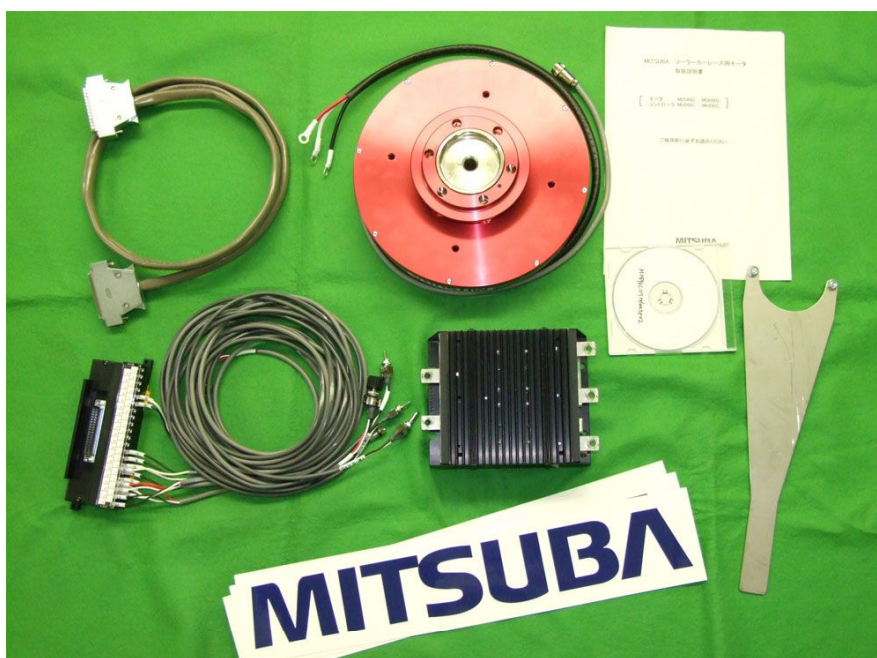


Special motor for solar car Powered by MITSUBA

First of all, we thank you very much you choose our product.
We wish you would have many opportunities and the best results in the races.

Please check the enclosed items;

- 1) motor
- 2) controller
- 3) electric wire with terminal
- 4) electric wire with terminal and switches
(volume switch 2pcs / switch 3pcs / LED 1pc)
- 5) application CD-ROM for set up parameters
- 6) instruction manual book
- 7) sticker of MITSUBA
- 8) tool for center hub close and release



If you have any further questions, please contact to us.

The special motor development team of MITSUBA Corporation

MITSUBA Special motor for solar car instruction manual book

(motor model : M2096D-
controller model : M1596C)



ATTENTION!!

Please read this installation manual carefully
and understand it fully without fail
before you start the installation and use it.

MITSUBA

株式会社 ミツバ

Main Features

 specially designed for purpose of solar car race
 very high efficiency of direct drive motor (wheel in motor)
 very small cogging torque brushless DC motors.(32-pole,36-slot)
 The efficiency more than 95% !! (including motor controller efficiency)
 very high efficiency with wide range
 An adapter compatible with MITSUBA M1596D motor is available (option)
 very light weight motor (less than 11kgs!!)
 very light weight motor controller (less than 3kgs!!)
 very low current consumption motor controller
 current control mode or manual PWM mode can be selected
 User can adjust many kinds of parameters by your themselves
 very high efficient generating brake

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operation / instruction manual·····	(contain in CD)

for safe

This instruction book is showing many kind of sketch.
It is shown for keep safe and no damage and no risk of bodily injury.
Make sure all the sketch and all of this instruction book.



WARNING

This indicate shows that the death or serious injuries can be expected,
If this warning is disregarded.



ATTENTION

This indicate shows that the serious injuries and some damages can be expected,
If this warning is disregarded.



IMPORTANT NOTE

This is showing important note for use this kit



WARNING

This kit is specially designed for solar car race, and purpose for solar car use only.
If this motor is used for other purpose, seriously accident or fire and burnout damage can be expected.
Above circumstance, only use for solar car, no use other purpose.

This kit is specially designed for solar car race, and this is not mass-production product.
And this kit is special kit and racing competition purpose.
So, we can not guarantee any of all things.
That mean you must understand you use under your responsibility by yourself.
Also we can not accept any claim even it is under the normal using.

Please not drive the car if you are using pacemaker on his heart.

Please confirm controller switch off and acceleration volume off (full unclockwise) before turn main switch on.

Please confirm forward / backward switch position before you make acceleration.

The motor controller is not waterproof.
So you must need waterproofing structure in by yourself in case driving in the rainy weather.
If you have flood or already flooded,
immediately make main switch off, and no make main switch on before all things be dry.

The car driver must turn the controller and main switch off when he get out car.

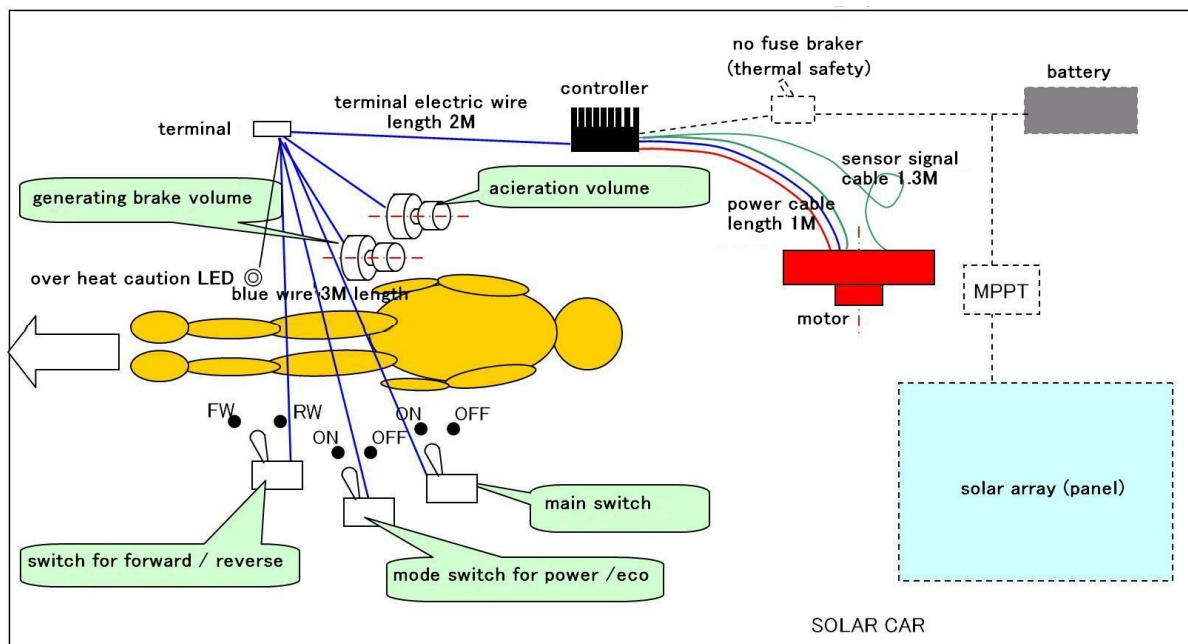
Please turn the main switch and controller switch off before you start the car maintainance or a adjustment.



ATTENTION

Please do not mistake the connection of positive (+) and negative (-), otherwise the control module will be damaged or broke.
Please use the thermal safety (no fuse breaker) = (NFB) at positive line (+) for the protection from over current discharge.
Please do not open motor and motor controller, otherwise some damage or trouble can be expected.
Please do not modify motor and motor controller, otherwise some damage or trouble can be expected.

System configuration



do not connect solar panel only it self.
must connect solar panel with battery like above sketch.
it make protection for solar panel open voltage (short circuit voltage)

must use thermal safety (no fuse braker) = (N F B) at positive line (+)

Mitsuba recommend electric wire for input power which size is about 14sq (14 square mm)

the contain switch are just for test purpose only. You can choose at your side if you like

description of contain kit

- 1) motor (power cable: 1m , signal cable : 1.3m)
- 2) motor controller
- 3) electric wire with terminal (2m)
- 4) electric wire with terminal and switches
(volume switch 2pcs / switch 3pcs / LED 1pc)
- 5) application CD-ROM for set up parameters
- 6) instruction manual book
- 7) sticker of MITSUBA (5pcs)
- 8) tool for center hub close and release

above sketch is just for outline dimension how connect electric wires.
so you need adjust electric wire length by yourself if require.

Mitsuba recommend to use 14sq (14 square mm) electric wire for make longer length.

please contact us, if you need longer signal cable.

description of electric terminals

controller - terminal

description	parts terminal of number and position	wire color	terminal bar terminal number	D-sub connector terminal number	note
main switch	center	white	01	01	
	side	black	20	20	
acceleration volume	2	white	02	02	
	1	black	21	21	
	3	red	03	03	
generating brake volume	2	white	22	22	
	1	black	04	04	
	3	red	23	23	
power / normal mode switch	center	white	05	05	
		-	24	24	prohibit to connect
	side	black	06	06	
forward / reverse switch	center	white	25	25	
	side	black	07	07	
			26	26	Test Mode SW
			08	08	Test Mode_GND-0V
			27	27	motor rotation pulse out put signal (0-5V)
			09	09	motor rotation analog output signal
			28	28	GND- (0V)
			10	10	Comn Tx (LCD)
			29	29	Comn Rx (LCD)
			11	11	Comn GND-PE (LCD)
			30	30	Comn CTS (LCD)
			12	12	Map Bit0
digital switch	red		31	31	Map Bit1
	orange		13	13	Map Bit2
	yellow		32	32	Map Bit3
	green				
LED	K (-) :3	black / (brown)	14	14	LED_GND-0V (Map_GND)
cooling fan	fan SIG	white	33	33	only use for genuine cooling fan
LED	A (+) :1	white	15	15	LED_+
			34	34	prohibit to connect
			16	16	prohibit to connect
			35	35	prohibit to connect
			17	17	prohibit to connect
			36	36	prohibit to connect
			18	18	prohibit to connect
			37	37	prohibit to connect
cooling fan	fun GND 0V	black	19	19	only use for genuine cooling fun

motor sensor signal cable - controller

sensor	wire	panel connector	
circuit board	color	positions of R05-PB6N	
CON01	yellow	A	power input (+)
CON02	black	B	GND (0V)
CON03	red	C	A line
CON04	white	D	B line
CON05	green	E	C line
-	sealed	F	sealed

motor - controller

motor	controller
red	A
white	B
black	C

battery - controller

battery	controller
positive +	+
negative -	-



**if make mistake connection
which will be make damage
or broken this kit.**

please contact to us if you require cooling fan.

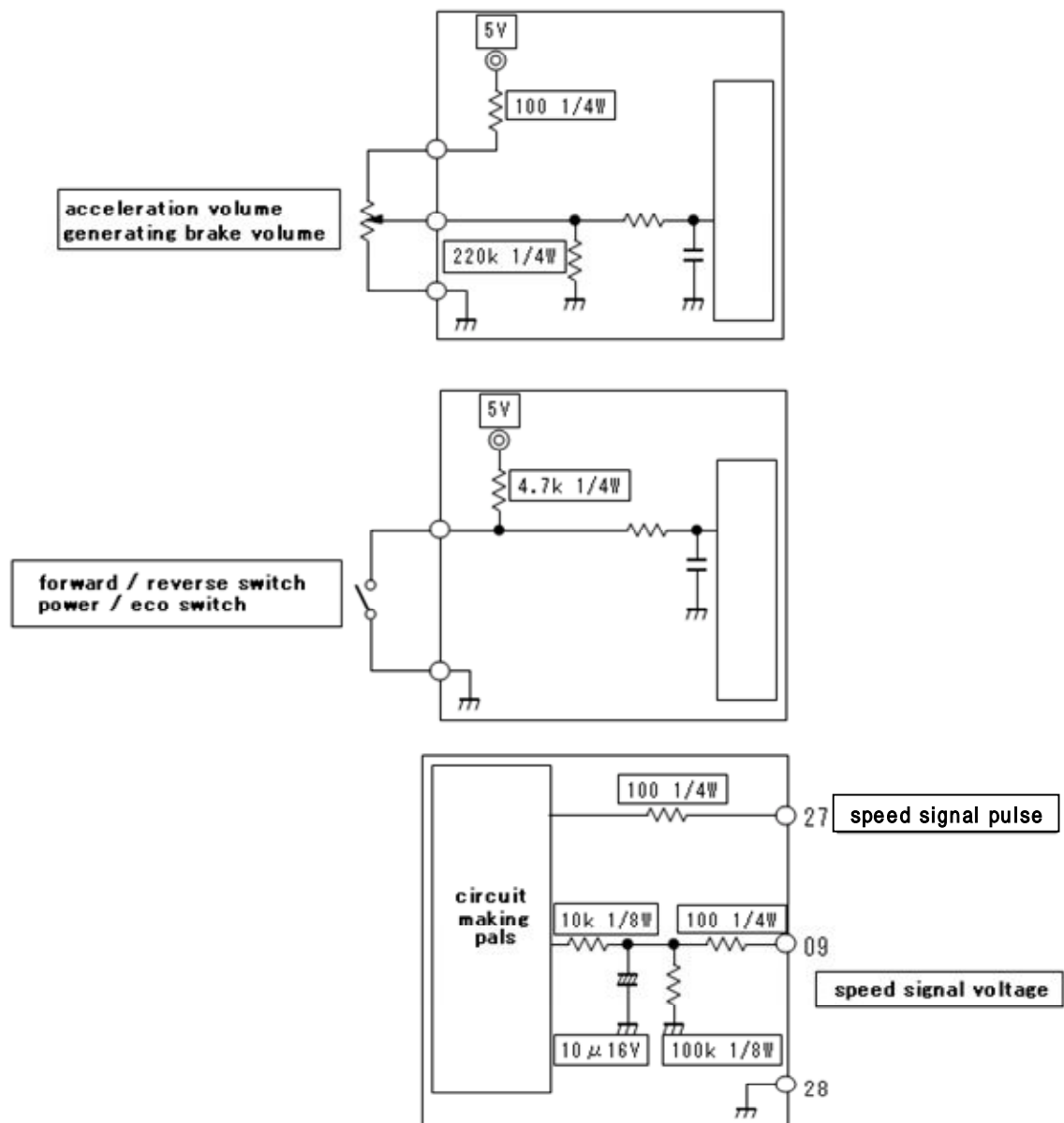
[signals for speed]

- pulse out put signal
- you will have 0/5V (off/on) at terminal 27 - 28(GND(0V))
- 36pulse/1rotation
- voltage signal
- you will have from 0V - up to 5V at terminal 09 - 28GND(0V)
- 370[rpm]/[V]
- the tlerance $\pm 15\%$ · · · (maximum)
- you need test actual speed for [rpm]/V.
- we have not checked temperature influence.

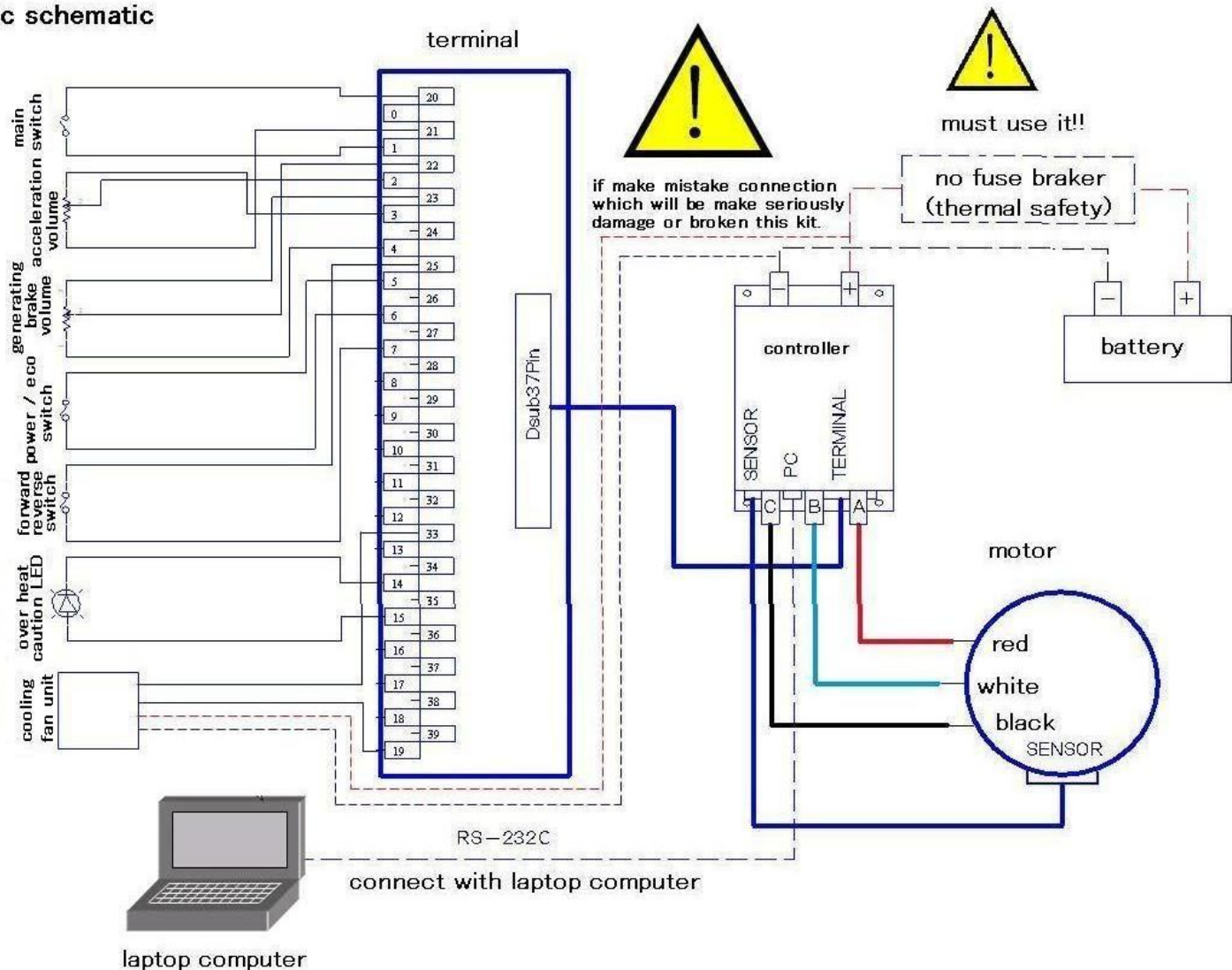
[acceleration volume]

Mitsuba recommend volume switch 5k ~ 10k
and at full acceleration you will have 4.85V
at 02 - 21GND(0V)which are correct voltage.

input / output composition figure



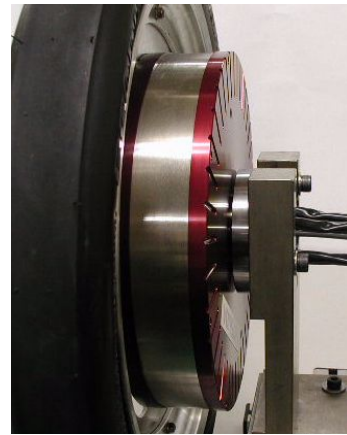
electric schematic



Handling notes for this kit



This is direct drive motor (wheel in motor).
So, motor housing makes rotation,
(NOT shaft makes rotation)
In case, you need bench test,
attention you must fix and tight motor shaft like attached photo.



1. posture for storage

In case you take out the motor from car and strage it,
Please keep the face with electric wire up side and
the face with wheel locking face down side.
Otherwise wire harness would be damaged by the motor weight.



< good >



< bad >



Please do not bring the motor with holding the wire harness.
attention Since sensor cable is sensitive and not durable.compared with power cable, please handle it carefully.

2. power cable length (red / white / black)

Original length of power cable is 1M.

You can cut and adjust power cable length according fix to you car.

we recommend to use the shorter wire length and a big diamater wire cable.

3. locking screw for wheel (rim) lock nut

wheel (rim) lock nut have screw hole for insert screw which protect the turning.(loosening)
After fix and tight wheel lock nut, you put in screw.

M4 screw is not included this kit, please arrange at your side.



4. **how to tighten wheel (rim) lock nut**
please refer to below photo.



this photo 2003 ver

We recommend to apply the the lubrication on motor housing screw partion.

5. **motor housing fixing bolt length**

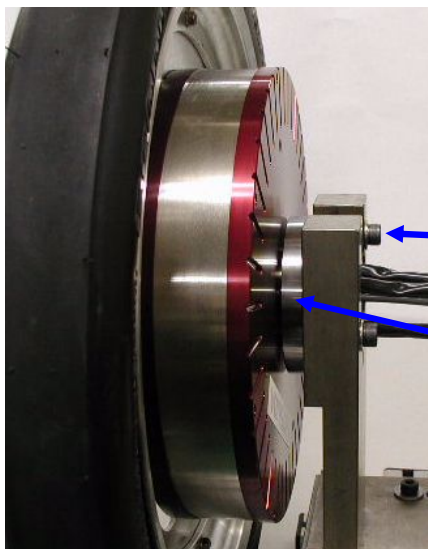


Please pay attention to the screw M8 length when the motor is installed to the car.
The screw length must be less than 12mm..

attention If too long screw is used, the motor housing would be damaged seriously.



attention



fix bolt

housing plate

this photo 2003 ver
this is a holder for test purpose

6. **others note**

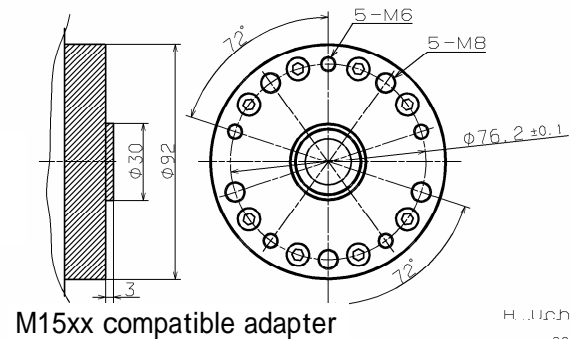
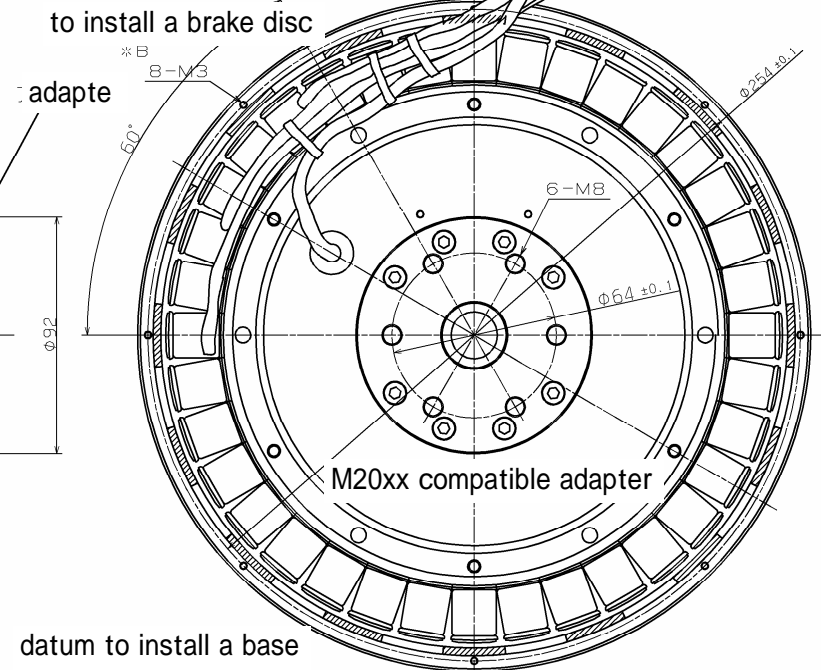
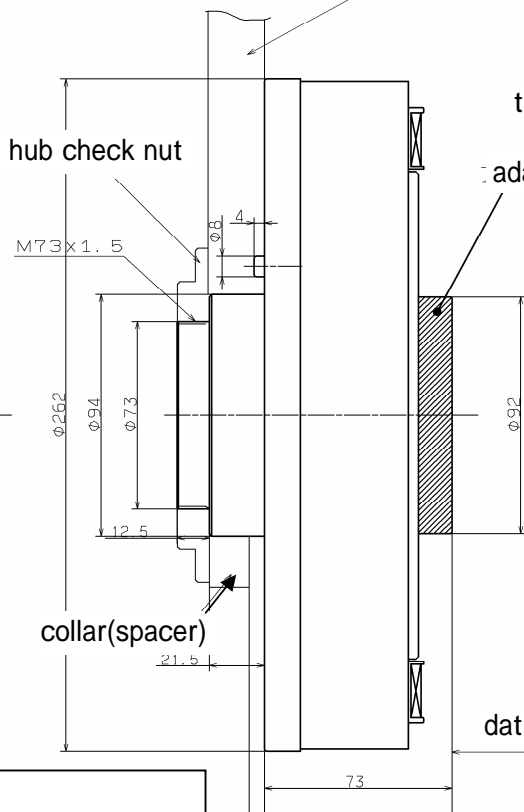
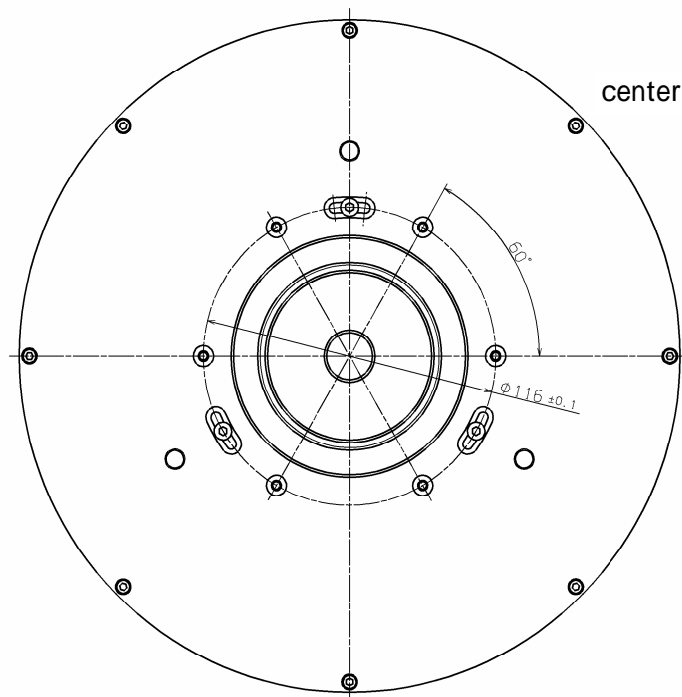
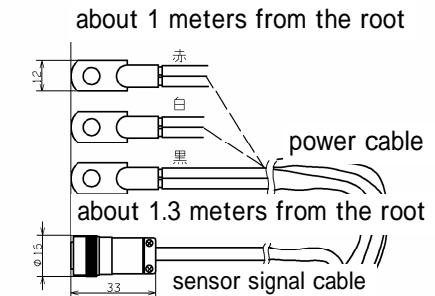


- Please do not loosen the screws and dis-assemble the motor.
- normally the inside bearings are maintenance free.
- If you would like overhaul, please contact to Mitsuba

M2096- Structures

2009model. M15xx compatible.

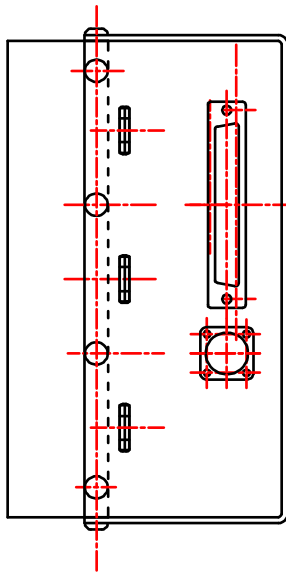
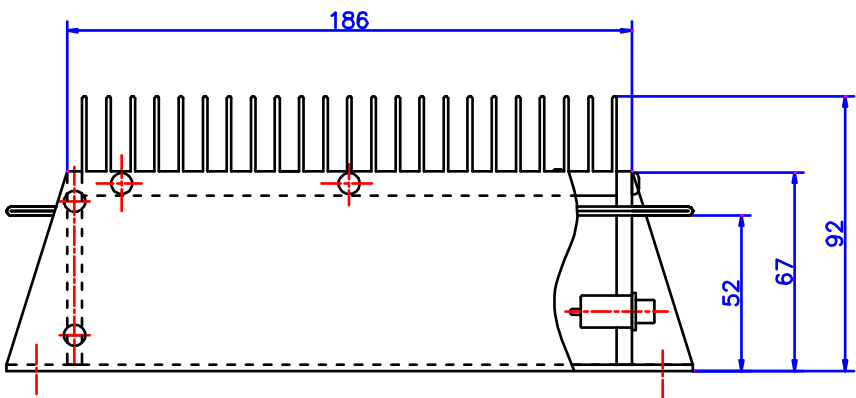
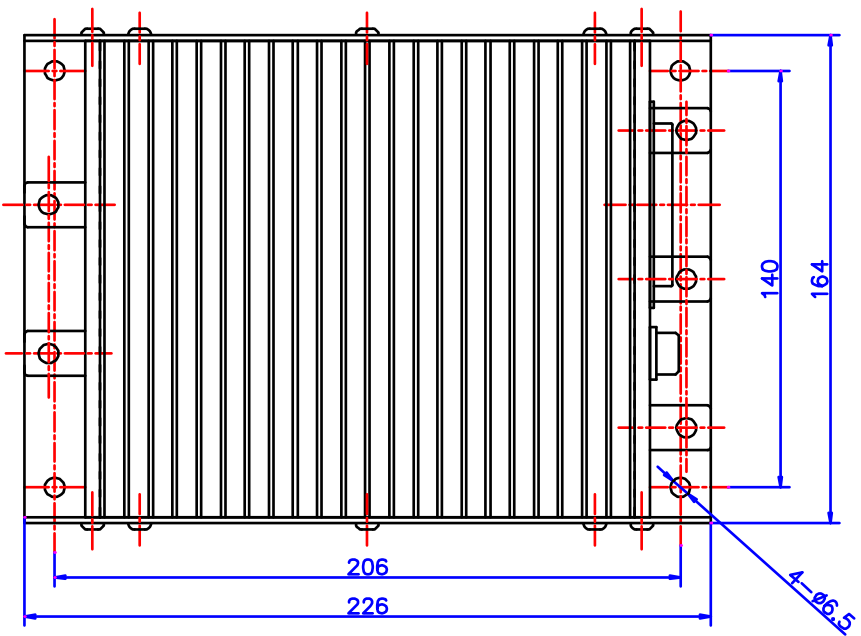
example which installed a wheel made in GH_Craft



NOTE

1. center hub check nut is bundled to the motor.
2. Th adapter compatible with MITSUBA M1596D motor is available
offset dimensions are same.(compatible with perfection)
3. electric wire is out from the coil side.
4. The parking disc brake only can be install to the screw hole to show in *B. (option)
5. motor is only for cantilever support.

H. Huchivama
2009. 3. 20



M2096 specification

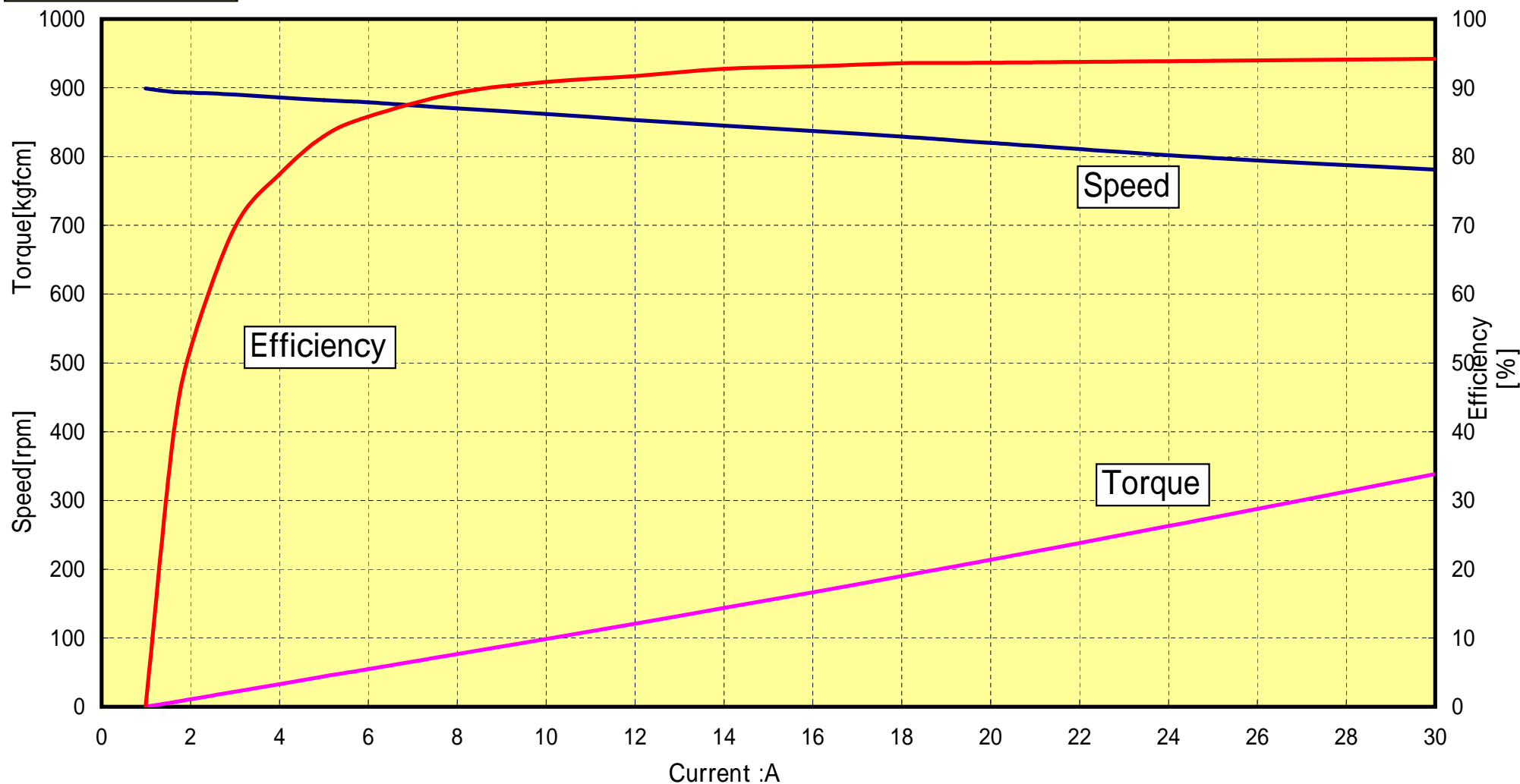
motor	
model number	M2096D-
dimension	262mm × L73mm
weight	11kg
type	DC brushless motor in wheel type (direct drive type)
nominal power	2.0kW
maximum power	about 5000W (see note)
efficiency	more than 95% (including motor controller efficiency)
nominal load rotation speed	810rpm
rotating direction	forward:left turn (when see the wheel) / right turn optionally
controller	
model number	M1596C
dimension	W164mm × D226mm × H92mm
weight	3.0kg
cooling operation	natural air cooling
nominal voltage	96V
input voltage	70 ~ 150V
operation	120 degrees Square-wave control
control mode	
current control	checking input current and automatic adjust PWM DUTY
manual PWM control	direct control PWM Duty
reverse switch	available (with speed limit)
generation brake system	power adjust and voltage limiter (program by use)

note: maximum power which depend on voltage and battery

Typical Motor chracteristics

96V ECO Mode

Motor Chracteristics



contact information

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Soft producer Mitunori Inaba	Extension number 5378 [Business mail address] mailto:m-inaba@mitsuba.co.jp
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