ELECTRIC REGULATOR

RM5 User Manual Warnings.

Danger

Hazardous High Voltage

Ground the control before servicing
Remove all power and wait 10 minutes
Verify that no voltage is present
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 RM5 control.
Megger or dielectric testing will damage the control.

Table of Contents

1. Receiving & Storage

Section 1.1 Physical Inspection

When you receive the ERC RM5 AC Control unit 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 Control unit 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.	RM5-2005
Input Power	200 to 230 VAC 50/60Hz
Output Power	3.7kW/ 5 HP 17A

- Model Number Scheme RM5 - 2 005
  A B C

  A: RM5..... 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

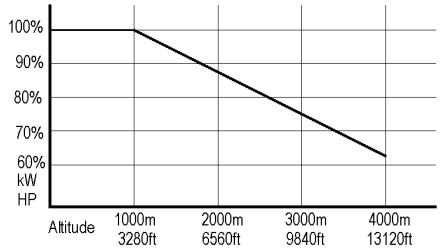
- Motor Specification Inverter duty motor compatible with IGBT variable frequency control.

2. Installation Location

2.1 Operating Environment

The ERC RM5 AC Control 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, for example: ocean air.
- Contamination Avoid locations subject to dust or iron particles.
- Hazardous Gases & Liquids The RM5 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. If normal operation is 15 Hz or above a self ventilated motor adequate. If the motor is operated at a low speed for a long periods of time. A separately ventilated motor is required. The motor's insulation should be a minimum of 100 M at 500V. Waterproof and submersible motors may have poor insulation due to sand and contaminates abrading the insulation. The synchronous motor's starting current is greater than standard induction motor's. The V/F pattern is lower, a higher rating RM5 should be used. When a motor designed to operate a 60 Hz is operated above 60 Hz the torque is decreased dramatically.

2.3 AC Line Reactors

- If the RM5's power is shared with equipment with SCR's, high power motors or welders, a AC line reactor should be used.
- If several RM5 are connected to one power source a AC line reactor should be used.

230V Table

Continuous rated power HP / KVA	Inductance	Current
1 / 2	0.4 mH	15A
2 / 3	0.4 mH	15A
3 / 4	0.4 mH	15A
5 / 6	0.3 mH	30A
7.5 / 9	0.3 mH	30A
10 / 13	0.08 mH	50A
15 / 18	0.08 mH	50A
20 / 22	0.04 mH	100A
25 / 28	0.04 mH	100A
30 / 33	0.04 mH	100A
40 / 44	0.03 mH	150A
50 / 55	0.02 mH	200A
60 / 67	0.02 mH	200A
75 / 84	0.02 mH	300A
100 / 115	0.02 mH	400A
125 / 134	0.02 mH	400A
150 / 160	0.01 mH	600A

460V Table

Continuous rated power HP / KVA	Inductance	Current
1 / 2	0.4 mH	15A
2 / 3	0.4 mH	15A
3 / 4	0.4 mH	15A
5 / 6	0.4 mH	15A
7.5 / 9	0.3 mH	30A
10 / 13	0.3 mH	30A
15 / 18	0.25 mH	40A
20 / 22	0.25 mH	40A
25 / 28	0.08 mH	50A
30 / 33	0.08 mH	50A
40 / 44	0.04 mH	100A
50 / 55	0.04 mH	100A
60 / 67	0.04 mH	100A
75 / 84	0.03 mH	150A
100 / 115	0.02 mH	200A
125 / 134	0.02 mH	200A
150 / 160	0.02 mH	300A

2.4 Wire Specifications

The output wire must be rated for high temperature 60^0 C. The fuse ratings are selected to protect the wire not the IGBTs.

Output, 230V, 3 Phase, 0 to 60 Hz

H.P.	Full Load Amps	Minimum Size for 40 ft length	Fuse Amps
5	19A	10 AWG	20A
7 ½	28A	8 AWG	25A
10	36A	6 AWG	35A
15	54A	4 AWG	50A
20	70A	2 AWG	70A
25	87A	1 AWG	90A
30	105A	0 AWG	100A
40	139A	000 AWG	130A
50	173A	250 MCM	160A
60	205A	300 MCM	200A
75	254A	500 MCM	250A

Output, 460V, 3 Phase, 0 to 60 Hz

H.P.	Full Load Amps	Minimum Size for 40 ft length	Fuse Amps
5	10A	12 AWG	10A
7 ½	14A	10 AWG	15A
10	30A	8 AWG	30A
15	30A	8 AWG	30A
20	38A	6 AWG	40A
25	45A	4 AWG	50A
30	60A	3 AWG	60A
40	75A	2 AWG	75A
50	90A	1 AWG	90A
60	110A	00 AWG	100A
75	135A	000 AWG	130A

Section 2.5) Carrier Frequency

Function code, F 081 programs the carrier frequency.

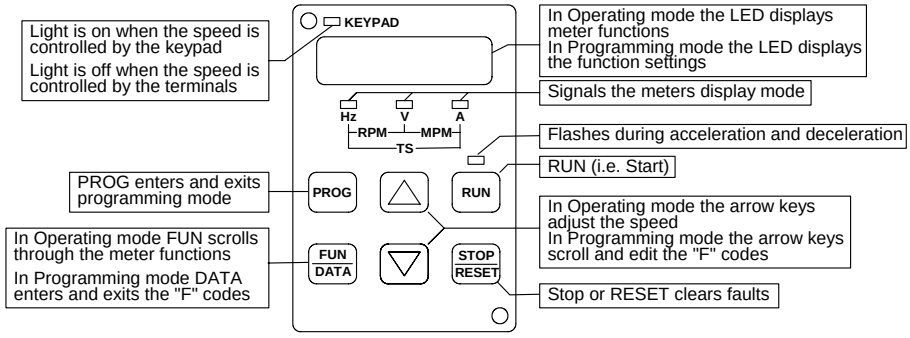
Wire Length	10m / 40 ft	25m / 80 ft	50m / 160 ft	100m / 320 ft	Over 100m
½ to 5 HP	12.5 kHz or less	10 kHz or less	7.5 kHz or less	5 kHz or less	2.5 kHz
7 ½ to 10 HP	10 kHz or less	7.5 kHz or less	5 kHz or less	2.5 kHz	2.5 kHz
15 to 30 HP	7.5 kHz or less	5 kHz or less	2.5 kHz	2.5 kHz	2.5 kHz
40 to 75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

Section 3) Keypad Fundamentals

Section 3.1) Keypad Operating Modes

The keypad has four operating modes.

- Monitoring Mode (default)
- Data Mode (Meter)
- Function Code Mode (Scrolls up and down from F 000 to F 117)
- Programming Mode (Edits the function codes)



When the power is switched on, the RM5 is by default in monitoring mode.

- The monitoring mode's default display is Hz. The default display can be changed to the user's preference. See the function code table for F 006.
- The data mode has 8 meter functions; Hz, Speed Setting in Hz, Output Voltage, DC Supply Voltage (i.e. P.N.), Current, RPM, User defined meter (i.e. MPM) and Terminal Status. To scroll through the 8 meter modes, press the FUN/DATA to scroll through the functions.
- To enter Function code mode press the PROG key. The arrow keys will then scroll up and down through the function codes F 000 to F 117. To exit the function codes press the PROG key.
- Programing mode edits the function codes. To enter the Function code and edit the program, press the FUN/DATA key. Use the arrow keys to scroll through the code program code numbers. After selecting the program code number, press the FUN/DATA key to exit the function code. To exit the function codes press the PROG key.

Programming Example: You want to change to the LED default monitoring mode display to Volts. Press the PROG key to enter programming mode. The LED will display the function codes. Then press the up arrow key to scroll to F 006. Press FUN/DATA key to enter function code F 006. To edit, use the arrow keys to scroll to the number 3 to set Voltage as the default display (see table below). Then press FUN/DATA key to exit F 006 and press the PROG key to exit programming mode and enter operating mode.

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	Factory set: 1

Section 3.2) Operating the RM5 with out the keypad.

The RM5 will operate with the keypad, if the RM5 is programed to be operated by the input terminals Vin, GND, FWD and REV (if REV is required). If more programing is required reconnected the keypad.

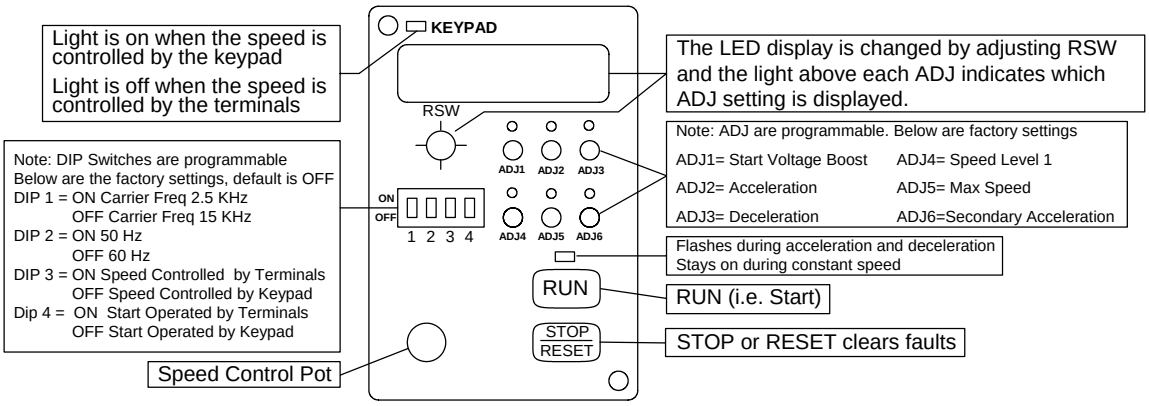
Section 3.3) How to Restore the Factory Program Settings.

When the keypad is in the operational mode. Press the PROG key to enter function code mode. Scroll to F 117 and then press the FUN/DATA key. Scroll until dEF60 is displayed. Next 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 60 Hz factory settings. (See section 4.3)

Section 3.4) Analog Keypad KP-202 Introduction

The KP-202 is an optional assertory. The analog keypad is a user friendly, quicker and easier of making adjustments. The KP-202 can not program all the functions. The KP-201 is required to program the RM5. The diagram below shows the KP-202.

More information about analog keypad KP-202 is in section 5.



Section 4) Programming Instructions

Section 4-1) Quick Set Up

This section covers the primary settings for typical applications. The RM5 factory default settings are to operated from the KP-101 digital key pad. The typical user wants to connect to the terminals auxiliary Start, Stop and Speed Pot and program the Acceleration and Deceleration time.

To program Start (Run) to operate from the terminals see F 001 in the table below.
If F001 is set to 0 or 1, the RM5 will stop if the auxiliary start circuit is opened or the Stop/Reset key is pushed. To disable the keypad stop key, see F 003. If the user wants the motor to coast to a stop (uncontrolled deceleration) see F082.

Accelerate and Decelerate time are easily program by F 019 and F 020.

The user is required to program the Motor's Ratings into the RM5. See the motor's name plate for the motor's ratings. The RM5 is programed at the factory for a typical AC motor. The user should program the RM5 for the following parameters. The motor's Maximum Current, No Load Current (if available on the name plate), Voltage (depending on how the motor is wired) and the Number of Poles.

Most user's will be interested in features such as;

- Energy Economy, reduces the voltage to the minimum required to maintain speed (F 102)
- Key pad default display (F 006)
- Motor over current switch off response time, standard or fast (F 047).

Note: Measuring the output voltage must be made with a **true RMS digital meter or analog meter**

F 001	Start, Forward & Reverse	0) Terminals activate Forward & Start or Reverse & Start.
		1) Terminals activate Forward & Start.
		2) Keypad Start, Terminals activate Forward or Reverse.
		3) Keypad Start, Terminals activate Forward only. Factory set: 3
Notes: Settings: 0, 1, 2. If FWD, COM or REV, COM are not connected the keypad display flashes, - - - - - . If both FWD, REV are connected to COM the keypad display 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)
F 003	Keypad Stop	0) Disable Keypad Stop
		1) Enable Keypad Stop, Factory set: 1
F 006	Keypad Default Display	1) Hz Output 4) DC Supply Voltage 7) Custom Speed Meter
		2) Hz Setting 5) Current 8) Terminal Status
		3) Voltage 6) RPM Factory set: 1
F 031	Maximum Frequency	Factory set: 60 Hz This setting overrides all others.
F 019	Acceleration Time	0 to 3200 sec. Factory set: (1/2 to 5 Hp 5 sec)(7.5to30 Hp)(15 sec,40Hp&up, 30 sec)
F 020	Deceleration Time	0 to 3200 sec. Factory set: (1/2to5 Hp, 5 sec)(7.5to30 Hp, 15 sec)(40Hp&up, 30 sec)
F 047	Over Current Switch Off	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	Setting 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 102	Energy Economy	0) Disable Energy Economy, Factory set: 0
		1) Enable Energy Economy, Reduces Voltage to minimum to maintain speed

Section 4.2) <u>Maximum Frequency Programming</u>

The output frequency of the RM5 will not exceed the frequency setting of F 031. Other frequency scales can be set greater than F 031 for scaling purposes.

F 031	Maximum Frequency And Master Freq., Reference	0.1 to 400 Hz Factory set: 60 Hz	This setting overrides all others.

Section 4.3) <u>Multiple Speed Levels Activation and Frequency Settings</u>.

The RM5 has a Main Speed plus 7 speed levels and jog. The speed levels 1 through 7 can be programmed to be active by inputs X1, X2, X3 in binary order. Input X3 is factory set to Jog. To change X3 to operate according to the table below. F 054 must be set to 5. See section 4.6 The settings of F 009 through F 017 will be overridden by F 031 setting. See Section 4.4

<u>Frequency Setting and Terminal Activation Table</u>

Terminals		Note* Levels 4,5,6,7 are only activated when F054 is set to 5	X3*	X2	X1
F 009	Main Speed	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: 0 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
F017	Jog	0 to 400 Hz, Factory set: 6 Hz, X3 is factory to Jog (F054 set 1)			

Section 4.4) <u>Input Terminal Programming: X1 through X6</u>

Terminals X1 through X6 can be custom programmed to the 12 functions in the table below.

<u>Input Terminal Table</u>

F 052	X1 Terminal Input	Factory set: 3	1) Jog	7) External fault signal input.
F 053	X2 Terminal Input	Factory set: 4	2) Secondary Accel & Decel	8) Disable Outputs Y1, Y2, Ta, Tb.
F 054	X3 Terminal Input	Factory set: 1	3) Multi Speed Level 1	9) Stop
F 055	X4 Terminal Input	Factory set: 2	4) Multi Speed Level 2	10) Resume Programmed Speed
F 056	X5 Terminal Input	Factory set: 7	5) Multi Speed Level 3	11) Resume Speed Ref. Setting
F 057	X6 Terminal Input	Factory set: 6	6) Reset	12) Disable accel & decel

Section 4.5) <u>Output Terminals Programming: Y1, Y2 and Ta, Tb</u>

Terminals Y1 & Y2 are opto-isolated transistor collector outputs with <u>common emitters</u> (CME). Terminal Ta, Tb and Tc are a <u>single pole double through</u> (SPDT) relay with Tc the pole.

<u>Output Terminal Table</u>

F 058	Y1 Terminal Output	Factory set: 1	1) Output Voltage Detect	7) Low input voltage
			2) Level Speed Detect	8) Braking
F 059	Y2 Terminal Output	Factory set: 2	3) Zero Output Voltage Detect	9) Ride-through Detect
			4) Frequency Output Detect	10) Restart after fault detect
F 060	Relay Ta, Tb, Tc Terminals	Factory set: 11	5) Overload Detect	11) General fault detect
			6) Stall Prevention Detect	

Section 4.6a) Acceleration & Deceleration Frequency Scale (F 018)

Acceleration & deceleration are dependent on the frequency scale set 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 60 Hz in 30 sec.

Section 4.6b) Acceleration & Deceleration (F 019 through F 026)

The acceleration and deceleration time of the Main speed level plus speed levels 4, 5, 6, 7 and Jog are all programmed by setting 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 4.6c) 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 to activate secondary acceleration. See Section 4.6

Acceleration & Deceleration Table

F 018	Accel & Decel Frequency Scale	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	Main Speed Level Acceleration Time & speed levels 4, 5,6, 7 & Jog	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 020	Main Speed Level Deceleration Time & speed levels 4, 5,6, 7 & Jog	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 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 4.6d) 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 over all 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 sec

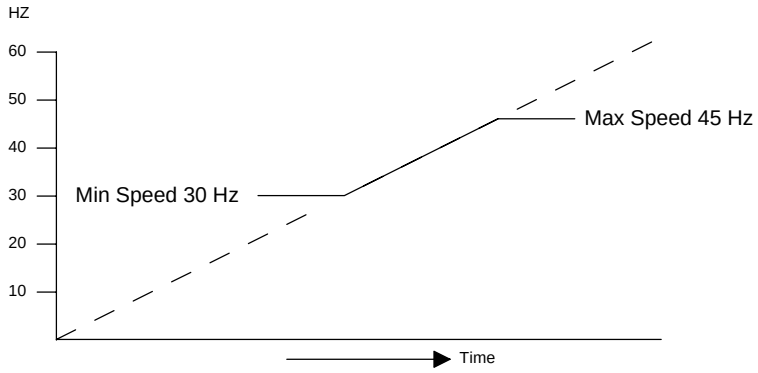
Section 4.7) <u>Speed Reference Scale (i.e. Speed Pot Voltage Scale)</u>

The RM5 is factory set for the arrow keys to adjust the speed. To change the speed reference to a speed pot (V_{REF}) connected to terminals Vin and GND set F 002 to 0. The factory default scale of V_{REF} is 0 to 10V. If terminal 12V is used, a dropping resistor is required (see wiring diagram). Current reference (I_{REF}) use's terminals Iin and GND. The factory default scale of Iref is 4 to 20 mA.

F 002	Speed Control	0) Speed Pot Terminals: 12V, Vin, GND or Current Ref.., Iin, GND	
		1) Arrow keys with Hz display. Factory set: 1	
		2) Arrow keys with RPM display when arrow keys are pressed.	
		3) Arrow keys with linear speed display when arrow keys are pressed.	
F 040	Analog Speed Ref. Scale Maximum	0.00 to 2 ratio Factory set: 1	The speed reference voltage scale is 0 to 10V and the current scale is 4 to 20 mA. The maximum value can be reduced. Example: (10/1.25=8) the scale is 0 to 8 V
F 041	Analog Speed Ref. Scale Minimum	-1 to 1 ratio Factory set: 0	The minimum value of the speed reference scale can be increased. Example: (-0.2x10 = 2) the scale is 2 to 10 Volts

Section 4.9) <u>Operating Speed Range</u>

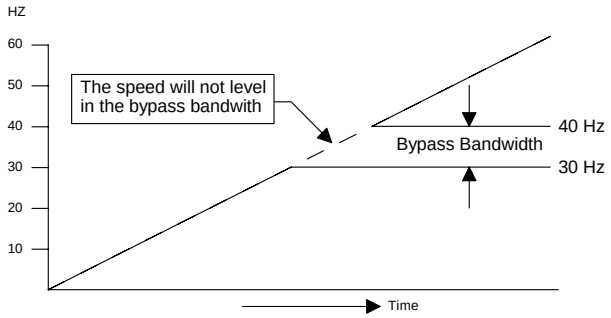
The operating speed range is factory set, 0 to 60 Hz. The speed range can be programmed to any range between 0 and 60 Hz. If for example you want the speed range to be 30 to 45 Hz. Follow the instructions in F042 and F043. If the settings are programed as in the example, The speed can only be adjusted between 30 to 45 Hz. When the motor is started and the speed reference is set at minimum, the motor will accelerate to 30 Hz. When the speed reference is set to maximum the motor will go to 45 Hz (See the graph below).



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 ratio of F 031. Example: If F 031 is 60 Hz and F 041 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 ratio 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 4.10) <u>Frequency Bypass</u>

Frequency bypass prevents the RM5's speed from being set with in the bypass bandwidth. The motor will quickly pass through the bypass bandwidth and will not level to a speed with in the bypass bandwidth.



If programmed as in example F 087, the speed will not level between 30 and 40 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. Application example: To bypass 30 to 40 Hz. Set F 084 to 35 Hz and F 087 to 5 Hz.

Section 4.11) <u>Keypad Default Display</u>

The keypad LED default display can be programmed to one of the eight functions 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

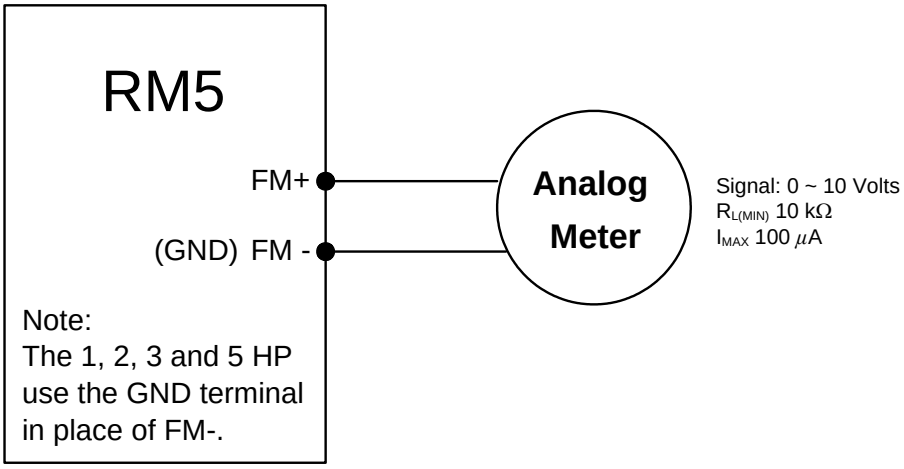
Section 4.12) <u>User Defined Meter (i.e. MPM) and RPM Calibration</u>

Custom speed calibration is for user defined units of measure. The custom speed can be display on the keypad LED (F 006 set 7) or a digital meter. See Section 4.15 Digital Meter Programming.

F 007	Custom Speed Calibration	0 to 500 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 4.13 <u>Analog Meter Programming: Terminals FM+ and FM- (alternat GND)</u>
Meters are available from Electric Regulator. Please contact the factory.

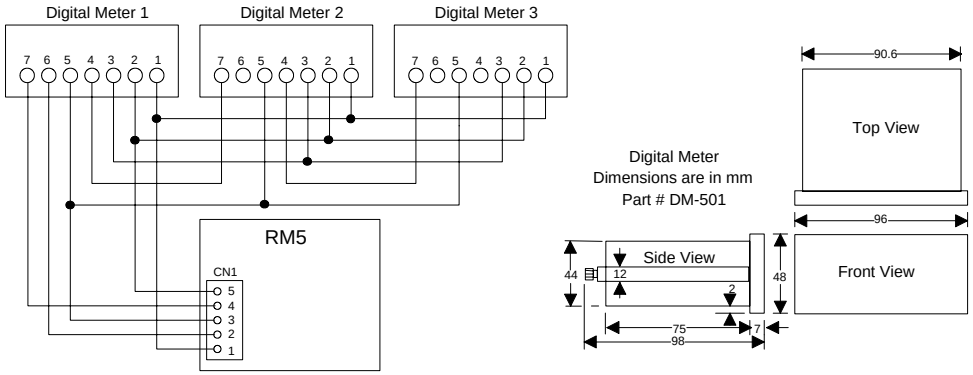
F 044	Analog Meter Output of FM+	0) Output Frequency, Factory set: 0
		1) Speed Reference setting.
		2) Current
F 045	Analog Meter Gain	0.01 to 2.00 Factory set: 1.00



Section 4.14a) <u>Digital Meter Programming</u>
Digital meters and CN1 plug are available from Electric Regulator, please contact the factory.

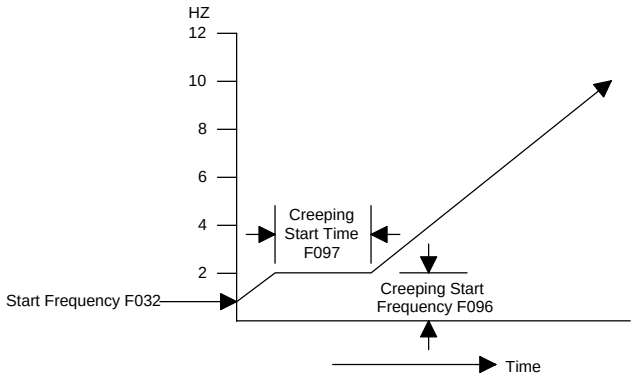
F 098	Number of Digital Meters	Factory set: 0	0 to 3 Digital Meters		
F 099	Digital Meter 1	Factory set: 1	0) None	3) Voltage	6) RPM
F 100	Digital Meter 2	Factory set: 2	1) Hz	4) PN Voltage	7) Custom Speed
F 101	Digital Meter 3	Factory set: 3	2) Set Speed, Hz	5) Current	8) Terminal Speed

Section 4.14b) <u>Digital Meter Connection Diagram</u>
Plug CN1 is the output for three digital meters. Plug CN1 is located near the left of the terminals.



Section 4.17) <u>Motor Starting Parameters</u>

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 F 081 (see section 4.18) 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 motor 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 Rotor Magnetizing Time	0 to 20 seconds Factory set: 0	Before starting, DC voltage is applied to the stator to magnetize the rotor. This function is similar to the starting capacitor on a single phase AC motor.
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 4.18) <u>Carrier Frequency</u>

The carrier frequency synthesizes a sinusoidal wave using Pulse Width Modulation (PWM) with the motor's inductance. A higher carrier frequency will run the motor quieter and smoother. Small motors have less inductance and can use a higher carrier frequency. Large motors require a lower carrier frequency. The length of the wire from the RM5 inverter to the motor increase inductance. The carrier frequency should be lowered as the wire length increases.

F 081	Carrier Frequency	1 to 6 Factory set: 4	Each unit is a multiple of 2.5kHz. Lowering the carrier frequency will increase starting torque. Also the carrier frequency is inverse to the length of the output wires.

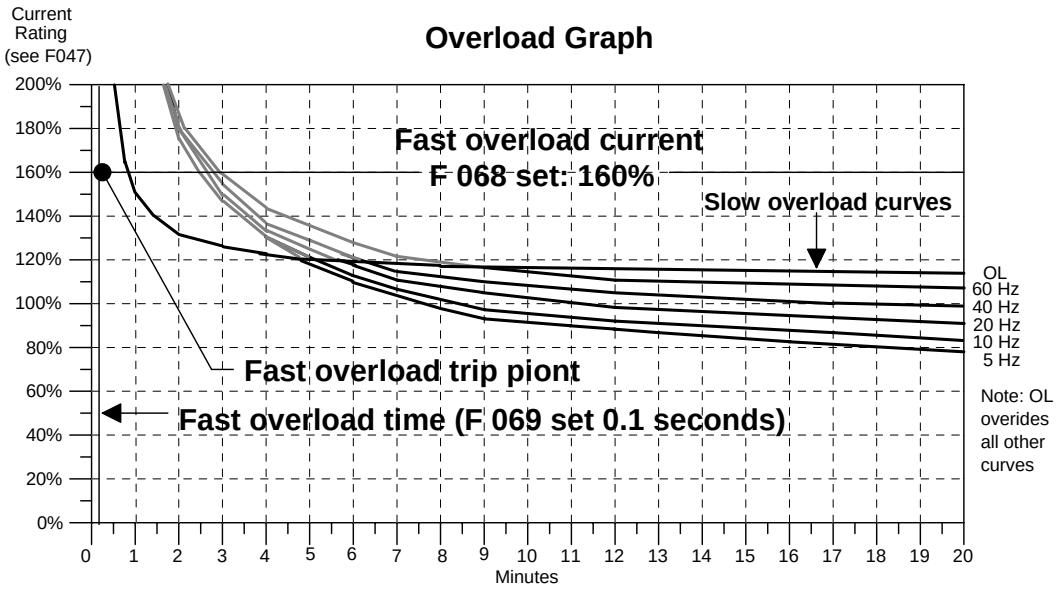
<u>Wire Length in relation to Carrier Frequency Table</u>

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

Section 4.19) <u>Motor Ratings and Overload Parameters</u>

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

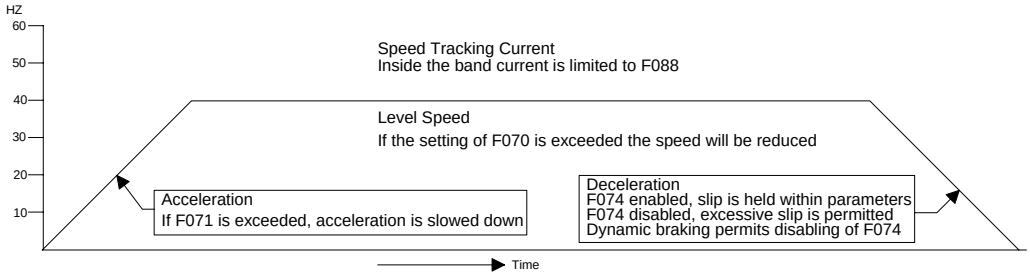
F 046	Slow Overload	0) Disable slow overload protection	
		1) Enable slow overload protection. Factory set: 1	
F 047	Slow Overload Options	0) Motor rating. Factory set: 1	Use when motor rating is equal or less than the RM5 rating (See F 048).
		1) RM5 inverter rating.	Use when motor's rating exceeds the RM5 rating.
F 048	Motor Current Rating	See the motor's name plate for the current rating.	
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 RM5 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.



<u>Fast overload</u> responds by switching off the motor when the current exceeds the setting of F068 by more than the time setting of F069. Important: F067 disables and enables F068 and F069. The factory default settings are shown on the "Overload Graph" above. If at any speed the motor current exceeds 160% for more than 0.1 second, the motor is switched off. **Important note: F067 default setting is: Disable fast overload.**

<u>Slow overload</u> curves can not be changed by the user. The 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.

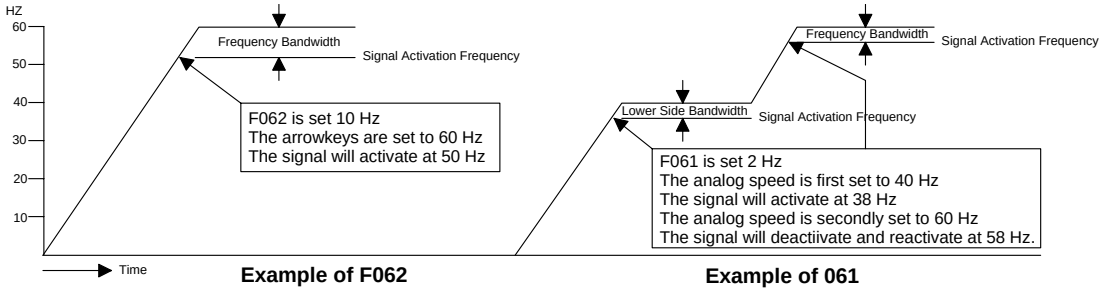
Section 4.20) Motor Slip and Stall Parameters



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.

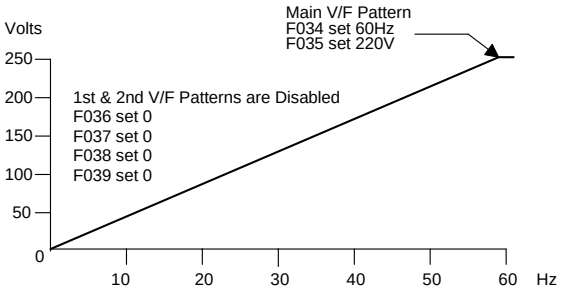


F 061	Level Speed Detect Signal Frequency Bandwidth for Speed Ref., Setting (Analog Speed Control)	0.0 to 10 Hz. Factory set: 2 Hz.	This bandwidth sets the frequency when the output signal is activated. When the speed is controlled by analog signal, typically a manual speed pot connected to terminals. (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)

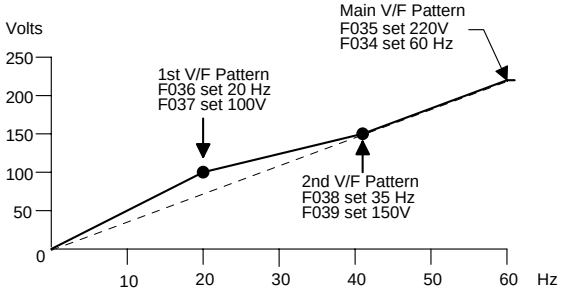
Section 4.22) Voltage Frequency Patterns (V/F Patterns)

The RM5 has three V/F patterns, the 1st, 2nd and Main V/F pattern. The factory settings uses only the main V/F pattern. The 1st and 2nd patterns can be added by the programmer.

Factory Default V/F Pattern



Example of user defined V/F Pattern

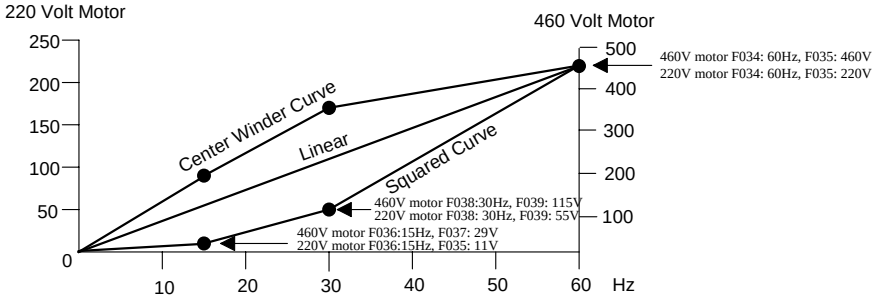


F 034	Main V/F Pattern Frequency Scale	0.01 to 400 Hz Factory set: 60 HZ	The main frequency scale (F034) is the frequency where the maximum voltage is reached. Example: If F034 is 60 Hz and F035 is 220V. Then at 60 HZ the voltage is 220V. Second Example: If F034 is 120Hz and F035 is F036 220V then at 60Hz the voltage is 110V.
F 035	Main V/F Pattern Maximum Voltage	220V Motor	0.1 to 255 Volts, Factory set: 220 Volts
		460V Motor	0.1 to 510 Volts, Factory set: 380 or 460 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 three sections, 1st, 2nd and Main 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.
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 RM5's default program.
- **Squared Curve** is for variable torque applications such as fans and pumps. Example: When the speed of a fan doubles the torque load increases by square (x^2).
- **Center Winding 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 increases, the motor's speed decreases and the torque load increase. The parameters of an expanded curve must be determined by the user. Keep in mind with AC motors with a constant torque load , if the voltage is decreased the current will increase.

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



Section 4.23) Power Interruption Ride-through

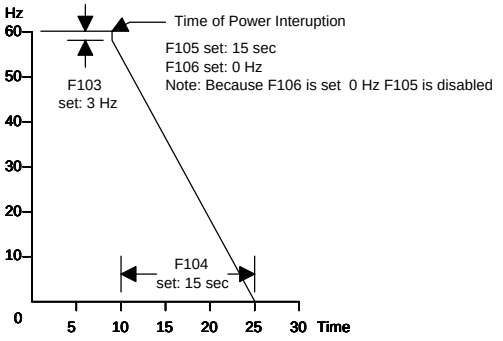
Power interruption is when the power goes off or the voltage goes below F 079 setting. If the power is interrupted the response is selected by F 078. Ride-through allows the to restart if the power is goes on in set time of F 089. For controlled stop programming see section 4.24

F 078	Power Interruption Response	0) Disable Ride-through Factory set: 0	
		1) Enable Ride-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 ride-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	

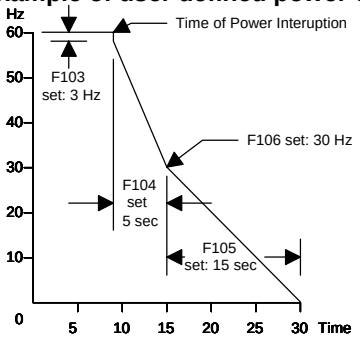
Section 4.24) Power Interruption Controlled Stop Program

If power is interrupted the factory settings are to let the motor coast to a stop. If controlled stop is required, F078 set to 3 will enable controlled stop. The deceleration curve can be defined by function codes F103, F104, F105, F106.

Factory set power off stop



Example of user defined power off stop



F 078	Power Interruption Response	0) Disable Ride-through Factory set: 0	
		1) Enable Ride-through	
		2) Shut Off (Uncontrolled Stop, Coast to Stop)	
		3) Enable Controlled Deceleration Stop when power is interrupted.	
F 079	Power Interruption Voltage Switch Point	220V Motor: 130V to 192V, Factory set 175V	
		460V Motor: 230V to 384V, Factory set 330V	
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 1st to 2nd decel 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.

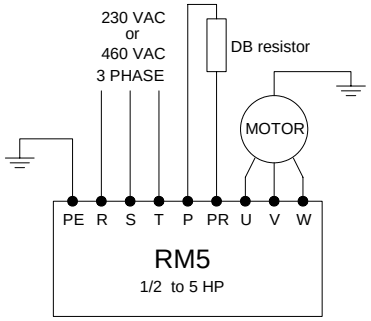
Section 4.25) DC Braking (i.e. Dynamic Braking, DB)

The RM5 will handle up to 50% of the motor's regenerative current without a dynamic braking resistor. If the motor's regenerative current exceeds 50%, a Dynamic Braking is required. The RM5 units rated from ½ to 5 Hp has a internal Dynamic Braking Transistor (DBT) as a standard feature. The RM5 from 7 ½ HP and higher require a external Dynamic Braking Unit (DBU), available at additional charge. If the customer requires the DBU (i.e. DBT) installed internally. It is available at additional charge and 4 weeks delivery time. The regenerative current created by the motor is determined by the motor's inertia, the load's inertia, the deceleration time and friction. The current rating of the DBU must be determined by the application engineer. If the current exceeds the rating of one DBU, additional DBUs can be connected in parallel (i.e. Master / Slave).

Instructions for ½ to 5 HP

Important, codes F075 and F077 only apply to ½ to 5 HP models or RM5 with the internal DBU installed. They don't apply to the external DBU5.

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: 0.5	This allows the DB resistor time to cool.



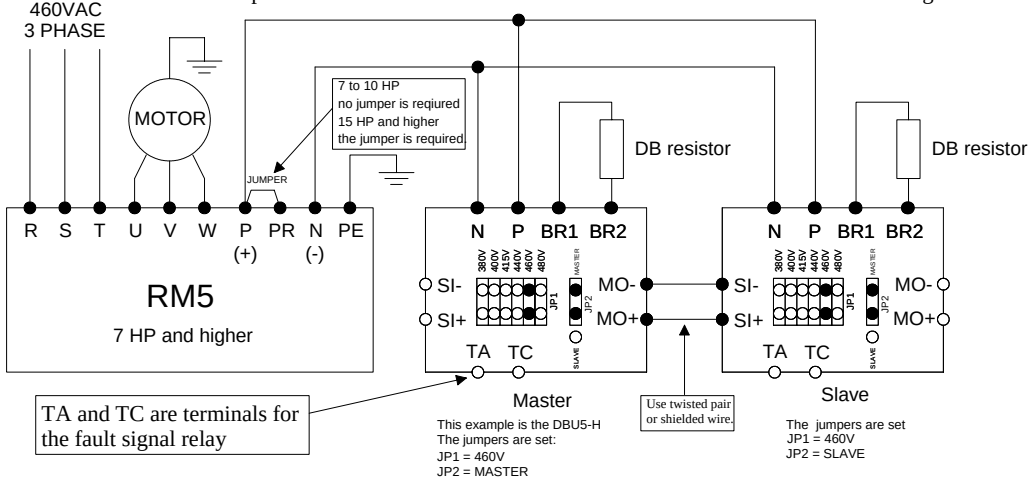
Instructions for external DBU

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

Four external DBU units are available.

Part # DBU5-L50 Rating: 230VAC, 50A Part # DBU5-H50 Rating: 460VAC, 50A
Part # DBU5-L75 Rating: 230VAC, 75A Part # DBU5-H75 Rating: 460VAC, 75A

WARNING: correct installation of the external DBU5 is critical. A wiring error will result in catastrophic failure of the DBU5 and RM5. Take extra care to be certian the wiring is correct.

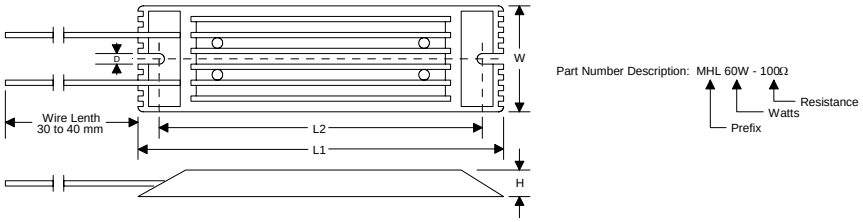


WARNING: If JP1 is set too low, the DBU5 will be on continuously, causing the the unit to fail

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 DBU and 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
RM5-200 ½	100Ω	MHL 100W-100Ω	RM5-4001	400Ω	MHL 100W-400Ω
RM5-2001	100Ω	MHL 100W-100Ω	RM5-4002	200Ω	MHL 100W-400Ω Two in parallel
RM5-2002	100Ω	MHL 100W-100Ω			
RM5-2003	40Ω	MHL 500W-40Ω	RM5-4003	133Ω	MHL 100W-400Ω Three in parallel
RM5-2005	40 Ω	MHL 500W-40Ω	RM5-4005	100Ω	MHL 100W-400Ω Four in parallel
RM5-2007	20 to 40Ω	MHL 500W-40Ω	RM5-4007	80Ω	MHL 500W-40Ω Two in series
RM5-2010	20 to 40Ω	MHL 500W-40Ω	RM5-4010	80Ω	MHL 500W-40Ω Two in series
RM5-2015	13.3Ω	MHL 500W-40Ω Three in parallel	RM5-4015	40Ω	MHL 500W-40Ω Two in series Two in parallel Total four pieces
RM5-2020	10Ω	MHL 500W-40Ω Four in parallel	RM5-4020	40Ω	MHL 500W-40Ω Two in series Two in parallel Total four pieces
RM5-2030	6.6Ω	MHL 500W-40Ω Six in parallel	RM5-4030	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 4.26) Store and Copy Programs

Function code F117 can be used to store custom a program and copy the program to another RM5 inverter. Example you have created a program and want to copy your program to another RM5. The program you created is now stored in the RM5 inverter, not the keypad. The program must be copied from the RM5 to the keypad.

Step One) Enter F117 and scroll to “rd_EE” and press and hold the enter key until the word “end” appears.

Step Two) Disconnect the keypad and connected it to the RM5 inverter you plan to copy the program to. Go to and enter F117 again and scroll to “UUr_EE” and press and hold enter until the word “end” appears again. If you want to copy the program to more inverters, repeat step two.

If the program you copied to the inverter is not satisfactory. The previous program can be restored by F117 setting “rES” by the same procedure performed previously.

F117	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 settings to RM5

Section 4.27) Locking Programs & 400 Hz Motors

The program can be locked to prevent unauthorized programing the RM5.

Typical 60 Hz motors can operate up to 120 Hz for 400 Hz motors F 092 must be set 2 or 3.

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 4.28) Restoring the factory settings

To restore the factory 60 Hz settings, go to F117. 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.

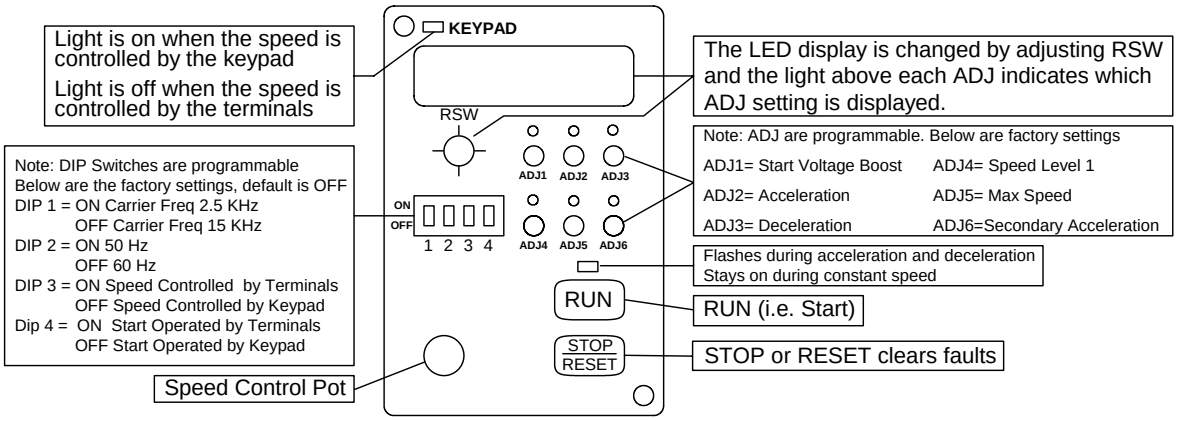
F117	Copy Commands	0) Not Active	SAu) Store User Settings
		CLF) Clear faults F 091	rES) Restore Previous settings
		dEF60) Restore factory 60 Hz settings	rd_EE) Copy RM5 settings to Keypad
		dEF50) Restore factory 50 Hz settings	UUr_EE) Copy Keypad setting to RM5

Section 5) Analog Keypad (KP-202)

Adjustments to the analog keypad (i.e. KP-202) are best made with a #00 Philips head screwdriver.

Section 5.1) KP-202 Factory Settings

The diagram below shows the KP-202 layout and factory default settings.
The KP-202 adjustment pots one through 6 (i.e. ADJ1 to 6) and dip switches function are shown in the diagram below. The RSW 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 Rotary Switch (RSW) Operation

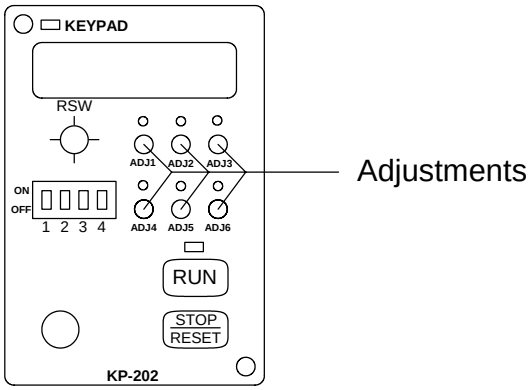
The RSW switch changes the LED display mode. See the table below for descriptions of each position of RSW. Positions 1 trough 6 display the program settings of ADJ 1 trough 6. All the other positions are not programmable (fixed).

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 Control 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) Adjustment (ADJ) Programming

The user can custom program the adjustments (ADJ) of the KP-202. Programming requires disconnecting the KP-202 and connecting KP-201. Function codes F 107 through F 112 are reserved for programming ADJ 1 to 6. See table below.

Adjustment	Function code reserved to program adjustment	Settings	Adjustment	Function code reserved to program adjustment	Settings
ADJ 1	F 107	1 to 47, factory set:19	ADJ 4	F 110	1 to 47, factory set: 1
ADJ 2	F 108	1 to 47, factory set: 9	ADJ 5	F 111	1 to 47, factory set:20
ADJ 3	F 109	1 to 47, factory set:10	ADJ 6	F 112	1 to 47, factory set:17



Example, to program ADJ 1 to Main Acceleration Time. Go to F107 and select 9. To read more information about Main Acceleration Time read F019 in the function code table.

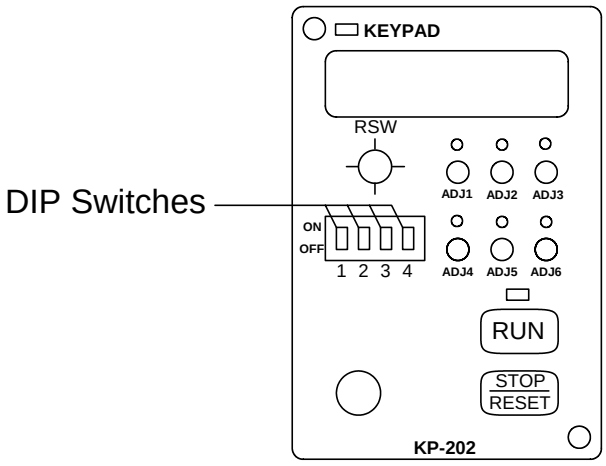
Setting	Function Description	Range of ADJ setting	See Code
0	Disable	No Function	NA
1	Speed Level 1 Hz	0.0 to 120 Hz	F010
2	Speed Level 2 Hz	0.0 to 120 Hz	F011
3	Speed Level 3 Hz	0.0 to 120 Hz	F012
4	Speed Level 4 Hz	0.0 to 120 Hz	F013
5	Speed Level 5 Hz	0.0 to 120 Hz	F014
6	Speed Level 6 Hz	0.0 to 120 Hz	F015
7	Speed Level 7 Hz	0.0 to 120 Hz	F016
8	Jog Speed	0.0 to 120 Hz	F017
9	Main 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 1 Freq., Switch Point	0.0 to the Freq., setting of F 034	F036
23	VF Pattern 1 Voltage., Switch Point	0.0 to the Volt., setting of F 035	F037

Setting	Function Description	Range of ADJ setting	See Code
24	VF Pattern 2 Freq., Switch Point	0.0 to the Freq., setting of F 034	F038
25	VF Pattern 2 Voltage., Switch Point	0.0 to the Volt., setting of F 035	F039
26	Speed Ref., Scale Max.	0.00 to 2.00	F040
27	Speed Ref., 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+, FM- Analog Meter Gain	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 of RM5 rating	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	DC 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

Section 5.4 DIP Switch Programing

The DIP switches enable or disable program functions. The user can custom program the DIP switches of the KP-202. Programming requires disconnecting the KP-202 and connecting KP-201. 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.

Section 6) Trouble Shooting

Section 6.1 Clearing Faults (Reset)

If one of the protection features is triggered. Trouble shoot the problem and then reset to clear the fault protection circuit. To reset press the STOP/RESET key or contact the RST terminal to COM.

Section 6.2 Keypad LED Display Fault Signals

When a fault occurs the keypad LED will display a abbreviation of the type of fault. The table below explains each abbreviation.

Keypad LED Display	Fault Condition	Possible Problems	Solutions
OC (Over Current)	If output current exceeds 200% of the control's rating. The over current protection circuit will switch off the control.	1) The acceleration time is too fast. 2) The motor ratings are incorrectly programmed.	1) Increase the acceleration time or use a higher horsepower control. 2) Check the motor's data plate and the control's program
OE (Over Voltage)	High regenerative voltage or high input voltage will cause the power filter circuit capacitor to exceed 125% of normal. The over voltage protection circuit will switch off the control.	1) The deceleration time is too fast. 2) The dynamic braking is inadequate. 3) Input voltage is too high.	1) Increase the deceleration time. 2) Increase the braking torque and the dynamic braking unit. 3) Lower the input voltage.
OL (Over Load of motor)	The motor's current rating was exceeded. See page 18.	Motor load too high.	Reduce motor load or the motor ratings are incorrectly programmed.
OLI (Over Load of Inverter)	The inverters power rating was exceeded.	Load is too high or inverter rating is too low.	Reduce motor load or install higher rated inverter.
OH (Over Heat)	If the heat sink temperature is too high. The thermal relay switches off the control.	1) Inadequate cooling. 2) Excessive load.	1) Improve heat sink ventilation and or clean the heat sink. 2) Reduce the load.
LE (Low Voltage)	If the input voltage is lower than 80% of normal. The output speed will be lowered. If the input voltage goes over 80% the output speed will go up to normal.	The input power is inadequate or faulty.	Trouble shoot the input power problem.
---- (Flashing)	Forward / Reverse operational error	The forward and reverse terminals are improperly wired or system is faulty.	Trouble shoot the forward and reverse wiring system.
GF (Ground Fault)	If the output current is unbalanced. The overload protection circuit switches off the control.	1) Faulty motor wiring 2) Motor leakage.	1) Check the motor wiring. 2) Check the leakage current of the motor.
EER	EEPROM error		Replace the control.
Err_00 or Err_01	Digital Keypad KP-201 disconnected during operation.		Reconnect keypad or check the wires and connections.
PadF	Analog Keypad KP-202 disconnected during operation.		Reconnect keypad or check the wires and connections.
SC (Blown Fuse)	Blown Fuse located inside the control.		Replace the fuse.

Section 6.3) Speed Oscillation during Acceleration

If the motor's speed is unstable during acceleration (the speed oscillates up and down). The function codes F048 Motor Maximum Load is set incorrectly. If F048 is set too high or low, excessive slip will occur, then causing the excessive slip compensation. Resulting in oscillation during acceleration.

RM5 Function Code Table					
F 000	Software Version	1 P5102A			
F 001	Start, Forward & Reverse Inputs	0) Terminals activate forward & start or reverse & start 1) Terminals activate forward & start 2) Keypad start, Terminals activate forward or reverse 3) Keypad start, forward only. Factory set:3			
F 002	Speed Control Input	0) Speed Pot Terminals 12V, Vin & GND or Current Ref., Iin & GND 1) Arrow keys with Hz display. Factory set:1 2) Arrow keys with RPM display when arrow keys are pressed 3) Arrow keys with Linear Speed display when arrow keys are pressed			
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 operation 1) Enable arrow key speed adjustment during operation. Factory set: 1			
F 005	Frequency Storage during operation	0) Disable frequency storage during operation, Arrow keys only. Factory set:0 1) Enable frequency storage during operation after 3 minutes, Arrow keys only			
F 006	Keypad Default Display	1) Hz Output 2) Speed Ref., Setting 3) Voltage 4) PN Voltage	5) Current 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	Main 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	Main Speed Level Acceleration Time also 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.) (40 HP and above 30 sec.)			
F 020	Main Speed Level Deceleration Time also 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.) (40 HP and above 30 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., Activated by input X4				
F 028	Secondary Decel Time	0.1 to 3200 Seconds, Factory set: 15 sec., Activated by input X4				
F 029	S-Curve Accel & Decel	0 to 5 Seconds, Factory set: 0 Sec.				
F 030	Maximum Output Voltage Options	0) Disable Maximum Output Voltage Limit 1) Enable Maximum Output Voltage Limit. Factory set: 1				
F 031	Maximum Output Frequency	0.01 to 400Hz, 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	220V Motor, 0 to 50 Volts, Factory set: 6 Volts 460V Motor, 0 to 100 Volts, Factory set: 12 Volts				

F 034	Main V/F Pattern Frequency Scale	0.01 to 400 Hz, Factory Set: 60 Hz	The main 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	Main V/F Pattern Maximum Voltage	220V Motor, 0.1 to 255 Volts, Factory set: 220 Volts 460V Motor, 0.1 to 510 Volts, Factory set: 460 Volts	
F 036	1st V/F Pattern Frequency Scale and 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	1st V/F Pattern Maximum Voltage	220V Motor, 0 to 255 Volts, Factory set: 0 Volts 460V Motor, 0 to 510 Volts, Factory set: 0 Volts	
F 038	2nd V/F Pattern Frequency Scale and 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	2nd V/F Pattern Maximum Voltage	220V Motor, 0 to 255 Volts, Factory set: 0 Volts 460V Motor, 0 to 510 Volts, Factory set: 0 Volts	
F 040	Speed Reference Scale Maximum	0.00 to 2 ratio Factory set: 1	The speed reference voltage scale is 0 to 10V and the current scale is 4 to 20 mA. The maximum value can be be reduced. Example: (10/1.25=8) the scale is 0 to 8 V
F 041	Speed Reference Scale Minimum	-1 to 1 ratio Factory set: 0	The minimum value of the speed reference scale can be increased. Example: (-0.2x10 = 2) the scale is 2 to 10 Volts
F 042	Frequency Operating Range, Maximum	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	Frequency Operating Range, Minimum	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	Meter Output of FM+	0) Frequency Output. Factory set: 0 1) Speed Ref. Setting in Hz 2) Current Output	
F 045	Meter Gain of FM+	0.01 to 2.00 of F 044 setting, Factory set: 1	
F 046	Slow Overload	0) Disable Motor Over Current Protection 1) Enable Motor Over Current Protection, Factory set: 1	
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 Maximum Current Rating	Set according to motor's data plate	
F 049	Motor's No Load Current Rating	Set according to motor's data plate	
F 050	Motor Slip Compensation	-9.9 to 5 Hz Set according to load condition. Factory set: 0	
F 051	Number of Motor Poles	2 to 10 Poles, Calibrates RPM and Custom Speed. Factory set: 4P	

			Table for Terminals X1 through X6 (Note: Input Signal +1 High, -1 Low)	
F 052	X1 Input Terminal	Factory set: 3	+/-1) Jog	+/-7) External fault signal input
F 053	X2 Input Terminal	Factory set: 4	+/-2) Secondary Accel & Decel	+/-8) Disable Outputs
F 054	X3 Input Terminal	Factory set: 1	+/-3) Multiple Speed Level 1	+/-9) E. Stop with no decel control
F 055	X4 Input Terminal	Factory set: 2	+/-4) Multiple Speed Level 2	+/-10) Resume Programmed Speed
F 056	X5 Input Terminal	Factory set: 7	+/-5) Multiple Speed Level 3	+/-11) Resume Speed Ref., Setting
F 057	X6 Input Terminal	Factory set: 6	+/-6) Reset	+/-12) Disable for Accel & Decel

			Table for Y1 and Y2 and Ta, Tb relay (Note: Input Signal +1 High, -1 Low)	
F 058	Y1 Terminal	Factory set: 1	+/-1) Rotation Detect	+/-7) Low Input Voltage Detect
F 059	Y2 Terminal	Factory set: 2	+/-2)Constant Speed Detect	+/-8) Braking
F 060	Ta, Tb Relay Terminals	Factory set:11	+/-3) Zero Rotation Detect	+/-9) Low Voltage Ride through Detect
			+/-4) Freq., Output Detect	+/-10) General Fault Ride through Detect
			+/-5) Overload Detect	+/-11) General Fault Detect
			+/-6) Stall Prevention Detect	

F 061	Constant Speed Bandwidth for Speed Ref., Setting	0.0 to 10 Hz, Factory set: 2 Hz	When Y1 or Y2 or relay T are set to 2 and the output frequency is within the bandwidth of F061 the terminals will signal
F 062	Constant Speed Bandwidth for Programmed Speed	0.0 to 10 Hz, Factory set: 2 Hz	When Y1 or Y2 or relay T 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	0) Disable Overload Signal, Factory set: 0 1) Enable Overload Signal	
F 066	Overload Conditions	0) Signal Overload only when operating 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	Constant Speed Stall Prevention	30 % to 200% of the motor's rated current before speed reduction Factory set: 170%	
F 071	Acceleration Stall Prevention	30 % to 200% of the motor's rated current before acceleration levels. Factory set: 160%	
F 072	Constant Speed Stall Prevention Recovery Acceleration	0.1 to 3200 sec. Factory set:15	Acceleration Time to recover from stall when running at constant speed.
F 073	Constant Speed Stall Prevention Recovery Deceleration	0.1 to 3200 sec. Factory set:15	Deceleration Time to recover from stall when running 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 Rotor Magnetizing Time	0 to 20 Sec. Factory set: 0	Before starting, DC voltage is applied to the stator to magnetize the rotor. This function is similar to the starting capacitor on a single phase AC motor.
F 078	Power Interruption Response	0) Disable Ride-through. Factory set: 0 1) Enable Ride-through 2) Switch Off 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 Ride-through	0 to 16 Factory set: 0	If a fault is dected and then quickly corrects its self. The RM5 will continue to run (ride through). F080 sets the number of permissible ride-throughs.
F 081	Carrier Frequency	1 to 6	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. Factory set: 4
F 082	Stop	0) Controlled Deceleration Stop, Factory set: 0 1) Uncontrolled Deceleration Stop (Freewheeling)	
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 skips 1, 2 and 3. Application 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 interrupted the motor will restart in the amount of time programmed.
F 090	V/F Pattern of Speed Tracking	0 to 100% Factory set: 100%	
F 091	Fault Record	Displays the last five faults	
F 092	Lock Program Functions	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 120 Hz to 400 Hz 3) Lock functions: Max frequency is 120 Hz to 400 Hz	
F 093	Automatic Voltage Regulation (AVR)	0) Disable AVR 1) Enable AVR, Factory set: 1	When external DBU is installed disable AVR
F 094	Overload Protection	0) Disable Overload Protection 1) Enable Overload Protection, Factory set: 1	
F 095	Input Voltage Reference	RM5-2*** 190 to 240 volts Factory set: 220V RM5-4*** 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	Energy 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 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 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 1st to 2nd decel time	0.0 to 400 Hz, Factory set: 0.0	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.
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	Copy Commands Default: 0	Table for F 117 0) Not active SAu) Store User Settings 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.	

F 092	400 Hz Operation (i.e. Lock Program Functions)
F 036	1st V/F Pattern Frequency Scale and Switch Point
F 037	1st V/F Pattern Maximum Voltage
F 038	2nd V/F Pattern Frequency Scale and Switch Point
F 039	2nd V/F Pattern Maximum Voltage
F 039	2nd V/F Pattern Maximum Voltage
F 018	Acceleration & Deceleration Frequency Scale
F 029	Acceleration & Deceleration Time of S-Curve
F 071	Acceleration Stall Prevention
F 019	Acceleration Time of Main Speed Level & Levels 4, 5, 6, 7 & Jog
F 027	Acceleration Time of Secondary
F 021	Acceleration Time of Speed Level 1
F 021	Acceleration Time of Speed Level 1
F 023	Acceleration Time of Speed Level 2
F 023	Acceleration Time of Speed Level 2
F 025	Acceleration Time of Speed Level 3
F 025	Acceleration Time of Speed Level 3
F 040	Analog Speed Ref. Scale Maximum
F 041	Analog Speed Reference Scale Minimum
F 093	Automatic Voltage Regulation (AVR)
F 033	Boost Voltage of Start
F 084	Bypass 1, Frequency
F 085	Bypass 2, Frequency
F 086	Bypass 3, Frequency
F 087	Bypass Bandwidth, Frequency
F 081	Carrier Frequency
F 062	Constant Speed Bandwidth for Programmed Speed
F 061	Constant Speed Bandwidth for Speed Reference Setting
F 063	Constant Speed Detect Output Signal
F 070	Constant Speed Stall Prevention
F 072	Constant Speed Stall Prevention Recovery Acceleration
F 073	Constant Speed Stall Prevention Recovery Deceleration
F 117	Copy Commands
F 096	Creeping Start Frequency
F 097	Creeping Start Time
F 007	Custom Speed Calibration
F 008	Custom Speed Decimal Point Display
F 075	DC Braking Current
F 077	DC Braking During Start
F 076	DC Braking Time Delay before Restart
F 029	Deceleration & Acceleration Time of S-Curve
F 074	Deceleration Stall Prevention
F 105	Deceleration Time after F 106
F 104	Deceleration Time from F103 to F106
F 020	Deceleration Time of Main Speed Level & Levels 4, 5, 6, 7 & Jog
F 028	Deceleration Time of Secondary
F 022	Deceleration Time of Speed Level 1
F 022	Deceleration Time of Speed Level 1
F 024	Deceleration Time of Speed Level 2
F 024	Deceleration Time of Speed Level 2
F 026	Deceleration Time of Speed Level 3
F 026	Deceleration Time of Speed Level 3
F 008	Decimal Point of Custom Speed Display

RM5 Function Code Table in Alphabetical Order

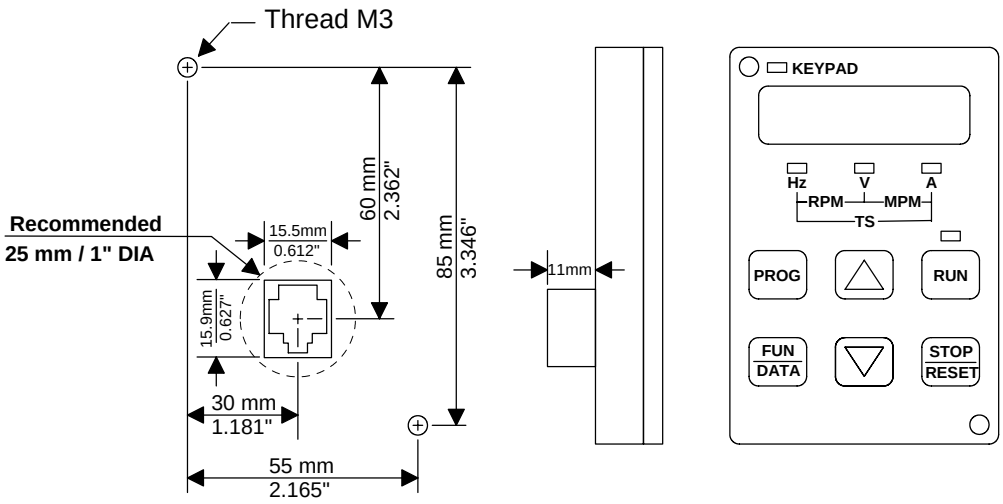
F 006	Default Display for Keypad
F 099	Digital Meter 1
F 100	Digital Meter 2
F 101	Digital Meter 3
F 102	Energy Economy
F 067	Fast Overload
F 068	Fast Overload Level
F 069	Fast Overload Response Time
F 091	Fault Record
F 045	FM+ Meter Gain
F 044	FM+ Meter Output Selection
F 001	Forward, Reverse & Start Inputs
F 084	Frequency Bypass 1
F 085	Frequency Bypass 2
F 086	Frequency Bypass 3
F 087	Frequency Bypass Bandwidth
F 031	Frequency Maximum Output
F 018	Frequency of Acceleration & Deceleration
F 017	Frequency of Jog
F 009	Frequency of Main Speed Level
F 010	Frequency of Speed Level 1
F 011	Frequency of Speed Level 2
F 012	Frequency of Speed Level 3
F 013	Frequency of Speed Level 4
F 014	Frequency of Speed Level 5
F 015	Frequency of Speed Level 6
F 016	Frequency of Speed Level 7
F 032	Frequency of Start
F 042	Frequency Operating Range, Maximum
F 042	Frequency Operating Range, Maximum
F 043	Frequency Operating Range, Minimum
F 043	Frequency Operating Range, Minimum
F 005	Frequency Storage during Operation
F 092	Function Program Locks
F 080	General Fault Ride-through Limit
F 095	Input Voltage Reference
F 017	Jog Frequency
F 006	Keypad Default Display
F 004	Keypad Speed Adjustment
F 003	Keypad Stop
F 080	Limit of General Fault Read-through
F 092	Lock Program Functions
F 103	Low Input Voltage Frequency Reduction
F 079	Low Input Voltage Switch Off Point
F 019	Main Speed Level Acceleration Time & Levels 4, 5, 6, 7 & Jog
F 020	Main Speed Level Deceleration Time & Levels 4, 5, 6, 7 & Jog
F 009	Main Speed Level Frequency
F 034	Main V/F Pattern Frequency Scale
F 035	Main V/F Pattern Maximum Voltage
F 031	Maximum Output Frequency
F 031	Maximum Output Frequency
F 030	Maximum Output Voltage
F 030	Maximum Output Voltage
F 099	Meter 1 Digital Display
F 100	Meter 2 Digital Display
F 101	Meter 3 Digital Display

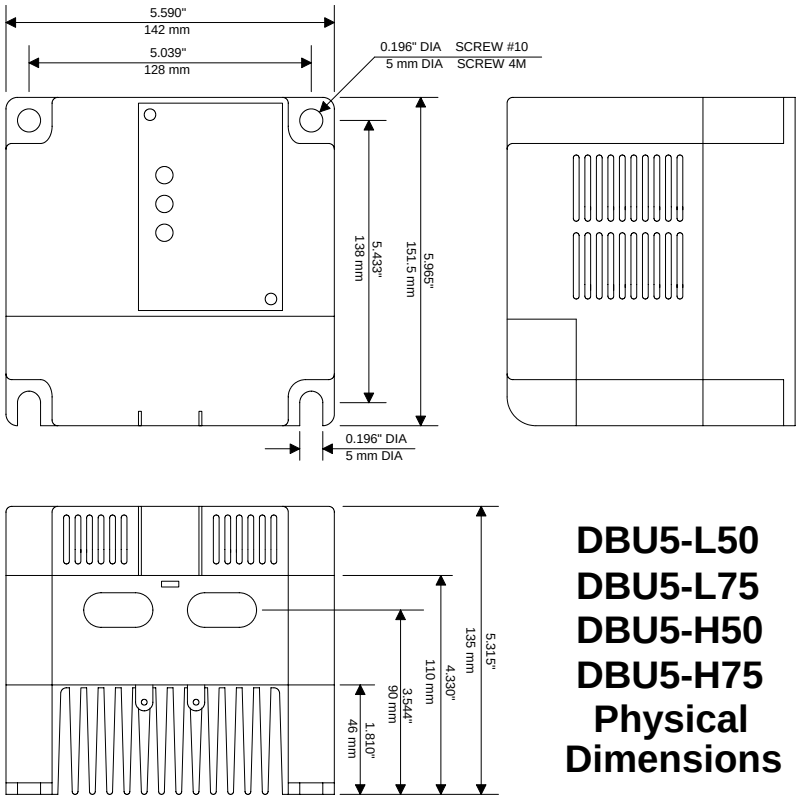
F 045	Meter Gain of FM+
F 044	Meter Output of FM+
F 098	Meters, Number of Digital Meters
F 046	Motor Over Current Protection
F 046	Motor Over Current Protection
F 047	Motor Over Current Shut Off Time
F 047	Motor Over Current Shut Off Time
F 050	Motor Slip Compensation
F 048	Motor's Maximum Current Rating
F 048	Motor's Maximum Current Rating
F 049	Motor's No Load Current Rating
F 049	Motor's No Load Current Rating
F 098	Number of Digital Meters
F 051	Number of Motor Poles
F 031	Output Frequency Maximum
F 030	Output Voltage Maximum
F 065	Overload Detect Signal
F 066	Overload Detect Signal Conditions
F 068	Overload Level
F 094	Overload Protection
F 067	Overload Response
F 069	Overload Response Time
F 051	Pole Count of Motor
F 078	Power Interruption Response
F 089	Power Interruption Restart Time
F 105	Power Interruption Deceleration Time after Switch Point F 106
F 104	Power Interrruption Deceleration Time from Switch Points F103 to F106
F 103	Power Interruption Frequency Reduction
F 106	Power Interruption Switch Point Frequency from F104 to F105
F 079	Power Interruption Voltage Switch Off Point
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	Restore Factory Settings
F 083	Reverse
F 001	Reverse, Forward & Start Inputs
F 080	Ride-through General Fault Limit
F 029	S-Curve Accel & Decel
F 027	Secondary Acceleration Time
F 028	Secondary Deceleration Time
F 050	Slip Compensation of Motor
F 000	Software Version
F 046	Slow Overload
F 047	Slow Overload Options
F 004	Speed Adjustment with Keypad
F 007	Speed Calibration of Custom Speed Display
F 002	Speed Control Input
F 010	Speed Level 1 Frequency
F 011	Speed Level 2 Frequency

RM5 Function Code Table in Alphabetical Order

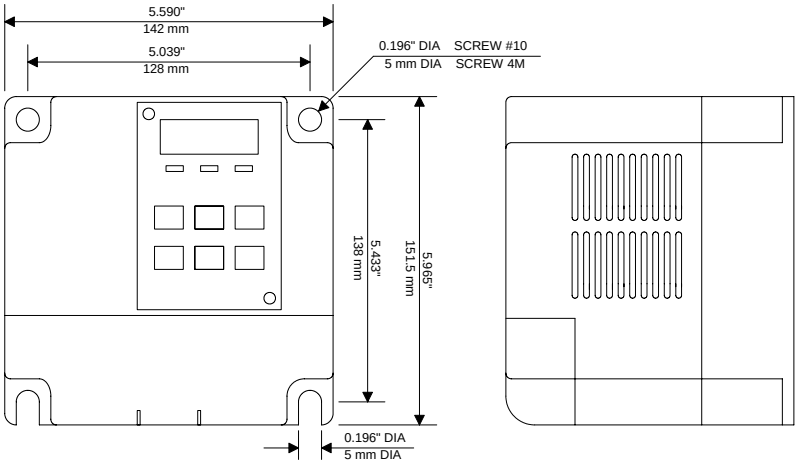
F 012	Speed Level 3 Frequency
F 013	Speed Level 4 Frequency
F 014	Speed Level 5 Frequency
F 015	Speed Level 6 Frequency
F 016	Speed Level 7 Frequency
F 040	Speed Reference, Analog Scale Maximum
F 041	Speed Reference, Analog Scale Minimum
F 088	Speed Tracking Current
F 090	Speed Tracking V/F Pattern
F 070	Stall Prevention at Constant Speed
F 071	Stall Prevention during Acceleration
F 074	Stall Prevention during Deceleration
F 072	Stall Prevention Recovery Acceleration at Constant Speed
F 073	Stall Prevention Recovery Deceleration at Constant Speed
F 001	Start, Forward & Reverse Inputs
F 033	Starting Boost Voltage
F 033	Starting Boost Voltage
F 032	Starting Frequency
F 032	Starting Frequency
F 082	Stop
F 003	Stop with Keypad
F 106	Switch Point Frequency from F104 to F105
F 060	Ta, Tb Relay Terminals
F 052	Terminal X1
F 053	Terminal X2
F 054	Terminal X3
F 055	Terminal X4
F 056	Terminal X5
F 057	Terminal X6
F 058	Terminal Y1
F 059	Terminal Y2
F 060	Terminals of Relay Ta, Tb
F 076	Time Delay before Restart after DC Braking
F 064	Torque Boost Gain
F 007	User Defined Meter (i.e.MPM)
F 036	V/F Pattern 1st Frequency Scale and Switch Point
F 037	V/F Pattern 1st Voltage Maximum
F 038	V/F Pattern 2nd, Frequency Scale and Switch Point
F 039	V/F Pattern 2nd, Maximum Voltage
F 034	V/F Pattern Main Frequency Scale
F 035	V/F Pattern Main Voltage Maximum
F 090	V/F Pattern of Speed Tracking
F 033	Voltage Boost of Start
F 030	Voltage Output Maximum
F 052	X1 Input Terminal
F 053	X2 Input Terminal
F 054	X3 Input Terminal
F 055	X4 Input Terminal
F 056	X5 Input Terminal
F 057	X6 Input Terminal
F 058	Y1 Terminal
F 059	Y2 Terminal

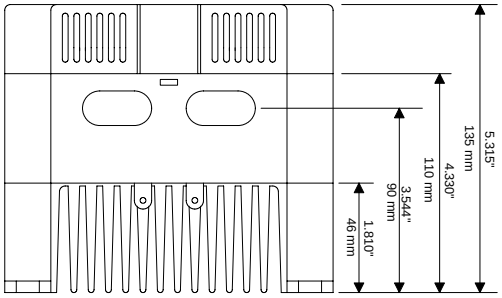
KP-201 and KP-202 have the same mounting dimensions



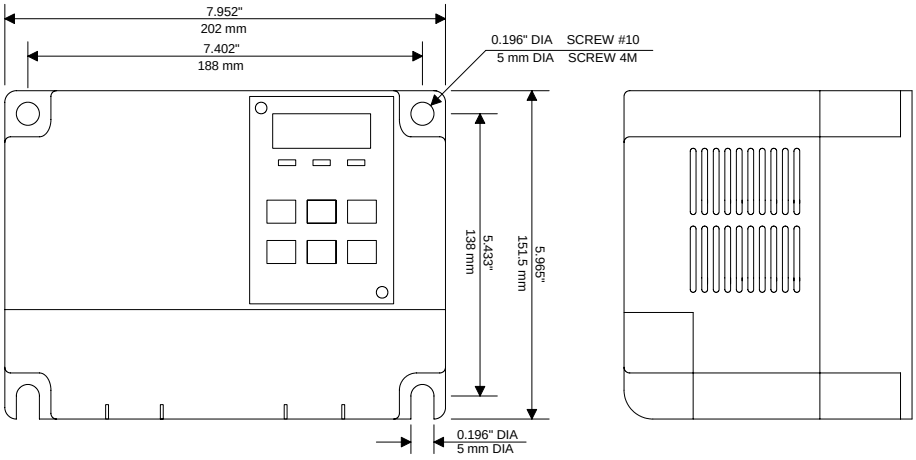


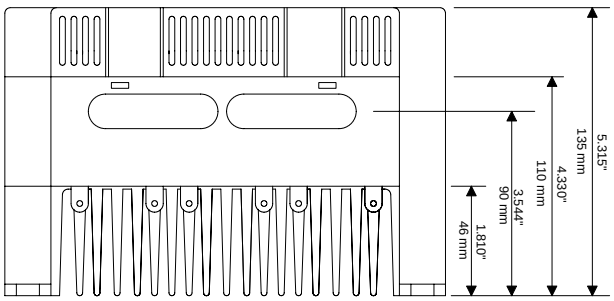
DBU5-L50
DBU5-L75
DBU5-H50
DBU5-H75
Physical Dimensions



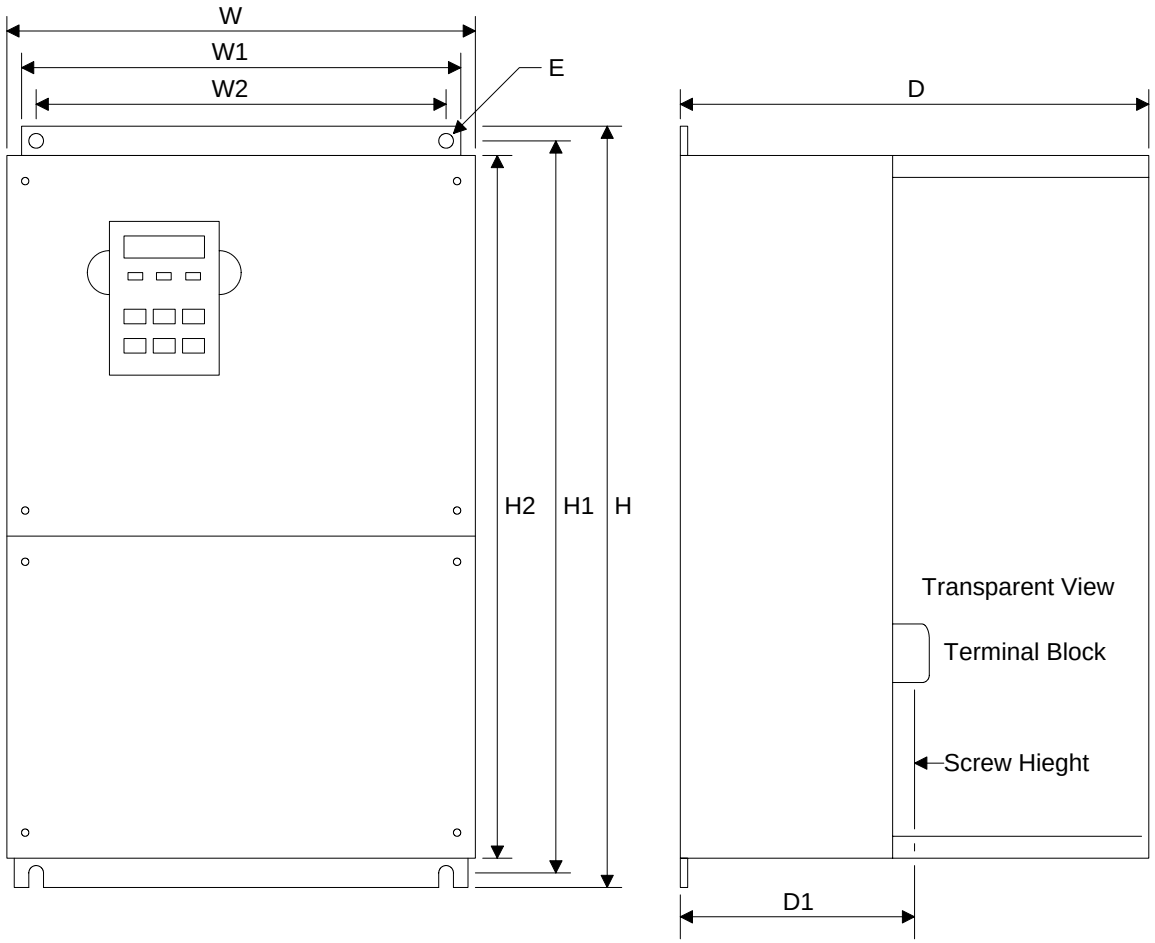


1 & 2 HP Physical Dimensions





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 21/32	8	7 9/32	12 7/16	11 13/16	11 1/2	7 9/16	3 13/16	10-32
10 (220/460)									
15 (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
20 (220/460)									
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)									

Specifications

230 Volt Input

Model Number	RM5-2001	RM5-2002	RM5-2003	RM5-2005	RM5-2007	RM5-2010	RM5-2015	RM5-2020	RM5-2025	RM5-2030	RM5-2040	RM5-2050	RM5-2060	RM5-2075
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 Power Range (V)	180 to 253 V													
Input Frequency Fluctuation Range (Hz)	+/- 5%													

460 Volt Input

Model Number	RM5- 4001	RM5- 4002	RM5- 4003	RM5- 4005	RM5- 4007	RM5- 4010	RM5- 4015	RM5- 4020	RM5- 4025	RM5- 4030	RM5- 4040	RM5- 4050	RM5- 4060	RM5- 4075	RM5- 4100	RM5- 4125	RM5- 4150
Horsepower	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
Current Rating (A)	2.5	4	6	9	14	18	24	30	39	45	61	73	87	110	137	176	204
Output Voltage (V)	380 to 460V 3ϕ																
Output Frequency Range (Hz)	0.01 to 400 Hz																
Input Power (V, ϕ, Hz)	380 to 460V / 50 to 60 Hz / 3ϕ																
Input Power Range (V)	323 to 506 V																
Input Frequency Fluctuation Range (Hz)	+/- 5%																

Common Specifications

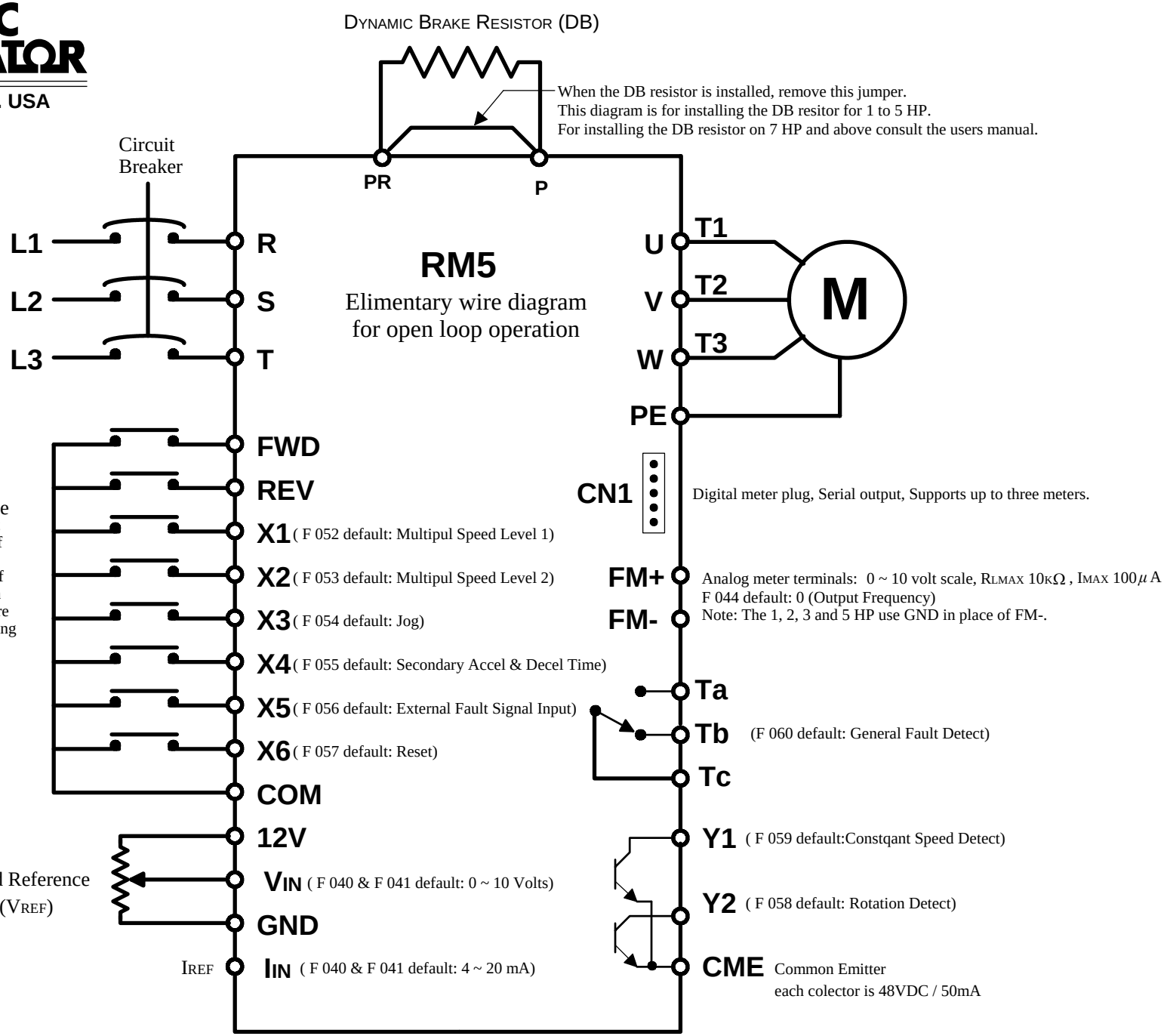
Motoring Features	Output Signal	Pulse Width Modulation (PWM) to synthesize sinusoidal wave
	Frequency Range	0.01 to 400 Hz (see F092)
	Frequency Resolution	0.1 Hz
	Overload Current	150% of motor's rating for 1 minute (see F046, F047, F048)
	Acceleration and Deceleration Scale	0.1 to 3200 seconds. Free 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)

ELECTRIC REGULATOR

CARLSBAD, CA. USA
1-800-458-6566

RM5

Elimentary wire diagram
for open loop operation



Multi Speed Table

	X1	X2
Main Level	Off	Off
Level 1	Off	On
Level 2	On	Off
Level 3	On	On

Levels 4, 5, 6 and 7 are availbe by programming X3 (F 054) to 5.