FAULHABER

Large DM Steppers connection

Introduction

One of the characteristics differentiating the largest disk magnet stepper motors (DM40, DM52, …) is the fact that they are composed of two half stators, each of them driving two phases.

1st Half
Phases A&B

2nd Half
Phases A&B

This results in 8 wires getting out of the motor, instead of 4 as most of the two phases stepper motors. The present application will help understanding how to connect the wires, in which situation.

Connection principle

For this type of motor, the datasheet provides the electrical specification for two connection options: Parallel and Serial:

Series DM52100N

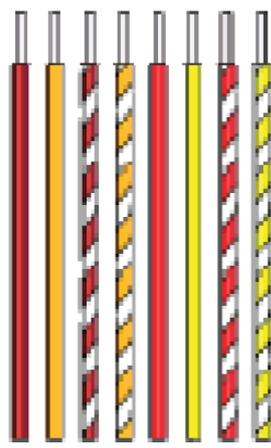|	Winding		5300		2000		
			Parallel	Serial	Parallel	Serial	Connection
1 Phase resistance (at 20°C)	± 14%		0,35	1,4	2,2	8,8	Ω
2 Phase inductance	± 20%		0,7	2,8	5	20	mH
3 Nominal current (1 phase ON)	typ.		5,3	2,6	2	1	A
4 Boosted current (1 phase ON)	typ.		12,2	6,1	4,6	2,3	A
5 Induced voltage at 600 min⁻¹	± 10%		2,38	4,76	6,3	12,6	V DC
6 Torque constant	± 10%		37,9	75,8	100,3	200,5	mNm/A

Connecting the motor to the driver in a parallel or serial way can be done as described below, by linking the appropriate wires together.
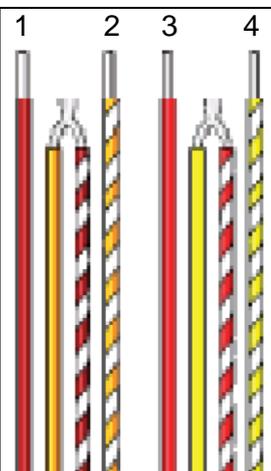
The single wires getting out of the motor are defined the following way:

Single connection				
Nr	**Colour**	**Phase**		1 2 3 4 5 6 7 8
1	Brown	Phase A	A+	
2	Orange		A'+	
3	Br-white		A-	
4	Or-white		A'-	
5	Red	Phase B	B+	
6	Yellow		B'+	
7	Re-white		B-	
8	Ye-white		B'-	

To drive the motor in parallel mode, the phases signals X and X' have to be connected together, as presented in the below table:

Parallel connection				
Nr	**Colour**	**Phase**		1　　2　　3　　4
1	Brown	Phase A	A+	
	Orange			
2	Br-white		A-	
	Or-white			
3	Red	Phase B	B+	
	Yellow			
4	Re-white		B-	
	Ye-white			

To drive the motor in serial mode, the signal X'+ and X- of both phases have to be connected together, as presented in the below table:

Serial connection			
Nr	**Colour**	**Phase**	1 2 3 4
1	Brown	Phase A — A+	
Connected together	Orange	Phase A	
	Br-white	Phase A	
2	Or-white	Phase A — A-	
3	Red	Phase B — B+	
Connected together	Yellow	Phase B	
	Re-white	Phase B	
4	Ye-white	Phase B — B-	

Which mode to use?

It can be seen from the motor datasheet that serial or parallel connection has a direct influence on the electrical properties, like driving current:

Series DM52100N

	Winding	5300	
		Parallel	**Serial**
1 Phase resistance (at 20°C)	± 14%	0,35	1,4
2 Phase inductance	± 20%	0,7	2,8
3 Nominal current (1 phase ON)	typ.	5,3	2,6
4 Boosted current (1 phase ON)	typ.	12,2	6,1
5 Induced voltage at 600 min^{-1}	± 10%	2,38	4,76
6 Torque constant	± 10%	37,9	75,8

It has to be known that while the performances are equivalent in both modes with large enough supply voltage, the behavior will be much more different with lower supply voltages (due to inductance effects).

Therefore, the following rule can be applied in most of the cases:

Voltage	Recommended connection	Reason
> 48V	Serial	- Large voltage compensates for the higher inductance - Smaller current consumption
< 48V	Parallel	- Recommended to maintain motor performances