



# ***DRV7***

## ***USERS GUIDE***



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## Overview

The DRV7 is a compact high- resolution 7A stepper driver.

### DRV7-80 Features:

- **18 – 80V** motor input supply voltage range
  - *5V logic input supply voltage provided by user on pin 9*
- **0 to 7A** phase current adjustable via DIP switches
- 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128 and 1/256 step resolution, set by DIP switch
- **Electrically- isolated** (optically coupled) STEP and DIR inputs
- Wide control input voltage: 5-30V
- Easy wiring - removable screw terminal connectors, included
- Integrated mounting base-plate

### DRV7-48 Features:

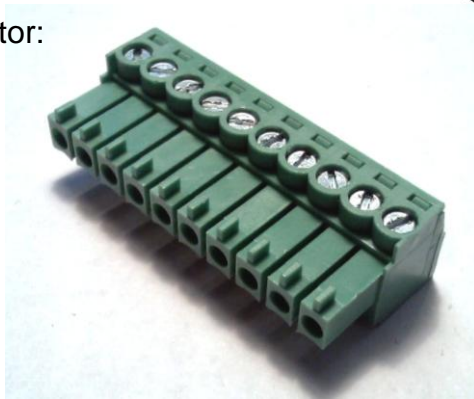
- **18 – 48V** motor input supply voltage range
  - **single input supply voltage** - no user logic supply required
- **Enable pin**, provided on pin 9
- **0 to 7A** phase current adjustable via DIP switches
- 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256 step set by DIP switch
- **Electrically- isolated** (optically coupled) STEP and DIR inputs
- Wide control input voltage: 5-30V
- Easy wiring - removable screw terminal connectors, included
- Integrated mounting base-plate

## Included in the Box:

DRV7 Drive:

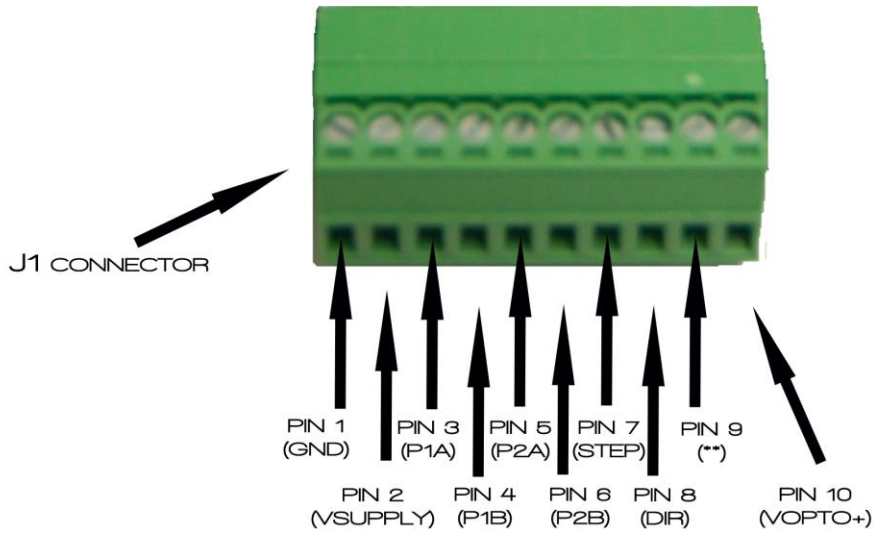


Mating Connector:



## Pinout

The following diagram shows the pins for connecting to the DRV7 board:



\*PIN 9 is model specific -- Logic Input Supply on -80 and ENABLE on -48 model

## Installation

This installation procedure outlines the steps required to make the DRV7 operational:

1. **Connect an 18VDC to 80VDC power supply** to connector J1 (see diagram). Pin 1 needs to be connected to Ground and Pin 2 to the positive voltage (VSUPPLY). Keep lead-length short between power supply and drive, and avoid ground loops. See section “Power Supply” for type and sizing of recommended power supply.
2. Connect Pin 9 - Enable or Logic Supply
  - DRV7-80:** Connect **5V power supply** (Logic Input Supply) to connector J1 as follows: Pin 1 connected to Ground and Pin 9 to the supply voltage (5VDC). Keep leads short and avoid Ground loops.
  - DRV7-48:** **ENABLE** input may be connected to Pin 9 - systems not requiring ENABLE logic function can connect 5V power supply (Logic Input Supply) to connector J1-9, or this input can be unconnected.
3. With the power OFF, **connect a motor to pins 3, 4, 5 & 6 of J1** (see pinout diagram). Be sure to insulate all motor leads (and any unused leads) to prevent shorts. Typical motor connection diagrams are shown in the *Stepping Motors* section of this manual.
4. **Set the appropriate current** value using the DIP Switches (JP1). See Section *Setting the Output Current* for more information.
5. **Connect the control signal reference voltage level (VIN+) and the STEP and DIRECTION signals** to connector J1 (and optional ENABLE signal, in case of DRV7-48) See section *Control Input* of this manual for more details.
6. **Set the resolution** required using the DIP switches. See Section *Microstep Resolution* for more information.
7. **Apply power to the DRV7** and the indexing controller.
  - For DRV7-80, both power supplies (18-80V and 5V) must be turned on at the same time.*

### Important Notes

**Do not connect or disconnect the motor when power is ON -- make sure the motor supply voltage is always fully discharged prior to connecting or disconnecting the connector to/from the unit. If unsure wait 2 minutes after turning off the device prior to plugging or unplugging the connector.**

**The power supply voltage must not exceed 80VDC or be less than 18VDC on the motor power supply, including ripple and line voltage fluctuations**

**Make sure the motor used and the drive are compatible**

**The DRV7-80 will not function properly without the 5VDC logic supply.**

## Power Supply

The **DRV7-80** is powered from two unregulated DC power supply inputs. The power supply inputs are connected via pins 1, 2, and 9 of the J1 Connector. The input voltage on pin 2 must be in the range of 18VDC to 80VDC. The input voltage on pin 9 must be 5VDC.

Pin	Function
1	Ground
2	High voltage Motor Supply
9	Low voltage Logic Supply

The **DRV7-48** is powered from a single unregulated DC power supply input. The power supply input is connected via pins 1 and 2 of J1. The input voltage must be in the range of 18VDC to 80VDC.

Pin	Function
1	Ground
2	High voltage Motor Supply
9	ENABLE signal, or no-connect

### Recommended Power Supply Circuit

In general, unregulated DC (or linear regulated) power supplies are best suited for stepper motor applications. Switching power supplies can be suited for some stepper motor applications, but their surge currents is limited, and may require additional capacitors depending on application.

A single power supply can be used for or multiple axis configurations, provided power is scaled accordingly. If multiple drivers are used with one power supply, each drive should have separate power and ground wires that connect directly to the output of the power supply. Individual axes can also be supported by individual power supplies if modularity is desired.

We recommend a power supply with an output power of 140 Watts, minimum. The required current of the power supply will depend on the output voltage and can be calculated by dividing the above wattage by the output supply voltage.

For example, when using a power supply with:

- 80V: a current capability of ~1.75A will be needed (140W/80V)
- 48V: a current capability of ~3.0A will be needed (140W/48V)
- 24V: a current capability of ~5.9A will be needed (140W/24V)

The 5V logic power supply (for DRV7-80 only) power input should be capable of providing at least 150mA. Both power supplies must be turned on and off at the same time.

## ***Important Power Notes***

***Individual axes should be independently fused, for fault isolation***

***The power supply voltage, including ripple and line voltage fluctuations must not exceed the peak rating of 80Vdc or be less than 18Vdc.***

***Do not connect or disconnect motor wires while power is applied. Make sure the motor supply voltage is always fully discharged prior to connecting or disconnecting the connector to/from the unit. If unsure wait 2 minutes after turning off the device prior to plugging or unplugging the connector.***

***Wire size used to connect the power source to the driver should be at least 18 gauge.***

***Keep the power supply leads as short as possible. Larger gauge should be used for distances between the power supply and the driver larger than 18 inches.***

***The power supply output current is dependent on the supply voltage, motor selection and load requirements.***

## Stepping Motors

The DRV7 is a bipolar chopper driver that works with both bipolar and unipolar motors; i.e. 8, 4 and 6 lead motors. It is also possible to half a 6 lead center tapped motor with the DRV7, however the performance may be compromised. To avoid unstable chopping conditions and to provide a higher speed-performance ratio, a motor with a low winding inductance is preferred.

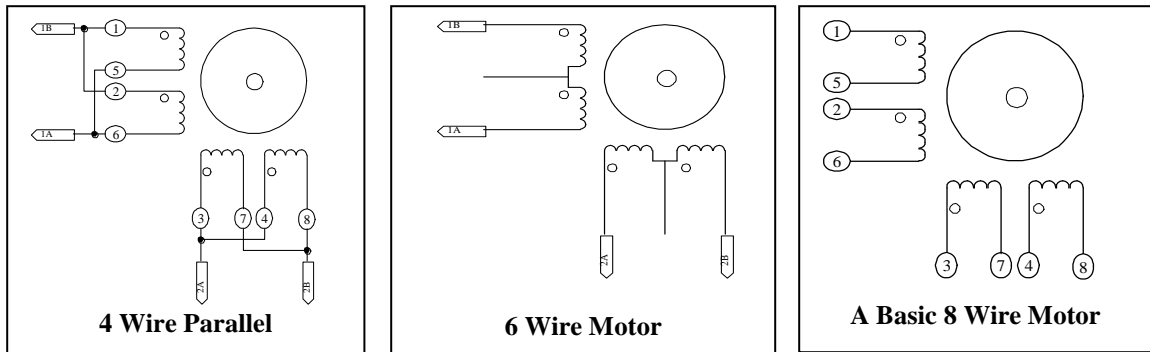
### Drive Current

The ideal current for a given motor is based on the specific characteristics of the motor and the requirements of the application. As a result, establishing the correct current is often determined empirically. Insufficient current will result in inadequate torque and under utilization of the motor. Excessive current can cause high-speed torque ripple, resulting in stalling or pole slippage, over heating of the motor and general inefficiency of the system. Current setting procedures are described in the next section; “Setting The Output Current”

### Connecting a Stepping Motor (J1 pins 3, 4, 5 and 6)

Pin #	Description	Function
3, 4	1A, 1B	Phase 1 of the Step Motor is connected between Pins 3 and 4 of J1.
5, 6	2A, 2B	Phase 2 of the Step Motor is connected between Pins 5 and 6 of J1.

### Typical 4, 6 and 8 lead motor configurations



### **Important Motor Notes**

***Do not connect or disconnect motor wires while power is supplied***

***When using a 6-lead motor be sure to insulate/isolate unused wires***

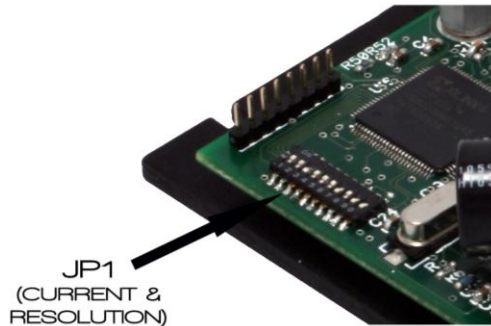
***The physical direction of the motor with respect to the direction input will depend on the connection of the motor windings:***

***To reverse the direction of the motor, switch the wires on phase 1 or phase 2 of the outputs.***



## DIP Switch (JP1) Location

The following picture shows the DIP Switch (JP1) location on the DRV7 board:



## Setting the Output Current (JP1)

The phase current is set using DIP switches SW1 - SW6. Switches SW1 - SW3 set the Hold Current, and switches SW4 - SW6 set the Run Current. See below for the settings as well as the values:

SW1 SW2 SW3	SW4 SW5 SW6	Value			
Hold Current	Run Current	18V	24V	48V	80V
OFF OFF OFF	OFF OFF OFF	0A	0A	0A	0A
ON OFF OFF	ON OFF OFF	1.0A	1.0A	1.0A	1.2A
OFF ON OFF	OFF ON OFF	2.0A	2.2A	2.3A	2.4A
ON ON OFF	ON ON OFF	3.1A	3.2A	3.4A	3.6A
OFF OFF ON	OFF OFF ON	4.1A	4.2A	4.5A	4.7A
ON OFF ON	ON OFF ON	4.9A	5.1A	5.5A	5.7A
OFF ON ON	OFF ON ON	5.9A	6.2A	6.6A	6.8A
ON ON ON	ON ON ON	6.1A	6.3A	6.7A	7.0A

Be sure to power down the drive prior to changing the current settings. The actual motor current will vary based on a number of factors including motor characteristics, cable length and shielding. The Rule of Thumb is to set the output current where reliable motion is achieved without excessive motor heating.

\*\*Hold Current is factory preset to 1.2A and Run Current to 2.4A.

### ***“Do’s, Don’ts and Important Notes”***

***Apply minimal force when adjusting the switches or you risk damaging them.***

***Using low power values may cause a slight change in the motor resting position.***

***If a different Current setting is desired, please contact the factory prior to ordering. It can be preset to your specifications.***

## Microstep Resolution (JP1)

The number of microsteps per full step is selected by three DIP switches (JP1 switch 7, 8 and 9) according to the below table. Note that the ON position is labeled on the DIP switch unit.

SW7	SW8	SW9		
Resolution Setting			Value	Steps/ Rev.
OFF	OFF	OFF	** 1/2	400
ON	OFF	OFF	1/4	800
OFF	ON	OFF	1/8	1600
ON	ON	OFF	1/16	3200
OFF	OFF	ON	1/32	6400
ON	OFF	ON	1/64	12800
OFF	ON	ON	1/128	25600
ON	ON	ON	1/256	51200

\*\*Factory preset to 1/2 step resolution

## Control Input

Control inputs are connected to J1. STEP and VIN+ inputs are the minimum required for motion.

Note that since the inputs are electrically isolated from the internal circuitry of the DRV7, a high level voltage connection to the input signals needs to be provided for the isolation circuitry. The low level does not need to be provided.

Pin #	Name	Description
7	STEP	Stepping is triggered on every falling transition of the STEP input. Minimum duration of both high and low level is 2µs
8	DIR	Direction signal - if unconnected, a high level is assumed
9	ENABLE	<b>DRV7-48 only:</b> If left unconnected or a 5V level, the drive is enabled. A low level on this input will disable the drive
	LOGIC SUPPLY	<b>DRV7-80 only:</b> Apply 5VDC, and connect ground to pin 1
10	VIN+	High level of input signals STEP / DIR / ENABLE - required as reference for the isolation circuitry

For the allowable voltage range on the control inputs please see the section *Electrical Specifications*.

## Electrical Specifications

Parameter	Min	Max	Unit	Notes
Motor Supply Voltage ( <b>DRV7-80</b> )	18	80	V (DC)	Abs. max
Motor Supply Voltage ( <b>DRV7-48</b> )	18	48	V (DC)	
Logic Supply Voltage on Pin 9 ( <b>DRV7-80 only</b> )	4.75	5.25	V (DC)	150mA min.
Run Output Current/Phase (PEAK)	0	7.0	A	DIP Switch Selectable
Hold Output Current/Phase (PEAK)	0	7.0	A	DIP Switch Selectable

### Control Input signals (STEP/DIR for DRV7-80 & STEP/DIR/ENABLE for DRV7-48)

Parameter	Min	Max	Unit
Frequency (limited by optocoupler)	0	250	kHz
High Input Voltage	5	30	V (DC)
Low time / high time for STEP input*	2		µs

\*A step sequence is triggered with the falling edge of the Step Input

On the DRV7-48, if ENABLE is unconnected the drive will always be enabled

## Thermal Specifications

Operating Temperature.....0 to +50° C  
 Storage Temperature..... -40 to +125° C

## Heat Sinking

To maximize product lifetime and avoid potential damage to the DRV7 due to thermal overload, it is critical to design your system with appropriate heat-sinking for the drive. The design of the DRV7 utilizes a base plate to efficiently transfer heat away from the drive and into its mounting. The operating temperature the device reaches depends on many factors; these include ambient temperature, current settings, duty cycle of operation, supply voltage, as well as the heat-sinking method used. This section provides an overview of the requirements to ensure appropriate temperature levels for the driver.

To utilize a heat-sink, firmly mount the base plate of the drive onto the heat-sink, and use thermal compound material between the base plate of the drive and the heat-sink to optimize the heat transfer. Aluminum works well as a heat-sink material due to its high thermal conductivity. The heat-sink should have a large surface area, with a fan to increase heat transfer where necessary.

Many applications can utilize the existing metal equipment cabinet or mounting plate as the heat-sink.

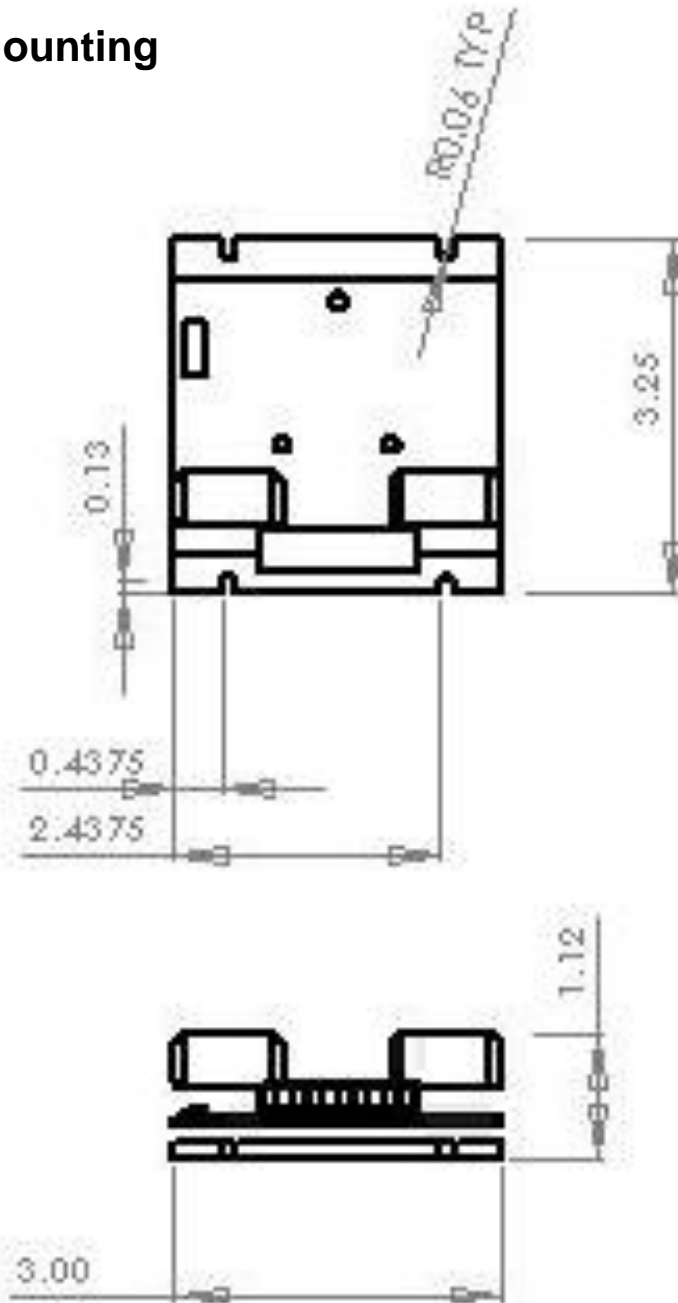
To verify if your heat-sink is sufficient, observe the DRV7 base plate temperature after continuous worst-case operation and compare it with the values given below. An infrared thermometer can provide an inexpensive and convenient way of measuring this temperature.

**Both versions of DRV7** require heat-sinking for current setting above 3A, or motor supply voltage above 24V.

The heat-sink must ensure a 55°C temperature (or less) on the base plate under worst-case operating conditions.

Operating the DRV7 exceeding the thermal parameters outlined  
without an appropriate heat-sink  
will result in damage that is not covered by AMS warranty

## Dimensions & Mounting



### ***Important Notes***

***Always mount this product in an enclosed but ventilated environment***

***Be sure it is only accessible by trained professionals***

***Be sure to make or break connections only when drive is not powered up***

## Design Tips

EMI (electromagnetic interference or electrical noise) can be a major source of problems when integrating power drivers with microprocessor based devices. EMI is typically generated through ground loops and AC power line disturbances. External devices such as, relays, coils, solenoids, arc welders, motors, drivers, and other computer-based equipment are also sources of EMI.

The following design tips will help to prevent EMI from interfering with the system operation:

- Shield the driver and wiring by mounting it in its own metal enclosure as far away from noise sources as possible.
- Ground motor shields only at the driver end.
- Make sure that all power wiring (motor, AC, etc.) is away from the signal wiring (I/O, communications lines, etc.).
- Mechanical grounds should all be tied to Earth at a single point. Chassis and motor grounds should be tied to the frame and the frame to Earth.
- Ground all signal wiring to one point.
- Use solid-state relays or opto isolators whenever possible to isolate remote signals. Suppress all mechanical relays with capacitors or MOV's.
- Use shielded, twisted pair cables for the motor, I/O and communications wiring.

**WARNING**  
**CONNECTING or DISCONNECTING MOTORS**  
**WHILE POWER IS APPLIED WILL CAUSE DAMAGE**  
**THAT IS NOT COVERED BY WARRANTY**

## Contact AMS

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