

# **7133/7133T MANUAL**

**Quad analog servo amp interface**

V1.2

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# GENERAL

## DESCRIPTION

The 7I33 and 7I33T are 4 axis analog servo interfaces intended for operation with MESA's Anything I/O cards when used for motion control applications. The 7I33 and 7I33T take the PWM and direction signals from the Anything I/O card and converts them to +- 10V analog output voltages for direct connection to analog input servo amplifiers.

The 7I33 and 7I33T also condition the encoder input signals with input filters for TTL inputs or a RS-422 receivers for differential encoder inputs.

The controller connection is a 50 pin header that matches the pinout of the Mesa 4I27 motion controller (2 axis only) or the 4I34M, 4I65, 5I20 and 7I60 anything I/O cards. The 7I33 uses another 50 pin header for servo amp/encoder connections, while the 7I33T has two 24 pin 3.5 mm headers compatible with Weidmueller pluggable screw terminal strips.

# HARDWARE CONFIGURATION

## GENERAL

Hardware setup jumper positions assume that the 7133 card is oriented in an upright position, that is, with the 50 pin controller connector is on the left hand side,

## DEFAULT CONFIGURATION

JUMPER	FUNCTION	DEFAULT SETTING
W4	CH0 TTL/RS-422 SELECT	DOWN = TTL
W3	CH1 TTL/RS-422 SELECT	DOWN = TTL
W2	CH2 TTL/RS-422 SELECT	DOWN = TTL
W1	CH3 TTL/RS-422 SELECT	DOWN = TTL

## TTL/RS-422 ENCODER SELECTION

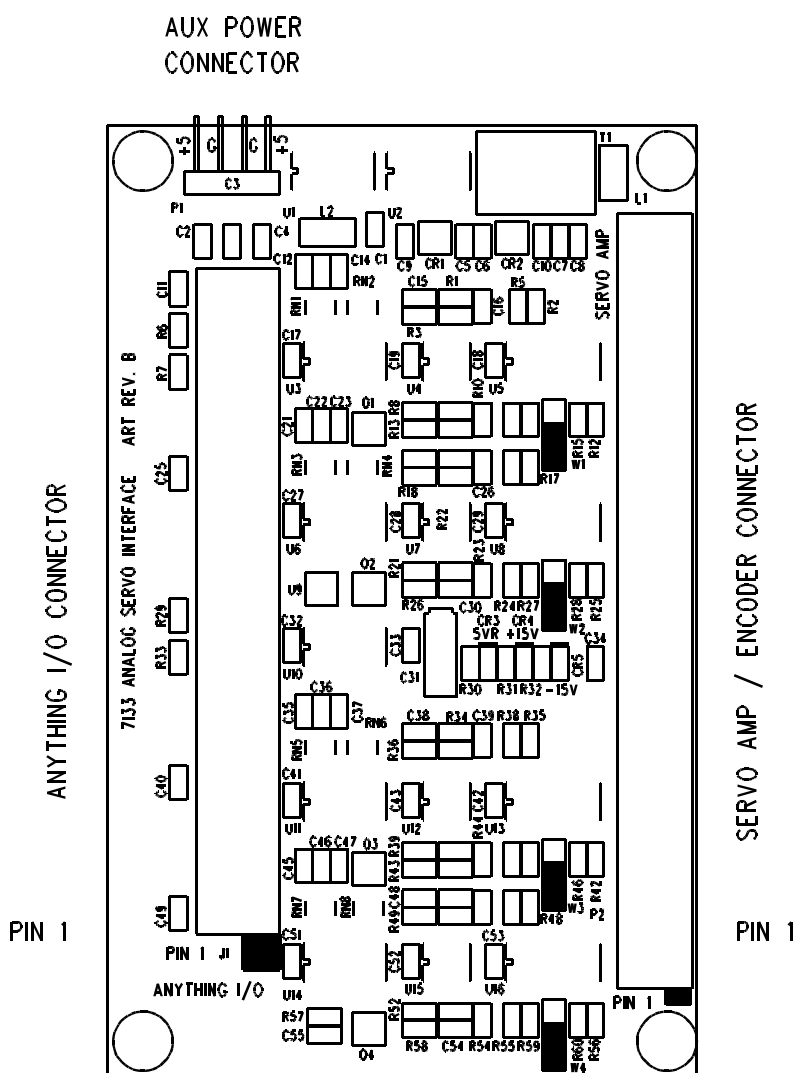
Each 7133 channel has a selectable TTL or RS-422 (differential) encoder input conditioning. W1,W2,W3,and W4 determine the encoder input mode. When the jumpers are in the "DOWN" position, TTL inputs are selected, When the jumpers are in the "UP" position, RS-422 inputs are selected. W1 selects the input mode for channel 3 , W2 for channel 2, W3 for channel 1 and W4 for channel 0.

### **IMPORTANT NOTE:**

*In TTL mode, 7133 cards previous to revision D have series resistors in the output pins driving the controller card. FPGA card inputs with 3.3K pull-ups will result in poor noise immunity of the quadrature signals from the 7133. If you are using TTL encoder inputs on a pre-rev D 7133 card with a FPGA card having 3.3K pull-up resistors, it is best to remove the pull-up resistor SIP packages connected to the 7133 from the FPGA card. This only affects TTL encoder inputs, not differential inputs.*

# CONNECTORS

## CONNECTOR LOCATIONS AND DEFAULT JUMPER POSITIONS



# CONNECTORS

## CONTROLLER CONNECTOR

50 pin header connector J1 connects to the anything I/O card/motion controller. This can be a male 50 pin header on the top of the 7I33 card or a female 50 conductor header on the bottom side of the 7I33 depending on 7I33 model. The controller connector pin-out matches the 4I34M, 4I65, 4I68, 7I43, 7I60, 5I20, 5I22, 5I23 (4 axis) pinouts. Controller connector pin-out is as follows:

<b>PIN</b>	<b>FUNCTION</b>	<b>DIRECTION</b>	<b>PIN</b>	<b>FUNCTION</b>	<b>DIRECTION</b>
1	QB1	FROM 7I33	25	QB3	FROM 7I33
3	QA1	FROM 7I33	27	QA3	FROM 7I33
5	QB0	FROM 7I33	29	QB2	FROM 7I33
7	QA0	FROM 7I33	31	QA2	FROM 7I33
9	IDX1	FROM 7I33	33	IDX3	FROM 7I33
11	IDX0	FROM 7I33	35	IDX2	FROM 7I33
13	PWM1	TO 7I33	37	PWM3	TO 7I33
15	PWM0	TO 7I33	39	PWM2	TO 7I33
17	DIR1	TO 7I33	41	DIR3	TO 7I33
19	DIR0	TO 7I33	43	DIR2	TO 7I33
21	/ENA1	TO 7I33	45	/ENA3	TO 7I33
23	/ENA0	TO 7I33	47	/ENA2	TO 7I33
			49	+5V PWR	TO 7I33

Note: all even pins are grounded.

## AUX 5V POWER

4 pin header P1 can be used to supply 5V power to the 7I33 if the controller cable is too long and voltage drop too high. P1 has the following pinout:

<b>PIN</b>	<b>FUNCTION</b>
1	5V
2	GND
3	GND
4	5V

# CONNECTORS

## 50 PIN SERVO AMP/ENCODER CONNECTOR

The 7I33s servo amplifier / encoder connector (P2) is a 50 pin latching header. P2 has the following pinout:

<b>PIN</b>	<b>FUNCTION</b>	<b>DIRECTION</b>	<b>PIN</b>	<b>FUNCTION</b>	<b>DIRECTION</b>
1	GND		26	ENCA2	TO 7I33
2	ENCA0	TO 7I33	27	/ENCA2	TO 7I33
3	/ENCA0	TO 7I33	28	GND	
4	GND		29	ENCB2	TO 7I33
5	ENCB0	TO 7I33	30	/ENCB2	TO 7I33
6	/ENCB0	TO 7I33	31	VCC	FROM 7I33
7	VCC	FROM 7I33	32	IDX2	TO 7I33
8	IDX0	TO 7I33	33	/IDX2	TO 7I33
9	/IDX0	TO 7I33	34	GND	
10	GND		35	AOUT2	FROM 7I33
11	AOUT0	FROM 7I33	36	GND	
12	GND		37	ENA2	FROM 7I33
13	ENA0	FROM 7I33	38	ENCA3	TO 7I33
14	ENCA1	TO 7I33	39	/ENCA3	TO 7I33
15	/ENCA1	TO 7I33	40	GND	
16	GND		41	ENCB3	TO 7I33
17	ENCB1	TO 7I33	42	/ENCB3	TO 7I33
18	/ENCB1	TO 7I33	43	VCC	FROM 7I33
19	VCC		44	IDX3	TO 7I33
20	IDX1	TO 7I33	45	/IDX3	TO 7I33
21	/IDX1	TO 7I33	46	GND	
22	GND		47	AOUT3	FROM 7I33
23	AOUT1	FROM 7I33	48	GND	
24	GND		49	ENA3	FROM 7I33
25	ENA1	FROM 7I33	50	GND	

# CONNECTORS

## TERMINAL BLOCK SERVO AMP/ENCODER CONNECTORS

The 7I33Ts servo amplifier / encoder connectors (TB1 and TB2) are 3.5MM 24 pin headers compatible with Weidmueller pluggable terminal block PN 162044000.

<b>TB1 PIN</b>	<b>FUNCTION</b>	<b>DIR</b>	<b>TB2 PIN</b>	<b>FUNCTION</b>	<b>DIR</b>
1	ENCA0	TO 7I33T	1	ENCA1	TO 7I33T
2	/ENCA0	TO 7I33T	2	/ENCA1	TO 7I33T
3	GND	FROM 7I33T	3	GND	FROM 7I33T
4	ENCB0	TO 7I33T	4	ENCB1	TO 7I33T
5	/ENCB0	TO 7I33T	5	/ENCA1	TO 7I33T
6	+5V	FROM 7I33T	6	+5V	FROM 7I33T
7	IDX0	TO 7I33T	7	IDX1	TO 7I33T
8	/IDX0	TO 7I33T	8	/IDX1	TO 7I33T
9	GND	FROM 7I33T	9	GND	FROM 7I33T
10	AOUT0	FROM 7I33T	10	AOUT1	FROM 7I33T
11	GND	FROM 7I33T	11	GND	FROM 7I33T
12	ENABLE0	FROM 7I33T	12	ENABLE1	FROM 7I33T
13	ENCA2	TO 7I33T	13	ENCB3	TO 7I33T
14	/ENCA2	TO 7I33T	14	/ENCA3	TO 7I33T
15	GND	FROM 7I33T	15	GND	FROM 7I33T
16	ENCB2	TO 7I33T	16	ENCB3	TO 7I33T
17	/ENCB2	TO 7I33T	17	/ENCA3	TO 7I33T
18	+5V	FROM 7I33T	18	+5V	FROM 7I33T
19	IDX2	TO 7I33T	19	IDX3	TO 7I33T
20	/IDX2	TO 7I33T	20	/IDX3	TO 7I33T
21	GND	FROM 7I33T	21	GND	FROM 7I33T
22	AOUT2	FROM 7I33T	22	AOUT3	FROM 7I33T
23	GND	FROM 7I33T	23	GND	FROM 7I33T
24	ENABLE2	FROM 7I33T	24	ENABLE3	FROM 7I33T

## **OPERATION**

### **PWM RATE**

The 7I33 is meant to operate with PWM rates from 100 KHz to 10 MHz. Operation at lower PWM rates will result in excessive output ripple . When used with *SOFTDMC* firmware, it is best to set the PWM rate to the maximum (192 KHz). If the motion control firmware is capable of generating interleaved PWM, that option should be enabled to minimize output ripple.

### **STEP RESPONSE**

The 7I33 PWM filter has an approximate 150 uSec time constant. This value is selected as a compromise between output ripple and settling time. This is much faster than most controlled devices and will not normally have any effect on loop stability or performance. The 7I33 can be assembled with different components if necessary to change this time constant.

### **ENCODER INPUT CIRCUIT**

The 7I33 input circuit is different depending on whether TTL or RS-422 encoder types have been selected.

In TTL mode 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.

In RS-422 mode, the input consists of a 132 Ohm termination resistor and a 26LS32 RS-422 differential receiver.

### **MAXIMUM COUNT RATE**

In TTL mode, 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) pull-up resistors on open collector outputs.

In RS-422 mode, maximum encoder input frequency is 10 MHz, giving a maximum count rate of 40 million counts per second

### **5V POWER**

The 7I33 requires ~60 mA of 5V power for operation. Encoder power can also be supplied from the 7I33's 5V source. Power for the 7I33 is normally supplied from pin 49 of the 50 conductor controller cable, but can also be supplied via P1.

# **OPERATION**

## **ENABLE INPUT**

Each 7I33 channel has an active low TTL level enable input. When this input is high, the corresponding AOUT is forced to 0V regardless of the state of the PWM and direction inputs. A pullup resistor keeps the enable input high if the controller connection is lost.

## **ENABLE OUTPUT**

Each 7I33 channel has an 5V CMOS active high enable output available on the SERVO AMP / ENCODER connector. These signals are the logical inversion of the Enable inputs.

## **ANALOG OUTPUT**

The analog output of the 7I33 swings from -10 v to +10V. Positive outputs are generated when the DIR input is high, and negative outputs when DIR is low. A 50 % duty cycle PWM signal will generate a 5V output. This mode of operation is often referred to as sign-magnitude.

Due to power supply limitations, The 7I33 has limited DC output drive capability and should not have loads of less than 5K Ohms on its analog outputs.

## SPECIFICATIONS

	MIN	MAX	UNITS
5V POWER SUPPLY	4.75	5.25	VDC
5V POWER CONSUMPTION (no external load)	---	100	mA
ANALOG OUTPUT VOLTAGE	+9.7	+10.3	V
MINIMUM AOUT LOAD RESISTANCE	5K	---	Ohm
OUTPUT RIPPLE @ 100 KHZ PWM	---	2	% FS
ENCODER FREQUENCY (TTL)	DC	1	MHz
ENCODER FREQUENCY (RS-422)	DC	10	MHz
OPERATING TEMP.	0	+70	°C
OPERATING TEMP. (-I version)	-40	+85	°C
OPERATION HUMIDITY	0	95%	NON-COND