

# **7I25 H-BRIDGE MANUAL**

VERSION 1.0

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## **SAFETY**

*Large servo motors are capable of inflicting serious injury both to people and to mechanisms associated with the servo system. In addition, some motors use potentially lethal supply voltages.*

*When a servo control system is first configured, unpredictable behavior should be EXPECTED. First time checks of basic servo operation (such as motor direction) should be checked with the motor disconnected.*

*Never depend on software commands to disable the motor when you or others would be exposed to a hazard should the motor start unexpectedly. Motor power should always be removed when working on mechanical parts of the servo system.*

## **HANDLING PRECAUTIONS**

### **STATIC ELECTRICITY**

The CMOS integrated circuits on the 7I25 can be damaged by exposure to electrostatic discharges. The following precautions should be taken when handling the 7I25 to prevent possible damage.

- A. Leave the 7I25 in its antistatic bag until needed.
- B. All work should be performed at an antistatic workstation
- C. Ground equipment into which 7I25 will be installed.
- D. Ground handling personnel with conductive bracelet through a 1 megohm resistor to ground.
- E. Avoid wearing synthetic fabrics, particularly Nylon.

## INTRODUCTION

The 7I25 is a dual channel, 150 watt per channel H-Bridge driver intended for use with the 6I27, 4I27, 4I34, or 7I60 servo motor controller cards. The 7I25 will supply 3 amps of drive per channel with motor supply voltages from 12 to 48 VDC.

Motor enable bits from the controller disable motor drive until specifically enabled by software.

The 7I25 terminates the 50 conductor flat cable from the 6I27 and provides header connectors for the quadrature encoders. Header connectors are also supplied for the MOTOR0SENSE and MOTOR1SENSE inputs. These inputs are useful for limit switches or opto-interrupters.

The H-Bridge ICs used in the 7I25 can generate over temperature warnings (at 145°C) that can be read by the 6I27. Thermal shutdown (at 170°C) prevents damage to the H-Bridge ICs in case of a long term overload.

LEDs on the 7I25 provide a quick indication of motor drive magnitude and polarity. This can simplify initial set-up and troubleshooting.

## **GENERAL**

The 7I25 has a one jumper configurable option that must be properly set to match the application. When the words "right", and "left" are used it is assumed that the 7I25 H-Bridge card is oriented with its terminal blocks pointing towards the person doing the configuration.

## **IDLE CONFIGURATION**

The 7I25 can be configured to short the motor leads together or leave the motor leads open when idle (when the /MOTORENA0 or /MOTORENA1 bits are inactive). Jumper W1 sets the idle mode for motor 0 and jumper W2 sets the idle mode for motor 1. When a jumper is placed in the left hand position, the corresponding motor leads will be shorted when idle, when the jumper is placed in the right hand position, the motor leads will be left open when idle.

***NOTE: Revision A 7I25s (no rev. letter) can only be operated in the 'short motor leads when idle' mode. These cards have the jumpers soldered in.***

## **CONTROLLER CONNECTION**

The 7I25 is intended for operation with the 6I27, 4I27, 4I34, or 7I60 servo motor controllers. The 7I25 connects to the controller with a 50 conductor flat cable.

The suggested maximum cable length is 5 feet. Make sure that pin one of the controller connects to pin one of the 7I25. Pin one of the 7I25 is on the left side of P3 when the 7I25 is oriented with its screw terminal blocks pointed towards you. It is suggested that center polarized 50 pin female headers (AMP PN 1-499508-2) be used on the cable to eliminate the possibility of reversed connections.

A 5 pin header is provided for each of the quadrature encoders. A 3 pin header is provided for each MOTORSENSE input.

## CHECK-OUT

It is suggested that first time tests of the 7I25 be done with a current limited motor power supply. A simple functional test can be accomplished via the 6I27TUNE or 4I27TUNE program supplied with the 6I27 or 4I27.

First connect the 7I25 to the controller with a flat cable of appropriate length. Then connect the motor encoder(s) to the 7I25. Executing the program 6I27TUNE or 4I27TUNE will enable the H- Bridge for motor 0, and enable servo control in the position mode.

Rotating the motor shaft back and forth should cause the LED for motor 0 to glow red or green with varying intensity depending on the motor shaft position.

## INTERFACE CONNECTOR PIN-OUT (P3)

PIN#	SIGNAL	PIN#	SIGNAL
1	MOTOR1A (ENCODER)	25	/MOTOR1 DRIVER OVERTEMP
3	MOTOR1B (ENCODER)	27	/MOTOR0 DRIVER OVERTEMP
5	MOTOR0B (ENCODER)	29	MOTOR1SENSE
7	MOTOR0A (ENCODER)	31	MOTOR0SENSE
9	MOTOR1IDX	33	BIT 7
11	MOTOR0IDX	35	BIT 6
13	MOTOR1PWM	37	BIT 5
15	MOTOR0PWM	39	BIT 4
17	MOTOR1DIR	41	BIT 3
19	MOTOR0DIR	43	BIT 2
21	/MOTOR1ENA	45	BIT 1
23	/MOTOR0ENA	47	BIT 0
		49	+5V POWER

All Even numbered pins are connected to ground

Note: pin 1 is on top of connector

## ENCODER CONNECTOR PIN-OUT

Connection to the quadrature encoders are made with 5 pin headers P1 and P5. The connector pin-out is as follows:

MOTOR 0 - P1		MOTOR 1 - P5	
PIN#	SIGNAL	PIN#	SIGNAL
1	GROUND	1	GROUND
2	MOTOR0IDX	2	MOTOR1IDX
3	MOTOR0A	3	MOTOR1A
4	+5V	4	+5V
5	MOTOR0B	5	MOTOR1B

### MOTORSENSE CONNECTOR PIN-OUT

Two input bits on the controller are terminated on the 7I25. These inputs are available on 3 pin headers P2 and P4.

MOTOR 0 - P2		MOTOR 1 - P4	
PIN#	SIGNAL	PIN#	SIGNAL
1	GROUND	1	GROUND
2	MOTOR0SENSE	2	MOTOR1SENSE
3	+5V	3	+5V

### MOTOR AND MOTOR POWER CONNECTIONS

Connections to the motors and motor power are made with screw terminal blocks on the 7I25. The negative motor power supply lead must be connected to logic ground. This connection is not made internally and must be made externally to the 7I25.

The motor and motor power connection pin-outs are as follows:

#### MOTOR 0 - (TB1)

TERMINAL#	SIGNAL
1	MOTOR DRIVE 1
2	POWER GROUND
3	MOTOR DRIVE 2

#### MOTOR 1 - (TB3)

TERMINAL#	SIGNAL
1	MOTOR DRIVE 1
2	POWER GROUND
3	MOTOR DRIVE 2

#### MOTOR POWER - (TB2)

TERMINAL#	SIGNAL
1	+5V (THROUGH 100 OHMS)
2	POWER GROUND
3	MOTOR POWER

## **POWER SUPPLY CONSIDERATIONS**

Motor power for the 7I25 can range from 12 to 55 VDC. A maximum operating voltage of 48 VDC is suggested to allow ample safety margin for power supply regulation, inductive spikes, braking EMF etc. The motor power supply voltage must not exceed 60 volts at any time.

Note that a quickly decelerated motor can dump current into the power supply, causing a potential overvoltage problem or power supply damage unless the power supply is designed to sink as well as source current. For lower operating voltages, (<30 VDC) a simple unregulated supply with a large output filter capacitor is probably the best choice. For higher voltages a ferroresonant type power supply is suggested. Power supplies with series pass transistors in the output stage may need to be modified by adding a diode such that current dumped *into* the power supply is routed to the power supply filter capacitor.

## **FUSE**

The 7I25 motor power is fused with 10 A fuse F1. This fuse is socketed for simple replacement. Replacement fuses are available from MESA or any Littlefuse distributor. The fuse part number is LT25010.

## **MOTOR LEDES**

The 7I25 has indicator LEDES to show the direction and approximate magnitude of the drive applied to the motor. These indicators can be used to determine proper servo system polarity without connecting instruments or the motors. A green glow indicates that pin 1 of the motor connector is more positive than pin 3.

## **THERMAL CONSIDERATIONS**

The 7I25 has a heatsink with approximately 7°C per watt per channel thermal resistance with natural convection. The H-Bridge ICs have a junction to heatsink thermal resistance of 2°C per watt. Power dissipation in the H-Bridge ICs is approximately 8 watts worst case (continuous 3A drive). With a suggested maximum H-Bridge junction temperature of 125°C, this results in a maximum ambient temperature rating of 53°C with worst case loads. It is suggested that forced air cooling be employed in high ambient temperature environments when continuous full scale output currents are needed. In most servo motor applications, natural convection cooling is more than adequate.

The H-Bridge ICs in the 7I25 have a thermal warning flag that is readable by the 6I27. This flag is activated at a junction temperature of 145 °C. At a temperature of 170 °C, the H-Bridge drivers shut off the motor drive.

## SPECIFICATIONS

	MIN.	MAX.	UNITS
MOTOR POWER SPECIFICATIONS:			
Operating voltage	12	55	VDC
Absolute maximum voltage	---	60	VDC
Idle supply current	---	20	mA (at 40 VDC)
OUTPUT CAPABILITY			
Continuous output current	---	3.0	A
Peak output current (10 ms)	---	6.0	A
Output voltage	VM - 2.4	---	V
+5V POWER SPECIFICATIONS: (from controller)			
Operating voltage	4.5	5.5	VDC
Power supply current	---	5	mA
ENVIRONMENTAL:			
Operating temperature range	0	+70	°C
Relative humidity	0	90	Percent

## **WARRANTY**

Mesa Electronics warrants the products it manufactures to be free from defects in material and workmanship under normal use and service for the period of 2 years from date of purchase. This warranty shall not apply to products which have been subject to misuse, neglect, accident, or abnormal conditions of operation.

In the event of failure of a product covered by this warranty, Mesa Electronics, will repair any product returned to Mesa Electronics within 2 years of original purchase, provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may at its option, replace the product in lieu of repair. With regard to any product returned within 2 years of purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operation, repairs will be billed at a nominal cost.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPLICIT OR IMPLIED. INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. MESA ELECTRONICS SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

If any failure occurs, the following steps should be taken:

1. Notify Mesa Electronics, giving full details of the difficulty. On receipt of this information, service data, or shipping instructions will be forwarded to you.
2. On receipt of the shipping instructions, forward the product, in its original protective packaging, transportation prepaid to Mesa Electronics. Repairs will be made at Mesa Electronics and the product returned transportation prepaid.