



AC Variable Frequency Drive  
GM2 Series.....

Quick Start Guide  
1 HP ~ 15 HP, 230V/460V

[www.Benshaw.com](http://www.Benshaw.com)



Caution

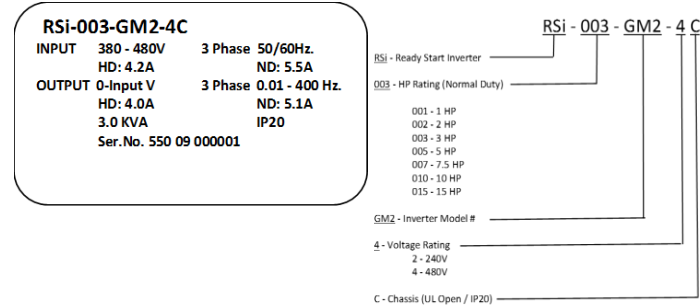
- Read the full instruction manual before installing, wiring, and operating the inverter.
- Keep this Quick Start Guide in close proximity to the inverter for quick reference.

1. Introduction of Startup Guide

- This quick start guide is intended for users with basic knowledge of electricity and electric devices.
- For detailed information on installation and commissioning, the full version of the GM2 manual can be downloaded at [Benshaw.com/890054-00-00.pdf](http://Benshaw.com/890054-00-00.pdf).

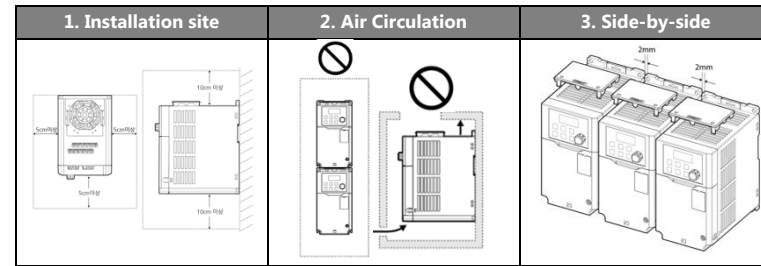
2. Verify & Identify Delivery

- Inspect the drive for any damage. If the drive appears damaged upon receipt, contact your supplier.
- Verify receipt of the correct model by checking the information on the label as shown below. If you have received the wrong model, contact your supplier.
- (The label is on the side of the product.)



3. Installation

- 1) Site Installation  
The location must be free from vibration, and the inverter must be installed on a wall that can support the inverter's weight.
- 2) Air Circulation  
The inverter can become very hot during operation. Install the inverter on a surface that is fire-resistant or flame-retardant and with sufficient clearance around the inverter to allow air to circulate. The illustrations below detail the required installation clearances.
- 3) Side-by-Side  
If you are installing multiple inverters in one a panel, arrange them side-by-side and remove the top covers. The top covers MUST be removed for side-by-side installations for proper heat dissipation. Use a flat head screwdriver to remove the top covers. (Din-rail installation is also available)



4) Inverters are composed of sensitive electronic components. Therefore, the installation environment can significantly impact the lifespan and reliability of the product. The table below details the ideal operation and installation conditions for the inverter.

Items	Description
Ambient temperature <sup>1</sup>	Heavy load: -10~50°C, Normal load: -10~40°C
Ambient humidity	Less than 95% relative humidity (no condensation)
Storage temperature	-20 - 65°C
Environmental factors	An environment free from corrosive or flammable gases, oil residue, or dust
Operation Altitude	Lower than 3,280 ft (1,000 m) above sea level, less than 1G (9.8 m/sec <sup>2</sup> )
Vibration	
Air Pressure	70~106 kPa

4. Lead Connection

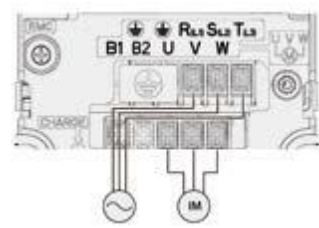
- 1) Power Terminal  
Utilize the below wiring diagrams to properly wire the main power connections to the inverter. **This step should be done with power OFF!** Refer to the User Manual for proper wire gauge recommendations. Be sure to follow good wiring and grounding practices. Follow applicable local codes if needed.

**Danger!**

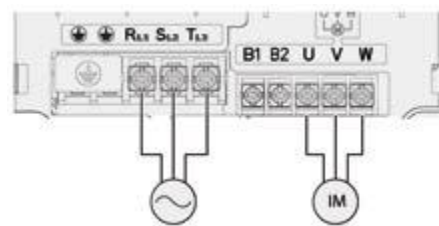
Lethal voltages are present. Be sure that all power is turned OFF while performing the recommended power wiring. Reinstall all protective covers on the GM2 before reapplying power

- Below is the proper wiring for three phase applications. The physical terminal layout differs slightly among inverters up to 5 HP. Terminal names (e.g. R, S, T, etc) will remain consistent.

- [Three Phase Input 1.0 HP ~ 5.0 HP]



- [Three Phase Input 7.5 ~ 15 HP]

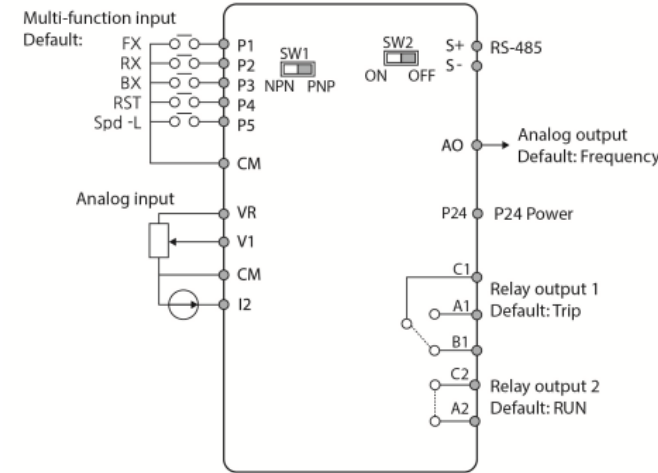


Terminal Label	Name	Description
	Ground Terminal	Connect earth grounding.
R(L1)/S(L2)/T(L3)	AC power input terminal	Mains supply AC power connections.
B1/B2	Brake resistor terminals	Brake resistor wiring connection.
U/V/W	Motor output terminals	3-phase induction motor wiring connections.

<sup>1</sup> The ambient temperature is the temperature measured at a point 2" (5cm) from the surface of the inverter.

- 2) The illustration below shows external connections to the control board terminals along with the control board switches.

Switch	Description
SW1	NPN/PNP mode selection switch
SW2	Terminating resistor selection switch



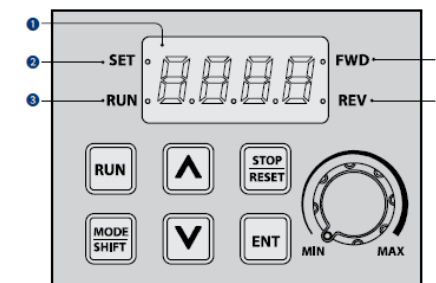
- Input terminal labels and descriptions

Labels	Parameters	Description/Factory default
P1~P5	IN-65	• Functions for digital input terminals P1: FX P2: Rx P3: BX P4: RST P5: Speed-L
	IN-66	
	IN-67	
	IN-68	
	IN-69	
VR	-	• Power source for analog freq. source (12Vout)
V1	IN-05~16	• Voltage source for analog input
I1	IN-50~62	• Current source for analog input
CM	-	• Common terminal

- Output/Communication terminal labels and descriptions

Labels	Parameters	Description/Factory default
A1/B1/C1	OU-31	• Relay output 1 Default: Trip
A2/C2	OU-33	• Relay output 2 Default: Run
AO		Analog voltage output terminal Default: Output Frequency
24		• External 24V power source
S+/S-		• RS-485 signal line

5. Keypad display



No.	Name	Function
①	7-Segment Display	Displays current operational status and parameter information.
②	SET Indicator	LED flashes during parameter configuration and when the ESC key operates as the multi-function key.
③	RUN Indicator	LED turns on (steady) during an operation, and flashes during acceleration or deceleration.
④	FWD Indicator	LED turns on (steady) during forward operation.
⑤	REV Indicator	LED turns on (steady) during reverse operation.

Key	Name	Function
	[RUN] key	Used to start and run the inverter
	[STOP/RESET] key	STOP: Stops the inverter. RESET: Resets the inverter after a fault occurs.
	[MODE/SHIFT] key	MODE - Moves between parameter groups. SHIFT - In Program mode (SET LED lit), moves to the digit on the left when setting the parameter. Press the MODE/SHIFT key once again on the maximum number of digits to move to the minimum number of digits.
	[ENT] key	ENTER - To view and change parameter setting (SET LED flashes). ENTER - Twice after changes, to apply changes. ENTER - At fault code to access fault information.
	[▲] key, [▼] key	Up/Down, Increase/Decrease parameter values and settings. Switches between codes, or increases or decreases parameter values.
	Potentiometer / [Volume]	Used to set the reference frequency when parameter Frq is set to 4 (V0).
	[ESC]*	* Operates as ESC key when two keys are entered at the same time. - While in the group navigation mode, use ESC to go to the initial screen (the frequency display screen). - While in the parameter change mode (SET LED lit), use ESC to go to group navigation mode without saving.

6. Basic Commissioning

- 1) Parameter Group Navigation and Setting [Operation Group]
    - 14 basic parameters are categorized in the operation group
    - Parameter Codes can be accessed by pressing [▲] and [▼] keys.
    - Settings can be accessed by pressing [ENT] key.
- [Parameter Groups and settings]
- 
- Groups can be accessed with the [MODE/SHIFT] key.
  - Group access in the other direction can be accessed by pressing the [MODE/SHIFT] key for more than 1sec.
  - Parameters within each group can be accessed with [▲] and [▼] keys.
  - Press the [ENT] key to view/change the setting of the parameter.
  - Press the [ENT] key twice to save the settings.

- 2) Motor Direction Verification  
This step explains how to check motor direction by running the motor at a low speed via the keypad. Verify that the power and motor wiring matches the previous step and covers are installed before applying power.
- 3) Speed Setting  
At the very first power up, the display will look like the "0.00". This indicates the frequency reference of 0.00 Hz.

- Press the [ENT] key.
- Set LED illuminates. Press [MODE/SHIFT] x3 key to shift over the digits.
- Press [▲] key until 10.00 is displayed.
- Then Press the [ENT] x2 to save the value.

• **Setting Command Source**



- Press **[▲]x4** key until **drv** is displayed.
- Press **[▼]** key to change setting to 0.
- Then Press the **[ENT] x2** to save the setting. ※ This activates the RUN and STOP keys as the command source.
- To return to the frequency display use the **[ESC]** key by pressing:
  - **[▲] + [▼]**,
  - **[▲] + [MODE/SHIFT]**,
  - or
  - **[▼] + [MODE/SHIFT]**

• **Checking Direction**

Check that it is safe to run the motor at low speed. When ready, press **[RUN]** key to run the motor. The display will briefly show the output frequency of the VFD until it reaches 10Hz.

- Look at the motor shaft to verify the rotation. Press the **[STOP/RESET]** key stop.
- If motor direction is **incorrect**, stop the motor with the **[STOP/RESET]** key, and power down the VFD.

Wait at least **5 minutes** to let the VFD capacitors discharge.

- Swap any two **output** leads between the inverter and the motor. This will change motor direction. Verify correct rotation via the previous steps.

4) Start/Stop and speed source settings

• [Run command source setting]

• 2-wire Control (1: Fx/Rx-1)

0	Keypad
1	Fx/Rx-1
2	Fx/Rx-2
3	Int 485
4	Field Bus

- Press **[▲]x3** key until parameter **drv** is displayed. Then press **[ENT]** to display the setting. Set to 1: (Fx/Rx-1) for 2-wire Start/Stop control.

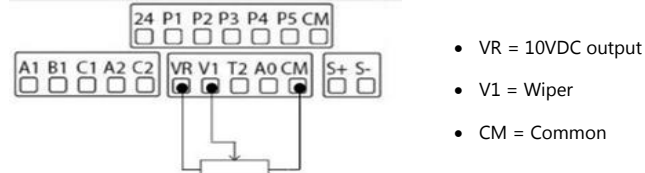
• [Frequency source setting]

0	KeyPad-1
1	KeyPad-2
2	V1
4	V0
5	I2
6	Int 485
8	Field Bus

- Press **[▲]x4** key until parameter **Frq** is displayed. Then press **[ENT]** to display the setting.

- **Speed Potentiometer Wiring (2: V1, 0-10V)**

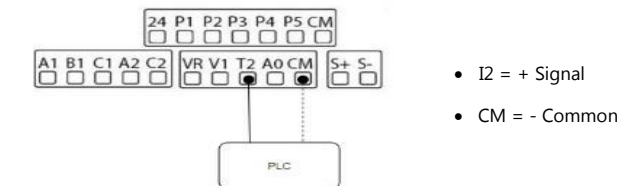
Controlling the VFD with an external speed POT can be accomplished by setting parameter **Frq=2** and wire per below. For 0-10VDC signals from a PLC or Controller simply wire to V1 and CM.



- VR = 10VDC output
- V1 = Wiper
- CM = Common

- **PLC or Controller Wiring (5: I2, 4-20mA)**

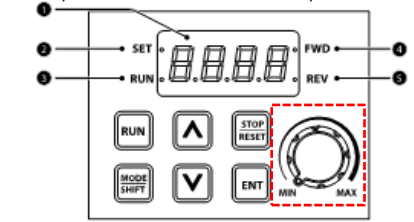
For speed control over a 4-20mA signal set **Frq=5**.



- I2 = + Signal
- CM = - Common

- **Built-in potentiometer (4: V0)**

For speed control over the built-in potentiometer.



5) Acceleration and Deceleration Time example.

- Press **[▲]** key from the main display (0.00) until Acc is displayed.
- Press **[ENT]** key to display the current setting.
- Use the **[▲]** and **[▼]** key to increase and decrease the value.
- Use the **[MODE/SHIFT]** key to move the cursor over to the next digit.
- Press the **[ENT] x2** to save the setting.
- Acc will be displayed again indicating the parameter change has taken effect.

6) Required Motor Parameters

- Set the below motor parameters based on the motor nameplate.

Grp	Code	Name	Setting
dr	14	Motor Capacity	Motor capacity setting
bA	11	Poles	Motor capacity (2~12)
	12	Motor Rated Slip	Motor capacity setting (RPM)
	13	Motor Rated Current	Motor capacity setting
	15	Motor Voltage	Motor capacity setting

- HP to kW conversion chart

HP	1/4	1/2	1	2	3	5	7.5	10	15
kW	0.2	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11

- Motor Poles to synchronous RPM

Poles	2	4	6	8
Hz	50	60	50	60
RPM	3000	3600	1500	1800
	1000	1200	750	900

- If the motor nameplate is 1750, set bA11\_poles=4 and bA12\_Motor rated slip=50 (Rated slip is the difference between the synchronous RPM – nameplate RPM)

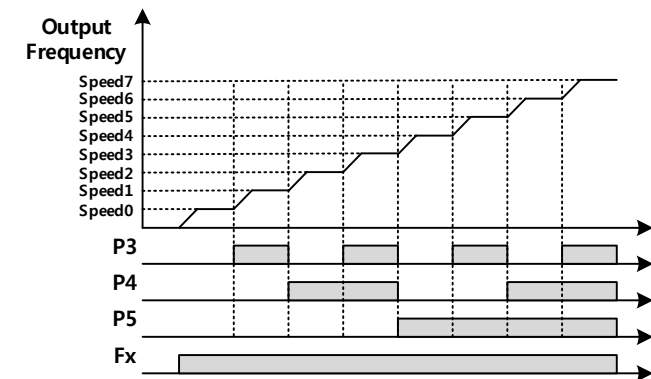
**7. Frequently Used Features**

1) Multi-step Frequency

- This step shows how to set up and use the multi-step frequency of the inverter.

Grp	Code	Name	Setting
In	65	P1 function setting	
	66	P2 function setting	7: Speed-L
	67	P3 function setting	8: Speed-M
	68	P4 function setting	9: Speed-H
	69	P5 function setting	

- Digital input of Speed-L/M/H function as a binary sequence that defines the different multi-steps from 1~7. (ex. P3=(7)Speed-L, P4=(8)Speed-M, P5=(9)Speed-H)



Speed	P3	P4	P5	Description
0	-	-	-	Speed setting according to the source setting in Frq
1	√	-	-	St-1_Multi-step speed frequency1
2	-	√	-	St-2_Multi-step speed frequency2
3	√	√	-	St-3_Multi-step speed frequency3
4	-	-	√	bA-53_Multi-step speed frequency4
5	√	-	√	bA-54_Multi-step speed frequency5
6	-	√	√	bA-55_Multi-step speed frequency6
7	√	√	√	bA-56_Multi-step speed frequency7

2) Power-on Run

- To automatically start after a power loss or start as soon as the inverter is powered up, set **Ad-10\_Poweron Run=1**.

3) Speed Search

- When a fault occurs, to operate a free running motor without an additional fault, set speed search after fault.

Grp	Code	Name	Setting	Description
Cn	71	Speed search selection	-- 1 _ (0010)	Initialization after a fault

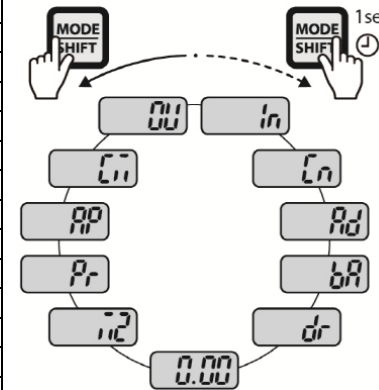
4) Automatic restart

- Automatic restart function is only operable when run command is set to (1) Fx/Rx-1, or -2 and the run command is active. Settings: Pr-08\_Auto Restart select= 1, Pr-09\_Restart No., Pr-10\_Restart delay time.

**8. Parameter List**

**Operation group**

<b>0.00</b>	Target frequency
<b>ACC</b>	Acceleration time
<b>DEC</b>	Deceleration time
<b>drv</b>	Command Source
<b>Frq</b>	Frequency reference source
<b>St1</b>	Multi-step speed frequency 1
<b>St2</b>	Multi-step speed frequency 2
<b>St3</b>	Multi-step speed frequency 3
<b>CUr</b>	Output current
<b>Rpm</b>	Motor revolutions per minute
<b>dVL</b>	Inverter DC voltage
<b>vOL</b>	Inverter output voltage
<b>nOn</b>	Out of order signal
<b>drC</b>	Select rotation direction



Drive(dr)			
09	Control mode	26	Auto torque boost filter gain
11	Jog Frequency	27	Auto torque boost motoring gain
14	Motor capacity	28	Auto torque boost regeneration gain
15	Torque boost mode	91	Smart copy
16	Forward Torque boost	93	Parameter initialization
17	Reverse torque boost	97	Software version
18	Base frequency	98	Display I/O board version
20	Maximum frequency		
Basic(bA)			
04	2nd command source	19	Input power voltage
05	2nd frequency source	20	Auto tuning
10	Input power frequency	53	Multi-step speed frequency 4
11	Number of motor poles	54	Multi-step speed frequency 5
12	Rated slip speed	55	Multi-step speed frequency 6
13	Motor rated current	56	Multi-step speed frequency 7
15	Motor rated voltage		

Advanced(Ad)			
01	Acceleration pattern (Linear/S-curve)	44	Brake release Forward frequency
02	Deceleration pattern (Linear/S-curve)	45	Brake release Reverse frequency
07	Start Mode	47	Brake engage frequency
08	Stop Mode	50	Energy saving operation
09	Run prevention options	64	Cooling fan control options
10	Starting with power on	66	Output contact On/Off control options
20	Dwell frequency on acceleration	70	Safe operation selection
22	Dwell frequency during deceleration	74	Selection of regeneration evasion function for press
24	Frequency limit	79	DB Unit turn on voltage level
27	Frequency jump	80	Fire Mode selection

Control (Cn)			
04	Carrier frequency	29	Speed compensation gain at no-load
09	Initial excitation time	30	Speed response adjustment gain
21	Out torque compensation gain at low speed	53	Torque limit setting
22	Out torque compensation gain	71	Speed search operation selection
23	Speed compensation sub gain	77	Energy buffering selection
24	Speed compensation main gain		

Input(In)			
01	Frequency for maximum analog input	11	V1 output at Maximum voltage (%)
05	V1 input voltage display	16	Changing rotation direction of V1
06	V1 input polarity selection	17	V1 quantization level
07	Time constant of V1 input filter	65~	P1~P5 define
08	V1 Minimum input voltage	~69	P1~P5 define
09	V1 output at Minimum voltage (%)	87	Multi-function input terminal NO/NC selection
10	V1 Maximum input voltage	90	Multi-function input terminal status

Output(OU)			
01	Analog output 1 item	31	Multi-function relay 1 item
02	Analog output 1 gain	33	Multi-function relay 2 item
03	Analog output 1 bias	41	Multi-function output monitor
04	Analog output 1 filter	52	Multi-function output contact selection
05	Analog constant output1	57	Detection frequency
06	Analog output1 monitor	58	Detection frequency band

Communication(CM)			
01	Built-in communication inverter ID	03	Built-in communication speed
02	Built-in communication protocol		

Application(AP)			
<i>Refer to the manual for PID operation</i>			

Protection(Pr)			
04	Load level setting	50	Stall prevention motion and flux braking
05	Input/output open-phase protection	59	Flux braking Gain value
08	Selection of startup on trip reset	66	DB resistor warning level
12	Motion at speed command loss	73	Speed deviation Error
17	Overload warning selection	78	Pre-overheat warning operation selection
20	Motion at overload fault	79	Cooling fan fault selection
25	Under load warning selection	80	Motion selection at option trip
27	Under load fault selection	82	LV2 Selection
31	No motor motion at detection	87	Fan exchange warning level
40	Electronic thermal fault selection	91~	Fault history 1~
41	Motor cooling fan type	~95	Fault history ~5
45	BX trip mode	96	Fault history deletion

**9. Troubleshooting Fault Codes**

*Refer to the instruction manual for fault codes and troubleshooting solutions.*