7I30 MANUAL

Quad 100W HBridge

V1.2

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GENERAL

DESCRIPTION

The 7I30 is a low cost 4 Axis H-bridge card for use with Mesa motion control cards. The 7I30 has a maximum per axis current rating of 3 Amps and a voltage rating of 48V. Current limits of 1 Amp and 3 Amp are user selectable, as are fast and slow current decay modes.

The H-bridge chips (Allegro A3959) use DMOS transistors and synchronous rectification for high efficiency and low power dissipation. PWM rates up to 50 KHz are 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 4I27, 4I34M, 5I20 and 7I60 motion controllers. 4 latching Mini Mate-N-Loc connectors are used for motor/encoder connections.

HARDWARE CONFIGURATION

GENERAL

Hardware setup jumper positions assume that the 7I30 card is oriented in an upright position, that is, with the 50 pin controller connector is on the left hand side, and the 4 (2 in the 7I30-2 case) motor connectors are on the right side.

DEFAULT CONFIGURATION

JUMPER	FUNCTION	DEFAULT SETTING
W2,W5,W8,W11	CURRENT LIMIT	DOWN = 1A
W3,W6,W9,W12	SLOW/FAST DECAY	DOWN = FAST

CURRENT LIMIT

Each 7I30 Hbridge channel has a selectable 1A or 3A current limit. The current limit is selected with jumper W11 for channel 0, W8 for channel1, W5 for channel 2 and W2 for channel 3. When the jumper is in the UP position (marked ‘H’ on the card) the current limit is 3A. When the jumper is in the DOWN position (marked ‘L’ on the card) the current limit is 1A.

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

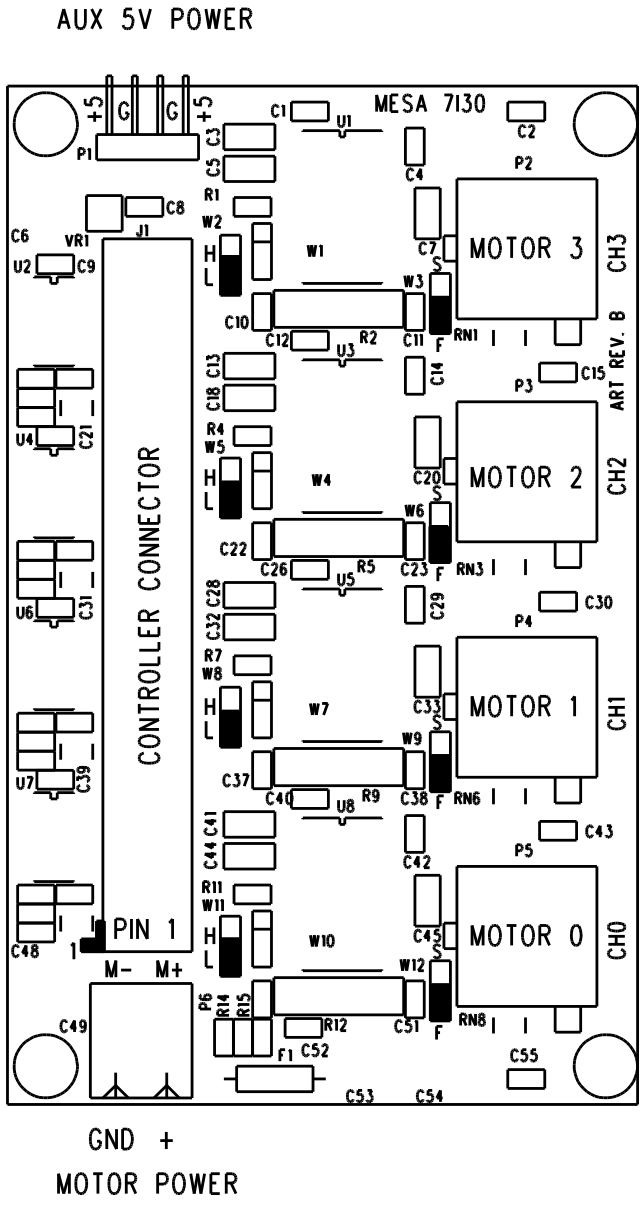
FAST/SLOW DECAY MODE

Each 7I30 Hbridge channel can be programmed to operate in fast or slow decay mode. In the fast decay mode, the load is connected to the power supplies in the reverse direction of drive during the current decay portion of the off time. This has the effect of quickly dumping the inductive flyback current into the supplies during the off period. The slow mode shorts out the load during the off period, resulting in slow current decay. The decay mode is selected with jumper W12 for channel 0, W9 for channel 1, W6 for channel 2 and W3 for channel 3. When the jumper is in the UP position (marked with a ‘S’ on the card) the slow decay mode is selected. When the jumper is in the DOWN position (marked with a ‘F’ on the card) the fast decay mode is selected.

For more information on the fast and slow decay modes, see the OPERATION section of the manual.

CONNECTORS

CONNECTOR LOCATIONS AND DEFAULT JUMPER POSITIONS



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 7I30 card or a female 50 conductor header on the bottom side of the 7I30 depending on 7I30 model. The controller connector pinout matches the 4I27 (2 axis 7I30-2 only), 4I34M, 7I60, 5I20 (2 or 4 axis) pinouts. Controller connector pinout is as follows:

PIN	FUNCTION	DIRECTION	PIN	FUNCTION	DIRECTION
1	QB1	FROM 7I30	25	QB3	FROM 7I30
3	QA1	FROM 7I30	27	QA3	FROM 7I30
5	QB0	FROM 7I30	29	QB2	FROM 7I30
7	QA0	FROM 7I30	31	QA2	FROM 7I30
9	IDX1	FROM 7I30	33	IDX3	FROM 7I30
11	IDX0	FROM 7I30	35	IDX2	FROM 7I30
13	PWM1	TO 7I30	37	PWM3	TO 7I30
15	PWM0	TO 7I30	39	PWM2	TO 7I30
17	DIR1	TO 7I30	41	DIR3	TO 7I30
19	DIR0	TO 7I30	43	DIR2	TO 7I30
21	/ENA1	TO 7I30	45	/ENA3	TO 7I30
23	/ENA0	TO 7I30	47	/ENA2	TO 7I30
			49	+5V PWR	TO 7I30

Note: all even pins are grounded.

AUX 5V POWER

Four pin header P1 can be used to supply 5V power to the 7I30 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

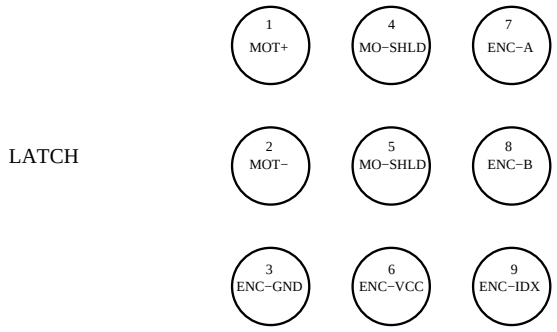
CONNECTORS

MOTOR CONNECTORS

The four 9 pin motor connector are AMP MINI-MATE-N-LOCK style connectors. The mating part# is 794194-1. Motor connector pinout is as follows:

PIN	FUNCTION	DIRECTION
1	MOTOR +	FROM 7I30
2	MOTOR -	FROM 7I30
3	ENCODER GND	
4	MOTOR SHIELD (GND)	
5	MOTOR SHIELD (GND)	
6	ENCODER VCC	FROM 7I30
7	ENCODER A	TO 7I30
8	ENCODER B	TO 7I30
9	ENCODER IDX	TO 7I30

MOTOR CONNECTOR (TOP VIEW)



OPERATION

PWM RATE

The 7I30 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 7I30 output channel can have its preset current limit set to 1A +-20% or 3A +- 10%. When the current limit is reached the 7I30 will start operating in a constant current mode, modulating the drive to maintain the current at the preset limit.

FAST/SLOW DECAY MODES

The Hbridge chips used by the 7I30 can operate in fast or slow decay modes. Each mode has different operating characteristics.

In fast decay mode, inductive flyback current is discharged into the power supplies, resulting in a fast decay of load current when the PWM drive is off. This has the advantage of fast response of load current to PWM changes. In fast decay mode, when the PWM drive is removed, the load will see an open circuit so no braking effect will be present. When fast decay mode is used, there may be considerable non-linearity between PWM drive and load current. This is caused by the fact that the load current is completely discharged during the off cycle at low PWM duty cycles and must start building up from zero when the PWM drive is on. This will manifest itself as a large dead zone. This effect can be minimized by running at the lowest practical PWM rate, which will allow a reasonable load current to build up during a PWM cycle. The non-linearity can sometimes also be compensated by the controller

In the slow decay mode, the load is shorted in the off PWM cycle. This results in the slowest decay of load current. Operation in this mode will result in better linearity of PWM drive versus output current than the fast decay mode. In slow decay mode, the load will be shorted if the PWM is disabled. This results in motor braking when PWM drive is removed, since the motor is shorted by the Hbridge chips when no drive is present.

It is important to note that the current limit circuit does not operate when the load is shorted, so if PWM drive to a motor is suddenly removed when moving at high speed, a large fault current can flow in the Hbridge circuit - potentially destroying it. Mesa *SOFT*DMC motion controllers disable the /ENA line to the Hbridge in the event of an excessive position error or drive limit to avoid this problem.

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 4 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 7I30 requires ~30 mA of 5V power for operation. Encoder power is also supplied from the 7I30's 5V source. The Hbridge chips have a logic voltage detector that disables operation when the 5V supply is less than ~4.2V. Power for the 7I30 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 P6. 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 7I30 card.

Minimum motor voltage is 10 VDC, maximum voltage is 48VDC. Note that the absolute maximum motor voltage is 50 VDC which cannot be exceeded without possible component damage.

To prevent the motor voltage from exceeding 50VDC during load-dump conditions, it is suggested that the power supply have a large output capacitor to absorb the inductive energy stored in the loads. The on card motor power capacitance (150 uF) is sufficient to protect the 7I30 running at 24 VDC from a load dump of 4 motors at 3A with 2.5 mH of inductance per motor. Motor power (or motor connectors) should not be disconnected when load current is flowing.

The total motor current supplied to all 4 axis should be limited to 8 Amps continuous to prevent thermal overload. A 10A replaceable fuse is located next to the motor power terminal block.

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 and direction inputs. When disabled, each Hbridge draws only leakage current from the motor power (< 1mA total when all channels disabled) and the logic power is reduced to less than 2mA (<10 mA total when all channels are disabled) 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	---	50	mA
SLEEP MODE 5V POWER CONSUMPTION	---	10	mA
MOTOR SUPPLY VOLTAGE	10	48	V
IDLE MOTOR SUPPLY CURRENT	---	30	mA
SLEEP MODE MOTOR SUPPLY CURRENT	---	1	mA
PER MOTOR CURRENT	---	3	A
TOTAL CONTINUOUS CURRENT	---	8	A
ENCODER FREQUENCY	DC	1	MHz
OPERATING TEMP.	0	+70	^{o}C
OPERATING TEMP. (-I version)	-40	+85	^{o}C
OPERATION HUMIDITY	0	95%	NON-COND

Note: Sleep mode means all /enable inputs are at a logic high level