Technical Document

for the

CB 016N6 Driver Card

Contents

Revision index:

rev.	date	pos.	name	Procedure / modification
000	6/22/2009			New document released

1. Introduction

The CB 016S6 driver card is a new driver card for brushless dc motorized roller to replace the current CB 016N3 driver card.
The design concept is to keep the basic functions of the current CB 016N3 driver card. And more importantly the CB 016N3 is designed to be lead free to comply with RoHS directive.
The CB 016N6 driver card is applicable to PM486 (or 500) FS, FE, FP series Power Moller.

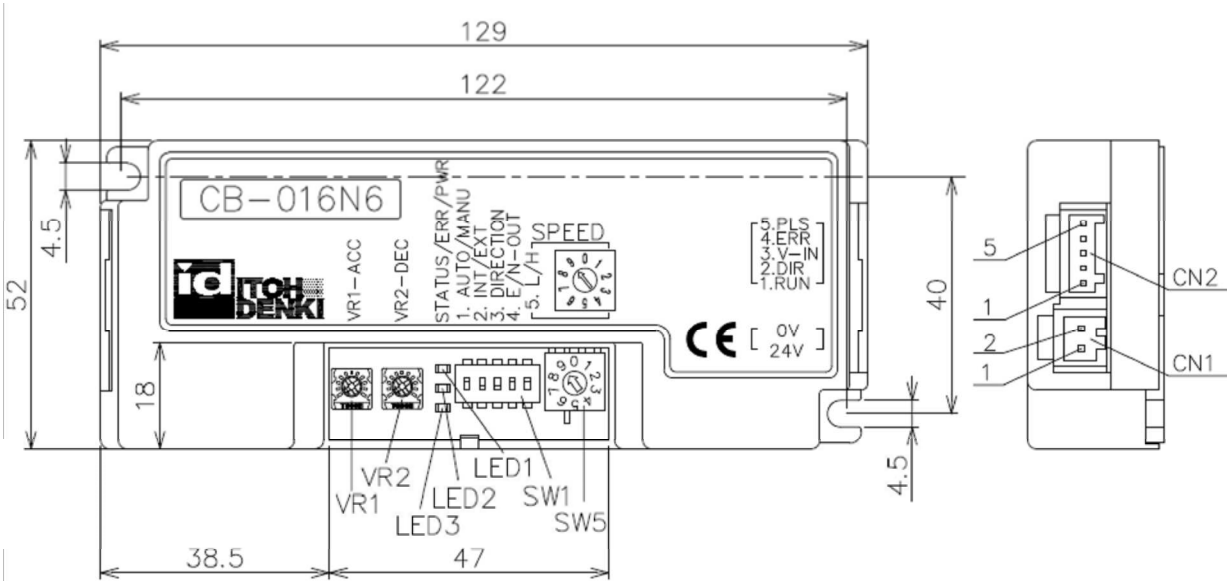
Also available are the following models depending on the type of signal and with or without brake option:

CB 016P6 for standard motor, PNP signal input and output
CB 016S6 for standard motor, NPN signal input and PNP signal output
CB 016BN6 for built-in brake motor, NPN signal input and output
CB 016BP6 for built-in brake motor, PNP signal input and output
CB 016BS6 for built-in brake motor, NPN signal input and PNP signal output

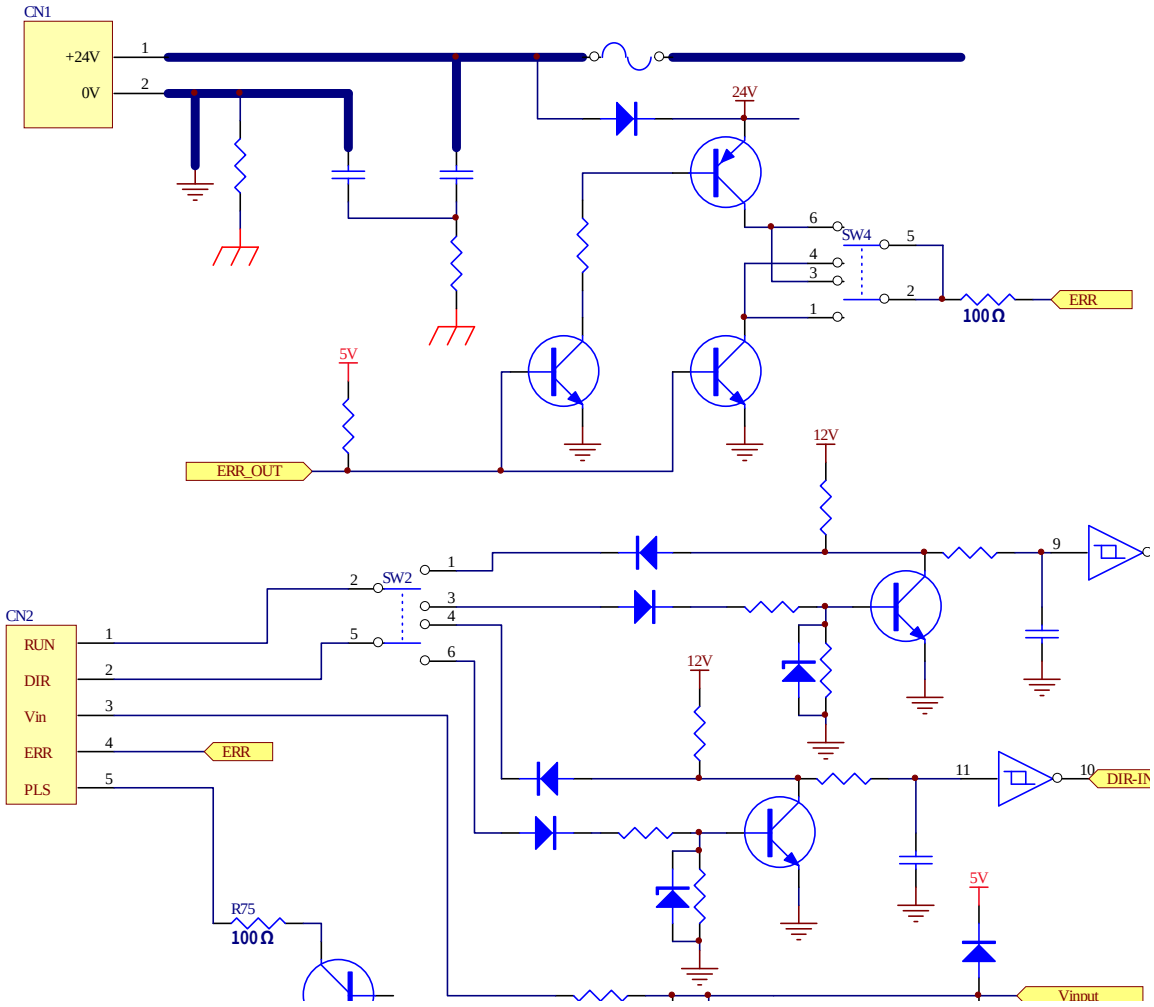
2. Features

- RoHS and EMC conformity.
- Motor pulse signal output (2 pulses / rotation) – NPN open collector output.
- Selections switch for manual or automatic recovery of thermal overload device or shortage voltage (to protect micro processor against voltage lower than 15V).
- Adjustable acceleration and deceleration time (up to 2.5 sec) by integral pot.
- Selection switch for manual or automatic recovery of the thermal overload device
- Integral 10 index rotary switch along with a dip switch to select 20 different fixed speeds.
- 20 step fixed speed can also be obtained by varying external voltage input between 0 and 10 V by selecting external speed variation mode
- Switch to select the timing of error signal discharge; discharge in normal or discharge in abnormal status.
- Forcibly stops the motor if motor blocking or thermal overload error lasts for 4 seconds or over to protect the motor from overheating.
- Allowable reversing motor while motor is running.
- Three (3) LEDs (green, red and orange) to identify the type of error and number of error occurrence

3. Dimensions



4. I/O Interface



5. Connectors

CN1 Power Connector 2P

	Driver side WAGO #734－162	Power cable side WAGO #734－102
1	Power（+24V）	+24V
2	Power（0V（GND））	0V

CN2 Control Connector 5P

	Driver side WAGO #733－365	Control cable side WAGO #733－105
1	Run / Stop	Run with NPN 0V or PNP24V input
2	Direction	Reversing from direction with SW1-3 setting
3	External analog voltage input for speed variation	When SW1-2 is ON, varying external voltage input (0-10V) can vary the motor speed
4	Error signal output	SW1-4 switching for signal discharge in normal or abnormal status (O.C output 24V,25mA or less)
5	Motor pulse output	2 pulses / motor rotation, open collector output NPN signal only – max. 24V, 25mA or less

CN 3 Motor Connector 9P for standard motor (10P for brake motor)

	Driver side JST #S9B-XH-A(9P) JST #S10B-XH-A(10P)	Motor cablse side JST #XHP-9 or #XHP-10 （Afixed to motor cable）
1	GND (grey)	Socket terminal SXH-001P-P0.6 (JST) Wire AWG 28～22 Except motor phase AWG24～22
2	+12V（blue）	
3	Motor phase（red）	
4	Motor phase（white）	
5	Motor phase（black）	
6	Hall IC U (violet)	
7	Hall IC V (orange)	
8	Hall IC W (green)	
9	Thermister (Lt blue)	
10	Brake（yellow）	

6. Switches

SW	Function	ON setting	OFF setting	Initial setting N/P/BN/BP	Initial setting S/BS
1	Selection of manual or automatic thermal device recovery	Manual	Automatic *1	ON	ON
2	Selection of internal or external speed change	External speed variation (0-10V input)	Internal speed variation	OFF	OFF
3	Selection of motor turning dierction; CW or CCW	in accordance with the combination of motor and CN2-2 *2		OFF	OFF
4	Selection of error signal discharge mode	Discharge on normal	Discharge on abnormal	OFF	ON
5	Speed range setting	High range	Low range	ON	ON

* 1 Motor restarts 1 minute after the thermal device is cooled down.

* 2 Motor turning direction according to combination

	SW1-3			
	FS/FP		FE/GE	
	ON	OFF	ON	OFF
CN2-2 ON	CW	CCW	CCW	CW
CN2-2 OFF	CCW	CW	CW	CCW

viewed from the motor power cable side

The motor turning direction cannot be changed while it is turning

Input signal selection

SW2	Left	NPN input
	Right	PNP input

Output signal selection

SW4	Upper	PNP output
	Bottom	NPN output

* 3 20 different fixed speeds with 2 stage gearing Power Moller (48.6mm diameter)
Set the sip switch 1-5 L (off) for setting low range speed and H (on) for high range speed.
Note: rotary is set to 9 as initial setting.

Rotary switch	Low range speed (m/min) +/-3%	Rotary switch	High range speed (m/min) +/-3%
0	7.5	0	32.5
1	10.0	1	35.0
2	12.5	2	37.5
3	15.0	3	40.0
4	17.5	4	45.0
5	20.0	5	47.5
6	22.5	6	50.0
7	25.0	7	52.5
8	27.5	8	55.0
9	30.0	9	60.0

Speed of 50mm diameter roller is about 3% faster than the figures in the table.

Note: Those speed ranges in the table can be obtained only when 60m/min motor is used.
In case of operating motor slower than 60m/min., any dip switch setting won't make its speed faster than its own maximum speed.

The below 20 step fixed speed can also be obtained by varying external analog voltage input between 0 and 10 V by selecting external speed variation mode (SW2 ON)

Input voltage	Speed (m/min) +/-3%	Input voltage	Speed (m/min) +/-3%
0.05-0.45V	7.5	5.05-5.45V	32.5
0.55-0.95V	10.0	5.55-5.95V	35.0
1.05-1.45V	12.5	6.05-6.45V	37.5
1.55-1.95V	15.0	6.55-6.95V	40.0
2.05-2.45V	17.5	7.05-7.45V	45.0
2.55-2.95V	20.0	7.55-7.95V	47.5
3.05-3.45V	22.5	8.05-8.45V	50.0
3.55-3.95V	25.0	8.55-8.95V	52.5
4.05-4.45V	27.5	9.05-9.45V	55.0
4.55-4.95V	30.0	9.55-9.95V	60.0

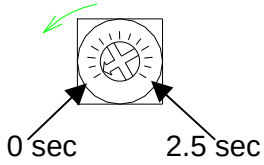
Note: Those speed ranges in the table can be obtained only when 60m/min motor is used.
In case of operating other speed motor, once it reached to its maximum speed, any voltage won't increase the speed faster than its maximum speed.

CB 016S6 driver card has stable speed and constant torque features, thus one fastest motor (FE-60 or FP-55) can basically cover the whole speed range.

7. Potentiometers

VR 1 – Acceleration time adjustment (0-2.5 sec)
Acceleration time from the RUN signal input can be adjusted between 0 and 2.5 sec
VR 2 – Deceleration time adjustment (0-2.5 sec)
Deceleration time from the stop signal input can be adjusted between 0 and 2.5 sec

Acceleration and deceleration time can individually be adjusted. VR switch can turn 270 degree maximum. Each card is shipped with both VR1 and VR 2 turned to the maximum.



8. LEDs and Error Indications

LED 1 – green (power)
LED 2 – red (error 1) illuminated with thermal error and blinks with motor block
LED 3 – orange (error 2)

Low voltage error will happen when voltage drops down to 15V or less and continues for 1 second, or repeats 5 times in 0.5 second. If SW1-4 is set to OFF for automatic recovery, motor restarts as soon as the voltage recovers to 18V or more. If SW1-4 is set to ON for manual recovery, motor won't restart unless signal is given to CN2-1 or CN2-2.

Motor won't restart for 1 minute after thermal temperature goes down with the automatic recovery mode. However, given the RUN signal or changing the DIR signal (CW-CCW-CW, CCW-CW-CCW) are able to reset error status as soon as thermal temperature goes down.

Error reset is done by inputting signal to either CN2-1 or CN2-2. If error occurs with signal being input to either CN2-1 or CN2-2, switch off the input signal, then input the signal again.

Table 1 SW1-4 OFF – error signal discharge when error arises

Sympton	LED1(grn)	LED2 (red)	Error signal output	Phenomenon	Post error operation	Solution
Normal	ON	Off	No	—	—	—
No power	Off	Off	No	No error signal output	—	Input power
Fuse blown	Off	blinks fast	Yes	Motor does not turn for 4 sec	Motor stops	Card is dead and to be replaced
Thermal device reacted	ON	ON	Yes	Heat on motor or circuit board	Motor stops 4 sec after the reaction	Input signal to CN2-1 or CN2-2 terminal to restart, after thermal release
Motor does not turn	ON	blinks slow	Yes	Motor does not turn for 4 sec	Motor stops	Input signal to CN2-1 or CN2-2 terminal
Motor connector not in place	ON	ON	Yes	Same as thermal device reaction	Motor stops	Input signal to CN2-1 or CN2-2 terminal after motor connector in place
Low voltage	ON	Blinks fast	Yes	Voltage drops down to 15V or less	Motor stops	Input signal to CN2-1 or CN2-2 terminal after voltage recovers to 18V or more.

*1: LED2 (red) won't blink for 1 second after starting motor.

Table 2 SW 4 ON - error signal discharges in normal status

Sympton	LED1 (grn)	LED2 (red)	Normal signal output	Phenomenon	Post error operation	Solution
Normal	ON	Off	Yes	—	—	—
No power	Off	Off	No	No error signal output	—	Input power
Fuse blown	ON	Blinks fast	No	Motor does not turn for 4 sec	Motor stops	Card is dead and to be replaced
Thermal device reacted	ON	ON	No	Heat on motor or circuit board	Motor stops 4 sec after the reaction	Input signal to CN2-1 or CN2-2 terminal to restart, after thermal release
Motor does not turn	ON	blinks slow	No	Motor does not turn for 4 sec	Motor stops	Input signal to CN2-1 or CN2-2 Terminal
Motor connector not in place	ON	ON	No	Same as thermal device reaction	Motor stops	Input signal to CN2-1 or CN2-2 terminal after motor connector in place
Low voltage	ON	Blinks fast	Yes	Voltage drops down to 15V or less	Motor stops	Input signal to CN2-1 or CN2-2 terminal after voltage recovers to 18V or more.

*1: LED2 (red) won't blink for 1 second after starting motor.

Identification of the number of error occurences

Number of error occurences (thermal reaction or motor block) from the power input can be identified as in the table below. (No LED illumination for this function during motor running, and it illuminates with next error stop.)

Number of occurrences	LED 2 (red)	LED 3 (orange)
0 (non)	Off	Off

Number of error	Phenomenon	LED (red)	LED (Orange)
1	Lock error	Blinks（1Hz）• • •	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（1Hz）• • •
3 or over	Lock error	Blinks（1Hz）• • •	On
1	Lock error	Blinks（1Hz）• • •	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（1Hz）• • •
3 or over	Thermal error	On	Blinks（6Hz）……
1	Lock error	Blinks（1Hz）• • •	Off
2	Thermal error	On	Blinks（6Hz）……
3 or over	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
1	Lock error	Blinks（1Hz）• • •	Off
2	Thermal error	On	Blinks（6Hz）……
3 or over	Thermal error	On	Blinks（6Hz）……
1	Thermal error	On	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
3 or over	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
1	Thermal error	On	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
3 or over	Thermal error	On	Blinks（6Hz）……
1	Thermal error	On	Off
2	Thermal error	On	Blinks（1Hz）• • •
3 or over	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
1	Thermal error	On	Off
2	Thermal error	On	Blinks（1Hz）• • •
3 or over	Thermal error	On	On
1	Lock error	Blinks（1Hz）• • •	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（1Hz）• • •
3 or over	Low voltage error	Blinks（6Hz）••••••	Blinks（6Hz）……
1	Lock error	Blinks（1Hz）• • •	Off
2	Low voltage error	Blinks（6Hz）••••••	Blinks（6Hz）……
3 or over	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
1	Lock error	Blinks（1Hz）• • •	Off
2	Low voltage error	Blinks（6Hz）••••••	Blinks（6Hz）……
3 or over	Low voltage error	Blinks（6Hz）••••••	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）••••••	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
3 or over	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）••••••	Off
2	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
3 or over	Low voltage error	Blinks（6Hz）••••••	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）••••••	Off
2	Low voltage error	Blinks（6Hz）••••••	Blinks（1Hz）• • •
3 or over	Lock error	Blinks（1Hz）• • •	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）••••••	Off
2	Low voltage error	Blinks（6Hz）••••••	Blinks（1Hz）• • •
3 or over	Low voltage error	Blinks（6Hz）••••••	On
1	Thermal error	On	Off

2	Thermal error	On	Blinks（1Hz）・・・
3 or over	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
1	Thermal error	On	Off
2	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
3 or over	Thermal error	On	Blinks（6Hz）……
1	Thermal error	On	Off
2	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
3 or over	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）・・・・・・	Off
2	Thermal error	On	Blinks（6Hz）……
3 or over	Thermal error	On	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）・・・・・・	Off
2	Thermal error	On	Blinks（6Hz）……
3 or over	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）・・・・・・	Off
2	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（1Hz）・・・
3 or over	Thermal error	On	Blinks（6Hz）……
1	Lock error	Blinks（1Hz）・・・	Off
2	Thermal error	On	Blinks（6Hz）……
3 or over	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
1	Lock error	Blinks（1Hz）・・・	Off
2	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
3 or over	Thermal error	On	Blinks（6Hz）……
1	Thermal error	On	Off
2	Lock error	Blinks（1Hz）・・・	Blinks（6Hz）……
3 or over	Low voltage	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
1	Thermal error	On	Off
2	Low voltage error	Blinks（6Hz）・・・・・・	Blinks（6Hz）……
3 or over	Lock error	Blinks（1Hz）・・・	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）・・・・・・	Off
2	Lock error	Blinks（1Hz）・・・	Blinks（6Hz）……
3 or over	Thermal error	On	Blinks（6Hz）……
1	Low voltage error	Blinks（6Hz）・・・・・・	Off
2	Thermal error	On	Blinks（6Hz）……
3 or over	Lock error	Blinks（1Hz）・・・	Blinks（6Hz）……

In case error occurred 4 times or more, the last 3 data is displayed.
The number of error occurrence display on LED3 is held even if the error is released.
1Hz = 1 blink / sec, 6Hz = 6 blinks / sec.

9. Electrical specifications

- 4A Locking current
- 3.2kHz PWM frequency
- Time delay initial setting <1 sec from power ON.
- 0,2 sec delay between stop signal and mechanical brake activation
- Time to start motor rotation <15msec
- Brake is not activated while the driver card is powered. The brake is released simultaneously as motor starts. 24V input 0.1 sec after the motor start will be 12V, with 50% duty rate PWM.
- Input signal can be either 0V or 24V (3V or less<NPN> or 18V or over<PNP> can activate)
- Output signal can be selected for either PNP or NPN by SW4
- Motor is automatically stopped if motor locking or thermal error lasts for 4 seconds
- Thermal overload device reacts either at 85 degree C on the PCB or 105 degree C inside of the motor. The motor stops if the thermal overload error last for 4 seconds.
- Error signal (open collector) will be discharged to CN2-4. To reset the error signal, input a RUN signal to CN2-1 or CN2-2. If the error signal is discharged while a RUN signal was input to the said connector, it is required to re-input the signal after turning off the input signal.
- Built-in diode for protection against miss wiring
- 5A fuse for line current to prevent overheat

50,000 hours expected service life

10. Environmental concerns

- Ambient temperature: between 0 and 40C (no condensation)
- Ambient humidity: < 90%RH
- Atmosphere: no corrosive gas
- Vibration: < 0.5G
- Indoor use only

11. Precautions to ensure the best performance

- Use stable power supply, that won't be influenced by load.
- When DC power supply gets heat, it normally tries to reduce the output current to avoid the further temperature rise. It this doesn't work sufficiently yet, it will then start deducing voltage, which could be lower than 15V. Low voltage error might happen more with battery before it reaches down to discharging voltage.
- Capacity of the 24VDC power supply should be greater than 5A. The power supply should not activate its protection in 1msec or less for 20A peak current. This is important to ensure the service life of the power supply, driver card and to prevent the malfunctions.
- Make sure the power is shut off before mounting or removing the CN 3 motor connector. Otherwise, back EMF could damage the PCB or the risk of electrical shock arises.
- Do not start or stop the motor from the power line. This could shorten the service life of the product.
- The driver card requires 1 second to activate a motor since it is first powered. (motor won't run for a second since the card is first powered)
- Do not use relay or contactor near the power line, signal line or the driver card. The ON/OFF switching could generate noise that may cause malfunction of the driver card.
- Do not remove the motor cable while the motor is in operation. This could cause damage or malfunction.
- Conveyor should connect to ground.

Specifications are subject to change without prior notice.