November 26, 2002
Kuper Controls
tel: 505-263-5949

I/O CONNECTORS ON THE KUPERDAT REV.A BOARD

STEP & DIRECTION signals are brought out on 16 pin header H1. Six axes are available. Step signals are square waves for efficient cable penetration. The polarity of each step signal can be individually programmed to accommodate drivers with "problem" direction input characteristics. Although faster rates are possible, cable considerations will normally limit the maximum practical step rate to 500 kHz on each axis.

QUADRATURE OUTPUTS are available as an alternative to step & direction outputs. Each of the six output pairs on H1 can be individually selected as either step & direction outputs or single-ended quadrature outputs. Maximum quadrature rate is 500,000 edges per second.

DIFFERENTIAL ENCODERS INPUTS are brought in through 50 pin headers JP2 (encoders 0 to 4) and JP3 (encoders 5 to 9). Maximum native encoder pulse input rate is 500,000 edges per second, when using well-made cables.

Both headers supply +5 volts and ground to power the encoders. An on-board DC-DC converter supplies +5 volts to the EVCC pins. This power source is separate from the computer supply, so that noise or short-circuits in the encoder circuitry will not crash the computer. The total current draw on all EVCC pins combined should not exceed 2.5 amps.

The pinout scheme is selected to be compatible with US Digital "PC4-PH10" differential line driver adapters. These small adapters fits directly on to the pins of standard S2-xxxx and S1-xxxx encoders, without substantially enlarging the form factor of the encoders. For use with short cable runs such as inside equipment, 50 pin ribbon cables can be split into groups of 10 wires, and terminated with standard 10 pin insulation displacement connectors. These 10 pin headers will directly connect to the PC4-PH10 adapters.

For use outside equipment, 10 wire, twisted pair, shielded cables should be used. 6 wires are for the differential pairs, 2 wires are for EVCC (+5 volts), and 2 for ground. The shield should not be used to carry the ground signal. Also, the shield should not be connected to any logic ground. A well-made cable of this type, when used with an encoder with line driver outputs, will transmit differential encoder signals of up to 500 kHz through cable lengths of up to 300 feet. Much longer encoder cable runs are possible at reduced frequencies.

The index marks can be used in the traditional way as "once-per-turn" encoder index marks, or as external homing marks on the encoded axes. The use of the index input is optional, but highly recommended.

HOME AND LIMIT SIGNALS are brought in through 34 pin header JP7. VLIM is a noise-isolated source of +5 volts to supply amplified sensors, such as those available from Omron.

The home sensor inputs record the position of the axis each time a signal transition occurs. **All axes should have a "black-or-white" homing flag, such that the signal is low for all travel on one side of the homing edge, and high for all travel on the opposite side**. The home position is the location where the logic signal changes from one polarity to the other. This allows the software to always know the direction towards home, even when a motor has stalled. A narrow homing slot can also be used, but this will require the system to spend time searching back and forth for home if position is lost. The main advantage of a black-or-white scheme over a slot scheme is that the black-or-white scheme does not require limit sensors in most cases, since the direction towards home is always known. A slot homing sensor requires limit switches since a back and forth, trial and error search for a narrow home slot is likely to drive an axis against a limit.

The home flag transition should be located in the normal range of axis motion, so that it is triggered frequently. This allows the system to maintain an accurate home position without the axis ever having to be specifically homed or home-checked. The axis is effectively re-homed each time it passes the flag transition point.

It is preferable that the limit switches pull the signal to ground when a limit is encountered. However, the active limit switch polarity can be selected by the operator in software.

The limit lines should be carried inside a shielded cable. The limit GND line should be carried as a separate line inside the shield -- the shield should never be used as a ground signal line, or attached to any logic ground input.

SYNCRHONIZATION INPUTS are available on 16 pin header H5. Inputs are provided for NTSC and PAL video, all standard film cameras, and SMPTE longitudinal or vertical-interval time code. The video inputs can be either composite video or sync only. The film shutter pulse input is optically isolated. No external signal conditioning is required on any input, provided that the shutter pulse input signal is 40 volts or less.

SYNCHRONIZATION OUTPUTS are available on 16 pin header H5. Three outputs can be user-programmed to fire at a specific point within each visual frame, or in selected visual frames. These signals can be used to operate electronic flashes, capping shutters, to simulate a camera shutter pulse, to synchronize to a motion control system, etc.

TIMECODE OUTPUT is available on 16 pin header H5. Output levels and either NTSC or EBU rise times can be specified in software. The time code transmission rate can be genlocked to the KuperDat motion control rate, or to an external camera or sync source connected to KuperDat.

VIDEO FRAME NUMBER INSERT. Either frame number or time code can be inserted into the video signal attached to H5. The processed video is available on the "video out" pin on header H5.

RS232 AND RS485 SIGNALS are brought out on 40 pin header H7. H7 is actually a stack of four, 10 pin connectors. For use inside equipment, a 40 pin ribbon cable can be split into four groups of ten wires, and terminated with IDC DB9 connectors -- the 10th wire in each group will have to stripped away and clipped off. It is recommended that male connectors be used for the two, RS232 channels, and female connectors be used for the two, RS485 channels.

"Normal sequence" Baud rates up to 921,600 are available on all serial ports. Cable electrical characteristics will normally limit RS232 connections to 115200 baud maximum with all but the shortest cables. RS485 channel 0 can be programmed both for "normal sequence" and also for "even sequence" baud rates such as 250 kilobaud, to as high a 1 megabaud.

The RS232 connectors on KuperDat are pre-wired for Null Modem. They can be connected directly to PC serial ports with a straight through, pin-to-pin, DB9 cable. A null modem cable or adapter should not be used.

The two, RS485 channels are fully optically isolated. Cables up to 3000 feet can be used, provided that the cables are well made and fully shielded.

RS485 channel 0 can also be used to operate a DMX-512 lighting network, including DMX-512 devices such as motorized lights. Both 8 and 16 bit DMX devices are supported. If connected to a DMX-512 network, the two "DMXGND" pins should be used instead of the normal "485GND" pins. The DMXGND pins allow for minor ground float as commonly found in DMX-512 systems.

The data transmission on any of the serial outputs can be rigorously hardware synchronized to the motion control or camera rate for the best possible conformity of logged data to image. For instance, the first bit in a serial data packet can be synchronized to the start of shutter open in a film camera, or to a specific scan line in a video signal.

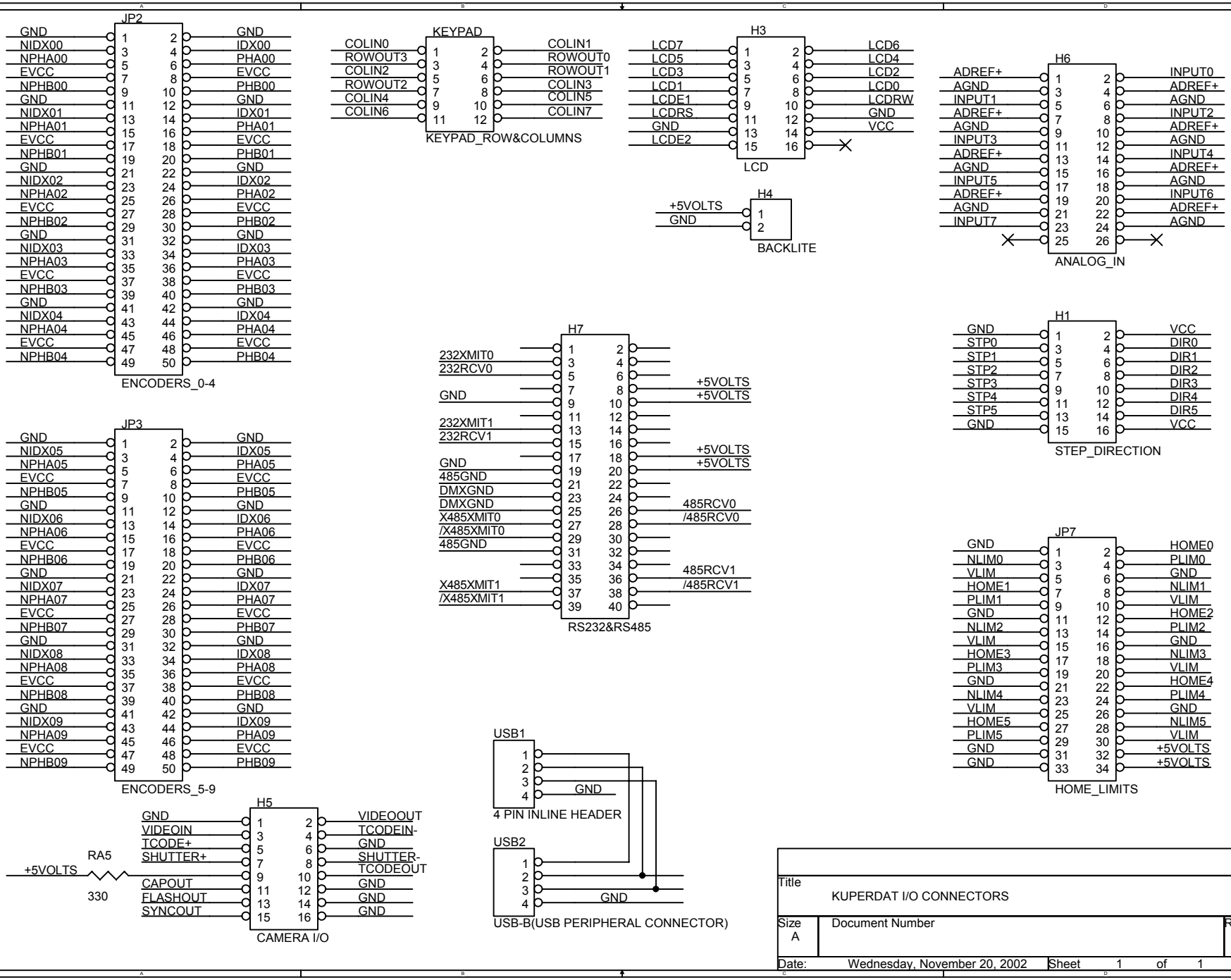
ANALOG INPUTS are brought in through 26 pin connector H6. The ADREF+ pins supply a precision 5.000 volt reference voltage to each of the eight inputs, and the AGND pins supply a noise-isolated common reference.

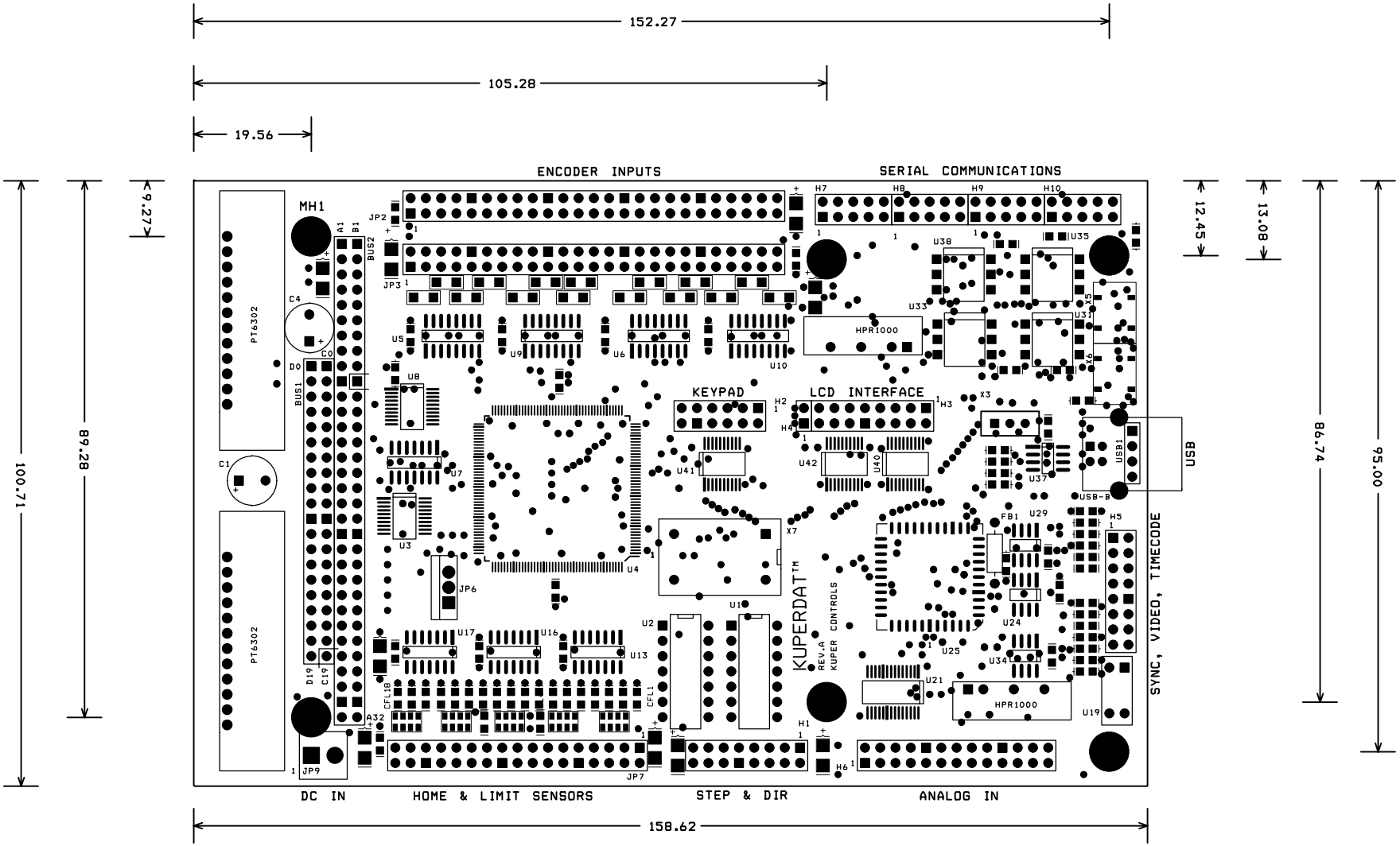
For use inside equipment, a 26 pin ribbon cable can be split into 8 groups of 3 wires each and connected to potentiometers of approximately 5,000 to 10,000 Ohms. ADREF+ and AGND connect to the two outside potentiometer pins, and INPUTx connects to the inside pin. No external voltage reference is required. Shielded cables must be used if the signals are used externally, and AGND should not be connected to the shield.

Input7 can also be jumpered to monitor the input power supply voltage supplied to the system, useful in battery powered applications. The connection between Input7 and the power supply voltage is made through on-board conditioning circuitry -- never connect an external power supply directly to Input7. Contact Kuper Controls for information on how to use Input7 for power supply monitoring.

USB communications are available through the USB2 peripheral connector. If a chassis mounted USB connector is required, USB signals are also brought out through the 4 pin, inline header USB1.

KEYPAD AND LCD connectors H2 and H3 are designed to interface via ribbon cables to a standard keypad and a standard 40 character by 4 line, low power LCD display. Two-pin connector H4 is located in-line with H3, and is a source of +5 volts for LCD's with back lights. In many applications, the user-interface display will be a TFT screen attached to the CPU card. The LCD interface is provided for low-power, embedded applications such as data-logging where a TFT and its high power consumption are not required.


JP2
GND 1 2 GND
NIDX00 3 4 IDX00
NPHA00 5 6 PHA00
EVCC 7 8 EVCC
NPHB00 9 10 PHB00
GND 11 12 GND
NIDX01 13 14 IDX01
NPHA01 15 16 PHA01
EVCC 17 18 EVCC
NPHB01 19 20 PHB01
GND 21 22 GND
NIDX02 23 24 IDX02
NPHA02 25 26 PHA02
EVCC 27 28 EVCC
NPHB02 29 30 PHB02
GND 31 32 GND
NIDX03 33 34 IDX03
NPHA03 35 36 PHA03
EVCC 37 38 EVCC
NPHB03 39 40 PHB03
GND 41 42 GND
NIDX04 43 44 IDX04
NPHA04 45 46 PHA04
EVCC 47 48 EVCC
NPHB04 49 50 PHB04
ENCODERS_0-4
KEYPAD
COLIN0 1 2 COLIN1
ROWOUT3 3 4 ROWOUT0
COLIN2 5 6 ROWOUT1
ROWOUT2 7 8 COLIN3
COLIN4 9 10 COLIN5
COLIN6 11 12 COLIN7
KEYPAD_ROW&COLUMNS
H3
LCD7 1 2 LCD6
LCD5 3 4 LCD4
LCD3 5 6 LCD2
LCD1 7 8 LCD0
LCDE1 9 10 LCDRW
LCDRS 11 12 GND
GND 13 14 VCC
LCDE2 15 16
LCD
H4
+5VOLTS 1
GND 2
BACKLITE
H6
ADREF+ 1 2 INPUT0
AGND 3 4 ADREF+
INPUT1 5 6 AGND
ADREF+ 7 8 INPUT2
AGND 9 10 ADREF+
INPUT3 11 12 AGND
ADREF+ 13 14 INPUT4
AGND 15 16 ADREF+
INPUT5 17 18 AGND
ADREF+ 19 20 INPUT6
AGND 21 22 ADREF+
INPUT7 23 24 AGND
25 26
ANALOG_IN
H7
232XMIT0 1 2
232RCV0 3 4
5 6 +5VOLTS
GND 7 8 +5VOLTS
9 10
232XMIT1 11 12
232RCV1 13 14
15 16 +5VOLTS
GND 17 18 +5VOLTS
485GND 19 20
DMXGND 21 22
DMXGND 23 24 485RCV0
X485XMIT0 25 26 /485RCV0
/X485XMIT0 27 28
485GND 29 30
31 32
33 34 485RCV1
X485XMIT1 35 36 /485RCV1
/X485XMIT1 37 38
39 40
RS232&RS485
H1
GND 1 2 VCC
STP0 3 4 DIR0
STP1 5 6 DIR1
STP2 7 8 DIR2
STP3 9 10 DIR3
STP4 11 12 DIR4
STP5 13 14 DIR5
GND 15 16 VCC
STEP_DIRECTION
JP3
GND 1 2 GND
NIDX05 3 4 IDX05
NPHA05 5 6 PHA05
EVCC 7 8 EVCC
NPHB05 9 10 PHB05
GND 11 12 GND
NIDX06 13 14 IDX06
NPHA06 15 16 PHA06
EVCC 17 18 EVCC
NPHB06 19 20 PHB06
GND 21 22 GND
NIDX07 23 24 IDX07
NPHA07 25 26 PHA07
EVCC 27 28 EVCC
NPHB07 29 30 PHB07
GND 31 32 GND
NIDX08 33 34 IDX08
NPHA08 35 36 PHA08
EVCC 37 38 EVCC
NPHB08 39 40 PHB08
GND 41 42 GND
NIDX09 43 44 IDX09
NPHA09 45 46 PHA09
EVCC 47 48 EVCC
NPHB09 49 50 PHB09
ENCODERS_5-9
JP7
GND 1 2 HOME0
NLIM0 3 4 PLIM0
VLIM 5 6 GND
HOME1 7 8 NLIM1
PLIM1 9 10 VLIM
GND 11 12 HOME2
NLIM2 13 14 PLIM2
VLIM 15 16 GND
HOME3 17 18 NLIM3
PLIM3 19 20 VLIM
GND 21 22 HOME4
NLIM4 23 24 PLIM4
VLIM 25 26 GND
HOME5 27 28 NLIM5
PLIM5 29 30 VLIM
GND 31 32 +5VOLTS
GND 33 34 +5VOLTS
HOME_LIMITS
H5
GND 1 2 VIDEOOUT
VIDEOIN 3 4 TCODEIN-
TCODE+ 5 6 GND
RA5 SHUTTER+ 7 8 SHUTTER-
+5VOLTS 9 10 TCODEOUT
330 CAPOUT 11 12 GND
FLASHOUT 13 14 GND
SYNCOUT 15 16 GND
CAMERA I/O
USB1
1
2
3 GND
4
4 PIN INLINE HEADER
USB2
1
2
3 GND
4
USB-B(USB PERIPHERAL CONNECTOR)
Title
KUPERDAT I/O CONNECTORS
Size A
Document Number
Rev A
Date: Wednesday, November 20, 2002
Sheet 1 of 1


152.27
105.28
19.56
ENCODER INPUTS
SERIAL COMMUNICATIONS
MH1
JP2
JP3
BUS2
BUS1
PT6302
PT6302
C4
C0
D0
C1
U5
U9
U6
U10
U8
U7
U3
U4
JP6
U17
U16
U13
U2
U1
CFL18
CFL1
D19
C19
A32
JP9
JP7
H1
H6
KEYPAD
LCD INTERFACE
H2
H3
H4
U42
U40
U41
X7
HPR1000
U38
U33
U35
U31
X5
X4
X3
U37
USB1
USB-B
USB
FB1
U29
H5
U24
U25
U34
U21
HPR1000
U19
KUPERDAT™
REV.A
KUPER CONTROLS
SYNC, VIDEO, TIMECODE
DC IN
HOME & LIMIT SENSORS
STEP & DIR
ANALOG IN
158.62
9.27
89.28
100.71
12.45
13.08
86.74
95.00