MESA 7I95T
ETHERNET STEP/DIR + ENCODER

# DESCRIPTION

The 7I95T is a Ethernet connected motion control interface designed for interfacing up to 6 Axis of step&dir step motor or servo motor drives and includes encoder feedback for each axis. Step rates up to 10 MHz are supported. The 7I95T also has 24 isolated inputs plus 6 isolated outputs for general purpose I/O use. 6 high speed encoder interfaces are provided axis feedback and for spindle synchronized motion. Two RS-422/RS485 serial expansion ports and a parallel expansion port are also provided.

All step and direction outputs are buffered 5V signals that can drive 24 mA. All outputs support differential mode to reduce susceptibility to noise. The encoders can be used with TTL or differential input.

24 isolated inputs are provided for general control use including limit switch and control panel inputs. Inputs operate with 4V to 36V DC and can have a positive or negative common for sourcing or sinking input applications. 8 of the isolated inputs can be used to support up to 4 quadrature MPGs. Six 36V 2A isolated outputs allow sinking, sourcing combinations of both.

Two RS-422/RS-485 interface is provided for I/O expansion via a serial I/O daughtercard. In addition to the on card I/O, A FPGA expansion connector compatible with Mesa's 25 pin daughtercards or standard parallel port breakout boards allow almost unlimited I/O options including additional quadrature or absolute encoder inputs, step/dir or PWM/dir outputs, and field I/O expansion to hundreds of I/O points. All field wiring is terminated in pluggable 3.5 mm screw terminal blocks. The 7I95T runs from a single 5V supply

### ENCODER INPUT MODES

The 7I95Ts six encoder inputs can be programmed for differential or single ended mode operation. Each encoder has 3 jumpers which set the input mode of the individual A/B/Z inputs. Normally these jumper will all be set to single ended or differential on a single encoder channel. The jumpers are set to the right hand position for differential inputs and the left hand position for single ended inputs. Note that the groups of three jumpers are close to the associated encoder connector. Default setting is differential (right hand position) for all encoders.

## IP ADDRESS SELECTION

The 7I95T has three options for selecting its IP address. These options are selected by Jumpers W15 and W16.

| W15 | W16 | IP ADDRESS | |
|---|---|---|---|
| DOWN | DOWN | FIXED 192.168.1.121 | (DEFAULT) |
| DOWN | UP | FIXED FROM EEPROM | 10.10.10.10 |

## FRAME GROUND

The top left mounting hole (near the Ethernet jack) is the frame ground connection. This should be grounded to earth/frame ground for best ESD/EMI resistance

CONNECTORS
5VP pins are PTC short circuit protected 5V output pins for field wirin

## STEP/DIR INTERFACE

The 7I95T provides six channels of step/dir interface with buffered 5V differential signal pairs. Each differential pair consists of two complementary 5V outputs. The differential signals allows reliable signal transmission in noisy environments and can directly interface with RS-422 line receivers. Step motor drives with single ended inputs connect to just one of the STEP and DIR signal outputs, that is either the STEP+/DIR+ or STEP-/DIR- signals, with the unused signals left unconnected at the 7I95T. The input common signal on drives with single ended inputs connects to the 7I95Ts GND or 5VP pins depending on the drive type.

## ENCODER INTERFACE

The 7I95T provides six channels of quadrature encoder interface with index. Encoder inputs can be programmed for differential or single ended encoders. The encoder interface also provides short circuit protected 5V power to the encoders. When used with single ended encoders, the ENCA+, ENCB+ and IDX+ signals are wired to the encoder and the ENCA-,ENCB-, and IDX- terminal left unconnected.

## MAXIMUM ENCODER COUNT RATE

The 7I975 uses multiplexed encoder signals to save FPGA pins. The multiplexing rate will determine the maximum encoder count rate. Default multiplexing rate with HostMot2 firmware is ClockLow /16,or approximately 6 MHz giving a resolvable count rate of 3 MHz.

## ISOLATED I/O

The 7I95T has 24 isolated inputs and 6 isolated outputs. All 24 Isolated inputs have a common pin per input pair. This common pin must be connected to ground for active high inputs and connected to the I/O power for active low inputs. The 6 isolated outputs are completely floating switches so can be use for pull-up/pull-down and mixed voltage switching.

## ISOLATED INPUT CHARACTERISTICS

The isolated inputs use opto-isolators with a 4.7K input series resistance. This results in an approximate current draw of 5 mA at 24V. The inputs will operate with +-4V to +-36V signals relative to input common. Isolated inputs are relatively slow and not suited for signals faster than about 4 KHz. Each input pair has a separate common connection to allow mixing of sinking/sourcing and mixed supply voltages.

For PNP type sensors or switches with a common positive, the input common pin for a given input pair is grounded.

For NPN type sensors or switches with a common ground, the input common for a given input pair is connected to +5 to +36V and the input pins are grounded to activate an input.

## ISOLATED OUTPUT CHARACTERISTICS

The 6 isolated outputs use full floating MOSFET switches ( a DC Solid State Relay or SSR ) and can be used just like a switch or relay contact. Maximum voltage is 36 VDC and maximum load current is 2A. Inductive loads must have a flyback diode. The output polarity must be observed (reversed outputs will be stuck-on).

**Note: The 7I95T outputs are not short circuit protected so a current limited power supply or a 2A to 5A fuse should be used in the power source that supplies the outputs.**

## LOGIC POWER

5V logic power for the host interface FPGA, expansion connectors, RS-422 and encoder connections and step/dir connections can be provided at connector P3, or alternatively TB2.

## P1 PULLUP/PULLDOWN RESISTORS

All P1 expansion I/O pins are provided with pull-up/pulldown resistors to allow connection to open drain, open collector, or OPTO devices and to set the power-up state of the pins. These resistors have a value of 4.7K so have a maximum pullup/pulldown current of ~1.07 mA at 5V.

## EXPANSION CONNECTOR IO LEVELS

The Efinix FPGAs used on the 7I95T have programmable I/O levels for interfacing with different logic families. The 7I95T does not support use of the I/O standards that require input reference voltages. All standard Mesa configurations use LVTTL levels.

Note that even though the 7I95T expansion I/O can tolerate 5V signal inputs, its outputs will not swing to 5V. The outputs are push pull CMOS that will drive to the output supply rail of 3.3V. This is sufficient for TTL compatibility but may cause problems with some types of loads. For example when driving an LED that has its anode connected to 5V, in such devices as OPTO isolators and I/O module rack SSRs, the 3.3V high level may not completely turn the LED off. To avoid this problem, either drive loads that are ground referred, Use 3.3V as the VCC for VCC referred loads, or use open drain mode.

## EXPANSION CONNECTOR STARTUP I/O VOLTAGE

After power-up or watchdog bite, the expansion connector pin states are determined by the pullup or pulldown resistors. If the expansion connector pins are used for motion control or controlling devices that could present a hazard when enabled, external circuitry should be designed so that this initial state results in a safe condition.

| GENERAL | MIN | MAX | NOTES |
|---|---|---|---|
| HOST SUPPLY VOLTAGE 5V | 4.75 VDC | 5.25 VDC | |
| 5V CURRENT | ---- | 500 mA | No ext load . |
| **STEP/DIR OUTPUTS** | | | |
| STEP/DIR OUTPUT HIGH V | 4V | ---- | 10 mA source |
| STEP/DIR OUTPUT LOW V | ---- | 1V | 10mA sink |
| STEP RATE | ---- | 10 | MHz |
| **ISOLATED INPUTS** | | | |
| INPUT RANGE | +-4V | +-36V | |
| INPUT RESISTANCE | 4.7K | 5K | |
| INPUT ISOLATION VOLTAGE | ---- | 100 | VDC |
| MAXIMUM INPUT FREQUENCY | ---- | 5 | KHz |
| **ISOLATED OUTPUTS** | | | |
| OUTPUT SWITCHED VOLTAGE | 0V | +36V | |
| OUTPUT SWITCHED CURRENT | ---- | 2A | |
| OUTPUT RESISTANCE | ---- | 75 | mOhm |
| OUTPUT ISOLATION VOLTAGE | ---- | 100 | VDC |
| MAXIMUM OUTPUT FREQUENCY | ---- | 5 | KHz |

| | MIN | MAX | NOTES |
|---|---|---|---|
| **HIGH SPEED ENCODER INPUTS** | | | |
| INPUT COMMON MODE RANGE | -7 | +12 | Volts |
| INPUT TTL MODE THRESHOLD | 1.4 | 1.8 | Volts |
| DIFFERENTIAL MODE IMPEDANCE | 118 | 122 | Ohms |
| COUNT RATE | ---- | 3 MHz | |