ITOH DENKI

TECHNOLOGY FOR TOMORROW

CIRCUIT BOARD
CBV-108FP
CBV-108FN

TECHNICAL DOCUMENTATION

POWER MOLLER®

SUMMARY

1 - Presentation of the Power Moller® product range

POWER MOLLER® solutions

Controls

- Standard circuit board
  - CB016 | CB016B
  - CBM-105
  - CBK-109 | CBK-109B — *Replacing CB030*
  - CB018
  - CBV-108
- ZPA circuit board
  - HB510 | HB510B
  - HBK-608
  - HBV-609
- Module circuit board
  - HBR-605
  - CBR-306
  - HBM-201
- Network controller
  - IB-E
  - IB-P

Motorized rollers

- DC Brushless
  - External circuit board
    - Ø50
      - PM500 FE (300 kg) — CBM-105, HB510, IB-E
      - PM500 VE (300 kg) — CBV-108, HBV-609, IB-P
      - PM500 FE-B (300 kg) — CB016B, HB510B — ◎
    - Ø60,5
      - PM605 FE (500 kg) — CBM-105, HB510, IB-E
      - PM605 VE (500 kg) — CBV-108, HBV-609, IB-P
      - PM605 FE-B (500 kg) — CB016B, HB510B — ◎
      - PM605 KT (1000 kg) — CBK-109, HBK-608, IB-P, IB-E
      - PM605 KT-B (1000 kg) — CBK-109B — ◎
    - Ø32
      - PM320 HS (10 kg) — CB018
  - Integrated circuit board
    - Ø50
      - PM500 XE (300 kg) — B&W AS-i 5.0, Wenglor
      - PM500 XP (300 kg) — B&W AS-i 5.0, Wenglor
      - PM500 XK (300 kg) — PEPPERL-FUCHS, AS-Interface, B&W AS-i 5.0
      - PM500 XC (300 kg) — PEPPERL-FUCHS, AS-Interface, B&W AS-i 5.0
    - Ø60,5
      - PM605 XE (500 kg) — B&W AS-i 5.0, Wenglor
      - PM605 XP (500 kg) — B&W AS-i 5.0, Wenglor

Modules

- 90° transfer
  - F-RAT-S250 — HBR-605, CBM-105, CBR-306
  - F-RAT-S300 — HBR-605, CBM-105, CBR-306
  - F-RAT-NX75 — CBK-109, CB016B, HBM-201, IB-E, IB-P
- 45° transfer
  - POP-UP — CBM-105, CBR-306
  - POP-UP VE — IB-P03F-P-UL, IB-P01FP-UL, CBV-108FP-LF1, CBV-108FP, CBV-108FP-LF1
- 30° / 45° / 90° transfer
  - MABS — IB-E06F-M1

Corresponding circuit board | Compatible module / sensor | Max load to be conveyed | Mechanical brake version

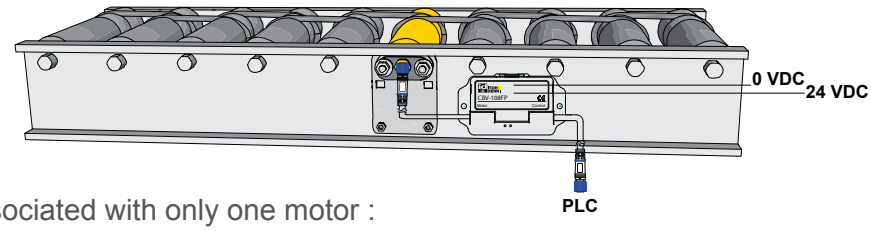
2. Circuit board presentation

General description

- Fastener hardware
  - 2 cross-head screws M4 x 15
  - 2 spring washers M4
  - 2 nuts M4
- 1 Connector M8 5 Pins
- 1 Connector M8 4 Pins

⇨ PNP Version : CBV-108FP
⇨ NPN Version: CBV-108FN

Motorized roller series compatible : PM500VE, PM605VE

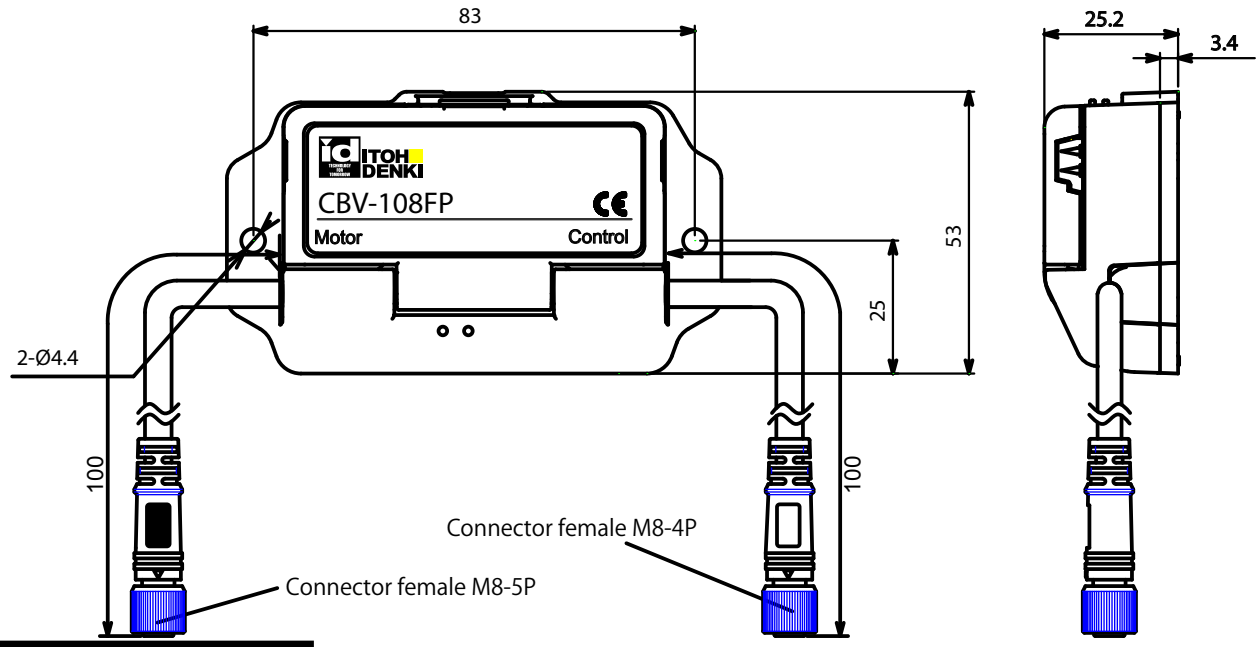


The circuit board CBV-108 must be associated with only one motor :

1 Power Moller ® 24 brushless = 1 CBV-108

⚠ The CBV-108 circuit board is not compatible with motorized roller equipped with mechanical brake.

Dimensions



Specifications

SPECIFICATIONS	Power supply	TBTS 24V DC ± 10% - ripple < 10% Protection 7A
	Input current without motorized roller	0.03A
	Input power without motorized roller	1,5W
	Start current limitation	4,4 A
	Motor start time after start signal (RUN / STOP)	< 15 ms
	Protection index	IP65
	Protection	Integrated fuse of 7A Against polarity reversal 24V and 0V Thermal protection (95°C for circuit board and 105°C for the motor) Against induced overvoltage
	Initialisation time Circuit board 24 V power supply	0.5s
	Environment	From 0 to 40 °C Less than 90% relative humidity (without condensation) Neither corrosive nor explosive atmosphere Vibrations < 0,5 G
FUNCTIONS	PWM frequency	10KHz
	Temporisation	● Initial reset 0.5sec or less ● Input signal (CN2#1,CN2#2) : Approx. 12ms The signal is checked once every 4ms. The signal is recognized when the signal matches three consecutive times. ● Analog input signal (External speed voltage)Approx. 20ms Checked once every 5ms, and average four bit. ● Free running time for switching “Drive → Brake” of motor
	Rotation direction	Rotating direction can be change
	Life time	50000 hours
	PNP/NPN input/output selection	CBV-108 does not have a switch to switch between PNP and NPN for input/output. (PNP for CBV-108FP, and NPN for CBV-108FN) CBV-108FP and CBV-108FN are not compatible together.

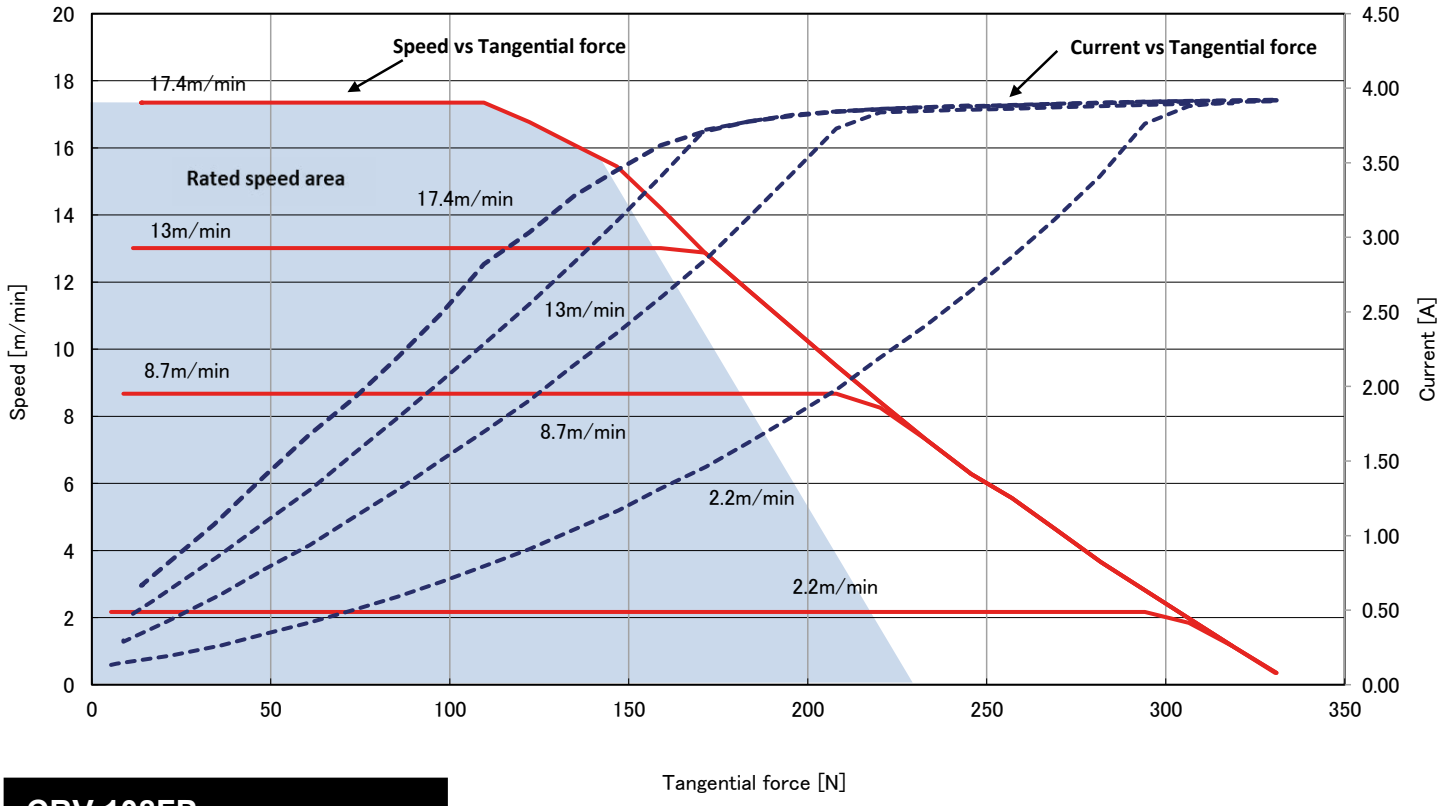
3. TECHNICAL DATA DEPENDING ON THE MOTORIZED ROLLER

With PM500VE motorized roller

PM500VE - Speed code 17

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
17.4	142.7	331.5	3.57	8.29	0.7	3.4	4,0	55	82
15.9	146.3		3.66		0.6	3.3		54	80
15.2	147.8		3.70		0.6	3.3		54	80
14.5	149.6		3.74		0.5	3.3		52	79
13.7	154.8		3.87		0.5	3.3		50	78
13.0	158.2		3.95		0.5	3.3		48	78
11.6	166.4		4.16		0.4	3.3		48	78
10.9	169.7		4.24		0.4	3.2		45	77
10.1	173.7		4.34		0.4	3.2		42	76
9.4	177.9		4.45		0.4	3.1		40	75
8.7	181.6		4.54		0.4	3.0		39	75
7.2	189.5		4.74		0.3	2.9		32	66
5.8	198.0		4.95		0.3	2.7		28	64
4.3	205.3		5.13		0.3	2.5		22	61
2.9	214.1		5.35		0.2	2.3		15	53
2.2	216.9		5.42		0.2	2.1		12	52

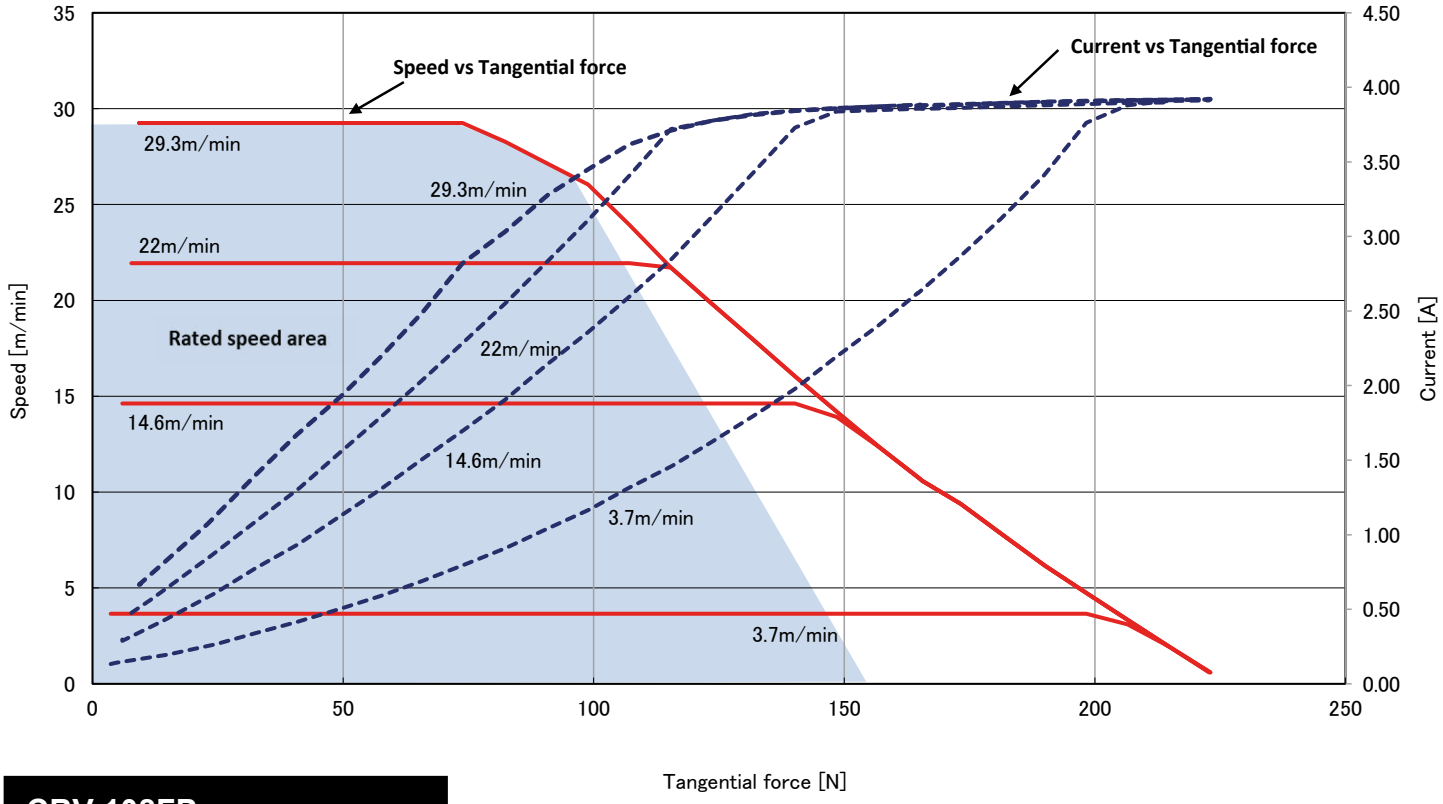
Reduction ratio	1/44,97



PM500VE - Speed code 25

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
29.3	96.1		2.40		0.7	3.4		55	82
26.8	98.6		2.47		0.6	3.3		54	80
25.6	99.6		2.49		0.6	3.3		54	80
24.4	100.9		2.52		0.5	3.3		52	79
23.2	104.3		2.61		0.5	3.3		50	78
22.0	106.6		2.67		0.5	3.3		48	78
19.5	112.1		2.80		0.4	3.3		48	78
18.3	114.4	223.5	2.86	5.59	0.4	3.2	4,0	45	77
17.1	117.1		2.93		0.4	3.2		42	76
15.9	119.9		3.00		0.4	3.1		40	75
14.6	122.4		3.06		0.4	3.0		39	75
12.2	127.7		3.19		0.3	2.9		32	66
9.8	133.5		3.34		0.3	2.7		28	64
7.3	138.4		3.46		0.3	2.5		22	61
4.9	144.3		3.61		0.2	2.3		15	53
3.7	146.2		3.65		0.2	2.1		12	52

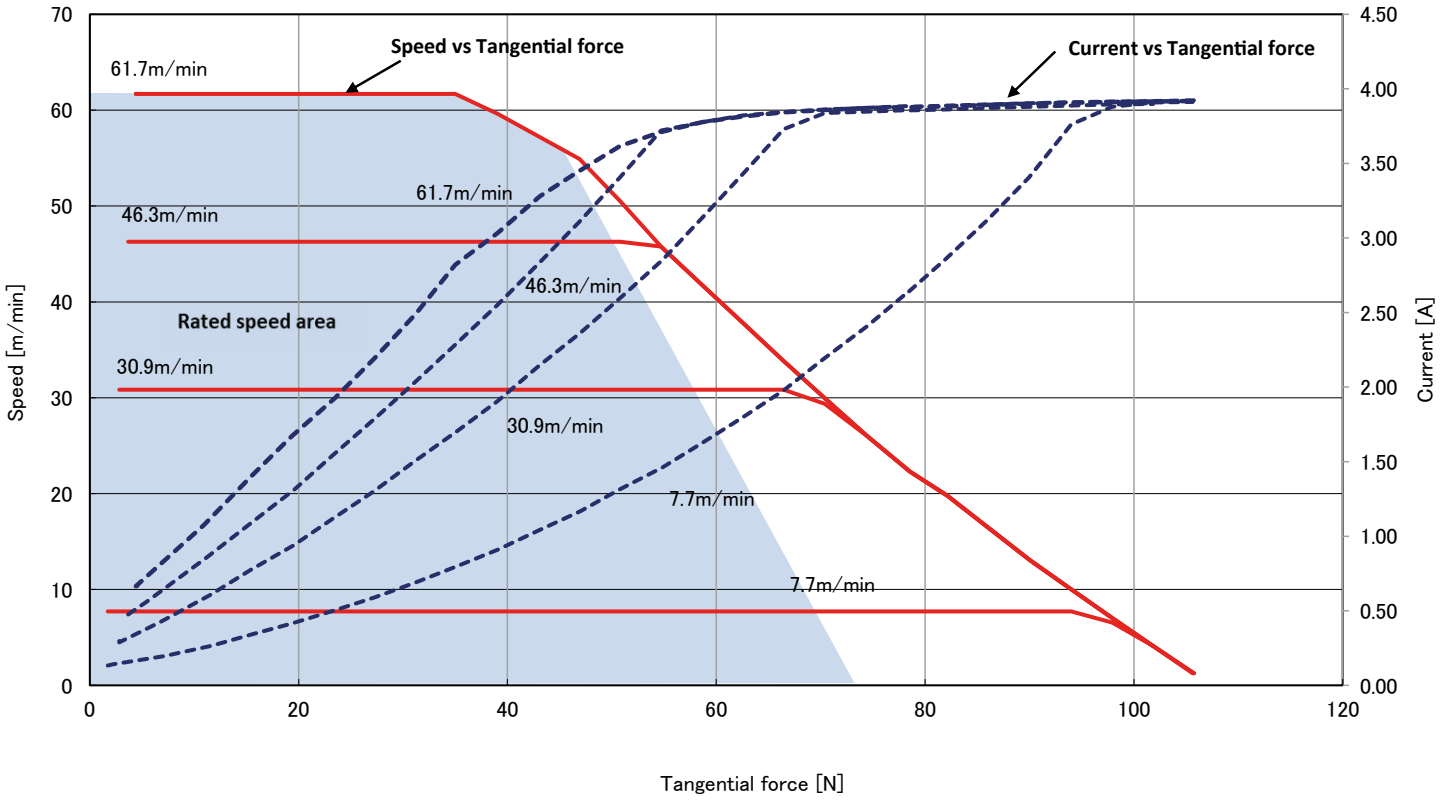
Reduction ratio	1/26,67



PM500VE - Speed code 60

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
61.7	45.6	105.9	1.14	2.65	0.7	3.4	4,0	55	82
56.6	46.8		1.17		0.6	3.3		54	80
54.0	47.2		1.18		0.6	3.3		54	80
51.4	47.8		1.20		0.5	3.3		52	79
48.9	49.5		1.24		0.5	3.3		50	78
46.3	50.5		1.26		0.5	3.3		48	78
41.2	53.2		1.33		0.4	3.3		48	78
38.6	54.2		1.36		0.4	3.2		45	77
36.0	55.5		1.39		0.4	3.2		42	76
33.4	56.9		1.42		0.4	3.1		40	75
30.9	58.0		1.45		0.4	3.0		39	75
25.7	60.6		1.51		0.3	2.9		32	66
20.6	63.3		1.58		0.3	2.7		28	64
15.4	65.6		1.64		0.3	2.5		22	61
10.3	68.4		1.71		0.2	2.3		15	53
7.7	69.3		1.73		0.2	2.1		12	52

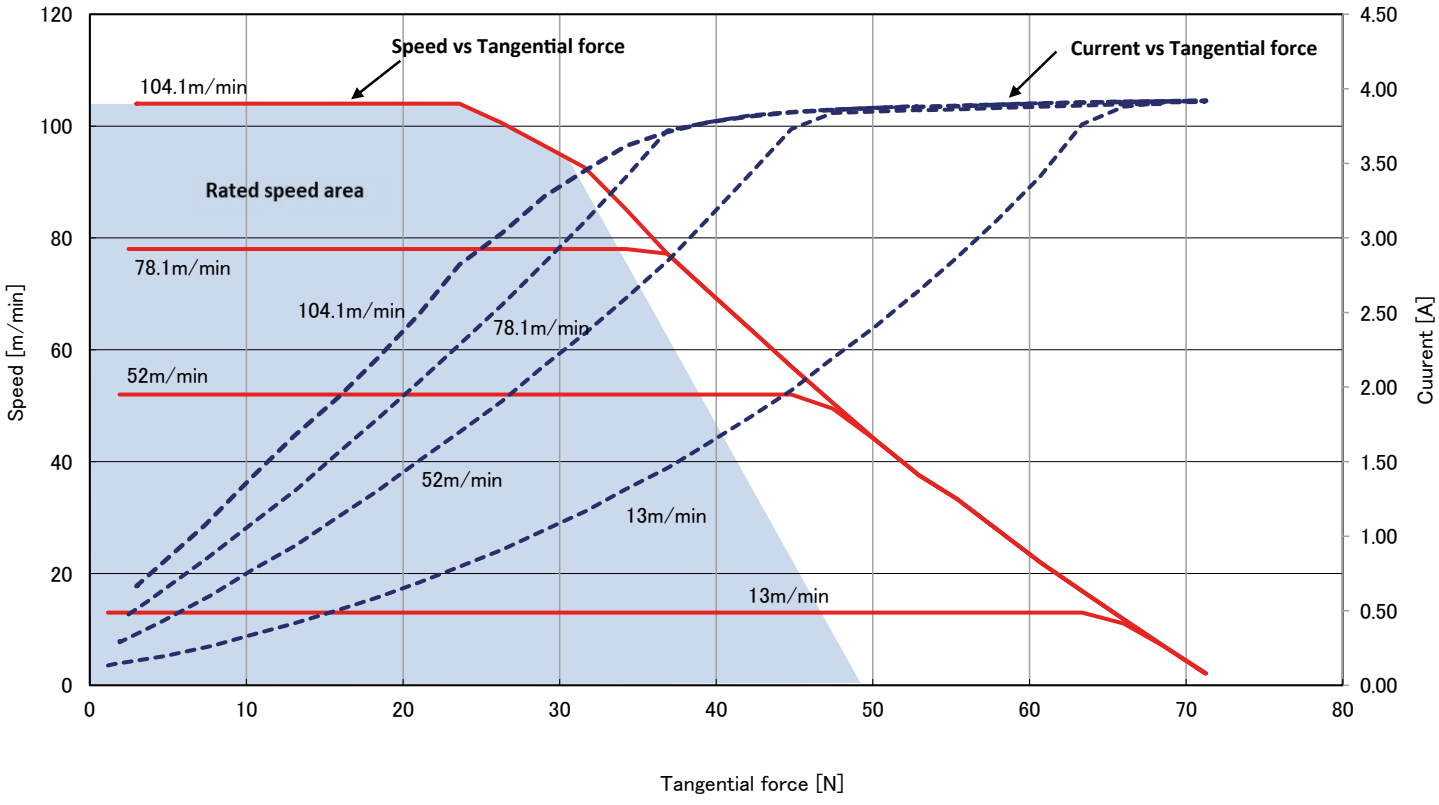
Reduction ratio	1/12,65



PM500VE - Speed code 90

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
104.1	30.7		0.77		0.7	3.4		55	82
95.4	31.5		0.79		0.6	3.3		54	80
91.1	31.8		0.80		0.6	3.3		54	80
86.7	32.2		0.81		0.5	3.3		52	79
82.4	33.3		0.83		0.5	3.3		50	78
78.1	34.1		0.85		0.5	3.3		48	78
69.4	35.8		0.90		0.4	3.3		48	78
65.1	36.6	71.4	0.91	1.79	0.4	3.2	4,0	45	77
60.7	37.4		0.94		0.4	3.2		42	76
56.4	38.3		0.96		0.4	3.1		40	75
52.0	39.1		0.98		0.4	3.0		39	75
43.4	40.8		1.02		0.3	2.9		32	66
34.7	42.6		1.07		0.3	2.7		28	64
26.0	44.2		1.11		0.3	2.5		22	61
17.3	46.1		1.15		0.2	2.3		15	53
13.0	46.7		1.17		0.2	2.1		12	52

Reduction ratio	1/7,5

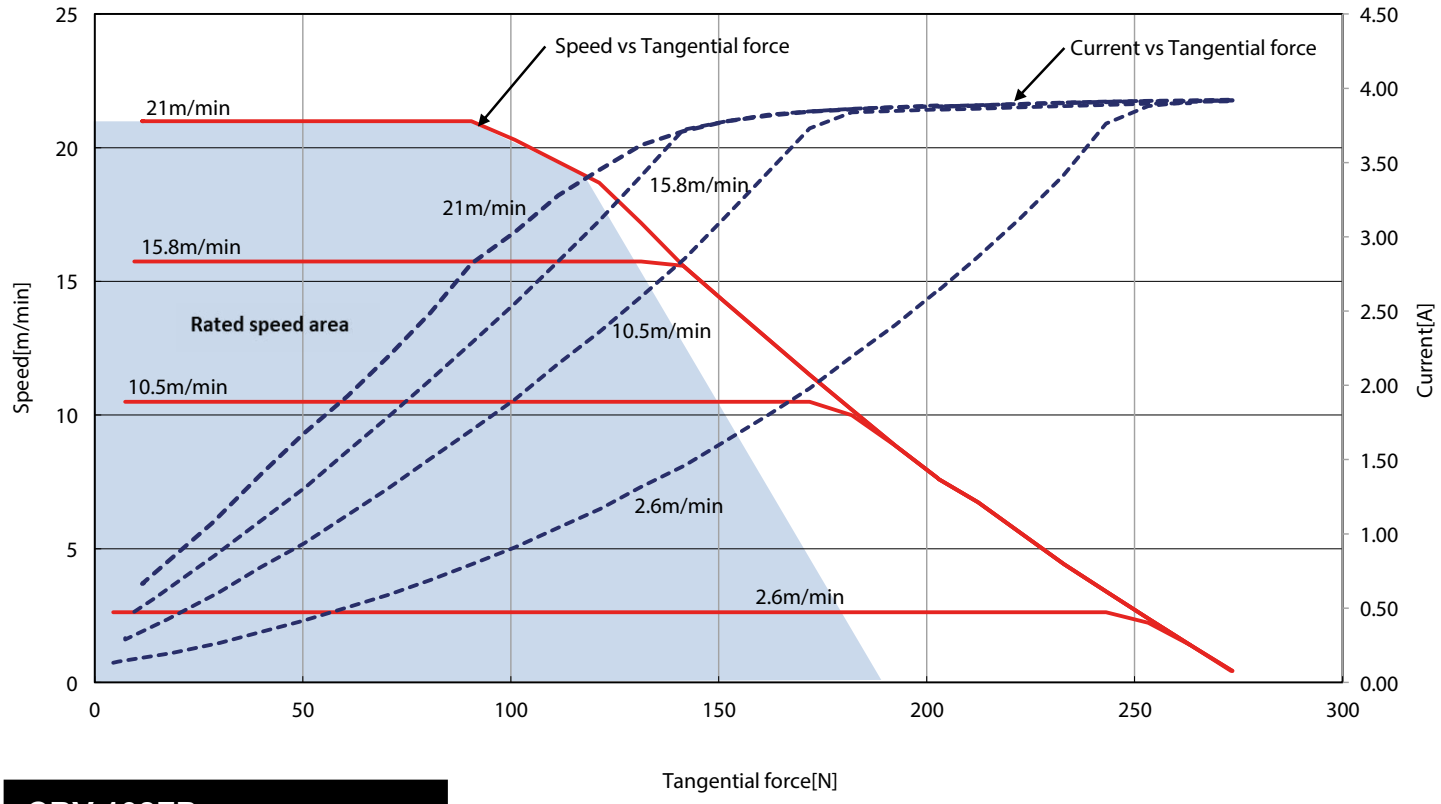


With PM605VE motorized roller

PM605VE - Speed code 17

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
21.0	117.9	274.1	3.57	8.29	0.7	3.4	4,0	55	82
19.3	120.9		3.66		0.6	3.3		54	80
18.4	122.2		3.70		0.6	3.3		54	80
17.5	123.7		3.74		0.5	3.3		52	79
16.6	128.0		3.87		0.5	3.3		50	78
15.8	130.7		3.95		0.5	3.3		48	78
14.0	137.5		4.16		0.4	3.3		48	78
13.1	140.3		4.24		0.4	3.2		45	77
12.3	143.5		4.34		0.4	3.2		42	76
11.4	147.1		4.45		0.4	3.1		40	75
10.5	150.1		4.54		0.4	3.0		39	75
8.7	156.6		4.74		0.3	2.9		32	66
7.0	163.6		4.95		0.3	2.7		28	64
5.2	169.7		5.13		0.3	2.5		22	61
3.5	177.0		5.35		0.2	2.3		15	53
2.6	179.2		5.42		0.2	2.1		12	52

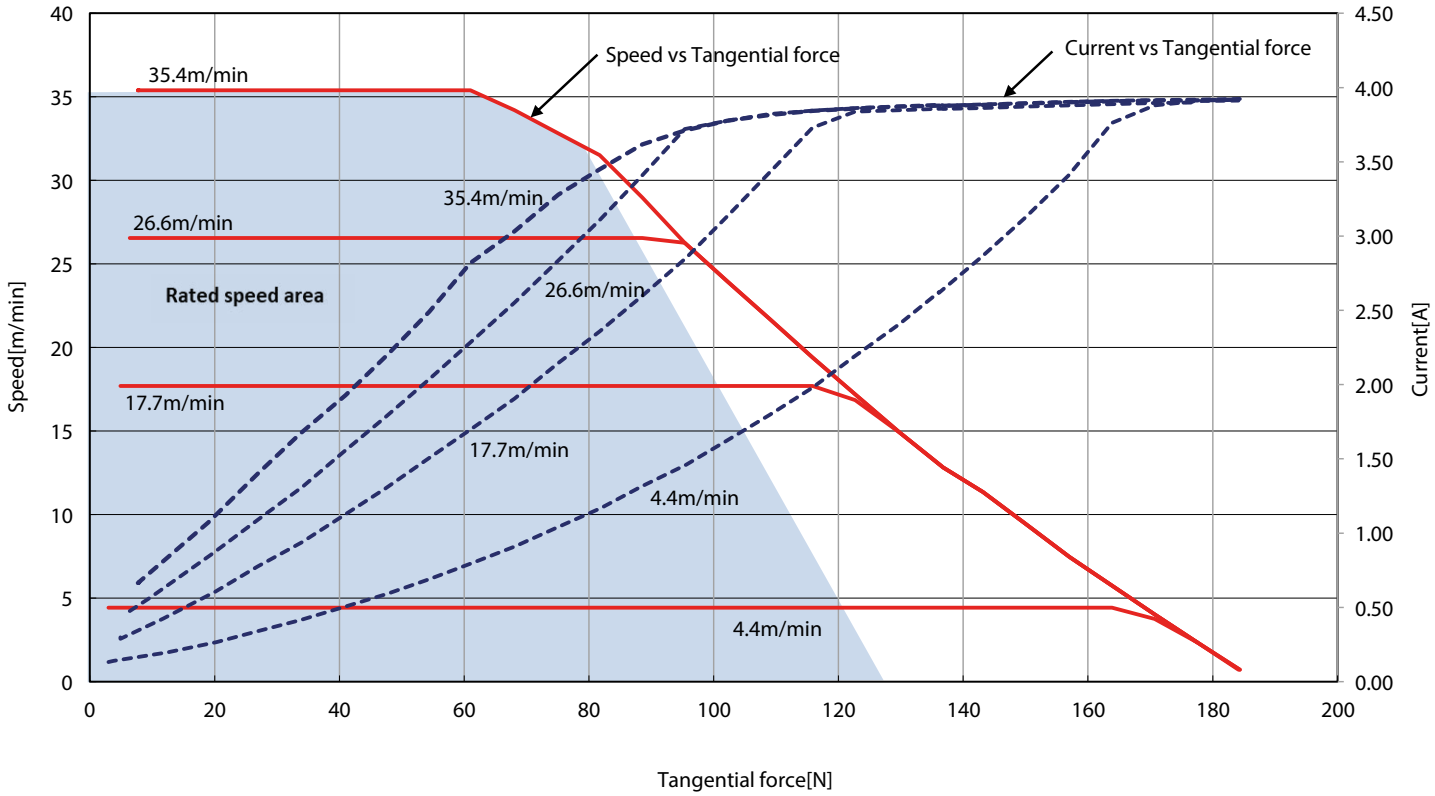
Reduction ratio	1/44,97



PM605VE - Speed code 25

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
35.4	79.5		2.40		0.7	3.4		55	82
32.5	81.5		2.47		0.6	3.3		54	80
31.0	82.3		2.49		0.6	3.3		54	80
29.5	83.4		2.52		0.5	3.3		52	79
28.0	86.2		2.61		0.5	3.3		50	78
26.6	88.1		2.67		0.5	3.3		48	78
23.6	92.7		2.80		0.4	3.3		48	78
22.1	94.5	184.8	2.86	5.59	0.4	3.2	4,0	45	77
20.7	96.7		2.93		0.4	3.2		42	76
19.2	99.1		3.00		0.4	3.1		40	75
17.7	101.1		3.06		0.4	3.0		39	75
14.8	105.6		3.19		0.3	2.9		32	66
11.8	110.3		3.34		0.3	2.7		28	64
8.9	114.4		3.46		0.3	2.5		22	61
5.9	119.3		3.61		0.2	2.3		15	53
4.4	120.8		3.65		0.2	2.1		12	52

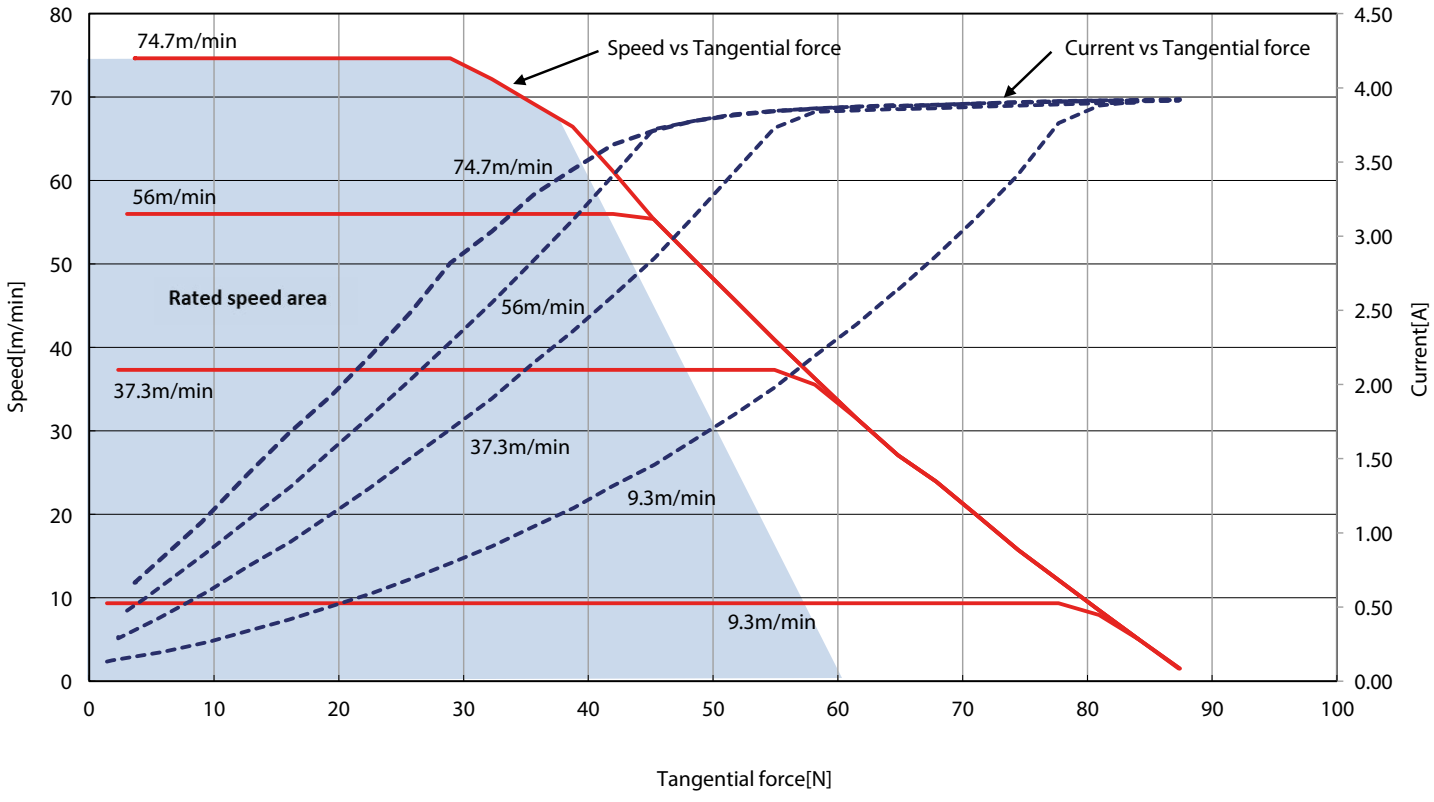
Reduction ratio	1/26,67



PM605VE - Speed code 60

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
74.7	37.7	87.6	1.14	2.65	0.7	3.4	4,0	55	82
68.5	38.6		1.17		0.6	3.3		54	80
65.4	39.0		1.18		0.6	3.3		54	80
62.2	39.5		1.20		0.5	3.3		52	79
59.1	40.9		1.24		0.5	3.3		50	78
56.0	41.8		1.26		0.5	3.3		48	78
49.8	43.9		1.33		0.4	3.3		48	78
46.7	44.8		1.36		0.4	3.2		45	77
43.6	45.9		1.39		0.4	3.2		42	76
40.5	47.0		1.42		0.4	3.1		40	75
37.3	48.0		1.45		0.4	3.0		39	75
31.1	50.0		1.51		0.3	2.9		32	66
24.9	52.3		1.58		0.3	2.7		28	64
18.7	54.2		1.64		0.3	2.5		22	61
12.4	56.6		1.71		0.2	2.3		15	53
9.3	57.3		1.73		0.2	2.1		12	52

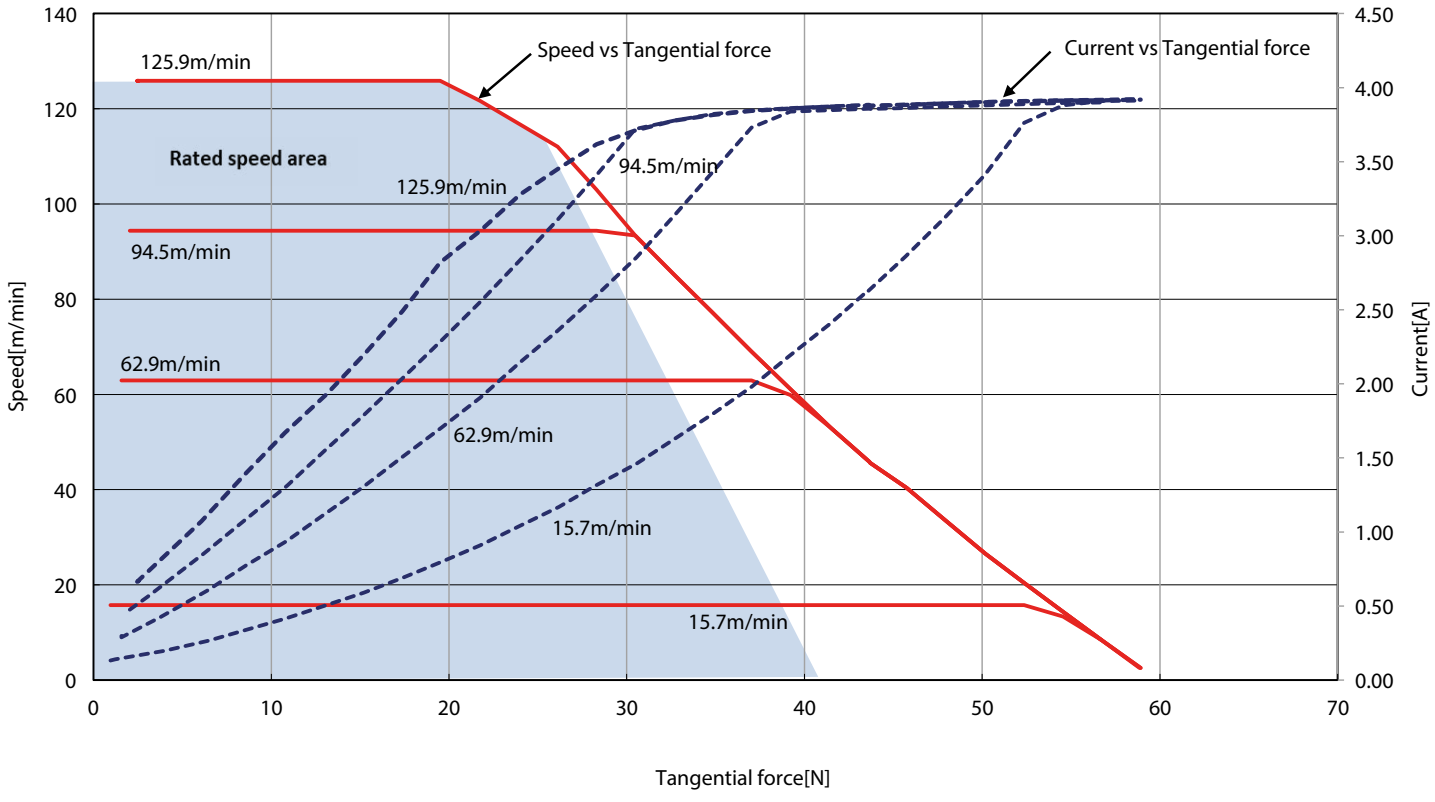
Reduction ratio	1/12,65



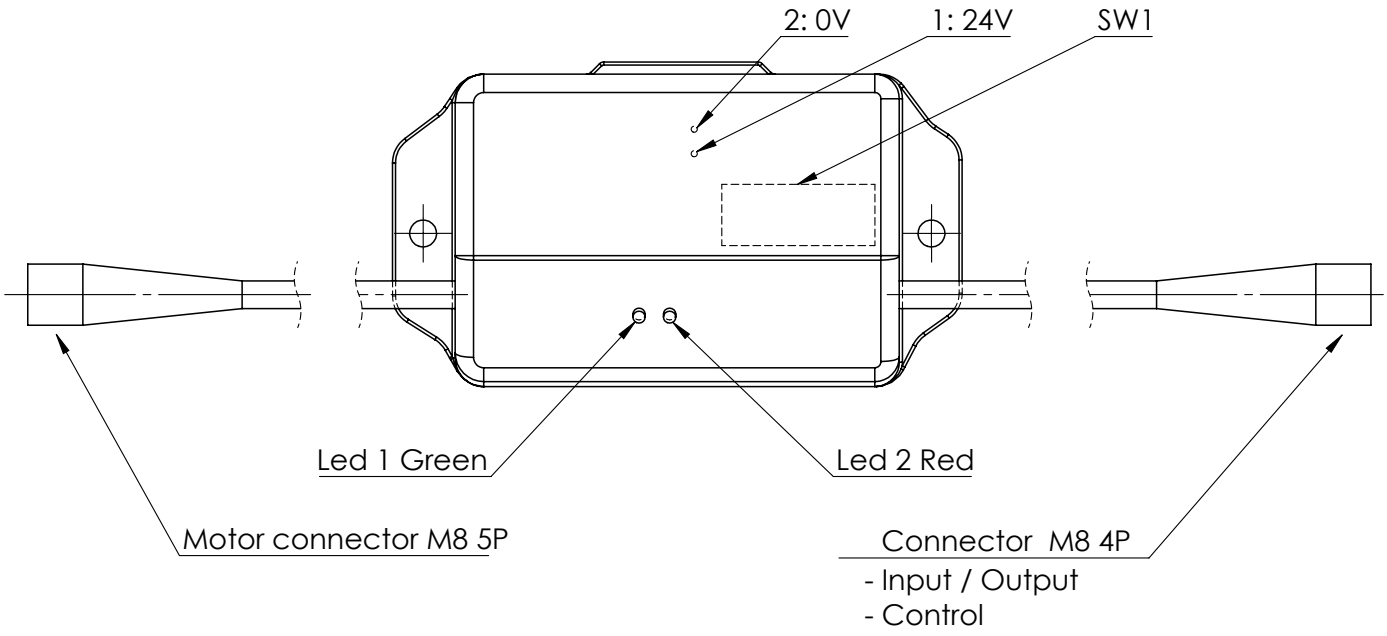
PM605VE - Speed code 90

Speed (m/min)	Tangential force (N)		Torque (Nm)		Current (A)			Rated output (W)	Rated input (W)
No load	Nominal	Start-up	Nominal	Start-up	No load	Nominal	Start-up		
125.9	25.4	59.0	0.77	1.79	0.7	3.4	4,0	55	82
115.4	26.0		0.79		0.6	3.3		54	80
110.2	26.3		0.80		0.6	3.3		54	80
104.9	26.6		0.81		0.5	3.3		52	79
99.7	27.6		0.83		0.5	3.3		50	78
94.5	28.2		0.85		0.5	3.3		48	78
84.0	29.6		0.90		0.4	3.3		48	78
78.7	30.2		0.91		0.4	3.2		45	77
73.5	30.9		0.94		0.4	3.2		42	76
68.2	31.7		0.96		0.4	3.1		40	75
62.9	32.3		0.98		0.4	3.0		39	75
52.5	33.7		1.02		0.3	2.9		32	66
42.0	35.2		1.07		0.3	2.7		28	64
31.5	36.5		1.11		0.3	2.5		22	61
21.0	38.1		1.15		0.2	2.3		15	53
15.7	38.6		1.17		0.2	2.1		12	52

Reduction ratio	1/7,5

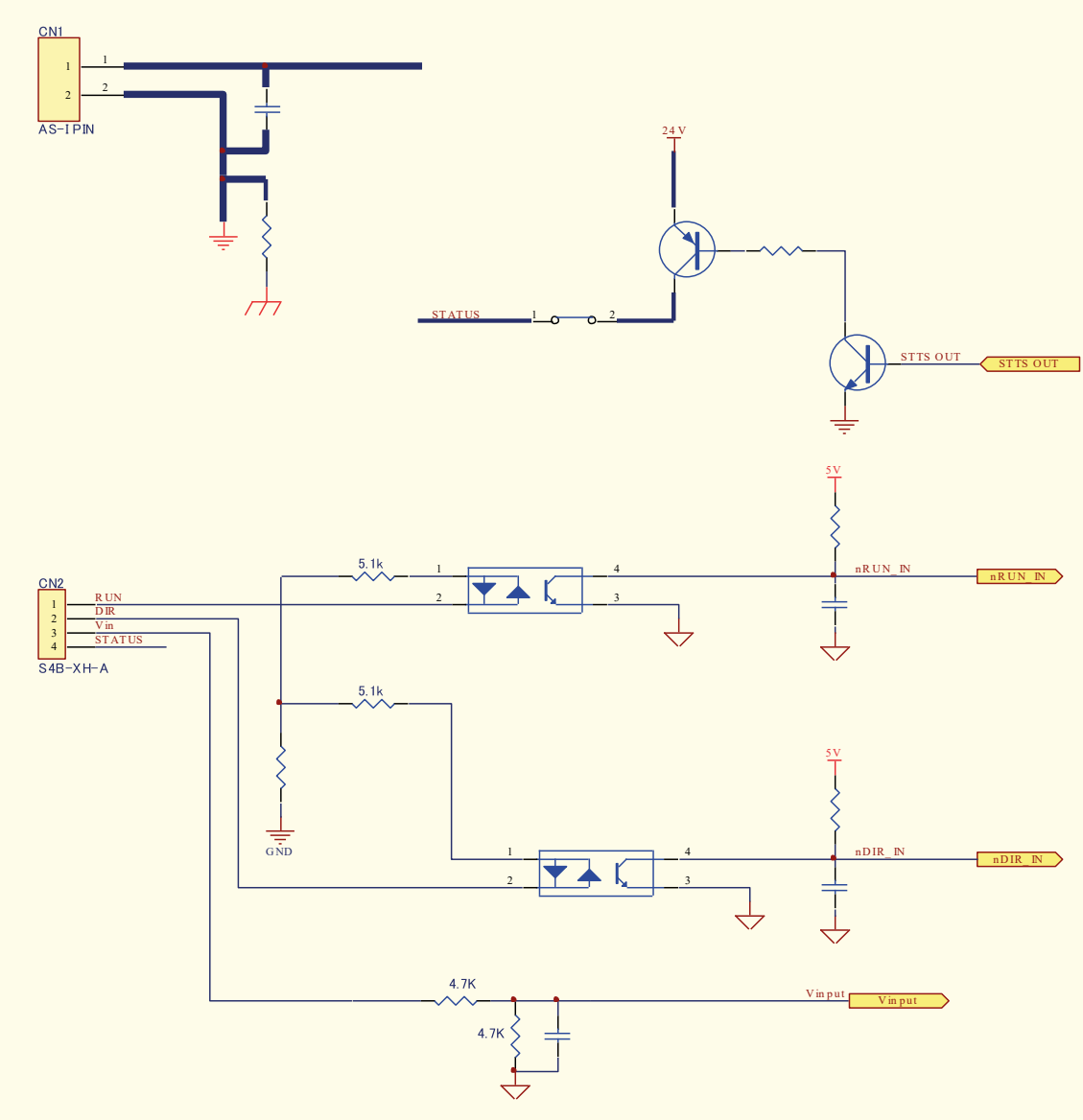


4. Location of items

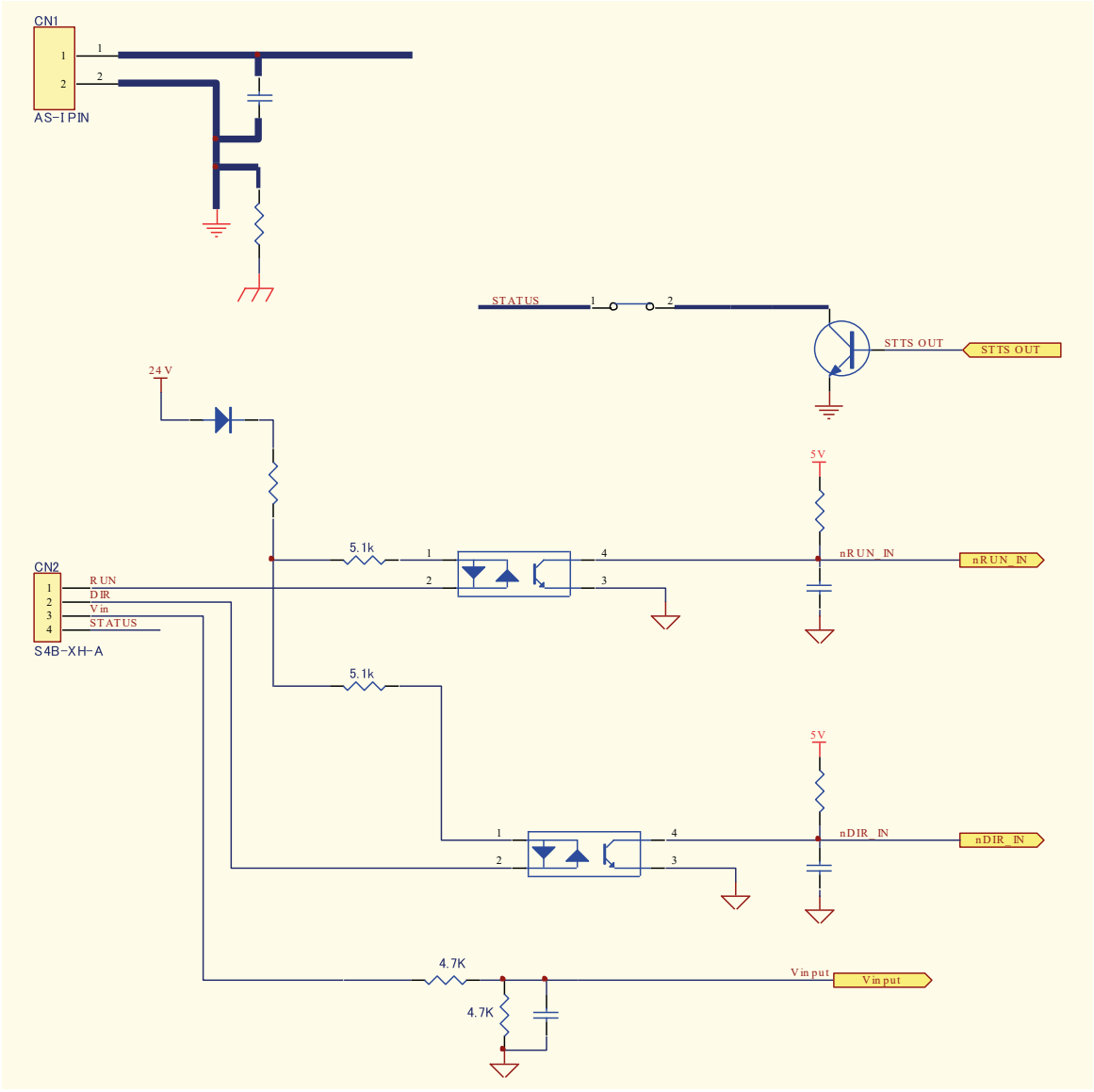


5. WIRING

CBV-108FP Internal circuit diagram



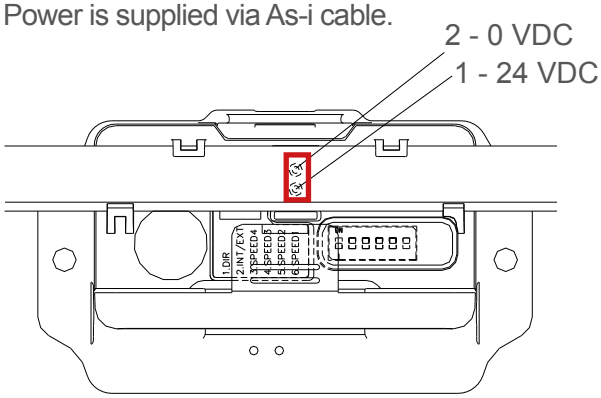
CBV-108FN Internal circuit diagram



6. Connectors

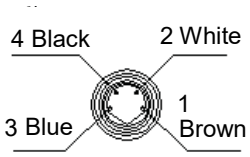
Power

Power is supplied via As-i cable.



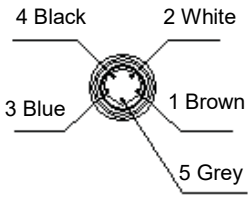
⚠ Provide a power supply that is sufficiently powerful in function of the type and number of motorized rollers to be powered.

M8-4P - Control connector



N°	Color	Driver side	Description
1	Brown	RUN / STOP	INPUT 24VDC (PNP) / 0VDC (NPN)
2	White	Direction	INPUT 24VDC (PNP) / 0VDC (NPN)
3	Blue	Analogic voltage for external speed	INPUT 0 V~10VDC
4	Black	Status	OUTPUT PNP Open collector (max25mADC) NPN Open collector (max25mADC)

M8-5P - Motor connector



N°	Color	Use
1	Brown	Motor Phase U
2	White	Motor Phase V
3	Blue	Hall signal (Analog)
4	Black	Motor Phase W
5	Grey	+12V

⚠ Make sure that all power supplies are turned off before connecting or disconnecting motorized rollers or doing any other wiring operations. Motorized rollers or circuit boards can be damaged by not following this precaution.

Connector CN2 - Terminal 1 - run / stop signal

- Input signal is decided either PNP or NPN based on the model, CBV-108FP or CBV-108FN.
- Motor is driven by input RUN/STOP signal.
- When no signal input, motor is stopped and dynamic brake works.
- Minimum 12ms between each ON/OFF signal.

⚠ The signal is checked once every 4ms. The signal is recognized when the condition is the same for three consecutive times.

Connector CN2 - Terminal 2 - Direction signal

- Input signal is decided either PNP or NPN based on the model, CBV-108FP or CBV-108FN.
- The rotation direction is set in combination with the SW1#1 dip-switch.

(Refer to «SW1 - Dip-switch 1 - Rotation direction» on Page 19 for the combination)

- Motor is stopped when the signal is switched while motor is being driven. The rotation direction is shifted and the motor is driven for 500ms after that. Dynamic brake works to stop the motor.
- Minimum 12ms between each ON/OFF signal.

Connector CN2 - Terminal 3 - Input voltage for external speed

- Possible to set speed by inputting an analogic voltage, from 0V to10V.
- Possible to change speed by inputting voltage during RUN.
- It is effective when SW1#2 dip-switch is ON. When it is OFF, SW1#3 to #6 dip-switches are effective. Possible to change external/internal speed by switching SW1#2 dip-switch ON/OFF during RUN.
- (Refer to «SW1 - Dip-switch 3, 4, 5 and 6 - Internal speed setting» on Page 20 for speed setting.

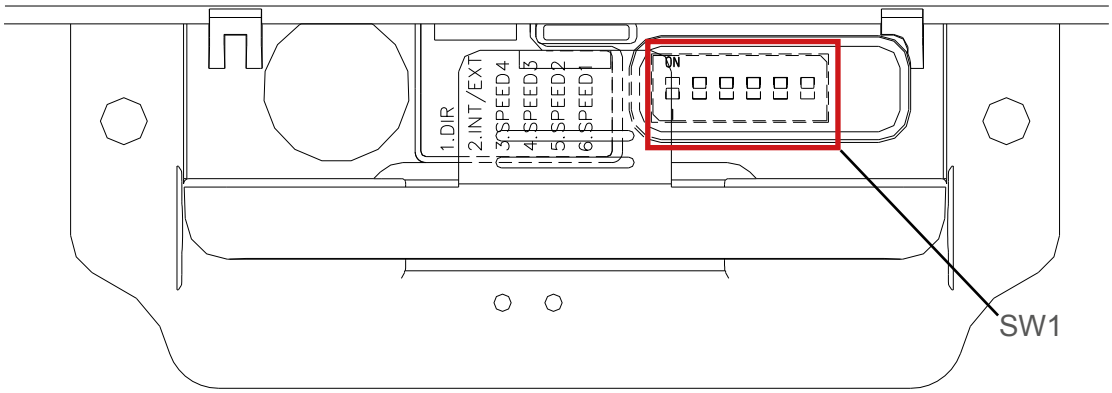
Connector CN2 - Terminal 4 - Error signal

- Output signal is decided PNP or NPN based on the model, CBV-108FP or CBV-108FN.
- The signal is ON when it is normal.
- Open collector output
- The output shall be under 25mA (add a resistor if needed).

⚠ Polyswitch fuse is integrated to prevent short-circuit at output. Polyswitch fuse works when the output part is short-circuited. Thus, error signal output the abnormality, but the motor is driven. (When it is abnormal, it is stopped.)

⚠ If output is connected to inductive load (Ex. Relay coil , solenoid , actuator , etc .), make sure to protect output from Back voltage with a free-wheeling diode.

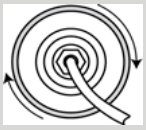
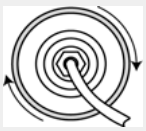
7. DIP-SWITCH FOR CONFIGURATION SW1



N°	Details	ON	OFF	Default setting
1	Rotation direction	Refer to the table below for combination with external input signal		OFF
2	Internal / external speed setting	External	Internal	OFF
3	Internal speed setting 4	Refer to the table for speed (Page 20)		ON
4	Internal speed setting 3			ON
5	Internal speed setting 2			ON
6	Internal speed setting 1			ON

SW1 - Dip-switch 1 - Rotation direction

- Rotation direction is set in combination with the direction signal.
- Rotation direction cannot be changed by SW while motor is being driven.

CN2-2	SW1-1	
	ON	OFF
ON	 CCW	 CW
OFF	 CW	 CCW

SW1 - Dip-switch 2 - Internal / External speed setting

- Internal speed setting is effective when dip-switch SW1#2 is OFF. Internal speed is set by the combination of dip-switches SW1#3 to #6.
- External speed setting is effective when dip-switch SW1#2 is ON. External speed is set by the input voltage to CN2#4.

SW1 - Dip-switches 3, 4, 5 and 6 - Internal speed setting

- There are 16 speed by the combination of 4 dip-switches.

	With PM500VE								
	Internal speed setting				Speed				Tolerance
	SW3	SW4	SW5	SW6	Code 17	Code 25	Code 60	Code 90	
16	ON	ON	ON	ON	17.4	29.3	61.7	104.0	±1%
15	ON	ON	ON	OFF	15.9	26.8	56.6	95.3	
14	ON	ON	OFF	ON	15.2	25.6	54.0	91.0	
13	ON	ON	OFF	OFF	14.5	24.4	51.4	86.7	
12	ON	OFF	ON	ON	13.7	23.2	48.9	82.3	
11	ON	OFF	ON	OFF	13.0	21.9	46.3	78.0	
10	ON	OFF	OFF	ON	11.6	19.5	41.1	69.3	
9	ON	OFF	OFF	OFF	10.8	18.3	38.6	65.0	
8	OFF	ON	ON	ON	10.1	17.1	36.0	60.7	
7	OFF	ON	ON	OFF	9.4	15.8	33.4	56.3	
6	OFF	ON	OFF	ON	8.7	14.6	30.9	52.0	
5	OFF	ON	OFF	OFF	7.2	12.2	25.7	43.3	
4	OFF	OFF	ON	ON	5.8	9.8	20.6	34.7	
3	OFF	OFF	ON	OFF	4.3	7.3	15.4	26.0	
2	OFF	OFF	OFF	ON	2.9	4.9	10.3	17.3	±3%
1	OFF	OFF	OFF	OFF	2.2	3.7	7.7	13.0	

	With PM605VE								
	Internal speed setting				Speed				Tolerance
	SW3	SW4	SW5	SW6	Code 17	Code 25	Code 60	Code 90	
16	ON	ON	ON	ON	21,1	35,5	74,7	125,8	±1%
15	ON	ON	ON	OFF	19,2	32,4	68,5	115,3	
14	ON	ON	OFF	ON	18,4	31,0	65,3	110,1	
13	ON	ON	OFF	OFF	17,5	29,5	62,2	104,9	
12	ON	OFF	ON	ON	16,6	28,1	59,2	99,6	
11	ON	OFF	ON	OFF	15,7	26,5	56,0	94,4	
10	ON	OFF	OFF	ON	14,0	23,6	49,7	83,9	
9	ON	OFF	OFF	OFF	13,1	22,1	46,7	78,7	
8	OFF	ON	ON	ON	12,2	20,7	43,6	73,4	
7	OFF	ON	ON	OFF	11,4	19,1	40,4	68,1	
6	OFF	ON	OFF	ON	10,5	17,7	37,4	62,9	
5	OFF	ON	OFF	OFF	8,7	14,8	31,1	52,4	
4	OFF	OFF	ON	ON	7,0	11,9	24,9	45,6	
3	OFF	OFF	ON	OFF	5,2	8,8	18,6	31,5	
2	OFF	OFF	OFF	ON	3,5	5,9	12,5	20,9	±3%
1	OFF	OFF	OFF	OFF	2,7	4,5	9,3	15,7	

8. LED 1 ET LED 2

LED 1 (green) PWR
The indicator is lit when the circuit board is powered.

LED 2 (red) ERR
The indicator is lit when a malfunction has occurred and allows the type of fault to be identified

LED 1

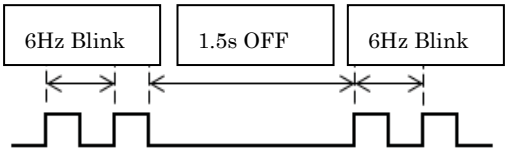
Led off	Led on	1 flash per seconde

LED 2

Led off	Led on	1 flash per seconde	7 flashes per seconde

Error type	LED1 (Green)	LED2 (Red)	Status output	When error occurs	Priority
Normal	●	●	Yes	-	-
Fuse blown	●	✳	Open	Motor stops	1
Under-voltage	●	✳	Open	Motor stops	
Motor unplugged / misplugged	✳	●	Open	Motor stops	2
Locked motor	●	✳	Open	Motor stops	3
Thermal for circuit board	●	●	Open	Motor stops	4
Thermal for motor	●	●	Open	Motor stops	
EMF error	●	✳ ● *1	Open	Motor stops	5

*1 Refer to the figure below for how the LED for EMF error is like.



Refer the details of error conditions, the conditions to recover, and time chart below.
LED indication is set in accordance with the priority when multiple errors occur.

Error type	Error condition	Condition to recover	How to recover
Under-voltage error	Abnormality is found when the voltage for supplying power has been kept at 15V or under for 1 sec. Also, abnormality is found when the voltage has been at 15V or less five times in a period of 500ms.	It is recovered when the voltage for supplying power has been over 18V.	When the condition to recover is satisfied and the input signal of CN2#1 (RUN/STOP signal) is switched OFF => ON, STATUS signal output / LED indication are reset and motor drives. Also, STATUS signal output / LED indication are reset by switching CN2#2 (Direction signal) input signal ON => OFF => ON or OFF => ON => OFF. * In case that RUN signal has been input, motor is driven when the error is released.
EMF error	Abnormality is found when motor voltage has been 40V or over for 2 sec. Also, abnormality is found when motor voltage has been 60V or over for 0.1 sec.	It is recovered when motor voltage has been 30V or under for 1 sec.	
Thermal error for circuit board	Abnormality is found when the temperature of circuit board (FET) has been 95°C or over for 1 sec.	It is recovered when the temperature is 85°C or under.	
Thermal error for motor	Abnormality is found when the temperature inside motor reaches 110°C or more.	It is recovered when the temperature has been under 110°C for 10 sec.	
Motor unplugged	There are two conditions. When supplying power : Abnormality is found when the power is supplied while motor connector is unplugged. After supplying power : Abnormality is found when motor connector has been unplugged for 1s.	It is recovered when motor connector is plugged properly.	
Motor misplugged	Abnormality is found when the VE motor connector and M8-5P connector are not plugged at appropriate position.	It is recovered when motor connector is plugged properly.	
Locked motor	When motor does not rotate for 1sec., it reduces the output to approx. 13% (0.5 to 0.6A) for 3 sec. (The value can output a rated torque) While lowering the output, abnormality is found when motor does not rotate or the speed is 3m/min or slower.	It is recovered when the cause of error is removed.	
Blown fuse	Abnormality is found one sec. after fuse is blown.	No solutions for that. Circuit board has to be replaced.	

9. Precautions

- Use a stabilized power supply.
- Make sure to shut off the power before inserting or removing motor connector and control connector. Otherwise, the circuit board might be broken because of back EMF or there might be a risk of electrical shock.
- Do not start / stop directly from the power supply line. Or it would shorten the board's lifetime.
- Motor cannot be started until approximately 1 sec has passed after supplying power.
- An error can appear when supplying power, if everything work, it remove automatically.
- Do not switch on or off the relay or contactor in close proximity to power or signal lines, or the circuit board as the generated electric noise could cause malfunction.
- Do not pull motor cable by force during operation. It causes the circuit board to malfunction.
- The grounding connection must be applied to the conveyor frame.
- The circuit board should be installed on a flat frame without any force on it.

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