ELECTRIC REGULATOR

RM5G Supplemental User Manual

Danger

Hazardous High Voltage

Ground the control before servicing
Remove all power and wait until all the control has discharged.
Measuring the voltage of terminals P and N to verified it has discharged.
Failure to comply will result in death or serious injury.

Warning

Separate over current protection is required by the national electric code. The user is responsible for conforming with the national electric code and all applicable local codes which govern such practices as wiring protection, grounding, disconnects and other current protection.

Warning

Never exceed the maximum input voltage

Exceeding the maximum input voltage
causes catastrophic failure.
Repair is impractical the control should be replaced.

Warning

The RM5 is for 3 phase induction motors only.
The RM5 will damage capacitor start motors.

CAUTION

Before MEGGER or DIELECTRIC testing the AC motor.
Disconnect the AC motor from the RM5G control.
Megger or dielectric testing will damage the control.

Table of Contents

1. Receiving & Storage

Section 1.1 Physical Inspection

When you receive the RM5G AC drive, avoid shock or vibration when unloading and transporting the unit. This can damage the semiconductors or other components.

Immediately upon receipt inspect the unit for the following;

- Check to be certain the unit is clean of packing materials.
- Check for damage incurred during shipment, dents, scratches, etc.
- Inspect mechanical the parts, loose screws, terminals, etc.
- Inspect for, damaged, loose or shorted electronic components or connections.
- If you find damage, don't connect power to it. The unit must be replaced or repaired. Connecting power could result in fire or further damage and could void warranty.

Promptly report damage or problems you found during inspection to Electric Regulator Corp. Telephone (760) 438-7873 Fax (760) 438-0437

Store the AC drive in a clean dry place in the package it was in shipped. Avoid storing the unit in a location with high temperatures, humidity, dust or corrosive gases. Outdoor storage is not recommended.

Section 1.2 Input Power & Motor Rating

Check the identification label to confirm that the input power and the motor's ratings are compatible with the drive.

- Identification Label On the right side of the drive please find the label with the model number, input power and output power. Example::

Model No.	RM5G-2005
Input Power	200 to 230 VAC 50/60Hz
Output Power	3.7kW/ 5 HP 17A

- Model Number Scheme RM5G - 2 005
  A B C

  A: RM5G..... Model Series Number
  B: 2..... Voltage 208V, 220V, 230V
  4..... Voltage 400V, 440V, 460V
  C: 005..... Horsepower: Example 5 HP

- Input Power Units rated from ½ HP to 5 HP can use 1ϕ or 3ϕ input power. Units 7 ½ HP and above require 3ϕ input power

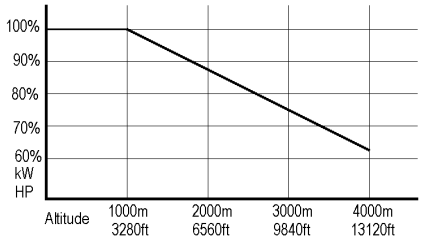
- Motor Specification Inverter duty motor compatible with IGBT variable frequency control.

2. Installation Location

2.1 Operating Environment

The RM5G AC drive should be located in a operating environment that meets the following conditions.

- Ambient Temperature between 14º to 122º Fahrenheit (-10º to 50º Celsius).
- Relative Humidity Avoid locations exceeding RH 90%.
- Condensation Do not locate the unit where condensation occurs.
- Altitude If located above 1000m/3280 ft above sea level, see table for power derating.



- Corrosion Avoid locations with corrosive gases or liquids; example: ocean air.
- Contamination Avoid locations subject to dust or iron particles.
- Hazardous Gases & Liquids The RM5G is not designed for explosive environments. Do not locate the unit were it is subject to combustible or flammable gases or liquids.
- Ventilation Mount the unit in a lengthwise vertical position to ensure proper cooling ventilation. Provide not less than 5 inches (125 mm) top and bottom and 2 inches (50 mm) each side of clear space around the unit. If the unit is in a sealed enclosure, provide adequate ventilation for air flow from top to bottom.
- Shock & Vibration Avoid mounting the unit in a location subject to shock or vibration.

2.2 Motor Selection

- The motor should be a standard three phase induction motor. The minimum insulation requirement is 100 M at 500V. Most modern motors meet or exceed this requirement. Submersible motors may fail due to sand and other contaminates abrading the insulation.
- If the normal speed is above 15 Hz a self ventilated motor normally adequate.
- If the motor speed is under 15 Hz for more than several minutes, separately powered ventilation for the motor is required.
- The resonance frequency of a typical motor is somewhere between 6 Hz to 9 Hz. If you plan to run close to the resonance frequency, read page 16 section 4.16, Frequency Bypass.
- If you run the motor above 60 Hz, see page 27, section 4.29

2.3 AC Line Reactors

AC line reactors should be used, if the RM5's input power is shared with 4 or more AC drives or equipment with SCR thyristors, high power motors or welders. Important, the AC line reactor should be located as close as possible to the input terminals of the RM5 AC drive.

200~240V Table

HP	Inductance	Amperes
1	0.4 mH	15A
2	0.4 mH	15A
3	0.4 mH	15A
5	0.3 mH	30A
7.5	0.3 mH	30A
10	0.08 mH	50A
15	0.08 mH	50A
20	0.04 mH	100A
25	0.04 mH	100A
30	0.04 mH	100A
40	0.03 mH	150A
50	0.02 mH	200A
60	0.02 mH	200A

440~480V Table

HP	Inductance	Amperes
1	0.4 mH	15A
2	0.4 mH	15A
3	0.4 mH	15A
5	0.4 mH	15A
7.5	0.3 mH	30A
10	0.3 mH	30A
15	0.25 mH	40A
20	0.25 mH	40A
25	0.08 mH	50A
30	0.08 mH	50A
40	0.04 mH	100A
50	0.04 mH	100A
60	0.04 mH	100A
75	0.03 mH	150A
100	0.02 mH	200A
150	0.02 mH	300A
200	0.03 mH	560A
300	0.03 mH	560A

Section 2.4 Wire Size Table and AC Power and Motor Connections

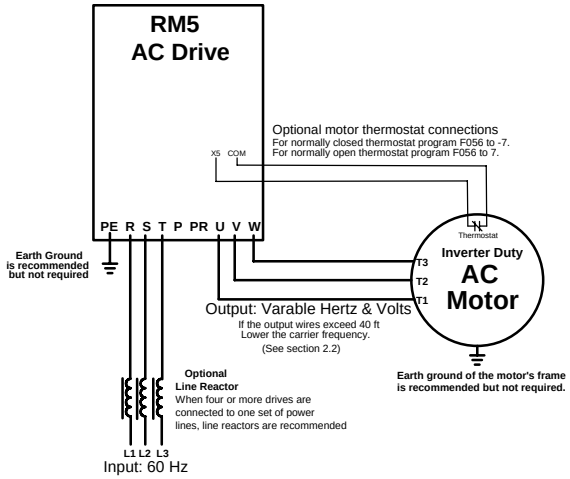
Input: 220 V_{AC} / 3 Phase / 60 Hz			
HP	200% Load AC Amps	Recommended Wire Size	Circuit Breaker AC Amps at 250V_{AC}
1	3.9	14 AWG	5
2	7.9	14 AWG	10
3	11.8	14 AWG	15
5	19.68	12 AWG	25
7.5	29.52	10 AWG	30
10	39.36	8 AWG	40
15	59.05	6 AWG	70
20	78.73	4 AWG	90
25	98.41	3 AWG	100
30	118.09	1 AWG	125
40	157.46	00 AWG	175
50	196.82	000 AWG	200
60	224.38	0000 AWG	225
75	295.24	300 MCM	300
100	393.65	500 MCM	400
125	492.06	(2) 250 MCM	500
150	590.47	(2) 350 MCM	600

Input: 460 V_{AC} / 3 Phase / 60 Hz			
HP	200% Load AC Amps	Recommended Wire Size	Circuit Breaker AC Amps at 600V_{AC}
1	1.9	14 AWG	5
2	3.8	14 AWG	5
3	5.7	14 AWG	10
5	9.41	14 AWG	10
7.5	14.12	14 AWG	15
10	18.83	12 AWG	20
15	28.24	10 AWG	30
20	37.65	8 AWG	40
25	47.07	8 AWG	50
30	56.48	6 AWG	60
40	75.31	4 AWG	75
50	94.13	4 AWG	100
60	112.96	3 AWG	125
75	141.2	1 AWG	150
100	188.27	00 AWG	200
125	235.33	0000 AWG	250
150	282.4	250 MCM	300

Output: Variable 0 ~ 60 Hz / 0 ~ 220 Volts		
HP	200% Load DC Amps	Recommended Wire Size for 40 ft length
1	3.9	14 AWG
2	7.9	12 AWG
3	11.8	12 AWG
5	19.68	10 AWG
7.5	29.52	8 AWG
10	39.36	6 AWG
15	59.05	4 AWG
20	78.73	2 AWG
25	98.41	1 AWG
30	118.09	0 AWG
40	157.46	0000 AWG
50	196.82	250 MCM
60	224.38	300 MCM
75	295.24	500 MCM
100	393.65	(2) 250 MCM
125	492.06	(2) 350 MCM
150	590.47	(2) 500 MCM

Output: Variable 0 ~ 60 Hz / 0 ~ 460 Volts		
HP	200% Load DC Amps	Recommended Wire Size for 40 ft length
1	1.9	14 AWG
2	3.8	14 AWG
3	5.7	14 AWG
5	9.41	12 AWG
7.5	14.12	12 AWG
10	18.83	10 AWG
15	28.24	8 AWG
20	37.65	8 AWG
25	47.07	6 AWG
30	56.48	4 AWG
40	75.31	3 AWG
50	94.13	2 AWG
60	112.96	1 AWG
75	141.2	00 AWG
100	188.27	0000 AWG
125	235.33	300 MCM
150	282.4	(2) 000 AWG

Elementary Power Connection Diagram



Section 2.5) Carrier Frequency

Longer wires require lower carrier frequency. Function code F 081 programs the carrier frequency.

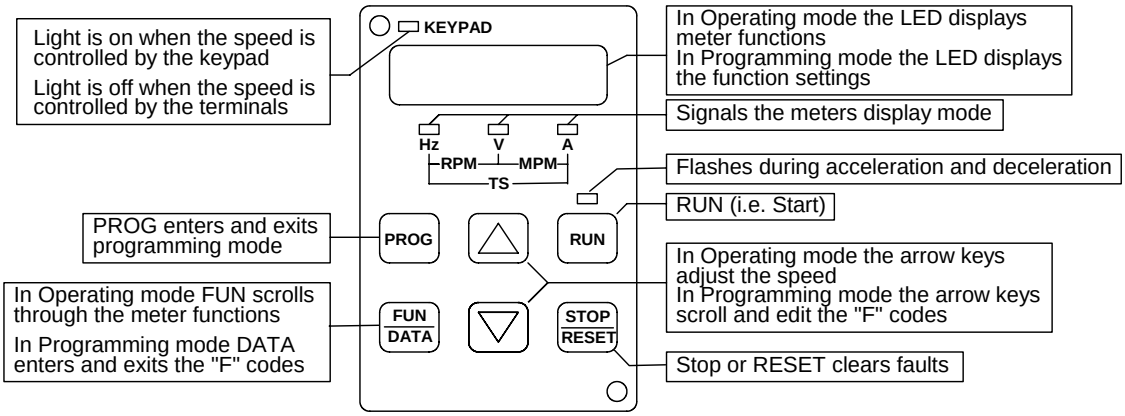
Wire Length	10m / 40 ft	25m / 80 ft	50m / 160 ft	100m / 320 ft	Over 100m
½ to 5 HP	12.5 kHz or less	10 kHz or less	7.5 kHz or less	5 kHz or less	2.5 kHz
7 ½ to 10 HP	10 kHz or less	7.5 kHz or less	5 kHz or less	2.5 kHz	2.5 kHz
15 to 30 HP	7.5 kHz or less	5 kHz or less	2.5 kHz	2.5 kHz	2.5 kHz
40 to 75 HP	5 kHz or less	2.5 kHz	2.5 kHz	2.5 kHz	2.5 kHz

F 081	Carrier Frequency	Factory set: 4	1) 2.5 kHz	4) 10.0 kHz
			2) 5.0 kHz	5) 12.5 kHz
			3) 7.5 kHz	6) 15.0 kHz

Section 3.1) Keypad Operation

The keypad has four operating modes.

- Monitoring Mode (default)
- Data Mode (Meter)
- Function Code Menu (Scrolls up and down from F 000 to F 134)
- Programming Mode (Edits the function codes)



When the power is switched on, the keypad LED display is in monitoring mode. In monitoring mode the default display is the frequency (Hz) output to the motor. The default display can be changed to the user's preference. Function code F 006 selects the default display, see the table below for function code F 006.

Example of how to program.

In this example you will change the default display to RPM. Press the PROG key to enter the function code menu. The function codes are numbered from F 000 through F 134. Then use the arrow keys to scroll up and down through the function codes, scroll to F 006. To change the program of F 006, press the FUN/DATA key to enter F006. Then used the arrow keys to scroll to the number 6 (RPM, see table below) then press the FUN/DATA key to exit F 006 and then press the PROG key to exit out of the function code menu. The default display should now be RPM.

Function code table for F 006

F 006	Keypad Default Display (Factory set: 1)	1) Hz	4) DC Supply Voltage	7) User Defined Meter
		2) Speed setting in Hz	5) Current	8) Terminal Status
		3) Voltage	6) RPM	

Section 3.2 Programing with positive and negative numbers.

The input and output terminals programs have positive and negative numbers. Positive numbers are for closed circuit and negative numbers are for open circuit. An example of when programing with negative numbers is required. The motor thermostat is normally closed until the temperature becomes too high and then opens. In this circumstance terminal X5 that is programmed by F 056 should be programed to negative seven (-7). When the motor is cool the thermostat closed and the motor is permitted to run. If the motor becomes too hot the thermostat opens and the motor stops.

Section 3.3) Operating the RM5G with out the keypad.

The RM5G will operate without the keypad, when the RM5 is controlled by terminals Vin, GND, FWD and REV. If more programing is required reconnected the keypad.

Section 3.4) How to Restore the Factory Program Settings.

Press the PROG key to enter function code menu, then scroll to F 134 and press the FUN/DATA key. Then scroll until dEF60 is displayed, press and hold down the FUN/DATA key until the word "end" is displayed. When the word "end" is displayed. All the function codes have been set to the factory 60 Hz settings.

Section 3.5) Quick Guide (to the most used program codes)

This page covers the most commonly used function codes for quick reference.

The RM5G default settings are for keypad operation. The motor will start when the run key is pressed and the arrow keys adjust the speed. When the RM5G is started for the first time, it will accelerate to 60 Hertz. If you do not want run at 60 Hertz, before starting, press the down arrow key to adjust the speed, then start.

Most users will want to program the following parameters

- **Motor Voltage** users of 440V ~ 480V motors will need to program F 034.
- **Speed Control Input** users that have speed potentiometers will need to program F 002.
- **Start and Stop** users that have auxiliary start and stop buttons will need to program F 001.
- **Stop** the user should select controlled deceleration or coast (freewheeling), see F 082.
- **Acceleration and Deceleration** times are programmed by F 019 and F 020.
- **The motors number of poles** see F051
- **Maximum Current** enter the motors maximum amps listed on the data plate into F 048.

Note: Measure the output voltage with a **True RMS digital meter or analog meter**. Analog meters are preferred.

F 001	Start, Forward & Reverse	0) Enable FWD and REV terminals to start, keypad start is disabled.
		1) Enable FWD and REV terminals to start, forward rotation only.
		2) Keypad Start, Terminals select forward or reverse.
		3) Keypad Start, forward only. Factory set: 3
Notes: Settings: 0, 1, 2. If FWD, COM or REV, COM are not connected the keypad flashes, - - - - - . If both FWD, REV are connected simultaneous to COM the keypad flashes, def.		
F 002	Speed Control	0) Speed Pot Terminals: 12V,Vin, GND or Current Ref.., Iin, GND
		1) Keypad Arrow Keys with Hz display. Factory set: 1
		2) Keypad Arrow Keys with RPM display when arrow keys are pressed.
		3) Keypad Arrow Keys with user defined meter displayed when arrow keys are pressed. (See F007)
		4) Digital Speed Input, terminals X2 trough X6
F 003	Keypad Stop	0) Disable Keypad Stop
		1) Enable Keypad Stop, Factory set: 1
F 006	Keypad Default Display	1) Hz Output 5) Current
		2) Speed Setting in Hz 6) RPM
		3) Voltage 7) User Defined Meter. Note see F002 number 3
		4) DC Link Voltage 8) Terminal Status Factory set: 1
F 019	Acceleration Time	0 to 3200 sec. Factory set: 1/2 to 5 Hp 5 sec, 7.5 to 30 Hp 15 sec, 40Hp & up, 30 sec.
F 020	Deceleration Time	0 to 3200 sec. Factory set: 1/2 to 5 Hp 5 sec, 7.5 to 30 Hp 15 sec, 40Hp & up, 30 sec.
F 035	Maximum Output Voltage	200V series, 0.1V ~ 255V, Factory default: 220V
		400V series, 0.1V ~ 510V, Factory default: 380V
F 047	Over Current Switch Off Time	0) Standard switch off time. Factory set : 0
		1) Fast switch off time
F 048	Motor's Maximum Current Rating	See motor's name plate for the maximum current rating
F 049	Motor's No Load Current Rating	See data on motor's name plate for no load current rating. If not available on name plate measure the current. Factory set: 0.1
F 051	Number of Poles	Entering the motor's number of poles calibrates the RPM and the User defined meter (See F007) . Select: 2P, 4P, 6P, 8P, 10P. Factory set: 4P
F 082	Stop Deceleration	0) Controlled Deceleration Stop
		1) Uncontrolled Deceleration Stop (coast to stop)
F 095	Input Voltage	200V series, 190V ~ 240V, Factory default: 220V
		400V series, 340V ~ 480V, Factory default: 380V

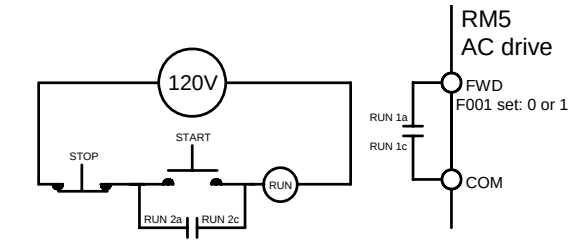
Section 4.1) Start, Stop, Forward and Reverse

The RM5's default program is to start and stop from the keypad. Many alternat methods beyond the diagrams shown here are possible.

F 001	Start, Stop, Forward and Reverse	0) Enable Terminals FWD and REV to Start and Stop (Keypad is disabled)
		1) Enable Terminal FWD to Start and Stop
		2) Keypad Start (i.e. Run), Terminals FWD and REV select direction
		3) Keypad Start (i.e.Run), Forward only (Factory set: 3)
F 003	Keypad Stop	0) Disable Keypad Stop
		1) Enable Keypad Stop (Factory set: 1)
F 056	Stop (Digital Input X5 Close)	When terminal X5 (F 056) is set: 0. Stop is achieved by momentarily closing X5 and COM for not less than 30 ms. This facilitates interfacing with PLC or momentary stop button. Note: When F 056 is set: 0. Terminals FWD and REV only require 30 ms signal to start. Sustaining the signal to FWD or REV is no longer required.
F 057	Stop (Digital Input X6 Open)	When terminal X6 (F 057) is set: 0. Stop is achieved by momentarily opening X6 and COM for not less than 30 milli seconds. This facilitates interfacing with PLC or simulation of a three line sustaining circuit. Note: When F 057 is set: 0. Terminals FWD and REV only require 30 ms signal to start. Sustaining the signal to FWD or REV is no longer required.
F 052 F 053 F 054	Emergency Stop (Freewheel, Coast to Stop)	When the application requires both controlled deceleration stop button and uncontrolled deceleration stop button (Some electrical codes require Emergency Stop to coast to stop). Program one of the terminals, X1(F 052) or X2(F 053) or X3(F 054) to ±9.
F 082	Stop	0) Controlled Deceleration Stop (Factory set: 0)
		1) Uncontrolled Deceleration Stop (i.e. Freewheeling, Coast to stop)
F 083	Reverse	0) Enable Reverse (Factory set: 0)
		1) Disable Reverse

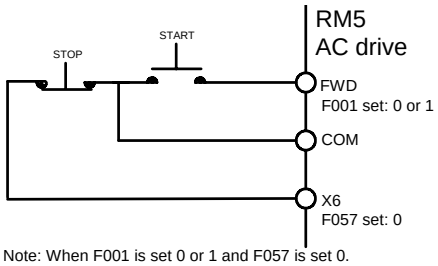
Examples of start, stop circuits

Classic Three Line Sustaining Circuit



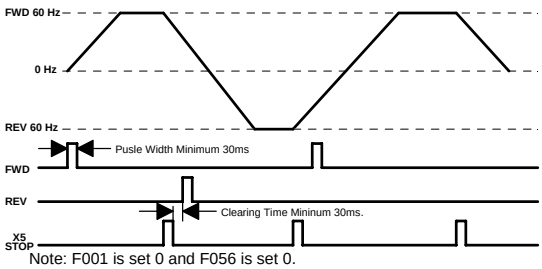
Note: When F001 is set 0 or 1, the input signal must be sustained.

Simulated Three Line Sustaining Circuit



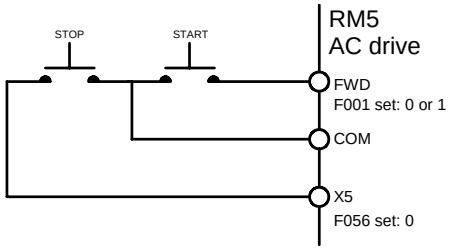
Note: When F001 is set 0 or 1 and F057 is set 0.
Then FWD and REV only require a momentary input signal.

Forward and Reverse using pulse signals



Note: F001 is set 0 and F056 is set 0.
When changing direction, first a stop signal next a REV or FWD signal.

Start & Stop circuit with momentary buttons



Section 4.2) Analog Inputs and Transfering Inputs

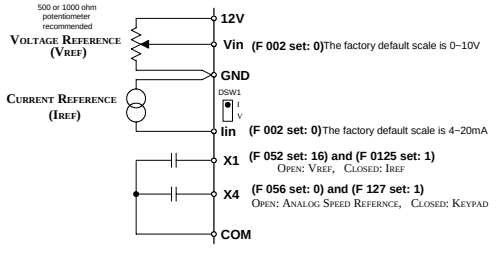
Analog inputs are also know as speed referance inputs.

- The RM5 has two analog inputs: Vin (voltage input) and Iin (current input: R_L=500Ω). The primary analog input is Vin and the secondary is Iin. The speed referance can be transfered while the motor is running. To transfer speed reference inputs see F122, F 55 and the X terminal table for F052 ~ F057.
- The Iin terminal can be changed to a voltage input by dip switch DSW1. The position I is for current reference (R_L 500Ω), position V is for voltage reference (R_L= 20kΩ).
- The scale of Vin and Iin can be defined by the user, see F 040, F 041, F 126, F 127 and F 128.
- The Vin and Iin inputs can be program perform other functions such as current limit, voltage limit, bias and gian. see F 124 and F 125.

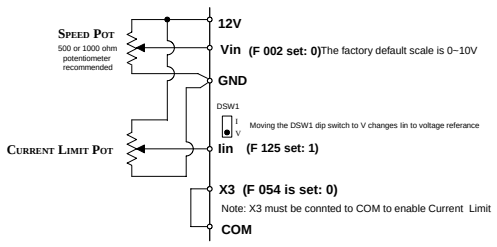
F 002	Speed Adjustment Input	0) Speed Pot (i.e. Analog Speed Ref.) Terminals Vin & GND or Iin and GND
		1) Keypad Arrow Keys with Hertz display (Factory set: 1)
		2) Keypad Arrow Keys with RPM displayed when keys are pressed.
		3) Keypad Arrow Keys with User Defined Units displayed when keys are pressed.
		4) Digital Speed Command (Terminals X1 ~ X6, See F052 ~ F057)
F 052 F 053 F 054 F 055 F 056 F 057	Transferring to Secondary Speed Input	When one of the digital inputs is set to ±16 (terminals X1 to X6). It will transfer control to the secondary speed input selected by F 122. Example: When F 122 is set to 0, F 123 is set to 3 and F055 is set to 0. A signal to a digital input X4 transfer s control to the secondary analog speed reference. Note: Vin is primary, Iin is secondary.
F 055	Transferring to Secondary Analog Speed Reference	When F055 is set to 0, F 122 is set to 0 and F 123 is set to 3. A signal to a digital input X4 transfer s control to the secondary analog speed reference. Note: Vin is primary, Iin is secondary.
F 122	Secondary Speed Input	0) Analog Speed Reference Vin or Iin, See F 123, number 3 (Factory set: 0)
		1) Keypad Arrow Keys — Note: A digital input must be set ±16, See F 052~F057, First example
		2) Digital Speed Adjustment
F 123	Secondary Analog Speed Ref., Function	0) Vin and Iin, the higher signal controls
		1) Vin-Iin (Vin sets maximum, Iin adjusts with in the range.)
		2) in-Vin (Iin sets maximum, Vin adjusts with in the range.)
		3) Vin or Iin is selected by digital input, See F055 set:±16
F 124	Vin Functions	0) Iin maximum scale (Iin Gain)
		1) Voltage Speed Reference (V_{REF}) Factory set: 1
		2) Current Limit (When terminal X3 is programed to 0)
		3) Voltage Limit (V/F pattern maximum voltage)
F 125	Iin Functions	0) Vin maximum scale (Vin Gain)
		1) Current Speed Reference (I_{REF}) Factory set: 1
		2) Current Limit (When terminal X3 is programed to 0) (Current Limit Range 0 ~ 150%)
		3) Voltage Limit (V/F pattern maximum voltage)

Examples of Analog Input Configurations

In this example the speed reference can be transfered from Vin to Iin or the keypad



In this example Iin is programed to be Current Limit



Section 4.3) Analog Input Scale

The two analog inputs Vin and Iin scales can be defined by the user. The default scale of Vin input is 0~10V and Iin default scale is 4~20mA.

Example for Vin: The user wants to change Vin scale to 0~8V. Divid the number 10 by 1.25 equals 8, the number 1.25 is entered in to F 040.

Example for Iin: The user wants to change Iin scale to 2~10mA. First program F126 to 1 (0~20mA). Next, dived the number 20 by 2 equals 10, the number 2 is entered in to F127.

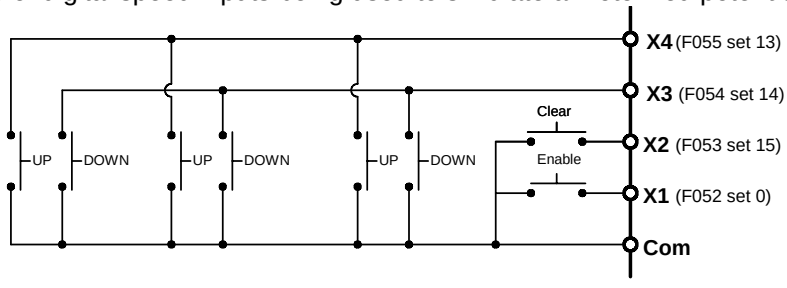
F 040	Vin Maximum Scale (Vin Gain)	0.00 to 2.00 (Factory set: 1.00)	Terminal Vin default voltage scale is 0 to 10V. The maximum value can be set between 5 to 10V. Example: If F 040 is set 1.25 the result is 0 to 8V scale. Formula (10/1.25=8)
F 041	Vin Minimum Scale (Vin Bias or Offset)	-1 to 1 (Factory Set: 0)	The minimum value of the scale can be increase. Example: (-0.2 x 10 = 2) the scale is 2 to 10 volts.
F 055	Transferring to Secondary Analog Speed Reference	When F055 is set to 0, F 122 is set to 0 and F 123 is set to 3. A signal to a digital input X4 transfer s control to the secondary analog speed reference. Note: Vin is primary, Iin is secondary.	
F 126	Iin Predefined Scales	0) 4 ~ 20mA (Factory set: 0)	
		1) 0 ~ 20mA	
F 127	Iin Maximum Scale (Iin Gain)	0.00 to 2.00 (Factory set: 1.00)	The speed reference default current scale is 4 to 20mA (See F 126). When modifying Iin scale we recommend setting F126 to 1 (0 to 20mA) this makes the mathematics simpler. The maximum value can be set between 10mA to 20mA. Example: If F 127 is set 2.00 the result is 0 to 10mA scale. Formula (20/2=10) Notes: These instructions apply when DWS1 is set: I. If DSW1 is set V, the instructions for F 040 will apply.
F 128	Iin Minimum Scale (Iin Bias or Offset)	-1.00 to 1.00 (Factory set: 0)	The minimum value can be set between 0 to 50% of Iin maximum. When modifying Iin scale we recommend setting F126 to 1 (0 to 20mA) this makes the mathematics simpler. Example: If F 127 is set 1.00 (20mA) Setting F 041 to -0.26 results in a 4 to 20mA scale. Iin minimum can not exceed 50% of Iin maximum. Notes: These instructions apply when DWS1 is set to I. If DSW1 is set V, the instructions for F 041 will apply.

Section 4.4) Digital Speed Input

The speed can be adjusted digitally to interface with a Programmable Logic Control (PLC) or to adjust speed with momentary buttons. This will also simulate a motorized pot with memory or without memory.

F 052	Enable Digital Speed Inputs	Terminal X1 must be programmed to zero and the circuit closed to enable digital speed input.
F 053 F 054 F 055 F 056 F 057	Digital Speed Input	Terminals X2 through X6 can be programed to be digital speed inputs. Accelerate (ramp up) ± 13 Decelerate (ramp down) ± 14 Clear speed setting ± 15
F 119	Digital Speed Input Frequency Adjustment	0) 0.01 Hz increments (Factory set to 0) 1 to 8) Increments of 0.05 Hz (example: 5 x 0.05Hz = 0.25 Hz) 9) 0.50 Hz increments 10 to 250) Increments of 0.10 Hz (example: 25x0.10 Hz = 0.250 Hz)
F 120	Digital Speed Input Response Time Delay	1 to 6 seconds in one second increments (faculty set to 1)
F 121	Digital Speed Input Adjustment with the Keypad	When digital speed adjustment is used, the user can adjust the speed with the keypad by entering F 121. **Important**, don't operate the keypad and digital speed buttons at the same time.

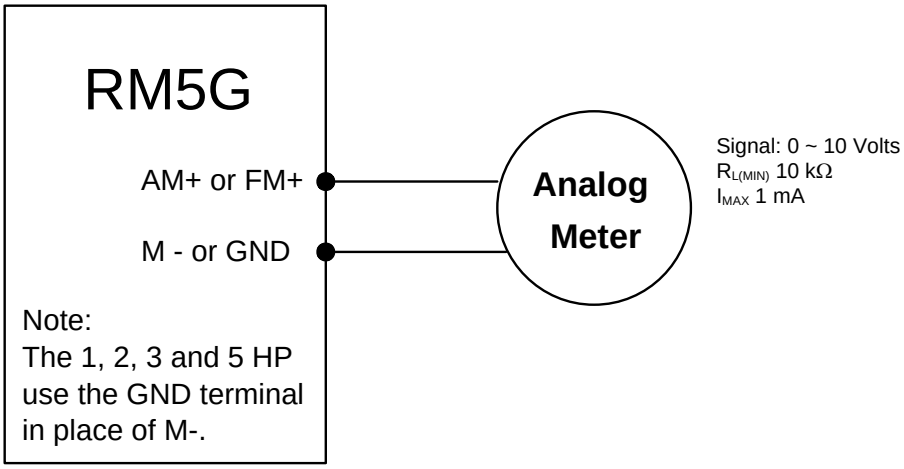
Example of digital speed inputs being used to simulate a motorized potentiometer



Section 4.5) Analog Outputs

The RM5G has two analog outputs, their maximum output power is 10V, 1mA.
Their recommend load resistance is 10,000 ohms (R_L = 10kΩ).

F 044	FM+ Analog Output	Factory set: 1	Table for AM+ and FM+ 0) Frequency (Hertz) 3) Signal to Vin 1) Speed Reference Signal 4) Signal to Iin 2) Amperes
F 129	AM+ Analog Output	Factory set: 2	
F 045	FM+ Scale (Gain)	Factory set: 1.00	The range of adjustment 0.00 ~ 2.00, this is a multplier of 10V. Example, to change the scale to 0 ~ 8 V, enter 0.80
F 130	AM+ Scale (Gain)	Factory set: 1.00	



Section 4.6) Digital Outputs

The RM5G has two relays and two transistor outputs. Relay one is a Single Pole Double Throw (SPDT) relay. Relay two is a one Single Pole Single Throw (SPST) relay. They are both rated up to 250V_{AC} / 0.5A. The two open collector, opto-isolated transistor outputs are rated up to 48V_{DC} / 50mA.

F 058	Y1 Terminal Open Collector Transistor	Factory set: 1	Table for Y1, Y2, Relay 1 and Relay 2 ±1) Motor Rotation ±8) Dynamic Braking ±2) Level Speed ±9) Low Voltage Pass-through ±3) Zero Speed ±10) General Fault Pass-through Detected ±4) Freq., Output Detection ±11) General Fault Detected ±5) Overload ±6) Stall Prevention ±7) Low Input Voltage
F 059	Y2 Terminal Open Collector Transistor	Factory set: 2	
F 060	Relay 1 Terminals: Ta1, Tb1, Tc1	Factory set: 11	
F 131	Relay 2 Terminals: Ta2, Tc2	Factory set: 3	

Section 4.7) Keypad Default Display

The keypad LED display can be programmed to display one of the eight parameters listed below.

F 006	Keypad Default Display	1) Hz Output	4) PN Voltage	7) User Defined Meter
		2) Hz Setting	5) Current	8) Terminal Status
		3) Voltage	6) RPM	Factory set: 1

Section 4.8) User Defined Meter (i.e. MPM)

The user defied meter is often referred to as MPM. The keypad default display or the auxiliary digital meters can be programed to display MPM.

Example: You have a conveyer that runs at 250 feet per minute when the motor is at full speed, 60 Hz. You want the meter to display feet per minute (FPM). Divide 250 FPM by 60 Hz (250/60=4.1666), enter 04.17 in to F007. If you have a speed potentiometer the keypad will display MPM (FPM) while you are adjusting speed. If you are using the keypad arrow keys to adjust the speed, when you press the arrow keys the keypad display will change to Hz. Several second after you stop pressing the arrow keys the keypad display will change back to MPM.

F 007	Custom Speed Calibration	0.00 to 500.00 Units per Hz. Factory set: 20	Example: 20 units per Hz is 1200 at 60 Hz.	
F 008	Keypad's Custom Speed Decimal Point	Factory set: 0	0) No Decimal Points	2) Two Decimal Points
			1) One Decimal Point	3) Three Decimal Points
F 051	Number of Motor Poles	2 to 10 Poles Factory set: 4P	Required for calibrating RPM and Linear Speed	

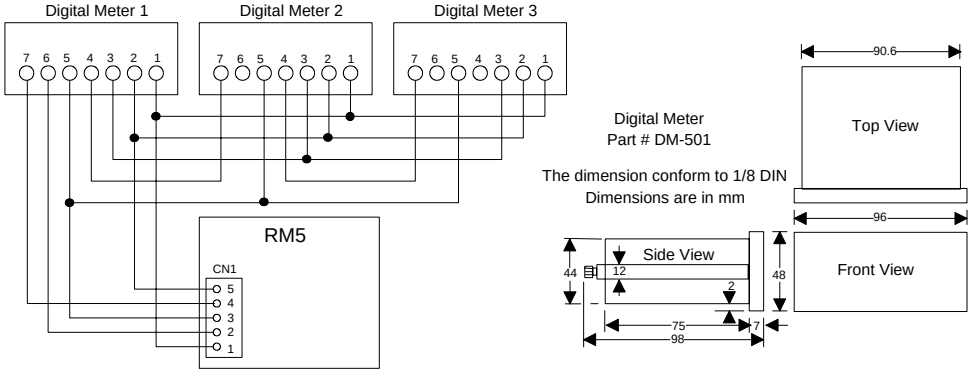
Section 4.9) Auxiliary Digital Meters

Digital meters and CN1 plug are available from Electric Regulator, please contact the factory.

F 098	Number of Digital Meters	Factory set: 0	0 to 3 Digital Meters		
F 099	Digital Meter 1	Factory set: 1	0) None	3) Voltage	6) RPM
F 100	Digital Meter 2	Factory set: 2	1) Hz	4) PN Voltage	7) Custom Speed
F 101	Digital Meter 3	Factory set: 3	2) Set Speed, Hz	5) Current	8) Terminal Speed

Section 4.10) Digital Meter Connection Diagram

Plug CN1 is the output for three digital meters. Plug CN1 is located near the left of the terminals.



Section 4.11) Frequency scale of acceleration & deceleration (F 018)

The frequency scale of the acceleration and deceleration times are determined by F 018. Example: If F 018 frequency is set to 60 Hz., and F 019 is set to 15 seconds. The motor will reach 60 Hz in 15 sec. If F 018 is changed to 30 Hz. The motor will reach 30 Hz in 15 seconds and 60 Hz in 30 seconds.

Section 4.12) Acceleration & Deceleration (F 019 through F 026)

The acceleration and deceleration time of the primary speed plus speed levels 4, 5, 6, 7 and Jog are programmed by F 019 and F 020. Speed levels 1, 2 and 3 acceleration and deceleration times are programmed independently by F 021 through F 026.

Section 4.13) Secondary Acceleration & Deceleration (F 027 & F028)

The secondary acceleration and deceleration will override all other settings when input X4 is activated. Secondary acceleration & deceleration are programmed by F 0 27 and F 028.
Note: F055 must be set to 2 for X4 or to activate secondary acceleration & deceleration.

Acceleration & Deceleration Table

F 018	Frequency Scale of Accelation & Deceleration	0.1 to 400 Hz Factory set: 60 Hz	If accel is set at 15 sec., and frequency scale is 60 Hz. The motor will reach 60 Hz in 15 sec. If the frequency scale is changed to 30 Hz. The motor will reach 60 Hz in 30 sec.
F 019	Primary Speed Acceleration Time Also speed levels 4, 5,6, 7 & Jog	0.1 to 3200 Sec.,	Factory default settings: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 020	Primary Speed Deceleration Time Also speed levels 4, 5,6, 7 & Jog	0.1 to 3200 Sec.,	Factory default settings: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 021	Speed Level 1 Acceleration Time	0.1 to 3200 Sec.,	Factory set: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 022	Speed Level 1 Deceleration Time	0.1 to 3200 Sec.,	Factory set: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 023	Speed Level 2 Acceleration Time	0.1 to 3200 Sec.,	Factory set: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 024	Speed Level 2 Deceleration Time	0.1 to 3200 Sec.,	Factory set: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 025	Speed Level 3 Acceleration Time	0.1 to 3200 Sec.,	Factory set: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 026	Speed Level 3 Deceleration Time	0.1 to 3200 Sec.,	Factory set: (1/2 to 5 Hp: 5 sec) (7.5 to 30 Hp: 15 sec) (40 Hp & up: 30 sec)
F 027	Secondary Accel Time	0.1 to 3200 Sec., Factory set: 15 sec., Activated by input X4 Note: F 055 must be set to 2 for X4 to activate secondary acceleration.	
F 028	Secondary Decel Time	0.1 to 3200 Sec., Factory set: 15 sec., Activated by input X4 Note: F 055 must be set to 2 for X4 to activate secondary acceleration.	

Section 4.14) S-curve Starting, Leveling and Stopping

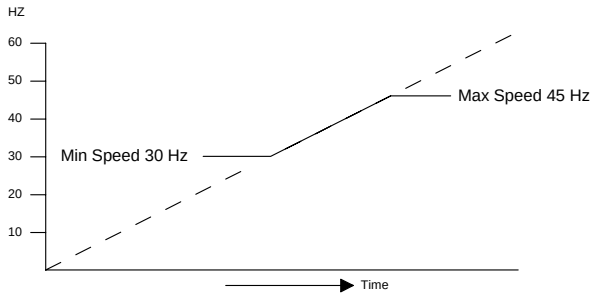
The s-curve time is in addition to the primary acceleration and deceleration times. Example: If the s-curve time is programmed to 4 seconds and the primary acceleration time is 10 seconds and primary deceleration time is 5 seconds. The total acceleration time is 14 seconds and deceleration time is 9 seconds.

F 029	S-curve Accel & Decel time	0 to 5 seconds.	Factory set: 5 seconds

Section 4.15) <u>Speed Range</u>

The speed range is factory set 0 to 60 Hz. The speed range can be programmed to any range between 0 and 60 Hz.

Example: You want the speed range to be 30 to 45 Hz. Follow the instructions in the table below for F042 and F043. When the reference is set at minimum (zero). When the start button is pressed the motor will accelerate to 30 Hz. When the speed reference is adjusted to maximum the motor will go to 45 Hz (See the graph below). The speed can only be adjusted between 30 to 45 Hz. When the speed

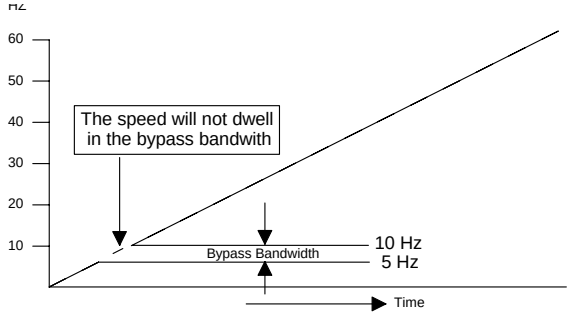


When F 042 is 0.75 and F043 is 0.50 the speed range is depicted in this graph

F 031	Maximum Output Frequency	0.1 to 400 Hz	Factory set 60 Hz This setting overrides all others
F 042	Frequency Operating Range, Maximum	0.00 to 1 ratio Factory set 0	F 042 is a decimal of F 031. Example: If F 031 is 60 Hz and F 042 is 0.75 the maximum frequency will be 45 Hz (0.75 x 60 = 45).
F 043	Frequency Operating Range, Minimum	0.00 to 1 ratio Factory set 0	F 043 is a decimal of F 031. Example: If F 031 is 60 Hz and F 043 is 0.5 the minimum frequency will be 30 Hz (0.5 x 60 = 30).

Section 4.16) <u>Frequency Bypass</u>

Frequency bypass prevents the motor's speed from dwelling with in the bypass bandwidth. The motor will quickly pass through the bypass bandwidth and not dwell in bypass bandwidth. The RM5G has up to three frequncy bypasses.



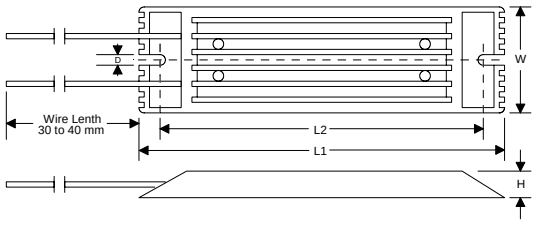
If programmed as in this example in F 087, the speed will not dwell or level between 5 Hz and 10 Hz.

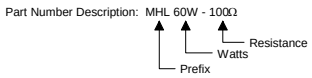
F 084	Frequency Bypass 1	0 to 400 Hz Factory set: 0
F 085	Frequency Bypass 2	0 to 400 Hz Factory set: 0
F 086	Frequency Bypass 3	0 to 400 Hz Factory set: 0
F 087	Frequency Bypass Bandwidth	The bandwidth applies to frequency skips 1, 2 and 3. Example: To bypass 5 to 10 Hz. Set F 084 to 7.5 Hz and F 087 to 2.5 Hz.

Section 4.17) Dynamic Brake Resistor (DB resistor)

The application engineer must determine the amount of current generated by the decelerating motor. Then select the value of the DB resistor, below is a table of typical resistor values for each model up to 30 HP.

Model #	Typical resistance	Recommended Resistor/s	Model #	Typical resistance	Recommended Resistor/s
RM5G-200 ½	100Ω	MHL 100W-100Ω	RM5G-4001	400Ω	MHL 100W-400Ω
RM5G-2001	100Ω	MHL 100W-100Ω	RM5G-4002	200Ω	MHL 100W-400Ω Two in parallel
RM5G-2002	100Ω	MHL 100W-100Ω			
RM5G-2003	40Ω	MHL 500W-40Ω	RM5G-4003	133Ω	MHL 100W-400Ω Three in parallel
RM5G-2005	40 Ω	MHL 500W-40Ω	RM5G-4005	100Ω	MHL 100W-400Ω Four in parallel
RM5G-2007	20 to 40Ω	MHL 500W-40Ω	RM5G-4007	80Ω	MHL 500W-40Ω Two in series
RM5G-2010	20 to 40Ω	MHL 500W-40Ω	RM5G-4010	80Ω	MHL 500W-40Ω Two in series
RM5G-2015	13.3Ω	MHL 500W-40Ω Three in parallel	RM5G-4015	40Ω	MHL 500W-40Ω Two in series Two in parallel Total four pieces
RM5G-2020	10Ω	MHL 500W-40Ω Four in parallel	RM5G-4020	40Ω	MHL 500W-40Ω Two in series Two in parallel Total four pieces
RM5G-2030	6.6Ω	MHL 500W-40Ω Six in parallel	RM5G-4030	20Ω	MHL 500W-40Ω Two in series Four in parallel Total eight pieces





Part Number	Dimensions in/mm				
	L1	L2	W	H	D
MHL60W-100Ω	4.5”/115mm	3.9”/100mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL60W-400Ω	4.5”/115mm	3.9”/100mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL80W-100Ω	5.5”/140mm	4.9”/125mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL80W-400Ω	5.5”/140mm	4.9”/125mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL100W-100Ω	6.5”/165mm	5.9”/150mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL100W-400Ω	6.5”/165mm	5.9”/150mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL120W-100Ω	7.5”/190mm	6.9”/175mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL120W-400Ω	7.5”/190mm	6.9”/175mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL150W-100Ω	8.46”/215mm	7.9”/200mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL150W-400Ω	8.46”/215mm	7.9”/200mm	1.57”/40mm	0.79”/20mm	0.2”/5.3mm
MHL200W-100Ω	6.5”/165mm	5.9”/150mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL200W-400Ω	6.5”/165mm	5.9”/150mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL300W-100Ω	8.46”/215mm	7.9”/200mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL300W-400Ω	8.46”/215mm	7.9”/200mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL400W-100Ω	10.43”/265mm	9.85”/250mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL400W-400Ω	10.43”/265mm	9.85”/250mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL500W-40Ω	13.19”/335mm	12.6”/320mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL500W-100Ω	13.19”/335mm	12.6”/320mm	2.36”/60mm	1.18”/30mm	0.2”/5.3mm
MHL1000W-40Ω	15.75”/400mm	15.16”/385mm	3.9”/100mm	1.97”/50mm	0.42”/10.6mm
MHL1000W-100Ω	15.75”/400mm	15.16”/385mm	3.9”/100mm	1.97”/50mm	0.42”/10.6mm

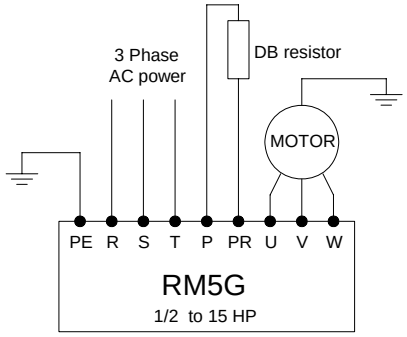
Section 4.17) Dynamic Braking (i.e. DC Braking)

The RM5G will handle up to 50% of the motor's regenerative current without a dynamic braking resistor. If the motor's regenerative current exceeds 50% then dynamic braking is required. The drives rated from ½ to 15 Hp have an internal Dynamic Braking Transistor (DBT) included as a standard feature. Drives above 15 HP the internal DBT is optional feature or the customer can order a external Dynamic Braking Unit (DBU). The regenerative current created by the motor is determined by the motor's inertia, load inertia, friction and deceleration time. The regenerative current and the resistor size must be determined by the application engineer. If the current exceeds the rating of one DBT or DBU, additional DBUs can be connected in parallel (i.e. Master / Slave).

Instructions for ½ to 15 HP or drives ordered with internal DBT

Important, codes F075, F077 and F 132 only apply to drives with the internal DBT. They don't apply to the external DBU.

F 075	Dynamic Braking Current	0 to 150% of the RM5 current rating. Factory set: 50%	
F 076	Time Delay before Restart after Dynamic Braking	0 to 20 Sec. Factory set: 0.5	This allows the DB resistor time to cool.
F 132	Dynamic Braking Beginning Frequency	Range 0.1 ~ 60.0 Hz (Factory set 0.5)	



Section 4.18) External Dynamic Braking Unit Installation

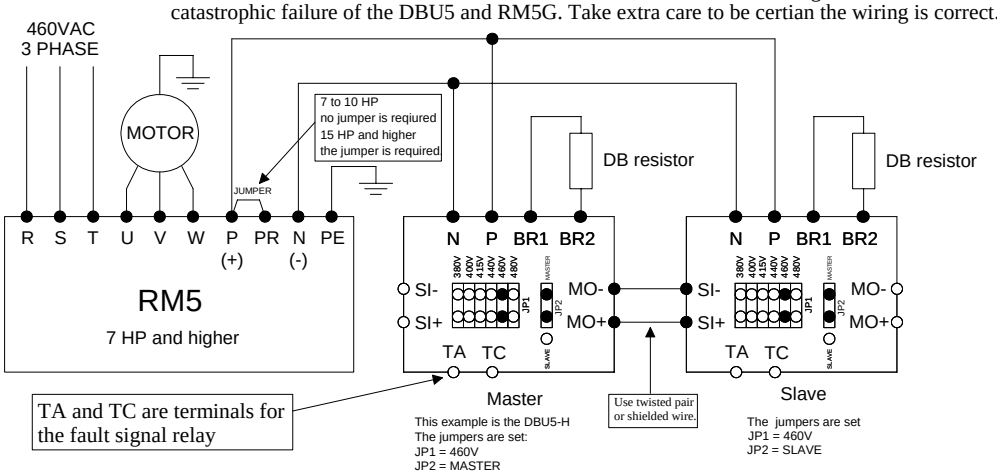
Important, when installing an external DBU function code F 093 must be changed to 1. Also the DBU voltage jumpers (JP-1) must not be set lower than the AC input power to prevent premature braking (setting JP-1 to a lower voltage will not increase braking power).

F 093	Automatic Voltage Regulation (AVR)	0) Disable AVR 1) Enable AVR (Factory set 1)	When the external DBU is installed, disable AVR.

Four model of external DBU are available.

Part # DBU5-L50 Rating: 230VAC, 50A
Part # DBU5-L75 Rating: 230VAC, 75A
Part # DBU5-H50 Rating: 480VAC, 50A
Part # DBU5-H75 Rating: 480VAC, 75A

WARNING: correct installation of the external DBU5 is critical. A wiring error will result in catastrophic failure of the DBU5 and RM5G. Take extra care to be certian the wiring is correct.

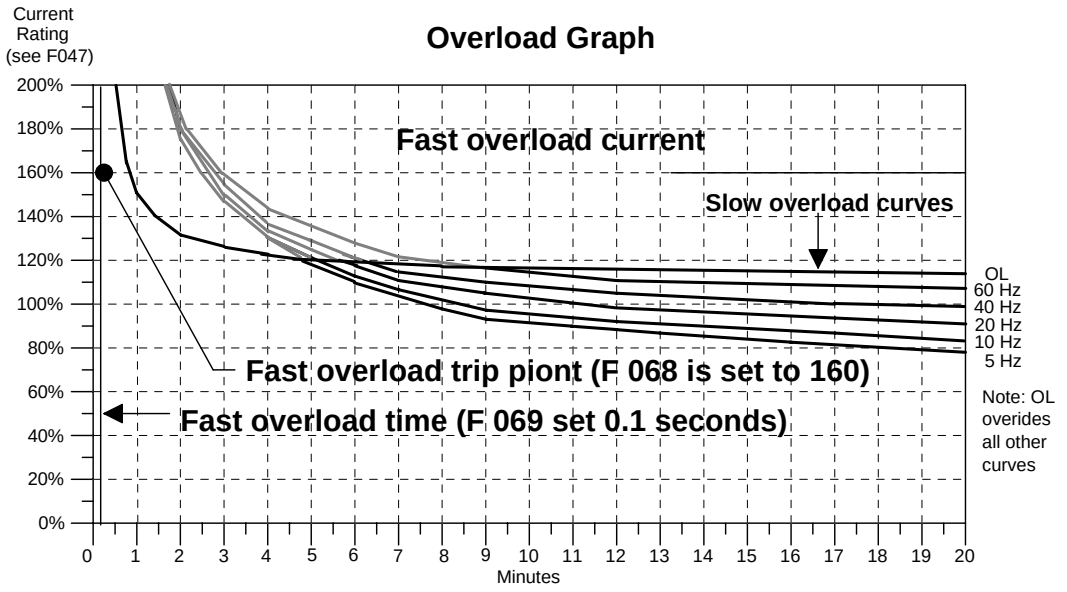


WARNING: If JP1 is set too low, the DBU5 will be on continuously, causing the the unit to fail

Section 4.19) Motor Ratings and Overload Parameters

Read the motor's name plate before programming this section.

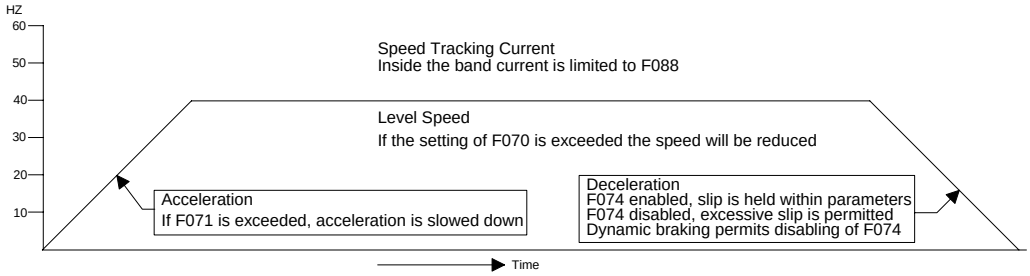
F 046	Slow Overload	0) Disable slow overload protection	
		1) Enable slow overload protection. Factory set: 1	
F 047	Slow Overload Options	0) Motor rating. Factory set: 1	Use when motor rating is equal or less than the RM5 rating (See F 048).
		1) RM5 inverter rating.	Use when motor's rating exceeds the RM5 rating.
F 048	Motor Current Rating	See the motor's name plate for the current rating. If this is set too high or low the motor speed may oscillate while accelerating or decelerating	
F 049	Motor's No Load Current Rating	See motor's name plate for no load current rating. If not listed on name plate, measure the current. Factory set: 0.1	
F 065	Overload Signal	0) Disable Overload Signal Factory set: 0	When outputs Y1, Y2 or relay T (i.e. F 058, F059 or F 060) are programmed to signal when an overload is detected (i.e. 5). F 065 enables or disables this output.
		1) Enable Overload Signal	
F 066	Overload Signal Conditions	0) Signal overload only when the motor is running at the set speed.	
		1) Signal overload when the motor is running at any speed.	
F 067	Fast Overload	0) Disable shut off when overload is detected. Factory set: 0	
		1) Enable shut off when overload is detected.	
F 068	Fast Overload Level	30% to 200% of the RM5G rated current. Factory set 160%	
F 069	Fast Overload Response Time	0.1 to 10 seconds. Factory set: 0.1	When an overload exceeds the setting of F 068 and the time setting of F 069 is exceeded, the RM5 will shut off. Note: F 069 does not sum the time of separate overload events.



Slow overload can not be changed by the user. Slow overload (OL curve) overrides all other curves. Example: If at any speed the motor current exceeds 150% for more than one minute the motor is switched off. Second example: If the motor is running at 20 Hz and the motor current exceeds 95% for more than 15 minutes, the motor is switched off.

Fast overload is normally disabled, function code F 067 must be set to 1 to enable fast overload. Fast overload will switch off the motor when the current exceeds the setting of F 068 by more than the time setting of F 069. The factory default settings are at any speed if the motor current exceeds 160% for more than 0.1 second, the motor is switched off. Important note: F 068 is a the drive's rated current, not the motors rated current. Fast overload is intended to protect the drive, not the motor.

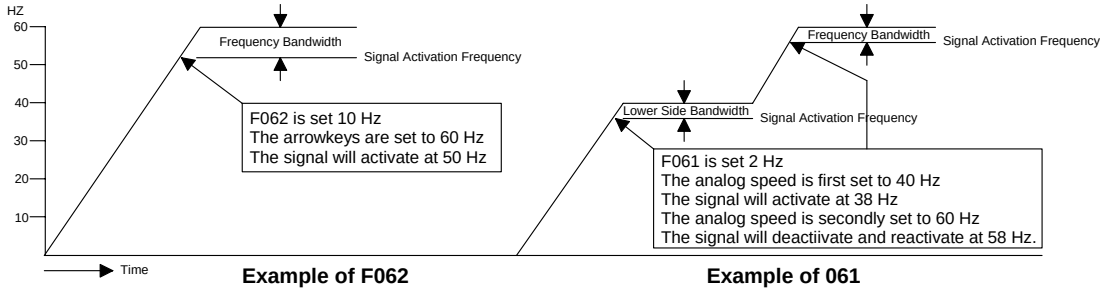
Section 4.20) Motor Slip and Stall Parameters



F 050	Motor Slip Compensation	-9.9 to 5 Hz Factory set: 0.0	F050= Motor Slip Compensation F049= Motor No load Current F048= Motor Max. Rated Current LC = Load Current (during normal operation) $F050 = \frac{LC - F049}{F048 - F049}$
F 070	Level Speed Stall Prevention	30% to 200% of the motor's rated current (F 048) before the speed is reduced. Factory set: 170%.	
F 071	Acceleration Stall Prevention	30% to 200% of the motor's rated current (F 048) before the speed is leveled. Factory set: 160%.	
F 072	Level Speed Stall Recovery Acceleration Time	0.1 to 3200 sec Factory set: 15 sec	Acceleration time after recovery from stall , during level speed.
F 073	Deceleration Stall Recovery Deceleration Time	0.1 to 3200 sec Factory set: 15 sec	Deceleration time after recovery from stall, during deceleration.
F 074	Deceleration Stall Prevention	0) Disable stall prevention during decel. If dynamic braking is used F 074 can be disabled. 1) Enable stall prevention during deceleration. Factory set: 1	
F 088	Level Speed Tracking Current	30% to 200% of the RM5 inverter's rated current. Factory set: 150%	

Section 4.21) Level Speed Detection Signal

Level speed detection signal is enabled when F058, F059 or F060 are set to 2. Then activating outputs Y1, Y2 or relay T (see section 4.7). If the operator wants the signal activated before the control reaches level speed. The level speed detection bandwidth can be set by F061, F062 or F063.

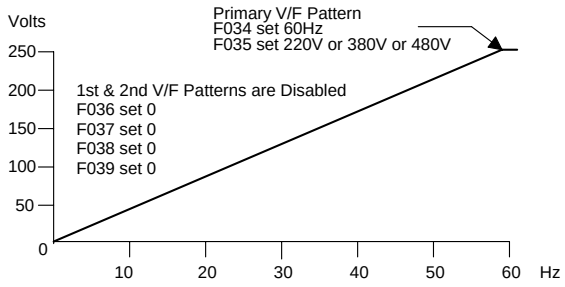


F 061	Level Speed Detect Signal Frequency Bandwidth for Speed Ref., Setting (Analog Speed Control)	0.0 to 10 Hz. Factory set: 2 Hz.	This bandwidth sets the frequency when the output signal is activated. When the speed is controlled by analog signal, typically a manual speed pot connected to terminals. (Output signals, When any of F058, F059, F060 are set 2. See section 4.7) (Analog speed control, see F002 and section 4.9)
F 062	Level Speed Detect Signal Frequency Bandwidth for Programmed Speed (Arrowkey Speed Control)	0.0 to 10 Hz. Factory set: 2 Hz.	This bandwidth sets the frequency were the output signal is activated. When the speed is controlled by arrow keys. (Output signals, when any of F058, F059, F060 are set 2. See section 4.7)(Arrowkey speed control, see F002)
F 063	Level Speed Detect Signal Frequency Bandwidth 400 Hz operation	0 to 400 Hz Factory set: 0 Hz	If 400 Hz operation is enabled (When F092 is set 3 or 4) (see section 4.2)

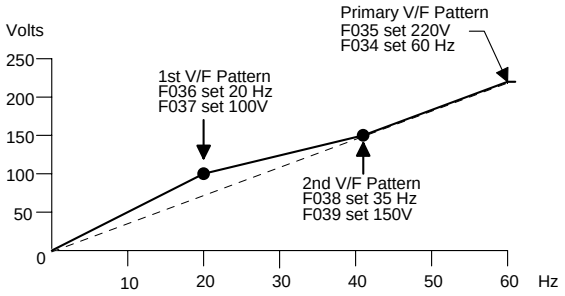
Section 4.22) Voltage Frequency Patterns (V/F Patterns)

The RM5G has a three segment V/F pattern, the 1st, 2nd and primary V/F pattern. The factory settings uses only the primary V/F pattern. The user can add the 1st and 2nd patterns.

Factory Default V/F Pattern



Example of user defined V/F Pattern

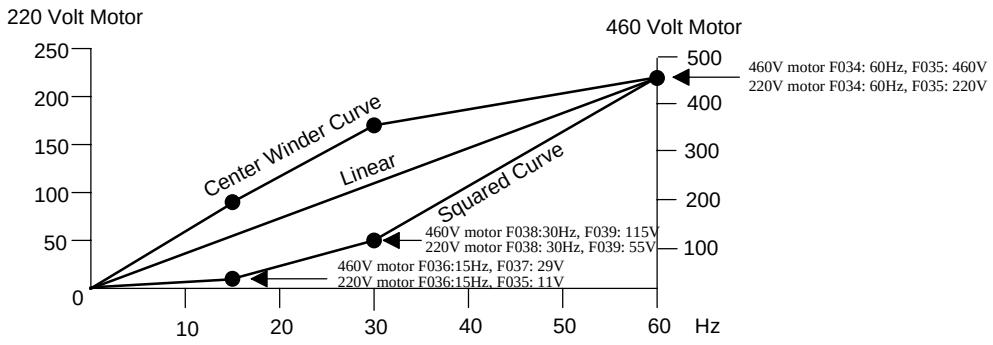


F 034	Primary V/F Pattern Frequency Scale	0.01 to 400 Hz Factory set: 60 HZ	The main frequency scale (F034) is the frequency where the maximum voltage is reached. Example: If F034 is 60 Hz and F035 is 220V. Then at 60 HZ the voltage is 220V. Second Example: If F034 is 120Hz and F035 is F036 220V then at 60Hz the voltage is 110V.
F 035	Primary V/F Pattern Maximum Voltage	208 ~ 220V Motor	0.1 to 255 Volts, Factory set: 220 Volts
		440 ~ 480V Motor	0.1 to 510 Volts, Factory set: 380 or 480 Volts
F 036	1st V/F Pattern Frequency Scale	0.01 to 400 Hz Factory set: 0 HZ	The V/F pattern can be customized into two or three segments, 1st, 2nd and primary V/F patterns. F036 sets the frequency when F037 voltage is reached. If F036 is set to zero the 1st V/F pattern is disabled. Note: When the 1st V/F pattern is used, set F036 higher than F032.
F 037	1st V/F Pattern Maximum Voltage	220V Motor	0.1 to 255 Volts, Factory set: 0 Volts
		460V Motor	0.1 to 510 Volts, Factory set: 0 Volts
F 038	2nd V/F Pattern Frequency Scale	0.01 to 400 Hz Factory set: 0 HZ	F038 sets the frequency when F039 voltage is reached. If F038 is set to zero the 2nd V/F pattern is disabled. Note: F038 must be higher than F036.
F 039	2nd V/F Pattern Maximum Voltage	220V Motor	0.1 to 255 Volts, Factory set: 0 Volts
		460V Motor	0.1 to 510 Volts, Factory set: 0 Volts

Examples of V/F Patterns

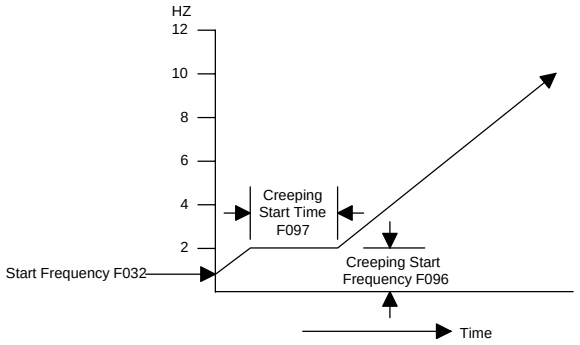
- **Linear** V/F pattern is the RM5G's default program.
- **Squared Curve** is for low inductance motors such as NEMA D. To determine the voltage settings of F 037 and F039. First go to the motor data plate and read the motor ampere rating. Then run the motor at typical load at low speed and observe the current. Then calculate what the voltage should be to equal the motor's rated current. Note: Lowering the voltage too much will result in too much slip and the current will increase.
- **Center Winder Curve** is for constant torque applications. Example: Center winding a roll of paper at constant linear speed, as the diameter and weight of the paper roll (package) increases, the motor's speed decreases and the torque load increases. The parameters of the center winder V/F pattern must be determined by the user. Read the squared curve paragraph above, then instead of decreasing the voltage, increase the voltage.

Examples of Linear, Squared Curve and Expanded Curve V/F Patterns



Section 4.23) Motor Starting Parameters

If the motor has difficulty starting, The first recommendation is increase the starting frequency F032. If the problem continues, two additional recommendations are: lower the carrier frequency, see the next section and increasing the pre-start rotor magnetizing time F077. The last solution is increasing the starting boost voltage. Creeping starts helps avoid excessive slip during acceleration. By giving the rotor time to catch up.



F 032	Start Frequency	0.1 to 10 Hz	
F 033	Starting Boost Voltage	220V Motor 0 to 50 Volts Factory set: 6 volts	
		460V Motor 0 to 100 Volts Factory set: 12 volts	
F 077	Pre-Start and Post-Stop Rotor Magnetizing Time	0 to 20 seconds Factory set: 0	Before starting, DC voltage is applied to the stator to magnetize the rotor. This will delay start by the amountThis function is similar to the starting capacitor
F 096	Creeping Start Frequency	0.0 to 400 Hz Factory set: 0.5 Hz	Creeping before accelerating helps avoid excessive slip during acceleration. Typically the Creeping frequency is set 1 Hz above the start frequency.
F 097	Creeping Start Time	0.0 to 25.5 Sec. Factory set: 0.0	

Section 4.245 Carrier Frequency (i.e. Switching Frequency)

The carrier frequency synthesizes a sinusoidal wave by using Pulse Width Modulation (PWM) and the motor's inductance. With a higher carrier frequency the motor will be quieter and smoother. Sometimes motors have difficulty starting, lowering the carrier frequqncy sometimes solves this problem. Also if the length of the wire from the drive to the motor is long, the carrier frequency should be lowered. Refer to the wires size table in this manual for more information.

F 081	Carrier Frequency	Factory set: 4	1) 2.5 kHz	4) 10.0 kHz
			2) 5.0 kHz	5) 12.5 kHz
			3) 7.5 kHz	6) 15.0 kHz

Section 4.26) Holding the Motor Stationary

When DC is applied to the motor it will hold the motor stationary and resist very small torque loads. This feature only works when the motor is stopped, it will not work when start engaged. If you want the motor to decelerate to stop and then hold stationary (hold) all the time. You must program both F 077 and F 053 and have input X2 engaged all the time.

F 052	Input X2 programmed to hold the motor when stopped	When F 052 is programmed to zero and engage (circuit closed) it will hold the motor stationary.	
F 077	Pre-Start and Post-Stop Rotor Magnetizing Time	0 to 20 seconds Factory set: 0	Before starting and after stopping, DC voltage is applied to the stator to magnetize the rotor. This function is similar to the starting capacitor on a single phase AC

Section 4.26) Power Interruption pass-through

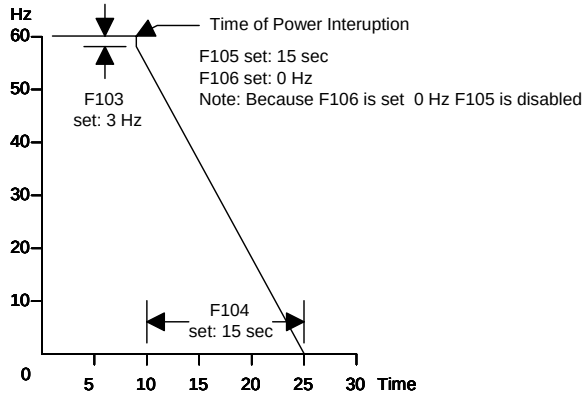
Power interruption is when the power is interruption sort time or the voltage is too low, see F079. The drive's DC link (capacitor bank) is large enough to supply power through very short power interruptions. This allows the motor to continue running (pass-through) short power interruptions. The user can selected the drives response to a power interruption by programming F 078. If you select stop see the next section about stopping when the power is interrupted.

F 078	Power Interruption Response	0) Disable pass-through Factory set: 0	
		1) Enable pass-through (see F 089)	
		2) Shut Off	
		3) Enable Controlled Deceleration Stop when power is interrupted.	
F 079	Power Interruption Switch Point Voltage	220V Motor: 130V to 192V, Factory set 175V	
		460V Motor: 230V to 384V, Factory set 330V	
F 089	Power Interruption Ride-through Restart Time Limit	0.5 to 5 sec. Factory set: 0.5	This sets the time limit the power can be interrupted and pass-through will restart. If this time is exceeded the RM5 will remain off. (Note: F 078 must be set to 1)
F 095	Input Voltage Calibration	RM5-2*** 190V to 240V Factory set: 220V	
		RM5-4*** 340V to 460V Factory set: 460V	

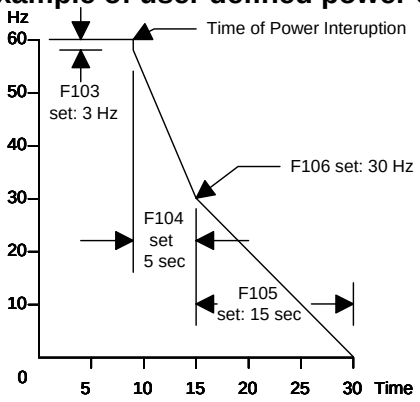
Section 4.27) Power Interruption Controlled Stop Program

If power is interrupted the factory settings are to let the motor coast to a stop, F 078 set to 0. If F078 set to 3 enabling controlled deceleration to stop. The deceleration curve is defined by function codes F103, F104, F105 and F106.

Factory set power off stop



Example of user defined power off stop



F 103	Power Interruption Frequency Reduction	0 to 20 Hz Factory set: 3	When the power is interrupted the frequency will immediately be reduced by this setting. A large decrease will cause hard braking. Example: The motor is running at 60 Hz and F 103 is set 3 Hz. When the power is shut off, the output frequency immediately be reduced to 57 Hz (60 - 3 = 57).
F 104	1st Decel Time from F 103 to F 106	0 to 3200 sec Factory set: 15	If F 106 is set 0 Hz and F 104 is set 15 sec., the motor will decel to a stop in 15 sec. If F 106 is set 30 Hz the motor will decel to 30 Hz in 15 sec.
F 105	2nd Decel Time from F 106 to stop	0 to 3200 sec Factory set: 15	If F 106 is set 0 Hz F 105 is inactive. If F 106 is set 30 Hz and F 105 is set 15 sec., the motor will decel from 30 Hz to stop in 15 sec.
F 106	Switch Point Frequency from first to second deceleration time	0 to 400 Hz Factory set: 0	This frequency is the point when the 1st decel time switches to the 2nd decel time. If F 106 is set 0 Hz, the 2nd decel time is disabled.

Section 4.28) Store and Copy Programs

The keypad can used to store and copy a program to another RM5G drive. Example you have created a program and want to copy your program to another RM5G.

- First, enter F134 and scroll to “rd_EE” and press and hold the enter key until the word “end” appears.
- Second, disconnect the keypad and connected it to the next RM5G. Go to F134 and scroll to “UUr_EE”, then press and hold the enter key until the word “end” appears.

F134	Copy Commands	0) Not Active	SAu) Store User Settings
		CLF) Clear fault history stored in F 091	rES) Restore Previous settings
		dEF60) Restore factory 60 Hz settings	rd_EE) Copy RM5G settings to Keypad
		dEF50) Restore factory 50 Hz settings	UUr_EE) Copy Keypad settings to RM5G

Section 4.29) Restoring the factory settings

To restore the factory 60 Hz settings, go to F134. Scroll to the display "dEF60" then press and hold the FUN/DATA key until the word "end" appears. Now all the original factory 60 Hz settings are restored. If you have a 440V ~ 480V motor. Scroll to F 034 and set the voltage according to your motor.

F134	Copy Commands	0) Not Active	SAu) Store User Settings
		CLF) Clear faults F 091	rES) Restore Previous settings
		dEF60) Restore factory 60 Hz settings	rd_EE) Copy RM5 settings to Keypad
		dEF50) Restore factory 50 Hz settings	UUr_EE) Copy Keypad setting to RM5

Section 4.30) Locking Programs & 400 Hz Motors

Function code F 092 performs two functions.
Locking the function codes to prevent unauthorized programing.
Enabling operation above 400 Hz motors. The factory default program limits operation to 120 Hz.

F 092	Program Locks & 400 Hz Operation	0) Unlock Program, Maximum frequency is limited to 120 Hz. Factory set: 0
		1) Lock Program, Maximum frequency is limited to 120 Hz.
		2) Unlock Program, Maximum frequency is 400 Hz.
		3) Lock Program, Maximum frequency is 400 Hz.

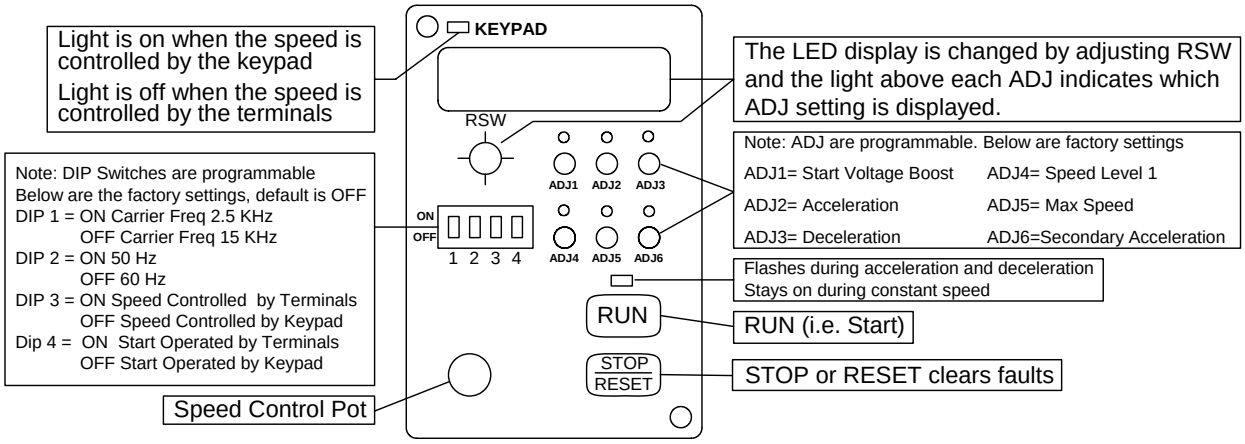
Section 4.31) Fault History

Function code F 091 stores in memory the last five faults that occurred. Enter F 091 and then scroll to see the faults. If you what to clear the fault history, go to F 134 and scroll to CLF then press and hold the enter key until the word “end” appears.

F 09	Fault History	Displays the last five faults

Section 5.1) KP-202 Factory Settings

Adjusting the potentiometers (pots) on the KP-202 analog keypad are best made with a #00 Philips head screwdriver. The diagram below shows the KP-202 layout and factory default settings. The KP-202 adjustment pots one through 6 (i.e. ADJ1 to ADJ6) and dip switch functions are shown in the diagram below. The RSW rotary switch selects the LED display mode. The functions of the pots and dip switches can be programmed, please see sections 5.3 and 5.4



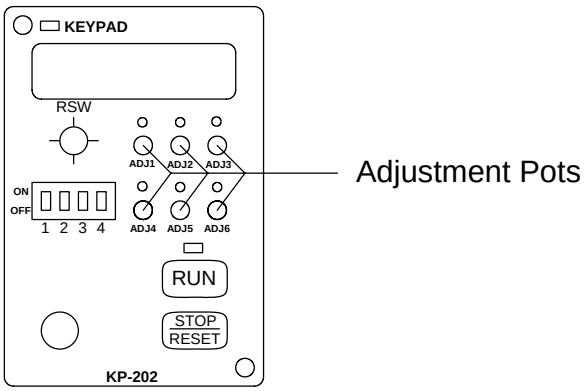
Section 5.2 Changing the LED display

The RSW rotary switch changes the LED display. See the table below for descriptions of each position of RSW. Positions 1 trough 6 display the program settings of ADJ 1 trough ADJ6. All the other positions are not programmable (fixed).

RSW Position	Function Displayed	Factory Default Setting	See Code
0	Frequency Output (Hz)	Not Programmable	NA
1	ADJ 1 setting	Start Boost Voltage, 0 to 127 Volts	F033
2	ADJ 2 setting	Acceleration Time , 0.0 to 165 seconds	F019
3	ADJ 3 setting	Declaration Time, 0.0 to 165 seconds	F020
4	ADJ 4 setting	Speed Level 1 Freq., 0.0 to 120 Hz	F021
5	ADJ 5 setting	Maximum Output Freq., 0.0 to 120 Hz	F031
6	ADJ 6 setting	Secondary Acc & Dec Time, 0.0 to 165 seconds	F027, F028
7	Speed Pot setting	Not Programmable	NA
8	Carrier Frequency	1=2.5k Hz, 2 = 5kHz, 3 = 7.5kHz, 4 = 10kHz, 5 = 12.5kHz, 15kHz	F081
9	Voltage Output	Not Programmable	NA
A	PN Voltage	Not Programmable	NA
B	Current Output	Not Programmable	NA
C	Motor RPM	Not Programmable	NA
D	Linear Speed	Not Programmable	NA
E	Terminal Status	Not Programmable	NA
F	DIP Status	Not Programmable	NA

Section 5.3) Programming the Adjustment Pots (ADJ)

Programming the parameters of ADJ 1 trough ADJ6 requires disconnecting the KP-202 and connecting KP-201. See table below.



Adjustment	Function Code	Settings
ADJ 1	F 107	1 to 49, factory set:19
ADJ 2	F 108	1 to 49, factory set: 9
ADJ 3	F 109	1 to 49, factory set:10
ADJ 4	F 110	1 to 49, factory set: 1
ADJ 5	F 111	1 to 49, factory set:20
ADJ 6	F 112	1 to 49, factory set:17

Example, to change ADJ 1 to primary acceleration time. Go to F107 and select 9. To read more information about primary acceleration time go to the function code table and read F019.

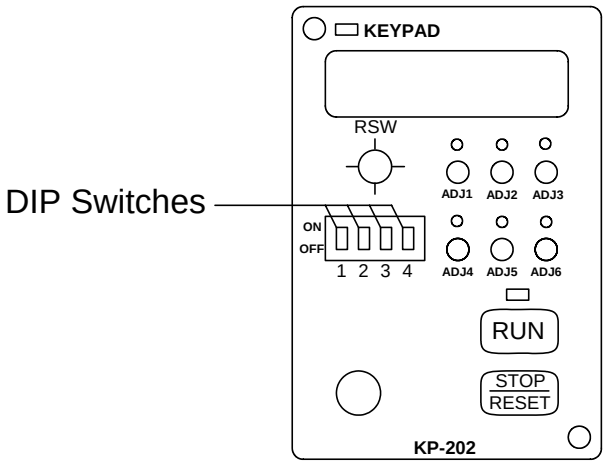
Setting	Function Description	Range of Adjustment	See Code
0		No Function	NA
1	Speed Level 1 Hz	0.0 to 120 Hz	F010
2	Speed Level 2 Hz	0.0 to 120 Hz	F011
3	Speed Level 3 Hz	0.0 to 120 Hz	F012
4	Speed Level 4 Hz	0.0 to 120 Hz	F013
5	Speed Level 5 Hz	0.0 to 120 Hz	F014
6	Speed Level 6 Hz	0.0 to 120 Hz	F015
7	Speed Level 7 Hz	0.0 to 120 Hz	F016
8	Jog Speed	0.0 to 120 Hz	F017
9	Primary Acceleration Time	0.1 to 165 sec	F019
10	Main Deceleration Time	0.1 to 165 sec	F020
11	Speed Level 1 Acc Time	0.1 to 165 sec	F021
12	Speed Level 1 Dec Time	0.1 to 165 sec	F022
13	Speed Level 2 Acc Time	0.1 to 165 sec	F023
14	Speed Level 2 Dec Time	0.1 to 165 sec	F024
15	Speed Level 3 Acc Time	0.1 to 165 sec	F025
16	Speed Level 3 Dec Time	0.1 to 165 sec	F026
17	Secondary Acc & Dec Time	0.1 to 165 sec	F027
18	Start Frequency	0.0 to 10 Hz	F032
19	Start Voltage Boost	0 to 127 Volts	F033
20	Maximum Frequency	0.0 to 120 Hz	F031
21	Maximum Voltage	0 to 255/230V input 0 to 510/460V input	F035
22	VF Pattern 1st Frequency Switch Point	0.0 to the Freq., setting of F 034	F036
23	VF Pattern 1st Voltage Switch Point	0.0 to the Volt., setting of F 035	F037
24	VF Pattern 2nd Freq., Switch Point	0.0 to the Freq., setting of F 034	F038
25	VF Pattern 2nd Voltage Switch Point	0.0 to the Volt., setting of F 035	F039

Setting	Function Description	Range of Adjustment	See Code
26	V_{IN} Analog Input Gain (V_{IN} Scale Max.)	0.00 to 2.00	F040
27	V_{IN} Analog Input Bias (V_{IN} Scale Min.)	-1.00 to 1.00	F041
28	Maximum Speed	0.00 to 1.00	F042
29	Minimum Speed	0.00 to 1.00	F043
30	FM+ Analog Output Gain (FM+ Scale Max.)	0.00 to 2.00	F045
31	Slip Compensation	-9.9 to 5.0	F050
32	Level Speed Signal	0.00 to F 031	F063
33	Torque Boost	0.0 to 3.0	F064
34	Overload	30 to 200%	F068
35	Stall Prevention during Acceleration	30 to 200%	F071
36	Stall Prevention during Level Speed	30 to 200%	F070
37	Stall Recovery Acceleration	0.0 to 165 Sec	F072
38	Stall Recovery Deceleration	0.0 to 165 Sec	F073
39	Dynamic Braking Current	0 to 150%	F075
40	1st Freq., Bypass	0.00 to F 031	F084
41	2nd Freq., Bypass	0.00 to F 031	F085
42	3rd Freq., Bypass	0.00 to F 031	F086
43	Bypass Bandwidth	0.0 to 25.5 Hz	F087
44	Creeping Start Freq.,	0.00 to F 031	F096
45	Creeping Start Time	0.0 to 25 sec	F097
46	Speed Meter Calibration Note: The resolution of the pot limits the scale to 100 units.	0.01 to 100	F007
47	I_{IN} Analog Input Gain (I_{IN} Scale Max.)	0.00 to 2.00	F127
48	I_{IN} Analog Input Bias (I_{IN} Scale Min.)	-1.00 to 1.00	F128
49	AM+ Analog Output Gain (AM+ Scale Max.)	0.00 to 2.00	F130

Section 5.4 DIP Switch Programing

The DIP switches enable or disable functions. The user can program the function of the DIP switches. Programming the dip switches requires disconnecting the KP-202 keypad and connecting KP-201 keypad. Function codes F 113 through F 116 are reserved for programming DIP switches 1 to 4. See table below.

DIP #	Function code reserved to program DIP	Settings
DIP 1	F 113	0 to 15, factory set: 8
DIP 2	F114	0 to 15, factory set: 5
DIP 3	F115	0 to 15, factory set: 3
DIP 4	F116	0 to 15, factory set: 2



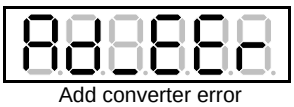
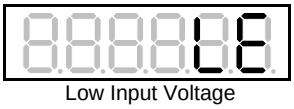
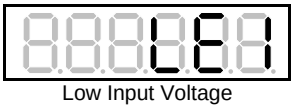
Example, to program DIP switch 1 to Energy Economy go to F113 and select 15. To read more information about Energy Economy read F102 in the function code table.

Setting	Function	See Code
0	Disable DIP Switch	NA
1	ON: FWD Terminal activates start OFF: Keypad activates start	F001
2	ON: FWD & REV Terminals activates start OFF: Keypad activates start	F001
3	ON: Terminals Vin, GND set speed OFF: Keypad sets speed.	F002
4	ON: Enable Keypad stop key OFF: Disable Keypad stop key	F003
5	ON: Maximum frequency 50 Hz OFF: Maximum frequency 60 Hz	F034
6	ON: Disable Stall prevention during accel OFF: Enable Stall prevention during accel.	F074
7	ON: Disable DC braking* OFF: Enable DC braking*	F075

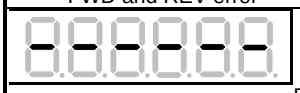
Setting	Function	See Code
8	ON: Carrier Frequency 2.5 kHz OFF: Programmed Carrier Frequency	F081
9	ON: Ridethrough short power interruptions OFF: Stop when power is interrupted	F078
10	ON: Coast to stop OFF: Controlled deceleration stop.	F082
11	ON: Disable Reverse OFF: Enable Reverse	F083
12	ON: Disable AVR OFF: Enable AVR	F093
13	ON: Disable motor overload protection OFF: Enable F046 overload program	F046
14	ON: Disable inverter overload protection OFF: Enable inverter overload protection	F094
15	ON: Enable Energy Economy OFF: Disable Energy Economy	F102

* Note: If F075 is set 50 or less DC braking is disabled, regardless of the DIP switch setting number 7.

Fault Codes Table

Keypad Display	Fault Description	Possible Problems	Recommendations
 EEPROM error	The EEPROM has failed.		The main processing board must be replaced.
 Add converter error	The main processor has failed.		The main processing board must be replaced.
 Over Current	The output current exceeded 200% of the AC drives rating.	1) The acceleration time is too fast. 2) The motor rating parameters are incorrectly programmed. 3) The input and / or output voltages are incorrectly programmed. 4) The motor load is too high.	1) Decrease the acceleration time or replace with a higher horsepower unit. 2) Compare the motor data plate to the motor program. 3) Often 400V series units are default programed for 380 volts input and output power. Program the unit to the correct voltage. 4) Reduce the load.
 Over voltage	The DC link voltage is too high. The DC link voltage has exceeded 125% of normal.	When the motor is decelerating it is regenerating too much power into the DC link.	Increase the deceleration time or for units 1 to 5 HP install dynamic braking resistor. Units 7 ½ HP and higher install dynamic braking system. See Section 4.25
 Low Input Voltage	Low input voltage. Signals if the input voltage drops below 80% of normal.	1) When the power is switched on or off. The LE signal may flash while charging or discharging. 2) If input power is too low, the motor speed is reduced. If power recovers it will return to normal speed.	1) The LE signal is normal while charging and discharging. 2) The power is inadequate.
 Low Input Voltage during operation	The input voltage dropped too low after initial charging up.	1) Phase Loss 2) Poor input power quality	1) Check if all three phases have voltage. 2) Investigate the input power source.
 Ground Fault	The output current is unbalance	1) Faulty motor wiring. 2) Motor is leaking voltage.	1) Check the motor wiring. 2) Test the motor leakage current. (i.e. Megger the motor).
 Over Heat	The heat sink temperature is too high.	1) Inadequate ventilation. 2) High ambient temperature. 3) Excessive motor load.	1) Improve ventilation. 2) Hot weather or direct sunlight can cause over heating. 3) If a motor is under heavy load and is accelerated too fast. The acceleration demand current can reach 300% to 600%. Recommendations, decrease acceleration time or increase the horsepower of the AC drive.
 Over Load of the motor	The motor load exceeded the permitted time duration. See graph in Section 4.19 on page 22.	1) The motor load is too high. 2) The motor parameters are incorrectly programmed.	1) Reduce the motor load. 2) Correct the motor program 3) Replace with larger motor and drive. 4) See Section 6.2c recommendation three.
 Over Load of Inverter	The drive's power rating was exceeded.	1) The motor load is too high. 2) The unit HP is too low.	1) Reduce the motor load. 2) Replace with larger AC drive. 3) See Section 6.2c recommendation three.

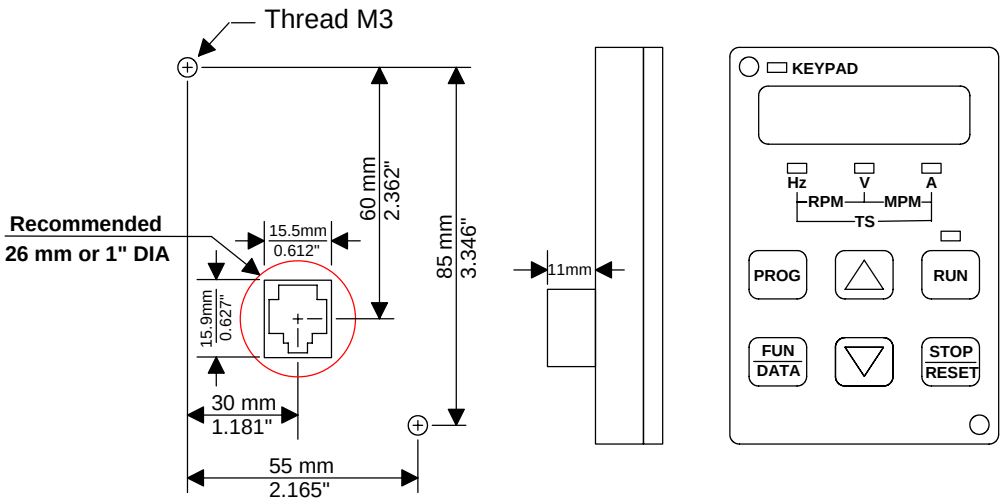
Fault Codes Table continued

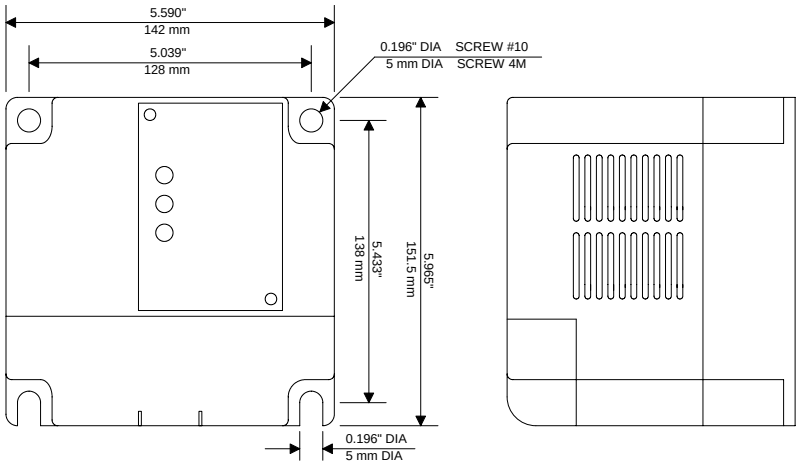
Keypad Display	Fault Description	Possible Problems	Recommendations
 General Over Load detected			
 Over Load detected			
 KP-202 Keypad Failure	The analog keypad (KP-202) was disconnected or failed.	Poor keypad wire connection.	If troubleshooting the keypad connection doesn't yield results. Then contact Electric Regulator.
 Fuse Blown	The internal fuse is blown.		Replace the fuse
 Keypad disconnected	The digital keypad (KP-201) was disconnected or failed.	Poor keypad wire connection.	If troubleshooting the keypad connection doesn't yield results. Then contact Electric Regulator.
 Keypad connection interrupted during operation	Keypad connection interrupted during operation	The keypad was disconnected and reconnected during motor operation.	Check keypad wire connections.
 External Thermostat	When an X input terminal is programed ±7, the display "thr" indicates the input received a signal. See F051 through F057.	1) Typically ±7 is used for the motor thermostat. This is why thr is displayed. 2) The system engineer may use ±7 for other purposed. Examine the system diagram.	A momentary signal will engage this fault signal. If the fault is present, clear the fault and press reset.
 Inhibition of Output	One or all of the output terminals has failed.		Contact Electric Regulator Corp.
 Freewheeling	The motor is freewheeling, coasting.	Fr will continue to be displayed after the motor has stopped. When an X input terminal is programmed ±9. When that input receives a signal, Fr is displayed until the signal is cleared. **Important:** If the keypad Run key was used to start. When the signal is cleared, the motor will begin running immediately.	
 FWD and REV error	The FWD and or REV input terminal have failed		Contact Electric Regulator Corp.
 Flashing	The FWD and REV input terminals are not receiving a signal.	This is normal when stopped	

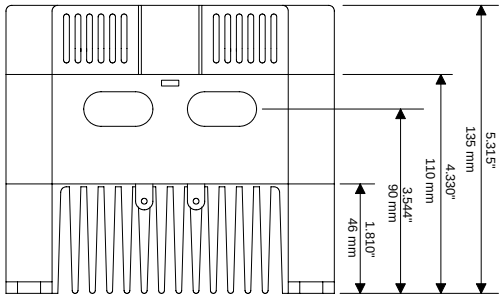
Clearing Faults or Warnings (Reset)

When a fault or warning is displayed, correct the problem and then press the STOP / RESET key or engage the auxiliary reset terminal.

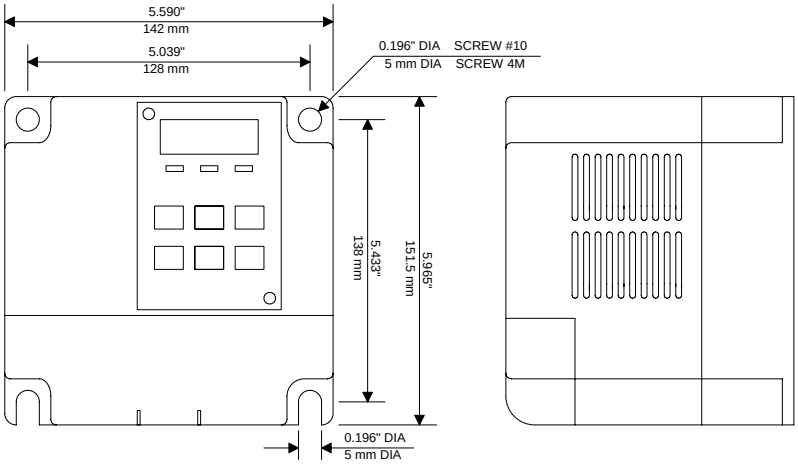
KP-201 and KP-202 have the same mounting dimensions

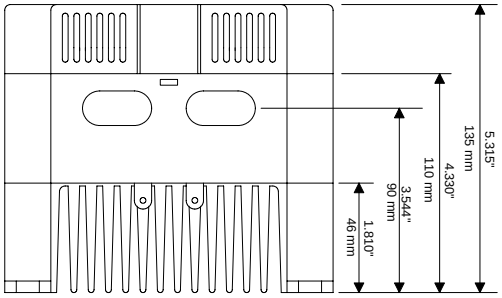




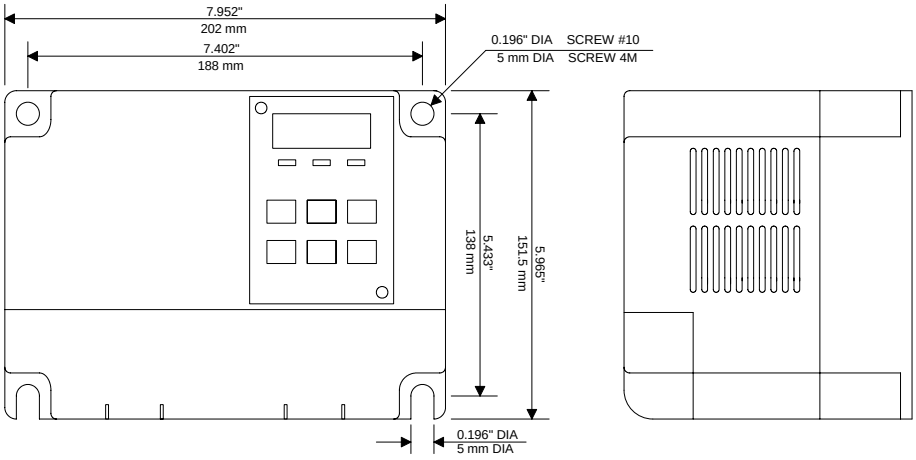


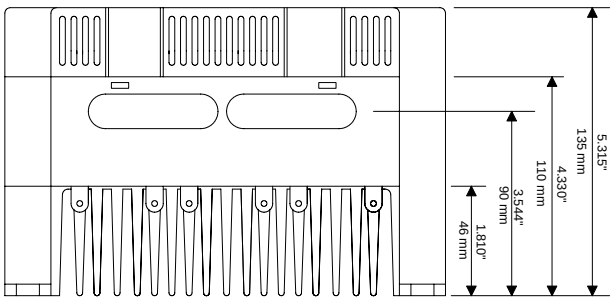
DBU5-L50
DBU5-L75
DBU5-H50
DBU5-H75
Physical Dimensions



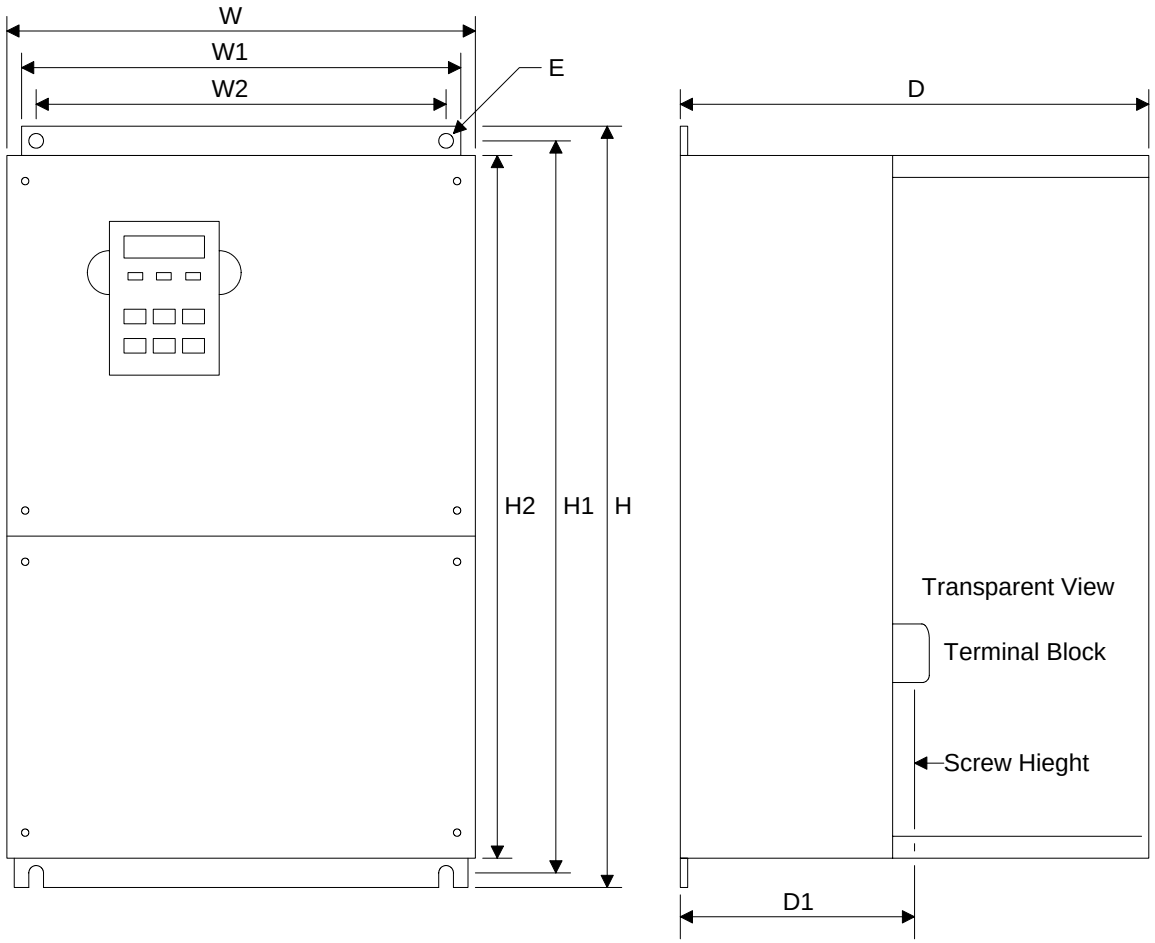


1 & 2 HP Physical Dimensions





3 & 5 HP Physical Dimensions



RM5 Rating Hp (Voltage)	**W**	W1	W2	**H**	H1	H2	**D**	D1	E Screw Size
7.5 (220/460)	8 1/2	8 1/16	7 5/16	12 9/32	11 13/16	11 13/16	7 7/8	3 15/16	10-32
10 (220/460)									
15 (220/460)									
20 (220/460)	10 5/8	10	10	18 1/8	17 1/2	16 7/8	9 1/4	7 7/8	5/16-18
25 (220/460)									
30 (220/460)									
40 (220)	15	14 1/8	14 23/32	21 5/8	20 3/32	19 3/4	11 1/4	7 7/16	5/16-18
50 (220)	17 5/16	16 1/2	17 3/32	27	26	24 3/4	11 1/4	8 1/16	3/8-16
60 (220)									
75 (220)									
100 (220)	19 3/4	18 7/8	18 29/64	32 9/64	30 31/32	29 17/32	14 3/8	9 27/32	7/16-14
40 (460)	15	14 1/8	14 23/32	21 5/8	20 3/32	19 3/4	11 1/4	7 7/16	5/16-18
50 (460)									
60 (460)									
75 (460)	17 5/16	16 1/2	17 3/32	27	26	24 3/4	11 1/4	8 1/16	3/8-16
100 (460)									
125 (460)	19 3/4	18 7/8	18 29/64	32 9/64	30 31/32	29 17/32	14 3/8	9 27/32	7/16-14
150 (460)									

Electric Power Specifications

208V ~ 240V Input Voltage

Model Number	RM5G-2001	RM5G-2002	RM5G-2003	RM5G-2005	RM5G-2007	RM5G-2010	RM5G-2015	RM5G-2020	RM5G-2025	RM5G-2030	RM5G-2040	RM5G-2050	RM5G-2060	RM5G-2075
Horsepower	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75
Current Rating (A)	5	8	11	17	25	33	46	60	74	90	115	145	175	220
Output Voltage Rating (V)	200 to 230V 3ϕ													
Output Frequency Range (Hz)	0.01 to 400 Hz													
Input Power (V, ϕ, Hz)	200 to 230V 50 to 60 Hz / 1ϕ or 3ϕ				200 to 230V / 50 to 60 Hz / 3ϕ									
Input Voltage Fluctuation Range	180 to 253 V													
Input Frequency Fluctuation Range (Hz)	+/- 5%													

440V ~ 480v Input Voltage

Model Number	RM5G- 4001	RM5G- 4002	RM5G- 4003	RM5G- 4005	RM5G- 4007	RM5G- 4010	RM5G- 4015	RM5G- 4020	RM5G- 4025	RM5G- 4030	RM5G- 4040	RM5G- 4050	RM5G- 4060	RM5G- 4075	RM5G- 4100	RM5G- 4125	RM5G- 4150	RM5G- 4200	RM5G- 4300	RM5G- 4420
Horsepower	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200	300	420
Current Rating (A)	2.5	4	6	9	14	18	24	30	39	45	61	73	87	110	137	176	204	304	415	585
Output Voltage (V)	380 to 460V 3ϕ																			
Output Frequency Range (Hz)	0.01 to 400 Hz																			
Input Power (V, ϕ, Hz)	380V to 480V / 50 to 60 Hz / 3ϕ																			
Input Voltage Fluctuation Range (V)	323 to 506 V																			
Input Frequency Fluctuation Range (Hz)	+/- 5%																			

Common Specifications

Motoring Features	Output Signal	Pulse Width Modulation (PWM) to synthesize sinusoidal wave
	Frequency Range	0.01 to 400 Hz (see F092)
	Frequency Resolution	0.1 Hz
	Overload Current	150% of motor's rating for 1 minute (see F046, F047, F048)
	Acceleration and Deceleration Scale	0.1 to 3200 seconds. Free running stop set deceleration to 0 seconds.
	Braking Torque	DC braking current is programmable form 0 to 150% of RM5 current rating with dynamic braking transistor (DBT) and resistor. If DBT and resistor are not used DC braking current is limited to 20%. (see F 075)
	Voltage Frequency Patterns	Three Voltage/Frequency Patterns (i.e. V/F pattern) Each V/F pattern is independently programmable (see F034 to F039)
	Stall Prevention	Stall prevention acceleration current and level speed current are independently programmable. (see F 070 and F071_
Control Features	Analog Speed Reference Scale	0 to 10 VDC Voltage Reference or 4 to 20 mA Current Reference (see F002, F040, F 041)
	Forward & Reverse Inputs	Activated by holding the circuit closed. (see F001)
	Multiple Function Inputs	6 Programmable inputs with a selection of 12 features. (see F 052 to F057)
	Multiple Function Outputs	3 Programmable outputs with a selection of 11 features. (see F 058, F059, F060)
Display Meters	Keypad Display	The keypad displays 8 meter functions. (see F006)
	Digital Meters, Auxiliary	The RM5 supports up to 3 digital meters with a selection of 8 settings. (see F098, F099, F100, F101. Meters plug to CNN)
	Analog Meters, Auxiliary	The RM. supports 1 analog meter with a selection of 3 settings. (see F 044. Meter connects to FM+ and FM-)
Protection Features	Diagnostics	When keypad displays the following. OC (Over Current) OE (Over Voltage) LE (Under Voltage) OL (Motor Overload) OLI (RM5 Inverter Overload) OH (Overheat) GF (Ground Fault) SC (Blown Fuse) PadF (Keypad Disconnected during Operation)
Ambient Conditions	Atmosphere	Non Explosive, Non Corrosive,
	Temperature	-10C to 50C No Condensation (14F to 122F)
	Humidity	90% Relative Humidity or less
	Vibration	Less than 5.9m/sec^2 (0.6G)
	Altitude	Less than 1000 meters (3280 ft) (see table in section 2.1)

RM5G Function Code Table					
F 000	Software Version	P5103D			
F 001	Start, Forward & Reverse Inputs	0) Terminals activate start forward or start reverse. 1) Terminals activate start forward only 2) Keypad start, Terminals select forward or reverse 3) Keypad start, forward only. (Factory set:3)			
F 002	Speed Adjustment Input	0) Analog Speed Ref. Terminals Vin & GND or Current Ref., Iin & GND 1) Keypad arrow keys with Hz display. (Factory set:1) 2) Keypad arrow keys with RPM displayed when keys are pressed 3) Keypad arrow keys with user defined units displayed when keys are pressed 4) Digital Speed Adjustment (Input Terminals X1 through X6, See F 052 through F 057)			
F 003	Keypad Stop	0) Disable keypad stop 1) Enable keypad stop. (Factory set:1)			
F 004	Keypad Speed Adjustment	0) Disable arrow key speed adjustment during motor operation 1) Enable arrow key speed adjustment during motor operation. (Factory set:1)			
F 005	Speed Memory (Keypad Only)	0) Disable Speed Memory, Keypad speed asjustment only. (Factory set:0) 1) Enable Speed Memory, Stored after 3 minutes of operation.			
F 006	Keypad Default Display	1) Hertz Output 2) Speed Ref., in Hertz 3) Voltage Output 4) DC Link Voltage	5) Current Output 6) RPM 7) User Defined Meter (i.e. MPM) 8) Terminal Status	(Factory Set: 1)	
F 007	User Defined Meter	0 to 500 Units per Hz	Factory set: 20		
F 008	Custom Speed Decimal Point Display	0) No Decimal Point 1) One Decimal Point	2) Two Decimal Points 3) Three Decimal Points	(Factory set: 0)	
		Note* Levels 4,5,6,7 are only activated when F054 is set 5		X3*	X2	X1
F 009	Primary Speed Level	0 to 400 Hz, Factory set: 60 Hz		Off	Off	Off
F 010	Speed Level 1	0 to 400 Hz, Factory set: 10 Hz		Off	Off	On
F 011	Speed Level 2	0 to 400 Hz, Factory set: 20 Hz		Off	On	Off
F 012	Speed Level 3	0 to 400 Hz, Factory set: 30 Hz		Off	On	On
F 013	Speed Level 4	0 to 400 Hz, Factory set: 0 Hz		On*	Off*	Off*
F 014	Speed Level 5	0 to 400 Hz, Factory set: 0 Hz		On*	Off*	On*
F 015	Speed Level 6	0 to 400 Hz, Factory set: 0 Hz		On*	On*	Off*
F 016	Speed Level 7	0 to 400 Hz, Factory set: 0 Hz		On*	On*	On*
F 017	Jog	0 to 400 Hz, Factory set: 6 Hz and programmed to input X3				
F 018	Acceleration & Deceleration Frequency Scale	0.01 to 400Hz Factory set: 60Hz	When the frequency scale is 60Hz and accel time is set to 15 seconds the motor will accel to 60 Hz in 15 seconds. If the frequency scale is changed to 30Hz the motor will accel to 60Hz in 30 seconds.			
F 019	Primary Acceleration Time and Levels 4, 5, 6, 7 & Jog	0.1 to 3200 Sec	Factory set: (1/2 to 5HP, 5 sec.) (7.5 to 30HP, 15 sec.) (7.5 to 30HP, 15 sec.)			
F 020	Primary Deceleration Time and Levels 4, 5, 6, 7 & Jog	0.1 to 3200 Sec.	Factory set: (1/2 to 5HP, 5 sec.) (7.5 to 30HP, 15 sec.) (7.5 to 30HP, 15 sec.)			
F 021	Speed Level 1 Accel Time	0.1 to 3200 Seconds. Factory set: Same as F 019				
F 022	Speed Level 1 Decel Time	0.1 to 3200 Seconds. Factory set: Same as F 020				
F 023	Speed Level 2 Accel Time	0.1 to 3200 Seconds. Factory set: Same as F 019				
F 024	Speed Level 2 Decel Time	0.1 to 3200 Seconds. Factory set: Same as F 020				
F 025	Speed Level 3 Accel Time	0.1 to 3200 Seconds. Factory set: Same as F 019				
F 026	Speed Level 3 Decel Time	0.1 to 3200 Seconds. Factory set: Same as F 020				
F 027	Secondary Accel Time	0.1 to 3200 Seconds, Factory set: 15 sec., and input X4				
F 028	Secondary Decel Time	0.1 to 3200 Seconds, Factory set: 15 sec., and input X4				
F 029	S-Curve Accel & Decel	0 to 5 Seconds, Factory set: 0 Sec.				
F 030	Maximum Voltage Output Options	0) Disable Maximum Output Voltage Limit 1) Enable Maximum Output Voltage Limit (Factory set: 1)				
F 031	Maximum Frequency Output	RM5G 0.01 to 400Hz (Factory set: 60Hz) RM5P 0.01 to 120Hz (Factory set: 60Hz)	This setting overrides all others.			
F 032	Starting Frequency	0.1 to 10 Hz (Factory set: 0.5 Hz)				
F 033	Starting Boost Voltage	208V~ 240V Motor, 0 to 50 Volts (Factory set: 8 Volts) 380V~480V Motor, 0 to 100 Volts (Factory set: 12 Volts)				

F 034	Primary V/F Pattern Maximum Frequency	0.01 to 400 Hz, Factory Set: 60 Hz	The primary frequency scale sets the frequency the maximum voltage (F035) is reached. Example: If F034 is 60 Hz and F035 is 220V then at 60 HZ the voltage is 220V. Second Example: If F034 is 120Hz and F035 is F036 220V then at 60Hz the voltage is 110V.
F 035	Primary V/F Pattern Maximum Voltage	208~240V Motor, 0.1 to 255 Volts (Factory set: 220 Volts) 380~480V Motor, 0.1 to 510 Volts (Factory set: 380 Volts)	
F 036	2nd Segment V/F Pattern Frequency Switch Point	0 to 400 Hz, Factory set: 0 Hz	The V/F pattern can be customized into three sections. 1st, 2nd and Main V/F patterns. F036 sets the maximum frequency in the 1st pattern and switch point to 2nd or main V/F pattern. If F036 is set:0, it is not active.
F 037	2nd V/F Pattern Voltage	208~240V Motor, 0 to 255 Volts (Factory set: 0 Volts) 380~480V Motor, 0 to 510 Volts (Factory set: 0 Volts)	
F 038	3rd Segment V/F Pattern Frequency Switch Point	0 to 400 Hz, Factory set: 0 Hz	The 2nd V/F pattern begins at F036 and ends at F038. If F038 is set 0, it is not active.
F 039	3rd V/F Pattern Voltage	208~240V Motor, 0 to 255 Volts (Factory set: 0 Volts) 380~480V Motor, 0 to 510 Volts (Factory set: 0 Volts)	
F 040	(Vin) Speed Reference Voltage Scale	0.00 to 2 ratio Factory set: 1.00	The factory default speed reference scale is 0 to 10 volts The maximum value can be programmed from 5V to 10V Example: (10/1.25=8) 1.25 sets the scale: 0 to 8 V
F 041	(Vin) Speed Reference Voltage Scale Offset	-1 to 1 ratio Factory set: 0	The minimum value of the scale (offset) is from 0 to 5 volts. Formula: sin(F041x-90)x5 is only valid when F040=1.00 Exsample: sin(-0.20x-90)x5 = sin18x5 = 0.309x5 = 1.545 Volts
F 042	Maximum Running Freq.	0.00 to 1 ratio Factory set: 1.00	F 042 is a ratio of F 031. Example: If F 031 is 60 Hz and F 041 is 0.75 the maximum the output is 45 Hz.
F 043	Minimum Running Freq.	0.00 to 1 ratio Factory set: 0	F 043 is a ratio of F 031. Example: If F 031 is 60 Hz and F042 is 0.5 the minimum output is 30 Hz.
F 044	FM+ Analog Output Properties	0) Hertz Output (Factory set: 0) 1) Speed Reference 2) Amperes Output 3) Vin Input Signal 4) Iin Input Signal	
F 045	FM+ Scale (FM+ Gain)	00.1 to 2.00 Factory set: 0.00	Factory default scale 0~10V
F 046	Slow Overload Protection	0) Disable Motor Over Current Protection 1) Enable Motor Over Current Protection (Factory set: 1) 2) Enable Motor with Blower Over Current Protection	
F 047	Slow Overload Options	0) Motor Overload, see F 048. Factory set: 0 (When motor & RM5 ratings are equal) 1) RM5 inverter overload (When motor rating exceeds RM5 rating)	
F 048	Motor's Rated Current	Set according to motor's data plate	
F 049	Motor's No Load Current	Set according to motor's data plate	
F 050	Motor Slip Compensation	-9.9 to 5 Hz	Set according to load condition at constant speed. (Factory set: 0)
F 051	Number of Motor Poles	2 to 10 Poles, Calibrates RPM and Custom Speed. (Factory set: 4P)	

Digital Input Terminals X1 through X6			**Table for Terminals X1 through X6** (Note: 0...+16 Close Circuit, -1…-16 Open Circuit)	
F 052	X1 Input Terminal	Factory set: 3	0) X1: Digital Speed Adjustment	±6) Reset
F 053	X2 Input Terminal	Factory set: 4	0) X2: DC when Stopped	±7) External fault signal input
F 054	X3 Input Terminal	Factory set: 1	0) X3: Current Limit Enable	±8) Disable Outputs
F 055	X4 Input Terminal	Factory set: 2	0) X4: Select Speed Reference	±9) E. Stop with no decel control
F 056	X5 Input Terminal	Factory set: 7	0) X5: Stop, close circuit	±10) Speed search from Max Freq
F 057	X6 Input Terminal	Factory set: 6	0) X6: Stop, open circuit	±11) Speed search from Set Freq
			±1) Jog	±12) Hold Speed
			±2) Secondary Accel & Decel	±13) Digital Speed Adjustment Accel
			±3) Multiple Speed Level 1	±14) Digital Speed Adjustment Decel
			±4) Multiple Speed Level 2	±15) Clear Digital Speed Adjustment
			±5) Multiple Speed Level 3	±16) Select Vin or Iin for Speed Ref.
Digital Output Terminals Y1, Y2 and Relay 1			**Table for Y1 and Y2 and Relay 1** (Note: Input Signal +1 High, -1 Low)	
F 058	Y1 Terminal (Open Collector Transistor)	Factory set: 1	±1) Rotation Detect	±7) Low Input Voltage Detect
F 059	Y2 Terminal (Open Collector Transistor)	Factory set: 2	±2) Constant Speed Detect	±8) Braking
F 060	Relay 1 (SPDT) Terminals: Ta1, Tb1, Tc1	Factory set:11	±3) Zero Rotation Detect	±9) Low Voltage Ridethrough Detect
			±4) Freq., Output Detect	±10) General Fault Ridethrough Detect
			±5) Overload Detect	±11) General Fault Detect
			±6) Stall Prevention Detect	

F 061	Constant Speed Bandwidth for Analog Speed Reference	0.0 to 10 Hz, (Factory set: 2 Hz)	When Y1 or Y2 or relay 1 or relay 2 are set to 2 and the output frequency is within the bandwidth of F061 the terminals will signal
F 062	Constant Speed Bandwidth for Keypad	0.0 to 10 Hz, (Factory set: 2 Hz)	When Y1 or Y2 or relay 1 or relay 2 are set to 2 and the output frequency is within the bandwidth of F062 the terminals will signal
F 063	Constant Speed Detect Output Signal	0 to 400 Hz, (Factory set: 0 Hz)	
F 064	Torque Boost Gain	0.0 to 3 ratio, (Factory set: 1)	
F 065	Overload Signal (OLO)	0) Disable Overload Signal, (Factory set: 0) 1) Enable Overload Signal	
F 066	Overload Conditions (OLO)	0) Signal Overload only when running at constant speed (Factory set: 0) 1) Signal Overload at any speed	
F 067	Fast Overload	0) Disable: Fast Overload. (Factory set: 0) 1) Enable: Fast Overload	
F 068	Fast Overload Level	30% to 200% of the RM5 rated current (Factory set 160%)	
F 069	Fast Overload Time	0.1 to 10 Seconds (Factory set: 0.1)	
F 070	Acceleration Stall Prevention	30% to 200% (Factory set: 160%)	Percentage of Motor's rated current (F 048). If stall is detected acceleration is declines or levels.
F 071	Constant Speed Stall Prevention	30% to 200% (Factory set: 160%)	Percentage of Motor's rated current (F 048). If stall is detected acceleration is declines or levels.
F 072	Constant Speed Stall Recovery Acceleration	0.1 to 3200 sec. (Factory set:15)	Acceleration Time after recovering from a stall at constant speed.
F 073	Constant Speed Stall Recovery Deceleration	0.1 to 3200 sec. (Factory set:15)	Deceleration Time after recovering from stall at constant speed.
F 074	Deceleration Stall Prevention	0) Disable Stall Prevention during deceleration 1) Enable Stall Prevention during deceleration (Factory set: 1)	
F 075	DC Braking Current	0 to 150% Of the RM5 current rating (Factory set: 50%)	
F 076	Time Delay before Restart after DC Braking	0 to 20 Sec. (Factory set: 0)	This setting allows the brake resistor time to cool.
F 077	Pre-start and Post Stop Rotor Magnetizing Time	0 to 20 Sec. (Factory set: 0)	Before start and after stop DC voltage is applied to the stator to magnetize the rotor. This serves two functions, First: Simulates the starting capacitor of a single phase AC motor. Second: Prevents motor from randomly rotating when stopped. Also see F053 set:0
F 078	Power Interruption Response	0) Disable Ridethrough (Factory set: 0) 1) Enable Ridethrough 2) Switch Off when power is interrupted 3) Enable Controlled Deceleration Stop (F103, F104, F105, F106)	
F 079	Low Input Voltage Switch Off Point	220V motor 130V to 192V, Factory set: 175V 460V motor 230V to 384V, Factory set: 320V	
F 080	Limit of General Fault Ridethroughs	0 to 16 Factory set: 0	If a fault is detected and then quickly corrects its self. The RM5 will continue to run (ridethrough). F080 sets the number of permissible ridethroughs
F 081	Carrier Frequency	1 to 6 Factory set:4	Each unit is a multiple of 2.5 kHz. The carrier frequency is inverse to the length of the wire from the control to the motor. See Table. (Example: 4 x 2.5kHz = 10kHz)
F 082	Stop	0) Controlled Deceleration Stop (Factory set: 0) 1) Uncontrolled Deceleration Stop (i.e. Freewheeling, Coasting)	
F 083	Reverse	0) Enable Reverse (Factory set: 0) 1) Disable Reverse	
F 084	Frequency Bypass 1	0 to 400 Hz, To avoid resonance problems (Factory set: 0)	
F 085	Frequency Bypass 2	0 to 400 Hz, To avoid resonance problems (Factory set: 0)	
F 086	Frequency Bypass 3	0 to 400 Hz, To avoid resonance problems (Factory set: 0)	
F 087	Frequency Bypass Bandwidth	0 to 25.5 Hz (Factory set: 0)	The bandwidth applies to F 084, F 085 and F 086. Example: To create a skip from 30 to 35Hz. Set F 084 to 32.5Hz and F 087 to 2.5 Hz.

F 088	Speed Tracking Current	0 to 200%	Of the RM5's current rating (Factory set: 150%)
F 089	Power Interruption Restart Time	0.5 to 5 sec Factory set: 0.5	If the power is interupted the motor will restart in the amount of time programmed.
F 090	V/F Pattern Speed Tracking	0 to 100% Factory set: 100%	
F 091	Fault History	Displays the last five faults	
F 092	Program Function Locks	0) Unlock functions: Max frequency is up to 120 Hz (Factory set: 0) 1) Lock functions: Max frequency is up to 120 Hz 2) Unlock functions: Max frequency is over 120 Hz 3) Lock functions: Max frequency is over 120 Hz	
F 093	Automatic Voltage Regulation (AVR)	0) Disable AVR 1) Enable AVR (Factory set: 1)	
F 094	Overload Protection	0) Disable Overload Protection 1) Enable Overload Protection (Factory set: 1)	
F 095	Input Voltage Program Reference	RM5-2*** RM5-4***	190 to 240 volts (Factory set: 220V) 340 to 460 volts (Factory set: 460V)
F 096	Creeping Start Frequency	0.0 to 400 Hz (Factory set: 0.5 Hz)	
F 097	Creeping Start Time	0.0 to 25.5 Sec. Factory set 0.0	The time length the motor runs before acceleration. This function helps avoid excessive slip during acceleration
F 098	Number of Digital Meters	0 to 3 (Factory set 0)	
F 099	Digital Meter 1	Factory set 1	Digital Meter Table 0) None 3) Voltage 6) RPM 1) Hz 4) PN Voltage 7) Linear Speed 2) Speed Ref, Hz 5) Current 8) Terminal Status
F 100	Digital Meter 2	Factory set 2	
F 101	Digital Meter 3	Factory set 3	
F 102	Eneregy Economy	0) Disable, Energy Economy, Factory set: 0 1) Enable, Energy Economy, Reduces voltage to minimum required.	
F 103	Power Interruption Frequency Reduction	0 to 20 Hz Factory set: 3	When the power is interrupted the frequency will immediately be reduced by this setting. A large decrease will cause hard braking. Example: The motor is running at 60 Hz and and F 103 is set 3 Hz. When the power is shut off, the frequency immediately be reduced to 57 Hz (60-3 =57).
F 104	1st Deceleration Time from F 103 to F 106	0 to 3200 sec. Factory set: 15	If F 106 is set 0 Hz and F 104 is set 15 sec., the motor will decel to a stop in 15 sec. If F 106 is set 30 Hz the motor will decel to 30 Hz in 15 sec.
F 105	2nd Deceleration Time from F 106 to stop	0 to 3200 sec. Factory set: 15	If F 106 is set 0 Hz F 105 is inactive. If F 106 is set 30 Hz and F 105 is set 15 sec., the motor will decel from 30 Hz to stop in 15 sec.
F 106	Switch Point Frequency from 1st to 2nd decel time	0.0 to 400 Hz, Factory set: 0.0	This frequency is the piont when the 1st decel time switches to the 2nd decel time. If F 106 is set 0 Hz, F106 is disabled.
F 107	Reserved for KP-202		
F 108	Reserved for KP-202		
F 109	Reserved for KP-202		
F 110	Reserved for KP-202		
F 111	Reserved for KP-202		
F 112	Reserved for KP-202		
F 113	Reserved for KP-202		
F 114	Reserved for KP-202		
F 115	Reserved for KP-202		
F 116	Reserved for KP-202		
F 117	Reserved for KP-202		
F 118	Digital Speed Adjustment Memory	0) Clear Memory when power is switched off (Factory set: 0) 1) Store in Memory when power is switched off.	
F 119	Digital Speed Adjustment Frequency Increments	0) 0.01Hz (Factory Set: 0) 1 to 8) Multiple of 0.05Hz per unit (Example: 5 x 0.05 Hz = 0.25 Hz per input signal) 9) 0.50Hz 10 to 250) Multiple of 0.10Hz per unit	
F 120	Digital Speed Adjustment Response Time Delay	1 ~ 6) One second increments (Factory set: 1)	

F 121	Keypad Adjustment of Digital Speed Adjustment	When digital speed adjustment is used. The user can adjusted the speed with the keypad by entering F 121. Important, don't operate F 121 and digital speed adjustment at the same time.
F 122	Secondary Speed Adjustment	0) Analog Speed Reference (Factory set: 0) 1) Keypad Speed Adjustment Note: X4 must be set: 0 2) Digital Speed Adjustment See F 055
F 123	Vin and Iin Properties	0) Vin and Iin are enabled, the higher signal controls (Factory set: 0) 1) Vin enabled, Iin disabled 2) Iin enabled, Vin disabled 3) Vin or Iin selected by X terminal programmed to ±16
F 124	Vin Properties	0) Frequency Limit 1) Speed Reference (Factory set: 1) 2) Current Limit 3) Voltage Limit
F 125	Iin Properties	0) Frequency Limit 1) Speed Reference (Factory set: 1) 2) Current Limit 3) Voltage Limit
F 126	Iin Predefined Scales	0) 4~20mA (Factory set : 0) 1) 0~20mA
F 127	Iin Maximum Scale (Iin Gain)	0.00 ~ 2.00 (Factory set: 0.01)
F 128	Iin Minimum Scale (Iin Bias, Offset)	-1.00 ~ 1.00 (Factory set: 0.00)
F 129	AM+ (Analog Output)	0) Hertz 1) Speed Adjustment Setting 2) Amperes (Factory set: 2) 3) Vin setting 4) Iin Setting
F 130	AM+ Gain	0.00 ~ 2.00 (Factory set: 1.00)
F 131	Relay 2 (SPST) Terminals Ta2, Tc2	**Table for relay Ta2, Tc2** (Note: Relay +1 Open, -1 Close) Factory set: 3 ±1) Rotation Detect ±7) Low Input Voltage Detect ±2) Constant Speed Detect ±8) Braking ±3) Zero Rotation Detect ±9) Low Voltage Ridethrough Detect ±4) Freq., Output Detect ±10) General Fault Ridethrough Detect ±5) Overload Detect ±11) General Fault Detect ±6) Stall Prevention Detect
F 132	Dynamic Braking Beginning Frequency	Range: 0.1 ~ 60.0 Hz (Factory set: 0.5)
F 133	Keypad Display Current Limit setting	0 to 150% Default Entering F133 permits viewing the current limit setting. Note: If F001 is set: 2 or 3. Run and Stop keys are disabled
F 134	Commands Default: 0	Table for F 129 0) Not active SAu) Save Program CLF) Clear faults F 091 rES) Restore Previous settings dEF60) Factory 60Hz settings rd_EE) Copy RM5 settings to Keypad dEF50) Factory 50Hz settings Uur_EE) Copy Keypad settings to RM5 Instructions for copy command F 117. Scroll to the function required then press and hold the FUN/DATA key and wait for the word "end" to appear.

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