

MD290-652 High Speed Spindle Dedicated AC Drive Commissioning Guide

Version	Author	Release Date	Revise record
V8.0	Eric, Bensen, David	2019-07-26	Added Wiring diagram
V9.0	Eric, Bensen, David	2019-09-09	Editorial corrections
V10.0	David	2020-01-16	Improved parameter explanations
V11.0	Bensen	2020-05-27	Add F0-22 Frequency resolution into parameters list
V12.0	David	2022-01-26	Add parameters F3-01, F3-10 and F3-23 into parameters list

1. Product Information.

1) General Specifications

MD290-652 high speed spindle dedicated AC drive is a variant of MD290, which is applied to driving high speed spindle of various machine tools and engraving machines. The key specifications are described as below table.

Product Series	Rated Input Voltage(V)	Power Rating (kW)	Max. Output Frequency (Hz)	Max. Switching Frequency (kHz)
MD290TXXXGB-652-INT	3ph*400	1.1~37	4500	27*
MD290-2TXXGB-652-INT	3ph*200	1.5~11	4500	27*

*Carrier frequency will be adjusted automatically with the increase of output frequency.

2) Product Models and Dimensions

The available models, output current ratings and dimensions are described in the tables below.

Table 1. 3ph 400V supply models

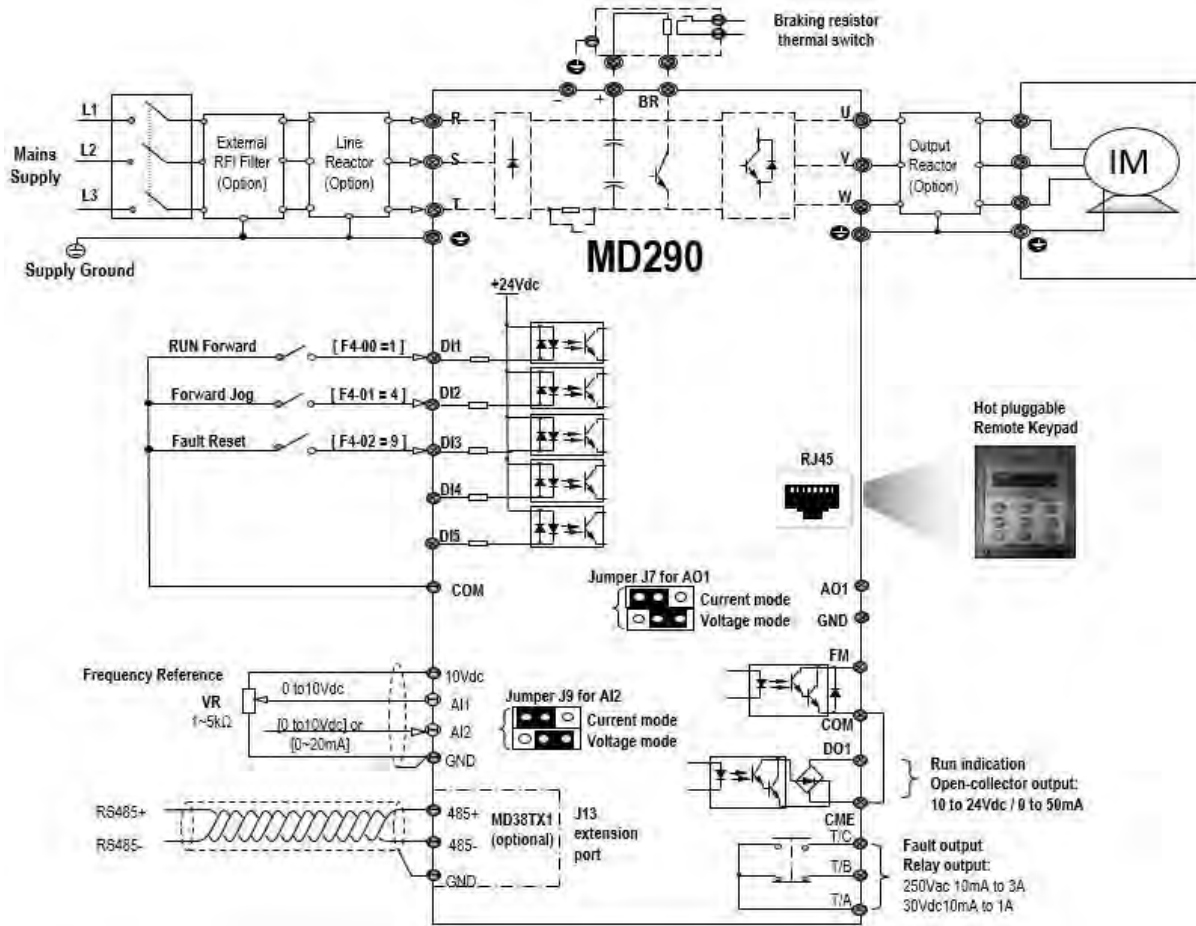
Models	Rated output Current (A)	Dimensions H x W x D (mm)	Frame Size
MD290T1.1G/1.5PB-652-INT	3.1	200x130x152	T1
MD290T1.5G/2.2PB-652-INT	3.8		
MD290T2.2G/3.0PB-652-INT	5.1		
MD290T3.0G/3.7PB-652-INT	7.2		
MD290T3.7G/5.5PB-652-INT	9.0	200x130x162	T2
MD290T5.5G/7.5PB-652-INT	13		
MD290T7.5G/11PB-652-INT	17	250x140x170	T3
MD290T11G/15PB-652-INT	25		
MD290T15G/18.5PB-652-INT	32	280x180x170	T4
MD290T18.5G/22PB-652-INT	37	350x210x192	T5
MD290T22G/30PB-652-INT	45		
MD290T30G/37PB-652-INT	60	400x250x220	T6
MD290T37G/45PB-652-INT	75		

Table 2. 3ph 200V supply models

Model	Rated output current (A)	Dimensions (H x W x D, mm)	Frame Size
MD290-2T1.5GB/2.2PB-652-INT	7.2	200x130x152	T1
MD290-2T2.2GB/3.7PB-652-INT	9	200x130x162	T2
MD290-2T3.7GB/5.5PB-652-INT	13		
MD290-2T5.5GB/7.5PB-652-INT	25	250x140x170	T3
MD290-2T7.5GB/11PB-652-INT	32	280x180x170	T4
MD290-2T11GB/15PB-652-INT	45	350x210x192	T5

Note: For the selection of above models, we should consider the actual working conditions, such as the actual output frequency and load level actually used in the application (please refer to appendix A, B and C).

2. Wiring diagram.



3. Quick Start to Set Parameters.

Most of the parameters of MD290-652 are the same as those of MD290 standard version, below table lists out the closely related parameters for spindle driving application.

No.	Para. code	Setting Value	Function Description	Remark
1	FP-01	1	Restore factory settings	Mandatory
2	F0-02	1	Running command selection: Terminal	Basic parameters for spindle application, set according to actual requirements.
3	F0-03	2	Main frequency reference AI1 (0 V-10 V)	
4	F0-10	400.00 Hz	Max. running frequency (e.g 400 Hz)	
5	F0-08	400.00 Hz	Preset running frequency (e.g 400 Hz)	
6	F0-12	400.00 Hz	Upper limit frequency (e.g 400 Hz)	
7	F0-17	2.0~3.0 s	Acceleration time	
8	F0-18	2.0~3.0 s	Deceleration time	
9	F0-22	1	Frequency resolution, 1: 0.1Hz; 2: 0.01Hz	
10	F0-15	20 kHz (default)	Carrier frequency between 1500 and 3300 Hz	A5-08 can be set to max.15 kHz. (For more details refer to Appendix A)
11	A5-08	0 (default, invalid)	Carrier frequency below 500 Hz	
12	F1-00	1	Motor type: asynchronous motor	Spindle motor parameters, set according to the nameplate.
13	F1-01	5.5 kW	Motor rated power	

No.	Para. code	Setting Value	Function Description	Remark
14	F1-02	380 V	Motor rated voltage	Spindle motor parameters, set according to the nameplate.
15	F1-03	12.0 A	Motor rated current	
16	F1-04	400.00 Hz	Motor rated frequency	
17	F1-05	24000 RPM	Motor rated Speed	
18	F3-00	1	Multi-point V/F curve	Set to 1 if F3-03 to F3-08 are also set (to values different than default)
19	F3-01	0.0	Torque Boost	Set to 0.0 (automatic) in case of performing motor auto-tuning. In case that auto-tuning is not possible, please increase the value in steps of 0.1 until the motor torque at low speeds is sufficient for the application.
20	F3-03	0.00 Hz (default)	Multi-point V/F frequency 1	e.g 0 Hz
21	F3-04	0.0 %(default)	Multi-point V/F voltage 1	e.g 2 %~4 %
22	F3-05	0.00 Hz (default)	Multi-point V/F frequency 2	e.g 100 Hz
23	F3-06	0.0 %(default)	Multi-point V/F voltage 2	e.g 26 %~30 %
24	F3-07	0.00 z (default)	Multi-point V/F frequency 3	e.g 300 Hz
25	F3-08	0.0 %(default)	Multi-point V/F voltage 3	e.g 75 %~80 %
26	F3-10	0	V/F over-excitation gain	Set to 0 when using braking resistors.
27	F3-23	0	Voltage limit selection	
28	F3-18	150 % (default)	Current limit trigger threshold	If overcurrent occurs, decrease trigger threshold and increase gain in the meantime.
29	F3-20	20 (default)	Current limit gain	
30	F3-22	770V (default)	Voltage limit trigger threshold	If overvoltage occurs, decrease trigger threshold and increase gain in the meantime. No need to set if braking resistor is used.
31	F3-25	30 (default)	Voltage limit gain	
32	F4-00	1	DI1 function selection: Forward Run (FWD)	Normally assign DI1.
33	F4-01	2	DI2 function selection: Reverse Run (REV)	Normally assign DI2.
34	F4-11	0 (default)	Terminal I/O control mode: 0: Two-wire control mode 1; 1: Two-wire control mode 2; 2: Three-wire control mode 1; 3: Three-wire control mode 2	Two-wire control mode 1 is the most commonly selected.
35	F4-15	10 V (default)	AI1 max. input voltage	Slightly adjust according to actual value if needed.
36	F4-16	100 % (default)	Corresponding setting of AI1 Max. input	
37	F5-04	1 (default)	DO1 function selection	VFD running indication.
38	F5-02	2 (default)	Relay (T/A-T/B-T/C) function selection	Fault output
39	F6-10	0 (default)	Stop mode 0: Decelerate to stop 1: Coast to stop	Should be set to "Decelerate to stop".
40	F6-11	0.00 Hz (default)	DC injection braking start frequency	Normally not needed.
41	F6-13	50 % (default)	DC injection braking current level	Recommended setting is
42	F6-14	0.0 s (default)	DC injection braking active time	F6-11=1 Hz, F6-14=1.0 s if needed.

4. Example of commissioning.

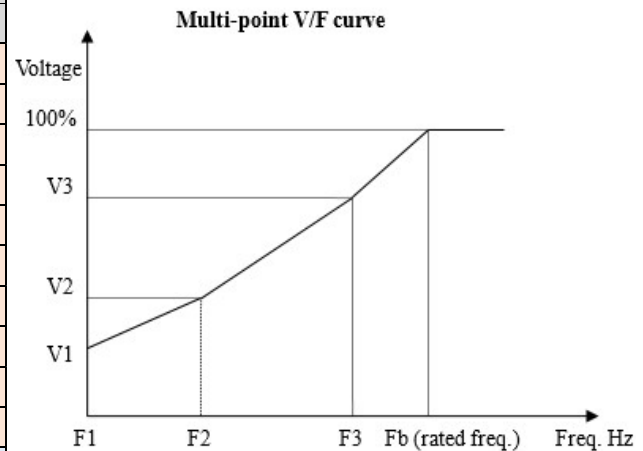
MD290T5.5G/7.5PB-652-INT applied to Spindle Driving of Precision engraving machine.

Spindle motor: 5.5 kW, 380 V, 12 A, 24000 rpm, 400 Hz, 2 poles.

- The machine requires AC drive to drive the spindle 0~24000 rpm corresponding to 0~10 V DC analog signal given by CNC controller.
- The machine requires that the speed fluctuation is small in the full speed range and large low-speed torque to ensure low-speed cutting.
- CNC controller outputs a digital signal to enable AC drive to forward run.
- CNC controller requires AC drive to feedback running indication and fault signal.

Key parameters setting list

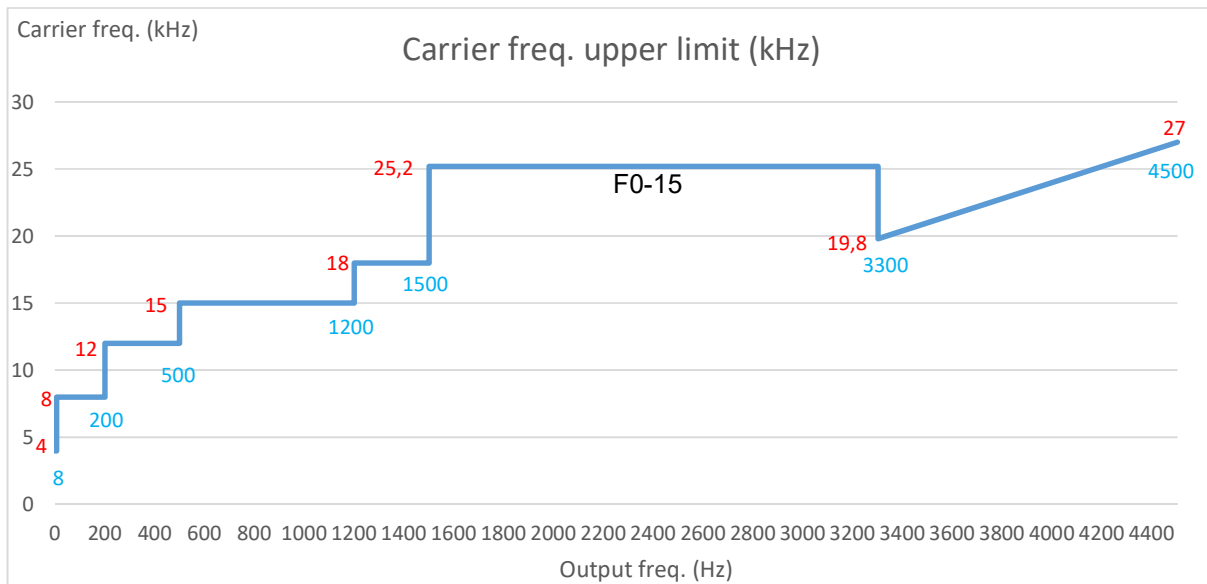
Para.	Setting Value	Function Description
F0-02	1	Terminal command
F0-03	2	Main freq. reference AI1
F0-10	400.00 Hz	Maximum running frequency
F0-08	400.00 Hz	Preset running frequency
F0-12	400.00 Hz	Upper limit frequency
F0-17	2.0~3.0 s	Acceleration time
F0-18	2.0~3.0 s	Deceleration time
F1-00	1	Asynchronous motor
F1-01	5.5 kW	Motor rated power
F1-02	380 V	Motor rated voltage
F1-03	12.0 A	Motor rated current
F1-04	400.00 Hz	Motor rated frequency
F1-05	24000 RPM	Motor rated Speed
F3-00	1	Multi-point V/F curve
F3-01	1.0	Torque boost
F3-03	0.00 Hz	Multi-point V/F frequency 1
F3-04	1.0 %~4.0 %	Multi-point V/F voltage 1
F3-05	100.00 Hz	Multi-point V/F frequency 2
F3-06	26.0 %~30.0 %	Multi-point V/F voltage 2
F3-07	300.00 Hz	Multi-point V/F frequency 3
F3-08	75.0 %~80.0 %	Multi-point V/F voltage 3
F3-10	0	V/F over-excitation gain
F3-23	0	Voltage limit selection
F4-00	1	DI1 function: Forward Run
F4-15	10 V (default)	AI1 max. input voltage
F4-16	100 % (default)	Corresponding setting of AI1 Max. input
F5-04	1 (default)	VFD running indication
F5-02	2 (default)	Fault output



Note: For other information such as Error codes and troubleshooting please refer the MD290 User Guide.

Appendix A: Carrier frequency characteristic MD290-652 drive.

The carrier frequency characteristic depending on the drive output frequency of MD290-652 drive is described in the chart and table below.



Output freq.(Hz)	0~8	8~200	200~500	500~1200	1200~1500	1500~3300	3300~4500
Carrier freq. upper limit (kHz)	4	8	12	15	18	25.2	19.8~27 (Synchronous Modulation)
Actual carrier freq. (kHz) when A5-08=0 (default) and F0-15=20 kHz (default)	Fixed to 4	Fixed to 8	Fixed to 12	Fixed to 15	Fixed to 18	F0-15=20	19.8~27 (Synchronous Modulation)
Actual carrier freq. (kHz) when A5-08=15 kHz and F0-15=25.2 kHz	A5-8=15	A5-8=15	A5-8=15	Fixed to 15	Fixed to 18	F0-15=25.2	19.8~27 (Synchronous Modulation)

Appendix B: Derating against carrier frequency of MD290 drive.

The output current derating depending on the applied carrier frequency of MD290 drive is described in the tables below.

Table B.1. Output current derating for 3ph 400V supply drives (MD290TxxG/yyPB-652-INT), where xx is from 1.1 to 37 kW

Rated power (xx)	1.1	1.5	2.2	3	3.7	5.5	7.5	11	15	18.5	22	30	37
Switching freq.	Rated output current (A)												
3 kHz	3,10	3,80	5,10	7,20	9,00	13,00	17,00	25,00	32,00	37,00	45,00	60,00	75,00
4 kHz	3,10	3,80	5,10	7,20	9,00	13,00	17,00	25,00	32,00	37,00	45,00	60,00	75,00
5 kHz	3,10	3,80	5,10	7,20	9,00	13,00	17,00	25,00	32,00	37,00	45,00	60,00	75,00
6 kHz	3,10	3,80	5,10	7,20	9,00	13,00	17,00	25,00	32,00	37,00	45,00	60,00	70,80
7 kHz	2,82	3,50	4,74	6,77	8,34	12,04	15,95	23,55	30,09	35,41	42,98	56,10	66,75
8 kHz	2,58	3,22	4,42	6,37	7,78	11,19	15,00	22,22	28,33	33,89	41,13	52,62	63,00
9 kHz	2,37	2,98	4,14	6,00	7,28	10,45	14,14	21,00	26,69	32,52	39,42	49,44	59,55
10 kHz	2,19	2,75	3,88	5,65	6,82	9,79	13,33	19,85	25,19	31,19	37,76	46,32	56,18
11 kHz	2,03	2,54	3,67	5,34	6,41	9,18	12,62	18,79	23,80	29,97	36,23	43,50	53,10
12 kHz	1,89	2,36	3,47	5,06	6,05	8,65	11,96	17,81	22,54	28,82	34,79	40,98	50,33
13 kHz	1,77	2,21	3,29	4,80	5,73	8,17	11,36	16,90	21,38	27,64	33,35	39,07	47,93
14 kHz	1,67	2,07	3,13	4,55	5,44	7,74	10,81	16,07	20,31	26,46	31,92	37,15	45,54
15 kHz	1,57	1,95	2,98	4,33	5,17	7,37	10,30	15,31	19,35	25,28	30,48	35,24	43,15
16 kHz	1,48	1,85	2,84	4,13	4,93	7,03	9,84	14,61	18,46	24,10	29,05	33,33	40,76
17 kHz	1,38	1,73	2,68	3,90	4,64	6,61	9,30	13,82	17,44	22,92	27,61	31,41	38,37
18 kHz	1,29	1,61	2,52	3,67	4,35	6,20	8,76	13,02	16,42	21,74	26,17	29,50	35,97
19 kHz	1,19	1,48	2,36	3,45	4,07	5,78	8,22	12,22	15,40	20,56	24,74	27,59	33,58
20 kHz	1,09	1,36	2,19	3,22	3,78	5,37	7,68	11,42	14,38	19,38	23,30	25,67	31,19

Table B.2. Output current derating for 3ph 200V supply drives (MD290-2TxxGB/yyPB-652-INT), where xx is from 1.5 to 11 kW

Rated power (xx)	1.5	2.2	3.7	5.5	7.5	11
Switching freq.	Rated output current (A)					
3 kHz	7,20	9,00	13,00	25,00	32,00	45,00
4 kHz	7,20	9,00	13,00	25,00	32,00	45,00
5 kHz	7,20	9,00	13,00	25,00	32,00	45,00
6 kHz	7,20	9,00	13,00	25,00	32,00	45,00
7 kHz	6,77	8,34	12,04	23,55	30,09	42,98
8 kHz	6,37	7,78	11,19	22,22	28,33	41,13
9 kHz	6,00	7,28	10,45	21,00	26,69	39,42
10 kHz	5,65	6,82	9,79	19,85	25,19	37,76
11 kHz	5,34	6,41	9,18	18,79	23,80	36,23
12 kHz	5,06	6,05	8,65	17,81	22,54	34,79
13 kHz	4,80	5,73	8,17	16,90	21,38	33,35
14 kHz	4,55	5,44	7,74	16,07	20,31	31,92
15 kHz	4,33	5,17	7,37	15,31	19,35	30,48
16 kHz	4,13	4,93	7,03	14,61	18,46	29,05
17 kHz	3,90	4,64	6,61	13,82	17,44	27,61
18 kHz	3,67	4,35	6,20	13,02	16,42	26,17
19 kHz	3,45	4,07	5,78	12,22	15,40	24,74
20 kHz	3,22	3,78	5,37	11,42	14,38	23,30

Appendix C: Drive selection example.

We need to select a drive for a spindle (asynchronous) motor with a rated current of 14.9 A, a maximum operating frequency of 800 Hz and a rated voltage of 380 VAC.

We do not know the load of the spindle motor, so we have to assume full load condition.

From the information in Appendix A, we know that at 800 Hz output frequency the carrier frequency applied is 15 kHz.

Then the available continuous output current of the drive at 15 kHz carrier frequency should be ≥ 14.9 A (rated current of the motor, because we assume full load condition).

From the information in Appendix B (table B.1), we look for the drive that fulfils above condition: therefore the drive selected is **MD290T11G/15PB-652-INT**. This drive can operate continuously the spindle motor at full load.