

HKS ELECTRONICS TECHNOLOGY

AFK

A/F-Knock Amp.

Instruction Manual



E84111-K00060-00
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Ver.3-1.01

INTRODUCTION

NOTICE

This manual assumes that you have and know how to use the tools and equipment necessary to safely perform service operations on your vehicle. This manual assumes that you are familiar with typical automotive systems and basic service and repair procedures. Do not attempt to carry out the operations shown in this manual unless these assumptions are correct. Always have access to a factory repair manual. To avoid injury, follow the safety precautions contained in the factory repair manual.

PRODUCT	A/F-Knock Amp.
USE	Measuring air-fuel ratio and knock level.
APPLICATION VEHICLE	Any vehicle that operates on a DC12V negative ground.
PART No.	44006-AK003
REMARKS	A/F Amp. is applicable to unleaded gasoline engine vehicles. Knock Amp. is applicable to vehicles with non-resonance type knock sensors for gasoline engines or vehicles in the vehicle specific wiring list.

OUTLINE

- HKS A/F Knock Amp. converts the signals from sensors to the air-fuel ratio and the knock level using the knock sensor equipped with the vehicle or the provided A/F sensor.
- The air-fuel ratio and knock level is displayed on the unit's screen, and can output voltage to other devices.
- 2 A/F sensors can be connected.
- 2 knock sensors equipped with the vehicle can be connected.
- A headphone terminal is provided with this product. It enables users to listen to the knock sensor signal so that knocking can be confirmed by sound.
- Connecting the A/F Knock Amp to an F-CON unit allows monitoring of the A/F value and knock level, as well as data-logging through use of the Power Writer software.
※ Power Writer software can only be used by HKS Certified Pro Dealers.

NOTE

This product does not include a headphone; it must be purchased separately.

There is only 1 A/F sensor provided with this product. If more sensors are necessary, they are available as an optional part.

PRODUCT SPECIFICATIONS

- Operating Voltage DC11~16V
- Displayable A/F 2.0~25.0 A/F
- Measuring Range 0.55~1.5 Lambda
1.0 Lambda = 14.54 A/F
8.0~22.0 A/F

- Operating Temperature (Min. - Max.) Monitor Unit -10~70°C
Amplifier -10~85°C
- Maximum Electrical Power Consumption 70W

- This manual indicates items that require careful attention in order to safely install this product, and lists precautions to avoid any possible damage and/or accidents.
- For any lost, defective and/or damaged parts, contact your dealer to order.
- HKS will not be responsible for any damage caused by incorrect installation, and/or use, or use after modification and/or dismantling of this product.
- HKS will not be responsible for any damage caused by the removing vehicle's interior/exterior, electric parts or modification for installation.
- This product was designed and tested based on installation onto a factory vehicle or a vehicle using other HKS products. The performance and/or safety cannot be guaranteed if this product is installed onto other inapplicable vehicles.
- This product operates only on vehicles with DC12V negative ground.
- The specifications of this product are subject to change without notice.
- This manual is subject to revision without notice.
- The user must keep this manual.

SAFETY INSTRUCTIONS



Warning

- To avoid possible accidents, do not mount the unit where it may become a distraction during driving
- Do not install this product on a vehicle with DC24V negative ground. It may cause a fire.
- Make sure to remove the cable from the negative terminal of the battery to avoid possible damage to other electronics parts and/or a fire caused by a short circuit.
- Cease use of this product if any unusual situation is noticed. Consult the dealer immediately.

Caution

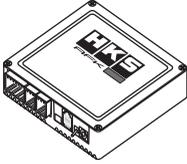
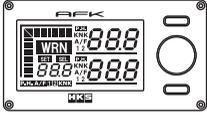
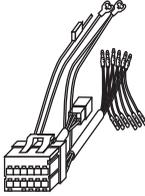
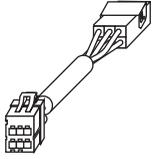
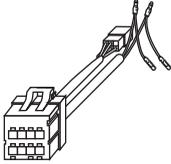
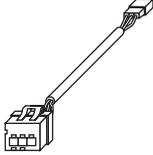
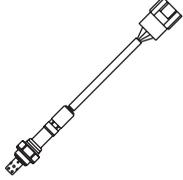
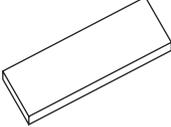
- Do not install this product by yourself unless you have and know how to use the tools and equipment necessary to safely perform service operations on your vehicle.
- Do not modify, disassemble, and/or remodel the product and attached parts to avoid any damage to the unit and/or harness.
- Handle this product carefully, as this product is made using precise electrical components.
- Prevent oil and/or water from entering the unit, or engine damage can result.
- Make sure all connections and wiring are not disconnected, short circuited, or incorrect. If so, it may cause an electric shock, short, or damage to the vehicle.
- If the product or the vehicle with the product does not perform properly, consult your retailer/dealer immediately.

- Daily maintenance of the vehicle is the responsibility of the owner/user.
- This manual shows a typical installation. Actual installation may vary depending on the vehicle application.
- Refer to the factory service manual when removing factory parts.
- Do not lose and/or damage any removed factory parts.
- Make sure to use appropriate tools to tighten nuts and bolts. Do not over-tighten bolts and nuts.

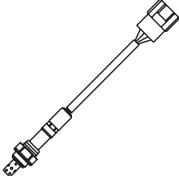
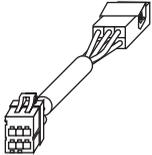
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Parts List

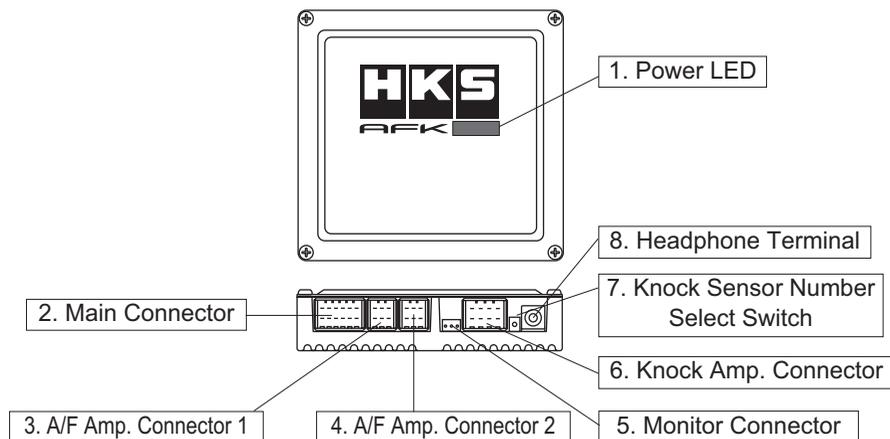
			
1 AMP UNIT	2 MONITOR UNIT	3 MAIN HARNESS	4 A/F SENSOR HARNESS
QT:1	QT:1	QT:1	QT:1
			
5 KNOCK SENSOR HARNESS	6 MONITOR UNIT HARNESS	7 O2 SENSOR BOSS	8 A/F SENSOR
QT:1	QT:1	QT:1	QT:1
FEMALE BULLET CONNECTOR x 4 FEMALE SLEEVE x 4 MALE BULLET CONNECTOR x 4 MALE SLEEVE x 4	FEMALE BULLET CONNECTOR x 2 FEMALE SLEEVE x 2 MALE BULLET CONNECTOR x 2 MALE SLEEVE x 2		 Japanese x 1 English x 1
9 CONNECTOR SET 1	10 CONNECTOR SET 2	11 DOUBLE-SIDED TAPE	12 INSTRUCTION MANUAL
1 Set	1 Set	QT:1	1 Set

OPTIONAL PARTS LIST

			
1 A/F SENSOR	2 A/F SENSOR HARNESS	3 O2 SENSOR BOSS	4 O2 SENSOR BOSS BOLT
44999-AK022 QT:1	44999-AK023 QT:1	17461-023259 QT:1	90370-006111 QT:1
 x 5			
 x 5			
5 O2 SENSOR BOSS + BOLTS(5 pc)			
44999-AK001 1 Set			

NAMES & FUNCTIONS

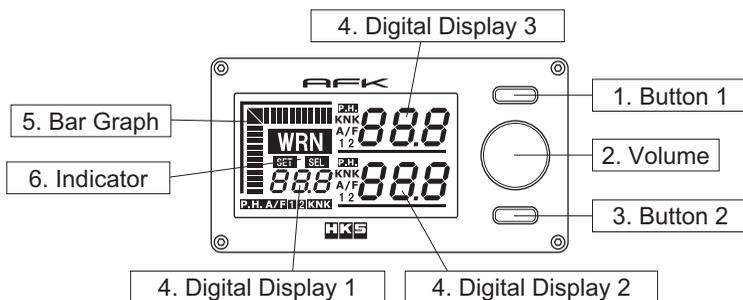
1. AMP UNIT



1. Power LED
LED turns on when the power is on.
2. Main Connector
Connect the main harness.
3. A/F Amp. Connector 1
Connect the A/F sensor harness.
4. A/F Amp. Connector 2
Connect the A/F sensor harness. (Option)
5. Monitor Connector
Connect the monitor harness.
6. Knock Amp. Connector
Connect the knock sensor harness.
7. Knock Sensor Number Select Switch
Select the number of the knock sensor to use; the lower for 1 and the upper for 2.
8. Headphone Terminal
Connect a headphone to listen for engine knock.

2. MONITOR UNIT

Front



1. Button 1

In monitor mode, press and hold this button for more than one second to decrease display refresh rate. Holding this button for an extended period of time will increase the refresh rate time value, such that the refresh rate decreases further. In setting mode, use this button to activate the setting.

2. Volume

Turn this knob to adjust the volume of the headphone. Press and hold this knob for more than one second to reset peak hold value. Rotate this knob while in setting mode to select and edit values.

3. Button 2

In monitor mode, press and hold this button for more than one second to increase display refresh rate. Holding this button for an extended period of time will decrease the refresh rate time value, such that the refresh rate increases further. In setting mode, use this button to switch the setting group.

4. Digital View 1 / 2 / 3

The following values are displayed: A/F Value 1, A/F Value 2, Knock Level, respective Peak Hold Values, and the A/F Comparison Value. Selection of the display values can be done via settings.

5. Bar Graph

A bar graph of the values shown in Digital Display 1. Each bar of the bar graph is based on the selected item or the minimum and maximum values of the selected item.

6. Indicator

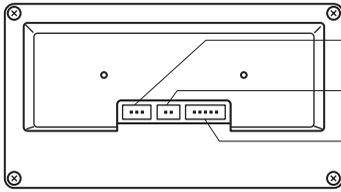
This item appears depending on the condition(s) below.

WRN : This appears when the value for the Digital Display 1 exceeds the warning value.

SET : This appears when changing values in setting mode.

SEL : This appears when selecting values in setting mode.

Back



7. Monitor Harness Connector (3 pin)

8. Spare Connector (2 pin)

9. Spare Connector (5 pin)

7. Monitor Harness Connector

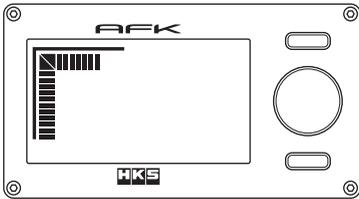
Connect the harness from the monitor.

8. Spare Connector (2 pin) - unused

9. Spare Connector (5 pin) - unused

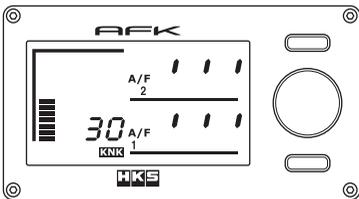
3. Display Index

1. Opening



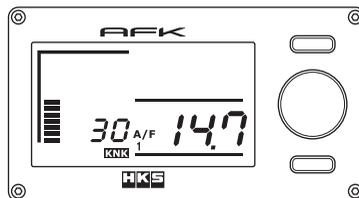
On initial start-up, an opening demo will appear on the monitor after the internal buzzer sounds. After the demo is finished, the display will switch to A/F sensor warm-up mode.

2. A/F Sensor Warm-up Mode



Knock level value will be displayed on the KNK area of the display. The A/F display will be in initial warm-up mode. Once the warm-up is complete, the unit will switch to monitor mode.

3. Monitor Mode



Monitored values are displayed.

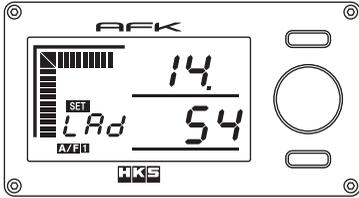
Default Setting

Digital Display 1: Knock Level

Digital Display 2: A/F Value 1

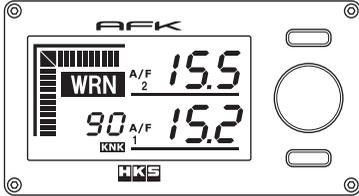
Digital Display 3: OFF

4. Setting Mode



While in monitor mode, press button 2 to switch to setting mode. All settings are performed in this mode. For details, see "Operation Outline" from page 17.

5. Warning



If warning is set to ON and the warning conditions are met, the internal buzzer will sound and the **WRN** indicator will show on the screen. Also, if the backlight setting is ON, the backlight will begin to blink.

NOTE

The display unit may show a black line/stripe. This is caused by static electricity and it does not affect the functions or performance of the unit. To remove the black line/stripe, wipe the monitor with an anti-static cloth or a cloth with an anti-static solution.

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WARNING

- Do not install this product onto a vehicle with DC24V negative ground. It may cause a fire.
- This manual shows a typical installation. Actual installation may vary depending on the vehicle application.

1. Advice for Installation

Do not install this product to the following locations:

1. Amp Unit and Monitor Unit

- Where they can be exposed to extremely high or low temperatures.
- Where temperature changes are extreme.
- High humidity areas.
- Where the unit may get wet.
- High dust areas
- In areas of high electro-magnetic disturbance.

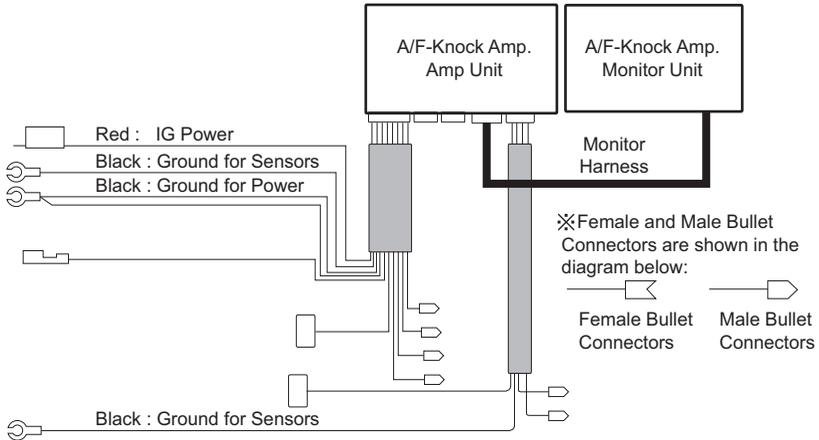
2. A/F Sensor

- Near flammable objects and/or flammable gas.
- Where an exhaust drain may enter.
- Where the unit comes into contact with other objects or the ground.

3.3 Wiring

(1) Ignition power and Ground

- Use the main harness. IG power must be connected to the wire capable of more than 10A such as the 12V power socket. (Do not connect to the ECU wire.)
- Use a chassis ground. If this process is not completed, the A/F and/or knock level voltage output readings may be incorrect.



About Grounding

● Main Harness

- Ground for Power
Ground for large voltage circuits such as A/F sensor heater voltage.
- Ground for Sensors
Ground for the A/F measuring circuit and the analog voltage output circuits.

● Knock Input Harness

- Ground for Sensors
Ground for the knock sensor signal input circuit.
If the knock amp. function is not used, this grounding process is not necessary.

※ If readings from the A/F and/or knock voltage output are incorrect, or if the sound from the knock sensor is not clear, changing the grounding location may solve the problem.

(2) A/F Amp. Functions Wiring

● Wiring to view the A/F Value on the Monitor.

Install the A/F sensor to the vehicle, and connect the sensor to the Amp. unit using the A/F sensor harness.

※ When only 1 A/F sensor is used, connect it to [A/F Amp.1] connector.

※ When 2 A/F sensors are used, connect one to [A/F Amp.1] and the other to [A/F Amp.2] connector.

Connect the Amp. unit to the monitor.

● Wiring for the A/F Voltage Output to F-CON

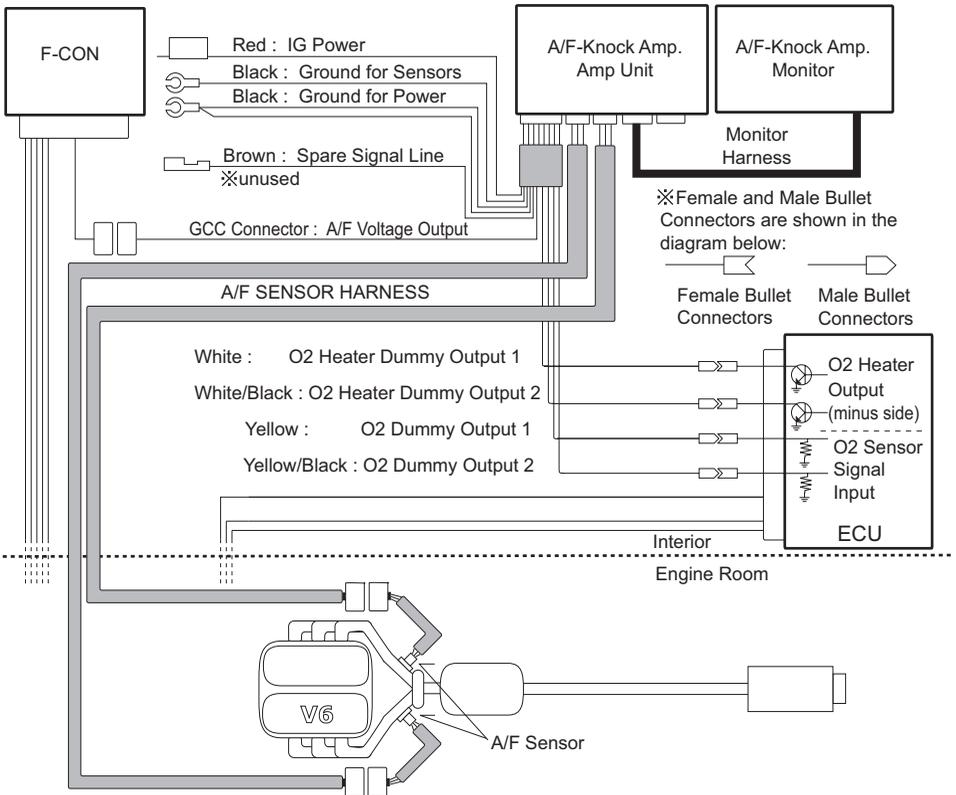
Connect the main harness of the GCC connector to [Ignition GCC Connector] of the F-CON unit. By default, A/F1(Blue wire) is connected. To use A/F2(Blue/Black wire), replace the wire with A/F1.

※ A/F1 and 2 cannot be used together.

● To Replace the Factory O2 Sensor

To replace the factory O2 sensor, use the provided bullet connector to connect the O2 dummy output wire and O2 heater dummy wire from the main harness to their respective vehicle-side wires.

※ The dummy signals may not be applicable depending on the vehicle. If not applicable, do not connect these wires.



(3) Knock Amp. Function Wiring

● Wiring to View Knock Level on the Monitor.

Reference the vehicle-specific wiring diagrams to connect wires of the knock sensor.

※ When only 1 knock sensor is used, connect it to [Knock Sensor 1] terminal (White wire) of the knock sensor harness. Set the knock sensor number select switch to the lowest position.

※ When 2 knock sensors are used, connect one to [Knock Sensor 1] terminal and the other to [Knock Sensor 2] terminal (Gray wire) of the knock sensor harness. Set the knock sensor number select switch to the uppermost position.

● Wiring for the Knock Voltage Output to F-CON

■ F-CON iS

Connect the GCC connector of the knock sensor harness to [Fuel GCC Connector] of the F-CON iS unit.

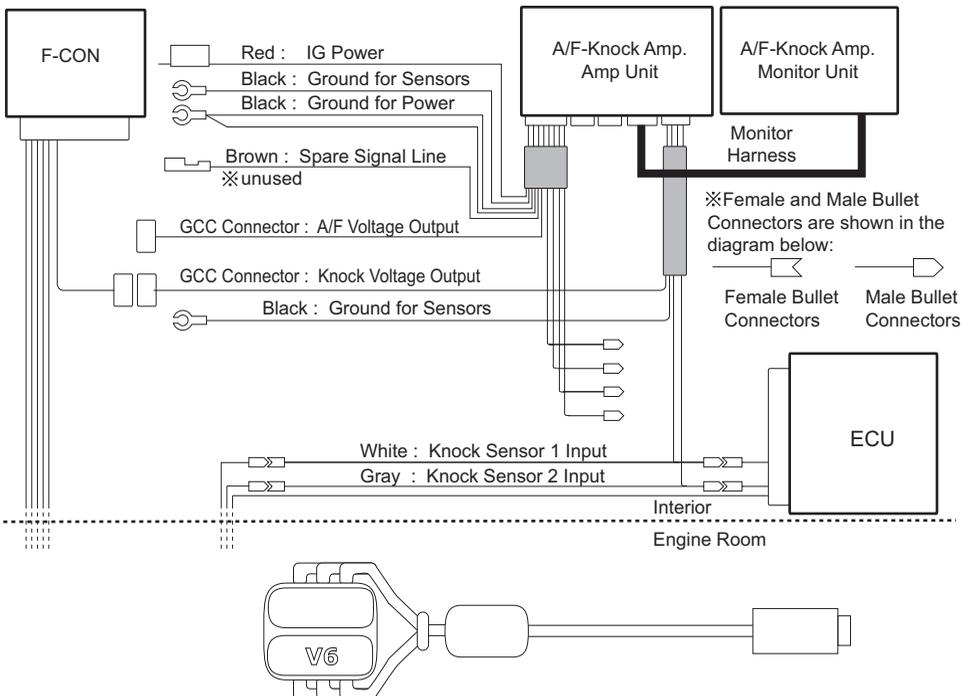
■ F-CON V Pro

Connect in the same manner as for the F-CON iS, or connect the GCC connector (Purple wire) of the knock sensor harness to either [Voltage Output 1 (Terminal #23)] or to [Voltage Output 2 (Terminal #24)].

※ Using the Power Writer Software (only used by HKS Certified Pro Dealers), edit the "Control" tab, under "Parameter Setting".

● Listen to Knock Sound Using a Headphone

This wiring is conducted to listen to the knock sensor signal via headphones. Enabled via "Wiring to View Knock Level on the Monitor" steps. Connect headphones to the headphone terminal and adjust volume as necessary.



4. Installing A/F Sensor

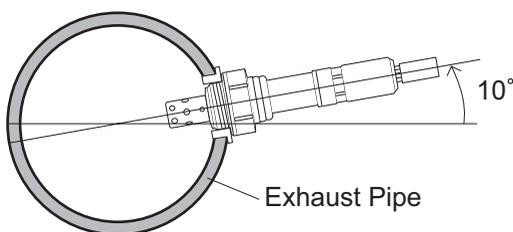
Install the A/F sensor onto the exhaust pipe using M18 x P1.5 bolt(s). If the vehicle is equipped with a factory O2 sensor that is mounted with the same size bolt(s), use these bolt(s) to install the replacement A/F sensor. The dummy signals of the O2 sensor signal and the O2 sensor heater signal will output from the amp unit. Connect the bullet connector of the main harness referencing Section 3.2. Wiring Diagram.

※ The dummy signals may not be applicable depending on the vehicle.

If the factory O2 sensor is not replaced with the A/F sensor, weld an O2 sensor boss (not included) onto the exhaust pipe to install the sensor.

※ Install the sensor so that the end of the sensor faces upward at least 10° higher than 180° (flat) position relative to the exhaust pipe, as illustrated in the diagram below. The point of the sensor should be faced downward to prevent moisture and/or fuel buildup, which can lead to shorter life span of the sensor.

※ When using an O2 sensor boss to install the sensor, apply heat-resistant grease to the screw thread to prevent burns to the sensor/boss.



※ For vehicles with turbochargers, do not install the sensor onto the exhaust manifold before the turbocharger. If exhaust gas pressure is high, A/F measurement errors may result.

※ Do not install the sensor where exhaust gas temperature can exceed 800°C, to prevent damage to the A/F sensor.

※ Do not leave the A/F sensor on the exhaust pipe when A/F Knock Amp. is not used.

A/F-Knock Amp. OPTIONAL PARTS

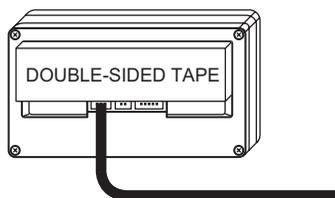
NAME	PART No.	REMARKS
O2 SENSOR BOSS	17461-023259	M18xP1.5(BOSS)
O2 SENSOR BOSS BOLT	90370-006111	M18xP1.5(BOLT)
O2 SENSOR BOSS + BOLTS(5 pc)	44999-AK001	5 pc

Warning

- Do not hit and/or drop the sensor as the sensor is made of precision components.
- When installing, make sure the sensor wires do not touch or come close to high heat areas.
- Do not handle the sensor right after operation, as the sensor becomes very hot during the operation.
- When welding the O2 sensor boss, the sensor must first be removed from the boss, to prevent damage to the sensor. Make sure there are no gas leaks from the welded location.

5. Installing the Monitor Unit

A/F-Knock Amp. Monitor Unit (Back)



- (1) Remove any dirt, dust, and/or oil from the area the unit is going to be mounted.
- (2) Mount the monitor using the double-sided tape.

Advice

The monitor can be best viewed if looking down on the monitor from a higher vantage point. Therefore, position the monitor lower than eye level or tilt the monitor downward.

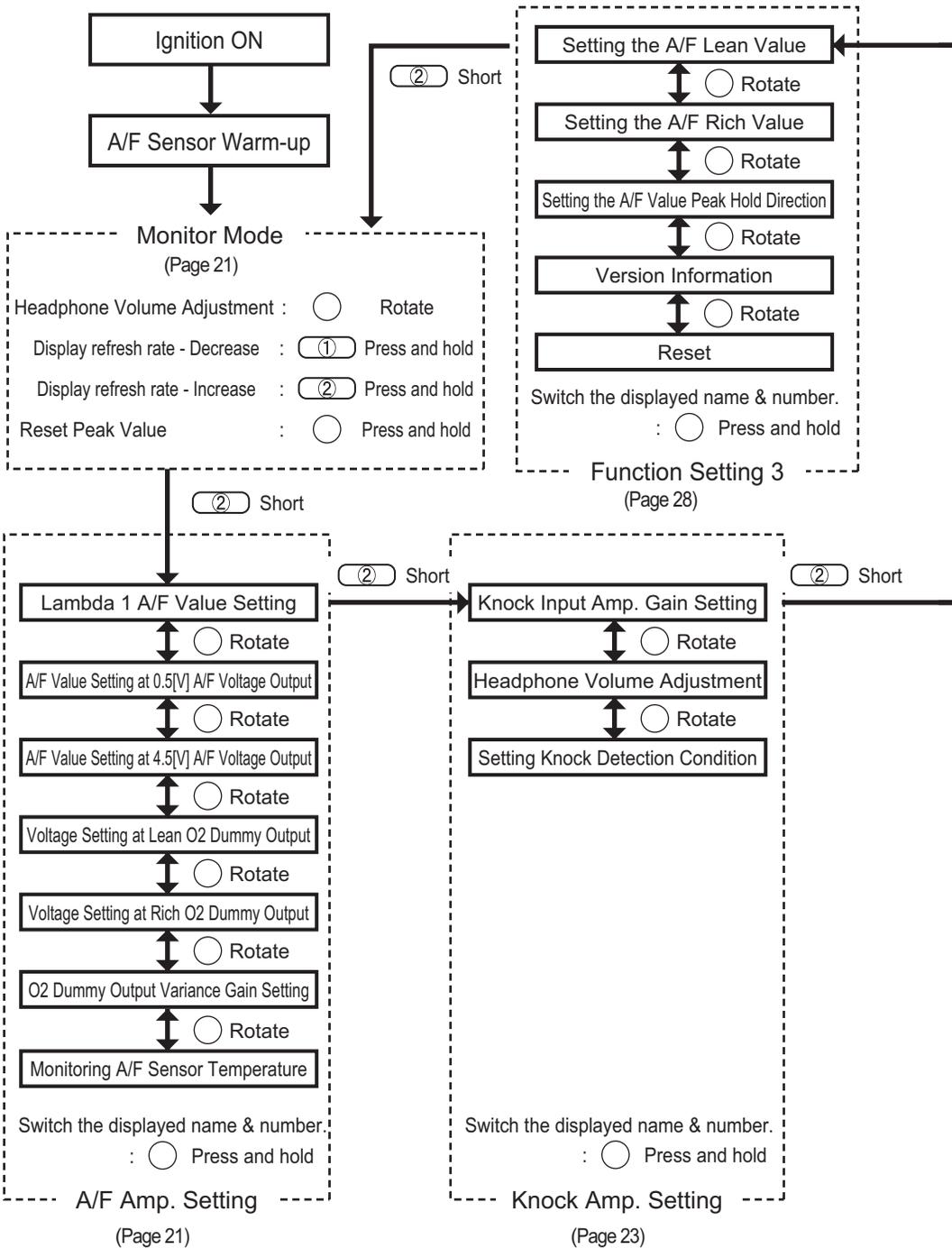
6. After Installation

- (1) Insulate unused wires with electrical tape to prevent shorts.
- (2) Make sure all wiring is correctly done.
Make sure all bullet connectors and connectors are connected correctly.
- (3) Reconnect the negative terminal to the battery.

OPERATION

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Operation Outline Diagram

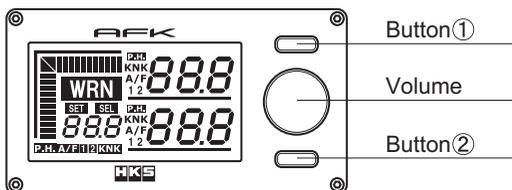


※Switch Operation

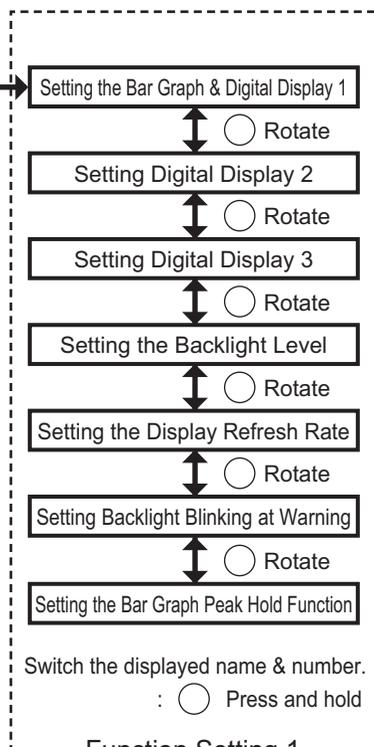
① : Button ①

② : Button ②

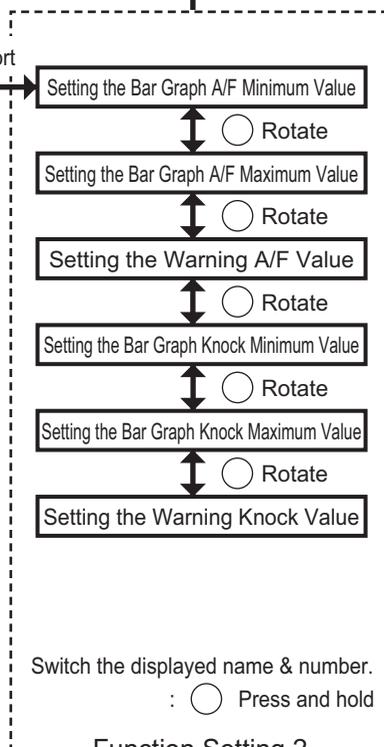
○ : Volume



② Short



(Page 25)



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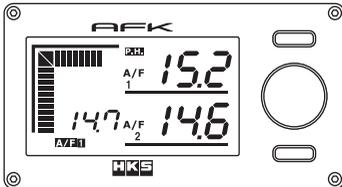
Monitor Mode

This mode is shown after the A/F sensor warm-up sequence is completed. The A/F value and the knock level can be monitored in this mode. Displayed items and warning alert timing can be changed via settings. See Setting Mode section from page 21 for more details.

- Operation Symbols
- : Press and release quickly
 - : Rotate volume dial
 - : Press and hold for more than one second

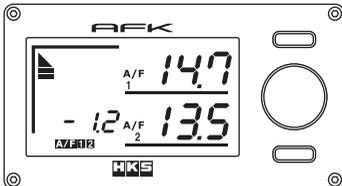
1. Viewing A/F Value

- Display position and display range of the A/F value can be edited.
- Peak hold can also be displayed. **P.H.** will be shown on the screen to indicate the peak hold display position.
- Select lean peak hold or rich peak hold to display via settings.
- To reset peak hold value, press and hold the volume knob for more than one second while in Monitor Mode. If the bar graph peak function is in use, the bar graph peak value is also reset.
- ※ Peak hold value/bar graph peak value are not saved, and are deleted when the unit is next powered off.
- The warning value can be set in Digital Display 1.



A/F Value display range
: 2.0 ~ 25.0 [A/F]

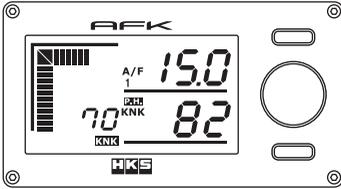
- When 2 A/F sensors are used, the difference between the A/F values 1 and 2 can be viewed. (A/F comparison value is based on A/F value 1.)
- While the A/F values are being compared, **A/F112** is shown on the display.
- ※ Peak hold function cannot be used while A/F values are being compared.



A/F Comparison Value Display Range
: -9.9 ~ 9.9 [A/F]

2. Viewing Knock Level Value

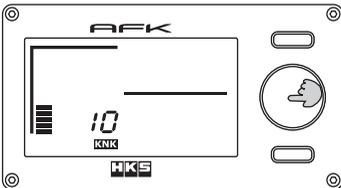
- The display position and knock level value display range can be edited.
- Peak hold can also be displayed. **P.H.** will be shown on the screen to indicate the peak hold display position.
- To reset peak hold value, press and hold the volume knob for more than one second while in Monitor Mode. If the bar graph peak function is in use, the bar graph peak value is also reset.
※Peak hold value/bar graph peak value are not saved, and are deleted when the unit is next powered off.
- The warning value can be set in Digital Display 1.
※When multiple knock sensors are connected, the average value is shown.



Knock Level Value Display Range
: 0 ~ 100

3. Volume Adjustment

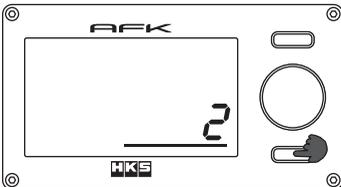
- Headphone volume can be adjusted when listening to knocking sounds via the unit's volume knob. (The volume also can be adjusted in Setting Mode.)
- Volume can still be adjusted for up to three seconds after initial volume adjustment. If no volume changes are made for longer than three seconds, the adjusted volume will be set to the Amp unit, and the unit will beep and the display will return to the Monitor Mode.



Headphone volume adjustment range
: 0 ~ 255

4. Display Refresh Rate Setting

- Pressing and holding button 1 or 2 will change the display refresh rate speed. (The rate also can be adjusted in Setting Mode.)
- Refresh rate can still be adjusted for up to one second after the initial adjustment. If no refresh rate changes are made for longer than one second, the change will be set to the Amp unit, and the unit will beep and the display will return to the Monitor Mode.



Display Refresh Rate Adjustment Range
: 1 ~ 5

Setting Mode

This mode is to set various A/F Amp and Knock Amp functions. If the factory sensor was replaced with the O2 sensor, O2 sensor settings can be made in this mode. If using this unit for the first time, or have performed a full reset, all settings will be set to default.

To Run Setting Mode:

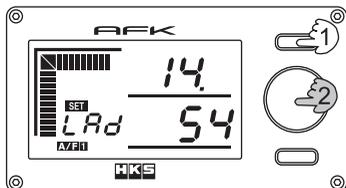
Power on the A/F-Knock Amp. Once the start-up demo finishes, press button 2 to run Setting Mode. See the operation outline diagram for more details.

Operation Symbols

- : Press and release quickly
- : Rotate volume dial
- : Press and hold for more than one second

- Pressing the volume knob for more than one second while in Setting Mode will change the Digital Display 1 name to the name/number of the currently active parameter that is being set.
- Use the above function if you are unsure of which settings are being made.
- Press the volume once more for more than 1 second to return.
- Settings are saved even when the unit is powered off.

Operation

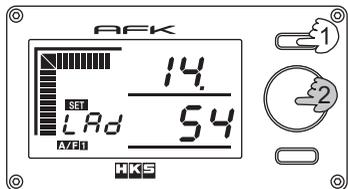


- (1) Press button 1 when settings displayed. The unit will beep, and **SET** or **SEL** will appear and blink on the screen.
- (2) Turn the volume knob to change values. When setting is complete, press button 1.

1. A/F Amp. Setting

1.1 Lambda 1 A/F Value Setting

Enter the A/F value coefficient for the fuel being used.



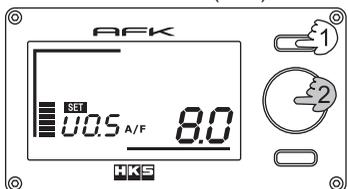
If the vehicle uses unleaded gasoline, the above step is not necessary.

Setting range : 4.00 ~ 20.00 (in 0.1 increments)

Default Value : 14.54

1.2 A/F Value Setting at 0.5[V] A/F Voltage Output

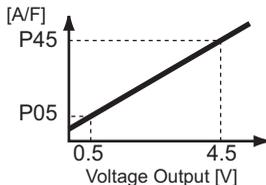
Set the A/F value (P05) when the A/F voltage output setting is 0.5[V].



Setting range : 2.0 ~ 25.0 (in 0.1 increments)

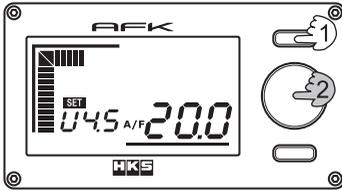
Default Value : 8.0

For settings using an F-CON V Pro, see section 1.3.



1.3 A/F Value Setting at 4.5[V] A/F Voltage Output

Set the A/F value (P45) when the A/F voltage output setting is 4.5[V].

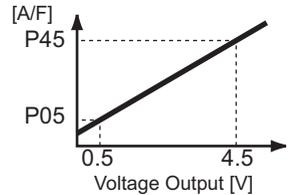


Setting range : 2.0~25.0 (in 0.1 increments)

Default Value : 20.0

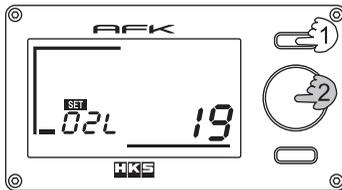
Settings Using an F-CON V Pro

Set P05 to 8.5 and P45 to 20.0. Use the F-CON V Pro PowerWriter software (used only by Certified HKS Pro Dealers) to change the parameter "Ignition GCC Input" to "A/F", and "A/F Conversion Table" to "HKS".



1.4 Voltage Setting at Lean O2 Dummy Output

Set the voltage at lean O2 dummy output.

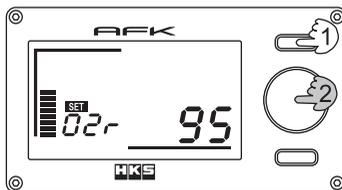


Setting range : 0~255 [x10mV] (in 1 increments)

Default Value : 19 [x10mV]

1.5 Voltage Setting at Rich O2 Dummy Output

Set the voltage at rich O2 dummy output.



Setting range : 0~255 [x10mV] (in 1 increments)

Default Value : 95 [x10mV]

1.6 O2 Dummy Output Variance Gain Setting

Set the gain for O2 dummy output variance.

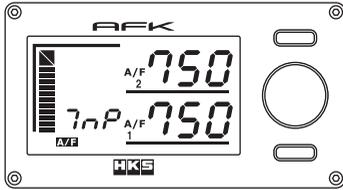


Setting range : 0.1~5.0 (in 0.1 increments)

Default Value : 1.0

1.7 Monitoring A/F Sensor Temperature

The current temperature reading of the A/F sensor is shown.



The A/F sensor temperature is shown to confirm that the A/F sensor is operational. No settings can be made here. Check the temperature reading as a reference if any problems occur.

2. Knock Amp. Setting

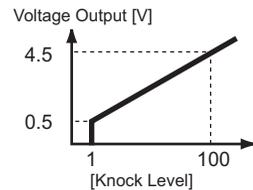
Perform basic settings for the Knock Amp.

The set value can be entered referring to the current knock level on the digital display 3. If the knock level display is not selected to use, setting is not necessary.

Knock Voltage Output

Knock Voltage Output will output voltage that corresponds with knock level. Reference 3.3(3) Knock Amp. Function Wiring from page 14.

※ Use the appropriate PowerWriter to set "Control" tab in "Parameter Setting" of F-CON to use.



2.1 Knock Input Amp. Gain Setting

Adjust the knock signal sensitivity. Sensitivity adjustments will affect the displayed knock signal level.

- The lower the sensitivity value, the less the knock level value display rises.
- The higher the sensitivity value, the higher the knock level value display rises. (or indicates)



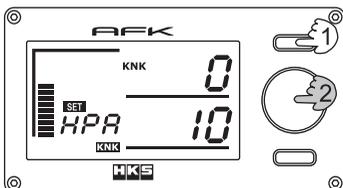
Setting range : 0~28 (in 1 increments)

Default Value : 23

2.2 Headphone Volume Adjustment

Set the headphone knock listening volume.

※ The volume can also be adjusted by turning the volume knob while in Monitor Mode.



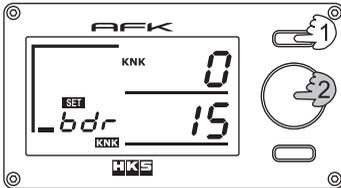
Setting range : 0~34 (in 1 increments)

Default Value : 10

2.3 Setting Knock Detection Condition

Sets the threshold value between knock signal and non-knock signal. To adjust knock detection condition: while in neutral, raise engine rpm up to the very limit that knock level values are not shown, then adjust. The threshold value may vary depending on slight engine variances and variances in each vehicle's knock sensor.

- ※ If this setting is not made properly, a non-knock signal may be incorrectly read as a knock signal.
- ※ This setting must be done after first completing section 2.1. Knock Input Amp Gain Setting.



Setting range : 0 ~ 255 (in 1 increments)

Default Value : 15

The knock sensor signal may vary depending on the engine specifications and/or vehicle's characteristics. For this reason, initial setup is necessary to properly display knock level values.

Knock Level Initial Setting

1. Set the knock input amp gain and headphones volume adjustment to the following initial set values:

knock input amp gain	23
headphones volume adjustment	10
 2. Connect the headphones and maintain high engine RPM while in neutral. Adjust the volume knob until you can hear sounds clearly. The knock sensor detects the vibration of the engine, therefore the volume will become louder as the engine rpm gets higher. Turn down the volume to avoid distortion at high revs.
 3. If distortion or crackling can be heard even with the volume turned down, lower the knock input amp gain value.
 4. While maintaining high engine RPM while in neutral, check to make sure there is no audible knocking.
 5. Adjust the knock detection condition set value. In small increments, decrease the knock detection condition value until the knock level value on Digital Display 3 does not read 0. Then increase the knock detection condition set value in small increments until the knock level value on Digital Display 3 continuously reads 0.
 - ※ If the knock level stays 0 even the knock detection condition set value is 0, set the knock detection condition set value to 0 and go to the procedure 6 below.
 6. Using headphones, listen to make sure that knocking is not occurring while checking the display to make sure the knock level display reads 0, even under load. If the knock level display does not read 0, increase the knock detection condition value to adjust.
 7. If the knock level value is too high when knocking occurs, lower knock input amp gain value, and repeat from step 4.
- ※1 The knock sensor converts engine block vibrations to electric signals. The knock sensor will detect engine block vibrations regardless of engine knock occurring, so signal levels will be constantly fluctuating. The knock level initial setting is done to prevent engine block vibrations from being misread as knock signals.
 - ※2 When knocking occurs, the knock sensor will output a high frequency burst signal. Depending upon such variables as engine specification, knock sensor wiring layout, or operational noise/vibrations from solenoid valves installed in the engine bay, the knock sensor may detect and output signals very similar to actual engine knock. In these cases, knock level values may be misconstrued as knock readings.
 - ※3 If sound coming through the headphones is unclear due to noise, check for proper ground of the Knock Amp connector's ground wire. Grounding this wire on a separate location than the main connector's ground wire may resolve the issue.

3. Function Setting 1

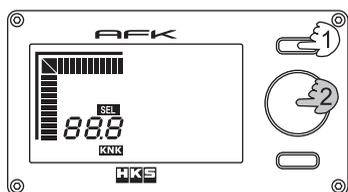
Function Setting 1 sets display position or display method.

OFF	Nothing is displayed.
A/F 1	Displays A/F sensor 1's A/F value readings. If P.H. is displayed, peak hold value is shown.
A/F 2	Displays A/F sensor 1's A/F value readings. If P.H. is displayed, peak hold value is shown.
KNK	Knock level value is displayed. (If multiple sensors are used, the average value is shown.) If P.H. is displayed, the peak hold value is shown.
A/F 1 2 CP _r	The difference between A/F Values 1 and 2 is calculated based on A/F Value 1.

※Pressing the volume knob for more than one second while displaying/setting Digital Display 2 or 3 will turn underlines ON/OFF.

3.1 Setting the Bar Graph & Digital Display 1

Select the item to be displayed for the bar graph and Digital Display 1.



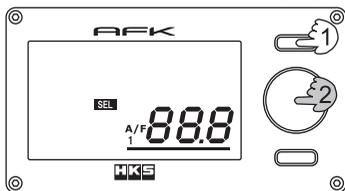
Only the bar graph and Digital Display 1 will be shown while setting.

Setting range : **OFF** · **A/F1** · **A/F2** · **KNK**
P.H./A/F1 · **P.H./A/F2** · **P.H./KNK**
A/F12 [Pr (A/F comparison value)]

Default Value : **KNK**

3.2 Setting Digital Display 2

Select the item to be displayed for Digital Display 2.



Only Digital Display 2 will be shown while setting.

Setting range : **OFF** · **A/F 1** · **A/F 2** · **KNK**
P.H./A/F 1 · **P.H./A/F 2** · **P.H./KNK**
A/F 12 [Pr (A/F comparison value)]

Default Value : **A/F 1**

3.3 Setting Digital Display 3

Select the item to be displayed for Digital Display 3.



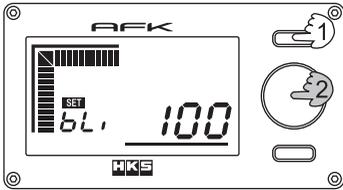
Only Digital Display 3 will be shown while setting.

Setting range : **OFF** · **A/F 1** · **A/F 2** · **KNK**
P.H./A/F 1 · **P.H./A/F 2** · **P.H./KNK**
A/F 12 [Pr (A/F comparison value)]

Default Value : **OFF**

3.4 Setting the Backlight Level

Set the backlight brightness level.



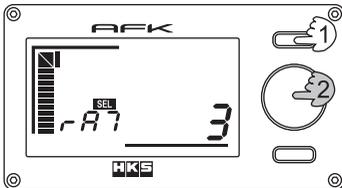
Setting range : 0~100 (in 1 increments)

Default Value : 100

3.5 Setting the Display Refresh Rate

Set the display refresh rate. If the values or bar graph refreshes too slow/fast, adjust the refresh value.

※ Press and hold button 1 and 2 while in Monitor Mode will also adjust the refresh rate.

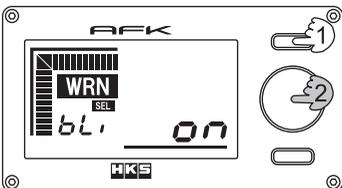


Setting range : 1~5 (in 1 increments)

Default Value : 3

3.6 Setting Backlight Blinking at Warning

Sets whether or not the backlight will blink when the warning function is activated.

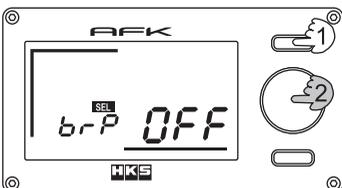


Setting range : ON/OFF

Default Value : ON

3.7 Setting the Bar Graph Peak Hold Function

Select ON or OFF for bar graph peak hold value setting.



Setting range : ON/OFF

Default Value : OFF

※ The bar graph peak hold value can be reset by pressing and holding the volume knob for more than one second while in Monitor Mode. However, if peak hold is on the "Lo" (rich) side, this function cannot be used.

4. Function Setting 2

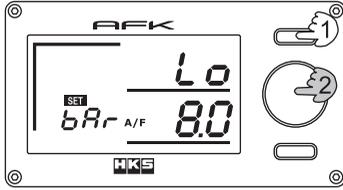
Function Setting 2 sets the bar graph's minimum, maximum, and warning values. The A/F value and the knock level value can be set separately.

When A/F comparison value is selected, both the bar graph's minimum and maximum values will be automatically set as a positive or negative value in relation to 0. Ex: If the bar graph A/F min value is set to -3.0, the A/F max value is automatically set to 3.0.

4.1 Setting the Bar Graph A/F Minimum Value

Set the A/F minimum value for the displayed bar graph.

When viewed as an A/F comparison value, setting the this minimum value will set the maximum value at the same time.



Setting range :

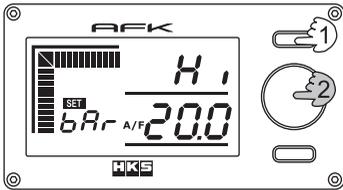
A/F value : 2.0 ~ Bar Graph A/F Maximum Value
(in 0.1 increments)
A/F comparison value : -9.9 ~ -0.1 (in 0.1 increments)

Default Value : A/F value (8.0)

4.2 Setting the Bar Graph A/F Maximum Value

Set the A/F maximum value for the displayed bar graph.

When viewed as an A/F comparison value, setting the this maximum value will set the minimum value at the same time.



Setting range :

A/F value : Bar Graph A/F Minimum Value ~ 25.0
(in 0.1 increments)
A/F comparison value : 0.1 ~ 9.9 (in 0.1 increments)

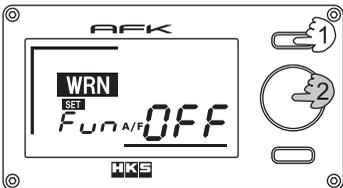
Default Value : A/F value (20.0)

4.3 Setting the Warning A/F Value

Sets the warning A/F value. This value is only applicable when both A/F value and A/F comparison values are shown on the bar graph and Digital Display 1, respectively.

When the A/F comparison value is selected, the warning A/F value will be shown as positive, however the warning value is still active as a negative value of the same number, as well.

Ex: If the warning A/F value setting is 2.0, the display will show "2.0". However, the warning function will activate at greater than +2.0, less than -2.0.



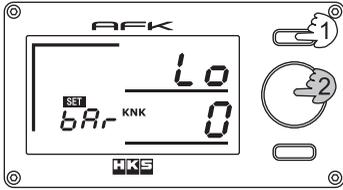
Setting range :

A/F value :
2.0 ~ 25.0 (in 0.1 increments)
• OFF (Turn the volume dial more than the max value)
A/F comparison value :
0.1 ~ 9.9 (in 0.1 increments)
• OFF (Turn the volume dial more than the max value)

Default Value : A/F value (OFF)

4.4 Setting the Bar Graph Knock Minimum Value

Set the bar graph knock minimum value.

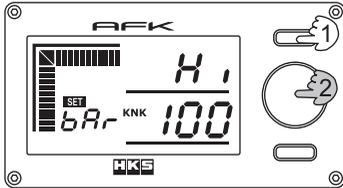


Setting range : 0 ~ Bar Graph Knock Maximum Value
(in 1 increments)

Default Value : 0

4.5 Setting the Bar Graph Knock Maximum Value

Sets the bar graph knock maximum value.

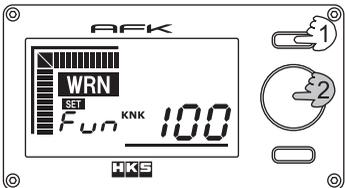


Setting range : Bar Graph Knock Minimum Value ~ 100
(in 1 increments)

Default Value : 100

4.6 Setting the Warning Knock Value

Sets the warning knock value. This value is only applicable when knock level value is displayed on the bar graph and Digital Display 1.



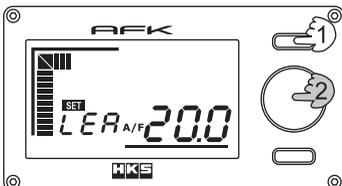
Setting range : 0 ~ 100 (in 1 increments), OFF

Default Value : 100

5. Function Setting 3

5.1 Setting the A/F Lean Value

Sets the A/F Lean value.

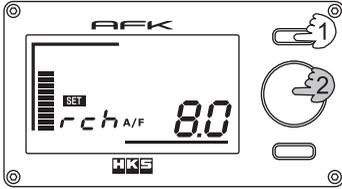


Setting range : 2.0 ~ 25.0 [A/F] (in 0.1 increments)

Default Value : 20.0

5.2 Setting the A/F Rich Value

Sets the A/F Rich value.

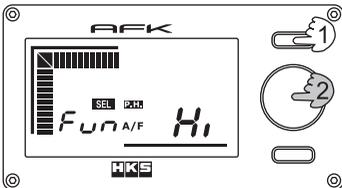


Setting range : 2.0~25.0 [A/F] (in 0.1 increments)

Default Value : 8.0

5.3 Setting the A/F Value Peak Hold Direction

Sets the A/F Value peak hold direction. "Lo", a smaller value (Rich-side) will be acquired as a peak hold value. "Hi", a larger value (Lean-side) will be acquired as a peak hold value.

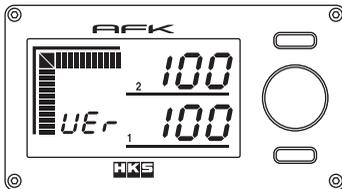


Setting range : Lo/Hi

Default Value : Hi

5.4 Version Information

The main unit version information will appear on Digital Display 2 and the display unit version information on Digital Display 3.

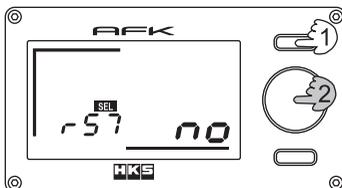


Digital Display 3 : display unit version

Digital Display 2 : main unit version

5.5 Reset

All settings are deleted and returned to the default setting.



Setting range : No/YES

Default Value : No

TROUBLESHOOTING

If this product is not performing properly; check all wiring and connections, referring to the following before contacting your HKS Certified Pro Dealer.

Symptom	Cause	Countermeasure
Unit does not power on.	The power cable is not connected.	Make sure the power cable/line is wired correctly.
	Improper grounding.	Remove any paint and/or rust from the grounding section.
Error message appears.	Communication error (1) - (if Error No.001)	Check to make sure the relay harness is connected properly. Turn the ignition off, then on.
	Communication error (2) - (if Error No.100)	Check if communication is interrupted by engine/chassis vibrations while driving. Make sure all harnesses are connected properly.
	Communication error (3) - (if Error No.010)	Make sure connectors are connected properly. Check if communication is interrupted by engine/chassis vibrations while driving.
	Communication error (4) - (if Error No.002)	
	Communication error (5) - (if Error No.008)	Make sure the display harness is connected properly.
	Communication error (6) - (if Error No.888)	Check if communication is interrupted by engine/chassis vibrations while driving. Make sure the display harness is connected properly.
Sensor's warm-up sequence does not end.	The A/F sensor is not connected.	Make sure the Setting Mode is not attempting to display other sensors that are not connected.
	The A/F sensor harness is cut off.	Make sure the A/F sensor harness is connected properly.
The A/F output does not respond properly/fast enough.	The A/F sensor is worn-out.	Replace the A/F sensor.
The A/F values on the A/F-Knock Amp display and on the F-CON Power Writer do not match.	Incorrect setting of the A/F value at 0.5[V] or 4.5[V] A/F voltage output.	Verify all settings. Make sure the A/F conversion table is correct.
	Incorrect Power Writer setting.	
	Improper grounding of the A/F Knock Amp and F-CON	Ground the black ground wire (the spade terminal with one wire) from the main harness and the black ground wire (the spade terminal with two wires) to different chassis ground positions.

If the error message does not disappear, turn the ignition off and on to erase the error message.

Caution

- Do not use this product if unusual occurrences should occur. Consult with your HKS Certified Pro Dealer immediately.

Warning

- Do not try to repair the product yourself. Consult with your HKS Certified Pro Dealer.
- If any unusual noises, scents, and/or vibrations are noticed while driving, please refer to a factory repair manual.

REPAIR SERVICE

For questions about this product, any optional, lost, defective and/or damaged parts, please contact your HKS Certified Pro Dealer.

FOR SUBSEQUENT OWNERS

If this product is passed on to a new owner, make sure this instruction manual is included along with the product. Do not uninstall this product by yourself.

Warning

- If this product is removed, make sure all wires from the vehicle are insulated with electrical tape to prevent a possible short.

AFK SET UP SHEET

Setup Date: _____

Vehicle:	Model:	Model Year:	Engine Type:
Specifications & Remarks			

▶ A/F Amp. Initial Setting

Lambda1 - A/F Value	A/F
A/F Value at A/F Voltage Output 0.5[v]	A/F
A/F Value at A/F Voltage Output 4.5[v]	A/F
Voltage at Lean O2 Dummy Output	x10mV
Voltage at Rich O2 Dummy Output	x10mV
Gain Setting for O2 Dummy Output Variance	

▶ Knock Amp. Initial Setting

Gain Setting for Knock Input amp.	
Headphone Volume	
Knocking Conditions	

▶ Function Setting 1

Bar Graph Display	OFF / A/F1 / A/F2 / KNK
	A/F1(P.H.) / A/F2(P.H.) / KNK(P.H.) / A/F Comparison Value
Digital Display 2	OFF / A/F1 / A/F2 / KNK
	A/F1(P.H.) / A/F2(P.H.) / KNK(P.H.) / A/F Comparison Value
Digital Display 3	OFF / A/F1 / A/F2 / KNK
	A/F1(P.H.) / A/F2(P.H.) / KNK(P.H.) / A/F Comparison Value
Backlight Level	
DisplayRefresh Rate	
Warning Backlight	OFF / ON
Bar Graph Peak Setting	OFF / ON

▶ Function Setting 2

Bar Graph A/F Min. Value	A/F
Bar Graph A/F Max. Value	A/F
Warning A/F Value	A/F
Bar Graph Knock Min. Value	
Bar Graph Knock Max. Value	
Warning Knock Value	

▶ Function Setting 3

Lean Value	A/F
Rich Value	A/F
A/F P.H. Direction	Lo / Hi

REVISION OF INSTRUCTION MANUAL

Ver.	Date	Details
3-1.01	Feb.2008	1st Edition



Pursuing the Ultimate in Engine Performance and Efficiency.
Produced by HKS Company Limited.