

Thank you for purchasing the controller manufactured by BFC Limited.
Please read this instruction manual thoroughly before use for proper use of the product.

This instruction manual should be handed to the end user.

1. Before use

●About vibrator

Be sure to use the specified piezoelectric feeder (AFR-xxxD, AFJ-xxxD, AFB-xxxD series).

*This product cannot be used with an electromagnetic feeder.

2. Safety precautions

○Precautions are classified into "Danger," "Warning" and "Caution" depending on the degree of risk in this instruction manual.

Danger 	<ul style="list-style-type: none"> Hazards are obviously anticipated. If the product is handled in an improper manner neglecting the indication, death or serious injury may occur.
Warning 	<ul style="list-style-type: none"> Hazards may occur depending on the situation. If the product is handled in an improper manner neglecting the indication, death or serious injury may occur.
Caution 	<ul style="list-style-type: none"> Hazards may occur depending on the situation. If the product is handled in an improper manner neglecting the indication, minor or medium-level injury may occur.

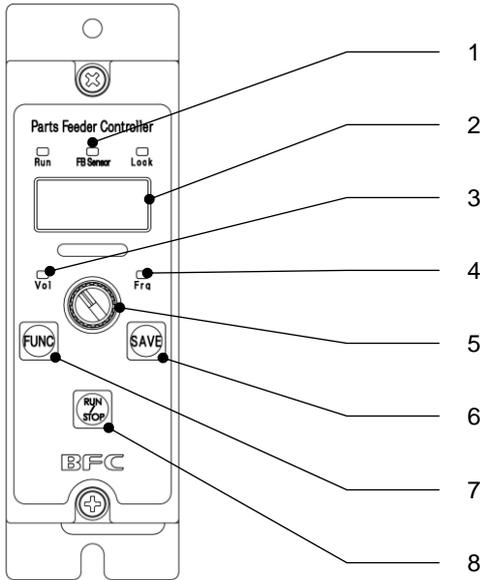
○ The Danger, Warning and Caution below do not cover all possible cases.

Read the catalog and the instruction manual carefully and place priority on the safety in performing operations.

Danger 	<ul style="list-style-type: none"> To prevent electrical shock, do not perform operations in live wire state. To prevent catching fire, do not use at places with hazardous objects such as ignitable objects and flammable objects. *The product is not explosion-proof. If the product is installed at a high place, it may drop or fall depending on conditions. Provide measures against drop and fall. Moreover, retain and fix firmly in installing the product. Do not splash water on the product, wash the product or use the product under water to avoid injury, electrical shock or fire due to malfunction.
Warning 	<ul style="list-style-type: none"> Shut OFF the power supply before removing the cover. Be sure to shut OFF the power supply before performing wiring to avoid electrical shock. Do not insert/remove the connector while the power supply is ON or apply unnecessary load on the connector to avoid damage to the system and electrical shock. Do not step on the product or put objects on the product to avoid accidents, falling of the product or damage to the product caused by dropping or falling of the product. Do not damage the lead wire to prevent fire or electrical shock caused by electrical leakage. Connect a ground before use. To prevent failure, damage and shortening of the service life, do not use the product exceeding the specified use range. Do not use the modified product to avoid failure and damage. *Failure of the product modified by the customer is not covered by the warranty regardless of the reasons. Wiring should be done properly according to the instruction manual and connections should be checked for mistakes before turning ON the power supply. *Mistakes of wiring may cause breakage or malfunction.
Caution 	<ul style="list-style-type: none"> Do not install the product at dusty places because the product is not dust-proof. Secure a working space around the installation place of the product, because failure to perform daily inspections and maintenance could lead to breakage of the product. Be sure to disconnect from the controller and ground the bowl or the chute before welding the bowl or the chute to avoid damage to the controller caused by leakage current. Be sure to hold the main body in carrying the product, without lifting up by holding the cord, to avoid damaged wire or bad connection. Never run/stop a vibrator to which the power supply to the input/output side is turned ON/OFF by an electromagnetic switch, etc. to avoid failure and damage. *If the vibrator ON/OFF is done frequently, check the external control method on the instruction manual and perform in a proper manner. Install in an adequately ventilated room, avoiding places of high temperature and humidity. The ambient temperature should be 0 to 40°C. Do not remove the labels and stickers. Dispose the product in a proper manner as an industrial waste.

3. Name and function of each part

3-1 Operation panel



1 State indicator

Indicates the state of the equipment.

- Run ON --- The vibrator is running.
Blink --- The vibrator is at standby.
OFF --- Stopped by RUN/STOP button.
- FB sensor ON --- The feedback function is enabled.
Blink --- The feedback sensor is connected.
OFF --- The feedback sensor is not connected.
- Lock ON --- The key lock function is enabled.
OFF --- The key lock function is disabled.

2 Set value display

Set value, etc. are displayed.

3 Voltage lamp

Vol Turns ON while the output voltage set value is displayed.

4 Frequency lamp

Frq Turns ON while the output frequency set value is displayed.

5 Encoder

Used to change the set value.

6 SAVE button

Used to save the set value.

7 FUNCTION button

Used to call out the function menu.

8 RUN/STOP button

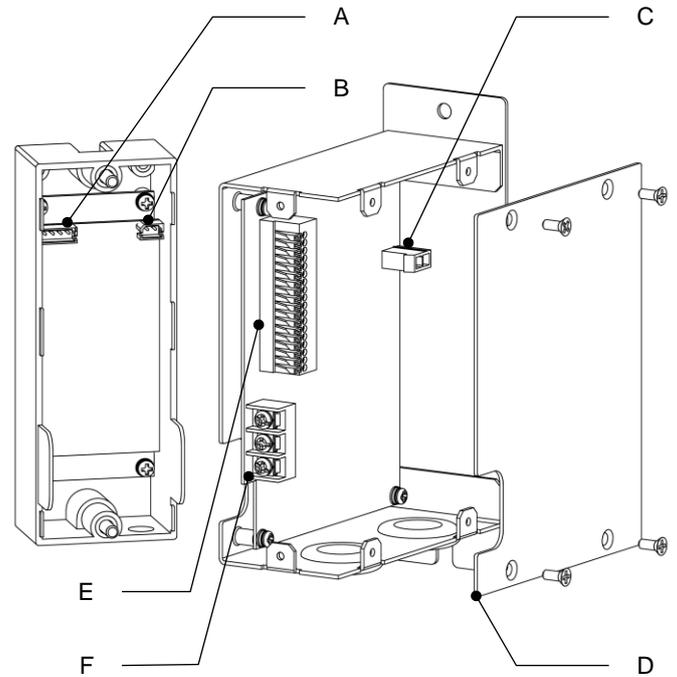
Used to manually run/stop.

*Special operations

 Hold down Used to switch between basic setting and advanced setting.

 Hold down Used to switch between ON/OFF of key lock function.

3-2 Internal area



A Feedback sensor connector

Connector for connecting the feedback sensor

B Analog input connector

Connecting analog voltage signal for adjustment of output voltage setting value

C Vibrator connector

Connecting piezoelectric vibrator is connected

D Side panel

E Control I/O

Terminal block for signals input to/output from the main unit

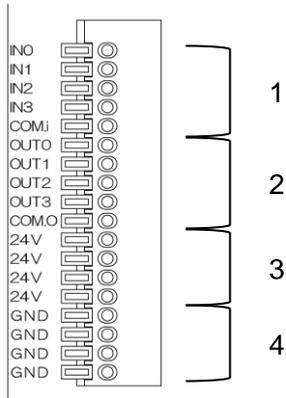
F Power input terminal block

Connecting input power line

3-3 Terminal block

Control I/O

Input/output terminal block for control



1 Input signal terminal

Used to externally control the vibrator operation

IN0	Operation signal 1
IN1	Operation signal 2
IN2	Pattern No. selection signal 1
IN3	Pattern No. selection signal 2
COM.i	Common for input signal terminal

2 Output signal terminal

Used to externally output the operation state of the vibrator

OUT0	Operation synchronization signal 1
OUT1	Operation synchronization signal 2 (equipped with off-delay function)
OUT2	Workpiece shortage signal (AFC-20H only)
OUT3	Alarm signal
COM.O	Common for output signal terminal

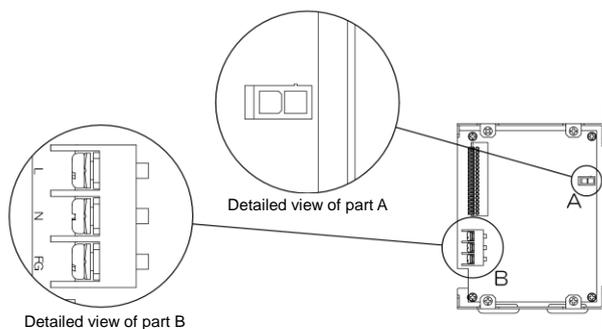
3.4 Service power supply terminal

24 VDC can be supplied to sensors used for parts feeder full control, etc.

Supply capacity	24 VDC 100 mA
24V	24 VDC
GND	0 V

Connection of power supply, vibrator

Power supply input terminal block, vibrator connector



Part A Vibrator connector: Connect the vibrator

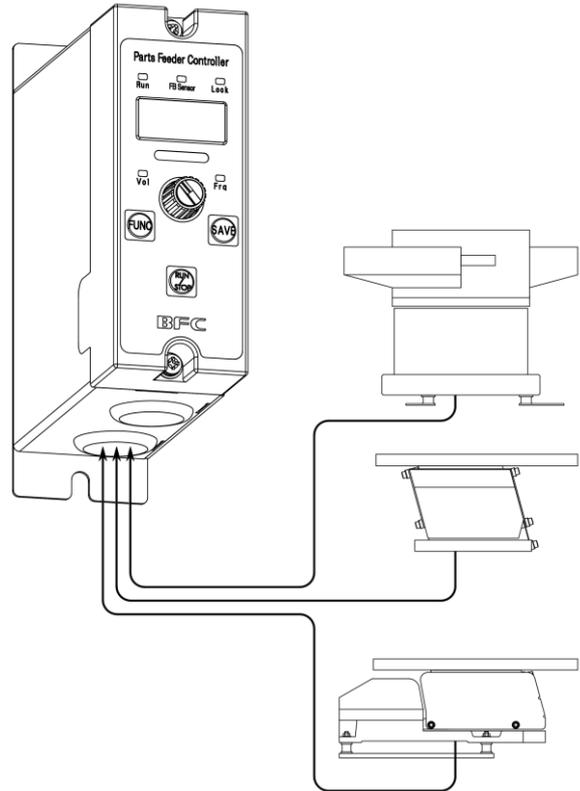
Part B Power supply input terminal: Supply 85 to 265 VAC 50 Hz/60 Hz

4. Wiring

4-1 Connection with vibrator

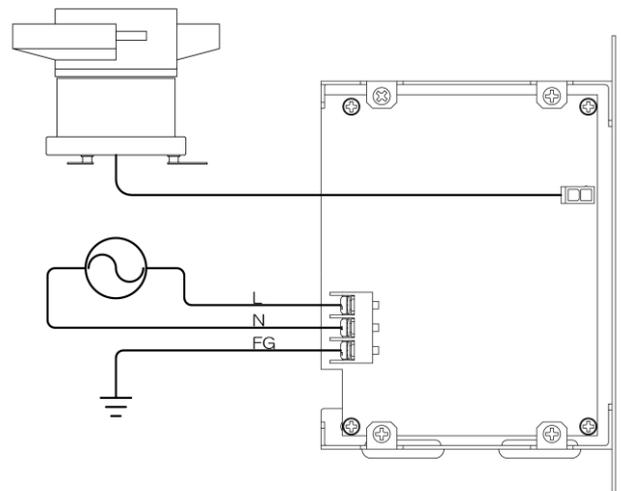
Connect the piezoelectric feeder to the output terminal of the equipment.

*Connect one piezoelectric feeder to each of the equipment.



4-2 Connection with input/output lines

Remove front unit of the equipment and the side cover, and connect the power supply to the power supply input terminal block and the vibrator to the vibrator connector.



Warning

Shut OFF the input power supply before removing the front unit.



Warning

Be sure to connect a ground to the "FG" terminal.

5. Preparation

- Check again whether wiring is done correctly before installing the front unit.



Caution

When installing the front unit, do not tuck in or push in the flat cable forcibly.

- Turn ON the power supply.

After initialization of the system, the output voltage set value is indicated on the set value display.

6. Let's use

- Let's move the vibrator.

6-1 Press the FUNCTION key to turn ON the voltage lamp and change the output voltage set value to 40.0 by using an encoder.

Press the SAVE key to determine the change.



6-2 If Run is OFF, press the RUN/STOP button to turn it ON.

If Run is blinking, check the operation signal.

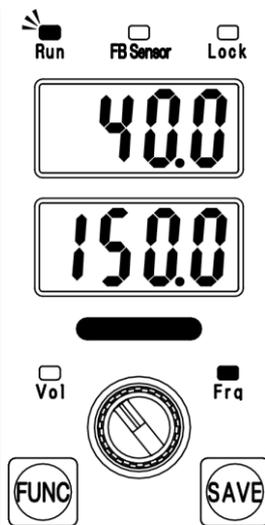
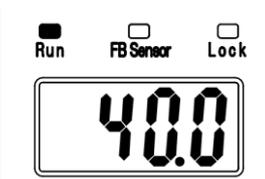
The vibrator changes to operation state if the operation signal is input.

6-3 Press the FUNCTION key to turn ON the frequency lamp and adjust the vibration to an area near the strongest state (resonance point) by using an encoder.

After adjustment, press the SAVE key to save the change.

*The resonance point is between 75 to 250 Hz, although the value varies depending on the load.

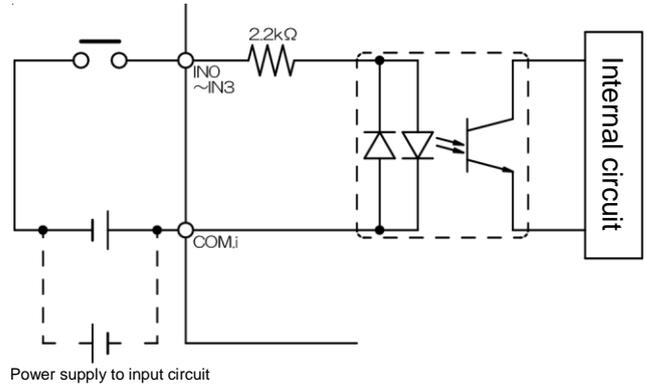
*If the vibration is weak and the area where it becomes strong is difficult to find out, increase the output voltage set value.



6-4 After determining the optimal frequency, change the voltage set value and obtain an appropriate vibration.

7. Connection with external devices

7-1 Input circuit diagram

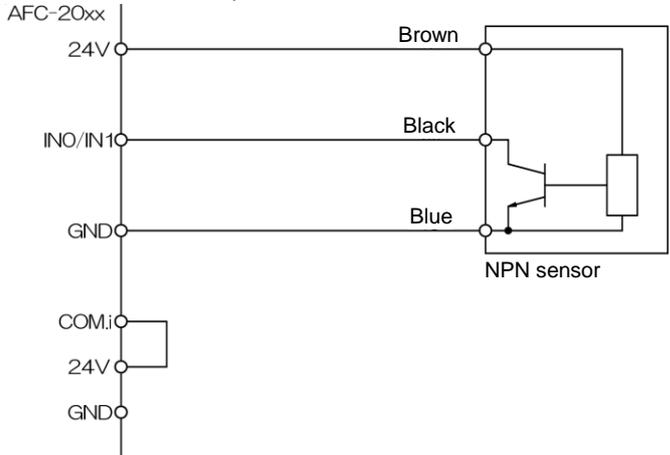


IN0, IN1, IN2, IN3

Rated input voltage 24 VDC 15 mA

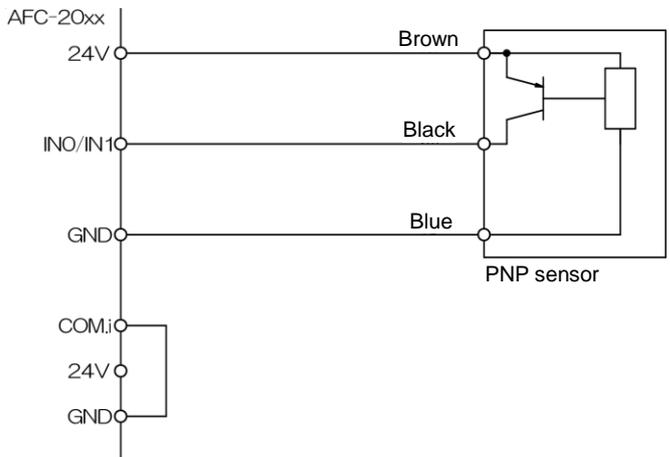
● Example of connection

Connection of NPN output sensor



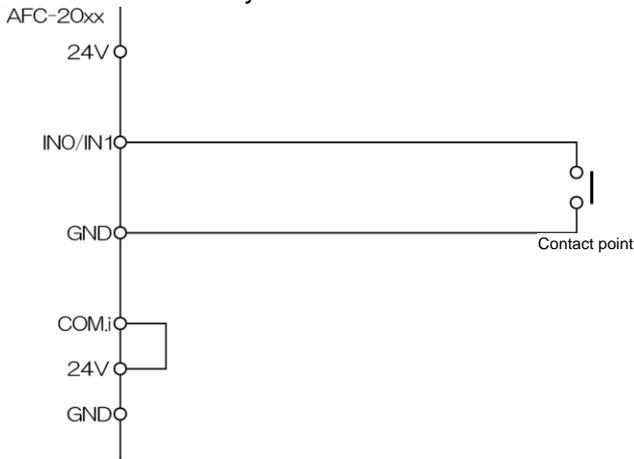
- 1 Short-circuit COM.i and 24 V of the equipment.
- 2 Connect 24 VDC of the sensor to 24 V of the equipment.
- 3 Connect the sensor output to IN0/IN1 of the equipment.
- 4 Connect 0 V of the sensor to GND of the equipment.

Connection of PNP output sensor



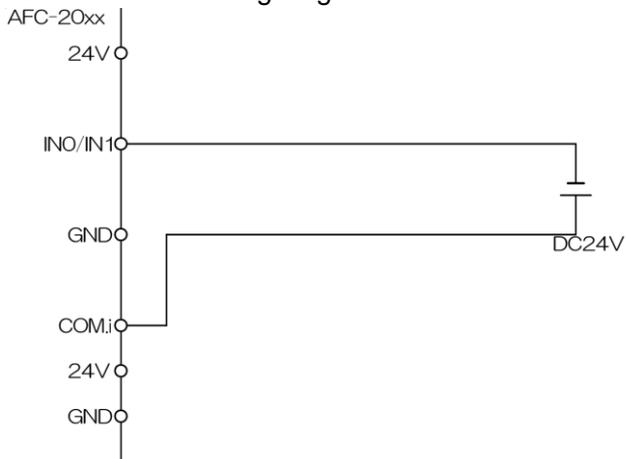
- 1 Short-circuit COM.i and GND of the equipment.
- 2 Connect 24 VDC of the sensor to 24 V of the equipment.
- 3 Connect the sensor output to IN0/IN1 of the equipment.
- 4 Connect 0 V of the sensor to GND of the equipment.

Connection of relay



- 1 Short-circuit COM.i and 24 V of the equipment.
- 2 Connect the contact point of the relay to GND and IN0/IN1 of the equipment.

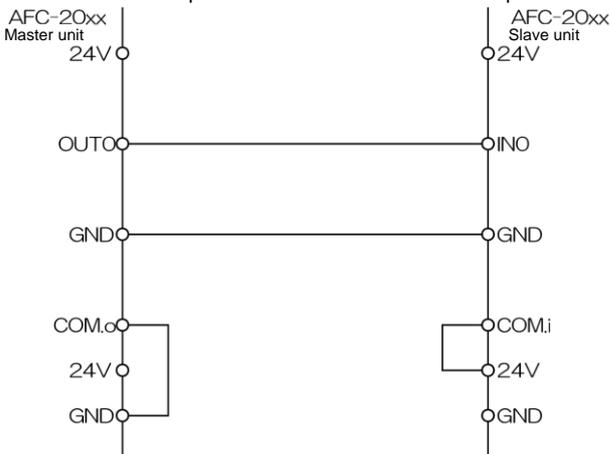
Connection of voltage signals



- 1 Connect voltage signal + to COM.i of the equipment.
- 2 Connect voltage signal - to IN0/IN1 of the equipment.

Linkage of controller

The slave unit is operated when the master unit is operated.



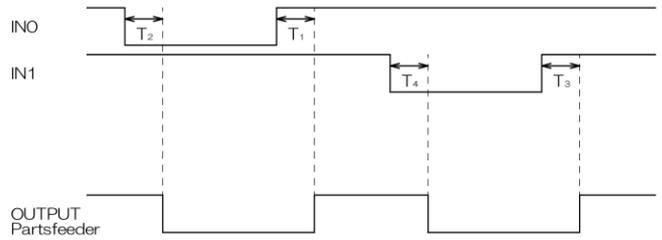
- 1 Short-circuit COM.o and GND of the master unit.
- 2 Short-circuit COM.i and 24 V of the slave unit.
- 3 Connect OUT0 of the master unit to IN0 of the slave unit.
- 4 Connect GND of the master unit to GND of the slave unit.

*Full sensor, etc. can be connected to IN1 of the slave unit.

*When connecting a sensor to IN1 of the slave unit, set the advanced setting to "nor." If connection is not done, set the advanced setting to "inv".

7-2 Terminals for IN0/IN1 operation signals

Operation/stop of the vibrator can be done by input to IN0 or IN1.



*Operation/stop logics for the input signal can be changed by the advanced setting.

*Operation/stop of the vibrator can be controlled by setting ON/OFF delay timer for the input signal by the advanced setting.

7-3 Input terminal for switching IN2/IN3 pattern No.

The amplitude setting can be switched by input to IN2 or IN3.

How to use

Select "Pt" in "input terminal detailed setting" for the advanced setting.

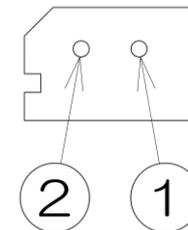
Four patterns of voltage and frequency can be set for input to IN2 or IN3.

*Currently used setting No. is displayed in "display of currently used extensions" in the basic setting.

Set No.	Pt1	Pt2	Pt3	Pt4
IN2	OFF	ON	OFF	ON
IN3	OFF	OFF	ON	ON

7-4 B analog input connector

The output voltage set value for AFC-20HG can be changed by analog voltage signal connected to the connector.



[1] Analog voltage input

[2] Common terminal

Molex 5267-02A connector pin layout

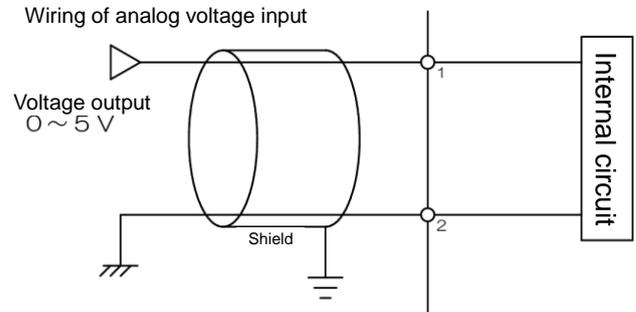
Applicable housing

Molex 5264-02

Applicable terminal

Molex 5263

Wiring of analog voltage input



How to use

Select "AnLG" in "input terminal detailed setting" for the advanced setting.

7-5 A feedback sensor connector

The vibrator is operated at a constant amplitude using the feedback sensor connected to the connector.

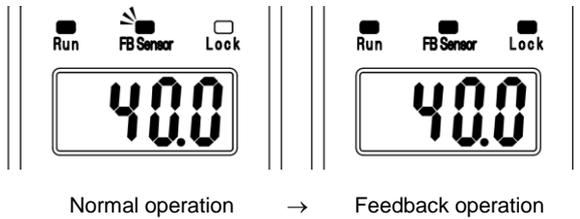
Special feedback sensor	PHA-03-C15 (1.5 m)
	PHA-03-C35 (3.5 m)
Sensor connection cable	PHA-03-CC (0.5 m)

When the feedback sensor is installed to the controller, state indicator FB sensor on the operation panel blinks.

When the SAVE key is held down while the vibrator is **running** and FB sensor is blinking, operation lock is activated and feedback operation is started.

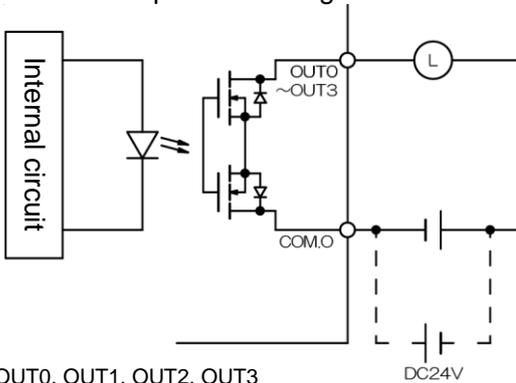
State indicator FB sensor is ON during feedback operation.

During feedback operation, the voltage set value is changed automatically by the controller to maintain the amplitude at a certain level in line with the vibrator load.



When the SAVE key is held down **during feedback operation**, operation lock is canceled and normal operation is started.

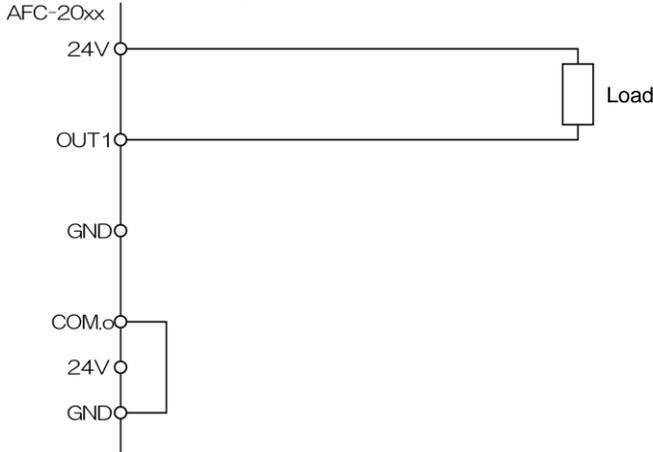
7-6 Output circuit diagram



OUT0, OUT1, OUT2, OUT3
Rated load 30 VDC 100 mA

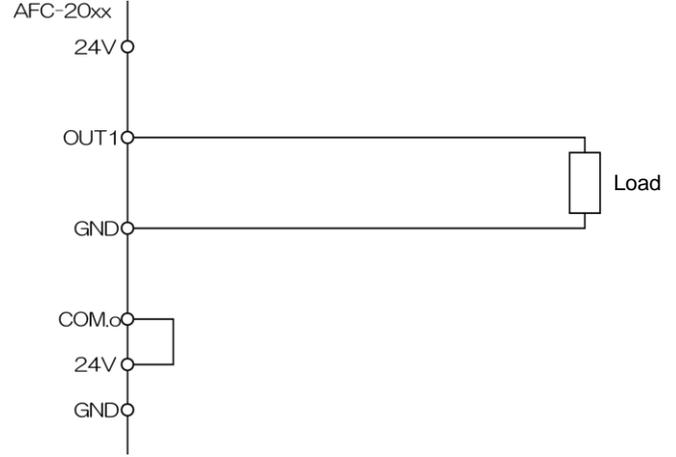
●Example of connection

Connection of electromagnetic valve load, etc. to the output (NPN)



- 1 Short-circuit COM.o and 24 V of the equipment.
- 2 Connect the load to 24 V and OUT1 of the equipment.

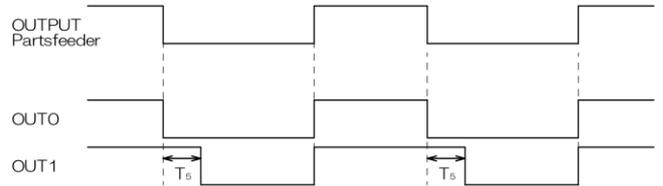
Connection of electromagnetic valve load, etc. to the output (PNP)



- 1 Short-circuit COM.o and 24 V of the equipment.
- 2 Connect the load to 24 V and OUT1 of the equipment.

7-7 OUT0/OUT1 operation synchronization output terminal

Load connected to the terminal can be driven in synchronization with vibrator operation.

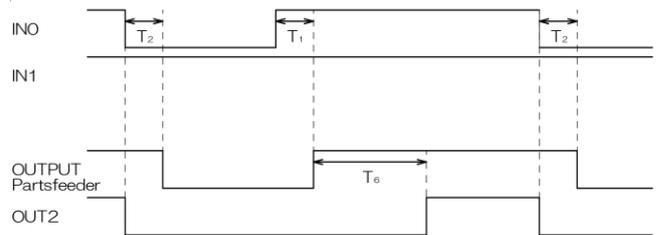


*Logic of the output signal can be changed by the advanced setting.

*Stop can be delayed if OFF delay timer is set for the output signal by the advanced setting (OUT1 only).

7-8 OUT2 workpiece shortage signal output terminal

The signal is output when shortage of workpieces in the parts feeder is detected by the full sensor.



*Logic of the output signal can be changed by the advanced setting.

*The function is for AFC-20HG only.

7-9 OUT3 alarm signal output terminal

Responding to controller errors, error indications are displayed on the set value display and alarm signals are output.

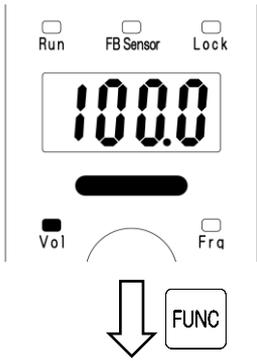
Error indication

- "Err2" Overcurrent is flowing to the output to the vibrator.
- "Err3" Signals are not input from the feedback sensor.

*In case of errors, remove the cause and then turn ON the power supply to the controller.

8. Setting change

8-1 Basic setting

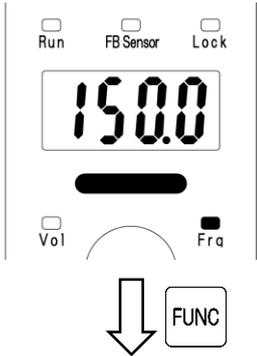


●Voltage setting
When the voltage lamp (Vol LED) is ON, the voltage set value is displayed on the set value display.

The values are changed with the encoder. The set value display blinks while the value is changed.

Save the setting by pressing the SAVE key after change.

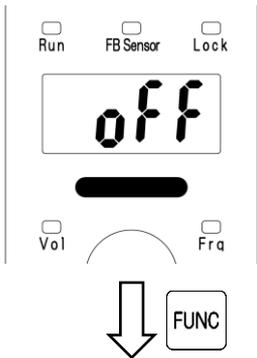
*Values cannot be changed when the advanced setting "Adv" is "AnLG".



●Frequency setting
When the voltage lamp (Frq LED) is ON, the frequency set value is displayed on the set value display.

The values are changed with the encoder. The set value display blinks while the value is changed.

Save the setting by pressing the "SAVE" key after change.



●Currently used extensions*1
Currently used extensions are displayed in the set value display.

Functions selected in advanced setting are displayed ("oFF", "Pt", "AnLG" or "drum").

When "oFF" is displayed, basic setting can be saved in pattern No.

When "Pt" is displayed, the selected pattern No. is displayed.

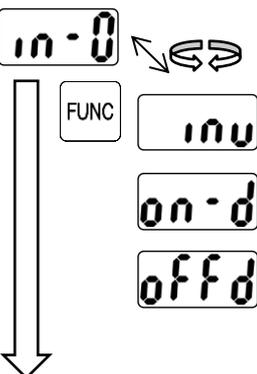
●Returned to voltage setting

8-2 Advanced setting

Press the "FUNC" key on the basic setting screen for 1 second or more.
*Switching to advanced setting is possible only at operation stop (RUN indicator OFF).

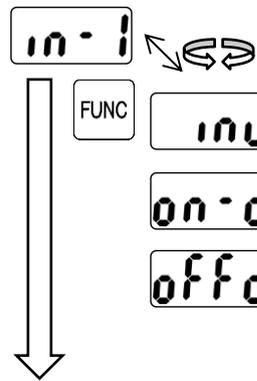
Press the "FUNC" key in the menu for 1 second or more to return to basic setting.

If the "FUNC" key is pressed on an item to be changed, the value can be changed with the encoder, and the value can be saved by pressing the "SAVE" key. (The change is discarded by pressing the "FUNC" key.)

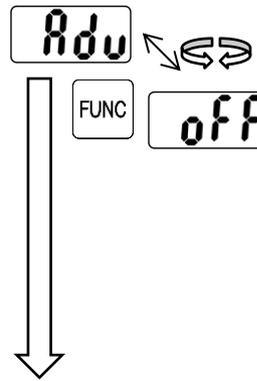


●Input signal terminal IN0 setting menu
Items can be selected with the encoder.
Switching of input terminal logic
 inu nqr Selected from the left
ON delay timer (T1)*1
Can be set between 0.0 to 10.0 seconds.
OFF delay timer (T2)*1
Can be set between 0.0 to 10.0 seconds.
 nqr Input when the input signal is ON.
 inu Input when the input signal is OFF.

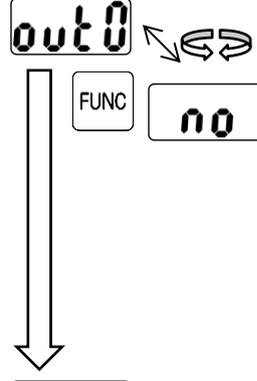
Switched to input signal terminal IN1 setting menu



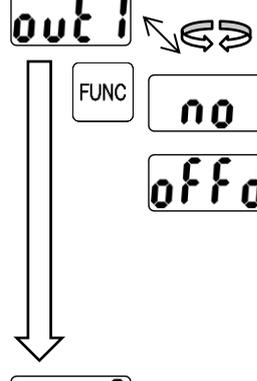
●Input signal terminal IN1 setting menu
Items can be selected with the encoder.
Switching of input terminal logic
 inu nqr Selected from the left
ON delay timer (T3)*1
Can be set between 0.0 to 10.0 seconds.
OFF delay timer (T4)*1
Can be set between 0.0 to 10.0 seconds.
 nqr Input when the input signal is ON.
 inu Input when the input signal is OFF.



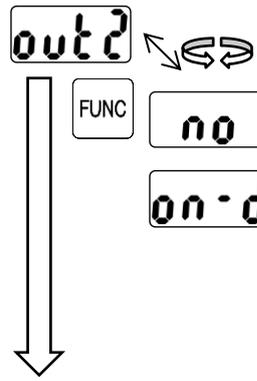
●Input signal terminal detailed setting menu
Items can be selected with the encoder.
Switching of input signal terminal extensions*1*2
 off Pt AnLG drum Selected from the left
 off Extensions are not used.
 Pt Pattern No. switching is enabled.
 AnLG Input terminal AN is enabled.
 drum Sequence corresponding to IN0/IN1 is changed.



●Output signal terminal OUT0 setting menu
Items can be selected with the encoder.
Switching of output terminal logic
 no nc Can be selected from the left
 no Output when the vibrator is in operation
 nc Output when the vibrator is at a stop



●Output signal terminal OUT1 setting menu
Items can be selected by the encoder
Switching of output terminal logic
 no nc Selected from the left
OFF delay timer (T5)
Can be set between 0.0 to 10.0 seconds.
 no Output when the vibrator is running.
 nc Output when the vibrator is at stop.

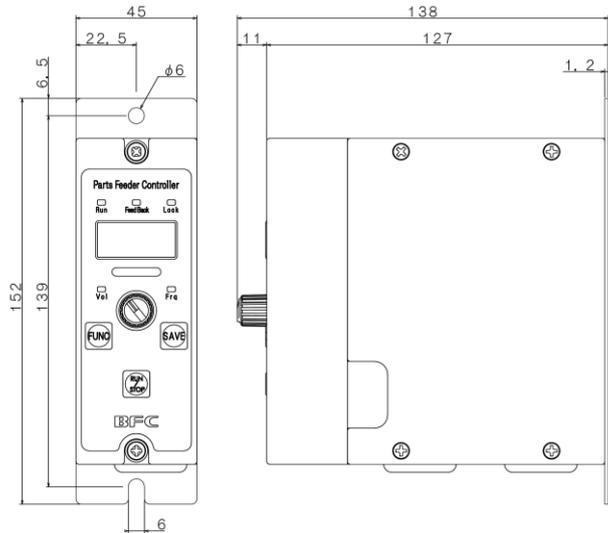


●Output signal terminal OUT2 setting menu*1
Items can be selected with the encoder.
Switching of output terminal logic
 no nc Selected from the left
ON delay timer (T6)
Can be set between 0.0 to 60.0 seconds.
 no Output when the alarm is enabled.
 nc Output when the alarm is disabled.

*1...AFC-20HG function

*2...The operation signal can be switched between AND/OR for AFC-20SE.

9. External dimensions



10. Specifications

Model	AFC-20HG AFC-20SE	
Control system	D class Amp system	
Input	Voltage	85 VAC to 265 VAC
	Frequency	50Hz/60Hz
	Number of phases	1
	Power reception capacity	85 VA
Output	Maximum current	200 mA
	Voltage	0 to 230 V (secondary side of transformer)
	Frequency	60 to 400 Hz
Additional functions	External control	Function to control operation by external signals
	Synchronization signal output	Output in synchronization with vibrator operation (2 points)
	Workpiece shortage signal	Workpiece shortage signal output from full sensor*1
	ON delay	Startup delay setting at a stop due to full*1
	OFF delay	Delay setting for stop due to full at operation state*1
	Constant amplitude function	Constant amplitude control by acceleration sensor (PHA-03)*1
Ambient operating temperature	0 to 40°C (freezing not allowed)	
Ambient operating humidity	0 to 90% RH (condensation not allowed)	
Paint color	Gray BN-75 (JPMA)	
Weight of main unit	0.7 Kg	

*1 AFC-20HG function

11. Initialization

Data is erased completely and all settings return to initial values if the power supply is turned ON while pressing the "RUN/STOP" key.

Be sure to prepare needed data in advance.

12. Troubleshooting

Phenomenon	Inspection item	Reference
A. Indicators and lamps do not turn ON when the power supply is turned ON.	Is the power cable connected correctly?	
B. Vibration does not occur (The Run lamp is ON).	Is the output line connected correctly?	
C. Vibration does not occur (The Run lamp is OFF.)	Press the RUN/STOP button to switch to the operation state.	
D. Vibration does not occur (The Run lamp is blinking)	Check the external operation signal and the full sensor as well as their parameters.	
E. The amplitude is not increased when voltage is increased.	Is the frequency adjusted properly?	
	Isn't the used load outside the specified range?	Instruction manual for the vibrator
F. The output frequency cannot be adjusted.	Isn't it locked?	
G. The vibration fluctuates.	Is the frequency adjusted properly?	
	Is the load attached firmly? Is it free from interference with peripheral devices?	Instruction manual for the vibrator
H. Abnormal noise from the controller	Stop using the controller immediately and turn OFF the power supply.	
I. Abnormal smell from the controller	Contact the dealer.	

13. Warranty

- The warranty period is one year after delivery of the product.
(Operation time per day is counted as 8 hours.)
- The warranty does not cover the following cases:
 - Failures attributable to disassembly or modification by the customer
 - Failures that are obviously attributable to erroneous use
 - Failures caused by natural disasters such as fire, earthquake and flood
 - Failures caused by non-conformity to use conditions, use methods and precautions written in the instruction manual
- As for repair for a fee, the fee will be charged upon discussion.

Sales Division, BFC Limited

Head office TEL: 0567-56-2550 FAX: 0567-56-2552
Postal code 490-1435, Nishiume 103-1,
Umenogo, Tobishima-mura, Ama-gun, Aichi
Prefecture

Osaka Sales Office TEL: 06-4806-4777 FAX: 06-4806-4778
Postal code 532-0011, Hanahara Daini
Building 702, Nishi-Nakajima 4-11-27,
Yodogawa-ku, Osaka City

BFC Applications, Ltd.

Tokyo Sales Office TEL: 03-5905-7160 FAX: 03-5905-7161
Postal code 178-0063, MB 1F, Higashi-Oizumi
3-42-8, Nerima-ku, Tokyo