APPLICATION NOTE #224

MC 3.6 Notes

5/19/95

MC-3.6 is a brushless DC three phase, pulse-width modulated , closed-loop crystal referenced motor control.

Specifications:

Supply voltage............................... 15 vdc to 28 vdc
Output drive current
       (continuous)...................... 2A
       (peak)................................ 3A
Speed range................................. 166-500 rps

Motor requirements:

Winding type............................... 3 phase "Y" configuration
Hall type...................................... digital (120 degree electrical spacing)
# of poles.................................... 2,4,8,12

Status:

Status output................................ once per rev. (4 pole only)
(output type)................................ open collector
Status output................................ at speed
(output type)................................ open collector
Status led.................................... at speed

Control:

Input control................................ motor enable (active low)
Input control................................ mode (speed reference)
Input control................................ line 1 & line 2 (on board speed reference select)

Configurations:

Direction of rotation.................... JB1
Hall feed-back or......................... JB2
external feed-back

Inputs & Outputs

Motor connector	J1	**Motor connector**	J3
(phase "A").........................	J1-1	(hall voltage supply)............	J3-1
(phase "B").........................	J1-2	(hall "3")..............................	J3-2
(phase "C").........................	J2-3	(n.c.)...................................	J3-3
(gnd)...................................	J2-4 &5	(n.c.)...................................	J3-4
		(n.c.)...................................	J3-5
Voltage supply connector	J2	(hall "2").............................	J3-6
		(gnd)...................................	J3-7
(gnd)...................................	J2-1	(n.c.)...................................	J3-8
(+V)....................................	J2-2	(n.c.)...................................	J3-9
		(hall "1").............................	J3-10

Status & control connector J4

(external frequency input)...	J4-1	(line 2)................................	J4-6
(gnd)...................................	J4-2	(gnd)...................................	J4-7
(mode).................................	J4-3	(at speed)............................	J4-8
(motor enable).....................	J4-4	(external feed-back)............	J4-9
(line 1)................................	J4-5	(once per rev.)....................	J4-10

Control logic: (0 = logic low, 1 = logic high)

motor enable...................   1= motor disable
                                 0= motor enable
mode..............................   1= internal speed reference
                                 0= external speed reference

line 1	line 2	mode	
0	0	1	speed "1"
1	0	1	speed "2"
0	1	1	speed "3"
1	1	1	speed "4"

Status I/O interface:

All status output signals are open collector type. It is suggested that this signal be monitored with a external 4.7k pull-up resistor to +5v.

All status input signals have internal 4.7k pull-up resistors to +5v. It is suggested that open collector drives be used to actuate these control lines.

Application Note

MC-3.6 can control rotational speed in several ways. It can be supplied with a external speed reference (user supplied). If this scheme is to be used one must understand how to calculate the proper reference frequency. This is very simple in that the speed reference freq. must match the feed-back freq.

EXAMPLE

desired rps		"60"
feed-back type	hall	
motor pole count		"8"

Speed reference = 60 X 4 = 240 HZ   (an "8" pole motor gives 4 pulses per revolution)

EXAMPLE

desired rps		"60"
feed-back type	external	
encoder pulses per rev		"1024"

Speed reference = 60 X 1024 = 61,440 HZ

MOTOR SPEED can also be controlled with the on board crystal reference. 4 speeds can be accessed via line1 and line2 and mode controls. With no connections on the I/O, internal speed control and speed #1 is selected by default. Internal speeds are programmed at factory. (consult factory for programmed speeds)

EXTERNAL FEED-BACK (encoder) is a good way to achieve better rotational stability. Especially with slower speeds and or light inertial loads. The on board loop-filter is configured to work best with a feed-back rate of 400 hz or more. Lower feed-back rates can be used if there is sufficient inertial loading or if rotational stability does not have to be held to tight tolerances. External feed-back is achieved first by having a feed-back device (encoder) and by placing "JB2" in position "A-B". Else position "B-C" will use 1 hall for motor feed-back.

MOTOR PEAK CURRENT can be controlled via "R23". This is a sense resistor placed in series with motor supply current. This is monitored via a comparator. When motor current builds up a voltage of 0.3V across the sense resistor the power drive shuts off. Power drives will stay off until sense resistor voltage decays by hysteresis voltage, then is enabled again. Lowering motor peak currents in some cases can help achieve better rotational stability.

ONCE PER REV is simply derived from a hall signal. A hall signal is divided by 2. Because it is divided by two, only a 4 pole motor will give one pulse per revolution. Being that it is derived from a hall, this signal is not at a constant shaft position.

DIRECTION OF ROTATION is easily changed by changing the position of "JB1". It is not advised to change direction when shaft is rotating. (Dangerous back-emf currents could damage output drivers).

Mating connectors

J1................   AMP # 103956-1 (loaded housing)

J2................   MOLEX # 39-01-2025
(contacts)....   MOLEX # 39-00-0214

J3................   THOMAS&BETTS # 622-1041

J4................   AMP # 103641-9 (loaded housing)