

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 1
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Instruction manual

Motor Model : M2096-DⅢ

Controller Model : M2096C2

1st Issue date : 2022/02/22

by

野村圭佑 (野村)

1st Revise date : 2022/08/01

by

野村圭佑 (野村)

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by

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3rd Revise date : 2022/08/25

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 2
---	-------------------------------------	------------------------	---------------	------------------



warning

Please read this instruction manual **very carefully**
and
have full understanding without any misunderstanding
before you start the installation and use.

This instruction manual is included necessary information. These information are included Contents List, wiring diagram, Setting Software Operating method, etc.

*The contents of this instruction are subject to change without prior notice.



warning

This indication shows that the death or serious injuries can be expected, also seriously broken motor kit, if this sign is disregarded.



attention

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



This is showing important note for use this kit

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 3
---	-------------------------------------	------------------------	---------------	------------------



warning

- ★ This kit is especially designed for solar car race, and purpose for solar car use only. If this motor is used for other purpose, seriously accident, fire, burnout, damage, etc can be expected. Above circumstance, only purpose for solar car only, no use other purpose.
- ★ This kit is especially designed for solar car race, and this is not mass-production product. Therefore, this kit is special kit and racing competition purpose. So, we can not any guarantee and any warranty, for any of all things. That mean user must understand that using responsibility is controlled by user. Also, we can not accept any claim even it is under the normal using condition.
Subject: We only accept some warranty parts and repair if we think it is our duty.
- ★ It is prohibited for drive if the person who driver is using pacemaker in his heart. Otherwise, motor controller electric noise can bad influence to pacemaker controller.
- ★ Please confirm controller switch off and acceleration potentiometer off (full un clockwise) before turn ON the main switch.
- ★ Please confirm forward / backward switch position before driver, and before acceleration.
- ★ The motor controller is not waterproofed. Therefore, waterproof need to be arranged by user if driving in the rainy weather conditions. If you have flood or already wet condition, immediately make main switch OFF, main circuit breaker OFF, and keep all switch OFF before all things to be dry.
- ★ The car driver must turn OFF the controller main switch, and main circuit breaker when he get off from the solar car.
- ★ Please turn off the main switch and controller switch off before you start the car maintenance or a adjustment.
- ★ It will be occurred overshooting high voltage when close acceleration throttle quickly if you use power supply, instead of battery. This high voltage can destroy motor controller. Therefore, if you use power supply, if you made high rotating condition, then you need close acceleration throttle very slowly. The overshooting high voltage is ONLY happened if used power supply.

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 4
---	-------------------------------------	------------------------	---------------	------------------



attention

- ★ Please do not mistake the connection polarity of positive (+) and negative (-), otherwise the control module will be damaged or broken.
- ★ 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.

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 5
---	----------------------------------	---------------------	------------	---------------

Special motor for racing 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 kindly double check all items are available in the box vas shown below list

- | | |
|--|---|
| 1) motor | 2) controller |
| 3) electric wire with terminal
(Potentiometer 2pcs / switch 3pcs / LED 1pc) | 4) electric wire with terminal and switches |
| 5) application CD-ROM for set up parameters | 6) non fuse circuit barker (NFB) |
| 7) instruction manual book | 8) sticker of MITSUBA |
| 9) tool for center hub close and release | |



* Please contact to us, if you have any further questions, or missing parts.

The special motor development team of MITSUBA Corporation

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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 6
--	------------------------------------	-----------------------	--------------	-----------------

Table of Contents

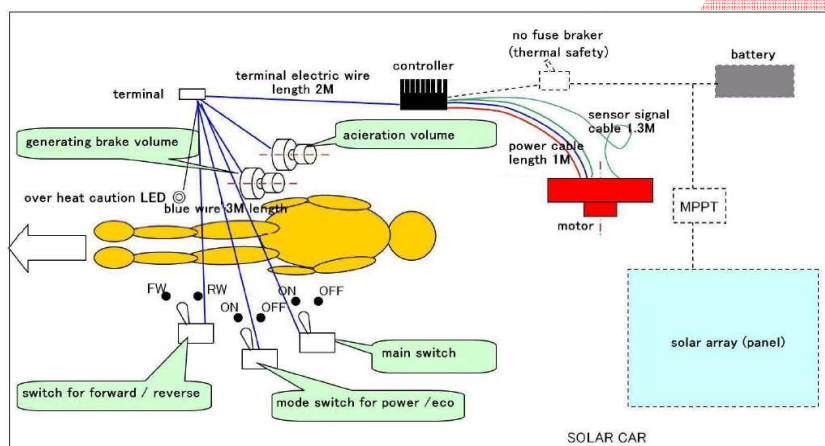
System configuration overview	P7
Switches	P8
Switch terminal pin location	P11
Handling notes	P12
Protection functions and error detection	P14
Basic note for operations	P16
MTA Magnetizing Timing Switch Instruction Manual	P20
Standard model performance graph	P23
Specification	P24
Motor structural drawing	P25
Motor structural controller structural drawing	P26
Memo	P27
Setting software instruction manual Controller	P28
Main page	P29
Response/Operation Mode Select	P32
Acceleration / Regeneration	P33
Throttle Control	P34
Regeneration Control	P35
Battery Protection Setup in regenerative charging	P35
Others	P36
Memo	P37
Contact details	P38

Main Features

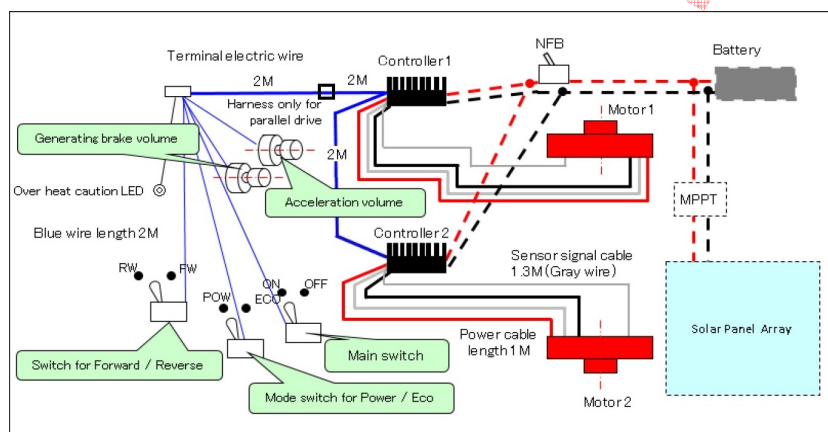
- Specially designed for purpose of solar car race.
- Very high efficiency of direct drive motor. (Wheel in motor)
- Brushless DC motors. (32-pole,36-slot) with very small cogging torque.
- The efficiency more than 95% which is included motor controller. (Optional high end is over 97%)
- Very high efficiency with wide range.
- Very light weight motor and motor controller. (motor about 11kg / controller about 3.2kg)
- Current control mode or manual PWM mode can be selected
- Motor reaction time, max current, several parameters can be adjusted by user
- User friendly easy set up software.
- High efficient generating brake which can be adjusted current and voltage.

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 7
--	------------------------------------	-----------------------	--------------	-----------------

System configuration overview



1WD



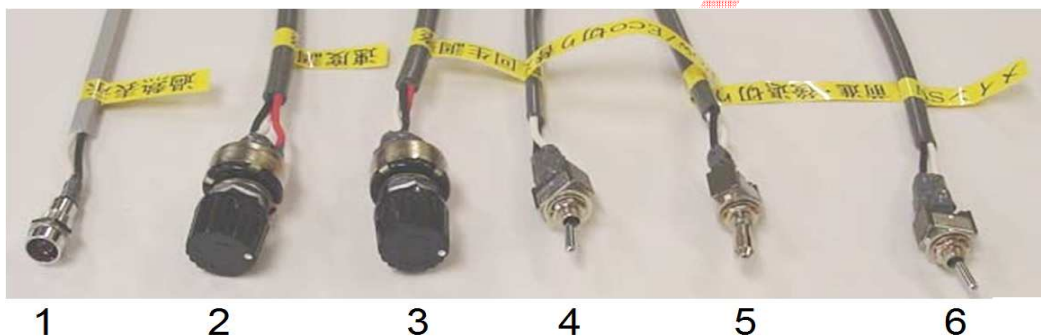
2WD

- ※ Do not make direct connection solar panel (or MPPT) to motor controller. It has to be connected solar panel (or MPPT) with battery such as above sketch. Because motor controller can brake if VOC (solar panel open voltage) is higher than motor controller acceptable working voltage range.
- ※ Must use circuit breaker (no fuse breaker) = (NFB) at positive line (+)
- ※ Mitsuba recommend that use electric wire size is about 14sq (14 mm²) for input power (power cable) which from battery to motor controller, also from motor controller to motor.
- ※ The contain switch are just for test purpose only. You can use other switch and potentiometer at your side if you like
- ※ Above sketch is just for outline dimension how connect electric wires, so you need adjust electric wire length accordingly by yourself.
- ※ Please contact us, if you need longer cable length.

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 8
--	------------------------------------	-----------------------	--------------	-----------------

Switches

The included switches which included this kit, these are mainly purpose for operational checking or desk top bench test, therefore it is not guaranteed for use in the racing condition. Please use proper switches for your car that are easy to operate and driving. (Please refer to the following for connection.)



- | | |
|--|-------------------------------------|
| 1: start up LED / temperature warning | 2: potentiometer for acceleration |
| 3: potentiometer for regeneration throttle | 4: ECO and POWER mode select switch |
| 5: forward backward select switch | 6: main switch |



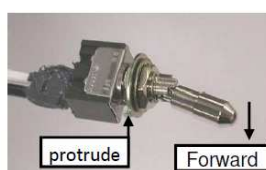
Note:

We have seen that many troubles are caused by bad soldering. Please check them carefully before use, also strongly suggest for use silicon glue for isolation and prevent broken

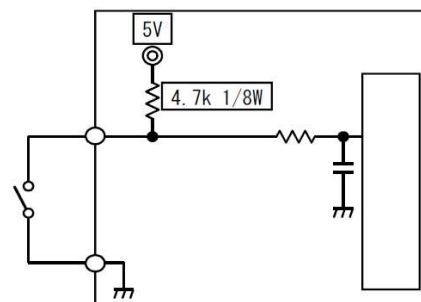
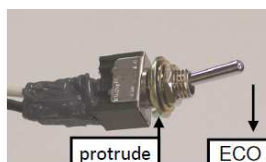
■ Schematic for Switches and potentiometers

forward / backward switch

terminal Nr # 25 Open = Forward
terminal Nr # 07 Close = Backward



Pow/Eco switch
terminal Nr # 05 Open = Eco Mode
terminal Nr # 06 Close = Power Mode



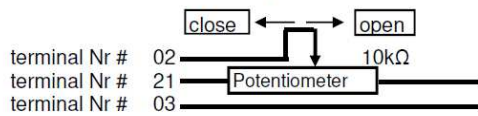
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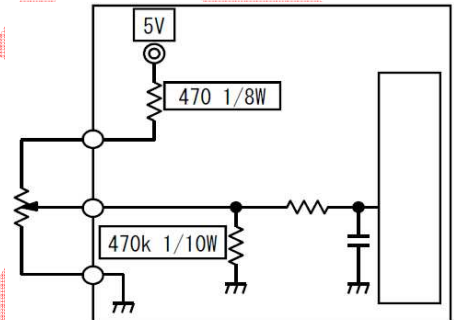
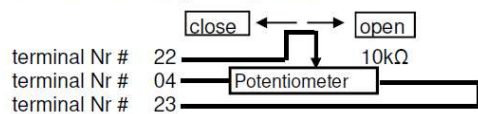
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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 9
--	------------------------------------	-----------------------	--------------	-----------------

Potentiometer for accelerate throttle



Potentiometer for Regenerative brake



Note:

Mitsuba recommend volume switch 5k-ohm~10k-ohm,
and full acceleration voltage should be around 4.7V~4.8V at 02 - 21GND(0V) which are proper range of voltage.

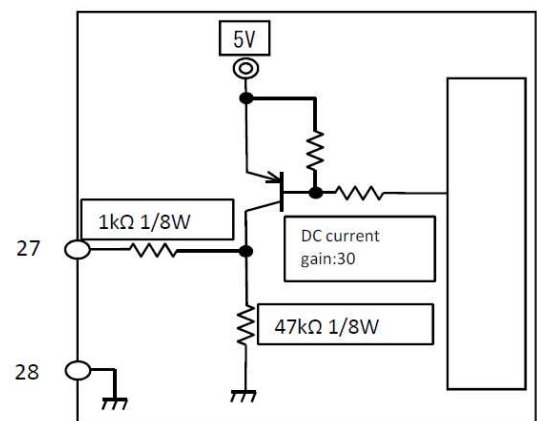
■ Speed (rotational) pulse signal I/O Circuit diagram

pulse output signal

you will have 0/5V (off/on) at terminal 27 - 28(GND(0V))

48pulse/1rotation

Speed (Impulse)



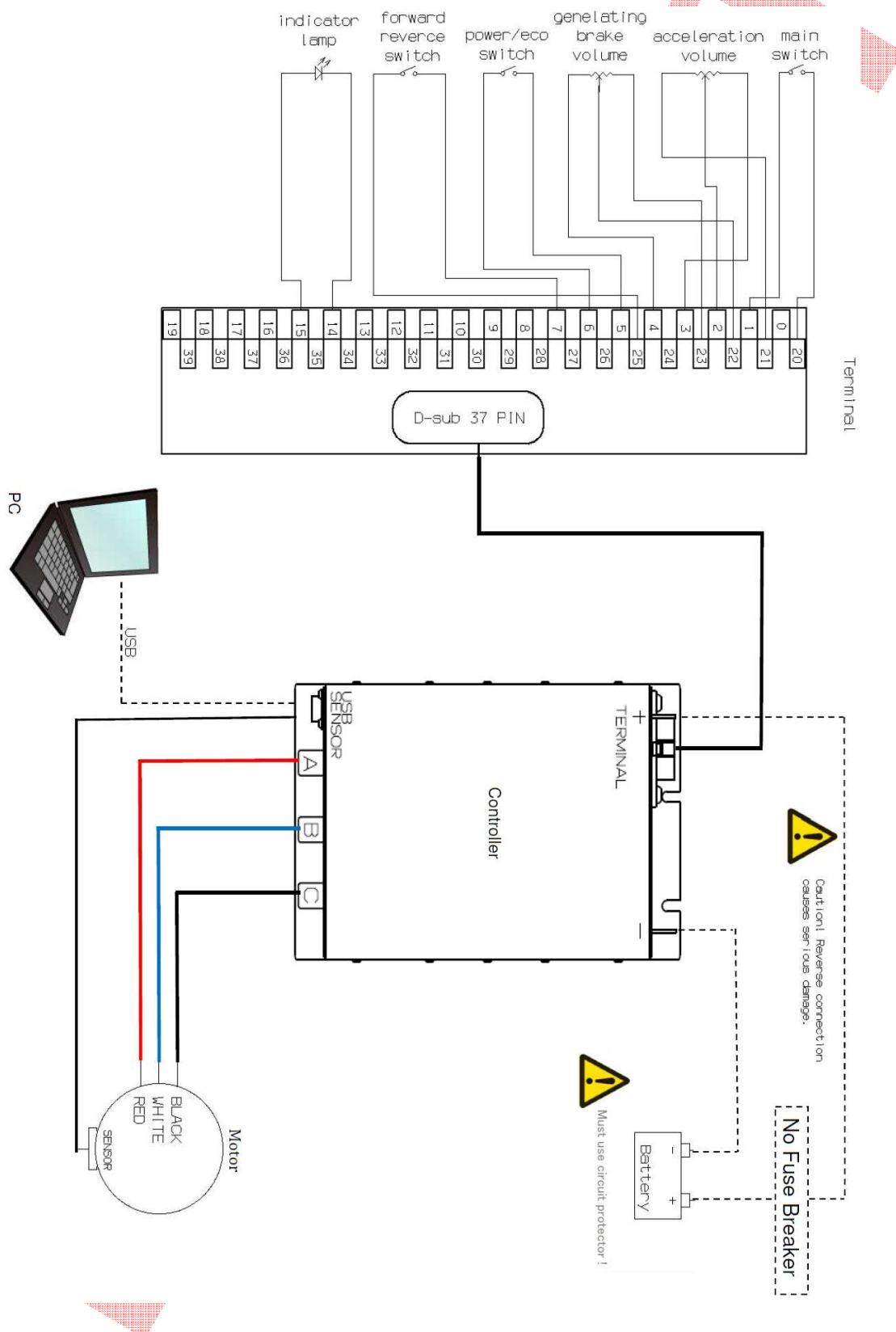
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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 10
--	------------------------------------	-----------------------	--------------	------------------

■ Switches, wire connections controller and motor overview



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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 11
--	------------------------------------	-----------------------	--------------	------------------

Switch terminal pin locations

Controller Terminal Chart

Between Controller and terminal

Operating Part	Part Terminal	Wiring	Terminal Side	Controller Side	Additional Info.
	Connection Terminal	Color	Terminal No.	Terminal No. (D-sub No.)	
Main Switch	Centre	White	01	01	system 12V OUT
	End	Black	20	20	system 12V IN
Acceleration Throttle Potentiometer	2	White	02	02	Acceleration throttle
	1	Black	21	21	GND
Regeneration Potentiometer	3	Red	03	03	5V(output 100Ω)
	2	White	22	22	Regen throttle
Power/Economy Switch	1	Black	04	04	GND
	3	Red	23	23	5V(output 100Ω)
Forward/Reverse Switch	Centre	White	05	05	Pow/Eco select
	End	Black	06	06	5V(output 100Ω)
LED	Centre	White	25	25	reverse selected
	End	Black	07	07	GND
Digital Switch			26	26	prohibited for connect
			08	08	prohibited for connect
			27	27	Rotation In pulse (0-5V)
			09	09	prohibited for connect
			28	28	GND
			10	10	prohibited for connect
			29	29	prohibited for connect
			11	11	Map GND
			30	30	prohibited for connect
		Red	12	12	Map Bit0
LED	Cathode:3	Orange	31	31	Map Bit1
		Yellow	13	13	Map Bit2
		Green	32	32	Map Bit3
LED	Anode:1	Black	14	14	LED GND-0V
		White	33	33	prohibited for connect
LED			15	15	LED +
			34	34	prohibited for connect
			16	16	prohibited for connect
			35	35	prohibited for connect
			17	17	prohibited for connect
			36	36	prohibited for connect
			18	18	prohibited for connect
LED			37	37	prohibited for connect

※If you consider using cooling fan, please contact us.

Between Motor sensor and controller

Sensor	Wiring	Panel Coupler
Sensor Base PCB	Color	R05-PB6M No.
CON01	Yellow	A Main Power Supply
CON02	Black	B Ground
CON03	Red	C A Line
CON04	White	D B Line
CON05	Green	E C Line
—	Shield	F Shield

Between Motor and controller

Motor	Controller
Red	A
White	B
Black	C

Between Main Power Supply and Controller

Main Power Supply	Controller
Battery (+)	(+)
Battery (-)	(-)



If happened wrong wire connection, or wrong polarity, controller will be damaged or, broken.

【About Car Speed Output】

Car Speed In pulse Output

- Between terminal 28: GND and 27 Output=0~5V
- 48 pulse/1 Rotation

【About replace to other throttle Potentiometer】

When you replace to other potentiometer for the throttle, Mitsuba recommend 5kΩ~10k type. It is proper voltage if between Terminal 21 (GND) and 02 voltage is 4.7-4.8V when throttle is fully opened.



Note: If user modify the main switch to digital signaled switch such like solid relay or so, instead of genuine mechanical switch. User should arrange enough capacity for the switch. recommendation capacity is minimum 1A. Otherwise motor working condition will be un stable or so.

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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 12
--	------------------------------------	-----------------------	--------------	------------------

Handling notes

■ Direct drive (Wheel In) Motor

This is direct drive motor which rotate outer housing, shaft will NOT rotate.



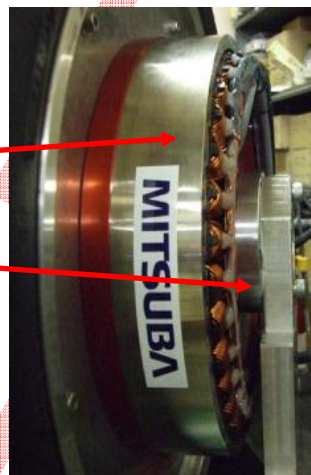
warning

This is direct drive motor (wheel in motor).

So, motor housing makes rotation, (NOT shaft makes rotation)

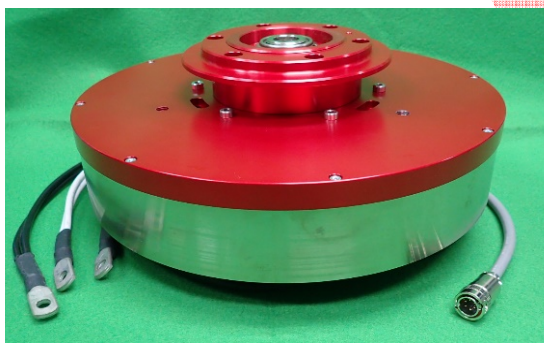
In case test, you need test bench for mount motor firmly,

You must fasten and tight motor shaft like attached photo.



■ posture for storage

In case you remove motor from the car for storage, please storage motor the face of wheel locking is down side, the face with electric wire is up side. Otherwise wire and cables can get damage by the motor weight.



<bad>



<good>



attention

Do not lift motor by pulling cables from motor (power cable and sensor cable). Especially sensor cable is thin and weak cable which can easy happen cut off inside of copper wire if pulled. Please handle with care these cables.

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

Original length of power cable is 1M. You can cut power cable for have suitable length to your car.

We recommend wire length as short as possible for reduce copper resistance.

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 13
---	----------------------------------	---------------------	------------	----------------

■ M4 safety screw to wheel (rim) locking ring nut .

wheel (rim) lock ring nut have M4 screw hole for insert screw which purpose of prevent loosen ring nut.

After fasten and tight wheel lock ring nut, you insert the M4 bolt.

Note: M4 screw is not included this kit, thus it needs to be arranged by user.



■ how to tighten wheel (rim) lock nut

please refer to right side photo.



We recommend keep clean and well lubricate to the M73 thread of the motor side, and wheel lock ring nut.



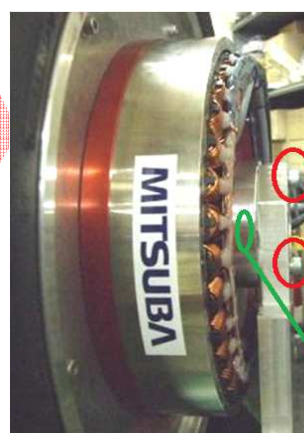
■ M8 bolt length for motor mounting

Please pay attention the M8 bolt length for the motor mounting when you install to the car.

The screw inserting length must be less than 25mm .



If longer than 25mm, the motor housing would be damaged seriously.



bolt for mounting

main shaft for motor mounting

■ others note

Please do not unfasten the screws and disassemble the motor and motor controller without our permission, or our instruction. Normally the inside bearings can work long terms. But after each race, we recommend maintain and replace bearing etc in Mitsuba for keep highest efficiency.

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 14
--	------------------------------------	-----------------------	--------------	------------------

Protection functions and error detection

■ over current protection

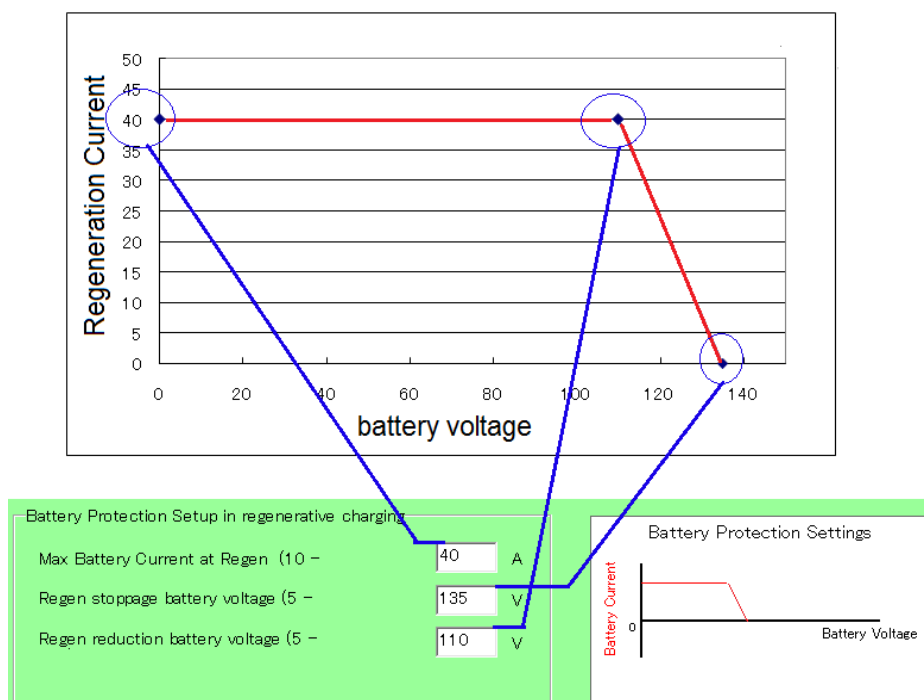
if happen short circuit, or some problem happens which create over current.
Then motor controller stop function automatically.

■ over voltage protection

If connected battery voltage is too high, and over than allowance voltage range.
Then motor controller stop function automatically.

■ regeneration over voltage protection

User can set regen current and voltage which purpose for battery protection.
Regeneration max current, voltage for reduce regeneration current, voltage for stop regeneration function.



■ hole sensor error

if something happen problem at hole sensor,
Then motor controller stop function automatically.

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 15
--	------------------------------------	-----------------------	--------------	------------------

■ controller over heating warning (with warning LED)

if something happens over heating temp at controller, then motor controller reduces output power, or stop function automatically. and indicate condition by blinking warning LED.

controller temp	Warning LED condition	Controller operation
below 85°C	LED keep OFF	according command of potentiometers
above 85°C	0.5Sec ON / 1.5Sec OFF	50% of power of command
above 95°C	0.5Sec ON / 0.5SecOFF	25% of power of command
above 105°C	continually ON	stop operation (*1)

(*1) controller need to be lower than trigger temp for the restart, also throttle potentiometer need to be closed.

■ list of the error code and details

flashing LED	fail safety trigger	fail safety reaction	condition (trigger) for reset
1 time	over current	stop function	reboot controller
2 times	-	-	-
3 times	hole sensor error	stop function if detect hole sensor problem.	
4 times	motor lock error	stop function if no start rotation even keep acceleration.	
5 times	sensor1 broken	stop function if detected broken current sensor, temp sensor, voltage sensor	
6 times	sensor 2 broken	stop function if detected abnormal acceleration signal	reboot controller
7 times	-	-	-
8 times	over voltage	stop function if high voltage detected	need to be less than 160V
9 times	controller over heating		
	1) 85°C over =	adjust output 50%	need to be less than 85°C
	2) 95°C over =	adjust output 25%	need to be less than 95°C
	3) 105°C over =	stop function	need to be less than 105°C

Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 16
---	-------------------------------------	------------------------	---------------	-------------------

Basic note for operations

■Main Switch■

This is the switch for controller enable and disable.

Open = Power OFF = controller is disable.

Close = Power ON = controller is enable.

Note:

controller will be reset for errors and fail safety by doing turn OFF then ON,

■forward / backward switch■

This is switch which purpose for select forward / backward (reverse).

Open = Backward : motor turns backward.

Close = Forward : motor turns forward.



warning

Note:

This is used special switch which need pull the lever when switching operation.

Do not switch forward to backward, or backward to forward if still car is moving, it will be error or safe mode, and controller stop operation.

■Pow/Eco (Power mode / Eco mode) switch■

This is switch which purpose for select ECO or Power mode of the current control mode.

Open = Eco Mode

The max current will be limited current which set in the user setting parameter of ECO MODE.

Close = Power Mode.

The max current will be limited current which set in the user setting parameter of POWER MODE.

Power Mode is purpose for use in race qualifying, rapid acceleration, and overtaking.

Eco Mode is purpose for use in normal condition.

If consider efficiency, or if not professional skilled driver, we strongly recommend keep stay ECO mode use



attention

Note:

this is only effective if current control mode is selected.

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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 17
--	------------------------------------	-----------------------	--------------	------------------

■ Potentiometer for accelerate throttle ■

This is potentiometer for adjust throttle of acceleration, also adjust regeneration.

Before Main Power Switch turn ON, it needs to be fully closed (fully left turned).

Then Main Power Switch turn ON, and wait for 3 seconds, then motor controller ready to operation.

Current Mode:

This is convenience for use circuit track race. Because easy for adjust how much current AMP supply for motor.

PWM Mode:

This is kind of speed control mode which same as cruising control function.



attention

Note:

If the potentiometer is still not closed (if stay at acceleration position) motor controller will not start operation.

The acceleration will be different even same throttle operation in case PWM duty control mode (PWM mode) and in case current control mode (current mode).

Standard setting is current control mode.



warning

NOTE :

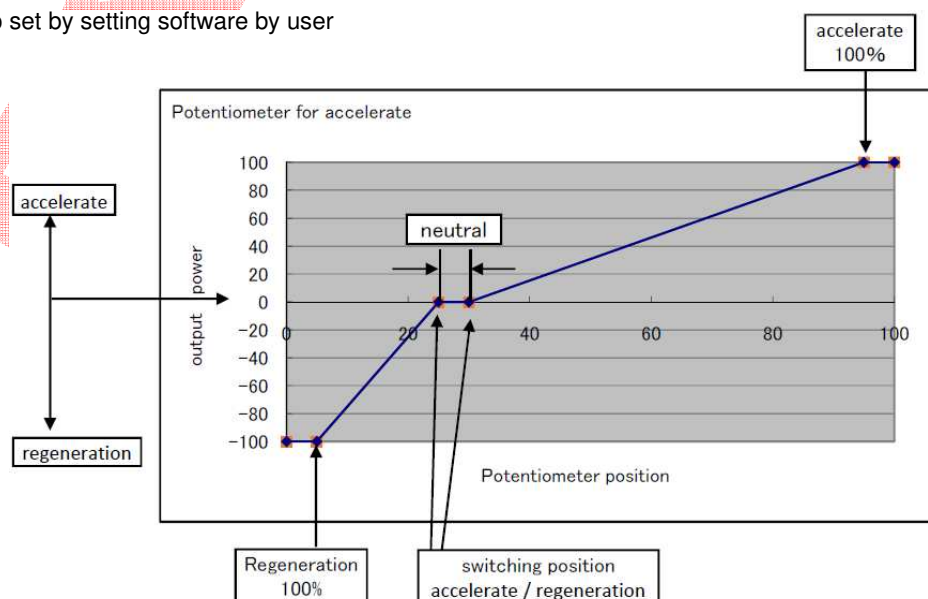
But in the PWM mode, controller is not checking any current AMP.

Therefore, it can easily happen over current if low speed driving.

Therefore, we do not recommend use this mode if driver is not professional or not skilled driver.

ALL set position (values) are possible to set by setting software by user

Regeneration 100% position :
Switching position of regeneration :
Switching position of acceleration :
Acceleration 100% position :



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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 18
--	------------------------------------	-----------------------	--------------	------------------

■ Potentiometer for Regenerative brake ■

This potentiometer is purpose for adjust maximum phase current value during regeneration.

The potentiometer turns to right (open) = higher regeneration current (stronger brake force).

There are two modes available:

Current control mode : This adjust phase current which current from motor to controller according potentiometer position.

PWM control mode : This adjust PWM duty of the regeneration according potentiometer position.



warning

Note: We strongly recommend use Current control mode. Because controller do not inspect current AMP in case PWM mode as PWM mode is speed control mode. that means it can happen over current easily driver is not professional or not skilled driver.

In the current control mode, the controller automatically adjusts the PWM duty cycle to achieve the target regeneration current which set by the regenerative brake potentiometer position. It automatically adjusts the PWM Duty Cycle and it operate in the high efficiency range.



warning

Note:

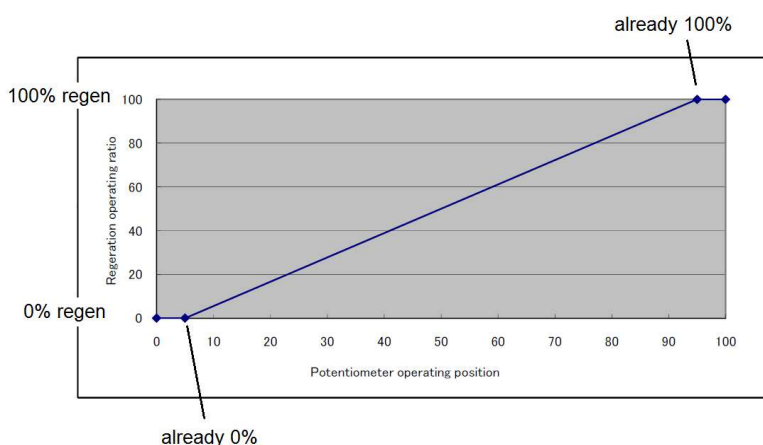
The main purpose of regenerative braking is to recover energy and regenerative brake does not guarantee any braking performance. Reliable mechanical brake must be arranged by user.

ALL set position (values) is possible to set by setting software by user

Switching position 100% of regeneration :

Switching position 0% of regeneration :

Phase current in case 100% :



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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 19
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Example:

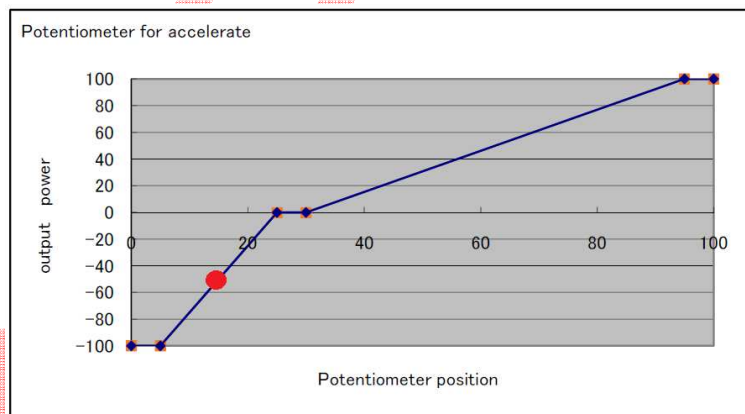
How set regeneration current

If Regenerative value set max 50A in the parameter.

Regeneration Control	
Target MOTOR Current at Regen 100% (10 -	<input type="text" value="50"/> A
Regen 0% VR position (3 -	<input type="text" value="10"/> %
Regen 100% VR position (80 -	<input type="text" value="80"/> %

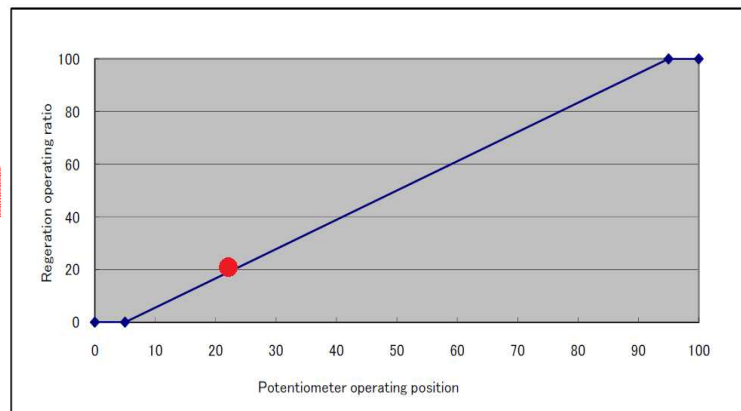
And....

Acceleration potentiometer position is
50% of regeneration area



And....

Regeneration potentiometer position is
20% of regeneration area



$50A \times 50\% \times 20\% =$ controller try to make 5A regeneration which current from motor to controller.

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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 20
--	------------------------------------	-----------------------	--------------	------------------

MTA Magnetizing Timing Switch Instruction Manual.

■at PWM control mode■

MAP "0" = Timing angle is OFF(0°)

MAP "1" = Timing angle is OFF(2°)

MAP "2" = Timing angle is OFF(4°)

MAP "F" = Timing angle is OFF(30°)

■at Current control mode■

in case using Current control mode, selected MAP "0" , then MTA is automatically functioning.

in case "Eco Mode" energizing (magnetizing) timing automatically adjust till 16°

in case "POWER Mode" energizing (magnetizing) timing automatically adjust till 30°

If selected MAP "1",

energizing (magnetizing) timing automatic adjust is till 2° even ECO or POWER mode.

If selected MAP "9",

energizing (magnetizing) timing automatically adjust is till 16° if ECO mode selected.

energizing (magnetizing) timing automatically adjust is till 18° if POWER mode selected.

If selected MAP "F",

energizing (magnetizing) timing automatically adjust is till 16° if ECO mode selected.

energizing (magnetizing) timing automatically adjust is till 30° if POWER mode selected.

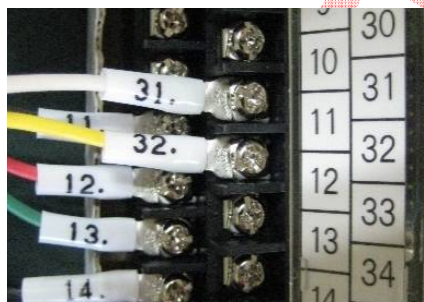
MAP	PWM control mode	Current control Eco mode	Current control Power mode
0	0	16	30
1	2	2	2
2	4	4	4
:	:	:	:
8	16	16	16
:	:	:	:
E	28	16	28
F	30	16	30

Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 21
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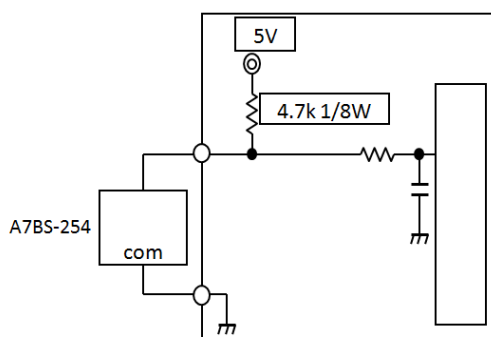
■ Installation

When use MTA, connect wiring of the rotary MAP switch to the terminal block according to the following table.

Nr. At terminal	wire color	note
# 11	black	COM
# 12	red	MAP_Bit0
# 31	white	MAP_Bit1
# 13	green	MAP_Bit2
# 32	yellow	MAP_Bit3



■ Input schematic



■ Switch Operation

The included digital rotary switch (A7BS-254) is an internally switch which make connection between the four signal input terminals and the COM terminal to create a binary signal that can be recognized by the microcontroller from values between 0 and F. The connection status for each value is as follows.

MAP	#12	#31	#13	#32
0				
1	○			
2		○		
3	○	○		
4			○	
5	○		○	
6		○	○	
7	○	○	○	
8				○
9	○			○
A		○		○
B	○	○		○
C			○	○
D	○		○	○
E		○	○	○
F	○	○	○	○

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 22
--	------------------------------------	-----------------------	--------------	------------------

MTA can forcibly increase max speed by changing the energizing (magnetizing) timing of the motor. But this is only for professional driver who knows our motor and solar car race.



warning

Since this switch is a rotary type,
if the dial is moved forward when MAP is "F", it will be set to "0", and if the dial is moved back from "0", it will be set to "F". Never tried MAP from "F" to "0", and "0" to "F". This improper operation may lead you to an accident, therefore pay attention when operating for MTA.

switch : OMRON A7BS-254
cover : OMRON A7B-M



In PWM control mode,

This switch is a rotary type, thus if the dial is moved forward when MAP is "F", it will be set to "0".

Such an improper operation may cause a sudden speed change or large regeneration, which may lead to an accident.

In Current control mode,

the same phenomenon occurs when operating between "0" and "1".

Such an improper operation may cause a sudden speed change or large regeneration, which may lead to an accident.

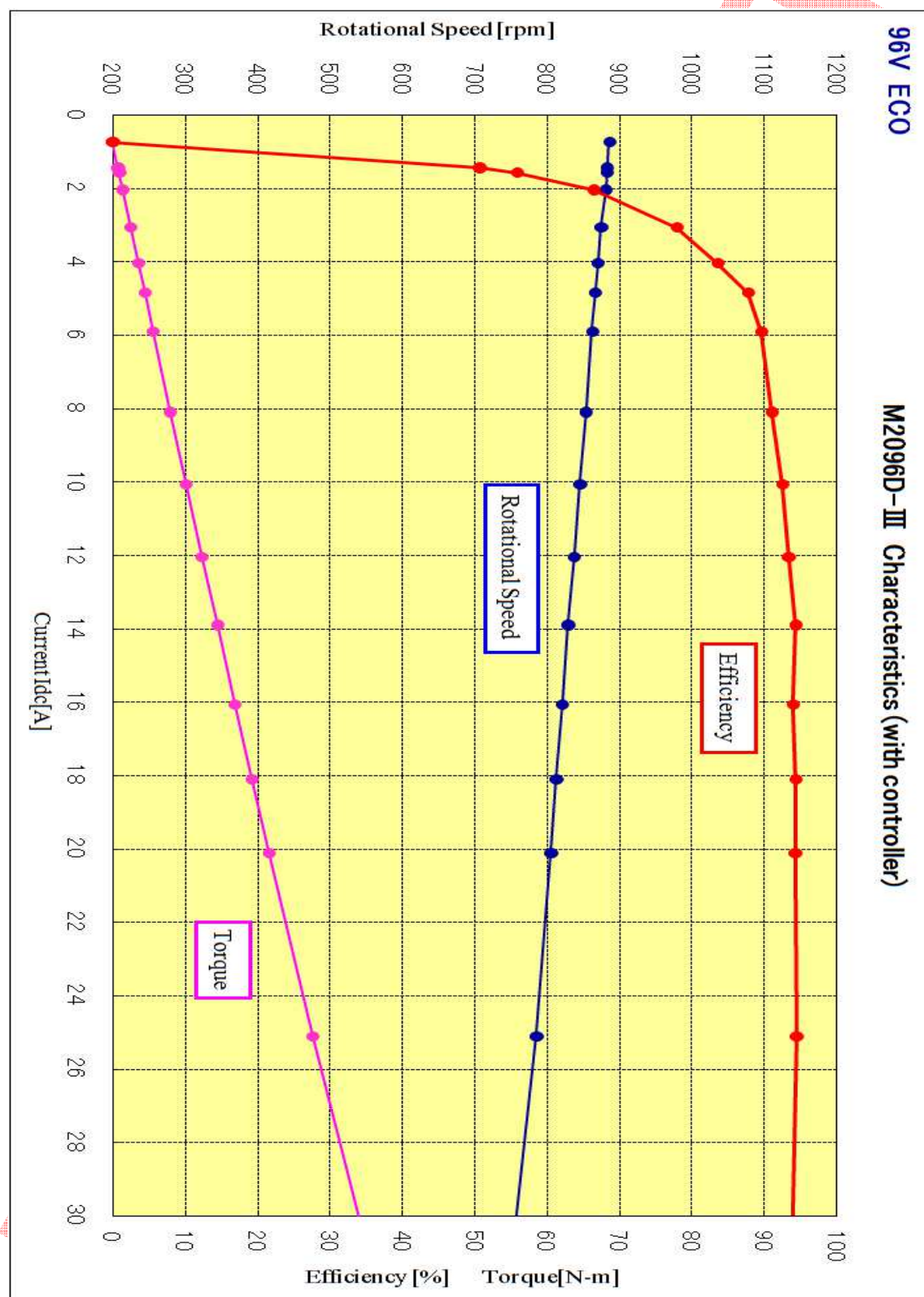
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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 23
--	------------------------------------	-----------------------	--------------	------------------

standard model performance graph (incl controller)



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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 24
--	------------------------------------	-----------------------	--------------	------------------

Specification

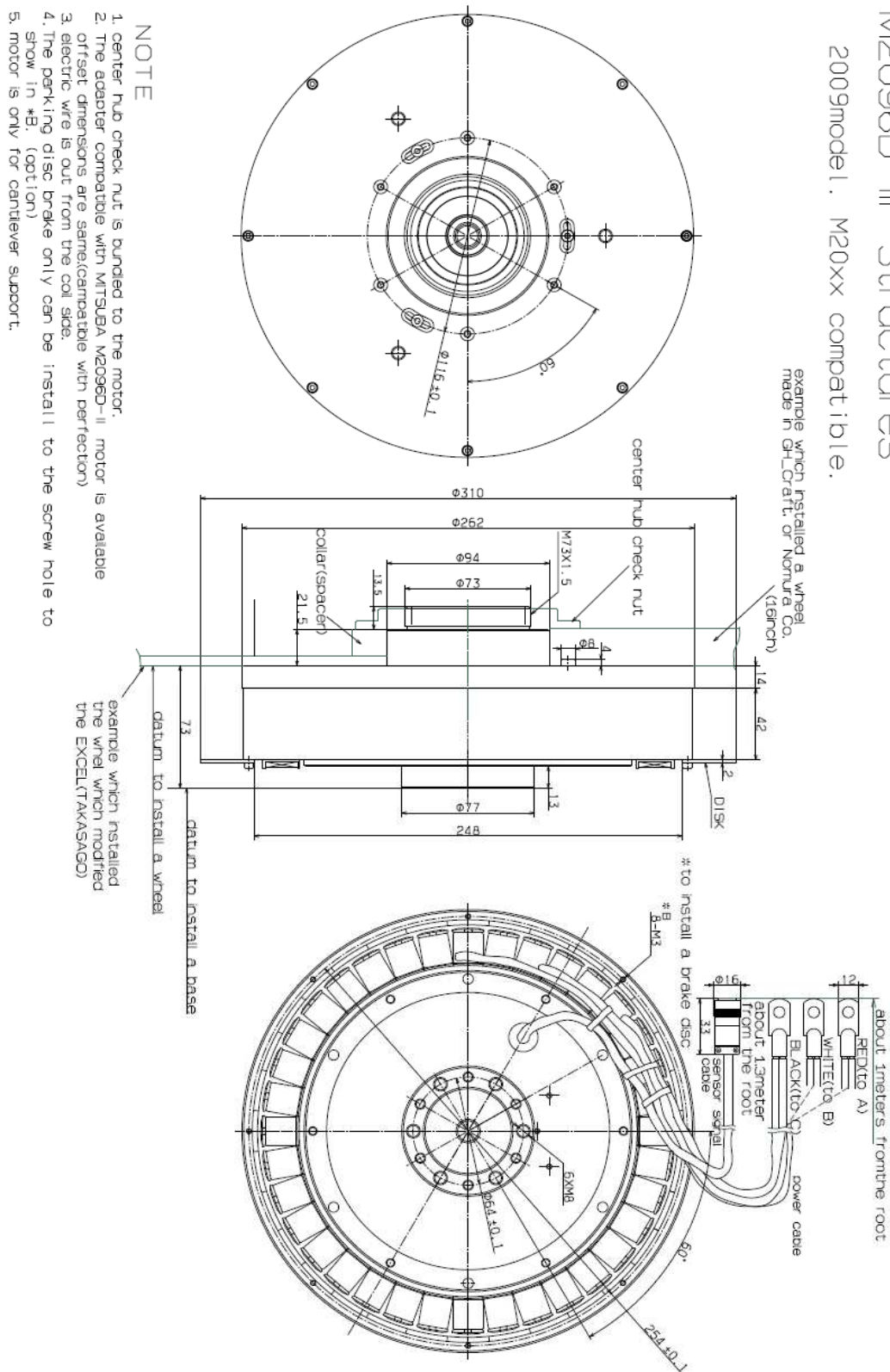
motor	
model number	M2096D-Ⅲ
dimension	φ262mm×L73mm
weight	11kg
type	DC brushless motor in wheel type (direct drive type)
nominal power	2.0kW
maximum power	about 5000W (note: maximum power is depended on voltage and current)
efficiency	Standard model : more than 94% (including motor controller efficiency) Customized high-end : more than 97% (including motor controller efficiency)
nominal load rotation speed	Standard model : about 785rpm Note : different speed setting (coil setting) is available in optionally Also high efficiency version motor core (amorphous) is available in optionally
rotating direction	forward: CCW ・Left turn if see from wheel face note: CW Right turn arrangement is available in optionally
controller	
model number	M2096C-Ⅱ
dimension	W163mm×L253mm×H83.5mm
weight	3.2kg
cooling operation	air cooling without cooling fan
capacity	2kw 96V 20A (note: maximum power is depended on voltage and current)
nominal voltage	96V
input voltage	45 ~140V
operation	120 degrees Square-wave control
control mode	
current control	automatic adjust PWM DUTY according consuming input current (Max current values is adjustable by user)
manual PWM control	direct control PWM Duty
reverse switch	available (with speed limited or current limited control etc)
generation brake system	Adjustable generate current with voltage limiter (set up values is adjustable by user)

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 25
--	------------------------------------	-----------------------	--------------	------------------

Motor structural drawing

M2096D-III structures
2009model. M20xx compatible.

example which installed a wheel,
made in GH_Craft or Nomura Co.
(16inch)



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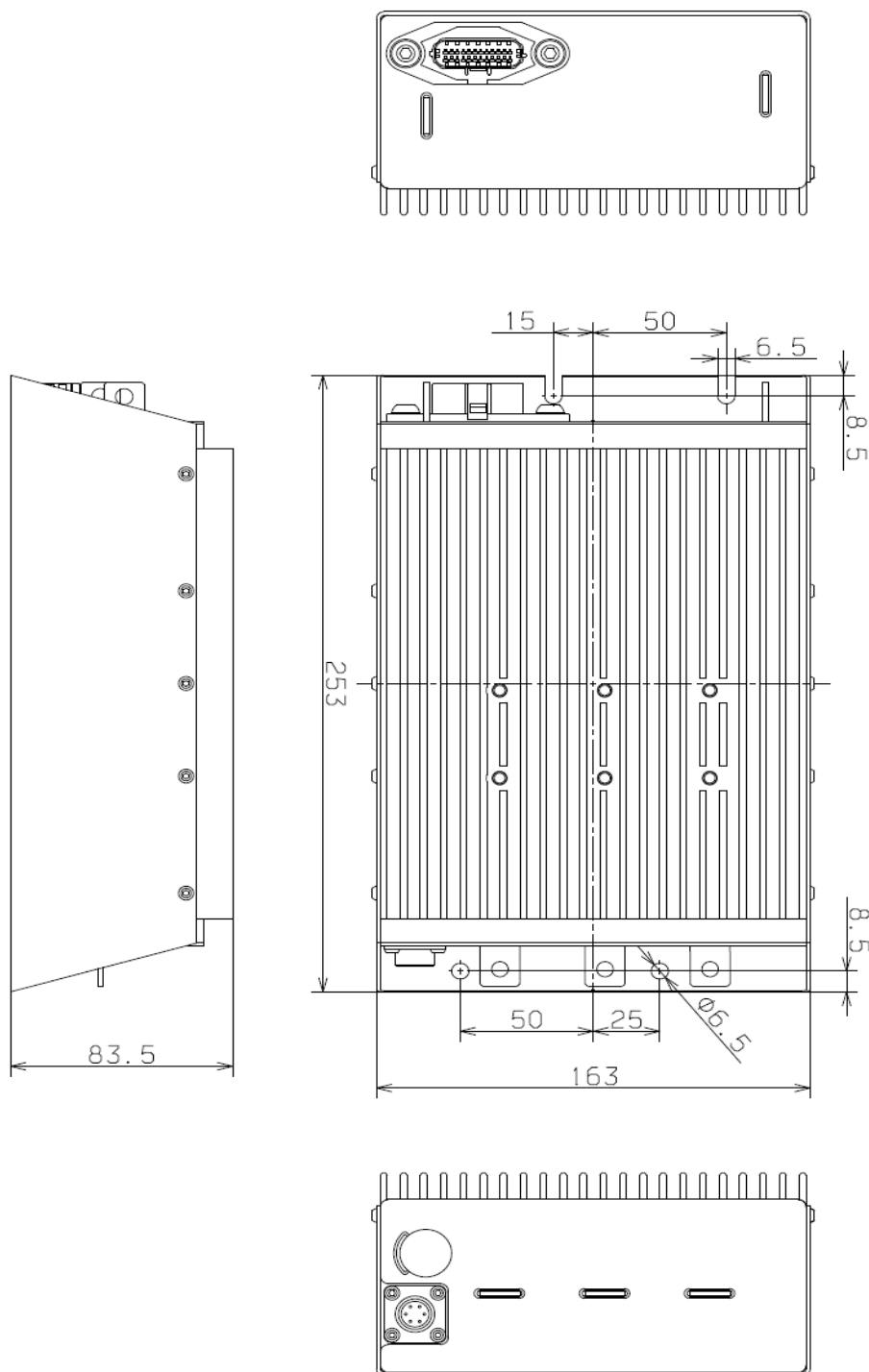
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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 26
--	------------------------------------	-----------------------	--------------	------------------

Motor structural controller structural drawing

M2096C-II
outline dimensional drawing



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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 27
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Memo

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 28
---	-------------------------------------	------------------------	---------------	-------------------



instruction manual Setting software

note: the system will be changed without notice

User can adjust controller settings by using setting software via laptop. Such like max current, reaction time, control mode, charge battery protection, so on. It is quite important for set each race if different condition, or each driver for make easy drive.

1). Connect USB cable between controller and laptop, then turn on the main switch.

2). Open Mitsuba ConfigTool For M2096C Ver xxxx.

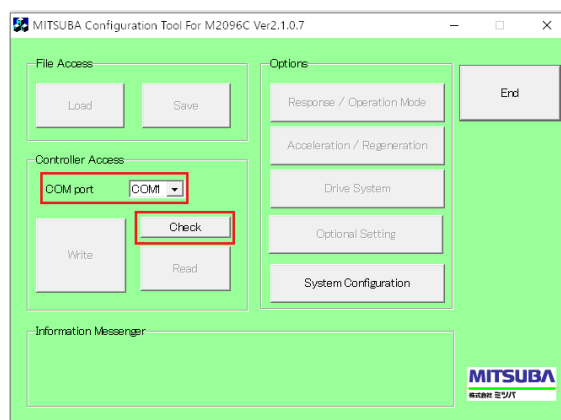
You can find the setting software " Mitsuba ConfigTool For M2096C Ver xxxxx" iin the CD-R which shipped with motor set. Basically operations are same as previous models [motor controller's one]. If other parameter setting values (e.g. voltage, current) is required to change, please refer "controller manual".



After open the setting software, please choose proper COM port. The COM port number will be different each laptop. Please check proper COM port number in the Device Manager of your laptop. In case you could not see proper COM port in the Device Manager. Pls install operation driver to your laptop from the <http://www.ftdichip.com/Drivers/VCP.htm>

3) Select proper COM port, and click check

Now ready for communicate!!

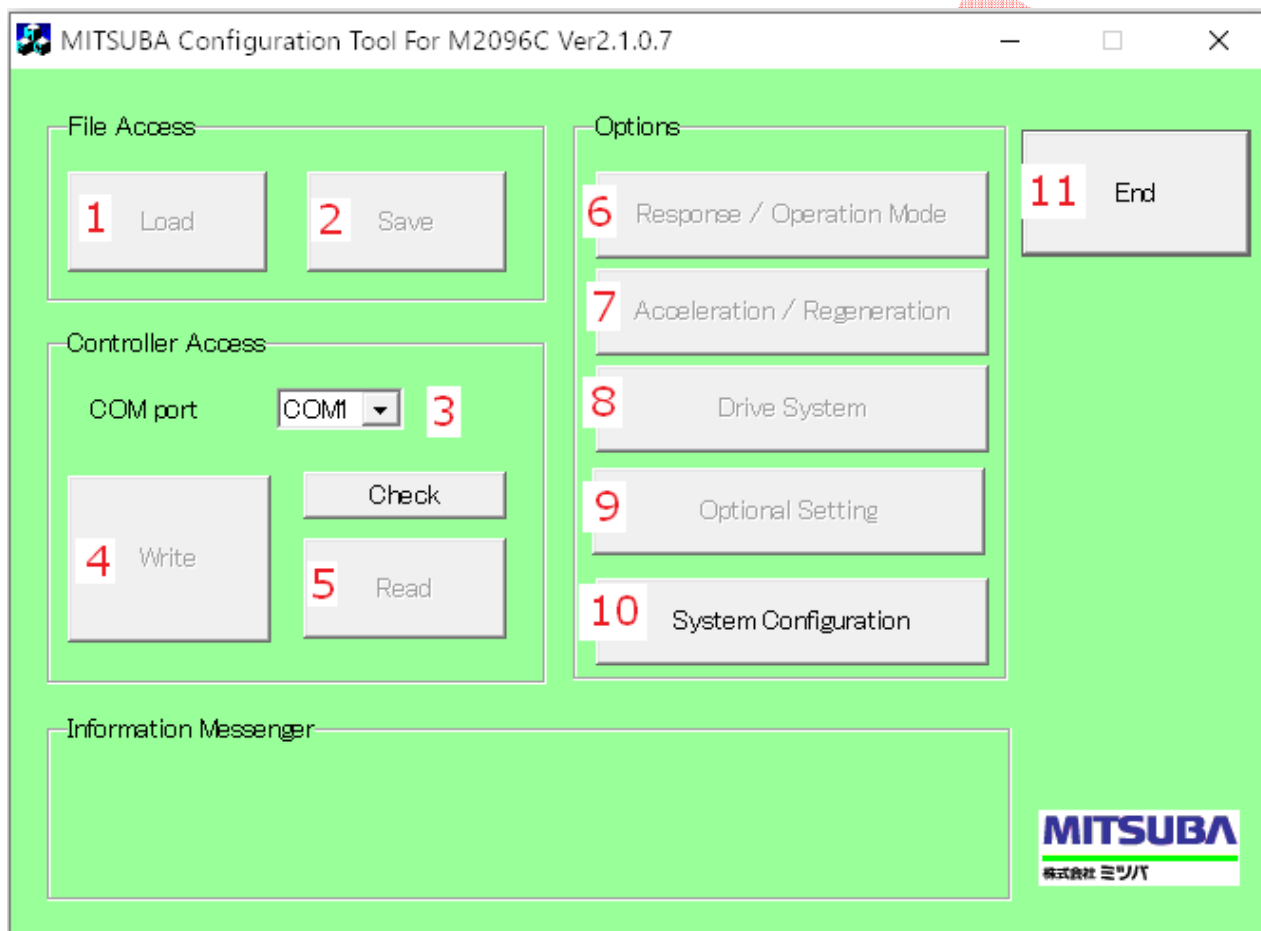


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Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 29
--	------------------------------------	-----------------------	--------------	------------------

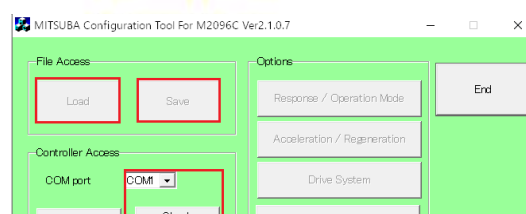
Main page



- 1: loading file from laptop
- 2: save file to laptop
- 3: laptop com port select, and check button
- 4: write data to controller
- 5: read data from controller
- 6: response and mode setting
- 7: voltage and current detail setting
- 8: use for VFM user only
- 9: no use
- 10: no use
- 11: finish and close software

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 30
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1: Load

You can select your saved file and load to software.

App will confirm YES or NO when you click Load

Parameter Reading



If you perform this process, the existing data will be deleted.
Do you want to proceed?

はい(Y)

いいえ(N)

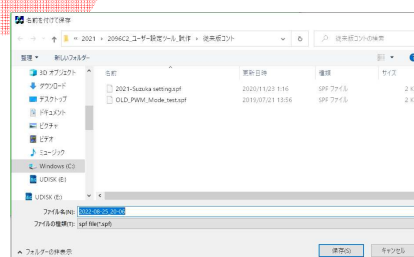
2: Save

You can save your data for your PC.

The file name is automatically generated by year, date, and time.

You can change file name according your convenience.

App will confirm YES or NO

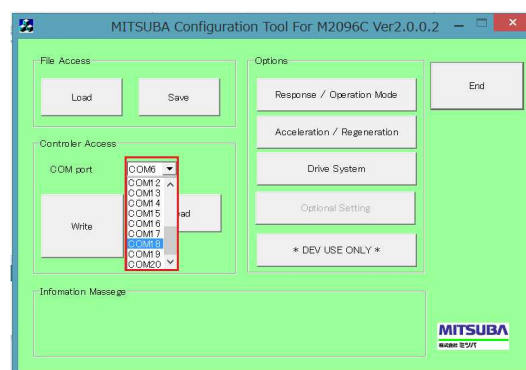


ファイル名(N): 2022-08-25_20-06

ファイルの種類(T): spf file(*.spf)

3: COM port

For make connection properly,
correct COM port need to be selected.



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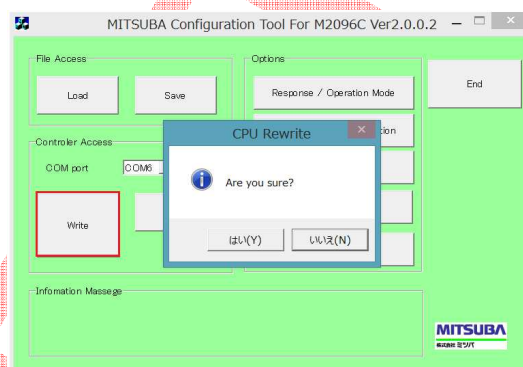
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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 31
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4: Wrier

If you wish write data to controller,
following procedure needed.

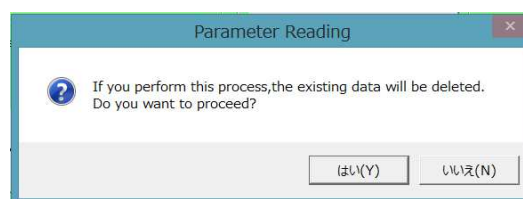
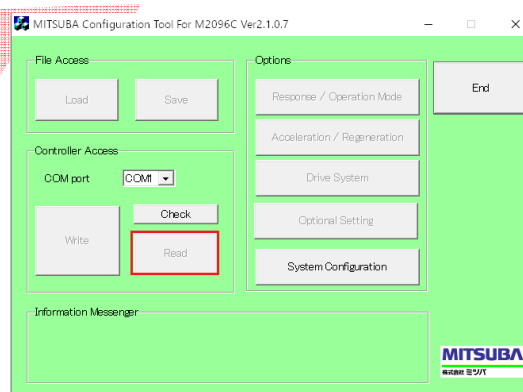
- 1). Connect USB between your laptop, and controller.
- 2). Need to be selected proper COM port
- 3). Circuit breaker ON for supply power to controller
- 4). controller main switch turns to ON
- 5). warning LED start blinking.
- 6). controller and laptop are ready for communication.
- 7). click [Write].
- 8). asking [Are you sure?] click YES for confirm
- 9). then start writing which takes few minutes



5: Read

If you wish to read data from controller,
following procedure is required

- 1). Connect USB between your laptop, and controller.
- 2). Select proper COM port
- 3). Circuit breaker ON for supply power to controller
- 4). controller main switch turn to ON
- 5). warning LED start blinking.
- 6). controller and laptop are ready for communication.
- 7). click [Read].
- 8). asking [If you perform this process, the existing data will be deleted. Do you want to proceed?] (*1)
- 9). click [YES] for confirm
- 10). then start reading which takes few minutes



Note (*1):

If read data from controller, loaded (using) data of software will be deleted. Because reading new data from controller. Save data before proceed If you wish keep current data. The data from motor will be kept controller.

Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 32
---	----------------------------------	---------------------	------------	----------------

6: Response/Operation Mode Select

You can select Response for Acceleration, and Regeneration. Also control mode PWM or Current control mode.

Drive Response is acceleration response, you can input 1-5, 1= quick / 5= slower

Regenerative Response regeneration response, you can input 1-5, 1= quick / 5= slower

Operation Mode

We strongly suggest **CURRENT MODE** for the circuit track, also beginner driver. We only suggest **PWM MODE** for very stable speed condition such like WSC as **PWM MODE** is controlling PWM-Duty cycle which means it is same function of the cruising speed which can have higher efficiency in the stable speed driving. However, **PWM MODE** is NOT care output current (no limiter), thus driver need to adjust current by manually when happen over current. This is QUITE important to understand how controller works.

- | | |
|---------------------------|-------------------------------------|
| 1 = Drive Response | 1 is quicker / 5 is slower response |
| 2 = Regeneration Response | 1 is quicker / 5 is slower response |
| 3 = Drive Operation | can be selected control mode (*1) |
| 4 = Regen Operation | can be selected control mode (*1) |



Note (*1):

We strongly recommend use [Current control mode]. Because controller do not inspect current AMP in case PWM mode as PWM mode is speed control mode. that means it can happen over current easily driver is not professional or not skilled driver.

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7: Acceleration / Regeneration

In this page, you need fill important values for have controller work properly.

Acceleration / Regeneration Setup

Throttle Control

Target Current at full throttle (Power Mode) (5 - 1 50) A

Target Current at full throttle (Eco Mode) (5 - 2 35) A

Regen100% throttle position (3 - 3 5) %

Drive/Regen switch throttle position (3 - 4 10) %

Drive0% throttle position (10 - 70)
*Drive/Regen switch < 3% < Drive0%
5 15) %

Drive100% throttle position (80 - 6 85) %

Regeneration Control

Target MOTOR Current at Regen 100% (10 - 7 100) A

Regen 0% VR position (3 - 8 10) %

Regen 100% VR position (80 - 9 80) %

Battery Protection Setup in regenerative charging

Max Battery Current at Regen (10 - 10 40) A

Regen stoppage battery voltage (5 - 11 140) V

Regen reduction battery voltage (5 - 12 137) V

Throttle Settings

Regeneration Settings

Battery Protection Settings

* DO NOT set 4.8V(96%) and

A displayed value might somewhat be shifted by the minimum value.

OK

Cancel

13 Graph Update

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Throttle Control

Throttle Control		
Target Current at full throttle (Power Mode) (5 -	1 50	A
Target Current at full throttle (Eco Mode) (5 -	2 35	A
Regen100% throttle position (3 -	3 5	%
Drive/Regen switch throttle position (3 -	4 10	%
Drive0% throttle position (10 - 70) *Drive/Regen switch < 3% < Drive0%	5 15	%
Drive100% throttle position (80 -	6 85	%

Throttle Settings

1: Target Current at full throttle (Power Mode)

This is MAX current for Power Mode, which means only for current control mode

2: Target Current at full throttle (ECO Mode)

This is MAX current for ECO Mode, which means only for current control mode

3: Regen 100% throttle position

Now set 5%, that means if potentiometer become 5% position, Regen will be 100% force of Regen set value

4: Drive / Regen switch throttle position

Now set 10%, that means Regen will start when potentiometer position is smaller than 10%.

5: Drive 0% Regen switch throttle position

* Drive / Regen switch < 3% < Drive 0%

This is set for neutral condition.

Now Drive Regen switch position is set 10%, this means this value need 13% at least as 3% difference is minimum value.

6: Drive 100% throttle position

Now set 85%, that means if potentiometer become 85% position, acceleration will be 100% power even still 85% throttle position.

Regeneration Control

Regeneration Control		
Target MOTOR Current at Regen 100% (10 -	7	100 A
Regen 0% VR position (3 -	8	10 %
Regen 100% VR position (80 -	9	80 %

Regeneration Settings

7: Target Motor Current at Regen 100%

This is max current from motor to controller (phase current)

8: Regen 0% VR position

Now set 10%, that means if potentiometer become 10% position, regeneration will be 0% power even still 10% throttle position.

9: Regen 100% VR position

Now set 80%, that means if potentiometer become 80% position, regeneration will be 100% power even still 10% throttle position

Battery Protection Setup in regenerative charging

Battery Protection Setup in regenerative charging		
Max Battery Current at Regen (10 -	10	40 A
Regen stoppage battery voltage (5 -	11	140 V
Regen reduction battery voltage (5 -	12	137 V

Battery Protection Settings

10: Max Battery Current at Regen

This is max current from controller to battery. That means battery pack acceptable max current need to be set.



Note: This is ONLY for in case Current control mode selected. This is NOT for PWM control mode.

Over current can happen if PWM mode selected, and if no professional driver, or un knowledge driver,

11: Regen stoppage battery voltage

Once reached this value of the battery voltage, then controller stop regenerating operation.

12: Regen reduction battery voltage

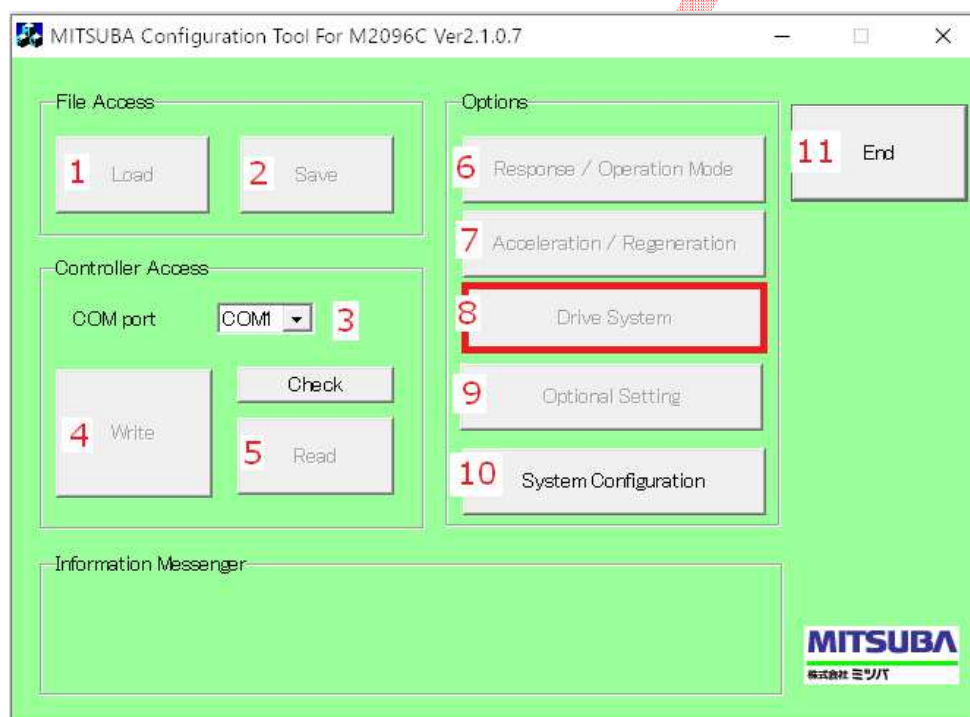
Once reached this value of the battery voltage, then controller reduce regenerating current.

Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 36
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8: Drive System

This is only for VFM user, or ECU type control. Usually, no need change setting if non VFM user.

refer VFM user guide in case VFM user

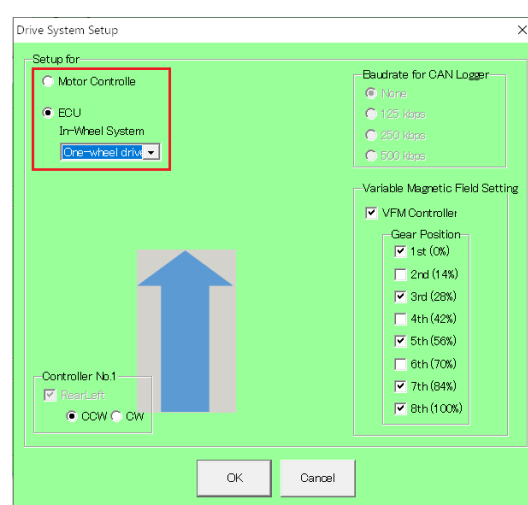


Here you can select mode

Motor controller mode, and **ECU** mode.

ECU is purpose for VFM motor.

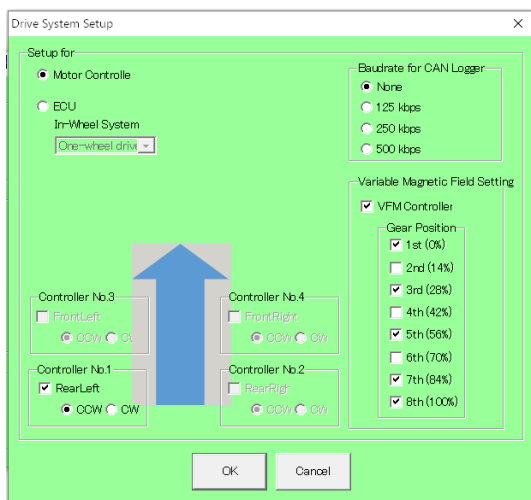
If non VFM user, use **Motor controller** mode



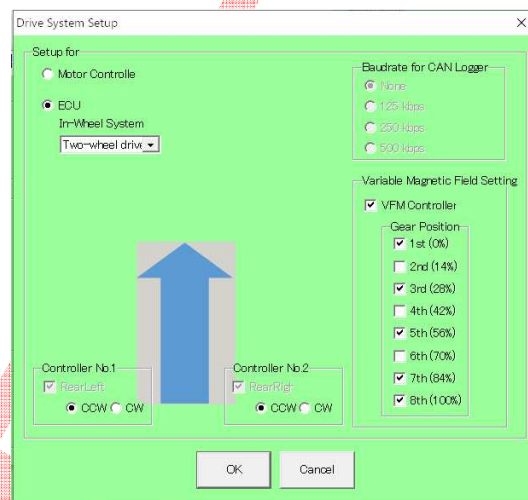
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Motor control mode



ECU mode

In case **Motor Control** mode.

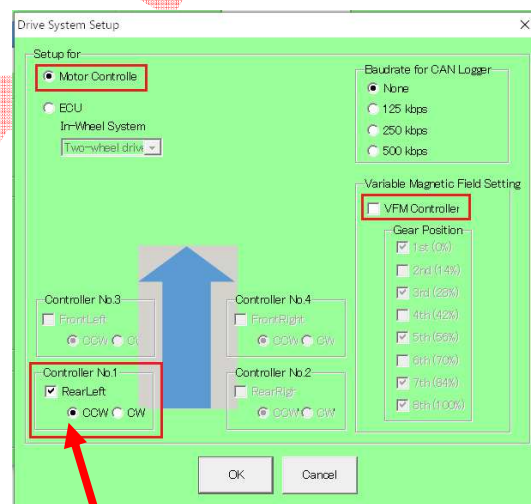
Motor Control mode is purpose for 1WD, 2WD and Non VFM user.
Therefore, do not select [VFM].

Controller location (position), Even 1,2,3,4WD configuration.

If Non VFM user, It is only possible for selected
[Controller No.1 / Rear Left].

Even any motor and CW motor,

Also, it needs to be selected [CCW] at any time.

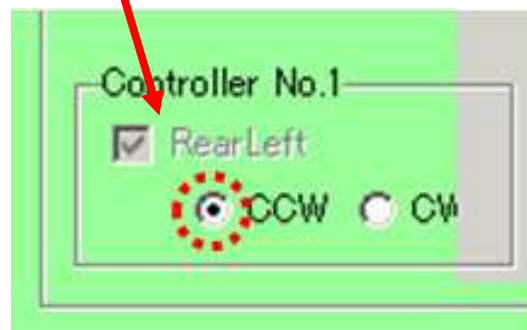


Important note : motor rotation direction and setting of CCW or CW

The Mitsuba motor rotation direction is not possible for change by software. The motor rotation direction is decided by 3phase power cable connection and hole sensor positioning adjustment. Thus, **DO NOT TRY** to select CW, ALWAYS need to be selected CCW The CCW needs to be selected even CW motor. In the worst case, motor controller will have over current, or broken.



attention



Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 38
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In case **ECU** mode

This mode is **only** purpose for **VFM user**

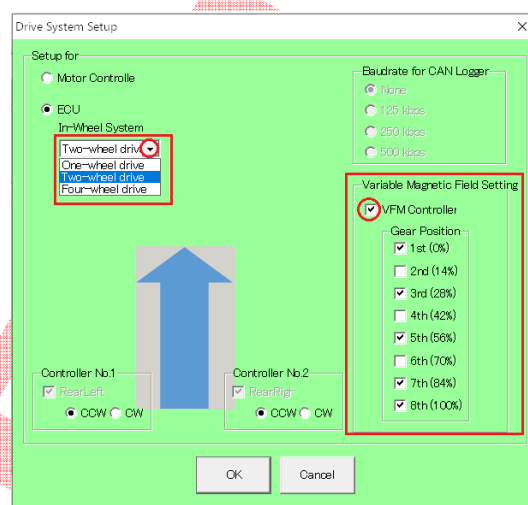
If non VFM user, select **motor controller** mode.

In case VFM user, it can be selected **[With]** or **[Without]** VFM.

If selected VFM, you can select which coil position you use.

And you can have VFM function.

You can select 1WD, 2WD, 4WD. According your configuration.

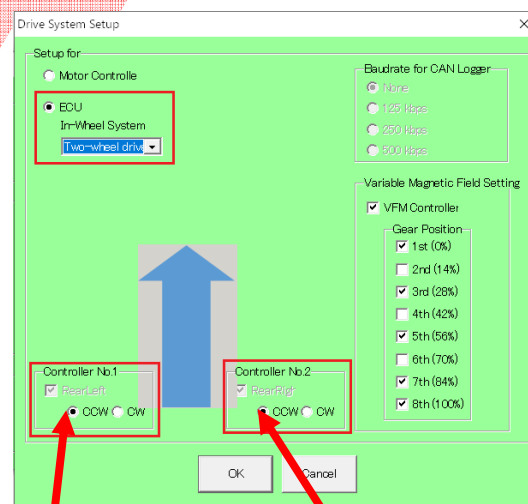


Even in the ECU mode,

It also needs to be selected **[CCW]** in **any time**, even **[CW]** motor.

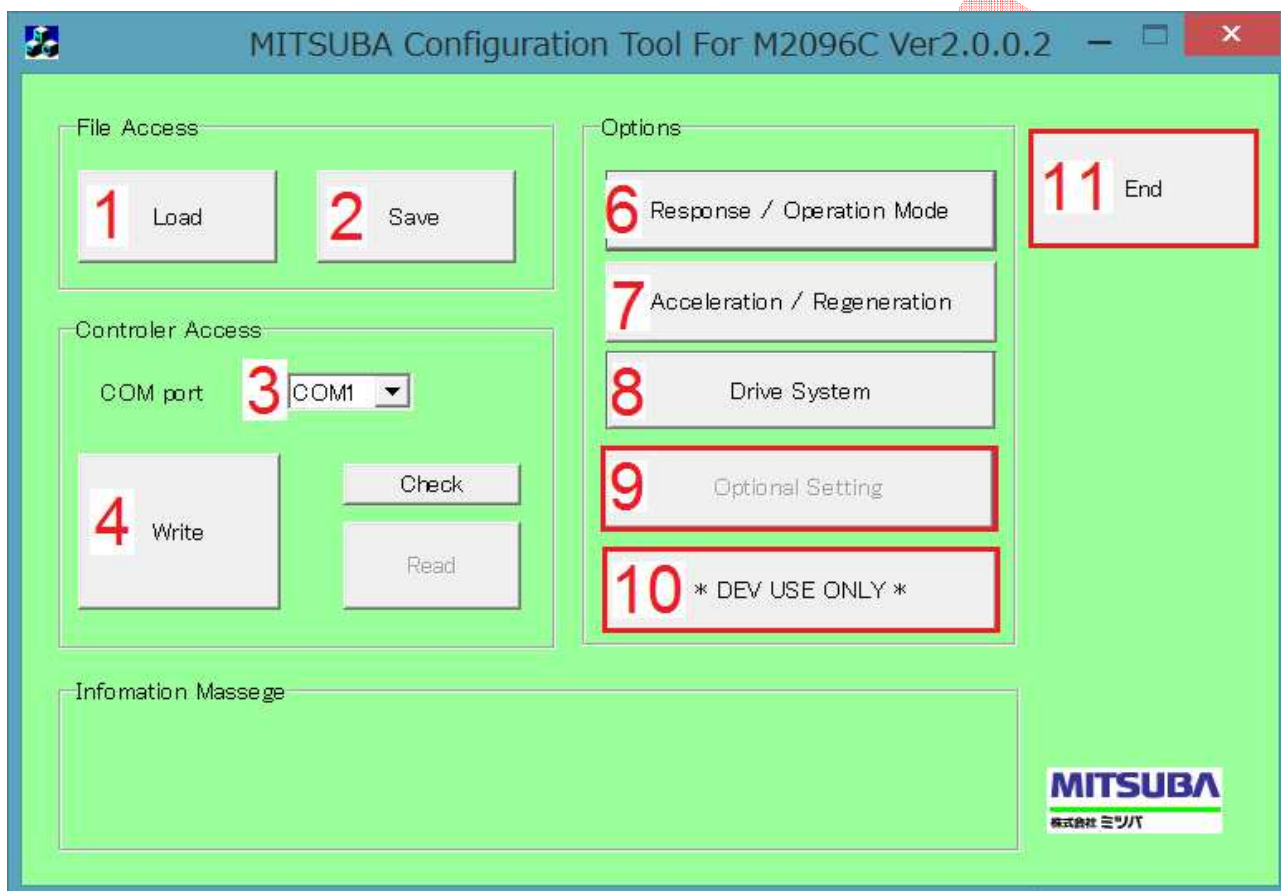
Even 2WD user, needs to be selected **[CCW]** for both motors,

And it is same even 4 wheel configuration.



Description : M2096D3 / M2096C2 instruction manual	Document No : M2096D3 / M2096C2	Date : 2022/Sep/15	Rev : 1.3	Page : pg. 39
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Others



9: no use

No use

10: no use

No use,

Sometimes we ask log data for investigate problem.

We will inform you when we need log data how to load log data

11: finish and close software

After fill all values, then click and close page and return main page

Memo

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 40
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DRAFT

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Description .: M2096D3 / M2096C2 instruction manual	Document No .: M2096D3 / M2096C2	Date .: 2022/Sep/15	Rev .: 1.3	Page .: pg. 41
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