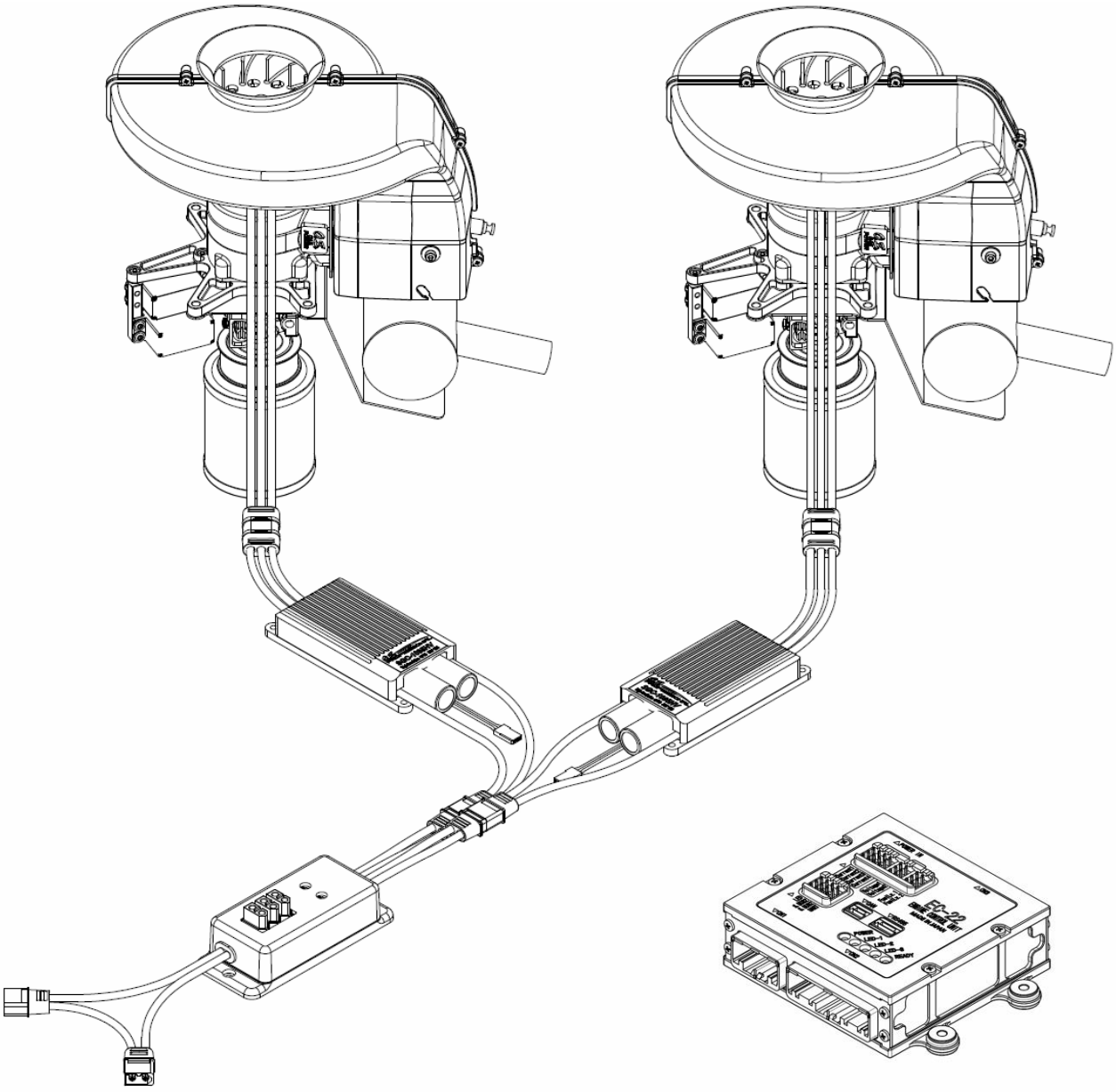
GT33REU TWIN

With EC-22 (ECU)

INSTRUCTION MANUAL

version 1.0E
2025.04.01



O.S. ENGINES MFG. CO., LTD.

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・Please read this instruction manual carefully before handling the engine.

【ENGINE】

・It is an electric generator for UAVs.
・Two sets of generators with the same specifications (rated 1kW) are connected in parallel and operate in conjunction.
・A continuous rated power of 2kW can be obtained.
・The engine for the generator is a 33cc air-cooled 2-stroke engine.
・The oil to be mixed with gasoline should be commercially available 2-stroke engine oil. Follow the oil manufacture's recommendations regarding the fuel and oil mixture ratios. If there is no recommendation, we recommend 50:1 mixture ratio.
・The engine runs counter-clockwise when viewed from the front.
・SGM (starter generator motor) is directly mounted on the engine crank shaft. Each is a 1000W class generator and has the ability as a cell starter at the time of starting.
・The system power supply should be 12(S)cell (Max50.4V)with two 6(S)cell lithium polymer batteries in series connection. Please use same batteries in brand and capacity of 3000mAh or more. Please fully charge the batteries before use and make sure the voltage of each cell is all same.
・If the battery voltage is under 48V, the battery will be automatically charged if there is sufficient power generating capacity and the voltage wil be recovered to 48V.
・The engine is to be started by built in starter.Both start at the same time.
・Periodical inspection after 50, 100 hours are necessary. Follow the maintenance manual, which is separately provided.

【ECU】

・The EC-22 is an engine control unit (ECU), which is 32-bit CPU-powered. It controll the engine based on the data of throttle opening, rpm, atomospheric pressure, induced air temperature, cylinder head temperature in the most suitable condition.
・For power supply 2 sets of 6 cell lipo ba as the battery voltage.
・The igniter's power is supplied by an isolated regulator inside the ECU, and you can turn on and off the igniter by sending a command to the ECU.
・ECU internal information such as engine RPM , cylinder head temperature, throttle opening, voltage, electric consumption, electric power generation, and etc. can be output to the outside of the ECU in real time by CAN and serial communication. By using Futaba S.BUS2 system, you can check the ECU internal information on trasmitter.(*1)
・The EC22-LINK software, which enables to change the parameters and to monitor the data in real time in Windows® platform, is included as a standard accessory.
・Supporting Futaba telemetry transmitter/receiver (for example T16IZ SUPER, T26SZ).

*The specifications are subject to alteration for improvement without notice.
*Please contact us for any questions on this product and return for repair.
*This instruction manual is created based on the product specifications as of February 2025.

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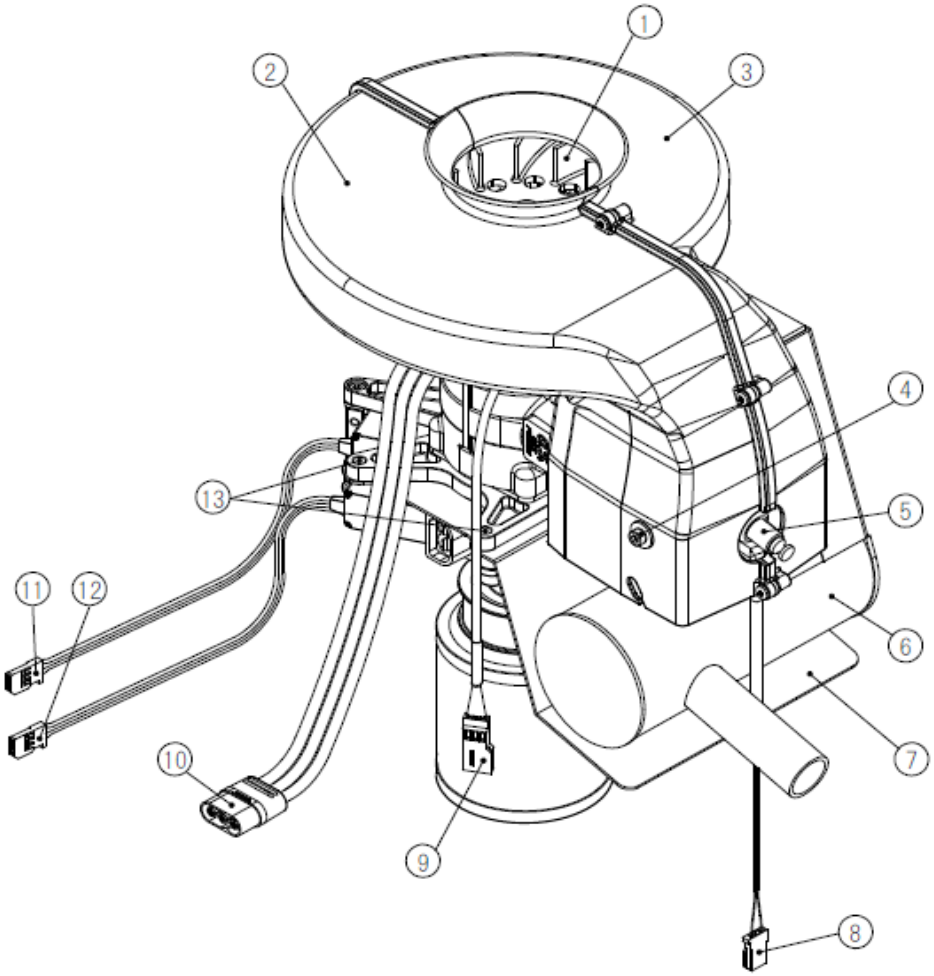
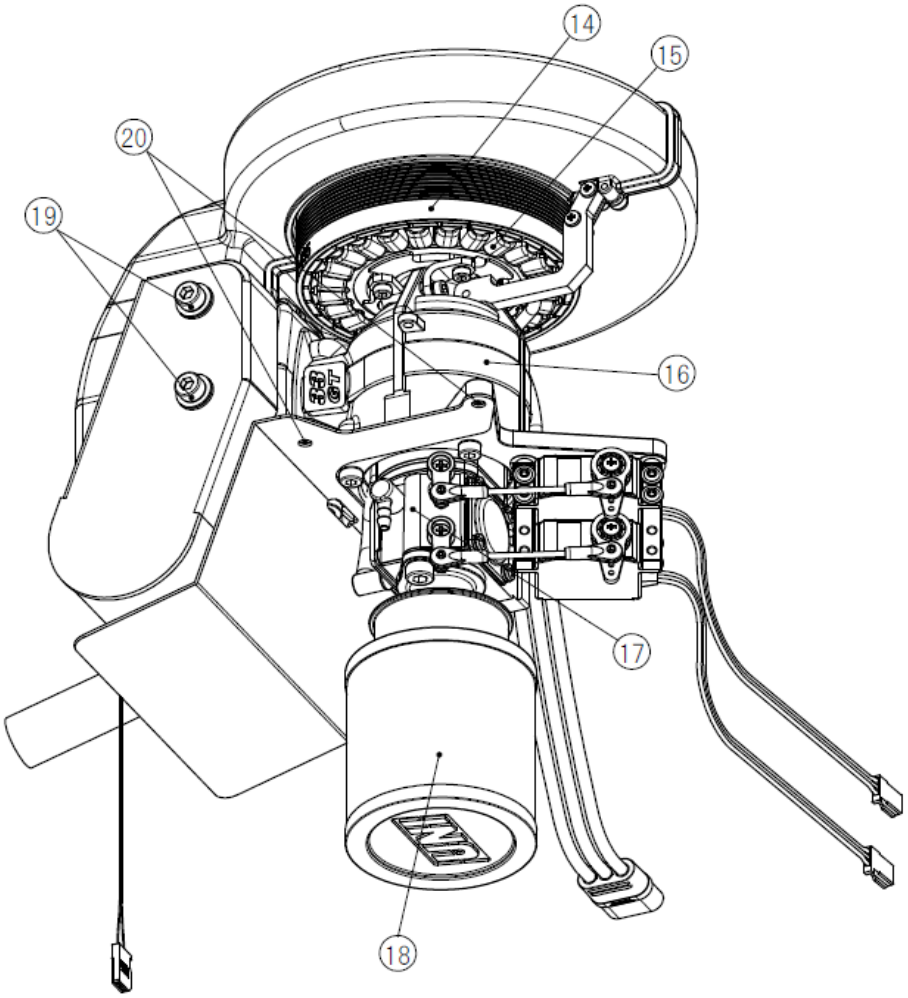
■Rated specifications

The engine generator specifications are the same for both Unit A and Unit B.

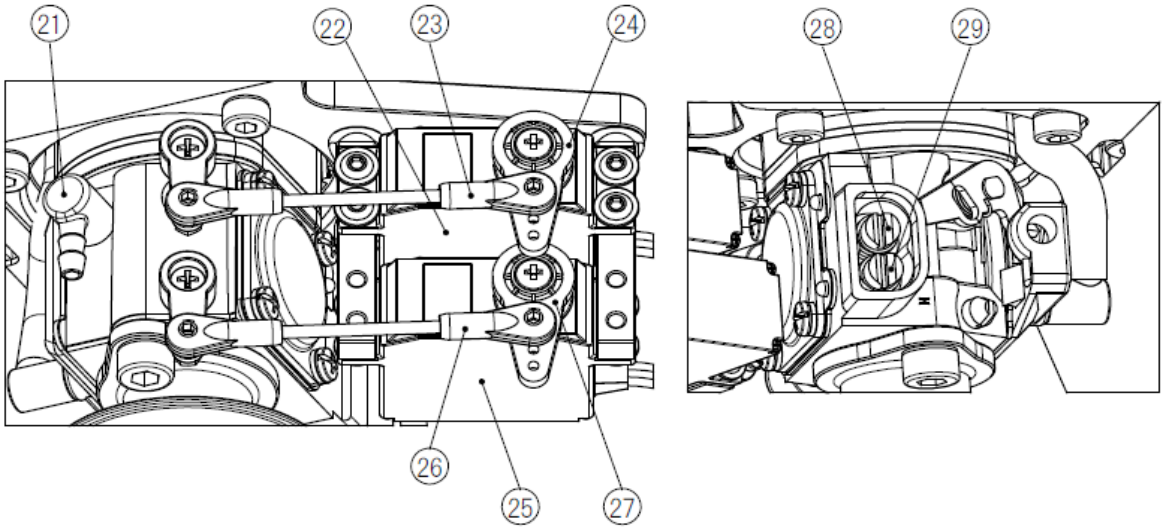
Device name	GT33REU-A	GT33REU-B
Description	3-phase AC electric generator for UAV	3-phase AC electric generator for UAV
Type of engine	air-cooled, 2-stroke, reciprocating single cylinder engine	air-cooled, 2-stroke, reciprocating single cylinder engine
Displacement (bore x stroke)	33cc (ϕ36.0mm x 32.4mm)	33cc (ϕ36.0mm x 32.4mm)
Rated voltage	48V	48V
Rated current	21A	21A
Generator output	1.0kW (continuous)	1.0kW (continuous)
Starting method	starter motor	starter motor
Fuel	Mixed gasoline with 2-stroke oil (25:1)	Mixed gasoline with 2-stroke oil (25:1)
Carburetor	diaphragm type, Walbro WT	diaphragm type, Walbro WT
Ignition	CDI ignition	CDI ignition
Spark plug	NGK CM-6 type (M10mm)	NGK CM-6 type (M10mm)
Fuel Consumption	1026g/kW・h (rated)	1026g/kW・h (rated)
Dimensions	Shown in page 64	Shown in page 64
Weight	2,250g	2,250g



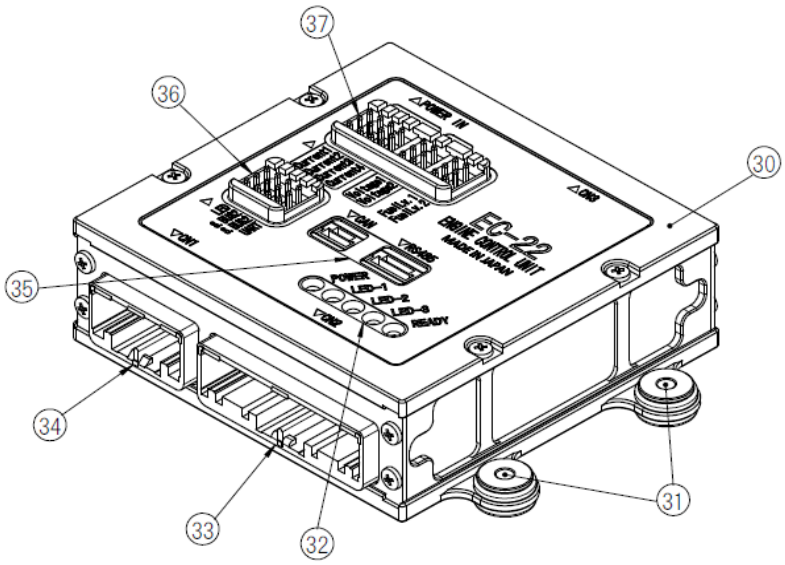
1. Cooling fan
2. Fan shroud L
3. Fan shroud R
4. Fan shroud screw
5. Spark plug CM-6
6. E-5033 Silencer
7. Heat shield plate
8. Temp. sensor connector
9. R.P.M. sensor connector
10. SGM lead connector: MR60(F)
11. Throttle servo connector
12. Choke servo connector
13. Engine mount screw

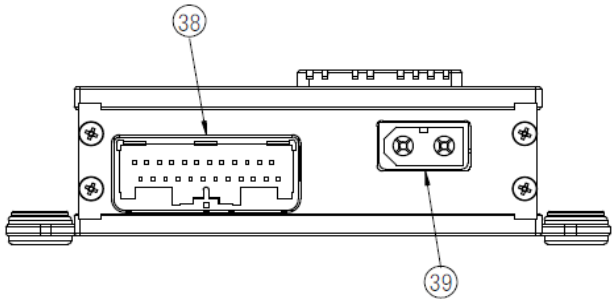


14. Starter generator rotor
15. Starter generator stator
16. Engine
17. Carburetor
18. Air cleaner
19. Silencer screw
20. Engine mount screw

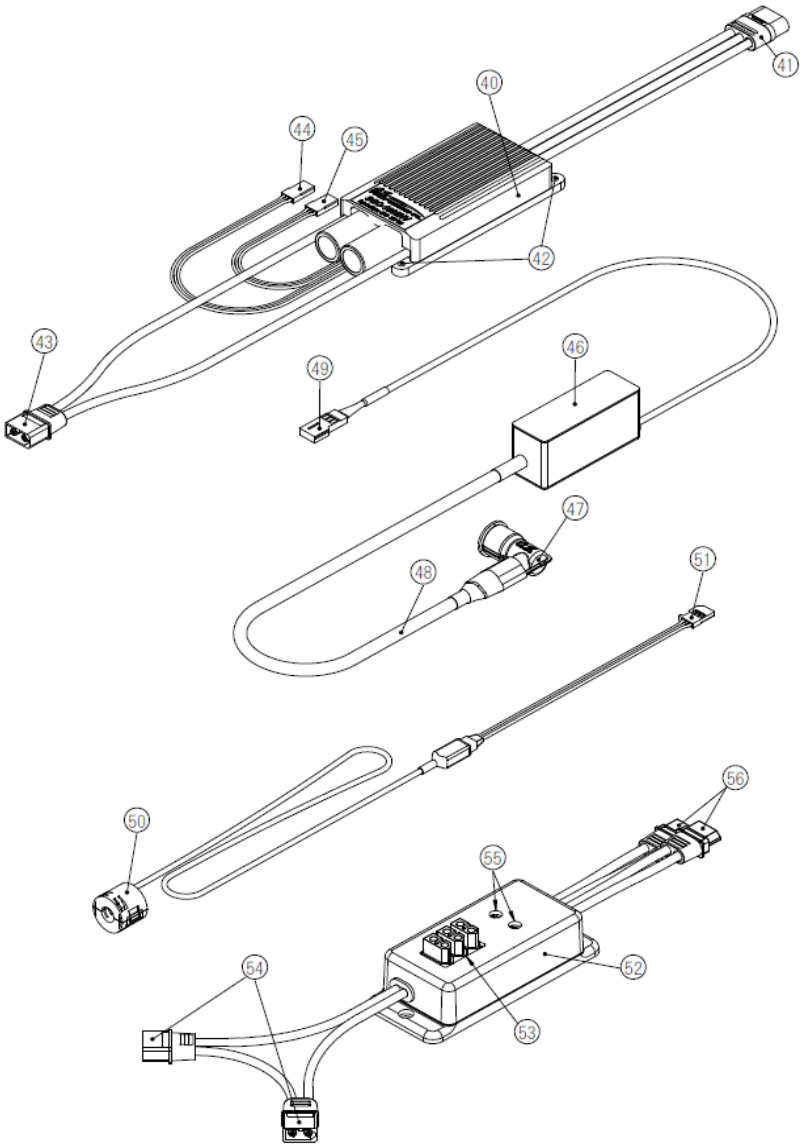


21. Fuel inlet
22. Throttle servo
23. Throttle servo rod
24. Throttle servo horn
25. Choke servo
26. Choke servo rod
27. Choke servo horn
28. Slow needle
29. High needle





30. Engine control unit (ECU)
31. ECU mounting hole
32. Status display LED
33. ECU connector [CN2]
34. ECU connector [CN1]
35. CAN/RS485 connection terminals
36. LED/S.BUS2/UART connection terminals
37. Current sensor/Voltage sensor/Fuel sensor connection terminals
38. ECU connector [CN3]
39. Power supply connection connector XT60(M)

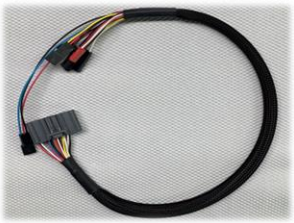


40. ESC for SGM (SGC-1095HV)
41. Starter generator connector: MR60(M)
42. Mounting hole
43. Power input/output connector: XT60(M)
44. Signal input connector (white, red, black)
45. Settings input connector (brown, red, orange) Unused
46. IG-13 Body (Igniter)
47. Plug cap
48. High tension cord
49. Power connector
50. SC-03 body (Current sensor)
51. ECU connection connector (connects to the sensor terminal on the top of the ECU)
52. Power distribution box with a fuse (HUB-02)
53. TX60(F),Load connectors. (One of them is used for the ECU)
54. TX60(M),Battery connectors(Two 6-cell Li-Po batteries connected in series)
55. Fuse visual inspection window (*1)
56. Connector for connecting SGC-1095HV: XT60(F)

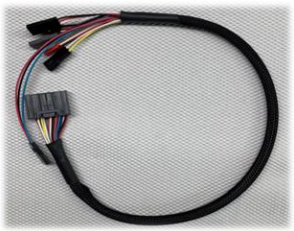
*1: When the fuse blows, it is suspected that SGC-1095HV or SGM-9020 has been short circuited. Do not use these products even after the fuse has been replaced.

3.Accessories

【ECU】Model：EC-22
・Engine Control Unit(ECU)

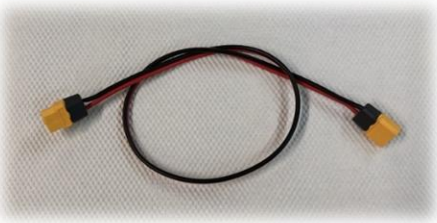


【ENGINE WIRING HARNESS[A]】
・Wiring harness that connect ECU and the engine[A].



【ENGINE WIRING HARNESS[B]】
・Wiring harness that connect ECU and the engine[B].

【PWM signal harness】
・It is used to input each signal of starter, choke1, choke2 and ignition on/off by PWM signals from RC receiver, etc. It is not used when connecting to S.BUS or RS485.



【ECU power cable】
・Connect load connector from HUB-02 to ECU(RED+/BLACK-).
・The ECU measures the battery voltage from power supply voltage. Always take the power from HUB-02's load connector.

【LED harness set】
・Install to the ECU's LED connection terminal and use as an ignition pilot lamp.

【Power distribution box with a fuse】Model：HUB-02
・Distribution box with a fuse for SGC.
・Connect two 6 cell li-po batteries with capacity of 3000mAh or more to 2 pieces of XT60(F). There is no balance charging function. Must use two batteries in same condition.
*For connection details, refer to the SGM(Starter Generator Motor) section in this manual.

【Clamp type current sensor】x 3pcs Model：SC-03
・These are Clamp type current sensors.
・Clamp the HUB-02 case in the direction shown in the picture. Connect ① and ② and ③ to the ECU's CURRENT1 and CURRENT2 and CURRENT3 icons engraved on the case of the HUB-02 . It will not work properly if you connect the cable incorrectly. For connection details, refer to the SGM(Starter Generator Motor) section.

【SGC(ESC)】x 2pcs Model ： SGC-1095HV
・It is an ESC with a high withstand voltage specification with a controller for SGM.
・The MR60 (M) connector connects to the SGM-9020.
・The XT60 (F) connector connects to HUB-02.
*For connection details, refer to the SGM(Starter Generator Motor) section.

【Igniter】x 2pcs Model：IG-13
・Power for the igniter will come from the ECU.
・Connect the red connector to the Ignition signal in the ECU harness.

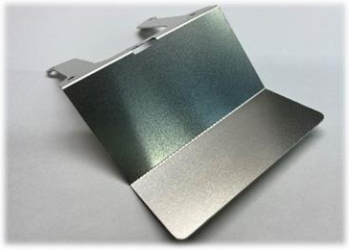
【Gasoline fuel filter L】(2PCS)
・This is an in-line fuel filter.
・Install it on the piping between the fuel tank and carburetor so that fuel flows in the direction of the arrow.
*For details on how to use it, please see the installation method section.

【Hose clamp】(5PCS)
・To be used to fix pressurized tubes to joints.

【Connector lock】(12PCS)
・For crankshaft rotation sensor, Ignition signal connector and servo to prevent connectors from disconnecting.

【Air cleaner UNI (PK-4E)】(2PCS)
・Attach to the air cleaner adapter.
・Tightening torque is 2N・m.

3.Accessories

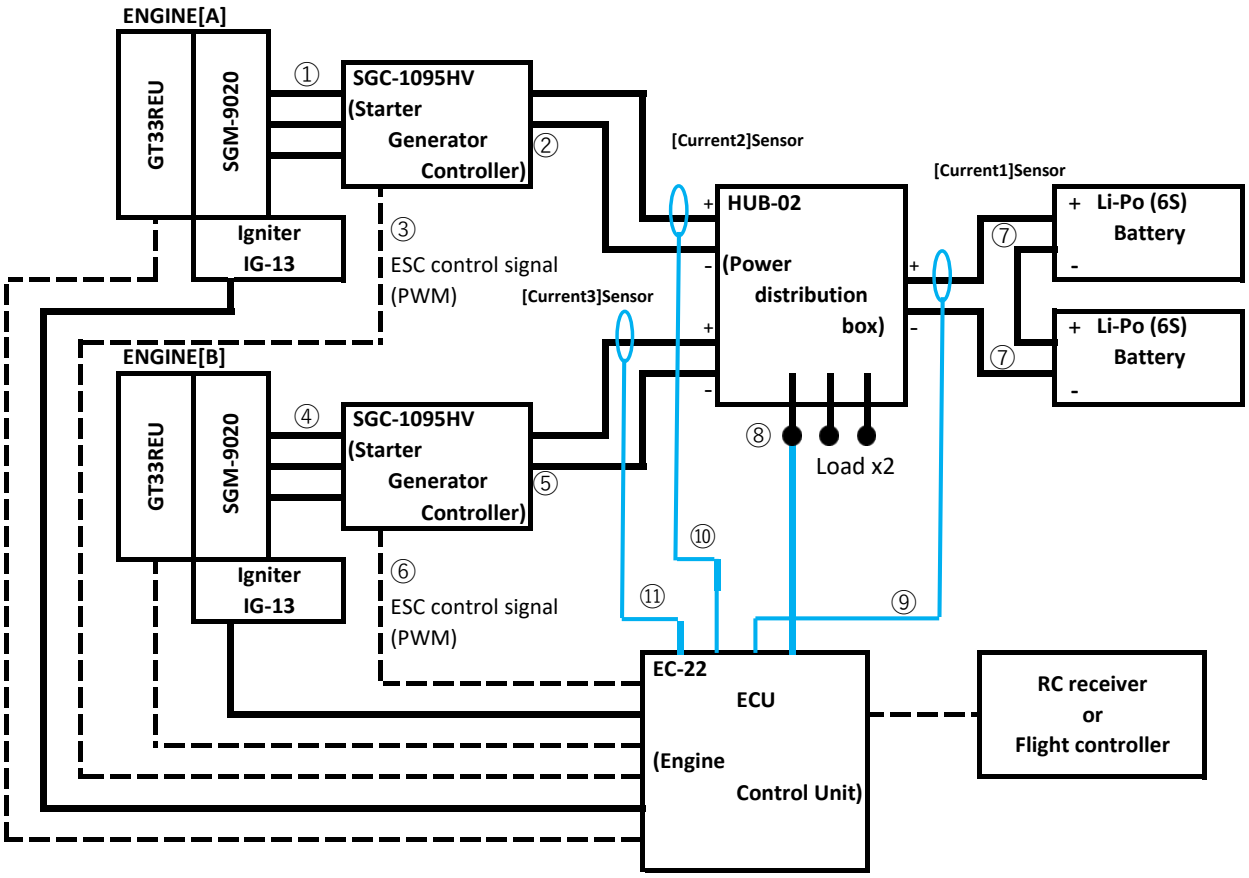


【Heat shield plate】(2PCS)
・Attach it to the engine mount.

【Serial signal converter】Model：U2S-2(for EC-2#)
・To be used to convert UART serial signal from ECU to USB serial signal when ECU is connected to a computer.

SYSTEM DIAGRAM OF GT33REU TWIN

The numbers ① to ⑪ in the diagram indicate where each device is connected.
* For connection details, please refer to the SGM (Starter Generator Motor) section.



・SGM(SGM-9020)is a starter generator motor that combines a starer and a generator. It can start an engine and generate a continuous 1.0kW of power.

・SGC(SGC-1095HV) is controlled by the ECU, it drives the SGM as a starter motor during startup and rectify the current and regulate the voltage of the output from the SGM during power generation.

・HUB-02 is power ditribution box for power supply. Equipped with three load connectors, one is used by ECU. Please use this power distribution box because it has built in fuse for SGC.

・The ECU (EC-22) monitors the engine control, the output/input current from/to HUB-02 and the voltage of power supply. The voltage of the load power supply is measured by checking the power supplied to the ECU.
Make sure to supply power to the ECU from HUB-02.

・It is designed to use with two 6S lipo batteries connected in series. Please use batteries with capacity more than 3,000mAh which are same brand, capacity and performance. If there is enough generated power, the battery will be charged automatically to recover 48V. There is no balance charging function. Before use, make sure the battery is fully charged and voltage of each cell is same.

・Power for igniter is supplied by the ECU, it can be turned on/off externally by inputting ignition on/off signal.

OPERATION OF GT33REU TWIN

(1) Engine RPM governor

The program of engine RPM governor activates to maintain the idling rpm of 3,500rpm when the engine is started. After starting the engine, when the battery supplies electricity to on-board equipment higher than 10A, the rpm of engine automatically rises to 7,200rpm and the engine starts to generate electricity. When the engine is generating electricity, the rpm of engine changes according to electric consumption. The fuel consumption and noise level also change accordingly. (See Fig.4.1)

When the electric consumption drops to 0.6kW or less, the rpm of engine automatically comes back to 3,500rpm and the engine stops generating electricity.

condition	Engine rpm	Electric consumption	remark
High electric consumption	7,400rpm	2.4kW or more	During power generation
	7,300rpm	2.2kW or more, less than 2.4kW	
Standard electric consumption	7,200rpm	2.0kW or more, less than 2.2kW	During power generation
	7,050rpm	1.8kW or more, less than 2.0kW	
Low electric consumption	6,750rpm	1.6kW or more, less than 1.8kW	During power generation
	6,500rpm	0.6kW or more, less than 1.6kW	
Idling	3,500rpm	Less than 0.6kW	Right after starting the engine, without power generation

Fig.4.1

(2) Control of maximum electric generation

Monitoring the current and voltage of the electricity generated by GT33REU and regulating the maximum generating power can avoid engine stall and overheating of the engine and the engine starter.

Note 1: If the load power exceeds the maximum power generation power (2.5kW), the power generation supply will be stopped.

Note 2: Regulating the maximum electric generation does not mean controlling the maximum load of the whole system. In case a UAV is hovering using only the generated electricity, and run out of the battery soaring in the sky, or controlling its attitude against a gust of wind, the UAV cannot continue hovering because the whole system needs electricity for charging the battery as well as the electricity for hovering.

(3) Control of the charging

Monitor and regulate the electric current (Max 48V) and voltage (Max 5A) to the Li-Po battery for normal charging.

(4) Control for Preventing overheating

To prevent overheating, CHT(cylinder head temperature) is monitored, and if CHT exceeds 170℃,the peak oerload limit value is automatically switched from 2.5kW to 2.0kW, and when CHT drops to 155℃, it will set back to 2.5kW.

CAUTION：

・There is no balance charging function in the ECU. Before use, make sure the battery is fully charged by a charger with balance charging function.

・If battery voltage is 45V or lower, there is a possibility that engine might not crank.

・The ECU regulates the power generation referring to three current sensors and the power voltage supplied from HUB-02.Be sure to connect the wires as instructed.（※See page 30）

INSTALLATION

(1) Installation of GT33REU TWIN

Screws for installation (4 pieces) are not included in this product. Use your own. They should be M4 cap screws made of steel and have nominal tensile strength 1200N/㎟ or more. Screw in cap screws 5mm or deeper into the UAV. Follow the tightening torque mentioned in the instructions of the UAV, if not, tighten them at 3.6N/m.

In case anti-vibration rubbers are used, make sure the vibrating engine and parts do not interfere the UAV with contact.

(2) Installation of IG-13 ignition module

① Stick IG-13 to a frame of the UAV with foam mounting tape and cable ties.

② Connect the plug cap to the spark plug on the engine. Apply silicon oil to the spark plug in case it is hard to connect and screw in the plug cap.

③ IG-13 uses high voltage, higher than 15kV and the high voltage produces noise, which creates harmful effects to other electrical devices. Isolate the ignition module as far as possible from other electrical devices and cables. The high-tension code of IG-13 needs to be wrapped with spiral cable tube not to contact to a frame of the UAV. Do not bind the high-tension code together with other electric cables.

(3) Installation of the air cleaner

Peel off the warning label and attach the black rubber adapter in the air cleaner. Fit the air cleaner to the aluminum air cleaner adapter of the carburetor binding it with a hose band. (tightening torque: 2.0N/m)

FUEL TANK

(1) GT33REU TWIN consumes approximately 1,400 – 2,400cc gasoline per hour though it depends on needle adjustment. Decide capacity of fuel tank according to your usage and flight time.
(2) Choose a gasoline resistant fuel tank. You cannot use a fuel tank for glow engines because the tank cap is not gasoline resistant.
(3) Wash a fuel tank with gasoline before the first use to wash off remaining plastic pieces and dusts.
(4) Use the following tube for piping.
Tygon® F-4040A, Fluoro rubber, or Nitrile rubber (I.D. 3.0 – 3.2mm, O.D. 6.0 – 6.4mm) The tubes should be replaced periodically because they harden with age. A tube in a fuel tank should be replaced in 6 months to one year.
(5) Fuel tank piping should be 3-way piping as shown in the below drawing. Use fuel line keepers ma de of ϕ0.6 – 0.8mm stainless steel wire to avoid the tubes coming off.
(6) In case of using a wide-mouthed fuel tank, set a fuel filter on a fuel inlet. Use one of them shown below in a fuel tank available from us.
Code no. 71531010 Non-bubble weight

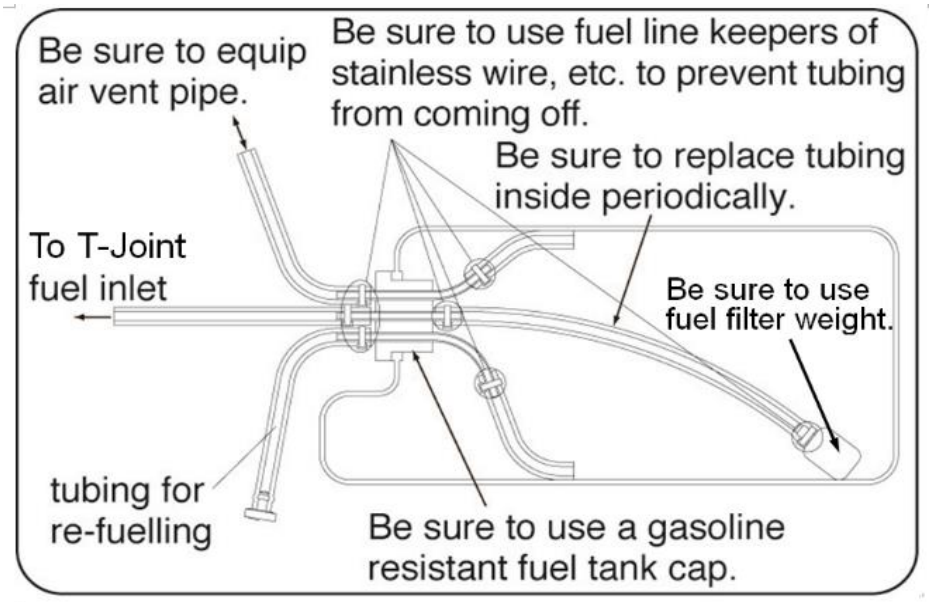


Fig.5.1

PIPING OF THE FUEL

(1) Use clips in the accessories or stainless steel wire (ϕ0.6 ~ 0.8mm) to fix tubes to pipes.
(2) Piping from/to the fuel tank, the fuel filter, and the carburetor
① The fuel filter in the accessories must be used in the piping between the fuel tank and the carburetor. Attention for the direction of the fuel filter. See the drawing Fig.5.2.
② Length of each tube connection should have a margin of 10mm.
③ Fix the tubes not to flap during flight. Do not press the tubes too strong when fix them.

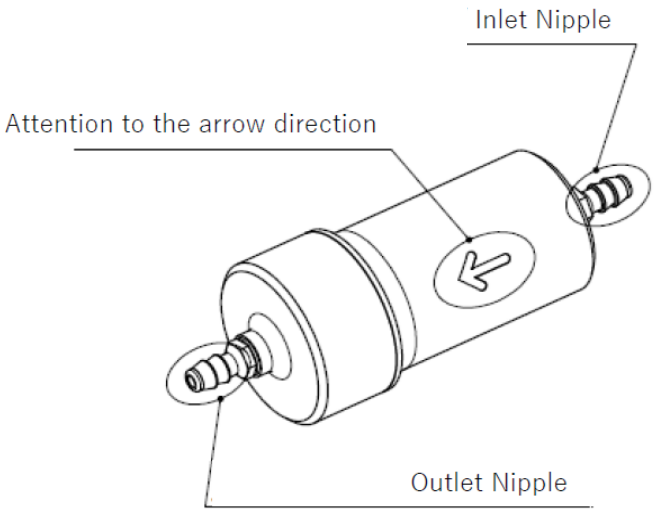


Fig.5.2

MIXING OF OIL

(1) Use the gasoline with high octane rating, 89 or more.
(2) Use high quality commercially available 2-stroke engine oil. Some of oil accumulates residues in combustion chamber and an exhaust port only in several hours' operation and causes a trouble. Check the combustion chamber if there is unusual residue in short period.
(3) Follow the oil manufacturer's recommendations concerning the mixture ratio of gasoline and oil. If there is no recommendation, mix with a 25:1 ratio. We have checked and approved the following oil mixture ratio. KLOTZ ModeLube (25:1). Castrol Power 1 – TTS Racing (25:1) (This does not mean we guarantee the quality of this oil.) Follow the instructions in the running-in section concerning the mixture for running-in.
(4) It is suggested to use optional accessory Super Filter L (Code No. 72403050) when filling a tank in a UAV from a container used for transportation or storing.

SETTING OF THE TRANSMITTER

Note: To fulfil all the function of GT33REU TWIN, it is necessary to use transmitter/receiver set of Futaba T16IZ SUPER or T26SZ. This manual is written assuming that one of the mentioned Futaba products you use.

(1) Channel for use

GT33REU TWIN requires 4 channels; ①Starter, ②Choke1, ③Choke2, ④Ignition switch.

(2) Function setting

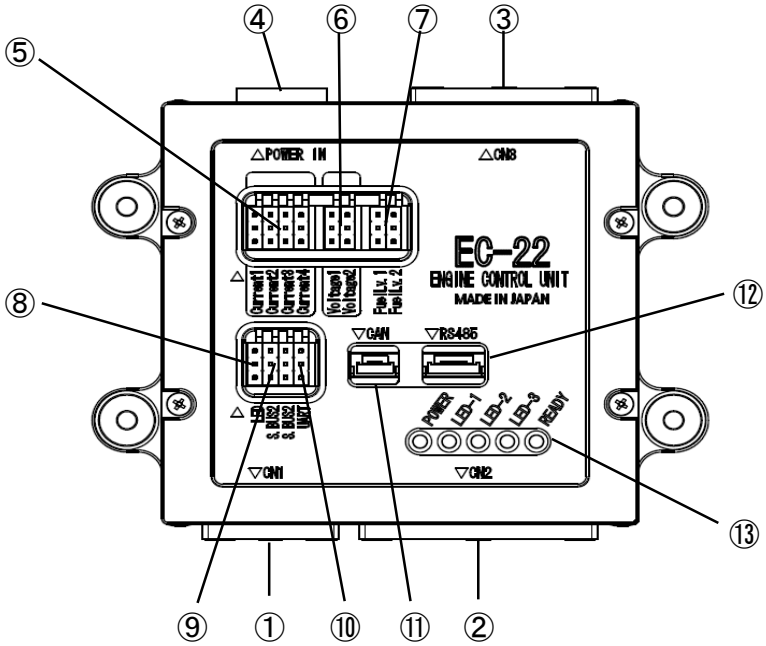
Set the Function, Servo Reverse, and End Point as follows.

	Starter	**Choke1**	**Choke2**	**Ignition switch**
Function	CH1	CH5	CH6	CH7
Control switch	SH	SG	SE	SF
Servo reverse	Normal	Normal	Normal	Normal
High Limit	135%	135%	135%	135%
High Travel	100%	100%	100%	100%
Low Travel	100%	100%	100%	100%
Low Limit	135%	135%	135%	135%

(3) Telemetry settings

For the operation method, see the instruction manual of transmitter.

ECU



①【CN1】

Connect PMW signal harness. It is not used when connecting to S.BUS or RS485.

②【CN2】

Connect engine wiring harness[A].

③【CN3】

Connect engine wiring harness[B].

④【Power connection connector】XT60(M)

Use power cable and connect power supply connector to supply power.

⑤【Current sensor connection terminal】

Use CURRENT 1 and CURRENT 2 and CURRENT 3. CURRENT 4 are for optional SC-03 current sensor. By adding the SC-03 current sensor, it can measure up to ±80A of DC current.

⑥【Voltage sensor connect terminal】

By connecting optional SV-01 Voltage sensor, it can measure up to DC100V of voltage.

⑦【Fuel sensor connect terminal】

By connecting optional SFL-01 fuel sensor, it can measure remaining fuel in the tank by measuring the height.

⑧【LED connect terminal】

By connecting the LED harness that is included, it will be used as a pilot lamp for ignition power.

⑨【S.BUS2 connect terminal】

Compliant terminal for FUTAB S.BUS2.

⑩【UART connect terminal】

UART serial communication terminal. Connect U2S-2 that is included.

⑪【CAN connect terminal】

CAN communication terminal.

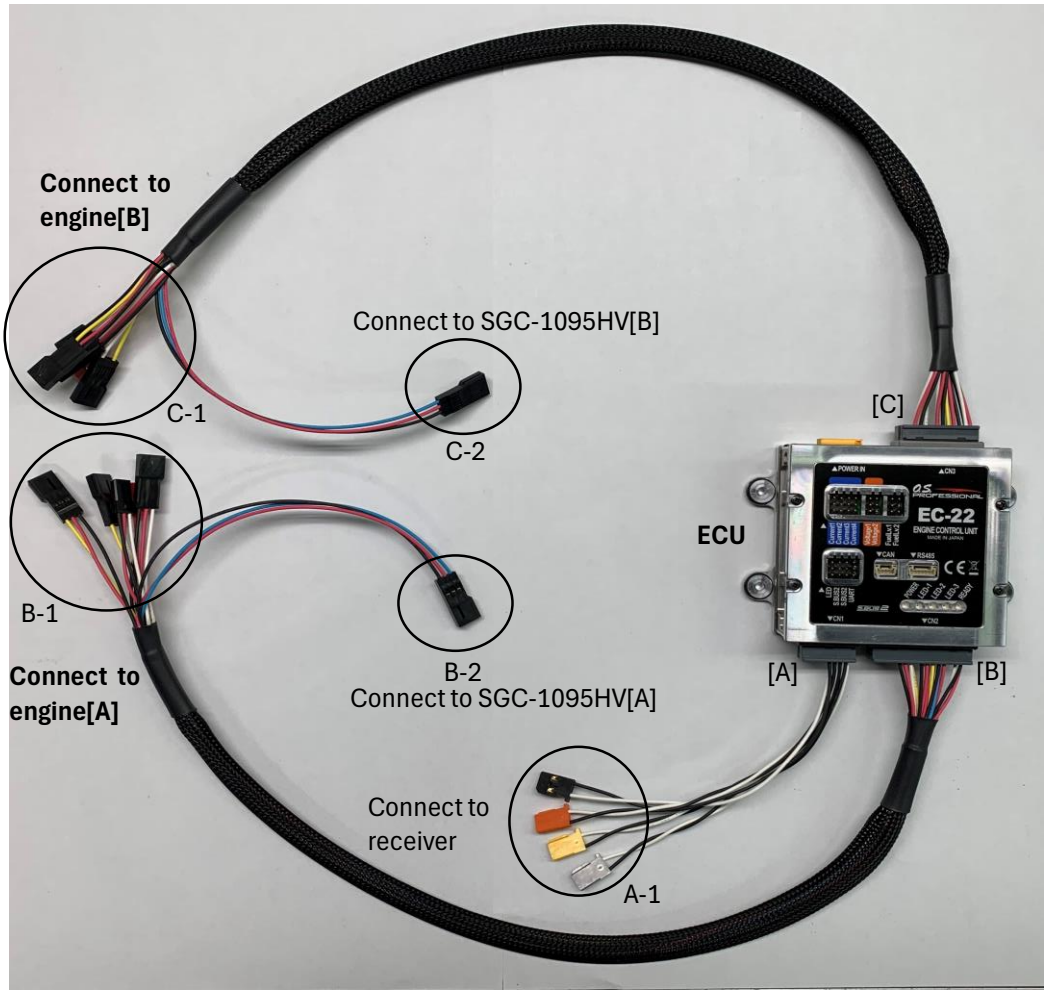
⑫【RS485 connect terminal】

RS485 communication terminal.

⑬【ECU status display LED】

It shows the condition of ECU.

ECU Wiring harness



[A] PWM signal input harness〔CN1〕

A-1
- Starter start signal input(PWM VIH=2.6V, VIL=0.4V, MAX5.5V)
- Choke1 signal input (PWM VIH=2.6V, VIL=0.4V, MAX5.5V)
- Choke2 signal input (PWM VIH=2.6V, VIL=0.4V, MAX5.5V)
- Ignition on/off signal input(PWM VIH=2.6V, VIL=0.4V, MAX5.5V)

[B] Engine wirring harness[A]〔CN2〕

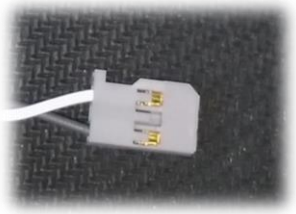
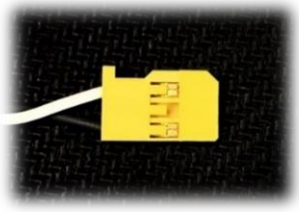
B-1
- Cylinder head temperature sensor
- Throttle servo
- Choke servo
- Ignition signal(RED)
- Crankshaft rotation sensor(BLACK)

B-2
- SGC signal output

[C] Engine wirring harness[B]〔CN3〕

C-1
- Cylinder head temperature sensor
- Throttle servo
- Choke servo
- Ignition signal(RED)
- Crankshaft rotation sensor(BLACK)

C-2
- SGC signal output

[A]	A-1	 Starter signal input	・Input the PWM signal from the external device such as transmitter, flight controller etc. to start the starter motor. ・The starter goes into standby mode when the PWM signal is 800 μs to 1400 μs. ・The PWM signal drives the starter at 1600 μs to 2200 μs. **Specification** PWM signal : 800μs～2200μs (*1) [W : Signal ／ B : GND] VIH=2.6V, VIL=0.4V, MAX5.5V
	A-1	 Choke1 signal input	・Connect to a choke1 signal cable from receiver or flight controller. **Specification** PWM signal (*1) ・Set the travel width so that the PWM signal width is 1100 μs or less on the choke closed side and the PWM signal width is 1940 μs or more on the choke opening side. [W : Signal ／ B : GND] VIH=2.6V, VIL=0.4V, MAX5.5V
	A-1	 Choke2 signal input	・Connect to a choke2 signal cable from receiver or flight controller. **Specification** PWM signal (*1) ・Set the travel width so that the PWM signal width is 1100 μs or less on the choke closed side and the PWM signal width is 1940 μs or more on the choke opening side. [W : Signal ／ B : GND] VIH=2.6V, VIL=0.4V, MAX5.5V
	A-1	 Ignition ON/OFF signal input	・ Input the command signal to power on/off for igniter from the external device. ・If the PWM signal is between 800μs～1400μs, the igniter power switch is off (standby mode).When the PWM signal is between 1600μs～2200μs, the igniter will be powered on. When the ECU is started, if the PWM signal is not between 800μs～1400μs, It will not turn on unless it is put into standby mode for 800μs to 1400μs. **Specification** PWM signal : 800μs～2200μs (*1) [W : Signal ／ B : GND] VIH=2.6V, VIL=0.4V, MAX5.5V

*1.The period of the PWM signal input to EC-22 should be 10 to 20 ms (50 to 100 Hz).
*2.The throttle is controlled by the ECU, so no external signal input is required.

Wiring color

R	Red	G	Green
W	White	Y	Yellow
B	Black	L	Blue

《About connection via S.BUS》

・The ECU top side has 2 connecting terminals for FUTABA S.BUS2. One of them can be used to input the four signals listed on the previous page, such as the starter signal, from a receiver or flight controller.+5V is supplied from the power pin. If connecting a device that does not require power supply, do not connect the power pin.

・By using S.BUS, the signal input to the ECU can be integrated to one wire, eliminating the need for the PWM signal harness on CN1.

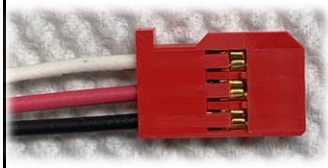
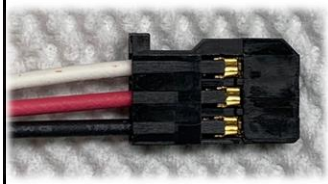
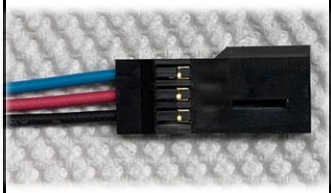
・Selection of S.BUS connection and setting of each signal channel are done by EC22-LINK. For the setting method, refer to the EC22-LINK section.

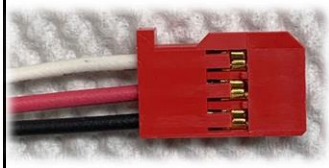
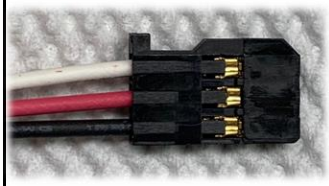
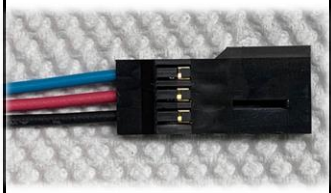
《About connection via RS-485》

・The ECU top side has a connecting terminal for RS485. By connecting RS485, it will be able to input 4 singals that were explained in the previous page such as starter signal, using a flight controller etc. By connecting this, CN1 signal harness will NOT be used.

・About selecting the connection and channel setting of each signal via RS485, refer to the EC22-LINK section.

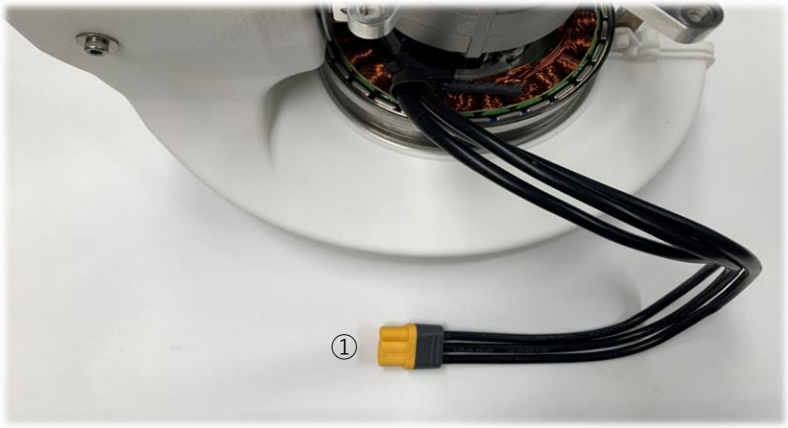
・About pin assignment and communication protocol, refer to communicating protocol(RS485) section.

[B]	B-1	 Cylinder head temperature sensor	・Connect to the temperature sensor of the cylinder head. **Specification** Thermistor resistance thermometer [Y : No polarity ／ W : No polarity]
	B-1	 Throttle servo	・Connect to Throttle servo. **Specification** PWM signal W : Signal ／ R : DC+5V ／ B : GND]
	B-1	 Choke servo	・Connect to Choke servo. **Specification** PWM signal Y : Signal ／ R : DC+5V ／ B : GND]
	B-1	 Ignition signal	・Connect to the rotation signal input cable for the ignitor. ・DC6V power that ECU need to send on/off command is supply to ignitor. **Specification** [W : Signal ／ R : DC+6V ／ B : GND]
	B-1	 Crankshaft rotation sensor	・Connect to rotation sensor. **Specification** Hall-effect switch. [W : Signal ／ R : DC+5V ／ B : GND]
	B-2	 SGC	・Connect to SGC-1095HV. **Specification** PWM signal for SGC Control [L : Signal ／ R : DC+5V ／ B : GND]

[C]	C-1	 Cylinder head temperature sensor	・Connect to the temperature sensor of the cylinder head. **Specification** Thermistor resistance thermometer [Y : No polarity ／ W : No polarity]
	C-1	 Throttle servo	・Connect to Throttle servo. **Specification** PWM signal W : Signal ／ R : DC+5V ／ B : GND]
	C-1	 Choke servo	・Connect to Choke servo. **Specification** PWM signal Y : Signal ／ R : DC+5V ／ B : GND]
	C-1	 Ignition signal	・Connect to the rotation signal input cable for the ignitor. ・DC6V power that ECU need to send on/off command is supply to ignitor. **Specification** [W : Signal ／ R : DC+6V ／ B : GND]
	C-1	 Crankshaft rotation sensor	・Connect to rotation sensor. **Specification** Hall-effect switch. [W : Signal ／ R : DC+5V ／ B : GND]
	C-2	 SGC	・Connect to SGC-1095HV. **Specification** PWM signal for SGC Control [L : Signal ／ R : DC+5V ／ B : GND]

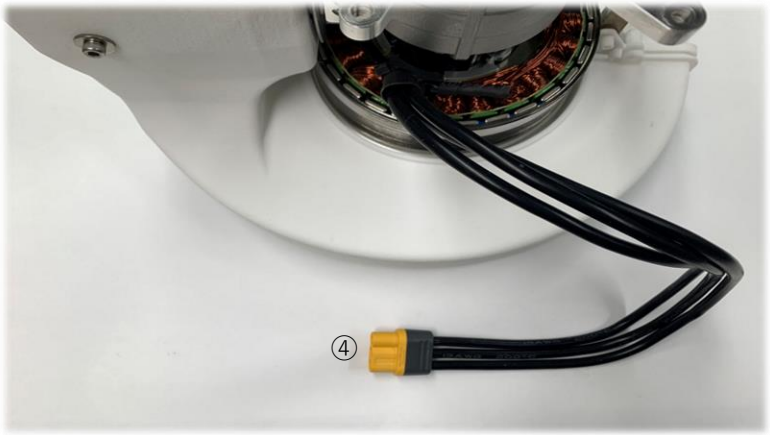
Connection

SGM-9020[A]



①	 SGM-9020	・Connect to the MR60 (M) connector of the SGC-1095HV[A]. **Specification** connector : MR60(F) ・3-phase AC

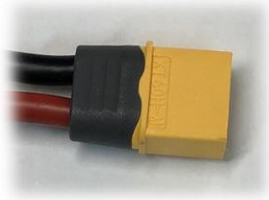
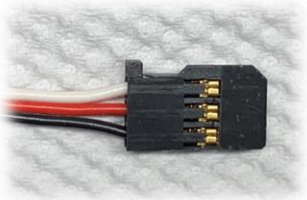
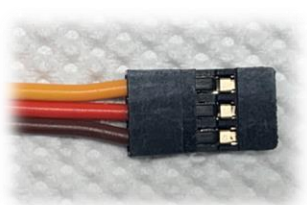
SGM-9020[B]



④	 SGM-9020	・Connect to the MR60 (M) connector of the SGC-1095HV[B]. **Specification** connector : MR60(F) ・3-phase AC

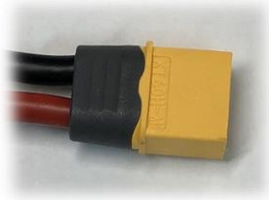
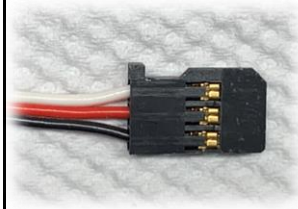
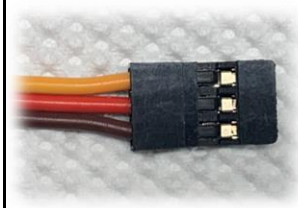
Connection

SGC-1095HV[A]

①	 SGC-1095HV	・Connect to the MR60 (F) connector of the SGM-9020[A] **Specification** connector : MR60(M) ・3-phase AC
②	 SGC-1095HV	・Connect to the XT60 (F) connector of the HUB-02. **Specification** connector : XT60(M) ・Power Input/Output
③	 SGC-1095HV	・Connect to the FUTABA Servo connector(M) of engine wiring harness[A]. **Specification** connector : FUTABA Servo connector(F) ・PWM [W : Signal ／ R : DC+5V ／ B : GND]
-	 SGC-1095HV	・Not Used. **Specification** ・Connector for factory settings.

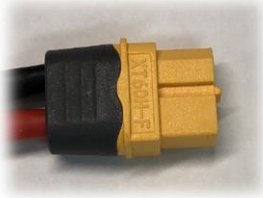
Connection

SGC-1095HV[B]

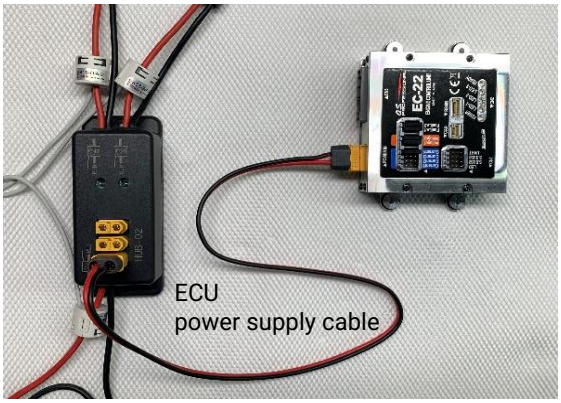
④	 SGC-1095HV	・Connect to the MR60 (F) connector of the SGM-9020[B] **Specification** connector : MR60(M) ・3-phase AC
⑤	 SGC-1095HV	・Connect to the XT60 (F) connector of the HUB-02. **Specification** connector : XT60(M) ・Power Input/Output
⑥	 SGC-1095HV	・Connect to the FUTABA Servo connector(M) of engine wiring harness[B]. **Specification** connector : FUTABA Servo connector(F) ・PWM [W : Signal ／ R : DC+5V ／ B : GND]
-	 SGC-1095HV	・Not Used. **Specification** ・Connector for factory settings.

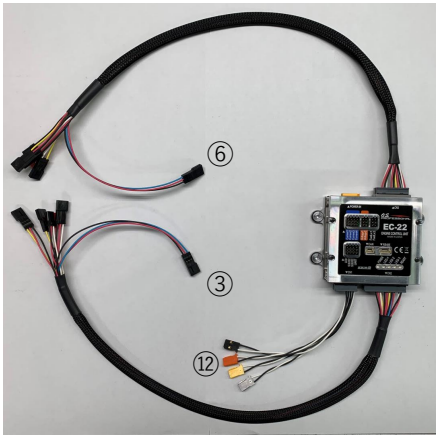
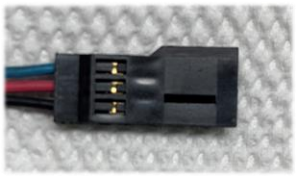
Connection

HUB-02

⑦	 HUB-02	・Battery connectors. ・Connect two 6 cell li-po batteries with capacity of 3000mAh or more to 2 pieces of XT60(F). ・There is no balance charging function. Must use two batteries in same condition. **Specification** connector：XT60(M) ・The two batteries are connected in series.
②	 HUB-02	・Connect to the XT60(M) connector of the SGC-1095[A]. ***Note: Be sure to connect to SGC-1095HV[A].** **Specification** connector：XT60(F)
⑤	 HUB-02	・Connect to the XT60(M) connector of the SGC-1095[B]. ***Note: Be sure to connect to SGC-1095HV[B].** **Specification** connector：XT60(F)
⑧	 HUB-02	・power supply connectors. ・All three connectors have the same specifications. ・Be sure to get power from one of these sources for the ECU. The voltage of battery is measured by checking the power supplied to the ECU. **Specification** connector：XT60(F)

Connection

<table>
<tr><td rowspan="6">EC-22</td><td colspan="3"> 


</td></tr>
<tr><td rowspan="2">③</td><td rowspan="2"> 
EC-22</td><td>・Connect to the FUTABA Servo connector(F) of the SGC-1095HV[A].</td></tr>
<tr><td>Specification connector：FUTABA Servo connector(M)
・PWM signal for SGC Control
[L：Signal ／ R：DC+5V ／ B：GND]</td></tr>
<tr><td rowspan="2">⑥</td><td rowspan="2"> 
EC-22</td><td>・Connect to the FUTABA Servo connector(F) of the SGC-1095HV[B].</td></tr>
<tr><td>Specification connector：FUTABA Servo connector(M)
・PWM signal for SGC Control
[L：Signal ／ R：DC+5V ／ B：GND]</td></tr>
<tr><td rowspan="2">⑫</td><td rowspan="2"> 
EC-22</td><td>・Input the PWM signal from the external device such as transmitter, flight controller etc. to start the starter motor. (*1)(*2)
・The starter goes into standby mode when the PWM signal is 800 µs to 1400 µs.
・The PWM signal drives the starter at 1600 µs to 2200 µs.</td></tr>
<tr><td>Specification connector：FUTABA Servo connector(F)

[W：Signal ／ B：GND] VIH=2.6V, VIL=0.4V, MAX5.5V</td></tr>
</table>

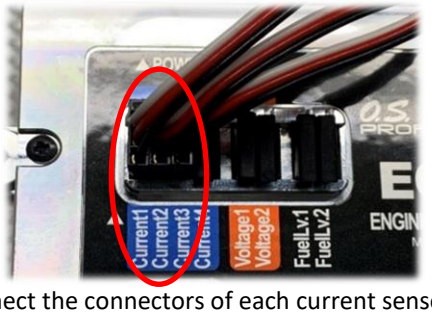
*1.Connection using FUTABA S.BUS is also possible. For information on connecting via S.BUS, please refer to the section "About connection via S.BUS".

*2.Connection using RS-485 is also possible. For information on connecting via RS-485, please refer to the section "About connection via RS-485".

Connection

SC-03

⑨	 SC-03 (CURRENT1)	・Clamp one SC-03 to the red lead of the battery. ・Please clamp in the direction shown in the illustration of HUB-02. ・This is the [CURRENT1] sensor. ・Connect this SC-03 connector (3P) to [CURRENT1] on the ECU.
⑩	 SC-03 (CURRENT2)	・Clamp the other SC-03 to the red lead wire on the SGC side. ・Please clamp in the direction shown in the illustration of HUB-02. ・This is the [CURRENT2] sensor. ・Connect this SC-03 connector (3P) to [CURRENT2] on the ECU.
⑪	 SC-03 (CURRENT3)	・Clamp the other SC-03 to the red lead wire on the SGC side. ・Please clamp in the direction shown in the illustration of HUB-02. ・This is the [CURRENT3] sensor. ・Connect this SC-03 connector (3P) to [CURRENT3] on the ECU.



・Connect the connectors of each current sensor to the sensor terminals on the top of the ECU.
・The current sensors can be opened by unlocking them.
・The sensors that connect to [CURRENT1] , [CURRENT2] and [CURRENT3] are identical but before initial use, connect the sensors to each channel and perform zero point calibration.
・The corrected value of zero point caliberation is memorized and remains undeleted in the ECU even the power is turned off. Once it is set, it doesn't need to be re-calibrated on every operation unless the sensor is replaced or the connected channel is changed.

Zero point calibration of current sensor

Before the initial start, the current sensors need zero point calibration connenting to each channel. The corrected value of zero point caliberation is memorized and remains undeleted in the ECU even the power is turned off. Once it is set, it doesn't need to be re-calibrated on every operation unless the sensor is replaced or the connected channel is changed.

【Equipment you need】
PC with Windows® (10/11) and USB port
The included U2S-2 (serial signal converter)
EC22-Calibration (application software)
Power for the ECU (Connect HUB-01 and a power cord to the battery you are actually using.)

・The included U2S-2 (serial signal converter) uses an FTDI chip, the driver is registered in Windows® Update. Therefore, in internet environment, the driver is automatically downloaded and installed by connecting the USB serial converter to the PC. Install the driver in advance in an internet environment.

・For EC22-Caliberation program, visit the URL below to go to download page.

URL
https://www.os-engines.co.jp/OS_professional/dll/index.html

【Installation of the software】
・Copy the EC22-Calibration_xxx.exe(xxxx:Version number) file to any file in the PC, then execute the file.
・When you intend to delete the software, just delete the EC22-Calibration_xxx.exe file.

【1】Connecting the U2S-2
・Connect the included U2S-2 3-pin connector to the UART connector on the top of the ECU.
・Connect the U2S-2 main unit to the USB port of the PC.

【2】Connecting Current sensors

・Connect current sensors to the ECU. Required current sensors are "CURRENT1" , "CURRENT2" and "CURRENT3". "CURRENT4" is optional.

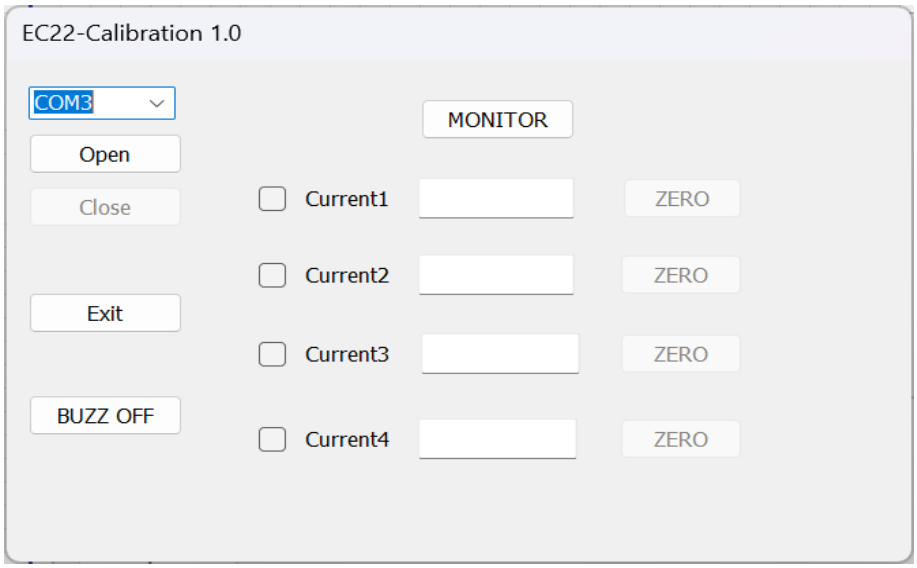
・Do not clamp the lead wire with the current sensor during the zero point calibration. The current sensor clamps must be closed.

【3】Turning of the ECU

・Turn on the ECU.

【4】Starting up the software

・ Execute the file EC22-Calibration_xxx.exe, which you copied to the PC. The following window will open.



【5】Confirmation of COM port assignment

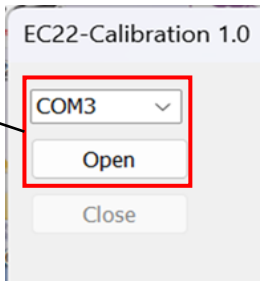
・Check which COM port the serial connection to the ECU is assigned using Windows® device manager. Refer to the operation manual of the Windows®.

・In case the serial connection is assigned to other than COM1～ COM20, assign it manually to one of them. Refer to the operation manual of the Windows® how to assign a COM port number.

【6】Setting of a COM port number

・Select the same COM port you have assigned from the pull down nenu. Then click [OPEN] and the connection is completed.

Select the same COM port number as you have confirmed by Device manager.



[Close] button

・For disconnecting a COM port connection. Do not click until you have finished using EC22-Calibration.

[Exit] button

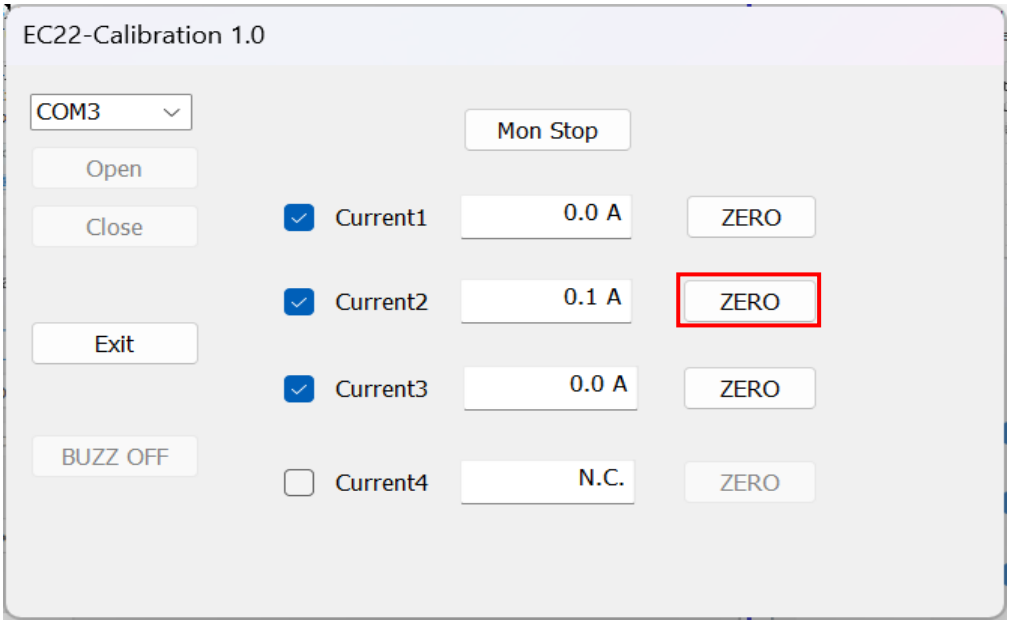
・For exiting EC22-Calibration.

【7】Zero point calibration

・Press [MONITOR] button. On default check boxes for Current1 , Current2 and Current3 are checked showing the current value of each sensor. In case the optional Current4 is connected, check the check boxes.

・With no lead wire clamped, the measurement should be 0.0A but if it shows differently, press ZERO button and make sure it shows 0.0A.

・This completes the procedures of Zero point calibration for current sensors. Press "Mon Stop" then "Close" button to close the port and then press "Exit"button to close EC22-Calibration.



NOTE:
・Using EC22-LINK, you can monitor the parameter data in real time and change the parameters.

《Preliminary arrangements》

【Equipment you need】

・PC with Windows® (10/11) and USB port. The included U2S-2 (serial signal converter) uses an FTDI chip, the driver is registered in Windows® Update. Therefore, in internet environment, the driver is automatically downloaded and installed by connecting the USB serial converter to the PC. Install the driver in advance in an internet environment.

【Installation of the software】

・There is no installation program for EC22-LINK.
・Copy the EC22-LINK_xxx.exe(xxxx:Version number) file to any file in the PC, then execute the file.
・When you intend to delete the software, just delete the EC22-LINK_xxx.exe file.

【Connecting】

・Connect the included U2S-2 3-pin connector to the UART connector on the top of the ECU.
・Connect the U2S-2 main unit to the USB port of the PC.

・Connect the ECU to the engine.

・EC22-LINK can be activated without connecting any sensors to the ECU.

《Connecting to EC22-LINK》

【1】Connecting the ECU to the engine

・Check the connectors of both the ECU and the engine.

【2】Connecting the ECU to the PC

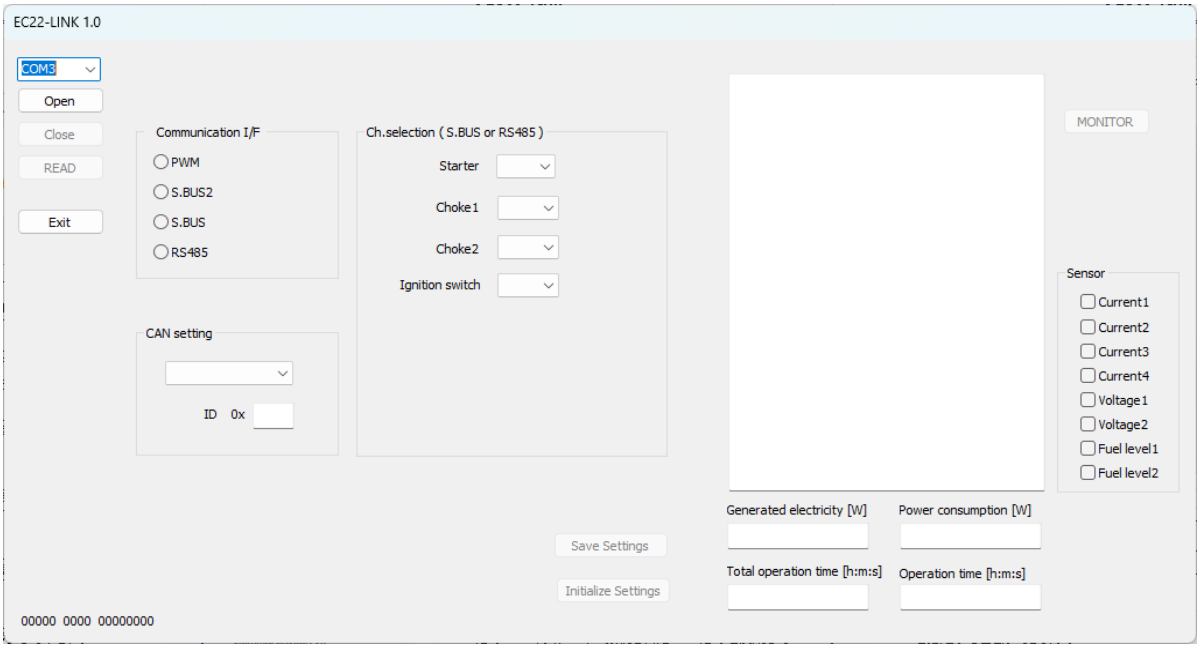
・Check the connection of the ECU and the PC.

【3】Turning of the ECU

・Turn on the ECU.

【4】Starting up the software

・Execute the file EC22-LINK_xxx.exe, which you copied to the PC. The following window will open.



【5】Confirmation of COM port assignment

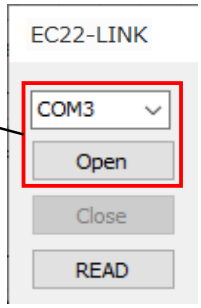
・Check which COM port the serial connection to the ECU is assigned using Windows® device manager. Refer to the operation manual of the Windows®.

・In case the serial connection is assigned to other than COM1～ COM20, assign it manually to one of them. Refer to the operation manual of the Windows® how to assign a COM port number.

【6】Setting of a COM port number

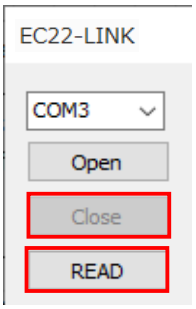
・Select the same COM port you have assigned from the pull down nenu. Then click [OPEN] and the connection is completed.

Select the same COM port number as you have confirmed by Device manager.



[Close] button

・For disconnecting a COM port connection. Do not click until you have finished using EC22-LINK.



[READ] button

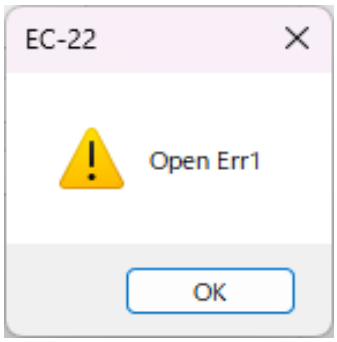
・For reading the current setting value in the ECU

[Exit] button

・For exiting EC22-LINK

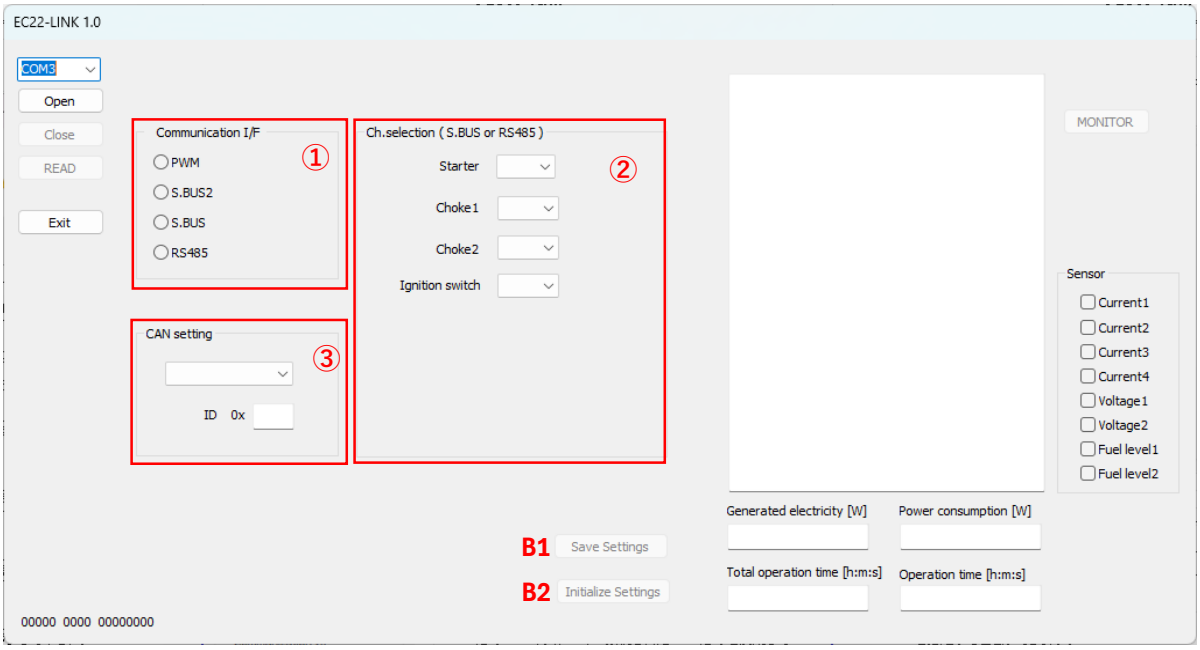
【ERROR MESSAGE】

・The following are error messages and what they mean.



Open Err1	① The serial port does not open. ② Check if the COM number of the serial port is correct. ③ Check the connection between the ECU and the PC.
RES TO	① Response signals from EC-22 are not received. ② Check if the ECU is turned on and electric power is properly supplied. ③ Check the connection between the ECU and the PC.
Now Open	① The serial port is open. ② Click [OK] button and continue the operation.
Open Err2	① Failed to acquire the serial port settings from the PC. ② Check the connection between the ECU and the PC.
Open Err3	① Failed the serial port setting in the PC. ② Check the connection between the ECU and the PC.
Open Err10	① The serial port is still closed. Open the serial port.
RES SUM ERR	① There is an error in the received data from the ECU. ② Check the connection between the ECU and the PC.

《Setting of the each value》

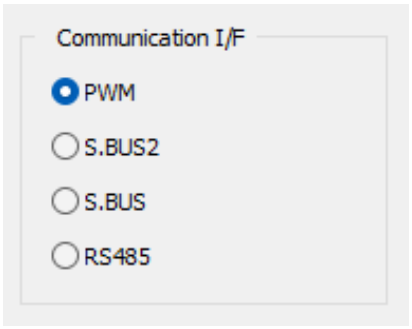


Input parameters in the edit boxes shown above (①～③), and click B1[Save Setting] to transfer the data to the ECU memory. You can initialize the settings by clicking B2 [Initialize Setting] button to return to the default settings.Turning off the ECU without doing so causes loss of all the input parameters.

【Setting Items】

①Communication I/F

Select the interface for sending commands to the ECU. Default is PWM.



・PWM

Select this when sending commands to the ECU using the PWM signals connected to the PWM signal harness(CN1).

・S.BUS2

Select this when sending commands to the ECU using the S.BUS2 singals after connecting to the S.BUS2 connector. Select this if you are using S.BUS2 which uses the telemetry function.

・S.BUS

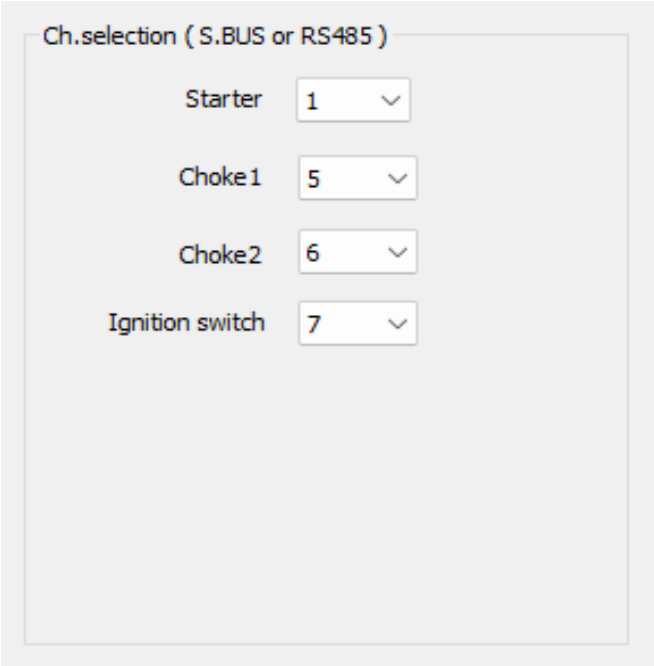
Select this when sending commands to the ECU using the S.BUS singals after connecting to the S.BUS2 connector. Select this if you are using S.BUS which does not use the telemetry function.

・RS485

Select this when sending commands to the ECU using serial signals after connecting to the RS485 connector.

②Ch. selection(S.BUS or RS485)

In ①, if S.BUS2, S.BUS or RS485 is selected, set the channels for each signal: Starter signal input, Choke1 signal input, Choke2signal input and Ignition ON/OFF signal input.
When selecting, you can set one channel from 1 to 24.

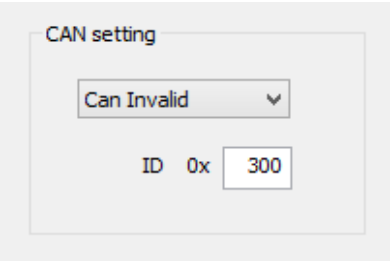


③CAN Setting

Select CAN Invalid or communication speed from the pull-down menu.
・Communication speed can be selected from 125Kbps, 250Kbps, 500Kpbs，1Mbps and CAN Invalid.
・If the communication speed is specified, CAN will be valid and the ECU will send data for ID: 0x300 to 0x31B(default) only once at intervals of about 100ms. With this CAN system, the data cannot be resent in case of an error.
・Refer to page 48 for the data format.

Determine and input the start point of CAN ID.
・0x0～0x7FF can be used.
・The CAN communication occupies 28 IDs including the start point.
・If 0x7FF is set, 28 IDs, 0x7FF, 0x0, 0x1, ... 0x1A, will be occupied.
・Do not use the same ID of other devices connected to the CAN.

Turn off the ECU and turn it on again to make the setting valid.



《MONITOR》

・Press [MONITOR] button with the ECU connected to the PC, and you can monitor the updated information in the ECU. To exit the MONITOR mode, click [Mon Stop] button.
([MONITOR] button is switched to [Mon Stop] during the MONITOR mode).

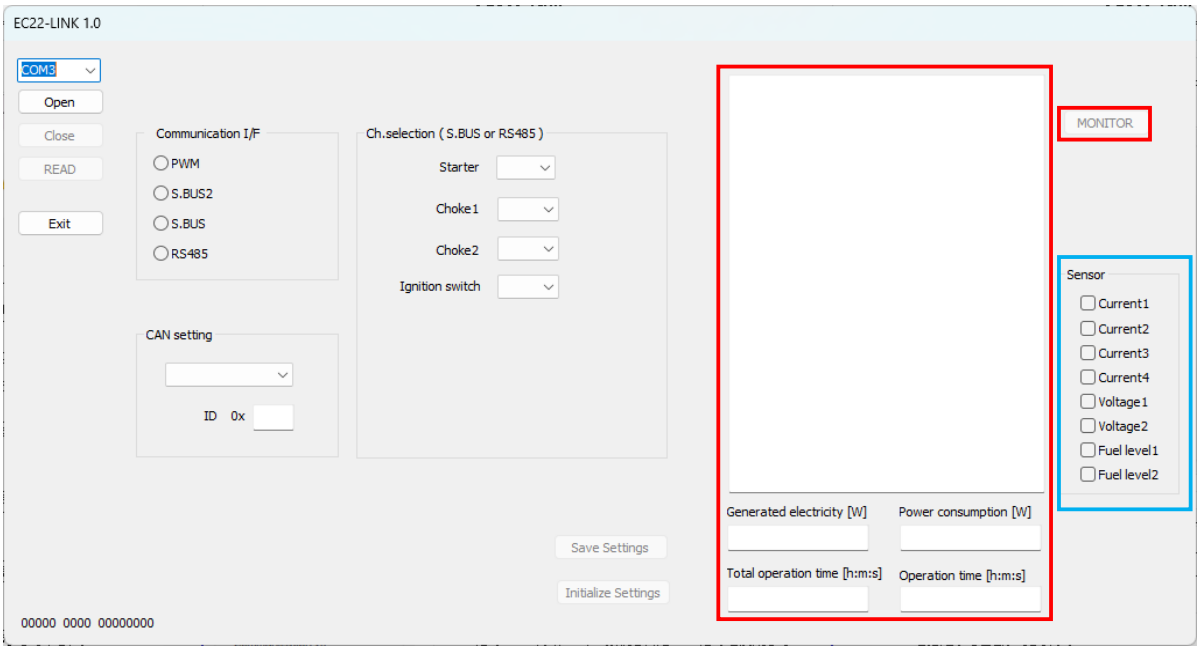


Fig.8.1

【Information shown during the MONITOR mode】

(1) Temperature1 [℃]
Temperature measured by the temp. sensor in the cylinder heads of the engine[A].

(2) Temperature2 [℃]
Temperature measured by the temp. sensor in the cylinder headsof the engine[B].

(3) Set Rotation1 [rpm]
Revolutions setting of the engine[A] per minute.

(4) Set Rotation2 [rpm]
Revolutions setting of the engine[B] per minute.

(5) Rotation1 [rpm]
Revolutions of the engine[A] per minute.

(6) Rotation2 [rpm]
Revolutions of the engine[B] per minute.

(7) Throttle signal1 [%]
The signal output to the throttle servo of the engine[A] ; how much throttle is open, is shown as 0% through 100%.

(8) Throttle signal2 [%]
The signal output to the throttle servo of the engine[B] ; how much throttle is open, is shown as 0% through 100%.

(9) Generated power1 [W]
It shows the generated power by SGM-9020[A].

(10) Generated power2 [W]
It shows the generated power by SGM-9020[B].

(11) Pressure [hPa]
Atmospheric pressure measured by the sensor in the ECU.

(12) Altitude [m]
Altitude measured by the sensor in the ECU.

(13) 12V Voltage [mV]
Voltage of the 12V power supply line of the ECU.

(14) 5V Voltage [mV]
Voltage of the 5V power supply line of the ECU.

(15) 3.3V Voltage [mV]
Voltage of the 3.3V power supply line of the ECU.

(16) Power voltage [V]
Voltage of the power line supplied to the ECU. (Battery voltage)

(Sensor measurement)

The measured value of the following articles (17)~(22) are shown on the display when the sensors are connected to the connection terminal on top of the ECU. (17)Current 1 , (18)Current 2 and (19)Current 3 have to be connected for power generation control. Eveything else is optional. In Fig 8.1, in the blue box, by putting a check on check boxes, you can select an item, which can be shown on the display.

(17) Current1 (Battery charging) [A]
It's the value of the current sensor, which is connected to the Current 1's connection sensor, and is measuring the battery current. It's positive when the battery is charged and negative when the battery is discharged.

(18) Current2 (Power generation1) [A]
It's the value of the current sensor, which is connected to the Current 2's connection sensor, and is measuring the current of the SGC-1095HV[A]. It's positive during the power generation and negative when the starter motor is driven.

(19) Current3 (Power generation2) [A]
It's the value of the current sensor, which is connected to the Current 3's connection sensor, and is measuring the current of the SGC-1095HV[B]. It's positive during the power generation and negative when the starter motor is driven.

(20) Current4 [A]
When an optional SC-03 current sensor is connected to Current 4's connection terminal, the DC current up to ±80A can be measured and monitored.

(21) Voltage1 [V], Voltage2 [V]
By connecting an optional SV-01 power sensor to the connect terminal of Voltage 1 or Voltage 2 , the voltage up to DC100V can be monitored.

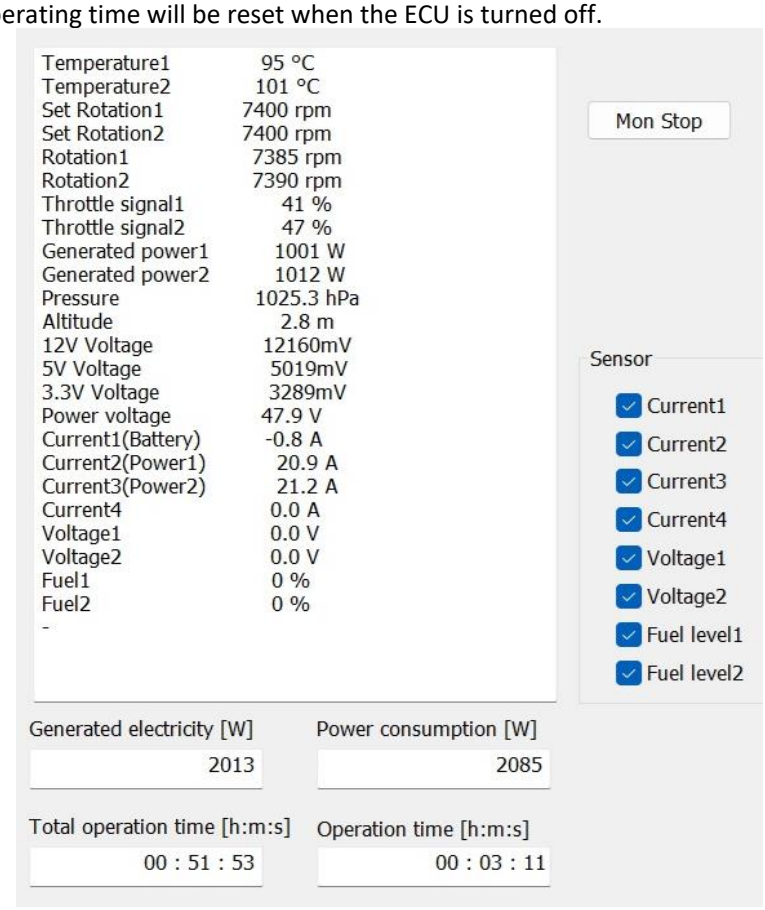
(22) Fuel level1 [%], Fuel level2 [%]
By connecting an optional SFL-01 fuel sensor to the connect terminal of FuelLv.1 or FuelLv.2, the remaining fuel(by measuring the height of fuel in the tank) can be monitored.

(23) Generated electricity[W]
It shows the total generated power by SGM-9020[A] and SGM-9020[B].

(24) Power consumption[W]
It shows the power consumption from the power supply connectors of HUB-02.

(25)Total operation time[h:m:s]
It shows the total operating time from the factory delivery. When engine is off, operating time is not counted.

(26) Operation time [h:m:s]
When the ECU is turned on, display will show the operating time. Operating time will not be counted when engine is off. Operating time will be reset when the ECU is turned off.



(Display example)

STARTING THE ENGINE

(1)Choke

① Turn on the transmitter.
② Turn on the UAV switch.
③ Turn on the ignitor switch.The pilot lamp of the LED harness will light up red.
④ Fully close the choke servo of engine A.
⑤ Run the engine starter until you hear first detonations. (See the following "Note").
⑥ Fully open the choke servo of engine A.
⑦ Fully close the choke servo of engine B.
⑧ Run the engine starter until you hear first detonations. (See the following "Note").
⑨ Fully open the choke servo of engine B.

Note: Listen carefully to the first detonations. If everything goes well, you will hear the first detonations within 2 – 3 seconds after running the starter. In case you hear no detonations for 5 seconds or longer, make sure the above (1). (2) procedures again.

(2)Starting the engine

① Make sure the igniter power is ON and the choke servo is open on both engine A and engine B.
② Run the starter.Engines A and B will automatically start at the same time.(In case the engine does not start after a few trials, return to the procedure (1). (2) and repeat the procedure.

(3)What to do when the engine does not start

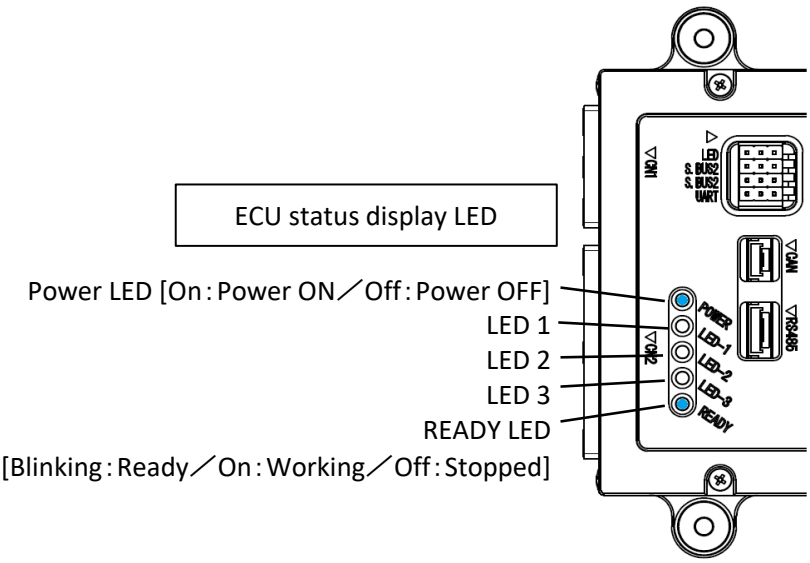
Probably the followings are the causes.
・Fuel mixture is thick due to over-choke
・Fuel mixture is thin due to insufficient choke
・Ignitor does not work because the switch is turned off

In case all the above are not the causes, try the followings.
① Check the ignitor switch. It has to be turned ON. Check the on-board ignitor switch and the engine kill switch. Check if the battery is fully charged. Check the electric cables and connectors.
② Check if the engine is over-choked. Remove the spark plug and check if the ground electrode is soaked with gasoline.
In case of over-choke, follow the procedures below.
❶ Turn off the ignitor.
❷ Remove the plug can and the spark plug from the engine.
❸ Fully open the choke valve.
❹ Run the starter for 10 seconds.
❺ Wipe the spark plug up the gasoline or blow compressed air to dry it.
❻ Install the spark plug and the plug cap in the engine.
③ Check if the engine is sufficiently choked. (If the ground electrode is not moistened, or you do not smell gasoline from the exhaust outlet, the engine is not sufficiently choked.
In case the carburetor is not sufficiently choked after repeating the procedures (1) – (2), the system should be malfunctioning. Also Check the dust in the fuel filter.
After checking all the above and still the choking problem continues, disassemble the carburetor and clean it according to the maintenance manual.

・the followings are display LED message's meaning.

	Power LED	LED 1	LED2	LED3	READY LED	
engine start mode	On	Off	Off	Off	Blink	
engine operation	On	Blink	Blink	On	On	(note.1)
engine stop	On	Off	Off	Off	Off	
System error 1	On	Blink	Blink	Blink	Blink	
System error 2	On	Off	Blink	Blink	Off	

Note.1 since the LED1, LED2 and LED3 are the monitor lamp of each signal, so they flashes at high speed during engine operation.



Information about each LED during operation

LED1	Crankshaft rotation sensor signal input of the engine[A]
LED2	Crankshaft rotation sensor signal input of the engine[B]
LED3	Igniter started signal output

WARMING UP THE ENGINE

As a carburetor type, the engine sometimes hesitates, stalls, and has unstable idling when Cylinder Head Temperature (CHT) is low, below 50℃. Warm up for about 1 minute.

ADJUSTMENT OF THE CARBURETOR

(1) We ran the engine and adjusted the carburetor before shipment. So it should work flawlessly except for using it in unusual conditions: operation in extremely cold/hot temperature, using extremely thick/thin oil etc. Adjust the carburetor only when you encounter the following issues.

① The engine starts but stalls as the throttle is opening.

② The rpm of the engine reaches the set value of the governor, but the engine stalls, or the rpm goes down lower than the set rpm of the governor when it is switched to “Generator Mode”.

③ Although the electric power generation is lower than the fixed rate 1.0kW, the CHT rises up to 140℃ or higher.

④ The rpm of the engine gradually comes down during continuous idling, and the engine stalls at last.

⑤ The CHT does not rise up to 80℃ or higher although the engine is generating enough electricity.

⑥ The rpm of the engine fluctuates 300rpm or more against the set value of the governor under the constant load.

⑦ The throttle servo opens 70% or more constantly with the CHT lower than 140℃ under the constant load.

(2) Adjustment range of the slow needle and the high needle

Fig.9.1 shows the adjustment range.

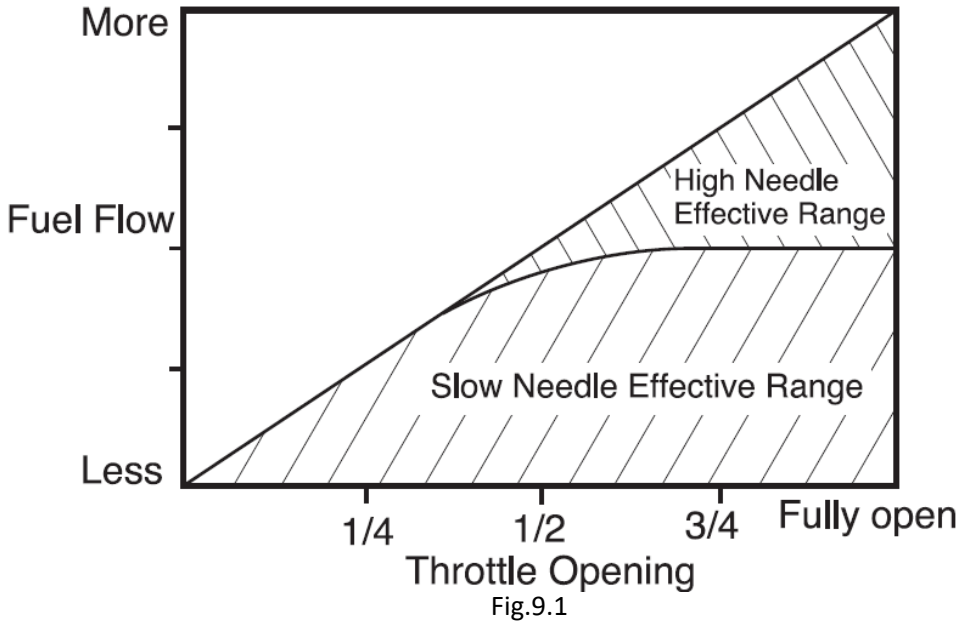


Fig.9.1

Fig 9.1 shows the slow needle affects even full throttle range and the high needle has an effect even to 1/4 throttle opening. Both needles give an effect each other in a wide range generally for gasoline engine carburetors, so both needles need to be adjusted for fine tuning. Adjust the slow needle first, then the high needle.

(3) The default setting of the slow and the high needle.
The following are the default settings.
Slow needle: 2.0 turns from the fully closed position (2 turns)
High needle: 1.5 turns from the fully closed position (1-1/2 turns)
When you are at a loss in adjustment, or after disassembling the carburetor for maintenance, start the adjustment from the default needle position.

(4) Adjustment of the slow needle
① Set the needle at the default position and make sure the issues in the above, "ADJUSTMENT OF THE CARBURETOR (1) ①～③" do not happen or solved. In case the troubles are not solved, check the fuel filter, the fuel tubes, or the fuel tank if dusts are clogged in it.
② Adjust the payload to make the electric power generation about 1.0kW during hovering.
③ Keep hovering around 10 minutes and check the CHT. If it is 130～140℃(about outside temperature +110℃), the slow needle adjustment is completed.
④ In case the CHT is 140℃ or higher, open the needle 30 degrees (turn CCW, counter-clockwise) and repeat the above procedure ③ until it is improved.
⑤ In case the CHT is 130℃ or lower, close the needle 30 degrees (turn CW, clockwise) and repeat the above procedure ③ until it is improved.

(5) Adjustment of the high needle
After completing the adjustment of the slow needle, the engine works fine most of the time with the high needle at the default setting. Proceed the following procedures only when you have an issue with the default setting of the high needle.
① Fix the UAV to the ground not to hover and fly.
② Start the engine for warming up.
③ Try to hover the UAV with fixing it to the ground.
④ Try to hover with full power. Check if the rpm of the engine and the set rpm of the governor shows the same value. The CHT necessarily becomes higher during adjustment of the high needle, and the engine tend to overheat. Keep the maximum engine output shorter than 10 seconds when you adjust the high needle.
⑤ Stop trying to hover and keep the engine at idling. Close the high needle 30 degrees (turn CW).
⑥ Repeat the above procedures ③～⑤ and find out a position at which the rpm of the engine comes down lower than the set rpm of the governor. The best high needle position is 90 degrees open (turn CCW)from the high needle position you have found out.
Note: The CHT necessarily becomes higher during adjustment of the high needle, and the engine tend to overheat. Keep the maximum engine output shorter than 10 seconds when you adjust the high needle.

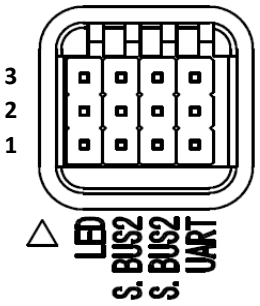
・The internal data of the ECU can be collected by other external devices through its serial communication function.

《communication specification》

・UART ・TTL logic level 3.3V

・Pin assignment (ECU side connector)

1	GND
2	RXD
3	TXD



・Connector : FUTABA servo connector

・Protocol

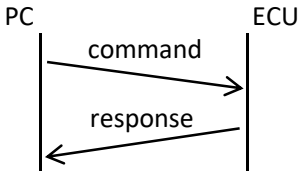
Bit rate	38,400 bps
Data length	8 bit
Parity bit	none
Stop bit	1bit
Flow control	none
Frame length	changeable

NOTE:

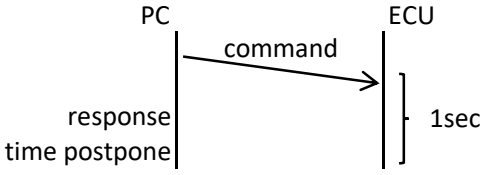
If power is required, the adjacent S.BUS2 pin 2 is DC +5V. You can use it if it is free. (MAX300mA)

《communication procedure》

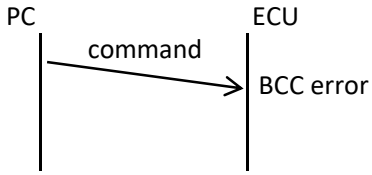
・normal



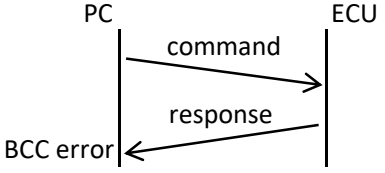
・abnormal (response postpone)



・abnormal（command BCC error）



・abnormal（response BCC error）



《Command》

Command【MON】 Reads 28 items of ECU internal information.

・command format

item	size	data (ASCII)	range
start mark	1byte	STX	0x02
command	3byte	"MON"	0x4D,0x4F,0x4E
end mark	1byte	ETX	0x03
BCC（XOR from command to end mark）	1byte	"O"	0x4F

・response format

item			size	data (ASCII)	range
start mark			1byte	STX	0x02
status			1byte	”0”	0x30
DATA			1byte	” ”	0x20
	① cylinder head temperature1	unit: ℃	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	② cylinder head temperature1	unit: ℃	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	③ engine rotation setting speed1	unit: rpm	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	④ engine rotation setting speed2	unit: rpm	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑤ engine rotation speed1	unit: rpm	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑥ engine rotation speed12	unit: rpm	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑦ signal output to throttle servo1 (fully close～fully open 0%～100%)	unit: %	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑧ signal output to throttle servo2 (fully close～fully open 0%～100%)	unit: %	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑨ Generated electricity1	unit: W	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑩ Generated electricity2	unit: W	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑪ Atmospheric pressure	unit: hPa	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑫ Altitude(from the point where the ECU is powered on)	unit: m	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)

Continued on next page

Continued from the previous page

DATA			1byte	” ”	0x20
	⑬ power supply (ECU internal 12V)	unit: mV	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑭ power supply (ECU internal 5V)	unit: mV	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑮ power supply (ECU internal 3.3V)	unit: mV	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑯ power supply (Battery voltage)	unit: dV	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑰ Current(Current1) (Battery Charging Current)	unit: dA	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑱ Current(Current2) (Generated current)	unit: dA	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑲ Current(Current3) (Generated current)	unit: dA	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	⑳ Current(Current4) (Option) *1	unit: dA	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉑ Voltage(Voltage1) (Option) *1	unit: dV	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉒ Voltage(Voltage2) (Option) *1	unit: dV	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉓ Fuel Level Sensor(Fuel Level1) (Option) *1	unit: %	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉔ Fuel Level Sensor(Fuel Level2) (Option) *1	unit: %	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉕ Generated electricity	unit: W	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉖ Power consumption	unit: W	4byte	”8000”～”7FFF”	0x8000～0x7FFF (-32768～32767)
			1byte	” ”	0x20
	㉗ Total operation time	unit: sec	8byte	”00000000”～ ”FFFFFFFF”	0x00000000～0xFFFFFFFF (0～4294967295)
			1byte	” ”	0x20
	㉘ Operation time (After ECU startup)	unit: sec	8byte	”00000000”～ ”FFFFFFFF”	0x00000000～0xFFFFFFFF (0～4294967295)
	Null-terminated string		1byte	NUL	0x00
end mark			1byte	ETX	0x03
BCC（XOR from status to end mark）			1byte		

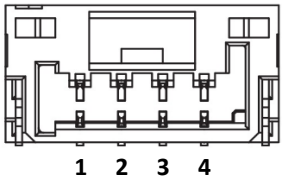
・The internal data of the ECU can be collected by other external devices through its CAN communication function. The communication protocal would show as followings.

《communication specification》

・CAN

・Pin assignment (ECU side connector)

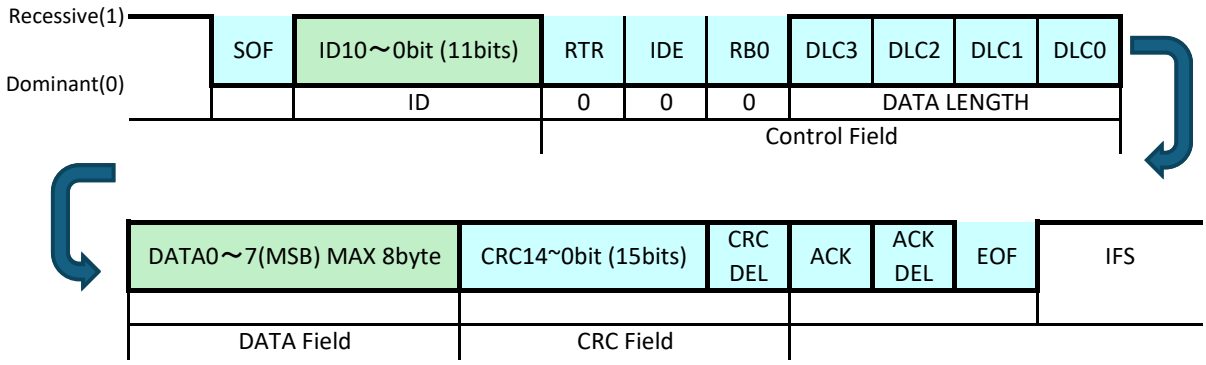
1	+5V power supply output
2	Signal(High)
3	Signal(Low)
4	GND



・Connector : JST-GH (4pin) 4 pin JST-GH

《data format》

・Data frame



・DATA

NAME	ID		DATA LENGTH	DATA 0～7		DATA RANGE
				0～5	6～7	
Head temperature1（℃）	768	0x0300	8	0x000000000000	DATA	0x8000 (-32768) ～ 0x7FFF (32767)
Head temperature2（℃）	769	0x0301	8	0x000000000000	DATA	
Set Rotation1（rpm）	770	0x0302	8	0x000000000000	DATA	
Set Rotation2（rpm）	771	0x0303	8	0x000000000000	DATA	
Rotation1（rpm）	772	0x0304	8	0x000000000000	DATA	
Rotation2（rpm）	773	0x0305	8	0x000000000000	DATA	
Throttle signal output1（%）	774	0x0306	8	0x000000000000	DATA	
Throttle signal output2（%）	775	0x0307	8	0x000000000000	DATA	
Generated power1(W)	776	0x0308	8	0x000000000000	DATA	
Generated power2(W)	777	0x0309	8	0x000000000000	DATA	
Pressure (hPa）	778	0x030A	8	0x000000000000	DATA	
Altitude(m(x10))	779	0x030B	8	0x000000000000	DATA	
12V Voltage（mV）	780	0x030C	8	0x000000000000	DATA	
5V Voltage（mV）	781	0x030D	8	0x000000000000	DATA	
3.3V Voltage（mV）	782	0x030E	8	0x000000000000	DATA	
Power voltage(V)	783	0x030F	8	0x000000000000	DATA	
Current1(Battery Charging Current)(dA)	784	0x0310	8	0x000000000000	DATA	
Current2(Power generation current1)(dA)	785	0x0311	8	0x000000000000	DATA	
Current3(Power generation current2)(dA)	786	0x0312	8	0x000000000000	DATA	
Current4(Option)(dA)	787	0x0313	8	0x000000000000	DATA	
Voltage1(Option)(dV)	788	0x0314	8	0x000000000000	DATA	
Voltage2(Option)(dV)	789	0x0315	8	0x000000000000	DATA	
Fuel Level1(Option)(%)	790	0x0316	8	0x000000000000	DATA	
Fuel Level2(Option)(%)	791	0x0317	8	0x000000000000	DATA	
Generated electricity(W)	792	0x0318	8	0x000000000000	DATA	
Power consumption(W)	793	0x0319	8	0x000000000000	DATA	
NAME	ID		DATA LENGTH	DATA 0～7		DATA RANGE
				0～3	4～7	
Total operation time（sec）	794	0x031A	8	0x00000000	DATA	0x00000000 (0) ～ 0xFFFFFFFF (4294967295)
Operation time（sec）	795	0x031B	8	0x00000000	DATA	

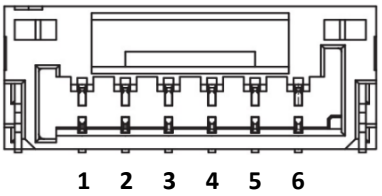
・The internal data of the ECU can be collected by other external devices through its RS485 serial communication function.
・By using RS485 serial communication funcion on the ECU, it can send indicated value to the ECU.

《communication specification》

・RS485

・Pin assignment (ECU side connector)

1	RXD(+)
2	RXD(-)
3	TXD(-)
4	TXD(+)
5	+5V power supply output
6	GND



6 pin JST-GH

・Connector : JST-GH (6pin)

・Protocol

Bit rate	115,200bps
Start bit	1bit
Data length	8bit
Stop bit	1bit
Parity	Even parity
Byte order	LSB first
Frequency	Sending 10Hz/Receiving 70Hz

【Real-time data reception (Input indicated value to the ECU)】

PWM signal used in the RC receiver's pulse width is converted to a value using the conversion table below, then sent and input to the ECU. Channels range from 1 to 24. Selecting RS485 and allocating each signal are performed by EC22-LINK. For how to set up, refer to EC22-LINK section.

・Conversion table

PWM Pulse width	Value
880µsec(minimum)	0x0000
1520µsec(Center)	0X0400
2160µsec(maximum)	0x07FF

■Starter signal input

At 1000µsec～1400µsec(0x0C0～0x0340), the starter will be in standby mode.
At 1600µsec～2000µsec(0x0480～0x0700), it drives the starter.

■Choke1 signal input

1100µsec(0x0160)Choke valve minimum output～1940µsec(0x06A0)Choke valve maximum output.

■Choke2 signal input

1100µsec(0x0160)Choke valve minimum output～1940µsec(0x06A0)Choke valve maximum output.

■Ignition ON/OFF signal input

At 1000µsec～1400µsec(0x0C0～0x0340), the igniter power switch will be OFF(stand by mode).
At 1600µsec～2000µsec(0x0480～0x0700) it power the igniter.
At the ECU start up, if its under 1000µsec～1400µsec(0x0C0～0x0340), it will not turn on unless you send (0x0C0～0x0340) and put it into standby mode.

・Packet

Name	Real-time data reception (sending indication values to ECU)
Category	Operation
Size	53Byte
Packet transmission time	5.061ms
Frequency	70Hz

No.	Item	Size (Byte)	Content	Remark
1	Header	1	0xAA (fixed)	A fixed value that indicates the beginning of the data.
2	length	1	0x30(fixed)	Total data size from No.3 to No.26.(fixed)
3	data_ch1	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
4	data_ch2	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
5	data_ch3	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
6	data_ch4	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
7	data_ch5	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
8	data_ch6	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
9	data_ch7	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
10	data_ch8	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
11	data_ch9	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
12	data_ch10	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
13	data_ch11	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
14	data_ch12	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
15	data_ch13	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
16	data_ch14	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
17	data_ch15	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
18	data_ch16	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
19	data_ch17	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
20	data_ch18	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
21	data_ch19	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
22	data_ch20	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
23	data_ch21	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
24	data_ch22	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
25	data_ch23	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
26	data_ch24	2	0x0000(880usec)~0x07FF(2160usec)	unused (0x0400 fixed)
27	Footer	1	0xFF (fixed)	A fixed value that indicates the end of the data.
28	CRC	2		CRC-16-CCITT(Header to Footer)

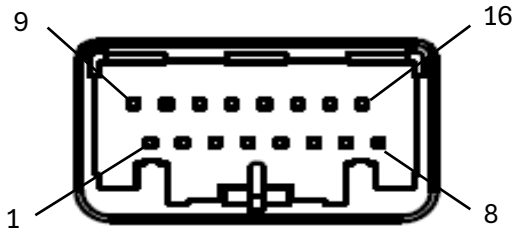
・Packet

Name	Real-time data transmission (receiving data from ECU)
Category	Sensors
Size	65Byte
Packet transmission time	6.207ms
Frequency	10Hz

No.	Item	Size (Byte)	Content	Remark
1	Header	1	0xAA (fixed)	A fixed value that indicates the beginning of the data.
2	length	1	0x3C(fixed)	Total data size from No.3 to No.30.(fixed)
3	Head temperature1	2	0x8000(-32,768 ℃) ~0x7FFF(+32,767 ℃)	Cylinder head temperature1
4	Head temperature2	2	0x8000(-32,768 ℃) ~0x7FFF(+32,767 ℃)	Cylinder head temperature2
5	Set Rotation speed1	2	0x8000(-32,768 rpm) ~0x7FFF(+32,767 rpm)	Engine rotation setting speed1
6	Set Rotation speed2	2	0x8000(-32,768 rpm) ~0x7FFF(+32,767 rpm)	Engine rotation setting speed2
7	Rotation speed1	2	0x8000(-32,768 rpm) ~0x7FFF(+32,767 rpm)	Engine rotation speed1
8	Rotation speed2	2	0x8000(-32,768 rpm) ~0x7FFF(+32,767 rpm)	Engine rotation speed2
9	Throttle signal output1	2	0x8000(-32,768 %) ~0x7FFF(+32,767 %)	Signal output to throttle servo1.(fully close～fully open 0%～100%)
10	Throttle signal output2	2	0x8000(-32,768 %) ~0x7FFF(+32,767 %)	Signal output to throttle servo2.(fully close～fully open 0%～100%)
11	Generated power1	2	0x8000(-32,768 W) ~0x7FFF(+32,767 W)	Generated electrictty1
12	Generated power2	2	0x8000(-32,768 W) ~0x7FFF(+32,767 W)	Generated electrictty2
13	Atmospheric pressure	2	0x8000 (-3,276.8 hPa) ~0x7FFF (3,276.7 hPa)	Barometric pressure
14	Altitude	2	0x8000 (-3,276.8 m) ~0x7FFF (3,276.7 m)	Altitude(from the point where the ECU is powered on)
15	12V voltage	2	0x8000(-32,768 mV) ~0x7FFF(+32,767 mV)	Power supply voltage (ECU internal 12V)
16	5V voltage	2	0x8000(-32,768 mV) ~0x7FFF(+32,767 mV)	Power supply voltage (ECU internal 5V)
17	3.3V voltage	2	0x8000(-32,768 mV) ~0x7FFF(+32,767 mV)	Power supply voltage (ECU internal 3.3V)
18	Power supply voltage	2	0x8000 (-3,276.8 V) ~0x7FFF (3,276.7 V)	Rower supply voltage (Battery voltage)
19	Current1(Battery charging)	2	0x8000 (-3,276.8 A) ~0x7FFF (3,276.7 A)	Current(Current1) (Battery Charging Current)
20	Current2(Power generation1)	2	0x8000 (-3,276.8 A) ~0x7FFF (3,276.7 A)	Current(Current2) (Generated current1)
21	Current3(Power generation2)	2	0x8000 (-3,276.8 A) ~0x7FFF (3,276.7 A)	Current(Current3) (Generated current2)
22	Current4	2	0x8000 (-3,276.8 A) ~0x7FFF (3,276.7 A)	Current(Current4) (Option) *1
23	Voltage1	2	0x8000 (-3,276.8 V) ~0x7FFF (3,276.7 V)	Voltage(Voltage1) (Option) *1
24	Voltage2	2	0x8000 (-3,276.8 V) ~0x7FFF (3,276.7 V)	Voltage(Voltage2) (Option) *1
25	Fuel level1	2	0x8000(-32,768 %) ~0x7FFF(+32,767 %)	Fuel Level Sensor(Fuel Level1) (Option) *1
26	Fuel level2	2	0x8000(-32,768 %) ~0x7FFF(+32,767 %)	Fuel Level Sensor(Fuel Level2) (Option) *1
27	Generated electricity	2	0x8000(-32,768 W) ~0x7FFF(+32,767 W)	Generated electricity
28	Power consumption	2	0x8000(-32,768 W) ~0x7FFF(+32,767 W)	Power consumption
29	Total operation time	4	0x00000000(0sec) ~0xFFFFFFFF(4294967295sec)	Total operation time
30	Operation time	4	0x00000000(0sec) ~0xFFFFFFFF(4294967295sec)	Operation time (After ECU startup)
31	Footer	1	0xFF (fixed)	A fixed value that indicates the end of the data.
32	CRC	2		CRC-16-CCITT(Header to Footer)

*1 : (Optional) items have values that can be read even if the optional sensor is not installed, but the values are meaningless.

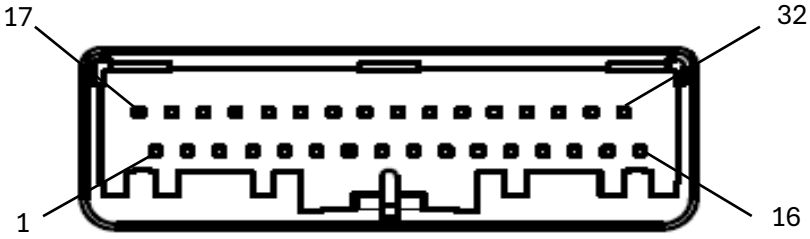
【CN1】



16Pin JAE-MX34

1		9	
2		10	
3		11	
4		12	
5	Choke signal input1〔SIGNAL〕	13	Choke signal input1〔GND〕
6	Starter signal input〔SIGNAL〕	14	Starter signal input〔GND〕
7	Ignition ON/OFF signal input〔SIGNAL〕	15	Ignition ON/OFF signal input〔GND〕
8	Choke signal input2〔SIGNAL〕	16	Choke signal input2〔GND〕

【CN2】

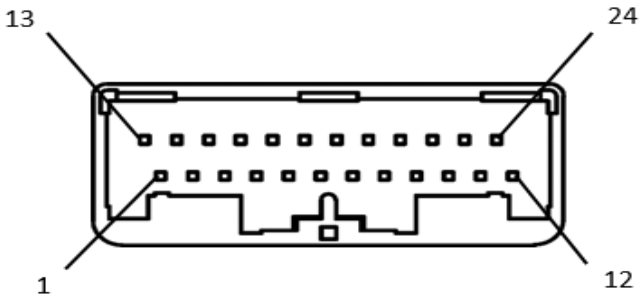


32Pin JAE-MX34

1		17	
2		18	
3		19	
4	(GND)	20	
5	Crankshaft rotation sensor1〔SIGNAL〕	21	Crankshaft rotation sensor1〔GND〕
6		22	Crankshaft rotation sensor1〔+5V〕
7	Cylinder head temperature sensor1〔+〕	23	Cylinder head temperature sensor1〔-〕
8		24	
9	Throttle servo1〔SIGNAL〕	25	Throttle servo1〔GND〕
10	Choke servo1〔Power supply DC+5V〕	26	Throttle servo1〔Power supply DC+5V〕
11	Choke servo1〔GND〕	27	Choke servo1〔SIGNAL〕
12	Signal output to starter ESC1〔SIGNAL〕	28	Signal output to starter ESC1〔GND〕
13		29	Power output to starter ESC1〔DC+5V〕
14		30	
15	Ignition signal output1〔IOL=max7mA〕	31	
16	Power supply for igniter1〔DC+6V〕	32	Ignition signal output1〔GND〕※

(It is isolated from other than the ※mark.)

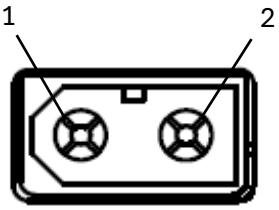
【CN3】



24Pin JAE-MX34

1	Ignition signal output2〔GND〕※	13	Power supply for igniter2〔DC+6V〕
2	(It is isolated from other than the ※mark.)	14	Ignition signal output2〔IOL=max7mA〕
3	Signal output to starter ESC2〔SIGNAL〕	15	Signal output to starter ESC2〔GND〕
4	Choke servo2〔Power supply DC+5V〕	16	Power output to starter ESC2〔DC+5V〕
5	Choke servo2〔GND〕	17	Choke servo2〔SIGNAL〕
6	Throttle servo2〔SIGNAL〕	18	Throttle servo2〔GND〕
7	(GND)	19	Throttle servo2〔Power supply DC+5V〕
8		20	
9	Cylinder head temperature sensor2〔+〕	21	Cylinder head temperature sensor2〔-〕
10	Crankshaft rotation sensor2〔SIGNAL〕	22	Crankshaft rotation sensor2〔GND〕
11		23	Crankshaft rotation sensor2〔+5V〕
12		24	

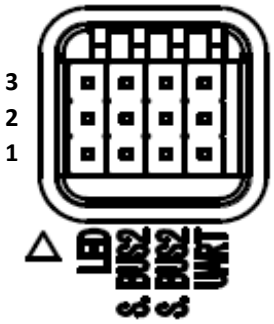
【POWER SUPPLY】



XT60

1	Power supply〔GND〕
2	Power supply〔Vcc〕Be sure to get power from a 12S (6Sx2) Li-Po battery via HUB-02.

【LED】
【S.BUS2】
【UART】



LED

3

2	Pilot lamp power output〔DC+6V〕
1	〔GND〕※ (It is isolated from other than the ※mark.)

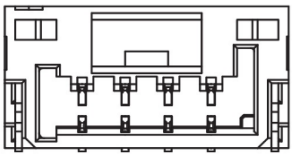
S.BUS2 (Both terminals are connected to the same bus.)

3	〔SIGNAL〕
2	〔DC+5V〕This is a power output. Do not connect if the connected device does not require power.
1	〔GND〕

UART

3	〔TX〕
2	〔RX〕
1	〔GND〕

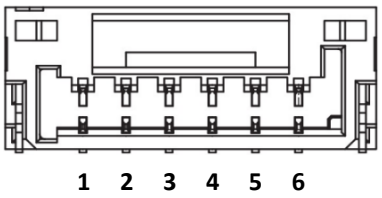
【CAN】



4 pin JST-GH

1	〔DC+5V〕
2	〔CAN_H〕
3	〔CAN_L〕
4	〔GND〕

【RS-485】



6 pin JST-GH

1	〔RXD(+)〕
2	〔RXD(-)〕
3	〔TXD(-)〕
4	〔TXD(+)〕
5	〔DC+5V〕
6	〔GND〕

12.Engine parts list

■ENGINE PARTS LIST / GT33REU TWIN (1/2)

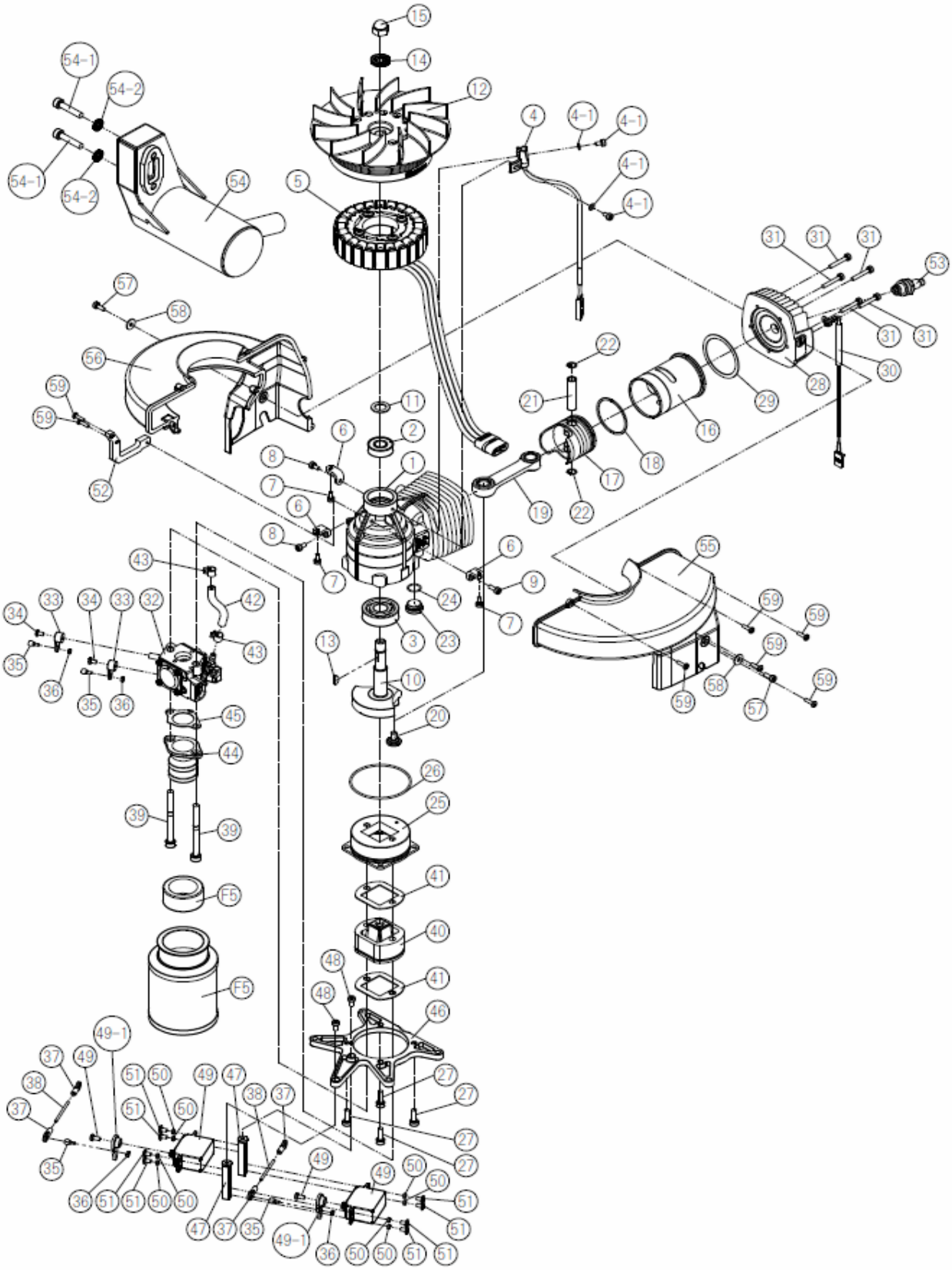
No.	Code No.	Description	
1	4AP01000	CRANKCASE GT33REU	
2	26731010	BALL BEARING (F) 120AX	
3	4AH30000	BALL BEARING (R) GT33REU	
4	74002A20	ROTATION SENSOR IG-10	
4-1	74002321	ROTATION SENSOR FIXING SCREW GT33.22.60	Tightening torque 0.4N・m
5	54076011	STATOR ASSEMBLY SGM-9020-135	
6	4AH50040	STATOR STAY GT33U2	
7	79871109	HEXAGON HEAD SCREW M3.0X 6 (10PCS/SET)	Tightening torque 1.5N・m LOCTITE243
8	79871110	HEXAGON HEAD SCREW M3.0X 8(10PCS/SET)	Tightening torque 1.5N・m
9	79871140	HEXAGON HEAD SCREW M3.0X12(10PCS/SET)	Tightening torque 1.5N・m
10	4AP02000	CRANKSHAFT GT33REU	
11	46120000	THRUST WASHER 46AX.91FX.SXH.SZ.FT160.FF	
12	54076020	ROTOR ASSEMBLY SGM-9020-135	
13	29008219	WOODRUFF KEY 61.90.91	
14	55500007	NORD LOCK WASHER M8 (10PCS.)	
15	4AP10000	BOX NUT 5/16	Tightening torque 30N・m
16	28303100	CYLINDER LINER GT33	
17	28303210	PISTON GT33	
18	28303400	PISTON RING GT33	
19	28305000	CONNECTING ROD GT33	
20	28302100	CRANK PIN STOP SCREW GT33	Tightening torque 1.5N・m Reverse screw
21	4A006000	PISTON PIN GF30	
22	28317000	PISTON PIN RETAINER GT33.GT22.GF30	
23	29701300	CRANKCASE PLUG GT55.33.22.GF30	Tightening torque 1.2N・m
24	29701310	O-RING (SS-10.5)	
25	4AP07000	COVER PLATE GT33REU	
26	29122540	SILENCER GASKET (O-RING) E-5020	
27	79871415	HEXAGON HEAD SCREW M4.0X15(10PCS/SET)	Tightening torque 3.6N・m
28	4AP04000	CYLINDER HEAD GT33REU	
29	28304160	HEAD GASKET (0.4T) GT33	
30	54065000	ST-01 TEMP. SENSOR FOR EM-100	
31	79871200	HEXAGON HEAD SCREW M3.0X20(10PCS/SET)	Tightening torque 1.7N・m
32	28381000	CARBURETTOR COMPLETE (WT1024) GT33	
33	22081408	THROTTLE LEVER (NO.5)	
34	29781350	WLA-2 SCREW 96-156	Tightening torque 0.8N・m
35	4AA07060	LINKAGE BALL M2X4 5X9 (10PCS/SET)	Tightening torque 0.15N・m
36	79850020	NUT 2.0 X 0.40 (10PCS/SET)	Tightening torque 0.15N・m LOCTITE243
37	4AA07310	BALL LINK 5.0 (5PCS/SET)	
38	4AP07010	LINK ROD 1.96XL35	
39	79871560	HEXAGON HEAD SCREW M5.0X60(10PCS/SET)	Tightening torque 3.6N・m
40	28316000	REED VALVE ASSEMBLY GT33	
41	28315000	CARBURETTOR & REED VALVE GASKET GT33	
42	28382500	GASOLINE FUEL TUBE YELLOW M	
43	70000001	HOSE CLIP 6 (5PCS/SET)	
44	4AP50000	AIR CLEANER ADAPTOR GT33REU	
45	29781500	CARBURETTOR GASKET GT55	
46	4AP51000	RADIAL MOUNT GT33REU	
47	4AP52000	SERVO MOUNT GT33REU	

12.Engine parts list

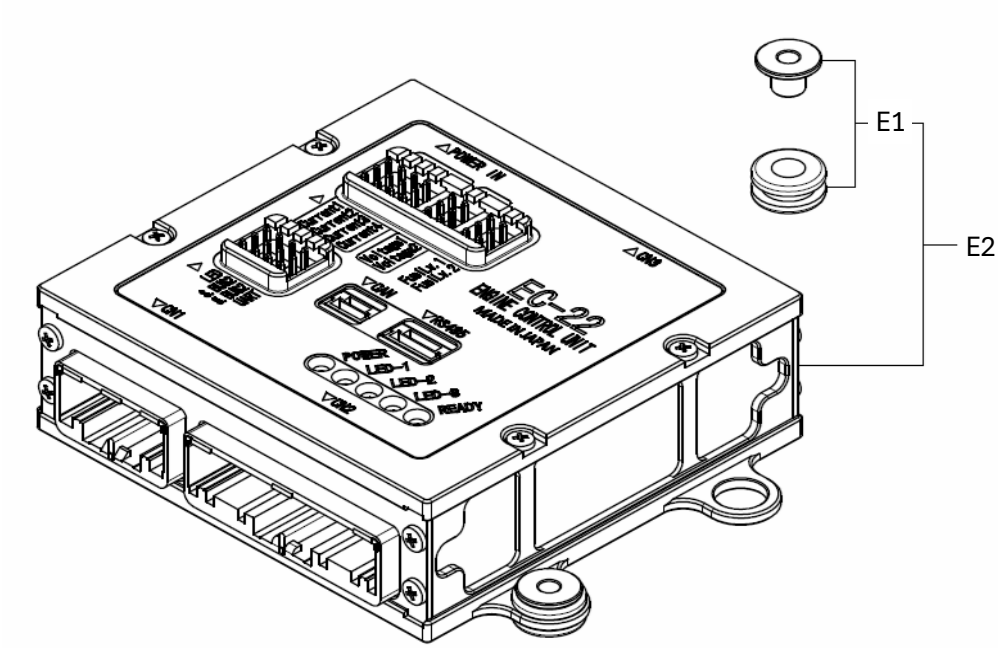
■ENGINE PARTS LIST / GT33REU TWIN (2/2)

No.	Code No.	Description	
48	79871109	HEXAGON HEAD SCREW M3.0X 6 (10PCS/SET)	Tightening torque 1.2N・m
49	4AP81201	THROTTLE SERVO BLA1HD21	
49-1	4AP81210	THROTTLE SERVO HORN BLA1HD21	
50	4AG80600	SERVO COLLAR 3X4X1.6 (10PCS/SET)	
51	79871730	BUTTON HEX. HEAD SCREW M3.0X6 (10 PCS)	Tightening torque 0.8N・m LOCTITE243
52	4AP56000	FAN SHROUD STAY GT33REU	
53	71669000	SPARK PLUG CM-6(NGK)	Tightening torque 12.0N・m
54	28325002	SILENCER E-5033 (GT33REU)	
54-1	79871525	HEXAGON HEAD SCREW M5.0X25(10PCS/SET)	Tightening torque 7.2N・m
54-2	55500004	NORD LOCK WASHER M5 (10PCS.)	
55	4AP54010	FAN SHROUD L GT33REU(N1)	
56	4AP55020	FAN SHROUD R GT33REU(N2)	
57	79871121	HEXAGON HEAD SCREW M3.0X10 SUS 10PCS/SET	Tightening torque 1.5N・m
58	79871740	WIDE WASHER 3X10X1 (10PCS/SET)	
59	79871760	P-HEAD SCREW 2.6X12(P-TITE) (10PCS/SET)	Tightening torque 0.2N・m
E1	75000007	MOUNT COLLAR (4PCS)	
E2	75008001	EC-22 ENGINE CONTROL UNIT	
E3	75008002	ECU WIRE HARNESS (A) EC-22	
E4	75008003	ECU WIRE HARNESS (B) EC-22	
E5	75007009	PWM SIGNAL HARNESS	
E6	54067020	SC-03 CURRENT SENSOR UNIT	
E7	74001200	LED HARNESS SET (RED)	
E8	75007018	POWER SUPPLY CORD EC-2#	
E9	74001220	U2S-2 FOR EC-2#	
E10	54063109	SGC-1095HV (FOR TWIN)	
E11	74001260	HUB-02 POWER DISTRIBUTION BOX W/FUSE	
F1	74002G00	IGNITION MODULE (IG-13)	
F2	70000001	HOSE CLIP 6 (5PCS/SET)	
F3	78300100	GASOLINE FUEL FILTER L	
F4	70000002	CONNECTOR LOCK (5PCS/SET)	
F5	4AG81000	AIR CLEANER UNI (PK-4E)	Tightening torque 2.0N・m
F6	4AP57000	HEAT SHIELD PLATE GT33REU	
F7	54060000	SV-01 VOLTAGE SENSOR	
F8	54068000	SFL-01 FUEL SENSOR	

EXPLODED VIEW



EC-22 ENGINE CONTROL UNIT



ENGINE WIRE HARNESS[A]

E3

ENGINE WIRE HARNESS[B]

E4

PWM SIGNAL HARNESS

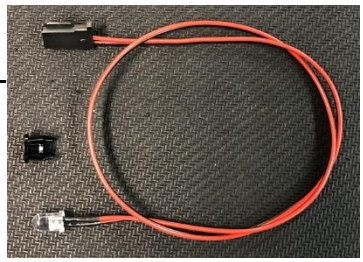
E5

SC-03 CURRENT SENSOR UNIT

E6

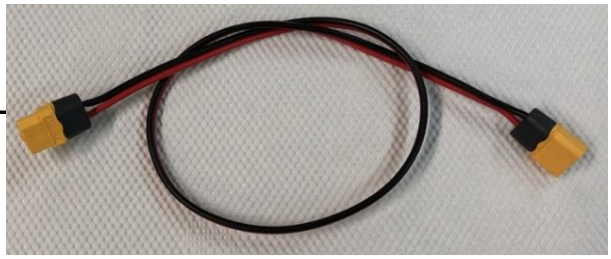
LED HARNESS SET(RED)

E7



POWER SUPPLY CORD

E8



U2S-2 FOR EC-2#(SERIAL SIGNAL CONVERTER)

E9

SGC-1095HV(FOR TWIN)

E10

HUB-02

E11

F1 —

IGNITION MODULE (IG-13)

F2 —

HOSE CLIP 6 (5pcs.)

F3 —

GASOLINE FUEL FILTER L

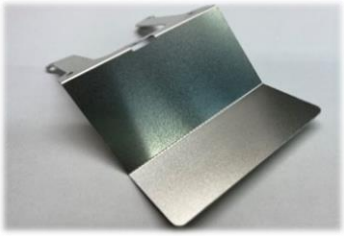
F4 —

CONECTOR LOCK (5pcs.)

F5 —

AIR CLEANER UNI (PK-4E)

F6 —



HEAT SHIELD PLATE

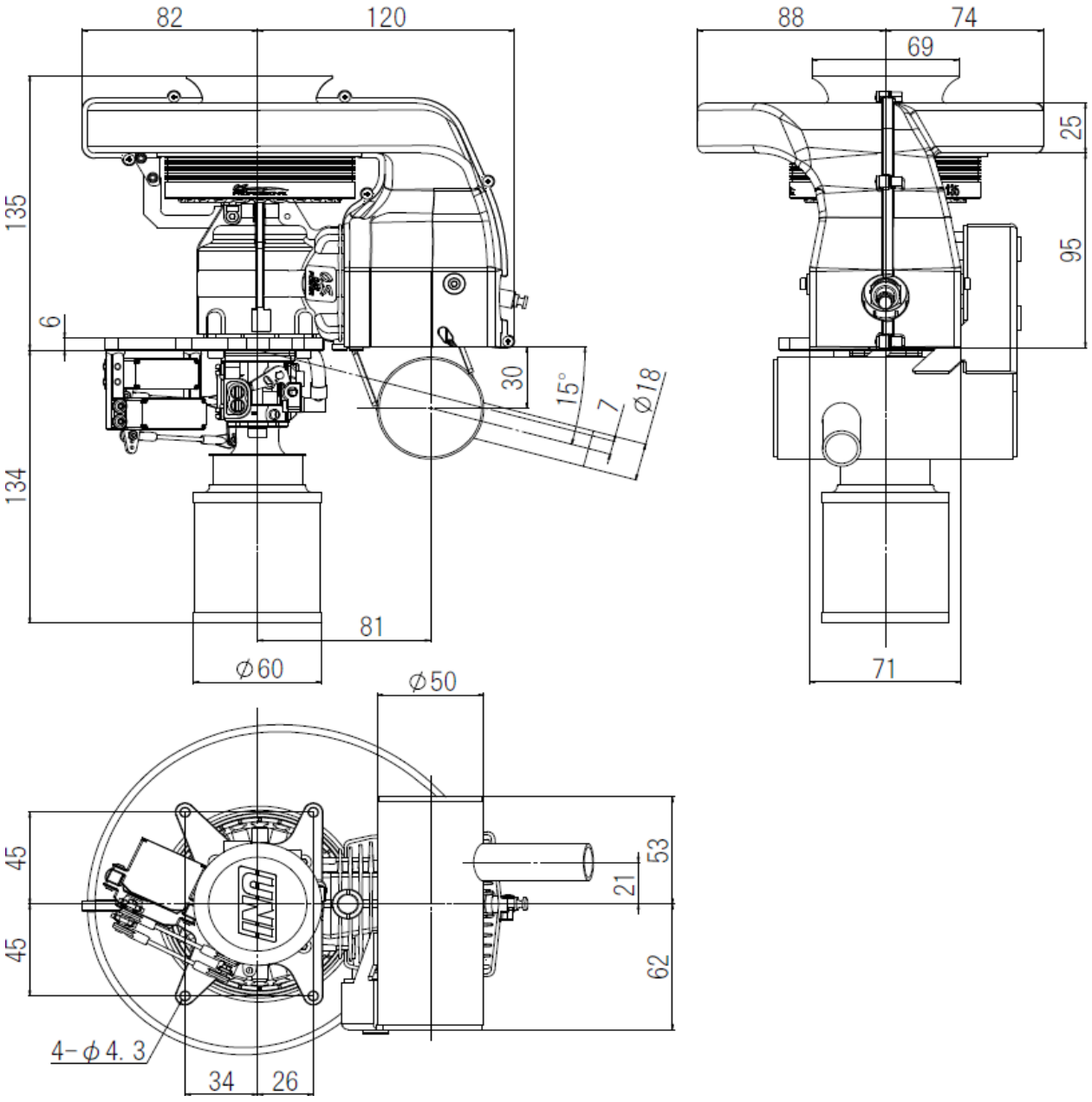
F7 —

VOLTAGE SENSOR(SV-01)
(Option)

F8 —

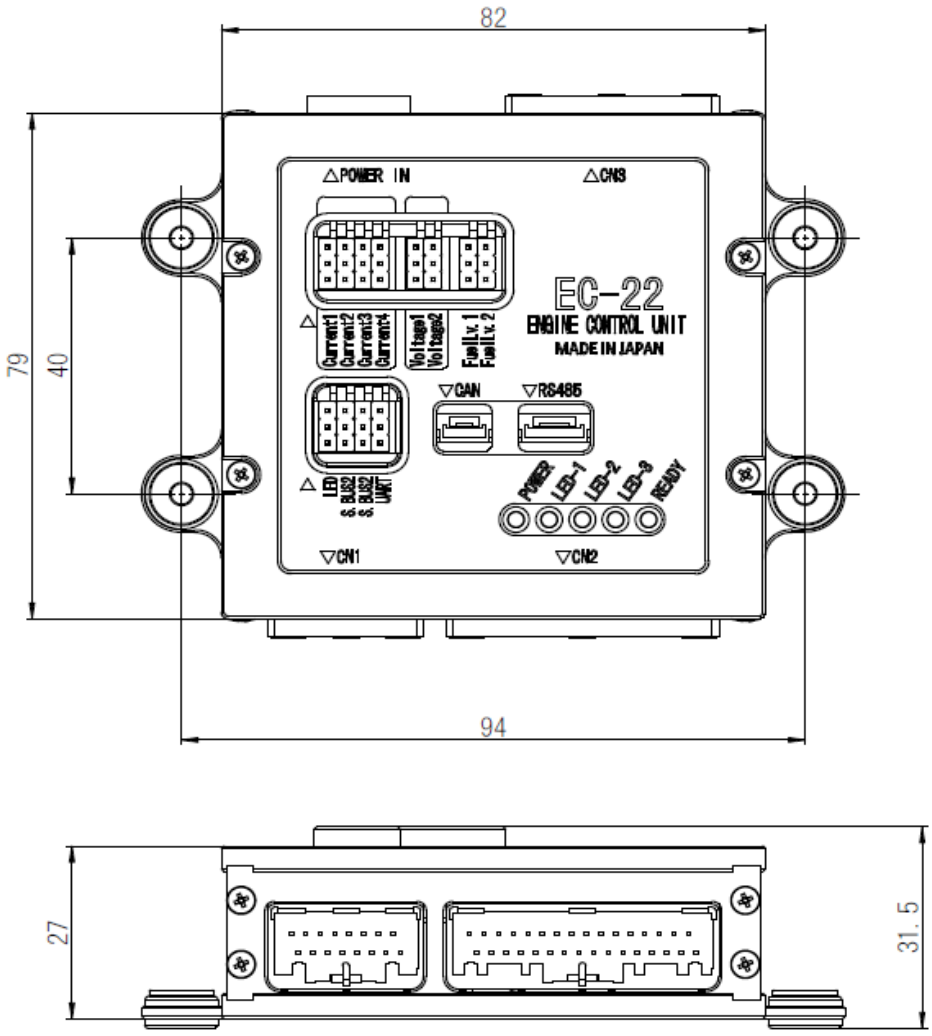
FUEL SENSOR(SFL-01) 100mm
(Option)

※For types with even longer measurement ranges, please contact us separately.



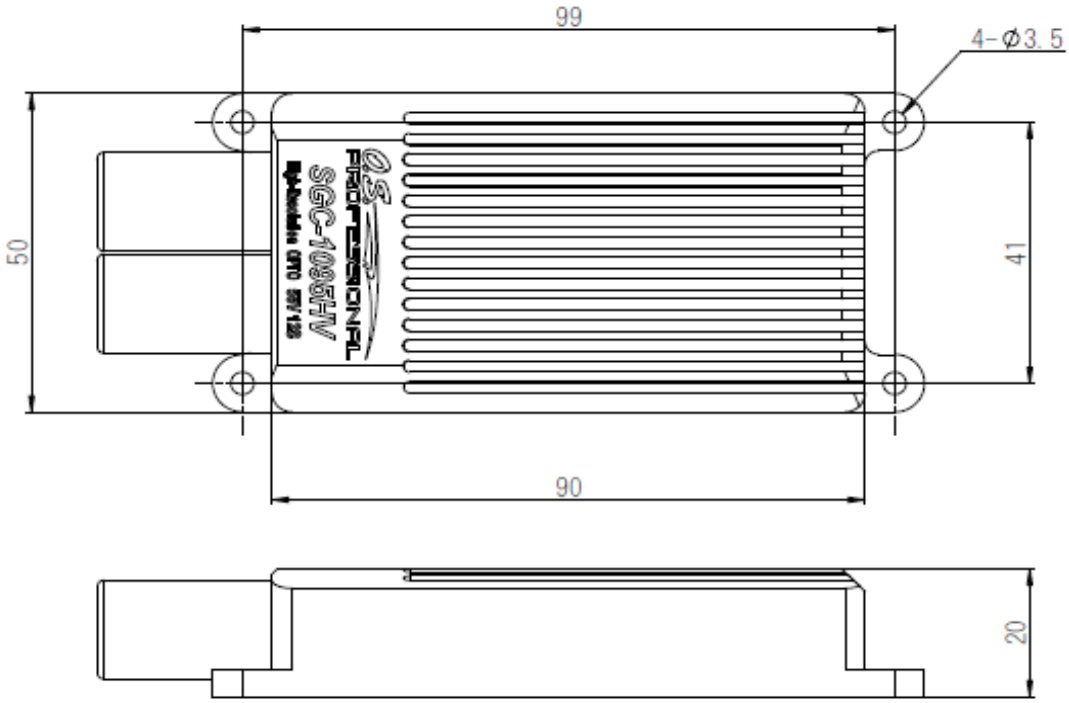
GT33REU with SGM-9020

Unit : mm

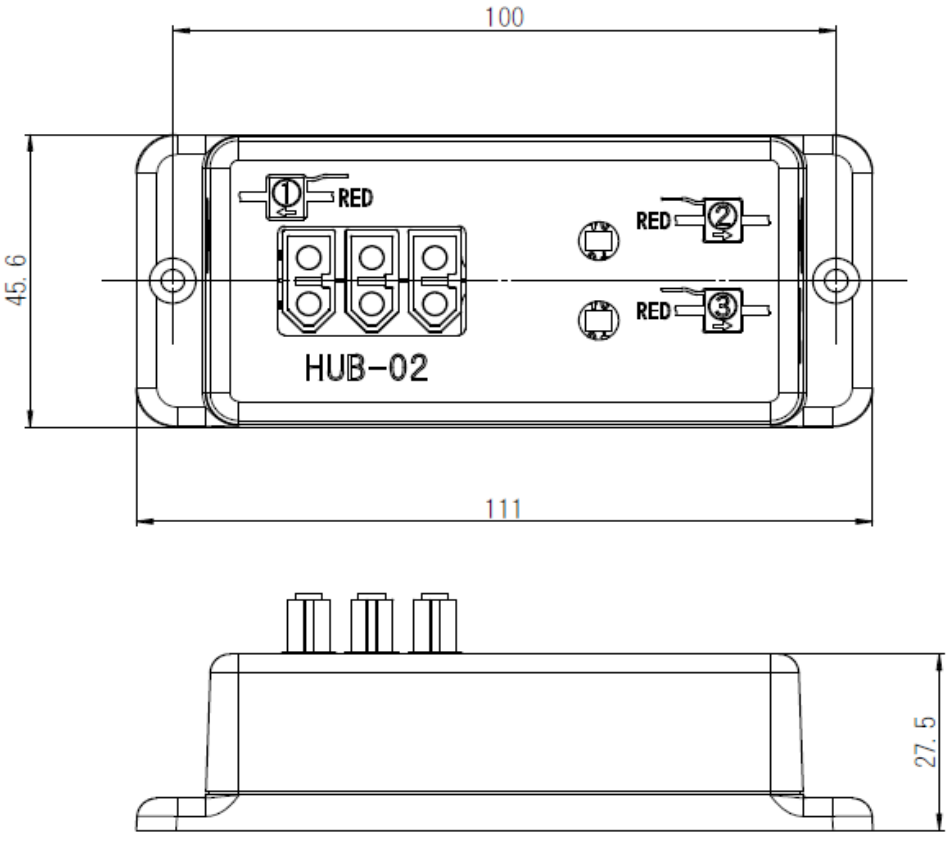


EC-22
ENGINE CONTROL UNIT

Unit : mm



SGC-1095HV
SGC(ESC)



HUB-02
Power distribution box with fuse

Unit : mm

MEMO