M&C®
ELECTRIC POWER

Electric Vehicle Motor

(PM BLDC motor)

CHINA ELECTRIC MOTOR ASSOCIATION
GUANGDONG M&C ELECTRIC POWER CO.,LTD

Applied to all kinds of Electric Vehicle

Electric bus

Electric car

Electric car

Electric boat

Permanent Magnet Blushless DC Motors

Permanent Magnet Blushless DC Motors Datasheet						
Item (Motor+Controller)	Battery voltage (VDC)	Max Torque (N • m)	Rated Torque (N • m)	Max Power (KW)	Rated Power (KW)	Max Speed (rpm)
PM15A+PMC15A	144	100	48	25	15	6000
PM20A+PMC20A	144	150	76	30	20	6000
PM20B+PMC20B	288	150	70	40	20	6000
PM30A+PMC30A	288	200	82	50	30	7000
PM30B+PMC30B	320	200	82	50	30	9000
PM30C+PMC30C	288	250	106	60	30	4000
PM40A+PMC40A	288	250	106	80	40	5000
PM40B+PMC40B	280	330	140	80	40	4000
PM50A+PMC50A	352	420	220	90	50	5000
PM75A+PMC75A	384	700	330	150	75	5000

20KW System User's Manual

1 System lntroduction

This system consists of motor and controller introduced as follows.

1.1 Motor

In this system PM motor is cooled by water and made of the following parts.

1.1.1 Stator

Stator comprises of casing and winding core.

1.1.2 Rotor

Rotor consists of rotor shaft and permanent magnet block core.

1.1.3 covers

Front cover is of a spigot for installation and rear cover has tapped holes for installation of speed sensor. There are high-quality deep-groove sealed and self oiling bearings in the front cover and the rear cover.

1.1.4 Speed sensor and protective cover

Speed sensor located on the rear end of the motor is kept from damage by protective cover. Its stator is fixed on the rear end-cover and its rotor is fixed on the motor shaft.

1.1.5 Three-phase lead-out cables

Three-phase lead-out cables is connected with the motor stator windings respectively and kept in connection with the cables of the controller by the same color mark at the terminal of each cable during working.

1.1.6 Motor serial number

Only one serial number is allocated to each motor and stamped on the fin of the motor casing, shown in the follow picture.

1 System Introduction

1.2 Controller

In the system controller cooled by water comprises the following parts.

1.2.1 Radiator

Radiator consists of aluminum heatsink and water channel parts.

1.2.2 Housing

The housing made of bended steel sheet keeps the electrical components from damage and its surface is painted with powder.

1.2.3 Main circuit

Main circuit consists of power device, electrolysis capacitors and absorption capacitors.

1.2.4 Lead-out signal wires

The lead-out signal wires of the controller are used for communication with outer device.

1.2.5 Controller serial number

Only one serial number is allocated to each controller and stamped on the edge of the heatsink, shown in the follow picture.

2、Wiring

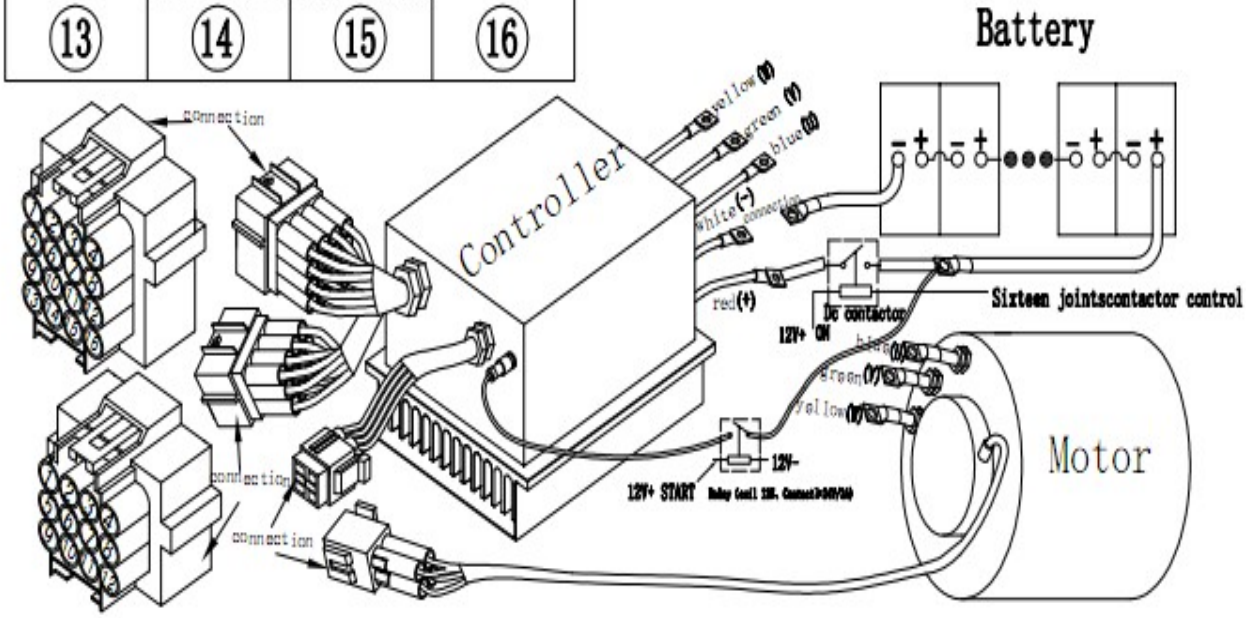
2.1 For 96V or above (for reference only)

Sixteen joints

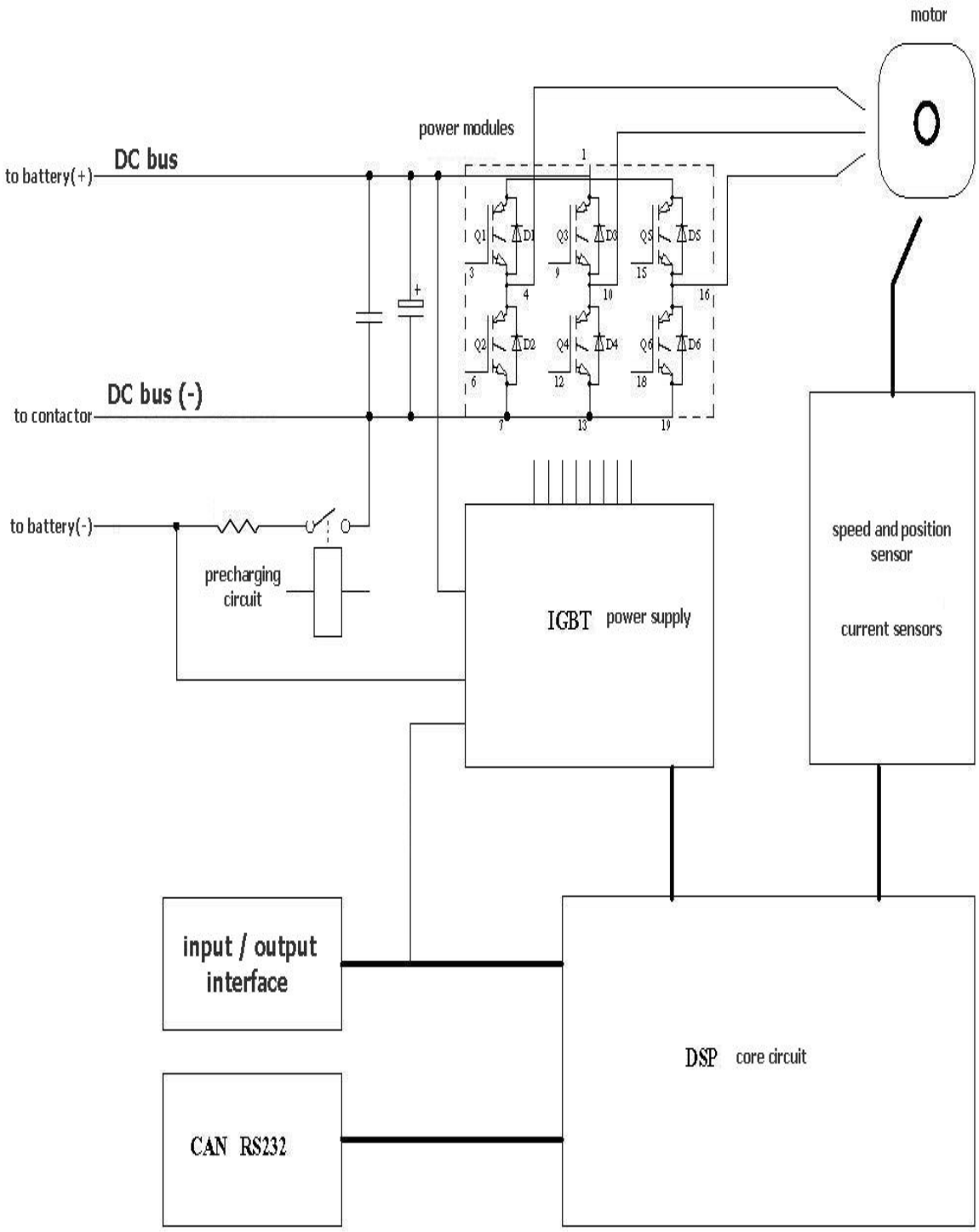
Keep ①	12V- ②	Keep ③	12V+ ④
Keep ⑤	Forward switch ⑥	Back switch ⑦	Braking switch ⑧
Function switch ⑨	Function switch ⑩	Function switch ⑪	Function switch ⑫
Keep ⑬	Function switch ⑭	Function switch ⑮	contactor control ⑯

Twelve joints

5V+Output ①	electronic accelerator signal ②	braking simulate signal ③	5V-Output ④
gorge line transmit ⑤	gorge line receiving ⑥	gorge line place ⑦	Keep ⑧
CANL ⑨	CANH ⑩	pulse output ⑪	simulate output ⑫



3、Circuit Diagram



4、Mounting

4.1 About motor

You can mount motor on the chassis of vehicle through 4 threaded holes in front cover and 4 threaded holes in rear cover with long bolts. And there is an external spigot on the front cover for fixing the motor to connecting plate or gear box. The torque is transmitted by joining the shaft of motor with the shaft of gear box.

You should keep enough space and a well-ventilated area for the natural air-cooled motor from damage.

4.2 About controller

- Keep the area around controller clean and dry. Avoid direct exposure to high temperature, wet environment, sunlight and corrosive air.
- Fix the controller on a level frame through four holes in the heatsink and add cushion for a vibratory place.
- Keep an ambient temperature of below 45^{o}C.

5、Communication Protocol

We use serial communications interface (SCI) in the controller for communication and send the state information of controller timely. You can also select CAN (controller area network) for communication as need.

6、Protective Functions

We have some protective functions for the controller, described as follows.

function	description
Power modules fault	Once the power modules detect overcurrent or overheat, the controller will close off any output and give an alarm, and switch off the main contactor. You can recover the system running by turning key switch to “on” position to reset the system. If this arises repetitively, it is regarded as a fault.
Overcurrent	Once the circuit detects the output current is greater than the set value, the controller will close off any output and give an alarm，and switch off the main contactor. You can recover the system running by turning key switch to “on” position to reset the system. If this arises repetitively, it is regarded as a fault.
Overvoltage	When the voltage of DC bus is over max. allowed value during brake or in any term, the controller will close off any output and give an alarm. You can recover the system running by turning key switch to “on” position to reset the system. If this arises repetitively, it is regarded as a fault.
Electronic thermal sensitive relay	Electronic thermal sensitive relay for motor overload makes an inverse proportion between time and load. It will keep an accumulation of repeated heat, and will ignore the heat arising contingently. It will give an alarm for motor overload instead of closing off the controller output.
Undervoltage	When the voltage of battery is under the low voltage threshold (this value is adjustable as you need), the controller will close off any output and give an alarm.

overheat	When the temperature of the heatsink is over 45ºC, the fans begin to work. When it is below 40ºC, the fans will be switched off. And when it is over 75ºC, the controller will give an alarm and decrease the output torque by a half, when it is still up to 85ºC, the controller will close off any output and give an alarm. The system will work again when the temperature drop to 70ºC after the half torque reduced.
Top motor speed	When motor speed is up to the top value, the controller will reduce the torque output. When the speed is still up to 6500rpm, the controller will close off any output.
Throttle pedal	An output of throttle potentiometer arises while power on the system, the controller will close off any output.

7、Maintenance

7.1 About motor

- Clean dust and smear on the surface of motor periodically.
- Please trained technician to replace jacket of the lead-out cables of motor if necessary.

7.2 About controller

- Don’t wash the controller in spite of the water-proof design.
- Don’t open the cover of controller unless necessary indeed.
- Clean dust and smear on the surface of controller periodically.
- Don’t test the control circuit with high-resistance meter.
- Begin to maintain, repair and reconnect the cables after one minute power off, and protect you from electrical shock or damage components of the controller.

8、Troubles and Solutions

8.1 About motor

8.1.1 Insulating resistance to ground

Insulating resistance to ground of motor in our factory is great than or equal to 20MΩ. It will be less than 2 MΩ when the motor is wetted，you should dry the motor before using it again.

8.1.2 hard to startup

Check mechanical and electrical parameters of the motor step by step, it is only permitted to break down and install motor by trained technician if necessary.

- The motor can not run at absence of phase.

8.2 About controller

Here are some troubles, possible causes and solutions, described as follows.

trouble	possible causes	solutions
over-current or power device defect	power device breakdown Grounded or shorted at load side.	Exchanged power device by trained technician. Check the cables motor and output cables.
unstable running with much noise	abnormal voltage output due to power device breakdown	Exchanged power device by trained technician.
no response to power on	Fuse tube onboard breakdown or without precharge.	Replace fuse tube (beside the 16-pin connector). If need, check and replace the resistor and relay for precharge.
unable to rotate but wobbling and without protective signal output	improper cables connection	Check and correct cables connection

Appendix A: Product Specification

A1: Motor parameters (PM20A)

Parameter	Unit	Value	Parameter	Unit	Value
Rated power	*kW*	20	Peak torque	*N.m*	150
Battery voltage	*V*	144	Sizes	*mm*	Φ238×245
Nominal speed	*rpm*	3200	Speed range	*rpm*	0－6000
Efficiency	%	95	Winding connection		Y-type
Insulation		class F	Protection		IP55
Cooling		coolant	Weight	*kg*	46

A2: Controller parameters (PMC20A)

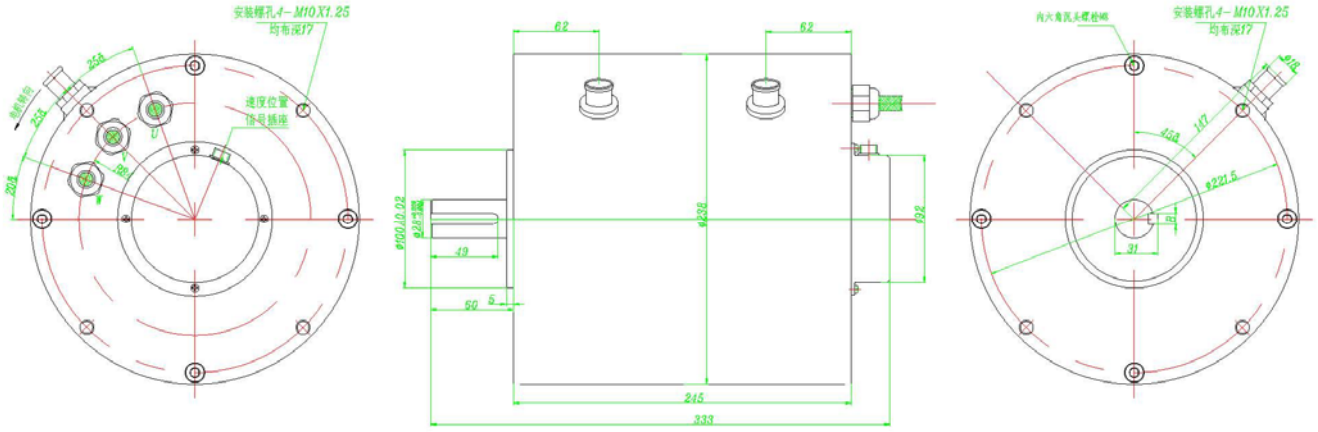
parameter	unit	value	parameter	unit	value
Max. capacity	*kVA*	45	Input voltage	*DCV*	144
Output voltage	*V*	84	Current rating	*A*	135
Ambient temperature	℃	-25-60	Peak current	*A*	250
efficiency	*%*	95	Protection		IP54
Cooling		coolant	weight	*kg*	11.5

Appendix A: Product Specification

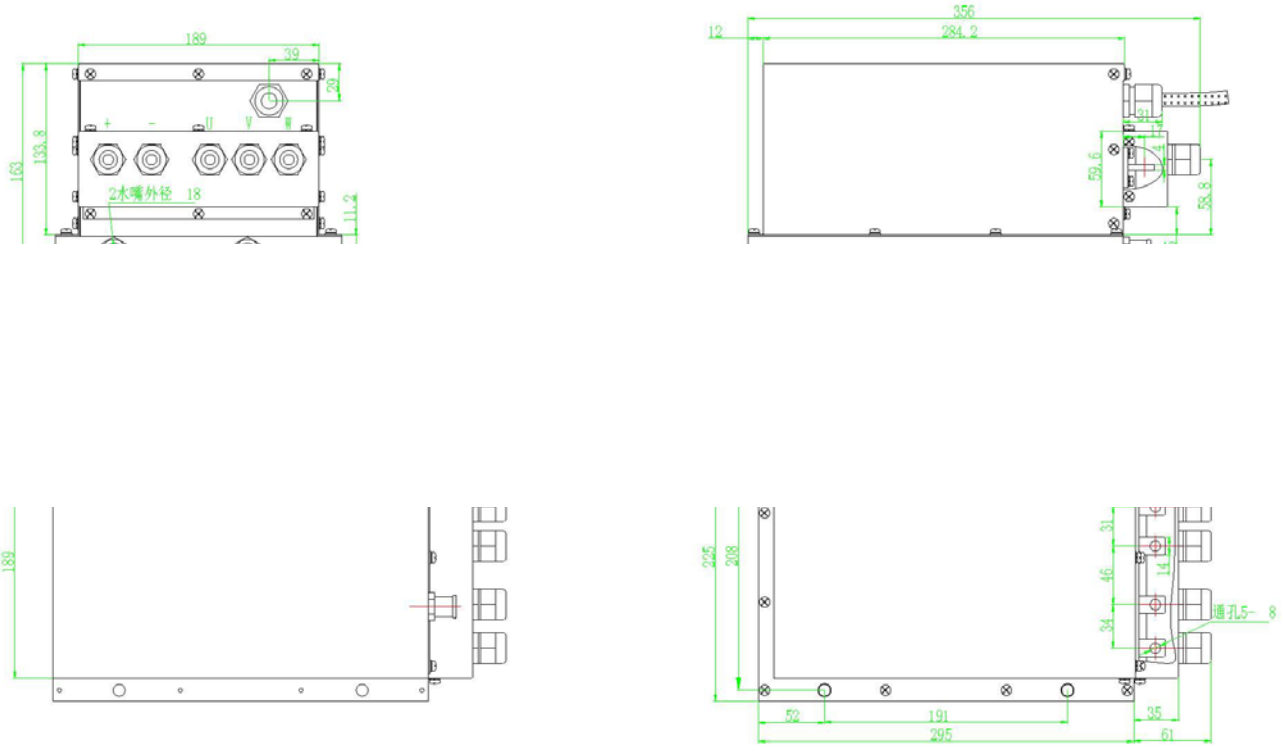
A3: System parameters

parameter	unit	value	description
Input voltage	*DCV*	144	Allowed value is 100~200 Vdc，but lower voltage will bring about poor ability.
Rated torque	*N.m*	76	Running in long-time
Max. torque	*N.m*	150	running time is about 1minute
Nominal speed	*rpm*	3200	
Top speed	*rpm*	6000	Adjustable by user
Speed range	*rpm*	0－6000	
Torque controlled by			Throttle pedal
Control strategy			Space vector
Communication interface			SPI (CAN optional)
Energy regen			Adjusted as need
Protection function			Overvoltage, overcurrent, power device default, undervoltage, overload and overheat etc.
Speed sensor			Position sensor，power supply 5VDC

Appendix B: Motor Outline and Dimensions



Appendix C: Controller Outline and



Battery Charger

Vehicle mounted Battery charger

MOSFET or IGBT power unit
Capacity:1~8kW
Voltage range: 36~420V
Current:3~150A
Suitable for LiFePO4 or Lead acid battery
Application: EV car

Fast charge Battery Charger

IGBT power unit
Capacity:8~50kW
Voltage range: 288~600V
Current:10~150A
Suitable for LiFePO4 or Lead acid battery
Application: EV car ,E-bus

DC-DC Converter

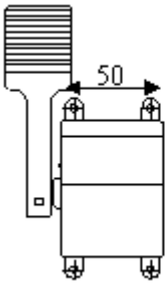
The DC/DC converter supplies the 12V、24 V circuitry of the electric vehicle with power from the traction battery. The converter can be used with or without a 12V backup battery .If the backup battery is not charged but the DC/DC has input voltage , the charge control lamp lights up.

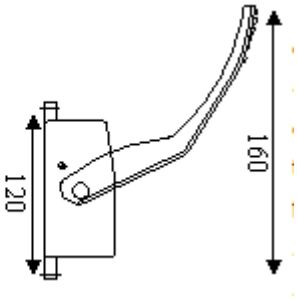
Input voltage (V)	50-200	160-300	280-420	0-600
Output voltage(v)	12、13.8、24	12、13.8、24	12、13.8、24	0-600v
POWER(w)	300-600	600-1200	1000-3000	300-20000
Dimensions(DxWxH)	250*180*100mm	270*250*135mm	270*250*135mm	
Weight (KG)	3	6	6	

Protection	Incorrect input connection and breakdown protected
	Overload and output short-circuit protected
	Overheat protected
	Input undervoltage and overvoltage protected
Output voltage ripple (0-50MHz)	<25mV RMS
Line/load regulation:	<1%
EMC-conducted emissions:	EN 55022 level A
Safety:	EN60950
Input to case isolation:	1.5kV AC
Output to case isolation:	500V DC
Efficiency (cont.current ,typ.):	86%
No load current consumption:	max.25mA
Ambient temperature range:	-25℃.. ＋3 5 ℃
Max.ambient temperature:	60℃

Pedal

The accelerator pedal can control the motor speed by giving control signal to the controller. It also can adjust the rotation direction shift from CW/CCW. Its effect is as the same as the gas accelerator.





Hall voltage:4.5~12V
IP: water-proof
Application:EV-car,Goft car

Output resistor:0~5k
IP:water proof
Application: EV-car,Goft car

Hall voltage:4.5~12V
IP: water-proof
Application:Goft car,Tour car

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CHINA ELECTRIC MOTOR ASSOCIATION
GUANGDONG M&C ELECTRIC POWER CO.,LTD
Add:3/f Dizhi Building No.739 Dongfeng Rd.E Guangzhou China
Tel.: 0086-20-89660216
Fax.: 0086-20-89660219
P.C.: 510080
E-mail: mc@china-electricmotor.com
Website: http://www.china-electricmotor.com