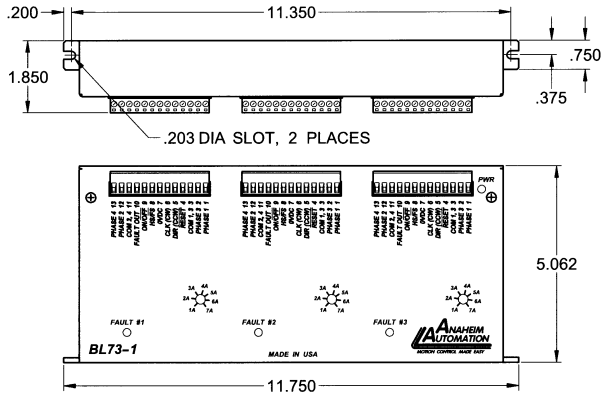
BL73-1 TRIPLE AXIS
BILEVEL STEP MOTOR DRIVER

- **10 Amperes/Phase Maximum**
- **Operating Current**
- **7 Amperes/Phase Standstill**
- **Motor Current Transient Voltage Suppression**
- **Half-Step and Full-Step Operation**
- **Bilevel Drive Operation**
- **No RFI or EMI Problems**
- **TTL/CMOS Compatible Inputs**
- **Clock and Direction or**
- **Dual Clock Operation**
- **Motor Turn-Off Input**



GENERAL DESCRIPTION

The Anaheim Automation BL73-1 Step Motor Driver is designed to operate six or eight lead, 4-phase step motors rated at 1 - 7 amps/phase. Outstanding motor performance is provided by means of a Bilevel Drive technique.

BILEVEL DRIVE

The basic function of a step motor driver is to control the motor winding currents. Motor performance is determined by how fast the driver can increase and decrease the winding currents. A rapid rise in winding current is achieved by applying a high voltage directly to a motor. This rapid rise of current is also referred to as the "kick" or operating current. When a desired current level is reached, a low voltage is applied to maintain a suitable holding current level. When a motor winding is turned off, a rapid decrease in winding current is achieved by routing the energy in the collapsing field back to the power supply through a high voltage path. The high voltage supply furnishes the energy necessary to maintain motor output torque at high step rates thus providing high mechanical power output. The low voltage supply provides much of the current needed at low step rates and all of the holding current.

Bilevel drivers do not use high frequency switching techniques as chopper drivers do. Consequently, they do not create the EMI, RFI, and motor heating problems that are associated with chopper drivers.

EXCITATION MODE SELECT

Users have a choice of dual-phase, full-step operation or half-step operation. Dual-phase, full-step operation occurs by energizing two phases at a time, rotating a typical motor 1.8 degrees per step. Half-step operation occurs by alternately energizing one, and then two, phases at a time, rotating the motor 0.9 degrees per step. Full-step operation is only suggested for applications that specifically require that mode, such as when retrofitting existing full-step systems.

STEP AND DIRECTION CONTROL

The BL73-1 has two clock options: Clock and Direction, or Dual Clock operation. PIN 5 on Terminal Block(s) 1,2 & 3 can be configured as the Direction Input or CCW Input by placing jumper JP2, JP8, and JP14 in the appropriate position (see Table 1). Pulses applied to the Clock input cause the motor to step in the clockwise direction if the Direction Input is a logic "1" or the counterclockwise direction if the Direction Input is a logic "0". Pulses applied to the CCW Input cause the motor to step in the counterclockwise direction. Either positive or negative going pulse may be selected by setting JP1, JP7, and JP13 to the appropriate position (See Table 1).

MOTOR ON/OFF INPUT

The motor on/off input allows for de-energizing a motor without disturbing the positioning logic. After re-energizing the motor, a routine can continue. This reduces motor heating and conserves power, especially in applications where motors are stopped for long periods and no holding torque is required.

ORDERING INFORMATION

DPF73003	3-AXIS DRIVER PACK
BL73-1	STANDALONE DRIVER ONLY
PSA100V5A	RECOMMENDED ANAHEIM AUTOMATION POWER SUPPLY

ANAHEIM AUTOMATION
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TRANSIENT VOLTAGE SUPPRESSION (TVS)
The BL73-1 contains TVS diodes on the motor phase outputs. The TVS diodes allow longer motor cables to be used. Normally when using long motor cables, voltage transients and spikes are created. These transients often exceed the voltage ratings of the output phase transistors, resulting in blown transistors. The addition of the TVS diodes suppresses these transients and protects the transistors against damage.

ADJUSTING KICK CURRENT
The kick (or operating) current level is the desired phase current level that the high voltage provides each time a step is taken. The high voltage is turned off when this level is reached. The kick current level should be set to approximately 1.4 times the rated phase current. For example, a motor rated at 5 amps/phase should be "kicked" to 7 amps (5x1.4=7). Table 2 shows various kick current levels for the corresponding phase currents.
WARNING: The kick current level must be set before operating a motor.

DETERMINING LOW-VOLTAGE SUPPLY LEVEL
The Low Voltage supply should provide the motor with 70% to 100% of the rated motor current. Higher motor current will produce more holding torque. To calculate the Low Voltage (VLV), use the following equation where $I\phi$ is the rated motor current and $R\phi$ is the resistance of the motor.

$$VLV = I\phi \times [R\phi + 0.1] + 1.6$$

Example: To operate a motor with ratings of $I\phi = 4.7$ Amps and $R\phi = 0.39$ Ohms, calculate VLV as follows:

$$VLV = 4.7 (0.39 + 0.1) + 1.6 = 3.9 \text{ Volts}$$

To calculate VLV for 70% of the rated motor current use the following equation:

$$VLV = 0.7\ I\phi \times [R\phi + 0.1] + 1.6$$

VERIFYING CORRECT STANDSTILL CURRENT
The final determination of whether adequate standstill current is provided by the VLV supply may be made as follows:

1. Ground the mode select (HS/FS pin 8) input.
2. Measure the voltage drop across resistors R7, R16 (Axis 1), R38, R47 (Axis 2), and R69, R78 (Axis 3). See Figure 3.
3. Multiplying the reading by 20 gives the standstill current in Amps, which should be between 70 and 100% of rating.
4. Adjust VLV accordingly. The VLV can be any voltage equal to the step motors rated volts/phase, plus two more volts, maximum.
5. Disconnect ground from Mode Select Input if the driver is to be used in half-step operation.

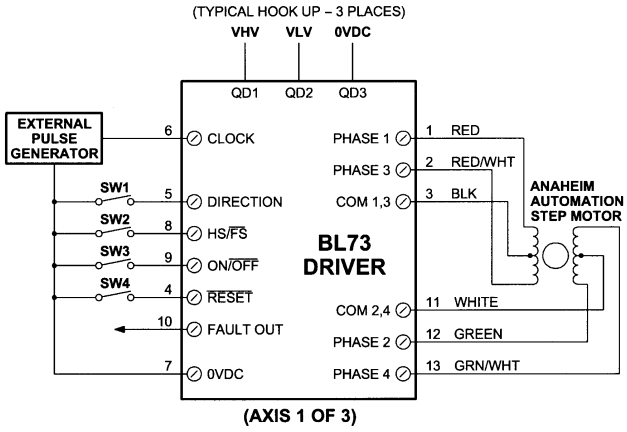
DETERMINING HIGH-VOLTAGE SUPPLY LEVEL
The high-voltage supply (VHV) can range from 24 VDC to 100 VDC. The BL73-1 requires only a single high voltage supply. The VHV supply determines high-speed torque performance and acceleration. Higher values for VHV will produce more torque at higher speeds. Lower values for VHV will result in lower torque at higher speeds.

POWER SUPPLY CONNECTIONS
The VLV and VHV power supplies and the 0VDC can be connected to the BL73-1 through the quick disconnects on the back of the board to the quick disconnects. QD1, QD4, and QD7 are High Voltage. QD2, QD5, and QD8 are Low Voltage. QD3, QD6, and QD9 are 0VDC.
See Figure 3.

MOTOR CONNECTIONS
A typical hookup diagram for BL73-1 driver applications is shown in figure 2 below. *Wiring connected to inputs should be separated from motor connections and all other possible sources of interference.*

IMPORTANT NOTE: When the wiring from the driver to the step motor extends beyond 25 feet, consult the factory.

Figure – 2: Typical Hook-up for BL73



SPECIFICATIONS

Control Inputs (All): (Terminals 5, 6, 8, 9)
TTL-compatible
Logic "0" - 0 to 0.8 V
Logic "1" - 3.5 to 5.0 V

Clock Inputs: (Terminals 5 & 6)
15 microseconds minimum pulse width required. The Clock inputs are internally pulled down to 0VDC through a 10KΩ resistor for positive going Clock inputs or pulled up to +5VDC through a 10KΩ resistor for negative going Clock inputs.

Fault Reset: (Terminal 4)
Pulled up to +5VDC through a 10kΩ resister.
Logic "1" (open) - Driver enabled
Logic "0" - Resets a Fault condition (driver is disabled when this input is low). This input must be held low for at least 100ms.

Direction Control: (Terminal 5)
Pulled up to +5VDC through a 10kΩ resistor
Logic "1" (open) - CW motor direction
Logic "0" - CCW motor direction

Excitation Mode Select: (Terminal 8)
Pulled up to +5VDC through a 10kΩ resistor
Logic "1"(open) - Half-step
Logic "0" - 2 ϕ Full-step

Motor On/Off: (Terminal 9)
Pulled up to +5VDC through a 10kΩ resistor
Logic "1" (open) - motor current on
Logic "0" - motor current off

Fault Output: (Terminal 10)
Open Drain Output
Capable of standing off 40VDC and sinking 100mA
Logic "0" (low) - Driver Fault Detected
Logic "1" (open drain) - No Fault

Output Current Rating:
(Terminals 1, 2, 3, 11, 12, & 13)
10 Amps per phase maximum operating or running current, and 7 Amps per phase maximum standstill current. Motor phase ratings of 1.0 Amp minimum are required to meet the minimum kick level.

Power Requirement:
High Voltage: 24VDC - 100VDC
Low Voltage: 3.0VDC - 7.0 VDC

Operating Temperature: 0 to 70 Degrees C
The BL73-1 driver should be mounted to a heat conducting structure; fan cooling is also recommended to keep the heat sink within the given temperature range.

FUNCTION	JP1 JP7 JP13	JP2 JP8 JP14	JP3 JP9 JP15
Terminal 5 = Direction	X	2 - 3	X
Terminal 5 = CCW	X	1 - 2	X
Positive Going Clocks	2 - 3	X	X
Negative Going Clocks	1 - 2	X	X
Small Motor	X	X	1 – 2
Large Motor	X	X	2 – 3
Standard Product	1 – 2	2 - 3	1 - 2

TABLE 1: JUMPER SETTINGS

Potentiometer Setting	Rated Motor Current	Kick current
0 - 10	1.0 - 1.4	1.2 - 2.0
10 - 20	1.4 - 2.0	2.0 - 2.8
20 - 30	2.0 - 2.5	2.8 - 3.6
30 - 40	2.5 - 3.1	3.6 - 4.4
40 - 50	3.1 - 3.7	4.4 - 5.2
50 - 60	3.7 - 4.2	5.2 - 5.9
60 - 70	4.2 - 4.8	5.9 - 6.7
70 - 80	4.8 - 5.4	6.7 - 7.5
80 - 90	5.4 - 5.9	7.5 - 8.3
90 - 100	5.9 - 7.0	8.3 - 10.0

TABLE 2: KICK CURRENT SETTINGS

Notes:

ANAHEIM AUTOMATION

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