# **GF80TU-FI** with SGM With EC-13 (ECU)

#### **INSTRUCTION MANUAL**

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

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• Please read this instruction manual and all attached instructions carefully before handling the engine.

#### [ENGINE]

• The engine is equipped with electronic fuel injection system to correspond to environmental changes during a long flight.

• This is a four stroke gasoline engine, but runs on a premixed gasoline/2-stroke engine oil.

• Use high quality commercially available 2-stroke engine oil.

• Follow the oil manufacturer's recommedation concerning the mixture ratio of gasoline and oil. In case of no recommendation by manufacturer, use a 30 : 1 gasoline-to-oil mixture.

•Adopted a crank chamber pressure supercharging method that utilizes the change in the volume of the crank chamber as the piston moves up and down. As a result, both the low fuel consumption of a 4-stroke engine and the high output of a 2-stroke engine are achieved.

• The engine runs counter-clockwise when viewed from the front.

• Recommended propellers are 23x8-12, 24x8-12, 25x8-10 (DxP Inch). We recommend a propeller whose rpm is within range of 6500 rpm  $\sim$  8000 rpm at full throttle.

•SGM (starter generator motor) is directly mounted on the crank shaft behind the engine. It is a 200W class generator and has the ability as a cell starter at the time of starting.

• Although the starter is a starter motor system, it can also be started by a starter. If the voltage of the battery for the starter motor drops, it may not be possible to crank the engine. In that case, please start with an external starter separately.

• Periodical inspection after 50, 100 hours are necessary. Follow the maintenance manual, which is separately provided.

#### 【ECU (Engine Control Unit)】

• The EC-13 is an engine control unit (ECU), which contains a 32-bit CPU. It collects the data of throttle opening, rpm, induction manifold pressure, atomospheric pressure, induced air temperature, cylinder head temperature and run the engine in the most suitable condition.

ECU internal information such as engine speed, cylinder head temperature, throttle opening, fuel pressure, etc. can be output to the outside of the ECU in real time by CAN and serial communication.
The EC13-LINK software, which enables to change the parameters and to monitor the data in real time in Windows<sup>®</sup> platform, is included as a standard accessory.

#### CAUTION:

• After overhauling the engine, after disconnecting the throttle linkage, reset the throttle position using the EC13-LINK.

\*The specifications are subject to alteration for improvement without notice.

\*Consult us for any questions on this product and return for repair.

\*This instruction manual was created bThis instruction manual was created based on the product specifications as of August 2024.

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- 1 . Cylinder head
- 2 . Push rod cover
- 3 . Propeller washer
- 4 . Pilot shaft
- 5 . Drive spacer
- 6 . Throttle valve
- 7. Air cleaner
- 8 . Throttle linkage rod
- 9. Spark plug (CM-6)
- 10 . Rocker cover
- 11 . Stand off engine mount
- 12 . Crankcase (Front housing)
- 13 . Intake manifold
- 14 . Cylinder



- 15 . Starter generator motor (SGM)
- 16. Mounting plate
- 17. Throttle servo18. Injector & connector (Injector harness)
- 19. Injector coupler
- 20 . Cylinder head temperature sensor
- 21 . Crankcase (Rear housing)
- 22 . Crankshaft rotation sensor23 . F-6050 Silencer



- 24 . Engine control unit (ECU)
- 25 . ECU connector [CN1]
- 26 . ECU connector [CN2]27 . Status display LED
- 28 . Fuel pressure sensor unit
- 29 . Pressure release valve
- 30. Fuel pump unit



- 31 . Regulator rectifier (ORF-200 FOR SGM)
  32 . 4S Li-Po Battery charger (CC-100(4S))
  33 . ESC for SGM (SGC-2100HV )

#### Accessories



【ECU】Model:IG-13
•Engine Control Unit(ECU)



[ECU WIRING HARNESS] •Wiring harness that connect ECU and the engine.

#### [PUMP CONNECTION CORD]



- Connect the ECU to the fuel pump and fuel pressure sensor unit.
- •Install the fuel pump and fuel pressure sensor unit near the fuel tank.





[CAN communication code]the connector for CAN communication.Connector is JST SMR-04V-B



[FUEL PUMP UNIT] Model : PM-02A • Fuel is pumped from the tank.

a a

[FUEL PRESSURE SENSOR UNIT] Model: SP-01 • Comes with a sensor that measures fuel pressure and a RELEASE VALVE that bleeds air.

#### Accessories



#### Accessories





[Regulator rectifier] Model: ORF-200(FOR SGM)

- The output voltage is adjusted to 18V. Please do not change.
- •The MR60 (M) connector connects to SGC-2100HV.
- •The XT60(F) connector connects to and CC-100.
- \*See the SGM(Starter Generator Motor) section of this manual for connection details.



- It is an ESC with a high withstand voltage specification with a controller for SGM.
- •The MR60 (F) connector connects to the ORF-200.
- •The MR60 (M) connector connects to SGM-8020.
- \*See the SGM(Starter Generator Motor) section of this manual for connection details.



[4S Li-Po Battery charger] Model: CC-100(4S)

- It is a charger for 4S Li-Po battery.
- CC charge: MAX 3A / CV charge: 16V.
- Compatible with 4S Li-Po batteries with capacities of 3000mAh to 4000mAh.
- It does not come with balance charging function.
- \*See the SGM(Starter Generator Motor) section of this manual for connection details.

[F-6050 Silencer] Model: F-6050 (2PCS)Compact silencer.



[ALUMINUM SPINNER] • A type of spinner that is used by covering the propeller washer after installing the propeller.



[Socket wrench (SST)]

• A special tool for attaching and detatching the temperature sensors. (intake air temperature sensor and cylinder head temperature sensor)

•Attach this tool to 1/4"(6.3mm) Socket wrench handle. (Socket wrench handle is not included in this set)

#### [Serial signal converter] Model : U2S-2

•To be used to convert UART serial signal from ECU to USB serial signal when ECU is connected to a computer.

Cap screw (Hex socket head bolts)

screw size	N∙m
M2.6	1.1
M3.0	1.5
M4.0	3.6
M5.0	7.2

% Follow the above tightning torque unless otherwise specified.



Install the standoff engine mounts that come standard with the engine at a position of 72 mm x 72 mm.
The length of the standard standoff engine mount is 60 mm.

Installation



• Use M5 20mm length allen bolts to secure the engine to stand off engine mount.

• Please used Nord-Lock Washer to tighten 4 bolts.

(Nord-Lock Washer) There is direction for stacking Nord-Lock washers. As shown in the photo below, stack them so that the large wedge sides face each other.



#### Installation **Fuel delivery** Hose clamp **Fuel filter** Fuel pump unit pressure sensor Pressure release valve Fuel tank Fuel pressure Return hose (not included in this set) sensor unit ①Between the Fuel pump unit and Fuel pressure sensor unit Connect to engine ${f 2}$ Between the Fuel pressure sensor unit and Injector coupler

• Connect the Fuel pump unit and the Fuel pressure sensor unit close to the Fuel tank.

• Use a Fuel filter between Fuel tank and Fuel pump unit.

• Fuel pump unit creates 300kPa pressure. Apply a hose clamp to each hose joint.

•Be sure to use the attached high-pressure fuel hose for the parts where high pressure is applied ① and ②.

• Connect the pressure release valve nipple to the fuel tank with a return hose.



• Use a Non-bubbleweight in the tank to avoid creating air bubbles in the fuel supply tube. Air bubbles may cause engine misfire and stalling.

• Connect the tubes in the fuel tank firmly to the pipes in a fashion in which they will not easily come off. Use clamps or wire ties if necessary.

Fuel pump

Connect Fuel pressure sensor unit

• The arrow mark shows the direction of fuel flow.

Apply a hose clamp to the pressurized side of the hose.

CAUTION :

•A one-way valve is built in the fuel pump so pressure remains in the fuel supply line even after stopping the pump. Open the Pressure release valve to remove residual pressure.

#### Fuel pressure sensor unit



• The Pressure sensor works both from A to B and B to A. Decide the mounting direction according to your fuselage layout. Apply Hose clamps to both sides of the Pressure sensor.

• To change the direction of Pressure release valve nipple, loosen the Hexagon head with an 8mm wrench. Tighten the Hexagon head again after deciding the direction.

• If there are air bubbles in the tube between the fuel tank and the fuel pressure sensor unit after filling up the fuel tank, when the ECU switch is turned on for the first time, open the valve until the screw top becomes flush with edge of the valve holder as shown below. After eliminating the air bubbles, close the valve. Do not open the valve more than the flush position to avoid the pressurized fuel from coming out of the valve.

• Air bubbles beween the Fuel pressure sensor unit and the engine (Injector) are of no concern as they do no harm since they are discharged through the Injector.



• Release the residual pressure in the fuel system after a days use to avoid fuel expanding the fuel joints and causing leaks.



• Connect the tube from the Fuel pressure sensor unit to the Injector joint nipple. Use a Hose clamp. It is a must.

• Once a tube is connected to a nipple, an end of the tube is expanded and deformed. Cut the end when you use the same tube again.





• Cut off an end of the tube when it is difficult to pull out from a nipple. Do not pull and twist the tube strongly to pull it out. Do not give damage to a nipple when you use a nipper or a knife to cut the end of the tube.





### Silencer

F-6050 Silencer structure



M16 thread pitch 1mm thread is cut. Tighten to the cylinder head. When tightening to the cylinder head, apply gasoline mixing oil to the threads to prevent seizure before tightening.

It is a hexagon (with an opposite side of 19 mm). use a 19mm spanner here and tighten the silencer to the cylinder head.

There is a two-sided cut (with a opposite side of 21 mm). When tightening the exhaust header pipe to the silencer body, use a 21 mm spanner here to fix the silencer body side.

It is a hexagon with flat-to-flat distance of 19mm. If the shape of the cowling does not allow to use a spanner tool on the hexagon of the exhaust header pipe made of steel, you should use a deep socket wrench instead of a spanner. Because its made of aluminum, do not use spanner or it will damage the hexagon.(Note.1)



If the exhaust header pipe remains on the cylinder head side when you try to remove the silencer by hooking a tool on the silencer body, you can remove the exhaust header pipe using a 19 mm deep socket wrench.

On the contrary, when installing, the exhaust header pipe can be attached to the cylinder head first, and then the silencer body can be attached. (Note.1)

#### Note.1

This method is an exceptional usage in situations where a tool cannot be inserted. Basically, hang a tool on the hexagon of 19 mm on the opposite side of the exhaust header pipe to attach or detach the silencer. Also, please design the aircraft so that it can be done.

## Propeller

• Use a wooden or carbon fiber propeller. Do not use nylon propellers as they may lack strength.

• Do not use a propeller that is slightly scratched or has a large impact even if it is not scratched.

• The size and shape of the propeller will be selected as the best one after actually flying, but first select it by referring to the following range.

23x8-12, 24x8-12, 25x8-10 (diameter x pitch Inch)

• It is recommended to use a spinner. You can use the included aluminum spinner or a commercially available metal or resin spinner, but use a well-balanced and strong spinner.

• Imbalance of the propeller or spinner may cause vibration and damage the propeller or the aircraft. Be sure to use a well-balanced and strong enough propeller and spinner.

•Be sure to tighten the propeller mounting bolts via the propeller washers when mounting the propeller. Propeller mounting bolts are included, but if you use a propeller with a thin hub and the screws bottom out, or if you use a propeller with a thick hub and cannot screw it into the drive spacer sufficiently, refer to the table below to select the right bolts.Please replace them with certain steel hexagon socket head cap bolts.

Propeller hub thickness	Bolts
14 <b>~</b> 20mm	M5x35mm
18 <b>~</b> 24mm	M5x40mm (included)
22 <b>~</b> 30mm	M5x45mm

• Install the propeller day of the first flight and remove it after the last flight.

• Check the appearance of the propeller mounting bolts every time, and replace them if they are scratched or rusted. Even if there is no abnormality in the appearance, replace them regularly (about 50 flights).





## Plug cap

• Insert the plug cap as shown in Photo.1 by aligning it with the recess of the cylinder head. There are two plug cords from the igniter, but there is no distinction between the left and right cylinders.



• To remove the plug cap, attach a commercially available nylon cable tie (repeat type with unlock) to the plug cap as shown in Photo.2, put your finger on it, and pull it while turning it toward the slope side of the recess of the cylinder head to remove it. (See Photo.3). If you remove the plug cap by hand, be sure to wear gloves to protect your hands. Immediately after the engine is stopped, the plug cap is also hot, so cool it down before proceeding.





Photo.3

## **ECU Wiring harness**



[A] EC-13 Wiring harness A-1

A-2

- Throttle signal input (PWM VIH=2.6V, VIL=0.4V, MAX5.5V)
- Fuel trim signal input (PWM VIH=2.6V, VIL=0.4V, MAX5.5V)
- Starter start signal input(PWM VIH=2.6V, VIL=0.4V, MAX5.5V)
- Serial communication (UART, TTL logic level is 3.3V)
- A-3 CAN communication
- A-4 • Fuel pressure sensor
- A-5 Fuel pump
- A-6 Power supply (DC10V~18V, MAX 1.5A)
- A-7 - Cylinder head temperature sensor
  - Injector
  - Throttle servo
  - Ignition signal
  - Crankshaft rotation sensor
- SGC signal output A-8 •

#### [B] pump connection cord (extendable) B-1

- fuel pressure sensor
- fuel pump unit

#### Engine control unit (ECU)

			-
	.1		•To be connected to a receiver or throttle signal cable from flight controller.
	4	BURN I HIGH	Specification PWM signal
			Set the travel width so that the PWM signal width is 1100 us or less on the throttle closed
		经和上的任何基本目的目的理论。	side and the DWM signal width is 1040 us as more on the throttle energing side
			Iside and the PWW signal width is 1940 µs of more on the throttle opening side.
		Throttle signal input	[W:Signal / B:GND] VIH=2.6V, VIL=0.4V, MAX5.5V
		And the property of the party o	If it is necessary to fuel adjustment from external device, connect it to the fuel
			adjustment signal from the receiver or flight controller.
			• ECU controls quantity of fuel injection normally, so correction signal from the outside is
	.	The second se	not necessary Leave it unconnected or connect 1520us (neutral) PWM signal When
	7		not necessary. Ecovert unconnected of connect 1520ps (neutral) i with signal when
	1	THE REAL PROPERTY AND INCOME.	pulling out during operation, it noids the state just before.
		1444年1月1日日本以前1967年1月1日日	Specification PWM signal : 1520µs (neutral) ±420µs
			PWM + $\rightarrow$ increase fuel supply The range of increase and decrease is ±30%.
		Fuel trim signal input	[W:Signal / B:GND] VIH=2.6V, VIL=0.4V, MAX5.5V
			Input the PWM signal from the external device such as transmitter, flight controller etc.
		TAPETAL TALETAL TALETAL	to start the starter motor
			The starter most into standle under the DMMA simplify 4000 up to 4400 up
			• The starter goes into standby mode when the PWW signal is 1000 µs to 1400 µs.
	년		• The PWM signal drives the starter at 1600 μs to 2000 μs.
	Á		
			Specification PWM signal: 1000µs~2000µs
		Starter signal input	$[W] \cdot Signal \neq B \cdot GND VIII - 2 6V VIII - 0 4V MAY5 5V$
Z		Starter signal input	the connector for social communication
		International Action in the second	
			• To be used to monitor parameters or to connect to a computer for initial setting.
		Canal Change	~
	- 7		
	A-2		
	A-2		Specification UART(TTL logic level is 3.3V.)
	A-2		Specification UART(TTL logic level is 3.3V.)
	A-2	Serial communication	Specification UART(TTL logic level is 3.3V.) JST UR: DC+5V
	A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST         [R: DC+5V / W: TX / G: RX / B: GND]
	A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST         IR: DC+5V / W: TX / G: RX / B: GND]         • the connector for CAN communication
	A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST         JST         04R-JWPF-VSLE-S         • the connector for CAN communication
	A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         IR: DC+5V / W:TX / G:RX / B:GND]         • the connector for CAN communication
	-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         [R: DC+5V / W: TX / G: RX / B: GND]         •the connector for CAN communication
	A-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         IR: DC+5V / W: TX / G: RX / B: GND]         • the connector for CAN communication         Specification       CAN
	A-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         IR: DC+5V / W: TX / G: RX / B: GND]         *the connector for CAN communication         Specification         CAN
	A-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         [R:DC+5V / W:TX / G:RX / B:GND]         *the connector for CAN communication         Specification       CAN         JST         Specification       CAN
	A-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         IR: DC+5V / W: TX / G: RX / B: GND]         * the connector for CAN communication         Specification       CAN         JST         Specification       CAN         JST       SMP-04C-BC
	A-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         [R:DC+5V ✓ W:TX ✓ G:RX ✓ B:GND]         *the connector for CAN communication         Specification       CAN         [R:DC+5V ✓ W:Signal(High) ✓ G:Signal(Low) ✓ B:GND]
	A-3 A-2	Serial communication	Specification       UART(TTL logic level is 3.3V.) $JST$ $JST$ $[R: DC+5V \swarrow W: TX \checkmark G: RX \checkmark B: GND]$ • the connector for CAN communication         • the connector for CAN communication $JST$ Specification       CAN $IR: DC+5V \checkmark W: Signal(High) \checkmark G: Signal(Low) \checkmark B: GND]$ • To be connected to Fuel pressure sonsor via Pump connection cord.
	A-3 A-2	Serial communication CAN communication	Specification       UART(TTL logic level is 3.3V.) $JST$ $JST$ $[R: DC+5V \neq W: TX \neq G: RX \neq B: GND]$ •the connector for CAN communication         •the connector for CAN communication $JST$ Specification       CAN $IR: DC+5V \neq W: Signal(High) \neq G: Signal(Low) \neq B: GND]$ •To be connected to Fuel pressure sonsor via Pump connection cord.
	A-3 A-2	Serial communication CAN communication CAN communication	Specification       UART(TTL logic level is 3.3V.) $JST$ $JST$ $[R: DC+5V \neq W: TX \neq G: RX \neq B: GND]$ •the connector for CAN communication         •the connector for CAN communication $JST$ Specification       CAN $[R: DC+5V \neq W: Signal(High) \neq G: Signal(Low) \neq B: GND]$ •To be connected to Fuel pressure sonsor via Pump connection cord.
	4 A-3 A-2	Serial communication   CAN communication	Specification       UART(TTL logic level is 3.3V.) $[R: DC+5V \neq W: TX \neq G: RX \neq B: GND]$ *the connector for CAN communication         Specification       CAN $[R: DC+5V \neq W: Signal(High) \neq G: Signal(Low) \neq B: GND]$ *To be connected to Fuel pressure sonsor via Pump connection cord.
	A-4 A-3 A-2	Serial communication   Communication Can communication Can communication	Specification       UART(TTL logic level is 3.3V.)         [R:DC+5V ∠ W:TX ∠ G:RX ∠ B:GND]         *the connector for CAN communication         Specification       CAN         [R:DC+5V ∠ W:Signal(High) ∠ G:Signal(Low) ∠ B:GND]         *To be connected to Fuel pressure sonsor via Pump connection cord.
	A-4 A-3 A-2	Serial communication   Communication Can communication	Specification       UART(TTL logic level is 3.3V.)         IR: DC+5V / W:TX / G:RX / B:GND]         *the connector for CAN communication         Specification       CAN         IR: DC+5V / W: Signal(High) / G: Signal(Low) / B:GND]         *To be connected to Fuel pressure sonsor via Pump connection cord.         Specification       Pressure sensor
	A-4 A-3 A-2	Serial communication   Communication Can communication	Specification       UART(TTL logic level is 3.3V.)         JST       JST         (R:DC+5V / W:TX / G:RX / B:GND)
	A-4 A-3 A-2	Serial communication   Control of the series of the se	Specification       UART(TTL logic level is 3.3V.)         [R: DC+5V / W: TX / G: RX / B: GND]         *the connector for CAN communication         Specification       CAN         [R: DC+5V / W: Signal(High) / G: Signal(Low) / B: GND]         *To be connected to Fuel pressure sonsor via Pump connection cord.         Specification       Pressure sensor         [R: DC+EV / W: Signal / B: GND]

Wiring color

	00101		
R	Red	Y	Yellow
W	White		
В	Black		
G	Green		

	A-5		To be connected to Fuel pump via Pump connection cord.     Specification
		Fuel pump	[R:DC+12V / B:GND]
	A-6		Supply power.     Specification DC10V~18V (MAX 2A)
		Bower supply	
			• To be connected to the temperature sensor of the cylinder head
	A-7		Specification PT100 Platinum resistance thermometer
		Culinder head temperature concer	[V: No polority / W: No polority]
$\leq$		Cymuer nead temperature sensor	To be connected to Injector barness
	A-7		Specification
		Injector	$[W: DC(12)/\langle C: CND \rangle$
		injector	•To be connected to Throttle servo.
	A-7		Specification DWM signal
		· · · · · · · · · · · · · · · · · · ·	
		Throttle servo	W:Signal / R:DC+5V / B:GND]
		and and the second s	• To be connected to the rotation signal input cable of Igniter.
	-		
	Å	THE REAL PROPERTY	
			Specification
		Ignition signal	[W:Signal / B:GND]

#### Engine control unit (ECU)

Wiring colorRRedYWWhiteBBlackGGreen

Y Yellow

#### Engine control unit (ECU)

<b>—</b>	. I		
	A-7		To be connected to Crankshaft rotation sensor.      Specification Hall-effect switch.
		部的原始	
٦		Crankshaft rotation sensor	[W:Signal / R:DC+5V / B:GND]
	8-		•To be connected to SGC-2100HV.
	A		Specification PWM signal
		SGC	[W:Signal / R:DC+5V / B:GND]
	3-1		To be connected to Fuel pump.
		Fuel pump	[[R:DC+12V / B:GND]
	B-1		• To be connected to Fuel pressure sensor.
			Specification (Extension cord)
B		Fuel pressure sensor	[R:DC+5V / W:Signal / B:GND]
	(A-4)	(To be	•To be connected to (A-4).
			Specification (Extension cord)
		Fuel pressure sensor	[R:DC+5V / W:Signal / B:GND]
	(A-5)		•To be connected to (A-5).
			Specification (Extension cord)
	Fuel pump		[R:DC+12V ∕ B:GND]

Wiring color

	0001		
R	Red	Y	Yellow
W	White		
В	Black		
G	Green		

#### NOTE :

• Using EC13-LINK, you can monitor the parameter data in real time and change the parameters. After overhauling the engine, after disconnecting the throttle linkage, reset the throttle position using the EC13-LINK.

#### [Equipment you need]

• PC with Windows<sup>®</sup> (10/11) and USB port. The included U2S-2 (serial signal converter) uses an FTDI chip, the driver is registered in Windows<sup>®</sup> 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]

• Copy the EC13-LINK\_xxxx.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 EC13-LINK\_xxxx.exe file.

[Connecting]

- Connect the 4-pin connector of U2S-2 to the ECU's serial communication connector (A-2).
- Connect the U2S-2 main unit to the USB port of the PC.



• Connect the ECU to the engine.

• EC13-LINK can be activated without connecting any sensors to the ECU. For example, in teaching of throttle positions, you can activate the throttle servo as long as it is connected to the ECU.

#### CAUTION :

• Do not turn on the ECU when the fuel tank is empty. Operating the pump without fuel may damage the pump.

• In case you need to turn on the ECU without fuel supply, for example, to rewright the settings by EC11-LINK, disconnect the connector of the pump not to let the pump activate. Thirty seconds after disconnecting the connector, the buzzer rings alarming abnormality of fuel pressure, but you can stop it by clicking "BUZZ OFF" button in EC11-LINK display.

#### $\langle$ connecting to EC11-LINK $\rangle$

[1] Connecting the ECU to the engineCheck the connectors of both the ECU and the engine.

[2] Connecting the ECU to the PCCheck the connection of the ECU and the PC.

【3】 Turning of the ECUTurn on the ECU.

[4] Starting up the software

• Execute the file EC11-LINK\_xxxx.exe, which you copied to the PC. The following window will open.

EC13-LINK				1 222 - 20 M	
COM1 V	Throttle fully closed position [us]	Th_CLOSE	Th_RETURN	Save Settings	
Open	Throttle idle position [us]	Th_IDOL		Initialize Settings	MONITOR
Close	Throttle fully open position [us]	Th_OPEN			
READ	Throttle start position[%]	Th_START			
	Idle Speed	IDLE SPEED			
	End of Starting Mode [Revolutions]	STARTING MODE			
	Fuel increase rate at startup [%]	FUEL STARTUP			
Exit	Trim center position[us]	TRIM	BUZZ OFF		
	Head temperature compensation	Head Temp			
	Altitude Correction	Altitude Correction		1	
00000 0000 0000	0000 0000000				

[5] Confirmation of COM port assignment

• Check which COM port the serial connection to the ECU is assigned using Windows<sup>®</sup> device manager. Refer to the operation manual of the Windows<sup>®</sup>.

• In case the serial connection is assigned to other than COM1 $\sim$  COM20, assign it manually to one of them. Refer to the operation manual of the Windows<sup>®</sup> 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 finish EC11-

[READ] button

• For reading the current setting value in the ECU

#### NOTE:

The setting values are stored in the flash memory in the ECU, and are read out in the memoty when the ECU is turned on. When you change the setting values via EC11-LINK, the new values are memorized in the momories at first, then by clicking [Save Settings] button, the new values are memorized the teh flash memories.

[Exit] button • For exiting EC13-LINK

COM4	
	~
Ope	en
Clos	se
DEA	D

Exit	

#### [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-11 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 It failed to acquire the serial port settings from the PC.
	2 Check the connection between the ECU and the PC.
Open Err3	① It failed the serial port setting in the PC.
	<sup>(2)</sup> 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**»**

EC13-LINK				
COM1 ~	Throttle fully closed position [us]	B1 Th_CLOSE Th_RETURN	Save Settings B12	
Open	Throttle idle position [us]	B2 Th_IDOL B11	Initialize Settings B13	MONITOR
Close	Throttle fully open position [us]	B3 Th_OPEN		
READ	Throttle start position[%]	B4 Th_START		
	Idle Speed	<b>B5</b> IDLE SPEED		
	End of Starting Mode [Revolutions]	B6ARTING MODE		
	Fuel increase rate at startup [%]	B7UEL STARTUP		
Exit	Trim center position[us]	BB TRIM BUZZ OFF		
	Head temperature compensation	Head Temp <b>B9</b>		
(9)				
	Altitude Correction	Altitude Correction B10		2
U U				
00000 0000 0000 00	00 0000000			

Input parameters in the edit boxes shown above  $(\bigcirc \sim \bigcirc)$ , and click each button corresponding to each number (B1 – B10) to transfer the data to the ECU memory. For example, input value in edit box  $(\bigcirc)$  and click B1 button to transfer the input value to the ECU memory.  $(\bigcirc \sim @)$  are for throttle servo settings. After inputting values in  $(\bigcirc \sim @)$  and clicking B1 – B4, the throttle servo moves according to the input values. Please be careful about pinching such as fingers. To return the operation of the throttle servo normal (control by throttle signals), click [Th\_RETURN] button (B11). After setting all the above parameters, you must always click [Save Settings] button (B12) to write the input data in the ECU memory into the flash memory. Turning off the ECU without doing so causes loss of all the input parameters. You can initialize the settings by clicking [Initialize Setting] button (B13) to return to the default settings, but when you initialize the settings, you need to set "Teaching processes" of throttle position again (setting items  $(\bigcirc \sim @)$  below).

#### [Setting Items]

#### **①**Throttle full close position [µs]

• Setting of the full close position by pulse width of PWM signal.

The mark on the throttle valve aligns with the mark at full close position usually around 1150µs. Change the parameter to align each mark as shown on the left.
Inputting extremely small value may cause damage to the throttle servo creating excessive tension on the throttle linkage. So change the parameter ±10µs or less at each adjustment.



#### **②**Throttle idle position [us]

• Setting of the idling position by pulse width of PWM signal. The position of the throttle valve is usually  $+50\mu$ s( $+40\mu$ s $\sim$  $+60\mu$ s) from the fully close position.



• This position, slightly open from the full close position is the reference position. The throttle valve is automatically controlled by the ECU to hold the idling rpm you have set when the throttle valve position is at idling position, in case you use a transmitter, the throttle stick of the transmitter is moved down to the bottom.

• In case the ECU could not hold the idling rpm and the engine stalls, add +5µs to the current parameter. When the aircraft is diving with the throttle control signal at the idling position, in case you use a transmitter, the throttle stick of the transmitter is moved down to the bottom, the propeller turns at higher rpm than the set rpm at idling by airflow to the propeller created by the dive. In this case, the ECU closes the throttle valve excessively until the engine stalls trying to reduce the propeller rpm. If it happens, add +5µs to the parameter also.

• In case the idling rpm doesn't decrease to the value you set in the prosess ③, even if temperature of the engine goes over 100°C, reduce the value by -5µs each time until the rpm decreases.

#### (3)Throttle full open position [µs]

• Setting of the full open position by pulse width of PWM signal.



full open position

• The mark on the throttle value aligns with the mark at full open position usually around 1870 $\mu$ s. Change the parameter to align each mark as shown on the left.

• Inputting extremely large value may cause damage to the throttle servo creating excessive tension on the throttle linkage. So change the parameter  $\pm 10\mu s$  or less at each adjustment.

#### **④**Throttle start position[%]

•Setting of the throttle valve position when you start the engine. To start the engine easier, the ECU opens the throttle valve at this position even throttle signal from your flight controller ordered to close more, in case you use transmitter, you move down the throttle stick of the transmitter and close the throttle valve more than this position. Parameter is to be set  $0\% \sim 100\%$  representing fully close to fully open with  $0\% \sim 100\%$ . The parameter is usually 20%.

#### **(5)**Idling speed[rpm]

• Setting of the idling rpm when the throttle stick of the transmitter is moved down to the bottom, or throttle signal from your flight controller ordered the throttle valve to stay at idling position. The parameter varies depending on your propeller choice and an aircraft. Although the rpm at idling depends on propeller, the parameter is usually between 1600 and 2400 rpm. In case you input the parameter beyond the range, the ECU controls the idling rpm between lower and upper limit. The ECU aim at the idling rpm you have set once the engine is warmed up. But the idling rpm is slightly higher than the set parameter when the engine is still cold.

#### **(6)**End of starting mode[revolutions]

Setting of the timing to release "engine starting mode". The counting starts when engine rpm excess 960rpm. You input the parameter to decide how many revolutions after the first 960rpm "engine starting mode" is released. The parameter is usually 50revolutions.

#### **⑦**Fuel increase rate at startup [%]

• Setting of extra fuel injection at engine start. The parameter shows how much percentage (%) of fuel is to be added to the basic fuel injection. Usually the parameter is 70%. If the parameter is 70%, 170% of the basic injection amount of fuel will be injected.

#### **(B)**Trim center position[us]

Setting of the central parameter (neutral) of Fuel increase/decrease adjustment signal (PWM). Set the parameter according to a receiver or flight controller you use. The pulse width parameter input here is the neutral position. Fuel increases/decreases  $\pm 30\%$  in the range of  $\pm 420\mu$ s. Positive (+) side increases fuel injection and negative (-) side decreases. The default setting is  $1520\mu$ s, which is the neutral position of Futaba receiver.

#### **(9)**Head temperature compensation

Increasing fuel injection according to the rise of Cylinder Head temperature (CHT).
This is the function to stabilize engine operation at low temperature and prevent the engine from overheating at high temperature. The parameter can be input at 16 points, by 20°C interval between 0~ 300°C. The parameter shows how much extra fuel is added to the basic fuel injection by percentage (%).
The temperature between the points is complemented by the lower and higher points. The parameter at 0°C is applied to below 0°C, and the one at 300°C is applied to more than 300°C. Use the default

Head temperature compensation	Head Temp	]
@ 0°C 20 @ 20°C 20 @ 40°C 20 @ 60°C	5 @ 80°C 5	@ 100°C 5
@ 120°C 0 @ 140°C 0 @ 160°C 0 @ 180°C	0 @ 200°C 0	@ 220°C 0
@ 240°C 0 @ 260°C 5 @ 280°C10 @300°C	20	

#### **(D**Altitude correction

• Increase/decrease fuel injection according to altitude. The parameter can be input at 13 points by 500m interval from  $-1000 \sim 5000$ m. The parameter shows how much extra fuel is added to the basic fuel injection by percentage (%). The altitude between the points is complemented by the lower and higher points. The parameter at -1000m is applied to below -1000m, and the one at 5000m is applied to more than 5000m.Use the default settings in an ordinary case.



#### CAUTION :

• Make sure to click [Save Settings] button (B12) to write the input data in the ECU memory into the flash memory. Turning off the ECU without doing so causes loss of all the input parameters. • Setting items  $1 \sim 4$  are the "Teaching processes" of throttle position.

• Do not change the parameters except for  $1 \sim 5$  unless it is needed. The engine performance might get worse.

•Settings of input side of throttle signal is adjusted using the following "MONITOR" function. Opening of throttle valve is affected by the setting of throttle servo position. Set throttle signal input after "Teaching processes" ( $(1 \sim 4)$ ).

#### **《MONTOR》**

• 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] is switched to [Mon Stop] during the MONITOR mode).

EC13-LINK					
COM1 V	Throttle fully dosed position [us]	Th_CLOSE	Th_RETURN	Save Settings	
Open	Throttle idle position [us]	Th_IDOL		Initialize Settings	MONITOR
Close	Throttle fully open position [us]	Th_OPEN			
READ	Throttle start position[%]	Th_START			
	Idle Speed	IDLE SPEED			
	End of Starting Mode [Revolutions]	STARTING MODE			
	Fuel increase rate at startup [%]	FUEL STARTUP			
Exit	Trim center position[us]	TRIM	BUZZ OFF		
	Head temperature compensation	Head Temp			
		Altitude Correction			
00000 0000 0000 0	000000000				

[Information shown during the MONITOR mode]

(1) Pressure (hPa)

Atmospheric pressure measured by the sensor in the ECU.

(2) Fuel pressure (kPa)Fuel pressure after the fuel pump.

(3) 3.3V voltage (mV)Voltage of the 3.3V power supply line of the ECU.

(4) 5V voltage (mV)Voltage of 5v power source line in the ECU.

(5) 12V voltage (mV)Voltage of the 12V power supply line of the ECU.

(6) Head temperature (°C)Temperature measured by the temp. sensor in the cylinder heads.

(7) Throttle signal input (%)

Throttle position (0 - 100%) controlled by throttle signals from a RC receiver or a flight controller.

#### NOTE :

•throttle positions are affected by the settings of the throttle servo. After teaching of the throttle positions, adjust the travel amount (end point) of throttle signal input from the receiver or the flight controller referring to the value on the monitor.

• The end points of throttle fully open and fully closed positions are to be set 0% and 100%, or -1% and 101% with some torelance. (signals 0% or less and 100% or more are recognized as 0% and 100% respectively.)

#### (8) Throttle signal output (%)

The signal output to the throttle servo; how much throttle is open, is shown as 0% through 100%.

(9) Trim signal Width (µs)

Input value (the width of PWM signal) of the fuel adjustment correction from a receiver or a flight controller.

(10) Rotation speed (rpm)

Revolutions of the engine per minute.

Pressure	1007 hPa	
Fuel pressure	300 kPa	
3.3V voltage	3270 mV	
5V voltage	5000 mV	
12V voltage	12040 mV	
Head temperature	20 °C	
Throttle signal input	0 %	
Throttle signal output	20 %	
Trim signal Width	1520 us	
Rotation speed	0 rpm	
*		

#### [Starter generator motor (SGM)]

System configuration



• A maximum of 200W can be generated by the Starter Generator Motor (hereafter SGM) located on the engine crank shaft.

•SGM also has the ability as a starter motor when starting the engine.

• Regulator rectifier ORF-200 and ESC SGC-2100HV are connected in parallel to SGM.

• ORF-200 is an open type regulator rectifier with a maximum of 200W (10 minutes) / continuous 120W.

• The SGC-2100HV is an ESC with a withstand voltage of 90V and drives the SGM when the engine is started.

• CC-100 is a charger dedicated to 4S Li-Po batteries, which charges the battery with the power output from the ORF-200 at 18V DC, and outputs power to the two load connection connectors. When the load is larger than the generated power, the battery powers the load.

• The CC-100 battery charging current is set to a maximum of 3A and the charging voltage is set to a maximum of 16V.

· Use a 4S Li-Po battery with a capacity of 3000mAh to 4000mAh and a C rate of 50C or more.

• Load1 and Load2, which are the load connection connectors of CC-100, have the same specifications. One is used by SGC-2100HV. Please connect the device used for the other side. The maximum usable capacity is 200W (10 minutes) / continuous 120W.

#### CAUTION:

• CC-100 does not have a balanced charging function. Please use the battery after fully charging it with a balance charger before flight.

• If the battery voltage drops below 15.5V, it may not be possible to crank the engine.

• Please note that 18V of the output voltage of ORF-200 is output as it is for both Load1 and Load2 of the load connection connector while the engine is running (power generation). If the system is configured assuming the maximum voltage of 4cell Li-Po battery is 16.8V, use a regulator etc. if necessary.

• For safety, be sure to supply the igniter power from the load connection connector via an isolated regulator.

• The battery connection connector outputs the appropriate voltage and current for battery charging by the charge monitoring circuit. Never connect anything other than a 4S Li-Po battery to the battery connector. If it is connected, the battery cannot be charged properly and it is dangerous.



Со	nne	ction	
		(	1       2       4 or 5       7
NHO	()	БС-2100HV	Connect to the MR60 (M) connector of the ORF-200.  Specification connector : MR60(F)  · 3-phase AC
SGC-2100	3	БС-2100HV	Connect to the MR60 (F) connector of the SGM-8020     Specification connector : MR60(M)     • 3-phase AC
	<b>(4)</b> or <b>(5)</b>	SGC-2100HV	<ul> <li>Connect to the XT60 (F) connector of Load1 or Load2 of the CC-2100HV.</li> <li>Specification connector: XT60(M)</li> <li>DC15.5V~18V</li> </ul>
			• Connect to the JST SM 3P (F) connector of CC-100 of ECU harness.
	D		Specification connector : JST SM 3P(M) • PWM
		SGC-2100HV	[W:Signal / R:DC+5V / B:GND]

#### Starter generator motor (SGM)

Co	nne	ction	
		Load Battery	
			Power input of CC-100.
			• Connect to the output connector XT60 (F) of the ORF-200.
CC-100	0		Specification connector:XT60(M) •DC18V
		CC-100	
	4		<ul> <li>Load1 load connection connector.</li> <li>Load 1 and Load 2 of the load connector have the same specifications.</li> </ul>
		CC-100	•DC18V during power generation, battery voltage otherwise.
	$\square$		Load 2 load connection connector.
	6		• Load 1 and Load 2 of the load connector have the same specifications.
	•	66.100	<ul> <li>Specification connector : TX60(F)</li> <li>DC18V during power generation, battery voltage otherwise.</li> </ul>
_		CC-100	Connect a 15 Li Be battery (canacity 2000mAb 4000mAb)
Q	9		<ul> <li>Use a battery with a C rate of 50C or higher.</li> </ul>
	•		Specification connector:XT60(M) •DC15.5V~18V
		CC-100	

Co	nne	ction				
EC-13			•Connect to SGC-2100 ⑦ connector.			
	0		Specification connector: JST SM 3P(F) •PWM			
		EC-13	[W:Signal / R:DC+5V / B:GND]			
			•Connect to RC receiver or flight controller.			
	$\odot$		Specification connector: Servo connector (FUTABA)			
		and the second s	•The starter goes into standby mode when the PWM signal is 1000 $\mu s$ to			
		254200000000000000000000000000000000000	1400 μs.			
		FC-13	• The PWM signal drives the starter at 1600 $\mu$ s to 2000 $\mu$ s.			
		LC-13	ן אָר אַראָדאר איז איזען אווא-2.0%, אוב-0.4%, אוארא-2.3%			

## Starting the engine

[1] Fill the fuel tank with fuel before turning on the switches of the ECU and the Igniter.

[2] If there are air bubbles in the tube between the fuel tank and the fuel pump unit after filling up the fuel tank, open the pressure release valve and eiminate the air bubbles.

#### NOTE :

Locate the pressure release valve in a place easily accessible to open and close it before/after a day's use.

[3] Turn on the ECU.

[4] Power LED is lit and Operation status LED blinks.

[5] The Fuel pump starts working as soon as the ECU is turned on. If the Pressure release valve is open, close it only after airbubles in the system are gone. When fuel pressure reaches specified value, the Pump works intermittently or stops.

If the temperature is high (35 ° C or higher) and vapor lock is expected to occur, open the pressure release valve one and a half turns from the fully closed position to circulate fuel between the tank and



#### NOTE :

In case the fuel pressure to the injector doesn't reach the specified value after turning on the switch within 30 seconds, the ECU beeps intermittently and the pump stops. (Turn off the switch and turn it on again when you reset the ECU)

[6] Move the throttle stick to check the movement of the throttle servo. If the ECU is in starting mode and the Operation status LED is blinking, you can't close the throttle completely but it still remains open a little even if you move the throttle stick fully down.During the start mode, if throttle is open and close in short period, choke function and warning alarm will activate. For detail, please read choke section of the manual.



[8] When the power to the igniter is turned on and the cell starter signal is turned on, SGM cranks and starts the engine.



• Starter signal input gives a starter start instruction to the ECU from the connector.

•The starter goes into standby mode when the PWM signal is 1000 µs to 1400 µs.

•The PWM signal drives the starter at 1600  $\mu$ s to 2000  $\mu$ s.

[W:Signal / B:GND] VIH=2.6V, VIL=0.4V, MAX5.5V

NOTE :

• To ensure cranking by SGM, the ECU rotates the crank in the reverse direction(about 180 degrees) to build up compressed pressure of piston and then turns to the forward rotation to start engine.

• SGM cannot crank the engine without the propeller attached because of no inertia.

• If the battery voltage drops below 15.5V, it may not be possible to crank the engine. In that case, start using an external starter or the like.

[9] Engine rpm goes up right after starting the engine, but it goes down immediately.

[10] Idling rpm control system starts working when cylinder head temperature reaches the set temperature otherwise the idling rpm is kept at the set rpm.

• the followings are display LED message's meaning.

Power LED —			LED2	LED3		Operation status LED
engine start mode	On	Off	Off	Off	Blink	
engine operation	On	Blink	Blink	Blink	On	(note.1)
fuel pressure abnormal	On	Plink	Off	Off	∩ff	at the same time, a buzzer sounds
(pressure low)	On	DIIIIK	011	011	UII	at the same time, a buzzer sounds
engine stop	On	Off	Off	On	Off	at the same time, a buzzer sounds
The set parameters are damaged	On	Off	Off	Blink	Off	at the same time, a buzzer sounds
System error 1	On	Blink	Blink	Blink	Blink	at the same time, a buzzer sounds
System error 2	On	Off	Blink	Blink	Off	at the same time, a buzzer sounds

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



## Choke

It is not necessary when starting with a cell starter, but the EC-13 has a choke function in case a choke is required for starting with a safety stick. The choke function works only in the engine start mode. The choking method is as follows.

[1] In the engine start mode, when the throttle signal is opened from the state where the opening is 20% or less to the opening of 80% or more within 1 second, and then closed to the opening of 20% or less within 1 second, the injector injects the fuel for the choke once. At that time, the ECU sounds the warning alarm once.

[2] If the same operation is performed again, fuel will be injected in the same way, but in order to prevent over-choke, use the choke function only once or twice, and flip the propeller with a safety stick each time to start the engine while checking for flow of fuel in the fuel line.

#### CAUTION :

Never start by flipping the propeller directly by hand as it may cause unexpected injuries. Be sure to use a cell starter, an external starter, or a safety stick.

## Stopping the engine 1

[1] Turn off the Ignitor switch to stop the engine.

[2] The ECU stops the fuel pump and emits Beep sound intermittently when it detects engine stop.

[3] Turn off the ECU.

[4] Release the residual pressure in the fuel system after a days use to avoid fuel expanding the fuel joints and causing leaks.

## Stopping the engine 2

By using application software(Engine setting\_xxxx.exe)(XXXX is name of the version), the engine stop function can be set. Enter throttle signal and you can use the throttle signal input to instruct the ECU to stop the engine.

 $\langle\!\!\!\langle$ Setting the engine stop function $\rangle\!\!\!\rangle$ 

[1]Connection of ECU and PC

• Turn on the switch of the ECU.For connection, use the serial signal converter in the same way as when using EC13-LINK.

[2] Turning on the ECU

• Turn on the switch of the ECU.

[3] Starting up the software.

• Execute the file {Engine setting\_xxxx.exe} and open the following window.

Engine setting 1.0.0.0	×
	~
(2) COM OPEN (3) COM CLOSE (4) Search	again
5 BUZZ	OFF
6 0 us 7 Reading 8 Save Se	ttings

[4]Confirming COM port assignment.

Make sure which COM port is assigned to the ECU serial connection by Windows<sup>®</sup> device manager.
In case the assigned COM port is other than COM1~COM10, reassign it to one of the port from COM1 to COM10. Refer to the instruction manual of the Windows<sup>®</sup> you are using how to assign a COM port.

[5] Setting the COM port.

• Select the confirmed COM port from the pull-down menu (① in the above picture). Click the [COM OPEN] button (② in the above picture) and the connection is completed.

• In the pull-down menu of ①, you can see what kind of connection ("USB serial port" in this sample below) next to port number (COM3 in this case). You can make a choice from the pull-down menu. In case you cannot find a connection, click ④ [Search again]. If it's still not displayed, check using the Windows®device manaager etc and set up the port number.

Engine setting 1.0.0.0	×
COM3(USB Serial Port)	~
COM3(USB Serial Port)	1000
COM1	
COM2	
COM3	
COM4	
COM5	
COM6	
COM7	

[6]Setting the threshold of pulse width of throttle signal (PWM) in 6, which carries out Engine Stop. •The setting, 0µs invalids the Engine Stop operation.

•The setting range is  $1 \sim 9999 \mu s$ .

• Within the setting range  $1 \sim 9999 \mu s$ , when the throttle signal input pulse width keeps lower than the setting value for more than 0.5 second, the Engine Stop operation is carried out.

[7] Click the [Save Settings] (⑧ in the above picture).

• The new setting is not memorized unless you click [SAVE Setting].

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

After making this setting, the ECU will stop the engine if the PWM signal width of the throttle signal input is held below the set threshold value for 0.5 second or longer.

# Restarting ECU

When the engine stops, the ECU stops the fuel pump, sounds the intermittent warning buzzer, and the engine will go into shut off mode. The engine cannot be restarted in this state.

To restart the engine, it is necessary to restart the ECU. There are three ways to restart the ECU.

(1) Turn off the power of the ECU and then turn it on again.

(2) Use the serial communication function to send a restart command to the ECU. (See Communication Protocol section)

(3) Use the starter signal input to give an instruction to restart the ECU.

On this page, we will explain the method (3).

Starter signal input connector

		<ul> <li>Input the PWM signal from the external device such as transmitter, flight</li> </ul>
		controller etc. to start the starter motor.
		•The starter goes into standby mode when the PWM signal is 1000 $\mu$ s to 1400 $\mu$ s.
A-1		•The PWM signal drives the starter at 1600 μs to 2000 μs.
		Specification PWM signal: 1000µs~2000µs
	Starter signal input	[W:Signal ∕ B:GND] VIH=2.6V, VIL=0.4V, MAX5.5V

If you input 1600µs to 2000µs of PWM signal from the Starter signal input connector for 2 seconds or more continuously during the engine stop mode, the ECU will restart.

After the ECU restarted, if the PWM signal of the Starter signal input connector becomes 1000  $\mu$ s to 1400  $\mu$ s, the starter will be in the standby state.

After the ECU restarted, if the ECU detects the PWM singnal of  $1600\mu$ s  $\sim 2000\mu$ s from the Starter signal input connector continuously, to prevent malfunction, the ECU will enter into engine shutdown mode and cease functioning. In this state, it will not accept restart command. To recover, ECU will need to be turned off and then on again, or to input reset command with serial communication. Bring back the Starter signal input connector's PWM signal to  $1000\mu$ s  $\sim 1400\mu$ s within 3 seconds after the ECU restarted.

①The internal data of the ECU can be collected by other external devices through its serial communication function.

②ECU can be reset by using serial communication function of the ECU.

The communication protocal would show as followings.

#### **«**communication specification**》**

- UART
- •TTL logic level 3.3V
- Pin assignment (ECU side connector)



1	red	+5V power supply output
2	white	TXD
3	green	RXD
4	black	GND

connector : JST 04R-JWPF-VSLE-S

protocol

bit rate	38400 bps
data length	8 bit
parity bit	none
stop bit	1bit
flow control	none
frame length	changeable

#### **«**communication procedure**»**

normal



#### ①《Data collection》

• command format

item	size	data	range
start mark	1 byte	02h	02h(2)
command	3 byte	"MOR"	4Dh、4Fh、52h
end mark	1 byte	03h	03h(3)
BCC(XOR from command to end mark)	1 byte	53h	53h

response format

	item		size	data	range		
sta	irt mark		1 byte	02h	02h(2)		
sta	itus		1 byte	"0"	30h(48)		
			1 byte	" "	20h(32)		
	(1) haromotric prossure	unit:	Abuto	" <u>2000</u> "~"7EEE"	8000h~7FFFh		
		hPa	40910	8000 · • 7FFF	(-32768~32767)		
			1 byte	" "	20h(32)		
	2 fuel pressure	unit:	Abyte	"8000"~"7EEE"	8000h~7FFFh		
		kPa	40916	8000 - 7111	(-32768~32767)		
			1 byte	" "	20h(32)		
	(Received)*	unit:	Abuto	"8000"~"7EEE"	8000h~7FFFh		
	(Neserved)	hPa	40910	8000 - 7111	(-32768~32767)		
		1 byte	" "	20h(32)			
	(Received)*	unit:	Abyte	"8000"~"7EEE"	8000h~7FFFh		
	(4) (Reserved)		40918	8000 - 7111	(-32768~32767)		
			1 byte	" "	20h(32)		
	(5) nower supply (ECIL internal 2.2)()	unit:	Abyte	"8000"~"7EEE"	8000h~7FFFh		
		mV	Hoyic	8000 - 7111	(-32768~32767)		
			1 byte	11 11	20h(32)		
	6 power supply (ECI Linternal 5)/)	unit: mV	Abuto	"8000"~"7EEE"	8000h~7FFFh		
-			40916	8000 - 7111	(-32768~32767)		
TA	(7) nower supply (ECI Linternal 12V)	unit: mV	Abyto	"8000"~"7FFF"	8000h~7FFFh		
DA			40916	8000 - 7111	(-32768~32767)		
		1 byte	" "	20h(32)			
	8 cylinder head temperature	unit: °C	4byte	"8000"~"7FFF"	8000h~7FFFh		
				8000 7111	(-32768~32767)		
			1 byte	" "	20h(32)		
	(Peserved)*	unit:	/hvto	"8000"~"7FFF"	8000h~7FFFh		
			ноусе	8000 7111	(-32768~32767)		
			1 byte	" "	20h(32)		
	throttle signal input from receiver	unit:	/hvto	"8000"~"7FFF"	8000h~7FFFh		
	(fully close~fully open 0%~100%)	%	HOYIC	0000 /111	(-32768~32767)		
		_	1 byte	" "	20h(32)		
	n signal output to throttle servo	unit:	<u>Ahvte</u>	"8000"~"7FFF"	8000h~7FFFh		
	(fully close~fully open 0%~100%)	%	ноусс	0000 /111	(-32768~32767)		
		_	1 byte	" "	20h(32)		
	fuel trim signal input from receiver	unit:	<u>Ahvte</u>	"8000"~"7FFF"	8000h~7FFFh		
	(PWM signal pulse wide range)	ноусе	8000 7111	(-32768~32767)			
		1 byte	" "	20h(32)			
	(13) engine rotation speed	unit:	Abuto	"8000"~"7FFF"	8000h~7FFFh		
		rpm	40918	0000 - 711F	(-32768~32767)		
en	d mark		1 byte	03h	03h(3)		
ВĊ	C(XOR from status to end mark)	1 byte					

\*The (Reserved) item is not used in EC-13. The value is readable but it does not mean anything.

# **(Restarting ECU)**• command format

item	size	data	range
start mark	1 byte	02h	02h(2)
command	9 byte	"rstrstrst"	72h、73h、74h、 72h、73h、74h、 72h、73h、74h、
end mark	1 byte	03h	03h(3)
BCC(XOR from command to end mark)	1 byte	76h	76h

item	size	data	range
start mark	1 byte	02h	02h(2)
status	1 byte	"0"	30h(48)
end mark	1 byte	03h	03h(3)
BCC(XOR from status to end mark)	1 byte	33h	33h

#### 《CAN setting software》

Use the serial signal converter and the CAN setting software {CAN setting\_xxxx.exe} (xxxx is the version name) to set the CAN of the ECU.

#### [Separately required items]

• PC with Windows<sup>®</sup> (10/11) and USB port. The included U2S-2 (serial signal converter) uses an FTDI chip, the driver is registered in Windows<sup>®</sup> 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.

#### [Installing software into PC]

• There is no installation program for CAN setting software. Copy the software {CAN setting\_xxxx.exe} to any location on your computer (hereafter PC). After copying it to any location, execute {CAN setting\_xxxx.exe} directly.

• When deleting the software, delete the {CAN setting\_xxxx.exe} file from the PC.

#### 《Setting》

[1]Connecting serial signal port

• Connect the 4-pin connector of U2S-2 to the ECU's serial communication connector (A-2).

• Connect the U2S-2 main unit to the USB port of the PC.



[2] Powering the ECU • Turn on the power of ECU

#### CAUTION:

• Do not turn on the ECU if the fuel is not going into the fuel pump. If fuel pump runs without any fuel, it may cause damage to the pump.

• If you need to power on the ECU without fuel, such as when changing settings using CAN configuration software, disconnect the pump connector and do not operate the pump. In that case, the buzzer (alarm) sounds due to abnormal fuel pressure 30 seconds after the ECU is turned on, but you can stop the buzzer by clicking the "BUZZ OFF" button in the CAN setting software.

#### [3] Starting up the software

• Execute {CAN setting\_xxxx.exe} copied to the PC. The window will open(picture below).

COM1		~
COM OPEN	3 COM CLOSE 4	Search again
		5 BUZZ OFF
CAN Invalid	√ 8 Reading	9Save Settings

#### [4] Confirming the COM port allocation

• Check which COM port the serial connection with the ECU is assigned to, using Windows<sup>®</sup> Device Manager, etc.

•At this time, if it is allocated outside the range of COM1 to COM10, change it to one of COM1 to COM10. For how to change, refer to the operation method of each Windows <sup>®</sup> you are using.

#### [5]Setting COM port

•Select the confirmed COM port from the pull-down menu (① in the above picture). Click the [COM OPEN] button (② in the above picture) and the connection is completed.

• In the pull-down menu of ①, you can see what kind of connection ("USB serial port" in this sample below) next to port number (COM3 in this case). You can make a choice from the pull-down menu. In case you cannot find a connection, click ④ [Search again]. If you still can't see it, check Windows® Device Manager and set the port number.

AN setting	>
COM3(USB Serial Port)	~
COM3(USB Serial Port)	
COM1	
COM2	
COM3	
COM4	DEE
COM5	
COM6	
COM7	ttings
COM8	cungo
COM9	
COM10	

[6]Select CAN Invalid or communication speed from the pull-down menu in 6.

• 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: 0x0300 to 0x030C(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 50 for the data format.

[7] Determine and input the start point of CAN ID in ⑦.

• Oh  $\sim$  7FFh can be used.

• The CAN communication occupies 13 IDs including the start point.

• In case 7FFh is determined, the ID circulates like 7FFh, 0h, 1h, ••••Ah.

• Do not use the same ID of other devices connected to the CAN.

[8]Click the [Save Settings](<sup>(()</sup>) in the above picture).

• The new setting is not memorized unless you click [SAVE Setting].

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

•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)

 $\wedge$ 

4	1	red	+5V power supply output
	2	white	Signal(High)
	3	green	Signal(Low)
1	4	black	GND
× 🥢			

connector : JST SMR-04V-BC

#### 《data format》

• Data frame

Recessive(1)															
Dominant(0)		SOF	ID10~0bit (11bits)		RTR	IDE	RBO	DLC	3 DI	LC2	DLC1	. DL	со		
Dominant(0)			ID		0	0	0		DATA LENGTH						
							С	ontrol	Field					Ļ	
L,	DATA	0~7(MSB) MAX 8byte CR			CRC14~0bit (15bits) CRC DEL			CRC DEL	ACK	AC DE	CK El I	OF		IFS	-
ļ															_
		DAT	rA Field		C	RC Fiel	d								

#### • DATA

NANAE	סו		DATA	DATA 0~7	,		
NAIVIE		ID	LENGTH	0~5	6 <b>~</b> 7	DATA KANGE	
barometric pressure (hPa)	768	0x0300	8	0x00000000000	DATA		
Fuel pressure (kPa)	769	0x0301	8	0x00000000000	DATA		
(reserved)*	770	0x0302	8	0x00000000000	DATA		
(reserved)*	771	0x0303	8	0x00000000000	DATA		
3.3V voltage (mV)	772	0x0304	8	0x00000000000	DATA	0x8000 (-32768)	
5V voltage (mV)	773	0x0305	8	0x00000000000	DATA	~	
12V voltage (mV)	774	0x0306	8	0x00000000000	DATA		
Head temperature(°C)	775	0x0307	8	0x00000000000	DATA	UX/FFF (32/0/)	
(reserved)*	776	0x0308	8	0x00000000000	DATA		
Throttle signal input(%)	777	0x0309	8	0x00000000000	DATA		
Throttle signal output(%)	778	0x030A	8	0x00000000000	DATA		
Trim signal Width (μs)	779	0x030B	8	0x00000000000	DATA		
Rotation speed (rpm)	780	0x030C	8	0x000000000000	DATA		

\*The (Reserved) item is not used in EC-13. The value is readable but it does not mean anything.



Not connected except to enclose with



Not connected except to enclose with

ENG	INE PARTS LIST	/ GF80TU-FI W/SGM ( 1/3 )	
No.	Code No.	Description	
1	4AL01000	CRANKCASE GF80TU	
2	74002A20	ROTATION SENSOR IG-10	
3	74002321	ROTATION SENSOR FIXING SCREW (2PCS)	
4	29730000	BALL BEARING(FF)	
5	4AL30000	BALL BEARING(FR)	
6	4AD30000	BALL BEARING(RF)	
7	4AL31000	BALL BEARING(RR)	
8	45231100	CAMSHAFT BEARING (1PC)	
9	4AL02000	CRANKSHAFT GF80TU	
10	29708200	PARAREL KEY (1PC)	
11	4AD62000	CAMSHAFT(F)	
12	4AL62000	CAMSHAFT(R)	
13	4AL01100	CAM COVER (1PC)	
14	4AL01101	CAM COVER O-RING (1PC)	
15	4AL08000	DRIVE SPACER GF80TU	
16	29708100	TAPER COLLET	
17	28602100	PILOT SHAFT	
18	79872100	WASHER 10.0	
19	29709000	PROPELLER WASHER	
20	4AL28003	MOUNTING PLATE GF80TU	
21	4AL81201	THROTTLE SERVO MOUNT GF80TU (1PC)	
22	4AD81221	THROTTLE SERVO	
23	4AD81401	THROTTLE SERVO HORN	
24	4AD81205	THROTTLE SERVO PLATE (1PC)	
25	4AL81202	THROTTLE LINK ROD	
26	4AL03300	CYLINDER GF80TU (1PC)	
27	29122540	SILENCER GASKET (O-RING)	
28	4AL03200	PISTON (1PC)	
29	49403400	PISTON RING (1PC)	
30	49406010	PISTON PIN (1PC)	
31	29717000	PISTON PIN RETAINER (2PCS)	
32	4AL04000	CYLINDER HEAD (1PC)	
33	49404160	HEAD GASKET (1PC)	
34	54056014	ST-02 TEMPERATURE SENSOR (1PC)	
35	4A004200	ROCKER COVER (1CP)	
36	44514300	ROCKER COVER GASKET (1PC)	
37	45761600	ROCKER ARM RETAINER (2PCS)	
38	49464000	ROCKER SUPPORT (1PC)	
39	4AD61100	ROCKER ARM (1PC)	
40	44561200	TAPPET ADJUSTING SCREW (1PC)	
41	45560410	COTTER PIN (2PCS/1PAIR)	
42	49460400	VALVE SPRING RETAINER (1PC)	
43	49460200	VALVE SPRING (1PC)	
44	49460110	POPPET VALVE (1PC)	
45	4AD66000	PUSH ROD (2PCS)	
46	45566310	PUSH-ROD COVER O-RING (2PCS)	
47	49466100	PUSH ROD COVER (1PC)	
48	44564000	CAM FOLLOWER (2PCS)	
49	4AL69401	INTAKE MANIFOLD A GF80TU	
50	4AL14010	INTAKE MANIFOLD A GASKET GF80TU	
51	4AL69402	INTAKE MANIFOLD B GF80TU (1PC)	
52	49414010	INTAKE MANIFOLD GASKET (2PCS)	
53	4AL69403	INTAKE PIPE GF801U (1PC)	
154	4AAU/410	IO-KING (1PC)	

Engine parts list

ENGINE PARTS LIST / GE80TU-ELW/SGM (2/3)						
	Code No	Description				
55	4AI 16100	REED VALVE MOUNT GE80TU				
56	4AI 15001	REED VALVE MOUNT GASKET GE80TU				
57	44115002	REED VALVE GASKET GEROTUL (1PC)				
58	4AI 16000	REED VALVE OSSERIO GEODIO (11.6)				
59	441 81 100	THROTTLE BODY GE80TU				
60	44181200					
61	54057025	O-RING THROTTLE VALVE GLOGIC				
62	4AD81400	THROTTLE ARM				
63	441 81220	ROTOR GUIDE WASHER				
64	4AD84000	INIECTOR				
65	44084003					
66	44084004	INIECTOR O-RING				
67	44084014					
68	44084005	INIECTOR SPACER (2PCS)				
69	44D83300					
70	44081950					
70	44112000	AIR CLEANER ADAPTER GEROTU				
72	44115003	AIR CLEANER ADAPTER GASKET GEROTU				
91	54085001	SGM-8020 (GE80TU)				
02	54085001					
92	45520000					
93	5/085007					
94	740035007	M5 STAND OFF FNGINE MOUNT 60mm (APCS)				
95	55500004					
90	44125000	SILENCER E-6050 (10C)				
97	4AL25000					
90	4AL25005	$\frac{1}{1}$				
100	4AL20000					
100	4AC24000					
<u> </u>	79871020					
$\frac{c_1}{c_2}$	79871020	HEXAGON HEAD SCREW M2.6X10 (10PCS/SET)				
C2 C3	79871110	HEXAGON HEAD SCREW M3.0X10 (101 CS/SET)				
C5	79871140	HEXAGON HEAD SCREW M3.0X 0(101 CS/SET)				
C6	79871410	HEXAGON HEAD SCREW M3.0X12(101 CS/SET)				
C7	79871415	HEXAGON HEAD SCREW M4.0X10 (101 C3/3E1)				
C8	79871415	HEXAGON HEAD SCREW M4.0X15(10FCS/SET)				
	79871/20	HEXAGON HEAD SCREW M4.0X20(10PCS/SET)				
C10	79871520	HEXAGON HEAD SCREW M5 0X20(10PCS/SET)				
C11	79871525	HEXAGON HEAD SCREW M5.0X25(10PCS/SET)				
C12	79871540	HEXAGON HEAD SCREW M5.0X20 (10PCS/SET)				
C13	79875616	HEXAGON FLAT-H SCREW M6.0X16(10PCS/SET)				
F1	75005100	FC-13 ENGINE CONTROL UNIT (FOR W/SGM)				
F2	75005100	EC-13 ECIL (FOR W/SGM)				
F3	75000007	MOUNT COLLAR (4PCS)				
F4	75005102	IFCU WIRE HARNESS EC-13 (FOR W/SGM)				
F5	75005012	POWER SLIPPLY CORD EC-13				
 	75000206					
F7	74001210	112S-2 SERIAL SIGNAL CONVERTER				
FR	54055002	ORE-200(FOR SGM)				
FQ	54086001	ISGC-2100HV				
E10	54088001	ICC-100(4S)				
D1	54087000					
P2	72500010					
<u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	5/052010					
1	54058013					

Engine parts list

ENGINE PARTS LIST / GF80TU-FI W/SGM ( 3/3 )			
No.	Code No.	Description	
S2	54058014	PRESSURE SENSOR SP-01	
S3	54058006	PRESSURE SENSOR ADAPTER SP-01	
S4	54058007	PRESSURE SENSOR BLOCK SP-01	
S5	54058010	PRESSURE RELEASE VALVE SP-01	
S5-1	54058015	NEEDLE SP-01	
S6	4AD81950	FUEL INLET (1SET)	
F1	75001014	PUMP CONNECTION CORD (50cm)	
F2	74002E10	IGNITION MODULE (IG-12)	
F3	54056001	SOCKET WRENCH FOR TEMPERATURE SENSOR	
F4	71669000	SPARK PLUG CM-6(NGK) (1PCS)	
F5	70000001	HOSE CLIP 6 (5PCS/SET)	
F6	78300000	GASOLINE FUEL FILTER S	
F7	71531010	NON-BUBBLE WEIGHT S	
F8	7000002	CONNECTOR LOCK (5PCS/SET)	
F9	28382303	FLUORINE (ETFE) RESIN TUBING (2M)	
F10	72200211	VALVE ADJUSTING TOOL KIT GF	
<u> </u>			

Engine parts list







#### Engine parts list

ORF-200(FOR SGM)

SGC-2100HV





#### SP-01 FUEL PRESSURE SENSOR UNIT



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#### Engine parts list



#### Engine parts list

CONECTOR LOCK (5pcs.)

FLUORINE(ETFE) RESIN TUBING (2m) (EIGHTRON Flexible Fluorine (ETFE) Resin Tubing Clear made by HAKKO CORPORATION / JAPAN )

VALVE ADJUSTING TOOL KIT GF (Option )



GF80TU-FI With SGM-8020

Unit : mm





FUEL PUMP UNIT

Unit : mm



JAE 34032NF (32Pin) /JAE 34016NF (16Pin) EC-13 ENGINE CONTROL UNIT

Unit : mm



MEMO