

7I39H/L MANUAL

Dual 300W 3 Phase HBridge

V1.2

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GENERAL

DESCRIPTION

The 7139 is a low cost 2 Axis 3 Phase H-bridge card for use with Mesa motion control cards and 3 Phase BLDC (AC synchronous) motors. There are two models of the 7139, the 7139H and 7139L. The 7139H has a maximum per axis current rating of 5 Amps continuous and a voltage rating of 48V. Current limits of 3.75 Amp and 7.5 Amp are user selectable. The 7139L has a maximum per axis current rating of 10A and a voltage rating of 28V. Current limits of 7.5A Amp and 15 Amp are user selectable.

The 7139 is protected against excessive current, excessive voltage and over temperature conditions. Low dead time (320 nS) allows PWM rates up to 50 KHz to be supported. Encoder and index inputs are conditioned with RC filters and Schmitt triggers for high noise rejection.

The controller connection is a 50 pin header that matches the pinout of the Mesa 4134M, 4138, 4165, 4168, 5120, 5122, 5123 and 7160 motion controllers. The 7139 is directly supported by the SoftDMC motion control firmware on that can be downloaded to these cards.

The 7139 accepts 3 PWM inputs per axis and one enable input. All cross conduction blanking and overcurrent protection is handled locally on the 7139 card.

HARDWARE CONFIGURATION

GENERAL

Hardware setup jumper positions assume that the 7I39 card is oriented in an upright position, that is, with the 50 pin controller connector is on the left hand side, and the 5 pin motor and and 10 pin encoder connectors are on the right side.

DEFAULT CONFIGURATION

JUMPER	FUNCTION	DEFAULT SETTING
W1	LED FUNCTION	LEFT = PWMA
W2	CURRENT LIMIT 1	LEFT = 7.5A(7I39H) 15A(7I37L)
W3	CURRENT LIMIT 0	LEFT = 7.5A(7I39H) 15A(7I39L)

CURRENT LIMIT

Each 7I39 Hbridge channel has a selectable current limit. The current limit is selected with jumper W3 for channel 0 and W2 for channel 1. When W2 or W3 are in the right hand position, the low current limit is selected. When W2 or W3 are in the left hand position, the high current limit is selected. Low current is 3.75A for the 7I39H and 7.5A for the 7I39L. High current is 7.5A for the 7I39H and 15A for the 7I39L.

For more information on current limit, see the OPERATION section of the manual.

LED FUNCTION

W1 determines whether CR8 and CR9 monitor PWMA1 and PWMA0 or PWMB1 and PWMB0. When W1 is on the left hand position, the LEDS monitor PWMA, When W1 is in the right hand position, PWMB is monitored.

CONNECTORS

CONTROLLER CONNECTOR

50 pin header connector J1 connects to the motion controller. This can be a male 50 pin header on the top of the 7I39 card or a female 50 conductor header on the bottom side of the 7I39 depending on 7I39 model. The controller connector pinout matches the 4I34M, 4I65, 4I68, 7I60, 5I20 pinouts. Controller connector pinout is as follows:

PIN	FUNCTION	DIRECTION	PIN	FUNCTION	DIRECTION
1	QA0	FROM 7I39	25	QA1	FROM 7I39
3	QB0	FROM 7I39	27	QB1	FROM 7I39
5	QIDX0	FROM 7I39	29	QIDX1	FROM 7I39
7	HALLA0	FROM 7I39	31	HALLA1	FROM 7I39
9	HALLB0	FROM 7I39	33	HALLB1	FROM 7I39
11	HALLC0	FROM 7I39	35	HALLC1	FROM 7I39
13	SENSEA0	FROM 7I39	37	SENSEA1	FROM 7I39
15	SENSEB0	FROM 7I39	39	SENSEB1	FROM 7I39
17	/ENA0	TO 7I39	41	/ENA1	TO 7I39
19	PWMA0	TO 7I39	43	PWMA1	TO 7I39
21	PWMB0	TO 7I39	45	PWMB1	TO 7I39
23	PWMC0	TO 7I39	47	PWMC1	TO 7I39
			49	+5V PWR	TO 7I39

Note: all even pins are grounded.

AUX 5V POWER

Four pin header P1 can be used to supply 5V power to the 7I39 if the controller cable is too long and +5V voltage drop too high. P1 has the following pinout:

PIN	FUNCTION
1	5V
2	GND
3	GND
4	5V

CONNECTORS

MOTOR CONNECTORS

The two 5 pin motor connector are 3.5 MM inline, Phoenix Contact 1843635. The suggested mating part is 1863181, This is a pluggable screw terminal type connector.

PIN	FUNCTION
1	MOTOR SHIELD (GND)
2	PHASEA
3	PHASEB
4	PHASEC
5	MOTOR SHIELD (GND)

ENCODER CONNECTORS

The two encoder connectors are standard 10 pin male headers. Suggested female receptacle is AMP 1658622-1. This is an IDC type connector for flat cable. Encoder connector pininput is as follows:

PIN	FUNCTION	NOTE
1	HALLA	1K OHM PULLUP - SCHMITT TRIGGER
2	HALLB	1K OHM PULLUP - SCHMITT TRIGGER
3	HALLC	1K OHM PULLUP - SCHMITT TRIGGER
4	SENSEA	
5	SENSEB	
6	ENC_+5V	
7	ENC_QA	RC FILTER - SCHMITT TRIGGER
8	ENC_QB	RC FILTER - SCHMITT TRIGGER
9	ENC_QIDX	RC FILTER - SCHMITT TRIGGER
10	ENC_GND	

OPERATION

PWM RATE

The 7I39 can operate with PWM rates from 1 KHz to 50 KHz. Higher PWM rates will result in slightly higher switching losses and a larger dead zone. PWM rates are normally set above 20 KHz to avoid audible noise from the load.

CURRENT LIMIT

Each 7I39H output channel can have its preset current limit set to 3.75A +-10% or 7.5A +- 10%. Each 7I39L output channel can have its preset current limit set to 10A +-10% or 15A +- 10% When the current limit is reached the 7I39 will start operating in a fixed off time constant current mode, modulating the drive to maintain the current at the preset limit.

OVER VOLTAGE PROTECTION

The 7I39 has built in over voltage protection on motor power. This protects the 7I39H from load dump type faults (for example disconnecting the motor power when current flows in the motor) without requiring large capacitors on the 7I39 card. The over voltage protection functions by turning on all driver MOSFETS when motor voltage exceeds the built in threshold. This threshold is 52 VDC on the 7I39H and 34VDC on the 7I39L. When this threshold is exceeded, all MOSFETS are turned on, thus shorting out the motor power. Once an overvoltage is detected the MOSFETS are all driven for a minimum of 20 uSec to prevent high frequency oscillations. If the 7I39 is run at a motor power near the overvoltage threshold, an external capacitor may be needed to prevent voltage surges from inadvertently tripping the protection circuit. This capacitor is usually needed only if the power supply does not have a output capacitor.

OVER TEMPERATURE PROTECTION

The 7I39 has 2 independent over temperature detection circuits, one per axis. These circuits will disable the output MOSFETS on the affected side when the card temperature reaches 100°C. Once disabled, the output MOSFETS will be kept off for 5 seconds at which point the temperature is re-sampled, and the MOSFETS either enabled or disabled for another 5 seconds depending on whether the temperature is above or below 100°C.

OPERATION

INPUT CIRCUIT

The input circuit on the encoder A,B, and index inputs consists of a RC filter followed by a Schmitt trigger. This helps to reject spike noise on the encoder lines. The input circuit inverts the signals, so, for example, an active high index signal will be active low at the controller interface.

MAXIMUM COUNT RATE

The input RC filter limits the maximum encoder input frequency to approximately 1 MHz. This corresponds to 2 million counts per second with most quadrature counters (4X mode). The maximum input frequency may be lower with encoders that have high value (>1K Ohm) pullup resistors on open collector outputs.

5V POWER

The 7I39 requires ~200 mA of 5V power for operation. Encoder power is also supplied from the 7I39's 5V source. Power for the 7I39 is normally supplied from pin 49 of the 50 conductor controller cable, but can also be supplied via P1.

MOTOR POWER

Motor power is supplied via terminal block P7. Positive motor power is on the right hand side of the terminal block, negative power on the left. The negative motor power is connected to ground on the 7I39 card.

Maximum motor voltage is 48VDC for the 7I39H and 28VDC for the 7I39L. Note that the absolute maximum motor voltage is 50VDC for the 7I39H and 30VDC for the 7I39L. Gate power on the 7I39 is derived from 5V power, which allows the 7I39 to function properly all the way down to 0V motor power supply voltage. This can be useful for safe first time setup and testing by using low motor power supply voltages.

The total motor current supplied to both axis should be limited to 10 Amps continuous to prevent thermal overload. A 10A replaceable fuse is located next to the motor power terminal block.

LED FUNCTIONS

CR2	GATE POWER	CR9	PWMA0 or PWMB0
CR7	FAULT ON AXIS 1	CR11	FAULT ON AXIS 0
CR8	PWMA1 or PWMB1		

Fault indication can be overvoltage, current limit, or over temperature.

OPERATION

ENABLE INPUT

Each Hbridge circuit has an active low enable input. When this input is high, the Hbridge is disabled regardless of the state of the PWM inputs. A pullup resistor keeps the enable input high if the controller connection is lost.

MOTOR/ENCODER WIRING

The motor wires carry high voltage signals with fast rise times. These signals can easily couple into the low voltage encoder inputs, causing position counting errors. One or more of the following methods should be used to reduce this coupling:

1. Twist motor leads
2. Shield motor leads
3. Route motor leads away from encoder leads (do not bundle together)
4. Shield encoder leads.

Longer wiring runs may require all of these methods to be used together.

SPECIFICATIONS

	MIN	MAX	UNITS
5V POWER SUPPLY	4.5V	5.5V	VDC
5V POWER CONSUMPTION	---	100	mA
MOTOR SUPPLY VOLTAGE (7I39H)	0	50	V (1)
MOTOR SUPPLY VOLTAGE (7I39L)	0	30	V (1)
IDLE MOTOR SUPPLY CURRENT	---	5	mA
CONTINUOUS MOTOR CURRENT (7I39H)	---	5	A (2)
CONTINUOUS MOTOR CURRENT (7I39L)	---	10	A (2)
TOTAL CONTINUOUS INPUT CURRENT	---	10	A
ENCODER FREQUENCY	DC	1	MHz
OPERATING TEMP.	0	+70	°C
OPERATING TEMP. (-I version)	-40	+85	°C
OPERATION HUMIDITY	0	95%	NON-COND

Notes:

1. Absolute maximum rating
2. Motor current rating is per phase at 55°C ambient, derated to 0 at 100°C