Brake release time	0.00 ~ 2.50 sec.	
$F346$	Creeping frequency	$F240$ ~ 20.0Hz	
$F347$	Creeping time	0.00 ~ 2.50 sec.	
$F348$	Braking time learning function	0:Deselect, 1: Learning (0 after adjustment)	

5. Setting motor constants

It is necessary to set related parameters of vector control to use functions(Braking function and Light-load high-speed operation function) for lift application in VFAS1.

Note: In the following capacity range, don't use $RU2=2(Pt=3)$ setting.

- 200V-55kW or higher

- 400V-90kW or higher

This accuracy of vector control depends on parameters of motor constants ($F40I$ to $F4I3$). Moreover, the braking functions and Light-load high-speed operation depends on these parammeters.

* The detail description of motor constants, please refer VFAS1's installation manual.

In this manual, the simple setting method is described.

Setting method of motor constants:

In case of using Pt (V/F control mode selection) = 4(Sensor-less vector control 2)

1. Set next parameters that are described in motor's nameplate.

TOSHIBA 3 PHASE INDUCTION MOTOR						
RATED OUTPUT	**15** kW	**4** POLES	TYPE	TIKK		
RATED VOLTAGE	200	200	220 V	FORM	FBKA21	
RATED FREQUENCY	50	60	60 Hz	FRAME NO.	160L	
RATED CURREENT	57.6	54.6	50.6 A	THERMAL CLASS B		
RATED SPEED	1440	1730	1740 min⁻¹	RATING	S1	
PROTECTION	**IP44**					
			BEARING L.S.	6310ZZ		
STANDARD	**JIS C 4210 : 2001**		NO. O.S.	6208ZZ		
SERIAL NO.						
TOSHIBA INDUSTRIAL PRODUCTS MANUFACTURING CORPORATION				MADE IN JAPAN		

TITLE	FUNCTIONS	Setting value
uL	Base frequency 1	60
uLu	Base frequency volatge 1	200
$F405$	Motor rated capacity	15
$F406$	Motor rated current	54.6
$F407$	Motor rated capacity evolutions	1730

2. Set Pt to 4 and execute $F400$ to 4 (Automatic calculation of motor constants).

   (Not to need motor wiring)

3. After motor wiring, set $F400$ to 2 (auto-tuning 1). After that, input operation signal.

   (To input operation signal, the auto-tuning function is executes.)

6. Braking time learning

TOSVERT VF-AS1 has 'Braking time learning' function that automatically sets brake timing.

This function sets next parameters.

$F345$	Brake release time
$F346$	Creeping frequency
$F347$	Creeping time

* The details of braking functions, please refer VFAS1's installation manual .

   In this manual, only described 'learning function' because of easy to set braking functions.

The operation of braking time learning:

1. Set $F348$ to 1.   The learning function is enabled after operation signal input.

   While learning, the LED display is indicated "tUn" and "Operation frequency" each other.

2. It sets paramerters $F343$ (Hoisting torque bias), and $F345$ (brake release time) by automatically

measuring.   In case of stop opertion, $F347$ (creep time) is set.

NOTICE:

This learning fucntion is necessary to execute the condiction of light load.   For example, it is only "Hook".

Sample of parameter setting at learing.

TITLE	FUNCTION	Setting range	Default setting	Setting sample
$F341$	Braking mode selection	0:Deselect, 1:Forward winding up 2:Reverse winding up 3:Horizontal operation (counter weight)	0	**1**
$F342$	Load portion torque input selection	0:Disabled, 1:VI/II (voltage/current input) 2:RR/S4 (potentiometer/voltage input) 3:RX (voltage input) 4:.343 enabled 5:2-wire RS485 communication input 6:4-wire RS485 communication input 7:Communications option input enabled 8:Optional AI1 (differential current input)	0	**4**
$F343$	Hoisting torque bias input (valid only when $F342=4$)	-250 ~ 250%	100%	100%
$F344$	Lowering torque bias multiplier	0 ~ 100%	100%	100%
$F345$	Brake release time	0.00 ~ 2.50 sec.	0.05 sec.	Auto
$F346$	Creeping frequency	$F240$ ~ 20.0Hz	3.0Hz	Auto
$F347$	Creeping time	0.00 ~ 2.50 sec.	0.10 sec.	Auto
$F348$	Braking time learning function	0:Deselect, 1: Learning (0 after adjustment)	0	**1**

7. Light-load high-speed learning function

TOSVERT VF-AS1 has "Light-load high-speed function" that is speed-up at light load for higher operation efficiency. Moreover, it has automatically setting mode to set light and heavy load switching that called "Ligh-load high-speed learning function".

* The details of " Light-load high-speed function ", please refer VFAS1's installation manual.

In this manual, only described 'learning function' because of easy to set this functions.

Opeartion of Light-load high-speed learning function:

When the 60 Hz operation is nomaly speed, please set by next method.

1. Set $F330$ (Automatic light-load high-speed operation frequency).
   ex. $F330$ = 90 Hz

2. Set $F329$ (Light-load high-speed learning function) to 1 (Learning only forword run).

3. Confirm to switch high-speed (90Hz) at forward run (60Hz) with maximum light-load.

   While learning, the 7 segment LEDs are indicated "t" and "operation frequency".

4. Set $F329$ (Light-load high-speed learning function) to 2 (Learning only reverse run).

5. Confirm to switch high-speed (90Hz) at reverse run (60Hz) with maximum light-load.

   While learning, the 7 segment LEDs are indicated "t" and "operation frequency".

6. After this opertion, next parameters are set automatically.

TITLE	FUNCTIONS	Default setting	Set value at learning function
$F335$	Switching load torque during power running	50	Motoring torque + 5% (Load torque monitor 1 for light-load/high-speed)
$F336$	Heavy-load torque during power running	100	Motoring torque + 5% (Load torque monitor 2 for light-load/high-speed)
$F337$	Heavy-load torque during constant power running	50	Maximum accelearation torque value between motoring normal speed and high-speed (Speed attainment)
$F338$	Switching load torque during regenerative braking	50	Regenerating torque + 5% (Load torque monitor 1 for light-load/high-speed)

7. Confirm that is not to switch high-speed with heavy-load.

8. In lift-up from ground, confirm to switch normal speed after high-speed operation.

   From ground: Usually, it will be high-speed because low wire tension.

NOTICE:

In case of next learning result, VF-AS1 doesn't switch high-speed.

The learning function is finished after stop operation.
- − Switching load torque during power running: Over 70%
- − Switching load torque during regenerative braking: Over 70%

In case of detection torque over 150% at high-speed, it stops high-speed operation and learning data isn't memorized.

Case of the detection torque is over 100% at constant speed after high-speed acceleration, it stops high-speed operation and learning data don't memory.

Setting sample: (Set at learning)

TITLE	FUNCTIONS	Setting range	Default setting	Setting sample
F328	Light-load high-speed operation selection	0:Deselect 1:High-speed operation speed set automatically (Power running at F command: Increase) 2:High-speed operation speed set automatically (Power running at R command: Increase) 3:High-speed operation speed set with F330 (Power running at F command: Increase) 4:High-speed operation speed set with F330 (Power running at R command: Increase)	0	**1**
F329	Light-load high-speed learning function	0:No learning, 1:Forward run learning 2:Reverse run learning	0	**1 or 2**
F330	Automatic light-load high-speed operation frequency	30.0 ~ Upper limit frequency Hz	60.0Hz	60.0Hz
F331	Light-load high-speed operation switching lower limit frequency	30.0 ~ Upper limit frequency Hz	40.0Hz	40.0Hz
F332	Light-load high-speed operation load waiting time	0.0 ~ 10.0 sec.	0.5 sec.	0.5 sec.
F333	Light-load high-speed operation load detection time	0.0 ~ 10.0 sec.	1.0 sec.	1.0 sec.
F334	Light-load high-speed operation heavy load detection time	0.0 ~ 10.0 sec.	0.5 sec.	0.5 sec.
F335	Switching load torque during power running	-250 ~ 250%	50%	AUTO
F336	Heavy-load torque during power running	-250 ~ 250%	100%	AUTO
F337	Heavy-load torque during constant power running	-250 ~ 250%	50%	AUTO
F338	Switching load torque during regenerative braking	-250 ~ 250%	50%	AUTO