

# Stepper Motor Convention

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March 10, 2009

The purpose of this document is to explain the convention used to connect stepper motors and encoders at the Advanced Photon Source.

## 1 Motor Cables

Our stepper motor cables use ELCO connectors, which are the standard at the Advanced Photon Source. The cable on the motor uses the male ELCO connector, with a sample motor cable shown in Fig. 1. The pinout layout for a male ELCO connector is shown in Fig. 2, while the cable pinout is described in Table 1.

The unipolar wiring diagrams for several motors are shown in Table 2.

The bipolar wiring diagrams for several motors are shown in Table 3. Bipolar mdrivers only use four leads, but motors with 6 or 8 leads can be used; 6 lead motors have 2 unused wires, and 8 lead motors need two pairs of wires connected.

A motor wired as unipolar can be run by a bipolar driver. To use the full windings of the motor, an adapter cable is needed. If simply connected, a bipolar driver will only use half of the motor's windings. An adapter cable's wiring is shown in Table 4.

## 2 Encoders

Optionally, encoders can be used with the drivers if the drivers support them. They need to be wired to a DB-9 connector. This is shown in Table 5.

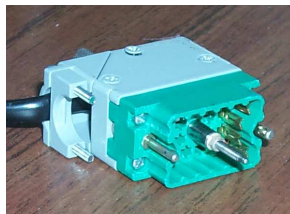


Figure 1: An ELCO motor connector.

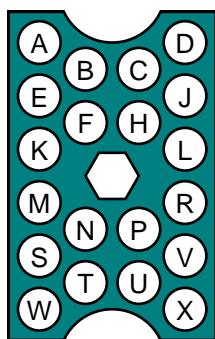


Figure 2: Male ELCO connector pinout diagram.

Table 1: APS motor cable ELCO connector pinout

Pin	Function	Pin	Function
A	Motor Phase 1 Out	E	Motor Phase 1 Return
B	Motor Phase 2 Out	F	Motor Phase 2 Return
C	Motor Phase 3 Out	H	Motor Phase 3 Return
D	Motor Phase 4 Out	J	Motor Phase 4 Return
K	Motor Phase 5 Out	L	Motor Phase 5 Return
W	High Limit	T	High Limit Return
X	Low Limit	U	Low Limit Return
N	Motor Home	P	Motor Home Return
V	Limits Supply Voltage	R	Limits Supply Voltage Return
S	<i>unused</i>	M	<i>unused</i>

Table 2: Unipolar motor wiring diagram

ELCO pin	SLO-SYN 6-wire motor	SLO-SYN 8-wire motor	Vexta motor
A	red	red	black
B	red/white	red/white	green
C	green	green	red
D	green/white	green/white	blue
E	black	black	yellow
F		white	
H	white	orange	white
J		black/white	

Table 3: Bipolar motor wiring diagram

ELCO pin	SLO-SYN 4-lead motor	SLO-SYN 6-lead motor	SLO-SYN 8-lead motor	Vexta motor
A	red	red	red	black
C	white/black	green	green	red
E	red/white	red/white	red/white	green
H	black	green/white	green/white	blue
		black <i>unused</i>	<i>connect black &amp; white</i>	yellow <i>unused</i>
		white <i>unused</i>	<i>connect orange &amp; black/white</i>	white <i>unused</i>

Table 4: Bipolar-Unipolar adapter cable wiring diagram

Bipolar driver ELCO pin	Unipolar motor ELCO pin
A	A
E	B
C	C
H	D
	E & F <i>jumpered</i>
	H & J <i>jumpered</i>

Table 5: Encoder wiring diagram

DB-9 pin	Function	Heidenhain	Superior
1	Index+	red	white
2	Phase A+	brown	orange
3	Phase B+	gray	green
4	Power	brown/green	red
5	<i>unused</i>		
6	Index-	black	white/black
7	Phase A-	green	orange/white
8	Phase B-	pink	green/white
9	Power Return	white/green	black