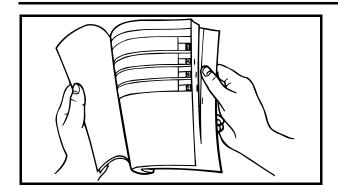


SERVICE MANUAL

e-Bike SYSTEMS



How to Use This Manual

Searching for Manual Contents

- 1. Refer to the table on the following page to determine the applicable parts according to the model type code and product code.
- 2. This manual is divided into four parts: General information, electrical components, Drive Unit, and service data.
- 3. The table of contents is provided at the beginning of the manual. Review the overall makeup of the manual and search for the chapters and sections you need.

Symbols

Important items in this manual are indicated by the following symbols:



The symbols indicate precautions pertaining to safety.



Indicates that incorrect use could result in death or serious injury.

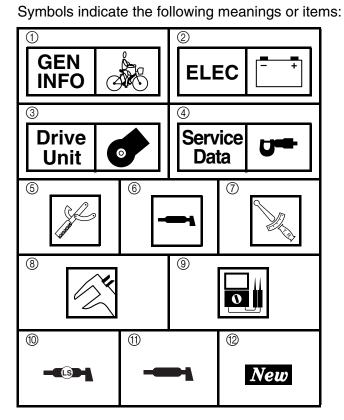
Indicates methods are correct operation or main elements of inspection

NOTICE

TIP

Indicates that incorrect use could cause property damage.

and maintenance.



- General information section
- ② Electrical Components section
- ③ Drive Unit section
- (4) Service data section
- (5) Special tools
- **6** Types of grease
- 7 Tightening torque
- ® Standard values or limits of use
- (9) Standard values for resistance (Ω), voltage (V), current (A)
- 10 Lithium-soap-based grease
- 1 Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP ACN®)
- 12 New parts to be used when replacing

List of part types and included crank parts according to the model type code and product code

		Mater/Display *1	splay *1	Battery	tery	Crank	Crank axle *2		Included c	Included crank parts	
		ГЕР	ГСБ	Rear carrier	Down tube	Square-type	Spline-type (ISIS)	Sprocket	Spacer	Spider	Nut, lock
Model type code	Product code										
X941	010		٨	٨		7			7		٨
† 6 7	080		7		7	7					7
X942	010		٨		7	7				٨	٨
X 9/3	010		7		7		7			>	7
25	020		7		7		7			>	7
X944	010		٨	٨		>		>	7		٨
	020	^		٨		>		>	7		٨
X945	010		٨		٨	>		>	7		^
X 946	010		٨	٨		٨		٨	7		٨
2	020		7		7	7				٨	٨

^{*1:} In the diagnosis section, refer to the applicable pages according to the type of meter display unit.
*2: For the illustrations and contents for disassembling the drive unit, refer to the applicable pages according to the shape of the crank arm mount.

Index

General Information Electrical Components Drive Unit Service Data GEN INFO 1 ELEC 2 Drive Unit 3

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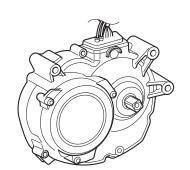
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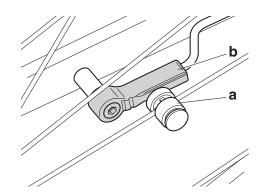
Description

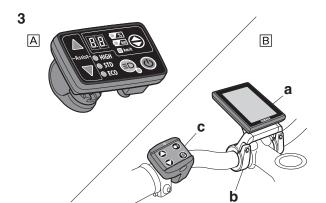
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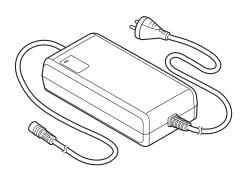
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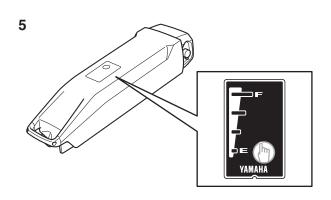
General Information

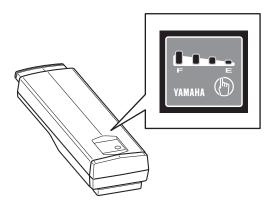




4







- 1. Drive Unit
- 2. Speed sensor set
 - a) Magnet sensor spoke type
 - b) Pick up
- 3. A Display Unit (LED type)
 - B Display Unit (LCD type)
 - a) Display (detachable)
 - b) Display holder
 - c) Switch

- 4. Battery charger
- 5. Battery pack (The battery may differ depending on the model.)

^{*} The actual Drive Unit may differ slightly from the picture shown.

Precautions relating to maintenance (1)

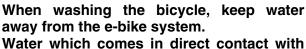




Precautions relating to maintenance (1)

Cleaning and Maintenance

NOTICE



Water which comes in direct contact with the e-bike system can get inside and reduce performance. Steam cleaning is particularly to be avoided.

- 1. Remove any mud or dust from the frame and Drive Unit to make sure that it does not get inside when performing service.
- Use water or neutral cleanser to clean covers, and wipe off water using a soft cloth to prevent scratching. Avoid wiping with a dry cloth prior to washing.

Keep away from fire

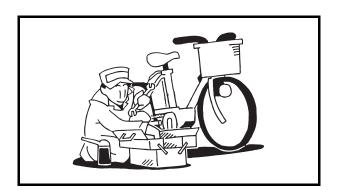
Keep the workplace away from open fire.





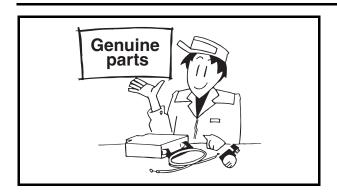
Proper tools

When servicing the bicycle, be sure to use the special tools intended for areas which require special tools in order to prevent damage to parts. Also, work appropriate work should be done using appropriate tools and measuring devices. (Avoid using spanner wrenches. Use offset or box wrenches instead.)



Precautions relating to maintenance (1)





Replacement parts

Replace gaskets (packing), O-rings, cotter pins, circlips (split rings), lock washers, etc. with new parts.

Be sure to use genuine new Yamaha parts and recommended parts for oils and greases, including periodic replacement parts and repair parts.

Do not use used parts because, even though these parts may appear to be the same, they may not be genuine parts, or there is the risk that their quality has changed due to previous use.



Precautions for disassembly and reassembly

- Inspect and measure parts as needed during disassembly. Keep good records which you can refer to when reassembling parts.
- 2. Organize parts by sections so that you do not mix them up or lose them.
- Use cleaning oil to clean Drive Unit parts after disassembly and blow parts clean with compressed air.
- Reassemble parts while checking any corrections made to parts and referring to the data collected prior to disassembly.
- 5. While reassembling parts make sure that each part is clean and free of foreign material.
- 6. Perform reassembly while checking the actions to be performed for each section.
- 7. Apply oil to sliding parts.
- 8. Tighten all nuts and bolts to their specified torque.
- 9. Maintain good communications when the work is done by 2 service personnel.

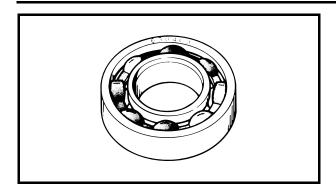
Precautions relating to maintenance (1)



Handling the Battery Pack

- 1. Use the dedicated battery charger for charging the battery pack.
- 2. The battery pack is a dedicated e-bike system battery. If it is connected to a product other than the e-bike system, it will cause a fluid leakage, "overheating, or breakage."
- 3. Be sure to charge the e-bike system before operating it for the first time or after it has been unused for a long period of time.
- 4. Do not expose the battery pack to fresh water or seawater. It can cause the battery pack to overheat or rust.
- 5. Do not disassemble or modify the battery pack. It can cause a fluid leakage, overheating, or breakage. To replace the battery pack, replace the entire assembly.
- If charging is not completed even after the specified charging time has elapsed, stop charging. If charging is continued, it can cause a fluid leakage, overheating, or breakage.
- The battery pack should be sorted for environmental-friendly recycling. Do not dispose of the battery pack as household waste.

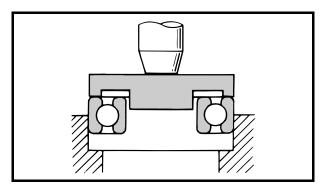




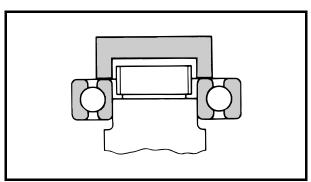
Servicing Precautions (2)

Bearing Installation

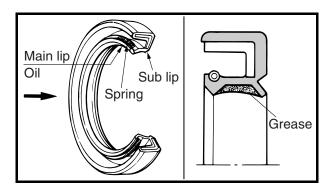
1. When installing a bearing, the surface with the manufacturer's mark and the size code should face outward.



2. When striking a bearing into the case, apply a parallel force to the outer race.

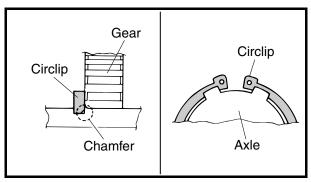


3. When striking a bearing onto an axle, apply a parallel force to the inner race.



Oil Seal Installation

- 1. To install an oil seal, direct the main lip towards the oil chamber (the object of sealing).
- 2. Be sure to apply a thin, even coat of grease to the sealing lip before installing the oil seal.



Circlip Installation

- 1. To install a circlip, direct the chamfered side of the circlip inward.
- 2. Install the circlip by aligning its opening with the center of the spline.
- 3. Do not expand the circlip more than necessary.

Precautions relating to maintenance (3)





Precautions relating to maintenance (3)

Handling of the torque sensor

- 1. Keep away from magnets. Do not use magnetized screwdrivers or perform maintenance near large sources of electric power.
- 2. Avoid strong mechanical impact.

Torque sensors which have been dropped or which have been removed through the use of a hammer or the like cannot be used because the torque sensor reference voltage can change significantly due to variations in the internal magnetic circuits.

3. Do not crush or press in the axial direction. Any deformation of the torque sensor case by crushing can result in changes in the torque sensor reference voltage. Torque sensor reference voltage changes can also be caused by the application of a force of over 2 kgf on the sensor shaft while the case is clamped in place.

The installation of a one-way clutch having a tightly-fitted spline can apply excessive force to the sensor shaft and result in voltage changes.

4. Do not pull leads.

Do not pull forcefully on the small circuit board leads which connect the torque sensor body to the torque sensor. It can change the torque sensor reference voltage.

5. Do not allow water to come in contact with the Drive Unit.

Any rust on the sensor shaft or the main axle can cause output fluctuations or can reduce the strength of the parts. Do not perform servicing on the sensor in wet locations.

6. Organic solvents

Do not apply gasoline or solvent-based lubricants (consumer spray-type lubricants) to the sensor shaft or the circuit board. It can reduce the unit's ability to prevent short-circuits.

7. Do not reuse damaged drive axles. The sensor shaft and the drive axle slide in a metal bearing. It will be difficult to install

the one-way clutch and the sensor shaft if there are scratches on the surface of the drive axle.

8. Do not disassemble the torque sensor.

Do not disassemble the interior of the sensor because the torque sensor cannot be readjusted. Torque sensors that have been disassembled cannot be used.

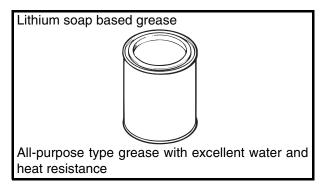
Specialized tools and equipment

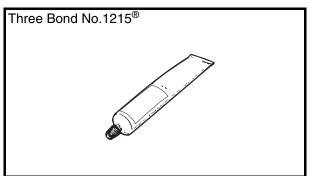


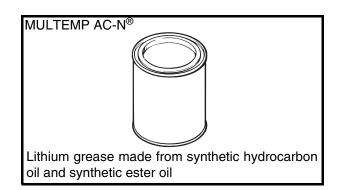
Specialized tools and equipment

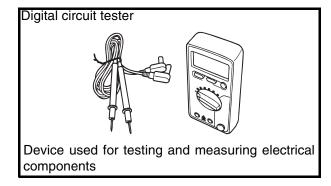
The appropriate specialized tools must be used for inspection, adjustment, disassembly, and reassembly.

Maintenance problems and mechanical breakage can be prevented by using the appropriate specialized tools.

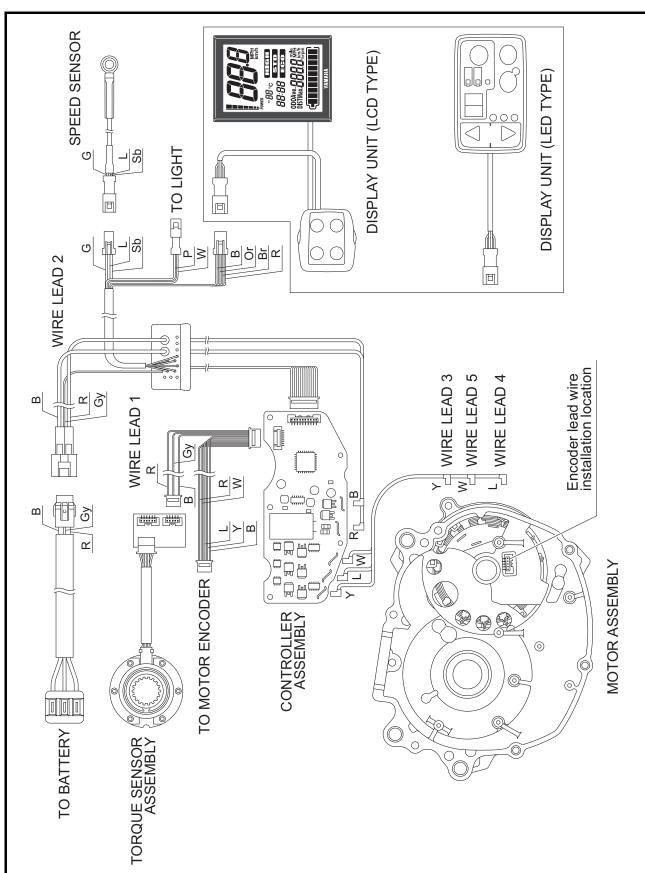








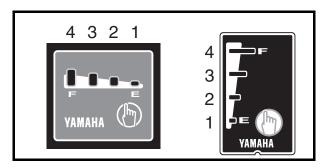
Electrical Components Electrical component wiring diagram

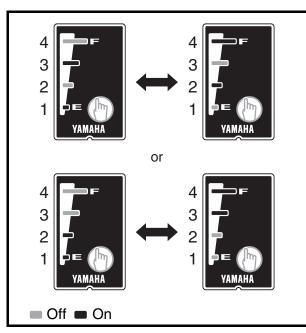


Battery pack display function

By holding down the battery capacity indicator button "" on the battery pack, the following items can be checked.

Length of time that the button is pushed	Display item	Display time	Details	Page
When pushed	Normal state: Residual battery capacity	5 seconds	See the owner's man- ual.	-
	Error detected: Error display	5 seconds	See "Error display".	P. 2-2
20 seconds	Total number of bat- tery charging cycle	5 seconds	See "How to check the total number of battery charging cycle".	P. 2-4
30 seconds	Absolute battery capacity	5 seconds	See "How to check the absolute battery capacity".	P. 2-5





Error display

1. Depending on the model, the battery capacity indicator lamps are arranged horizontally or vertically as shown.

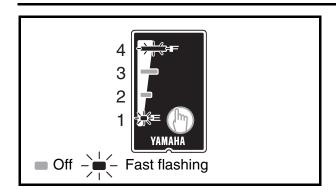
In the explanations in this manual, the numbers used for the battery capacity indicator lamps are 4, 3, 2, and 1 from left to right or from top to bottom.

Although the illustrations in this manual show only the vertical-type battery capacity indicator, the operation of the lamps is the same for both types of battery capacity indicators.

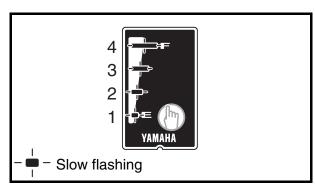
2. If the battery capacity indicator lamps [1]/[3] and [2]/[4] turn on alternately, or the lamps [1]/[2] and [3]/[4] turn on alternately when the battery capacity indicator button "" is pushed or connect the battery charger, see "Recoverable errors of battery pack or battery charger".

(P. 2-8)





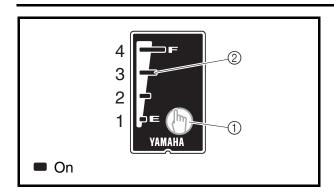
3. If the battery capacity indicator lamps [1] and [4] are fast flash simultaneously when the battery capacity indicator button "" is pushed or connect the battery charger, see "Non-recoverable errors of battery pack". (P. 2-10)



4. If all four battery capacity indicator lamps flash slowly at the same time <u>when the bat-</u> <u>tery capacity indicator button "(b" is</u> <u>pushed</u>, see "Temperature protection function". (P. 2-14)

If all four battery capacity indicator lamps flash slowly at the same time **when connect the battery charger**, see "Charging on stand-by mode". (P. 2-7)





How to check the total number of battery charging cycles

Check the total number of battery charging cycles as follows:

- 1. Hold down the battery capacity indicator button "(*)" 1) for 20 seconds.
- 2. The total number of battery charging cycles is indicated by the four battery capacity indicator lamps ② on the battery pack.

TIP_

While holding down the battery capacity indicator button "not of property of particular than the currently applicable condition (residual battery capacity, * error diagnosis), for five seconds for each condition.

*The error diagnosis are displayed only for a malfunction, and is not displayed in normal state.

The table below indicates the relationship between the total number of battery charging cycles and the battery capacity indicator lamps.

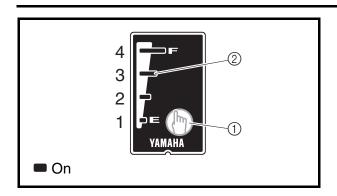
Display of the total number of battery charging cycles

battery capacity indicator lamps on battery pack	The total number of battery charging cycles
4 3 2 1 1 VAMAHA	0 to 100 times
4 3 2 1 1 VAMAHA	101 to 200 times
4 3 2 1 1 YAMAHA	201 to 300 times
4 3 2 1	301 to 400 times

■ Off ■ On Slow flashing	Off On
--------------------------	--------

battery capacity indicator lamps on battery pack	The total number of battery charging cycles
4 3 2 1 1 1 1	401 to 500 times
4 3 2 1 1 YAMAHA	501 to 600 times
4 3 2 1 1 YAMAHA	601 to 700 times
4 3 2 1 1 VAMAHA	701 times or more





How to check the absolute battery capacity Check the *1 absolute battery capacity as follows:

- 1. Hold down the battery capacity indicator button "(f)" 1 for 30 seconds.
- 2. The *1 absolute battery capacity is indicated by the four battery capacity indicator lamps
 ② on the battery pack.

TIP

While holding down the battery capacity indicator button "" for 30 seconds, the lamps will display the currently applicable conditions (residual battery capacity, *2 error diagnosis, Total number of battery charging cycles), for five seconds for each condition.

- *1 Absolute battery capacity: Absolute battery capacity is not the relative specified electric power capacity that the battery pack has at any given point, but the actual electric capacity that the battery pack itself can store. The capacity at the time of shipment is considered 100%.
- *2 The error diagnosis are displayed only during a malfunction, and is not displayed in normal state.

The table below indicates the relationship between the absolute battery capacity and the battery capacity indicator lamps.

Display of the absolute battery capacity

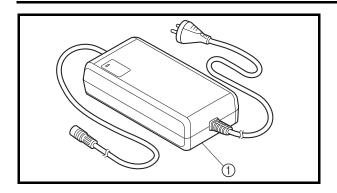
battery capacity indicator lamps on battery pack	Absolute battery capacity (%)
4 3 2 1 YAMAHA	0 to 24%
4 3 2 1 YAMAHA	25 to 49%

battery capacity indicator lamps on battery pack	Absolute battery capacity (%)
4 3 2 1 1 YAMAHA	50 to 74%
4 3 2 1 1 YAMAHA	75 to 100%

□ Off ■ On

Charging

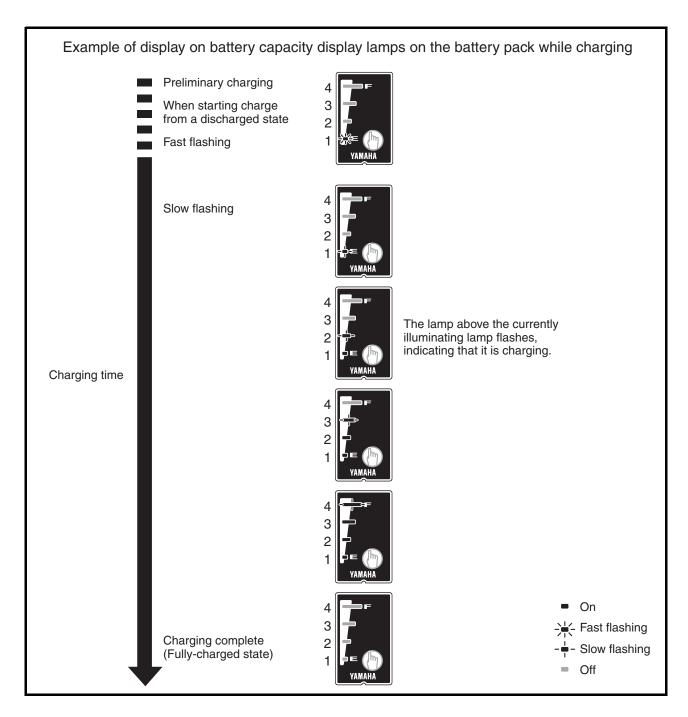




Charging

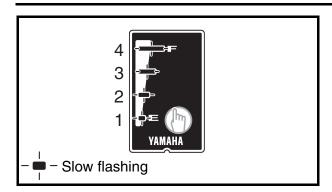
e-Bike system dedicated battery charger

This battery charger ① is a dedicated battery charger for the e-Bike system's battery pack.



Charging





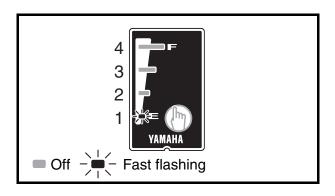
Display on battery capacity indicator lamps while charging

Some phenomena such as the following may occur while charging the battery pack, depending on the battery pack's state; however, these are not malfunctions.

Charging on stand-by
 Display on the battery capacity indicator
 lamps on the battery pack: [All four lamps
 flashing slowly at the same time].
 When the battery pack's internal temperature goes out of operating range, the battery
 pack changes to the "Charging on stand-by"
 state automatically.

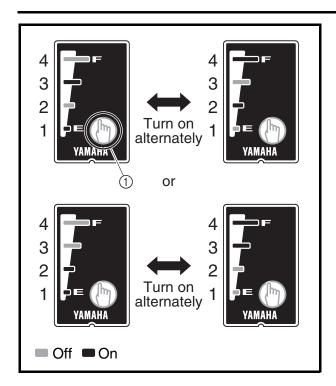
TIP.

- Once the temperature inside the battery pack becomes suitable for charging, the charging starts automatically.
 (In such case, the charging time becomes longer by the time during which all four battery capacity indicator lamps on the battery pack were flashing simultaneously.)
 As much as possible, charge at an optimal room temperature, approximately 15 to 25°C.
- Even if you start charging properly, if the battery pack exceeds the specified temperature range while charging, the charging process is aborted to protect the battery pack. This may result in insufficient charging. In such case, when checking the residual battery capacity, not all of the four battery capacity indicator lamps on the battery pack may not turn on. Cool down the battery pack for a while, and charge again, preferably in a cool place.
- Even if the room temperature is within the 0 to 45°C range, if attempting to charge the battery pack immediately after driving, or if the battery pack had been left in the sun during summer, the battery pack's internal temperature may be outside the allowable temperature range for charging. If the room temperature is 30°C, it may take approximately 4 hours until the battery pack's internal temperature is within the allowable temperature range for charging.



During pre-charging
 Display on the battery capacity indicator lamps on the battery pack: [Battery capacity indicator lamps [1] flash rapidly].





Diagnosis mode

Recoverable errors of battery pack or battery charger

If the battery pack or battery charger has the errors, the following procedure can be used to access the error diagnosis mode and confirm the details regarding the error of the battery pack or battery charger.

- 1. If there is an error when the battery capacity indicator button "(1)" (1) on the battery pack is pushed or connect the battery charger, the battery capacity indicator lamps [1]/[3] and [2]/[4] turn on alternately, or the lamps [1]/[2] and [3]/[4] turn on alternately. When the battery capacity indicator lamps turn on alternately, the residual battery capacity is not displayed.
- 2. Hold down the battery capacity indicator button "(b)" (1) for 10 seconds.
- 3. The lighting display of the battery capacity indicator lamps indicates the error of the battery pack or battery charger.

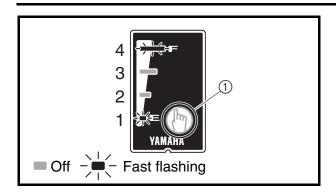
TIP

- If the battery pack or battery charger is operating normally, the battery capacity indicator lamps indicate the residual battery capacity.
- If there are multiple errors, only the latest error will be displayed.
- The error diagnosis mode can be accessed whether the battery charger is connected or disconnected.

List of battery pack/battery charger diagnosis	ittery charg	jer diagnos	is items		
Battery capacity indicator Iamps		Battery capacity indicator lamps	Fault device	Failure	Action
		4 6 8 9 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Overcharg- ing during discharging	 Connect the battery pack to the dedicated battery charger for the e-Bike system and charge it for a while. The battery pack returns to the normal state after the step 1, install the battery pack to the bicycle and ride it for a while.
1/3 and 2/4 turn on alter-		4 6 8 9 1 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Charging over current during dis- charging	 3. If the battery pack error occurs again, perform the following: Check the Drive Unit failure. Replace the battery pack.
	Hold down the battery capacity indicator button "@" for 10 sec-	2 2 1 PE (MAN)	Battery pack failure	Discharging over current	
YAMBAK	spuo	2 2 1 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4		Short circuit	
		1 P E (1)		FET temper- ature fault	

Replace the battery charger. The battery pack will return to the normal state, after the battery pack is installed to the bicycle and the bicycle is ridden for a while.		 Disconnect the charging plug. Clean the charging connector and charging plug, and dry them. Connect the charging plug to the charging connector. If the battery pack error occurs again, replace the battery charger.
Overcharg- T ing during the charging	Charging over current during charging	Zero charg- 2 ing current 4
Battery charger failure		
4 & & & L	4 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	Hold down the battery capacity indicator button "@"	for 10 sec- onds
1/2 and 3/4 turn on alter-	nately	инжил уници





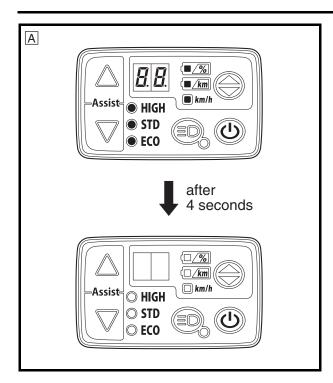
Non-recoverable errors of battery pack

If the battery pack has the errors, the following procedure can be used to access the error diagnosis mode and confirm the details regarding the error of the battery pack.

- 1. If there is a non-recoverable errors when the battery capacity indicator button "()" (1) on the battery pack is pushed or connect the battery charger, the battery capacity indicator lamps [1] and [4] fast flash simultaneously.
- 2. Hold down the battery capacity indicator button "()" 1 for 10 seconds.
- 3. The lighting display of the battery capacity indicator lamps indicates the error of the battery pack.

■ Off ■ On → Fast flashing





When the battery pack signal lead wire becomes disconnected

Although the power to the display unit is turned on.

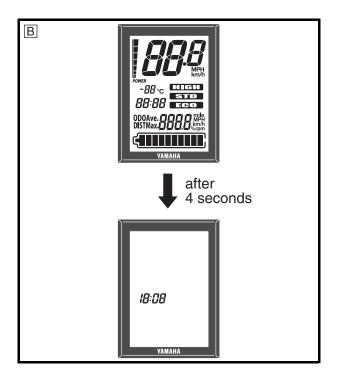
- All of the LED displays of the display unit (LED type) turn on for 4 seconds, and then the power turns off automatically (LED) A
- All segments of the display unit (LCD type) unit turn on for 4 seconds, and then the power turns off automatically (LCD) 🖪

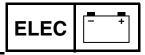
If the motor is rotating (while running), the power assist becomes weak and finally stops it. The battery pack stops discharging after a short time.

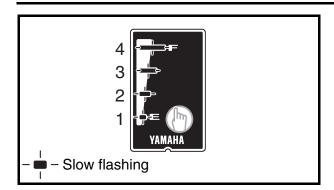
Action:

Check the battery pack signal lead wire (gray) for a wire break or disconnection.

→ Replace the DC plug or power lead wire.







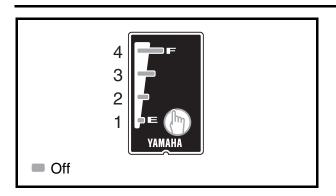
Temperature protection function

If the battery pack's internal temperature is -20°C or less or 80°C or higher while the battery pack is discharging (during the power assist), the temperature protection function of the battery pack operates and the battery pack stops discharging. If the battery capacity indicator button "" is pushed at this time, the battery capacity indicator lamps [1], [2], [3], and [4] flash slowly at the same time.

TIP

The battery pack automatically recovers when the battery pack's internal temperature returns to the allowable temperature range for charging.





Over-discharge protection function

If the battery pack becomes over-discharged, the over-discharge protection function of the battery pack operates.

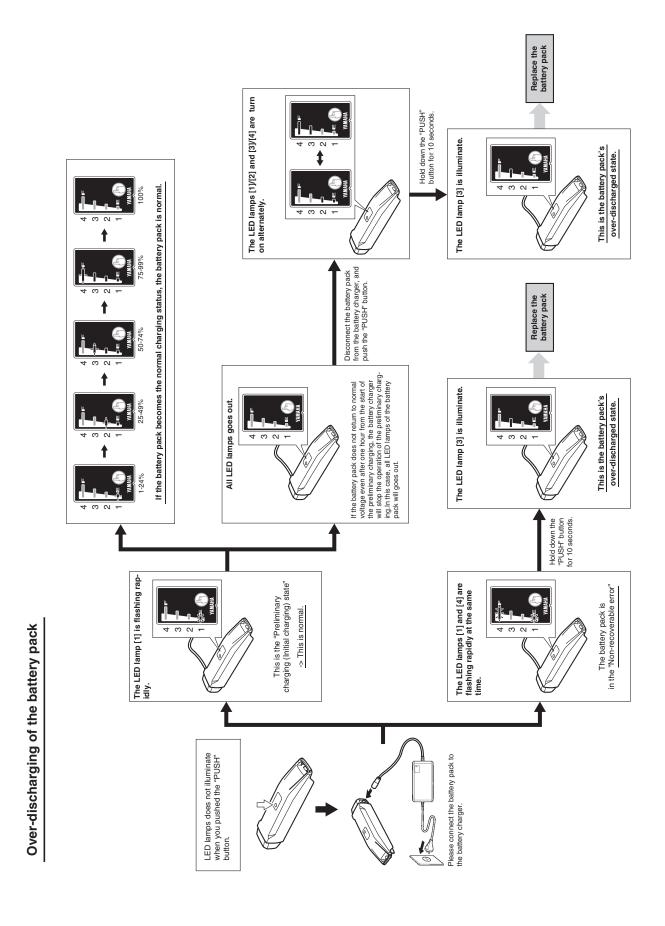
If the battery capacity indicator button "" is pushed at this time, the battery capacity indicator lamps do not turn on.

The following procedure can be used to access the over-discharge protection function diagnostic mode and confirm the details regarding the malfunction of the battery pack.

*First connect the battery charger to the battery.

*Because the battery voltage is insufficient when the battery pack is over-discharged, the battery capacity indicator lamps will not turn on or flash if the battery pack is not connected to the battery charger.





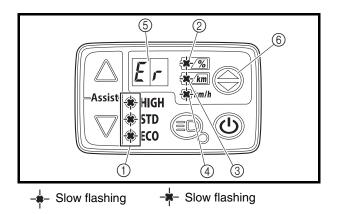


Display unit's display when there is an error

Detects system malfunctions, changes assist operation, and displays the errors as well as performing error code recording.

Error displays are indicated by the display of "Er" and an error code indicating the type of error. You can switch between "Er" and the error code display by pressing the function select switch "\enline{\circ}".

When a malfunction which may reflect a abnormal operation is displayed, the malfunction is recorded to prevent recurrence of the condition, and thereafter the power assist will be immediately blocked after the power is turned on and the error will be displayed on the function display in display unit.



How communication errors are displayed

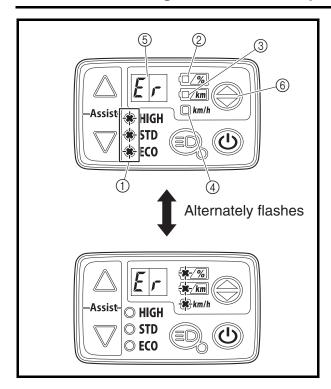
The 3 assist mode lamps ①, the "%" lamp ②, the "km" lamp ③, and the "km/h" lamp ④ will flash at the same time, and "Er" will be displayed on the function display ⑤ of the display unit.

When the function select switch "●" ⑥ is pressed, error code "12" or "13" will be displayed.

TIP_

- The error code is not stored.
- See "List of error codes and corresponding power assist operations" for more details.
- If there is a communication error, the power cannot be turned off using the "POWER" switch of the display unit. To turn the power off, remove the battery.





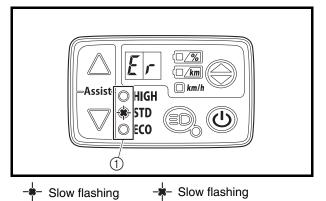
How Drive Unit malfunctions are displayed

The 3 assist mode lamps ①, the "%" lamp ②, the "km" lamp ③, and the "km/h" lamp ④ will flash alternately, and "Er" will be displayed on the function display ⑤ of the display unit.

When the function select switch "♠" ⑥ is pressed, error code "16" or higher will be displayed.

TIP_

- Error codes are stored.
- See "List of error codes and corresponding power assist operations" for more details.



How speed sensor malfunctions are displayed

The "HIGH", "STD", or "ECO" assist mode lamps ① are displayed with a slow flash (0.5 seconds).

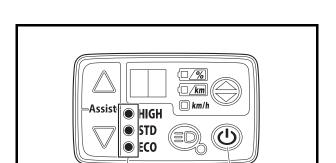
TIP_

- Error codes are not stored.
- See "List of error codes and corresponding power assist operations" for more details.
- In assist off mode, displays of malfunctions cannot be made using the assist mode lamp.

Recovery method when there is a speed sensor malfunction

The display will return to normal when the speed sensor returns to normal condition.





(2)

(1)

Operating Procedures to Diagnosis Mode

This is the mode in which each type of diagnosis and the content of error codes which are stored when there is an error are displayed. You can switch between speed sensor diagnosis mode, Drive Unit diagnosis mode, and error log check mode by using the display unit according to the following procedures.

1. Make sure that the power is turned off to the display unit.

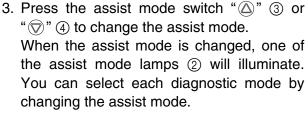
Press the power switch " $\mbox{\it 0}$ " $\mbox{\it 0}$ to turn on the power.

When the power is turned on, all lamps and segments of the display unit will illuminate. After approximately 2 seconds, the lamps and segments will turn off, and then the display will return to normal.

Press the power switch "O" again, and continue pressing the switch until only the 3 assist mode lamps are illuminated. (Approximately 10 seconds)
 Confirm that only the 3 assist mode lamps are illuminated, and then release the power switch "O" (1).



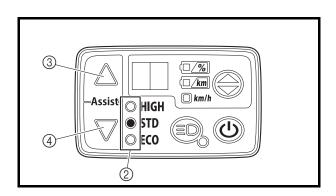
Steps 1 and 2 must be performed within 30 seconds.

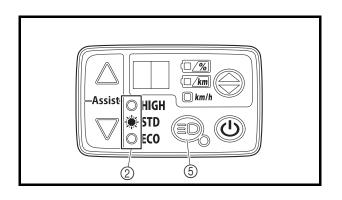


Press the light switch "≡D" ⑤.
 The "HIGH", "STD", or "ECO" assist mode lamp ② will flash rapidly (0.2 second) to indicate each of the diagnostic modes.

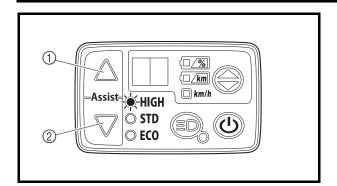


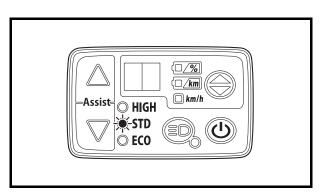
If you pressed the wrong switch, turn off the power and perform steps 1–4 again.

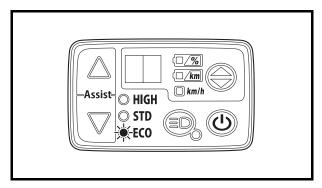












+ Fast flashing

Speed Sensor Diagnosis Mode

Press the assist mode switch "\(\triangle \)" (1) until the "HIGH" assist mode lamp is illuminated.

Press the light switch "≡D".

The "HIGH" assist mode lamp flashes rapidly (0.2 second).

For more information about the speed sensor diagnosis mode, see "Speed sensor diagnosis mode display method".

Drive Unit Diagnosis Mode

Press the assist mode switch " \triangle " ① \rightarrow " \bigcirc " ② or " \bigcirc " ② \rightarrow " \triangle " ① until the "STD" assist mode lamp is illuminated.

Press the light switch "≡D".

The "STD" assist mode lamp flashes rapidly (0.2 second).

For more information about the drive unit diagnosis mode, see "Drive unit diagnosis mode display method".

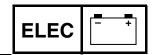
Error Log Check Mode

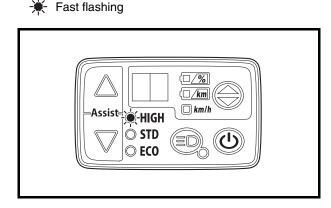
Press the assist mode switch "
" 2 until the "ECO" assist mode lamp is illuminated.

Press the light switch "≡D".

The "ECO" assist mode lamp flashes rapidly (0.2 second).

For more information about the error log check mode, see "Error log check mode".





Number of Wheel Rotations	Rotation number display of the display unit	
1 rotation		
\$	\$	
12 rotations	12	
13 rotations		

Speed Sensor Diagnosis Mode Display Method

To determine if the controller is correctly recognizing the speed sensor signal, rotate the wheel to which the speed sensor is connected and make sure that the number of rotations of the wheel indicated matches the actual number of rotations.

- 1. Go into speed sensor diagnosis mode.
 - See "Operating Procedures to Diagnosis Mode."
 - Confirm that the "HIGH" lamp of the assist mode lamps is flashing fast.
- 2. When you raise and rotate the wheel (with the speed sensor), the rotation number display ① on the display unit will change.

Before rotating the wheel (with the speed sensor), "0" will be displayed on the rotation number display ① of the display unit.

When you rotate the wheel (with the speed sensor) 1 time, "1" will be displayed on the rotation number display ① of the display unit.

When you rotate the wheel (with the speed sensor) 12 times, "12" will be displayed on the rotation number display ① of the display unit.

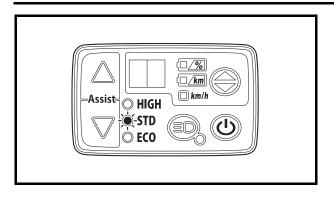
When you rotate the wheel (with the speed sensor) 13 times, the display of the rotation number display ① of the display unit will return to "1".

Thereafter, each time the wheel (with the speed sensor) is rotated, the number of rotation number display ① on the display unit will be from "1" to "12".

TIP_

- You should at least rotate the wheel (with speed sensor) 3 times and make sure that "3" is displayed.
- If the speed sensor malfunctions, the number of rotations displayed on the display unit will increase before the wheel (with speed sensor) is rotated even once, or the number will not increase even when the wheel (with speed sensor) is rotated once (or there is a delay in the increase in the value).





+ Fast flashing

<u>Drive Unit Diagnosis Mode Display Method</u> You can check the status of or malfunctions in

1. Go into Drive Unit diagnosis mode.

the Drive Unit.

See "Operating Procedures to Diagnosis Mode."

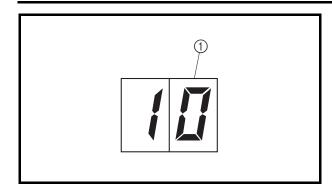
Confirm that the "STD" of the assist mode lamps is flashing fast.

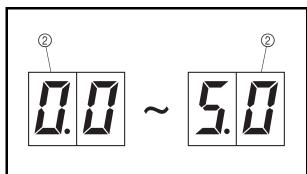
After the diagnosis mode indicator of the display unit has displayed "1" for up to 10 seconds, you can check the torque sensor reference voltage, motor current, error displays ("E2", "E4"), and the display unit function check.

List of Drive Unit Diagnosis Mode Display Methods

Inspection items	Diagnosis mode display	Press operating button	Diagnosis data display	Press operating button
1) Torque sensor reference voltage			Values are displayed from 0.0 to 5.0 (V)	To 2) Motor current
2) Motor current	14		Motor output current in "HIGH" mode is displayed as 00 to "FL (= FULL)" (= % output).	To 3) Error display
3) Error display	15		There is no display when there are no errors. When there is an error, either "E2" (motor) or "E4" (controller) are displayed.	To 4) Display unit function check
4) Display unit function check	18		All segments and lamps are illuminated. (Segments and lamps that are not illuminated indicate a malfunction.)	Power goes off







* Determining whether or not the torque sensor is good

0.2 to 1.1 V = normal

If the torque sensor is outside of this range

→ Implement the torque sensor reference voltage adjustment function.

If the torque sensor remains outside of its normal range after torque sensor reference voltage adjustment

→ Torque sensor malfunction (replace)

1) Torque sensor reference voltage

- 1. Torque sensor reference voltage display
- a. "10" is displayed in the diagnosis mode display ① of the display unit.
- b. Press the function select switch "

 " of the display unit.
- c. Displayed in units of 0.1 V from 0.0 to 5.0 V in the diagnosis data display ② of the display unit.
- d. The torque sensor is normal if the display voltage is 0.2 to 1.1 V.
 Perform a torque sensor reference voltage adjustment if values outside of this range are displayed.
- e. Press the light switch "≡D" of the display unit.
- f. Proceed to 2) Motor current.
- 2. Torque sensor reference voltage adjustment function

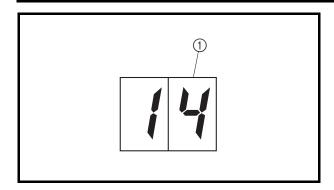
Turn the power on to the display unit and let it stand.

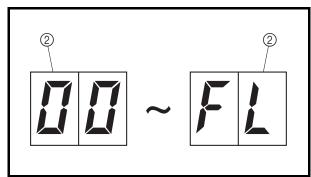
Guideline: Until the power to the display unit is turned off automatically (about 5 min.).

TIP_

Do not place feet on the pedals while performing a torque sensor reference voltage adjustment.





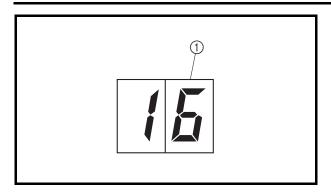


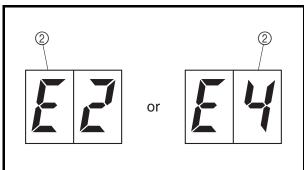
2) Motor current

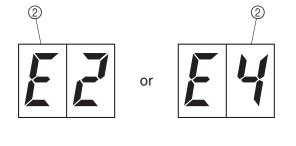
- a. "14" is displayed in the diagnosis mode display ① of the display unit.
- b. Press the function select switch "

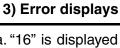
 " button of the display unit.
- c. The diagnosis data display ② of the display unit displays the motor output current (%) from "00" to "FL (= FULL)".
- d. Confirm that the diagnosis data display ② of the display unit displays "FL" when applying the rear brake and strongly pressing on the pedals.
 - "FL" is displayed: good
 - "FL" is not displayed: If the bicycle was ridden immediately before checking the motor current, it is possible that the battery or the controller temperature control is working; therefore, wait until the bicycle cools down. If the bicycle was not ridden immediately before checking the motor current, recheck using a battery that is operating properly.
 - "FL" is not displayed: The battery response is weak in winter (low temperatures), so use a battery that has been stored in a heated room.
 - "FL" is not displayed: Replace the controller assembly.
- e. Press the light switch "=D" of the display unit.
- f. Proceed to 3) Error displays.











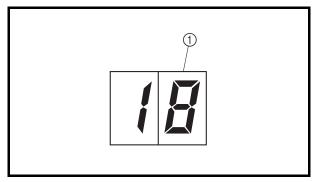
- a. "16" is displayed in the diagnosis mode display (1) of the display unit.
- b. Press the function select switch "

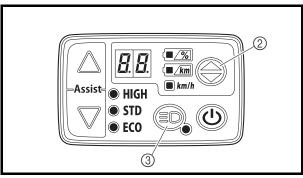
 " of the display unit.
- c. When there is a malfunction, "E2" (motor) or "E4" (controller) will be displayed on the diagnosis data display ② of the display unit.

Check the error code if "E2" or "E4" are displayed.

- d. Press the light switch "=D" of the display unit.
- e. Proceed to 4) Display unit function check.

- When there is no malfunction the next "18" is displayed without the diagnosis mode "16" being displayed.
- Perform a final check to make sure there is no error display in this mode when performing repairs or replacing parts.

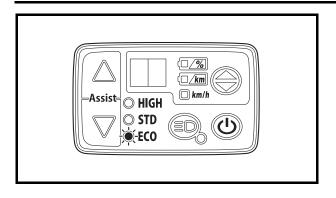




On On

4) Display unit function check

- a. "18" is displayed in the diagnosis mode display 1 of the display unit.
- b. Press the function select switch " () of the display unit.
- c. All segments and all lamps of the display unit will illuminate.
- d. Replace the display unit if there are segments or lamps which are not illuminated.
- e. Press the light switch "≡D" ③ of the display
- f. The power to the display unit is turned off.



Fast flashing

Error Log Check Mode Display Method

The three most recent types of error codes which are stored when there is an error are stored and these are displayed in order from the most recent every 10 seconds.

1. Go into error log check mode.

See "Operating Procedures to Diagnosis Mode."

Confirm that the "ECO" lamp of the assist mode lamps is flashing fast.

The display unit displays the three most recent error codes in the order stored as "E1" to "E3". To display the error codes, press the function select switch "

" of the display unit.

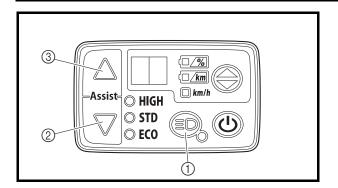
"0" will be displayed when there are no errors.

When other error codes are stored, the display will switch to the next error in 10 seconds.

List of Error Log Check Mode Display Methods

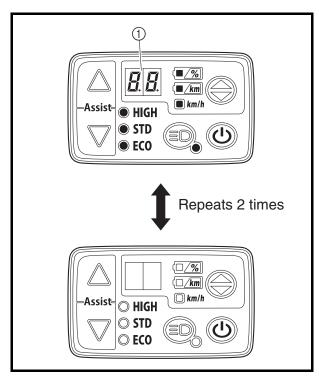
Number of error codes	How error codes are displayed on the display unit
When there are no error codes	
When there is 1 error code	E / Error code displays
When there are 2 error codes	Error code displays ([E1] along with the error code are displayed for 10 seconds) Error code displays ([E2] along with the error code are displayed for 10 seconds)
When there are 3 error codes	Error code displays ([E1] along with the error code are displayed for 10 seconds) [E2] along with the error code are displayed for 10 seconds) [E3] along with the error code are displayed for 10 seconds)





How to delete the malfunction history

While pressing the light switch "≡D" ① during the error code display, press the assist mode switch power assist decrease ② and power assist increase ③ to switch.



2. The diagnostic display pattern will stop, all lamps will turn on and off twice ("8.8." will be shown in the error code display ① of the display unit), and the history will be deleted. The power to the display unit will be turned off at this time.

TIP_

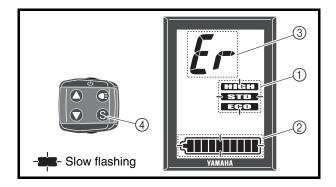
Be sure to clear the diagnosis history after replacing the motor or other parts.



Display unit's display when there is an error Detects system malfunctions, changes assist operation, and displays the errors as well as performing error code recording.

Error displays are indicated by the display of "Er" and an error code indicating the type of error. You can switch between "Er" and the error code display by pressing the function select switch "©".

When a malfunction which may reflect a serious abnormal operation is displayed, the malfunction is recorded to prevent recurrence of the condition, and thereafter the power assist will be immediately blocked after the power is turned on and the error will be displayed on the speedometer section in display unit.



How communication errors are displayed

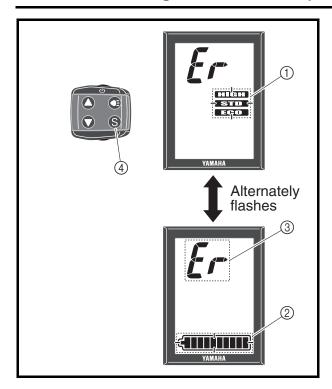
All segments of the assist mode indicator ① and battery capacity indicator ② will flash at the same time, and "Er" will be displayed on the speedometer section ③ of display unit.

When the function select switch "⑤" ④ is

When the function select switch "§" ④ is pressed, error code "12", "13" or "15" will be displayed.

TIP_

- The error code is not stored.
- See "List of error codes and corresponding power assist operations" for more details.
- If there is a communication error, the power cannot be turned off using the "POWER" switch of the display unit. To turn the power off, remove the battery.

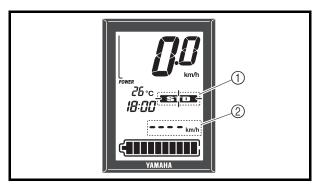


How Drive Unit malfunctions are displayed

All segments of the assist mode indicator ① and all segments of the battery capacity indicator ② will flash alternately, and "Er" will be displayed on the speedometer section ③ of the display unit. When the function select switch "⑤" ④ is pressed, error code "16" or higher will be displayed.

TIP_

- Error codes are stored.
- See "List of error codes and corresponding power assist operations" for more details.



Slow flashing

How speed sensor malfunctions are displayed

The "HIGH", "STD", or "ECO" assist mode indicator ① are displayed with a slow flash (0.5 seconds).

The function display part ② are displayed with "----" when you select as follwing functions.

- Average bicycle speed
- Maximum bicycle speed
- Trip meter
- Odometer

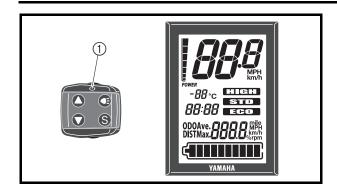
TIP_

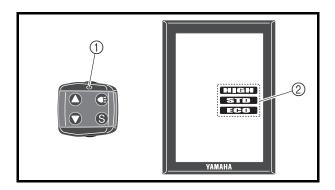
- Error codes are not stored.
- In assist off mode, displays of malfunctions cannot be made using the assist mode display.
- Average bicycle speed, maximum bicycle speed, tripmeter, and odometer are not updated when speed sensor malfunction is occurred.
- See "List of error codes and corresponding power assist operations" for more details.

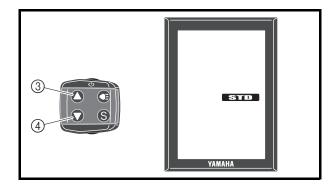
Recovery method when there is a speed sensor malfunction

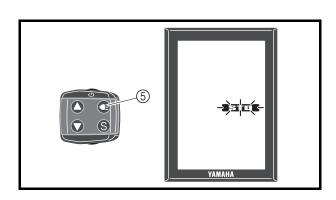
The display will return to normal when the speed sensor returns to normal condition.











Operating Procedures to Diagnosis Mode

This is the mode in which each type of diagnosis and the content of error codes which are stored when there is an error are displayed. You can switch between speed sensor diagnosis mode, Drive Unit diagnosis mode, and error log check mode by using the display unit according to the following procedures.

1. Make sure that the power is turned off to the display unit.

Press the power switch " $\mbox{\it 0}$ " $\mbox{\it 0}$ to turn on the power.

When the power is turned on, all segments of the display unit will come on.

After approximately 2 seconds, the segments will turn off, and then the display will return to normal.

2. Press the power switch " \circlearrowleft " ① again, and continue pressing the switch until only the 3 assist mode indicators ② come on. (Approximately 10 seconds)

Confirm that only the 3 assist mode indicators ② have come on, and then release the power switch " \circlearrowleft " ①.

TIP

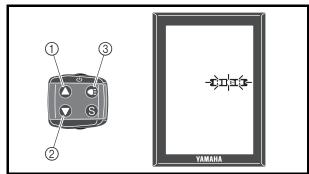
Steps 1 and 2 must be performed within 30 seconds.

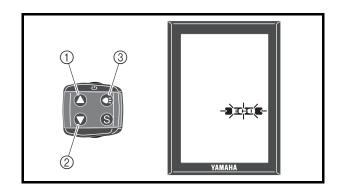
- 3. Press the assist mode switch "\(\tilde{\rm} \)" \(\tilde{\rm} \) or "\(\tilde{\rm} \)" \(\tilde{\rm} \) to change the assist mode. When the assist mode is changed, one of the assist mode indicators \(\tilde{\rm} \) will come on. You can select each diagnostic mode by changing the assist mode.
- Press the light switch "≡D" ⑤.
 The "HIGH", "STD", or "ECO" assist mode indicator ② will flash rapidly (0.2 second) to indicate each of the diagnostic modes.

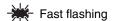
TIP

If you pressed the wrong switch, turn off the power and perform steps 1–4 again.









Speed Sensor Diagnosis Mode

Press the assist mode switch "\(\tilde{\rm} \)" (1) until the "HIGH" assist mode indicator comes on.

Press the light switch "≡D" ③.

The "HIGH" assist mode indicator flashes rapidly (0.2 second).

For more information about the speed sensor diagnosis mode, see "Speed sensor diagnosis mode display method".

Drive Unit Diagnosis Mode

Press the assist mode switch " \triangle " ① \rightarrow " \bigcirc " ② or " \bigcirc " ② \rightarrow " \triangle " ① until the "STD" assist mode indicator comes on.

Press the light switch "≡D" ③.

The "STD" assist mode indicator flashes rapidly (0.2 second).

For more information about the drive unit diagnosis mode, see "Drive unit diagnosis mode display method".

Error Log Check Mode

Press the assist mode switch "\overline{\pi}" 2 until the "ECO" assist mode indicator comes on.

Press the light switch "≡D" ③.

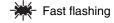
The "ECO" assist mode indicator flashes rapidly (0.2 second).

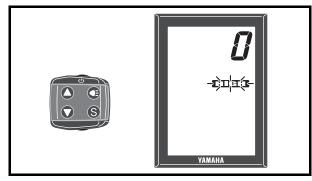
For more information about the error log check mode, see "Error log check mode".



Speed Sensor Diagnosis Mode Display Method

To determine if the controller is correctly recognizing the speed sensor signal, rotate the wheel to which the speed sensor is connected and make sure that the number of rotations of the wheel indicated matches the actual number of rotations.





 Go into speed sensor diagnosis mode.
 See "Operating Procedures to Diagnosis Mode."

Confirm that the assist mode display is flashing "HIGH" rapidly (0.2 seconds).

Number of Wheel Rotations	Rotation number display of the display unit
1 rotation	①— /
5	5
12 rotations	12
13 rotations	1

 When you raise and rotate the wheel (with the speed sensor), the rotation number display ① on the display unit will change.
 Before rotating the wheel (with the speed sensor), "0" will be displayed on the rotation number display ① of the display unit.

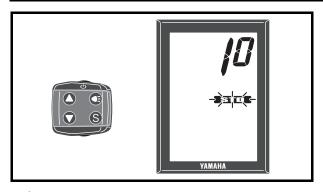
When you rotate the wheel (with the speed sensor) 1 time, "1" will be displayed on the rotation number display ① of the display unit. When you rotate the wheel (with the speed sensor) 12 times, "12" will be displayed on the rotation number display ① of the display unit.

When you rotate the wheel (with the speed sensor) 13 times, the display of the rotation number display ① of the display unit will return to "1".

Thereafter, each time the wheel (with the speed sensor) is rotated, the number of rotations display ① on the display unit will be from "1" to "12".

TIP

- You should at least rotate the wheel (with the speed sensor) 3 times and make sure that "3" is displayed.
- If the speed sensor malfunctions, the number of rotations displayed on the display unit will increase before the wheel (with the speed sensor) is rotated even once, or the number will not increase even when the wheel (with the speed sensor) is rotated once (or there is a delay in the increase in the value).



Fast flashing

<u>Drive Unit Diagnosis Mode Display Method</u> You can check the status of or malfunctions in the Drive Unit.

 Go into Drive Unit in diagnosis mode.
 See "Operating Procedures to Diagnosis Mode."

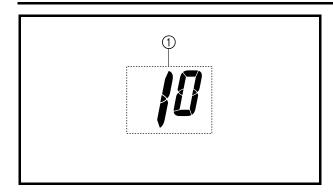
Confirm that the assist mode display is flashing "STD" fast (0.2 seconds).

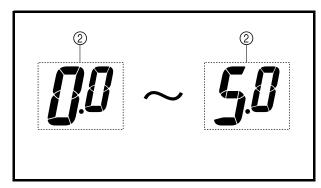
After the diagnosis mode indicator of the display unit has displayed "1" for up to 10 seconds, you can check the torque sensor reference voltage, motor current, error displays ("E2", "E4"), and the display unit function check.

List of Drive Unit Diagnosis Mode Display Methods

LIST OF DITIVE OF	=g		<u> </u>	
Inspection items	Diagno- sis mode display	Press operating button	Diagnosis data display	Press operating button
1) Torque sensor reference voltage	10	S	Values are displayed from 0.0 to 5.0 (V) $ {\it 0.0} \sim {\it 5.0} $	To 2) Motor current
2) Motor current	14		Motor output current in "HIGH" mode is displayed as 0 to 100 (= % output). $ 0 \sim 000 $	To 3) Error display
3) Error display	<i>{</i> 5		There is no display when there are no errors. When there is an error, either "E2" (motor) or "E4" (controller) are displayed.	To 4) Display unit function check
4) Display unit function check	18	S	All segments are illuminated (segments that are not illuminated indicate a malfunction.)	Power goes off







* Determining whether or not the torque sensor is good

0.2 to 1.1 V = normal

If the torque sensor is outside of this range
→Implement the torque sensor reference
voltage adjustment function.

If the torque sensor remains outside of its normal range after torque sensor reference voltage adjustment

→Torque sensor malfunction (replace)

1) Torque sensor reference voltage

- 1. Torque sensor reference voltage display
- a. "10" is displayed in the diagnosis mode display ① of the display unit.
- b. Press the function select switch "S" of the display unit.
- c. Displayed in units of 0.1 V from 0.0 to 5.0 V in the diagnosis data display ② of the display unit.
- d. The torque sensor is normal if the display voltage is 0.2 to 1.1 V.
 Perform a torque sensor reference voltage adjustment if values outside of this range are displayed.
- e. Press the light switch " " of the display unit.
- f. Proceed to 2) Motor current.
- 2. Torque sensor reference voltage adjustment function

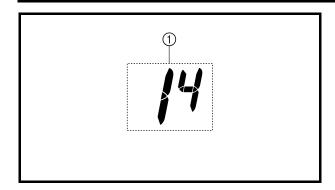
Turn the power on to the display unit and let it stand.

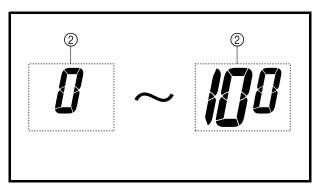
Guideline: Until the power to the display unit is turned off automatically (about 5 min.).

TIP_

Do not place feet on the pedals while performing a torque sensor reference voltage adjustment.





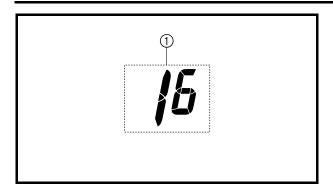


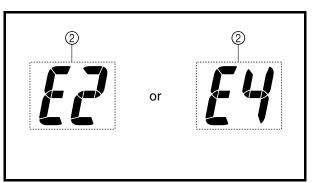
2) Motor current

- a. "14" is displayed in the diagnosis mode display ① of the display unit.
- b. Press the function select switch "\$" of the display unit.
- c. The diagnosis data display ② of the display unit displays the motor output current (%) from "0" to "100".
- d. Confirm that the diagnosis data display ② of the display unit displays "100" when applying the rear brake and strongly pressing on the pedals.
 - "100" is displayed: good
 - "100" is not displayed: If the bicycle was ridden immediately before checking the motor current, it is possible that the battery or the controller temperature control is working; therefore, wait until the bicycle cools down. If the bicycle was not ridden immediately before checking the motor current, recheck using a battery that is operating properly.
 - "100" is not displayed: The battery response is weak in winter (low temperatures), so use a battery that has been stored in a heated room.
 - "100" is not displayed: Replace the controller assembly.
- e. Press the light switch "

 " of the display unit.
- f. Proceed to 3) Error displays.







3) Error displays

- a. "16" is displayed in the diagnosis mode display ① of the display unit.
- b. Press the function select switch "\$" of the display unit.
- c. When there is a malfunction, "E2" (motor) or "E4" (controller) will be displayed on the diagnosis data display ② of the display unit.

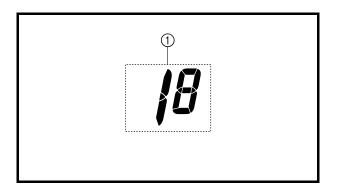
TIP

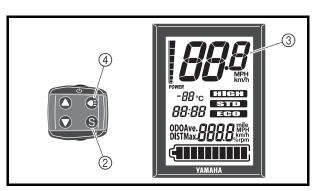
Check the error code if "E2" or "E4" are displayed.

- d. Press the light switch " of the display unit
- e. Proceed to 4) Display unit function check.

TIP

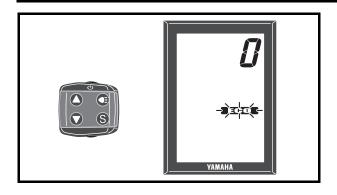
- When there is no malfunction the next "18" is displayed without the diagnosis mode "16" being displayed.
- Perform a final check to make sure there is no error display in this mode when performing repairs or replacing parts.





4) Display unit function check

- a. "18" is displayed in the diagnosis mode display ① of the display unit.
- b. Press the function select switch "S" ② of the display unit.
- c. All segments of the display unit ③ will illuminate.
- d. Replace the display unit if there are segments which are not illuminated.
- e. Press the light switch " () of the display unit.
- f. The power to the display unit is turned off.





Error Log Check Mode Display Method

The three most recent types of error codes which are stored when there is an error are stored and these are displayed in order from the most recent every 10 seconds.

1. Go into error log check mode.

See "Operating Procedures to Diagnosis Mode."

Confirm that the assist mode display is flashing "ECO" fast (0.2 seconds).

The display unit displays the three most recent error codes in the order stored as "E1" to "E3". To display the error codes, press the function select switch "⑤" of the display unit.

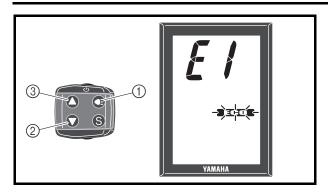
"0" will be displayed when there are no errors.

When other error codes are stored, the display will switch to the next error in 10 seconds.

List of Error Log Check Mode Display Methods

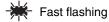
Number of error codes	How error codes are displayed on the display unit
When there are no error codes	
When there is 1 error code	Error code displays
When there are 2 error codes	Error code displays ([E1] along with the error code are displayed for 10 seconds) Error code displays ([E2] along with the error code are displayed for 10 seconds)
When there are 3 error codes	Error code displays ([E1] along with the error code are displayed for 10 seconds) Error code displays ([E2] along with the error code are displayed for 10 seconds) ([E3] along with the error code are displayed for 10 seconds)

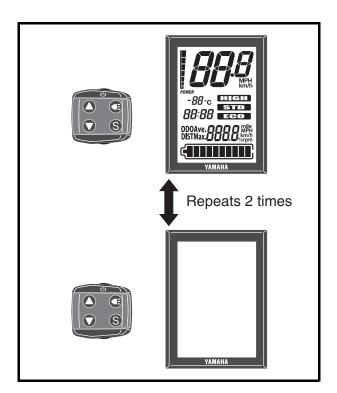




How to delete the malfunction history

1. While pressing the light switch " " 1 during the error code display, press the assist mode switch power assist decrease 2 and power assist increase 3 to switch.





2. The diagnostic display pattern will stop, all segment lights will turn on and off twice, and the history will be deleted.

The power to the display unit will be turned off at this time.

TIP_

Be sure to clear the diagnosis history after replacing the motor or other parts.

Diagnosis function List of error codes and corresponding power assist operations.

Display pattern	Fault device	Error	Fault details	Power assist behavior and error code record	*Restoration Max Level	Action
	Diene verneit	5	Stopped the communications to the display unit.	Power assist is normal.	c	Replace the display unit assem-
Or Assisted # High # From # Company Company	مروري والمراجع والم والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع والمراجع و	13	Communication data failure to display unit.	Error code does not record.	o	bly.
Er m	Display unit	15	Display comes off from the holder.	Power assist will stop after determine the error. Error code does not record.	0	Replace the display unit assembly.
Alternately flashes	Focoder	16	Disconnected or red wire is short-circuited.	Power assist will immediately stop	1	 Check the encoder connector. Replace the encoder lead
		17	Black wire is short-circuited.	Error code will record.	-	wire. 3. Replace the motor assembly.
		20	Disconnected.			
Alternately flashes	Torque Sen- sor	21	Short-circuited.	Power assist will stop after determine the error. Error code will record.	-	 Replace the encoder lead wire. Replace the torque sensor assembly.
A EL TONE -Assist O HIGH -Assist O HIGH -Assist O STO		22	Wiring failure between the torque sensor and the controller.			

Display pattern	Fault device	Error	Fault details	Power assist behavior and error code record	*Restoration Max Level	Action
		23	Abnormal voltage. (detected during running / with slight voltage rise)			 Perform the torque sensor reference voltage adjustment. Replace the torque sensor assembly.
Er		24	Abnormal voltage. (detected during running / with high constant voltage)			6011000
		25	Abnormal voltage. (detected during running / others)			
Alternately flashes		56	Abnormal voltage. (detected during running at low speeds)		Ø	
Or	Torque Sen- sor	27	Wiring failure between the coil and the circuit board. (wire chattering: nearly disconnected)	Power assist will stop after determine the error. Error code will record.		Replace the torque sensor
A EL CA A		28	Wiring failure between the coil and the circuit board. (wire chattering: nearly disconnected)			assembly.
Alternately flashes Alternately flashes Assist of Heritage flashes		59	Abnormal no-load voltage.			 Perform the torque sensor reference voltage adjustment. Replace the torque sensor assembly.
O Sto		30	Abnormal voltage. (detected during running/with high constant voltage.)		6	Replace the torque sensor
		31	Abnormal voltage. (detected during running/with slight voltage rise.)		J	assembly.



Display pattern	Fault device	Error	Fault details	Power assist behavior and error code record	*Restoration Max Level	Action
	Crank sen-	32	Torque sensor or crank sensor failure.	Power assist will stop after determine the error.	۰	 Replace the torque sensor. Replace the crank sensor. Replace the encorder lead wire. Replace the drive axle assembly.
Alternately flashes	5	33	Short-circuited or crank sensor failure.	Error code will record.		 Replace the crank sensor. Replace the encorder lead wire. Replace the drive axle assembly.
or or		40	A lead wires are disconnected. After determine the error. Error code will record.	Power assist will immediately stop after determine the error. Error code will record.		 Replace the controller assembly. Replace the motor assembly.
TO THE STATE OF TH	, cto M	41	Yellow lead wire is discon- nected. (U phase)		.	
Alternately flashes		42	Blue lead wire is discon- nected. (V phase)	Power assist will stop after determine the error. Error code will record.	-	Replace the controller assembly.
O SEO CO		43	White lead wire is discon- nected. (W phase)			

Display pattern	Fault device	Error	Fault details	Power assist behavior and error code record	*Restoration Max Level	Action
		20	Abnormal voltage of the sensor for U phase current while the motor is not operating.			
3		51	Abnormal voltage of the sensor for V phase current while the motor is not operating.	Power assist will immediately stop after determine the error.	-	Replace the controller assembly.
		52	Abnormal voltage of the sensor for W phase current while the motor is not operating.			
Alternately flashes		53	Over current is applied to the U phase of the motor.			
(7)	Motor or	54	Over current is applied to the V phase of the motor.	Power assist will stop after determine the error. Error code will record.	2	1. Replace the controller assem-
Or C.	Controller	55	Over current is applied to the W phase of the motor.			Replace the motor assembly.
The stop of the st		99	Abnormal DC current	Power assist will immediately stop after determine the error.	-	
- Assists O HGH (See all Colored)		09	Not within the 12V output range	Power assist will immediately stop after determine the error.	-	Replace the controller assembly.
3		70	External memory data error	Power assist will immediately stop	+	Replace the controller assembly
		71	Failure in data reading	Error code will record.		

Display pattern	Fault device	Error	Fault details	Power assist behavior and error code record	*Restoration Max Level	Action
		80	Detected circuit board temperature is too low. (-20°C)			
Alternately flashes	Motor or Controller	81	Detected circuit board temper- ature is too high. (125°C) (including DC circuit)	Power assist will stop after determine the error. Error code will record.	2	Replace the controller assembly.
Or Assity & High Assity & StD Assity & StD Alternately flashes		82	Sensor on the board is nearly detached.			
Active Ontole	Others	68	Detected circuit board temper- ature is too high. (90°C)	circuit board temper-Power assist is normal. o high. (90°C) Error code will record.	0	 Check the environment of usage. Replace the controller assembly.

Display pattern	Fault device	Error	Fault details	Power assist behavior and error code record	*Restoration Max Level	Action
	-beed Sen-	1:	The vehicle speed has not gone out though the motor is rotating.	Power assist becomes weak.	c	Check the speed sensor lead connector. Check the gap between the part sensor sick in and the mannet sensor.
Assist mode lamps ① are displayed with "".	sor	1	Abnormal width of the pulse (detected during running)	Error code does not record.		spoke type. (See "Speed sensor sor" for the specified gap.) 3. Replace the speed sensor set.
All segments or LED turned off	**************************************	06	Detected battery voltage is too high.(45V)	Power assist will stop after determine the error. (Also display unit will turn off) Error code will record.	•	Replace the battery.
All segments or LED turned off. When you turn on the main switch, all segments or LED will turn on during 4 seconds, then automatically turn off.	Datiety	91	Can't receive data from bat- tery correctly.	Power assist will immediately stop after determine the error. (Also display unit will turn off) Error code will record.	-	Check the battery communication connector. Replace the plug DC. Replace the controller assembly. By. Replace the battery.

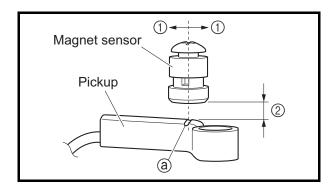
*Restoration Max Level:

Level If the 8 But will fit the 9 But the 1 But the 1 But the 9 Bu	If the system detects this error, the power assist mode will be down or turns to off. But when the system is restored to normal, the power assist mode will return to normal and the error indicator will be unshown immediately. If the system detects this error prescribed number of times, the power assist mode turns to off and the error indicator is displayed on the display unit. But they can return to normal, if the system will not detect any errors when the power is cycled.
2	They can not return to normal, even if the power is cycled.

Speed sensor set

Speed sensor inspection

- 1. Pickup
- Check that the pickup is installed at the specified location on the bike.
- Check that the pickup is not damaged.



- 2. Magnet sensor
- a. Check that the magnet sensor is not damaged.
- b. Check that no metallic foreign material has adhered to the magnet sensor.
- c. Check that the magnetic surface of the magnet sensor is facing the sensing point on the pickup.
- d. Install the magnet sensor to match the center of the magnet sensor and the cutout point ⓐ of the pickup.
- e. Check that the center location of the magnet sensor ① is within specification.



Center location of the magnet sensor ①
5 mm

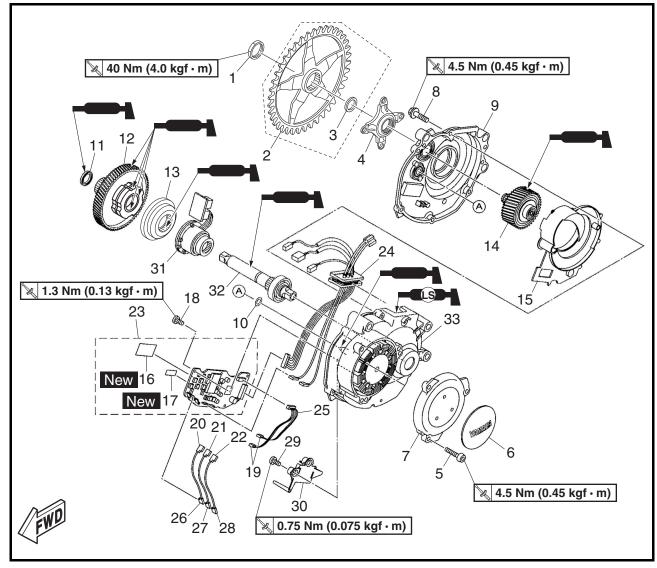
f. Check that the gap ② between the pickup and the magnet sensor is within specification.



Gap (between the pickup and magnet sensor) ②
10 mm or less



Drive Unit Drive axle, Motor (drive axle with square-type end)

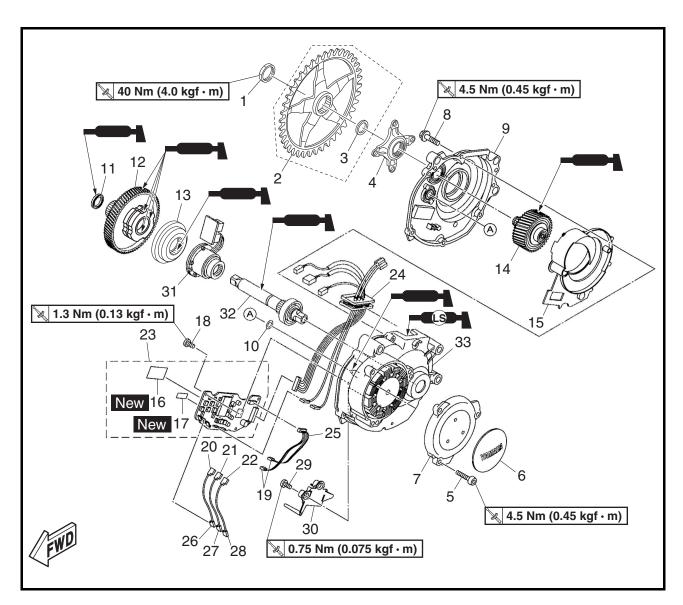


Order	Job/Part	Q'ty	Remarks
	Removal of the Drive axle, Motor		Follow the work procedures for removal.
	Drive Unit assembly		
1	Lock nut	1	Left-hand screw
2	Sprocket	1	
3	Spacer	1	
4	Spider	1	for spider type only
5	Button head bolt	3	
6	Cover assembly	1	
7	Stator cover	1	
8	Flanged bolt	6	
9	Housing complete	1	

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.

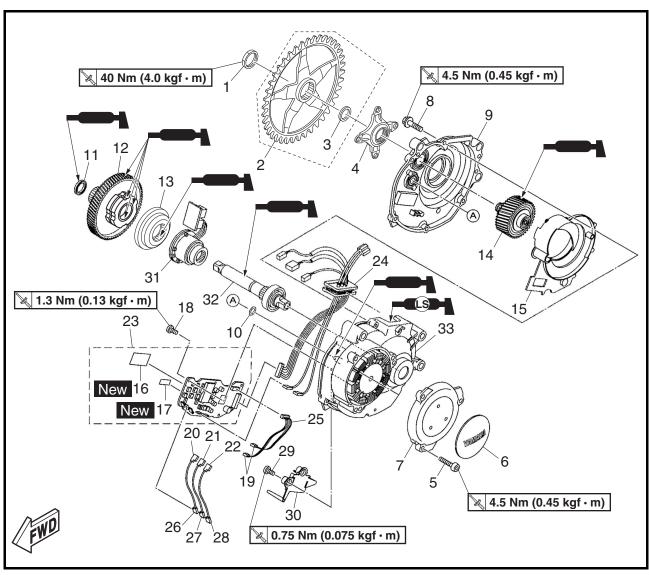
Drive axle, Motor (drive axle with square-type end)





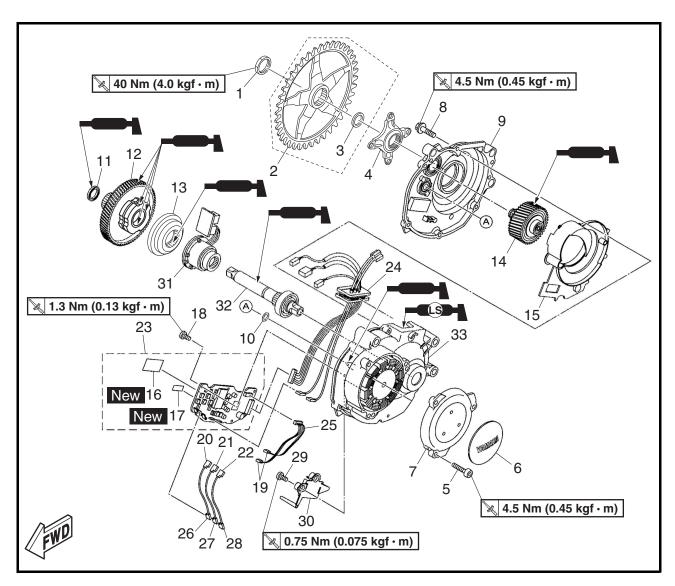
Order	Job/Part	Q'ty	Remarks
10	Plate washer	1	
11	Oil seal	1	
12	Clutch boss assembly	1	
13	One-way outer boss	1	
14	Driven gear assembly	1	
15	Gear cover	1	
16	Heat-dissipating sheet	1	
17	Heat-dissipating sheet	1	
18	Tapping screw	5	
19	Wire lead 1 couplers	2	Disconnect.
20	Wire lead 3 couplers	1	Disconnect.
21	Wire lead 4 couplers	1	Disconnect.

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.



Order	Job/Part	Q'ty	Remarks
22	Wire lead 5 couplers	1	Disconnect.
23	Controller assembly	1	NOTICE
			 Do not touch the circuit board with greasy or dirty fingers. Do not drop the circuit board or subject it to impact.
24	Wire lead 2	1	
25	Wire lead 1	1	
26	Wire lead 3	1	
27	Wire lead 4	1	
28	Wire lead 5	1	
29	Tapping screw	2	
30	Holder	1	

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.

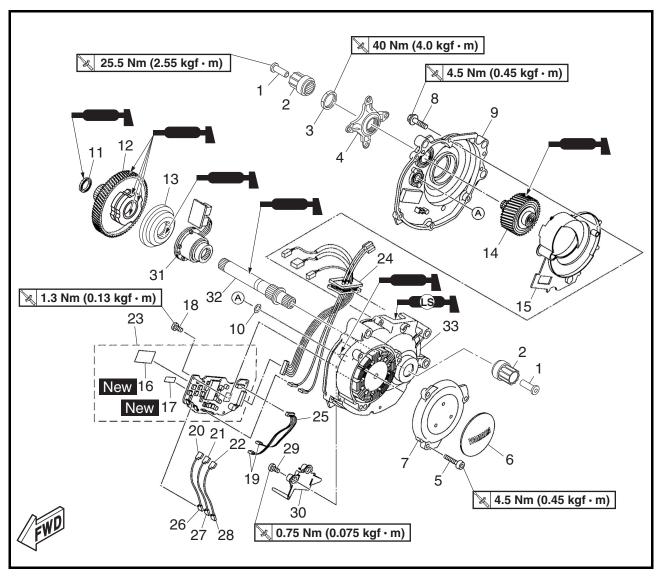


Order	Job/Part	Q'ty	Remarks
31	Torque sensor assembly	1	
32	Drive axle	1	Both end shapes of the drive axle is different by the specifications of Drive Unit.
33	Motor complete	1	
			Reverse the removal process for installation.

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.



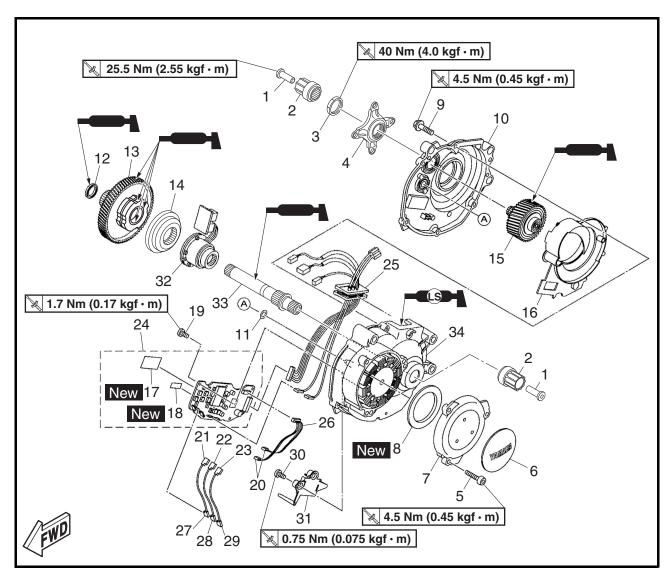
Drive axle, Motor (drive axle with spline-type end [ISIS])



Order	Job/Part	Q'ty	Remarks
	Removal of the Drive axle, Motor		Follow the work procedures for removal.
	Drive Unit assembly		
1	Screw	2	
2	Adapter	2	
3	Lock nut	1	Left-hand screw
4	Spider	1	
5	Button head bolt	3	
6	Cover assembly	1	
7	Stator cover	1	
8	Flanged bolt	6	
9	Housing complete	1	

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.

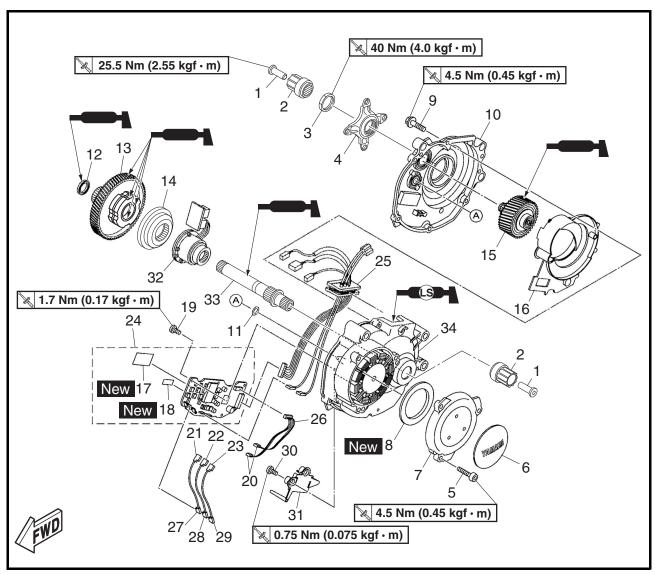




Order	Job/Part	Q'ty	Remarks
10	Plate washer	1	
11	Oil seal	1	
12	Clutch boss assembly	1	
13	One-way outer boss	1	
14	Driven gear assembly	1	
15	Gear cover	1	
16	Heat-dissipating sheet	1	
17	Heat-dissipating sheet	1	
18	Tapping screw	5	
19	Wire lead 1 couplers	2	Disconnect.
20	Wire lead 3 couplers	1	Disconnect.
21	Wire lead 4 couplers	1	Disconnect.

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.

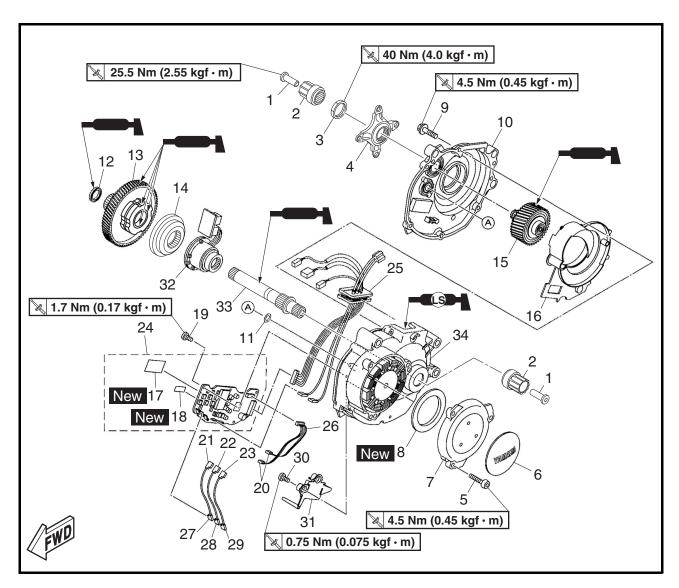




Order	Job/Part	Q'ty	Remarks
22	Wire lead 5 couplers	1	Disconnect.
23	Controller assembly	1	NOTICE
			 Do not touch the circuit board with greasy or dirty fingers. Do not drop the circuit board or subject it to impact.
24	Wire lead 2	1	
25	Wire lead 1	1	
26	Wire lead 3	1	
27	Wire lead 4	1	
28	Wire lead 5	1	
29	Tapping screw	2	
30	Holder	1	

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.





Order	Job/Part	Q'ty	Remarks
31	Torque sensor assembly	1	
32	Drive axle	1	Both end shapes of the drive axle is different by the specifications of Drive Unit.
33	Motor complete	1	
			Reverse the removal process for installation.

^{*} The actual lead wire may differ with the variety of Drive Unit from the pictures shown.

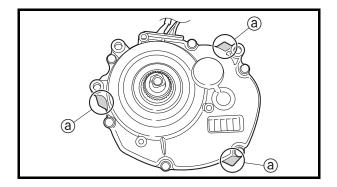


Removal of the parts from the drive axle (drive axle with square-type end)

- 1. Remove the following parts:
- Locknut (Left-hand screw)
- Drive sprocket or spider
- Spacer (for sprocket only)
- Flanged bolt

Removal of the parts from the drive axle (drive axle with spline-type end)

- 1. Remove the following parts:
- Screw
- Adapter
- Locknut (Left-hand screw)
- Spider
- Flanged bolt



Removal of the Controller Assembly

1. Separate the housing complete from the motor complete.

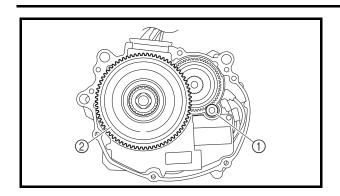
TIP

Separator ribs (a) are provided in 3 locations for separating the housing complete.

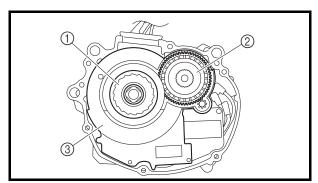
NOTICE

- Take care not to scratch the mating surfaces of the housing complete and the motor complete with screwdrivers or other tools.
- Take care not to damage the boards of the controller assembly and the torque sensor assembly with tools.

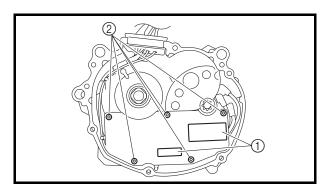




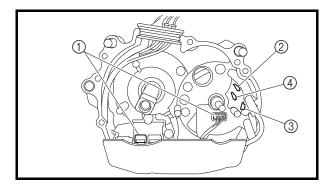
- 2. Remove the following parts:
- Plate washer ①
- Clutch boss assembly ②



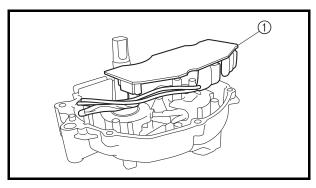
- 3. Remove the following parts:
- One-way outer boss ①
- Driven gear assembly ②
- Gear cover ③



- 4. Remove the following parts:
- Heat-dissipating sheet ①
- Tapping screw ②



- 5. Disconnect the following couplers:
- Wire lead 1 couplers ①
- Wire lead 3 coupler ②
- Wire lead 4 coupler ③
- Wire lead 5 coupler 4

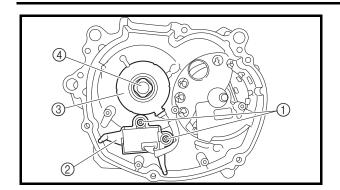


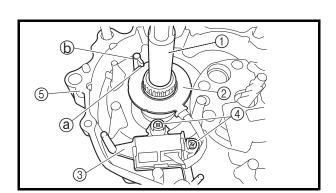
- 6. Remove the following part:
- Controller assembly ①

NOTICE

- Do not touch the board of the controller assembly with greasy or dirty fingers.
- Do not drop the board or subject it to impact.







Removal of the Torque sensor assembly and Drive axle.

- 1. Remove the following parts:
- Tapping screw ①
- Holder (2)
- Torque sensor assembly ③
- Drive axle (4)

NOTICE

Do not disassemble the torque sensor assembly because it cannot be readjusted.

Installation of the Drive axle and Controller assembly

- 1. Install the following parts:
- Drive axle (1)
- Torque sensor assembly ②
- Holder ③
- Tapping screw 4 3 0.75 Nm (0.075 kgf·m)

TID

When installing the drive axle, align the cut out parts ⓐ of the torque sensor assembly ② with the projections ⓑ on the motor complete ⑤.

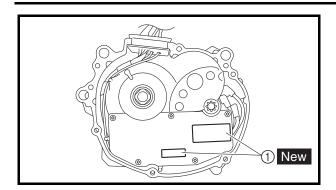
Installation of the Controller assembly

- 1. Install the following parts and connect the following couplers:
- Controller assembly
- Wire lead 5 coupler
- Wire lead 4 coupler
- Wire lead 3 coupler
- Wire lead 1 coupler

NOTICE

The tapping screw of the controller assembly must be installed because it also serves as a ground.





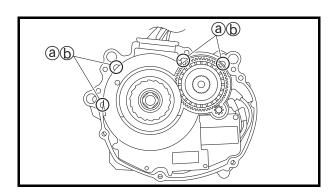
- 2. Install the following part:
 - Heat-dissipating sheet ①

NOTICE

Thermal protection may be compromised by an ill-fitting heat-dissipating sheet, so be sure to replace the heat-dissipating sheet with a new one when the assembly is disassembled.

TIP_

- Put the heat-dissipating sheet to designated location of controller.
- The heat-dissipating sheet should not be stretched more than 10% beyond its original dimensions.

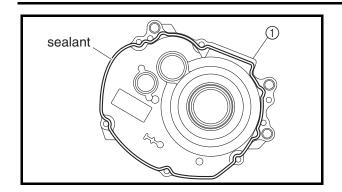


- 3. Install the following parts:
- Gear cover
- Driven gear assembly
- One-way outer boss
- · Clutch boss assembly
- Plate washer

TIP_

When installing the gear cover, align the projections (a) of the gear cover with the cut out parts (b) of the motor complete.





Installation of the Bearing Housing

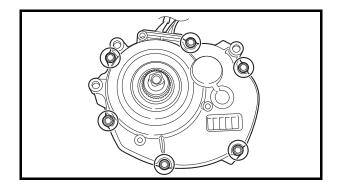
- 1. Apply Three Bond 1215® to the following parts:
- Housing complete ①
 Apply a continuous 2 to 3 mm thick coating as shown in the drawing (area indicated by dark line).



Three Bond 1215®

TIP_

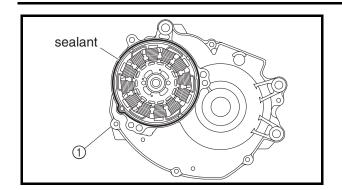
- Before applying the sealant, thoroughly clean all the mating surface of housing complete and motor complete.
- If there is any oil or grease on the housing complete or motor complete mating surfaces, wipe the surfaces clean and then apply sealant.
- Within 5 min. after applying the sealant, join the left and right halves together.



- 2. Install the following part:
- Housing complete

 √ 4.5 Nm (0.45 kgf·m)





Installation of the Stator Cover

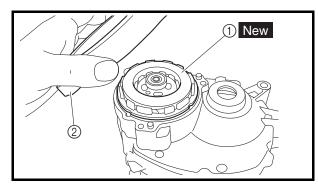
- 1. Apply Three Bond 1215® to the following parts:
- Motor complete ①
 Apply a continuous 2 to 3 mm thick coating as shown in the drawing (area indicated by dark line).

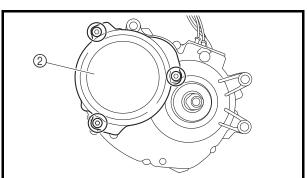


Three Bond 1215®

TIP_

- Before applying the sealant, thoroughly clean all the mating surface of stator cover and motor complete.
- Within 5 min. after applying the sealant, join the left and right halves together.





- 2. Install the following part:
- Damper rubber ①
- Stator cover ②

№ 4.5 Nm (0.45 kgf·m)

TIP

- When assembling the stator cover, hand tighten the three flanged bolts and then tighten them evenly.
- Install the Damper rubber ① inside the stator cover
- Be sure to replace the Damper rubber ①
 with a new one when the assembly is disassembled.

Tightening Torque/ Lubricants, areas to apply sealant and specified types





Service Data

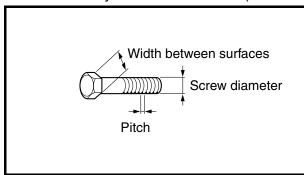
Tightening Torque

Unit: Nm kgf·m (in)

Tightening locations	Screw diameter	Q'ty	Tightening torque	Notes
Drive sprocket lock nut	M27	1	40 (4.0)	Left hand screw
Stator cover installation	M5	3	4.5 (0.45)	
Motor assembly and bearing housing	M5	6	4.5 (0.45)	
Circuit board installation	M3	5	1.3 (0.13)	Self-tapping screw
Holder installation	М3	2	0.75 (0.075)	Self-tapping screw
LCD type display holder	M3	2	0.3 (0.03)	
ISIS adapter installation	M8	2	25.5 (2.55)	Torx T30

Other, general tightening torques

The tightening torques of bolts and nuts other than those with tightening force for specified locations is determined by the screw diameter (width between two surfaces) and the pitch.



Screw diameter (width between two surfaces) × pitch	Tightening torque
M4 (7 mm) × P0.7	1.5 to 2.5 Nm (0.15 to 0.25 kgf⋅m)
M5 (8 mm) × P0.8	3 to 4.5 Nm (0.3 to 0.45 kgf⋅m)
M6 (10 mm) × P1.0	5 to 8 Nm (0.5 to 0.8 kgf·m)
M8 (12 mm) × P1.25	12 to 19 Nm (1.2 to 1.9 kgf·m)

Lubricants, areas to apply sealant and specified types

Where to apply	Types of oils, grease, and sealants
All oil seal lips	Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP AC-N®)
Pawl kicks	Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP AC-N®)
Drive axle O-rings	Lithium-soap-based grease
Interior of torque sensor bushing	Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP AC-N®)
Spline of torque sensor	Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP AC-N®)
Interiors of the drive axle assembly and the one-way inner/outer bosses	Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP AC-N®)
All driven gear surfaces	Lithium grease made from synthetic hydrocarbon oil and synthetic ester oil (MULTEMP AC-N®)
Motor assembly's surface which contact to the gromet of power lead wire.	Lithium-soap-based grease
Mating surfaces between motor assembly and bearing housing	Three Bond 1215®

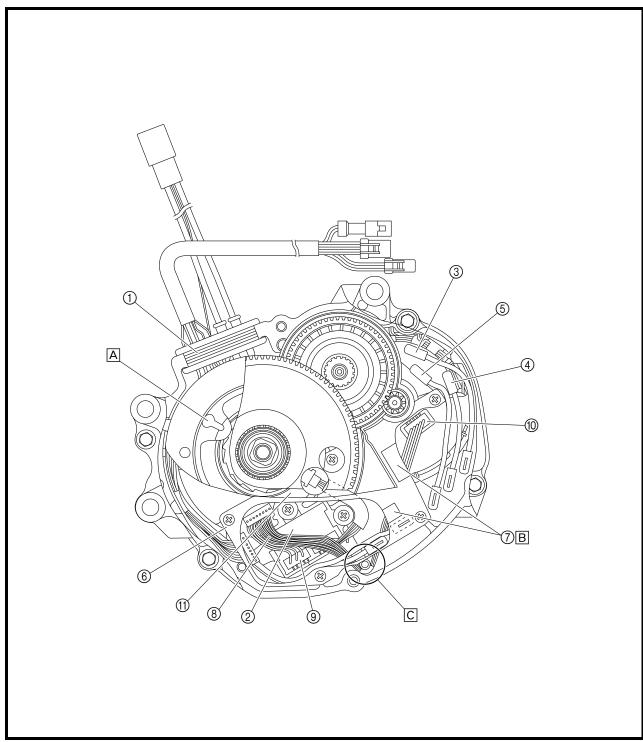
Cable, Wire, and Pipe routing diagram



Cable, Wire, and Pipe routing diagram

- ① Wire lead 2
- ② Torque sensor plate
- ③ Wire lead 3 (Yellow)
- 4 Wire lead 4 (Blue)
- (5) Wire lead 5 (White)
- 6 Controller assembly
- (7) Heat-dissipating sheet
- ® Wire lead 1
- Wire lead 1 couplers 1
- Wire lead 1 couplers 2

- (1) Crank sensor
- A Torque sensor positioner.
- B Apply the heat-dissipating sheet so that it does not protrude from the heat sink plate. The heat-dissipating sheet should not be stretched beyond 10% of its original dimensions.
- Route the encoder lead wires through the outer side of holder projections as shown in the drawing.



^{*}The actual lead wire may differ with the variety of Drive Unit from the pictures shown.



Symptom	Check point/method	Possible cause/check	Part replacement/action
	Is the air pressure in the tires normal?	Check for appropriate air pressure. Check for punctures.	Repair puncture, replace tube.
	Is the gear-shifting working smoothly?	Check the gear shifting system.	Replace the gear shifting system.
The pedal feels heavy.	Is it being driven up a long slope in the summer, or carrying a heavy load?	This is due to the tempera- ture rising in the battery pack or the Drive Unit assembly, and is not a malfunction.	The assist power is restored once the temperature of the battery pack or the Drive Unit assembly drops.
	Is the ambient temperature low (around 10°C or below)?	Check the ambient temperature.	During the winter, store the battery pack indoors before use.
The e-bike systems activates and cuts off during driving.	Is the battery pack securely locked?	Check the battery pack lock.	Check if the battery pack is securely locked. Inspect the battery pack terminals and wiring for loose connection.
	Has the battery pack been sufficiently charged?		Charge until full.
The cruising distance is short.	Is it being used in a low-tem- perature environment?	Check the ambient temperature.	This will be restored when the ambient temperature warms up.
SHOIL.	Is the battery pack degrading?	Check the battery pack's Total number of battery charging cycles, actual capacity.	Replace the battery pack.
The 3 assist mode lamps, the "%" lamp, the "Km" lamp, and the "km/h" lamp are flashing at the same time, and "Er" is displaying on the LED type display unit. All segments of the assist mode display and battery capacity indicator are flashing at the same time, and "Er" is displaying on the speedometer section of the LCD type display unit.	Check the error according to the display on the display unit when the error occurred. (See Chapter 2 "How communication errors are displayed".)	Communication error. Check the "List of error codes and corresponding power assist operations".	Replace parts according to "List of error codes and corresponding power assist operations".



Symptom	Check point/method	Possible cause/check	Part replacement/action
The 3 assist mode lamps, the "%" lamp, the "km" lamp, and the "km/h" lamp are flashing alternately, and "Er" is displaying on the LED type display unit. Alternately flashes All segments of the assist mode display and battery capacity indicator are flashing alternately, and "Er" is displaying on the speedometer section of the LCD type display unit.	Check the error log according to the display on the display unit when the error occurred. (See Chapter 2 "How Drive Unit malfunctions are displayed".)	Drive Unit assembly error. Check "List of error codes and corresponding power assist operations".	Replace parts according to "List of error codes and corresponding power assist operations".
One of the assist mode lamps in the display unit 1 is flashing.	Speed sensor set (See Chapter 2 "How speed sensor malfunctions are dis- played".)	A state persists where the speed sensor unit cannot detect the signal correctly.	Inspect the speed sensor set lead wires, pick up, and magnet sensor spoke type.



		5	
Symptom	Check point/method	Possible cause/check	Part replacement/action
Although the power to the display unit is turned on, all of the LED display of the LED type display unit turn on for 4 seconds, and then the power turns off automatically. Although the power to the display unit is turned on, all segments of the LCD type display unit turn on for 4 seconds, and then the power turns off automatically.	Battery pack signal lead wires (See Chapter 2 "When the battery pack signal lead wire becomes disconnected".)	Disconnection of signal lead wires in the battery pack.	Replace the lead wires for the DC plug or the power supply.
Charged the battery pack, but the residual battery capacity display lamp on the display unit does not show [FL].	Was the charging started immediately after driving, or when the battery pack temperature was high?		Recharge the battery in a location where the temperature is suitable for charging (0 to 45°C).
All four residual residual bat- tery capacity display lamp on the battery pack are slow flashing simultaneously while charging the battery pack.	This is not a malfunction.	On standby for charging.	The charging will start once the internal temperature of the battery pack is within the 0 to 45°C range.
When pressing the battery capacity indicator button on the battery pack, all four battery capacity indicator lamps flash slowly at the same time.	This is not a malfunction.	See chapter 2 "Temperature protection function".	The battery pack automatically recovers when the battery pack's internal temperature returns to the allowable temperature for charging.



Symptom	Check point/method	Possible cause/check	Part replacement/action
When pressing the battery capacity indicator button on the battery pack, lamps [1]/[3] and [2]/[4] or [1]/[2] and [3]/[4] turn on alternately.	Hold down the battery capacity indicator button on the battery pack for 10 seconds. (See Chapter 2 "Error diagnosis mode".)	(See Chapter 2 "Battery pack/battery charger diagno- sis items table".)	Replace the parts according to "Battery pack/battery charger diagnosis items table".
The battery capacity indicator lamps [1] and [4] on the battery pack flash simultaneously.	Hold down the battery capacity indicator button on the battery pack for 10 seconds. (See Chapter 2 "Battery pack protection function diagnosis mode".)	(See Chapter 2 "Battery pack/battery charger diagno- sis items table".)	Replace the battery pack.
After disconnecting the charging plug on the battery charger from the battery pack, the battery capacity indicator lamps continue to light.	Charging connector on the battery pack.	Charging connector and charging plug are wet.	Clean the charging connector and charging plug, and dry them.
Abnormal sound is produced from the Drive Unit assembly.	Assist driving	Abnormal sound is produced during assist driving.	Check for sprocket wear or stretched chain
		Abnormal sound is produced when the motor is operating.	Disassemble the Drive Unit. Inspect the driven gear. Replace the motor assembly.
	Turn the crank.	Turning the crank produces periodic abnormal sound.	Inspect the housing bearing. Inspect the bearing.
	Turn off the power for manual pedalling.	Stepping on the pedal produces abnormal sound and vibration (clicking).	Check the joints. If further tightening does not improve the problem, replace parts.

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