

SERVICE MANUAL

e-Bike SYSTEMS Drive Unit and Display

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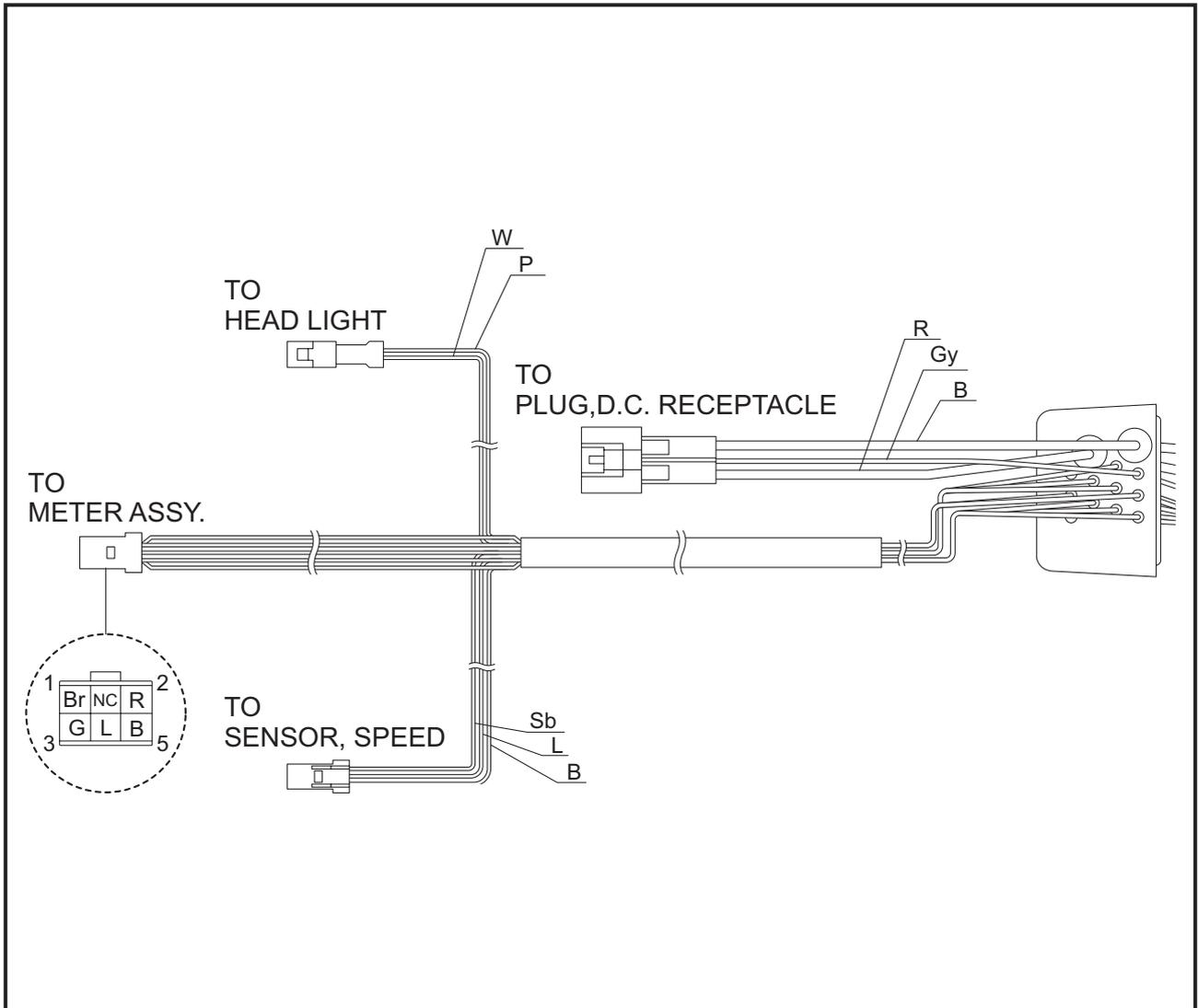
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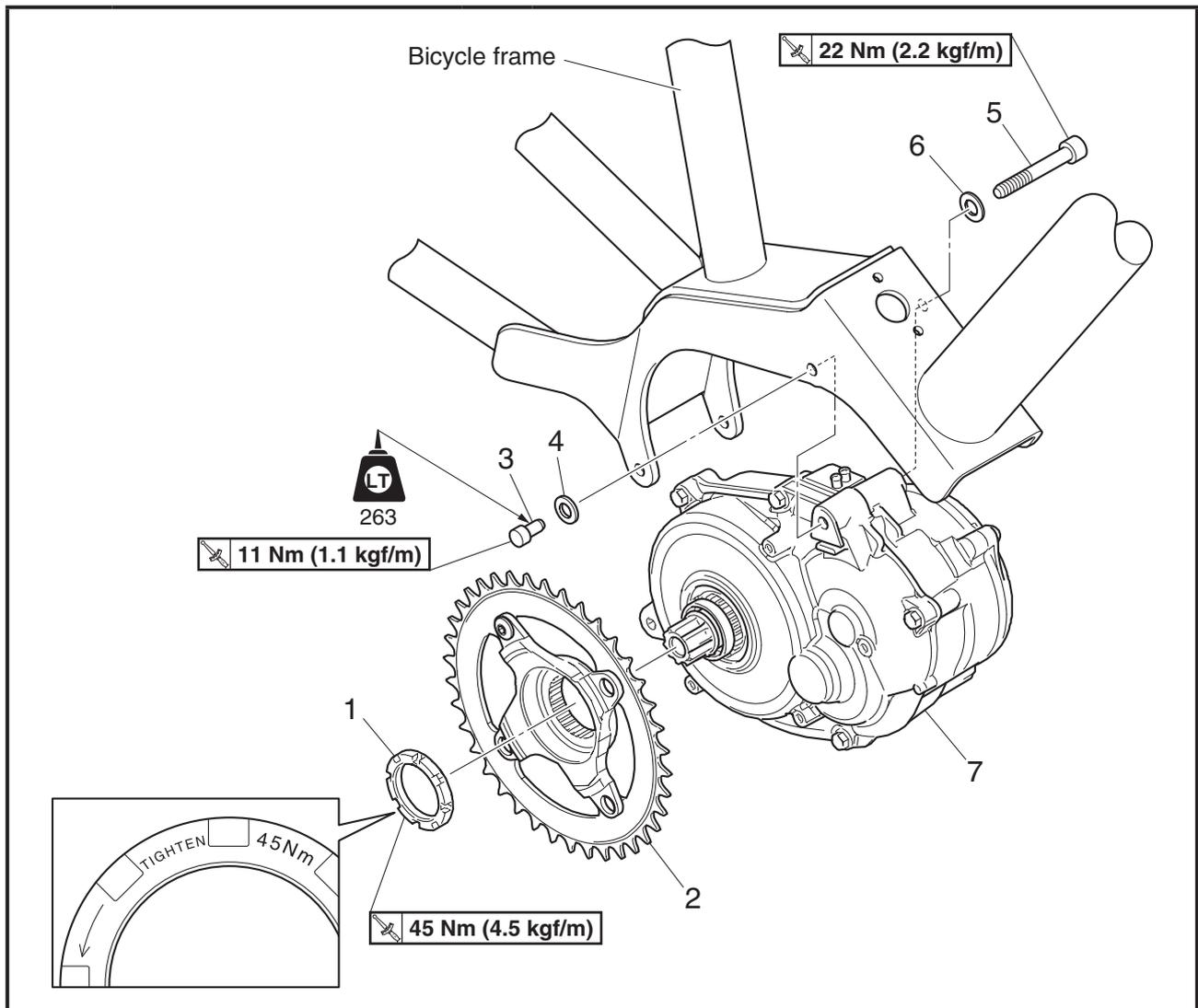
Installation

Electrical component wiring diagram



B = Black	P = Pink
Br = Brown	R = Red
G = Green	Sb = Sky blue
Gy = Gray	W = White
L = Blue	Y = Yellow
Or = Orange	

Drive Unit assy.



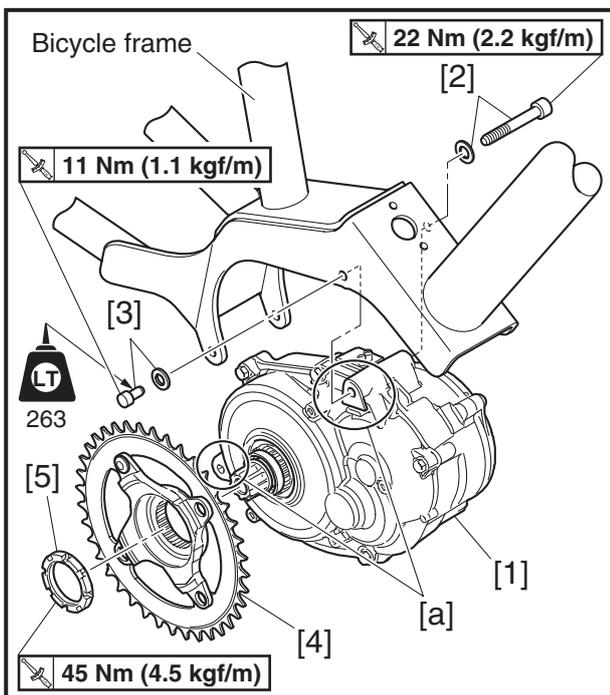
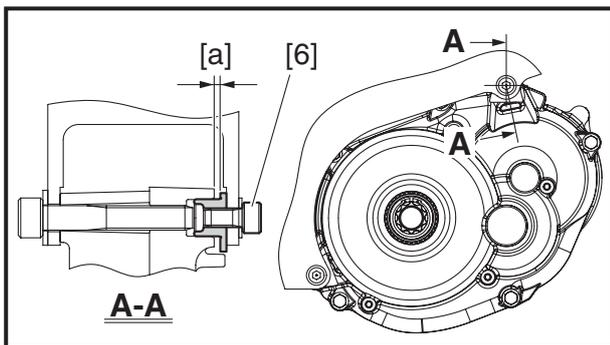
Order	Job/Part	Q'ty	Remarks
	Removal of the Drive Unit assy. from the bicycle frame.		Follow the work procedures for removal.
1	Lock nut	1	Left-hand screw
2	Spider & Chainring(s)	1	
3	Bolt (M6)	2	
4	Washer	2	
5	Bolt (M8)	2	
6	Washer	2	
7	Drive Unit assy.	1	
			Reverse the removal process for installation.

Introduction

NOTICE

Because a Drive Unit assy. is a precision machinery, do not disassemble or exert any strong force on it (for example, do NOT hit this product with a hammer).

Especially the crank axle is directly connected to the inside of the Drive Unit assy., any large damages inflicted on the crank axle may lead to failures.



Removing the Drive Unit assy.

Remove the parts in the order listed in “Removal of the Drive Unit assy. from the bicycle frame”.

TIP

To remove the Drive Unit assy. from the bicycle frame easily, loosen the bolt (M6) [6] 2–3 turns, and then lightly tap the bolt head with a plastic hammer to push in the protruding portion [a] of the Drive Unit assy. plug.

Installing the Drive Unit assy.

1. Install:

- Drive Unit assy. [1]
- Bolt (M8) and washer × 2 [2]
- Bolt (M6) and washer × 2 [3]

TIP

- Before installing the Drive Unit assy. to the bicycle frame, lightly tap the protruding portion [a] of the Drive Unit assy. plug with a plastic hammer to push it in.
- Apply LOCTITE 263 to the threaded portion of the bolt (M6) [3].
- Do not fully tighten the bolt and washer.

2. Tighten:

- Bolt (M8) and washer [2] × 2
22 Nm (2.2 kgf/m)
- Bolt (M6) and washer [3] × 2
11 Nm (1.1 kgf/m)

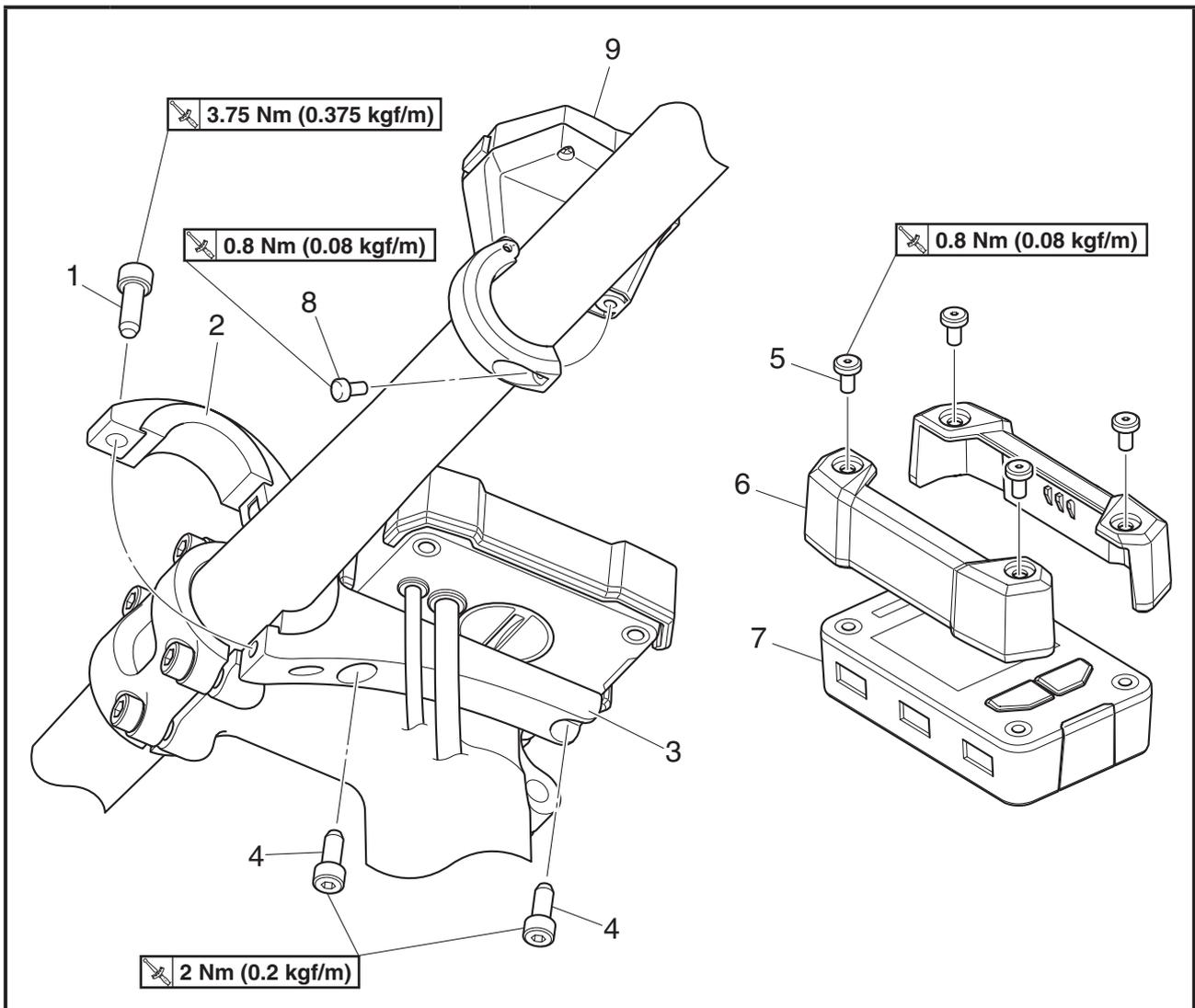
3. Install:

- Spider & Chainring(s) [4]
- Lock nut (Left-hand screw) [5]

4. Tighten:

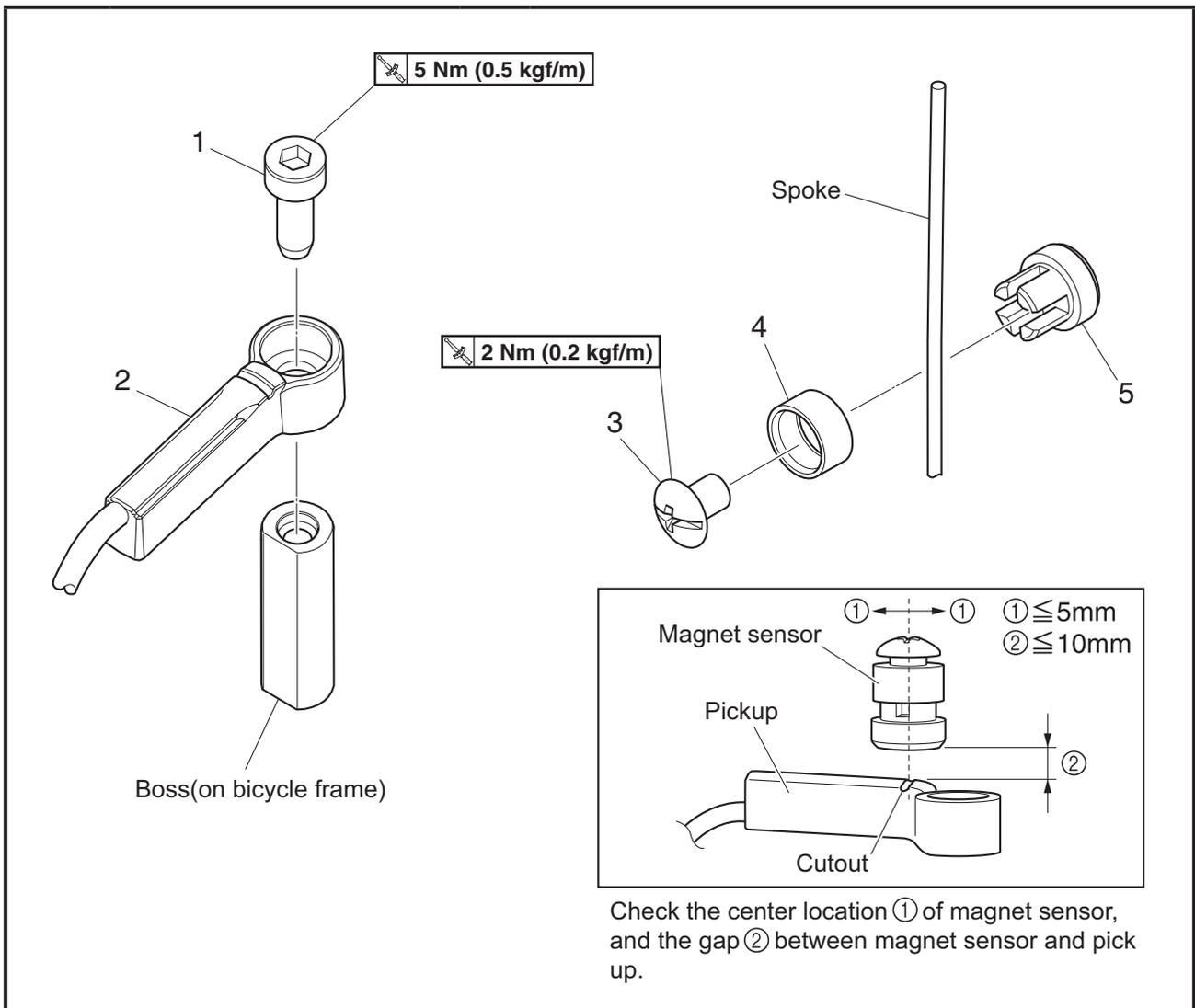
- Lock nut (Left-hand screw) [5]
45 Nm (4.5 kgf/m)

Display Unit



Order	Job/Part	Q'ty	Remarks
	Removal of the display and switch from the bicycle handle.		Follow the work procedures for removal.
1	Bolt	1	
2	Rubber adapter	2	
3	Clamp	1	
4	Bolt	2	
5	Bolt	4	
6	Display cover	2	
7	Display	1	
8	Screw	1	
9	Switch	1	
			Reverse the removal process for installation.

Speed Sensor



Order	Job/Part	Q'ty	Remarks
	Removal of the speed sensor from the bicycle.		Follow the work procedures for removal.
1	Bolt	1	
2	Pickup assy.	1	
3	Bolt	1	
4	Hoop	1	
5	Magnet sensor	1	
			Reverse the removal process for installation.

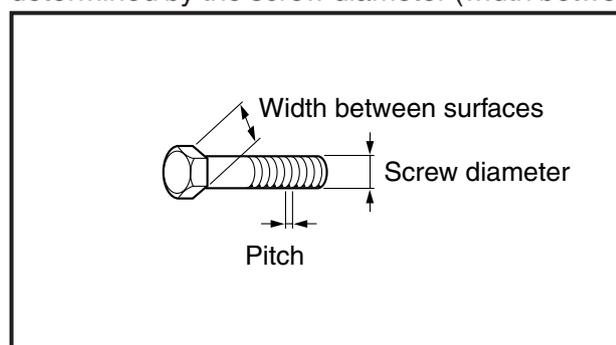
Tightening Torque

Unit: Nm kgf·m (in)

Tightening locations	Screw diameter	Q'ty	Tightening torque	Notes
Drive sprocket lock nut	M32	1	45 (4.5)	Left hand screw The part can be removed and installed using a commercially available bottom bracket tool.
Drive Unit fixed bolt	M8	2	22 (2.2)	
Drive Unit fixed bolt	M6	2	11 (1.1)	
Display clamp fixed bolt	–	1	3.75 (0.375)	
Display fixed bolt	–	2	2 (0.2)	
Display cover fixed bolt	–	4	0.8 (0.08)	
Switch fixed screw	–	1	0.8 (0.08)	
Pickup assy.	M5	1	5 (0.5)	Because the parts are provided by the bicycle manufacturer, the tightening torque is for reference only.
Magnet sensor	–	1	2 (0.2)	

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)

Diagnosis function

System malfunction

This model is equipped with a self-diagnosis function in order to ensure that the assist system is operating normally.

If this function detects a malfunction in the system, it immediately operates the assist system under substitute characteristics and displays the error indication to alert the rider that a malfunction has occurred in the system.

For details about error codes, see the error code tables.

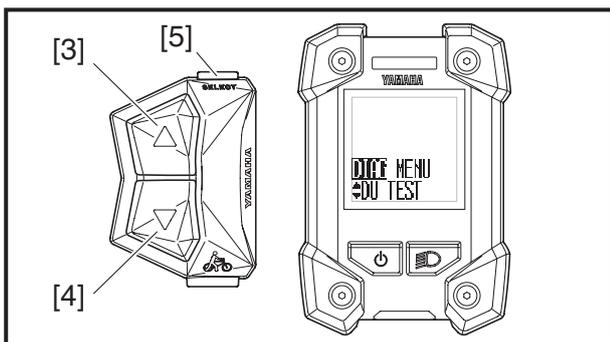
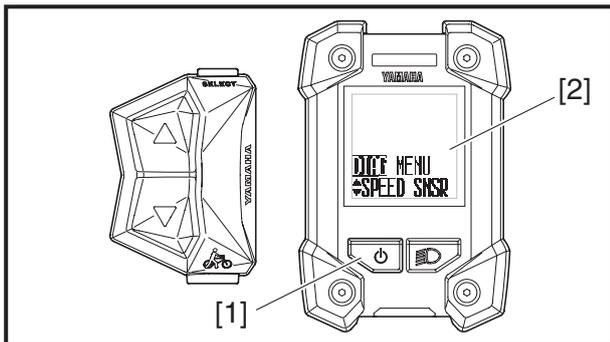
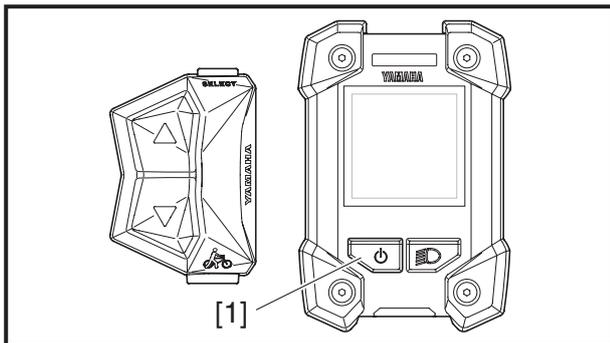
In addition, the Yamaha e-kit diagnostic tool can be connected to this model for more detailed troubleshooting. For details, see “YAMAHA E-KIT DIAGNOSTIC TOOL”.

List of Error Codes Display

Display pattern	Error codes [1]	Error message [2]	Fault device	Power assist behavior and error code record
<p>LED indicator: RED</p> <p>Alternately displays</p> <p>LED indicator: RED</p>	12	METER CHK CONN	Drive Unit – Display unit communication	Power assist is normal. Error code does not record.
	13	DU-METER INCOMPATIBLE	Display unit	
	31	TRQ SNSR PWR OFF/ON	Torque sensor	
	32			
	33			
	34			
	35			
	36			
	37			
	38	CRK SNSR PWR OFF/ON	Crank sensor	
	39			
	61	CONT PWR OFF/ON	Controller	
	62	MOTOR PWR OFF/ON	Motor	Power assist will stop after determine the error. Error code will record.
	63	CONT PWR OFF/ON	Controller	
66				
64				
67	MOTOR PWR OFF/ON	Motor		
68	ENCODER PWR OFF/ON	Encoder		
71	BATTERY PWR OFF/ON	Battery		
73				
79	DC/DC PWR OFF/ON	DC/DC converter		
	–	SPD SNSR CHK MAGNET	Speed sensor	Power assist is normal. Error code does not record.
<p>Even if the power switch is pressed to turn the power on, the power turns off automatically after 4 seconds.</p>	–	–	Drive Unit - Battery	Power assist will stop after determine the error. Error code does not record.

Self-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 the display unit operation.



Operating procedures to self-diagnosis mode

1. Make sure that the power is turned off to the display unit.
Press the power switch [1] to turn on the power.
When the power is turned on, the initial display sequence is shown, and then the display will return to normal.
2. Press the power switch [1] again, and continue pressing the switch until the DIAG MENU [2] is displayed (approximately 10 seconds). Confirm that the DIAG MENU is displayed, and then release the power switch [1].

TIP

Steps 1 and 2 must be performed within 30 seconds.

3. Press the assist mode switch [3] or [4] to change the DIAG MENU.
4. Press the function select switch [5] to enter the selected self-diagnosis mode.

TIP

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

Self-diagnosis mode table

Layer 1	Layer 2	Layer 3	Layer 4	Description
 <p>Normal display</p>	 <p>Speed sensor diagnosis mode</p>	 <p>Speed sensor rotation check</p>		Checks the functionality of the speed sensor operation
	 <p>Drive Unit diagnosis mode</p>	 <p>Torque sensor reference voltage</p>		Displays the condition of the torque sensor reference voltage
		 <p>Motor current</p>		Checks the functionality of the motor current (%)
		 <p>Error display</p>		Displays the error from the motor and controller
		 <p>Display unit function check</p>	 <p>All segments illuminate</p>	Checks the functionality of the display unit operation
	 <p>Error log check mode</p>	 <p>Error log results</p>		Retrieves the fault records from the controller to display the list of error codes
	 <p>Firmware ver. check mode</p>	 <p>Meter hardware</p>		Imports the display hardware version
		 <p>Meter software</p>		Imports the display firmware version
		 <p>Drive Unit hardware</p>		Imports the Drive Unit hardware version
		 <p>Drive Unit software</p>		Imports the Drive Unit firmware version
 <p>EXIT</p>				EXIT



Speed sensor diagnosis mode display method

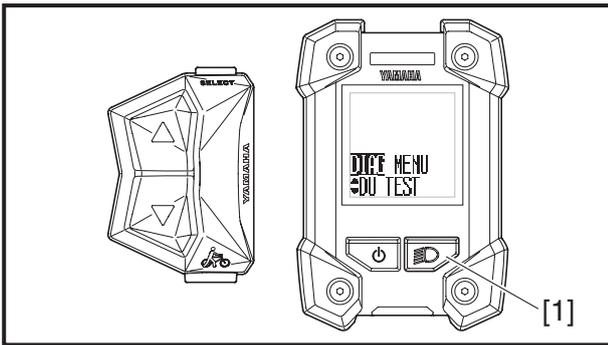
To determine if the controller is correctly recognizing the speed sensor signal, rotate the wheel to which the speed sensor is connected and make sure that the number of rotations of the wheel indicated matches the actual number of rotations.

1. Enter the speed sensor diagnosis mode.
See "Operating procedures to self-diagnosis mode".
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.
Each rotation of the wheel is counted. The rotation number display shows up to <999> and will return to <1> when the wheel is rotated 1,000 times.

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).

Diagnosis function



Drive Unit diagnosis mode display method

You can check the status of malfunctions in the Drive Unit.

1. Enter the Drive Unit diagnosis mode.

See “Operating procedures to self-diagnosis mode”.

Press the light switch [1] to select 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	Display		
1) Torque sensor reference voltage			Values are displayed from 0.0 to 5.0 (V)
Press the light switch ↓			
2) Motor current		~	Motor output current in “HIGH” mode is displayed as 0 to 100 (= % output)
Press the light switch ↓			
3) Error display		·	When there is an error, either (E2) (motor) or (E4) (controller) is displayed. *There is no display when there are no errors.
Press the light switch ↓			
4) Display unit function check			All segments are illuminated. (Segments that are not illuminated indicate a malfunction.)
Press the light switch or Press the power switch ↓			
Power turn 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. <1> is displayed in the diagnosis mode display [1] of the display unit for several seconds.
 - b. Displayed in units of 0.1 V in the diagnosis data display [2] of the display unit.
 - c. 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.
 - d. Press the light switch “” of the display unit.
 - e. Proceed to 2) Motor current.

Torque sensor reference voltage adjustment function.

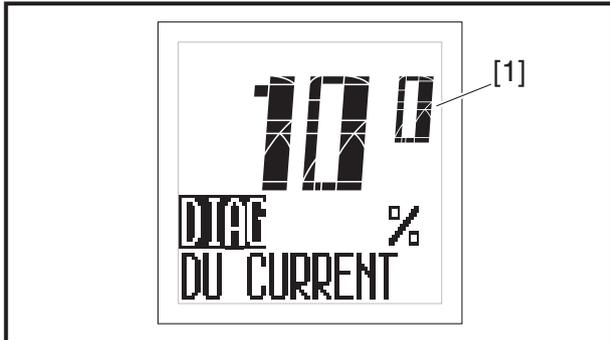
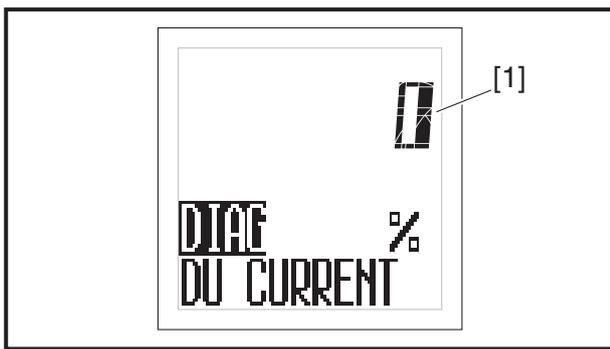
Turn the power on to the display unit and let it stand.

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.

Diagnosis function



2) Motor current

- a. The diagnosis data display [1] of the display unit displays the motor output current (%).
- b. Confirm that the diagnosis data display [1] 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.
- c. Press the light switch “” of the display unit.
- d. Proceed to 3) Error display.

Diagnosis function



3) Error display

- When there is a malfunction, <E2> (motor) or <E4> (controller) will be displayed on the diagnosis data display [1] of the display unit.

TIP

Check the error code if <E2> or <E4> is displayed.

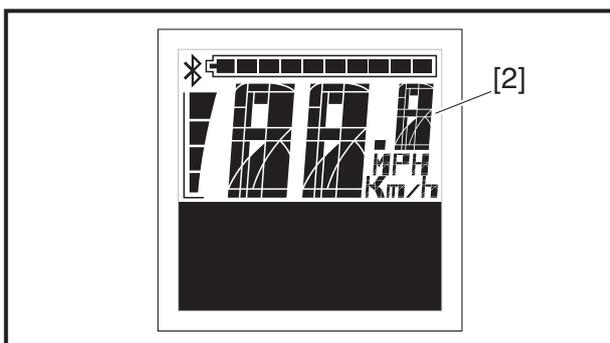
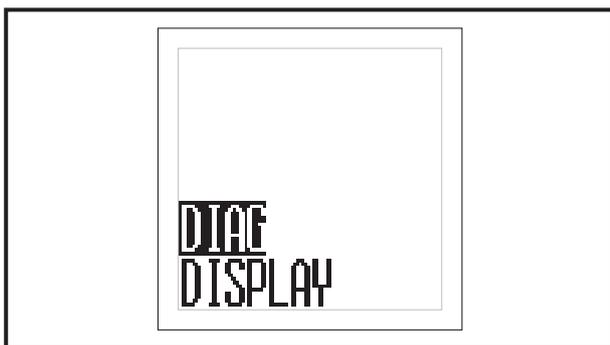
- Press the light switch “” of the display unit.

- Proceed to 4) Display unit function check.

TIP

Check the error code if <E2> or <E4> is displayed.

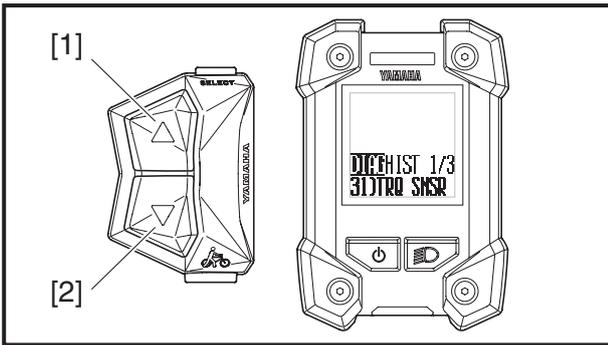
- When there is no malfunction, the next [DISPLAY] is displayed without the diagnosis mode [ERR] being displayed.
- Perform a final check to make sure there is no error display in this mode when performing repairs or replacing parts.



4) Display unit function check

- Press the function select switch “SELECT” 2 of the display unit.
- All segments of the display unit [2] will illuminate.
- Replace the display unit if there are segments which are not illuminated.
- Press the power switch “” of the display unit.
- The power to the display unit is turned off.

Diagnosis function



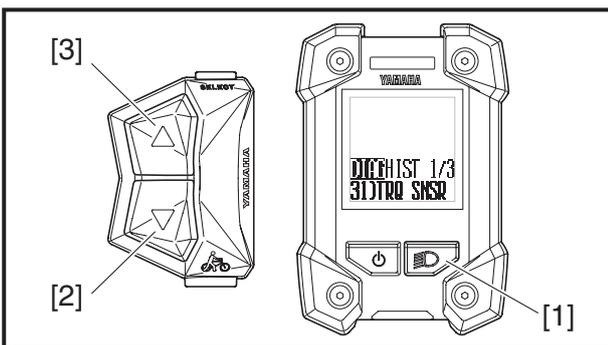
Error log check mode display method

The three most recent types of error codes which are stored when there is an error are stored.

1. Enter the error log check mode.
See "Operating procedures to self-diagnosis mode".
The display unit displays the three most recent error codes. To display the error codes, press the assist mode switch [1] or [2].
"NO ERROR" will be displayed when there are no errors.
Press the power switch to turn off the display unit.
Press the assist mode switches [1] or [2] to switch the display.

List of error log check mode display methods

When there are no error codes					
When there are 1-3 error codes					

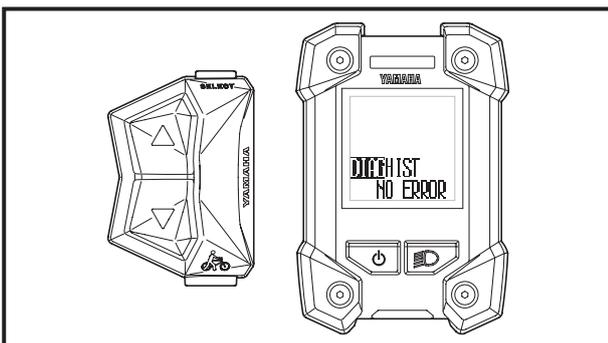


How to delete the malfunction history

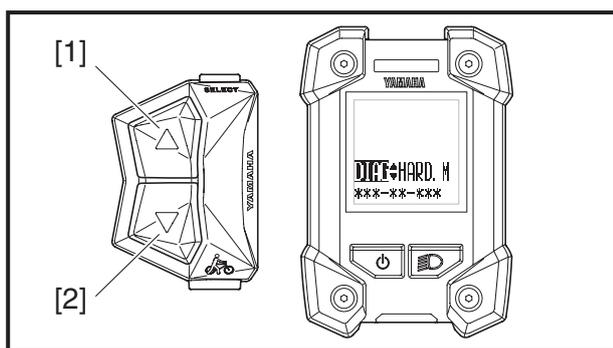
1. While pressing the light switch [1] during the error code display, press the assist mode switches [2] or [3].
2. When the history is deleted, "NO ERROR" is displayed. Press the power switch to turn off the display unit.

TIP

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



Diagnosis function



Firmware ver. check mode

You can confirm the version information for the hardware and firmware of the Drive Unit and meter.

1. Enter the firmware ver. check mode.
See “Operating procedures to self-diagnosis mode”.
2. Press the assist mode switch [1] or [2] to display the version information for the meter hardware, meter firmware, Drive Unit hardware, and Drive Unit firmware.

TIP

For details about the displayed version information, refer to the information supplied separately by Yamaha.

List of firmware ver. check mode display methods

Items	Display
1) Meter hardware version	
2) Meter firmware version	
3) Drive Unit hardware version	
4) Drive Unit firmware version	

List of error codes and corresponding assist operation

Error codes	Fault device	Fault details	Restoration condition	Action
12	Display unit	Stopped the communications to the display unit	If the system will not detect any errors, the system can return to normal immediately.	1. Replace the display unit assembly. 2. Replace the wire lead 2. 3. Replace the controller assembly.
13	Drive Unit - Display unit	Communication data failure to display unit		Replace the display unit assembly.
31	Torque sensor	No communication signals	If the system will not detect any errors, the system can return to normal when the power is cycled.	1. Replace the torque sensor assembly. 2. Replace the controller assembly.
		Disconnected		
Short-circuited				
Wiring failure between the torque sensor and the controller				
32		Wiring failure between the coil and the circuit board (wire chattering; nearly disconnected)	If the system will not detect any errors, the system can return to normal when the power is cycled. (When the system detects same error several times, the system can not return to normal even if the power is cycled.)	1. Perform the torque sensor reference voltage adjustment. 2. Replace the torque sensor assembly. 3. Replace the controller assembly.
33		Abnormal no-load voltage		
34		Abnormal voltage (detected during running / with high constant voltage)		
35		Abnormal voltage (detected during running / others)		
36	Abnormal voltage (detected during running at low speeds)			
37				
38	Crank sensor	Torque sensor or crank sensor failure	If the system will not detect any errors, the system can return to normal when the power is cycled.	Replace the torque sensor assembly or controller assembly or drive axle assembly.
39		Short-circuited or crank sensor failure		Replace the controller assembly or drive axle assembly.
61	Controller	Abnormal voltage of the sensor for U phase current while the motor is not operating	If the system will not detect any errors, the system can return to normal when the power is cycled.	Replace the controller assembly.
		Abnormal voltage of the sensor for W phase current while the motor is not operating		
62	Motor	Over current is applied to the U phase of the motor	The system can not return to normal even if the power is cycled.	Replace the controller assembly.
		Over current is applied to the V phase of the motor		
		Over current is applied to the W phase of the motor		
		Abnormal current is applied to the U phase of the motor		
		Abnormal current is applied to the V phase of the motor		
		Abnormal current is applied to the W phase of the motor		

Diagnosis function

Error codes	Fault device	Fault details	Restoration condition	Action
63	Controller	Failure in data reading	If the system will not detect any errors, the system can return to normal when the power is cycled.	Replace the controller assembly.
66		External memory data error		
		EEPROM error		
64		Detected circuit board temperature is too low (-20°C)	If the system will not detect any errors, the system can return to normal when the power is cycled. (When the system detects same error several times, the system can not return to normal even if the power is cycled.)	
		Detected circuit board temperature is too high (125°C) (including DC circuit)		
	Sensor on the board is nearly detached			
67	Motor	2 lead wires are disconnected	If the system will not detect any errors, the system can return to normal when the power is cycled.	<ol style="list-style-type: none"> 1. Replace the controller assembly. 2. Replace the wire lead 3 or wire lead 4 or wire lead 5.
		Yellow lead wire is disconnected (U phase)		
		Blue lead wire is disconnected (V phase)		
		White lead wire is disconnected (W phase)		
68	Encoder	Disconnected or led wire is short-circuited	If the system will not detect any errors, the system can return to normal when the power is cycled.	<ol style="list-style-type: none"> 1. Check the encoder connector. 2. Replace the encoder lead wire. 3. Replace the controller assembly. 4. Replace the motor assembly.
		Black wire is short-circuited		
71	Battery	Can't receive data from battery correctly	If the system will not detect any errors, the system can return to normal when the power is cycled.	<ol style="list-style-type: none"> 1. Replace the plug D.C. receptacle or wire lead 2. 2. Replace the controller assembly. 3. Replace the battery assembly.
73		Detected battery voltage is too high (45V)		
79	DC/DC converter	Abnormal DC current	If the system will not detect any errors, the system can return to normal when the power is cycled.	<ol style="list-style-type: none"> 1. Replace the external DCDC converter. 2. Replace the controller assembly.
–	Speed sensor	Speed sensor disconnected	If the system will not detect any errors, the system can return to normal immediately.	<ol style="list-style-type: none"> 1. Check the speed sensor lead connector. 2. Check the gap between the pick up and the magnet sensor. 3. Replace the speed sensor set.
–	Drive Unit - Battery	Communication error between the Drive Unit and the battery	If the system will not detect any errors, the system can return to normal immediately.	<ol style="list-style-type: none"> 1. Check the battery communication connector. 2. Replace the plug DC. 3. Replace the controller assembly. 4. Replace the battery.

YAMAHA E-KIT DIAGNOSTIC TOOL

This model uses the Yamaha e-kit diagnostic tool to identify malfunctions.

For more information about using the Yamaha e-kit diagnostic tool, refer to the operation manual that is included with the tool.

Functions of the Yamaha e-kit diagnostic tool

Drive Unit malfunction diagnosis:

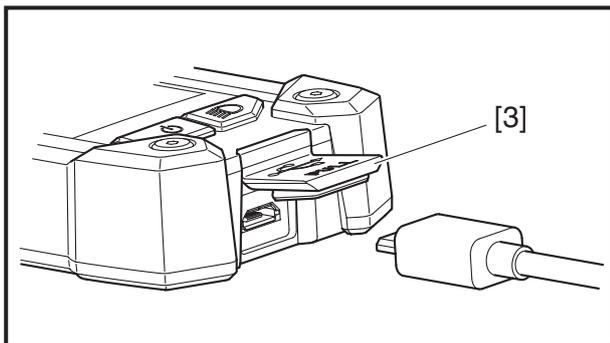
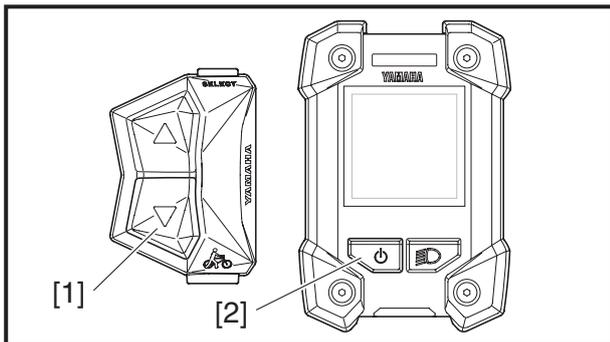
Drive Unit malfunction codes recorded on the controller are read, and the contents are displayed. The freeze frame data (FFD) is the operation data when a malfunction was detected. This data can be used to identify when the malfunction occurred and check the Drive Unit conditions and running conditions when it occurred.

Drive Unit system function test:

Check the operation and the output value of each sensor and actuator.

Battery information:

Displays the battery data.



Connecting the Yamaha e-kit diagnostic tool

1. Make sure that the power is turned off to the display unit.
2. Continue to press the assist mode switch (down) [1] and power switch [2] over 2 sec.
3. Confirm that the “PC CONN” is displayed, and then release the assist mode switch (down) [1] and power switch [2].
4. Open the USB receptacle cap [3] of the display.
5. Connect the USB cable to the switch and computer with the Yamaha e-kit diagnostic tool.

TIP

- After disconnecting the USB cable, be sure to close the USB receptacle cap [3].
- For the USB cable, use a Type-A to Micro-B cable that is not an OTG cable.
- When the Yamaha e-kit diagnostic tool is connected to the vehicle, the operation of the multifunction meter and indicators will be different from the normal operation.

**Drive Unit and Display Service Manual
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